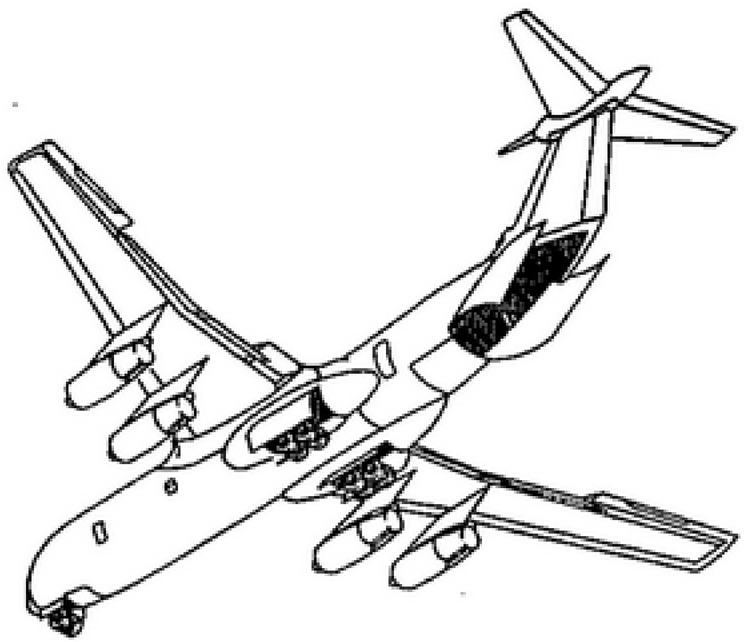
FLIGHT MANUAL

C-141C

USAF SERIES AIRCRAFT



NOTE: PERFORMANCE DATA IS CONTAINED IN TO 1C-141B-1-1

SEE TECHNICAL ORDER INDEX TO 0-1-1-3 AND ITS SUPPLEMENTS FOR CURRENT STATUS OF FLIGHT MANUALS, SAFETY SUPPLEMENTS, OPERATIONAL SUPPLEMENTS, AND FLIGHT CREW CHECKLISTS.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS PUBLICATION TO THE ATTENTION OF ALL AIR FORCE PERSONNEL CLEARED FOR OPERATION OF SUBJECT AIRCRAFT.

THIS PUBLICATION SUPERSEDED TO 1C-141C-1SS-3; TO 1C-141C-1SS-4; TO 1C-141C-1SS-5; TO 1C-141C-1SS-6; TO 1C-141C-1SS-9; TO 1C-141C-1SS-10; TO 1C-141C-1SS-11; TO 1C-141C-1SS-12; AND TO 1C-141C-1SS-12 ERRATA IN CHANGE 1 DATED, 17 OCTOBER 2001. TO 1C-141C-1SS-7 WAS SUPERCEDED BY TO 1C-141C-1SS-12, AND TO 1C-141C-1SS-8 HAS BEEN RESCINDED.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

23 AUGUST 1999

CHANGE 2 – 1 AUGUST 2002

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands.

Dates of issue for original and changed pages are:

Original .... 0 .... 23 August 1999
Change .... 1 .... 17 October 2001
Change .... 2 .... 1 August 2002

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1042 CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Title	2
A – B	2
C Blank	2
i – iv	0
v	2
vi – xi	1
xii	0
1-1 – 1-8	1
1-9 – 1-77	0
1-78 – 1-80	1
1-80.1 – 1-80.14 Added	1
1-81 – 1-94	0
1-95 – 1-97	1
1-98 – 1-103	0
1-104	1
1-105	0
1-106	1
1-107 – 1-113	0
1-114 – 1-121	1
1-122 – 1-133	0
1-134	1
1-135 – 1-137	0
1-138	1
1-139	0
1-140	1
1-140.1 Added	1
1-140.2 Blank Added	1
1-141 – 1-146	0
1-147 – 1-150	1
1-151 – 1-152	2
1-153	1
1-154	0
1-155 – 1-156	1
1-157	0
1-158 – 1-159	1
1-160	0
1-161 – 1-163	1
1-164	0
1-165 – 1-167	1
1-168	0
1-169 – 1-180	1
1-180.1 Added	1
1-180.2 Blank Added	1
1-181 – 1-182	1
1-182.1 Added	1
1-182.2 Blank Added	1
1-183 – 1-187	0
1-188 – 1-189	1
1-190 – 1-191	0
1-192 – 1-193	1
1-194 – 1-198	0
1-199 – 1-200	1
1-201	0
1-202 – 1-204	1
1-205 – 1-207	0
1-208 – 1-211	1
1-212 – 1-215	0
1-216	1
1-217	0
1-218 – 1-221	1
1-222 – 1-232	0
1-233 – 1-234	1
1-234.1 Added	1
1-234.2 Blank Added	1
1-235 – 1-237	0
1-238	1
1-238.1 Added	1
1-238.2 Blank Added	1
1-239 – 1-241	0
1-242	1
1-243	0
1-244 – 1-245	1
1-246 – 1-260	0
1-261 – 1-262	1
1-262.1 Added	1
1-262.2 Blank Added	1
1-263 – 1-266	0
1-267 – 1-274	1
1-274.1 – 1-274.6 Added	1
1-275	1
1-276 – 1-283	0
1-284	1
1-285 – 1-290	0
1-291	1
1-292 – 1-295	0
1-296 – 1-297	1
1-298 – 1-299	0
1-300 – 1-302	1
1-302.1 – 1-302.2 Added	1
1-303 – 1-306	0
1-307 – 1-308	1
1-309 – 1-311	0
1-312	1
1-313 – 1-315	0
1-316 – 1-318	1
1-318.1 – 1-318.2 Added	1
1-319 – 1-320	1
1-321 – 1-331	0
1-332	1
1-333 – 1-336	0
1-337	1
1-338 – 1-342	0
1-343 – 1-344	1
1-345 – 1-363	0
1-364 – 1-374	1
1-374.1 – 1-374.9 Added	1
1-374.10 Blank Added	1
1-375	1
1-376 – 1-387	0
1-388	1
1-389 – 1-390	0
1-391 – 1-394	1
1-395	0
1-396	1
1-397 – 1-426	0
1-427	1
1-428	0
1-429	1
1-430	0
1-431 – 1-432	2
1-433 – 1-438	0
1-439 – 1-440	1
1-441 – 1-444	0
1-445	1
1-446 – 1-461	0
1-462	1
1-463	0
1-464	1
1-465 – 1-471	0
1-472	1
1-473 – 1-509	0
1-510 – 1-511	1
1-512 – 1-513	0
1-514 – 1-516	1
1-517 – 1-525	0

*Zero in this column indicates an original page.

USAF

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the margins of the page. Changes to illustrations are indicated by miniature pointing hands.

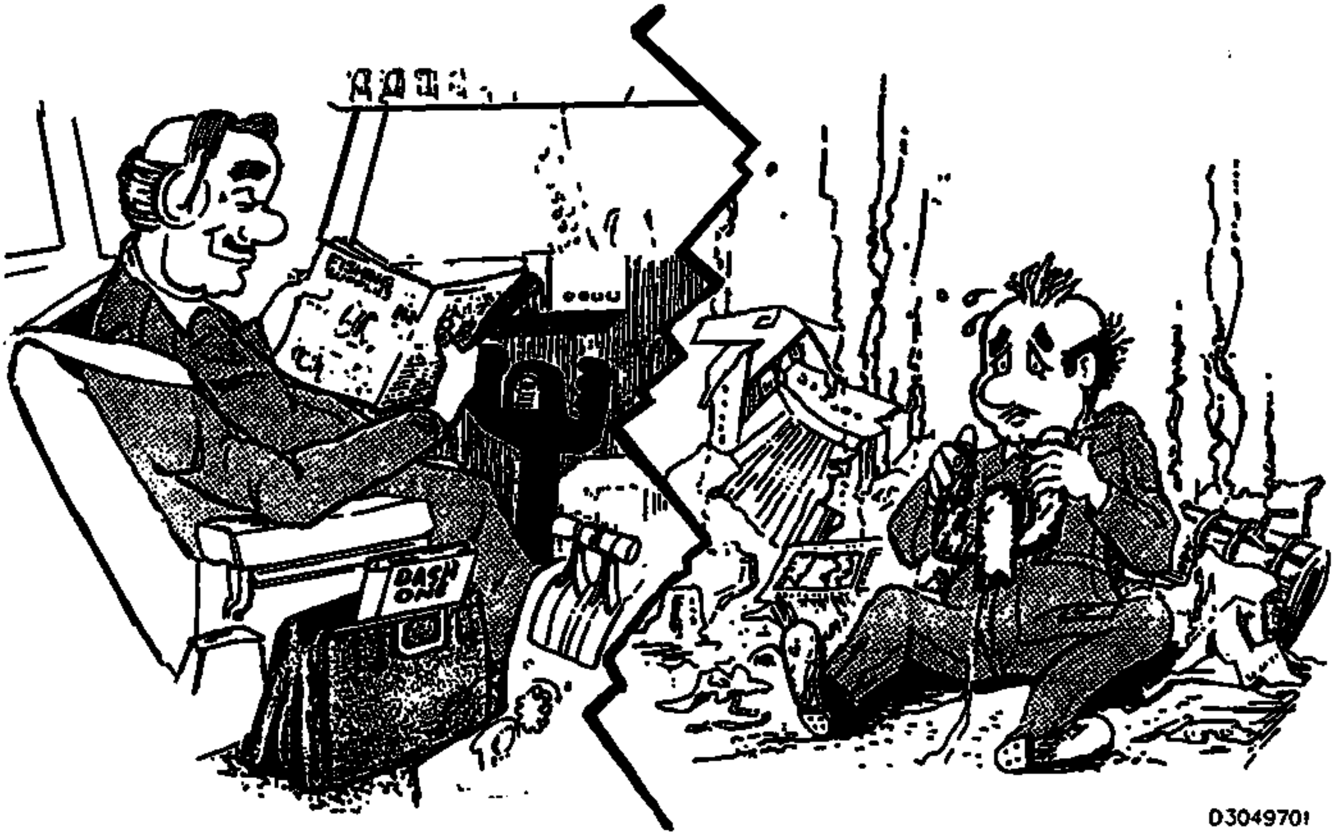
Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
1-526	1	3-64.1 – 3-64.2 Added	1		
1-526.1 Added	1	3-65 – 3-71	0		
1-526.2 Blank Added	1	3-72	2		
1-527 – 1-547	0	3-73 – 3-78	0		
1-548	1	3-79	1		
1-549 – 1-553	0	3-80 – 3-82	0		
1-554	1	3-83	2		
1-554.1 Added	1	3-84 – 3-144	0		
1-554.2 Blank Added	1	4-1 – 4-5	0		
1-555	1	4-6 – 4-7	1		
1-556 – 1-558	0	4-8	0		
1-559	1	4-9 – 4-10	1		
1-560 – 1-585	0	4-11 – 4-14	0		
1-586	1	4-15 – 4-16	1		
1-587 – 1-597	0	4-16.1 Added	1		
1-598 Blank	0	4-16.2 Blank Added	1		
2-1 – 2-2	1	4-17	0		
2-3	0	4-18	1		
2-4 – 2-5	1	4-19 – 4-20	0		
2-6 – 2-37	0	4-21	1		
2-38	1	4-22 – 4-28	0		
2-38.1 – 2-38.3 Added	1	4-29	1		
2-38.4 Blank Added	1	4-30 – 4-66	0		
2-39	1	5-1 – 5-2	0		
2-40 – 2-42	0	5-3	1		
2-43 – 2-44	1	5-4 – 5-24	0		
2-45	0	5-25	1		
2-46	1	5-26 – 5-35	0		
2-47 – 2-60	0	5-36 Blank Added	0		
1-61	2	6-1 – 6-4	0		
1-62	0	7-1	1		
2-63	1	7-2 – 7-6	0		
2-64 – 2-67	0	7-7	1		
2-68	1	7-8	0		
2-69	0	7-9 – 7-10	1		
2-70	1	7-11 – 7-14	0		
2-71 – 2-72	0	7-15 – 7-16	1		
2-73	1	7-17 – 7-19 Added	1		
2-74 – 2-84	0	7-20 Blank Added	1		
2-85	1	Index-1 – Index-23	0		
2-86 – 2-99	0	Index-24 Blank	0		
2-100	1				
3-1	0				
3-2	1				
3-3 – 3-6	0				
3-7	1				
3-8 – 3-26	0				
3-27	1				
3-28 – 3-33	0				
3-34	1				
3-35 – 3-59	0				
3-60	2				
3-61	1				
3-62	0				
3-63 – 3-64	1				

*Zero in this column indicates an original page.

TABLE OF CONTENTS

SECTION I	DESCRIPTION AND OPERATION	1-1
SECTION II	NORMAL PROCEDURES	2-1
SECTION III	EMERGENCY PROCEDURES	3-1
SECTION IV	CREW DUTIES	4-1
SECTION V	OPERATING LIMITATIONS	5-1
SECTION VI	FLIGHT CHARACTERISTICS	6-1
SECTION VII	ADVERSE WEATHER OPERATIONS	7-1
APPENDIX I	PERFORMANCE DATA	SEE TO 1C-141B-1-1
INDEX	ALPHABETICAL	INDEX-1

Read Carefully —— Don't Learn By Accident



03049701

SCOPE.

This manual contains information which will provide you with a general knowledge of the aircraft, its characteristics, and specific normal operating procedures. Your flying experience is recognized; therefore, basic flight principles are avoided. Multiple emergencies, adverse weather, terrain or extenuating circumstances may require modification of any procedure(s) presented in this manual.

PERMISSIBLE OPERATIONS.

The flight manual takes a positive approach and normally states only what you can do. Unusual operations or configurations which exceed the limitations as specified in this manual must be approved, through Command channels, by the flight manual manager (WR-ALC/LJLET). Clearance must be obtained from the Major Command (with information to the flight manual manager) before any questionable operation is attempted which is not specifically permitted in this manual.

In some cases, the limits and tolerances presented in the flight manual are not precisely identical to those presented in the maintenance manuals. The numerical values in the flight manual are to be used as operating guides by flight personnel.

HOW TO BE ASSURED OF HAVING LATEST DATA.

You must be constantly aware of the latest manual, checklist and status of supplements. The latest formal supplement (safety or operational) will have a supplement status page which provides the current status of your flight manual. If you should have any doubts concerning the status of your flight manual, check with your flight manual distribution officer.

SAFETY AND OPERATIONAL SUPPLEMENTS.

Safety supplements are issued as an expeditious means of reflecting safety information when hazardous safety conditions exist. These supplements contain operational, precautionary and restrictive instructions that affect safety and safety modifications. Operational supplements are issued as an expeditious means of reflecting information when mission essential operational procedures are involved. Supplements are issued by teletype (interim) or by printed copy (formal) depending upon the urgency. Interim supplements are formalized and replaced with a new number within 30 days. Formal printed supplements are identified by red letters "SS" for safety supplements and black letters "OS" for operational supplements printed around the borders of the title pages. In accordance with TO 00-5-1, both Safety and Operational supplements are numbered sequentially using the same block numbers. They will be filed in reverse numerical sequence in front of the manual. The flyleaf page will be retained with supplements until rescinded or incorporated.

CHECKLISTS.

The flight manual contains amplified normal and emergency procedures. Checklists contain these procedures in abbreviated form and are issued as separate technical orders. Line items in the flight manual and checklists are identical with respect to arrangement and item number. If authorized by an interim safety operational supplement that affects a checklist, write in the applicable change on the affected checklist. Within 40 days, a formal supplement will be issued with the revised checklist page attached.

HOW TO GET PERSONAL COPIES.

Each flight crewmember is entitled to personal copies of the Flight Manual, Safety Supplements, and Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your publications personnel; it is their job to fulfill your Technical Order requests. Basically, you must order the required quantities on the Publication Requirements Table (TO 0-1-1-3). Technical order 00-5-2 gives detailed information for properly ordering these publications. Make sure a system is established at your base to deliver these publications to the flight crews immediately upon receipt.

FLIGHT MANUAL BINDERS.

Looseleaf binders and sectionalized tabs are available for use with your manual. They are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies Part I). Check with your supply personnel for assistance in procuring these items.

DEFINITIONS.

The following definitions apply to the use of the words "shall," "will," "should," and "may."

shall - Construed to mean that the requirements are binding or mandatory.

will - Construed to mean that the requirements are binding or mandatory.

should - Used to express a non-mandatory desire or preferred method of accomplishment, and shall be construed as a non-mandatory provision.

may - Used to express an acceptable or suggested means of accomplishment and shall be construed as a non-mandatory provision.

WARNINGS, CAUTIONS, AND NOTES.

Warnings, Cautions and Notes will always appear in the text where appropriate and will always follow the numbered line items (steps or procedures) and/or amplifications to which they apply.

The following definitions apply to "Warnings," "Cautions" and "Notes" found throughout the manual.

WARNING

Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.

NOTE

An operating procedure, technique, etc., which it is considered necessary to emphasize.

USE OF CAPITAL LETTERS AND QUOTATION MARKS.

In Section I of this manual, where most of the descriptive material is located, control or switch positions are identified by the use of capital letters reflecting the identification visible in the aircraft, enclosed by quotation marks, and the placarded name of the item is shown in capital letters without quotation marks.

Example:

The throttle is moved to "IDLE START" position ....

The unmarked neutral position of certain switches, when mentioned specifically, is identified by capital letters without quotation marks.

Example:

The switch is placed successively in the "NORM" and OFF positions ....

In Sections II, III, and IV, capital letters enclosed by quotation marks are reserved for spoken responses. Switch and control positions are shown in capital letters without quotation marks, items being operated are shown with initial capital letters only, while the crew member making the spoken response is identified by an abbreviation in parentheses.

Example:

Windshield Heat - "OFF" (CP)

If an item is normally identified by a capitalized abbreviation, such as CADC, MTC, APU, etc., this identification is used.

Example:

APU Control Switch - START/RUN

EFFECTIVITY.

This manual incorporates TCTO 1C-141B-541 and TCTO 1C-141-768 and pertains to the following 62 tail numbers:

63-8080, 63-8084, 63-8085, 64-0614, 64-0620, 64-0622, 64-0627, 64-0632, 64-0637, 64-0640, 64-0645, 65-0216, 65-0222, 65-0225, 65-0226, 65-0229, 65-0232, 65-0237, 65-0245, 65-0248, 65-0249, 65-0250, 65-0256, 65-0258, 65-0261, 65-0271, 65-9409, 65-9412, 65-9414, 66-0130, 65-0132, 66-0134, 66-0136, 66-0139, 66-0148, 66-0151, 66-0152, 66-0153, 66-0157, 66-0164, 66-0167, 66-0174, 66-0177, 66-0181, 66-0182, 66-0185, 66-0190, 66-0191, 66-0193, 66-0201, 66-7950, 66-7952, 66-7953, 66-7954, 66-7957, 66-7959, 67-0015, 67-0021, 67-0024, 67-0027, 67-0029, 67-0031

TIME COMPLIANCE TECHNICAL ORDERS.

The following Time Compliance Technical Orders have been incorporated in this manual.

NUMBER	TITLE
1C-141-542	INSTALLATION OF AN/ALE-47 COUNTERMEASURES DISPENSING SYSTEM AND AN/AAR-47 MISSILE WARNING SET.
1C-141-550	REPLACEMENT OF NO. 1 KY-75 (PARK-HILL COMSEC EQUIP.) WITH ADVANCED NARROWBAND DIGITAL VOICE TERMINAL ON C-141B AIRCRAFT.
1C-141-555	INSTALLATION OF L-BAND SATELLITE COMMUNICATION SYS ON C-141 AIRCRAFT.
1C-141-559	INSTALLATION OF SECOND COMFORT PALLET RECEPTACLE.
1C-141-576	INSTALLATION OF SELECTIVE CALL (SELCAL) ON C-141 AIRCRAFT.
1C-141-763	FUEL QUANTITY INDICATION SYS REPLACEMENT.
1C-141-768	INSTALLATION OF ALL WEATHER FLIGHT CONTROL SYSTEM/GCAS ON C-141 AIRCRAFT.
1C-141-801	REMOVE RADIO RECEIVER-TRANSMITTER RT-1341 (V) 3/5 AN/ARC-190 AND REPLACE WITH RT-1341 (V) 8 AN/ARC-190 ON C-141 AIRCRAFT.
1C-141B-520	INSTALLATION OF FIRS INTEGRATION OF AN/APN-169 ENHANCED SKE SYSTEM.
1C-141B-541	INSTALLATION OF GLOBAL POSITIONING SYSTEM ENHANCED NAVIGATION SYSTEM ON C-141 AIRCRAFT.
1C-141B-588	INSTALLATION OF TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM AND INSTALLATION OF TERRAIN AWARENESS AND WARNING SYSTEM, C-141C AIRCRAFT.
1C-141-853	REMOVAL OF MODE S/IFF APX-100 CONTROL PANEL, PART NUMBER 4070741-0506 AND INSTALLATION OF MODE S/IFF APX-100 CONTROL PANEL, PART NUMBER 4070741-0507 AND REMOVAL OF MODE S/IFF APX-100 TANSPONDER, PART NUMBER 4070740-0508 AND INSTALLATION OF MODE S/OFF APX-100 TRANSPONDER, PART NUMBER 4070740-0510 ON C-141B/C AIRCRAFT.

YOUR RESPONSIBILITY TO LET US KNOW.

Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be submitted in accordance with AFI 11-215 and forwarded through your Command Headquarters to Warner Robins Air Logistics Center, Robins AFB, Georgia 31098, Attn: LJET.

GLOSSARY OF TERMS.

CUSTOM DATABASE - All database files contained in the NP, except the Navigation Database.

NAVIGATION DATABASE - The Navigation database for which the identifier is displayed on the Power-Up page.

≠	Not equal to
A	Altitude
AA	Absolute Altitude
AA	Air-to-Air
AA	At or Above
AB	At or Below
A/C	Air Conditioning
ACC	Accuracy Warning Annunciator
ACS	Automatic Communications System
ACT	Active
ADC	Air Data Computer
ADDR	Address
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADS	Airdrop System
ADU	Air Data Unit
AEC	Aeromedical Evacuation Crew
AECC	Aeromedical Evacuation Control Center
AEOO	Aeromedical Evacuation Operations Officer
AERP	Aircrew Eye and Respiratory Protection
AET	Aeromedical Evacuation Technician
AFCP	Automatic Flight Control Processor
AFCS	Automatic Flight Control System
AHD	Ahead
AHRS	Attitude Heading Reference System
AI	Anti-ice
AI/ON	Anti-ice <on
AIU	Auxiliary Interface Unit
AJ	Anti-Jam
ALE	Automatic Link Establishment
ALOG	Analog
ALT	Altitude
ALTN	Alternate
AM	Amplitude Modulation
AMLCD	Active Matrix Liquid Crystal Display
ANDVT	Advanced Narrowband Digital Voice Terminal
ANG	Angle
ANNUNC	Annunciator
AOA	Angle of Attack
AP	Autopilot
APP	Approach
APPR	Approach
APT	Airport
APU	Auxiliary Power Unit
ARR	Arrival
A/S	Airspeed
A/T	Autothrottle
ATA	Actual Time of Arrival
ATCC	Air Traffic Control Center
ATCRBS	Air Traffic Control Radar Beacon System
ATGL	Air Transportable Galley/Lavatory
ATS	Automatic Throttle System
AUTO	Automatic
AV	Avionics
AVAIL	Available
AWLS	All Weather Landing System
BAL	Ballistic
BARO	Barometric
BDHI	Bearing Distance Heading Indicator
BHD	Behind
BIT	Built-in Test
BITE	Built-in Test Equipment
BMAX	Braking Maximum
BOD	Bottom of Descent
BRG	Bearing
BRGW	Brake Release Gross Weight
BTU	Basic Terminal Unit
BU	Battery Unit
C	Celsius
C/A	Course/Acquisition
CADC	Central Air Data Computer
CALC	Calculated
CARA	Combined Altitude Radar Altimeter System
CARP	Computed Air Release Point
CART	Cartridge
CAS	Calibrated Airspeed

C-BIT	Continuous Built-in Test
CBC	CDS Brightness Control
CBR	California Bearing Ratio
CCU	Cockpit Control Unit
CDI	Course Deviation Indicator
CDS	Container Delivery System
CDS	Control Display System
CDU	Control Display Unit
CEFS	Critical Engine Failure Speed
CF	Course to a Fix
CFL	Critical Field Length
CG	Center of Gravity
CHAN	Channel
CHK	Check
CI	Control Indicator
CIV	Carousel IV INS
CLB	Climb
CM	COMSEC Module
CMD	Command
CMDS	Countermeasures Dispensing Set
CMT	Charge Medical Technician
C/N_0	Carrier-to-Noise Power Spectral Density Ratio
COMM	Communication
CP	Curved Path
CPA	Closest Point of Approach
CPU	Computer Processing Unit
CRC	Cyclic Redundancy Check
CRS	Course
CRZ	Cruise
CSD	Constant Speed Drive
CVR	Cockpit Voice Recorder
CW	Continuous Wave
CWA	Caution/Warning/Advisory
CWFS	Column/Wheel Force Sensor
CWS	Control Wheel Steering
DA	Descent Altitude
DA	Descent Angle
DAMU	Display Avionics Management Unit
DB	Database
DC	Direct Control
DECEL	Deceleration
DEP	Departure
DES	Descent
DESC	Description
DESEL	Deselect
DEST	Destination
DF	Direct to a Fix
DFDR	Digital Flight Data Recorder
DH	Decision Height
DICU	Display Interface Control Unit
DIR	Direct
DISAB	Disable
DISC	Discrete
DIST	Distance
DIU	Display Interface Unit
DL	Download
DLR	Data Loader Receptacle
DLS	Data Loader System
DLY	Delay
DME	Distance Measuring Equipment
DOM	Day-of-Month
DPU	Display Processor Unit
DR	Dead Reckoning
DRF	Drift
DROP	Dropped
DRP	Drop
DRU	Data Receptacle Unit
DSPY	Display
DSRV	Deep Submergence Rescue Vehicle
DTD	Data Transfer Device
DTG	Distance To Go
DTK	Desired Track
DU	Display Unit
DZ	Drop Zone
DZESC	Drop Zone Escape
E	East
EAI	Engine Anti-Ice
ECEF	Earth-Centered Earth-Fixed
ECON	Economy
EEBD	Emergency Escape Breathing Device
EFC	Expect Further Clearance
EGR	Embedded GPS Receiver
EGT	Exhaust Gas Temperature
EHE	Estimated Heading Error
EHE	Estimated Horizontal Error
EL	Electroluminescent
ELEV	Elevation
ELT	Emergency Locator Transmitter
EMB	Expanded Memory Board
EMER	Emergency

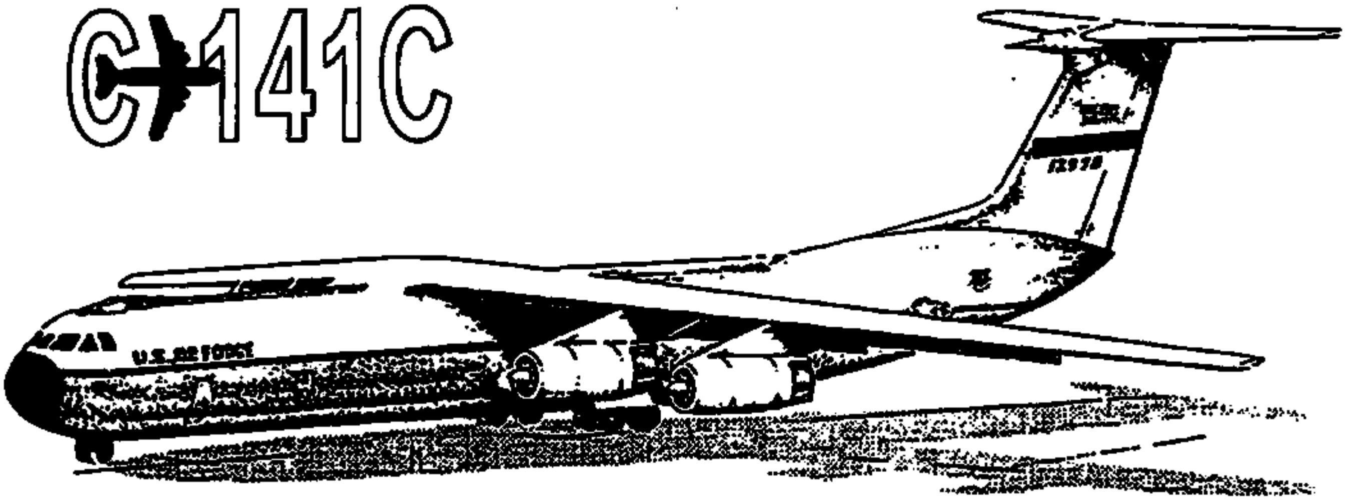
EMI	Electro Magnetic Interference
ENCDR	Encoder
ENG	Engine
ENS	Enhanced Navigation System
EO	Engine Out
EOD	End of Descent
EPOS	Emergency Passenger Oxygen System
EPR	Engine Pressure Ratio
EQUIP	Equipment
EREO	Emergency Retract, Emergency Off
ESC	Escape
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETE	Estimated Time Enroute
ETI	Elapsed Time Indication
ETP	Equal Time Point
EVI	Engine Vibration Indicator
EWP	Emergency War Planning
F	Fahrenheit
FA	Course from a Fix to an Altitude
FAF	Final Approach Fix
FC	Frequent Tracked/Tracking Code
FCI	Flight Command Indicator
FCP	Flight Control Panel
FCR	Flight Command Repeater
FF	Fuel Flow
FL	Flight Level
FLC	Flight Level Change
FLT	Flight
FMS	Flight Management System
FMT	Frequency Managed Training
FN	Flight Nurse
FOB	Fuel on Board
FOD	Foreign Object Damage
FOM	Figure of Merit
FP	Flight Plan
FPM	Feet per Minute
FPS	Feet per Second
FQI	Fuel Quantity Indicator
FT	Feet
FTD	Forward Travel Distance
FTT	Forward Travel Time
G	Grid
GA	Go-Around
GPS	Global Positioning System
GPSD	Ground Speed
GRAD	Gradient
GRD	Ground
GS	Glideslope
GS	Ground Speed
GTRK	Ground Track
H	Hours
HA	High Altitude
HARP	High Altitude Release Point
HAT	Height Above Touchdown
HDG	Heading
HE	Heavy Equipment
HF	High Frequency
HG	Mercury
HGT	Height
HH	High Altitude/High Power
HIALTRF	High Altitude Rate of Fall
HIST	History
HP	Hecto Pascal
HS	Heading Select
HSI	Horizontal Situation Indicator
HTR	Turn Radius
IAA	Indicated Absolute Altitude
IAF	Initial Approach Fix
IAS	Indicated Airspeed
IBIT	Initiated Built-In Test
ICAO	International Civil Aviation Organization
ID	Indentifier
ID	Inner Diameter
IDENT	Identify/Identifier
IDTK	Instantaneous Desired Track
IF	Initial Fix
ILS	Instrument Landing System
ILSDME	ILS/DME
IN	Inches
INAV	Integrated Navigation
INBD	Inbound
INDX	Index
INIT	Initialization
INS	Inertial Navigation System
INV	Invalid
INU	Inertial Navigation Unit
IP	Initial Point
ITA	Indicated True Altitude
ISA	International Standard Atmosphere
K	Kilo (Thousand)

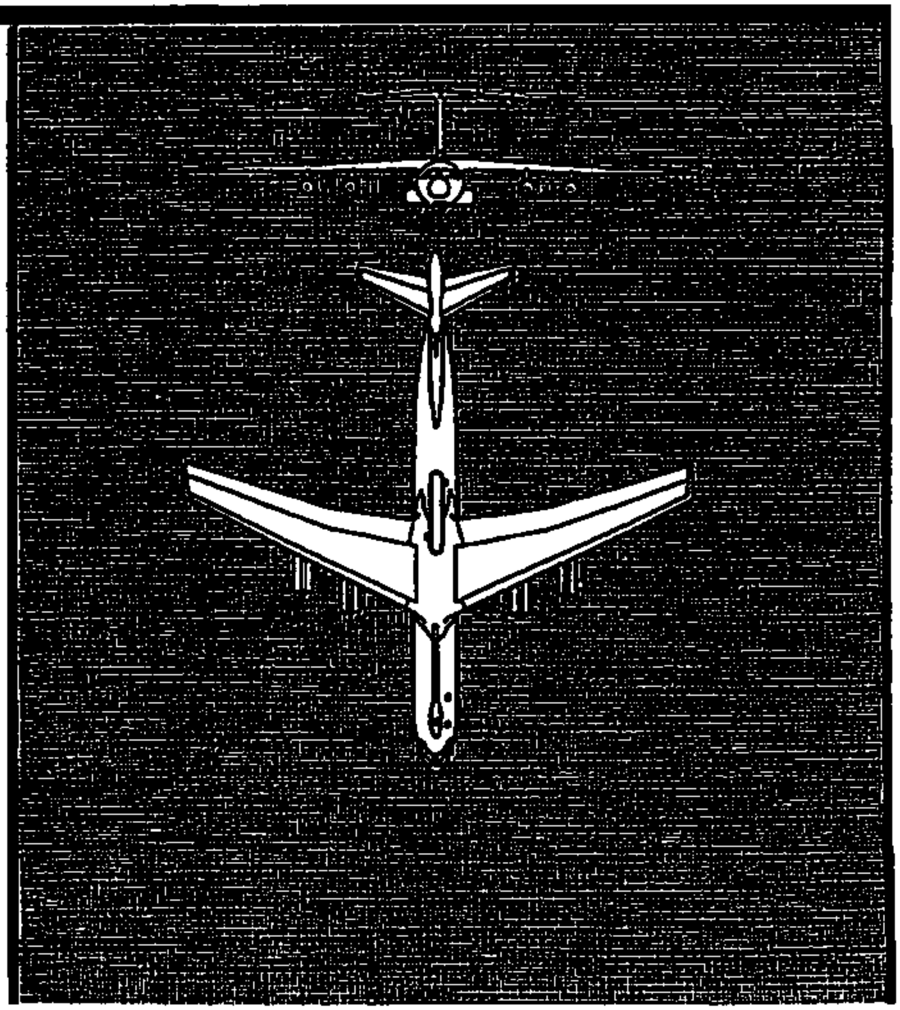
KEYBD	Keyboard
KFD	Keyfill Device
KHZ	Kilohertz
KNS	Kalman Navigation Solution
KT	Knot
KVA	Kilovolt-Ampere
LA	Low Altitude
LAT/LON	Latitude/Longitude
LB	Pound
LDR	Leader
LG	Long
LBL	Label
LDG	Landing
LL	Latitude/Longitude
LIM	Limiter
LGTH	Length
LNAV	Lateral Navigation (or Lateral Guidance)
LOC	Localizer
LQA	Link Quality Analysis
LRC	Long Range Cruise
LRU	Line Replaceable Unit
LSK	Line Select Key
LT	Left
LVL	Level
LZ	Landing Zone
LZ/NPA	Landing Zone/Non-Precision Approaches
M	Minutes
MAC	Mean Aerodynamic Chord
MAG VAR	Magnetic Variation
MAINT	Maintenance
MAN	Manual
MAP	Missed Approach Point
MAX	Maximum
MB	Millibars
MBIT	Maintenance Built-In Test
MC	Medical Crew
MCD	Medical Crew Director
MDA	Minimum Descent Altitude
MDB	Mission Database
MDF	Mission Data File
MFCDU	Multi-function Control Display Unit
MFD	Multi-function Display
MFP	Mission Flight Parameter
MFSI	Multifunction Standby Instrument
MGRS	Military Grid Reference System
MHZ	Megahertz
MIN ACCEL	Minimum Acceleration
ML	Master Lost
MLG	Main Landing Gear
MLS	Microwave Landing System
MLSDME	MLS/DME
Mmo	Maximum Allowable Mach
MOD	Provisional
MOPS	Minimum Operational Performance
MS	Mode S
MSL	Mean Sea Level
MSN	Mission
MSP	Mode Select Panel
MSTR	Master
MSU	Mode Selector Unit
MWOD	Multiple-Word-of-Day
MWS	Missile Warning System
N	North
NAR	Non-Altitude Reporting
NAV	Navigation
NDB	Navigation Database
NDB	Non-Directional Beacon
NE	Northeast
NM	Nautical Miles
NOD	Nurse of the Day
NP	Navigation Processor
NPA	Non-Precision Approach
NS	Navigation Solution
NTA	Number of TCAS-Equipped Aircraft
NVG	Night Vision Goggles
NVIS	Night Vision Imaging System
NVM	Non-Volatile Memory
NW	Northwest
OAT	Outside Air Temperature
OB	Outboard
OBS	Obstacle
OBSTR	Obstruction
OD	Outer Diameter
OPER	Operation
OPT	Optimum
PA	Pressure Altitude
PAV	Pressure Altitude Variation
PAYLD	Payload
PBD	Place/Bearing/Distance
PBPB	Place/Bearing/Place/Bearing
PDB	Performance Data Base
PER	Personnel
PERF	Peformance

PFBIT	Preflight Built-In-Test
PFD	Primary Flight Display
PI	Point of Impact
PIREPS	Pilot Reports
POBIT	Power-on Built-in Test
PPOS	Present Position
PPP	Patient Positioning Plans
PPS	Precise Positioning System
PREV	Previous
PRS	Position Reporting System
PVT	Position, Velocity, and Time
P-P	Point-to-point
QFE	Field Elevation Barometric Setting
QNE	Standard Atmosphere Setting
QNH	MSL Barometric Setting
QTY	Quantity
QUAD	Quadrant
QUOT	Quotient
RA	Resolution Advisory
RA	Runway Available
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RCR	Runway Condition Reading
RCU	Remote Control Unit
RCVR	Receiver
RDR	Rotary Function Switch
REC	Receive
RED	Reduced EPR Takeoff
REF	Reference
REF GS	Reference Ground Speed
REMAIN	Remaining
REQ	Required
REV	Reverse
RF	Radio Frequency
R/G-A	Rotation/Go-Around
RNDZ	Rendezvous
RNG	Range
ROT	Rotate
RR	Rain Removal
RSC	Runway Surface Covering
RSP	Reference Set Panel
RSS	Root Sum Square
RT	Receiver-Transmitter
RT	Right
RTA	Required Time of Arrival
RTE	Route
RTN	Return
RW	Runway
RWYS	Runways
RZ	Rendezvous
S	Seconds
S	South
S	Surface
SAT	Static Air Temperature
SCADC	Standard Central Air Data Computer
SD	Slow Down
SE	Southeast
SEL	Select
SELCAL	Selective Call
SEQ	Sequence
SFC	Surface
SFD	Secondary Flight Display
SH	Short
SID	Standard Instrument Departure
SIGMETS	Significant Meteorological Information
SKE	Station Keeping Equipment
SLEN	Slot Enable
SN	C/No
SOC	Start of Climb
SOP	Speed On Pitch
SPD	Speed
SPO	System Program Office
SPR	Single Point Refueling System
SRCU	Split Remote Control Unit
SRS	Software Requirements Specification
ST	State
STAB	Stabilizer
STAR	Standard Terminal Arrival Route
STAT	Status
STBY	Standby
STC	Sensitivity Time Control
STRT	Set Prior To Brake Release TRT EPR Takeoff
SU	Sensor Unit
SV	Satellite Number
SVS	Secure Voice System
SW	Southwest
T	Terminal
T	True
TA	Traffic Alert

TA	True Altitude
TACAN	Tactical Air Navigation
TCAS	Traffic Alert and Collision Avoidance System
TAS	True Airspeed
TAWS	Terrain Awareness and Warning System
TAV	Temperature Altitude Variation
TD	Touchdown
TDZE	Touchdown Zone Elevation
TEK	Traffic Encryption Key
TEMP	Temperature
TF	Track to a Fix
THR	Threshold
TLS	Tire Limit Speed
TO	Takeoff
TOA	Time of Arrival
TOC	Top of Climb
TOD	Time of Day
TOD	Top of Descent
TOLD	Takeoff and Landing Data
TOT	Time Over Target
T-OUT	Time Out
TP	Turn Point
TR	Transformer Rectifier
TRANS	Transition
TR-REC	Transmit-Receive
TRT	Takeoff Rated Thrust
TSP	Thrust Speed Parameter
TTFF	Time to First Fix
TTG	Time to Go
TW	Tailwind
TWS	Track-While-Scan
UARRSI	Universal Aerial Refueling Receptacle Slipway Installation
UHF	Ultra High Frequency
UPS	Universal Polar Stereographic
UR	Unrestricted
UTC	Universal Time Coordinates
UTM	Universal Transversal Mercator
VA	Heading from a Fix to an Altitude
VALI	Variable Altitude Limit Index
VAPP	Velocity Approach Speed
VHF	Very High Frequency
VMCA	Velocity Minimum Control Airspeed
VMCG	Velocity Minimum Control Ground Speed
VMCO	Velocity Minimum Climbout Speed
VMFR	Velocity Minimum Flap Retraction Speed
Vmo	Maximum Allowable Indicated Airspeed
VNAV	Vertical Navigation (or Vertical Guidance)
VOR	VHF Omni-Range
VORDME	VOR/DME
VORTAC	VOR/TACAN
VPTH	Vertical Path
VROT	Rotate Airspeed
VSI	Vertical Scale Indicator
VTK	Vertical Track
VVI	Vertical Velocity Indicator
W	West
WAI	Wing Anti-Ice
WGS-84	World Geodetic System 1984
WOD	Word-of-Day
WOW	Weight on Wheels
WP/WPT	Waypoint
WSE	Waypoint Select Page Exclusion
WT	Weight
W/V/L	Wind Bearing/Wind Speed/Wind Limit
X	Cross
XFER	Transfer
XTK/XTRK	Crosstrack
XW	Crosswind
ZFW	Zero Fuel Weight
ZM	Zone Marker

THE C-141C





SECTION I
DESCRIPTION AND OPERATION
TABLE OF CONTENTS

TEXT PAGE

THE AIRCRAFT 1-9

TURBOFAN ENGINES 1-9

COMPRESSOR SURGE BLEED SYSTEM 1-10
ENGINE FUEL SYSTEM 1-10
FUEL HEATER OPERATION 1-11
OIL SYSTEM 1-11
IGNITION SYSTEM 1-12
CONTINUOUS IGNITION SYSTEM 1-12
STARTING SYSTEM 1-12
ENGINE INSTRUMENTS 1-13
ENGINE THRUST REVERSER SYSTEM 1-14
ENGINE OPERATION 1-14

AUXILIARY POWER UNIT (APU) 1-16

FUEL SUPPLY SYSTEM 1-18

NORMAL FUEL MANAGEMENT 1-22

SINGLE POINT REFUELING AND DEFUELING SYSTEM 1-24

AERIAL REFUEL SYSTEM 1-24

ELECTRICAL SYSTEM 1-26

ENGINE BLEED AIR SYSTEMS 1-29

AIR CONDITIONING SYSTEMS 1-31

PRESSURIZATION SYSTEM 1-33

CARGO COMPARTMENT FLOOR HEAT SYSTEM 1-35

WINDSHIELD RAIN REMOVAL SYSTEM 1-36

ELECTRONIC COOLING SYSTEM 1-36

ANTI-ICING AND DE-ICING SYSTEMS 1-37

ICE DETECTION SYSTEM 1-37
TOTAL TEMPERATURE PROBES DE-ICING SYSTEM 1-37
ANGLE-OF-ATTACK VANES ANTI-ICING SYSTEMS 1-38
ENGINE RAM PRESSURE PROBE ANTI-ICING SYSTEM 1-38
WING ANTI-ICING SYSTEM 1-38
EMPENNAGE DE-ICING SYSTEM 1-39
ENGINE ANTI-ICING SYSTEM 1-40
WINDSHIELD HEATING SYSTEM 1-41

HYDRAULIC SYSTEMS 1-41

FLIGHT CONTROL SYSTEMS 1-43

AILERON SYSTEM 1-43
RUDDER SYSTEM 1-43
ELEVATOR SYSTEM 1-44
HORIZONTAL STABILIZER TRIM SYSTEM 1-45
WING FLAP SYSTEM 1-46
WING SPOILER SYSTEM 1-47

LANDING GEAR SYSTEM 1-49

NOSE GEAR STEERING SYSTEM 1-51
RUDDER PEDAL STEERING SYSTEM 1-51

BRAKE SYSTEM 1-52

ANTI-SKID SYSTEM 1-52

FLIGHT RECORDER 1-53

COCKPIT VOICE RECORDER 1-54

COMMUNICATION SYSTEMS 1-54

INTERPHONE SYSTEM (AN/AIC-18) 1-54
PUBLIC ADDRESS SYSTEM (AN/AIC-13) 1-56
UHF RADIO AN/ARC-164(V) 1-56
UHF SATELLITE TERMINAL SYSTEM (USTS) ANTENNA SUBSYSTEM 1-62
VHF AM/FM RADIO AN/ARC-186(V) 1-63
HF RADIO AN/ARC-190(V) AUTOMATIC COMMUNICATIONS SYSTEM (ACS) 1-65
MULTIPLE RADIO TRANSMIT 1-78
CADC DATA INPUT IFF AND YAW DAMPER POWER PANEL 1-78
AN/APN-244, INTERROGATOR TRANSPONDER SET 1-78

TEXT PAGE

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) 1-80.10
SECURE VOICE SYSTEM (KY-58/TSEC) VINSON 1-80.14
SECURE VOICE SYSTEM (KY-75/TSEC) PARK-HILL 1-82
ADVANCED NARROWBAND DIGITAL VOICE TERMINAL (ANDVT) 1-83
L-BAND SATELLITE COMMUNICATIONS SYSTEM (L-BAND SATCOM) 1-90

NAVIGATION SYSTEMS 1-91

VOR/ILS/MB NAVIGATION SYSTEMS (AN/ARN -147(V)) 1-91
GLIDE SLOPE SYSTEM 1-93
TACAN SYSTEMS (AN/ARN-118(V)) 1-93
HAND-HELD GLOBAL POSITIONING SYSTEM (HHGPS) 1-94
ADF SYSTEMS (ADF-73) 1-94
BEARING DISTANCE HEADING INDICATOR (BDHI) SYSTEM (ID 798/ARN) 1-95
STANDARD CENTRAL AIR DATA COMPUTER (SCADC) SYSTEM 1-95
MULTI-FUNCTION STANDBY INSTRUMENT (MFSI) SYSTEM 1-96

CONTROL DISPLAY SYSTEM (CDS) 1-98

CDS HEAT 1-98
CDS COOLING SYSTEM 1-98
REFERENCE SET PANEL (RSP) 1-99
DISPLAY UNIT (DU) 1-100
PRIMARY FLIGHT DISPLAY (PFD) 1-100
SECONDARY FLIGHT DISPLAY (SFD) 1-108
CONTROL DISPLAY SYSTEM OPERATION 1-113

COMBINED ALTITUDE RADAR ALTIMETER (CARA) SYSTEM 1-133

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) 1-134

AUTOPILOT 1-135
ALL WEATHER LANDING SYSTEM (AWLS) 1-141
AUTOTHROTTLE SYSTEM (A/T) 1-142
STALL WARNING SYSTEM 1-144
YAW DAMPING SYSTEM 1-145
AFCS MODE/STATUS ANNUNCIATIONS 1-146
AFCS CAUTIONS, WARNINGS, AND ADVISORIES (CWAS) 1-148
AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) OPERATION 1-148

TEXT PAGE

ATTITUDE HEADING REFERENCE SYSTEM (AHRS) 1-154

FLIGHT MANAGEMENT SYSTEM (FMS) 1-155

FMS COMPONENTS 1-155
POWER-UP CONDITION 1-160
INITIAL POWER-UP 1-178
DATA LOADER SYSTEM (DLS) MANAGEMENT 1-181
MAP DATUM 1-182
SENSOR MANAGEMENT 1-184
COMMUNICATION MANAGEMENT 1-192
RADIO NAVIGATION MANAGEMENT 1-194
FLIGHT PLAN MANAGEMENT 1-198
DIRECT-TO 1-213
PROGRESS PAGES 1-217
MISSION FLIGHT PARAMETERS 1-221
VERTICAL NAVIGATION (VNAV) 1-245
PERFORMANCE MANAGEMENT 1-252
TAKEOFF AND LANDING DATA 1-267
FMS CAUTION, WARNING AND ADVISORY (CWA) MESSAGES 1-295
INERTIAL NAVIGATION SYSTEM (INS) 1-303
NORMAL OPERATION OF THE FLIGHT MANAGEMENT SYSTEM 1-306

RADAR SET (AN/APS-133) 1-316

DEFENSIVE SYSTEMS (AN/AAR-47 MWS, AN/ALE-47 CMDS) 1-323

STATION KEEPING EQUIPMENT (SKE) 1-326

NORMAL PROCEDURES 1-332
PREFLIGHT PROCEDURES 1-332
IN-FLIGHT PROCEDURES 1-339

EMERGENCY LOCATOR TRANSMITTER (ELT) SYSTEM 1-342

UNDERWATER ACOUSTIC BEACON SYSTEM 1-343

LIGHTING SYSTEM 1-343

EXTERIOR LIGHTS 1-343
INTERIOR LIGHTING - FLIGHT STATION 1-343
CARGO AND SERVICE COMPARTMENT LIGHTING 1-346

CARGO LOADING EQUIPMENT 1-348

CARGO DOOR AND RAMP SYSTEM 1-348

GROUND OPERATION OF THE CARGO DOOR AND RAMP SYSTEM 1-350

TEXT	PAGE
IN-FLIGHT OPERATION OF THE CARGO DOOR AND RAMP SYSTEM	1-352
MANUAL OPERATION OF THE CARGO DOOR AND RAMP SYSTEM	1-353
AIRDROP SYSTEM (ADS)	1-355
TROOP-CARRYING EQUIPMENT	1-355
CASUALTY-CARRYING EQUIPMENT	1-355
PARATROOP EQUIPMENT	1-355
OXYGEN SYSTEM	1-357
CREW OXYGEN SYSTEM	1-357
OXYGEN PREFLIGHT CHECK	1-358
PORTABLE OXYGEN BOTTLE	1-359
TROOP OXYGEN SYSTEM	1-359
THERAPEUTIC OXYGEN SYSTEM	1-362
WARNING SYSTEMS	1-362
ALTITUDE ALERT WARNING	1-362
APU FIRE DETECTION AND WARNING SYSTEM	1-362
APU FIRE EXTINGUISHING SYSTEM	1-362
BAILOUT ALARM/WARNING SYSTEM	1-363
DOOR WARNING SYSTEM	1-363
ENGINE FIRE AND PYLON FIRE/OVERHEAT DETECTION AND WARNING SYSTEM	1-363
ENGINE FIRE EXTINGUISHER SYSTEM	1-363
TERRAIN AWARENESS AND WARNING SYSTEM (TAWS)	1-364
MASTER CAUTION SYSTEM	1-375
MAXIMUM SPEED WARNING SYSTEM	1-376
MISSILE WARNING SYSTEMS	1-376
SMOKE DETECTOR SYSTEM	1-376
STALL WARNING SYSTEM	1-376
TAKE-OFF WARNING SYSTEM	1-376
EMERGENCY EQUIPMENT	1-377
AIRCREW EYE AND RESPIRATORY PROTECTION SYSTEM (AERP)	1-377
CRASH AXE	1-377
EMERGENCY ESCAPE BREATHING DEVICE (EEBD)	1-377
EMERGENCY PASSENGER OXYGEN SYSTEM (EPOS)	1-377
ESCAPE LADDERS	1-377
ESCAPE ROPES	1-377
FIRE EXTINGUISHERS	1-377
FIREFIGHTERS SMOKE MASKS	1-378
FIRST AID KITS	1-378
LIFE RAFT PROVISIONS	1-378
LIFE VEST STOWAGE PROVISIONS	1-378
OXYGEN MASK PROVISIONS	1-378
TROOP OXYGEN MASKS	1-378
MISCELLANEOUS EQUIPMENT	1-378
BLACKOUT CURTAINS	1-378
CHECKLIST HOLDERS	1-379
COMFORT PALLETS	1-379
CREW BUNK	1-379
CREW ENTRANCE DOOR	1-379
GALLEY EQUIPMENT	1-379
INSTRUMENTS	1-379
NAVIGATOR'S ALTIMETER	1-379
FLIGHT ENGINEER'S ALTIMETER	1-379
NAVIGATOR'S TRUE AIRSPEED INDICATOR	1-379
ACCELEROMETER	1-379
CLOCKS	1-379
MAGNETIC COMPASS	1-379
TOTAL AIR TEMPERATURE INDICATOR	1-379
LAVATORY FACILITIES	1-380
LETDOWN CHART HOLDER	1-380
PERSONNEL PROTECTIVE ARMOR	1-380
PERSONNEL WARNING SIGNS	1-380
PITOT-STATIC SYSTEM	1-380
PROTECTIVE COVERS	1-380
SEATS	1-381
SIGNAL LIGHT STOWAGE	1-381
UHF FREQUENCY CARD HOLDERS	1-381
WEATHER CURTAIN	1-381

ITEM	FIG	PAGE
AC POWER DISTRIBUTION	1-179	1-426
AC POWER SYSTEM	1-178	1-424
ADS PANELS	1-256	1-579
AERIAL REFUEL SLIPWAY DOOR CONTROL HANDLE	1-173	1-418
AERIAL REFUELING INDICATOR LIGHTS	1-174	1-419

ITEM	FIG	PAGE
AERIAL REFUELING LIGHTS CONTROL PANEL	1-175	1-420
AERIAL REFUELING SYSTEM	1-172	1-416
AIR CONDITIONING MASTER SWITCH POSITION CHART	1-185	1-478
AIR TRANSPORTABLE GALLEY/ LAVATORY	1-264	1-590
AIRCRAFT ELECTRICAL SYSTEM	1-177	1-422
AN/APS-133 RADAR PANELS	1-238	1-559
ANALOG STATUS	1-123	1-293
ANTENNA LOCATIONS	1-208	1-514
ANTI-ICING SYSTEMS CONTROL PANEL	1-188	1-481
APU CONTROL PANELS	1-168	1-411
ARRIVAL RWYS	1-114	1-288
ARRIVAL STARS	1-115	1-288
ARRIVAL TRANS	1-116	1-289
ATTITUDE HEADING REFERENCE SYSTEM (AHRS)	1-229	1-550
AUTOPILOT CONTROLS AND INDICATORS	1-228	1-549
AUXILIARY POWER UNIT	1-167	1-410
BDHI SYSTEM INDICATORS AND SELECTOR SWITCHES	1-236	1-557
CABIN PRESSURE ALTITUDE CHART	1-187	1-480
CABIN PRESSURE CONTROL SYSTEM	1-186	1-479
CADC TEST SWITCHES	1-235	1-556
CARGO COMPARTMENT LIGHTING CONTROLS	1-251	1-573
CARGO DOOR AND RAMP CONTROL PANELS	1-253	1-576
CARGO DOOR CONTROL VALVE PANEL	1-255	1-578
CARGO RAMP MANUAL LOCK PINS	1-254	1-577
CARP	1-233	1-554
CARP END OF RUN	1-76	1-244
CARP INIT 1/6	1-69	1-233
CARP INIT 2/6	1-70	1-235
CARP INIT 3/6	1-71	1-236
CARP INIT 4/6	1-72	1-238
CARP INIT 5/6	1-73	1-239
CARP INIT 6/6	1-74	1-242
CARP PROGRESS	1-75	1-242
CDS MENU HIERARCHY	1-227	1-548
CHUTE LIST 1/2	1-77	1-245
CHUTE LIST 2/2	1-78	1-245
CIRCUIT BREAKER INDEX	1-182	1-442
CIRCUIT BREAKER PANELS (TYPICAL)	1-181	1-433
CLIMB 1/2	1-81	1-256
CLIMB ALTITUDE TARGET VERTICAL PROFILE	1-79	1-248
COCKPIT VOICE RECORDER/DIGITAL FLIGHT DATA RECORDER	1-202	1-507
COMBINED ALTITUDE RADAR ALTIMETER (CARA) SYSTEM	1-237	1-558
COMM TUNE INDEX	1-38	1-192
COMM TUNE MENU HIERARCHY	1-37	1-192
COMM TUNE VHF	1-39	1-193
CONFIRM ACTION	1-24A	1-180
CONTROL DISPLAY SYSTEM	1-222	1-535
CONTROL PEDESTAL	1-156	1-394
CONTROL WHEEL	1-192	1-490
COPILOT'S INSTRUMENT PANEL	1-155	1-393
COPILOT'S SIDE PANEL	1-151	1-389
COPILOT'S STATION (TYPICAL)	1-149	1-387
COUNTERMEASURES DISPENSER LOCATIONS	1-243	1-564
CREW MOVEMENT AND COMPARTMENT DIAGRAM	1-147	1-384
CRUISE	1-82	1-261
CUSTOM DATA	1-102	1-279
CUSTOM DATA LIST	1-103	1-280
CVR AND DFDR TEST SWITCH LOCATIONS	1-204	1-509
CVR COMPONENT LOCATIONS	1-203	1-508
DAMU - AIR DATA (LEFT SCREEN)	1-19	1-132

ITEM	FIG	PAGE
DAMU - APPROACH DATA (LEFT SCREEN)	1-20	1-132
DAMU BIT	1-10	1-123
DAMU DISPLAY CONTROL (LEFT SCREEN) - DAMU CONTROL (RIGHT SCREEN)	1-17	1-130
DAMU DISPLAY CONTROL (LEFT SCREEN) - HANDOFF (RIGHT SCREEN)	1-18	1-131
DAMU DISPLAY CONTROL (LEFT SCREEN) - INBOARD (RIGHT SCREEN)	1-14	1-127
DAMU DISPLAY CONTROL (LEFT SCREEN) - OUTBOARD (RIGHT SCREEN)	1-15	1-128
DAMU DISPLAY CONTROL (LEFT SCREEN) - PROCESSOR SELECT (RIGHT SCREEN)	1-16	1-129
DAMU MAIN MENU (LEFT SCREEN) - AP/FD (RIGHT SCREEN)	1-6	1-118
DAMU MAIN MENU (LEFT SCREEN) - ATT (RIGHT SCREEN)	1-5	1-117
DAMU MAIN MENU (LEFT SCREEN) - HDG (RIGHT SCREEN)	1-7	1-119
DAMU MAIN MENU (LEFT SCREEN) - PTR-1 (RIGHT SCREEN)	1-3	1-115
DAMU MAIN MENU (LEFT SCREEN) - PTR-2 (RIGHT SCREEN)	1-4	1-116
DAMU MAIN MENU (LEFT SCREEN) - SKE (RIGHT SCREEN)	1-8	1-120
DAMU MAIN MENU (LEFT SCREEN) - STATUS (RIGHT SCREEN)	1-2	1-114
DAMU PFD	1-9	1-121
DAMU SFD (HSI) (LEFT SCREEN) - ZM (RIGHT SCREEN)	1-11	1-124
DAMU SFD (LEFT SCREEN) - MAP (RIGHT SCREEN)	1-12	1-125
DAMU SFD (SKE) (LEFT SCREEN) - ZM (RIGHT SCREEN)	1-13	1-126
DATA TRANSFER	1-26	1-181
DC POWER DISTRIBUTION	1-180	1-430
DEP/ARR INDEX	1-109	1-284
DEPARTURE ARRIVAL TREE	1-108	1-283
DEPARTURE RWYS	1-110	1-285
DEPARTURE SIDS	1-111	1-285
DEPARTURE TRANS	1-112	1-286
DESCENT	1-83	1-265
DESCENT ALTITUDE TARGET VERTICAL PROFILE	1-80	1-248
DESCENT FORECAST	1-84	1-266
DIRECT / INTERCEPT	1-57	1-216
DIRECT TO MENU HIERARCHY	1-56	1-215
DIRECT TO WAYPOINT	1-44	1-200
DISCRETE STATUS	1-122	1-292
DISPLAY AVIONICS MANAGEMENT UNITS	1-223	1-538
EMERGENCY EXIT LIGHT	1-252	1-575
EMERGENCY LOCATOR TRANSMITTER (ELT) PANEL	1-247	1-569
EMERGENCY RETURN DATA RTE n 2/2	1-91	1-274.3
ENGINE CONTROLS, NORMAL OPERATION (TYPICAL)	1-163	1-405
ENGINE FUEL FLOW	1-162	1-404
ENGINE INSTRUMENTS/ INDICATORS	1-165	1-407
ENVIRONMENTAL CONTROL PANEL	1-183	1-473
ENVIRONMENTAL, ENGINE BLEED AIR AND ANTI-ICING SYSTEM	1-184	1-474
EQUAL TIME POINTS	1-61	1-219
EQUIPMENT HIST	1-120	1-291
EQUIPMENT STATUS	1-121	1-292
EXTERIOR LIGHTING CONTROL PANELS	1-249	1-571
EXTERIOR LIGHTS LOCATIONS	1-248	1-570
FIRE WARNING & EXTINGUISHING SYSTEM CONTROLS AND INDICATORS	1-261	1-588
FIX INFO	1-99	1-276
FLAP SYSTEM	1-193	1-491

ITEM	FIG	PAGE
FLIGHT CONTROL SYSTEMS	1-191	1-486
FLIGHT CREW SEATS	1-271	1-597
FLIGHT ENGINEER'S AND NAVIGATOR'S ALTIMETERS	1-268	1-594
FLIGHT ENGINEER'S ELECTRICAL PANEL	1-176	1-421
FLIGHT ENGINEER'S PANEL (TYPICAL)	1-166	1-409
FLIGHT ENGINEER'S STATION (TYPICAL)	1-159	1-399
FLIGHT MANAGEMENT SYSTEM COMPONENTS	1-230	1-551
FMS INTERFACE DIAGRAM	1-232	1-553
FROM/TO	1-104	1-280
FUEL MANAGEMENT PANEL	1-169	1-412
FUEL QUANTITY DATA TABLE	1-170	1-413
FUEL SUPPLY SYSTEM	1-171	1-414
GENERAL ARRANGEMENT DIAGRAM (TYPICAL)	1-146	1-382
GPS STATUS 1/2	1-33	1-190
GPS STATUS 2/2	1-34	1-190
HAND HELD GPS (HHGPS)	1-220	1-532
HF RADIO ACS KEYFILL PANELS	1-214	1-524
HF RADIO AN/ARC-190(V)	1-213	1-522
HIGH ALTITUDE TERRAIN DISPLAY	1-145A	1-374.9
HOLD	1-65	1-228
HYDRAULIC SYSTEMS	1-189	1-482
HYDRAULIC SYSTEMS CONTROL AND INDICATOR PANEL	1-190	1-485
IBIT RESULTS	1-126	1-294
IFF PANELS	1-216	1-526
INAV CTRL INDEX 2/2	1-32	1-189
INAV CTRL SOLN	1-30	1-187
INITIATED BIT	1-125	1-294
INS MAINT	1-124	1-293
INS POSITION UPDATE	1-31	1-188
INS STATUS	1-35	1-191
INTERIOR LIGHTS	1-250	1-572
INTERPHONE PANEL LOCATIONS	1-206	1-512
KEYBOARD ECHO TEST	1-128	1-295
KY-58 COMPONENT LOCATION	1-217	1-527
KY-75 COMPONENT LOCATION	1-218	1-529
KYV-5 COMPONENT LOCATIONS	1-219	1-530
L-BAND SATCOM COMPONENTS	1-221	1-533
LANDING DATA RTE n	1-92	1-274.4
LANDING GEAR SYSTEM LEGEND	1-195	1-495
LANDING INIT RTE n 3/4	1-88	1-273
LANDING INIT RTE n 4/4	1-89	1-274.1
LANDING ZONE INIT 1/2	1-67	1-231
LANDING ZONE INIT 2/2	1-68	1-232
LEGS HISTORY	1-49	1-207
LEGS HISTORY	1-58	1-216
LEGS PAGE PROCEDURE DISPLAY	1-51	1-209
LEGS PRIMARY	1-50	1-208
LEGS TO ALTERNATE	1-53	1-211
LOADMASTER/JUMPMASTER PANEL (TYPICAL)	1-257	1-580
LOW ALTITUDE TERRAIN AWARENESS DISPLAY (TYPICAL)	1-145	1-374.6
MAGNETIC STANDBY COMPASS	1-266	1-592
MAIN INSTRUMENT PANEL	1-152	1-390
MAIN LANDING GEAR	1-200	1-503
MAIN LANDING GEAR DOORS	1-198	1-501
MAIN LANDING GEAR FLAPPER DOOR	1-199	1-502
MAIN LANDING GEAR LEVELER ROD	1-201	1-506
MAIN MENU 1/2	1-94	1-274.6
MAIN MENU 2/2	1-95	1-274.6
MAIN MENU TREE	1-93	1-274.5
MAINTENANCE INDEX	1-119	1-291
MAINTENANCE INDEX TREE	1-118	1-291
MAP DATUMS 1/5	1-27	1-183
MARK LIST	1-105	1-281
MARK POSITION	1-97	1-275
MFCDU	1-231	1-552

ITEM	FIG	PAGE
MFCDU BIT PASS	1-22	1-178
MFCDU DISPLAY TEST	1-127	1-295
MFD CONTROLS	1-128A	1-318.1
MFSI	1-1B	1-96
MISSILE WARNING CPU LOCATION	1-241	1-562
MISSILE WARNING OPTICAL SENSOR UNIT LOCATION	1-240	1-561
MISSION PROCEDURE IDENTIFIERS	1-52	1-209
MISSION TREE	1-63	1-227
MISSIONS	1-64	1-227
MODE 1	1-131	1-371
MODE 2A	1-132	1-372
MODE2B	1-133	1-373
MODE 2B - CUTOFF	1-134	1-373
MODE 3	1-135	1-374
MODE 4A	1-136	1-374
MODE 4B	1-137	1-374.1
MODE 4C	1-139	1-374.2
MODE 5	1-140	1-374.2
MODE 6	1-142	1-374.4
MODE 6 - EXCESSIVE BANK ANGLE	1-141	1-374.3
MODE 7	1-143	1-374.4
MODE S/IFF CONTROL PANEL	1-1	1-79
MULTIPLE RADIO TRANSMIT PANEL	1-215	1-525
MULTIPLE RUN CARP INDICATIONS	1-234	1-555
NAV DATA	1-100	1-277
NAV INHIBIT	1-101	1-278
NAV TUNE INDEX	1-41	1-196
NAV TUNE MENU HIERARCHY	1-40	1-195
NAV TUNE TAC	1-43	1-197
NAV TUNE VOR	1-42	1-197
NAVIGATOR'S ALE-47 DS PANELS	1-242	1-563
NAVIGATOR'S INSTRUMENT PANEL	1-160	1-400
NAVIGATOR'S TRUE AIRSPEED INDICATOR	1-267	1-593
NOSE LANDING GEAR	1-197	1-499
NOSE LANDING GEAR EMERGENCY EXTEND SYSTEM	1-196	1-498
OPERATING ENVELOPE FOR TERRAIN CLEARANCE FLOOR (TCF) ALERTS	1-144	1-374.5
OXYGEN DURATION	1-260	1-583
OXYGEN SYSTEM	1-259	1-581
PERF INIT RTE X	1-85	1-268
PILOT'S ACCELEROMETER	1-265	1-591
PILOT'S DEFENSE SYSTEM PANELS	1-239	1-560
PILOT'S SIDE CONSOLE	1-150	1-388
PILOT'S STATION (TYPICAL)	1-148	1-386
PILOTS' CENTER INSTRUMENT PANEL	1-154	1-392
PILOTS' INSTRUMENT PANEL	1-153	1-391
PILOTS' OVERHEAD CONTROL PANELS	1-158	1-398
PILOTS' OVERHEAD CONTROL PANELS (TYPICAL)	1-157	1-397
PITOT-STATIC SYSTEM	1-270	1-596
POWER UP	1-24	1-179
POWER-UP MENU HIERARCHY	1-21	1-178
PRIMARY FLIGHT DISPLAY	1-225	1-540
PRIMARY FLIGHT DISPLAY LAYOUT	1-224	1-539
PRIMARY ROUTE	1-47	1-205
PROGRESS - ETP 3/3	1-62	1-220
PROGRESS 1/3	1-59	1-217
PROGRESS 2/3	1-60	1-218
PUBLIC ADDRESS SYSTEM CONTROLS (TYPICAL)	1-207	1-513
REMOTE DISPENSE SWITCH LOCATIONS	1-245	1-566
RENDEZVOUS	1-66	1-230
ROUTE AND LEGS PAGES MENU HIERARCHY	1-45	1-201
ROUTE PLAN	1-46	1-203
ROUTE TO ALTERNATE	1-48	1-207
SAFETY SWITCH LOCATIONS	1-244	1-565
SCADC	1-36	1-191
SECONDARY FLIGHT DISPLAY	1-226	1-544
SID REVIEW	1-113	1-287

ITEM	FIG	PAGE
SKE SYSTEM CONTROLS	1-246	1-567
SKE TEST	1-129	1-336
SOLUTION MENU HIERARCHY	1-29	1-187
STAR REVIEW	1-117	1-290
STATIC LINE RETRIEVER WINCH CONTROL HANDLE	1-258	1-580
STORED ROUTE LIST	1-98	1-276
SYSTEM CONDITION LIGHTS	1-261	1-586
SYSTEM CONTROL	1-96	1-275
TABLE OF COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT	1-205	1-510
TACTICAL MISSION MODE	1-138	1-374.1
TAKEOFF DATA RTE n 1/2	1-90	1-274.2
TAKEOFF INIT RTE n 1/4	1-86	1-270
TAKEOFF INIT RTE n 2/4	1-87	1-272
TAWS CONTROLS AND INDICATORS	1-130	1-368
THE ENGINE	1-161	1-403
THROTTLE POSITIONS	1-164	1-406
TIMEOUT	1-23	1-178
TIMERS	1-106	1-282
TOTAL AIR TEMPERATURE INDICATOR	1-269	1-595
TRANSPONDER CONTROLS AND INDICATORS	1-1A	1-80.9
TYPICAL BLOWER INSTALLATION MOUNTING PROVISIONS	1-263	1-589
UHF RADIO AN/ARC-164(V) DIGITAL	1-211	1-520
UNDERDECK ELECTRONICS EQUIPMENT	1-209	1-515
USER DEFINED DATUM	1-28	1-183
USTS ANTENNA SUBSYSTEM	1-210	1-518
VHF RADIO AN/ARC-186(V)	1-212	1-521
WAYPOINT DATA 1/2	1-54	1-211
WAYPOINT DATA 2/2	1-55	1-212
WAYPOINT SELECT	1-25	1-180.1
WING SPOILER SYSTEM	1-194	1-492
ZEROIZE	1-107	1-282

THE AIRCRAFT.

The C-141 Starlifter, manufactured by the Lockheed Georgia Company, is a long-range, high-speed, high altitude, swept-wing monoplane, designed for use as a heavy logistic transport. The aircraft is designed to airlift various types of combat support equipment, personnel, air evac patients, and fully assembled missiles. It also has an aerial delivery system capability. The aircraft is equipped with a fully retractable tricycle landing gear and a steerable nose wheel. The landing gear consists of two "four-wheel bogie" type main gears which mount dual wheels forward and aft of the shock strut (in pods on each side of the aircraft), and a steerable, dual nose wheel. The aircraft is powered by four Pratt & Whitney turbofan jet engines that are equipped with target type thrust reverser doors which are used to assist in decelerating the aircraft on the ground. The aircraft has an auxiliary power unit (APU), located in the forward portion of the left wheel pod, which provides electrical and pneumatic power for starting the engines, and can be used to satisfy other electrical and pneumatic requirements of the aircraft while the aircraft is on the ground. The aircraft has in-flight refueling capability. (See figures 1-146 through 1-160.)

AIRCRAFT DIMENSIONS.

The principal dimensions of the aircraft are:

Span	160 feet
Length	168 feet 4 inches
Height (Minimum, stabilizer and elevators neutral)	39 feet 3 inches
Height (Minimum, stabilizer bullet tip full down, elevators full up)	40 feet 7 inches
Stabilizer Span	50 feet 4 inches
Tread Centerline of outboard main tires	20 feet 2 inches

Refer to figure 1-147 for the cargo compartment's sectional view dimensions. Refer to figure 2-4 for ground clearance dimensions.

AIRCRAFT GROSS WEIGHT.

The normal maximum ramp gross weight is 325,000 pounds. For complete weight information, see Section V.

INTERIOR ARRANGEMENT.

The flight station and cargo compartment are pressurized. Loading is through the aft cargo door. The aircraft is fitted with a complete rapid cargo loading and tiedown system. The rapid cargo loading system uses roller conveyor sections running forward and aft in the cargo compartment. The roller conveyor channels are mounted in recesses on each side of the floor panels, with the rollers sticking up about 1-1/2 inches above the floor. When not used, the roller conveyor channels are turned over in the recesses and fit flush with the floor panels. A power winch is provided in the forward part of the compartment to winch cargo into the main compartment. The cargo tiedown system restrains cargo movement.

TURBOFAN ENGINES.

The aircraft is equipped with four axial flow Pratt & Whitney TF33-P-7 flat rated, forward fan engines. The engine thrust output is 20,250 lbs at TRT (Take-off Rated Thrust) for temperatures below 15° C at sea level. Above 15° C thrust decreases with increasing temperature. The TF33-P-7 engine has two compressors which, with their respective turbines, form two rotor systems that are mechanically independent but related by airflow (figure 1-161). The low pressure compressor (N_1) consists of a two-stage large diameter fan, plus seven additional compression stages and is driven by a three-stage turbine. The high pressure compressor (N_2) has seven compression stages and is driven by a single stage turbine. This fan engine consists of two basic airflows. The primary airflow flows through the large two stage fan and into the engine. The secondary airflow flows through the fan only and is discharged into a bifurcated fan duct which directs the airflow aft to be expelled through the fan nozzle. A hydromechanical fuel control establishes the engine thrust output in accordance with a predetermined schedule set by the throttle. Engine bleed air is used for starting, air conditioning, engine anti-icing, wing anti-icing, fuel heat, rain removal, under floor heat, fan duct seals, Zone II cooling, and CSD oil tank pressurization control systems. There are two accessory cases on the engine. One is on the air inlet case (auxiliary drive housing), which mounts the N_1 compressor tachometer generator and an oil scavenge pump. The other case is on the bottom of the engine (main accessory drive housing), which mounts the main oil pumps, engine fuel control, constant speed drive and engine generator, engine fuel pump, thrust reverser pump, hydraulic pump, N_2 compressor tachometer generator, and pneumatic starter. The engines are identically mounted in nacelles suspended below the wing. The power plant nacelle consists of the engine and installed accessories, nose dome, nose cowling, forward cowling, bifurcated duct, aft cowling and duct assembly, engine tail pipe, fan duct nozzle, thrust reverser assembly and stang fairings. Access doors are provided in the cowling for engine and constant speed drive oil tank servicing, engine and CSD oil coolers, oil cooler bypass valves, thrust reverser regulator valve and fire extinguisher access. Auxiliary air doors are installed around the periphery of the nose cowl to provide an additional source of air for ground operation and high power settings at slow airspeeds. The doors are spring-loaded to the closed position and are opened by differential pressure that exists between the inlet duct and outside air during engine operation. Thrust output is indicated by the ratio of exhaust gas total pressure to inlet total pressure and is displayed to the crew by the engine pressure ratio instruments.

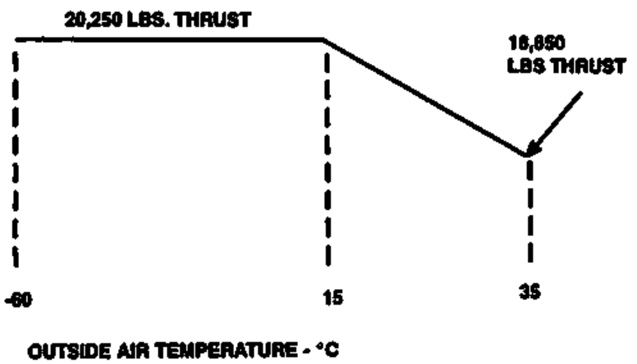
COMPRESSOR SURGE BLEED SYSTEM.

Since the stages of the twin-spool compressor assembly are matched to perform at optimum efficiency at or near normal operating RPM, some discrepancy in airflow through the sixteen compressor stages will exist when operating at low RPM, during acceleration from standstill to steady RPM, and during deceleration. During these conditions, the first few stages of the compressor assembly would deliver more air than the last few stages of the compressor assembly could handle without stalling. Therefore, to prevent compressor stall and surge during these conditions, a surge bleed system is incorporated consisting of a 6-inch diameter surge bleed valve, located on the right side of the compressor case, and a 4-3/4-inch diameter surge bleed valve, located on the left side of the compressor case. These valves are controlled by differential pressure sensed between the compressor inlet and the ninth stage, and will relieve 12th stage pressure when actuated to the open position. The actuation pressure for the system is obtained from the 16th stage air. The control for the surge bleed system is designed so that the 4-3/4-inch valve will remain closed during all operating conditions except during rapid deceleration, when it will open to assist the 6-inch valve to relieve the 12th stage pressure. The 6-inch valve is open when the engine is not operating and remains open until N_2 compressor RPM reaches approximately 80% RPM, when it closes. Above 80% N_2 RPM, this valve opens during rapid deceleration and when the engine approaches a compressor stall. During normal, on-speed operation, both bleed valves remain closed until N_2 RPM is reduced below 80% RPM, when the 6-inch valve again opens. The 12th stage air, when relieved by either or both of the two surge bleed valves, is ported into the fan duct.

ENGINE THRUST.

The primary purpose of the flat-rated engine is to provide constant thrust over a wide ambient temperature range. Below 15° C, the engine operating at sea level develops 20,250 pounds of static thrust. Above 15° C, thrust decreases with increasing temperatures. The amount of thrust is obtained by measuring the ratio between the air inlet total pressure and the exhaust gas total pressure.

FLAT RATED ENGINE



CONDITIONS:

SEA LEVEL
STATIC
TAKEOFF RATED THRUST

141A-1-X3/0-097

ENGINE FUEL SYSTEM.

The engine fuel system is shown schematically in figure 1-162.

Engine-Driven Fuel Pumps.

Each engine has a two-stage fuel pump which receives pressurized fuel from the aircraft fuel system and increases the pressure and supply fuel to the control units. The fuel tank boost pumps can supply the engine gear pump for all power settings needed for normal engine operation.

Fuel Control System.

Pressurized fuel from the second stage of the engine driven fuel pump is delivered to the fuel control which then meters fuel at pressures and flow rates required to obtain desired engine operation. The fuel control is driven by the N_2 compressor through an accessory drive train; it incorporates an electrically controlled fuel shutoff valve, a solenoid-operated fuel enrichment valve, and a mechanical lever connected to the throttle linkage. The control performs the following functions:

1. It automatically provides a fuel starting schedule to allow the engine to accelerate from standstill to steady idle RPM without exceeding the temperature limits or compressor surge limits.

2. During flight, it maintains a constant turbine inlet temperature for each given throttle setting.

3. It prevents overtemperature and compressor surging during acceleration, and prevents flameout during rapid deceleration.

4. It affords protection against overspeeds.

Fuel Pressurizing and Dump Valve.

Fuel leaving the fuel-oil cooler is ported into the fuel pressurizing and dump valve. This consists of a fuel inlet check valve, a self-relieving filter, a manifold dump valve, and a pressurizing valve. The inlet check valve prevents fuel from draining overboard from the fuel-oil cooler when the engine is not operating. The manifold dump valve opens when the engine is shut down and allows fuel from the primary and secondary manifold to drain overboard, assisted by the air pressure within the combustion chamber which persists until the compressor rotation decreases to a low value.

Fuel Manifolds.

The dual manifold is used to provide proper fuel nozzle pressures and spray patterns during all operating conditions.

Fuel Heater.

A fuel de-icing heater (figures 1-161 and 1-162) and an air-fuel heat exchanger provides temperature control of the fuel entering the fuel filter. The heater prevents engine malfunction due to fuel filter icing, and consists of an air chamber surrounded by a fuel jacket. Engine bleed air from one of the outside diameter ports is circulated through the air chamber, and the heat from this air is transferred to the fuel circulating in the fuel jacket. During engine operation, all of the fuel from the first stage of the fuel pump passes through the fuel heater. The airflow through each heater is controlled by a FUEL HEATER switch located on the flight engineer's fuel management panel.

Fuel Bypass.

Fuel filter flow is monitored by a fuel filter bypass system. When the differential pressure across the fuel filter reaches a point slightly lower than that required to open the bypass valve, a FIL BY-PASS light on the flight engineer's fuel management panel will illuminate, warning of a clogging condition in the fuel filter.

Fuel Heater Switch.

Four 2-position ("ON", "OFF") FUEL HEATER switches, one for each engine, are provided on the flight engineer's fuel management panel (figure 1-169). The "ON" position of these switches energizes the DC motor of the related fuel heater valve, opening the valve to allow bleed air to enter the heater assembly and transfer heat to the fuel. The "OFF" position energizes the related heater valve closed.

Fuel Heater Operation.

On the ground, the fuel heaters may be used at idle thrust if the engines have been operating at idle for five minutes or more. If fuel heater operation is required and the engines have not been at idle for five minutes or more, the fuel flow should be increased to a minimum of 1,500 PPH before operating the fuel heaters.

NOTE

Fuel heaters should not be used for take-off or go-around.

Prior to take-off, with all fuels, the fuel heaters should be turned on for one minute when the fuel temperature is 0° C or below. In flight with alternate fuels, whenever the fuel temperature is 0° C or below the fuel heaters should be turned on for one minute every 30 minutes as long as the low fuel temperature exists.

Turn on the fuel heater when the FIL BY-PASS light illuminates or fuel flow is fluctuating for any unexplained reason (see Section III).

Engine Fuel Enrichment System.

A fuel enrichment system is provided for ground starting cold-soaked engines and airstarts.

A FUEL ENRICHMENT switch (figure 1-163) opens the fuel enrichment valve when actuated. Additional fuel bypasses the metering portion of the engine fuel control unit and flows to the burner nozzles. The system is designed so that enrichment fuel is automatically shut off any time fuel flow exceeds 1,500 PPH.

The fuel enrichment switch should be turned off after engine start.

Engine Fuel System Temperature Indicator and Selector Switch.

A FUEL IN TEMP indicator and a two-position ("OUTBD", "INBD") toggle switch are located on the lower center of the fuel management panel. The switch permits selective indication of fuel temperature in the No. 1 and No. 2 engine feed lines.

Engine Fuel System Indicator Lights.

Two engine fuel system indicator lights, a PUMP OUT and a FIL BY-PASS light, are provided on the flight engineer's fuel management panel (figure 1-169) for each engine.

The PUMP OUT light illuminates if differential pressure across the first stage of the engine-driven pump drops below 10 PSID, thereby indicating failure of that pump. Illumination of the FIL BY-PASS light indicates the filter is clogged by icing or solid contaminants.

OIL SYSTEM.

Each engine has an integral oil system which includes a 7.8-gallon oil tank. The tank contains approximately 6 gallons of oil, of which 4.1 gallons are usable. Oil flows from the tank to a gear-type, engine-driven pump which supplies oil to the engine bearings. Scavenge pumps remove oil from these areas and return it to the oil tank through oil coolers. These coolers are of the air-oil and fuel-oil type and are thermostatically controlled. To monitor the oil system, each engine has a low quantity warning light, an oil pressure indicator, a low pressure warning light, and an oil temperature indicator.

Oil Pressure Indicator.

The oil pressure indicating system consists of a pressure transmitter and a pressure indicator for each engine. The OIL PRESS indicator (figure 1-165) is located on the flight engineer's panel.

Low Oil Pressure Warning Light.

A LOW OIL PRESSURE warning light (figures 1-154 and 1-165) for each engine is located on the pilots' center instrument panel and is controlled by two pressure switches. One switch will cause the light to illuminate whenever the pressure becomes less than approximately 33 PSI, indicating a failure in the oil system. The light extinguishes at approximately 38 PSI. The other switch will cause the light to illuminate whenever the pressure differential across the main engine oil filter becomes approximately 50 PSID, indicating a possible clogged filter.

The low pressure warning light may remain illuminated up to 2 minutes after engine start of a cold soaked engine with oil temperature at approximately 40° C and pressure within limits.

Oil Temperature Indicators.

An OIL TEMP indicator (figure 1-165) for each engine is located on the flight engineer's engine instrument panel.

Low Oil Quantity Lights.

A LOW OIL QTY light (figure 1-165) for each engine is located on the flight engineer's engine panel. The light illuminates when the amount of remaining usable oil reaches 25 percent of usable oil in each tank (approximately one gallon).

IGNITION SYSTEM.

The engine ignition system consists of an ignition exciter, two high-tension ignition leads, and two spark igniters. The spark igniters are located in combustion chambers No. 4 and No. 5. The high-tension leads carry the high ignition voltage from the ignition exciter to the spark igniters. The ignition exciter unit contains two separate systems. One is a 20-Joule intermittent system used during all engine starts, and the other is a 4-Joule continuous ignition system.

Fuel and Start Ignition Switch.

Four 3-position ("RUN", "AIR START", "STOP") lever-lock FUEL AND START IGNITION switches (figure 1-163), are provided, one for each engine, on the pilots' forward overhead panel for controlling the related ignition systems and fuel shutoff valves. The "RUN" position and the momentary "AIR START" position energize the 28-volt DC motor of the fuel shutoff valve, opening the valve. If the related STARTER button has been actuated to START, the "RUN" position also energizes the 28-volt, 20-Joule ignition exciter. The "AIR START" position energizes the ignition exciter regardless of the position of the STARTER button. The "STOP" position energizes the fuel shutoff valve closed. Power for operation of the fuel shutoff valves and the ignition exciters is supplied from the isolated DC bus.

CONTINUOUS IGNITION SYSTEM.

The 4-Joule continuous ignition system is an auxiliary system that minimizes the possibility of an engine flameout due to temporary fluctuations under operating conditions other than starting. When the continuous igniter plug is operating, the engine automatically relights as soon as the condition causing flameout corrects itself. A single CONTINUOUS IGNITION switch (figure 1-163), located on the pilots' overhead panel, arms the continuous ignition systems on all four engines. When the switch is "ON" AC current is fed into the continuous ignition exciter. The current is then passed through a series of filters, transformers, and rectifiers until a high voltage DC current is obtained that will ionize the gap in the continuous ignition spark igniter in No. 4 combustion chamber and provide a continuous spark as long as the CONTINUOUS IGNITION switch is "ON" and the FUEL AND START IGNITION switch is in the "RUN" position.

Continuous Ignition Switch.

A CONTINUOUS IGNITION switch (figure 1-163) is located on the pilots' overhead start panel and controls the continuous ignition systems on all four engines. It is a lever-lock switch that arms all four continuous ignition systems.

STARTING SYSTEM.

Each engine is equipped with a starting system consisting of a pneumatic starter, starter control valve, pneumatic ducting, and the starting and ignition control system. The starter, when supplied with pneumatic and electric power, rotates the N_2 compressor rotor until a predetermined starter or engine speed has been reached. At this time a cutout switch, located in the starter, is actuated and closes the starter control valve. When the starter control valve is closed the starter is disengaged from the engine by means of a clutch. Electric power for starting the engine may be supplied from an external ground source, the aircraft battery, from the aircraft auxiliary power unit (APU), or any operating engine. Pneumatic power may be supplied to the starter from an external ground source, the APU, or any operating engine through the aircraft pneumatic system ducting. The starting system provides automatic operation of the starter and control valve once the STARTER button has been depressed. The FUEL AND START IGNITION switch circuit provides control of the starting fuel and ignition and has no direct control over the engine starter or starter control valve.

Starter Button.

Four 2-position (START, STOP) STARTER buttons (figure 1-163) are on the pilots' forward overhead panel. The buttons control the opening of the related starter control valve. Depressing the button energizes the valve solenoid, opening the valve. A holding coil automatically holds the button in the depressed (START) position until the N_2 compressor speed increases to between 35 and 45 percent RPM. A cutout switch then automatically releases the button, allowing it to pop out. The button can be manually pulled out at any time. A red light in the center of the button glows while the button is in the START position. A guard is provided around the button to prevent inadvertent energizing of the starter. The overheat protection normally provided by the automatic closing feature of the pylon shutoff, wing isolation and floor heat shutoff valves is removed when a STARTER button is in the START position.

Starter Valve Light.

Four STARTER VALVE OPEN lights (figure 1-165) are on the pilots' center instrument panel, one for each engine. The light illuminates when the related starter control valve is opened and remains illuminated until the valve is closed.

THROTTLES.

Two sets of four throttles (figure 1-163) are located on the pilot's control pedestal. The throttle quadrant has positions marked "FULL REV", "REV IDLE", "IDLE START," and "TAKEOFF." The engines are started and shut down with the throttles in "IDLE START." The pilots can move any throttle from "IDLE START" to "TAKEOFF." This part of the quadrant is the flight range, and it is not possible for the pilots to extend the thrust reversers while the throttles are being moved in this area. A common shaft connects all the throttles, although each throttle is independent of the others, so that any combination of power can be set by the pilots. Each set of throttles can be moved simultaneously by one hand. Detents are provided in the throttle quadrant to locate frequently used throttle positions. The detent at "IDLE START" prevents inadvertent movement of the throttles into the reverse thrust area of the quadrant.

ENGINE INSTRUMENTS.

The engine instruments consist of five integrally lighted, hermetically sealed, vertical scale indicators (VSI) (figure 1-165) and are located on the pilots' center instrument panel and on the flight engineer's panel. Each instrument monitors engine operating conditions by showing four servo-driven vertical tapes against a fixed scale.

An electrical or mechanical malfunction of one instrument will not affect any other of the VSI instruments. A black "OFF" position is displayed against a red fluorescent portion of the tape to indicate a power-off condition of the instruments. The tape drive mechanism incorporates lower and upper stops that limit tape travel. A series of off-scale indicator dots is located on the upper portion of the exhaust gas temperature and fuel flow tapes. The dots provide indications of EGT or fuel flow that are less than that which would be registered by the lowest mark on the respective fixed scale. The distance between the centers of the dots is equal to the distance between the smallest increments of scale graduation at the bottom of the indicator scales. The dots permit indications down to -60° C EGT and zero PPH, respectively.

Engine Pressure Ratio (EPR) Indicator.

An Engine Pressure Ratio (EPR) indicator (figure 1-165) shows the ratio of engine turbine exit (exhaust) total pressure to compressor inlet total pressure which is used as a measure of engine thrust. The engine exhaust and inlet total pressures are compared by a converter-transmitter which electrically transmits an indication to the EPR indicator that is calibrated from 1.0 to 2.3.

N_1 and N_2 RPM Indicators.

Two engine RPM indicators (figure 1-165) indicate the speed of the low-pressure compressor rotor (N_1) and the high-pressure compressor rotor (N_2). The N_1 indicator monitors the individual speeds of all four engine low-pressure rotors, and the N_2 indicator monitors the individual speeds of all four engine high-pressure rotors.

Exhaust Gas Temperature (EGT) Indicator.

Exhaust gas temperature of each engine is shown on the EGT indicator (figure 1-165). The EGT indicator is calibrated from 0° to 700° C.

Fuel Flow Indicator.

A fuel flow indicator (figure 1-165) shows fuel flow in 1,000 pounds per hour, and is calibrated from 400 to 16,000 PPH.

Engine Vibration Indicating System.

Engine vibration is monitored by an engine vibration indicating system. This system consists of two vibration pickups mounted on the engine, a vibration indicator, FILTER selector switch, a PICKUP selector switch mounted on the flight engineer's instrument panel, and a pickup selector relay mounted on the underdeck relay panel. The vibration pickups detect engine vibration over a wide frequency range. The signals from the pickups are displayed on the indicator as a displacement which is the engine's radial movement. The indicator is graduated in units of relative amplitude which is equal to MILS (1/1000-inch) single amplitude displacement.

The FILTER selector switch is spring-loaded to the "LOW" position. In this position the indicator will reflect both high and low rotor displacement. In the "HI" position, the high filter blocks out the low rotor frequencies, and only displacement associated with high rotor unbalance will be displayed on the indicator.

The PICKUP selector switch selects either of the two pickups on the engine. In the "FWD" position, signals from the pickup mounted on the compressor case are selected. The "AFT" position selects signals from the pickup mounted on the turbine case.

ENGINE THRUST REVERSER SYSTEM.

Each engine nacelle is equipped with an independent thrust reverser system operated through the throttle control quadrant. The system permits reverse thrust application of engine power and is used during ground operation only. Two target-type, thrust reverser doors are extended or stowed by hydraulic actuators acting through a mechanical linkage. The thrust reversers are mechanically and electrically actuated and hydraulically operated. Each thrust reverser system consists of a hydraulic pump, filter, two actuators, a control assembly, a flow regulator, a mechanical lockout, and indicator lights. Oil for actuation of the system is taken from the CSD (constant speed drive) reservoir. The fluid is circulated through the thrust reverser system and then ported through the CSD oil cooler and back to the reservoir.

WARNING

Engine thrust reverse shall not be attempted during flight.

Thrust Reverser System Operation.

Thrust reverser operation is initiated by retarding the throttles to "IDLE START" and then lifting them 1-1/8 inches to clear the detent stop. Further aft movement of the throttle levers causes the thrust reversers to extend. The reverser doors are moved from the stowed position to the extended position and back to the stowed and locked position by hydraulic actuators that are pressurized by an engine-driven hydraulic pump. When fully extended, the doors mechanically actuate a mechanical interlock on the throttle linkage, allowing the throttle to be moved from the "REV IDLE" position to the "FULL REV" thrust position. The diverted engine exhaust gases which are deflected forward by the reverser doors produce the desired reverse thrust. When the throttle is moved from the reverse thrust range to the forward thrust range, the reverser doors are actuated to the stowed position. Indicator lights are provided on the pilots' center instrument panel and the engineer's station to show the position of the reverser doors and the condition of the system. When the reverser is stowed and locked, all indicator lights are extinguished.

THRUST REVERSE LIMITER Knob.

A THRUST REVERSE LIMITER knob (figure 1-163) provides a means of limiting reverse thrust.

THRUST REVERSE LIMITER Operation.

The THRUST REVERSE LIMITER knob is set to prevent exceeding engine and thrust reverse operating limits and structural loads. This is accomplished by a slotted cam arrangement which changes the mechanical advantage between the throttle and the fuel control power lever throughout the operating environment of the aircraft. Any setting of the THRUST REVERSE LIMITER knob allows full movement of the throttles to the "FULL REV" position.

CAUTION

After reaching the stops at the "0" or "12" index indicator position, only a slight additional amount of turning force may damage the reverser limiter internally. If this occurs the calibration between the index indicator and the THRUST REVERSE LIMITER is no longer valid.

Thrust Reverser System Indicator Lights.

A THRUST REV NOT LOCKED light, a THRUST REV EXTENDED light, and a PRESS light are provided for each engine. The THRUST REV NOT LOCKED light and the THRUST REV EXTENDED light (figures 1-154 and 1-165) are located on the pilots' center instrument panel. The PRESS light (figure 1-166) is located on the flight engineer's panel. The PRESS light illuminates when the related hydraulic control valve assembly is pressurized. The THRUST REV NOT LOCKED light illuminates when the related thrust reversers are moved from the stowed (not closed and locked) position. The THRUST REV EXTENDED light illuminates when the related thrust reversers are fully extended. All three of the lights are illuminated when the related thrust reversers are fully extended. When the reversers are stowed and locked, all indicator lights are extinguished.

ENGINE OPERATION.

Normal Engine Starting Sequence.

The engine starting system provides automatic operation of the starter and control valve once the STARTER button has been depressed. The FUEL & START IGNITION switch circuit only controls the starting fuel and ignition. During a normal start, the following actions take place automatically:

PERCENT ENGINE RPM (APPROX.)	ACTION	CONTROLLED BY
0 - 45 N_2	Starter Control Valve Opens	STARTER button
0 - 45 N_2	Starter is Engaged	STARTER button
15 N_2	Ignition System is Energized	FUEL AND START IGNITION switch
15 N_2	Fuel Shutoff Valve Opens	FUEL AND START IGNITION switch
35 - 45 N_2	Starter Control Valve Closes	Starter cutout switch
35 - 45 N_2	Starter is Disengaged	Starter clutch mechanism
35 - 58 N_2	Engine Idle Range	Fuel control governor unit

Engine Turbine Blade Creep.

Turbine blades are frequently the first parts to suffer distress in a gas turbine engine that has been operated too long at high thrust. High temperatures, high blade loadings, and high RPM will cause the blades to neck down and stretch (creep). The more conservative the engine operation, the longer the turbine blades will last and the longer the time between overhauls.

Hot Start.

This occurs when the engine lights off but the EGT exceeds the starting limit of 455° C. EGT and fuel flow should be carefully monitored during a start. If EGT approaches 400° C, or fuel flow is higher than normal, the start should be immediately discontinued. No further attempt should be made to start the engine until an inspection is made and the cause corrected.

CAUSES.

Possible causes for a hot start are:

1. FUEL AND START IGNITION switch placed in "RUN" prior to established N_2 RPM for starting.
2. Low manifold pressure.
3. No N_1 RPM during start (possibly frozen due to ice in inlet).
4. Faulty fuel control.

False or Hung Start.

This condition occurs when the engine lights off normally, but fails to accelerate to idle RPM. If the condition is allowed to continue, a hot start may result.

CAUSES.

Possible causes for a false or hung start are:

1. Insufficient manifold pressure.
2. Faulty fuel control.
3. Early starter dropout.
4. 6-inch surge bleed valve stuck closed.

No Start.

The engine does not light off within a normal 20 second time limit.

CAUSES.

Possible causes for no start are:

1. Insufficient electrical power.
2. No fuel to the engine.
3. Difficulty in the ignition system or at the igniter plugs.
4. Faulty fuel control.

Engine Compressor Stall.

Compressor stalls are a result of some change in airflow pattern within the engine wherein the airflow and compressor speeds are no longer compatible. Stalls may be recognized by pulsations through the aircraft structure. They may be heard or they may only be known by the inability of the engine to accelerate properly or by the engine decelerating when the throttle has not been moved. Stalls can range from a mild form which gives off no sound or motion to one that causes a very loud bang.

There are several things that can be done to avoid compressor stall, or to reduce its intensity. Erratic and abrupt throttle movements should be avoided. Rapid throttle advances at low airspeeds are sometimes the cause of stalls. Once a stall occurs, slowly retard throttle until the stall ceases and then slowly advancing the throttle may correct the condition. During periods of compressor stall, observe EGT closely and reduce throttle to avoid overtemping. Operation at a reduced angle of attack and higher airspeed may help to eliminate the stall condition. If the stall condition cannot be controlled, shut down the engine.

Flameout.

A flameout is the loss of flame in the combustion section followed by rapid loss of all engine indications with the corresponding warning lights: generator out light, low oil pressure light, engine fuel pump out light, etc.

Rollback.

A rollback is the uncommanded reduction of engine power to idle or sub-idle without corresponding throttle movement. A sub-idle engine may show an EGT increase developing into an over-temperature condition requiring engine shutdown. A rollback is usually caused by a degradation of bleed air or fuel scheduling.

AUXILIARY POWER UNIT (APU).

The APU (figure 1-167), located in the left wheel well, supplies air for engine starting, and environmental systems, and mechanically drives an AC generator during ground operation only. The unit consists of a compressor assembly, power turbine assembly, and an accessory assembly.

COMPRESSOR ASSEMBLY.

The compressor assembly (figure 1-167) consists of two interconnected centrifugal compressor stages, a discharge diffuser and de-swirl assembly. Air from the compressor is delivered to the power turbine plenum chamber. A portion of the plenum air is bled off to furnish bleed air for aircraft environmental systems or engine starts. The remainder of the air enters the power turbine assembly.

POWER TURBINE ASSEMBLY.

The power turbine assembly (figure 1-167) consists of the power turbine plenum chamber, the combustor can, and turbine wheel.

ACCESSORY ASSEMBLY.

The APU accessory assembly consists of a starter, oil and fuel pumps, oil cooler, fuel governor, centrifugal speed switch, and a 50 KVA AC generator. The accessories, with the exception of the starter, are driven through a reduction gear train connected directly to the compressor drive shaft. The starter is coupled to the drive shaft through a clutch which is disengaged when the APU is running.

APU OIL SYSTEM.

The oil system provides lubrication for all gears and shaft bearings. Oil from an externally mounted reservoir is delivered to the gears and bearings through the oil pump mounted on the accessory case. A relief valve maintains the desired oil pressure. Temperature is controlled by an oil cooler in the system. An oil temperature switch automatically shuts down the APU when temperature exceeds approximately 120 ° C. A sequencing switch in the oil system is actuated at 3.5 PSI. When the switch is actuated, one set of contacts completes the circuit to the ignition unit and a second set of contacts opens the circuit to the door closing actuators. During APU shutdown, the door closing circuit is completed through the switch contacts when oil pressure decreases to 3.5 PSI. A low oil pressure switch in the oil system automatically shuts down the APU if oil pressure drops to approximately 55 PSI when the engine is operating above 95 percent.

APU FUEL SYSTEM.

Fuel is supplied to the APU fuel pump from the No. 2 main fuel tank. The fuel pressure is maintained by the APU fuel pump and supplied to the combustor through a fuel governor. Fuel supply to the APU may be shut off by the APU control switch or the fire handle.

APU STARTING SYSTEM.

The APU is started by a hydraulic motor which receives its power from two accumulators. These accumulators are pressurized from the No. 3 hydraulic system of the aircraft. An additional accumulator is installed in the APU starter inlet line. This accumulator acts as a shock absorber, absorbing the initial starting pressure.

APU SPEED CONTROL.

Speed of the APU is controlled by the fuel governor which regulates fuel flow into the combustor to maintain a constant speed under varying load conditions. The centrifugal speed switch causes the fuel valve to shut off fuel when turbine speed exceeds 110 percent.

APU CONTROLS.

The normal operating controls, other than those mounted on the APU itself, are located on the APU control panel (figure 1-168).

APU Control Switch.

The APU CONT switch is a three-position ("OFF", "RUN", "START") rotary switch. Setting the spring-loaded switch to "START" energizes the self-holding start relay. This relay will remain closed until the circuit is broken by the centrifugal speed switch at 35 percent or by setting the control switch to "OFF". When the switch is released from "START", it will move to "RUN" by spring action. When the switch is at "RUN", all APU electrical circuits are energized and controlled by their automatic controls. When the switch is set to "OFF", all circuits are deenergized.

APU Accumulator Selector Switch.

The APU ACCUM SEL switch is a three-position ("BOTH", "NO. 1", "NO. 2") toggle switch. A start capability is provided by selecting the accumulator as desired.

APU Door Controls.

The APU DOOR switch located on the APU control panel is a three-position ("OPEN", "OFF", "CLOSED") switch. When the switch is set to "OPEN" or "CLOSED", the air intake door is actuated to the selected position. The door must be fully open before the APU CONT switch will receive power for APU operation. Automatic door closing is initiated by pulling the APU FIRE handle or by actuation of the touchdown relay. When the handle is pulled, the APU circuits are deenergized and the air intake door closes.

The APU door closing sequence is delayed during APU shutdown. This delay prevents overheat or exhaust condensation damage to the APU. If the aircraft takes off with the APU running, the APU shuts down.

Bleed Load and Flow Control Valve.

The BLEED LOAD AND FLOW CONTROL VALVE switch controls the solenoid-operated bleed air valve. The switch is interlocked through a 95 percent speed switch which prevents an air load from being applied to the APU before it reaches operating speed. Setting the switch from "CLOSE" to "OPEN" will supply air to the environmental systems or for engine starting.

APU Fire Handle.

(See paragraph titled Fire Handles under Emergency Equipment in this section).

APU INDICATORS.

The indicators for the APU consist of lights and an Exhaust Gas Temperature (EGT) indicator located on the APU control panel. If electrical power failure occurs, the word OFF will be in view on the face of the indicator.

Start Light.

The START light illuminates to indicate that the starter is operating. The light extinguishes when the APU reaches starter cutout speed.

On Speed Light.

The ON SPEED light illuminates to indicate the APU is at operating speed.

APU Door Warning Light.

The door warning light illuminates to show NOT CLOSED when the APU doors are not fully closed.

APU OPERATING INSTRUCTIONS.

The APU can be operated on the ground only and is operated from the APU control panel on the flight engineer's instrument panel.

WARNING

During all starts and operation of the APU, the battery switch will be "ON". Additionally, personnel must stay clear of the air intake, the exhaust, and the plane of rotation of the turbine and compressor. Exercise extreme care to prevent entry of foreign material into the intake.

Starting the APU.

To start the APU:

1. If external power is to be used to start the APU, place the power selector switch to "EXT". The battery switch must be "ON".

2. Set APU DOOR switch to "OPEN". The NOT CLOSED indicator light should illuminate.

3. Check accumulator pressure. If less than 3,000 PSI, pressurize with the handpump or the No. 3 system hydraulic pumps.

4. Set the BLEED LOAD AND FLOW CONTROL VALVE to "CLOSE", and check that the auxiliary generator control switch is in the "OFF" position.

5. Hold the APU CONT switch momentarily in "START" and then release to "RUN". The START light should illuminate and then extinguish when the APU accelerates to starter cutout speed. When the APU accelerates to operating speed, the ON SPEED light should illuminate.

CAUTION

- If the ON-SPEED light does not illuminate within 20 seconds after illumination of the START light, move APU CONT switch to "OFF".
- If low accumulator pressure is suspected, a second start may be attempted.

6. Monitor the EGT indicator during the start of operation.

CAUTION

A scanner or flight engineer will monitor the audible APU Fire Warning System at all times when the APU is required by the aircrew.

Loading Operation.

Apply electrical and bleed air loading to the APU by energizing the generator and pressurizing the bleed air manifold as required.

Stopping the APU.

Stop the APU as follows:

1. Place the power selector switch to "OFF".

NOTE

Placing the power selector switch to "OFF" prior to shutdown of the APU may prevent tripping the wing flaps asymmetry system.

2. Auxiliary Generator Control Switch to "OFF".

3. BLEED LOAD AND FLOW CONTROL VALVE switch to "CLOSE".

4. APU CONT switch to "OFF".

Prior to APU shutdown, operate at no-load for 30 seconds or until EGT stabilizes.

5. APU DOOR switch to "CLOSED". Ensure the door NOT CLOSED light extinguishes.

FUEL SUPPLY SYSTEM.

The fuel supply system (figures 1-169 and 1-171) consists of ten wing tanks served by a multipurpose manifold which is segmented by separation valves to provide an independent supply for each engine. The fuel tanks are integral with the wing and consist of four main tanks, four auxiliary tanks, and two extended range tanks.

The system is designed so that each engine is normally supplied fuel only from its related main and auxiliary tanks. The engines are also supplied when necessary by the related extended range tanks. The four main tanks provide direct tank-to-engine fuel while the auxiliary and extended range tanks supply their respective engine through the fuel manifold and crossfeed lines. The system is designed so that no transfer of fuel between tanks is required for normal operation. The usable capacity (figure 1-170) for the basic supply system consisting of the four main tanks and four auxiliary tanks is 15,336 U.S. gallons (99,680 pounds of JP-4). The total usable capacity of all tanks is 23,592 U.S. gallons (153,352 pounds of JP-4). The tanks can be pressure refueled from the ground, selectively or in unison, through the Single Point Refueling (SPR) system. They can also be filled individually through conventional fillers in the wing upper surfaces. The fuel manifold, in addition to providing the engine feed usage described above, permits crossfeed operation from any tank to any engine or combination of engines, and is also used for refueling, defueling, and jettisoning operations.

FUEL TANKS.

Each main tank is capable of providing a direct supply of fuel to its correspondingly numbered engine under all conditions of aircraft attitude. Surge boxes, complete with flapper valves and jet-pump-ejectors, are installed in each main tank. An additional ejector is installed at the outboard end of each outboard tank, to transfer fuel from this area to the surge box, thus increasing the amount of usable fuel. In the outboard main tanks, the surge box is partitioned to provide a wet well sump. A check valve and a cable-operated engine fire shutoff valve are the only flow control devices installed between the main tanks and their correspondingly numbered engine fuel systems.

Each auxiliary tank is designed to supply fuel through the fuel manifold and crossfeed lines primarily to the correspondingly numbered engine. Two boost pumps, a primary and a secondary pump, are installed in each auxiliary tank. A sump is provided around each outboard pump. A jet-pump-ejector pumping into the sump is used to scavenge the low point of the tank to reduce unusable fuel to a minimum. A vortex breaker is installed at the inlet of each boost pump to reduce further the amount of unusable fuel. A condensate drain is provided in the lower wing surface at the low point of each auxiliary tank.

Each extended range tank is designed to supply fuel through the fuel manifold and crossfeed lines primarily to the engines of the related wing. To reduce fore and aft CG shift with pitch attitude, each extended range tank is partitioned into two compartments, an inboard and an outboard compartment. Flapper valves installed in the partition allow gravity feed from the inboard to the outboard compartment. Two boost pumps, an inboard and an outboard pump, are installed in the outboard compartment of each tank. They are connected independently to the fuel manifold, one on each side of a separation valve. Each pump normally supplies a single engine. Jet-pump ejectors are used to transfer fuel from the inboard to the outboard compartment of each extended range tank. A jet-pump-ejector installed in each inboard auxiliary tank is used to scavenge the adjacent extended range tank and reduce the unusable fuel in the extended range tank to a minimum. A vortex breaker is installed at the inlet of each extended range tank pump to reduce the amount of unusable fuel. A condensate drain is provided in the lower wing surface of the outboard compartment of each extended range tank.

FUEL TANK VENTING.

The fuel tanks are nonpressurized and are vented overboard by an open system not containing any valves or other moving parts. There are two vent boxes on each side: one in the inboard compartment of the extended range tank, which vents the inboard main and auxiliary tanks, and one in the outboard main tank, which vents the outboard auxiliary, outboard main, and extended range tanks. A line connects the two vent boxes, which vent overboard through a standpipe in the outboard box. The vent lines are large enough to carry fuel overboard in the event of a refuel valve failure during ground refueling, thereby preventing structural damage to the tanks. All vent pipes have their openings at the center inboard end of the tanks above the three percent expansion space. Lines are routed to minimize the amount of fuel sloshing into the vent boxes and to prevent any siphoning of fuel. The outboard main tank vent line therefore has its openings at the inboard edge of the tank and runs to the wing tip before returning to the vent box. The inboard vent box has a capacity of approximately 13 gallons, and the outboard vent box has a capacity of approximately 27.5 gallons. Ejectors, operated by the main tank boost pumps, transfer any fuel that may slosh into the vent boxes back to the respective main tank surge box.

FUEL DIPSTICK.

A fuel dipstick is stowed on the left side of the flight station, below the No. 1 (flight station) escape hatch. The dipstick is calibrated in inches, and may be used through the filler opening of any of the fuel tanks. See appropriate TO for conversion of fuel depth in inches to gallons of fuel, and for instructions concerning boost pump operation during dipstick reading.

FUEL BOOST PUMPS.

Two boost pumps are installed in each fuel tank. In addition to performing their normal function of supplying fuel under pressure to the related engines, the pumps can be used to transfer fuel, crossfeed fuel, defuel and jettison. The main tank boost pumps are AC motor-driven, and are rated at 23,700 pounds per hour flow at 6 PSI. The auxiliary and extended range tank boost pumps are the same type as those used in the main tanks, except that the rated output of these two pumps is 17,000 pounds per hour at 31 PSI. This higher output pressure allows the auxiliary or extended range tank pumps to override the main tank pumps during crossfeed operation. This provides backup from main tank pumps while feeding the engines from the extended range or the auxiliary tanks.

FUEL JETTISONING.

Provisions for jettisoning fuel have been made so that the aircraft gross weight can be reduced to the normal landing weight or less. It is necessary to jettison only from the auxiliary and extended range tanks to meet normal landing weight with any payload. Complete dual capability of the jettison system exists for normal requirements, and if one pump in any or several tanks should fail, all the fuel can still be dumped, since each extended range and auxiliary tank contains two pumps. In an emergency, all fuel can be jettisoned also from the main tanks, if required.

FUEL EJECTORS.

Use is made throughout the fuel system of jet-pump-ejectors instead of motor-operated pumps for the scavenge and transfer of fuel. Each ejector is operated by boost pump discharge bleed and operates whenever its respective pump is running.

FUEL SUPPLY SYSTEM CONTROLS.

Boost Pump Switches.

A two-position ("ON", OFF") toggle switch is provided on the fuel management panel (figure 1-169) for each boost pump. The BOOST PUMP switches associated with the main tank primary boost pumps provide direct control of the related 115/200-volt AC pump. The boost pump switches, associated with the main tank secondary boost pumps, control the related 115/200-volt AC pump through a 115-volt AC relay.

The BOOST PUMP switches associated with the auxiliary and extended range tanks control the related 115-volt AC pump through a 28-volt DC relay.

Center, Left, and Right Separation Switches.

Three rotary switches, CTR SEP, LEFT SEPARATION and RIGHT SEPARATION, are located on the fuel management panel (figure 1-169) for controlling valves in the fuel manifold between the inboard and outboard engines. These valves are normally closed in-flight and provide an independent fuel supply to each engine from its associated tanks.

Crossfeed Switches.

Four rotary CROSSFEED switches, No. 1, No. 2, No.3, and No. 4, are located on the fuel management panel (figure 1-169). These switches control valves in the flow line to their respective engines which isolate each engine and its associated main tank from the fuel manifold. When open, they permit flow to the associated engine from any tank(s) feeding into the fuel manifold.

Jettison Switches.

Two JETTISON switches are provided on the fuel management panel (figure 1-169). Each switch is guarded to a NORMAL (non-jettisoning) position and controls the 28-volt DC actuator of the related jettison valve. When positioned to JETTISON, each switch opens a line from the fuel manifold to the related jettison mast.

Placing the left wing JETTISON switch to the JETTISON position while either of the No. 1 auxiliary tank BOOST PUMP switches is "ON" also connects the related STOP PUMP lights to the No. 1 auxiliary tank fuel quantity indicator. Similarly, placing the right wing JETTISON switch to the JETTISON position while either of the No. 4 auxiliary tank BOOST PUMP switches is "ON" also connects the related STOP PUMP lights to the No. 4 auxiliary tank fuel quantity indicator.

FUEL SUPPLY SYSTEM INDICATORS.

Fuel Quantity Indicators.

The C-141C aircraft has a digital based fuel quantity indicating system which indicates fuel quantity in pounds.

The entire system is DC powered and includes ten digital fuel quantity indicators (FQI) with adjacent TEST buttons and one digital TOTAL FUEL QTY indicator (Totalizer) (see figure 1-169). All eleven indicators are interchangeable and receive their information from full-height compensated tank sensing units. Fuel quantity is displayed on four 7-segment LCDs with a 100-pound resolution per indicator. The digital system provides full-time individual and system built-in-test (BIT) capabilities.

When power is first applied to an indicator, that FQI will automatically execute an all-segment-lit display test for approximately five seconds after which normal gauging operation will commence. The FQI will then display the quantity of fuel in its associated tank. An extensive BIT routine operates continuously in the background to detect failures of the associated fuel probes and wiring as well as failures internal to the FQI. Each FQI has an internal circuit and four separate channels to the tank units and their associated wiring.

A flashing "E" legend in the lower right display area (figure 1-170) alerts the flight engineer to new error (fault) conditions. Fault codes associated with each system fault are stored in two memory locations within the FQI. One location contains a short-duration RAM (current BIT) memory and the other contains a long-duration EEPROM (BIT history) memory.

The FQIs are designed to prevent the application of dangerous voltages or currents into their associated fuel tanks. This is true even with a malfunctioning fuel quantity indicator. There are two categories of digital fuel indicating system failures, catastrophic or secondary. All catastrophic failures are indicated immediately by the display of the applicable fault code in the main numeric display of the affected FQI.

The following chart defines the catastrophic fault codes:

CATASTROPHIC FAILURE FAULT CODES			
FAULT CODE	FAULT DESCRIPTION	FAULT LOCATION	EFFECT ON FQI INDICATION
01	EEPROM Failure	FQI Displaying Fault Code	1) "0" In Main Numerics 2) "E" Flashing
02	RAM Failure	FQI Displaying Fault Code	1) "02" In Main Numerics 2) "E" Flashing
03	Invalid Pin Programming	Interfacing of FQI Displaying Fault Code	1) "03" In Main Numerics 2) "E" Flashing

Secondary fault codes on tank FQIs are recalled from memory storage by continuing to hold the TEST button after all-segments-on display test of the BIT reporting sequency.

The following charts define the secondary fault codes and the effect on the displays of the fuel tank FQI and Totalizer, respectively.

FUEL TANK FQI SECONDARY FAILURE FAULT CODES			
FAULT CODE	FAULT DESCRIPTION	FAULT LOCATION	EFFECT ON FQI INDICATION
04	RS-485 Communications Failure	TANK	1) No Effect on Displayed Fuel Weight 2) "E" Flashing
05	EEPROM Failure	FQI	1) Minimal Impact on Displayed Fuel Weight Accuracy
06	Factory Calibration Data Invalid		
07	Internal Measurement Failure	(INTERNAL)	1) "0" in Main Numerics 2) "E" Flashing
11 12 13 14	Open/Grounded Tank Unit/Wiring Short Circuit Tank Unit(s)/Wiring Probe Contamination Out-Of-Range Tank Unit(s)	Channel No. 1 TU(s)/Wiring	1) Reduction in Accuracy of Displayed Fuel Weight 2) "E" Flashing
21 22 23 24	Open/Grounded Tank Unit/Wiring Short Circuit Tank Unit(s)/Wiring Probe Contamination Out-Of-Range Tank Unit(s)	Channel No. 2 TU(s)/Wiring	1) Reduction in Accuracy of Displayed Fuel Weight 2) "E" Flashing
31 32 33 34	Open/Grounded Tank Unit/Wiring Short Circuit Tank Unit(s)/Wiring Probe Contamination Out-Of-Range Tank Unit(s)	Channel No. 3 TU(s)/Wiring	1) Reduction in Accuracy of Displayed Fuel Weight 2) "E" Flashing
41 42 43 44	Open/Grounded Tank Unit/Wiring Short Circuit Tank Unit(s)/Wiring Probe Contamination Out-Of-Range Tank Unit(s)	Channel No. 4 TU(s)/Wiring	1) Reduction in Accuracy of Displayed Fuel Weight 2) "E" Flashing

FUEL TOTALIZER SECONDARY FAILURE FAULT CODES			
FAULT CODE	FAULT DESCRIPTION	FAULT LOCATION	EFFECT ON FQI INDICATION
4	RS-485 Communications Failure	Totalizer/Wiring	1) "0" In Main Numerics 2) "E4" Flashing
8	Failed Tank FQI(s)	Tank FQI	1) Reduction in Accuracy of Displayed Fuel Weight* 2) "E8" Flashing 3) Back-up of Failed Tank FQI(s)**
* Totalizer display reflects the sum of the 10 tank FQIs (including degraded operation due to tank failures). ** Totalizer alternates total display with last known good indication from each failed tank FQI.			

Each TEST button on the fuel management panel initiates the BIT reporting function of the associated FQI. Pressing and holding the TEST button begins a decremental display of the displayed fuel weight. Releasing the TEST button causes the FQI to return to normal gauging. Continuing to press the TEST button will cause the FQI to decrement down to zero pounds and enter the next phase of BIT reporting, the all-segments-on display test.

The FQI all-segments-on display test illuminates all display segments for approximately four seconds to provide a visual check of correct segment operation.

CAUTION

If the TEST button remains depressed, all history fault codes in long-duration (EEPROM) memory are erased.

Fuel Pressure Indicator.

An analog FUEL PRESS indicator is installed on the fuel management panel (figure 1-169). The 26 VAC pressure indicator is connected to the cross-wing fuel manifold and is used for ground-checking the boost pumps, crossfeed valves, separation valves, and the aerial refuel isolation valves. It is also used to monitor fuel pressure during ground and in-flight fueling operations.

FUEL SUPPLY SYSTEM INDICATOR LIGHTS.

Main Tank Sump Low Warning Lights.

Four SUMP LOW lights, one for each main tank, are provided on the fuel management panel (figure 1-169).

The lights associated with the outboard main tanks illuminate when the surge box fuel level drops below approximately 125 gallons. The lights associated with the inboard main tanks illuminate when the surge box fuel level drops below approximately 60 gallons.

Boost Pump Low Pressure Lights.

Boost pump PRESS. LOW lights are provided on the fuel panel (figure 1-169).

One PRESS. LOW light is provided for the two pumps in each main tank and one light is provided for each pump in the auxiliary and extended range tanks. The lights are controlled by pressure sensing switches and illuminate when the output pressure of the corresponding boost pump(s) drops below the normal operating pressure.

WARNING

Momentary illumination of any fuel boost pump pressure low light is permissible, but the corresponding fuel pump should be turned off when the pressure light illuminates steadily.

Fuel Jettison Stop Pump Lights.

Four STOP PUMP lights, one for each outboard auxiliary tank boost pumps are located on the fuel management panel (figure 1-169). The lights are provided to warn against inadvertent fuel mismanagement when jettisoning fuel. Each light is wired through the "ON" position of the related BOOST PUMP switch and the JETTISON position of the related, left or right, JETTISON valve switch. The STOP PUMP lights can only illuminate when these switches are positioned to "ON" and JETTISON, respectively. A switch within the related fuel quantity indicator controls both of the associated STOP PUMP lights. The switch causes the lights to illuminate when the FQI indicates 5,500 pounds or less.

FUEL USAGE SEQUENCE.

The sequence for normal fuel usage is:

1. For take-off, use tank-to-engine feed from auxiliary tanks. Burn approximately 1,050 pounds per tank.
2. Use fuel equally from extended range tanks until empty.
3. Use fuel equally from auxiliary tanks until auxiliary tanks No. 2 and No. 3 are empty.
4. Use fuel equally from auxiliary tanks No. 1 and No. 4 and main tanks No. 2 and No. 3 until auxiliary tanks No. 1 and No. 4 are empty.
5. Use fuel equally from all main tanks.

NORMAL FUEL MANAGEMENT.

Engine Start.

Engine start will be accomplished using main tank primary boost pumps only. Secondary pumps will be used if a primary pump is inoperative.

Taxi, Engine Run-up, and Take-off.

Main Tanks Full, Some Fuel in All Auxiliary Tanks:

Main Tank Primary Boost Pumps	ON
Aux Tank Primary Boost Pumps	ON
Crossfeed Valves	OPEN
Extended Range Tank Boost Pumps	OFF
Separation Valves	CLOSED

Main Tanks Full, Some Outboard Auxiliary Fuel:

Outboard Main Tank Primary Boost Pumps	ON
Inboard Main Tank Primary and Secondary Pumps	ON
Outboard Auxiliary Tank Primary Boost Pumps	ON
Outboard Crossfeed Valves	OPEN
Inboard Crossfeed Valves	CLOSED
Inboard Auxiliary and Extended Range Tank Pumps	OFF
Separation Valves	CLOSED

Main Tanks Only:

Main Tank Primary and Secondary Boost Pumps	ON
Auxiliary and Extended Range Tank Boost Pumps	OFF
Crossfeed Valves	CLOSED
Separation Valves	CLOSED

Climb and Cruise.

When Extended Range Tanks Contain Fuel:

Main Tank Primary Boost Pumps	ON
Extended Range Tank Boost Pumps	ON
Auxiliary Tank Boost Pumps	OFF
Crossfeed Valves	OPEN

After Extended Range Tanks are Depleted:

Main Tank Primary Boost Pumps	ON
Auxiliary Tank Primary Boost Pumps	ON
Extended Range Tanks Boost Pumps	OFF

When Auxiliary Tank Fuel is Depleted:

Main Tank Primary Boost Pumps	ON
Auxiliary Tank Boost Pumps	OFF
Crossfeed Valves	CLOSED

WARNING

During engine operation in-flight, one fuel boost pump for the associated main tank must be on.

NOTE

After the No. 2 and No. 3 auxiliary tanks are empty and the No. 2 and No. 3 crossfeed valves are closed, the pressure in the manifold may rise due to thermal expansion. This is normal, and should the pressure rise to 87 PSI, it will be relieved through the pressure relief in the refuel valves.

Landing.

Except as noted below, this procedure is the same as the respective take-off procedure for tanks still containing fuel.

NOTE

- Maximum Gross Weight of 257,500 pounds and fuel weight of 75,000 pounds must not be exceeded for landing at a touchdown sink rate of 10 feet per second.
- If only the main tanks are to be used for landing, both the primary and secondary pump of each main tank should be on.

Touch-and-Go Landing/Go-Around.

Fuel Management Panel	Same as landing

NOTE

When touch-and-go landings are made on local training flights with fuel weights in excess of 100,000 pounds (in accordance with procedures in Section 11), use extended range tank boost pumps in lieu of auxiliary tank boost pumps until the extended range tanks are depleted.

Before Leaving Aircraft.

All fuel Switches	OFF
All Valves	CLOSED

SINGLE POINT REFUELING AND DEFUELING SYSTEM.

A single point refueling and defueling system allows all normal refueling and defueling operations to be accomplished through either or both of the two receptacles located in the fairing of the aft right main gear pod. All tanks can be refueled simultaneously or in any combination desired. All refueling or defueling operations are controlled from the flight engineer's fuel management panel (figure 1-169). When refueling, fuel enters the tanks through float-operated refuel valves which close when the refuel switches are turned off or when the tanks are filled to capacity. Single point defueling is accomplished by using the aircraft boost pumps to pump fuel through the fuel manifold and out the single point fueling adapters.

SINGLE POINT REFUELING AND DEFUELING SYSTEM CONTROLS.

Single point refueling and defueling controls are located on the flight engineer's fuel management panel (figure 1-169).

Refuel Switches.

Ten 3-position ("OPEN PRI", "CLOSE", "OPEN SEC") REFUEL lever-lock switches control fuel flow into the tanks by controlling the refuel valves. During a refueling operation, the switch may be in the "OPEN PRI" or "OPEN SEC" position.

Ground Isolation Valve Switch.

This two-position switch is labeled GRD ISO VALVE and its switch positions are "OPEN" and "CLOSE". This switch controls the refueling isolation valve between the single point refueling line and the fuel manifold. The switch guard positions the switch to the "CLOSE" position.

AERIAL REFUEL SYSTEM.

The aerial refuel system allows refueling any or all of the fuel tanks from a boom-type tanker aircraft. The system also has the capability of reverse refueling from the auxiliary fuel tanks or the extended range tanks. A Universal Aerial Refueling Receptacle Slipway Installation (UARRSI) is installed in an external fairing on the top center line of the aircraft just aft of the pilot's station. Fuel from the receptacle flows through a "Y" to two aerial refuel isolation valves on each side of the center separation valve and from there to the left and right fuel manifolds. (See figure 1-172.) The manifold is drained from the bottom of the "Y" fitting through a motor-operated shutoff valve and a drain line that connects to an ejector pump mounted in the No. 3 main tank. The ejector motive flow is provided by operation of either or both boost pumps in the No. 3 main tank.

AERIAL REFUEL SYSTEM CONTROLS.

Aerial Refuel Master Switch.

A two-position MASTER switch, located on the AERIAL REFUEL portion of the fuel management panel (figure 1-169), is used to provide power for the aerial refuel system operation. Placing the switch to "ON" supplies power to the signal amplifier, leading edge lights dimming relay, removes power from the aerial refueling/throttle switch control relay, controls power to the UARRSI fairing and slipway lights. Placing the switch to "ON" deactivates the portion of the landing gear warning light system which controls the illumination of the light by throttle position.

Aerial Refuel Mode Select Switch.

The MODE SELECT switch is a two-position switch located on the AERIAL REFUEL portion of the fuel management panel (figure 1-169). When placed in the "NORM" position, power is supplied to the signal amplifier. When placed in the "ORIDE" (override) position, power bypasses the signal amplifier (except audio) and is routed to the override relay.

Aerial Refuel Isolation Valve Switches.

Two aerial refuel isolation valve switches are located on the AERIAL REFUEL portion of the fuel management panel. The switches control the left and right aerial refuel isolation valves through which fuel flows to the left (LH VALVE) and right (RH VALVE) fuel manifold. In the "OPEN" position, the valves are open and in the "CLOSED" position, the valves are closed.

Fuel Line Drain Switch.

The fuel LINE DRAIN switch is located on the fuel management panel (figure 1-169). The LINE DRAIN switch has "A/R", "OFF", and "SPR" positions. When placed in the "A/R" position, power is supplied to open the aerial refuel manifold drain valve. Fuel from the aerial refuel manifold is pumped into the No. 3 main tank through a jet-pump-ejector. One or both of the No. 3 main tank boost pumps must be energized for operation of the jet-pump-ejector. When the LINE DRAIN switch is placed in the "SPR" position, power is supplied to energize the SPR drain valve and the SPR drain pump. Fuel from the SPR manifold is then pumped into the No. 3 main tank.

Aerial Refuel Slipway Door Control Handle.

The aerial refuel slipway door control handle (figure 1-173) is located in the overhead trim directly above the flight engineer's seat. The handle has a detent lock in both the OPEN and CLOSED position to prevent inadvertent operation. To open the slipway door, the handle is pulled inboard to override the detent lock and then pulled down approximately 2 inches. Pulling the handle down causes a slipway door lock to become manually unlocked, and also manually moves a hydraulic control valve that allows hydraulic pressure from the No. 2 system to pressurize the door actuator, causing the door to open hydraulically. The slipway door also contains springs which will cause it to open when the handle is pulled down if hydraulic pressure is not available. To close the slipway door, the handle must be pushed inboard to override the detent lock, and then up. The door will not close if hydraulic pressure is not available. Door operation is not interconnected electrically with any portion of the aerial refuel system.

Aerial Refuel Disconnect Switches.

The pilot and copilot have a disconnect switch located on the throttles. The switches are the same switches that are used for the automatic throttle system. Their function is changed to A/R disconnect switches by means of a relay that is deenergized when the aerial refuel MASTER switch is placed to "ON". Pressing either of the disconnect switches causes power to be removed from the boom latch solenoid and thereby effects a disconnect. A backup disconnect can be initiated by placing the aerial refuel MASTER switch to OFF, or by pressing the RESET button.

AERIAL REFUEL SYSTEM INDICATORS.

The aerial refuel system indicators consist of three blue READY lights, three green LATCHED lights, three DISCONNECT lights and three OVERRIDE lights. One of each is located on the pilot's and copilot's overhead station and on the engineer's AERIAL REFUEL portion of the fuel management panel (figures 1-169 and 1-174). The fuel management panel also contains a green DOOR UNLOCKED light (see figure 1-169).

Aerial Refuel Door Unlocked Light.

The DOOR UNLOCKED light comes on when the aerial refuel slipway door is unlocked. This light is wired directly to the AERIAL REFUELING CONTROL circuit breaker and works independently of the other system control switches.

Aerial Refuel Ready Lights.

When the slipway door is opened and locked, a limit switch is actuated which provides power from the signal amplifier to the READY lights. The lights indicate that the air refueling slipway door is opened and locked and that the signal amplifier is in the ready mode.

Aerial Refuel Latched Lights.

The LATCHED lights come on when the tanker boom is latched in the receptacle.

Aerial Refuel Disconnect Lights.

The DISCONNECT lights come on when the tanker boom is disconnected from the refueling receptacle. The DISCONNECT lights will remain on until the system is reset or the aerial refuel MASTER switch is placed in the "OFF" position.

Aerial Refuel Override Lights.

The OVERRIDE lights come on when the aerial refuel system is being operated in the override mode without the signal amplifier in the circuit. In the override mode, power remains on the audio portion of the signal amplifier.

AERIAL REFUELING EXTERIOR LIGHTS.

Fairing Lights.

Three fairing lights are located on the forward fuselage just ahead of the UARRSI fairing. One light is located directly in front of the slipway door, and one on each side of the fuselage directed at the UARRSI fairing. The lights are shielded so that the light beam illuminates the UARRSI fairing, but does not interfere with the tanker boom operator's vision. The aerial refuel MASTER switch must be in the "ON" position to supply electrical power to the UARRSI fairing lights dimming transformer before the fairing lights can be illuminated. The fairing lights are controlled by a FAIRING rotary switch, with "OFF" and "BRT" positions, located on the aerial refueling lights control panel. (See figure 1-175.) The brightness of the fairing lights can be varied by turning the rotary switch from "OFF" towards "BRT". The center fairing light can be controlled separately by a CTR FAIRING switch with "ON" and "OFF" positions located on the aerial refueling lights control panel. The FAIRING rotary switch must be on before the CTR FAIRING switch can turn the center light on.

Slipway Lights.

There are 12 lights provided to illuminate the slipway door area. Six are located on either side of the slipway. The aerial refuel master switch must be in the "ON" position to supply electrical power to the SLIPWAY lights rotary switch located on the aerial refueling lights control panel. The SLIPWAY rotary switch has "OFF" and "BRT" positions and varies the brightness of the slipway lights.

Wing Leading Edge Lights.

During aerial refueling operations, the aerial refueling master switch is placed to "ON" position to supply power to the leading edge light dimming relay.

The LEADING EDGE lights rotary switch (located on the aerial refueling light control panel) controls the brightness of the leading lights from "OFF" to "BRT". Dimming of the wing leading edge lights is not possible when the aerial refuel master switch is OFF.

ELECTRICAL SYSTEM. (See figure 1-176.)

Alternating current (200/115 VAC) is the basic power source and is provided by four engine-driven generators. Direct current (28 VDC) is provided by two transformer rectifiers. A hydraulically-driven generator is available for a limited amount of AC and DC power during emergencies. On the ground, AC power can be supplied by an external source or by an Auxiliary Power Unit (APU) driven AC generator. A 24-volt battery is provided for APU starting power. All circuits (figures 1-181 and 1-182) are protected by circuit breakers, current limiters, or fuses. During normal operations, the aircraft has a parallel AC and parallel DC system.

AC POWER SUPPLY SYSTEM.

The AC electrical system consists of four engine-driven, 50 kilovolt-ampere (KVA) AC generators, one 50 KVA APU-driven AC generator, and one 2.0 KVA AC (20 ampere DC) hydraulic motor-driven generator. Each generator supplies 200/115 volt, 3-phase 400 hertz power. Transformers are used for reduced voltage AC requirements.

Engine Driven Generators.

AC power is normally supplied by four generators (figures 1-177 and 1-178). Protection panels protect each generator against system malfunctions. If a protection panel deenergizes a generator, a visual indication is provided on the electrical panel. A differential fault can be reset after rotation of the engine has stopped and the fault has been cleared. The differential fault can be reset with a button located on the connector side of the related generator protection panel in the right hand underdeck area.

A differential fault has occurred when the GEN OUT light remains on when the generator switch is "OFF". Mechanical failure of a generator illuminates a GEN FAIL light.

Constant Speed Drive (CSD) Units.

A CSD unit is mounted on the accessory pad of each engine and drives the related generator. The CSD converts variable input speed from the engine to maintain constant generator frequency output. Each CSD contains an oil reservoir with an oil-to-air heat exchanger. A disconnect feature is provided to uncouple the CSD from the engine. A disconnect switch, an oil temperature indicator and an overheat warning light are provided on the electrical panel.

Emergency Generator.

A hydraulic motor-driven generator powered by hydraulic system No. 2 is installed in the hydraulic system No. 2 service center. The generator automatically provides power necessary to maintain operation of the emergency and isolated buses if normal power fails. Automatic operation is triggered by loss of normal power. A switch on the pilot's instrument panel allows the pilot to turn the generator on or off. A switch on the electrical panel permits testing the generator output.

External/APU Generator Power Sources.

External power or APU generator power is used to supply power during ground operations. A contactor in the APU generator/external power supply line prevents connecting both sources to the tie bus at the same time. The protection panels of the engine generators prevent paralleling APU generator or external power with the engine generators. A phase-sensitive relay in the external power supply line prevents connecting external power of incorrect phase sequence or undervoltage to the tie bus. When external power is available and selected, it will automatically take over the main AC buses as the generators are deenergized. When APU generator power is available and selected, it will automatically take over main AC buses No. 1 and No. 4. An automatic load monitoring system disconnects main AC buses No. 2 and No. 3 when APU generator power is used. Switches are provided to override the load monitoring system. A touchdown switch prevents the APU from being used except when the aircraft is on the ground. External power is supplied through an external power receptacle located on the right forward side of the aircraft.

NOTE

The 200/115 volt, 3-phase 400 Hz AC external power source should have a minimum capacity of 50 KVA. Its phase rotation must be A-B-C.

AC SYSTEM BUSES.

The tie bus serves, during normal operation, as a transfer medium between generated AC power and the buses of two essential AC load systems. Parallel AC is anytime the main AC tie bus is powered and both essential load systems are receiving power from the main tie bus. Isolated AC operation is anytime the main AC tie bus is depowered. As long as one generator is supplying the tie bus, all buses of the essential AC load systems and the main AC buses No. 1 and No. 4 will be powered. Main AC buses No. 2 and No. 3 are automatically disconnected by a load monitoring circuit during single generator operation. Switches are provided on the electrical panel to manually override the load monitoring system. If the tie bus becomes deenergized, the buses of essential AC load system No. 1 automatically transfer to the feeder leads of main generator No. 1, or if it is deenergized, to those of main generator No. 2. In a like manner, essential AC load system No. 2 has two standby power sources in generators No. 4 and No. 3. (See figure 1-179.)

AC ELECTRICAL SYSTEM CONTROLS.

Controls for operation of the AC electrical system are located on the electrical panel (figure 1-176), except for an INST POWER switch located on the pilot's instrument panel. During parallel operation, all switches, except those associated with the APU generator or external power, are positioned to a placarded "ON" or "NORMAL" position, or to a guarded CLOSED position.

Engine Generator Control Switches.

Each generator has a three-position ("ON", "OFF", "TEST") toggle switch to control the testing and connecting of the generator to its main AC bus. The "ON" position energizes the generator and the generator line contactor. The "TEST" position is a momentary position which allows only the generator to be energized for checking voltage and frequency output. The generator can be reset by turning the generator control switch to "OFF", then back to "ON".

Bus Tie Switches.

Each generator has a two-position ("NORMAL", "OPEN") toggle switch which is used to connect the generator to the tie bus. When the tie bus is being supplied by a source other than the associated generator, the switch controls the connection.

Placing the switch to "NORMAL" energizes the bus tie contactor closed. The "OPEN" position deenergizes the bus tie contactor. The bus tie contactor can be reset by placing the switch to "OPEN", then back to "NORMAL".

Auto-Load Disconnect Switches.

Two-position ("NORM", "OVERRIDE") AUTOLOAD DISC switches control closing the monitor relays. These relays open automatically during single generator operation. The "NORMAL" position permits DC power to be supplied through the respective generator protection panel to the monitor relay. The "OVERRIDE" position permits the same supply of DC power to be routed to the monitor relay through a circuit which bypasses the protection panel.

APU Generator Control Switch and the Power Selector Switch.

A generator control switch is provided for the APU generator. It is similar in operation to the main generator control switches. The power selector switch is used for ground operation to select APU generator or external power.

AC ELECTRICAL SYSTEM EMERGENCY CONTROLS.

CSD Disconnect Switches.

Each CSD has a guarded CSD DISC switch (figure 1-176). This switch is used to disconnect the CSD if a malfunction occurs.

CAUTION

Do not disengage the CSD when the engine is static or below idle speed because damage to the shaft disconnect will take place.

Bus Power Disconnect Switches.

Four BUS PWR DISCONNECT switches are provided (figure 1-176) to remove power from selected buses. These lever-lock switches have two positions, "NORM" or "NORMAL" and "OFF". The first switch disconnects main AC buses No. 2 and No. 3 by opening their respective monitor relays. The second switch disconnects main AC buses No. 1 and No. 4 by opening their respective generator line contactors and bus tie contactors. The third switch disconnects essential AC buses No. 1 and No. 2 by opening No. 2 and No. 3 generator line contactors and the two essential bus power relays No. 1. At the same time, the emergency generator is automatically started to maintain power supply to the emergency and isolated buses. The fourth switch disconnects the isolated buses by de-energizing the associated isolated bus power relays. The emergency generator continues to supply power to the emergency buses.

Instrument Power Switch.

A three-position ("EMERG", "NORM", "OFF") INST POWER switch, located on the pilot's instrument panel, provides manual control for the emergency generator (figures 1-153 and 1-261). Normally the switch is positioned at "NORM", and operation of the emergency generator is automatic. Placing the switch to "OFF" disconnects the emergency generator from its buses. Placing the switch to "EMERG" allows the generator to start and power its buses.

Emergency Power Test Switch.

A two-position ("NORMAL", "TEST") EMERGENCY POWER TEST switch is provided to test the emergency generator (figure 1-176). The momentary "TEST" position causes the emergency generator to operate but does not connect it to a bus. Releasing the switch from "TEST" returns the emergency generator to normal operation.

AC ELECTRICAL SYSTEM INDICATORS.

Indicators for the AC electrical system are located on the electrical panel (figure 1-176). Exceptions are an EMER PWR ON light located on the pilot's instrument panel and an EXT PWR ON light in the external power receptacle.

AC Loadmeters.

Five AC loadmeters, one for each engine generator and one for the APU generator, are provided. Each loadmeter gives a continuous indication of the percent of total load capability being supplied by its generator. A reading of 1.0 on the meter corresponds to 50 KVA load on the generator.

CSD Oil Temperature Gauges.

Each CSD has a CSD OIL TEMP gauge to indicate CSD oil temperature.

CSD Overheat Light.

The CSD has a CSD OVERHT light, which illuminates if the CSD oil temperature exceeds 179 ($\pm$5.5)° C or if the oil pressure drops below a preset value.

Generator Fail Light.

Each generator has a GEN FAIL light. The light illuminates if the generator has a mechanical failure that causes the rotor to rub the stator.

Generator Out Light.

Each generator has a GEN OUT light. This light illuminates if the generator protection panel has disconnected the generator from all buses.

Bus Tie Open Light.

Each engine generator has a BUS TIE OPEN light. It illuminates when the related bus tie contactor is open, and indicates that the generator and respective main AC lines are not connected to the tie bus.

Main Bus Off Lights.

Each main AC bus has a MAIN BUS OFF light. The light illuminates if bus voltage drops to 90 ($\pm$5) volts, and remains illuminated until bus voltage has increased to 105 ($\pm$5) volts.

Essential Bus No. 1 and Essential Bus No. 2 Lights.

Each of the essential AC buses has three lights. The ESSEN NO. 1 lights are labeled OFF, GEN 1, and GEN 2; the ESSEN NO. 2 lights are labeled OFF, GEN 3, and GEN 4. A GEN light illuminates if the associated generator is supplying the respective essential AC bus. The OFF light illuminates if power is lost to the respective essential AC bus.

Emergency AC Bus and Isolated AC Bus Lights.

Two lights are provided for the emergency AC bus and three lights for the isolated AC bus. The emergency AC bus lights are labeled EMER PWR and EMER AC BUS. These lights illuminate if the emergency generator is supplying power to the emergency AC bus. EMER PWR and ISOL AC BUS lights are provided for the isolated AC bus to indicate the emergency generator is powering the bus. An ISOL AC OFF light illuminates if power to the isolated AC bus is lost.

Emergency Power On Light.

An EMER PWR ON light is located on the pilot's instrument panel. The light illuminates when the emergency generator is supplying power.

External Power Ready Light.

An EXT POWER READY light illuminates when external power of the proper phase sequence and minimum voltage (109 volts) is connected to the aircraft. The light will illuminate even though an overvoltage condition exists.

AC Voltmeter, Frequency Meter, and Selector Switches.

An AC VOLTS meter and a FREQUENCY meter (figure 1-176) permit monitoring of the frequency and voltage output per phase of the AC power sources. Selection of the source and phase to be monitored is accomplished by two rotary selector switches. The seven-position AC VOLT & FREQ SELECT switch is used to select the source to be monitored; the three-position PHASE SELECT switch is used to select the phase.

External Power On Light.

An EXT PWR ON light, located on the external power receptacle, illuminates when external power is connected and supplying power.

DC ELECTRICAL SUPPLY SYSTEM.

The Direct Current (DC) electrical supply system consists of two Transformer Rectifier (TR) units, a lead acid battery, and an emergency generator. (See figure 1-180.)

TR Units.

DC current (28 VDC) requirements are furnished by two TR units. The input to these units is 200/115 VAC power supplied through the AC essential bus power feeder circuits. The voltage output of the TRs decreases as the load increases. Under load conditions of 5 to 200 amps, the voltage output will vary from 29 to 25 volts.

Battery.

A 24 volt, 8.4 Amp/hour battery is provided to supply control and ignition power for starting the APU. The battery is charged when the battery switch on the electrical panel is "ON".

Emergency DC Power.

A TR unit, which forms an integral part of the emergency generator, provides emergency power when the emergency generator is operating. When generated power is not available, the battery can supply a limited amount of emergency power to the isolated buses.

DC System Buses.

The system buses consist of: main DC bus No. 1, main DC bus No. 2, an isolated DC bus, an emergency DC bus, and three avionics buses. The main DC buses are powered separately by their TRs, through a reverse current relay. The reverse current relay disconnects the TR from the bus if the reverse current exceeds set limits. A current limiter connects the main DC feeder buses and permits either TR to supply both buses. The current limiter also isolates the main DC buses from each other should a fault occur on either one. The isolated DC bus is supplied from the main DC bus No. 1 feeder circuits through a current limiter and a reverse current relay. The current limiter protects the main DC buses from faults downstream of the limiter. The isolated bus reverse current relay prevents emergency generator power from being supplied to the low priority main DC buses. The emergency DC bus is supplied from the isolated DC bus through an emergency bus power relay. The DC avionics buses are supplied from the related main or isolated DC buses.

Emergency DC Power.

If the normal flow of DC power is interrupted as a result of AC electrical system failure, the emergency generator will supply power to the isolated and emergency DC buses. Switches are provided to disconnect the isolated buses. The battery is automatically disconnected when the emergency generator is supplying power to the isolated DC bus.

DC ELECTRICAL SYSTEM CONTROLS AND INDICATORS.

The DC electrical system controls and indicators are located on the flight engineer's electrical panel (figure 1-176).

Battery Switch.

A two-position ("ON", "OFF") battery switch, located on the electrical panel, controls battery power to the isolated DC buses.

Main DC Bus No. 1 and No. 2 Off Lights.

A main DC bus No. 1 and a main DC bus No. 2 OFF light, located on the electrical panel, illuminate if the respective bus is deenergized.

Isolated DC Bus Lights.

Four lights on the electrical panel advise of isolated DC bus conditions. These lights are a BATTERY light, an EMER PWR light, an ISOL DC BUS light, and an ISOL DC OFF light. The BATTERY light indicates the battery is supplying power to the isolated DC bus. The EMER PWR/ISOL DC BUS lights indicate that the isolated DC bus is being powered by the emergency generator. The ISOL DC OFF light indicates that the isolated DC bus is not powered.

Emergency DC Bus Lights.

An EMER PWR light and an EMER DC BUS light on the electrical panel indicate the emergency DC bus is being powered by the emergency generator.

DC Voltmeter and Source Selector Switch.

A DC VOLTS meter and a DC VOLT SELECT switch on the electrical panel permit monitoring of the voltage on the DC buses and the voltage output of the emergency generator.

ENGINE BLEED AIR SYSTEMS.

There are two separate engine bleed air systems: a high-pressure outer-diameter (OD) and inner-diameter (ID) system. (See figure 1-184.)

HIGH-PRESSURE OD BLEED AIR SYSTEM.

Each engine contains its own high-pressure OD bleed air ducting. High-pressure bleed air is taken from ports in the diffuser case after the 16th compression stage. The ports take high-pressure bleed air from the outer-diameter of the diffuser case interior for use by the fuel de-icing heater, engine anti-icing, engine inlet lip anti-icing, zone 11 cooling ejectors, CSD oil tank pressurization, and fan duct seals.

HIGH-PRESSURE ID BLEED AIR SYSTEM.

The high-pressure ID bleed air system uses bleed air extracted from identical installations on all four engines. Bleed air output from each engine is interconnected by pylon ducting that leads to a crosswing manifold.

Each engine has four bleed air struts that extend into the diffuser case interior after the 16th compression stage. Each bleed air strut has a venturi to limit the amount of bleed air extracted from the inner diameter of the diffuser case. The bleed air struts are located symmetrically around the diffuser case upper half and are connected by a bleed air manifold.

The manifold is branched with one branch along the upper right quarter and the other along the upper left quarter of the diffuser case. Each branch receives bleed air from two bleed air struts. The two branches are connected at the top of the engine by a manifold coupler with a check valve installed at the connection to prevent reverse flow of bleed air. The manifold coupler connects to the engine starter and pylon ducting.

Each pylon ducting contains a bleed air shutoff valve used to isolate its engine. From each pylon duct, bleed air flows into a crosswing manifold located in the leading edge of the wing. At the midpoint, a wing isolation shutoff valve separates the crosswing manifold into a right and left section.

The high-pressure ID bleed air system supplies air for air conditioning, pressurization, wing anti-icing, windshield rain removal, cargo floor heating, and fan duct seals during normal operation.

BLEED AIR SYSTEM CONTROLS.

Bleed Air Shutoff Switches.

Four 2-position ("OPEN", "CLOSE") switches (figure 1-183) control the bleed air shutoff valve for the associated engines.

Wing, Pylon, And Air Conditioning Compartment Overheat Switches.

Two 3-position (momentary "TEST", lever-lock center NORMAL, and momentary "RESET") L and R WING PYLON & AIR COND COMPT switches (figure 1-183) are used to check the bleed air overheat sensing system; illuminate the LEFT OVHT and RIGHT OVHT indicator lights; and close the bleed air shutoff valves and wing isolation shutoff valve. When held in "RESET" the overheat relay is released, and the valves return to the positions selected on their controls.

Wing Isolation Switch.

The WING ISOLATION switch is a two-position ("NORMAL", "OPEN") switch (figure 1-183). In "NORMAL", the wing isolation valve is closed, the "APU" and "ENG START" positions of the AIR COND MASTER switch can override the WING ISOLATION switch and open the valve. The "OPEN" position is used with an engine inoperative during wing anti-icing to allow bleed air to flow from one wing manifold to the other. The valve can be opened manually while on the ground.

System Shutoff Switches.

A left and right, three-position ("OPEN", "CLOSE", "TEST") SYS SHUTOFF switch (figure 1-183) controls bleed airflow to the air conditioning system. The "OPEN" position energizes the system shutoff valves and allows bleed air to flow to the primary heat exchangers. A primary heat exchanger overheat or selection of "ENG START" on the AIR COND MASTER switch overrides the "OPEN" position and closes the shutoff valve. The "CLOSE" position closes the shutoff valve. The "TEST" position closes the system shutoff valve and energizes a test solenoid.

BLEED AIR SYSTEM INDICATORS.

The bleed air system has indicators and lights for monitoring the system, and are on the environmental control panel (see figure 1-183).

System Pressure Relief Valve Lights.

Two SYS PRESS RELIEF VALVE lights, LEFT OPEN RIGHT OPEN, illuminate when the left or right system pressure relief valve unseats to relieve overpressure in the range from 90 to 115 PSIG.

Bleed Air Shutoff Valve Lights.

Four bleed air shutoff valve lights, one for each engine, are placarded CLOSED. As the bleed air shutoff valve closes, a switch is closed to illuminate the light.

Wing, Pylon, And Air Conditioning Bleed Air Overheat Lights.

The L and R WING PYLON & AIR COND COMPT lights illuminate LEFT OVHT and RIGHT OVHT to indicate an overheat. When the overheat sensor senses an overheat, the appropriate light illuminates LEFT OVHT or RIGHT

OVHT and both affected bleed air shutoff valves and wing isolation valve close automatically. After the temperature drops, the illuminated light extinguishes.

Manifold Bleed Air Pressure Indicator.

A MANIFOLD BLEED PRESS indicator displays duct pressure from a crosswing manifold.

AIR CONDITIONING SYSTEMS.

The aircraft has two air conditioning systems that form a part of the environmental systems. (See figure 1-184.)

The two air conditioning systems are independent, but operate in parallel. System equipment is housed in the left and right wing fillets. During normal operation, the left system conditions air for the flight station and the right system conditions air for the cargo compartment. One system can provide limited air conditioning for the entire cabin.

Each system consists of ram air ducting, an air conditioning unit, and distribution ducting. The two systems are identical except for ram air ventilating provisions in the right ram air ducting, and gasper air in the left system; an alternate air shutoff valve in the right distribution ducting and a diverter valve in the left distribution ducting.

RAM AIR VENTILATION.

The right ram air inlet scoop provides for ram air ventilation of the cabin. The "RAM" position of the AIR COND MASTER switch (figure 1-183) opens the ram air vent valve and permits ambient air to enter the cabin through the ram air ducting.

AIR FLOW SOURCES.

In-flight, both air conditioning systems use engine bleed air. On the ground, both air conditioning systems use engine bleed air, APU bleed air, or an external source of heated air. The air pressure is regulated to approximately 70 PSI before entering the air conditioning units.

AIR CONDITIONING UNITS.

The left and right air conditioning units are identical. Pressure regulated air enters each air conditioning unit at a primary heat exchanger. A primary heat exchanger temperature control balances inputs from two temperature sensors downstream of the primary heat exchanger. The first temperature sensor is a primary sensor calibrated to approximately 230° C. The second temperature sensor is an anticipator and high limit sensor. Initially, if incoming bleed air temperature is above 230° C, the primary sensor causes the primary heat exchanger temperature control to position the primary heat exchanger cooling air control valve full open for maximum ambient ram air flow across the primary heat exchanger. As the desired temperature is approached, inputs from the anticipator and high limit sensor cause the primary heat exchanger temperature control to modulate the position of the primary heat exchanger cooling air control valve. Modulation gradually reduces the rate of temperature change and thus minimizes overshoot and undershoot of the desired temperature. If the anticipator and high limit sensor signals an overheat condition of approximately 280° C, the primary heat exchanger temperature control commands the system shutoff valve to close.

Temperature adjusted bleed air leaves the primary heat exchanger ducting that contains a temperature sensor, the ducting branches to rain removal regulator valve and an air conditioning flow control and shutoff valve. After the flow control and shutoff valve, the ducting branches to a secondary heat exchanger in the air cycle refrigerator and to a temperature control valve. The secondary heat exchanger uses ambient air flow across cooling vanes to drop the temperature of the bleed air to approximately 65° C. The bleed air from the secondary heat exchanger is sent to the turbine and turbine bypass valve. The turbine inlet ducting contains a temperature sensor. If the inlet temperature rises to approximately 100° C, the sensor triggers a thermal switch that causes the flow control and shutoff valve to close. The thermal switch resets and allows the flow control and shutoff valve to reopen when temperature at the turbine inlet temperature sensor drops below approximately 100° C.

The turbine processes refrigerated air and sends it to a water separator. The water separator removes excess moisture from the air to reduce fogging in the cabin. Downstream of the water separator, the turbine outlet air ducting contains a low limit temperature sensor. The sensor provides an input to the low limit temperature control which modulates the turbine bypass valve to maintain a temperature above approximately 2° C to prevent icing in the water separator.

GROUND OR LOW AIRSPEED OPERATION.

On the ground or at low airspeed below Mach 0.3, the CADC provides a signal that opens the primary heat exchanger ejector valve so that engine bleed air ejects into the ram air ducting and draws an increased flow of ambient air across the primary heat exchanger cooling vanes. When the motor driven primary heat exchanger ejector valve opens, the EJECTOR ON light illuminates on the environmental control panel.

DISTRIBUTION DUCTING.

After leaving the air conditioning units, heated air at approximately 230° C and refrigerated air at approximately 2° C simultaneously enter the distribution ducting. The distribution ducting leads to outlets in the cabin. The flight station gaspers receive the refrigerated (2° C) air only.

CABIN TEMPERATURE REGULATION.

Automatic temperature commands from the environmental control panel together with inputs from a primary sensor and an anticipator and high limit sensor in the distribution ducting are balanced by a temperature control box to modulate the position of the temperature control valve. The temperature control valve then establishes a ratio of heated air to refrigerated air. The anticipator and high limit sensor is preset to signal an overheat condition if the temperature approaches 150° C, and causes the temperature control valve to close.

Manual temperature commands from the environmental control panel override the primary sensor and the anticipator and high limit sensor inputs to the temperature control box. When the manual mode of operation is selected, controls on the environmental control panel enable direct positioning of the temperature control valve. An overheat sensor in the distribution ducting overrides manual control when distribution ducting temperature of approximately 150° C is sensed by the overheat sensor. Once a ratio of heated air to refrigerated air is manually established, the ratio is maintained until manually changed or until controls are returned to the automatic mode.

CABIN AIRFLOW REGULATION.

The left distribution ducting contains a diverter valve with four positions. The diverter valve enables all left system airflow to the cargo compartment, routes all left system airflow to the flight station, splits approximately one-third of the left system airflow to the flight station and two-thirds to the cargo compartment, or splits approximately two-thirds of the left system airflow to the flight station and one-third to the cargo compartment.

The right distribution ducting contains an alternate air shutoff valve that routes all right system airflow to the cargo compartments or splits approximately one-third of right system airflow to the flight station and two-thirds to the cargo compartment.

CARGO COMPARTMENT RECIRCULATION FAN.

A recirculation fan is installed overhead in the forward cargo compartment to increase air flow in the cargo compartment. The fan runs anytime the AIR COND MASTER switch is in "APU", "BOTH", "LEFT", or "RIGHT". The recirculation fan is shut off when an emergency depressurization switch is in the emergency depressurize position.

AIR CONDITIONING SYSTEMS CONTROLS.

Controls for the air conditioning systems are on the environmental control panel (figure 1-183).

Air Conditioning Master Switch. (See figure 1-185.)

The AIR COND MASTER switch is a seven-position ("APU", "ENG START", "BOTH", "LEFT", "RIGHT", "OFF", "RAM") rotary-type switch that selects the type of air conditioning operation. The switch also controls the flight station alternate air shutoff valve and cargo compartment recirculation fan.

Flight Station Temperature Control Switch.

The FLT STA CONTROL switch is a four-position ("COOL", "HOLD", "AUTO", "HOT") toggle switch that provides automatic or manual commands to the left air conditioning system. In "AUTO", the FLT STA CONTROL switch circuits work in conjunction with the rheostat-type FLT STA switch.

In the "COOL" or "HOT" momentary positions, the FLT STA switch and the temperature control sensor inputs are bypassed. In "HOT", the temperature control valve is moved toward open. An overheat sensor completes a circuit to override the manual command at a temperature of approximately 150° C. The overheat sensor circuit also causes the control valve to move back toward closed until the temperature drops below approximately 150° C. In "COOL", the control valve is moved toward closed. The control valve remains in any position selected when the FLT STA CONTROL switch is placed to "HOLD". The FLT STA CONTROL switch is enabled anytime the AIR COND MASTER switch is in "LEFT", "BOTH", or "APU".

Cargo Compartment Temperature Control Switch.

The CARGO COMPT CONTROL switch (figure 1-183) is a four-position ("COOL", "HOLD", "AUTO", "HOT") toggle switch that functions in the same way as the FLT STA CONTROL switch except that the CARGO COMPT CONTROL switch commands the right air conditioning system and is enabled any time the AIR COND MASTER switch is in "RIGHT", "BOTH", or "APU".

Cabin Temperature Control Switches.

FLIGHT STATION TEMPERATURE SELECTOR. A rotary, rheostat-type ("COOL" to "HOT") FLT STA temperature selector selects the desired automatic temperature for the flight station. With the FLT STA CONTROL switch at "AUTO", the FLT STA selector provides inputs to the flight station temperature control box. The temperature control box controls the flight station temperature control valve.

Cargo Compartment Temperature Selector.

A rotary, rheostat-type ("COOL" to "HOT") CARGO COMPT temperature selector selects the desired automatic temperature for the cargo compartment. With the CARGO COMPT CONTROL switch at "AUTO", the CARGO COMPT selector provides inputs to the cargo compartment temperature control box. The temperature control box controls the cargo compartment temperature control valve.

Flight Station Airflow Switch.

A rotary-type, four-position ("MIN", "NORM", "INCR", "MAX") FLT STA AIR FLOW switch controls the diverter valve in the left air conditioning system distribution ducting. The "MIN" position diverts all left system airflow (except gasper airflow) to the cargo compartment. The "MAX" position provides all airflow to the flight station. The "NORM" position splits one-third of the airflow to the flight station and two-thirds to the cargo compartment. The "INCR" position splits two-thirds of the airflow to the flight station and one-third to the cargo compartment.

AIR CONDITIONING SYSTEMS INDICATORS.

Indicators and lights for the air conditioning systems are on the environmental panel. Overheat lights are on the annunciator panel.

Regulated Bleed Air Pressure Indicator.

The REG PRESS indicator is a dial-type indicator that has an "L" pointer and an "R" pointer. The indicator receives inputs from pressure probes located in the system shutoff valve outlet ducting.

Primary Heat Exchanger Temperature Indicators.

Two PRIMARY HEAT EXCH temperature indicators are provided. The indicators receive inputs from sensors located in the left and right air conditioning unit.

Cargo Compartment Temperature Indicator.

The COMPT TEMP indicator (figure 1-183) receives inputs from a sensor located on the aft cargo compartment upper-deck area forward of the RH outflow safety valve.

EJECTOR ON Lights.

Two EJECTOR ON lights (figure 1-183) illuminate when the ejectors are operating and providing an increased airflow across the primary heat exchanger cooling vanes.

NOTE

An EJECTOR ON light that remains illuminated above Mach 0.3 means only that some bleed air is being lost overboard.

NORMAL OPERATION OF AIR CONDITIONING SYSTEMS.

1. BLEED AIR SHUTOFF Switches - "OPEN"
2. WING ISOLATION Switch - "NORMAL
3. SYS SHUTOFF Switches - "OPEN"
4. AIR COND MASTER Switch - "BOTH"
5. FLT STA CONTROL Switch - "AUTO"
6. FLT STA AIR FLOW Switch - "NORM"

CAUTION

With both air conditioning systems operating, the "MIN" position of the FLT STA AIR FLOW switch must be used with caution or overheating of the cargo compartment may result.

7. CARGO COMPT CONTROL Switch - "AUTO"
8. EMER DEPRESS Switches - "NORMAL"
9. CABIN ALT LIMIT ORIDE Switch "NORMAL"

PRESSURIZATION SYSTEM.

The pressurization system forms a part of the environmental systems. (See figures 1-184 and 1-186.)

The pressurization system controls the rate of escape of cabin air to the atmosphere, selects the desired cabin altitude, and enables emergency depressurization. The system contains automatic, manual, and emergency controls, indicators, two cabin pressure outflow safety valves, a jet pump pressure regulator, a cabin pressure control fan and venturi, and two emergency depressurization solenoid shutoff valves.

Cabin pressure is maintained in a prescribed schedule within the limits shown in figure 1-187.

The cabin pressure outflow safety valves relieve excess cabin pressure. The safety valve portions of the cabin pressure outflow safety valves open to give additional pressure relief if the outflow valve portions fail to regulate properly. The cabin pressure outflow safety valves operate on a differential air pressure basis and require a low air pressure source and a high air pressure source. The low air pressure source (reference pressure) is supplied by the cabin pressure control venturi. The high air pressure source (cabin pressure) is supplied through a manual control valve. The cabin pressure outflow safety valve has two reference sections separated by a diaphragm. The difference between reference pressure on one side of the diaphragm and cabin pressure on the other side of the diaphragm positions a poppet valve that meters air from the cabin to regulate pressure. A cabin limit control in the head section of the outflow safety valve limits cabin altitude to approximately 13,000 feet unless manually overridden from the flight station. The cabin limit control is an aneroid-operated poppet valve that opens when cabin altitude reaches a calibrated pressure and floods the reference pressure diaphragm section with cabin air, thus preventing the outflow valve poppet from opening further.

The jet pump pressure regulator, located inside the pressurized area, reduces engine bleed air pressure entering the system to 15 (±5) PSIG relative to existing cabin pressure. A relief valve in the regulator outlet limits downstream air pressure to 25 (±5) PSIG.

The cabin pressure control fan and venturi is actuated by a safety switch while the aircraft is on the ground. The fan pulls cabin air through the venturi to produce a vacuum to hold the cabin pressure outflow safety valves in the full-open position and prevent any cabin pressurization.

PRESSURIZATION SYSTEM CONTROLS.

The pressurization system contains a CABIN PRESSURE MANUAL CONTROL, an automatic cabin pressure control, a cabin altitude limit override switch, two emergency depressurization switches, and two emergency pressurization switches.

Cabin Pressure Manual Control.

The CABIN PRESSURE MANUAL CONTROL is a three-position ("DECREASE PRESS", "AUTO", "INCREASE PRESS") control (figure 1-183). The control is pneumatically placed between the automatic cabin pressure control and the cabin pressure outflow safety valves and can manually override the automatic cabin pressure control. In the "AUTO" position, the automatic cabin pressure control commands the cabin pressure outflow safety valves. In the "INCREASE PRESS" or "DECREASE PRESS" positions, the CABIN PRESSURE MANUAL CONTROL biases the outflow safety valve control system to change cabin pressure accordingly.

Automatic Cabin Pressure Control.

The automatic CABIN PRESSURE CONTROL contains an indicator, a CABIN ALT selector knob, and a RATE knob (figure 1-183). The RATE knob is variable between "DEC" and "INC" positions. With the CABIN PRESSURE MANUAL CONTROL in "AUTO", the CABIN ALT selector knob is used to select the desired altitude on the indicator and the RATE knob is used to select the desired rate of change of cabin altitude.

Cabin Attitude Limit Override Switch.

The cabin altitude limit override switch is a guarded two-position ("NORMAL", "CABIN ALT LIMIT ORIDE") switch. In "NORMAL" the cabin limit control operates to limit cabin altitude to 13,000 (±1,500) feet. In "CABIN ALT LIMIT ORIDE", the cabin limit control is bypassed and the cabin altitude is controlled manually to any aircraft altitude.

Emergency Depressurization Switches.

There are two guarded, two-position emergency depressurization switches installed in the aircraft. One switch is located on the pilots' aft overhead control panel (figure 1-157) and the other is located on the engineer's environmental control panel (figure 1-183). The pilots' switch positions are labeled "NORMAL" and "EMER DEPR". The engineer's switch positions are labeled "NORMAL" and "EMER DEPRESS". In "EMER DEPR" (pilots') or "EMER DEPRESS" (engineer's), either switch completes an electrical circuit to two emergency depressurization solenoids. The first solenoid, when energized, is positioned to vent regulated bleed air to override the cabin limit control on the outflow safety valves, allowing complete cabin depressurization. The second solenoid is open to vent the pneumatic relay in the outflow safety valve to the cabin pressure control venturi. This action bypasses both the manual and automatic cabin pressure controllers and opens the outflow valves to their maximum extent.

WARNING

When either of the emergency depressurization switches has been used to depressurize the aircraft, place the cabin altitude limit override switch to the "CABIN ALT LIMIT ORIDE" position before the emergency depressurization switches are returned to the "NORMAL" position. If this is not accomplished the cabin limit control will be reestablished and the cabin altitude will descend rapidly to 13,000 feet, resulting in possible damage to the eardrums of crew members and passengers.

The "EMER DEPR/DEPRESS" position of these switches also completes electrical circuits that close the right and left air conditioning flow control and shutoff valves and the floor heat modulating valve, thereby shutting off all flow of conditioned air into the cabin, and shuts off the cargo compartment recirculation fan. Use of the Emergency Depressurization switches will result in an initial cabin altitude of 8,000 feet equalizing with an aircraft altitude of 41,000 feet in approximately 90 seconds.

Emergency Pressurization Switches.

The LH and RH EMERGENCY PRESSURIZATION switches are located on the emergency circuit breaker panel (figure 1-181). The two-position lever-lock switches are labeled "EMERG" and "NORMAL" and provide emergency electrical power to maintain aircraft pressurization. In the "EMERG" position, electrical power for system valves is switched from the main DC bus No. 2 to the emergency DC bus for the RH EMERGENCY PRESSURIZATION switch, and from the isolated DC bus to the emergency DC bus for the LH EMERGENCY PRESSURIZATION switch. At the same time, the left and right primary heat exchanger temperature indicators, and the LEFT OPEN pressure relief valve indicator, will receive power from the emergency DC bus. The system shutoff switches on the flight engineer's panel are inoperative at this time and will not open or close the shutoff valves.

PRESSURIZATION SYSTEM INDICATORS.

The pressurization system contains two cabin altimeter and differential pressure indicators, a cabin rate of climb indicator, and a cabin pressurization low light.

Cabin Altimeter and Differential Pressure Indicators.

Two cabin altimeter and differential pressure indicators (figures 1-155 and 1-183) provide indications of cabin altitude and differential pressure. The short pointer indicates cabin altitude while the long pointer indicates the difference in PSI between cabin pressure and the atmosphere.

Cabin Rate-of-Climb Indicator.

A cabin rate-of-climb indicator (figure 1-183) indicates the rate of cabin altitude change (climb or descent).

Low Pressurization Lights.

There are two low pressurization lights that illuminate when the cabin altitude goes above 10,000 (±1,000) feet. The CABIN PRESS. LOW light is located on the pilots' annunciator panel (figure 1-261). The CABIN PRESS light is located on the engineer's environmental control panel (figure 1-183).

NORMAL OPERATION OF PRESSURIZATION SYSTEM.

Before Take-off.

1. All doors and hatches - CLOSED AND LOCKED

2. CABIN PRESSURE MANUAL CONTROL - "AUTO"

3. Emergency Depressurization Switches - "NORMAL"

4. CABIN ALT Selector Knob - Set cabin altitude 500 feet above field pressure altitude.

5. AIR COND MASTER Switch - "BOTH"

6. CABIN ALT LIMIT ORIDE Switch - "NORMAL"

7. RATE Knob - As required

After Take-Off, Climb, and Cruise.

1. CABIN ALT Selector Knob - Desired cabin altitude (normally 500 feet above planned cruise altitude).

2. RATE Knob - As Required

Descent.

1. CABIN ALT Selector Knob - Set cabin altitude 500 feet above field pressure altitude.

2. RATE Knob - Desired rate of descent.

MANUAL PRESSURIZATION PROCEDURE.

1. Move the manual pressure control knob out of the "AUTO" position.

The rate of cabin pressure change corresponds to the degree of rotation of the manual control. The "INCREASE PRESS" position lowers the cabin altitude. The "DECREASE PRESS" position will raise the cabin altitude.

2. Adjust the manual control and closely monitor the cabin rate-of-climb indicator to maintain the desired cabin pressure change.

CARGO COMPARTMENT FLOOR HEAT SYSTEM.

The cargo compartment floor heat system forms a part of the environmental systems. The cargo compartment floor heat system consists of bleed air ducting, a floor heat shutoff valve, a floor heat modulating valve, a bleed air ejector, and forward and aft floor heat ducting. When the floor heat shutoff valve and modulating valve are open, hot airflow through the bleed air ejector into the ducting is established. The ejected bleed air and ambient cargo compartment air mix in the ducting and is distributed to outlets running laterally across the underside of the cargo compartment floor panels.

A primary sensor and an anticipator and high limit sensor in the ducting provide inputs to a cargo compartment floor temperature control that, in turn, provides signals to modulate the position of the floor heat modulating valve. The system is protected against overheating by a continuous loop temperature sensor.

CARGO COMPARTMENT FLOOR HEAT SYSTEM CONTROLS.

The system is controlled by a FLOOR HEAT switch and a FLOOR OVHT SYS switch on the environmental panel (figure 1-183).

Floor Heat Switch.

The two-position ("ON", "OFF") FLOOR HEAT switch controls flow of heated bleed air to the bleed air ejector. In "ON", the switch completes a circuit to open the shutoff valve and energize the solenoid in the modulating valve. In "OFF", when the AIR COND MASTER switch is in "APU" or "ENG START", it overrides the FLOOR HEAT switch and opens the shutoff valve but holds the heat modulating valve closed.

When the AIR COND MASTER switch is placed to "APU" and the FLOOR HEAT switch is "ON", the shutoff valve and the modulating valve are both open and APU heated air is available for under floor heating.

Floor Overheat System Switch.

The three-position (momentary "TEST", center unplacarded NORMAL, momentary "RESET") FLOOR OVHT SYS switch provides a test capability for the continuous loop temperature sensor and a reset capability after an overheat condition has disabled the cargo compartment floor heat system. In "TEST", circuits are completed to close the floor heat shutoff valve, close the floor heat modulating valve, lock in the overheat relay, check continuity through the cargo compartment floor temperature control, and illuminate the floor overheat lights. In "RESET", the switch circuits release the locked-in overheat relay and enable the shutoff valve and the floor heat modulating valve to return to their selected positions.

Cargo Compartment Floor Heat System Overheat Light.

The floor overheat light is placarded OVERHEAT. The light illuminates when an overheat condition is sensed by the continuous loop temperature sensor.

WINDSHIELD RAIN REMOVAL SYSTEM.

The windshield rain removal system forms a part of the environmental systems.

Rain is removed from the pilot's and copilot's windshields by high-velocity, high-temperature bleed air directed at the windshield bases through slot-type nozzles. The high velocity deflects and breaks up large rain drops. The high temperature evaporates residual droplets that are not deflected. The bleed air is taken from downstream of the air conditioning system primary heat exchangers, at approximately 230° C.

WINDSHIELD RAIN REMOVAL SYSTEM CONTROLS AND INDICATORS.

Windshield Rain Removal System Selector Switch.

A four-position ("OFF", "PILOT", "BOTH", "COPILOT") rotary-type RAIN REMOVAL selector switch (figure 1-188) controls the system. With the switch in "PILOT", "BOTH", or "COPILOT" positions, the appropriate regulator valves and shutoff valves open. The windshield rain removal circuits are designed so that power cannot be supplied to the corresponding windshield ice and fog protection system when the windshield rain removal system is operating.

Windshield Rain Removal System Overheat Lights.

A PLT OVHT light, a CO-PLT OVHT light (figure 1-188), and a RAIN REMOVAL OVHT light (figure 1-261) illuminate to warn of system overheating. An overheat sensing element is embedded in the vinyl layer in each of the two windshields. The sensing element circuit closes to illuminate the appropriate overheat light whenever the temperature of the vinyl layer reaches approximately 71° C. The overheat light extinguishes whenever the temperature of the vinyl layer drops below approximately 64° C. These overheat sensing elements monitor the windshield ice and fog protection system operation as well as the windshield rain removal system operation.

WINDSHIELD RAIN REMOVAL SYSTEM OPERATION.

To operate the rain removal system, accomplish the following:

1. BLEED AIR SHUTOFF Switches - "OPEN"
2. SYS SHUTOFF Switches - "OPEN"

CAUTION

The windshield rain removal system should be operated only momentarily on a dry windshield. Failure to observe this can result in overheat damage.

3. RAIN REMOVAL Switch - "BOTH"
4. RAIN REMOVAL Switch - "OFF"

Turn the rain removal system off as soon as the windshield is clear.

ELECTRONIC COOLING SYSTEM.

The electric cooling system operates automatically. The system uses two large fans that work in conjunction with an electronic cooling flow control valve, and two small fans. The two large fans cool the electronic equipment in the forward fuselage underdeck area while the two small fans cool the flight engineer's circuit breaker panels and electrical equipment in the forward fuselage underdeck area. The system operates in a ground and a flight mode. The electronic cooling flow control valve remains in the modulating position during all operations.

ELECTRONIC COOLING SYSTEM MANUAL HANDLE.

A handle is provided in the left underdeck area to manually position the electronic flow control valve. The handle is normally secured in the mid position. This position provides a valve setting which allows the optimum airflow through the electronic cooling system. When pushed full in, the valve moves to full open. When pulled full out, the valve assumes a modulated position towards closed (minimum airflow).

ELECTRONIC COOLING SYSTEM COOLING FAN FAILURE LIGHT.

The COOLING FAN FAILURE light illuminates AVIONICS when the large fans fail, and illuminates ELECTRICAL when the small fans fail (see figure 1-176). On the ground, the appropriate light illuminates if any fans fail. In-flight, the appropriate light illuminates momentarily during switch-over if large fan No. 1 or small fan No. 1 fails. If both large fans or both small fans fail in-flight, the appropriate light illuminates steady. If large fan No. 1 or small fan No. 1 fails in-flight, the appropriate light illuminates as soon as the aircraft is on the ground.

ELECTRONIC COOLING SYSTEM OPERATION.

Ground Mode Of Operation.

To accomplish maximum cooling, touchdown relays complete circuits to all four fans. The No. 2 electronic cooling fan is normally inoperative on the ground; however, should the No. 1 electronic cooling fan fail, the No. 2 fan will operate. Both small fans operate continuously on the ground.

Flight Mode Of Operation.

During flight, large fan No. 1 and small fan No. 1 run continuously to provide cooling. The circuits for large fan No. 2 and small fan No. 2 are opened by touchdown relays. If large fan No. 1 or small fan No. 1 fails in-flight, load current sensing relays automatically switch circuits to run large fan No. 2 or small fan No. 2.

ANTI-ICING AND DE-ICING SYSTEMS.

The aircraft has anti-icing systems that prevent ice formations and de-icing systems that remove ice formations. The anti-icing system uses engine bleed air. The de-icing system and the windshield heat system use electrically heated elements. Controls and indicators for all anti-icing and de-icing systems are located on the pilots' overhead panel. (See figure 1-188.)

ICE DETECTION SYSTEM.

The ice detection system has a temperature probe and a moisture probe, located on the left-hand side of the fuselage.

If both probes simultaneously detect low ambient temperature and moisture, a circuit is completed to illuminate a warning light.

Ice Detection Controls.

ICE DETECTION TEST SWITCH.

A two-position ("NORM", "TEST") ICE DET switch (figure 1-188) tests the ice detection system. In "TEST", the switch simulates an icing condition to illuminate the warning light. In "NORM", the switch returns the system to normal operation.

ICE DETECTION CONTROL SWITCH.

A three-position ("OFF", "AUTO", "MAN") ICE DET CONTROL switch enables selection of operating mode. In "OFF", the system is inoperative. In "AUTO", the ice detection system is armed and if icing conditions are detected, a warning light illuminates, and the engine anti-icing system and the engine ram pressure probes anti-icing systems start. In "MAN", the system is armed and if icing conditions are detected, the warning light illuminates. The wing anti-icing system and the empennage de-icing system must be manually started regardless of ICE DET CONTROL switch position.

Ice Detection System Icing Warning Light.

An ICING warning light illuminates whenever the system is operating and the probes detect icing conditions.

TOTAL TEMPERATURE PROBES DE-ICING SYSTEM.

Two total temperature probes are installed on the forward fuselage skin. Total temperature probe No. 1 provides an input to CADC No. 1 and to a total temperature indicator on the flight engineer's panel. Total temperature probe No. 2 provides an input to CADC No. 2 and to a total temperature indicator on the copilot's instrument panel. Both total temperature probes have electrical heating elements for de-icing.

Temperature Probe De-Ice Switch.

A two-position ("ON", "OFF") TEMP PROBE DEICE switch manually controls electrical de-icing of the total temperature probes.

PITOT-STATIC TUBES ANTI-ICING SYSTEMS.

Anti-icing systems are provided for the pilot's and copilot's pitot-static tubes. Operation of both systems is the same except that the pilot's system controls the engine ram air pressure probe anti-icing system. Each pitot tube has mast and head heating elements.

Pitot-Static Tubes Anti-Icing Systems Controls.

PILOT PITOT HEAT SWITCH.

A two-position ("ON", "OFF") PILOT PITOT HEAT switch controls the pilot's pitot-static tubes anti-icing system. The

"ON" position energizes heating elements in the pilot's pitot-static tubes, and energizes an EPR heater relay that controls the engine ram air pressure probe anti-icing system if it is not already operating.

COPILOT PITOT HEAT SWITCH.

A two-position ("ON", "OFF") COPILOT PITOT HEAT switch operates the same as the PILOT PITOT HEAT switch, except that it does not control the EPR heater relay.

Pitot-Static Tubes Anti-icing Systems Lights.

HEATER FAULTED LIGHTS.

A PILOT HTR FAULTED light and a COPILOT HTR FAULTED light illuminate during anti-icing operation if failure of a head heating circuit element circuit occurs.

PITOT HEAT LIGHT.

A PITOT HEAT light on the annunciator panel illuminates whenever one or both of the HTR FAULTED lights illuminate.

ANGLE-OF-ATTACK VANES ANTI-ICING SYSTEMS.

The pilot's and copilot's angle-of-attack vanes are electrically heated. The angle-of-attack vanes heating elements are controlled and monitored by the PILOT and COPILOT ANGLE OF ATTACK DE-ICE switches and indicators on the pilots' overhead control panel.

Angle-of-Attack Vanes Anti-icing Systems Controls.

The PILOT and COPILOT ANGLE OF ATTACK DEICE two-position ("ON", "OFF") switches supply electrical power to the heating elements when placed to "ON".

Angle-of-Attack Vanes Anti-icing Systems Lights.

A HTR FAULTED light above the corresponding ANGLE OF ATTACK DE-ICE switch illuminates when a fault occurs in a heater circuit. In addition the STALL PREV 1 or STALL PREV 2 annunciator lights will illuminate.

ENGINE RAM PRESSURE PROBE ANTI-ICING SYSTEM.

Four engine ram pressure probes, one on each pylon, provide pressure input to their corresponding Engine Pressure Ratio (EPR) indicator. Each engine ram pressure probe is heated electrically for anti-icing.

Engine Ram Pressure Probe Anti-icing System Controls.

There are three methods for controlling the electrical heating elements. Each electrical heating element is energized when the corresponding ENGINE ANTIICE switch is "ON". All four electrical heating element circuits are energized when the ICE DET CONTROL switch is in "AUTO" and the ice detection system signals icing conditions. All four electrical heating element circuits are energized when the PILOT PITOT HEAT switch is turned "ON".

WING ANTI-ICING SYSTEM.

The wing anti-icing system uses bleed air from the crosswing manifold. The bleed air routes through six modulating and shutoff valves to six piccolo-tube ducts. Bleed air ejected from the ducts mixes with air inside the wings and then routes through passages in the leading edge skin. The mixed air is discharged through louvered vents in each wing tip and through slots between each pylon and wing.

The system is capable of anti-icing three leading-edge sections of each wing; one section between the pylons and two sections outboard of each pylon. The system does not provide anti-icing for each wing leading-edge section between the fuselage and the inboard pylon.

Wing Anti-icing System Switches.

Three 2-position ("ON", "OFF") WING ANTI-ICE switches control the wing anti-icing system. In "ON", each switch controls a pair of modulating and shutoff valves, one valve in each wing, for symmetrical anti-icing. Thermostats in the wing leading edge plenums regulate the amount of bleed air entering the anti-icing ducts. In "OFF", all flow of bleed air is stopped to the wing leading-edge sections controlled by the switch.

Wing Anti-icing System Lights.

Three groups of lights designated the OUT-BOARD, INNER-OUTBD, and MID monitor the wing anti-icing system. The lights are placarded LEFT ON, RIGHT ON, L OVERHEAT, and R OVERHEAT. The LEFT ON and RIGHT ON lights illuminate when the corresponding modulating and shutoff valves open.

Each L OVERHEAT and R OVERHEAT light is connected to overheat sensors in the wing leading edge. The MID overheat lights illuminate if the temperature at the mid leading edge reaches 90° C. The INNER-OUTBD and OUT-BOARD lights illuminate if the temperature in these leading-edge sections reaches 105° C. A WG ANTI ICE OVHT light on the annunciator panel illuminates whenever one or more of the L OVERHEAT or R OVERHEAT lights illuminate.

Normal Operation of Wing Anti-icing System.

To place the full wing anti-icing system in operation, proceed as follows.

1. OUT-BOARD WING ANTI-ICE Switch - "ON". OUT-BOARD LEFT ON and RIGHT ON lights must illuminate.

2. INNER-OUTBD WING ANTI-ICE Switch - "ON". INNER-OUTBD LEFT ON and RIGHT ON lights must illuminate.

3. MID WING ANTI-ICE Switch - "ON". MID LEFT ON and RIGHT ON lights must illuminate.

CAUTION

- On the ground, the system must never be used to remove ice, frost, or snow from the wings. With no airflow over the wing surfaces, temperatures within the leading edges rise quickly to the point where damage to fuel tank sealants, paint, structures, and other components can occur.
- Dry air operation is restricted to a 30-second test. Prolonged operation in dry air can result in damage to the leading edge.

EMPENNAGE DE-ICING SYSTEM.

Empennage de-icing is provided by electrically heated metal elements imbedded in the leading edge sections of the horizontal stabilizer. No provision is made for de-icing the vertical stabilizer. The horizontal stabilizer leading edge is divided into eight sections, each containing two shedding areas and three parting strips. The de-icing and temperature controllers route AC power to the shedding areas and parting strips. The electrical power to the shedding areas is cycled on and off, and the ice is blown off by the airstream. Electrical power to the parting strips is applied continuously.

Control of the system is maintained by a temperature controller, a de-icing controller, and temperature sensing elements in the leading edge of the horizontal stabilizer.

The de-icing controller provides power to the shedding areas. The temperature sensors in the shedding areas provide overheat protection. These sensors signal the controller to shut off power whenever the heating elements exceed 32° C.

The temperature controller provides power to the parting strips. The total temperature sensor signals the controller to remove power when a temperature of -29° C is reached.

The parting strip temperature sensors signal the controller to remove power when the parting strip heating elements exceed 32° C. In air temperatures below -29° C, the controller removes power from both parting and shedding areas.

Empennage De-Ice Switch.

The empennage de-icing system is controlled by a three-position ("ON", "OFF", "TEST") EMP DE-ICE switch on the anti-icing control panel. When the switch is placed to "ON", the system is armed and becomes operative after the aircraft is airborne.

After the de-icing controller is activated, the circuit to the cyclic shedding areas is closed, the temperature controller becomes activated, and the parting strip circuit is closed. The heating time for each cyclic area is determined by the shedding area temperature sensors or by a maximum heating timer built into the controller.

The de-icing controller allows a maximum heating time of 15 seconds on each cyclic area. If an entire de-icing cycle is completed in less than three minutes, a dwell period delays the next cycle until the three-minute interval has elapsed. Therefore, no cycle area receives power more often than once every three minutes.

When the EMP DE-ICE switch is placed to the "OFF" position, and a de-icing cycle has begun, the de-icing controller continues to operate until the cycle is completed. The "TEST" position is described in paragraph "Empennage De-icing System Test Procedures".

Empennage De-Ice Indicator Lights.

Three EMP DE-ICE INDICATOR lights (SYS OFF, ELEM FAULT, and STRIP OFF) are on the pilots' overhead control panel. The SYS OFF light illuminates continuously if the controller stops cycling while the control switch is in the "ON" position and intermittently during a test cycle to indicate the stepping of the system from one shedding area to the next area during test. It is thus illuminated once for each shedding area or sixteen times for a complete test cycle. The ELEM FAULT light illuminates if there is an overload in any of the phases of the shedding area circuit or if there is an open circuit in any one phase or two phases of the three phase shedding area circuit. These conditions are detected only during the time the faulted shedding area is selected for heating and power is connected to the leading edge. The system operates normally on all other shedding areas and the light is extinguished. The STRIP OFF light illuminates whenever the parting strips are disconnected from three phase power as a result of either the airplane being on the ground, an overheat condition at the parting strips on the leading edge, or a circuit malfunction causing a circuit breaker to open which is in the parting strip circuit but is located on the de-ice controller. Temperature controlled cycling of the parting strip power during a de-icing operation will result in cycling of the STRIP OFF light.

Empennage De-Icing System Test Procedures.

The empennage de-icing system test is accomplished as follows:

1. Place the EMP DE-ICE switch momentarily to "TEST". This activates the de-icing controller through the temperature controller.

When the aircraft is on the ground and a test cycle has been initiated, the SYS OFF light blinks rapidly 16 times. Should one of the shedding area sensors be faulted, the SYS OFF light illuminates for 15 seconds when that particular area is selected by the de-icing controller. The safety switches on the main landing gear prevent the parting strips from being heated on the ground.

The STRIP OFF light illuminates during the test which lasts approximately three minutes. The ELEMENT FAULT light remains extinguished. At the end of the test, the STRIP OFF light extinguishes.

CAUTION

> If the STRIP OFF light fails to illuminate during the ground test cycle, immediately open the three EMP DE-ICE PWR circuit breakers on the flight engineer's No. 1 circuit breaker panel. A maintenance inspection must be performed prior to use of the system.

When the control switch is momentarily placed in the "TEST" position, while airborne, power is applied to both the shedding areas and the parting strips. The system functions exactly as if it is on except that the SYS OFF light illuminates each time a shedding area is selected for a total of 16 areas. The length of time that power is applied to the shedding area is determined by the temperature control or the 15 second timer whichever occurs first. Should an element be faulted, utilization of this test cycle identifies the faulted area by permitting counting of the SYS OFF blinks preceding the ELEM FAULT light.

Since power is applied to the parting strip during this airborne cycle, the STRIP OFF light does not illuminate.

CAUTION

> Do not operate the Empennage De-ice system during dry air flight for more than one test cycle.

Empennage De-Icing System Normal Operation.

The EMP DE-ICE switch may be placed to "ON" after the system is tested. This action arms the system. After take-off, the system becomes operative when the temperature sensors detect a range between approximately -29° C to +32° C.

ENGINE ANTI-ICING SYSTEM.

The engine anti-icing system is made up of two separate subsystems; the engine nacelle lip anti-icing system and the engine inlet anti-icing system.

The engine nacelle lip anti-icing system utilizes outer diameter (OD) bleed air ducted forward to the nacelle inlet lip. A venturi is attached to the bleed port, and the ducting to the inlet lip contains a pressure regulating shutoff valve. The venturi is designed to limit bleed airflow during normal operation at low thrust settings when the valve is not regulating and any time a downstream failure occurs. At high thrust settings, the pressure regulating valve restricts the flow of bleed air to the nacelle lip by maintaining a maximum downstream pressure of approximately 17 PSIG. Should the pressure regulating valve fail, the Nacelle Inlet Pressure Limiter Valve limits maximum downstream pressure to 40 PSI.

Engine inlet anti-icing is accomplished by ducting engine bleed air through a flow control valve and a shutoff valve to a chamber formed by the inner and outer skins of the fan inlet case. The flow control valve regulates the flow, and therefore the temperature, of the air into the fan inlet case. The air is then ducted through the inlet vanes into a plenum chamber which is part of the front bearing support housing. From this chamber the air is discharged into the outer periphery of the engine nose dome and then into the engine.

Engine Anti-Icing System Controls.

ICE DET CONTROL SWITCH.

When the switch is placed to "AUTO", automatic operation of the engine anti-icing system is initiated and controlled by the ice detector system. The systems remain on as long as icing exists, and are automatically turned off one minute after the detector ceases to sense icing conditions.

ENGINE ANTI-ICE SYSTEMS SWITCHES.

Four 2-position ("ON", "OFF") ENGINE ANTI-ICE systems switches (figure 1-188) manually control the engine anti-icing systems. Each switch controls two separate anti-icing control valves; one for the inlet lip anti-icing systems, and one for the engine anti-icing systems.

CAUTION

> When the ambient temperature is above 10 degrees C (50° F), do not operate engine anti-ice more than ten seconds. This is to avoid deterioration of the rubber compound used in the center bay of the inlet guide vanes. This does not preclude checking the anti-icing system at temperatures above 10 degrees C for less than 10 seconds.

Engine Anti-Icing System Indicators.

ENGINE ANTI-ICE ON LIGHTS.

Four ANTI-ICE ON lights are installed on the anti-icing control panel to indicate when the valves have opened. When an ENGINE ANTI-ICE switch is "OFF" and one valve remains open, the light remains illuminated.

WINDSHIELD HEATING SYSTEM.

An electrical heating system provides protection to all the flight station windshields. The three front windshield panels are of laminated glass and vinyl construction with a thin coating of transparent, electrically conductive material between the outer glass layer and the vinyl interlayer. This coating provides both ice and fog protection and maintains an optimum temperature for protection against bird strikes. The clear vision and side windshield panels are protected against fogging only.

Windshield Heat Switches.

Three 3-position ("HIGH", "OFF", "NORMAL") lever-lock type switches, incorporating the locking feature in the "OFF" position, are located on the pilots' overhead control panel. The switches are placed in "NORMAL", for defogging and de-icing. If severe icing conditions are encountered, the switches can be placed in the "HIGH" position which increases the voltage to the forward windshields for faster heat cycles. The "HIGH" position is intended to be used only in-flight whenever the "NORMAL" position does not provide enough heat. After landing and while taxiing, the switch should be returned to the "NORMAL" or "OFF" position if the "HIGH" position was used in-flight. The heat on the side windshields does not increase with a change in switch position. Opening a clear vision windshield cuts power to both side windshields on that side.

COLD START switches are located on the pilots' overhead control panel to provide manual heat control to the forward windshields when the temperature at the sensor is below -43° C. The manual cycling should be 5 seconds on and 10 seconds off until the windshield temperature reaches -43° C when automatic operation commences. The side windshield heat starts at temperatures down to -54° C.

CAUTION

The windshield heat switches should be in the "NORMAL" position when using the "COLD START" switches.

HYDRAULIC SYSTEMS.

Three separate hydraulic systems are installed on the aircraft. (See figure 1-189.)

HYDRAULIC SYSTEM NO. 1.

Hydraulic system No. 1 is powered by two variable displacement pumps driven by No. 3 and No. 4 engines. The pumps furnish 3,000 PSI to supply half the normal power for the ailerons, rudder, and elevator. Other components in this system are an AC electric motor-driven suction boost pump, pressure switches, electrically actuated shutoff valves, engine driven pump runaround circuit, filters, pressure relief valve, and a 2.4-gallon reservoir located on the right wall of the cargo compartment. (A more detailed description of the various components may be found in the hydraulic system No. 2 description.)

HYDRAULIC SYSTEM NO. 2.

Hydraulic system No. 2 is powered by two variable displacement hydraulic pumps driven by No. 1 and No. 2 engines. The pumps furnish 3,000 PSI to operate the landing gear, normal wheel brakes, nosewheel steering, pitch trim, UARRSI slipway door, and emergency generator. It also supplies half the power for the ailerons, rudder, elevator, spoilers and flaps. Two suction boost pumps are used to provide a flow of pressurized fluid from a nonpressurized reservoir to the engine-driven pumps. One of the suction boost pumps is driven by an AC electrical motor, the other by a hydraulic motor. The hydraulically operated suction boost pump receives its operating power when the hydraulic system is pressurized. A pressure switch causes a low pressure warning light on the flight engineer's panel to illuminate if suction boost pump pressure drops to approximately 25 PSI. Electrically actuated shutoff valves, installed in the supply line and in the output line, are used to isolate the associated engine-driven pump. The valves are controlled by a switch on the flight engineer's panel or by the fire handle for that engine. A runaround circuit is provided to cool the engine-driven pump and prevent cavitation of the pump when the shutoff valves are closed. A pressure switch causes a PRESS. LOW light on the flight engineer's panel to illuminate if the pump output pressure drops to approximately 1,350 PSI. A pressure relief valve prevents excessive pressure from developing if an engine driven pump fails to regulate the pressure. A reservoir, which contains 4.2 gallons with the gear down and 5 gallons with the gear up, is located on the left wall of the cargo compartment.

HYDRAULIC SYSTEM NO. 3.

Hydraulic system No. 3 is powered by two electrically-driven variable displacement pumps located in the left wheel well. The pumps provide 3,000 PSI for operating the pressure door, ramp, petal doors, APU starter, aileron tab lockout, emergency brakes, and elevator emergency systems. They also provide half the power for the flaps and spoilers. A pressure switch causes a PRESS. ON light on the pilots' center instrument panel to illuminate when system pressure is above approximately 1,350 PSI. A pressure relief valve prevents excessive system pressure from developing if the pumps fail to regulate pressure. Two piston accumulators are installed to provide a reserve supply of fluid under pressure and are used to start the APU. They also can provide emergency brake pressure. The accumulators are located on the left wall of the cargo compartment, immediately forward of the system reservoir. A handpump, located on the left wall of the cargo compartment immediately below the No. 3 reservoir, provides a means of pressurizing the accumulators when electrical power is not available. Approximately

460 strokes of the hand pump are required to pressurize the accumulators to 3,000 PSI. A direct-reading gauge is located adjacent to each accumulator to show accumulator system pressure. A 4.8-gallon reservoir is located forward of system No. 2 reservoir on the left wall of the cargo compartment. Manually operated interconnect valves, located between systems No. 2 and No. 3, permit use of system No. 3 pressure to ground-check the operation of components in system No. 2. A check valve in system No. 2, upstream of the interconnect valve, ensures integrity of system No. 2 if the interconnect valve leaks. This check valve also prevents pressurization of system No. 3 from system No. 2.

HYDRAULIC SYSTEM CONTROLS. (See figure 1-190.)

Engine Valve Switches (Hydraulic Systems No. 1 and No. 2).

Four 2-position ("NORM", "OFF"), lever-lock ENG VALVES switches are on the hydraulics panel. Each switch controls the 28-volt DC motor-operated shutoff valve in the supply line and the 28-volt DC solenoid-operated shutoff valve in the pressure line of its own engine-driven pump. The "OFF" position energizes both valves closed. The "NORM" position energizes the motor-operated valve and deenergizes the solenoid-operated valve, opening both valves.

Suction Boost Pump Switches (Hydraulic Systems No. 1 and No. 2).

Two SUCT BOOST PUMP switches are located on the hydraulic panel. The switches have two positions; "ON", "OFF". The "ON" position energizes the respective AC suction boost pump through a DC relay.

No. 1 Pump and No. 2 Pump Switches (Hydraulic System No. 3).

Two, three-position ("ON", "OFF", "RAMP CONTROL") toggle switches on the hydraulic panel control the hydraulic system No. 3 pumps and two solenoid operated shutoff valves. One valve controls system No. 3 pressure to the spoiler cable servo; the other ports accumulator pressure to the operating systems supplied by hydraulic system No. 3. The "ON" position of each switch energizes the associated AC hydraulic pump and the two solenoid-operated shutoff valves through, respectively, a DC pump control relay and DC spoiler cable valve relays. A two-second time delay relay is incorporated in the control circuit for pump No. 2 to protect the electrical system against overloads. The "RAMP CONTROL" position of each switch transfers control of the related pump to the ramp control panel in the aft end of the cargo compartment.

Controls Which Automatically Actuate Hydraulic System No. 3 Pumps.

The hydraulic system No. 3 pumps will turn on automatically if:

1. An aileron is in tab operable.
2. Elevator emergency power is selected.
3. Spoiler lever is moved from CLOSED.
4. Spoilers move from closed position.

The two-second time delay will still occur during automatic operation.

HYDRAULIC SYSTEM INDICATORS. (See figure 1-190.)

Hydraulic Pressure Indicators.

An AC HYD pressure indicator is provided on the hydraulic systems control panel for each of the three hydraulic systems. A direct-reading indicator is provided for each of the three hydraulic systems. Each indicator is located in the respective hydraulic service center in the cargo compartment.

Pressure Low Lights (Hydraulic Systems No. 1 and No. 2).

A PRESS. LOW light, mounted above each of the ENG VALVES switches and SUCT BOOST PUMP switches on the hydraulic systems control panel, warns that the output pressure of the related pump is below limits. The lights associated with the engine-driven pumps illuminate when pump pressure drops to approximately 1,350 PSI. The light associated with each suction boost pump illuminates when pump output pressure drops to approximately 25 PSI. Pressure switches control operation of the lights.

Pressure On Light (Hydraulic System No. 3).

A PRESS. ON light, located on the pilots' center instrument panel, illuminates when hydraulic system No. 3 is pressurized. A pressure switch supplies DC power to the light when system pressure is approximately 1,350 PSI.

Accumulator Pressure Indicators (Hydraulic System No. 3).

Each accumulator has a direct-reading pressure indicator. The indicator is located immediately above the servicing fitting on each accumulator.

Hydraulic Reservoir Quantity Gauges.

A direct-reading sight gauge calibrated "FULL" and "REFILL" is mounted on the side of hydraulic reservoirs No.

1 and No. 3. A similar gauge, calibrated "FULL" and "REFILL" for gear-up and gear-down conditions, is mounted on the side of the No. 2 reservoir.

FLIGHT CONTROL SYSTEMS. (See figure 1-191.)

The aircraft is controlled by hydraulically powered ailerons, rudder, and elevator systems. Control inputs are transmitted to quadrants by a dual cable system. Quadrant motion is transmitted by pushrod and cable systems to each power control assembly. The resulting mechanical displacement of a servo flow control valve allows hydraulic actuation of the flight control surface. During normal operation, the control assemblies are powered by hydraulic systems No. 1 and No. 2. A check valve is installed in the pressure inlet line of each hydraulic power control unit. This check valve will prevent damage to the respective flight control hinge points and mechanical stops when the hydraulic systems are depressurized. If one hydraulic system is lost, the flight controls remain operational. If both hydraulic systems are lost, an emergency system is available for the aileron and elevator systems.

AILERON SYSTEM.

Aileron Power Control Switches.

Four 3-position ("NORMAL", "OFF", "TAB OPERABLE") lever-lock LH and RH AILERON switches on the pilots' overhead panel control the power control assemblies and select tab operation. The "NORMAL" position causes the related shutoff and bypass valve to open and port fluid to the servo flow control valve. The "OFF" position closes the valve, discontinuing the supply of hydraulic pressure to the servo flow control valve. The "OFF" position also opens the shutoff valve bypass port to connect the two ends of the actuator to each other and to the return line, permitting the actuating piston to move freely with aileron surface movement. The "TAB OPERABLE" position performs the same function as the "OFF" position as far as the power control assemblies are concerned. When "TAB OPERABLE" is selected with either the two left (LH) or the two right (RH), or all four aileron power control switches, the corresponding aileron tab becomes operable. Placing either the two left or the two right, or all four power control switches, to "TAB OPERABLE" energizes the pumps of hydraulic system No. 3 and energizes the corresponding solenoid-operated tab lock valve. The valve then opens, porting system No. 3 pressure to the related tab lockout actuator. Actuator movement adjusts the tab input linkage, allowing control wheel movement to be transmitted to the tab.

Aileron Trim Control Switches.

Two AIL TRIM switches, located on the control pedestal, are provided for trimming the aircraft about the roll axis. The switches are three-position ("LOWER LEFT WING", "LOWER RIGHT WING", "OFF") toggle switches, spring-loaded to the center (OFF) position. The switches must be operated simultaneously to provide both power and ground to the AC trim actuator. The trim actuator acts on the center wing quadrant to position the quadrant mechanically and thereby to position the aileron surfaces hydraulically.

Aileron Trim Position Indicator.

A DC AILERON TRIM position indicator is installed on the pilots' center instrument panel.

Aileron System Power Off Lights.

Two POWER OFF lights for the left aileron power control assembly and two for the right aileron power control assembly are located on the pilots' forward overhead panel. The lights illuminate if pressure drops to approximately 1,500 PSI within the related power control assembly. A pressure switch controls the associated light.

Aileron System 1 Power and Aileron System 2 Power Lights.

An AILERON SYS 1 PWR and an AILERON SYS 2 PWR light are installed on the annunciator panel. The lights illuminate if the respective hydraulic system pressure drops to approximately 1,500 PSI within at least one of the power control assemblies. The POWER OFF lights on the pilots' overhead panel indicate which control assembly has suffered a loss of hydraulic pressure. Subsequent power failure of the system in the remaining power assembly will be indicated only by the related POWER OFF light.

Aileron Tab Operable Lights.

Two lights, R AIL. TAB OPER and L AIL. TAB OPER, are provided on the annunciator panel to give positive indication when the corresponding aileron tab linkage is in the operable configuration.

RUDDER SYSTEM.

The rudder system provides control, trim and yaw damping about the yaw axis.

Rudder Pedals.

The rudder system is mechanically controlled by a duplicate set of conventionally hinged rudder pedals. Two handcranks, one located below the pilot's instrument panel and one below the copilot's instrument panel, provide adjustment.

CAUTION

Do not force the rudder pedal adjustment handle after the pedals have contacted the mechanical stops.

Rudder Hydraulic Power Control Switches.

Two 2-position ("NORMAL", "POWER OFF") lever-lock switches are provided on the pilots' forward overhead panel. The "NORMAL" position of these switches causes the related system No. 1 or system No. 2 shutoff and bypass valve to open and port fluid to the servo flow control valve. The "POWER OFF" position closes the shutoff and bypass valve, discontinuing the supply of hydraulic pressure to the servo flow control valve and also opens the shutoff valve bypass port, permitting the actuating piston to move freely with rudder surface movement.

Rudder Trim Control Switches.

Two rudder trim control switches, located on the control pedestal, are provided for trimming the aircraft about the yaw axis. The switches are three-position "NOSE LEFT", spring-loaded center (OFF), and "NOSE RIGHT". The switches must be operated simultaneously to provide both power and ground to the AC trim actuator. This, in turn, mechanically positions the servo flow control valve of the power control assembly to hydraulically actuate the rudder surface.

Rudder Trim Position Indicator.

A DC RUDDER TRIM indicator is located on the pilots' center instrument panel.

Rudder System Power Off Lights.

Two POWER OFF lights, one for hydraulic system No. 1 and one for hydraulic system No. 2, are located on the pilots' forward overhead panel. The lights illuminate if the respective system pressure drops to approximately 1,500 PSI within the power control assembly. A pressure switch controls the associated POWER OFF light.

Rudder System 1 Power and Rudder System 2 Power Lights.

A RUDDER SYS 1 PWR light and a RUDDER SYS 2 PWR light are installed on the annunciator panel. The lights illuminate if the respective system inlet pressure drops to approximately 1,500 PSI. The lights are controlled by the pressure switches which control the POWER OFF lights.

Rudder System High Pressure Lights.

Two HI PRESS lights, one for each half of the dual power control assembly, are provided on the pilots' forward overhead panel to advise that high pressure is available at the related rudder actuator. The lights are normally illuminated when aircraft airspeed is below 160 (± 10) KCAS and extinguish above 160 (± 10) KCAS. Operation is controlled automatically by inputs from the CADCs.

Rudder High Pressure Override Switch.

A two-position ("NORM", "OVERRIDE") lever-lock type RUDDER HI PRESS OVERRIDE switch is located on the pilots' forward overhead panel. The "NORM" switch position allows the load limiting relief system to respond to CADC signals. The "OVERRIDE" position overrides the CADC signal to provide high pressure to the control assembly.

Rudder System Overpressure Light.

A RUDDER OVERPRESS light is provided on the annunciator panel to advise of an overpressure condition within the power control assembly. The light illuminates only when aircraft airspeed is above 160 (± 10) KCAS and high rudder system pressure is being supplied to at least one of the rudder actuators. The light is controlled by pressure switches and a CADC relay.

YAW DAMPING SYSTEM.

The yaw damper function is covered under the Automatic Flight Control System (AFCS) in this manual.

ELEVATOR SYSTEM.

The elevator consists of two control surfaces mounted symmetrically about the centerline of the aircraft at the trailing edge of the horizontal stabilizer. A central air data computer (CADC)-controlled artificial feel system is incorporated in the elevator control system.

Elevator Artificial Feel System.

The artificial feel system includes an artificial feel mechanism and a motor-operated "Q" system actuator. Signals from CADC No. 1 energize the motor of the "Q" system actuator to increase or decrease the feel produced by the artificial feel mechanism in accordance with increases and decreases in aircraft airspeed. Minimum "Q" and maximum "Q" positions represent approximately 220 KCAS and 380 KCAS respectively.

A signal comparator, which receives signals from a potentiometer in the "Q" system actuator and signals from CADC No. 2 and a Mach rate signal from CADC No. 1, is used to monitor the actual versus the desired operation of the "Q" system actuator. If a discrepancy exists, the comparator deenergizes the actuator, causing the artificial feel mechanism to be held in the position it was in at the time the discrepancy was detected. A light is provided on the annunciator panel to advise when the "Q" system has been deactivated by the signal comparator. A switch is provided on the pilots' forward overhead panel to move the artificial feel mechanism to the "LOQ" position. "LOQ" is approximately 220 KCAS or 0.53 Mach.

Elevator Hydraulic Power Control Switches.

Two 3-position ("NORM", "OFF", "EMER") ELEVATOR SYS 1, SYS 2 lever-lock switches are on the pilots' forward overhead panel. The "NORM" position of these switches causes the related system No. 1 or system No. 2 shutoff and bypass valve to open and port fluid to the servo flow control valve. The "OFF" position closes the shutoff and bypass valve, discontinuing the supply of hydraulic pressure to the servo flow control valve. The "OFF" position also opens the shutoff valve bypass port, permitting the actuating piston to move freely with elevator surface movement. The "EMER" position performs the same function as the "OFF" position as far as hydraulic systems No. 1 and No. 2 are concerned. It also turns the No. 3 hydraulic system pumps on and opens the system No. 3 shutoff and bypass valve porting fluid to the emergency system servo flow control valve.

Elevator Artificial Feel Selector Switch.

A three-position ("NORM", "LOQ", "RESET") lever-lock ELEVATOR ARTIFICIAL FEEL selector switch, located on the pilots' forward overhead panel, can be used to obtain the minimum "Q" feel value of the artificial feel mechanism if the "Q" system malfunctions. Placing the switch to "LOQ" results in the quadrant attachment point of the "Q" spring being driven to the "LOQ" position. The "NORM" position of the switch inputs "Q" feel forces to the control quadrant giving normal pilot elevator control feel. The "RESET" position is effective only when the aircraft is on the ground for clearing an ELEV FEEL MALFUNC annunciator light.

Elevator System Power Off Lights.

Two POWER OFF lights, one for elevator hydraulic system No. 1 and one for elevator hydraulic system No. 2 are on the pilots' forward overhead panel. A pressure switch controls the associated POWER OFF light.

Elevator System 1 Power And Elevator System 2 Power Lights.

An ELEV SYS 1 POWER light and an ELEV SYS 2 PWR light are on the annunciator panel. The lights illuminate if the respective system pressure drops to approximately 1,500 PSI within the power control assembly. The lights are controlled by the pressure switches which control the associated POWER OFF lights.

Elevator Emergency Power On Lights.

An EMER PWR ON light is on the pilots' forward overhead panel to give a positive indication of the elevator emergency system pressure when using the emergency actuator. A pressure switch controls the light.

Elevator Emergency Power Light.

An ELEV EMER PWR light is on the annunciator panel. The light illuminates if the pressure within the emergency actuator drops to approximately 1,500 PSI while the emergency elevator system is being used. A pressure switch controls the light.

Elevator Feel Malfunction Light.

An ELEV FEEL MALFUNC light is on the annunciator panel to indicate a malfunctioned artificial feel system. Illumination of the light indicates that a discrepancy between CADC input and follow-up signals has de-energized the "Q" system actuator and the artificial feel mechanism is being held in the last position required by the CADC prior to system malfunction. If the system has malfunctioned, normal operation in the air may be restored by stabilizing the speed at approximately 220 KCAS or 0.53 Mach and placing the switch to "LOQ" then back to "NORM". The light is controlled by a signal comparator incorporated in the system.

NOTE

- Above 220 KCAS or 0.53 Mach, operate the autopilot only in the pitchoff mode whenever an elevator artificial feel malfunction annunciator is present.
- If airspeed of 220 KCAS does not restore normal operation, consideration should be given to slowing to 0.53 Mach. A descent may be necessary.

HORIZONTAL STABILIZER TRIM SYSTEM.

Changing the angle of attack of the horizontal stabilizer is the method used to trim the aircraft's pitch axis. The horizontal stabilizer is limited to 4 degrees leading edge up travel under all conditions through limit switches. Leading edge down travel is limited through switches to 8 degrees with the flaps up and 9.6 degrees with the flaps extended. Mechanically, the horizontal stabilizer is limited to 4.5 degrees leading edge up travel and 10 degrees leading edge down travel. Nose-up trim is interrupted if a stall signal is present in the stall prevention system.

A trim actuator (linear jackscrew), attached to the horizontal stabilizer, and a trim actuator nut, attached to the vertical stabilizer, are used to change the angle of attack. Two completely separate systems are used for pitch trim operation. The first, hydromechanical (hydraulic or electrohydraulic), uses a hydraulic motor to drive the trim actuator nut. Rotation of the nut will either pull the trim actuator and the horizontal stabilizer down or push the trim actuator and the horizontal stabilizer up. The second, electromechanical (electric), uses an electric motor to turn the actuator. Rotation of this actuator will screw the actuator through the trim actuator nut either bringing the horizontal stabilizer down or sending the horizontal stabilizer up.

The rate of hydraulic/electrohydraulic pitch trim change is modulated by a flow control valve and can be up to five times faster than electric pitch trim operation. Power to operate the hydraulic motor comes from hydraulic system No. 2.

Hydraulic Pitch Trim Lever.

A HYD PITCH TRIM lever is located on each side of the control console just below and outboard of each set of throttle levers. A flow control valve operated by a cable system from these levers controls hydraulic operation.

The solenoid-operated hydraulic trim valve is maintained closed by electrical power supplied by the main DC bus No. 1 through a HYD/ELEC PT CONT circuit breaker on the No. 4 circuit breaker panel. Depressing the lever switches, or an electrical power failure, allows the valve to open, and permits hydraulic operation of the system by the pitch trim levers. When the autopilot pitch axis is engaged, depressing the pitch trim lever switches will disengage the autopilot.

Electrical Pitch Trim Switches.

Two electrical pitch trim switches are located on the center portion of the control pedestal. The dual switches must be operated simultaneously to provide both power and ground to one clutch in the electric pitch trim power unit. For electrical actuation of pitch trim, both switches are moved up for nose-down trim or down for nose-up trim. The switches are spring-loaded to a central (OFF) position. If the autopilot pitch axis is engaged, the switches are inoperative and the autopilot must be disengaged to operate the electrical pitch trim switches.

Electrohydraulic Pitch Trim Switch.

Two electrohydraulic pitch trim switches are located on the pilot's control wheels (figure 1-192). These dual switches must be operated simultaneously. The circuitry is designed so that opposing signals from pilot and copilot cancel each other. The switches are spring-loaded to a center (OFF) position. Switch operation automatically disengages the autopilot.

Electrical Pitch Trim Disconnect Buttons.

A TRIM DISC button on each pilot's control wheel provides disconnect of electrical and electrohydraulic pitch trim. Hydraulic pitch trim will still be available through use of the hydraulic pitch trim levers.

Electrical and Electrohydraulic Pitch Trim Reset Switch.

A TRIM RESET switch (figure 1-156) will restore power to either the electrical or the electrohydraulic pitch trim system after trim has been disconnected. The switch has three positions, "ELEC", "ELEC HYD" and an unmarked, spring-loaded center OFF position. The switch is held momentarily in the "ELEC" position to restore electric pitch trim. The switch is held momentarily in the "ELEC HYD" position to restore electrohydraulic pitch trim. Both "ELEC" and "ELEC HYD" must be reset to restore both modes of operation.

Horizontal Stabilizer Trim Position Indicator.

A HORIZ STAB trim position indicator is located on the pilots' center instrument panel and is calibrated in degrees of stabilizer travel.

WING FLAP SYSTEM.

The aircraft has double-slotted, high-lift, Lockheed-Fowler flaps. The wing flaps consist of two sections on each wing, extending from the wing root to the aileron. The flaps are mounted on carriages which roll on curved tracks extending aft from the trailing edge of the wing structure. Two hydraulic motors are mounted on a gearbox and drive the jackscrew actuators by means of torque tubes. Hydraulic system No. 2 supplies one of the motors and hydraulic system No. 3 supplies the other. The flaps are normally fully extended or retracted in 15 seconds. With either motor inoperative, this time is approximately 30 seconds.

An asymmetry detection system monitors the operation of the flap system and automatically stops movement of the flaps if either an inboard or an outboard flap lags its counterpart. Position transmitters and a computer amplifier detect asymmetric conditions. Solenoid-operated, spring-loaded torque tube brakes, and a solenoid-operated hydraulic supply shutoff valve are used to stop movement of the flaps when an asymmetric condition has been detected (figure 1-193). The flaps will stay locked in the asymmetric condition until they are reset on the ground. A broken cable detection device, located near the gear box input quadrant, is held in the armed position by the control cables. If a cable breaks, the detector actuates the flap cable detection switch to energize the asymmetry shutoff valve at the flap drive gear box and stop flap operation.

A manually operated shutoff valve located on the gearbox, can be used to shutoff the hydraulic systems of the wing flaps if required. A manually operated isolation valve, installed in the No. 3 hydraulic system pressure line, permits testing the No. 2 and No. 3 systems individually on the ground. The isolation valve is located at the right of the flap drive gearbox.

CAUTION

> The life of the wing flap motor-driven gearbox is significantly reduced, under single motor operation, if a complete flap cycle is attempted more frequently than one cycle every five minutes. The limit for dual motor operation is one cycle every two minutes.

Wing Flap Lever.

The wing flap lever, located on the control pedestal has three detent positions, placarded "FLAPS UP", "TAKE OFF/APPROACH" and "LANDING".

Additional markings are provided for the "25" percent and "50" percent positions. Any percentage of fully extended flaps can be selected with the lever. A spring-loaded friction brake locks the lever in position. The aft edge of the lever knob must be tilted upward to release the brake.

Flap Lever Stop Position Indicator.

The FLAP STOP POSITION INDICATOR pin (figure 1-156) is located on the flap lever quadrant. The pin is activated by a solenoid operated high force detent whenever the spoilers move from the locked position or the spoiler handle is armed in-flight. Refer to Section III for override procedure.

Flap Position Indicator.

The Wing Flap Position Indicator is located on the pilots' center instrument panel. The indicator is calibrated in percent of travel in increments of ten percent (100% equals 49 ± 1 degree). The transmitter is located on the flap gearbox output.

FLAP ASYMMETRY SYSTEM.

Flap Asymmetry Light.

A FLAP ASYM light on the annunciator panel illuminates in the event the Flap Asymmetry System has actuated one or more spring-loaded torque tube brakes. The flaps will be inoperative until the system has been reset.

Flap Asymmetry Test Panel.

A flap asymmetry test panel, located in the APU compartment, permits ground operational checkout and resetting of the flap asymmetry system.

Flap Asymmetry Detector Light.

A FLAP ASYM DET light on the annunciator panel illuminates if there is an electrical power interruption in the flap asymmetry system.

WING SPOILER SYSTEM.

The wing spoiler system (figure 1-194) is used in-flight to increase drag, and during ground roll to reduce lift and increase drag. Four banks of spoiler panels, two in each wing (totaling 36 panels), hinged at their leading edges, are installed on the upper and lower surfaces of the wing. A bank of spoilers is a section controlled by an actuator (i.e., LH inboard, LH outboard, RH inboard, or RH outboard). The upper spoilers are located near the wing trailing edge and the lower spoilers are located between the wing rear beam and the wing flaps. A spoiler lever, located on the center console, mechanically operates a cable servo located below the center console. The cable servo reduces the effort required for spoiler control and allows rapid spoiler lever movement with the actuation system following at a slower rate. The servo valves on the spoiler actuators control the flow of high pressure fluid directly to the inboard and outboard actuator cylinders. Each inboard and outboard actuator cylinder has a main and auxiliary piston connected to a common drive tube. Aerodynamic forces cause relief valves to operate, causing the spoilers to "blowdown" above 250 KCAS. Hydraulic pressure is supplied to the cylinders from the No. 2 and No. 3 hydraulic systems. Spoiler panel deflections are limited by mechanical stops.

If either hydraulic system fails, the cylinders will operate from the remaining hydraulic system at a reduced rate. Relief valves prevent excessive aerodynamic loads and subsequent structural damage by relieving pressure at 3,060 PSI.

Two drive tubes located in each wing actuate the spoiler panels. The drive tubes rotate cable quadrants, which transmit motion to the push-pull rods connected to the spoiler panels. In the closed position, the push-pull rods go overcenter on the cable quadrants, forming a mechanical lock. In the ground position, the lower spoiler push-pull rods go overcenter before the lower spoiler panels reach their ground position, preventing "blowdown".

WING SPOILER ASYMMETRY SYSTEM.

An asymmetry control circuit monitors travel of the outboard spoiler drive tubes and automatically closes and locks the spoiler surfaces if one of the drive tubes travels two and one-half inches while its counterpart on the opposite wing travels less than three-quarters of an inch. If an asymmetry occurs, the spoilers will retract. SPOILER INOP lights on the annunciator panel indicate that the asymmetry system has actuated. The system will remain inoperative until the asymmetry system is reset. Asymmetry reset capability is provided by a limit switch actuated by the spoiler lever.

Wing Spoiler System Controls.

WING SPOILER LEVER.

A spoiler lever is located on the center console between the pilot's and copilot's throttles. The spoiler lever has four placarded positions; "RESET", "CLOSED," "FLT LIMIT" and "GROUND," and an un-placarded "ARMED" position. The spoiler lever will allow any spoiler setting between the "CLOSED" and "GROUND" positions under certain circumstances described below.

The "RESET" position is a momentary, spring-loaded position forward of the "CLOSED" position. Pushing the spoiler lever forward into "RESET" will reset the system if an asymmetry occurred. The "RESET" position is not affected by the spoiler high/low-force detent.

The spoiler lever should be lifted up ("ARMED") before moving it out of the "CLOSED" position. The spoiler system incorporates a high-force detent at the "CLOSED" position to prevent inadvertent in-flight operation of the spoilers while the flaps are deployed. This high-force detent is solenoid controlled and is removed by energizing the solenoid into low-force detent. The high/low-force detent mechanism is spring-loaded to high-force detent whenever the solenoid is deenergized. The high-force detent can be overridden if a malfunction occurs by applying approximately 46 pounds of force to move the spoiler lever out of the "CLOSED" position.

Normally, the high-force detent is removed in-flight when the flaps are retracted and the spoiler lever is "ARMED." The high-force detent is also removed on the ground to allow operation of both the flaps and spoilers. When the high-force detent is removed, the low-force detent provides a positive resistance to prevent inadvertent movement of the lever out of the "CLOSED" position. It will take approximately 12 pounds of force to the spoiler lever to override the low-force detent.

Once out of the "CLOSED" position it takes approximately five pounds of force to move the spoiler lever. The No. 3 hydraulic system automatically turns on when the spoiler lever is moved from the "CLOSED" position. The No. 3 hydraulic system will remain on until the spoilers are closed and locked, even if the spoiler lever itself is closed.

The "FLT LIMIT" position results in 27 degrees of upper spoiler deflection and 59 degrees of lower spoiler deflection. A flight limit mechanical stop is provided by a solenoid whenever the aircraft is inflight. Under normal circumstances, this prevents spoiler lever movement past the "FLT LIMIT" position.

CAUTION

> Do not exceed the "FLT LIMIT" position inflight because structural damage will result.

The flight limit mechanical stop is removed automatically when touchdown occurs and the spoiler lever is "ARMED."

The "GROUND" position of the spoiler lever results in 90 degrees of upper spoiler deflection and 86 degrees of lower spoiler deflection.

SPOILER, EMERGENCY RETRACT, EMERGENCY OFF (EREO) SWITCH.

A three-position ("EMER RETRACT", "NORM", "EMER OFF") switch on the control pedestal can be used to retract the spoilers if they cannot be retracted with the spoiler lever.

"EMER RETRACT" is a spring-loaded, momentary position and simulates an asymmetrical condition. The No. 2 and No. 3 hydraulic systems retract the spoilers. The SPOILER INOP lights illuminate and all modes are inoperative until the spoiler lever is moved to "RESET".

"EMER OFF" is a lever-locked position and, with the spoilers closed, will prevent deployment of the spoilers. Hydraulic systems No. 2 and No. 3 are shut off at the spoiler actuators. The 2 SPOILER INOP and 3 SPOILER INOP lights illuminate. If the spoilers are deployed when the switch is placed in this position, No. 2 hydraulic system power is shut off at the spoiler actuators. No. 3 hydraulic system remains on to close the spoilers. When the spoilers close, the No. 3 system is automatically shut off. If the spoilers move from the closed position, No. 3 system is automatically energized to close them.

In "NORM", normal spoiler circuitry is restored and the spoilers may be operated after resetting.

SPOILER AUTO RETRACT DEFEAT SWITCH.

A two-position ("NORMAL", "DEFEAT") SPOILER AUTO RETRACT DEFEAT switch, located on the copilot's side console, can be used to defeat the auto-retract feature of the spoilers. The switch will be left in "NORMAL" at all times except when it is necessary to defeat the retract feature of the spoilers. The only feature that can be defeated is automatic retraction with the landing gear lever down and No. 1 or 2 and No. 3 or 4 throttles advanced beyond the 54-degree throttle position (figure 1-164). If it is necessary to defeat the retract feature, place the switch to "DEFEAT".

Wing Spoiler System Indicators.

SPOILER LEVER HIGH-FORCE DETENT POSITION INDICATOR.

A SPOILER STOP POSITION INDICATOR pin (figure 1-156), located below the spoiler lever on the console face, indicates engagement or disengagement of the spoiler lever high-force detent. When the high-force detent is engaged (solenoid deenergized), the pin protrudes from the face of the console. When the low-force detent is engaged (solenoid energized), the pin is retracted.

WING SPOILER POSITION INDICATOR.

Spoiler position is indicated by a dual-pointer dial on the center instrument panel. The indicator is marked for spoiler "CLOSED" and "GRD" positions. The dual-pointers are marked "L" and "R". The indicators are driven by synchros which are driven by the inboard spoiler drive tubes. The indicator contains a display window which shows that the spoilers are "LOCKED" or "UNLKD". The outboard and inboard spoiler actuator limit switches control this portion of the indicator. The indicator will show "LOCKED" when all spoiler drive tubes reach the closed and locked position.

SPOILER INOPERATIVE LIGHTS.

The 2 SPOILER INOP and 3 SPOILER INOP lights are located on the annunciator panel. The lights illuminate when the solenoid-operated asymmetry pilot valves are deenergized by either the asymmetry detectors or the "EMER RETRACT", "EMER OFF" (EREO) switch. Illumination of only one light indicates that an electrical malfunction has occurred in the hydraulic system asymmetry control circuit and the associated asymmetry shutoff valve is inoperative. The spoilers will remain fully operational with one light illuminated. Both lights illuminated indicate that an asymmetry has occurred and hydraulic pressure has been routed to close the spoilers. Placing the spoiler lever to "RESET" extinguishes the lights if they have illuminated because of an asymmetry.

SPOILER TEST PANEL.

A spoiler test panel located on the copilot's side console is used to test operation of the spoiler asymmetry detection system. The panel consists of a two-position ("ARM", "OFF") asymmetry toggle switch and two DET 2 and two DET 3 lights. The "ARM" position of the toggle switch connects the indicator lights to the related asymmetry switches. The spoiler asymmetry circuits can be checked during preflight by observing that the indicator lights illuminate momentarily during normal operation or that they illuminate steadily when the spoilers are closed and the SPOILER INOP lights are illuminated.

UNDER SPOILER SPEED WARNING SYSTEM.

The system consists of an UNDER SPLR SPEED warning light on the pilots' annunciator panel and an audible tone. The system will warn the pilot to discontinue the use of spoilers whenever the spoiler handle is armed, or the spoilers are open, and the aircraft approaches a stall condition.

SPOILER OPERATION IN-FLIGHT.

With the landing gear lever up, the main and auxiliary pistons are used in unison to operate the spoilers, since high output loads are required. Full in-flight deflections are obtained up to 250 KCAS; above this, "blowdown" occurs.

Spoiler retraction will occur when the spoiler lever is moved five degrees or more aft of the "FLT LIMIT" position.

CAUTION

The spoilers must not be extended while the flaps are down to avoid possible damage to the spoilers due to aerodynamic buffeting.

SPOILER OPERATION ON GROUND.

When the landing gear handle is down, the fluid flow to the auxiliary piston in each cylinder is hydraulically shut off and bypassed by solenoid-operated valves. The main piston is used, since the loads are lower and a faster response is required. The inboard cylinder uses pressure from the No. 2 system only, and the outboard cylinder uses pressure from the No. 3 system only.

With the landing gear lever down, the spoilers will retract when No. 1 or 2 and No. 3 or 4 throttles are advanced beyond the 54-degree throttle position. This feature can be defeated by placing the SPOILER AUTO RETRACT DEFEAT switch to "DEFEAT".

LANDING GEAR SYSTEM.

The landing gear is a fully retractable tricycle type. The main gear consists of two "four wheel bogie" type units which mount dual wheels forward and aft of each shock strut and which retract into pods on each side of the aircraft. The nose gear is a dual wheel unit and incorporates hydraulic steering. The gear is electrically controlled and hydraulically operated, using pressure from hydraulic system No. 2. The hydraulic part of the system can be manually controlled to extend or retract the gear (figure 1-195). If hydraulic pressure is not available, the gear can be manually extended. When the gear is extended, the travel is downward and aft. Normal extension time is approximately 15 seconds; retraction is approximately 10 seconds. Hydraulic system return pressure is automatically applied to the brakes during gear retraction to stop the rotation of the main wheels. Nose gear wheel spin is stopped during final retraction by contact with friction pads installed in the wheel well. The uplock and downlock mechanisms of the landing gear are hydraulically/mechanically actuated. Mechanical means for manually releasing the main gear uplocks and engaging the main gear downlocks are provided. A hand-operated hydraulic pump provides the emergency means for releasing the nose gear uplock and engaging the nose gear downlock. A nose landing gear uplock emergency release handle is also provided to unlock the nose gear uplock. The hand-operated hydraulic pump must be used to then engage the nose gear downlock.

Each gear will gravity free-fall when the related uplock is released. The main gear doors and the nose wheel doors are mechanically actuated and are automatically opened and closed by gear extension or retraction. To prevent in-flight gapping of the main gear doors, two electrically controlled, hydraulically operated main gear door uplock latches (flapper doors) are provided to hold the door leading edges closed when the gear is in the up position. Unlocking of the latches can be manually controlled.

The latches are mechanically locked overcenter when in the closed position, and must be released manually before manual extension of the gear is attempted. Main landing gear door lock emergency release handles are provided. If a door latch fails to reach the fully locked position after the gear is up and locked, a warning of the condition is provided by illumination of the light in the landing gear lever.

Safety pins, stowed in the cargo compartment, are provided for mechanically locking each main gear in the down position. A safety pin for mechanically locking the nose gear in the down position is stowed in the right avionics compartment. The pins can be installed in-flight, through the gear inspection windows.

LANDING GEAR CONTROLS.

Landing Gear Lever.

A two-position ("LG UP", "LG DN") landing gear lever on the pilots' center instrument panel controls gear extension and retraction. Placing the lever to "LG UP" energizes selector valves to direct hydraulic system No. 2 pressure to retract the gear. A DC, solenoid operated locking mechanism prevents movement of the landing gear lever from the "LG DN" position until the main gear struts are fully extended. The gear "LG UP" circuitry is inoperative until main gear strut extension occurs. Placing the lever to "LG DN" energizes selector valves to direct No. 2 hydraulic system pressure to extend and lock the gear.

Landing Gear Down Lock Release.

A landing gear DOWN LOCK RELEASE, located adjacent to the landing gear lever, can be used to release the solenoid-operated locking mechanism after take-off should an electrical malfunction occur.

Main Landing Gear Door Uplock Latch Emergency Release Handles.

A "T" handle is adjacent to the corresponding gear uplock emergency release handle (figure 3-6), and must be pulled to release the door uplock latches before the main gear uplock release handles are pulled.

Main Landing Gear Emergency Uplock Release Handles.

A "T" handle, located aft of each main gear inspection window (figure 3-6), provides a means of mechanically releasing the associated gear uplock.

Main Landing Gear Emergency Downlock Engage Handles.

The main gear emergency downlock engage handles are located aft of the main gear inspection window (figure 3-6). Operating the handle mechanically moves the associated gear to the downlock position.

Main Landing Gear Pry Bar.

A main landing gear pry bar is stowed on the forward cargo compartment bulkhead. It may be used to provide a manual method to force the main gear to the full down position and/or provide a manual method to engage the MLG downlock(s).

Nose Landing Gear Emergency Extension Hydraulic System Hand Pump.

A manually operated hydraulic selector valve and a hand pump, located in the right-hand underdeck area (figure 3-6), provide an emergency means of extending the nose gear (figure 1-196). Placing the selector valve to "EMERG" directs hand pump pressure to the downside of the nose gear up-down lock and the nose gear actuator. Operation of the hand pump unlocks the uplock, extends the gear, and engages the gear downlock.

Selector Valves Manual Controls.

Manual override buttons are provided on each of the four landing gear system selector valves. The buttons provide a means of manually controlling landing gear extension and retraction. Operating instructions are provided on or near the respective selector valves. The three valves for the main gear system are located in the hydraulic system No. 2 service center (figures 3-12, 3-13, 3-14, and 3-15). The nose gear selector valve is located in the left center underdeck area (figure 3-16).

LANDING GEAR INDICATION.

Landing Gear Position Indicators.

Three DC flag-type position indicators, located above the landing gear lever (figure 1-154), show the position of each landing gear. A miniature wheel flag indicates gear down and locked, an UP flag indicates gear up and locked, and a black and yellow striped flag indicates the gear is not locked. Limit switches, actuated by movement of the landing gear locks, control the position indicators.

Bogie Position Indicator.

A DC flag-type BOGIE POSITION indicator for each main gear bogie is located on the pilots' center instrument panel (figure 1-154). A miniature wheel flag indicates the associated bogie is in position for landing. A striped flag indicates the bogie is either in transit or up. Limit switches, actuated by movement of the bogies, control the position indicators.

Nose Landing Gear Emergency Extension Hydraulic System Pressure Gauge.

A direct reading pressure gauge is located on the panel with the selector valve in the right-hand underdeck rack area (figure 3-6).

LANDING GEAR WARNING SYSTEMS.

Landing Gear Warning Light.

A DC landing gear warning light is installed in the knob of the landing gear lever. The light illuminates when any of the following conditions exist:

1. The landing gear is not locked in the selected position.

2. The landing gear is not down and locked and any engine throttle is retarded to a position approximately one inch forward of the "IDLE START" position.

3. The landing gear is up and locked and a main gear door uplock latch is not locked.

4. The landing gear is down and locked and a main gear door uplock latch is locked.

Limit switches associated with the landing gear and with each throttle control illumination of the light.

The portion of the landing gear warning light system which controls the illumination of the light by throttle position is deactivated whenever the AERIAL REFUEL MASTER switch is in "ON".

Landing Gear Warning Horn.

A warning horn, located in the flight station, sounds when either of the following occur:

1. Any throttle is retarded to a position within one inch of "IDLE START" when the landing gear is not down and locked.

2. The wing flap lever is moved to "LANDING" when the landing gear is not down and locked.

Horn Silence Button.

A HORN SILENCE button, located beneath the landing gear lever, is provided for silencing the warning horn if it has been actuated as a result of an engine throttle being retarded. The horn cannot be silenced if it has been activated as a result of the wing flap lever being moved to the "LANDING" position. Advancing the throttle past the position which actuated the horn rearms the warning for that throttle.

Landing Gear Warning Horn Cutout Switch and ON/OFF Light.

A two-position ("NORMAL", "OFF") GEAR-UP WARNING HORN cutout toggle switch is located on the copilot's ADS panel (figure 1-256). When the switch is in "NORMAL" the horn will operate normally. With the switch in "OFF", the horn will not sound except when the wing flap lever is moved to the "LANDING" position when the landing gear is not down and locked. The ON/OFF light, located just below the switch, illuminates when the switch is moved to "OFF" and the light is out when the toggle switch is in "NORMAL".

Landing Gear Warning Light and Horn Test Button.

A WARN LIGHT & HORN TEST button, located adjacent to the HORN SILENCE button is used to check the operation of the warning light and the warning horn. The WARN LIGHT is deactivated whenever the AERIAL REFUEL MASTER switch is in "ON".

NOSE GEAR STEERING SYSTEM.

Hydraulic pressure for the nose gear steering system is supplied by hydraulic system No. 2 from the nose gear downline. A steering wheel, located on the pilot's side console (figure 1-150), provides the control for steering the nose wheels. Turning the steering wheel mechanically positions a control valve which ports pressurized fluid to the left or right nose gear steering cylinders to actuate the rack and pinion steering mechanism. A cable-type mechanical feedback mechanism repositions the control valve to neutral when the selected degree of turn is achieved. A centering mechanism automatically holds the control valve in neutral when the nose wheels are not being turned, allowing free castering of the nose wheels and providing hydraulic shimmy damping. The nose gear wheels can be steered 60 degrees left or right of center with the steering wheel. Centering cams within the strut position the nose wheels when the nose landing gear strut is fully extended after take-off.

CAUTION

Forcing nose gear steering past the 60-degree stops may result in complete loss of nose gear steering.

RUDDER PEDAL STEERING SYSTEM.

Nose gear steering by movement of the rudder pedals is also incorporated. Eight degrees left or right of center is available. Either main gear safety switch actuation or the spin-up signal opens the rudder pedal steering selector valve and makes rudder pedal steering available.

Rudder Pedal Steering System Operation.

The rudder pedal nose wheel steering system provides the pilot with the capability of maintaining steering control of the aircraft during take-off and landing while retaining aileron control. The effect of the nose wheel on directional control of the aircraft depends on the amount of elevator download applied during take-off and landing. The steering wheel rotates with pedal movement and the rudder pedals move with steering wheel rotation unless restrained. The system also provides the capability of full rudder in one direction and full wheel rotation in the other direction.

To achieve an apparent reduction in breakout force at the steering wheel, the pilot may elect to initiate a taxi turn with the rudder, then continue with the nose gear steering wheel. No noticeable increase in rudder pedal force due to rudder pedal nose wheel steering should be encountered. If it is necessary to deflect the rudder pedals in the opposite direction, firm smooth pressure should be applied. Abrupt application of rudder pedal steering in a direction opposite to the nose wheel steering may shear rivets in the nose steering interconnect and render rudder pedal steering inoperative. Normal nose wheel steering will still operate under this condition.

BRAKE SYSTEM.

The wheel brakes are of the multiple disk, hydraulically actuated type. Pressurized fluid to actuate the brakes may be supplied from the No. 2 or No. 3 hydraulic system. Manual selection of either system is provided by a switch on the center instrument panel. The pressurized fluid for normal brakes is taken from the downline of the main landing gear. Control pressure for metering the pressure applied to the brakes is taken from the nose gear downline. The control pressure is routed to a set of pilot brake metering valves which are actuated by linkage connected to the toe pedals on the pilot's and copilot's rudder controls. When the toe pedals are depressed, metered control pressure is forwarded to the anti-skid metering valves, metering the amount of hydraulic pressure applied to the wheel brakes. The anti-skid metering valves are also controlled by an anti-skid brake control system to prevent locking the wheels due to excessive pressure being metered to the brakes by a pilot. Hydraulic pressure for the emergency wheel brake system is supplied by hydraulic system No. 3.

The pressurized fluid applied to the brake is routed through a metering valve. The control pressure for metering the pressure applied to the brakes is routed to the main metering valves through the pilot brake metering valves. The anti-skid brake control system is inoperative when the emergency brake system is used. Two accumulators in hydraulic system No. 3 provide a standby emergency brake system when the pumps of hydraulic system No. 3 are inoperative. Approximately ten brake applications can be made with both accumulators fully charged.

FUSIBLE PLUGS.

Three fusible plugs are installed in each main landing gear wheel and function to minimize tire blowout caused by wheel brake overheat. When the wheel rim heats to 390° F the fusible plug core melts, allowing the tire to deflate at a safe rate.

BRAKE PRESSURE SELECTOR SWITCH.

A two-position ("NORM", "EMER") toggle switch, located on the pilots' center instrument panel (figure 1-154), selects the hydraulic system to be used to actuate the brakes. The "NORM" position selects hydraulic system No. 2 pressure, energizes a DC solenoid to close the emergency brake selector valve, and deenergizes a DC solenoid to open the normal brake selector valve. The "EMER" position selects hydraulic system No. 3 pressure by energizing the normal brake selector valve closed and deenergizing the emergency brake selector valve open.

NOTE

If DC electrical power fails, the deenergized valves admit both No. 2 and No. 3 hydraulic pressures to the brake system. The shuttle valve is positioned by the system supplying the greater pressure.

PARKING BRAKE HANDLE.

The brakes can be locked for parking by using the BRAKE T-handle on the pilot's instrument panel (figure 1-153). The parking brakes are set by fully depressing the brake pedals, pulling the BRAKE T-handle, and then releasing the brake pedals. To release the parking brakes, depress either set of brake pedals.

BRAKE PRESSURE INDICATORS.

Two BRAKE PRESSURE indicators, located adjacent to the brake pressure selector switch on the pilots' center instrument panel, provide indication of available brake pressure. Operation of the indicators is dependent upon the position of the brake selector switch. If the brake selector switch is positioned to "NORM", the normal brake pressure indicator registers the brake pressure available from hydraulic system No. 2. If the switch is positioned to "EMER", the emergency indicator registers the pressure available from hydraulic system No. 3. The pointer of each indicator is controlled by a pressure transmitter installed downstream of the brake selector valve.

ANTI-SKID SYSTEM.

The anti-skid control system is installed to provide maximum braking efficiency and to prevent wheel lockup. A switch located on the pilots' center instrument panel energizes the system. Anti-skid operation is accomplished through the brake-releasing and pressure-modulating features of solenoid-operated, three-way (modulating, dump, and anti-skid metering) anti-skid control valves. An AC generator (wheel speed detector) is attached to each main gear wheel and is used to detect wheel skidding and lockup. Each generator produces a voltage signal that is proportional to the speed of its own wheel. An anti-skid control box receives these voltage signals and determines if skids and locked wheels are developing. Either a standard or enhanced anti-skid control box will be installed on the aircraft.

The anti-skid control function is fully operational anytime the ground speed of the aircraft is approximately 15 knots or higher. When a deceleration-sensing circuit in the anti-skid control box senses excessive deceleration, it completes a circuit to the pressure modulating valve cutting off control pressure to the anti-skid metering valve, which in turn reduces application pressure to the affected brake. Should the deceleration rate continue to increase, the anti-skid control box will drive the pressure dump valve open to dump all control pressure off the anti-skid metering valve, thereby relieving all application pressure to the affected brake. The wheel is then permitted to freewheel until it has accelerated back to speed. If a locked wheel condition occurs, a locked wheel detection circuit in the anti-skid control box simultaneously energizes both the pressure modulating and the pressure dumping valves, releasing all control and application pressures. The standard anti-skid control box will allow one wheel to lock out (freewheel) before disabling the entire anti-skid system. The enhanced anti-skid control system will allow freewheeling on two wheels, but no more than one per side, before disabling the entire anti-skid system.

The locked wheel detection circuit is armed through a safety switch on the main landing gear strut which prevents brake application prior to touchdown.

Anti-Skid Control Switch.

An ANTI-SKID control switch is located on the pilots' center instrument panel. The switch is a three-position ("ON", "OFF", "GND TEST") toggle switch. The "ON" position of the switch is effective only if the BRAKE SELECTOR switch is in "NORM". When this condition is satisfied, power is applied to the anti-skid circuits and anti-skid function is available. The "GND TEST" switch position is a momentary position and provides a means of testing the brake release and fail-safe functions of the skid control system. Holding the switch in the "GND TEST" position while applying the brakes will result in the following sequence of events: all brakes release, then the ANTI-SKID DET OUT lights illuminate, followed by the ANTI-SKID OFF lights and all brakes reapplying.

NOTE

> When the switch is first placed in the "ON" or "GND TEST" position, the DET OUT lights may illuminate momentarily while the system is resetting. ANTI-SKID OFF and ANTI-SKID DET OUT lights may illuminate momentarily during power transfer while the system recovers from the power interruption.

Anti-Skid Detector Out Light.

Two ANTI-SKID DET OUT lights are provided on the pilot's and copilot's instrument panels. These lights illuminate when a wheel skid continues to be sensed after the anti-skid control box has removed all its control and application brake pressure. This light could indicate either a failed wheel detector circuit or a locked wheel. A steady light indicates one wheel with this malfunction and a flashing light (enhanced anti-skid control box only) indicates two wheels on opposite sides with this malfunction. Unless the ANTI-SKID OFF lights also illuminate, normal anti-skid protection is available for all other wheels. ANTI-SKID DET OUT indications extinguish when the gear is retracted and return when the gear is extended.

Anti-Skid Off Light.

Two ANTI-SKID OFF warning lights are provided on the pilot's and copilot's instrument panels. These lights illuminate after the anti-skid control system fails on more than one wheel (standard anti-skid control box) or on more than one wheel on one side (enhanced anti-skid control box). These lights indicate no anti-skid protection or locked wheel brake release functions. These lights also illuminate when the ANTI-SKID switch is in the "OFF" position or the BRAKE PRESSURE selector switch is in the "EMER" position.

Brakes Released Light.

A green BRAKES REL light is provided on the BRAKE PRESSURE and ANTI-SKID control panel on the pilots' center instrument panel. Illumination of this light occurs while airborne with the gear down and indicates that locked wheel protection should be available at touchdown. The light does not sense brake pressure, but is illuminated by anti-skid circuitry. If the light does not illuminate, or if the ANTI-SKID OFF light is illuminated, locked wheel protection is not available at touchdown and there is a possibility of blown tires if the pilots apply any amount of brake pressure prior to, or immediately after touchdown.

FLIGHT RECORDER.

The digital flight data recorder system records the latest 25 hours of aircraft flight performance data for incident analysis. The system consists of a Digital Flight Data Recorder (DFDR) located in the upper-aft fuselage "hayloft" area (figure 1-202) and a Flight Data Acquisition Unit (FDAU) located in the avionics bay. A red-guarded test switch, located in the right underdeck area on the center avionics rack, will bypass the power interlock.

Sixteen flight performance parameters are recorded on an endless loop, 25-hour duration, magnetic tape which is encased to withstand effects of an aircraft accident. A water-actuated, battery-powered underwater acoustic locator beacon is mounted on the DFDR. Signals from parameter origins are processed by the FDAU and recorded in a timed sequence data stream by the DFDR. Signal input to the FDAU is received from the following sources:

Altitude - Through central air data computer number two from static pressure system.

Airspeed - Through central air data computer number two from pitot-static pressure system.

Heading - Attitude heading reference system.

Acceleration: Vertical, lateral, and longitudinal - From triaxial accelerometer.

Pitch Attitude - Inertial navigation unit number one or attitude heading reference system, whichever is selected on the pilot's Display Avionics Management Unit (DAMU).

Roll Attitude - Inertial navigation unit number one or attitude heading reference system, whichever is selected on the pilot's DAMU.

Rudder Position - Rudder position synchro sensor.

Pitch Trim - Pitch trim position transmitter.

Engine Pressure Ratio; four engines - Engine-mounted pressure ratio transmitter.

Flap Position - Flap position synchro sensor.

Spoiler Position - Left hand spoiler position transmitter.

Thrust Reversers Extended - Thrust reverser status circuit.

Thrust Reversers Locked - Thrust reverser not locked relay.

Landing Gear Position - Landing gear indication system.

Radio Keying - HF, VHF, and UHF radio systems.

Aircraft Identification - Discrete input logic state.

Operation of the DFDR system is fully automatic when 115-volt, 400 Hz, phase C, AC power, supplied from the isolated 115 VAC excitation bus and the isolated 26 VAC excitation bus, is applied through the FLT REC and FDAU circuit breakers on the avionics circuit breaker panel. External power or power from the APU is isolated from the DFDR system by a power interlock. A red-guarded test switch, located in the right underdeck area on the center avionics rack, will bypass the power interlock (figure 1-209). Illumination of the FLT REC INOP (flight recorder inoperative) light on the annunciator panel gives warning of DFDR failure. The DFDR system does not affect flight operation of the aircraft.

COCKPIT VOICE RECORDER.

The cockpit voice recorder (CVR) system is comprised of the CVR (figure 1-202) located in the upper-aft fuselage "hayloft" area and the CVR control unit (figure 1-158) located just aft of the pilots' overhead control panel. The CVR utilizes an endless loop magnetic tape recorder to record all voice signals transmitted or received by the pilot, copilot, and flight engineer for the latest 30 minutes of flight. Audible signals in the flight station are received by an area microphone located in the CVR control unit and sent to the CVR for recording. The CVR case is designed to protect these recorded signals from the effects of an aircraft accident.

The CVR control unit is used to remotely test the area microphone channel and the recording circuitry in all four CVR channels. The control unit incorporates a monitoring meter, audio monitoring headset jack, and test switch. Functional operation of all channel circuitry is verified on the meter and audibly by a test tone input to the headset. Recording quality is verified through the audible test input and by playback monitoring of voice inputs.

Operation of the CVR system is fully automatic when 115-volt, 400 Hz, phase C, AC power from the isolated 115 VAC excitation bus is applied through the CVR circuit breaker on the avionics circuit breaker panel. Recorded signals that precede the past 30 minutes of recording are automatically erased as the CVR continues to record new signals. The CVR system does not affect the flight operation of the aircraft. External power is isolated from the CVR system by a power interlock. A red-guarded test switch, located in the right underdeck area on the center avionics rack, will bypass the power interlock (figure 1-209).

NOTE

The CVR continues to operate until external power is selected, the aircraft electrical system is deenergized, or circuit protection is open.

COCKPIT VOICE RECORDER SYSTEM OPERATIONAL CHECKOUT.

Operational checkout of the recorder system is accomplished by the flight crew as part of the aircraft preflight checklist as follows:

1. Insert headset plug into CVR control unit (figure 1-158) HEADSET jack.

2. Press and hold TEST switch for a minimum of five seconds. The four channels sequentially receive a test tone, switching approximately every 0.8 second, and the meter needle indicates in the green range.

NOTE

The short interval between each channel test tone will cause the meter needle to rise and then fall in an oscillating action. In the event of a channel failure, the meter needle will return to zero.

3. Speak in a normal voice six inches from the control unit area microphone. Sidetone playback (approximately 1/2-second delay) should be heard without any significant distortion.

COMMUNICATION SYSTEMS.

The communications equipment provides aircraft-to-satellite (SATCOM), aircraft-to-aircraft, aircraft-to-ground, and intra-aircraft communication. For antenna locations, see figure 1-208. For a list of communications and associated electronic equipment, see figure 1-205. For electronic equipment locations, see figure 1-209.

INTERPHONE SYSTEM (AN/AIC-18).

The interphone system allows communication between flight stations, forward fuselage underdeck station, cargo compartment stations and the vertical stabilizer station. External receptacles at each main wheel and on the forward fuselage allow communication with ground servicing personnel. An extension cord, stored near the forward crew entrance door, allows walk-around communication capabilities. Hand-held microphones are installed at the pilot's and copilot's positions and at each of the three cargo compartment interphone stations.

An additional microphone and headset outlet is installed at the flight engineer's and navigator's flight stations. Extension cord receptacles are located at the crew entrance, left troop door and vertical stabilizer stations.

Interphone control and monitor panels (figure 1-207) allow monitoring of navigation and communications equipment. The controls provide radio communication capabilities from four flight station positions and from the forward fuselage underdeck station. A loudspeaker, mounted over the pilot's station, can be used to monitor all signals heard through the pilot's headset. A PUBLIC ADDRESS switch allows interphone communications to be broadcast through the public address system. The interphone system receives power from the avionics and emergency DC buses.

Aircraft modified with TCTO 542 have the interphone system interconnected to the AN/AAR-47 Missile Warning Set. When a missile is detected by the AN/AAR-47, a warbling tone is heard through the interphone system by the pilot, copilot, navigator, jump seat, flight engineer, and the left and right troop door observers.

Ground Collision Avoidance System (GCAS) Interface.

GCAS audio warnings will be heard over the GCAS loudspeaker at the pilot's, copilot's, and jump seat interphone headsets during self-test of the GCAS and when the aircraft penetrates a GCAS warning mode. The GCAS loudspeaker, located overhead in the flight compartment, does not interface with the interphone system.

Altitude Alert.

When an altitude alert is activated, a tone comes through the GCAS speaker and interphone. The tone may be inhibited by momentarily pressing the ALT ALERT INHB switch located on the Reference Set Panel (RSP).

Cockpit Voice Recorder Interface.

The input signals through the aircraft interphone system, either received or transmitted by the pilot, copilot, or flight engineer, are fed from their interphone stations to the cockpit voice recorder (CVR). Operation is automatic with no control functions required at the interphone stations. The CVR control unit area microphone, located overhead in the flight compartment, does not interface with the interphone system.

Secure Interphone.

The pilot, copilot, and flight engineer have the capability of communicating with the tanker boom operator through the secure interphone system. The secure interphone system provides this capability through the induction coils of the tanker boom and the A/R receptacle when the boom is connected.

Flight Station Loudspeaker.

The flight station loudspeaker is controlled by an "ON", "OFF" switch located near the speaker. The speaker is connected to the pilot's system, and monitors any signals selected on the pilot's interphone panels plus the audible warnings for engine/APU fire, excess speed, or spoiler under speed. These warning signals actuate the speaker CALL circuit so that it is not necessary for the speaker switch to be "ON" in order to hear the warning signals.

Microphone Switches.

Three-position ("INTERPHONE", unmarked OFF, "MIC") switches are on the pilot's and copilot's control wheels. When the switch is held to "INTERPHONE", the operator transmits on interphone. When the switch is held to "MIC", the operator can transmit through the communications system selected on the interphone control panel by the transmission selector switch. An INPH button is located on the hub of the nose wheel steering wheel. All interphone stations except the pilot's, copilot's and vertical stabilizer, have microphone switches integral with the headset cord. In addition, the navigator's and flight engineer's stations have floor mounted switches. The hand-held microphones installed in the flight station and cargo compartment have integral MIC switches.

Interphone Panels.

Nine interphone panels are installed in the aircraft. Controls on each panel consist of push-pull switches, a rotary transmission selector switch, VOLUME control knob, and a CALL button.

PUSH-PULL SWITCHES.

The push-pull switches are two-position (pull ON, push OFF) switches. When a switch has been pulled (ON), it can be rotated to set the volume level of the audio system being monitored. The push-pull switches provide connection to UHF, HF and VHF communication equipment, interphone (INT), and hot mike (HOT MIC). The hot mike system uses two switches (LISTEN, TALK).

TRANSMISSION SELECTOR SWITCH.

The selector switches at the pilot's, copilot's, jump seat's, navigator's, and underdeck control panel can be set to transmit on any communications radio. The engineer's panel can only be used to transmit on interphone.

The selector switch at the crew entrance door station and the two jumpmaster/loadmaster station panels can be set at the following positions:

I - Interphone
PA - Public Address

HOT MICROPHONE (HOT MIC) SWITCHES.

The hot microphone switches permit direct transmission to all interphone stations on the flight deck, at the crew entrance door, and in the underdeck area without pressing the microphone switch. Two push-pull switches (LISTEN, TALK) on the control panel control operating mode. The forward crew entrance door interphone station has a hot microphone switch that operates on LISTEN only.

CALL BUTTON.

A CALL button is located on each of the interphone panels. When this button is depressed, the interphone signal from the station initiating the call will be heard at the other stations regardless of the position of their selector switches. The call circuit at the vertical stabilizer panel is not wired for operation.

Interphone Monitor Panels.

Five interphone monitor panels are mounted above the interphone panels for the pilot, copilot, jump seat, and navigator, and the underdeck station. Push-pull (ON-OFF) switches on the panel allow connection of the interphone system to the communications and navigation systems. The desired system is selected by pulling the proper control switch (ON). Volume is controlled by rotating the switch after it has been pulled.

Auxiliary Interphone Panel.

An auxiliary interphone system panel is mounted in the vertical stabilizer. Controls on the panel consist of a VOLUME control and a CALL pushbutton. When the interphone button is pressed, the auxiliary station is connected to the interphone system.

PUBLIC ADDRESS SYSTEM (AN/AIC-13).

The public address system provides one-way communication with the cargo area through six loudspeakers located in the cargo compartment. The main panel is located on the flight engineer's instrument panel. The aft speakers may be used to communicate with the areas to the rear of the aircraft. Auxiliary panels are located at the forward crew entrance door and at the two jumpmaster/loadmaster stations in the aft cargo compartment. Microphone connections to the system are made through the interphone system panels.

Public Address System Main Panel.

Controls for the public address system (figure 1-207) are mounted on the PA system main panel at the flight engineer station. Controls consist of a power switch, speaker selector switch, mixer switches, and a volume control knob.

POWER SWITCH.

The power switch is a two-position ("PWR ON", OFF) toggle switch. When the switch is set to "PWR ON", power is supplied to the system.

SPEAKERS SELECTOR SWITCH.

The speaker selector switch is a four-position ("ALL", "FWD", "AFT", "JUMP") rotary switch which allows selection of individual speakers or a combination of speakers. The switch allows the following selections:

"ALL" - All six speakers operate.

"FWD" - No. 1 speaker above LH forward cargo compartment side escape hatch.

"AFT" - No. 6 speaker aft of pressure door.

"JUMP"- No. 4 and 5 speakers adjacent to paratroop exit doors.

VOLUME CONTROL.

The VOL control is an eleven-position rotary switch which determines audio volume of the system.

MIXER SWITCHES.

Five mixer switches are provided on the control panel. The switches allow the public address system to be connected to radio receivers in the aircraft. Only two switches are used, ADF-1 and ADF-2.

Public Address System Auxiliary Panel.

Two volume control switches ("DECREASE", "INCREASE") are mounted on each auxiliary panel.

Public Address Switch.

The two-position ("INPH & PA", "INPH") PUBLIC ADDRESS switch is located on the pilot's side console. When the switch is set to "INPH", interphone communications are confined to the interphone system. When the switch is set to "INPH & PA", the interphone system is connected to the public address system.

UHF RADIO AN/ARC-164(V).

The C-141 has two identical UHF AN/ARC-164(V) digital communication radio systems installed. The systems provide two-way aircraft-to-ground or aircraft-to-aircraft voice communication on any one of 20 preset channels, on an emergency guard frequency, or on a manually selected frequency. Each system operates in a frequency range of 225 to 399.95 MHz. Controls for the UHF systems are located on the center console (figure 1-156).

Description.

The system consists of a modification to selected airborne and ground-based radios, providing a frequency hopping or anti-jam capability. Frequency hopping is a technique where the channel of frequency being used for communication on a given link is rapidly changed many times per second. The purpose of this is to make it difficult for an adversary to jam the link since the operator cannot determine which channel is being used. By the time determination is made as to which channel is being used, the communication link has changed to another channel. The strength of this system comes from the use of channels in an apparently random manner; meaning that no pattern is evident to the external observer and jamming is consequently more difficult.

The frequency hopping scheme is implemented in the equipment by storing or initializing every radio with a Word-of-Day (WOD), Time-of-Day (TOD), and a Net Number. The WOD programs the frequency-hopping rate and frequency-hopping pattern. The radio cannot function in the anti-jam mode without a valid WOD. Up to six WODs may be entered at one time, allowing for multi-day use of the radio set without installing another WOD. The procedure for storing multiple WODs is called Multiple-Word-of-Day (MWOD) loading. The TOD provides the synchronization necessary for communicating in the anti-jam mode by allowing frequency-hopping at the same instant in time. The Net Number enables multiple users to operate simultaneously on a non-interfering basis in the anti-jam mode while sharing a common WOD and TOD.

System Operation.

The normal mode of operation uses any one of the 7000 channels available to the UHF communication band. The radio set provides a 7000 channel UHF tunable receiver, an auxiliary guard receiver (nominally 243.000 MHz, tunable from 238.000 to 248.000 MHz, with crystal replacement and realignment), and a 7000 channel, 10-watt carrier transmitter for normal AM voice communications and communication in the anti-jam mode of operation.

If jamming is encountered, the radio will be able to switch to the anti-jam mode by selecting a suitable Net Number and continue communication. In order to permit this switchover the radio will have to be loaded with a valid WOD and TOD. This is usually done prior to take-off.

In the anti-jam mode, the radio can receive and process two simultaneous transmissions on the same operating Net. This is called CONFERENCING. (Three simultaneous transmissions result in garbled reception.) This is accomplished by automatically offsetting the second transmitter frequency to the next lower channel (-25 MHz) when it monitors a transmission on the primary frequency. Reception is possible due to the wideband characteristics of the radio receiver. This conferencing capability is enabled or disabled by the last two digits of the WOD element loaded in memory location 19. If the WOD element ends with 00 or 50, conferencing is enabled. If the WOD element ends with 25 or 75, conferencing is disabled.

UHF AN/ARC-164(V) Controls.

FUNCTION SELECTOR SWITCH.

In "MAIN", the main receiver and transmitter are operational. In "BOTH", the main receiver and transmitter and the guard receiver are operational. The ADF position does not work.

FREQUENCY MODE SELECTOR SWITCH.

A three-position ("MNL", "PRESET, "GRD" or M-P-G) switch selects the main transmitter and receiver frequency. In "MNL", frequency is manually selected using five rotary switches. The "PRESET" position allows selection of one of twenty preset channels with the rotary channel selector switch. The "GRD" position tunes the receiver and the transmitter to the emergency frequency.

VOLUME CONTROL KNOB.

The rotary knob is used to set the receiver volume. (It does not control transmitter output.)

T-TONE SWITCH.

This is a three-position toggle switch with two of the positions being spring-loaded, the middle position being off. When placed in the "TONE" position, a tone is transmitted on the selected frequency. When placed in the "T" position, enables reception of TOD message for one minute.

FREQUENCY/STATUS INDICATOR.

The FREQUENCY/STATUS (f/s) INDICATOR displays the individual frequency switch settings or any of the following operator prompts:

VER/OP	-	Indicates radio is in normal operating mode.
M-LOAD	-	Indicates radio is in MWOD load mode.
ERASE	-	Indicates radio is in MWOD erase mode.
FMT.CHG	-	Radio is in Frequency Management Training Change mode.
FILL	-	Indicates a keyfill device is connected to the front panel FILL Connector.
WOD OK	-	A valid WOD was successfully received from the keyfill device.
BAD	-	No WOD or a bad parity WOD was received from the keyfill device.

STATUS SWITCH.

When pressed, indicates an alternate display on the f/s and channel indicators for five seconds.

TEST DISPLAY SWITCH.

Lights all segments of the f/s and channel indicators when pressed. Also used with the T-TONE switch for emergency clock start.

ZERO SWITCH.

Erases all Multiple-Word-of-Day (MWOD) elements when pressed down to ZERO position.

2-3-A/FREQUENCY SWITCHES.

These rotary switches select the corresponding hundreds, tens, units, tenths, and thousandths digits (as shown on the f/s indicator) for the desired frequency in the normal mode, and the desired WOD elements or net number in the anti-jam mode. The A position puts the radio into the anti-jam frequency-hopping mode of operation when selected.

Operation of the AN/ARC-164(V).

To put the radio into operation:

1. Function Switch to MAIN or BOTH. All segments of both displays will light momentarily on power-up and a series of beeps may be heard. After power-up, if frequency/status (f/s) indicator displays a frequency, the radio is in the VERIFY/OPERATE mode and proceed to step b. If M-LOAD, FMT.CHG or ERASE is displayed, proceed as follows:

   a. Set CHAN switch to channel 20.

   b. Set frequency switches to 220.000 on f/s indicator.

   c. Set M-P-G switch to PRESET.

   d. Lift access cover and press LOAD pushbutton. The radio is now in the VERIFY/OPERATE mode.

2. Set M-P-G switch to MNL or PRESET and select desired frequency or channel.

3. Place the function switch to OFF to turn off the UHF.

Guard Operation.

Guard receiver operation is not affected while operating in the anti-jam mode. The guard frequency may be monitored regardless of what mode the radio is in as long as the function switch is in the BOTH position. Selecting GRD on the M-P-G switch position disables the anti-jam mode, tunes the receiver/transmitter to the guard frequency of 243.000 MHz, and disables the guard receiver.

Anti-Jam Operational Procedures.

NOTE

To operate in the AJ mode, the radios must be initialized, by entering Word-of-Day, Time-of-Day and Net Number.

Word of Day (WOD).

The Word of Day (WOD) programs the frequency hopping rate and frequency-hopping pattern. The radio cannot function in the anti-jam mode without a valid WOD. In the Have Quick II radio, the WOD data is stored in nonvolatile memory.

The WOD does not take up preset memory, but the WOD memory is accessed through preset locations 20 through 14. WOD length may vary and may require one to six locations (20-15). The seventh location, accessed through channel 14, stores the Day-of-Month (DOM) information. This date code or DOM works in conjunction with the TOD and specifies which day the WOD is to be utilized when Multiple Word-of-Day are entered.

At midnight (GMT) transitions, the radio automatically generates a new frequency-hop pattern based on the new day's WOD. Up to six WODs may be entered at one time, allowing for multi-day use of the radio set without installing another WOD. This procedure of storing multiple WODs is called Multiple Word-of-Day (MWOD). Radios with this MWOD capability are referred to as HAVE QUICK II (HQ II) radios. The radio retains the most recently entered WODS.

There are four separate COMMAND CODE functions associated with the loading of the WOD in the HAVE QUICK II radio. These command codes are used to access memory locations and process instructions without unnecessarily consuming preset storage or necessitate switch modifications. The operator enters a six-digit command code into PRESET channel 20 to begin the unique initialization procedure. Thereafter, all other switch actions are performed with the radio in the MNL (MANUAL) mode, but using switch actions normally associated with loading preset channels.

NOTE

The COMMAND CODES listed below are used in conjunction with MWOD loading procedures only.

HQ II COMMAND CODES

COMMAND CODE	FUNCTION	F/S INDICATOR
220.000	VERIFY/OPERATE	VER/OP
220.025	MWOD LOAD	M-LOAD
220.050	MWOD ERASE	ERASE
220.075	FMT-NET FREQUENCY LOAD	FMT.CHG

WOD Loading.

There are two methods of loading a WOD: the Multiple Word-of-Day (MWOD) which requires a date code DOM and the single Word-of-Day. These loading procedures are different and the operator must take care not to mix the two methods.

Multiple WOD Loading.

1. Set CHAN switch to 20.

2. Set M-P-G switch to PRESET.

3. Set frequency selector switches to 220.025 (MWOD LOAD).

4. Press and release LOAD pushbutton. Listen for single beep.

NOTE

- The radio is now in the MWOD load mode. M-LOAD will be displayed on the f/s indicator for five seconds by pressing the STATUS switch.

- The radio will transmit and receive in the VERIFY/OPERATE mode only. The radio is disabled and will not transmit or receive in the MWOD load, MWOD erase or FMT-change modes.

5. Set M-P-G selector switch to MNL (MANUAL).

If MWODs have been previously loaded, proceed to Step 12.

6. Set CHAN switch to channel 20. Set five frequency switches to first WOD element.

7. Set T-TONE switch to TONE position and release. Listen for a wavering tone. The first WOD element is entered.

8. Select next lower channel with CHAN switch. All remaining WOD elements may be loaded in channels 19 through 15 by repeating steps 6 and 7.

9. Set CHAN switch to channel 14.

NOTE

If two or more WODs loaded have the same date code, the radio recognizes only the latest one entered.

10. Select the applicable day of month code using the frequency switches. The format is XAB.XXX, where A is the 10's digit and B is the 1's digit of the current day-of-month. X can represent any value. For example, if today were 26 June, then select 226.025 or 326.475.

NOTE

Multiple WODs must be linked with an associated day-of-month (DOM). This "date code" element has been added to every operational and training segment in Have Quick and need only be loaded when MWOD is used.

11. Set T-TONE switch to TONE and release. Note a double beep. One complete WOD is now loaded. To load more WODS, reselect channel 20 and repeat steps 6 through 11.

Load an operational date as follows:

NOTE

The operational date is the current Day-of-Month and must be entered into CHAN 1 so the radio can select the proper WOD.

12. Set CHAN switch to 01.

13. Set frequency selector to current Day-of-Month. The format is XAB.XXX.

14. Set T-TONE switch to TONE position and release. Listen for a wavering tone.

15. Set function switch to PRESET.

16. Set CHAN switch to 20.

17. Set frequency selectors to 220.000 (VERIFY/ OPERATE).

18. Press and release LOAD pushbutton. Listen for single beep. The radio is now ready to receive TOD and then operate in the active mode.

NOTE

- HQ II radios are designed to transmit and receive date information in the TOD signal. A future modification will result in date information being transmitted in all TODS. This will alleviate the need to perform steps 12 through 14 above. In the meantime HQ II radios can add date information to their TOD if they are manually loaded with DOM (steps 12 through 14 above), are self-started, and then receive the basic TOD. This expanded TOD may then be passed to other HQ II radios using MWODS.

- When using MWOD procedures with radio in VERIFY/OPERATE mode, the operator must load the current date into the radio prior to receiving TOD or receive a TOD with date attached.

MWOD Loading Using a KYK-13/TSEC Keyfill Device.

The KYK-13/TSEC keyfill device, normally used with the Vinson Secure Voice System, can now be used to load

MWOD electronically. The KYK-13 has six channels and can hold up to six WODs. MWOD keying material is supplied through cryptologic sources. Load the radio as follows:

1. Ensure radio is in the VERIFY/OPERATE mode.

2. Set M-P-G switch to MNL.

3. Lift front access panel to reveal FILL connector.

NOTE

The fill cable for the KYK-13 may be used while loading MWOD information into the radio, but it is not required.

4. Set KYK-13 mode switch to OFF/CHECK.

5. Install KYK-13 on FILL connector.

6. Set KYK-13 mode switch to ON. Observe indicator displays FILL.

7. Set KYK-13 address switch to applicable channel (1 through 6).

8. Press LOAD pushbutton for two seconds. Note a series of beeps are heard and f/s indicator displays WOD OK. If f/s indicator displays BAD, KYK-13 must be reloaded and steps 4 through 8 repeated.

NOTE

The CHAN indicator steps down from memory location 20 to 14, then displays 01 while the KYK-13 is connected and turned on. This allows entry of operation date information (DOM), if required. The operational DOM must match date code of one of the WODs being loaded with KYK-13 fill device.

9. Set KYK-13 to next applicable channel and repeat step 7. Observe that WOD OK is displayed on f/s indicator after each WOD is loaded.

10. If desired, load operational DOM by pressing status switch, then select date on frequency switches in the format XAB.XXX. Momentarily set T-TONE, switch to TONE position and release.

11. Set KYK-13 mode switch to OFF/CHECK.

12. Remove KYK-13 and close access panel. The radio will return to its previous mode and both displays return to previous settings.

Verifying an MWOD is Loaded.

The verify/operate mode serves a dual function. It is used to enter normal or anti-jam modes and to verify DOM codes of WODs loaded in the radio. The operator may verify the storage of a particular day's WOD as follows:

1. Ensure the radio is in the VERIFY/OPERATE mode.

2. Set M-P-G switch to MNL.

3. Set frequency selector switches to DOM to be verified. The format is XAB.XXX, where A is the 10's digit and B is the 1's digit of the DOM. (5 May would be 205.375.)

4. Set CHAN switch to 20.

5. Set CHAN switch momentarily to 19 and return to 20. A single beep verifies an MWOD with a matching DOM code is stored in memory. If single beep is not heard, DOM code selected is not stored in memory.

WOD Erase.

The ERASE mode is used to clear the memory of all MWOD elements. To accomplish MWOD erasure, proceed as follows:

1. Set CHAN switch to 20.

2. Set M-P-G switch to PRESET.

3. Set frequency switches to 220.050 and press LOAD pushbutton.

4. Set M-P-G switch to MNL.

5. Momentarily set T-TONE switch to TONE position. MWODs are now erased.

6. Set M-P-G switch to PRESET.

7. Set frequency switches to 220.000 and press LOAD pushbutton. Radio is now in the VERIFY/ OPERATE mode.

Alternate - MWOD Erase.

An alternate and quicker method of erasing MWODs is available as follows:

1. Lift front access panel to reveal ZERO switch.

2. Press ZERO switch down, then return to normal position, ERASE is displayed on f/s indicator. All MWODs are now erased.

Single WOD Loading.

Using single WOD loading, WOD elements are entered and stored into PRESET channel 20 through 15. The WOD may vary in length and may require anywhere from one to all six of these channels. Loading starts with channel 20 and works backward to 15. To use the single WOD method, proceed as follows:

1. Set M-P-G switch to PRESET.

2. Set CHAN switch to 20.

3. Set frequency switches to select WOD element.

4. Lift access panel and press LOAD pushbutton.

5. Set CHAN switch to next lower channel.

6. Repeat steps 3 through 5 until all WOD elements are loaded.

All WOD elements are now in the radio's PRESET memory and now must be transferred to the radio's nonvolatile memory.

NOTE

The following steps are done automatically by the radio set immediately after power-up if a WOD is loaded using this method.

1. Set CHAN switch to 20 and listen for a single beep.

2. Continue setting lower channels with the CHAN switch until a double beep is heard. The double beep signifies that WOD elements have been transferred.

3. Set M-P-G switch to MNL.

Time of Day.

TOD synchronization is necessary for communicating in the anti-jam mode to allow frequency-hopping at the same instant in time. TOD information is obtained from UHF radios that have been modified to receive Universal Time Coordinates (UTC) signal. UTC is a worldwide standard and is available from a variety of sources, such as Command Post and AWACS. A valid TOD signal will be heard as a two-beat frequency tone. Once all radios are operating on UTC, uninterrupted voice communications are ensured in a communications-jamming environment.

The radio automatically accepts the first TOD signal after power up. The first TOD reception must occur in the normal mode, updates of TOD may be performed in the anti-jam or normal mode. Subsequent TOD transmissions are ignored unless the operator enables the radio to receive a new TOD. If communications during anti-jam operations become slightly garbled, it is an indication of drift in TOD synchronization. To resynchronize radio, a TOD update can be performed. The operator may also send TOD contained in a radio to other radios similarly equipped.

TOD is loaded as follows:

1. UHF Radios - ON

2. On the COMM TUNE INDEX page, TOD XMIT - PRESSED (6R)

Verify that TOD XMIT OFF momentarily changes to ON.

NOTE

Normally, the UHF radios will automatically accept only the first TOD Message received after power-up. To load TOD after power-up set the UHF Control A-3-2-T switch to T and press TOD XMIT.

Time of Day (TOD) and TOD Update Reception.

NOTE

On initial power-up, the radio set automatically accepts first TOD message it receives. Subsequent TOD transmissions are ignored.

1. Set M-P-G switch to MNL or PRESET; rotate frequency switches or CHAN switch to a predesignated frequency for TOD transmission.

2. Momentarily select T position on T-TONE switch and then release.

3. Request TOD from another station.

NOTE

- If time is being automatically beaconed, the first TOD message received within one minute of selected T position will be accepted.
- A steady warning tone will be heard when the anti-jam mode is selected and TOD or a valid WOD has not been entered. A pulsating tone will be heard if an invalid net is elected.

TOD Transmission.

1. Set M-P-G switch to MNL or PRESET; rotate frequency switches or CHAN switch to a predesignated frequency for TOD transmission.

2. Momentarily select TONE position on T-TONE switch and then release.

NOTE

If the radio has a valid TOD (i.e., synchronized to UTC), the TOD transmitted will be synchronized to the coordinated time. If transmitted TOD is self-initiated and not synchronized to UTC, the radio will only communicate in the anti-jam mode with those radios synchronized to that radio.

TOD Emergency Clock Start.

1. Set CHAN switch to 20.

2. Set M-P-G switch to PRESET.

3. Set frequency selector switches to 220.025 (MWOD LOAD).

4. Press and release LOAD pushbutton. Listen for single beep.

Load the operational date code as follows:

NOTE

The operational date is the current Day-of-Month and must be entered into CHAN 01 so the radio can select the proper WOD.

5. Set CHAN switch to 01.

6. Set frequency switches to operational date in the format XAB.XXX. A represents the 10's digit and B the 1's digit. X can be any value.

7. Set T-TONE switch to TONE position and release. Listen for a wavering tone.

8. Set function switch to PRESET.

9. Set CHAN switch to 20.

10. Set frequency selectors to 220.000 (VERIFY/ OPERATE).

11. Press and release LOAD pushbutton. Listen for single beep.

12. Set T-TONE switch to T position while simultaneously pressing TEST DISPLAY switch, then release.

Net Numbers.

The net number is used in the anti-jam mode in the same fashion as a radio frequency in the normal mode of operation. The net number enables multiple users to operate simultaneously on a non-interfering basis with other users while sharing a common WOD and TOD. There are three nets available to the operator: Frequency Managed A-Nets (FMA-NETs), Training Nets (T-NETs), and Frequency Managed Training Nets (FMT NETS).

Frequency Managed A-Nets.

The FMA-NET provides four frequency tables or hopsets. There are 1000 possible nets for each hopset. The frequency table to be used is determined by the geographical area of operation. One large hopset has been coordinated for use in NATO-Europe and another large hopset for employment in non-NATO countries. The net number begins with "A" and is followed by three digits "000" to "999". The last two digits designate the frequency table to be used.

Nets are selected in accordance with ABB.BCC where:

1. A = A (Active).
2. BB.B = Desired Net.
3. CC = 00 for basic HAVE QUICK 25 for NATO-Europe. 50 for non-NATO Europe. 75 Reserved for future use.

Training Nets.

Each Major Command is assigned a training WOD for daily training and radio maintenance. Training WODs may be loaded using single WOD or MWOD method. All training WODs are initialized with 300.0XX in channel location 20. XX sets the frequency hop rate for the WOD. In this training mode, the radio hops between the five frequencies loaded in with the WOD (locations 19 to 15) and five training nets are available. As shown below, a net number ending in 00 selects a training net.

Training Nets
A00.000
A00.100
A00.200
A00.300
A00.400

Frequency Managed Training (FMT) Nets.

To expand the number of training nets available to Have Quick users, 16 FMT-nets are available. To use the FMT-nets, 16 frequencies have been loaded into the radio by unit maintenance personnel and are permanently stored in the radio's memory. The FMT-net frequencies are not part of the training Word-of-Day.

To use FMT-Nets, a training WOD must first be entered. The training WOD entry will have no effect on the FMT-Net other than hop rate.

The 16 FMT-Nets are selected the same as the other nets. They are numbered A00.025 through A01.525. All six characters must be selected and the last two digits MUST be 25. Selection of an FMT-net greater than A01.525 or ending in 50 or 75 will result in a pulsating tone.

UHF Antennas.

Two antennas are used with the UHF radio system. UHF 2 is connected to the top antenna and UHF 1 is connected to the bottom antenna. (See figure 1-208).

UHF SATELLITE TERMINAL SYSTEM (USTS) ANTENNA SUBSYSTEM (AIRCRAFT MODIFIED BY TCTO 530).

The principal components of the modification are the installation of the USTS interface panel, the RF amplifier shelf, the SATCOM antenna, the USTS POWER circuit breaker on the flight engineer's No. 3 circuit breaker panel, and cabling (figure 1-210). The USTS interface panel and the RF amplifier shelf link the aircraft's UHF SATCOM transceiver and the SATCOM antenna. All transmissions and receptions for this system are routed through the RF amplifier assembly. The USTS interface panel provides for the selection of system operating power and selection of a HIGH ANGLE or LOW ANGLE ANTENNA MODE. In the transmit mode, the UHF SATCOM transceiver's push-to-talk switch signals the RF amplifier assembly to directly switch the transmission to the selected antenna and bypass the internal amplifier. In the receive mode, the RF amplifier is signaled to switch satellite communications from the selected antenna to a high gain amplifier before injection into the transceiver.

USTS Subsystem Operation.

Activate the USTS antenna subsystem as follows:

1. System Power-Up.

CAUTION

Ensure UHF Transceiver AN/ARC-164 #2 POWER switch is in OFF position before utilizing the transmitting function of the UHF Satellite Terminal System (USTS).

a. At the USTS interface panel, set the POWER switch to ON.

b. Turn on the UHF SATCOM transceiver.

2. Antenna Mode Selection.

At the USTS interface panel, pull to unlock the ANTENNA MODE SELECT switch, then move the switch to either the HIGH ANGLE or LOW ANGLE position.

NOTE

The antenna mode selection cannot be changed until the push-to-talk button is released.

VHF AM/FM RADIO AN/ARC-186(V).

Two VHF communications systems are installed in the aircraft. Both VHF radios may be operated simultaneously. However, transmitting on one set while monitoring the other VHF set can produce an apparent side tone distortion. This generally occurs when both sets are operating on the same frequency but can occur on different frequencies.

VHF Control.

Any FMS MFCDU can serve as a control head for either of the two ARC-186 Receiver/Transmitter Sets. NP 1 controls VHF 1, and NP 2 controls VHF 2. A backup control is provided for VHF system No. 1.

Normal Operations.

The following guidelines are provided on the proper usage of the VHF Comm radios.

1. On any MFCDU POWER UP page, press 4R. Observe that MSTR AV ON changes to small font.

NOTE

MSTR AV ON turns power on to all VHF COMM/NAV units. Each radio can be turned on or off individually from its respective COMM TUNE page.

2. On any MFCDU, press the COMM TUNE key. MFCDU displays the COMM TUNE INDEX page.

a. Select COMM 1 or 2. MFCDU displays the COMM TUNE V1 or V2 page.

NOTE

The MFCDU COMM TUNE INDEX will display "<V1" in small font if the radio is being controlled by the VHF backup control panel, the NP controlling this radio has determined that the radio is unavailable, or the controlling NP is unavailable. Otherwise "<V1" is displayed in large font. If the VHF 1 radio is powered off, "OFF" will be displayed in small font.

b. Select PWR (1R).

c. On the keypad, enter desired identifier, channel, or frequency. Identifier, channel, or frequency appears in scratch pad section of display.

d. Depress key 1L. Data upselects.

NOTE

If a requested identifier is not contained in the database, the error message NOT IN DATABASE is displayed. If the commanded channel has no identifier, "---" is displayed for the identifier. If the radio is powered off, tuning results in the radio being powered up and commanded to tune.

e. Set emergency frequency (EMG FRQ), squelch (SQL), and tone (TONE) as required (refer to the Flight Management System (FMS) in Section I).

NOTE

- If EMERGENCY A is selected, the MFCDU displays:
  IDENT = E_AM
  FREQUENCY = 121.500
  SQUELCH = Current Value
- If EMERGENCY F is selected, the MFCDU displays:
  IDENT = E_FM
  FREQUENCY = 40.500 (Non-functional)
  SQUELCH = Current Value
- If no identifier is present, "-----" will be displayed. Otherwise, the data field displays the identifier currently being commanded in large font.
- If TONE is selected, the TONE generation is set to on. After 3 ±0.5 seconds the TONE is turned OFF.

3. Select appropriate VHF-1/2 monitoring switch on the interphone control panel. Set switch to a comfortable reception level.

VHF 1 Backup Control and Operation.

Controls are located on the COMM section of the VHF panel. The set is turned on and the frequency selected with two rotary control knobs located below the digital counter window on the COMM panel. The COMM-TEST pushbutton bypasses the receiver squelch to test the receiver. The following guidelines are provided on the proper usage and control of the No. 1 VHF radio using the VHF backup control panel. Turning on the VHF Backup Control takes control of VHF 1 and VOR 1 away from FMS. Data previously supplied by the FMS is now unavailable. The FMS will now display "<V1" and "<VOR 1" in small font on their respective FMS tune pages.

MODE SELECT SWITCH.

The lower right-hand corner rotary control knob is a 5-position switch controlling the COMM radio sets as follows:

"OFF" disables both the COMM and NAV VHF radios.

"COMM/NAV" enables both the COMM and NAV VHF radios.

"COMM" enables only the COMM radio set. NAV radio set is disabled.

"NAV" enables only the NAV radio set. COMM radio set is disabled.

"DF" is not used.

COMM MODE CONTROL SWITCH.

A 5-position rotary switch located at the lower left-hand corner of the control panel. The functions are as follows:

"EMER FM" is non-functional.

"EMER AM" selects stored emergency AM frequency. (121.5 MHz is displayed)

"MAN" allows manual selection of AM frequencies.

"PRE" allows selection of preset channels.

"READ" displays preset frequency of channel selected.

COMM/NAV DISPLAY SELECT SWITCH.

A momentary switch that enables the slew switches for approximately 26 seconds. Switch is located to the right of display window.

SQ DIS/TONE SWITCH.

A 3-position switch located to the left of the display panel with the following functions: "SQ DIS" position disables squelch; center position enables squelch; "TONE", a momentary position, transmits a tone of approximately 100 Hz.

NAV/LAMP TEST SWITCH.

A 3-position switch located adjacent to the COMM volume control. When in the "LAMP" position, tests all segments and decimals of the frequency display. The "NAV" position activates the built-in self-test of the navigation receiver.

NOTE

The self-test function is operative only while external VOR TEST (VOT) signal is being received.

LOAD SWITCH.

A pushbutton switch located at the lower center of the control panel. When depressed, puts manually selected frequency into selected preset channel.

BRT CONTROL.

Located below the NAV VOL control, controls intensity of the frequency display.

FREQUENCY DISPLAY.

The selected COMM frequency is displayed on the upper half of the digital display. The selected NAV frequency is displayed on the lower half of the digital display. A lighted decimal point to the upper far right indicates active slew switches.

NOTE

The NAV VOL control is disabled.

FREQUENCY SELECT SLEW SWITCHES.

Four 3-position momentary (toggle) slew switches are located below the display window. Pressing the switch forward increases the frequency. Pressing the switch rearward decreases the frequency.

Twenty communication channels may be preset. To preset channels, accomplish the following:

1. Rotate the Mode Select Switch to COMM position.
2. Place the COMM Mode Control to PRE position.
3. Set SQ DIS/Tone Switch to center.
4. Place Display Select Switch to COMM.
5. Select desired channel using the hundredths/thousandths frequency select slew.
6. Place COMM Mode Control Switch to MAN position.
7. Place Display Select Switch to COMM.

8. Using the frequency select slew switches, select desired frequency.

9. Press Load Switch to input frequency into selected preset channel.

10. Place COMM Mode Control Switch to READ position. Preset frequency of channel selected is displayed.

11. Place COMM Mode Control Switch to PRE. Correct channel number is displayed.

TO OPERATE THE EMER MODE.

Place the COMM Mode Control Switch to EMER AM position. When COMM Mode Control Switch is placed in EMER AM position 121.5 MHz is displayed.

VHF Antennas.

The antenna for VHF No. 1 is mounted on the bottom of the fuselage and the antenna for VHF No. 2 is mounted on the top of the fuselage (figure 1-208). No provisions are made for switching the antennas between the two systems. If transmission or reception is weak on one of the systems, the operator may use the other system to attempt to improve operation. The No. 2 system with its fuselage top antenna location is usually the best selection for ground operation.

HF RADIO AN/ARC-190(V) AUTOMATIC COMMUNICATIONS SYSTEM (ACS).

Two identical AN/ARC-190 HF ACS are installed on the aircraft. They provide long range two-way voice and data communication with other aircraft or with ground stations. The HF-ACS can transmit and receive on any one of 280,000 frequency channels spaced at 100 Hz increments in the HF band (2.0000 to 29.9999 MHz). Modulation methods are either single sideband or amplitude modulation. The available modulation modes are: Upper sideband Voice (UV), Lower sideband Voice (LV), Upper sideband Data (UD), Lower sideband Data (LD), Amplitude Modulation (AM), and Continuous Wave (CW).

Each HF-ACS consists of a radio control panel, Receiver/Transmitter (R/T), HF ACS Processor, antenna coupler, and bandpass filter. A relay switching unit, dual blower assembly, and antenna are shared by both systems. The radio control panels are located in the pilots' center console. The R/T units are located on the center avionics rack through the right underdeck area. The dual blower assembly is located on the shelf directly above the R/T units. The HF antenna is located on the forward bullet of the horizontal stabilizer (tail probe) and both couplers are attached to it. The relay switching unit (part of the left-side coupler mount) is used to provide RF switching necessary to ensure the transmitting system is connected to the tail probe antenna while the non-transmitting system coupler RF input is grounded. The communications processor is located on the top shelf in the left forward underdeck equipment rack. The system also uses a lightning arrester to prevent damage to the antenna couplers and R/T units should a lightning strike occur.

WARNING

- Ensure that no personnel or equipment remains in the vicinity of the tail probe antenna while the HF radio is transmitting. Maintain minimum safe distances from the antenna: radiation danger zones are 5 feet for personnel, 100 feet for fuel ignition, and 200 feet for electro-explosive devices.
- Do not make contact with the aircraft outer skin while the HF radio is transmitting.
- If not in silent mode, ALE equipped radios will sound and reply to ALE calls automatically. During air and ground refueling operations or ammunition uploading/downloading, or if other directives forbid HF emissions, ensure each HF radio is set to silent mode or the unused system is turned off.

Description.

The AN/ARC-190(V) ACS is an automatic communications system employing channel scanning and selective calling techniques. The ACS improves HF communications quality, connectivity, and reduces operator tasks required to communicate under varying propagation conditions.

Using conventional manual methods, an HF operator will reach a distant station on the first try less than 30 percent of the time. Using ACS in the automatic mode, the success rate for first-try communications is greatly improved. Establishing communications using the ACS is similar to placing calls using a telephone. An operator selects a calling station's address, initiates the call, and the communications processor automatically establishes a 2-way communications link. Operators at both ends of the link are alerted that communications can begin when the CALL indicator on the HF control panel lights and headset audio is enabled (if muted). The calling station's address is displayed on the receiving station's HF control panel to indicate who placed the call.

Selective Call (SELCAL) alerts the aircrew of a need to communicate with the Air Traffic Control Center (ATCC) during transoceanic flights. Upon entering a control air route/space the flight crew is required to contact the ATCC using voice communications. The flight crew provides the ATCC with the aircraft's unique four-character SELCAL address. The BF ACS system is then placed in SELCAL mode and the ATCC verifies proper operation of the ACS. The flight crew can then turn the volume down on the HF radio or enable mute to eliminate all BF noise and communication until contact by the ATCC using the aircraft SELCAL address. SELCAL mode reduces the crew's workload by eliminating the need for the crew to monitor HF communications for voice call during long transoceanic flights.

The basic communications technique employed by ACS is known as automatic link establishment (ALE). ALE is accomplished when a scanning receive station identifies an incoming call containing its unique address and automatically exchanges data with the calling station to establish and confirm the 2-way link. Optimum channel selection is accomplished via link quality analysis (LQA) circuits within the ACS. LQA is a means of analyzing the received signal characteristics and measuring signal quality for each scanned channel. The ACS continuously updates the LQA data base, storing LQA values for all received sounding transmissions and for incoming or outgoing calls. The system will automatically attempt alternate channels, based on stored LQA information and channel traffic, if a call on the initial channel fails to complete the link.

To initiate an ALE call, an operator selects the desired alphanumeric station address or corresponding address index number and keys the HF system. The ACS reviews channel LQA values for the desired address which represents recent propagation conditions and establishes a handshake between the two stations on the optimum channel. Once the 2-way link is established, the ACS alerts both operators and voice communications can begin. Once the CALL indicator lights, indicating a link is established, the calling station should initiate the voice transmission.

In addition to placing station-to-station calls using a specific called station address, the operator can select an all-call or net address to reach all stations or a selected group of stations within a net.

The ACS also provides an anti-jam (AJ) communication mode employing frequency hopping techniques used to combat the effects of enemy jammers and direction finding attempts. Anti-jam keys control the pseudorandom hopping pattern and are loaded from the remote keyfill/data load panel located on the navigator's instrument panel using a KYK-13 or KOI-18 keyfill device (figure 1-214). KY-75 secure voice operation is not possible in the AJ mode.

Limited data message transmission and reception capability is provided by the ACS. Short data messages are stored in message buffers and can be transmitted at any time once an automatic link is established with the desired station. Received data messages are also stored in a message buffer and can be read in the control panel address display field, three characters at a time. An operator is alerted that a message has been received by "MR1" or "MR2" appearing in the address display field.

Channel presets, addresses, and other parameters must be programmed to allow automatic communications. A DOS-compatible PC device is used to datafill the system at the remote keyfill/data load panel located on the navigator's console. Most parameters are stored in nonvolatile memory for power-off retention. A keep-alive circuit breaker located on the EMERGENCY DC panel provides battery-bus keep-alive voltage for the ACS.

If a short-term power outage (less than 10 seconds) occurs, programmed information is retained. If the keep-alive circuit breaker is set and a long-term power outage (more than 10 seconds) occurs, programmed information is retained. However, AJ time synchronization will have to be repeated to reestablish the accurate time required for frequency hopping. If a power outage occurs for more than 10 seconds and the associated keep-alive circuit breaker is not set, AJ keys, date/time, and data messages may be lost and should be reprogrammed.

HF-ACS Controls.

POWER SWITCH.

The radio power switch, labeled "PWR", is an alternate action pushbutton switch. Pressing the switch alternately turns the radio on and off but does not affect primary power to the ACS processor or control. To turn the radio off, the PWR switch must be depressed until display blanks, then released.

SQUELCH SWITCH.

The squelch switch, labeled "SQL", is a 5-position rotary switch that controls radio squelch and positive muting. Positive muting provides a positive indication of link establishment by disabling receive audio while scanning and restoring receive audio when a link is made. Radio squelch is signal strength dependent, positive muting is not. Both radio squelch and positive muting are disabled in the fully counterclockwise position. The first clockwise position enables positive muting while scanning, but disables radio squelch. The next three clockwise positions enable radio squelch and positive muting. Each position has a higher squelch threshold.

VOLUME SWITCH.

The volume control switch, labeled "VOL", is an 8-position rotary switch which varies the receiver-transmitter audio output level.

AJ SWITCH.

The anti-jam switch, labeled "AJ", is an alternate action pushbutton switch used to switch the radio system in and out of the AJ mode.

FIELD SLEW SWITCH.

The field slew switch, labeled "FLD", is a 3-position return-to-center rotary switch. Rotation causes the cursor to move to different fields throughout the display.

VALUE SLEW SWITCH.

The value slew switch, labeled "VAL", is a 3-position return-to-center rotary switch. Rotation causes the value indicated in the selected field to change. Values can be increased or decreased depending on direction of rotation.

INITIATE SWITCH.

The initiate switch, labeled "INIT", is a momentary-action pushbutton switch used to initiate calls, store information in memory, and initiate self-test, depending upon the operational field selected.

HF SELCAL Operational Mode. (Aircraft Modified By TCTO 576).

When the ATCC transmits on the predetermined frequency with the aircraft's address, the ACS deciphers the data. If the ACS recognizes the aircraft address, the ACS provides the flight crew with audible and visual notification. Upon receipt of an HF call, the interphone headset emits an audible tone and illuminates an HF Call alert light for 30 seconds. Received audio is automatically unmuted and squelch is turned to disable, allowing the crew to communicate with the ATCC. When communication with the ATCC is completed, the ACS automatically returns to SELCAL mode and mutes received audio until another call is received. The primary function of SELCAL is to provide the flight crew with a visual and audible alert of a need to communicate with the ATCC.

HF-ACS Normal Operational Modes.

The ACS provides the following normal operational modes:

1. Manual - Manual (MAN) mode enables manual frequency and radio mode selection. Manual mode allows communications with conventional HF radio stations that do not have ALE capability. ALE calls can be made once frequency and mode are manually selected.

2. Channel - Channel (CHN) mode allows an operator to use selectable preset channels. The preset channel contains programmed mode and frequency information. Channel mode allows communications with conventional HF radio stations that do not have ALE capability. Channel mode can also be used to make ALE calls.

3. Automatic - Automatic (AUT) mode employs automatic link establishment, selective scanning, and link quality analysis to make HF communications fully automatic. In the automatic mode, the ACS can communicate with other stations having ALE capability.

4. SELCAL (Aircraft Modified by TCTO 576) - ALE and SELCAL operations require a Datafill with information containing SELCAL address, station address, channel presets, and other operational parameters to optimize the system's automatic capabilities. Datafill is required for all operational modes except manual non-ALE or direct control operation. Each aircraft or station requires a unique self-address and SELCAL address. A remote Datafill connector for the ACS system is located at the Navigator's station and is used to serially load data into the system communications processor.

HF-ACS SELCAL Annunciator (Aircraft Modified by TCTO 576).

The SELCAL Annunciator Panel provides the flight crew with audible and visual notification when an HF call is received. Upon receipt of an HF call, the interphone headset emits an audible tone. This audible tone is only transmitted when a link is first established with a transmitting HF station. An indicator, BF CALL light, illuminates for 30 seconds when a link is first established. The VOL knob provides volume control for the tone and the PTT/TONE knob enables the user to test the three indicators and the tone.

HF-ACS Datafill.

In order to utilize the automatic capabilities of the ACS, each system must be loaded with information containing station addresses, channel presets, and other operational parameters. For all operational modes, except manual non-ALE or direct control operation, datafill is required. Each aircraft or station requires a unique datafill. Successful ALE operation requires accurate network planning and datafill file generation. A remote keyfill/data load panel for each ACS is located on the navigator's instrument panel (figure 1-160) and is used to serially load data into the communications processor. The following procedures provide ACS datafill instructions using a datafill device that has been loaded with the appropriate operational datafill files.

1. Connecting datafill device to ACS remote keyfill/data load panel.

   a. Locate the HF No. 1 and HF No. 2 remote keyfill/data load panels located in the upper right corner of the navigator's console as shown in figure 1-160, items 8 and 9.

   b. Remove protective cover from HF No. 1 or HF No. 2 DATA connector.

   c. Connect datafill cable to the datafill device.

   d. Connect other end of datafill cable to navigator's keyfill/data load panel DATA connector.

2. Performing datafill at ACS remote keyfill/data load panel.

   a. Ensure at least 3 minutes have elapsed since setting HF circuit breakers to allow the communications processor to finish self-test, and turn the datafill device on.

   b. Select the datafill directory.

   c. View the datafill directory, noting which datafill file (.FIL extension) will be loaded.

NOTE

The DATAFILL.EXE program defaults to comm port 1. If comm port 2 is desired, enter /COM2 following DATAFILL.EXE in step d (Example: DATAFILL.EXE/COM2).

d. Run DATAFILL.EXE.

e. Enter operational datafill file name, including file extension, after the prompt. After approximately 20 seconds, "Beginning datafill operation. Press any key to abort" is displayed followed by datafill parameters being loaded. The time to complete the datafill depends on the size of the file but is typically completed in 2 minutes.

NOTE

- If the operator wishes to abort the datafill in process, pressing any key on the datafill device will cause the data transfer to halt. The datafill device screen will display "***ABORTING DATAFILL! ***".
- If an invalid datafill command is contained in the datafill file, "*** ERROR OCCURRED ***" followed by "*** OBSERVE LOG FILE ***" will be displayed on the datafill device screen. If "FATAL ERROR - CANNOT CONTINUE DATAFILL" is displayed, it may be caused by a bad connection between the datafill device and the keyfill/data load panel. Check the connection and repeat step 2.

f. When datafill device display indicates "***DATAFILL COMPLETE***", turn off and disconnect the datafill device from the keyfill/data load panel.

g. Replace protective cover on applicable HF DATA connector.

HF-ACS Operation.

Operation of the ACS is accomplished using a menu driven HF control panel that provides a limited number of discrete switches to perform numerous options. The control has several display fields that can be selected by rotating the FLD switch to position the cursor in the desired field. Once a particular field is selected, the VAL switch is used to change the displayed value. The HF control panel is shown in figure 1-156. Perform the following power and preliminary setup procedures before beginning system operation.

HF-ACS SELCAL Pre-Flight Setup (Aircraft Modified by TCTO 576).

1. Ensure HF system(s) AC and DC circuit breakers are set (including keep-alive circuit breaker on pilot's EMERGENCY DC panel). If AC circuit breakers were not set, set breakers and wait 3 minutes while the communications processor performs a self-test before performing next step, otherwise proceed to step 2.

NOTE

If the HF control panel PWR switch is depressed prior to the 3-minute time-out after AC circuit breakers are set, the system will be running a self-test or will default to direct control operation. The self-test takes approximately 90 seconds to complete and starts by lighting all segments of the control panel display for approximately 15 seconds. After approximately 20 seconds, "01" is displayed in the "ADRS" field followed by "02", "OK", "03", and finally "OK+". After "OK+" is displayed, perform step 3. During direct control operation, "D C" is displayed in the address field. To exit direct control operation, depress PWR switch until display blanks, and momentarily depress PWR switch again. See HF-ACS Default Mode for more information pertaining to direct control operation.

2. Depress and release PWR switch on HF control panel. All display segments light momentarily and then current operational status is displayed.

3. Ensure radio is in SIL mode; if not, move cursor to OP field and then rotate VAL selector counterclockwise to alternately enable and disable silent operation. SIOL is displayed when silent operation is enabled and goes out when silent operation is disabled.

Ensure radio display shows SIL mode to prevent inadvertent RF transmission. This equipment includes an ALE communications processor. If not in the silent mode, ALE equipped radios sound (transmit short tone bursts) and reply to ALE calls automatically (without operator intervention). Anytime flight directives forbid HF emissions, ensure HF system is set to silent mode (see HF-ACS Silent Operation) or turned off.

4. Move cursor to function (FN) field using field (FLD) selector and select AUT using VAL selector. This power-up handshake between the processor and control panel initializes the control display.

5. Set interphone controls for HF operations.

6. Set SQL fully counterclockwise (positive muting disabled) and then set VOL as desired.

7. Rotate SQL switch two positions clockwise from the DSBL position; this is the recommended SQL setting. Receiver noise quiets. If the radio breaks in and out of squelch, select the fourth or fifth detent.

8. Check SELCAL Annunciator Panel volume and HF indicator lamps by pressing the SELCAL Annunciator Panel TONE PRESS TEST switch. Set tone and volume using Annunciator Panel control knobs.

9. Move cursor to FN field and select desired operating mode (AUT, CHN or MAN), normally the AUT mode. Refer to appropriate paragraph heading for further operating instructions.

10. If SELCAL operations are required for mission, perform Datafill using HP-95LX as follows:

NOTE

Use of any equivalent IBM-compatible PC may be used as a substitute for the HP-95LX. However, the interface cabling may be different.

a. Locate remote HF keyfill/data load panel at navigator's station.

b. Remove protective cover from HF DATA connector.

c. Connect Datafill cable to Datafill device.

d. Connect other end of Datafill cable to DATA connector on BF remote keyfill/data load panel.

e. Ensure at least 3 minutes have elapsed since setting HF circuit breakers to allow the communications processor to complete power-up self-test.

f. Turn on the Datafill device and select the Datafill directory.

NOTE

The SELCAL.EXE program defaults to Comm port 1. If Comm port 2 is desired, enter /COM2 following SELCAL.EXE in step g (e.g., SELCAL.EXE/COM2).

g. Run SELCAL.EXE.

h. After approximately 20 seconds, begin SELCAL Datafill operation. "PRESS ANY KEY TO ABORT"' is displayed followed by SELCAL address being loaded. The time to complete Datafill depends on the size of the SELCAL file, but is typically complete in 2 minutes.

NOTE

- If the operator wishes to abort the fill in process, pressing any key on the Datafill device causes the data transfer to halt. The PC screen displays "***ABORTING DATAFILL! ***".
- If an invalid address is contained in the SELCAL.EXE file, "***ERROR OCCURRED***" followed by "***OBSERVE LOG FILE***" is displayed on the Datafill device screen. If "FATAL ERROR-CANNOT CONTINUE DATAFILL:" is displayed, it may be caused by a bad connection between the Datafill device and the keyfill data load panel. Check the connection and repeat steps 11c through 11h.

i. When Datafill device displays "***SELCAL ADDRESS COMPLETE***, turn Datafill device off and disconnect from the DATA connector.

j. Replace protective cover on HF DATA connector.

HF-ACS Power-Up.

1. Ensure HF system(s) AC and DC circuit breakers are set (including keep-alive circuit breakers on pilot's EMERGENCY DC panel). If AC circuit breakers were not set, set breakers and wait 3 minutes while the communications processor performs a self-test before performing next step, otherwise proceed to step 2.

NOTE

If the HF control panel PWR switch is depressed prior to the 3-minute time-out after AC circuit breakers are set, the system will be running a self-test or will default to direct control operation. The self-test takes approximately 90 seconds to complete and starts by lighting all segments of the control panel display for approximately 15 seconds. After approximately 30 seconds, "01" is displayed in the "ADRS" field followed by "02", "OK", "03", and finally "OK+". After "OK+" is displayed, perform step 3. During direct control operation, "D C" is displayed in the address field. To exit direct control operation, depress PWR switch until display blanks, and momentarily depress PWR switch again. See HF-ACS Default Mode for more information pertaining to direct control operation.

2. Depress and release PWR switch on HF control panel. All display segments light momentarily and then current operational status is displayed.

3. Move cursor to "FN" field using FLD selector and temporarily select "CHN" in the "FN" field using VAL selector. This power-up handshake between the processor and control initializes the control display. Proceed to preliminary setup.

HF-ACS Preliminary Setup.

The following preliminary setup procedures should be performed after power on and prior to normal operation.

1. Set interphone controls for HF operation.

2. If installed, set applicable KY-75 PLAIN/BYPASS/CIPHER switch to "BYPASS".

NOTE

Steps 3 through 15 are used to enable sounding when scanning in the automatic mode. If automatic sounding operation is not desired, proceed to step 16.

3. Move cursor to "FN" field using FLD selector and select "CHN" using VAL selector if not already selected.

4. Move cursor to "OP" field using FLD selector and then rotate VAL selector clockwise to select "PRG" in "OP" field.

5. Move cursor to "FN" field using FLD selector and select "ADR" using VAL selector.

6. Move cursor to "ADRS" field so three cursors illuminate, and rotate VAL selector until "90" is displayed just left of the "ADRS" field.

7. Depress and release the INIT switch. System parameter "I" is displayed in the channel field (approximate center of display).

8. Move cursor to channel field (cursor position above "SQL" silkscreened on the control panel) using FLD selector and rotate VAL selector counterclockwise to select system parameter "33" in channel field.

9. Move cursor to "ADRS" field using FLD selector so that only one of the three "ADRS" field cursors is lit.

10. If not already displayed, rotate VAL selector to select "EN" (enabled) in "ADRS" field.

11. Depress and release INIT switch.

12. Move cursor to "OP" field using FLD selector and then rotate VAL selector clockwise to select "OPR" in "OP" field.

13. Move cursor to "FN" field using FLD selector and select "AUT" using VAL selector.

14. Move cursor to "ADRS" field so three cursors illuminate and rotate VAL selector to select "S-D" in the "ADRS" field.

WARNING

This equipment includes an ALE communications processor. If not in the silent mode, ALE-equipped radios will sound (transmit short tone bursts) and reply to ALE calls automatically (without operator intervention). Anytime flight directives forbid HF emissions, ensure HF 1 and HF 2 systems are set to silent mode (see HF-ACS Silent Operation) or turned off (see Power Turn Off).

15. Depress and release INIT switch. The radio system starts sounding (transmitting short bursts of data) on each scanned channel. As the radio sounds on each scanned channel, the TX indicator illuminates momentarily. The length of time sounding will take depends on the number of scanned channels. When sounding is complete, the TX indicator will remain off and the "CH" field indicates "SC" or steps through channel numbers. It is not necessary to wait for sounding to be completed to place ALE calls. Sounding will continue after the calls are completed.

NOTE

While operating the ACS system, the "OP" field should remain set to "OPR" (operate) unless directed to select "PRG" (program) or "TST" (test). If "PRG" or "TST" is selected, inadvertent movement of controls could result in changes to or loss of programmed information or a timed lockout from system operation.

16. Set "SQL" fully counterclockwise (positive muting disabled) and then set "VOL" as desired.

NOTE

When both HF systems are used at the same time, one system should be set for silent operation. This will prevent missed calls that will occur if both systems attempt to respond to ALE calls with a shared HF antenna configuration. This does not apply when one system is operated in direct control.

17. Move cursor to "OP" field using FLD selector and then rotate VAL selector counterclockwise to alternately enable and disable silent operation. "SIL" is displayed when silent operation is enabled and will go out when silent operation is disabled.

18. Rotate VAL selector clockwise to select "OPR" in "OP" field if not already selected.

19. Move cursor to "FN" field using FLD selector and select desired operating mode ("AUT", "CHN", or "MAN") using VAL selector. Refer to appropriate paragraph heading for further operating instructions.

HF-ACS Manual (MAN) Operation.

Ensure power-up and preliminary setup procedures were performed and proceed as follows:

NOTE

In manual mode, the HF radio system operates conventionally. The operator manually selects radio mode and frequency prior to placing a call. The system can also send and receive ALE calls in the manual mode.

1. Move cursor to "FN" field using FLD selector and then select "MAN" in "FN" field using VAL selector.

2. Move cursor to "MD" field using FLD selector and then select desired radio mode in "MD" field using VAL selector.

3. Move cursor to MHz "FREQ" field using FLD selector and then select desired MHz frequency digit(s) (2 through 29) using VAL selector.

4. Select and set remaining frequency digits in the "FREQ" field for desired operating frequency using FLD and VAL selectors.

5. Rotate SQL switch two positions clockwise from the "DSBL" position; this is the recommended SQL setting in the manual mode. Receiver noise will quiet. If the radio breaks in and out of squelch, select the fourth or fifth detent.

6. For conventional HF (non-ALE) communications, momentarily depress mic push-to-talk switch and allow system to tune. When tune tone ceases, depress mic push-to-talk switch and begin communication. If manual ALE communications are desired, proceed to step 7, otherwise no further action is required for manual non-ALE communications.

NOTE

If an ALE net call or all call is desired, refer to HF ACS Calling Options.

7. For manual ALE communications, move cursor to "ADRS" field so all three cursors illuminate using the FLD selector, and then select desired station address using the VAL selector. As the VAL selector is toggled, the ADRS field will display all programmed addresses. If the desired 3-character address is not programmed, proceed to step 8, otherwise proceed to step 10.

8. To manually select an address, rotate VAL selector so that "S-D" or "XAL" is not displayed in "ADRS" display and then rotate FLD selector so a single cursor is under the left "ADRS" field position. Rotate VAL switch to select first address character. Addresses greater than three characters cannot be manually selected at the control.

9. Select and set remaining two address characters using FLD and VAL selectors.

10. Momentarily depress INIT switch on HF control panel. When CALL indicator illuminates, the link is established. The amount of time it takes for the CALL indicator to light will vary. If CALL indicator does not light in approximately 30 seconds, or if the CALL indicator illuminates but voice communications are not successful, repeat steps 3 through 10 on a different calling frequency.

11. When CALL indicator illuminates, depress mic push-to-talk switch and begin voice communications. Once communications are complete, the system will automatically terminate the link after a programmed period of time. The CALL indicator will extinguish when the link is terminated.

NOTE

If an ALE call is received, the CALL indicator illuminates along with the calling station's address. The "FREQ" field indicates calling frequency. The operator at the receiving station should wait for the caller to make the first transmission. To answer the call, depress mic push-to-talk switch and begin voice communications.

HF-ACS Channel (CHN) Operation.

Ensure power-up and preliminary setup procedures were performed and proceed as follows:

NOTE

In channel mode, the HF radio system operates conventionally. The operator selects a preset channel that has been programmed with mode and frequency information to place a call. The system can also send and receive ALE calls in the channel mode.

1. Move cursor to "FN" field using FLD selector and then select "CHN" in "FN" field using VAL selector.

2. Move cursor to "CH" field using FLD selector and then select desired preset channel using VAL selector. "FREQ" field indicates frequency for selected preset channel and "MD" field indicates programmed radio mode.

3. Rotate SQL switch two positions clockwise from the "DSBL" position; this is the recommended SQL setting in the channel mode. Receiver noise will quiet. If the radio breaks in and out of squelch, select the fourth or fifth detent.

NOTE

In channel mode, tuning information is stored in memory the first time a preset channel 1 is tuned. Once learned, preset tune time is very short and a tune tone may not be audible when keying the mic switch.

4. For non-ALE communications, momentarily depress mic push-to-talk switch and allow the coupler to tune. When tune tone ceases, depress mic push-to-talk switch and begin communication. For ALE communications in the channel mode, proceed to step 5.

NOTE

If an ALE net call or all call is desired, refer to HF ACS Calling Options.

5. For channel ALE communications, move cursor to "ADRS" field so three cursors illuminate using the FLD selector and then select desired station address using VAL selector. As the VAL selector is toggled, the "ADRS" field will display all programmed addresses. If the desired three-character address is not programmed, proceed to step 6, otherwise proceed to step 8. Addresses greater than three characters cannot be manually entered at the control.

6. To manually select an address, rotate VAL selector so that "S-D" or "XAL" is not displayed in "ADRS" display, and then rotate FLD selector so a single cursor is under the left "ADRS" field position. Rotate "VAL" switch to select first address character.

7. Select and set remaining two address characters using FLD and VAL selectors.

8. Momentarily depress INIT switch. When CALL indicator illuminates, the link is established. The amount of time it takes for the CALL indicator to light will vary. If CALL indicator does not light in approximately 30 seconds, or if the CALL indicator illuminates but voice communications

are not successful, repeat steps 2 through 8 on a different channel.

9. When CALL indicator illuminates, depress mic push-to-talk switch and begin voice communications. Once communications are complete, the system will automatically terminate the link after a programmed period of time. The CALL light will extinguish when the link is terminated.

NOTE

If an ALE call is received, the CALL indicator will illuminate along with the calling station's address. The "CH" display indicates channel number and "FREQ" display indicates calling frequency. The operator at the receiving station should wait for the caller to make the first transmission. To answer the call, depress mic push-to-talk switch and begin voice communications.

HF-ACS Automatic (AUT) Operation.

Ensure power-up and preliminary setup procedures were performed.

NOTE

- If an ALE net call or all call is desired, refer to HF ACS Calling Options.
- In the automatic mode, receive audio is muted until a link is established. Positive muting prevents an operator from having to listen to noise and/or traffic on scanned channels. With positive muting enabled, an operator does not have to monitor the CALL indicator to verify a link is established. When a link is established, headset audio is restored and the CALL indicator illuminates. Positive muting is disabled if the SQL switch is rotated fully counterclockwise.

1. Move cursor to "FN" field using FLD selector and then select "AUT" in "FN" field using VAL selector.

2. Rotate SQL switch one position clockwise from the "DSBL" position; this is the recommended squelch switch setting in the automatic mode. Headset audio will be muted until a communications link is established.

3. Move cursor to "ADRS" field so all three cursors illuminate using the FLD selector and then select desired station address using VAL selector. As the VAL selector is toggled, the "ADRS" field will display all programmed addresses. If the desired three-character address is not programmed, proceed to step 4, otherwise proceed to step 6. Addresses greater than three characters cannot be manually selected from the control.

4. To manually select an address, rotate VAL selector so that "S-D" or "-XAL" is not displayed in "ADRS" then rotate FLD selector so a single cursor is under the left "ADRS" field position. Rotate VAL selector to select first address character.

5. Select and set remaining two address characters using FLD and VAL selectors.

6. Momentarily depress INIT switch on HF control panel. As a link attempt is made on each programmed channel, the "CH" field displays calling channel number, the "FREQ" field displays calling frequency, and "TX" light comes on momentarily. When CALL indicator illuminates and headset audio is restored, the link is established. The time it takes for the CALL indicator to light will vary. Typically, the CALL indicator will light in approximately 30 seconds but can take as long as 3 minutes. If a link is unsuccessful, the ACS will return to scan after a programmed time-out.

7. When the CALL indicator illuminates, depress mic push-to-talk switch and begin voice communications. The calling station should make the first transmission. Once communications are complete, the system will automatically terminate the link and return to scan after a programmed period of time. The CALL indicator will extinguish when the link is terminated. After returning to scan, the operator may select another address, or place another call to the same address.

8. To interrupt a calling sequence or terminate a link prior to the programmed time-out, move cursor to "FN" field using FLD selector. Momentarily select "CHN" or "MAN" using VAL selector, then return to "AUT".

NOTE

- If an automatic call is received, the CALL indicator will illuminate along with the calling station's address. The "CH" field indicates channel number and "FREQ" field indicates calling frequency. The operator at the receiving station should wait for the caller to make the first transmission. To answer the call, depress mic push-to-talk switch and begin voice communications.
- If the CALL indicator illuminates after a call is placed, but voice communications are unsuccessful, return to scan IAW step 8 and attempt the call again by repeating steps 6 and 7.

HF-ACS Scan List Selection.

The following steps provide instructions for enabling/disabling scan lists. When programmed, up to 20 scan lists are available and can be activated simultaneously.

1. Move cursor to "OP" field using FLD selector and then rotate VAL selector clockwise until "OP" displays.

2. Move cursor to function "FN" field using FLD selector and then rotate VAL selector to select "CHN".

NOTE

In the "CH" field, "SL" is located between channels 99 and 0. Depending on what number is displayed, it may be quicker to rotate the VAL selector counterclockwise to reach "SL" in step 3.

3. Move cursor to "CH" field using FLD selector and then rotate VAL selector to select "SL" in "CH" field.

4. The MHz "FREQ" field displays scan list index number "1" and 100-Hz "FREQ" field displays "0". If "0" is not displayed in the 100-Hz "FREQ" field, use FLD and VAL switches to select "0" and then move cursor back to the MHz "FREQ" field.

5. Rotate VAL switch to step through scan lists 1 through 20. "ADRS" field shows "--XEN" (scan list enabled) or "-XDI" (scan list disabled) for each scan list number. If no changes are required, proceed to step 10. To enable or disable scan lists, proceed to step 6.

6. Move cursor to MHz "FREQ" field and select desired scan list number (1 through 20) using VAL switch.

7. Move cursor to "ADRS" field so all three cursors illuminate using the FLD selector, and rotate VAL selector to "EN" (enable) or "DI" (disable) the scan list.

8. Depress and release INIT switch. An asterisk will appear (*EN or *DI) to indicate the selected scan list is enabled or disabled.

NOTE

Multiple scan lists can be activated depending upon operational requirements. When enabling a new scan list, remember to disable scan lists that are no longer required.

9. Repeat steps 6 through 8, until all desired scan lists are enabled or disabled.

10. Move cursor to "OP" field using FLD selector and rotate VAL selector clockwise to select "OPR" in "OP" field.

11. Move cursor to "FN" field using FLD selector and momentarily select "CHN" or "MAN" before returning to "AUT" using VAL selector.

HF-ACS Default Mode - Direct Control (DC).

If the communications processor fails, or is removed from the HF system, the system defaults to direct control operation. When the system has defaulted to direct control, the address display will indicate "D", followed by a blank, followed by a "C". In direct control, the HF radio system operates conventionally without automatic link establishment or AJ capability. For operation in direct control, refer to manual or channel non-ALE operation. Automatic and silent operation is not possible in direct control.

HF-ACS Silent (SIL) Operation.

Silent operation is used to prevent the ACS from automatically sounding or responding to ALE calls during periods of HF emission control (HF EMCON) or when directives restrict such emissions. During silent operation, the ACS will not transmit unless an operator intervenes or keys the system.

Normally, each aircraft within a net will be assigned a unique self-address shared by both HF systems onboard the aircraft. In order to prevent missed calls due to the shared antenna, one system must be set for silent operation as directed in the HF-ACS Preliminary Setup. Silent operation is not applicable if the ACS is in direct control. To enable or disable silent operation, proceed as follows:

1. To enable silent operation, move cursor to "OP" field using FLD selector and rotate VAL selector counterclockwise to alternately enable and disable silent operation. "SIL" is displayed just to the right of "OPR" in the "OP" field when silent operation is enabled and will go out when silent operation is disabled.

2. Move cursor to "FN" field using FLD selector and select "AUT", "CHN", or "MAN" using VAL selector.

HF-ACS Tri-Service Anti-jam Mode.

The tri-service AJ mode employs a frequency hopping technique to combat the effects of communication jammers. Tri-service AJ communication is possible during manual operation only. No AJ capability exists during direct control operation. KY-75 secure voice operation is not possible in the AJ mode.

HF-ACS Tri-Service Anti-jam Preflight Setup.

In order to communicate in the tri-service AJ mode, AJ time must be set, AJ keys must be loaded, and AJ tuning and AJ time synchronization must be performed. It is recommended that these procedures be performed prior to a mission.

1. Tri-Service (Military Standard) AJ Time. The following procedures provide instructions for programming the processor with coarse time (universal time coordinated (UTC) ± 5 seconds) and current date information.

a. Move cursor to "OP" field using FLD selector and rotate VAL selector clockwise to select "OPR" in "OP" field.

b. Move cursor to "FN" field using FLD selector and then select "MAN" in "FN" field using VAL selector.

c. Move cursor to "FREQ" field using FLD selector and select a frequency to provide UTC using VAL selector. Adjust volume and interphone controls as required to monitor time reference.

d. Move cursor to "OP" field using FLD selector and rotate VAL selector clockwise to select "PRG" in "OP" field.

e. Move cursor to "FN" field using FLD selector and then select "TIM" in "FN" field using VAL selector.

f. If "AJ" indicator is not lit, depress and release AJ switch. The address field displays "- -C".

g. Move cursor to address field so three cursors illuminate using the FLD selector, and then select " - - M" in "ADRS" field using "VAL" selector. The "TIME" field displays programmed military time, or zeroes, if no time has been programmed.

NOTE

Time entered is UTC ± 5 seconds.

h. If time is correct, go to step j. If time is incorrect or is not advancing, use FLD and VAL selectors to enter correct 24-hour military time to next whole minute.

i. While listening to time tick, depress and release INIT switch at start of next whole minute. The time displayed in the "TIME" field starts advancing.

NOTE

Julian date consists of five numbers representing the year and the day of the year. For example, the 100th day of 1994 is 94100.

j. Move cursor to address field so three cursors illuminate using the FLD selector, and then select "- JD" in address field using VAL selector. "TIME" field displays current Julian date if previously loaded, or zeroes, if no date has been programmed.

k. If Julian date is correct, go to step 1. If the Julian date is incorrect, use FLD and VAL selector to enter correct Julian date in "TIME" field and proceed to step 1.

l. Depress and release INIT switch; "- - M" appears in address field and time is displayed. Time programming is complete.

NOTE

Perform either step 2 or step 3 depending on which keyfill device is used.

2. Tri-Service AJ Key Loading From a KYK-13 Keyfill Device (KFD).

NOTE

The fill cable for the KYK-13 may be used while loading AJ keys into the processor, but is not required.

a. Set KYK-13 Z-ON-OFF/CHECK switch to "OFF/CHECK".

b. Connect KYK-13 to "FILL" connector on applicable HF remote keyfill/data load panel on navigator's console.

c. Ensure HF-ACS power-up procedures have been performed.

d. Set KYK-13 Z-ON-OFF/CHECK switch to "ON".

e. Set KYK-13 fill switch to switch position containing primary AJ key to be loaded.

f. Move cursor to "OP" field using FLD selector, and then rotate VAL selector clockwise until "OP" field displays "PRG".

g. Move cursor to function "FN" field using FLD selector, and then rotate VAL selector to select "KEY".

h. If AJ indicator is not lit, depress and release AJ switch. "AI" indicator illuminates and "-XP" (external primary AJ key) is displayed in the address field.

i. To load primary AJ key, depress and release INIT switch. "-XA" (external alternate AJ key) appears in the "ADRS" field and the KEY indicator goes off. If an alternate AJ key is to be loaded, proceed to step j, otherwise proceed to step 1.

j. Turn KYK-13 fill switch to switch position containing alternate key to be loaded if an alternate key is desired.

k. To load alternate AJ key, depress and release INIT switch. "-ZA" appears in the "ADRS" field.

l. Turn KYK-13 Z-ON-OFF/CHECK switch to "OFF/CHECK" and disconnect KYK-13 from fill panel.

3. Tri-Service AJ Key Loading From A KOI-18 Keyfill Device (KFD).

a. Connect KOI-18 fill cable to "FILL" connector on applicable HF remote keyfill/data load panel on navigator's console.

b. Ensure HF-ACS power-up procedures have been performed.

c. Move cursor to "OP" field using FLD selector, and then rotate VAL selector clockwise until "OP" field displays "PRG".

d. Move cursor to function "FN" field using FLD selector, and then rotate VAL selector to select "KEY".

e. If AJ indicator is not lit, depress and release AJ switch. AJ indicator illuminates and "-XP" (external primary AJ key) is displayed in the address field.

f. To load primary AJ key, depress and release INIT switch and insert tape leader into KOI-19 slot marked "IN". Ensure smaller holes line up with white dots on KOI-18 and pull tape through KOI-18 at a steady rate. If keyfill is successful, "-XA" (external alternate AJ key) appears in the address field and KEY indicator goes off. If keyfill fails, "----" is displayed in the address field; repeat step f. To load an alternate AJ key, proceed to step g; otherwise proceed to step h.

g. To load alternate AJ key, depress and release "INIT" switch and insert tape leader into KOI-18 slot marked "IN". Ensure smaller holes line up with white dots on KOI-18 and pull tape through KOI-18 at a steady rate. If keyfill is successful, "-ZA" appears in the address field and the "KEY" indicator goes off. If keyfill fails, "---" is displayed in the address field. If keyfill fails, select "-XA" in the address field and repeat step g.

h. Disconnect KOI-18 from fill panel.

4. Tri-Service AJ Tuning. The frequency hopping employed during AJ communications requires the antenna coupler be pretuned on each of the AJ frequencies. Tuning information is stored in the communications processor. Up to 14 AJ frequency lists can be stored in the communications processor, and each list can contain numerous frequencies. Only one AJ frequency list can be activated at a time and is normally selected as part of the datafill information. When AJ tuning is performed per the following procedure, all programmed AJ frequencies are tuned, regardless of which list is activated.

a. Move cursor to "OP" field using FLD selector and then rotate VAL selector clockwise until "OP" field displays "TST".

b. Depress and release INIT switch. The ACS performs a receive self-test which takes approximately 90 seconds. After approximately 20 seconds, the address field displays "01", "OK", "02" and then "OK" if the test is successful. If receive self-test fails, "FAULT" is displayed in the upper center of the display. Clear the fault by setting "OP" field to "OPR", "FN" field to "MAN", change any digit in the "FREQ" field momentarily, and repeat steps a and b. If the fault was erroneous, it will not recur. If the fault recurs, call maintenance.

c. Momentarily key radio and allow radio to tune.

d. Depress and hold mic push-to-talk key and momentarily depress AJ switch. The AJ indicator comes on and the ACS runs AJ self-test and tunes AJ frequencies. During self-test, address field displays "03", "TUN", and finally "OK" or "OK+" if AJ tests/tuning are successful. If one or more of the AJ frequencies fail to tune, -UT (untuned) is displayed in the address display.

e. Release mic push-to-talk key when "OK", "OK+", or "-UT" appears in address field. If "-UT" is displayed, repeat steps d and e.

5. Tri-Service (Military Standard) AJ Time Synchronization. The frequency hopping employed during AJ communications requires extremely accurate time synchronization (time-sync). The following procedures provide instructions for fine-tuning the previously entered coarse time by performing a time-sync (handshake data transmission) with a master time station. This ensures all units required to interoperate in the tri-service AJ mode are precisely synchronized from the same time standard.

NOTE

If power outage of more than 10 seconds occurs, the following time-sync procedures will have to be repeated once power is restored in order to reestablish AJ communications.

a. For the station designated as the master time station, perform steps b through i only. For the station designated as the secondary time station, perform steps j through o, followed by steps b through i. For all other stations, perform steps j through o only.

b. Move cursor to "OP" field using FLD selector and rotate VAL selector clockwise to select "PRG" in "OP" field.

c. Move cursor to "FN" field using FLD selector and then select "TIM" in "FN" field using VAL selector.

d. If AJ indicator is not lit, depress and release AJ switch.

e. Move cursor to address field so three cursors illuminate using the FLD selector. For master time station, select "-MM" (master military standard time station) in address field using VAL selector. For secondary time station, select "-SM" (secondary military standard time station) in address field using VAL selector.

f. Depress and release INIT switch. Address field displays "-XMM" for master time station or "XSM" for secondary time station.

g. Move cursor to "OP" field using FLD selector and rotate VAL selector clockwise to select "OPR" in "OP" field.

h. Move cursor to "FN" field using FLD selector and then select "MAN" in "FN" field using VAL selector.

NOTE

If the AJ indicator is already lit, press and release the INIT switch so that the AJ indicator extinguishes before performing step i.

i. Depress and release AJ switch. AJ indicator illuminates and channel "60" is displayed along with AJ center frequency. No further action is required by the master time station. For all stations other than the master time station, proceed to step j.

j. Move cursor to "OP" field using FLD selector and rotate VAL selector clockwise to select "PRG" in "OP" field.

k. Move cursor to "FN" field using FLD selector and then select "TIM" in "FN" field using VAL selector.

l. If AJ indicator is not lit, depress and release AJ switch.

m. Move cursor to address field so three cursors illuminate using the FLD selector and then select "-RM" (request military standard AJ time) in address field using VAL selector.

n. Depress and release INIT switch. Time display stops advancing and the TX (transmit) indicator illuminates as transmission is made, requesting time from the master or secondary time station.

o. When the clock starts running (typically 5 seconds), time-sync is complete. If time-sync fails, "----" is displayed in the address field. If time-sync fails, repeat steps m through o.

HF-ACS Tri-Service Anti-jam Operation.

To communicate in the tri-service AJ mode, ensure tri-service AJ preflight setup is complete and proceed as follows:

1. Move cursor to "OP" field using FLD selector and then use VAL selector to select "OPR" in "OP" field.

2. Move cursor to "FN" field using FLD selector and then select "MAN" using VAL selector.

3. Move cursor to "MD" field using FLD selector and then select "UV" in "MD" field using VAL selector.

4. Depress and release AJ switch. AJ indicator illuminates and channel "60" is displayed along with the AJ channel center frequency. AJ communications can begin.

NOTE

- Each time mic push-to-talk is keyed, a short preamble of audio tones is transmitted. After pressing mic switch, wait for audio tones (present in headset) to cease before beginning communications. The CALL indicator will illuminate when the preamble is complete and communications can begin. When receiving an AJ call, wait for the CALL indicator to extinguish before keying the radio to respond.

- To disable AJ communications, depress and release the AJ switch. The AJ indicator will extinguish, signifying AJ communications are disabled.

HF-ACS Zeroizing Keys.

The following procedure is used to zeroize the primary and alternate AJ key.

1. Move cursor to "OP" field using FLD selector and then use VAL selector to select "PRG" in "OP" field.

2. Move cursor to "FN" field using FLD selector and then select "KEY" in "FN" field using VAL selector.

3. Move cursor using FLD selector to lower left corner of display just left of "ZO" (zeroize) displayed in mode field.

4. Depress and release INIT switch. The display blinks and the KEY indicator illuminates to indicate all keys are zeroized.

HF-ACS Calling Options.

In addition to placing station-to-station ALE calls, the ACS provides the option of placing net calls or all calls. Net calls are used to place a call to a preplanned group of stations that have been programmed with a common net address. All calls are generally used in an emergency to broadcast a call to all comparably equipped ALE stations. The following operating procedures describe address selection only and are used in conjunction with manual, channel, and automatic ALE operation described earlier under the heading "HF-ACS Operation".

1. Net calls.

a. Move cursor to "ADRS" field so three cursors illuminate using the FLD selector and then select desired net address (201 through 220) using VAL selector. As VAL selector is toggled, the "ADRS" field steps through all programmed addresses. In the automatic mode, corresponding index numbers are displayed to the left of the "ADRS" field.

b. Depress and release the INIT switch and follow normal operating instructions for selected mode.

c. When a net call is received, the receiving station CALL indicator illuminates and the calling station address is displayed in the "ADRS" field.

2. All calls.

NOTE

Each station is permanently programmed with the military standard all call address (-XAL) at index number 299 and is not user programmable.

a. Move cursor to "ADRS" field so all three cursors illuminate using the FLD selector, and then select the military standard all call address "XAL" (index number 299) in the "ADRS" field using VAL selector. As the VAL selector is toggled, the "ADRS" field steps through all programmed addresses. In the automatic mode, corresponding index numbers are displayed to the right of the "ADRS" field.

b. Depress and release the INIT switch and follow normal operating instructions for selected mode.

c. When a military standard all call is received, the CALL indicator illuminates. The address field does not change to display the standard "XAL" all call address.

HF-ACS Data Messages.

The ACS provides the capability to send and receive text messages up to 408 characters in length once a link is established. Four message buffers are available for processing data messages. Normally, message buffers 1 and 2 store received data messages and buffers 3 and 4 store transmit data messages. All four buffers can be used to store transmit data messages. However, any received data messages will overwrite transmit messages stored in buffers 1 and 2. To read received data messages and transmit programmed data messages, proceed as follows:

1. HF-ACS Data Message Sending.

a. To transmit a programmed data message, a link must be established as indicated by the CALL indicator being lit.

b. Move cursor to "ADRS" field so all three cursors illuminate using the FLD selector, and then select programmed message number (M-1, M-2, M-3, or M-4) in "ADRS" field using VAL selector.

c. Depress and release INIT switch to begin transmission of data message. The TX indicator illuminates. When transmission is complete, the TX indicator turns off and the system reverts to previously selected status.

2. HF-ACS data message receiving. If a data message is received, "MR1" or "MR2" is displayed in the "ADRS" field. To read a received data message, proceed as follows:

a. Move cursor to "OP" field using FLD selector and then use VAL selector to select "PRG" in "OP" field.

b. Move cursor to "FN" field using FLD selector and select "ADR" in "FN" field using VAL selector.

c. Move cursor to "ADRS" field so all three cursors illuminate using the FLD selector and then select address index number "91" for "MR1" or "92" for "MR2", using VAL selector. Index numbers are displayed just to the left of the "ADRS" field.

d. Messages are read in the "ADRS" display three characters at a time. For example, if the received data message is "MISSION COMPLETE", a message nibble number (00 - 135) is displayed in the time field and the first three characters of the message are displayed in the "ADRS" field as shown below. To read the next three message characters, place cursor under nibble number and rotate VAL selector to increase value of nibble number from "00" to "01". The next three message characters are displayed in the "ADRS" field. Continue selecting next higher nibble number until entire message is read as shown below.

NIBBLE NUMBER IN "TIME" FIELD	MESSAGE CHARACTERS IN "ADRS" FIELD
00	MIS
01	SIO
02	N C
03	OMP
04	LET
05	E

NOTE

A received message writes over the message currently stored in address indexes 91 or 92 (MR1 or MR2). The oldest message is written over first.

e. To return to normal operation, move cursor to "OP" field using FLD selector and then use VAL selector to select "OPR" in "OP" field.

f. Move cursor to "FN" field using FLD selector and then use VAL selector to select "AUT", "CHN", or "MAN" in "OP" display.

HF Selective Call (SELCAL) Operation (Aircraft Modified by TCTO 576).

NOTE

Upon entering an ATCC controlled air space contact the ATCC on a predetermined frequency using MAN voice procedures. Provide ATCC with aircraft's valid SELCAL address and place the ACS in SELCAL operation. MUTE received audio and have ATCC place SELCAL to the ACS SELCAL address and verify proper operation. If call fails, maintain voice communication with ATCC.

1. Place HF ACS in MAN Mode.

2. Select the predetermined frequency for ATCC operator.

3. Rotate the FLD switch to the ADRS field.

4. Rotate the VAL switch until *SL appears.

5. Press the radio control head INIT button.

6. Verify that *SL appears in the ADRS field indicating SELCAL operation has been selected.

7. Verify RCV audio is muted unless squelch is disabled.

8. Upon receipt of a call, the Annunciator Panel HF CALL indicators illuminate, the communications link is available for use.

NOTE

Once communications are complete, the system automatically terminates the link and returns to scan after a programmed period of time. The HF CALL indicator extinguishes when the link is terminated. The Annunciator Panel indicator extinguishes 30 seconds after the call is received. After returning to scan, the operator may select another address or place another call to the same address.

9. After communications are complete, reset SELCAL by pressing the INIT button.

10. Verify *SL is still present.

11. To disable SELCAL operations, rotate FLD switch to address field.

HF-ACS Power Turn Off.

The radio power switch, labeled "PWR", is an alternate action pushbutton switch. Pressing the switch alternately turns the radio on and off but does not affect primary power to the ACS processor or control. To turn the radio off, the HF control panel PWR switch must be depressed until display blanks, then released.

Selective Call (SELCAL) Annunciator (Aircraft Modified by TCTO 576).

Aircraft modified by TO 1C-141B-576 (SELCAL) are equipped with the capability to alert a crew of the need to communicate. Crew alerting is accomplished via a chime and illuminated annunciator. Typical operation for SELCAL is a direct link between an Air Traffic Control Center (ATCC) and a particular aircraft. The crew is notified when the aircraft receives a Radio Frequency (RF) signal, with its address embedded, on a predetermined frequency. The aircrew selects a predetermined RF signal and provides ATCC with the aircraft address. Once communication has been established and the SELCAL VOL and TONE/PTT controls are set to mid range the volume can be turned down on the ARC-190 radio system. When ATCC transmits on the predetermined frequency with aircraft address embedded, a tone will be generated for approximately one second and the applicable annunciator lamp will illuminate for approximately 30 seconds. The SELCAL panel also includes a Satellite Communications (SATCOM) annunciator. This annunciator will illuminate anytime a SATCOM message is received. The SATCOM annunciator will remain illuminated until it is manually reset.

The SELCAL annunciator, located on the copilot's side console, has two switch controls (TONE/PI7 and VOL) and three annunciators (HF CALL NO. 1, HF CALL NO. 2, and SATCOM MSG). The two switches control checkout and operate the system and the three annunciators illuminate to identify the communication system receiving a message. Rotating the TONE/PTT control varies the audio output tone (frequency). When the TONE/PTT switch is depressed a one-second tone is generated, the HF CALL NO. 1 and HF CALL NO. 2 annunciators will illuminate for approximately 30 seconds, and the SATCOM MSG annunciator will illuminate until it is manually reset. The VOL (volume) control in the OFF (detent) position attenuates all signal output. Rotating the knob from OFF to clockwise increases the audio output.

HF Antenna.

One antenna located on the "T" tail serves both sets. It is only possible to transmit on one radio at a time. Aircraft modified by TCTO 503 have RH and LH wing antenna probes that are used with the AN/URC-56 Communication System.

MULTIPLE RADIO TRANSMIT (TCTO 598).

Aircraft modified by TCTO 598 are equipped with the capability to simultaneously transmit and receive on UHF 1, VHF 1, and HF 1. The control is located on the pilot's side console (figure 1-215). Simultaneous transmission is accomplished by selecting "U_1" on the pilot's interphone control and placing the two-position ON-OFF switch to "ON" on the MULT RAD XMIT control. To receive simultaneously, the V_1 and H_1 monitor buttons must be pulled up. An indicator light on the MULT RAD XMIT control indicates that the ON-OFF switch is placed in the "ON" position. Each interphone station equipped with radio transmit capability will have the capability to transmit simultaneously when the pilot has selected "U_1" and MULT RAD XMIT ON-OFF switch is placed to "ON".

CADC DATA INPUT IFF AND YAW DAMPER POWER PANEL.

A CADC DATA INPUT IFF and YAW DAMPER Power panel supplies pressure altitude inputs to the transponder for the altitude reporting feature of the system. A two-position ("No. 1", "No. 2") selector switch on the panel controls the source of the altitude inputs to the system.

AN/APN-244, INTERROGATOR TRANSPONDER SET

The Interrogator Transponder Set consists of a SCADC data input select switch, Mode S/IFF Control Panel, RT-1717/APX-100, Mode S/IFF Transponder with embedded crypto computer, and two antennas (upper and lower). Both the switch and the control panel are located in the center of the Control Pedestal (see figure 1-216); the transponder is located in the left hand center underdeck rack (see figure 1-216); and see figure 1-208 for the antenna locations.

The IFF Mode S Set is powered by 28 VDC supplied by the main avionics DC bus via a circuit breaker labeled IFF (26-B). A 5-amp fuse on the transponder provides overcurrent protection.

The purpose of the Mode S IFF set is to provide information based on the type (mode) of interrogation received. The transponder provides cooperative Identification Friend or Foe (IFF) capability, as well as Mode Select (Mode S) capability. In addition, Mode S operation provides interface capability with the aircraft's Traffic Alert and Collision Avoidance System (TCAS). The transponder receives interrogation signals in any of seven modes (1, 2, 3/A, C, 4, S, and Test), decodes the signals, and transmits a pulse-coded reply.

Mode S IFF operation includes Selective Identification Feature (SIF) Modes 1, 2, 3/A, C, and Test, as well as secure Mode 4. The IFF will reply to any interrogation modes depending on how the master selector switch and mode switches are set. IFF capability also includes compatibility with the Air Traffic Control Radar Beacon System (ATCRBS) in SIF Modes 1, 2, 3/A, and C. Mode 3/ A provides aircraft identification to the Air Traffic Control Radar System. Mode C is used to provide altitude data from either of the aircraft's SCADC as determined by the positioning of the CADC DATA INPUT IFF switch. Mode 4 provides a secure (encrypted IFF) capability. The special Mode 4 computer processes Mode 4 interrogations and causes the transponder to generate appropriately coded reply signals.

TCAS monitors other transponder-equipped aircraft within the TCAS range and continually adjusts the power output of the interrogations in order to minimize the combined effects of simultaneous operation of numerous transponder-equipped aircraft. This results in the maximum detection range varying from the minimum required to provide collision avoidance up to 40 nm in the forward quadrant. TCAS is capable of tracking up to a combined total of 45 transponder-equipped aircraft. TCAS can send up to 30 transponder-equipped aircraft to the display.

Once a Mode S or Mode C intruder is confirmed, TCAS places the intruder in track. TCAS will also track non-altitude reporting (NAR) aircraft, but will only issue a traffic alert (TA) based on distance and closure rate. TCAS will not issue a resolution advisory (RA) for NAR aircraft.

TCAS

Mode S operations are defined by the International Civil Aviation Organization (ICAO). The Mode S system typically constitutes a ground-to-air system for Air Traffic Control (ATC) surveillance. A TCAS system is an air-to-air, air-to-ground system that employs an airborne TCAS processor (interrogator) and airborne TCAS-capable transponder.

The IFF control panel also performs Mode Select (S) transponder functions and controls the TCAS. When Mode S is enabled, the IFF performs Mode S anytime M3/A is selected and the MASTER switch is set to TA or TA/RA functions, even if TCAS is inoperative.

Operation and control of the system is accomplished with the transponder control panel, which contains the controls and indicators listed below.

MASTER SWITCH.

A rotary-type MASTER switch allows the operator to select the following operating conditions: OFF, STBY (standby), NORM (normal sensitivity), TA (Traffic Advisory), TA/RA (Traffic Advisory/Resolution Advisories), and EMER (emergency). When the switch is set to OFF, all power

MODE S/IFF Control Panel

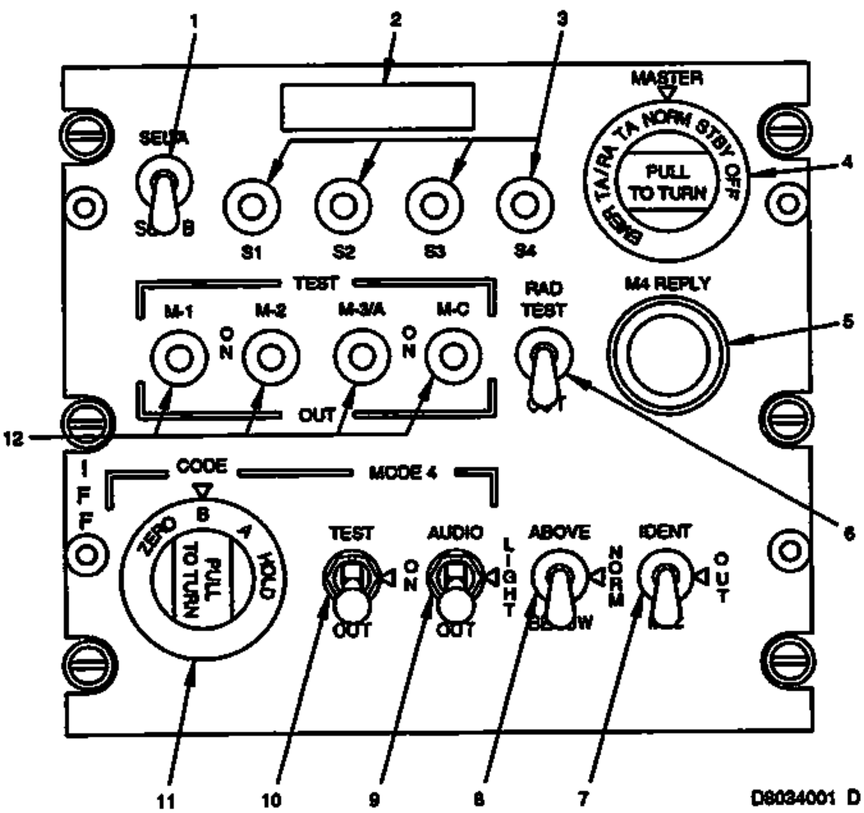


Figure 1-1.

Index No.	Description
1.	SEL A/SEL B – Spring-loaded three-position switch SEL A — Enables selection of Mission Menu functions. Enables M, M1, and M3/A code data,and ATC and TCAS broadcast modes to be displayed and changed. Momentary (up) position. Normal — Enables normal operation of display. SEL B — Enables selection of Maintenance functions. Enables display intensity, M2 mode code data, Mode S data, and maintenance functions to be displayed and changed. Momentary (down) position.
2.	Eight Character Display With power applied, provides visual indication of loaded codes and equipment status.
3.	S1, S2, S3, S4 – Spring-loaded three-position switches Up — Increments information on eight character display. When held in up position, continuously increments displayed information. Momentary switch position. Middle — Disables update of displayed information. Normal switch position. Down — Decrements information on eight character display. When held in down position, continuously decrements displayed information. Momentary switch position.
4.	MASTER – Six-position, pull to turn, rotary switch OFF — Removes power from control panel and transponder. STBY — Applies power to control panel and transponder, but disables transponder from transmitting. Control panel is operational and monitors the operator's selections. Puts TCAS in Standby. NORM — Enables transponder to reply to all enabled modes (M-1, M-2, M-3/A, TEST, M-C, M-4 or M-S). Puts TCAS in Standby. Mode S defaults to enable during powerup if airplane is on the ground (Air/Ground). TA — Enables transponder to reply to all enabled modes (M-1, M-2, M-3/A, TEST, M-C, M-4 or M-S). Provides Traffic Advisory warnings. TA/RA — Enables transponder to reply to all enabled modes (M-1, M-2, M-3/A, TEST, M-C, M-4 or M-S). Provides Traffic Advisory and Resolution Advisory warnings. EMER — Enables transponder to generate an emergency code in all SIF Modes and Mode S. In addition, the TCAS processor will be enabled to operate in TA mode (if operational).
5.	MODE 4 REPLY – Indicator Provides visual indication of Mode 4 reply being transmitted. Disabled when MODE 4 AUDIO/LIGHT /OUT switch is set to OUT.

Index No.	Description	
6.	RAD TEST – Spring-loaded two-position switch	
	RAD TEST	Not used on this installation.
	OUT	Enables normal transponder operation. Normal switch position.
7.	IDENT/OUT/MIC – Three-position switch	
	IDENT	Manually initiates Special Position Identification (SPI) pulse for 15 to 30 seconds. Momentary switch position.
	OUT	Disables generation of SPI pulse. Normal switch position.
	MIC	Each time microphone is keyed, initiates SPI pulse for 15 to 30 seconds.
8.	ABOVE/NORM/BELOW (Altitude Select) Switch – Three-position switch	
	ABOVE	Enables TCAS to monitor and display aircraft up to 8,700 feet above and 2700 feet below the TCAS processor.
	NORM	Enables TCAS to monitor and display aircraft up to 2,700 feet above and below TCAS processor.
	BELOW	Enables TCAS to monitor and display aircraft up to 8,700 feet below and 2700 feet above the TCAS processor.
9.	MODE 4 AUDIO/OUT/LIGHT Switch – Three-position switch	
	AUDIO	Enables Mode 4 reply and caution lights and Mode 4 audio tone.
	LIGHT	Enables Mode 4 reply and caution lights and disables Mode 4 audio tone.
	OUT	Disables Mode 4 reply and caution lights and Mode 4 audio tone. If the Mode 4 computer is not installed, the switch should be left in OUT position.
10.	MODE 4 TEST/ON/OUT – Three-position switches	
	TEST	Enables transponder to perform Mode 4 self test. Momentary switch position.
	ON	Enables Mode 4 computer to reply to compatible Mode 4 interrogations. Normal switch position.
	OUT	Disables cryptographic operations.
11.	MODE 4 CODE ZERO/B/A/HOLD PULL TO ZERO – Four-position rotary switch	
	ZERO	Clears Mode 4 code held in Mode 4 computer. Pull to rotate to position.
	B	Selects next code period.
	A	Selects current code period.
	HOLD	Activates the Mode 4 code hold logic in Mode 4 computer, which prevents the loss of Mode 4 key if power is removed. If HOLD is activated, Mode 4 key may only be ZEROIZED by manually selecting ZEROIZE on the transponder. Momentary switch position.

Index No.	Description	
12.	M-1, M-2, M-3/A, M-C TEST/O· OUT – Three-position switches	
	TEST	Enables transponde·· to perform self test in selected mode. During TEST, selected mode is radiated. If self-test is initiated with the MASTER switch in STBY, FAIL message will be displayed. Momentary switch position.
	ON	Enables respective mode. Normal switch position.
	OUT	Disables respectiv· mode. Transponder will not reply to interrogations in the disabled mode.
		NOTE When M-3/A switch is set to OUT, Mode C and Mode S are disabled and self test (BIT) for Mode C is disabled. If Mode S is enabled and M-3A switch is set to TEST, Mode 3/A and Mode S are tested. If Mode S is disabled and M-3/A switch is set to TEST, display will indicate MODE S DISABLE.

the system. In STBY, operating power is applied, and after a power up BIT is complete, the system is ready for operation when the MASTER switch is set to NORM. However, when in STBY, the absence of replies when interrogated in Mode 4 causes the IFF MODE 4 caution light to illuminate. When the MASTER switch is set to EMER, the system transmits an emergency reply when interrogated, and places TCAS in TA mode. To prevent accidentally switching to either EMER or OFF, the MASTER switch knob must be pulled out before the MASTER switch can be turned to either of these positions. The TCAS system self-test is initiated anytime Mode S is enabled and the M-3/A test is initiated. The test will last approximately 13 seconds and will be performed on the Mode S transponder and the TCAS processor. During the test, a traffic test pattern will appear on the MFD. Aural annunciation on the intercom will be either "TCAS SYSTEM TEST OK" or "TCAS SYSTEM TEST FAIL".

NOTE

The MASTER switch must be in the NORM position for self-test with the mode/enabling switches.

IDENTIFICATION-OUT-MICROPHONE SWITCH.

A three-position (IDENT, OUT, MIC) toggle switch controls the identification function. When the switch is set to IDENT and the Mode 1 or Mode 3 has a code set in, the system generates coded replies for Modes 1 through 3. Modes C and 4 are not affected. The identification pulse trains are transmitted from 15 to 30 seconds, plus the time the switch is held to IDENT. The switch is spring-returned to the OUT position. The OUT position disables the identification function. When the MIC position is selected, control of the identification function is transferred to the pilot's, copilot's, navigator's, or instructor's station microphone switch when the UHF 1 or UHF 2 communication radio is selected on the transmit rotary switch.

LED DISPLAY.

The LED display is an NVIS-compatible eight-character alphanumeric display. The SEL A/SEL B switch and four increment/decrement switches located below the LED display are used for data entry and change.

SELECT A/SELECT B SWITCH.

The SEL A/SEL B switch is used to select the data to be displayed or changed. Toggling the SEL A/SEL B to the SEL A position displays either Mode 1 (M1) or Mode 3/A (M3) code. Toggle to the opposite position to exit current mode. To enter or modify Mode 1 (M1) or Mode 3/A (M3) codes, toggle the SEL A/SEL B switch to SEL A position until the desired mode is displayed. Toggle the corresponding increment/decrement switches to change the displayed code.

WARNING

On airplanes not modified by TCTO 853, when FM Mode has been ENABLED and MEMBER Mode has been selected, these entries will remain set in the control panel even after the system is turned off. This will result in the transponders remaining in the Formation Mode of operation, which does not respond to ground ATCRBS interrogations for Mode 3/A, Mode C, Mode S All Call, and Mode S UF-11 during the next system power up. The FM Mode should remain disabled on C-141 aircraft.

NOTE

- On airplanes not modified by TCTO 853, the Formation (FM) Mode is normally disabled on C-141 aircraft. However, the control panel permits the operator to activate the Formation is removed from Mode either as a LEADER or as a MEMBER. When MEMBER is selected, the transponder does not reply to Mode 3/A, Mode C, Mode S All Call, and Mode S UF-11 ground interrogations; however, aircraft to aircraft TCAS retains full capability. To deselect the formation mode, toggle SEL A to FM-MODE. Toggle S1, S2, S3, or S4 to enable FM. With ENABLE displayed, toggle SEL A switch to momentarily display FM-STAT and then MEMBER or LEADER. Toggle S1, S2, S3, or S4 to select LEADER. Toggle SEL A to return to FM-MODE and toggle S1, S2, S3, or S4 to DISABLE. Toggle SEL B to exit the Formation Mode setup.

- On airplanes modified by TCTO 853, E-TCAS and FM displays are deactivated.

Toggling the SEL A/SEL B switch to the SEL B position with the MASTER switch in STBY allows the display to show the following: range (RNG) (non-functional), display brightness (DISP), Mode 2 (M2) code, Mode S enable/disable, Mode S address (MS ADDR), Mode S flight identification (FLT ID)(not used), RT configuration (RT-1717), and control panel self-test (CP TEST).

The display brightness control has seven settings: DISP 100, DISP 80, DISP 53, DISP 27, DISP 13, DISP 0.1, and DISP 0.05. Settings DISP 0.1 and DISP 0.05 are NVIS settings. To select the brightness setting, toggle the SEL A/SEL B switch to SEL B position until the current display brightness setting is displayed. Any increment/decrement switch can be used to scroll through available settings.

To enter Mode 2 code data, toggle the SEL A/SEL B switch to SEL B position until M2 is displayed. Toggle the corresponding increment/decrement switches to change the code. The Mode S address is a unique identification assigned to the airplane and must be verified by the flight crew during preflight checkout. A label below the MFD contains the airplane's Mode S address. To verify or change the Mode S address, toggle the SEL A/SEL B switch to SEL B until MS ADDR is displayed. After 2 seconds, MS ADDR disappears and the current Mode S address is displayed. A flashing digit indicates which digit is selected for change. A digit can be selected for change by using the leftmost or rightmost increment/decrement switch. After the digit is selected, use the middle increment/decrement switches to enter or change the Mode S address code. Changes to the Mode S address are only temporary; the unit defaults to the airplane assigned address when power is removed.

RT configuration selection is a maintenance data requirement that tells the control panel which RT configuration is installed in the airplane. To select RT configuration, toggle the SEL A/SEL B switch to SEL B position until RT-1717 is selected. Control panel self-test selection is a maintenance function that provides a troubleshooting tool. To select control panel self-test, toggle the SEL A/SEL B switch to SEL B position until CP TEST is displayed. Toggling any increment/decrement switch will start the test. Toggling SEL A/SEL B switch will end the test.

INCREMENT/DECREMENT SWITCHES.

After desired data is selected on the LED display by using the SEL A/SEL B switch, the increment/decrement switches located below the LED display window are used to enter/change data.

MODE 1 ENABLE AND TEST SWITCH.

A three-position toggle-type switch allows the operator to enable, test, and disable Mode 1. When held in the TEST position, the transponder test set is energized and generates a Mode 1 interrogation. The display will indicate results of the test with MX PASS or MX FAIL. (X = selected mode.) The ON position enables the Mode 1 function and the OUT position disables the Mode 1 function. The switch is spring-returned from the TEST position to the ON position.

MODE 2 ENABLE AND TEST SWITCH.

This switch is the same as the Mode 1 switch and performs functionally for Mode 2 in the same manner as Mode 1.

MODE 3/A ENABLE AND TEST SWITCH.

This switch is the same as the Mode 1 switch and performs functionally for Mode 3/A in the same manner as Mode 1. If Mode S is enabled, Mode S test will be initiated after Mode 3/A. The Mode S test will then initiate TCAS self-test. If Mode S is disabled, the display will indicate MS DISAB after M3 PASS is displayed. M-3/A ON activates Mode 3/A and Mode S.

NOTE

Mode S will also operate with M-3/A off when the MASTER switch is set to TA or TA/RA.

MODE C ALTITUDE REPORTING ENABLE AND TEST SWITCH.

NOTE

Mode 3/A must be enabled for a valid Mode C test.

This switch is the same as the Mode 1 switch and performs functionally for Mode C in the same manner as Mode 1. Mode C must be enabled for proper operation of TCAS.

RADIATION ENABLE SWITCH (not used in the C-141 installation).

A two-position (RAD TEST, OUT) toggle-type switch is provided for control of the monitor and radiation test functions of the system. The monitor circuits of the transponder test set are enabled for inflight monitoring of the transponder's replies to interrogations on any mode other than Mode 4. Maintenance personnel use the RAD TEST position when performing checkout of the system using an IFF test set. The switch is spring-returned from the RAD TEST position to the OUT position.

MODE 4 ENABLE SWITCH.

NOTE

If the mode 4 crypto computer module in the RT unit is not installed, placing the Mode 4 enable switch to ON or initiating BIT will result in a KIT FAIL being displayed.

A lever lock-type switch is provided for control of the Mode 4 operation. When placed to ON, Mode 4 is enabled to allow a reply to Mode 4 interrogations. When the switch is moved to the OUT position, a reply to Mode 4 interrogations is prevented. The TEST position allows a built-in-test (BIT) to test the receiver-transmitter in Mode 4. Place the switch to the OUT position when not using MODE 4.

MODE 4 INDICATION SWITCH.

A three-position (AUDIO, OUT, LIGHT) lever lock-type switch is provided for control of the Mode 4 indication. The AUDIO position enables both the visual and audio reply indication. The OUT position disables the Mode 4 indication function of the system. When the switch is placed to LIGHT, only the visual indication is enabled.

The Mode 4 Audio function (when activated by the control panel switch) provides an audible tone to pilot's and copilot's ICS to indicate that the IFF has received an incompatible Mode 4 interrogation. The term "incompatible" means the Mode 4 interrogations received contain a "Key" (or code) that is different than the "Key" loaded in the Mode 4 computer for the Code (A or B) that is selected by the pilot. Therefore, if the tone occurs, it means one of three things:

a. The operator has the wrong code of the day (A or B) selected.

b. The Mode 4 codes loaded in the Mode 4 computer are incorrect.

c. The interrogation source is not using correct Mode 4 codes.

MODE 4 CODE SWITCH.

A four-position (HOLD, A, B, ZERO) rotary type switch is provided for control of Mode 4 operation. HOLD position provides for retaining Mode 4 codes on the ground when removing power from the system. When the Mode 4 code switch is momentarily placed to the HOLD position at least 15 seconds prior to turning system power off, the codes are electronically latched and will be retained when power is removed from the set provided the airplane's landing gear is down and locked. The switch is spring-loaded to return to A from the HOLD position. The A position selects A codes. The B position selects B codes. The ZERO position zeroizes the code settings. The switch is designed so that it must be pulled out before it can be turned to ZERO, thereby preventing inadvertent selection of this position.

MODE 4 REPLY INDICATOR LIGHT.

A green indicator light is provided for indication of Mode 4 replies that occur when the Mode 4 indication switch is in either the AUDIO or LIGHT position.

NOTE

Information within parentheses ( ) is data that is set by the operator or provided by the platform. When STBY is selected, the message STBY is displayed every 15 seconds. Switches are disabled when STBY is displayed. Sequence of display is the same with Mode S disabled or enabled.

ABOVE, NORM, BELOW SWITCH

This three-position switch provides 2 functions. In the first function, during normal operation, the ABOVE position allows the TCAS to display targets within range up to 8700 feet above and 2700 feet below. The NORM position allows display of targets ± 2700 feet. BELOW allows display of targets 8700 feet below and 2700 feet above. The second function provides the ability to select the top or bottom IFF antenna during maintenance antenna test. Selection of this maintenance function disables MODE S and TCAS.

Data Entry and Display.

Data entry is accomplished through setting SEL A/SEL B switch to SEL A or SEL B and setting switches S1, S2, S3, or S4 in the up or down position. With the exception of display intensity function (DISP), all variables used to set up the functions identified use a wraparound feature (i.e., increment from 0 to 7, next increment starts at 0.) Once the desired value is displayed, toggle the SEL A/SEL B switch. The eight-character display provides a readout of the data.

As the data is entered, it is stored in NVRAM. When power is removed from the control panel, the data in NVRAM is saved. Data is restored when power returns. Exception: if Mode S is disabled when power is removed from the control panel, it will be enabled when power is restored if the AIR GROUND signal line indicates the aircraft is on the ground.

A description of each display message that may be seen on the control panel display is provided below.

DISPLAY	FUNCTION	UPDATE DESCRIPTION
FUNCTIONS SELECTABLE WITH SEL A/SEL B SWITCH SET TO SEL A (Airplanes not modified by TCTO 853)		
*M3 (0123)	Enter or display Mode 3/A code.	Selectable Mode 3/A codes are 0000 to 7777. Switches S1 through S4 are used to change codes from 0 to 7. Switch S1 changes the leftmost digit (0123), S4 changes the rightmost digit (0123). An asterisk (*) is displayed when Formation Mode (E-TCAS) is enabled. During normal operation, the asterisk should be OFF; refer to SELECT A/ SELECT B SWITCH in this section.
ETCAS	Select E-TCAS operation	On C-141 aircraft the E-TCAS is not used and should display ETCAS OF. Momentarily pressing S1, S2, S3 or S4 (up or down) causes the display to toggle between ETCAS ON and ETCAS OF.
*M1 (7300)	Enter or display Mode 1 code	Selectable Mode 1 codes are 00 to 73; rightmost two digits are always zero (0). Switch S1 changes the leftmost digit from 0 to 7 and switch S2 changes the middle-left digit from 0 to 3. An asterisk (*) is displayed when Formation Mode (E-TCAS) is enabled. During normal operation, the asterisk should be OFF; refer to SELECT A/SELECT B SWITCH in this section.

DISPLAY	FUNCTION	UPDATE DESCRIPTION
FUNCTIONS SELECTABLE WITH SEL A/SEL B SWITCH SET TO SEL A (Airplanes modified by TCTO 853)		
*M3 (0123)	Enter or display Mode 3/A code.	Selectable Mode 3/A codes are 0000 to 7777. Switches S1 through S4 are used to change codes from 0 to 7. Switch S1 changes the leftmost digit (0123), S4 changes the rightmost digit (0123). An asterisk (*) is displayed when Formation Mode (E-TCAS) is enabled. During normal operation, the asterisk should be OFF; refer to SELECT A/ SELECT B SWITCH in this section.
*M1 (7300)	Enter or display Mode 1 code	Selectable Mode 1 codes are 00 to 73; rightmost two digits are always zero (0). Switch S1 changes the leftmost digit from 0 to 7 and switch S2 changes the middle-left digit from 0 to 3. An asterisk (*) is displayed when Formation Mode (E-TCAS) is enabled. During normal operation, the asterisk should be OFF; refer to SELECT A/SELECT B SWITCH in this section.
ATC ON/OFF	Activate or disable ATC mode operation aircraft	ATC mode is normally turned off when an is assigned as a formation member. Momentarily pressing S1, S2, S3 or S4 (up or down) causes the display to toggle between ATC ON and ATC OF. In a formation, ATC ON is generally used by the Formation Leader. ATC ON indicates that TA/RA is active. Once the formation mission is completed, the ATC ON mode should be enabled again. ATC ON retains the standard Mode S/TCAS II operation. ATC OF is selected by all Formation Members (except the lead aircraft) during a formation mission. When ATC OF is selected, the transponder does not reply to Modes 3/A, Mode C, Mode S All Call, and Mode S UF-11 interrogations. Mode 3/A codes needed to identify a Formation Member are provided via Mode S UF/DF-5 message. An asterisk (*) appears in the leftmost character position when ATC is off, Broadcast is off, Mode S is disabled, or Antenna Test is enabled.

DISPLAY	FUNCTION	UPDATE DESCRIPTION
BCST	Broadcast mode	An independent function used in conjunction with formation missions. Momentarily pressing S1, S2, S3 or S4 (up or down) causes the display to toggle between BCST ON and BCST OF. BCST OF inhibits the TCAS broadcast interrogation transmissions. BCST ON enables the TCAS broadcast interrogation transmissions. An asterisk (*) appears in the left-most character when ATC is off, Broadcast is off, Mode S is disabled, or Antenna Test is enabled,
FUNCTIONS SELECTABLE WITH SEL A/SEL B SWITCH SET TO SEL A (Airplanes not modified by TCTO 853)		
RNG (40)	Mode S range	Not used on aircraft modified by TCTO 588. RNG display deactivated by TCTO 853.
DISP (100)	Display intensity	Display intensity can be changed from 100 (full brightness) to 0.05 (NVIS) percent. Any switch, S1 through S4, can be used to scroll through values. The values for display intensity are 100, 80, 53, 27, 13, 0.1 and 0.05. Display intensities 0.1 and 0.05 are for NVIS settings. Display will not increment past 100 nor decrement past 0.05.
M2 (0123)	Enter or display Mode 2 code	Selectable Mode 2 codes are 0000 to 7777. Switches S1 through S4 are used to change codes from 0 to 7. Switch S1 changes the leftmost digit (0123), S4 changes the rightmost digit (0123).
MODE S (ENABLE or DISABLE)	Mode S activation	Enables or disables Mode S/TCAS operations. When DISABLE is displayed, press S1, S2, S3, or S4 switch, and display will change to ENABLE.

DISPLAY	FUNCTION	UPDATE DESCRIPTION
FUNCTIONS SELECTABLE WITH SEL B (MAINT) **WARNING** Aircrew selection of SEL B maintenance-only functions may result in degraded TCAS capability.		
MS ADDR (01234567)	Mode S address	Mode S addresses are 00000001 to 77777777. When displayed, MS ADDR momentarily appears, then current Mode S address appears. Toggle S1 switch to move a cursor to the left and toggle S4 switch to move cursor to the right. Switch S2 or S3 can be used to change the selected digit from 0 to 7. A mode S address of all zeros (0) or all ones (1) shall not be accepted.
MS FLTID (ABCDEFGH)	Mode S flight identification (not currently being used)	Selectable Mode S flight identifications are 00000000 to ZZZZZZZZ. When displayed, MS FLTID momentarily appears, then current Mode S flight identification appears. Toggle S1 switch to move a cursor to the left and toggle S4 switch to move cursor to the right. Switch S2 or S3 can be used to change the selected digit from 0 to 9, "blank space", and A to Z.
RT TYPE (RT-1717)	Transponder type	When displayed, RT TYPE momentarily appears, then currently selected transponder type appears. Any switch, S1 through S4, can be used to toggle between RT-1717 and RT-1157. If the control panel is connected to an RT-1717 and RT-1157 is selected, display will indicate a SERIAL FAIL or RT FAIL during initial power up.
ANT TEST	Enable selection of IFF TOP of BOTTOM antennas	Mode S and TCAS are disabled.
CP TEST	Control panel self-test	When displayed, CP TEST momentarily appears, then currently selected ENABLE or DISABLE appears. S1, S2, S3, or S4 switch can be used to change to ENABLE or DISABLE. Self-test terminates by pressing SEL A/SEL B switch.

Transponder Controls and Indicators

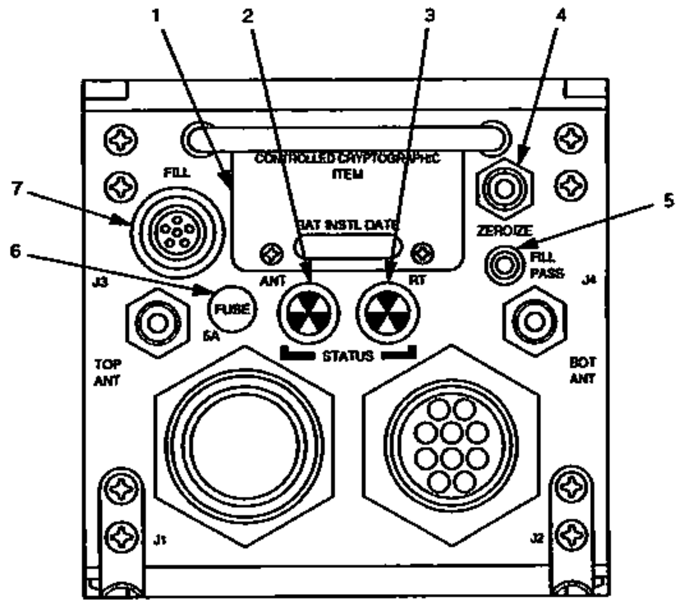


Figure 1-1A.

ITEM	DESCRIPTION
1.	Battery Cover - Secures two BAA5567/U batteries to hold the Mode 4 key in memory when primary aircraft power is lost. The battery cover should display CONTROLLED CRYPTOGRAPHIC ITEM.
2.	Antenna Status Indicator - A latching fault indicator. When no fault has been detected in the antenna path, latch displays all black. When a fault has been detected in the antenna path, latch displays white and black. Rotate the latch a ¼ turn clockwise to reset.
3.	RT Status Indicator - A latching fault indicator. When no fault has been detected in the transponder, latch displays all black. When a fault has been detected in the antenna path, latch displays white and black. Rotate the latch a ¼ turn clockwise to reset.
4.	Zeroize Pushbutton Switch - When pressed, zeroizes Mode 4 keys.
5.	Fill Pass Indicator. Momentarily lights when Mode 4 keys are loaded properly.
6.	Fuse 5A - Provides overcurrent protection for the 28 VDC supply.
7.	Connector - Provides interface with fill device for loading Mode 4 code into the integrated Mode 4 computer.

Mode 4 Fill Connection.

The front panel of the transponder contains a Mode 4FILL connector that is used to load codes into the integrated Mode 4 Computer. Using either a KOI-18 or ::YK-13 Mode 4 code loader and cable, data is transferred to the transponder.

OPERATING PROCEDURE.

Completion of the starting procedure leaves the transponder in operating condition. The following additional steps may be required, depending upon mission instructions:

1. If Mode 4 code needs to be updated, change MODE 4 CODE rotary switch from A to B.

NOTE

Step 2. is true only if aircraft landing gear has cycled (up and down).

2. If code retention in the Mode 4 computer is desired during on-ground operations, set MODE 4 CODE switch to HOLD and then release it. Wait 15 seconds before turning MASTER rotary switch to OFF. Go to step 4.

3. If code retention is not desired, set MODE 4 CODE rotary switch to ZERO to zeroize Mode 4 computer code setting.

4. Set any of the M-1, M-2, M-3/A, M-C, or MODE 4 switches to OUT in order to inhibit transmission of replies in the undesired modes.

Placing the IFF in Operation.

1. Set the MASTER switch to STBY.
2. Set the MASTER switch to NORM (TA or TA/RA if TCAS is required).
3. Set the ABOVE - BELOW switch to NORM.
4. Set in the required operational code for Mode 1 and Mode 3/A.
5. Set in the required operational code for Mode 2.
6. Verify Mode S address.
7. Ensure correct code has been inserted for Mode 4.
8. Set the M-1, M-2, M-3/A, M-C, and Mode 4 switches to ON as required by the operational codes being used.
9. Set IDENT/OUT/MIC switch to OUT.

Checking System Proper Operation:

1. Set the M-1 switch momentarily to TEST. M1 PASS is displayed.
2. Repeat step 1. for the M-2 and M-3/A switches and M-C.

NOTE

Placing Mode 3/A switch in the TEST position initiates Mode 3, Mode S, and TCAS bit. Mode 3/A switch must be in the ON position to initiate Mode C test.

3. Set the Mode 4 code switch to A. If the computer is used, set a code in it.
4. Set the Mode 4 enable switch momentarily to TEST. M4 PASS is displayed and IFF Mode 4 caution indicator does not illuminate.

NOTE

If Mode 4 codes are not loaded, placing switch M4 to TEST will cause KIT FAIL message to be displayed.

5. Set Mode 4 indication switch to LIGHT if code is loaded or to OUT if code is not loaded.
6. Set the Mode 4 enable switch to ON if code is loaded or to OUT if code is not loaded.

Turning the IFF System Off:

If Mode 4 codes are to be retained after landing, momentarily place the CODE switch to HOLD prior to turning OFF the IFF.

1. Pull up on the MASTER switch and rotate to the OFF position.

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

TCAS is a traffic surveillance and collision avoidance system. The surveillance system is monitoring the airspace around your aircraft out to approximately 15 - 40 nm in the forward quadrant, 5 - 15 nm in the aft quadrant and 10 - 20 nm on both sides. TCAS monitors transponder-equipped aircraft in the above listed ranges within +/- 10000 feet of own aircraft. The Above/Below switch settings act only as display filters. The collision avoidance system will issue a vertical maneuver command to avoid conflict with the offending aircraft.

The TCAS system consists of a TCAS processor, two antennas, two RA annunciators, and interfaces to the MFD and interphone. The TCAS processor is located in the left hand underdeck rack and an RA annunciator is located on each TCAP installed on the upper portion of the pilot's and copilot's instrument panels. For antenna location, refer to figure 1-208.

115 VAC power to operate the TCAS processor is supplied from Avionics AC Bus 1 through a circuit breaker

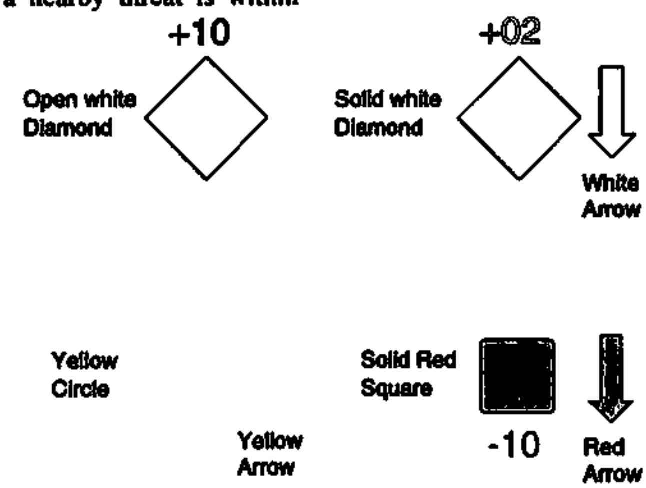
on the Avionics Circuit Breaker Panel labeled TCAS.

TCAS Display Symbols

TCAS will display different traffic symbols on the MFD. The type of symbol selected by TCAS is based on the intruder's location (Distance and Altitude) and closing rate. The symbols change shape and color to represent increasing levels of urgency. An open diamond is a surveillance target beyond proximity advisory range. A filled diamond represents an intruder that is ± 850 - 1,200 ft. of own altitude and within 6 nm range (Proximity Advisory). A yellow circle (TA) indicates the intruder is within 20 - 48 seconds of closest point of approach (CPA). A red square (RA) indicates a nearby threat is within approximately 15 - 35 seconds of CPA.

Traffic symbols may also have an associated altitude tag. Altitude tag shows the relative altitude in hundreds of feet.

A + sign and number above the Traffic Symbol means the intruder is above your altitude. A - sign and number beneath the traffic symbol means the intruder is below your altitude. A trend arrow appears when the intruder's vertical rate of climb or descent is 500 fpm or greater. The trend arrow is the same color as the target. If the intruder is non-altitude reporting (NAR), the traffic sym-



F1019201

Symbols	Warning	Type of Traffic	Significance
Open White Diamond	NONE	Non-Threat (Surveillance Target)	Traffic more than1200 feet above or below own altitude or beyond 6 nm.
Solid White Diamond	NONE	Proximity Intruder	Traffic within ±1200 feet and within 6 nm. Not immediate threat, possible threat.
Yellow Circle	"Traffic, Traffic"	Traffic Advisory (TA)	Time to closest point of approach (CPA) is between 20 and 48 sec. and within ±1200 feet of your altitude if above 42,000 feet or within ±850 feet of your altitude if above 20,000 feet. Pilot is given auditory warning.
Solid Red Square	EXAMPLE "Climb, Climb"	Resolution Advisory (RA)	Time to CPA is between 15 and 35 seconds and within ±800 feet of your altitude if above 42,000 feet or within ±700 feet of your altitude if above 20,000 feet. Pilots are given visual and aural flight path commands to ensure avoidance.
Red Arrow			Arrow shows intruder rate of climb or descent exceeds 500 fpm.

TCAS RESOLUTION ADVISORIES

ADVISORY	VOICE COMMAND	ACTION REQUIRED
	Version 7	
TRAFFIC ADVISORY	"Traffic, Traffic"	Monitor the MFD and look for intruder.
ANY WEAKENING OR SOFTENING OF A RA	"Adjust Vertical Speed"	
PREVENTATIVE ADVISORY	"Monitor Vertical Speed" (2)*	Maintain existing vertical speed.
MAINTAIN EXISTING VERTICAL SPEED	Maintain Vertical Speed, Maintain	Maintain existing vertical speed.
MAINTAIN EXISTING VERTICAL SPEED WHILE CROSSING THREAT'S ALTITUDE	Maintain Vertical Speed, Crossing Maintain	Maintain existing vertical speed.
CLIMB	"Climb, Climb"	+1500 FPM climb.
DESCENT	"Descend, Descend"	-1500 FPM descent.
INCREASE CLIMB RATE	"Increase Climb, Increase Climb"	+2500 FPM climb.
INCREASE DESCENT RATE	"Increase Descent, Increase Descent"	-2500 FPM descent.
CHANGE FROM DESCENT TO CLIMB	"Climb, Climb NOW" (2)	Initiate change to climb.
CLIMB TO DESCENT	"Descend, Descend NOW" (2)	Initiate change to descent.
CROSS OVER CLIMB	"Climb Crossing Climb" (2)	+1500 FPM climb through the intruder's altitude.
CROSS OVER DESCENT	"Descend Crossing Descend" (2)	-1500 FPM descent through the intruder's altitude.
VERTICAL SPEED RESTRICTED (CLIMB OR DESCENT)	"Adjust Vertical Speed, Adjust"	Reduce climb or descent to rate indicated.
RA CLEARED	"Clear of Conflict"	Resume normal flight.

* Spoken only once if it follows a previous advisory.
(#) Number in parentheses indicates the number of times the Advisory is repeated.

Traffic Advisory

TCAS calculates the potential threat of nearby aircraft and issues specific aural warnings to the aircrew, such as "TRAFFIC, TRAFFIC". These are traffic advisories (TAs) and are the initial alert provided by TCAS:

1. When the intruder aircraft is 20 - 48 seconds away and could pose a potential threat.

2. Purpose is to attract attention to the traffic display on the MFD. TAs give the pilot time to prepare for a potential evasive maneuver. Pilot should not maneuver the aircraft based on a Traffic Advisory.

Resolution Advisory

When TCAS predicts an increased collision threat, a Resolution Advisory (RA) is issued. RAs are issued by TCAS when the intruder aircraft is 15 - 35 seconds from the CPA. TCAS issues the RA based on the CPA prediction and not on absolute distance unless the aircraft is extremely close. When a TCAS RA is issued, the aircrew must respond by following the vertical maneuvering command displayed on the MFD RA vertical scale. This vertical maneuver must be initiated within 5 seconds with 0.25g. If an RA reversal is issued, the aircrew must respond within 2.5 seconds using 0.35g.

WARNING

An RA can command an initial maneuver of .25 Gs maximum and a reversal maneuver of .35Gs maximum. Performing either maneuver with unrestrained personnel or cargo may result in injury to personnel and damage to cargo or aircraft.

When TCAS issues an RA, a TCAS RA pop-up screen is displayed on the MFD. The display defaults to the 360-degree format with a 10 nm range. When the TCAS RA pop-up becomes active, all other overlays are removed (WXR, TAWS, NAV) unless the TCAS overlay was already active in the 360-degree format prior to the issuance of the RA. When the RA is issued, an RA/Vertical Speed Command Indicator Tape will be displayed on the right side of the MFD. The RA/VSI tape provides a vertical speed display range of +/- 6,000 fpm. The RA/VSI tape provides a Vertical Speed Pointer that provides current vertical speed as well as a red "no fly" zone and a green "fly to" zone. TCAS will typically command a 300 - 500 ft vertical avoidance maneuver.

Warnings, Notes, and Limitations

WARNING

- It is imperative to follow resolution advisories (RAs) to obtain the airplane separation computed by TCAS. Always attempt to visually clear the airspace before maneuvering your airplane in response to a TCAS RA.
- The TCAS installation is wired to give TAWS higher priority than TCAS. In case of simultaneous audio alarms, the TCAS alarm is inhibited during the TAWS alert.

NOTE

- Proper operation of the TCAS requires valid input signals for pitch, roll, and heading.
- The intruding airplane must be equipped with a properly operating transponder. TCAS is unable to detect an airplane without an operating transponder, military IFF systems operating in mode 4 only, Terra TRT 250 transponders not modified to clear their Airworthiness Directive, and CIS (Eastern block countries) transponders.
- If the intruder is Non-Altitude Reporting (NAR), TCAS will display range and bearing only. It can issue a Traffic Alert based on distance and closure rate, but will not generate a Resolution Advisory. Note that the bearing of an intruder is needed to generate a TA or RA.
- A lower priority threat (typically a more distant target) might disappear from the display when a higher priority threat (possibly outside the selected display range or altitude) is detected by TCAS. This can occur in high-density traffic areas because the traffic display may be limited.
- When lowering the landing gear with the intruder being tracked by only the lower antenna, the TCAS continues to track the intruder, but the bottom antenna does not provide valid bearing when the landing gear is extended. The collision avoidance function continues to operate normally. An applicable TA or RA will appear as a "No Bearing" annunciation on the traffic display if an intruder becomes a threat.
- Each directional antenna provides valid bearing coverage for relative elevation angles of –10/+70 degrees for the top antenna and +10/-70 degrees for the bottom antenna. All other elevation angles cause the "bearing" to be invalid. Intruders are still tracked by TCAS and will be displayed in non-bearing symbology if it is declared a threat (TA or RA).
- Aircraft cannot be tracked by the bottom antenna to the same distance as achieved by the top antenna because the bottom antenna outputs less interrogation power than the top antenna.
- TCAS might drop an intruder that passes from the stronger forward quadrant or from the side quadrant to the weaker aft quadrant. By design, TCAS

output power is reduced to the side and aft quadrants because the closure threat is lessened when compared to the forward quadrant.

- TCAS calculates the closure rate of the intruder and derives the time to the closest point of approach (CPA). If there is no closure rate, no advisory will be issued unless the intruder is very close (within approx. ¼ mile).
- If TCAS becomes invalid, all TCAS targets are removed from the display, and TCAS is displayed in black letters on a red background on the MFD.
- The TCAS overlay display range will be the currently selected display range when the TCAS is selected. However, TCAS targets will only display out to approximately 40 nm in the forward quadrant, 15 nm aft quadrant, and 20 nm to the side quadrants.

Interference Limiting

In congested areas, TCAS uses Interference Limiting. Once the number of aircraft operating TCAS in a geographic area reaches a predefined limit, Interference Limiting is activated and LIM annunciates on the MFD. TCAS interrogation rate, power, or both are automatically adjusted to minimize interference. This reduction results in fewer intruders being tracked and displayed. However, the avoidance function is maintained.

Altitude Limitations:

1. RAs are inhibited below 900 ft AGL on descent.
2. RAs are inhibited below 1,100 ft AGL on ascent.
3. Aural annunciations are announced down to 500 ± 100 feet.

RA Pop-up Limitations:

1. No more than 3 RAs may be simultaneously computed.
2. No "Descent" RAs are issued below 1,000 ± 100 ft AGL.
3. No "Increase Descent" RAs are issued below 1,450 ft AGL.
4. "Climb" and "Increase Climb" RAs may be inhibited when the maneuver cannot be accomplished due to lack of computed aircraft performance capability (i.e., high altitude, landing gear extended, flaps extended).

When the active display is SKE or SKE/INS and a TCAS RA is issued, the only way to exit the pop-up display is to move the DICU rotary mode select switch to a mode other than SKE or SKE/INS and then back to SKE or SKE/INS.

SECURE VOICE SYSTEM (KY-58/TSEC) VINSON.

Four KY-58/TSEC systems are installed. Two of the systems encrypt and decode transmissions through the VHF transceivers and two of the systems encrypt and decode transmissions through the UHF transceivers. The four KY-58 processors are located in the navigator's panel (figure 1-217). Cryptovariables are loaded into the KY-58 processors from a KOI-18 (Tape Reader) or a KYK-13 (Transfer Device). Fill connectors are provided on the KY-58 for connections to KOI-18 or KYK-13.

Controls For the Secure Voice System (KY-58/TSEC).

Controls are located on each of the four KY-58 processors. Four remote control units (Z-ANP RCU) are also provided, two in the pilot's side console and two in the copilot's side console (figure 1-217). A LOCAL/REMOTE switch is located in the navigator's panel (figure 1-217).

KY-58 Controls.

1. Mode switch. Rotary type, four-position: "P", "C", "LD", "RV".
2. Fill switch. Rotary type, eight-position: "1-5", "6", "Z1-5", "Z ALL".
3. Power switch. Rotary type, three-position: "OFF", "ON", "TD".
4. Volume control. Rotary type.

Z-ANP Controls.

1. Mode Switch. Rotary type, five-position: "P", C", "CO", "LD", "RV".
2. Fill Switch. Rotary type, six-position: "1-6."
3. Power Switch. Rotary type, four-position: "OFF", "ON", "TD", "Z".
4. Dim Switch. Rotary type.

Loading Secure Voice Systems (KY-58/TSEC).

Loading Secure Voice Systems (SVS) will be accomplished on the ground from a KOI-18 or a KYK-13, in the following manner:

1. Loading from a KOI-18.

   a. Turn KY-18 mode switch to "C".

   b. Turn KY-18 power switch to "ON". The cryptoalarm (continuous beeping) with background noise will be heard in headset.

   c. Clear alarm by pressing and releasing PRESS-TO-TALK button.

d. Connect KOI-18 to KY-58 with a fill cable.

e. Turn KY-58 mode switch to "LD". Constant tone when entering the LD mode indicates an empty storage register; a single beep when entering indicates a cryptovariable stored in the storage register.

f. Turn KY-58 fill switch to storage register to be filled.

g. Insert tape leader into KOI-18 slot marked IN. Ensure that smaller holes line up with white dots on the KOI-18.

h. Press and release PUSH-TO-TALK button.

i. Pull tape through the KOI-18 at a steady rate. A beep should be heard in the headset indicating good parity. If beep is not heard, repeat steps g through i.

j. Enter identifying information for the cryptovariable loaded on the KY-58 writing surface.

k. To load any additional cryptovariable, repeat steps f through j.

l. Turn KY-58 mode switch to "C".

m. Disconnect fill cable from the KY-58.

2. Loading from a KYK-13.

a. Turn LOCAL/REMOTE switch in navigator's panel to "LOCAL" and connect the KYK-13 in "OFF" position to the KY-58 to be loaded directly or with a key fill adapter cable.

b. Turn mode switch on the KY-58 to be loaded to "C".

c. Turn associated power switch to "ON". The cryptoalarm (continuous beeping) with background noise is heard in the headset.

d. Press PUSH-TO-TALK button and release. The cryptoalarm stops beeping and the KY-58 is ready for loading.

e. Turn KY-58 mode switch to "LD". A constant tone indicates an empty storage register. A beep indicates a variable is stored in the register.

f. Turn KYK-13 on.

g. Turn fill switch on the KY-58 to the storage register to be filled.

h. Turn KYK-13 fill switch to storage register containing cryptovariable to be transferred.

i. Press and release PUSH-TO-TALK button.

NOTE

Do not press KYK-15 initiate button.

j. Turn mode switch on loading device to "OFF/CHECK".

k. Turn KY-58 mode switch to "C".

l. Disconnect KYK-13.

m. Turn KY-58 power switch to "OFF".

Operation of the Secure Voice System (KY-58/TSEC).

The Secure Voice System (KY-58/TSEC) may be operated in the following three modes:

1. Plain Text
2. Cipher Text
3. Cipher Text Only

Operation in the Plain Text Mode.

1. Establish communication with SVS turned OFF.

2. Turn LOCAL/REMOTE switch on navigator's panel to "REMOTE".

3. On side console RCU, turn mode switch to "P", fill switch to storage register with cryptovariable stored, and power switch to "ON".

4. Depress PUSH-TO-TALK switch to clear cryptoalarm.

5. Select assigned frequency on associated control unit.

6. Proceed with communication.

NOTE

After pressing PUSH-TO-TALK, wait for tone on headset before communicating.

7. To turn off SVS, move RCU power switch to "OFF".

Operation in the Cipher Text Mode.

1. Establish communication with SVS turned OFF.

2. Turn LOCAL/REMOTE switch on navigator's panel to "REMOTE".

3. On side console, turn mode switch on remote control unit to "C," fill switch to storage register with cryptovariable stored, and power switch to "ON". The cryptoalarm will be heard.

4. Depress PUSH-TO-TALK switch to clear cryptoalarm.

5. Select assigned frequency on associated control unit.

6. Proceed with communication.

NOTE

After pressing PUSH-TO-TALK, wait for tone on headset before communicating.

7. To turn off SVS, move RCU power switch to "OFF".

Operation in the Cipher Text Only Mode.

1. Establish communication with SVS turned OFF.

2. Turn LOCAL/REMOTE switch on navigator's panel to "REMOTE".

3. On side console, turn mode switch on remote control unit to "C", fill switch to storage register with cryptovariable stored, and power switch to "ON". The cryptoalarm will be heard.

4. Depress PUSH-TO-TALK switch to clear cryptoalarm.

5. Select assigned frequency on associated control unit.

6. Proceed with communication.

NOTE

After pressing PUSH-TO-TALK, wait for tone on headset before communicating.

7. To turn off SVS, move RCU power to "OFF".

Zeroizing Procedures.

NOTE

The KY-58 power control switch may be in the "ON" or "OFF" position for zeroizing.

1. To zeroize the CNVS: (Refer to KAO-168B/TSEC.) Turn fill select switch to "Z 1-5" by pulling out on the knob while turning it. This will zeroize only those cryptovariables stored in registers 1, 2, 3, 4, and 5. Storage register 6 will not be affected. Execute a parity check on storage registers 1 through 5 to ensure cryptovariables were zeroized.

2. To zeroize the CNVs and the RKV: (Refer to KAO-168B/TSEC.) Turn fill select switch to "Z ALL" by pulling out on the knob while turning it. This will zeroize all cryptovariables stored in the KY-58. Execute a parity check on all storage registers to ensure cryptovariables were zeroized.

SECURE VOICE SYSTEM (KY-75/TSEC) PARK-HILL.

Two KY-75/TSEC systems are installed. Both systems encrypt and decode transmissions through HF transceivers. The two KY-75 processors are mounted on the floor underneath the navigator's work table.

Controls for the Secure Voice System (KY-75/TSEC).

Four remote control units (RCUs) are provided (figure 1-218). Two RCUs (Z-AKV) are located on the navigator's panel. One RCU (Z-AKW) is located on the pilot's side console and one RCU (Z-AKW) is located on the copilot's side console.

Z-AKV And Z-AKW Controls.

Refer to KAM-334A/TSEC for a description of Z-AKV and Z-AKW controls.

Loading Secure Voice Systems (KY-75/TSEC).

Loading Secure Voice Systems (SVS) will be accomplished on the ground from a KOI-18 (Tape Reader) or a KYK-13 (Transfer Device) in the following manner:

1. Loading from a KOI-18.

a. Position mode switches on the side console RCUs to "CIPHER".

b. Connect KOI-18 to the fill connector on the associated RCU, on the navigator's panel, with a fill cable.

c. Turn PWR/FILL switch on the navigator's panel RCU to "REGISTER". The cryptoalarm (continuous audible alarm) will be heard in the headset and alarm indicators on both RCUs will be illuminated.

d. Insert tape leader into KOI-18 slot marked IN. Ensure that smaller holes line up with white dots on the KOI-18.

e. Depress SIG CLR button on navigator's panel RCU. Upon release, it will request a fill from attached KOI-18.

f. Pull tape through KOI-18 at a steady rate. The cryptoalarm will stop if there is good parity. If alarm tone does not stop, repeat steps d through f above.

g. To load any additional cryptovariables, repeat steps c through f above.

h. Disconnect fill cable from the RCU.

2. Loading from a KYK-13.

a. Turn PWR/FILL switch on RCU, on the navigator's panel, to "OFF/ZEROIZE".

b. Position mode switch on associated console RCU to "CIPHER".

c. Connect KYK-13, in OFF position, to the fill connector on the RCU, directly or with a keyfill adapter cable.

d. Turn PWR/FILL switch on navigator's panel RCU to "REGISTER". The cryptoalarm will be heard on the headset.

e. Turn KYK-13 switch to required fill register.

f. Set KYK-13 to "ON" position.

g. Push SIG CLR button on the navigator's panel RCU. Upon release, it will request a fill from attached KYK-13. The parity indicator light of the KYK-13 will flash once, to indicate transfer of fill. The cryptoalarm will stop.

h. To load any additional cryptovariables, repeat steps d through g above.

i. Turn KYK-13 switch to "OFF/CHECK".

j. Disconnect KYK-13 from RCU.

Operation of the Secure Voice System (KY-75/TSEC).

The Secure Voice System (KY-75/TSEC) may be operated in the following two modes:

1. Plain Text
2. Cipher Text

Operation in the Plain Text Mode.

1. Establish communication with SVS turned OFF.
2. Set side console RCU mode switch to "PLAIN".
3. Turn fill switch on the navigator's panel RCU to the required filled storage register.
4. Press PUSH-TO-TALK button to communicate. Preamble will be heard on headset. Wait for preamble to stop before talking.
5. Release PUSH-TO-TALK button when communication is completed. Postamble will be heard on headset.

NOTE

The HF radio may be operated in the PLAIN mode with the SVS turned off and the pilot's/copilot's side console RCU switches in "BYPASS".

Operation in the Cipher Text Mode.

1. Establish communication with SVS turned OFF.
2. Set side console RCU mode switch to "CIPHER".
3. Turn FILL switch on the navigator's panel RCU to the required filled storage register.
4. Press PUSH-TO-TALK button to communicate. Preamble will be heard on headset. Wait for preamble to stop before talking.
5. Release PUSH-TO-TALK button when communication is completed. Postamble will be heard on headset.

Zeroizing Procedures.

1. When power switch is in "OFF" position, all power is removed from processor and fill is zeroized. To enter or leave this position, power switch must be pulled out and then rotated. In standby position, transmit/RCV function is disabled but power remains to key fill memories.

ADVANCED NARROWBAND DIGITAL VOICE TERMINAL (ANDVT).

Aircraft modified by TCTO 550 have the KY-75 Secure Voice System replaced by two complete sets of the advanced narrowband digital voice terminal (ANDVT) system (KYV-5). The ANDVT is a narrowband secure communications system used to transmit and receive voice and data. The ANDVT is integrated with the AN/ARC-190 HF radio. The ANDVT may be used with the No. 1 or the No. 2 HF radios. An ANDVT system consists of a basic terminal unit (CV-3591), a COMSEC module (KYV-5), the module's mount assembly, and two split remote control units (KYV-5 RCU). A "Y" cable is used to connect the COMSEC module fill port to a split remote control unit (SRCU) and the secure interlock relay. The split KYV-5 RCUs consist of a pilot RCU and a navigator's RCU.

NOTE

The ANDVT system installation is interchangeable with the KY-75 system. The ANDVT system uses the same processor mount, secure interlock relay and installed aircraft wiring. Individual components are not interchangeable and the system will not communicate with mixed components.

Basic Terminal Unit (CV-3591).

The basic terminal unit (BTU) provides the voice processing, coding and modem functions of the ANDVT. The BTU supplies operation and standby power to the SRCUs.

COMSEC Module (KYV-5)

The COMSEC module (CM) provides the encryption, decryption and bypass (plain text) functions of the system. See figure 1-219. When the CM is installed on the BTU, the unit becomes a TACTERM (ANDVT processor) and is located on the floor, just below the jump seat's oxygen regulator. The CM utilizes a 6.7 volt mercury battery to hold the key codes when power is not applied to the BTU.

COMSEC Module Controls and Displays.

NOTE

The discrete indicators listed for the KYV-5's control are LEDs that may be disabled by selecting the first "ON" position of the POWER switch.

1. KU/BIT/PAR Display. This numeric display is a two-digit LED hexadecimal display (00-FF). The display

indicates key status, BIT results, operational status, and channel quality status. The display is under the control of the BTU when on-line or during the BTU portion of the BIT. It is under the control of the KYV-5 at all other times.

2. XMT CIPH Indicator. When lit it indicates that the terminal set (BTU) is off-line and conditioned to transmit in the secure mode.

3. XMT PLAIN Indicator. When lit it indicates that the BTU is off-line and conditioned to transmit in the non-secure (plain text) mode.

4. POWER Indicator. When lit it indicates that the POWER switch is in the second "POWER ON" position. The BTU is on and is being controlled by the KYV-5 control module.

5. POWER Switch. The POWER Switch is a four-position ("OFF", "ON", "POWER ON", "POWER RMT") rotary switch:

a. "OFF" - Inhibits power supply voltages.

b. "ON" - Enables BTU power supply voltages, but KYV-5 SRCU indicator lamps and displays are off.

c. "POWER ON" - Enables BTU power supply voltages, KYV-5 SRCU indicator lamps and displays are on.

d. "POWER RMT" - Transfers power and system control to the optional remote control unit. In this position the KYV-5 controls, lamp indicators and display are disabled (not used).

6. KEY SELECT Switch. The KEY SELECT switch is an eight-position ("1" - "6", "U", "RCU") rotary switch that controls the following:

a. "1 - 6" - Selects the memory store for traffic keys.

b. "U" - Selects the store for re-keying AK and MK operation.

c. "RCU" - Selects the memory store for an RCU-CM key.

7. ZERO ALL/INIT Switch. This switch is a three-position (momentary pull out to activate "ZERO ALL", NORMAL, momentary "INIT") toggle type switch.

a. "ZERO ALL" - Pulling the switch out and momentarily placing the switch to this position erases all stored keys. This function is active whether or not the equipment is powered.

b. "INIT" - Momentarily placing the switch in this position initiates the selected function.

8. ALARM Indicator. When illuminated indicates a CRYPTO alarm. This indicator flashes momentarily during the alarm check.

9. FILL Connector. Used to connect a loading device and transfer TEKs (traffic encryption keys) to the KYV-5.

10. DATA/VOICE Switch. The DATA/VOICE switch is an eight-position ("RK", "DATA 3, 6, 12, 24", "VOICE P-P", "VOICE NET", "VOICE PLAIN") rotary switch used in conjunction with the FUNCTION switch to select the desired on-line operating mode.

a. "RK" - For the operation of the receive key, refer to KAM-477B.

b. "DATA 3, 6, 12, 24" - Selects transmission data rates of 300, 600, 1,200 or 2,400 bits per second (bps).

c. "VOICE P-P" - Selects the point-to-point operating mode (typically used with landline circuits). After synchronization, each transmission uses an abbreviated preamble.

d. "VOICE NET" - Selects the network operating mode (typically used with line-of-sight and beyond-line-of-sight radios). Each transmission uses the complete preamble.

e. "VOICE PLAIN" - Selects the non-secure mode of operation.

11. FUNCTION Switch. The FUNCTION switch is a nine-position ("BIT", "AC", "LT", "ON-LINE MODE", "LD", "KU", "UNLK", "LK" and "ZRO SEL") switch that selects off-line functions or puts the BTU in the on-line mode. The function of each switch position follows:

a. "BIT" - This off-line function enables manual initiation of the BIT procedures on the KYV-5 control and BTU. The ZERO ALL/INIT switch must be set to the "INIT" position. The BIT results are displayed on the KU/BIT/PAR display.

b. "AC" - The alarm check position is an off-line function that enables manual initiation of a COMSEC validation check. COMSEC logic is validated with the ZERO ALL/INIT switch placed in the "INIT" position.

c. "LT" - The lamp test position is an off-line function that enables testing of discrete front panel indicators with the ZERO ALL/INIT switch in the "INIT" position.

d. "ON LINE MODE" - This position places the BTU in the selected on-line operating mode. When in this position, the appropriate XMT CIPH or XMT PLAIN indicator will come on.

e. "LD" - The load key ("LD") position is an off-line function that enables a traffic encryption key (TEK) to be transferred from a fill device to a storage location selected by the KEY SELECT switch.

f. "KU" - The key update position is an off-line function that enables the display of the update status. Update of keys 1 through 6 can be performed in this position by selecting the variable to be updated via the KEY SELECT switch and placing the ZERO ALL/INIT switch to the "INIT" position. The update limit is 99, then returns to zero.

NOTE

The "U" and "RCU" positions of the KEY SELECT switch are automatically updated by the equipment.

g. "UNLK" - The unlock position is an off-line function. Refer to KAM-477B, Table 3-1, for the "UNLK" positions operation.

h. "LK" - The lock position is an off-line function. Refer to KAM-477B, Table 3-1, for the "LK" positions operation.

i. "ZRO SEL" - This position is an off-line function that permits zeroizing of the key selected by the KEY SELECT switch when placing the ZERO ALL/INIT switch to the "INIT" position.

12. RCV CIPH Indicator. The RCV CIPH indicator signals the reception of a secure transmission.

Split Remote Control Unit (SRCU).

The split remote control unit (KYV-5 RCU) consists of two separate units (figure 1-219). This allows an operator to control the TACTERM functions from one of two remote locations. The navigator's KYV-5 RCU is a capable stand-alone device with or without the pilots' KYV-5 RCU. The navigator's KYV-5 RCU, also known as RCU-IIA or Z-ANG, is located on the navigator's instrument panel. There are two units, one for HF-1 and the other for HF-2. The pilots' KYV-5 RCU is not a stand-alone device and must be connected to the navigator's KYV-5 RCU to operate.

There are two pilots' KYV-5 RCUs, also known as RCU-IIB or Z-ANH. One is located on the pilot's side console and the other is located on the copilot's side console. For our purposes here, the navigator's KYV-5 RCU will be identified as RCU-IIA and the pilots' as RCU-IIB.

SRCU Functions.

The SRCU provides the CM with information selected by the operator. The operator uses the SRCU front panel controls to make the data selection. The CM provides status information to the SRCU for display on the front of RCU-IIA. Data transferred between the SRCU and the CM flows through the BTU and is in half-duplex format. The front panel of the RCU-IIA has a connector fill device.

Navigator's KYV-5 RCU-IIA.

There are two units, one for HF-1 and the other for HF-2. The navigator's KYV-5 RCU is used to select 1 of 6 traffic encryption keys (TEK) to be used for encryption/decryption when in the on-line mode. It is used to select plain text operation, to select Net or Point-to-Point mode of on-line operation, or to select key locations to be modified off-line (Fill, Update or Zeroize). The KYV-5 RCU-IIA is used to initiate a CM alarm check and perform a lamp test on RCU-IIA indicators and its display. It is also used to disable the main power supply in the BTU. It will select RCU-IIB for net control and zeroize all TEKs in the COMSEC Module (KYV-5).

KYV-5 RCU-IIA Controls and Indicators.

The navigator's KYV-5-IIB front panel contains the following controls and indicators:

1. RCV CT Indicator. When the RCV CT green indicator is illuminated, it indicates audio output is decrypted data.

2. XMT MODE CT Indicator. When the XMT MODE CT green indicator is lit it indicates the ANDVT is on-line and conditioned to transmit in the cipher (secure text) mode.

3. XMT MODE PT Indicator. When the amber XMT MODE PT indicator illuminates, it indicates the ANDVT is on-line and conditioned to transmit in the plain text (non-secure) mode of operation.

4. ALM Indicator. When this amber light illuminates it indicates a CRYPTO alarm in the ANDVT system.

5. FILL Connector. The connection port for a fill device.

6. Numeric Display. The display window indicates a 2-digit result or status of various functions (see below).

7. INIT/ZERO (PULL) Switch. This switch is a three-position (momentary "INIT", NORMAL, "ZERO") toggle switch. In "INIT" it initiates off-line functions. In "ZERO" it zeroizes all stored keys.

8. A-KEY SELECT Switch. This eight-position ("B", "1 6", "PL") rotary switch selects one of six TEKs or in "B" selects KYV-5 RCU-IIB operation. In "PL", plain text (non-secure) operation is selected.

9. FUNCTION Switch. The FUNCTION switch initiates off-line functions or puts the BTU in the online mode. The FUNCTION switch is a seven-position "OFF", "AC", "LT", "ONL/LD NET", "ONL/LD P-P", "KU", and "ZERO SEL" rotary selector. This switch mimics the operation of the FUNCTION and DATA/VOICE switches on the KYV-5 (COMSEC Module).

10. "A" Indicator. The green "A" indicator light illuminates to indicate BTU power is on and KYV-5 RCU-IIA TEK selection is possible.

11. DIM Switch. This eight-position rotary switch controls the intensity of all indicators and displays on the unit. The intensity of the integrated face plate panel lighting is controlled by the navigator's normal lighting controls.

KYV-5 RCU-IIA Numeric Display.

The KYV-5 RCU-IIA numeric display provides operational and diagnostic data from the COMSEC Module and the Basic Terminal Unit. The indicators are hexadecimal displays and provide the following data:

CM/BTU NUMERIC INDICATOR DATA

CM STATUS	FUNCTION SWITCH	ON-LINE MODE	DISPLAY DATA SOURCE	DISPLAY		MEANING
				LEFT	RIGHT	
COLD START	N/A	N/A	CM	C	4	INIT Required
				C	3	INIT in Progress
				C	2	INIT in Progress
				C	1	INIT in Progress
				-	-	CM Initialized
POWER UP	N/A	N/A	CM	B	F	Low Battery
				D	1 - 8	CM Test Fail
				B	5 - 8	Low Battery and CM Test Error
				-	-	CM Operational
		ANY	BTU	-	-	BTU Operational
				E	0 - 7	BTU Test Fail/Status
				C	C	Key Received OK
		N/A	CM	B	F	Low Battery
				D	1 - 8	CM Test Error
				B	5 - 8	Low Battery and CM Test Error
			BTU	0 - 7	0 - 7	BTU BIT Status
OPERATIONAL	AC	N/A	CM	B	F	Low Battery
				D	1 - 8	CM Test Error
				B	5 - 8	Low Battery and CM Test Error
				-	-	CM Operational
	LT	N/A	CM	0 - F	0 - F	Lamp Test
	ONL/LD	N/A		0	1	Successful Key Transfer
				F	F	Parity Failure
	KU	N/A	CM	0	0	Zeroized
				0	1	Initial Upload
				0	2	First Update
				0	3	Second and Subsequent Updates
				9	9	Next to Last Update
				A	A	Last Update
	UNLK or LK (Perform from CM front panel only)	N/A	CM	C	D	CM Locked
				—	—	CM Unlocked

CM/BTU NUMERIC INDICATOR DATA

DISPLAY		FAILURE INDICATION
LEFT	RIGHT	
D	1	CPU Failure
D	2	ROM Integrity Failure
D	3	RAM Integrity Failure
D	4	Plain Text Relay Failure
D	5	KG and/or Alarm Failure
D	6	Variable Processor Failure
D	7	Cold Start Test Failure
D	8	New CKV Failure
B	5	Battery Low and KG Alarm Failure
B	6	Battery Low and Variable Processor Failure
B	7	Battery Low and Cold Start Test Failure
B	8	Battery Low and New CKV Failure
B	9	Battery Low, no other Failures
F	F	No TEK (Panel initiated Alarm Check only)

Pilots' KYV-5 RCU-IIB.

There are two units: the pilot's is used with HF-1 and the copilot's is used with HF-2. The pilots' KYV-5 RCUs are used to select one of six traffic encryption keys (TEK) to be used for encryption/decryption, select plain text operation, perform a lamp test on RCU-IIB indicators and to zeroize all TEKs in CM.

KYV-5 RCU-IIB Controls and Indicators.

1. DIM Switch. This eight-position rotary switch controls the intensity of all indicators and displays on the unit. The intensity of the integrated face plate panel lighting is controlled by the pilots' normal lighting controls.

2. LT Push Button. The lamp test pushbutton activates the lamp test of the unit.

3. XMT MODE PT Indicator. When the amber XMT MODE PT indicator illuminates, it indicates the ANDVT is on-line and conditioned to transmit in the plain text (non-secure) mode.

4. XMT MODE CT Indicator. When the XMT MODE CT green indicator is lit it indicates the ANDVT is on-line and conditioned to transmit in the cipher (secure text) mode.

5. NET/P-P Switch. This seven-position ("1 - 6", "PL") rotary switch selects one of six TEKs or in "PL" selects plain text (non-secure) operation.

6. "B" Indicator. The green "B" indicator light illuminates to indicate BTU power is on and that KYV-5 RCU-IIB TEK selection is possible.

7. BYPASS/ANDVT/ZERO (PULL) Switch. This switch is a three-position ("BYPASS", "ANDVT", "ZERO") toggle switch. In "BYPASS" it initiates offline functions. In "ANDVT" it enables KYV-5 operation and in "ZERO" it zeriozes all store keys.

8. RCV CT Indicator. When the RCV CT green indicator is illuminated, it indicates audio output is decrypted data.

Interconnecting "Y" Cable.

The "Y" cable is a multi-pin wiring harness that connects J3 on the TACTERM and the fill port of the CM (KYV-5) to J2 on the RCU-IIA to transfer fill port capability to RCU-IIB.

Secure Interlock Relay.

The interlock relay provides an interface between the AN/ARC-190 HF radio, the aircraft interphone system and the ANDVT. When the BYPASS/ANDVT/ZERO switch on an RCU-IIB control is in "BYPASS", there is no signal processing. The switch-activated relay provides signal routing around the ANDVT processor.

KYV-5 Operational Procedures.

GENERAL INFORMATION.

The functions of the ANDVT TACTERM can be controlled locally at the TACTERM or by the SRCUs from either the navigator's or the pilots' positions.

Apply power to the BTU (CV 3591) and ensure the CM (KYV-5) is set to the following:

1. KYV-5 POWER Switch - "POWER RMT" (remote)

2. KEY SELECT Switch - "RCU"

3. DATA/VOICE Switch - "VOICE NET"

4. FUNCTION Switch - "ON-LINE MODE"

KYV-5 TEST AND OPERATIONAL SEQUENCE.

POWER ON.

NOTE

Moving the KYV-5 RCU-IIA FUNCTION switch to any position, except "OFF", will apply power to the system. The BTU provides power to the CM, KYV-5 RCU-IIA and KYV-5 RCU-IIB.

Rotate the DIM switch to adjust indicator and display to a visible level.

CM INITIALIZATION. Using the KYV-5 RCU-IIA for the HF radio to be checked, accomplish the following:

NOTE

Observe displays during initialization.

1. FUNCTION Switch - "ONL/LD"

Select "NET" or "P-P". Observe the display remains C4.

2. INIT/ZERO Switch - "INIT" AND RELEASE

Observe the display changes to C3.

3. FUNCTION Switch - "AC"

Observe the display remains C3.

4. INIT/ZERO Switch - "INIT" AND RELEASE

Observe the display changes to C2.

5. FUNCTION Switch - "ONL/LD"

Select "NET" or "P-P". Observe the display remains C2.

6. INIT/ZERO Switch - "INIT" AND RELEASE

Observe the display changes to Cl.

7. FUNCTION Switch - ANY POSITION

Observe the display remains Cl.

8. INIT/ZERO Switch - "INIT" AND RELEASE

Observe the display goes blank indicating CM initialization is complete.

9. FUNCTION Switch - "ONL/LD NET"

10. INIT/ZERO Switch - "ZERO"/NORMAL

This should clear any residual update counts or CD displays. The keys may now be filled.

LOADING A TRAFFIC ENCRYPTION KEY. The following procedure is used to load a TEK into a storage location selected by the A-KEY select switch. The CM must first be initialized.

1. Connect a fill device to the KYV-5 RCU-IIA FILL port.

2. Turn the fill device on then select the location of the TEK to be transferred.

3. FUNCTION Switch - "ONL/LD NET" OR "ONL/LD P-P"

4. INIT/ZERO Switch - "INIT" AND RELEASE

NOTE

If the fill device is a paper tape reader (such as a KO1-18), pull the tape through the reader within 7 seconds.

Observe the front panel display. The display will flash "Ol" momentarily on a successful transfer or "FF" if the transfer was not successful or timed out. If loading is not successful or timed out, repeat steps 1 through 4.

NOTE

The ANDVT will not accept a new code while processing traffic.

TRAFFIC ENCRYPTION KEY UPDATING. The following procedure is used by the KYV-5 RCU-IIA to update a TEK (locations 1 through 6). Since the update process is irreversible, the procedure is structured to prevent inadvertent multiple updating of the same TEK.

CAUTION

Each update advances TEK encryption. Every station communicated with must update the same TEK the same number of times.

1. A-KEY Switch - DESIRED LOCATION

Select the location of TEK (1 through 6) to be updated on the A-KEY select switch.

2. FUNCTION Switch - "KU"

The display indicates the status of the selected TEK location.

3. INIT/ZERO Switch - "INIT" AND RELEASE

Observe the display now indicates the new status of the selected TEK. (The old status is incremented by one.)

Subsequent operation of the INIT/ZERO switch does not result in additional updates. To update the same TEK, the FUNCTION switch must be moved out of the "KU" (update) position ("LT" or ONL/LD") and then back to the "KU" position. Operation of the INIT/ZERO switch then results in another update of that TEK. To update a different TEK, move the A-KEY select switch to the desired position. The INIT/ZERO switch action is ignored when "B" or "PL" is selected on the A-KEY select switch.

ZEROIZATION OF STORED TEK.

SELECTIVE ZEROIZATION. The following procedure is accomplished using a KYV-5 RCU-IIA to zeroize a designated TEK location in the KYV-5 storage memory.

1. FUNCTION Switch - "ZERO SEL"

2. A-KEY Switch - DESIRED LOCATION

3. INIT/ZERO Switch - "INIT" AND RELEASE

Observe that the display shows "00" momentarily confirming the selective zeroization. The status of any memory location can be checked by placing the FUNCTION switch in the "KU" position ("00" indicates zeroization). INIT/ZERO switch action is ignored when the A-KEY select switch is in the "B" or "PL" positions.

ZEROIZE ALL. All TEKs can be zeroized at the KYV-5 RCU-IIA or IIB locations by placing the INIT/ZERO switch in the "ZERO" position. To place the switch in ZERO, it must be pulled out and down. This action zeroizes all TEKs in a connected CM (HF-1 or HF-2) only. This procedure must be repeated to zeroize the other CM.

ALARM CHECK. The following procedure is used at the KYV-5 RCU-IIA to perform a cryptographic alarm check of the CM. The TEK selected on the A-KEY select switch is used to perform the alarm check. The INIT/ZERO switch is ignored if the A-KEY select switch is in the "B" or "PL" position. Selection commands the CM to do an alarm check with the selected TEK.

1. FUNCTION Switch - "AC"

2. A-KEY Switch - DESIRED LOCATION

The position selected (1 through 6) must contain a valid TEK for a successful alarm check.

3. INIT/ZERO Switch - "INIT" AND RELEASE

Observe the ALARM indicator flashes momentarily during a successful alarm check and the hexadecimal display counts from D1 to D8 or BF (battery failure if CM battery needs to be replaced) and goes blank. If the alarm check is unsuccessful, then the TEK is either invalid or the CM is malfunctioning. "FF" indicates a bad or nonexistent TEK.

LAMP TEST. The following procedure is used to verify the operability of the KYV-5 RCU-IIA and IIB panel indicator devices and their associated driver circuitry.

1. FUNCTION Switch - "LT"

2. INIT/ZERO Switch - "INIT" AND HOLD

Observe that the "A" power indicator remains on and the other four discrete indicators cycle on-off sequentially as long as the INIT/ZERO switch is held in "INIT".

3. INIT/ZERO Switch - RELEASE

Observe that the hexadecimal display sequences once through its character set (00, 11, 22, AA through FF). The lamp test can be used to distinguish between indicator faults and control channel faults as well as verification of the CM/SRCU control channel operation.

NON-LOCAL KYV-5 RCU-IIB LAMP TEST. KYV-5 RCU-IIB is in control and the "B" indicator is illuminated.

1. RCU-IIA FUNCTION Switch - "ONL/LD"

Select either "ONL/LD NET" or "ONL/LD P-P".

2. RCU-IIA A-KEY Switch - "B"

3. RCU-IIB LT Button - PUSH AND HOLD

Observe that the "B" indicator remains illuminated and the other three discrete indicators cycle on-off sequentially as long as the LT button is held.

4. RCU-IIB LT Button - RELEASE

The RCU-IIA hexadecimal display will cycle after a non-local RCU-IIB lamp test. The lamp test can be used to distinguish between indicator faults and control channel faults as well as verification of the CM/SRCU control channel operation.

LOCAL KYV-5 RCU-IIB LAMP TEST. KYV-5 RCU-IIB is not in control.

1. RCU-IIB LT Button - PUSH/CHECK/RELEASE

Observe that all the LEDs illuminate simultaneously.

ON-LINE COMMUNICATION MODE.

Selection of either "NET" or "P-P" position on the KYV-5 RCU-IIA FUNCTION switch in conjunction with the selection of the appropriate TEK (1 through 6) places the TACTERM in the on-line communication mode. The mode in which the terminal receives is determined by the preamble of the received message, except for plain voice that has no preamble. The following procedure is used to prepare the terminal for On-Line communications:

OPERATION FROM THE KYV-5 RCU-IIA.

NOTE

Distant stations must be equipped with ANDVT for communications.

1. FUNCTION Switch - "ONL/LD"

Select "NET" or "P-P".

2. A-KEY Switch - DESIRED LOCATION

Select the location of the desired TEK (1 through 6) or plain text ("PL").

The green XMT MODE indicator is illuminated when the ANDVT is in the secure mode. The amber XMT MODE PT indicator is illuminated when the ANDVT is in plain text (non-secure) mode. Only one of these indicators should be illuminated whenever the TACTERM is transmitting, receiving or idle. In the receive mode, the green RCV CT indicator is controlled by the BTU and illuminates when the current audio output is the product of decrypting an encrypted signal.

3. Desired HF Radio - ON

4. A-KEY Switch - "PL"

Communicate with another aircraft or ground station.

5. A-KEY Switch - DESIRED LOCATION

Select a loaded key position (1 through 6).

6. HF Radio - KEYED/CHECKED/RELEASED

Check that the preamble is heard then release key. Establish communications with other aircraft or ground stations. When other aircraft or ground station is transmitting, RCV CT indicator should illuminated.

OPERATION FROM THE KYV-5 RCU-IIB.

1. KYV-5 RCU-IIA A-KEY Switch - "B"

2. KYV-5 RCU-IIB Light Intensity - ADJUST

Set the light control to the desired level. Observe that the "B" light is illuminated.

3. LT Push Button - PRESS

Observe that all indicators sequentially illuminate.

4. BYPASS/ANDVT/ZERO Switch - "BYPASS"

Ensure the proper HF radio is operating. The volume may need to be increased while in the bypass position.

5. BYPASS/ANDVT/ZERO Switch - "ANDVT"

6. NET/P-P Switch - "PL"

Establish communications with another aircraft or ground station. Have the aircraft or ground station go encrypted (the other aircraft or ground station must also be keyed for encrypted communication).

7. NET/P-P Switch - DESIRED LOCATION

Select a loaded key position (1 through 6).

8. HF Radio - KEYED/CHECKED/RELEASED

Check that the preamble is heard then release key. Reestablish communications with the other aircraft or ground station. When other aircraft or ground station is transmitting, RCV CT indicator should illuminated.

KYV-5 SYSTEM SHUTDOWN.

NOTE

If the KYV-5 RCU-IIB is not set to BYPASS during shutdown, the HF radio will not transmit, even with the TACTERM turned off.

1. BYPASS/ANDVT/ZERO Switch - "ZERO" AND RELEASE

2. BYPASS/ANDVT/ZERO Switch - "BYPASS"

3. KYV-5 RCU-IIA FUNCTION Switch - "OFF"

L-BAND SATELLITE COMMUNICATIONS SYSTEM (L-BAND SATCOM) (TCTO 555).

L-Band SATCOM is a worldwide communication system used for automatic data reporting, position reporting, and the transmission and receipt of messages. It is used to communicate via the International Maritime Satellite Communication Network (INMARSAT) to and from nearly any location in the world. The primary system controls are located at the navigator's station, under the left-hand side of the table.

L-Band SATCOM Components.

The L-Band SATCOM system has six major components (figure 1-221). They are the GPS antenna, transceiver, printer, printer box assembly, remote indicators, and computer. GPS position is required for transmitting and receiving L-Band SATCOM messages.

The GPS antenna is located on the UARRSI faring, aft of the A/R receptacle. The transceiver is located in the left-hand under deck area.

L-Band SATCOM Operation.

A received signal sent from the GPS antenna is split and then shared with the PLGR GPS at the pilots' center console. The signal is then sent to the transceiver and then to both the printer and the computer simultaneously. The crew receives notification of an incoming message via the SATCOM MSG indicator light on the copilot's side console and the MAIL indicator on the front of the printer. The computer is not required in order to receive or print incoming messages. The computer must be plugged in and operating to edit and store received messages. Outgoing messages are entered into the keyboard, properly formatted and then transmitted by use of the computer.

The transceiver has three indicator lights of importance to the crew located on the front of the unit. The POWER light indicates the transceiver power is on. The LOGIN light indicates the L-Band SATCOM system is logged into the INMARSAT network. The SEND light indicates the transmission of a message.

The printer box assembly is located at the navigator's station, under the left-hand side of the table. The printer box assembly contains the printer and acts as a storage container for the portable computer. It also contains the connections for the computer, the control switches/buttons and system indicator lights.

L-Band SATCOM Controls.

The controls consist of a POWER switch, a printer FEED button, and a printer OK button.

1. L-Band SATCOM Power Switch. The two-position ("ON", "OFF") POWER switch turns the system on or off through power supplied by the main DC bus.

2. Printer Feed Button. The FEED button performs two functions:

   a. The first function is to remove any remaining paper in the printer before reloading and to advance paper during reloading.

   b. The second feature is used in conjunction with the OK button to adjust the lighting intensity of the indicator and panel lights.

3. Printer OK Button. The OK button resets the printer indicators, adjusts lighting intensity, and initiates the built-in-test (BIT) feature. Pushing the OK button will:

   a. When used in conjunction with the FEED button, adjusts the lighting intensity of the indicator and panel lights.

   b. Initiates a printer self-test if pressed when power is first applied to the system.

   c. Resets the MAIL indicator turning off the MAIL and SATCOM MSG lights.

   d. If printer paper was low and the printer was disabled, once new paper is loaded, pressing the OK button will extinguish the PAPER and SATCOM MSG indicator lights and enable the printer.

Printer Indicator Lights.

The printer system indicator lights are POWER, LOGIN, PAPER, and MAIL.

1. Printer Power Indicator. The printer POWER light indicates that printer power is on. The light performs two functions:

   a. The light illuminates to indicate power is applied to the system. When power is first applied, the indicator flashes on and off until communication is established with the transceiver.

   b. The indicator will flash on and off to indicate the transceiver does not have power, or to indicate that data cabling is disconnected or defective.

2. Printer Login Indicator. The printer LOGIN light indicates the L-Band SATCOM system is logged into the INMARSAT network.

3. Printer Paper Indicator. The PAPER light indicates that printer paper is low and the printer is disabled. The indicator will flash for 20 seconds after paper has been loaded. When the indicator stops flashing and illuminates steady, the printer is ready to resume printing. Pressing the OK button will extinguish the light and enable the printer. Data in the printer is not lost during a paper-empty condition unless the printer's memory overflows.

4. Printer Mail Indicator. The MAIL light indicates that an incoming message has been received. The indicator will extinguish when the OK button is depressed or when the message is finished printing.

NAVIGATION SYSTEMS.

VOR/ILS/MB NAVIGATION SYSTEMS (AN/ARN -147(V)).

Two VOR/ILS/MB navigation systems are provided. These systems receive signals transmitted by ground-based navigation systems and provide outputs for the aircraft control display system and BDHIs. Each system independently processes VHF omni-range (VOR), localizer, glide slope, and marker beacon signals. Each generates outputs for VOR bearing; course deviation; to/from; vertical and horizontal guidance for instrument landings; signal valid; marker beacon position; and aural outputs for VOR, localizer, and marker beacon signals.

Marker Beacon.

The marker beacon function is integrated into both VOR/ILS/MB receivers but is available from the No. 1 receiver only. The receiver provides aural and visual indication when the aircraft is in range of a marker beacon transmitter. When the aircraft is over the Outer Marker, Middle Marker, or Inner Marker, PFDs display "O", "M", or "I" respectively. An MBCN LOW - HIGH receiver sensitivity selection is provided on the NAV TUNE INDEX page (figure 1-41). Pressing Line Select Key 6R toggles the selection.

Normal Operation Of the VHF Navigation System.

1. On any MFCDU POWER UP page, press 4R. Observe that MSTR AV ON changes to small font.

NOTE

MSTR AV ON turns power on to all VHF COMM/NAV and TACAN units. Each radio can be turned on or off individually from its respective NAV TUNE page.

2. On any MFCDU, depress the NAV TUNE key. MFCDU displays the NAV TUNE INDEX page.

a. Select VOR 1 or 2. MFCDU displays the NAV TUNE VOR 1 or 2 page.

b. Select PWR ON (1R). (If required.)

c. Enter desired frequency or identifier. Frequency or identifier appears in scratch pad section of display.

d. Press 1L. Data upselects.

NOTE

If a requested identifier is not contained in the database, the error message NOT IN DATABASE is displayed. If the commanded channel has no identifier, "---" is displayed for the identifier. If the radio is powered off, tuning results in the radio being powered up and commanded to tune.

e. Set PAIRING as required (Refer to the Flight Management System (FMS) in Section I).

NOTE

- V1 in small font on the NAV TUNE INDEX page indicates that VOR 1 is unavailable (inoperative or under control of the VHF backup control panel).
- When using an MFCDU to control VHF/NAV system No. 1, ensure that VHF backup control panel mode switch is in the OFF position.

3. Select appropriate VHF NAV monitoring switch on the interphone control panel. Set switch to a comfortable reception level and check station identification.

4. On the appropriate DAMU, select NAV PTR1/2 and then VOR/ILS1/2.

5. On the appropriate BDHI Selector Panel, select VOR1/2.

Backup Operation of the VHF NAV System 1.

1. Turn mode selector switch on the VHF/NAV control panel to NAV. If VHF COMM1 is required, place selector to COM/NAV.

2. On VHF/NAV control, select a valid VOR frequency.

3. Select appropriate VHF NAV monitoring switch on the interphone control panel. Set switch to a comfortable reception level and check station identification.

4. On the appropriate DAMU, select NAV PTR1/2 and then VOR/ILS 1.

5. On the appropriate BDHI Selector Panel, select VOR 1.

VOR/Marker Beacon Self-Test.

NOTE

- The VOR/marker beacon self-test is used for ground preflight only. It is inhibited when the aircraft is airborne.
- The self-test feature is inhibited when in the localizer mode.

1. AHRS ON.

2. Turn on and adjust pilot's and copilot's CDS common brightness control.

3. On both DAMUs select:

a. NAV PTR 1 - VOR/ILS 1

b. ATT - AHRS

c. HDG - AHRS

4. Set pilot's and copilot's HSI course arrow to 315 degrees.

5. Select VOR-1 pilot's, copilot's, and navigator's BDHI select panel.

6. Set both FMS power switches to "ON".

7. On any MFCDU:

a. On the POWER UP page toggle MSTR AV ON (4R).

b. Press the NAV TUNE key.

c. On the NAV TUNE INDEX page:

(1) Enter VOR station identifier or valid frequency and upselect (1R).

d. Press the MAIN MENU key.

(1) On MAIN MENU page, select MAINT (6R).

(a) On MAINTENANCE INDEX page, select IBIT (1R).

(b) On INITIATED BIT page, select VOR 1 (5R).

8. Observe the following:

a. HSIs and BDHI bearing-pointers indicate 315 degrees.

b. HSI TO-FROM pointer indicates TO.

c. CDIs center with course arrow.

d. All marker beacon annunciators sequentially display on ADIs.

9. Repeat steps 3, 5, 7, and 8 for VOR 2 if desired. Indications should be the same except that marker beacon annunciator does not display.

GLIDE SLOPE SYSTEM.

The two glide slope receivers have been replaced with the No. 1 and No. 2 VOR/ILS/MB (AN/ARN-147 (V)) multifunction receivers. Operation of the system is automatic when a localizer is selected.

TACAN SYSTEMS (AN/ARN-118(V)).

Two AN/ARN-118(V) TACAN Navigation Systems are installed. This system is used to determine the relative bearing and slant range distance to a selected TACAN station. This station can be a ground, shipboard, or airborne station. An airborne station only supplies slant range distance information unless the aircraft is especially equipped with a bearing transmitter and rotating antenna. The set is not capable of transmitting bearing information but does supply slant range distance replies when interrogated. The set has provisions for 126X channels and 126Y channels. The Y channels differ from the X channels in frequency assignment and pulse spacing. If the TACAN channel is paired with a 5-digit (0.05 KHz spacing) VOR, the Y mode must be selected. The maximum operating range is approximately 250 NM with a surface station and 200 NM with an airborne station.

Bearing and distance information is visually presented on bearing distance heading indicators (BDHI) on the pilot's, copilot's, and navigator's instrument panels; and on the CDS PFDs and SFDs when in the HSI or MAP modes.

Antennas.

Antennas for both TACAN sets are located on the bottom of the fuselage (figure 1-208). Receiver-transmitter units are automatically transferred to an antenna receiving usable signals. During turns, TACAN system transmission and reception may be blanked.

Normal Operation of the TACAN System(s).

1. On any MFCDU POWER UP page, press 4R. Observe that MSTR AV ON changes to small font.

NOTE

MSTR AV ON turns power on to all VHF COMM/NAV and TACAN units. Each radio can be turned on or off individually from its respective NAV TUNE page.

2. On any MFCDU, depress the NAV TUNE key. MFCDU displays the NAV TUNE INDEX page.

a. Select TAC 1 or 2. MFCDU displays the NAV TUNE TAC 1 or 2 page.

b. Enter desired channel or identifier. Channel or identifier appears in scratch pad section of display.

c. Press 1L. Data upselects.

NOTE

If a requested identifier is not contained in the database, the error message NOT IN DATABASE is displayed. If the commanded channel has no identifier, "---" is displayed for the identifier. If the radio is powered off, tuning results in the radio being powered up and commanded to tune.

d. Select TR-REC (transmit-receive) as required by pressing 2R.

e. Select GND (ground) or AA (air-to-air) as required by pressing 3R.

f. Set PAIRING as required (Refer to the Flight Management System (FMS) in Section I).

NOTE

TAC 1 or 2 in small font on the NAV TUNE INDEX page indicates that the TACAN is unavailable.

3. Select appropriate TAC monitoring switch on the interphone control panel. Set switch to a comfortable reception level and check station identification.

4. On the appropriate DAMU, select NAV PTR1/2 and then TAC1/2.

5. On the appropriate BDHI Selector Panel, select TAC1/2.

Manual Self-Test of TACAN System(s).

Set DAMU NAV PTR 1 to desired TACAN. Select desired TACAN on BDHI NAV select panel. Select a course of 180 degrees on HSI. On the MFCDU press the NAV TUNE function key. From the NAV TUNE INDEX page select the desired TACAN. From the TACAN menu apply power and select the T/R - REC mode, and allow 90 seconds to warm up. To initiate self-test, on the MFCDU MAIN menu select MAINT (6R), IBIT (1R) and press the desired TAC test button (4L or 5L).

NOTE

It may be necessary to perform the test twice, once to observe the displays and a second time to observe the BDHI.

Observe that the DME, CDI, and bearing pointer are green then turn red for approximately seven seconds and the bearing pointer indicates approximately 270 degrees. For the next fifteen seconds, the DME, CDI and bearing pointer return to green, the DMEs indicate 00.0 (+0.5), the bearing pointer indicates 180 (+3) degrees, the course deviation bar centers to within ± 1/2 dot, and the TO-FROM arrow indicates TO. When the self-test is complete, the IBIT RESULTS page annunciates TACAN (1/2) NO FAULTS.

NOTE

The BDHI pointer should follow the NAV PTR 1. A green NAV PRT 1 equates to a no flag condition on the BDHI. A red NAV PTR 1 equates to a flag condition on the BDHI.

Automatic Self-Test of TACAN System(s).

An automatic self-test occurs when the receiver signal becomes unreliable or the signal is lost, to ensure that the system is operating properly.

HAND HELD GLOBAL POSITIONING SYSTEM (HHGPS).

TCTO 570 installed provisions for connecting a Hand Held Global Positioning System (HHGPS) device to assist in aircraft navigation. The HHGPS is a self-contained portable navigation unit based on Global Positioning System (GPS) satellite technology. A GPS panel is located on the aft left corner of the pilots' center console (figure 1-227). The GPS panel (also known as PLGR GPS) is hard-wired into the aircraft and provides connections for power and an antenna for use by the HHGPS. The GPS antenna is located on the UARRSI fairing, aft of the A/R receptacle. Circuit protection is provided through two circuit breakers, one located on the isolated DC bus, and the other installed on the side of the GPS panel.

CAUTION

- To prevent electrical arcing, ensure the HHGPS power cord is attached to the HHGPS unit prior to plugging the power cord into the aircraft power receptacle.
- To prevent damaging the HHGPS unit, the HHGPS must be turned off, or disconnect the power cord from the PLGR panel, prior to switching aircraft power sources.

NOTE

The HHGPS shares an antenna with the L-Band SATCOM. The L-Band SATCOM transceiver must be ON to enable the GPS to couple to the L-Band SATCOM/HHGPS antenna.

ADF SYSTEMS (ADF-73).

Two ADF systems are installed in the aircraft. The range is 190 to 1750 KHz. Each system provides both automatic and manual direction finding capability. Controls for the two ADF systems are located on the center console. ADF receivers 1 and 2 are installed in the overhead cargo compartment at FS 388.

ADF Controls.

The rotary band selector switch on the control panel is a three-position ("190-400", "400-840", "840-1750") switch that positions a shutter in the FREQUENCY indicator window to display the appropriate frequency markings. The TUNE knob positions the tape under the index mark on the window and tunes in the selected station. Exact station tuning is indicated by maximum needle deflection of the TUNE MAX indicator needle. The VOL control is a dual rotary control that provides a volume (VOL) control on the inner knob and "OFF", "ADF", "ANT", "LOOP", "TEST" operating functions on the outer dial. The "ADF" position selects the automatic direction finding function. The antenna system automatically locates the null position of the selected station and displays the radio bearing to the station on the BDHI system pointers. The "LOOP" selection on the switch provides for manual location of the null position using the LOOP switch on the control panel. The antenna null position is found by placing the LOOP switch to left ("L") or right ("R") until a null is found by a minimum deflection of the needle of the TUNE MAX indicator. The aircraft radio bearing to the station is displayed on the BDHI. Two nulls, 180 degrees apart can be obtained using "LOOP" selection. The "ANT" position does not provide directional information. When the function selector switch is positioned and held in the spring-loaded "TEST" position and the corresponding ADF is selected on either the pilot's or copilot's BDHI, the receiver can be tuned from one end of the band to the other. As a result, a relative bearing of 180 (±5) degrees should be displayed, except at multiples of 142.5 kilohertz, indicating that the ADF system is functioning satisfactorily. The VOICE - CW switch selects voice reception or CW signal reception.

BEARING DISTANCE HEADING INDICATOR (BDHI) SYSTEM (ID 798/ARN).

Three BDHI instruments provide displays of heading, bearing, and distance information from navigation systems installed on the aircraft. The indicators are mounted on the pilot's instrument panel, copilot's instrument panel, and the navigator's instrument panel. The BDHI displays are independent of other navigation system displays.

The heading source for the pilot's and copilot's BDHIs are cross cockpit; that is, the heading source selected on copilot's DAMU drives the pilot's BDHI and vice versa.

Bearing and distance information from other navigation systems are selected for display on the pilot's and copilot's indicators by switches on the BDHI Selector Panel. These assemblies are mounted above the pilot's and copilot's inboard display units (figure 1-236). The pilot's and copilot's BDHI No. 1 bearing pointer will indicate the bearing to a TAC-1 or -2, VOR-1 or ADF-1, depending upon the switch depressed. The No. 2 bearing pointer shows the bearing to ADF-2 or VOR-2, dependent on the switch selected. On the navigator's BDHI, the No. 1 bearing pointer displays TAC-2. The No. 2 bearing pointer displays VOR-2 or ADF-2 as selected on the INDICATOR SELECT panel mounted adjacent to the indicator. The distance indicator shows the distance in nautical miles to a selected TACAN station. The heading marker is set by the HEADING SET knob and rotates with the compass card after it has been set. The BDHI is provided with a power/signal inadequacy flag, which comes into view if the instrument loses power or the heading source is unreliable.

NOTE

After power transfers or transients, confirm BDHI source selection.

The BDHI bearing pointer select buttons are powered in the select position. When power is removed, depending on the duration of the power interrupt, they may revert to the non-selected position.

STANDARD CENTRAL AIR DATA COMPUTER (SCADC) SYSTEM.

Two independently operating SCADC systems are installed on the aircraft. Each SCADC receives pitot and static pressure from the pitot static system (figure 1-278) and outside temperature from an external probe. These primary inputs are processed by the computer and outputs are provided as electrical signals to the components listed on the following chart. No provision is made for switching the outputs of SCADC to furnish signals normally supplied by the other SCADC, except selection of the navigator's true airspeed indicator and IFF Mode C.

COMPONENT/SYSTEM	SCADC #1	SCADC #2
CDS		
DPU NO. 1	X	X
PILOT'S PFD	X	
ALTITUDE	X	
AIRSPEED	X	
MACH	X	
DPU NO. 2	X	X
COPILOT'S PFD		X
ALTITUDE		X
AIRSPEED		X
MACH		X
AFCS		
AFCP #1	X	X
AP #1	X	X
STALL WARN #1	X	X
AUTOTHROTTLE	X	X
R/G-A	X	X
AFCP #2	X	X
AP NO. 2	X	X
STALL WARN #2	X	X
AUTOTHROTTLE	X	X
R/G-A	X	X
AIR CONDITIONING	LEFT EJECTOR	RIGHT EJECTOR
IFF	IF SELECTED	IF SELECTED
ARTIFICIAL FEEL	X	COMPARATOR
RUDDER PRESSURE REDUCER	PRIMARY	SECONDARY
RUDDER OVER-PRESSURE WARNING	PRIMARY	SECONDARY
INS #1	X	
INS #2		X
GCAS	X	X
FMS	X	X

SCADC Test Switch. (See figure 1-235.)

Three-position (SELF-TEST, NORM, MON TEST) CENTRAL AIR DATA COMPTR toggle switches, one located on the pilot's side console and one on the copilot's side console, are used to test the operation of the SCADC system. The test circuits are interlocked through landing gear switches to prevent activation while in flight.

Upon initiation of test, red hatch marks are annunciated on the DU airspeed and altitude tapes and the Mach readout box turns red immediately.

When the switch is held in the SELF-TEST position, the corresponding PFD/SFD should display the following after no more than 150 seconds of testing:

NOTE

When the pilot's CADC switch is placed in the SELF-TEST position, GPWS INOP, TERRAIN INOP, and WINDSHEAR INOP annunciators will flash.

Altitude - 50,000 (±110) feet

Airspeed - 225 (±3.5) knots

Mach No. - 0.92 (±0.02 M)

True Airspeed (navigator's panel) - 527 (±5) knots

The corresponding EJECTOR ON light on the flight engineer's panel should extinguish at 0.3 (0.01) Mach.

The audible overspeed warning should sound at 0.825 (±0.01) Mach.

When the switch is held in the MON-TEST position, the corresponding PFD/SFD should annunciate red hatch marks on the airspeed and altitude tapes and the Mach readout box turns red.

MULTI-FUNCTION STANDBY INSTRUMENT (MFSI) SYSTEM.

UNIT	CIRCUIT BREAKER (BUS)
MFSI and ADU	MFSI SYS (EMERGENCY DC) MFSI-2 (BATTERY BUS)

The MFSI system is a 3-in-1 system that provides attitude, altitude, and airspeed indications on a single, Active Matrix Liquid Crystal Display (AMLCD). The system consists of an MFSI, an air data unit (ADU) and an MFSI SYS ON - OFF switch. The system is an independent system requiring only pitot and static pressure and 28 VDC. The MFSI system normally receives 28 VDC from the Emergency DC Bus through MFSI-SYS CB on the Emergency Power Circuit Breaker Panel. In the event of Emergency DC Bus power loss, the MFSI receives power from the battery bus. When Emergency DC bus power is restored, the MFSI again receives power from the emergency DC bus. The MFSI is installed in the pilots' center instrument panel (figure 1-154).

CAUTION

To prevent aircraft battery discharge, ensure that the MFSI SYS switch is in the OFF position when engines are shut down and no APU or external power is available.

Multi-Function Standby Instrument (MFSI).

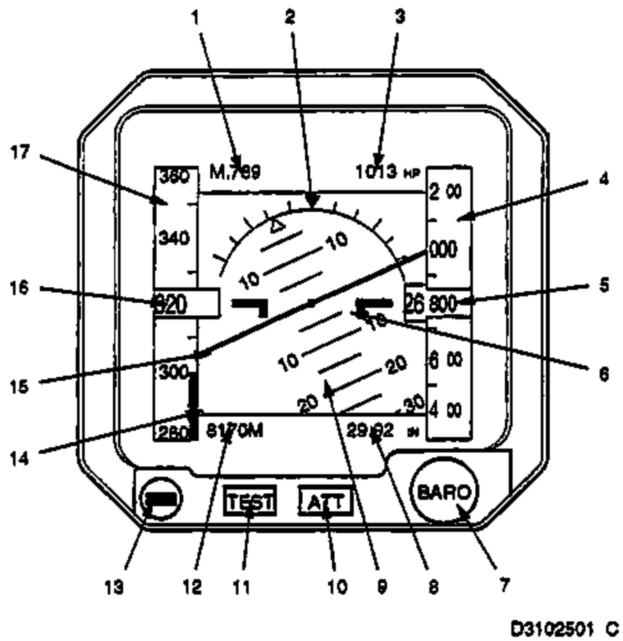


Figure 1-1B. MFSI

1. MACH NO. READOUT
2. BANK ANGLE SCALE
3. BAROMETRIC PRESSURE READING (HECTO PASCAL HP)
4. VERTICAL ALTITUDE SCALE
5. ALTITUDE READOUT
6. AIRCRAFT SYMBOL
7. BAROMETRIC PRESSURE SET KNOB
8. BAROMETRIC PRESSURE READING (INCHES)
9. PITCH LADDER
10. ATT SWITCH (CAGE)
11. TEST SWITCH (INITIATED BIT)
12. BAROMETRIC ALTITUDE IN METERS
13. LIGHT SENSOR
14. Vmo/Mmo WARNING INDICATION
15. HORIZON LINE
16. AIRSPEED READOUT
17. VERTICAL AIRSPEED SCALE

The MFSI is similar in format to the PFD. The display is NVIS compatible. The MFSI contains inertial sensors and a microprocessor that measures aircraft pitch and roll.

ATTITUDE DIRECTOR INDICATOR (ADI).

An ADI presentation is centered on the display. It has an instantaneous display range of 360° of roll and 50° pitch. The pitch scale is graduated in 5° intervals. The bank scale, displayed at the top, is graduated at 10°, 20°, 30°, 45°, and 60°.

ALTITUDE.

The altitude display is a "rolling digit" numeric display to the right of and centered on the ADI aircraft symbol. The numeric readout is supplemented by an altitude tape display. This tape has an instantaneous display of 1000 feet and is graduated in 100-foot increments. Altitude is also displayed in meters (bottom left) to a resolution of one meter.

BAROMETRIC SETTING.

The Barometric Datum is adjusted by the knob on the bottom right corner of the display bezel. Clockwise rotation of the knob increases the pressure setting. The setting is displayed simultaneously in both millibars (top right), and inches of mercury (bottom right) with a resolution of 1 mb and 0.01 in. Hg, respectively.

AIRSPEED/MACH NUMBER.

The indicated airspeed display is a "rolling digit" numeric display to the left of and centered on the ADI aircraft symbol. The numeric readout is supplemented by an airspeed tape display. This tape has an instantaneous display range of 80 knots and is graduated in 10 knot increments. The Mach No. is shown as a numeric display with a resolution of 0.001 in the top left section of the display.

MAXIMUM ALLOWABLE INDICATED AIRSPEED (VMO) AND MAXIMUM ALLOWABLE MACH (MMO).

Vmo is displayed as a red warning strip on the airspeed tape showing when the airplane is approaching its maximum airspeed. When Vmo is reached, the numerals on the numeric airspeed display turn red. When Mmo is reached, the numeric Mach No. display changes to red.

AIR DATA UNIT (ADU).

The ADU is located in the right hand avionics compartment and is connected to the copilot's side of the pitot-static system. The ADU provides the MFSI airspeed, altitude and mach number.

Multi-Function Standby Instrument (MFSI) System Operation.

BUILT-IN TESTS (BIT).

Power-on BIT (POBIT) is initiated at power-up only. POBIT confirms correct system function and is transparent to the pilots unless a failure is detected. Continuous BIT (C-BIT) is initiated after the successful completion of POBIT and runs until power is removed. C-BIT is transparent to the pilots. If the system detects a failure, the appropriate part of the display will be disabled and replaced with a failure annunciation. Failure annunciations are:

FAILURE	ANNUNCIATION
Attitude	ATTITUDE
Altitude	ALT
Airspeed	ASI
Mach	Mach Number is blanked and units displayed in red.
Baro Set	Barometric pressure readout is blanked and units are displayed in red.

When it is not possible to display an appropriate message, e.g., processor failure, the display backlight is disabled.

INITIATED BIT (IBIT).

IBIT is a maintenance test that is inhibited when aircraft speed is greater than 40 knots. This is done to prevent IBIT initiation in flight. The MFSI TEST pushbutton, in conjunction with the ATT pushbutton, activates IBIT. Release of the TEST pushbutton terminates IBIT. On termination of IBIT, the MFSI performs a cold start that takes three minutes.

INITIALIZATION.

Upon power application, the system enters an attitude initialization process indicated by the "Attitude Initializing" annunciation on the MFSI. The initialization period is approximately three minutes, with the unit maintained in the stable conditions as follows:

Roll Angle - Less than 7°

Pitch Angle - Less than 7°

Yaw Angle - Less than 2.5° in a 5-second period

If the operating conditions are outside the stable conditions, the initialization will halt until stable conditions are achieved. After satisfactory initialization, the standard display format will appear.

BARO SET KNOB.

The BARO SET knob is used to set the local barometric pressure. Turning the knob changes the barometric setting in millibars and in inches of mercury on the display.

ATT PUSHBUTTON.

The ATT pushbutton (caging) on the MFSI is used to align the display attitude. It is important to remember that after pressing the ATT switch, the display indication is oriented relative to the position of the unit and not necessarily to true, vertical earth axis.

CAUTION

In-flight caging must be done only when the airplane is known to be in straight and level, non-accelerating flight.

TEST PUSHBUTTON.

The TEST pushbutton on the MFSI is used in conjunction with the ATT pushbutton to activate IBIT.

LIGHT SENSOR.

The light sensor measures the ambient cockpit light. The MFSI uses the ambient light reading in conjunction with a reference provided by the PILOT'S SIDE CONSOLE switch to automatically adjust the display brightness.

CONTROL DISPLAY SYSTEM (CDS).

The CDS displays flight instrumentation, navigation information, warnings and cautions, and other aircraft system parameters in selectable formats. The CDS consists of system heat, system cooling, two Display Processor Units (DPUs), two Display Avionics Management Units (DAMUs), two Reference Set Panels (RSPs), a CDS Brightness Control, and four Display Units (DUs) (see figure 1-222).

CDS HEAT.

The DAMUs and DUs require heat at cabin temperatures below 32° F (0° C) to stabilize displays. These units contain heaters that require 28 VDC power to operate. Circuit breakers located on the Avionics Circuit Breaker panel supply DC power.

UNIT	CIRCUIT BREAKER (BUS)
PILOT'S DAMU	DAMU NO. 1 HTR (MAIN DC AVIONICS 2)
DU NO. 1	DU NO. 1 HTR (MAIN DC AVIONICS 1)
DU NO. 2	DU NO. 2 HTR (MAIN DC AVIONICS 2)
COPILOT'S DAMU	DAMU NO. 2 HTR (MAIN DC AVIONICS 1)
DU NO. 3	DU NO. 3 HTR (MAIN DC AVIONICS 1)
DU NO. 4	DU NO. 4 HTR (MAIN DC AVIONICS 2)

CDS COOLING SYSTEM.

The CDS cooling system provides forced air cooling to the DAMUs and DUs at cabin temperatures above 30 (±5) °F. The system consists of a fan selector/OFF switch, a primary fan, power relay and temperature sensor, a backup fan, power relay, temperature sensor, a duct pressure sensor switch, and associated ducting. The CDS COOLING - FAN NO. 1/OFF/ FAN NO. 2 switch is located on the control pedestal (see figure 1-156). Both temperature sensors are located below the instrument panel. Both fans and the pressure sensor are located in the nose compartment. Operating power is supplied by:

UNIT	CIRCUIT BREAKER (BUS)
FAN NO. 1	CDS FAN NO. 1 (EMER AC)
FAN NO. 2	CDS FAN NO. 2 (AVIONICS AC 1)
FAN CONTROL	CDS FAN CONT (EMER DC)

DISPLAY PROCESSOR UNIT (DPU).

UNIT	CIRCUIT BREAKER (BUS)
DPU NO. 1	DPU NO. 1/CBC (EMER DC)
	AHRS ATTD NO. 1 (AC NAV EXCITATION 1)
	AHRS ATT 2/RSP 1 & 2 EXC (26V EMER AC BUS A)
	MAG HDG INS-1 HDG NO. 3 & 5 (ISOL AC EXCITATION 1)
	INS-2/CADC-2 (AC NAV EXCITATION 2)
DPU NO. 2	DPU NO. 2 (MAIN DC AVIONICS 1)
	AHRS ATTD NO. 1 (AC NAV EXCITATION 1)
	AHRS ATT 2/RSP 1 & 2 EXC (26V EMER AC BUS A)
	IJB NO. 1 (AVIONICS AC 2)
	INS-2/CADC-2 (AC NAV EXCITATION 2)

The two DPUs process the flight instrumentation, navigation information, warnings and cautions, and other aircraft system parameters, and provide the outputs to the display units. The DPU allows each DU to have unique displays, as selected by the DAMUs. A partial or complete failure of any DPU will not disable any Display Unit, DAMU, or RSP. INS 1, TACAN 1, VOR/ILS 1, and ADF 1 are connected to DPU NO. 1. INS 2, TACAN 2, VOR/ILS 2, and ADF 2 are connected to DPU NO. 2. In the event of a total individual DPU failure, e.g., DPU NO. 1, both pilots will lose access to the INS 1, TACAN 1, VOR 1, and ADF 1, but they still have access to the systems connected to DPU NO. 2. The DPUs are located in the left-hand side of the Underdeck Avionics Rack (see figure 1-209). Normally, DPU NO. 1 is the bus controller. Should DPU NO. 1 fail, DPU NO. 2 automatically becomes the bus controller.

WARNING

Failure of both DPUs results in the loss of both DAMUs, the four DUs, the stall warning, and yaw damper system.

NOTE

After power transients, confirm DPU and NP selections.

DISPLAY AVIONICS MANAGEMENT UNIT (DAMU).

There are two DAMUs installed in the glare shield of the aircraft (see figure 1-223). The DAMU provides for selection of navigation aids, attitude and heading reference sources, and which Secondary Flight Display (SFD) page is displayed. In addition, it provides selection and control of the information to be displayed on the DUs. Each DAMU has two display screens, 16 line select keys (eight associated with the left screen and eight associated with the right screen), a BASIC Primary Flight Display (PFD) key, and an up/down brightness control rocker switch. This control allows each pilot to independently adjust the brightness of the DAMU ±25 percent. Operating power is supplied by:

UNIT	CIRCUIT BREAKER (BUS)
PILOT'S DAMU	DAMU NO. 1 (EMER DC)
	DAMU NO. 1 HTR (MAIN DC AVIONICS 2)
COPILOT'S DAMU	DAMU NO. 2 (MAIN DC AVIONICS 1)
	DAMU NO. 2 HTR (MAIN DC AVIONICS 1)

The BASIC PFD key places the display unit's PFD to the default configuration. Pressing the BASIC PFD key will result in the following:

1. Removal of flight path related symbology and transition to attitude reference symbology.

2. Removal of the airspeed and altitude digital readouts but retains the lubber line.

The CDS allows the pilot and copilot to independently exercise control over the configuration of their respective PFD pages through the pilot's or copilot's DAMU. In the event of a failure of a DAMU, the remaining DAMU provides the ability to control the configurations of both the pilot's and copilot's DU PFD and SFD pages by selecting the DAMU CNTRL on the Display Control Menu of the functional DAMU.

Each display can have up to 11 lines with 24 characters per line. The top line is the title/identifier line. The identifier shows which pilot's instruments the DAMU is controlling, P (pilot) or CP (copilot). The next eight lines display options. Each line is beside a corresponding line select key (LSK). The bottom two lines of both DAMUs left screens display WPT ALRT (WAYPOINT ALERT), VNAV ALERT, and/or CDU MSG. The bottom two lines of the pilot's right screen displays TAC 1 (TACAN 1), VOR 1, VHF 1, and frequencies when tuned. The bottom two lines of the copilot's right screen displays TAC 2 (TACAN 2), VOR 2, VHF 2, and frequencies when tuned. The DAMU uses menus to control the DU displays. Upon application of power to the CDS, the left DAMU screen will display the MAIN MENU and the right screen will display the STATUS MENU. The main menu provides access to the other CDS menus. The activation of a key on the MAIN MENU results in the selected menu appearing on the DAMU left screen, with the exception of the SKE menu, which will appear on the DAMU right screen. Figure 1-227 shows the CDS menu hierarchy.

The DAMUs control information displayed on the DUs, enable systems to drive the information displayed, and provide outputs to the AFCS to select navigation aids and drive the flight director system. The CDS also accepts inputs from the AFCS for setting markers and for displaying the autopilot modes on the DUs.

In the event of an in-flight DU failure, the CDS will implement automatic switching of the display pages to provide a PFD.

Through selections on either DAMU, the display pages may be rerouted to another functional DU. Upon restoration of power after a power failure, the display page location will be the same as before the power loss. The lighting will remain in the mode previously selected, either Normal or Night Vision Imaging System (NVIS).

CDS BRIGHTNESS CONTROL. (See figure 1-222.)

The CDS brightness control (CBC) has a pilot's DIM/BRT switch and a copilot's DIM/BRT switch. The pilot's and copilot's DIM/BRT switches control the brightness of the respective DAMU and DUs when in the normal lighting mode. Each switch has an OFF position at full counterclockwise that turns off the power to the appropriate DU and DAMU. This OFF function is only available on the ground. The CBC is installed in the center instrument panel.

REFERENCE SET PANEL (RSP).

UNIT	CIRCUIT BREAKER (BUS)
PILOT'S & COPILOT'S RSP	AHRS ATT 2/RSP 1 & 2 EXC (26V EMER AC BUS A)

The RSPs provide the pilot and copilot the ability to input reference values to the Automatic Flight Control System (AFCS) and the DUs PFD for selected heading, selected course, command altitude, command airspeed slew switches, barometric altimeter setting, alert altitude setting, and inhibit autothrottle speed trim. The RSPs are installed in the center console (see figure 1-222). Changing the Baro Reference, Command Airspeed, Command Altitude, Heading Select, and Course Select will only be displayed on the pilot's PFD that is making the adjustment. The Altitude Alert Set and Airspeed Trim settings change both positions simultaneously. The switches and their functions are as follows:

BARO SET Knob.

Pressing SET and then rotating the knob within 10 seconds sets Baro correction on PFD. Pressing SET again within 10 seconds will set the altimeter reference to 29.92 inches or 1013 millibars. If no action is taken within 10 seconds, the knob is inhibited. The pilot's knob adjusts the BARO setting on SCADC 1 Page 2 of the FMS. The copilot's knob also adjusts the BARO setting on SCADC 2 page 2 of the FMS.

A/S (AIRSPEED) TRIM Switch.

The A/S TRIM switch is a rocker type switch with + on the top and - on the bottom. When the command airspeed is slewed in the autothrottle mode, it trims the airspeed ±5 knots. When the command airspeed is slewed in the speed on pitch mode, it trims the airspeed ±25 knots.

A/S (CMD AIRSPEED SLEW) Switch.

Selects the command airspeed to be displayed on the associated PFD. Moving the switch sideways from center position will cause the airspeed command to be set to existing airspeed. The rate of change varies according to the length of time the switch is held in the decrease or increase position to allow for fine or gross changes.

ALT (CMD ALTITUDE SLEW) Switch.

Selects the command altitude to be displayed on the associated PFD. Moving the switch sideways from center position will cause the altitude command to be set to the alert altitude. To set the command altitude, press the center of the alt alert knob twice. The box around the command altitude numbers on top of the baro altitude scale will be highlighted. Rotate the alt alert knob to the desired altitude. Fine tuning may be accomplished by moving the toggle switch forward or aft.

HDG (HEADING SELECT) Knob.

Rotating the knob selects the heading on the associated HSI. Pushing the center of the knob will slew the heading bug to current heading.

CRS (COURSE SELECT) Knob.

Rotating the knob selects the course reference on the associated HSI. Pushing the center of the knob causes the course arrow to slew to bearing pointer 1 if pointer 1 is receiving a valid signal.

ALT ALERT (ALTITUDE ALERT) SET Knob.

Pressing SET and then rotating the knob within 10 seconds sets the FMS altitude alert and is displayed on both PFDs. Pressing SET a second time and then rotating the knob within 10 seconds sets the CMD altitude and command altitude marker on the PFD. If no action is taken within 10 seconds, the knob is inhibited.

ALT ALERT INHB (ALTITUDE ALERT INHIBIT) Pushbutton.

Pressing INHB causes the current or next altitude alert to be inhibited.

DISPLAY UNIT (DU).

There are four smart, multicolor, 6" x 8" active-matrix, liquid-crystal DUs installed in the main instrument panel of the aircraft. The DUs are powered as follows:

UNIT	CIRCUIT BREAKER (BUS)
DU 1	DU NO. 1 (MAIN DC AVIONICS 1) DU NO. 1 HTR (MAIN DC AVIONICS 1)
DU 2	DU NO. 2 (EMERGENCY DC) DU NO. 2 HTR (MAIN DC AVIONICS 2)
DU 3	DU NO. 3 (MAIN DC AVIONICS 1) DU NO. 3 HTR (MAIN DC AVIONICS 1)
DU 4	DU NO. 4 (EMERGENCY DC) DU NO. 4 HTR (MAIN DC AVIONICS 2)

Display Unit (DU) Brightness Control.

Each DU contains a BRT -/+ control. This control allows each pilot to independently adjust the brightness of the PFD and SFD ±25 percent from the setting selected on the CDS Brightness Control.

DUs display flight, navigation, caution and warning information to the aircrew. To provide this information, the CDS generates a PFD and an SFD page that are displayed on the DUs. The configuration of the flight display pages is controlled by the pilot's or copilot's DAMU. The DUs are numbered 1 through 4, from left to right, with default page displays as follows:

DU NO.	PAGE DISPLAY
1	Pilot's SFD
2	Pilot's PFD
3	Copilot's PFD
4	Copilot's SFD

PRIMARY FLIGHT DISPLAY (PFD).

The PFD page (see figures 1-224 and 1-225) consists of mode/status annunciator area, attitude director indicator (ADI) area; an airspeed indication area including Mach - airspeed indicator, altitude and vertical velocity indicator area; and a horizontal situation indicator (HSI) area with a course deviation indicator (CDI). They provide autothrottle/autopilot mode/status annunciations, heading, track, course, glide slope deviation, flight path angle, flight director steering, horizontal and vertical deviation, airspeed, altitude, velocity, mode annunciations, and bank scale. The following paragraphs explain each area displayed on the PFD.

Mode/Status Annunciator Area.

The top of the PFD is divided into five vertical segments of one or two rows. From left to right, they are: Autothrottle Mode (single row), Autopilot Arm Mode (double row), Roll Mode (double row), Pitch Mode (double row), and Autopilot Mode/Status (single row).

	ARM	AP/FD ROLL	AP/FD PITCH	
AT ARM	CAT I	ATT HLD	ATT	AP1 ON
AT SPD	ILS	HDG SEL	SOP	AP2 ON
AT FMS	LAND	HDG HLD	GS CAP	AP1 CWS
AT RTD	VOR	FMS	GS TRK	AP2 CWS
AT G/A	TAC	VOR CAP	FLARE	AP1 SPLIT
AT OFF	BCRS	VOR TRK	VNAV	AP2 SPLIT
	LOC	VOR STA	G/A	AWLS
	FMS	TAC CAP	T/O	AP OFF
		TAC TRK	ALT HLD	
		TAC STA	CWS	
		LOC CAP	VIAS	
		LOC TRK	VPATH	
		BCRS	VALT HLD	
		G/A	VALT CAP	
		T/O		
		CWS		

Attitude Director Indicator (ADI) Area.

The ADI portion of the PFD serves as an attitude indicator and provides computed steering information, radar altitude, and vertical deviation (glide slope or SKE). Fixed symbology consists of the outline of the ADI, dots, major, and minor roll tick marks. White dots are positioned clockwise, starting at the bottom of ADI at 45, 135, -45, and -135°. Major tick marks are positioned clockwise at 30, 60, 120, 150, 180, -150, -120, -60, and -30°. A bank pointer rotates about the center of the ADI as a function of roll. The horizon is positioned by signals from INS 1 or 2 or AHRS and is read relative to the fixed attitude marker (miniature aircraft) to display roll and pitch attitude of the aircraft. The flight director roll bar indicates the bank correction necessary to intercept and maintain a selected course or heading or SKE crosstrack deviation when in SKE mode. A portion of the pitch scale is displayed inside the ADI fixed symbology. The pitch reference scale has a range of +90 to -90° in 5-degree increments. The flight director pitch bar indicates the pitch correction necessary to maintain an ILS glide slope or flare path during an AWLS landing. The pitch bar is used in the rotation go-around mode to indicate a safe climb angle. The vertical deviation indicator presents aircraft displacement above or below an ILS glide slope.

DH/MDA (DECISION HEIGHT/MINIMUM DESCENT ALTITUDE) ANNUNCIATION.

DH or MDA is displayed top center of the ADI. DH annunciates when the glide slope is valid and MDA annunciates when the glide slope is invalid or not present.

MARKER BEACON ANNUNCIATIONS.

O (Outer Marker), M (Middle Marker), or I (Inner Marker) annunciates in top center of ADI (above MDA or DH) when the aircraft passes over the corresponding beacon transmitter.

MOVING CLIMB/DIVE MARKER.

The Moving Climb/Dive Marker symbol moves vertically within the ADI to indicate the flight path angle of the aircraft. When roll is zero, the flight path angle is read off the pitch scale. The symbol moves to the top of the ADI and flashes when its position is greater than 22.78° on the pitch scale.

REFERENCE FLIGHT PATH ANGLE.

The Reference Flight Path Angle symbol is displayed on the pitch scale to indicate the reference flight path angle as entered on the DAMU PFD page. It rotates as a function of roll angle with pitch scale. The Reference Flight Path Angle has a range of -9.9 to +9.95 with a resolution of 0.15.

RISING RUNWAY.

When the radar altimeter height reaches 180 feet, a rising runway symbol appears, then grows and ends up inside the fixed attitude marker when radar altimeter height is 0 feet. Lateral motion of the rising runway is a function of localizer and mirrors the position provided by the horizontal deviation.

AIRSPEED DEVIATION WORM.

The airspeed deviation worm grows out of the left end of the Fixed Attitude Marker to indicate the difference between command airspeed and computed airspeed. When the difference is positive, the worm is displayed above the reference to indicate that the aircraft is faster than commanded airspeed. The airspeed worm has a range of -25 to +25 knots. Each dashed line equals 5 knots.

GLIDE SLOPE ANNUNCIATIONS.

The glide slope scale is displayed to the left of the ADI when in AWLS mode and receiving a valid glide slope. A glide slope pointer moves vertically against the scale to indicate the magnitude and direction of deviation from the desired glidepath. When the glide slope pointer is aligned with the middle dot, the aircraft is on the glidepath. The glide slope pointer has a scale of -2.2 to +2.2 dots.

SKE MODE ANNUNCIATIONS.

When the SKE mode is selected, a SKE annunciation is positioned to the left and at the bottom of the flight director roll bar and moves with the bar. A SKE Relative Range Scale is displayed to the left of the ADI as scale for the

SKE Range Pointer. The SKE Relative Range Marker (aircraft pointer) moves vertically against the SKE Range Scale to indicate SKE range close - far. The position of the plane symbol at the center of the display indicates proper range to the lead aircraft. Too-close and too-far range is indicated by upward and downward movement respectively. Displayed on the right side of the ADI is a SKE Vertical Deviation Scale. A SKE Vertical Deviation Marker (diamond) moves vertically against the SKE Vertical Deviation Scale. Deviation above center indicates the aircraft is below the desired position in formation. The SKE Vertical Deviation Marker has a scale of -2 to +2 dots.

FMS VERTICAL DEVIATION POINTER.

The FMS Vertical Deviation Pointer indicates vertical deviation along the Vertical Deviation Scale on the right side of the ADI. It has a scale of -2.0 to +2.0 dots.

BOTH ATTITUDE ANNUNCIATORS.

BOTH (AHRS/INS 1/INS 2) is displayed to the lower left of the ADI to indicate when both pilots are using the same attitude source.

Airspeed Area.

The airspeed tape is centered on the left side of the ADI centerline and read under the fixed index line. Calibrated airspeed tape has a range from 0 to 500 knots with a display range of 100 knots (±50 knots from centerline). Major tick marks are displayed at every 20 knots and minor tick marks are displayed every 10 knots. Smaller numbers are at the top. A rolling drum type airspeed readout is positioned at the center of the airspeed tape. The readout has a range of 50 to 500 knots with a resolution of 1 knot. Additionally, an airspeed indicator bar is centered on the ADI centerline indicating current airspeed. The command airspeed marker will position itself over the value set in the command airspeed readout window, if that value is in view. The command airspeed marker symbol scrolls onto or off the display with the airspeed and overwrites the airspeed scale. The command airspeed slewing is set by moving the command airspeed slew switch on the RSP.

COMMAND AIRSPEED READOUT.

The Command Airspeed Readout is displayed above the airspeed tape and indicates the selected reference airspeed. It has a range of 70 to 500 knots with a resolution of 1 knot.

AIRSPEED CARET.

The Airspeed Caret symbol moves along the right inside of the airspeed tape, pointing toward the tape. It indicates the target airspeed whenever the autothrottles, speed on pitch, or VNAV are engaged. It has a range of 70 to 500 knots.

MACH READOUT.

The Mach Readout (below the Airspeed Tape) provides a digital readout of Mach numbers and warnings when the Mach limit is being reached. As Mach increases, the color of the display changes to indicate caution and warning conditions. The Mach Readout has a range of .001 to .999 Mach.

Altitude Area.

The Altitude Area of the PFD displays instantaneous vertical velocity, Baro altitude, and radar altitude.

VERTICAL VELOCITY ANNUNCIATIONS.

The Vertical Velocity Scale is displayed to the right of the ADI as a scale for the Vertical Velocity Indicator (VVI). The scale normally shows a range of ±1.5 x 1000 feet per minute (fpm), with numeric labels at 0 and 1 (x1000) fpm. Major ticks are at 0, .5, 1.0, and 1.5. Minor ticks are provided at every 100 fpm between 0 and ±1.5. A VVI grows out of the center of the vertical velocity scale. The VVI has a range of -1.5 (x 1000 fpm) to +1.5 (x 1000 fpm). When vertical velocity reaches + or -1500 fpm, a boxed 1.5 label is added to the top or bottom of the scale, respectively. As vertical velocity exceeds + or -1500 fpm, the digital readout in the box changes up to 9.9 x 1000 fpm to the nearest 100 fpm.

ALTITUDE ANNUNCIATIONS.

Baro Altitude Tape may be displayed in one of two formats: FT (feet) or MTRS (meters). The default mode is FT. Selection is made on the DAMU's left PFD MENU, SCALE - FT or MTRS. A FT or MTRS annunciator is positioned below the Baro altitude tape corresponding to the DAMU SCALE selection. The Baro altitude tape is positioned to the right of the Vertical Velocity Scale and the current altitude is centered on the ADI centerline. The altitude tape has a total range of -1,000 to 60,000 feet or -305 to 18,288 meters. It has a displayed range of 2,000 feet (±1,000 feet) or 700 meters (±350 meters). Major tick marks are displayed every 500 feet or 100 meters. Minor tick marks are displayed every 100 feet or 50 meters. A rolling drum type altitude readout is positioned at the center of the altitude tape. The readout has a range of -1,000 to 60,000 feet with a resolution of 20 feet in the FT mode, or -305 to 18,288 meters with a resolution of 10 meters in the MTRS mode. A baro altitude readout is centered on the ADI centerline, which indicates current altitude.

BAROMETRIC PRESSURE ANNUNCIATOR.

Barometric pressure may be displayed in one of two formats: IN (inches) or MB (millibars). The default mode is IN. Selection is made on the DAMU's left PFD MENU, BARO - IN or MB. The Barometric Pressure Annunciation appears under the FT or MTRS annunciator. The Barometric Pressure annunciator has a range of 28.00 to 31.00 IN with a resolution of .01 IN or 948 to 1049 MB with a resolution of 1 MB. A barometric (BARO) set knob is provided on the RSP to set the altimeter setting. By turning the BARO set knob, a corresponding change will be made on the altimeter scales.

WARNING

It is possible to set the altitude tape to FT and Barometric Pressure annunciation to MB, or the altitude tape to MTRS and Barometric Pressure annunciation to IN.

COMMAND ALTITUDE READOUT.

Command Altitude Readout is positioned above the altitude tape and displays the current command altitude. It has a range of -1,000 to 60,000 feet with a resolution of one foot.

COMMAND ALTITUDE MARKER.

The Command Altitude Marker indicates command altitude on the altitude tape. It has a range of –1,000 to 60,000 feet with a resolution of one foot in the FT mode, or -305 to 18,288 meters with a resolution of one meter in the MTRS mode. The command altitude slew switch is located on the RSP and its operation is similar to the airspeed slew switch (figure 1-222). Major command altitude settings are accomplished by pressing the center of the ALT ALERT SET knob twice to highlight the box around the numeric CMD ALT and then rotating the SET knob to the desired setting. If fine adjustments in the CMD altitude setting are required, move the SLEW switch forward or aft to increase or decrease the setting. The command altitude marker will be positioned over the altitude set in the altitude command readout window, if that altitude is in view on the altitude scale. If the set altitude is above or below the visible values, the command altitude marker will be positioned at the top or bottom of the scale, respectively. With an altitude set, any changes in flight altitude will cause the command marker to follow the set altitude as long as that value is visible on the scale. A side detent position on the altitude slew switch will cause the command altitude marker to align with the fixed index line.

RADAR ALTITUDE SCALE.

The Radar Altitude Scale is displayed on the Baro altitude tape when radar altitude is less than 1,000 feet (305 meters). The symbol rises with the tape as radar altitude decreases so the distance from the center of the tape to the top of this symbol represents the height above ground. The Radar Altitude tape has a range of 0 to 1,000 feet (0 to 305 meters).

NOTE

The meter and feet tape are scaled to display the same vertical distance; therefore, the radar altitude tape indication is valid irrespective of the altitude mode selected on the PFD.

RADAR ALTITUDE READOUT.

The Radar Altitude Readout is a boxed alphanumeric display below the barometric pressure annunciator. It provides a digital indication of AGL altitude. The default mode is FT. Selection is made on the DAMU's left PFD MENU, SCALE - FT or MTRS. The readout has a range of 0 to 5,000 feet with a resolution of one foot in the FT mode and 0 to 1524 meters with a resolution of one meter in the MTRS mode.

Horizontal Situation Indicator (HSI) Area.

The HSI portion of the PFD presents a graphic display of the aircraft heading and position relative to a selected heading or course and provides bearing, distance, and to-from information. The aircraft heading is displayed on the compass card and read under the upper lubber line.

HEADING READOUT.

The Heading Readout is a boxed display above the compass card with digits that scroll to the actual aircraft heading.

HEADING TYPE ANNUNCIATOR.

The Heading Type Annunciator is displayed to the right of the heading readout. The heading type annunciations are MAG, TRUE, or GRID.

TRACK ANNUNCIATOR.

The Track (TRK) Annunciator is displayed to the left of the heading readout when the HSI is in the track mode.

HORIZONTAL SITUATION - FIXED SYMBOLOGY AND COMPASS CARD.

The Horizontal Situation - Fixed Symbology consists of tick marks at 45, 90, 135, 180, 225, 270 and 315°, and a miniature fixed aircraft symbol. The fixed aircraft symbol overwrites the CDI when centered. The compass card overlays the fixed symbology and rotates to indicate aircraft heading or ground track at the top of the display. The HSI display is always displayed on both PFDs, and an expanded HSI display can be displayed on either or both SFDs.

HSI MODE	HEADING MODE	TOP OF COMPASS CARD
HDG	MAG	MAGNETIC HEADING
	TRUE	TRUE HEADING
	GRID	GRID HEADING
TRK	MAG	MAGNETIC HEADING + DRIFT ANGLE
	TRUE	TRUE HEADING + DRIFT ANGLE
	GRID	GRID HEADING + DRIFT ANGLE

BEARING POINTER NO. 1.

Bearing Pointer No. 1 indicates the bearing to the station selected on the DAMU's NAV SELECT, NAV PTR1 MENU. The input signal provides this information relative to the aircraft heading as follows:

NAV MODE	HSI MODE	BEARING
VOR 1 or 2, ADF 1 or 2, or TAC 1 or 2	HDG TRK	Relative Bearing to Selected Station
FMS 1, FMS 2	HDG	Drift Angle

BEARING POINTER NO. 2.

Bearing Pointer No. 2 indicates the bearing to the station selected on the DAMU's NAV SELECT PTR 2 MENU. The input signal provides this information relative to the aircraft heading.

COURSE ARROW WITH DEVIATION SCALE.

Direction and deviation from course is displayed against the Course Arrow and Deviation Scale. The scale consists of four dots that are arranged in a line that remains perpendicular to the Course Arrow. The arrow points to the selected course on the HSI scale. For radio NAV modes, this is the course entered using the RSP. For FMS NAV modes, this is the desired track as provided by the FMS. The symbol rotates about the HSI as follows:

NAV MODE	HSI MODE	ROTATION ANGLE
VOR 1 or 2, ILS 1 or 2, or TAC 1 or 2	HDG	SELECTED COURSE - MAGNETIC HEADING
VOR 1 or 2, or TAC 1 or 2	TRK	SELECTED COURSE - (MAGNETIC HEADING + DRIFT ANGLE)
FMS 1, FMS 2	HDG	SELECTED COURSE - TRUE HEADING
FMS 1, FMS 2	TRK	SELECTED COURSE - (TRUE HEADING + DRIFT ANGLE)
ILS 1, ILS 2	TRK	SELECTED COURSE - MAGNETIC

COURSE DEVIATION INDICATOR (CDI).

The CDI rotates with the course pointer inside the HSI and is offset to either side as follows:

1. For VOR 1, VOR 2, TAC 1, or TAC 2 NAV modes, the CDI lateral movement indicates 5° error per dot on the deviation scale.

2. For ILS 1 or ILS 2 LOC modes, the CDI lateral motion indicates deviation from the ILS course of 1/4 of the width of the localizer beam. Example: the localizer beam is 5° wide, full scale deflection is 2-1/2° and each dot is 1-1/4°.

3. For FMS 1 or FMS 2 NAV modes, the CDI lateral motion is a function of crosstrack from the FMS.

The CDI has a range of 2.2 dots on either side of center.

CDI SCALING READOUT.

When FMS is selected from the DAMU, the CDI scaling readout displays the deviation scale for the phase of flight. If the CDI is set to AUTO on the DAMU, the phase of flight is displayed without the CDI scaling readout. If the CDI scaling is manually selected on the DAMU, both phase of flight and CDI scaling are displayed. A two-dot deviation (in NM) is as follows:

PHASE OF FLIGHT	SCALING (NM)
ENR	4
TERM	1
NPA	0.3

NOTE

During FMS flight plan LZ and CARP operation, the CDI scaling automatically changes to NPA when the turn point is transitioned. During CARP, at the DZ Escape waypoint, the CDI reverts to ENR or TERM as appropriate.

CDI ACCURACY WARNING ANNUNCIATOR.

The CDI Accuracy Warning Annunciator (ACC) indicates that the current deviation scaling does not satisfy accuracy requirements. ACC annunciates in yellow across the HSI if the Estimated Horizontal Error (EHE) of the selected FMS navigation source exceeds the following tolerances:

PHASE OF FLIGHT	EHE
Enroute (ENR)	0.54 NM
Terminal (TERM)	0.27 NM
Non-Precision Approach (NPA)	0.054 NM

COURSE TO/FROM ARROW.

The To/From indicator is a triangle symbol that is in-line with the course arrow above or below the HSI aircraft symbol. When indicating a "to" condition, the triangle symbol points to the head of the arrow. When indicating a "from" condition, the triangle symbol points to the tail of the course arrow.

HEADING SET MARKER.

The Heading Set Marker symbol moves on the compass card to indicate the heading selected using the RSP.

HEADING/DRIFT ANGLE DIAMOND.

The Heading/Drift Angle Diamond indicates aircraft heading when the HSI is in the track mode.

GROUND TRACK CROSS.

The Ground Track Cross indicates the aircraft ground track when the HSI is in the heading mode. Rotation is equal to drift angle. The cross has a range of ±39.95 with a resolution of one degree.

AT OFF AND AP OFF ANNUNCIATORS.

The AT OFF or AP OFF annunciates when either the autothrottles or autopilot are disengaged. When both are disengaged, the annunciations alternate.

CDI SCALING ANNUNCIATOR.

When FMS navigation is selected, the CDI Scaling Annunciator indicates either En Route (ENR), Terminal (TERM), or Non-Precision Approach (NPA) modes.

BEARING POINTER NO. 1 DISTANCE READOUT.

Bearing Pointer No. 1 Distance Readout is displayed to the left of the HSI. It indicates distance to the selected navigational source or FMS waypoint. Distance No. 1 Readout has a range of 0.0 to 999.9 NM and 1000 to 9999 with a resolution of 0.1 NM below 1000 NM and 1 NM at 1000 NM and above.

BEARING POINTER NO. 1 IDENTIFIER.

The Bearing Pointer No. 1 Identifier symbol consists of a stationary picture Bearing Pointer No. 1 and an alphanumeric display below the pointer. The alphanumeric display consists of VOR1, VOR2, TAC1, TAC2, ADF1, ADF2, ILS1, ILS2, FMS1, or FMS2, as selected on the DAMU.

GROUND SPEED READOUT.

The Ground Speed Readout is displayed to the left of the HSI. It has a range of 1 to 999 knots with a resolution of one knot. Groundspeed readout is only displayed when a navigation source is selected on the INAV CTRL SOLN Page.

COURSE READOUT.

The Course Readout is displayed to the upper right of the HSI when the selected NAV mode is other than ADF1 or ADF2. It has a range of 000 to 359° with a resolution of one degree.

BEARING POINTER NO. 2 DISTANCE READOUT.

Bearing Pointer No. 2 Distance Readout is displayed to the right of the HSI. It indicates distance to the selected navigational source (TAC 1 or TAC 2). Distance No. 2 Readout has a range of 0.0 to 999.9 NM with a resolution of 0.1 NM.

BEARING POINTER NO. 2 IDENTIFIER.

The Bearing Pointer No. 2 Identifier symbol consists of a stationary picture Bearing Pointer No. 2 and an alphanumeric display below the pointer. The alphanumeric display consists of VOR1, VOR2, TAC1, TAC2, ADF1, or ADF2, as selected on the DAMU.

ALTITUDE ALERT READOUT.

The Altitude Alert Readout is displayed under the Bearing Pointer No. 2 Identifier. It is set using the ALT ALERT knob on the RSP. The readout has a range of –1,000 to 60,000 feet with a resolution of 100-feet. After the ALT ALERT is set, the CDS provides a 200-foot cruise altitude envelope above and below the selected cruise altitude, and a 1,000-foot pre-intercept envelope for selected target or fly-to altitude. If the aircraft leaves the cruise altitude envelope without changing the ALT ALERT setting, the CDS will provide a single tone beep and visual annunciation on both pilots' PFDs. The beep will be a 1,000-Hz tone for two seconds every 5 to 10 seconds, through the cockpit Ground Collision Avoidance System (GCAS) speaker until the envelope is reentered, a new altitude is selected, or the tone is manually inhibited through the RSP's ALT ALERT INHB switch. The pre-intercept envelope annunciation will beep when the aircraft passes through the 1,000-foot pre-intercept envelope during climb or descent. The tone will be activated for two seconds as the aircraft approaches the selected altitude. The 1,000-Hz tone is generated in the GCAS by a discrete pulse from the CDS DPU.

WARNING

Turning off or a failure of the radar altimeter will turn off GCAS audio, altitude alert, and intercept tones.

TAKEOFF Annunciator.

A take-off warning system monitors various systems in the aircraft to assure that they are in the normal condition prior to takeoff. The green TAKEOFF annunciator illuminates under the altitude alert readout.

Warning Annunciation.

In the CDS, the mechanical warning flags have been replaced by the following scheme: the DU screen is black (DU failure), symbology is not displayed, symbol turns red, and/or a failure message is on the Caution, Warning, Advisory (CWA) message section of the SFD. PFD valid/invalid annunciations are:

SYMBOL NAME			VALID COLOR	INVALID COLOR
ADI AREA				
ADI Fixed Symbology			White	Red
Bank Pointer			White	NA
Fixed Attitude Marker			White with black shadow	Red
Pitch Scale			White	NA
Flight Director Bank Steering Bar			Yellow	NA
Flight Director Pitch Steering Bar			Yellow	NA
Marker Beacon		-Outer	O-Cyan on black box	NA
		-Middle	M-Yellow on black box	
		-Inner	I-White on black box	
DH/MDA Annunciator			Yellow	NA
STALL Annunciator			Red	NA
Climb/Dive Marker			Black	NA
Reference Flight Path Angle			White	NA
Rising Runway (≤180 feet Radio Height)			White	NA
Airspeed Deviation Worm			White	NA
Glide Slope Scale			White	Red
Glide Slope Pointer			White	NA
SKE Mode Annunciator			Yellow	NA
SKE Relative Range Scale			White	Red
SKE Relative Range Marker			Yellow	NA
SKE Vertical Deviation Scale	SKE MODE	VERT. DEV. VALID		
	YES	YES	White	
	YES	NO		Red
	NO	YES	White	
	NO	NO		NA
SKE Vertical Deviation Marker			Yellow, Black Border	NA
FMS Vertical Deviation Pointer			White	NA
BOTH Annunciator			Yellow	
AIRSPEED TAPE AREA				
Airspeed Tape			White	Red Hatch Marks
Airspeed Readout			White	Red Box
Airspeed Indicator Bar			White	Red Hatch Marks
Command Airspeed Readout - Set			Magenta on Black background	
- Change			Magenta on White background	
Autothrottle Airspeed Caret			Magenta	NA
Mach Readout	≤0.78 Mach		White Readout, White Box	Red M, Red Box
	>0.78 Mach ≤0.80 Mach		Yellow Readout, Yellow Box	
	>0.80 Mach ≤0.825 Mach		Yellow Readout, Red Box	
	>0.825 Mach		Red Readout, Red Box	
ALTITUDE TAPE AREA				
Vertical Velocity Scale			White	Red
Vertical Velocity Readout			White	Red Hatch Marks

SYMBOL NAME		VALID COLOR	INVALID COLOR
Vertical Velocity Indicator		White	Red Hatch Marks
BARO Altitude Readout		White	Red Box
BARO Altitude Tape		White	Red Hatch Marks
BARO Altitude Indicator Bar		White	Red Hatch Marks
Feet/Meters Annunciator		White	Red
Barometric Pressure Annunciator		White	
Command Altitude Readout		Magenta	NA
Command Altitude Marker		Magenta	NA
Radar Altitude Indicator		White	NA
Radar Altitude Readout	-Valid	White	NA
	-Test	Red	
HSI AREA			
Heading Readout		White	Box only in Red
Lubber line		White	Red
Heading Type (MAG, TRUE, GRID) Annunciator		White	Red
Track (TRK) Annunciator		White	Red
Horizontal Situation - Fixed Symbology		White	Red
HSI Compass Card		White	NA
Bearing Pointer No. 1		Green	Red
Bearing Pointer No. 2		Cyan	Red (not displayed in ADF)
Course Arrow with Deviation Scale		Green	Red
Course Deviation Indicator		Green	Red
Course To/From Indicator		Green	NA
Heading Set Marker		Yellow	NA
Heading/Drift Angle Diamond		White	NA
Ground Track Cross		White	NA
AP OFF Annunciator		Flashing Red	NA
AT OFF Annunciator		Steady Red	NA
Distance No. 1 Readout		Green	NA
CDI Scaling Annunciator/Readout		Green	
CDI Accuracy Warning Annunciator (ACC)		Yellow	
Bearing Pointer No. 1 Identifier		Green	Red
Groundspeed Readout		White	GS in Red
Course Readout		Green	Red
Distance No. 2 Readout		Cyan	Red
Bearing Pointer No. 2 Identifier		Cyan	Red
Altitude Alert Readout	-Display Set	White numbers on Black background	
	-Altitude Change	White number on Black background with white box	
	-Altitude Alert	Red numbers on Black background	
	-Altitude Alert Inhibit	Black number on White background	
TAKEOFF Annunciator		Green	NA

SECONDARY FLIGHT DISPLAY (SFD).

The Secondary Flight Display (SFD) pages (figure 1-226) consist of three different navigation formats that are selectable through the DAMU. The different formats are: expanded HSI, map, and Station Keeping Equipment (SKE).

The SFD provides a Caution, Warning, and Advisory (CWA) area at the bottom of each display.

Common SFD Mode Annunciations.

SFD mode annunciations are similar to the PFD HSI annunciations (figure 1-226):

- CDI Accuracy Warning Annunciator (ACC)
- CDI Scaling Annunciator/Readout
- Course Arrow with Deviation Scale
- Course Deviation Indicator (CDI)
- Course Readout
- Course To/From Indicator
- Heading/Drift Angle Diamond
- Heading Readout and Heading Type (MAG, TRUE, GRID) Annunciator
- Heading Set Marker
- Horizontal Situation - Fixed Symbology and HSI Compass Card
- Ground Track Cross
- Groundspeed Readout
- Track (TRK) Annunciator

Unique SFD Expanded HSI Mode Annunciations.

BEARING POINTER.

The following bearing pointer information is displayed:

- Bearing Pointer No. 1 Distance and Bearing Pointer No. 2 Distance Readout.
- Bearing Pointer No. 1 Identifier and Bearing Pointer No. 2 Identifier
- Bearing Pointer No. 1 and Bearing Pointer No. 2

CROSS TRACK RANGE.

The Cross Track Range is an alphanumeric display in the lower left corner. It indicates the aircraft's horizontal deviation to the left or right of the desired track. The readout has two ranges: 0.0 to 9.9 NM and 10 to 199 NM with an accuracy of 0.1 NM for ranges below 10 NM and 1.0 for ranges at or above 10 NM.

DRIFT ANGLE.

The Drift Angle annunciation is an alphanumeric display representing left (L) or right (R) drift angle. It has a range of ±39.9° with a resolution of one degree.

ALTITUDE READOUT.

The ALT Readout displays baro-corrected altitude in feet or meters as selected on the DAMU. It has a range of -1,000 to 60,000 feet (-305 to 18,288 meters) with a resolution of 10 feet (10 meters).

STATIC AIR TEMPERATURE (SAT).

The SAT Readout displays static air temperature. It has a range of -100 to +50° C with a resolution of 1° C.

TRUE AIRSPEED (TAS).

The TAS Readout displays true airspeed. It has a range of 70 to 999 knots with a resolution of one knot.

WIND ARROW.

A Wind Arrow icon rotates relative to the aircraft heading to show relative wind direction.

WIND SPEED.

This is a numeric display of wind speed in knots. It has a range of 0 to 999 knots with a resolution of one knot.

Unique SFD MAP Mode Annunciations.

BEARING POINTER.

The following bearing pointer information is displayed:

- Bearing Pointer No. 1 Distance.
- Bearing Pointer No. 1 Identifier
- Bearing Pointer No. 1

ESTIMATED TIME ENROUTE (ETE).

The ETE display, located in the upper left corner, indicates the time remaining to the next waypoint or the drop zone, if the aircraft has sequenced the TP. The time counts down to the next waypoint. The ETE display has a range of 23:59:59 down to 00:00:00 with a resolution of one second.

MAP PARTIAL COMPASS CARD.

A partial compass card is displayed across the top of the display. Major tick marks are displayed every 10° with labels every 30°. Minor tick marks are displayed every 5°. The compass card rotates to indicate the aircraft heading or ground track according to HSI mode as follows:

HSI MODE	HEADING MODE	TOP OF COMPASS CARD
HDG	MAG	MAGNETIC HEADING
	TRUE	TRUE HEADING
	GRID	GRID HEADING
TRK	MAG	MAGNETIC HEADING + DRIFT ANGLE
	TRUE	TRUE HEADING + DRIFT ANGLE
	GRID	GRID HEADING + DRIFT ANGLE

MAP FIXED AIRCRAFT SYMBOL.

A fixed symbol serves as the center of the partial compass in Map mode.

MAP RANGE RINGS.

Four circles (or circular segments) represent equidistant ranges from the aircraft.

MAP RANGE RING LABELS.

The four range rings are labeled with the distance in nautical miles (NM); each ring represents the distance from the aircraft.

MAP SCALE	DISPLAY RANGE RING LABELS OF:
5	1, 2, 3, and 4
25	5, 10, 15, and 20
50	10, 20, 30, and 40
150	30, 60, 90, and 120
300	60, 120, 180, and 240

TACAN STATION.

The TACAN station icon represents the position and ICAO identifier of a TACAN station. The SFD/MAP display is capable of displaying up to five TACAN station icons. Each icon is positioned on the display based on MAP Scale, HSI mode, and computed distance to waypoint.

FLIGHT PLAN WAYPOINTS.

Flight Plan Waypoint icons are positioned on the display based on Map Scale, computed distance to waypoint, and aircraft heading and drift.

LNAV WAYPOINT ICONS.

Normal, Offset, CARP TP, CARP PI, TACAN, and Runway waypoint icons may be displayed on the SFD in the MAP mode. Normal waypoints are displayed with up to a 5-character identifier. Up to 15 offset waypoints may be displayed as part of the offset flight plan with the added capability to display the first three original waypoints. **xxxxx⊘** identifies an offset waypoint. □**xxxxx** identifies a CARP TP and Δ**xxxxx** identifies a CARP PI. A TACAN waypoint is identified by a ⬡ **xxxxx**. ||**xxxxx** identifies a runway waypoint.

VNAV WAYPOINT ICONS.

Three VNAV waypoint icons may be displayed on the SFD in the MAP mode. TOC ○ identifies a Top-of-Climb waypoint, TOD ○ identifies the Top-of-Descent, and BOD ○ identifies Bottom-of-Descent.

COURSE LINES.

The straight line path is drawn between waypoints. The line segments are clipped by the edge of the map.

ESTIMATED TIME OF ARRIVAL (ETA).

The ETA display, located in the upper left corner, indicates the time of arrival at the next waypoint or the DZ, if the aircraft has sequenced the TP. The ETA display has a range of 00:00:00 to 23:59:59 with a resolution of one second.

SKE ANNUNCIATOR.

SKE is displayed to annunciate SKE selected for the AP/FD mode.

SKE ZONE MARKER ANNUNCIATOR.

ZM annunciates when zone marker is selected on the DAMU.

SKE Mode Page.

The SFD-SKE page displays Intraformation Positioning System (SKE) information and is a repeat of the SKE representation at the multi-function display. Both displays are controlled by the Display Interface Control Unit (DICU), provided the SKE Primary Control is in the XMIT mode.

UNIQUE SFD SKE MODE ANNUNCIATIONS.

LEADER AIRCRAFT. The Leader Aircraft icon (open circle with center dot) represents the position of the leader aircraft. The SFD/SKE page displays a single leader aircraft icon with its position based on the aircraft's vertical and horizontal position.

FOLLOWER AIRCRAFT. The Follower Aircraft icon (open square with center dot) represents the position of up to 36 follower aircraft. The SFD/SKE page displays the icons with their position based on the aircraft's vertical and horizontal position.

SKE OWN AIRCRAFT. The SKE Own Aircraft symbol is displayed in the center of the SKE rings indicating own aircraft.

MIX ANNUNCIATOR. MIX annunciates in white above the SKE Zone Marker indicating that the Zone Marker is updating the INS navigation solution.

SKE RANGE RINGS.

Centered - Four circles (or circular segments) representing equidistant ranges from the aircraft.

Up - Six proportionally spaced circles (or partial circles) centered 25% down from the top of the SKE presentation.

Down - Six proportionally spaced circles (or partial circles) centered 75% down from the top of the SKE presentation.

SKE RANGE READOUT. A numeric display represents the SKE range (x 1000) that corresponds to the number of feet between rings. The maximum range varies depending on where the Own Aircraft symbol is on the SFD (for SKE Up, Down, and Center).

SKE RANGE SCALE	DISPLAY
1000	1
2000	2
4000	4
8000	8
16000	16

SKE CAUTION ANNUNCIATOR. CAUTION annunciation indicates a SKE fault condition.

PROXIMITY WARNING (PROX) ANNUNCIATOR. PROX annunciates to indicate a SKE proximity warning.

PROXIMITY WARNING LINE. The Proximity Warning Line is a flashing line from the center of the SKE rings (own aircraft symbol) through the offending aircraft symbol to the outer SKE ring.

SKE TEST ANNUNCIATOR. TEST annunciates on the left side of the SFD when SKE BITE is selected on the Navigator's SKE Control Panel.

MASTER ANNUNCIATOR. "M" symbol displays to indicate your aircraft is designated as the master.

MASTER LOST (M/L) ANNUNCIATOR. M/L annunciates to indicate SKE master lost.

SFD Warning Annunciation.

In the CDS, the mechanical warning flags have been replaced by the following scheme: the DU screen is black (DU failure), symbology is not displayed, symbol turns red, and/or a failure message is on the Caution, Warning, Advisory (CWA) message section of the SFD. SFD valid/invalid annunciations are:

SYMBOL NAME	VALID COLOR	INVALID
UNIQUE SFD EXPANDED HSI MODE ANNUNCIATIONS		
Drift Angle	White	No Display
Altitude Readout	White	No Display
Static Air Temperature (SAT)	White	No Display
True Airspeed (TAS)	White	No Display
Wind Arrow Icon	White	No Display
Wind Speed	White	No Display
UNIQUE SFD MAP MODE ANNUNCIATIONS		
Estimated Time Enroute (ETE)	White	No Display
Map Partial Compass Card	White	No Display
Map Fixed Aircraft Symbol	White	
Map Range Rings	Green	No Display
Map Range Ring Labels	Green	No Display
TACAN Station Icon	White	No Display
Flight Plan Waypoints	White	No Display
Course Lines	White	No Display
Estimated Time of Arrival (ETA)	White	No Display
SKE Zone Maker	Green	No Display
UNIQUE SFD SKE MODE ANNUNCIATIONS		
SKE Annunciator	Cyan	
Leader Aircraft	Yellow	No Display
Follower Aircraft	Yellow	No Display
SKE Own Aircraft	Cyan	
Mix	White	No Display
SKE Range Rings	Range Ring in White	NO SKE DATA
SKE Range Readout	White	
SKE Caution Annunciator	CAUTION in Yellow	No Display
Proximity Warning Annunciator	PROX in Magenta	No Display
Proximity Warning Line	Flashing Line in Magenta	No Display
SKE Test Annunciator	TEST in White	No Display
Master Annunciator	White M	No Display
Master Lost Annunciator	M/L in Magenta	No Display

Cautions, Warnings, and Advisories (CWA) Area.

The bottom of the SFD page is dedicated for display of caution, warning, and advisory (CWA) information. This area is reserved for CWA information regardless of the SFD page selected. Major failures which result in the display of a CWA will also cause the Master Caution light to illuminate. The CWA will flash until the Master Caution light is pressed and then it will illuminate steady. The SFD has room for 18 messages. The most recent CWA is displayed in the upper left position, with previous CWAs progressing (in chronological order) to the right and down. All CWAs remain annunciated until either the failure is corrected, failed unit is turned off, the navigational function that failed is deselected on the DAMU, or CWA - OFF is selected on the DAMU. When CWA - OFF is selected on the DAMU, CWA will be displayed. If a new message is received when CWA - OFF is selected, the new message and all previous messages will be displayed. CWAs and their cause(s) are:

CWAs	CAUSES
GS 1, 2, or 1/2	Glide slope 1, 2, or both signals not present. Activates Master Caution Indicator.
LOC 1, 2, or 1/2	Localizer 1, 2, or both signals not present. Activates Master Caution Indicator.
VOR 1, 2, or 1/2	No VOR 1, 2, or 1/2 signals.
TACAN 1, 2, or 1/2	No TACAN 1, 2, or 1/2 signals.
AFCP 1, 2, or 1/2 FAIL	Indicates a failure of AFCP 1, 2, or both 1 and 2. Activates Master Caution Indicator.
AP 1, 2, or 1/2 FAIL	Indicates a failure AP 1, 2, or both 1 and 2, AFCP OK. Activates Master Caution Indicator.
AP TRIM FAILURE	Indicates a failure of the Autopilot Trim function in the AFCP when AP is engaged. Activates Master Caution Indicator.
AT FAIL	Indicates a failure of Autothrottle function in an AFCP. Activates Master Caution Indicator.
CDS AIR FAIL	Loss of CDS cooling air to DAMUs and DUs (CDS cooling Fan 1 or Fan 2 failure). Activates Master Caution Indicator. **NOTE** During abnormal operation (aircraft unpressurized above 20,000 feet) CDS AIR FAIL may annunciate due to the decrease in air density. If fan noise can be heard, reset Master Caution and continue operation.
CWA	Indicates that the CWA message display has been turned off and valid messages exist.
DAMU 1/2 FAIL	Indicates a failure of the pilot's, copilot's, or both DAMUs.
DU 1/2/3/4 FAIL	Indicates a failed DU or combination of failed DUs.
DPU NO. 1, 2 or 1/2 FAIL	Indicates a failure of Display Processor 1, 2, or both 1 and 2. Activates Master Caution Indicator.
PFD REPEAT	PFD repeat is active on either pilot's or copilot's side.
RAD ALT FAIL	Indicates a failure of the CARA. Activates Master Caution Indicator if CARA fails after LOC or GS capture.
SFD REPEAT	SFD repeat is active on either pilot's or copilot's side.
SKE FAIL	Indicates a failure of the SKE function, if selected.
STALL 1, 2, or 1/2 FAIL	Loss of the stall warning function within AFCP 1, 2, or both 1 and 2. Activates Master Caution Indicator.
INS 1 ATT, INS 2 ATT, AHRS ATT	Indicates that attitude fails the DPU or AFCP validity test (comparisons, validity reasonableness). Activates Master Caution Indicator.
YAW DAMP FAULT	Indicates a failure of one yaw damper mode. Activates Master Caution Indicator.
YAW DAMP INOP	Indicates a failure of both yaw damper modes. Activates Master Caution Indicator.
NP 1/2 FAIL	Navigation Processor 1/2 has failed.
CDU 1/2/3 FAIL	The Navigation Processors can no longer communicate with MFCDU 1/2/3 and, therefore, the MFCDU(s) will no longer display.
DPU 1 LINK FAIL	DPU 1 is no longer responding to NP 1. DPU 1 might still be accepting data, but it is more likely that this is a Comm NAV 1553 bus failure.
DPU 2 LINK FAIL	DPU 2 is no longer responding to NP 2. DPU 2 might still be accepting data, but it is more likely that this is a Comm NAV 1553 bus failure.
TAC 1/2 FAIL	TACAN 1 or 2 is reporting to the NP that some portion of its data is invalid.
RAIM 1/2 ALERT	The GPS 1/2 RAIM function has detected a problem with the GPS Navigation solution. NP 1 or 2 will throw out GPS as an input to its KNS solution. The operator can still select GPS 1 or 2 as the NP's NAV source.
RAIM 1/2 UNAVL	The current satellite geometry detected by EGR 1 or 2 does not support RAIM. At least 5 satellites must be available.
NO SPOOF 1/2	GPS 1/2 has detected that SPOOF protection is not available. This is because the receiver is not keyed or because SPOOF protection has been turned off.

CONTROL DISPLAY SYSTEM OPERATION.

System Interface.

The CDS interfaces with the following aircraft systems: Automatic Flight Control System (AFCS), Standard Central Air Data Computer System (SCADC), Attitude and Heading Reference System (AHRS), Glide Slope System, Marker Beacon System, IFF System, Inertial Navigation System (INS), Automatic Direction Finder (ADF), VHF Navigation System, TACAN System, Station Keeping Equipment (SKE), Flight Management System (FMS), plus other miscellaneous aircraft systems by means of analog and discrete inputs and outputs and dual-redundant, MIL-STD-1553 data buses (primary/secondary CDS Bus and primary/secondary Comm/Nav Bus).

CDS Cooling System Operation.

When CDS Cooling Fan Select Switch is in either No. 1 or No. 2 position and the cockpit temperature is above 30 (±5)° F, the selected fan provides cooling air to the DAMUs and DUs. If CDS Cooling Fan Select Switch is in the OFF position or the selected fan fails, CDS AIR FAIL annunciates on both SFDs. In flight, the MASTER CAUTION indicator also illuminates. Either pilot can manually set the switch to the desired position. If the temperature in the cockpit drops below 15 (±5)° F, the selected fan automatically turns off. When the fan is automatically turned off, no fan failures are annunciated.

CAUTION

The DUs and DAMUs are specified to work up to 131°F. If cooling air is disrupted and the units operating temperature exceeds 131°F, they are subject to fail.

The CDS has three modes of operation: power-up, normal operation, and test mode.

Power-up Mode.

The Power-up Mode occurs immediately following application of power to the CDS. During this mode, the CDS performs a power-on Built-In Test (POBIT). The POBIT is performed every time that power is applied to the system, providing that power has been removed for more than one second. The on-ground POBIT tests all LRUs and interfaces and is completed in less than 60 seconds. The in-flight POBIT is abbreviated and takes less than five seconds to complete. After successfully completing POBIT, the CDS will automatically advance to the Normal Operation Mode. The DAMUs default to the MAIN MENU (left screen) and STATUS (right screen) displays. DUs default as follows:

DU NO.	DISPLAY PAGE
1	Pilot's SFD HSI display.
2	Pilot's PFD with the following settings: Altitude in feet (FT) Barometric readings in inches (IN) ADI in attitude format HSI in heading (HDG)
3	Copilot's PFD with the following settings: Altitude in feet (FT) Barometric readings in inches (IN) ADI in attitude format HSI in heading (HDG)
4	Copilot's SFD with HSI display.

Normal Operation Mode.

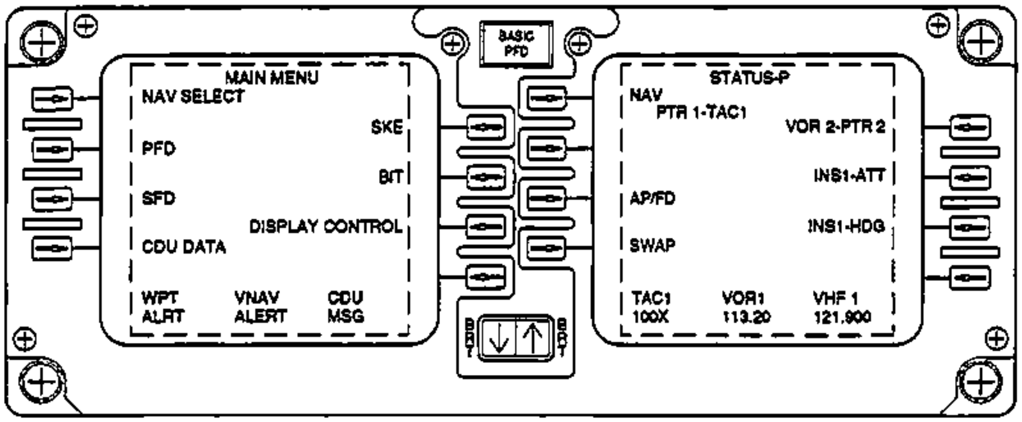
The Normal Operation Mode is the basic operating mode for the CDS. This mode is entered from the Power-up Mode automatically, or upon exiting from the test mode. During the Normal Operation Mode, the CDS performs its functions of disply and control. To chnage a default display or configure the CDS for a particular mission profile, start at he DAMU main menu. Menu hierarchy is shown in figure 1-227. To select a desired option, press the associated Line Select Key (LSK). LSKs 1, 3, 5, and 7 (⇒) are located on the left side of the screen and LSKs 2, 4, 6, and 8 (⇐) are located on the right side.

NOTE

- Pressing left screen LSK 8 when MAIN is displayed adjacent to the key causes the left screen to return to the MAIN MENU and the right screen returns to the STATUS display.
- If NAV PTR 1 screen was selected from the STATUS screen, to return to the STATUS screen press any key other than LSK 2, 4, or 8 on the left screen and then LSK 8 on the right screen, or press left LSK 2 and then right screen LSK 8.

Typical menu and submenu options are depicted in figures 1-2 through 1-20 as follow:

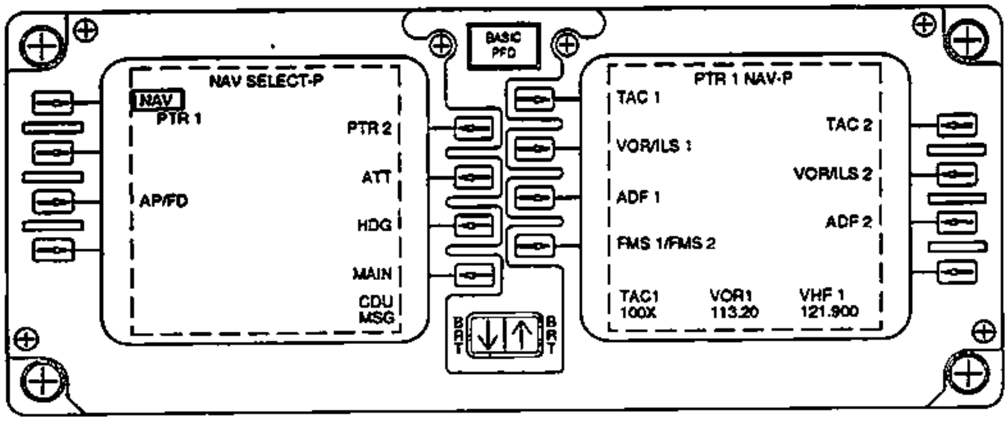
DAMU (TYPICAL)
MAIN MENU (LH SCREEN) - STATUS (RH SCREEN)



F1018901

MAIN MENU (LEFT SCREEN)			STATUS (RIGHT SCREEN)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**OPTION**	**STATUS/ACTION/RESULTS**
1	NAV SELECT	Pressing LSK 1 selects the NAV SELECT menu on the left screen (see NAV SELECT MENU).	1	NAV PTR 1 -	Shows NAV source assigned to pointer 1. Pressing LSK 1 selects the NAV PTR 1 menu on the right screen.
2	SKE	Pressing LSK 2 selects the SKE menu display on the right screen (see SKE MENU).	2	- PTR 2	Shows NAV source assigned to pointer 2. Pressing LSK 2 selects the PTR 2 menu on the right screen.
3	PFD	Pressing LSK 3 selects the PFD menu on the left and right screens (see PFD MENU).	3		(NOT ASSIGNED)
4	BIT	Pressing LSK 4 selects the BIT menu display on the left and right screens (see BIT MENU).	4	- ATT	Shows CDS attitude source. Pressing LSK 4 selects the ATT menu on the right screen.
5	SFD	Pressing LSK 5 selects the SFD menu displayed on the left and right screens (see SFD MENU).	5	AP/FD -	Shows AP or FD Mode. Pressing LSK 5 selects the AP/FD menu on the right screens.
6	DISPLAY CONTROL	Pressing LSK 6 selects the DISPLAY CONTROL menu display on the left screen (see DISPLAY CONTROL MENU).	6	- HDG	Shows CDS heading source. Pressing LSK 6 selects the HDG menu on the right screen.
7	CDU DATA	Pressing LSK 7 results in the FMS/ AIR DATA being displayed on the left DAMU screen.	7	SWAP	Pressing LSK 7 toggles between PTR1 and PTR2 selections. Does not cause a lower level menu to be displayed.

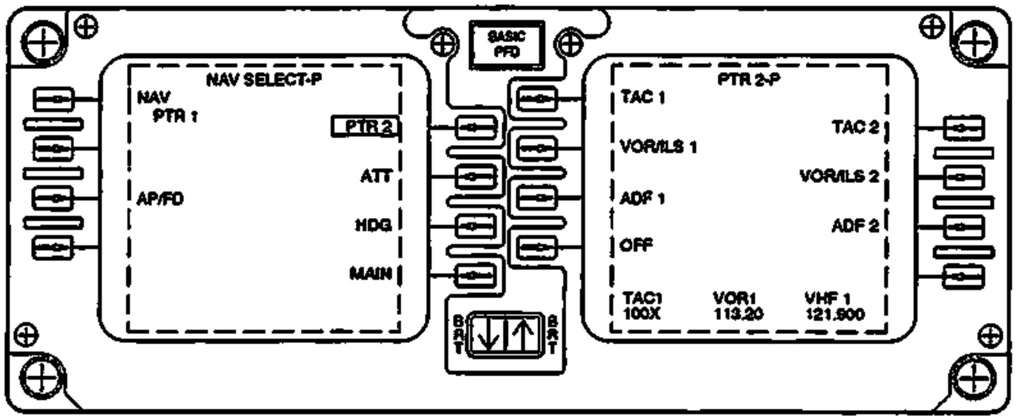
Figure 1-2. DAMU MAIN MENU (Left Screen) - Status (Right Screen)



D3095201 F

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**PTR 1**	**ACTION/RESULTS**
1	NAV PTR 1	Pressing LSK 1 causes the right display to display the PTR 1 source select submenu.	1	TAC 1	Pressing LSK 1 selects TACAN 1 as the source for PTR 1. PFD and SFD annunciate TAC 1 in green when the signal is valid or red if invalid.
			2	TAC 2	Pressing LSK 2 selects TACAN 2 as the source for PTR 1. PFD and SFD annunciate TAC 2 in green when the signal is valid or red if invalid.
			3	VOR/ILS 1	Pressing LSK 3 selects VOR/ILS 1 as the source for PTR 1. PFD and SFD annunciate VOR 1 or ILS 1 green when the signal is valid or red if invalid.
			4	VOR/ILS 2	Pressing LSK 4 selects VOR/ILS 2 as the source for PTR 1. PFD and SFD annunciate VOR 2 or ILS 2 in green when the signal is valid or red if invalid.
			5	ADF 1	Pressing LSK 5 selects ADF 1 as the source for PTR 1. PFD and SFD annunciate ADF 1 in green when the signal is valid or red if invalid.
			6	ADF 2	Pressing LSK 6 selects ADF 2 as the source for PTR 1. PFD and SFD annunciate ADF 2 in green when the signal is valid or red if invalid.
			7	FMS 1/FMS 2	Pressing LSK 7 toggles the selection between FMS 1 and FMS 2 as the source for PTR 1. FMS 1 will be the initial selection on the pilot's side and FMS 2 will be the initial selection on the copilot's side.
8	MAIN	Pressing LSK 8 returns the left screen to the MAIN MENU and the right screen to the STATUS menu.	8	BLANK/ STATUS	When PTR 1 is selected from the NAV SELECT menu, LSK 8 will be blank. If PTR 1 is selected from the STATUS menu, then STATUS will be displayed. Pressing LSK 8 when STATUS is displayed returns the operator to the STATUS menu.

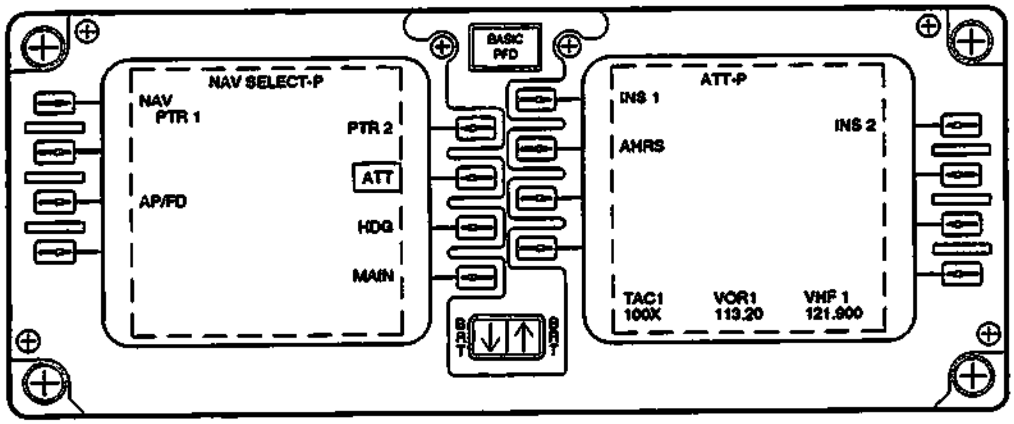
Figure 1-3. DAMU NAV SELECT Menu (Left Screen) - PTR-1 Menu (Right Screen)



D3095301 E

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**PTR 2**	**ACTION/RESULTS**
2	PTR 2	Pressing LSK 2 causes the right display to display the PTR 2 source selected submenu.	1	TAC 1	Pressing LSK 1 selects TACAN 1 as the source for PTR 2. PFD and SFD annunciate TAC 1 in cyan when the signal is valid or red if invalid.
			2	TAC 2	Pressing LSK 2 selects TACAN 2 as the source for PTR 2. PFD and SFD annunciate TAC 2 in cyan when the signal is valid or red if invalid.
			3	VOR/ILS 1	Pressing LSK 3 selects VOR 1 as the source for PTR 2. PFD and SFD annunciate VOR 1 or ILS 1 cyan when the signal is valid or red if invalid.
			4	VOR/ILS 2	Pressing LSK 4 selects VOR 2 as the source for PTR 2. PFD and SFD annunciate VOR 2 or ILS 2 in cyan when the signal is valid or red invalid.
			5	ADF 1	Pressing LSK 5 selects ADF 1 as the source for PTR 2. PFD and SFD annunciate ADF 1 in cyan when the signal is valid or red if invalid.
			6	ADF 2	Pressing LSK 6 selects ADF 2 as the source for PTR 2. PFD and SFD annunciate ADF 2 in cyan when the signal is valid or red if invalid.
			7	OFF	Pressing LSK 7 toggles PTR 2 OFF.
8	MAIN	Pressing LSK 8 returns the left screen to the MAIN MENU and the right screen to the STATUS menu.	8	BLANK/ STATUS	When PTR 2 is selected from the NAV SELECT menu, LSK 8 will be blank. If PTR 2 is selected from the STATUS menu, then STATUS will be displayed. Pressing LSK 8 when STATUS is displayed returns the operator to the STATUS menu.

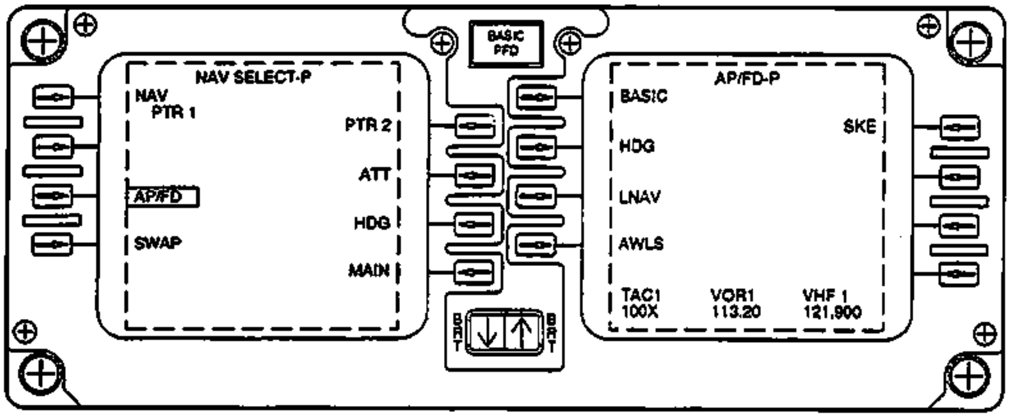
Figure 1-4. DAMU NAV SELECT Menu (Left Screen) - PTR-2 (Right Screen)



D3095401 E

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**ATT**	**ACTION/RESULTS**
4	ATT	Pressing LSK 4 causes the right display to display the ATT source select submenu.	1	INS 1*	Pressing LSK 1 selects INS 1 as the source for Attitude Data for the ADI.
			2	INS 2*	Pressing LSK 2 selects INS 2 as the source for Attitude Data for the ADI.
			3	AHRS*	Pressing LSK 3 selects AHRS as the source for Attitude Data for ADI.
				NOTE:* If both pilots select the same ATT source, BOTH INS1, BOTH INS2, or BOTH AHRS annunciates to the lower left of the ADI in amber.	
8	MAIN	Pressing LSK 8 returns the left screen to the MAIN MENU and the right screen to the STATUS menu.	8	BLANK/ STATUS	When ATT is selected from the NAV SELECT menu, LSK 8 will be blank. If ATT is selected from the STATUS menu, then STATUS will be displayed. Pressing LSK 8 when STATUS is displayed returns the operator to the STATUS menu.

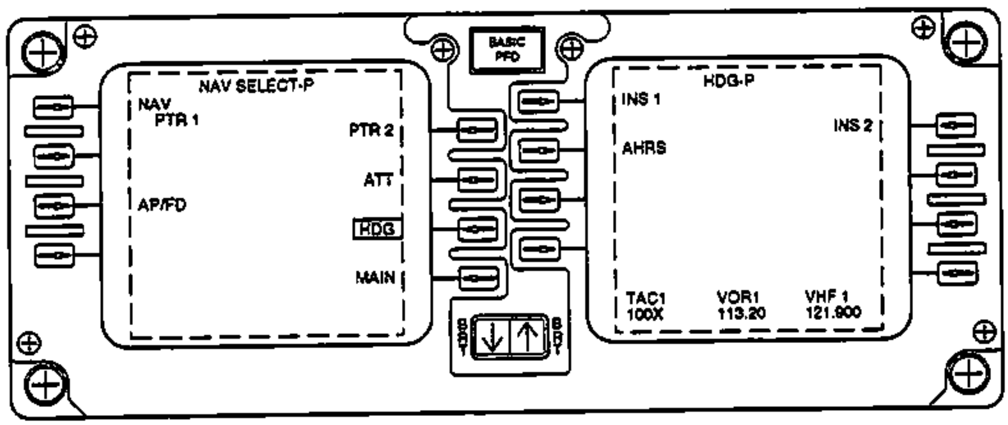
Figure 1-5. DAMU NAV SELECT Menu (Left Screen) - ATT (Right Screen)



D3095501 F

DAMU Left Display option and associated Line Select Key (LSK)			**DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)**		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**ATT**	**ACTION/RESULTS**
5	AP/FD	Pressing LSK 5 causes the right display to display the AP/FD source select submenu.	1	BASIC	Pressing LSK 1 causes the autopilot to revert to the basic mode (maintains current pitch and roll), default mode when engaged, and turns steering bars off, except in SKE mode (only roll bar is displayed).
			2	SKE**	Pressing LSK 2 provides SKE output to flight director roll steering, replaces the pilot's and copilot's SKE select switch, causes the SKE Range Scale to appear on the left side of the ADI, and causes the SKE Altitude Scale to appear on the right side of the ADI. SKE is annunciated on PFD in amber and on SFD in white.
			3	HDG	Pressing LSK 3 causes the Flight Director/ Autopilot to provide roll steering commands. Heading Set Marker is set on the Reference Set Panel.
			5	LNAV**	Pressing LSK 5 causes the autopilot to guide the airplane to intercept and track the course displayed on the CDI. If an ILS frequency is selected, the ADI will not display glide slope and pitch steering data.
			7	AWLS**	Pressing LSK 7 causes the autopilot to guide the airplane to intercept and track the course and glide slope displayed.
				NOTE:** SKE can only be selected when in BASIC or HDG mode. If in SKE mode, AWLS and LNAV cannot be selected.	
8	MAIN	Pressing LSK 8 returns the left screen to the MAIN MENU and the right screen to the STATUS menu.	8	BLANK/ STATUS	When AP/FD is selected from the NAV SELECT menu, LSK 8 will be blank. If AP/FD is selected from the STATUS menu, then STATUS will be displayed. Pressing LSK 8 when STATUS is displayed returns the operator to the STATUS menu.

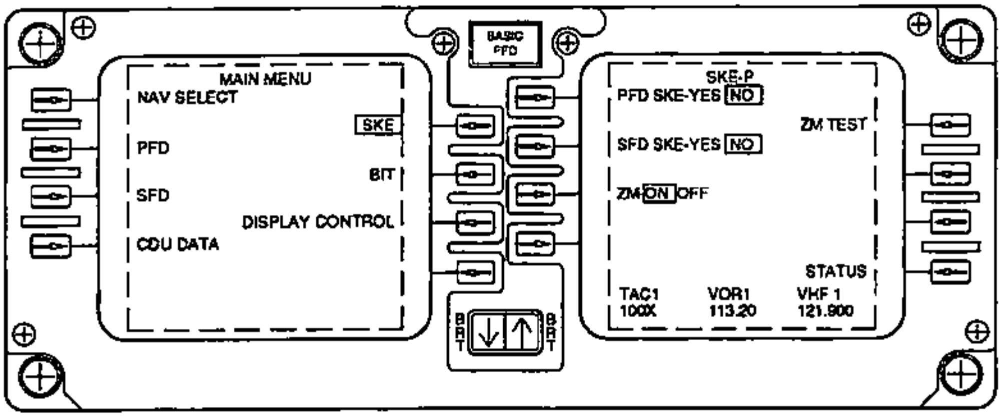
Figure 1-6. DAMU NAV SELECT Menu (Left Screen) - AP/FD (Right Screen)



D3095801 F

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	OPTION	ACTION/RESULTS	LSK	HDG	ACTION/RESULTS
6	HDG	Pressing LSK 6 causes the right display to display the HDG source select submenu.	1	INS 1	Pressing LSK 1 selects INS 1 as heading source to the HSI.
			2	INS 2	Pressing LSK 2 selects INS 2 as heading source to the HSI.
			3	AHRS	Pressing LSK 3 selects AHRS as heading source to the HSI.
8	MAIN	Pressing LSK 8 returns the left screen to the MAIN MENU and the right screen to the STATUS menu.	8	BLANK/ STATUS	When HDG is selected from the NAV SELECT menu, LSK 8 will be blank. If HDG is selected from the STATUS menu, then STATUS will be displayed. Pressing LSK 8 when STATUS is displayed returns the operator to the STATUS menu.

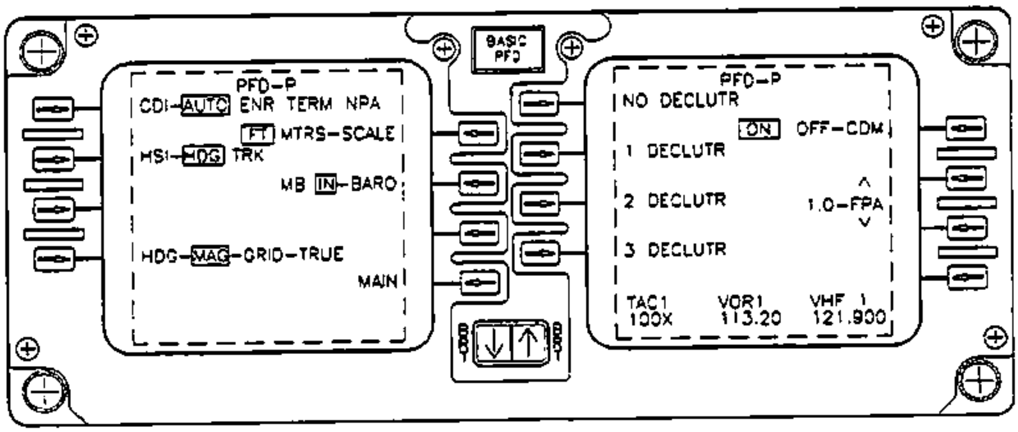
Figure 1-7. DAMU NAV SELECT Menu (Left Screen) - HDG (Right Screen)



D3095701 F

DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	OPTION	ACTION/RESULTS
1	PFD SKE - YES NO	Pressing LSK 1 toggles display between YES and NO. When YES, the PFD displays SKE Range Indicator, SKE Vertical Deviation Indicator, and "SKE" Roll Command symbology. When NO, deselects all PFD SKE symbology.
2	ZM TEST	Pressing LSK 2 turns the SKE zone marker test ON or OFF.
3	SFD SKE - YES NO	Pressing LSK 3 toggles display between YES and NO. When YES, selects the SFD SKE mode. When NO, deselects SFD SKE mode.
5	ZM ON OFF	Pressing LSK 5 toggles display between ON and OFF. When ON, interrogated SKE zone markers will be displayed on MAP. Range and bearing of the ZM, with respect to aircraft location and heading, will be shown. When OFF, zone markers are not displayed, including zone marker test.
8	STATUS	Pressing LSK 8 returns the operator to the STATUS menu.

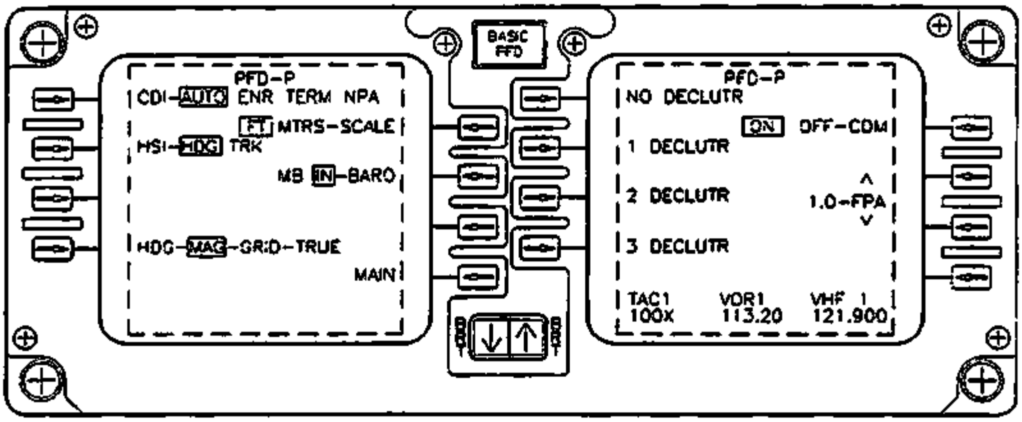
Figure 1-8. DAMU MAIN MENU (Left Screen) - SKE (Right Screen)



D3095801 C

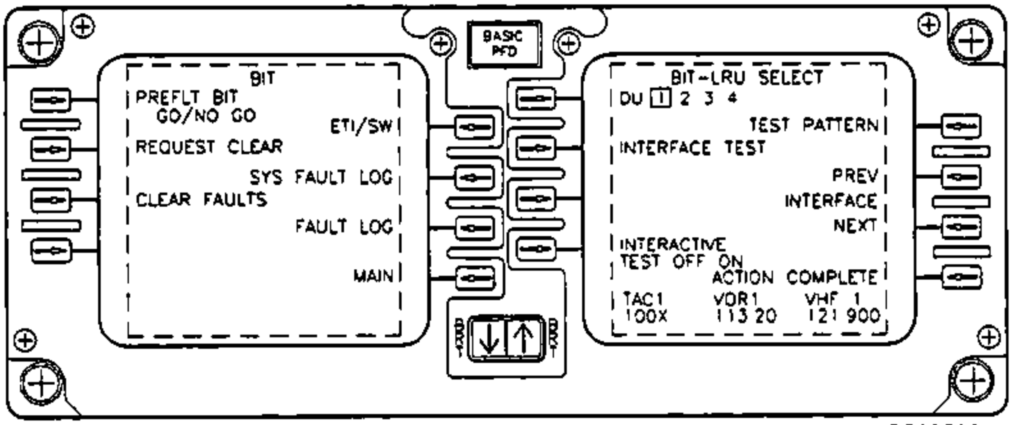
DAMU Left Display option and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**
1	CDI - AUTO ENR TERM NPA	Defaults to AUTO. Pressing LSK 1 toggles CDI scaling options. If AUTO, Enroute (ENR/4), Terminal (TERM/1), or Non-Precision Approach (NPA/0.3).
2	FT MTRS - SCALE	Pressing LSK 2 toggles display between FT and MTRS. If FT is selected, the Barometric Altitude display is in feet and FT annunciates in white at the bottom of the scale. Selecting MTRS causes Barometric Altitude to be displayed in METERS and MTRS is annunciated at the bottom of the scale. Also, an M is displayed between Altitude Scale Numeric readouts. Power-up defaults to the FEET scale.
3	HSI - HDG TRK	Pressing LSK 3 toggles display between HDG and TRK. If HDG is selected, aircraft heading is shown at the top of the HSI compass, ground track is presented by the Ground Track Cross symbol, aircraft heading is displayed in the Digital Readout Box, and HDG annunciates left of the digital readout box. When TRK is selected, aircraft ground track is shown at the top of the HSI compass, magnetic heading is presented by the Heading/Drift Angle Diamond, aircraft ground track is displayed in the Digital Readout Box, and TRK is annunciated to the left of the digital readout box. Power-up defaults to HDG mode.
4	MB IN - BARO	Pressing LSK 4 toggles display between MB and IN. If IN is selected, barometric altitude reference is displayed in inches of mercury. When MB is selected, the barometric altitude reference is displayed in millibars. Power-up defaults to IN.
7	HDG - MAG TRUE GRID	Pressing LSK 7 toggles display between MAG, GRID, or TRUE.

Figure 1-9. DAMU PFD (Sheet 1 of 2)



DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**
1	NO DECLUTR	Pressing LSK 1 deselects any declutter mode and displays all symbology.
2	ON OFF - CDM	Pressing LSK 2 toggles between ON and OFF. When ON, the climb/dive marker is displayed on the ADI. When OFF, the climb/dive marker is removed from the ADI.
3	1 DECLUTR	Pressing LSK 3 selects the Declutter 1 mode. When selected, the following PFD symbols are removed: Baro Altitude Readout, Airspeed Readout, Airspeed Deviation Worm, Rising Runway, Autothrottle Airspeed Caret, and Reference Flight Path Angle.
4	▲ 1.0 - FPA	Pressing LSK 4 changes flight path angle up by increments of 0.1° to a maximum of +9.9° and is changed by holding key until desired angle is displayed.
5/7	2/3 DECLUTR	Non-functional - for future growth.
6	1.0 - FPA ▼	Pressing LSK 6 changes flight path angle down by increments of 0.1° to a maximum of -9.9° and is changed by holding key until desired angle is displayed.

Figure 1-9. DAMU PFD (Sheet 2 of 2)



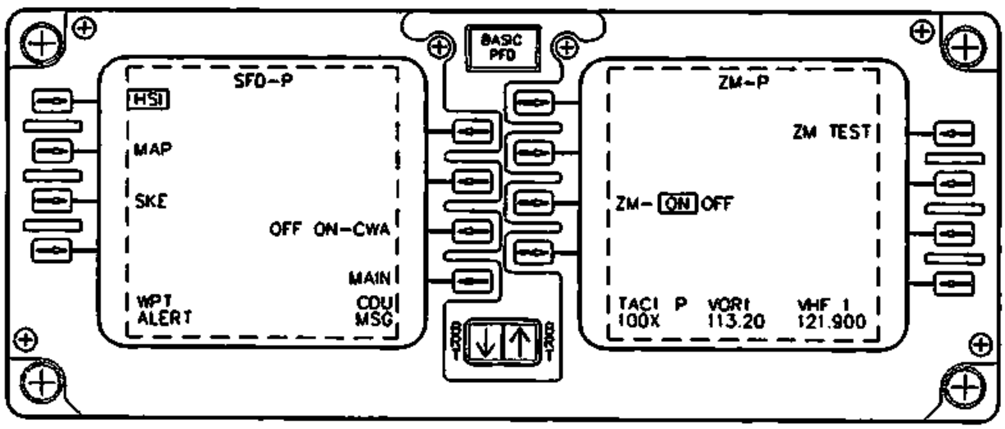
D3095901H

NOTE: Operator-initiated BIT testing (preflight or interactive maintenance BIT) is inhibited when the aircraft speed exceeds 80 knots or when airborne.

DAMU Left Display option and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**
1	PREFLT BIT - GO/ NO GO	Pressing LSK 1 initiates the preflight BIT. At the completion of BIT, GO or NO GO annunciates under the legend.
2	ETI/SW	Pressing LSK 2 calls up the Elapsed Time Indication (ETI) and Software Version (SW) for the AFCPs, DPUs, DUs, and DAMU on a selected DU.
3	*REQUEST CLEAR	Pressing LSK 3 causes CLEAR FAULTS to be displayed adjacent to LSK 5.
4	SYS FAULT LOG	Pressing LSK 4 calls up the selected SYSTEM FAULT LOG for the AFCPs and DPUs on the selected DU. The highlighted line on the ETI/SW screen is used to select which fault log is displayed.
5	*CLEAR FAULTS	Pressing LSK 5 clears the system fault log. LSK 5 is pressed after LSK 4 and LSK 3. Pressing LSK 5 will erase all faults on the fault log being displayed.
6	LRU FAULT LOG	Pressing LSK 6 calls up the selected LRU FAULT LOG for the AFCPs, DPUs, DUs, or DAMUs on the selected DU. The highlighted line on the ETI/SW screen is used to select which fault log is displayed.

NOTE: *Not a default display

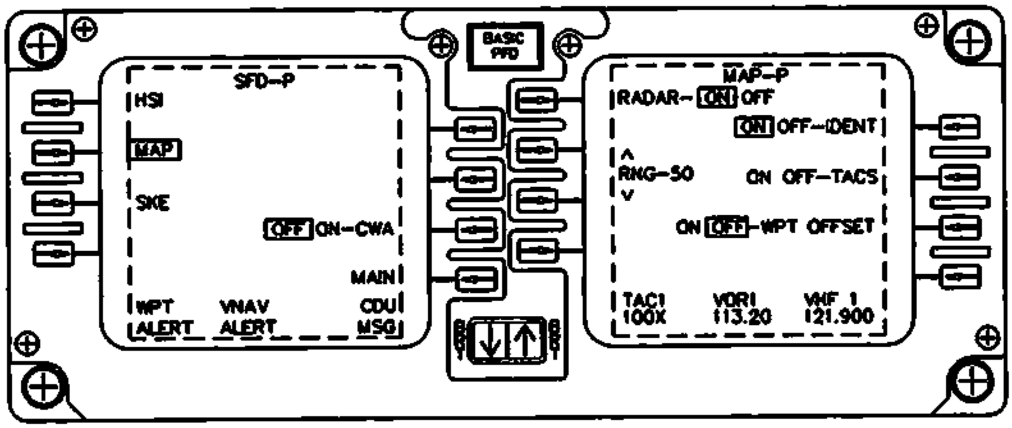
Figure 1-10. DAMU BIT



D3096001F

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**ZM**	**ACTION/RESULTS**
1	HSI	Pressing LSK 1 causes the expanded HSI to display on the SFD and the right DAMU screen to display the ZM submenu.	2	ZM TEST	Pressing LSK 2 turns ON or OFF the SKE zone marker test.
			5	Pressing LSK 5 toggles ZM display between ON and OFF.	

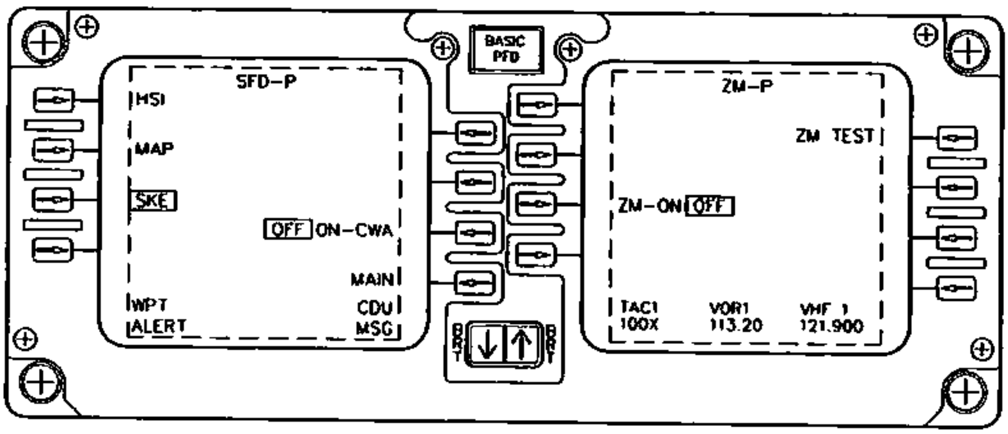
Figure 1-11. DAMU SFD (HSI) (Left Screen) - ZM (Right Screen)



D3096101F

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	OPTION	ACTION/RESULTS	LSK	MAP	ACTION/RESULTS
3	MAP	Pressing LSK 3 causes a partial compass with way-point map to display on the SFD and the right screen to display the MAP submenu.	1	RADAR - ON OFF	Growth provision. Power-up default is OFF.
			2	ON OFF - IDENT	Pressing LSK 2 toggles display between ON and OFF. Power-up default is OFF. ON turns on TACAN station IDENT (only when FMS flight plan is active). OFF turns off the TACAN station IDENT.
			3	Λ RNG - 50	Pressing LSK 3 increases range in 5/25/50/150/300 increments. Power-up de-faults to the 50 NM range.
			4	ON OFF - TACS	Pressing LSK 4 toggles display between ON and OFF. Power-up default is OFF. ON turns on TACAN station symbology. OFF turns off the TACAN station symbology.
			5	RNG - 50 V	Pressing LSK 5 decreases range in 5/25/50/150/300 increments.
			6	ON OFF - WPT OFFSET	Pressing LSK 6 toggles display between ON and OFF. Power-up default is OFF. When ON, displays up to the next three original waypoints.

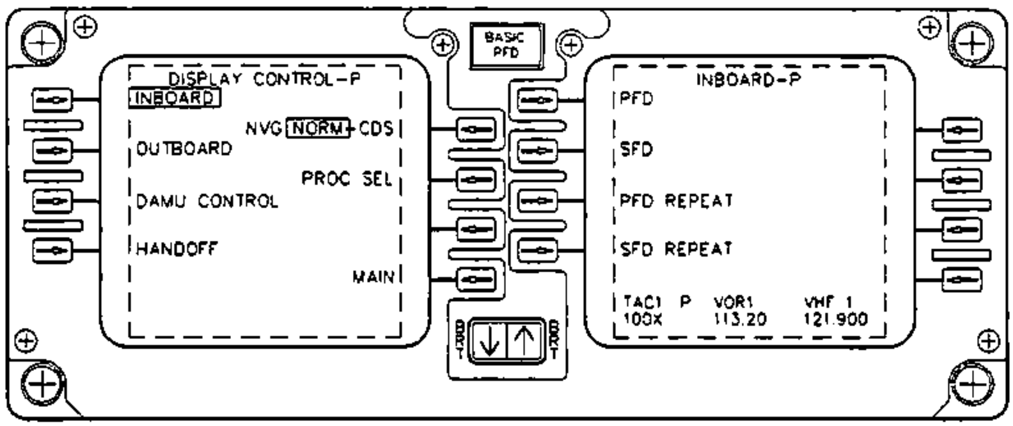
Figure 1-12. DAMU SFD (Left Screen) - MAP (Right Screen)



D3096201E

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**ZM**	**ACTION/RESULTS**
5	SKE	Pressing LSK 5 causes SKE data to display on the SFD and the right DAMU screen to display the ZM submenu. SKE primary control panel must be in XMIT.	2	ZM TEST	Pressing LSK 2 turns ON or OFF the SKE zone marker test.
			5	ZM - ON OFF	Pressing LSK 5 toggles ZM display between ON and OFF. ON selects the SFD SKE mode. OFF deselects SFD SKE mode.
6	OFF ON - CWA	Pressing LSK 6 toggles display between ON and OFF. Power-up defaults to ON. When ON, all current CWA messages are displayed at the bottom of the SFD. When OFF, all current CWA messages are removed from the bottom of the SFD.			

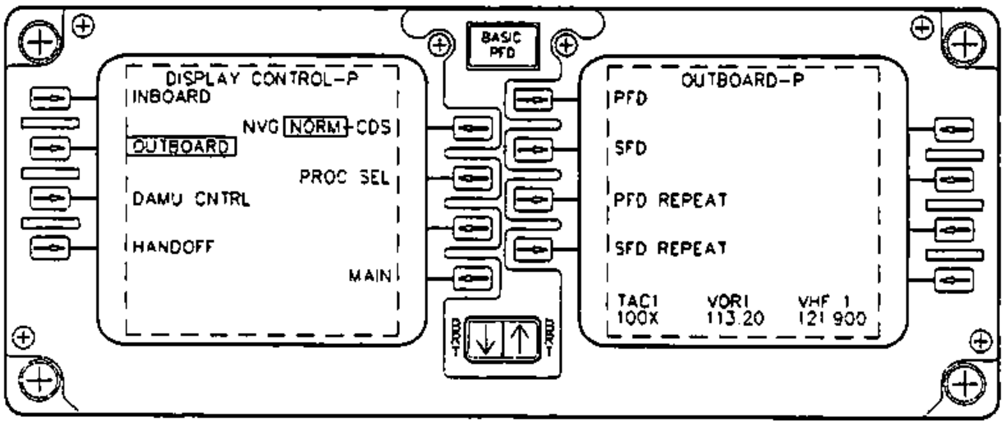
Figure 1-13. DAMU SFD (SKE) (Left Screen) - ZM (Right Screen)



D3096301D

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**INBOARD**	**ACTION/RESULTS**
1	INBOARD	Pressing LSK 1 causes the right DAMU screen to display the INBOARD submenu.	1	PFD	Pressing LSK 1 places the inboard DU in the PFD mode.
			3	SFD	Pressing LSK 3 places the inboard DU in the SFD mode.
			5	PFD REPEAT	Pressing LSK 5 places a repeat of the other crewmember's PFD on the inboard DU.
			7	SFD REPEAT	Pressing LSK 7 places a repeat of the other crewmember's SFD on the inboard DU.
			NOTE: A PFD must be displayed on either the inboard or outboard DU.		
2	NVG NORM - CDS	Pressing LSK 2 toggles between Night Vision Goggles (NVG) and Normal (NORM) modes. When the NVG mode is selected, the associated DAMU and DU display intensity is set to .1 fL. Additionally, when the NVG mode is selected on either DAMU, the annunciator (green) intensity on both BDHI Switch Indicator Matrix Assemblies, both MSPs, FCPs, DICUs and AWFCS Mode REPEATERS are also set to .1 fL. **NOTE:** The CAUTION BRIGHT/DIM switch on the overhead panel controls the GCAP annunciator light level. Panel edge lighting is controlled by the associated side console switch. See Pilot's and Copilot's Side Console Lighting in Section I.			

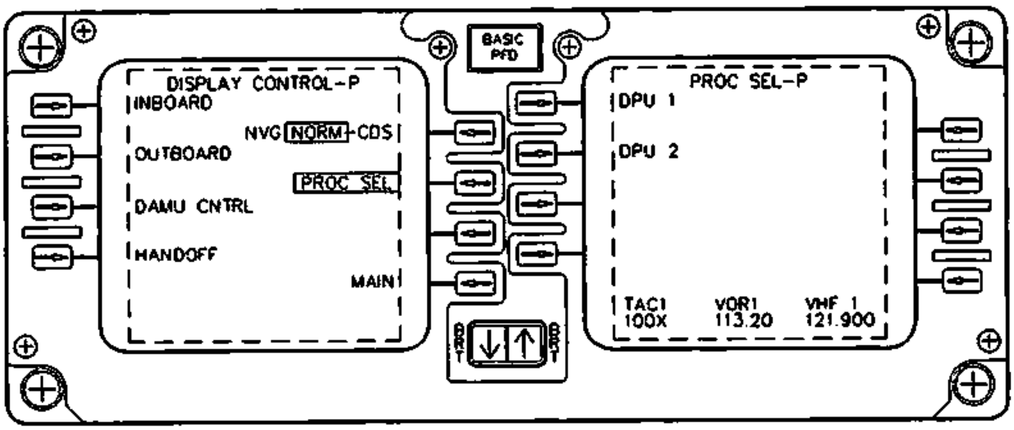
Figure 1-14. DAMU Display Control (Left Screen) - Inboard (Right Screen)



D3096501 C

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**OUTBOARD**	**ACTION/RESULTS**
3	OUTBOARD	Pressing LSK 3 causes the right DAMU screen to display the OUTBOARD submenu.	1	PFD	Pressing LSK 1 places the outboard DU in the PFD mode.
			3	SFD	Pressing LSK 3 places the outboard DU in the SFD mode.
			5	PFD REPEAT	Pressing LSK 5 places a repeat of the other crewmember's PFD on the outboard DU.
			7	SFD REPEAT	Pressing LSK 7 places a repeat of the other crewmember's SFD on the outboard DU.
			NOTE: A PFD must be displayed on either the inboard or outboard DU.		

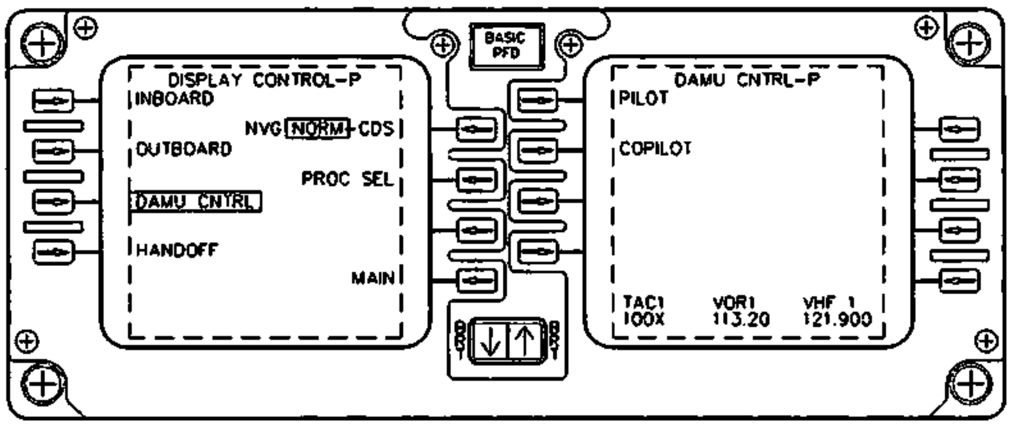
Figure 1-15. DAMU Display Control (Left Screen) - Outboard (Right Screen)



D3096701 C

DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**PROC SEL**	**ACTION/RESULTS**
4	PROC SEL	Pressing LSK 4 causes the right DAMU screen to display the PROC SEL submenu.	1	DPU 1	Pressing LSK 1 selects DPU NO. 1. DPU NO. 1 is the default for the pilot's DUs and DAMU.
			3	DPU 2	Pressing LSK 3 selects DPU NO. 2. DPU NO. 2 is the default for the copilot's DUs and DAMU.

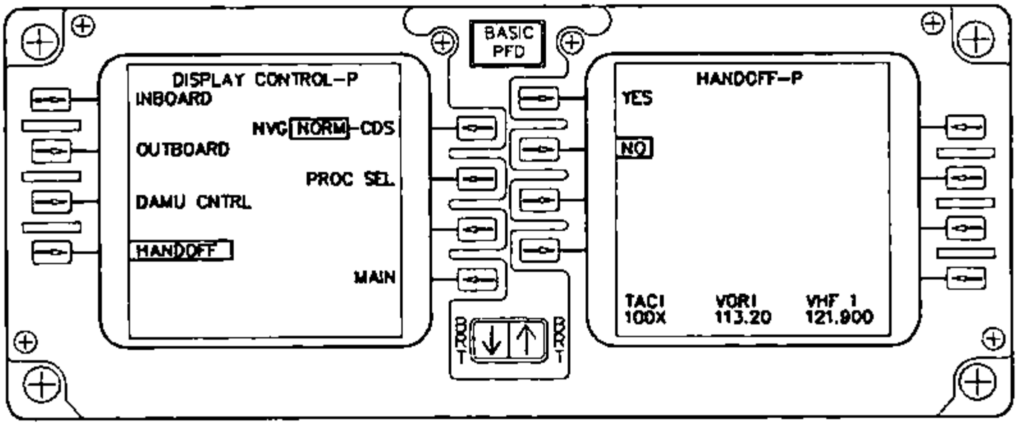
Figure 1-16. DAMU Display Control (Left Screen) - Processor Select (Right Screen)



D3096801C

<table>
<tr><th colspan="3">DAMU Left Display option and associated Line Select Key (LSK)</th><th colspan="3">DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)</th></tr>
<tr><th>LSK</th><th>OPTION</th><th>ACTION/RESULTS</th><th>LSK</th><th>DAMU CNTRL</th><th>ACTION/RESULTS</th></tr>
<tr><td rowspan="3">5</td><td rowspan="3">DAMU CNTRL</td><td rowspan="2">Pressing LSK 5 causes the right DAMU screen to display the DAMU CNTRL submenu.</td><td>1</td><td>PILOT</td><td>Pressing LSK 1 selects the pilot's DAMU menus for control. PILOT is the default for the pilot's DAMU.</td></tr>
<tr><td>3</td><td>COPILOT</td><td>Pressing LSK 3 selects the copilot's DAMU menus for control. COPILOT is the default for the copilot's DAMU.</td></tr>
<tr><td colspan="4">NOTE: Control of the other pilot's DAMU menu is only available when the other pilot has YES selected on the HANDOFF page.</td></tr>
</table>

Figure 1-17. DAMU Display Control (Left Screen) - DAMU Control (Right Screen)



DAMU Left Display option and associated Line Select Key (LSK)			DAMU Right Display submenu, submenu options, and associated Line Select Key (LSK)		
LSK	**OPTION**	**ACTION/RESULTS**	**LSK**	**HANDOFF**	**ACTION/RESULTS**
7	HANDOFF	Pressing LSK 7 causes the right DAMU screen to display the HANDOFF submenu.	1	YES	Pressing LSK 1 enables the handoff of the pilot's/copilot's DAMU displays and controls.
			3	NO	Pressing LSK 3 disables the handoff of the pilot's/copilot's DAMU displays and controls.
		NOTE: Used in conjunction with DAMU CNTRL.			

Figure 1-18. DAMU Display Control (Left Screen) - Handoff (Right Screen)

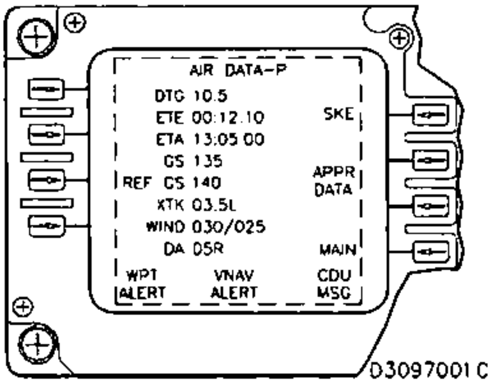


Figure 1-19. DAMU - Air Data (Left Screen)

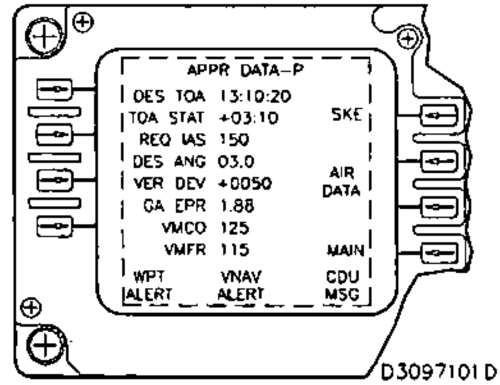


Figure 1-20. DAMU - Approach Data (Left Screen)

AIR DATA	
DTG	Distance-To-Go resolution is 00.1 NM from 0.0 to 99.9 and 1 NM from 100 to 9999 NM.
ETE	Estimated Time Enroute display, indicates the time remaining to the next waypoint or the drop zone, if the aircraft has sequenced the TP. The ETE display has a range of 23:59:59 to 00:00:00 with a resolution of one second.
ETA	Estimated Time of Arrival display, indicates the time to the next waypoint or the drop zone, if the aircraft has sequenced the TP. The ETA display has a range of 00:00:00 to 23:59:59 with a resolution of one second.
GS	Ground Speed is equal to True Air Speed ± winds.
REF GS	REF GS is the Approach Speed at the current flap setting converted to a TAS using Take-off or Landing Pressure Altitude, then converted to Ground Speed using the Take-off or Landing head/tail wind. **NOTE** REF GS will be displayed only after all the following conditions have been met: (1) A destination runway has been entered on the ACT RTE x 1/3 page, (2) Winds have been entered on LANDING DATA RTE x 1/2 page and TOLD INIT 1/3 page, and (3) The aircraft is within 2500 feet of the landing runway elevation.
XTK	Cross Track resolution is 00.1 NM from 0.0 to 99.9 and 1 NM from 100 to 199 NM.
WIND	Bearing/Speed (The reference in which the bearing was entered, either grid, magnetic or true north.)/Speed (in knots)
DA	DRIFT ANGLE in degrees, right ("R") or left ("L") of the aircraft track.

APPR DATA	
DES TOA	DESIRED TIME OF ARRIVAL specified by the user.
TOA STAT	"+" Indicates Early Arrival, "-" Indicates Late Arrival.
REQ IAS	Target IAS RANGE 0 to 350 knots
DES ANG	FMS Pilot-entered DESCENT ANGLE. Defined at the end of the descent at a waypoint. RANGE 0.1 to 15 DEG.
VER DEV	"+" Indicates Distance Above Vertical Path, "-" Indicates Distance Below Vertical Path. VER DEV Scaling - 2 Dots = 500 feet
GA EPR	Either calculated or pilot entered from the FMS TAKE OFF 1/2 page. Displayed after FMS route activation.
VMCO	Either the calculated or pilot entered from the FMS TAKE OFF 1/2 page. Displayed after FMS route activation.
VMFR	Either calculated or pilot entered V Minimum Flap Retraction Speed from the FMS TAKE OFF 1/2. Displayed after FMS route activation.

Test Mode.

The CDS performs four types of BIT: power-on (POBIT), continuous (C-BIT), pre-flight (PFBIT), and maintenance (MBIT). POBIT is initiated at power-up only. POBIT confirms the system is functioning correctly. C-BIT is self-initiated after the successful completion of POBIT and runs until power is removed. C-BIT is transparent to the pilot unless a failure is detected. PFBIT is an operator-initiated BIT. PFBIT can be initiated from either the DAMU or the Flight Control Panel (FCP). It can only be performed when the airplane is on the ground and the airspeed is below 80 knots. PFBIT checks the AFCS LRUs, CDS LRUs, and interfaces. The BIT indicator on the FCP will stay ON while the PFBIT is in progress. The PFBIT takes approximately two minutes to run. During the test, both Altitude Alert and Stall Warning Horns sound, all indicators on the FCP, AWFCS Mode Repeater, and both MSPs will come on for approximately five seconds. Upon successful completion of PFBIT, the DAMU annunciates GO, the BIT indicator on the FCP will go off, and the FLT DIR annunciator bar on the respective MSP will illuminate. If the PFBIT test fails, the DAMU displays NO GO and the BIT indicator on the FCP will remain illuminated. If an AFCP has failed, the AP1 or AP2 indicator on the FCP will also flash, showing which AFCP failed. CDS MBIT is initiated through the BIT menu on the DAMU when the airplane is on the ground and airspeed is below 80 knots. MBIT is an operator-controlled test to check various system interfaces and LRUs on an individual basis.

NOTE

Autopilot (AP), Autothrottle, Stall Warning, and Rotation/Go-Around (R/G-A) are functions embedded within each AFCP.

COMBINED ALTITUDE RADAR ALTIMETER (CARA) SYSTEM.

WARNING

Radar altimeter is not to be used to maintain aircraft altitude.

The CARA system indicates aircraft altitude above the ground. These signals are visually displayed on a height indicator on the pilots' center instrument panel. The height indicator (figure 1-237) provides absolute altitude height indication from 0 to 50,000 feet. Indications are provided by a pointer on a graduated dial and by a five-digit display.

CARA CONTROLS AND INDICATORS.

The height indicator assembly consists of the following indicators and controls:

Analog Altitude Pointer and Dial.

The pointer indicates altitude from 0 to 5,000 feet. Above 5,000 feet the pointer is masked. The dial is graduated in increments of 10 feet from 0 to 500 feet, 50 feet from 500 to 1,000 feet, and 500 feet from 1,000 to 5,000 feet.

Digital Altitude Display.

Five LEDs provide a digital indication of altitude and display in 1-foot increments from 0 to 100 feet, and 10-foot increments from 100 to 50,000 feet. The word FAIL is displayed by the LEDs if the system fails. Horizontal dashes are displayed when the radar altimeter is in search mode.

Variable Altitude Limit Index (VALI).

The VALI indicates the altitude setting at which the low altitude warning indicator (LO) will illuminate. The SET control knob is used to preset the VALI.

R/T Status Indicator.

The R/T status indicator, when illuminate, indicates a fault in the receiver transmitter, antennas, or cabling.

Low Altitude Warning Indicator (LO).

The low altitude warning indicator illuminated to indicate that the aircraft has passed below the low altitude preset limit (VALI setting).

Ambient Light Sensor.

1. Senses cockpit light level and works in conjunction with the BRT knob to set digital display brightness.

2. During night operation, when the instrument panel lights are turned on, the altimeter R/T and LO lights will automatically dim to half the brilliance.

SET Knob.

The radar altimeter SET control knob serves three functions: on-off control, set the VALI indicator, and as a test button to check the system. Turning the knob clockwise initially, applies power to the system; further rotation of the knob moves the VALI indicator from zero to any desired minimum altitude setting. Pressing the SET control knob activates the self-test feature of the system. In-flight, when descending below the set VALI altitude, the MDA light on both AWLS Progress Display panels illuminate.

BRT Knob.

The BRT control knob is used to change the brightness of the digital display, as set by the ambient light sensor during cockpit low light conditions. During bright light conditions, the ambient light sensor sets the display to bright and the BRT knob cannot dim the display.

CARA TEST.

To test the system, perform the following steps:

1. Rotate the SET control knob clockwise to apply initial power to the system and allow 30 seconds to permit AUTOMATIC SELF TEST (AST) ALIGNMENT.

2. Continue SET control knob rotation to enable the variable altitude limit index (VALI) control to be set to an index mark of 400 ft.

3. Press and release the SET control knob to activate the system self-test feature.

4. Ensure that the system is operating properly by monitoring the following steps.

WARNING

All warning modes of the TAWS are inhibited while the radar altimeter is in the self-test mode.

5. The analog altitude pointer will move to 500 feet, the digital display will read 88888, and the R/T lamp will light for 1.5 seconds. The MDA/DH annunciations should extinguish.

6. After 1.5 seconds the digital readout is 300 (±10) feet, the analog pointer is at 300 feet, the R/T lamp is out, and the LO light on the CARA illuminates, and MDA or DH annunciates on the PFD. The display lasts 1.5 sec and then goes to normal operation.

NOTE

The altitude low annunciation on the PFD will be DH if a valid ILS frequency is set in the VHF Nav receivers and the receiver is on. MDA will be annunciated if the receivers are off or a VOR frequency is tuned. The annunciation is not affected by what is selected for Pointer 1.

7. If the preceding events do not occur and the word FAIL appears on the digital display, the radar altimeter height indicator is the probable cause. If the word FAIL appears and R/T lamp is on, the probable cause is the R/T, the antennas, or cabling.

NOTE

The above test procedure is operable throughout the altitude range of the aircraft, except that to check the MDA lights, the VALI must be set between aircraft altitude and 300 feet.

CARA OPERATION.

To put the system into use, rotate the SET control knob to on. Rotate the VALI index to the desired setting as applicable.

WARNING

Terrain clearance indications received from the radar altimeter are unreliable when operating over ice and snow. Radar may penetrate the full depth of the ice and snow before reflection, causing indications of greater terrain clearance than what actually exists.

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS).

The Automatic Flight Control System (AFCS) is a dual integrated system providing the embedded functions of a 3-axis Autopilot, Autothrottle (A/T) System, All Weather Landing System (AWLS), Flight Director System, Rotation Go-Around System (R/G-A), Stall Warning System, and Yaw Damping System. The AFCS interfaces with the CDS to display status, cautions and warnings, and initiate tests.

UNIT	CIRCUIT BREAKER (BUS)
AUTOMATIC FLIGHT CONTROL PROCESSOR (AFCP) NO.1	AFCP NO. 1 (EMER AC)
	AFCP NO. 1 (EMER DC)
	AHRS ATTD NO.1 (AC NAV EXCITATION 1)
	AHRS ATT 2/RSP 1 & 2 EXC (26V EMER AC BUS A)
	AUDIO STALL WARN (26V AC BUS 1)
	MAG HDG INS-1 HDG NO. 3 & 5 (ISOL AC EXCITATION 1) INS-2/CADC-2 (AC NAV EXCITATION 2)
AFCP NO. 2	AFCP NO. 2 (AVIONICS AC 2)
	AFCP NO. 2 (MAIN DC AVIONICS 1)
	AHRS ATTD NO.1 (AC NAV EXCITATION 1)
	AHRS ATT 2/RSP 1 & 2 EXC (26V EMER AC BUS A)
	AUDIO STALL WARN (26V AC BUS 1)
	MAG HDG INS-1 HDG NO. 3 & 5 (ISOL AC EXCITATION 1) INS-2/CADC-2 (AC NAV EXCITATION 2)
ELEVATOR SERVO	ELEV SERVO (MAIN DC AVIONICS 2)
ELEVATOR SYNC NO. 1	ELEV POSN NO. 1 (AC NAV 1)
ELEVATOR SYNC NO. 2	ELEV POSN NO. 2 (AC NAV 2)

UNIT	CIRCUIT BREAKER (BUS)
RUDDER SERVO NO. 1	RUD SERVO NO. 1 (EMER DC)
RUDDER SERVO NO. 2	RUD SERVO NO. 2 (MAIN DC AVIONICS 1)
AUTO-THROTTLE SERVO	A/T SERVO (MAIN DC AVIONICS 2)
	FCP 1 /A/T SERVO (ISOL 26V AC)
STALL WARNING NO. 1	STALL WRN NO. 1 (ISOL AC EXCITATION)
STALL WARNING NO. 2	STALL WRN NO. 2 (AC NAV EXCITATION 2)
PILOT'S STICK SHAKER	STALL PREVENT NO. 1 (MAIN DC 1)
COPILOT'S STICK SHAKER	STALL WARN (OR PREVENT) NO. 2 (MAIN DC 2)
ANGLE OF ATTACK ANTI-ICING	
NO. 1 SYSTEM PILOT	PLT ANGLE OF ATTACK VANE HTR PWR (ESSENTIAL AC BUS 1)
NO. 2 SYSTEM COPILOT	COPLT ANGLE OF ATTACK VANE HTR PWR (ESSENTIAL AC BUS 2)
FLIGHT CONTROL PANEL/ MODE SELECT PANEL	FCP/MSP NO. 1 (EMER DC) FCP 2 (AC NAV EXCITATION 2) MSP NO. 2 (MAIN DC AVIONICS 1)

AUTOPILOT.

The autopilot operates the flight control system of the aircraft to maintain normal, stabilized attitudes automatically. The autopilot also maintains any desired heading and provides coordinated turn control, automatic electric elevator trim, constant-pressure altitude control, automatic VOR, FMS, and TACAN tracking and automatic approach control for instrument landing system (ILS) approaches.

Controls for the autopilot are located on the center pedestal. Autopilot disconnect buttons are located on the outer rim of the pilot's and copilot's control wheel. A new force sensor for control wheel steering is incorporated in the pilot's and copilot's control wheels. A mode repeater panel is located at the Navigator's station (figure 1-228).

Flight Control Panel (FCP).

The Flight Control Panel (FCP) is the primary flight crew controller for the AFCS. The FCP provides AFCS engagement and disengagement, pitch and roll attitude control, pitch or lateral axis disengage control, altitude hold mode engagement, and BIT initiation. The control and annunciators contained on the FCP and their functions are as follows:

AP1/AP2 PUSHBUTTONS.

Pressing the AP1/AP2 pushbutton couples the flight control system rudder, aileron, and elevator servos to the aircraft main surface control cable systems. Autopilot engagement also maintains automatic electric pitch trim through the elevator trim system.

NOTE

> There is a two-second delay from actuation of the AP1/AP2 pushbutton to when the servos actually engage to control the flight control surfaces.

When the autopilot is engaged by actuating the AP1/AP2 pushbutton, the annunciator bar above the AP1/AP2 pushbutton will illuminate and the autopilot normally engages in the basic autopilot mode (heading hold or roll attitude hold, and pitch attitude hold). The autopilot will now respond to pitch and roll inputs from the integrated pitch and roll control. When AP1/AP2 is disengaged, the annunciator bar above the AP1/AP2 pushbuttons will extinguish.

TURN RING/PITCH WHEEL.

The Turn Ring is the outer ring of the Turn Ring/Pitch Wheel, which inputs roll commands to the AFCS that are proportional to the movement of the turn ring. With movement of the turn ring from the center detent position, any lateral mode which is active, except when ILS, LOC, or back course is captured, will be disengaged and the turn ring will have priority.

The Pitch Wheel is the thumbwheel on the Turn Ring/Pitch Wheel that inputs pitch commands to the AFCS that are proportional to the movement of the pitch wheel. The pitch wheel will reset so that its present position represents the present pitch of the aircraft whenever the autopilot is in the basic mode. The pitch wheel will be inoperative whenever the Altitude Hold, VNAV, or Speed on Pitch modes are selected, or after glide slope capture during an ILS approach.

LAT SWITCH.

The LAT switch is a two-position (ON/OFF) solenoid-held switch that is spring-loaded to the ON position. This switch allows switching between off and on for autopilot control of the aircraft flight control surfaces in the lateral axis. When the LAT switch is set to the OFF position, lateral control of the aircraft is made manually with the control wheel. In the normal ON position, roll attitude (lateral) hold or heading hold will be activated when the autopilot is engaged. The switch will automatically return to the normal ON position from the OFF position if the autopilot is either automatically or manually disengaged. When the LAT switch is in the OFF position, AP1/AP2 SPLIT will annunciate on both PFDs.

NOTE

Reduce pressure on the Control Wheel prior to disengaging the autopilot (placing the LAT switch in the OFF position). Placing the LAT switch in the OFF position with excessive Control Wheel force will cause the autopilot to disconnect.

PITCH SWITCH.

The Pitch switch is a two-position (ON/OFF) solenoid-held switch that is spring-loaded to the ON position. This switch allows switching between off and on for autopilot control of the aircraft flight control surfaces in the pitch axis. When the Pitch switch is set to the OFF position, control of pitch is made manually with the control column. In the normal ON position, with autopilot engaged, pitch attitude hold is activated. The switch will automatically return to the normal ON position from the OFF position if the autopilot is either automatically or manually disengaged. When the PITCH switch is in the OFF position, AP1/AP2 SPLIT will annunciate on both PFDs.

ALT HLD PUSHBUTTON.

The ALT HLD pushbutton is a momentary action, pushbutton/annunciator that places the engaged autopilot in the altitude hold mode and will cause the AFCS to capture and hold the aircraft altitude at ALT HLD selection if the pitch axis is ON. The annunciator bar will illuminate when Altitude Hold mode is engaged. Selection of ALT HLD will automatically deselect the Speed on Pitch mode, if active, and deactivate the pitch wheel on the FCP.

BIT PUSHBUTTON.

The BIT Pushbutton is a momentary action, lighted pushbutton that allows the operator to initiate a Preflight Built-in Test (PFBIT) of the AFCS. Actuation of the BIT switch causes the AFCS to enter PFBIT when the aircraft is on the ground and the airspeed is less than 80 knots. The annunciator bar above the pushbutton will annunciate to indicate PFBIT is in process. If no faults have been detected, the BIT annunciator will extinguish, indicating the test has been successfully completed.

Mode Select Panel (MSP).

The AFCS contains two identical MSPs; one for the pilot and one for the copilot. The Mode Select Panel contains five legend switches that provide the following functions: flight director (FLT DIR) select/deselect, speed on pitch mode (SPEED ON PITCH) engage/disengage, control wheel steering (CWS) mode arm/disarm, vertical navigation (VNAV) mode engage/disengage, and autothrottle or FMS autothrottle (A/T) arm/disarm. The switches and their functions are as follows.

FLT DIR PUSHBUTTON. The FLT DIR pushbutton enables/disables the Flight Director Function. When there is a valid pitch or roll signal, the bars will provide steering commands. With an autopilot engaged, both pilot and copilot steering commands reflect the active mode of the engaged autopilot. The flight directors are independent when neither autopilot is engaged.

SPEED ON PITCH PUSHBUTTON. The Speed on Pitch pushbutton places the engaged autopilot in the speed on pitch mode and commands the AFCS to capture and maintain the calibrated airspeed at the time of speed on pitch selection. Present airspeed will then be maintained by means of varying the pitch of the aircraft. Selection of speed on pitch will automatically deselect the altitude hold mode, if active.

CWS (CONTROL WHEEL STEERING) PUSHBUTTON. The CWS button activates the AFCS pitch and roll CWS mode if the autopilot is engaged. If autopilot disengagement occurs, the button automatically returns to the OFF position. Maximum bank angle using CWS is 38°. The aircraft may be rolled into greater than 38° of bank, but when CWS force is released, the aircraft will return to 38° of bank.

VNAV PUSHBUTTON. Pressing the VNAV pushbutton couples either the flight director and/or the autopilot pitch axis to the FMS vertical mode.

A/T PUSHBUTTON. When not in the VNAV mode, actuation of the A/T pushbutton places the AFCS in the basic autothrottle arm mode and the annunciator above the A/T switch illuminates. When in the VNAV mode, actuation of this switch places the AFCS in FMS autothrottle arm mode. The autothrottle is then engageable from the autothrottle engage button on the throttle. Once autothrottle is engaged, disengagement of basic autothrottle or FMS autothrottle for any reason will extinguish the annunciator and AT OFF is annunciated in the upper left corner of the PFD and in the lower center of the HSI display on the PFD.

AWFCS Mode Repeater.

The AWFCS mode repeater (figure 1-228) is located in the navigator's instrument panel. The mode repeater annunciates the navigation system and autopilot mode selected by the pilots. The indicators are controlled by signals from the Automatic Flight Control Processor (AFCP), except the MDA (Minimum Descent Altitude), which is controlled by the CDS. Mode repeater annunciations are as follows:

ANNUNCIATOR	DESCRIPTION
AP1	Annunciates when AP1 is engaged.
AP2	Annunciates when AP2 is engaged.
FMS1	Annunciates when the autopilot is engaged and FMS 1 is selected for PTR1 on either DAMU.
FMS2	Annunciates when the autopilot is engaged and FMS 2 is selected for PTR1 on either DAMU.
FD1	Annunciates when FLT DIR is enabled on the pilot's MSP.
FD2	Annunciates when FLT DIR is enabled on the copilot's MSP.
TAC1	Annunciates when the autopilot is engaged and TACAN 1 is selected for PTR1 on the DAMU.
TAC2	Annunciates when the autopilot is engaged and TACAN 2 is selected for PTR1 on the DAMU.
HDG	Annunciates when the autopilot is engaged and HDG is selected for AP/FD on the DAMU.
NAV	Annunciates when the autopilot is engaged and when a TAC, VOR/ILS, or INS system is selected to PTR1 on the DAMU.
NAV1	Annunciates when the autopilot is engaged and VOR/ILS 1 is selected for PTR1 on the DAMU
NAV2	Annunciates when the autopilot is engaged and VOR/ILS 2 is selected for PTR1 on the DAMU.
APP	Annunciates when VOR/ILS 1 or 2 is selected for PTR1, AWLS is selected for AP/FD on the DAMU, and the autopilot is engaged.
VNAV	Annunciates when VNAV is selected and active on either MSP.
MDA	Annunciates when airplane is at the selected Minimum Descent Altitude (MDA).
G/A	Annunciates when the go-around mode is active.

Autopilot Disconnect Button.

A disconnect button is installed on both the pilot's and copilot's control wheels. Pressing either of these pushbuttons disengages the autopilot and causes the AP OFF annunciation to flash on both PFDs and "AUTOPILOT" annunciates five times. The AP OFF annunciator and aural warning may be turned off by pressing the disconnect button a second time.

Column/Wheel Force Sensor (CWFS).

The CWFS is placed, in series, between the wheel and airplane control column in the control hub of the pilot's and copilot's control wheel assemblies. It supplies the value of column and wheel forces applied to the AFCP for use in the CWS mode computations. Sensor design is based upon a bending beam principle wherein stresses placed on a metal beam are sensed by solid state strain gages arranged in a bridge configuration cemented to the surface of the beam. When no force is applied to the beam the bridge is balanced; thus, the bridge is null. With force applied to the beam, the bridge is unbalanced and an output proportional to the applied force is developed. There are four gage assemblies (two pitch, two roll) to provide independent sensors for each autopilot (AFCP).

Autopilot Engagement.

The following conditions must be satisfied before the autopilot can be engaged:

1. AFCS must be fully operational.
2. Autopilot disconnect button on either control wheel is not depressed.
3. Turn ring on the FCP is in the center detent position.
4. Electric pitch trim is enabled.
5. Rotation/Go-Around button on either control wheel is not depressed.
6. PITCH or LAT switches on the FCP are in the ON position.
7. The yaw damper is engaged.
8. Elevator, aileron, and at least one yaw damper servo are operational.

9. One of two available attitude sources must be operational; that is, AHRS or INS1 must be operational to engage AP1, or AHRS or INS2 must be operational to engage AP2.

10. Two heading and attitude sources must be within ±4 degrees to engage the autopilot.

Autopilot Disengagement.

The autopilot will disengage as a result of any of the following conditions:

1. AFCS not fully operational.

2. Actuation of either control wheel autopilot disconnect button.

3. Loss of electrical power (power degraded beyond the steady-state and normal transient limits).

4. Disconnect of electric pitch trim.

5. AP1/AP2 pushbutton pressed.

6. PITCH and LAT switches on the FCP are in the OFF position.

7. Rotation/Go-Around button pressed twice.

8. Failure of the elevator, aileron, or both yaw damper servos.

9. Detection of failure by AFCS BIT logic in the active autopilot.

10. Degradation in signals required from interfacing systems.

11. Loss of both attitude sources; that is, the loss of both AHRS and INS1 will disengage AP1, or the loss of both AHRS and INS2 will disengage AP2.

12. Selection of LAT switch to OFF with force applied to the roll axis of the control wheel.

13. Actuating the electric pitch trim switch on the pilot's or copilot's control wheel.

14. LOC TRK becoming invalid when in the AWLS mode.

Autopilot Operating Modes.

Basic autopilot operating modes are selected and engaged by switches on the flight control panel and the mode select panels. Selection of navigation aids used in conjunction with some of the modes is made on the DAMU. The following paragraphs describe the operating modes.

DUAL AFCP MODE.

It is possible to engage the autopilot with either AFCP as the controlling autopilot. During AWLS approach and landing, both autopilots are engageable to provide autoland capability. If the engaged autopilot fails, it will automatically disengage, the failure is annunciated, and the other autopilot automatically assumes control. The determination of which AFCP provides the autopilot flight control functions is as follows:

1. AFCP 1, if autopilot 1 is engaged on the FCP.

2. AFCP 2, if autopilot 2 is engaged on the FCP.

3. AFCP that was engaged first, if autopilots 1 and 2 are both engaged when in automatic approach mode.

The AFCS provides automatic turn coordination during all turns commanded through the AFCS, either from the FCP turn ring, through control wheel steering, or during automatic commanded turns.

Whenever an autopilot is engaged, the engaged AFCP provides automatic aircraft trim through the electromechanical trim actuating system on the aircraft. The transient response of the autopilot is not affected by the automatic trim rate. Autopilot malfunctions do not affect the manual trim operations after autopilot disengagement. Trim runaway or other automatic trim system failures are detected, annunciated, and processed in a fail-safe manner.

The AFCS flight director function is available upon application of aircraft power to the AFCS. The flight director functions are available with or without the autopilots engaged and operate independent of each other without the autopilots engaged. Flight directors 1 and 2 are fully operational when required system inputs (e.g., heading, INS cross track error, bearing) are valid and independently provide ADI command steering signals to the pilot and copilot ADIs, respectively.

HEADING HOLD MODE.

The heading hold mode is a basic operating mode. The mode is selected when the AP1/AP2 pushbutton is pressed. The autopilot uses the existing aircraft heading at time of engagement as the heading reference. The heading reference is removed when CWS or the turn control knob is used to change aircraft attitude. Bank angles in this mode are limited to 38°. The altitude hold mode may be used in conjunction with the heading hold mode. The heading hold mode is active when the following conditions are met:

1. The autopilot is engaged.

2. The turn ring is in the center detent.

3. No other lateral autopilot mode is active.

4. The LAT switch on the FCP is ON.

5. The aircraft roll attitude is within ±6° of wings level when not in control wheel steering mode or ±3° when in control wheel steering mode.

The heading hold mode disengages upon activation of any incompatible flight control mode. In heading hold mode, the autopilot commands the aircraft to capture and maintain the heading existing at the moment the mode is entered. Aircraft heading is maintained with respect to the INS or AHRS reference heading. Once the heading hold mode is engaged, the autopilot commands the aircraft to hold the engagement heading to within ±1°.

ROLL ATTITUDE HOLD MODE.

The roll attitude hold mode is engaged instead of the heading hold mode if the LAT switch on the FCP is ON and the aircraft is in a roll attitude of greater than 6° at the time of autopilot engagement. The roll attitude hold mode also automatically engages if a roll is commanded via the turn ring, or a roll greater than 3° is present upon release of roll control wheel steering force.

The roll attitude hold mode disengages when the turn ring is returned to detent and the roll attitude is less than ±3° (control wheel steering active) or ±6° (control wheel steering inactive). This condition will engage the heading hold mode. The mode also disengages upon application of roll CWS force.

Upon autopilot engagement, the autopilot holds the aircraft at its existing roll attitude within ±0.5° if the attitude is between 6° and 38° at the time of the engagement. Following a control wheel steering maneuver, the autopilot holds the aircraft at its existing roll attitude within ±0.5° if the attitude is between 3° and 38° at the time the control wheel forces are removed. During a turn ring commanded turn, the autopilot holds the aircraft in the commanded roll attitude within ±0.5° within the roll attitude limit of ±38°.

HEADING SELECT MODE.

The heading select mode is activated by selecting HDG on the DAMU AP/FD MENU. The heading select mode is disengaged whenever the approach or navigation course selected is captured. The mode is disengaged when the control wheel steering mode is active or the FCP turn ring is placed out of detent.

In the heading select mode, the flight director provides roll steering commands indicating the shortest direction in which to roll the aircraft in order to intercept and maintain the heading indicated by the HSI heading bug. The maximum bank angle commanded should not be more than 30°.

When the autopilot is engaged in the heading select mode, the autopilot automatically turns the aircraft the shortest direction to the HSI heading bug and maintains the aircraft on that heading to a static accuracy of ±1°. Headings are selectable in this mode using the heading knob on the RSP. The maximum bank angle is limited to 30°.

LATERAL NAVIGATION MODE.

The lateral navigation mode is activated/deactivated by selecting/deselecting LNAV on the DAMU AP/FD MENU.

OVERSTATION MODE. The overstation mode is entered when the aircraft enters the cone of confusion over the TACAN/VOR station or when a large, rapid CDI movement occurs. The CDI movement can be caused by rotation of the course knob or variance in the signal from the ground station.

When the system enters the overstation mode it will go into a heading hold mode that equates to the head of the course arrow ± any drift correction prior to mode entry.

The Autopilot/Flight Director system will remain in the overstation mode for 30 to 180 seconds. If the signal is stable for 30 seconds after entry into the overstation mode, the system will recapture and track the course.

If the signal is still unstable after 30 seconds, the system will remain in the overstation mode for an additional 150 seconds. At the end of that time it will recapture the track if the signal is good or disengage the lateral navigation mode if the signal is still unstable.

FLIGHT DIRECTOR FUNCTIONS. The flight director in the lateral navigation mode provides roll steering commands indicating the direction in which to roll the aircraft in order to intercept and maintain the course selected on the HSI. The turn commanded is through the smallest angle between the existing aircraft heading and the selected course. The maximum bank angle commanded should not be more than 30°. The lateral navigation mode uses the following navigation sources that are selected for PTR 1 on the DAMU.

When FMS 1 or 2 is selected, the flight director provides roll steering commands indicating the direction in which to maneuver the aircraft to capture and track sequential course lines to waypoints in the flight plan.

When a VOR or TACAN NAV source is selected, the flight director provides roll steering commands indicating the direction in which to maneuver the aircraft to capture and track the selected VOR or TACAN course. Roll steering commands for tracking of the selected VOR or TACAN radial are automatically initiated after capture of the radial. Crosswind compensation is provided so that the track can be maintained.

During overflight of the "cone of confusion", the flight director roll commands revert to magnetic heading and maintain the heading of the aircraft to within ±5° of the heading existing when the "cone of confusion" was entered. If a new VOR/TACAN course is set while in the "cone of confusion", flight director roll commands are given to turn to a heading parallel to the new VOR/TACAN course. If a new course is not selected while in the "cone of confusion", the flight director continues to provide commands to maintain the magnetic heading existing upon entry to the cone. Upon exiting the "cone of confusion", the system will provide roll commands to intercept and track the outbound course.

AUTOPILOT FUNCTIONS. When the autopilot is engaged and laterally coupled, the autopilot automatically turns the aircraft through the smallest angle to the heading or course provided by the selected NAV source, as described in the following paragraphs. The autopilot maintains the aircraft on that heading to a static accuracy of ±1° with respect to the heading reference.

Once the VOR or TACAN course capture zone is entered, the autopilot automatically controls the aircraft to capture and maintain the selected VOR or TACAN course. The roll attitude of the aircraft will not exceed ±30° during capture or ±15° once the aircraft is stabilized and on course.

During overflight of the "cone of confusion", the autopilot reverts to magnetic heading and maintains the heading of the aircraft to within ±5° of the heading existing upon entering the "cone of confusion". Any bank angle transient will be less than 10°. After selection of the new VOR/TACAN course while in the "cone of confusion", the aircraft will turn to parallel the new VOR/TACAN course. When out of the "cone of confusion", the autopilot will turn the aircraft to intercept and maintain the selected course.

PITCH ATTITUDE HOLD MODE.

The pitch attitude hold mode is the default longitudinal (pitch) engage mode of the autopilot, active when the autopilot and pitch axis are engaged and no other longitudinal mode is selected. The pitch attitude hold mode disengages upon selection of an incompatible mode or disengagement of the pitch axis.

ALTITUDE HOLD MODE.

The altitude hold mode is engaged when the autopilot and pitch axis are engaged and the ALT HLD switch on the FCP is pressed. The altitude hold mode is disengaged whenever the mode is active and the ALT HLD switch is pressed. The mode is also disengaged upon activation of the speed on pitch, VNAV mode, or when the control wheel steering mode is active. Additionally, the mode automatically disengages upon glide slope capture when the approach mode (AWLS) is active.

In the altitude hold mode, the autopilot commands the aircraft, through changes in aircraft pitch, to capture and maintain the aircraft barometric altitude existing at the time of engagement. The pitch wheel and pitch control wheel steering are inactive in this mode.

Engagement of the altitude hold mode at rates of climb or dive of less than 2,000 feet per minute levels and holds the aircraft at the existing altitude at the time of engagement without exceeding a 0.2g incremental normal acceleration.

SPEED ON PITCH MODE.

In the speed on pitch mode, the autopilot commands the aircraft to capture and maintain the calibrated airspeed existing at engagement through variations in aircraft pitch attitude. The autopilot, by pitch attitude adjustments, stabilizes and maintains the aircraft at the engaged airspeed within ±5 KCAS. During operation in speed on pitch mode, the pitch wheel is inhibited.

The speed on pitch mode engages whenever the autopilot and pitch axis are engaged and the SPEED ON PITCH switch is pressed. The speed on pitch mode disengages whenever the mode is active and the SPEED ON PITCH switch is pressed. The mode also disengages upon activation of the altitude hold or VNAV modes, or while the control wheel steering mode is active, or upon disengagement of the pitch axis. Additionally, the mode automatically disengages upon glide slope capture when the approach mode is active.

The AFCS provides the flight crew the capability to adjust the airspeed over a range of ±25 KCAS about the engaged airspeed by using the airspeed trim switch on the RSP, without disengaging speed on pitch mode.

VNAV MODE.

This mode is activated by pressing the VNAV switch on either MSP. The VNAV mode deactivates when the VNAV switch is pressed while the mode is active or by the activation of an incompatible mode. VNAV can be coupled to the autopilot, flight director, or both. Selection of the VNAV mode allows the AFCS to follow the FMS vertical flight path commands (refer to figures 1-79 and 1-80). In VNAV the autopilot couples to the FMS for automatic control of the aircraft vertical flight path during climb, cruise, and descent phases of flight.

NOTE

- VNAV will not engage when the pitch steering bar deviation command is greater than approximately 2 bar widths.
- If the VNAV is disengaged after the autopilot has been actively engaged in the VALT HOLD mode, the autopilot will revert to the ALT HOLD mode and the DU's AP PITCH annunciator will change from VALT HLD to ALT HLD.

When coupled, the flight director provides pitch steering commands indicating the direction to maneuver the aircraft to follow the flight plan. A typical AP/FD PITCH Mode Annunciation sequence would be: VIAS, VALT CAP, and VALT HLD with simultaneous illumination of ALT HLD annunciator bar on the FCP. If the cruise altitude is changed, perform a flight level change initiation (FLCH INIT) by pressing the ALT HLD switch on the FCP. The ALT HLD annunciator bar extinguishes, the VALT HLD annunciation reverts to VIAS, and the pitch steering bar commands the appropriate actions.

CONTROL WHEEL STEERING (CWS) MODE.

The control wheel steering mode is armed whenever the autopilot is engaged and the CWS switch on the MSP is pressed. Arming of the control wheel steering mode causes the autopilot to revert to the basic autopilot mode (pitch attitude hold and roll attitude hold or heading hold). The exception is that the CWS armed mode and the Altitude Hold mode are compatible and the Altitude Hold mode has priority over the CWS mode on the pitch axis. The control wheel steering mode engages whenever sufficient force is applied to the yoke while the mode is armed. The control wheel steering mode disengages whenever the mode is armed and the CWS switch is pressed. Placing the turn ring out of detent also disengages the control wheel steering mode.

In the control wheel steering mode, the autopilot maneuvers the aircraft through roll and pitch attitudes in response to pilot or copilot applied control wheel forces. When the lateral control of the autopilot is engaged, control wheel forces applied in excess of 2.5 pounds in roll develop proportional aircraft roll rates of 1° per second per pound of wheel force. If not in the approach mode, release of the control wheel forces causes a return to heading hold if the bank angle is less than

3°, or stabilizes the aircraft at the acquired bank angle if the bank angle is between 3° and 38°. When a bank angle greater than 38° is commanded, the CWS will roll to 38° when the CWS force is released.

When the pitch control of the autopilot is engaged, column forces applied in excess of 2.5 pounds in pitch develops proportional aircraft pitch rates of approximately 0.2° per second per pound of column force. If not in the approach mode following release of column forces, the autopilot stabilizes the aircraft at the acquired pitch attitude up to the pitch attitude hold limit.

APPROACH MODE.

The approach mode is armed when the VOR/ILS is selected and AWLS is selected via the DAMU AP/FD MENU. The approach mode engages when valid localizer and glide slope signals are received.

FLIGHT DIRECTOR FUNCTIONS. The flight director provides lateral and vertical steering commands to allow the pilot to manually steer the aircraft to a CAT I or CAT II ILS approach. The flight director continues to provide lateral and vertical steering commands through flare and touchdown. The flight director is capable of directing approaches initiated with one engine inoperative.

The AFCS provides direct signal flow from the localizer receiver to the HSI Course Deviation Indicator (CDI), even in the event of AFCS power loss. Also, the AFCS provides roll steering commands to acquire the localizer at the desired intercept heading set on the HSI heading bug until a point corresponding to two dots of lateral deviation on the HSI is reached. At this point, the flight director commands the roll steering bar to intercept and track the localizer. Crosswind compensation is provided to optimize tracking.

The AFCS provides direct signal flow from the glide slope receiver to the ADI glide slope pointer, even in the event of AFCS power loss. The glide slope pointer indicates glide slope deviation during the approach. When the glide slope deviation decreases near zero, the flight director function causes the pitch steering bar to come into view and display the steering information necessary to intercept and track the glide slope beam. If glide slope information becomes invalid or glide slope deviation exceeds two dots on the ADI, the pitch steering bar is driven out of view.

While tracking the localizer and glide slope signals down to landing, the AFCS displays flare information on the pitch steering bar at the nominal flare-engage altitude of 45 feet. The pitch steering bar provides steering information for a smooth transition from the point of flare-engage to touchdown. Should the flare signal become invalid, the pitch steering bar disappears from view. The roll steering bar continues to display localizer tracking information.

The AFCS provides a localizer back course approach capability. In the back course approach, performance is the same as for the front course approach except that the glide slope capture and track functions are inhibited. The flight director is armed to enter the back course approach mode when the following conditions are met:

1. The localizer frequency is tuned on the navigation receiver.

2. The course arrow on the HSI or course indicator is set to the published inbound (front) course.

CAUTION

> The autopilot may attempt to intercept and fly a false ILS glidepath until the autopilot recognizes the back course localizer.

The AFCS executes automatic back course switching by comparing the aircraft heading with the localizer front course as indicated by the course arrow. If the difference between aircraft heading and the course arrow exceeds 105°, the flight director automatically switches to back course approach and provides flight director lateral command steering to smoothly capture and track the back course localizer. As in a front course approach, the runway (localizer) deviation pointer, the ADI roll steering bar, and the CDI indicate proper direction (i.e., they are not reversed).

AUTOPILOT FUNCTIONS. The autopilot approach mode (AWLS) provides CAT I and CAT II automatic approach and automatic landing capability. During automatic approach mode, the autopilots in both AFCPs are engaged at the same time, with one autopilot active and the second autopilot in standby, for fail-safe operation.

In the approach mode, the AFCS automatically responds to the Instrument Landing System (ILS) localizer signals for lateral guidance and glide slope signals for vertical guidance. The autopilot automatically steers the aircraft to maintain localizer and glide slope track. At this time, with no further action required by the flight crew, the autopilot automatically controls the aircraft through flare and touchdown, or the pilot can disengage the autopilot and complete the landing manually. On approaches initiated with one engine inoperative, the autopilot can safely conduct the approach.

WARNING

> When AP1 or AP2 and not AWLS is annunciated in the AP Status window of the PFD, indicating only one autopilot is engaged, that single autopilot will fly the entire approach and autoland if the system is not disengaged prior to landing.

The autopilot steers the aircraft to capture the localizer beam from any intercept angle, up to and including 90°. The maximum bank angle during capture is limited to 30°.

The autopilot automatically maneuvers the aircraft to glide slope capture from attitude hold or altitude hold modes and maintains the aircraft on the glide slope beam. Upon acquiring the glide slope beam, the autopilot automatically disengages altitude or attitude hold, if either mode was engaged.

ALL WEATHER LANDING SYSTEM (AWLS).

An AWLS function provides information to control the aircraft throughout the normal approach down to the CAT I or CAT II DH. With the mode functional, automatic control to touchdown is provided, although visual reference is required for manual control during decrab and roll-out.

System requirements for a Category II approach are as follows:

1. Radar altimeter must be operative.

2. Both ILS receivers must be operative and tuned to the same approach aid.

NOTE

Both pilots must not have the same ILS receiver selected during a CAT II approach.

3. The CDS must be fully operational.

4. Both autopilots must be fully operational (automatic approach).

5. Both Flight Directors must be fully operational.

6. Both pilots must have independent attitude and heading sources selected.

AWLS Mode Annunciations.

AWLS mode annunciations are displayed on the upper portion of both the pilot's and copilot's PFD. Annunciations associated with AWLS are:

(ATS)	ARM	AP ROLL	AP PITCH	(AP STATUS)
	ILS (Y)			
AT ARM (Y)	ILS (G) LAND (Y)	LOC CAP (G)	GS CAP (G)	AWLS (G)
AT SPD (G)	LAND (G)	LOC TRK (G)	GS TRK (G)	
AT RTD (G)			FLARE (G)	AP1 ON (G) AP2 ON (G)
	CAT I (Y)			

(Y) - YELLOW (G) - GREEN

AT ARM - Annunciates when MSP A/T pushbutton is pressed.

AT SPD - Annunciates when the engage/disengage pushbutton on the pilot's or copilot's throttle is pressed, engaging the throttle.

AT RTD - Annunciates when AFCP commands automatic throttle retard.

ILS - Annunciates yellow when only one VOR/ILS is tuned.

ILS - Annunciates green when both VOR/ILS are tuned and both Flight Directors are enabled.

LAND - Annunciates yellow when one autopilot fails during dual autopilot operation or when only one autopilot is engaged.

LAND - Annunciates green at 900 feet AGL after LOC TRK and GS TRK have been achieved on both pilot and copilot sides.

CAT I - Annunciates yellow when the AFCP detects loss of CAT II capability.

LOC CAP - Annunciates when localizer course is captured.

LOC TRK - Annunciates when aircraft is tracking localizer course.

GS CAP - Annunciates when glide slope capture occurs.

GS TRK - Annunciates when aircraft is tracking glideslope.

FLARE - Annunciates at 45 feet AGL when AFCP provides flare commands to the autopilot.

AWLS - Annunciates green when AWLS is selected on the DAMU and both AP1 and AP2 are engaged.

AUTOTHROTTLE SYSTEM (A/T).

UNIT	CIRCUIT BREAKER (BUS)
AFCP NO.1	AFCP NO. 1 (EMER AC)
	AFCP NO. 1 (EMER DC)
AFCP NO. 2	AFCP NO. 2 (AVIONICS AC 2)
	AFCP NO. 2 (MAIN DC AVIONICS 1)
AUTO-THROTTLE SERVO	A/T SERVO (MAIN DC AVIONICS 2)
	FCP 1 /A/T SERVO (ISOL 26V AC)

An integrated automatic throttle system is provided to maintain and hold the airspeed existing at engagement. When the aircraft is stabilized in a climb, cruise, or in a coordinated turn, and the throttle is not operating at the minimum or maximum limit stops, the autothrottle maintains the aircraft speed within ±5 knots of the engaged airspeed. The autothrottles may be engaged in any mode except Speed On Pitch (SOP). If SOP is selected while the autothrottles are engaged, the autothrottles will disengage. When used in conjunction with AWLS mode, the autothrottle system controls the airspeed during approach, flare and touchdown. Once engaged, airspeed may be adjusted ± 5 knots in 1-knot increments using the TRIM rocker on the RSP. When VNAV mode is selected, the airspeed selected in the FMS is used for climb and cruise. Autothrottle control is normally provided by AFCP 1. A failure of the autothrottle function in AFCP 1 causes AFCP 1 to automatically discontinue autothrottle control, annunciate a failure, and AFCP 2 automatically assumes autothrottle control. The pilots can manually override any throttle lever, or all four levers, using normal force. In the event of a catastrophic failure, a force of up to 65 pounds may be required to overpower the throttles.

NOTE

The autothrottle system is inoperative when the aerial refuel master switch is ON.

The autothrottle system consists of an A/T arm switch located on both MSPs, engage pushbuttons located on the pilots No. 1 and copilots No. 4 throttle, an A/S TRIM rocker switch located on both RSPs, autothrottle computation functions embedded in both Automatic Flight Control Processors (AFCPs) located in the underdeck rack, and a servo clutch pack located under the flight deck.

Annunciations.

Autothrottle arm and engage annunciations appear in the upper left corner of both PFDs. When the autothrottles are engaged, a magenta autothrottle airspeed caret appears adjacent to the select airspeed.

Operation.

The autothrottle is armed by pressing the A/T switch on the MSP. If in VNAV mode, pressing the A/T switch arms the FMS-coupled autothrottle capability. If in the approach mode, pressing the A/T switch arms the autothrottle mode's auto land capabilities. If not in the VNAV or approach mode, selection of the autothrottle arm switch arms the basic autothrottle function for airspeed hold. After the autothrottle is armed, it is possible to engage basic autothrottle (A/T speed) or FMS-coupled (FMS speed) autothrottle by pressing either throttle lever switch.

CAUTION

There is no overboost protection in the A/T speed mode.

Pressing the A/T switch while the mode is active, or actuating either outside throttle lever switch a second time disengages the autothrottle. Also, activation of the speed on pitch mode deactivates the autothrottles. If neither air data computer validity signal is present, the autothrottle automatically disengages.

While in the approach mode, the autothrottle performs airspeed hold as described above until the flare initiation altitude is reached, at which time the throttles are driven to the idle position. When executing an automatic approach with autothrottles engaged and with appropriate data entered on the FMS PERF INIT page, actuation of either go-around button will advance the autothrottles to FMS calculated go-around EPR.

The autothrottle responds to throttle commands generated from the FMS when in the combined VNAV and FMS autothrottle mode, allowing control of the EPR during climb and cruise. The autothrottle uses the SCADC 1 airspeed error as the source for airspeed hold corrections as long as the validity signal from SCADC 1 is present. If the SCADC 1 validity signal is not present, the autothrottle automatically switches to the airspeed error signal provided by SCADC 2. If neither SCADC valid signal is present, the autothrottle disengages automatically.

The autothrottle system provides the pilot an airspeed trim adjustment to change engaged speed setting ±5 knots in 1-knot increments without requiring disengagement of the autothrottle. The autothrottle responds to the airspeed select input made from the RSP airspeed slew switch to capture and maintain the new selected airspeed.

Restrictions.

Autothrottles shall be disengaged for:

1. Take-off
2. Engine-out go-around

FLARE/LAND.

The flare/land computations are embedded functions within each AFCP. This function controls the pitch axis of the aircraft during the landing phase. The flare maneuver is entered automatically at 45-foot radar altitude when in the AWLS mode. When the flare maneuver is entered, FLARE is annunciated under AP PITCH column on both PFDs. Flare steering is also provided by the pitch steering bar.

If the engaged AFCP fails, the other AFCP takes over to complete the landing. Should both AFCPs fail, the autopilot and autothrottles will disengage.

ROTATION/GO-AROUND FUNCTION.

The rotation/go-around functions are embedded within each AFCP. Activation/deactivation of rotation function activates or deactivates the flight director mode. Additionally, the go-around function may be activated or deactivated with autopilot and/or flight director mode engaged.

Operation.

Pressing the rotation/GO-AROUND button on either control wheel activates this function. Pressing the button a second time disengages the autopilot and autothrottles, leaving the flight director mode active. A third button press deactivates the flight director mode.

If the autopilot is disengaged and either rotation/GO-AROUND button is pressed, the flight director mode activates. Pressing either button a second time causes the flight director mode to disengage.

Autopilot Mode.

If the autopilots are engaged in the automatic approach mode when the go-around maneuver is commanded the following sequence of events occurs:

1. The autopilot remains engaged but enters the CWS mode and the CWS light illuminates on the MSP. If the second autopilot is engaged (AWLS) in approach mode it remains engaged in standby mode for fail safe operation.

2. The Flight Director steering bars command an angle-of-attack corresponding to 1.1 V_S until a positive rate of climb has been attained. Then the pitch steering command smoothly transitions to 1.3 V_S. The roll steering bar commands wings level unless the heading select mode is active. A roll steering command will be provided if the heading mode is active.

3. If autothrottles were engaged, the autothrottles drive forward toward the take-off thrust position and then capture and maintain go-around EPR (in between 1 to 4 seconds). The autothrottles will disengage if all data is not entered on the FMS PERF INIT page when the go-around is activated.

Flight Director Mode.

If the aircraft is on the ground when activated, the AFCP commands a rotation maneuver. When either GO-AROUND button is actuated for take-off and climbout when the aircraft is on the ground, the pitch steering bar commands an angle-of-attack corresponding to 1.3 V_S. The roll steering bar commands wings level unless the heading select mode is active. A roll steering command will be provided if the heading mode is active.

STALL WARNING SYSTEM.

UNIT	CIRCUIT BREAKER (BUS)
AUTOMATIC FLIGHT CONTROL PROCESSOR AFCP NO. 1	AFCP NO. 1 (EMER AC) AFCP NO. 1 (EMER DC)
AFCP NO. 2	AFCP NO. 2 (AVIONICS AC 2) AFCP NO. 2 (MAIN DC AVIONICS 1)
STALL WARNING NO. 1	STALL WRN NO. 1 (ISOL AC EXCITATION)
STALL WARNING NO. 2	STALL WRN NO. 2 (AC NAV EXCITATION 2)
PILOT'S STICK SHAKER	STALL PREVENT NO. 1 (MAIN DC 1)
COPILOT'S STICK SHAKER	STALL WARN (OR PRE-VENT) NO. 2 (MAIN DC 2)
ANGLE OF ATTACK ANTI-ICING	
NO. 1 SYSTEM PILOT	PLT ANGLE OF ATTACK VANE HTR PWR (ESSENTIAL AC BUS 1)
NO. 2 SYSTEM COPILOT	COPLT ANGLE OF ATTACK VANE HTR PWR (ESSENTIAL AC BUS 2)
HTR FAULTED LIGHT	PITOT EPR & ANGLE OF ATTACK (EMERGENCY DC BUS)

A dual integrated stall warning system is provided. This system consists of electrically heated left and right angle of attack (AOA) vanes, overhead switches (PILOT and COPILOT - OFF, NORM), pilot's and copilot's control column shakers, spoiler position input and stall warning computation embedded in both automatic flight control processors (AFCPs). Both AFCPs analyze performance data from the AOA vanes, flap position, and Mach from the SCADC. When approaching a stall angle of attack, AFCP 1 activates the pilot's control column shaker and AFCP 2 activates the copilot's control column shaker. Additionally, either or both AFCPs is capable of disabling nose up trim. If either pilot attempts to extend the spoilers in an underspeed condition, UNDER SPLR SPEED annunciates on the annunciator panel and the warning horn sounds.

Angle of Attack (AOA) Vanes.

An angle of attack vane is mounted on each side of the forward fuselage. The vanes are electrically anti-iced and positioned by airflow. Vane movement rotates a shaft to which a transducer is coupled. The transducer transmits signals to both automatic flight control processors.

Stall Warning System Inhibit Switches.

The STALL PREVENTION SYS panel on the pilot's overhead panel contains two toggle switches (PILOT, COPILOT). The PILOT switch controls the stall warning function of AFCP 1 and the COPILOT switch controls the stall warning function of AFCP 2. Each switch has two positions: OFF and NORM. When a switch is in the NORM position, the applicable AFCP's stall warning function is armed. When a switch is in the OFF position, the applicable AFCP's warning function is inhibited.

Stall Warning Fault Indications.

A STALL1/2 FAIL annunciates (flashes) on the Caution Warning Advisory (CWA) section of the Secondary Flight Display (SFD) and activates the Master Caution Indicator. A STALL 1 FAIL annunciation indicates a loss of stall warning capability within AFCP 1. A STALL 2 FAIL annunciation indicates a loss of stall warning capability within AFCP 2.

Either pilot can acknowledge a STALL1/2 FAIL by pressing either master caution light. Upon acknowledgment, the master caution lights go out and the fault annunciation stops flashing.

Stall Warning Test.

Testing of the stall warning is an integrated function of the Control Display System (CDS)/Automatic Flight Control System (AFCS) Preflight BIT Test. CDS Preflight BIT Test can be initiated from either DAMU by selecting the BIT page and then PREFLT BIT ON. Preflight BIT Test can also be initiated by pressing the BIT pushbutton on the FCP.

Stall Warning Operation.

The system is activated by placing the associated system switch on the overhead panel to the NORM position. The AFCP receives an aircraft attitude signal with respect to relative wind from the associated angle of attack transducer, a Mach signal from the SCADC, and flap position. From this information, the AFCP determines the permissible angle of attack in relation to Mach for the existing flight conditions. The AFCP continuously compares the aircraft angle of attack with the permissible angle of attack. Warning signals are dispensed as aircraft angle of attack approaches, equals, or exceeds the permissible angle of attack.

Audible Stall Warning.

An audible stall warning is provided to indicate that immediate action should be taken to restore the aircraft to a safe angle of attack. The audible warning is provided through the intercom system and the overhead speaker. The audible stall warning does not occur unless the shaker has already energized. The audible warning is energized by either or both AFCPs after 5.0 seconds of shaker operation.

Visual Stall Warning.

The word STALL annunciates across the center of both ADIs when the stall shaker activates.

WARNING

Failure of both DPUs results in the loss of the stall warning system.

YAW DAMPING SYSTEM.

UNIT	CIRCUIT BREAKER (BUS)
AUTOMATIC FLIGHT CONTROL PROCESSOR (AFCP) NO. 1	AFCP NO. 1 (EMER AC)
	AFCP NO. 1 (EMER DC)
AFCP NO. 2	AFCP NO. 2 (AVIONICS AC 2)
	AFCP NO. 2 (MAIN DC AVIONICS 1)
RUDDER SERVO NO. 1	RUD SERVO NO. 1 (EMER DC)
RUDDER SERVO NO. 2	RUD SERVO NO. 2 (MAIN DC AVIONICS 1)

A dual integrated Yaw Damping System is provided. This system consists of yaw damping switch, two rudder servos, and yaw damping computation embedded in both automatic flight control processors (AFCP). The yaw damping function of the AFCS provides compensating rudder movement, in relation to the rate of yaw, to damp out inherent Dutch roll tendencies of the aircraft. Yaw damper operation will not obstruct pilot rudder inputs and has functional compatibility with manual flight controls. Engagement of the yaw damper causes no objectionable transients or oscillations noticeable by the flight crew.

The yaw damper commands for the rudder servo No. 1 originate from AFCP 1. The yaw damper commands for rudder servo No. 2 originate from AFCP 2. Failure of the yaw damper commands from the originating AFCP or failure to respond to commands by the actuator will disengage the AFCP/actuator combination.

Yaw Damper Switch. (See figure 1-228.)

The YAW DAMPER switch is on the CADC/YAW DAMPER switch panel. It is a two-position ("ON, OFF") lever-lock switch that enables/disables the automatic yaw damping function of both AFCSs. The YAW switch locks in the ON (forward) position and is a lift to unlock (OFF) switch.

Yaw Damper System Fault Indications.

A YAW DAMP FAULT annunciates (flashes) on the Caution Warning Advisory (CWA) section of the Secondary Flight Display (SFD) and activates the Master Caution Indicator. The YAW DAMP FAULT annunciations indicate a failure of one yaw damper mode or Automatic Flight Control Processor (AFCP).

A YAW DAMP INOP annunciates (flashes) on the Caution Warning Advisory (CWA) section of the SFD and activates the Master Caution Indicator. The YAW DAMP INOP annunciations indicate failure of both yaw dampers, or both AFCPs or that YAW DAMPER switch is placed in the OFF position.

Either pilot can acknowledge a YAW DAMP FAULT or YAW DAMP INOP fault by pressing either master caution light. Upon acknowledgment, the master caution lights go out and the fault annunciation stops flashing.

Yaw Damper Test.

Testing of the Yaw Damper is an integrated function of the Control Display System (CDS)/Automatic Flight Control System (AFCS) Preflight BIT Test. Preflight BIT Test can be initiated from either DAMU BIT page or by pressing the BIT pushbutton on the Flight Control Panel.

CAUTION

Failure of both DPUs results in the loss of the yaw damper system. Refer to the lateral stability chart (Section III).

AFCS MODE/STATUS ANNUNCIATIONS.

AFCS mode/status annunciations are displayed on the top of the PFD as follows:

(ATS)	ARM	AP ROLL	AP PITCH	(AP STATUS)
AT ARM (Y)	CAT I (Y)	ATT HLD (G)	ATT (G)	AP 1 ON (G)
AT SPD (G)	ILS (Y)	HDG HLD (G)	SOP (G)	AP 2 ON (G)
AT FMS (G)	ILS (G)	HDG SEL (G)	GS CAP (G)	AP 1 CWS (G)
AT G/A (G)	LAND (Y)	FMS (G)	GS TRK (G)	AP 2 CWS (G)
AT RTD (G)	LAND (G)	VOR CAP (G)	FLARE (G)	AP 1 SPLIT (G)
AT OFF (R)	VOR (Y)	VOR TRK (G)	VNAV (G)	AP 2 SPLIT (G)
	TAC (Y)	VOR STA (G)	VIAS (G)	AWLS (G)
	BCRS (Y)	TAC CAP (G)	VPATH (G)	AP OFF (R)*
	FMS (Y)	TAC TRK (G)	VALT CAP (G)	
	LOC (Y)	TAC STA (G)	VALT HLD (G)	
		LOC CAP (G)	ALT HLD (G)	
		LOC TRK (G)	CWS (G)	
		BCRS (G)	G/A (G)	
		G/A (G)	T/O (G)	
		T/O (G)		
		CWS (G)		

(Y) - YELLOW (G) - GREEN (R) - RED

* INDICATES FLASHING

ATS Window (no title)	
AT ARM	Annunciates when MSP A/T pushbutton is pressed.
AT SPD	Annunciates when the engage/disengage pushbutton on the pilot's or copilot's throttles is pressed, engaging the throttles.
AT FMS	Annunciates when the autothrottles are coupled to the FMS.
AT RTD	Annunciates when AWLS commands automatic throttle retard.
AT G/A	Annunciates when go-around button is pressed.
AT OFF	Annunciates when the autothrottles are automatically disengaged. Annunciates in red until acknowledged. Extinguishes after acknowledgment. **NOTE** AT OFF also annunciates in red across the HSI.
ARM Window: the first row is for the title (ARM) and the second row displays the annunciation.	
CAT I	Annunciates a failure that prevents a CAT II approach (CARA failure).
ILS	Annunciates yellow when one ILS is not tuned or flight directors are not active. Annunciates green when both ILSs are tuned and flight directors are enabled.
LAND (G)	Annunciates after LOC TRK and GS TRK have been achieved.

LAND (Y)	Annunciates yellow when autopilot fails during dual autopilot operation.
VOR	Annunciates yellow when VOR is selected as the source for pointer 1 and LNAV is selected. Extinguishes after the VOR course is captured.
TAC	Annunciates yellow when TACAN is selected as the source for pointer 1 and LNAV is selected. Extinguishes after the TACAN course is captured.
BCRS	Annunciates yellow when Localizer is selected as the source for pointer 1, LNAV is selected, and a difference between aircraft and course exceeds 105°. Extinguishes after the Localizer Back Course is captured.
FMS	Annunciates when FMS is armed.
LOC	Annunciates yellow when ILS is selected as the source for pointer 1 and LNAV is selected on the DAMU.
AP ROLL Window: The first row is for the title (AP ROLL) and the second row displays the annunciation.	
ATT HLD	Annunciates when the autopilot is engaged in Attitude Hold mode.
HDG HLD	Annunciates when the autopilot is engaged in Heading Hold mode.
HDG SEL	Annunciates when the autopilot is engaged in Heading Select mode.
FMS	Annunciates when the autopilot is engaged, LNAV is selected, and the FMS track is captured.
VOR CAP	Annunciates when the autopilot is engaged, LNAV is selected, and the VOR course is captured.
VOR TRK	Annunciates after the VOR course is captured and the autopilot is tracking the selected VOR course.
VOR STA	Annunciates when the aircraft passes over the VOR station.
TAC CAP	Annunciates when the autopilot is engaged, LNAV is selected, and the TACAN course is captured.
TAC TRK	Annunciates after the TACAN course is captured and the autopilot is tracking the selected TACAN course.
TAC STA	Annunciates when the aircraft passes over the TACAN station.
LOC CAP	Annunciates autopilot is engaged and localizer course is captured.
LOC TRK	Annunciates when autopilot is tracking localizer course.
BCRS	Annunciates when the autopilot is tracking the Back Course Localizer.
G/A	Annunciates when either pilot presses the Rotation/Go-Around button on the control wheel.
T/O	Annunciates when either pilot presses the Rotation/Go-Around button on the ground and the autopilot is not engaged.
CWS	Annunciates when either pilot presses the MSP CWS pushbutton and either autopilot is engaged.
AP PITCH Window: The first row is for the title (AP PITCH) and the second row displays the annunciation.	
ATT	Annunciates when the autopilot is engaged in Attitude Hold mode.
SOP	Annunciates when the autopilot is engaged and the SPEED ON PITCH pushbutton on the MSP is pressed.
GS CAP	Annunciates when the autopilot is engaged, AWLS selected, and glide slope capture occurs.
GS TRK	Annunciates when the autopilot is tracking the glide slope.
FLARE	Annunciates when AWLS provides flare commands to the autopilot.
VNAV	Annunciates when the autopilot is engaged and the VNAV pushbutton on the MSP is pressed.
VIAS	Annunciates when the VNAV is active and the AFCP is flying the target airspeed. VIAS flashes when climb speed is too low or descent speed is too high. The transition point from a flashing VIAS to a steady VIAS is based on aircraft acceleration. The higher the rate of acceleration/deceleration, the greater the point for transition to a steady VIAS and vice versa.
VPATH	Annunciates when VNAV is active. While the VPATH mode is active, the FMS supplies valid speed, altitude, and vertical speed targets for use by the AFCS.
VALT CAP	Annunciates when VNAV is active and the AFCP is capturing the altitude target.
VALT HLD	Annunciates when VNAV is active and the AFCP is holding the altitude target.
G/A	Annunciates when either pilot presses the Rotation/Go-Around button on the control wheel in flight.

T/O	Annunciates when either pilot presses the Rotation/Go-Around button on the control wheel, autopilot not engaged, and the aircraft is on the ground.
ALT HLD	Annunciates when the autopilot is engaged and the ALT HLD pushbutton on the FCP is pressed.
CWS	Annunciates when either pilot presses the CWS button on the MSP, the autopilot is engaged, and ALT HLD is not active.
AP STATUS (no title)	
AP 1 ON	Annunciates green when autopilot 1 is engaged.
AP 2 ON	Annunciates green when autopilot 2 is engaged.
AP 1 CWS	Annunciates green when autopilot 1 is engaged and CWS is selected on either MSP.
AP 2 CWS	Annunciates green when autopilot 2 is engaged and CWS is selected on either MSP.
AWLS	Annunciates green when both autopilots are engaged, AWLS is armed, and no failures are detected.
AP 1 SPLIT	Annunciates green when autopilot 1 is engaged and either axis (LAT or PITCH) is off.
AP 2 SPLIT	Annunciates green when autopilot 2 is engaged and either axis (LAT or PITCH) is off.
AP OFF	Flashes red to indicate that the autopilot has been disengaged. Acknowledge by pressing the AP disconnect button on either control wheel. **NOTE** AP OFF also annunciates in red across the HSI.

AFCS CAUTIONS, WARNINGS, AND ADVISORIES (CWAs).

AFCS CWAs are located at the bottom of the SFD as follows:

CWA	CAUSE
AFCP1/2 FAIL	Indicates a failure of AFCP1/2. Activates Master Caution Indicator.
AP1/2 FAIL	Indicates a failure AFCS1/2, AFCP OK. Activates Master Caution Indicator.
AT FAIL	Indicates a failure of Autothrottle function in an AFCP. Activates Master Caution Indicator.
	NOTE A/T OFF also annunciates in red across the HSI.
AP TRIM FAILURE	Indicates a failure of the Autopilot Trim function in the AFCP when AP is engaged. Activates Master Caution Indicator.
YAW DAMP FAULT	Indicates a failure of one yaw damper mode. Activates Master Caution Indicator.
YAW DAMP INOP	Indicates a failure of both yaw damper modes. Annunciation in Red. Activates Master Caution Indicator.
STALL1/2 FAIL	Loss of the stall warning function within AFCP1/2. Activates Master Caution Indicator.

Acknowledge Procedure.

When a selected message first becomes active, both master caution lights will illuminate. Either pilot can acknowledge the message by pressing either of the master caution lights to reset the system. Upon acknowledgment, the master caution lights go out and the message stops flashing. If cleared, the fault will extinguish.

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) OPERATION.

The AFCS may be used during climb, cruise, descent, and approach. The AFCS is capable of course intercepts up to 90°.

Autopilot Limitations.

1. Do not perform missed approaches or go-arounds with autopilot and/or autothrottles engaged.
2. Do not operate with the autopilot engaged at speeds in excess of 350 KCAS/0.825 Mach.
3. Do not adjust rudder trim with autopilot engaged.

Engine Out Condition.

The autopilot is capable of flying the aircraft with an engine inoperative. With an engine inoperative, the following restrictions apply:

1. Do not perform missed approaches or go-arounds with autopilot and/or autothrottles engaged.

2. No large asymmetric power applications with autopilot engaged. Large asymmetric power conditions could result in an unusual attitude.

3. Do not apply rudder trim with autopilot engaged.

Before Engaging the Autopilot.

1. Ensure that all flight control system circuit breakers are in.
2. Ensure that at least one attitude reference (INS1, INS2, or AHRS) is operating properly.
3. Ensure that the YAW DAMPER switch is in the ON position.
4. Ensure the airplane is in a trimmed condition.
5. Ensure that the FCP Turn Ring is in the center detent.

The autopilot will not engage if the CWA displays any of the following messages:

1. AFCP1 and AFCP2 FAIL
2. AP1 and AP2 FAIL
3. YAW DAMP INOP

Rotation/Go-Around Mode (executed on the ground for take-off and climb).

1. Press the Rotation/Go-Around button on either control wheel.

   a. The PFDs annunciate T/O in green under FD ROLL and FD PITCH.

   b. The flight director positions the pitch steering bar for an AOA of 1.3 Vs.

Basic Autopilot Mode.

1. Verify the PITCH and LAT switches on the FCP are set to ON.
2. Press the AP1 or AP2 pushbutton on the FCP to engage the AFCS. AP1 ON or AP2 ON annunciates in the upper right corner of both the pilot's and copilot's DUs.

NOTE

Wait at least two seconds after engaging AP 1 or AP 2 before selecting any other mode.

3. Maneuver the aircraft with the integrated pitch and roll controller on the FCP.

WARNING

During high speed operations, the aircraft responds quickly to large movements of the pitch wheel. The aircraft's quick response to pitch commands could result in injury to unsecured personnel or cause the autopilot to disengage.

Control Wheel Steering Mode.

1. With either autopilot engaged, press the CWS pushbutton on the MSP.

   a. The CWS mode is armed and the annunciator bar above the CWS pushbutton illuminates.

   b. AP1 CWS or AP2 CWS annunciates in the upper right corner of both the pilot's and copilot's PFDs.

   c. The autopilot reverts to the basic mode.

2. When pressure is applied to the control wheel/column, the CWS mode is activated.

   a. CWS annunciates under AP ROLL on the PFD.

   b. CWS annunciates under AP PITCH on the PFD.

NOTE

The CWS pitch function is inhibited whenever the autopilot is engaged in SOP or ALT HOLD mode.

Altitude Hold Mode.

1. Press the AP1 or AP2 pushbutton on the FCP to engage the AFCS.

   a. The annunciator bar above AP1 or AP2 pushbutton illuminates.

   b. AP1 ON or AP2 ON annunciates in the upper right corner of both the pilot's and copilot's DUs.

NOTE

Wait at least two seconds after engaging AP1 or AP2 before selecting ALT HLD.

2. Press the ALT HLD pushbutton switch on the FCP.

   a. The annunciator bar above the ALT HLD pushbutton illuminates.

   b. ALT HLD annunciates under the AP PITCH on both the pilot's and copilot's DUs.

Speed on Pitch Mode.

1. Engage AP1 or AP2.

   a. The annunciator bar above AP1 or AP2 pushbutton illuminates.

   b. AP1 ON or AP2 ON annunciates in the upper right corner of both the pilot's and copilot's DUs.

NOTE

Wait at least two seconds after engaging AP1 or AP2 before selecting SOP.

2. Attain desired airspeed.

WARNING

- When climbing in SOP mode, the engaged calibrated airspeed will be maintained without regard to Mach. The autopilot will remain engaged in the SOP mode beyond 0.825 Mach. Failure to monitor Mach during the climb may cause the aircraft speed to exceed structural limitations.
- If autothrottles are engaged, pressing the SPEED ON PITCH pushbutton will disengage the auto throttles.

3. On MSP, press the SPEED ON PITCH pushbutton.

a. The annunciator bar above SPEED ON PITCH pushbutton illuminates.

b. SOP annunciates under AP PITCH on both the pilot's and copilot's PFDs.

Heading Select Mode.

1. Press the AP1 or AP2 pushbutton on the FCP to engage the AFCS.

a. The annunciator bar above AP1 or AP2 pushbutton illuminates.

b. AP1 ON or AP2 ON annunciates in the upper right corner of both the pilot's and copilot's PFDs.

2. On RSP, set the heading marker on the HSI corresponding to the selected AFCS to the airplane heading.

3. On the DAMU STATUS menu:

a. Select AP/FD

(2) Select - HDG

4. HDG SEL annunciates under AP ROLL on both the pilot's and copilot's PFDs.

5. For airplane heading control, set the HSI heading marker corresponding to the engaged AFCS to the desired heading. The AFCS will turn to and maintain the selected heading. The bank angle is limited to 30° during heading select mode.

Lateral Navigation Mode.

VOR OR TACAN.

1. If VOR or TACAN navigation is to be selected, tune the appropriate receiver and identify the station.

2. From the DAMU STATUS menu:

a. Select - NAV PTR1

(1) Select - TAC 1, TAC 2, VOR/ILS 1, or VOR/ILS 2

b. Select - AP/FD

(1) Select - LNAV

NOTE

If aircraft is not on a parallel or an intercept heading, the system will enter capture mode and turn to a 30.8° intercept.

3. VOR or TAC annunciates in yellow under ARM on both the pilot's and copilot's PFDs. Annunciation ceases when the VOR or TACAN course is captured.

4. Press the AP1 or AP2 pushbutton on the FCP to engage the AFCS.

a. The annunciator bar above AP1 or AP2 pushbutton illuminates.

b. AP1 ON or AP2 ON annunciates in the upper right corner of both the pilot's and copilot's PFDs.

c. VOR CAP or TAC CAP annunciates under AP ROLL on both the pilot's and copilot's PFDs when the VOR or TACAN course is captured. The annunciation changes to VOR TRK or TAC TRK when the autopilot tracks the selected course.

Autothrottles.

1. Depress MSP A/T pushbutton - AT ARM annunciates on both PFDs.

CAUTION

If autothrottles are engaged in a climb, monitor engine instruments to ensure that the auto throttles do not overboost the engines.

2. When the aircraft has stabilized at the desired airspeed, depress either autothrottle engage button. The AT ARM annunciation on the PFDs changes to the appropriate AT (SPD or FMS) engaged annunciation.

NOTE

At least one throttle must be forward of the idle disengage switch to engage the autothrottles.

3. To disengage the autothrottles, depress either autothrottle engage pushbutton. AT OFF annunciates on both PFDs.

NOTE

If autothrottles disengage, the AT OFF annunciation must be cleared by depressing either autothrottle engage pushbutton before the autothrottles can be re-engaged (steps 1 and 2).

AWLS CAT I Coupled Approach (Typical).

1. Verify that the FLT DIR annunciator bar is illuminated on both MSPs. If not, select FLT DIR.

2. Tune and identify ILS 1 receiver.

3. Set heading marker on pilot's HSI to the aircraft heading.

4. Set published front course on pilot's HSI.

5. Set radar altimeter to published RA/HAT.

6. On pilot's DAMU STATUS menu:

a. Select - NAV PTR 1

(1) Select - VOR/ILS 1

b. Select - AP/FD

(1) Select - HDG

7. Engage AP1:

NOTE

Autopilot must be engaged prior to GS TRK, or sudden pitch changes could occur.

The annunciator bar above the AP1 pushbutton illuminates.

a. AP1 ON annunciates in the upper right corner of both PFDs.

b. Both PFDs annunciate as follows:

	ARM ILS (yellow) (green)*	AP ROLL HDG SEL (green)	AP PITCH ATT (green)	AP1 ON (green)

* Green if both ILSs are tuned and flight directors are active.

8. Engage ALT HLD to maintain a constant altitude. Verify that:

a. The PFD AP pitch annunciation changes from ATT to ALT HLD.

9. Rotate the heading marker to the desired intercept heading on the pilot's HSI.

a. Once established on base or dog leg, from the pilot's DAMU STATUS menu:

(1) Select - LNAV or AWLS as desired.

WARNING

If AWLS is selected and the glide slope beam is intercepted prior to intercepting the localizer beam, the autopilot will capture glide slope, which may result in descent prior to entering the cleared descent zone.

(2) Select AWLS prior to glide slope intercept point.

10. When localizer capture occurs, verify that:

a. The PFD AP ROLL annunciation changes from HDG SEL to LOC CAP and then to LOC TRK.

b. The flight director roll bar provides proper steering.

11. When glide slope capture occurs, verify that:

a. The PFD AP pitch annunciation changes from ALT HLD to G/S CAP and then to G/S TRK.

b. The flight director pitch bar provides proper steering.

12. Marker beacon annunciations. Visual annunciations appear in the upper portion of the ADI as the aircraft passes over the outer, middle, and inner markers.

13. Monitor ILS progress on the ADI and HSI on the PFDs. When DH annunciates on the PFDs, the aircraft is at decision height based on radar altimeter setting.

NOTE

GCAS mode 6 callout "MINIMUMS - MINIMUMS" is issued at the point where the aircraft passes through the decision height based on the radar altimeter setting.

14. Disengage the autopilot(s) at decision height and land or go around.

WARNING

The AFCS will perform an automatic landing with only one autopilot engaged. However, failure to engage the second autopilot may result in a hazardous situation if the engaged autopilot fails during autolanding.

AWLS CAT II Flight Director Approach (Typical).

The flight director provides lateral and vertical steering commands to allow the pilot to manually steer the aircraft to a CAT II ILS approach.

1. Verify that the FLT DIR annunciator bar is illuminated on both MSPs. If not, select FLT DIR.

2. Tune and identify both ILS receivers.

3. Set heading marker on pilot's and copilot's HSI to the aircraft heading.

4. Set published front course on pilot's and copilot's HSI.

5. From the pilot's DAMU STATUS menu:

a. Select - NAV PTR 1

(1) Select - VOR/ILS1

b. Select - AP/FD

(1) Select - HDG

6. From the copilot's DAMU STATUS menu:

   a. Select - NAV PTR 1

      (1) Select - VOR/ILS 2

   b. Select - AP/FD

      (1) Select - HDG

7. Set radar altimeter to published RA/HAT.

8. ILS annunciates in green under ARM and HDG SEL annunciates under FD ROLL on the pilot's and copilot's PFDs.

9. Determine the desired intercept angle and rotate the heading marker on the pilot's HSI to the desired intercept heading.

   a. Once established, on base or dog leg, from the pilot's and copilot's DAMU AP/FD menu:

      (1) Select - LNAV or AWLS

WARNING

If the glide slope beam is intercepted prior to intercepting the localizer beam, the Flight Director will provide steering to capture glide slope, which may result in descent prior to entering the cleared descent zone.

      (2) Select AWLS prior to glide slope intercept.

10. When localizer capture occurs, verify that:

   a. The PFD FD ROLL annunciation changes from HDG SEL to LOC CAP and then to LOC TRK.

   b. The ROLL Steering Bar provides proper steering commands to intercept and maintain localizer track.

11. Verify that at glide slope capture the pitch bar is displayed and provides proper steering commands to intercept and maintain glide slope.

NOTE

At 900 feet AGL, the ARM ILS changes to ARM LAND (green).

12. Marker beacon annunciations. Visual annunciations appear in the upper portion of the ADI as the aircraft passes over the outer, middle, and inner markers.

13. Monitor ILS progress on the ADI and HSI on the PFDs. When DH annunciates on the PFDs, the aircraft is at decision height. At approximately the same time, "I" annunciates momentarily above DH, indicating that the aircraft is over the Inner Marker.

NOTE

GCAS mode 6 callout "MINIMUMS - MINIMUMS" is issued at the point where the aircraft passes through the decision height based on the radar altimeter setting.

   a. Visual cues must be sufficient to determine that the aircraft is within, and tracking to remain within, lateral confines of the runway extended. If cues are sufficient, the pilot may continue. If cues are insufficient, execute missed approach.

AWLS CAT II Coupled Approach (Typical).

1. Verify that the FLT DIR annunciator bar is illuminated on both MSPs. If not, select FLT DIR.

2. Tune and identify both ILS receivers.

3. Set heading marker on pilot's HSI to the aircraft heading.

4. Set published front course on pilot's and copilot's HSI.

5. Set radar altimeter to published RA/HAT.

6. Engage AP1.

NOTE

Autopilot must be engaged prior to GS TRK, or sudden pitch changes could occur.

7. On pilot's DAMU STATUS menu:

   a. Select - NAV PTR 1

      (1) Select - VOR/ILS 1

   b. Select AP/FD

      (1) Select - HDG

8. On copilot's DAMU STATUS menu:

   a. Select - NAV PTR 1

      (1) Select - VOR/ILS 2

9. ILS annunciates in green under ARM and HDG SEL annunciates under AP ROLL on the pilot's and copilot's PFDs.

10. Engage ALT HLD when a constant altitude is desired. The ALT HLD annunciator bar on the FCP will illuminate and ALT HLD annunciates on the PFD under AP PITCH.

11. Determine the desired intercept angle and rotate the heading marker on the pilot's HSI to the desired intercept heading.

12. When on base or dog leg, from either DAMU AP/FD menu:

   a. Select - LNAV or AWLS

13. Engage AP2 after intercepting localizer.

   a. AWLS annunciates in the upper right corner of both the pilot's and copilot's PFDs.

WARNING

If AWLS is selected and the glide slope beam is intercepted prior to intercepting the localizer beam, the autopilot will capture glide slope, which may result in descent prior to entering the cleared descent zone.

   b. Select AWLS prior to glide slope intercept.

14. Select A/T on MSP, if desired.

15. Prior to LOC/GS capture, the pilot's and copilot's PFDs annunciate as follows:

Pilot's PFD

AT ARM	ARM ILS	AP ROLL HDG SEL	AP PITCH ALT HLD	AWLS
(yellow)	(green)	(green)	(green)	(green)

Copilot's PFD

AT ARM	ARM ILS	AP ROLL	AP PITCH	AWLS
(yellow)	(green)	(green)	(green)	(green)

16. When stabilized at final approach speed, engage autothrottles, if desired.

a. On PFD, AT ARM (yellow) changes to AT SPD (green) when the autothrottles engage.

17. When the AFCS captures the localizer and glide slope, it drops out of heading select and altitude hold modes.

18. On PFD, HDG SEL and ALT HLD annunciations change to LOC CAP and GS CAP.

19. As the AFCS acquires localizer and glide slope track, both PFDs should annunciate as follows:

AT ARM	ARM ILS	AP ROLL LOC TRK	AP PITCH GS TRK	AWLS
(green)	(green)	(green)	(green)	(green)

NOTE

At 900 feet AGL, the ARM ILS changes to ARM LAND (green).

20. Marker beacon annunciations. Visual annunciations appear in the upper portion of the ADI as the aircraft passes over the outer, middle, and inner markers.

21. Monitor ILS progress on the ADI and HSI on the PFDs. When DH annunciates on the PFDs, the aircraft is at decision height. At approximately the same time, "I" annunciates momentarily above DH, indicating that the aircraft is over the inner marker.

NOTE

GCAS mode 6 callout "MINIMUMS - MINIMUMS" is issued at the point where the aircraft passes through the decision height based on the radar altimeter setting.

a. Visual cues must be sufficient to determine that the aircraft is within, and tracking to remain within lateral confines of the runway extended. If cues are sufficient, the pilot may continue. If cues are insufficient, execute missed approach.

b. If the approach is continued to landing, verify that the AT SPD and GS TRK annunciations change to FLARE (at 45 feet AGL) followed by AT RTD on the PFD.

c. The pilot may allow the autopilot to remain engaged to touchdown. At touchdown, disengage the autopilot and complete roll out manually.

NOTE

The pilot must manually decrab the aircraft prior to touchdown.

Rotation/Go-Around (Executed From an AWLS Coupled Approach).

1. Press the GO-AROUND button once on either control wheel.

a. The autopilot enters control wheel steering mode and autothrottles, if engaged, advances to go-around EPR.

b. The LAND annunciation ceases and both LOC TRK and GS TRK annunciations change to G/A.

c. The flight director positions the pitch steering bar for an AOA of 1.1 Vs until climb rate has been attained, then transitions to 1.3 Vs.

2. Pressing the GO-AROUND button a second time causes the autothrottle (if engaged) and the AWLS annunciations to change to AT OFF (red) and AP OFF (red). AP OFF flashes until acknowledged.

3. When Go-Around is completed, pressing the GO-AROUND button a third time takes the flight director out of the Go-Around mode.

4. Deselect AWLS on both the pilot's and copilot's DAMUs.

Back Course Localizer Approach (Typical).

1. Tune to and identify the localizer facility on both VOR/ILS receivers.

2. Engage AP1 or AP2 (if desired).

3. On pilot's DAMU STATUS menu:

a. Select - NAV PTR 1

(1) Select - VOR/ILS 1

4. On copilot's DAMU STATUS menu:

a. Select - NAV PTR 1

(1) Select - VOR/ILS 2

5. Set the published localizer front course in the pilot's/copilot's HSI course.

6. Set published Height Above Touchdown (HAT) on the radar altimeter.

7. Using the RSP, set the heading marker on the pilot's/copilot's HSI to the aircraft heading.

8. On either DAMU's AP/FD menu:

a. Select - HDG

9. HDG SEL is annunciated on both PFDs.

10. Press the ALT HLD pushbutton on the FCP when constant altitude is to be maintained.

11. Use the heading marker on engaged autopilot side to turn the airplane to the desired intercept angle.

12. On either DAMU's AP/FD menu, select:

a. Select - LNAV

NOTE

If aircraft heading is <105° from the front course, the aircraft may intercept the front course instead of the desired back course.

13. LOC annunciates under the ARM window on both PFDs.

14. When the aircraft heading is greater than 105° from the front course that is set in the HSI course window, BCRS (yellow) annunciates under the ARM window on the PFD.

NOTE

If AWLS is selected, the autopilot may attempt to intercept and fly a false ILS glidepath until the autopilot recognizes the back course localizer. It will then revert to LNAV BCRS and disregard the false glide slope.

15. BCRS annunciates (green) under AP ROLL on the PFD when the autopilot captures the back course localizer. The yellow BCRS annunciation under the ARM window will extinguish. All localizer course indications will be the same as a normal ILS.

NOTE

GCAS Mode 6C smart callouts annunciate at 500, 300, and 50 feet.

16. At the FAF, disengage ALT HLD and use the FCP pitch wheel to establish and maintain the desired rate of descent.

17. When published minimum descent altitude is reached, MDA annunciates on the upper portion of the ADI. Level the airplane with the pitch wheel.

18. Disengage the autopilot at the visual descent point (VDP) or the missed approach point (MAP).

ATTITUDE HEADING REFERENCE SYSTEM (AHRS).

The AHRS consists of three major components: the Dual Displacement Gyroscope Unit, the Electronic Control Amplifier, and the Compass System Controller. An AHRS POWER CONTROL panel, containing the PWR ON/OFF switch and the FAST ERECT/NORM switch is located on the copilot's right-hand console (figure 1-229).

The Dual Displacement Gyroscope Unit consists of a vertical gyro and a directional gyro. The vertical gyro provides attitude signals to the CDS and other aircraft systems. The directional gyro provides alternate heading signals to the flight directors, autopilot, and other aircraft systems.

AHRS POWER CONTROL PANEL.

The AHRS Power Control panel has two switches. The ON-OFF power switch is used to supply power to the AHRS. The FAST ERECT-NORM switch is used to erect the gyros. In "NORM", the erection rate is normal; in "FAST ERECT", the gyros will erect within 2.5 minutes.

COMPASS SYSTEM CONTROLLER.

SYN IND Indicator.

In the SLV mode, the SYN IND indicates magnetic system alignment. When the needle is centered, the directional gyro is aligned with the earth's magnetic field.

Mode Switch.

The mode switch is a three-position switch which permits the selection of "SLV", "DG", and "COMP" modes.

LAT Control.

The LAT Control is set to the aircraft latitude.

N/S Switch.

The N/S Switch is set to "N" or "S", as appropriate, for northern or southern hemisphere operation.

MAG VAR Switch.

The MAG VAR switch is a three-position rotary switch which provides an approximation of the magnetic variation to derive true heading for proper earth-rate correction.

HDG/PUSH TO SYNC Control.

The HDG/PUSH TO SYNC control is a push-to-turn control. In the slaved mode, pushing in on the control commands automatic magnetic synchronization. In the DG mode, pushing and turning the control permits aligning the directional gyro to the desired heading. The control is spring-loaded to the disengaged position.

AHRS OPERATING MODES.

The AHRS can operate in three major modes: Directional Gyro (DG), Slave (SLV), and Compass (COMP).

Directional Gyro (DG).

In the DG mode, the gyro acts as an independent directional gyro not slaved to any magnetic source.

Slave (SLV).

In the slaved mode, the AHRS uses the signal from the flux valve to slave the directional gyro to the earth's magnetic field to produce gyro-stabilized magnetic heading output.

Compass (COMP).

In the COMP mode, the AHRS provides magnetic heading without gyro stabilization, and as a result the heading output is unstable. The COMP mode is an emergency mode and a warning flag is provided along with the heading output to the using systems. No directional stabilization signals are provided for the Flight Director Systems in this mode.

The AHRS provides an alternate source of heading and/or attitude signals to the following aircraft equipment:

1. CDS
2. Pilot's BDHI
3. Copilot's BDHI
4. AFCS
5. Flight Recorder
6. VOR and TACAN
7. Radar

FLIGHT MANAGEMENT SYSTEM (FMS).

UNIT	CIRCUIT BREAKER (BUS)
PILOT'S MFCDU	MFCDU NO. 1 (MAIN DC AVIONICS 1)
COPILOT'S MFCDU	MFCDU NO. 2 (MAIN DC AVIONICS 2)
NAVIGATOR'S MFCDU	MFCDU NO. 3 (MAIN DC AVIONICS 2)
NP NO. 1	NP NO. 1 (MAIN DC AVIONICS 1)
NP NO. 2	NP NO. 2 (MAIN DC AVIONICS 2)
FMS RELAY	FMS RELAYS (MAIN DC AVIONICS 1)
FMS REFERENCE	FMS REF (ISOL AC AVIONICS)
DIU	DIU (MAIN DC AVIONICS 1)
DATA LOADER	DATA LOADER (MAIN DC AVIONICS 1)

The FMS is an integrated system that provides the flight crew with centralized control of the aircraft's navigation, flight management, communication, and display systems. The FMS capabilities also include Global Positioning System (GPS) navigation, enhanced navigation modes, and uploading and downloading mission dependent data.

The FMS interfaces with the Control Display System, both TACANs, both VOR/ILS, both Inertial Navigation Units, both Mode Select Units, both VHF Radios, Station Keeping Equipment, Standard Central Air Data Computer No. 2, landing gear position sensors, Weight on Wheels sensors, Pressure Indicator, Environmental Control Panel, Fuel Flow Indicator, Anti-Ice Control Panel, and Auxiliary Power Unit. Figure 1-232 shows the interfaces between FMS components and other systems.

Two redundant navigation processors (NPs) use data from aircraft navigation systems, aircraft sensors, database information, and flight crew inputs to compute required navigation solutions. The navigation processors can operate independently or in combination with each other. Flight profile information, system status, and warnings are provided to the flight crew through the control display system, Multifunction Control Display Unit, and annunciators.

FMS COMPONENTS.

The FMS is composed of two GPS antennas with integral signal amplifiers, two Navigation Processors (NPs) with embedded GPS receivers, one FMS Power Panel, one Data Receptacle Unit (DRU), one GPS Key Fill panel, and three Multifunction Control Display Units (MFCDU) (figure 1-230).

NOTE

Onside is defined as the side associated with the position; offside is defined as the opposite side. For example, if an individual is performing a task from the pilot's seat then NP 1 is the onside processor and NP 2 is the offside processor.

GPS Antenna.

Two GPS antennas are mounted on top of the airplane on the aerial refueling fairings. The low profile antennas receive L1 and L2 band GPS signals from NAVSTAR satellites. Each antenna houses an integral RF signal amplifier. Each antenna is connected to only one navigation processor and its embedded GPS receiver.

Navigation Processor (NP).

Two navigation processors (NP 1 and NP 2) are installed in the left-hand underdeck rack. Each NP and the associated systems connected to it comprise two identical and redundant navigation systems. Within each NP there are non-volatile memory storage areas for storage of the operating software, Navigation Database, and Mission Database. Aircraft systems designated "No. 1" (e.g., TACAN No. 1) are connected to NP No. 1, and systems designated "No. 2" are connected to NP No. 2.

The Guidance Master is defined as the navigation processor that provides both vertical and lateral navigation data to the autopilots and flight directors. Upon power-up, NP 1, if available, will be designated as the Guidance Master, with NP 2 designated as the Slave. If NP 1 is unavailable (e.g., powered off), NP 2 will be designated as the Master. When NP 1 becomes available it will be designated as the Master by default.

When both NPs are available and both have valid navigation solutions, the FMS will designate NP 1 as the Guidance Master.

When an autopilot is engaged and FMS is selected for the onside PTR 1 navigation source, Guidance Master designation will follow the selected FMS source. If FMS 1 is selected as the nav source, NP 1 will be designated as the Master. If FMS 2 is selected, NP 2 will be Master. If the Master's nav solution becomes invalid, the FMS will select the other NP as Master. When the autopilot is disengaged, NP 1 will be designated as the Master by default.

NAVIGATION DATABASE.

The navigation database is capable of containing worldwide navigation data. The navigation database is provided in NP memory-image format.

MISSION DATABASE.

The Mission Database contains custom data and parameters specific to the current mission. The Mission Database is composed of the following components: Custom Waypoints, Inhibited NAVAIDs, Stored Routes, Comm Radio Presets, Parachute Ballistic Data, and flight plans.

CUSTOM WAYPOINTS. Custom waypoints are user-defined locations stored in non-volatile memory. The NP supports up to and including 200 custom waypoints.

INHIBITED NAVAIDS. Inhibited Navaids identify Navigation Database Navaids that are either permanently or temporarily non-operational.

STORED ROUTES. Stored Routes are basic flight plans stored in non-volatile memory. The NP supports up to and including 100 stored routes containing up to and including a total of 1,200 Stored Route Legs.

COMM RADIO PRESETS. Up to 40 Comm Radio presets may be stored in non-volatile memory.

PARACHUTE BALLISTIC DATA. Parachute Ballistic Data defines parachute ballistic characteristics in support of the airdrop function. The NP supports Parachute Ballistic Database data for up to and including 20 parachute types.

FLIGHT PLANS. The flight plan provides information necessary to construct the lateral path and vertical profile. Mission flight parameters and initialization parameters are included as part of the flight plan. Two flight plans may be processed as Route 1 and Route 2.

FLIGHT PLAN WAYPOINT CAPACITY. The NP allows for up to 127 waypoints in a flight plan. When a waypoint or waypoints are to be inserted into the flight plan and the number of waypoints after the insertion will exceed the maximum number of waypoints allowed, the NP issues FLIGHT PLAN FULL annunciation on the MFCDU.

FLIGHT PLAN HISTORICAL WAYPOINT CAPACITY. The NP stores up to and including five historical waypoints in non-volatile memory. The active waypoint will become historical when it is sequenced by Lateral Guidance. The NP uses the last five active waypoints sequenced as the historical waypoints.

FLIGHT PLAN MISSION FLIGHT PARAMETER (MFP) FUNCTIONS. The NP allows the inclusion of up to 10 computed air release points (CARPs) into a flight plan. The NP allows the inclusion of up to four approaches and the inclusion of up to five rendezvous intercept points into a flight plan.

ALTERNATE FLIGHT PLAN WAYPOINT CAPACITY. The NP allows for at least 127 waypoints in the alternate flight plan.

ALTERNATE FLIGHT PLAN MFP FUNCTIONS. An alternate flight plan allows the inclusion of all MFP functions.

MAINTENANCE HISTORY DATA.

Maintenance History data is collected by the NPs and provides information on equipment failures.

GPS ALMANAC DATA.

GPS Almanac data provides a means of predicting satellite coverage over a specific geographic location.

GPS.

Each NP also contains an embedded GPS receiver. The GPS is a six-channel single board receiver that processes the L1 and L2 C/A components and Encrypted Precision (P/Y) components from signals transmitted by NAVSTAR GPS satellites. The GPS receives navigational messages broadcast by the satellite during tracking. As a minimum, the almanac and ephemeris parameters are collected. This data is periodically recollected in order to maintain current data.

GPS INITIALIZATION.

GPS POWER-UP PROCESSING. Power-up processing allows the GPS to begin acquisition of satellites as soon after NP power-up as possible. Ten seconds after NP power-up or RECEIVER RESET, the GPS initiates acquisition.

LOADING ALMANAC DATA. The almanac provides a means of predicting satellite coverage over a specific geographic location. When the aircraft is on the ground, the NP is capable of loading almanac data for up to 32 satellites.

MINIMUM OPERATIONAL PERFORMANCE (MOPS). MOPS for Airborne Supplemental Navigation Equipment using GPS requires that GPS equipment must be capable of detecting when the errors in its navigation solution exceed limits using RAIM (Receiver Autonomous Integrity Monitoring). Additionally, the GPS must be capable of detecting and excluding a failed GPS satellite. If the signals are detected to be out of specification for any reason, a warning is provided to the user.

RAIM is defined as the ability of a GPS receiver to assess the integrity of its navigation solution without depending upon information from other systems, or without requiring other elements of the GPS system (e.g., the Control Segment or the satellites) to detect and report an error. RAIM requires redundancy, and to do a self-consistency check on an instantaneous basis, there must be at least five satellites in view and the receiver must be tracking them all.

RAIM MONITORING. When the GPS is tracking five or more satellites and determines that a satellite signal is faulty, the NP issues a RAIMn ALERT that is displayed on both SFD's CWA and MFCDU GPSn STATUS page 2/2. If the GPS is tracking four or less satellites, the NP issues a RAIMn UNAVL that is displayed on both SFD's CWA and MFCDU GPSn STATUS page 2/2 (figure 1-34).

NO SPOOF MONITORING. When the GPS is not keyed or is receiving a channel that is not protected, the NP issues a NO SPOOFn alert that is displayed on both SFD's CWA. The MFDCU GPSn STATUS page 2/2 should show 2 C under the FC Column for that satellite.

NOTE

Spoofing is the deliberate transmission of incorrect information.

GPS STATUS MONITORING. If the NP BIT detects a GPS failure, the GPSn FAIL message annunciates on all MFCDUs.

RECEIVER RESET. When RECEIVER RESET (5R) is selected on the GPSn STATUS page 1/2, the NP causes the GPS to reset, perform power-on BIT and restart satellite acquisition.

When primary power is removed, each GPS utilizes a backup battery power to preserve critical memory data and crypto keys, if loaded.

Data Receptacle Unit (DRU).

The DRU is installed at the navigator's station. The DRU consists of a receptacle to receive and read a Data Transfer Device (DTD) and the interface connections to the FMS. The DRU facilitates uploading preplanned mission data from a DTD cartridge to the navigation processor's internal memory and downloading mission activity to the cartridge.

Data uploading and downloading can only be performed with aircraft weight on wheels.

GPS Key Fill Panel. (See figure 1-230.)

One key fill panel is installed at the navigator's station. The key fill panel is used to key and zeroize the two GPS receivers. A locking GPS zeroize switch is installed on the panel.

Multi-Function Control Display Unit (MFCDU).

Three identical and interchangeable MFCDUs are installed on the airplane (figure 1-230). Two are installed on the center pedestal, one for the pilot and one for the copilot. The third MFCDU is at the navigator's station. The MFCDUs provide the interface between the flight crew and the FMS. The MFCDU provides alphanumeric data inputs to the navigation processors and displays pertinent information to the crew. Data display is performed through the use of the MFCDU display. Alphanumeric inputs are obtained through the use of a keyboard. Line select keys provide the ability to transfer data to and from the scratch pad, to transfer between display pages, and to select various functions.

NOTE

When switching MFCDU pages, it is possible to encounter a blank page momentarily due to the page refresh rate.

MFCDU COMPONENTS.

MFCDU DISPLAY. (See figure 1-231.) There are 14 lines of 24 characters each on the display. Line 1 is used for page titles. Each page is shown with the appropriate title and page numbers on the top line. Lines 2 through 13 are associated with the line select keys and data fields. Line 14 is used for data entry and is referred to as the scratch pad. The lines associated with the line select keys are referenced in pairs.

The format of the data fields is displayed as either box prompts (□) or solicit dashes (-). The data fields displayed with box prompts require data entry in the given format. The solicit dashes are displayed on optional fields that have default values.

LINE SELECT KEYS (LSKs). There are six LSKs on each side of the display. For reference, the keys are defined one through six from top to bottom on each side of the display. A left and right designator is also assigned to define the side of the display that the key is located. For example, 1L is the top left line select key.

DIRECT ACCESS PROMPTS/MODE SELECTS. In displays other than index pages, 6L and 6R are primarily used for direct access to other modes in the FMS. The crew may also access these modes via the main navigation and performance menus if so desired. The modes that are most likely to be accessed from the present page are displayed as prompts.

SELECT TO SCRATCH PAD. Data can be copied to the scratch pad through the use of a line select key. Pressing a line select key when there is no data in the scratch pad will copy the data from the selected field to the scratch pad. Exceptions to this will be noted in the individual page descriptions.

SELECT TO DISPLAY PROMPTS. Once data has been entered into the scratch pad, either via line selection or manual keyboard entry, it may be up selected to any of the allowable data fields on a given page. This can be accomplished simply by depressing the key adjacent to the line in which scratch pad data will be inserted.

KEYBOARD DESCRIPTION.

ALPHANUMERIC KEYS. The MFCDU provides an alphanumeric keyboard to allow crew inputs to the scratch pad of the MFCDU. A key is provided for each letter of the alphabet (A-Z), for each number (0-9), and for a decimal point, minus sign, and slash.

CLEAR Key (CLR). This key has the following functions:

1. When a message is present in the scratch pad, depressing the CLR key will delete that message.

NOTE

Cautions and advisories will be displayed in inverse video in the scratch pad.

2. When an alphanumeric entry resides in the scratch pad, one character will be cleared from the scratch pad (from right to left) for each time the button is depressed.

3. When an alphanumeric entry resides in the scratch pad and the CLR key is held down, characters will be cleared from right to left for as long as the key is held down.

DELETE FUNCTION. When there is no message in the scratch pad and the CLR key is depressed, DELETE will appear in the scratch pad. Delete can then be used to delete items on the MFCDU pages by using the line select keys. Items deleted by this method are replaced with the default value or with entry prompts. If an event causing a message occurs while Delete is displayed, the Delete is stacked and the message is displayed.

MODE KEYS. The mode keys enable the crew to select the various pages as listed below. When a mode is selected, the MFCDU will display that mode's index or primary display page. The MFCDU has 12 mode keys.

MAIN MENU - Pressing results in displaying of the MAIN MENU 1/2 page.

COMM TUNE - Pressing results in displaying of the COMM TUNE INDEX page. From the COMM TUNE INDEX page, the comm radios (VHF1/2) can be tuned and lower level comm radio control pages can be accessed.

NAV TUNE - Pressing results in displaying of the NAV TUNE INDEX page. From the NAV TUNE INDEX page, the nav radios (VOR/ILS 1/2 and TAC 1/2) can be tuned and lower level nav radio control pages can be accessed.

SOLN - Pressing results in displaying of the INAV CONTROL SOLUTION 1/2 page. From the INAV CONTROL SOLUTION pages, control and status of the navigation function and sensors is displayed and can be controlled.

PROG - Pressing results in displaying of the PROGRESS 1/3 page. The PROGRESS page displays progress information relative to the active flight plan (waypoint, fuel, crosstrack, winds).

D→ - Pressing results in displaying of the LEGS DIRECT TO page. From the LEGS DIRECT TO page, either a direct to a waypoint or a direct to a course intercept can be initiated.

FPL - Pressing results in displaying of the active LEGS 2/X page. From the LEGS page, changes to the active flight plan can be made and other Flight Plan construction and status pages can be accessed (LEGS HISTORY, LEGS TO ALTERNATE, LEGS AT HOLD, WAYPOINT DATA, DEP/ARR, ROUTE).

TOLD - Pressing results in display of the following:

a. PERF INIT RTE n if Gross Weight or Percent CG is not available on that page. Otherwise display the following pages.

b. Based on flight phase.

(1) Preflight, takeoff, or climb, TAKEOFF INIT RTE n 1/4 is displayed when Outside Air Temperature, Baro Setting, or Elevation is not available; otherwise TAKEOFF DATA RTE n 1/2 is displayed.

(2) Cruise, Descent or Approach, LANDING INIT RTE n 3/4 is displayed when Outside Air Temperature, Baro Setting, or Elevation is not available; otherwise LANDING DATA RTE n is displayed.

NOTE

When Route 2 is active n = 2, otherwise n = 1.

MSN - Pressing results in displaying of the MISSION INDEX page. From the MISSION INDEX page, a present position hold can be initiated, CARP and RNDZ/INTCPT, CHUTE LIST, and Approach/Landing Zone pages can be accessed.

VNAV - Pressing results in displaying of the VNAV XXXX page. XXXX can be either CLIMB, CRUISE or DESCENT, depending on the phase of flight. On the VNAV pages, the VNAV modes and target speeds can be selected and other VNAV data is displayed.

EXEC - Pressing results in acceptance of new flight plan or a change to a previously accepted flight plan when the annunciator above the EXEC key is lit. If the annunciator is not lit, pressing the EXEC key results in no action.

BRT/DIM - Pressing the BRT half of this key results in brightening of the MFCDU display. Pressing the DIM half results in dimming of the MFCDU display.

PAGE KEYS. The PREV and NEXT keys provide the method of changing pages on the MFCDU. The number of pages in a particular mode or menu display are shown in the upper right-hand corner of the display. The format is AA/BB. AA signifies the number of the current page that is displayed. BB signifies the total number of pages that are available for crew viewing or modification. For example, pressing the NEXT will change the displayed page from 1/3 to 2/3. Selecting PREV key will change the displayed page to (AA minus 1). The pages operate in a circular fashion such that the page after 3/3 is 1/3.

ANNUNCIATORS. The MFCDU incorporates two annunciators beside the keyboard. These annunciators are used to alert the crew about operations as specified below.

MSG - Anytime a message is in the scratch pad, this annunciator is illuminated. When all messages are cleared, this annunciator is turned off.

MIX - This annunciator is lit whenever SKE Zone Marker data or TACAN data is being received and used to update the INS navigation solution. If the SKE update mode is selected, the MIX annunciator will flash. If the TACAN mode is selected, the MIX annunciator will illuminate steady.

GENERAL OPERATIONAL RULES.

This section describes general rules of operation that are independent of the pages displayed.

SCRATCH PAD. The scratch pad, which is the bottom line of the display, is used for data entry, messages, the delete function, and data transfer using the line select keys. Display of caution messages is first priority followed by advisory messages, the delete function, and then an entry from the keyboard or line select keys. The alphanumeric keys are used to enter characters into the scratch pad. Alphanumeric keys do not make entries to other lines on the MFCDU.

All numeric entries are assumed to be positive. If the entry is to be negative, the ± key can be used.

LINE SELECT KEYS. The line select keys are used to provide various functionality for data associated with that line select key. Functions may include, but are not limited to:

1. Data Upselect - Data from the scratch pad is placed into the data field(s) associated with the line select key. Typically, lines that accept entries are indicated by solicit dashes or box prompts, showing that there is a possible entry and indicating input format.

Normally data which is enterable will be displayed in large font. Data which was entered on one page and is displayed but is not enterable on another page will be displayed in small font. Data which is computed, default or extracted for the Navigation Database will be displayed in small font unless specified otherwise. Mission Database data loaded via the Data Loader System will be treated as though the data were entered from the MFCDU keyboard. If a system or data is unavailable, that system or data will also appear in small font.

2. Data Downselect - When a data field is associated with a line select, selection when the scratch pad is empty typically results in the data in the data field being placed into the scratch pad.

3. Page Branching - Typically, when a data field associated with a line select is of the form page_name> or <page_name, selection results in a branch to page_name.

4. Function Execution - If a data field associated with a line select contains a function name, its availability will be indicated by its font. Large font indicates the function is available, and small font indicates the function is not currently available. Selection when the function is available will result in that function being performed. Selection when the function is unavailable results in no action.

5. Mode Switch - A line select may also serve to control a mode switch associated with that line select key. A switch

may have any number of possible positions. The switch positions are shown on the page descriptions, and the positions are described as position a, b, c, etc. Selection of the line select increments the switch position (for example, from position "b" to "c"). The switches operate in a circular fashion, so that when the last switch position is active, selection results in the first switch position being selected. The active switch mode is displayed in inverse video, large font, while the inactive modes are displayed in small font.

6. Momentary Switch - A line select may serve to control a mode by providing a momentary switch. Momentary switches always have two possible states. Pressing the line select and holding it down causes a change in states. When the line select is released, the switch returns to its original state.

POWER-UP CONDITION.

The FMS displays the POWER UP page on power up. If the NP does not contain a navigation database, the error message NO NAV DB is displayed.

NP Source Indication.

The top left corner cell of each page display is reserved for an indicator of which NP is supplying the MFCDU display data. A "1" indicates NP1 and a "2" indicates NP2. This indicator is always displayed in small font. If the NP that is supplying the MFCDU data is Guidance Master, the number indicating the source NP is displayed in inverse video (1 or 2).

NOTE

After power transfer or transients, confirm DPU and NP selections.

Active Route.

The MFCDU contains two independent routes. These routes are referred to as Route 1 and Route 2. At any time, only one route may be active and providing guidance information for the aircraft. Upon power-up, neither route is active.

Route States.

There are three possible route states: active, provisional, and inactive.

ACTIVE.

An active route is indicated by ACT being placed in the page title of the route or legs page (for example, ACT ROUTE 1). Only one route may be active at one time. An active route is capable of providing guidance for the aircraft.

INACTIVE.

Upon power-up, both routes default to the inactive state. The route and legs page titles will indicate, for example, "RTE 1". Flight plan changes that are made to an inactive route go directly into the route; no provisional route is created. A route changes from the inactive state to the provisional state when the "ACTIVATE" function is selected for that route.

PROVISIONAL.

The purpose of the provisional route is to provide for a two-step process in making route changes that affect the guidance of the aircraft. A provisional route is indicated in flight plan page titles by placing MOD in front of the page name (for example, MOD ROUTE 1). There may be only one provisional route at a time. When a route is provisional and being displayed, the execute light is illuminated, and the corresponding route pages will display ERASE in 6L.

A provisional route is created in one of two ways. First, selecting the "ACTIVATE" function in an inactive route creates a provisional route. This provisional route can then be modified, and as this is done, it remains a provisional route. Second, an active route can be modified, at which point a provisional with the modifications is created. When this occurs, the original active route remains intact to provide guidance to the aircraft. Changes may be made to this provisional route and it remains a provisional route.

Selecting the ERASE function when the provisional exists deletes the provisional route. The page being displayed reverts to displaying the route without any modifications made to the provisional.

Selecting the EXEC key when a provisional exists changes the route state from provisional to active. If, for example, Route 2 is active and Route 1 is provisional, Route 2 will be placed in the inactive state and Route 1 will become active.

If one of the routes is in the provisional state and the operator forces the other route into the provisional state, the original provisional route will be erased before the other provisional route is created.

Erase/EXEC.

The ERASE function and the EXEC key allow for erasing or executing flight plan changes. These functions operate the same across all flight plan pages, unless specified otherwise on the individual page description.

The ERASE function will be selectable and the EXEC key illuminated and selectable only when a route is provisional and a page displaying information for that route is displayed on the MFCDU.

Selecting ERASE will delete the provisional route and restore display of the active route. Selecting EXEC will change the provisional route into an active route, and the Execute annunciator will be extinguished.

Selection, Entry and Deletion.

The specification of line select operations will often refer to the line select as being NON-OPERATIONAL under certain conditions. Unless noted otherwise, a NON-OPERATIONAL selection, entry, or deletion produces no action. No messages are generated, any scratch pad data remains intact, and no functions are performed. Unless noted otherwise, pressing a line select key when selection is permitted and the scratch pad contains data leaves the scratch pad intact and the selection operation takes place.

Power Transfer.

If power interruption is less than 1 second, the NP will warm start and all data will be saved (i.e., active flight plan, PERF INIT data). If the power interruption is more than 50 msec, the EGR (not the NP) is going to perform a "cold start" by running a power-up BIT. This cold start is indicated by a "GPSX FAIL" in the scratch pad for approximately 10 seconds. It will take about 50 seconds for the EGR to restart and reacquire the Satellite Vehicles (SV) and produce a solution. If GPS has been manually selected as the Nav Solution, during a power swap the system will revert to "NO NAV" condition because of the EGR power-up BIT, which will invalidate the nav data supplied to the displays (i.e., red bearing pointer and lost stick map). If the system is left in AUTO on the INAV page during the power swap, the system will revert to another nav source with the next best FOM, most likely KNS. With the system in AUTO the nav data sent to the displays will always be valid (green).

Display/Entry Conventions.

Each entry made to the MFCDU is checked for correct syntax at the time the entry is line selected from the scratch pad. The following lists the format for each type of entry. Symbols used for the entries are:

X Indicates the field for display.
N Indicates that the entry is a number.
A Indicates that the entry is a letter.
C Indicates that the entry is a letter, num ber, or sign.
" " Indicates no entry.

The font for each type of display is indicated on each page description. The font applies to the actual data in each data field, but not to the units (if they apply). All units, unless noted otherwise, are displayed in small font. Also, unless noted otherwise, the solicit dashes (- - -) and box prompts (□) used to indicate possible entries are displayed in large font.

An asterisk * to the left of a waypoint indicates that it is a temporary waypoint. Temporary waypoints PLACE/BEARING/DISTANCE (*PBXX) and PLACE/BEARING/PLACE/BEARING (*RRXX) when stored in route will result in an INVALID WAYPOINT being annunciated when the route is retrieved. To enter *PBXX and or *RRXX waypoint into a route for storage, first assign the waypoint a name, enter the name and *PBXX and/or *RRXX into the custom data base. Enter the alias name in place for the *PBXX or *RRXX waypoint into the route. Next, store the route.

AHEAD/BEHIND INDICATOR.

1. Display Format:

   "AHD" or Ahead
   "BHD" Behind

2. Entry Format:

   None

ALTITUDE (ANY ALTITUDE ENTRY).

1. Display Format:

   XXXXX
   Altitude below transition altitude
   "FL"XXX
   Altitude above transition altitude

2. Entry Format:

   NNNNN
   Altitude "FL"NNN Where "FL" means flight level

3. Entry Description:

   Altitude: Entry in feet with one to five numbers. Entry in flight level with "FL" plus two or three numbers, leading zeros not required, may have a minus sign. Minimum display for altitude is three numbers without leading zeros.

NOTE

Altitude entries above the applicable transition altitude or transition level are displayed in flight levels if the entry is divisible by 100. If not, the actual altitude is displayed.

4. Range:

   Altitude: FL000 to FL600
   -1300 to 60000

ALTITUDE CONSTRAINT.

1. Display Format:

   XXXXXXX

2. Entry Format:

   /CNNNNNC Altitude with constraint
   /C"FL"NNNC

3. Entry Description:

   Altitude: See Altitude Entry section

   Trailing C: "A" designates at-or-above Altitude
   "B" designates at-or-below Altitude
   " " designates at Altitude

   Leading C: "C" designates Climb phase constraint
   "D" designates Descent phase constraint
   "S" designates a step climb or step descent.

4. Range:

Altitude: See Altitude Range section

Trailing C:	"A" or "B" or " "
Leading C:	"C" or "D" or "S"

BANK ANGLE.

1. Display Format:

XX "°"

2. Entry Format:

NN	Angle

3. Entry Description:

Angle: One or two digits, leading zero not required.

4. Range:

Angle: 0° <= NN <= 30°

BAROSET.

1. Display Format:

XX"."XX"IN/"XXXXMB

2. Entry Format:

NNNN or	Millibars or inches of mercury
NN"."NN	Inches of mercury

3. Entry Description:

Millibars:	Three or four digits, leading zero not required.
Inches of mercury:	Two to four digits. Decimal point not required.

4. Range:

Millibars:	940 to 1050
Inches of mercury:	27.80 to 31.00

BRAKES / REV ENG.

1. Display Format:

X/X

2. Entry Format:

N or	Number of Brakes Operational
N/N	Number of Brakes Operational Engines to be in Reverse
/N	Engines to be in Reverse

3. Entry Description

Brakes:	One Digit
Engines:	One Digit

4. Range:

Brakes:	6 or 8
Engines:	0, 2 or 4

CAS/MACH SCHEDULE.

1. Display Format:

XXX"/."XXX or "."XXX"/"XXX

2. Entry Format:

NNN"/."NNN	CAS/Mach
"."NNN"/"NNN	Mach/CAS
NNN	CAS only (available for updates after the first entry
"."NNN	Mach only (available for updates after the first entry)

3. Entry Description:

CAS	Three numbers
Mach	One to three numbers prefixed by a decimal point

4. Range:

CAS:	100 to 350 in 1 increments
Mach:	.100 to .825 in .001 increments

CHANNEL, VHF.

1. Display Format:

XX

2. Entry Format:

NN	Maritime Channel

3. Entry Description:

Channel: Leading zeros not required.

4. Range:

Channel: 1 to 28 and 60 to 88

CHUTE NAME/NUMBER.

1. Display Format:

XXXXXXXX	Chute Name only
XXXXXXXX"/"X	Chute Name/Number

2. Entry Format:

CCCCCCCC	Chute Name only
CCCCCCCC"/"	Chute Name only
CCCCCCCC"/"N	Chute Name/Number
"/"N	Number only

3. Entry Description:

   One to eight characters in length for the Chute Name. One digit for the number of parachutes per element.

4. Range:

   Number: 1 to 9 parachutes

CLIMB GRADIENT.

1. Display Format:

   X"."XX"%"

2. Entry Format:

   N"."NN Percent

3. Entry Description:

   Climb Gradient:

   Entry of one to three numbers. If one number is entered, then decimal is not required. If more than one number is entered, then the decimal is required after the first number.

4. Range:

   Climb Gradient:

   Entry and display range is 2.50 to 3.30 in 0.01 increments.

COUNTRY CODE.

1. Display Format:

   XXXXX Country Code

2. Entry Format:

   None

COURSE.

1. Display Format:

XXX"°"	Course Magnetic
XXX"T"	Course True
XXX"G"	Course Grid

The units, "°", "T" or "G" are displayed in the same font as the course data. The units "°", "T" or "G" are selected to be consistent with the Heading Reference selected by the pilot for display on those MFCDUs controlled by NP1 and by the copilot for display on those MFCDUs controlled by NP2.

2. Entry Format:

NNN or	Course Magnetic
NNN"T" or	Course True

3. Entry Description:

   Course: Entry of one to three numbers, leading zeros not required. Course followed by "T" indicates the course is referenced to true north.

4. Range:

   Course: Entry range is 0 to 360
   Display range is 0 to 359

DATE.

1. Display Format:

   XXXXXXX

2. Entry Format:

   NNAAANN Date

3. Entry Description:

   Date: Entry in Day Month Year, Day entry is one to two numbers, leading zero not required, Month entry required to be three alpha characters, Year entry re quired to be two numbers.

4. Range:

   Day: 1 to 31 (dependent on month)

   Month: 1st 3 characters for one of the twelve months "JAN", "FEB", "MAR", "APR", "MAY", "JUN", "JUL", "AUG", "SEP", "OCT", "NOV", "DEC"

   Year: 00 to 99

DATUM DELTA OFFSET.

1. Display Format:

   XXXXXX

2. Entry Format:

   NNNNNN Delta Offset, meters

3. Entry Description:

   Delta Offset, meters: leading zeros not required

4. Range:

   Delta Offset: 0 to ± 99999 meters

DATUM DELTA RADIUS.

1. Display Format:

   XXXXX.XXX

2. Entry Format:

   NNNNN.NNN Delta radius, meters

3. Entry Description:

   Delta radius, meters: leading zeros not required

4. Range:

   Delta radius: 0 to ± 9999.999 meters

DATUM DELTA FLATTENING.

1. Display Format:

   X.XXXXXXXX

2. Entry Format:

   N.NNNNNNNN Delta flattening

3. Entry Description:

   Delta flattening: entry is true value * 10^4; leading zero not required

4. Range:

   Delta flattening: 0 to ± 0.99999999

DESCENT ANGLE.

1. Display Format:

   XX"."X"°"

2. Entry Format:

   NN"."N Degrees

3. Entry Description:

Degrees:	Entered in tenths of degrees, leading zero not required, trailing decimal and zero not required.

4. Range:

Degrees:	0.1 to 15.0 in 0.1 increments

DESCENT ANGLE OR IAS.

1. Display Format:

"XX"."X"°/"	Descent Angle
XXX"/"	IAS

Unless a descent angle has been entered as a constraint, the predicted or entered IAS will be displayed in the format XXX"/".

2. Entry Format:

NN"."N"°/"	Descent Angle
NNN"/"	IAS

3. Entry Description:

Descent Angle:	See Descent Angle Entry Description
IAS:	See Speed, IAS Entry Description

4. Range:

Descent Angle:	See Descent Angle Range
IAS:	See Speed, IAS Range

DIRECTION.

1. Display Format:

XXX"°/"XXX"T/"
XXX"G/"XXX"T/"

2. Range:

Direction:	See Course Range

DISTANCE, (CARP).

1. Display format:

XX"."X"NM"

2. Entry format:

NN"."N	Distance, NM

3. Entry Description:

Distance, NM:	One or two numbers, optionally followed by a decimal and an other digit.

4. Range

Entry:

Distance, NM:	0.1 to 99.9 nautical miles

Display:

Distance, NM:	0.1 to 99.9 nautical miles

DISTANCE, (NM).

1. Display format:

XXX"."X"NM"
XXXX"NM"

2. Entry format:

NNN"."N	Distance, NM

3. Entry Description:

Distance, NM:	One to three numbers, optionally followed by a decimal and another digit.

4. Range

Entry:

Distance, NM:	0.1 to 999.9 nautical miles

Display:

Distance, NM:	0.0 to 9999 nautical miles

DISTANCE, FEET

1. Display Format:

XXXXX	Distance

2. Entry Format:

NNNNN	Distance

3. Entry Description:

Distance:	One to five digits, leading zeros optional, may be preceded by a minus sign.

4. Range:

Distance, feet:	(-9999) to 99999 feet

DISTANCE, VERTICAL.

1. Display format:

XXX"FT" or XXXX"FT"

2. Entry format:

NNN or NNNN Distance, Feet

3. Entry Description:

NNN Distance:	One to three numbers. Leading zeros not required.
NNNN Distance:	One to four numbers. Leading zeros not required.

4. Range

Entry/Display:

NNN Distance, Ft:
0 to 999 feet

NNNN Distance, Ft:
0 to 9999 feet

DRIFT ANGLE.

1. Display Format:

   XXX"°"A

2. Range:

   Drift Angle: 0 to 90°
   A: "L" (left) or "R" (right)

ELEVATION.

1. Display Format:

   XXXXX"FT" Elevation

2. Entry Format:

   NNNNN Elevation

3. Entry Description:

   Elevation: One to five digits, leading zeros optional, may be preceded by a minus sign.

4. Range:

   Elevation: (-2,000) to 32,500 feet

ENTRY TYPE (HOLDING PATTERNS).

1. Display Format:

PARALLEL	Parallel Entry
DIRECT	Direct Entry
TEAR DRP	Tear Drop entry

EPR.

1. Display Format:

   X.XX Engine Pressure Ratio, "truncated" to the second decimal point, not rounded.

2. Entry Format:

   Not Allowed

3. Range:

   EPR 1.00 to 2.30

ESTIMATED HORIZONTAL ERROR (EHE).

1. Display Format:

   X.XX EHE

2. Range:

   EHE: 0.00 to 9.99 nautical miles

ESTIMATED TIME ENROUTE.

1. Display Format:

   XXXX":"XXC

2. Range:

   HHMM:SS 0000:00 to 5959:59

FIGURE OF MERIT (FOM).

1. Display Format:

   X FOM

2. Range:

   FOM: 0 to 9

FLIGHT PLAN NAME (ANY ENTRY).

1. Display Format:

   XXXXXXXXXX

2. Entry Format:

   CCCCCCCCCC Flight Plan Name

3. Entry Description:

   Flight Plan Name: Entry of six to ten alphanumeric characters in any combination.

4. Range:

   Flight Plan Name:
   First character may not be numeric or a "-".

FREQUENCY (TACAN CHANNEL).

1. Display Format:

   XXX"X" or XXX"Y"

2. Entry Format:

   NNNC TACAN Channel

3. Entry Description:

   Channel: Leading zeros not required
   C: "X" or "Y" or " "; " " assumes "X"

4. Range:

   Channel: 1 to 126
   C: "X" or "Y" or " "

FREQUENCY(VHF).

1. Display Format:

   XXX"."XXX

2. Entry Format:

   NNN"."NNN Frequency VHF

3. Entry Description:

Frequency: Minimum entry is the three digits left of the decimal, trailing decimal and/or zeros not required. When a "2" or "7" is entered in the hundredths decimal place, entry of "5" in the thousandths decimal place is not required.

4. Range:

Frequency: AM Receiver is 108.0 to 115.975

AM Receive/Xmit is 116.0 to 151.975, 156.000-158.000

Frequencies are in steps of 0.025MHz

FREQUENCY (VOR).

1. Display Format:

XXX"."XX

2. Entry Format:

NNN"."NN Frequency VOR

3. Entry Description:

Frequency: Minimum of the three digits left of the decimal required for entry, trailing decimal and/or zeros not required.

4. Range:

Frequency: Range of frequency is 108.00 to 117.95 MHz.

FUEL FLOW.

1. Display Format:

XXXXX"LB/HR"

2. Entry Format:

NNNNN Fuel Flow

3. Entry Description:

Fuel Flow: Minimum of two numbers, leading zero not required

4. Range:

Fuel Flow: 0 to 16,000 pounds/hour

FUSELAGE STATION.

1. Display Format:

XXXX Fuselage Station

2. Entry Format:

NNNN Fuselage Station

3. Entry Description:

Fuselage Station: One to four digits, leading zeros optional.

4. Range:

Fuselage Station: 975 to 1400

GRID FACTOR.

1. Display Format:

X.XXXXX

2. Entry Format:

N.NNNNN Grid Factor

3. Entry Description:

Grid Factor: Decimal and trailing digits not needed for entries of "1" and "-1".

4. Range:

Grid Factor: -1.00000 to 1.00000

HOLD LEG DISTANCE/APPROACH FAF DISTANCE.

1. Display Format:

XX"."X"NM"

2. Entry Format:

NN"."N Leg distance

3. Entry Description:

Leg Distance: Entry in nautical miles and tenths of miles, leading zeros not required, trailing decimal and zeros not required.

4. Range:

Leg Distance: 0.1 to 99.9

HOLD LEG TIME.

1. Display Format:

XX":"XX

2. Entry Format:

NN or NN.NN Leg Time

3. Entry Description:

Leg Time: Entry in minutes and seconds, leading zeros not required.

4. Range:

Leg Time: 0.30 to 99.59 in 0.01 increments

IDENTIFIER.

1. Display Format:

   XXXXX

2. Entry Format:

   CCCCC

3. Entry Description:

Two to five alphanumeric characters in length, where the first character cannot be numeric.

4. Range:

   None

INBOUND COURSE/DIRECTION.

1. Display Format:

   XXX"°/"X" TURN Course Magnetic
   XXX"T/"X" TURN Course True
   XXX"G/"X" TURN Course Grid

2. Entry Format:

NNN"T/"A	Course$_{Magnetic}$/Turn Direction
NNN"T/"A	Course$_{True}$/Turn Direction
NNN	Course$_{Magnetic}$
NNN"T"	Course$_{True}$
NNN"/"	Course$_{Magnetic}$
NNN"T/"	Course$_{True}$
"/"A	Turn Direction

3. Entry Description:

Inbound Course:	See Course Entry Description
A:	Turn Direction, may be "R" or "L"

4. Range:

   Inbound Course: "R" or "L".

ISA TEMPERATURE DEVIATION.

1. Display Format:

   XXX"°C" or XXX"°F"

2. Entry Format:

NNNC	Temperature Deviation in °C
NNNF	Temperature Deviation in °F

3. Entry Description:

Temperature:	Entry of one to three digits, optionally preceded by "-", leading zero not required. Appended with a C indicates degrees Celsius; Appended with an F indicates degrees Fahrenheit.

4. Range:

   Temperature (C): -100° to 80° C

   Temperature (F): -148° to 176° F

L/R INDICATOR.

1. Display Format:

"L"	- left
"R"	- right

2. Entry Format:

   "L"

   "R"

LT/RT INDICATOR.

1. Display Format:

"LT"	- left
"RT"	- right

2. Entry Format:

   "LT"

   "RT"

LATITUDE.

1. Display Format:

   XXX"°"XX"."XX

2. Range:

Latitude:	Degrees range is 0 to 90, minutes range is 0 to 59, hundredths range is 0 to 99.
A:	"N" or "S"

LATITUDE / LONGITUDE.

1. Display Format:

   XXX"°XX"."XX XXXX"°"XX"."XX

2. Entry Format:

   ANNNN"."NNANNNNN"."NN
   Latitude
   Longitude

3. Entry Description:

Latitude:	Entry in degrees, minutes, and hundredths of minutes, alpha entry required to be "N" or "S", minimum numeric entry is one digit, first two digits are interpreted as degrees, next two digits are interpreted as minutes, trailing zeros not required, decimal and fractional minutes not required.
Longitude:	Entry in degrees, minutes, and hundredths of minutes, alpha entry required to be "E" or "W", mini mum numeric entry is one digit, first three digits are interpreted as degrees, next two digits are interpreted as minutes, trailing zeros not required, decimal and fractional minutes not required.

4. Range:

Latitude:	See Latitude Range.
Longitude:	See Longitude Range.

Examples:

Entry	Display
=====	============
N0W0	N00°00.00 W000°00.00
N1W1	N01°00.00 W001°00.00
N12W12	N12°00.00 W012°00.00
N123W123	N12°30.00 W123°00.00
N1234W1234	N12°34.00 W123°40.00
N1234.5W12345	N12°34.50 W123°45.00
N1234.5W12345.6	N12°34.50 W123°45.60
N1234.56W12345.67	N12°34.56 W123°45.67

NOTE

For coordinate entries of 1 to 5 characters where a waypoint name may also be entered, the waypoint list is examined first for an occurrence of the entered character string. If found, the entry is interpreted as a named waypoint. For coordinate entries of 6 to 10 characters where a flight plan name may also be entered, the flight plan list is examined first for an occurrence of the entered character string. If found, the entry is interpreted as a flight plan name.

LENGTH, (YARDS).

1. Display format:

XXXXX"YDS"

2. Entry format:

NNNNN	Length, Yards

3. Entry Description:

Length, Yds:	One to five numbers.

4. Range

Entry/Display:

Length, Yds:	1 to 20,000 yards

LIST POSITION.

1. Display Format:

XX

2. Entry Format:

NN	List Position

3. Entry Description:

List Position:	One to two digits, where leading zeros are optional.

4. Range

List Position:	1-40

LOAD WEIGHT/QUANTITY.

1. Display Format:

XXXXX"/"XXX

2. Entry Format:

NNNNN"/"NNN	Weight/Quantity
"/"NNN	Quantity only

3. Entry Description:

Weight:	Weight per load element in pounds, one to five digits, leading zeros not required.
Quantity:	Number of load elements, one to three digits, leading zeros not required.

4. Range:

Weight:	See Weight CARP
Quantity	1 to 155 elements

LONGITUDE.

1. Display Format:

XXXX"°"XX"."XX

2. Range:

Longitude:	Degrees range is 0 to 180, minutes range is 0 to 59, hundredths range is 0 to 99.
A:	"E" or "W"

MAGNETIC VARIATION (MAG VAR).

1. Display Format:

XX"°"X	Magnetic Variation
XXX"°"XX.X	Display on INS STATUS page only.

2. Entry Format:

   Entry allowed on INS STATUS page only:
   AXXX°XX.X

3. Entry Description:

   Entry in degrees, minutes, and tenths of minutes, alpha entry required to be "E" or "W", minimum numeric entry is one digit, first two digits are interpreted as degrees, next two digits are interpreted as minutes, trailing zeros not required, decimal and fractional minutes not required.

4. Range:

   Magnetic Variation: 0 to 180

   A: "E" or "W"

MAP DATUMS.

1. Display Format:

ADINDAN.05	NA 27 CONUS
ARC 50	NA 27 ALCAN
AUS GEO 84	MAUI
BUKIT RIMPAH	OAHU
CAMP A ASTRO	KAUAI
DJAKARTA	ORD GB 36
EUROPEAN 50	QORNOQ
GEO DAT	S LEONE 60
GHANA	SA PROV 56
GUAM 63	SA C ALEGRE
G SEGARA	SA CAMPO IN
G SERINDUNG	SA C ARTRO
HERAT NORTH	SA YACARE
HJORSEY 55	TANANARIVE
HU-TZU-SHAN	TIMBALAI
INDIAN	TOKYO
IRELAND 65	VOIROL
KERTAU	SPECIAL INDIAN
LIBERIA 64	SPECIAL LUZON
USER DEF	SPECIAL TOKYO
LUZON	SPECIAL WGS 84
MERCHICH	WGS-72
MONTJONG LOWE	WGS-84
NIGERIA	

MILITARY GRID REFERENCE SYSTEM (MGRS).

1. Display Format:

XXXXXXXXXXXXXX	Polar MGRS (from UPS grid)
XXXXXXXXXXXXXXXXX	Non-polar MGRS (from UTM grid)

   (Polar MGRS applies north of N84 and south of S80 latitudes)

2. Entry Format:

   Polar MGRS:

   AAANNNN
   AAANNNNNN
   AAANNNNNNNN
   AAANNNNNNNNNN

   Non-polar MGRS:

   NNAAANNNN
   NNAAANNNNNN
   NNAAANNNNNNNN
   NNAAANNNNNNNNNN

3. Entry Description:

   Polar MGRS:

A	Grid zone designation
AA	100 km square identification
NNNNNNNNNN	Easting/Northing

   Non-polar MGRS:

NN	Grid zone designation
AAA	100 km square identification
NNNNNNNNNN	Easting/Northing

4. Range

   Polar MGRS

   Grid zone: "Y" or "Z" for north pole, "A" or "B" for south pole.

   Polar MGRS 100 km square:

Grid Zone	First Character	Second Character
Y	R	E to K except I
	S	C to M except I
	T, U	B to N except I & O
	X, Y, Z	A to P except I & O
Z	A, B, C	A to P except I & O
	F, G	B to N except I & O

Grid Zone	First Character	Second Character
	H	C to M except I
	J	E to K except I
A	J	L to P except O
	K	H to S except I & O
	L	F to U except I & O
	P	E to V except I & O
	Q	D to w except I & O
	R, S	C to X except I & O
	T, U, X	B to Y except I & O
	Y, Z	A to Z except I & O
B	A, B	A to Z except I & O
	C, F, G	B to Y except I & O
	H, J	C to X except I & O
	K	D to W except I & O
	L	E to V except I & O
	P	F to U except I & O
	Q	H to S except I & O
	R	L to P except O

Non-polar MGRS Grid zone: 01 to 60

Non-polar MGRS 100 km square:

First character is "C" to "W" excluding "I" & "O", second character is "A" to "Z" excluding "I" & "O", third character is "A" to "Y' excluding "I" & "O"

Easting/Northing: Defined as pairs of numbers, zero to five digit pairs, each digit range 0 to 9.

Examples:

Entry	Display
=====	============
AYN0000	AYN0000000000
AYN003005	AYN0030000500
AYN12345678	AYN1234056780
AYN0123456789	AYN0123456789
11SMK3849	11SMK3800049000
11SMK380499	11SMK3800049901
11SMK38014993	11SMK3801049930
11SMK3801249934	11SMK3801249934

NAVIGATION SOURCE.

1. Display Format:

"KNS1" or "KNS2"
"GPS1" or "GPS2"
"INS1" or "INS2"

OAT/ALTITUDE.

1. Display Format:

XXX"°C/"XXXXX	Altitude below transition altitude.
XXX"°F/"XXXXX	Altitude below transition altitude.
XXX"°C/FL"XXX	Altitude above transition altitude.
XXX"°F/FL"XXX	Altitude above transition altitude.

2. Entry Format:

NNN"C/"NNNNN	Temperature in degrees C/Altitude.
NNN"F/"NNNNN	Temperature in degrees F/ Altitude.
NNN"C/FL"NNN	Where "FL means flight level.
NNN"F/FL"NNN	Where "FL means flight level.
NNN"C/"	Temperature in degrees C when altitude is already present.
NNN"F/"	Temperature in degrees F when altitude is already present.
"/"NNNNN	Altitude entry when temperature is already present.
"/FL"NNN	Where "FU means flight level and temperature is already present.

3. Entry Description:

Altitude:	Entry in feet with one to five numbers. Entry in flight level with "FL" plus two or three numbers, leading zeros not required, may have a minus sign. Minimum display for altitude is three numbers without leading zeros.
Temperature:	Entry of one to three digits, optionally preceded by "-", lead ing zero not required. Entered value is displayed.

If neither temperature nor altitude is already displayed, then both must be entered. If a temperature and altitude are displayed, then temperature only entry or altitude only entry is allowed.

4. Range:

Altitude:	-1300 to 60000 feet FL000 to FL600
Temperature (C):	-60° to 80° Celsius
Temperature (F):	-76° to 176° Fahrenheit

OBSTACLE DISTANCE, (TOLD).

1. Display Format:

   XXXXX"FT"/X.X"NM"

2. Entry Format:

   NNNNN or Feet
   "/"N.N Nautical Miles

3. Entry Description:

Feet:	One to five digits, leading zeros not required
Nautical Miles:	Two digits with decimal point, leading zero not required.

4. Range:

Feet:	0 - 60,113
Nautical Miles:	0 - 9.9

OBSTACLE ELEVATION, (TOLD).

See Elevation.

OFFSET.

1. Display Format:

   X XX.XNM

2. Entry Format:

   ANN.N Offset

3. Entry Description:

   Offset: Entry of direction plus nautical miles and tenths of nautical miles, leading zeros not required, trailing decimal and zero not required, alpha entry required to be R or L.

4. Range:

Offset:	0.1 to 99.9 in 0.1 increments
A:	"L" (left) or "R" (right)

PERCENT

1. Display Format:

   XXX"%"

   Units of "%" are displayed in the same font as the data.

2. Entry Format:

   NNN Percent

3. Entry Description:

   Percent: One to three characters in length, leading zeros not required.

4. Range:

   Percent: 1 - 100

PERCENT MAC CG, (TOLD).

1. Display Format:

   XX.X% Percent MAC CG

2. Entry Format:

   NN.N% Percent MAC CG

3. Entry Description:

   Three digits

4. Range:

   15.0 to 34.0

PLACE/BEARING/DISTANCE.

1. Display Format:

   XXXXX"/"XXX"/"XXX"."X
   Place/Bearing$_{Magnetic}$/Distance

   XXXXX"/"XXX"T/"XXX"."X
   Place/Bearing$_{True}$/Distance

2. Entry Format:

   CCCCC"/"NNN"/"NNN"."N
   Place/Bearing$_{Magnetic}$/Distance
   CCCCC"/"NNN"T/"NNN"."N
   Place/Bearing$_{True}$/Distance

NOTE

- When a magnetic bearing entry is attempted and the current PBD WAYPOINT is in a polar region (FP WAYPOINT LATITUDE is greater than 72.0 N or less than 59.0 S) that MFCDU will annunciate a "BEARING MUST BE IN TRUE" message.
- If in polar region, enter PBD data in the CCCCC/NNNT/NNN.N format.

3. Entry Description:

Place: See Identifier Entry Description.
Bearing: See Course Entry Description.
Distance: See Distance, NM Entry.

4. Range:

Bearing: See Course Range.
Distance: See Distance, NM Entry.

PLACE/BEARING/PLACE/BEARING.

1. Display Format:

XXXXX"/"XXX"/"XXXXX"/"XXX
Place/Bearing$_{Magnetic}$/Place/Bearing$_{Magnetic}$

XXXXX"/"XXX"T/"XXXXX"/"XXX
Place/Bearing$_{True}$/Place/Bearing$_{Magnetic}$

XXXXX"/"XXX"/"XXXXX"/"XXX"T"
Place/Bearing$_{Magnetic}$/Place/Bearing$_{True}$

XXXXX"/"XXX"T/"XXXXX"/"XXX"T"
Place/Bearing$_{True}$/Place/Bearing$_{True}$

2. Entry Format:

CCCCC"/"NNN"/"CCCCC"/"NNN
Place/Bearing$_{Magnetic}$/Place/Bearing$_{Magnetic}$

CCCCC"/"NNN"T/"CCCCC"/"NNN
Place/Bearing$_{True}$/Place/Bearing$_{Magnetic}$

CCCCC"/"NNN"/"CCCCC"/"NNN"T"
Place/Bearing$_{Magnetic}$/Place/Bearing$_{True}$

CCCCC"/"NNN"T/"CCCCC"/"NNN"T"
Place/Bearing$_{True}$/Place/Bearing$_{True}$

NOTE

- **When a magnetic bearing entry is attempted and the current PBPB WAYPOINT is in a polar region (FP WAYPOINT LATITUDE is greater than 72.0 N or less than 59.0 S) that MFCDU will annunciate a "BEARING MUST BE IN TRUE" message.**
- **If in polar region, enter PBPB data in the CCCCC/NNNT/CCCCC/NNNT format.**

3. Entry Description:

Place: See Identifier Entry Description.
Bearing: See Course Entry Description.

4. Range:

Bearing: See Course Range.

POSITION.

See Waypoint Name, MGRS, Latitude/Longitude, Place/Bearing/Distance, Place/Bearing/Place/Bearing.

QUADRANT/RADIAL.

1. Display Format:

XX"/"XXX"°" Quadrant/Radial$_{Magnetic}$
XX"/"XXX"T" Quadrant/Radial$_{True}$
XX"/"XXX"G" Quadrant/Radial$_{Grid}$

2. Entry Format:

AA or Quadrant
NNN or Radial$_{Magnetic}$
NNN"T" Radial$_{True}$
AA"/"NNN Quadrant/Radial$_{Magnetic}$
AA"/"NNN"T" Quadrant/Radial$_{True}$

3. Entry Description:

Quadrant: One to two alpha characters, eight possible entries which are:
N, NE, E, SE, S, SW, W, NW.
Radial: See Course Entry Description.

4. Range:

Quadrant: "N", "NE", "E", "SE", "S", "SW", "W", "NW".
Radial: See Course Range.

REVERSE LIMITER SETTING, (TOLD).

1. Display Format:

XX.X Reverse Limiter Setting

2. Range:

0 to 10.9

ROUTE NAME.

See Flight Plan Name.

ROUTE STATE.

1. Display Format:

"ACT"
"MOD"
" "

2. Range:

   Route State: "ACT" = active
   "MOD" = provisional
   " " = inactive

RUNWAY.

1. Display Format:

"RW"NNA	(Where A=C, L, or R for Center, Left or Right respectively)
"RW"NN	
NN	TOLD PAGES ONLY
NNC	TOLD PAGES ONLY

2. Entry Format:

NNA	Runway
"RW"NNA	Runway
"/"NN	TOLD PAGES ONLY
"/"NNA	TOLD PAGES ONLY

3. Entry Description.

   Runway Number: NN = runway number (leading zero is required)

   A: Indicates Left, Right, Center or none.

4. Entry Range:

   Runway Number: 01 to 36

   A: "L", "R', "C", " "

RUNWAY CONDITION READING (RCR) / RUNWAY SURFACE COVERING (RSC).

1. Display Format:

XX"/"X.X	(When both RCR and RSC are displayed)
XX	(When only RCR is displayed)

2. Entry Format:

NN	RCR only
NN"/"N.N	RCR/RSC
"/"N.N	RSC only

3. Entry Description:

   RCR: One to two digits, leading zero not required.

RUNWAY CONDITION	ICAO REPORT	RCR
Dry.	Good	23
Wet	Medium	12
Icy	Poor	5

   RSC: One to two digits, leading zero not required. Entry is in tenths of an inch depth.

4. Range:

   RCR: 3 to 23
   RSC: 0 to 1.0

RUNWAY LENGTH.

1. Display Format:

   XXXXX"FT"

2. Entry Format:

   NNNNN Runway length in feet.

3. Entry Description:

   Runway length: Four to five digits, leading zeros not required.

4. Range:

   Runway length: 1,000 to 16,000 feet

RUNWAY SLOPE.

1. Display Format:

   CX"."X"%" or -X"."X"%"

   Units of "%" are displayed in the same font as the data.

2. Entry Format:

   N"."N Slope
   -N"."N

3. Entry Description:

   Runway Slope: Entry in percent, minimum of one digit for entry, decimal and tenths not required, entry of "-" optional.

4. Range:

   Runway Slope: 2.0 to -2.0 percent

SH/LG INDICATOR.

1. Display Format:

   "SH" - short
   "LG" - long

2. Entry Format:

   "SH"
   "LG"

SINK RATE.

1. Display Format:

   XXXFPM

2. Entry Format:

   Not Allowed

3. Entry Description:

   Skin Rate: 360 to 600 FPM

SPEED/ALTITUDE.

1. Display Format:

   XXX"/"XXXXXXX

2. Entry Format:

NNN"/"CNNNNNC
Speed/Altitude
NNN"/"C"FL"NNNC
Speed/Altitude
"/"CNNNNNC Altitude only
"/"C"FL"NNNC Altitude only

3. Entry Description:

   Speed: See Speed (IAS) Entry Description.

   Altitude: See Altitude/Altitude Constraint Entry Description.

4. Range:

   IAS: See Speed (IAS) Range.

   Altitude: See Altitude Range.

SPEED TRANSITION.

1. Display Format:

   XXX"/"XXXXX

2. Entry Format:

   NNN"/"NNNNN Speed/Altitude
   NNN Speed Only
   "/"NNNNN Altitude Only

3. Entry Description:

   Speed: Entry in CAS with three numbers
   Altitude See Altitude Entry Description

4. Range:

   CAS: 100 to 350 in 1 increments
   Altitude See Altitude Range

SPEED.

1. Display Format:

   XXX or "."XXX

2. Entry Format:

   NNN or ".NNN"Speed (knots)

3. Entry Description:

   Speed: Two or three numbers, leading zeros not required, prefixed by a decimal point for Mach.

4. Range:

Ground Speed:	75 to 750
IAS:	0 to 350
CAS:	0 to 350
TAS:	10 to 585
Mach:	0 to 0.825

STABILIZER SETTING, (TOLD).

1. Display Format:

   XX.X or -X"."X Stabilizer Setting

   X is "-" or blank

2. Range:

   (-2.0) to 7.2

TEMPERATURE.

1. Display Format:

   XXX"°C/"XXX"°F"
   XXX"°C"
   XXX"°F"

2. Entry Format:

NNN C	Temperature in degrees C
NNN"/"	Temperature in degrees C
NNNF	Temperature in degrees F
"/"NNN	Temperature in degrees F

3. Entry Description:

   Temperature: Entry of one to three digits, optionally preceded by "-", leading zero not required.

4. Range:

   Temperature (C): -60° to 60° Celsius

   Temperature (F): -76° to 140° Fahrenheit

TIME.

1. Display Format:

   XXXX":"XXX

2. Entry Format:

   NNNNA Time (HHMM.SS)
   NNNN":"NNA

3. Entry Description:

   NNNN or NNNN.NN Leading zero not required, except when entering seconds less than one minute (when entry must be "0.NN" sec).

4. Range:

   HHMM.SS HH defined as 0-23, MM as 0-59 and SS as 0-59.

   C: Time Zone, "A" - "Z"

NOTE

Time Zone only applies to the POWER UP page. On the GPS STATUS pages (1/2 and 2/2), GPS-Supplied time is always supplied as ZULU time, and "C" is always Z.

TIME (CARP).

1. Display Format:

XX":"XX

2. Entry Format:

NN	Time [MM:SS]
NN"."NN	

3. Entry Description:

NN or NN.NN	Leading zero not required.

4. Range:

NN:NN	0 to 59:59, digit one and three range is 0 to 5, digit two and four range is 0 to 9.

TIME (HOLD).

1. Display format:

XX"+"XX (HOLD Page)	Time (HH:MM)
XX":"XX (All other pages)	

2. Entry Format:

NN"."NN	Time [HH.MM]

3. Entry Description:

NN.NN	Leading zero not required.

4. Range:

HHMM.SS	HH defined as 0-23, MM as 0-59 and SS as 0-59.

TIME (SECONDS).

1. Display Format:

XXX	Time seconds and tenth of seconds

2. Entry Format:

NN
N
N.N
NN.N
.N

3. Entry Description:

See Entry Format

4. Range:

XX.X	0.1 to 99.9

TIME (TIMERS).

1. Display Format:

XXXX"."XX

2. Entry Format:

NNNN (HHMM)
NNNN.NN (HHMM.SS)
NN.NN (HH.MM)

3. Entry Description:

See Entry Format

4. Range:

Same as TIME.

NOTE

For time entry less than one minute, a leading zero is required (e.g., 0.55).

VERTICAL POINT TITLE.

1. Display format:

"TO TOC"	To Top of Climb
"TO TOD"	To Top of Descent
"TO BOD"	To Bottom of Descent
" "	invalid or out of range

VERTICAL SPEED (VS).

1. Display Format:

XXXXX

2. Entry Format:

NNNN	V/S
"-"NNNN	

3. Entry Description:

V/S:	One to four digits, leading zeros optional, optionally preceded by a minus sign.

4. Range:

V/S:	Integers in the range -9999 to 9999.

VERTICAL SPEED (F/S).

1. Display Format:

XXX"."X"FT/SEC"

2. Entry Format:

   NNN.N   Feet/Second

3. Entry Description:

   Vertical Speed: One to three numbers, optionally followed by a decimal and another digit.

4. Range:

   Vertical Speed: 0.1 to 999.9 Feet/Second

VIA.TO.

1. Display Format:

   XXXXX

NOTE

Even though the entry is VIA.TO, the display after entry is only a waypoint.

2. Entry Format:

CCCCC"."CCCCC	Airway.waypoint
CCCCCCCCCC"."CCCCC	Flight Plan Name.waypoint
CCCCCCCCCC	Flight Plan Name

3. Entry Description:

Airway:	Entry of one to five alphanumeric characters in any combination. Entry of an airway must have an ending waypoint.
FPL Name:	See Flight Plan Entry Description.
Waypoint:	See Waypoint Entry Description.

VOR/TACAN IDENTIFIER.

1. Display Format:

   XXXX

2. Entry Format:

   CCCC   VOR/TACAN

3. Entry Description:

   VOR/TACAN: Entry of one to four alphanumeric characters.

WAYPOINT LABEL.

1. Display Format:

   XX/

2. Entry Format:

   CC"/"   Waypoint Label

3. Entry Description:

   Waypoint Label: Entry of one or two alphanumeric characters, followed by a "/". Defined waypoint labels may be used in place of the waypoint to which it refers.

WAYPOINT LABEL/NAME.

1. Display Format:

   XX/XXXXX

2. Entry Format:

   CC/CCCCC

3. Entry Description:

   Waypoint Name or /Waypoint Name

   Entry from two to five alphanumeric characters in any combination, except first character may not be a "-". The Waypoint Name may be preceded by a "/".

WAYPOINT NAME.

1. Display Format:

   XXXXX

2. Entry Format:

   CCCCC   Waypoint Name

3. Entry Description:

   Waypoint Name: Entry from two to five alphanumeric characters in any combination, except first character may not be a "-". First character is assigned a "*" when the NP names the waypoint, and then one to five alphanumeric characters may follow.

WAYPOINT NUMBER.

1. Display Format:

   NN

2. Entry Format:

   Not Allowed

3. Range:

   Waypoint Number: 01 to 79

WEIGHT

1. Display Format:

XXX.X	Leading zeros not displayed.

2. Entry Format:

NNN.N	Weight in 1,000's of pounds.

3. Entry Description:

Weight:	One to three numbers with a decimal number, leading zeros not required, trailing decimal and zero not required.

4. Range:

Operating Weight:	140.0 to 170.0 KLbs, in 0.1 increments.
Cargo Weight:	0.0 to 95.0 KLbs, in 0.1 increments.
Fuel on Board:	0.0 to 153.4 KLbs, in 0.1 increments.
FUEL OVHD:	0.0 to 153.4 KLbs, in 0.1 increments.
BRGW:	140.0 to 344.9 KLbs, in 0.1 increments.

WEIGHT CARP.

1. Display Format:

XXXXX	Leading zeros not displayed.

2. Entry Format:

NNNNN	Weight in pounds

3. Entry Description:

Weight:	One to five numbers, leading zeros not required.

4. Range:

Payload:	0 to 92,000 Lbs.

WIND (ANY WIND ENTRY).

1. Display Format:

XXX"°/"XXX	Wind $\text{Bearing}_{\text{Magnetic}}$/Speed
XXX"/T/"XXX	Wind $\text{Bearing}_{\text{True}}$/Speed
XXX"G/"XXX	Wind $\text{Bearing}_{\text{Grid}}$/Speed

2. Entry Format:

NNN"/"NNN	Wind $\text{Bearing}_{\text{Magnetic}}$/Speed
NNN"T/"NNN	Wind $\text{Bearing}_{\text{True}}$/Speed
NNN	Wind $\text{Bearing}_{\text{Magnetic}}$
NNN"T"	Wind $\text{Bearing}_{\text{True}}$
NNN"/"	Wind $\text{Bearing}_{\text{Magnetic}}$
NNN"T/"	Wind $\text{Bearing}_{\text{True}}$
"/"NNN	Wind Speed

3. Entry Description:

Wind Speed:	One to three numbers, leading zeros not required.
Wind Bearing:	See Course Entry Description.

4. Range:

Wind Speed:	0 to 200 knots
Wind Bearing:	See Course Range.

WIND, CARP.

1. Display Format:

XXX"°/"XX	Wind $\text{Bearing}_{\text{Magnetic}}$/Speed
XXX"T/"XX	Wind $\text{Bearing}_{\text{True}}$/Speed
XXX"G/"XX	Wind $\text{Bearing}_{\text{Grid}}$/Speed

2. Entry Format:

NNN"/"NN	Wind $\text{Bearing}_{\text{Magnetic}}$/Speed
NNN"T/"NN	Wind $\text{Bearing}_{\text{True}}$/Speed
NNN	Wind $\text{Bearing}_{\text{Magnetic}}$
NNN"T"	Wind $\text{Bearing}_{\text{True}}$
NNN"/"	Wind $\text{Bearing}_{\text{Magnetic}}$
NNN"T"	Wind $\text{Bearing}_{\text{True}}$
NNN"/"	Wind $\text{Bearing}_{\text{Magnetic}}$
NNN"T/"	Wind $\text{Bearing}_{\text{True}}$
"/"NN	Wind Speed

3. Entry Description:

Wind Speed:	One to two numbers, leading zeros not required.
Wind Bearing:	See Course Entry Description

4. Range:

Wind Speed:	0 to 99 knots
Wind Bearing:	See Course Range

WIND, SURFACE.

1. Display Format:

XXX"°/"XX"-"XX"KT"

Wind $\text{Bearing}_{\text{Magnetic}}$/Speed

XXXX"T"/"XX"-"XX"KT"

Wind $\text{Bearing}_{\text{True}}$/Speed

XXX"G/"XX"-"XX"KT"

Wind $\text{Bearing}_{\text{Grid}}$/Speed

2. Entry Format:

NNN"/"NN"-"NN	Wind Bearing$_{Magnetic}$/Speed-Gusts
NNN"T/"NN"-"NN	Wind Bearing$_{True}$/Speed-Gusts
NNN	Wind Bearing$_{Magnetic}$
NNN"T"	Wind Bearing$_{True}$
NNN"/"	Wind Bearing$_{Magnetic}$
NNN"T/"	Wind Bearing$_{True}$
NNN"/"NN	Wind Bearing$_{Magnetic}$/Speed
NNN"T/"NN	Wind Bearing$_{True}$/Speed
"/"NN	Wing Speed
"/"NN"-"NN	Wind Speed-Gusts
"-"TN	Gusts

Entry of any entry except Bearing/NN-NN or Bearing/NN can only be made when a Bearing/NN-NN or Bearing/NN already exists. Gust entry must be greater than speed entry.

3. Entry Description:

   Wind Bearing: See Course Entry Description.

   Wind Speed: One to two numbers, leading zeros not required.

   Wind Gusts: One to two numbers, leading zeros not required.

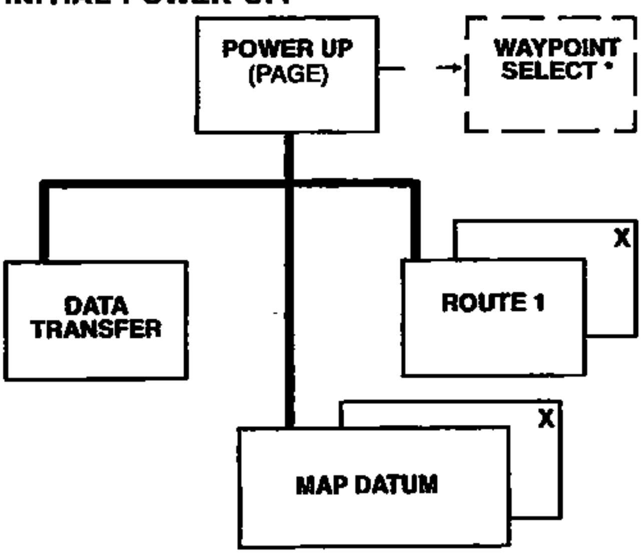
4. Range:

   Wind Bearing: See Course Range.

   Wind Speed: 0 to 99 knots

   Wind Gusts: 0 to 99 knots

INITIAL POWER-UP.



*** NOTE**

There is no direct access to WAYPOINT SELECT page. However, attempting to upselect an identifier that has more than one location to the 4L field will cause an automatic branch to WAYPOINT SELECT page.

Figure 1-21. Power-Up Menu Hierarchy

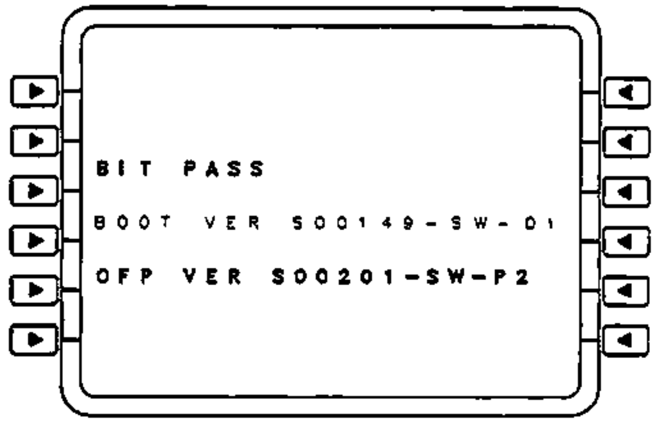
Power-Up.

The FMS enters the power-up mode immediately after the application of primary power to the FMS components or after a loss of primary power to both Navigation Processors for greater than one second. The FMS automatically transitions from the power-up mode to the operational mode and can process operator commands and performing NP-to-NP synchronization within 60 seconds when on the ground, and within 15 seconds when airborne.

Normal power-up mode processing is bypassed for an interruption of primary power to the NP of duration of less than one second and no data is lost.

BIT PASS Page.

This BIT PASS page is momentarily displayed upon successful completion of MFCDU built-in-test.

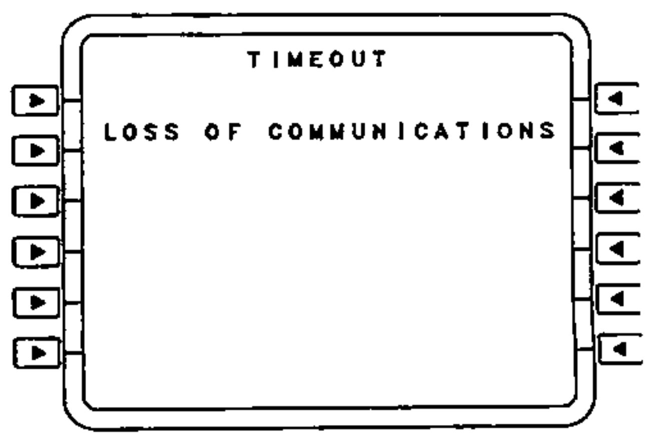


D3185001

Figure 1-22. MFCDU BIT PASS

TIMEOUT Page.

The TIMEOUT page will be displayed continuously if the MFCDU cannot communicate with either Navigation Processor.



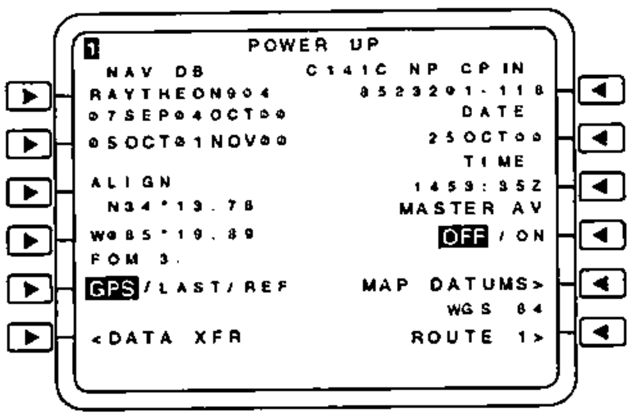
D3185101

Figure 1-23. TIMEOUT

POWER UP Page.

The POWER UP page displays information about the Navigation Database, date/time, INS alignment position, Map Datum, and the current Navigation Processor software. The POWER UP page is displayed when any of the following conditions are met.

1. Displayed upon POWER UP.
2. Selection of the POWER UP prompt on the MAIN MENU 1/2 page.
3. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the POWER UP page.
4. Selection of the POWER UP prompt on the DATA TRANSFER, MAP DATUM, and USER DEFINED pages.
5. Selection of 6L or 6R on the CONFIRM ACTION page when the CONFIRM ACTION page was accessed from the POWER UP page.



D3186401 F

Figure 1-24. POWER UP

1L **Navigation Database Identifier.** This data field displays the identifier of the navigation database. Selection, entry, and delete are non-operational.

2L **Nav Database Cycle.** LSK 2L data field displays the active Navigation Database Cycle in a large font. The inactive Navigation Database Cycle is displayed in a small font above the active cycle. When the aircraft is airborne, selection generates the error message "NOT ALLOWED," and no database cycle takes place. Otherwise, selection results in display of the CONFIRM ACTION page to allow acceptance or cancellation of the Nav Database cycle change. Entry and delete are non-operational.

3L **ALIGN (INS).** This LSK provides a means to command the NPs to send the alignment position displayed below the "ALIGN" annunciation to the INSs. "ALIGN" will be displayed in a large font when a position is displayed in the two data fields below "ALIGN" and at least one INS is in the STBY mode. Selection while "ALIGN" is in a large font will result in the displayed position below it being sent to the INS(s) in the STBY mode. While the INS(s) is loading the position, ALIGN will be displayed in large inverse video. ALIGN will be displayed in a small font when no position is displayed in the two data fields below it, when neither of the INSs are in the STBY mode or when the INS Loading mode was activated from the INS STATUS, POSITION UPDATE, IBIT or INS MAINTENANCE page. Selection while data field is in a small font is non-operational. Entry and delete are non-operational.

4L-5L **Selected Initialization Position/Reference Waypoint.** 4L data fields display the Latitude/Longitude (lat/long) selected by 5L. 5L selections are GPS, LAST, and REF. Selection appears in inverse video.

If GPS is selected, and the GPS position is valid, the current GPS position will be displayed in the 4L lat/long data fields, and "FOM x" (x is the GPS's current Figure of Merit) will appear above the GPS annunciation. If the GPS position is not valid, these data fields are blank.

FOM Value	Estimated Horizontal Error (EHE)
1	≤ 25 M
2	>25 M≤50 M
3	>50 M ≤ 75 M
4	>75 M≤100 M
5	>100M ≤ 200M
6	>200 M ≤ 500 M
7	>500 M ≤ 1000 M
8	>1000M ≤ 5000M
9	>5000 M

If LAST is selected, and the last valid INAV present position is available, the last valid present position will be displayed in the lat/long data fields, and "FOM x" will disappear. If the last valid present position is not available, these data fields will be blank.

If REF is selected and a valid position entry has not been made, 4L data field will display "- - - -" in a large font. Upon entry of a valid lat/long position into the 4L data fields, the data field below the lat/long entry will display the position as it was entered (waypoint name, MGRS, PRD, lat/long, etc.). Entry of a valid position when GPS or LAST is selected will result in 5L data field automatically selecting REF and its associated data fields displaying the reference position latitude, longitude, and position entry string, respectively.

If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active.

Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the reference waypoint field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

Selection of 4L results in the displayed data being placed into the scratch pad. Entry is non-operational for 5L. Delete is non-operational for 4L and 5L.

6L **Branch to DATA TRANSFER page.**

1R **NP CPIN.** The upper data field displays the aircraft type as defined by the hardware program pins and the title "NP CPIN." 1R data field displays the NP Computer Program Identification Number (CPIN). Selection, entry, and delete are non-operational.

2R **Date.** The date may be manually entered or sourced from the GPS receiver and navigation database effectivity period. An entered date is displayed in a large font. GPS/navigation database effectivity period sourced date is displayed in a small font. GPS sourced day and month and current navigation database effectivity period year is displayed whenever the date field does not contain an entry and the navigation database is valid. When no date is available, the date field displays dashes "- - - - -."

If a manually entered date is deleted, a GPS/navigation database sourced date is available, and the navigation database is valid, the GPS date will then be displayed. In all other cases, delete is non-operational. Selection is non-operational.

3R **Time.** The time may be sourced from the NP, GPS receiver or manually entered. Time received from the GPS receiver, is always appended with a "Z" to indicate Zulu time. Time entries may be appended with a single character in the range A-Z to indicate a time zone. Entered data is displayed in a large font, while NP and GPS data are displayed in a small font. GPS data is displayed whenever it is available and the time field does not contain an entry. NP data is displayed when GPS is not available and no time entry is present.

Upon power-up, if GPS time is not available, the time is started to midnight and time starts counting from there. No time zone character is appended, and this time is displayed in a small font. Otherwise, delete is non-operational. Selection is non-operational.

4R **MASTER AV OFF/ON.** This LSK provides a means to power on or off all VHF, VOR, and TACAN radios. Upon power-up, the field displays "OFF/ON" defaulted to OFF. Entry and deletion are non-operational.

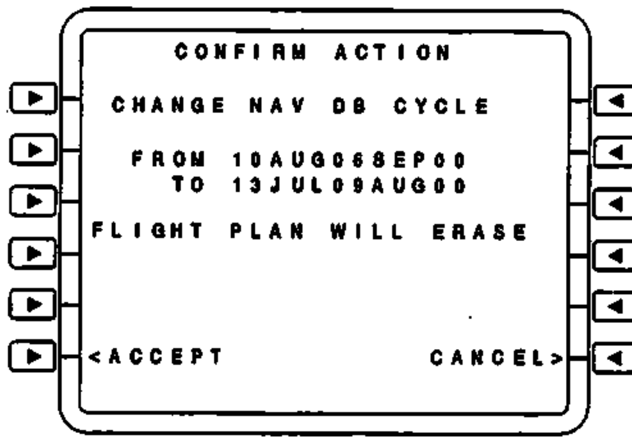
5R **Branch to MAP DATUM.** Selection results in a branch to the MAP DATUM page 1. Entry and delete are non-operational. The data field below the MAP DATUM > annunciation displays the selected map datum.

6R **Branch to ROUTE 1 page.**

CONFIRM ACTION Page.

The CONFIRM ACTION page allows acceptance or cancellation of a nav data base change. The CONFIRM ACTION page is displayed when 2L on the POWER UP page is selected.

When the CONFIRM ACTION page is accessed, the FROM data field displays the proposed inactive cycle of the navigation database and the TO data field displays the proposed active cycle of the navigation database.



D3262401

Figure 1-24A. CONFIRM ACTION

1L-5L **Non-operational.**

6L **Acceptance prompt.** Selection results in acceptance of the change and return to the POWER UP page. Entry and delete are non-operational.

1R-5R **Non-operational.**

6R **Cancellation prompt.** Selection results in cancellation of the change shown and return to the POWER UP page. Entry and delete are non-operational.

WAYPOINT SELECT Page.

The WAYPOINT SELECT page is displayed when a fix identifier entry is made and duplicate records of the identifier exists in the database. However, if the Waypoint Select Page Exclusion (WSE) is active at the time of upselection, the WAYPOINT SELECT page will not be displayed.

Waypoint Select Page Exclusion. The Waypoint Select Page Exclusion (WSE) allows same name identifiers to be down-selected and then upselected without displaying the WAYPOINT SELECT page as follows:

1. When a named WAYPOINT IDENTIFIER that is defined in more than one location in the navigation database is downselected from the following locations, WSE become active:

a. Waypoint via line selects 1L-5L on the LEGS HISTORY, LEGS PRIMARY, LEGS TO ALTERNATE, and DIRECT/INTERCEPT pages.

b. Origin via line select 1L on the ROUTE PLAN page.

c. Destination via line select 1R on the ROUTE PLAN page.

d. Alternate Destination via line select 2R on the ROUTE PLAN page.

e. Waypoint via line selects 1R-4R on the PRIMARY ROUTE page and ROUTE TO ALTERNATE page.

f. Last Waypoint via line select 1L on the PROGRESS 3 page.

g. First Waypoint via line select 2L on the PROGRESS 3 page.

h. Last Nearest Airport via line select 1R on the PROGRESS 3 page.

i. First Nearest Airport via line select 2R on the PROGRESS 3 page.

j. Fix Identifier via line select 1L on the FIX INFO page.

k. Down Track Fix via line selects 2L-4L on the FIX INFO page.

l. ABEAM Intercept via line select 5L on the FIX INFO page.

m. Waypoint via line select 1L on the NAV DATA page.

2. For any downselected named WAYPOINT IDENTIFIERS from step 1 that are modified to form a PBD or PBPB entry, WSE remains active. However, if the actual identifier is modified or the identifier is removed from the scratch pad, then WSE become inactive.

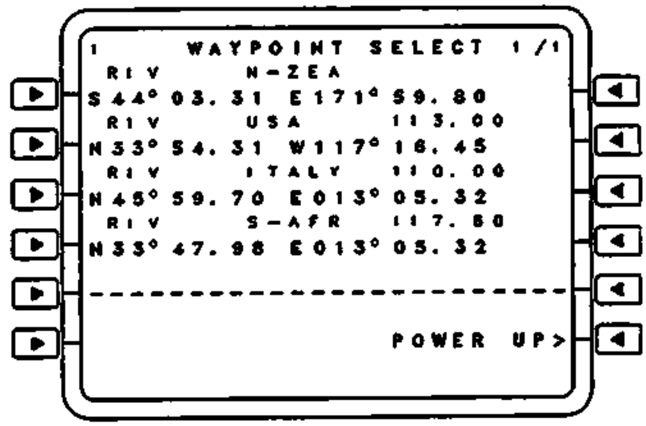
If the databases contain more than five entries of the fix displayed on the page, the following applies:

1. Selection of the PREV key will display the previous WAYPOINT SELECT page. If WAYPOINT SELECT page 1/X is displayed and the PREV key is pressed, then the last WAYPOINT SELECT page is displayed.

2. Selection of the NEXT key will display the next WAYPOINT SELECT page. If WAYPOINT SELECT page X/X is displayed and the NEXT key is pressed, then WAYPOINT SELECT page 1/X is displayed.

1L-5L,

1R-5R **Fix Occurrence Data.** LSK data fields contain fix data, consisting of the Identifier, the Country Code, the Latitude and Longitude, and, possibly, the Frequency or Channel.



D3185201 A

Figure 1-25. WAYPOINT SELECT

The Fix Identifier is displayed in the data field above each LSK. The Country Code is displayed to the right of the Fix Identifier. Latitude and Longitude are displayed next to each LSK. If the fix is a navaid, the frequency or channel is also displayed. If the Navaid is a VORTAC, then the channel is displayed. If there are less than five fixes to display on the page, the remaining lines are left blank.

Selection is made by pressing the line select key next to the desired record regardless of the scratch pad contents. When this is done, the process that was interrupted to display this page will continue where it left off using the selected fix. Any attempted selection of entry to or deletion from a blank line is non-operational. Entry and deletion functions are non-operational.

6L **Non-operational.**

6R **Branch to calling page.** This data field displays the page that resulted in the WAYPOINT SELECT page being displayed. Selection results in a branch to the page being displayed in the data field. Entry and delete are non-operational.

DATA LOADER SYSTEM (DLS) MANAGEMENT.

The Flight Manager System provides the capability to read from and write to the Data Loader System. Uploading and downloading of data to/from the Data Loader System is allowed only when the aircraft is on the ground.

DATA TRANSFER Page.

The DATA TRANSFER page stores information to and loads information from the Data Loader System and controls Crossload operation. The DATA TRANSFER page is accessed when any of the following occur:

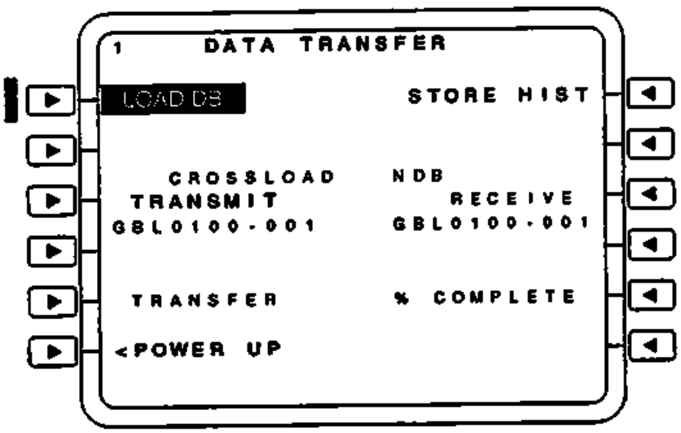
1. Selection of the < DATA XFR prompt on the MAIN MENU 1/2 page.

2. Selection of the < DATA XFR prompt on the POWER UP page.

3. When the two Navigation Processors are operating in independent mode, the DATA TRANSFER page will be displayed automatically.

NOTE

When either NP detects a data base miscompare, all MFCDU displays automatically switch to the DATA TRANSFER page. If conditions allow, crossload data. Otherwise, select the required MFCDU page, perform required action, and then crossload data at your earliest convenience.



F1013801 A

Figure 1-26. DATA TRANSFER

1L **Load Database from DLS.** This data field will display "Load DB" in a small font if the aircraft is airborne, the DRU is not powered on, or the controlling NP is not the Guidance Master. Otherwise, this data field defaults to a large font.

Selection when "FROM DLS" is displayed in a large font will result in loading all database information on the DTM into the Guidance Master Navigation Processor. Otherwise, selection is non-operational. When a database transfer is in progress, this data field is displayed in a large font, inverse video. Entry and delete are non-operational.

2L **Non-operational.**

3L **Transmit Crossload Data.** Title field displays "CROSSLOAD NDB" if the two NPs have a mismatch in their navigation data bases (NDBs). "CROSSLOAD CUSTOM" is displayed if the two NPs' NDBs match and their custom databases have a mismatch. Otherwise, the field is blanked.

"TRANSMIT" is displayed in large font when either "CROSSLOAD NDB" or "CROSSLOAD CUSTOM" is displayed in the title field and the onside data is valid. "TRANSMIT" is displayed in small font if the title field is blanked, the onside NP is receiving a crossload, or the onside database is invalid. The field below 3L displays the onside NDB identifier if CROSSLOAD NDB is displayed. Otherwise, it is blanked.

Selecting "TRANSMIT" when in large font results in the database displayed in the 3L title field being transmitted to the offside NP. When transmit is in progress, TRANSMIT is displayed. Otherwise, selection in non-operational.

4L Non-operational.

5L **Data Transfer Status.** If a data transfer is in progress, this data field will display "TRANSFER xxx% COMPLETE," with the completed percentage of the transfer displayed in place of "xxx." If an upload is being performed, the percent complete is defined by DL UPLOAD PERCENT COMPLETE. If a download is being performed, the percent complete is defined by DL DOWNLOAD PERCENT COMPLETE. If a Crossload is being performed, the percent complete is defined by RM DB XLOAD PERCENT COMPLETE. If a fault occurs while a transfer is in progress, the transfer will be aborted and a message will be displayed in this data transfer status line.

If a fault occurs while a transfer is in progress, the transfer will be aborted and a message will be displayed on the data transfer status line.

Messages are listed in priority order. A higher priority message will overwrite any existing lower priority message. If a message ceases, it will be removed and either a lower priority message will be displayed or the field will be blanked if no messages are queued.

Selection, entry, and delete are non-operational.

6L **Branch to POWER UP page.** "< POWER UP" is displayed in a small font if a data transfer is in progress or if the NPs are operating in Independent mode. Otherwise, "< POWER UP" defaults to a large font. Selection, when displayed in a large font, results in a branch to the POWER UP page. Otherwise, selection is non-operational. Entry and delete are non-operational.

1R **Store Maintenance History to DLS.** "STORE HIST" is displayed in a small font if the aircraft is in flight or the DRU is not powered on. Otherwise, "STORE HIST" defaults to a large font.

STATUS MESSAGE	DESCRIPTION
ABORT DLS FAILED	Displayed if the DLS is not responding.
DTM NOT INSTALLED	Displayed if the DTM is not installed.
ABORT INVALID FORMAT	Displayed when there is a DRM flash memory format error.
ABORT NO DB ON CART	Displayed if the DTM does not contain uploadable data.
ABORT DLS READ FAILED	Displayed when an error is detected while reading from the DTM.
ABORT DLS WRITE FAILED	Displayed if an error is detected while writing to the DTM.
ABORT NDB CLEAR FAILED	Displayed if an error is detected while erasing the existing NDB from Flash Memory
ABORT NDB WRITE FAILED	Displayed if an error is detected while writing the NDB to Flash Memory
ABORT INVALID HEADER	Displayed when the cartridge contains an invalid header CRC.
ABORT INVALID SYS ID	Displayed when the cartridge contains an invalid system idenifier.
ABORT INVALID REV	Displayed when the cartridge contains an invalid software revision number.
ABORT INVALID NDB CRC	Displayed when the uploaded Nav DB failed the CRC test.
ABORT INVALID CUSTOM WPT	Displayed when an error was detected in the Custom Waypoint Mission DB segment (either CRC or processor)
ABORT INVALID STORED RTE	Displayed when an error was detected in the Stored Route Mission DB segment (either CRC or preprocessor).
ABORT INVALID NOTAM	Displayed when an error was detected in the Inhibited Navaid Mission DB segment (either CRC or preprocessor).
ABORT INVALID COMM	Displayed when an error was detected in the Comm Presets Mission DB segment (either CRC or preprocessor).
ABORT INVALID CHUTE	Displayed when an error was detected in the Parachute Ballistics Mission DB segment (either CRC or preprocessor).
ABORT INVALID FPL1	Displayed when an error was detected in the Flight Plan 1 Mission DB segment (either CRC or preprocessor).
ABORT INVALID FPL2	Displayed when an error was detected in the Flight Plan 2 Mission DB segment (either CRC or preprocessor).
ABORT INVALID ALMANAC	Displayed when an error was detected in the GPS Almanac Mission DB segment (either CRC or preprocessor).
ABORT INVALID THREAT	Displayed when an error was detected in the Thrust Database Mission DB segment (either CRC or preprocessor).

Selection of 1R when "STORE HIST" is displayed in a large font results in storing all maintenance history information from both NPs, if available, to the DTM. Otherwise, selection is non-operational. When a maintenance history transfer is in progress, this data field is displayed in a large font, inverse video. Entry and delete are non-operational.

2R **Non-operational.**

3R **Receive Crossload data.** "RECEIVE" is displayed in a large font when the offside data is valid and a load is not in progress. "RECEIVE" is displayed in small font if the 3L title field is blanked, the onside NP is transmitting a crossload, or the offside NP has an invalid database. The field below 3R displays the offside NDB identifier if the field displays CROSSLOAD NDB. Otherwise, the field is blanked.

Selecting "RECEIVE" when displayed in large font results in the database displayed in the 3L title field being received from the offside NP. When a transfer from the offside NP is in progress, RECEIVE is displayed. Otherwise, selection is non-operational. Entry and delete are non-operational.

4R-6R Non-operational.

MAP DATUM.

Definition.

A datum is the mathematical model of the earth used to calculate the coordinates on any map. Internal navigational computations and navigation information provided by the FMS to interfaced subsystems are referenced to World Geodetic System 1984 (WGS-84), regardless of the datum selected for MFCDU positional entry and display. There are 107 local geodetic datums which are currently related to WGS-84.

WARNING

Unintentional selection of map datums other than WGS-84 will result in gross navigational errors.

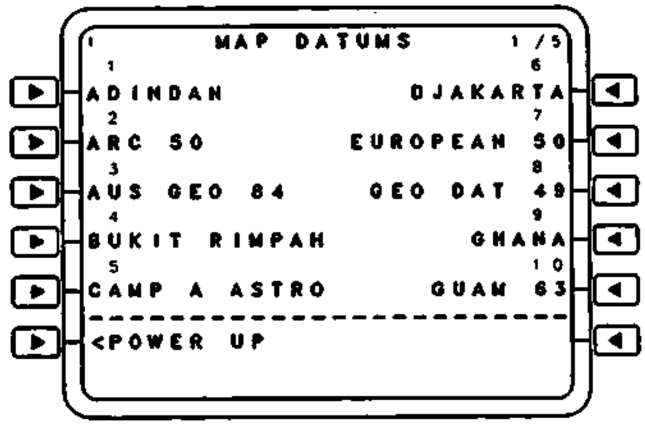
Selection.

The FMS provides position definitions in and transformations between local datums. There are 47 local map datums listed on pages 1/5 through 5/5. Additional datums may be crew entered on the USER DEFINED DATUM page (see figure 1-28).

MAP DATUMS 1/5 Page.

The MAP DATUMS 1/5 page allows selection of the map datum to be used for position entry and display. All map datums on the MAP DATUMS 1/5 through MAP DATUMS 5/5 pages are mutually exclusive (i.e., only one may be selected at a time).

MAP DATUMS 1/5 page is accessed by selection of the MAP DATUMS prompt on the POWER UP or MAIN MENU 1/2 page. MAP DATUMS 1/5 page is also accessible by pressing the NEXT page.



D3185401

Figure 1-27. MAP DATUMS 1/5

USER DEFINED DATUM Page.

The USER DEFINED DATUM page allows entry of a user-defined datum that will be used for position entry and display.

For example the datum for Iran is:

Continent Europe						
Local Geodetic Datum	Reference Ellipsoide and Parameter Difference			Transformation Parameters		
Name	Name	Δa (m)	Δf x 10^4	ΔX (m)	ΔY (m)	ΔZ (m)
EUROPEAN 1950	International 1924	-251	-0.14192702			
Iran				-117 ±9	-132 ± 12	-164 ± 11

To enter this datum, enter the following in the scratch pad:

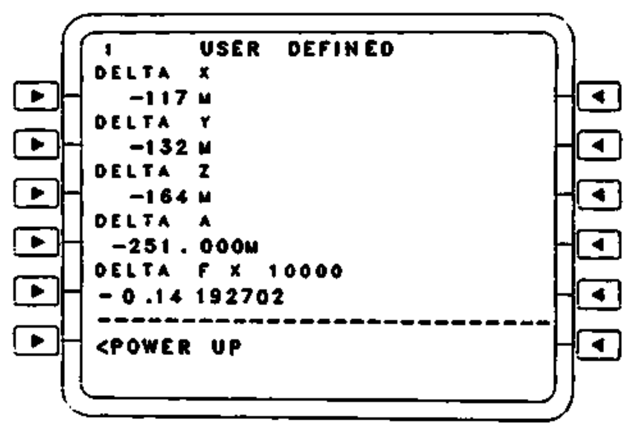
1. -117 and press 1L.
2. -132 and press 2L.
3. -164 and press 3L.
4. -251 and press 4L.
5. -0.14192702 and press 5L.

The page should resemble figure 1-32.

6. Press 6L and branch to the POWER UP page. Note that 5R annunciates MAP DATUMS USE_DEF.

USER DEFINED Page.

The USER DEFINED page is accessed by selection of the USER DEF prompt on the MAP DATUMS 2/5 page.



D3186301B

Figure 1-28. USER DEFINED DATUM

1L **Delta X Offset.** This data field displays "------" (6 dashes) if a delta X offset has not been entered. Entry of a valid delta X offset from the default (WGS-84) datum results in the entered value being used in the calculation of the datum shift for the user defined datums. Selection and delete are non-operational.

2L Delta Y Offset. This data field will display "------" (6 dashes) if a delta Y offset has not been entered. Entry of a valid delta Y offset from the default (WGS-84) datum results in the entered value being used in the calculation of the datum shift for the user defined datums. Selection and delete are non-operational.

3L Delta Z Offset. This data field will display "------" (6 dashes) if a delta Z offset has not been entered. Entry of a valid delta Z offset from the default (WGS-84) datum results in the entered value being used in the calculation of the datum shift for the user defined datums. Selection and delete are non-operational.

4L Delta A Offset. This data field displays "---------" (9 dashes) if a delta A offset has not been entered. Entry of a valid delta A offset from the default (WGS-84) datum semi-major axis results in the entered value being used in the calculation of the datum shift for the user defined datums. Selection and delete are non-operational.

5L Delta F Offset. This data field displays "----------" (10 dashes) if a delta F offset has not been entered. Entry of a valid delta F offset from the default (WGS-84) datum flattening value results in the entered value being used in the calculation of the datum shift for the user defined datums. Note that the delta F value entered is the nominal delta F times 10^4. Selection and delete are non-operational.

6L Branch to POWER UP page. Selection results in a branch to the POWER UP page.

1R-6R Non-operational.

SENSOR MANAGEMENT.

Management of the navigation sensors consists of mode control, sensor data handling, and sensor evaluation.

INS Management.

The FMS controls and monitors both Inertial Navigation Units. Each NP interfaces to one INU. The following capabilities are provided:

1. Entering an alignment position.
2. Entering a manual update position or an update position from the TACAN or SKE Zone Marker.
3. Display of INU status and mode of operation.
4. Monitor/control of an INU built-in test.
5. Monitor and display of an INU inertial data.

GPS Management.

The FMS controls and monitors two embedded GPS receivers. Each NP hosts one GPS receiver module and the following capabilities are provided:

1. Entry of GPS receiver initialization data.
2. Display of receiver status and mode of operation.
3. Loading the GPS receiver crypto keys.
4. Zeroizing the GPS receiver crypto keys.
5. Monitor and control of the receiver built-in test.
6. Loading GPS almanac data into the GPS receiver.
7. Monitor and display of the GPS-derived information.

GPS Acquisition and Tracking.

In normal operations, the GPS initiates tracking functions whenever the receiver has current almanac data for four or more satellites visible five or more degrees above the GPS sensor horizon. If precision-encrypted signals cannot be obtained, the GPS reverts to the Coarse Mode. Without a valid almanac, the GPS sensor enters a search-the-sky mode.

SCADC Management.

The FMS receives inputs from SCADC No. 2 directly. Inputs from SCADC No. 1 are received via the DPU. SCADC No. 1 is the default air data source. SCADC No. 2 data is used when SCADC No. 1 data is invalid. Data from both SCADCs can be viewed on the MFCDUs.

Sensor Data Checking.

The FMS performs tests on the sensor data to determine validity and to provide early detection of sensor failure. When the data from a particular sensor is rejected consistently, the sensor is omitted from the navigation solution.

Integrated Navigation.

The Integrated Navigation (INAV) function performs management of the navigation suite and top level control of the navigation solution. The functional modes of the INAV subsystem control the navigation solutions and allow for selection of navigation parameters. The INAV modes are divided into Operational Modes and Functional Modes, and are described as follows:

OPERATIONAL MODES.

The INAV system operates in either the Manual mode or the Auto mode.

1. Manual Mode: In the Manual operational mode, the selection of the functional mode is made by crew selection on the MFCDU. Manual mode is the default operational mode.

2. Auto Mode: In the Auto operational mode, selection of the navigation solution is made by the FMS based on the best Figure of Merit (FOM) and Estimated Horizontal Error (EHE). The order of preference in selecting a navigation solution is as follows:

- KNS
- INS only
- GPS only
- No Nav

Attitude/Heading Selection.

Normally, the NP uses its onside INS, attitude, heading, and navigation data. If the onside AFCP selects AHRS as its attitude source, the onside NP then uses the AHRS pitch, roll, and heading (this includes converting AHRS MAG heading to TRUE). Otherwise it uses the respective INS attitude, heading, and navigation data.

FUNCTIONAL MODES.

The INAV subsystem operates in either the Kalman Navigation Solution (KNS) functional mode, the Independent INS functional mode, the Independent GPS functional mode, or the No Nav mode, as described in the following paragraphs. No Nav is the default functional mode.

KNS NAVIGATION MODE. The KNS Navigation mode is entered when selected via the MFCDU or when selected by the Autonav function. KNS Navigation mode uses the INS with filtered GPS correction terms and SCADC inputs, if available, to produce the navigation solution. A Kalman filter is used to provide the correction terms. When GPS operation is degraded, the FMS uses the INS with the last available filtered GPS correction terms from the Kalman filter and SCADC inputs, if available, to produce the navigation solution. When only three satellites are available, the FMS will use GPS position and time and INS velocities to generate the navigation solution.

When operating in the KNS mode and the integrity monitoring system indicates that the GPS operation is degraded or if the GPS becomes unavailable, the FMS suspends GPS inputs into the Kalman filter. When the integrity monitoring system subsequently indicates that GPS data is valid or the GPS otherwise becomes available, GPS correction terms are restored.

The navigation solution, while in the KNS Navigation Mode, is not less accurate than the solution derived from the Independent GPS Mode or the Independent INS Mode. The integration does not allow less accurate sensors to degrade the accuracy of the basic GPS navigation solution.

INDEPENDENT INS MODE. Independent INS Mode is selected via the MFCDU or when selected by the Autonav function. This mode uses the INS with inputs from the SCADC, if available, to produce the navigation solution. GPS-derived data is not used in generating the navigation solution while in this mode.

INS SOLUTION UPDATES.

NOTE

> The mix lamp annunciation is side dependent. This will result in MFCDU being controlled by NP 1 displaying the MIX status of INS 1 and MFCDU being controlled by NP 2 displaying the MIX status of INS 2.

Position updates are provided from the following sources:

1. A position entered via the MFCDU. INS solution corrections derived from the manual update are removable via the MFCDU.

2. TACAN range and bearing information, when selected via the MFCDU. The TACAN update is performed continuously as long as valid TACAN range and bearing are available. The FMS provides an annunciation via the MFCDU when a TACAN update is being performed. INS solution corrections derived from the TACAN update are removable via the MFCDU.

3. SKE Zone Marker (ZM) range and bearing information, when selected via the MFCDU. The FMS provides an annunciation via the MFCDU when a SKE ZM update is being performed. SKE ZM updates to the INS solution are performed continuously while in this mode. INS solution corrections from the SKE ZM are automatically zeroed when the Drop Zone Escape point is sequenced.

4. The KNS solution, when a manual or automatic transition from KNS mode to Independent INS mode is performed. INS solution corrections derived from the KNS update are removable via the MFCDU.

INDEPENDENT GPS MODE. Independent GPS Mode is selected via the MFCDU or when selected by the auto mode. This mode uses the GPS with SCADC inputs, if available, and INS inputs to produce the navigation solution. The GPS data continues to be used to derive INS error estimates while in this mode. These error estimates are not applied to the navigation solution unless the KNS Navigation Mode is selected. INS attitude and position aiding data is used to produce the navigation solution and to aid the GPS tracking loop.

NO NAV MODE. The FMS is in the No Nav mode when no functional mode has been selected while in the manual operational mode. If the crew-selected operational mode subsequently becomes unavailable, the FMS sets the functional mode to No Nav. The FMS is in the No Nav mode when no functional modes are available while in the auto mode and warns the crew via the NO NAV 1/2 system advisory message.

NOTE

No Nav mode will disable the following: SFD stick map, groundspeed readout, ETE, ETA, grid heading, PERF predictions, autopilot and flight director VNAV, and FMS autothrottles.

Navigation Accuracy.

KNS SOLUTION/GPS ONLY/INS ONLY SOLUTION.

The FMS monitors the Estimated Horizontal Error (EHE) as stated below.

PHASE OF FLIGHT	EHE
Enroute (ENR)	0.54 NM
Terminal (TERM)	0.27 NM
Non-Precision Approach (NPA)	0.054 NM

NAVIGATION ACCURACY ANNUNCIATION.

If the selected nav solution accuracy exceeds the current phase of flight threshold, ACC annunciates on the PFD.

Navigation Data Display.

The FMS provides separate capabilities to observe data and to amend navigation data. Observing the navigation data does not interrupt or affect the navigation guidance. The FMS continuously provides an indication of the aircraft deviation right or left from the selected or computed courses. To-from information based on the current waypoint, current aircraft position, and course is provided.

Display Data Resolution.

The following information is provided for display.

1. Aircraft position with a precision of at least 0.1 minutes of latitude or longitude, or the equivalent precision for another coordinate system.

2. Waypoint position with a precision of at least 0.01 minutes of latitude or longitude, or the equivalent precision for another coordinate system.

3. Selected bearing to the nearest one degree. Bearing may be either true, magnetic, or grid.

4. Desired track to the nearest one degree. Desired track may be either magnetic, true, or grid.

5. Minimum 4-character range display with a precision of at least 0.1 nautical miles (NM) for ranges up to 99.9 NM and a precision of at least 1 NM for ranges of 100 NM or greater.

6. Ground speed to the nearest one knot.

7. Estimated time from the aircraft present position to the selected waypoint with a precision of at least six seconds or 0.1 minutes.

8. Cross-track distance with a minimum range of ± 200 NM. At distances equal to or less than 9.9 NM, the precision will be at least 0.1 NM. At distances greater than 9.9 NM, the precision will be at least 1 NM.

9. Relative bearing with 0.5° precision. The relative bearing may be either true, magnetic, or grid.

Fault Detection.

The FMS uses RAIM to determine the integrity of GPS navigation signals. The FMS notifies the crew via the MFCDU whenever RAIM is unavailable or satellite geometry constraints or equipment fail.

Coordinate Systems.

The FMS uses navigation information referenced to the World Geodetic System 1984 (WGS-84). The default coordinate system is WGS-84 latitude/longitude. Data entry of lat/long waypoints via the MFCDU is in degrees, minutes, and hundredths of minutes. Lat/long waypoints are displayed on the MFCDU to a resolution of a hundredth of a minute, regardless of source data resolution.

The FMS accepts entry of waypoint positional data in Military Grid Reference System (MGRS) coordinates. The FMS accepts MGRS coordinate locations using the Universal Transverse Mercator (UTM) grid for waypoints between Latitude 80° South and 84° North and accepts MGRS coordinate locations using the Universal Polar Stereographic (UPS) grid for waypoints south of Latitude 80° South and north of Latitude 84° North. MGRS coordinates displayed on the MFCDU have a resolution of one meter, regardless of source data resolution.

Internal storage of waypoints within the FMS are in WGS-84 lat/long coordinates only. Waypoints stored to the Data Loader Subsystem as part of the post-mission processing function are in lat/long coordinates.

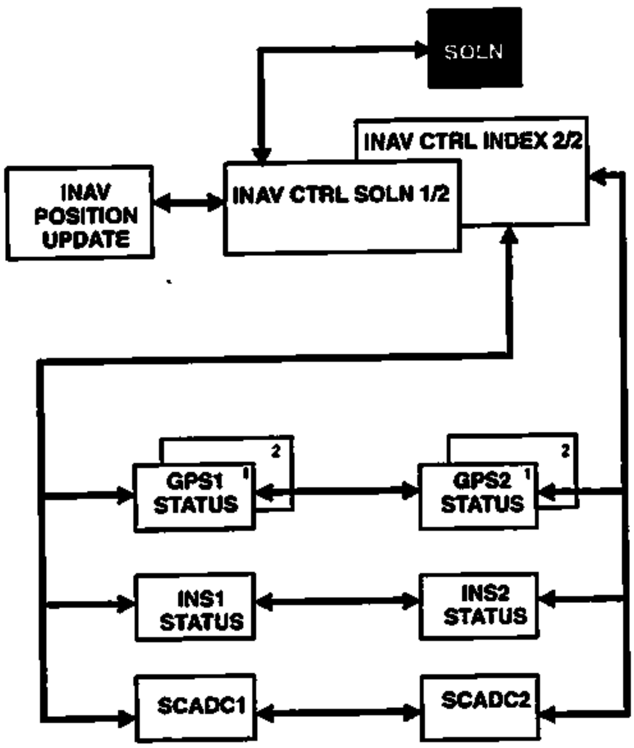


Figure 1-29. SOLUTION Menu Hierarchy

INAV CTRL SOLN Page.

The INAV CTRL SOLN page displays information for the navigation sources and displays the selected navigation source. Selection of the SOLN Mode key or NEXT or PREV page from the INAV CTRL INDEX 2/2 page results in display of the INAV CTRL SOLN page. The INAV CTRL SOLN page can also be accessed by selecting 6L on the INS POSITION UPDATE page. The data field below the page title displays the lat/long navigation position for the Navigation Processor.

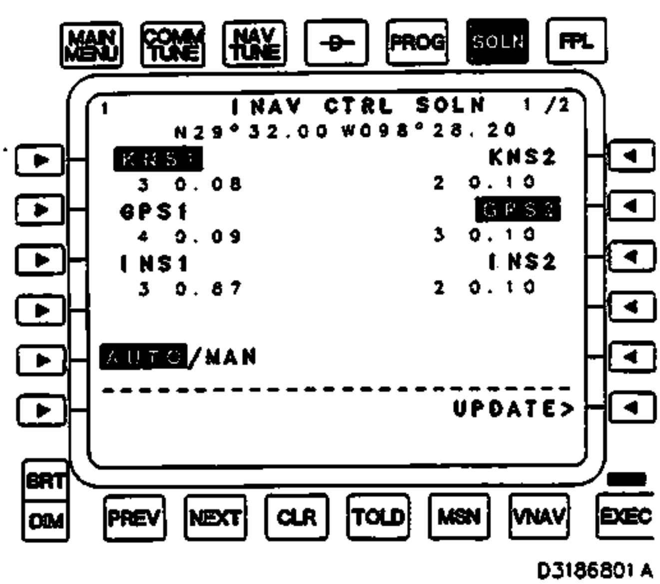


Figure 1-30. INAV CTRL SOLN

1L **KNS 1 status.** If the navigation source is displayed in a large font, it is available for use. A small font indicates it is not usable. The two data fields under the KNS 1 navigation source display the FOM and EHE, respectively. Selection of the navigation source, when it is available, will result in the selection being displayed in a large font, inverse video. Entry and delete are non-operational on the navigation source LSKs.

2L **GPS 1 status.** If the navigation source is displayed in a large font, it is available for use. A small font indicates it is not usable. The two data fields under the GPS 1 navigation source displays the FOM and EHE, respectively. Selection of the navigation source, when it is available, results in the navigation source being displayed in a large font, inverse video. Entry and delete are non-operational on the navigation source LSKs.

3L **INS 1 status.** If the navigation source is displayed in a large font, it is available for use. A small font indicates it is not usable. The two data fields under the INS 1 navigation source displays the FOM and EHE, respectively. Selection of the navigation source when it is available, results in the navigation source being displayed in a large font, inverse video. Entry and delete are non-operational on the navigation source LSKs.

5L **Automatic Navigation Selection.** When AUTO is selected, the NP is permitted to choose its navigation source, and to re-select its source at any time.

When MAN is selected, the NP is prohibited from changing the navigation source. When the switch is changed from AUTO to MAN, the current navigation source remains selected. Entry and delete are non-operational.

1R **KNS 2 status.** Function same as 1L.

2R **GPS 2 status.** Function same as 2L.

3R **INS 2 status.** Function same as 3L.

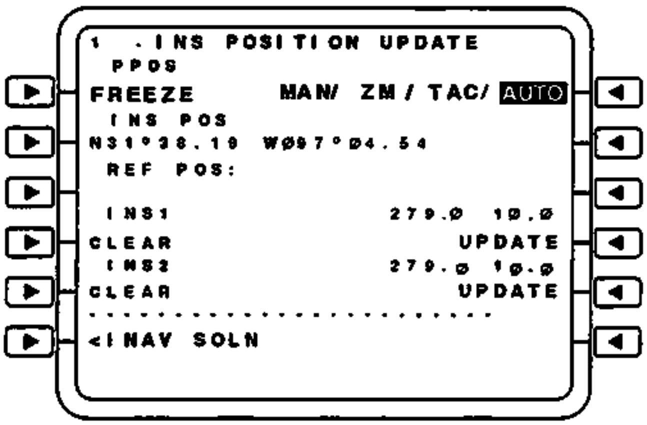
4R-5R **Non-operational.**

6R **UPDATE >.** Selection results in a branch to the INS Position Update page. Entry and delete are non-operational.

INS POSITION UPDATE Page.

The INS POSITION UPDATE page allows updating of the INS solution and is displayed when any of the following conditions are satisfied:

1. Selection of the UPDATE prompt displayed on any of the INAV pages.
2. Selection of a waypoint on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the POSITION UPDATE page.
3. Selection of the return prompt on the CUSTOM DATA page when the CUSTOM DATA page was accessed from the POSITION UPDATE page.



D3188901 E

Figure 1-31. INS POSITION UPDATE

1L **Position Freeze.** When the INS position is not valid or when "ZM" or "TAC" is the selected Position Update mode, 1L data field displays "FREEZE" in a small font. Otherwise, the data field displays "FREEZE" in a large font. If "FREEZE" is displayed in a large font, then selection results in the position freeze operation. Entry and delete are non-operational.

2L **INS Position.** This data field displays the current INS Present Position Lat/Long. The position freeze operation will be performed when the LSK 1 data field is selected and a valid INS Present Position exists. The position freeze operation will record the current INS Present Position and display the Freeze Position in this data field.

When a Freeze Position is displayed in the 2L data field, delete will result in the display of the current INS Present Position Lat/Long into this data field. Otherwise, delete is non-operational. Selection and entry are non-operational.

3L **Reference Position.** The Reference Position is the Target Location in the Manual mode, the data field to the right of the REF POS title displays the Reference Position Identifier, if entered. The Reference Position Lat/Long is displayed in the data field below the REF POS title. In the TACAN mode, the REF POS data field displays the valid TACAN 1 Station ID, the data field below REF POS is blank, and the valid TACAN 2 Station ID will be displayed to the right of the valid TACAN 1 Station ID. In the ZM mode, these three data fields are blank. Also, when the Target Location Data is invalid, these three data fields are blank.

Valid entries of a Reference Position will be of the form Position. If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page. A return from the WAYPOINT SELECT page with a waypoint selected will result in the selected waypoint being displayed in the Reference Position fields. A return from the WAYPOINT SELECT page when a waypoint is not selected will result in the waypoint identifier being displayed in the scratch pad. Valid waypoint entries that are not contained in a database will result in the display of the CUSTOM DATA page. A return from the CUSTOM DATA page with the waypoint defined will result in the custom waypoint being displayed in the REF POS data fields. A return from the CUSTOM DATA page with the waypoint undefined will result in the waypoint identifier being displayed in the scratch pad. Selection results in the lat/long displayed in the data field below REF POS being placed into the scratch pad.

4L **INS 1 Clear Prompt.** When an offset is applied to the INS 1 position and an update is not active, the 4L data field will display "CLEAR" in a large font. Otherwise, this data field will display "CLEAR" in a small font.

If "CLEAR" is displayed in a large font, selection will result in "CLEAR" being displayed in a large font, inverse video. If "CLEAR" is displayed in a large font, inverse, video, selection will result in "CLEAR" being displayed in a small font. Entry and delete are non-operational.

5L **INS 2 Clear Prompt.** When an offset is applied to the INS 2 position and an update is not active, the 5L data field will display "CLEAR" in a large font. Otherwise, data field will display "CLEAR" in a small font. If "CLEAR" is displayed in a large font, selection will result in "CLEAR" being displayed in a large font, inverse video. If "CLEAR" is displayed in a large font, inverse video, selection will result in "CLEAR" being displayed in a small font. Entry and delete are non-operational.

6L **Branch to INAV CTRL SOLN page.** Selection results in a branch to the INAV CTRL SOLN page.

1R **Position Update Mode.** The update mode type is displayed in the 1R field and controlled from this LSK. This LSK allows selection of four update mode types: "MAN" (manual), "ZM" (SKE Zone Marker), "TAC" (TACAN), AUTO. When AUTO is selected, the INS position will automaticaly be updated with the selected KNS or GPS position. Entry and delete are non-operational.

2R-3R **Non-operational.**

4R **INS 1 Offset Update.** In the Manual mode, if a freeze position exists in the Selected Position, a Reference Position is available, and the INS 1 solution is available, the data field above 4R displays the INS 1 Offset Distance and Offset Direction. Otherwise, these data fields are blank.

Once armed and activated, the ZM update mode will stay active until the CARP is exited or deselected. In the ZM mode, if SKE ZM input data is valid, the aircraft is within 22 nm of the ZM position, and the INS1 solution is available, then the INS1 Offset Distance and the INS1 Offset Direction is displayed in the data fields between 3R and 4R respectively. Otherwise, these data fields are blank. When INS1 Update is active, the MIX annunciator flashes.

In the TACAN mode, if TACAN input data is valid and the INS 1 solution is available then the INS 1 Offset Distance and Offset Direction is displayed in the data field between 3R and 4R. Otherwise, these data fields are blank.

If an INS 1 Offset exists and has not been applied to the INS 1 solution, then the 4R data field displays "UPDATE" in a large font. Otherwise, "UPDATE" is displayed in a small font.

In the MANUAL mode, when "UPDATE" is in a large font, selection results in the offset position being applied to the INS 1 solution. The 4R data field will revert to a small font and the two data fields between 3R and 4R will be blank. Selection when "UPDATE" is in a small font is non-operational.

In the ZM or TAC mode, when "UPDATE" is in a large font, selection results in "arming" of the update to INS 1, and the 4R data field reverts to a large font, inverse video. Selection when "UPDATE" is in large font, inverse video results in "disarming" of the update to INS 1 and the data field reverts to a large font. When the 4R data field is large font, inverse video and the MFCDU "MIX" annunciator is on steady (TAC) or flashing (ZM) because of an INS 1 ZM or TAC update, the update will be applied to the INS 1 position and data field between 3R and 4R will be blank.

5R **INS 2 Offset Update.** Function same as 4R.

6R **Non-operational.**

INAV CTRL INDEX Page.

The INAV CONTROL INDEX 2/2 page provides a menu to access the various navigation sensors. Selection of PREV or NEXT key from the INAV CTRL SOLN page, or selection of INAV CTRL prompt from the SCADCx, INSx, STATUS or GPSx STATUS pages, results in display of the INAV CTRL INDEX page. The data field under the title displays the navigation position for the NP.

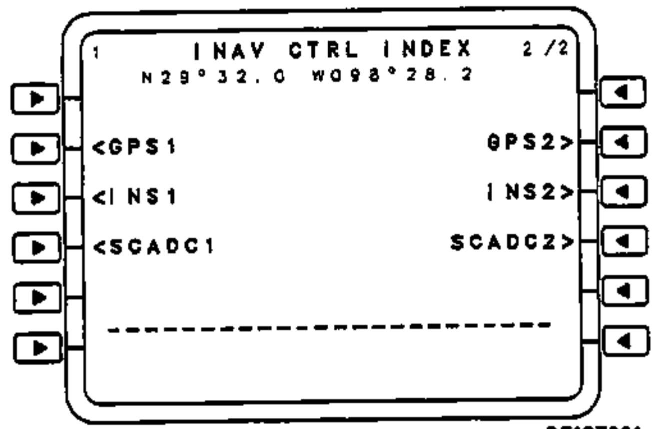


Figure 1-32. INAV CTRL INDEX 2/2

1L **Non-operational.**

2L **Branch to GPS 1 STATUS 1/2 page.**

3L **Branch to INS 1 STATUS page.**

4L **Branch to SCADC 1 page.**

5L-6L **Non-operational.**

1R **Non-operational.**

2R **Branch to GPS 2 STATUS.** Function same as 1L.

3R **Branch to INS 2 STATUS.** Function same as 3L.

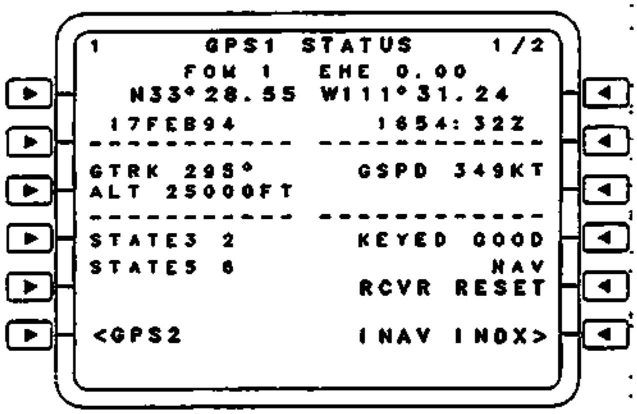
4R **Branch to SCADC 2.** Function same as 4L.

5R-6R **Non-operational.**

GPS STATUS 1/2 Page.

The GPS STATUS 1/2 page monitors the GPS indicated in the page title. The GPSx STATUS 1/2 page is accessible from the GPS 1 and GPS 2 prompts on the INAV CTRL INDEX and from the GPSx prompt on the GPSx STATUS 1/2 or GPSx STATUS 2/2 pages.

The GPS number for the page is displayed in the title. The Figure of Merit (FOM) and Estimated Horizontal Error (EHE) for the GPS is indicated below the title. The 6L data field contains the number for the GPS that is not contained in the title data field. Other data fields on this page show the current navigation source position, date, time, ground track, ground speed, altitude, key state, and mode for the GPS indicated in the title. The possible values for the 4R data field are "KEYED GOOD," "KEYED UNVER," "KEYED BAD," "KEY FAILED," and "NOT KEYED." The possible valves below the 4R data field are "NAV" and "NO NAV".



D31871018

Figure 1-33. GPS STATUS 1/2

1L-3L **Non-operational.**

4L **State 3 and State 5.** Data fields for State 3 and State 5 are the operation indicators. State 3 is the code track only mode and as such provides position data only. The number adjacent to state 3 indicates the number of satellites in code track only mode. State 5 (costas track) is the more desirable mode tracking carrier and code. In state 5, position and velocity data is provided. A minimum of four satellites are required. If carrier and code tracking is not achievable (due to jamming level), the GPS will attempt to code track. Selection, entry and delete are non-operational.

5L **Non-operational.**

6L **Branch to GPS STATUS 1/2 page.**

1R-3R **Non-operational.**

4R **Crypto Variable (CV) Status.** KEYED GOOD: indicates CVs are loaded and verified. KEYED BAD: Insufficient CVs. KEY FAILED: Invalid CV entry (e.g., parity failure). This message is displayed if there is an unsuccessful attempt to load CVs, and is cleared after one second. KEYED UNVER: CV verification failure. This message is displayed if a CV is loaded, but the verification process involving satellite signals fails. It is cleared after one second. NOT KEYED: There is no valid CV loaded. Entry and delete are non-operational.

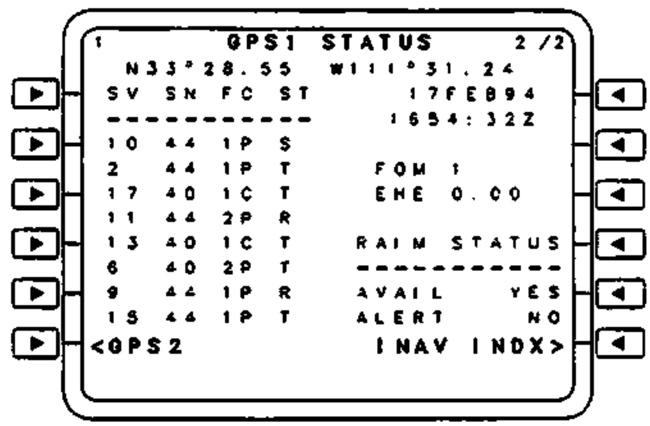
5R **Receiver Reset.** Selection results in the GPS receiver, specified in title, being reset. While the receiver is in reset and POBIT, "RCVR RESET" will be displayed in a small font. When the receiver completes POBIT, "RCVR RESET' will be displayed in a large font. Entry and delete are non-operational.

6R **Branch to INAV CTRL INDEX page.**

GPS STATUS 2/2 Page.

The GPS STATUS 2/2 page monitors the GPS indicated in the title.

The 3R data fields display the FOM and EHE for the GPS indicated in the page title. The 6L data field contains the number for the other GPS, whose data is not contained on this page. The lat/long coordinates below the title show the current navigation sources position. The two data fields for 1R display the date and time for the GPS indicated in the title. The AVAIL and ALERT data fields show the RAIM Availability and Alert Status.



D31872018

Figure 1-34. GPS STATUS 2/2

1L **SV SN FC ST.** SV is the satellite number, SN is a signal to noise ratio, FC is the frequency tracked/tracking code, and ST is the channel state. A good unjammed satellite signal to noise ratio is normally better than 38. Frequency tracked (F) are "1" or "2", tracking Codes (C) are "P" Precision code or "C" Coarse acquisition code. Channel states (ST) are "S", "P", "T", "R" or blank. "S" = Searching, "P" = Protected, "T" = Tracking, and "R" = Reacquisition and a blank entry indicates no channel is being tracked. Selection, entry and delete are non-operational.

2L-5L Shows the SV, SN, FC, and ST information for up to eight satellites in use by the GPS. Selection, entry and delete are non-operational.

6L **Branch to GPS STATUS 2/2 page.**

1R-5R **Non-operational.**

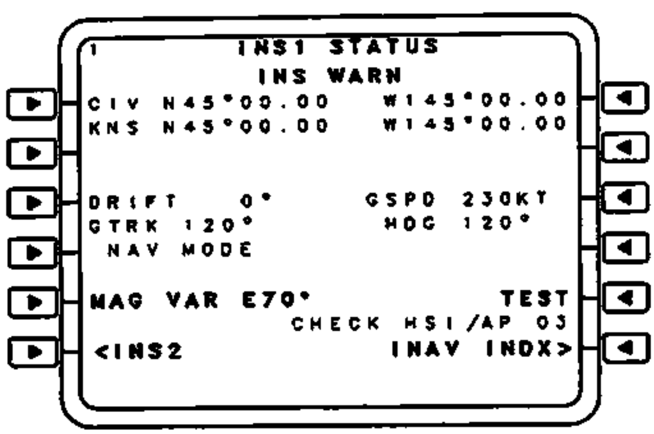
6R **Branch to INAV CTRL INDEX page.**

INS STATUS Page.

The INS STATUS page monitors and controls the INS. The INS STATUS page is accessible from the INS 1 and INS 2 prompts on the INAV CTRL and INS STATUS pages. Selection of either prompt displays the INS STATUS page for the INS indicated in the prompt.

The selected INS is displayed by a number in the page title. Displayed adjacent to 1L is "CIV" which stands for Carousel IV. After the latitude and longitude are transferred from the MFCDU to INU, the latitude and longitude are displayed to the right of CIV. The data field under "CIV" displays the selected navigation solution (KNS, INS, GPS) and its latitude and longitude. The 6L data field contains the INS number for the INS data that is not contained in this page. The 4R data field displays the text "ALIGN ST" followed by the alignment FOM during the Align mode for the INS indicated in the title. The 1R data field displays the INS inertial position. Also displayed on the page are the INS ground track, ground speed, drift angle, heading, and INS Mode. The 4L INS mode values are OFF, STBY, ALIGN, NAV, and ATT. The data field under the INS inertial position displays the present position of the currently selected navigation source.

When a NP detects that the associated INU has logged a fault code, CDU MSG annunciates on the DAMU, INS x ACTION CODE annunciates in the MFCDU scratch pad and INS WARN is annunciated on the appropriate INS STATUS page. Refer to 5R.



D3187301

Figure 1-35. INS STATUS

1L-4L **Non-operational.**

5L **MAG VAR.** The MAG VAR data field will be blank upon page entry. Selection of the MAG VAR key when the scratch pad is empty will result in display of INS magnetic variation for 60 seconds.

Selection of the MAG VAR key when the scratch pad contains a valid magnetic variation entry will result in loading it into the INS and displaying it for 60 seconds. When a valid MAG VAR entry is made, the NP sends the magnetic variance data to the INS, then reads the MAG VAR the INS is using.

6L **Branch to INS STATUS page.**

1R-4R **Non-operational.**

5R **TEST.** Selection of the test key will initiate the INS TEST function. Upon page entry, the data field below 5R will display the following text when an INS ACTION CODE exists:

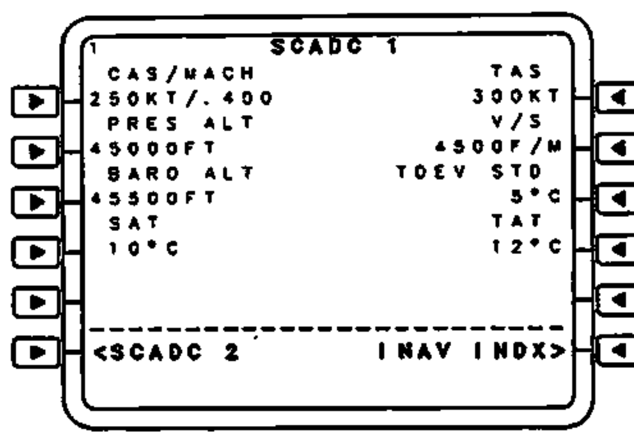
CODE	TEXT
01	SET INS OFF 01
02	DEGRADED NAV/ATT 02
03	CHECK HSI/AP 03
04	RESTART ALIGN 04
05	AIRDROP INOP 05

Following completion of the INS TEST function, and while the page is still being displayed, if malfunction codes exist, this data field will display the text "MALF" followed by up to the first five malfunction codes retrieved.

6R **Branch to INAV CTRL INDEX page.**

SCADC Page.

The SCADC page displays the data being received from the SCADC indicated in the page title. The prompt at 6L will provide access to the SCADC not being displayed in the title.



D3187401

Figure 1-36. SCADC

1L **CAS/MACH.** This data field displays the CAS and Mach being received from the indicated SCADC. Selection, entry and delete are non-operational.

2L **Pressure Altitude.** Displays the pressure altitude being received from the indicated SCADC. Selection, entry, and delete are non-operational.

3L **Barometric Altitude.** Data field displays the Barometric altitude being received from the indicated SCADC. Selection, entry, and delete are non-operational.

4L **Static Air Temperature.** Data field displays the Static Air Temperature being received from the indicated SCADC. Selection, entry, and delete are non-operational.

5L **Non-operational.**

6L **Branch to SCADC.** The 6L data field will indicate a "2" if the page title contains a "1" and vice versa. Selection results in the display of the SCADC page for the SCADC displayed in this data field.

1R **TAS.** Displays the True Airspeed being received from the indicated SCADC. Selection, entry, and delete are non-operational.

2R **Vertical Speed.** Displays the Vertical Speed being received from the indicated SCADC. Selection, entry, and delete are non-operational.

3R **Temperature Deviation.** Displays the Temperature Deviation calculated from the data being received from the indicated SCADC. Selection, entry and delete are non-operational.

4R **Total Air Temperature.** Displays the Total Air Temperature being received from the indicated SCADC. Selection, entry, and delete are non-operational.

5R **Non-operational.**

6R **Branch to INAV CTRL INDEX page.**

COMMUNICATION MANAGEMENT.

The FMS provides control and processing necessary to manage the communication radios as described in the following paragraphs.

VHF Radio Tuning.

The FMS is capable of tuning the VHF radios to frequencies in the AM frequency range of 116.000 to 151.975 MHz and in the FM frequency range of 30.000 to 87.975 MHz. The receive only AM frequency range is 108.000 to 115.975 MHz (frequency spacing of .025 MHz within each range). Channel selection is accomplished by manual entry of a valid frequency, a valid preselect list identifier, or a valid preselect list position. Up to 40 VHF Identifier/Frequency preselects in non-volatile memory are provided for tuning selection by the two VHF radios via selection through the MFCDU. On power-up, VHF radio is tuned to the last set frequency.

VHF Radio Control.

Control of the VHF radio's power, squelch, and tone generation is provided via the MFCDU. Selection of the emergency AM, emergency FM, and normal operating modes are accomplished through the MFCDUs. The FMS relinquishes control of the VHF radio when the VHF backup control panel is activated.

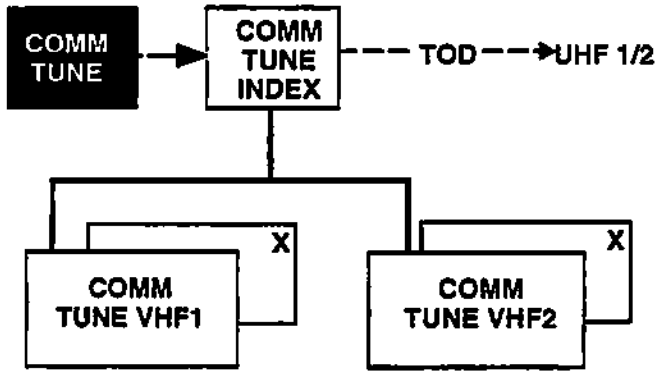


Figure 1-37. COMM TUNE Menu Hierarchy

COMM TUNE INDEX Page.

The COMM TUNE INDEX page displays information on both VHF communication radios and provides access to the individual (V1 or V2) COMM TUNE pages. If the COMM TUNE V1 page is selected and the VHF backup control panel is manually activated, the display reverts to the COMM TUNE INDEX page.

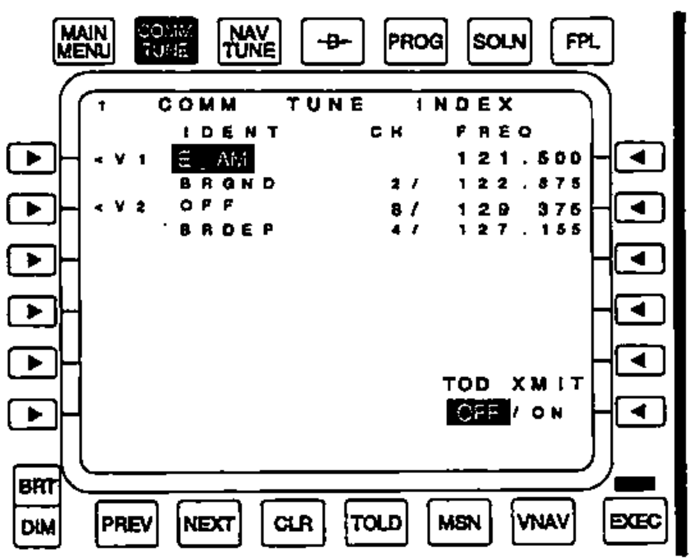


Figure 1-38. COMM TUNE INDEX F1017901

1L **Branch to COMM TUNE V1 page.** This data field displays "<V1". "<V1" will be displayed in small font if the radio controlled by the VHF backup control panel, the NP controlling this radio has determined that the radio is unavailable, or the controlling NP is unavailable. Otherwise "<V1" is dis-

played in large font. If the VHF 1 radio is powered off, "OFF" is displayed in small font. If emergency has been selected on the VHF 1 page, data field 2 will display, in large font, inverse video, either "E_AM" if AM has been selected on the VHF 1 page, or "E_FM" if FM has been selected (non-operational). If no identifier is present, "- - - - - -" will be displayed. Otherwise, the identifier currently being commanded is displayed in large font.

The data field under the identifier currently being commanded (large font), displays the previously commanded identifier for V1 in a small font. When no identifier is present, blanks will be displayed.

Selection results in a branch to the COMM TUNE VHF page for VHF 1. If V1 is being controlled by the backup control panel, selection is non-operational.

2L **Branch to COMM TUNE V2 page.** Function same as 1L, except operations apply to the VHF 2 radio.

3L-6L **Non-operational.**

1R **VHF 1 List Position and Frequency.** Two data fields under "CH" and "FREQ" apply to the VHF 1 radio. The currently selected frequency and its set channel are displayed in the upper two data fields in large font. If the selected frequency is not in the preset channel list, the channel field will be blank.

The two lower data fields display the previously commanded frequency with its associated channel in small font. If no previous frequency exists, blanks will be displayed. If a previous entry exists and that entry is deleted from the VHF preselect channel list, the previously commanded identifier for V1 is displayed in a small font and its preset channel will be blank. The frequency will continue to be displayed.

Valid entries are an identifier contained in the VHF Comm preselect channel list, a list position contained in the VHF Comm preselect list, a valid VHF radio frequency, or an identifier/frequency. A valid entry results in commanding the V1 radio to the entered identifier/frequency. The identifier/list position/frequency that has been previously commanded gets placed into the lower data fields. If the radio is powered off, tuning requests result in the radio being powered up and tuned.

When an identifier or list position/frequency is entered and is not contained in the VHF Comm preselect list, the error message "NOT IN DATABASE" is displayed. Selection results in commanding the previously commanded identifier/frequency. The currently commanded identifier/frequency is placed in the previously tuned fields. Selection results in commanding the previously commanded identifier/frequency. The currently commanded identifier/frequency is placed in the previously tuned fields.

If the V1 radio is being controlled by the backup control panel, all four data fields will be blank. Selection and entry when blank are non-operational. Delete is non-operational.

2R **VHF 2 List Position and Frequency.** Function same as 1R, except operations are performed on VHF 2 radio.

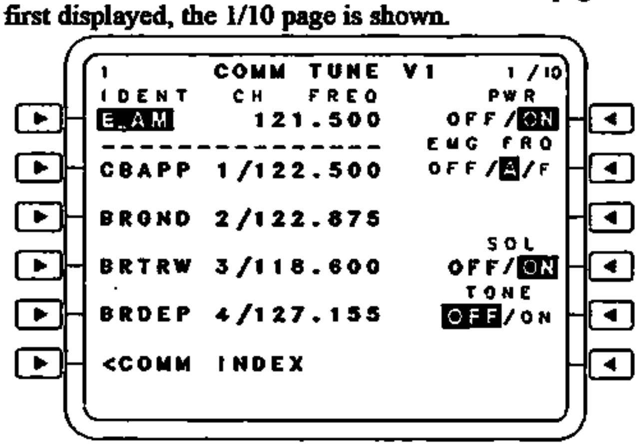
3R-5R **Non-operational.**

6R **TOD XMIT Switch.** The TOD XMIT legend is displayed in a large font if a valid GPS time is being received. Otherwise, the TOD XMIT legend is displayed in a small font. The key is inactive when it is displayed in a small font. Selection of TOD XMIT toggles ON, transmits the TOD signal to the UHF radios and then returns to OFF. Entry and delete are non-operational.

COMM TUNE VHF Page.

The COMM TUNE VHF page displays the VHF tuning list and information pertaining to the control of the VHF radio. Selection of the V1 or V2 prompt from the COMM TUNE INDEX page results in display of the COMM TUNE VHF page. If access was via the V1 prompt, the title line will display "V1", and all operations on this page will apply to VHF 1. If access was via the V2 prompt, the title line will display "V2" and all operations will apply to VHF 2. If VHF 1 is turned OFF or the NP determines the radio is unavailable while the V1 page is being displayed, the display will return to the COMM TUNE INDEX.

The page number is displayed in the upper right corner. Each page in this sequence will display the identical control information on the right side of each display and in the 1R data fields. The multiple pages display the VHF radio stations in the VHF preselect preset channel list. When the COMM TUNE VHF page is first displayed, the 1/10 page is shown.



D3187601C

Figure 1-39. COMM TUNE VHF

1L **Commanded VHFn Identifier/Frequency.** The 1L data fields display the identifier, channel, and frequency of the commanded radio station. Valid entries are an identifier or list position contained in the VHF preselect list, a valid VHF radio frequency, or an identifier/frequency. A valid entry results in tuning the VHFn radio to the entered identifier/frequency. If the commanded frequency has no identifier, "-----" is displayed for the identifier. If a commanded radio has no list position, the CH data field will be blank. If the radio is powered off, tuning requests result in the radio being powered up and tuned. When emergency tuning has been selected, the emergency identifier is displayed in a large font, inverse video.

If an identifier is not contained in the VHF preselect list and is entered with a frequency, the error message "NOT AVAIL" is displayed. Selection and delete are non-operational.

2L **VHFn Identifier/Frequency.** Three data fields display the following data: VHF identifier, list position (sequential position in the VHF preselect list) of the radio frequency, and the radio frequency. If the list position does not contain an entry, the identifier and radio frequency data fields will display dashes. The identifier data field will also contain dashes if no identifier has been entered along with the radio frequency.

A valid entry is an identifier/frequency as long as the identifier is not already contained in the list. If it is already in the list, the error message "DUPLICATE ID" is displayed and the new entry is not allowed. New entries will replace the data currently existing in the identifier and radio frequency data fields.

A "/frequency" is a valid entry as long as the identifier is not already contained in the list. If it is in the list, the new entry will replace the data currently existing in the identifier and radio frequency data fields.

Selection results in the list position being placed into the scratch pad if a frequency is associated with the list position. Otherwise, selection is non-operational.

Delete results in the frequency/identifier being deleted from the VHF preselect list, if it is not currently being commanded, and that list position displaying dashes in the identifier and radio frequency data fields. If the frequency is currently being commanded, the message "INVALID DELETE" is displayed, and no deletion takes place. If no frequency is here, delete is non-operational. (Operation of 3L, 4L and 5L is the same as 2L.)

6L **Branch to COMM TUNE INDEX page.**

1R **VHFn Power Control.** This LSK controls the VHFn radio power. In the "OFF" position, the radio is turned off. In the "ON" position, the radio is turned on. When the VHFn Emergency frequency "A" (AM) or "F" (FM) is selected, or the radio is tuned using 1L. The VHFn radio is turned "ON." Entry and delete are non-operational.

2R **VHFn Emergency Frequency Selection.** 2R selects AM and FM emergency frequencies. In the OFF position, emergency tuning is turned off. In the "A" position, the VHF AM Emergency frequency is commanded, and the identifier "E_AM" is displayed in the 1L data field under the IDENT annunciation in a large font, inverse video. In the "F" position, the VHF FM Emergency frequency is commanded, and the identifier "E_FM" is displayed in the 1L data field in a large font, inverse video. Entry and delete are non-operational.

NOTE

While E_FM is selectable, it is not operational.

3R **Non-operational.**

4R **VHFn Squelch control.** The commanded VHFn radio squelch status is displayed and controlled with this LSK. Selections are ON and OFF. Entry and delete are non-operational.

5R **VHFn Tone control.** The commanded VHFn radio tone status is displayed and controlled from this LSK. Selections are ON and OFF. Entry and delete are non-operational.

6R **Non-operational.**

RADIO NAVIGATION MANAGEMENT.

The FMS provides the control and processing necessary to manage the navigation radios as described in the following paragraphs.

TACAN Transceiver Tuning.

The FMS can tune both TACAN transceivers up to 126 X and 126 Y channels. On power-up, the transceivers are set to the last tuned frequency. The FMS provides the tuned channel of the TACAN transceiver to the AFCS. Independent tuning capabilities are provided for each TACAN transceiver as follows:

1. Remote Tuning. The TACAN transceiver is tuned (Navaid identifiers, valid TACAN channels) through the MFCDU.

2. Paired Tuning. When paired tuning is selected for a receiver, and the onside VOR receiver is not being controlled by the VHF backup control panel, that TACAN transceiver will select the channel that is paired with the VOR frequency currently tuned in the onside VOR receiver.

NOTE

When pairing is selected, P annunciates between TAC and VOR on the appropriate DAMU. See figure 1-11.

3. Ground/Airborne Navaids. The FMS provides the capability to specify ground-based or airborne Navaids for tuning by a TACAN transceiver.

TACAN Transceiver Control.

Transceiver power and test initiation is provided by the MFCDU. Selection of the TACAN radio transmit/receive (T/R-REC) mode, air-to-air (AA) or ground (GND) mode and VOR paired/not-paired operation is made via the MFCDU.

VOR Receiver Tuning.

The FMS can tune both VOR receivers to 160 channels between 108.000 MHz and 117.950 MHz with 50 kHz channel spacing. The localizer frequencies make up the frequencies in the odd tenths MHz from 108.000 to 111.950 MHz. On power-up, the VOR receivers are tuned to the last tuned frequency. When in control of the receiver, the FMS provides the tuned frequency of the VOR receiver to the AWFCS. The following independent tuning capabilities are provided for each VOR receiver:

1. Remote Tuning - VOR receivers are tuned to valid identifiers or frequencies through the MFCDU.

2. Paired Tuning - When paired tuning is selected for a receiver, and the VOR receiver is not being controlled by the VHF backup control panel, that VOR receiver will select the frequency paired with the TACAN channel currently tuned in the onside TACAN transceiver.

VOR Receiver Control.

Control of the receiver's power and test initiation is accomplished via the MFCDU. Selection of marker beacon sensitivity and TACAN paired/not paired operation is made via the MFCDU. The FMS relinquishes control of the VOR 1 receiver when the VHF backup control panel is activated.

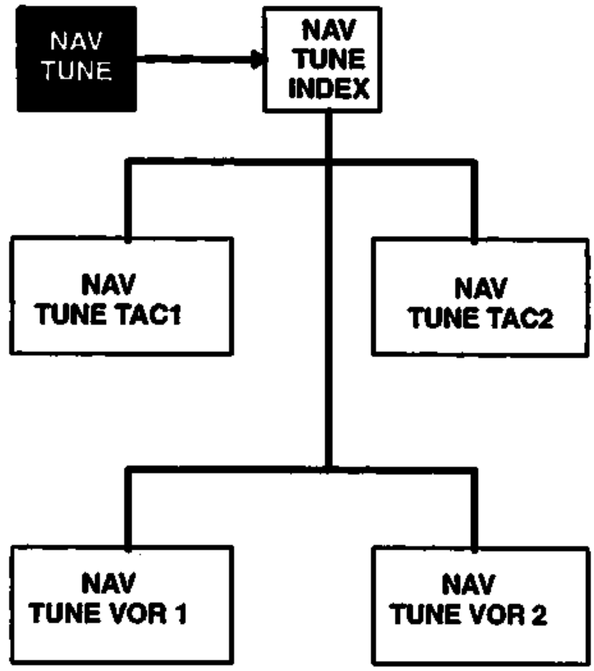


Figure 1-40. NAV TUNE Menu Hierarchy

NAV TUNE INDEX Page.

The NAV TUNE INDEX page displays information on the navigational radios and provides access to the individual (VOR 1, VOR 2, TAC 1, or TAC 2) NAV TUNE pages.

The NAV TUNE INDEX page is displayed when any of the following conditions are satisfied:

1. Selection of the NAV TUNE Mode key.

2. Selection of the NAV TUNE INDEX prompt from either the NAV TUNE VOR or NAV TUNE TACAN.

3. Selection of IL-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the NAV TUNE INDEX page.

4. If the NAV TUNE VOR 1 page is selected and the VHF backup control panel is manually activated.

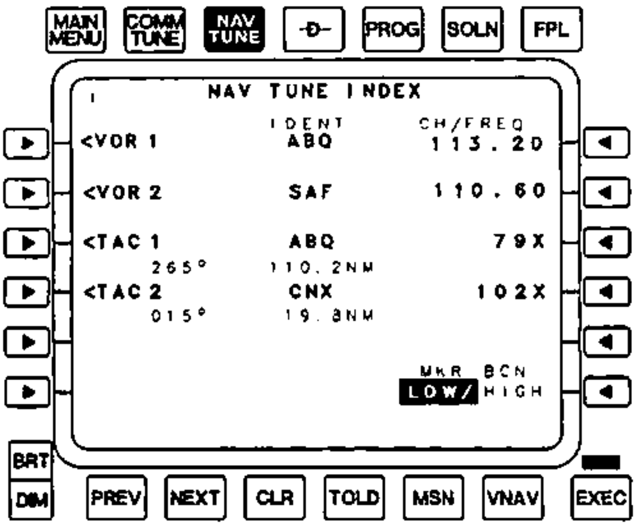


Figure 1-41. NAV TUNE INDEX

1L **Branch to NAV TUNE VOR 1 page.** This data field displays "<VOR 1". This will be in a small font if the VOR being controlled by a VHF backup control panel or if the NP determines that the VOR is unavailable. If the VOR 1 radio is powered off, "OFF" will be displayed in a small font in the data field under IDENT. If the radio is turned ON and no identifier is associated with the entered frequency, the data field will display "---". Otherwise, this data field will display the identifier in a large font. Tuning requests when the radio is powered off results in the radio being powered on.

Selection of 1L branches to the NAV TUNE VOR 1 page. If VOR 1 is being controlled by the VHF backup control panel, it will be unavailable.

2L **Branch to NAV TUNE VOR 2 page.** Function same as 1L, except operations apply to the VOR 2 radio.

3L **Branch to NAV TUNE TAC1 page.** The 3L data field displays "<TAC1". This will be in small font if the radio is powered off or failed, and in large font otherwise. If the TAC 1 radio is powered off or determined to be failed, the data field under IDENT will display "OFF" in small font. If the radio is powered up and no identifier is associated with the commanded channel, then this data field will display "---". Otherwise, the identifier currently being commanded is displayed in large font. Tuning requests when the radio is powered off result in the radio being powered on. Selection when "<TAC1" is displayed in large font results in a branch to the NAV TUNE TAC1 page. Selection when "<TAC1" is displayed in small font is non-operational.

4L **Branch to NAV TUNE TAC 2 page.** Function same as 3L, except operations apply to the TAC 2 radio.

5L-6L **Non-operational**

1R **VOR 1 Frequency.** The currently commanded VOR 1 frequency is displayed under the CH/FREQ data field. If no frequency is being commanded, the field will be filled with dashes. Valid entries are an identifier contained in the VOR database, a VOR frequency, or a VOR identifier/frequency, both of which are in the database. A valid entry results in commanding the VOR 1 radio to the entered identifier/frequency. If an identifier or frequency is entered and is not contained in the database, the error message "NOT IN DATABASE" is displayed.

If more than one VOR with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a VOR selected, the NP will use the selected VOR in the identifier field. Upon return from the WAYPOINT SELECT page when a VOR is not selected, the NP will display the previously entered VOR identifier in the scratch pad. When the VOR 1 radio is determined to be unavailable, this data field will be blank and entry will be non-operational. Selection and delete are non-operational.

2R **VOR 2 Frequency.** Function same as 1R, except operations are performed on VOR 2 radio.

3R **TAC 1 Channel.** Function same as 1R. Operations are performed on TAC 1 radio. The bearing and distance being received from TAC 1 will be displayed in the lower data field. Valid entries are an identifier contained in the TACAN database, a VOR frequency, a TACAN channel, or a TACAN identifier/channel. If the TACAN was commanded by entering a VOR frequency, the equivalent TACAN channel is displayed.

4R **TAC 2 Channel.** Function same as 3R. Operations are performed on TAC 2 radio.

5R **Non-operational.**

6R **Marker Beacon Sensitivity Switch.** The commanded VOR marker beacon sensitivity status is displayed and controlled from the 6R data field. Selections are LOW and HIGH.

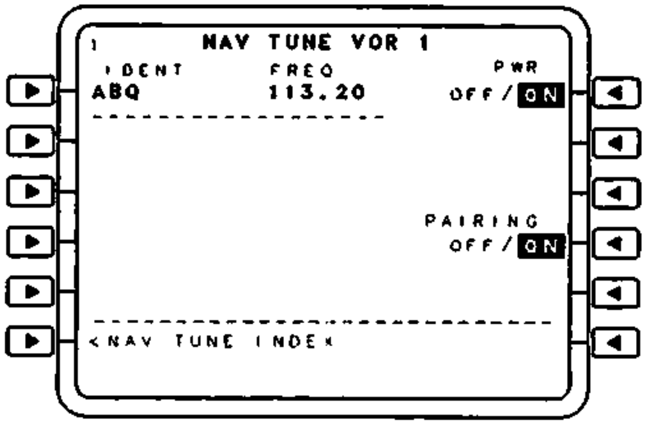
NAV TUNE VOR Page.

The NAV TUNE VOR page displays information pertaining to the control of the VOR radio. If page access was via the VOR 1 prompt, "1" will be displayed in the page title and all operations on this page will apply to VOR 1. If access was via the VOR 2 prompt, "2" will be displayed in the page title and all operations will apply to VOR 2. The NAV TUNE VOR page is displayed when any of the following conditions are satisfied.

1. Selection of the VOR 1 or VOR 2 prompt from the NAV TUNE INDEX 1/2 page.

2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the NAV TUNE VOR page.

If the VHF backup control panel is turned on while the VOR 1 page is being displayed, the display will return to the NAV TUNE INDEX page.



D3187701 A

Figure 1-42. NAV TUNE VOR

1L **Tuned Station.** The 1L data field displays the VOR IDENT and Frequency tuning information for the selected VOR.

Valid entries are an identifier contained in the VOR database, a VOR frequency, or a VOR identifier/frequency, both of which are in the database. If an identifier or identifier/frequency is not contained in the database, the error message "NOT IN DATABASE" is displayed. If the commanded frequency has no identifier, "---" is displayed for the identifier. When the radio is powered off, tuning requests result in the radio being powered up and tuned.

If more than one VOR with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a VOR selected, the NP will use the selected VOR in the VOR identifier field. Upon return from the WAYPOINT SELECT page when a VOR is not selected, the NP will display the previously entered VOR identifier in the scratch pad.

2L-5L **Non-operational.**

6L **Branch to NAV TUNE INDEX 1/2 page.**

1R **VOR Power Control.** The commanded VOR radio power status is displayed and controlled from 1R. Entry and delete are non-operational.

2R-3R **Non-operational.**

4R **VOR/TACAN Pairing.** VOR/TACAN Pairing status is displayed and controlled from 4R. Selecting PAIRING sets the TACAN to the channel paired with the VOR frequency. Any further tuning operation on either the VOR or the TACAN is performed on both. Deselecting PAIRING separates any future tuning operations. Entry and delete are non-operational.

NOTE

When pairing is selected, a "P" annunciates between TAC and VOR on the onside DAMU (refer to figure 1-12 or 1-13).

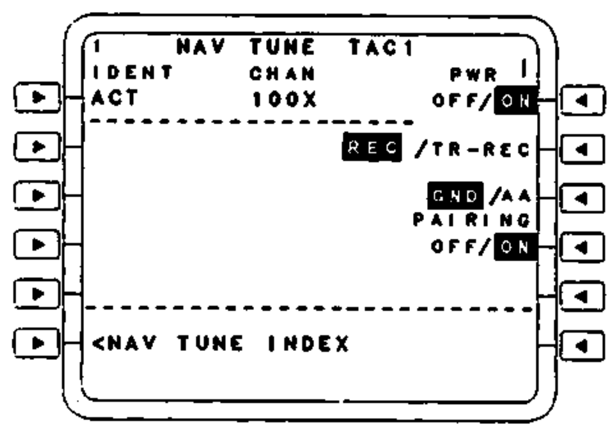
5R-6R **Non-operational.**

NAV TUNE TAC Page.

The NAV TUNE TAC page displays information pertaining to the control of the TACAN radio. If access was via the TAC 1 prompt, the title data field will display "1" and all operations on this page will apply to TAC 1. If access was via the TAC 2 prompt, the title data field will display "2" and all operations will apply to TAC 2. The NAV TUNE TAC page is displayed when any of the following conditions are satisfied.

1. Selection of the TAC 1 or TAC 2 prompt from the NAV TUNE INDEX page.

2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the NAV TUNE TAC page.



D3188101 B

Figure 1-43. NAV TUNE TAC

1L **Tuned Station.** This data field displays the IDENT and Frequency information for the selected TACAN.

Valid entries are an identifier contained in the TAC database, a TAC channel, a VOR frequency, or a TAC identifier/channel, both of which are in the database. If an identifier or identifier/frequency is not contained in the database, the error message "NOT IN DATABASE" is displayed. When the commanded channel has no identifier, "---" is displayed for the identifier. If the radio is powered off, tuning requests result in the radio being powered up and commanded to tune.

If more than one TAC with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a TAC selected, the NP will use the selected TAC in the TAC identifier field. Upon return from the WAYPOINT SELECT page when a TAC is not selected, the NP will display the previously entered TAC identifier in the scratch pad.

2L-5L **Non-operational.**

6L **Branch to NAV TUNE INDEX page.**

1R **TACAN Power Control.** The commanded TACAN radio power status is displayed and controlled from 1R. Entry and delete are non-operational.

2R **TACAN Transmit/Receive.** The commanded TACAN radio Transmit-Receive mode is displayed and controlled from 2R. Entry and delete are non-operational.

3R **TACAN Ground/Air-to-Air mode.** The TACAN Ground/Air-to-Air mode is displayed and controlled from 3R. Entry and delete are non-operational.

4R **VOR/TACAN Pairing.** VOR/TACAN Pairing status is displayed and controlled from 4R. Selecting PAIRING sets TACAN to the channel paired with the VOR frequency. Any further tuning operation on either the VOR or the TACAN is performed on both. Deselecting PAIRING separates any future tuning operations. Selections are "ON" and "OFF." Entry and delete are non-operational.

NOTE

When pairing is selected, a "P" annunciates between TAC and VOR on the onside DAMU (refer to figure 1-12 or 1-13).

5R-6R **Non-operational.**

FLIGHT PLAN MANAGEMENT.

The flight planning function constructs a lateral flight plan and provides the altitude, speed, time, fuel, and descent angle definitions for the vertical profile definition. Flight planning function provides the lateral and vertical flight plan to the Control Display System (CDS) and the autopilot system. The following terms will be used to describe the flight plan functionality.

1. The active flight plan is the route (1 or 2) in use. The active flight plan will be selected by the user through the activate function and the execute (EXE) function key. Only one route may be active at a time. When route 1 is active, route 2 will be inactive and vice versa.

2. The provisional flight plan is a copy of the active flight plan with modifications, i.e., the "MOD ROUTE" described on the Route page. A provisional flight plan will be created anytime a modification is made by the user to the active flight plan. A provisional flight plan will not be created for modifications to the inactive flight plan.

3. The selected flight plan will be ROUTE 1 when the operation is to be performed from a ROUTE 1 or LEGS 1 page. The selected flight plan will be ROUTE 2 when the operation is to be performed from a ROUTE 2 or LEGS 2 page. The selected flight plan is the provisional flight plan when the operation is to be performed from the MOD ROUTE or MOD LEGS page, or the page is displaying the active flight plan.

4. The primary flight plan is the part of the route (1 or 2) from the origin to the primary destination and may contain the following:

Origin
Standard Instrument Departure (SID)
Airways/Jet Routes
Holding Pattern/Refueling Pattern
Approach/LZ
Airdrops
Rendezvous
Standard Terminal Arrival Route (STAR)
Destination

5. The path to the alternate destination is the part of the route (1 or 2) from the waypoint following the primary destination to the alternate destination and may contain the following:

Airways/Jet Routes
Holding Pattern/Refueling Pattern
Approach/LZ
Airdrops
Rendezvous
Standard Terminal Arrival Route (STAR)
Alternate Destination

6. The selected waypoint will be the waypoint on the line next to the line select key used in the operation. The selected waypoint originates from either the ROUTE or LEGS page.

7. The preceding waypoint will be the waypoint before the selected waypoint in the flight plan.

8. When matching waypoints within a flight plan and FP WAYPOINT LABELs exist, then the FP WAYPOINT LABELs must be the same.

Flight Planning.

Flight planning for the FMS consists of defining a series of waypoints that will be used as navigation legs. A flight plan may consist of up to 127 waypoints and the associated speed, altitude, and descent angle constraints arranged in sequence. The active flight plan will be partitioned into flight plan waypoints and historical waypoints. The flight plan size is the number of waypoints currently in the flight plan, including the waypoints to both the primary and alternate destinations. When a waypoint is inserted into the flight plan and the number of waypoints after the insertion will exceed 127, the originating MFCDU annunciates "FLIGHT PLAN FULL".

FLIGHT PLAN HISTORICAL WAYPOINT.

Up to five historical waypoints may be stored in non-volatile memory. The active waypoint will become historical when it is sequenced by Lateral Guidance.

FLIGHT PLAN MISSION FLIGHT PARAMETER FUNCTIONS.

Up to 10 Computed Air Release Points (CARPs), four approaches, and five rendezvous intercept points may be inserted into a flight plan. When an MFP is to be inserted into the flight plan and the number of MFPs exceeds the maximum, MFCDU annunciates "LIST FULL."

Flight Plans.

The FMS can define two flight plans, route 1 and route 2, each consisting of a primary flight plan and, if desired, a path to an alternate destination. Arming the alternate destination incorporates the path to the alternate destination into the active flight plan. Flight plans can be entered via the MFCDU alphanumeric keyboard, via recall from non-volatile memory, and via the data loader subsystem upload. The MFCDUs provide the capability of previewing the flight plan. Both flight plans are retained in non-volatile memory.

Separate capabilities are provided to observe and to amend flight plan data. Observing the flight plan does not interrupt or affect the navigation guidance. Amending the flight plan affects navigation guidance only when the amendment is commanded by the operator. Amendments to the active flight plan waypoint are not permitted.

Individual waypoints or strings of waypoints may be inserted into the flight plan as follows:

1. Waypoint or Mark Point.
2. Airways (or portions thereof) from the navigation database.
3. Stored Routes from the custom database.
4. Terminal area procedures, including SID (Standard Instrument Departure) and STARs (Standard Terminal Arrival Routes), from the navigation database.
5. Non-precision Approach (NPA) procedures based on crew-entered data.

The FMS provides the current To waypoint, the current From waypoint, and the next 14 waypoints of the active flight plan in sequence. When operating in a parallel offset mode, the FMS provides the current To offset waypoint, the current From offset waypoint, the next 14 offset waypoints of the active flight plan, the current To parent waypoint, and the next two parent waypoints in sequence.

WAYPOINTS.

Use of a navigation database stored waypoints, a custom database stored waypoints, temporary waypoints, and computed waypoints are provided. Each custom waypoint is described by an identifier and a position. Custom waypoints are retained in non-volatile memory. The FMS supports operator entry of waypoints defined as follows:

1. Position in latitude/longitude or MGRS.
2. Range and bearing from an existing waypoint.
3. Bearings from two existing waypoints.
4. Identifier for a waypoint contained in either the navigation database or the custom database.

An origin waypoint and a destination waypoint may be inserted into the primary flight plan. The alternate origin waypoint is the destination waypoint of the primary flight plan. The FMS provides the ability to insert a destination waypoint into the alternate flight plan. An altitude constraint may be entered for each waypoint via the MFCDU. The precision of the constraint will be less than or equal to 100 feet for enroute and terminal phases and less than or equal to 10 feet for the approach phase of flight.

NAVIGATION LEGS.

The use of the following parameters in specifying a given leg are supported by the FMS:

1. Leg Type
2. Waypoint Position
3. Leg Speed
4. Transition Type
5. Leg Length
6. Leg Course

DISCONTINUITIES.

The FMS provides for a discontinuity in the flight plan where there is no lateral flight plan definition.

CAUTION

The FMS will cause the autopilot to switch from LNAV to BASIC mode without operator intervention after sequencing the last waypoint prior to a discontinuity.

LEG TRANSITIONS.

The following types of leg transitions are provided and are selectable on WAYPOINT DATA page 2/2, 3L.

1. The Radius of Turn Transition overflies the current leg's waypoint and then flies directly to the next waypoint.

2. The Curve Path Transition begins the turn to the next leg before reaching the current leg's waypoint. The curve path provides a smooth transition to the next leg.

3. The Point-to-Point Transition overflies the current leg's waypoint and then captures the track defined for the next leg.

DIRECT-TO AND INTERCEPTS.

Flight planning capabilities for issuing a direct-to any waypoint and for issuing an intercept to a course into any waypoint are provided.

PARALLEL OFFSETS.

The FMS provides the capability of defining a flight path offset from the defined flight plan. The parallel offset distance is adjustable from 0 to 99.9 nautical miles in 0.1 nautical mile increments.

FMS PATTERNS.

Flight planning capabilities for Holding patterns/Refueling Orbits and Computed Air Release Point patterns are provided.

HOLDING PATTERNS/REFUELING ORBITS.

The FMS provides flight planning capabilities for a single holding pattern per flight plan. The holding pattern may be specified at either the present position or a down path waypoint. Refueling orbits are specified as extended holding patterns.

COMPUTED AIR RELEASE POINT.

Flight planning capabilities for up to 10 airdrops per flight plan are provided.

RENDEZVOUS/INTERCEPT.

Up to five rendezvous/intercept points may be inserted into a flight plan. They are "*Rznn", where nn are numbers from 01 to 05 assigned by the NP.

NAVIGATION MODES.

TO-TO and DIRECT-TO modes of operation are allowed. The DIRECT-TO mode functions may be implemented as a sub-mode that incorporates the display requirements of the TO-TO mode.

TO-TO NAVIGATION MODE. TO-TO navigation is navigation along a great circle path defined by two waypoints. The FMS provides instantaneous desired track (IDTK) for the TO-TO mode. The magnetic variation used to determine the magnetic values of the course and bearing to the destination waypoint is the value at the aircraft present position. The Desired Track (DTK) is the IDTK along the great circle path.

DIRECT-TO NAVIGATION MODES. DIRECT-TO Navigation is navigation along a great circle path defined by the aircraft present position and a single waypoint. When selected, the FMS provides steering commands to turn the aircraft toward the waypoint. Once the aircraft is headed toward the waypoint and no turn is required, the FMS executes the DIRECT-TO mode.

DIRECT TO-TO NAVIGATION SUB-MODE. The navigation path is defined in accordance with the DIRECT-TO mode. The magnetic variation for the course and bearing is in accordance with the TO-TO mode.

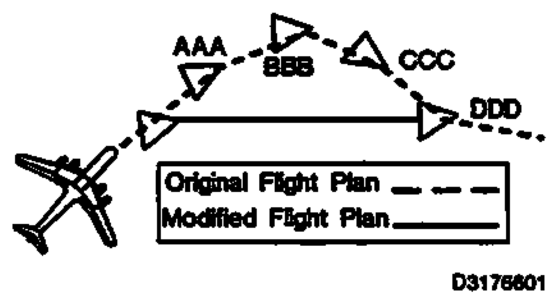


Figure 1-44. Direct To Waypoint

DIRECT TO-FROM NAVIGATION SUB-MODE. The capability to intercept a course to a waypoint is provided. The course and the waypoint are designated via the MFCDU. The DTK for this sub-mode is the designated course. The magnetic variation for the course and bearing is the value at the designated waypoint.

MARK POINT.

The FMS has the capability of recording and storing the current aircraft position based on the selected navigation solution, date, and time in non-volatile memory for use as a waypoint in the flight plan. A list of up to 10 mark points may be maintained.

RENDEZVOUS/INTERCEPT,

Based on crew entry of intercept targets, the FMS can generate intercept locations. The computed intercept point is available for insertion into the flight plan. The FMS can compute up to 10 intercept targets and their corresponding intercept locations.

LATERAL GUIDANCE (LNAV).

The FMS generates a lateral steering command for use by the AFCS flight director/autopilot system to allow the aircraft to follow the lateral flight plan. Each Navigation Processor generates an independent lateral guidance solution based upon the selected navigation solution for that NP. The FMS steering commands are bank angle targets.

ENGAGEMENT CRITERIA.

The FMS lateral steering engagement requires the following minimum criteria:

1. A flight plan is active.
2. Valid SCADC data.
3. At least one valid MFCDU.
4. A valid INAV solution in the on side NP (i.e., the NP being engaged).
5. Valid roll attitude data.

FLIGHT PLAN GUIDANCE.

Great circle steering guidance between flight plan waypoints is provided. The FMS automatically sequences between the legs of the flight plan as the flight progresses. Flight progress is displayed on the MFCDU. The FMS provides great circle steering along direct-to or intercept legs to a direct waypoint. Guidance to Standard Instrument Departure (SID) and Standard Arrival (STAR) procedures contained in the navigation database are provided. LNAV supports the following lateral leg types:

1. Initial Fix (IF)
2. Course to a Fix (CF)
3. Track to a Fix (TF)
4. Direct To a Fix (DF)
5. Course from a Fix to an Altitude (FA)
6. Heading from a Fix to an Altitude (VA)
7. Heading to an Intercept (VI)
8. Heading To a Manual Termination (VM)
9. Heading Select (HS)

NON-PRECISION APPROACH GUIDANCE.

The FMS provides lateral steering guidance when the flight phase is Nonprecision Approach. LNAV flies the approach as a normal lateral leg type.

HOLDING PATTERN/REFUELING ORBIT GUIDANCE.

Lateral steering guidance capability includes both present position (PPOS) holding patterns and holding patterns at a waypoint. The lateral steering guidance capability includes direct, parallel and teardrop entry procedures to the holding pattern.

For refueling orbits, the FMS establishes an outbound course that is parallel to the inbound course. The offset of the outbound course is adjusted for aircraft turn radius and variations in wind speed and direction.

COMPUTED AIR RELEASE POINT (CARP) GUIDANCE.

Lateral steering guidance is provided to the CARP. LNAV flies the CARP as one of the lateral leg types specified. Up to nine runs of the same CARP are supported.

OFFSET GUIDANCE.

Lateral steering guidance for flight plans offset from zero to 99.9 NM (in 0.1 nautical mile increments) to the left or to the right of the active flight plan are provided.

RENDEZVOUS/INTERCEPT.

LNAV flies the Rendezvous/Intercept as a normal lateral leg type.

TREND VECTORS.

The FMS computes 30, 60, and 90-second trend vectors for use by the weather radar. The trend vector computes expected aircraft position based on the selected navigation solution.

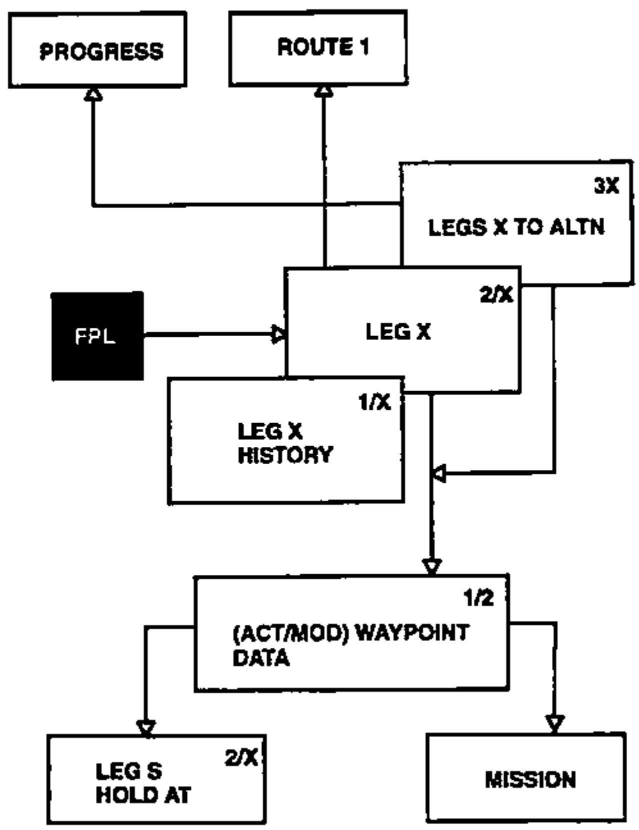


Figure 1-45. ROUTE and LEGS Pages Menu Hierarchy

ROUTE and LEGS Pages.

The ROUTE and LEGS pages are similar in their layout and display of data. The following applies to all the ROUTE and LEGS pages, unless otherwise noted in the specific page descriptions.

ROUTE PAGES.

ROUTE pages are laid out sequentially (ROUTE PLAN, PRIMARY ROUTE, and ROUTE TO ALTERNATE) for each of the two routes. The ROUTE PLAN page displays the airfield and certain parameters for the route. The PRIMARY ROUTE page displays the waypoints contained in the primary flight plan. Typically, more than one PRIMARY ROUTE page will be needed to display the entire route. MULTIPLE PRIMARY ROUTE pages will then be created, permitting the entire list of route waypoints to be laid out sequentially. The ROUTE TO ALTERNATE content is identical to PRIMARY ROUTE page, except that the legs displayed are in the route to alternate destination portion of the flight plan. Additional ROUTE TO ALTERNATE pages will be created, as needed, to display the entire route to the alternate destination.

For example, to show the layout of the route page numbering two PRIMARY ROUTE pages are needed to display all of the Route waypoints, and three ROUTE TO ALTERNATE pages are needed to display the waypoints in the route to the alternate destination. The page numbering would then be as follows:

ROUTE PLAN	page 1/6
PRIMARY ROUTE	page 2/6
PRIMARY ROUTE	page 3/6
ROUTE TO ALTERNATE	page 4/6
ROUTE TO ALTERNATE	page 5/6
ROUTE TO ALTERNATE	page 6/6

LEGS PAGES.

The LEGS pages consist of LEGS HISTORY, LEGS PRIMARY, and LEGS TO ALTERNATE. These too are laid out sequentially.

The LEGS HISTORY page displays the last five waypoints sequenced. The LEGS PRIMARY displays the current waypoints in the primary route. MULTIPLE LEGS PRIMARY pages may be needed to display all of the legs sequentially and these pages are created as needed. The LEGS TO ALTERNATE pages are essentially the same as the LEGS PRIMARY pages, except the legs displayed are the legs to the alternate destination.

For example, to show the layout of the LEGS page numbering three LEGS PRIMARY pages are needed to display the legs in the flight plan, and two LEGS TO ALTERNATE pages are needed to display the legs in the route to the alternate destination. The legs pages would then be numbered as follows:

LEGS HISTORY	page 1/6
LEGS PRIMARY	page 2/6
LEGS PRIMARY	page 3/6
LEGS PRIMARY	page 4/6
LEGS TO ALTERNATE	page 5/6
LEGS TO ALTERNATE	page 6/6

GENERAL RULES.

Before any destination or waypoint data can be entered into the flight plan, the origin must be entered. If an origin has not been entered, the PRIMARY ROUTE and ROUTE TO ALTERNATE page will not exist. The LEGS PRIMARY page will exist, but all data fields will be blank, and the LEGS TO ALTERNATE page will not exist.

Once an origin has been entered, the PRIMARY ROUTE page will be created and accessible. The LEGS PRIMARY page will allow for data entry. Once the destination has been entered, ROUTE TO ALTERNATE and LEGS TO ALTERNATE pages will be accessible.

ROUTE PLAN Page.

This page provides a means of entering or storing a route and of defining certain parameters for the route. The ROUTE PLAN page is displayed when any of the following conditions are satisfied. The Route prompt will always specify a Route Number (1 or 2); selection results in that Route Number being displayed.

1. Selection of the ROUTE prompt(s) on the MAIN MENU 1/2 page.

2. Selection of the ROUTE prompt on any of the following pages:

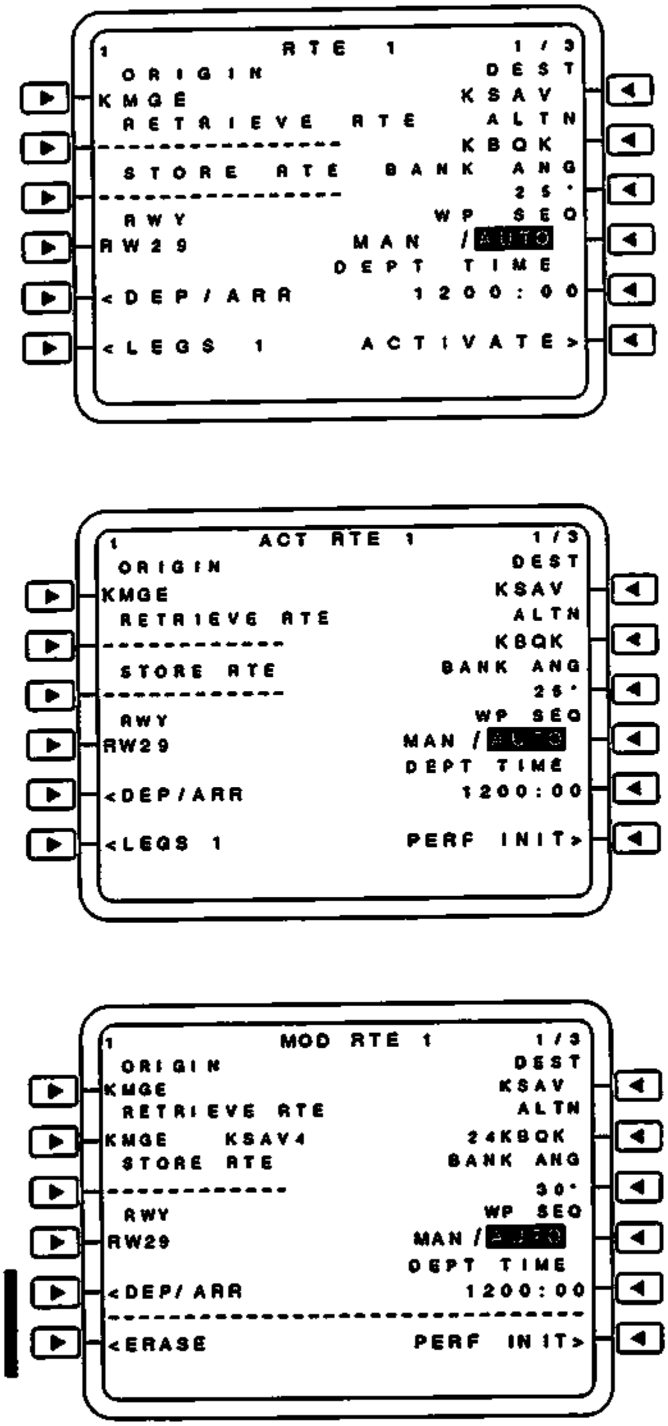
   a. LEGS
   b. DEPARTURE RWYS
   c. DEPARTURE SIDS
   d. DEPARTURE TRANS
   e. SID REVIEW
   f. ARRIVAL RWYS
   g. ARRIVAL STARS
   h. ARRIVAL TRANS
   i. STAR REVIEW
   j. LANDING ZONE INIT
   k. CARP INIT
   l. CUSTOM DATA
   m. PERF INIT

3. Selection of the PREV PAGE from the PRIMARY ROUTE page 2/X.

4. Selection of the NEXT PAGE from ROUTE TO ALTERNATE page X/X.

5. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the ROUTE PLAN page.

If the route is inactive, RTE 1 or RTE 2 will be displayed in the title. If the route is provisional, "MOD" will be displayed in the title. If the route is active and "ACT" is displayed in the title, the page number is displayed in the upper right corner of the page. For the ROUTE PLAN page, the Page Number is 1/X where X is the total number of route pages. A blank ROUTE PLAN page (i.e., the route is cleared) is generated whenever the Navigation Database is cycled or Flight Complete occurs.



F1016001 A

Figure 1-46. ROUTE PLAN

1L **Origin Waypoint.** The Origin may be defined through line selection entry or a Stored Route entry (2L) that contains an Origin. Entries that do not follow the format of a position entry will result in the "INVALID ENTRY" message. Valid waypoint entries that are not contained in the database will result in the display of the CUSTOM DATA page. If more than one waypoint with the entered identifier exists in the databases, the result is a branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Valid PBD and PBPB entries whose waypoint identifiers are not contained in the database will result in a branch to the CUSTOM DATA page for definition of the identifier.

A valid entry accepted over a previous entry will clear all existing waypoints, runways, destinations, and enroute procedures from the route. Entry of an Origin into an active route while airborne is not permitted. Attempted entries result in the "NOT ALLOWED" message. Selection downselects the Origin if it exists, and activates the Waypoint Select Page Exclusion. Deletion of the field 1L is not allowed and results in the "INVALID DELETE" message.

2L **Retrieve Route.** This data field defaults to "----------." Entry of a valid Route Identifier into this data field will result in the stored database origin, destination, and en route procedures (airways) being displayed on the appropriate Route pages, where applicable. All previously selected procedures, airports, runways, etc., will be cleared and replaced with the Stored Route. If the entry is not found in the STORED ROUTE LIST, the error message "NOT IN DATABASE" is displayed. Invalid entry formats will result in the "INVALID ENTRY" message.

Deletion is not allowed and results in the "INVALID DELETE" message. Once a Stored Route has been entered, any route modifications will not alter the data field display. The data field will return to dashes whenever the origin airport is changed (via 1L entry).

Entry into 2L data field is not permitted into an active route while airborne. Attempted entry results in the "NOT ALLOWED" error message. If the route is active while airborne and a route has not been retrieved, this data field will be blank.

Upon entry of an Origin into the flight plan, or upon storing the flight plan into the 3L data field, 2L data field will be cleared and returned to its default state. Selection results in a branch to the STORED ROUTE LIST page.

3L **Store Route.** This data field is used to store the current flight plan. If the displayed flight plan contains no Origin, the data field will be blank and 3L is non-operational. Otherwise, the data field defaults to "----------."

Valid entry formats are Stored Route names. Entering a Stored Route name stores the current flight plan in the stored route list under the entered name and the 2L data field will display the Stored Route. If the entered name exists in the stored route list, the message "ROUTE ALREADY EXISTS" will be displayed, and the route will not be stored. If the route list is full, attempting to store the route will generate the message "LIST FULL", and the route will not be stored. Upon entry of an Origin into the flight plan, the STORE RTE data field is cleared and returned to its default state. Selection downselects the Route Identifier into the scratch pad, if it exists. Delete is non-operational.

4L **Runway.** Valid entries are airport runways contained in the database. If no origin airport is entered into 1L data field, the RWY data field is blanked, and attempts to enter a Runway identifier are non-operational. If an origin airport has been entered, this data field displays dashes until a Runway has been entered. The 4L Runway data field may be transferred from the DEPARTURES page. The Runway may be overwritten by pilot entry only when the entry is compatible with the selected SID or when no SID has been entered. If a valid Runway that is not compatible with the SID is entered, then the "RUNWAY N/A FOR SID" message will be displayed. A Runway entry causing one of the above messages to be displayed is rejected and no modification to the flight plan is made.

Upon the first waypoint sequence on the active route, 4L entries are not allowed. This will only occur on the active route and is independent of whether a valid Runway has been entered. Deletion is not allowed while Runway data is displayed and results in the "INVALID DELETE" message.

5L **Branch to DEP/ARR INDEX page.**

6L **Erase/Legs.** If the route is provisional (MOD displayed in TITLE), then "ERASE" is displayed in 6L data field. Selection deletes the provisional route, extinguishes the EXEC light, and returns the route to its previous state (either inactive or active). If the route is not provisional, this data field displays "<LEGS x", where x is the Route Number displayed in the title. Selection will result in a branch to the LEGS PRIMARY page 2/X.

1R **Destination.** Entry of a Destination is non-operational unless an Origin has been entered. The 1R data field will be blanked if no Origin exists. Once an Origin does exist, the data field will display dashes until a valid entry has been accepted.

Valid waypoint entries that are not contained in the database will result in the display of the CUSTOM DATA page. If more than one waypoint with the entered identifier exists in the databases, the result is a branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Valid PBD and PBPB entries whose waypoint identifiers are not contained in the database will result in a branch to the CUSTOM DATA page for definition of the identifier. Destination airport entries may be made any time, regardless of whether the route is active or the aircraft is airborne.

Entry of any valid Destination identifier will cause any STAR, STAR transition, approach, or approach transition associated with the previous destination airport to be deleted.

The newly entered Destination will be displayed in the 1R data field, replacing the previous Destination. If the aircraft is airborne and active on a leg contained in an approach, approach transition, STAR, or STAR transition, entry of a valid destination will cause all approach procedures to be deleted, with the exception of the active waypoint.

Deletion of field 1R "DEST" data field is not allowed and results in the "INVALID DELETE" message. Selection downselects the destination if it exists and activates the Waypoint Select Page Exclusion. Otherwise selection is non-operational.

2R **Alternate Destination.** Alternate Destination entries may be made into the 2R data field as long as a destination exists in the route. If no destination exists, this data field will be blank. If a destination does exist, then this data field will display dashes "------" until a valid Alternate Destination has been entered.

Valid entries are the same as Destination entries. Entry of any valid Alternate Destination Identifier will cause any STAR, STAR transition, approach, or approach transition associated with the previous Alternate Destination to be deleted. Deletion of the Alternate Destination results in the deletion of the entire alternate flight plan.

3R **Bank Angle.** This data field contains the nominal Bank Angle to be used for constructing waypoint transitions not in SIDs, STARS, MFPs, holding pattern, and legs that specify a bank angle. The default value is displayed in a small font. Entries are displayed in a large font. Delete results in the Bank Angle Limit being deleted and the default value restored.

4R **Waypoint Sequence Switch.** Route sequencing status is displayed and controlled by this LSK. Two selections are displayed under the title "WP SEQ". Selecting "AUTO" allows guidance to sequence the lateral legs as this flight plan is flown. Selecting "MAN" prohibits any sequencing by the guidance function when the flight plan is active.

5R **Departure Time.** This data field allows entry of estimated departure time. Entry results in the Performance function using the entered estimated departure time as the start time for waypoint ETAs on the LEGS, WAYPOINT DATA, HOLD, FIX INFO and PROGRESS pages and RTA function. If estimated departure time is not entered, the Performance function will use current time for the ETAs and RTA function.

6R **Activate/PERF INIT branch.** If the route is defined, but not active (ACT not shown in the page title), this data field displays "ACTIVATE". Selection creates a provisional route and illuminates the EXEC light.

If the route is undefined, provisional, or active, "PERF INIT>" is displayed in this data field. Selection results in a branch to the PERF INIT WEIGHT page for the specified route.

PRIMARY ROUTE Page.

The PRIMARY ROUTE page provides a means of entering legs and procedures in the route. The PRIMARY ROUTE page represents all primary route pages except the ROUTE PLAN page. The Route Number displayed in the title is dependent upon where the Route page was accessed. If access was from a prompt that specified the Route Number, this Route Number will be reflected in the title. If access was from another Route page, the Route Number on this page will be the same as the Route Number of the page that accessed this page. The PRIMARY ROUTE page is displayed when any of the following conditions are met:

1. Selection of the PREV PAGE from the first ROUTE TO ALTERNATE page.

2. Selection of the NEXT PAGE from ROUTE PLAN page.

3. Selection of 1L-6L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the PRIMARY ROUTE page.

4. CUSTOM DATA page - When access to the CUSTOM DATA page was from the PRIMARY ROUTE page, the CUSTOM DATA page provides a prompt back to the PRIMARY ROUTE page.

5. Selection of the ROUTE prompt on the Legs page.

If the route is inactive, the Route State displayed in the page title will be blank. If the route is provisional, then "MOD" will be displayed in the title as shown. Otherwise, the route is active and "ACT" is displayed in the page title. This page is replaced with a blank ROUTE PLAN page whenever the Navigation DB is cycled or Flight Complete occurs.

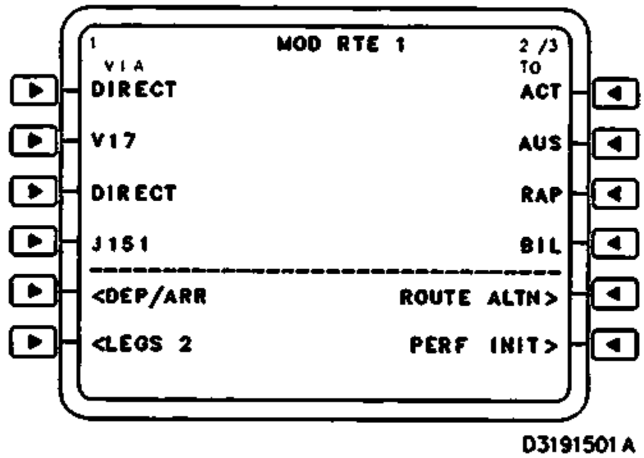


Figure 1-47. PRIMARY ROUTE

1L-4L **Via.** If an enroute transition is preceded in the route by a SID procedure, then the SID and transition are displayed as "SID Name. Transition Name." When an enroute transition is followed by a STAR procedure, then the STAR and transition are displayed as "Transition Name. STAR Name."

When no procedure is displayed, five large font dashes "-----" will be displayed. If the preceding Via field contains dashes or blanks, the data field will be blank.

Entry of an airway or stored route is allowed in the Via field when the Via field is not blank. To insert an airway, the start point, the airway identifier, and the end waypoint must be specified. The start point is the waypoint preceding the insertion point. The airway identifier and end waypoint are specified by the "AIRWAY WAYPOINT" entry. Both the start point and the end point must be on the airway.

When two airways exist consecutively in the flight plan having the same airway identifier but are in opposite directions of flight, the airways will be displayed separately.

Inserting a stored route is accomplished by entering the stored route identifier. The end point along the stored route can also be specified. This allows insertion of only part of a stored route. The form of the entry is "STORED ROUTE NAME WAYPOINT". When a stored route is inserted, flight planning takes the active flight plan waypoint prior to the point of insertion and searches forward in the stored route for that waypoint. If the waypoint is found in the stored route, the waypoints before it in the stored route are not inserted. Flight planning also takes the specified end point or last waypoint of the stored route and searches forward of the point of insertion in the selected flight plan. If the last waypoint is found, the waypoints prior to it in the active flight plan are deleted.

5L **Branch to DEP/ARR INDEX page.**

6L **Erase/Legs Branch.** If the route is a provisional (MOD displayed in the title), "ERASE" is displayed in 6L data field. Selection deletes the provisional route, extinguishes the EXEC light, and returns the route to its previous state (either inactive or active).

If the route is not provisional, "<LEGS x", is displayed, where x is the Route Number displayed in the title. Selection results in a branch to the LEGS PRIMARY page, where the waypoint displayed in 1R data field of this page is contained on that LEGS PRIMARY page. If this data field terminates a procedure, the first waypoint in the procedure will be displayed on the LEGS PRIMARY page to where the branch takes place.

1R-4R **To Fix.** These data fields display the last Waypoint Identifier contained in the procedure displayed in the related Via field (4L). When no To Fix is displayed and the adjacent data field is blank, this data field will also be blank.

When no To Fix is displayed and the left line select field displays dashes, this data field will display dashes. When these data fields are not blank, entry of a waypoint, navaid, airfield, Place/Bearing/ Distance, Place/Bearing/Place/Bearing, Latitude/ Longitude, or MGRS is allowed on the data field.

If more than one waypoint with the entered identifier exists in the databases, the result is a branch to the WAYPOINT SELECT page. If the waypoint is not defined in the database, a branch to the CUSTOM DATA page will result.

When these data fields contain a Waypoint Identifier, a two-character label can be added by entering the label at the line select key. The label cannot be deleted once entered without deleting the waypoint. The label can be changed by entering the new label followed by "/" at the line select key. A label can only be in a flight plan once. Attempting to enter a label more than once results in the error message "DUPLICATE LABEL".

Route discontinuities (discussed on the LEGS PRIMARY page) are displayed by the text string ">> DISCONTINUITY <<" being displayed on the page at the point of the discontinuity. The left and right data fields will display dashes.

A discontinuity may be cleared by first pressing the CLR key, then pressing the right line select key next to the discontinuity. A discontinuity defined by a database SID or STAR procedure or the discontinuity preceding a runway will not be cleared and a NOT ALLOWED message will be displayed.

When the data field contains a Waypoint Identifier, selection results in the Waypoint Identifier being downselected to the scratch pad.

Waypoint deletion is accomplished by using the Delete function, which inserts "*DELETE*" into the scratch pad. After entering "*DELETE*" in the scratch pad, line selecting deletes the associated waypoint. When the waypoint is deleted, the flight plan is closed and linked together. Deletion of a waypoint that terminates a procedure or airway results in the entire procedure/airway being deleted. As described above, waypoints can be deleted by entering a waypoint or label that is in the flight plan forward of the point of entry.

5R **Branch to ROUTE TO ALTERNATE page.** This data field displays "ROUTE ALTN >" in a large font if the flight plan contains a destination and in a small font otherwise. Selection when displayed in a large font results in a branch to the first ROUTE TO ALTERNATE page for the route specified in the title data field.

6R **Activate/PERF INIT Branch.** If the route is inactive, this data field will display "ACTIVATE." Selection creates a provisional route and illuminates the EXEC light. If the route is provisional or active, "PERF INIT >" will be displayed. Selection results in a branch to the PERF INIT WEIGHT page for the specified route.

ROUTE TO ALTERNATE Page.

This page provides a means of entering legs in the route to an alternate destination. The ROUTE TO ALTERNATE page represents all routes to alternate pages. The Route number displayed in title depends on where the Route page was accessed. If access was from a prompt that specified the route number, this route number will be reflected in the title data field. If access was from another route page, the route number on this page will be the same as the route number of the page that accessed this page. The ROUTE TO ALTERNATE page exists only when the ROUTE PLAN page contains a destination. The ROUTE TO ALTERNATE page is displayed when any of the following conditions are satisfied:

1. Selection of the PREV PAGE from the ROUTE PLAN page.

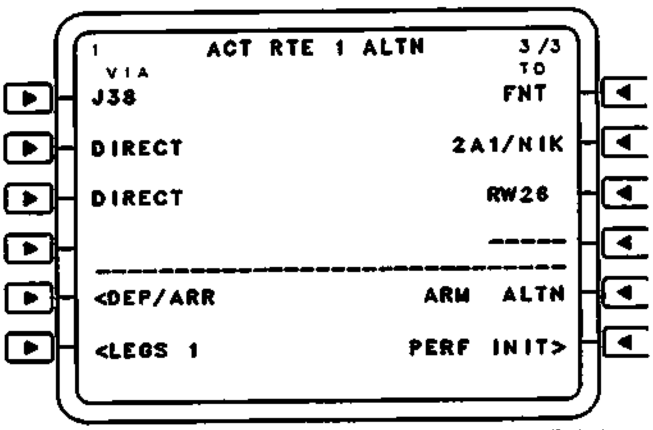
2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the ROUTE TO ALTERNATE page.

3. Selection of the NEXT PAGE mode key from the last PRIMARY ROUTE page.

4. Selection of the ROUTE ALTN prompt on the ROUTE PLAN page.

5. Selection of the ROUTE prompt on the LEGS TO ALTERNATE page.

The ROUTE TO ALTERNATE page can be multiple pages. Pages are created to display the Route to Alternate destination flight plan sequentially. If the route is provisional, then "MOD" will be displayed in the title data field. Otherwise, the route is active and "ACT" is displayed here.



D3191601 A

Figure 1-48. ROUTE TO ALTERNATE

If flight completion occurs and the route is active, the active route will be cleared and the route to alternate becomes the active route. The route to alternate destination is then cleared. If no primary destination exists, this page will not be accessible.

1L-4L **VIA.** Entry, selection, and deletion of the Via data fields are as described on the PRIMARY ROUTE page for 1L-4L. All operations are the same as PRIMARY ROUTE page, except that operations here apply to the route to alternate destination.

5L **Branch to DEP/ARR INDEX page.**

6L **Erase/Legs Branch.** If the route is provisional (MOD displayed in the title), "ERASE" is displayed in this data field. Selection deletes the provisional route, extinguishes the EXEC light, and returns the route to its previous state (either inactive or active).

If the route is not provisional, this data field displays "<LEGS x", where x is the route number displayed in the title. Selection results in a branch to the LEGS TO ALTERNATE page, where the waypoint displayed on this page is contained on that LEGS TO ALTERNATE page. If the waypoint in the data field terminates a procedure, the first waypoint in the procedure will be displayed on the LEGS TO ALTERNATE page to where the branch takes place.

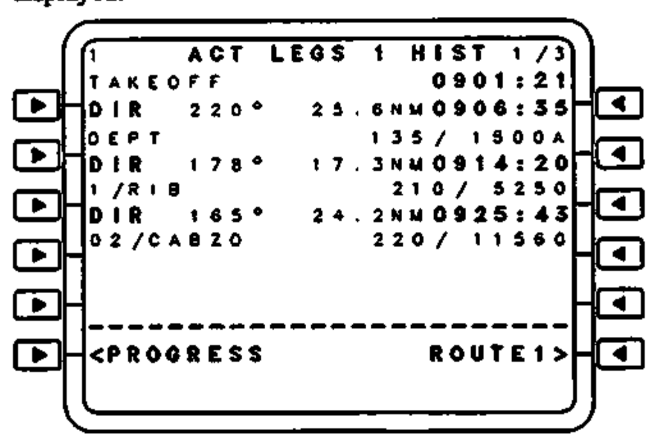
1R-4R **TO Fix.** These LSK data fields operate the same as 1R-4R on the PRIMARY ROUTE page. The only exception is these apply to the Route to Alternate destination.

5R **Arm Alternate.** This data field will display "ARM ALTN" in large font when at least one waypoint exists in the route to an alternate flight plan, and the route is active. Selection when displayed in large font results in the flight plan to alternate destination being appended to the flight plan to the primary destination.

6R **Activate/PERF INIT Branch.** If the route is defined, but not active, this data field displays "ACTIVATE." Selection creates a provisional route and illuminates the EXEC light. If the route is undefined, provisional or active, "PERF INIT>" is displayed in this data field. Selection results in a branch to the PERF INIT WEIGHT page for the specified route.

LEGS HISTORY Page.

The LEGS HISTORY page displays historical leg information. The last five waypoints sequenced are shown. LEGS HISTORY page is only accessible by pressing the PREV mode key from LEGS PRIMARY page, or the NEXT mode key from the last LEGS TO ALTERNATE page. The Route Number on the page that accessed this page will be the Route Number on this page. If the route is provisional, then "MOD" will be displayed in the title. If the route is active, "ACT" is displayed.



D3191701

Figure 1-49. LEGS HISTORY

1L-5L & 1R-5R **Historical Legs.** The LEGS HISTORY page displays the last five waypoints sequenced. Take-off is defined as the first waypoint sequenced. "TAKEOFF" is initially displayed in the data field below the MFCDU annunciation. Additional data that will be displayed for each procedure or waypoint include Waypoint bearing, Leg distance, Speed Target or Descent Angle, Actual Time of Arrival, and Altitude Target. The take-off time will be displayed in the 1L data field using the format HH:MM:SS in a large font. When the first waypoint is sequenced, the sequenced waypoint, along with its associated data, is displayed in the 2L data fields. Subsequent waypoint sequences continue to fill the page with data one at a time. When data is present for 5L and a waypoint sequence occurs, the data for 1L is discarded, and the 2L-5L data gets shifted up into 1L-4L data fields. 1L-5L may be used to downselect a label/waypoint and results in activation of the Waypoint Select Page Exclusion. Otherwise, line selects 1-5 are non-operational.

NOTE

If a constraint speed or altitude was displayed on the LEGS PRIMARY page when the waypoint was sequenced, the constraint data will be displayed, instead of the actual speed or altitude at the time of sequence.

6L **Progress Branch, Erase, and Exit Hold Prompts.** If a provisional route exists ("MOD" displayed in the title), then "ERASE" will be displayed. If a provisional does not exist, "EXIT HOLD" will be displayed if the route is active and either a holding pattern is being flown or a hold will become the active leg within one minute. Otherwise, "<PROGRESS" is displayed.

Selection of EXIT HOLD prior to entering holding will generate a provisional flight plan and delete the holding pattern from the provisional route. Selection of EXIT HOLD while holding will generate a provisional flight plan where the hold is exited. Selection of PROGRESS results in a branch to the PROGRESS 1 page.

6R **Branch to PRIMARY ROUTE page.** The Route Number being branched to will be the Route Number displayed in the 6R data field. Entry and delete are non-operational.

LEGS PRIMARY Page.

The LEGS PRIMARY page displays legs and leg data in the primary portion of the flight plan. LEGS PRIMARY page is accessible by pressing the "FPL" mode key from LEGS HISTORY page by pressing the NEXT mode key, or from the first LEGS TO ALTERNATE page by pressing the PREV mode key. If access is from the FPL mode key, the title Route Number will be determined as follows:

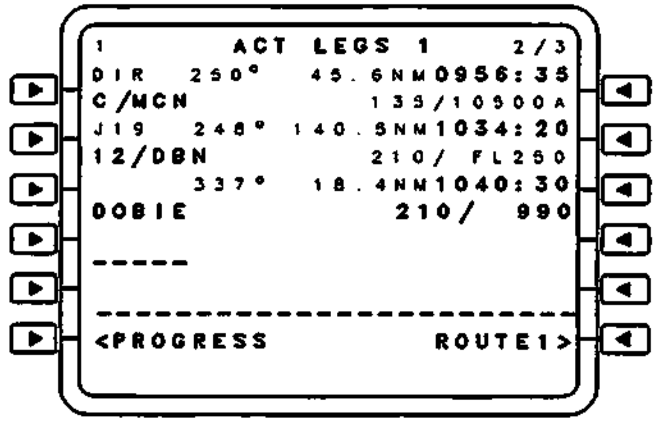
1. If a provisional or active route exists, displays that route number or else displays legs for route 1.

2. If access was not from the FPL mode key, the Route Number on the page that accessed this page will be the Route Number on this page.

The Legs page is also accessible by pressing the LEGS prompt from the PRIMARY ROUTE page. The Legs page displayed will contain the waypoint displayed as the first waypoint on the PRIMARY ROUTE page. If the first waypoint on the ROUTE page is the termination of a procedure, the Legs page displayed will display the first waypoint of that procedure.

Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the Legs page will display the Legs page with the selected waypoint.

The LEGS PRIMARY page is created as required to display the entire route. If flight completion occurs and a route is active, the active route will clear.



D3191801

Figure 1-50. LEGS PRIMARY

1L-5L **Waypoint Information.** Each waypoint displays procedure information. The following describes the procedure information displayed in the header. The displayed Waypoint Bearing is dependent upon the leg type.

1. If the leg is a heading leg then the specified heading will be displayed.

2. If the leg is a course leg, the computed or specified course (depending upon whether the leg was pilot or database generated) will be displayed.

3. If the leg is a holding pattern, then the course of the inbound leg will be displayed followed by the turn direction of the hold ("L" for a left turn and "R" for right). This extends the bearing data field to the right. Since leg distance is invalid here, there is no loss of display area.

4. If the leg has no defined course, small font dashes "---T," "---°," or "---G" will be displayed.

When the waypoint in 1L is the active waypoint, the bearing will be the guidance Desired Course. In the air, the active waypoint may not be altered; only legs past the active waypoint may be modified in a provisional flight plan. The course displayed in 1L upper data field will be the course to this first waypoint.

Single waypoints can be added to the flight plan. Selection to the scratch pad will result in activation of the Waypoint Select Page Exclusion. Additions can be line selected to the scratch pad or entered in the scratch pad. Entered waypoints can be in the form of waypoint name, label/waypoint name, place/bearing/distance, place/bearing/place/bearing, MGRS, or latitude/longitude. To add the waypoint to the flight plan, a line select key is used on the appropriate line and the added waypoint is displayed on this line. When adding a waypoint, the flight plan is searched forward of the point of insertion. If the waypoint appears in the flight plan (the Waypoint Identifier, Label, and latitude/longitude are the same as the entered waypoint), all the waypoints between the point of insertion and the first appearance of the added waypoint are deleted. If the waypoint does not appear forward of the point of insertion, the flight plan is opened and the new waypoint inserted. Searching forward in the flight plan is restricted to the portion of the flight plan being modified, i.e. either the primary flight plan or the alternate flight plan.

NOTE

Downselecting a waypoint containing both a label and name will result in the automatic deletion of the waypoint label.

If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Upon return from the WAYPOINT SELECT page with a waypoint selected, the FMS will use this waypoint in the waypoint identifier field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the FMS will display the waypoint identifier in the scratch pad.

PROCEDURE	LEGS PAGE DISPLAY	EXAMPLE
SID	SID Name	CYN9
STAR	STAR Name	LGC2
Enroute Transition	Transition Name	ALS
Airway	Airway Name	J5
Direct To	"DIR"	DIR
Hold	"HOLD"	HOLD
Approach	"APPR" +Number	APPR1
CARP	"CARP" +Number	CARP2
Track to Fix	Blank	
Initial Fix	"- - - - -"	- - - - -

Figure 1-51. LEGS PAGE PROCEDURE DISPLAY

If the waypoint is not defined in the NAV or Custom Database, a branch to the CUSTOM DATA page will result.

Route discontinuities are displayed by overwriting data fields on the page with the text string ">> DISCONTINUITY <<" centered on the row. When this occurs, the data field next to the LSK will display dashes. A discontinuity may be removed with the route bypass operation.

A discontinuity may be cleared by first pressing the CLR key, then pressing the left line select key next to the discontinuity. A discontinuity defined by a database SID or STAR procedure or the discontinuity preceding a runway will not be cleared and a NOT ALLOWED message will be displayed.

When holding patterns are displayed on the Legs page, the bearing field overwrites the distance field, which is blank. The bearing field displays either "XXXTC," "XXX °C," or "XXXGC" where "XXX" is the holding pattern inbound course and "C" is the turn direction of the hold, either "R" or "L."

When a Heading leg is displayed on the Legs page, the upper data fields for 1L-5L are overwritten by the text string "FLY XXX OR AS ASSIGNED", in a small font. The bearing displayed will always be specified heading. If bearings are being displayed in True heading, the degree symbol is replaced with a "T."

Single waypoints can be deleted from the flight plan. Waypoint deletion is accomplished by using the delete function, which inserts "*DELETE*" into the scratch pad. After entering "*DELETE*" in the scratch pad, line selecting deletes the associated waypoint. When the waypoint is deleted, the flight plan is closed and linked together. As described above, waypoints can be deleted by entering a waypoint that is in the flight plan forward of the point of entry.

The MISSIONS identifiers displayed are as follows:

PROCEDURE	TYPE	DISPLAY ID
CARP	Turn Point	*TP
	Release Point	*CARP
	DZ Escape	*DZESC
RENDEZVOUS	Rendezvous Intercept	*RZnn
NPA	Turn Point	*TP
	Slowdown	*SD
	Final Approach Fix	*FAF
	Missed Approach Point	*MAP
	Runway	RWnns
	Landing Zone	*LZnns

Figure 1-52. MISSION Procedure Identifiers

Deletion of a waypoint associated with a CARP or Landing Zone will result in deletion of all waypoints which display the procedure identification corresponding to the deleted waypoint. The CARP or LZ waypoint will be replaced with a single waypoint that uses the LBL/IDENT from the CARPx INIT 1/6 or LZ x INIT 1/2 page for 1L-5L data fields and the THRESHOLD POS or PI POS for the waypoint position.

The computed leg distance will be displayed for certain leg types. Distance To Go is displayed for leg distance if the waypoint is active. If the provisional is displayed, Distance To Go is displayed for the first waypoint.

Deletion of solicit dashes or prompt boxes is nonoperational. When the waypoint in 1L is the active waypoint, entry and delete are nonoperational.

6L **Progress Branch, Erase, and Exit Hold Prompts.** If a provisional exists ("MOD" is displayed in the title), then "ERASE" will be displayed in 6L data field. If a provisional does not exist, "EXIT HOLD" will be displayed if the route is active and a holding pattern is being flown, or a hold will become active within one minute. Otherwise, "<PROGRESS" will be displayed.

Selection of EXIT HOLD prior to entering holding will generate a provisional flight plan and delete the holding pattern from the provisional route. Selection of EXIT HOLD while holding will generate a provisional flight plan where the hold is exited. Selection of PROGRESS results in a branch to the PROGRESS page.

1R-5R **Time, Speed, and Altitude.** If the aircraft is on the ground, the Estimated Time Enroute will be displayed in the upper data field for these line select keys. If the aircraft is airborne, then the Estimated Time of Arrival is displayed. Blanks are displayed if the leg is a holding pattern. If performance predictions are not available, the display is "----:--." Pilot entered or procedure constraint data has priority over predicted data. Altitude constraints will be either AT, AB, or AA constraints.

Window constraints are not enterable, but are defined in SID and STAR procedures. If a waypoint has an altitude window, the higher altitude will be displayed if the waypoint is in climb, and the lower altitude will be displayed if the waypoint is in cruise or descent.

Constraints may be pilot-entered or Mission Plan-generated. Airspeed constraint entries will be allowed at any altitude, however, when above airspeed/Mach crossover altitude nonconstraint speeds will be displayed as Mach and when below airspeed/Mach crossover altitude nonconstraint entries will be displayed as airspeed.

Display conventions are as follows:

1. If there is no waypoint identifier or dashes are in the opposite LEGS page field, then blanks will be displayed in the corresponding constraint field.

2. If there is a valid waypoint and the waypoint has a constraint specified, then the constraint(s) will be displayed in a large font in these data field(s). If the constraint altitude is greater than the current Cruise Altitude, the constraint altitude is displayed in a large inverse font. A climb altitude constraint that is lower than a previously occurring climb altitude constraint will be displayed in a large inverse font. A descent altitude constraint that is higher than a previously occurring descent constraint will be displayed in a large inverse font.

3. If there is a valid waypoint but no performance speed or altitude predictions are displayed in the constraint field, then dashes in large font will be displayed in these data fields except in the following cases:

   a. If the waypoint is TP or CARP, a speed and altitude constraint will be displayed at each of these waypoints in a large font or large inverse, as determined by (2) above.

   b. If the waypoint is FAF, MAP, LZ or RWnns of a Landing Zone/Non-Precision Approach an altitude constraint will be displayed at each of these waypoints in large font or large inverse, as determined by (2) above.

   c. A speed or altitude constraint that is part of a SIDS or STAR will be displayed in a large font or large inverse, as determined by (2) above.

   d. If the waypoint is a runway, the runway elevation will be displayed in a small font.

4. If a valid waypoint is displayed and if performance predictions are valid for the waypoint, the predictions will be displayed in a small font. When above airspeed/Mach crossover altitude, Mach values will be displayed for the speed. When below airspeed/Mach crossover altitude, airspeed values will be displayed.

5. If the waypoint is a HOLD Fix, either the predicted speed or the entered constraint speed/angle is displayed up to the time the HOLD fix is reached the first time. Either the predicted Best Hold Speed or the entered Hold Speed from the HOLD page is then displayed. Once active in the Hold, entry of a speed constraint for the active waypoint will change the Hold Speed and will be propagated to the HOLD page and vice versa. In either case if predictions are not available and no entries have been made, dashes in large font will be displayed.

Selection of the data field results in the display of the WAYPOINT DATA 1/2 page corresponding to the waypoint selected on the Legs page.

Deletion of the data field when a constraint(s) is present will remove the constraint(s) from the waypoint, thus reverting to predicted speed and altitude.

6R **Branch to PRIMARY ROUTE page.** The Route Number being branched to will be the Route Number displayed. The first waypoint displayed on the LEGS page will be displayed on the ROUTE page.

If the first waypoint on the LEGS page is part of a procedure, the procedure containing that leg will be displayed on the ROUTE page displayed. Entry and delete are non-operational.

LEGS TO ALTERNATE Page.

The LEGS TO ALTERNATE page displays the legs in the route to the alternate destination.

The LEGS TO ALTERNATE page is accessible by pressing the LEGS prompt on the ROUTE TO ALTERNATE page. The LEGS TO ALTERNATE page displayed will contain the waypoint displayed as the first waypoint on the ROUTE TO ALTERNATE page. The LEGS TO ALTERNATE page is also accessible by pressing the LEGS prompt from the WAYPOINT DATA page.

Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the LEGS TO ALTERNATE page will display the LEGS TO ALTERNATE page with the selected waypoint.

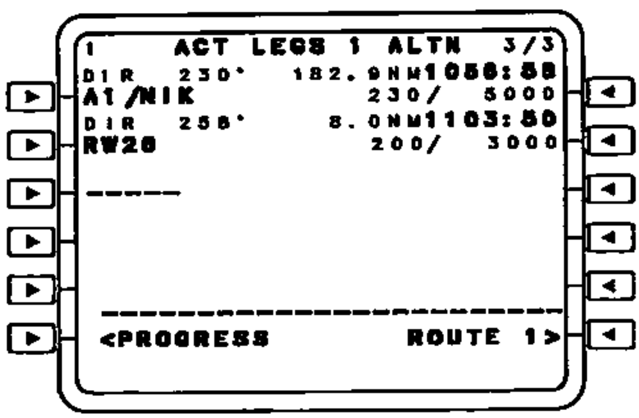


Figure 1-53. LEGS TO ALTERNATE

1L-6L &

1R-5R **Legs Data.** The LEGS TO ALTERNATE page is identical to LEGS PRIMARY page, except that the LEGS TO ALTERNATE page displays the legs in the route to the alternate destination.

6R **Branch to ROUTE TO ALTERNATE page.** The Route Number for the ROUTE TO ALTERNATE page will be the Route Number displayed in the data field. The first waypoint displayed on the LEGS TO ALTERNATE page will be displayed on the ROUTE TO ALTERNATE page. If the first waypoint on this LEGS TO ALTERNATE page is part of a procedure, the procedure containing that leg will be displayed on the ROUTE TO ALTERNATE page. Entry and delete are non-operational.

WAYPOINT DATA 1/2 Page.

The WAYPOINT DATA page displays leg and waypoint information for the flight plan waypoints. Selection of the right line select key next to the waypoint on the LEGS PRIMARY or LEGS TO ALTERNATE page results in display of the WAYPOINT DATA 1/2 page for that waypoint.

If the route of that waypoint data page is part of a valid provisional state, the provisional waypoint data should be displayed.

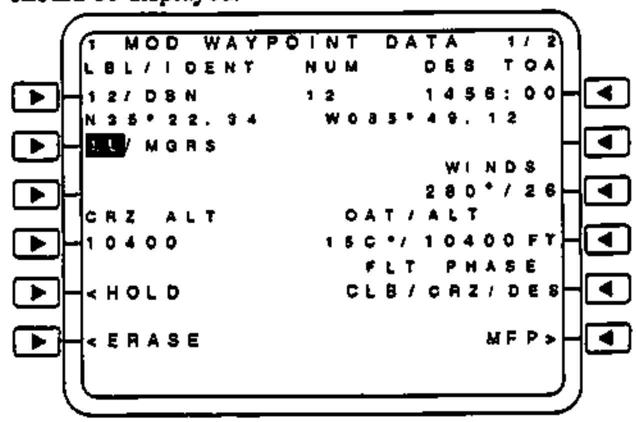


Figure 1-54. WAYPOINT DATA 1/2

1L **Waypoint Label/Name.** This data field displays the waypoint's label and identifier. The waypoint's number will be displayed under the "NUM" annunciation. Selection, entry and delete are non-operational.

2L **Waypoint Position Definition Switch.** 2L provides for the selection of LAT/LONG or MGRS. This selection will be displayed in the data field between LSK 1 and 2. In the LAT/LONG position, the waypoint's Latitude/Longitude is displayed, and in the MGRS position, the waypoint's MGRS coordinates are displayed.

3L **Non-operational.**

4L **Cruise Altitude.** When the waypoint type is CARP (other than *DZESC), LZ, or RNDZ, these two data fields are blanks. Otherwise, the Cruise Altitude title and the leg's Cruise Altitiude are displayed if a valid entry is available or the default value if a valid entry is not available. When the waypoint type is CARP (other than *DZESC), LZ, or RNDZ, then entries are non-operational.

When the 4L data field displays Cruise Altitude, delete results in the Cruise Altitude being deleted and the default data being restored. Otherwise, delete is non-operational.

5L **Hold Branch Prompt.** If the route does not contain a hold or a hold is at the waypoint shown in the

1L data field, data (<HOLD) in this field is displayed in a large font. Selection when this data field is displayed in a large font will result in a branch to the HOLD page.

6L Branch to Legs Page/ERASE. If the displayed route is provisional, this data field will display "ERASE". Selection results in the provisional route being deleted and the route being restored to its previous state. Otherwise, this data field will display "<LEGS x", where x is the route number of the displayed waypoint. Selection results in a branch to the Legs page where the waypoint in the 1L data field is shown.

1R Desired Time of Arrival. The Desired or Predicted Time of Arrival at the waypoint is displayed in this data field. When the data is an entered time constraint, the TOA is displayed in a large font and the title will change to "DES" TOA (Desired Time of Arrival). Otherwise, this data field displays the predicted time of arrival at the waypoint in a small font and displays the title TOA.

When a time constraint is displayed in this data field, delete results in the data being deleted and default data restored.

2R Non-operational.

3R WINDS Prompt. This data field will display "CRZ" if a Cruise Altitude is displayed on this page. When the waypoint type is CARP, LZ, or RNDZ, the "WINDS" title, wind direction, and speed will not be displayed in this data field. Otherwise, the winds title and associated wind data are displayed.

4R Outside Air Temperature (OAT) / Altitude. The Altitude and Outside Air Temperature at that altitude is displayed in this data field. Valid entries are displayed in a large font. Valid entries are propagated downpath through the flight plan. If the OAT/ALT data is displayed in a large font, delete will remove the data and return the default or propagated data.

5R Flight Phase Selection. When the displayed waypoint type is a CARP, LZ, or RNDZ, LSK 5R data fields are blank. Otherwise, the title "FLT PHASE" will be displayed along with the Performance Predicted Flight Phase, either "CLB, CRZ, or DES".

6R Mission Flight Parameter (MFP) Branch. When the Waypoint displayed under LBL/IDENT is not part of a SID, STAR, or Hold, data in this field is displayed in a large font.

When the data is displayed in a large font and the displayed waypoint type is not CARP, LZ, or RNDZ, selection results in a branch to the MISSIONS page.

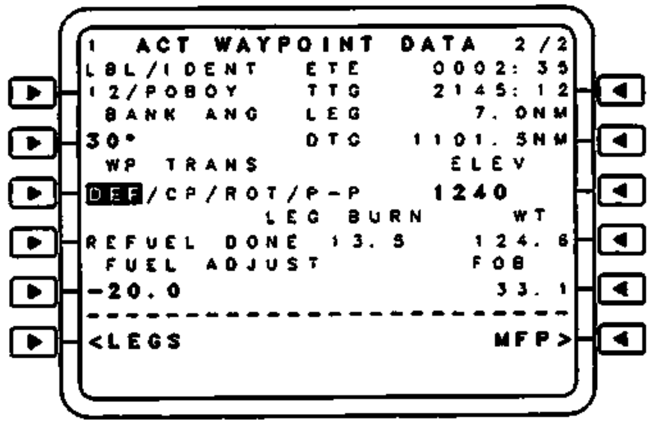
When the data is displayed in a large font and the waypoint type is a CARP, selection results in a branch to the CARP INIT page for the CARP associated with the waypoint.

When the data is displayed in a large font and the Waypoint Type is an LZ, selection results in a branch to the LZ INIT page for the landing zone associated with the waypoint.

When the data is displayed in a large font and the waypoint type is an RNDZ, selection results in a branch to the RENDEZVOUS page for the Rendezvous associated with the waypoint.

WAYPOINT DATA 2/2 Page.

The WAYPOINT DATA 2/2 page displays leg and waypoint information for the flight plan waypoints. If the route of this waypoint data page is part of a valid provisional state, the provisional waypoint data should be displayed.



D3192101

Figure 1-55. WAYPOINT DATA 2/2

1L Waypoint Label/Name. Waypoint's Label/Names are displayed in this data field.

2L Leg Bank Angle. The Leg Bank Angle limit to be used by guidance for waypoint transitions not in SIDs, STARs, and MFPs is displayed here. The default value specified on the ROUTE PLAN page is initially displayed in a small font. Entries into this field are displayed in a large font. Delete results in the Bank Angle being deleted and the default value restored.

3L Waypoint Transition Type. The Waypoint Transition Type is displayed in this data field under the title "WP TRANS" and is controlled from 3L. This LSK selects the transition type for waypoint transitions not in SIDs, STARs, MFPs, and legs whose leg type specify the transition type. If a leg transition is specified by one of these pattern types, the transition type specified will be highlighted and selection will be non-operational. When "DEF" is selected, it is highlighted along with the route default waypoint transition.

4L Refuel Done. When a pilot entered (i.e., large font) Leg Fuel Adjustment in 5L, REFUEL DONE will be displayed in large font. Selection while in large font results in adding the Leg Fuel Adjustment to the Fuel on Board and display of REFUEL DONE in small font. The default display is REFUEL DONE in small font. Selection will not result in a flight plan mod and will not illuminate the EXEC light.

5L **Leg Fuel Adjustment.** This data field displays the Leg Fuel Adjustment. Default value is displayed in large font. Valid entries are displayed in data field 5L in large font. After the REFUEL DONE prompt is processed in accordance with description for 4L, the entry will be displayed in small font.

Delete results in the Leg Fuel Adjustment being deleted from data field 5L, and the default data being restored.

6L **Branch to Legs page/ERASE.** If the displayed route is provisional, "ERASE" will be displayed. Selection results in the provisional route being deleted and the route being restored to its previous state. Otherwise, "<LEGS x" is displayed, where x is the route number of the displayed waypoint. Selection results in a branch to the page where the waypoint in 1L data field is shown.

1R **Leg ETE/Accumulated Leg ETE.** These two data fields display the Leg ETE and Accumulated Leg ETE, respectively.

2R **Leg Distance/Accumulated Leg Distance.** These two data fields display the Leg Distance and Accumulated Leg Distance, respectively.

3R **Waypoint Elevation.** The Waypoint Elevation from the database, if available, is displayed in a small font. If no elevation is available, dashes "----" are displayed. Valid Waypoint Elevation entries are displayed in a large font.

4R **Leg Burn/Leg Weight.** These two data fields display the Leg Burn and Leg Weight, respectively.

5R **Waypoint Fuel on Board.** This data field displays the Waypoint Fuel on Board.

NOTE

If the aircraft's present altitude exceeds the FMS calculated MAX ALT, FMS fuel calculation will cease. Fuel calculations can be restored one of two ways: (1) descend below MAX ALT and reenter the CRZ ALT or (2) continue cruise until fuel burnoff allows an increase in the FMS calcuated MAX ALT and then reenter the CRZ ALT on the appropriate PERF INIT page.

6R **Branch to MFP> (MISSIONS) page.** When the waypoint displayed in 1L data field is not part of a SID, STAR, or Hold, MFP> is displayed in a large font.

When MFP> is displayed in a large font and the waypoint type is not CARP, LZ, or RNDZ, selection results in a branch to the MISSIONS page.

When MFP> is displayed in a large font and the waypoint type is CARP, selection results in a branch to the CARP INIT page for the CARP associated with the waypoint.

When MFP> is displayed in a large font and the waypoint type is LZ, selection results in a branch to the LZ INIT page for the landing zone associated with the waypoint.

When MFP> is displayed in a large font and the waypoint type is RNDZ, selection results in a branch to the RENDEZVOUS page for the rendezvous associated with the waypoint.

DIRECT-TO.

The FMS provides flight planning capabilities for issuing a direct-to a waypoint when the aircraft is in the air. The following paragraphs describe the direct-to processing for waypoints on the flight plan and off the flight plan.

On Flight Plan Direct-To.

The FMS provides the ability to specify a direct-to a waypoint in the active flight plan under the following conditions:

1. The selected waypoint is not the CARP or DZ Escape waypoints.

2. The preceding waypoint is not an approach waypoint.

Invalid Direct-to.

When direct-to a waypoint in the flight plan is selected and any one of the following conditions is true, the NP causes INVALID DIRECT TO to be annunciated:

1. The selected waypoint is the CARP or DZ Escape waypoints.

2. The preceding waypoint is an approach waypoint.

On Flight Plan Direct-to Processing.

When a direct-to is specified to a waypoint in the active flight plan, the NP performs the following actions.

1. The legs between the aircraft present position and the direct-to waypoint will be deleted. If the flight plan contains more than one occurrence of the selected waypoint, the deletion will be up to the first occurrence.

2. The selected waypoint will be the termination of the active leg, i.e., the "To" waypoint.

3. The selected waypoint's LEG TYPE will be DF.

Off Flight Plan Direct-To.

The NP provides the ability to specify a direct-to a waypoint not in the flight plan. The waypoint will be a navigation or custom database waypoint, a latitude/longitude, place/bearing/distance (PBD), a course intersection waypoint (RR), a mark point, or a rendezvous/intercept point. When a direct-to waypoint that is not part of the active flight plan is specified and the number of waypoints associated with the active flight plan is less than or equal to the maximum number of waypoints after the direct-to, the NP performs the following actions:

1. The direct-to waypoint will be inserted into the active flight plan as the active waypoint.

2. The direct-to waypoint's LEG TYPE will be set to DF.

3. A discontinuity will be inserted between the direct-to waypoint and the next waypoint in the flight plan.

4. If the active waypoint's WAYPOINT TYPE is CARP, the CARP waypoints will be deleted.

5. If the active waypoint is the missed approach point or runway of an NP Approach, the approach waypoints will be deleted.

6. If the active waypoint is a holding pattern/refueling pattern, the hold data will be set to default and the hold will be removed at the fix. The fix waypoint will not be deleted.

Insert Direct-To Computed Waypoint.

When a direct-to function is performed the NP inserts a computed waypoint representing the current aircraft position as an historical leg.

Direct-To Computed Waypoint Data.

The computed waypoint generated by the NP when a direct-to function is performed has the following characteristics:

1. The WAYPOINT IDENTIFIER will be set to "DIRECT."

2. The "DIRECT" waypoint will be the historical leg defined as the "FROM" waypoint.

3. The "DIRECT" waypoint's latitude/longitude will be the aircraft's present position. The "DIRECT" waypoint's latitude/longitude will be updated when the EXEC mode key is pressed and the direct-to waypoint becomes active.

4. The "DIRECT" waypoint's WAYPOINT TRANSITION will be radius of turn. The calculation of the location of the final turn point will use IN GROUND SPEED.

Course Intercepts.

The FMS will provide the following flight planning capabilities for issuing an intercept to a course into a waypoint.

Course Intercept Resolution.

The resolution of the selected desired course shall be at least one degree over a range of 360 degrees.

On Flight Plan Intercept.

The NP provides the ability to specify an INTERCEPT COURSE to a waypoint in the active flight plan under the following conditions:

1. The selected waypoint is not the CARP or DZ Escape waypoints.

2. The preceding waypoint is not an approach waypoint.

On Flight Plan Intercept Processing.

When an INTERCEPT COURSE is specified to a waypoint in the active flight plan, the NP performs the following actions:

1. The legs between the aircraft present position and the intercept waypoint will be deleted. If the flight plan contains more than one occurrence of the selected waypoint, the deletion will be up to the first occurrence.

2. The selected waypoint will be the termination of the active leg, i.e, the "To" waypoint.

3. The selected waypoint's LEG TYPE will be CF.

4. The specified INTERCEPT COURSE will be used as the selected waypoint's COURSE TO.

Off Flight Plan Intercept.

The NP provides the ability to specify an INTERCEPT COURSE to a waypoint not in the flight plan. The waypoint will be a navigation or custom database waypoint, a Latitude/Longitude, place/bearing/distance (PBD), a course intersection waypoint (RR), a mark point, or a rendezvous/intercept point. When a course intercept waypoint that is not part of the active flight plan is selected, the specified INTERCEPT COURSE does intercept the current aircraft heading, and the number of waypoints associated with the active flight plan will be less than or equal to the maximum number of waypoints. After the insertion, the NP performs the following actions:

1. The course intercept waypoint will be inserted into the active flight plan as the active waypoint.

2. The course intercept waypoint's LEG TYPE will be CF.

3. The specified INTERCEPT COURSE will be used as the waypoint's COURSE TO.

4. A discontinuity will be inserted between the course intercept waypoint and the next waypoint in the flight plan.

Intercept Computed Waypoint.

When the course intercept function is performed, the NP inserts a computed waypoint representing the current aircraft position into the active flight plan as described under Flight Plan and Waypoints.

Intercept Computed Waypoint Definition.

The computed waypoint generated by the NP when an intercept function is performed has the following characteristics:

1. The FP WAYPOINT IDENTIFIER will be blank.

2. The computed waypoint will be placed in the active flight plan as the active waypoint before the intercept waypoint.

3. The computed waypoint's latitude/longitude will be the aircraft's present position. The computed waypoint's latitude/longitude will be updated when the EXEC mode key is pressed and the intercept waypoint becomes active.

4. The computed waypoint's FP WAYPOINT TRANSITION will be set to radius of turn.

Not on Intercept Processing.

When a course intercept is specified and the INTERCEPT COURSE does not intercept the current aircraft heading, an Operational Message "NOT ON INTCPT HDG" will be displayed.

Direct-to the Alternate.

When a direct-to function is selected to a waypoint on the path to the alternate destination, the NP performs a direct-to the selected waypoint with the following operations:

1. The remainder of the primary flight plan waypoints, including the primary destination, will be deleted.

2. The direct-to operation as described under On Flight Plan Direct-to.

3. The alternate waypoints from the selected waypoint to the alternate destination become primary waypoints.

4. The alternate destination will become the new primary destination.

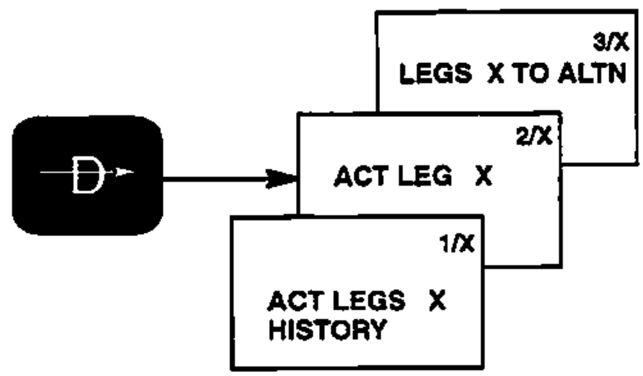


Figure 1-56. Direct To Menu Hierarchy

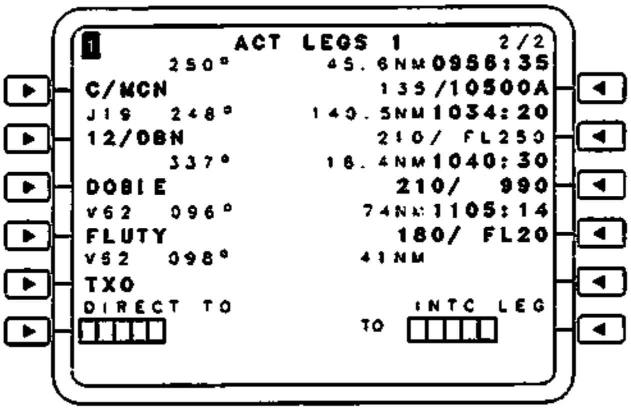
Direct/Intercept.

The Direct/Intercept mode provides a means of flying direct to or intercepting a course to any waypoint stored in the navigation or custom database or line selectable waypoint in the route or crew-defined waypoint. The Direct/Intercept mode uses the LEGS PRIMARY page with provisions for entry of the direct-to or intercept waypoint. All page discussions refer to the Direct/Intercept page diagram, unless noted otherwise.

Activation of either a "DIRECT TO" or "INTC LEG" will cause cancellation of any offset path that may be active. A constraint on the waypoint in which a "DIRECT TO" or "INTC LEG" is performed will be retained.

Display of the DIR/INTC page 2/X will occur when the DIR INTC mode key is pressed and a route is provisional or active. If a provisional exists, the provisional will be displayed. Otherwise, the active will be displayed. If no route is provisional or active, then the error message "NO ACTIVE ROUTE" is displayed and no page branching occurs.

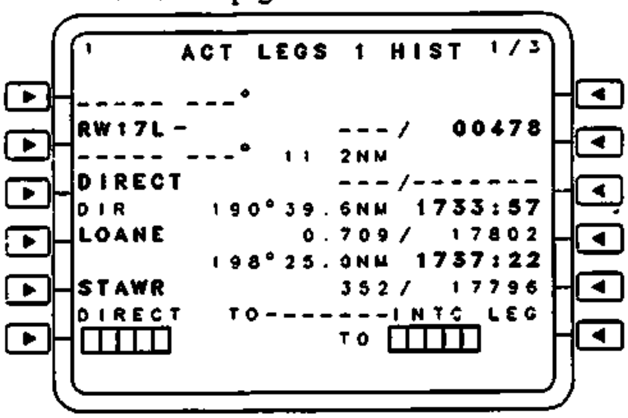
Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the DIR/INTC page will display the DIR/INTC page with the selected waypoint.



03192201B

Figure 1-57. DIRECT / INTERCEPT

1L-5L **Leg Data.** These data fields are identical, in both display format and operation, to 1L through 5L on the LEGS PRIMARY pages. Note that although lateral or vertical flight planning may be performed on this page, the ERASE prompt will not appear in 6L, and erasing a modification must be performed on another lateral or vertical page.



03192301C

Figure 1-58. LEGS HISTORY

6L **Direct-To.** Valid waypoint entries are NAVAIDS, waypoints, airports, or destination airport runways contained in the NDB or Custom Database. In addition, any enroute, Latitude/Longitude, MGRS, course intersection, or place/bearing/distance waypoint may be entered. Waypoint entry may be from line selection at any line selectable waypoint field (1L through 5L on LEGS PRIMARY page, 1L through 5L on DIR/INTC page, etc.) or from keyboard entry.

If more than one airport with the entered identifier exists in the airport file of the navigation database, the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will display the selected waypoint identifier in the Direct-to field.

Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad. If the waypoint is not defined in the databases, a branch to the CUSTOM DATA page will result.

Entry of a valid fix into 6L will cause the MOD LEGS PRIMARY page to be displayed with the "DIRECT TO" waypoint in 1L and the EXEC light illuminated.

Response to a "DIRECT TO" waypoint entry is dependent upon the waypoint type, the active waypoint, and whether the waypoint is in the alternate route.

Direct to Down-path (Non-alternate) Waypoint.

If the waypoint is a down-path waypoint but is not part of the alternate route, then the "DIRECT TO" waypoint will be displayed in 1L and all previously intervening waypoints will be deleted.

If the selected down-path waypoint occurs more than once in the flight plan, the first occurrence of the identifier will be used, regardless of whether the waypoint was line selected or entered into the scratch pad. If a DIRECT TO a holding fix is performed, a direct leg to the holding fix will always precede the hold.

Direct to an Off-path Waypoint.

If the "DIRECT TO" waypoint entered is not contained in the active route, then the "DIRECT TO" waypoint will be displayed in 1L, followed by a discontinuity in 2L, followed by the rest of the route. (Discontinuity displays are discussed on LEGS PRIMARY Page.)

Direct to an Alternate Route Waypoint.

If the "DIRECT TO" waypoint is a waypoint in the route to alternate destination, then the "DIRECT TO" waypoint will be displayed in 1L. All waypoints remaining in the primary, and the waypoints in the alternate up to the "DIRECT TO" waypoint, will be deleted. Waypoints following the DIRECT TO waypoint will be moved into the primary, along with the alternate destination.

If a waypoint is entered into the Direct line select (6L) when no present position exists, the error message "NO PRESENT POSITION" will be displayed, and no flight plan change will occur.

1R-5R **Waypoint Speed/Altitude.** These fields are identical, in both display format and operation, to 1R through 5R on the LEGS PRIMARY page.

6R **Intercept Leg.** Valid waypoint entries and multiple identical identifiers are identical to Direct-To function. Entry of a valid fix into "6R" will cause the MOD LEGS INTERCEPT page to be displayed and the EXEC light illuminated.

Response to an "INTERCEPT" waypoint entry is dependent upon the waypoint type, the active waypoint; and whether the waypoint is in the alternate route.

1. INTERCEPT a Down-path (Non-alternate) Waypoint.

If the INTERCEPT waypoint is a down-path waypoint but is not part of the alternate route, an HS leg will be displayed in 1L, the INTERCEPT waypoint will be displayed in 2L and all previously intervening waypoints will be deleted. The course to the INTERCEPT waypoint, prior to entering the course into 6R, will be the existing course prior to the modification.

Upon EXECution, whether or not a course has been entered in 6R, the HS leg will cause LNAV to disengage, then the INTERCEPT waypoint will become the active waypoint.

For an HS leg, left-hand data fields are blank, except data field 7 that displays --- 0. Right-hand data fields display dashes.

2. INTERCEPT a Waypoint to the Alternate Destination Waypoint.

If the INTERCEPT waypoint is a waypoint in the route to the alternate destination, the INTERCEPT waypoint will be displayed in 1L. All waypoints remaining in the route to the primary destination and any waypoints in the route to the alternate destination prior to the INTERCEPT waypoint will be deleted. The INTERCEPT waypoint and the waypoints following the INTERCEPT waypoint will be moved into the route to the primary destination, along with the alternate destination. The course to the INTERCEPT waypoint, prior to entering the course into 6R, will be the existing course prior to the modification.

Upon EXECution, whether or not a course has been entered in 6R, the HS leg will cause LNAV to disengage, then the INTERCEPT waypoint will become the active waypoint.

3. INTERCEPT an Off-path Waypoint.

If the "INTERCEPT" waypoint entered is not contained in the active route, an HS leg will be displayed in 1L, the INTERCEPT waypoint will be displayed in 2L and a discontinuity will be displayed in 3L. The course to the INTERCEPT waypoint, prior to entering the course into 6R, will be the existing course prior to the modification.

Upon EXECution, whether or not a course has been entered in 6R, the HS leg will cause LNAV to disengage, then the INTERCEPT waypoint will become the active waypoint.

Erasing the mod route prior to entering a course will cause the DIRECT/INTERCEPT page to be displayed. Selection and delete are non-operational.

PROGRESS PAGES.

PROGRESS 1/3 Page.

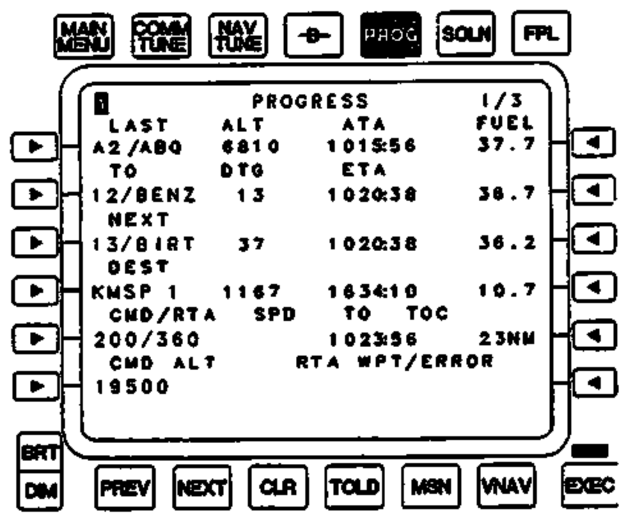
The PROGRESS 1 page displays current aircraft position relative to the active flight plan. The PROGRESS 1 page is displayed when any of the following occurs:

1. Selection of PROGRESS prompt from the LEGS page.

2. Selection of NEXT page from the PROGRESS 3 page, or selection of PREV page from the PROGRESS 2 page.

3. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the PROGRESS 1 page.

4. Pressing the PROG button on the CDU.



D3192501C

Figure 1-59. PROGRESS 1/3

1L-1R **Last Waypoint's Status.** The fields LAST, ALT, ATA, and FUEL display the last sequenced waypoint's Identifier, actual altitude, actual time and Fuel on Board, respectively. If the Label/Name exceeds the allocated field length, the Label/Name is truncated to fit into the field.

NOTE

If the aircraft's present altitude exceeds the FMS calculated MAX ALT, FMS fuel calculation will cease. Fuel calculations can be restored one of two ways: (1) descend below MAX ALT and reenter the CRZ ALT or (2) continue cruise until fuel burnoff allows an increase in the FMS calculated MAX ALT and then reenter the CRZ ALT on the appropriate PERF INIT page.

2L-2R **Current Waypoint's Status.** "ETA" is displayed if the aircraft is airborne and Time is valid. The Data fields below then display ETAs. Otherwise, "ETE" is displayed and data fields below display ETEs.

These data fields display the active waypoint's Identifier, distance to go, estimated time of arrival at the waypoint, and predicted Fuel on Board, respectively. If the Label/Name exceeds the allocated field length, the Label/Name is truncated to fit into the field.

3L-3R **Next Waypoint's Status.** These data fields display the next waypoint's Identifier, distance to go, estimated time of arrival at the waypoint, and predicted Fuel on Board, respectively. If the Label/Name exceeds the allocated field length, the Label/Name is truncated to fit into the field.

4L-4R **Destination/Enroute/Alternate Waypoint's Status.** These data fields display the next waypoint's Identifier, distance to go, estimated time of arrival at the waypoint, and predicted Fuel on Board, respectively. If the Label/Name exceeds the allocated field length, the Label/Name is truncated to fit into the field.

Data field defaults to "DEST" upon display of the PROGRESS 1 page and data for the active flight plan's destination is displayed. If the flight plan is provisional, "MOD DEST" is displayed. Entries into 4L are a valid database identifier. If the entered identifier is in the active flight plan, "ENROUTE WPT" and data pertaining to the enroute waypoint is displayed. If the entered identifier is not in the flight plan, "ALTN WPT" and data assuming a direct course to that waypoint is displayed.

If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion Page is not active. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the Destination/Alternate Waypoint field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

If a waypoint ident other than the destination is displayed in the data field, delete results in the default data being displayed.

5L **Commanded Speed.** Displays the VNAV targeted airspeed as a CAS/Mach pair with the targeted speed highlighted (Mach or CAS). When RTA Speed is valid and active, it displays "RTA SPD". Otherwise, "SPD" is displayed.

6L **Commanded Altitude.** For VIAS Climbs and Descents it shows the next Constraint Altitude or Alert Altitude, whichever is lower for climbs adn higher for descents. For VPATH Descents it shows the next level off altitude.

5R **Vertical Profile Point** displays the title for the next Vertical Profile Point. This data field is blanked if the next Vertical Profile Point is undefined. If the next vertical profile point is defined, the ETA and DTG to that point are displayed.

6R **Required Time of Arrival Waypoint and Error.** The next time, constrained waypoint, its predicted time error, and an ahead or behind indicator for the time error, are displayed respectively.

PROGRESS 2/3 Page.

The PROGRESS 2 page displays current aircraft position relative to the active flight plan current speed, wind, and temperature information.

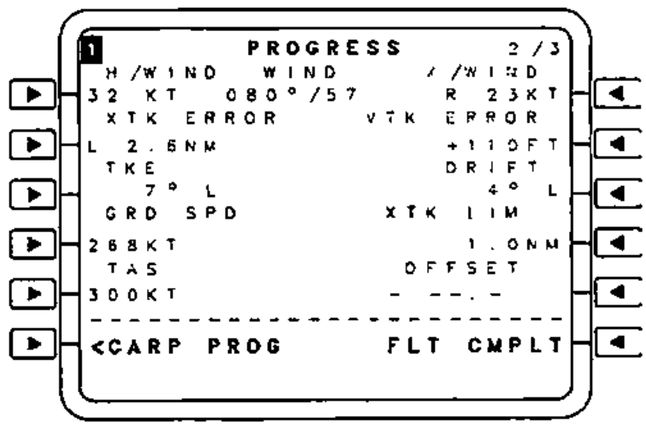


Figure 1-60. PROGRESS 2/3

1L-1R **Current Wind.** These data fields display the current wind information.

2L **Current Crosstrack Error.** Displays the direction and magnitude of the crosstrack error, respectively.

3L **Track Angle Error.** This data field displays the current track angle error in degrees. The direction of the track angle error is right ("R") for clockwise direction from desired track and left ("L") for counterclockwise.

4L **Current Ground Speed.** Displays the aircraft's current ground speed.

5L **Current True Airspeed.** Displays the aircraft's current true airspeed.

6L **ERASE or Branch to Pattern Progress page.** "ERASE" is displayed if a provisional flight plan exist. Selection results in the provisional fliught plan being deleted. IOf no provisional exists and the active waypoint is part of a CARP, the "<CARP PROG>" displays. Selection results in a branch to the CARP PROGRESS page.

2R **Vertical Track error.** This data field displays the vertical track error.

3R **Drift Angle.** Displays the current drift angle in degrees and direction of the drift angle, right ("R") or left ("L") of the aircraft track.

4R **Crosstrack Limit.** Initially, the crosstrack limit field is dashed, indicating no crosstrack limit messages will be generated. Upon entry of a crosstrack limit, the message "XTK LIM EXCEEDED" will be generated when the crosstrack error is greater than the Crosstrack Limit. Entries into the cross-track limit do not affect the flight plan or create a provisional flight plan. Delete results in the crosstrack limit being restored to its default value.

5R **Lateral Offset.** The lateral offset direction and magnitude are displayed respectively. If no flight plan is active, these fields are blanked.

If a flight plan is active, the fields default to "--.-" and "-". Valid entries are of the form "L" or "R", followed by a distance, or "0". An entry of "0" cancels the offset. Valid entries result in a provisional flight plan being created. When a provisional flight plan exists, the ERASE/EXEC logic becomes active. Delete results in the lateral offset being canceled.

6R **Flight Complete.** "FLT CMPLT" is displayed in a large font when it is permitted to declare flight complete. Otherwise, it is displayed in a small font.

Selection when "FLT CMPLT" is displayed in a large font results in the flight complete function being performed, and the flight complete prompt is then displayed in a small font.

PROGRESS ETP 3/3 Page.

The PROGRESS 3 page computes and displays Equal Time Point information.

EQUAL TIME POINT SEGMENT DEFINITION.

The ETP segment is the great circle path from the last nearest airport direct to the last waypoint, along the flight plan to the first waypoint, and direct to the first nearest airport as shown in figure 1-61. The NP accepts as pilot entry the following equal time point segment definition data:

1. LAST NEAREST AIRPORT.
2. LAST WAYPOINT - Last waypoint in the flight plan prior to the ETP segment.
3. FIRST WAYPOINT - First waypoint in the flight plan following the ETP segment.
4. FIRST NEAREST AIRPORT.
5. ALTERNATE TAS (optional pilot entry).

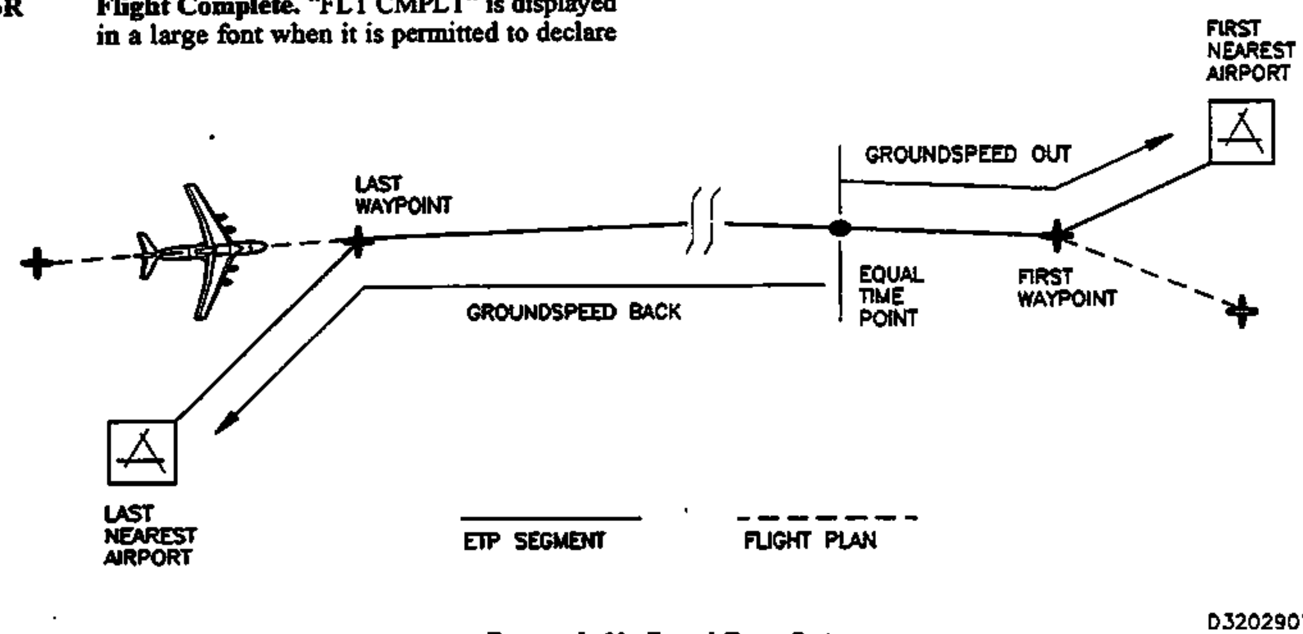


Figure 1-61. Equal Time Points

EQUAL TIME POINT CALCULATIONS.

While the FMS is calculating ETP data intermediate values may be displayed on the PROGRESS ETP page that appears incorrect. Additionally, if the aircraft has not laterally sequenced the last waypoint in the flight plan prior to the ETP segment the ground speed out may not be accurately calculated.

EQUAL TIME POINT PROCESS.

1. The FMS accepts as pilot entry the following ETP data: (Defined on PROGRESS page 3)
   a. Last nearest airport.
   b. Last waypoint prior to the ETP segment.
   c. First waypoint following the ETP segment.
   d. First nearest airport.

e. Alternate True airspeed.

2. The FMS computes the ETP and the following data for display on the MFCDU:

a. ETP Segment Distance - The total distance of the equal time segment. Defined as the distance from the last nearest airport direct to the last waypoint, along the flight plan to the first waypoint and to the first nearest airport.

b. Ground Speed Out - The estimated ground speed assumed for travel on the equal time segment out towards the first nearest airport.

c. Time Out - The estimated time required for traversal of the equal time segment from start to end.

d. Ground Speed Back - The estimated ground speed assumed for travel on the equal time segment back towards the last nearest airport.

e. ETP Position - The latitude/longitude for the equal time point. The equal time point is the point where the time required to continue forward along the flight plan to the first waypoint and direct to the first nearest airport is the same time as the time required to return via the flight plan to the last waypoint and direct to the last nearest airport.

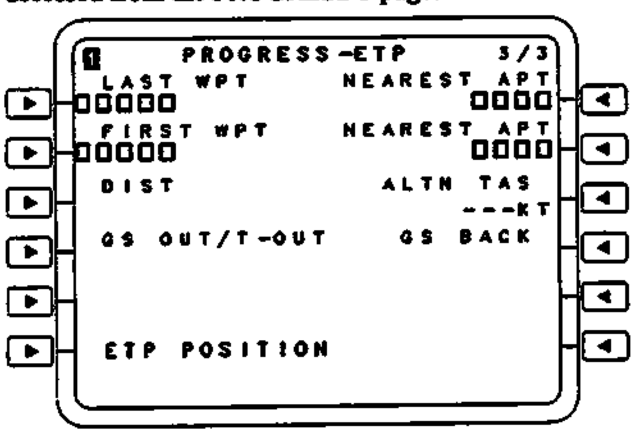
f. Time to the ETP - Time to/past the ETP.

PAGE ACCESS.

The PROGRESS 3 page is displayed when any of the following occur:

1. Selection of NEXT page from the PROGRESS 2 page or selection of PREV page from the PROGRESS 1 page.

2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the PROGRESS 3 page.



D3192901A

Figure 1-62. PROGRESS - ETP 3/3

1L **Last Waypoint.** Displays the last waypoint in the flight plan prior to entry of the ETP segment. Defaults to dashes until a valid entry is received.

If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the Last Waypoint field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad. Entry of a waypoint which is not in the route results in the "WAYPOINT NOT FOUND" message. Entries which do not meet the entry format result in the "INVALID ENTRY" message. Entry of a valid waypoint when a valid entry is displayed in data fields 1, 2, 3, or 4 results in data fields 2 through 11 being reset to their defaults.

Delete results in the entered waypoint being deleted, and the default data restored. Selection results in the entry being placed into the scratch pad and activation of the Waypoint Select Page Exclusion.

2L **First Waypoint.** This data field displays the first waypoint in the flight plan following the ETP segment. Defaults to dashes until a valid entry is received.

If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the First Waypoint field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

Entry of a waypoint which is not in the route results in the "WAYPOINT NOT FOUND" message. Entries which do not meet the entry format result in the "INVALID ENTRY" message.

Delete results in the entered waypoint being deleted, and the default data restored. Selection results in the entry being placed into the scratch pad and activation of the Waypoint Select Page Exclusion.

3L **ETP Segment Distance.** The distance from the last nearest airfield direct to the last waypoint, along the flight plan to the first waypoint, and direct to the first nearest airport.

4L **Ground Speed and Time Out.** Display the ground speed out and time enroute from the last waypoint along the flight plan to the first waypoint.

5L **Time To or Past ETP.** These data fields display the TO/PAST ETP Indicator and time. If the aircraft is past the ETP point, data field 10 will display the time past the ETP, and field 12 will display "TIME PAST ETP". If the aircraft has not reached the ETP point, data field 10 will display the time to the ETP and field 12 will display "TIME TO ETP". If the time calculation is invalid, data fields 10 and 12 are blanked.

6L **ETP Position.** Displays the ETP Position. If the position calculation is invalid, the data field is blanked.

1R **Last Nearest Airport.** This Data field displays the entered ident of the airport nearest the Last Waypoint.

If more than one airport with the entered identifier exists in the airport file of the navigation database, the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with an airport selected, the NP will use the selected airport in the Last Nearest Airport field. Upon return from the WAYPOINT SELECT page when an airport is not selected, the NP will display the airport identifier in the scratch pad. Entry of an airport which is not in the airport file of the navigation database results in the "WAYPOINT NOT FOUND" message. Entries which do not meet the entry format result in the "INVALID ENTRY" message.

2R **First Nearest Airport.** This data field displays the entered ident of the airport nearest the First Waypoint.

If more than one airport with the entered identifier exists in the airport file of the navigation database, the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Upon return from the WAYPOINT SELECT page with an airport selected, the NP will use the selected airport in the First Nearest Airport field. Upon return from the WAYPOINT SELECT page when an airport is not selected, the NP will display the airport identifier in the scratch pad. Entry of an airport which is not in the airport file of the navigation database results in the "WAYPOINT NOT FOUND" message. Entries which do not meet the entry format result in the "INVALID ENTRY" message.

3R **Alternate TAS.** This data field displays the Alternate TAS to be used in the ETP calculation. Field defaults to dashes and displays the Alternate TAS upon entry.

4R **Ground Speed Back.** This data field displays the computed ground speed back to the last waypoint.

5R-6R **Non-operational.**

MISSION FLIGHT PARAMETERS.

The following paragraphs will describe the functional and performance requirements of the Mission Flight Parameters (MFPs) as they relate to the flight plan. The MFPs will consist of CARP patterns, Approach, and Rendezvous/Intercepts. The data describing the MFPs will be entered by the user or uploaded from the DLS. The data will be used in constructing the pattern legs in the flight plan.

Flight Plan Approach.

The FMS provides the ability to support Landing Zones or Non-Precision Approaches (LZ/NPA) in the selected flight plan. There will be a minimum of three lateral waypoints in a LZ/NPA path, the final approach fix (FAF), the missed approach point (MAP), and the runway waypoint. The Turn point (TP) and Slow Down Point (SD) are optional. The LZ/NPA will not be inserted into the flight plan until the threshold position, threshold elevation, inbound course, descent path angle, FAF altitude, FAF distance, and MAP distance and minimum descent altitude are defined.

NON-PRECISION APPROACH AND LANDING ZONE CAPABILITY.

The FMS provides the capability for construction of an RNAV approach to the primary and alternate destinations or as part of a Landing Zone (LZ). Entry of the following data from the LANDING ZONE INIT 1/2, and 2/2 pages will be used for construction of the RNAV approach at a designated point. Inputs:

MFCDU Page:	LZ INIT 1/2 THRESHOLD POSITION

LZ INIT 1/2 PAGE.

1. LZ IDENTIFIER - Runway Ident (defaults from NDB if available).
2. LZ THRESHOLD POSITION - Threshold Position (RWY position if an NDB airport) - lat/lon or MGRS.
3. LZ TDZE - Touchdown Zone Elevation (from NDB if approach is to an NDB airport runway) or entered elevation - ft.
4. MDA - Minimum Descent Altitude - ft.
5. HAT ALTITUDE - Height Above Touchdown - ft.
6. LZ INBOUND COURSE - Runway (RWY) heading (from NDB if approach is to an NDB airport runway) or entered course - deg.
7. MAP DISTANCE - Threshold To Missed Approach Point distance - nm.

LZ INIT 2/2 PAGE.

1. LZ DESCENT ANGLE - Descent Angle (DA) - deg.
2. FAF DISTANCE - Threshold To Final Approach Fix Distance (FAF) - nm.
3. FAF ALTITUDE - Final Approach Fix altitude (FAF ALT) - ft.
4. SLOW DOWN DISTANCE - Threshold to Slow Down Distance (SD) - nm.
5. TURN POINT DISTANCE - Threshold to Turn Point (TP) distance - nm.

APPROACH DATA DEFAULT VALUE AND RANGE.

The default values and allowed ranges for the approach construction data are as follows:

PARAMETER	DEFAULT VALUE	RANGE
TOUCHDOWN ZONE ELEVATION (TDZE)	TDZE from NAV DATABASE OR SOLICIT BOXES	N/A
LZ INBOUND COURSE	RWY HEADING from NAV DATABASE or SOLICIT BOXES	1 to 360 DEG.
DESCENT ANGLE (DA)	SOLICIT BOXES	0.1 to 15 DEG.
FAF ALTITUDE (FAF ALT)	SOLICIT BOXES	-1300 to 600000 FT.
TURN POINT DISTANCE (TP)	SOLICIT BOXES	0 to 99.9 NM
MINIMUM DESCENT ALTITUDE (MDA)	SOLICIT BOXES	0 to 99.9 NM
FINAL APPROACH FIX DISTANCE (FAF)	SOLICIT BOXES	0 to 99.9 NM
THRESHOLD TO SLOW DOWN DISTANCE (SD)	DASHES	0 to 99.9 NM
MAP DISTANCE (MAP)	0 NM	0 to 99.9 NM

RESTRICTIONS.

No waypoints are allowed to be entered between the TP and the RWY which are not created directly as part of the approach. A valid data entry that replaces an existing value in either FAF Altitude, FAF Distance, or Descent Angle on LZ INIT 2/2 page causes the other two fields to be replaced with their default values.

TURN POINT WAYPOINT INSERTION.

The FMS inserts the Turn Point (TP) waypoint into the selected flight plan using the requirements under Flight Plan and Waypoints and the following:

1 The FP LEG TYPE will be TF and the WAYPOINT TRANSITION will be a curve path.

2. The TP waypoint will be the first waypoint in the lateral path of the approach. The TP waypoint will be placed in the flight plan between the selected waypoint and the previous waypoint.

3. The TP waypoint's WAYPOINT LATITUDE and LONGITUDE will be the computed TURN POINT LATITUDE/LONGITUDE.

4. The TP waypoint's COURSE FROM, COURSE TO, and LEG DISTANCE will be determined from the great circle path between the previous waypoint's location and the TP location.

5. The TP waypoint's LOW ALTITUDE will be set to the TP ALTITUDE CONSTRAINT (MSL) and the ALTITUDE CONSTRAINT TYPE will be set to AT ALTITUDE.

SLOW DOWN WAYPOINT INSERTION.

The FMS inserts the Slow Down (SD) point waypoint into the selected flight plan using the requirements under Flight Plan and Waypoints and the following:

1. The FP LEG TYPE will be TF and the WAYPOINT TRANSITION will be curve path.

2. The SD waypoint will follow the FAF waypoint in the lateral path of the approach.

3. The SD waypoint's WAYPOINT LATITUDE and WAYPOINT LONGITUDE will be the computed AP SLOW DOWN LATITUDE/LONGITUDE.

4. The SD waypoint's COURSE FROM, COURSE TO, and LEG DISTANCE will be determined from the great circle path between the turn point waypoint's location and the SD location.

5. The SD waypoint's LOW ALTITUDE will be set to the TP ALTITUDE CONSTRAINT (MSL) and the ALTITUDE CONSTRAINT TYPE will be set to AT ALTITUDE.

FAF WAYPOINT INSERTION.

The FMS inserts the final approach fix waypoint into the selected flight plan using the requirements under Flight Plan and Waypoints and the following:

1. The LEG TYPE will be TF and the WAYPOINT TRANSITION will be curve path.

2. The FAF waypoint will follow the TP or SD waypoint in the lateral path of the approach, respectively, if either or both are defined.

3. The FAF waypoint's WAYPOINT LATITUDE and LONGITUDE will be the computed FINAL APPROACH FIX LATITUDE/LONGITUDE.

4. The FAF waypoint's COURSE FROM, COURSE TO, and LEG DISTANCE will be determined from the great circle path between the previous waypoint's location and the FAF waypoint's location.

5. The FAF waypoint's LOW ALTITUDE will be set to the FINAL APPROACH FIX ALTITUDE CONSTRAINT

(MSL) and the ALTITUDE CONSTRAINT TYPE will be set to AT ALTITUDE.

MAP WAYPOINT INSERTION.

The FMS inserts the missed approach point waypoint into the selected flight plan using the requirements under Flight Plan and Waypoints and the following:

1. The LEG TYPE will be TF and the WAYPOINT TRANSITION will be curve path.

2. The MAP waypoint will follow the FAF waypoint in the lateral path of the approach. The MAP waypoint will be placed in the flight plan between the FAF waypoint and the runway waypoint.

3. The MAP waypoint's WAYPOINT LATITUDE and LONGITUDE will be the computed MISSED APPROACH POINT LATITUDE/LONGITUDE.

4. The MAP waypoint's COURSE FROM, COURSE TO, and LEG DISTANCE will be determined from the great circle path between the FAF waypoint's location and the MAP location.

5. The MAP waypoint's LOW ALTITUDE will be set to the MISSED APPROACH POINT ALTITUDE CONSTRAINT (MSL) and the ALTITUDE CONSTRAINT TYPE will be set to AT ALTITUDE.

APPROACH RUNWAY WAYPOINT INSERTION.

The FMS inserts the approach runway waypoint into the selected flight plan as follows:

1. The LEG TYPE will be TF and the WAYPOINT TRANSITION will be point to point.

2. The runway waypoint will follow the MAP in the lateral path of the approach.

3. The waypoint's WAYPOINT LATITUDE will be the specified RUNWAY THRESHOLD LATITUDE/LONGITUDE.

4. The runway waypoint's COURSE FROM and COURSE TO will be set to the RUNWAY HEADING.

5. The runway waypoint's LEG DISTANCE will be set to the MAP DISTANCE.

6. The runway waypoint's LOW ALTITUDE will be set to the AP RUNWAY ALTITUDE CONSTRAINT and the ALTITUDE CONSTRAINT TYPE will be set to AT ALTITUDE.

Computed Air Release Point (CARP).

The FMS supports payload delivery profiles known as Computed Air Release Point (CARP) patterns. The CARP is a point in space at which the aircraft will be positioned to release the payload to ensure the payload lands on the desired ground location. The CARP function will support deployments of Personnel (PER), Container Delivery System (CDS), and Heavy Equipment (HE). The CARP function will compute low and high altitude profiles. The CARP function will support both one and two stages. A one-stage drop is available with both the low and high altitude profiles. A two-stage drop will have an additional free fall component and assumes a high altitude drop. Figure 1-233 illustrates the CARP lateral path.

AIRDROP ALTIMETER SETTING.

The altimeter may be specified in terms of QFE (field elevation) or QNH (sea level). When the BARO PRESSURE QFE is specified, the FMS determines the DZ BARO PRESSURE QNH using the PI ELEVATION as the Field Elevation. When the BARO PRESSURE QNH is specified, the FMS determine the DZ BARO PRESSURE QFE using the PI ELEVATION as the Field Elevation.

DROP ALTITUDE.

When TYPE DROP is CARP, the DROP ALT will be entered as an AGL. Parameters for the various altitudes will be determined as follows:

When the TYPE DROP is CARP, the FMS computes True Altitude (TA) as follows:

When the TRRN ELEV and DROP ALT are specified, the True Altitude (TA) will be defined as TA = TRRN ELEV + DROP ALT. If DROP ALT or TRRN ELEV are not specified or if: OBSTRUCTION ELEVATION + REQUIRED CLEARANCE is greater than TRRN ELEV + DROP ALT

TA will is defined as: TA = OBSTRUCTION ELEVATION + REQUIRED CLEARANCE.

The FMS computes the Pressure Altitude (PA) and Indicated Altitude (IND ALT) as PA = PAV + TA. Corrected Drop Alt = DROP ALT * 1/TAV[PA, DROP ALT TEMP]. IND ALT = Corrected Drop Alt + TRRN ELEV.

The MFCDU annunciates AIRDROP ALT CONFLICT if any of the following conditions are satisfied:

1. When the IND ALT is entered and IND ALT is less than TA.

2. PI ELEV is greater than TRRN ELEV, OBSTRUCTION ELEV, ACTUATION ALTITUDE, or INDICATED ALTITUDE,

3. TRRN ELEV is greater than INDICATED ALTITUDE,

4. ACTUATION ALTITUDE is greater than INDICATED ALTITUDE.

When the condition that caused AIRDROP ALT CONFLICT is corrected, the annunciation is terminated.

When the TYPE DROP is HARP, the FMS computes Drop Pressure Alt (PA), Drop True Altitude (TA), Drop Alt, and PI Pressure Alt as follows:

If IND ALT TYPE is PA: PA = IND ALT

If IND ALT TYPE is MSL: PA = IND ALT + PAV

the TA and PI Press ALT will be defined as: TA = TAV[PA, DROP ALT TEMP] * PA, Drop Alt = TA - PI ELEV,PI Pressure Alt = PI ELEV + PAV.

ACTUATION ALTITUDE.

The ACTUATION ALTITUDE is entered as either an AGL, MSL, or PA as defined by ACTUATION ALTITUDE TYPE. When the CARP STAGE is two (TYPE DROP = HARP) and the ACTUATION ALTITUDE TYPE is AGL, the FMS computes the Indicated True Altitude ($ITA_{Actuation}$) as follows:

$ITA_{Actuation}$ = ACTUATION ALTITUDE + PI ELEV

When the CARP STAGE is two (TYPE DROP = HARP) and the ACTUATION ALTITUDE TYPE is AGL or MSL, the FMS computes the Pressure Altitude ($PA_{Actuation}$), and Absolute Altitude ($AA_{Actuation}$) as follows:

$PA_{Actuation}$ = $ITA_{Actuation}$ + PAV

When the CARP STAGE is two (TYPE DROP = HARP) and the ACTUATION ALTITUDE TYPE is AGL, MSL or PA, the FMS computes the Actuation True Altitude ($TA_{Actuation}$) and Act Alt as follows:

$TA_{Actuation}$ = $PA_{Actuation}$ * TAV[$PA_{Actuation}$, ACTUA TEMP]

Act Alt = $TA_{Actuation}$ - PI ELEV

WIND DATA FOR CARP COMPUTATION.

Wind adjustments to the CARP location will be determined from entries of altitude winds (surface, drop, and actuation altitudes) or from ballistic winds (high and low altitude). For a one-stage airdrop, a single Ballistic Wind will be used. For two-stage airdrops, a High Ballistic Wind and Low Ballistic Wind will be used to compute the CARP location.

WIND DATA FOR SINGLE STAGE CARP. When the CARP STAGE is one and the BALLISTIC WIND BEARING/VELOCITY has not been specified, the FMS computes the DZ BALLISTIC WIND BEARING/VELOCITY as the vectorial average of the DROP ALTITUDE WIND and SURFACE WIND.

WIND DATA FOR TWO-STAGE CARP. When the CARP STAGE is two and the HIGH BALLISTIC WIND BEARING/VELOCITY has not been specified, the FMS computes the DZ HIGH BALLISTIC WIND BEARING/VELOCITY as the vectorial average of the DROP ALTITUDE WIND and ACTUATION ALTITUDE WIND.

When the CARP STAGE is two and the LOW BALLISTIC WIND BEARING/VELOCITY has not been specified, the FMS computes the DZ LOW BALLISTIC WIND BEARING/VELOCITY as the vectorial average of the ACTUATION ALTITUDE WIND and the SURFACE WIND.

FLIGHT PLAN CARP PATTERNS.

The FMS supports airdrops in the selected flight plan. There will be three waypoints in the CARP lateral path: the Turn Point (TP), the Computed Air Release Point (CARP), and the Drop Zone Escape (DZ Escape). The waypoint preceding the CARP TP will be identified as the Initial Point (IP) (see figure 1-233). The CARP solution and the three waypoint locations will not be inserted into the flight plan until the data is defined for the type of CARP being specified. If not all the data is defined, a single waypoint will reside in the flight plan as a place holder. When all the data is defined, a CARP solution will be determined and the three waypoints will replace the single waypoint. Required CARP data is listed below.

Single Stage Airdrop	Two Stage Airdrop
DZ POINT OF IMPACT LOCATION	DZ POINT OF IMPACT LOCATION
DZ DROP ZONE ELEVATION	DZ DROP ZONE ELEVATION
DZ POINT OF IMPACT ELEVATION	DZ POINT OF IMPACT ELEVATION
DZ RUN IN COURSE	DZ RUN IN COURSE
DZ DISTANCE SD TO CARP	DZ DISTANCE SD TO CARP
DZ DISTANCE TP TO PI	DZ DISTANCE TP TO PI
DZ USABLE DZ	DZ USABLE DZ
DZ DROP ALTITUDE	DZ DROP ALTITUDE
DZ ELEMENT WEIGHT	DZ ELEMENT WEIGHT
DZ SURFACE TEMPERATURE	DZ SURFACE TEMPERATURE
DZ DROP ALTITUDE TEMPERATURE	DZ DROP ALTITUDE TEMPERATURE
DZ DROP ALTITUDE WIND BEARING/VELOCITY	DZ ACTUATION ALTITUDE
DZ SURFACE WIND BEARING/VELOCITY	DZ ACTUATION ALTITUDE WIND
blank	DZ ACTUATION ALTITUDE TEMPERATURE
DZ PARACHUTE DATA	DZ PARACHUTE DATA

FLIGHT PLAN CARP PATTERN INPUTS. The inputs for the Flight Plan CARP Pattern and the calculations for the CARP waypoint position will be described under Computed Air Release Point.

CARP LATITUDE	CARP LONGITUDE
TP LATITUDE	TP LONGITUDE
ESC LATITUDE	ESC LONGITUDE
DISTANCE TP TO PI	RUN IN COURSE
DROP ALTITUDE	
DROP SPEED CAS	

CARP WAYPOINT DEFINITION.

When a CARP is specified in the selected flight plan and not all the data is defined, a single waypoint exists in the selected flight plan with the following:

1. The WAYPOINT IDENTIFIER will be "*CARP".

2. The PROCEDURE IDENTIFIER will be "CARPn", where n is the CARP number.

3. The WAYPOINT TYPE will be CARP.

4. The WAYPOINT LATITUDE/LONGITUDE will be set to the POINT OF IMPACT LATITUDE/ LONGITUDE.

5. The LEG TYPE will be IF.

6. A discontinuity will be defined between the previous waypoint and the CARP waypoint.

CARP DISCONTINUITY.

When the CARP exists as a single waypoint in the flight plan and a CLEAR DISCONTINUITY is requested, the FMS clears the discontinuity as follows.

1. The PROCEDURE IDENTIFIER will be blank.

2. The WAYPOINT TYPE will be LL.

3. The LEG TYPE will be TF.

CARP INSERTION.

When a CARP is specified in the selected flight plan and the data in the Required CARP Data table for the specified CARP is defined, the three waypoints, TP, CARP, and DZ Escape, exist in the flight plan. The information defining the three CARP waypoints are described in the following paragraphs.

TURN POINT WAYPOINT INSERTION. The FMS inserts the TP waypoint into the selected flight plan using the requirements under Flight Plan and Waypoints and the following.

1. The LEG TYPE will be TF and the WAYPOINT TRANSITION will be curve path.

2. The TP waypoint will be the first waypoint in the lateral path of the approach, if defined. The TP waypoint will be placed in the flight plan between the previous waypoint and the selected waypoint.

3. The TP waypoint's WAYPOINT LATITUDE and WAYPOINT LONGITUDE will be the computed TURN POINT LATITUDE/LONGITUDE.

4. The TP waypoint's COURSE FROM, COURSE TO, and LEG DISTANCE will be determined from the great circle path between the previous waypoint's WAYPOINT LATITUDE/LONGITUDE and the TP WAYPOINT LATITUDE/LONGITUDE.

CARP WAYPOINT INSERTION. The FMS inserts the CARP waypoint into the selected flight plan using the following.

1. The LEG TYPE will be TF and the WAYPOINT TRANSITION will be point to point.

2. The CARP waypoint will follow the TP in the lateral path of the airdrop pattern.

3. The CARP waypoint's LEG DISTANCE will be set to the DISTANCE TP TO PI.

4. The CARP waypoint's LOW ALTITUDE will be set to the DROP ALTITUDE (MSL) and the ALTITUDE CONSTRAINT TYPE will be set to AT ALTITUDE.

5. The CARP waypoint's SPEED CONSTRAINT will be set to the DROP SPEED (CAS).

ESC WAYPOINT INSERTION. The FMS inserts the ESC waypoint into the selected flight plan using the requirements under Flight Plan and Waypoints and the following.

1. The LEG TYPE will be TF and the WAYPOINT TRANSITION will be radius of turn transition.

2. The ESC waypoint will be the last waypoint in the lateral path of the airdrop and follows the CARP waypoint.

3. The ESC waypoint's COURSE FROM and COURSE TO will be set to the RUN IN COURSE.

4. The ESC waypoint's LEG DISTANCE will be the distance from CARP to ESC, computed to give the following result: LEG DISTANCE = USABLE.

CARP CONNECTION TO THE FLIGHT PLAN.

The FMS connects the ESC waypoint to the selected waypoint using a DF leg.

CARP WAYPOINT UPDATE.

The FMS updates the CARP waypoints when a new CARP solution is computed.

COMPUTED AIR RELEASE POINT OUTPUTS.

The outputs of the CARP processing will be the three waypoints inserted into the selected flight plan, TP, CARP, and ESC.

Airdrop Multiple Runs.

Each airdrop in the flight plan may be flown multiple times. After each run over the drop zone, a new CARP location will be computed. The return track to the new CARP location will be computed.

MFCDU Page: CARP INIT pages
RUN IN COURSE
POINT OF IMPACT LATITUDE/LONGITUDE
NUMBER OF RUNS
(# OF PASSES)

MFCDU Page: CARP END OF RUN page
CARP TURN DIRECTION
DZ CARP LATITUDE/LONGITUDE

MULTIPLE RUNS OF THE SAME AIRDROP.

When the NUMBER OF RUNS is greater than one and Red On has occurred, the FMS computes a new DZ CARP LATITUDE/LONGITUDE using $\text{Distance}_{\text{Along Track}}$ and $\text{Distance}_{\text{Cross Track}}$ defined in CARP Drift Computation.

Fifteen seconds after RED ON, a turn is initiated to set up for the next circuit of the airdrop. The default DZ CARP TURN DIRECTION is the direction (RIGHT or LEFT) that results in the aircraft flying away from the drop zone.

The circuit is flown at drop altitude and 160 knots. The reciprocal of the RUN IN COURSE is used to fly back to a point that allows a capture of the course (RUN IN COURSE) into the CARP.

The countdown annunciations under CARP Annunciations, are operable for each circuit after the initial turn back to the drop zone. If the return to the CARP is less than six minutes, then the 6-minute annunciation is displayed after completing the initial turn. When the NUMBER OF RUNS is greater than one and Red On has occurred, the FMS decrement NUMBER OF RUNS by one.

When the NUMBER OF RUNS is equal to one and RED ON has occurred, the FMS sequences the CARP waypoint.

HSI Behavior.

When making multiple runs on the same CARP the bearing pointer 1 (PTR 1) will continue to point toward the CARP as shown in figure 1-234 (DAMU AP/FD set to LNAV and PTR 1 set to FMS 1). Position 1 shows the aircraft has passed the TP and is aligned on the run in course. Position 2 shows the aircraft at RED LIGHT, note that PTR 1 points to the CARP. Position 3 shows the PTR 1 is fixed on the CARP while the aircraft makes the initial turn. Position 4 shows the HSI as the aircraft proceeds on the outbound track. Figure 1-234 shows that the crew has shortened the TP - CARP distance, adjusting the entry point for turn two. However, PTR 1 is still pointing to the CARP (Position 5). Position 6 shows that the aircraft has rolled out of turn two with PTR 1 still pointing to the CARP. As the aircraft passes the run in course it decrements the run counter. With no additional passes remaining, PTR 1 indicates the bearing to the DZ ESC point. The distance shown above pointer 1 is the computed ground track distance remaining from the aircraft's present position to the active CARP waypoint.

Rendezvous/Intercept Waypoints.

Rendezvous/Intercept points will be used as waypoints in the flight plan. The location of the Rendezvous/Intercept waypoint will be updated periodically when the waypoint becomes active.

RENDEZVOUS/INTERCEPT INSERTION.

The FMS provides the ability to insert rendezvous/intercept points into the selected flight plan.

RENDEZVOUS/INTERCEPT LOCATION UPDATE.

The FMS updates the rendezvous/intercept FP WAYPOINT LATITUDE and LONGITUDE when the flight plan changes, or the RZ data is modified.

ACTIVE RENDEZVOUS/INTERCEPT LOCATION UPDATE.

When the Rendezvous/Intercept waypoint is the active waypoint, the FMS updates the Rendezvous/Intercept FP WAYPOINT LATITUDE and LONGITUDE.

Holding Patterns/Refueling Orbits.

Holding patterns, entry, and exit procedures are constructed by the Lateral Guidance function. Refueling orbits are treated identically to holding patterns; therefore, all requirements for holding patterns also apply to refueling orbits. The width of the holding pattern is resized each time the holding fix is crossed based on a nominal 25-degree bank angle and expected ground speeds. The size of the holding pattern is limited to remain within the allowed holding airspace. Holding patterns can be located at a waypoint or at the aircraft present position provided the defined conditions are met.

PRESENT POSITION (*PPOS) HOLDING PATTERN.

PRESENT POSITION (*PPOS) HOLDING PATTERN CRITERIA. A *PPOS Holding pattern is allowed if the following criteria are met:

1. The cross track error of the Master NP is < 0.25 NM.

2. LNAV is not in a transition state.

3. There is an active "TO" waypoint.

PRESENT POSITION (*PPOS) HOLDING START. LNAV starts the PPOS hold immediately if the above criteria are met and the Hold is executed.

1. Holding Pattern Size Determination.

2. Holding Pattern Bank Angle Limiting. The Bank Angle Limit when a Holding Pattern is active is ± 30 degrees.

3. Holding Ground Speed Calculation. Five different ground speeds are used in calculating the holding pattern parameters, based on the wind components as measured relative to the inbound leg of the pattern.

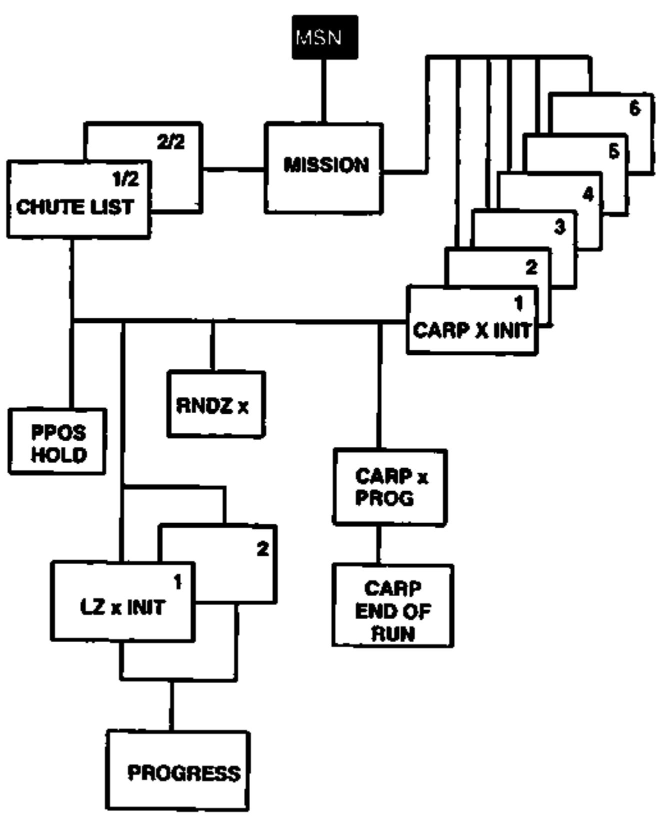


Figure 1-63. Mission Tree

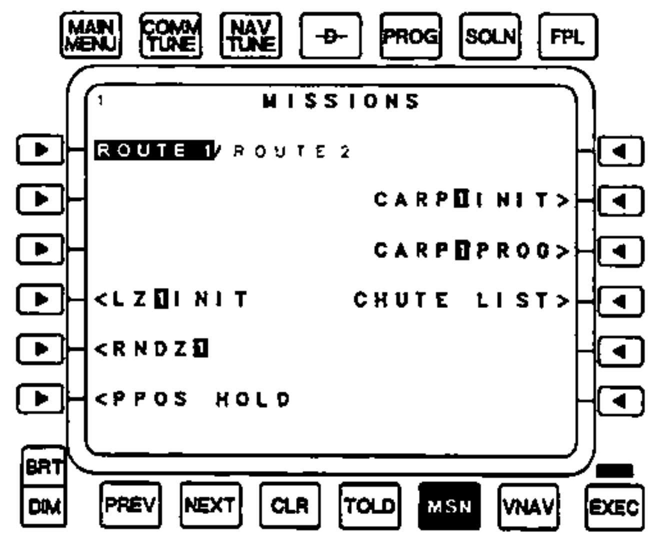
MISSIONS Page.

The MISSIONS page provides the Route 1 and Route 2 activate function, access to the CARP, LZ, RENDEZVOUS, and CHUTE LIST pages and the PPOS HOLD page. The MISSIONS page is displayed when any of the following conditions are satisfied:

1. Pressing the MSN mode key.

2. Selection of the MFP prompt on the WAYPOINT DATA page.

3. Selection of the MSN prompt on the CHUTE LIST page when that page was accessed from the MISSIONS page.



D3193001

Figure 1-64. MISSIONS

1L **Route Selection.** When the MISSIONS page is accessed from the MSN mode key, 1L provides a means of selecting either Route 1 or Route 2. When Route 1 is selected, Route 1 will be used for 2L-5L, 2R, and 3R operations. When Route 2 is selected, Route 2 will be used for 2L-5L, 2R, and 3R operations. Selection will switch between Route 1 and Route 2 with the selection being highlighted.

When the MISSIONS page was accessed from the WAYPOINT DATA page, 1L data field displays the route ("ROUTE 1" or "ROUTE 2" in a small font) associated with the waypoint. Selection is non-operational. Delete and entry are non-operational.

2L-3L **Non-operational.**

4L **Branch to Landing Zone n Page.** The previously entered Landing Zone Number will be displayed in this data field. If a Landing Zone Number has not been entered, then the data field displays the default. Entry of a valid Landing Zone Number (1-4) results in a branch to the LZ n INIT page of the route selected in the 1L data field.

Selection results in a branch to the LZ n INIT page of the route selected in 1L data field.

5L **Branch to Rendezvous page.** The 5L data field displays the previously entered Rendezvous Number. If a Rendezvous Number has not been entered, this data field displays the default. Entry of a valid Rendezvous Number (1 through 5) results in a branch to the RENDEZVOUS n page of the route selected by 1L.

6L **Branch to PPOS HOLD page.** If the active route does not contain a holding pattern, lateral guidance is engaged, and the crosstrack error is less than 0.25 NM, then 6L data field is displayed in large font. If this data field is displayed in large font, selection results in a branch to the active route HOLD page.

1R **Non-operational.**

2R **Branch to CARP n INIT Page.** This data field displays the previously entered CARP Number. If a CARP Number has not been entered, then this data field displays the default.

Entry of a valid CARP Number (1-10) results in a branch to the CARP n INIT page of the route selected in the 1L data field.

3R **Branch to CARP n Progress Page.** This data field displays the previously entered CARP Progress Number. If a CARP Progress Number has not been entered, then this data field displays the default.

Entry of a valid CARP Progress Number (1-10) results in a branch to the CARP n Progress page of the route selected in the 1L data field.

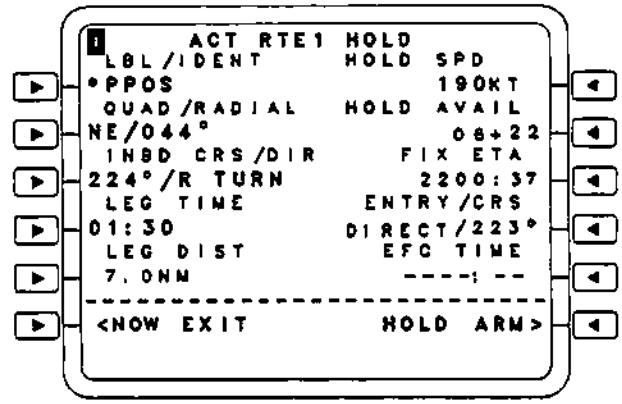
4R **Branch to CHUTE LIST page.**

5R-6R **Non-operational.**

HOLD Page.

The HOLD page displays detailed information about selected holding patterns. There are two HOLD pages, one for Route 1 and one for Route 2. The title data field displays the route number to which the HOLD page applies.

Selection of the HOLD prompt on the WAYPOINT DATA page 1/2 results in display of the HOLD page. Selection of the PPOS HOLD prompt from the MISSIONS page displays the HOLD page for the active route.



D3193501C

Figure 1-65. HOLD

1L **Hold Fix.** The Hold Fix is displayed in the 1L data field. If the Hold was selected as a present position hold from the MISSIONS page, "PPOS" will be displayed as the Fix.

2L **Quadrant/Radial.** The 2L data field displays the holding Quadrant/Radial. Specified values for Quadrant and Radial are displayed in a large font while computed and default values are displayed in a small font.

Valid entries are of the form Quad/Radial, Quadrant, and Radial. A valid entry causes the reciprocal of the Radial to be displayed in the Inbound Course field. When a Radial is specified without the Quadrant, the Radial value is used in determining the Quadrant. When a Quadrant is specified without the Radial, then the Quadrant value is used in determining the Radial. The table below illustrates the relationship between the Quadrant and Radial.

Quadrant/Radial Relationship		
QUADRANT	**RADIAL RANGE (Deg)**	**DEFAULT RADIAL (Deg)**
N	>337.5 to 22.5	0
NE	>22.5 to 67.5	45
E	>67.6 to 112.5	90
SE	>112.5 to 157.5	135
S	>157.5 to 202.5	180
SW	>202.6 to 247.5	225
W	>247.5 to 292.5	270
NW	>292.5 to 337.5	315

3L **Inbound Course/Direction.** The 3L data field displays the Inbound Course/Turn Direction. Specified values for Inbound Course and Turn Direction are displayed in a large font while computed and default values are displayed in a small font. If the Quadrant, Radial, and Inbound Course are not specified, then the Inbound Course defaults to the course of the leg preceding the hold. The Turn Direction defaults to Right.

Valid entries are of the form Course/Direction, Course, Direction and Direction. An Inbound Course only entry will retain the Turn Direction. The Turn Direction can be changed without altering the Inbound Course. Entry of a course results in the radial that is displayed in the 2L data field being recomputed.

4L **Inbound Leg Time**. The Leg Time (in Min:Sec) is displayed in this data field. When the HOLD altitude (starting altitude in the case of a spiraling Hold) is at or below 14,000 ft. (MSL), data field 4 displays "01:00", otherwise data field 4 displays "01:30". Entry of a time will result in the leg distance being recomputed and displayed.

5L **Leg Distance**. The Leg Distance is displayed in this data field. The default leg distance will be computed using the default leg time in data field 4L and the hold ground speed. Entry of a leg distance will result in the leg time being recomputed and displayed.

6L **Branch to LEGS 2/X Page/Erase/Exit Now.** When "MOD" is displayed in the title "ERASE" adjacent to 6L. Selection when "DELETE" is displayed will result in provisional data being deleted.

If the displayed HOLD is not the active leg of the active flight plan, then "<LEGS X", where X is the route number. Selection when "<LEGS" is displayed results in a branch to the LEGS 2/X page for the indicated route.

If the Hold is the active leg, "EXIT NOW" is displayed. Selection when "EXIT NOW" is displayed results in the creation of a provisional flight plan with an immediate Direct-To the waypoint following the Hold.

1R **Hold Speed Target**. This Data field displays the hold speed (CAS). The default display is the best hold speed computed by the Performance function if available. Otherwise, "170KT" is displayed.

NOTE

- Best hold speed is computed as best endurance + 10 knots or Vs (30° bank) + 25 knots when applicable.
- This "170KT" is also assumed to be the groundspeed for the HOLD until the aircraft is active in the Hold when the Performance function is not available. Changes to the Hold speed when the Performance function is not available are accepted but do not change the groundspeed for the Hold. Once the aircraft is active in the Hold, the current groundspeed is used regardless of whether or not the Performance function is available.

When active in Hold, the Hold Speed Target is displayed and is propagated to the active waypoint on the LEGS 2/X page and vice versa. Prior to activation entries of this page are not propagated to the legs pages nor are entries of speed constraints on legs pages propagated to the HOLD page.

If the display is in large font, deletion will result in display of the default both on this page and, if active in HOLD, on the LEGS 2/X page. Otherwise, delete is non-operational.

2R **Hold Time Available.** This data field displays holding time available (in Hrs+Min) before an exit is required in order to reach the destination with fuel overhead specified on the PERF INIT page.

3R **FIX ETA**. Displays the ETA of the next fix crossing if an Expect Further Clearance (EFC) Time has not been entered in 5R. If an EFC Time has been entered in 5R, 3R displays the last possible fix crossing time prior to the EFC.

4R **Holding Pattern Entry type and course.** These fields display the holding pattern's entry type and course into the holding pattern. Default display is determined by the aircraft track (when the Hold is the next leg, along track distance to go to the Hold fix is less than 25nm. Holding pattern inbound course and turn direction are displayed in 3L.

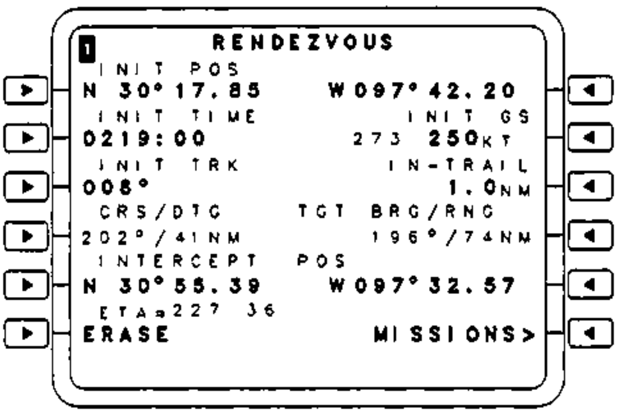
5R **Expect Further Clearance Time.** Displays the Expect Further Clearance (EFC) Time. This is the estimated time the aircraft is expected to leave the holding pattern as assigned by ATC. If the display in 3R is in large font, delete will result in display of the default.

6R **Delete Hold/Exit Arm/Deleted.** If active in the Hold Pattern, "EXIT ARM" will be displayed. Selection when "EXIT ARM" is displayed will result in displaying "EXIT ARMED" and the creation of a provisional flight plan where the hold pattern will be exited at the next fix crossing.

Otherwise, "DELETE HOLD" is displayed. Selection when "DELETE HOLD" is displayed results in 1L through 5L, and 1R through 5R displaying blanks, with 6R displaying "DELETED" and deletion of the Hold if the title displays blanks or "MOD" or creation of a provisional in which the hold has been deleted if the title displays "ACT".

RENDEZVOUS Page.

The RENDEZVOUS page allows definition of a target's position, time, ground speed, track and in-trail distance, and then computes an intercept position and time with the target, the course and distance to the intercept position, and the target's current bearing and range.



D3193601 A

Figure 1-66. RENDEZVOUS

The RENDEZVOUS page is displayed when any of the following conditions are satisfied.

1. Selection of the Rendezvous prompt on the MISSIONS page. If access to the MISSIONS page was from the WAYPOINT DATA page, then the Rendezvous waypoint will be inserted in the route following the waypoint associated with the WAYPOINT DATA page on which the MFP prompt was selected.

2. Selection of the MFP prompt on the WAYPOINT DATA 1/2 page when the waypoint type is RNDZ.

3. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the RENDEZVOUS page.

4. Selection of the return prompt on the CUSTOM DATA page when the CUSTOM DATA page was accessed from the RENDEZVOUS page.

If the route is active, "ACT" is displayed in the page title. If the route is provisional, then "MOD" is displayed. The title will also display the Rendezvous number corresponding to the selected Rendezvous, 1-5.

1L **Target's Initial Position.** This data field displays the target's initial position. If more than one waypoint with the entered identifier exists in the databases (Navigation and Custom), the NP will branch to the WAYPOINT SELECT page where a waypoint is selected. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint to determine the target's initial position. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

2L **Target's Initial Time.** This data field displays the target's time at the initial position.

3L **Target's Initial Track.** This data field displays the target's track at the initial position. Delete results in the data field returning to its default data. Selection is non-operational.

4L **Course and Distance to Intercept Position.** When the intercept position has not been calculated, these two data fields are blank. When the intercept position has been calculated, these two data fields will display the course and distance to the intercept position.

5L **Intercept Position.** When the intercept position has not been calculated, this data field will be blank. When the intercept point has been calculated, the intercept position's latitude and longitude will be displayed. Selection of 5L when a latitude and longitude is being displayed will result in the LAT/LONG being placed in the scratch pad.

6L **Intercept Position ETA/Erase.** When the intercept position has not been calculated, the data field to the right of "ETA =" will be blank. When the intercept position has been calculated, this data field displays the ETA to the intercept position. "ERASE" will be displayed in a large font if the route that contains the Rendezvous is provisional. Selection of the ERASE prompt results in the provisional Rendezvous data being erased. If the resulting route does not contain the Rendezvous number that is displayed in the page title, a branch will be executed to the page that resulted in the RENDEZVOUS page being displayed.

1R **Non-operational.**

2R **Target's Initial Ground Speed.** This data field displays the target's ground speed at the initial position.

3R **In-Trail Distance.** This data field displays the In-Trail distance of the target and the intercept position will be computed.

4R **Current Bearing and Distance to Target.** When the target's current position is not known, the bearing and range data fields are blank. When the target's current position is known, the current bearing and range to the target will be displayed. When the range to the target is greater than 999NM, the distance field will display "***nm."

5R **Non-operational.**

6R **Return Branch.** This data field displays a branch to the page that resulted in the rendezvous page to be displayed, either LEGS 1, LEGS 2, or MISSIONS. If the RENDEZVOUS page was displayed via the WAYPOINT DATA page, this data field will display either LEGS 1 or LEGS 2. Selection results in a branch to the particular LEGS page where the rendezvous is displayed or to the MISSIONS page.

LANDING ZONE INIT 1/2 Page.

The LANDING ZONE INIT 1/2 page is displayed when any of the following conditions are satisfied.

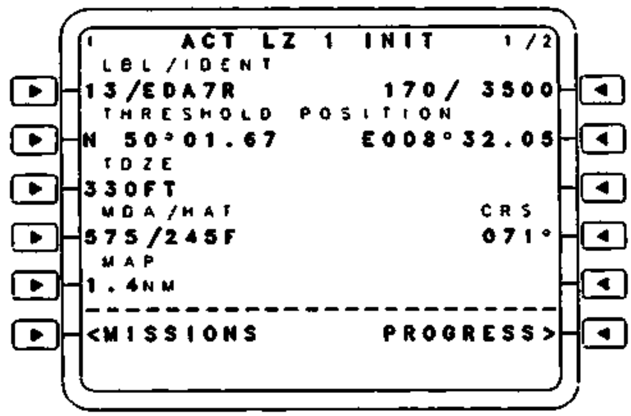
1. Selection of the MFP prompt on the WAYPOINT DATA page when the Waypoint Type is LZ.

2. Selection of the LZx INIT prompt on the MISSIONS page. If access to the MISSIONS page was from the WAYPOINT DATA pages, then the Waypoint Identifier and Waypoint Position from the WAYPOINT DATA page will be displayed. If access to the Missions page was not from the MFP prompt on the WAYPOINT DATA pages and the LZ was not previously defined, then 1L and 2L data fields will display the default. If access to the MISSIONS page was not from the MFP on the WAYPOINT DATA pages and the LZ was previously defined, then these two data fields as well as all other data fields, on the LZx INIT pages, will display the previously defined data.

3. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the LANDING ZONE INIT 1/2 page results in display of the LANDING ZONE INIT page.

4. Selection of the return prompt on the CUSTOM WAYPOINT page when the CUSTOM WAYPOINT page was accessed from the LANDING ZONE INIT 1/2 page results in display of the LANDING ZONE INIT page.

If the route associated with the Landing Zone is inactive, the data field to the left of LZ in the title is blanked. If the route is provisional, then "MOD" will be displayed in this data field. Otherwise, the route is active and "ACT" is displayed in the page title as shown below. The Landing Zone Number corresponding to the selected Landing Zone will also be displayed in the title.



D3193701 A

Figure 1-67. LANDING ZONE INIT 1/2

1L **Landing Zone Identifier.** This data field displays the Waypoint Label and Waypoint Identifier associated with the Landing Zone displayed in the title. Entry of the LZ Identifier will be in the form of Position.

Valid Place/Bearing/Distance, PBPB, Lat/Long, or MGRS entries will result in the creation of the Waypoint Identifier using the route associated with the LZ.

Valid waypoint entries that are not contained in a database will result in a branch to the CUSTOM DATA page. Upon return from the CUSTOM DATA page with a waypoint defined, the NP will use the waypoint to define 1L and 2L data fields. Upon return from the CUSTOM DATA page when the waypoint is not defined, the NP will display the entry in the scratch pad and in 1L data field. Valid waypoint entries that are contained in a database will result in the display of the entered identifier into this data field and the waypoint's latitude/longitude displayed in 2L data field.

If more than one waypoint with the entered identifier exists in the databases, the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page, the NP will use the selected waypoint to define 1L and 2L data fields. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

2L **Threshold Position.** The Latitude/Longitude of the threshold position associated with the LZ is displayed in this data field.

3L **Touchdown Zone Elevation (TDZE).** This data field displays the runway or LZ touchdown zone elevation (TDZE). Valid entries are displayed. The runway elevation from the Nav DB is displayed if the LZ is associated with a runway.

4L **MDA/HAT.** This data field displays the MDA elevation followed by small font "FT". The HAT elevation is preceded by a small font "/" and followed by a small font "FT". Leading zeros and blanks are not displayed, with MDA and HAT data fields concatenated. The MDA data field displays box prompts for a default, and the HAT data field displays dashes for a default. Entry of a MDA results in the MDA being displayed, and the HAT is then computed and displayed as MDA - TDZE. Entry of HAT results in the HAT being displayed, and the MDA is then computed and displayed as HAT + TDZE. Entry of both HAT and MDA results in the display of the "INVALID ENTRY" message.

5L **Missed Approach Point.** This data field displays a valid entered MAP distance in nautical miles. Data field defaults to box prompts.

6L **Erase/Branch to calling page.** This data field displays "ERASE" if the flight plan that contains this Landing Zone is provisional. Otherwise, this data field displays a branch to the page that resulted in the LZ INIT page to be displayed (either LEGS, MISSIONS, or DEP/ARR). If the LZ INIT page was displayed via the WAYPOINT DATA page, this data field will display "< LEGS x", where x is the route (1 or 2) of the associated waypoint.

If the flight plan does not contain the Landing Zone number displayed in the page title, a branch will be executed to the page that resulted in the LZ INIT page to be displayed.

Selection when a branch is displayed results in a branch to the displayed page. The Legs page displayed will contain the Landing Zone number indicated in the page title.

1R-3R **Non-operational.**

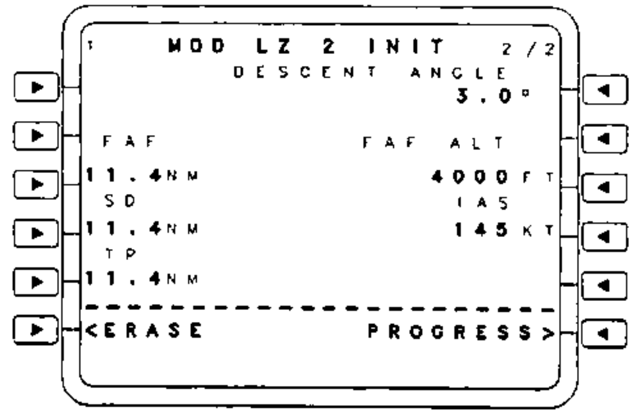
4R **LZ Inbound Course.** This data field displays the LZ's inbound course. Data field defaults to Runway (RWY) heading (from NDB if approach is to an NDB airport runway, otherwise to box prompts). Entered values are displayed in large font and default values in small font.

5R **Non-operational.**

6R **Branch to PROGRESS page.** Data field displays "PROGRESS >" when the LZ is in the flight plan. Selection results in display of the PROGRESS 1 page.

LANDING ZONE INIT 2/2 Page.

The LANDING ZONE INIT 2/2 page is accessed by pressing the PREV or NEXT page mode key from the LANDING ZONE INIT 1/2 page.



D3193801

Figure 1-68. LANDING ZONE INIT 2/2

1L-2L **Non-operational.**

3L **FAF Distance.** This data field displays a valid entered or computed FAF distance. Data field defaults are to box prompts. A valid entry that replaces an entered or computed data in the data field will result in the 1R data field (Descent Angle) and 3R data field (FAF Altitude) being replaced with their default value.

4L **Slowdown Distance.** This data field displays the slowdown distance. The slowdown distance defaults to FAF distance, if it is valid, or displays box prompts otherwise. Entries are displayed in a large font.

5L **Turn Point Distance.** Data field displays the Turn Point Distance. The turn point distance defaults to FAF distance, if it is valid, or displays box prompts otherwise. Entries are displayed in a large font.

6L **Branch to calling page.** Data field displays **ERASE** if the flight plan that contains this Landing Zone is provisional. Otherwise, this data field displays a branch to the page that resulted in the LZ INIT 1/2 page to be displayed (either LEGS, MISSIONS, or DEP/ARR). If the LZ INIT 1/2 page was displayed via the WAYPOINT DATA page, this data field will display "< LEGS x", where x is the route (1 or 2) of the associated waypoint.

If the flight plan does not contain the Landing Zone number displayed in the page title, a branch will be executed to the page that resulted in the LZ INIT page to be displayed.

Selection when a branch is displayed results in a branch to the displayed page. The Legs page displayed will contain the Landing Zone number indicated in the page title data field.

1R **Descent Angle.** Data field displays a valid entered or computed Descent Angle. Data field defaults to box prompts. A valid data entry that replaces existing entered or computed data in this data field will result in the FAF Distance and FAF Altitude data fields being replaced with their default value. Computed/default values are displayed in a small font and entered values are displayed in a large font. An out-of-range data entry will result in the "INVALID ENTRY" message. Delete results in the displayed data in field 4 being replaced with the default value.

2R **Non-operational.**

3R **FAF Altitude.** This data field displays a valid entered or computed FAF altitude. Data field defaults to box prompts.

4R **LZ IAS.** This data field displays the IAS to be flown from slowdown to touchdown.

5R **Non-operational.**

6R **Branch to PROGRESS page.** This data field displays "PROGRESS >" when the LZ is in the flight plan. Selection results in display of the PROGRESS 1 page.

CARP Structure.

IP **Initial Point.** The point in the flight plan that precedes the computed slowdown point is designated as the "CARP defined IP", and will be assigned a speed/altitude constraint.

NOTE

The altitude constraint will always display a descent regardless of aircraft altitude in relation to predrop altitude.

SD **Slowdown Distance.** This point consists of either a pilot-entered distance from the CARP INIT page or the default distance, at 0 wind and 0 time difference. The slowdown distance is continuously adjusted based upon: winds, required altitude change, and ahead or behind time to determine the actual slowdown distance when a TOT is entered for the CARP. The limitations are 40 knots for wind adjustment and 90 seconds for time adjustment.

This distance is located on the CARP PROGRESS page. Pilot entry is not allowed on the CARP PROGRESS page.

TP **Turn Point.** The point at which the aircraft is expected to be on the in-bound course to the drop zone and the CDI scaling to NPA. The TP will not necessarily have a speed or altitude constraint.

CARP **Computed Air Release Point.** The point at which the aircraft is at the inflight ballistic release coordinates. Waypoints may exist between the defined IP and the TP. The defined IP is the Nav Processor generated geographic point along the programmed route of flight whereby the aircraft slowdown calculation assumes that the aircraft is at the programmed pre-drop altitude and 230 KIAS. The CARP has a drop speed and drop altitude constraint.

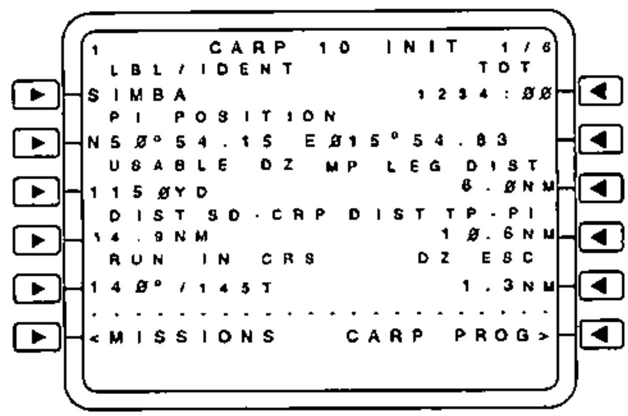
DZESC **Drop Zone Escape.** The point at which the CARP run is terminated.

Waypoints may exist between the defined IP and the TP. The following criteria will be imposed on any such waypoints:

1. Constraints are not allowed.
2. Direct-to is not allowed.
3. Hold or PPOS is not allowed.
4. Delete and insertion are not allowed after the defined IP becomes active.

CARP INIT 1/6 Page.

The CARP INIT 1/6 page describes the physical description of the CARP drop zone. The CARP INIT 1/6 page is displayed when any of the following conditions are satisfied.



D3193901 D

Figure 1-69. CARP INIT 1/6

1. Selection of the MFP prompt on the WAYPOINT DATA page when the Waypoint Type is CARP.

2. Selection of the CARPx INIT prompt on the MISSIONS page. If access to the MISSIONS page was from the WAYPOINT DATA page, then the Waypoint Identifier and Waypoint Position from the WAYPOINT DATA page will be displayed for the Drop Zone Identifier and Point of Impact Position. If access to the Missions page was not from the MFP prompt on the WAYPOINT DATA pages and the CARP was not previously defined, then 1L and 2L data fields will display their defaults. If access to the MISSIONS page was not from the MFP on the WAYPOINT DATA pages and the CARP was previously defined, then these two data fields as well as all other data fields on the CARPx INIT pages will display the previously defined data.

3. Selection of the PREV PAGE from the CARP INIT 2/6 page.

4. Selection of the NEXT PAGE from the CARP INIT 6/6 page.

5. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the CARP INIT 1 page.

6. Selection of the return prompt on the CUSTOM WAYPOINT page when the CUSTOM WAYPOINT page was accessed from the CARP INIT 1 page.

If the route is active, then "ACT" will be displayed in the title. If the route is provisional (including changes to the CARP data), then "MOD" will be displayed in the title. Otherwise, the route associated with the CARP is inactive and "ACT" and "MOD" will not be displayed. The title will also display the CARP Number corresponding to the selected CARP.

1L **Drop Zone Identifier.** This data field displays the Waypoint Label and Waypoint Identifier associated with the Airdrop displayed in the title line. Entry of the Drop Zone Identifier will be in the form of Position. Entries that do not follow the Position format will result in the "INVALID ENTRY" message. Valid Place/Bearing/Distance, Place/Bearing/Place/Bearing, Latitude/Longitude, or MGRS entries will result in the creation of the Waypoint Identifier using the route associated with the CARP.

Valid waypoint entries that are not contained in a database will result in a branch to the CUSTOM DATA page. Upon return from the CUSTOM DATA page with a waypoint defined, the NP will use the waypoint to define the 1L and 2L data. Upon return from the CUSTOM DATA page when the waypoint is not defined, the NP will display the entry in the scratch pad and in 1L data field. Valid waypoint entries that are contained in a database will result in the display of the entered identifier in the 1L data field and the waypoint's latitude/longitude being displayed in 2L data field. Entry of a waypoint which is not in the route results in the "WAYPOINT NOT FOUND" message. Entries which do not meet the entry format result in the "INVALID ENTRY" message.

If more than one waypoint with the entered identifier exists in the databases, the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the 1L and 2L data fields. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad. Selection and delete are non-operational.

2L **Point of Impact Position.** This data field displays the latitude/longitude of the Point of Impact (PI) position associated with the Airdrop displayed in the title line.

3L **Usable Drop Zone.** This data field displays the drop zone length associated with the Airdrop displayed in the title line. Usable DZ is the length from the PI to the Trailing Edge along the drop zone axis. Entry of the Usable DZ will be in yards.

4L **Distance Slowdown to CARP.** This data field displays the Distance Slow Down (SD) to CARP associated with the Airdrop displayed in the title line. Distance SD to CARP is the great circle distance from the SD to the computed CARP.

Default display of Distance SD to CARP is computed using Time Over Target Status, Wind, Drop Speed, and the Slow Down Tables.

Entry of Distance SD to CARP will be in nautical miles. Entries that do not follow the Distance (CARP) format will result in the "INVALID ENTRY" message. Deletion will result in the Distance SD to CARP being set to the default. Entries and updates displayed on this page will also update the CARP PROGRESS page.

5L **Run In Course.** The Run In Course defines the alignment of the drop zone axis. This data field displays the CARP Run In Course referenced to either magnetic (NNN" ") or grid north (NNN"G"). If the selected Heading Reference is set to MAG or TRUE, the left data field will display the Run In Course referenced to magnetic north (NNN"M"). If the selected Heading Reference is set to GRID, this data field will display the Run In Course referenced to grid (NNN"G"). The right data field displays the CARP Run In Course referenced to true north (NNN"T").

Entry of the Run In Course will be referenced to magnetic (NNN) or true (NNN"T" or "/"NNN) north.

6L **Erase/Return Branch.** This data field displays ERASE if the flight plan that contains this CARP is provisional. Otherwise, the data field displays a branch to the page that resulted in the CARP INIT 1/6 page to be displayed (either LEGS or MISSIONS page). If the CARP INIT 1/6 page was displayed via the WAYPOINT DATA page, the prompt will be to the Legs page.

Selection when the ERASE prompt is displayed results in the provisional being erased. If the resulting flight plan does not contain the CARP number displayed in the title line, a branch will be executed to the page that resulted in the CARP INIT page to be displayed.

Selection when a branch is displayed results in a branch to the displayed page. The route/legs page displayed will contain the CARP number indicated in the title line.

1R Desired Time Over Target. This LSK data field displays the Time Over Target (TOT) associated with the Airdrop displayed in the title line. Entry of the TOT will use the Time format. Entries that do not follow the Time format will result in the "INVALID ENTRY" message. Deletion will set the TOT field to its default and clear the time over target at the CARP waypoint. Selection is non-operational.

2R Non-operational.

3R MP LEG DIST. The distance prior to the CARP at which the aircraft will roll inbound on a multi pass CARP. Entry will be in nautical miles. Deletion when an entered value is present results in display of the default. The default is 6.0 NM.

4R Distance Turn Point to Point of Impact. This LSK data field displays the Distance Turn Point (TP) to Point of Impact (PI) associated with the Airdrop displayed in the title line. Distance TP to PI is the great circle distance from the TP to the entered PI. Entry of Distance TP to PI will be in nautical miles.

5R Drop Zone Escape Distance. This data field displays the Drop Zone Escape Distance associated with the Airdrop displayed in the title line.

The Drop Zone Escape Distance defines the distance from Red Light to the DZ ESC waypoint. Entry of the Drop Zone Escape Distance will be in nautical miles.

6R Branch to CARP PROGRESS page.

CARP INIT 2/6 Page.

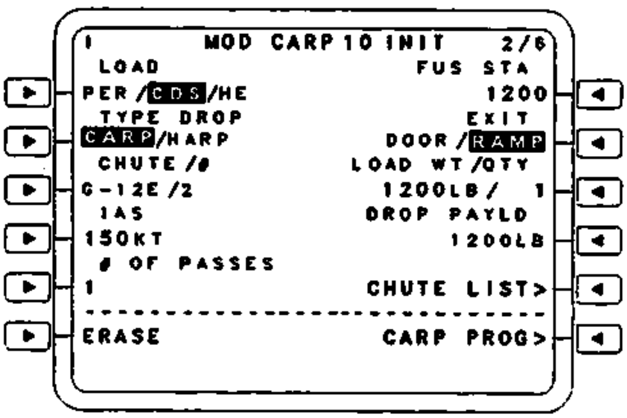
The CARP INIT 2/6 page describes the payload to be dropped. The CARP INIT 2/6 page is displayed when any of the following conditions are satisfied.

1. Selection of the PREV PAGE from the CARP INIT 3/6 page.

2. Selection of the NEXT PAGE from the CARP INIT 1/6 page.

3. Selection of the CARP prompt on the CHUTE LIST page when the CHUTE LIST page was accessed from the CARP INIT 2/6 page.

If the route is active, then "ACT" will be displayed in the title line. If the route is provisional (including changes to the CARP data), then "MOD" will be displayed. Otherwise, the route associated with the CARP is inactive and the title will be blank. The title will also display the CARP Number corresponding to the selected CARP.



D3194001 A

Figure 1-70. CARP INIT 2/6

1L **CARP Payload Type.** This data field provides a means of selecting or controlling the CARP Payload Type. In the left position (PER), the CARP Payload Type will be set to Personnel. In the center position (CDS), the CARP Payload Type will be Container Delivery System. In the right position (HE), the CARP Payload Type will be set to Heavy Equipment.

Selection of the CARP Payload Type when the CARP solution is in the flight plan is non-operational. Selection of the CARP Payload Type when the CARP solution is not in the flight plan will operate as a normal switch. If the Parachute Identifier in the 3L data field is not valid for the selected Payload Type, then 3L data field (Parachute Identifier) will be set to its default.

2L **Type Drop.** This data field will provide a switch for controlling the Number of Stages associated with the Airdrop displayed in the title line. The Number of Stages is the number of separate drift effect vectors used in the airdrop calculation. If CARP is selected, the airdrop will be defined using a single stage calculation. If HARP is selected, the airdrop will be defined using a two-stage calculation.

3L **Parachute Identifier and Number of Parachutes.** This data field contains two elements associated with the airdrop. The Parachute Identifier and the Number of Parachutes attached to an element are displayed. The Parachute Identifier will be one of the parachutes defined in the Chute List.

Valid entries are of the form Parachute Identifier, Parachute Identifier/Number of Parachutes, and Number of Parachutes. Entering a Parachute Identifier that is defined in the Chute List for the given payload will result in the data fields on the CARP INIT 5/6 page, including crew specified data, being replaced with the ballistic database values. If the Parachute Identifier is not defined in the Chute List for the Payload Type, then the NP will branch to the CHUTE LIST page.

When CARP Payload Type is PER, this data field will default to "T-1OC/1". When CARP Payload Type is CDS or HE, this data field will default to "G-12E/2".

4L **Drop Speed.** This data field displays the Drop Speed associated with the Airdrop displayed in the title line. When the CARP Payload Type is CDS or HE, the Drop Speed will default to 150 knots. When the CARP Payload Type is PER, the Drop Speed will default to 130 knots. Entry of the Drop Speed will be in the form defined by Speed, IAS. Deletion will result in the Drop Speed being set to the default.

5L **Number of Passes.** This data field displays the number of passes over the CARP for the Airdrop displayed in the title line. Entries of a number from 1 to 9 will result in the Number of Passes being set to the entered value. Deletion when Number of Passes is displayed in large font will result in the Number of Passes being set to the default.

6L **Erase/Return Branch.** This data field will display "ERASE" if the flight plan that contains this CARP is provisional. Otherwise, a branch to the page that resulted in the CARP INIT 1/6 page to be displayed (either LEGS or MISSIONS page) will be displayed. If the CARP INIT 1/6 page was displayed via the WAYPOINT DATA page, the prompt will be to the Legs page.

Selection when the ERASE prompt is displayed results in the provisional being erased. If the resulting flight plan does not contain the CARP number displayed in the title line data field, a branch will be executed to the page that resulted in the CARP INIT page to be displayed.

1R **Fuselage Station.** When the CARP Payload Type is CDS or Heavy Equipment, these two data fields will display the Fuselage Station Title and Fuselage

Station, respectively. These data fields will be blank when the CARP Payload Type is Personnel (PER).

When the "FUS STA" title is displayed, a valid Fuselage Station entry can be made into the data field. Entries that do not follow the Fuselage Station format will result in the "INVALID ENTRY" message.

When the "FUS STA" title is displayed, deletion of the Fuselage Station entry will result in this data field being set to its default. When the "FUS STA" title is not displayed, deletion of the Fuselage Station entry is non-operational. Default value for the entry data field is "□□□□□" when CARP Payload Type is CDS or HE.

2R **Exit Location.** This data field provide a means of selecting the Exit Location. One of two selections can be made, DOOR or RAMP, which will indicate the exit location of the load to be dropped. When CARP Payload Type is PER, "DOOR" will be the default selection. When CARP Payload Type is CDS or HE, "RAMP" will be the default selection.

3R **Load Weight/Load Quantity.** This data field displays the Load Weight followed by the Load Quantity associated with the Airdrop displayed in the title line.

Valid entries are of the form Load Weight, Load Weight/Load Quantity, and Load Quantity.

4R **Drop Payload.** This data field displays the computed or entered Drop Payload associated with the Airdrop displayed in the title line. Entered Drop Payload has priority over computed.

Valid entries are in pounds. The product of the Load Weight times the Load Quantity, when both are displayed, is displayed in this data field when a Drop Payload has not been entered.

The Drop Payload will contribute to the aircraft's Payload Weight. Deletion of the entered Drop Payload results in display of the computed Drop Payload, if available. Otherwise, deletion results in display of the default.

5R **Branch to CHUTE LIST page.**

6R **Branch to CARP PROGRESS page.**

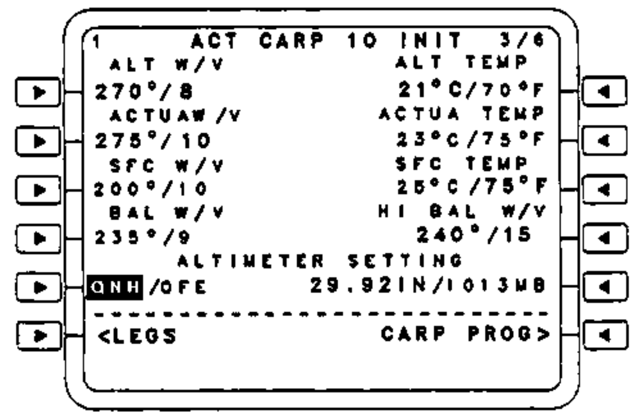
CARP INIT 3/6 Page.

The CARP INIT 3/6 page describes the meteorological data for the given airdrop. The CARP INIT 3/6 page is displayed when any of the following conditions are satisfied.

1. Selection of the PREV PAGE from the CARP INIT 4/6 page.

2. Selection of the NEXT PAGE from the CARP INIT 2/6 page.

If the route is active, then "ACT" will be displayed in the title line. If the route is provisional (including changes to the CARP data), then "MOD" will be displayed in title line. Otherwise, the route associated with the CARP is inactive and "ACT" or "MOD" will not be displayed. Also, the title line displays the CARP Number (10) corresponding to the selected CARP.



D3194101B

Figure 1-71. CARP INIT 3/6

1L **Drop Altitude Wind.** This data field displays the Drop Altitude Wind Bearing and Speed associated with the Airdrop displayed in the title line. Entry of the Drop Altitude Wind will be in the form defined by Wind.

2L **Actuation Altitude Wind.** When the Type Drop is HARP, the Actuation Altitude Wind Title "ACTUA W/V" is displayed. When the Type Drop is CARP, this data field is blank.

When "ACTUA W/V" title is displayed, the Actuation Altitude Wind Bearing and Speed associated with the CARP displayed in the title line will be displayed below the ACTUA W/V title. When "ACTUA W/V" title is displayed, entry of the Actuation Altitude Wind will be in the form defined by Wind. When this data field is blank, entry is non-operational.

3L **Surface Wind.** This data field displays the Surface Wind Bearing, Speed, associated with the Airdrop displayed in the title line. Entry of the Drop Altitude Wind will be in the form defined by Wind. For entries that do not follow the Wind, format will result in the "INVALID ENTRY" message.

4L **Low Ballistic Wind/Ballistic Wind.** The Low Ballistic Wind is the vector average of the Actuation

Altitude Wind and the Surface Wind used in two-stage drops. Ballistic Wind is the vector average of the Drop Altitude Wind and the Surface Wind used in single-stage drops.

When the Type Drop is HARP, this data field displays the Low Ballistic Wind Title "LO BAL W/V". When the Type Drop is CARP, "BAL W/V" is displayed.

When "LO BAL W/V" is displayed, the Low Ballistic Wind Bearing and Speed associated with the CARP displayed in the title line will also be displayed. When "BAL W/V" is displayed, the Ballistic Wind Bearing and Speed associated with the CARP displayed in the title line will also be displayed.

Entry of the Low Ballistic Wind or Ballistic Wind will be in the form defined by Wind. Entry of a Low Ballistic Wind or Ballistic Wind will override the vector average computed by the NP.

When the computed vector average wind is available and a Low Ballistic Wind or Ballistic Wind is specified, deletion of the 4R data will result in the NP computed vector average to be used for the Low Ballistic Wind or Ballistic Wind.

5L **Altimeter Reference.** This field provides a means of selecting the Altimeter Reference, QNH/QFE. In the QNH position, the pressure displayed is referenced to QNH. In the QFE position, the pressure displayed is referenced to QFE. An altimeter placed on the Point of Impact and referenced to QNH will indicate the Point of Impact Elevation. An altimeter placed on the Point of Impact and referenced to QFE will indicate zero.

Selection of QNH or QFE will result in the displayed Barometric Pressure to be referenced to the new Altimeter Reference using the Point of Impact Elevation. If the data required to compute the new Altimeter Reference has not been defined, then the Barometric Pressure data field will display dashes.

6L **Erase/Return Branch.** This field displays ERASE if the flight plan that contains this CARP is provisional. Otherwise, a branch to the page that resulted in the CARP INIT page to be displayed (either LEGS or MISSIONS page) will be displayed. If the CARP INIT page was displayed via the WAYPOINT DATA page, the prompt will be to the LEGS page.

Selection when the ERASE prompt is displayed results in the provisional being erased. If the resulting flight plan does not contain the CARP number displayed in the title line, a branch to the page that resulted in the CARP INIT page to be displayed.

1R **Drop Altitude Temperature.** This data field displays the Drop Altitude Temperature associated with the Airdrop displayed in the title line. The temperature is displayed in both Celsius and Fahrenheit.

Entry of the Drop Altitude Temperature will be in the form defined by Temperature. Entry of temperature in one unit will result in the calculation of the equivalent value in the other unit.

2R **Actuation Altitude Temperature.** This data field displays the Actuation temperature title "ACTUA TEMP" and the Actuation Altitude Temperature associated with the HARP displayed in the title line. The temperature is displayed in both Celsius and Fahrenheit.

Entry of the Actuation Altitude Temperature will be in the form defined by Temperature. Entry of temperature in one unit will result in the calculation of the equivalent value in the other unit.

3R **Surface Temperature.** This data field displays the Surface Temperature associated with the Airdrop displayed in the title line. The temperature is displayed in both Celsius and Fahrenheit.

Entry of the Surface Temperature will be in the form defined by Temperature. Entry of temperature in one unit will result in the calculation of the equivalent value in the other unit.

4R **HI Ballistic Wind.** The HI Ballistic Wind is the vector average of the Drop Altitude Wind and the Actuation Altitude Wind used in two stage drops. When the Type Drop is a HARP, this data field displays the HI Ballistic Wind Title "HI BAL W/V". When the Type Drop is CARP, this data field is blank.

When the title "HI BAL W/V" is displayed, the HI Ballistic Wind Bearing and Speed associated with the CARP displayed in the title line will also be displayed in this data field. When the title "HI BAL W/V" is not displayed, the Ballistic Wind Bearing and Speed data field will be blank.

Entry of the HI Ballistic Wind will be in the form defined by Wind. Entry of a HI Ballistic Wind will override the vector average computed by the NP.

When the computed vector average wind is available and a HI Ballistic Wind is specified, deletion of the 4L data field will result in the NP computed vector average to be used for the HI Ballistic Wind.

5R **Altimeter Setting.** This data field displays the Altimeter Setting associated with the Airdrop displayed in the title line. The barometric pressure is displayed in both inches Hg and millibars.

Entry of the Altimeter Setting will be in the form defined by Barometric Pressure. Entry of barometric pressure in one unit will result in the calculation of the equivalent value in the other unit.

6R **Branch to CARP PROGRESS page.**

CARP INIT 4/6 Page.

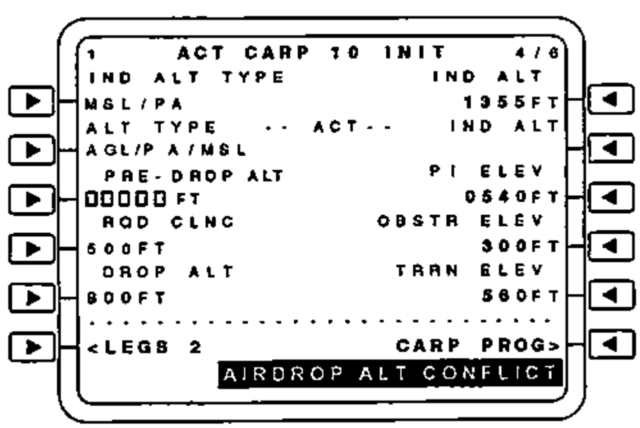
The CARP INIT 4/6 page describes the altitudes and elevations used in the CARP. The page has two forms for single-stage and two-stage airdrops. The CARP INIT 4/6 page is displayed when any of the following conditions are satisfied.

1. Selection of the PREV PAGE from the CARP INIT 5/6 page.

2. Selection of the NEXT PAGE from the CARP INIT 3/6 page.

If the route is active, then "ACT" will be displayed in the title line. If the route is provisional (including changes to the CARP data), then "MOD" will be displayed. Otherwise, the route associated with the CARP is inactive and this data field will be blank. The title line also displays the CARP Number corresponding to the selected CARP.

When Type Drop is CARP, the Indicated Altitude will be the greater of the Minimum Chute Altitude and the Minimum Obstruction Clearance Altitude. The Minimum Chute Altitude will be the sum of the pressure and temperature compensated Drop Altitude, and the Terrain Elevation.



D3194201 F

Figure 1-72. CARP INIT 4/6

1L Indicated Altitude Type. When the Type Drop is HARP, the title for this data field displays the Indicated Altitude Type Title "IND ALT TYPE". Otherwise, blanks are displayed. When the TYPE DROP is CARP, the data field adjacent to this LSK will be blank.

When TYPE DROP is HARP, the data field adjacent to 1L will provide a switch for controlling the Indicated Altitude Type. In the MSL position, the Indicated Altitude will be based on a QNH altimeter setting. In the PA position, the Indicated Altitude will be based on a QNE (29.92) altimeter setting.

2L **Actuation Altitude Type.** When the Type Drop is HARP, this data field displays the Actuation Altitude Title "ALT TYPE—ACT—IND ALT".

When the Type Drop is HARP, 2L data field will provide three selections (AGL, PA, and MSL) for controlling the Actuation Altitude Type. In the AGL position, the Actuation Altitude will be based on a QFE altimeter setting. In the PA position, the Actuation Altitude will be based on a QNE (29.92) altimeter setting. In the MSL position, the Actuation Altitude will be based on a QNH altimeter setting.

3L **PRE-DROP ALT.** The pre-drop altitude is altitude at which the aircraft will fly from the CARP defined IP to the point at which the aircraft begins a climb or descent to the drop altitude. When the type drop is HARP, 3L will be blank and non-operational.

4L **Required Obstruction Clearance.** The Required Clearance is the minimum clearance that must be maintained above the obstruction elevation. When the Type Drop is CARP, the Required Clearance Title "RQD CLNC" is displayed along with the Required Clearance associated with the CARP displayed in the title line. When the Type Drop is HARP, both data fields are blank. When the Type Drop is CARP, entry of the Required Clearance will be in the form defined by Elevation.

5L **Drop Altitude.** The Drop Altitude is the minimum altitude required to assure full parachute deployment before the load impacts the ground. When the Type Drop is CARP, the Drop Altitude Title "DROP ALT" and the Drop Altitude will be displayed. When the Type Drop is a HARP, these two data fields are blank.

When the Type Drop is CARP, entry of the Drop Altitude will be in the form defined by Elevation. When the Type Drop is CARP, deletion will result in the Drop Altitude being set to the default.

6L **Erase/Return Branch.** This field displays ERASE if the flight plan that contains this CARP is provisional. Otherwise, a branch to the page that resulted in the CARP INIT page to be displayed (either LEGS or MISSIONS page) is displayed. If the CARP INIT page was displayed via the WAYPOINT DATA page, the prompt will be to the Legs page.

Selection when the ERASE prompt is displayed results in the provisional being erased. If the resulting flight plan does not contain the CARP number displayed in the title line, a branch will be executed to the page that resulted in the CARP INIT page to be displayed. Selection when a branch is displayed results in a branch to the displayed page. The legs page displayed will contain the CARP number indicated in the title line.

1R **Indicated Altitude.** This field displays the computed (only for TYPE DROP = CARP) or entered Indicated Altitude associated with the Airdrop displayed in the title line. The Indicated Altitude Type selected on 1L defines the reference for the Indicated Altitude displayed when TYPE DROP is HARP. If the required data for the computed Indicated Altitude is not available, then the data field associated with this LSK will display dashes.

Deletion of the entered Indicated Altitude when the computed Indicated Altitude is available will result in the Indicated Altitude being set to the computed Indicated Altitude.

2R **Actuation Indicated Altitude.** When the Type Drop is HARP, this LSK data field displays the Actuation Indicated Altitude associated with the HARP displayed in the title line. The Actuation Indicated Altitude is referenced to the Actuation Altitude Type selected on 2L. If the required data is not available, then this data field will display dashes.

When the Type Drop is HARP, entry of the Actuation Indicated Altitude will be in the form defined by Altitude.

3R **Point of Impact Elevation.** The Point of Impact Elevation associated with the Airdrop displayed in the title line will be displayed in this data field. The Point of Impact Elevation is measured in feet above mean sea level. Entry of the Point of Impact Elevation will be in the form defined by Altitude.

4R **Obstruction Elevation.** The Obstruction Elevation is the elevation above mean sea level of the obstruction that a minimum clearance must be maintained. When the Type Drop is CARP, the Obstruction Elevation Title "OBSTR ELEV" and the Obstruction Elevation associated with the CARP displayed in the title line will be displayed in this LSK data field.

When the Type Drop is CARP, entry of the Obstruction Elevation will be in the form defined by Altitude.

5R **Terrain Elevation.** The Terrain Elevation is the highest point on the drop zone measured in feet above mean sea level. When the Type Drop is CARP, the Terrain Elevation Title "TRRN ELEV" and the Terrain Elevation associated with the CARP displayed in the title line will be displayed in this data field. When the Type Drop is CARP, entry of the Terrain Elevation will be in the form defined by Altitude.

6R **Branch to CARP PROGRESS page.**

CARP INIT 5/6 Page.

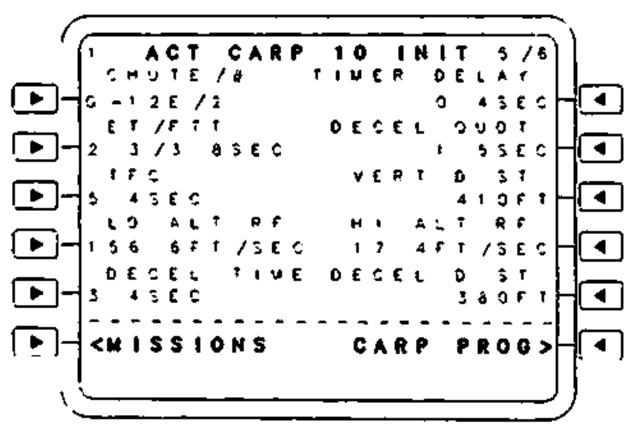
The CARP INIT 5/6 page displays the ballistic data associated with the Airdrop in the title line. The CARP INIT 5/6 page is displayed when any of the following conditions are satisfied.

1. Selection of the PREV PAGE from the CARP INIT 1/6 page.

2. Selection of the NEXT PAGE from the CARP INIT 4/6 page.

3. Selection of the CARP INIT prompt on the CHUTE LIST page.

If the route is active, then "ACT" will be displayed in the title data field. If the route is provisional (including changes to the CARP data), then "MOD" will be displayed in the title. Otherwise, the route associated with the CARP is inactive and the data field will be blank. The title data field also displays the CARP Number corresponding to the selected CARP.



D3194301

Figure 1-73. CARP INIT 5/6

1L **Parachute Identifier/Number of Parachutes.** This data field displays the identifier defining the parachute and the Number of Parachutes attached to an element. The Parachute Identifier will be one of the parachutes defined in the Chute List. When the parachute is defined in the Chute List and is appropriate for the payload defined by Payload Type, then the data displayed on this page is computed using the chute's ballistic data.

Valid entries are of the form Parachute Identifier, Parachute Identifier/Number of Parachutes, and Number of Parachutes.

Entering a Parachute Identifier either on this page or on CARP INIT 2/6 that is defined in the Chute List for the given payload will result in the data fields, including crew specified data, being replaced with the ballistic database values. Entering a Parachute Identifier that is not defined in the Chute List for the given payload will result in the CHUTE LIST page being displayed.

When CARP Payload Type is PER, this data field will default to "T-1OC/1". When CARP Payload Type is CDS or HE, this data field will default to "G-12E/2".

2L **Exit Time/Forward Travel Time.** Exit Time defines the elapsed time, in seconds, from the green light signal to the exit of the first element from the aircraft. Forward Travel Time is the sum of the Exit Time and the Deceleration Quotient. Forward Travel Time is computed when the Forward Travel Time is not entered and the Exit Time and Deceleration Quotient are available. This data field displays the Exit Time and Forward Travel Time associated with the Airdrop displayed in the title line.

Valid entries are of the form Exit Time or Forward Travel Time. Entry of the Exit Time when a Deceleration Quotient is available results in the Forward Travel Time being computed and displayed. Entry of the Exit Time when a Deceleration Quotient is not available results in the Forward Travel Time being set to dashes. A valid entry of Forward Travel Time results in the Exit Time and Deceleration Quotient data fields being set to dashes.

When these data fields display a crew entered value and ballistic database values for Exit Time and Deceleration Quotient are available, deletion will result in the entered Exit Time data being replaced by the ballistic database value and the Forward Travel Time data being replaced by the computed value.

3L **Time of Fall Constant.** Time of Fall Constant, defined in the ballistic database, compensates for the nonlinear rate of fall of the element. This data field displays the Time of Fall Constant associated with the Airdrop displayed in the title line. When the ballistic database value of Time of Fall Constant is not available and an entry to this data field has not been made, then this data field displays the default.

When a crew entered value is displayed and a ballistic database value for Time of Fall Constant is available, deletion will result in the crew entered value being replaced by the ballistic database value.

4L **Rate of Fall/Low Altitude Rate of Fall.** Rate of Fall, defined in the ballistic database, defines the vertical velocity, in feet per second, of the element under full canopy. Low Altitude (also referred to as Deployed) Rate of Fall, defined in the ballistic database, defines the vertical velocity, in feet per second, of the element under full canopy on a two-stage drop.

When the Type Drop is CARP, the Rate of Fall Title "RF" is displayed. When the Type Drop is HARP, the Low Altitude Rate of Fall Title "LO ALT RF" will be displayed.

When the Type Drop is a CARP, the Rate of Fall will be displayed under the title. When the ballistic database value of Rate of Fall is not available and an entry to this data field has not been made, then this data field displays the default "•••.•".

When the Type Drop is a HARP, the Low Altitude Rate of Fall is displayed. When the ballistic database value of Low Altitude Rate of Fall is not available and an entry to this data field has not been made, then this data field displays the default "••••".

When the data field displays a crew entered value and a ballistic database value for Rate of Fall (when Type Drop is CARP) or Low Altitude Rate of Fall (when Type Drop is HARP) is available, deletion will result in the crew entered value being replaced by the ballistic database value.

5L **Deceleration Time.** Deceleration Time, defined in the ballistic database, is the elapsed time from actuation until deployment. When the Type Drop is CARP, the two data fields associated with LSK 5L display blanks.

When the Type Drop is HARP, the Deceleration Time Title "DECEL TIME" and the Deceleration Time associated with the HARP shown in the title line will be displayed. When the ballistic database value of Deceleration Time is not available and a deceleration time entry has not been made, then the data field displays the default.

When the Deceleration Time data field displays a crew entered value and a ballistic database value for Deceleration Time is available, deletion will result in the crew entered value being replaced by the ballistic database value.

6L **Erase/Return Branch.** This data field displays ERASE if the flight plan that contains this CARP is provisional. Otherwise, a branch to the page that resulted in the CARP INIT page to be displayed (either LEGS or MISSIONS page) is displayed. If the CARP INIT page was displayed via the WAYPOINT DATA page, the prompt will be to the Legs page.

1R **Timer Delay.** Timer Delay is the time at actuation altitude where the parachute deployment is delayed. The Timer Delay is added to the Deceleration Time when computing the Deceleration Distance.

When the Type Drop is a CARP, the two 1R data fields are blank. When the Type Drop is a HARP, the Timer Delay Title "TIMER DELAY" is displayed. When the Type Drop is a HARP, the Timer Delay associated with the CARP number in the title line will be displayed under the title. When a Timer Delay Time has not been made, this data field displays the default.

When the Type Drop is a CARP, entry of 1R data field is non-operational. When the Type Drop is HARP, valid entries are of the form "Time". Deletion of the data field when the Type Drop is HARP will set the Timer Delay to the default.

2R **Deceleration Quotient.** Deceleration Quotient, defined in the ballistic database, is a time added to Exit Time to determine the Forward Travel Time. 2R field displays the Deceleration Quotient associated with the Airdrop displayed in the title line.

Valid entries are of the form Time and will override the ballistic database value. Entry of the Deceleration Quotient when an Exit Time is available results in the Forward Travel Time being computed. Entry of the Deceleration Quotient when an Exit Time is not available results in the Forward Travel Time being set to dashes.

When the field displays a crew entered value and a ballistic database value for Deceleration Quotient is available, deletion will result in the crew entered value being replaced by the ballistic database value and the Forward Travel Time being replaced by the computed value.

3R **Vertical Distance.** Vertical Distance is the distance the element descends after exiting the aircraft until reaching a stabilized condition. This data field displays the Vertical Distance associated with the Airdrop displayed in the title line. When the ballistic database value of Vertical Distance is not available and an entry into this data field has not been made, then this data field displays the default.

When the field displays a crew entered value and a ballistic database value for Vertical Distance is available, deletion will result in the crew entered value being replaced by the ballistic database value.

4R **High Altitude Rate of Fall.** High Altitude (also referred to as High Velocity) Rate of Fall defines the vertical velocity of the element under free fall on a two-stage drop. When the Type Drop is a CARP, the two data fields associated with 4R will display blanks. When the Type Drop is a HARP, the High Altitude Rate of Fall Title "HI ALT RF" is displayed.

When the Type Drop is a HARP, the High Altitude Rate of Fall time value is displayed. When the ballistic database value of High Altitude Rate of Fall is not available and a time entry has not been made, then the data field displays the default.

Valid entries are of the form Vertical Speed and will override the ballistic database value. When a crew entered value and a ballistic database value for High Altitude Rate of fall is available, deletion will result in the crew entered value being replaced by the ballistic database value.

5R **Deceleration Distance.** Deceleration Distance is the distance the element descends after exiting the aircraft until reaching a stabilized condition. When the Type Drop is a CARP, 5R data fields display blanks. When the Type Drop is a HARP, the Deceleration Distance Title "DECEL DIST" is displayed.

When the Type Drop is a HARP, the Deceleration Distance associated with the CARP displayed in the title line is displayed. When the ballistic database value of Deceleration Distance is not available and an entry into this data field has not been made, then this data field displays the default.

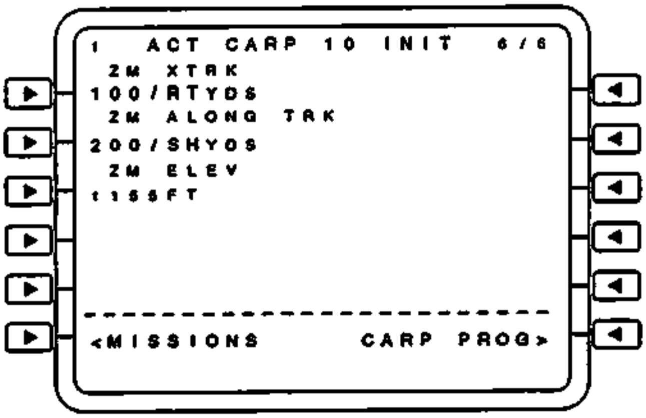
When a crew entered value and a ballistic database value for Deceleration Distance is available, deletion will result in the crew entered value being replaced by the ballistic database value.

6R **Branch to CARP PROGRESS page.**

CARP INIT 6/6 Page.

The CARP INIT 6/6 page displays the position data associated with the SKE ZM. The CARP INIT 6/6 page is displayed when either of the following conditions are satisfied.

1. Selection of the PREV PAGE from the CARP INIT 1/6 page.
2. Selection of the NEXT PAGE from the CARP INIT 5/6 page.



D3194401 A

Figure 1-74. CARP INIT 6/6

1L **Zone Marker Cross Track Distance and Direction.** This data field displays the Cross Track (XTRK) Distance between the Zone Marker (ZM) and the Point of Impact (PI) in yards. The data field also displays the direction, either right or left of the ZM relative to the PI from the Turn Point side of the CARP along the Run In Course. Valid entries are of the form Length (Yards), Length (Yards)/LT/RT Identifier, and LT/RT Identifier.

2L **Zone Marker Along Track Distance and Direction.** This data field displays the Along Track Distance between the Zone Marker (ZM) and the Point of Impact (PI) in yards. Also displayed is the direction, either short (SH) or long (LO) of PI from the Turn Point side of the CARP along the Run In Course. Valid entries are of the form Length (Yards), Length (Yards) / LT/RT Identifier, and LT/RT Identifier.

3L **Zone Marker Elevation.** This data field displays the elevation (MSL) of the Zone Marker. Valid entries are of the form Elevation.

4L-5L **Non-operational.**

6L **Erase/Return Branch.** This data field displays "ERASE" if the flight plan that contains this CARP is provisional. Otherwise, a branch to the page which resulted in the CARP INIT page to be displayed (either LEGS or MISSIONS page) is displayed. If the CARP INIT page was displayed via the WAYPOINT DATA page, the prompt will be to the LEGS page.

Selection when the ERASE prompt is displayed results in the provisional being erased. If the resulting flight plan does not contain the CARP number displayed in the title line, a branch will be executed to the page that resulted in the CARP INIT page being displayed. Selection when a branch is displayed results in a branch to the displayed page.

The legs page displayed will contain the CARP number indicated in the title line data field.

1R-5R **Non-operational.**

6R **Branch to CARP PROGRESS page.**

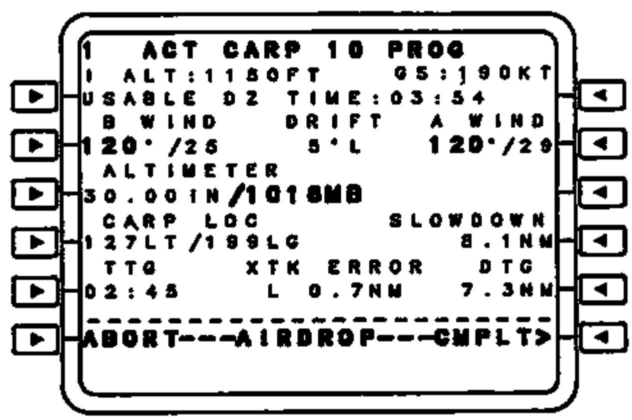
CARP PROGRESS Page.

CARP PROGRESS page displays current guidance and ballistic information on the current airdrop.

Display of the CARP PROGRESS page will occur when any of the following conditions are satisfied.

1. Selection of the CARP PROG prompt on the CARP n INIT pages.
2. Selection of the CARP prompt on the PROGRESS page 2/3 when the CARP is the next waypoint in the route.
3. Selection of the CARP PROG prompt on the CARP COMPLETE page.
4. Selection of the CARP PROG prompt on the MISSION page.

If the route is provisional, then "MOD" will be displayed in the title data field. Otherwise, the route is active and "ACT" is displayed in the page title. If the route associated with the CARP is inactive, this data field in the title line is blank. The data field between "CARP" and "PROG" in the title displays the CARP Number corresponding to the active CARP.



D3194501 A

Figure 1-75. CARP PROGRESS

1L **Indicated Altitude and Usable Drop Zone Time.** Indicated Altitude is the drop altitude in feet above Mean Sea Level. The Usable Drop Zone Time is the time of flight from the release point to the end of the drop zone. If the aircraft is between the release point (CARP) and the end of the drop zone, then the time is computed from the aircraft's present position.

This data field displays the Indicated Altitude used in the CARP computation. If the altitude is not available, then blanks are displayed.

The Usable Drop Zone Time in minutes and seconds are also displayed in this data field. If the time is not available, then blanks are displayed. Entry, selection, and delete are non-operational.

2L **Surface, Ballistic or Low Ballistic Wind.** This data field displays the Ballistic or Low Ballistic Wind in components of direction and velocity as entered on this page or as entered on CARP INIT 3/6. This data field displays the Surface Wind in components of direction and velocity as entered on this page or if a surface wind was entered on CARP INIT 3/6 and neither a Ballistic wind nor a Low Ballistic wind was entered on CARP INIT 3/6. Data entries will appear under a "WIND" title. If neither Ballistic, Low Ballistic, or Surface Wind are specified, this data field displays a default. Page entries will result in an update of the corresponding data on CARP INIT 3/6 and vice versa.

To the left of the "WIND" title will be displayed a "B" if a ballistic wind was entered on CARP INIT 3/6. An "L" is displayed if a low ballistic wind was entered on CARP INIT 3/6. An "S" will be displayed if no Ballistic or Low Ballistic wind entry was made on CARP INIT 3/6.

2LC **Drift Angle.** The 2L (center) data field displays the current drift angle in degrees. It also displays the direction of the drift angle right ("R") or left ("L") of the aircraft track. The angle in degrees and direction of the drift angle are displayed under the "DRIFT" title.

3L **Altimeter Setting.** This data field displays the Altimeter Setting associated with the CARP displayed in the title line. The barometric pressure is displayed in both inches Hg and millibars.

Entry of the Altimeter Setting will be in the form defined by Barometric Pressure. Entry of barometric pressure in one unit will result in the calculation of the equivalent value in the other unit. Entry of Altimeter Setting on CARP INIT 3/6 will result in an update of this line and vice versa.

4L **CARP Cross and Along Track Distance and Direction.** Two data fields are associated with this LSK. The left data field displays the Cross Track Distance in yards between the Point of Impact position and the CARP position relative to the Run In Course. Also displayed is the Cross Track Direction, right or left as viewed from the Slowdown point along the Run In Course, between the Point of Impact position and the CARP position.

Display field 16 displays the Along Track Distance in yards between the Point of Impact position and the CARP position along the Run In Course. Data field 17 displays the Along Track Direction, short or long, along the Run In Course, between the Point of IMPACT position and the CARP position. Short is defined as between the Slow Down position and point of impact. Long is defined as between the point of impact and the DZ Escape position.

5L **Time To Go.** Time To Go (TTG) is the time in minutes and seconds to reach the CARP location from the aircraft's present position along the route's predicted flight path. This data displays the Time To Go of the form Time, CARP. If the Time To Go is not available, then the data field displays blanks. If the Time To Go is greater than 59:59, then the data field displays 59:59.

5LC **Cross Track Error.** The 5LC (center) data field displays the Cross Track Error of the form Distance, NM. The range of the Cross Track Error is 0 to 20.0 nautical miles. If the aircraft is to the left of the predicted ground track, then the cross track symbol "L" is displayed. If the aircraft is to the right of the predicted ground track, then the cross track symbol "R" is displayed. If the Cross Track Error is not available, these data fields are blank.

6L **Airdrop Abort.** If the flight plan associated with the CARP is not provisional, then "ABORT" is displayed in a large font. If there is a provisional, "ERASE" will be displayed. Selection when ABORT is displayed results in the following:

1. A provisional route is created with the airdrop waypoints deleted. If the Initial Point has been sequenced, then a Direct-To the waypoint following the CARP is used. If the Initial Point has not been sequenced, then a discontinuity is inserted in place of the CARP. If a provisional route already exists, then the abort will become part of the existing provisional.
2. "ERASE" is displayed in a large font. The Airdrop Label data field displays blanks.
3. The EXEC mode key is illuminated.

If ERASE is displayed, selection will result in the clearing of the flight plan modification including CARP abort, if pending.

1R **Ground Speed.** This data field displays the Ground Speed used in the CARP calculation to the right of the title GS. If the Ground Speed is not available, blanks are displayed.

2R **Drop Altitude or High Ballistic Wind.** This data field displays an "H" WIND title if a High Ballistic wind was entered on CARP INIT 3/6. Otherwise, an "A" WIND title is displayed.

Below the "WIND" title, the Drop Altitude or High Ballistic Wind in components of direction and velocity are displayed. The wind displayed is either specified or measured (Drop Altitude only). Specified winds are displayed in a large font, while measured wind is displayed in a small font. If neither a specified wind nor measured wind are available, then the data field displays ---/--. Valid entries are of the form Wind.

Deletion of the specified Drop Altitude or High Ballistic Wind will remove the specified wind and use the measured wind. Deletion of the measured wind is non-operational. Entries on this page will result in an update of the corresponding data on CARP INIT 3/6 and vice versa.

3R **Non-operational.**

4R **Slowdown to CARP Distance.** The Slow Down (SD) distance to CARP associated with the Airdrop displayed in the title line is displayed in this data field under the title "SLOWDOWN". Distance SD to CARP is the great circle distance from the SD to the computed CARP position. Default display of Distance SD to CARP is computed using Time Over Target Status, Wind, Drop Speed, and the Slow Down Tables.

Entry, deletion, and selection are non-operational.

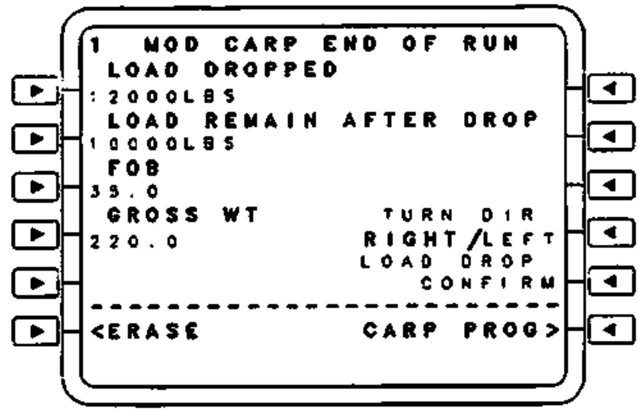
5R **Distance to Go.** Distance To Go is the distance in nautical miles to reach the CARP location from the aircraft's present position along the route's predicted flight path. This data field displays the Distance To Go in the form of Distance, NM. If the Distance to Go is not available, then this data field is blank.

6R **Airdrop Complete.** If there is not a provisional or an Airdrop Abort pending, then this data field displays the Airdrop Label. Otherwise, this data field is blank. If the CMPLT is displayed, selection of the CMPLT prompt will branch to the CARP END OF RUN page.

CARP END OF RUN Page.

The CARP END OF RUN page is the means by which the load drop is confirmed. The actual payload weight released may be updated before confirming the dropped payload. Display of the CARP END OF RUN page will occur when selection of the CMPLT prompt on the CARP n PROGRESS page is made.

If the route is provisional, then "MOD" will be displayed in the title line data field. Otherwise, the route is active and "ACT" is displayed. If the route associated with the CARP is inactive, this data field is blank.



D3194601

Figure 1-76. CARP END OF RUN

1L **Load Dropped.** This data field displays the Load Dropped in pounds. If no entries have been made in this field and the Drop Payload on the CARP INIT 2/5 page is available, then the Drop Payload is displayed in a small font. If no Load Dropped is available, then data field will be blank.

Valid entries are of the form Weight, CARP. Changes to the Load Dropped will be reflected in the Load Remaining After Drop (Payload Weight) and Gross Weight fields.

Deletion of data field 2 when a Load Dropped value has been entered will result in the Drop Payload from the CARP INIT 2/5 page being displayed if available.

2L **Load Remaining After Drop.** Load Remaining After Drop is the Total Payload Weight - Load Dropped. This data field displays the Load Remaining After Drop in pounds. The display format is of the form Weight, CARP. If Total Payload Weight is not available, then this data field will display blanks.

3L **Fuel on Board.** This data field displays the remaining Fuel On Board.

4L **Gross Weight.** This data field displays the current NP-computed Gross Weight in thousands of pounds.

5L **Non-operational.**

6L **Erase Prompt.** "ERASE" is displayed if the flight plan that contains this CARP is provisional. Otherwise, the data field will be blank. Selection when the ERASE prompt is displayed results in the provisional being erased.

1R-3R **Non-operational.**

4R **CARP Turn Direction.** If multiple passes to the airdrop still exist, this data field will display the CARP Turn Direction Title "TURN DIR". Below the title, the turn direction for the return to the drop zone will be displayed. If "RIGHT" is selected, the CARP Turn Direction will be set to RIGHT. If "LEFT" is selected, the CARP Turn Direction will be set to LEFT. Selection of the CARP Turn Direction results in the selection toggling between "LEFT" or "RIGHT".

5R **Confirm Load Dropped.** Once the CARP has been sequenced, this data field displays CONFIRM in a large font under the title LOAD DROP. Prior to sequencing the CARP, or after selection of the CONFIRM prompt, the data field is displayed in a small font.

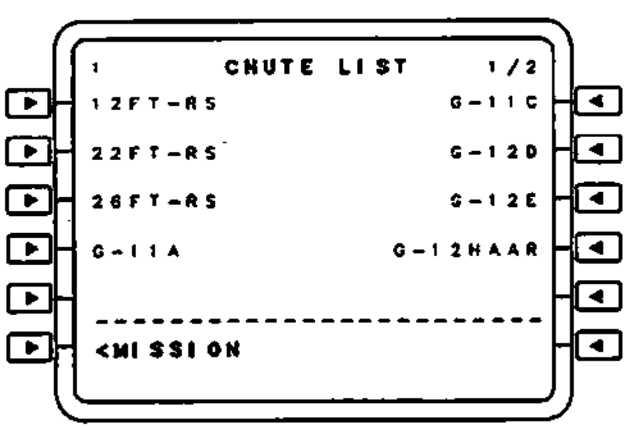
Selection when CONFIRM is displayed in a large font results in the EXEC key being illuminated, ERASE being displayed in the 6L data field, and the provisional copy of the Drop Payload and Gross Weight being updated.

6R **Branch to CARP PROGRESS page.**

CHUTE LIST Page.

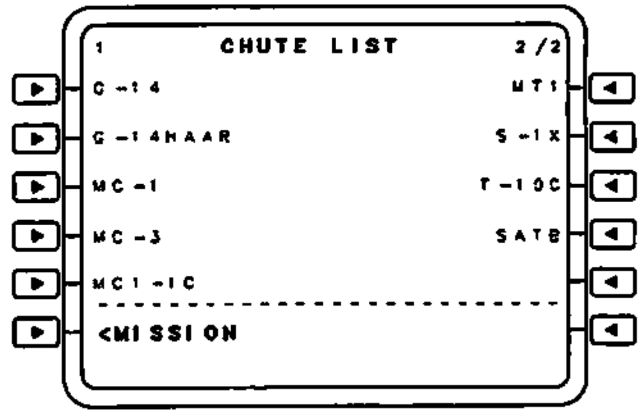
The CHUTE LIST page provides a listing of the stored parachutes. Selection of the CHUTE LIST prompt on the CARP 2/6 page or on the MISSIONS page results in the display of the CHUTE LIST page. In addition, a miscompare between the selected chute and the selected drop type will result in an automatic branch to the CHUTE LIST page.

The CHUTE LIST pages are created as required to display the entire list of parachutes stored in the NP. The number of parachutes determines the number of CHUTE LIST pages, with 10 chutes shown per page. Multiple CHUTE LIST pages are distinguished by the page number located in the upper right corner. The page number is of the form X/Y, where X is the current page number and Y is the total number of pages needed to view the entire stored chute listing. The PREV and NEXT PAGE mode keys are used to move between these multiple pages.



D3194701

Figure 1-77. CHUTE LIST 1/2



D3194801 A

Figure 1-78. CHUTE LIST 2/2

1L-5L **Stored Chute.** If a Chute name is present in the data field next to this line select, selection results in the chute name being placed into the scratch pad.

6L **Branch to calling page.** This data field displays a prompt to the page that resulted in the CHUTE LIST page being displayed. Selection results in a branch to that page. Entry and delete are non-operational.

1R-5R **Stored Chute.** Function same as 1L.

6R **Non-operational.**

VERTICAL NAVIGATION (VNAV).

The FMS VNAV function provides the Vertical Guidance necessary to direct the aircraft along the active flight path. Provisional flight plan data will not be used by Vertical Guidance until the flight plan modification is executed, making it part of the active flight plan. The FMS performs all Vertical Guidance calculations using data from the selected onside INAV solution.

VNAV Modes.

The three VNAV control modes are altitude hold (VALT HLD), vertical path (VPATH), and airspeed target (VIAS). Vertical Guidance uses the aircraft state and flight plan information to determine which of the modes should be active. In addition to altitude hold, the autopilot implements an altitude capture (VALT CAP) mode. The autopilot automatically initiates a VALT CAP mode-based aircraft state and the VNAV altitude target.

NOTE

- If VNAV is disengaged after the autopilot has been actively engaged in the Valt hold mode, the autopilot will revert to the basic autopilot mode and the DPU AP PITCH annunciation will change from VALT HLD to ALT HLD.
- For correct data entry format see Display/Entry Conventions, this section.

Vertical Guidance Terminology/Definitions.

Terms shown in uppercase correspond to computed quantities.

Abeam the waypoint	Any point in a lateral line that intersects the subject waypoint and is oriented perpendicular to the lateral flight path to the waypoint.
ACT CLB ALT CSTR	Active climb altitude constraint. The first defined AT constraint or AB constraint prior to any descent phase altitude constraintin the flight plan.
ACT DES ALT CSTR	Active descent altitude constraint. The first defined descent AT or AA altitude constraint that exists in the flight plan.
AT Constraint	A waypoint altitude constraint where the aircraft must be flown at the constraint altitude while passing the waypoint laterally.
AA Constraint	A waypoint altitude constraint where the aircraft must be flown at or above the constraint altitude while passing the waypoint laterally.
AB Constraint	A waypoint altitude constraint where the aircraft must be flown at or below the constraint altitude while passing the waypoint laterally.
BOD	Bottom of Descent. The lateral point that defines the bottom of a descent path segment. This point is fixed at the waypoint where a descent altitude constraint is defined for a path descent. For a VIAS descent, this point is a computed value.
BOD ALTITUDE	Bottom of Descent Altitude. The altitude that defines the bottom of a descent path segment.
EOS	End of Segment. The lateral point that defines either the BOD or the start of climb (SOC) for the next vertical segment.
FLC	Flight Level Change. This indicates that the FCPs ALT HLD pushbutton has been pressed to direct Vertical Guidance to initiate a climb or descent to the next target altitude.
FLCH INIT	Flight level change initiation. Only active when in ALT CAP or VALT HLD modes. Performed by pressing the ALT HLD button on the FCP.
Path Descent	The descent path is a contiguous sequence of straight line segments approximating the exact vertical descent trajectory in space to be followed by the aircraft during path descent mode.
Single Path Descent	Any path descent that does not result in a Smoothing Descent, as defined below.
Smoothing Descent	A Smoothing Descent occurs when the distance between the active BOD and the TOD of the next descent segment is less than 3 NM apart and there is no pilot entered descent angle at the next altitude constrained waypoint. The level segment between the active BOD and the TOD is deleted and the descent angle for the next descent segment is adjusted to smooth the transition between the two paths.
TOC	Top of Climb. The lateral point at which the aircraft is predicted to reach the cruise altitude and end the climb segment.
TOD	Top of Descent. The lateral point the aircraft is predicted to begin a descent.
Top of Descent Distance to Go	This is the distance from the aircraft current position to the predicted TOD.
Vertical Sequence Point	This is a point abeam the waypoint to be sequenced laterally. Altitude and speed constraints are sequenced here, as opposed to the lateral sequence point, which can be different.
Window Constraint	A waypoint altitude constraint that includes both an AA constraint and an AB constraint. The aircraft must be flown above the AB constraint and below the AA constraint when passing the waypoint laterally. Window constraints are only available through SIDs and STARs.

Vertical Guidance Availability/Engagement.

The FMS provides a valid mode request for use by the autopilot to allow engagement when the minimum Vertical Guidance availability conditions are satisfied. When the VNAV button is pressed, the Autopilot will engage Vertical Guidance if a valid mode request and valid speed and altitude targets are present. The autopilot has engagment into a VNAV mode is indicated by illumination of the VNAV annunciator light on the MSP and the VNAV annunciations on the PFD.

The FMS determines whether the minimum Vertical Guidance availability criteria is met before it generates any Vertical Guidance outputs. The Navigation Processor will set VNAV to valid when all of the following criteria are met:

1. SCADC data is valid.

2. INS data is valid.

3. The onside NP INAV solution is valid.

4. Performance initialization data is available (PERF INIT complete).

5. DPU alert altitude is valid and at least one MFCDU is valid.

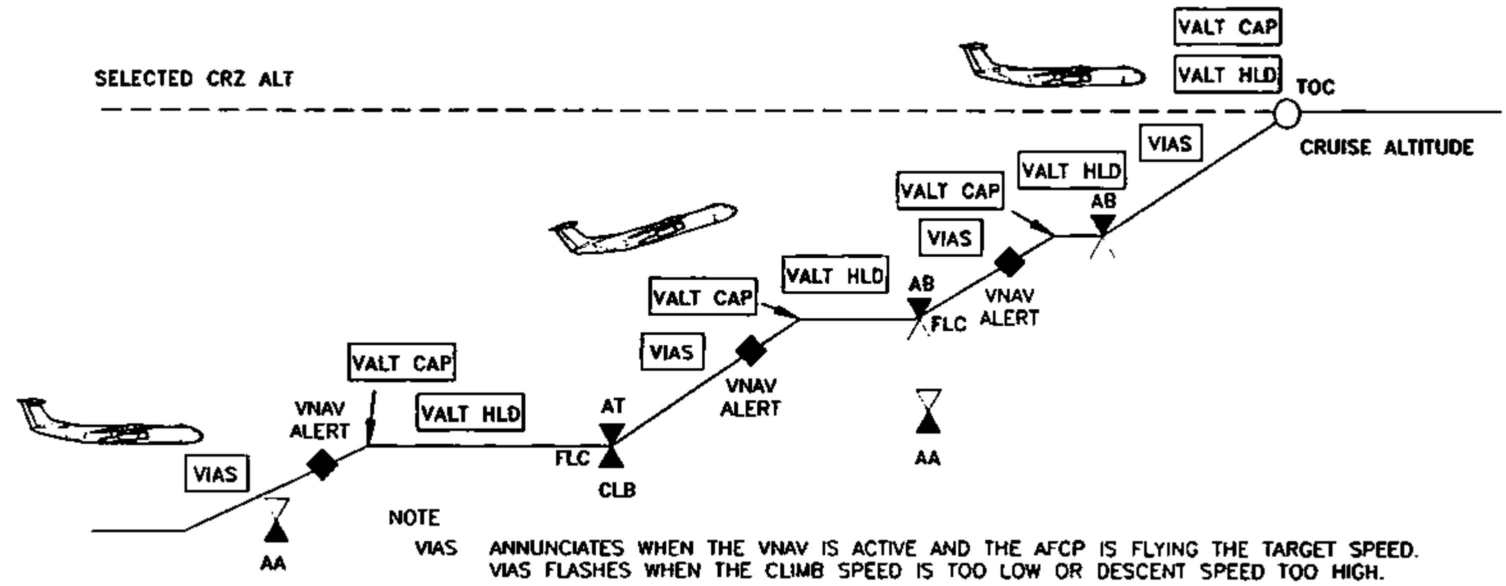
If the minimum Vertical Guidance availability criteria are not met, the FMS will not compute any vertical targets for display or for use by the autopilot. If the FMS detects an attempt to engage VNAV while the minimum Vertical Guidance availability criteria are not met, the MFCDUs will annunciate PERF-VNAV UNAVAILABLE.

Vertical Guidance Altitude Target.

Vertical Guidance altitude target is used by the autopilot for altitude captures of constraints and the alert altitude. The types of flight plan altitude constraints are "at" (AT), "at or above" (AA), "at below" (AB), and Window constraints, which are made up of an AA and AB constraint at the same waypoint. The crew-selected alert altitude will always cause a level-off when encountered by Vertical Guidance.

NOTE

For pictorial representations of the general climb and descent vertical profiles obtained using the altitude target definitions given in the following paragraphs (see figures 1-79 and 1-80).



D31768O1 B

Figure 1-79. Descent Altitude Target Vertical Profile

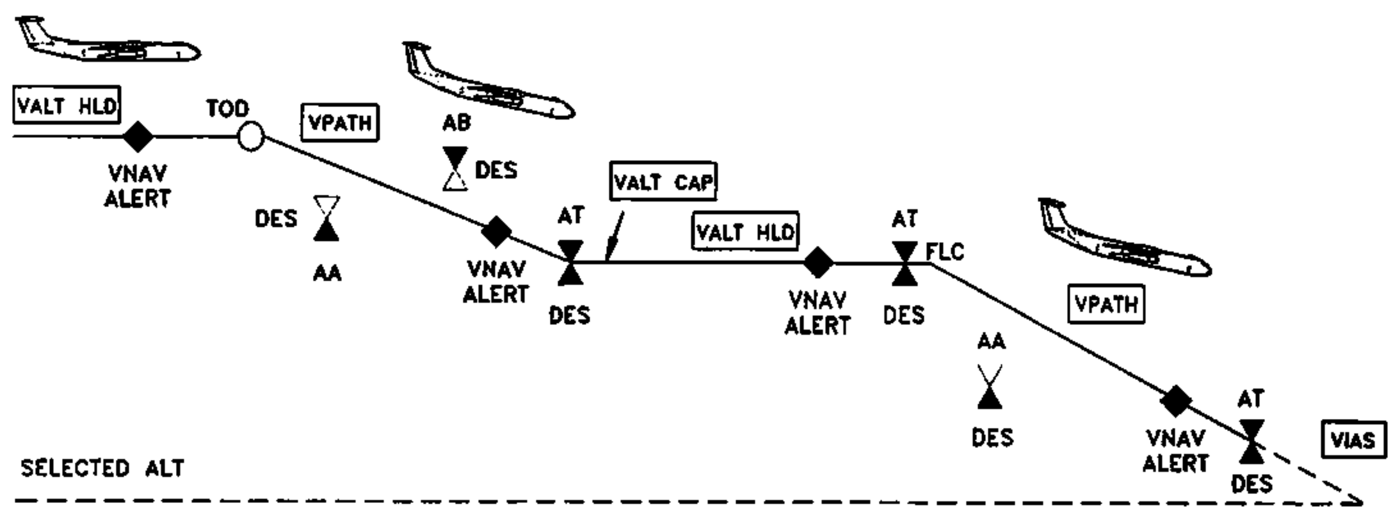


Figure 1-80. Descent Altitude Target Vertical Profile

D3176901B

Altitude and Airspeed Target Determination In Climb Flight Phase.

In the climb flight phase, the following two rules will be followed for determination of the VNAV altitude and airspeed targets.

1. Vertical Guidance will honor AT and AB altitude constraints while in a climb by leveling off at the constraint altitude prior to reaching the associated waypoint. AA altitude constraints in a climb will not result in any special action by Vertical Guidance and will not cause the aircraft to fly level. Window constraints will be honored by obeying the specified upper altitude as an AB constraint only.

2. Altitude and airspeed constraint information is contained in the flight plan for each lateral waypoint in the flight plan. Since the active climb altitude and airspeed constraint may be specified on a flight plan leg that is beyond the current active leg, the Vertical Guidance function will perform a search through the legs to determine the active climb altitude and airspeed constraint.

NOTE

Flight plan airspeed constraints entered into the active flight plan while in a VNAV climb segment may immediately affect the commanded climb speed.

ALTITUDE TARGET WHEN NO ALTITUDE CONSTRAINTS EXIST IN CLIMB.

When no altitude constraints exist in a climb, the VNAV mode is VIAS. Vertical Guidance will set the target constraint altitude to the alert altitude setting.

CLIMB ALTITUDE CONSTRAINT SEQUENCING.

Vertical Guidance sequences the active climb altitude constraint when present position latitude/longitude is abeam the active waypoint. If the active climb constraint is associated with the laterally sequenced waypoint, Vertical Guidance holds the target constraint altitude at its current value until the active climb constraint sequence process is complete. The SFD may show a lateral sequence independent of the vertical shown on the PFD.

ALTITUDE TARGET FOR FLIGHT PLAN MODIFICATIONS IN CLIMB.

If the active climb constraint is deleted or modified while the VNAV MODE is VALT CAP or HLD mode at the approaching constraint altitude prior to the vertical sequence point of the constraint, the target constraint altitude remains equal to the original constraint altitude until a FLCH INIT is performed.

ALTITUDE TARGET FOR FLIGHT LEVEL CHANGE INIT IN CLIMB.

If a FLCH INIT is performed while in VALT CAP or VALT HOLD, Vertical Guidance will delete the active climb altitude constraint, if it exists, and re-computes the target constraint altitude using the next climb altitude constraint.

Altitude Target Determination In Cruise Flight Phase.

In the cruise flight phase, the Vertical Guidance sets the TARGET ALTITUDE directly to CRUISE ALTITUDE.

Altitude Target Determination In Descent Flight Phase.

In the descent flight phase, the following rules will be followed for determination of the VNAV altitude targets:

1. Vertical Guidance uses the BOD altitude from the Performance function to determine its altitude target.

2. Vertical Guidance will honor AT and AA altitude constraints while in descent by leveling off at the constraint altitude prior to reaching the associated waypoint laterally. AB altitude constraints in a descent will not result in any special action by Vertical Guidance and will not cause the aircraft to fly level unless a BOD and corresponding level segment has been computed by the Performance function. Window constraints will be honored by obeying the specified lower altitude as an AA constraint only.

3. Altitude constraint information is contained in the flight plan for each lateral waypoint. Since the active descent altitude constraint may be specified on a flight plan leg that is beyond the current active leg, the Vertical Guidance function will perform a search through the legs to determine what the active descent altitude constraint will be. Vertical Guidance then sets the active descent altitude constraint equal to the flight plan altitude for the first descent altitude constraint found ahead of the aircraft.

4. When the aircraft is in descent and a path descent exists for the active altitude constraint, Vertical Guidance sets the target constraint altitude to the flight plan active BOD altitude for the active path descent.

ALTITUDE TARGET DURING THE FINAL PATH TO THE LAST DESCENT ALTITUDE CONSTRAINT.

During the final descent into the last descent altitude constraint in the flight plan, additional requirements apply to the altitude target determination.

LAST DESCENT CONSTRAINT IS AN AT OR AA.

When the last active descent altitude constraint is an AT or AA constraint and the aircraft is descending to that final constraint and is not more than 250 ft. below the defined descent path, Vertical Guidance sets the target constraint altitude to the alert altitude setting. If the aircraft is more than 250 ft. below the defined path, Vertical Guidance sets the target constraint altitude equal to the BOD altitude or active descent constraint ALT, whichever is higher. When the aircraft converges back to within 100 feet of the defined path, Vertical Guidance sets the target constraint altitude to the alert altitude.

LAST DESCENT CONSTRAINT IS AN AB. When the last active descent altitude constraint is an AB constraint and the aircraft is descending to that final constraint, Vertical Guidance sets the target constraint altitude equal to the alert altitude.

ALTITUDE TARGET IN VIAS DESCENT (VPATH REVERSION). When the aircraft is in a VIAS descent, Vertical Guidance sets the target constraint altitude equal to the active descent altitude constraint.

ALTITUDE TARGET WHEN NO ALTITUDE CONSTRAINTS EXIST IN DESCENT. When no altitude constraints exist in descent with VNAV MODE in VIAS, Vertical Guidance sets the target constraint altitude equal to the alert altitude.

DESCENT ALTITUDE CONSTRAINT SEQUENCING.

Vertical Guidance sequences the active descent altitude constraint when the abeam constrained waypoint. This may occur after the lateral waypoint sequence.

ALTITUDE TARGET FOR FLIGHT PLAN MODIFICATIONS IN DESCENT.

If the active descent constraint is deleted or modified while the VNAV MODE is VALT CAP or VALT HLD at or approaching the constraint altitude prior to the vertical sequence point of the constraint, the target constraint altitude remains equal to the original constraint altitude until a FLCH INIT is performed.

ALTITUDE TARGET FOR FLIGHT LEVEL CHANGE INIT IN DESCENT.

If FLC INIT is performed while in VALT CAP or VALT HLD, Vertical Guidance will delete the active descent altitude constraint if it exists and re-computes target constraint altitude using the next descent altitude constraint.

ALTITUDE TARGET DETERMINATION FOR CARP LEGS.

When the active lateral leg is a CARP leg, Vertical Guidance sets the target constraint altitude to the entered drop altitude for the CARP. When Drop Zone escape wayoint becomes active, Vertical Guidance resets the target constraint altitude to the cruise altitude.

ALTITUDE TARGET DETERMINATION WITH CLIMB/DESCENT DIRECT.

When CLB DIR or DES DIR is selected, Vertical Guidance removes the altitude constraints in the flight plan from the active waypoint up to the selected waypoint under the following conditions:

1. The altitude constraint is not defined at a CARP waypoint.

2. The altitude constraint is not defined at a landing zone waypoint.

3. The alert altitude is not the same altitude as the altitude constraint.

VNAV Characteristics.

TOP OF DESCENT (TOD) PATH CAPTURE.

When the aircraft is approaching the TOD, Vertical Guidance computes path capture time, path capture distance, and path capture deviation.

The descent flight path angle target is the angle that the descent path is built to, as measured from the BOD. Vertical Guidance will attempt to fly this angle in a VPATH path descent so that the BOD altitude constraint is met.

MULTIPLE DESCENT PATH SMOOTHING.

For cases where the current path descent is followed by a second path descent and the level distance between the BOD of the first path and the TOD of the second is less than 3 NM, Vertical Guidance smooths out the descent. This will result in the elimination of the short level segment.

VERTICAL TRACK ERROR.

The vertical track error is computed to determine the aircraft's position with respect to the vertical descent path. It is used for VNAV mode and control processing and is also made available for display on the MFCDU PROGRESS page 2 and DAMU Air Data page.

VERTICAL TRACK ERROR ACCURACY AND RANGE.

Vertical Guidance computes the vertical track error with a range of not less than ±500 feet for Enroute and Terminal flight operations and not less than ±150 feet for approach operations. The vertical track error minimum resolution is 100 feet for Enroute and Terminal operations and 30 feet for approach operations.

When the aircraft altitude is less than or equal to 5,000 feet, the maximum allowable vertical path error is 100 feet. If the present position altitude is between 5,000 feet and 10,000 feet, the maximum allowable vertical path error is 150 feet. When the present position altitude is greater than 10,000 feet, the maximum allowable vertical path is 220 feet.

VERTICAL SPEED COMMAND.

In the VIAS and VALT HLD modes, the autopilot uses the speed and altitude targets supplied by Vertical Guidance to control the aircraft. In the VPATH mode, Vertical Guidance uses the control law described in the following paragraphs to supply a vertical speed command to follow the intended vertical path. The vertical speed command is displayed on the MFCDU PROGRESS page.

VERTICAL SPEED FAST CAPTURE.

The fast capture allows for an increase or decrease in the rate of descent when the aircraft is more than 250 feet off the center of the computed descent path. Vertical Guidance limits the maximum increase or decrease in the descent vertical speed target due to the fast capture to 2,400 ft./min. For the below-path capture, Vertical Guidance limits the maximum decrease in the descent vertical speed target to 1,200 ft./min.

VERTICAL SPEED COMMAND LIMITING.

Vertical Guidance limits the maximum descent speed to 7,500 ft./min. at all times. The minimum vertical speed target changes depending on current conditions. When the aircraft is less than 250 feet below the path, it uses 90 ft./min. as the limit. When the aircraft is more than 250 feet below the path, it uses 120 ft./min. as the limit.

Top of Climb (TOC). (See figures 1-1, 1-84, and 1-226.)

Top of Climb information is displayed on the PROGRESS 1/2 page as well as the SFD map display. Vertical Guidance computes TOC position, distance, and time to the TOC.

Vertical Track Alert.

VNAV ALERT annunciates on both DAMUs to alert the pilot of an impending vertical mode change (see figures 1-85 and 1-86).

VERTICAL TRACK ALERT WHEN APPROACHING ALTITUDE CONSTRAINTS.

When the aircraft gets to within 1000 feet of the constraint altitude, the DAMU annunciates VNAV ALERT. When the aircraft gets to within 250 feet of the constraint altitude, the VNAV ALERT annunciation on the DAMU extinguishes. These annunciations also apply to altitude constraints that are part of a smoothing descent and the predicted altitude at a holding pattern waypoint that is part of a path descent.

VERTICAL TRACK ALERT AT TOP OF DESCENT. (See figure 1-226.)

When the aircraft is within one minute of approaching the top of descent (TOD), the VNAV ALERT annunciates on both DAMUs, provided VNAV MODE is VALT CAP or HLD and there is no holding pattern fix within one minute of the aircraft present position. If the aircraft is currently in a holding pattern, EXIT HOLD must be selected before the vertical track alert can be issued. Once VNAV ALERT annunciates, the VNAV function will not repeat the annunciation due to the aircraft slowing down for the TOD. The annunciation ceases after one minute.

VERTICAL TRACK ALERT WHEN LEAVING ALTITUDE CONSTRAINTS.

If in VALT CAP or HLD mode when the aircraft comes within one minute of a constrained waypoint requiring a climb or descent, Vertical Guidance activates VNAV ALERT provided that there is no holding pattern fix within one minute from the aircraft present position. If the aircraft is currently in a holding pattern, EXIT HOLD must be selected before the vertical track alert can be issued. The annunciation ceases after one minute.

Alert Altitude Reset Conditions.

Vertical Guidance detects conditions where a change in an altitude is commanded in the flight plan but the alert altitude has not been reset. The aircraft will not change altitude until the selected altitude is reset. The MFCDU annunciates RESET ALT SEL as follows:

1. If the aircraft is within one minute of the TOD and the alert altitude is at or above TOD altitude.

2. If the VNAV mode is VALT HLD mode, the aircraft altitude and alert altitude are within 150 feet of the CMD ALTITUDE, and a FLCH INIT is performed.

3. If the aircraft is within one minute of a climb altitude constraint and the alert altitude is not greater than 150 feet above the active climb altitude constraint.

4. If CLB DIR is selected to an active climb altitude constraint that is greater than the aircraft altitude, but the alert altitude is not more than 150 feet above the aircraft altitude.

5. If DES DIR is selected to an active descent altitude constraint that is less than aircraft altitude, but the alert altitude is not more than 150 feet below the aircraft altitude.

If the pilot resolves the altitude conflict by moving the alert altitude up for a climb situation or down for a TOD or descent situation, the annunciation ceases.

Vertical Guidance Operation In Holding Patterns.

Vertical Guidance includes holding pattern leg distances in the Vertical Guidance calculations for TOC and TOD, assuming one complete pass around the pattern if the aircraft is not yet in holding, and completion of the current pass if the aircraft is currently established in holding.

HOLDING PATTERNS IN CLIMB.

When the aircraft is climbing in a holding pattern, Vertical Guidance will continue to compute speed and altitude targets as it would in a normal climb leg. If the TOC is close enough to the aircraft so as to fall on the inbound holding leg, Vertical Guidance places TOC at the holding fix.

HOLDING PATTERNS IN CRUISE.

If the TOD is close enough to the aircraft so as to fall on the inbound holding leg, Vertical Guidance places TOD at the holding fix.

HOLDING PATTERNS IN DESCENT.

For holding patterns encountered in descent, Vertical Guidance will extinguish the vertical deviation scale upon entering the holding pattern and redisplay it, along with the vertical track alert, one minute prior to exiting holding. Special altitude target and mode logic applies to the different types of descent segments as follows.

HOLDING PATTERNS IN VIAS DESCENT. When the aircraft is active in a holding pattern in a VIAS descent segment, Vertical Guidance continues to compute speed and altitude targets as it would in a normal VIAS descent segment.

ALTITUDE CONSTRAINED WAYPOINT HOLDING PATTERNS IN VPATH DESCENT. If a holding pattern is entered at an altitude constrained waypoint in descent, Vertical Guidance performs the following:

1. Vertical Guidance treats the holding fix as the BOD of the path descent to the altitude constraint.

2. The aircraft flies the holding pattern in VALT HLD mode.

NON-ALTITUDE CONSTRAINED WAYPOINT HOLDING PATTERNS IN VPATH DESCENT. If a holding pattern is entered at a waypoint that is in a VPATH descent but does not contain an altitude constraint, Vertical Guidance performs the following:

1. The aircraft will fly the holding pattern in VALT HOLD mode at the predicted waypoint altitude.

2. Vertical Guidance will continue to base its vertical deviation calculation on the BOD altitude for the active constrained waypoint altitude.

PRESENT POSITION HOLDING PATTERNS IN VPATH DESENT. If a present position holding pattern is entered while the aircraft is in a VPATH descent, Vertical Guidance performs the following:

1. The VNAV mode will revert to VIAS mode.

2. The aircraft will descend to either the alert altitude or BOD altitude, whichever is higher.

3. Vertical Guidance will continue to base its vertical deviation calculation on the BOD altitude for the active constrained waypoint altitude.

Vertical Guidance Dual Operation Considerations.

The pilot and copilot side Vertical Guidance solutions are computed utilizing the data from the independently selectable INAV solutions. However, only the Guidance Master's Vertical Guidance data is sent to the CDS for display on both the pilot and copilot flight instruments. The flight crew has the capability to select between the two Vertical Guidance solutions by driving the Guidance Master to NP 1 or NP 2.

Vertical Guidance Sequencing in Dual.

Vertical Guidance is provided through the maintenance of identical flight plans in both NPs. This ensures that the two Vertical Guidance solutions will be nearly identical. However, since the pilot and copilot NPs run independently, small timing and aircraft state differences can occur between the two sides that would result in differences between the Vertical Guidance data displayed on the MFCDUs and DAMUs, especially during flight plan sequence events. Each NP computes independent Vertical Guidance solutions with the following exceptions:

1. Vertical flight plan sequencing will be driven by the Guidance Master.

2. If a vertical sequence occurs on the Guidance Master prior to the sequence on the Slave, the Slave will perform the same vertical sequence and update its altitude and speed targets accordingly.

3. If a vertical sequence occurs on the Slave prior to sequencing on the Guidance Master, the Slave will inhibit the sequence and hold its altitude and speed targets constant until the Guidance Master performs the sequence.

PERFORMANCE MANAGEMENT.

The Performance Management consists of the following:

1. FMS Flight Phases
2. FMS VNAV Modes
3. Speed Target Generation
4. Atmosphere Model
5. Speed Envelope Protection
6. Reference Data
7. Thrust Management
8. Fuel and Weight Management
9. Performance Predictions
10. Time Navigation

FMS Flight Phases.

1. The FMS defines the flight phase as pre-flight when the airplane is on the ground with ground speed less than or equal to 100 knots.

2. The FMS defines the flight phase as takeoff when the airplane is on the ground with a valid ground speed greater than 100 knots, or when the airplane is in the air and the aircraft altitude is less than 1,500 feet AGL.

3. The FMS defines the flight phase as climb when the aircraft is in the air and the current altitude is greater than or equal to 1,500 feet AGL.

4. The FMS defines the flight phase as cruise when the airplane has sequenced TOC and not TOD.

5. The FMS defines the flight phase as descent when the aircraft has sequenced TOD.

6. The FMS defines the flight phase as approach when the aircraft is in the air with flight phase as descent and current altitude is less than 2,500 feet AGL.

7. The FMS defines flight completion to occur when the airplane is on the ground with the engines shut down.

FMS VNAV Modes.

FMS provides a set of performance modes selectable through the MFCDU for each phase of flight.

1. Climb - The FMS provides two all engine climb guidance modes: Economy (ECON) and Selectable Speed (SEL SPD). It also provides for an Engine Out (EO) climb mode.

2. Cruise - The FMS provides three all engine cruise guidance modes: Economy, Long Range Cruise, and Selectable Speed. It also provides Engine Out (EO), Long Range Cruise (LRC), and Selectable Speed (EO SEL SPD) modes. The FMS provides Cruise Climb as a sub-mode of the three cruise guidance modes. The FMS, in the event of Cruise Climb selection, provides immediate climb guidance to the selected target altitude while maintaining the cruise speed appropriate for the current altitude and cruise mode. The FMS also provides Cruise Descent as a sub-mode of the three cruise guidance modes.

3. Descent - The FMS provides two descent guidance modes: Economy and Selectable Speed. The descent predictions, computed by the FMS, complies with speed or altitude constraints imposed by the guidance flight plan.

Default performance mode for each flight phase is the Selectable Speed until another mode selection is made. The FMS determines the engine operational status when operating in an engine-out mode. The FMS is able to detect that an engine failure has occurred.

Speed Target Generation.

All speeds are limited by the speed limits described in Basic Speed Limits.

CLIMB SPEEDS.

The FMS calculates one of three different climb speeds depending on the climb mode. Economy Climb sets the best trip economy, Selectable Speed climb mode is based on pilot entered speeds, and Engine-Out climb is a selected speed defaulted to 260/.65 Mach.

ECONOMY CLIMB. The FMS calculates Economy Climb as a function of Start-of-Climb Weight. The FMS corrects for wind and temperature. The Economy Climb is computed based on the predicted conditions at Top of Climb, independent of the currently selected cruise mode.

SELECTABLE SPEED CLIMB. When a pilot enters a climb airspeed, Mach, or airspeed/Mach value, it is used as the speed target.

ENGINE-OUT CLIMB. The FMS sets the airspeed for an Engine-Out climb at 250 knots below 10,000 feet and 260/.65 Mach above 10,000 feet. When a pilot-entered engine-out climb CLB airspeed/Mach value exists, it is used as the speed target.

MAXIMUM ANGLE CLIMB SPEED. The maximum angle climb speed is computed as a pilot advisory speed based on aircraft gross weight and predicted temp deviation.

SELECTABLE SPEED CRUISE.

When a pilot enters a airspeed or Mach number, it is used as the speed target.

CRUISE CLIMB. The Cruise Climb sub-mode provides a climb to a selected target altitude while maintaining the cruise speed appropriate for the current cruise mode.

ECONOMY CRUISE. The FMS computes the Mach number that will yield the best trip economy. The FMS corrects the Mach number for wind by using predicted wind speed and direction.

LONG RANGE CRUISE. The FMS computes the Long Range Cruise Mach. The FMS corrects the Mach for wind by using predicted wind speed and direction.

CRUISE DESCENT. The Cruise Descent sub-mode provides immediate descent to a selected target altitude while maintaining the cruise speed appropriate for the current cruise mode.

ENGINE-OUT CRUISE. The FMS computes the Engine-Out airspeed at the present gross weight and pressure altitude. Engine-Out Speed is the default cruise speed mode displayed when the Engine-Out mode is selected by the pilot. When the LRC prompt from the Engine-Out Cruise page is selected in a climb, the FMS computes the Engine-Out Long Range Cruise Mach for the Top of Climb Altitude and gross weight. The FMS corrects the Engine-Out Long Range Cruise Mach using current aircraft weight and predicted wind speed and direction. When a pilot-entered Engine-Out cruise airspeed or Mach exists, it is used as the speed target.

DESCENT SPEEDS.

ECONOMY DESCENT. The FMS computes the airspeed that will yield best trip economy, as defined by the gross weight at Top-Of-Descent. The FMS corrects the airspeed for wind by using predicted wind speed and direction. The Economy Descent Mach is the ECON cruise Mach at the top of the descent point, independent of the currently selected cruise mode. When a pilot-entered airspeed, Mach, or airspeed/Mach value exists, it is used as the speed target.

RAPID DESCENT SPEED. The rapid descent speed is computed as pilot advisory speed. When a rapid descent prompt is active and spoilers are deployed, the FMS sets the rapid descent speed to 0.75 Mach if the pressure altitude is above 19,750 feet and to 350 knots if the pressure altitude is at or below 19,750 feet. When the rapid descent prompt is active and the spoilers are not deployed, the FMS sets the rapid descent speed to 0.825 Mach if the pressure altitude is above 25,000 feet and to 350 knots if the pressure altitude is at or below 25,000 feet. When rapid descent is deactivated, the FMS sets the performance mode to SEL SPD.

HOLDING SPEEDS.

The best holding speed generated by the FMS is a function of altitude and weight. The FMS calculates best holding speed as the best endurance speed plus 10 knots where at or below best endurance altitude, and Vstall for 30 degrees bank plus 25 knots above best endurance altitude.

Atmospheric Model.

The Atmospheric Model (Wind/Temperature) function provides predicted wind and temperature deviation for a specified altitude and distance to a destination. It interpolates between waypoint forecasts values to obtain forecast wind and temperature deviation for the point of interest and combines these forecast values with measured values.

The atmospheric model defaults winds to 000/000. The atmospheric model is updated by flight crew inputs of forecast conditions and actual ambient conditions. If the airplane is below the transition level (DESCENT FORECAST Page), the FMS uses the barometric corrected altitude for performance computations. The atmospheric model contains the capability to enter one altitude/wind/temperature value at each waypoint. The atmospheric model also contains the capability to enter up to four altitudes/wind values for descent forecasts (DESCENT FORECAST Page).

The FMS uses linear interpolation between altitudes and between waypoints for the wind model. Pilot entered wind direction on the DESCENT FORECAST page that is not in TRUE shall cause BEARING MUST BE IN TRUE to be annunciated.

If a waypoint temperature entry is not made, standard day temperatures are used. The FMS uses linear interpolation between waypoints for entered temperature values. A standard atmosphere temperature lapse rate and standard tropopause altitude are used.

Speed Envelope Protection.

SPEED ENVELOPE.

Speed envelope protection is divided into two categories, Performance Speed Protection and Active Speed Protection. The Performance Speed Protection process defines the limiting speeds for performance prediction utilization. The Active Speed Protection process defines the minimum and maximum speeds for active aircraft control.

BASIC SPEED LIMITS.

The FMS sets Vmo (maximum operating airspeed) to the lowest applicable speed from the following:

Configuration	Vmo
Clean	350 KTS
Spoilers Extended	350 KTS
0% <= Flaps <= 75%	200 KTS
75% < Flaps <= 100%	185 KTS
Gear Extended	235 KTS

The FMS sets Mmo (maximum operating Mach) to the lowest applicable speed from the following:

Configuration	Mmo
Clean	0.825
Spoilers Extended	0.750
0% <= Flaps <= 75%	0.480
75% < Flaps <= 100%	0.450
Gear Extended	0.550

The FMS computes shaker onset speed (at 30° bank) and then adds 10 knots. The FMS computes low speed buffet speed (at 30° bank) and then adds 10 knots. The FMS sets minimum speed to the higher of these two speeds.

Reference Data.

MAXIMUM ALTITUDE.

The maximum altitude (cruise ceiling) is the highest altitude that the C-141 aircraft can attain and maintain a 300 feet per minute climb rate. Maximum Altitude is abbreviated as MAXALT.

If the cruise altitude entered on the PERF INIT, CLIMB, or CRUISE page is above the calculated maximum altitude, the MFCDU displays the CRZ ALT ABOVE MAX ALT message. This message is issued once and is not re-issued until a pilot initiated operation occurs to change the vertical profile: i.e., a change in the cruise altitude, a speed mode change on the CLB, CRZ, or DES pages or a gross weight change.

ENGINE-OUT MAXIMUM ALTITUDE.

When the engine-out mode is selected by the pilot, the FMS calculates the engine-out MAXALT.

OPTIMUM ALTITUDE.

The optimum altitude is the minimum cost altitude. The optimum altitude is abbreviated OPTALT.

TAKEOFF AND LANDING DATA.

The C-141 FMS provides a Takeoff and Landing Data (TOLD) function to compute, store, and retrieve the takeoff and landing performance data listed in the following sections. TOLD computations will be performed for the active flight plan only.

Thrust Management.

Thrust Management is a collective term for airspeed control and thrust control. These functions provide the FMS with the ability to automatically control the throttles in climb and cruise when VNAV is engaged. The Autothrottle controller performs throttle positioning and engaged logic.

Fuel and Weight Management.

The FMS determines the fuel and weight parameters independently for Route 1 and for Route 2, except for the special case that occurs when the inactive route is activated in-flight. The handling of this special case is designed to prevent sudden unexpected changes in the estimated aircraft gross weight during flight. When an active route exists and a pending activation of the inactive route is executed while in-flight, the parameters which affect gross weight (operating weight, fuel weight, and cargo weight) will be copied from the previously active route to the newly activated route.

CARGO WEIGHT DETERMINATION UPON DROP CONFIRMATION.

When CARGO WEIGHT is available and the CONFIRM LOAD DROPPED prompt is selected, the FMS sets the CARGO WEIGHT minus the LOAD DROPPED.

Performance Predictions.

The performance predictions function provides estimated values for the following:

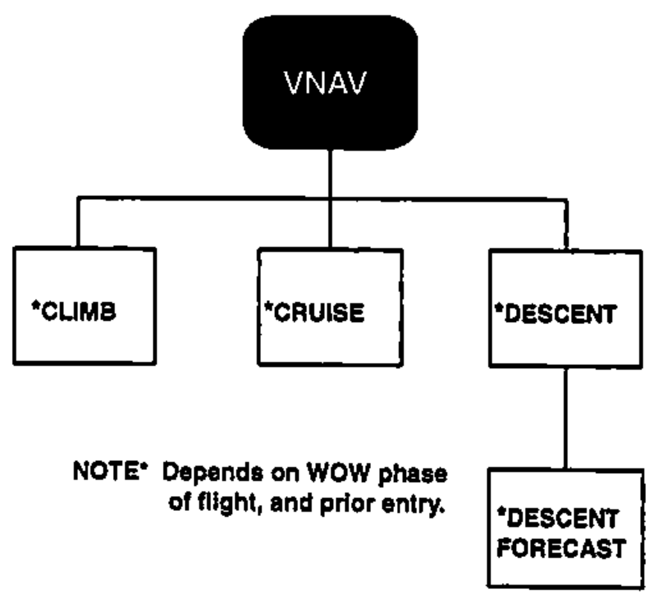
1. Time of arrival (ETA)
2. Fuel on board (FOB)
3. Altitude
4. Speed
5. Step climb capability

Performance predictions are displayed on the Legs pages and Waypoint Data pages for each flight plan waypoint as well as on the Progress pages. Step climb capability predictions are generated whenever a step climb constraint is entered on the Legs pages or when a step climb "STEP TO" altitude is entered on the VNAV cruise page.

Time Navigation.

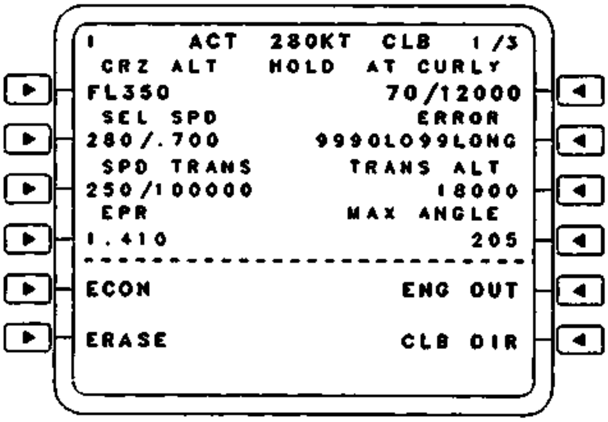
The FMS will determine the leg ground speeds necessary to reach a waypoint at a Required Time of Arrival (RTA). The FMS computes a separate ground speed for each flight plan leg that exists between the current aircraft position and the RTA waypoint. The FMS will provide these speeds to the Vertical Guidance function for active speed control. The FMS will determine if the aircraft can meet the specified RTA while adhering to all defined speed constraints and restrictions, and advise the crew if the RTA is not attainable via the MFCDU.

VNAV TREE



CLIMB Page.

The CLIMB page displays information pertinent to the climb portion of the vertical flight plan. Various parameters are entered to modify the default climb profile. The CLIMB page is displayed when the VNAV mode key is selected and the FMS flight phase is takeoff or climb.



D3194901 A

Figure 1-81. CLIMB 1/2

CLIMB Page Title Line.

CLB will be displayed in the page title when no cruise altitude has been entered, aircraft gross weight is not valid, there is no active or provisional flight plan, air data is not valid, or active FMS flight phase is cruise or descent.

MOD CLB will be displayed when a flight plan modification is pending and engine out has not been selected, and either no cruise altitude has been entered or aircraft gross weight is not valid or there is no active or provisional flight plan, or air data is not valid, or active FMS flight phase is cruise or descent.

EO CLB will be displayed when engine-out mode has been selected and either climb is not active or engine out is the first valid climb segment, aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

EO XXXKT CLB (where XXX is the airspeed of the first valid climb segment) will be displayed when the first valid climb segment is an engine-out specified airspeed climb and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

EO M.XXX CLB (where .XXX is the Mach climb speed of the first valid climb segment) will be displayed when the first valid climb segment is an engine-out specified Mach climb and aircraft gross weight is not valid, or no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

ECON CLB will be displayed when economy mode has been selected and either climb is not active or economy is the first valid climb segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS climb flight phase is not active.

XXXKT CLB (where XXX is the airspeed of the first valid climb segment) will be displayed when the first valid climb segment is a specified airspeed segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS climb flight phase is not active.

M.XXX CLB (where .XXX is the Mach climb speed of the first valid climb segment) will be displayed when the first valid climb segment is a specified Mach segment and aircraft gross weight is not valid, no cruise altitude has been entered, or there is not an active or provisional flight plan, air data is not valid, or a FMS climb flight phase is not active.

MAX ANG CLB will be displayed when maximum angle climb speed has been selected and either climb is not active or a maximum angle climb is the first valid climb segment and aircraft gross weight is not valid, no cruise altitude has been entered or there is not an active or provisional flight plan, or air data is not valid.

ACT EO CLB will be displayed when an engine-out climb is the active flight mode with an engine-out climb speed (EO SPD) selected.

MOD EO CLB will be displayed when a modified flight plan exists and either an engine-out mode has been selected and FMS cruise or descent flight phase is active, or an engine-out climb segment is active.

ACT EO XXXKT CLB (where XXX is the current VNAV airspeed target) will be displayed when engine-out climb is the active flight phase with a specified climb airspeed selected.

MOD EO XXXKT CLB (where XXX is the current VNAV airspeed target) will be displayed when a modified flight plan exists and engine-out climb is the active flight phase with a specified climb airspeed selected.

ACT EO M.XXX CLB (where .XXX is the current VNAV Mach speed target) will be displayed when engine-out climb is the active flight phase with a specified Mach climb speed selected.

MOD EO M.XXX CLB (where .XXX is the current VNAV Mach speed target) will be displayed when a modified flight plan exists and engine-out climb is the active flight phase with a specified Mach climb speed selected.

ACT ECON CLB will be displayed when climb is the active flight mode with an economy climb speed (ECON) selected.

MOD ECON CLB will be displayed when a modified active flight plan exists and climb is the active flight phase with an economy climb speed (ECON) selected.

ACT XXXKT CLB (where XXX is the current VNAV airspeed target) will be displayed when climb is the active flight phase with a specified climb airspeed selected.

MOD XXXKT CLB (where XXX is the current VNAV airspeed target) will be displayed when a modified flight plan exists and climb is the active flight phase with a specified climb airspeed selected.

ACT M.XXX CLB (where .XXX is the current VNAV Mach speed target) will be displayed when climb is the active flight phase with a specified Mach climb speed selected.

MOD M.XXX CLB (where .XXX is the current VNAV Mach speed target) will be displayed when a modified flight plan exists and climb is the active flight phase with a specified Mach climb speed selected.

ACT MAX ANG CLB will be displayed when climb is the active flight phase with a maximum angle speed climb selected.

MOD MAX ANG CLB will be displayed when a modified flight plan exists and the first valid climb segment is a maximum angle speed climb segment.

ACT LIM SPD CLB will be displayed when climb is the active flight phase and an envelope-limited climb speed is active.

MOD LIM SPD CLB will be displayed when a modified flight plan exists and climb is the active flight phase and an envelope-limited climb speed is active.

1L **Cruise Altitude.** The cruise altitude is displayed in this data field under the title "CRZ ALT". Data field will be blank if there is not an active or provisional flight plan. When on the ground with a valid current aircraft altitude, only entries greater than the current aircraft altitude will be displayed. Entries will result in a flight plan modification and illumination of the EXEC annunciator. A cruise altitude is displayed, if a cruise altitude exists and a climb segment remains in the flight plan. When no cruise altitude exists or descent is the active flight mode, the data field will display "-----". Data can also be entered from the PERF INIT and CRUISE pages.

When the PFD alert altitude is dialed above the current cruise altitude displayed in this data field and the aircraft is airborne, the FMS will change the displayed cruise altitude to equal the alert altitude. Any invalid altitude entry will be rejected and the "INVALID ENTRY" message will be displayed in the scratch pad. Selection when data is displayed will result in the downselection of the data. Selection when dashes or blanks are displayed is non-operational. Attempted deletion will result in the "INVALID DELETE" message being displayed in the scratch pad.

NOTE

Any cruise altitude entry on the PERF INIT or CRUISE page will be propagated to this page.

2L **Speed.** The 2L title field will display "SPD" if aircraft gross weight is not valid. This data field displays blanks if aircraft gross weight is not valid, or there is not an active flight plan. The 2L title field will display "ECON SPD" when the FMS flight phase is climb with an economy climb speed selected. It will display "MAX ANG SPD" when the flight phase of the active route is climb with a max angle speed selected. It will display "EO SEL SPD" when the flight phase is climb with an engine-out speed selected. It will display "LIM SPD" when the flight phase is climb with an FMS computed speed envelope speed selected. Otherwise, it will display "SEL SPD".

The 2L data field will display the selected economy, limit, engine-out, or maximum angle climb speed of the active or first climb target speed. The data field display can be a Mach, airspeed or airspeed/Mach schedule. The default display is "280/.700".

For economy, engine-out, maximum angle, or limit speed climbs, the airspeed/Mach will be displayed if at or below airspeed/Mach crossover altitude and Mach will be displayed if above airspeed/Mach crossover altitude.

Entries in this data field will use the airspeed/Mach format. Entries which do not follow the airspeed/Mach format will result in the "INVALID ENTRY" scratch pad message.

Entry will be allowed only when data is displayed and will result in "SEL SPD" being displayed in the data field title, the entered Mach, airspeed, or airspeed/Mach schedule being displayed in the 2L data field and either MOD M.XXX CLB, or MOD XXXKT CLB (where XXX is the three-digit climb airspeed and .XXX is the Mach climb speed) being displayed in the page title, depending on whether or not the aircraft is above or below the crossover altitude. Entry will also result in illumination of the EXEC annunciator.

Selection will be allowed only when data is displayed in this data field and will result in "SEL SPD" being displayed as the data field title, the entered Mach, airspeed or airspeed/Mach schedule being displayed in 2L data field, and either MOD XXX/ .XXX CLB, MOD M.XXX CLB or MOD XXXKT CLB (where XXX is the three-digit airspeed climb speed and .XXX is the Mach climb speed) being displayed in the page title. Selection will also result in illumination of the EXEC annunciator.

Entries or selection which fall outside of the FMS computed speed envelope will result in the limit Mach, airspeed or airspeed/Mach schedule being displayed and display of MOD LIM CLB in the page title. This will also result in illumination of the EXEC annunciator.

Data field deletion will be allowed when a SEL SPD is displayed. Deletion of an entered SEL SPD will result in the display of the default climb speed, 280/.700. Attemped deletion of default or FMS computed data will result in the "INVALID DELETE" scratch pad message. When blank, selection, entry and delete are non-operational.

3L **Speed Transition.** The title for this data field is "SPD TRANS". The data field below the title will display the default speed transition, "250/10000", the entered speed transition, or "---/-----". The default display of "250/10000" will be displayed in a small font. An entered speed transition and "---/-----" will be displayed in a large font.

Entry will be of the form Speed Transition, and wil result in a flight plan modification and illumination of the EXEC annunciator. Entries which do not follow the Speed Transition format will result in the "INVALID ENTRY" message.

Data field deletion will be allowed when a speed transition is displayed; otherwise, deletion will be non-operational. Deletion of an entered speed transition will result in the display of the default speed transition, "250/10000". Deletion of the default speed transition will result in display of "---/-----". Selection is non-operational.

4L **EPR.** This data field will display the title "EPR" when all of the following conditions are met:

1. The FMS is receiving valid engine data.
2. No pending active or modified active route exists.
3. The active FMS flight phase is a climb.

The title will be blank when any of the above conditions are not met.

The 4L data field will display the EPR target in N.NNN format when the title "EPR" is displayed and the EPR target is valid. The 4L data field will be blank when the title is blank. Selection, entry, and delete are non-operational.

5L **ECON or SEL SPD prompts.** "ECON" is displayed when economy is not the current climb mode target speed. "SEL SPD" is displayed when economy is the current climb mode target speed. Data field will be blank when the aircraft gross weight is not valid. Selection of the ECON prompt will result in changing the climb mode to economy, display of "ECON SPD" for the 2L title, display of the economy airspeed/Mach speed in the 2L data field, and display of MOD ECON DES in the page title and illumination of the EXEC annunciator.

Selection of the "SEL SPD" prompt will result in changing the climb speed mode to the default selected speed, display of "SEL SPD" and the default selected speed as described under 2L, display of MOD XXXKT CLB or MOD M.XXX CLB (where XXX is the three-digit default airspeed climb speed and .XXX is the default Mach climb speed) in the page title as described under 2L, and illumination of the EXEC annunciator. When the data field is blank, selection is non-operational. Entry and delete are non-operational.

6L **ERASE.** This data field will display "ERASE" when a flight plan change is pending, i.e., "MOD ..." is displayed in the page title. This data field will be blank when a flight plan change is not pending, i.e., "MOD ..." is not displayed in the page title. Selection will be allowed when "ERASE" is displayed and will result in deletion of the pending flight plan change and restoration of all entries to the pre-MOD status. Entry and delete are non-operational.

1R **Constrained Waypoint.** The 1R data field will display the constraint as propagated from the Legs page. If a speed constraint exists associated with the altitude constraint at the fix, the altitude display will be preceded by the three-digit airspeed constraint and a slash.

When the route is in the active state or modified active state, and a new airspeed/altitude or altitude-only restriction is entered into the data line on the Legs page and propagated to this field, the airspeed/altitude or altitude will be displayed in a large font, normal text. When an altitude or airspeed/altitude constraint has been entered on a Legs page, the data field will display "AT", a space, and the constrained waypoint identifier (up to six characters). Deletion when the title is blank will be non-operational. Entry and selection for this data field will be non-operational.

If no climb constraint exists in the active or modified active route, or there is not an active route, the two 1R data fields will be blank. When the constrained leg is a holding pattern leg, the title data field will display "HOLD AT", a space, and then the fix identifier (up to six characters).

2R **Predicted Error at Constraint.** The two 2R data fields will be blank if any of the following conditions are true:

1. No cruise altitude has been entered, aircraft gross weight is not valid, there is no active or provisional flight plan, or air data is not valid.

2. The undershoot error is predicted to be less than 200 feet low.

3. The distance error is predicted to be less than 1 NM long.

4. No climb waypoint constraint exists.

The title data field will display "ERROR" when all of the above conditions are not true.

The 2R data field will display XXXXLOYYLONG (e.g., 350LO 2LONG) where XXXX will represent the undershoot error in a small font with a leading blank space used if the vertical error is less than four digits. LO will be in small font. YY will represent the along track error distance in small font with a leading blank space used if the error is less than two digits, and LONG will be in small font.

The undershoot error is a predicted error at the waypoint. The vertical error will have a range from 200 through 9,990 feet, rounded to the nearest 10 feet. The along track error range will be from 1 through 99 nautical miles rounded to the nearest 1 nautical mile. Selection, entry, and deletion will be non-operational.

3R **Transition Altitude.** The climb transition altitude is displayed under the title "TRANS ALT". The default climb transition altitude is 18,000 feet.

The transition altitude setting will force any FMS altitude entry greater than or equal to the transition altitude to be displayed as a flight level. For example, with a transition altitude setting of 18,000 feet, an entry of "35000" will be displayed as "FL350". With a transition altitude setting of 7,000 feet, an entry of "9000" will be displayed as "FL090".

Any invalid altitude entry will be rejected and the scratch pad message "INVALID ENTRY" is displayed. Selection will be non-operational. Attempted deletion will result in the "INVALID DELETE" scratch pad message.

4R **Max Angle.** Selection when the data field is blank, is non-operational. Selection while a Maximum Angle Climb airspeed is displayed will result in the displayed airspeed being copied to the 2L data field, with the title "MAX ANG SPD" displayed above the airspeed, MOD XXXKT CLB (where XXX is the three-digit airspeed climb speed) being displayed in the page title, and illumination of the EXEC annunciator. Subsequent execution of the modification will result in activating the speed and setting the autothrottle EPR to MRT. Entry will be non-operational. Attempted deletion when data is displayed will result in the INVALID DELETE scratch pad message. Deletion when the 4R data field is blank will be non-operational. Both the 4R data fields will be blank if aircraft gross weight is not valid. The title data field will display "MAX ANGLE", if aircraft gross weight at the start of a climb is valid and the engine-out mode has not been selected. If "MAX ANGLE" is displayed as the title, the 4R data field will display the current flaps-up maximum angle climb speed.

5R **Engine Mode Prompt.** "ENG OUT >" prompt is displayed when the engine-out mode has not been selected for the vertical profile. "ALL ENG >" prompt is displayed when the engine-out mode has been selected for the active vertical profile.

When ENG OUT is selected, the title display will be MOD EO CLB or MOD EO XXXKT CLB or MOD EOM.XXX CLB or MOD EO XXX/.XXX CLB (depending upon whether the aircraft is above or below the crossover altitude; XXX is the three-digit airspeed climb speed and .XXX is the Mach climb speed). The engine-out speed will be displayed in the 2L data field and the EXEC annunciator will be illuminated. This data field will be blank when engine-out mode has been selected but not executed.

When ALL ENG is selected, the appropriate title (as described in the Climb Page Title Line section) will be displayed, the default SEL SPD will be displayed for the 2L data field title, and the EXEC annunciator will be illuminated. This data field will be blank after an engine mode has been selected but not executed. Selection of the ENG OUT or ALL ENG prompt will be allowed regardless of scratch pad contents. Selection, entry, and delete when this data field is blank will be non-operational.

6R **Climb Direct Prompt.** This data field will display "CLB DIR" when climb is active and an altitude constraint exists in the climb phase of the flight plan between the current aircraft altitude and the alert altitude; otherwise, this data field will be blank.

Selection of the CLB DIR prompt, will result in deletion of all climb constraints between the current aircraft position and the alert altitude, creation of a modified flight plan, and illumination of the EXEC annunciator. Entry and delete when CLB DIR is displayed is non-operational. Selection, entry and delete when data field is blank is non-operational.

CRUISE Page.

The CRUISE page displays information about the cruise segment, including cruise altitude, a "step to" altitude, the current speed schedule, and various other parameters. Entry of data alters the cruise segment of the vertical trajectory.

The CRUISE page is displayed when the VNAV mode key is selected and the performance flight phase is cruise. The CRUISE page is displayed upon selection of the NEXT function key from the CLIMB page. The CRUISE page is displayed upon selection of the PREV function key from the DESCENT page.

CRUISE Page Title Line.

CRZ will be displayed in the page title when no cruise altitude has been entered, aircraft gross weight is not valid, there is no active or provisional flight plan, air data is not valid, or active FMS flight phase is climb or descent.

MOD CRZ will be displayed when a flight plan modification is pending and engine out has not been selected, and either no cruise altitude has been entered or aircraft gross weight is not valid or there is no active or provisional flight plan, or air data is not valid, or active FMS flight phase is climb or descent.

EO CRZ will be displayed when engine-out mode has been selected and either cruise is not active or engine out is the first valid cruise segment, aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

EO LRC CRZ will be displayed when engine-out mode and LRC mode have been selected and either cruise is not active or the first valid cruise segment is an engine-out LRC cruise and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

EO XXXKT CRZ (where XXX is the airspeed of the first valid cruise segment) will be displayed when the first valid cruise segment is an engine-out specified airspeed cruise and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

EO M.XXX CRZ (where .XXX is the Mach cruise speed of the first valid cruise segment) will be displayed when the first valid cruise segment is an engine-out specified Mach cruise and aircraft gross weight is not valid, or no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid.

ECON CRZ will be displayed when economy mode has been selected and either cruise is not active or economy is the first valid cruise segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or a FMS cruise flight phase is not active.

LRC CRZ will be displayed when LRC mode has been selected and either cruise is not active or LRC is the first valid cruise segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS cruise flight phase is not active.

RTA CRZ will be displayed when RTA mode has been selected and either cruise is not active or RTA is the first valid cruise segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS cruise flight phase is not active.

XXXKT CRZ (where XXX is the airspeed of the first valid cruise segment) will be displayed when the first valid cruise segment is a specified airspeed segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS cruise flight phase is not active.

M.XXX CRZ (where .XXX is the Mach cruise speed of the first valid cruise segment) will be displayed when the first valid cruise segment is a specified Mach segment and aircraft gross weight is not valid, no cruise altitude has been entered, or there is not an active or provisional flight plan, air data is not valid, or an FMS cruise flight phase is not active.

ACT EO CRZ will be displayed when an engine-out cruise is the active flight mode with an engine-out cruise speed (EO SPD) selected.

ACT EO LRC CRZ will be displayed when engine-out cruise is the active flight phase with LRC mode selected.

MOD EO CRZ will be displayed when a modified flight plan exists and either an engine-out mode has been selected and FMS climb or descent flight phase is active, or an engine-out cruise segment is active.

MOD EO LRC CRZ will be displayed when a modified flight plane exists and an engine-out cruise is the active flight phase with an LRC cruise speed selected.

ACT EO XXXKT CRZ (where XXX is the current VNAV airspeed target) will be displayed when engine-out cruise is the active flight phase with a specified cruise airspeed selected.

MOD EO XXXKT CRZ (where XXX is the current VNAV airspeed target) will be displayed when a modified flight plan exists and engine-out cruise is the active flight phase with a specified cruise airspeed selected.

ACT EO M.XXX CRZ (where .XXX is the current VNAV Mach speed target) will be displayed when engine-out cruise is the active flight phase with a specified Mach cruise speed selected.

MOD EO M.XXX CRZ (where .XXX is the current VNAV Mach speed target) will be displayed when a modified flight plan exists and engine-out climb is the active flight phase with a specified Mach cruise speed selected.

ACT ECON CRZ will be displayed when cruise is the active flight mode with an economy cruise speed (ECON) selected.

MOD ECON CRZ will be displayed when a modified active flight plan exists and cruise is the active flight phase with an economy cruise speed (ECON) selected.

ACT LRC CRZ will be displayed when cruise is the active flight mode with an LRC cruise speed (ECON) selected.

MOD LRC CRZ will be displayed when a modified flight plan exists and an engine-out cruise is the active flight phase with an LRC cruise speed selected.

ACT RTA CRZ will be displayed when cruise is the active flight mode with an RTA cruise speed (ECON) selected.

MOD RTA CRZ will be displayed when a modified flight plan exists and an engine-out cruise is the active flight phase with an RTA cruise speed selected.

ACT XXXKT CRZ (where XXX is the current VNAV airspeed target) will be displayed when cruise is the active flight phase with a specified cruise airspeed selected.

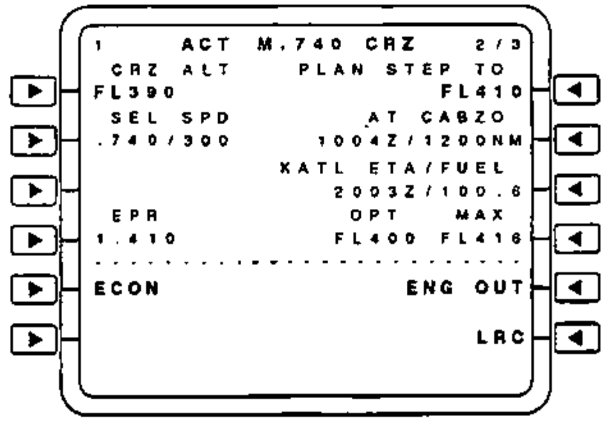
MOD XXXKT CRZ (where XXX is the current VNAV airspeed target) will be displayed when a modified flight plan exists and cruise is the active flight phase with a specified cruise airspeed selected.

ACT M.XXX CRZ (where .XXX is the current VNAV Mach speed target) will be displayed when cruise is the active flight phase with a specified Mach cruise speed selected.

MOD M.XXX CRZ (where .XXX is the current VNAV Mach speed target) will be displayed when a modified flight plan exists and cruise is the active flight phase with a specified Mach cruise speed selected.

ACT LIM SPD CRZ will be displayed when cruise is the active flight phase and an envelope-limited cruise speed segment is active.

MOD LIM SPD CRZ will be displayed when a modified flight plan exists and cruise is the active flight phase and an envelope-limited cruise speed is active.



D3195001 C

Figure 1-82. CRUISE

1L **Cruise Altitude.** The 1L data field will be blank if there is not an active or provisional flight plan. When on the ground with a valid current aircraft altitude, only entries greater than the current aircraft altitude will be valid for this data field. Entries will result in a flight plan modification and illumination of the EXEC annunciator.

Cruise altitude is displayed in standard altitude format if a cruise altitude exists and descent is not the active flight plan mode. When no cruise altitude exists or descent is the active flight mode, this data field will display "-----". Data can also be entered from the PERF INIT and CLIMB pages. When the alert altitude is dialed above the current displayed altitude in this data field and the aircraft is airborne, the FMS will set the data field altitude equal to the alert altitude. Any invalid altitude entry will be rejected and the "INVALID ENTRY" message will be displayed in the scratch pad.

Selection of 1L when data is displayed will result in the downselection of the data. Selection when dashes or blanks are displayed is non-operational. Attempted deletion will result in the "INVALID ENTRY" message being displayed in the scratch pad.

NOTE

Any valid cruise altitude entry on the PERF INIT or CLIMB page will be propagated to this page.

2L **Cruise Speed Mode and Target.** The Cruise Speed Mode and Target data fields will be blank if there is not an active or provisional route. The Cruise Speed Mode data field will display "SPD" if an active or provisional route exists but there is no valid aircraft gross weight. If aircraft gross weight is valid and there is either a provisional or active route, the mode data field displays "ECON SPD" when economy speed has been selected, "LRC

SPD" when long range cruise speed has been selected, "EO SPD" when engine out speed has been selected, "EO LRC SPD" when engine and long range cruise have been selected, and "RTA SPD" when RTA cruise speed has been selected. Otherwise, "SEL SPD" will be displayed.

The 2L target data field will be blank if aircraft gross weight is not valid or there is not an active or provisional route. If aircraft gross weight is valid and there is either a provisional or active route, the target data field displays ECON, LRC, EO LRC, RTA or selected CAS or Mach as follows:

1. When "SEL SPD" is displayed in mode data field, either the default all engine selected speed of ".740/300" or the entered CAS, Mach, or Mach/CAS schedule is displayed in the target data field.

2. When "ECON SPD" is displayed in mode data field, the economy Mach/CAS pair is displayed in the target data field if a cruise altitude/flight level is displayed in data field 1L.

3. When "LRC SPD" is displayed in mode data field, the LRC Mach/CAS pair is displayed in the target data field if a cruise altitude/flight level is displayed in data field 1L.

4. When "EO SPD" is displayed in mode data field, either the default engine-out mach of ".650/260" or the entered CAS, Mach, or Mach/CAS schedule is displayed in the target data field.

5. When "EO LRC SPD" is displayed in mode data field, the engine out LRC Mach is displayed in the target data field if a cruise altitude/flight level is displayed in data field 1L.

6. When "RTA SPD" is displayed in mode data field, the target data field displays Mach if a cruise altitude/flight level is displayed in data field 1L.

7. When "ECON SPD", "LRC SPD", "EO LRC SPD", or "RTA SPD" is displayed in the mode data field and no cruise altitude/flight level is displayed in data field 1L, then "—" will be displayed in the target data field.

In cruise, the active cruise speed target CAS or Mach will be highlighted green.

Entry is allowed only when speed target data is displayed. Entry results in "SEL SPD" if Eng Out is not selected, or "EO SPD" if Eng Out is selected. Entered Mach, CAS, or Mach/CAS will be displayed in target data field. If an active route existed at time of entry, the EXEC annunciator illuminates. Entries that do not follow the entry format will result in the "INVALID ENTRY" scratch pad message.

Attempted deletion of default or computed data will result in the "INVALID DELETE" scratch pad message. Deletion when the data field displays large font will result in the default All Eng or Eng Out SEL SPD being displayed, respectively. Valid deletion when an active route exists will result in the EXEC annunciator being illuminated. When data field is blank or "—", deletion is non-operational.

Selection is non-operational.

3L **Transition Speed/Altitude.** The title for this data field is "TRANS" when the cruise speed is limited to the transition speed, otherwise it is blank. The data field below the title displays the transition speed/altitude from the CLIMB page in small font when the cruise speed is limited to the transition speed, otherwise it is blank. In cruise, if the data field contains the active cruise speed target, the target CAS data will be highlighted green. Selection, entry, and deletion are non-operational.

4L **Level Segment EPR Target.** If the Autothrottle Function is valid, the title field displays "EPR". The data below the title displays the EPR target required to maintain VNAV speed target for the VNAV VALT Capture and VALT Hold modes. Selection, entry, and deletion are non-operational.

5L **RTA, SEL SPD, or ECON Prompt.** The RTA, SEL SPD or ECON prompt is displayed in large font when cruise altitude is valid, the active flight phase is not descent and an engine-out cruise speed is not selected. For the prompt to display "RTA" a valid RTA fix and time must exist.

This field will be blank if cruise altitude is not valid, active flight mode is descent or aircraft gross weight is not valid.

Selection of the RTA prompt, will result in changing the cruise speed mode to RTA, creation of a flight plan MOD, and illumination of the EXEC annunciator, regardless of scratch pad content.

Selection of the ECON prompt, will result in changing the cruise speed mode to economy, creation of a flight plan MOD, and illumination of the EXEC annunciator, regardless of scratch pad content.

Selection of the "SEL SPD" prompt will result in changing the cruise speed mode to the default selected speed, display of "SEL SPD" in title data, display of the default selected speed as described under LSK 2L, and display of MOD .XXX CRZ (where .XXX is the default Mach cruise speed) in the page title, and illumination of the EXEC annunciator. Entry and delete are non-operational.

6L **ERASE.** The 6L data field will display "ERASE" when a flight plan change is pending, i.e., "MOD ..." is displayed in the page title. The data field will be blank when a flight plan change is not pending, i.e., "MOD..." is not displayed in the page title. Selection will be allowed when "ERASE" is displayed and will result in deletion of the pending flight plan change and restoration of all entries to the pre-MOD status. Entry and delete are non-operational.

1R **STEP TO Altitude.** The title will display "OPT STEP TO" or "PLAN STEP TO" when the following conditions are met:

1. Cruise altitude is valid.
2. An active lateral route exists.
3. No pending activation or modified active route exists.

4. The Top of Descent point is more than 200 NM in front of the aircraft.

5. Engine-out has not been slected.

The 1R title display is "OPT STEP TO" and will be shown as long as a flight plan step climb constraint does not exist. The title will display "PLAN STEP TO" when a valid flight plan step climb constraint has been entered on the Legs page.

When the title "OPT STEP TO" is displayed, the 1R data field will display "-----" if a step altitude has not been entered into the data field. Data field entries in a standard altitude format will be accepted when the altitude entry is greater than the current cruise altitude. Invalid entries will result in the display of "INVALID ENTRY" in the scratch pad.

When the title "PLAN STEP TO" is displayed, the 1R data field will display the next flight plan step climb constraint altitude propagated from the Legs page. Entry and delete are non-operational and will result in the display of "INVALID ENTRY" or "INVALID DELETE", respectively, in the scratch pad.

Selection when an altitude is displayed will downselect the altitude into the scratch pad.

2R **TO TOD, AT XXXXXX or AVAIL AT.** The title will display "TO TOD", "AT XXXXXX" or "AVAIL AT" when the following conditions are met:

1. Cruise altitude is valid.

2. An active lateral route exists.

3. No pending activation or modified active route exists.

4. The active flight phase is climb or constraint.

5. Engine-out has not been selected.

The title data field will display "TO TOD" when the aircraft is within 200 NM of the Top of Descent. The 2R data field will display the estimated time of arrival (ETA) and distance to go (DTG) to the TOD in the ETA/DTG format

The title will display "AT XXXXXX" (where XXXXXX is a 6-character flight plan fix identifier associated with the next flight plan waypoint containing a step climb constraint) when the step climb can begin within 5 NM of the constrained waypoint. The 2R data field will display the ETA/DTG to the constrained waypoint.

The title will display "AVAIL AT" when the step climb cannot begin within 5 NM of the constrained waypoint or the step climb computation has been determined that a climb to the planned step altitude (propagated from a waypoint constraint or entered in the 1R data field) cannot be accomplished. If the step climb can begin immediately the 2R data field will display "NOW". If the step climb cannot begin immediately but can begin prior to 200 NM from the TOD, the 2R data field will display the ETA/DTG to the point where the step climb can begin. If the step climb cannot be accomplished prior to 200 NM from the TOD, the 2R data field will display "NONE".

3R **ETA/Predicted Fuel.** Both data fields will be blank when one of the following conditions is true:

1. No active and no modified active lateral route.

2. The lateral route associated with the vertical profile contains no legs and no defined destination.

3. The performance predictions of fuel and ETA at the destination are invalid.

The title field will display "ETA/FUEL W/MOD" when a modified active route is displayed and the logic for blanking this data field has not been met. The title data field will display XXXXXX "ETA/FUEL" (XXXXXX will represent the destination airport or fix identifier) when there is an active route but no modified active route (and the logic for blanking the data field has not been met).

When the title field is not blank, the 3R data field will display the Estimated Time of Arrival (ETA) and the predicted fuel remaining at the destination. The ETA will be displayed in small font, followed by a Z in small font, followed by a small font slash. Blanks will be displayed for the ETA, including the slash if the ETA is invalid. The fuel remaining will immediately follow the slash in small font, in thousands of pounds, to a precision of .1 thousands of pounds. The fuel remaining will be allowed five spaces with blanks preceding the value if five spaces are not required (e.g., 10.0). Selection, entry, and delete will be non-operational.

4R **Optimum/ Maximum Altitude.** "OPT" and "MAX" will be displayed in the title when RTA is not the cruise target speed.

The 4R data field will display the optimum altitude at the pilot selected speed under the title "OPT", when the optimum altitude is valid and RTA is not the active cruise target. The optimum altitude will be displayed to the next lower 100-foot increment. The maximum altitude is displayed under the title "MAX" when the maximum altitude is valid and RTA is not the active cruise target. All four data fields associated with 4R will be blank when RTA is the cruise target speed.

5R **ENG OUT Page Prompt.** This data field will display "ENG OUT" when engine-out mode has not been selected for the vertical profile. "ALL ENG" is displayed when engine-out mode has been selected for the active vertical profile.

When ENG OUT is selected, MOD EO CRZ, MOD EO XXXKT CRZ or MOD EOM.XXX CRZ (depending upon active flight mode and whether the aircraft is above or below the crossover altitude) will be displayed in the title, the engine-out speed will be displayed in the 2L data field, and the EXEC annunciator will be illuminated. This data field will be blank when engine-out mode has been selected but not executed. When ALL ENG is selected, the appropriate title will be displayed, the default SEL SPD will be displayed in the 2L data field and the EXEC annunciator will be illuminated. The data field will be blank when ALL ENGINE mode has been selected but not executed.

6R **Long Range Cruise Prompt.** Selection when LRC is displayed will result in changing the cruise speed mode to LRC, creation of a flight plan MOD, and illumination of the EXEC annunciator. The data line will display "LRC" when all of the following conditions are met:

1. The active flight mode is not descent.
2. The cruise altitude is valid.
3. The selected cruise speed is not LRC.
4. The selected cruise speed is not engine-out long range cruise.

Otherwise, the data line will be blank.

DESCENT Page.

The DESCENT page displays information pertinent to the descent portion of the vertical flight plan. Various parameters are entered to modify the default descent profile. The DESCENT page is displayed when the VNAV mode key is selected and the FMS flight phase is descent or approach.

MOD DES will be displayed when a flight plan modification is pending and engine-out has not been selected, and either no cruise altitude has been entered or aircraft gross weight is not valid or there is no active or provisional flight plan, or air data is not valid, or active FMS flight phase is cruise or climb.

ECON DES will be displayed when economy mode has been selected and either descent is not active or economy is the first valid descent segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS descent flight phase is not active.

XXXKT DES (where XXX is the airspeed of the first valid climb segment) will be displayed when the first valid descent segment is a specified airspeed segment and aircraft gross weight is not valid, no cruise altitude has been entered, there is not an active or provisional flight plan, or air data is not valid, or an FMS descent flight phase is not active.

M.XXX DES (where .XXX is the Mach descent speed of the first valid descent segment) will be displayed when the first valid descent segment is a specified Mach segment and aircraft gross weight is not valid, no cruise altitude has been entered, or there is not an active or provisional flight plan, air data is not valid, or a FMS descent flight phase is not active.

ACT ECON DES will be displayed when climb is the active flight mode with an economy descent speed (ECON) selected.

MOD ECON DES will be displayed when a modified active flight plan exists and descent is the active flight phase with an economy descent speed (ECON) selected.

ACT XXXKT DES (where XXX is the current VNAV airspeed target) will be displayed when descent is the active flight phase with a specified descent airspeed selected.

MOD XXXKT DES (where XXX is the current VNAV airspeed target) will be displayed when a modified flight plan exists and descent is the active flight phase with a specified descent airspeed selected.

ACT M.XXX DES (where .XXX is the current VNAV Mach speed target) will be displayed when descent is the active flight phase with a specified Mach descent speed selected.

MOD M.XXX DES (where .XXX is the current VNAV Mach speed target) will be displayed when a modified flight plan exists and descent is the active flight phase with a specified Mach descent speed selected.

ACT LIM SPD DES will be displayed when descent is the active flight phase and an envelope-limited descent speed is active.

MOD LIM SPD DES will be displayed when a modified flight plan exists and descent is the active flight phase and an envelope-limited cdescent speed is active.

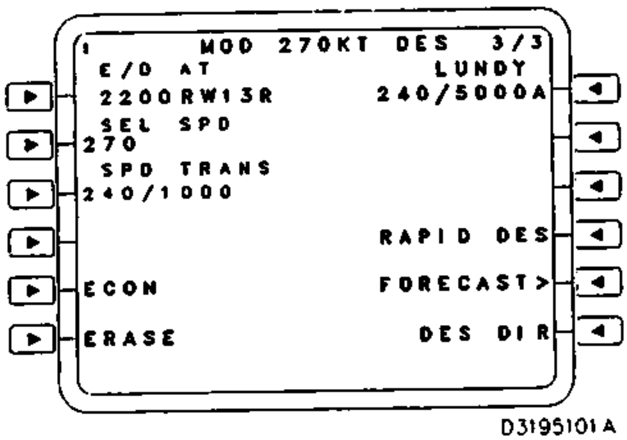


Figure 1-83. DESCENT

1L **E/D Altitude.** Title data field will display "E/D AT" when an end-of-descent constraint is contained in the active route or provisional route.

The 1L title and data fields will be blank if an end-of-descent constraint is not contained in the active or provisional route or the aircraft has sequenced the end-of-descent waypoint.

When a title is displayed, the 1L data field will display the end-of-descent constraint altitude and the end-of-descent waypoint name.

The 1L data is propagated from an entry on the LEGS page of the active route or provisional route. Selection, entry, and delete are non-operational.

2L **Speed.** The data field title will display "SPD" and the 2L data field will be blank if the aircraft gross weight is not valid or there is not an active flight plan. The data field title will display "ECON SPD" when the flight mode of the active route is descent with an economy descent speed selected. A "RAPID SPD" title is displayed when the flight mode of the active route is a descent with a rapid speed selected. "LIM SPD" is displayed when the flight mode of the active route is a descent with an FMS-computed envelope-limited speed selected. Otherwise, this title data field will display "SEL SPD".

The 2L data field will display the selected, economy, limit, or rapid speed descent of the active or first descent target speed. Displayed data can be Mach, airspeed or Mach/airspeed schedule. This data field will display the speed from 3L when "SEL SPD" is displayed as the title, the aircraft is at or below the altitude displayed in the 3L data field, and an entry in the 2L data field has not been made, or all entries in this data field have been deleted. The default descent speed schedule of ".740/300" will be displayed when the title "SEL SPD" is displayed unless an entry in the 2L data field has been made. For economy, rapid speed, or limit speed, the airspeed will be displayed if at or below Mach/airspeed crossover altitude and Mach/airspeed will be displayed if above a Mach/airspeed crossover altitude.

Entry will be allowed only when data is displayed that will result in the title "SEL SPD" being displayed, the entered Mach, airspeed or airspeed/Mach schedule being displayed in the data field and either "MOD M.XXX DES" or "MOD XXXKT DES" (where XXX is the three-digit airspeed descent speed and .XXX is the Mach descent speed) being displayed in the page title, depending on the form of the entry. Attempted deletion of default or FMS-computed data will not be allowed.

3L **Speed Transition.** The data field title will display "SPD TRANS". The 3L data field will display either the default speed transition, "250/10000", the entered speed transition, or "---/-----". The default display "250/10000" will be displayed in small font. An entered speed transition and "---/-----" will be displayed in large font.

Data deletion will be allowed when a speed transition is displayed; otherwise, delete will be non-operational. Deletion of an entered speed transition will result in display of the default speed transition, "250/10000". Deletion of the default speed transition will result in display of "---/-----". Selection is non-operational.

4L **Non-operational.**

5L **ECON Prompt or SEL SPD Prompt.** "ECON" will be displayed when economy is not the current descent mode target speed. "SEL SPD" will be displayed when economy is the current descent mode target speed. The data field will be blank when aircraft gross weight is not valid.

Selection of the ECON prompt when "ECON" is displayed will result in changing the descent speed mode to economy, display the "ECON SPD" title and economy airspeed/Mach speed in the 2L data fields and display of "MOD ECON DES" in the page title and illumination of the EXEC annunciator.

Selection of the "SEL SPD" prompt will result in changing the descent speed mode to the default selected speed, display of "SEL SPD" in the 2L title field, display of the default selected speed in the 2L data field as described under 2L, display of "MOD XXXKT DES" (where XXX is the default descent airspeed) in the page title, and illumination of the EXEC annunciator.

6L **ERASE.** "ERASE" is displayed when a flight plan change is pending, i.e., "MOD ..." is displayed in the page title. This data field will be blank when a flight plan change is not pending, i.e., "MOD ..." is not displayed in the page title. Selection will be allowed when the "ERASE" prompt is displayed and will result in deletion of the pending flight plan change and restoration of all entries to the pre-MOD status.

1R **Active Constraint.** If no descent constraint exists in either the active or provisional route, the data field under the page title, LSK the data field title, and the data field adjacent to 1R will be blank. For the active route or provisional route, if the leg on which the constraint is defined does not terminate at a fix, then the 1R data field title will display one of the following:

1. The leg termination altitude. For Mission Plan-generated leg types (i.e., legs resulting from SIDs and STARs) that terminate in an altitude, the altitude will be displayed with no leading zeroes, inside parentheses, i.e., "(NNNNN)", "(NNNN)", "(NNN)" or "(NN)".

2. "VECTORS" for Mission Plan-generated legs that terminate in radar vectors.

3. "(INTC)" for Mission Plan-generated legs that terminate at an intersection.

4. The waypoint fix identifer for all other leg types.

The data field, under the page title, will display "HOLD AT" or "AT", dependent upon if the constrained leg is a holding pattern leg or any other leg, respectively.

The 1R data field will display the Speed/Altitude constraint as displayed from the LEGS page. If a speed constraint exists associated with the altitude constraint at the fix, the altitude display will be preceded by the three-digit airspeed constraint and a slash.

2R-3R **Non-operational.**

4R **Rapid Descent Prompt.** Selection of 4R will result in the rapid descent speed being copied to the 2L data field, "RAPID SPD" being displayed in the 2L data field title, "MOD RAPID DES" being displayed in the page title, and illumination of the EXEC annunciator. Subsequent execution of the modification will result in activating the speed, setting the page title to "ACT RAPID DES," setting the 5L data field to "SEL SPD", and blanking of the 6R data field.

NOTE

Rapid Descent mode is a flight director-only mode. Activation of the Rapid Descent mode will cause the autopilot to disengage and exit the VNAV mode. VNAV must be reselected on the MSP in order to provide vertical flight director guidance to the Rapid Descent target speed.

5R **Branch to DESCENT FORECAST page.**

6R **Descend Now or Descent Direct Prompt.** This data field will display "DES NOW" when the active route contains at least one descent constraint, VNAV cruise mode is active, a cruise altitude has been entered, aircraft gross weight is valid, air data is valid, and there is an active or provisional flight plan.

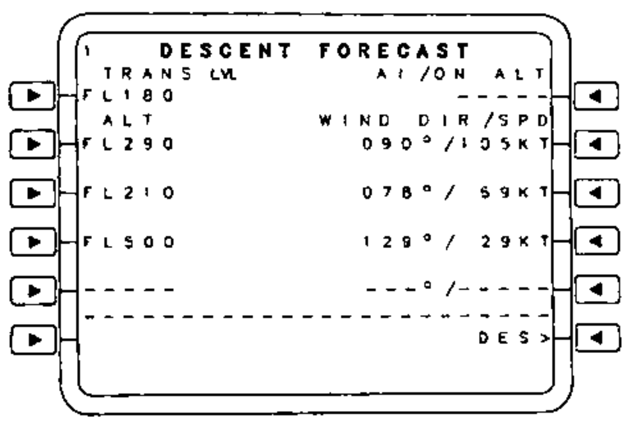
"DES DIR" is displayed when descent is active and an altitude constraint exists in the descent phase of the flight plan between the current aircraft altitude and the alert altitude. If the conditions for display of the "DES NOW" prompt or "DES DIR" prompt are not met, this data field will be blank.

Selection when "DES NOW" is displayed will result in immediate activation of the VNAV descent mode, creation of a modified flight plan, and illumination of the EXEC annunciator.

Selection when "DES DIR" is displayed will result in deletion of all descent constraints between the current aircraft position and the alert altitude, creation of a modified flight plan, and illumination of the EXEC annunciator.

DESCENT FORECAST Page.

The DESCENT FORECAST page allows four entries that define the wind profile for the descent phase. Each entry includes an altitude, wind direction, and speed. The DESCENT FORECAST page is displayed when the FORECAST prompt on the DESCENT page is selected.



D3195201

Figure 1-84. DESCENT FORECAST

1L **Transition Level.** The 1L data field displays the entered descent transition level. If no entered descent transition level exists and neither the destination airport nor the arrival procedures contain a stored descent transition level, this data field will default to "FL 180".

The transition level displayed in 1L affects the display of altitudes entered and displayed on the DESCENT FORECAST page. Any altitude entry lower than the transition level will be displayed as an altitude while any entry at or above the transition level will be displayed as a flight level. Changes made to the transition level will cause all altitude values on the page to be reformatted as described above. Selection is non-operational.

2L-5L **Wind Altitude.** These data fields display the entered wind altitude. When no wind altitude is entered, these data fields will display "——". Attempted entry of a wind altitude equal to one of the displayed wind altitudes will result in the display of "INVALID ENTRY" in the scratch pad.

Deletion of the displayed wind altitude will result in the display of dashes and the deletion of the corresponding wind direction and speed in the 2R-5R data fields. Selection is non-operational.

6L **Non-operational.**

1R **Anti-Ice On Altitude (AI/ON ALT).** This data field displays the entered anti-Ice on altitude. When no anti-Ice altitude is entered, the data field will display "-----". Deletion will result in display of "-----". Selection of is non-operational.

Entries in 1R will be used by the FMS to refine the thrust model used in calculating a VPATH descent. If no entry is made or an entered value is deleted, the FMS will use the default thrust model.

2R-5R **Wind Direction/Speed.** When no wind direction/speed is entered, data fields will display "---/---". Wind direction must always be entered in TRUE. Entry format is NNNT with leading zeros optional.

Initial data entry requires a wind direction and speed separated by a slash. Subsequent entries can contain direction and speed, direction alone followed by an optional slash, or speed alone preceded by a mandatory slash. When the entered wind direction/speed are valid, the wind direction, including the degree symbol, a "/", and then the wind speed with "KT" will be displayed. When only a partial entry has been made, only the entered value will be changed. Selection is non-operational.

Deletion of displayed direction/speed values will result in the deletion of the corresponding altitude displayed in 2L-5L, and display of "-----".

6R **Branch to DESCENT page.**

TAKEOFF AND LANDING DATA.

The C-141 FMS provides a Takeoff and Landing Data (TOLD) function to compute, store, and retrieve the takeoff and landing performance data.

NOTE

> The Flight Plan should be entered and activated prior to entering TOLD information. This will ensure that the flight plan origin and runway information matches the ICAO and Runway data used for TOLD calculations.

TOLD Initialization Data Source.

The FMS provides for entry of TOLD initialization data and takeoff performance data from the MFCDU. FMS then stores the TOLD data in Non-Volatile Memory (NVM) for both Route 1 and Route 2.

TOLD Airfield.

TOLD Airfield computations are performed as follows:

When an AIRFIELD entry is available from the TAKEOFF INIT RTE n 1/4 page, the FMS will use this entry for Takeoff and Emergency Return calculations. When an AIRFIELD entry from the TAKEOFF INIT RTE n 1/4 page is not available and the FLIGHT PLAN ORIGIN is, the FMS will use it for Takeoff and Emergency Return calculations.

When an AIRFIELD entry is available from the LANDING INIT RTE n 3/4 page, the FMS will use it for Landing data calculations. When an AIRFIELD entry from the LANDING INIT RTE n 3/4 is not available, the FMS will use the Flight Plan Destination.

TOLD Wind.

Surface wind bearing, speed, and wind gusts are all part of the TOLD initialization process. Wind Bearing and Runway Heading must be in the same reference (i.e., Magnetic, True, or Grid). When the TOLD function detects a tailwind greater than 10 knots, the FMS will annunciate "ABORT: EXCESS TW". For takeoff and landing, when the TOLD function detects a crosswind greater than 25 knots or greater than the limit outlined in the performance manual, the FMS will annunciate "ABORT: EXCESS XW".

TOLD Obstacle.

The OBSTACLE DISTANCE and ELEVATION are part of the TOLD initialization for takeoff data. Obstacle Distance is entered in feet/nautical miles from the departure end of the runway. Obstacle Elevation is the height in feet from Mean Sea Level (MSL). When an Obstacle Distance and Elevation are not entered, the TOLD function will assume that an obstacle does not exist.

Selected Flaps Position.

FLAPS POSITION is the flap position to be used for highlighting the display of landing data.

When CDS DPU FLAPS POSITION is	FMS FLAPS POSITION is =
<=25	0
>25 but <=67.5	50
>67.5 but <=87.5	75
>87.5	100

The FMS sets FLAPS POSITION to 0, 50, 75, and 100 percent as required for Approach Speed, Threshold Speed, Touchdown Speed, Ground Roll, and Landing Distance calculations.

Landing Data Computations.

The FMS computes for display the landing data based on the performance data for the C-141C aircraft and the TOLD initialization data. At that time, the FMS calculates landing parameters for the destination or emergency return airfield.

PERF INIT RTE X Page.

The PERF INIT RTE X page displays the various aircraft weights. There are two PERF INIT RTE X pages, one for Route 1 and one for Route 2. The page title displays the route number to which the PERF INIT page applies. Selecting the "PERF INIT" prompt from the TOLD INIT or MAIN MENU pages displays the PERF INIT RTE X page.

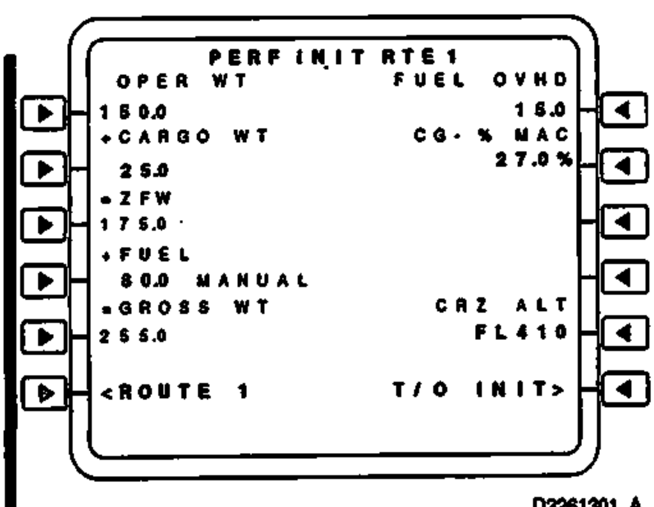


Figure 1-85. PERF INIT RTE X

1L **Operating Weight.** The Operating Weight is entered in thousands of pounds and displayed in this data field in large font. The operating weight range that can be entered in this data field is 140.0 - 170.0 thousand pounds, in 0.1 increments. Default value is displayed as box prompts (□□□.□).

If cargo weight has already been entered and the operating weight entry when added to the cargo weight is greater than 239,000 pounds, the entry will not be accepted and **ABORT: ZFW > EWP** will be displayed in the scratch pad.

If fuel and cargo weight have already been entered and the operating weight entry when added to the fuel and cargo weight is greater than 344,900 pounds, the entry will not be accepted and **ABORT: GW > EWP** will be displayed in the scratch pad.

2L **Cargo Weight.** Cargo Weight is entered and displayed in this data field under the title "+ CARGO WT". The cargo weight range that can be entered in this data field is 0.0 to 95.0 thousand pounds, in 0.1 increments. Default value is (□□□.□). An entered value is displayed in large font.

If operating weight has already been entered and the cargo weight entry when added to the operating weight is greater than 239,000 pounds, the entry will not be accepted and **ABORT: ZFW > EWP** will be displayed in the scratch pad.

If fuel and operating weight have already been entered and the cargo weight entry when added to the fuel and operating weight is greater than 344,900 pounds, the entry will not be accepted and **ABORT: GW > EWP** will be displayed in the scratch pad. Delete results in the entered value being removed, and the default value restored.

3L **Zero Fuel Weight.** The calculated weight without fuel is displayed in thousands of pounds under the title "= ZFW" in small font.

4L **Fuel.** The left data field below the title "+ FUEL" displays the Fuel on Board. The fuel on board range that can be entered in this data field is 0.0 to 153.4 thousand pounds, in 0.1 increments. When valid, the calculated fuel values are displayed in small font. If the calculated fuel is not valid, box prompts are displayed. Entries and box prompts " □□□.□" are displayed in large font.

If cargo weight and operating weight have already been entered and the fuel entry when added to the cargo weight and operating weight is greater than 344,900 pounds, the entry will not be accepted and **ABORT: GW > EWP** will be displayed in the scratch pad.

The right data field displays the source of the Fuel on Board. If the Fuel on Board is from a manual entry, "MANUAL" is displayed. If the Fuel on Board is calculated fuel, then "CALC" is displayed. The FMS uses fuel flow to calculate fuel on board.

Delete results in the entered fuel on board value being deleted, and the default value being restored. Attempted deletion of the default data will result in an "INVALID DELETE" message being displayed in the scratch pad.

5L **Gross Weight.** The GROSS WEIGHT is part of the PERF initialization for takeoff data. Gross Weight is calculated as a summation of the PERF INIT RTE n entered items. From the Gross Weight, the FMS computes TOLD Weight (Brake Release Gross Weight) which accounts for the fuel burn during engine start, taxi, and takeoff. Entry of a weight on the TAKEOFF INIT RTE n 1/4 and LANDING INIT RTE n 3/4 does not affect GROSS WEIGHT. The calculated aircraft gross weight is displayed under the title "= GROSS WT". Selection, entry, and delete are non-operational. The following four annunciations are associated with aircraft weight entries: **ABORT: ZFW > EWP, ABORT: GW > EWP, ZFW > 218K** and **GW > 325K.**

6L **Branch to Route Plan page.** Selection branches to the Route Plan X page for the route displayed. Entry and deletion are non-operational.

1R **Fuel Overhead.** This data field displays the desired fuel on board the aircraft overhead the destination airport. Default value is " □□□.□ ". Selection and deletion are non-operational.

2R **Mean Aerodynamic Chord (MAC) Center of Gravity.** The percent of (MAC) Center of Gravity is displayed under the title "CG - % MAC". The default is "□□□. □ %". Entry display range is 15 - 34. Ground limits are 15.8 - 33.4.

3R-4R **Non-Operational.**

5R **Cruise Altitude.** This data field displays the Cruise Altitude associated with the Route number displayed in the title. A cruise altitude will be displayed if a cruise altitude has been entered (on either this page, the CLIMB page or the CRUISE page, the latter two when the provisional has been executed) for the route number displayed in the page title and descent is not the active flight phase and a flight plan modification for the Route number displayed in the title is not pending.

When no cruise altitude has been entered or a descent is the active flight phase, box prompts "□□□□□ " will be displayed. Altitude entries below the transition altitude are made by using one to five numbers. Altitude entries above the transition altitude are made by entering "FL" plus two or three numbers with leading zeros not required. Minimum display for altitude is three numbers without leading zeros. Altitude entry range is -1300 to 60000 and FL000 - FL600.

When a flight plan modification for the displayed Route is pending, this data field will be blank. If barometric altitude is not valid, an entry which meets the entry format is allowed unless entry is not allowed by any of the following.

When the aircraft is on the ground and barometric altitude is valid, only entries greater than the current barometric altitude will be allowed. When the aircraft is on the ground, entry will be allowed whenever the data field is not blank. If the aircraft is airborne, an entry will only be allowed if box prompts are displayed. When the data field is blank, entries are not allowed.

When the alert altitude from the DPU is dialed above the cruise altitude displayed in this data field and the aircraft is airborne, the NP will set the cruise altitude equal to the alert altitude.

Any invalid altitude entry will be rejected and the "INVALID ENTRY" message will be displayed in the scratch pad. Selection of this data field when numeric data is displayed will result in the downselection of the data. Selection when box prompts are displayed or when the data field is blank is non-operational. Attempted deletion will result in the "INVALID DELETE" message being displayed in the scratch pad.

Upon activation of a route, the cruise altitude displayed on the PERF INIT page associated with the activated route will be propagated to the CLIMB and CRUISE page. If an active route exists, entry of a cruise altitude on the CLIMB or CRUISE page will be propagated to the PERF INIT page associated with the active route when the modification is EXECuted. Any valid and allowable entry of a cruise altitude on the PERF INIT page associated with the active route will be propagated to the CLIMB and CRUISE page immediately without creating a provisional route.

6R **Branch to T/O INIT 1/4 page.** Selection displays the TAKEOFF INIT RTE n 1/4 page.

TAKEOFF INIT RTE n 1/4 Page

The TAKEOFF INIT RTE n 1/4 page defines aircraft and airfield parameters used for takeoff and emergency return landing computations for the origin or entered airfield.

If a flight plan has been entered and activated, the flight plan route origin and runway will be shown in the ICAO / RWY data field. An ICAO entry must be made in order to enter a magnetic wind. Otherwise, if a magnetic wind entry is attempted, the message "BEARING MUST BE IN TRUE" will annunciate in the scratch pad.

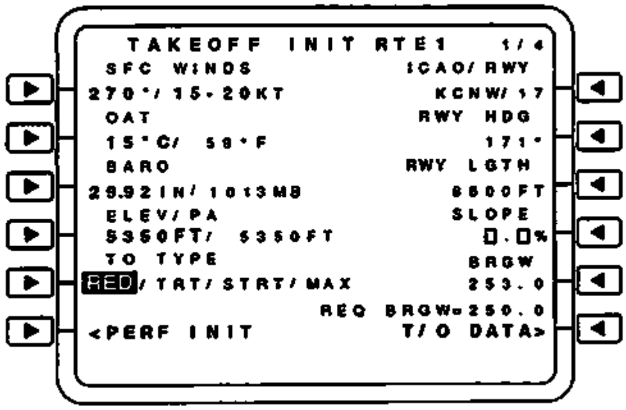
The TAKEOFF INIT RTE n 1/4 page is displayed when:

1. Selecting the TOLD key on the MFCDU under certain conditions. For preflight, takeoff, or climb, TAKEOFF INIT RTE n 1/4 is displayed when Outside Air Temperature, Baro Setting, or Elevation is not available.

2. Selecting the "T/O INIT" prompt from the PERF INIT, TAKEOFF DATA, or EMER RTN DATA pages.

3. Pressing the NEXT PAGE from the LANDING INIT RTE n 4/4 page or PREV PAGE from the TAKEOFF INIT RTE n 2/4 page.

4. Selection of 1L-6L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the TAKEOFF INIT RTE n 1/4 page.



D3261401 B

Figure 1-86. TAKEOFF INIT RTE n 1/4

1L **Surface Winds.** Valid entries of surface winds and the gust factor utilized for takeoff and emergency return are displayed in this data field under the title "SFC WINDS". Wind bearing and runway heading must be in the same reference, either Magnetic, True, or Grid. Default is True if an ICAO airfield entry has not been made. If an ICAO airfield entry has been made, default is magnetic.

NOTE

When operating in Grid, surface winds must be entered in true. That value will be converted to GRID within the FMS and will be used for TOLD calculations.

If a gust value is currently displayed, entering a new wind into the data field without a new gust value being entered will clear the previously entered gust value. Any gust value entered must be greater than the value of the steady state wind. If a gust value is not entered, the gust value field will display dashes (- -). Entered wind data is displayed in large font. Delete will remove the entered data and return the default data.

2L **Outside Air Temperature (OAT).** The Outside Air Temperature utilized for takeoff and emergency return is displayed in this data field. The default value, received from the TOLD function, (□□□C/— F) will be displayed in small font. Valid entries are displayed in large font and "delete" will remove the entered data and return the default data. A temperature entered in degrees Celsius is converted to the equivalent temperature in degrees Fahrenheit, and vice versa, and both are displayed.

3L **Baro Setting.** A Barometric Pressure setting entry in inches of mercury is converted to millibars, and vice versa. Both are displayed under the data field titled "BARO" in the following format "□□□□□ IN/——MB". When entering the barometric pressure in inches of mercury, only the four-digit entry into the scratch pad is required.

The decimal point "." entry is not required.

The barometric pressure setting range for millibars is 940-1050 and for inches of mercury it is 27.80-31.00.

4L **Elevation/Pressure Altitude.** Elevation and Pressure Altitude are displayed in units of feet. Data is displayed under the title "ELEV / PA".

The default elevation value received from the TOLD function is displayed in small font. The default pressure altitude value is displayed in small font. Valid Elevation and Pressure Altitude entries are displayed in large font. The TOLD function uses the BARO and elevation entries to calculate pressure altitude and the BARO and pressure altitude entries to calculate elevation. Entries of both elevation and pressure altitude will result in the "INVALID ENTRY" message.

If either the elevation or pressure altitude is displayed in large font, delete results in the entries being removed and display of the NAV DB data, if available, or display of the default if the NAV DB is not available.

5L **Takeoff Type.** This data field displays the status of the TOLD Type. Selection results in toggling between four Takeoff Type selections: Reduced Thrust EPR (RED), Takeoff Rated Thrust (TRT), Set Prior to Brake Release Takeoff Rated Thrust (STRT), and Maximum Effort Takeoff (MAX). Default is "RED".

A RED thrust takeoff is used when takeoff and climbout are accomplished with reduced engine thrust because maximum aircraft capability is not required. A TRT takeoff is made when gross weight is limited by critical field length, obstacle clearance, three-engine climb, windshear, or a gust front from a thunderstorm or CB is anticipated. An STRT takeoff is setting TRT prior to brake release when gross weight is limited by critical field length or obstacle clearance. A MAX takeoff is when maximum aircraft capability is required to accommodate the maximum gross weight using all available runway, clear all obstacles, and maintain a minimum climb gradient.

Takeoff type selections are made by toggling between the four different takeoff types: (RED/TRT/STRT/MAX). Selections are displayed in large font inverse video.

6L **Branch to PERF INIT RTE n page.** The active route number will be displayed in the page title. If no route is active, "1" is displayed. Selection results in a branch to the PERF INIT RTE n page for the route displayed in the title. Entry of a "1" or "2" results in a branch to the PERF INIT RTE n page for that route number.

1R **Airfield / Runway.** The ICAO Identifier or Waypoint Name and Runway are displayed in this data field under the title "ICAO / RWY". The default value, (-----or □□□□□ /— or □□□), received from the TOLD function, will be displayed in small font. Entries that do not follow the format of a position entry will result in the "INVALID ENTRY" message. The default for the ICAO entry is " □□□□□ ".

Valid Airfield or Waypoint entries are displayed in large font. Valid waypoint entries that are not contained in the database will result in the display of the CUSTOM DATA page. Valid Place Bearing Distance (PBD) and Place Bearing Place Bearing (PBPB) entries whose waypoint identifiers are not contained in the database will result in a branch to the CUSTOM DATA page for definition of the identifier. If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page if the Waypoint Select Page Exclusion is not active. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the ICAO field. Upon return from the WAYPOINT SELECT page when an airfield is not selected, the NP will display the waypoint identifier in the scratch pad.

If the ICAO data field does not display a runway identifier, the default value for the Runway data field will be "- - -". If a valid runway for the airfield displayed in the ICAO data field exists, the default value is " □□□ ". If a valid runway for the airfield does not exist, the default value for the runway data field will be " - - - ". The default value, received from the TOLD function will be displayed in small font. Valid Airfield Runway entries are displayed in large font. Entries that do not match a valid runway for the airfield displayed will result in the "NOT IN DATABASE" message. Entries into the RWY data field can only be made if the Airfield Identifier (ICAO) data field contains a valid airfield entry.

2R **Runway Heading.** The Runway Heading is displayed in this data field under the title "RWY HDG". The default value, - - - or □□□ , from the TOLD function is initially displayed in small font, if available. An entered runway heading is displayed in large font. If Runway Heading is displayed in large font, delete results in the default value being placed into this data field. Otherwise, delete is non-operational.

If the runway heading is displayed in large font, delete results in the default runway heading value being place into the data field. When LSK 1R does not contain a valid airfield runway entry, the Runway Heading default will be " □□□ ".

3R **Runway Length.** The Runway Length is displayed in this data field under the title "RWY LGTH". The default value, "- - - - -", from the TOLD function is displayed in small font. Valid runway length entries are displayed in large font. When the RWY data field contains a valid entry, the default in this data field will be " □□□□□".

If RED or TRT is selected, runway available is runway length minus 400 feet. If STRT or MAX is selected, runway available is runway length minus 200 feet.

If Runway Length is displayed in large font, delete will remove the entered data, and the NAV DB data will be displayed, if available, or displays the default if the NAV DB data is not available. Otherwise, delete is non-operational.

4R **Runway Slope.** Runway slope is displayed in this data field under the title "SLOPE". The default value "□.□" is displayed is small font. An entered value is displayed in large font.

5R **Brake Release Gross Weight.** The aircraft brake release gross weight for takeoff is displayed in this data field under the title "BRGW". The PERF INIT GW minus 1400 pounds of fuel used for start and taxi is used in the calculations of this entry. Default value, "—.-" received from the TOLD function is displayed in small font. Valid weight entries made by the aircrew are displayed in large font. If the value is displayed in large font (aircrew entered), the TOLD will not represent data calculated from PERF INIT entries.

CAUTION

- This data field should be displayed in small font to ensure TOLD calculations are made from data entries on the PERF INIT page prior to takeoff. If the data is displayed in large font, delete will remove the entered data and return the default data. Otherwise, delete is non-operational.
- To obtain a valid sink rate when conducting "WHAT-IF" drills, the ZFW on the PERF INIT page must be consistent with the desired "what-if" conditions. All "WHAT-IF" entries must be reset to actual conditions prior to take-off in order to display accurate TOLD calculations.

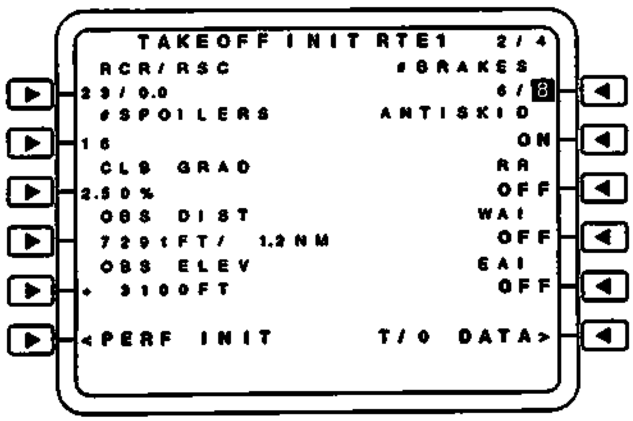
Below the BRGW data field, a title field and display may be annunciated. The annunciation **"REQ BRGW = XXX.X"** is shown and the weight displayed is the reverse calculation that is performed for gross weight when MAX mode takeoff is selected and an ABORT for 3 Engine Climb Gradient, Obstacle Height, or Critical Field Length Greater Than Runway Available happens. The annunciation is displayed in large font inverse video.

6R **Branch to T/O DATA page.** Selection of LSK 6R will branch to the TAKEOFF DATA RTE n 1/2 page.

TAKEOFF INIT RTE n 2/4 Page.

The TAKEOFF INIT RTE n 2/4 page defines aircraft and airfield parameters used for takeoff computations for the origin or entered airfield.

The TAKEOFF INIT RTE n 2/4 page is displayed when pressing NEXT PAGE from the TAKEOFF INIT n 1/4 page or PREV PAGE from the LANDING INIT n 3/4 page.



D3261501 A

Figure 1-87. TAKEOFF INIT RTE n 2/4

1L **Runway Condition Reading and Runway Surface Covering.** The Runway Condition Reading and Runway Surface Covering associated with the Takeoff and Emergency Return Runway are displayed in this data field under the title "RCR / RSC". Default values are (23/0.0) and are displayed in small font. Entered RCR/RSC values are displayed in large font. If either the RCR or RSC is displayed in large font, delete results in the entries being removed and the default values being displayed. Otherwise, delete is non-operational.

2L **Spoilers.** The number of spoilers that can be deployed is displayed in this data field under the title "# SPOILERS". Selection is made by toggling the number of symmetrical pairs of spoilers to be deployed from 18, to 16, to 14, to 0, and then back to 18. Default is 18 and selections are displayed in large font.

3L **Three Engine Climb Gradient.** The Three Engine Climb Gradient is displayed in this data field under the title "CLB GRAD". The default is 2.50% and displayed in small font. An entered three engine climb gradient is displayed in large font. Delete results in the display of the default data. Otherwise, delete is non-operational. The entry range is 2.50% to 3.30%, in .01 % increments. Climb gradient entries are made using one to three numbers. If one number is entered, then the decimal is not required. If more than one number is entered, then the decimal is required after the first number. The gradient is based on three engines operating. The desired climb gradient may be entered by using the scratch pad.

4L **Obstacle Distance.** Obstacle Distance is displayed in this data field under the title "OBS DIST". Obstacle distance is displayed both in feet and nautical miles in the following format (- - - - - FT / - . - NM). Default values from the TOLD function and calculated values are displayed in small font. Entered values are displayed in large font. An entry in feet will be calculated and displayed in miles. An entry in miles will be calculated and displayed in feet. If the Obstacle Distance is displayed in large font, delete results in the default value being placed into the data field. Otherwise, delete is non-operational.

5L **Obstacle Elevation.** Obstacle Elevation is displayed in this data field under the title "OBS ELEV". Valid entries are displayed in feet. The default value, "- - - - -" is displayed in small font. Entered values are displayed in large font. Valid entries are -1300 to 32,500 feet. If Obstacle Elevation is displayed in large font, delete results in the default value being placed in the data field. Entries that are not in "feet" format will result in an "INVALID ENTRY" message being displayed.

6L **Branch to PERF INIT RTE n page.** The active route number will be displayed in the page title. Selection results in a branch to the PERF INIT RTE n page for the route displayed. If no route is active, "1" is displayed.

1R **Number of Brakes.** This data field displays the status of the Number of Brakes that are operational under the title "# BRAKES". Selection results in toggling between the selected number of brakes. Selection of either six or eight brakes will be displayed in large font inverse video. Default is "8".

2R **Anti Skid.** This data held displays the predicted state of the anti-skid brakes below the title "ANTI SKID". The brake anti-skid state defaults to "ON". Selection of LSK 2R will result in the toggling between ON and OFF in large font.

3R **Rain Removal.** The predicted state of the aircraft Rain Removal system is displayed in this data field under the title "R R". Selection results in toggling between the selected Rain Removal state, OFF and ON. Default is OFF. Selection is displayed in large font.

4R **Wing Anti-ice.** This data field displays the sensed state or selected state of the Wing Anti-Ice System under the title "WAI". Selection results in toggling the Wing Anti-Ice between OFF and ON. Default is OFF.

If the wing anti-ice selected state matches the wing anti-ice system status, ON or OFF will be displayed in small font. If the wing anti-ice selection does not match the wing anti-ice sensed state, ON or OFF will be displayed in large font inverse video. Otherwise, the sensed state will be displayed in small font.

5R **Engine Anti Ice.** This data field displays the sensed or selected state of the Engine Anti-Ice System under the title "EAI". Selection results in toggling the selected Engine Anti-Ice state, OFF or ON. Default is OFF. If the engine anti-ice selected state is different from the sensed state, the display will be large font inverse video. Otherwise, the sensed state, ON or OFF, will be displayed in small font.

6R **Branch to T/O DATA page.** Selection branches to the Takeoff Data 1/2 page.

LANDING INIT RTE n 3/4 Page.

The LANDING INIT RTE n 3/4 page defines aircraft and airfield parameters used for landing computations for the destination or entered airfield.

The LANDING INIT RTE n 3/4 page is displayed when any of the following conditions are satisfied.

1. Pressing the NEXT PAGE from the TAKEOFF INIT RTE n 2/4 page or PREV PAGE from the LANDING INIT RTE n 4/4 page.
2. Selecting the "LDG INIT" prompt from the LANDING DATA page.
3. Selection of LSK 1L-6L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the LANDING INIT RTE n 3/4 page.

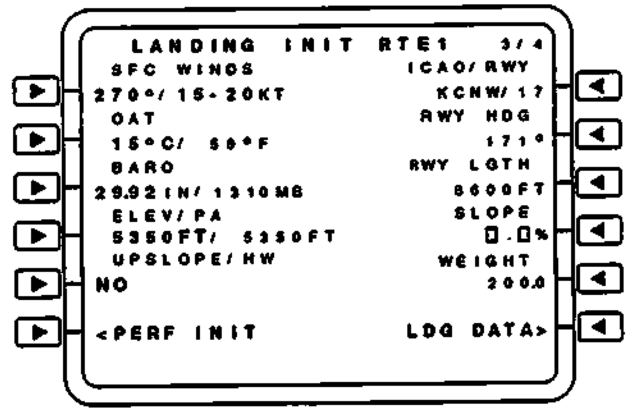


Figure 1-88. LANDING INIT RTE n 3/4

1L **Surface Winds.** Valid entries of surface winds and the gust factor utilized for takeoff and emergency return are displayed in this data field under the title "SFC WINDS". Wind bearing and runway heading must be in the same reference, either Magnetic, True, or Grid. Default is True if an ICAO airfield entry has not been made. If an ICAO airfield entry has been made, default is magnetic.

NOTE

When operating in Grid, surface winds must be entered in true. That value will be converted to GRID with the FMS and will be used for TOLD calculations.

If a gust value is currently displayed, entering a new wind into the data field without a new gust value being entered will clear the previously entered gust value. Any gust value entered must be greater than the value of the steady state wind. If a gust value is not entered, the gust value field will display dashes (- -).

2L **Outside Air Temperature (OAT).** The Outside Air Temperature is displayed in this data field. The default value, (□□□°C/— °F), received from the TOLD function, will be displayed in small font. Valid entries are displayed in large font and "delete" will remove the entered data, and return the default data. Otherwise, delete is non-operational.

A temperature entered in degrees Celsius is converted to the equivalent temperature in degrees Fahrenheit, and vice versa, and both are displayed.

3L **Baro Setting.** A barometric pressure setting entry in inches of mercury is converted to millibars, and vice versa. Both are displayed in the data field under the title "BARO".

When entering the barometric pressure in inches of mercury, only the four-digit entry into the scratch pad is required. The decimal point "." entry is not required.

4L **Elevation/Pressure Altitude.** Elevation and Pressure Altitude are displayed in units of feet. Data will be displayed under the title "ELEV / PA".

The default value, (□□□□□ FT or ——FT), received from the TOLD function is displayed in small font. Valid entries are elevation in feet or pressure altitude in feet displayed in large font. A valid elevation entry is -1300 to 32,500 feet. A valid pressure altitude entry is -1300 to 60,000 feet. The TOLD function uses the BARO and elevation entries to calculate pressure altitude and the BARO and pressure altitude entries to calculate elevation. Entries of both elevation and pressure altitude will result in the "INVALID ENTRY" message. Elevation or pressure altitude computations use BARO setting value to compute either item.

If either the elevation or pressure altitude is displayed in large font, delete results in the entries being removed and display of the NAV DB data, if available, or display of the default if the NAV DB is not available.

5L **Upslope / Headwind.** This data field will display the status of Upslope / Headwind application to the TOLD computations. The default is NO. The selection will toggle between NO and YES in large font.

6L **Branch to PERF INIT RTE n page.** The active route number is displayed in the title. Selection results in a branch to the PERF INIT RTE n page for the route displayed. If no route is active, "1" is displayed.

1R **Airfield/Runway.** The ICAO Identifier or Waypoint Name and Runway are displayed in this data field under the title "ICAO / RWY". The default value, (□□□□□or ——/□□□or —), received from the TOLD function, will be displayed in small font. Valid ICAO entries are displayed in large font. Entries that do not follow the format of a position entry will result in the "INVALID ENTRY" message. The default for the ICAO entry is " □□□□□".

Valid waypoint entries that are not contained in the database will result in the display of the CUSTOM DATA page. Valid Place Bearing Distance (PBD) and Place Bearing Place Bearing (PBPB) entries whose waypoint identifiers are not contained in the database will result in a branch to the CUSTOM DATA page for definition of the identifier. If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the ICAO field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

If the ICAO data field does not display a runway identifier, the default value for the runway data field will be "- - -". If a valid runway for the airfield displayed in the ICAO data field exists, the default value is " □□□". If a valid runway for the airfield does not exist, the default value for the runway data field will be "- - -". The default value, received from the TOLD function will be displayed in small font. Valid Airfield Runway entries are displayed in large font. Entries that do not match a valid runway for the airfield displayed will result in the "NOT IN DATABASE" message. Entries into the RWY data field can only be made if the Airfield Identifier (ICAO) data field contains a valid airfield entry.

2R **Runway Heading.** The Runway Heading is displayed in this data field under the title "RWY HDG". The default value, "- - -", from the TOLD function is initially displayed in small font. If the runway data field is blank, or does not contain a valid airfield runway, the default value for this data field is "□□□". An entered runway heading is displayed in large font. If the runway heading is displayed in large font, delete results in the default runway heading value being place into the data field.

3R **Runway Length.** The Runway Length is displayed in this data field under the title "RWY LGTH". The default value, "——", from the TOLD function is displayed in small font. When a valid airfield runway has been entered on this page, the default value for this data field will be "□□□□□". Valid runway length entries into this data field are displayed in large font.

If Runway Length is displayed in large font, delete will remove the entered data, and the NAV DB data will be displayed, if available, or displays the default if the NAV DB data is not available. Otherwise, delete is non-operational.

4R **Runway Slope.** Runway slope is displayed in this data field under the title "SLOPE". The default value "□.□" is displayed in small font. An entered value is displayed in large font. If runway slope is displayed in large font, delete results in display of the default value, " □.□".

5R WEIGHT. The projected TOLD aircraft weight at the destination airfield based on the Flight Management System calculated fuel burn is displayed in this data field under the title "WEIGHT". The weight will automatically be amended when the flight plan is changed or airdrop weight change is executed for air refueling and fuel dumping. A fuel weight may be manually entered to perform "what-if" drills, creating a MANUAL mode of operation. The MANUAL mode weight is displayed in large font and the AUTOMATIC mode received from the TOLD function is displayed in small font. To return back to the Automatic mode from the Manual mode, press the CLEAR key and then press LSK 5R.

CAUTION

This data field should be displayed in small font to ensure TOLD calculations are made from data entries on the PERF INIT page prior to takeoff. If the data is displayed in large font, delete will remove the entered data and return the default data. Otherwise, delete is non-operational.

If the data is displayed in large font, delete will remove the entered data and return the default data.

6R **Branch to LANDING DATA RTE n page.** Selection of LSK 6R will branch to the LANDING DATA RTE n page.

LANDING INIT RTE n 4/4 Page.

The LANDING INIT RTE n 4/4 page defines aircraft and airfield/runway parameters used for landing computations at the destination airfield.

The LANDING INIT RTE n 4/4 page is displayed when pressing the NEXT PAGE from the LANDING INIT RTE n 3/4 page or PREV PAGE from the TAKEOFF INIT RTE n 1/4 page.

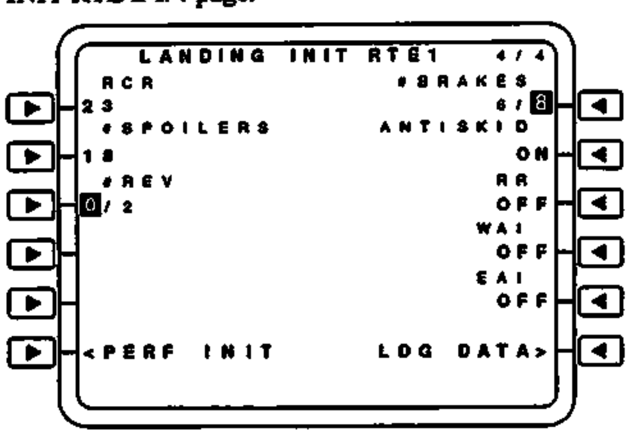


Figure 1-89. LANDING INIT RTE n 4/4

1L **Runway Condition Reading.** The Runway Condition Reading is displayed in this data field under the title "RCR". Default value is "23" and is displayed in small font. Entered RCR values are displayed in large font.

If the RCR value is displayed in large font, delete will result in the entered value being removed and the default value displayed. Otherwise, delete is non-operational.

2L **Spoilers.** The number of spoilers that can be deployed upon landing is displayed in this data field under the title "# SPOILERS". Selection results in toggling the selected number of spoilers deployed from 18, to 16, to 14, to 0, and then back to 18. Default is 18. Selections are displayed in large font.

3L **Reverse Engines.** This data field displays the number of engines that will deploy reverse thrusters under the title "# REV". The default thrust reverse default value is "0". The selection will toggle between 0 and 2 and will be displayed in inverse video, large font.

4L-5L **Non-operational.**

6L **Branch to PERF INIT RTE n page.** The active route number is displayed in the page title. Selection of LSK 6L results in a branch to the PERF INIT RTE n page for the route displayed. If no route is active, "1" is displayed. Entry of a "1" or "2" results in a branch to the PERF INIT RTE n page for that number.

1R **Number of Brakes.** This data field displays the status of the number of brakes that are operational under the title "# BRAKES". Selection results in toggling between the selected number of brakes. Selection of either six or eight brakes will be displayed in inverse video large font. Default is "8". Entry and deletion are non-operational.

2R **Anti-Skid.** This data field displays the predicted state of the anti-skid brakes below the title "ANTI SKID". The brake anti-skid state defaults to ON and is displayed in large font. Selection of LSK 2R will result in the toggling between ON and OFF. Entry and deletion are non-operational.

3R **Rain Removal.** The predicted state of the aircraft Rain Removal system is displayed in this data field under the title "R R". Selection results in toggling between the selected Rain Removal state, OFF and ON. Default is OFF displayed in large font. Entry and deletion are non-operational.

4R Wing Anti-ice. This data field displays the sensed or selected state of the Wing Anti-Ice System under the title "WAI". Selection results in toggling the selected Wing Anti-Ice state, OFF or ON. Default is "OFF". If the wing anti-ice selected state matches the wing anti-ice sensed state, ON or OFF will be displayed in small font. If the wing anti-ice selection does not match the wing anti-ice sensed state, ON or OFF will be displayed in large font inverse video.

5R Engine Anti ice. This data field displays the sensed or selected state of the Engine Anti-Ice System under the title "EAI". Selection results in toggling the selected Engine Anti-Ice state, OFF or ON. Default is "OFF".

If the engine anti-ice selected state matches the engine anti-ice sensed state, ON or OFF will be displayed in small font. If the engine anti-ice selection does not match the engine anti-ice sensed state, ON or OFF will be displayed in large font inverse video. Entry and deletion are non-operational.

6R Branch to LANDING DATA page. Selection of LSK 6R will branch to the LANDING DATA RTE n page.

TAKEOFF DATA RTE n 1/2 Page.

The TAKEOFF DATA RTE n 1/2 page displays the computed takeoff speeds for the origin airfield/runway.

All computed Takeoff Data Values, except as noted, are received from the TOLD function and are displayed in small font. Entry, selection, and deletion are non-operational.

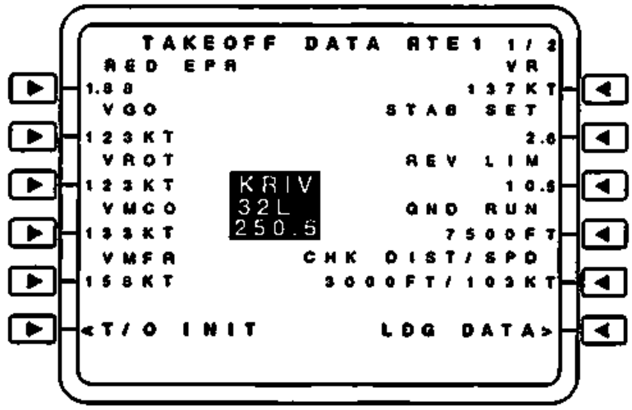
The Takeoff Airfield, Takeoff Runway and TOLD Weight are displayed in large font inverse video in the center of the display. Entry is not permitted into these data fields.

The TAKEOFF DATA RTE n 1/2 page is displayed when any of the following conditions are satisfied.

1. Selection of the TOLD key under certain conditions displays the TAKEOFF DATA RTE n 1/2 page.

2. Selection of the "T/O DATA" prompt on the TAKEOFF INIT RTE n 1/4 and TAKEOFF INIT RTE n 2/4 pages results in display of the TAKEOFF DATA RTE n 1/2 page.

3. Pressing NEXT Page or PREV Page from the EMER RTN DATA RTE n 2/2 page results in display of the TAKEOFF DATA RTE n 1/2 page.



D3261801 A

Figure 1-90. TAKEOFF DATA RTE n 1/2

1L Takeoff EPR. Takeoff EPR is displayed in this data field under the title of the selected Takeoff Type (RED, TRT, STRT, and MAX) along with "EPR". Takeoff EPR is calculated to the third decimal place to accurately determine the bleed air reductions and to enter the figures based on EPR, but is only displayed to the second decimal place. Default is "- . - -".

2L Go Speed (V_{GO}). The "GO" Speed is the speed at which the pilot becomes committed to continue the takeoff and is displayed in this data field under the title "VGO". V_{GO} speed will be the lowest of the following:

1. Refusal Speed (V_R)
2. Rotation Speed (V_{ROT})
3. Maximum Braking Speed VB (MAX)
4. 147 KCAS (Maximum Ground Spoiler Speed). Default is "- - - KT".

When an abort condition exists, the V_{GO} data field will be displayed as stars (***KT). The display cannot be cleared or overwritten. The "stars" will be replaced with a go speed value when the abort condition no longer exists. Stars will be displayed on all the MFCDUs when the condition exists.

3L Rotate (V_{ROT}). Rotation speed is that speed at which rotation from the three-point attitude to the take-off attitude is initiated. Rotation speed may be less than V_{MCO} but never less than V_{MCA}. This data field displays the Rotation Speed under the title "VROT". Default is "- - - KT".

4L Minimum Climb Out (VMCO). This data field displays the Minimum Climb Out Speed under the title "VMCO". The default value is "- - - KT".

5L Minimum Flap Retraction Speed (VMFR). This data field displays the Minimum Flap Retraction Speed under the title "VMFR". The default value is a calculated Minimum Flap Retraction Speed or "- - - KT".

6L **Branch to T/O INIT 1/4 page.** Selection branches to the TAKEOFF INIT RTE n 1/4 page.

1R **Refusal.** Refusal Speed is the maximum speed that the aircraft can attain under normal acceleration and then stop in the available runway. Refusal Speed is displayed in this data field under the title "VR". The default value is refusal speed or "- - -KT".

2R **Stabilizer Setting.** The Stabilizer Setting is displayed in this data field under the title "STAB SET". The default value is "-. - -" or the computed stabilizer setting received from the TOLD function. Stabilizer setting range is -2.0 to 7.2.

3R **Reverse Limiter Setting.** The Reverse Limiter Setting is displayed in this data field under the title "REV LIM". The default value is "- - -" or the computed reverse limiter setting received from the TOLD function. Range is 0 to 10.9.

4R **Takeoff Ground Run.** Takeoff Ground Run is the distance through which the aircraft must be accelerated to reach the take-off point. Increased rotation speed will increase ground run. Takeoff Ground Run is displayed in this data field under the title "GND RUN". The default is a ground run value received from the TOLD function or - - - - - FT.

5R **Acceleration Check Distance and Speed.** The Acceleration Check Distance and Speed are displayed in this data field under the title "CHK DIST / SPD". The default value entered from the TOLD function is displayed in small font. An entered value is displayed in large font.

Valid entries are of the form Distance in feet or /Speed in knots. Entries that do not follow the Distance or /Speed format, or entries of both Distance and Speed result in the "CHK SPD DST INVALID " message. Defaults are "check distance or - - - - -FT and check speed or - - -KT".

If Check Distance or Speed is displayed in large font, delete results in the default value being placed into the data fields. Otherwise, selection and delete is non-operational.

6R **Branch to LANDING DATA 1/2 page.** Selection of LSK 6R will branch to the LANDING DATA RTE n 1/2 page.

EMERGENCY RETURN DATA RTE n 2/2 Page.

The EMERGENCY RETURN DATA RTE n 2/2 page displays computed speeds and landing distance, for emergency return at the departure airfield/runway. Selection of the "NEXT PAGE" or "PREV PAGE" pushbutton while on the TAKEOFF DATA RTE n 1/2 page results in the display of the EMERGENCY RETURN DATA RTE n 2/2 page.

All computed Takeoff Data Values, except as noted, are received from the TOLD Entry, selections, and deletions are non-operational.

The Landing Airfield, Landing Runway and Aircraft Landing Weight are displayed in large font inverse video in the center of the display. Entry is not permitted into these data fields.

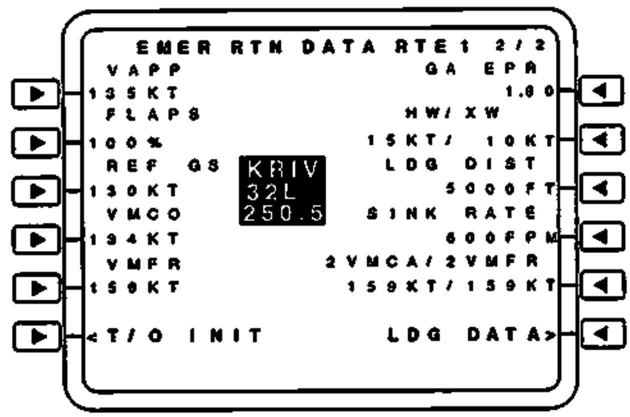


Figure 1-91. EMERGENCY RETURN DATA RTE n 2/2

1L **Approach (VAPP).** Approach speed is displayed in this data field under the title "VAPP". When an abort condition exists, the V_{APP} data field will be displayed as "***KT". The stars cannot be cleared or overwritten. The stars will be replaced with an approach speed value when the aircraft/airfield conditions have been changed and the abort condition no longer exists. The abort condition stars will be displayed on all MFCDUs. Default values are an Approach Speed, - - -KT, or ***KT.

2L **Flap Position.** The flap position will be displayed in large font in this data field under the title "FLAPS". The default flap position is 100%. The display may be toggled between the various flap positions in the following order, 100%, 75%, 50%, 25%, 0%, and 100%.

3L **Reference Ground Speed.** Reference Ground Speed (REF GS) is the Approach Speed converted to a TAS using Takeoff or Landing Pressure Altitude, then converted to Ground Speed using the Takeoff or Landing headwind tailwind. This data field displays the Reference Ground Speed under the title "REF GS". Default value is a Referenced Ground Speed or - - - KT.

4L **Minimum Climb-Out (VMCO).** This data field displays the Minimum Climb-Out Speed under the title "VMCO". The default value is a calculated Minimum Climb Out Speed or - - - KT.

5L **Minimum Flap Retraction Speed (VMFR).** This data field displays the Minimum Flap Retraction Speed under the title "VMFR". The default value is a calculated Minimum Flap Retraction Speed or - - - KT.

6L **Branch to T/O INIT 1/4 page.** Selection branches to the TAKEOFF INIT RTE n 1/4 page.

1R **GO-Around EPR (GA EPR).** The Go-Around EPR is displayed in this data field under the title "GA EPR". The default value is a calculated EPR or "- . - -".

2R **Headwind, Tailwind / Crosswind.** The Headwind, Tailwind /Crosswind is displayed in this data field in small font under the title "HW / XW" or "TW / XW". Displayed are the headwind/tailwind and crosswind components, respectively, of the SFC WINDS displayed on the TAKEOFF INIT RTE n 1/4 page relative to the RWY HDG displayed on the TAKEOFF INIT RTE n 1/4 page. If the data for either of these two fields is not available, these data fields will display the default of "- - KT/- - KT".

3R **Landing Distance.** This data field displays the landing distance in feet for the flap position selected under the title "LDG DIST". Default is a calculated landing distance or - - - - -FT.

4R **Sink Rate.** An aircraft sink rate calculation is required when the aircraft gross weight is equal to or greater than 257,500 pounds or the fuel weight is equal or greater than 75,000 pounds for landing. The sink rate will be calculated both as a function of landing aircraft gross weight and fuel weight and displayed under the title "SINK RATE". The sink rate will display a maximum value of 600 feet per minute (FPM) and a minimum value of 360 FPM. No annunciation or other indication will be displayed for a sink rate outside of these values. Default is a calculated sink rate or - - - FPM if no PERF INIT data is entered.

CAUTION

To obtain a valid sink rate when conducting "WHAT-IF" drills, the ZFW on the PERF INIT page must be consistent with the desired "what-if" conditions. All "WHAT-IF" entries must be reset to actual conditions prior to take-off in order to display accurate TOLD calculations.

5R **2 VMCA / 2 VMFR.** The two engine Air Minimum Control Speed and two engine Minimum Flap Retraction speed received from the performance Database function is displayed in this data field under the title "2 VMCA / 2 VMFR". Default is a 2 VMCA /2 VMFR speed or "- - - KT/- - KT".

6R **Branch to LANDING DATA RTE n page.** Selection of LSK 6R will branch to the LANDING DATA RTE n page.

LANDING DATA Page.

The LANDING DATA RTE n page displays computed approach speeds, flaps, reference ground speeds, go-around EPR, and minimum control airspeeds for landing at the destination airfield/runway.

All computed Landing Data Values, except as noted, are received from the TOLD functions and are displayed in small font. Entry, selection, and deletion are non-operational.

The LANDING DATA page is displayed when any of the following conditions are satisfied.

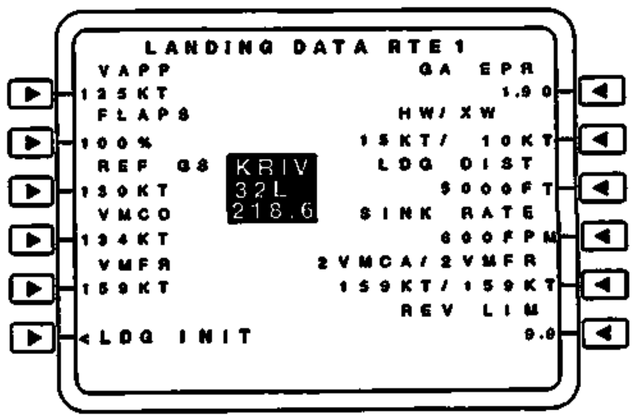
1. Selection of LSK 6R on the LANDING INIT RTE n 3/4 page.

2. Selection of LSK 6R on the LANDING INIT RTE n 4/4 page.

3. Selection of LSK 6R on the TAKEOFF DATA 1/2 page.

4. Selection of LSK 6R on the EMER RTN DATA 2/2 page.

The Landing Airfield, Landing Runway and aircraft landing weight are displayed in large font inverse video in the center of the display. Entry is not permitted into these data fields.



D3262001 B

Figure 1-92. LANDING DATA RTE n

1L **Approach (VAPP).** Approach speed is displayed in this data field under the title "VAPP". Approach speeds received from the TOLD function are displayed in small font. When an abort condition exists, the V_{APP} data will be displayed as "***KT". The stars cannot be cleared or overwritten. The stars will be replaced with an approach speed value when the aircraft/airfield conditions have been changed and the abort condition no longer exists. The abort condition "stars" will be displayed on all MFCDUs.

2L **Flap Position.** The flap position will be displayed in large font in this data field under the title "FLAPS". The default flap position is 100%. The display may be toggled between the various flap positions in the following order, 100%, 75%, 50%, 25%, 0%, and 100%.

3L **Reference Ground Speed.** This data field displays the Reference Ground Speed under the title "REF GS". Default is a reference Ground Speed or - - - KT.

4L **Minimum Climb Out (VMCO).** This data field displays the Minimum Climb Out Speed under the title (VMCO).

5L **Minimum Flap Retraction Speed (VMFR).** This data field displays the Minimum Flap Retraction Speed under the title "VMFR".

6L **Branch to LDG INIT RTE n 3/4 page.** Selection branches to the LANDING INIT RTE n 3/4 page.

1R **GO-Around EPR.** The Go-Around EPR is displayed in this data field under the title "GA EPR". The default value is a calculated EPR or "- . - -".

2R **Headwind, Tailwind / Crosswind.** The Headwind, Tailwind / Crosswind is displayed in this data field in small font under the title "HW / XW" or "TW / XW". Displayed are the headwind/tailwind and crosswind components, respectively, of the SFC WINDS displayed on the LANDING INIT RTE n 3/4 page relative to the RWY HDG displayed on the LANDING INIT RTE n 3/4 page. If the data for either of these two fields is not available, these data fields will display the default of "- - -KT/- - KT".

3R **Landing Distance.** This data field displays the landing distance in feet for the flap position selected under the title "LDG DIST. Default is a landing distance or "- - - - -FT".

4R **Sink Rate.** An aircraft sink rate calculation is required when the aircraft gross weight is equal to or greater than 257,500 pounds or the fuel weight is equal or greater than 75,000 pounds for landing. The sink rate will be calculated both as a function of landing aircraft gross weight and fuel weight and displayed under the title "SINK RATE". The sink rate will display a maximum value of 600 feet per minute (FPM) and a minimum value of 360 FPM. No annunciation or other indication will be displayed for a sink rate outside of these values. Default is a calculated sink rate or - - - FPM if no PERF INIT data is entered.

CAUTION

To obtain a valid sink rate when conducting "WHAT-IF" drills, the ZFW on the PERF INIT page must be consistent with the desired "what-if" conditions. All "WHAT-IF" entries must be reset to actual conditions prior to take-off in order to display accurate TOLD calculations.

5R **2 VMCA / 2 VMFR.** The two engine Air Minimum Control Speed and two engine Minimum Flap Retraction speed is displayed in this data field under the title "2 VMCA / 2 VMFR". Default is a 2 VMCA / 2 VMFR speed or "- - KT/- - KT".

6R **Reverse Limiter.** The Reverse Limiter Setting is displayed in this data field under the title "REV LIM". The default value is "- - . -" or the computed reverse limiter setting received from the TOLD function. Range is 0 to 10.9.

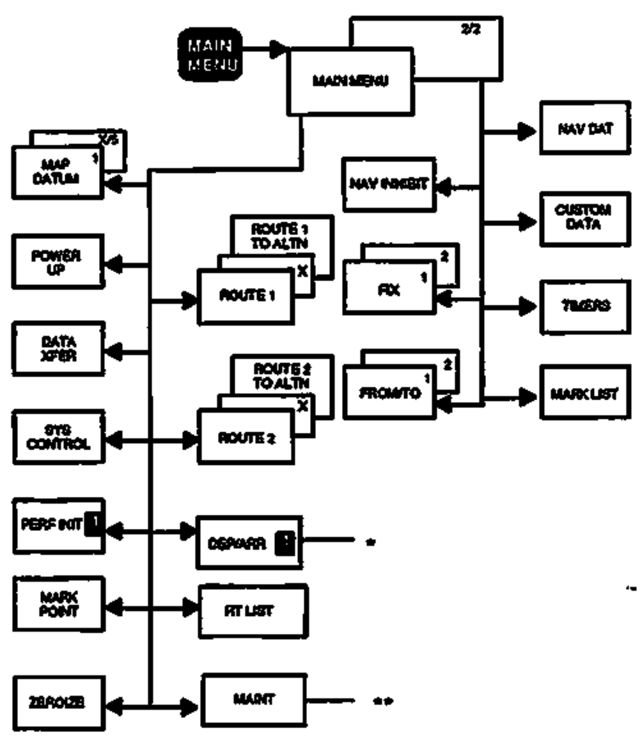
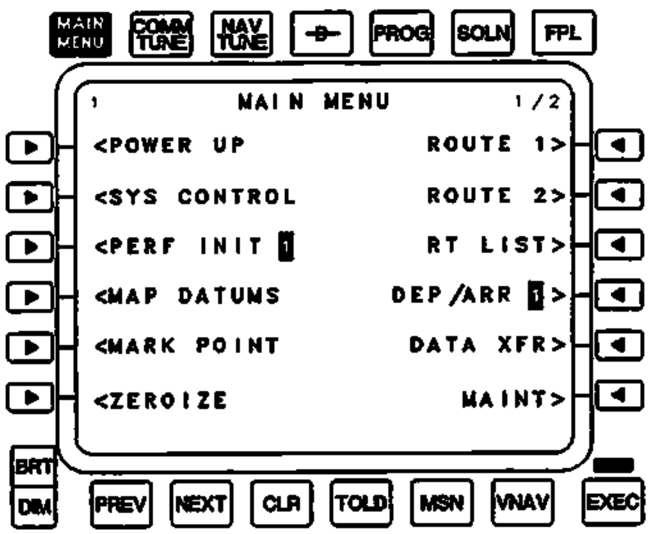


Figure 1-93. MAIN MENU TREE

MAIN MENU 1/2 Page.

The MAIN MENU 1/2 page provides a menu to access functions within the Navigation Processor. The MAIN MENU 1/2 page is primarily accessed by pressing the MFCDU MAIN MENU mode key. Pressing the PREV or NEXT page mode key from the MAIN MENU 2/2 page accesses the MAIN MENU 1 page.



D3196101

Figure 1-94. MAIN MENU 1/2

1L Branch to POWER UP page.

2L Branch to SYSTEM CONTROL page.

3L Branch to PERF INIT RTE X page associated with the active route. The active route number will be displayed.

Entry with either a "1" or "2" in the scratch pad will result in a branch to the PERF INIT RTE X page associated with the route number in the scratch pad. The default value for the route number is 1. If 3L is depressed with no active route, branching to the appropriate empty page will occur. Further, if a 1 or 2 is entered in the scratch pad prior to pressing 3L, branching to the page for the route number entered in the scratch pad will occur.

4L Branch to MAP DATUMS page 1.

5L Branch to MARK POINT page.

6L Branch to ZEROIZE page.

1R Branch to ROUTE 1 page 1.

2R Branch to ROUTE 2 page 1.

3R Branch to STORED ROUTE LIST page.

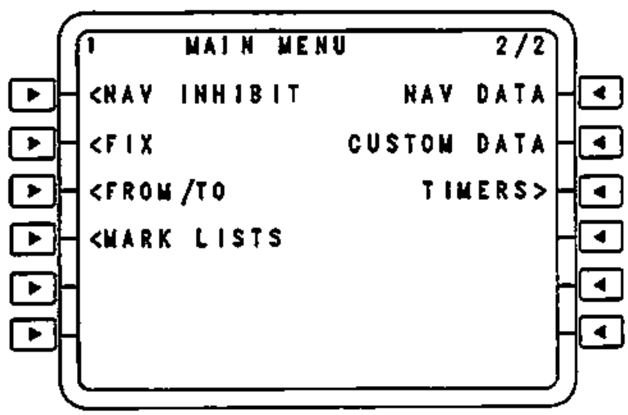
4R Branch to active route DEP/ARR INDEX X page. The active route number will be displayed in this data field. Entry with either a "1" or "2" in the scratch pad will result in a branch to the DEP/ARR INDEX X page associated with the route number in the scratch pad. The default value for route number is 1. If 4R is depressed with no active route, branching to the appropriate empty page will occur. Further, if a 1 or 2 is entered in the scratch pad prior to pressing 4R, branching to the appropriate page for the route number entered in the scratch pad will occur.

5R Branch to DATA TRANSFER 1/3 page.

6R Branch to MAINT INDEX page.

MAIN MENU 2/2 Page.

The MAIN MENU 2/2 page provides a menu to access functions within the FMS.



D3187401

Figure 1-95. MAIN MENU 2/2

1L Branch to NAVAID INHIBIT page.

2L Branch to FIX page 1.

3L Branch to FROM/TO page.

4L Branch to MARK LIST page.

5L,6L Non-operational.

1R Branch to NAV DATA page.

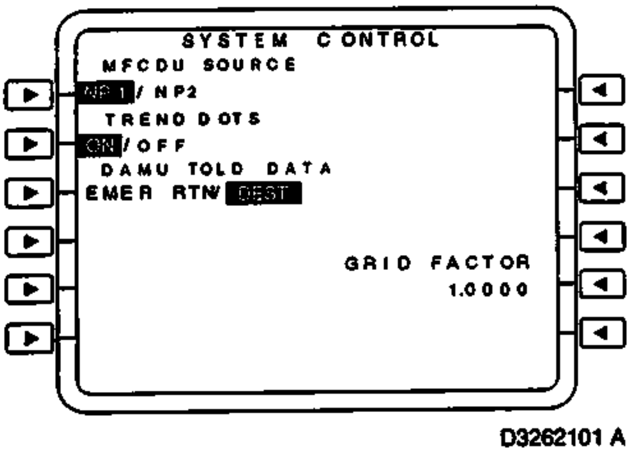
2R Branch to CUSTOM DATA LIST page.

3R Branch to TIMERS page.

4R-6R Non-operational.

SYSTEM CONTROL Page.

The SYSTEM CONTROL page is used to specify which NP is driving the MFCDU, entering the grid convergence factor, selection of trend dots, and for the selection of DAMU TOLD DATA. The SYSTEM CONTROL page is accessed from the SYS CONTROL prompt on the MAIN MENU 1/2 page.



D3262101 A

Figure 1-96. SYSTEM CONTROL

1L **MFCDU Source.** The title MFCDU SOURCE is displayed and controlled in this data field. Selection results in toggling between NP 1 and NP 2, if the other NP is available.

2L **Trend Dots ON/OFF.** Pressing 2L toggles the trend dots ON or OFF. When ON is selected the NP that is guidance master supplies trend vector 30 sec, 60 sec, and 90 sec latitude/ longitude data to the DIU for display on the MFD.

3L **DAMU TOLD Data.** The DAMU TOLD DATA display may be toggled between the Emergency Return Airfield Landing Data and the Destination Airfield Landing Data. Under the title DAMU TOLD DATA is displayed the two selections, "EMER RTN / DEST". The selected airfield option is displayed in large font, inverse video. The non-selected airfield option is displayed in small font. Entry and deletion are non-operational.

4L-4R **Non-operational.**

5R **Grid Convergence Factor.** The 5R data field displays the grid convergence factor that is displayed below the "GRID FACTOR" title. Default value of 1.00000 is displayed when the INAV latitude is north of the equator. When the INAV latitude is south of the equator, –1.00000 is displayed. Selection results in the grid convergence factor being placed in the scratch pad. Delete results in the default value being placed into this data field.

6R **Non-operational.**

MARK POSITION Page.

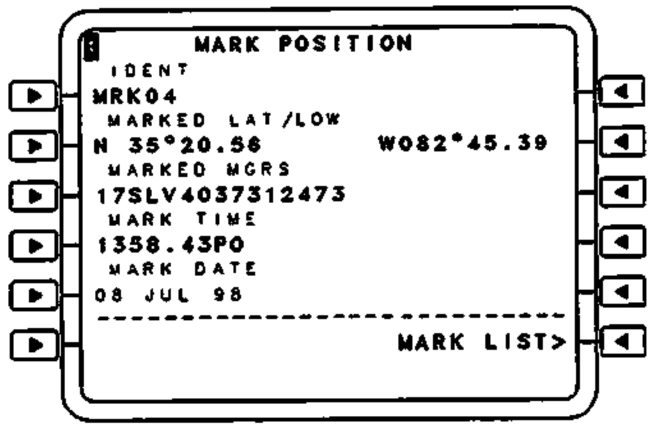
The MARK POSITION page displays information relative to the Mark waypoints.

Selection of the "MARK POINT" prompt on the MAIN MENU 1/1 page results in display of the MARK POSITION page, if the NP has a valid position. Otherwise, the error message "NO PRESENT POSITION" is displayed.

Selection of 1R-5R on the Mark List page which contain a valid Mark position results in display of the MARK POSITION page.

When the MARK POSITION page is accessed via the MARK POINT prompt, a mark point is created. Mark points are assigned sequentially (MRK01-MRK10). Pressing the MARK POINT prompt the 11th time would overwrite the first Mark point, as the list operates in a circular fashion. The newly assigned Mark identifier is then displayed on the MARK POSITION page.

If access to the MARK POSITION page is via the MARK LIST page, the identifier whose prompt was selected to access this page will be displayed. When the Mark point is created, the latitude/longitude, MGRS, time and date are recorded and associated with the Mark Identifier.



D3200901 A

Figure 1-97. MARK POSITION

1L **Mark Identifier.** Data field 1 displays the Mark Identifier. Selection results in the Mark Identifier being placed into the scratch pad. Delete results in the MARK Identifier's mark point being deleted.

2L **Marked Latitude/Longitude.** Displays the Mark Identifier's latitude/longitude. Selection results in the latitude/longitude being placed into the scratch pad.

3L **Marked MGRS.** Data field displays the Mark Identifier's MGRS. Selection results in the MGRS being placed into the scratch pad.

4L **Identifier's Mark Time.** Data field displays the time the Identifier was marked.

5L **Identifier's Mark Date.** Data field displays the date the Identifier was marked.

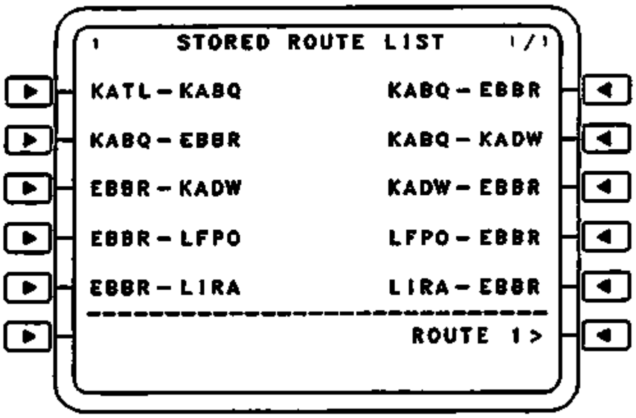
6L-5R **Non-operational.**

6R **Branch to MARK LIST page.**

STORED ROUTE LIST Page.

The STORED ROUTE LIST page provides a listing of the stored routes. Selection of the RT LIST prompt on the MAIN MENU 1/2 page or the Retrieve Route (2L) prompt on ROUTE PAGE 1 results in the display of the STORED ROUTE LIST X/10 page.

The STORED ROUTE LIST pages are created as required to display the entire list of routes stored in the NP. The number of routes determines the number of STORED ROUTE LIST pages, with 10 routes shown on each page.



D3196201

Figure 1-98. STORED ROUTE LIST

1L-5L **Stored Route.** If a Route name is displayed in the 1L data field, selection results in the route name being placed into the scratch pad. If a Route name is displayed in the 1L data field, delete results in the route being removed from the stored route list. The other routes following this route are then moved up in the list display.

6L **Non-operational.**

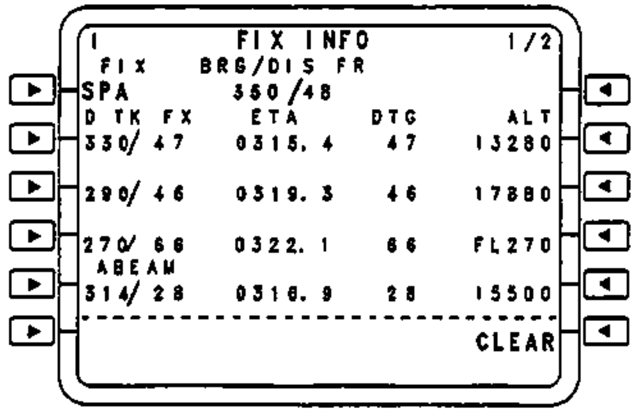
1R-5R **Stored Route.** Function same as 1L.

6R **Branch to ROUTE PAGE 1.** If the STORED ROUTE LIST page was accessed from a route page, this data field will display that route number. Otherwise, this data field displays "1". Selection results in a branch to ROUTE PAGE 1 of the route number shown in the data fields for 1L-5L or 1R-5R.

FIX INFO Page.

The FIX INFO page displays fix information from a waypoint to the active flight plan or Route 1 if neither route is active. There are two FIX INFO pages. The two pages operate completely independent of each other. The FIX page is displayed when the FIX prompt key on the MAIN MENU 2/2 page is selected.

1L **Fix Identifier.** Entries into FIX data field may be any waypoint name that meets the waypoint name format. Entries that do not follow the Waypoint Name format will result in display of "INVALID ENTRY". Waypoints that cannot be located in either the Navigation DB or Custom Waypoints List will result in display of "NOT IN DATABASE". A valid entry into the FIX data field clears all the other data fields, with the exception of the "BRG" and "DIS FR" data fields.



D3197201

Figure 1-99. FIX INFO

If more than one waypoint with the entered identifier exists, the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the FIX data field. Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

Selection when data is displayed results in the FIX data field identifier being placed into the scratch pad.

The "BRG" and "DIS FR" data fields are blanked when no FIX identifier has been entered. These two data fields display the bearing and distance from identifier to the aircraft's present position, if present position is available when a valid FIX (waypoint name) is displayed. If no present position is available, the BRG, DIS FR, FIX Intersection ETA, DTG, and ALT data fields will remain blank. The BRG data field is displayed using leading zeros. If the distance in the DIS FR data field is greater than 6553, the BRG and DIS FR data fields will be blank.

2L-4L **Down Track Fix Information.** The D TK FX, Fix Intersection ETA, DTG, and ALT data fields are blanked when no identifier has been entered into the FIX data field. Upon entry of a valid FIX waypoint name, the D TK data field will display "---". When this data field displays "---" or data, a radial, defined as outward from the fix, may be entered into this data field. When a valid course is entered into the D TK data field, the FX data field will display the down track fix distance along the radial from the FIX entered in 1L data field to the intersection with the flight path. Also displayed is the ETA or ETE to, along track distance to, and predicted altitude at the intersection. If no intersection exists, this information will not be displayed. Entries into the D TK data field that do not follow the course format result in display of "INVALID ENTRY". "ETA" will be displayed to the right of D TK FX if the aircraft is airborne and Time is valid. Under "ETA" will be displayed the ETA times. Otherwise, this data field displays "ETE", and below it, the ETE times are displayed.

The D TK data field is displayed with leading zeros. If the down track fix distance is greater than 999 NM, "999" is displayed.

If the FX data field contains data, selection results in the FIX identifier being placed into the scratch pad along with the D TK and FX data, in the format of a PBD. If the D TK data is displayed in Grid reference, the PBD format will use mag for bearing.

If the D TK data field contains data, delete results in all data fields along this line select being cleared.

5L **ABEAM Intercept.** If the FIX data field is blanked or contains an identifier and no abeam intercept exists within 400 nM of the FIX, then "ABEAM" is displayed in a small font in this data field. If the FIX data field contains data and an abeam intercept point does exist within 400 NM of the FIX, then "ABEAM" is displayed in this data field in a large font. When "ABEAM" is in either font, the data field above "ABEAM" and the three to the right of "ABEAM" on this same line will be blank.

When displayed in a large font, selection results in the data field above "ABEAM" displaying "ABEAM" in a small font and the three data fields to the right of the large font "ABEAM" displaying the abeam point and flight path intersection information. Upon selection, this data field will display the abeam radial and the distance from the fix to the abeam point. The data field display format will be course for the abeam radial followed immediately by the distance and NNN. The abeam radial will be displayed with leading zeros.

When the ABEAM, Fix Intersection ETA, and ALT data fields display abeam data, deletion results in all fields, except the left data field being blanked. The left field will display "ABEAM" according to the rules described above.

6L-5R **Non-operational.**

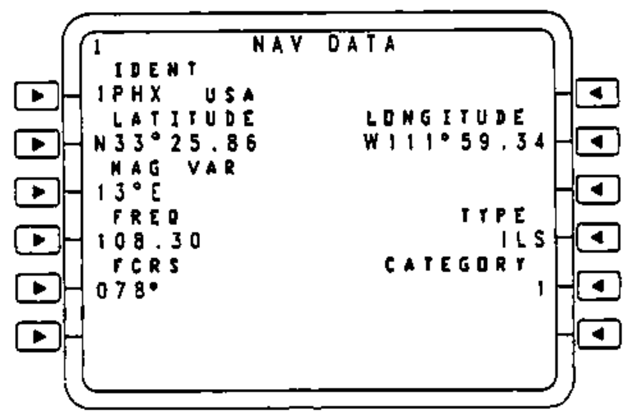
6R **Clear Prompt.** If the FIX data field contains data, "CLEAR" is displayed in this data field in a large font. Selection results in all data fields on the FIX X/2 page being cleared. If no data is contained in the FIX data field, CLEAR is displayed.

NAV DATA Page.

The NAV DATA page is used to retrieve information from the Navigation Database. Upon accessing the NAV DATA page, all data fields are cleared. The NAV DATA page is displayed when any of the following conditions are satisfied:

1. Selection of the NAV DATA prompt from the MAIN MENU 2/2 page.

2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the NAV DATA page.



D3197301C

Figure 1-100. NAV DATA

1L **Identifier and Country Code.** This data field displays box prompts if a valid identifier has not been entered. Otherwise, this data field displays the entered identifier under the "IDENT" title. When an identifier has been entered, the identifier's country code will be displayed to the right of the identifier.

Valid entries are any permanent database navaid, waypoint, or airport. Entries not in the navigation database generate the message "NOT IN DATABASE".

If more than one waypoint with the entered identifier exists in the databases (navigation and custom), the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint as the "Identifier". Upon return from the WAYPOINT SELECT page when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

Selection when the data field contains an entry results in the identifier being placed into the scratch pad.

2L **Identifier's Latitude and Longitude.** If the 1L data field contains an identifier, the two data fields between 1L and 2L will display "LATITUDE" and "LONGITUDE" titles and the 2L data fields will display the identifier's latitude and longitude coordinates.

3L **Identifier's Magnetic Variation.** If an identifier is displayed in 1L data field, "MAG VAR" title is displayed under the latitude coordinates displayed in the 2L data field. The magnetic variation will be displayed under the "MAG VAR" title.

4L **Identifier's Frequency/Channel.** If 1L contains a navaid identifier, the data field below the magnetic variation will display "CHAN" if the navaid is a TACAN, or "FREQ" if the navaid is a VOR or DME type. The data field below "CHAN" or "FREQ" will display the identifier's frequency or channel.

If the navaid identifier is a VORTAC, "FREQ" and "CHAN" titles will be displayed, respectively. The navaid's frequency and channel will be displayed under the title.

5L **Front Course.** If the 1L navaid identifier is an ILS, the title "FCRS" will be displayed. Below the "FCRS" title, the ILS's front course is displayed.

6L,1R **Non-operational.**

2R **Function same as 2L.**

3R **Elevation.** If the identifier has an elevation in the database, 3R data fields will display an "ELEVATION" title along with the identifier's elevation in feet.

4R **Identifier Type.** If the 1L identifier has an associated type in the database, "TYPE" will be displayed.

5R **Identifier Class.** If a navaid identifier is shown, "CLASS" will be displayed. The 5R data field will then display the class. The acronyms used to display navaid class are as follows:

"T"	Terminal
"LA"	Low altitude
"UR"	Unrestricted
"HA"	High altitude, low power
"HH"	High altitude, high power
"TEST"	Test

If the identifier is an ILS/MLS, "CATEGORY" will be displayed. The 5R data field will then display the category. The acronyms used to display ILS/MLS categories are as follows:

"LOC"	LOC only
"I"	ILS category I
"II"	ILS category II
"III"	ILS category III

If no type is contained in the database for the 1L identifier, these data fields are blank.

6R **Non-operational.**

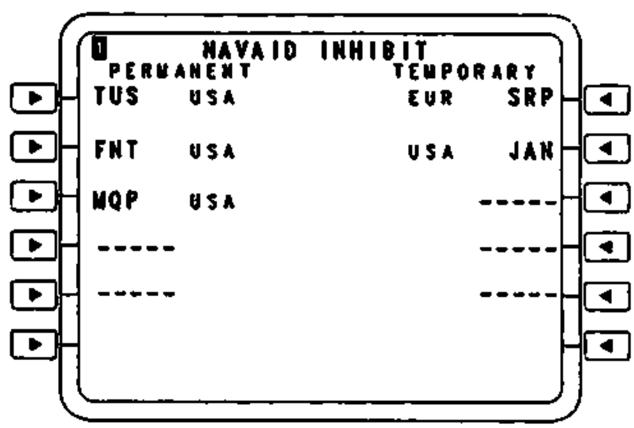
NAVAID INHIBIT Page.

The NAVAID INHIBIT page is used to invalidate navaids used for navigation. The NAVAID INHIBIT page is displayed when any of the following conditions are satisfied:

1. Selection of the NAV INHIBIT prompt from the MAIN MENU 2/2 page.

2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the NAVAID INHIBIT page.

Permanently inhibited navaids remain inhibited until cleared by the crew and are displayed on the left side of this page. Temporarily inhibited navaids are cleared on flight completion and are displayed on the right side of this page. Each LSK contains two data fields. The titles "PERMANENT" and "TEMPORARY" are displayed below the page title line.



D3221701

Figure 1-101. NAV INHIBIT

1L **First Navaid Permanently Inhibited.** Navaids that are entered as permanently inhibited remain in this list until manually deleted.

The left data field displays "-----" if a navaid has not been entered. The right data field displays the country code for the navaid displayed in the left data field. If the left data field does not contain a navaid, the right data field is blank.

Valid entries into the left data field are any TACAN, VOR, or DME type navaid that is contained in the navigation database. If an entry already exists in this field, that entry will be deleted and the data being entered will be placed into the data field.

If an entry already exists as a Temporary Inhibited Navaid, the Temporary Inhibited Navaid will be deleted and an "ALREADY IN TEMP LIST" message will be generated. If more than one navaid with the entered identifier exists in the navigation database, the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a navaid selected, the NP will use the selected navaid in the NAVAID Identifier field. Upon return from the WAYPOINT SELECT page when a navaid is not selected, the NP will display the identifier in the scratch pad.

Selection of 1L places the navaid identifier into the scratch pad, if this entry exists.

Delete removes the 1L navaid identifier from this data field and replaces it with "-----", if this navaid exists.

2L **Second Navaid Permanently Inhibited (see 1L).**

3L **Third Navaid Permanently Inhibited (see 1L).**

4L **Fourth Navaid Permanently Inhibited (see 1L).**

5L **Fifth Navaid Permanently Inhibited (see 1L).**

6L **Non-operational.**

1R **First Navaid Temporarily Inhibited.** The Temporarily Inhibited data fields operate in the same manner as the Permanently Inhibited data fields.

2R **Second Navaid Temporarily Inhibited (see 1R).**

3R **Third Navaid Temporarily Inhibited (see 1R).**

4R **Fourth Navaid Temporarily Inhibited (see 1R).**

5R **Fifth Navaid Temporarily Inhibited (see 1R).**

6R **Non-operational.**

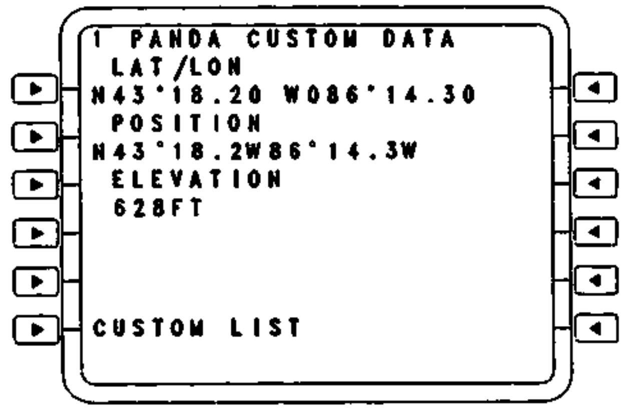
CUSTOM DATA Page.

The entered identifier will be displayed in the page title. The CUSTOM DATA page is displayed when any of the following conditions are satisfied:

1. Entry of a waypoint identifier into the SHOW WAYPOINT field on the CUSTOM DATA LIST page.

2. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the CUSTOM DATA page.

3. Entry of an undefined waypoint identifier in a field that accepts waypoint identifier entries on one of the pages listed in the 6L data field.



D3197501

Figure 1-102. CUSTOM DATA

1L **Custom Waypoint Latitude/Longitude.** This data field displays the latitude/longitude of the custom waypoint identified in the page title, if the waypoint is defined. Selection results in the latitude/longitude data being placed into the scratch pad if the custom waypoint is defined.

2L **Custom Waypoint Position.** If the custom waypoint identified in the page title is defined, 2L data field displays the waypoint's position definition.

Valid position entry formats are Latitude/Longitude, MGRS, Place/Bearing/Distance, and Place/Bearing/Place/Bearing. Entry of a valid position when the custom waypoint database is full generates the error message "WPT LIST FULL" and no further action occurs. Entry of a valid position when the custom waypoint is in a flight plan generates the error message "WPT IN FPL" and no further action occurs. Otherwise, when a valid position entry occurs, the latitude/longitude is computed, the latitude/longitude is displayed in the data field, and the defined custom waypoint is stored.

If a Place/Bearing/Distance or Place/Bearing/Place/Bearing position entry contains a place identifier that matches multiple navigation and custom database waypoints, the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint to determine the entered position.

Selection results in this data field being placed into the scratch pad if the waypoint is defined.

3L **Custom Waypoint Elevation.** If the custom waypoint identified in the page title is defined and an elevation has been entered, this data field displays the waypoint's elevation.

Entry of a valid elevation, when the custom waypoint is in a flight plan, generates the error message

"WPT IN FPL", and no further action occurs. Otherwise, a valid elevation entry will be stored if the custom waypoint exists.

Delete, when an elevation is displayed and the custom waypoint is in a flight plan, generates the error message "WPT IN FPL", and no further action occurs.

4L,5L **Non-operational.**

6L **Branch to calling page.** This data field will display a branch prompt for the page that accessed the CUSTOM DATA. Selection when "<ROUTE "x or "<LEGS "x is displayed results in a branch back to the particular page where the CUSTOM DATA page was accessed from. Otherwise, selection results in a branch back to the displayed calling page.

1R-6R **Non-operational.**

CUSTOM DATA LIST Page.

The CUSTOM DATA LIST page provides a listing of the stored custom waypoints. The CUSTOM DATA LIST page is displayed when any of the following conditions are satisfied:

1. Selection of the CUSTOM DATA prompt on the MAIN MENU 2/2 page.

2. Selection of the CUSTOM LIST prompt on the CUSTOM DATA page.

The CUSTOM DATA LIST pages are created as required to display the entire list of custom waypoints stored in the NP. The number of custom waypoints determines the number of CUSTOM DATA LIST pages, with nine waypoints shown per page.

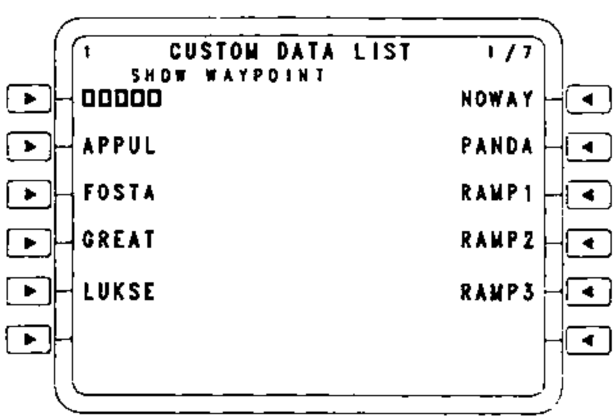


Figure 1-103. CUSTOM DATA LIST

1L **Show Waypoint.** Valid waypoint identifier format entries into this data field result in a branch to the CUSTOM DATA page with the entered identifier displayed in the CUSTOM DATA page Waypoint Identifier field. Entries are made into the box prompts below the title "SHOW WAYPOINT".

2L-5L **Stored Waypoint.** If a waypoint identifier is displayed in the data field next to this LSK, selection results in the waypoint identifier being placed into the scratch pad. Delete, when a waypoint identifier is displayed and the waypoint is in a flight plan, generates the error message "WPT IN FPL".

6L **Non-operational.**

1R-5R **Stored Waypoint.** Function same as 2L, except that the right data fields replace the left data fields on the page.

6R **Non-operational.**

FROM/TO Page.

The FROM/TO page allows for entry of two reference points and a selected ground speed and computes the bearing, distance, and time between the two points. Two identical pages are provided, pages 1/2 and 2/2. The FROM/TO page is displayed when any of the following conditions are satisfied:

1. The FROM/TO prompt on the MAIN MENU 2/2 page is selected. Selection results in display of page 1 of the FROM/TO page.

2. Access between page 1/2 and 2/2 is accomplished using the PREV and NEXT PAGE keys.

3. Selection of 1L-5L on the WAYPOINT SELECT page when the WAYPOINT SELECT page was accessed from the FROM/TO page.

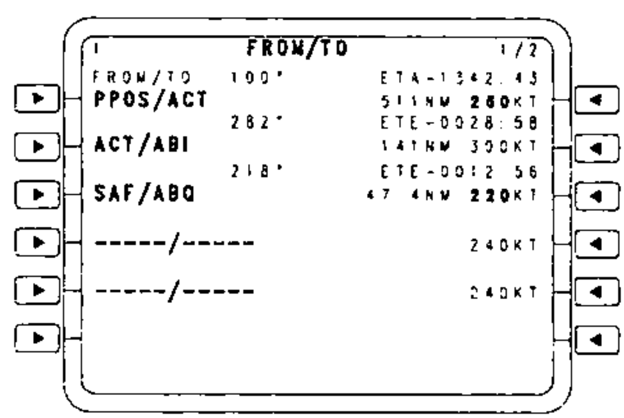


Figure 1-104. FROM/TO

1L **From/To.** This data field displays the FROM/TO reference points. Initially, this field defaults to "-----/-----". A valid entry consists of a reference point defined in the database or flight plan followed by a "/", followed by a second reference point. Entry of PPOS as the first reference point implies the current aircraft position is to be used as the FROM waypoint and the FROM point is displayed as PPOS. A third type of valid entry consists of "/" followed by a reference point. This permits entry of only the TO reference point. If a FROM reference point already exists, it remains. If one doesn't exist, PPOS is assumed and displayed as the FROM reference point.

If more than one waypoint with the entered identifier exists in the databases (navigation or custom), the NP will branch to the WAYPOINT SELECT page. Upon return from the WAYPOINT SELECT page with a waypoint selected, the NP will use the selected waypoint in the FROM/TO field. Upon return from the WAYPOINT SELECT page, when a waypoint is not selected, the NP will display the waypoint identifier in the scratch pad.

When the FROM/TO reference points are entered, the outbound bearing from the FROM point is displayed to the right of the 1L FROM/TO title and below the page title. The time between these two points is displayed to the right of the outbound bearing. The distance (in nautical miles) between the From and To points is displayed in the 1L center data field in row 3. The time will be an Estimated Time Enroute (ETE) if the FROM reference point is not PPOS, or an Estimated Time of Arrival (ETA) if the FROM reference point is PPOS. The ground speed, shown in knots, in the 1L far right data field will be used to compute the time.

If each reference point in the LSK left data field is six characters in length, the "/" in this data field will be eliminated to accommodate this situation.

If LSK left data field contains an entry, the delete function will delete the data in this field, and the outbound bearing, time between these points, and distance data fields will also be cleared.

2L-5L **From/To.** Function same as 1L, except operation is on the data fields associated with these line select keys.

6L **Branch to INDEX 2/2 page.**

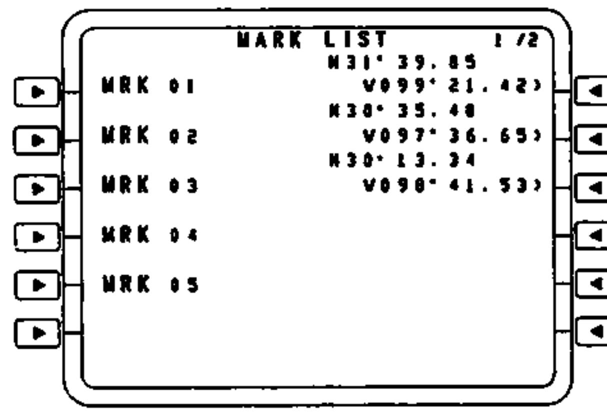
1R-5R **Groundspeed.** Initially, the groundspeed in these data fields defaults to current aircraft ground speed if airborne, and 280 knots if not airborne. If a ground speed is entered, it will be displayed in a large font. Delete results in this data field displaying its default ground speed.

6R **Non-operational.**

MARK LIST Page.

The MARK LIST page lists the Mark Identifiers and their positions. Selection of the MARK LIST prompt from either the MAIN MENU 2/2 or MARK POSITION page results in display of the MARK LIST page 1/2.

The MARK LIST page consists of two similar pages, pages 1/2 and 2/2. The two pages are necessary to list the 10 mark point identifiers. Page 1/2 lists mark points 01-05 sequentially down the left side of the page. Page 2/2 lists mark points 06-10 in the same way.



D3197801

Figure 1-105. MARK LIST

1L-5L **Mark Point.** Selection results in the Mark point identifier being placed in the scratch pad. Delete results in the Identifier's latitude/longitude and all other data associated with the Mark point being cleared.

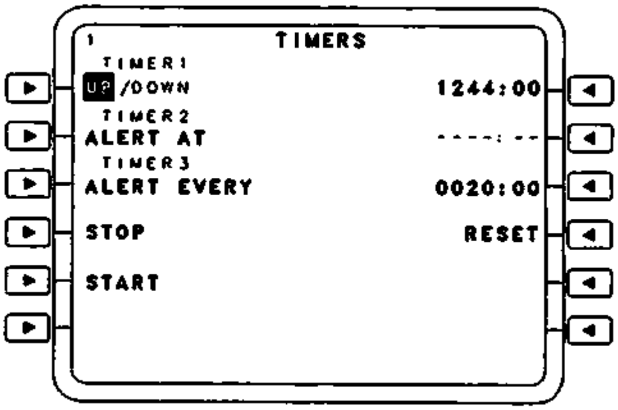
6L **Non-operational.**

1R-5R **Mark Point Additional Data.** If the Mark point at 1L has been marked, its latitude/longitude will be displayed. The last character is a ">" to indicate branching to the Mark Position page to view additional data is valid. Otherwise, these data fields are blanked. If column 24 contains a ">", then selection results in a branch to the Mark Position page, where the Mark point displayed in column 2 will be displayed. Otherwise, selection is non-operational. Delete results in the Identifier's latitude/longitude and all other data associated with the Mark point being cleared.

6R **Non-operational.**

TIMERS Page.

The TIMERS page allows the setting of crew-alerting timers. Selection of the TIMERS prompt from the MAIN MENU 2/2 page results in display of the TIMERS page.



D3198001 A

Figure 1-106. TIMERS

1L Timer 1 Up / Down Mode. The data field displays the title "TIMER 1" and the state of Timer 1. Selections are Up or Down. Default is UP.

2L,3L Non-operational.

4L Timer 1 Stop. This data field displays "STOP" in a large font if timer 1 is active (running). Selection in this case stops timer 1 from running. If timer 1 is not running, "STOP" is displayed in a small font (default), and selection is non-operational. Entry and delete are non-operational.

5L Timer 1 Start. This data field displays "START" in a large font if: (1) timer 1 is not running and the timer 1 Up/Down mode is Up, or (2) timer 1 is not running, the timer 1 Up/Down mode is down, and a time is displayed in the timer 1 time field. Selection results in timer 1 starting. If the mode is UP, timer 1 starts counting up at (1) 0000:00 if no data has been entered into the timer 1 time field, or (2) the currently displayed time in the timer 1 time field. If the mode is down, timer 1 starts counting down from the currently displayed time in the timer 1 time field. When 0000:00 is reached, the timer stops and a message is generated ("TIMER 1 EXPIRED").

6L Non-operational.

1R Timer 1 Time. This data field displays timer 1's time. Entry while the timer is running generates the error message "NOT ALLOWED". Otherwise, entries are displayed in this data field. Deletion clears the time displayed in this data field and the default data, "----:--", is displayed. If deletion occurs while the timer is running, the timer is also stopped.

2R Timer 2 Time. This data field displays Timer 2's time. Valid entries are displayed in this data field. If the data field displays a time, the message "TIMER 2 EXPIRED" will be generated when the NP's time is equal to that time and the data field will then be cleared.

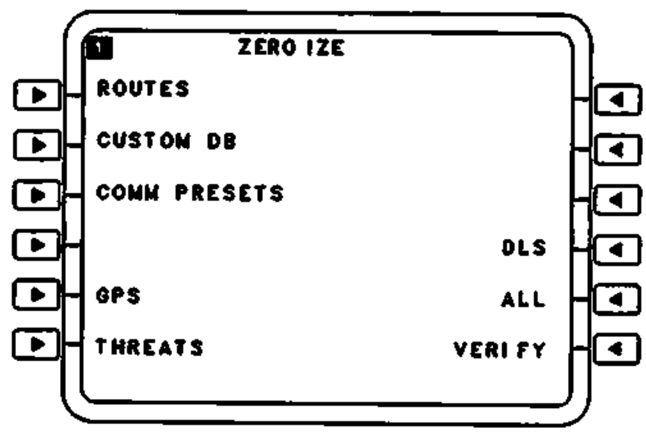
3R Timer 3 Time. This data field displays timer 3's time. Valid entries are displayed in this data field. Upon entry of a time, X, the message "TIMER 3 EXPIRED" will be generated every X from the time of entry.

4R Timer 1 Reset. This data field displays "RESET" in a small font if no time is displayed in timer 1's time field. Selection will be non-operational. At all other times, "RESET" will be displayed in a large font.

5R,6R Non-operational.

ZEROIZE Page.

The ZEROIZE page allows the operator to select the items to be zeroized, and then perform the zeroization on all selected items. The ZEROIZE page is accessed from the ZEROIZE prompt on the MAIN MENU 1/2 page.



D3198101

Figure 1-107. ZEROIZE

1L Routes Selected. Selection of Zeroization of Routes is displayed and controlled from this data field. When the page is selected for display, the "ROUTES" prompt is displayed in a large font. Selection toggles the "ROUTES" between selected (inverse large font) and deselected (large font). If the ROUTES have been commanded to ZEROIZE, "ROUTES" will be displayed in a small font.

2L Custom Database Selected. Function same as 1L.

3L Comm Presets Selected. Function same as 1L.

4L Non-operational.

5L **GPS Selected.** Function same as 1L.

6L **Threats Selected.** Function same as 1L.

1R-3R **Non-operational.**

4R **DLS Selected.** Function same as 1L.

5R **All Selected.** Selection of Zeroization of All is displayed and controlled from the 5R data field. Selection toggles the "ALL" between selected (inverse large font) and deselected (large font). Selection of ALL selects all available items on the ZEROIZE page for Zeroization. All items on the page are then displayed as selected. Selection of an item when ALL has been selected results in that item being deselected, along with the ALL prompt. All other items on the page that were selected by the selection of ALL remain selected. Deselection of ALL deselects all items on the page.

Zeroization when ALL has been selected results in the ALL prompt being displayed in a small font while the page continues to be displayed.

6R **Verify.** This data field displays the status of Zeroization verify. "VERIFY" is displayed in a large font, inverse video, if any item on the page is selected. Otherwise, VERIFY is displayed in a small font.

Selection when VERIFY is displayed in a large font, inverse video, results in the selected items being commanded to ZEROIZE. All items will then be deselected. Selection when VERIFY is displayed in a small font.

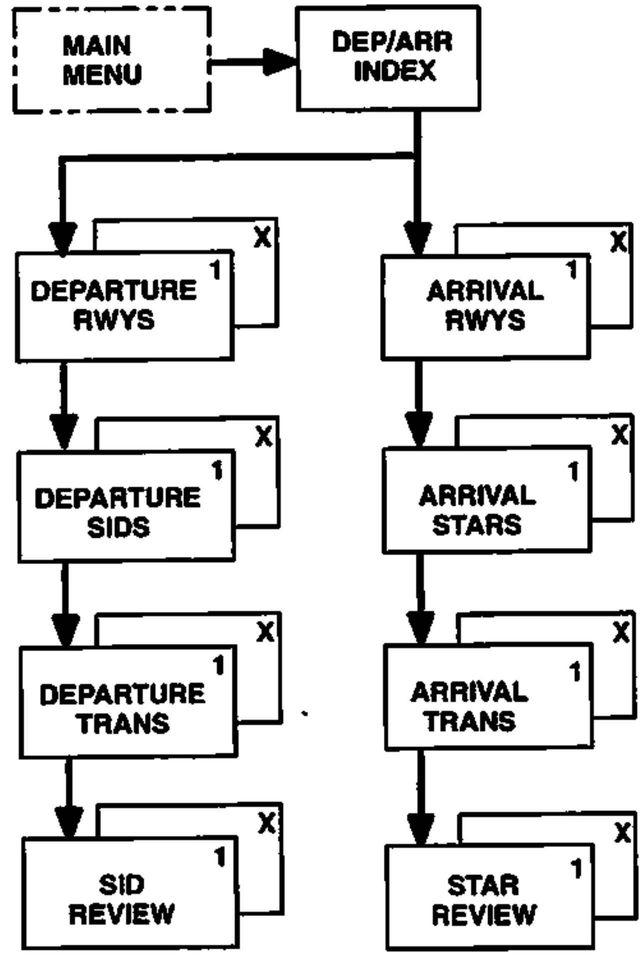


Figure 1-108. DEPARTURE ARRIVAL TREE

DEP/ARR INDEX Page.

The DEP/ARR INDEX page provides access to the departure and arrival procedures for origin and destination airports selected for the flight plan (primary and alternate flight plans). This page also provides access to departure and arrival procedures for any airport contained in the database.

Selection of the DEP/ARR prompt on the Route or MAIN MENU page results in display of the DEP/ARR INDEX page. If selection was from Route 1, the Route 1 DEP/ARR INDEX page is displayed. If selection was from Route 2, the Route 2 DEP/ARR INDEX page is displayed. Selection from the MAIN MENU page results in displaying the DEP/ARR INDEX page for an indicated route.

The DEP/ARR INDEX page is also accessible from the Departure and Arrival pages, if those pages were accessed from the OTHER selection (see 6L and 6R on this page). Selecting the DEP/ARR prompt on these pages follows the same logic as selection of the DEP/ARR prompt on the MAIN MENU page.

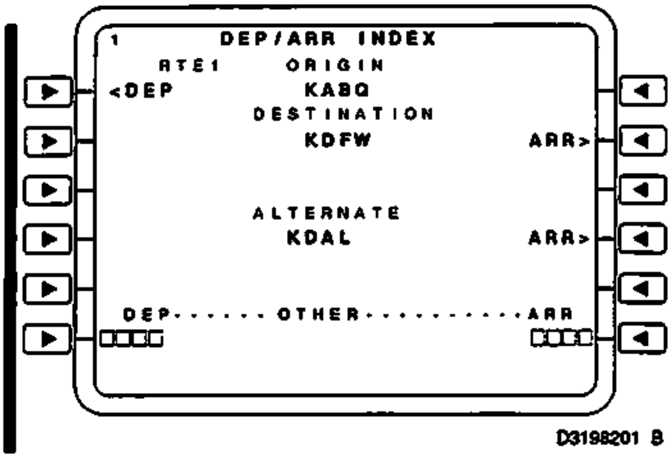


Figure 1-109. DEP/ARR INDEX

1L **Origin Departure.** If an origin exists for the route number, either 1 or 2, displayed on the page, the ICAO identifier will be displayed under the "ORIGIN" title. If an origin identifier is displayed, and the Navigation database contains runway information for that origin, this data field will display "<DEP" in a large font; otherwise, it is displayed in a small font. If displayed in a large font, selection results in a branch to the DEPARTURE RWYS page for the specified origin.

2L-5L **Non-operational.**

6L **Other Departure Procedure Prompt.** Entry of a valid airport identifier into the MFCDU scratch pad and subsequent selection of 6L results in the display of the DEPARTURE RWYS page corresponding to that airport. Valid entries are four-character ICAO (International Civil Aviation Organization) airport identifiers contained in the database.

1R **Non-operational.**

2R **Destination Arrival.** If a destination exists for the displayed route, either 1 or 2, the destination airport ICAO identifier will be displayed under the "DESTINATION" title. If a destination is displayed, and the Navigation database contains runway information for that destination, 2R data field will display ARR>. If displayed in a large font, selection results in a branch to the ARRIVAL RWYS page for the specified destination.

3R **Non-operational.**

4R **Alternate Destination Arrival.** If an alternate destination exists for the displayed route, the alternate airport ICAO identifier is displayed under the "ALTERNATE" title. If an alternate destination is displayed, and the Navigation database contains arrival information for that destination, 4R data field will display ARR>. If displayed in a large font, selection results in a branch to the ARRIVAL RWYS page for the specified alternate destination.

5R **Non-operational.**

6R **Other Arrival Procedure Prompt.** Entry of a valid airport identifier into the scratch pad and subsequent selection of 6R results in the display of the ARRIVAL RWYS page corresponding to that airport. Valid entries are four-character ICAO airport identifiers contained in the database.

DEPARTURE RWYS Page.

The DEPARTURE RWYS page provides a means for the pilot to select a runway from a list of runways associated with a selected airport. Selection of the <DEP prompt on the DEP/ARR INDEX page results in the display of the DEPARTURE RWYS page corresponding to the origin airport displayed on the DEP/ARR INDEX page.

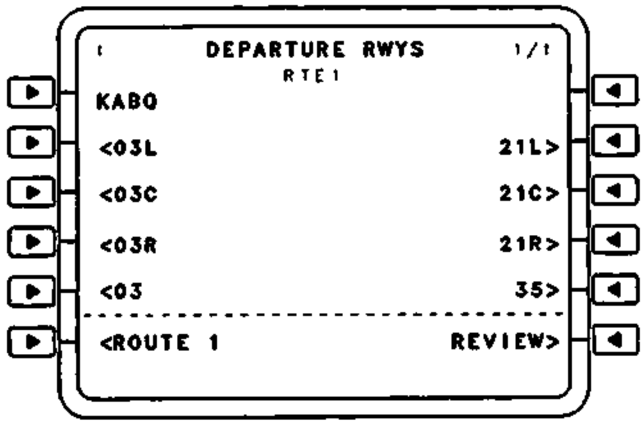
Entry of a valid airport identifier into the MFCDU scratch pad and subsequent selection of 6L on the DEP/ARR INDEX page results in the display of the DEPARTURE RWYS page corresponding to that airport.

Deletion of the 1L departure procedure on the DEPARTURE SIDS, DEPARTURE TRANS, or SID REVIEW page will result in the display of the DEPARTURE RWYS page.

Selection of 6R on the SID REVIEW page when the SID REVIEW page was accessed via the DEPARTURE RWYS page will result in the display of the DEPARTURE RWYS page.

The DEPARTURE RWYS page provides a list of the runways for the specified airfield. If the list is greater than can be displayed on one page, a second DEPARTURE RWYS page is provided and accessed through the PREV and NEXT page mode keys.

The route that is selecting the procedure is displayed in the data field under the page title. If access to the procedure pages was via the OTHER departure prompt on the DEP/ARR INDEX page, this data field is blank.



D3198301

Figure 1-110. DEPARTURE RWYS

1L,1R **Departure Procedure.** The 1R data field displays the airport identifier associated with the access of this page. The selected departure procedure will be displayed in 1R data field. Format is Runway followed by a space, followed by the SID, and then followed by "TRANS", where TRANS is the transition name.

Deletion results in the currently selected departure being deleted. If an active departure procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when a departure procedure is pending activation results in the departure procedure being deleted while leaving the previous departure procedure or origin airport displayed (the origin airport will be displayed unless an active departure procedure exists). Deletion when only the airport identifier is displayed is non-operational.

2L-5L **Runway.** Selection results in any previous runway, SID, or departure being cleared from 2R data field and the selected runway being displayed. If the route, displayed under the page title, is active or provisional, the EXEC button will be illuminated and "ERASE" will be displayed in 6L data field. If no route is displayed, the selected procedure does not affect either flight plan. If SIDs are available from the navigation database, the DEPARTURE SIDS page is displayed upon runway selection; otherwise, this page remains displayed.

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays "ERASE" if the route specified under the page title is provisional. <ROUTE 1 is displayed if the route specified under the page title shows route 1, and <ROUTE 2 is displayed if the indicated route shows route 2. If no route is specified, <DEP/ARR will be displayed.

Selection when ERASE is displayed will result in the pending departure modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed for the route that was being modified. Selection when <ROUTE x is displayed will result in the display of the ROUTE PAGE 1 page for that route. Selection when <DEP/ARR is displayed will result in a branch to the DEP/ARR INDEX page.

2R-5R Function same as 2L.

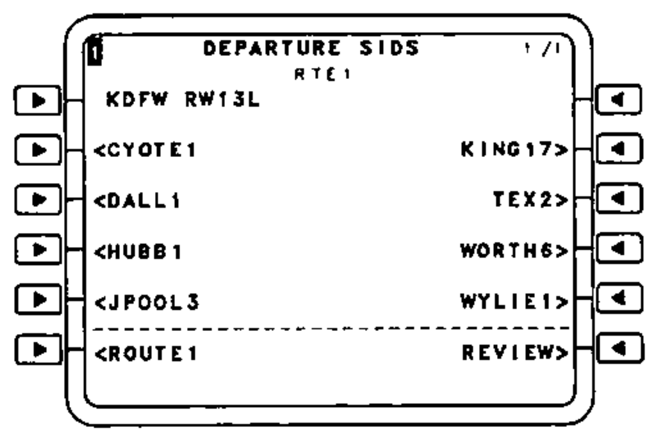
6R **Branch to SID REVIEW page.**

DEPARTURE SIDS Page.

Selection of a runway on the DEPARTURE RWYS page will result in the display of the DEPARTURE SIDS page, if SIDs are available.

Selection of 6R on the SID REVIEW page when the SID REVIEW page was accessed via the DEPARTURE SIDS page will result in the display of the DEPARTURE SIDS page.

The DEPARTURE SIDS page provides a list of the SIDS for the specified airfield and runway. If the list is greater than can be displayed on one page, a second DEPARTURE SIDS page is provided and accessed through the PREV and NEXT page mode keys. The data field under the page title displays the route that is selecting the procedure. If access to the procedure pages was via the OTHER departure prompt on the DEP/ARR INDEX page, this data field is blanked.



D3198601 A

Figure 1-111. DEPARTURE SIDS

1L,1R **Departure Procedure.** The 1L data field displays the airport identifier associated with the access of this page. The selected departure procedure will be displayed to the right of the airport identifier in 1R data field. Format is Runway followed by a space, followed by the SID, and then followed by "TRANS", where TRANS is the transition name.

Deletion results in a branch to the DEPARTURE RWYS page and the currently selected departure being deleted. If an active departure procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when a departure procedure is pending activation results in the departure procedure being deleted while leaving the previous departure procedure or origin airport displayed (the origin airport will be displayed unless an active departure procedure exists).

2L-5L **Standard Instrument Departure.** Selection results in the SID identifier being appended to the runway identifier in LSK 1L and the DEPARTURE TRANS page being displayed if transitions are available. If no transitions are available, the DEPARTURE SIDS page remains displayed. Selection when no SID is displayed at that line select is nonoperational. Selection of a SID when the route number data field is blank will result in no changes to either flight plan.

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays ERASE if the route specified under the page title is provisional. <ROUTE 1 is displayed if the specified route is route 1, and <ROUTE 2 is displayed if the indicated route is route 2. If no route is specified, <DEP/ARR will be displayed.

Selection when ERASE is displayed will result in the pending departure modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed for the route being modified. Selection when <ROUTE x is displayed will result in the display of the ROUTE PAGE x page for that route. Selection when <DEP/ARR is displayed will result in a branch to the DEP/ARR INDEX page.

2R-5R Function same as 2L.

6R **Branch to SID REVIEW Page.**

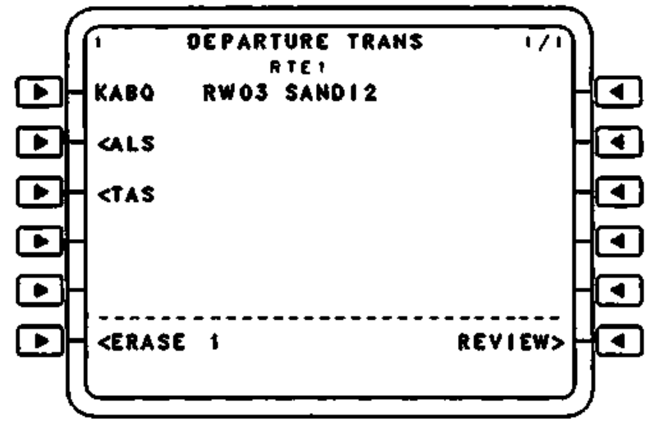
DEPARTURE TRANS Page.

The DEPARTURE TRANS page provides a means for the pilot to select a transition from a list of transitions associated with a selected airport and SID. Selection of a SID on the DEPARTURE SIDS page results in the display of the DEPARTURE TRANS page, if transitions are available.

Selection of 6R on the SID REVIEW page, when the SID REVIEW page was accessed via the DEPARTURE TRANS page, will result in the display of the DEPARTURE TRANS page.

The DEPARTURE TRANS page provides a list of the transitions for the specified airfield and SID. If the list is greater than can be displayed on one page, a second DEPARTURE TRANS page is provided and accessed through the PREV and NEXT page mode keys.

The route that is selecting the procedure is displayed under the page title. If access to the procedure pages was via the "OTHER" departure prompt on the DEP/ARR INDEX page, this data field is blank.



D3198701

Figure 1-112. DEPARTURE TRANS

1L,1R **Departure Procedure.** The 1L data field displays the airport identifier associated with the access of this page. The selected departure procedure will be displayed to the right of the airport identifier in the 1R data field. Format is Runway (RWNNA) followed by a space, followed by the SID, and then followed by "TRANS", where TRANS is the transition name.

Deletion results in a branch to the DEPARTURE RWYS page and the currently selected departure being deleted. If an active departure procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when a departure procedure is pending activation results in the departure procedure being deleted while leaving the previous departure procedure or origin airport displayed (the origin airport will be displayed unless an active departure procedure exists).

2L-5L **Departure Transition.** Selection results in the transition identifier being appended to the SID identifier in 2R data field.

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays "ERASE" if the route specified under the page title is provisional. "<ROUTE 1" is displayed if the specified route is route 1, and "<ROUTE 2" is displayed if the specified route is route 2. If no route is specified, "<DEP/ARR" will be displayed.

Selection when "ERASE" is displayed will result in the pending departure modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed. Selection when "<ROUTE x" is displayed will result in the display of the ROUTE PAGE 1 page for that route. Selection when "<DEP/ARR" is displayed will result in a branch to the DEP/ARR INDEX page.

2R-5R Function same as 2L.

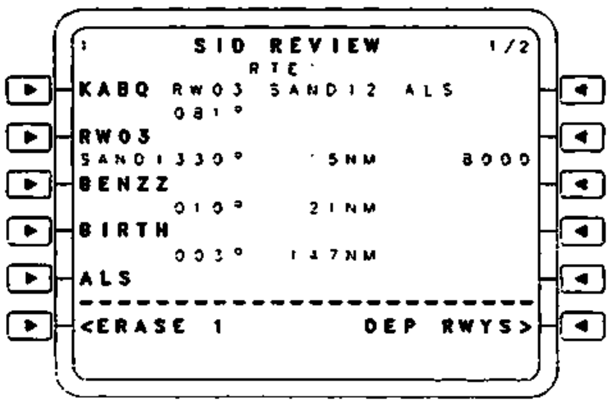
6R **Branch to SID REVIEW page.**

SID REVIEW Page.

The SID REVIEW pages are used to display the legs of SID, sequentially. Information about each waypoint such as course, distance, and constraint data is displayed if available.

Selection of 6R on the DEPARTURE RWYS, DEPARTURE SIDS, or DEPARTURE TRANS page results in the display of the SID REVIEW page.

The data field under the page title displays the route that is selecting the procedure. If access to the procedure pages was via the "OTHER" departure prompt on the DEP/ARR INDEX page, this data field is blanked.



D3'98801

Figure 1-113. SID REVIEW

1L,1R **Departure Procedure** 1L data field displays the airport identifier. The selected departure procedure will be displayed to the right of the airport identifier. Format is Runway followed by a space, followed by the SID, and then followed by "TRANS", where TRANS is the transition name.

Deletion results in a branch to the DEPARTURE RWYS page and the currently selected departure being deleted. If an active departure procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when a departure procedure is pending activation results in the departure procedure being deleted while leaving the previous departure procedure or origin airport displayed (the origin airport will be displayed unless an active departure procedure exists).

2L,2R **Departure Procedure Waypoint.** Six data fields associated with 2L and 2R display leg data for SIDs. These data fields are the same as other data fields shown on the LEGS page. However, no leg data may be changed on this page. After the last waypoint in the procedure, the next LSK data field will display "END OF PROCEDURE" in a large font.

3L-5L Function same as 2L.

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays "ERASE" if the route specified is provisional. "<ROUTE 1" is displayed if the specified route is route 1, and "<ROUTE 2" is displayed if the specified route is route 2. If no route is specified, "<DEP/ARR" will be displayed.

Selection when "ERASE" is displayed will result in the pending departure modification and any other pending flight plan modifications being erased and the ROUTE Page 1 being displayed for the route that was being modified. Selection when "<ROUTE x" is displayed will result in the display of the ROUTE PAGE 1 page for that route. Selection when "<DEP/ARR" is displayed will result in a branch to the DEP/ARR INDEX page.

3R-5R Function same as 2R.

6R **Branch to Departure Page.** This data field displays a branch to the page that accessed the SID REVIEW page. Branch data field displays are "DEP RWYS>," "DEP SIDS>" and "DEP TRANS>." Selection results in a branch to the page shown in this data field.

ARRIVAL RWYS Page.

The ARRIVAL RWYS page provides a means for the pilot to select a runway from a list of runways associated with a selected airport.

Selection of either ARR > prompt on the DEP/ARR INDEX page will result in the display of the ARRIVAL RWYS page corresponding to the origin or a destination airport displayed on the DEP/ARR INDEX page.

Entry of a valid airport identifier into the MFCDU scratch pad and subsequent selection of 6R on the DEP/ARR INDEX page results in the display of the ARRIVAL RWYS page corresponding to that airport. The "RTE x" data field on this page will then be blank.

Deletion of an arrival procedure displayed in 1L on the ARRIVAL STARS, ARRIVAL TRANS, or STAR REVIEW page results in the display of the ARRIVAL RWYS page.

Selection of 6R on the STAR REVIEW page, when the STAR REVIEW page was accessed via the ARRIVAL RWYS page, will result in the display of the ARRIVAL RWYS page.

The ARRIVAL RWYS page provides a list of the runways for the specified airfield. If the list is greater than can be displayed on one page, a second ARRIVAL RWYS page is provided and accessed through the PREV and NEXT page mode keys. Page numbering will be displayed in the page upper right corner.

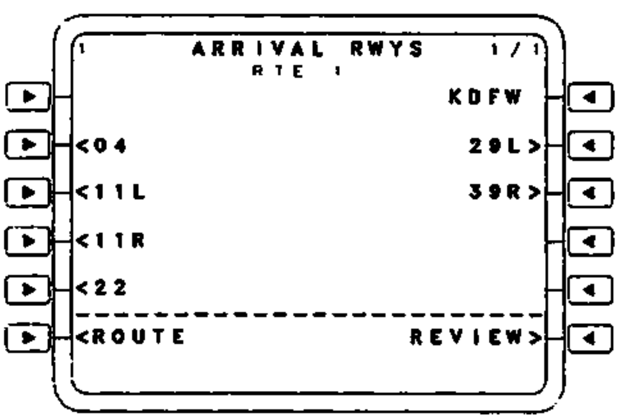
The route that is selecting the procedure is displayed under the page title and will appear as either "RTE 1 or RTE 2".

If access to the procedure pages was via the OTHER arrival prompt on the DEP/ARR INDEX page, the "RTE x" data field is blank.

1L,1R **Arrival Procedure.** The 1R data field displays the airport identifier associated with the access of this page. The selected arrival procedure will be displayed to the left of the airport identifier in LSK 1L data field. Format is "TRANS", where TRANS is the transition name, followed by the STAR, followed by a space, and then followed by Runway.

Deletion results in the currently selected arrival being deleted. If an active arrival procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when an arrival procedure is pending activation results in the arrival procedure being deleted while leaving the previous arrival procedure or destination airport displayed (the destination airport will be displayed unless an active arrival procedure exists).

2L-5L **Runway.** Selection results in any previous runway, STAR, or arrival being cleared from 1L data field and the selected runway being displayed in that data field. Selection when the data field is empty is non-operational. If the displayed route under the page title is active or provisional, the EXEC button will be illuminated and "ERASE" will be displayed in 6L data field. If STARs are available from the navigation database, the ARRIVAL STARS page is displayed; otherwise, this page remains displayed. Selection of a runway when the route data field under the page title is blank does not affect either flight plan.



D3193901

Figure 1-114. ARRIVAL RWYS

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays "ERASE" if the specified route specified is provisional. "<ROUTE 1" or "<ROUTE 2" will be displayed if "RTE 1 or RTE 2" is displayed respectively under the page title. If no route is specified, "<DEP/ARR" will be displayed.

Selection when "ERASE" is displayed will result in the pending arrival modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed. Selection when "<ROUTE x" is displayed will result in the display of the ROUTE PAGE 1 page for that route. When "<DEP/ARR" is displayed, selection will result in a branch to the DEP/ARR INDEX page.

2R-5R Function same as 2L.

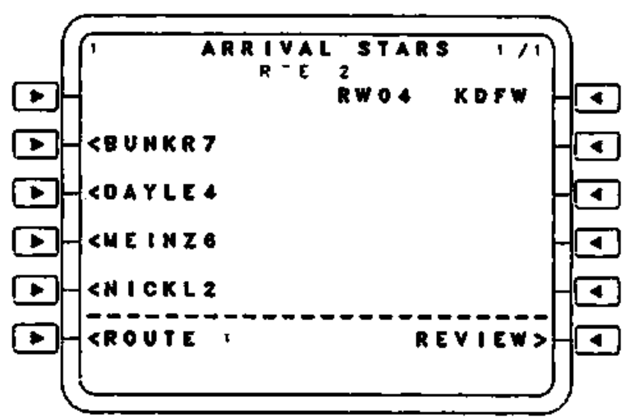
6R **Branch to STAR REVIEW page.**

ARRIVAL STARS Page.

The ARRIVAL STARS page provides a means for the pilot to select a STAR from a list of STARS associated with a selected airport and runway. Selection of a runway on the ARRIVAL RWYS page results in the display of the ARRIVAL STARS page, if STARS are available. Selection of 6R on the STAR REVIEW page when the STAR REVIEW page was accessed via the ARRIVAL STARS page will result in the display of the ARRIVAL STARS page.

The ARRIVAL STARS page provides a list of the STARS for the specified airfield and runway. If the list is greater than can be displayed on one page, a second ARRIVAL STARS page is provided and accessed through the PREV and NEXT page mode keys.

The route that is selecting the procedure is displayed in the data field under the page title. If access to the procedure pages was via the "OTHER" arrival prompt on the DEP/ARR INDEX page, this data field is blanked.



D3199001

Figure 1-115. ARRIVAL STARS

1L,1R **Arrival Procedure.** 1R data field displays the airport identifier associated with the access of this page. The selected arrival procedure will be displayed to the left if the airport identifier in 1L data field. Format is "TRANS.", where TRANS is the transition name, followed by the STAR, followed by a space, and then followed by the Runway. Deletion results in a branch to the ARRIVAL RWYS page and the currently selected arrival being deleted.

If an active arrival procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when an arrival procedure is pending activation results in the arrival procedure being deleted while leaving the previous arrival procedure or destination airport displayed (the destination airport will be displayed unless an active arrival procedure exists).

2L-5L **Standard Arrival.** Selection results in the STAR identifier being appended to the runway identifier in 1L and the ARRIVAL TRANS page being displayed if transitions are available. Selection when 2L-5L and 2R-5R data fields are blank is non-operational. Selection when the RTE x data field is blank does not affect either route.

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays "ERASE" if the specified route is provisional. "<ROUTE 1" is displayed if the specified route shows route 1, and "<ROUTE 2" is displayed if the specified route shows route 2. If no route is specified, "<DEP/ARR" will be displayed.

Selection when "ERASE" is displayed will result in the pending arrival modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed. Selection when "<ROUTE x" is displayed will result in the display of the ROUTE PAGE 1 page for that route. When "<DEP/ARR" is displayed, selection will result in a branch to the DEP/ARR INDEX page.

2R-5R Function same as 2L.

6R **Branch to STAR REVIEW page.**

ARRIVAL TRANS Page.

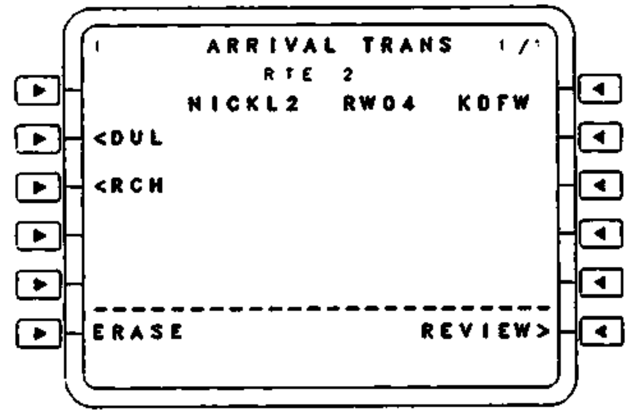
The ARRIVAL TRANS page provides a means for the pilot to select a transition from a list of transitions associated with a selected airport and STAR.

Selection of a STAR on the ARRIVAL STARS page results in the display of the ARRIVAL TRANS page, if transitions are available.

Selection of 6R on the STAR REVIEW page when the STAR REVIEW page was accessed via the ARRIVAL TRANS page will result in the display of the ARRIVAL TRANS page.

The ARRIVAL TRANS page provides a list of the transitions for the specified airfield and STAR. If the list is greater than can be displayed on one page, a second ARRIVAL TRANS page is provided and accessed through the PREV and NEXT page mode keys.

The route that is selecting the procedure will be displayed in the data field under the page title. If access to the procedure pages was via the OTHER arrival prompt on the DEP/ARR INDEX page, this data field is blank.



D3199101

Figure 1-116. ARRIVAL TRANS

1L,1R **Arrival Procedure.** The 1R data field displays the airport identifier associated with the access of this page. The selected arrival procedure will be displayed to the left of the airport identifier in LSK 1L data field. Format is "TRANS.", where TRANS is the transition name, followed by the STAR, followed by a space, and then followed by the Runway.

Deletion results in a branch to the ARRIVAL RWYS page and the currently selected arrival being deleted. If an active arrival procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when an arrival procedure is pending activation results in the arrival procedure being deleted while leaving the previous arrival procedure or destination airport displayed (the destination airport will be displayed unless an active arrival procedure exists). Entry and selection are non-operational.

2L-5L **Arrival Transition.** Selection results in the transition identifier being appended to the STAR identifier in 1L data field. Selection when this data field is blank is non-operational. Selection when the specified route data field is blank does not affect either flight plan. Entry and delete are non-operational.

6L **Branch to ROUTE Page, ERASE Prompt.** This data field displays "ERASE" if the specified route is provisional. "<ROUTE 1" is displayed if the specified route shows "RTE 1", and "<ROUTE 2" is displayed if the specified route shows "RTE 2". If no route is specified, "<DEP/ARR" will be displayed.

Selection when "ERASE" is displayed will result in the pending arrival modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed for the route that was being modified. Selection when "<ROUTE x" is displayed will result in the display of the ROUTE PAGE 1 page for that route. Selection when "<DEP/ARR" is displayed will result in a branch to the DEP/ARR INDEX page.

2R-5R Function same as 2L.

6R **Branch to STAR REVIEW page.**

STAR REVIEW Page.

The STAR REVIEW pages are used to display the legs of the STAR sequentially. Information about each waypoint such as course, distance, and constraint data is displayed if available.

Selection of 6R on the ARRIVAL RWYS, ARRIVAL STARS, or ARRIVAL TRANS page results in the display of the STAR REVIEW page.

The data field under the page title displays the route that is selecting the procedure. If access to the procedure pages was via the OTHER arrival prompt on the DEP/ARR INDEX page, this data field is blanked.

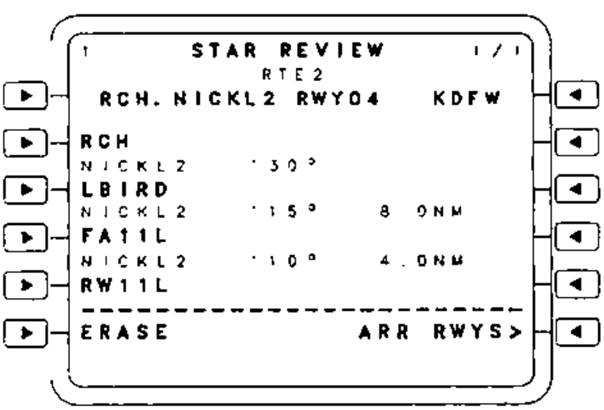


Figure 1-117. STAR REVIEW

1L,1R **Arrival Procedure.** The airport identifier associated with the access of this page is displayed in 1R data field. The selected arrival procedure will be displayed to the left of the airport identifier in 1L data field. Format is "TRANS.", where "TRANS" is the transition name, followed by the STAR, followed by a space, and then followed by the Landing Runway.

Deletion results in a branch to the ARRIVAL RWYS page and the currently selected arrival being deleted. If an active arrival procedure is deleted, a provisional flight plan will be created and the EXEC button will be illuminated. Deletion when an arrival procedure is pending activation results in the arrival procedure being deleted while leaving the previous arrival procedure or destination airport displayed (the destination airport will be displayed unless an active arrival procedure exists).

2L-5L **Arrival Procedure Waypoint.** These data fields display leg data for the STAR. These data fields contain some of the same information as that on the Legs page. However, no leg data may be changed on this page. After the last waypoint in the procedure, the next line select will display "END OF PROCEDURE".

6L **Branch to ROUTE Page, ERASE Prompt.** "ERASE" is displayed if the route specified is provisional. "<ROUTE 1" is displayed if the specified route shows "RTE 1", and "<ROUTE 2" if the specified route shows "RTE 2". If no route is specified, "<DEP/ARR" will be displayed.

Selection when "ERASE" is displayed will result in the pending arrival modification and any other pending flight plan modifications being erased and the ROUTE PAGE 1 page being displayed for the route that was being modified. Selections when "<ROUTE x" is displayed will result in the display of the ROUTE PAGE 1 page for that route. Selection when "<DEP/ARR" is displayed will result in a branch to the DEP/ARR INDEX page.

2R-5R **Non-operational.**

6R **Branch to Arrival page.** This data field displays a branch to the page that accessed the STAR REVIEW page. Possible branch displays are "ARR RWYS>," "ARR STARS>", and "ARR TRANS>". Selection results in a branch to the page displayed in the data field. Entry and delete are non-operational.

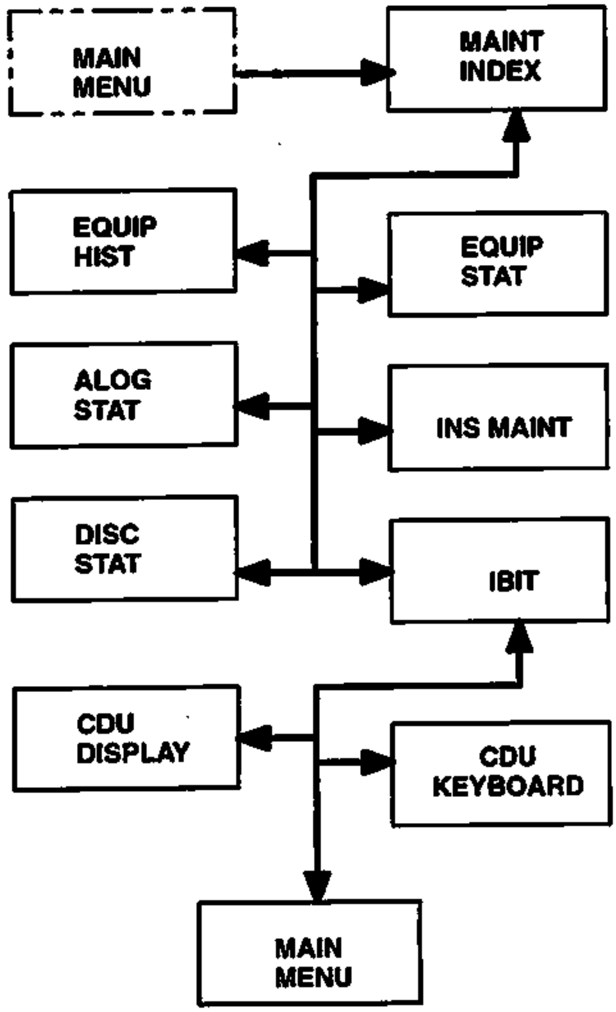


Figure 1-118. Maintenance Index Tree

MAINTENANCE INDEX Page.

The Maintenance Index page is an index to pages providing information, status, and test initialization for the various aircraft LRUs. The Maintenance Index page is accessed in one of the following ways:

1. Selection of the "MAINT" prompt on the MAIN MENU 1/1 page.

2. Selection of the "MAINT INDX" prompt from any of the maintenance pages - EQUIPMENT HIST, INITIATED BIT, EQUIPMENT STATUS, DISCRETE STATUS, ANALOG STATUS.

1L **Branch to EQUIPMENT STATUS page.**

2L **Branch to EQUIPMENT HIST page.**

3L **Branch to ANALOG STATUS page.**

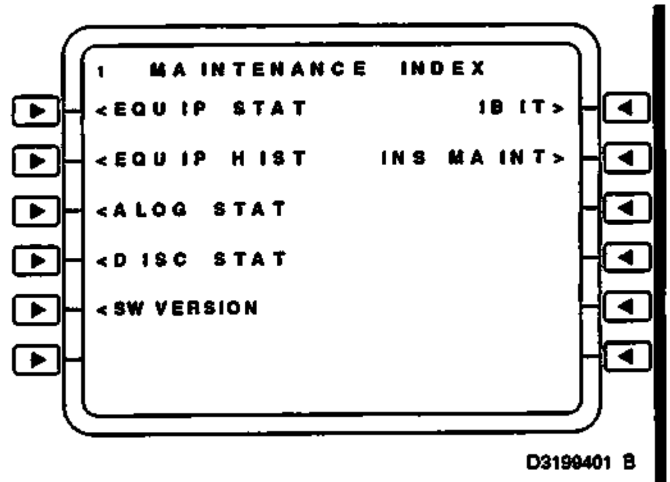


Figure 1-119. MAINTENANCE INDEX

4L **Branch to DISCRETE STATUS page.**

5L **Branch to SOFTWARE VERSION page.** The SOFTWARE VERSION page is used during software loading only and is of no value the flight crew. Therefore, this page is not shown.

6L **Non-operational.**

1R **Branch to INITIATED BIT page.** The data field displays IBIT> in a large font if the aircraft is on the ground, or in a small font if the aircraft is not on the ground. Selection results in a branch to the INITIATED BIT page if the aircraft is on the ground. If the aircraft is not on the ground, the selection has no effect.

2R **Branch to INS MAINT page.**

3R-6R **Non-operational.**

EQUIPMENT HIST Page.

The EQUIPMENT HIST page provides information on the historical operational status of the various aircraft LRUs. The EQUIPMENT HIST page is accessed by selection of the EQUIP HIST prompt on the MAINTENANCE INDEX page.

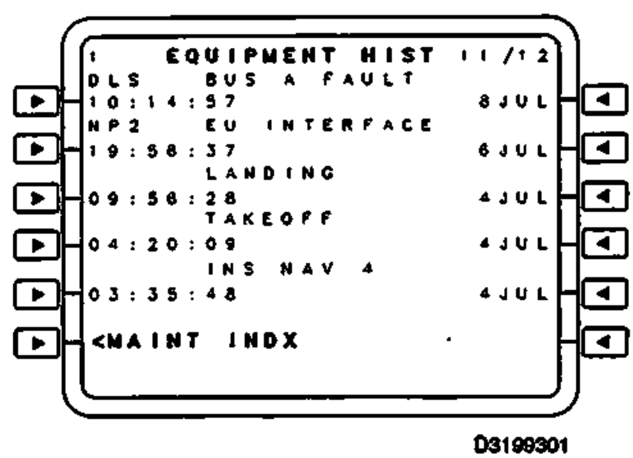


Figure 1-120. EQUIPMENT HIST

1L-5L **Logged failure/event.** One of the following will be displayed in the header field: (1) The LRU generating the log (up to five characters), followed by a description of the failure (up to 16 characters). (2) For events other than failures that may be recorded in EQUIPMENT HISTORY, the event description is displayed in the second data field and the LRU data field is blank.

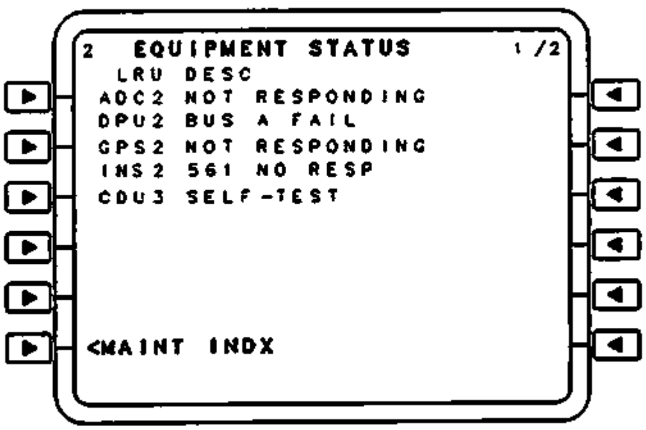
The time of the logged failure or event, in the format HH:MM:SS, is displayed under the LRU data field. The date of the failure or event, in the format DDMM, is also displayed. Multiple events are listed in descending chronological order. If no failure or event has been logged, all data fields are blank.

6L **Branch to MAINTENANCE INDEX page.**

1R-6R **Non-operational.**

EQUIPMENT STATUS Page.

The EQUIPMENT STATUS page provides information on the current operational status of the various aircraft LRUs. The EQUIPMENT STATUS page is accessed by selection of the EQUIP STAT prompt on the MAINTENANCE INDEX page.



D3199501

Figure 1-121. EQUIPMENT STATUS

1L **Currently logged failure.** Under the title "LRU" is displayed the LRU identifier, and under the title "DESC" is displayed the failure description. If no failure has been logged, the data fields under the titles are blank.

2L-5L **Currently logged failure.** This field displays the failure that occurred prior to the above failure, or is blank if no failure has been logged. Selection, entry and delete are non-operational.

6L **Branch to MAINTENANCE INDEX page.**

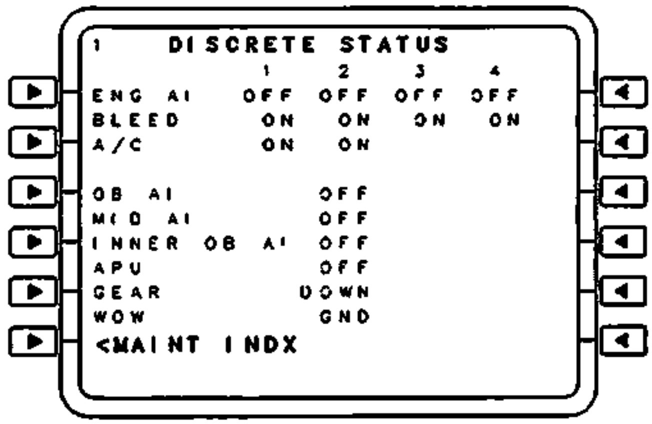
1R-6R **Non-operational.**

DISCRETE STATUS Page.

The DISCRETE STATUS page provides a display of the state of the aircraft discretes. The DISCRETE STATUS page is accessed by selection of the DISC STAT prompt on the MAINTENANCE INDEX page.

The 1L and 2L data fields display the current state of the Engine Anti-ice, Bleed Air, and Air Conditioning discretes (ON/OFF).

The 3L and 4L data fields display the current state of the Wing Outboard Anti-ice, Mid-wing Anti-ice, and Wing Inner Outboard Anti-ice discretes (ON/OFF). Also displayed is the current state of the APU (ON/OFF), the current state of the landing gear (UP/DOWN), and the current state of the WOW switch (AIR/GND).



D3199601

Figure 1-122. DISCRETE STATUS

1L-5L **Non-operational.**

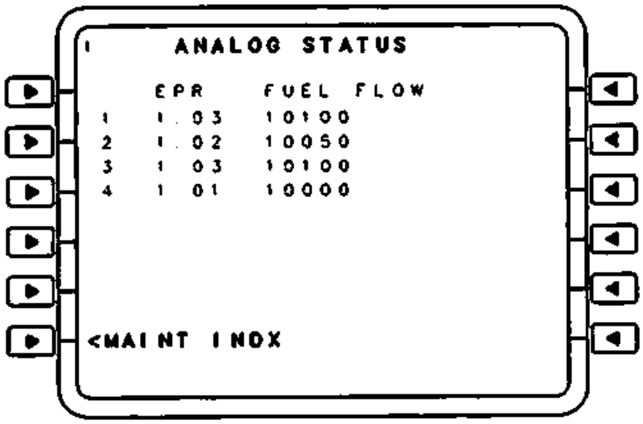
6L **Branch to MAINTENANCE INDEX page.**

1R-6R **Non-operational.**

ANALOG STATUS Page.

The ANALOG STATUS page provides a display of the state of the aircraft analog signals. The ANALOG STATUS page is accessed by selection of the ALOG STAT prompt on the MAINTENANCE INDEX page.

The current EPR value and Fuel Flow in pounds per hour (PPH) for engines 1-4 are displayed on this page.



03199701

Figure 1-123. ANALOG STATUS

1L-5L Non-operational.

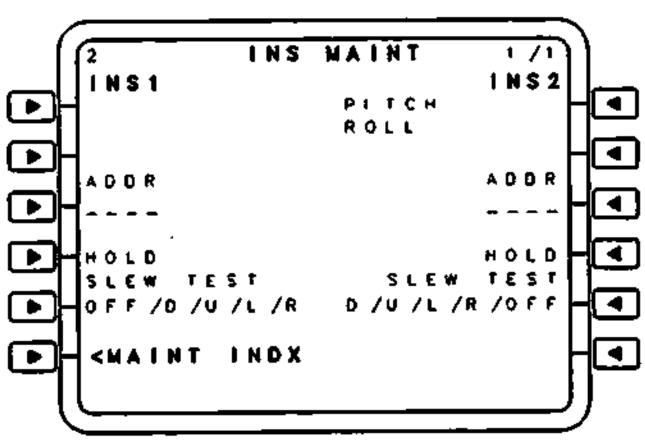
6L Branch to MAINTENANCE INDEX page.

1R-6R Non-operational.

INS MAINT Page.

The INS MAINT page displays information about the INS Memory Address Look function and the INS Gimbal Slew Test function. The INS MAINT page is displayed when the INS MAINT prompt on the MAINT INDX page is selected.

The 1L data field displays the title "INS1" when the NS INS1 LOADING mode is FALSE. When the NS INS1 LOADING mode is TRUE, "LOADING" is displayed. The 1R data field displays the text "INS 2" when the NS INS 2 LOADING mode is FALSE. When the NS INS 2 LOADING mode is TRUE, "LOADING" is displayed.



03199801

Figure 1-124. INS MAINT

1L **INS 1 Pitch/Roll.** This data field displays "PITCH ROLL" when the INS1 Gimbal Slew Test Plug is installed (NS INS 1 SLEW TEST). Otherwise, this data field is blank. To the right of the PITCH ROLL data fields is the INS 1 Pitch (NS INS 1 SLEW PITCH) and INS 1 Roll (NS INS 1 SLEW ROLL) data fields.

2L Non-operational.

3L **INS 1 Address.** 3L has three data fields and can display an INS 1 address and the data contents of that address. Upon selection of the INS MAINT page, "----" is displayed in the data field under the title "ADDR", and the two right data fields are blank. A valid INS address entry is a four-digit octal number. When a valid INS address entry is made, the entered address is displayed in the "ADDR" data field, and the associated high and low data is displayed in the two data fields to the right of the "ADDR" title. When the INS1 Gimbal Slew Test Plug is installed, this key is non-operational.

4L,5L **INS 1 Gimbal Slew Test Direction.** The 5L data field displays the state of the HOLD function (NS INS1 HOLD). The 5R data field displays the selected slew direction (NS INS 1 SLEW DIRECTION). When the selected slew direction changes, the HOLD function is set to TRUE.

6L Branch to MAINTENANCE INDEX page.

1R **INS 2 Pitch/Roll.** Function same as 1L.

2R Non-operational.

3R **INS 2 Address.** Function same as 3L.

4R-5R **INS 2 Gimbal Slew Test Direction.** Functions same as 4L-5L.

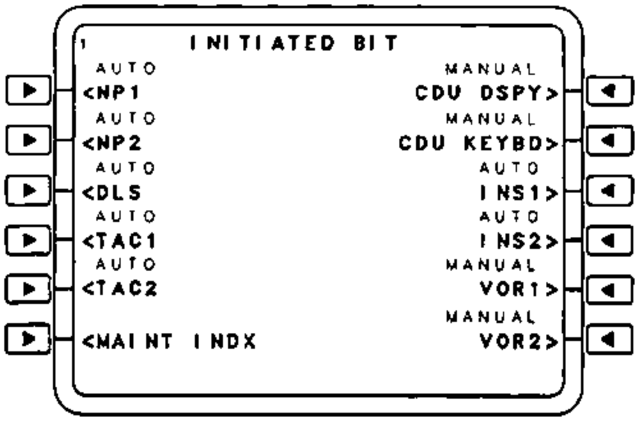
6R Non-operational.

INITIATED BIT Page.

The INITIATED BIT page is an index page that allows initiated testing to be performed on the various aircraft LRUs. The LRU IBIT tests are categorized as either Auto, Monitor, or Manual. For Auto tests, the NP sets up, sequences, and monitors the test. It then collects and reports the results without operator intervention. For Monitor tests, the operator is responsible for at least part of a test setup and results collection, with the NP autonomously performing and reporting part of the test. For Manual tests, all test setup, sequencing, and results collection are performed by the operator. The INITIATED BIT page is accessed in the following ways:

1. Selection of the IBIT prompt on the MAINTENANCE INDEX page.

2. Selection of the IBIT prompt from the IBIT RESULTS, MFCDU DISPLAY TEST, or MFCDU KEYBOARD ECHO TEST pages.



D3199901 A

Figure 1-125. INITIATED BIT

1L **Start NP 1 Initiated BIT.** The 1L data field is displayed in a large font if the aircraft is on the ground and either (1) the NPs are in Dual mode, or the NP is in Single mode and the MFCDU is onside to the NP.

Selection of 1L when the data field is displayed in a large font results in starting the NP 1 Initiated BIT routine, and a branch to the IBIT RESULTS page.

2L **Start NP 2 Initiated BIT.** Function same as 1L.

3L **Start DLS Initiated BIT.** This data field is displayed in a large font if the aircraft is on the ground and the DRU power is on. Otherwise, data field is displayed in a small font. Selection when the data is displayed in a large font results in starting the DLS Initiated BIT and a branch to the IBIT RESULTS page.

4L **Start TAC 1 Initiated BIT.** The 4L data is displayed in a large font if the aircraft is on the ground, TAC 1 power is on, and either the NPs are in Dual mode or the NP is in Single mode, and the TACAN is onside to the NP. Otherwise, this data field is displayed in a small font. Selection of this data field when displayed in a large font results in starting the TACAN 1 Initiated BIT and a branch to the IBIT RESULTS page.

5L **Start TAC 2 Initiated BIT.** Function same as 4L.

6L **Branch to MAINTENANCE INDEX page.**

1R **Start MFCDU Display Test.**

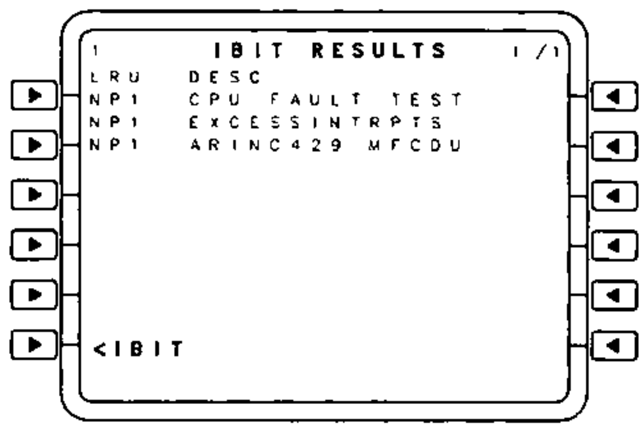
2R **Start MFCDU Keyboard Echo Test.**

3R-4R **Start INS 1/2 Initiated BIT.** This data field is displayed in a large font if the aircraft is on the ground, INS 1/2 power is on, the INS is not loading, and either the NPs are in Dual mode or the NP is in Single mode, and the INS is onside to the NP. Otherwise, this data field is displayed in a small font. Selection when data is displayed in a large font results in starting the INS 1/2 Initiated BIT and a branch to the IBIT RESULTS page.

5R-6R **Start VOR 1/2 Test.** The 5R data field is displayed in a large font if the aircraft is on the ground, VOR 1/2 power is on, a VOR 1/2 test is not in progress, and either the NPs are in Dual mode or the NP is in Single mode, and the VOR is onside to the NP. Otherwise, this data field defaults to a small font. Selection when data is displayed in a large font will result in starting the VOR 1/2 test. Otherwise, selection is non-operational. Data is displayed in a large font, inverse video when a VOR 1/2 test is in progress.

IBIT RESULTS Page.

The IBIT RESULTS page displays the results of an Initiated BIT test. The IBIT RESULTS page is accessed from the IBIT page by selection of any of the IBIT tests. Selection of NEXT PAGE/PREV PAGE will result in display of the next or previous IBIT RESULTS pages for the current LRU, if they exist.



D3200001

Figure 1-126. IBIT RESULTS

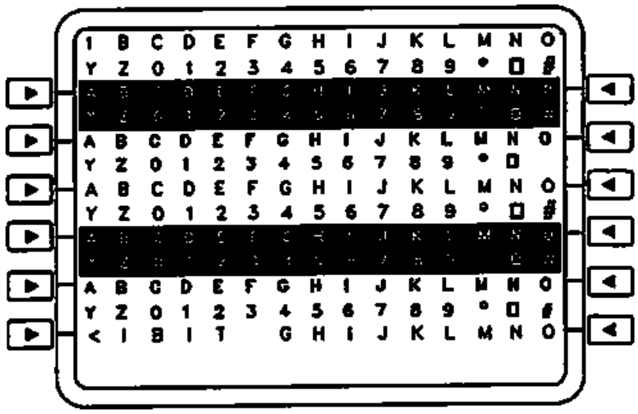
1L-5L **IBIT Result Code.** If the selected IBIT has completed, the header displays LRU and DESC. Otherwise, the header displays blanks. If the selected IBIT has completed, the data field under the title "LRU" will display the LRU identifier. If the selected IBIT is still in progress, the left data field of 3L displays the LRU identifier and the right data field of 3L displays "TEST IN PROGRESS" in a large font. The data field under the title "DESC" will display the IBIT failure description, or "NO FAILURES" in a small font if no IBIT failures are detected.

6L **Branch to INITIATED BIT page.**

1R-6R **Non-operational.**

MFCDU DISPLAY TEST Page.

The MFCDU DISPLAY TEST displays a test pattern on the MFCDU and illuminates all MFCDU indicators. Only the MFCDU from which the test was selected is affected. The MFCDU DISPLAY TEST page is accessed by selection of the CDU DSPY prompt on the INITIATED BIT page. The title line displays BCDEFGHIJKLMNOPQRSTUVWX in a large font.



D3200101B

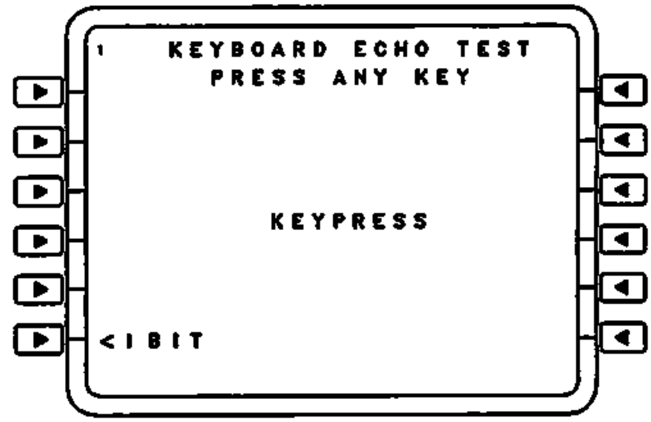
Figure 1-127. MFCDU DISPLAY TEST

1L-6R Non-operational. See figure 1-127.

KEYBOARD ECHO TEST Page.

The KEYBOARD ECHO TEST page allows the CDU alphanumeric, line select, and function keys to be exercised. Only the CDU from which the test was selected is affected. The KEYBOARD ECHO TEST page is accessed by selection of the CDU KEYBD prompt on the INITIATED BIT page.

When a line select key (except 6L) or function key (except CAR) is pressed, "KEYPRESS" will be displayed in the center of the page for one second. After one second, the data field will be cleared. When any alphanumeric key is pressed, the corresponding character will be displayed in the scratch pad.



D3200201

Figure 1-128. KEYBOARD ECHO TEST

1L-5L Line Select Test. Selection displays KEYPRESS in the center of the page.

6L Branch to INITIATED BIT page.

1R-6R Line Select Test. Selection displays KEYPRESS in the center of the page.

FMS CAUTION, WARNING AND ADVISORY (CWA) MESSAGES.

The FMS Navigation Processors generate CWA messages for display on the MFCDU scratch pads or the SFD CWA display area. CWA messages fall into two categories: Caution Messages and Advisory Messages. Advisory Messages are further broken into two types: System Advisories that apply to the entire subsystem and appear on all MFCDUs and Operational Advisories that apply to a single MFCDU. There are no warning messages generated by the FMS.

FMS Caution and Advisory Messages. (See figure 1-226.)

These messages are displayed on the SFD CWA area:

Caution and Advisory Messages	DEFINITIONS
NP 1 FAIL	Navigation Processor 1 has failed.
NP 2 FAIL	Navigation Processor 2 has failed.
MFCDU1 FAIL	The Navigation Processors can no longer communicate with MFCDU 1 and, therefore, the MFCDU will no longer display.
MFCDU2 FAIL	The Navigation Processors can no longer communicate with MFCDU 2 and, ttherefore, the MFCDU will no longer display.
MFCDU3 FAIL	The Navigation Processors can no longer communicate with MFCDU 3 and, therefore, the MFCDU will no longer display.
DPU 1 LINK FAIL	DPU 1 is no longer responding to NP 1. DPU 1 might still be accepting data, but it is more likely that this is a Comm NAV 1553 bus failure.
DPU 2 LINK FAIL	DPU 2 is no longer responding to NP 2. DPU 2 might still be accepting data, but it is more likely that this is a Comm NAV 1553 bus failure.
TAC1 FAIL	TACAN 1 is reporting to the NP that some portion of its data is invalid.
TAC2 FAIL	TACAN 2 is reporting to the NP that some portion of its data is invalid.
RAIM 1 ALERT	The GPS 1 RAIM function has detected a problem with the GPS Navigation solution NP 1 will throw out GPS as an input to its KNS solution. The operator can still select GPS 1 as the NP's NAV source.
RAIM 2 ALERT	The GPS 2 RAIM function has detected a problem with the GPS Navigation solution NP 2 will throw out GPS as an input to its KNS solution. The operator can still select GPS 2 as the NP's NAV source.
RAIM 1 UNAVL	The current satellite geometry detected by GPS 1 does not support RAIM. At least 5 satellites must be available.
RAIM 2 UNAVL	The current satellite geometry detected by GPS 2 does not support RAIM. At least 5 satellites must be available.
NO SPOOF 1	GPS 1 has detected that SPOOF protection is not available. This is because the receiver is not keyed or because SPOOF protection has been turned off.
NO SPOOF 2	GPS 2 has detected that SPOOF protection is not available. This is because the receiver is not keyed or because SPOOF protection has been turned off.
SCADC 2 INOP	SCADC 2 has informed the Navigation Processor that it has failed, or the NP is simply unable to communicate with the SCADC.
CN LINK FAIL	Annunciates when both DPUs do not receive a status query from the FMS indicating that both Com Nav buses have failed.

FMS System Advisory Messages. (See figure 1-2.)

These messages indicate aircraft configuration, condition of performance, operation of essential equipment, or attract attention for routine purposes. When a condition is detected, the Navigation Processor activates the corresponding system advisory message and displays it on all MFCDUs. When any System Advisory Message is activated, the Navigation Processor activates DAMU CDU MESSAGE ALERT. System Advisory Messages are:

System Advisory Messages	DEFINITIONS
GPS 1 FAIL	GPS 1 has informed the Navigation Processor that it has failed, or the Navigation Processor is simply unable to communicate with GPS 1.
GPS 2 FAIL	GPS 2 has informed the Navigation Processor that it has failed, or the Navigation Processor is simply unable to communicate with GPS 2.
INS 1 NAV FAIL	INS 1 has informed the Navigation Processor that it has failed, or the Navigation Processor is simply unable to communicate with INS 1.
INS 2 NAV FAIL	INS 2 has informed the Navigation Processor that it has failed, or the Navigation Processor is simply unable to communicate with INS 2.
DLS FAIL	DLS has informed the Navigation Processor that it has failed, or the Navigation Processor is simply unable to communicate with the DLS.
SKE FAIL	SKE has informed the Navigation Processor that it has failed, or the Navigation Processor is simply unable to communicate with the SKE.
RESYNC OFFSIDE	Displayed when an NP receives the current flight plan, status, etc. from the other NP. Typically, this occurs when the receiving Navigation Processor has just come back from cycling power, a loss of comm's, etc.
SINGLE OPERATION	Only a single NP is operating, or the two NPs are not communicating with one another. Therefore, only half the system is available.
INDEPENDENT NP's OPERATION	Annunciated when the NPs have determined that difference exists between the two Navigation or Mission Databases. The NPs will wait (Independent mode operation) until the operator can initiate a transfer of the Navigation and Mission Databases (to allow Dual NP operations) or the operator can power one of the NPs off (Single NP operations).
NO NAV 1	No NAV solution has been selected or Auto NAV was selected, but no NAV solution is available KNS1, INS1 ONLY, or GPS1 ONLY.
NO NAV 2	No NAV solution has been selected or Auto NAV was selected, but no NAV solution is available KNS2, INS2 ONLY, or GPS2 ONLY.
NO NAV DB	Annunciates when the NP does not contain a navigation database.
INS 1 ACTION CODE	INS 1 is transmitting an action code. The action code can be viewed by going to the INS Status page and pressing the TEST line select key.
INS 2 ACTION CODE	INS 2 is transmitting an action code. The action code can be viewed by going to the INS Status page and pressing the TEST line select key.
INS 1 BATTERY	This message indicates that INS 1 is operating on battery.
INS 2 BATTERY	This message indicates that INS 2 is operating on battery.
POSITION DIFFERENCE	The navigation solutions on NP 1 and NP 2 differ by more than 10 NM.
COMPARE POSITIONS	The navigation solutions on NP 1 and NP 2 differ by more than 5 NM.
CARP ACC	CARP Accuracy. The CARP function has determined that release of cargo will miss the designated ground point by more than 165 yards. This can be caused by: (1) Flying above or below the designated altitude window; (2) Flying the wrong lateral guidance; (3) Not maintaining a stable altitude (climbing or diving within the designated altitude window).

System Advisory	DEFINITIONS
CHECK ALT CONSTRAINT	There are two cases in which this message will be displayed: First, this message will be displayed if the aircraft is in a VNAV climb flight phase and the altitude constraint is less than the current altitude (suggesting that the aircraft should not continue to climb), but the next waypoint has an altitude constraint that is above the current altitude (suggesting that the aircraft should continue to climb). Second, this message will be displayed if the aircraft is in a VNAV descent flight phase and the altitude constraint is above the current altitude (suggesting that the aircraft should not continue to descend), but the next waypoint has an altitude constraint that is below the current altitude (suggesting that the aircraft should continue to descend).
INDICATE FLIGHT COMPLETE	When the aircraft transitions from airborne to on the ground, present position lat/long is within 10 nm of the primary destinations's lat/long, and the alternate destination waypoint of the active flight plan is defined, the NP performs the following actions: 1. The primary destination waypoint will be the new origin. 2. The path to the alternate destination will be the new primary flight plan. 3. The alternate destination will be the new primary destination. 4. The FP ANNUNC FLT COMPLETE is set True.
XTRK LIM EXCEEDED	The crew entered cross track limit (Progress page 2) has been exceeded.
RESET ALT SEL	Due to an impending change in the vertical profile, aircrew should change the alert altitude so the FMS can auto-sequence the impending change.
NO ACTIVE ROUTE	When the D→ mode key is pressed and no route is provisional or active, then the error message "NO ACTIVE ROUTE" is displayed, and no page branching occurs.
CHECK SPEED CONSTRAINT	The aircraft is flying beyond the crew-entered speed constraint.
HIGH HOLDING GRD SPD	The crew-entered hold speed results in too high of a ground speed.
NOT ON INTERCEPT HEADING	Displayed when the selected course will not intercept the current leg of the active flight plan.
MISSION DB MISCOMPARE	When the NPs are operating in either the DUAL or INDEPENDENT mode, mission data base (MDB) synchronization is defined as the Cyclic Redundancy Check (CRC) of the Mission Database in the NP matching that CRC received from the other NP. If the mission database synchronization fails to meet criteria, the NP annunciates the error condition.
LAST LEG	The current leg is the last leg of the active flight plan. This message is displayed when the flight plan transitions to the last leg.
END OF FLIGHT PLAN	This is the conclusion of the active flight plan. This message is displayed when the flight plan has sequenced the last waypoint.
OFFSET CANCEL OFFSET CANCEL NEXT WPT	When an offset is automatically canceled, or will be canceled prior to reaching the next waypoint, advisory messages is issued as follow: 1. When the offset is automatically canceled, the "OFFSET CANCEL" MFCDU message will be issued. 2. When LNAV sequences onto a leg for which the offset will be automatically canceled at the terminating waypoint, the "OFFSET CANCEL NEXT" MFCDU message will be deleted.

System Advisory	DEFINITIONS
NAV DB MISCOMPARE	When the NPs are operating in either the DUAL or INDEPENDENT mode and both NPS have valid navigation databases, navigation database (NDB) synchronization is defined as satisfying all of the following criteria: 1. The Cyclic Redundancy Check (CRC) of the Navigation Database in an NP matches that CRC received from the other NP. 2. The Navigation Database identifier in the NP matches that identifier in the other NP. 3. The database cycle for the NDB in the NP matches the database cycle for the NDB in the other NP. If the navigation database synchronization fails to meet these criteria, the NP causes the message NAV DB MISCOMPARE to be displayed.
PERF-VNAV UNAVAILABLE	An attempt was made to engage VNAV, but the crew has not entered Perf Init weight and/or cruise altitude.
NP SW MISCOMPARE	The OFP (software) in the two NPs are not identical. Since the OFP cannot be cross-loaded on this system, the NP with the incorrect software version should be loaded with the proper software (via an MLV) or should be turned off.
NP 1 NDB INVALID	The Navigation Database in NP 1 has failed the CRC check. Assuming Navigation Processor 2's NAV Database did not also fail the CRC check, the crew should initiate a Navigation Database cross-load from NP 2 to NP 1. If both Navigation Databases fail the CRC check, they must be reloaded.
NP 2 NDB INVALID	The Navigation Database in NP 2 has failed the CRC check. Assuming Navigation Processor 1's NAV Database did not also fail the CRC check, the crew should initiate a Navigation Database cross-load from NP 1 to NP 2. If both Navigation Databases fail the CRC check, they must be reloaded.
NP 1 NDB OUT OF DATE	The current date as entered (or defaulted) on NP 1 is outside the effectivity dates for the NAV Database in this NP. The crew should pick the correct effectivity cycle or load the correct NDB.
NP 2 NDB OUT OF DATE	The current date as entered (or defaulted) on NP 2 is outside the effectivity dates for the NAV Database in this NP. The crew should pick the correct effectivity cycle, or load the correct NDB.
UNABLE RTA	The RTA function provides a system advisory message "UNABLE RTA" if a RTA speed cannot be computed which will provide a predicted time of arrival within one minute (± 30 seconds) of the desired time of arrival.
INS1 STORED HEADING	Indicates INS 1 has a stored heading for alignment.
INS2 STORED HEADING	Indicates INS 2 has a stored heading for alignment.
CHK SPD DST INVALID	When MIN ACCEL CHECK SPEED entry is greater than ROTATION SPEED, the CHK SPD DST INVALID message is issued. This message is issued once and is not re-issued until a pilot initiated operation occurs to change the zero wind ground run (PM ZERO WIND GND RUN) or the rotation speed (PM ROTATION SPEED): i.e., entry of EPR on TAKEOFF DATA page 1, pressure altitude on TOLD INIT page 1, outside air temperature on TOLD INIT page 1, weight on TOLD INIT page 1, runway slope on TOLD INIT page 2, runway surface covering on TOLD INIT page 2, or rotation speed on TAKEOFF DATA page 1. Invalid entry flag for check speed and distance entry.

System Advisory	DEFINITIONS
CRZ ALT ABOVE MAX ALT	If the cruise altitude entered on the PERF INIT, CLIMB, or CRUISE page is above the calculated maximum altitude (PM MAXALT), the NP issues the CRZ ALT ABOVE MAX ALT message. This message is issued once and is not re-issued until a pilot initiated operation occurs to change the vertical profile: i.e., a change in the cruise altitude, a speed mode change on the CLB, CRZ, or DES pages or a gross weight change. The NP clears the CRZ ALT ABOVE MAX ALT message upon MFCDU CLR key push or if PM MAXALT is greater than cruise altitude minus 200 feet.
20 MIN UNTIL CARP	Twenty minutes until the Computed Air Release Point.
10 MIN UNTIL CARP	Ten minutes until the Computed Air Release Point.
6 MIN UNTIL CARP	Six minutes until the Computed Air Release Point.
1 MIN UNTIL CARP	One minute until the Computed Air Release Point.
10 SEC UNTIL CARP	Ten seconds until the Computed Air Release Point.
5 SEC UNTIL CARP	Five seconds until the Computed Air Release Point.
4 SEC UNTIL CARP	Four seconds until the Computed Air Release Point.
3 SEC UNTIL CARP	Three seconds until the Computed Air Release Point.
2 SEC UNTIL CARP	Two seconds until the Computed Air Release Point.
1 SEC UNTIL CARP	One second until the Computed Air Release Point. .
SLOW DOWN	Begin the airspeed slowdown in preparation for the CARP.
GREEN LIGHT	Begin CARP activity. Airdrop activity is commenced.
RED LIGHT	Terminate CARP activity. Airdrop activity is terminated.
UNABLE NEXT ALT	Provides annunciation that, at the current aircraft configuration, performance predictions are predicting that the aircraft cannot attain the active altitude constraint.
GPS 1 LOW BATTERY	During NP CBIT processing, the NP will periodically monitor GPS BATTERY. Replace battery.
GPS 2 LOW BATTERY	During NP CBIT processing, the NP will periodically monitor GPS BATTERY. Replace battery.
TOTAL FUEL INVALID	When there is not an engine out indication and one or more fuel flow (FUEL FLOW 1, FUEL FLOW 2, FUEL FLOW 3, or FUEL FLOW 4) is below 400 lbs/hr for more than 2 minutes, the MFCDUs annunciate TOTAL FUEL INVALID. Annunciator to indicate total fuel is invalid.
INSUFFICIENT FUEL	The INSUFFICIENT FUEL message is displayed when the predicted fuel at destination (PREDICTED FUEL AT DEST) is less than the reserve fuel value (RESERVES).
USE TRT TAKEOFF	If the climbout path is not sufficient to clear the obstacle, use TRT for take-off.
USE MAX TAKEOFF	If the climbout path is not sufficient to clear the obstacle, use MAX for take-off.
TIMER 1 EXPIRED	Timer 1 is a countdown timer. This message indicates that Timer I has counted down to zero from the crew-entered start.
TIMER 2 TARGET	Timer 2 is an "alarm clock". This message indicates that Timer 2 has reached the crew-entered alarm time.
TIMER 3 INTERVAL	Timer 3 is an interval timer which reoccurs at the crew-entered rate. This message indicates that Timer 3 has (again) reached the crew-entered interval.
INVALID TAC 1 TUNE	This message indicates a TACAN tune failure. The TACAN was not able to tune as requested.

System Advisory Messages	DEFINITIONS
INVALID TAC 2 TUNE	This message indicates a TACAN tune failure. The TACAN was not able to tune as requested.
TAC 1 FAIL	Indicates a TACAN1 failure exists.
TAC2 FAIL	Indicates a TACAN2 failure exists.
ALIGN POS REQUIRED	This message is a reminder that when aligning the INS, an align position must be entered on the Power Up page. INS requires a present position.
UNABLE CRZ ALT	The climb trajectory prediction software issues the "UNABLE CRZ ALT" message whenever there is at least one descent constraint and predicts that the aircraft will reach the predicted top-of-descent distance prior to reaching cruise altitude. The message is issued at most once, following each vertical flight plan modification. Once the message is issued, it is cleared from the display when ever one of the following occurs: 1. The MFCDU CLR key is pushed. 2. Conditions change such that the NP predicts the aircraft will reach cruise altitude prior to reaching the predicted top-of-descent distance. 3. Flight plan change.
ABORT: EXCESS TW	Annunciates when the tailwind exceeds 10 knots. The component wind will be used. The gust value will be applied to the tailwind calculation.
ABORT: EXCESS XW	Annunciates when the crosswind exceeds 25 knots or as limited by the runway RCR. The component wind will be used. The crew will not see the RCR calculation.
ABORT: GW > EWP	Annunciates when the gross weight displayed in LSK 5L, is greater than 344.9 thousand pounds (i.e., the maximum EWP gross weight).
ABORT: LD > RA	Annunciates when the landing distance is greater than the runway available. When an abort condition exists, the V_{APP} display will be "***". Display cannot be cleared or overwritten. The "*s" will be replaced with a value when the aircraft/airfield conditions have been changed and the abort condition no longer exists. The "*s" and a message will be displayed on all MFCDUs.
ABORT: LS > TLS	Annunciates when the touchdown speed is greater than the tire limit speed. When an abort condition exists, the V_{APP} display will be "***". Display cannot be cleared or overwritten. The "*s" will be replaced with a value when the aircraft/airfield conditions have been changed and the abort condition no longer exists. The "*s" and a message will be displayed on all MFCDUs.
ABORT: VCEF > 147	Annunciates when the 147 knots is V_{GO} and the V_{CEF} is greater than 147 knots.
ABORT: VCEF > VBMAX	Annunciates when the V_{BMAX} is V_{GO} and the V_{CEF} is greater than V_{BMAX}.
ABORT: VMCG > VR	Annunciates when the V_R is V_{GO} and the V_{MCG} is greater than V_R.
ABORT: VMCG > 147	Annunciates when 147 knots is V_{GO} and the V_{MCG} is greater than 147 knots.
ABORT: VMCG > VBMAX	Annunciates if VBMAX is V_{GO} and V_{MCG} is greater than V_{BMAX}.
ABORT: VROT > TLS	Annunciates when the V_{ROT} is greater than the tire limit speed (TLS).
ABORT: ZFW > EWP	Annunciates when the ZFW displayed in line 3L is greater than 239 thousand pounds (i.e., the maximum EWP ZFW).

System Advisory Messages	DEFINITIONS
GW > 325K	Annunciates when the gross weight displayed in LSK 5L is greater than 325 thousand pounds (i.e., the normal planning maximum gross weight) and equal to or less than 344.9 thousand pounds (i.e., the maximum emergency war planning (EWP) gross weight).
TO-1-1 TABLE EXCEEDED	This message is displayed whenever the input to, or the output from, a table exceeds the limits for that table.
USE STRT	If the climb path is not sufficient to clear the obstacle, use STRT for take-off.
ZFW > 218K	Annunciates when the zero fuel weight (ZFW) displayed in LSK 3L is greater than 218 thousand pounds (i.e., the maximum normal planning ZFW weight) and equal to or less than 238 thousand pounds (i.e., the maximum EWP ZFW).
TOLD Type Scratch pad Warning Annunciations: If RED, TRT, or STRT is selected, warning messages will be displayed in the scratch pad as follows:	
WARNING: CFL > RA	Annunciates when the critical field length is greater than the runway available.
WARNING: GW (3ENG)	Annunciates when the gross weight limits the climb performance and the 3-engine climb gradient cannot be achieved.
WARNING: OBSTACLE	Annunciates when the gross weight limits the climb performance and the obstacle clearance cannot be achieved.
TOLD Scratch pad Abort Annunciation: If MAX is selected, abort messages will be displayed in the scratch pad as follows:	
ABORT: CFL > RA	Annunciates when the critical field length is greater than the runway available.
ABORT: GW (3ENG)	Annunciates when the gross weight limits the climb performance and the 3-engine climb gradient cannot be achieved.
ABORT: OBSTACLE	Annunciates when the gross weight limits the climb performance and the obstacle clearance cannot be achieved.

FMS Operational Advisory Messages.

Operational advisory messages indicate improper data entries or improper operation of the FMS. When either condition is detected, the NP activates the corresponding operational advisory message and displays it on the MFCDU where the error occurred. Operational Advisory Messages are:

Operational Advisory Messages	DEFINITIONS
CDU CONTROL SWITCH OVER	The control of this MFCDU has switched from the NP that was controlling it to the other NP.
ALREADY IN PERM LIST	The crew has attempted to enter into the permanent inhibited Navaid list a Navaid that is already in that list.
ALREADY IN TEMP LIST	The crew has attempted to enter into the temporary inhibited Navaid list a Navaid that is already in that list.
AIRDROP ALTITUDE CONFLICT	AIRDROP ALTITUDE CONFLICT annunciates on the MFCDUs when any of the following occur: 1. The IND ALT is entered and IND ALT < TA, 2. PI ELEV > TRRN ELEV, OBSTRUCTION ELEV, ACTUATION ALTITUDE, or INDICATED ALTITUDE, 3. TRRN ELEV > INDICATED ALTITUDE, 4. ACTUATION ALTITUDE > INDICATED ALTITUDE.
FLIGHT PLAN FULL	The crew has attempted to enter the 128th waypoint. The Flight Management System supports only 127 waypoints in each flight plan.
ROUTE ALREADY EXISTS	This message occurs when a route is being stored under a name for which a stored route already exist.

Operational Advisory Messages	DEFINITIONS
DELETE	When there is no message in the scratchpad and the "CLR" key is depressed, "*DE LETE*" will appear in the scratchpad. "*DELETE*" can then be used to delete items on the MFCDU pages by using the line select keys. Items deleted by this method are replaced with the default value or with entry prompts. If an event causing a message occurs while "*DELETE*" is displayed, the "*DELETE*" is stacked and the message is displayed.
FPL CONTAINS INVALID WPT	The flight plan that has been retrieved from Stored Routes contains a waypoint that is invalid (i.e., a waypoint which is no longer in the database). The identifier of the waypoint(s) that is invalid will be preceded by a "#" to indicate that it is invalid. The primary reasons for which a waypoint on a stored route would no longer be in the database when retrieved (and, therefore, invalid) are: (1) the revision of the NDB now in use is different from the revision of the NDB that was used to create the stored route; (2) the stored route contains a temporary waypoint (e.g., mark point, PBPB, etc.) that is no longer in memory.
INVALID APPROACH	INVALID APPROACH annunciates on the MFCDUs when any of the following occur: 1. FAF DISTANCE <= MAP DISTANCE, 2. SD DISTANCE is entered and SD DISTANCE <= FAF DISTANCE, 3. TP DISTANCE and SD DISTANCE are entered and TP DISTANCE <= SD DISTANCE or if TP DISTANCE is entered and SD is not entered and TP DISTANCE <= FAF DISTANCE, 4. MDA <= TDZE or 5. FAF ALTITUDE <= MDA.
INVALID DELETE	Crew attempted to delete CDU data that does not permit deletion.
INVALID DIRECT-TO	The crew attempted a Direct-To into the middle of a CARP.
NOT AN AIRPORT	The crew attempted to define a SID or a STAR, but the entered waypoint is not a runway.
NOT A NAVAID	This message indicates that the identifier entered for a VOR or TACAN 1 is in the database but is not a Navaid.
NOT IN DATABASE	The entered waypoint, airport, etc. was not found in the Navigation or Custom database.
RADIALS DO NOT INTERSECT	The entered PBPB radials do not intersect.
RUNWAY NOT FOUND	Crew attempted to enter a runway number on the Route Plan or TOLD Init pages which does not exist at that (crew-entered) airport.
RUNWAY N/A FOR SID	Crew has selected a procedure (SID or STAR) and is now attempting to change the designated runway. This message indicates that the selected procedure does not apply to this newly selected runway.
NO PRESENT POSITION	The error message "NO PRESENT POSITION" annunciates when a waypoint is entered into the Direct line select line select ("6L") of the LEGS page when no present position exists or selection of the "MARK POINT" prompt on the MAIN MENU 1/1 page if the NP does not have a valid position.
UNABLE OFFSET	The crew attempted to enter an offset while in a Hold, CARP, or procedure (SID or STAR).
WPT IN FP	The crew has attempted to delete a custom waypoint that is being used in the flight plan.
WAYPOINT NOT FOUND	This message is displayed if the selected waypoint is not found within the crew-entered airway.
WPT LIST FULL	The crew has attempted to enter the 201st custom waypoint. The FMS supports no more than 200 custom waypoints.

Operational Advisory Messages	DEFINITIONS
BEARING MUST BE IN TRUE	The crew has attempted to enter a PBD or PBPB using magnetic bearing while operating above 72.0 N or below 59.0 S.
LIST FULL	The crew has attempted to enter the 41st comm radio preset (limit is 40) or the 6th permanent/temporary inhibit Navaid list entry (limit is 5).
DUPLICATE LABEL	Crew attempted to enter a WP label that has already been used.
DUPLICATE ID	The Crew attempted the reuse of an existing comm radio preset identifier.
INVALID INTERCEPT	The crew has attempted to enter an RNDZ that does not converge with the existing flight plan.

Operational Advisory Messages	DEFINITIONS
INVALID ENTRY	When an entry of data is attempted using the MFCDU line select keys and the scratchpad data does not match the correct input format the MFCDU displays the "INVALID ENTRY" error message.
NOT ALLOWED	When an invalid operation is attempted using the MFCDU line select keys the MFCDU displays the "NOT ALLOWED" error message.

Operational Advisory Message Deactivation.

When a Mode key or the CLEAR key on the MFCDU that is displaying an active operational advisory message is pressed, the NP makes the operational advisory message inactive.

Mix Lamp Annunciation.

The mix lamp annunciation is side dependent. This will result in MFCDU being controlled by NP 1 displaying the MIX status of INS 1 and MFCDU being controlled by NP 2 displaying the MIX status of INS 2.

Execute Annunciator.

The MFCDU illuminates the EXEC annunciator when a provisional flight plan exists and any of the following MFCDU pages are displayed for the provisional route.

1. ROUTE pages 1 and 3.
2. LEGS pages except for page 1.
3. WAYPOINT DATA pages 1 and 2.
4. Any DEPARTURE RWYS page.
5. Any DEPARTURE SIDS page.
6. Any DEPARTURE TRANS page.
7. Any SID REVIEW page.
8. Any ARRIVAL RWYS page.
9. Any ARRIVAL STARS page.
10. Any ARRIVAL TRANS page.
11. Any STAR REVIEW page.
12. CLIMB page.
13. CRUISE page.
14. DESCENT page.
15. PROGRESS 2/3 page.

INERTIAL NAVIGATION SYSTEM (INS).

The Carousel IV-E Inertial Navigation System consists of three major components: The Battery Unit (BU), the Inertial Navigation Unit (INU), and the Mode Selector Unit (MSU).

The INS continuously computes horizontal navigation data and senses aircraft attitude in pitch, roll, and yaw for local horizontal and vertical references. Output signals from the INS are used to steer the aircraft over a preselected great circle course and display navigation data and aircraft attitude on navigation and flight instruments. Accurate INS operation is unlimited for any latitude or longitude during flight.

Unit Descriptions.

BATTERY UNIT (BU).

The battery unit provides auxiliary DC power to initiate INS turn-on and supply essential power to maintain INS operation should the 115-volt primary power be interrupted after INS turn-on. The battery unit will sustain INS operation for up to 30 minutes. Each INS has its own battery unit.

INERTIAL NAVIGATION UNIT (INU).

The INU contains an inertial reference unit, digital computer unit, and inertial reference unit electronics. All INS attitude, navigation, and steering information is determined in the INU.

MODE SELECTOR UNIT (MSU).

The MSU contains a mode selector and two indicator lights mounted on an illuminated panel. Panel lettering illumination intensity is controlled by the center console lighting control.

The mode selector controls operating modes of the INS. The knob must be pulled for rotation across mechanical stops between STBY and ALIGN and between NAV and ATT. To prevent overshooting to ATT, thus destroying alignment, do not pull on the knob when switching from ALIGN to NAV or NAV to ALIGN.

OFF. The INS is inoperative when the mode selector is set to OFF.

STBY. The STBY (Standby) position is used only during ground operation.

NOTE

- FMS power switch must be ON before INS power is applied.
- The INS cannot be turned on unless both battery unit power and primary power are available, but it will operate on either power after turn-on.

The characteristics of the STBY mode vary, depending on whether the INS is being turned on or is being downselected from ALIGN, NAV, or ATT. If the INS is being turned on, the fast warmup heaters bring the INU up to operating temperature, the gyro wheels are brought up to speed, and the INS platform is aligned to the aircraft axis. If the INS is downselected from a higher mode, the INS platform retains its alignment with local horizontal.

1. State 9 is an automatic standby mode. The system remains in state 9 until fast warmup is complete and gyros reach speed.

2. During state 8, the INS platform is aligned to local horizontal and the INS Battery is tested. If the battery unit charge is low when the test is accomplished, the INS will automatically shut down. Attitude warnings are removed at the beginning of state 8, but all other instrument flags controlled by the INS continue to indicate warning. The INS spends a minimum of 51 seconds in state 8.

ALIGN. The ALIGN (alignment) position is used during ground operation while the aircraft is parked. Setting the mode selector to ALIGN from STBY or OFF will start automatic INS alignment. The INS computer progresses through a series of alignment states during ALIGN.

1. The primary function of states 6 and 7 is to establish a known relationship between the INS platform and true north. Present position coordinates must be inserted before the INS computer will advance to alignment state 6. In state 6, the INS compares the loaded present position with the final inertial position of the previous flight, and it uses the result of the comparison, together with a statistical error model, to improve the accuracy of the INS for the ensuing flight. The total time spent in states 6 and 7 will normally not exceed 8.5 minutes.

2. Entry into state 5 indicates that an adequate alignment of the INS platform has been achieved. The READY NAV light on the MSU illuminates when state 5 is attained. The NAV mode can now be entered by setting the mode selector to NAV.

3. States 4 through 0 indicate continuing self-calibration.

Moving the mode selector to ALIGN from NAV will not downselect the INS but will allow automatic shutdown if an overtemperature is detected.

NAV. The NAV (navigation) position is used for normal operation after automatic alignment has been completed.

The INS will automatically sequence through standby and alignment modes of operation when NAV position is selected from STBY, providing present position is inserted and the aircraft is not moved.

INS ACTION CODES				
STEP	CONTROL	OPERATION	INDICATOR/DISPLAY	INDICATION
1	MFCDU		MSG light illuminates	Fault message annunciates in scratch pad.
	NOTE During flight, if the malfunctioning INS is being used as the FMS navigation source, select an alternate source.			
2	SOLN Function Key	Press and release	INAV CTRL SOLN 1/2 page	
a.	NEXT Function Key	Press and release	INAV SOLN INDEX 2/2 page	
b.	INS 1(3L)/INS2 (3R)	Press and release	INS STATUS page	
c.	INS 1 STATUS page TEST (5R)	Press and release	Right-hand data display	Malfunction code replaces action code.
3	MFCDU	Record malfunction code		
4	Repeat steps 2 and 3 until fault data clears and scratch pad warning MSG light extinguishes, or action code appears. **NOTE** Action code 04, malfunction code 41, and the MFCDU warning can be cleared by the above procedure, even though an erroneous present position has been inserted.			
5	If MSG light goes off, scratch pad warning and fault data clears, failure was intermittent and has been cleared. INS can resume operation in the mode in which the INS was operating when the warning annunciated and INS outputs can be used by aircraft systems and instruments.			
6	If MSG light remains illuminated and action code reappears following last malfunction code, comply with action code as follows:			
		CODE	ACTION	
		01	SET MODE SELECTOR TO OFF	
		02	SELECT ATT IF DEGRADED NAV DATA CAUSES ADI TO DRIFT FROM LEVEL.	
		03	CHECK HSI AND AUTOPILOT INPUTS	
		04	DOWNMODE TO STBY AND RESTART ALIGNMENT (GROUND OPERATIONS ONLY)	
		05	SEE SPECIFIC MALFUNCTION CODE 48	

INS MALFUNCTION CODES			
Malf Code	Failed Test	Modes of Operation	Recommended Action Code
13	Y Velocity Change	NAV	02
14	X Velocity Change	NAV	02
15	X or Y Gyro Torque Limited	ALIGN, NAV	02
18	Too Long In Align 8	ALIGN	04
20	Feedback, DSRTK	ALIGN, NAV	03
21	Feedback, HDG2	ALIGN, NAV	03
22*	Feedback, MAG HDG	ALIGN, NAV	03
23*	Feedback, Drift	ALIGN, NAV	03
24*	Feedback, Roll	ALIGN, NAV	03
25*	Feedback, HDG	ALIGN, NAV	03
26*	Feedback, XTK	ALIGN, NAV	03
27*	Tick Mark Pulse Timing	ALIGN	None
31	Ground Speed	NAV	02
32	Memory Parity	STBY, ALIGN, NAV	02
33	Azimuth Stabilization Loop Noise	STBY, ALIGN, NAV	01
34	Inner Roll Stabilization Loop Noise	STBY, ALIGN, NAV	01
35	Pitch Stabilization Loop Noise	STBY, ALIGN, NAV	01
36	Accelerometer Loop Noise	STBY, ALIGN, NAV	01
37	Z Platform Overtemperature	NAV	01
38	XY Platform Overtemperature	NAV	01
39	Oven Overtemperature	NAV	01
41 **	Loaded Present Position	STBY, ALIGN	04
42	Drift Angle 45° or Greater	NAV	02
43	Intersystem Comparison	ALIGN	04
45	Gyro Scale Factor or Loaded Latitude	ALIGN	04
48*	Air Drop Altitude Invalid	NAV	05
49	Position Update	NAV	02
57	XY Platform Rotation Rate	ALIGN	04
59	600 Millisecond Loop	STBY, ALIGN, NAV	02
60	X or Y Sample and Hold Change	ALIGN	04
61	X or Y Sample and Hold	NAV	02
62	XY Platform Rotation Rate	NAV	02
63	Computer Self Check	STBY, ALIGN, NAV	02

* If ground speed is less than 75 knots, failure must continue for a minimum of 6 seconds before this malfunction code is set. During flight, momentary power loss due to switchover can set this code.

** This malfunction code is set if the loaded present position is more than 36 nm from the calculated inertial position stored in the computer when the INS was last shut down. Check that correct present position was loaded. Reload if required. On the MFCDU, select the INS STATUS and press test (5R) to clear malfunction codes.

NORMAL OPERATION OF THE FLIGHT MANAGEMENT SYSTEM.

Preflight.

GPS KEY LOAD.

GPS receiver crypto variables may be loaded with aircraft power on or off. Crypto variables are loaded as follows:

1. Verify KYK-13 key load as follows:

    a. Set mode switch to OFF CHECK.

    b. Set selector to position containing variable to be transferred.

    c. Press the INITIATE pushbutton.

    d. Verify PARITY indicator flashes.

2. Connect KYK-13 to the KEY FILL Panel GPS 1 jack.

3. On the KYK-13:

    a. Set SELECTOR switch to position containing variable to be transferred.

    b. Set MODE switch to ON.

c. Verify PARITY indicator flashes.

d. Set MODE switch to OFF CHECK.

4. Disconnect KYK-13 from the KEY FILL Panel GPS 1 jack and reconnect to the GPS 2 jack.

5. Repeat step 3.

6. Disconnect KYK-13.

POWER UP.

1. FMS POWER PWR 1 and PWR 2 switches - ON

2. CDS Cooling Fan Switch - No. 1

3. CDS Brightness Control - ON/SET

4. MSU 1 - STBY

Ensure that INS 1 AIR TEMP annunciator light extinguishes within 20 seconds.

5. MSU 2 - STBY

Ensure that INS 2 AIR TEMP annunciator light extinguishes within 20 seconds.

6. Pilot's MFCDU displays 1 POWER UP.

NOTE

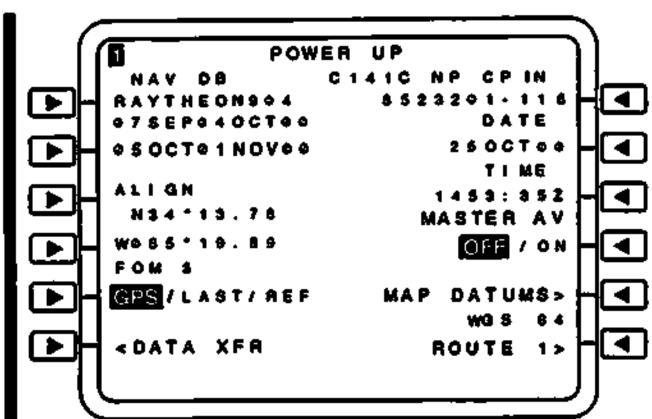
1 Indicates guidance master.

7. Copilot's and Navigator's MFCDU POWER UP page displays 2 POWER UP.

NOTE

Presentation of these displays indicates that the FMS (NP 1, NP 2, and MFCDUs 1, 2, and 3) has passed BIT and is ready for operation.

POWER UP PAGE.



D3186401 F

1. CPIN number - CHECKED (1R)

NOTE

If the CPIN number is incorrect shut down the FMS.

2. DATE - ENTERED (2R)

To aid in satellite acquisition, enter ZULU date.

NOTE

If NP1 NDB OUT OF DATE displayed after date is entered, proceed to Data NAV DB Load after performing steps 3 and 4.

3. TIME - ENTERED (3R)

To aid in satellite acquisition, enter ZULU date and time.

4. MSTR AV ON - SELECTED (4R).

NOTE

The VHF MODE SELECT Switch on the VHF backup control panel must be in the OFF position for the NP to tune the VHF No. 1 radios.

Verify that the pilot's DAMU displays the TAC 1, VOR 1, and VHF 1 tuned channel/frequency. Verify that the copilot's DAMU displays the TAC 2, VOR 2, and VHF 2 tuned channel/frequency.

NOTE

MSTR AV ON changes to MSTR AV ON when power is supplied to VHF 1, VHF 2, TAC 1, TAC 2, VOR 1, and VOR 2.

5. MAP DATUM - AS REQUIRED (5R)

6. NAV DB - CHECKED/CURRENT SELECTED (1L)

NOTE

If the database is about to expire, load a new database after aligning the INSs.

7. INSs Present Position - SELECTED/ENTERED.

If the LAT/LONG for the parking spot is known, enter it into the scratch pad and upselect by pressing 4L.

or

LAST - If the aircraft is in the position that it was in when the INS was shut down, toggle 5L to select LAST.

or

REF - If a reference has been established for this position, toggle 5L to select REF and enter identifier at 4L.

or

GPS - Wait for GPS FOM to equal 3 (keyed) or 5 (unkeyed).

8. ALIGN - PRESSED (3L)

Verify that ALIGN momentarily changes to ALIGN and then returns to ALIGN, indicating that the INUs accept the present position.

NOTE

After the INU completes alignment mode 8 (a minimum of 51 seconds), ALIGN changes to ALIGN. No further present position entries will be accepted by the INUs.

9. MSU 1/MSU 2 - ALIGN

10. NAV DB LOAD - IF REQUIRED

a. DRU PWR Switch - ON

b. Place Data Transfer Device (DTD) into the Data Receptacle Unit (DRU).

c. Branch to XFER DATA (6L).

d. Press 1L.

Verify that LOAD, TRANSMIT, RECEIVE, and POWER UP changes to LOAD, TRANSMIT, RECEIVE, and POWER UP and TRANSFER % COMPLETE annunciates while database loads.

e. DTD - REMOVED

f. DRU PWR Switch - OFF

g. Branch to POWER UP page (6L).

11. Branch to ROUTE 1 (6R).

ROUTE 1 - ENTERED.

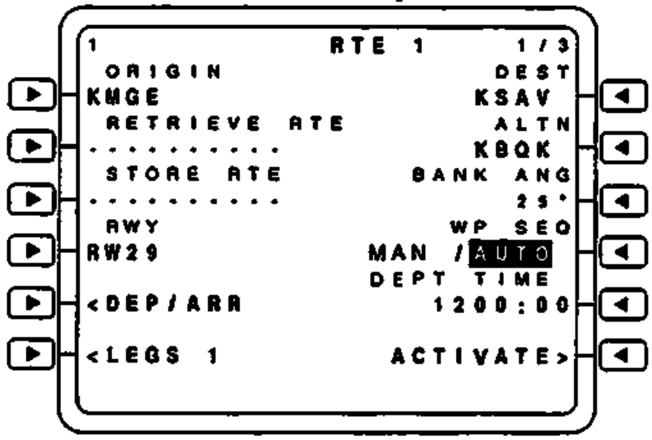
NOTE

- If a new mission database was loaded, all previously stored routes have been erased.
- A route may be entered manually or, if loaded, retrieved as a stored route.

RTE 1 PAGE.

NOTE

- The title of the route pages changes to indicate its status; RTE 1 indicates inactive, ACT RTE indicates that route is active, MOD RTE indicates that it is being changed.
- The total number of route pages (1/X) automatically increases to accommodate a maximum of 127 waypoints, 10 CARPs, four approaches, and five rendezvous intercept.



1. To retrieve a stored route, enter the route identifier and upselect by pressing 2L.

NOTE

- If the identifier is not found in the database, the scratch pad will display NOT IN DATABASE .
- If the identifier is improperly entered, the scratch pad will display INVALID ENTRY .

2. To manually enter route, enter the origin identifier and upselect by pressing 1L.

3. Enter runway, if known, and upselect by pressing 4L.

or

4. Branch to DEP/ARR (5L).

NOTE

Selecting the runway from the DEP/ARR INDEX page has the advantage of automatically retrieving the SID page, if one exists, for selected departure.

a. Select origin DEP/ARR by pressing associated line select key (LSK).

b. Select runway by pressing associated LSK.

c. If SIDs exist, select desired SIDs by pressing associated LSK.

NOTE

If modifying a route, you have to execute the change prior to branching back to the route page.

d. Branch back to the route page by pressing 6L.

Verify that selected runway identifier annunciates under RWY.

5. DEST - ENTERED (1R)

or

6. Branch to DEP/ARR by pressing 5L.

NOTE

Selecting the Destination from the DEP/ARR INDEX page has the advantage of automatically retrieving the STARS page, if one exists, for selected arrival.

a. Select DEP/ARR by pressing associated LSK.

b. If STAR exists, review and select desired STAR by pressing associated LSK.

c. Branch back to the route page by pressing 6L.

7. ALTN - ENTERED (2R)

8. Bank ANG - ENTERED (3R)

9. DEPT TIME - ENTERED (5R)

10. Activate route by pressing 6R and then the EXEC key.

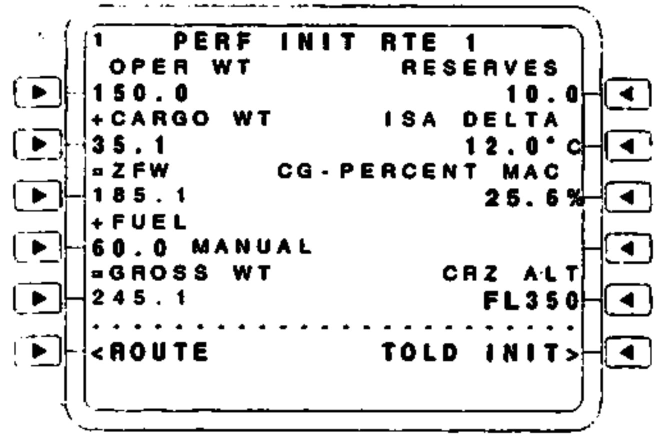
NOTE

Verify the page title changes from RTE 1 to ACT RTE 1.

11. Branch to PERF INIT Page by pressing 6R.

PERF INIT RTE 1 PAGE.

1. OPER WT - ENTERED



2. CARGO WT - ENTERED

3. ZFW - CHECKED

4. FUEL - ENTERED

5. Gross WT - CHECKED

6. Reserves - ENTERED (1R)

7. ISA DELTA - ENTERED

8. CG - PERCENT MAC - ENTERED

9. CRZ ALT - ENTERED

10. Branch to TOLD INIT page.

TOLD INIT RTE 1 PAGE 1/3.

1. OAT - ENTERED

2. SFC WINDS - ENTERED and upselect by pressing 2L

3. Baro - ENTERED and upselect by pressing 3L

4. ELEV/PA - CHECKED

5. RED/TRT/MAX - SET AS REQUIRED

6. FIELD - CHECKED

7. Rwy - CHECKED

8. Rwy LGTH - CHECKED

9. Weight - CHECKED

10. NEXT key - PRESSED

TOLD INIT RTE 1 PAGE 2/3 (LANDING AT ORIGIN).

1. RCR/RSC - SET/ CHECKED

2. SLOPE - SET/CHECKED

3. RWY HDG - ENTERED (3L)

4. # BRAKES - CHECKED/SET

5. OBS ELEV - ENTERED (5L)

6. OBS DIST - ENTERED (1R)

7. ANTI SKID - ON (2R)

8. RAIN REMOVAL - AS REQUIRED (3R)

9. WING AI - AS REQUIRED

10. ENG AI - AS REQUIRED (5R)

11. NEXT key - PRESSED

TOLD INIT RTE 1 PAGE 3/3 (LANDING AT DESTINATION).

1. RCR/RSC - SET/CHECKED (1L)

2. SLOPE - SET/CHECKED (2L)

3. OAT - SET/CHECKED (3L)

4. Baro Setting - SET/CHECKED (4L)

5. # BRAKES/REV ENG - SET/CHECKED (5L)

6. # SPOILERS - SET/CHECKED (1R)

7. ANTI SKID - ON (2R)

8. RAIN REMOVAL - AS REQUIRED (3R)

9. WING AI - AS REQUIRED (4R)

10. ENG AI - AS REQUIRED (5R)

PILOT'S CDS/FMS/INS INTERFACE - OPTIONAL.

1. DAMU NAV PTR 1 - FMS 1

2. DAMU HDG - INS 1

3. MFCDU, MAIN MENU key - PRESSED

   a. MAINT - PRESSED (6R)

   b. IBIT - PRESSED (1R)

   c. INS 1 - PRESSED (3R)

4. Observe pilot's PFD:

HSI: Course arrow defaults to N and CDI centers. Both annunciate in red. The compass card annunciates in white. Compass card rotates to 030° for approximately six seconds, then Compass card rotates to 000° for approximately six seconds. Compass card annunciates in red.

5. Copilot's BDHI: Indicates 30° under upper lubber line with OFF flag retracted for approximately six seconds then rotates to N under upper lubber line, OFF flag retracted. After approximately six seconds the OFF flag returns to view.

6. MSUs: BAT and READY NAV lights illuminated.

COPILOT'S CDS/FMS/INS INTERFACE - OPTIONAL.

1. DAMU NAV PTR 1 - FMS 2

2. DAMU HDG - INS 2

3. MFCDU, MAIN MENU key - PRESSED

   a. MAINT - PRESSED (6R)

   b. IBIT - PRESSED (1R)

   c. INS 2 - PRESSED (4R)

4. Observe copilot's PFD:

HSI: Course arrow defaults to N and CDI centers. Both annunciate in red. The compass card annunciates in white. Compass card rotates to 030° for approximately six seconds, then Compass card rotates to 000° for approximately six seconds. Compass card annunciates in red.

5. Pilot's and NAV's BDHI: Indicates 30° under upper lubber line with OFF flag retracted for approximately six seconds, then rotates to N under upper lubber line, OFF flag retracted. After approximately six seconds, the OFF flag returns to view.

6. MSUs: BAT and READY NAV lights illuminated.

SOLN PAGE.

NOTE

Automatic Navigation Source selection is enabled when AUTO is selected. When MAN is selected, the NP is prohibited from changing the navigational source. MAN is the default setting.

1. On both MFCDUs SOLN key - PRESSED

2. On INAV CTRL SOLN Page, select:

   a. AUTO/MAN - AUTO (5L)

3. On either MFCDU NEXT key - PRESSED

   a. SELECT GPS 1 - PRESSED (2L)

   Verify GPS 1 STATUS:

(1) KEYED GOOD

(2) SELECT GPS 2 - PRESSED (6L)

Verify GPS 2 STATUS:

(3) KEYED GOOD

(4) Branch to INAV CTRL INDEX (6R)

b. PRESS INS 1 - 3L PRESSED

Note CIV LAT/LONG and alignment state number.

c. Branch to INS 2 by pressing 6L.

Note CIV LAT/LONG and alignment state number.

4. Branch to INAV CTRL INDEX - PRESSED (6R)

5. Branch to INAV CTRL SOLN - PREV key PRESSED

6. MSU 1/MSU 2 - NAV

COMM TUNE PAGE.

1. COMM TUNE key - PRESSED

2. On COMM TUNE Index V1 - SELECTED (1L)

3. On COMM TUNE V1 Page:

a. Frequency - SET/CHECKED

b. Presets - SET/CHECKED AS REQUIRED

c. EMG FRQ - AS REQUIRED

d. SQL - ON

e. TONE - OFF

f. Branch to COMM INDEX by pressing 6L.

4. Repeat steps 3a through f above for V2.

5. TOD - LOADED AS REQUIRED

a. UHF Radios - ON

b. TOD XMIT - PRESSED (6R)

Verify that TOD XMIT OFF momentarily changes to ON.

NOTE

Normally, the UHF radios will automatically accept only the first TOD Message received after power-up. To load TOD after power-up set the UHF Control A-3-2-T switch to T and press 6R on the COMM TUNE INDEX page.

NAV TUNE PAGE.

1. Press NAV TUNE key.

2. On NAV TUNE INDEX Page select - VOR 1

a. Station IDENT - ENTERED

b. PAIRING - AS REQUIRED

c. Branch to NAV TUNE INDEX (6L)

3. On NAV TUNE INDEX Page select - VOR 2

Repeat steps 2a through c for VOR 2.

4. On NAV TUNE INDEX Page select - TAC 1

a. Enter station IDENT - ENTERED

b. REC/TR - AS REQUIRED

c. GND/ON - AS REQUIRED

d. PAIRING - AS REQUIRED

e. Branch to NAV TUNE INDEX (6)

5. On NAV TUNE INDEX Page select - TAC 2

Repeat steps 4a through e for TAC 2.

NAVAID INHIBIT PAGE.

NOTE

Permanently inhibited navaids remain inhibited until cleared by the crew. Temporarily inhibited navaids are cleared on flight completion.

1. MAIN MENU key - PRESSED

2. NEXT key - PRESSED

3. NAVAID INHIBIT - PRESSED (1L)

a. TACAN, VOR, or DME - ENTERED

b. To permanently inhibit a NAV AID - PRESS FIRST AVAILABLE LEFT LSK.

c. To temporarily inhibit a NAV AID - PRESS FIRST AVAILABLE RIGHT LSK.

LANDING ZONE/NON-PRECISION APPROACH (LZ/NPA).

1. MSN key - PRESSED

NOTE

Up to 4 LZs may be loaded. If an LZ other than 1 is displayed, enter desired LZ number and upselect to 4L.

2. LZ 1 INIT 1/2 Page - SET AS REQUIRED

a. LZ IDENTIFIER - Runway Ident - ENTERED (1L)

b. LZ THRESHOLD POSITION - RWY position, LAT/LONG or MGRS - ENTERED (2L)

c. TDZE - ENTERED (3L)

d. MDA or HAT - ENTERED (4L)

e. LZ Inbound CRS - ENTERED (4R)

f. MAP Distance - ENTERED (5L)

3. NEXT Key - PRESSED

4. LZ 1 INIT 2/2 Page - SET AS REQUIRED

a. FAF Distance - SET/CHECKED (3L)

b. SD Distance - SET/CHECKED (4L)

c. TP Distance - SET/CHECKED (5L)

d. DESCENT ANGLE - SET/CHECKED (1R)

e. FAF ALTITUDE - SET/CHECKED (3R)

f. LZ IAS - CHECKED/DELETE

MSU.

1. MSU 1/MSU 2 - NAV

BEFORE TAKE-OFF.

1. TOLD key - PRESSED

2. TAKEOFF DATA - CHECKED

3. LANDING DATA - CHECKED

In Flight.

1. On PILOT'S DAMU

a. NAV SELECT - NAV PTR1 - FMS 1 AP/FD - LNAV

b. SFD - MAP

2. On COPILOT'S DAMU

a. NAV SELEC - NAV PTR 1 - FMS 2 AP/FD - LNAV

b. SFD - MAP

3. MSP

a. FLT DIR - AS REQUIRED

b. VNAV - AS REQUIRED

c. A/T - AS REQUIRED

4. Autopilot - AS REQUIRED

5. Autothrottles - AS REQUIRED

VNAV.

1. VNAV key - PRESSED

CLB PAGE.

NOTE

Each time a change is made the activate light (green) illuminates and the page title changes from ACT to MOD. The change will not take effect until the EXEC key is pressed at which time the page returns to ACT.

1. CRZ ALT - CHECKED/SET AS REQUIRED

2. SEL SPD - CHECKED/SET AS REQUIRED (2L)

3. EPR - CHECKED

4. ECON/ENG OUT/CLB DIR/MAX ANG - AS REQUIRED

5. If modified, EXEC key - PRESSED

CRZ PAGE.

NOTE

Each time a change is made the activate light (green) illuminates and the page title changes from ACT to MOD. The change will not take effect until the EXEC key is pressed at which time the page returns to ACT.

1. CRZ ALT - CHECKED/SET AS REQUIRED

NOTE

The CRZ SEL SPD defaults to .74 MACH. The SEL SPD becomes active when the Present Position Altitude is equal to the CRZ ALT. If the CRZ ALT is set to ≤ 10,000 feet, when the aircraft's Present Position Altitude becomes equal to the CRZ ALT, the commanded speed will be a LIM SPD of 350 IAS.

2. SEL SPD - CHECKED/SET AS REQUIRED

3. EPR - CHECKED

4. ECON/ENG OUT/LRC/TOA - AS REQUIRED

5. If modified, EXEC key - PRESSED

6. NEXT key - PRESSED

DES PAGE.

NOTE

Each time a change is made the activate light (green) illuminates and the page title changes from ACT to MOD. The change will not take effect until the EXEC key is pressed at which time the page returns to ACT.

1. E/D AT - CHECKED AS REQUIRED (1L)

2. SEL SPD - CHECKED AS REQUIRED (2L)

3. RAPID DES/ ECON/ DES DIR - AS REQUIRED

4. If modified, EXEC key - PRESSED

DESCENT FORECAST PAGE.

1. TRANS LVL - CHECKED AS REQUIRED (1L)

2. AI/ON ALT - CHECKED AS REQUIRED (1R)

3. ALT - ENTERED/AS REQUIRED (2L)

4. WIND DIR/SPD - ENTERED/AS REQUIRED (2R)

5. Branch to DES - PRESSED (6R)

GRID ENTRY - ENROUTE.

WARNING

When NO NAV is displayed, the NP GRID function is inoperative. If the annunciation is a result of a power transient, reset the MASTER CAUTION, reselect NAV source, and reenter the GRID FACTOR to restore operation.

1. Grid Heading - COMPUTED

2. Convergence Factor - ENTERED

   a. MFCDU MAIN MENU key - PRESSED

   b. On MAIN MENU Page SYS CONTROL - SELECTED (2L)

   c. On SYS CONTROL Page GRID FACTOR - ENTERED (5R)

3. Pilot's DAMU MAIN MENU

   a. NAV SELECT - NAV PTR 1 - FMS 1

   b. ATT - INS 1

   c. HDG - AHRS

   d. PFD - GRID

   e. AP/FD - HDG

4. Copilot's DAMU MAIN MENU

   a. NAV SELECT - NAV PTR 1 - FMS 2

   b. ATT - INS 2

   c. HDG - AHRS

   d. PFD - GRID

5. AP 1/2 - ENGAGED

6. AHRS Controller - DG MODE

7. AHRS Controller - SET LOCAL LATITUDE

8. AHRS HDG/SYNC Knob - SLEW COPILOT'S BDHI TO GRID HEADING

9. Headings - CROSS CHECKED

GRID EXIT - ENROUTE.

1. Pilot's DAMU MAIN MENU

   a. NAV SELECT - NAV PTR 1 - AS REQUIRED

   b. NAV SELECT - ATT - INS 1

   c. NAV SELECT - HDG - INS 1

   d. PFD MENU - MAG

   e. AP/FD - AS REQUIRED

2. Copilot's DAMU MAIN MENU

   a. NAV SELECT - NAV PTR 1 - AS REQUIRED

   b. ATT - INS 2

   c. HDG - INS 2

d. PFD - MAG

3. AP 1/2 - AS REQUIRED

4. AHRS Controller - SLV MODE

5. AHRS Controller - SET LOCAL LATITUDE

6. AHRS Controller - CHECK SYNCHRONIZED

7. AHRS Controller - CHECK MAG VAR SWITCH

8. Headings - CROSS CHECKED

PPOS HOLD PAGE.

NOTE

Before PPOS HOLD can be activated, the cross track error of the Master NP has to be <0.25 NM, LNAV is not in a transition state, and there is an active "TO" waypoint.

1. MSN key - PRESSED

2. On MISSIONS page select - PPOS HOLD - 6L PRESSED

3. On PPOS HOLD page - CHECK/SET - AS REQUIRED

4. EXEC Key - PRESSED

5. To terminate a PPOS HOLD select:

a. EXIT ARM - PRESSED (6R)

b. EXEC - PRESSED

or

c. EXIT NOW - PRESSED (5L)

d. EXEC - PRESSED

NOTE

- When the EXIT ARM is EXECuted, LNAV exits the holding pattern upon the next crossing of the holding fix, either by completing the pattern or by shortening the pattern depending upon which part of the pattern is currently active. If the active leg is in turn two or inbound leg, then exit upon crossing the holding fix. If the active leg is turn one or outbound leg then perform a "DIRECT TO" the holding fix when outbound leg is active and exit upon crossing the holding fix.
- When the EXIT NOW is EXECuted, LNAV exits the holding pattern by performing a "DIRECT TO" the next waypoint in the flight plan after the holding pattern.

HOLD AT A WAYPOINT PAGE.

1. FPL Key - PRESSED

2. From the LEGS page select a waypoint - corresponding R key - PRESSED

3. On the WAYPOINT DATA page - SELECT HOLD

4. RTE (x) HOLD Page - CHECKED/SET - AS REQUIRED

5. EXEC Key - PRESSED

Verify that the page title changes to ACT RTE (x) HOLD

6. To terminate a HOLD select:

a. EXIT ARM - PRESSED (6R)

b. EXEC - PRESSED

or

c. EXIT NOW - PRESSED (5L)

d. EXEC - PRESSED

RENDEZVOUS PAGE.

The RENDEZVOUS page allows definition of a target's position, time, groundspeed, track and in-trail distance, and then computes an intercept position and time with the target, the course and distance to the intercept position and the target's current bearing and range.

1. MSN key - PRESSED

2. On MISSION page - ENTER RENDEZVOUS NUMBER - PRESSED (5L)

3. On the RENDEZVOUS page:

a. Enter Target's INIT POS LAT/LONG - PRESSED (1L)

b. Enter Target's INIT TIME - PRESSED (2L)

c. Enter Target's INIT TRK - PRESSED (3L)

d. Enter Target's INIT GS - SET/CHECKED (2R)

e. INTERCEPT - CHECKED (4L)

f. INTERCEPT POS - CHECKED (5L)

g. TGT BRG/RNG - CHECKED (4R)

4. EXEC Key - PRESSED

Air Refueling.

PRECONTACT.

1. Autopilot - OFF
2. Autothrottles - OFF

POST AIR REFUELING.

1. FMS - "AS REQUIRED"

a. PERF INIT RTE page FUEL - "ENTERED" (CP) (4L)

b. EXEC key - "PRESSED" (CP)

2. Autothrottles - "AS REQUIRED" (P)
3. Autopilot - "AS REQUIRED" (P)
4. VNAV - "AS REQUIRED" (P)

DIRECT TO (LNAV).

1. D→ Key - PRESSED
2. On LEGS page, downselect the direct-to waypoint.
3. Enter waypoint - PRESSED (6L)
4. EXEC key - PRESSED

or

5. Enter course intercept - PRESSED (6R)
6. EXEC key - PRESSED

MARK POINT.

1. MAIN MENU key - PRESSED
2. MARK POINT - PRESSED (5L)

Post Flight.

NAV ACCURACY.

1. SOLN key - PRESSED
2. On the SOLN INDEX Page select:

a. GPS 1 (2L)

b. GPS 2 (2R)

3. MAIN MENU key - PRESSED

a. On the MAIN MENU Page select - MARK POINT

b. MARK POINT number - RECORD OR DOWNSELECTED (1L)

4. SOLN key - PRESSED
5. On the SOLN INDEX Page select:

a. INS 1 (3L)

b. INS 2 (3R)

c. UPDATE (6R)

6. On the INS UPDATE Page select:

a. MARK POINT NUMBER - ENTERED OR UPSELECTED (3L)

b. CLEAR - PRESSED (4L)

c. CLEAR - PRESSED (5L)

d. Select - MAN (1R)

e. Select - FREEZE (1L)

7. Record INS OFFSETS.

a. INS 1 above UPDATE (4R) ____.____

b. INS 2 above UPDATE (5R) ____.____

GPS ZEROIZE.

NOTE

The crypto keys will be deleted automatically after two passings of 23:59:59 Zulu (UTC).

1. On the KEY FILL Panel momentarily pull and lift the GPS ZEROIZE Switch.
2. MFCDU SOLN key - PRESSED

a. NEXT key - PRESSED

b. Select GPS 1 - PRESSED (2L)

Verify GPS 1 STATUS - NOT KEYED (4R)

3. Select GPS 2 - PRESSED (6L)

Verify GPS 2 STATUS - NOT KEYED

ZEROIZE PAGE.

1. Routes - AS REQUIRED (1L)
2. COMM PRESETS - AS REQUIRED (3L)
3. GPS - AS REQUIRED (5L)
4. THREATS - AS REQUIRED (6L)
5. DLS - AS REQUIRED (4R)
6. ALL - AS REQUIRED (5R)
7. VERIFY - CHECKED (6R)

RADAR SET (AN/APS-133).

The radar set consists of a receiver-transmitter, pilot's multi-function display (MFD), navigator's MFD (on SKE-equipped airplanes only), MFD ON/OFF switch, antenna, radar control panel, and a radar data processor (RDP). A RADAR control panel contains operating controls for the set (figure 1-238).

The primary function of the radar set is to provide weather avoidance information. It can also be used for long or short range terrain mapping, air-to-air mapping, and beacon navigation. The azimuth scan sector for all functions is fixed at 180 degrees (90 degrees either side of aircraft heading). Antenna stabilization circuits allow the 0-degree elevation plane of the radar to be locked to either the true horizontal plane (as determined by onboard reference systems) or to the actual plane of the aircraft. Antenna tilt control allows the azimuth scan plane to be tilted above or below the selected reference plane. The radiated beam is automatically shaped to provide optimum performance in each function. Target returns in all functions are digitized and presented in color on the multifunction display. Automatic gain correction circuits eliminate apparent size differences between equal targets at different ranges. It provides "normalized" target capability for a true picture of weather cells within 80 miles. Internally generated fixed azimuth lines, fixed and variable range markers, and alphanumeric information are also displayed.

The display portion of the radar system is also used by the Traffic Collision and Avoidance System (TCAS) and Terrain Awareness and Warning System (TAWS). The MFD is also used to display SKE information on SKE-equipped airplanes. These systems provide visual advisories and warnings that are displayed on the pilot's multi-function display (MFD) when there is potential conflict with other air traffic or terrain clearance. As a terrain mapping radar, it provides a display of prominent terrain features such as cities, shorelines, islands, and high ground as an aid to navigation. As a beacon interrogation set, it interrogates ground or air beacons within range and displays their response(s) as a further aid to navigation. The set also generates fixed azimuth cursors, fixed and variable range markers, and explanatory alphanumerics.

ANTENNA STABILIZATION.

When the ANT STAB switch is "ON", the radar set antenna is stabilized by inputs from INS 1, INS 2, or AHRS system, so that the radar beam scan plane at 0-degree ANT TILT control setting is the true horizontal plane as determined by the selected reference. Selection of INS 1, INS 2, or AHRS as the antenna reference is accomplished by the pilot's DAMU attitude selection. If autopilot 2 is coupled (in single autopilot mode), antenna reference reverts to copilot's DAMU attitude selection. In the event of dual DPU failure, the antenna attitude reference defaults to AHRS.

Mechanical Limits.

The antenna stabilization limits are mechanically fixed at ± 25 degrees in pitch and ± 43 degrees in roll.

The pitch stabilization limit is based on the combination of aircraft pitch angle and antenna tilt setting. If the aircraft maneuvers exceed these stabilization limits, antenna stabilization will be affected, but will automatically correct when the maneuver is ended. Gyro precession errors are not a factor in antenna stabilization criteria.

RADAR SET MODES OF OPERATION.

As a weather avoidance radar, the set detects and displays precipitation areas in red, yellow, and green. The red areas indicate heaviest precipitation or storm centers, yellow indicates lower precipitation rates, and green indicates lightest rainfall. Azimuth lines, fixed range marks, and alphanumerics are displayed in blue. Automatic penetration circuits prevent storm areas at close range from masking other storm areas at the same azimuth but longer range.

As a terrain mapping radar, the set scans a selected range of earth and provides a display of prominent topographical features such as lakes, rivers, islands, high ground, bridges, cities, etc. These features are presented on the indicator in a display resembling an ordinary pilotage chart. The detected terrain features are displayed in red, yellow, and blue according to the strength of the target returns: red for strongest returns, yellow for medium, and blue for lowest. Azimuth lines, range marks, and alphanumerics are displayed in green.

In the air-to-air mapping function, the set presents a display of other aircraft in the immediate vicinity of the present flight path. Detected aircraft are displayed in red, yellow, or blue: red for strongest returns, yellow for medium level, and blue for lowest level. Azimuth lines, fixed range marks, and alphanumerics are displayed in green. The effective range in this function is limited by the size of the target aircraft, but detection of a large aircraft could be expected at 10 NM.

As a beacon navigation radar, the set transmits an interrogation signal to trigger an X-band beacon. Operating beacons within range transmit a response pulse which is received by the radar set and displayed as an arc on the indicator at the relative bearing and distance to the beacon. The beacon response is displayed in green only. Azimuth lines, range marks, and internally generated alphanumerics are displayed in blue.

RADAR SET CONTROLS AND INDICATORS.

The radar set operating controls and indicators are contained in the multi-function display (MFD) unit, the RADAR control panel, the display interface control unit (DICU), and (on aircraft modified by TCTO 520) in the navigator's radar display select panel. On aircraft not modified by TCTO 520 (SKE), a single MFD is mounted in the pilot's center instrument panel (figure 1-154) and the RADAR control panel and DICU are mounted in the pilot's center pedestal (figure 1-156). On SKE-equipped aircraft (TCTO 520), the navigator's radar display select panel and a second MFD are mounted at the navigator's station (figure 1-160). On SKE-equipped aircraft, additional mounting is provided in the navigator's instrument panel (figure 1-160) for the RADAR control panel so that this control panel may be mounted either in the navigator's instrument panel (figure 1-160) or the pilot's control pedestal (figure 1-156). On SKE-equipped aircraft, a dummy panel is installed in the alternate mounting position not containing the RADAR control panel.

MFD ON/OFF SWITCH.

The MFD receives operating power from 28 VDC Avionics Main DC Bus No. 2 through the TCAS circuit breaker and the MFD ON/OFF switch. The TCAS circuit breaker is on the avionics circuit breaker panel at the navigator's station, and the MFD ON/OFF switch is located on the pilot's side console.

RADAR DATA PROCESSOR (RDP).

The RDP receives analog data from the weather radar and converts it to an ARINC 453 digital format for presentation on the pilot's MFD. The RDP receives display range, target clarity, delay range, and delay azimuth commands from the pilot's MFD through an ARINC 429 interface. The RDP has additional discrete connections to other radar control signals and aircraft systems.

RADAR CONTROL PANEL.

The RADAR control panel contains the following controls for the weather radar set.

Function Selector Switch.

A 7-position, pull-and-turn action switch. In "OFF", all power is removed from the radar set. In "STBY", a three-minute warm-up time delay is activated. In "TEST", the radar set radiates into a dummy load, a test pattern is displayed on the multifunction display (if three-minute delay from "OFF" has expired), and the system executes an internal test sequence. The ANT and/or RT fault indicators may light to signal detected faults. In "WX", the set displays weather detection information. The antenna radiates an arrow pencil beam and the STC circuit is activated. "MAP 1" and "MAP 2" are used for terrain mapping. The antenna beam pattern is selectable by the PENCIL/FAN switch. The STC circuit is disabled in "MAP 1" and enabled in "MAP 2". The "MAP 2" is recommended for low level mapping and for short-range, air-to-air operation. In "BCN", bearing and distance information relative to responding beacon stations is displayed. In all positions except "OFF" and "STBY" the selected function is displayed on the upper left of the radar indicator scope.

Pencil-Fan Switch.

Enabled only in the "MAP 1" and "MAP 2" functions. When enabled, selects radiated beam shape. Pencil beam is a narrow symmetrical beam approximately 3 degrees in elevation and azimuth. Fan beam is broadened in the elevation plane.

ANT Tilt Control.

Selects the tilt of the azimuth scan plane from +14 to −14 degrees in relation to the selected 0 degrees plane selected by the ANT STAB switch.

ANT Stab Switch.

Enables or disables antenna stabilization. In "ON", antenna is roll and pitch stabilized within limits throughout azimuth scan so that 0 degree tilt is the true horizontal plane. In "OFF", the 0 degree antenna tilt is the present plane of the aircraft.

CAUTION

The ANT STAB switch should be "ON" during all normal operation of the AN/APS-133. It may be turned "OFF" if antenna stabilization fails during flight.

Gain Control.

Provides manual control of receiver gain. When fully clockwise in "AUTO" position, the gain is preset for calibrated functions such as STC, contour, and penetration compensation.

ANT and RT Indicators.

In "TEST" function only, light to indicate detected faults.

MULTI-FUNCTION DISPLAY.

The multi-function display contains the following controls for the multi-function display presentation.

Range Selector.

Selects the range in nautical miles (NM) displayed on the radar indicator and the distance between fixed range markers: 5 NM with 1 NM range markers; 25 NM with 5 NM range markers; 50 NM with 10 NM range markers; 150 NM with 30 NM range markers; or 300 NM with 60 NM range markers. The selected range/range markers combination is displayed in the upper right corner of the multifunction display scope.

Hold Pushbutton.

Allows the operator to freeze the display. When "HOLD" is pressed in, the present display on the multifunction display is retained instead of being updated by subsequent azimuth scans. The notation "HOLD" flashes alternately with the function (WX, BCN, etc.) in the upper left corner of the multifunction display scope. Pressing "HOLD" again or changing range selector position resumes normal updating of the display.

TGT Clar Control.

Adjusts threshold for first-level radar returns (green data in WX and BCN, blue data in MAP 1 and MAP 2). Allows reduction of extraneous background noise.

INT Control.

Adjusts brightness (intensity) of presentation on multifunction display for best signal visibility and contrast.

NOR-MKR-DLY Switch.

Selects the video presentation mode. In "NOR", the normal video display is presented with zero range at the bottom center of scope. In "MKR", a yellow variable range marker is added. The position (range) of the variable marker is controlled by the SLEW control and is displayed in the upper right comer of the multifunction display. In "DLY", the range sweep starts at the variable range marker setting, as displayed in the upper right of the indicator. The full range (with fixed range marks) selected by the range selector switch on the indicator is displayed. The notation "DLY" is displayed in the upper left of the multifunction display and the minimum range is displayed in the upper right. For example: if the range scale selected is 50/10 and the variable marker is set at 100 NM, only the range from 100 NM to 150 NM would be displayed, with 100 NM at the bottom center of the indicator, and the legends "DLY" and "100" would be displayed in the upper left and upper right, respectively.

MULTI-FUNCTION DISPLAY (MFD).

One multi-function display is located on the pilot's center instrument panel. On airplanes equipped with station keeping equipment (SKE), a second MFD is located at the navigator's table. Intraformation positioning (SKE) information can be displayed only on the pilot's MFD.

The pilot's MFD is a software-controlled multicolor Active Matrix/Liquid Crystal Display (AM/LCD). In addition to displaying weather radar information, the MFD displays flight information and aircrew situational awareness data from the TCAS, TAWS, SKE, and FMS/INS systems. The pilot's MFD has control buttons aligned vertically on the left and right sides of the bezel. The buttons on the left side are identified from top to bottom as 1L, 2L, 3L, and 4L. The buttons on the right side are identified from top to bottom as 1R, 2R, 3R, and 4R. Two rotary knobs at the lower left and right positions contain center-mounted pushbuttons. When power is applied to the MFD, the display comes on at the default brightness level.

The navigator's MFD (only on SKE airplanes) is the current 4-color cathode ray tube (CRT) type display.

DISPLAY INTERFACE CONTROL UNIT (DICU).

The DICU contains an 8-position rotary function switch (RDR) that selects the video information to be presented on the pilot's multifunction display unit. In all positions of the switch, except "SKE" and "SKE/INS", AN/APS-133 weather radar information is presented on the pilot's multifunction display unit. In "RDR" position, only AN/APS-133 is presented. In "WRN", "FMS", "CSR", "INS/FMS", and "AR" positions, various combinations of information are superimposed on the AN/APS-133 data. In "SKE" and "SKE/INS" positions, the AN/APS-133 information is suppressed from the pilot's multifunction display unit. In "SKE" position, only AN/APN-169C Intraformation Positioning System Station Keeping Equipment (SKE) information is displayed. In "SKE/INS" position, information from the Inertial Navigation System (INS) is superimposed on the SKE display. In SKE-equipped aircraft, AN/APS-133 information is presented on the navigator's multifunction display in all 8 positions of the DICU function switch. For descriptions of the AN/APS-133 data that can be presented on the two multifunction display units, refer to the descriptions of the AN/APN-169C SKE, the Inertial Navigation System, and the Flight Management System (FMS).

NAVIGATOR'S RADAR DISPLAY SELECT PANEL (AIRCRAFT MODIFIED BY TCTO 520).

The navigator's radar display select panel contains a 2-position NAV/RADAR ONLY toggle switch that selects the information to be displayed on the navigator's multifunction display unit. In "RADAR ONLY" position, AN/APS-133 radar information alone is displayed on the navigator's multifunction display unit. In "NAV" position, information from the Inertial Navigation System (INS) is superimposed on a portion of the weather radar display. Refer to the INS descriptions for the information displayed in the "NAV" position of the NAV/RADAR ONLY switch.

RADAR SET (AN/APS-133) OPERATION.

WARNING

Ensure all personnel are clear of the antenna radiation hazard area anytime the function selector switch is in "WX", "MAP 1", "MAP 2" or "BCN". Avoid directing the energy beam toward inhabited structures, personnel or areas where aircraft are being refueled/defueled.

CAUTION

Operation of the radar system and hydraulic system pumps and/or the winch system simultaneously, from a external power unit, may damage the radar system due to power fluctuations. Coordinate with the flight engineer and loadmaster prior to checking operation of the AN/APS-133.

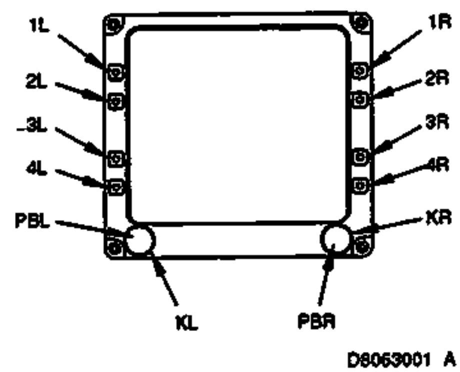


Figure 1-128A. MFD Controls

<table>
<tr><th>Control</th><th>Purpose</th><th>Label</th><th colspan="3">Function</th></tr>
<tr><td>1L</td><td>INCREASE display brightness control</td><td rowspan="2">▲ B R T ▼</td><td colspan="3">Increases brightness</td></tr>
<tr><td>2L</td><td>DECREASE display brightness control</td><td colspan="3">Decrease brightness.</td></tr>
<tr><td>3L</td><td>OFF/TERR/WXR overlay select</td><td>M O D E</td><td colspan="3">Selects weather radar or TAWS or neither for display.</td></tr>
<tr><td>4L</td><td>ARC/360° display format select</td><td>F M T</td><td colspan="3">ARC display is 180° compass, FULL display is 360 compass. Weather radar and terrain data are displayed only in ARC display format.</td></tr>
<tr><td>1R</td><td rowspan="3">Selects the range and range arcs in nautical miles (NM) displayed for both ARC and 360</td><td rowspan="3">▲ R N G ▼</td><td colspan="3">Selects the following display ranges. Applicable range arcs and spacing are:</td></tr>
<tr><td rowspan="2">2R</td><td>MAX Range (NM)</td><td>Number of ARCs displayed (NM)</td><td>ARC spacing</td></tr>
<tr><td>2.5
5
10
20
40
80
160
320</td><td>5
5
2
4
2
2
2
2</td><td>0.5
1
5
5
20
40
80
160</td></tr>
<tr><td>3R</td><td>NAV mode select</td><td>N A V</td><td colspan="3">Displays active Flight Plan map symbols in proper position with respect to the selected range and aircraft position symbol. Displays partial compass and digital true heading.</td></tr>
<tr><td>4R</td><td>TCAS overlay select</td><td>T C A S</td><td colspan="3">Provides situation awareness and displays traffic advisories (TA) or resolution advisories (RA) when other transponder-equipped aircraft come near your airplane. Displays transponder equipped traffic within TCAS range.</td></tr>
<tr><td>KL</td><td colspan="2">Target Clarity</td><td colspan="3">Five-level adjustment for weather return threshold. Clockwise increases target clarity.</td></tr>
</table>

Control	Purpose Label	Function
PBL	HOLD	Press to freeze current weather data on display. Press again to unfreeze weather data on display.
KR	Slew variable range arc while in MKR mode and minimum range while in DLY mode.	Clockwise rotation increases range, counter-clockwise rotation decreases range.
PBR	Normal/Marker/Delay mode selection. Press to toggle weather display through NOR/MKR/DLY modes respectively.	NOR: Normal indicator display, no yellow range arc or sweep range delay. MKR: A yellow variable range arc added to display. Arc position controlled by rotation of this knob. DLY: Display sweep is delayed in range. Minimum range is range of variable marker.

System Test.

To place the radar system in the test function, proceed as follows:

1. Verify that the selected stabilization reference (INS 1 or AHRS) is operating. Set the following controls to the positions listed:

   a. Multifunction Display.

      (1) Range selector to "150"

      (2) TGT CLAR control to Midrange

      (3) INT control to Midrange

      (4) NOR-MKR-DLY switch to "NOR"

   b. Radar Control Panel.

      (1) Function selector switch to "TEST"

      (2) ANT TILT control to "0"

      (3) GAIN control to "AUTO"

NOTE

If the function selector switch was in "OFF" position, there will be a three-minute warmup delay before the test pattern can be evaluated. If the function selector switch is positioned to "TEST" before the expiration of the three-minute warm-up delay, the multifunction display will either remain dark or display a series of narrow, colored bands ("Persian Rug" effect).

2. After expiration of initial three-minute warm-up period, a test pattern (figure 7-1) should be displayed on the multifunction display.

3. Adjust the INT control on the multifunction display for a comfortable brightness of the test pattern display.

4. Check test pattern for:

   a. The presence of five distinct color bands in the lower third of the scope; green, yellow, red, yellow, green. The width of each band is not critical. Absence of these color bands or an illuminated ANT or RT fault light on the Radar Control Panel indicates a probable fault in either the receiver-transmitter (RT) or antenna (ANT).

   b. A gradual increase of green test noise from outer edge of outer green test band to approximately 80 NM, and a fairly uniform band of test noise (green) from approximately 80 NM to 100 NM. Either a uniform noise level from 50 to 100 NM or the absence of all noise in this region indicates a failed RT unit.

   c. Some random noise may be displayed beyond the green test noise band. The TGT CLAR control may be used to adjust background and test noise level. Adjustment of TGT CLAR control should reduce background noise to only a few random dots.

   d. Alphanumerics (TEST and 150/30), five azimuth cursors, and five segmented range markers displayed in blue.

   e. A 3-color bar (red, yellow, green) below the 150/30 in upper right.

5. After evaluating test pattern, set function selector switch on RADAR control panel to "STBY".

Weather Avoidance Operation.

To operate the radar set in the weather avoidance function, proceed as follows:

1. Set the following controls to the positions listed:

   a. Multifunction Display.

      (1) Range Selector to desired range

      (2) TGT CLAR control to Midrange

(3) INT control to Midrange

(4) NOR-MKR-DLY switch to "NOR"

NOTE

If the function selector switch was in "OFF" position, an initial three-minute warm-up delay will be initiated.

b. Radar Control Panel.

(1) Function selector switch to "WX"

(2) ANT STAB switch to "ON"

(3) GAIN control to "AUTO"

2. When the initial three-minute warm-up delay has expired, weather returns will be displayed in red, yellow, and green: red indicates areas of heaviest precipitation, yellow areas are medium precipitation, and green areas are lowest precipitation rate. Azimuth lines, range marks, and alphanumerics will be displayed in blue. A 3-color (red, yellow, green) video bar is displayed in upper right.

NOTE

The GAIN control on the RADAR control panel must be in "AUTO" for display colors to be significant.

3. Adjust INT control for a comfortable display brightness.

4. Adjust TGT CLAR control as required to set background noise level. Only a few random dots of noise should be visible.

5. Set range selector on multifunction display to desired range.

6. Adjust the ANT TILT control on the RADAR control panel until ground clutter begins to creep into the periphery of the display. This will provide a scan of the normal area of interest, and precipitation areas will be displayed in map form relative to the aircraft heading.

NOTE

This tilt adjustment will normally provide maximum range performance.

7. To scan above or below the normal scan area, adjust ANT TILT knob on radar control panel up or down in 1/2-degree increments. Allow sufficient time between adjustments for antenna to make one complete scan.

8. After scanning above or below normal area, readjust ANT TILT control as in step 6 above.

9. To evaluate detected storm systems, make fine changes in ANT TILT setting to obtain greatest signal return from storm. Allow at least one full scan between changes in ANT TILT.

NOTE

Proper use of ANT TILT control is essential to effective display of weather information. Corrections as fine as 1/4-degree in ANT TILT can make significant changes in weather return presentation.

Long Range Terrain Mapping.

The following procedure uses the radar set for long range terrain mapping operation:

1. Position the radar set controls as follows:

a. Multifunction Display.

(1) Range Selector to "150" to "300"

(2) TGT CLAR control to Midrange

(3) INT control to Midrange

(4) NOR-MKR-DLY switch to "NOR"

NOTE

If the function selector switch was in "OFF", there will be a three-minute delay before the set begins operation.

b. Radar Control Panel.

(1) Function selector switch to "WX"

(2) ANT STAB switch to "ON"

(3) GAIN control - As required

2. When the initial three-minute warm-up delay has expired, detected returns will be displayed in red, yellow, and green: red for strongest returns, yellow for medium, and green for weakest. Range marks, azimuth lines, and alphanumerics (WX and range) will be in blue. A 3-color video bar (red, yellow, green) will be displayed below range in upper right.

3. Set range selector on multifunction display to "150" to "300", depending on aircraft altitude and area of interest.

4. Adjust INT control on multifunction display for comfortable level of brightness.

5. Adjust ANT TILT control slightly downward to obtain the most uniform display of terrain within the area of interest. The ANT TILT should be adjusted in increments of 1/2-degree with a delay of one full scan time between adjustments.

6. Adjust TGT CLAR control to set background noise level. Only a few random dots of background noise should be present.

Medium (MAP 1) or Short (MAP 2) Range Terrain Mapping.

To operate the radar set for medium or short range terrain mapping, proceed as follows:

1. Position the radar set controls as follows:

   a. Multifunction Display.

      (1) Range Selector to range of interest

      (2) TGT CLAR control to Midrange

      (3) INT control to Midrange

      (4) NOR-MKR-DLY switch to "NOR"

NOTE

If function selector switch was "OFF", radar set operation will be delayed for an initial three-minute warm-up period.

   b. Radar Control Panel.

      (1) Function selector switch to "MAP 2"

      (2) PENCIL-FAN switch to "FAN"

      (3) ANT STAB switch to "ON"

      (4) GAIN control - As required

2. When initial three-minute delay has expired, detected target returns will be displayed in red, yellow, or blue according to strength: red for strongest returns, yellow for medium, and blue for weakest. The azimuth lines, range marks, and alphanumerics will be displayed in green. A 3-color video bar (red, yellow, blue) will be displayed in upper right.

3. Set range selector on multifunction display range of interest.

NOTE

Short range terrain mapping is recommended only for ranges of 50 NM or less. For ranges greater than 50 NM, the Long Range Terrain Mapping procedure is recommended.

4. Adjust INT control on multifunction display for a comfortable brightness of display.

5. Adjust ANT TILT control a few degrees downward to obtain uniform display of terrain over area of interest.

6. Adjust TGT CLAR control to set background noise level. Only a few random dots of blue background noise should be visible.

7. When adjustments are correct, terrain returns will cover most of the indicator screen in red, yellow, or blue

according to relative size and reflectivity. At normal cruise altitude, fields and farmland will appear blue, hills and small towns display yellow, and large cities and mountains as red areas. Dark areas among the display indicate features of low reflectivity such as smooth water in rivers, lakes, or bays.

Air-to-Air Mapping.

To operate the radar set for air-to-air mapping, proceed as follows:

1. Set the following controls to the position listed:

   a. Multifunction Display.

      (1) Range selector to "25"

      (2) TGT CLAR control to Midrange

      (3) INT control to Midrange

      (4) NOR-MKR-DLY switch to "NOR"

NOTE

If function selector switch was in "OFF" position, radar set operation will be delayed for a three-minute warm-up.

   b. Radar Control Panel.

      (1) Function selector switch to "MAP 1"

      (2) PENCIL-FAN switch to "FAN"

      (3) GAIN control to "AUTO"

      (4) ANT STAB switch to "ON"

      (5) ANT TILT control (As Required)

2. After expiration of initial three-minute warm-up period, any target returns will be displayed in red, yellow, or blue according to strength: red for strongest returns, yellow for medium, and blue for weakest. Azimuth lines, range marks, and alphanumerics will be displayed in green.

3. Adjust INT control on multifunction display fo a comfortable brightness of presentation.

4. Adjust TGT CLAR control to set background noise level. Only a few random dots of blue noise should be displayed.

5. Adjust ANT TILT control in small increments to obtain the best return from aircraft of interest. Readjustment of ANT TILT control may be required at very close ranges.

NOTE

The ANT TILT control should be adjusted in very small increments because the elevation covered by even the Fan beam is quite small at close ranges.

6. As target range decreases, the target return on the radar indicator will change from blue to yellow to red.

7. When the target of interest increases strength to red, adjust GAIN control counterclockwise to reduce level to yellow or blue.

NOTE

If target level is not reduced, the target display may "blossom" or "smear" and lose definition.

8. If desired, change range selector on radar indicator to "5" when range to target decreases to less than 5 NM.

9. If GAIN control is fully counterclockwise and target return is still red, set function selector switch to "MAP 2" and GAIN control to "AUTO". The MAP 2 function enables STC (sensitivity time control) which reduces the strength of close-in target returns.

10. As target range continues to decrease, target return level may again increase to red. If so, again adjust GAIN control counterclockwise to reduce level to yellow or blue.

Mapping Interpretation.

Terrain mapping range is a function of the radar system characteristics, altitude and type of terrain over which the aircraft is flying. Desert terrain provides the least power return, woods and fields return more power and cities and mountains return the most power. Lakes, rivers, and bays provide very little reflectivity and, therefore, show up as "holes" in the normal radar ground background.

WARNING

Do not rely on the AN/APS-133 as a primary means of Low Altitude Navigation, Terrain Identification, or Terrain Avoidance.

Altitude affects the mapping range. Higher altitudes will increase line of sight range (see page 7-4).

The radar set characteristics also affect the mapping range. The AN/APS-133 uses the long pulse of the WX mode when ground mapping at ranges of 50 NM or greater is desired.

The short pulse of the MAP 1 mode is used for short to medium range terrain mapping and is used to develop high range resolution. In the MAP 1 mode, the STC circuit is disabled and the PENCIL-FAN switch is usually placed in the "FAN" position, to provide broader coverage. In this mode, greater detail of terrain targets can be identified on the indicator screen.

The MAP 2 mode is used for low altitude terrain mapping. This mode's primary purpose is for approach and drop zone identification. The FAN beam is used to provide broad geographical coverage. It can also be used for air to air identification of other aircraft at close ranges of 5 NM or less.

The "PENCIL" beam will provide detailed painting of medium and short range ground point targets.

Beacon Interrogation.

The following procedure operates the radar-set in the beacon interrogation mode.

NOTE

When the radar is operating in the beacon interrogation mode, no weather or ground target information is processed. Therefore, it may be desirable to frequently switch between beacon operation and weather avoidance or mapping operation.

1. Set the following controls to the positions listed:

   a. Multifunction Display

      (1) Range selector to "300"

      (2) TGT CLAR control to Midrange

      (3) INT control to Midrange

      (4) NOR-MKR-DLY switch to "NOR"

NOTE

If function selector switch was in "OFF" position, there will be an initial three-minute warm-up delay before radar starts operating.

   b. Radar Control Panel.

      (1) Function selector switch to "BCN"

      (2) ANT STAB switch to "ON"

      (3) GAIN control to "AUTO"

2. When the initial three-minute warm-up delay has expired, responses from any beacons within range will be displayed as green arcs on radar indicator. Azimuth lines, fixed range marks, and alphanumerics will be displayed in blue.

3. Adjust INT control on multifunction display for comfortable brightness of display.

4. Adjust TGT CLAR control on multifunction display to set level to background noise. Only a few dots of random noise should be visible.

5. Adjust ANT TILT control up or down as necessary to provide best return from beacon(s) of interest.

6. At long ranges, each beacon response will be displayed as a single green arc approximately 3 to 4 degrees wide.

7. As range to beacon decreases to less than 150 NM, change range selector setting to "150". As range decreases, continue to change range selection so that beacon response remains in upper half of display.

8. Additional adjustment of ANT TILT control may be required to maintain strong beacon response presentation.

9. The identity of beacon stations having coded responses can be checked by using the "MKR" and "DLY" positions of the radar indicator NOR-MKR-DLY switch as follows:

   a. Set NOR-MKR-DLY switch to "MKR".

   b. Operate SLEW switch on multifunction display to move yellow variable range marker to a range slightly less than beacon response. The range to the yellow marker will be displayed in upper right of indicator in increments of 0.1 NM.

NOTE

The variable marker will move slowly when the SLEW switch is first operated, then faster if SLEW is held to "IN" or "OUT".

   c. After yellow range marker is positioned, set NOR-MKR-DLY switch to "DLY". The displayed range is now the range selected by the range selector on the multifunction display, starting at the range of the variable marker as displayed in the upper right of the indicator screen. For example, if the range selector is set to "50" and the variable marker is at 70 NM, the indicator will display 50 NM of range from 70 NM to 120 NM (70 plus 50).

   d. The display can now be expanded by reducing range selected in steps and operating SLEW switch to keep target at midrange on indicator.

   e. If the selected beacon response is a coded reply, the response should now consist of a series of green arcs. The arc closest in range is the true range to the beacon, and the remaining arcs are the beacon code.

   f. After examining beacon code, return NOR-MKR-DLY switch to "NOR" and range selector to appropriate range (refer to Delayed Range readout).

10. As range to the beacon continues to decrease, the displayed arc will increase in width and may start to "blossom". At ranges of 5 NM or less, the arc displayed may increase to 6 to 8 degrees.

11. At short ranges, it may be desirable to reduce radar beacon response strength by adjusting GAIN control counter-clockwise or by small adjustments of ANT TILT control.

Radar Turn Off.

To turn off the radar system equipment after use, position the controls as follows:

1. Radar Control Panel.
   a. ANT TILT control to "0"
   b. ANT STAB switch to "ON"
   c. GAIN control to "AUTO"
   d. Function selector switch to "OFF"
2. Multifunction Display.
   a. NOR-MKR-DLY Switch - "NOR"
   b. Range Selector to "OFF".

RADAR SYSTEM - STANDBY.

When the radar function selector switch is set to "STBY" from "TEST", "WX", "MAP 1", "MAP 2", or "BCN", most of the system components remain warmed up; only the magnetron and high-voltage circuits are deenergized. Full operation is resumed immediately when the function switch is returned to "TEST", "WX", "MAP 1", "MAP 2", or "BCN". When the function switch is set to "STBY", the ANT STAB switch should be left in the "ON" position. If use of the radar system is discontinued during flight for extended periods, the radar set should be turned "OFF".

DEFENSIVE SYSTEMS (AN/AAR-47 MWS, AN/ALE-47 CMDS).

The purpose of the defensive system is to protect the airplane against surface-to-air infrared (IR) guided missiles that may be encountered during routine and special operations missions. The system detects plume signatures from these missiles, alerts the flight crew, and automatically ejects flare decoys to divert the heat-seeking missiles away from the airplane. A manual dispense option is also selectable.

The defensive system contains a threat warning detector and a countermeasures unit. The system is designated by the specific components that make up a specific countermeasure and dispensing system. The system is made up of the AN/AAR-47 MWS and the AN/ALE-47 CMDS.

The MWS is controlled by the pilot; the CMDS is controlled by the navigator/scanner. The MWS detects incoming missiles, provides a visual and audio alarm to the flight crew, and automatically cues the CMDS to eject flares at the optimum time to divert missiles away from the airplane. Flares can also be ejected manually by the flight crew from controls at the navigator's station, jump seat, and from remote controls near the cargo compartment paratroop doors.

MISSILE WARNING SYSTEM (AN/AAR-47).

The Missile Warning System (MWS) detects the presence and direction of launched missile thermal signatures. It provides an audio warning and a visual sector warning via the system's Control Indicator (CI). Indicator lamps show the direction of the missile relative to the aircraft and an audible alarm is sounded over the aircraft interphone. The MWS can automatically dispense countermeasures through the Countermeasures Dispensing System (CMDS) upon missile detection when the AAR-47 AUTO DISPENSE CONTROL panel switch is in the "AUTO" position. Flares serve as diversions for infrared seeking missiles. The MWS contains two built-in-test (BIT) features, which provide both a failure detection function and a failure location function for the three system components; CI, Computer Processing Unit (CPU), and the Optical Sensors (4 each).

MWS Built-In-Tests.

The THREAT and FAILURE indicators double as PRESS-TO-TEST pushbuttons. To test the CI, press and hold the CI THREAT pushbutton. The THREAT and FAILURE lamps illuminate, and a two-tone frequency is audible for as long as the pushbutton is held. Upon release of the pushbutton, the lamps remain illuminated for approximately two seconds. If the THREAT lamps remain illuminated at the end of the test or fail to illuminate during the test, the CI is inoperative.

The SYSTEM test checks the CPU and the four optical sensors. Press and immediately release the CI FAILURE pushbutton. This BIT runs for approximately 30 seconds. During the test, FAILURE lamps will illuminate. At the end of the test, the THREAT lamps will illuminate and the alternating two-tone frequency will become audible for two seconds indicating that the system is back on-line. At the end of the test, if a FAILURE lamp remains illuminated, the lamps are numbered and indicate which sensor(s) has/have failed. If all FAILURE lamps remain illuminated a CPU failure is indicated. A continuous BIT is activated whenever the MWS is energized. This BIT continuously monitors the CPU and sensor performance and reports failures to the CI.

Control Indicator (CI).

All missile warning controls and indicators are located on the CI. The CI provides system power control, initiates system BIT, displays BIT, gives threat warning indications, and provides audible warnings to the flight crew. Is is located on the pilot's glare shield. The THREAT indicator is divided into four quadrants with arrows that light to display the relative direction of the threat. It also doubles as a PRESS-TO-TEST switch that activates the CI self-test. The POWER indicator turns the MWS on and off. The FAILURE indicator is also divided into four quadrants to determine sensor failures. It also doubles as a PRESS-TO-TEST switch that activates the SYSTEM self-test. The AUDIO knob controls the volume level of the warning tone. The LAMP control adjusts the brightness of the CI display.

Computer Processing Unit (CPU).

The CPU (figure 1-241) performs the data processing and input/output functions of the MWS. The CPU receives and processes threat signals from the Optical Sensor-Converters. When an actual threat is received and processed by the CPU, signals are sent to the CI to provide visual and audio warning. The CPU also sends a signal to the CMDS to dispense countermeasures when the AUTO/MANUAL switch on the AUTO DISPENSE CONTROL panel (pilot's glare shield) is set to "AUTO".

Optical Sensor-Converters.

The four sensors are installed so as to provide incoming missile detection 360 degrees around the aircraft (figure 1-240). Two are installed on the forward fuselage (one left, one right), and two are installed on the vertical stabilizer. Sensor data is sent to the MWS CPU for signature analysis.

COUNTERMEASURES DISPENSING SYSTEM (CMDS) (AN/ALE-47).

The AN/ALE-47 CMDS dispenses flares under automatic or manual control. Flare cartridges are loaded into magazines that are then inserted into dispenser assemblies mounted at strategic locations on the aircraft. Flares are launched as necessary when the flight crew or MWS determines that there is a need for protection. They can be fired individually, at timed intervals, or in bursts as determined by the operators control settings and the Mission Data File (MDF) stored in the programmer. The system consists of a Control Display Unit (CDU), Programmer, 12 dispensers, 6 sequencers, 5 safety switches, INDICATOR/ARM CONTROL panel, REMOTE DISPENSE CONTROL panel, AAR-47/ALE-47 AUTO DISPENSE CONTROL panel, and a series of touchdown/safing relays.

Programmer.

The programmer generates dispense signals in response to input commands (figure 1-242). The number and type of dispense signals, and the time interval between them, is determined by CDU switch settings and the MDF. During manual operation, four stored software programs (the MDF) are used to dispense countermeasures. These programs are selected at the CDU using the PRGM switch. During automatic operation, countermeasures are dispensed according to a non-selectable program established by the MDF. Dispense signals are routed from the programmer to the sequencers, which then apply squib power to the appropriate contacts in the dispensers.

Sequencers.

Each sequencer routes squib power to the breech plate contacts for a pair of dispensers upon receipt of a dispense signal. Switches on the sequencers must be set for the proper addressing. These addresses are used by the programmer MDF to select the locations from which the countermeasures will be dispensed. The sequencer are located near the dispensers that they control. Squib power is inhibited by touchdown relays. Each sequencer has a bypass program that can be activated by setting the CDU MODE switch to "BYP". This mode is used whenever the CDU or programmer fails.

Dispenser Assemblies.

Each dispenser assembly houses a magazine of flare cartridges and holds the electrical contacts used to fire explosive squibs that launch the flare cartridges. Pairs of dispenser assemblies are provided with a sequencer for cartridge selection. There are two dispensers in each wing between the inner and outer flaps, aft of the landing lights (figure 1-243). These dispensers discharge downward. Each main landing gear pod houses two dispensers that fire outward. There are also two pair of downward firing dispensers (four total) on the bottom of the aircraft in the Doppler cavity. When magazines are not installed a cover assembly protects each dispenser from moisture and dust, and reduces aircraft drag. Each magazine will hold thirty - 1 x 1-inch, fifteen - 1 x 2-inch, or six - 2 x 2.5-inch cartridges. The preferred load is fifteen - 1 x 2-inch flares per magazine for a total of 180 flare cartridges.

WARNING

- Do not stand in front of or under loaded dispensers except for inspection. Flares are dispensed by explosive squibs and can be dangerous.
- Do not perform test or operational checks on defensive systems when flares are loaded.
- If the end cap is missing on an unexpended flare cartridge and the cartridge is protruding, clear the area and call EOD. Failure to comply may damage the aircraft or injure personnel.

NOTE

Ensure covers are installed when dispensers are not loaded.

Safety Switches. (See figure 1-244.)

Safety switches, when pinned, keep squib power from reaching the sequencers, thus preventing accidental firing of countermeasures. Four of the switches are mounted in the cargo area at FS 1118, forward of the paratroop doors, two on the left side and two on the right side. These switches serve their respective wing and main landing gear dispensers. One additional switch is mounted in the forward cargo compartment at FS 498 on the right side aft of the latrine. It serves the four Doppler cavity dispensers.

WARNING

- During normal operations, in-flight refueling, or fuel dumping, ensure the CMDS is deactivated and the safety pins are installed. Failure to install the safety pins may result in serious injury or death due to accidental discharge.

- If safing the system is impossible prior to landing, do not taxi near other aircraft until the system is safed.

Remote Dispense Pushbuttons.

There are three remote dispense pushbuttons available to command countermeasures dispensing (figure 1-245). Remote dispense pushbuttons are located at the pilot's side console and at the left and right paratroop doors. These pushbuttons are hand-held pushbuttons on cords that allow their use while moving about the aircraft.

Control Display Unit (CDU).

Located at the navigator's panel (figure 1-242), the CDU has controls and indicators that allow the navigator/scanner to select manual dispense programs in MAN mode and to monitor the countermeasures inventory. Four programs are selectable by the PRGM switch. A fifth is nonselectable. The MDF, which is loaded into the programmer by ECM maintenance, determines how many flares are fired upon command, the interval between them, and the locations from which they are fired. As each countermeasure is dispensed, the appropriate counter on the CDU decrements. The bypass mode (BYP) allows the system to continue dispensing countermeasures by bypassing the programmer and CDU if either should fail. The JETT switch is used to jettison flares in any mode, including "OFF". Flares cannot be jettisoned if squib power has been removed by installing the safety pins, placing the ARM/SAFE switch to "SAFE", or if the aircraft has weight-on-wheels.

If squib power has been removed and a jettison is attempted, the FL display on the CDU will indicate "Lo 0" even though no flares were jettisoned. Power must be removed from the system and reapplied before a subsequent jettison attempt is made. Rearming the system (removing the safety pins or placing the ARM/SAFE switch to "ARM") will have no effect unless the power is first removed from the system by placing the CDU MODE switch to "OFF". When power is reapplied, the system will again poll the inventory and jettison can be re-initiated. In emergency situations, flares can be jettisoned even when the CDU is in the OFF mode by simply placing the JETT switch to "ON". As in other modes the safety pins must be removed before any jettison will occur. The SEMI and AUTO modes are not used. The RWR, JMR, and MSW switches are also not used. The programmer performs a continuous Built-in-Test (BIT) and the CDU displays a continuous GO/NO GO status of the system. A BIT can be initiated by placing the PRGM switch to "BIT". The CDU is mounted at the navigator's station and its lighting is compatible with night vision goggles.

AAR-47/ALE-47 AUTO DISPENSE CONTROL Panel.

The AAR-47/ALE-47 AUTO DISPENSE CONTROL panel is located on the pilot's glareshield (figure 1-239) and provides an interface between the CMDS and MWS. When the AUTO/MANUAL switch is in "AUTO", the MWS can initiate dispensing according to a non-selectable program established by the MDF. With the switch in "MANUAL", the CMDS is disconnected from the MWS, allowing countermeasures to be dispensed only by the remote dispense pushbuttons. With the switch in "AUTO", countermeasures can be dispensed both automatically by the MWS, and manually using the remote dispense pushbuttons.

ALE-47 INDICATOR/ARM CONTROL Panel.

Located on the navigator's panel (figure 1-242), the INDICATOR DIM/BRIGHT control adjusts the intensity of the CDU annunciators. The LAMP TEST switch is used to check the operation of the annunciators. When it is placed to the "TEST" position, all annunciators illuminate. The ARM/SAFE switch is a safing device used to interrupt squib power to the sequencers through a series of relays when it is placed to the "SAFE" position.

REMOTE DISPENSE CONTROL Panel.

Located on the navigator's panel (figure 1-242), the REMOTE DISPENSE CONTROL panel is equipped with a single switch, the ENABLE/DISABLE switch. It is an additional safety device with the purpose of preventing accidental firing of countermeasures. When placed to the "DISABLE" position, the three remote dispense pushbuttons are inoperative.

GROUND SAFETY BYPASS Switch.

The GROUND SAFETY BYPASS switch is located in the forward right side cargo area at FS 498. It is a two-position ("TEST", "SAFE") guarded toggle switch. The normal operating position is in "SAFE". Placing the switch to "TEST" allows squib power to bypass the touchdown relays. This position permits ground testing of the system. The "TEST" position can be selected in-flight to discharge countermeasures if the touchdown switches or relays malfunction.

WARNING

Do not place the GROUND SAFETY BYPASS switch to "TEST" while the airplane is on the ground with countermeasures loaded.

Accidental discharge of countermeasures may occur causing injury to personnel and damage to aircraft.

CMDS Normal Operating Procedures.

Perform the following steps for normal operation of the Countermeasures Dispensing System.

WARNING

Do not place the GROUND SAFETY BYPASS switch to "TEST" while the airplane is on the ground with countermeasures loaded. Accidental discharge of countermeasures may occur causing injury to personnel and damage to aircraft.

1. Ensure GROUND SAFETY BYPASS switch is set to "SAFE".

2. Ensure safety pins (5) are removed from Safety Switches.

3. Ensure all ALE-47 and AAR-47 circuit breakers are in.

4. On INDICATOR/ARM CONTROL panel set the INDICATOR DIM/BRIGHT control to a comfortable level.

5. On CONTROL DISPLAY UNIT (CDU) place the MODE switch to "MAN"; verify correct OFP and MDF numbers are displayed, GO is shown on the CDU STATUS display within 10 seconds, and the correct inventory is displayed above each Enable switch.

6. To check the CDU lamps, place the INDICATOR/ARM CONTROL panel LAMP TEST switch to "TEST".

7. On CDU place the PRGM switch to the desired program number.

8. On INDICATOR/ARM CONTROL panel place the ARM/SAFE switch to "ARM".

9. On REMOTE DISPENSE CONTROL panel place the ENABLE/DISABLE switch to "ENABLE".

10. On CDU place the applicable ENABLE switch(es) (01, 02, CH, FL) to "ON".

11. Depress any one of the three REMOTE DISPENSE pushbuttons to manually dispense countermeasures; CDU inventory displays decrement.

12. To enable automatic dispensing, place the AUTO MANUAL CONTROL panel AUTO/MANUAL switch to "AUTO".

13. To jettison all flares, place the CDU JETT switch to "ON".

CMDS Abnormal Operating Procedures.

1. If a CDU or Programmer failure occurs, place the CDU MODE switch to the "BYP" position. This position activates a dispense program that is loaded into each Sequencer when power is applied to the system. Dispense signals then bypass the CDU and Programmer, and are applied directly to the sequencers. Manual and automatic dispensing are both available in the BYP mode. The CDU display is blank in this mode.

WARNING

Do not place the GROUND SAFETY BYPASS switch to "TEST" while the airplane is on the ground with countermeasures loaded. Accidental discharge of countermeasures may occur causing injury to personnel and damage to aircraft.

2. If countermeasures cannot be dispensed from either the MAN or BYP modes, the GROUND SAFETY BYPASS switch can be placed to "TEST" in order to send squib power to the Sequencers. Placing the switch to "TEST" bypasses the touchdown switches and landing gear touchdown relays.

CMDS Shutdown.

Perform the following steps to deactivate the CMDS.

1. Place the REMOTE DISPENSE CONTROL panel switch to "DISABLE".

2. Place the AUTO DISPENSE CONTROL panel switch to "MANUAL".

3. Place the INDICATOR/ARM CONTROL panel ARM/SAFE switch to "SAFE".

4. Ensure that the GROUND SAFETY BYPASS switch is in the "SAFE" position.

5. Install safety pins (5) into each of the SAFETY switches.

6. Place CDU ENABLE switches to "OFF".

7. Place CDU MODE switch to "OFF".

STATION KEEPING EQUIPMENT (SKE) (AIRCRAFT MODIFIED BY TCTO 520).

The Intraformation Positioning Set (SKE) is a system that allows up to 36 aircraft to maintain fixed separation between aircraft in formation and to locate each other and identify the leader aircraft during flights under adverse weather conditions. The SKE can also be operated in conjunction with a ground-based Zone Marker (ZM). The SKE performs three functions: (1) the display of relative range and azimuth positioning information of other cooperating SKE-equipped aircraft in the formation on a multifunction display and/or track-while-scan (TWS) positioning data (in-track, cross-track, and altitude) relative to the selected leader aircraft; (2) an integral signaling capability for the transfer of flight commands and other data to facilitate coordinated changes of the formation's flight path; and (3) an audio and visual proximity warning system to signal the presence of SKE-equipped aircraft intruding within a selectable zone.

The multifunction display and SFD are capable of indicating up to 35 other cooperating SKE-equipped aircraft within a 10 nautical mile radius. The TWS indications provide the capability of maintaining selected in-track, cross-track, and altitude position within approximately four nautical miles with respect to one selected leader aircraft. The data transfer function permits the transmission of flight commands and other data from any aircraft. These flight commands and data are received by all aircraft that have selected the aircraft transmitting the commands and data as the leader aircraft. In addition, altitude information is transmitted via the data transfer function. Each aircraft can function as either a master or follower. One aircraft, which can be at any position within the formation, must function as a master with regard to clock-timing synchronization and all other aircraft function as followers. The clock-timing circuits in all follower aircraft are synchronized to the clock in the master aircraft. If the SKE in the aircraft functioning as the master becomes inoperative for any reason, a master lost indicator (M/L) illuminates on the multifunction display of all cooperating followers.

When operated in conjunction with the Zone Marker, up to 34 aircraft can participate in a SKE formation. The ZM operates in time slots 1 and 2 as a follower. Time slots 1 and 2 may be utilized when the ZM is not required. The ZM is positioned in the drop-zone area and automatically activated, after set-up, when interrogated by a SKE-equipped master aircraft. The ZM, when interrogated by and synchronized to the master aircraft, transmits signals to the SKE-equipped aircraft formation. These signals are used to determine range and bearing of the ZM relative to the aircraft and are used to calculate the computed air release point. The ZM target is presented on the multifunction display. The power output of the ZM is sufficient to permit an operating range of 20 miles.

SKE/WEATHER RADAR SYSTEM INTERFACE.

The AN/APS-133 weather radar system multifunction display has been made compatible with the SKE system with the installation of the Auxiliary Interface Unit. All operating procedures of display of weather, mapping, and beacon data remain unchanged. The SKE formation situation displays (range rings, proximity warning and built-in test) have been retained. The display is modified to include a unique leader target symbol (circle) that distinguishes the leader from all other formation members (square). A unique ZM symbol (small vertical bar) is also retained.

Signal Data Converter (CV-3838/AP Auxiliary Interface Unit) (AIU).

The Signal Data Converter (AIU) is a peripheral device that receives and processes serial and discrete data from the SKE system. The AIU processed data is transmitted to the multifunction display at the pilot's position. Normal connections to the multifunction display are through the Display Interface Unit (DIU); however, the AIU may be connected directly to the multifunction display via the DIU Bypass Panel located in the underdeck avionics equipment rack. The AIU and its shock mount are located in the underdeck avionics equipment rack (figure 1-209).

MULTI-FUNCTION DISPLAY CONTROLS.

The SKE presentation at the multi-function display is controlled via the DIU and AIU by controls located on the Display Interface Control Unit (DICU) located at the pilot's center console (figure 1-156).

The DICU contains controls for the FMS display to multi-function display and provides controls for selecting SKE range, a cursor direction control switch for the display, and a function select switch that controls SKE data displayed on the multi-function display screen.

Selection of displayed data is controlled by the three SKE modes - SKE, SKE/INS, and RDR/WRN can be selected by the function select rotary switch. A SKE UP/DOWN toggle switch provides the capability to change the location of OWN aircraft from the center position by shifting the display up or down, and a second rotary switch provides selection of SKE range. The ranges that can be selected are:

1	(1000-foot range ring separation)
2	(2000-foot range ring separation)
4	(4000-foot range ring separation)
8	(8000-foot range ring separation)
16	(16,000-foot range ring separation)

SKE System Modes.

SKE MODE.

Range rings are generated when the SKE mode is selected at the DICU function select switch, if the SKE serial data bus is active. If the data bus is inactive for 3 to 5 seconds, the range rings will be omitted and the message "NO SKE DATA" is then displayed in white characters in the center of the multifunction display. With the UP/CENTER/DOWN switch on the DICU in the CENTER position, the display will show 4 complete range rings with OWN aircraft symbol centered on the display. With the switch in the UP or DOWN position, a portion of 6 range rings will be displayed and the OWN aircraft symbol moves from the center to half the distance to the top or bottom of the display, respectively. When the maximum range (16) is selected, the operation of the UP/CENTER/DOWN switch has no effect on the multifunction display. Sizes of targets are reduced for long ranges (8 and 16) to reduce overlap of adjacent targets. The display will accommodate 36 targets. The types of targets displayed include the following:

DESIGNATION	COLOR	SYMBOL	GRAPHIC
Leader Aircraft	Yellow	Circle	⊙
Follower Aircraft	Yellow	Square	⊡
Zone Marker	Yellow	Vertical Line	|
Own Aircraft	Cyan	Horizontal Line	—

SKE/INS MODE.

The SKE/INS mode is only accessible if the AIU is interfaced to the DIU. The DIU will generate the INS map and mix the INS and the SKE display data. Everything on the SKE display, with the exception of the range rings and OWN aircraft symbol, has priority over the INS map display. An overlay signal from the AIU is used in the SKE/INS mode/to blank portions of the INS map. The display generated by the AIU in the SKE/INS mode is identical to the display described for the SKE mode, except that the mode annunciation is SKE/INS instead of SKE.

RADAR WARN MODE.

The RDR/WRN Mode provides SKE warning annunciation overlaid over the radar presentation data. The RDR/WRN Mode is annunciated by "SKE" in the upper left corner of the display below the radar related alphanumeric. If SKE system problems are deleted, these annunciations will be shown on the right edge of the display.

RDR MODE.

The RDR Mode functions when the AIU is interfaced directly to the multifunction display and the DIU is bypassed. A radar only display is available at the multifunction display.

SKE System Warnings and Status Annunciators. (See figure 1-129.)

SKE system warnings and status annunciator legends are displayed. Master status is indicated by a single white letter "M" located just below the mode in DOWN and CENTER formats, and just above the mode in the UP format. Test status is indicated by the word "TEST" displayed on the left edge of the display. Caution is indicated by the "CAUTION" displayed on the right edge of the display. Master lost warning is indicated by "M/L" displayed on the right edge of the display. Proximity warning is indicated by "PROX" displayed on the right edge of the display. Proximity warning strobes are drawn for targets that the SKE system indicates as being too close. The strobe consists of a flashing line drawn from OWN aircraft position, passing through the symbol of the offending aircraft, and terminating at the arc of the last range ring, or at the edge of display.

WARNING

The SKE proximity warning system is designed for aircraft avoidance in relatively stable flight conditions, and will not provide adequate warning when significant aircraft closure rates exist.

PRIMARY CONTROL (APN-169C).

The primary control, located in the navigator's console (figure 1-160 and 1-246), contains switches, indicators, and the BITE (built-in test equipment) controls for the SKE system.

BITE TEST switch - Initiates automatic BITE function when depressed.

NO GO indicator - Illuminates (red) when the BITE circuitry fails to automatically program through the BITE sequence.

LAMP TEST switch - Illuminates all status indicator lamps and the flight command indicator receive (REC) indicators when depressed.

TWO MASTERS indicator - Illuminates (red) in a two master condition.

MASTER Indicator - Illuminates (blue) when aircraft is functioning as a master.

FREQ A/B/C/D switch - Selects one of the following frequencies:

A - 3390 MHz

B - 3510 MHz

C - 3350 MHz

D - 3470 MHz

SKE functions switch - Applies power to system without transmitting in STBY. Allows system to transmit in XMIT and removes power from system in OFF.

MASTER/FOLLOWER switch - Selects master or follower mode of operation.

IND DIM switch - Controls dimming of all SKE control panel indicators.

SECONDARY CONTROL (APN-169C).

The Secondary Control located in the navigator's console (figure 1-160 and 1-246) is used to select and enter the following data into the SKE system Coder-Decoder:

OWN Slot Number - Selects own slot number from 01 to 09, 11 to 19, 21 to 29, or 31 to 39.

LDR (Leader) Slot Number - Selects leader slot number for 01 to 09, 11 to 19, 21 to 29, or 31 to 39. Own slot number cannot be same value as leader slot number. Leader selection is required for track-while-scan generation.

SLEN (Slot Enable) - Selects slot numbers to be enabled from 01 to 09, 11 to 19, 21 to 29, or 31 to 39.

XTRK (X100) - Selects cross-track range from 0 to 4,900 feet in 100-foot increments to left or right of selected leader. Required for track-while-scan operation.

NOTE

> The XTRK (X100) function is used in conjunction with the ADI bank steering bar. The ADI sensitivity for this pointer has three scale sensitivities depending upon the selection of the ITRK (X1000) offset. When the ITRK (X1000) selection is between 1,000 and 4,000 feet, the sensitivity is plus or minus 1,000 feet; between 5,000 and 9,000 feet it is plus or minus 2,000 feet; and between 10,000 and 24,000 feet it is plus or minus 4,000 feet. The bank steering bar is normally used as a command signal indicating steer left or steer right. The maximum offset that can be set for lateral offset from the selector leader is 49 (X100) feet.

ITRK (X1000) - Selects in-track range from 0 to 24,000 feet behind selected leader. Required for track-while-scan operation.

NOTE

> The ITRK (X1000) selection is used in conjunction with the Navigator Station and RRI on both pilot ADIs, which has a display capability of ±1,000 feet above the desired track offset position. The ITRK (X1000) selection also changes the scale sensitivity of the cross-track display on the ADI roll steering bar. The maximum ITRK distance that can be set is 24 (X1000) feet. Relative range is displayed on left side of ADIs when SKE is selected.

ALT (X1000) - Selects altitude offsets, above (+) or below (-), selected leader in 100-foot increments from 0 to 2900 feet. Can also select ±5,000 feet scaling of glide slope indicator. ALT is displayed on right side of ADIs when SKE is selected.

NOTE

> The offset may be above the leader (+ prefix) or below the leader (- prefix). The scale factor on the glide slope indicator of the ADI is plus or minus 1,000 feet (full scale). A third prefix on the switch (50) ignores the offset inserted and changes the scale factor on the ADI from plus or minus 1,000 feet to plus or minus 5,000 feet. The maximum offset that can be set specifically above or below the selected leader is 29 (X100) feet.

BITE - When in BITE position, FUNCTION Indicator displays fault codes when a fault is detected. If no fault is present, the display is blank.

ENTER Pushbutton - Enters data selected by the above position of the FUNCTION switch when depressed. If data is accepted, FUNCTION indicator will display entered data. If data is not valid, ERROR legend will illuminate for approximately four seconds and data will be entered.

The PROXIMITY WARNING controls and functions are as follows:

PROXIMITY WARNING (X100) Switch - Selects the desired proximity warning range. In the OFF position, it disables the proximity warning capability. Desired proximity warning range can be selected in 500-foot increments from 500 feet to 4500 feet.

PROXIMITY WARNING TONE Switch - Controls the warning tone when aircraft is on the ground only. The switch is bypassed by the landing gear touchdown relay when the aircraft is airborne to prohibit disabling of the tone signal.

PROXIMITY WARNING TONE RESET Switch - Interrupts the warning tone for approximately 30 seconds when momentarily depressed.

ALL/SLEN Switch - Enables all slots when in ALL position. Enables only those slots selected by slots enable feature when in SLEN position.

SLOTS RESET Pushbutton - Is operative only when FUNCTION switch is in SLEN position. When depressed, all previously enabled slots are disabled.

SLOTS REVIEW - Is operative only when FUNCTION switch is in SLEN position. As pushbutton is depressed, FUNCTION digital indicator displays number of enabled slot. Each time pushbutton is depressed, next higher enabled slot number is displayed.

FLIGHT COMMAND INDICATOR (APN-169C).

The Flight Command Indicator (FCI) located in the navigator's instrument panel (figures 1-160 and 1-246) contains 22 rectangular pushbutton-type switches and associated green (transmit) legend and amber (receive) legend (one receive legend, for no-drop, is red). Two additional rectangular pushbutton-type switches are provided, one (CLR) without an associated legend, and one (XMT) with an associated transmit legend. In addition, ten circular pushbutton-type switches (keyboard) are located on the panel and are identified as 0 through 9.

Seven of the rectangular-type switches are used to initiate the transmission of a flight command and, once depressed, the associated green (transmit) legend on the FCI and green symbol on the flight command repeater (FCR) will illuminate. In all aircraft that have selected the transmitting aircraft as their leader, the associated amber receive legend on the FCI and the amber symbol on the FCR will illuminate. The pushbuttons and indicators provide the capability of transmitting and receiving the following functions: Left turn; right turn; minus (decelerate); plus (accelerate); descend; climb; and execute. The green XMT legend and green repeater symbol illuminate for 12 to 18 seconds after pushbutton is depressed. The amber receive legend and symbol in the receiving aircraft illuminate for 12 to 18 seconds after the command has been received. If a second pushbutton is depressed in the leader aircraft before the 12-to-18 second period of the first command transmission has elapsed, the first command transmission is terminated, the associated legend and symbol are extinguished, and the second command is transmitted with associated green legend and green symbol illuminated. At the receiving aircraft, the amber legend and amber symbol for the first command received will extinguish and the amber legend and symbol for the newly transmitted command will illuminate. The execute (E) pushbutton is the exception at the receiving aircraft. When an execute command is received, the amber legend and symbol for the previous command will remain illuminated. An execute command cannot be transmitted without having one of the other six maneuvering commands presently being transmitted.

Fifteen rectangular type pushbutton switches are used to initiate the transmission of other data from the reader aircraft to those aircraft that have selected the transmitting aircraft as their leader. These 15 pushbuttons are identified as follows:

TAS	True Airspeed
BAR	Barometric Altitude
IAS	Indicated Airspeed
SD	Slow Down
OR	Overrun
PH	Present Heading
LD	Left Drift
FRQ	Go to Alternate Frequency
RD	Right Drift
CNX	Cancel Previous Transmission
NH	New Heading
ALT	Altitude
TOT	Time Over Target
#	Any Preflight Parameter
	No Drop

Depressing one of these pushbuttons will send the command, illuminate the associated green XMIT leg end on the FCI, and illuminate an associated symbol on the FCI repeater. Like the previous seven flight command pushbuttons, depressing one of these 15 pushbuttons before the transmission of a previously depressed pushbutton, (data) has been completely transmitted for the 12 to 18 seconds will immediately terminate the transmission of the first and initiate the transmission of the second. Likewise, at the receiving aircraft, the first illuminated amber legend and symbol will extinguish and the second amber legend and associated symbol will illuminate. The 10 keyboard pushbuttons can be used in various numerical combinations (up to three digits per transmission) with the 15 rectangular-type pushbuttons described above. For example, 3, 5, 0 can be transmitted with TAS to indicate true airspeed.

NOTE

The data must be transmitted while the command is being transmitted.

Three-digit numerical information can also be transmitted independently of these 15 rectangular pushbuttons. Numerical data transmission restrictions associated with three rectangular pushbuttons are as follows:

TAS	from 115 to 559
NH	from 0 to 359
PH	from 0 to 359

The CLR (clear) pushbutton is used to extinguish all green transmit indicators (and terminate transmissions) and to clear the XMT digital display.

The XMT pushbutton initiates the transmission of numerical data selected by the keyboard pushbuttons. An associated XMT legend illuminates for 12 to 18 seconds when the pushbutton is depressed.

Three digital displays are located on the Flight Command Indicator. They are the TIME, XMT, and REC.

The TIME display counts down from 120 to 0 during the two-minute duration of the system BITE test. During turning maneuvers, the TIME display counts down the time interval from the receipt of execute turn command from the leader aircraft until the follower aircraft should initiate the turn. In addition, a 12-second countdown (maximum) is provided in follower aircraft from completion of turn (returning to straight flight). The XMT display indicates the numerical number being transmitted by the leader aircraft (as selected by the keyboard pushbuttons). The REC display indicates the numerical number being received from the leader aircraft.

The SELF TEST pushbutton is used to self-test the Flight Command Indicator during maintenance.

FLIGHT COMMAND REPEATER.

The Flight Command Repeater (FCR), located on the main instrument panel glare shield (figure 1-246), contains seven flight command indicating pushbutton type switches with associated indicating symbols, 17 indicating data command symbols without associated pushbuttons, two 3-digit displays, an indicating XMT legend, and an indicating REC legend. This repeater provides the pilot with a display of the information sent or received by the Flight Command Indicator (FCI) in the navigator's instrument panel. It also provides the pilot with the capability of originating the seven flight commands.

FLIGHT COMMAND pushbuttons and indicating symbols. The seven indicating pushbutton-type switches and associated indicating symbols repeat the flight commands being transmitted from or received by the Flight Command Indicator (FCI) in the navigator's instrument panel. Pressing any flight command pushbutton on the FCI of the leader aircraft will cause a symbol on the corresponding pushbutton on the repeater in the leader aircraft to illuminate green. In the follower aircraft, the SKE receive tone will sound and a symbol associated with that pushbutton on the repeater will illuminate amber. The green symbols on the repeater pushbutton in the leader aircraft and the amber symbols in the follower aircraft will remain illuminated for 12 to 18 seconds, unless extinguished by CLR or a new command.

The flight command pushbuttons on the repeater can also be used to originate the transmission of flight commands. Pressing a flight command pushbutton on the leader aircraft repeater illuminates the symbol on the pressed pushbutton green and illuminates the associated green (transmit) legend on the leader aircraft FCI. In the follower aircraft, the SKE receive tone will sound, the associated symbol on the repeater will illuminate amber, and the associated amber receive symbol on the FCI will illuminate. The legends and symbols will remain illuminated for 12 to 18 seconds unless extinguished sooner by CLR or a new flight command, as if the command originated at the FCI.

Pressing any flight command pushbutton on the repeater except execute (E), while another flight command is being transmitted will terminate the first command, extinguish the first pushbutton, send the new command, and illuminate the new command pushbutton. On the follower aircraft, the SKE receive tone will sound, the repeater and FCI receive symbols for the previous command will be extinguished, and the repeater and FCI symbols for the new command will illuminate.

If the execute (E) pushbutton on the repeater in the leader aircraft is pressed while any of the other six flight command pushbuttons are illuminated, both the previous command and the execute (E) will be sent, the previous command green (transmit) symbols will be extinguished, the green execute (E) pushbutton on the repeater will be illuminated, and the green execute (E) on the FCI will be illuminated. On the follower aircraft, the SKE receive tone will sound, the associated command and execute (E) symbols on the repeater will illuminate amber, and the associated receive symbols on the FCI for the command and the execute (E) will illuminate amber.

DATA COMMAND Legends.

(Refer to Flight Command Repeater.)

TIME Display.

The three-digit TIME display repeats the three-digit time in seconds display on the flight command indicator. The TIME display counts down from 120 to 0 during the 2-minute (120 seconds) duration of the system BITE test. During turning maneuvers, the TIME display counts down the time interval from the receipt of execute turn command from the leader aircraft until the follower aircraft should initiate the turn. In addition, a 12-second countdown (maximum) is provided in follower aircraft for completion of turn (returning to straight flight).

TRANSMIT/RECEIVE Display.

The three-digit transmit/receive display repeats the three-digit number being transmitted by the leader aircraft to the follower aircraft. The small associated XMT and RCV legends illuminate to indicate whether the number is being transmitted or received.

XMT and RCV Legends.

The XMT and RCV legends indicate whether the information in the TIME display, transmit/receive display, and/or data command symbols (TAS, BAR, etc.) is being transmitted from (XMT) or receive (RCV) this aircraft.

RELATIVE RANGE INDICATOR (APN-169A).

A Relative Range Indicator, located on the navigator's console (figure 1-246), provides a visual presentation of own aircraft in relation to the aircraft selected as leader. The distance from the needle in the form of a small airplane at the top of the indicator to the center of the indicator represents 1,000 feet; the total distance from the top to the bottom of the indicator represents 2,000 feet. When the SKE is not operating, a warning (OFF) flag extends into the center of the indicator.

WARNING

> The small aircraft will only register 1,000 feet too close to 750 feet too far.

AUDIO ALARM SPEAKER.

The audio alarm speaker, mounted over the navigator station, provides an aural warning coincident with the illumination of the PROXIMITY WARNING lamp on the pilot multifunction display, and PROX on the SFD.

RADAR RECEIVER-TRANSMITTER (APN-169C).

The SKE Receiver-Transmitter (RT) is located in the overhead equipment rack in the cargo compartment. The RT provides circuitry necessary for the operation of the intraformation positioning set on any one of the four frequencies.

CODER-DECODER (KY-889/APN-169).

The SKE Coder-Decoder unit, located in the overhead equipment rack in the cargo compartment adjacent to the RT, provides timing, encoding, decoding, and automatic gain control for the received signals. The Coder-Decoder includes the range mark generator, range-time-to-voltage converter that furnishes position information to the multi-function display, and track-while-scan circuits. A stable crystal clock and INS/ZM interface circuitry are also contained in the Coder-Decoder. Various signal parameter/functions are monitored by the circuits in the Coder-Decoder. If a fault is detected during a system BITE test, the applicable fault code will appear on the FUNCTION digital indicator. Refer to SKE malfunction analysis table.

SKE ANTENNA SYSTEM.

The antenna system comprises two antennas; a Directional Antenna mounted on a pedestal, and an Omni Antenna. The Directional Antenna and pedestal are housed within a radome mounted at station 1088 at the bottom of the fuselage. The Omni Antenna is mounted just aft of the radome. Transmitting and receiving functions are accomplished by both antennas. One-way station keeping transmissions take place via the Omni Antenna. The multifunction display within the cockpit is slaved electronically via the Coder-Decoder to the directional antenna resolver contained on the pedestal. The array is driven by a pedestal-mounted drive motor and gear train that rotate the antenna through 360 degrees at a rate of 40 rpm.

NOTE

Antenna may require up to 10 minutes to warm up in cold temperatures.

NORMAL PROCEDURES.

Preflight Procedures.

Before placing the Intraformation Positioning Set AN/APN-169C(V) into operation, perform the following procedures (see figure 1-129).

I. SKE SYSTEM PREFLIGHT.

1. Primary Control OFF/STBY/XMIT switch to STBY. Allow a 90-second warmup.

CAUTION

The SKE primary control switch must be in the OFF position prior to power transfers.

2. IFF - STBY

3. DICU

   a. Multi-Function Display switch - SKE

   b. Range Select - 1,000

   c. UP/DOWN switch - Centered

4. MFD

   a. MFD ON/OFF switch - ON

   b. BRT - As Required

5. Flight Command Repeater IND DIM - fully clockwise.

6. On pilot's and copilot's DAMUs:

   a. From the MAIN MENU, select SKE.

   b. SKE menu (right display), toggle PFD SKE to YES.

   c. SKE menu (right display), toggle SFD SKE to YES.

   d. SKE menu (right display), toggle ZM to OFF.

7. On pilot's and copilot's PFD and SFD, observe the following:

   a. SKE annunciates on ADIs. Roll steering bar.

   b. SKE annunciates in upper left corner of SFDs.

8. Set DIMMER on Nav's panel fully clockwise.

9. Observe that BITE FUNCTION display on Secondary Control displays blank/0/0, indicating that OWN slot number has not been entered.

10. On Primary Control, set desired frequency A, B, C, or D.

11. On Primary Control, set IND DIM fully clockwise.

12. Perform lamp test as follows: On Primary Control, hold LAMP TEST pushbutton depressed and observe the following:

   a. On Primary Control - NO GO, TWO MASTERS, master indicator (blue), and panel lights illuminate.

   b. On Secondary Control - ERROR, 888,X100, X1000, and panel lights illuminates.

   c. On Flight Command Indicator - 888 appears in TIME, REC, and XMT windows.

   d. On Flight Command Repeater - 888 appears in TIME and REC windows.

   e. The multifunction display and both SFDs - ZM, M, 1, four range rings - centered on displays, CAUTION, and M/L (Master Lost) legends are displayed.

II. BITE TEST.

1. On Secondary Control, select and enter BITE data as follows:

NOTE

For each series of settings on thumbwheel switches, depress ENTER pushbutton to enter data and observe that data selected has been accepted as evidenced by a display of selected data on FUNCTION display indicator.

	FUNCTION	SIGN	X10	X1
a.	ALT	+	0	0
b.	ITRK	Blank	0	1
c.	XTRK	L	1	4

d. On SECONDARY CONTROL, set switches as follows:

PROXIMITY WARNING (X100) - 25

PROXIMITY WARNING TONE - ON

e. ALL/SLEN - ALL

2. On Primary Control, set OFF/STBY/XMIT switch to XMIT position.

3. Depress BITE TEST pushbutton and observe the following indications on the multifunction display:

NOTE

BITE test may be repeated as necessary to perform the following test. Reinitiate BITE test, depress BITE TEST pushbutton at the end of BITE (2 minutes for BITE test).

a. On Flight Command Indicator and Flight Command Repeater, observe that 120 is displayed in TIME window and starts counting down to 0.

b. The audio proximity warning tone sounds and the Proximity Warning (PROX) legend illuminates.

4. On Secondary Control, set PROXIMITY WARNING (X100) switch to 15 (see figure 1-246).

a. On the multifunction display and both SFDs observe the following indications:

(1) Proximity warning tone silences and the PROX legend extinguished.

(2) The leader target appears at intersection of 2,000-foot range ring and proximity warning strobe (45°).

(3) The TEST and Master Lost (M/L) legends annunciate.

(4) The CAUTION legend is extinguished.

b. On both ADIs, observe the following indications:

(1) The roll steering bars and vertical deviation marker (◇) are approximately centered.

(2) The Relative Range Marker (⍏) indicates 400 ± 100 feet too far (below midpoint).

c. At the Nav's position, the Relative Range Marker indicates 400 ± 100 feet too far (below midpoint) and the red flag disappears.

5. On Secondary Control, reset BITE data as follows:

	FUNCTION	SIGN	X10	X1
a.	XTRK	L	2	4
b.	ITRK	Blank	0	2
c.	ALT	+	1	0

6. On both ADIs, observe the following indications:

a. The roll steering bar moves to the left wing tip ± 2.5 bar widths and the vertical deviation marker (◊) moves to second dot above horizontal.

b. The Relative Range Marker (⍏) indicates 600 ± 100 feet too close (above midpoint).

c. At the Nav's position, the Relative Range Marker indicates 600 ± 100 feet too close (above midpoint).

7. On Secondary Control, reset the BITE data as follows:

	FUNCTION	SIGN	X10	X1
a.	ALT	-	1	0
b.	XTRK	L	0	4

8. On both ADIs, observe the following indications:

The roll steering bar moves to the right wing tip ± 2.5 bar widths and the vertical deviation marker (◊) moves to second dot below horizontal.

9. During automatic BITE test, check Flight Command Indicator as follows:

a. Depress left-turn pushbutton and observe associated transmit legend (green) and receive legend (amber) illuminate for a period of 12 to 18 seconds and audio alert sounds.

b. Depress decelerate pushbutton and observe associated transmit and receive legends illuminate and audio alert sounds. After legends illuminate, proceed immediately to step c below.

c. Continue the sequence of depressing pushbuttons (down, E, up, +, right-turn, TAS, SD, IAS, OR, PH, LD, FRQ, RD, CNX, NH, ALT, TOT, #, and No Drop). Note that transmit and receive legends associated with depressed pushbuttons extinguish. At end of the sequence, the "No Drop" transmit and receive legends will remain illuminated for 12-18 seconds.

d. Depress the 1, 2, 3 pushbuttons in sequence. Observe that 123 appears in the XMT window.

e. Depress the pushbutton and observe associated green legend illuminates. Also, observe 123 appears in REC window and audio alert sounds.

f. Depress CLR pushbutton and observe that XMT window goes blank, followed by REC window becoming blank.

g. Continue with 4, 5, 6, and 7, 8, 9, and 0, 0, 0.

10. Check the transmit and receive pushbuttons/legends on the Flight Command Repeater in the same manner as in a, b, and c above.

11. BITE TEST ENDS - When the count on the Flight Command Indicator TIME indicator reaches 000 (signifying end of BITE), observe that NO GO legend on Primary Control remains extinguished.

NOTE

If NO GO legend illuminates, a possible malfunction exists in the SKE system. Observe BITE FUNCTION indicator on Secondary Control for a fault code. Should NO GO legend illuminate, rerun BITE to see if fault persists.

12. On Secondary Control, enter OWN slot #.

13. Observe BITE FUNCTION displays CODE 35.

14. Select MASTER on the Primary Control and observe:

a. The BLUE IND light illuminates and CODE 35 disappears in the BITE FUNCTION display (approx 14 sec).

b. The Master Lost (M/L) and CAUTION legends on the multifunction display and SFD extinguishes.

c. Master (M) on multifunction display and SFD illuminates.

15. Select FOLLOWER on the Primary Control and observe:

a. The BLUE IND light extinguishes and CODE 01 (master lost) illuminates (approx 14 sec).

b. The Master Lost (M/L) and the CAUTION legends on the multi-function display and SFD illuminate.

c. Master (M) on multi-function display and SFD extinguishes.

16. Turn the Primary Control OFF/STBY/XMIT switch to OFF.

17. On pilot's and copilot's DAMUs:

a. MAIN MENU select SKE.

b. SKE menu (right display), toggle PFD SKE to NO.

c. SKE menu (right display), toggle SFD SKE to NO.

18. On pilot's and copilot's PFD and SFD, observe the following:

a. SKE annunciation on ADIs extinguishes.

b. SKE annunciation on SFDs extinguishes.

III. MALFUNCTION CODES.

NOTE

- If the SKE malfunctions, you will get a CAUTION indication on the MFD/SFD. Set the FUNCTION thumbwheel to BITE and read the malfunction codes in the DATA display window.
- If a malfunction code appears and you can confirm the accuracy of the track-while-scan and the pilot's scope presentation, you may elect to continue with lead's permission.

CODE - MALFUNCTION.
(recommended action)

00 Own slot number not set
(enter own slot number)

01 No master
(1 - verify own slot number)
(2 - verify formation has master)
(3 - select another master)
(4 - if persists more than 5 minutes - ABORT)

02 Loss of synchronization
(1 - select another master)
(2 - make the A/C with code 02 master)
(3 - if persists more than 5 minutes - ABORT)

03 Two masters
(have one master select follower)

05 Clock limit
(select another master)

06 Clock control
(occurs only during BITE - rerun BITE - if recurs - REPAIR)

07 Sync hardware
(occurs only during BITE - rerun BITE - if recurs - REPAIR)

08 Sync measurement
(1 - occurs only during BITE - will cause NO GO indication - go to STBY to clear poss false code)
(2 - rerun BITE - if recurs - REPAIR)

10 MFD interface failure
(if persists more than 1 minute - ABORT)

11 PPI interface failure
(IGNORE)

12 INS interface failure
(if SKE mix is needed for drop - ABORT)

13 Control serial interface
(if persists more than 1 minute - ABORT)

14 Own alticoder failure
(1 - verify CADC/IFF works)
(2 - if persists - IGNORE TWS altitude)

15 Antenna rotation
(if persists more than 10 minutes - ABORT)

16 Antenna interface
(if persists more than 1 minute - ABORT)

17 Range measurement
(occurs only during BITE - rerun BITE - if recurs - REPAIR)

18 AGC
(occurs only during BITE - rerun BITE - if recurs - REPAIR)

19 Slot number/target input (if persists more than 1 minute - ABORT)

20 Data transfer from leader
(1 - switch leader)
(2 - if persists more than 1 minute - ABORT)

21 Leader altitude
(1 - switch leader)
(2 - if persists - IGNORE TWS altitude)

22 Hit count
(occurs only during BITE - rerun BITE - if recurs - REPAIR)

25 Program memory messed up
(if persists more than 1 minute - ABORT)

26 Data memory messed up
(if persists more than 1 minute - ABORT)

27 Sine table memory
(if persists more than 1 minute - ABORT)

28 PPI table memory
(verify good PPI presentation - if not norm - ABORT)

29 Invalid interrupt
(if persists more than 1 minute - ABORT)

30 Hardware failure
(if persists more than 1 minute - ABORT)

31 Real time clock malfunction
(if persists more than 1 minute - ABORT)

34 Abnormal end of test
(if OFF/STBY/XMIT switch set to STBY prior to time reaching 60 seconds - IGNORE)
(if OFF/STBY/XMIT switch set to STBY after time reaching 60 seconds - REPAIR)

35 R/T power
(1 - if OFF/STBY/XMIT switch set to STBY - IGNORE)
(2 - if TWS and MFD/SFD indications are norm - IGNORE)
(3 - if TWS and MFD/SFD indications are not norm - ABORT)

36 R/T VSWR
(1 - if TWS and MFD/SFD indications are norm - IGNORE)
(2 - if TWS and MFD/SFD indications are not norm - ABORT)

37 R/T frequency
(1 - select another freq)
(2 - if TWS and MFD/SFD indications are norm - IGNORE)
(3 - if TWS and MFD/SFD indications are not norm - ABORT)

38 R/T temperature
(turn SKE OFF - ABORT)

40 Secondary control panel inop
(if persists more than 1 minute - ABORT)

41 FCI panel inop
(if persists more than 1 minute - ABORT)

43 Dual FCI control inop
(if persists more than 1 minute - ABORT)

SKE TEST

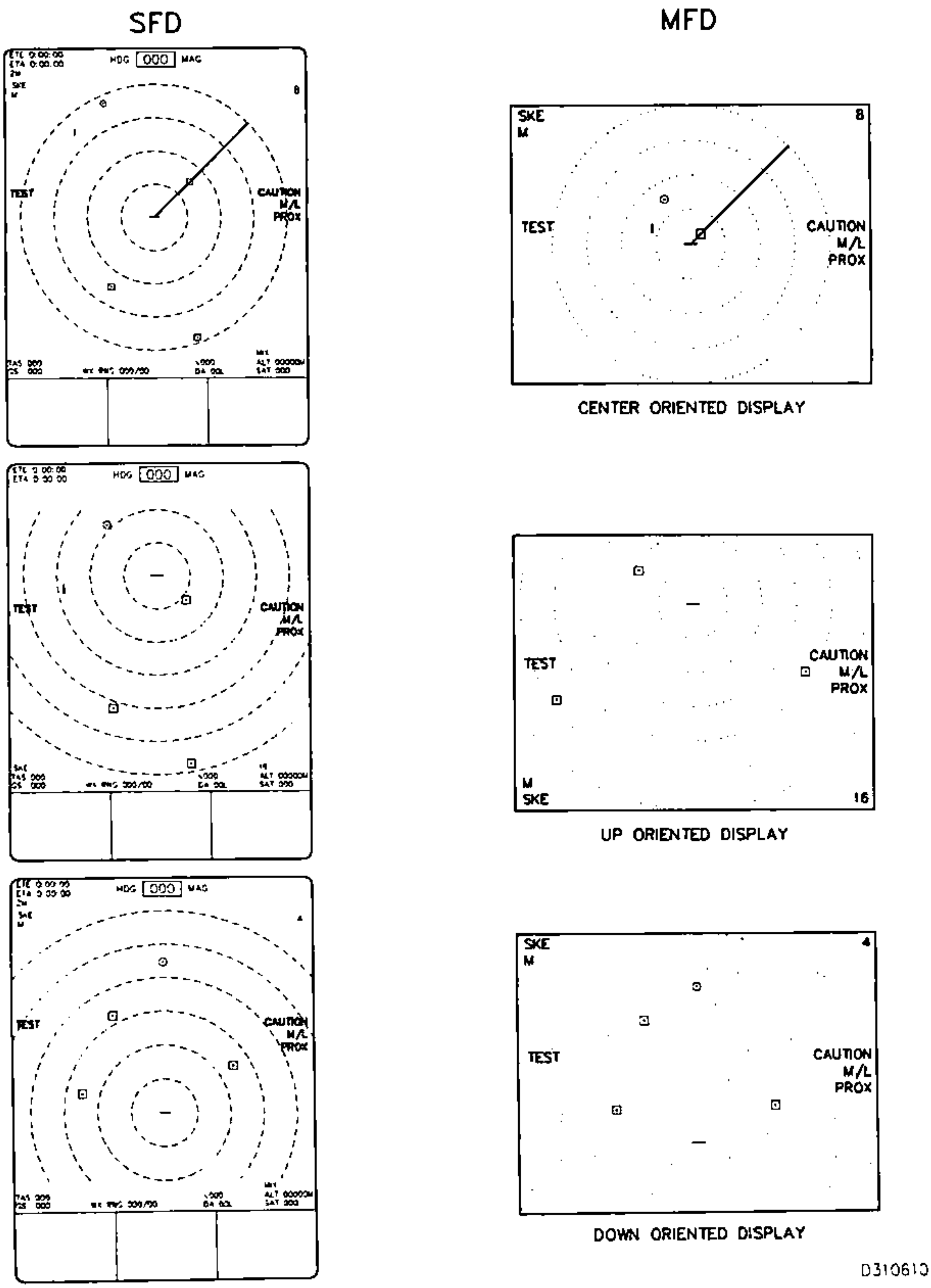
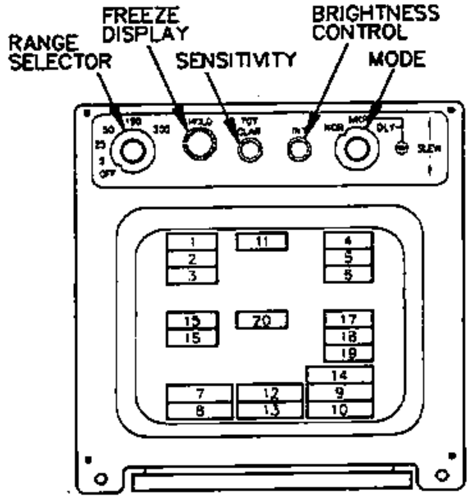
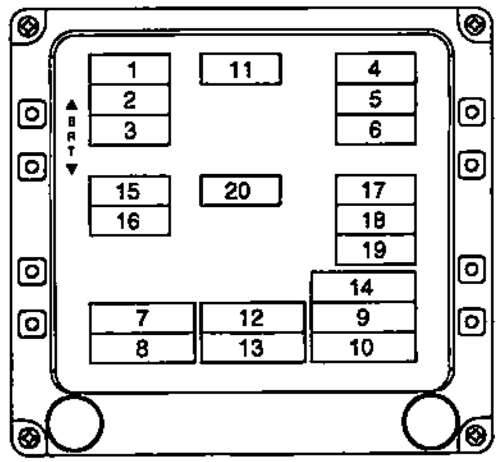


Figure 1-129. SKE Test (Sheet 1 of 3)



D3189801



D8063101 B

* LOCATION 9, 12, 13 AND 16 NOT USED

** Represents the number of digits in the legend

				MODES				
•		DISPLAY LEGEND	COLOR	RDR ONLY	RDR/SKE WARN	SKE	SKE/INS	NOTES
1	Display Mode	RDR Mode (WX, MAP, BCN)	Cyan	X	X			
2	Marker/Delay Mode	SKE, SKE/INS	Cyan			X	X	
		MRK or IDLY	Cyan	X	X			
		M	White			X	X	G
3	Display Mode	SKE	Cyan		X			H
4	Display Range	5/1, 25/5, 50/10, 150/30, 300/60	Cyan	X	X			
		1, 2, 4, 8, 16	Cyan			X	X	G
5	Marker/Display Range	000*	Cyan	X	X			
6	Radar Return Level Color Bar	(WX)	R/Y/G	X	X			
		(B)	G					
		(MAP)	R/Y/B	X	X			
7	Master	M	White			X	X	A
8	Mode	SKE, SKE/INS	Cyan			X	X	G
10	Display Range	1, 2, 4, 8, 16	Cyan			X	X	G
11	True Heading	000*	White				X	
14	Time of Arrival	F 0:00 or S 0:00*	White				X	B
15	SKE Test Mode	TEST	White			X	X	C
17	SKE Caution	CAUTION	Yellow		X	X	X	D
18	Master Lost	M/L	Magenta		X	X	X	E
19	Proximity Warning	PROX	Magenta		X	X	X	F
20	Warning	No SKE Data	White			X	X	E

NOTES

A. Displayed only when SKE system on this aircraft is operated as MASTER.

B. Optional data displayed on command in INS Modes.

C. When discrete signal TL (TEST) is active, the corresponding legend, TEST, is displayed. Indicates SKE is in manually initiated built-in-test (BIT).

D. When discrete signal CAUL (CAUTION) is active, the corresponding legend, CAUTION, is displayed. Indicates a SKE fault condition.

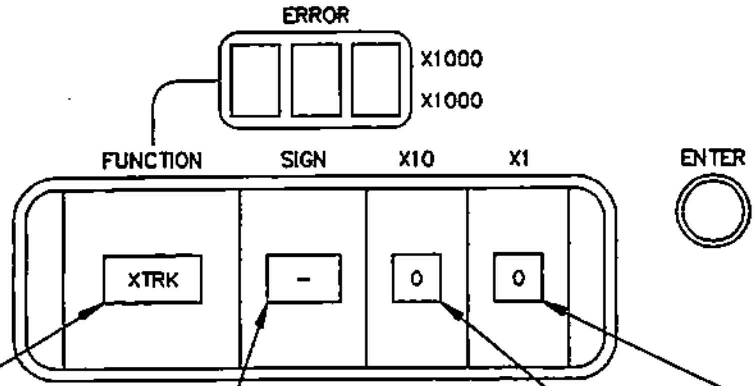
E. When the discrete signal MLL (MASTER LOST) is active, the corresponding legend, M/L, is displayed. Indicates no SKE MASTER is present.

F. When the discrete signal PXWL (PROX WARN) is active, the corresponding legend, PROX, is displayed. Indicates proximity warning with another SKE aircraft.

G. Displayed in top left and right corners of indicator when in the CENTER or DOWN positions, and in the lower left and right corners in the UP position.

H. Mode location if the RDR/SKE Warn mode is selected.

Figure 1-129. SKE Test (Sheet 2 of 3)



FUNCTION	BLANK	50	−	+	L	R	0	1	2	3	4	0–9
XTRK (X100)	E	E	E	E	X	X	MAX VALID XTRK IS 4,900 FT					
ITRK (X1000)	X	E	E	E	E	E	MAX VALID ITRK IS 24,000 FT					
ALT (X100)	E	X	–	–	E	E	WITH 50 SELECTED AS FUNCTION, X10 WILL BE IGNORED					
	E	•	X	X	E	E	MAX ALT IS 2,900 FT					
LDR=	X	E	E	E	E	E	00, 10, 20, 30, 40, AND OWN= WILL GIVE ERROR					
SLEN	X	E	E	E	E	E	00, 10, 20, 30, 40, AND GREATER WILL GIVE ERROR					
OWN=	X	E	E	E	E	E	00, 10, 20, 30, AND LDR= WILL GIVE ERROR					
BITE	DISPLAY READS SYSTEM FAULTS											

D3190001

NOTE

E = ERROR, NOT VALID FOR SELECTED FUNCTION.

X = VALID FOR SELECTED FUNCTION.

• = IF ±0 TO 2,900 FEET SELECTED, 50 CANNOT BE SELECTED.

Figure 1-129. SKE Test (Sheet 3 of 3)

In-Flight Procedures.

The following procedures cover in-flight operation using several operating modes. Each aircraft in the formation will be assigned a time slot numbered consecutively from 1 to 39. Time slots 10, 20, and 30 are not assigned. Time slots 1 and 2 are seldom assigned as these slots are required for operation by the Zone Marker. Proper station keeping is initiated when all follower aircraft clocks are synchronized with the master aircraft clock. Perform the following steps for in-flight operation.

NOTE

The CAUTION indicator on the Multi-function Display and SFD illuminates in the event of a system malfunction, marginal operation, or certain incorrect operational procedures. If a CAUTION indication occurs, refer to SKE Malfunction Analysis table.

Master/Follower Aircraft Information Operation.

NOTE

The SKE clock operates from the +28V dc system. Fifteen minutes must be allowed after power is applied to the aircraft and the SKE dc circuit breakers have been closed before the SKE can be used for flight. This 15-minute warmup is not necessary if power was removed for a short period of time (less than one hour).

1. On Secondary Control, select and enter SKE own slot number (OWN# on FUNCTION switch) and leader aircraft slot (LDR# on FUNCTION switch).

NOTE

Leader aircraft do not enter a slot number as LDR#, because the system will not accept the same slot for OWN# and LDR#. Attempting to enter same slot as OWN# and LDR# will cause ERROR indication on secondary control.

2. On Secondary Control, set ALL/SLEN switch to ALL position if all slots are to be enabled. If less than all slots are to be enabled and slot enable feature is to be utilized, set ALL/SLEN switch to SLEN position, and select and enter slots to be enabled (SLEN on FUNCTION switch).

3. On Primary Control, select frequency (A, B, C, or D) as required.

4. On Primary Control, set OFF/STBY/XMIT switch to XMIT position and allow for a 90-second warmup (if SKE has been in STBY for less than 90 seconds).

5. On Primary Control, set and hold MASTER/ FOLLOWER switch to MASTER position until master indicator glows blue. Release MASTER/ FOLLOWER switch. (Required only if own aircraft is the designated master aircraft.)

NOTE

The target for each cooperating follower aircraft will appear on the Multi-function Display or SFD when the follower aircraft has synchronized to the master aircraft.

Sending FCI Commands And Data.

SENDING AN FCI COMMAND.

An individual FCI command may be sent by performing the procedures listed in this paragraph. This pertains to all FCI commands except for the execute command. An FCI command may be sent by the leader at any time.

RESTRICTIONS. The following may not be sent during a TWS turn, since they could disrupt the turn algorithm:

a. TAS (True air speed)

b. PH (Present heading)

c. NH (New heading)

d. ←

e. →

1. Depress the pushbutton associated with the command.

2. Observe that the green legend associated with the command illuminates.

SENDING AN FCI COMMAND WITH EXECUTE.

The purpose of this action is to send a maneuvering command with execute (E) key.

1. Depress the pushbutton associated with the command and observe that the associated green legend illuminates.

2. Depress the execute (E) pushbutton while the green legend for the maneuvering command is still illuminated.

SENDING FCI DATA.

The purpose of this action is to send FCI data. FCI data can be sent at any time during flight.

1. If the data to be sent is already present in the XMIT display, proceed to step 4.

2. If the XMIT display is not blank, momentarily depress the CLR pushbutton and observe that the XMIT display changes to blank.

3. Enter the three digits to be sent into the XMIT display by depressing the associated three numeric board pushbuttons in succession. Keyboard entries are displayed in the XMIT readout, progressing from right or left with each entry.

4. Depress the XMIT pushbutton and observe that the green legend for the XMIT pushbutton illuminates.

SENDING FCI DATA WITH A COMMAND.

The purpose of this action is to send FCI data with command. FCI data and a non-maneuvering command can be sent simultaneously at any time during flight.

RESTRICTIONS. The following may not be set during a TWS turn, since they could disrupt turn algorithm:

a. TAS (True air speed)

b. PH (Present heading)

c. NH (New heading)

d. ←

e. →

1. If the data to be sent are already present in the XMIT display, proceed to step 4.

2. If the XMIT display is not blank, depress to CLR pushbutton and observe that the XMIT display changes to blank.

3. Enter the three digits to be sent into the XMIT display by depressing the associated three numeric keyboard pushbuttons in succession. Keyboard entries are displayed in the XMIT readout, progressing from right to left with each entry.

4. Depress the pushbutton associated with the command to be sent and observe that the associated green legend illuminates.

5. While command transmission is in progress, depress the XMIT pushbutton and observe that the green legend for the XMIT pushbutton and the green legend for the command being sent illuminate.

RECEIVING FCI COMMANDS.

Follower aircraft will receive FCI commands from selected leader as indicated by an FCI receive tone and the amber legend associated with one of the FCI commands (except Execute).

TWS Coordinated Turns.

TWS TURN FOR A FORMATION LEADER.

A formation leader must transmit the following data in order for his followers to perform a TWS coordinated turn:

RESTRICTIONS. (Refer to Sending FCI Data With Command)

1. For steps 1, 2, and 3, the green legend for the XMIT pushbutton will not illuminate if the specified limits are exceeded.

2. The heading difference between present heading and new heading must be less than 180 degrees and greater than 6 degrees.

3. The follower coder-decoder(s) will not enter the turn mode if the turn profile is not properly sent.

a. Send the TAS command along with the turn airspeed as directed in Sending FCI Data With A Command. Limits are 115 to 559 knots.

b. Send the PH command along with the present heading value as directed in Sending FCI Data With A Command. Limits are 0 to 359 degrees.

c. Send the NH command along with the new heading value as directed in Sending FCI Data With A Command. Limits are to 359 degrees.

d. Depress the turn direction pushbutton (← or →) and observe that the associated green legend illuminates (preparatory command).

RESTRICTIONS.

1. The turn must be less than 180 degrees.

2. The execute command must be sent within one minute after the turn direction was first sent. If not, the turn profile (steps 1 thru 3) must be sent again.

a. Before start to turn, depress the turn direction pushbutton (← or →), and observe that the associated green legend illuminates.

b. When you start to bank, depress the execute pushbutton to signal the start of the turn and observe that the associated green legend for the execute command illuminates.

TWS Turns For A Follower.

1. The TAS, PH, and NH commands and data are received as directed in Receiving FCI Data With A Command.

2. Time permitting, you will receive the turn direction command (← or →) (preparatory command). At

this time, observe that the FCI receive tone sounds. Confirm that the associated amber receive legend for the turn direction command illuminates.

RESTRICTIONS. The execute command must be received within 1 minute after the turn direction is first received. If it is not, the turn profile must be received again.

1. Before the lead aircraft starts to bank, observe that the FCI receive tone sounds and the associated amber receive legend for the turn direction (← or →), illuminates.

2. When the lead aircraft starts to bank, observe the following:

a. The FCI receive tone sounds and the receive legends for both the turn direction and the execute command illuminate.

b. The TIME display on the FCI shows time to start turn and is decremented in one-second intervals.

3. When the turn timer counts down to 000, start to bank.

4. During a TWS turn, you must maintain position relative to your leader by keeping the TWS meters centered as follows:

a. RRI. This meter on the left side of the ADIs shows the difference between the desired in-track and the measured in-track distance to the leader. Full scale = ± 1,000 feet. Needle above center scale indicates your position is too close; needle below center scale indicates your position is too far.

b. Vertical Deviation Marker. This meter on the right side of ADIs show the difference between the desired altitude offset and the measured altitude offset to the leader. Full scale = ± 1,000 feet, or ± 5,000 feet if "50" is entered on the secondary control. Needle above center scale indicates your position is too low; needle below center scale indicates your position is too high.

c. ADI Bank Steering Bar. This meter shows the difference between the desired cross track and the measured cross track with respect to the leader. Full scale varies with the in-track value entered through the secondary control as follows:

Crosstrack Full Scale	Desired In-track
± 1000 feet	In-track 4000 feet or less
± 2000 feet	In-track 5000 feet to 9000 feet
± 4000 feet	In-track 10,000 feet or greater

Needle to the left of center scale indicates your position is too far to the right; and needle to the right of center scale indicates your position is too far left.

5. The positions of all aircraft, relative to your aircraft, can be viewed on the Multi-function Display and SFD.

6. When the time left in your turn is 12 seconds or less, the time display on the FCI shows time left in your turn. This time is decremented in one-second intervals.

7. When the end-of-turn timer counts down to 000, come out of your bank and return to straight flight TWS.

Operation With Zone Marker.

Perform the following steps for operation with Zone Marker.

1. Set pilot DAMU SKE ZM to ON.

CAUTION

When portable, ground-based Zone Marker Radar Set AN/TPN-27A (Zone Marker) is to be used in conjunction with a mission, participating aircraft must not be assigned to the time slots 01 or 02.

2. Zone Marker target, a unique vertical bar, will appear on the Multi-function Display and the SFD SKE when the master aircraft is within approximately 20 miles of Zone Marker. When SKE/INS mix occurs, this will be indicated on the MFCDU Mix Annunciator.

Shut Down Procedures.

To shut down the SKE system, set OFF/STBY/XMIT switch on Primary Control to OFF. All other switches may remain in their respective positions.

ABNORMAL OPERATING PROCEDURES.

Loss of Targets Only.

The aircraft may station keep with the aid of the track-while-scan mode of operation. To check the operation of the TWS mode, the pilot should perform a slight right, then left maneuver and observe ADI indicator for the appropriate flight path responses. Check the SKE system BITE FUNCTION indication on the Secondary Control.

Loss Of Range Marks.

Turn off SKE and then restart as previously indicated, including the reentry of Secondary Control parameters.

WARNING INDICATIONS.

Proximity Warning.

The PROXIMITY WARNING indicator legend alerts the pilot and crew that another SKE-equipped aircraft operating on the same frequency is within the PROXIMITY WARNING setting on the SKE Secondary Control. The proximity warning indication is accomplished by an aural warning from the flight station loudspeaker. A visual display of the intruding aircraft is provided by a strobe marker on the Multi-function Display.

Caution.

The CAUTION legend illuminates during system malfunction, marginal operation, or certain incorrect operational procedures. The system may be capable of operating even though the CAUTION legend is illuminated; therefore, it is important that normal station keeping routine be maintained when the CAUTION legend first lights until an assessment of system operation is completed by pilot and crew. The following procedures should be followed in the event of a CAUTION indication.

1. If indicators such as master lost (M/L) or TWO MASTERS are illuminated, follow existing procedures to eliminate the applicable condition.

2. If no red indicators are illuminated or after the indicated condition has been remedied and the CAUTION indicator is still illuminated for an additional 30 seconds, set OFF/STBY/XMIT switch to STBY and back to XMIT.

3. Wait an additional 10 seconds and if CAUTION indicator is still illuminated, see SKE Malfunction Analysis Table.

NOTE

During the BITE test, the system stops station keeping and drops synchronization. If at all possible, avoid using BITE test during formation operations.

Master Lost.

The master lost (M/L) legend illuminates to warn of repeated absence of signals from the master aircraft in the flight formation. The system will remain closely synchronized without a master signal for 5 minutes under normal operating conditions.

Two Masters.

The TWO MASTERS legends on Primary Control illuminates to alert the crews in the flight formation that two or more aircraft are on one frequency as master. The crews must consult their flight plan to check for proper master assignment.

EMERGENCY LOCATOR TRANSMITTER (ELT) SYSTEM.

The Emergency Locator Transmitter (ELT) System as installed in the forward empennage bullet will sense decelerating forces along the longitudinal axis of the aircraft. When the ELT system is in the normal (AUTO) mode, an impact force along this axis above a predetermined amplitude and time period will cause the system to activate. The transmitter will then continuously broadcast emergency signals on the VHF and UHF frequencies of 121.5 and 243 MHz, respectively. These transmissions will continue until the battery pack contained in the ELT is depleted or the transmitter is deactivated by momentarily placing the switch on the remote control unit to the "RESET" position.

The Emergency Locator Transmitter (ELT) System consists of three major components: the emergency locator transmitter with its self-contained battery pack and impact sensor, the VHF/UHF antenna, and the remote control unit.

The transmitter and antenna, when mounted to empennage bullet panel H-27, provide an assembly which remains functional after an impact of up to 100 gs. The remote control unit is not necessary for the ELT to accomplish its primary function (transmission of emergency distress signals). The remote control unit's purpose is twofold: to provide a means of deactivating the ELT system in case of accidental activation and to provide manual activation of the ELT for checkout purposes or any time at the pilot's command.

The remote control unit (RCU) is located on the navigator's instrument panel (figures 1-160 and 1-247). The switch on the RCU provides the following three functions:

1. "AUTO" - Places the ELT system in a standby condition to be automatically activated by an impact force along the aircraft longitudinal axis.

2. "TEST" - Bypasses the ELT's self-contained impact sensor and results in transmission of the emergency RF signals at 121.5 and 243 MHz.

3. "RESET" - Allows for deactivation of the ELT terminating the emission of the emergency RF signals.

ELT SYSTEM OPERATIONAL CHECK.

To check for ELT system operation, accomplish the following:

1. Tune the VHF and UHF communications receivers to their guard channels.

2. Obtain clearance from the control tower for transmission on the International Distress frequencies (121.5 and 243 MHz).

3. Remove the safety pin and momentarily place the RCU switch to the "TEST" position and monitor each guard channel. The operator should hear several cycles of the downward swept tone modulation which is indicative of proper ELT system operation.

4. Return the RCU switch to the "AUTO" position, and observe that the distress frequency transmissions stop. Reinstall the safety pin to prevent inadvertent operation of the system.

UNDERWATER ACOUSTIC BEACON SYSTEM.

The beacon is mounted on the flight recorder (figure 1-202), and is contained in a cylindrical watertight aluminum case capable of withstanding high-G impact shock and deep water immersion. The beacon consists of a self-contained battery, an electronic module and a transducer. One end contains a teflon-insulated water switch. The beacon radiates a pulsed acoustic signal upon activation by its water sensitive switch.

LIGHTING SYSTEM.

EXTERIOR LIGHTS.

The exterior lights consist of two landing lights, four taxi lights, nine formation lights, three navigation lights, three anti-collision lights, and two leading edge lights (figure 1-248). Aerial refueling system lighting is covered under the Aerial Refueling System.

Landing Lights.

A landing light is mounted on the underside of each wing between the engine pylons. Switches for extending and retracting and for illumination of the lights are located on the LANDING LIGHTS portion of the extension pilot's overhead control panel (figure 1-249). The two extension and retraction switches are three-position ("EXT", "OFF", "RET") toggle switches. These switches control the landing actuators retracting or extending the lights when the switches are moved to "RET" or "EXT" positions. A LT EXTENDED indicator located above the extension and retraction switches illuminates when the landing lights leave the retracted position. When either switch is moved to the "OFF" position, the landing light actuator motor is deenergized and the light will lock in position. Two 2-position ("ON", "OFF") toggle switches control the illumination of the landing lights. When either switch is moved to "OFF", the corresponding light is extinguished.

Taxi Lights.

Two taxi lights are mounted on the side of the main landing gear doors. Illumination of these lights is controlled by a two-position ("ON", "OFF") TAXI LIGHT toggle switch located just forward of the exterior lighting control panel. In addition, there is an interconnect between this switch and the wing leading illumination lights, so that when the taxi lights are illuminated, the wing leading edge lights are also illuminated. These lights should be turned off when the gear is retracted.

Formation Lights.

Nine formation lights are installed on the aircraft: three on the outer section of each wing and three on the top fuselage, aft of the wing. The illumination and brilliance of all nine formation lights are controlled through a three-position ("DIM", "OFF", "BRIGHT") EXTERIOR FORMATION toggle switch on the exterior lighting control panel.

Navigation Lights.

The navigation lighting system consists of three 2-bulb light assemblies. A red light is on the left wing tip, a green light is on the right wing tip, and a white light is on the trailing edge of the tailcone. These lights illuminate continuously. The navigation lights are controlled by a two-position ("ON", "OFF") NAVIGATION toggle switch located on the exterior lighting control panel.

Anti-Collision Lights.

The aircraft is equipped with three rotating anti-collision lights: one on the upper surface of the horizontal stabilizer, one on the top of the fuselage in line with the wing, and one on the lower side of the fuselage at approximately the same line. Each light is contained within a red, transparent housing. The lights are controlled by a three-position ("LOWER", "OFF", "ALL") ANTI-COLLISION toggle switch located on the exterior lighting control panel. This allows the upper light to be turned off during air refueling operations. This switch also controls operation of the motor-driven lights. When the switch is set to "ON", the lights are illuminated and the motor turns the lights.

Anti-Collision, Strobe Lights (TCTO 631).

Modified aircraft are equipped with three anti-collision lights: one rotating beacon on the upper surface of the horizontal stabilizer, one strobe light on the top of the fuselage in line with the wing, and one strobe light on the lower side of the fuselage at approximately the same line. The rotating beacon is contained within a red, transparent housing and is controlled by a two-position ("ON", "OFF") ANTI-COLLISION toggle switch located on the exterior lighting control panel. This switch also controls operation of the motor-driven reflector. When the switch is set to "ON" the light is illuminated and the reflector starts rotating. The strobe light assemblies each have a red-lens strobe light and white-lens (clear) strobe light. Each strobe light assembly is controlled individually by a three-position ("WHT", "RED", "OFF") TOP/BOT STROBE toggle switch located on the exterior lighting control panel. When each switch is set to "WHT", the white strobe flashes and the red strobe is off. (See figure 1-249.)

Wing Leading Edge Lighting.

A light is installed on each side of the forward fuselage in a position which will illuminate the engine nacelles and the immediate leading edge area of each wing. The lights are controlled through a two-position ("ON", "OFF") LEADING EDGE toggle switch located on the exterior lighting control panel and are interconnected with the taxi lights so that they will come on when the taxi lights are turned on. Refer to paragraph titled Aerial Refueling System for operation of the wing leading edge lights during aerial refueling.

INTERIOR LIGHTING - FLIGHT STATION.

The interior lighting system provides general illumination of cargo and flight station areas, supplementary lighting of instrument and control panels, and lighting at emergency exits. The lights are controlled by toggle switches and rotary switches. The switches provide an "OFF" position and control light dimming. (See figure 1-250.)

NVIS Lighting.

The flight station is equipped for Night Vision Imaging System (NVIS) lighting. Night vision goggles are worn when required. There is no interlock between NVIS selection and overhead dome lighting. Under NVIS conditions, the overhead dome lights are turned off. New flight station panel lighting, new instrument lighting, CDS units, and MFCDUs are compatible with the night vision goggles. The DAMU facilitates switching between NVIS and normal lighting on the instrument displays, the annunciator lighting on both MSPs, both RSPs, the DICU, the FCP, both BDHI controls, GCAP AND TAC Switches, the navigator's Mode Repeater, and the annunciators on the pilot's, copilot's and navigator's MFCDUs. All other instrument lighting and control panel lighting are filtered or use NVIS lighting fixtures.

DAMUs provide for selecting normal and NVIS lighting on the DAMUs, associated DUs, and selected panel lights and annunciators. The pilot's DAMU controls his DUs and the copilot's controls his DUs. Either DAMU controls the remaining panels. The Common Brightness Control controls the brightness of the CDS displays. A BRT/DIM switch controls the brightness of the display on each MFCDU.

Thunderstorm Lighting.

Thunderstorm lighting is provided to allow the flight station flood lighting to be quickly increased to maximum brightness during thunderstorm conditions. Thunderstorm lighting is controlled by the THUNDERSTORM switch on the pilots' overhead panel. The switch controls the following lights:

a. Overhead dome lights
b. Pilots' overhead panel floodlights
c. Pilot's instrument panel floodlights
d. Center instrument panel floodlights
e. Pilots' standby compass light
f. Copilot's instrument panel floodlights
g. Navigator's panel floodlights
h. Flight engineer's panel floodlights
i. All Caution and annunciators lights to bright.

Pilots' Overhead Panel Lighting.

The pilots' overhead panel is provided with edge lighting, which illuminates nomenclature markings on the panel. The lights are controlled by a rotary switch labeled OVERHEAD PANEL on the pilots' overhead panel.

Pilots' Overhead Floodlighting.

Six floodlights are installed on the pilots' overhead panel. Three floodlights are located at the top edge of the panel and three at the center division of the panel. The lights are controlled by a rotary switch labeled OVERHEAD FLOOD on the pilots' overhead panel.

Pilot's Side Console Lighting.

Pilot's side console lighting consists of embedded lighting and integral lighting in instruments and controls mounted on the console. The lights are controlled by a rotary switch labeled PILOTS SIDE CONSOLE on the pilots' overhead panel. The PILOTS SIDE CONSOLE Switch also controls lighting for the following:

PILOTS INSTURMENT PANEL	CENTER INSTRUMENT PANEL
DAMU BEZEL	MFSI
BDHI BEZEL	CBC
SLIP INDICATOR	

CONTROL PEDESTAL	
PILOTS THROTTLE QUADRANT	
PILOT'S MFCDU Keypad	FCP
PILOT'S MSP	IFF PANEL
PILOT'S RSP	CADC/YAW DAMPER Switch Panel

NOTE

- The pilot's DAMU bezel, BDHI bezel, and slip indicator lighting are controlled by the PILOT'S SIDE CONSOLE Switch. The copilot's DAMU bezel, BDHI bezel, and slip indicator lighting are controlled by the COPILOT'S SIDE CONSOLE Switch.
- A PLT CTR CSL LTS 5 VAC circuit breaker, 29-C, has been added on the Avionics Circuit Breaker Panel. This breaker provides circuit protection for the Pilot's Throttle Quadrant, MFCDU Keypad, MSP, RSP, FCP, IFF Panel, and CADC/YAW DAMPER Switch panel lights.

Pilot's Instrument Panel Lighting.

The pilot's instrument panel lights consist of integral lights in controls and indicators mounted on the panel. The lighting is controlled by a rotary switch labeled PILOTS INSTRUMENT PANEL INSTRUMENTS on the pilots' overhead panel.

NOTE

The DAMU BEZEL, BDHI BEZEL, BDHI Control and SLIP INDICATOR are controlled by the PILOTS SIDE CONSOLE rotary switch.

Pilot's Instrument Panel Floodlighting and Standby Compass Light.

Two floodlights are located on the underside of the pilot's glareshield and two illuminate the center instrument panel. The standby compass, located at the forward edge of the pilots' overhead panel, contains an integral light. The lighting is controlled by a rotary switch labeled PILOTS INSTRUMENT PANEL FLOOD on the pilots' overhead panel.

Center Instrument Panel Lighting.

The center instrument panel lighting consists of integral lights in the instruments mounted on the panel. The lights are controlled by a rotary switch labeled CENTER INSTRUMENT PANEL on the pilots' overhead panel.

NOTE

The pilot's MFSI and CBC lighting are controlled by the PILOTS SIDE CONSOLE Switch.

Center Console Lighting.

The center console lighting consists of embedded lighting and integral lighting in the instruments and controls mounted on the panel. The lights are controlled by a rotary switch labeled CENTER CONSOLE on the pilots' overhead panel.

NOTE

- The FCP, CADC/YAW DAWMPER panel and pilot's MSP, RSP, and MFCDU Keypad lighting are controlled by the PILOTS SIDE CONSOLE Switch.
- The DICU and copilot's MSP, RSP, and MFCDU Keypad lighting are controlled by the COPILOTS SIDE CONSOLE Switch.

Pilot's and Copilot's Utility Lights.

Pilot's and copilot's utility lights are mounted on the left and right side of the pilots' overhead panel and the left and right sides of glare shield. Each light has an integral dimming rheostat and a momentary ON switch.

Pilot's and Copilot's Letdown Chart Lights.

The pilot's and copilot's letdown chart holders contain integral rheostat controlled lights.

Copilot's Instrument Panel Lighting.

The copilot's instrument panel lights consist of integral lights in controls and indicators mounted on the panel. The lighting is controlled by a rotary switch labeled COPILOTS INSTRUMENT PANEL INSTRUMENTS on the pilots' overhead panel.

NOTE

The DAMU BEZEL, BDHI BEZEL BDHI Control and SLIP INDICATOR are controlled by the COPILOTS SIDE CONSOLE rotary switch.

Copilot's Instrument Panel Floodlighting.

Two floodlights are located on the underside of the glare shield to the right of aircraft centerline. The lights are controlled by a rotary switch labeled COPILOTS INSTRUMENT PANEL FLOOD on the pilots' overhead panel.

Copilot's Side Console Lighting.

The copilot's side console lighting consists of embedded lighting and integral lighting in instruments and controls mounted on the panel. The lights are controlled by a rotary switch labeled COPILOTS SIDE CONSOLE on the pilots' overhead panel. The COPILOTS SIDE CONSOLE Switch also controls lighting for the following:

COPILOT'S INSTRUMENT PANEL	CONTROL PEDESTAL
DAMU BEZEL	COPILOT'S MSP
BDHI BEZEL	COPILOT'S RSP
SLIP INDICATOR	COPILOT'S MFCDU Keypad
	DICU

Annunciator and Caution Lights.

Annunciator and caution lights are located on the pilot's, engineer's and navigator's instrument panels. All the pilot's and copilot's annunciator and caution lights can be tested by pushing forward on and then holding the ANNUNCIATOR AND CAUTION LIGHT switch on the center console to TEST. The caution lights at the engineer's and navigator's stations are tested by holding the CAUTION LIGHT switch on the flight engineer's electrical control panel in "TEST". For a complete description of the annunciator and caution lights system operation, see the "Warning Systems" paragraph in Section I.

NOTE

The brightness CWA portion of the SFDs is controlled by the control display system. For a complete descrption of the caution, warning, and advisories operation, see the "Control Display System" in Section I.

Master Caution Light System.

The master caution light system consists of a combined light and reset switch on the pilot's and copilot's instrument panels, and annunciator lights mounted on the center console. For a complete description of the master caution system, see the "Warning Systems" paragraph in Section I.

Master Caution, Annunciator, and Caution Lights.

These lights have two brightness levels, bright and dim. The dim and bright levels are controlled by the CAUTION switch located on the pilots' overhead panel. The CAUTION switch is a two-position ("DIM", " BRIGHT") toggle switch. When the PILOTS and COPILOTS SIDE CONSOLE controls are in any position other than OFF the CAUTION switch controls the light level.

NVIS mode of operation is selected on the CONTROL DISPLAY menu of the pilot's and or copilot's DAMU respectively. When either pilot selects NVIS, his DUs, the navigator's AFCDS Mode Repeater lights along with his MFCDU, and the MSG, MIX, and EXEC annunciators are set to NVIS.

Navigator's Panel Lighting.

The navigator's panel lighting consist of edge lights which illuminate nomenclature markings on individual control panels and the navigator's circuit breaker panel. The panel lights are controlled by a rotary switch labeled PANEL LIGHTS on the navigator's light control panel.

Navigator's Instrument Lights.

The navigator's instrument lights consist of integral lights in the instruments mounted on the panel. The lights are controlled by a rotary switch labeled INST LIGHTS on the navigator's light control panel.

Navigator's White Flood, Worktable, and Utility Lights.

The navigator's flood lighting consists of four fixed position white floodlights mounted above the navigators worktable. The worktable light consists of one fixed position floodlight mounted above and inboard of the navigator's instrument panel. The lights are controlled by a rotary switch labeled WHITE FLOOD AND WORKTABLE and a three-position toggle switch on the navigator's light control panel. The three-position toggle switch ("FLOOD", "BOTH", "TABLE") allows the floodlights to be selected individually or simultaneously as needed. The white FLOOD AND WORKTABLE switch also controls the navigator's utility light.

Flight Engineer's Panel Lighting.

Panel lighting at the flight engineer's station consists of panel edge lights that illuminate the nomenclature markings on the panel and embedded lights illuminating instruments and controls mounted on the panel. The lights are controlled by a rotary switch labeled PANEL LIGHTS on the flight engineer's lighting control panel.

Flight Engineer's Instrument Lights.

The flight engineer's instrument lighting consists of integral lights in instruments mounted on the flight engineer's panel. In addition to panel lights, integral lights in upper and lower bunk and inboard auxiliary crew seat oxygen regulators are illuminated by instrument lighting circuits. The lights are controlled by a rotary switch labeled INSTR lights on the flight engineer's lighting control panel.

Flight Engineer's White Flood and Worktable Lights.

Lighting at the flight engineer's station consists of four fixed position floodlights mounted above the station, four fixed position floodlights and one adjustable worktable light mounted above the fuel management and engine instruments panel, and one utility light mounted on the top forward edge of the fuel management panel. The lights are controlled by a rotary switch labeled WHITE FLOOD AND WORKTABLE on the flight engineer's lighting control panel. In addition, a three-position ("FLOOD", "TABLE", "BOTH") toggle switch on the lighting control panel permits selection of combinations of lighting. The utility light has a dimming rheostat and momentary on switch integral with the light.

Flight Engineer's Main Circuit Breaker Panel Lights.

The main circuit breaker panel lights consist of edge panel and embedded lights in the four main circuit breaker panels. The lights are controlled by the MAIN CKT BKR PANEL circuit breaker on the flight engineer's lighting control panel.

Flight Station Dome Lights.

Flight station dome lighting consists of six dome lights: three forward of the blackout curtain and three aft of the curtain. All six lights are controlled by the DOME knob on the pilots' overhead panel. The FWD DOME switch permits the three forward dome lights to be turned off, leaving the three aft dome lights on.

Reading Lights.

Five reading lights are located in the bunk and crew rest area. A two-position ("ON", "OFF") toggle switch controls each light.

CARGO AND SERVICE COMPARTMENT LIGHTING.

Cargo and service compartment lighting is achieved with cargo compartment dome and overhead lights, crew rest platform lights, a flight station access light, a lavatory light, main and nose wheel well lights, paratroop jump platform lights, ramp loading lights, under flight deck area lights, and vertical stabilizer lights.

Flight Station Access Light.

A flight station access light is located on the ceiling above the flight station entrance door. The light is controlled by a two-position LADDER LIGHTS switch on the right side of the entrance door (figure 1-251).

Lavatory Light.

The lavatory ceiling light is located above the sink in the lavatory. It is controlled by a switch on the left side of the canted ceiling panel inside the lavatory door.

Nose Wheel Well Light.

A nose wheel well light is installed in the nose wheel well to provide illumination for inspection of the nose landing gear downlock. Access to the nose wheel well observation window and the two-position ("ON", "OFF") wheel well light switch is gained by removing the forward panel in the lavatory.

Main Wheel Well Lights.

A light is installed in each main wheel well compartment to enable inspection of the main landing gear downlocks. A two-position ("ON", "OFF") switch, located adjacent to each main landing gear observation window, controls each individual light.

Under Flight Deck Rack Lights.

Two lights are installed in the under flight deck area for illumination of the avionic and electrical equipment racks. Each light is controlled by a two-position ("ON", "OFF") switch mounted adjacent to the light.

Cargo Compartment Dome Lights.

Cargo compartment dome lighting consists of white and red lights mounted in the cargo compartment ceiling. The lights are normally controlled by the CARGO COMPT LIGHTS and the CARGO COMPT DIM-BRIGHT switches located on the forward crew interphone and PA panel (figure 1-251). In addition a CARGO COMPT LIGHTS RED-WHITE switch on the door and ramp control box (figure 1-253) selects red or white dome lights. For emergency use, a guarded CARGO COMPT DOME LTS switch located on the flight station door switch panel overrides the CARGO COMPT LTS and CARGO COMPT DIM-BRIGHT switches and turns on the white dome lights to full brightness. The switch is set to OFF for normal operation. If the troop oxygen warning system is activated, the white dome lights will automatically turn on to full brightness regardless of the position of any switch.

A COMPARTMENT WHITE LIGHT DIM CONTROL panel is installed in the lower left-hand portion of the center fuselage junction box panel. Five dimming knobs, LEFT FWD, RIGHT FWD, CENTER, LEFT AFT AND RIGHT AFT, provide variable dimming when rotated to any position between "OFF" and "BRIGHT".

Cargo Compartment Overhead Lights.

The cargo compartment contains an additional 38 overhead white lights. No dimming feature is provided for these lights. The two most forward lights are controlled by the LADDER LIGHTS switch at the flight station entrance door (figure 1-251). The remaining lights are controlled by eight toggle switches on the CARGO COMPARTMENT OVERHEAD LIGHTS control panel located on the cargo compartment left forward side (figure 1-251).

Cargo Ramp Loading Lights.

Two cargo loading lights are mounted on the left and right outboard edges of the aft cargo deck. The lights are controlled by the RAMP LOADING LIGHTS switch on the door and ramp control box.

NOTE

> These lights were not designed to be left on continuously; they should be turned OFF when not being used.

Paratroop Platform Lights.

A red paratroop platform light is located aft of each aft entrance door. The left light is controlled by the PLATFORM LIGHTS switch on the left jumpmaster/loadmaster panel; the right-hand light is controlled by a PLATFORM LIGHTS switch on the right jumpmaster/loadmaster panel.

Aft Crawlway and Vertical Stabilizer Inspection Lights.

Inspection lights are installed in the aft fuselage upper deck compartment and in the vertical stabilizer. These lights are controlled by the VERT STAB. LIGHTS switch on the DOOR AND RAMP CONTROLS panel (figure 1-253).

Emergency Exit Lights.

Eleven emergency exit lights (figure 1-252) are installed in the aircraft. One light is installed at each emergency exit, one is installed at the crew entrance door and each troop door. The emergency lights have integral batteries that are charged by aircraft electrical power. A three-position ("TEST", "ARM", "EXTING") EMER EXIT toggle switch located on the pilots' overhead panel (figure 1-157), and two inertial switches, located behind an inspection door above the interphone panel at the main entrance door, control the system.

The EMER EXIT switch is spring-loaded to the "ARM" position. With the switch in this position, aircraft electrical power failure or a sudden deceleration causes the lights to illuminate with power from the internal batteries. After the emergency lights are illuminated, they can be extinguished and the lights reset to normal operation by pushing the RESET BUTTON on each inertia switch. The lights are tested and illuminated by placing the EMER EXIT switch to the momentary "TEST" position and then releasing. Placing the switch momentarily to "EXTING" and then releasing the "ARM", extinguishes the lights and then arms the lights for normal operation. The lights can be made portable by pulling the red release handle. When the handle is pulled, a quick disconnect severs the light's electrical connection to the aircraft and the lights remain illuminated. The light may be extinguished by placing the handle in the stowed position.

CARGO LOADING EQUIPMENT.

TIEDOWN FITTINGS.

The cargo compartment floor design contains a grid pattern for 10,000 and 25,000 pound tiedown receptacles. The 25,000 pound tiedown fittings are also used for restraint rail tiedowns. The 10,000 pound fittings are stowed in channels on the right cargo compartment sidewall forward of the wing. The 25,000 pound fittings are stowed in the forward tiedown chain locker on the right side of the cargo compartment.

WHIFFLETREE SNATCH BLOCKS.

Two whiffletree snatch blocks are stowed on the forward left side of the cargo compartment. They can be attached, laterally or longitudinally only, to the cargo compartment floor 10,000-pound tiedown points at 20-inch intervals.

TIEDOWN DEVICES.

Two types of tiedown devices are used: MB-I/ CGU-4/E and MB-2/CGU-3/E. The MB-I/CGU-4/E tiedown is rated at 10,000 pounds. The MB-2/ CGU-3/E tiedown is rated at 25,000 pounds: The tiedown devices are stowed on racks that are provided in sidewall lockers on the right and left side of the aircraft. An elastic snubbercord with an end hook attaches to the tiedown device and holds it secure in the locker.

TIEDOWN CHAINS.

The tiedown chains provided with the aircraft are used in conjunction with the tiedown devices.

CARGO LOADING STABILIZING STRUTS.

Stabilizing struts are located on the bottom of the fuselage forward of the cargo ramp. The struts are stowed in a tube mounted to the aircraft structure when not in use. During cargo loading the struts are rotated out of the stowage tubes and placed in contact with the ground to stabilize the aircraft. For complete information and operating instructions for the stabilizing struts, refer to TO 1C-141B-9, "Cargo Loading".

AUXILIARY LOADING RAMPS.

Two auxiliary loading ramps are provided to bridge the gap between the aft end of the ramp and the loading vehicle. The ramps may be used during loading/off-loading of vehicles or palletized cargo from the ground.

CARGO WINCH.

The cargo winch is located in a recess at the forward end of the cargo compartment, beneath the flight station. The winch attaches to the floor in the compartment. An electrical connector adjacent to the recess supplies electric power for winch operation. A remote control on an extension cable is provided. A hinged door encloses the winch recess when the winch is not in use.

LOADING INSTRUCTIONS.

For detailed information concerning cargo loading, tiedown, and aerial delivery instructions, see TO 1C-141B-9, "Cargo Loading".

CARGO DOOR AND RAMP SYSTEM.

The cargo door and ramp system is used for loading cargo or vehicles and for aerial delivery of cargo and or personnel. The system consists of pressure door, ramp, petal doors, and operating controls. The system is operated by hydraulic pressure from No. 3 hydraulic system. In-flight, the system is operated from the pilot's and copilot's ADS panels. Ground operation is controlled from the cargo door and ramp controls panel (figure 1-253) after the system is armed from the pilot's control panel.

PRESSURE DOOR.

The pressure door seals the cargo compartment during pressurized flight. Operation of the door is part of the normal door opening sequence; however, if desired, the door may be individually opened inflight or on the ground by the PRESSURE DOOR control switch located on the cargo door and ramp controls panel or the forward crew door interphone and PA panel.

When the pressure door is closed, it is secured to the cargo ramp by 13 hydraulically actuated latch hooks. These latch hooks are mounted on the lower aft edge of the pressure door and hook over stirrups mounted on the aft end of the cargo ramp. Pressure seals around the pressure door prevent cabin pressure leakage during pressurized flight. View ports are provided in the pressure seal across the bottom of the pressure door to visually check that the hooks are properly engaged in the ramp stirrup fittings.

Two cam jacks are installed by the crew between cup assemblies on the cargo ramp floor and the forward lower edge of the pressure door. The cam jacks provide mechanical pressure against the lower edge of the door to hold the toes of the latch hooks engaged below the pins of the ramp stirrup fittings. When not installed, the cam jacks and anchoring devices will be stowed in two stowage bags located on the left and right side of the fuselage forward of the pressure door.

A holding relay in the door circuit holds locking pressure on the pressure door latch hooks and applies pressure to the open side of the pressure door actuator. This action causes the pressure door latch hook toes to engage below the pins of the ramp stirrup fittings while the pressure door is moved aft until positive engagement of the hooks and stirrup fittings is achieved.

Seven auxiliary pressure door latches are installed on the lower forward edge of the pressure door and are attached to the aft row of tiedown fitting receptacles on the cargo ramp floor. When the pressure door is open, the latches, with the tiedown fittings are stowed in auxiliary latch stowage receptacles on the pressure door. During pressurized flight these latches will have slack and will not be carrying a load.

CARGO RAMP.

The cargo ramp, when closed, is part of the pressure bulkhead and aft fuselage. The ramp may be opened to a fixed position in the air and a fixed or variable position for ground loading. The fixed position is used for aerial delivery and truck bed loading. By removing the ADS links, the ramp may be lowered to the ground for ground loading operations.

CAUTION

> The ADS links must be connected to prevent ramp extension below the horizontal position if it is to be opened in-flight. Over travel in-flight can result in damage to the ramp or ramp actuators.

PETAL DOORS.

The petal doors are "clamshell" structures used to fair in the aft opening of the aircraft. In the air, the doors may be opened to a full open position (65 degrees) for aerial delivery of cargo. For ground loading, a second position (80 degrees) is available to accommodate large loaders. The 80 degree door position is available only during ground operation.

CAUTION

> Observe limit speeds when opening petal doors in-flight.

The petal doors may also be opened manually by inserting a hand crank into the hand crank receptacle in the central gear box located in the aft empennage.

CARGO DOOR AND RAMP SYSTEM CONTROLS AND INDICATORS.

Controls and indicators for the system are located on the pilot's and copilot's ADS panels (figure 1-256), the annunciator panel, the cargo door and ramp control panel, and on the forward crew door and PA panel (figure 1-253). In addition, a door indicator light is located on the navigator's ADS panel. During flight, opening the external doors is controlled entirely from the pilots' control panels. During ground operation, door opening and closing is controlled from the cargo door and ramp panel in conjunction with switch settings on the pilot's panel.

Pilot's Control and Indicators.

The pilot's controls and indicators are located on the CARGO DOORS section of the pilot's ADS panel. The DOOR ARMING switch is a two-position ("OFF", "ARM") toggle lock switch that is set to "ARM" to energize the system. The ALL DOORS switch is a three-position ("OPEN", "OFF", "CLOSE") switch that initiates system operation. Five indicator lights on the panel (EXTERNAL CL, IN TRANSIT, PRESS. OPEN, PETAL INTMD, PETAL OPEN) illuminate to indicate door status. An AUX OPEN light is installed on Aircraft 38075 and 38076 in lieu of the PETAL INTMD light; however, neither of these lights is operative on any aircraft.

When a door operating sequence is initiated, the IN TRANSIT light illuminates indicating that the operating sequence is in progress. When the PRESS DOOR light illuminates, the IN TRANSIT light extinguishes and illuminates again if further cargo/ramp door opening sequence has been selected.

Copilot's Controls and Indicators.

The copilot's control and indicators are located on the CARGO DOORS section of the copilot's ADS panel. The controls and indicators consist of an ALL DOORS switch and indicator lights which are identical to those on the pilot's panel. However, the pilot's ALL DOORS switch has priority over the copilot's switch and can override any door movement initiated by the copilot.

Navigator's Indicator.

A CARGO DOORS "OPEN" Light on the navigator's ADS and jump light panel illuminates when the cargo doors are open.

CARGO COMPARTMENT CONTROLS AND INDICATORS.

Controls and indicators for the system are located on the forward crew door and interphone panel and on the cargo door and ramp control panel. The PRESSURE door only switch on the crew door interphone and PA panel is a three-position ("OPEN", "OFF", "CLOSE") guarded switch. Arming of the system will be indicated when the DOORS ARMED indicator on the panel illuminates, and the pressure door may then be opened with this switch. The door may be closed with the switch only if the external cargo doors are closed and locked. The pilot's and copilot's ALL DOORS switches will override any operation initiated by this switch. The IN TRANSIT and ALL OPEN lights on the panel illuminate during system operation to indicate door status.

Door and ramp operating controls are located on the DOOR AND RAMP CONTROLS section of the cargo door and ramp control panel. The switches on this section of the panel consist of guarded switches for operation of the system. Prior to operating the system from this control panel, the system must be armed from the pilot's ADS panel. When the system is armed, the CARGO DOORS SYSTEM ARMED light on the door and ramp control panel will illuminate. The PRESSURE DOOR switch on this panel is operated identically to the switch on the forward door interphone and PA panel. The RAMP switch on the cargo door and ramp control panel is a three-position (momentary "LOWER", OFF, momentary "RAISE") switch that controls ramp height. To adjust ramp height for loading, the switch is momentarily set to "RAISE", the ramp supports are disconnected and stowed and the ramp is adjusted to desired loading height by manipulating the switch in the desired direction. The PETAL DOORS switch has two positions "80°" and "55°". When the PETAL DOORS switch is set to "55°", the petal doors will open to 65 degrees (IN-FLIGHT) position. If the switch is set to "80°", the petal doors will open to the 80 degree (GROUND) position. The ALL DOORS switch on the door and ramp control panel is a three-position (momentary "OPEN", "OFF", momentary "CLOSE") switch. The "OPEN" position opens the doors to selected positions only while the aircraft is on the ground, the "CLOSE" position will close all the doors when the aircraft is on the ground or in-flight. The pilot's and copilot's ALL DOORS switches will override this switch during flight. When on the ground, the pilot's and copilot's switches have no effect on the system.

CARGO COMPARTMENT DOOR WARNING SYSTEM.

Controls and indicators on the DOOR WARNING CONTROL section of the panel consist of four (PRESSURE DOOR, RAMP, PETAL DOORS, and STAB ACCESS DOOR) NOT LOCKED indicators and associated two-position ("NORM", "BY PASS") switches. The aircraft also has a RAMP LOCK PINS FULLY RETRACTED green light. When a particular door is unlocked, the red NOT LOCKED indicator for the door and the DOOR OPEN indicator on the annunciator panel illuminate. When one of the four indicators illuminates, the switch for that indicator may be set to "BY PASS" to extinguish the DOOR OPEN annunciator light. The individual red indicator will remain illuminated regardless of the door lock condition once the switch is placed in "BY PASS".

GROUND OPERATION OF THE CARGO DOOR AND RAMP SYSTEM.

To open the cargo doors and ramp while the aircraft is on the ground, proceed as follows:

1. Energize the electrical buses, using either the APU or external power.

NOTE

If the APU is powering the aircraft, the No. 3 Bus AUTO-LOAD DISC switch must be placed in "OVERRIDE" to get power to the No. 3 hydraulic system's No. 2 hydraulic pump.

2. Set No. 1 and No. 2 PUMP switches on the flight engineer's No. 3 hydraulic panel to "RAMP CONTROL".

NOTE

When the No. 1 and No. 2 PUMP switches are placed in "RAMP CONTROL", the No. 3 hydraulic system pressure should remain at zero. If pressure should rise, these switches should be placed to "OFF" and the No. 1 and No. 2 PUMP switches on the cargo door and ramp control panel placed to "OFF".

3. Place the DOOR ARMING switch on the pilot's ADS panel to "ARM".

CAUTION

If it is necessary to activate any manual override button to operate the system out of sequence, the DOOR ARMING switch must be in the "OFF" position until the manual override operation is complete.

4. Remove and stow the pressure door cam jacks, aux latches and the ramp manual safety pins (figure 1-254).

5. Select petal door opening:

   a. For 65 degree opening, place the PETAL DOORS switch to "55°".

   b. For 80 degree opening, place the PETAL DOORS switch to "80°".

6. Place the No. 1 and No. 2 PUMP switches on the cargo door and ramp control panel to "ON".

7. Place the ALL DOORS switch on the cargo door and ramp control panel to "OPEN".

CAUTION

To prevent damage to the petal doors, ensure that no obstructions are within the opening envelope of the petal doors during operation.

NOTE

- If the aft anchor cable supports are connected, the pressure door must be opened by placing the PRESSURE DOOR switch to "OPEN".
- If the pressure door holding circuit has been energized, it must be deenergized by placing the pilot's DOOR ARMING switch to the "OFF" position and then returning it to "ARM" before the doors can be operated.

8. When the cargo doors and ramp are open and it is necessary to adjust the cargo ramp height below horizontal:

   a. Place the RAMP switch on the cargo door and ramp control panel to "RAISE" until the load is relieved from the ramp supports (ADS links).

b. Disconnect the ramp supports (ADS links) and stow them in the stowage tubes.

c. Position RAMP switch to adjust ramp height to desired level.

9. Place the No. 1 and No. 2 PUMP switches on the cargo door and ramp control panel to "OFF".

To close the cargo doors and ramp while the aircraft is on the ground, proceed as follows:

1. Energize the electrical buses, using either the APU or external power.

NOTE

If the APU is powering the aircraft, the No. 3 Bus AUTO-LOAD DISC switch must be placed in "OVERRIDE" to get power to the No. 3 hydraulic system's No. 2 hydraulic pump.

2. Position the No. 1 and No. 2 PUMP switches on the flight engineer's No. 3 hydraulic system control panel to "RAMP CONTROL".

NOTE

When the No. 1 and No. 2 PUMP switches are placed in "RAMP CONTROL", the No. 3 hydraulic system pressure should remain at zero. If pressure should rise, these switches should be placed to "OFF" and the No. 1 and No. 2 PUMP switches on the cargo door and ramp control panel placed to "OFF".

3. Place the DOOR ARMING switch on the pilot's ADS panel to "ARM".

4. Place the No. 1 and No. 2 PUMP switches on the cargo door and ramp control panel to "ON".

NOTE

A RAMP LOCK PINS FULLY RETRACTED light is installed on the DOOR WARNING CONTROL section of the cargo control panel. The light will illuminate to indicate that the sliding ramp lock pins are fully retracted. The light must be illuminated before lowering or raising the ramp.

5. If the ramp has been positioned at a setting other than the horizontal position, place the RAMP switch to "RAISE" and raise the ramp to a position above horizontal and connect the ramp supports (ADS links).

CAUTION

The RAMP LOCK PINS FULLY RETRACTED light must be illuminated, indicating that the ramp lock pins are fully retracted (electrical power available). If the light does not illuminate, a visual check must be made to insure ramp lock pins are fully retracted. Damage to locking system will occur if pins are not fully retracted.

6. If the RAMP LOCK PINS FULLY RETRACTED green light is not illuminated, proceed with the following procedure:

a. Prior to using manual selector valves, place the ALL DOORS switch to "OPEN". This should cause the ramp pins to fully retract and the green light to illuminate. If ramp pins do not fully retract or the green light fails to illuminate, proceed with step b.

b. With the ramp in the horizontal position and with the system pressurized, depress the UNLOCK button of the ramp manual selector valve. This should cause the ramp pins to fully retract and the green light to illuminate.

c. If the pins visually check retracted and the green light illuminated, proceed to item 7.

d. If the pins do not retract and/or the green light does not illuminate, make no further attempt to close the doors.

NOTE

Enter the door malfunction in the aircraft forms if step b or d above is required.

7. Lower ramp until ramp supports (ADS links) bottom.

NOTE

If the ramp raises up while using the "LOWER" position, momentarily place the ALL DOORS switch to "OPEN".

8. Place ALL DOORS switch to "CLOSE".

NOTE

If either of the aft ADS static line cable positioning actuator assemblies (A-frames) is connected, the pressure door must be closed by placing the PRESSURE DOOR switch to "CLOSE".

9. As the pressure door closes and locks, observe that all door seals are properly positioned and that the pressure door moves out slightly.

NOTE

Do not return the DOOR ARMING switch or the No. 3 hydraulic system No. 1 and No. 2 PUMP switches to "OFF" until the cam jacks have been installed.

10. Install the two cam jacks between the cam jack cup assemblies on the cargo ramp floor and the forward lower edge of the pressure door. Actuate the jacks with hand pressure only.

11. Place the No. 1 PUMP and No. 2 PUMP switches on the cargo door and ramp control panel to "OFF".

12. Visually check through the pressure door seal latch view ports that the pressure door latch hooks are properly engaged in the ramp stirrup fittings. The green alignment marks on the pressure door hooks should be aligned with the alignment marks on the shoulders of the stirrups when the pressure door is closed and locked.

CAUTION

If visual inspection reveals that any of the latch hooks are not properly engaged in the ramp stirrups, rigging maintenance must be performed prior to pressurized flight.

13. Check that the green portion of each pressure door locked indicator is visible.

14. Install the seven auxiliary pressure door latches. These latches will have slack and will not be carrying any load.

15. Ensure that the ramp is up and properly locked by visually checking that the latching system is properly engaged. Insert the manual safety pins.

16. Place the PETAL DOORS switch to "55°".

17. Place the DOOR ARMING switch on the pilot's ADS panel to "OFF".

IN-FLIGHT OPERATION OF THE CARGO DOOR AND RAMP SYSTEM.

To open the cargo door and ramp system while the aircraft is in-flight, proceed as follows:

WARNING

- The aircraft must be unpressurized and the air conditioning and floor heat must be "OFF" prior to unlocking and opening the pressure door.
- In-flight, the troop doors should not be opened while the ramp and petal doors are open. If it becomes absolutely necessary to open the troop doors while the ramp and petal doors are open, use extreme caution to prevent personal injury.

1. Remove and stow the pressure door cam jacks, aux latches and the ramp manual safety pins.

2. Position the No. 1 PUMP and No. 2 PUMP switches on the flight engineer's No. 3 hydraulic panel to "ON".

3. Place the DOOR ARMING switch on the pilot' ADS panel to "ARM".

CAUTION

If it is necessary to activate any manual override button to operate the system out of sequence, the DOOR ARMING switch must be in the "OFF" position until the manual override operation is complete.

4. Place the pilot's or copilot's ALL DOORS switch to "OPEN". Pressure door, ramp, and petal doors should open to the in-flight position, and the ALL DOORS switch should automatically return to "OFF".

To close the cargo doors and ramp while the aircraft is in-flight, proceed as follows:

1. Position the No. 1 PUMP and No. 2 PUMP switches on the flight engineer's No. 3 hydraulic panel to "ON".

2. Place the DOOR ARMING switch on the pilot's ADS control panel to "ARM".

CAUTION

The RAMP LOCK PINS FULLY RETRACTED light must be illuminated, indicating that the ramp lock pins are fully retracted (electrical power available). If the light does not illuminate, a visual check must be made to insure ramp lock pins are fully retracted. Damage to locking system will occur if pins are not fully retracted.

NOTE

If either of the aft ADS static line cable positioning actuator assemblies (A-frames) are connected, the pressure door must be closed by placing the PRESSURE DOOR switch (located on the cargo door and ramp controls panel) to "CLOSE".

3. Place the pilot's or copilot's ALL DOORS switch to "CLOSE". Petal doors, ramp, and pressure door should close.

NOTE

Both the pilot's and copilot's ALL DOORS switches must be in "OFF" before the PRESSURE DOOR switch will close the pressure door.

4. As the pressure door closes and locks, observe that all door seals are properly positioned and that the pressure door moves out slightly.

NOTE

Do not return the DOOR ARMING switch or the No. 3 hydraulic system No. 1 and No. 2 PUMP switches to "OFF" until after the cam jacks have been installed.

5. Install the two cam jacks between the cam jack cup assemblies on the cargo ramp floor and the forward lower edge of the pressure door. Actuate the jacks with hand pressure only.

6. Place the DOOR ARMING switch on the pilot's ADS panel to "OFF".

7. Position the No. 1 PUMP and No. 2 PUMP switches on the flight engineer's No. 3 hydraulic panel to "OFF".

8. Visually check through the pressure door seal latch view ports that the pressure door latch hooks are properly engaged in the ramp stirrup fittings. The green alignment marks on the pressure door hooks should be aligned with the alignment marks on the shoulders of the stirrups when the pressure door is closed and locked.

CAUTION

If visual inspection reveals that any of the latch hooks are not properly engaged in the ramp stirrups, rigging maintenance must be performed prior to pressurized flight.

9. Check that the green portion of each pressure door locked indicator is visible.

10. Install the seven auxiliary pressure door latches. These latches will have slack and will not be carrying any load.

11. Ensure that the ramp is up and properly locked by visually checking that the latching system is properly engaged. Insert the manual safety pins.

12. Pressurize the aircraft as desired.

CARGO RAMP AND DOOR SYSTEM ELECTRICAL CONTROL CAPABILITIES

SWITCH	ON-THE-GROUND-OPERATION	IN-THE-AIR-OPERATION
RAMP switch on cargo door control panel	Lower and raise ramp.	No effect.
PRESSURE DOOR switch on crew door interphone panel	Open pressure door; extend A-frames; retract A-frames.	Open pressure door; extend A-frames; retract A-frames.
PRESSURE DOOR switch on cargo door control panel	Open pressure door; extend A-frames; retract A-frames; close pressure door.	Open pressure door; extend A-frames; retract A-frames; close pressure door.
ALL DOORS switch on cargo door control panel	Open pressure door; extend A-frames; lower ramp; open petal doors; close petal doors; retract A-frames; raise ramp.	Close petal doors; raise ramp; retract A-frames; (will not close pressure door). (If A-frames are not connected, pressure door will close.)
ALL DOORS switch on pilots'ADS panels	No effect.	Open pressure door; extend A-frames; lower ramp; open petal doors; close petal doors; raise ramp; retract A-frames; (will not close pressure door). (If A-frames are not connected, pressure door will close.)

NOTE:
1. Operation shown in this table assumes proper door arming and proper door sequencing.
2. Petal door opening is limited to the ADS full open position in-flight. Ground loading opening is available only when on the ground.
3. Pilot's ALL DOORS switch overrides the copilot's ALL DOORS switch and returns the copilot's switch to "OFF".

MANUAL OPERATION OF THE CARGO DOOR AND RAMP SYSTEM.

NOTE

Manual operation of the cargo door and ramp system requires two crewmembers: one to operate the cargo door and ramp system control switches or the manual override control valves, and the other to operate the hydraulic handpump.

Hydraulic Pump Failure (Both Pumps in No. 3 System).

With electrical power available at the cargo door and ramp system control panel (figure 1-253) the system may be operated in the following manner:

TO OPEN:

1. System armed light ON.

2. Hold the ALL DOORS switch on the cargo door and ramp control panel to the "OPEN" position.

3. Operate the hydraulic handpump to unlock and open the pressure door, unlock and lower the ramp, and unlock the petal doors.

4. With the petal door locks in the unlocked position, insert the petal door handcrank into the petal door actuator and manually crank the doors to the desired position.

TO CLOSE:

1. System armed light ON.

2. Insert the petal door handcrank into the petal door actuator and crank the doors to the closed position.

3. Hold the ALL DOORS switch on the cargo door and ramp control panel to the "CLOSE" position.

4. Operate the hydraulic handpump to lock the petal doors, raise and lock the ramp, and close and lock the pressure door.

Control Valve Electrical Failure.

NOTE

With the loss of electrical power the switches on the cargo door and ramp controls panel and both hydraulic pumps in the No. 3 system will be inoperative. In this situation it will be necessary to use the manual override valves and the hydraulic handpump to operate the cargo door and ramp system. Place the DOOR ARMING switch on the pilot's ADS panel to "OFF".

CAUTION

It is necessary that the following sequence be observed during this type of operation.

Press the Selector Valve (SV) Manual Override Buttons (figure 1-255) in the sequence shown:

1. Pressure door SV to "CLOSE" - Hold.

2. Pressure door UP-DOWN locks SV to "UNLOCK" - Release step 1.

3. Pressure door SV to "OPEN". Pressure door will mechanically lock in the UP position when fully open.

4. Ramp SV to "UP" - Hold.

5. Ramp locks SV to "UNLOCK" - Hold/Release step 4. Continue to hold ramp locks SV button in while accomplishing steps 6 and 7.

6. RAMP LOCK PINS FULLY RETRACTED light - ILLUMINATED.

CAUTION

The RAMP LOCK PINS FULLY RETRACTED light must be illuminated, indicating that the ramp lock pins are fully retracted (electrical power available). If light does not illuminate or electrical power is not available, a visual check must be made to insure ramp lock pins are fully retracted prior to accomplishing step 7. Damage to locking system will occur if pins are not fully retracted.

7. Ramp SV to "DOWN" to horizontal position. Release step 5.

8. Petal doors SV to "CLOSE" - Hold.

9. Petal door locks SV to "UNLOCK" - Hold - Release step 8.

CAUTION

When using manual override to open the petal doors and the operator's view of the petal door locks is obscured, an additional crew member should be positioned to determine that both locks are unlocked prior to applying pressure to open the doors.

10. Petal doors SV to "OPEN" or insert petal door handcrank into the petal door actuator and manually crank the doors to the desired position, if required.

TO CLOSE:

1. Petal door locks SV to "UNLOCK " - Hold.

2. Petal door SV to "CLOSE" - Hold or insert handcrank into petal door actuator and crank doors closed.

3. Petal door locks SV to "LOCK".

4. Ramp locks SV to "UNLOCK" - Hold.

Continue to hold valve button in while accomplishing steps 5 and 6.

5. RAMP LOCK PINS FULLY RETRACTED light - ON.

CAUTION

The RAMP LOCK PINS FULLY RETRACTED light must be illuminated, indicating that the ramp lock pins are fully retracted (electrical power available). If light does not illuminate or electrical power is not available, a visual check must be made to ensure ramp lock pins are fully retracted prior to accomplishing step 6. Damage to locking system will occur if pins are not fully retracted.

6. Ramp SV to "UP" - Hold.

7. Ramp locks SV to "LOCK" - Release step 6.

8. Pressure door SV to "OPEN" - Hold.

9. Pressure door UP-DOWN locks SV to "UNLOCK" - Hold - Release step 8.

10. Pressure door SV to "CLOSE" - Hold.

11. Pressure door UP-DOWN locks SV to "LOCK" - Release step 10.

12. Hold pressure door UP-DOWN locks SV to "LOCK", press and release pressure door SV to "OPEN" - Release step 11.

Ensure pressure door moves out slightly.

AIRDROP SYSTEM (ADS).

Provisions for air-dropping of ground support equipment and emergency equipment are made using an in-flight cargo door and ramp operating system, parachute extraction system and miscellaneous airdrop system accessories. Controls for operating the system are located on the ADS panels (figure 1-256) on the pilot's and copilot's side consoles. The controls on the panels allow the crew to open the cargo doors, actuate an extraction parachute release device, and close the cargo doors when the drop is complete. For detailed information concerning the installation of miscellaneous equipment, refer to TO 1C-141B-9, "Cargo Loading".

ADS CONTROLS AND INDICATORS.

Controls and indicators for the ADS are located on the pilot's and copilot's ADS panels, the navigator's ADS panel, and on the forward crew door interphone and PA panel. The pilot's and copilot's cargo door and ramp operating controls are used in conjunction with the ADS controls for air-dropping cargo or personnel. A description of the cargo door and ramp control is included in the "Cargo Door and Ramp System" paragraphs in this section.

ADS Extraction Parachute Holder.

The parachute extraction holder must be armed by an electrical switch at the loadmaster's station in the forward cargo compartment before it can be electrically actuated from the ADS control panels. The electric release circuit will not release unless the aircraft is airborne and the cargo doors and ramp are in the airdrop position. In an emergency, the loadmaster can actuate the extraction parachute manually.

Chute Release Switch.

A CHUTE REL switch is located on the pilot's and copilot's ADS panels and a CHUTE RELEASE switch is located on the navigator's ADS panel. The switches are guarded two-position ("REL", "OFF") switches that control release of the extraction parachute. When the ADS system is armed, the CHUTE REL/RELEASE switches receive power.

Extraction Parachute Manual Release.

A two-position, manual release handle adjacent to the crew entrance door permits the loadmaster to manually actuate the release hooks on the extraction parachute holder when the holder is raised into its support housing. When the handle is pulled down, rotated 60 degrees and pulled all the way down, it mechanically releases the hooks.

ADS Armed Indicator.

The ADS ARMED indicator on the pilot's, copilot's and the navigator's ADS panels illuminates when the system is armed. The indicator illuminates when the aircraft is airborne, the cargo doors are open to the airdrop position, and the electrical switch at the loadmaster's station in the forward cargo compartment is in the ARMED position.

TROOP-CARRYING EQUIPMENT.

When the aircraft is used as a troop carrier, seating accommodations are provided for 210 ground troops or 155 paratroops. Various other troop-carrying configurations are possible, in combination with cargo or adding comfort pallets in combination with the seats. For detailed information, see TO 1C-141B-9, "Cargo Loading".

CASUALTY-CARRYING EQUIPMENT.

Provisions for the installation of 103 litters are incorporated in the cargo compartment. Fourteen seats for attendants can be included. Litter and side-facing seat stanchions are provided in a kit. These kits are installed only when the litter capability is required. For further information see TO 1C-141B-9, "Cargo Loading".

PARATROOP EQUIPMENT.

Provisions for configuring the aircraft for an airdrop mission are contained in a kit. These provisions permit paratroopers to be dropped from both troop doors simultaneously. The kit includes paratroop seats, a static anchor line cable kit, electrically actuated air deflector doors, jump platforms, and a retriever roller bar.

Seats.

Seats are provided for a maximum of 155 paratroops. When not in use, the seats are stowed. For full details on paratroop seats and arrangement, refer to TO 1C-141B-9, "Cargo Loading".

Troop Doors.

Troop doors are located on each side of the aft cargo compartment. The doors are raised inward and up manually and held open by a spring-loaded latch.

WARNING

In-flight, the troop doors should not be opened while the ramp and petal doors are open. If it becomes absolutely necessary to open the troop doors while the ramp and petal doors are open, use extreme caution to prevent personal injury.

Air Deflector Doors.

An air deflector door is attached to the cargo compartment sidewall forward of each troop door. The doors are electrically actuated in the extended position; they serve as air deflectors for the paratroopers during jump operations. The air deflector doors are a part of a paratroop kit and are not a permanent part of the aircraft. A three-position (momentary "EXTEND", OFF, "RETRACT") guarded switch on the SPOILER DOOR (AIR DEFLECTOR) CONTROL section of the cargo door and ramp control panel controls door movement when the ARMED light adjacent to the switch illuminates. The system is armed by setting the two-position ("ARM", "OFF") switch on the PARATROOP SPOILERS section of the pilot's ADS panel to "ARM". Three lights (IN TRANSIT, L EXTEND, R EXTEND) on the pilot's and copilot's ADS panels illuminate during door movement to show door status.

Two guarded TROOP DOOR BYPASS switches are installed below the left troop door intercom panel (figure 1-257). The switches are two-position ("NORM", "BYPASS") and are labeled "L" and "R". These switches provide a means for extension and retraction of the left and right paratroop air deflector doors in the event either troop door limit switch malfunctions. If during normal operation of the air deflector doors, either deflector door fails to operate, the "BYPASS" switch should be placed to "BYPASS" until the deflector door has reached the desired position.

CAUTION

Do not actuate the switches to "BYPASS" unless troop doors are mechanically locked in the full open position. Damage to troop doors and air deflector doors may occur.

Troop Jump Platforms.

Two jump platforms can be installed on the sill of the troop doors. A special tiedown fitting locks the platform to the cargo floor. A hinge adjacent to the tiedown points permits the platform to be retracted into the aircraft while still attached to the floor. When lowered into position, support arms on the side of the platform hook over the door frames. A downlock on the support arm holds the platform extended in the airstream.

Anchor Cables.

Four anchor cables are provided, two in the aircraft and two in the paratroop kit for anchoring the static lines of parachutes during an airdrop.

Provisions have been incorporated to install two anchor cables to two forward anchor cable support brackets and to two electrically actuated ADS static line cable positioning A-frame assemblies mounted on the left and right sides of the fuselage aft of the pressure door. Sealed cutouts in the left and right pressure bulkheads allow the two cables to seat in the cutouts during the A-frame retraction and before the pressure door closes.

Before the pressure door can be opened, the A-frames must be in their stowed (down and retracted) positions so that the retract limit switches can be actuated. The cargo doors can be operated with the anchor cables disconnected from the A-frames. However, if the A-frames have been removed from their installation brackets, a dummy plug must be inserted in the same electrical receptacle that provides power for the A-frame actuators. This plug will jumper the retract limit switch circuit so that the doors will operate.

Static Line Retriever.

The paratroop static line retrievers pull the static lines trailing from the anchor cables, back into the aircraft after a paratroop drop.

Static Line Retriever Controls.

A remote-control pistol grip winch control handle (figure 1-258) hangs on a hook on the side of the ramp and door control panel. The handle is connected to an extension cord.

Two 3-position ("IN", "OFF", "OUT") thumb switches on the handle provide separate control of the two winches. A squeeze grip on the handle must be compressed before either winch will operate.

Jump Signals.

A panel with a red and green light is installed forward and aft of each paratrooper door to inform the jumpmaster and paratroops of jump instructions from the flight station. An additional light panel is installed aft of the crew entrance door and two panels are mounted above the ramp so the lights are visible from all parts of the compartment. The lights are controlled from the JUMP SIGNAL toggle switches on the pilot's, copilot's and navigator's ADS panels. The CAUTION LTS switch controls the red jump lights; the JUMP LTS switch controls the green lights. A mechanical interlock prevents the JUMP LTS switch from being actuated until the CAUTION LTS switch is actuated. When one of the switches is actuated on any of the panels, a corresponding CAUTION or JUMP indicator light on all the panels illuminates to indicate that the signal lights are on in the cargo compartment.

A BRIGHT or DIM push button on each of the loadmaster/jumpmaster panels (figure 1-257) provides brilliance control of the jump signal lights. The switches on either of the panels control the brilliance of all of the jump lights. All lights are dimmed automatically when the cargo compartment red dome lighting is in use, or when the white dome lighting is dimmed. The jump lights automatically brighten when the cargo compartment lights are brightened.

OXYGEN SYSTEM.

The aircraft is equipped with two independent liquid oxygen systems, one for the crew and one for personnel in the cargo compartment. (See figures 1-259 and 1-260.)

CREW OXYGEN SYSTEM.

The crew oxygen system uses diluter demand regulators and operates at 290-430 PSI. Oxygen is supplied from a 25-liter converter located in the left-hand side of the nose wheel well and serviced through an externally accessible valve. The oxygen supply is fed from the converter through a manual shutoff valve and two heat exchangers to nine regulators in the flight station. The system also supplies five portable unit recharging outlets: one forward of the flight engineer's station, one aft of the navigator's station, one in the crew latrine, one on the right side of the forward bulkhead, and one aft of the crew entrance door. An oxygen quantity indicator and a push-to-test button for the indicator are on the copilot's side console. A low oxygen warning light on the annunciator panel comes on when the oxygen quantity reaches 2.5 liters.

Oxygen Regulators.

A diluter demand pressure breathing regulator is installed at each of the following stations: pilot, copilot, jump seat, navigator, flight engineer, two lower bunk seats, and the two auxiliary crew seats. Each regulator has a visual flow indicator, a pressure gauge and three switches.

OXYGEN SUPPLY LEVER.

A two-position ("ON", "OFF") supply lever is located at the lower right-hand corner of each regulator.

DILUTER LEVER.

A two-position ("100% OXYGEN", "NORMAL OXYGEN") diluter lever on each regulator unit is used to select pure oxygen or automatic mixing of ambient air and oxygen.

EMERGENCY TOGGLE LEVER.

Each regulator is set to one of three positions: "EMERGENCY", "NORMAL", or "TEST MASK". In "EMERGENCY", oxygen is supplied to the mask at continuous positive pressure. In "NORMAL", oxygen flow is controlled automatically by the regulator. The "TEST MASK" setting may be used to test the fit of the mask.

FLOW INDICATOR.

The flow indicator on the regulator is a slide-and-window device which blinks with the breathing cycle of the user. The blinker is masked when the oxygen flow ceases.

PRESSURE GAUGE.

The pressure gauge on the regulator is a dial-type instrument which indicates oxygen system pressure in pounds per square inch.

Liquid Oxygen Converter.

The 25-liter liquid oxygen converter is mounted in the left side of the nose wheel well. The converter is serviced through a combination fill-buildup-vent valve contained in a filler box adjacent to the converter and accessible through a door on the left side of the fuselage. The filler box also contains a drain valve. The operation of the combination fill-buildup-vent valve is automatic, and charging of the oxygen system is automatic once the filling operation is completed.

Heat Exchanger Units.

One heat exchanger unit is located below the flight station floor, and one in the overhead trough, above the crew rest platform. Oxygen is warmed by passing through the heat exchangers.

Liquid Oxygen Quantity Indicator.

A liquid oxygen quantity indicator is located on the copilot's side console. A push-to-test button adjacent to the quantity indicator tests the indicator.

Low Oxygen Quantity Warning Light.

An OXY QUANTITY low light, on the pilots' annunciator panel illuminates when the supply of liquid oxygen remaining is below 2.5 liters.

Manual Shutoff Valve.

A manual shutoff valve is used to isolate the liquid oxygen supply from the system. The valve is located near the converter in the nose wheel well, and is operated by a control knob aft of the pilot's side console.

Flight Crew Quick-Don Oxygen Masks.

Each unit consists of a quick-don suspension device and an oxygen mask. The oxygen mask contains an integral microphone assembly which connects to the crew members headset and the aircraft communications system. Microphone switching from the headset to the oxygen mask is automatic and is completed as the suspension device is donned.

OXYGEN PREFLIGHT CHECK.

NOTE

Quick-don masks will be cleaned prior to use.

1. Connect the mask assembly to a headset and the aircraft interphone system. Check the headset microphone for proper operation.

2. Check oxygen pressure within limits of 290 to 430 PSI.

3. Position the regulator SUPPLY lever to "ON".

4. Position the diluter lever to "100% OXYGEN".

Check the visual flow indicator for a no-flow indication. The sound of escaping oxygen should not be heard.

5. Inspect the mask and suspension device for condition. Check all hoses and connectors for condition.

6. Connect the mask to the supply hose, don the suspension assembly and goggles, and adjust for proper fit.

7. Check the oxygen mask microphone for proper operation.

8. Close the purge valve.

9. Position the emergency toggle lever to "EMERGENCY".

10. Breathe normally for a minimum of three cycles. The flow indicator should alternate black and white.

11. Hold breath. A white indication on the flow indicator indicates a leak.

12. Position the diluter lever to "NORMAL OXYGEN". Flow indicator should remain black. A white indication indicates a leak.

13. Breathe normally for a minimum of three cycles. The flow indicator should show alternately black and white.

NOTE

It is possible for the white of the flow indicator to show by movement of the crew member's head with respect to the regulator. Therefore, leaks should be detected by the movement of the blinker in relation to its "at rest" position.

14. Hold breath and open the purge valve. A white indication on the flow indicator ensures the ports to the goggles are clear.

NOTE

The purge valve should be in the open (pulled out) position except during preflight and when oxygen is in use where smoke or fumes are not present and goggles are not required.

15. Position the emergency toggle lever to "NORMAL".

16. If no leaks can be detected, return the remaining regulator settings to "100% OXYGEN" and "OFF".

WARNING

If leaks are detected, corrective action will be taken prior to flight. Due to the design of the quick-don oxygen mask, some individuals may experience minor leakage around the face form.

17. Bleed, or breathe, off residual pressure and attempt to breathe normally. There should be resistance and the mask should draw in and seal. This is normal. However, the ability to breathe unrestricted indicates a faulty oxygen regulator.

18. Stow the quick-don assembly.

Route the quick release strap through the loop of the crown strap, under the nape bracket, and into the quick release clamp. The suspension assembly will be folded behind the oxygen mask when properly stowed.

NOTE

- Improper stowage will allow the suspension assembly to unfold and transfer capability from the headset to the oxygen mask microphone.
- The navigator may disconnect his headset from the quick-don oxygen mask microphone cord and connect to the normal interphone when performing airdrop duties. Upon completion of these duties, the navigator shall reestablish interphone contact through the quick-don mask system.

IN-FLIGHT OPERATION OF CREW OXYGEN SYSTEM.

During flight the oxygen system regulator will be set with the Oxygen Supply Lever "ON", the Diluter Lever "100% OXYGEN", and the Emergency Toggle Lever "NORMAL". This will allow immediate use of oxygen if it is needed. When oxygen is used under normal conditions, the Diluter Lever should be placed to "NORMAL OXYGEN".

OXYGEN SYSTEM POSTFLIGHT PROCEDURES.

Ensure that the dust cover is in place on the oxygen mask and the regulator settings are in "NORMAL", "100% OXYGEN" and "OFF".

PORTABLE OXYGEN BOTTLE.

Eleven portable oxygen bottles are provided for use during emergencies. Two units are stowed forward of the flight engineers station; two are stowed aft of the navigator's station, one is stowed in the crew latrine; two are stowed on the overhead trough above the crew rest platform; and four are stowed in the cargo compartment (two forward, and two aft). Provisions for additional units are available in the cargo compartment. Recharging the portable units can be accomplished at system pressure through a filler valve and flexible hose located at the recharging point. The MA-1 portable oxygen bottle assembly consists of an A-6 low pressure cylinder and an A-21 pressure demand regulator. The regulator consists of an oxygen pressure gage, altitude selector knob, and a strap and a clip for attachment. The pressure gage is red lined at 450 PSI and is normally serviced to 300 PSI from the aircraft system. The altitude selector has positions of "NORM", "30M", "42M", and "EMER". The regulator delivers 100 percent oxygen in all positions. The "NORM" position is selected for all cabin altitudes up to 30,000 feet and delivers pressure on demand. The "30M" position is used from 30,000 to 42,000 feet cabin altitude. This position delivers oxygen at a slight positive pressure. The "42M" position is used from 42,000 to 45,000 feet cabin attitude. The "EMER" position further increases the pressure for use over 45,000 feet.

TROOP OXYGEN SYSTEM.

The troop oxygen system, a continuous flow system, operates through two regulators on the regulator panel assembly. The regulators open automatically so that oxygen will begin to flow at 12,500 feet to 14,000 feet cabin altitude, and will continue to flow until the cabin altitude drops below 11,500 feet. A manual override switch is installed on the regulator panel so that the regulator may be turned on manually at any cabin altitude.

The troop oxygen system operates at a pressure of 300 PSI and a distribution system pressure varying with cabin altitude from 29 PSI at low altitudes to 69 PSI at maximum altitude. This system supplies the supplemental oxygen requirements for a maximum of 200 troops. The system consists of two major sections:

1. Permanently installed distribution system.
2. Removable oxygen distribution kits.

Converter Pallet Assembly.

The converter pallet assembly is installed in the nose section of the right gear pod. Mounted on the pallet assembly are two 75-liter liquid oxygen converters, two combination fill-buildup-vent valves, two liquid oxygen drain valves, and two heat exchangers. Two supply lines and a common vent line from the pallet assembly are connected to permanently installed supply and vent lines in the gear pod.

Regulator Panel Assembly.

The regulator panel assembly is installed in the cargo compartment on the right side of the fuselage just forward of the wing between fuselage stations 678 and 698. Mounted on the panel are two continuous flow regulators, four heat exchangers, two dual check valves, a pressure sensing switch, and a troop oxygen panel.

MA-1 PORTABLE OXYGEN SYSTEM DURATION SCHEDULE

(300 PSIG initial, 50 PSIG final, discharge pressures)

NOTE

System consists of Air Force Type MBU-5/P, MBU-12/P, Smoke, Quick Don, or C.B. mask connected to a Type A-21 Regulator and MS21227-1 Cylinder Assembly.

REGULATOR SETTING	CABIN ALTITUDE	PHYSICAL ACTIVITY (3)	
		MODERATE	HEAVY
Normal (Sea Level to 30,000 ft.)	Sea Level	2.7 - 4.7 minutes	1.3 minutes
	8,000 ft.	3-2 - 6.0 minutes	1.6 minutes
	18,000 ft.	4.8 - 9.2 minutes	2.4 minutes
	25,000 ft. (1)	6.7 - 12.4 minutes	3.5 minutes
30M (30,000 ft. to 42,000 ft.)	30,000 ft. (1)	8.2 - 15.3 minutes (2)	4.2 minutes (2)
	31,000 ft. (1)	8.6 - 16.0 minutes (2)	4.5 minutes (2)
	35,000 ft. (1)	10.2 - 19.3 minutes (2)	5.3 minutes (2)
	41,000 ft. (1)	13.0 - 24.5 minutes (2)	6.7 minutes (2)
42M (42,000 ft. to 45,000 ft.)	42,000 ft. (1)	13.5 - 25.2 minutes (2)	7.1 minutes (2)
	45,000 ft. (1)	15.6 - 28.1 minutes (2)	8.1 minutes (2)
EMER (45,000 ft. and above)	Sea Level	3.1 - 4.5 minutes (2)	1.2 minutes (2)
	8,000 ft.	3.1 - 5.7 minutes (2)	1.6 minutes (2)
	18,000 ft.	4.6 - 8.3 minutes (2)	2.4 minutes (2)
	25,000 ft. (1)	6.0 - 11.1 minutes (2)	3.1 minutes (2)
	32,000 ft. (1)	8.1 - 15.0 minutes (2)	4.2 minutes (2)
	40,000 ft. (1)	11.3 - 20.3 minutes (2)	5.8 minutes (2)
	45,000 ft. (1)	13.5 - 25.2 minutes (2)	7.1 minutes (2)

(1) Flight rules governing cargo-passenger aircraft require immediate descent to 25,000 ft. altitude or below upon complete loss of cabin pressurization.

(2) These duration times do not provide for leakage around the mask face seal.

(3) All times are approximate. System oxygen duration is dependent upon workload, mask fit, stress, body size and proper regulator settings.

(4) The firefighter's smoke mask is limited to 40,000 feet when connected to a portable oxygen bottle.

The oxygen supply lines on the regulator panel are connected to the regulators through check valves. Because of differential spring loads in the check valves, either or both converters can supply either or both regulators. The regulators are installed in parallel so that with the failure of either regulator, the supply will not be interrupted. A pressure-actuated ON indicator is mounted on each regulator to indicate that the regulator has been turned on either automatically or manually.

The six heat exchangers in the troop oxygen system warm the oxygen to breathing temperature. Contacts in a pressure sensing switch close when oxygen starts to flow through one or both of the regulators. This causes a warning horn to sound, the dome lights in the cargo compartment to come on full bright, and an OXYGEN ON indicator light on the troop oxygen panel to illuminate.

Troop Oxygen Panel.

The troop oxygen panel (figure 1-259) is installed on the regulator panel assembly. The troop oxygen panel contains two 75-liter quantity indicators with PUSH TO TEST buttons, two LOX QTY LOW warning lights, an OXYGEN ON indicator light, a push button HORN SHUTOFF switch, and two control switches.

LIQUID OXYGEN QUANTITY INDICATORS.

These indicators permit monitoring of the supply of liquid oxygen available in the two converters. A PUSH TO TEST button located immediately below each indicator permits testing of the indicators.

LOW OXYGEN QUANTITY WARNING LIGHTS.

The warning light (LOX QTY LOW) illuminates when the quantity of liquid oxygen remaining in its converter drops to 7.5 liters.

OXYGEN ON INDICATOR LIGHT.

The OXYGEN ON indicator light illuminates when the system is pressurized. The light is activated by a pressure sensing switch in the regulator panel or by a test switch on the troop oxygen panel.

OXYGEN LIGHTS AND HORN TEST SWITCH.

The OXY LIGHTS AND HORN test switch is a two-position ("NORMAL", momentary "TEST") switch.

When the switch is held to "TEST", the OXYGEN ON light illuminates, the cargo dome lights illuminate full bright and the warning horn will sound. When the switch is released, the OXYGEN ON light extinguishes; the warning horn is silenced and the cargo compartment lights are returned to normal. When, the switch is in "NORMAL" and oxygen first starts to flow, the OXYGEN ON light illuminates, the cargo compartment dome lights illuminate to full bright and the warning horn sounds. The OXYGEN ON light remains on as long as oxygen is flowing.

WARNING HORN SHUTOFF BUTTON.

The HORN SHUTOFF button is used to silence the horn after a test or after the system has been energized due to insufficient cabin pressurization.

INDICATOR LIGHTS ILLUMINATION CONTROL SWITCH.

A two-position ("DIM", "BRIGHT") IND LIGHTS switch is used to control the brightness of the indicator lights.

PERMANENTLY INSTALLED OXYGEN DISTRIBUTION SYSTEM.

The permanently installed oxygen distribution system consists primarily of distribution lines extending along each side and along the center overhead of the cargo compartment. Installed in the lines, along each side at approximately 11-inch intervals, are self-sealing outlets into which the oxygen masks for the outboard rows of side-facing seats and for the litters and all of the aft facing seats may be attached. These outlets contain metering valves which regulate the quantity of oxygen flowing to the masks in accordance with the pressure.

The line along the center overhead supplies the center rows of litters and side-facing seats when alternate mission kit No. 8 is installed. Also permanently installed are two supply lines extending from the converter pallet position in the right gear pod to the regulator panel in the cargo compartment. Manual shutoff valves which are operated from inside the cargo compartment are installed in the supply lines in the gear pod, and are used to isolate the liquid oxygen supply from the distribution system in case of a downstream fire or leak. The valves are operated by handwheel controls on the right side of the cargo compartment just forward of the converter pallet assembly at fuselage station 831. To close either valve, rotate the handwheel in a clockwise direction.

Oxygen Distribution Kits.

Alternate mission kit No. 7 provides the connection between the permanent sidewall outlets and the individual sidewall seats or the rigid aft-facing seats. The kit contains a quantity of oxygen masks and individual distribution hoses for installation on the sidewall seats after the seats are installed.

Alternate mission kit No. 8 provides the connection between the permanent overhead outlets and the individual center seats or litters. The kit contains one liquid oxygen converter and a quantity of oxygen masks, individual distribution hoses, and centerline manifold and hose assemblies. This kit may be installed to supply oxygen to troops in centerline canvas seats, to supply occupants in aft-facing rigid seats, or to supply litter patients in either center or sidewall litters. The oxygen converter is to be installed in the right gear pod on the pallet supplied with alternate mission kit No. 6 to increase the capacity of the pallet supply. The manifold and hose assemblies connect into the overhead distribution outlets and are fastened to the centerline stanchions (alternate mission kit No. 3) to provide convenient distribution connection points near the users. These manifold and hose assemblies must be used whenever it is desired to supply seats or litters at the centerline stanchions.

When rigid aft-facing seats are installed in the cargo compartment, oxygen can be supplied to each seat by using the No. 6 kit with one No. 7 and one No. 8 kit.

THERAPEUTIC OXYGEN SYSTEM.

Provisions are made for the installation of seven oxygen regulators in two therapeutic oxygen boxes for patients requiring special therapeutic treatment. The two boxes are located on the forward and center right side of the cargo compartment and contain connections for mounting three regulators in the forward box and connections for mounting four regulators in the aft box. The oxygen supply lines are connected to a manual shutoff valve on the troop oxygen regulator panel. When the therapeutic oxygen regulators are installed and the manual shutoff valve is turned on, oxygen under 300 PSI is delivered to the regulators.

Three additional portable oxygen bottle recharger outlets are installed on the right-hand side of the fuselage, aft of the troop oxygen panel. To service portable oxygen bottles from these outlets the therapeutic manual shutoff valve must be opened.

WARNING SYSTEMS.

ALTITUDE ALERT WARNING.

The Control Display System (CDS) provides two altitude cautions, pre-intercept and cruise. An Alert Altitude is selected using the ALT ALERT SET knob on the Reference Set Panel (RSP) (see figure 1-222). The pre-intercept envelope for a selected fly-to altitude is 1,000 feet (±50 feet). The pre-intercept mode is active when the airplane is in a climb or descent to an alert altitude. As the airplane approaches to within 1,000 feet of the alert altitude, the CDS alerts the crew with a single beep and the ALRT readout on the PFD momentarily changes from white to red. The cruise mode provides a 200-foot (±50 feet) cruise altitude envelope. When the airplane leaves the cruise altitude envelope, the CDS annunciates on both pilot's PFDs and a 1000-Hz tone is heard over the GCAS speaker and the pilot's and copilot's interphones. The tone is repeated every 5 to 10 seconds or until the envelope is re-entered, a new altitude is selected, or the tone is inhibited by pressing the INHB pushbutton on either RSP. The ALRT readout on the PFDs turns red until the envelope is re-entered or a new altitude is selected. If the INHB switch is pressed, the ALRT readout changes to a black readout on a white background.

WARNING

Turning off or a failure of the radar altimeter will turn off GCAS audio, altitude alert, and intercept tones.

APU FIRE DETECTION AND WARNING SYSTEM.

A fire in the APU compartment actuates a sensing element loop located in the exhaust eject area resulting in audible and visual indications. Visual warnings are displayed on the pilots' annunciator panel and in the APU fire handles located on the flight engineer's panel and aft of the crew entrance door (figure 1-168). Audible warnings are sounded over the flight station loudspeaker and through the pilot's, copilot's, flight engineer's and jump seat's headsets. The audible fire alarm silence button on the pilots' emergency engine shutdown panel provides a means for silencing the audible fire alarm. It will not silence the bailout alarm which is also activated in the cargo compartment provided any of the doors in the door warning circuit are unlocked.

APU FIRE EXTINGUISHING SYSTEM.

A high-rate-discharge extinguishing system is provided and uses dibromodifluoromethane as the extinguishing agent. The single agent container is located in the forward part of the left-hand wheel well. The agent container provides a single discharge into the ejector exhaust area. The container has fusible relief plugs.

WARNING

The APU fire extinguishing agent can be harmful after prolonged contact. It should be handled with caution.

APU Fire Warning Test Switch.

An APU FIRE WARN TEST switch on the flight engineer's APU control panel permits testing of the fire warning system.

APU Fire Handles.

The fire handles (figure 1-168) on the flight engineer's control panel and in the cargo compartment just aft of the crew entry door are pulled to close the APU intake door, shut off the APU fuel valves and arm the agent discharge switch at the control panel where the fire handle was pulled.

APU Fire Agent Discharge Switches.

Two AGENT DISCH switches provide instant fire extinguishing to the APU compartment. The fire emergency control handle must be pulled at the station where the AGENT DISCH switch is to be used before the discharge switch can fire the agent container squib.

BAILOUT ALARM/WARNING SYSTEM.

One warning horn is installed near the center of the cargo compartment. The horn is manually controlled by a guarded, two-position ("ON", "OFF") BAILOUT ALARM switch located on the pilots' forward overhead panel (figure 1-261). It is automatically controlled by automatic oxygen flow in the troop oxygen system or an APU fire warning if the door warning circuit is activated.

The BAILOUT ALARM switch is wired directly to the battery through a MANUAL BAILOUT HORN circuit breaker. Power is available for the bailout horn circuitry when engines are shut down and no APU or external power is available.

DOOR WARNING SYSTEM.

The door warning circuit system deals with seven doors/entrances: the pressure door, ramp, petal doors, stab access door, troop doors, and crew entrance door. The system consists of limit switches at all of the doors which, when unlocked, complete a circuit causing the individual door warning light in the cargo compartment to illuminate.

The DOOR OPEN light on the annunciator panel and the master CAUTION lights on the pilot's and copilot's instrument panels also illuminate. The door warning circuit is connected to the take-off warning circuit so that the green TAKEOFF light on the main instrument panel will not illuminate if the door warning circuit indicates that a door is open.

Provisions are made to bypass individual warning circuits if a door warning circuit is malfunctioning. This allows the crew to receive a new warning if another door in the door warning circuit becomes unlocked or opens. (For operation of the warning lights for the pressure door, petal doors and ramp, see their description under Cargo Door and Ramp System, this section.) Adjacent to each DOOR NOT LOCKED indicator light is a corresponding two-position ("NORM", "BY PASS") BY PASS switch. Placing the switch to "BY PASS" will cause the DOOR OPEN annunciator light to extinguish. The DOOR NOT LOCKED indicator light for the associated BY PASS switch will remain illuminated.

ENGINE FIRE AND PYLON FIRE/OVERHEAT DETECTION AND WARNING SYSTEM.

Engine Fire Detection System.

The aircraft is equipped with an electrically operated engine fire detection system. Each engine contains four separate pneumatic detectors; two 15-foot detectors mounted on the forward cowl doors, and two 35-foot detectors mounted on the aft cowl doors. These Systron Donner detectors operate on a pneumatic principle. When the helium within the detectors is heated, the pressure is increased. When a preset pressure limit is reached the alarm switch closes. Audible and visual warning devices will then be activated. (See figure 1-262.) The engine fire detection system has no capability of sensing an overheat condition caused by a bleed air leak.

Pylon Fire/Overheat Detection System.

The aircraft is equipped with an electrically operated pylon fire/overheat detection system, which operates in the same manner as the engine fire detection system. One pneumatic detector is located in each pylon, but because of the difference in preset pressure limits and cooling features, the system can differentiate between a fire or an overheat condition caused by a bleed air leak. Only a visual warning will be received once the system has been activated. (See figure 1-262.) If a pylon/fire overheat warning extinguishes 10 seconds after the throttle has been placed to idle, a bleed air leak is indicated.

Master Fire and Overheat Warning Lights.

An engine fire or pylon fire/overheat warning is signalled by the illumination of master fire and overheat warning lights on the pilots' instrument panels, and a light in the fire handle of the affected engine. The engine system indicates an engine fire by means of a steady fire light and an audible warning to the flight station loudspeaker and the pilot's, copilot's, flight engineer's, and jump seat's headsets. The pylon system indicates a pylon fire/overheat by means of a flashing fire light.

Fire Warning Test Switches.

Test switches on the pilots' control pedestal allow testing of the overheat and fire warning functions.

Audible Fire Alarm Silence Button.

A fire alarm silence button is located above the pilots' engine instruments between the number two and three engine fire handles. Pushing the button silences the audible fire warning signal to the flight station loudspeaker and applicable headsets. The audible fire warning is automatically reset for future warnings after the associated steady fire warning light has been extinguished.

ENGINE FIRE EXTINGUISHER SYSTEM.

A high-rate-discharge extinguishing system is provided, using dibromodifluoromethane. Two identical subsystems are installed, one on each wing, each subsystem serving the two engines on its side of the aircraft. Each of these two subsystems provides two discharges to one nacelle, or one discharge to each nacelle. The fire extinguishing agent is piped to the compartment enclosing the combustion-turbine section of the engine, and to the compartment enclosing the fan case-compressors section of the engine. The engine fire extinguishing agent is contained in four spherical containers located in the upper portion of each outboard engine pylon, two to a pylon.

WARNING

The fire extinguishing agent can be harmful after prolonged contact. It should be handled with caution.

Two spherical containers have a dual outlet and by operating the selected discharge head, the agent can be directed to either nacelle. The two containers provide a two-shot discharge capability. A two-way check valve is provided to direct the fire extinguishing agent automatically from either of the two containers in the outboard pylon to the selected nacelle. Discharge is normally accomplished by pulling the desired engine fire handle and pushing the discharge button.

The containers have temperature relief, fusible plugs that will release the agent at 96 to 104° C. A drain line carries the agent overboard from the discharge port. The two containers in each outboard pylon are manifolded together so the two shots of agent can be discharged (NORMAL and/or ALTERNATE). Either shot can go to either nacelle, or both shots can go to one of the nacelles.

Engine Fire Handles.

The four engine fire handles are located just above the pilots' engine instruments. Pulling the fire handle accomplishes the following:

1. Shuts down the engine by electrically actuating the engine fuel control shutoff valve to the closed position and turning off both ignition systems.
2. Opens the generator line contactor of the related generator, and interrupts power to the related voltage regulator, deenergizing the generator.
3. Shuts off the flow of fuel into the nacelle by mechanically closing a cable operated shutoff valve.
4. Shuts off the flow of hydraulic fluid in the supply and pressure lines by electrically actuating the hydraulic shutoff valves.
5. Shuts off all bleed airflow into the nacelle by electrically actuating the bleed air shutoff valve.
6. Electrically closes the doors in the nacelle cooling air ducts exit of Zone II.
7. Exposes the fire extinguisher discharge button.

Fire Bottle Discharge Buttons.

Four PUSH TO DISCHARGE buttons located above each fire handle provide instant fire extinguishing to any engine The buttons are protected by plastic covers, but may, in an emergency, be depressed at any time to discharge the extinguishing agent.

Fire Bottle Select Switches.

Two "NORMAL" - "ALTERNATE", BOTTLE SELECT switches are located between the engine fire handles on the fire emergency shutoff panel. If the container does not discharge or a second discharge is desired in the same nacelle, the switch can be moved from the "NORMAL" to the "ALTERNATE" position. Pushing the exposed button will then discharge the second bottle. The circuit provides maximum reliability for discharge since no single electrical fault or failure can prevent discharge of at least one container.

Fire Bottle Low Pressure Warning Lights.

Warning lights marked "FIRE BOTTLE 1, 2, 3, and 4" are located on the pilots' annunciator panel. When the pressure in the fire extinguisher agent container reaches 225 PSI, the panel light will come on indicating a low-pressure condition.

Fire Bottle Pressure Gauges.

Pressure gauges for each agent container are located on the side of each container, in each outboard pylon. The pressure gauge is the only means to determine if the container is adequately pressurized for operation.

TERRAIN AWARENESS AND WARNING SYSTEM (TAWS).

The Terrain Awareness and Warning System (TAWS) provides the flight crew with warning of impending controlled flight into terrain, approaching obstacles, unsafe flight conditions, and windshear. TAWS achieves this by accepting inputs from various airplane sensor systems, and by applying alerting algorithms and providing aural alert messages and visual annunciations and displays to the flight crew when the boundaries of any alerting envelope are entered. The TAWS computer compares the airplane's present position to a worldwide terrain database. If a conflict exists between the airplane flight path and terrain, the TAWS computer provides aural and visual warnings to the pilots. Aural warnings consist of synthesized voice advisories (e.g., CAUTION TERRAIN, CAUTION TERRAIN) and commands (e.g., TERRAIN, TERRAIN, PULL UP) over the TAWS loudspeaker in the flight deck and the pilot's and copilot's headsets. Visual warnings consist of lighted pushbuttons on the TCAS/TAWS Control and Annunciator Panel (TCAP) and a two-dimensional multicolored graphic of terrain on the multi-function display (MFD). When a warning occurs, the flight crew should take corrective action (such as pull up) immediately. The warning stops only when the unsafe condition no longer exists. Some warning modes can be modified to allow for more aggressive tactically-oriented flight operation. The aural and visual warnings are prioritized as follows:

- Windshear warnings
- Terrain warnings
- TCAS Resolution Advisories.

Terrain Awareness and Warning System Components.

TAWS consists of the Terrain Awareness and Warning computer, two TCAS/TAWS Control and Annunciator Panels (TCAP), two Tactical (TACT) switches/annunciators, a biaxial accelerometer, a TAWS loudspeaker, and a WINDSHEAR INOP indicator, a GPWS INOP indicator, and a TERRAIN INOP indicator on the center pedestal annunciator panel. The weather radar Multi-function Display (MFD) is an associated component.

TERRAIN AWARENESS AND WARNING COMPUTER.

The TAWS computer is located in the center avionics equipment rack under the flight deck. Two connectors on the rear of the computer mate with plugs on the rack mount. The top connector provides the interface to all airplane systems. Power to the computer comes in through the bottom connector. The front panel has three status and test LEDs labeled EXTERNAL FAULT, COMPUTER OK, and COMPUTER FAIL. A hinged door provides access to a self-test switch, a headphone jack, a PCMCIA interface jack, an RS232 TEST CONNECTOR, and four upload/download status indicators. The TAWS computer receives 115 VAC power from Avionics Bus No. 1 through the TAWS circuit breaker on the avionics circuit breaker panel. The computer can tolerate power interruptions up to 200 msec without affecting system operation. Power interruptions exceeding 200 msec initiate a cold start that can take up to 20 seconds to return to normal operation.

The TAWS computer performs the functions of a basic ground proximity warning system. It contains a world-wide terrain database with varying degrees of resolution and a database containing information on most hard-surface runways of 3,500 feet or longer. The TAWS computer also includes a Terrain Clearance Floor feature and a Terrain Look-Ahead Alert feature, and provides a video output for displaying terrain in colors that indicate potential for conflict.

The TAWS computer automatically performs the following functions:

- interfaces with and monitors the airplane sensors and systems necessary to provide the required warnings
- provides appropriate visual warnings on the TCAP, displays terrain on the MFD, and provides audio warnings to the flight crew through the interphone system and TAWS speaker.

Inputs to the TAWS computer come from the radar altimeter, flap position synchro, WOW, Central Air Data Computers (CADCs), both VOR/ILS receivers, Biaxial Accelerometer, Landing Gear, Angle of Attack Vanes, MFD, Automatic Flight Control System (AFCS), Control Display System (CDS), TACT mode switch, Flight Management System (FMS), and the TCAP. By combining these inputs with airplane flight performance data and terrain and obstacle database information stored in memory, the TAWS computer performs the functions necessary to detect impending unsafe flight conditions and warn the flight crew of the danger.

The computer provides visual alerts and warnings by lighting the TAWS indicators on the TCAP and by displaying images of surrounding terrain in varying density dot patterns of green, yellow, and red on the MFD. It produces voice alerts and warnings for unsafe flight condition modes. The voice warning audio is routed to the pilot's and copilot's headsets through the interphone system. The voice warning audio is also routed to the TAWS speaker located overhead on the flight deck.

The TAWS computer continuously monitors its external interfaces. Failures are indicated on the flight deck by lighting the GPWS INOP, TERRAIN INOP, and /or WINDSHEAR INOP indicators on the center pedestal annunciator panel. A red TERR annunciation on the MFD indicates a loss of the terrain display. Depending on the nature of a failure, whether internal to the computer or an external component or system, either the GPWS INOP, TERRAIN INOP, or WINDSHEAR INOP indicator, or all, could come on. The TAWS computer also indicates its status with three LEDs on its front panel. A green LED indicates normal operation, a yellow LED indicates a failure external to the computer, and a red LED indicates an internal failure in the computer. BIT testing does not require any special on-airplane support equipment.

TCAS/TAWS CONTROL AND ANNUNCIATOR PANEL (TCAP).

Two TCAPs are installed on the main instrument panel, one in the pilot's forward line of vision, and one in the copilot's forward line of vision. Each TCAP consists of six blackface switches or lights with text engraved in white on each switch or light segment. From left to right, the switches are:

- RA annunciator (TCAS resolution advisory)
- TER INHB switch
- G/S OVRD switch/indicator
- FLAPS OVRD switch/indicator
- TAWS caution annunciator
- TAWS warning annunciator/TEST switch.

The TER INHB, G/S OVRD, and FLAPS OVRD switch/indicators consist of two separately lighted segments. The top segment of each switch (TER, G/S, and FLAPS respectively) is lighted by the setting of the pilot's or copilot's instrument panel lighting control. The lights in the lower segments remain off until the function is engaged by pressing the associated switch. The lower segments of these switches and the RA, TAWS caution and TAWS warning and TEST switches receive 28 VDC from Main Avionics Bus No. 2 through the TCAP circuit breaker on the avionics circuit breaker panel. The RA light is controlled by the Traffic Collision Avoidance System (TCAS). The RA light comes on at the same time a synthesized voice warns the pilots to climb, descend, or maintain altitude to avoid collision with another aircraft. The RA lamp test is accomplished by pressing the Annunciator & Caution light test switch on the center pedestal.

TACT SWITCH.

The two TACT switches/annunciators are located on the pilot's and copilot's instrument panels. Momentarily pressing either switch sets the TAWS to the tactical mission mode and causes both TACT annunciator lights to turn on. When the Tactical Mode is not selected, the lights in both TACT switches are off. These switches select the tactical mission mode when mission requirements specify en route flight below 800 feet AGL or during cargo drops below 400 feet AGL with gear up. The TAWS can be reset to the normal mode by momentarily pressing either switch again.

BIAXIAL ACCELEROMETER.

A biaxial accelerometer in the center wingbox provides normal acceleration and longitudinal acceleration inputs to the TAWS computer. These inputs are used for windshear calculation.

MULTI-FUNCTION DISPLAY (MFD).

The MFD displays information from the FMS, SKE, TCAS, TAWS, and Weather Radar systems. The TAWS image overlay and the weather radar data cannot be displayed at the same time on the MFD. Button 3L on the MFD selects either the TAWS image, weather radar data, or blank display. TAWS information is displayed on the MFD in the form of an image depicting surrounding terrain in varying density dot patterns of black, blue, green, yellow, and red (see Figure 1-145 and Figure 1-145A). Black represents areas of no significant terrain such as flat desert or plains. Blue represents significant bodies of water. Green represents terrain below the airplane, yellow represents terrain near the airplane altitude, and red represents terrain above the airplane altitude.

TAWS LOUDSPEAKER.

The TAWS loudspeaker is located in the cockpit ceiling between the flight engineer and navigator stations. The TAWS audio warnings go from the computer directly to the loudspeaker. The audio warnings are also sent to the interphone system for distribution to the pilot's and copilot's headsets. An audio warning will always sound from the loudspeaker to alert flight crew if headsets are not being worn.

Alarm Mode	Mode	When Detected	GREEN - ALERT		RED - WARNING	
			Visual	Audio	Visual	Audio
Mode 1	Excessive Sink Rate	All Flight Profiles	TAWS	Sink Rate Sink Rate	TAWS	Pull Up
Mode 2A	Excessive terrain Closure Rate - Flaps Up	Climbout, Cruise, & Initial Approach	TAWS	Terrain Terrain	TAWS	Pull Up
Mode 2B	Excessive terrain Closure Rate - Flaps Down	Approach	TAWS	Terrain Terrain	TAWS	Pull Up
Mode 3	Descent After Take-Off	Takeoff and Go-Around	TAWS	Don't Sink Don't Sink		
Mode 4A	Insufficient Terrain Clearance	Cruise and Approach	TAWS	Too Low Terrain		
Mode 4B	Insufficient Terrain Clearance Incorrect Airplane Configuration	Approach and Landing	TAWS	Too Low Gear or Too Low Flaps		
Mode 4B	Insufficient Terrain Clearance Tactical Mode	Approach and Landing	TAWS TAWS	Too Low Gear or Too Low Flaps		
Mode 4C	Minimum Terrain Clearance After Takeoff	Takeoff and Climb	TAWS	Too Low Terrain		
Mode 5	Descent Below Glide slope	Approach	TAWS	Glide slope		Glide slope (louder)
Mode 6	Descent Below Selected Decision Height	All Flight Profiles		Minimums		
Mode 6	Descent Below Selected Decision Height, Tactical Mode	All Flight Profiles		Altitude		
Mode 6	Smart Altitude Call Outs			500		
Mode 6	Altitude Call Outs	Approach and Landing		300 50 40 30 20 10		
Mode 6	Excessive Bank Angle	All Flight Profiles		Bank Angle (Single)		Bank Angle (Continuous)
Mode 7	Wind shear	Approach and Landing	TAWS	CAUTION WINDSHEAR	TAWS	Siren Wind-shear (3 times)

TAWS CONTROLS AND INDICATORS

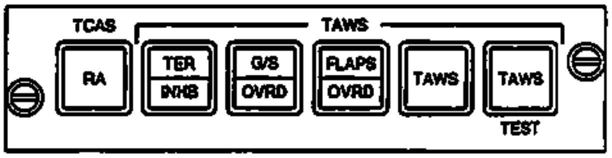


Figure 1-130.

Switch/Indicator	Function
RA indicator	The RA indicator is part of the TCAS system. It provides a visual warning to the pilot and copilot that immediate vertical correction to the flight path is required to avoid a collision with other air traffic.
TER INHB switch/indicator	Press to inhibit alerts for unsafe terrain clearance. When engaged, the INHB segment is visible white or NVIS green indicating that the function has been selected. TERR INHB will be displayed on the MFD indicating that TERRAIN is not displayed.
G/S OVRD switch/indicator	Press to inhibit glide slope warnings. The OVRD segment lights when the airplane enters the warning envelope of descent below glide slope (Mode 5). The indicator is visible white or NVIS green.
FLAPS OVRD switch/indicator	Press to inhibit flaps warnings. This setting is for operations below 245 feet with partial flap settings. The OVRD segment is visible white or NVIS green when the override function is engaged.
TAWS caution indicator	The TAWS caution indicator alerts the pilots of a developing unsafe terrain clearance. The indicator displays visible white or NVIS green.
TAWS warning indicator	The TAWS warning indicator warns the pilots of an unsafe flight path in relation to the ground. The indicator is visible red or NVIS red.
TEST switch	Press to manually initiate the TAWS computer's self-test BIT function when the airplane is on the ground. Pressing the switch for less than two seconds initiates a short test. Pressing the switch for more than two seconds initiates a long test (normally a maintenance function).

Terrain Awareness and Warning System Operation.

The TAWS computer has three states of operation: power-up, flight operations, and test operations.

POWER UP.

The power-up state occurs immediately following application of power to the computer. The TAWS computer uses 115 VAC from Avionics AC bus No. 1. The TCAP and TACT switches get 28 VDC from the Main No. 2 DC Avionics bus. During the power-up state, the computer performs the power-on BIT and recognizes the airplane type and configuration as determined by the program strapping pins. At successful completion of the power-up state, the TAWS automatically advances to the flight operation state.

FLIGHT OPERATION.

During the flight operation state, the TAWS performs warning functions, system monitoring, and continuous BIT. There are two states of flight operation, normal and tactical. In the normal state, the TAWS monitors for conditions that are outside the normal flight mission profile of the airplane. The tactical state is activated by pressing either the pilot's or the copilot's TACT switch. In the tactical state, the TAWS flight parameters are modified to allow for more aggressive, tactically-oriented missions without presenting nuisance warnings. These missions can include low-level tactical operations where the airplane performs terrain-following, assault approaches and drops below 800 feet AGL. These missions require the pilots to respond more quickly to changing conditions as compared to normal missions. From the tactical state, pressing either TACT switch again causes the TAWS to return to the normal state. During the flight operation state, the TAWS provides visual and audio warnings, which include voice commands heard over the TAWS loudspeaker and in the pilot's and copilot's headsets.

The flight operation state consists of nine functions that are further divided into modes and sub-modes. Associated with the modes are aural and visual alerts, cautions, and warnings that indicate that the flight path and configuration could result in the airplane impacting the ground. The alerts, cautions, and warnings are active when the airplane is in a flight state of (1) takeoff and go-around after the airplane has attained a radar altitude of 30 feet and an airspeed of 80 knots, (2) cruise, including climb, descent, and low level tactical operations, and (3) approach, including assault approach. In detecting an unsafe flight condition, the TAWS utilizes a combination of inputs from different airplane systems and parameters such as aircrew response time, airplane performance, attitude, barometric altitude, height above ground, sink rate, airspeed, terrain closure rate, airplane configuration (e.g., gear and flap position), time after takeoff or go-around initiation, barometric altitude rate, and normal or tactical mode selection. The warnings give the aircrew sufficient response time to avoid the unsafe condition.

TAWS Alert/Caution/Warning Message Priorities

Mode/Condition	Aural Message	Activated TCAP Lamp	MFD Display
Mode 7 Windshear Warning	Siren WINDSHEAR, WINDSHEAR, WINDSHEAR	TAWS WARNING	None
Mode 6 Bank Angle	BANK ANGLE	None	No Change
Mode 1 Pull Up	PULL UP	TAWS WARNING	No Change
Mode 2 Preface	TERRAIN, TERRAIN	TAWS CAUTION	No Change
Mode 2 Pull Up	PULL UP	TAWS WARNING	No Change
Terrain Awareness Caution	CAUTION TERRAIN, CAUTION TERRAIN	TAWS CAUTION	180° Terrain Display
Terrain Awareness Warning	PULL UP	TAWS WARNING	180° Terrain Display

Mode/Condition	Aural Message	Activated TCAP Lamp	MFD Display
Obstacle Awareness Preface	OBSTACLE, OBSTACLE	TAWS CAUTION	180° Terrain Display
Obstacle Awareness Pull Up	PULL UP	TAWS WARNING	180° Terrain Display
Mode 2 Terrain	TERRAIN	TAWS CAUTION	No Change
Mode 6 Minimums	MINIMUMS, MINIMUMS/ALTITUDE	None	No Change
Obstacle Awareness Caution	CAUTION OBSTACLE, CAUTION OBSTACLE	TAWS CAUTION	180° Terrain Display
Mode 4 Too Low Terrain	TOO LOW TERRAIN	TAWS CAUTION	No Change
Terrain Clearance Function Too Low Terrain	TOO LOW TERRAIN	TAWS CAUTION	No Change
Altitude Alert Tone	960 Hz Tone	None	No Change
Mode 6 Altitude Callouts	300, 100, 50, 40, 30, 20, 10	None	No Change
Mode 6 Smart Callouts	FIVE HUNDRED	None	No Change
Mode 4 Too Low Gear	TOO LOW GEAR	TAWS CAUTION	No Change
Mode 4 Too Low Flaps	TOO LOW FLAPS	TAWS CAUTION	No Change
Mode 1 Sinkrate	SINKRATE, SINKRATE	TAWS CAUTION	No Change
Mode 3 Don't Sink	DON'T SINK, DON'T SINK	TAWS CAUTION	No Change
Mode 5 Glide slope	GLIDE SLOPE	TAWS CAUTION	No Change
Mode 6 Bank Angle	BANK ANGLE, BANK ANGLE		No Change
Mode 7 Windshear Alert	CAUTION WINDSHEAR	TAWS CAUTION	No Change
Autopilot Disconnect	AUTOPILOT... (5 times)	None	No Change

The computer provides visual warnings to the TCAP indicators and terrain displays to the MFD, and different audio warning voice signals to the airplane interphone system for the different flight condition modes. There are two types of warning announcements: initial and urgent. Initial announcements require prompt but moderate adjustments to the flight controls within three to five seconds to return the airplane to a safe flight condition. Urgent announcements require immediate and aggressive action to initiate a recovery maneuver within one to two seconds, requiring maximum airplane performance to avoid a collision with the terrain. The visual announcements on the TCAP or TACT indicators are shown as a steady or flashing signal. During initial alarm, the alarm lamp will be on steady, and during an urgent alarm the alarm lamp will flash. Visual warnings are also displayed on the MFD in some modes. If the MFD is not in the TERRAIN display mode, the terrain display automatically "pops up" on the MFD to give the pilots immediate visual reference to the terrain hazard warning. The priority of announcements is based on relative urgency, crew response times, and airplane performance. With the possibility of more than one warning occurring at the same time, the highest priority message takes precedence. A higher priority message immediately interrupts any lower priority message. When a message is started, if it is not switch is pressed, the FLAPS OVRD annunciator is illuminated and flap warnings are inhibited. This setting is provided for operations below 245 feet with partial flap settings.

ALT ANNUNCIATOR. The ALT annunciator illuminates yellow whenever the aircraft descends below the decision height setting.

GCAS TACTICAL SWITCH/ANNUNCIATORS.

The two TACT switch/annunciators are located on the pilot's and copilot's instrument panels. These switches are used to select the tactical mission mode whenever requirements specify enroute flight below 800 feet AGL. When in the tactical mission mode, the warning boundaries of two operating mode envelopes are modified to ensure that accurate warnings are provided under these special flight conditions. Momentarily pressing either switch sets the GCAS to the tactical mission mode and the TACT annunciators illuminate. The GCAS can be reset to the normal mode by momentarily pressing either switch again.

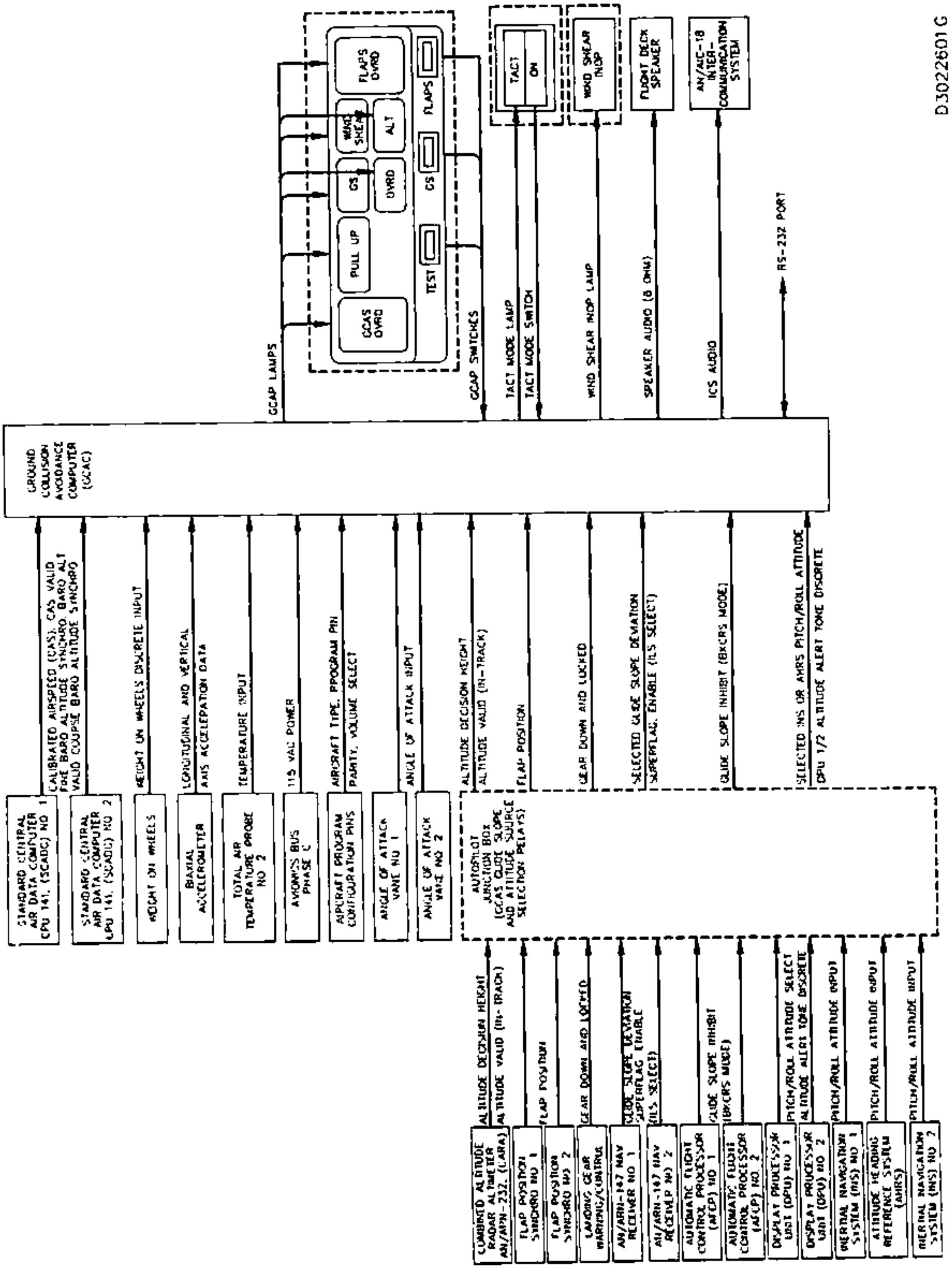


Figure 1-145. GCAS Block Diagram

Summary of System Visual/Aural Alerts and Warnings.

Simultaneous visual alert annunciation and audio alert advisories occur when the outer envelopes of Modes 1 through 5 are penetrated. Warnings are issued upon entering the inner envelopes of Modes 1A, 1B, 2A, and 2B. Modes 3, 4, and 5 issue alert advisories only and are not followed by warnings.

MODE	VISUAL ALERT	AUDIO ALERT	WARNING
MODE 1 Excessive sink rate	PULL UP	SINKRATE	WHOOP WHOOP PULL UP
MODE 2 Excessive terrain closure rate	PULL UP	TERRAIN TERRAIN	WHOOP WHOOP PULL UP
MODE 3 Negative climb rate or altitude loss	PULL UP	DON'T SINK	
MODE 4 Minimum terrain clearance			
Gear up, Flaps up <178 KTS Gear up, Flaps up >178 KTS	PULL UP	TOO LOW GEAR TOO LOW TERRAIN	
Gear down and flaps up <159 KTS Gear down and flaps up >159 KTS	PULL UP	TOO LOW FLAPS TOO LOW TERRAIN	
Gear cycled <159 KTS Gear cycled >159 KTS	PULL UP	TOO LOW GEAR TOO LOW TERRAIN	
Insufficient terrain clearance for airspeed	PULL UP	TOO LOW TERRAIN	
MODE 5 Excessive Descent below glide slope	GS	GLIDE SLOPE (Soft)	GLIDE SLOPE (Loud)
MODE 6			
Descent below set minimum height	ALT	MINIMUMS - MINIMUMS	
Descent below set minimum height tactical mission mode	ALT	ALTITUDE - ALTITUDE	
Descent below set minimum altitude - altitude callouts		500, 300, and 50 feet	
MODE 7 Wind shear	Wind Shear		(SIREN) WIND SHEAR - WIND SHEAR - WIND SHEAR -
MODE 8 Excessive bank angle		BANK ANGLE (Single)	BANK ANGLE (Continuous)
Autopilot Interface - Autopilot Off		AUTOPILOT (five times)	

Message Priorities.

With the possibility of more than one warning occurring at the same time, the highest priority message takes precedence. A higher priority message will immediately interrupt any lower priority message. If not overridden by a higher priority message, once a message starts it is completed, even if the warning/alert ceases during the message. The various messages, their priorities and associated modes are as follows:

PRIORITY	MESSAGE	MODE
1	(SIREN) - WIND SHEAR - WIND SHEAR - WIND SHEAR	7
1	BANK ANGLE (Single)	8
2	WHOOP WHOOP - PULL UP	1A, 1B, 2A, and 2B
3	Altitude Callouts (500, 300, and 50 feet)	6C
4	TERRAIN - TERRAIN	2A and 2B
5	MINIMUMS - MINIMUMS	6A
6	ALTITUDE - ALTITUDE	6B
7	TOO LOW TERRAIN	4A, 4B, and 4C
8	TOO LOW GEAR	4A and 4B
9	TOO LOW FLAPS	4B
10	SINK RATE	1A and 1B
11	DON'T SINK	3
12	GLIDE SLOPE	5
13	BANK ANGLE (Continuous)	8
14	AUTOPILOT	

GCAS Operational Limitations.

The GCAS is operationally limited under the following conditions.

BELOW 30 FEET AGL.

In order to avoid nuisance warning/alert signals caused by ground effect induced static pressure, all modes, except Mode 8, are inactive below 30 feet AGL.

ABOVE 2450 FEET AGL.

This cutoff eliminates possible nuisance warnings/alerts for Modes 1 through 7 at enroute altitudes.

WARNING

- When there is no preceding rising terrain, the GCAS will not warn of an approach to a sheer cliff.
- When the aircraft is in normal landing configuration and descending at normal sink rate, the GCAS will not warn of an approach to terrain where there is no runway.

GCAS Operating Procedures.

The GCAS is operational whenever the essential AC and DC buses are powered and the radar altimeter is turned ON.

WARNING

Turning off or a failure of the radar altimeter will turn off GCAS audio, altitude alert, and intercept tones.

GCAS Built-In-Test.

Three Built-in-Tests (BITs) reside in the GCAS. They are Power-up BIT, Continuous BIT, and Initiated BIT. Power-up BIT activates when power is applied and has a cold start and warm start mode. A cold start is initiated when power is applied after a power loss of greater than one second. A warm start is initiated when power loss is less than one second. Continuous BIT runs continuously and is transparent to the crew. An Initiated BIT may have up to four levels.

Pressing the GCAP TEST switch activates the Initiated BIT. Normally, Level 1 system status is the only level the crew needs to check. Level 2 is maintenance information. Level 3 is flight history. Level 4 is configuration information. Levels 3 and 4 are only accessible on the ground.

To accexx the next level, press and momentarily hold the GCAP TEST switch within 5 seconds after the "BEEP".

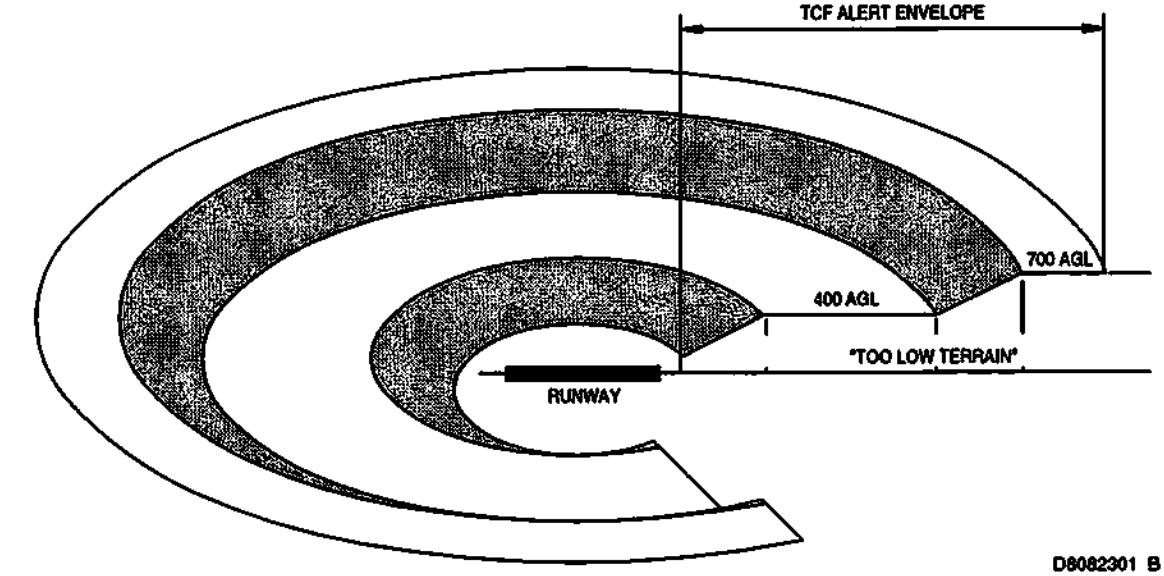


Figure 1-144. Operating Envelope For Terrain Clearance Floor (TCF) Alerts

LOW ALTITUDE

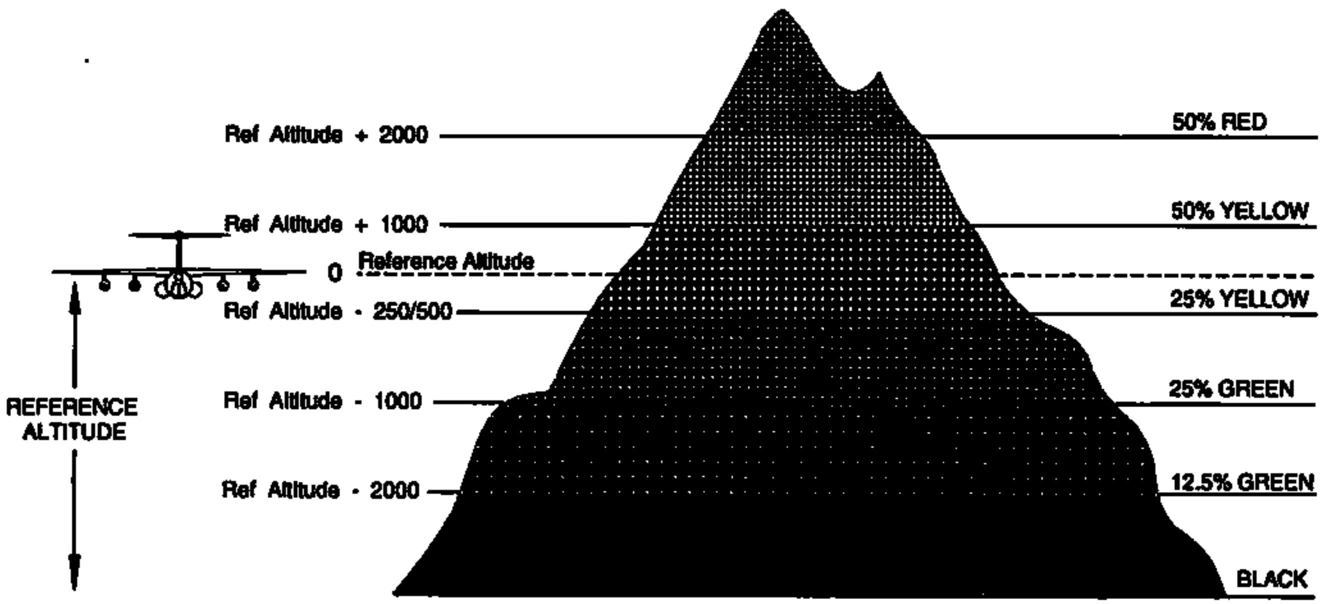
The TAWS terrain awareness alerting and display functions use aircraft geographic position, aircraft altitude, and a terrain database to predict potential conflicts between the airplane flight path and the terrain, and to provide graphic displays of the conflicting terrain. The terrain awareness alerting algorithms continuously compute terrain clearance envelopes ahead of the airplane. If the boundaries of these envelopes conflict with terrain elevation data in the terrain database, then alerts are issued. Two envelopes are computed, one corresponding to a terrain caution alert level and the other to a terrain warning alert level. The caution and warning envelopes use the terrain clearance floor as a baseline, and "look ahead" of the aircraft in a volume that is calculated as a function of airspeed and flight path angle.

Airplane latitude, longitude, ground track, and ground speed, provided by the FMS, are used by the TAWS computer for the terrain awareness function. Aircraft altitude is computed from pressure altitude and static air temperature inputs received from the Standard Central Air Data Computer (SCADC). The TAWS computer also receives radio altitude from the radar altimeter, and airplane heading and attitude data from the INS. Discrete control inputs from the TERR INHB and TACT switches, when selected, disable the aural alerts and MFD "pop-up" terrain display feature.

Terrain processing within the TAWS computer extracts and formats local topographic data and terrain features from databases and creates matrix overlays for use by the terrain threat detection and display processing functions. The terrain overlays are positioned with respect to airplane position. Each matrix element contains the highest terrain altitude with respect to mean sea level. The TAWS computer database also contains obstacle data. Obstacles are displayed on the MFD using the same color features as terrain hazards and cause visual indication of warning and caution alerts like terrain.

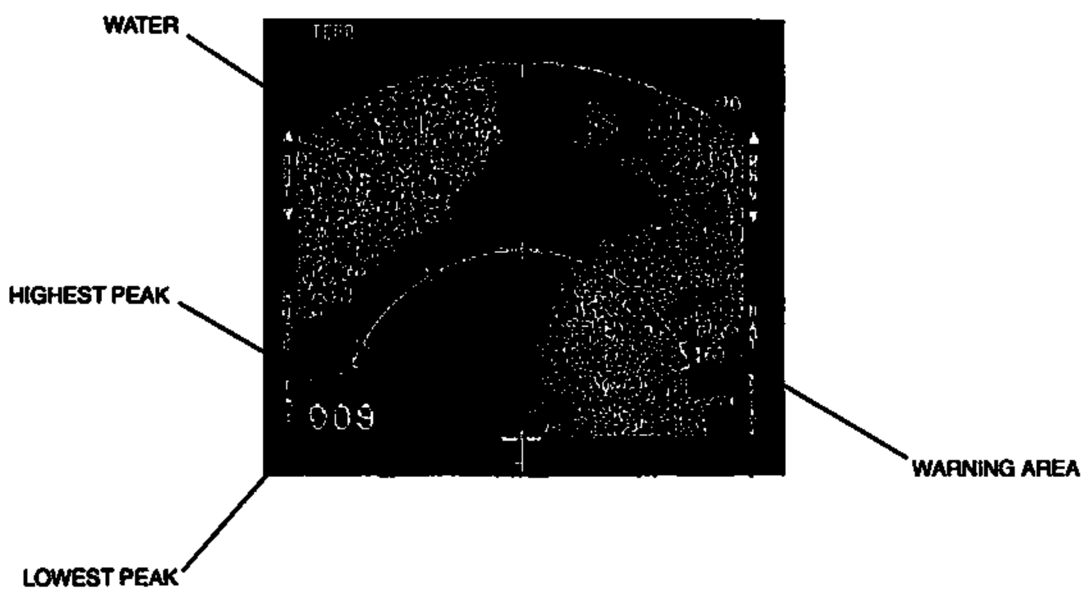
Terrain threat detection and display processing in the TAWS computer performs threat analysis on the terrain and obstacle data within computed caution and warning envelope boundaries below and forward of the airplane path. Results of these threat assessments are combined with background terrain data and data for the nearest runway and is formatted into a terrain display image. In the event of terrain caution or warning conditions, a specific audio alert is triggered and the terrain display image is enhanced to highlight each of the types of terrain threats.

The terrain caution envelope (yellow alert envelope) boundary is determined from the caution altitude floor and the caution look ahead distance. The caution altitude floor is computed as a function of airplane altitude with respect to nearest runway altitude and range to the nearest runway threshold position. This parameter represents a distance below the airplane. The relationship to the nearest runway threshold location prevents undesired alerts when the airplane is taking off or landing at an airport. The caution look ahead distance is computed from airplane ground speed and turn rate to provide an advanced warn-



Terrain not shown if more than 2000 feet below reference altitude and/or within 400 feet of the runway elevation nearest the aircraft.

D8006501



D8077801

Figure 1-145. Low Altitude - Terrain Awareness Display (Typical) ing with adequate time for the aircrew to react safely. Depending on the situation, this distance roughly corresponds to between 40 and 60 seconds of advance alerting.

The terrain warning envelope (red alert envelope) boundary is determined from the warning altitude floor and the warning look ahead distance. The warning altitude floor is set to a fraction of the caution altitude floor. It is computed as a function of airplane altitude with respect to nearest runway altitude and range to the nearest runway threshold position. This parameter represents a distance below the airplane. The relationship to the nearest runway threshold location prevents undesired alerts when the airplane is taking off or landing at an airport. The warning look ahead distance is a fraction of the caution look ahead distance (computed from airplane ground speed and turn rate) to provide an advanced warning with adequate time for the crew to react safely.

The terrain and obstacle alerting and display function maintains a background display of local terrain forward of the airplane. Background terrain is depicted as variable density dot patterns in green, yellow, or red. The density and color represent how close the terrain or obstacle is relative to airplane altitude. Terrain and obstacles that trigger a caution or warning condition are displayed as solid yellow or solid red respectively.

The pilot's MFD has provision to manually select either the weather radar display or the terrain display. However, when conditions for a terrain caution or a terrain warning are detected, the TAWS computer sends a data word to the MFD that instructs it to select the terrain display.

Sophisticated look ahead algorithms generate both caution and warning alerts if terrain conflicts are projected forward of the aircraft. The caution alert is given typically 60 seconds ahead of a conflict. A warning is given typically 30 seconds ahead of a conflict. Actual caution and warning look ahead distances are computed from ground speed and predicted flight path.

If the airplane penetrates the caution envelope boundary, the aural message "CAUTION TERRAIN, CAUTION TERRAIN" is sounded, and NVIS green TAWS illuminates on both TCAPs. Simultaneously, the terrain display will pop up if not already selected and depict, in yellow, the conflicting terrain. If the airplane penetrates the warning envelope boundary, the aural message "TERRAIN TERRAIN, PULL UP" is sounded, NVIS red TAWS illuminates on the TCAPs, and conflicting terrain is displayed in solid red color on the MFD.

HIGH ALTITUDE

The Peaks Function allows terrain below the aircraft to be viewed on the MFD during cruise. At altitudes safely above all terrain for the display range chosen, the terrain is displayed independent of aircraft altitude emphasizing the highest and lowest elevations to provide increased situational awareness. This increased awareness can be particularly valuable in the event of an unplanned descent or off-route deviation and for the purpose of previewing terrain prior to descent.

The standard terrain display uses colors and shading patterns corresponding to the vertical displacement between terrain elevation and the current altitude of the aircraft. The Peaks Function Display adds additional density patterns and level thresholds based on terrain elevations relative to the range and distribution of terrain in the display area. The Peaks Function display is thus a "merged" display applicable to all phases of flight.

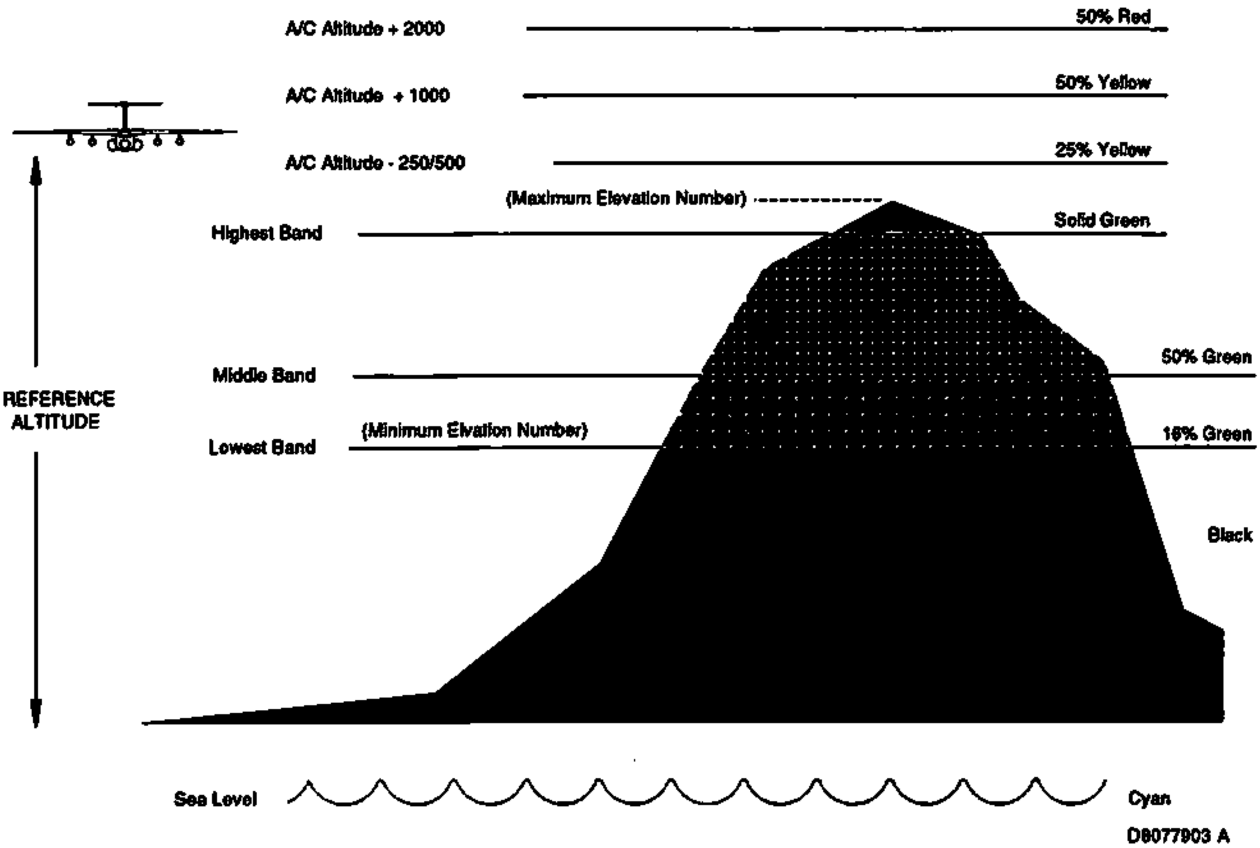
Peaks Function displays two elevation numbers indicating the highest and lowest terrain currently being displayed overlaid on the display. The elevation numbers indicate terrain in hundreds of feet above sea level (MSL). The terrain elevation numbers are displayed with the "highest" terrain number on top, and the "lowest" terrain number beneath it. The "highest" terrain number is shown in the same color as the highest terrain color pattern on the display, and the "lowest" terrain number is shown in the color of the lowest terrain color pattern shown on the display. A single elevation number is displayed when the screen is all black or blue as a result of flying over water or relatively flat terrain where there is no appreciable difference in terrain elevations. The elevation numbers on the display are an additional indication that the terrain display is selected.

The background color dot patterns and terrain elevation threshold values are shown in the table below.

Color	Terrain Elevation
Solid Red	Terrain Threat Area - Warning
Solid Yellow	Terrain Threat Area - Caution
50% Red Dots	Terrain that is more than 2000 feet above aircraft altitude
50% Yellow Dots	Terrain that is between 1000 and 2000 feet above aircraft altitude
25% Yellow Dots	Terrain that is 500 (250 with gear down) feet below to 1000 feet above aircraft altitude
Solid Green	Shown only when no Red or Yellow terrain areas are within range on the display. Highest terrain not within 500 (250 with gear down) feet of aircraft altitude.
50% Green Dots	Terrain that is 500 (250 with gear down) feet below to 1000 feet below aircraft altitude. OR Terrain that is the middle elevation band when there are no Red or Yellow terrain areas within range on the display.
16% Green Dots	Terrain that is 1000 to 2000 feet below aircraft altitude. OR Terrain that is the lower elevation band when there are no Red or Yellow terrain areas within range on the display.
Black	No significant terrain.
16% Cyan	Terrain Elevation equal to 0 feet MSL
Magenta Dots	Unknown terrain.

The Peaks Function display adds a solid green level to indicate the highest non-threatening terrain. The existing lower density green display patterns indicate mid and upper terrain in the display area as well as terrain that is within 2000 feet below the aircraft. The red and yellow dot patterns indicate terrain that is near or above the current altitude of the aircraft. Solid yellow and red colors indicate alert and warning areas relative to the flight path of the aircraft. Terrain identified as water (0 Ft MSL) is displayed as cyan color dot patterns. The Peaks Function display is prioritized such that higher level colors and densities override lower color and densities for maximum situational awareness of the most significant terrain relative to the altitude and flight path of the aircraft.

Peaks Function is enabled via a Program Pin during aircraft installation of TAWS. Pilot selection between "standard" and "Peaks Function" is not available.



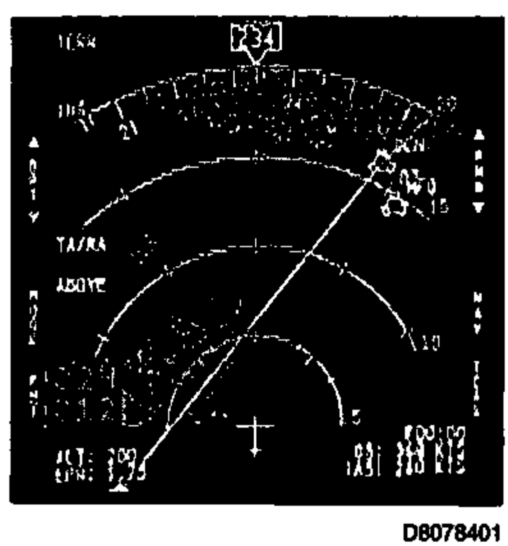


Figure 145A. High Altitude Terrain Display

EXTERNAL ALERTS.

There are two externally triggered alerts, autopilot disconnect and a 906 Hz altitude alert tone. The voice message "AUTOPILOT" is sounded five times over the TAWS speaker, separated by 0.75 second pauses when the AP1 or AP2 discrete disconnect lines indicate an autopilot disconnect condition. A 906 Hz tone is sounded for two seconds on the TAWS speaker when the altitude alert discrete signal is received from the Display Processor Units (DPUs) in the CDS.

TEST OPERATIONS.

The TAWS provides system performance monitoring and built-in test (BIT). In the event of a failure, the TAWS will prevent false warnings and use other inputs to continue functioning; i.e., other sensors to indicate a degraded mode of operation. The TAWS BITs are power-on, continuous, and push-to-test/maintenance BIT.

Power-on BIT is performed on the TAWS components every time that power is applied to the system, providing that power has been removed for greater than one second. An abbreviated power-on BIT is executed when power has been removed for less than one second. The full power-on BIT takes approximately 20 seconds and the abbreviated BIT takes 2 seconds. Upon completion of the power-on BIT, the TAWS automatically enters the flight operation state.

Continuous BIT is automatically performed as a background function of the TAWS. The test consists of a series of tests to check that the hardware and software are operating correctly. The continuous BIT does not interfere with the normal operation of the warning functions for more than five msec. If the BIT detects a critical fault, the crew will be informed by the GPWS INOP, WINDSHEAR INOP, and TERRAIN INOP indicators coming on.

Push-to-test/maintenance BIT is initiated from the TCAP panel by pressing the TEST switch. The push-to-test/maintenance BIT is divided into six levels of information. The six levels of information may be voice annunciated by pressing the TAWS TEST switch at the correct times. The press-to-test function will only operate while the aircraft is on the ground.

Level 1.	System Status Short Long (add all voices)
Level 2.	Current Faults
Level 3.	Configuration Information
Level 4.	Flight History Information
Level 5.	Warning History
Level 6.	Discrete Input Test

LEVEL 1 - SYSTEM STATUS. The present status information can be obtained by momentarily pressing either TAWS TEST switch. This action starts a short sequence of tests that will not destroy data. Level 1 long test and levels 2 through 6 are for maintenance use. Refer to appropriate maintenance manuals for additional information.

LANDING GEAR WARNING SYSTEMS.

See Landing Gear System, this section, for the description of landing gear warning systems and their operation.

MASTER CAUTION SYSTEM.

A master caution system provides a centrally located means for monitoring caution and warning indicators in the pilots' flight stations (see figure 1-261). The system is so designed that both pilots are warned simultaneously, and it consists of two master caution lights and an annunciator panel having word warning lights.

A malfunction signal from monitored systems will cause the pilot's and copilot's caution lights and the appropriate annunciator light to illuminate. If the condition that caused the signal is corrected, both caution lights and the annunciator light will extinguish, and the master caution lights will again monitor all the systems.

The master caution and annunciator light system provides indication of which is the latest malfunction signal to be received, if a second malfunction occurs after a first malfunction has been indicated. The first malfunction signal causes the master caution lights to illuminate and the appropriate annunciator light to flash. When the malfunction has been noted by the crew, the flashing indication may be changed to steady illumination by depressing either of the master caution lights to reset the system. This also extinguishes the master caution lights. The annunciator light remains illuminated until the indicated condition has been corrected. If a second malfunction is indicated, the master caution lights illuminate and the applicable annunciator lights flash.

Annunciator and Caution Lights Test Switches.

An ANNUNCIATOR & CAUTION LIGHT TEST switch is located at the top right of the pilot's throttle quadrant and a CAUTION LIGHT test switch is on the flight engineer's electrical control panel.

Placing the ANNUNCIATOR & CAUTION LIGHT TEST switch to "TEST" causes the annunciator lights on the annunciator panel to flash and the caution lights, the annunciator lights on the main instrument panel, the control pedestal, the side consoles, and the overhead panel to illuminate.

Placing the engineer's caution light switch to TEST causes the caution lights, except the APU start light on the engineer's panel, to illuminate. This switch also tests the navigator's ADS PANEL LIGHTS.

Caution Lights Dimming Switch.

A two-position ("BRIGHT," "DIM") CAUTION lights dimming switch on the copilot's side of the aft overhead panel permits dimming of the caution lights. The pilot's and copilot's instrument panel lights must be on before the lights will dim. The "DIM" position of the switch is ineffective if the THUNDERSTORM switch is "ON".

MAXIMUM SPEED WARNING SYSTEM.

A speed warning circuit is provided that sends an audible warning signal to each pilot, the jump seat, flight engineer, and to the flight station loudspeaker whenever the allowable maximum speed is being exceeded. The warning circuit is composed of the No. 1 and No. 2 CADCs, a speed warning generator, a speed warning relay, and amplifiers; one each for the pilot, copilot, jump seat, and flight engineer. The flight station loudspeaker is connected to the pilot's amplifier. The No. 1 and No. 2 CADCs are interconnected so that a signal from either one or both will activate the warning system. When the aircraft exceeds a predetermined maximum airspeed or Mach number, a signal is sent to the maximum speed audible warning generator, and the output is sent to the four amplifiers. It will cease when the maximum speed is reduced. The signal level is set so that conversation can be carried on through the interphone system.

MISSILE WARNING SYSTEMS.

See Defensive Systems, this section, for the description of missile warning systems and their operation.

SMOKE DETECTOR SYSTEM.

The smoke detector system in the aircraft consists of six detector devices, an amplifier, a test selector switch, and warning lights. Five detectors are mounted in different areas of the, cargo compartment. A sixth is mounted under the flight deck just aft of the left-hand avionics rack. The detectors are composed of a light and a photocell which sends a signal to an amplifier. The amplifier then sends a signal to the annunciator panel, to the master CAUTION lights on the pilots' instrument panels, and to the CARGO SMOKE light on the flight engineer's panel.

Smoke Detector Warning Lights and Test Switch.

Two CARGO SMOKE lights, one on the pilot's annunciator panel and one on the flight engineer's panel, and the master CAUTION lights on the pilots' instrument panels, illuminate either by the presence of smoke or by the actuation of the 7-position rotary SMOKE DETECT TEST switch on the flight engineer's panel. This rotary test switch has "NORM", "1", "2', "3", "4", "5", and "6" positions, and when turned to any numbered position, illuminates the CARGO SMOKE and master CAUTION lights.

STALL WARNING SYSTEM.

See Automatic Flight Control System.

TAKE-OFF WARNING SYSTEM.

A take-off warning system monitors various systems in the aircraft to assure that they are in the normal condition prior to takeoff. TAKEOFF annunciates in green in the lower right corner of both PFDs, when the following conditions have been satisfied:

- The isolated AC avionics bus is powered.
- The isolated AC bus is powered.

- The main DC bus No. 1 is powered.
- The main DC bus No. 2 is powered.
- The isolated DC bus is powered.
- The spoilers are closed and locked.
- All thrust reversers are closed and locked.
- The flaps are in the TAKE OFF/APPROACH position.
- The autopilot is off.
- All doors in door warning circuit are closed and locked.
- The spoiler lever is ARMED.
- The button on one of the hydraulic pitch trim levers is depressed and released.

The take-off warning circuit is wired to prevent the annunciator from coming on in the air.

NOTE

See Section III, Part II for take-off warning annunciation malfunctions.

UNDER SPOILER SPEED WARNING SYSTEM.

See Wing Spoiler System, this section, for description of the under spoiler speed warning system.

EMERGENCY EQUIPMENT.

AIRCREW EYE AND RESPIRATORY PROTECTION SYSTEM (AERP).

Seven blower mounting brackets and electrical connections are installed at the following locations: one on the pilot's side console, one on the copilot's side console, one on the engineer's table, two on navigator's table, one on the left side wall, forward fuselage and one on the left side of the fuselage forward of the left troop door. The aircrew member will install their blower in the mount provided and make the electrical connection with the connector adjacent to the bracket (figure 1-263). There are two circuit breakers on the flight deck. One is for the flight station and one is for the cargo compartment. The flight engineer shall ensure that the circuit breakers are closed when use of the system is anticipated.

CRASH AXE.

One crash axe is provided on the bulkhead behind the inboard auxiliary crew seat in the flight compartment.

EMERGENCY ESCAPE BREATHING DEVICE (EEBD).

Four emergency escape breathing devices (EEBD) are installed at the following locations: one in the crew latrine, one on the left and right side wall, forward fuselage, and one on the right side of fuselage aft of the troop door (figure 3-4). This device is a 15-minute, self-contained, completely disposable breathing unit, with a solid state oxygen supply source. The universal size hood permits oral communication without compromising protection. Preflight consists of checking the color of the light blue litmus paper through the serviceability window in the side of the case. If the litmus paper has turned pink, the unit is no longer serviceable. Maximum operating altitude is 41,000 feet. The containers are not to be opened unless oxygen deficient, smoke-laden, or toxic atmospheres exist.

EMERGENCY PASSENGER OXYGEN SYSTEM (EPOS).

The emergency passenger oxygen system (EPOS) is a vacuum-sealed, self-contained protective device typically used by passengers or troops in emergencies. It is disposable and can provide oxygen during aircraft decompression, when smoke or toxic fumes are present, and to aid in exiting oxygen deficient smoke filled cabins. The unit's maximum operating altitude is 41,000 feet and it can be donned in less than 15 seconds. An EPOS unit contains five major components: a heat and flame resistant hood, an oxygen cylinder containing 18 liters of gaseous oxygen, a carbon dioxide controller, a neck seal, and a storage pouch.

Operation of an EPOS unit is similar to the description of an EEBD above. The major difference is that an EPOS unit contains a limited amount of oxygen vs. an EEBD that generates oxygen. The EPOS will remove excess CO_2 and moisture from exhaled air allowing oxygen in the hood to be rebreathed. EPOS unit duration is dependent on user body weight and workload and is approximately 5 minutes under a heavy workload, 20 minutes under a light to moderate workload, and up to 60 minutes while sitting.

ESCAPE LADDERS.

A stationary metal escape ladder is provided near the No. 1 hatch in the flight station. A rope escape ladder can be installed near each of the three cargo compartment overhead hatches. "T" shaped release handles provide a means of mechanically releasing the rope ladders (figure 3-4).

ESCAPE ROPES.

An escape rope is located near each of the side emergency exits and at each overhead escape hatch (figure 3-4).

FIRE EXTINGUISHERS.

Six Halon 1211 hand fire extinguishers are provided. One extinguisher is located in the flight station under the inboard auxiliary crew seat. Five are located in the cargo compartment: Two immediately forward of the left-hand troop door, one approximately midway down the cargo compartment on the right side, and two aft of the crew entrance door (figure 3-4).

A trigger handle located at the top of the extinguisher permits it to be operated with one hand. The extinguisher is charged with bromochlorodifluoromethane and dry nitrogen. Position the extinguisher vertically and about 8 feet from the fire.

Remove the pull-ring pin. Aim the nozzle at the base of the fire. Squeeze the lever and sweep the agent across the base of the fire.

WARNING

Although Halon 1211 vapor has a low toxicity, its decomposition products can be hazardous. On decomposition, Halon 1211 has a characteristic sharp, acrid odor, even in concentrations of only a few parts per million. The odor provides a built-in warning system for those who are in the hazard area during and following a fire. Leave and/or ventilate the area after fighting a fire.

NOTE

Halon 1211 extinguishers have their greatest effectiveness on class B and class C fires. Extinguishers with a capacity of less than 9 pounds are not rated for use on class A fires; however, they have shown to be effective in extinguishing surface class A fires.

FIREFIGHTERS SMOKE MASKS.

Normally two smoke masks are installed in the aircraft, one in the crew latrine and one aft of the right troop door.

NOTE

- The firefighters smoke mask is limited to 35,000 foot maximum cabin altitude operations when connected to a crew diluter demand regulator.

- The firefighters smoke mask is limited to 40,000 foot maximum cabin altitude operations when connected to a portable oxygen bottle.

FIRST AID KITS.

Provisions are provided for the stowage of 26 first aid kits. Two first aid kits are normally installed on the flight station between the flight station door and the outboard auxiliary crew seat, two immediately aft of the crew entrance door and one immediately aft of each troop door. Twenty additional first aid kits can be installed in the cargo compartment, five each immediately aft of each side emergency exit.

LIFE RAFT PROVISIONS.

The aircraft has provisions for stowing a number of 20-man life rafts. Two rafts may be stowed in wing fillet compartments, one on each side of the fuselage. A raft may be stowed in straps adjacent to No. 2 and No. 4 overhead hatches. One raft may be stowed in each of two side-by-side overhead containers above the ramp.

Life Raft Release Handles.

"T"-shaped life raft release handles located near the ramp hinge allow release of the life rafts and survival kits stowed in the aft cargo overhead containers. When released, the life rafts and survival kits are lowered to the floor by a friction device on a tether rope. The life raft release handles must be rotated 90° before they can be pulled.

The life rafts and survival kits stowed adjacent to the overhead hatches have quick-release fasteners. The life rafts and survival kits are tethered to prevent their falling to the floor and to permit their removal through the respective hatches.

Wing Life Raft Release Handles.

"T"-shaped life raft handles are provided near the No. 1 hatch, the No. 3 hatch and the right troop door to release the wing life rafts. The handles are placarded LIFERAFT LEFT SIDE and LIFERAFT RIGHT SIDE. The handles unlatch the related life raft compartment door and discharge the related carbon dioxide bottle, inflating the life raft and forcing it out of its compartment as it inflates. When operating life raft release handles, ensure that they are pulled to their fullest extent (approximately 10 inches) as it may be possible to release the compartment latches and not discharge the carbon dioxide bottle if the cables are not fully extended.

LIFE VEST STOWAGE PROVISIONS.

Pouches are provided on the backs of the pilot's, copilot's seats, and on the back of the auxiliary seats to stow the crew's life vests. The life vests for the bunk seats are stowed in the right-hand open compartment (above reading file shelves).

OXYGEN MASK PROVISIONS.

There are nine permanently installed quick donning oxygen masks installed in the crew compartment. They are installed for the pilot, copilot, jump seat, navigator, engineer, outboard and inboard auxiliary crew seat and two above the lower crew bunk.

TROOP OXYGEN MASKS.

The troop oxygen system is adaptable to service the three seating configurations. Masks may be installed and left connected at each position. Oxygen is supplied to the mask through a plastic tube which is connected to the system supply. The masks are not to be opened unless an in-flight emergency occurs.

MISCELLANEOUS EQUIPMENT.

BLACKOUT CURTAINS.

Blackout curtains are installed behind the pilots' seats to prevent flight station lighting from interfacing with pilots' vision. The curtains are on a sliding track in the ceiling of the flight station. They may be pulled to the side of the compartment and tied in place when not being used. Blackout curtains are also installed in tracks around the crew bunks to provide darkened sleeping areas for the crew.

CHECKLIST HOLDERS.

An integrally lighted, rheostat controlled, scroll checklist holder is provided for the copilot and flight engineer. The copilot's scroll checklist holder is attached to the center glareshield, and the flight engineer's scroll checklist holder is attached to the left-hand side of the flight engineer's instrument panel.

COMFORT PALLETS.

Provisions are made for the installation of an Air Transportable Galley/Lavatory (ATGL) (figure 1-264) or a C-5 or C-141 Comfort Pallet in the forward section of the cargo compartment. The ATGL and comfort pallets each provide two additional lavatories with waste storage tanks, a galley section with ovens, refrigeration units, and provisions for making hot water and coffee, and a potable water storage unit. Electrical connections are located on the right forward cargo compartment to provide the ATGL and comfort pallets with a source of electrical power. An access door located just above the floor allows for the draining and servicing of these comfort pallets without the need to remove them from the aircraft.

CREW BUNK.

A double bunk is provided in the flight compartment.

CREW ENTRANCE DOOR.

The crew entrance door is the forward entrance door on the left side of the fuselage and opens inboard and upward in tracks with a spring-activated counterbalance. When closed, four bayonet latches lock the door against a rubber seal installed around the perimeter of the door. A flush-mounted outside handle and a protruding inside handle, when rotated, lock or unlock the door. A switch in the upper aft bayonet latch is connected to two warning lights, with one light mounted on the annunciator panel and the other installed just aft of the crew door. If the switch is not depressed, the warning lights illuminate indicating that the crew door is open or unlatched. A bypass switch is installed beside the warning light near the crew door to remove the switch from the door warning system.

GALLEY EQUIPMENT.

The flight crew galley is located on the forward cargo compartment bulkhead near the crew entrance door.

Galley Operating Controls.

Galley operating controls consist of switches, indicator lights, and timers located on the galley control panel. The MAIN POWER SWITCH is a two-position ("ON", "OFF") switch that controls all power to the galley circuits. When the switch is set to "ON", an indicator lamp on the panel illuminates. The food warming timer is a rotary timing switch that may be set to a maximum of 30 minutes. When the timer has been set, an indicator light illuminates to indicate the timer is in operation. A two-position ("ON", "OFF") switch supplies power to the hot beverage unit. Galley work area lighting is controlled by a two-position ("ON", "OFF") switch on the panel.

INSTRUMENTS.

These paragraphs cover only instruments which are not part of a complete system, and include pitot-static operated instruments, electrically operated instruments, and self-powered instruments.

Navigator's Altimeter.

The navigator's altimeter indicator, located on the navigator's console, is a standard barometric altimeter and operates on static pressure from the lower right and upper left pitot static tubes. (See figure 1-268.)

Flight Engineer's Altimeter.

The flight engineer's altimeter is located on the flight engineer's upper instrument panel and is the same type as the navigator's. (See figure 1-268.)

Navigator's True Airspeed Indicator.

The navigator's true airspeed indicator is a remotely operated indicator located in the center of the navigator's instrument panel. The indicator receives signals from either the No. 1 or No. 2 SCADC as selected by the CADC switch. (See figure 1-267.)

Accelerometer.

A standard accelerometer is located on the left side of the pilot's instrument panel. The accelerometer is designed to monitor inflight parameters only and is not to be used for hard landing determinations. (See figure 1-265.)

Clocks.

Standard 8-day clocks are provided on the left and right sides of the pilots' instrument panels and on the flight engineer's panel.

Magnetic Compass.

A magnetic standby compass is located at the top of the center of the windshield. (See figure 1-266.)

Total Air Temperature Indicator.

One total air tempature indicator is installed on the top center portion of the flight engineer's panel. There is one dual total air temperature probe on each side of the forward fuselage beneath the pilot's windows. Each probe contains two sensing elements. Probe No. 1 uses both sensors, one for the pilot's SCADC and one for the flight engineer's total temperature gauge. Probe No. 2 is for No. 2 SCADC and the ground collision avoidance computer. The indicator incorporates a power-off warning flag on the indicator face. (See figure 1-275.)

LAVATORY FACILITIES.

Lavatory facilities consist of an electrically operated flushing toilet located in the cargo compartment forward of the flight station bulkhead, a wash basin and an electric razor outlet. A pushbutton for flushing the toilet is located on the wall behind the toilet below the electric razor plug-in receptacle. The wash water for the sink is gravity fed through a pushbutton on the faucet.

LETDOWN CHART HOLDER.

Two integrally lighted, rheostat controlled, letdown chart holders are installed under the lower left and right-hand sides of the pilots' glare shields. The holders can be pivoted to a stowed position when not in use.

PERSONNEL PROTECTIVE ARMOR.

Armor kits are designed to provide a limited amount of protection from small caliber weapons and shrapnel to the crew and some vital aircraft components. The C-141 aircraft can be configured to provide a limited amount of personnel protection with the installation of an armor kit. There are a number of armor kits available ranging from bolt-together steel linings to velcro attached armor plating and/or kelvar layered padding. The kits typically provide protection to the crew and troop lox converters, flight station floor and side walls. Shielding is also provided for the loadmaster's seat and the left and right troop doors when the need to scan for defensive systems use is anticipated.

NOTE

> The weight of armor kits is typically concentrated toward the front in the aircraft. This weight and moment shift will have an effect on the aircraft's center of gravity. The specific weight and moment of the armor kit that is installed must be taken into consideration when completing the DD Form 365-4.

PERSONNEL WARNING SIGNS.

Three brackets containing electrical disconnect receptacles are installed in the cargo compartment. These receptacles provide plug-in provisions for removable illuminated personnel warning signs.

These signs, which can be read from either side, have three legends, NO SMOKING, FASTEN SEAT BELTS, and DON OXY MASKS, and may be illuminated separately or in any combination with the other legends.

Personnel Warning Sign Switches.

Three 2-position ("ON", "OFF") toggle switches are on the PERSONNEL WARNING SIGNS portion of the pilots' overhead control panel (figure 1-157). These switches, with the following decals: DON OXY MASKS, NO SMOKING, and FASTEN SEAT BELTS, provide power to all three receptacles simultaneously and control the illumination of the signs.

PITOT-STATIC SYSTEM.

The pitot-static system (figure 1-270) comprises four pitot tubes, two on each side of the forward fuselage, and provides pressure inputs for the operation of certain instruments and equipment. The pitot tubes are electrically anti-iced by actuating two PITOT HEAT switches on the pilots' overhead control panel. The system is broken down into a pilot's and copilot's pitot-static system.

Manual Shutoff Valve (Static Pressure).

A manual shutoff valve is installed in the copilot's static pressure line. It is used to isolate a portion of the system in the event of a leak. The valve is located in the right underdeck area and can be reached through an access door in the floor behind the engineer's station. The shutoff valve is normally open. When the valve is closed, the engineer's and navigator's altimeters are isolated from the system, and pitot and static pressure will still be available to the copilot's (No. 2) SCADC and the Air Data Unit.

Pitot-Static Operated Instruments.

The pitot-static system (figure 1-270) provides pitot and/or static air pressure for the operation of the SCADCs, the flight engineer's and navigator's altimeters, and the MFSI. On aircraft previously equipped with a life history recorder system, an altitude/airspeed transducer and a cabin differential pressure transducer are still incorporated in the pilot's pitot-static system, but are deactivated.

PROTECTIVE COVERS.

Protective covers for the engine inlets are stowed in either the left or right aft gear pod stowage compartments when not in use. Pitot-static protective covers are stowed in the flight engineer's lower drawer or in a pouch on the forward cargo compartment bulkhead, outboard of the latrine door.

SEATS.

Auxiliary Crew Seats.

Two seats are installed in the flight compartment on either side of the flight station door to accommodate two auxiliary crewmembers.

WARNING

When the outboard auxiliary crewmember's seat (aft of NAV station) is occupied, ear protection is required.

Crew Bunk Seat Backs.

Three seat backs are installed on the bulk head in the flight compartment between the upper and lower bunks. The seat backs are used in conjunction with the lower bunk to provide seating accommodations for three crewmembers.

Engineer's and Navigator's Seats.

The engineer's and navigator's stations are equipped with full-swivel, vertically and horizontally adjustable seats (figure 1-271) which can be moved inboard or outboard to provide adjustment at the tables. The seats are equipped with seat belts, headrests, and movable armrests which can be pivoted to a position parallel to the seat back.

Jump Seat.

A portable jump seat is stowed under the aft end of the navigator's table. The seat, when in use, is mounted on the floor behind the control pedestal.

WARNING

This seat will not be occupied for planned ditching or crash landing.

Pilots' Seats.

The pilots' seats (figure 1-271) are installed on tracks and provide forward and aft, lateral, vertical, and reclining position adjustments. Each seat is equipped with an adjustable and removable headrest, a safety belt, and a shoulder harness. The armrest of each seat can be pivoted and stowed to a position parallel to the back of the seat during seating or egress.

SIGNAL LIGHT STOWAGE.

Hand signal lamp and filter stowage are provided near the copilot's map case. A DC outlet is located near each map case for the lamp.

UHF FREQUENCY CARD HOLDERS.

Two spring-loaded, hinged, UHF frequency card holders are attached to the left and right-hand underside of the pilots' glareshields. The holder is stowed flat against the underside of the glareshield. Pulling down and aft on the holder brings the frequency card into view.

WEATHER CURTAIN.

A weather curtain and stowage bag are installed on the aft right-hand sidewall in the ramp area. Attachment provisions for the curtains are located on the aft face of the side frames, the aft face of the aft upper deck, and in the seat tracks, approximately in line with the ramp hinge. The curtains are installed, when carrying passengers, to maintain an adequate temperature comfort level.

GENERAL ARRANGEMENT DIAGRAM (TYPICAL)

1. MAIN INSTRUMENT PANEL
2. PILOT'S SEAT
3. OVERHEAD CONTROL PANEL
4. JUMP SEAT (INSTALLED POSITION)
5. COPILOT'S SEAT
6. COPILOT'S SIDE CONSOLE
7. ALDIS LAMP STOWAGE
8. NAVIGATOR'S SEAT
9. FLIGHT ENGINEER'S SEAT
10. CURTAIN
11. STOWAGE PROVISIONS: PORTABLE OXYGEN BOTTLES
12. FLIGHT ENGINEER'S CIRCUIT BREAKER PANEL
13. CREW BUNKS
14. BOOK SHELF
15. BUNK SEAT BACK INSTALLATIONS
16. INBOARD AUXILARY CREW SEAT
17. OUTBOARD AUXILIARY CREW SEAT
18. FLIGHT STATION ACCESS DOOR

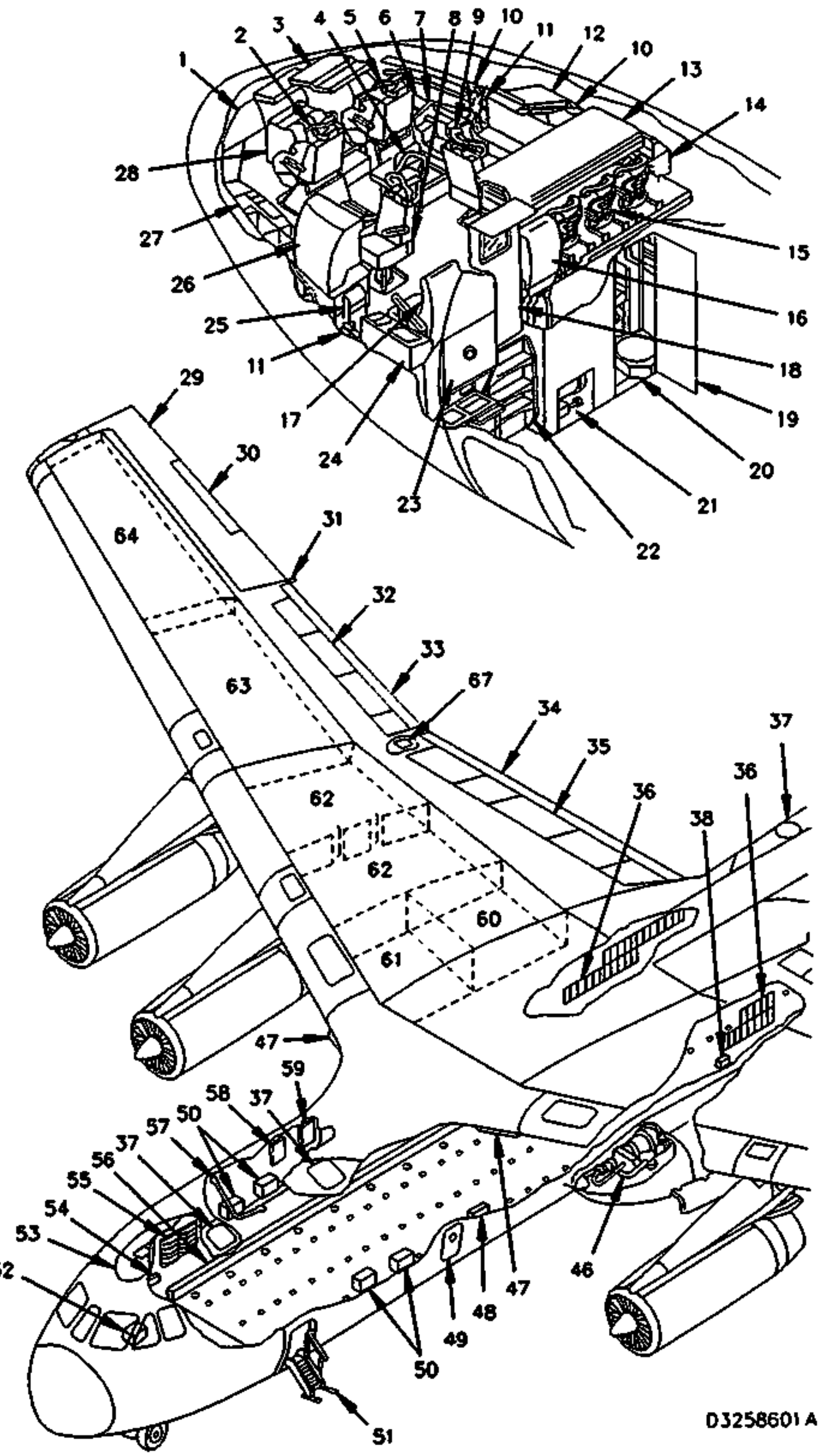
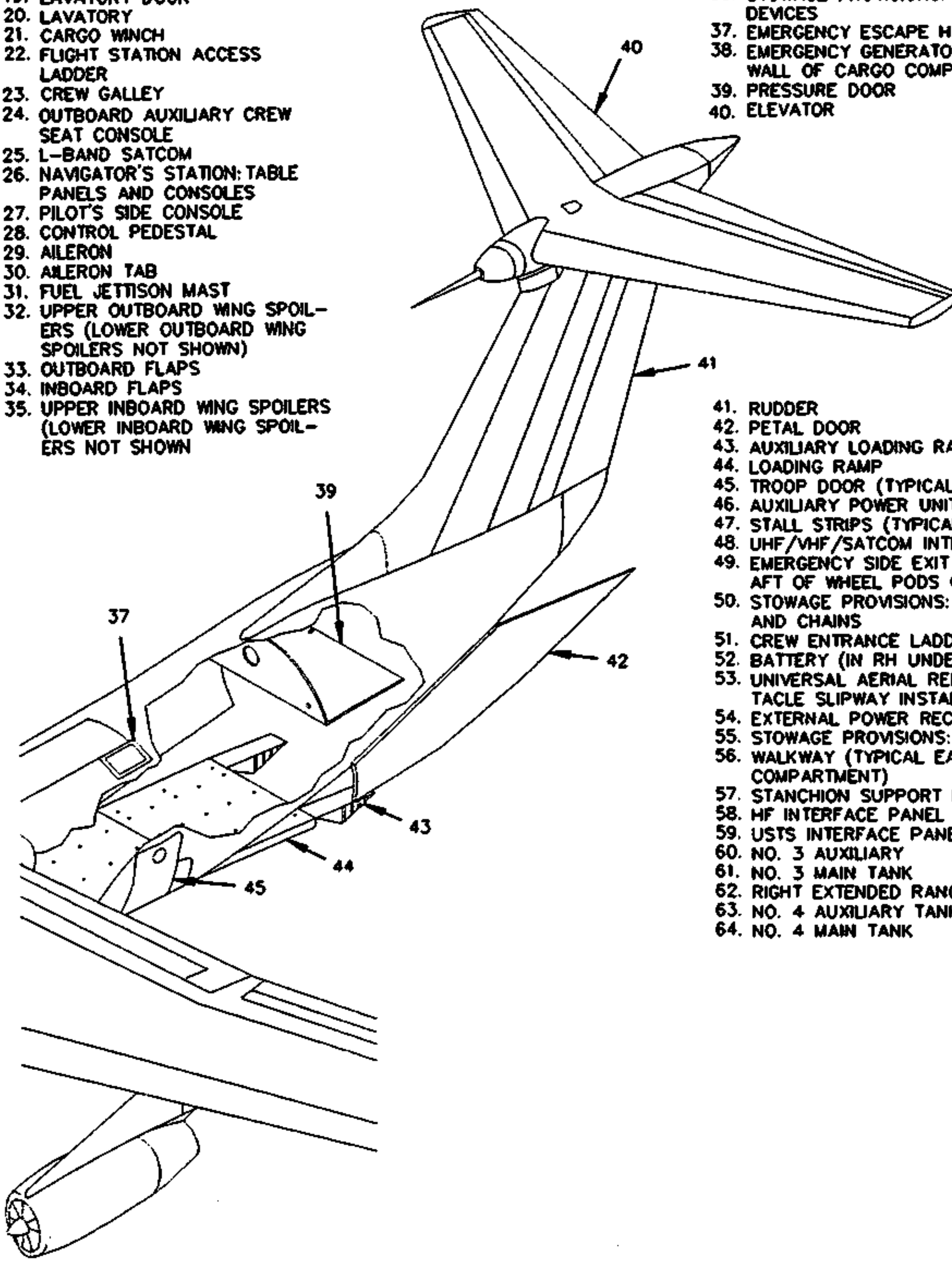


Figure 1-146. General Arrangement Diagram (Typical) (Sheet 1 of 2)

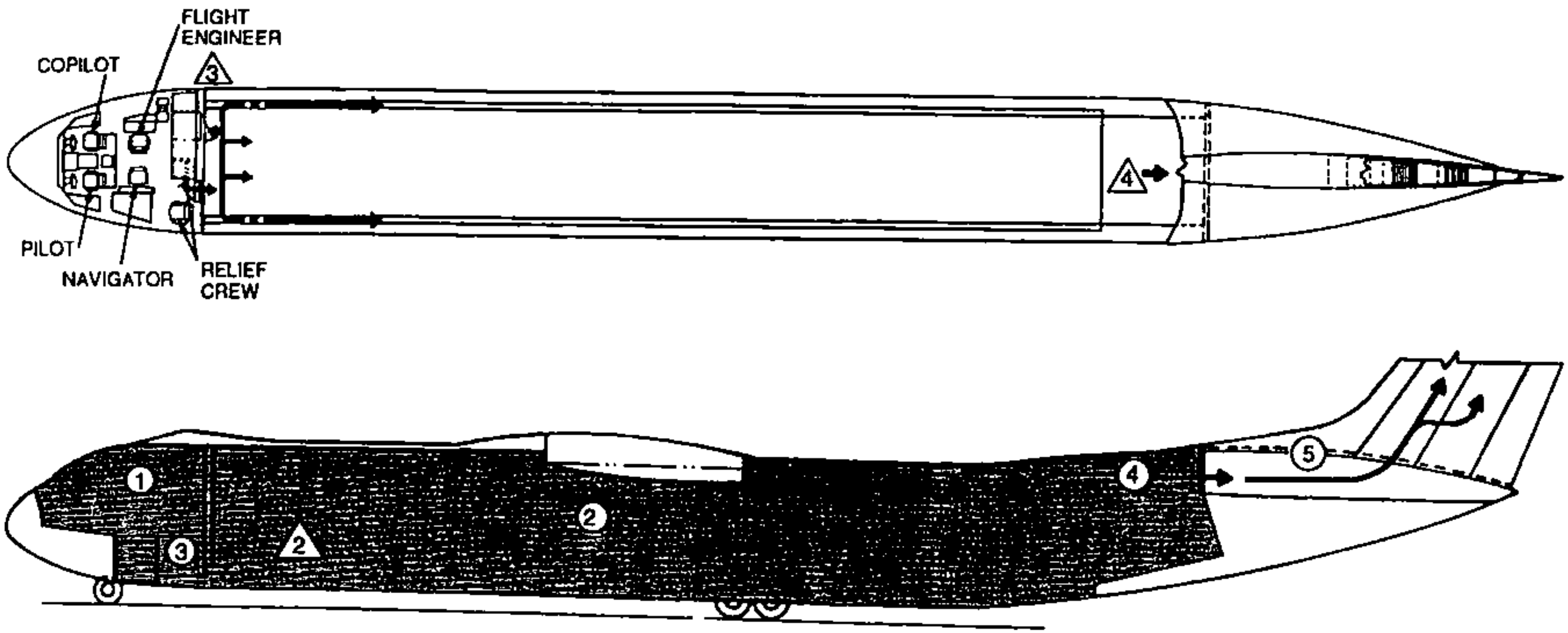
19. LAVATORY DOOR
20. LAVATORY
21. CARGO WINCH
22. FLIGHT STATION ACCESS LADDER
23. CREW GALLEY
24. OUTBOARD AUXILIARY CREW SEAT CONSOLE
25. L-BAND SATCOM
26. NAVIGATOR'S STATION: TABLE PANELS AND CONSOLES
27. PILOT'S SIDE CONSOLE
28. CONTROL PEDESTAL
29. AILERON
30. AILERON TAB
31. FUEL JETTISON MAST
32. UPPER OUTBOARD WING SPOILERS (LOWER OUTBOARD WING SPOILERS NOT SHOWN)
33. OUTBOARD FLAPS
34. INBOARD FLAPS
35. UPPER INBOARD WING SPOILERS (LOWER INBOARD WING SPOILERS NOT SHOWN
36. STOWAGE PROVISIONS: TIEDOWN DEVICES
37. EMERGENCY ESCAPE HATCH
38. EMERGENCY GENERATOR (ON LEFT WALL OF CARGO COMPARTMENT)
39. PRESSURE DOOR
40. ELEVATOR
41. RUDDER
42. PETAL DOOR
43. AUXILIARY LOADING RAMP
44. LOADING RAMP
45. TROOP DOOR (TYPICAL EACH SIDE)
46. AUXILIARY POWER UNIT
47. STALL STRIPS (TYPICAL BOTH WINGS)
48. UHF/VHF/SATCOM INTERFACE PANEL
49. EMERGENCY SIDE EXIT (FORWARD AND AFT OF WHEEL PODS ON EACH SIDE)
50. STOWAGE PROVISIONS: TIEDOWN FITTINGS AND CHAINS
51. CREW ENTRANCE LADDER
52. BATTERY (IN RH UNDERDECK RACK)
53. UNIVERSAL AERIAL REFUELING RECEPTACLE SLIPWAY INSTALLATION (UARRSI)
54. EXTERNAL POWER RECEPTICLE
55. STOWAGE PROVISIONS: TIEDOWN RINGS
56. WALKWAY (TYPICAL EACH SIDE OF CARGO COMPARTMENT)
57. STANCHION SUPPORT INSTALLATION
58. HF INTERFACE PANEL
59. USTS INTERFACE PANEL
60. NO. 3 AUXILIARY
61. NO. 3 MAIN TANK
62. RIGHT EXTENDED RANGE
63. NO. 4 AUXILIARY TANK
64. NO. 4 MAIN TANK



D3258602

Figure 1-146. General Arrangement Diagram (Typical) (Sheet 2 of 2)

CREW MOVEMENT AND COMPARTMENT DIAGRAM



NOTE

1. WALKWAYS ARE PROVIDED FOR CREW MOVEMENT WHEN THE CARGO COMPARTMENT IS LOADED TO WIDTH CAPACITY. MOVEMENT UNDER OTHER CONDITIONS IS LIMITED BY THE CONFIGURATION OF THE LOAD.

△2 ACCESS TO L.H. AND L.H. CENTER UNDERDECK EQUIPMENT. ACCESS UNDER CREW LADDER.

△3 ACCESS TO R.H. CENTER AVIONICS UNDERDECK EQUIPMENT, BATTERY, ELECTRICAL EQUIPMENT AND NOSE LANDING GEAR INSPECTION WINDOW. ACCESS THROUGH CREW LATRINE.

△4 ACCESS TO AFT FUSELAGE UPPER DECK COMPARTMENT AND VERTICAL STABILIZER.

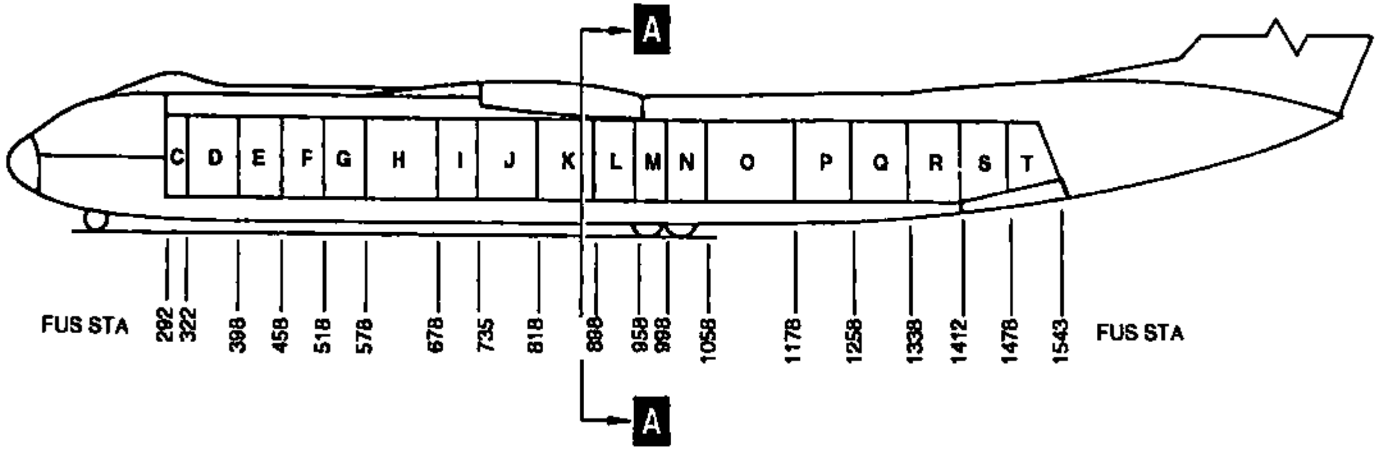
5. THE FOLLOWING CIRCLED ITEMS CONSTITUTE THE CABIN: (1), (2), (3), (4).

(1) FLIGHT STATION
(2) CARGO COMPARTMENT
(3) FORWARD FUSELAGE UNDERDECK EQUIPMENT RACK
(4) AFT CARGO COMPARTMENT UPPER DECK AREA
(5) AFT UPPER DECK COMPARTMENT
AIR CONDITIONED AND PRESSURIZED AREAS (CABIN)

141A-1-X3/0-002-1

Figure 1-147. Crew Movement and Compartment Diagram (Sheet 1 of 2)

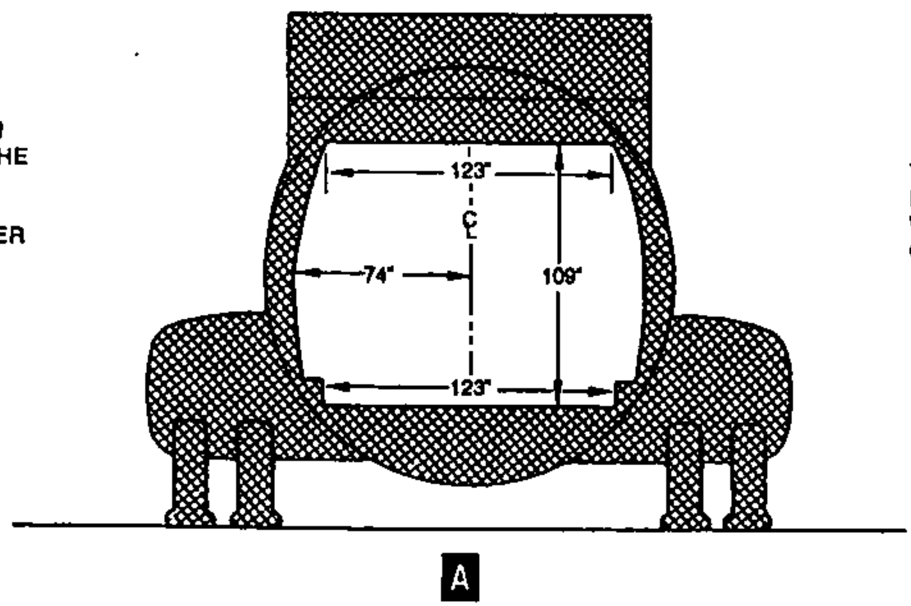
COMPARTMENT DIAGRAM



LOADING COMPARTMENTS

NOTE

THE DIMENSIONS SHOWN IN VIEW A ARE TYPICAL FOR THE ENTIRE COMPARTMENT. ALL OTHER SECTIONS WILL HAVE AN EQUAL OR GREATER CLEAR AREA.



CAUTION

THE TROOP DOORS EXTEND INTO THE CLEAR CARGO AREA WHEN OPEN AND REDUCE THE CLEARANCE HEIGHT.

141B-1-X0/0-002-2

Figure 1-147. Crew Movement and Compartment Diagram (Sheet 2 of 2)

PILOT'S STATION (TYPICAL)

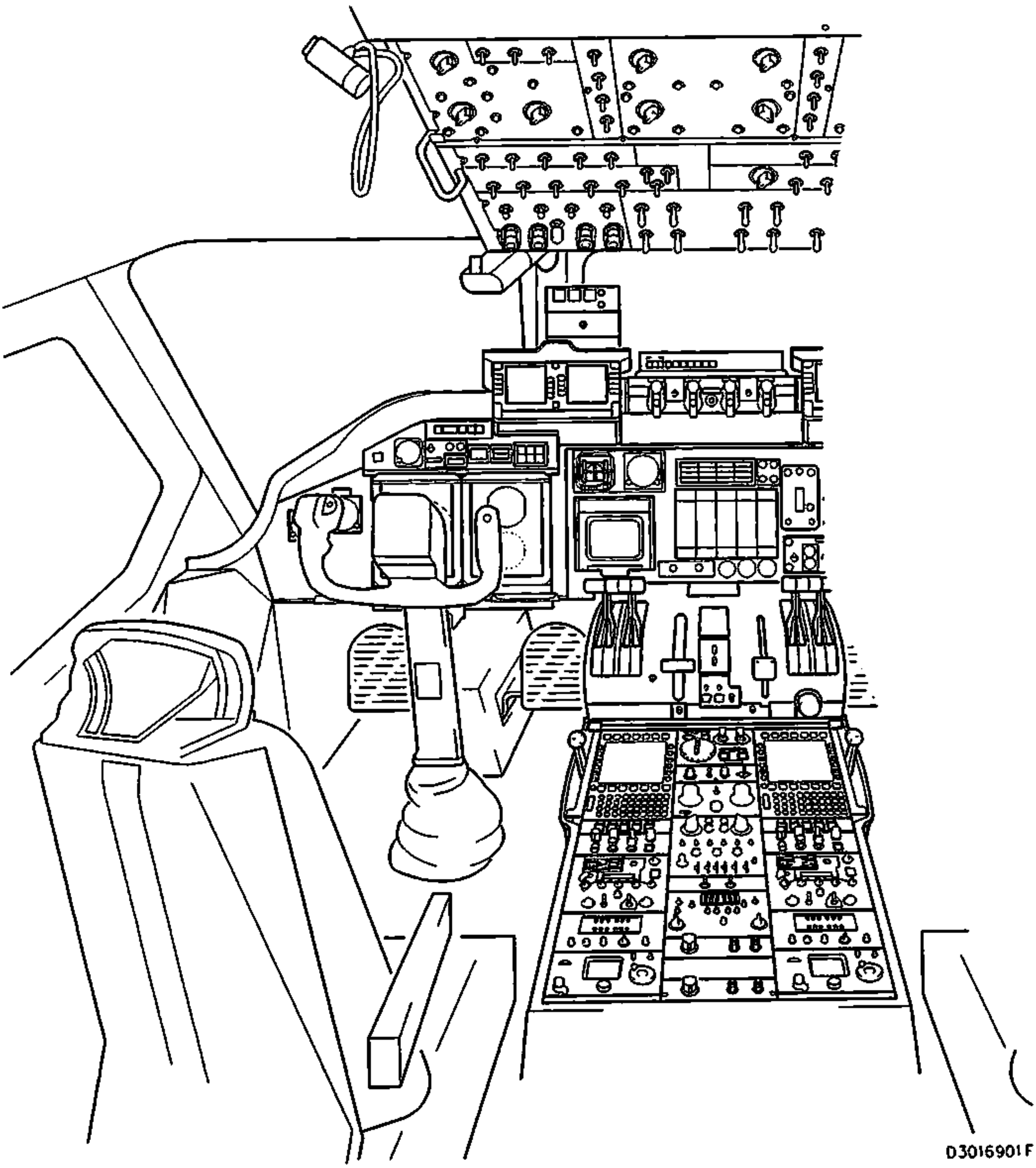


Figure 1-148. Pilot's Station (Typical)

COPILOT'S STATION (TYPICAL)

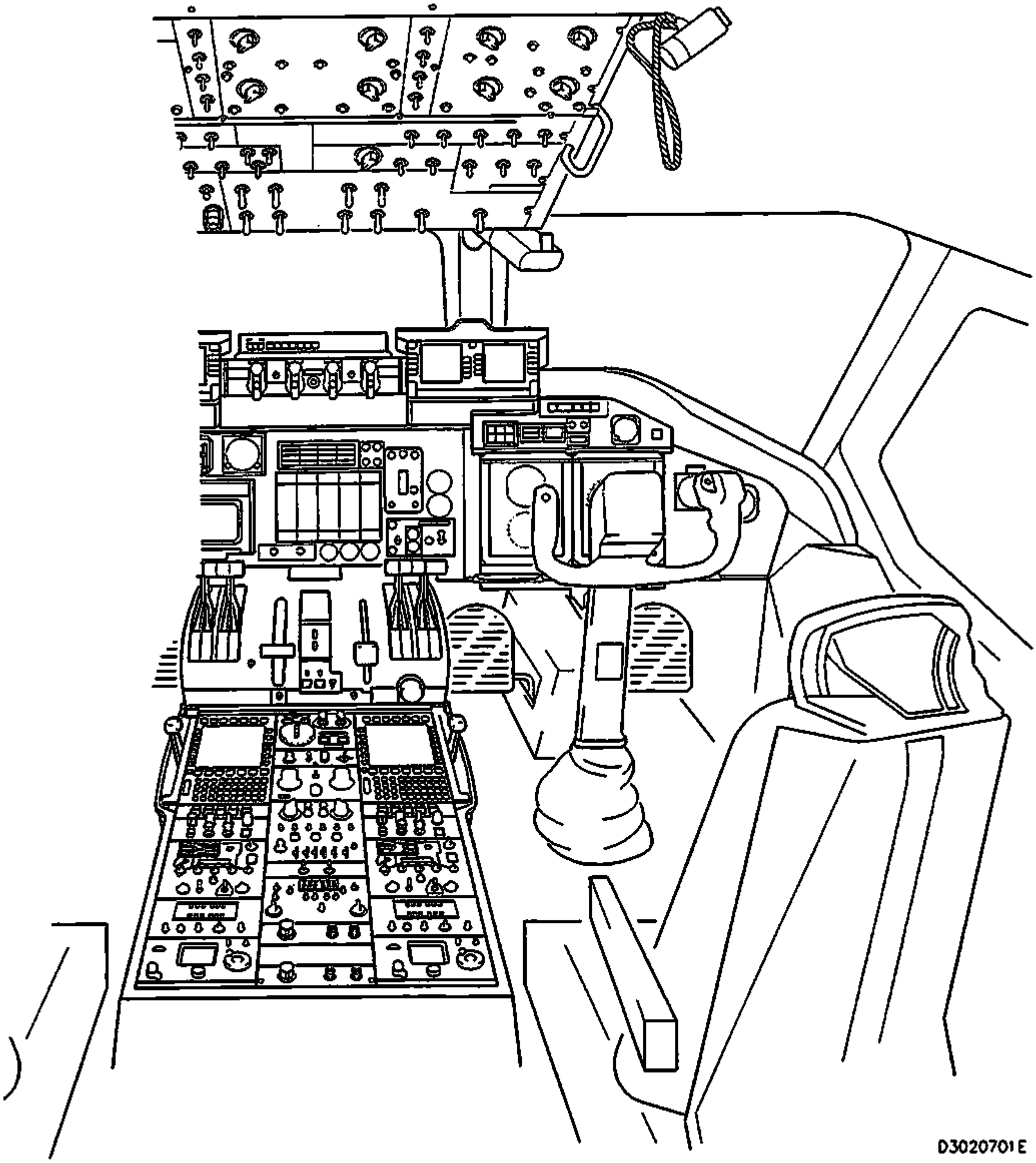
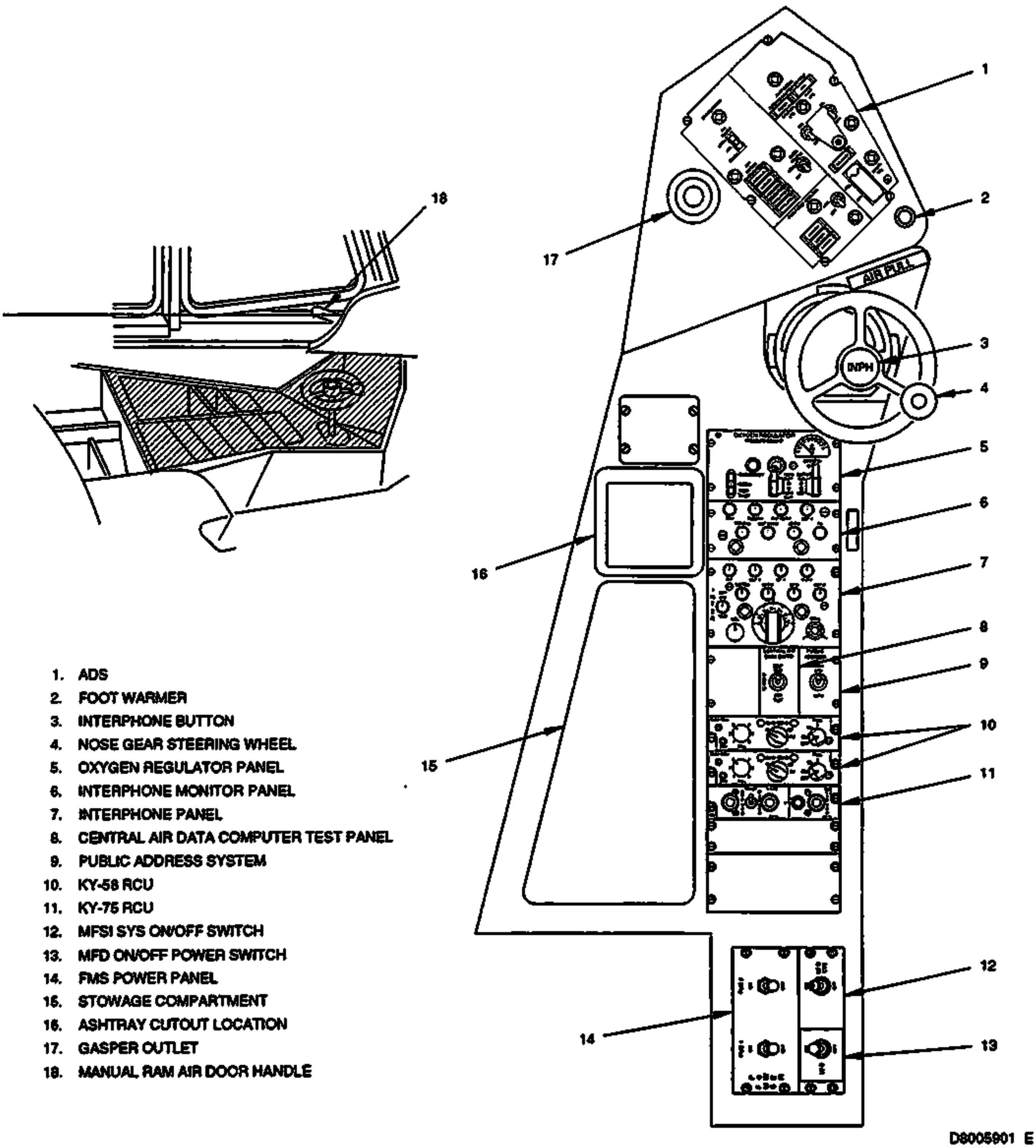


Figure 1-149. Copilot's Station (Typical)

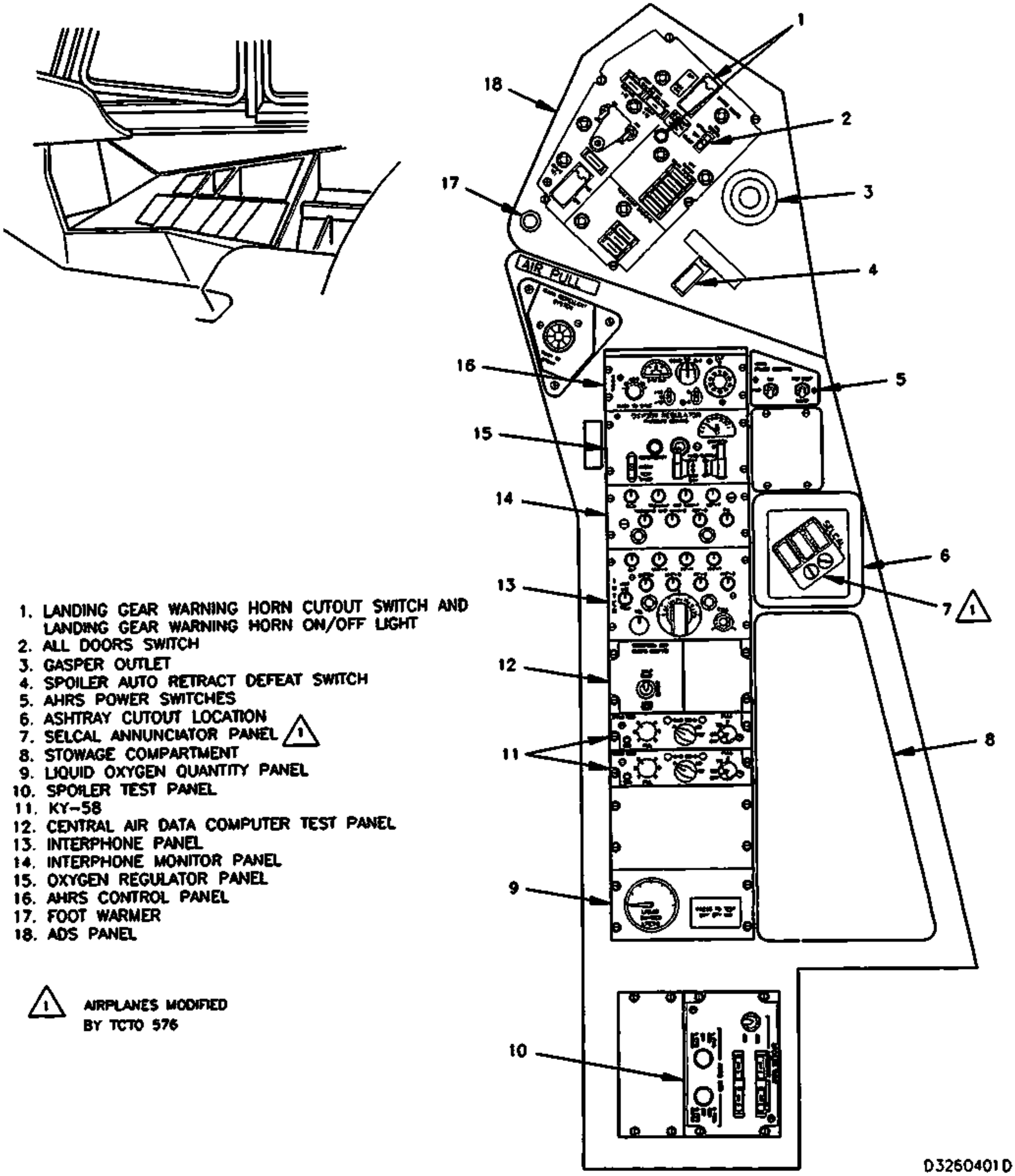
PILOT'S SIDE CONSOLE



1. ADS
2. FOOT WARMER
3. INTERPHONE BUTTON
4. NOSE GEAR STEERING WHEEL
5. OXYGEN REGULATOR PANEL
6. INTERPHONE MONITOR PANEL
7. INTERPHONE PANEL
8. CENTRAL AIR DATA COMPUTER TEST PANEL
9. PUBLIC ADDRESS SYSTEM
10. KY-58 RCU
11. KY-75 RCU
12. MFSI SYS ON/OFF SWITCH
13. MFD ON/OFF POWER SWITCH
14. FMS POWER PANEL
15. STOWAGE COMPARTMENT
16. ASHTRAY CUTOUT LOCATION
17. GASPER OUTLET
18. MANUAL RAM AIR DOOR HANDLE

Figure 1-150. Pilot's Side Console

COPILOT'S SIDE PANEL



1. LANDING GEAR WARNING HORN CUTOUT SWITCH AND LANDING GEAR WARNING HORN ON/OFF LIGHT
2. ALL DOORS SWITCH
3. GASPER OUTLET
4. SPOILER AUTO RETRACT DEFEAT SWITCH
5. AHRS POWER SWITCHES
6. ASHTRAY CUTOUT LOCATION ⚠1
7. SELCAL ANNUNCIATOR PANEL ⚠1
8. STOWAGE COMPARTMENT
9. LIQUID OXYGEN QUANTITY PANEL
10. SPOILER TEST PANEL
11. KY-58
12. CENTRAL AIR DATA COMPUTER TEST PANEL
13. INTERPHONE PANEL
14. INTERPHONE MONITOR PANEL
15. OXYGEN REGULATOR PANEL
16. AHRS CONTROL PANEL
17. FOOT WARMER
18. ADS PANEL

⚠1 AIRPLANES MODIFIED BY TCTO 576

Figure 1-151. Copilot's Side Panel

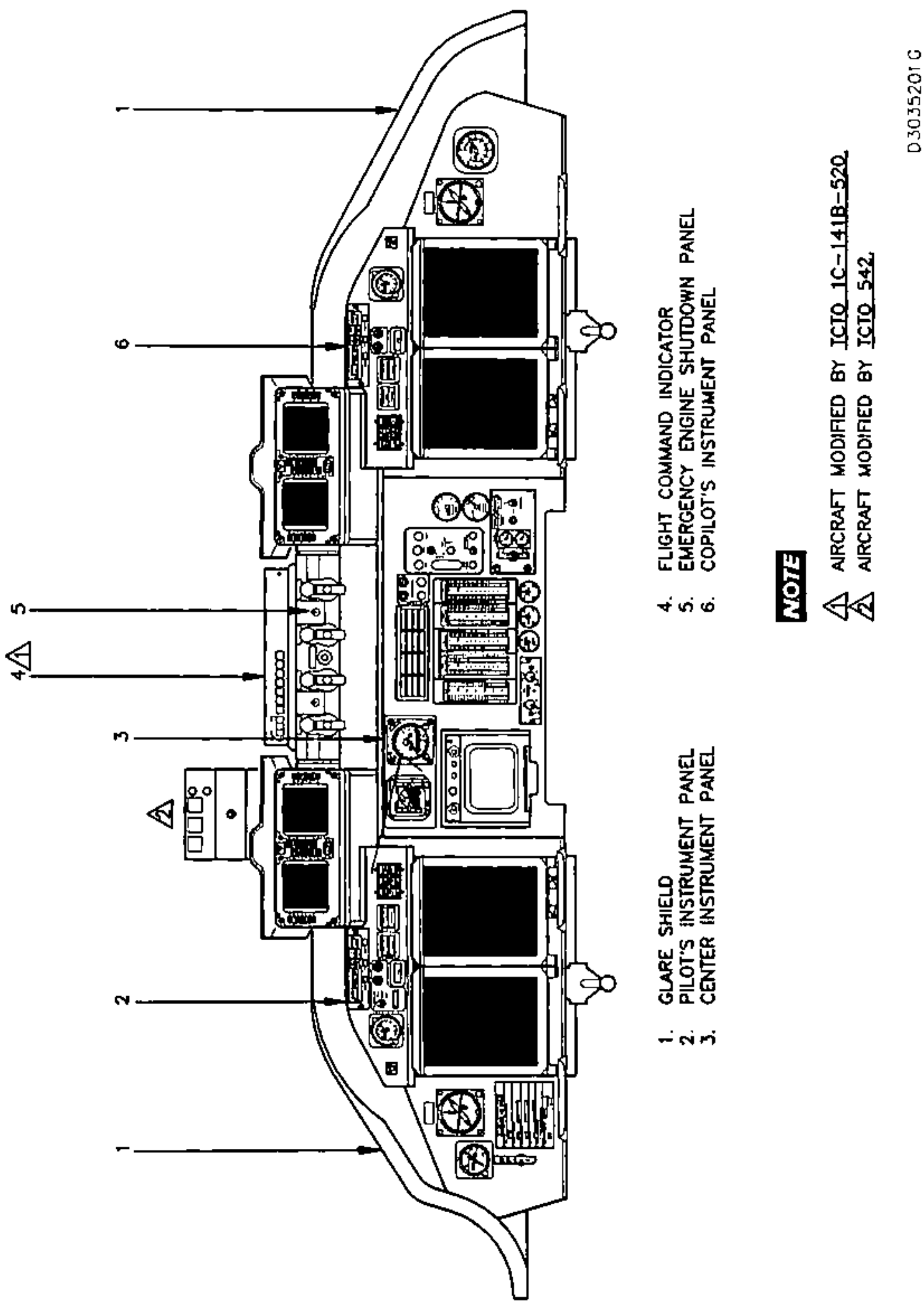
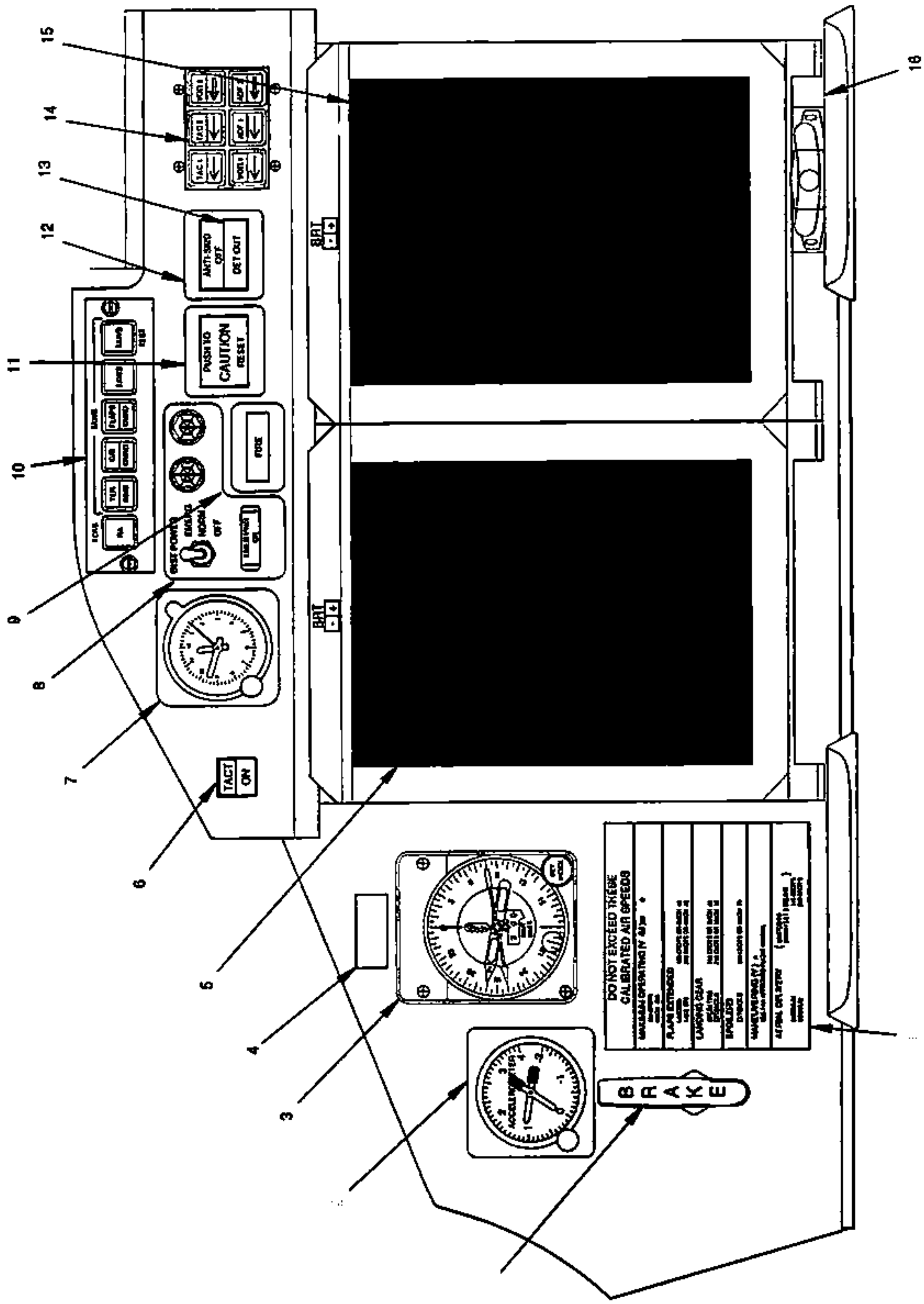


Figure 1-152. Main Instrument Panel

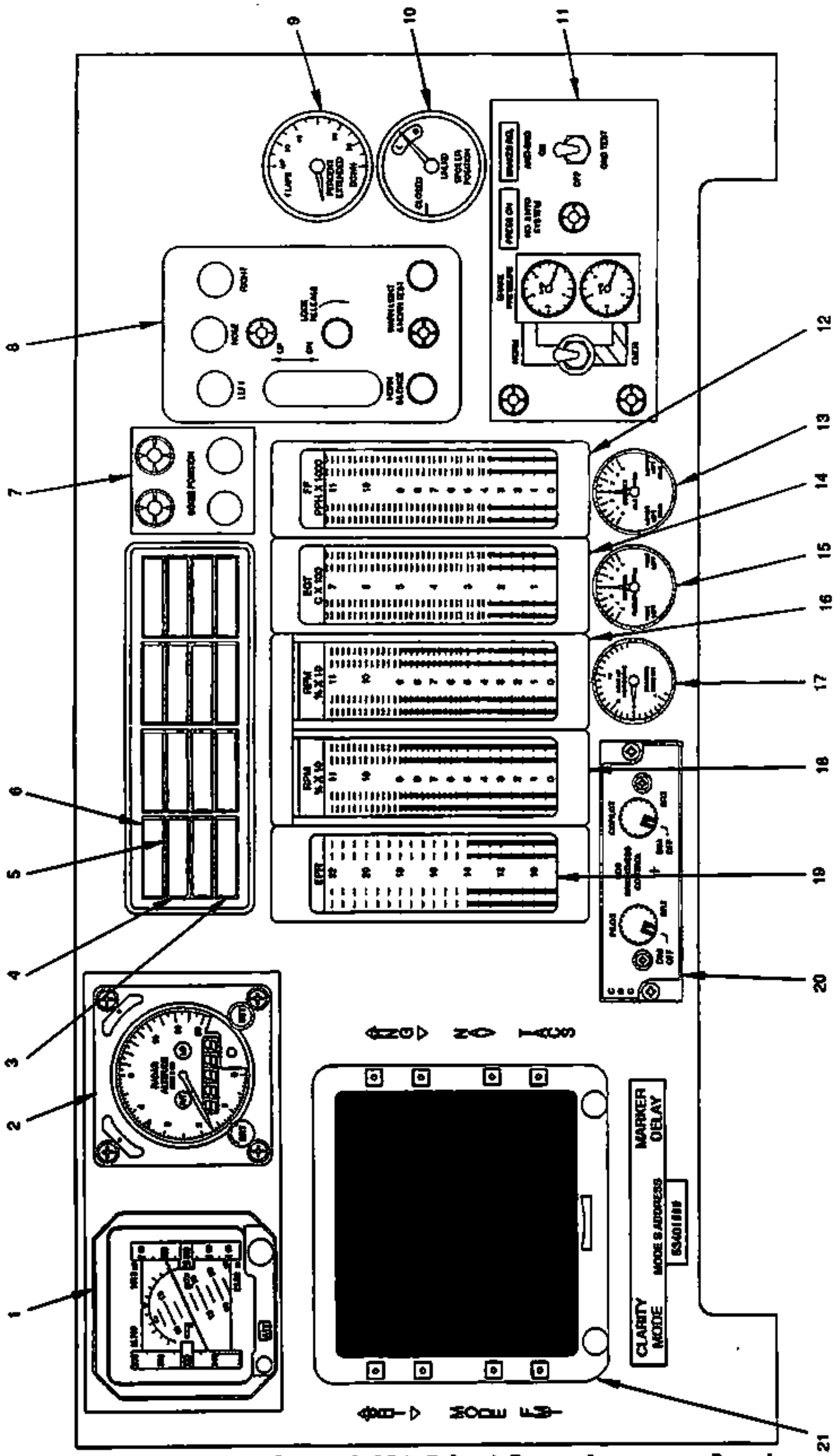
PILOTS' INSTRUMENT PANEL



1. PARKING BRAKE HANDLE
2. ACCELEROMETER
3. BEARING-DISTANCE-HEADING INDICATOR (BDHI)
4. RADIO CALL PLACARD
5. PILOT'S DISPLAY UNIT (DU) #1
6. TAWS TACTICAL SWITCH ANNUNCIATOR
7. CLOCK
8. EMERGENCY POWER CONTROL
9. FIRE/OVERHEAT LIGHT
10. TAWS CONTROL AND ANNUNCIATOR PANEL (TCAP)
11. MASTER CAUTION LIGHT
12. ANTI SKID OFF LIGHT
13. DET OUT LIGHT
14. BDHI CONTROL
15. PILOT'S DISPLAY UNIT (DU) #2
16. SLIP INDICATOR (INCLINOMETER)
17. AIRSPEED LIMITATION PLACARD

Figure 1-153. Pilots' Instrument Panel

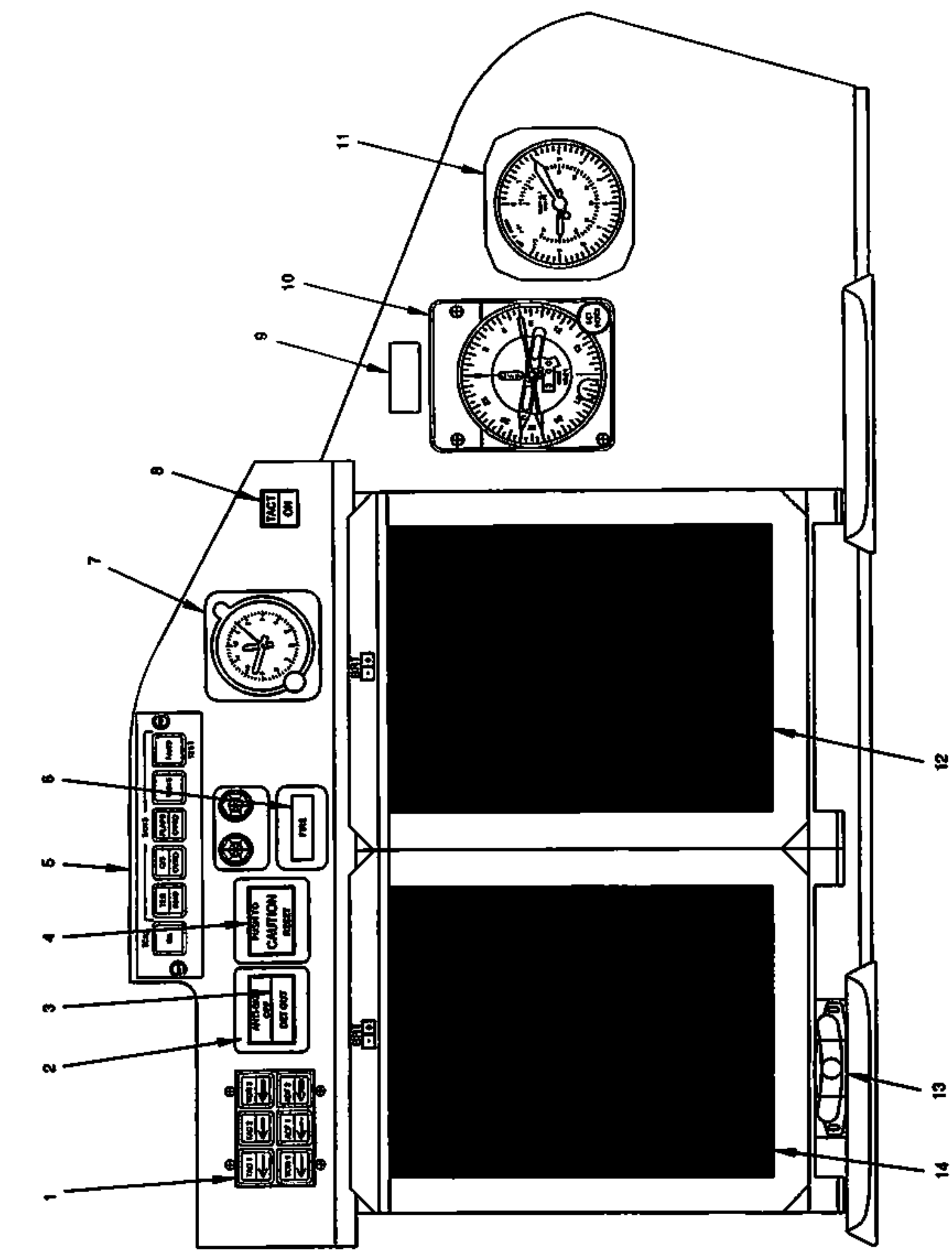
PILOT'S CENTER INSTRUMENT PANEL



1. MULTIFUNCTION STANDBY INSTRUMENT
2. RADAR ALTIMETER
3. START VALVE OPEN LIGHTS
4. THRUST REV EXTENDED LIGHTS
5. THRUST REV NOT LOCKED LIGHTS
6. LOW OIL PRESSURE LIGHTS
7. BOGIE POSITION INDICATOR
8. LANDING GEAR PANEL
9. FLAP POSITION INDICATOR
10. WING SPOILER POSITION INDICATOR
11. BRAKE PRESSURE AND ANTI SKID PANEL
12. FUEL FLOW INDICATORS
13. AILERON TRIM INDICATORS
14. EXHAUST GAS TEMPERATURE INDICATORS
15. RUDDER TRIM INDICATOR
16. PERCENT OF RPM N INDICATORS
17. HORIZONTAL STABILIZER TRIM POSITION INDICATOR
18. PERCENT OF RPM N INDICATORS
19. ENGINE PRESSURE RATIO INDICATORS
20. CDS BRIGHTNESS CONTROL
21. MULTI FUNCTION DISPLAY

Figure 1-154. Pilots' Center Instrument Panel

COPILOT'S INSTRUMENT PANEL



1. BEARING-DISTANCE-HEADING INDICATOR (BDHI) CONTROL
2. ANTI SKID OFF LIGHT
3. DET OUT LIGHT
4. MASTER CAUTION LIGHT
5. TAWS CONTROL ANNUNCIATOR PANEL (TCAP)
6. FIRE/OVERHEAT LIGHT
7. CLOCK
8. GCAS TACTICAL SWITCH ANNUNCIATOR
9. RADIO CALL PLACARD
10. BDHI
11. CABIN ALTITUDE INDICATOR
12. COPILOT'S DISPLAY UNIT (DU) #4
13. SLIP INDICATOR (INCLINOMETER)
14. COPILOT'S DISPLAY UNIT (DU) #3

D8008102 D

Figure 1-155. Copilot's Instrument Panel

CONTROL PEDESTAL

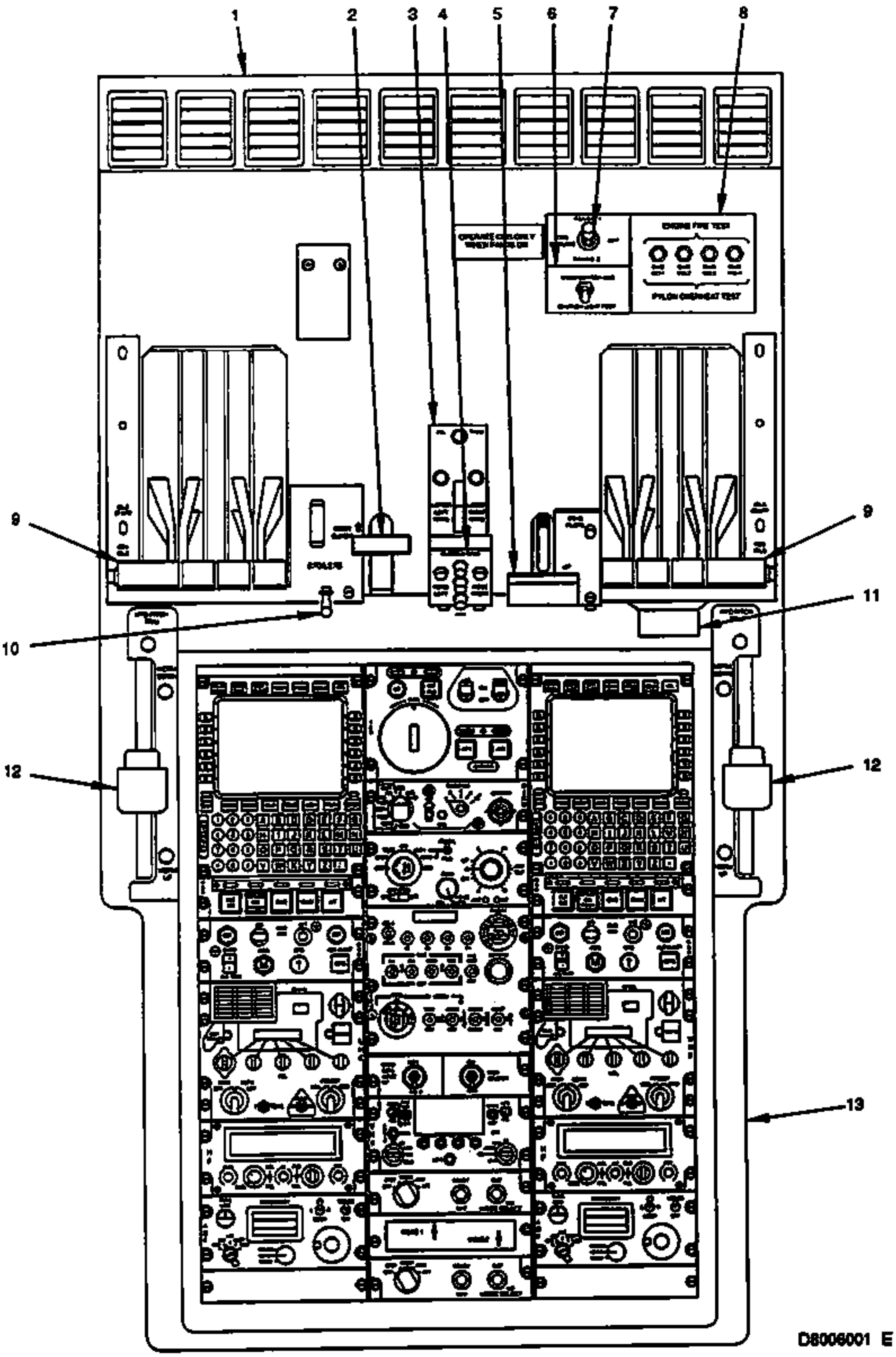
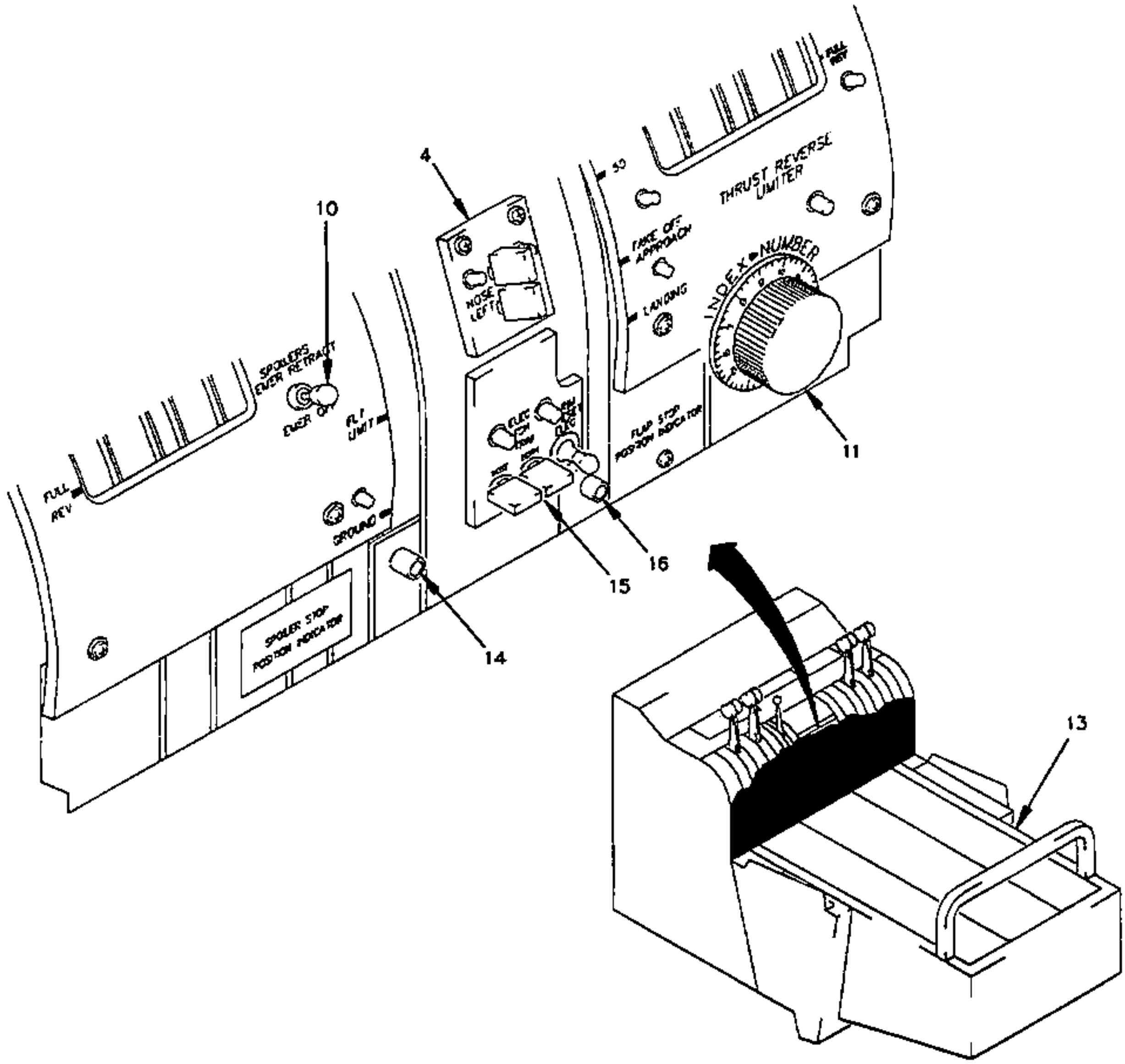


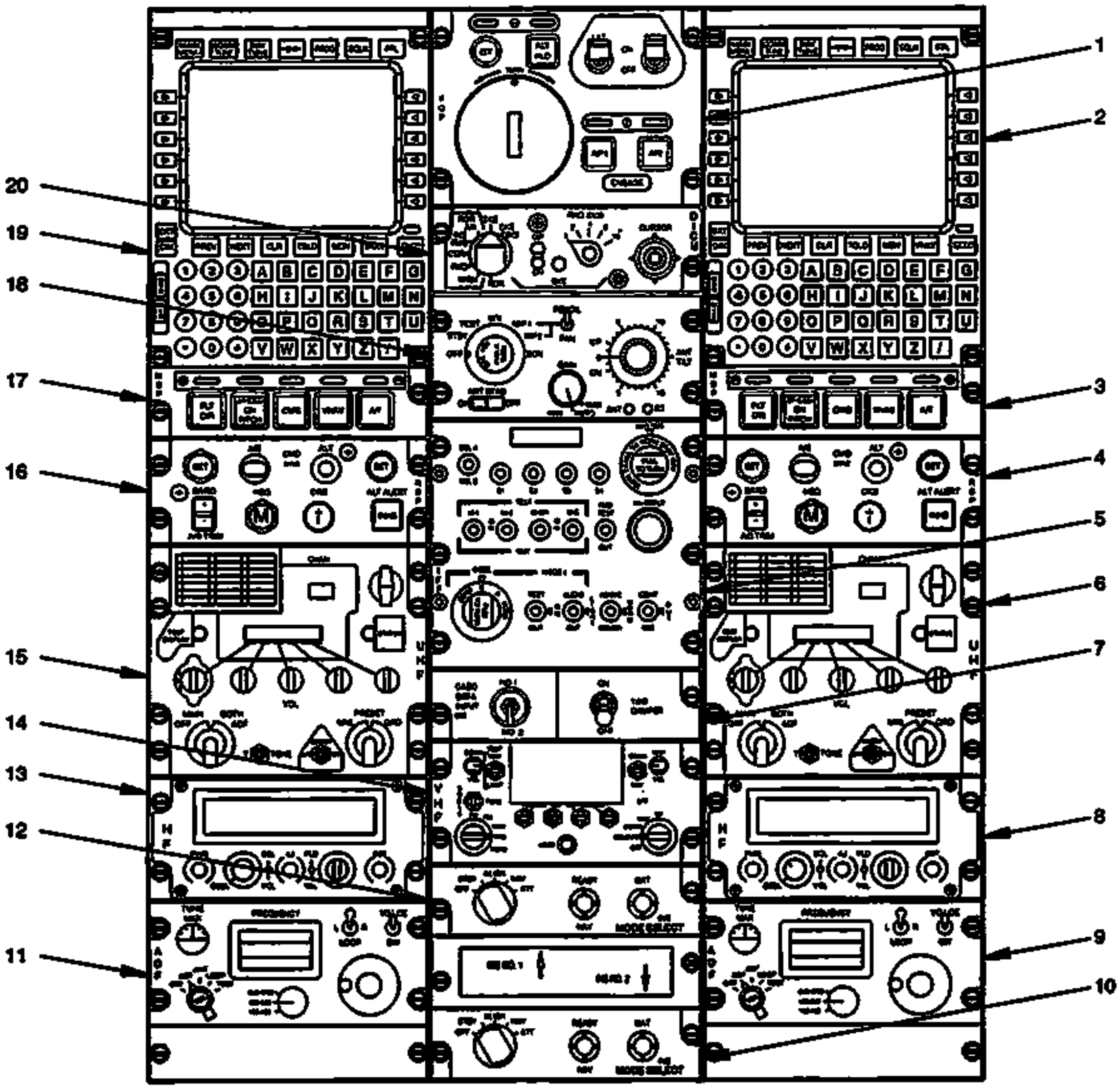
Figure 1-156. Control Pedestal (Sheet 1 of 3)



1. ANNUNCIATOR PANEL
2. WING SPOILER LEVER
3. AILERON TRIM PANEL
4. RUDDER TRIM PANEL
5. WING FLAP LEVER
6. ANNUNCIATOR AND CAUTION LIGHT TEST PANEL
7. CDS COOLING FAN NO. 1/OFF/FAN NO. 2
8. FIRE AND OVERHEAT TEST PANEL
9. AUTO THROTTLE ENGAGE SWITCH/THROTTLE LEVER
10. SPOILER EMERGENCY RETRACT/EMERGENCY OFF SWITCH
11. THRUST REVERSER LIMIT KNOB
12. HYDRAULIC PITCH TRIM LEVER
13. CENTER CONSOLE
14. SPOILER STOP POSITION INDICATOR
15. ELECTRIC PITCH TRIM PANEL
16. FLAP STOP POSITION INDICATOR

D3036101E

Figure 1-156. Control Pedestal (Sheet 2 of 3)

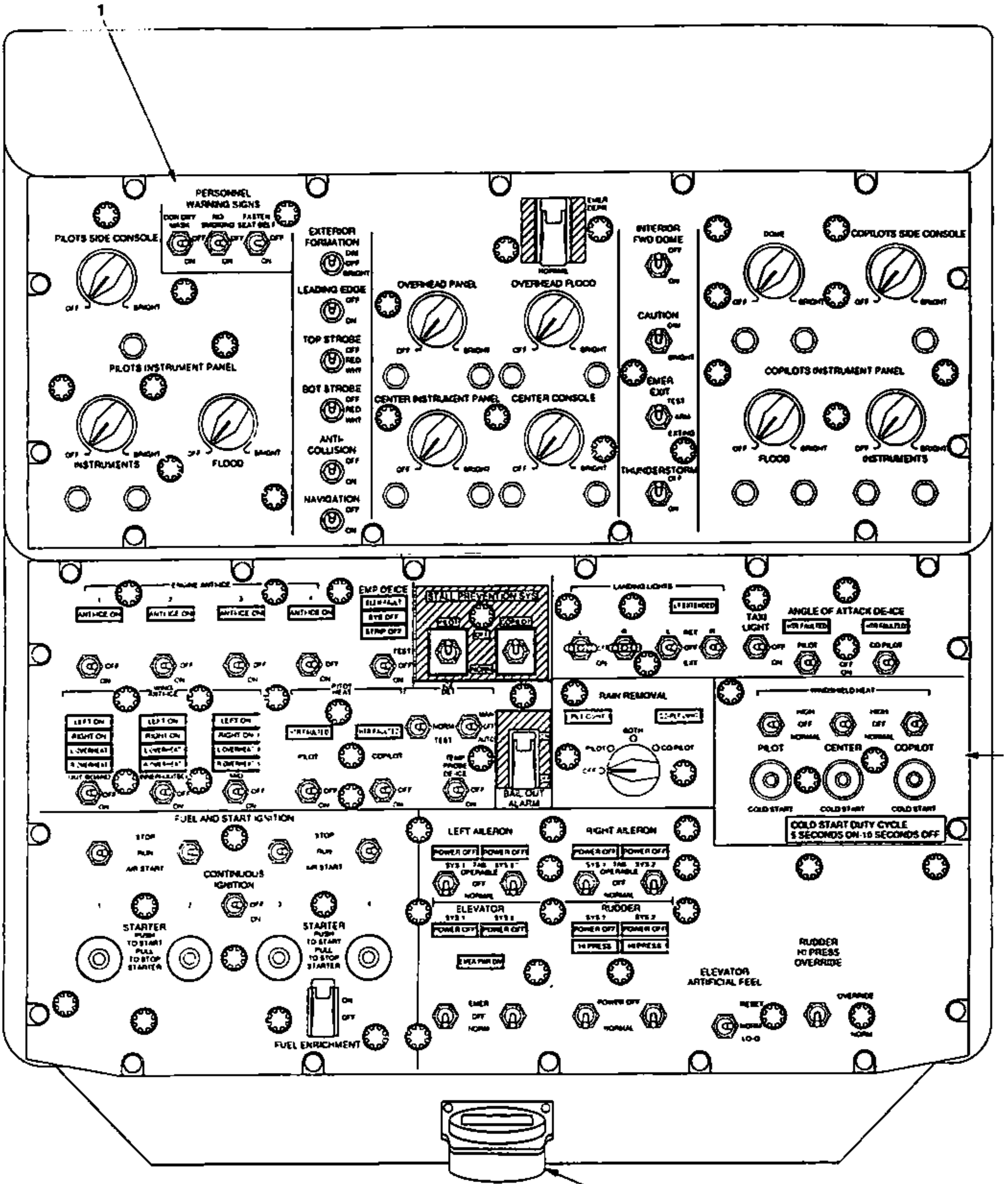


1. FLIGHT CONTROL PANEL (FCP)
2. COPILOT'S MULTI-FUNCTION CONTROL DISPLAY UNIT (MFCDU)
3. COPILOT'S MODE SELECT PANEL (MSP)
4. COPILOT'S REFERENCE SET PANEL (RSP)
5. MODE S/IFF/TCAS CONTROL PANEL
6. UHF NO. 2 CONTROL PANEL
7. CADC/YAW DAMPER SWITCH PANEL
8. HF NO. 2 CONTROL PANEL
9. ADF NO. 2 CONTROL PANEL
10. MODE SELECT UNIT NO. 2 (MSU-2)
11. ADF NO. 1 CONTROL PANEL
12. MODE SELECT UNIT NO. 1 (MSU-1)
13. HF NO. 1 CONTROL PANEL
14. VHF CONTROL PANEL
15. UHF NO. 1 CONTROL PANEL
16. PILOT'S RSP
17. PILOT'S MSP
18. RADAR CONTROL PANEL (CON-ISB)
19. PILOT'S MFCDU
20. DISPLAY INTERFACE CONTROL UNIT (DICU)

D8006002 E

Figure 1-156. Control Pedestal (Sheet 3 of 3)

PILOTS' OVERHEAD CONTROL PANELS (TYPICAL)



1. AFT PANEL
2. FORWARD PANEL
3. MAGNETIC COMPASS

141A-1-X3/0-013

Figure 1-157. Pilots' Overhead Control Panels (Typical)

PILOTS' OVERHEAD CONTROL PANELS

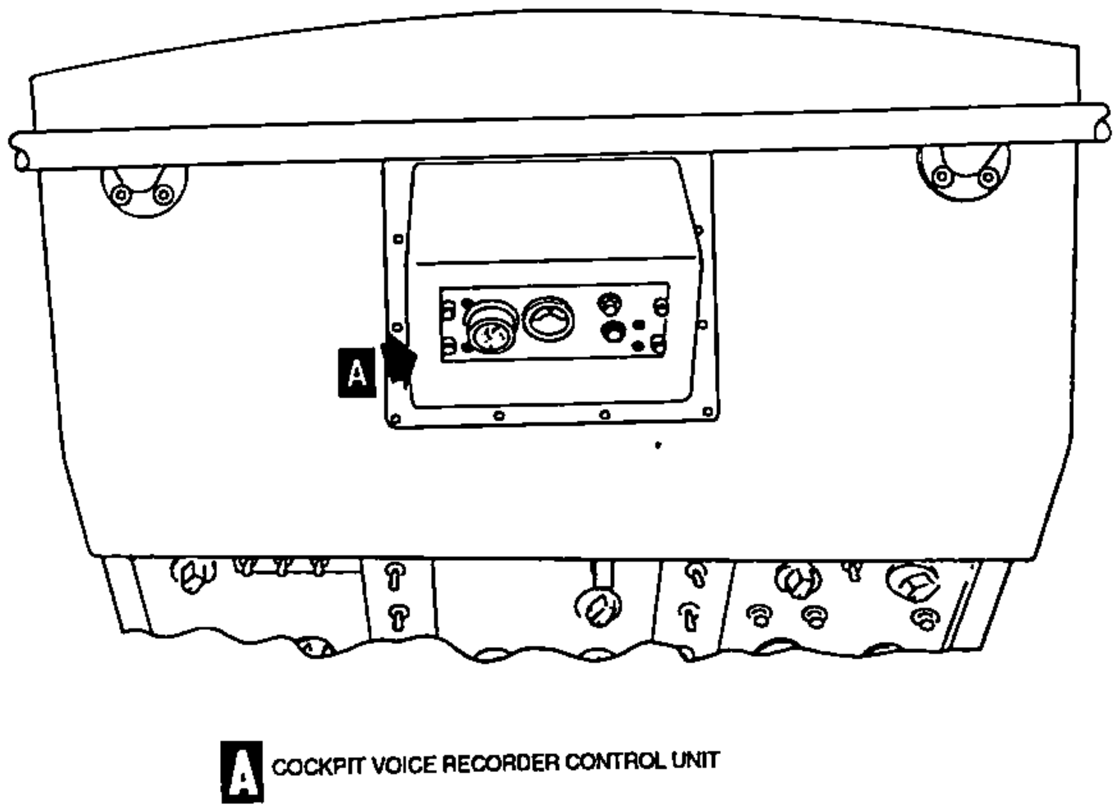


Figure 1-158. Pilots' Overhead Control Panels

FLIGHT ENGINEER'S STATION (TYPICAL)

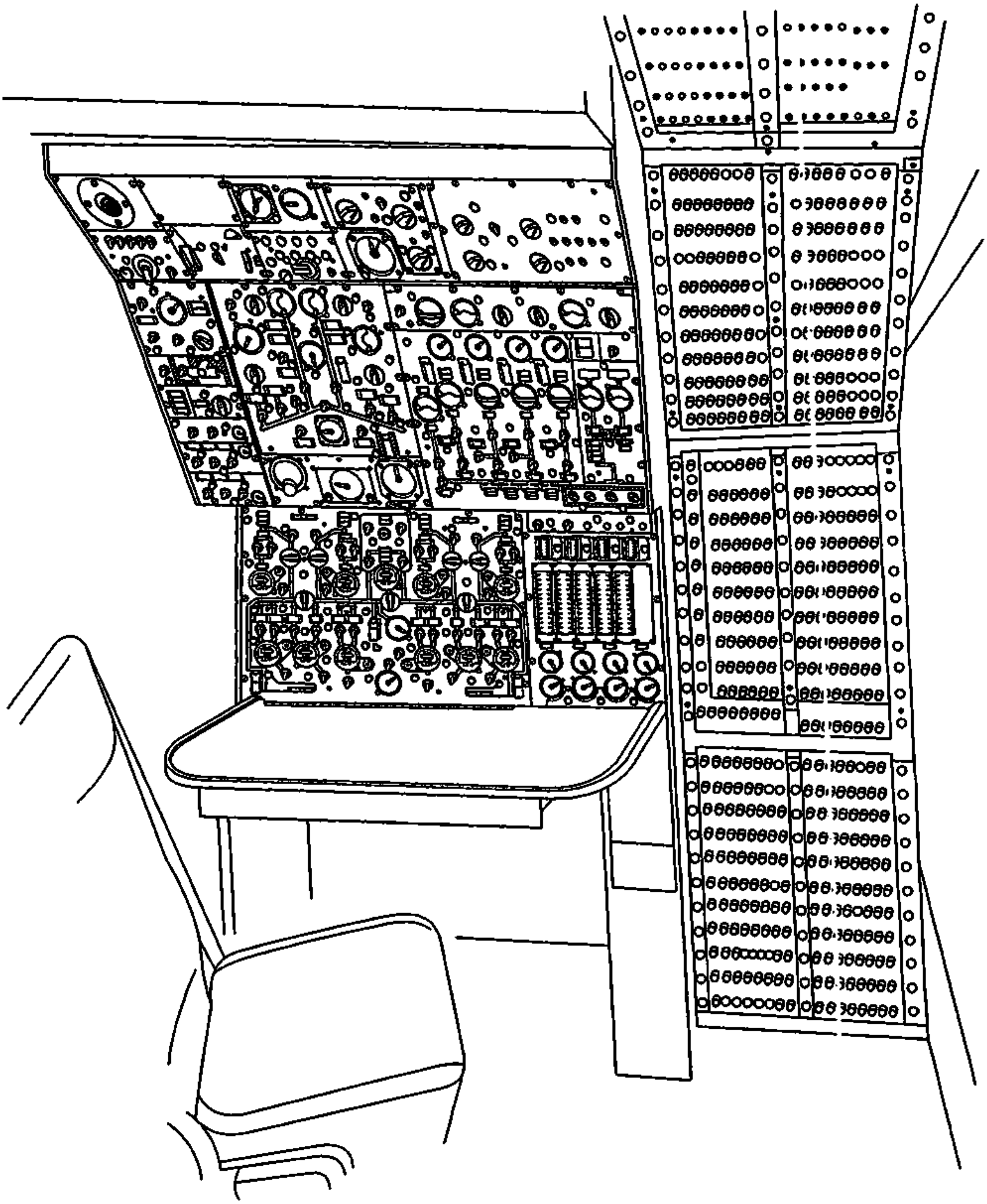


Figure 1-159. Flight Engineer's Station (Typical)

NAVIGATOR'S INSTRUMENT PANEL

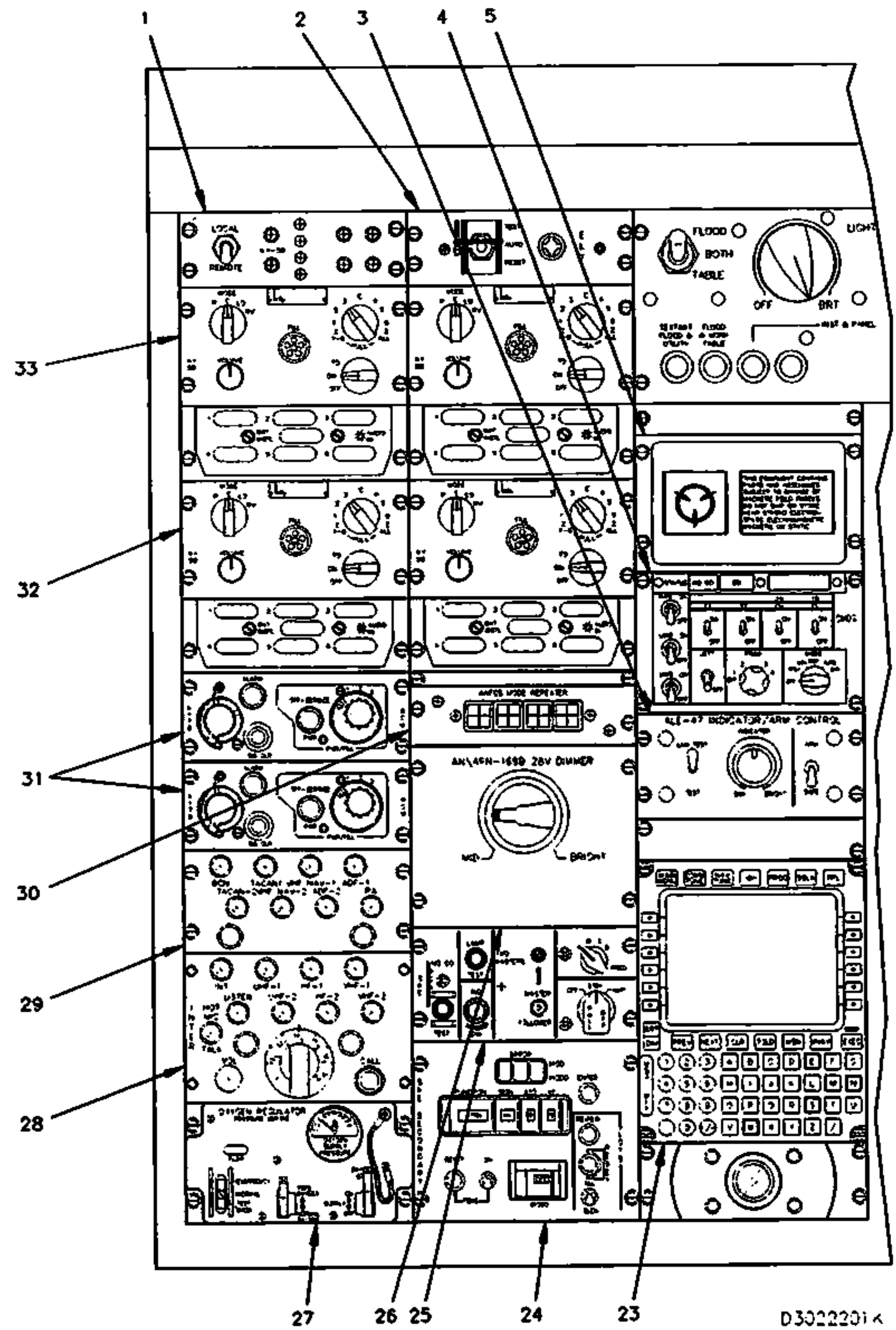


Figure 1-160. Navigator's Instrument Panel (Sheet 1 of 3)

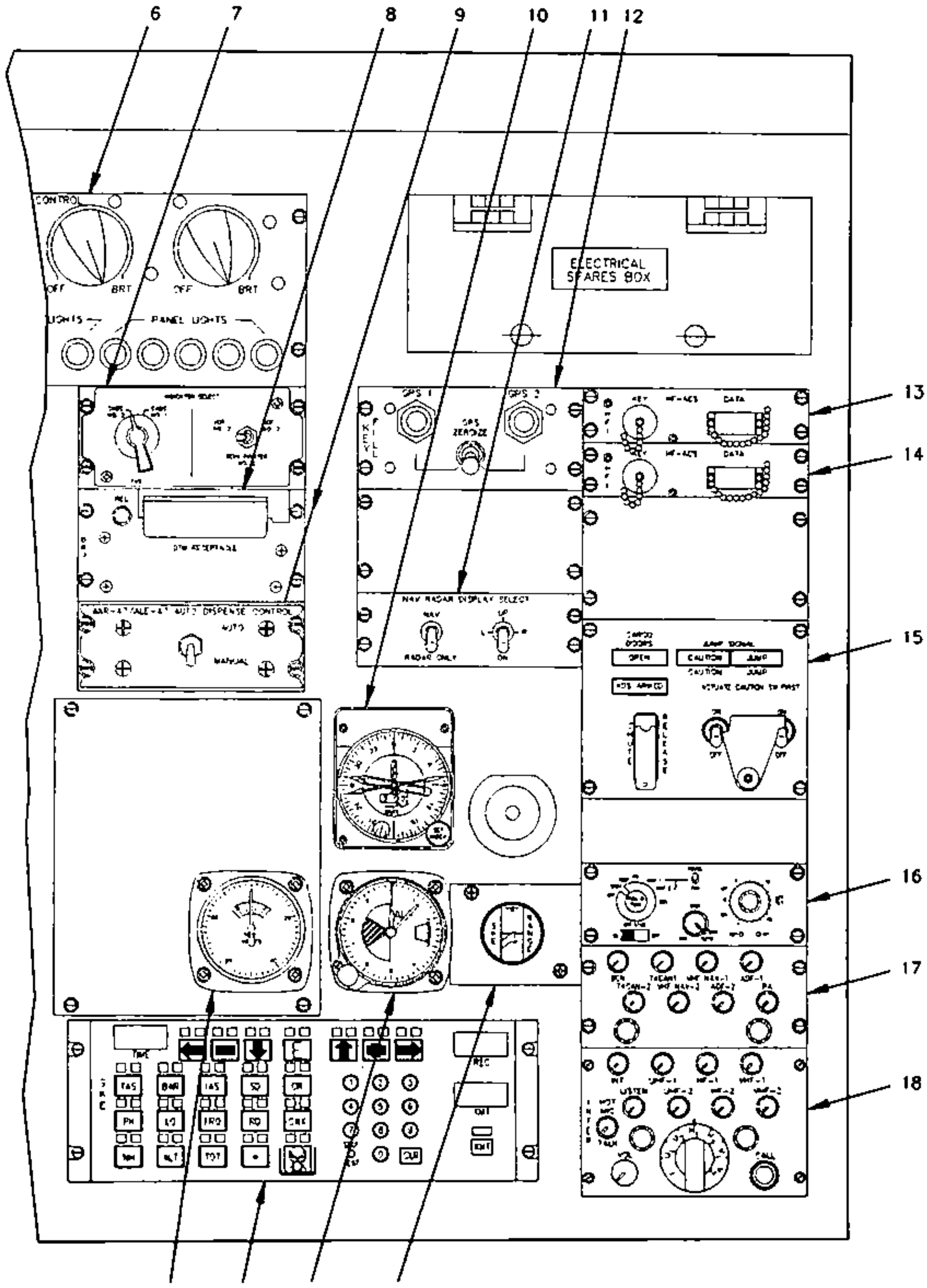


Figure 1-160. Navigator's Instrument Panel (Sheet 2 of 3)

1. KY-58 LOCAL/REMOTE SWITCH PANEL 2 3
2. EMERGENCY LOCATOR TRANSMITTER (ELT) REMOTE CONTROL PANEL
3. INDICATOR/ARM CONTROL PANEL
4. PROGRAMMER (AN/ALE-47)
5. COCKPIT CONTROL UNIT (AN/ALE-47)
6. LIGHT CONTROL PANEL
7. INDICATOR SELECTOR
8. DATA LOADER ASSEMBLY
9. REMOTE DISPENSE CONTROL PANEL
10. NAVIGATOR'S BDHI (ID-798/ARN)
11. NAVIGATOR'S RADAR DISPLAY SELECT PANEL
12. ZEROIZE PANEL (GPS)
13. HF-1 ACS KEYFILL/DATA LOAD PANEL 4 5
14. HF-2 ACS KEYFILL/DATA LOAD PANEL 4 5
15. ADS PANEL
16. RADAR CONTROL PANEL (ALTERNATE LOCATION)
17. JUMPSEAT INTERPHONE MONITOR (AIC-18)
18. JUMPSEAT INTERPHONE PANEL (AIC-18)
19. NAVIGATOR'S RELATIVE RANGE INDICATOR
20. PRESSURE ALTITUDE (ARU-7/A)
21. FLIGHT COMMAND INDICATOR (APN-169C)
22. TRUE AIRSPEED INDICATOR (TAS) (AVU-15/A)
23. NAVIGATOR'S MFCDU
24. SKE SECONDARY CONTROL
25. SKE PRIMARY CONTROL
26. AN/APN-169 DIMMER CONTROL
27. OXYGEN REGULATOR PANEL
28. NAVIGATOR'S INTERPHONE PANEL (AIC-18)
29. NAVIGATOR'S INTERPHONE MONITOR PANEL (AIC-18)
30. AFCS MODE REPEATER
31. Z-AKV REMOTE CONTROL UNIT HF 1-2 1
32. KY-58 PROCESSOR UHF 1-2 2 3
33. KY-58 PROCESSOR VHF 1-2 2 3

NOTE

1 AIRCRAFT MODIFIED BY <u>TCTO 636</u>
2 AIRCRAFT MODIFIED BY <u>TCTO 637</u>
3 ALTERNATE UNIT KY-58 BYPASS
4 AIRCRAFT MODIFIED BY <u>TCTO 769</u>
5 AIRCRAFT MODIFIED BY <u>TCTO 776</u>

Figure 1-160. Navigator's Instrument Panel (Sheet 3 of 3)

THE ENGINE

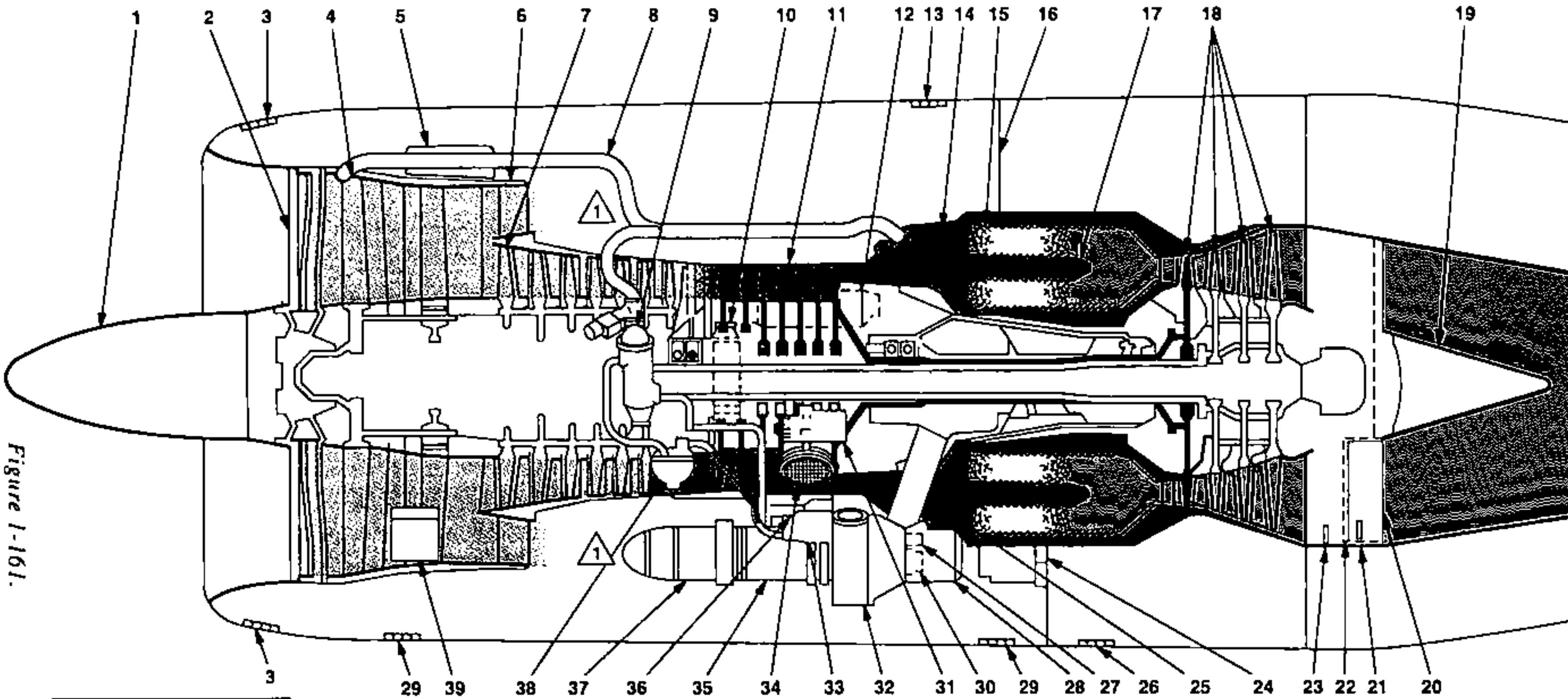


Figure 1-161.

TYPE TF33-P-7

1. NOSE DOME
2. INLET GUIDE VANES
3. AUXILIARY AIR INLET DOORS
4. LOW PRESSURE COMPRESSOR (N_1), FAN STAGE
5. ENGINE OIL TANK
6. FAN AIR EXIT BANES
7. LOW PRESSURE COMPRESSOR (N_1), BLADE STAGES
8. BLEED AIR DUCT
9. FUEL HEATER
10. FUEL FLOWMETER
11. HIGH PRESSURE COMPRESSOR (N_2)
12. FUEL-OIL-COOLER
13. ZONE II COOLING OUTLET
14. FUEL MANIFOLD (DUAL)
15. COMBUSTION CHAMBER
16. FIRE SEAL
17. COMBUSTION CHAMBER CENTER TUBE
18. TURBINE, BLADE STAGES
19. EXHAUST CONE
20. CSD OIL COOLER
21. EGT PROBE
22. ENGINE AIR OIL COOLER
23. Pt_7 PROBE
24. PRESSURIZING AND DUMP VALVE
25. ACCESSORY DRIVE
26. ZONE I COOLING OUTLET
27. TACHOMETER GENERATOR (N_2)
28. STARTER
29. ZONE II COOLING INLET
30. HYDRAULIC PUMP
31. SURGE BLEED VALVE ACTUATOR AND GOVERNOR
32. ACCESSORY DRIVE CASE
33. FUEL PUMP
34. SURGE BLEED VALVE PORT
35. CONSTANT SPEED DRIVE
36. FUEL CONTROL UNIT
37. AC GENERATOR
38. FUEL FILTER
39. IGNITION UNIT

141A-1-X3/0-015

⚠1 FAN AIR CONTINUES THROUGH BIFURCATED DUCT, EXITING AROUND THE EXHAUST AREA.

ENGINE FUEL FLOW

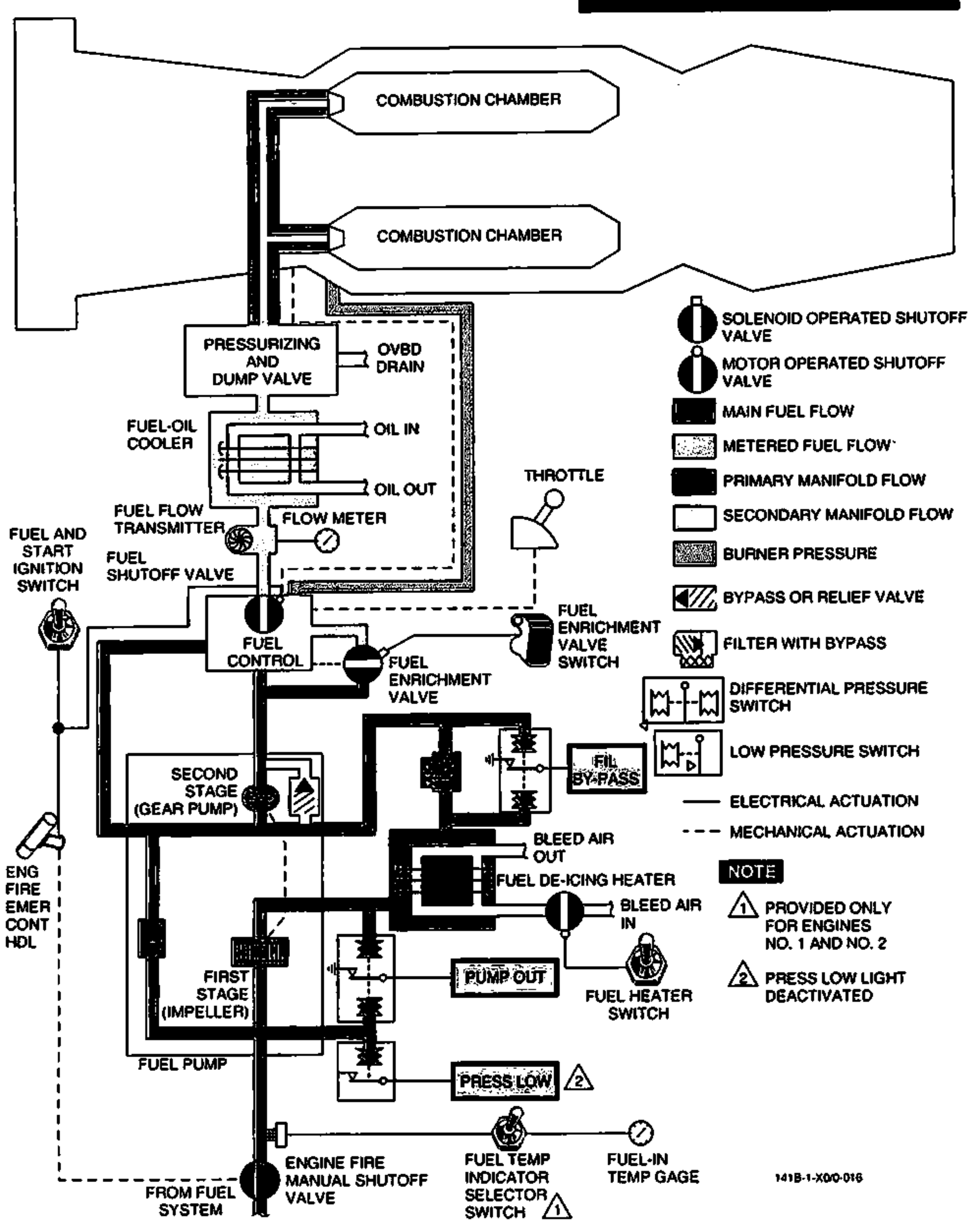


Figure 1-162.

ENGINE CONTROLS, NORMAL OPERATION (TYPICAL)

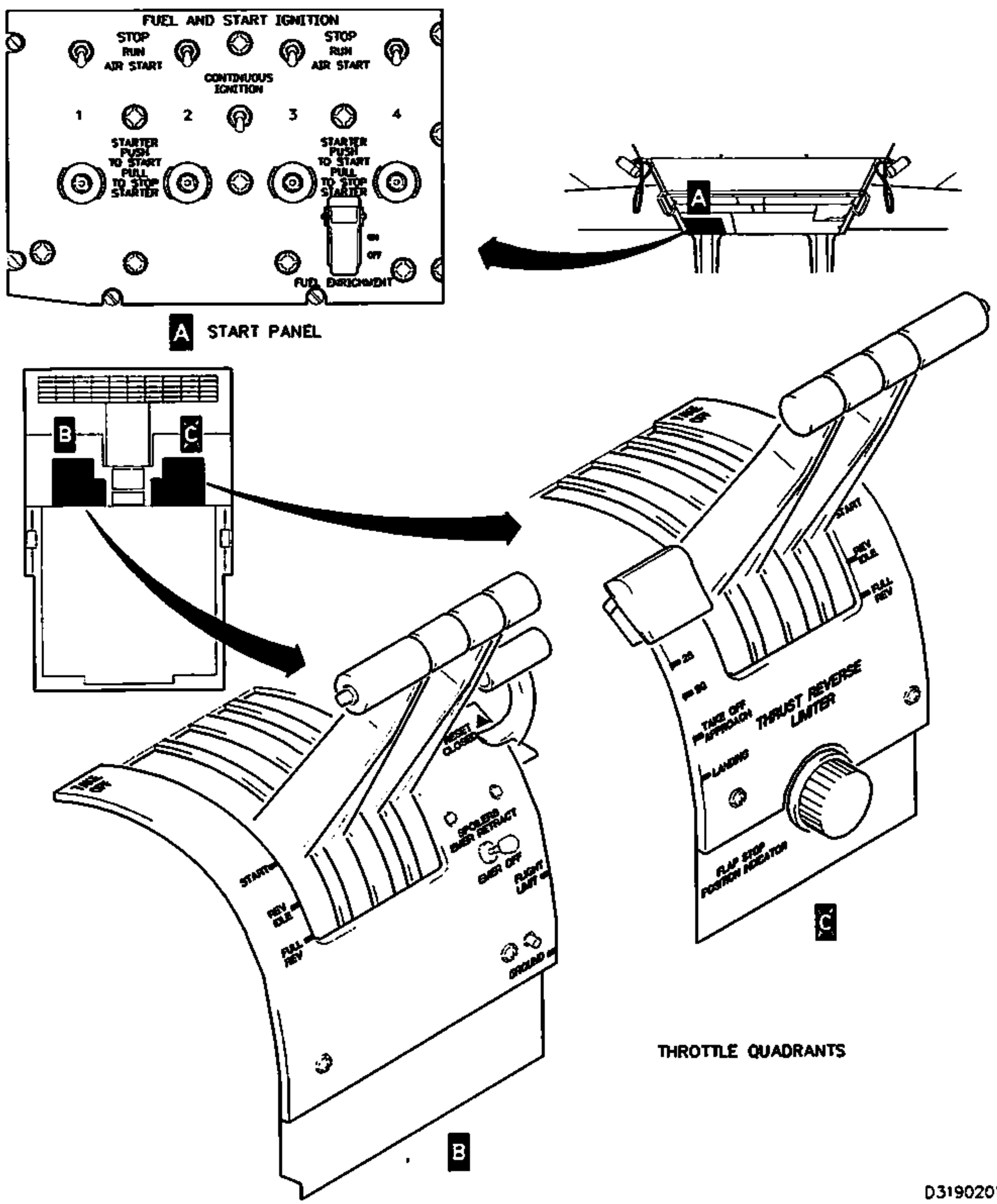


Figure 1-163. Engine Controls, Normal Operation (Typical)

THROTTLE POSITIONS

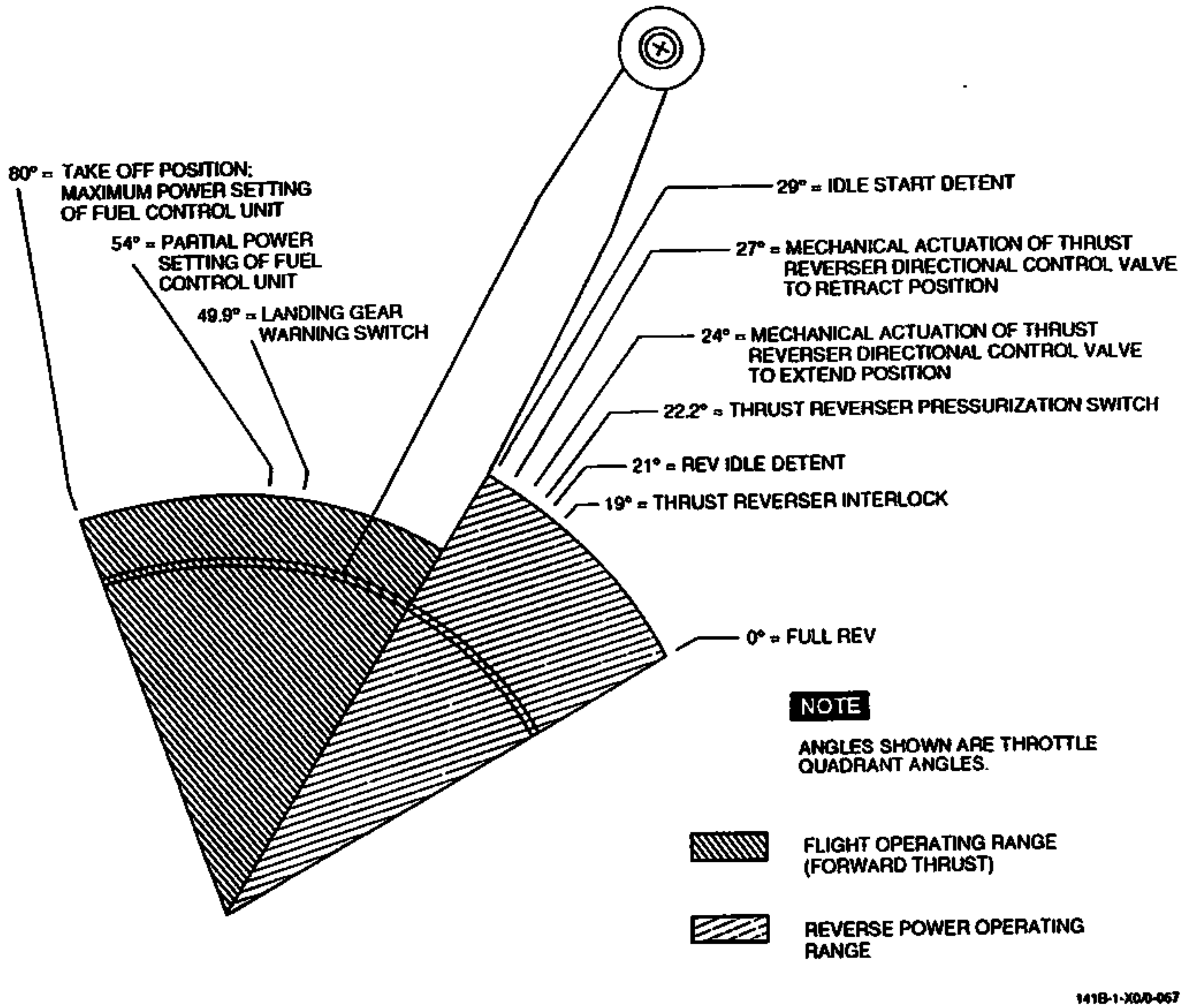
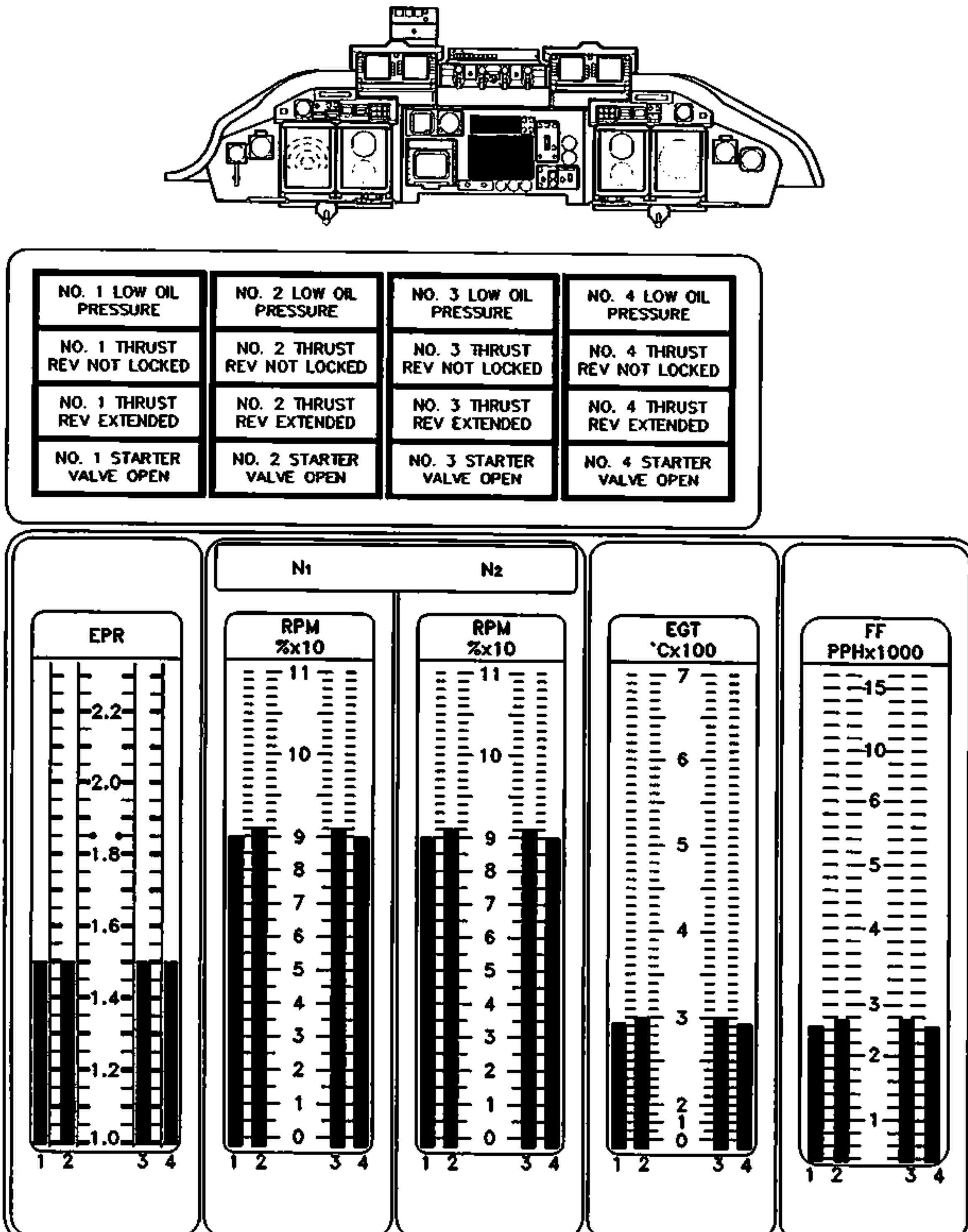


Figure 1-164. Throttle Positions

ENGINE INSTRUMENTS/INDICATORS

PILOTS' ENGINE INSTRUMENTS/INDICATORS



D3190701B

Figure 1-165. Engine Instruments/Indicators (Sheet 1 of 2)

FLIGHT ENGINEER'S ENGINE INSTRUMENTS/INDICATORS

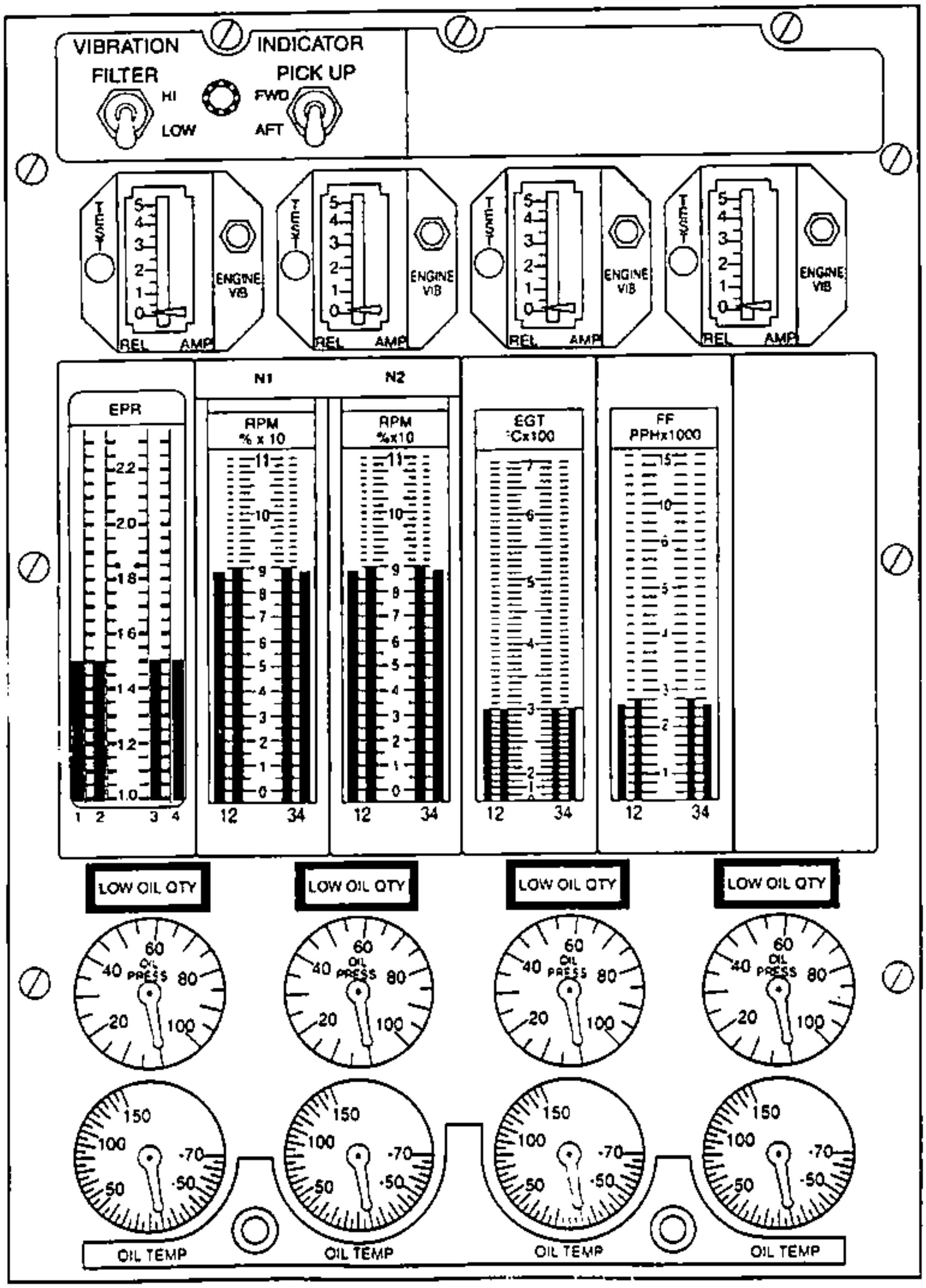
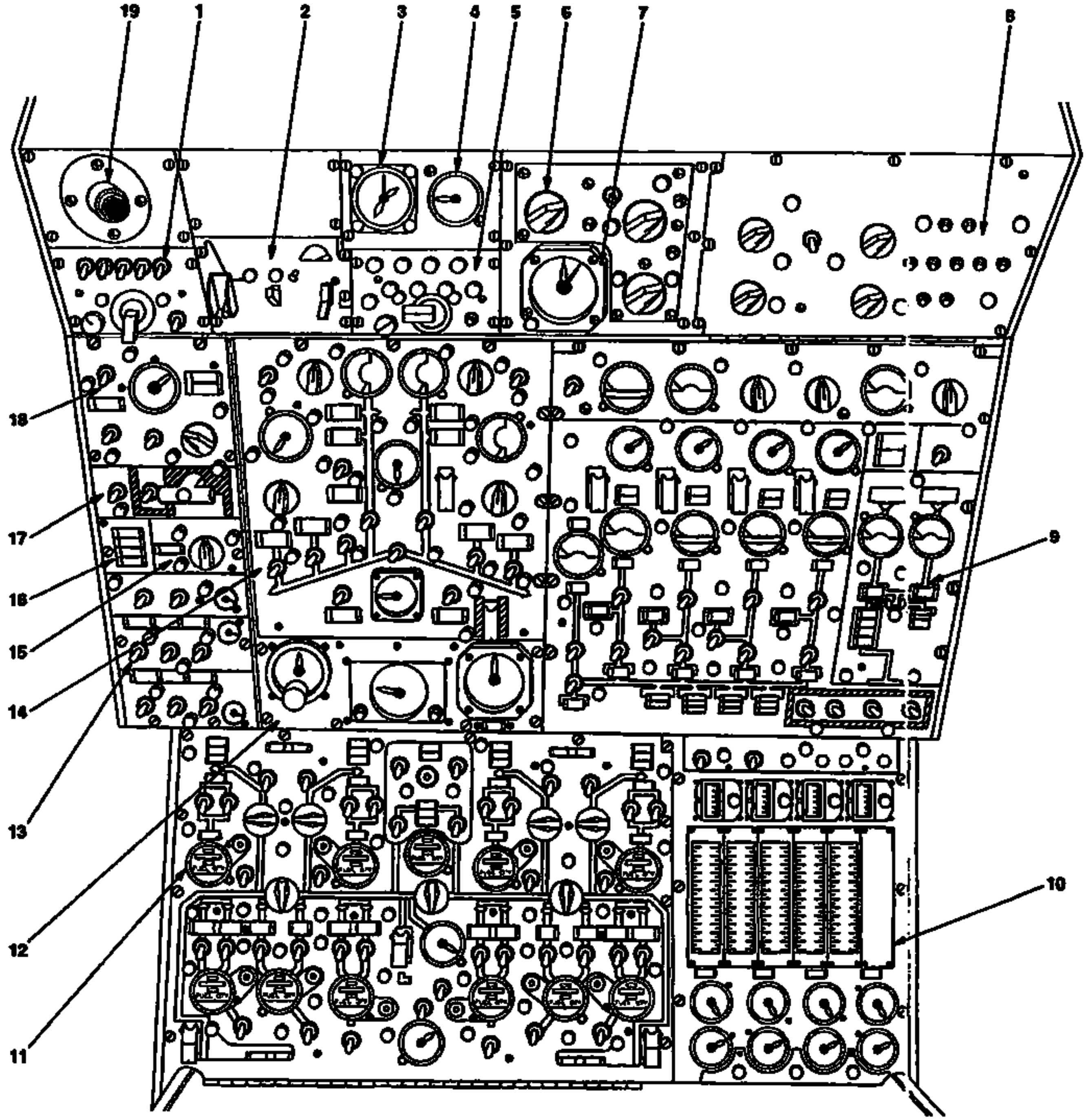


Figure 1-165. Engine Instruments/Indicators (Sheet 2 of 2)

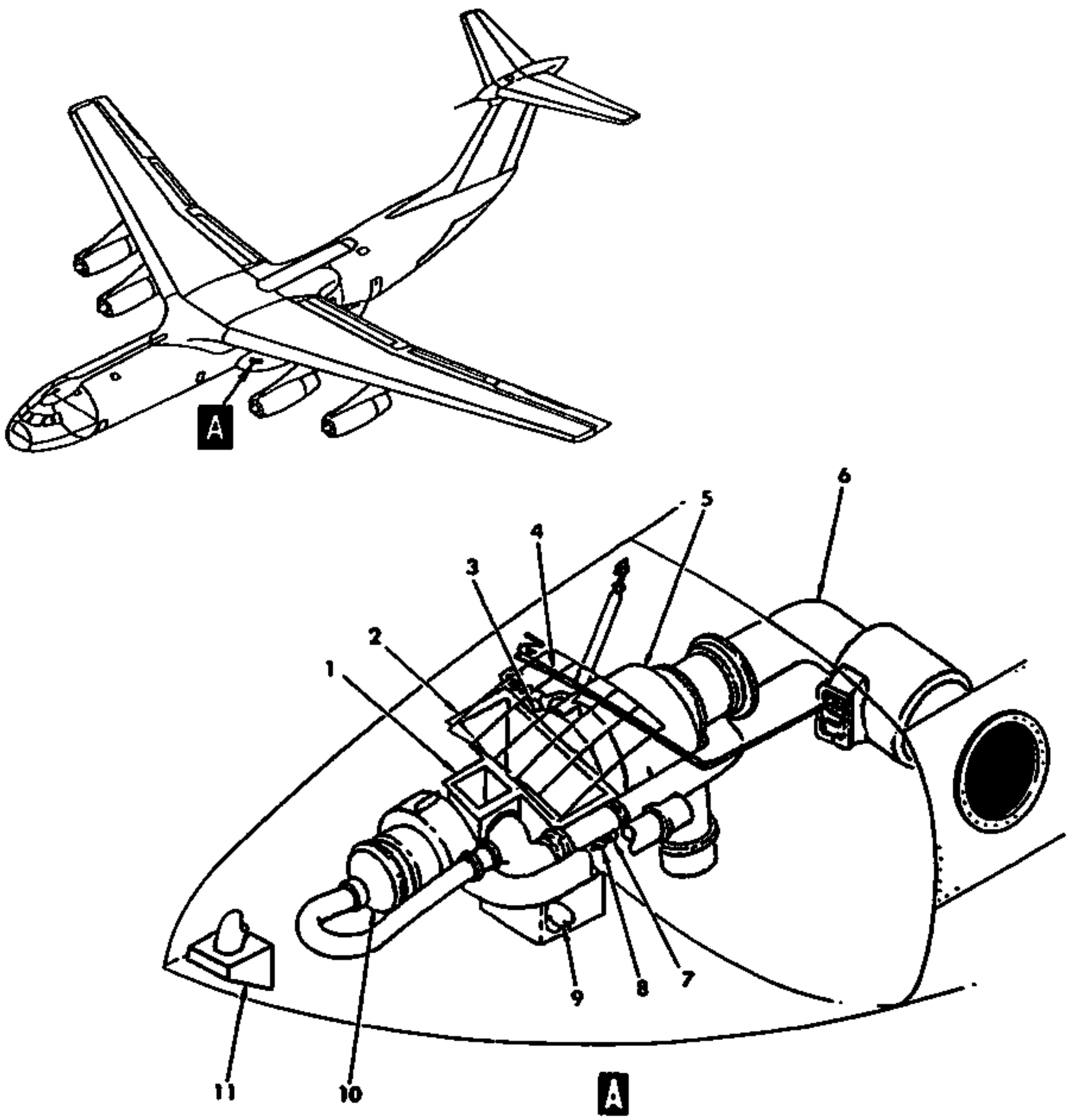
FLIGHT ENGINEER'S PANEL (TYPICAL)



1. PUBLIC ADDRESS PANEL
2. OXYGEN REGULATOR PANEL
3. CLOCK
4. TOTAL AIR TEMPERATURE INDICATOR
5. INTERPHONE PANEL
6. AERIAL REFUELING LIGHT PANEL
7. ALTIMETER
8. STATION LIGHTING PANEL
9. ELECTRICAL PANEL
10. ENGINE INSTRUMENT PANEL
11. FUEL PANEL
12. FLIGHT STATION PRESSURIZATION PANEL
13. HYDRAULIC PANEL
14. ENVIRONMENTAL PANEL
15. SMOKE DETECTOR PANEL
16. THRUST REVERSER PRESSURE INDICATOR PANEL
17. APU FIRE PANEL
18. APU PANEL
19. GASPER OUTLET

Figure 1-166. Flight Engineer's Panel (Typical)

AUXILIARY POWER UNIT

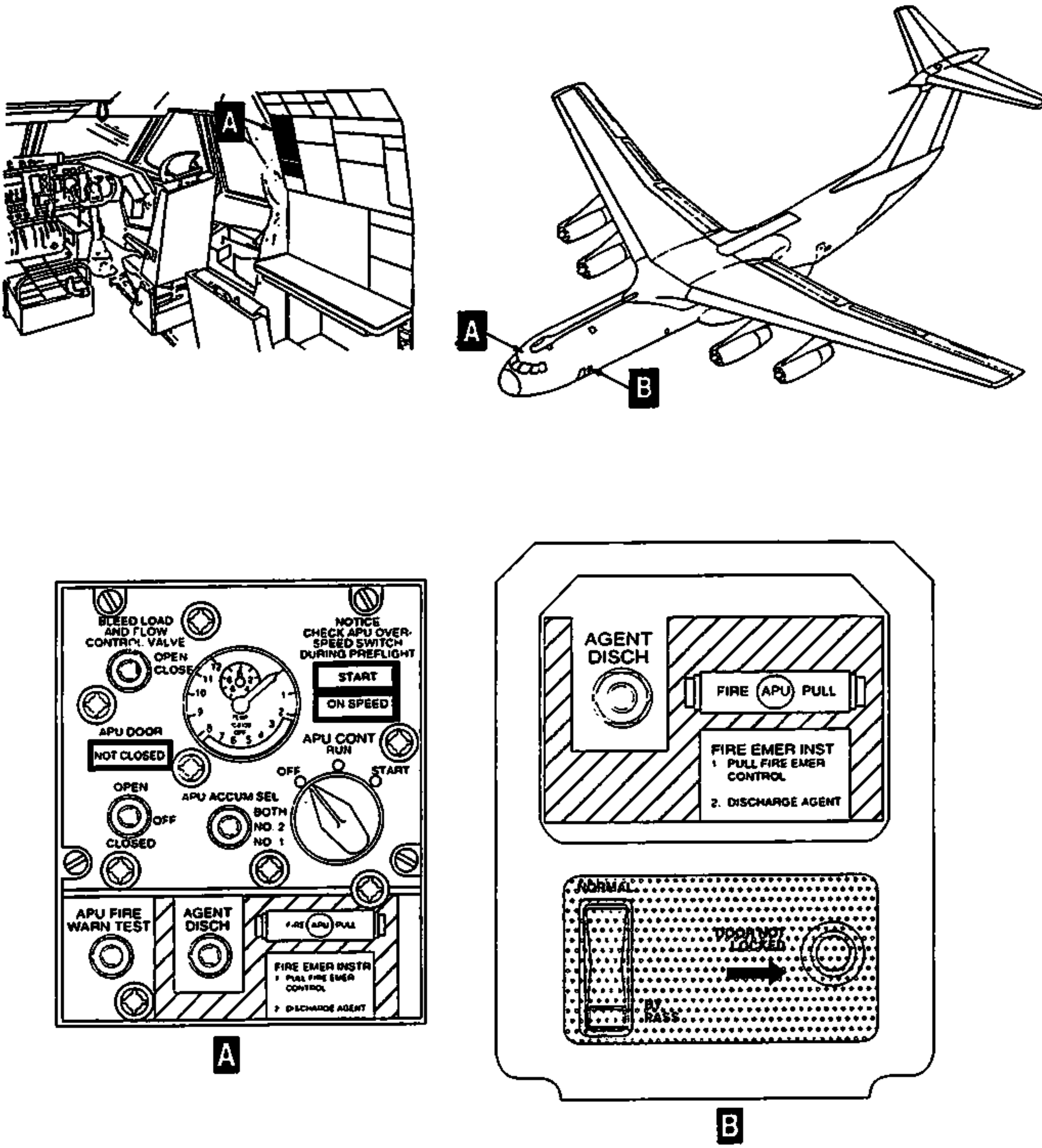


1. COOLING AIR INLET
2. COMPRESSOR AIR INLET
3. COMPRESSOR ASSEMBLY
4. FIRE DETECTOR ELEMENTS
5. POWER TURBINE ASSEMBLY
6. TURBINE EXHAUST
7. START COUNTER
8. HOUR METER
9. OIL FILLER CAP
10. A.C. GENERATOR
11. EXTERNAL PNEUMATIC SUPPLY CONNECTION

141A-1-X3/0-021

Figure 1-167. Auxiliary Power Unit

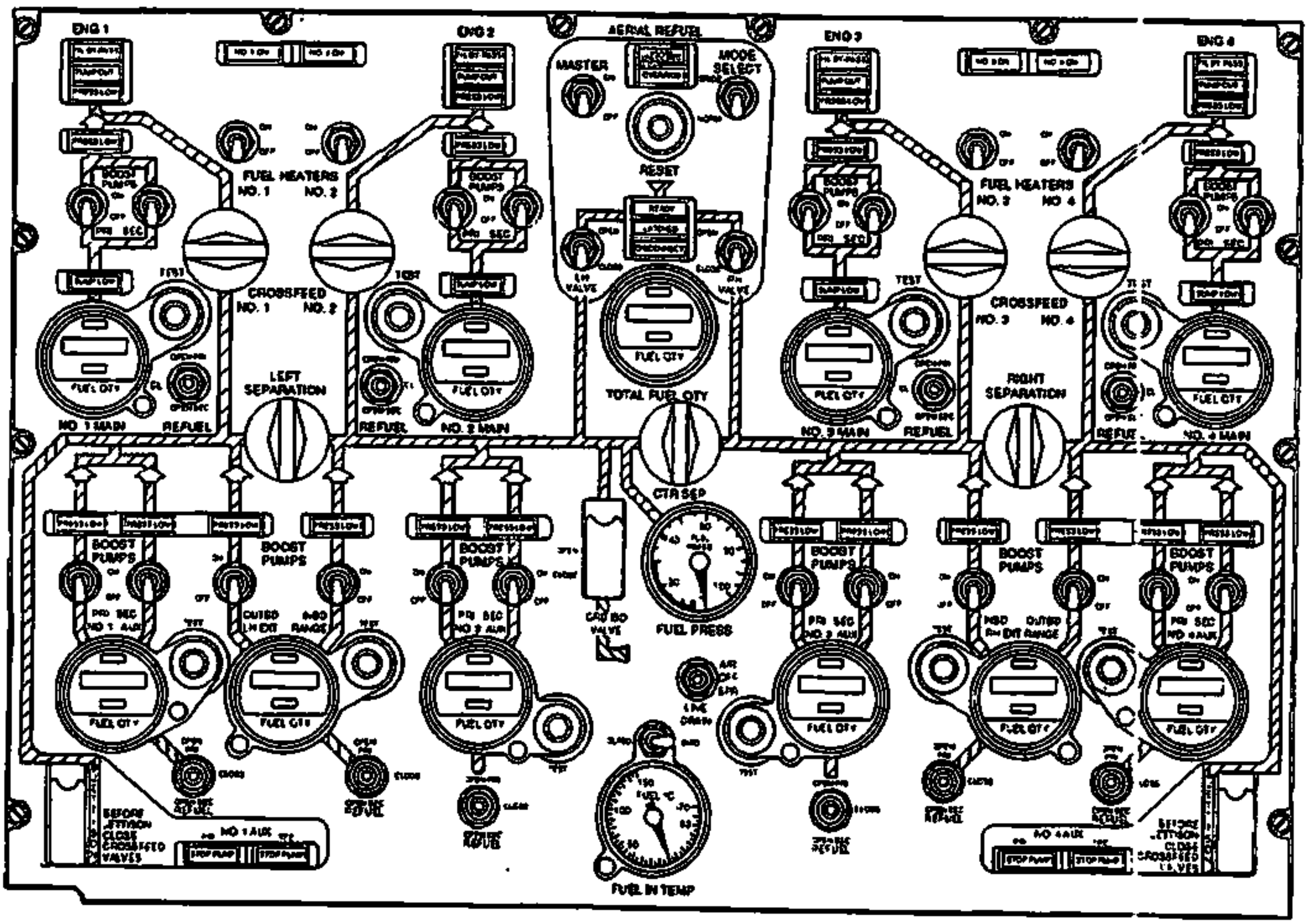
APU CONTROL PANELS



141A-1-X3/0-022

Figure 1-168. APU Control Panels

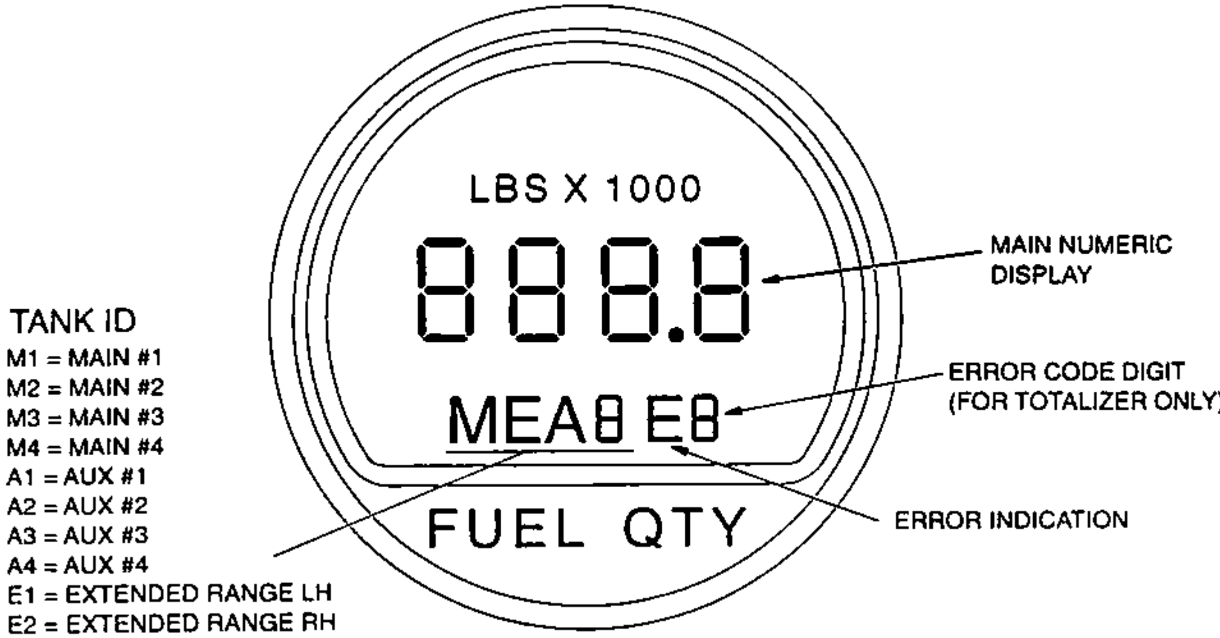
FUEL MANAGEMENT PANEL



141B-1-X0/0-017

Figure 1-169. Fuel Management Panel

DIGITAL FUEL QUANTITY INDICATOR



FUEL QUANTITY DATA TABLE

TANK CAPACITIES				
	USABLE FUEL		FULLY SERVICED	
	GALLONS	POUNDS	GALLONS	POUNDS
NO. 1 OR NO. 4 MAIN	1,233	8,014	1,265	8,221
NO. 2 OR NO. 3 MAIN	2,169	14,100	2,178	14,159
NO. 1 OR NO. 4 AUX	2,570	16,704	2,572	16,716
NO. 2 OR NO. 3 AUX	1,696	11,022	1,701	11,056
LH OR RH EXT RANGE	4,128	26,836	4,140	26,915
PLUMBING (EACH SIDE)			32	208
TOTAL (EACH WING)	11,796	76,676	11,888	77,275
TOTAL (BOTH WINGS)	23,592	153,352	23,776	154,550

NOTE

THE TABLE IS BASED ON:

1. JP-4 FUEL AT 6.5 LB/GAL (ICAO STANDARD DAY CONDITIONS).
2. MEASURED DATA.

Figure 1-170. Fuel Quantity Data Table

FUEL SUPPLY SYSTEM

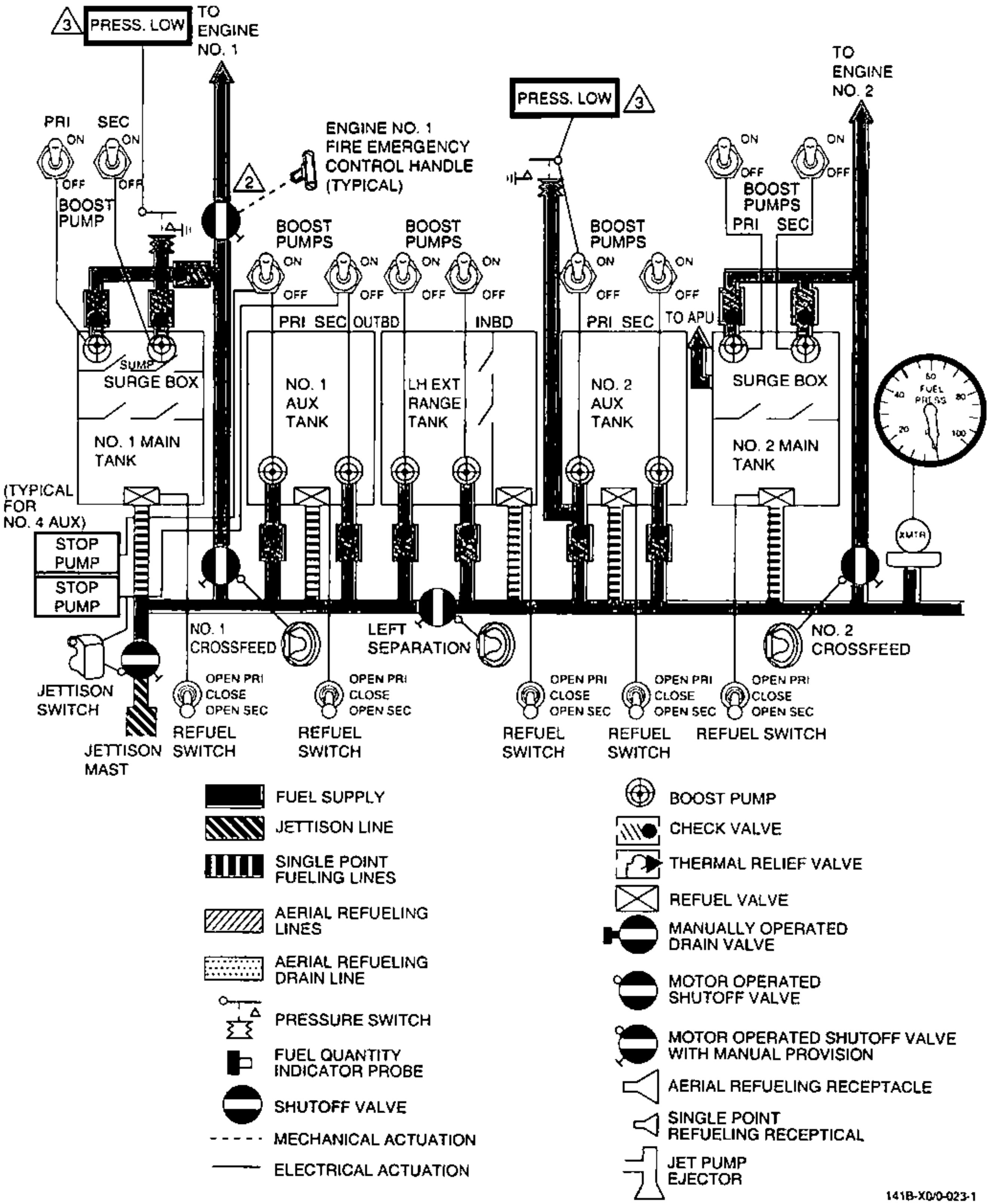
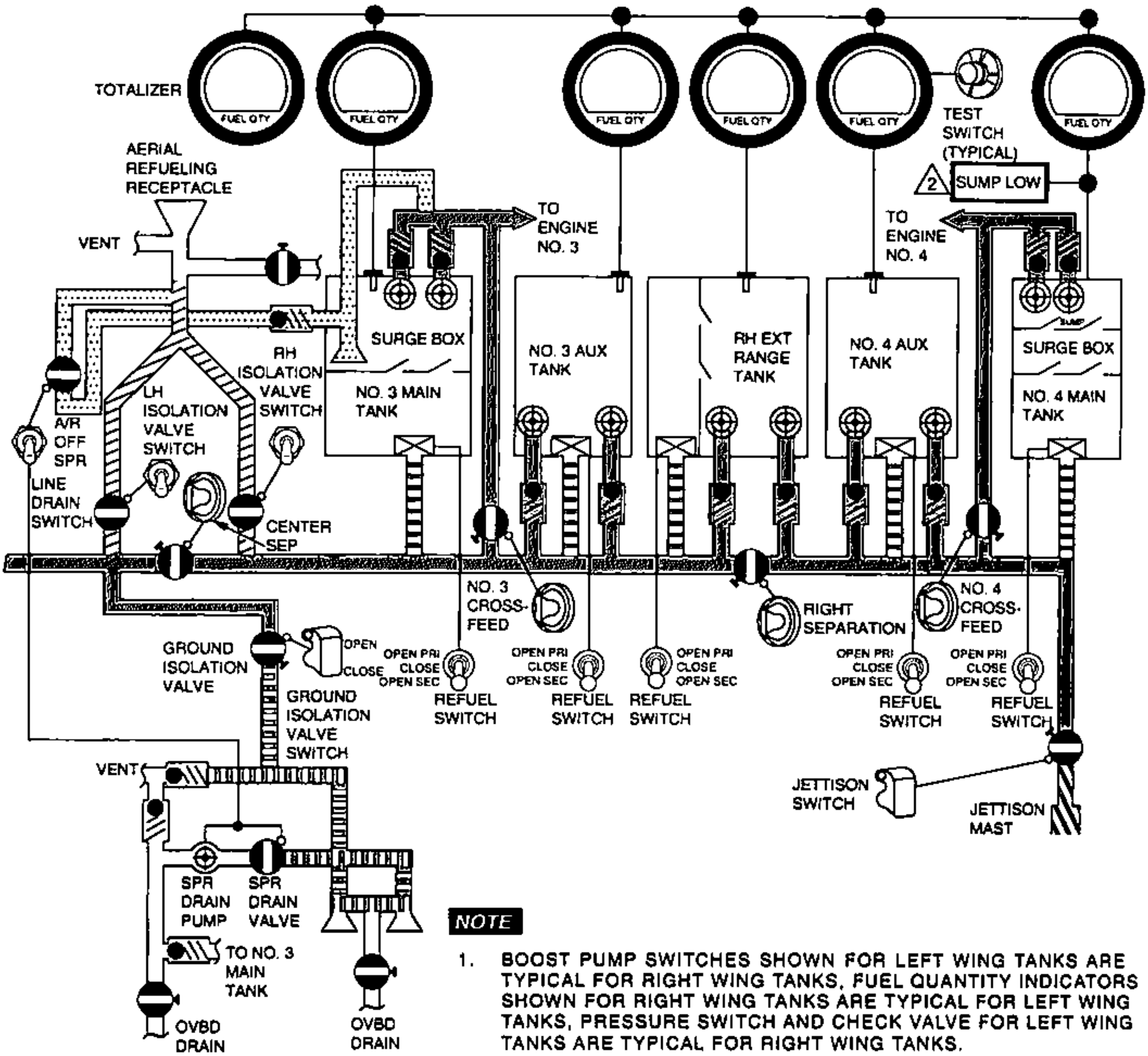


Figure 1-171. (Sheet 1 of 2)



NOTE

1. BOOST PUMP SWITCHES SHOWN FOR LEFT WING TANKS ARE TYPICAL FOR RIGHT WING TANKS, FUEL QUANTITY INDICATORS SHOWN FOR RIGHT WING TANKS ARE TYPICAL FOR LEFT WING TANKS, PRESSURE SWITCH AND CHECK VALVE FOR LEFT WING TANKS ARE TYPICAL FOR RIGHT WING TANKS.

⚠2 TYPICAL FOR THE FOUR MAIN TANKS.

⚠3 PRESS. LOW LIGHTS ASSOCIATED WITH THE MAIN TANK BOOST PUMPS ARE INDEPENDENT OF THE BOOST PUMP SWITCH. PRESS. LOW LIGHTS ASSOCIATED WITH ALL OTHER TANK BOOST PUMPS ARE NOT.

141B-1-X0/0-023-2

Figure 1-171. (Sheet 2 of 2)

AERIAL REFUELING SYSTEM

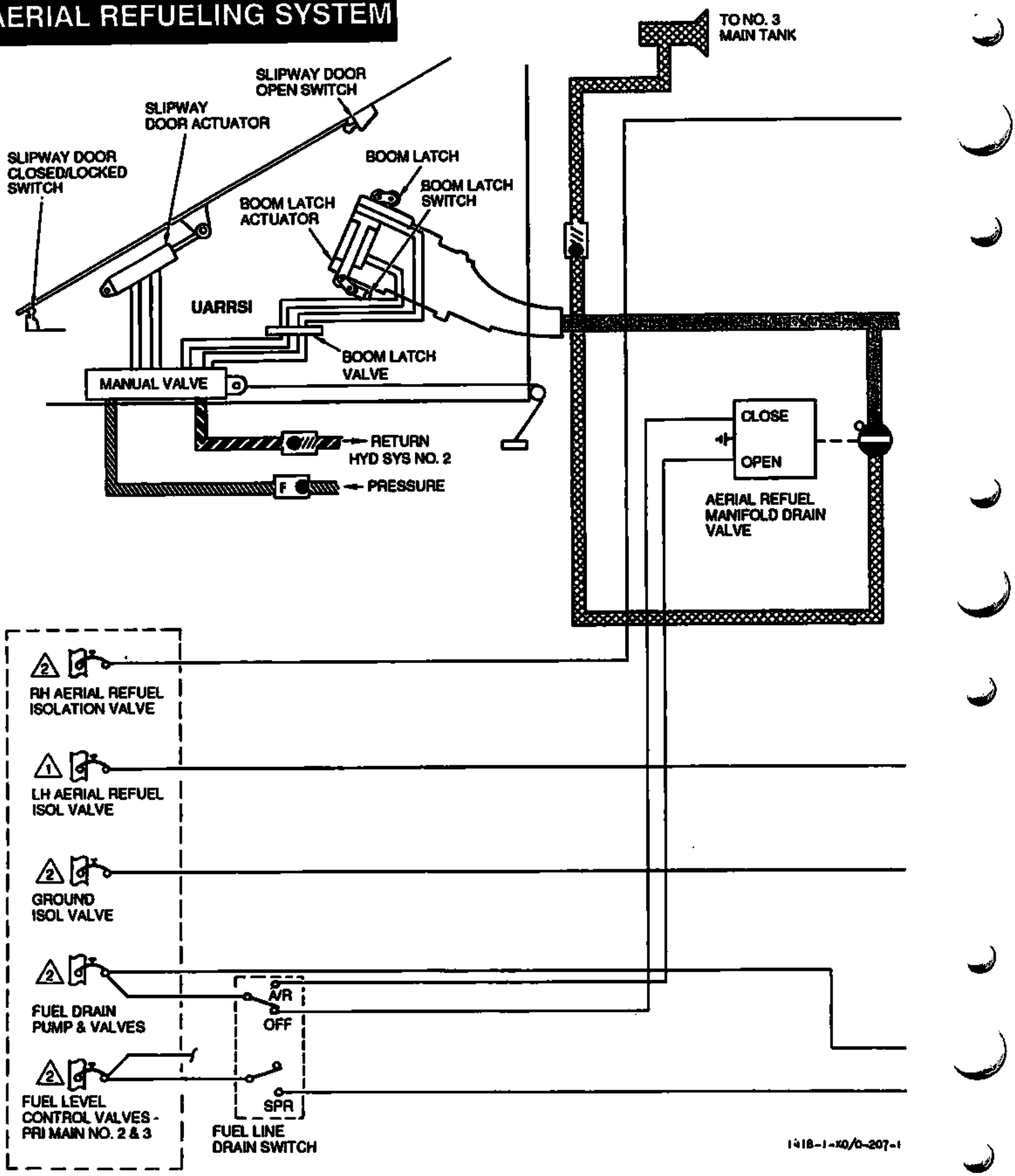


Figure 1-172. Aerial Refueling System (Sheet 1 of 2)

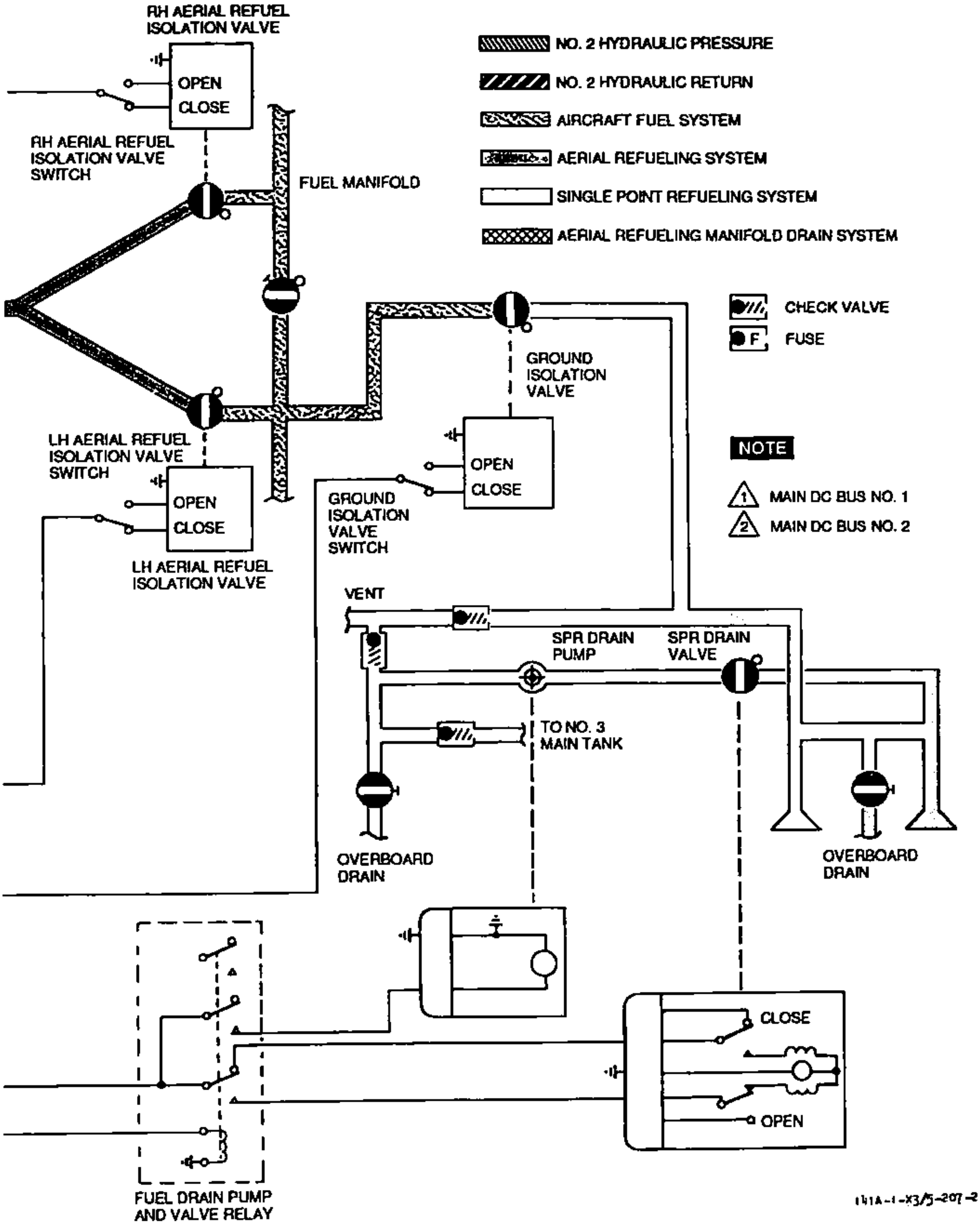


Figure 1-172. Aerial Refueling System (Sheet 2 of 2)

AERIAL REFUEL SLIPWAY DOOR CONTROL HANDLE

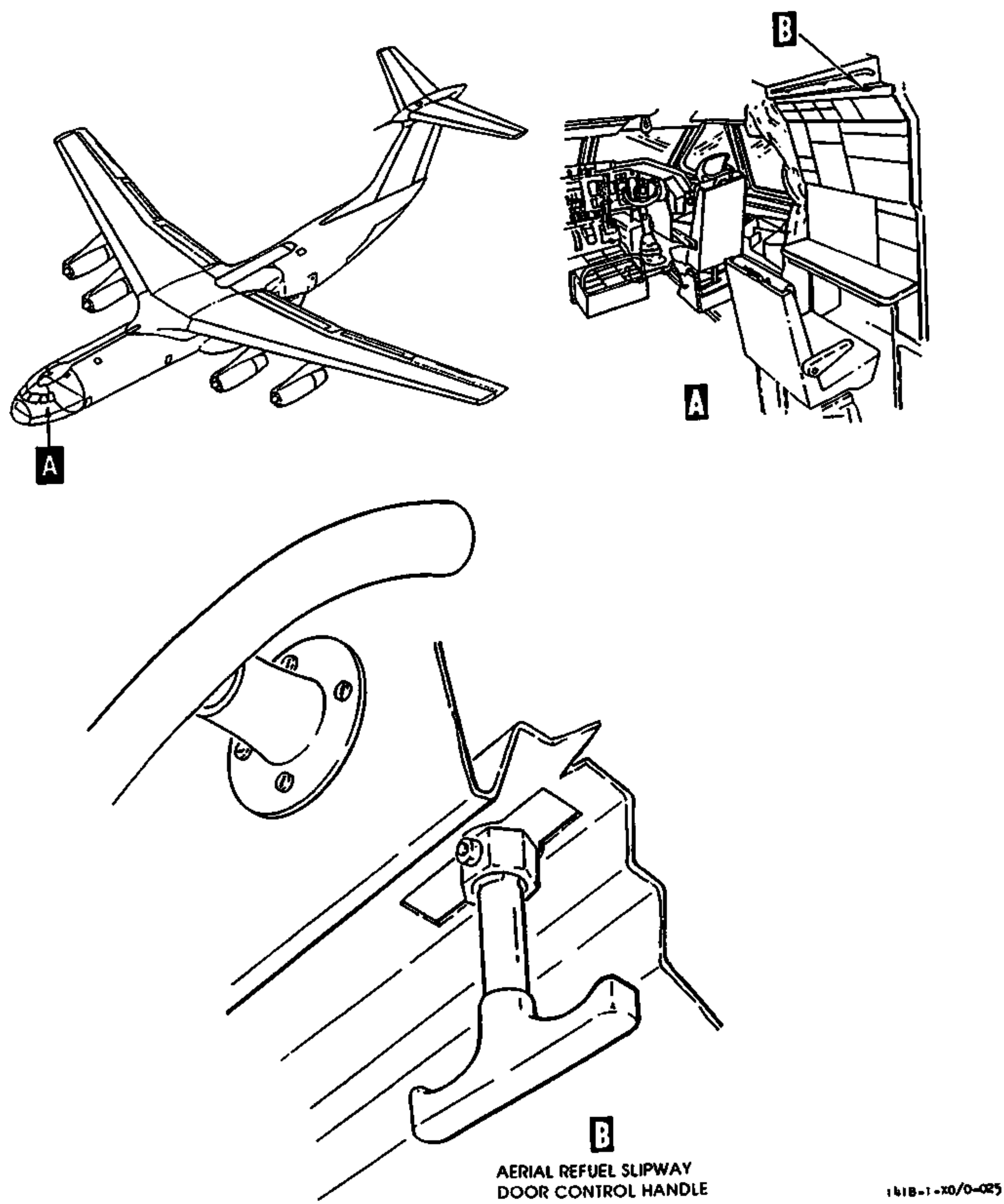
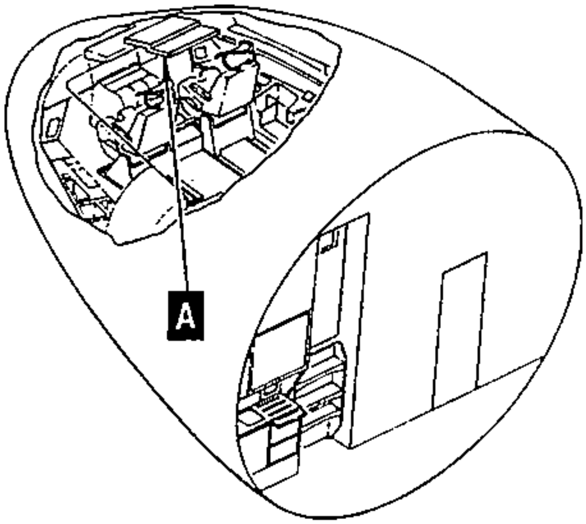
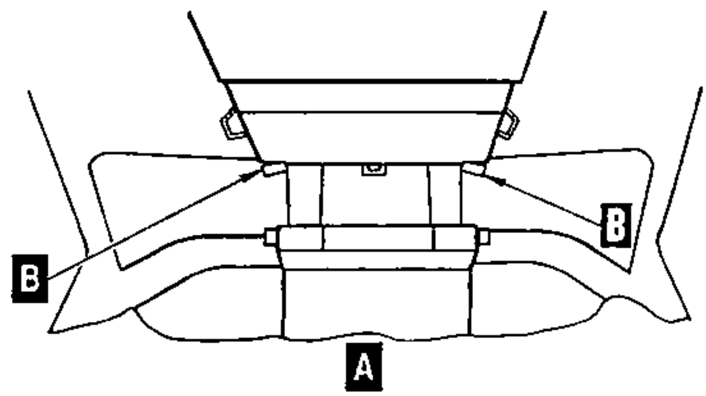


Figure 1-173. Aerial Refuel Slipway Door Control Handle

AERIAL REFUELING INDICATOR LIGHTS





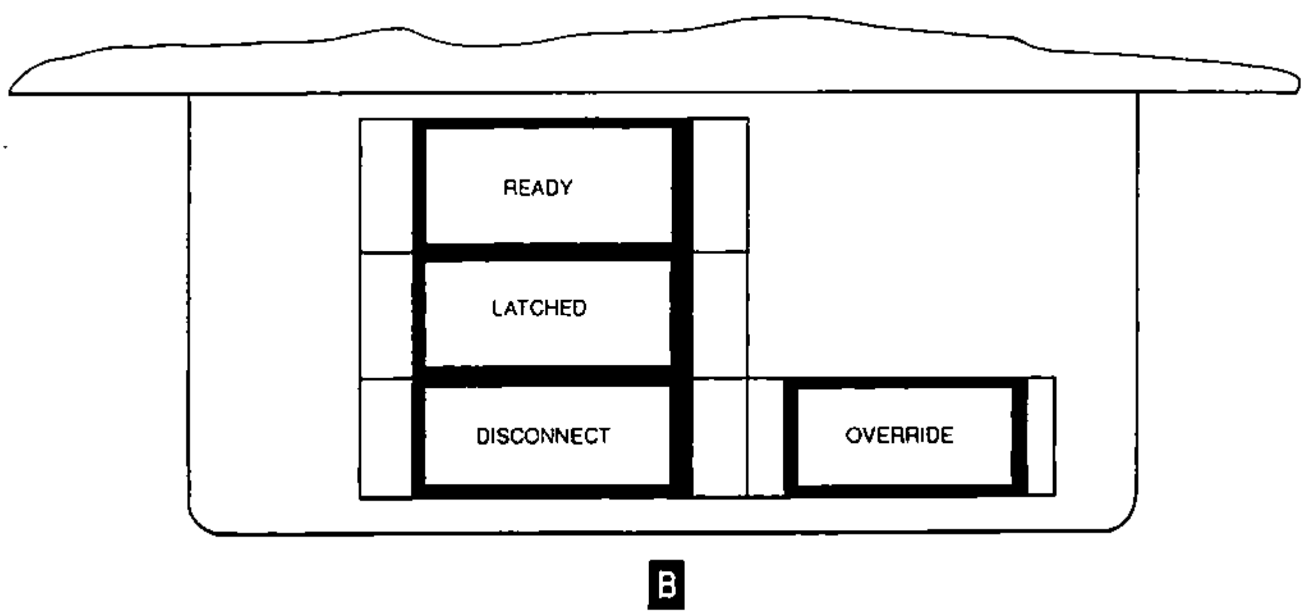


Figure 1-174. Aerial Refueling Indicator Lights

AERIAL REFUELING LIGHTS CONTROL PANEL

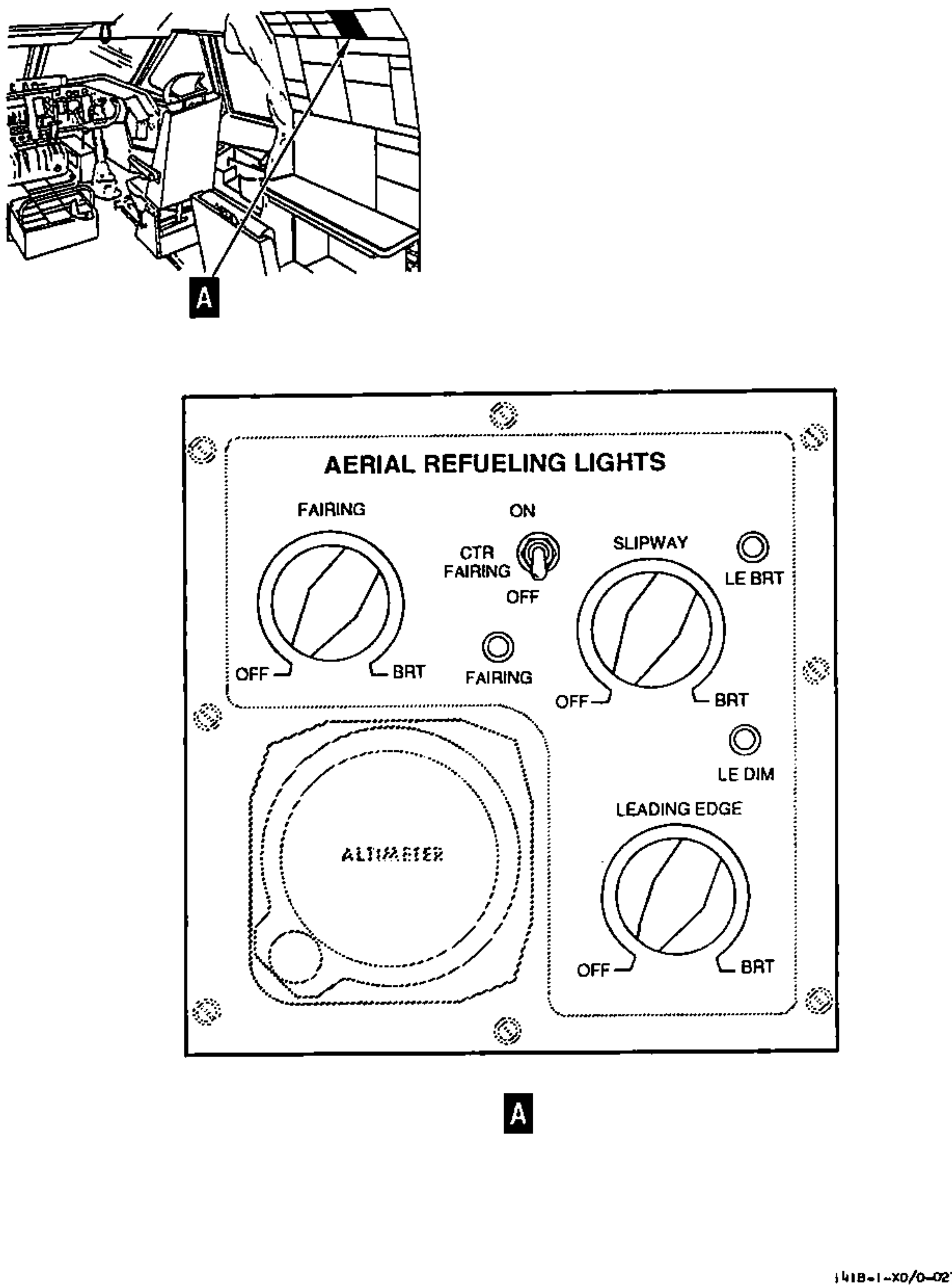


Figure 1-175. Aerial Refueling Lights Control Panel

FLIGHT ENGINEER'S ELECTRICAL PANEL

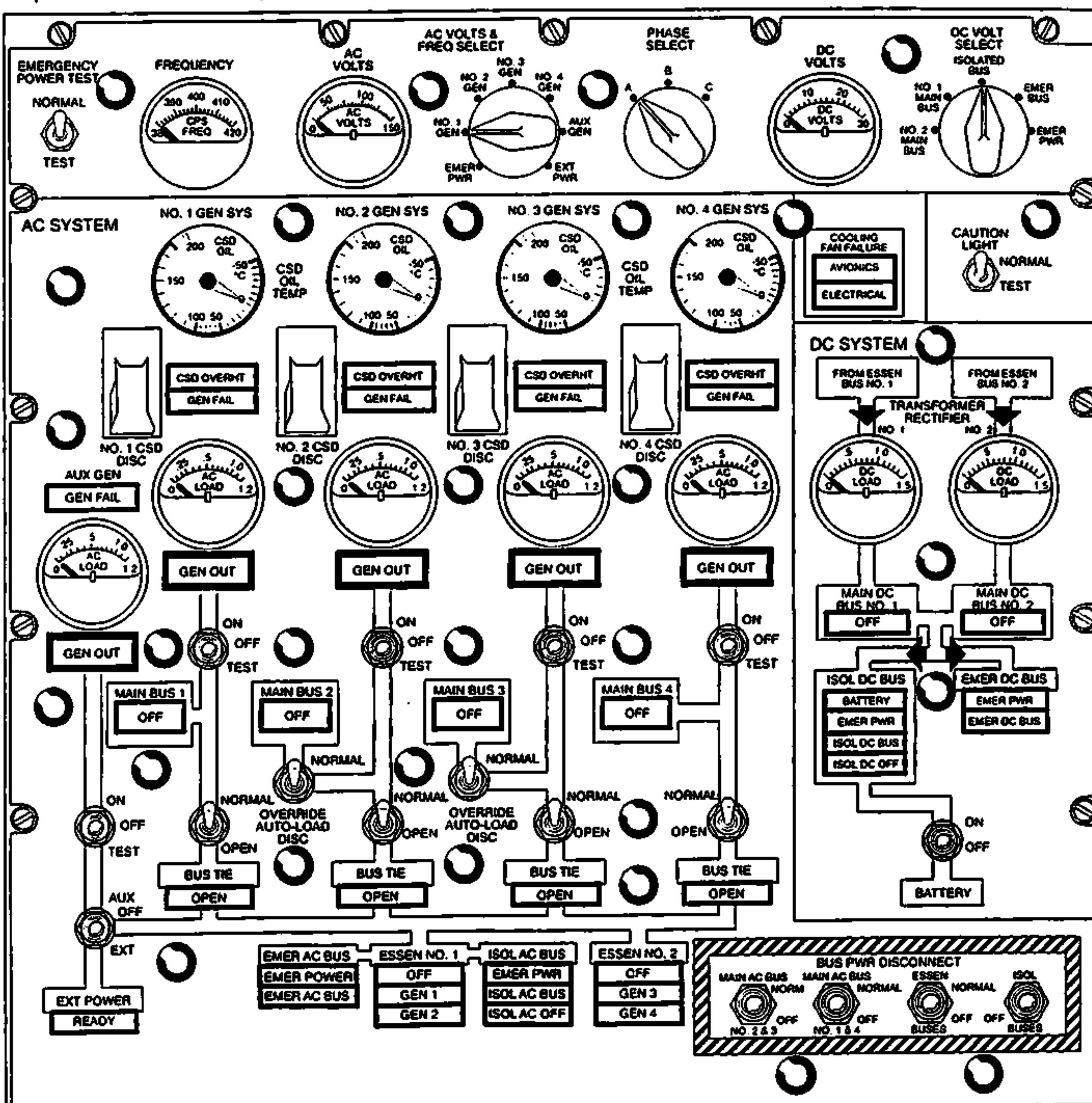
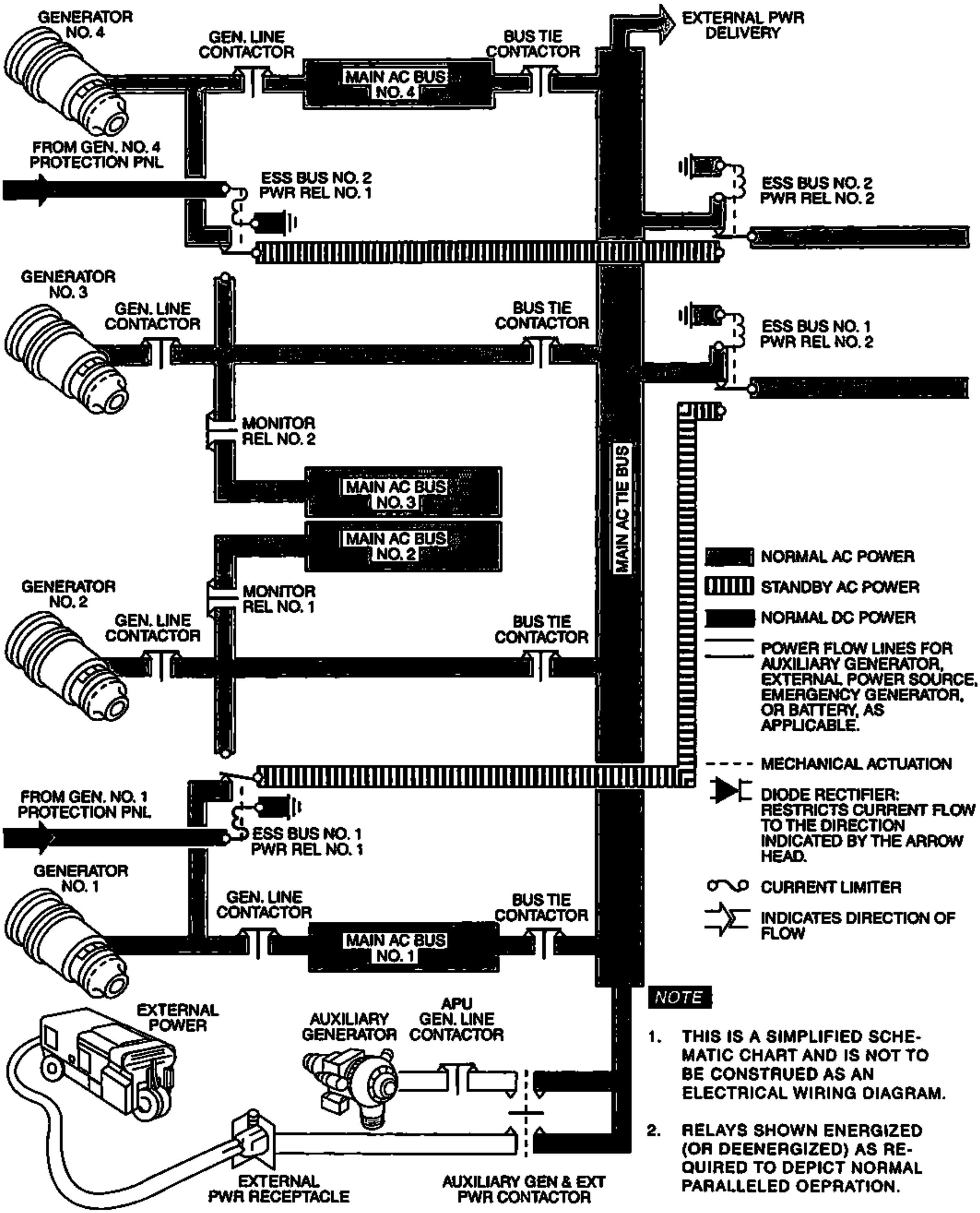


Figure 1-176. Flight Engineer's Electrical Panel



NOTE

1. THIS IS A SIMPLIFIED SCHEMATIC CHART AND IS NOT TO BE CONSTRUED AS AN ELECTRICAL WIRING DIAGRAM.
2. RELAYS SHOWN ENERGIZED (OR DEENERGIZED) AS REQUIRED TO DEPICT NORMAL PARALLELED OEPRATION.

Figure 1-177. (Sheet 1 of 2)

AIRCRAFT ELECTRICAL SYSTEM

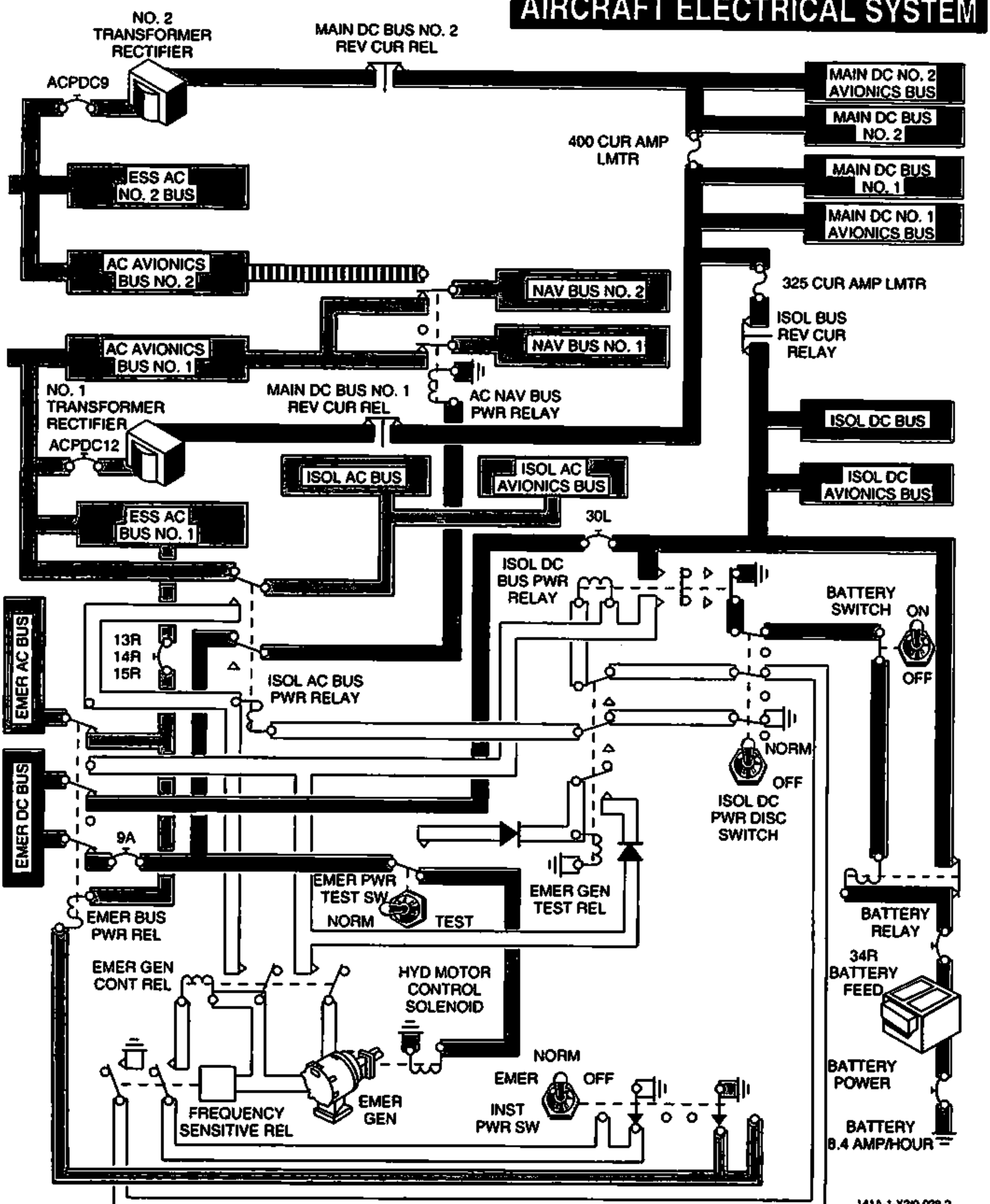


Figure 1-177. (Sheet 2 of 2)

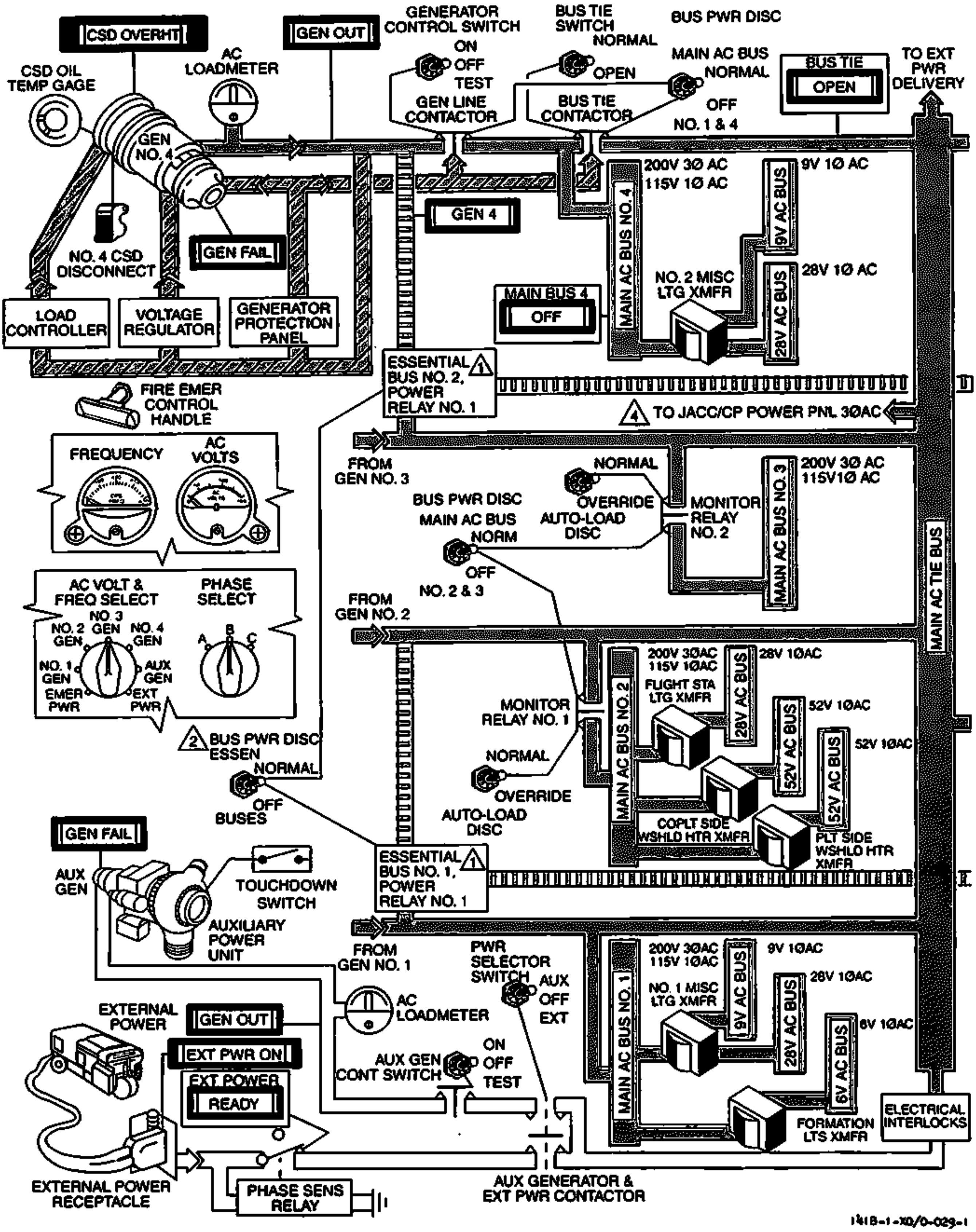


Figure 1-178. (Sheet 1 of 2)

AC POWER SYSTEM

NOTE

1. EXCEPT AS NOTED, THE CONTROL SWITCHES, INDICATORS, CONTACTORS AND AUTOMATIC CONTROL CIRCUITS SHOWN FOR MAIN GENERATOR SYSTEM NO. 4 ARE TYPICAL FOR THE REMAINING MAIN GENERATOR SYSTEMS.
2. TO SHOW BOTH THE NORMAL AND EMERGENCY SYSTEMS ON ONE ILLUSTRATION, ALL RELAYS EXCEPT THOSE NOTED HAVE BEEN SHOWN IN THEIR ENERGIZED POSITION.

⚠1 THE ESSENTIAL BUS POWER RELAYS AUTOMATICALLY TRANSFER THE RELATED ESSENTIAL LOAD SYSTEM TO A SOURCE OF STANDBY POWER IF THE TIE BUS BECOMES DE-ENERGIZED.

⚠2 SWITCH ALSO CONTROLS THE OPENING OF THE GENERATOR LINE CONTACTORS ASSOCIATED WITH GENERATOR SYSTEM NO. 2 AND NO. 3.

⚠3 RELAY SHOWN IN ITS NORMALLY DE-ENERGIZED POSITION. IF THE EMERGENCY GENERATOR WERE OPERATING AND THE ISOLATED BUSES DISCONNECT SWITCH WERE POSITIONED TO "NORMAL" (AS SHOWN), THE RELAY WOULD BE ENERGIZED CLOSED TO EMERGENCY POWER; AND THE ISOLATED BUSES WOULD BE SUPPLIED BY THE EMERGENCY GENERATOR.

⚠4 AIRCRAFT MODIFIED BY TCTO - 503.

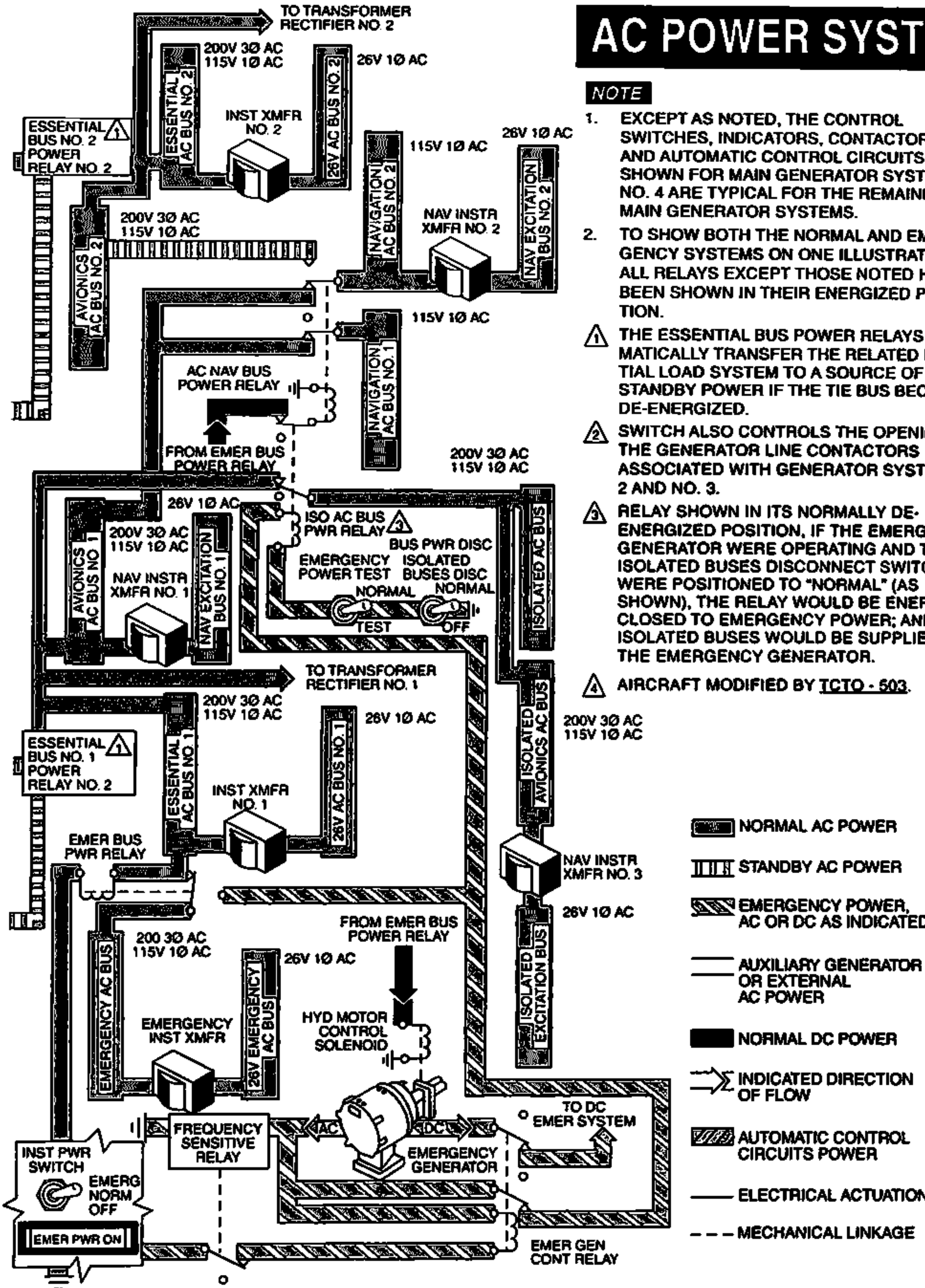


Figure 1-178. (Sheet 2 of 2)

AC POWER DISTRIBUTION

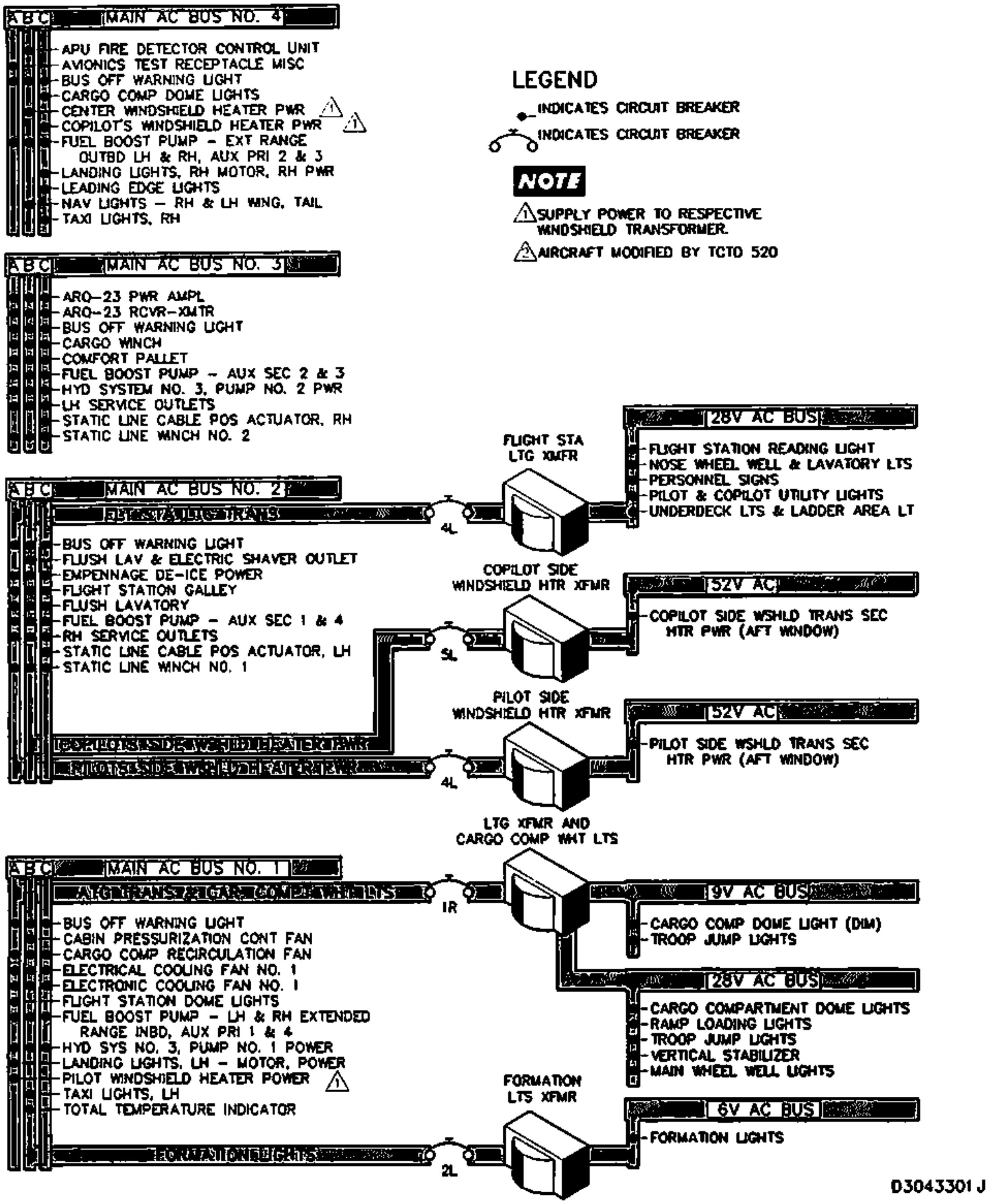


Figure 1-179. AC Power Distribution (Sheet 1 of 4)

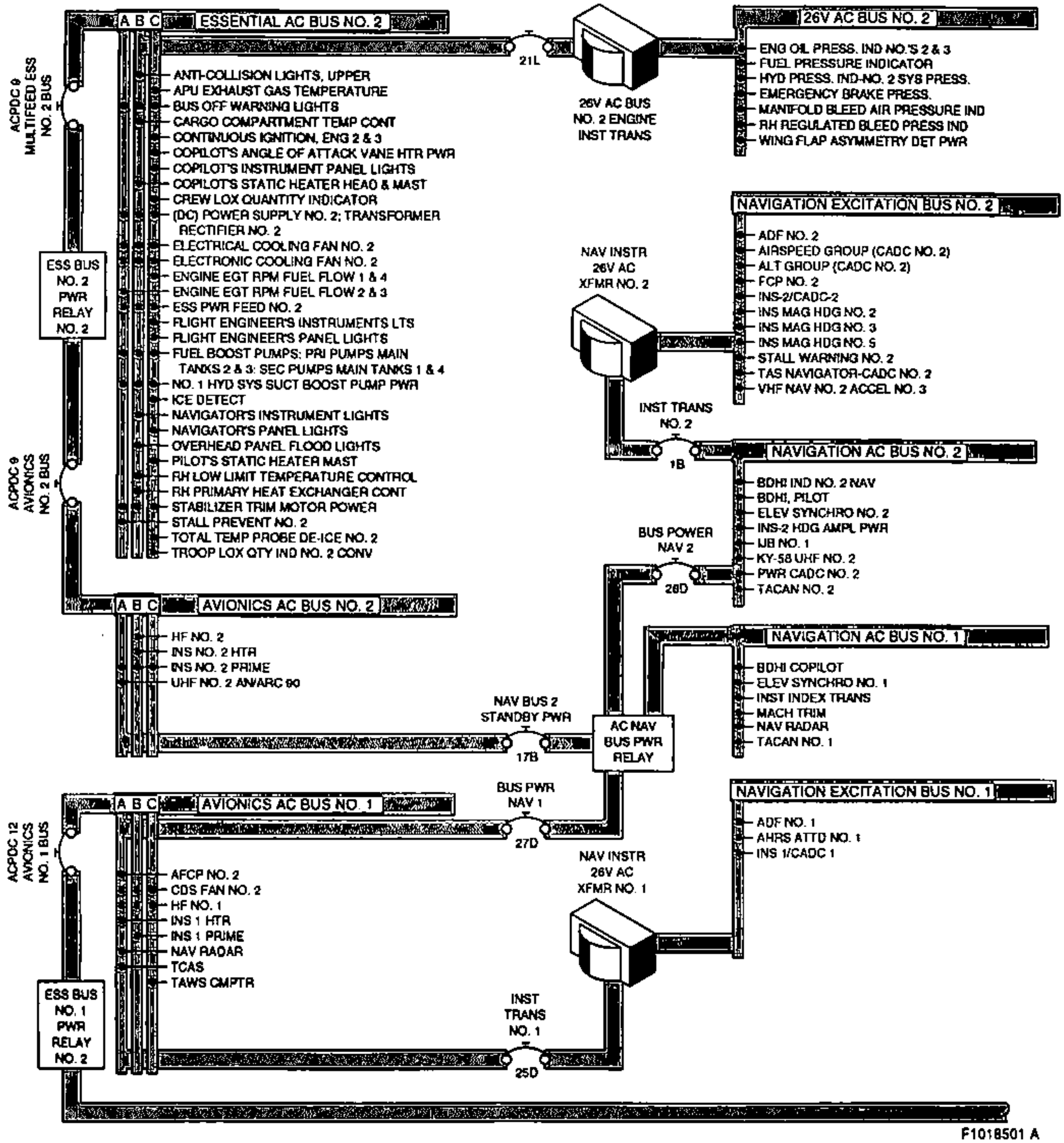


Figure 1-179. AC Power Distribution (Sheet 2 of 4)

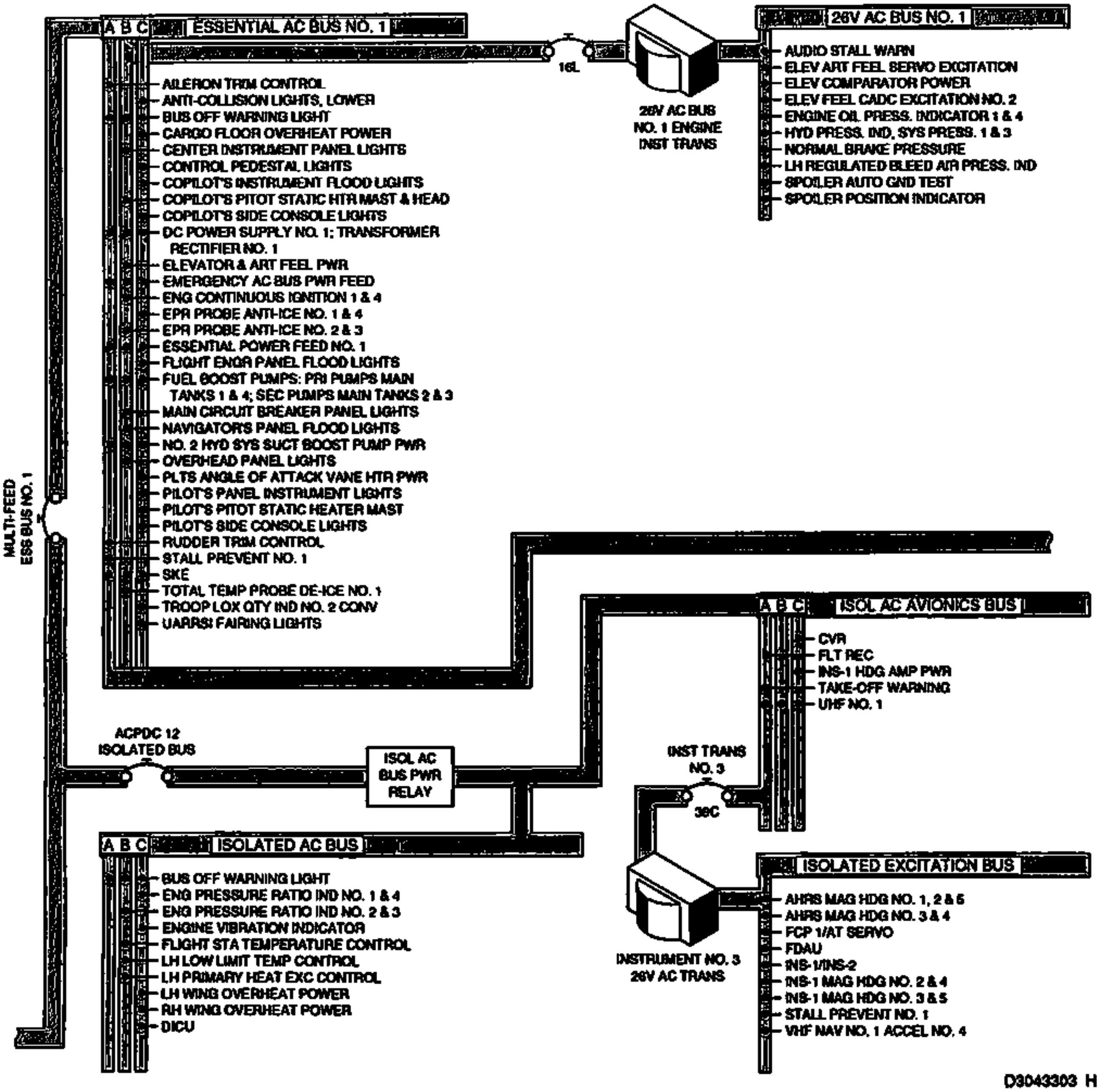


Figure 1-179. AC Power Distribution (Sheet 3 of 4)

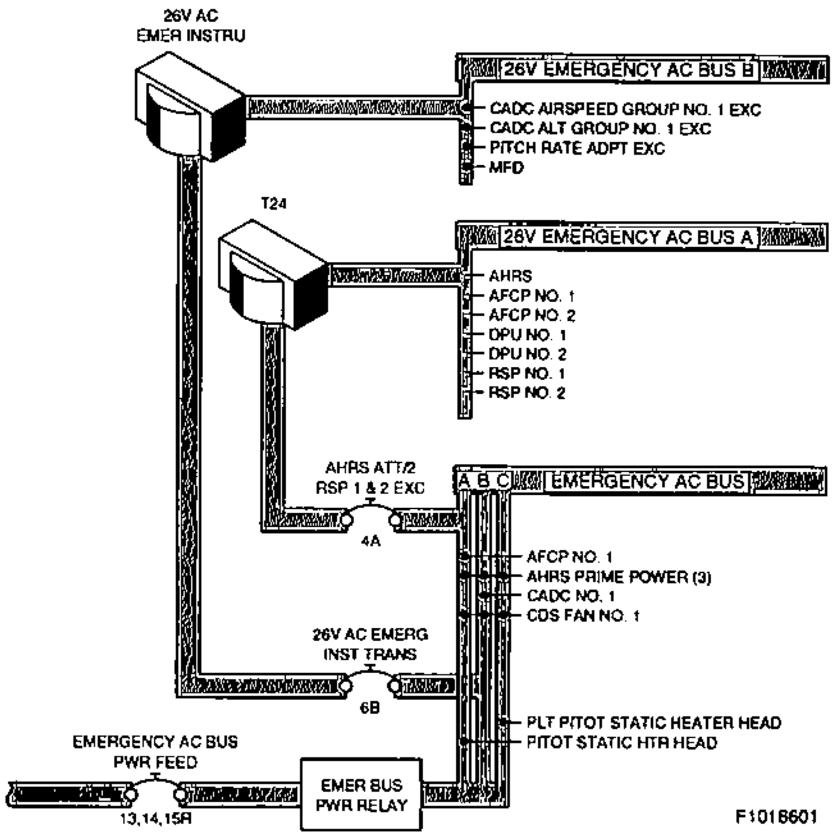


Figure 1-179. AC Power Distribution (Sheet 4 of 4)

NORMAL AC POWER
NORMAL DC POWER
EMERGENCY AC POWER
EMERGENCY DC POWER

INDICATES DIRECTION OF FLOW
ELECTRICAL ACTUATION
MECHANICAL LINKAGE
CIRCUIT BREAKER
CURRENT BREAKER

1. TO SHOW BOTH THE NORMAL AND EMERGENCY SYSTEMS AS IF ACTIVATED, ALL RELAYS, EXCEPT THOSE NOTED, HAVE BEEN SHOWN IN THEIR ENERGIZED POSITIONS.

2. THE BLACK "DASH" LINES LEAD FROM THE BUSES TO THE INDIVIDUAL CIRCUIT BREAKER.

3. RELAY SHOWN IN ITS NORMAL DE-ENERGIZED POSITION. IF THE EMERGENCY CIRCUIT WIRE COMPLETED TO GROUND AS INDICATED, THE LOWER (ON PAGE) CONTACTS OF THE RELAY WOULD BE CLOSED, ENERGIZING THE ISOLATED DC BUSES.

4. COPILOT'S, NAVIGATOR'S, FORWARD CREW DOOR, AND RIGHT TROOP DOOR AND RIGHT MAIN LANDING GEAR POD INTERPHONE SYSTEMS.

5. JUMP SEAT, LEFT UNDERDECK AREA, AND FORWARD FUSELAGE, LEFT TROOP DOOR AND LEFT MAIN LANDING GEAR POD, AND VERTICAL STABILIZER INTERPHONE SYSTEMS.

6. PILOT'S AND FLIGHT ENGINEER'S INTERPHONE SYSTEM.

7. LABELED "IRON LUNG FWD" ON 12778 THRU 38090.

8. LABELED "IRON LUNG AFT" ON 12778 THRU 38090.

9. LABELED "SPOILER MLG INTLK" ON 12778 THRU 38090.

10. USTS AIRCRAFT MODIFIED BY TCTO 530.

11. AERP AIRCRAFT MODIFIED BY TCTO 540.

12. ANDVT (KYV-5) AIRCRAFT MODIFIED BY TCTO 550.

13. L-BAND SATCOM AIRCRAFT MODIFIED BY TCTO 555.

14. AERO MEDICAL EQUIPMENT AIRCRAFT MODIFIED BY TCTO 595.

15. ANTI-COLLISION STROBE LIGHT AIRCRAFT MODIFIED BY TCTO 631.

16. KY-75 HF NO. 1 AND NO. 2 AIRCRAFT MODIFIED BY TCTO 636.

17. KY-58 UHF NO. 1 AND VHF NO. 1 AIRCRAFT MODIFIED BY TCTO 637.

18. KY-58 UHF NO. 2 AND VHF NO. 2 AIRCRAFT MODIFIED BY TCTO 637.

19. HF NO. 1 ACS AIRCRAFT MODIFIED BY TCTO 769.

20. HF NO. 2 ACS AIRCRAFT MODIFIED BY TCTO 776.

21. THIS CIRCUIT BREAKER CONTROLS EMERGENCY DC VOLTAGE INDICATION.

D3027501 M

Figure 1-180. DC Power Distribution (Sheet 1 of 3)

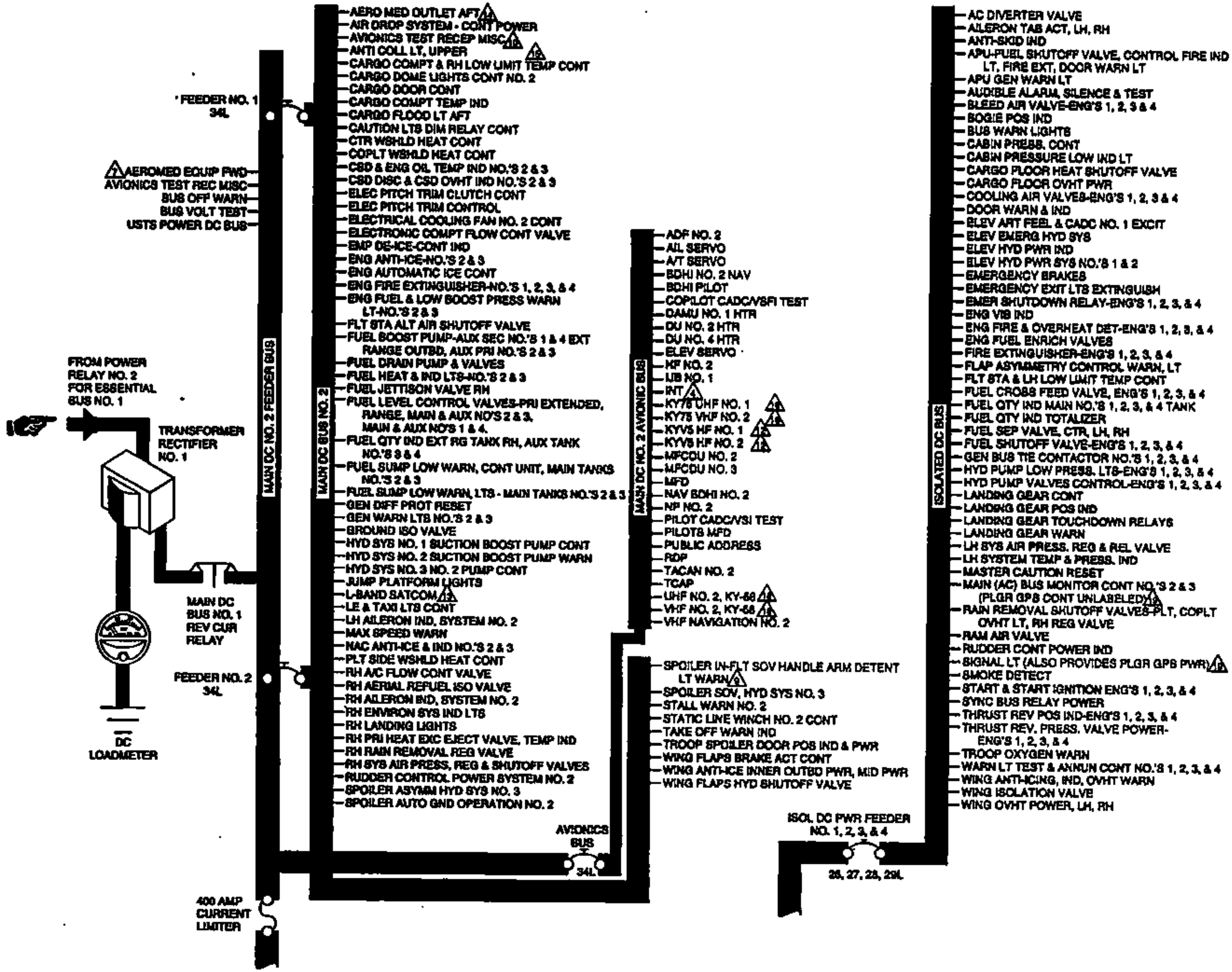


Figure 1-180. DC Power Distribution (Sheet 2 of 3)

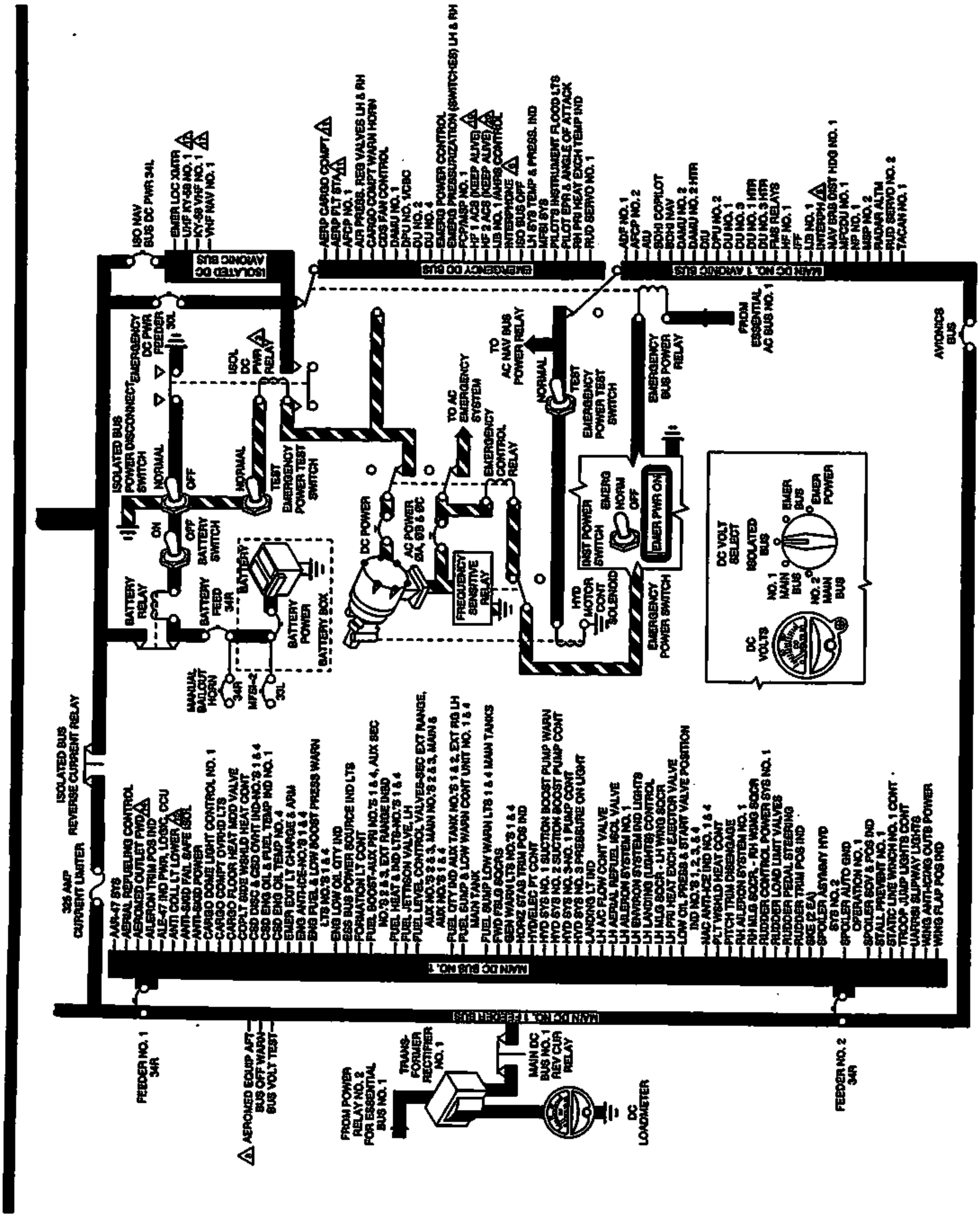


Figure 1-180. DC Power Distribution (Sheet 3 of 3)

CIRCUIT BREAKER PANELS (TYPICAL)

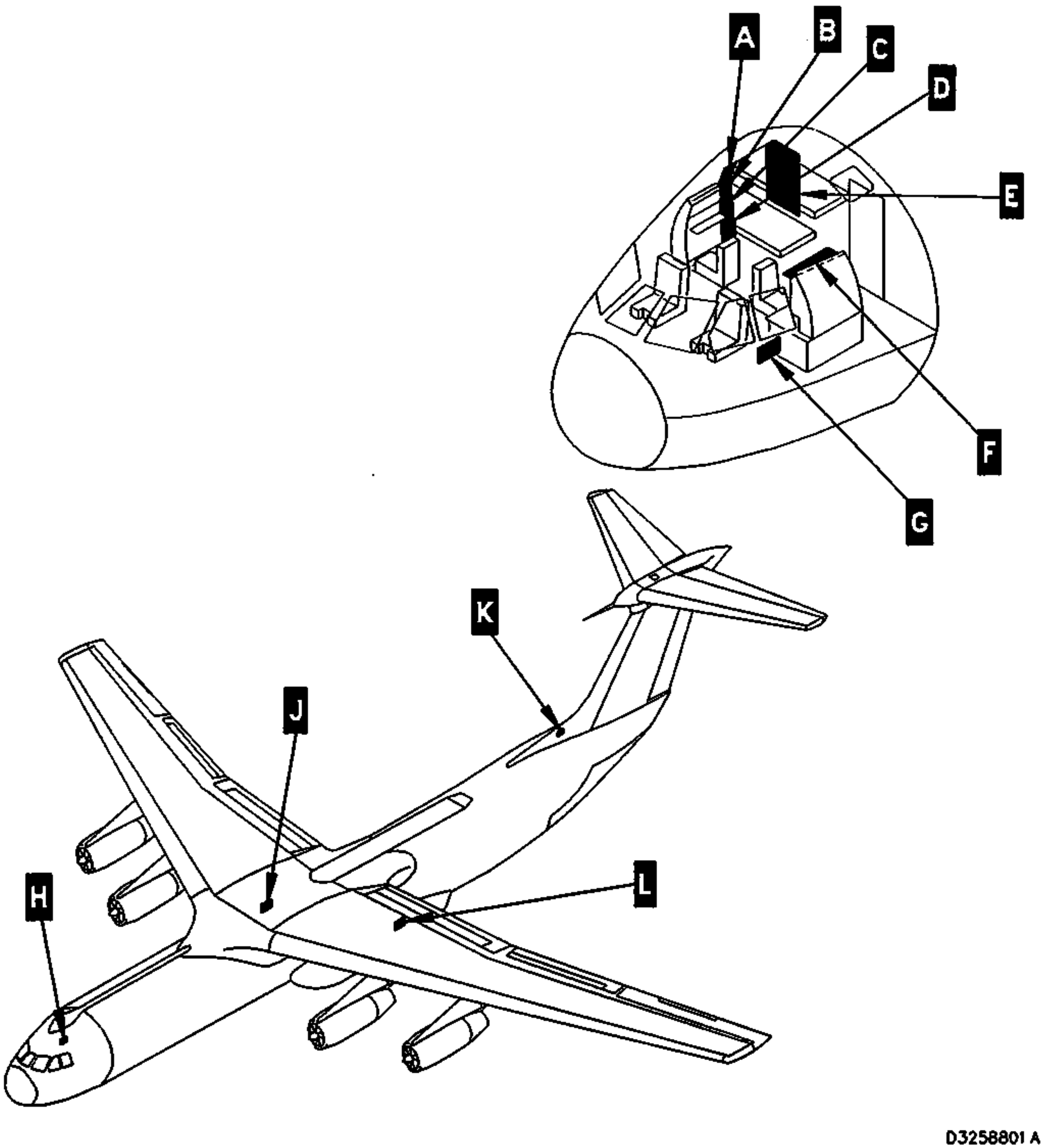
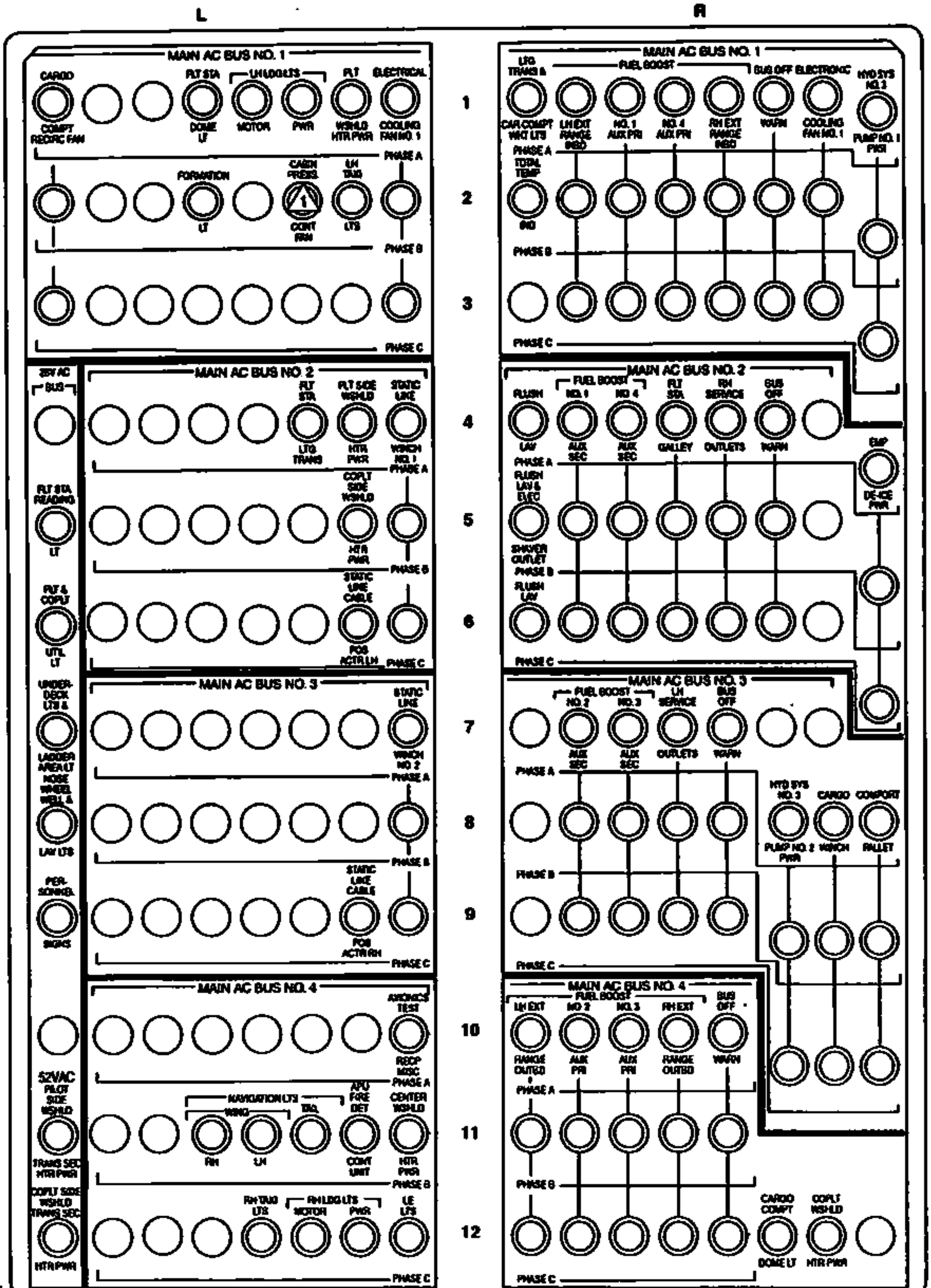


Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 1 of 9)

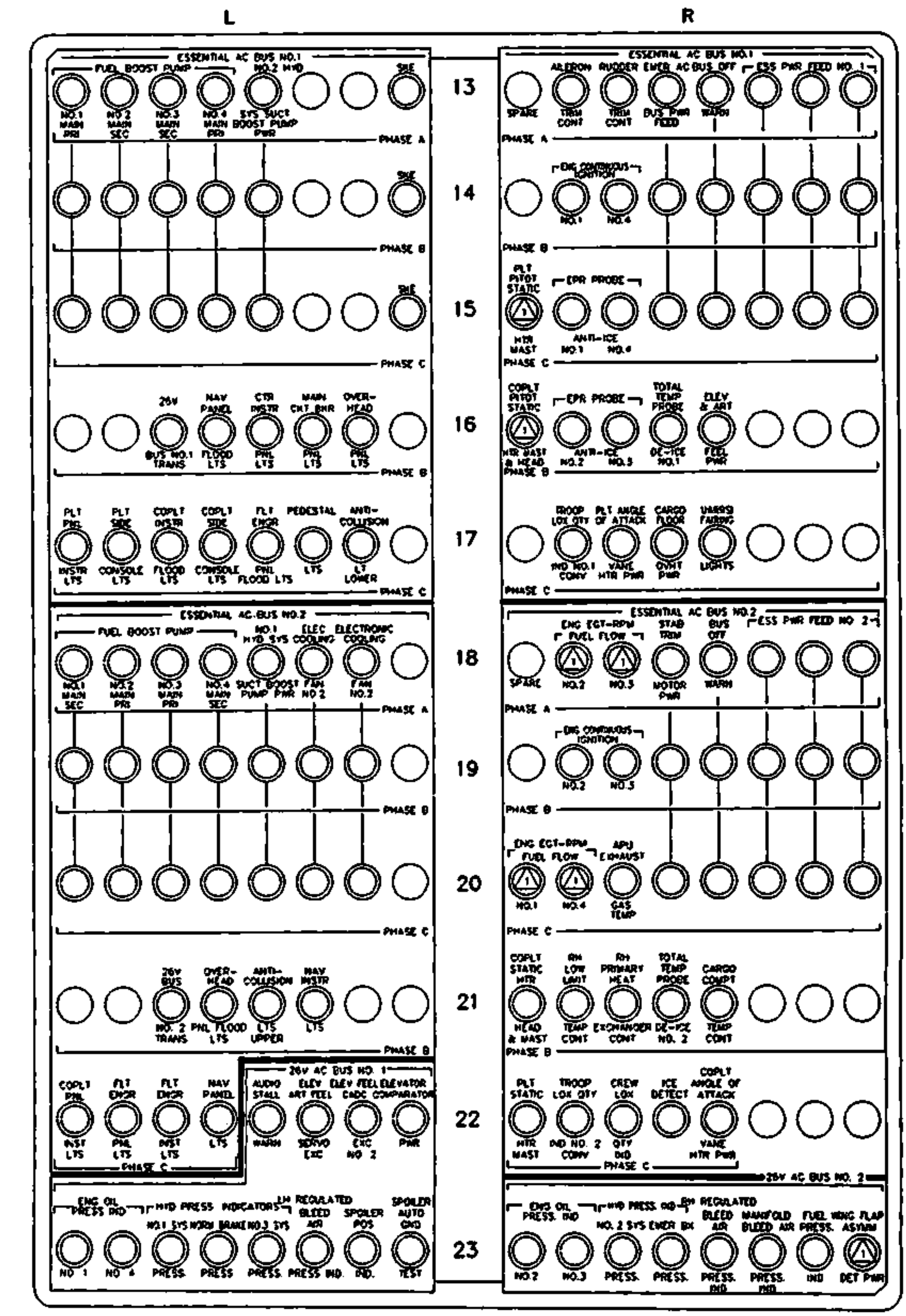


NOTE

⚠ PAINTED YELLOW

A FLIGHT ENGINEER'S NO. 1 CIRCUIT BREAKER PANEL (TYPICAL)

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 2 of 9)



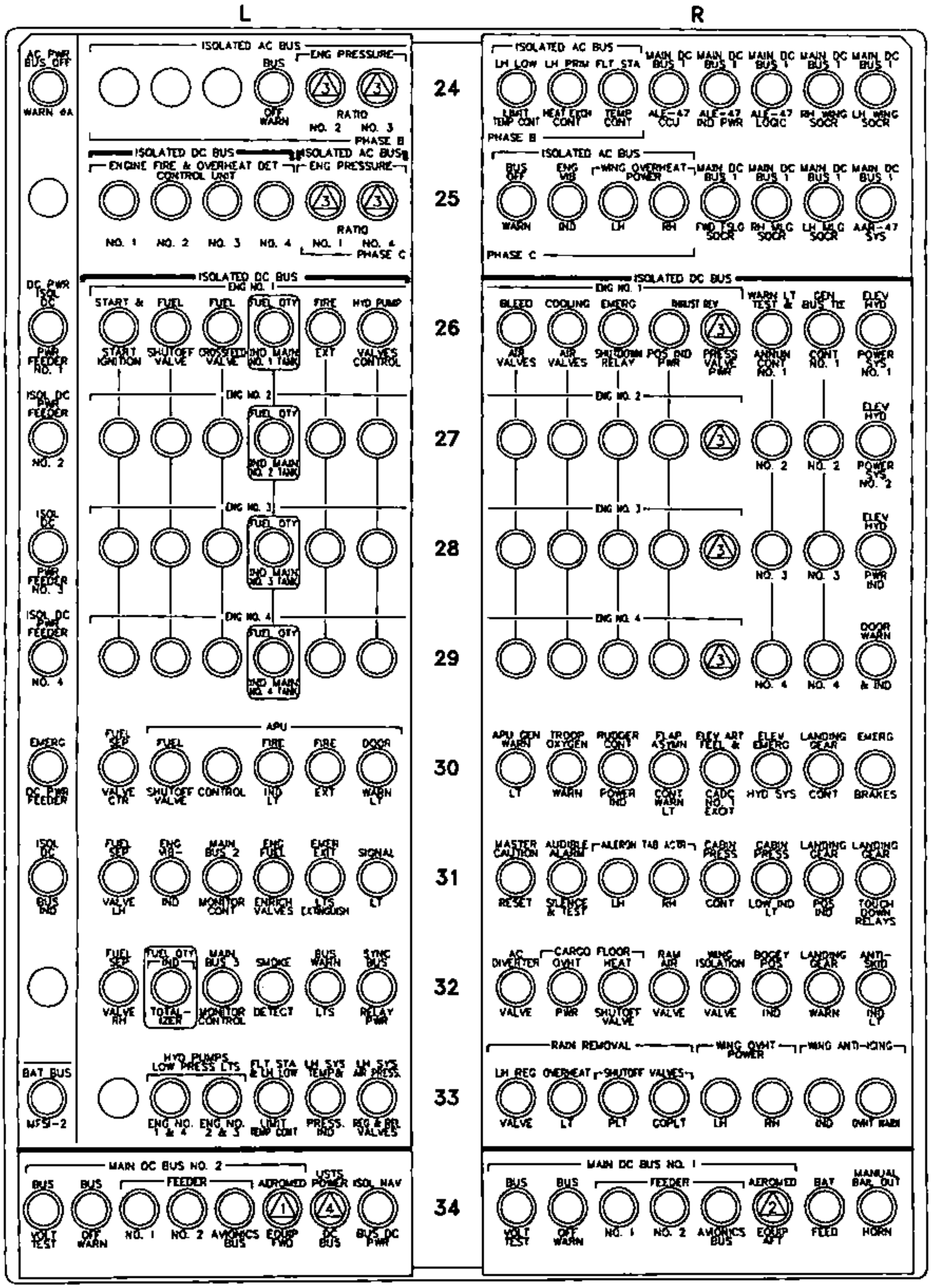
B FLIGHT ENGINEER'S NO. 2 CIRCUIT BREAKER PANEL

NOTE

⚠ PAINTED YELLOW

D3021403 G

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 3 of 9)

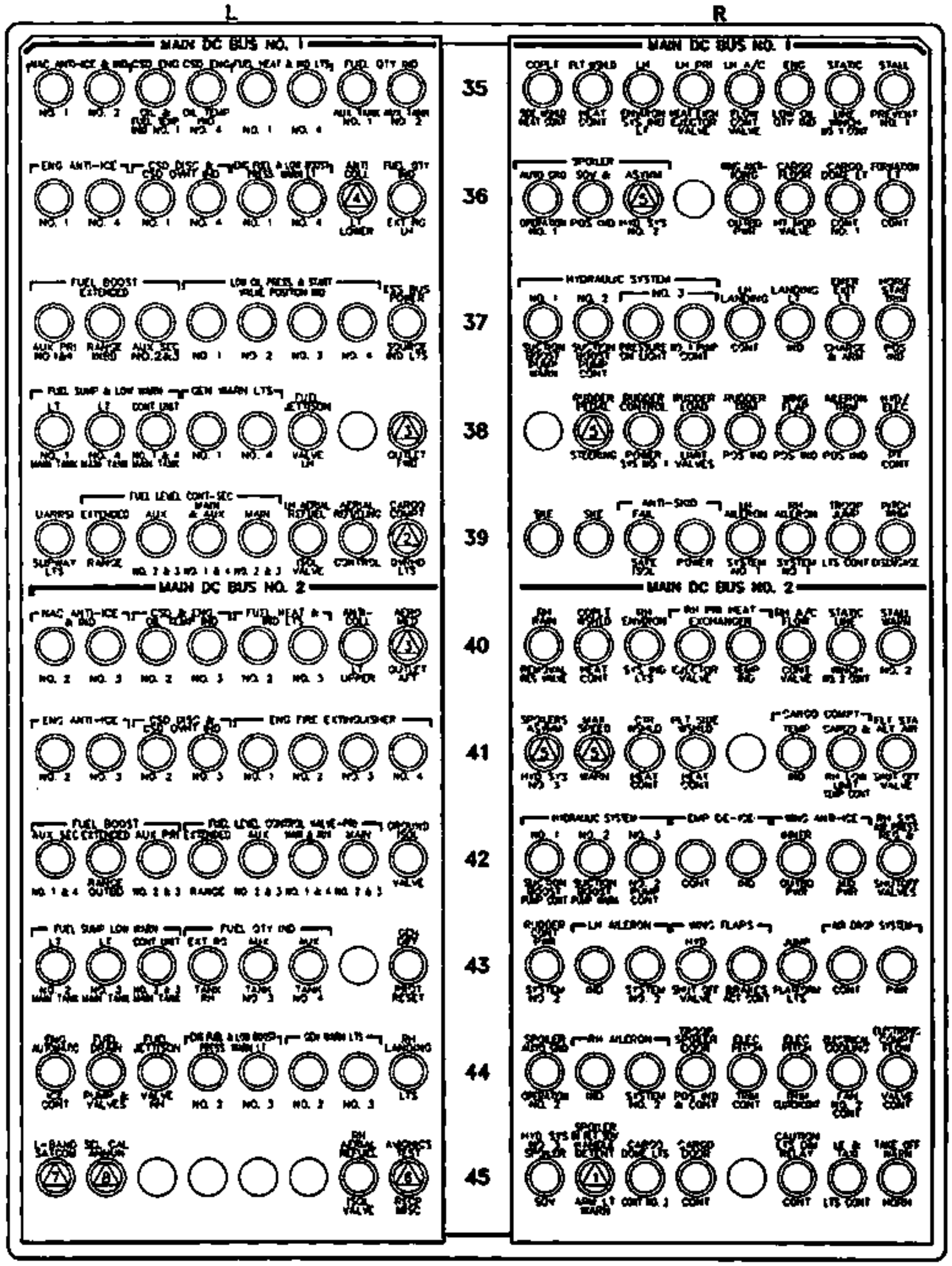


C FLIGHT ENGINEER'S NO. 3 CIRCUIT BREAKER PANEL (TYPICAL)

1. "IRON LUNG FWD" ON 12778 THRU 38090
2. "IRON LUNG AFT" ON 12778 THRU 38090
3. PAINTED YELLOW
4. AIRCRAFT MODIFIED BY TCTO 530

D3114801D

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 4 of 9)

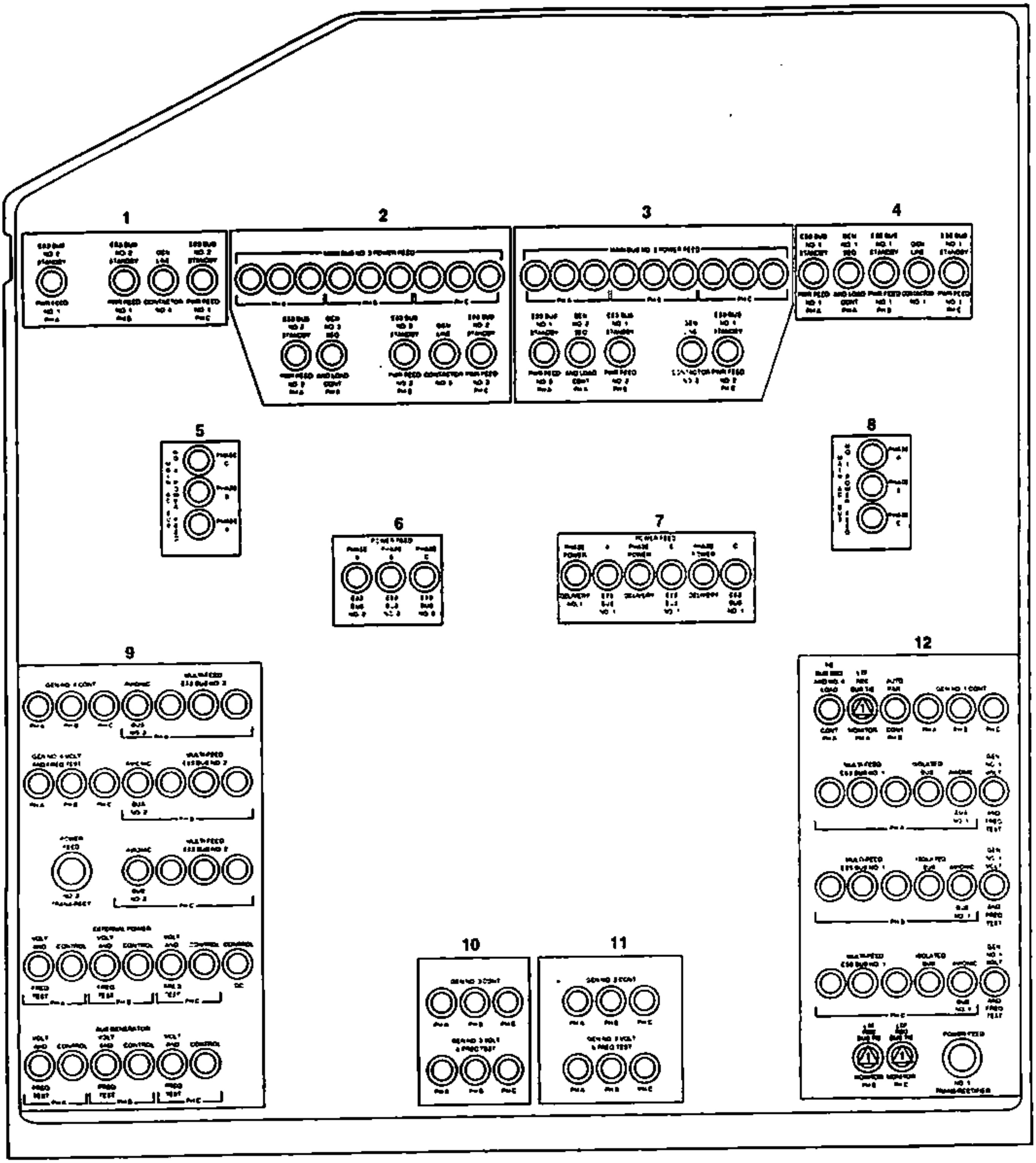


D FLIGHT ENGINEER'S NO. 4 CIRCUIT BREAKER PANEL (TYPICAL)

1. "SPOILER MLG INTLK" ON 12778 THRU 38090.
2. AIRCRAFT MODIFIED BY TCTO 504.
3. AIRCRAFT MODIFIED BY TCTO 595.
4. AIRCRAFT MODIFIED BY TCTO 631.
5. PAINTED YELLOW.
6. AIRCRAFT MODIFIED BY TCTO 530.
7. AIRCRAFT MODIFIED BY TCTO 555.
8. AIRCRAFT MODIFIED BY TCTO 576.

D3188801 C

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 5 of 9)



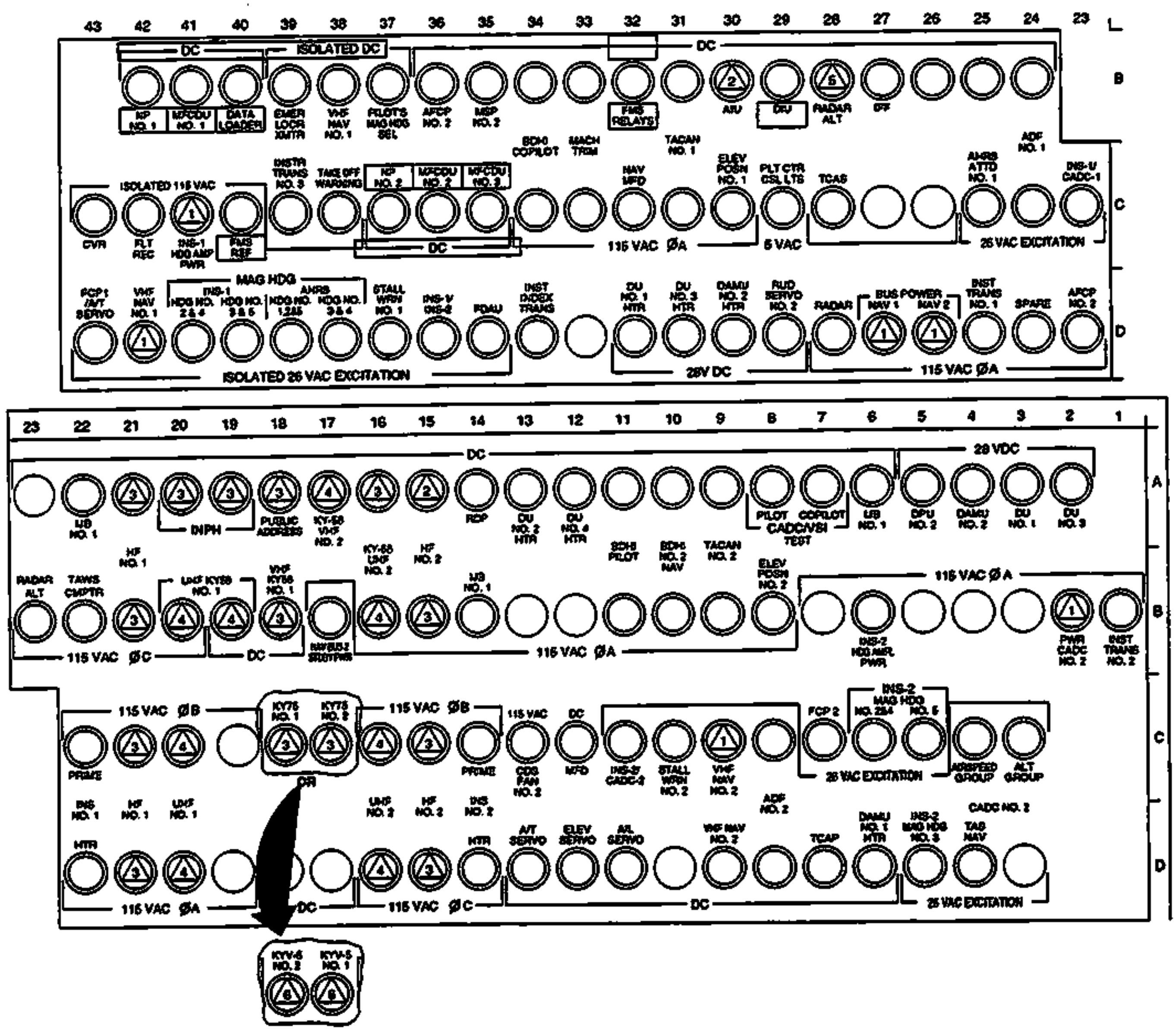
E AC POWER DISTRIBUTION CENTER (ACPDC)

NOTE

⚠1 SOME 63 MODEL AIRCRAFT ONLY - DISCONNECTED.

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 6 of 9)

AVIONICS CIRCUIT BREAKER PANEL



F AVIONICS CIRCUIT BREAKER PANEL

NOTE

1. PAINTED YELLOW
2. AIRCRAFT MODIFIED BY TCTO 520.
3. AIRCRAFT MODIFIED BY TCTO 636. KY-75
4. AIRCRAFT NOT MODIFIED BY TCTO 637. KY-58
5. PAINTED YELLOW. AIRCRAFT MODIFIED BY TCTO 520.
6. AIRCRAFT MODIFIED BY TCTO 550. KVY-58

D6004101 E

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 7 of 9)

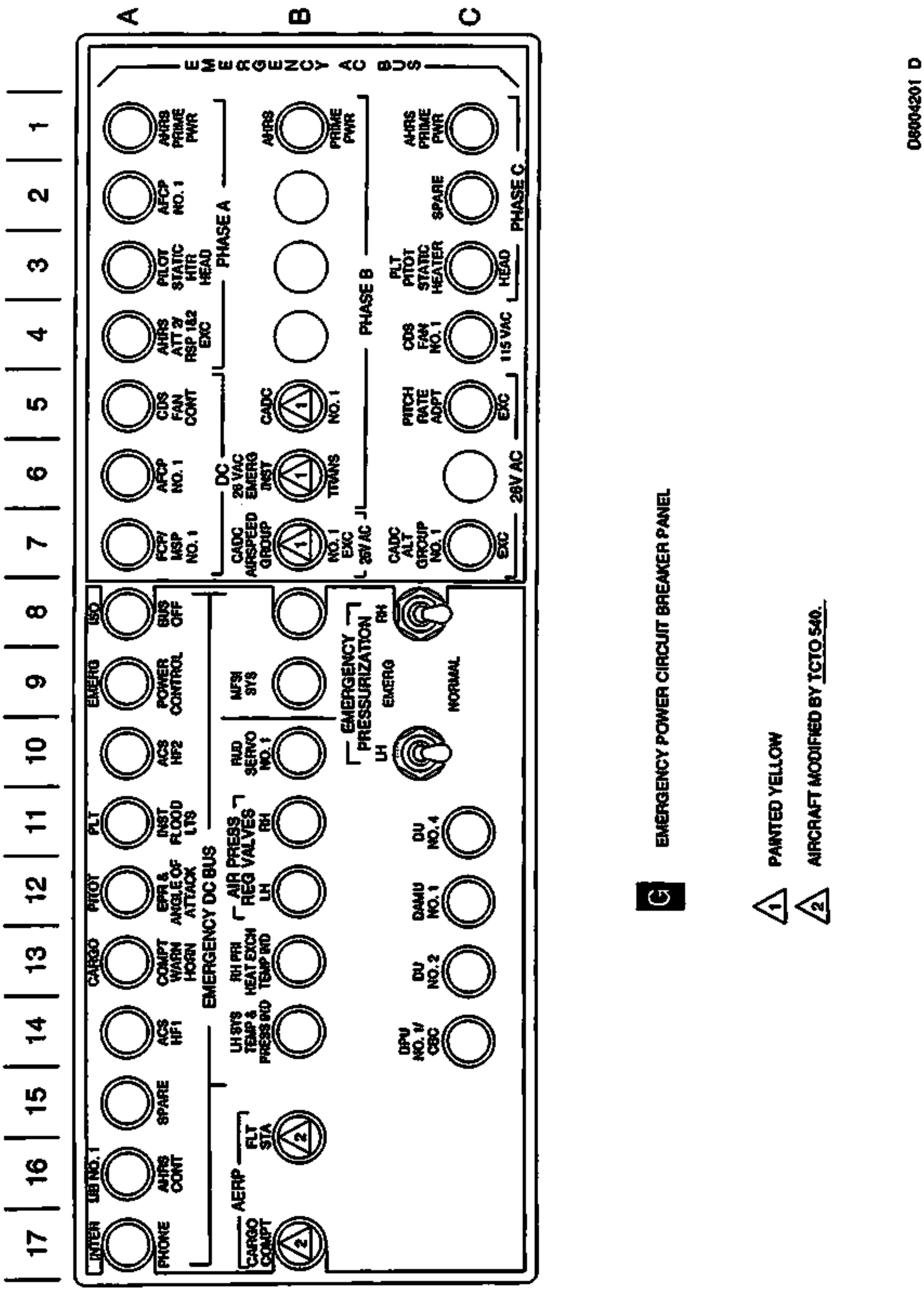
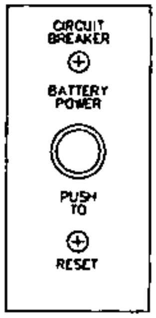
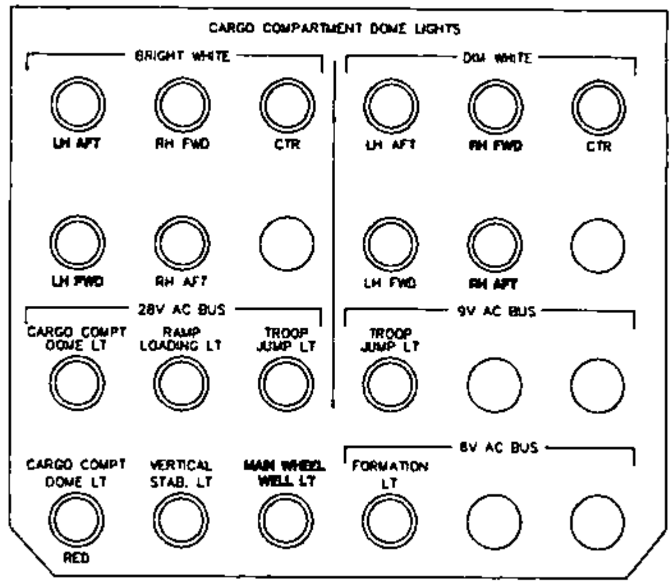


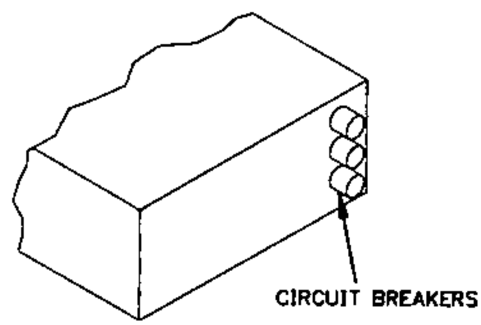
Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 8 of 9)



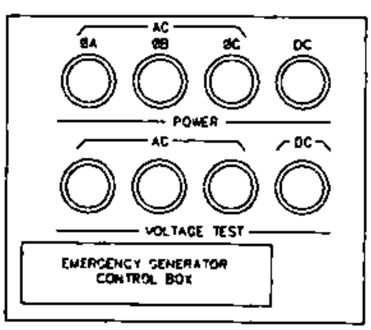
H BATTERY BOX CIRCUIT BREAKER



J CENTER FUSELAGE JUNCTION BOX (CFJB)



K EMPENNAGE DE-ICING SYSTEM CONTROLLER



L EMERGENCY GENERATOR CONTROL BOX PANEL (EGCB)

D3259301B

Figure 1-181. Circuit Breaker Panels (Typical) (Sheet 9 of 9)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
AILERONS			
AILERON POWER CONTROL SWITCHES:			
LEFT	LH AILERON SYSTEM NO. 1 LH AILERON SYSTEM NO. 2	39-R 43-R	MAIN DC BUS 1 MAIN DC BUS 2
RIGHT	RH AILERON SYSTEM NO. 1 RH AILERON SYSTEM NO. 2	39-R 44-R	MAIN DC BUS 1 MAIN DC BUS 2
POWER OFF LIGHTS	LH AILERON IND RH AILERON IND	43-R 44-R	MAIN DC BUS 1 MAIN DC BUS 2
SYSTEM POWER ANNUNCIATOR LIGHTS	WARN LT TEST & ANNUN CONT NO. 1 WARN LT TEST & ANNUN CONT NO. 2	26-R 27-R	ISOLATED DC BUS ISOLATED DC BUS
TAB OPERABLE:			
LEFT RIGHT	AILERON TAB ACTR LH AILERON TAB ACTR RH	31-R 31-R	ISOLATED DC BUS ISOLATED DC BUS
TAB OPERABLE ANNUNCIATION	WARN LT TEST & ANNUN CONT NO. 1 WARN LT TEST & ANNUN CONT NO. 2	26-R 27-R	ISOLATED DC BUS ISOLATED DC BUS
TRIM	AILERON TRIM CONT	13-R	ESSENTIAL AC BUS 1
TRIM INDICATOR	AILERON TRIM POS IND	38-R	MAIN DC BUS 1
ANTI-ICING/DE-ICING			
ANGLE OF ATTACK ANTI-ICING:			
NO. 1 SYSTEM - PILOT	PLT ANGLE OF ATTACK VANE HTR PWR	17-R	ESSENTIAL AC BUS 1
NO. 2 SYSTEM - COPILOT	COPLT ANGLE OF ATTACK VANE HTR PWR	22-R	ESSENTIAL AC BUS 2
HTR FAULTED LIGHT	PITOT EPR & ANGLE OF ATTACK	(12-A)	EMERGENCY DC BUS
EMPENNAGE DE-ICE:			
CONTROL	EMP DE-ICE CONT	42-R	MAIN DC BUS 2
INDICATOR LIGHTS	EMP DE-ICE IND	42-R	MAIN DC BUS 2
POWER	EMP DE-ICE PWR	4, 5, 6-R	MAIN AC BUS 2
SYSTEM CONTROLLER		EMP DE-ICE SYS CONTROLLER	MAIN AC BUS 2
ENGINE ANTI-ICE:			
ANTI-ICE ON LIGHTS	ENG ANTI-ICE (NO. 1 & 4) ENG ANTI-ICE (NO. 2 & 3)	36-L 41-L	MAIN DC BUS 1 MAIN DC BUS 2
SWITCH & VALVES	NAC ANTI-ICE & IND NO. 1 & 4 NAC ANTI-ICE & IND NO. 2 & 3	35-L 40-L	MAIN DC BUS 1 MAIN DC BUS 2
EPR:			
EPR HEAT CONTROL EPR HEAT POWER	PITOT EPR & ANGLE OF ATTACK EPR PROBE ANTI-ICE	(12-A) 15, 16-R	EMERGENCY DC BUS ESSENTIAL AC BUS 1
ICE DETECTION SYSTEM:			
ICE DETECTION CONTROL SWITCH	ENG AUTOMATIC ICE CONT	44-L	MAIN DC BUS 2
ICE DETECTION TEST SWITCH	ICE DETECT	22-R	ESSENTIAL AC BUS 2
ICING WARNING LIGHT	ENG AUTOMATIC ICE CONT	44-L	MAIN DC BUS 2
TOTAL TEMPERATURE SYSTEM:			
TOTAL TEMP PROBE DE-ICE	TOTAL TEMP PROBE DE-ICE NO. 1 TOTAL TEMP PROBE DE-ICE NO. 2	16-R 21-R	ESSENTIAL AC BUS 1 ESSENTIAL AC BUS 2

Figure 1-182. Circuit Breaker Index (Sheet 1 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
ANTI-ICING/DE-ICING (CONTINUED)			
PITOT-STATIC ANTI-ICING SYSTEM: ---	--------	--------	--------
PILOT	PLT PITOT STATIC HEATER HEAD	(3-C)	EMERGENCY AC BUS
	PLT PITOT STATIC HTR MAST	15-R	ESSENTIAL AC BUS 1
	PLT STATIC HTR HEAD	(3-A)	EMERGENCY AC BUS
	PLT STATIC HTR MAST	22-R	ESSENTIAL AC BUS 1
COPILOT	COPLT PITOT STATIC HTR MAST & HEAD	16-R	ESSENTIAL AC BUS 1
	COPLT STATIC HTR HEAD & MAST	21-R	ESSENTIAL AC BUS 2
HEATER FAULTED LIGHTS	PITOT EPR & ANGLE OF ATTACK	(12-A)	EMERGENCY DC BUS
PITOT HEAT ANNUNCIATOR	WARN LT TEST & ANNUN CONT NO. 4	29-R	ISOLATED DC BUS
WING ANTI-ICING SYSTEM: ---------	--------	--------	--------
INDICATIONS:			
LEFT ON & RIGHT ON LIGHTS	WING ANTI-ICING IND	33-R	ISOLATED DC BUS
L OVERHEAT & R OVERHEAT LIGHTS	WING ANTI-ICING OVHT WARN	33-R	ISOLATED DC BUS
WING ANTI-ICE OVERHEAT ANNUNCIATOR LIGHT	WARN LT TEST & ANNUN CONT NO. 4	29-R	ISOLATED DC BUS
POWER:			
INNER-OUTBOARD POWER	WING ANTI-ICE INNER OUTBD PWR	42-R	MAIN DC BUS 2
MID WING POWER	WING ANTI-ICE MID PWR	42-R	MAIN DC BUS 2
OUTBOARD POWER	WING ANTI-ICING OUTBD PWR	36-R	MAIN DC BUS 1
AUTOMATIC FLIGHT CONTROLS SYSTEM (AFCS)			
AUTOPILOT/FLIGHT DIRECTOR AUTOMATIC FLIGHT CONTROL PROCESSOR	AFCP NO. 1	(2-A)	EMER AC
	AFCP NO. 1	(6-A)	EMER DC
	AFCP NO. 2	23-D	AVIONICS AC 2
	AFCP NO. 2	36-B	MAIN DC AVIONICS 1
	AIL SERVO	11-D	MAIN DC AVIONICS 2
FLIGHT CONTROL PANEL/ MODE SELECT PANEL	FCP/MSP NO. 1	(7-A)	EMER DC
	FCP 2	7-C	AC NAV EXCITATION 2
	MSP NO. 2	35-B	MAIN DC AVIONICS 1
ELEVATOR SERVO	ELEV SERVO	12-D	MAIN DC AVIONICS 2
ELEVATOR SYNC	ELEV POSN NO. 1	30-C	AC NAV 1
	ELEV POSN NO. 2	8-B	AC NAV 2
AUTOTHROTTLE SERVO	A/T SERVO	13-D	MAIN DC AVIONICS 2
	FCP 1/A/T SERVO	43-D	ISOL 26V AC
AUTOPILOT/YAW DAMPER	RUD SERVO NO. 1	10-B	EMER DC
	RUD SERVO NO. 2	29-D	MAIN DC AVIONICS 1
STALL WARNING	AUDIO STALL WARN	22-L	26V AC BUS 1
	STALL WRN NO. 1	37-D	ISOL AC EXCITATION
	STALL WRN NO. 2	10-C	AC NAV EXCITATION 2
PILOT'S STICK SHAKER	STALL PREVENT NO. 1	35-R	MAIN DC 1
COPILOT'S STICK SHAKER	STALL WARN (OR PREVENT) NO. 2	40-R	MAIN DC 2
AUXILIARY POWER UNIT			
CONTROL	CONTROL	ACPDC9	
	CONTROL	30-L	ISOLATED DC BUS
	FUEL SHUTOFF VALVE	30-L	ISOLATED DC BUS
EGT	APU EXHAUST GAS TEMP	20-R	ESSENTIAL AC BUS 2
FIRE EXTINGUISHER	FIRE EXT	30-L	ISOLATED DC BUS
TEST	AUX GENERATOR VOLT AND FREQ TEST	ACPDC9	
WARNING LIGHTS	APU FIRE DET CONT UNIT	11-L	MAIN AC BUS 4
	APU GEN WARN LT	30-R	ISOLATED DC BUS
	DOOR WARN LT	30-L	ISOLATED DC BUS
	FIRE IND LT	30-L	ISOALTED DC BUS

Figure 1-182. Circuit Breaker Index (Sheet 2 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
CARGO DOORS, RAMP & ADS			
AIR DROP SYSTEM (ADS):			
ADS ARMED SWITCH	AIR DROP SYSTEM CONT	43-R	MAIN DC BUS 2
ADS INDICATOR LIGHTS	DOOR WARN & IND	29-R	ISOLATED DC BUS
DOOR OPEN LIGHT ANNUNCIATOR	WARN LT TEST & ANNUN CONT NO. 4	29-R	ISOLATED DC BUS
AIR DEFLECTION DOORS CONTROL AND INDICATION	TROOP SPOILER DOOR POS IND & CONT	44-R	MAIN DC BUS 2
ANCHOR CABLE ACTUATOR ARMS:			
LEFT	STATIC LINE CABLE POS ACTR LH	6-L	MAIN AC BUS 2
RIGHT	STATIC LINE CABLE POS ACTR RH	9-L	MAIN AC BUS 3
ARMED INDICATOR	AIR DROP SYSTEM CONT	43-R	MAIN DC BUS 2
CHUTE RELEASE SWITCH	AIR DROP SYSTEM CONT	43-R	MAIN DC BUS 2
STATIC LINE RETRIEVER WINCH NO. 1:			
CONTROL	STATIC LINE WINCH NO. 1 CONT	35-R	MAIN DC BUS 1
POWER	STATIC LINE WINCH NO. 1	4, 5, 6-L	MAIN AC BUS 2
STATIC LINE RETRIEVER WINCH NO. 2:			
CONTROL	STATIC LINE WINCH NO. 2 CONT	40-R	MAIN DC BUS 2
POWER	STATIC LINE WINCH NO. 2	7, 8, 9-L	MAIN AC BUS 3
PARATROOP PLATFORM LIGHTS	JUMP PLATFORM LTS	43-R	MAIN DC BUS 2
JUMP SIGNALS:			
CONTROL	TROOP JUMP LTS CONT	39-R	MAIN DC BUS 1
POWER	TROOP JUMP LT TROOP JUMP LT	CFJB CFJB	28V AC BUS 9V AC BUS
CARGO DOORS AND RAMP:			
DOOR ARMING SWITCH:	AIR DROP SYSTEM CONT	43-R	MAIN DC BUS 2
CONTROL	CARGO DOOR CONT	45-R	MAIN DC BUS 2
POWER	AIR DROP SYSTEM PWR	43-R	MAIN DC BUS 2
COMMUNICATIONS			
ELT:			
	EMER LOCR XMTR	39-B	ISOLATED DC AVIONICS
HF RADIO:			
HF-1	HF NO. 1 HF NO. 1	21-B, C, D 21-A	AC AVIONICS BUS 1 MAIN DC AVIONICS 1
KY-75 ⚠1	KY75 NO. 1	18-C	MAIN DC AVIONICS 2
KYV-5 ⚠2	KYV-5 NO. 1	17-C	MAIN DC AVIONICS 2
HF1 ACS (KEEP ALIVE) ⚠3	HF1 ACS	(14-A)	EMERGENCY DC BUS

⚠1 AIRCRAFT MODIFIED BY TCTO 636

⚠2 AIRCRAFT MODIFIED BY TCTO 550

⚠3 AIRCRAFT MODIFIED BY TCTO 769

Figure 1-182. Circuit Breaker Index (Sheet 3 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
COMMUNICATIONS (CONTINUED)			
HF RADIO (CONTINUED):			
HF-2	HF NO. 2 HF NO. 2	15-B, C, D 15-A	AC AVIONICS BUS 2 MAIN DC AVIONICS 2
KY-75 △1	KY75 NO. 2	17-C	MAIN DC AVIONICS 2
KYV-5 △2	KYV-5 NO. 2	18-C	MAIN DC AVIONICS 2
HF2 ACS (KEEP ALIVE) △3	HF2 ACS (KEEP ALIVE)	(10-A)	EMERGENCY DC BUS
IFF:			
IFF	IFF	(27-B)	MAIN DC AVIONICS 1
INTERPHONE:			
PILOT, ENGINEER	INTERPHONE	(17-A)	EMERGENCY DC BUS
JUMP SEAT, LH UNDERDECK, LH TROOP DOOR	INPH	19-A	MAIN DC AVIONICS 1
COPILOT, NAV, CREW ENT DOOR, RH TROOP DOOR	INPH	20-A	MAIN DC AVIONICS 2
L-BAND SATCOM △4:			
	L-BAND SATCOM	45-L	MAIN DC BUS NO. 2
MULTI-RADIO TRANSIT △5:			
	INHP	19-A	MAIN DC AVIONICS 1
PUBLIC ADDRESS SYSTEM:			
	PUBLIC ADDRESS	18-A	MAIN DC AVIONICS 2

△1 AIRCRAFT MODIFIED BY TCTO 636

△2 AIRCRAFT MODIFIED BY TCTO 550

△3 AIRCRAFT MODIFIED BY TCTO 776

△4 AIRCRAFT MODIFIED BY TCTO 555

△5 AIRCRAFT MODIFIED BY TCTO 598

Figure 1-182. Circuit Breaker Index (Sheet 4 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	LOCATION	POWER SOURCE
COMMUNICATIONS (CONTINUED)			
UHF RADIOS:			
AN/ARC-164 (V)	UHF KY58 NO. 1 KY-58 UHF NO. 2	19-B 16-A	ISOL DC AVIONICS MAIN DC AVIONICS
VHF RADIO:			
	VHF KY58 NO. 1 KY-58 VHF NO. 2	18-B 17-A	ISOL DC AVIONICS MAIN DC AVIONICS 2
DEFENSIVE SYSTEMS (DS)			
MISSILE WARNING SET (AN/AAR-47)	AAR-47 SYS	25-R	MAIN DC BUS 1
COUNTERMEASURES DISPENSING SYSTEM (AN/ALE-47):			
COCKPIT CONTROL UNIT	ALE-47 CCU ALE-47 IND PWR ALE-47 LOGIC	24-R 24-R 24-R	MAIN DC BUS 1 MAIN DC BUS 1 MAIN DC BUS 1
FLARE SEQUENCE & DISPENSE EMI FILTERS:			
FORWARD FUSELAGE	FWD FSLG SQCR	25-R	MAIN DC BUS 1
LT GEAR POD	LH MLG SQCR	25-R	MAIN DC BUS 1
LT WING	LH WING SQCR	24-R	MAIN DC BUS 1
RT GEAR POD	RH MLG SQCR	25-R	MAIN DC BUS 1
RT WING	RH WING SQCR	24-R	MAIN DC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 5 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
ELECTRICAL SYSTEMS (AC)			
AUTO PARALLELING CONTROL: ----------	----------	----------	----------
	AUTO PAR CONT PH C	ACPDC 12	
AUTOLOAD DISCONNECT SWITCHES: ------	----------	----------	----------
MAIN AC BUS NO. 2 LOAD MONITOR RELAY	MAIN BUS 2 MONITOR CONT	31-L	ISOLATED DC BUS
MAIN AC BUS NO. 3 LOAD MONITOR RELAY	MAIN BUS 3 MONITOR CONT	32-L	ISOLATED DC BUS
BUS WARNING LIGHTS: ----------	----------	----------	----------
EMERGENCY AC BUS LIGHTS	EMER POWER CONTROL	(9-A)	EMERGENCY DC BUS
EMERGENCY POWER ON LIGHT	EMER POWER CONTROL	(9-A)	EMERGENCY DC BUS
ESSENTIAL AC NO. 1 BUS LIGHTS (CONTROL):			
OFF	BUS OFF WARN	13, 14, 15-R	ESSENTIAL AC BUS 1
GEN 1 & GEN 2	ESS BUS POWER SOURCE IND LTS	37-L	MAIN DC BUS 1
ESSENTIAL AC NO. 2 BUS LIGHTS (CONTROL):			
OFF	BUS OFF WARN	18, 19, 20-R	ESSENTIAL AC BUS 2
GEN 3 & GEN 4	ESS BUS POWER SOURCE IND LTS	37-L	MAIN DC BUS 1
ESSENTIAL AC BUS OFF LIGHTS (POWER)	BUS WARN LTS	32-L	ISOLATED DC BUS
ISOLATED AC BUS LIGHTS:			
EMER PWR - ISOL AC BUS (CONTROL)	EMERG POWER CONTROL	(9-A)	EMERGENCY DC BUS
EMER PWR/ISOL AC BUS (POWER)	ISOL DC BUS IND	31-L	ISOLATED DC BUS
ISOL AC OFF (CONTROL)	BUS OFF WARN	24-L & 25-R	ISOLATED AC BUS
ISOL AC OFF (POWER)	ISO BUS OFF	(8-A)	EMERGENCY DC BUS
MAIN AC BUS OFF LIGHTS:			
NO. 1 CONTROL	BUS OFF WARN	1, 2, 3-R	MAIN AC BUS 1
NO. 2 CONTROL	BUS OFF WARN	4, 5, 6-R	MAIN AC BUS 2
NO. 3 CONTROL	BUS OFF WARN	7, 8, 9-R	MAIN AC BUS 3
NO. 4 CONTROL	BUS OFF WARN	10, 11, 12-R	MAIN AC BUS 4
POWER	BUS WARN LTS	32-L	ISOLATED DC BUS
BUS TIES: ----------	----------	----------	----------
BUS TIE CONTACTORS:			
NO. 1	GEN BUS TIE CONT NO. 1	26-R	ISOLATED DC BUS
NO. 2	GEN BUS TIE CONT NO. 2	27-R	ISOLATED DC BUS
NO. 3	GEN BUS TIE CONT NO. 3	28-R	ISOLATED DC BUS
NO. 4	GEN BUS TIE CONT NO. 4	29-R	ISOLATED DC BUS
BUS TIE OPEN LIGHTS:			
NO. 1 & 4	GEN WARN LTS NO. 1 & 4	38-L	MAIN DC BUS 1
NO. 2 & 3	GEN WARN LTS NO. 2 & 3	44-L	MAIN DC BUS 2
BUS TIE SWITCHES:			
NO. 1	GEN BUS TIE CONT NO. 1	26-R	ISOLATED DC BUS
NO. 2	GEN BUS TIE CONT NO. 2	27-R	ISOLATED DC BUS
NO. 3	GEN BUS TIE CONT NO. 3	28-R	ISOLATED DC BUS
NO. 4	GEN BUS TIE CONT NO. 4	29-R	ISOLATED DC BUS
BUS TIE SYNCHRONIZATION CONTROL	SYNC BUS RELAY PWR	32-L	ISOLATED DC BUS
CSDs: ----------	----------	----------	----------
CSD DISCONNECT SWITCHES:			
NO. 1	CSD DISC & CSD OVHT IND NO. 1	36-L	MAIN DC BUS 1
NO. 2	CSD DISC & CSD OVHT IND NO. 2	41-L	MAIN DC BUS 2
NO. 3	CSD DISC & CSD OVHT IND NO. 3	41-L	MAIN DC BUS 2
NO. 4	CSD DISC & CSD OVHT IND NO. 4	36-L	MAIN DC BUS 1
CSD OIL TEMPERATURE GAUGE:			
NO. 1	CSD ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
NO. 2	CSD & ENG OIL TEMP IND NO. 2	40-L	MAIN DC BUS 2
NO. 3	CSD & ENG OIL TEMP IND NO. 3	40-L	MAIN DC BUS 2
NO. 4	CSD ENG OIL TEMP IND NO. 4	35-L	MAIN DC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 6 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
ELECTRICAL SYSTEMS (AC) (CONTINUED)			
CSDs (CONTINUED):			
CSD OVERHEAT LIGHT:			
NO. 1	CSD DISC & CSD OVHT IND NO. 1	38-L	MAIN DC BUS 1
NO. 2	CSD DISC & CSD OVHT IND NO. 2	41-L	MAIN DC BUS 2
NO. 3	CSD DISC & CSD OVHT IND NO. 3	41-L	MAIN DC BUS 2
NO. 4	CSD DISC & CSD OVHT IND NO. 4	38-L	MAIN DC BUS 1
GENERATORS:			
DIFFERENTIAL FAULT RESET	GEN DIFF PROT RESET	43-L	MAIN DC BUS 2
GENERATOR CONTROL:			
NO. 1	GEN NO. 1 CONT (PH A, B, C [3 C/Bs])	ACPDC 12	
NO. 2	GEN NO. 2 CONT (PH A, B, C [3 C/Bs])	ACPDC 11	
NO. 3	GEN NO. 3 CONT (PH A, B, C [3 C/Bs])	ACPDC 10	
NO. 4	GEN NO. 4 CONT (PH A, B, C [3 C/Bs])	ACPDC 9	
APU GENERATOR	AUX GENERATOR CONTROL (PH A, B, C [3 C/Bs])	ACPDC 9	
GENERATOR FAIL & GENERATOR OUT LIGHTS:			
NO. 1	GEN WARN LTS NO. 1	38-L	MAIN DC BUS 1
NO. 2	GEN WARN LTS NO. 2	44-L	MAIN DC BUS 2
NO. 3	GEN WARN LTS NO. 3	44-L	MAIN DC BUS 2
NO. 4	GEN WARN LTS NO. 4	38-L	MAIN DC BUS 1
APU	APU GEN WARN LT	30-R	ISOLATED DC BUS
GENERATOR LINE CONTACTORS:			
NO. 1	GEN LINE CONTACTOR NO. 1	ACPDC 4	
NO. 2	GEN LINE CONTACTOR NO. 2	ACPDC 3	
NO. 3	GEN LINE CONTACTOR NO. 3	ACPDC 2	
NO. 4	GEN LINE CONTACTOR NO. 4	ACPDC 1	
GENERATOR SEQUENCING & LOAD CONTROL:			
NO. 1	GEN NO. 1 SEQ & LOAD CONT	ACPDC 4	ISOLATED AC BUS
NO. 2	GEN NO. 2 SEQ & LOAD CONT	ACPDC 3	ISOLATED AC BUS
NO. 3	GEN NO. 3 SEQ & LOAD CONT	ACPDC 2	ISOLATED AC BUS
NO. 4	TIE BUS SEQ & NO. 4 LOAD CONT	ACPDC 12	ISOLATED AC BUS
POWER FEEDERS - AC:			
AVIONICS AC BUS:			
POWER FEEDER NO. 1	AVIONICS BUS NO. 1	ACPDC 12	
POWER FEEDER NO. 2	AVIONICS BUS NO. 2	ACPDC 9	
TEST RECEPTACLE	AVIONICS TEST RECP MISC	10-L	MAIN AC BUS 4
EMERGENCY AC BUS POWER FEEDER	EMER AC BUS PWR FEED	13, 14, 15-R	ESSENTIAL AC BUS 1
ESSENTIAL AC BUS NO. 1:			
POWER DELIVERY	POWER FEED PHASE POWER DELIVERY NO. 1 (3 C/Bs)	ACPDC 7	
POWER FEED	MULTI-FEED ESS BUS NO. 1 (PH A, B, C) (9 C/Bs)	ACPDC 12	
POWER FEED	POWER FEED (A, B, C) ESS BUS NO. 1 (3 C/Bs)	ACPDC 7	
STANDBY POWER FEED NO. 1	ESS BUS NO. 1 STANDBY PWR FEED NO. 1 (PH A, B, C) (3 C/Bs)	ACPDC 4	
STANDBY POWER FEED NO. 2	ESS BUS NO. 1 STANDBY PWR FEED NO. 2 (PH A, B, C) (3 C/Bs)	ACPDC 3	
ESSENTIAL AC BUS NO. 2:			
POWER FEEDERS	(PH A, B, C) MULTI-FEED ESS BUS NO. 2 (9 C/Bs)	ACPDC 9	
POWER FEEDERS	POWER FEED (PHASE A, B, C) ESS BUS NO. 2 (3 C/Bs)	ACPDC 6	
STANDBY POWER FEEDERS NO. 1	ESS BUS NO. 2 STANDBY PWR FEED NO. 1. (PH A, B, C [3 C/Bs])	ACPDC 1	
STANDBY POWER FEEDERS NO. 2	ESS BUS NO. 2 STANDBY PWR FEED NO. 2 (PH A, B, C [3 C/Bs])	ACPDC 2	

Figure 1-182. Circuit Breaker Index (Sheet 7 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
ELECTRICAL SYSTEMS (AC) (CONTINUED)			
POWER FEEDERS - AC (CONTINUED): ------	------------------------------	-------------	-----------------
ESSENTIAL AC POWER FEEDERS NO. 1	ESS PWR FEED NO. 1 (PHASE A, B, C [9 C/Bs])	13, 14, 15-R	ESSENTIAL AC BUS 1
ESSENTIAL AC POWER FEEDERS NO. 2	ESS PWR FEED NO. 2 (PHASE A, B, C [9 C/Bs])	18, 19, 20-R	ESSENTIAL AC BUS 2
EXTERNAL AC POWER CONTROL	EXTERNAL POWER CONTROL (PHASE A, B, C [3 C/Bs])	ACPDC 9	EXTERNAL AC POWER
EXTERNAL DC POWER CONTROL EXTERNAL POWER	EXTERNAL POWER CONTROL DC EXT POWER CONTROL	ACPDC 9 EXT PWR RECPT.	(EXT AC PWR CONVERTED BY PHASE SEQUENCE RELAY)
ISOLATED AC BUS POWER FEEDERS	ISOLATED BUS (PH A, B, C [3 C/Bs])	ACPDC 12	
MAIN AC BUS NO. 1 POWER FEEDERS	MAIN AC BUS NO. 1 POWER FEED (PHASE A, B, C [3 C/Bs])	ACPDC 8	
MAIN AC BUS NO. 2 POWER FEEDERS	MAIN AC BUS NO. 2 POWER FEED (PHASE A, B, C [3 C/Bs])	ACPDC 3	
MAIN AC BUS NO. 3 POWER FEEDERS	MAIN AC BUS NO. 3 POWER FEED (PHASE A, B, C [3 C/Bs])	ACPDC 2	
MAIN AC BUS NO. 4 POWER FEEDERS	MAIN AC BUS NO. 4 POWER FEED (PHASE A, B, C [3 C/Bs])	ACPDC 5	
NAVIGATION AC BUS NO. 1	BUS POWER NAV 1	27-D	AC AVIONICS BUS 1
NAVIGATION AC BUS NO. 2	BUS POWER NAV 2	26-D	AC AVIONICS BUS 1
NAVIGATION AC BUS NO. 2 STANDBY POWER	NAV BUS 2 STDBY PWR	17-B	AC AVIONICS BUS 2
26V AC NAVIGATION BUS 1	INST TRANS NO. 1	25-D	AC AVIONICS BUS 1
26V AC NAVIGATION BUS 2	INST TRANS NO. 2	1-B	AC AVIONICS BUS 2
28V AC & 9V AC LIGHTING BUS 1	LGT XMFR & CAR COMPT WHT LTS	1-R	MAIN AC BUS 1
28V AC & 9V AC LIGHTING BUS 2	CARGO COMPT DOME LT	12-R	MAIN AC BUS 4
TRANSFORMERS: -------------------	------------------------------	-------------	-----------------
COPILOT'S FRONT WINDSHIELD (52V AC)	COPLT WSHLD HTR PWR	12-R	MAIN AC BUS 4
COPILOT SIDE WINDSHIELD HEATER (52V AC)	COPLT SIDE WSHLD HTR PWR	5-L	MAIN AC BUS 2
DC POWER SUPPLY NO. 1, TRANSFORMER RECTIFIER NO. 1	POWER FEED NO. 1 TRANS-RECTIFIER	ACPDC 12	ESSENTIAL AC BUS 1
DC POWER SUPPLY NO. 2, TRANSFORMER RECTIFIER NO. 2	POWER FEED NO. 2 TRANS-RECT	ACPDC 9	ESSENTIAL AC BUS 2
26V AC EMERGENCY INSTRUMENTS	26 VAC EMERG INST TRANS	(6-B)	EMERGENCY AC BUS PH B
26V AC T24 (26V AC)	AHRS ATT/2 RSP 1 & 2 EXC	(4-A)	EMERGENCY AC BUS PH A
FLIGHT STATION LIGHTING 28V AC XMFR	FLT STA LTG TRANS	4-L	MAIN AC BUS 2
FORMATION LIGHTS 6V AC XMFR	FORMATION LT	2-L	MAIN AC BUS 1
INSTRUMENT INDEX 26V AC XMFR	INST INDEX TRANS	34-D	NAVIGATION AC 1
MISCELLANEOUS LTG 9 & 28V AC XMFR NO. 1	LTG TRANS & CAR COMPT WHT LTS	1-R	MAIN AC BUS 1
MISCELLANEOUS LTG 9 & 28V AC XMFR NO. 2	CARGO COMPT DOME LT	12-R	MAIN AC BUS 4
NAV INSTRUMENT 26V AC XMFR NO. 1	INST TRANS NO. 1	25-D	AC AVIONICS BUS 1
NAV INSTRUMENT 26V AC XMFR NO. 2	INST TRANS NO. 2	1-B	AC AVIONICS BUS 2
NAV INSTRUMENT 26V AC XMFR NO. 3	INSTR TRANS NO. 3	39-C	ISOLATED AC AVIONICS
PILOT'S FRONT WINDSHIELD HEAT (52V AC)	PLT WSHLD HTR PWR	1-L	MAIN AC BUS 1
PILOT'S SIDE WINDSHIELD HEAT (52V AC)	PLT SIDE WSHLD HTR PWR	4-L	MAIN AC BUS 2
PILOT'S CENTER WINDSHIELD HEAT (52V AC)	CENTER WSHLD HTR PWR	11-L	MAIN AC BUS 4
26V AC BUS NO. 1 ENGINE INST TRANS	26V BUS NO. 1 TRANS	16-L	ESSENTIAL AC BUS 1
26V AC BUS NO. 2 ENGINE INST TRANS	26V BUS NO. 2 TRANS	21-L	ESSENTIAL AC BUS 2

Figure 1-182. Circuit Breaker Index (Sheet 8 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
ELECTRICAL SYSTEMS (AC) (CONTINUED)			
VOLTMETER/FREQUENCY METER: --------	------------------------------	------------	----------------
GENERATOR NO. 1	GEN NO. 1 VOLT AND FREQ TEST (3 C/B)	ACPDC 12	
NO. 2	GEN NO. 2 VOLT & FREQ TEST (PH A, B, C [3 C/Bs])	ACPDC 11	
NO. 3	GEN NO. 3 VOLT & FREQ TEST (PH A, B, C [3 C/Bs])	ACPDC 10	
NO. 4	GEN NO. 4 VOLT AND FREQ TEST (PH A, B, C [3 C/Bs])	ACPDC 9	
APU GENERATOR	AUX GEN VOLT AND FREQ TEST (3 C/Bs)	ACPDC 9	
EXTERNAL POWER	EXTERNAL POWER VOLT AND FREQ TEST (PH A, B, C [3 C/Bs])	ACPDC 9	
EMERGENCY POWER	AC VOLTAGE TEST	EMERGENCY GEN. CONTROL BOX	
ELECTRICAL SYSTEMS (DC)			
BATTERY: -------------------------	------------------------------	------------	----------------
FEEDER	BAT FEED	34-R	MAIN DC BUS 1
POWER	BATTERY POWER	BATTERY BOX	BATTERY
BATTERY/DC BUS WARNING LIGHTS: ------	------------------------------	------------	----------------
BATTERY	BUS WARN LTS	32-L	ISOLATED DC BUS
EMER DC BUS LIGHTS:			
EMER PWR LIGHT	DC	EMER GEN CONT	EMERGENCY GEN
EMER DC BUS LIGHT	DC	EMER GEN CONT	EMERGENCY GEN
ISOL DC BUS LIGHTS:			
EMER PWR LIGHT (CONTROL)	ISO DC BUS IND	31-L	ISOLATED DC BUS
EMER PWR LIGHT (POWER)	ISO DC BUS IND	31-L	ISOLATED DC BUS
ISOL DC BUS LIGHT (CONTROL)	BUS WARN LTS	32-L	ISOLATED DC BUS
ISOL DC BUS LIGHT (POWER)	BUS WARN LTS	32-L	ISOLATED DC BUS
ISOLATED DC OFF LIGHT (POWER)	ISO BUS OFF	(8-A)	EMERGENCY DC BUS
MAIN DC BUS LIGHTS:			
MAIN BUS NO. 1 OFF LIGHT (CONTROL)	BUS OFF WARN	34-R	MAIN DC BUS 1
MAIN BUS NO. 2 OFF LIGHT (CONTROL)	BUS OFF WARN	34-L	MAIN DC BUS 2
MAIN DC NO. 1 & NO. 2 OFF LIGHT POWER	BUS WARN LTS	32-L	ISOLATED DC BUS
DC SUPPLY: -----------------------	------------------------------	------------	----------------
DC POWER SUPPLY NO. 1, TRANSFORMER RECTIFIER NO. 1	POWER FEED NO. 1 TRANS-RECTIFIER	ACPDC 12	ESSENTIAL AC BUS 1
DC POWER SUPPLY NO. 2, TRANSFORMER RECTIFIER NO. 2	POWER FEED NO. 2 TRANS-RECT	ACPDC 9	ESSENTIAL AC BUS 2
EXTERNAL POWER: ------------------	------------------------------	------------	----------------
EXTERNAL POWER CONTROL	EXTERNAL POWER CONTROL DC	ACPDC 9	(EXT AC PWR CONVERTED BY PHASE SEQUENCE RELAY)
EXTERNAL POWER	EXT POWER CONTROL	EXT PWR RECPT.	
POWER FEEDERS: -------------------	------------------------------	------------	----------------
AEROMEDICAL EQUIPMENT			
FORWARD ⚠1	AEROMED EQUIP FWD	34-L	MAIN DC NO. 2 FEEDER BUS
AFT ⚠2	AEROMED EQUIP AFT	34-R	MAIN DC NO. 1 FEEDER BUS
EMERGENCY DC BUS POWER FEEDER	EMERG DC PWR FEEDER	30-L	MAIN DC NO. 1 FEEDER BUS/BATTERY
ISOLATED DC BUS:			
POWER FEEDER NO. 1	ISOL DC PWR FEEDER NO. 1	26-L	MAIN DC NO. 1 FEEDER BUS/BATTERY
POWER FEEDER NO. 2	ISOL DC PWR FEEDER NO. 2	27-L	MAIN DC NO. 1 FEEDER BUS/BATTERY

⚠1 LABELED "IRON LUNG FWD" ON AIRCRAFT 12778 THRU 38090.

⚠2 LABELED "IRON LUNG AFT" ON AIRCRAFT 12778 THRU 38090.

Figure 1-182. Circuit Breaker Index (Sheet 9 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
ELECTRICAL SYSTEMS (DC) (CONTINUED)			
POWER FEEDERS (CONTINUED):			
POWER FEEDER NO. 3	ISOL DC PWR FEEDER NO. 3	28-L	MAIN DC NO. 1 FEEDER BUS/BATTERY
POWER FEEDER NO. 4	ISOL DC PWR FEEDER NO. 4	29-L	MAIN DC NO. 1 FEEDER BUS/BATTERY
ISOLATED DC AVIONICS BUS	ISO NAV BUS DC PWR	34-L	MAIN DC NO. 1 FEEDER BUS/BATTERY
MAIN DC NO. 1 FEEDER BUS			TRANSFORMER RECEIVER NO. 1
MAIN DC BUS NO. 1			
POWER FEEDER NO. 1	FEEDER NO. 1	34-R	MAIN DC NO. 1 FEEDER BUS
POWER FEEDER NO. 2	FEEDER NO. 2	34-R	MAIN DC NO. 1 FEEDER BUS
MAIN DC NO. 2 FEEDER BUS			TRANSFORMER RECEIVER NO. 2
MAIN DC BUS NO. 2			
POWER FEEDER NO. 1	FEEDER NO. 1	34-L	MAIN DC NO. 2 FEEDER BUS
POWER FEEDER NO. 2	FEEDER NO. 2	34-L	MAIN DC NO. 2 FEEDER BUS
MAIN DC AVIONICS BUS NO. 1 POWER FEED	FEEDER AVIONICS BUS	34-R	MAIN DC NO. 1 FEEDER BUS
MAIN DC AVIONICS BUS NO. 2 POWER FEED	FEEDER AVIONICS BUS	34-L	MAIN DC NO. 2 FEEDER BUS
TEST RECEPTACLE	AVIONICS TEST RECP MISC	34-L	MAIN DC NO. 2 FEEDER BUS
OR			
USTS POWER ⚠1	USTS POWER DC BUS	34-L	MAIN DC NO. 2 FEEDER BUS
VOLTMETER:			
EMERGENCY DC BUS	BUS WARN LTS	32-L	ISOLATED DC BUS
ISOLATED DC BUS	ISOL DC BUS IND	31-L	ISOLATED DC BUS
MAIN DC BUS NO. 1	BUS VOLT TEST	34-R	MAIN DC BUS 1
MAIN DC BUS NO. 2	BUS VOLT TEST	34-L	MAIN DC BUS 2
ELECTRICAL SYSTEM - EMERGENCY GENERATOR			
AC	AC PH A, B, C POWER	CFJB	EMERGENCY GEN
DC	DC POWER	CFJB	EMERGENCY GEN
EMERGENCY GENERATOR CONTROL	EMERG POWER CONTROL	(9-A)	EMERGENCY GEN
EMERGENCY POWER ON LIGHT	EMERG POWER CONTROL	(9-A)	EMERGENCY GEN
ELEVATOR			
ARTIFICIAL FEEL:	ELEV & ART FEEL PWR	16-R	ESSENTIAL AC BUS 1
	ELEV ART FEEL & CADC NO. 1 EXCIT	30-R	ISOLATED DC BUS
	ELEV ART FEEL SERVO EXC	22-L	26V AC BUS 1
	ELEV FEEL CADC EXC NO. 2	22-L	26V AC BUS 1
	ELEVATOR COMPARATOR PWR	22-L	26V AC BUS 1
ARTIFICIAL FEEL MALFUNCTION LIGHT	WARN LT TEST & ANNUN CONT NO. 1	26-R	ISOLATED DC BUS
ELEVATOR POWER CONTROL SWITCHES:			
HYDRAULIC SYSTEM NO. 1	ELEV HYD POWER SYS NO. 1	26-R	ISOLATED DC BUS
HYDRAULIC SYSTEM NO. 2	ELEV HYD POWER SYS NO. 2	27-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER	ELEV EMERG HYD SYS	30-R	ISOLATED DC BUS
POWER OFF LIGHTS	ELEV HYD PWR IND	28-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER ANNUNCIATOR LIGHT	WARN LT TEST & ANNUN CONT NO. 2	27-R	ISOLATED DC BUS

⚠1 AIRCRAFT MODIFIED BY TCTO 530

Figure 1-182. Circuit Breaker Index (Sheet 10 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
ELEVATOR (CONTINUED)			
ELEVATOR EMERGENCY POWER ON LIGHT	ELEV HYD PWR IND	28-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER OFF LIGHT	ELEV HYD PWR IND	28-R	ISOLATED DC BUS
ELEVATOR SYSTEM POWER OFF ANNUNCIATOR LIGHTS	WARN LT TEST & ANNUN CONT NO. 1 WARN LT TEST & ANNUN CONT NO. 2	26-R 27-R	ISOLATED DC BUS ISOLATED DC BUS
PITCH RATE ADAPTER	PITCH RATE ADPT EXC	(5-C)	26V EMERGENCY AC
ENGINE			
ENGINE FIRE CONTROL HANDLES: --------	------------------------------	-------------	----------------
ENGINE NO. 1	ENG NO. 1 EMERG SHUTDOWN RELAY	26-R	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 EMERG SHUTDOWN RELAY	27-R	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 EMERG SHUTDOWN RELAY	28-R	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 EMERG SHUTDOWN RELAY	29-R	ISOLATED DC BUS
FUEL: ----------------------------	------------------------------	-------------	----------------
FUEL ENRICHMENT	ENG FUEL ENRICH VALVES	31-L	ISOLATED DC BUS
FUEL HEATERS AND FUEL HEAT LIGHTS:			
ENGINE NO. 1	FUEL HEAT & IND LTS NO. 1	35-L	MAIN DC BUS 1
ENGINE NO. 2	FUEL HEAT & IND LTS NO. 2	40-L	MAIN DC BUS 2
ENGINE NO. 3	FUEL HEAT & IND LTS NO. 3	40-L	MAIN DC BUS 2
ENGINE NO. 4	FUEL HEAT & IND LTS NO. 4	35-L	MAIN DC BUS 1
FUEL INDICATOR LIGHTS:			
ENGINE NO. 1	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 1	36-L	MAIN DC BUS 1
ENGINE NO. 2	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 2	44-L	MAIN DC BUS 2
ENGINE NO. 3	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 3	44-L	MAIN DC BUS 2
ENGINE NO. 4	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 4	36-L	MAIN DC BUS 1
FUEL INLET TEMPERATURE INDICATOR	CSD, ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
FUEL SHUTOFF VALVES:			
POWER:			
ENGINE NO. 1	ENG NO. 1 FUEL SHUTOFF VALVE	26-L	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 FUEL SHUTOFF VALVE	27-L	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 FUEL SHUTOFF VALVE	28-L	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 FUEL SHUTOFF VALVE	29-L	ISOLATED DC BUS
CONTROL - FUEL AND START IGNITION SWITCH:			
ENGINE NO. 1	ENG NO. 1 START & START IGNITION	26-L	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 START & START IGNITION	27-L	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 START & START IGNITION	28-L	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 START & START IGNITION	29-L	ISOLATED DC BUS
CONTROL - FIRE CONTROL HANDLE:			
ENGINE NO. 1	ENG NO. 1 EMERG SHUTDOWN RELAY	26-R	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 EMERG SHUTDOWN RELAY	27-R	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 EMERG SHUTDOWN RELAY	28-R	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 EMERG SHUTDOWN RELAY	29-R	ISOLATED DC BUS
IGNITION: -------------------------	------------------------------	-------------	----------------
CONTINUOUS IGNITION SWITCH:			
ENGINE NO. 1	ENG CONTINUOUS IGNITION NO. 1	14-R	ESSENTIAL AC BUS 1
ENGINE NO. 2	ENG CONTINUOUS IGNITION NO. 2	19-R	ESSENTIAL AC BUS 2
ENGINE NO. 3	ENG CONTINUOUS IGNITION NO. 3	19-R	ESSENTIAL AC BUS 3
ENGINE NO. 4	ENG CONTINUOUS IGNITION NO. 4	14-R	ESSENTIAL AC BUS 1
FUEL AND START IGNITION SWITCH:			
ENGINE NO. 1	ENG NO. 1 START & START IGNITION	26-L	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 START & START IGNITION	27-L	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 START & START IGNITION	28-L	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 START & START IGNITION	29-L	ISOLATED DC BUS

Figure 1-182. Circuit Breaker Index (Sheet 11 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
ENGINE (CONTINUED)			
IGNITION (CONTINUED):			
STARTER BUTTON/VALVE:			
ENGINE NO. 1	ENG NO. 1 START & START IGNITION	26-L	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 START & START IGNITION	27-L	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 START & START IGNITION	28-L	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 START & START IGNITION	29-L	ISOLATED DC BUS
STARTER VALVE OPEN LIGHTS:			
ENGINE NO. 1	LOW OIL PRESS. & START VALVE POSITION IND NO. 1	37-L	MAIN DC BUS 1
ENGINE NO. 2	LOW OIL PRESS. & START VALVE POSITION IND NO. 2	37-L	MAIN DC BUS 1
ENGINE NO. 3	LOW OIL PRESS. & START VALVE POSITION IND NO. 3	37-L	MAIN DC BUS 1
ENGINE NO. 4	LOW OIL PRESS. & START VALVE POSITION IND NO. 4	37-L	MAIN DC BUS 1
INSTRUMENTS & INDICATORS:			
ENGINE PRESSURE RATIO (EPR):			
ENGINE NO. 1	ENG PRESSURE RATIO NO. 1	25-L	ISOLATED AC BUS
ENGINE NO. 2	ENG PRESSURE RATIO NO. 2	24-L	ISOLATED AC BUS
ENGINE NO. 3	ENG PRESSURE RATIO NO. 3	24-L	ISOLATED AC BUS
ENGINE NO. 4	ENG PRESSURE RATIO NO. 4	25-L	ISOLATED AC BUS
ENGINE VIBRATION INDICATOR (EVI):	ENG VIB IND	25-R	ISOLATED DC BUS
N1 RPM, N2 RPM, EGT & FUEL FLOW:			
ENGINE NO. 1	EGT-RPM FUEL FLOW NO. 1	20-R	ESSENTIAL AC BUS 2
ENGINE NO. 2	ENG EGT-RPM FUEL FLOW NO. 2	18-R	ESSENTIAL AC BUS 2
ENGINE NO. 3	ENG EGT-RPM FUEL FLOW NO. 3	18-R	ESSENTIAL AC BUS 2
ENGINE NO. 4	ENG EGT-RPM FUEL FLOW NO. 4	20-R	ESSENTIAL AC BUS 2
LOW OIL QUANTITY LIGHT	ENG LOW OIL QTY IND	35-R	MAIN DC BUS 1
LOW OIL PRESSURE WARNING LIGHT			
ENGINE NO. 1	LOW OIL PRESS. & START VALVE POSITION IND NO. 1	37-L	MAIN DC BUS 1
ENGINE NO. 2	LOW OIL PRESS. & START VALVE POSITION IND NO. 2	37-L	MAIN DC BUS 1
ENGINE NO. 3	LOW OIL PRESS. & START VALVE POSITION IND NO. 3	37-L	MAIN DC BUS 1
ENGINE NO. 4	LOW OIL PRESS. & START VALVE POSITION IND NO. 4	37-L	MAIN DC BUS 1
OIL PRESSURE INDICATOR			
ENGINE NO. 1	ENG OIL PRESS. IND NO. 1	23-L	26V AC BUS 1
ENGINE NO. 2	ENG OIL PRESS. IND NO. 2	23-R	26V AC BUS 2
ENGINE NO. 3	ENG OIL PRESS. IND NO. 3	23-R	26V AC BUS 2
ENGINE NO. 4	ENG OIL PRESS. IND NO. 4	23-L	26V AC BUS 1
OIL TEMPERATURE INDICATOR			
ENGINE NO. 1	CSD ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
ENGINE NO. 2	CSD & ENG OIL TEMP IND NO. 2	40-L	MAIN DC BUS 2
ENGINE NO. 3	CSD & ENG OIL TEMP IND NO. 3	40-L	MAIN DC BUS 2
ENGINE NO. 4	CSD ENG OIL TEMP IND NO. 4	35-L	MAIN DC BUS 1
THRUST REVERSERS:			
POSITION & PRESS. INDICATOR POWER:			
ENGINE NO. 1	ENG NO. 1 THRUST REV POS IND PWR	26-R	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 THRUST REV POS IND PWR	27-R	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 THRUST REV POS IND PWR	28-R	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 THRUST REV POS IND PWR	29-R	ISOLATED DC BUS
PRESSURE VALVE POWER:			
ENGINE NO. 1	ENG NO. 1 THRUST REV PRESS. VALVE POWER	26-R	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 THRUST REV PRESS. VALVE POWER	27-R	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 THRUST REV PRESS. VALVE POWER	28-R	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 THRUST REV PRESS. VALVE POWER	29-R	ISOLATED DC BUS

Figure 1-182. Circuit Breaker Index (Sheet 12 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
FLAPS			
ASYMMETRY:			
CONTROL:	WING FLAPS BRAKES ACT CONT	43-R	MAIN DC BUS 2
	WING FLAPS HYD SHUT OFF VALVE	43-R	MAIN DC BUS 2
DETECTION AND WARNING LIGHTS	FLAP ASYMN CONT WARN LT	30-R	ISOLATED DC BUS
POWER	WING FLAP ASYMM DET PWR	23-R	26V AC BUS 2
FLAP POSITION INDICATOR	WING FLAP POS IND	38-R	MAIN DC BUS 1
STOP POSITION INDICATOR (HIGH-FORCE DETENT)	SPOILER AUTO GND OPERATION NO. 2	44-R	MAIN DC BUS 2
FLIGHT CONTROL SYSTEMS			
AILERON:			
AILERON POWER CONTROL SWITCHES			
LEFT	LH AILERON SYSTEM NO. 1	39-R	MAIN DC BUS 1
	LH AILERON SYSTEM NO. 2	43-R	MAIN DC BUS 2
RIGHT	RH AILERON SYSTEM NO. 1	39-R	MAIN DC BUS 1
	RH AILERON SYSTEM NO. 2	44-R	MAIN DC BUS 2
POWER OFF LIGHTS	LH AILERON IND	43-R	MAIN DC BUS 2
	RH AILERON IND	44-R	MAIN DC BUS 2
SYSTEM POWER ANNUNCIATOR LIGHTS	WARN LT TEST & ANNUN CONT NO. 1	26-R	ISOLATED DC BUS
	WARN LT TEST & ANNUN CONT NO. 2	27-R	ISOLATED DC BUS
TAB OPERABLE:			
LEFT	AILERON TAB ACTR LH	31-R	ISOLATED DC BUS
RIGHT	AILERON TAB ACTR RH	31-R	ISOLATED DC BUS
TAB OPERABLE ANNUNCIATION	WARN LT TEST & ANNUN CONT NO. 1	26-R	ISOLATED DC BUS
	WARN LT TEST & ANNUN CONT NO. 2	27-R	ISOLATED DC BUS
TRIM	AILERON TRIM CONT	13-R	ESSENTIAL AC BUS 1
TRIM INDICATOR	AILERON TRIM POS IND	38-R	MAIN DC BUS 1
ELEVATOR:			
ARTIFICIAL FEEL:			
	ELEV & ART FEEL PWR	16-R	ESSENTIAL AC BUS 1
	ELEV ART FEEL & CADC NO. 1 EXCIT	30-R	ISOLATED DC BUS
	ELEV ART FEEL SERVO EXC	22-L	26V AC BUS 1
	ELEV FEEL CADC EXC NO. 2	22-L	26V AC BUS 1
	ELEVATOR COMPARATOR PWR	22-L	26V AC BUS 1
ARTIFICIAL FEEL MALFUNCTION LIGHT	WARN LT TEST & ANNUN CONT NO. 1	26-R	ISOLATED DC BUS
ELEVATOR POWER CONTROL SWITCHES:			
HYDRAULIC SYSTEM NO. 1	ELEV HYD POWER SYS NO. 1	26-R	ISOLATED DC BUS
HYDRAULIC SYSTEM NO. 2	ELEV HYD POWER SYS NO. 2	27-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER	ELEV EMERG HYD SYS	30-R	ISOLATED DC BUS
POWER OFF LIGHTS	ELEV HYD PWR IND	28-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER ANNUNCIATOR LIGHT	WARN LT TEST & ANNUN CONT NO. 2	27-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER ON LIGHT	ELEV HYD PWR IND	28-R	ISOLATED DC BUS
ELEVATOR EMERGENCY POWER OFF LIGHT	ELEV HYD PWR IND	28-R	ISOLATED DC BUS
ELEVATOR SYSTEM POWER OFF ANNUNCIATOR LIGHTS	WARN LT TEST & ANNUN CONT NO. 1	26-R	ISOLATED DC BUS
	WARN LT TEST & ANNUN CONT NO. 2	27-R	ISOLATED DC BUS
PITCH RATE ADAPTER	PITCH RATE ADPT EXC	(5-C)	26V EMERGENCY AC
FLAPS:			
ASYMMETRY SYSTEM:			
CONTROL:	WING FLAPS BRAKES ACT CONT	43-R	MAIN DC BUS 2
	WING FLAPS HYD SHUT OFF VALVE	43-R	MAIN DC BUS 2
DETECTION AND WARNING LIGHTS	FLAP ASYMN CONT WARN LT	30-R	ISOLATED DC BUS
POWER	WING FLAP ASYMM DET PWR	23-R	26V AC BUS 2
FLAP POSITION INDICATOR	WING FLAP POS IND	38-R	MAIN DC BUS 1
STOP POSITION INDICATOR (HIGH-FORCE DETENT)	SPOILER AUTO GND OPERATION NO. 2	44-R	MAIN DC BUS 2

Figure 1-182. Circuit Breaker Index (Sheet 13 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
FLIGHT CONTROL SYSTEMS (CONTINUED)			
PITCH TRIM:			
ELECTRICAL & ELECTROHYDRAULIC PITCH TRIM:			
ELECTRICAL TRIM CONTROL	ELEC PITCH TRIM CONT	44-R	MAIN DC BUS 2
ELECTRICAL TRIM CLUTCH CONTROL	ELEC PITCH TRIM CLUTCH CONT	44-R	MAIN DC BUS 2
ELECTRICAL TRIM POWER	STAB TRIM MOTOR PWR	18, 19, 20-R	ESSENTIAL AC BUS 2
TRIM DISCONNECT	PITCH TRIM DISENGAGE	39-R	MAIN DC BUS 1
TRIM RESET:			
ELECTRICAL	ELEC PITCH TRIM CONT	44-R	MAIN DC BUS 2
ELECTROHYDRAULIC	HYD/ELEC PT CONT	38-R	MAIN DC BUS 1
HYDRAULIC PITCH TRIM CONTROL	HYD/ELEC PT CONT	38-R	MAIN DC BUS 1
PITCH TRIM INDICATOR	HORIZ STAB TRIM POS IND	37-R	MAIN DC BUS 1
RUDDER:			
RUDDER POWER CONTROL SWITCHES:			
HYDRAULIC SYSTEM NO. 1	RUDDER CONTROL POWER SYS NO. 1	38-R	MAIN DC BUS 1
HYDRAULIC SYSTEM NO. 2	RUDDER CONT PWR SYSTEM NO. 2	43-R	MAIN DC BUS 2
LOAD LIMIT VALVES	RUDDER LOAD LIMIT VALVES	38-R	MAIN DC BUS 1
POWER OFF LIGHTS	RUDDER CONT POWER IND	30-R	ISOLATED DC BUS
SYSTEM POWER ANNUNCIATOR LIGHTS	WARN LT TEST & ANNUN CONT NO. 1 WARN LT TEST & ANNUN CONT NO. 2	26-R 27-R	ISOLATED DC BUS ISOLATED DC BUS
SYSTEM HIGH PRESSURE LIGHTS	RUDDER CONT POWER IND	30-R	ISOLATED DC BUS
RUDDER OVER PRESSURE LIGHT	RUDDER CONT POWER IND	30-R	ISOLATED DC BUS
TRIM	RUDDER TRIM CONT	13-R	ESSENTIAL AC BUS 1
TRIM INDICATOR	RUDDER TRIM POS IND	38-R	MAIN DC BUS 1
SPOILERS:			
ASYMMETRY SYSTEM:			
NO. 2 HYDRAULIC SYSTEM	SPOILER ASYMM HYD SYS NO. 2	36-R	MAIN DC BUS 1
NO. 3 HYDRAULIC SYSTEM	SPOILERS ASYMM HYD SYS NO. 3	41-R	MAIN DC BUS 2
TEST	SPOILERS AUTO GND TEST	23-L	26V AC BUS 1
CONTROL	SPOILER AUTO GRD OPERATION NO. 1 SPOILER AUTO GND OPERATION NO. 2 HYD SYS NO. 3 SPOILER SOV	36-R 44-R 45-R	MAIN DC BUS 1 MAIN DC BUS 2 MAIN DC BUS 2
FLIGHT LIMIT STOP ⚠1	SPOILER IN FLT SOV HANDLE DETENT ARM LT WARN	45-R	MAIN DC BUS 2
POSITION INDICATOR:			
POINTERS	SPOILER POS IND.	23-L	26V AC BUS 1
LOCKED/UNLKD FLAG	SPOILER SOV & POS IND	36-R	MAIN DC BUS 1
SPOILER CABLE SERVO VALVE	HYD SYS NO. 3 SPOILER SOV	45-R	MAIN DC BUS 2
SPOILER UNDER SPEED LIGHT & AUDIBLE WARNING	STALL PREVENT NO. 1 STALL WARN (OR PREVENT) NO. 2	35-R 40-R	ESSENTIAL AC BUS 1 ESSENTIAL AC BUS 2
STOP POSITION INDICATOR (HIGH/LOW FORCE DETENT)	SPOILER IN FLT SOV HANDLE DETENT ARM LT WARN	45-R	MAIN DC BUS 2
FLIGHT RECORDERS			
COCKPIT VOICE RECORDER:			
	CVR	43-C	ISOLATED AC AVIONICS
DIGITAL FLIGHT DATA RECORDER:			
FLIGHT RECORDER	FLT REC	42-C	ISOLATED AC AVIONICS
FLIGHT DATA ACQUISITION UNIT	FDAU	35-D	ISOL AC EXCITATION

⚠1 LABELED "SPOILER MLG INTLK" ON AIRCRAFT 12778 THRU 38090.

Figure 1-182. Circuit Breaker Index (Sheet 14 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
FUEL SUPPLY SYSTEMS			
AIR REFUELING:			
A/R ISOLATION VALVES:			
LEFT	LH AERIAL REFUEL ISOL VALVE	39-L	MAIN DC BUS 1
RIGHT	RH AERIAL REFUEL ISOL VALVE	45-L	MAIN DC BUS 2
DISCONNECT SWITCHES	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
FUEL LINE DRAIN SWITCH	FUEL DRAIN PUMP & VALVES	44-L	MAIN DC BUS 2
INDICATOR LIGHTS:			
DISCONNECT	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
DOOR UNLOCKED	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
LATCHED	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
OVERRIDE	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
READY	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
MASTER POWER SWITCH	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
MODE SELECT SWITCH	AERIAL REFUELING CONTROL	39-L	MAIN DC BUS 1
BOOST PUMPS:			
AUX TANK BOOST PUMP CONTROL:			
NO. 1 & NO. 4 PRIMARY PUMPS	FUEL BOOST AUX PRI NO. 1 & 4	37-L	MAIN DC BUS 1
NO. 2 & NO. 3 PRIMARY PUMPS	FUEL BOOST AUX PRI NO. 2 & 3	42-L	MAIN DC BUS 2
NO. 1 & NO. 4 SECONDARY PUMPS	FUEL BOOST AUX SEC NO. 1 & 4	42-L	MAIN DC BUS 2
NO. 2 & NO. 3 SECONDARY PUMPS	FUEL BOOST AUX SEC NO. 2 & 3	37-L	MAIN DC BUS 1
AUX TANK BOOST PUMP POWER:			
NO. 1 PRIMARY PUMP	FUEL BOOST NO. 1 AUX PRI	1, 2, 3-R	MAIN DC BUS 1
SECONDARY PUMP	FUEL BOOST NO. 1 AUX SEC	4, 5, 6-R	MAIN DC BUS 2
NO. 2 PRIMARY PUMP	FUEL BOOST NO. 2 AUX PRI	10, 11, 12-R	MAIN DC BUS 4
SECONDARY PUMP	FUEL BOOST NO. 2 AUX SEC	7, 8, 9-R	MAIN DC BUS 3
NO. 3 PRIMARY PUMP	FUEL BOOST NO. 3 AUX PRI	10, 11, 12-R	MAIN DC BUS 4
SECONDARY PUMP	FUEL BOOST NO. 3 AUX SEC	7, 8, 9-R	MAIN DC BUS 3
NO. 4 PRIMARY PUMP	FUEL BOOST NO. 4 AUX PRI	1, 2, 3-R	MAIN DC BUS 1
SECONDARY PUMP	FUEL BOOST NO. 4 AUX SEC	4, 5, 6-R	MAIN DC BUS 2
EXTENDED RANGE TANK PUMP CONTROL:			
LEFT: INBOARD	FUEL BOOST EXTENDED RANGE INBD	37-L	MAIN DC BUS 1
OUTBOARD	FUEL BOOST EXTENDED RANGE OUTBD	42-L	MAIN DC BUS 2
RIGHT: INBOARD	FUEL BOOST EXTENDED RANGE INBD	37-L	MAIN DC BUS 1
OUTBOARD	FUEL BOOST EXTENDED RANGE OUTBD	42-L	MAIN DC BUS 2
EXTENDED RANGE TANK PUMP POWER:			
LEFT: INBOARD	FUEL BOOST LH EXT RANGE INBD	1, 2, 3-R	MAIN DC BUS 1
OUTBOARD	FUEL BOOST LH EXT RANGE OUTBD	10, 11, 12-R	MAIN DC BUS 4
RIGHT: INBOARD	FUEL BOOST RH EXT RANGE INBD	1, 2, 3-R	MAIN DC BUS 1
OUTBOARD	FUEL BOOST RH EXT RANGE OUTBD	10, 11, 12-R	MAIN DC BUS 4
MAIN TANKS:			
NO. 1 PRIMARY PUMP	FUEL BOOST PUMP NO. 1 MAIN PRI	13, 14, 15-L	ESSENTIAL AC BUS 1
SECONDARY PUMP	FUEL BOOST PUMP NO. 1 MAIN SEC	18, 19, 20-L	ESSENTIAL AC BUS 2
NO. 2 PRIMARY PUMP	FUEL BOOST PUMP NO. 2 MAIN PRI	18, 19, 20-L	ESSENTIAL AC BUS 2
SECONDARY PUMP	FUEL BOOST PUMP NO. 2 MAIN SEC	13, 14, 15-L	ESSENTIAL AC BUS 1
NO. 3 PRIMARY PUMP	FUEL BOOST PUMP NO. 3 MAIN PRI	18, 19, 20-L	ESSENTIAL AC BUS 2
SECONDARY PUMP	FUEL BOOST PUMP NO. 3 MAIN SEC	13, 14, 15-L	ESSENTIAL AC BUS 1
NO. 4 PRIMARY PUMP	FUEL BOOST PUMP NO. 4 MAIN PRI	13, 14, 15-L	ESSENTIAL AC BUS 1
SECONDARY PUMP	FUEL BOOST PUMP NO. 4 MAIN SEC	18, 19, 20-L	ESSENTIAL AC BUS 2
FUEL SYSTEM INDICATORS:			
FUEL INLET TEMPERATURE INDICATOR	CSD ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
FUEL PRESSURE INDICATOR	FUEL PRESS. IND	23-R	26V AC BUS 2

Figure 1-182. Circuit Breaker Index (Sheet 15 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
FUEL SUPPLY SYSTEM (CONTINUED)			
FUEL SYSTEM INDICATORS (CONTINUED):			
FUEL QUANTITY SYSTEM:			
AUX TANK NO. 1	FUEL QTY IND AUX TANK NO. 1	35-L	MAIN DC BUS 1
NO. 2	FUEL QTY IND AUX TANK NO. 2	35-L	MAIN DC BUS 1
NO. 3	FUEL QTY IND AUX TANK NO. 3	43-L	MAIN DC BUS 2
NO. 4	FUEL QTY IND AUX TANK NO. 4	43-L	MAIN DC BUS 2
EXTENDED RANGE TANKS: LEFT	FUEL QTY IND EXT RG LH	36-L	MAIN DC BUS 1
RIGHT	FUEL QTY IND EXT RG TANK RH	43-L	MAIN DC BUS 2
MAIN TANK MAIN TANKS NO. 1	FUEL QTY IND MAIN NO. 1 TANK	26-L	ISOLATED DC BUS
NO. 2	FUEL QTY IND MAIN NO. 2 TANK	27-L	ISOLATED DC BUS
NO. 3	FUEL QTY IND MAIN NO. 3 TANK	28-L	ISOLATED DC BUS
NO. 4	FUEL QTY IND MAIN NO. 4 TANK	29-L	ISOLATED DC BUS
TOTALIZER	FUEL QTY IND TOTALIZER	32-L	ISOLATED DC BUS
VALVES:			
A/R ISOLATION VALVES:			
LEFT	LH AERIAL REFUEL ISOL VALVE	39-L	MAIN DC BUS 1
RIGHT	RH AERIAL REFUEL ISOL VALVE	45-L	MAIN DC BUS 2
CROSSFEED VALVES:			
NO. 1	ENG NO. 1 FUEL CROSSFEED VALVE	26-L	ISOLATED DC BUS
NO. 2	ENG NO. 2 FUEL CROSSFEED VALVE	27-L	ISOLATED DC BUS
NO. 3	ENG NO. 3 FUEL CROSSFEED VALVE	28-L	ISOLATED DC BUS
NO. 4	ENG NO. 4 FUEL CROSSFEED VALVE	29-L	ISOLATED DC BUS
FUEL HEAT VALVES:			
ENGINE NO. 1	FUEL HEAT & IND LTS NO. 1	35-L	MAIN DC BUS 1
ENGINE NO. 2	FUEL HEAT & IND LTS NO. 2	40-L	MAIN DC BUS 2
ENGINE NO. 3	FUEL HEAT & IND LTS NO. 3	40-L	MAIN DC BUS 2
ENGINE NO. 4	FUEL HEAT & IND LTS NO. 4	35-L	MAIN DC BUS 1
GROUND ISOLATION VALVE	GROUND ISOL VALVE	42-L	MAIN DC BUS 1
JETTISON VALVES:			
LEFT	FUEL JETTISON VALVE LH	38-L	MAIN DC BUS 1
RIGHT	FUEL JETTISON VALVE RH	44-L	MAIN DC BUS 2
SEPARATION VALVES:			
CENTER	FUEL SEP VALVE CTR	30-L	ISOLATED DC BUS
LEFT	FUEL SEP VALVE LH	31-L	ISOLATED DC BUS
RIGHT	FUEL SEP VALVE RH	32-L	ISOLATED DC BUS
REFUELING VALVES/PUMPS:			
AUX TANK: NO. 1 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI MAIN & AUX NO. 1 & 4	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC MAIN & AUX NO. 1 & 4	39-L	MAIN DC BUS 1
NO. 2 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI AUX NO. 2 & 3	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC AUX NO. 2 & 3	39-L	MAIN DC BUS 1
NO. 3 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI AUX NO. 2 & 3	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC AUX NO. 2 & 3	39-L	MAIN DC BUS 1
NO. 4 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI MAIN & AUX NO. 1 & 4	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC MAIN & AUX NO. 1 & 4	39-L	MAIN DC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 16 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
FUEL SUPPLY SYSTEM (CONTINUED)			
REFUELING VALVES/PUMPS (CONTINUED): --	--------------------------------	-------------	----------------
EXTENDED RANGE TANKS			
LEFT PRIMARY	FUEL LEVEL CONTROL VALVE-PRI EXTENDED RANGE	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC EXTENDED RANGE	39-L	MAIN DC BUS 1
RIGHT PRIMARY	FUEL LEVEL CONTROL VALVE-PRI EXTENDED RANGE	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC EXTENDED RANGE	39-L	MAIN DC BUS 1
GROUND ISOLATION VALVE	GROUND ISOL VALVE	42-L	MAIN DC BUS 1
MAIN TANKS: NO. 1 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI MAIN & AUX NO. 1 & 4	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC MAIN & AUX NO. 1 & 4	39-L	MAIN DC BUS 1
NO. 2 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI MAIN NO. 2 & 3	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC MAIN NO. 2 & 3	39-L	MAIN DC BUS 1
NO. 3 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI MAIN NO. 2 & 3	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC MAIN NO. 2 & 3	39-L	MAIN DC BUS 1
NO. 4 PRIMARY	FUEL LEVEL CONTROL VALVE-PRI MAIN & AUX NO. 1 & 4	42-L	MAIN DC BUS 2
SECONDARY	FUEL LEVEL CONT-SEC MAIN & AUX NO. 1 & 4	39-L	MAIN DC BUS 1
SPR DRAIN PUMP AND VALVES	FUEL DRAIN PUMP & VALVES	44-L	MAIN DC BUS 2
WARNING LIGHTS: --------------------	--------------------------------	-------------	----------------
BOOST PUMP PRESSURE LOW LIGHTS:			
NO. 1 MAIN, NO. 1 AUX AND LH EXT RNG OUTBD	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 1	36-L	MAIN DC BUS 1
NO. 2 MAIN, NO. 2 AUX AND LH EXT RNG INBD	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 2	44-L	MAIN DC BUS 2
NO. 3 MAIN, NO. 3 AUX AND RH EXT RNG INBD	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 3	44-L	MAIN DC BUS 2
NO. 4 MAIN, NO. 4 AUX AND RH EXT RNG OUTBD	ENG FUEL & LOW BOOST PRESS. WARN LT NO. 4	36-L	MAIN DC BUS 1
FUEL JETTISON STOP PUMP LIGHTS:			
PRIMARY PUMPS	FUEL BOOST AUX PRI NO. 1 & 4	37-L	MAIN DC BUS 1
SECONDARY PUMPS	FUEL BOOST AUX SEC NO. 1 & 4	42-L	MAIN DC BUS 2
SUMP LOW LIGHTS:			
CONTROL UNITS: NO. 1 & 4 MAIN TANKS	FUEL SUMP & LOW WARN CONT UNIT NO. 1 & 4 MAIN TANK	38-L	MAIN DC BUS 1
NO. 2 & 3 MAIN TANKS	FUEL SUMP LOW WARN CONT UNIT NO. 2 & 3 MAIN TANK	43-L	MAIN DC BUS 2
LIGHTS: NO. 1 MAIN TANK	FUEL SUMP & LOW WARN LT NO. 1 MAIN TANK	38-L	MAIN DC BUS 1
NO. 2 MAIN TANK	FUEL SUMP LOW WARN LT NO. 2 MAIN TANK	43-L	MAIN DC BUS 2
NO. 3 MAIN TANK	FUEL SUMP LOW WARN LT NO. 3 MAIN TANK	43-L	MAIN DC BUS 2
NO. 4 MAIN TANK	FUEL SUMP & LOW WARN LT NO. 4 MAIN TANK	38-L	MAIN DC BUS 1
HYDRAULIC SYSTEMS			
HYDRAULIC PRESSURE INDICATORS: ------	--------------------------------	-------------	----------------
EMERGENCY BRAKE PRESSURE	HYD PRESS. IND EMER BK PRESS.	23-R	26V AC BUS 1
NORMAL BRAKE PRESSURE	HYD PRESS. INDICATORS NORM BRAKE PRESS.	23-L	26V AC BUS 2
HYD SYSTEM NO. 1	HYD PRESS. INDICATORS NO. 1 SYS PRESS.	23-L	26V AC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 17 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
HYDRAULIC SYSTEMS (CONTINUED)			
HYD SYSTEM NO. 2	HYD PRESS. IND NO. 2 SYS PRESS.	23-R	26V AC BUS 2
HYD SYSTEM NO. 3	HYD PRESS. INDICATORS NO. 3 SYS PRESS.	23-L	26V AC BUS 1
HYDRAULIC SYSTEM LIGHTS:			
PRESSURE LOW LIGHTS:			
NO. 1 & 4 ENGINE-DRIVEN PUMPS	HYD PUMPS LOW PRESS LTS ENG NO. 1 & 4	33-L	ISOLATED DC BUS
NO. 2 & 3 ENGINE-DRIVEN PUMPS	HYD PUMPS LOW PRESS LTS ENG NO. 2 & 3	33-L	ISOLATED DC BUS
NO. 1 SYSTEM SUCTION BOOST PUMP	HYDRAULIC SYSTEM NO. 1 SUCTION BOOST PUMP WARN	37-R	MAIN DC BUS 1
NO. 2 SYSTEM SUCTION BOOST PUMP	HYDRAULIC SYSTEM NO. 2 SUCTION BOOST PUMP WARN	42-R	MAIN DC BUS 2
NO. 3 HYD SYS PRESSURE ON LIGHT	HYDRAULIC SYSTEM NO. 3 PRESSURE ON LIGHT	37-R	MAIN DC BUS 1
HYDRAULIC SYSTEMS NO. 1 AND NO. 2:			
ENGINE-DRIVEN PUMP VALVES:			
ENGINE NO. 1	ENG NO. 1 HYD PUMP VALVES CONTROL	26-L	ISOLATED DC BUS
ENGINE NO. 2	ENG NO. 2 HYD PUMP VALVES CONTROL	27-L	ISOLATED DC BUS
ENGINE NO. 3	ENG NO. 3 HYD PUMP VALVES CONTROL	28-L	ISOLATED DC BUS
ENGINE NO. 4	ENG NO. 4 HYD PUMP VALVES CONTROL	29-L	ISOLATED DC BUS
SUCTION BOOST PUMPS:			
CONTROL: NO. 1 SYSTEM	HYDRAULIC SYSTEM NO. 1 SUCTION BOOST PUMP CONT	42-R	MAIN DC BUS 2
NO. 2 SYSTEM	HYDRAULIC SYSTEM NO. 2 SUCTION BOOST PUMP CONT	37-R	MAIN DC BUS 1
POWER: NO. 1 SYSTEM	NO. 1 HYD SYS SUCT BOOST PUMP PWR	18, 19, 20-L	ESSENTIAL AC BUS 2
NO. 2 SYSTEM	NO. 2 HYD SYS SUCT BOOST PUMP PWR	13, 14, 15-L	ESSENTIAL AC BUS 1
HYDRAULIC SYSTEM NO. 3:			
ELECTRIC-DRIVEN HYDRAULIC PUMPS			
CONTROL: NO. 1 PUMP	HYDRAULIC SYSTEM NO. 3 NO. 1 PUMP CONT	37-R	MAIN DC BUS 1
NO. 2 PUMP	HYDRAULIC SYSTEM NO. 3 NO. 2 PUMP CONT	42-R	MAIN DC BUS 2
POWER: NO. 1 PUMP	HYD SYS NO. 3 PUMP NO. 1 PWR	1, 2, 3-R	MAIN AC BUS 1
NO. 2 PUMP	HYD SYS NO. 3 PUMP NO. 2 PWR	8, 9, 10-R	MAIN AC BUS 3
ACCUMULATOR CONTROL VALVE	HYD SYS NO. 3 SPOILER SOV	45-R	MAIN DC BUS 2
SPOILER CABLE SERVO VALVE	HYD SYS NO. 3 SPOILER SOV	45-R	MAIN DC BUS 2
INSTRUMENTS/AVIONICS			
AILERON TRIM INDICATOR	AILERON TRIM POS IND	38-R	MAIN DC BUS 1
BOGEY POSITION INDICATOR	BOGEY POS IND	32-R	ISOLATED DC BUS
CENTRAL AIR DATA COMPUTER (CADC): ---	------------------------------	-------------	----------------
SCADC NO. 1 (PILOT'S)	CADC NO. 1 CADC AIRSPEED GROUP NO. 1 EXC	(5-B) (7-B)	EMERGENCY AC BUS 26V EMER AC BUS B
	CADC NO. 1 CADC ALT GROUP NO. 1 EXC CADC/VSFI TEST (PILOT)	(5-B) (7-C) 8-A	EMERGENCY AC 26V EMER AC BUS B MAIN DC AVIONICS 2
SCADC NO. 2 (COPILOT'S)	PWR CADC NO. 2 AIRSPEED GROUP ALT GROUP	2-B 4-C 3-D	NAVIGATION AC 2 26 VAC EXCITATION 26 VAC EXCITATION
	TAS NAV	4-D	26V AC NAV EXCITATION 2
	CADC/VSFI TEST (COPILOT)	7-A	MAIN DC AVIONICS 2

Figure 1-182. Circuit Breaker Index (Sheet 18 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
INSTRUMENTS /AVIONICS (CONTINUED)			
DISPLAY UNIT:			
DU 1	DU NO. 1	3-A	MAIN DC AVIONICS 1
	DU NO. 1 HTR	32-D	MAIN DC AVIONICS 1
DU 2	DU NO. 2	(12-C)	EMERGENCY DC
	DU NO. 2 HTR	13-A	MAIN DC AVIONICS 2
DU 3	DU NO. 3	2-A	MAIN DC AVIONICS 1
	DU NO. 3 HTR	31-D	MAIN DC AVIONICS 1
DU 4	DU NO. 4	(11-C)	EMERGENCY DC
	DU NO. 4 HTR	12-A	MAIN DC AVIONICS 2
ELECTRICAL SYSTEM:			
CDS OIL TEMPERATURE GAGE			
NO. 1	CDS ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
NO. 2	CDS & ENG OIL TEMP IND NO. 2	40-L	MAIN DC BUS 1
NO. 3	CDS & ENG OIL TEMP IND NO. 3	40-L	MAIN DC BUS 1
NO. 4	CDS ENG OIL TEMP IND NO. 4	35-L	MAIN DC BUS 1
AC VOLTMETER/FREQUENCY METER:			
GENERATOR NO. 1	GEN NO. 1 VOLT AND FREQ TEST (3C/B)	ACPDC 12	
GENERATOR NO. 2	GEN NO. 2 VOLT & FREQ TEST (PH A, B, C) (3C/B)	ACPDC 11	
GENERATOR NO. 3	GEN NO. 3 VOLT & FREQ TEST (PH A, B, C) (3C/B)	ACPDC 10	
GENERATOR NO. 4	GEN NO. 4 VOLT AND FREQ TEST (PH A, B, C) (3C/B)	ACPDC 9	
APU GENERATOR	AUX GEN VOLT AND FREQ TEST (3C/B)	ACPDC 9	
EXTERNAL POWER	EXTERNAL POWER VOLT AND FREQ TEST (PH A, B, C) (3C/B)	ACPDC 9	
EMERGENCY POWER	AC VOLTAGE TEST (PH, A, B, C) (3C/B)	EMERGENCY GEN. CONTROL BOX	
DC VOLTMETER			
EMERGENCY DC BUS	BUS WARN LTS	32-L	
ISOLATED DC BUS	ISOL DC BUS IND	31-L	
MAIN DC BUS NO. 1	BUS VOLT TEST	34-R	
MAIN DC BUS NO. 2	BUS VOLT TEST	34-L	
ENGINE INSTRUMENTS:			
ENGINE PRESSURE RATIO (EPR)			
NO. 1 ENGINE	ENG PRESSURE RATIO NO. 1	25-L	ISOLATED AC BUS
NO. 2 ENGINE	ENG PRESSURE RATIO NO. 2	24-L	ISOLATED AC BUS
NO. 3 ENGINE	ENG PRESSURE RATIO NO. 3	24-L	ISOLATED AC BUS
NO. 4 ENGINE	ENG PRESSURE RATIO NO. 4	25-L	ISOLATED AC BUS
ENGINE VIBRATION INDICATOR (EVI)	ENG VIB IND	25-R	ISOLATED AC BUS
	ENG VIB-IND	31-L	ISOLATED DC BUS
N_1, RPM, N_2, RPM EGT & FUEL FLOW:			
NO. 1 ENGINE	ENG EGT-RPM FUEL FLOW NO. 1	20-R	ESSENTIAL AC BUS 2
NO. 2 ENGINE	ENG EGT-RPM FUEL FLOW NO. 2	18-R	ESSENTIAL AC BUS 2
NO. 3 ENGINE	ENG EGT-RPM FUEL FLOW NO. 3	18-R	ESSENTIAL AC BUS 2
NO. 4 ENGINE	ENG EGT-RPM FUEL FLOW NO. 4	20-R	ESSENTIAL AC BUS 2
OIL PRESSURE INDICATOR			
NO. 1 ENGINE	ENG OIL PRESS IND NO. 1	23-L	26V AC BUS 1
NO. 2 ENGINE	ENG OIL PRESS. IND NO. 2	23-R	26V AC BUS 2
NO. 3 ENGINE	ENG OIL PRESS. IND NO. 3	23-R	26V AC BUS 2
NO. 4 ENGINE	ENG OIL PRESS IND NO. 4	23-L	26V AC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 19 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
INSTRUMENTS/AVIONICS (CONTINUED)			
ENGINE INSTRUMENTS (CONTINUED): ----	------------------------------------	--------------	------------------
OIL TEMPERATURE INDICATOR			
NO. 1 ENGINE	CSD ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
NO. 2 ENGINE	CSD & ENG OIL TEMP IND NO. 2	40-L	MAIN DC BUS 2
NO. 3 ENGINE	CSD & ENG OIL TEMP IND NO. 3	40-L	MAIN DC BUS 2
NO. 4 ENGINE	CSD ENG OIL TEMP IND NO. 4	35-L	MAIN DC BUS 1
FLAP POSITION INDICATOR	WING FLAP POS IND	38-R	MAIN DC BUS 1
FUEL SYSTEM INDICATORS: -----------	------------------------------------	--------------	------------------
FUEL INLET TEMPERATURE INDICATOR	CSD ENG OIL & FUEL TEMP IND NO. 1	35-L	MAIN DC BUS 1
FUEL PRESSURE INDICATOR	FUEL PRESS. IND	23-R	26V AC BUS 2
FUEL QUANTITY SYSTEM:			
AUX TANK: NO. 1	FUEL QTY IND AUX TANK NO. 1	35-L	MAIN DC BUS 1
NO. 2	FUEL QTY IND AUX TANK NO. 2	35-L	MAIN DC BUS 1
NO. 3	FUEL QTY IND AUX TANK NO. 3	43-L	MAIN DC BUS 2
NO. 4	FUEL QTY IND AUX TANK NO. 4	43-L	MAIN DC BUS 2
EXTENDED RANGE TANKS:			
LEFT	FUEL QTY IND EXT RG LH	36-L	MAIN DC BUS 1
RIGHT	FUEL QTY IND EXT RG TANK RH	43-L	MAIN DC BUS 2
MAIN TANK: NO. 1	FUEL QTY IND MAIN NO. 1 TANK	26-L	ISOLATED DC BUS
NO. 2	FUEL QTY IND MAIN NO. 2 TANK	27-L	ISOLATED DC BUS
NO. 3	FUEL QTY IND MAIN NO. 3 TANK	28-L	ISOLATED DC BUS
NO. 4	FUEL QTY IND MAIN NO. 4 TANK	29-L	ISOLATED DC BUS
TOTALIZER	FUEL QTY IND TOTALIZER	32-L	ISOLATED DC BUS
HYDRAULIC PRESSURE INDICATORS: -----	------------------------------------	--------------	------------------
EMERGENCY BRAKE PRESSURE	HYD PRESS. IND EMER BK PRESS.	23-R	26V AC BUS 2
	HYD PRESS. INDICATORS NORM BRAKE PRESS.	23-L	26V AC BUS 1
HYD SYSTEM NO. 1	HYD PRESS. INDICATORS NO. 1 SYS PRESS.	23-L	26V AC BUS 1
HYD SYSTEM NO. 2	HYD PRESS. IND NO. 2 SYS PRESS.	23-R	26V AC BUS 2
HYD SYSTEM NO. 3	HYD PRESS. INDICATORS NO. 3 SYS PRESS.	23-L	26V AC BUS 1
LANDING GEAR: --------------------	------------------------------------	--------------	------------------
BOGEY POSITION INDICATOR	BOGEY POS IND	32-R	ISOLATED DC BUS
LANDING GEAR POSITION INDICATOR	LANDING GEAR POS IND	31-R	ISOLATED DC BUS
MISCELLANEOUS INDICATORS: ----------	------------------------------------	--------------	------------------
MULTIFUNCTION STANDBY INSTRUMENT SYSTEM (MFSI)	MFSI SYS	9-B	EMERGENCY DC
	MFSI-2	33L	BATTERY BUS
NAVIGATOR'S TRUE AIRSPEED INDICATOR	TAS NAV	4-D	26 VAC NAV EXCITATION 2
FLIGHT CONTROL PANEL/MODE SELECT PANEL:	FCP/MSP NO. 1	(7-A)	EMER DC
	FCP 2	7-C	26V AC NAV EXCITATION 2
	MSP NO. 2	35-B	MAIN DC AVIONICS 1
REFERENCE SET PANEL:			
PILOT'S AND COPILOT'S RSP	AHRS ATT2/RSP 1 & 2 EXC	(4-A)	26V EMER AC BUS A

Figure 1-182. Circuit Breaker Index (Sheet 20 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
INSTRUMENTS /AVIONICS (CONTINUED)			
MISCELLANEOUS INDICATORS (CONTINUED):	--------------------	--------------------	--------------------
RADAR ALTIMETER	RADAR ALT	28B	MAIN DC AVIONICS 1
RADAR (AN/APS-133):			
POWER	RADAR	28-D	AC AVIONICS BUS 1
RADAR DATA PROCESSOR (RDP)	RDP	14-A	MAIN DC AVIONICS 2
PILOT'S MFD	DC MFD	12-C	MAIN DC AVIONICS 2
SKE RADAR (AN/APN169B): △1			
AUXILIARY INTERFACE UNIT	AIU	30-B	MAIN DC AVIONICS 1
NAVIGATOR'S MFD	NAV MFD	32-C	AC AVIONICS BUS 1
POWER	SKE	13, 14, 15-L	ESSENTIAL AC 1
	SKE	39-R (2 C/Bs)	MAIN DC 1
PITCH TRIM INDICATOR	HORIZ STAB TRIM POS IND	37-R	MAIN DC BUS 1
RUDDER TRIM INDICATOR	RUDDER TRIM POS IND	38-R	MAIN DC BUS 1
SPOILER POSITION INDICATOR			
POINTERS	SPOILER POS IND.	23-L	26V AC BUS 1
LOCK/UNLKD FLAG	SPOILER SOV & POS IND	36-R	MAIN DC BUS 1
TOTAL TEMPERATURE INDICATOR	TOTAL TEMP IND	2-R	MAIN AC BUS 1
LANDING GEAR AND BRAKES			
BRAKES:--------------------	--------------------	--------------------	--------------------
ANTI-SKID	ANTI-SKID FAIL SAFE ISOL	39-R	MAIN DC BUS 1
	ANTI-SKID POWER	39-R	MAIN DC BUS 1
BRAKE SELECTOR SWITCH:			
EMERGENCY BRAKES	EMERG BRAKES	30-R	ISOLATED DC BUS
NORMAL BRAKES	ANTI-SKID PWR	39-R	MAIN DC BUS 1
PRESSURE INDICATORS			
EMERGENCY BRAKE PRESSURE	HYD PRESS. IND EMER BK PRESS.	2[illegible]R	26V AC BUS 2
NORMAL BRAKE PRESSURE	HYD PRESS. INDICATORS NORM BRAKE PRESS.	23-L	26V AC BUS 1
BRAKE SYSTEM LIGHTS:			
ANTI-SKID DET OUT LIGHT	ANTI-SKID IND LT	32-R	ISOLATED DC BUS
ANTI-SKID OFF LIGHT	ANTI-SKID IND LT	32-R	ISOLATED DC BUS
BRAKES RELEASED LIGHT	ANTI-SKID POWER	39-R	MAIN DC BUS 1
LANDING GEAR:--------------------	--------------------	--------------------	--------------------
CONTROL	LANDING GEAR CONT	30-R	ISOLATED DC BUS
BOGEY POSITION INDICATOR	BOGEY POS IND	32-R	ISOLATED DC BUS
LANDING GEAR POSITION INDICATOR	LANDING GEAR POS IND	31-R	ISOLATED DC BUS
LANDING GEAR WARNING HORN	LANDING GEAR WARN	32-R	ISOLATED DC BUS
RUDDER PEDAL STEERING	RUDDER PEDAL STEERING	38-R	MAIN DC 1
TOUCHDOWN RELAYS	LANDING GEAR TOUCH DOWN RELAYS	31-R	ISOLATED DC BUS

△1 AIRCRAFT MODIFIED BY TCTO 520

Figure 1-182. Circuit Breaker Index (Sheet 21 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
LIGHTING			
EXTERIOR LIGHTING:			
AIR REFUELING LIGHTING:			
AIR REFUELING FAIRING LIGHTS	UARRSI FAIRING LIGHTS	17-R	ESSENTIAL AC BUS 1
SLIPWAY LIGHTS	UARRSI SLIPWAY LTS	39-L	MAIN DC BUS 1
ANTI COLLISION LIGHTS:			
LOWER	ANTI-COLLISION LT LOWER	17-L	ESSENTIAL AC BUS 1
UPPER	ANTI-COLLISION LTS UPPER	21-L	ESSENTIAL AC BUS 2
ANTI COLLISION STROBE LIGHTS: (1)			
LOWER	ANTICOLL LT LOWER	36-L	MAIN DC BUS 1
UPPER	ANTI-COLL LT UPPER	40-L	MAIN DC BUS 2
FORMATION LIGHTS:			
CONTROL	FORMATION LT CONT	36-R	MAIN DC BUS 1
POWER	FORMATION LT	2-L	MAIN AC BUS 1
	FORMATION LT	CFJB	6V AC BUS
LANDING LIGHTS:			
CONTROL	LH LANDING CONT	37-R	MAIN DC BUS 1
	RH LANDING LTS	44-L	MAIN DC BUS 2
INDICATOR	LANDING LT IND	37-R	MAIN DC BUS 1
MOTOR	LH LDG LTS MOTOR	1-L	MAIN AC BUS 1
	RH LDG LTS MOTOR	12-L	MAIN AC BUS 4
POWER	LH LDG LTS PWR	1-L	MAIN AC BUS 1
	RH LDG LTS PWR	12-L	MAIN AC BUS 4
LEADING EDGE LIGHTS:			
CONTROL	LE & TAXI LTS CONT	45-R	MAIN DC BUS 2
POWER	LE LTS	12-L	MAIN AC BUS 4
NAVIGATION LIGHTS:	NAVIGATION LTS WING LH	11-L	MAIN AC BUS 4
	NAVIGATION LTS WING RH	11-L	MAIN AC BUS 4
	NAVIGATION LTS TAIL	11-L	MAIN AC BUS 4
TAXI LIGHTS:			
CONTROL	LE & TAXI LTS CONT	45-R	MAIN DC BUS 2
POWER	LH TAXI LTS	2-L	MAIN AC BUS 1
	RH TAXI LTS	12-L	MAIN AC BUS 4

(1) AIRCRAFT MODIFIED BY TCTO 631

Figure 1-182. Circuit Breaker Index (Sheet 22 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
LIGHTING (CONTINUED)			
INTERIOR LIGHTING (FLIGHT STATION): --	------------------------------------	--------------	------------------
COPILOT'S:			
INSTRUMENT FLOOD	COPLT INSTR FLOOD LTS	17-L	ESSENTIAL AC BUS 1
INSTRUMENT PANEL	COPLT PNL INST LTS	22-L	ESSENTIAL AC BUS 2
LETDOWN HOLDER	COPLT INSTR FLOOD LTS	17-L	ESSENTIAL AC BUS 1
SCROLL CHECKLIST	COPLT INSTR FLOOD LTS	17-L	ESSENTIAL AC BUS 1
SIDE CONSOLE	COPLT SIDE CONSOLE LTS	17-L	ESSENTIAL AC BUS 1
UTILITY - GLARE SHIELD	COPLT INSTR FLOOD LTS	17-L	ESSENTIAL AC BUS 1
FLIGHT ENGINEER'S:			
FLOOD	FLT ENGR PNL FLOOD LTS	17-L	ESSENTIAL AC BUS 1
INSTRUMENT	FLT ENGR INST LTS	22-L	ESSENTIAL AC BUS 2
PANEL	FLT ENGR PNL LTS	22-L	ESSENTIAL AC BUS 2
MAIN CIRCUIT BREAKER PANELS	MAIN CKT BKR PNL LTS	16-L	ESSENTIAL AC BUS 1
SCROLL CHECKLIST	FLT ENGR PNL FLOOD LTS	17-L	ESSENTIAL AC BUS 1
FLIGHT STATION DOME	FLT STA DOME LT	1-L	MAIN AC BUS 1
NAVIGATOR'S:			
FLOOD, UTILITY	NAV PANEL FLOOD LTS	16-L	ESSENTIAL AC BUS 1
INSTRUMENT	NAV INSTR LTS	21-L	ESSENTIAL AC BUS 2
PANEL	NAV PANEL LTS	22-L	ESSENTIAL AC BUS 2
PILOT'S:			
INSTRUMENT FLOOD	PLT INST FLOOD LTS	(11-A)	EMERGENCY DC BUS
INSTRUMENT PANEL	PLT PNL INSTR LTS	17-L	ESSENTIAL AC BUS 1
LETDOWN HOLDER	PLT INST FLOOD LTS	(11-A)	EMERGENCY DC BUS
SIDE CONSOLE	PLT SIDE CONSOLE LTS	17-L	ESSENTIAL AC BUS 1
CENTER CONSOLE MFCDU, MSP, RSP, FCP, IFF, AND CADC/YAW DAMPER PANEL	PLT CTR CSL LTS (5VAC)	29-C	ESSENTIAL AC BUS 1
UTILITY - OVERHEAD	PLT INST FLOOD LTS	(11-A)	ESSENTIAL DC BUS
PILOTS' OVERHEAD:			
OVERHEAD FLOOD	OVERHEAD PNL FLOOD LTS	21-L	ESSENTIAL AC BUS 2
OVERHEAD PANEL	OVERHEAD PNL LTS	16-L	ESSENTIAL AC BUS 1
UTILITY - OVERHEAD	PLT & COPLT UTIL LT	6-L	28V AC BUS 2
PILOTS' CENTER:			
CONSOLE	PEDESTAL LTS	17-L	ESSENTIAL AC BUS 1
INSTRUMENT PANEL	CTR INSTR PNL LTS	16-L	ESSENTIAL AC BUS 1
READING LIGHTS:			
POWER	FLT STA LTG TRANS	4-L	MAIN AC BUS 2
PROTECTION	FLT STA READING LT	5-L	28V AC BUS 2
THUNDERSTORM	CAUTION LTS DIM RELAY CONT	45-R	MAIN DC BUS 2

Figure 1-182. Circuit Breaker Index (Sheet 23 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
LIGHTING (CONTINUED)			
INTERIOR LIGHTING (CARGO COMPT): ----	----------------------------------	--------------	------------------
DOME:			
CONTROL	CARGO DOME LT CONT NO. 1 CARGO DOME LTS CONT NO. 2	36-R 45-R	MAIN DC BUS 1 MAIN DC BUS 2
POWER	LTG TRANS & CAR COMPT WHT LTS CARGO COMPT DOME LT CARGO COMPT DOME LT	1-R 12-R CFJB	MAIN AC BUS 1 MAIN AC BUS 4 28V AC BUS 1
EMERGENCY EXIT:			
CHARGING/ARMING EXTINGUISHING	EMER EXIT LT CHARGE & ARM EMER EXIT LTS EXTINGUISH	37-R 31-L	MAIN DC BUS 1 ISOLATED DC BUS
PARATROOP PLATFORM	JUMP PLATFORM LTS	43-R	MAIN DC BUS 2
RAMP LOADING:			
POWER PROTECTION	LTG TRANS & CAR COMPT WHT LTS RAMP LOADING LTS	1-R CFJB	MAIN AC BUS 1 28V AC BUS 1
INTERIOR LIGHTING (SERVICE COMPT): ----	----------------------------------	--------------	------------------
FLIGHT STATION ACCESS:			
POWER PROTECTION	FLT STA LTG TRANS UNDERDECK LTS & LADDER AREA LT	4-L 7-L	MAIN AC BUS 2 28V AC BUS 2
LAVATORY:			
POWER PROTECTION	FLT STA LTG TRANS NOSE WHEEL WELL & LAV LTS	4-L 8-L	MAIN AC BUS 2 28V AC BUS 2
MAIN WHEEL WELLS:			
POWER PROTECTION	LTG TRANS & CAR COMPT WHT LTS MAIN WHEEL WELL LT	1-R CFJB	MAIN AC BUS 1 28V AC BUS 1
NOSE WHEEL WELL:			
POWER PROTECTION	FLT STA LTG TRANS NOSE WHEEL WELL & LAV LTS	4-L 8-L	MAIN AC BUS 2 28V AC BUS 2
UNDERDECK AREA:			
POWER PROTECTION	FLT STA LTG TRANS UNDERDECK LTS & LADDER AREA LT	4-L 7-L	MAIN AC BUS 2 28V AC BUS 2
VERTICAL STABILIZER & AFT CRAWL WAY:			
POWER PROTECTION	LTG TRANS & CAR COMPT WHT LTS VERTICAL STAB. LT	1-R CFJB	MAIN AC BUS 1 28V AC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 24 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
MISCELLANEOUS			
AEROMEDICAL EVACUATION EQUIPMENT △1	AEROMED EQUIP FWD	34-L	MAIN DC BUS 2
	AEROMED EQUIP AFT	34-R	MAIN DC BUS 1
ALDIS LAMP	SIGNAL LT	31-L	ISOLATED DC BUS
CARGO WINCH	CARGO WINCH	8,9,10-R	MAIN AC BUS 3
COMFORT PALLET POWER	COMFORT PALLET	8,9,10-R	MAIN AC BUS 3
CREW GALLEY	FLT STA GALLEY	4,5,6-R	MAIN AC BUS 2
LAVATORY			
ELECTRIC SHAVER OUTLET	FLUSH LAV & ELEC SHAVER OUTLET	5-R	MAIN AC BUS 2
TOILET FLUSH	FLUSH LAV	4,5,6-R	MAIN AC BUS 2
PERSONNEL WARNING SIGNS	PERSONNEL SIGNS	9-L	28V AC BUS 2
SERVICE OUTLETS LH	LH SERVICE OUTLETS	7,8,9-R	MAIN AC BUS 3
SERVICE OUTLETS RH	RH SERVICE OUTLETS	4,5,6-R	MAIN AC BUS 2
NAVIGATION			
ADF RADIO:			
ADF NO. 1	ADF NO. 1	24-C	AC NAV EXCITATION 1
	ADF NO. 1	24-B	MAIN DC AVIONICS 1
ADF NO. 2	ADF NO. 2	8-C	AC NAV EXCITATION 2
	ADF NO. 2	8-D	MAIN DC AVIONICS 2
AHRS:			
	AHRS ATTD NO.1	25-C	AC NAV EXCITATION 1
	AHRS ATT 2 /RSP 1 & 2 EXC	(4-A)	26V EMER AC BUS A
	MAG HDG AHRS HDG NO. 3 & 4	38-D	ISOL AC EXCITATION
	MAG HDG AHRS HDG NO. 1, 2 & 5	39-D	ISOL AC EXCITATION
	AHRS PRIME PWR	(1-A, 1-B, 1-C)	EMERGENCY AC BUS
	IJB NO. 1 AHRS CONT	(16-A)	EMERGENCY DC BUS
BDHI:			
	INST INDEX TRANS	34-D	NAVIGATION AC 1
	BDHI PILOT	11-A	MAIN DC AVIONICS 2
	BDHI PILOT	11-B	AC NAV 2
	BDHI COPILOT	34-B	MAIN DC AVIONICS 1
	BDHI COPILOT	34-C	AC NAV 1
	BDHI NO. 2 NAV	10-A	MAIN DC AVIONICS 2
	BDHI NO. 2 NAV	10-B	AC NAV 2
CONTROL DISPLAY SYSTEM (CDS):			
	AHRS ATT 2/RSP 1 & 2 EXC	(4-A)	26V EMER AC BUS A
			EMERGENCY DC
FAN CONTROL	CDS FAN CONT	(5-A)	EMERGENCY AC
FAN NO. 1	CDS FAN NO. 1	(4-C) (3 PHASE C/B)	
			AVIONICS AC 1
FAN NO. 2	CDS FAN NO. 2	13-C	EMERGENCY DC
PILOT'S DAMU	DAMU NO. 1	(12-C)	MAIN DC AVIONICS 2
	DAMU NO. 1 HTR	6-D	MAIN DC AVIONICS 1
COPILOT'S DAMU	DAMU NO. 2	4-A	MAIN DC AVIONICS 1
	DAMU NO. 2 HTR	30-D	

△1 AIRCRAFT MODIFIED BY TCTO 595

Figure 1-182. Circuit Breaker Index (Sheet 25 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
NAVIGATION (CONTINUED)			
CDS (CONT):			
DPU NO. 1	DPU NO. 1/CBC	(14-C)	EMERGENCY DC
DPU NO. 2	DPU NO. 2	5-A	MAIN DC AVIONICS 1
DU NO. 1	DU NO. 1	3-A	MAIN DC AVIONICS 1
	DU NO. 1 HTR	32-D	MAIN DC AVIONICS 1
DU NO. 2	DU NO. 2	(12-C)	EMERGENCY DC
	DU NO. 2 HTR	13-A	MAIN DC AVIONICS 2
DU NO. 3	DU NO. 3	2-A	MAIN DC AVIONICS 1
	DU NO. 3 HTR	31-D	MAIN DC AVIONICS 1
DU NO. 4	DU NO. 4	(11-C)	EMERGENCY DC
	DU NO. 4 HTR	12-A	MAIN DC AVIONICS 2
FMS:			
	DATA LOADER	40-B	MAIN DC AVIONICS 1
	DIU	29-B	MAIN DC AVIONICS 1
	FMS RELAYS	32-B	MAIN DC AVIONICS 1
	FMS REF	40-C	ISOL AC AVIONICS
PILOT'S MFCDU	MFCDU NO. 1	41-B	MAIN DC AVIONICS 1
COPILOT'S MFCDU	MFCDU NO. 2	36-C	MAIN DC AVIONICS 2
NAVIGATOR'S MFCDU	MFCDU NO. 3	35-C	MAIN DC AVIONICS 2
	NP NO. 1	42-B	MAIN DC AVIONICS 1
	NP NO. 2	37-C	MAIN DC AVIONICS 2
HHGPS ⚠1:			
CONTROL		PLGR GPS PNL	ISOLATED DC BUS
POWER	SIGNAL LT	31-L	ISOLATED DC BUS
INS:			
	IJB NO. 1	6-A	MAIN DC AVIONICS 1
	IJB NO. 1	14-B	AVIONICS AC 2
	IJB NO. 1	22-A	MAIN DC AVIONICS 2
	INS-1/INS-2	36-D	ISOL AC EXCITATION
	INS-1/CADC-1	23-C	26V AC NAV EXCITATION 1
	INS-1 HDG AMP PWR	41-C	ISOLATED AVIONICS AC
	MAG HDG INS-1 HDG NO. 3 & 5	40-D	ISOL AC EXCITATION 1
	MAG HDG INS-1 HDG NO. 2 & 4	41-D	ISOL AC EXCITATION
	INS NO. 1 PRIME	22-C	AVIONICS AC 1
	INS NO. 1 HTR	22-D	AVIONICS AC 1
	INS-2/CADC-2	11-C	AC NAV EXCITATION 2
	INS-2 HDG AMPL PWR	6-B	NAV AC 2
	INS-2 MAG HDG NO. 2 & 4	6-C	AC NAV EXCITATION 2
	INS-2 MAG HDG NO. 3	5-D	AC NAV EXCITATION 2
	INS-2 MAG HDG NO. 5	5-C	AC NAV EXCITATION 2
	INS NO. 2 HTR	14-D	AVIONICS AC 2
	INS NO. 2 PRIME	14-C	AVIONICS AC 2
TACAN:			
	TACAN NO. 1	31-C	AC NAV 1
	TACAN NO. 1	31-B	MAIN DC AVIONICS 1
	TACAN NO. 2	9-B	AC NAV 2
	TACAN NO. 2	9-A	MAIN DC AVIONICS 2
VHF NAV:			
	VHF NAV NO. 1	38-B	ISOLATED DC AVIONICS
	VHF NAV NO. 1	42-D	ISOL AC EXCITATION
	VHF NAV NO. 2	9-D	MAIN DC AVIONICS 2
	VHF NAV NO. 2	9-C	AC NAV EXCITATION 2

⚠1 AIRCRAFT MODIFIED BY TCTO 570

Figure 1-182. Circuit Breaker Index (Sheet 26 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
OXYGEN			
CREW SYSTEM:			
LOX QUANTITY INDICATOR	CREW LOX QTY IND	22-R	ESSENTIAL AC BUS 2
OXYGEN QUANTITY WARNING ANNUNCIATOR	CREW LOX QTY IND	22-R	ESSENTIAL AC BUS 2
TROOP SYSTEM:			
LOX QUANTITY INDICATORS:			
CONVERTER NO. 1	TROOP LOX QTY IND NO. 1 CONV	17-R	ESSENTIAL AC BUS 1
CONVERTER NO. 2	TROOP LOX QTY IND NO. 2 CONV	22-R	ESSENTIAL AC BUS 2
LOX QUANTITY WARNING LIGHTS:			
CONVERTER NO. 1	TROOP LOX QTY IND NO. 1 CONV	17-R	ESSENTIAL AC BUS 2
CONVERTER NO. 2	TROOP LOX QTY IND NO. 2 CONV	22-R	ESSENTIAL AC BUS 2
OXYGEN LIGHTS AND HORN TEST	TROOP OXYGEN WARN	30-R	ISOLATED DC BUS
OXYGEN ON INDICATOR	TROOP OXYGEN WARN	30-R	ISOLATED DC BUS
PITCH TRIM			
ELECTRIC & ELECTROHYDRAULIC PITCH TRIM:			
ELECTRICAL TRIM CONTROL	ELEC PITCH TRIM CONT	44-R	MAIN DC BUS 2
ELECTRICAL TRIM CLUTCH CONTROL	ELEC PITCH TRIM CLUTCH CONT	44-R	MAIN DC BUS 2
ELECTRICAL TRIM POWER	STAB TRIM MOTOR PWR	18, 19, 20-R	ESSENTIAL AC BUS 2
TRIM DISCONNECT	PITCH TRIM DISENGAGE	39-R	MAIN DC BUS 1
TRIM RESET:			
ELECTRICAL	ELEC PITCH TRIM CONT	44-R	MAIN DC BUS 2
ELECTROHYDRAULIC	HYD/ELEC PT CONT	38-R	MAIN DC BUS 1
HYDRAULIC PITCH TRIM CONTROL	HYD/ELEC PT CONT	38-R	MAIN DC BUS 1
PITCH TRIM INDICATOR	HORIZ STAB TRIM POS IND	37-R	MAIN DC BUS 1
PNEUMATIC SYSTEMS			
AIR CONDITIONING:			
AIR CONDITIONING MASTER SWITCH	RAM AIR VALVE	32-R	ISOLATED DC BUS
	LH A/C FLOW CONT VALVE	35-R	MAIN DC BUS 1
	RH A/C FLOW CONT VALVE	40-R	MAIN DC BUS 2
AIR PRESSURE REGULATING & S/O VALVES:			
EMERGENCY PRESSURIZATION SWITCHES:			
LEFT	AIR PRESS REG VALVES LH	(12-B)	EMERGENCY DC BUS
RIGHT	AIR PRESS REG VALVES RH	(11-B)	EMERGENCY DC BUS
LEFT SYSTEM SHUTOFF SWITCH	LH SYS AIR PRESS. REG & REL VALVES	33-L	ISOLATED DC BUS
RIGHT SYSTEM SHUTOFF SWITCH	RH SYS AIR PRESS. REG & SHUTOFF VALVES	42-R	MAIN DC BUS 2
CARGO COMPARTMENT RECIRCULATION FAN	CARGO COMPT RECIRC FAN	1,2,3-L	MAIN AC BUS 1

Figure 1-182. Circuit Breaker Index (Sheet 27 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
PNEUMATIC SYSTEMS (CONTINUED)			
AIR CONDITIONING (CONTINUED): -----	------------------------------	------------	-----------------
CARGO COMPARTMENT TEMP INDICATOR	CARGO COMPT TEMP IND	41-R	MAIN DC BUS 2
EJECTOR ON LIGHTS	LH ENVIRON SYS IND LT RH ENVIRON SYS IND LTS	35-R 40-R	MAIN DC BUS 1 MAIN DC BUS 2
EJECTOR VALVES	LH PRI HEAT EXCH EJECTOR VALVE RH PRI HEAT EXCHANGER EJECTOR VALVE	35-R 40-R	MAIN DC BUS 1 MAIN DC BUS 2
FLIGHT STATION AIR FLOW SWITCH	AC DIVERTER VALVE	32-R	ISOLATED DC BUS
FLIGHT STATION ALTERNATE AIR S/O VALVE	FLT STA ALT AIR SHUT OFF VALVE	41-R	MAIN DC BUS 2
LOW LIMIT TEMP CONTROL	LH LOW LIMIT TEMP CONT RH LOW LIMIT TEMP CONT	24-R 21-R	ISOLATED AC BUS ESSENTIAL AC BUS 2
PRIMARY HEAT EXCHANGER CONTROL:			
LEFT RIGHT	LH PRIM HEAT EXCH CONT RH PRIMARY HEAT EXCHANGER CONT	24-R 21-R	ISOLATED AC BUS ESSENTIAL AC BUS 2
PRIMARY HEAT EXCHANGER TEMP IND:			
EMERGENCY PRESSURIZATION SWITCHES:			
LEFT RIGHT	LH SYS TEMP & PRESS. IND RH PRI HEAT EXCH TEMP IND	(14-B) (13-B)	EMERGENCY DC BUS EMERGENCY DC BUS
LEFT RIGHT	LH SYS TEMP & PRESS. IND RH PRI HEAT EXCHANGER TEMP IND	33-L 40-R	ISOLATED DC BUS MAIN DC BUS 2
REGULATED AIR PRESSURE INDICATORS	LH REGULATED BLEED AIR PRESS IND. RH REGULATED BLEED AIR PRESS. IND	23-L 23-R	26V AC BUS 1 26V AC BUS 2
TEMPERATURE CONTROL SWITCHES:			
FLT STA CONTROL CARGO COMPT CONTROL	FLT STA & LH LOW LIMIT TEMP CONT CARGO COMPT CARGO & RH LOW LIMIT TEMP CONT	33-L 41-R	ISOLATED DC BUS MAIN DC BUS 2
TEMPERATURE SELECTORS:			
FLT STA CARGO COMPT	FLT STA TEMP CONT CARGO COMPT TEMP CONT	24-R 21-R	ISOLATED AC BUS ESSENTIAL AC BUS 2
BLEED AIR: ---------------------	------------------------------	------------	-----------------
BLEED AIR SHUTOFF VALVES:			
NO. 1 ENGINE NO. 2 ENGINE NO. 3 ENGINE NO. 4 ENGINE	ENG NO. 1 BLEED AIR VALVES ENG NO. 2 BLEED AIR VALVES ENG NO. 3 BLEED AIR VALVES ENG NO. 4 BLEED AIR VALVES	26-R 27-R 28-R 29-R	ISOLATED DC BUS ISOLATED DC BUS ISOLATED DC BUS ISOLATED DC BUS
BLEED AIR SHUTOFF VALVE LIGHTS:			
NO. 1 & NO. 2 ENGINES NO. 3 & NO. 4 ENGINES	LH ENVIRON SYS IND LT RH ENVIRON SYS IND LTS	35-R 40-R	MAIN DC BUS 1 MAIN DC BUS 2
MANIFOLD PRESSURE INDICATOR	MANIFOLD BLEED AIR PRESS. IND	23-R	26V AC BUS 2
LEFT SYSTEM SHUTOFF SWITCH RIGHT SYSTEM SHUTOFF SWITCH	LH SYS AIR PRESS. REG & REL VALVES RH SYS AIR PRESS. REG & SHUTOFF VALVES	33-L 42-R	ISOLATED DC BUS MAIN DC BUS 2
LEFT SYS PRESS RELIEF VALVE OPEN LIGHT:			
NORMAL LH EMERGENCY PRESS SWITCH	LH ENVIRON SYS IND LT LH SYS TEMP & PRESS. IND	35-R (14-B)	MAIN DC BUS 1 EMERGENCY DC BUS

Figure 1-182. Circuit Breaker Index (Sheet 28 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
PNEUMATIC SYSTEMS (CONTINUED)			
BLEED AIR (CONTINUED):			
RIGHT SYS PRESS RELIEF VALVE OPEN LIGHT	RH ENVIRON SYS IND LTS	40-R	MAIN DC BUS 2
WING ISOLATION VALVE	WING ISOLATION VALVE	32-R	ISOLATED DC BUS
WING, PYLON, AND AIR CONDITIONING COMPARTMENT OVERHEAT SYSTEM:			
SWITCHES: LEFT SIDE	WING OVERHEAT POWER LH WING OVHT POWER LH	25-R 33-R	ISOLATED AC BUS ISOLATED DC BUS
RIGHT SIDE	WING OVERHEAT POWER RH WING OVHT POWER RH	25-R 33-R	ISOLATED AC BUS ISOLATED DC BUS
LIGHTS: LEFT SIDE	WING OVHT POWER LH	33-R	ISOLATED DC BUS
RIGHT SIDE	WING OVHT POWER RH	33-R	ISOLATED DC BUS
ELECTRONIC COOLING SYSTEM:			
COOLING FAN FAILURE LIGHTS	RH ENVIRON SYS IND LTS	40-R	MAIN DC BUS 2
ELECTRONIC COMPARTMENT FLOW CONTROL VALVE	ELECTRONIC COMPT FLOW VALVE CONT	44-R	MAIN DC BUS 2
ELECTRONIC FANS:			
LARGE FAN NO. 1 LARGE FAN NO. 2	ELECTRICAL COOLING FAN NO. 1 ELECTRONIC COOLING FAN NO. 2	1, 2, 3-L 18,19, 20-L	MAIN AC BUS 1 ESSENTIAL AC BUS 2
ELECTRICAL FANS:			
SMALL FAN NO. 1 SMALL FAN NO. 2 SMALL FAN NO. 2 CONTROL	ELECTRICAL COOLING FAN NO. 1 ELEC COOLING FAN NO. 2 ELECTRICAL COOLING FAN NO. 2 CONT	1, 2, 3-L 18, 19, 20-L 44-R	MAIN AC BUS 1 ESSENTIAL AC BUS 2 MAIN DC BUS 2
FLOOR HEAT:			
FLOOR HEAT SWITCH	CARGO FLOOR HT MOD VALVE CARGO FLOOR HEAT SHUTOFF VALVE	36-R 32-R	MAIN DC BUS 1 ISOLATED DC BUS
FLOOR OVERHEAT SYSTEM:			
CONTROL AND POWER OVERHEAT LIGHT AND POWER	CARGO FLOOR OVHT PWR CARGO FLOOR OVHT PWR	17-R 32-R	ESSENTIAL AC BUS 1 ISOLATED DC BUS
PRESSURIZATION:			
CABIN ALTITUDE LIMIT OVERRIDE SWITCH	CABIN PRESS CONT	31-R	ISOLATED DC BUS
CABIN PRESSURIZATION CONTROL FAN & VENTURI	CABIN PRESS. CONT FAN	2-L	MAIN AC BUS 1
EMERGENCY DEPRESSURIZATION SWITCHES	CABIN PRESS CONT	31-R	ISOLATED DC BUS
EMERGENCY PRESSURIZATION SWITCHES:			
LEFT SWITCH:			
LEFT AIR PRESSURE REGULATING SHUTOFF VALVE	AIR PRESS REG VALVES LH	(12-B)	EMERGENCY DC BUS
LEFT PRIMARY HEAT EXCHANGER TEMPERATURE INDICATOR	LH SYS TEMP & PRESS. IND	(14-B)	EMERGENCY DC BUS
LEFT SYS PRESS RELIEF VALVE OPEN LIGHT	LH SYS TEMP & PRESS. IND	(14-B) (8-C)	EMERGENCY DC BUS
RIGHT SWITCH:			
RIGHT AIR PRESSURE REGULATING & SHUTOFF VALVE	AIR PRESS REG VALVES RH	(11-B)	EMERGENCY DC BUS
RIGHT PRIMARY HEAT EXCHANGER TEMPERATURE INDICATOR	RH PRI HEAT EXCH TEMP IND	(13-B)	EMERGENCY DC BUS
CABIN LOW PRESSURE LIGHTS:	CABIN PRESS LOW IND LT	31-R	ISOLATED DC BUS

Figure 1-182. Circuit Breaker Index (Sheet 29 of 31)

COMPONENT	CIRCUIT BREAKER		POWER SOURCE
	DESIGNATION	LOCATION	
PNEUMATIC SYSTEMS (CONTINUED)			
RAIN REMOVAL:			
OVERHEAT LIGHT	RAIN REMOVAL OVERHEAT LT	33-R	ISOLATED DC BUS
SWITCH	RAIN REMOVAL LH REG VALVE RH RAIN REMOVAL REG VALVE	33-R 40-R	ISOLATED DC BUS MAIN DC BUS 2
SWITCH AND OVERHEAT SENSING CIRCUIT	RAIN REMOVAL SHUTOFF VALVES PLT RAIN REMOVAL SHUTOFF VALVES COPLT	33-R 33-R	ISOLATED DC BUS
RUDDER			
RUDDER POWER CONTROL SWITCHES:			
HYDRAULIC SYSTEM NO. 1 HYDRAULIC SYSTEM NO. 2	RUDDER CONTROL POWER SYS NO. 1 RUDDER CONT PWR SYSTEM NO. 2	38-R 43-R	MAIN DC BUS 1 MAIN DC BUS 2
LOAD LIMIT VALVES	RUDDER LOAD LIMIT VALVES	38-R	MAIN DC BUS 1
POWER OFF LIGHTS	RUDDER CONT POWER IND	30-R	ISOLATED DC BUS
SYSTEM POWER ANNUNCIATOR LIGHTS	WARN LT TEST & ANNUN CONT NO. 1 WARN LT TEST & ANNUN CONT NO. 2	26-R 27-R	ISOLATED DC BUS ISOLATED DC BUS
SYSTEM HIGH PRESSURE LIGHTS	RUDDER CONT POWER IND	30-R	ISOLATED DC BUS
RUDDER OVER PRESSURE LIGHT	RUDDER CONT POWER IND	30-R	ISOLATED DC BUS
TRIM	RUDDER TRIM CONT	13-R	ESSENTIAL AC BUS 1
TRIM INDICATOR	RUDDER TRIM POS IND	38-R	MAIN DC BUS 1
SPOILERS			
ASYMMETRY SYSTEM:			
NO. 2 HYDRAULIC SYSTEM NO. 3 HYDRAULIC SYSTEM TEST	SPOILER ASYMM HYD SYS NO. 2 SPOILERS ASYMM HYD SYS NO. 3 SPOILER AUTO GND TEST	36-R 41-R 23-L	MAIN DC BUS 1 MAIN DC BUS 2 26V AC BUS 1
CONTROL	SPOILER AUTO GRD OPERATION NO. 1 SPOILER AUTO GND OPERATION NO. 2 HYD SYS NO. 3 SPOILER SOV	36-R 44-R 45-R	MAIN DC BUS 1 MAIN DC BUS 2 MAIN DC BUS 2
FLIGHT LIMIT STOP [1]	SPOILER IN FLT SOV HANDLE DETENT ARM LT WARN	45-R	MAIN DC BUS 2
POSITION INDICATOR:			
POINTERS	SPOILER POS IND.	23-L	26V AC BUS 1
LOCKED/UNLKD FLAG	SPOILER SOV & POS IND	36-R	MAIN DC BUS 1
SPOILER CABLE SERVO VALVE	HYD SYS NO. 3 SPOILER SOV	45-R	MAIN DC BUS 2
SPOILER UNDER SPEED LIGHT & AUDIBLE WARNING	STALL PREVENT NO. 1 STALL WARN (OR PREVENT) NO. 2	35-R 40-R	ESSENTIAL AC BUS 1 ESSENTIAL AC BUS 2
STOP POSITION INDICATOR (HIGH/LOW-FORCE DETENT)	SPOILER IN FLT SOV HANDLE DETENT ARM LT WARN	45-R	MAIN DC BUS 2
WARNING & EMERGENCY SYSTEMS			
ALTITUDE ALERT AUDIBLE TONE	FMS RELAYS	32-B	MAIN DC AVIONICS 1
APU FIRE WARNING	APU FIRE IND LT APU FIRE DET CONT UNIT	30-L 11-L	ISOLATED DC BUS MAIN AC BUS 4
APU FIRE EXTINGUISHING	APU FIRE EXT	30-L	ISOLATED DC BUS
BAILOUT HORN	CARGO COMPT WARN HORN MANUAL BAIL OUT HORN	(13-A) 34-R	EMERGENCY DC BUS MAIN DC BUS 1

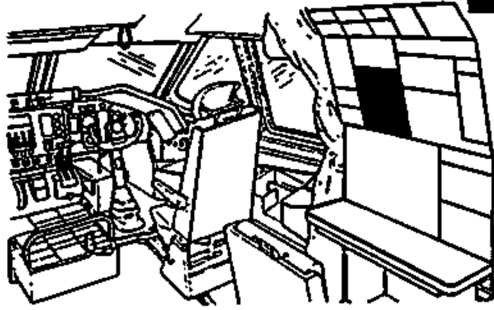
[1] LABELED "SPOILER MLG INTLK" ON AIRCRAFT 12778 THRU 38090

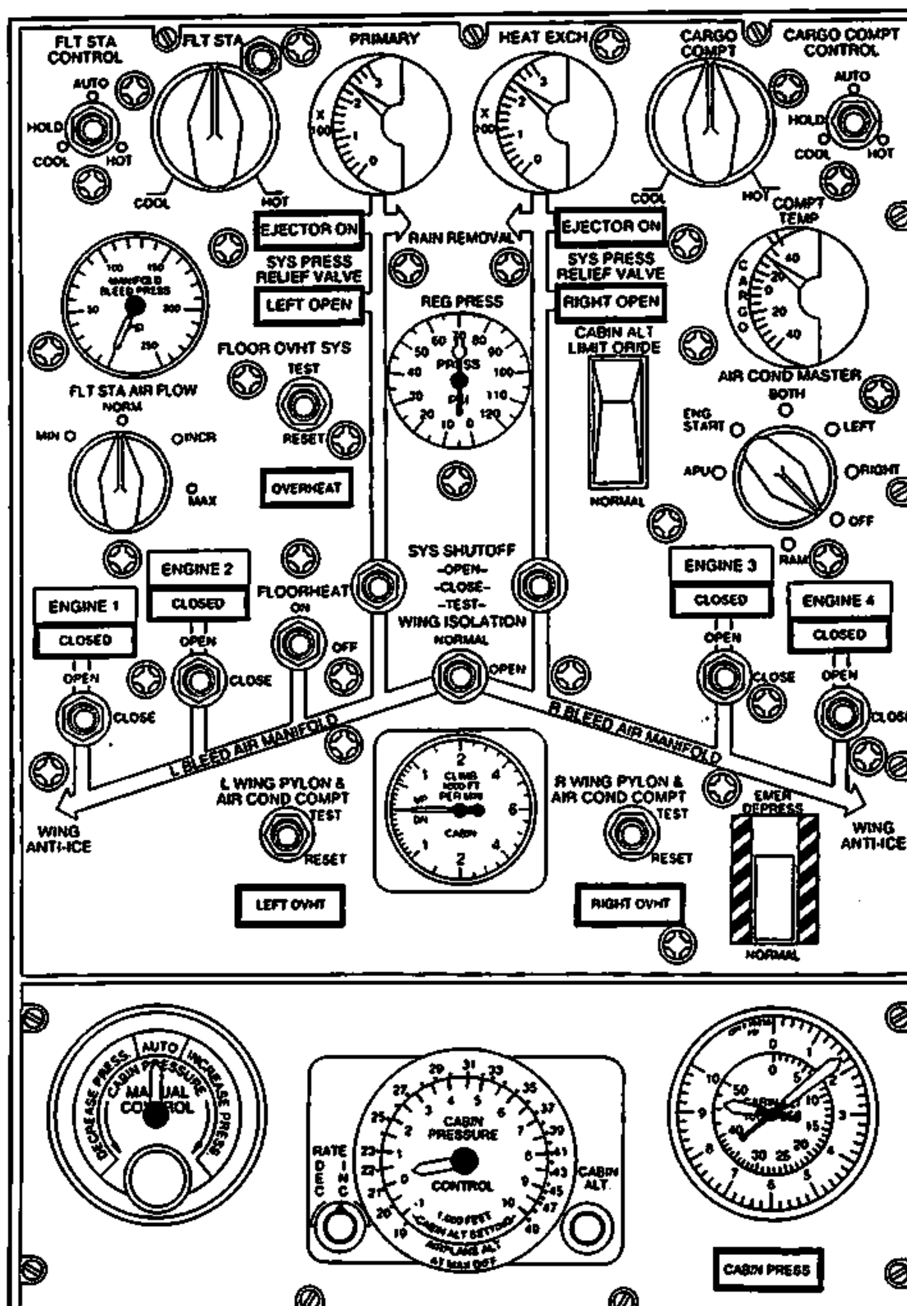
Figure 1-182. Circuit Breaker Index (Sheet 30 of 31)

COMPONENT	CIRCUIT BREAKER DESIGNATION	CIRCUIT BREAKER LOCATION	POWER SOURCE
WARNING & EMERGENCY SYSTEM (CONTINUED)			
ENGINE FIRE & PYLON FIRE AND OVERHEAT:			
NO. 1 ENGINE	ENGINE FIRE & OVERHEAT DET CONTROL UNIT NO. 1	25-L	ISOLATED DC BUS
NO. 2 ENGINE	ENGINE FIRE & OVERHEAT DET CONTROL UNIT NO. 2	25-L	ISOLATED DC BUS
NO. 3 ENGINE	ENGINE FIRE & OVERHEAT DET CONTROL UNIT NO. 3	25-L	ISOLATED DC BUS
NO. 4 ENGINE	ENGINE FIRE & OVERHEAT DET CONTROL UNIT NO. 4	25-L	ISOLATED DC BUS
TEST SWITCHES	AUDIBLE ALARM SILENCE & TEST	31-R	ISOLATED DC BUS
ENGINE FIRE EXTINGUISHERS:			
NO. 1 ENGINE	ENG NO. 1 FIRE EXT	26-L	ISOLATED DC BUS
	ENG FIRE EXTINGUISHER NO. 1	41-L	MAIN DC BUS 2
NO. 2 ENGINE	ENG NO. 2 FIRE EXT	27-L	ISOLATED DC BUS
	ENG FIRE EXTINGUISHER NO. 2	41-L	MAIN DC BUS 2
NO. 3 ENGINE	ENG NO. 3 FIRE EXT	28-L	ISOLATED DC BUS
	ENG FIRE EXTINGUISHER NO. 3	41-L	MAIN DC BUS 2
NO. 4 ENGINE	ENG NO. 4 FIRE EXT	29-L	ISOLATED DC BUS
	ENG FIRE EXTINGUISHER NO. 4	41-L	MAIN DC BUS 2
TCAS/TAWS:			
	TCAS	28-C	AC AVIONICS BUS 1
	TCAP	7-D	MAIN DC AVIONICS 2
TAWS COMPUTER	TAWS CMPTR	22-B	AC AVIONICS BUS 2
LANDING GEAR WARNING HORN & LIGHT	LANDING GEAR WARN	32-R	ISOLATED DC BUS
MASTER CAUTION			
ANNUNCIATOR LIGHT	WRN LT TEST & ANNUN CONT NO. 1	26-R	ISOLATED DC BUS
	WRN LT TEST & ANNUN CONT NO. 2	27-R	ISOLATED DC BUS
	WRN LT TEST & ANNUN CONT NO. 3	28-R	ISOLATED DC BUS
	WRN LT TEST & ANNUN CONT NO. 4	29-R	ISOLATED DC BUS
RESET	MASTER CAUTION RESET	31-R	ISOLATED DC BUS
MAX SPEED WARNING	MAX SPEED WARN	41-R	MAIN DC 2
TAKE-OFF WARNING	TAKE OFF WARNING	38-C	ISOL AC AVIONICS
TAKE-OFF ANNUNCIATOR	TAKE OFF WARN HORN	45-R	MAIN DC 2
WIND SHEAR WARN AUDIBLE TONE	FMS RELAYS	32-B	MAIN DC AVIONICS 1
WINDSHIELD HEAT			
CONTROL:			
PILOT'S FRONT WINDSHIELD	PLT WSHLD HEAT CONT	35-R	MAIN DC BUS 1
PILOT'S SIDE WINDSHIELDS	PLT SIDE WSHLD HEAT CONT	41-R	MAIN DC BUS 2
PILOT'S CENTER WINDSHIELD	CTR WSHLD HEAT CONT	41-R	MAIN DC BUS 2
COPILOT'S FRONT WINDSHIELD	COPLT WSHLD HEAT CONT	40-R	MAIN DC BUS 2
COPILOT'S SIDE WINDSHIELDS	COPLT SIDE WSHLD HEAT CONT	35-R	MAIN DC BUS 1
POWER:			
PILOT'S FRONT WINDSHIELD XMFR	PLT WSHLD HTR PWR	1-L	MAIN AC BUS 1
PILOT'S SIDE WINDSHIELDS XMFR	PLT SIDE WSHLD HTR PWR	4-L	MAIN AC BUS 2
PILOT'S FWD SIDE WINDSHIELD XMFR TO WINDOW PWR	PILOT SIDE WSHLD TRANS SEC HTR PWR	11-L	52V AC
PILOT'S CENTER WINDSHIELD XMFR	CENTER WSHLD HTR PWR	11-L	MAIN AC BUS 4
COPILOT'S FRONT WINDSHIELD XMFR	COPLT WSHLD HTR PWR	12-R	MAIN AC BUS 4
COPILOT'S SIDE WINDSHIELDS XMFR	COPLT SIDE WSHLD HTR PWR	5-L	MAIN AC BUS 2
COPILOT'S FWD SIDE WINDSHIELD XMFR TO WINDOW PWR	COPLT SIDE WSHLD TRANS SEC HTR PWR	12-L	52V AC

Figure 1-182. Circuit Breaker Index (Sheet 31 of 31)

ENVIRONMENTAL CONTROL PANEL





141A-1-X3/0-038

Figure 1-183. Environmental Control Panel

ENVIRONMENTAL, ENGINE BLEED AIR AND ANTI-ICING SYSTEMS

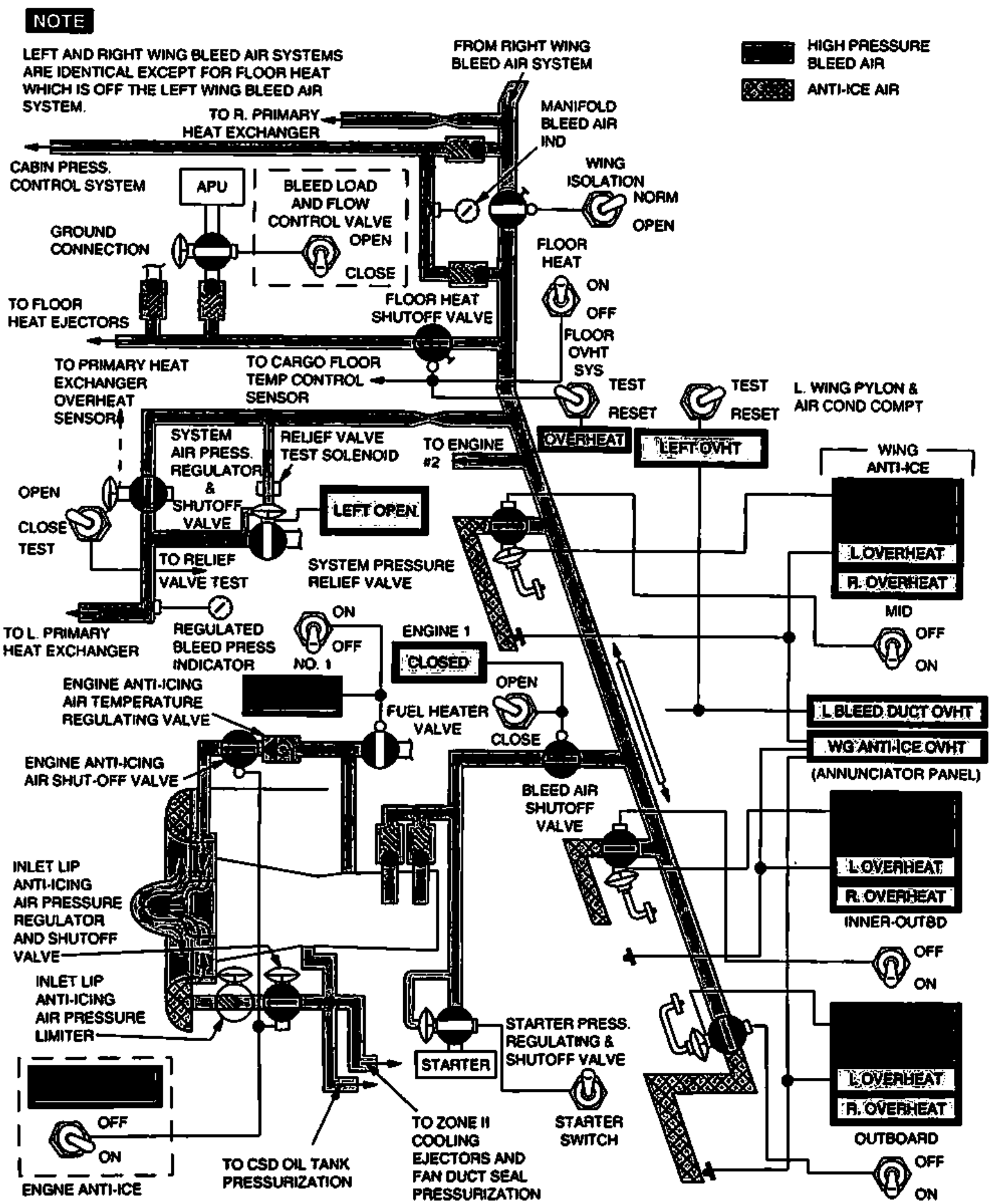


Figure 1-184. (Sheet 1 of 4)

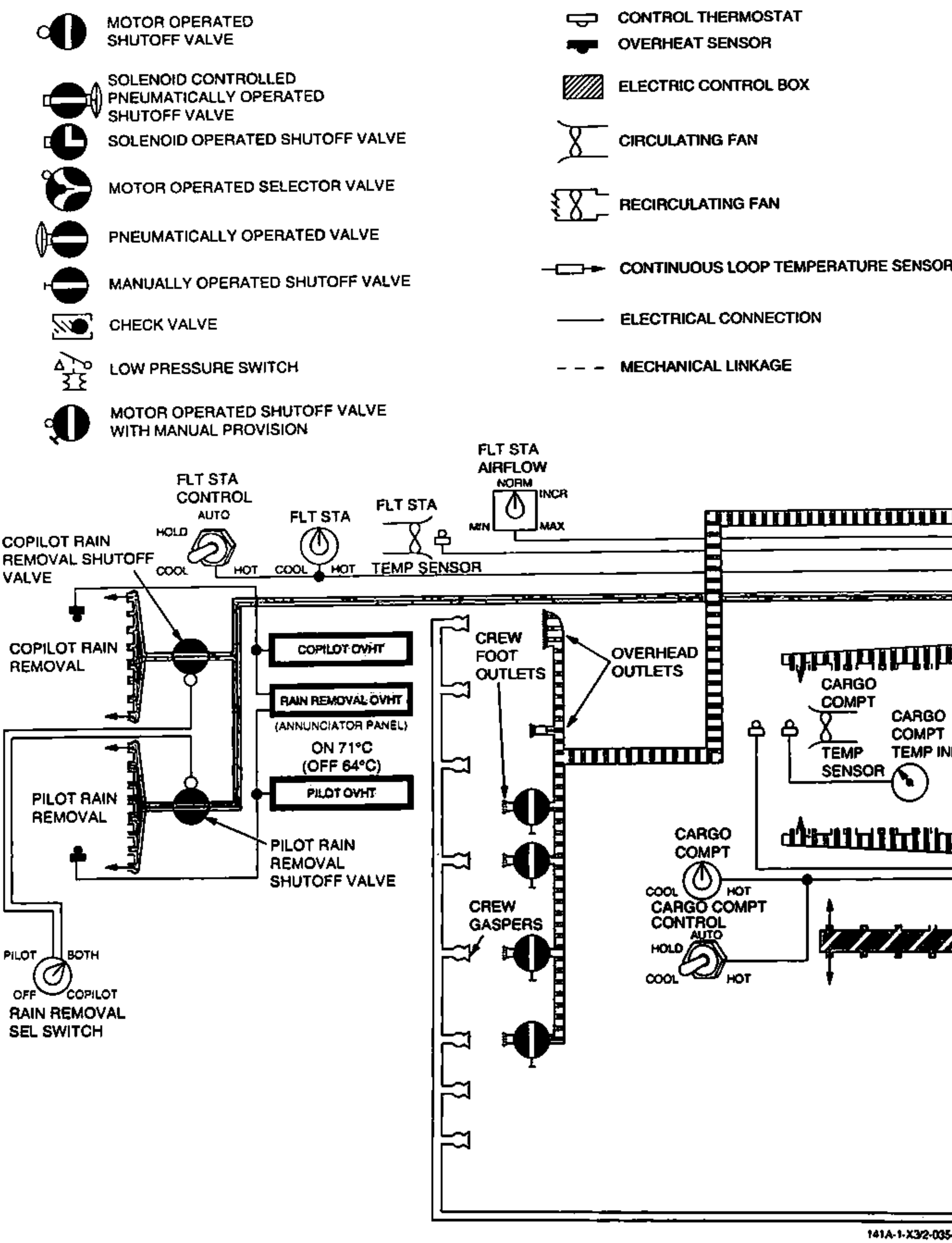


Figure 1-184. (Sheet 2 of 4)

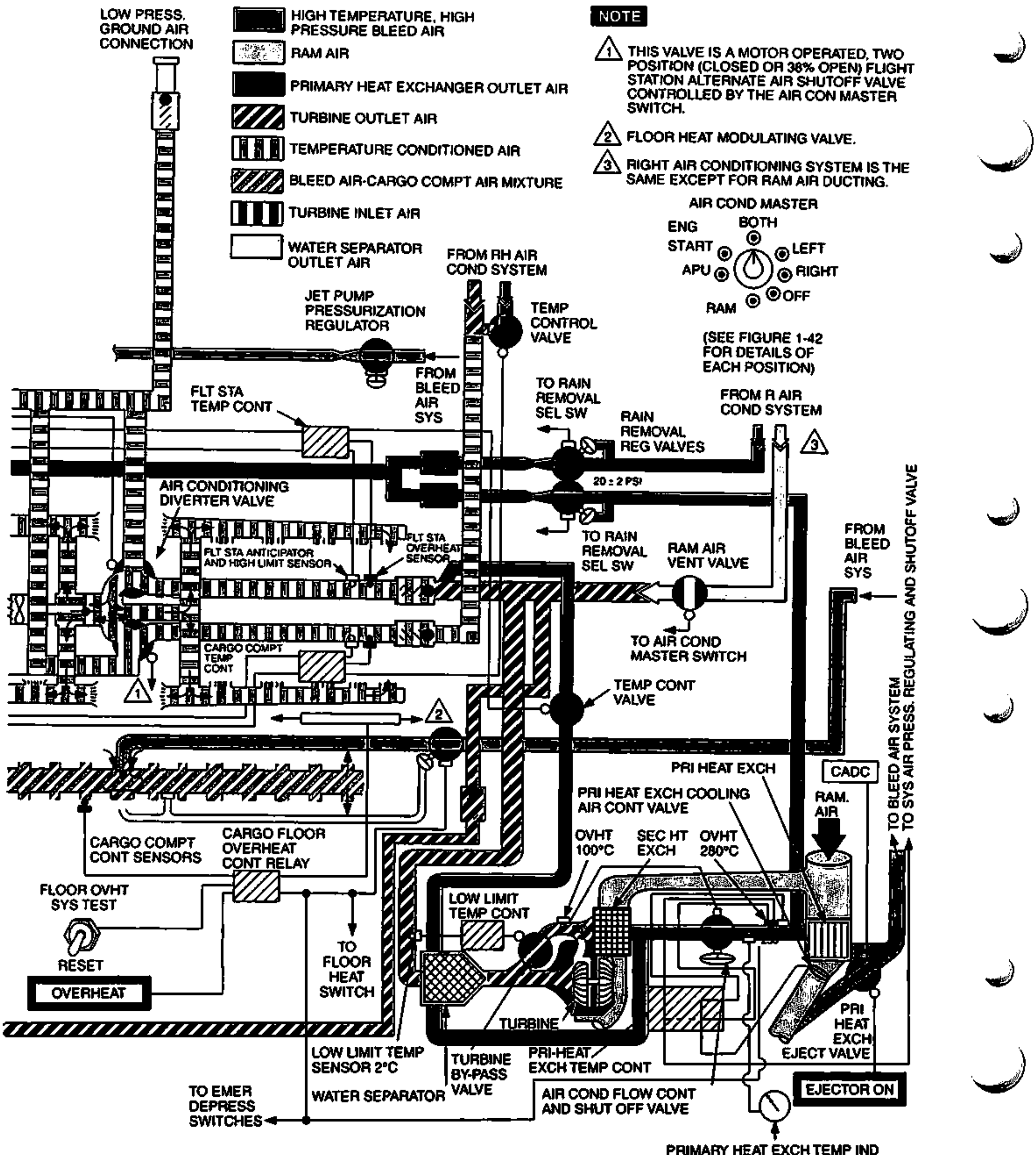


Figure 1-184. (Sheet 3 of 4)

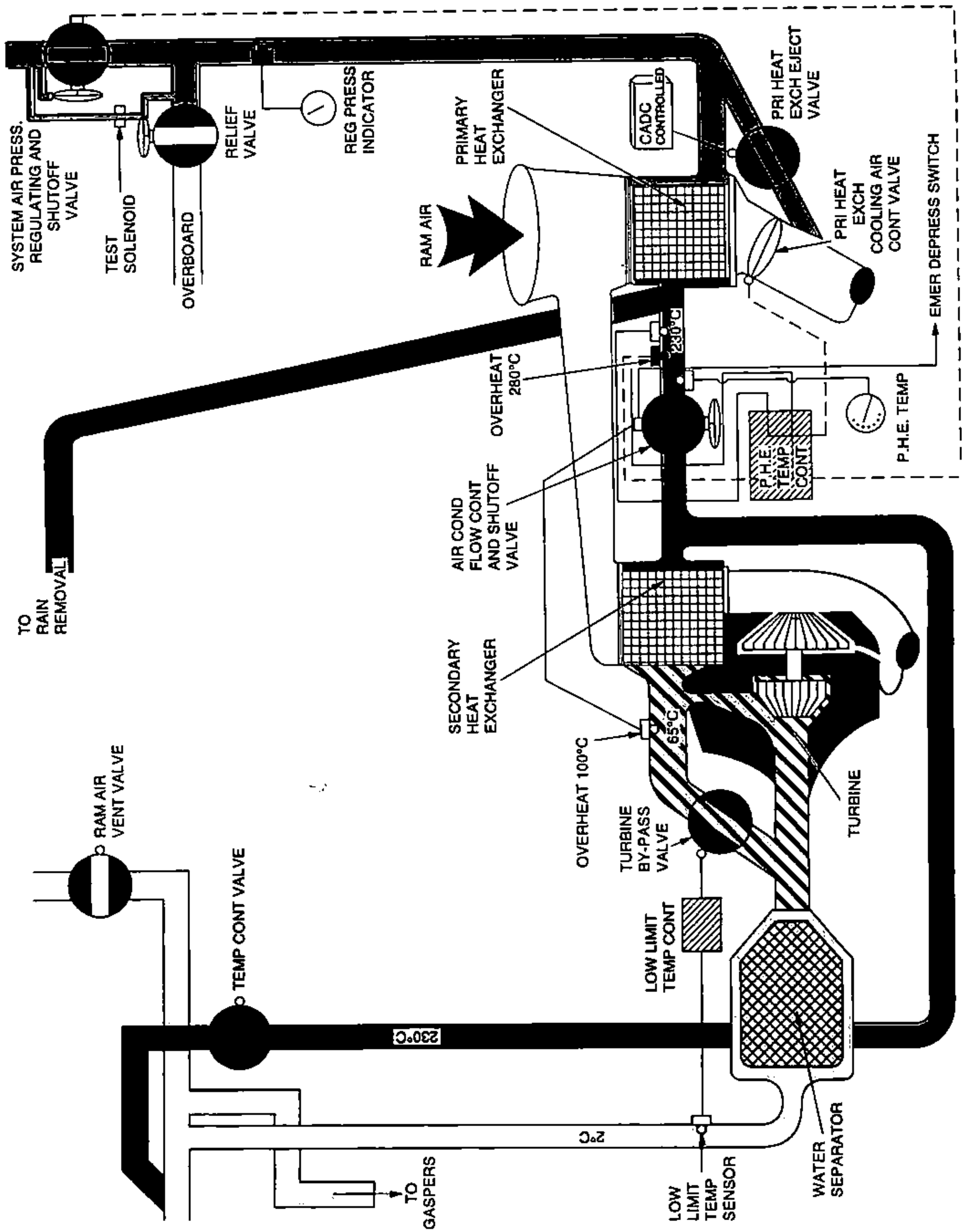


Figure 1-184. (Sheet 4 of 4)

AIR CONDITIONING MASTER SWITCH POSITION CHART

COMPONENTS AFFECTED	AIR CONDITIONING MASTER SWITCH POSITION						
	APU	ENG START	BOTH	LEFT	RIGHT	OFF	RAM
SYS AIR PRESS. REG VALVES	AS SELECTED	CLOSED	AS SELECTED	AS SELECTED	AS SELECTED	CLOSED 1 2	AS SELECTED
PRIM HT EXCH EJECT S/O VALVES	CLOSED	POS BY CADC	POS BY CADC	POS BY CADC	POS BY CADC	POS BY CADC	POS BY CADC
LH AIR COND FLOW CONT AND S/O VALVES	OPEN	POWER OFF	OPEN	OPEN	CLOSED	CLOSED	CLOSED
RH AIR COND FLOW CONT AND S/O VALVE	OPEN	POWER OFF	OPEN	CLOSED	OPEN	CLOSED	CLOSED
LH TURBINE BYPASS VALVE	CONTROL-LING	POWER OFF	CONTROL-LING	CONTROL-LING	POWER OFF	POWER OFF	POWER OFF
RH TURBINE BYPASS VALVE	CONTROL-LING	POWER OFF	CONTROL-LING	POWER OFF	CONTROL-LING	POWER OFF	POWER OFF
LH TEMP CON-TROL VALVE	CONTROL-LING	POWER OFF	CONTROL-LING	CONTROL-LING	POWER OFF	POWER OFF	POWER OFF
RH TEMP CON-TROL VALVE	CONTROL-LING	POWER OFF	CONTROL-LING	POWER OFF	CONTROL-LING	POWER OFF	POWER OFF
FLT STA ALT AIR SHUTOFF VALVE	CLOSED	CLOSED	CLOSED	CLOSED	38% FLT STA	CLOSED	CLOSED
PRIM HT EXCH COOL AIR CONT VALVE	CONTROL-LING	CONTROL-LING	CONTROL-LING	CONTROL-LING	CONTROL-LING	CONTROL-LING	CONTROL-LING
FLOOR HEAT SHUTOFF VALVE	OPEN	OPEN	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED
FLOOR HEAT MOD AND SHUTOFF VALVE	AS SELECTED	CLOSED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED
BLEED AIR WING ISOLATION VALVE	OPEN	OPEN	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED
BLEED AIR SHUT-OFF VALVES	CLOSED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED	AS SELECTED
RAM AIR VENT VALVE	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN
FLT STA TEMP SENSOR AND FAN	POWER ON	POWER OFF	POWER ON	POWER ON	POWER OFF	POWER OFF	POWER OFF
CARGO COMPT TEMP SENSOR AND FAN	POWER ON	POWER OFF	POWER ON	POWER OFF	POWER ON	POWER OFF	POWER OFF
CARGO COMPT RECIRCULATION FAN	POWER ON	POWER OFF	POWER ON	POWER ON	POWER ON	POWER OFF	POWER OFF
CABIN PRESS. CONT FAN AND VENTURI	POWER ON (GROUND ONLY)	POWER ON	POWER ON (GROUND ONLY)	POWER ON (GROUND ONLY)	POWER ON (GROUND ONLY)	POWER ON	POWER ON
CABIN ALT LIMT SOLENOID VALVE	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	OPEN

1 ON 38075 AND UP, IF RAIN REMOVAL SWITCH IS OFF, SYSTEM AIR PRESSURE REGULATOR VALVES WILL BE CLOSED, OR AS SELECTED WITH RAIN REMOVAL ON.

2 ON 12778 AND 12779 FOR RAIN REMOVAL TO BE OPERATIONAL, THE AIR CONDITIONING MASTER SWITCH MUST BE IN THE BOTH, LEFT OR RIGHT POSITION.

Figure 1-185. Air Conditioning Master Switch Position Chart

CABIN PRESSURE CONTROL SYSTEM

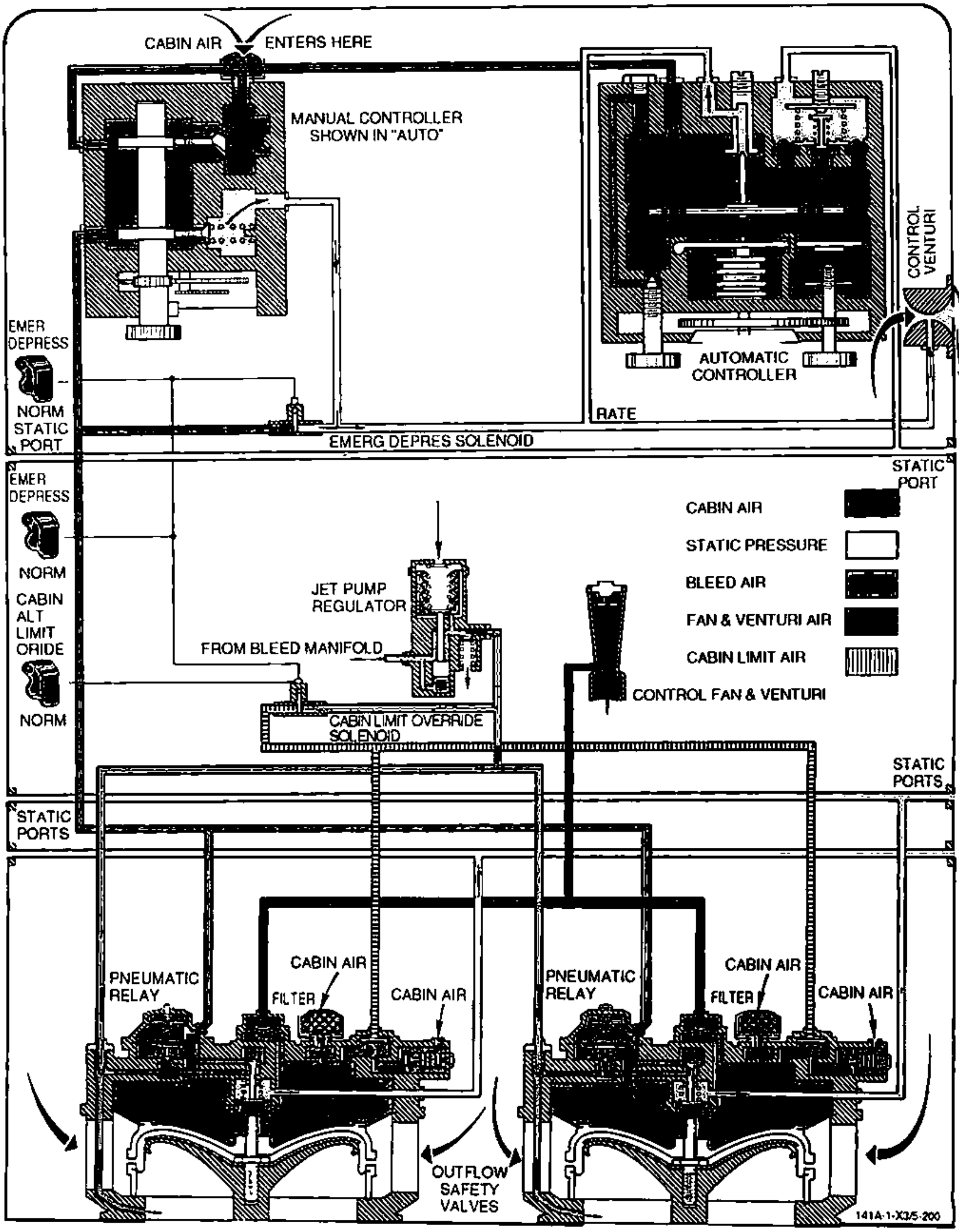


Figure 1-186.

CABIN PRESSURE ALTITUDE CHART

1. CABIN ALTITUDE LIMIT CONTROL
2. DIFFERENTIAL PRESSURE CONTROL BEGINS OPENING OUTFLOW VALVE (8.3 PSIG)
3. DIFFERENTIAL PRESSURE MAY INCREASE TO A MAXIMUM OF 8.6 PSID WITH ONE OUTFLOW VALVE FAILED IN THE CLOSED POSITION

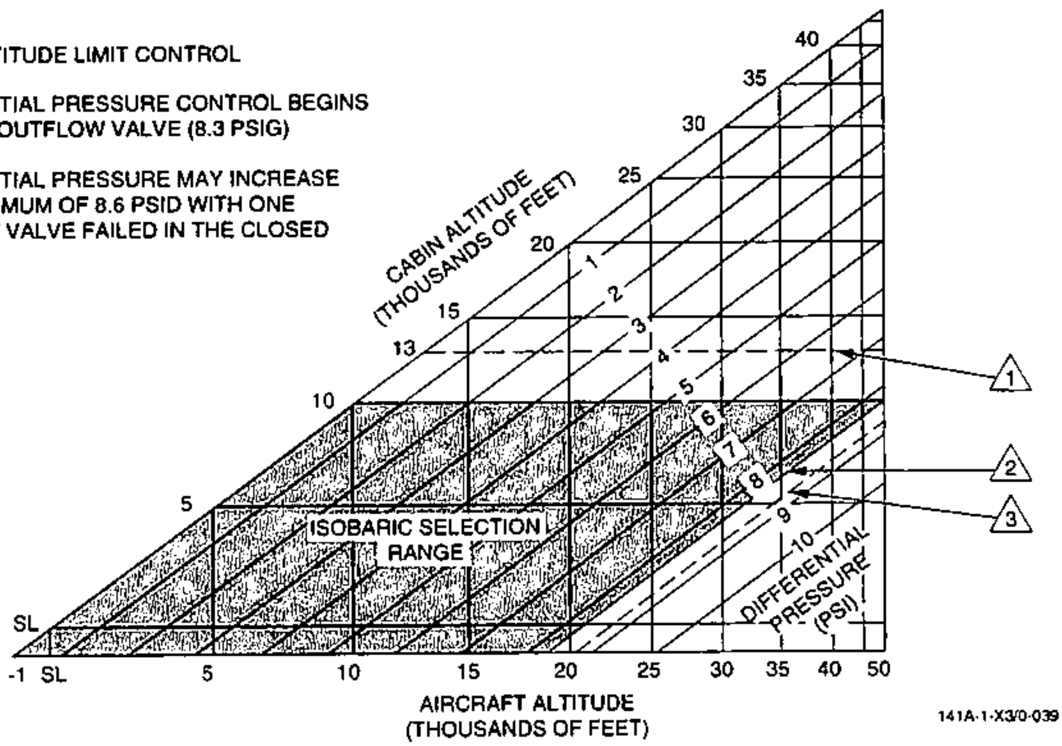
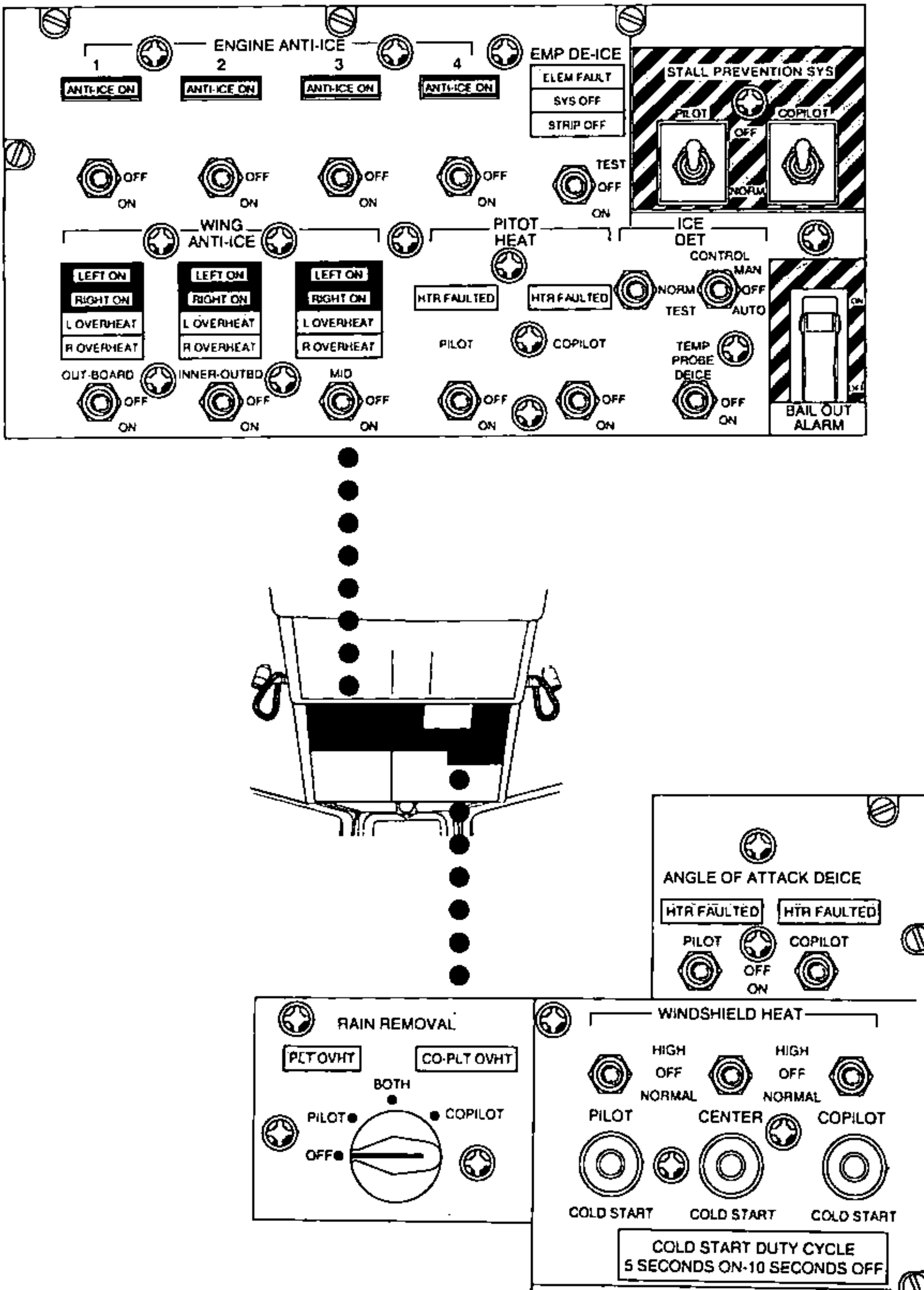


Figure 1-187. Cabin Pressure Altitude Chart

ANTI-ICING SYSTEMS CONTROL PANEL



141A-1-X3/0-040

Figure 1-188.

HYDRAULIC SYSTEMS

SYSTEM NO. 1

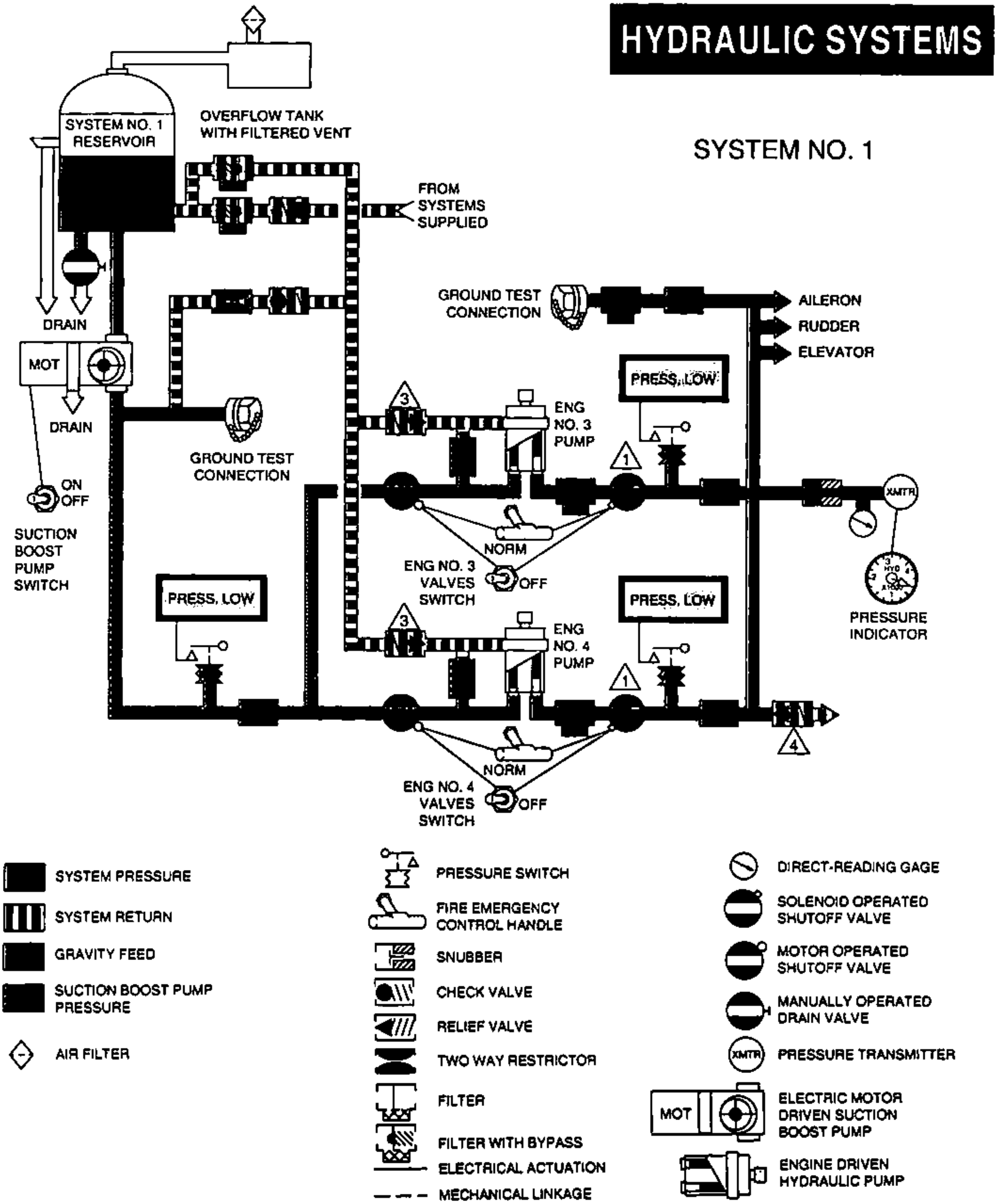


Figure 1-189. (Sheet 1 of 3)

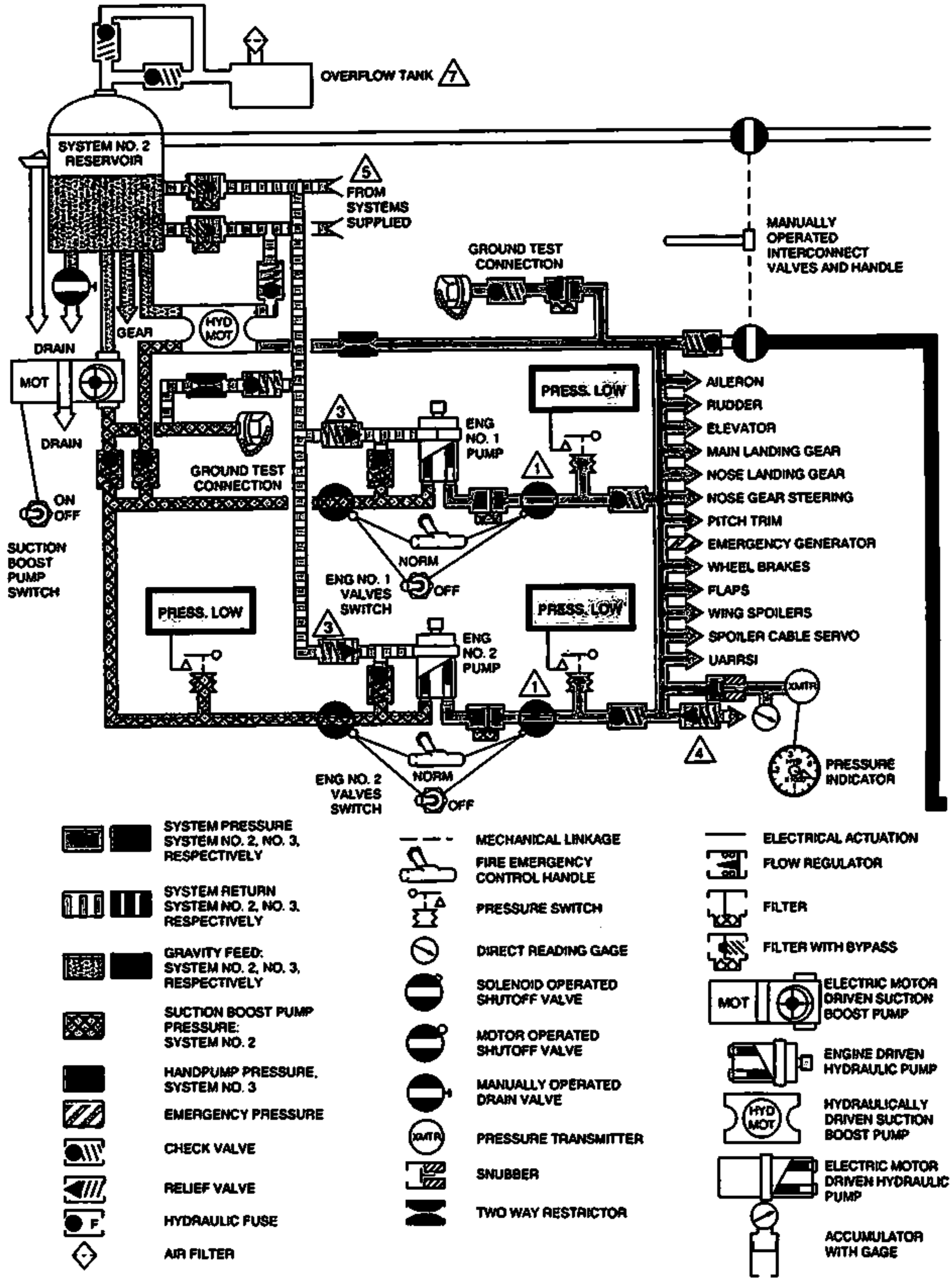
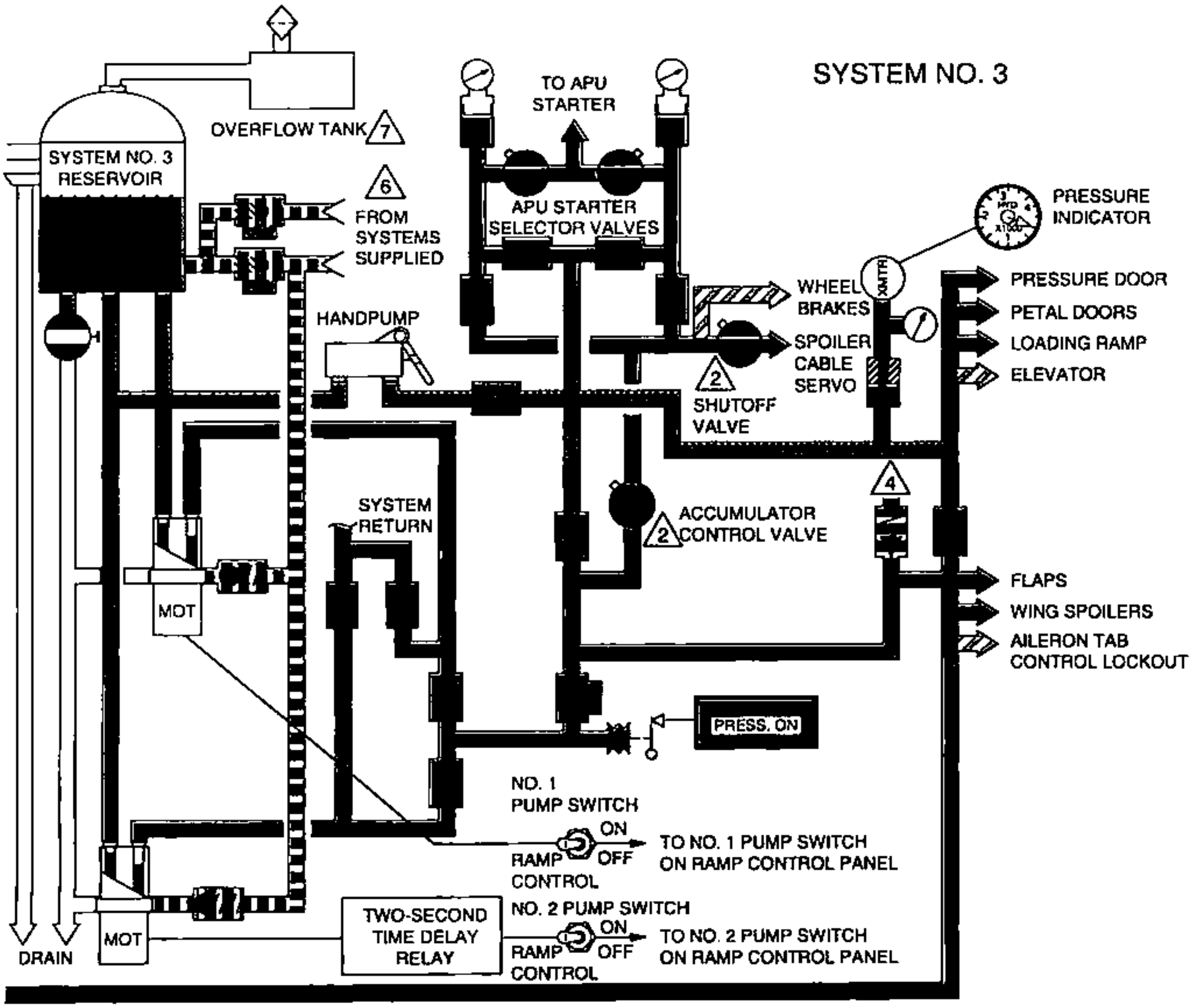


Figure 1-189. (Sheet 2 of 3)

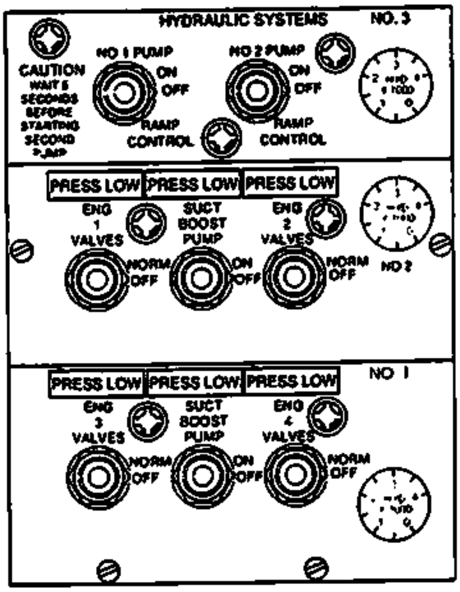


NOTE

1. VALVE IS DE-ENERGIZED OPEN.
2. VALVE OPENS WHEN PUMPS ARE TURNED ON, CLOSED WHEN PUMPS ARE SHUTOFF.
3. CASE DRAIN RELIEF VALVE SET TO RELIEVE AT APPROXIMATELY 20 PSI.
4. SET TO RELIEVE AT APPROXIMATELY 3,560 PSI.
5. ALSO FILTER RETURN FLUID FROM LANDING GEAR, PITCH TRIM, EMERGENCY GENERATOR, WHEEL BRAKES AND WING FLAPS.
6. ALSO FILTERS RETURN FLUID FROM PETAL DOOR MOTOR AND WING FLAPS.
7. OVERFLOW VENT TANK IS SHARED BY NO. 2 AND NO. 3 HYDRAULIC SYSTEMS.

Figure 1-189. (Sheet 3 of 3)

HYDRAULIC SYSTEMS CONTROL AND INDICATOR PANEL



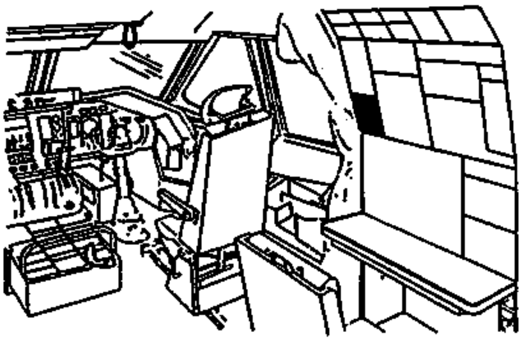


Figure 1-190. Hydraulic Systems Control and Indicator Panel

FLIGHT CONTROLS SYSTEMS

AILERON SYSTEM

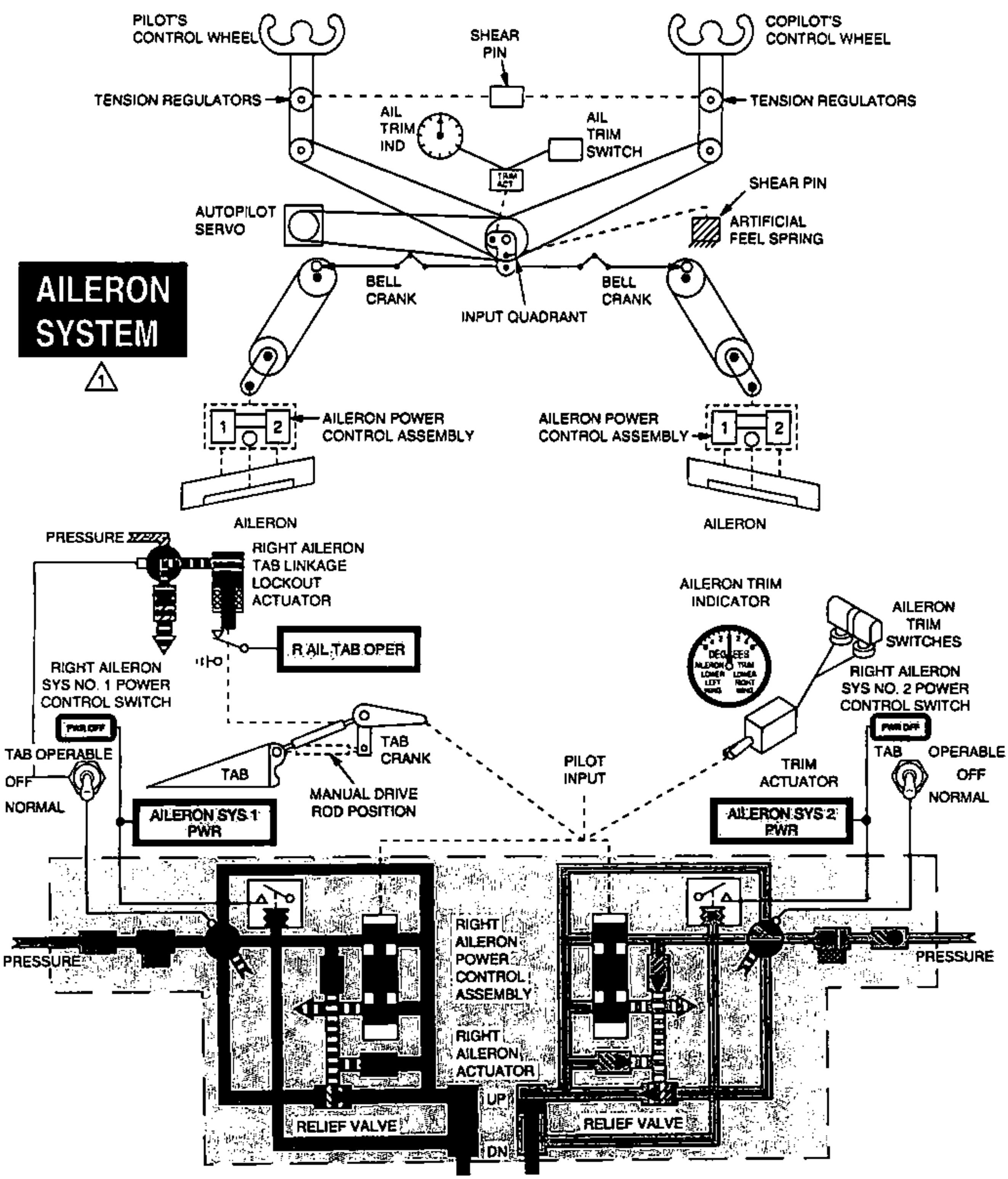


Figure 1-191. (Sheet 1 of 4)

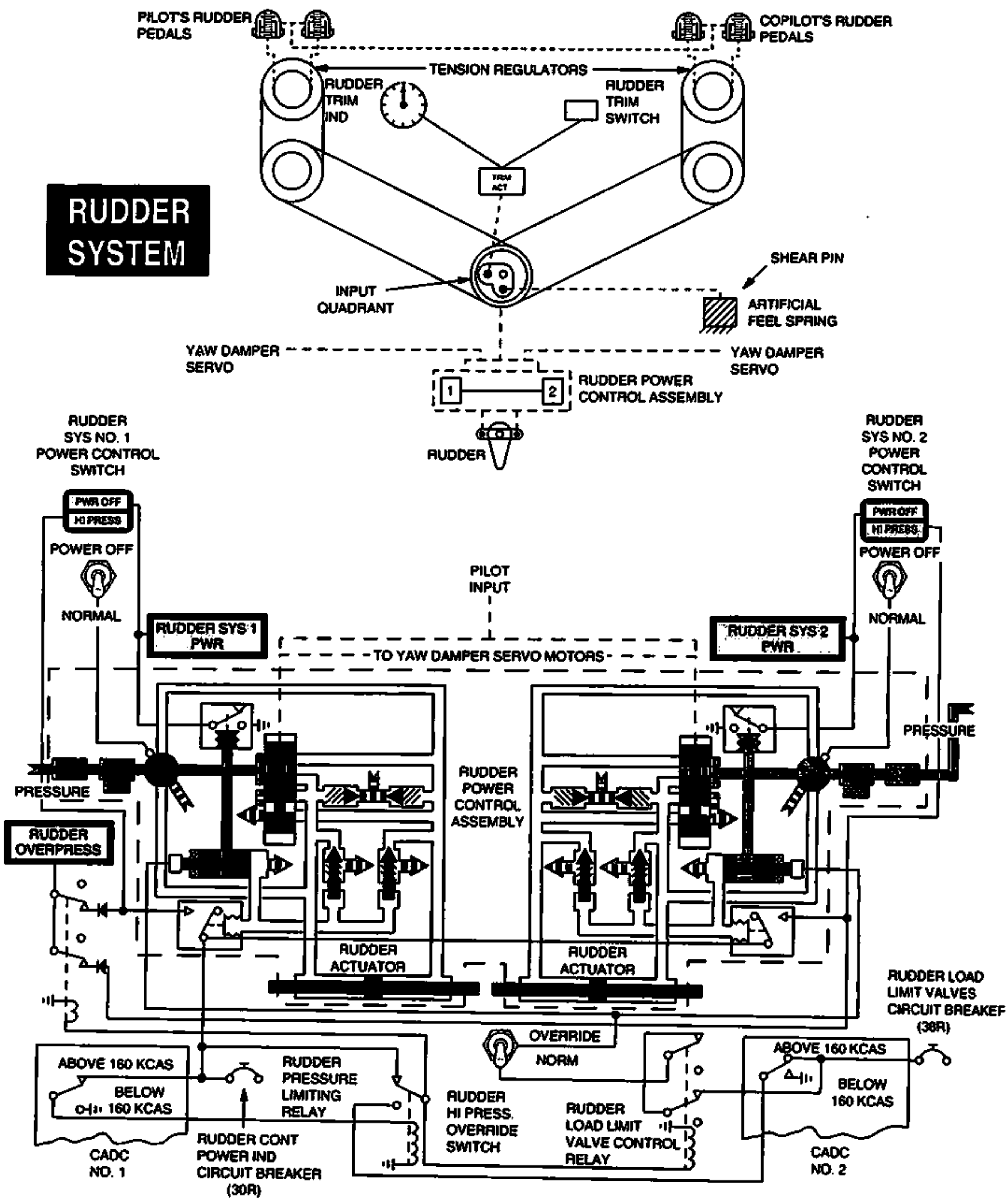


Figure 1-191. (Sheet 2 of 4)

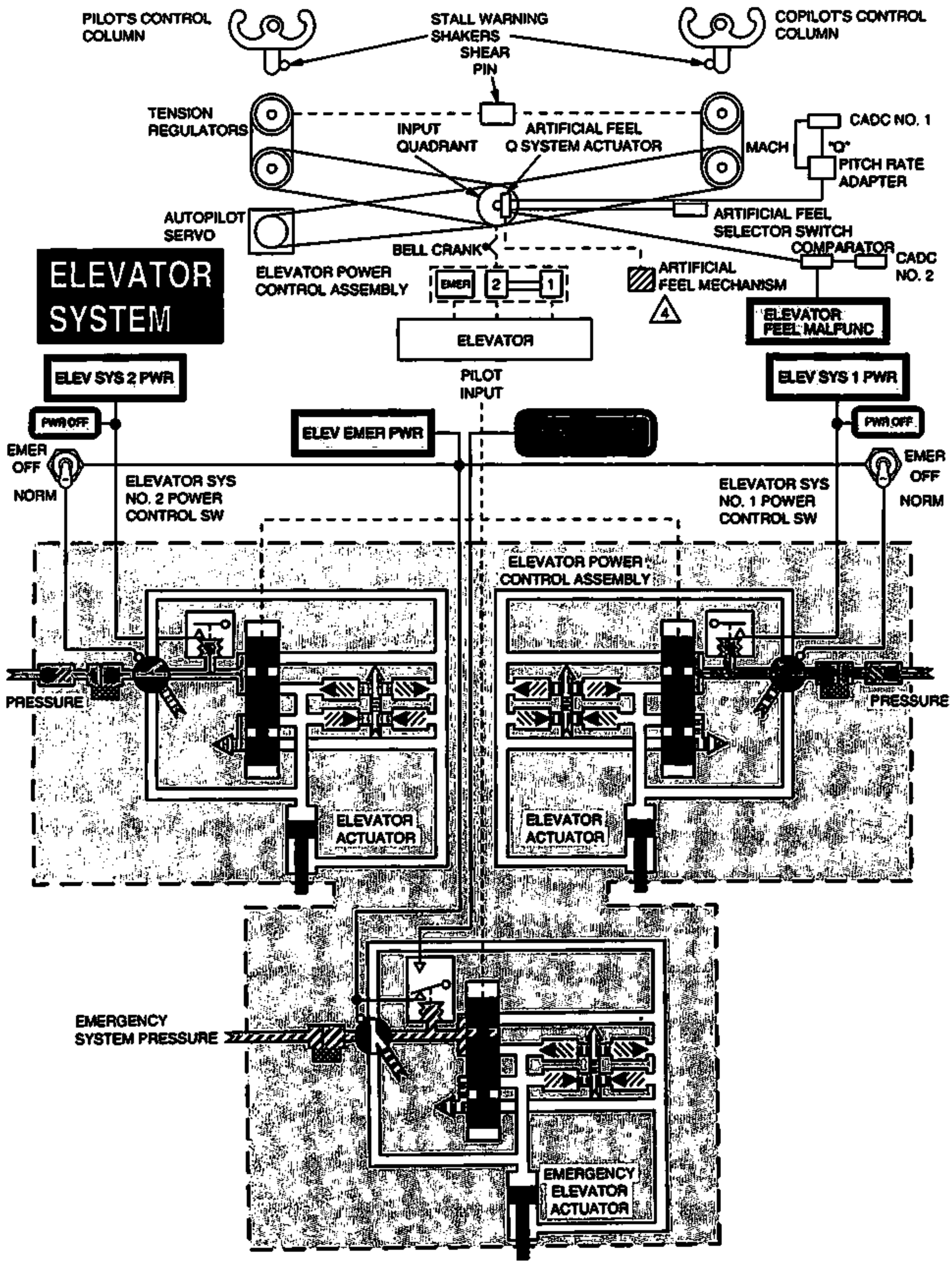


Figure 1-191. (Sheet 3 of 4)

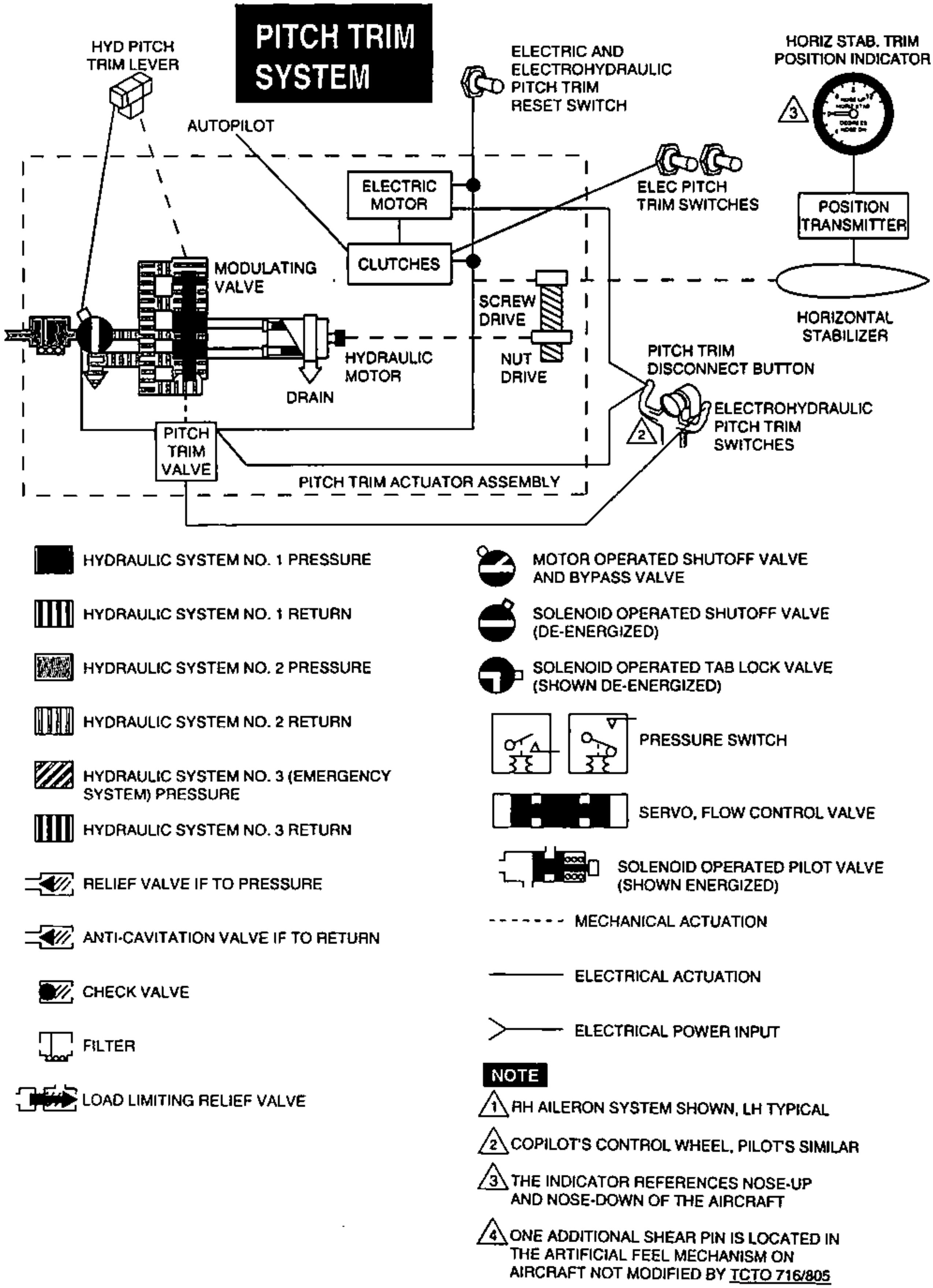
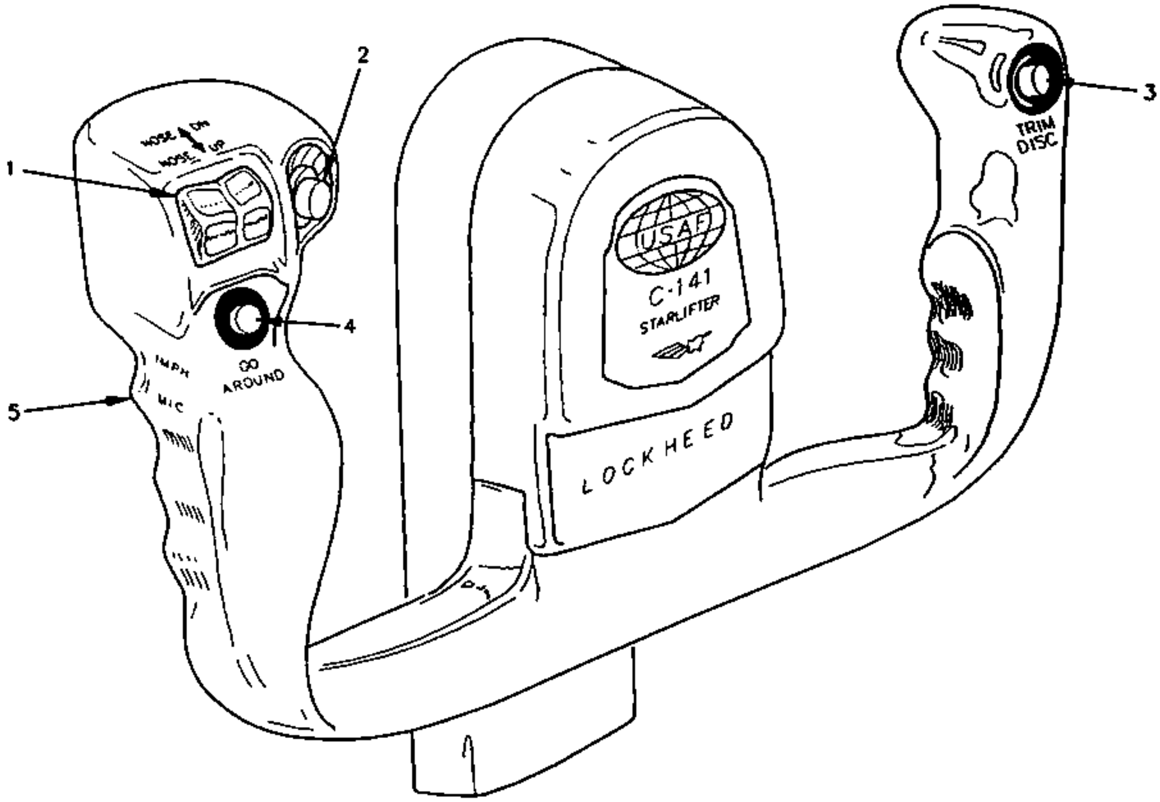


Figure 1-191. (Sheet 4 of 4)

CONTROL WHEEL

NOTE

1. PILOT'S CONTROL WHEEL SHOWN. COPILOT'S OPPOSITE.

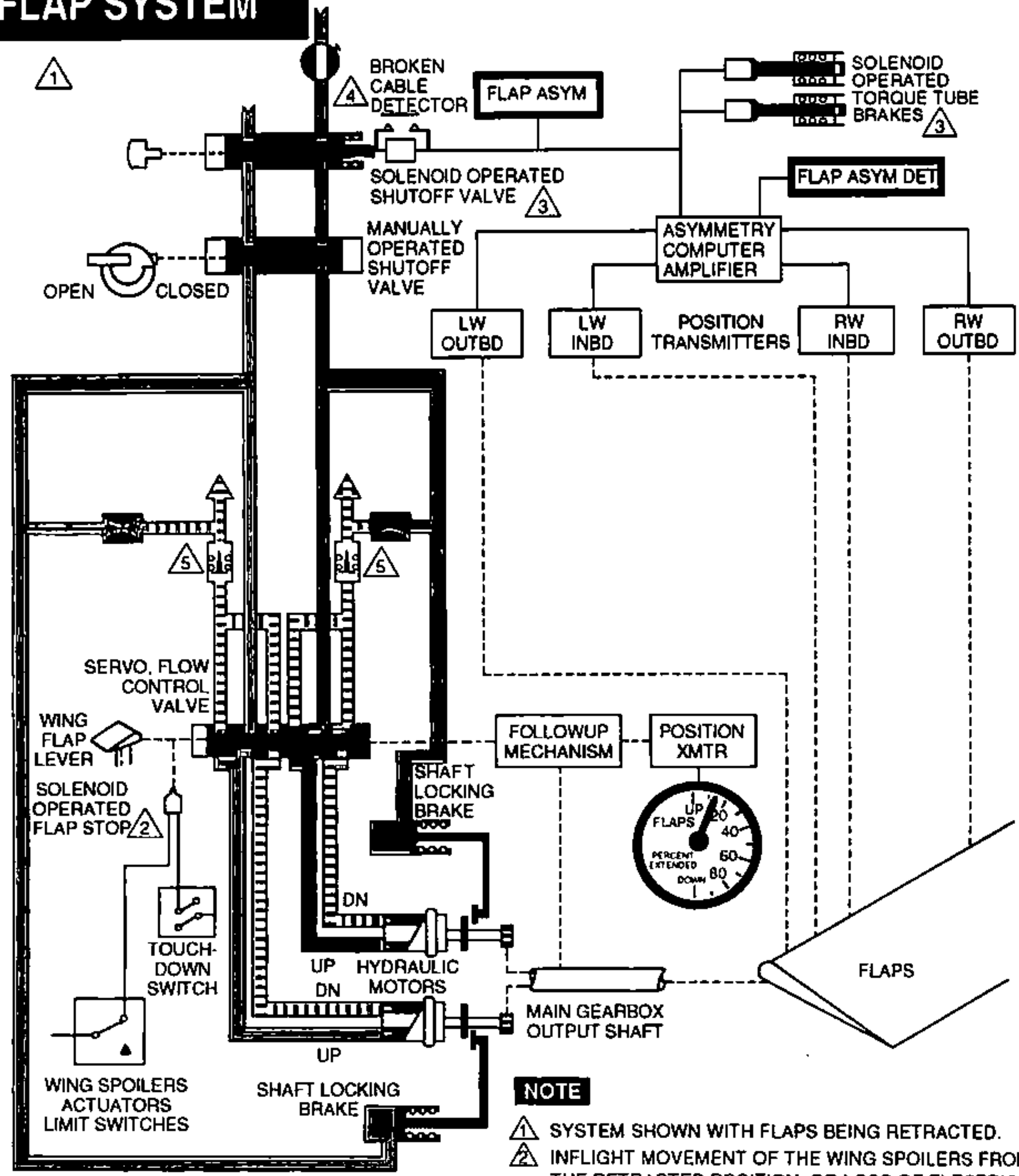


1. ELECTRO-HYDRAULIC PITCH TRIM SWITCHES
2. AUTOPILOT DISCONNECT BUTTON
3. PITCH TRIM DISCONNECT BUTTON
4. ROTATION/GO-AROUND BUTTON
5. MICROPHONE SWITCH

D3259401B

Figure 1-192. Control Wheel

FLAP SYSTEM



HYDRAULIC SYSTEM NO. 2 PRESSURE

HYDRAULIC SYSTEM NO. 2 RETURN

HYDRAULIC SYSTEM NO. 3 PRESSURE

HYDRAULIC SYSTEM NO. 3 RETURN

---- MECHANICAL ACTUATION

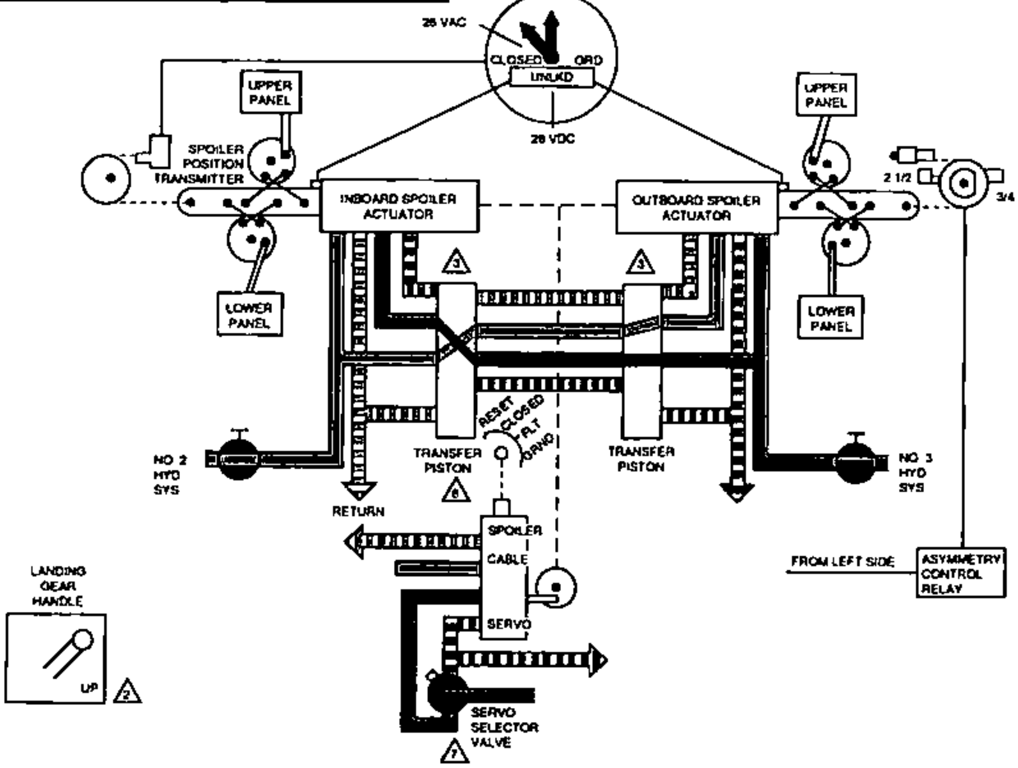
—— ELECTRICAL ACTUATION

NOTE

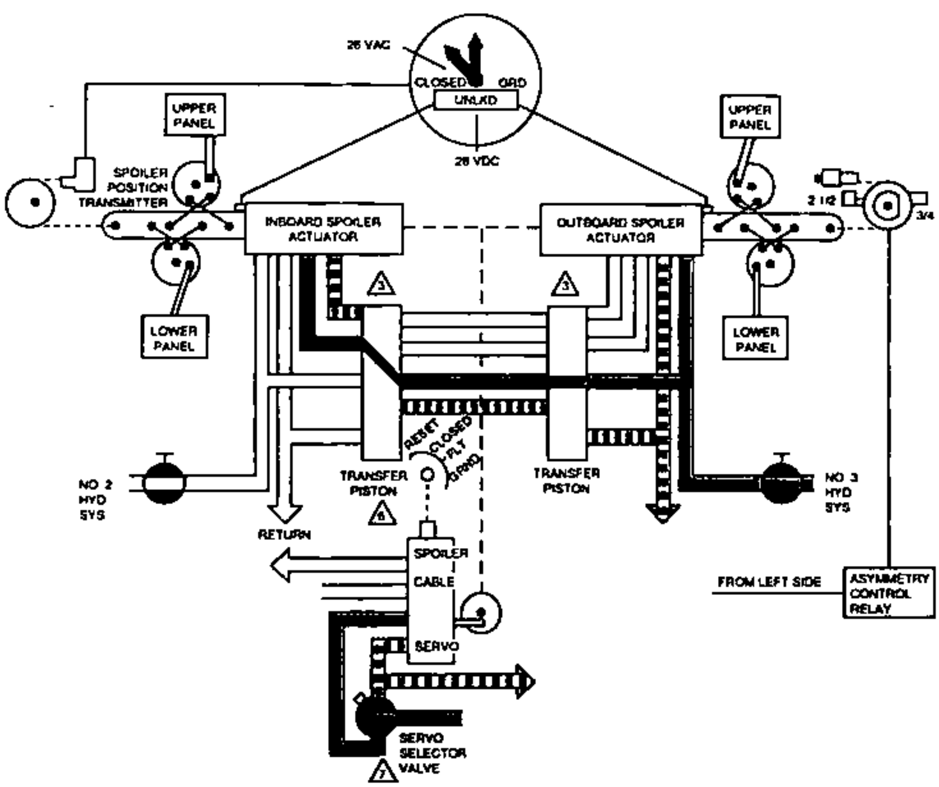
1. SYSTEM SHOWN WITH FLAPS BEING RETRACTED.
2. INFLIGHT MOVEMENT OF THE WING SPOILERS FROM THE RETRACTED POSITION, OR LOSS OF ELECTRICAL POWER AT ANYTIME, DE-ENERGIZES THE SOLENOID, ENGAGING THE STOP.
3. LOSS OF ELECTRICAL POWER IN THE ABSENCE OF AN ASYMMETRIC CONDITION LEAVES THESE NORMALLY DE-ENERGIZED SOLENOIDS DE-ENERGIZED, AND THE FLAP SYSTEM REMAINS OPERATIONAL, BUT THE ASYMMETRY PROTECTION SYSTEM IS RENDERED IN-OPERATIVE.
4. SWITCH ACTUATES IF FLAP CONTROL CABLE BREAKS.
5. 10 GPM NOMINAL TO PREVENT FLAP MOTOR OVER SPEED.

Figure 1-193.

WING SPOILER SYSTEM

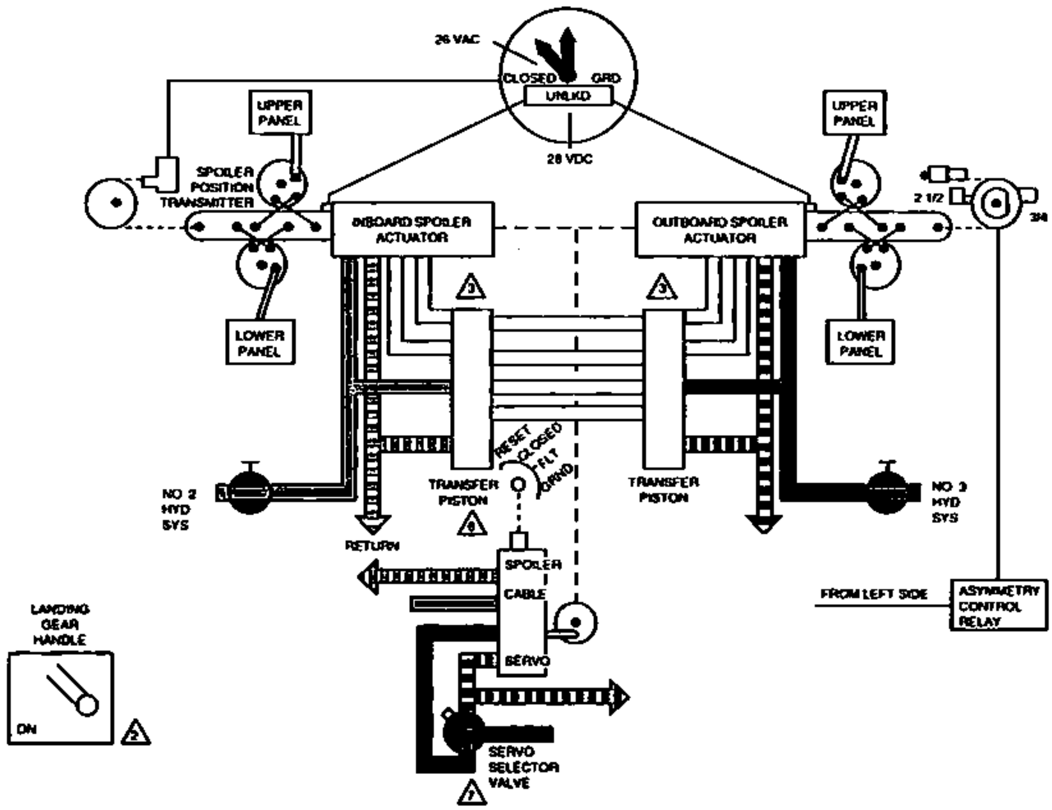


NO. 2 AND NO. 3 HYD. SYSTEM-OPERATING

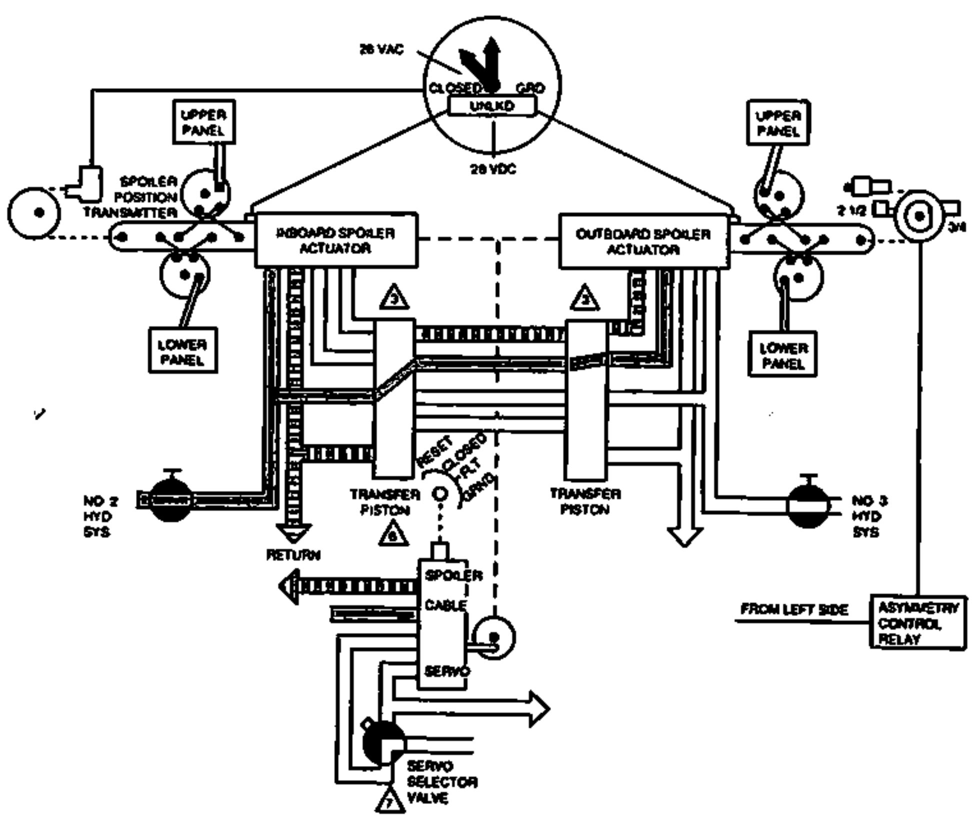


LOSS OF NO. 2 HYD. SYSTEM

Figure 1-194. (Sheet 1 of 3)



NO. 2 AND NO. 3 HYD. SYSTEM-OPERATING

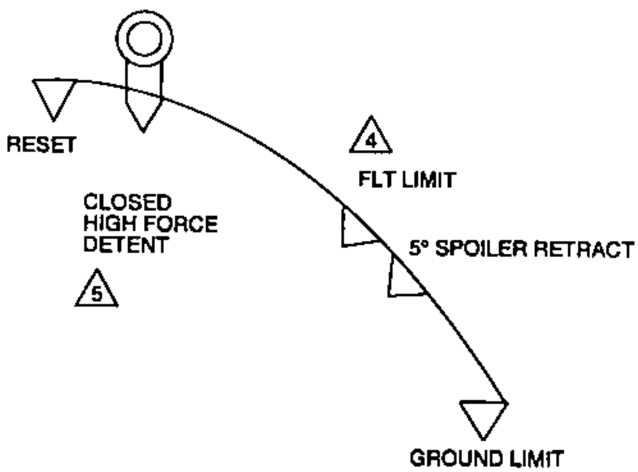


LOSS OF NO. 3 HYD. SYSTEM

Figure 1-194. (Sheet 2 of 3)

NOTE

1. RH SPOILER SYSTEM SHOWN LH SPOILER SYSTEM TYPICAL.
2. INFLIGHT SOLENOIDS ENERGIZED WHEN LANDING GEAR LEVER IS IN THE UP POSITION.
3. INBOARD SPOILER ACTUATOR RECEIVES STANDBY PRESSURE FROM NO. 3 HYDRAULIC SYSTEM. THE REVERSE IS TRUE FOR THE OUTBOARD SPOILER ACTUATOR.
4. THE MECHANICAL FLIGHT LIMIT STOP IS REMOVED AUTOMATICALLY BY THE GROUND SPOILER SOLENOID WHEN TOUCHDOWN OCCURS, AND THE SPOILER HANDLE IS LIFTED.
5. WITH THE HANDLE LIFTED AND THE HIGH FORCE DETENT REMOVED, THE FORCE REQUIRED TO MOVE THE LEVER FROM THE CLOSED POSITION IS 12 (±2) POUNDS. WITH THE HIGH FORCE DETENT IN PLACE, THE FORCE REQUIRED IS 46 (±7) POUNDS. FORCE AT ALL INTERMEDIATE POSITIONS IS 5 (±1) POUNDS. DURING FLIGHT, AVOID RAPID MOTION OF THE HANDLE IN THE EVENT THE MECHANICAL FLIGHT LIMIT STOP IS OUT OF POSITION.
6. SPOILER CABLE SERVO IS OPERATED BY MECHANICAL LINKAGE TO THE SPOILER HANDLE.
7. TO SPOILER LEVER LIMIT SWITCHES.



MANUALLY OPERATED SHUTOFF VALVE

SOLENOID OPERATED SERVO SELECTOR VALVE (SHOWN ENERGIZED TO OPEN POSITION)

HYDRAULIC SYSTEM NO. 2 PRESSURE

HYDRAULIC SYSTEM NO. 2 RETURN

HYDRAULIC SYSTEM NO. 3 PRESSURE

HYDRAULIC SYSTEM NO. 3 RETURN

—— ELECTRICAL ACTUATION

- - - - MECHANICAL ACTUATION

8. THE SPOILER ASYMMETRY SYSTEM:

		HYD SYS	COND:
a.	2 1/2" VS. 3/4"	#2 & #3	ANYTIME
b.	EMER RETRACT (EREO SWITCH)	#2 & #3	ANYTIME
c.	EMER OFF (EREO SWITCH)	#3	ANYTIME
d.	5° PAST FLIGHT LIMIT	#2 & #3	UP
e.	54° SPOILER AUTO RETRACT	#2 & #3	DN

NOTE: SPOILER AUTO RETRACT DEFEAT SW WILL DEFEAT THE 54° SPOILER RETRACT FEATURE

Figure 1-194. (Sheet 3 of 3)

LANDING GEAR SYSTEM LEGEND

- HYD SYSTEM NO. 3/EMERGENCY BRAKE PRESSURE
- HYD SYSTEM NO. 3 RETURN
- LANDING GEAR UP LINE PRESSURE
- HYD SYSTEM NO. 2 GRAVITY FEED
- HYD SYSTEM NO. 2 PRESSURE
- HYD SYSTEM NO. 2 RETURN
- NORMAL OR EMERGENCY BRAKE PRESSURE (DEPENDING ON SYSTEM SELECTED)
- BRAKE PRESSURE
- BRAKE CONTROL PRESSURE
- NLG EMERGENCY PRESSURE
- F FUSE
- SNUBBER
- CHECK VALVE
- FLOW REGULATOR
- SHUTTLE VALVE
- FILTER
- STRUT ACTUATED SAFETY SWITCH
- XMTR PRESSURE TRANSMITTER
- PRESSURE MODULATING ⚠3 SOLENOID VALVE (DE-ENERGIZED AS SHOWN)
- PRESSURE DUMPING ⚠3 SOLENOID VALVE (DE-ENERGIZED AS SHOWN)
- SOLENOID OPERATED SELECTOR VALVE WITH MANUAL PROVISION
- MANUALLY OPERATED SELECTOR VALVE
- MANUALLY OPERATED GROUND BYPASS VALVE
- PRESSURE REDUCER
- RESTRICTOR
- ELECTRICAL ACTUATION
- MECHANICAL LINKAGE

NOTE

1. LANDING GEAR SHOWN IN THE DOWN POSITION.
2. LH WHEEL BRAKE SYSTEM SHOWN, RH WHEEL BRAKE SYSTEM TYPICAL.
3. VALVE IS CONTROLLED BY THE DECELERATION SENSING AND NON ROTATION SENSING CIRCUITS OF THE ANTI-SKID CONTROL BOX.
4. SOLENOID/HYDRAULIC OPERATED, ACTUATED BY MLG CONTROLLED LIMIT SWITCHES.
5. THE DOWN LOCK ACTUATOR SOLENOID VALVES BECOME ENERGIZED AFTER THE DRAG BRACES HAVE REACHED THE FULL DOWN POSITION.

141B-1-X0/0-049-3

Figure 1-195. (Sheet 1 of 3)

LANDING GEAR SYSTEMS

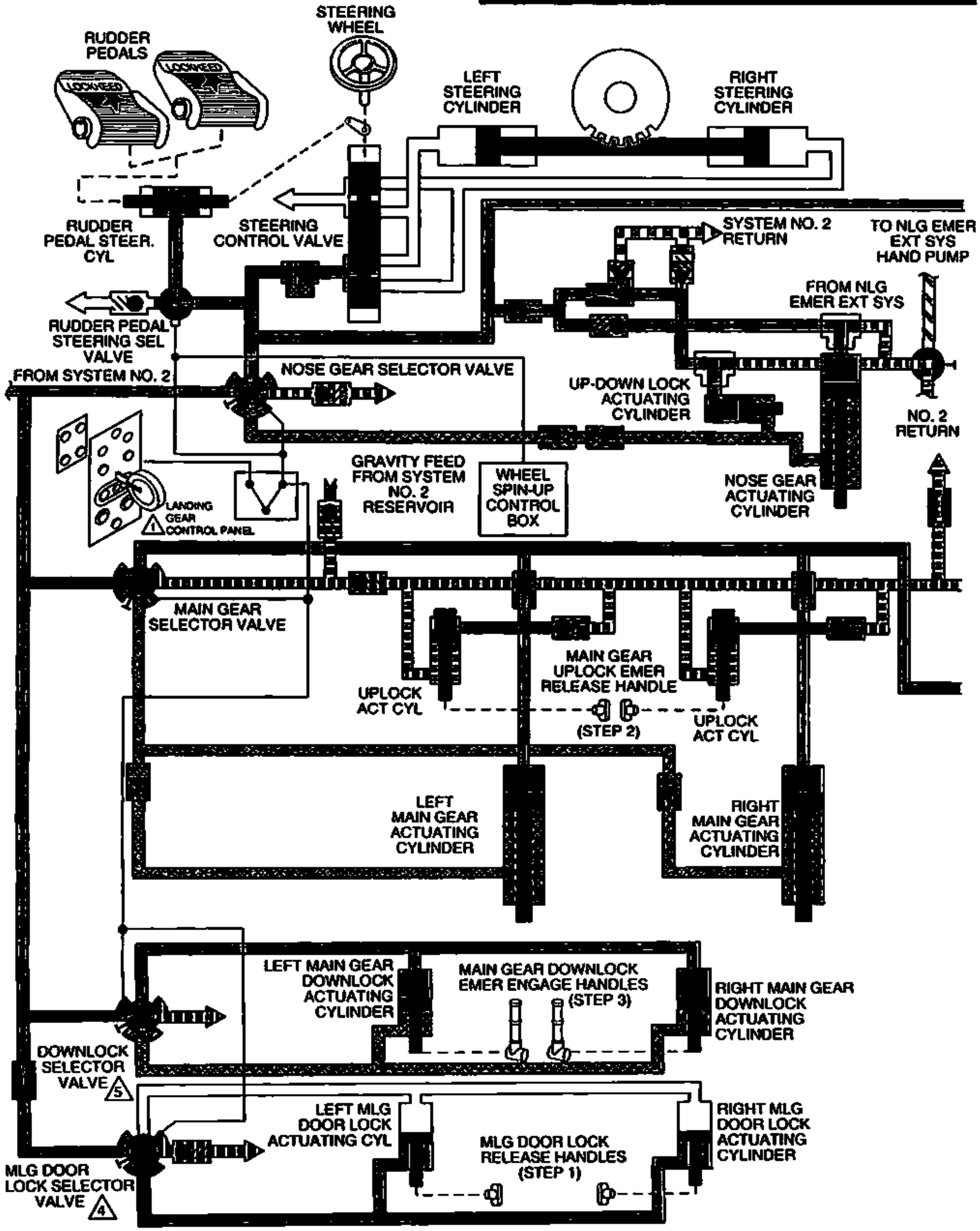


Figure 1-195. (Sheet 2 of 3)

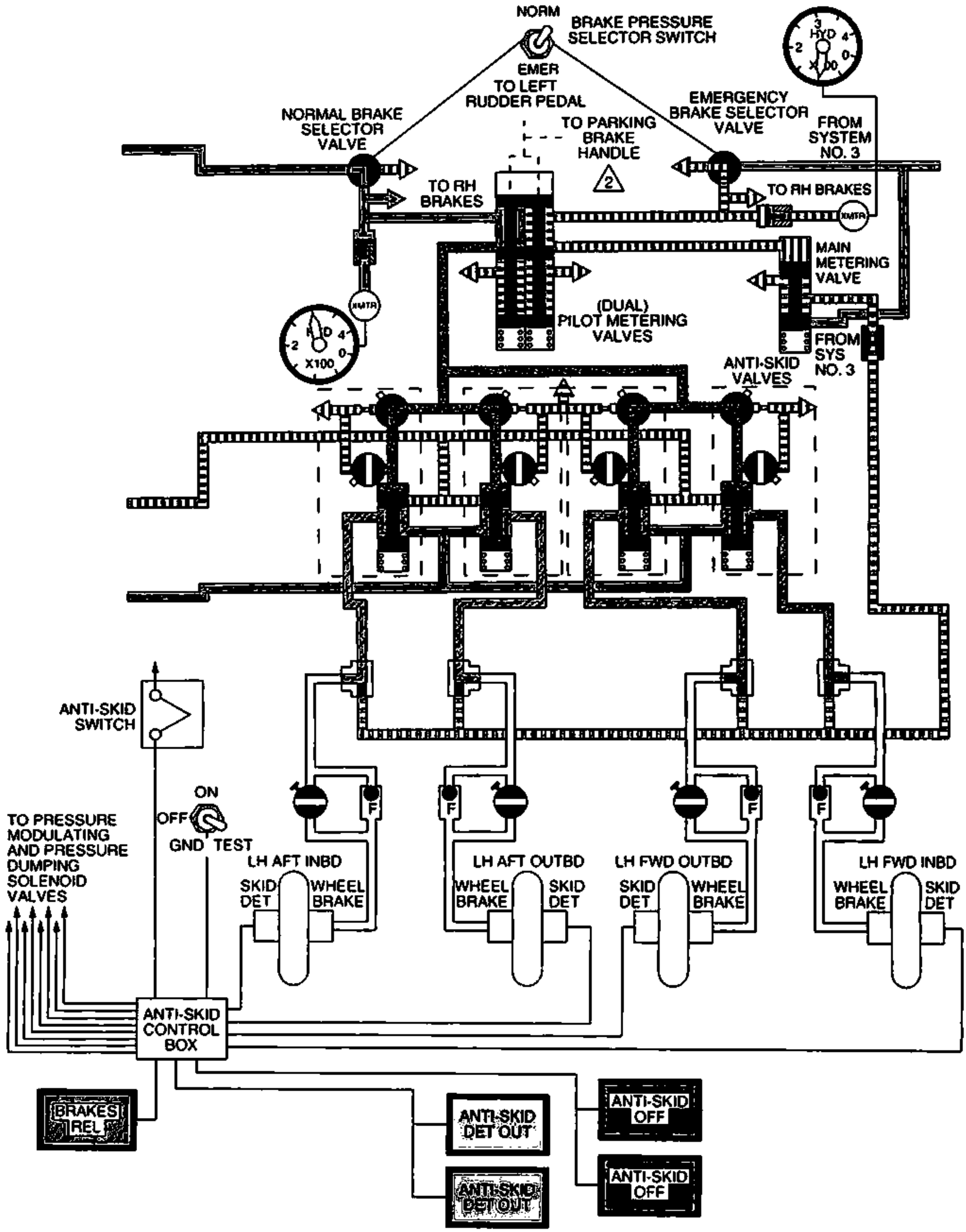


Figure 1-195. (Sheet 3 of 3)

NOSE LANDING GEAR EMERGENCY EXTEND SYSTEM

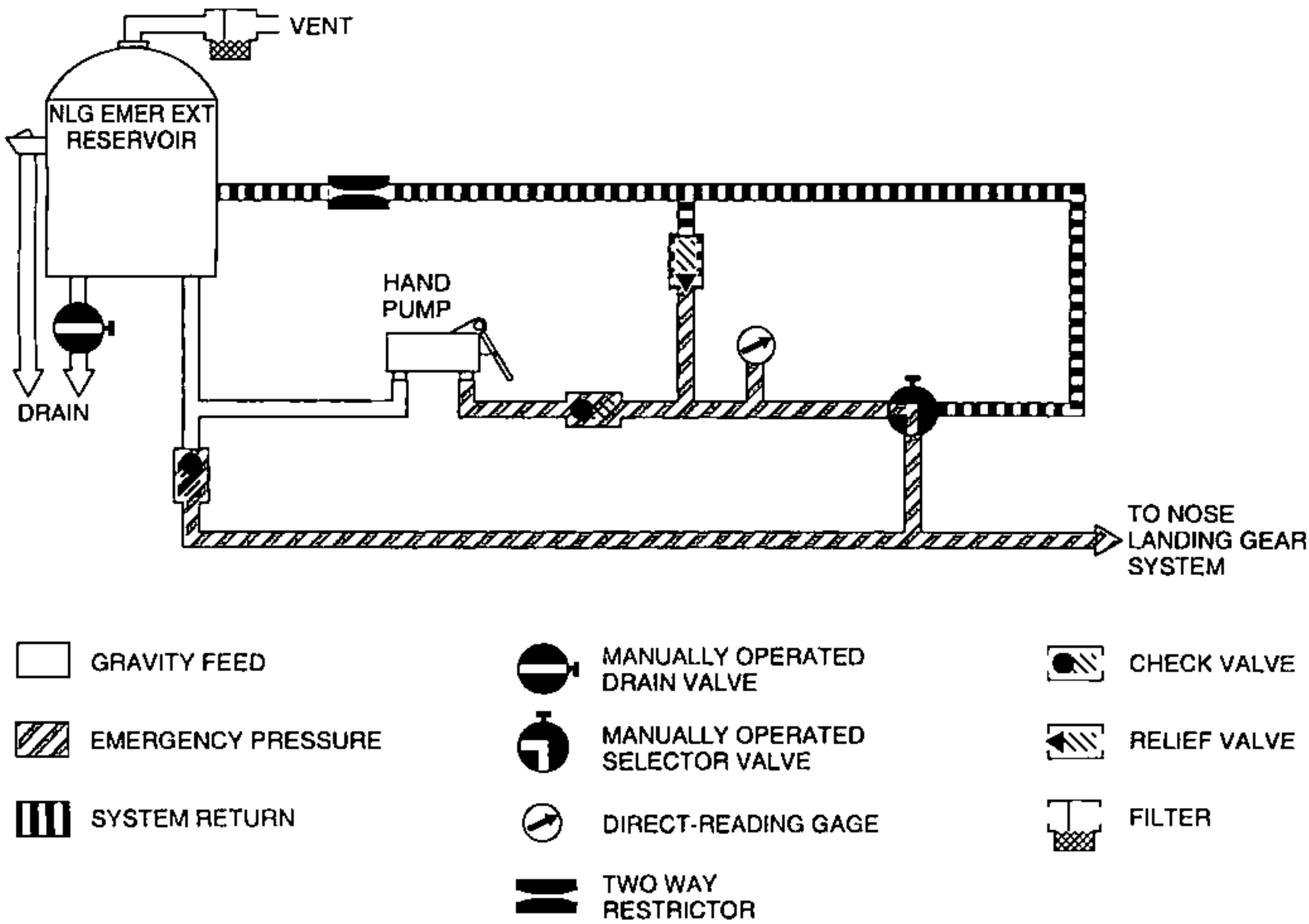
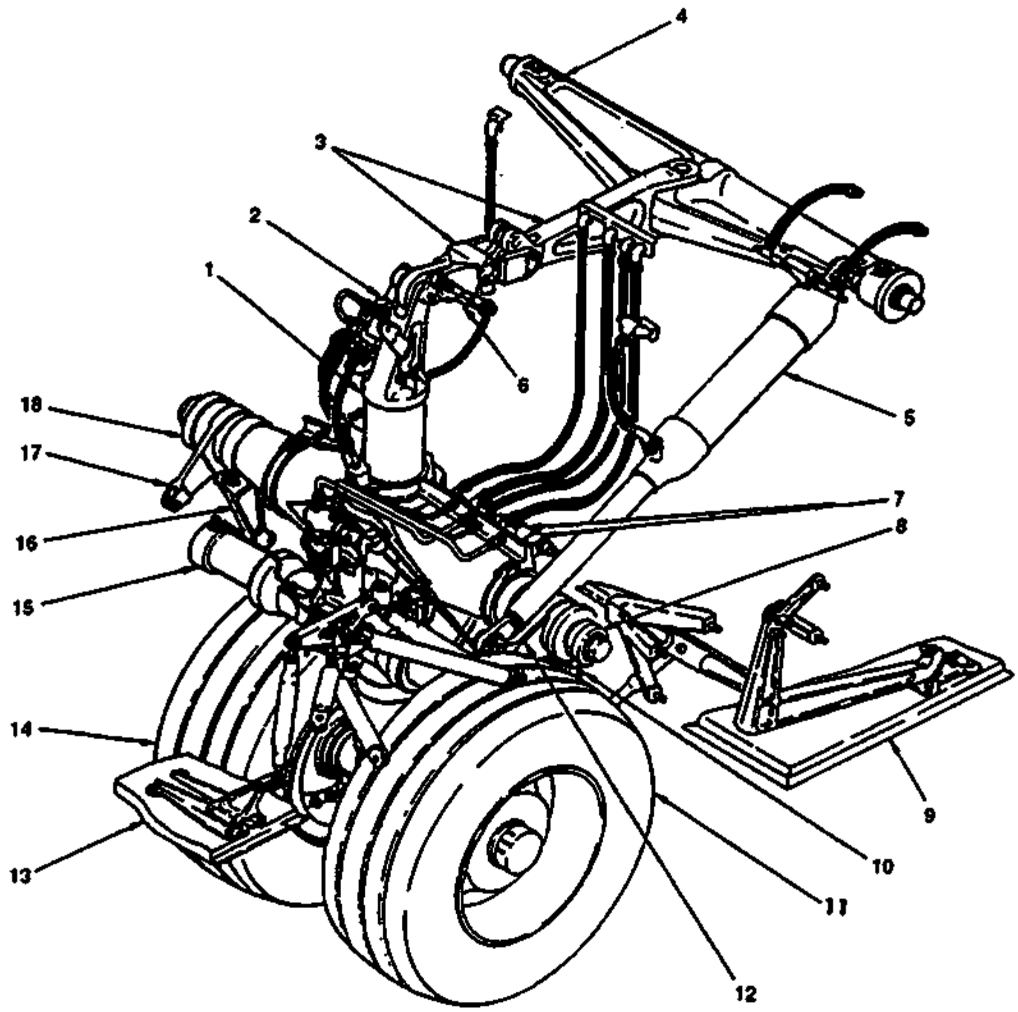


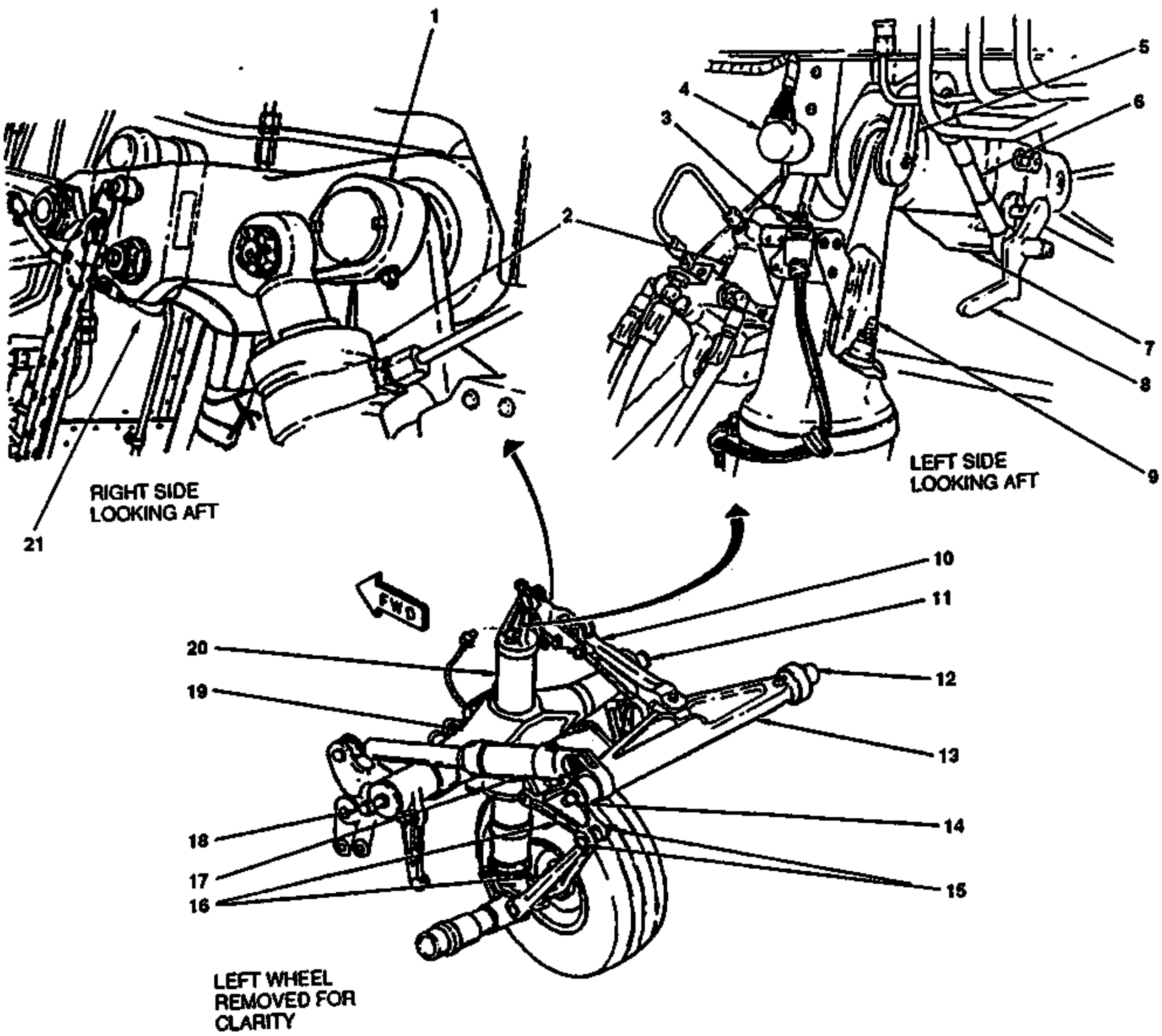
Figure 1-196.

NOSE LANDING GEAR



1. SHOCK STRUT
2. UP/DOWN LOCK ACTUATOR
3. DRAG BRACE ASSEMBLY
4. TRUNNION
5. HYDRAULIC ACTUATOR
6. UP/DOWN LOCK MECHANISM
7. TORQUE ARM ASSEMBLY
8. BEARINGS
9. AFT DOOR
10. LH BELLCRANK (AFT DOOR)
11. LH WHEEL AND TIRE ASSEMBLY
12. BELLCRANK (LH FORWARD DOOR)
13. LH FORWARD DOOR
14. RH WHEEL AND TIRE ASSEMBLY
15. STEERING ACTUATOR
16. RH BELLCRANK (AFT DOOR)
17. BELLCRANK (RH FORWARD DOOR)
18. SHOCK STRUT TRUNNION

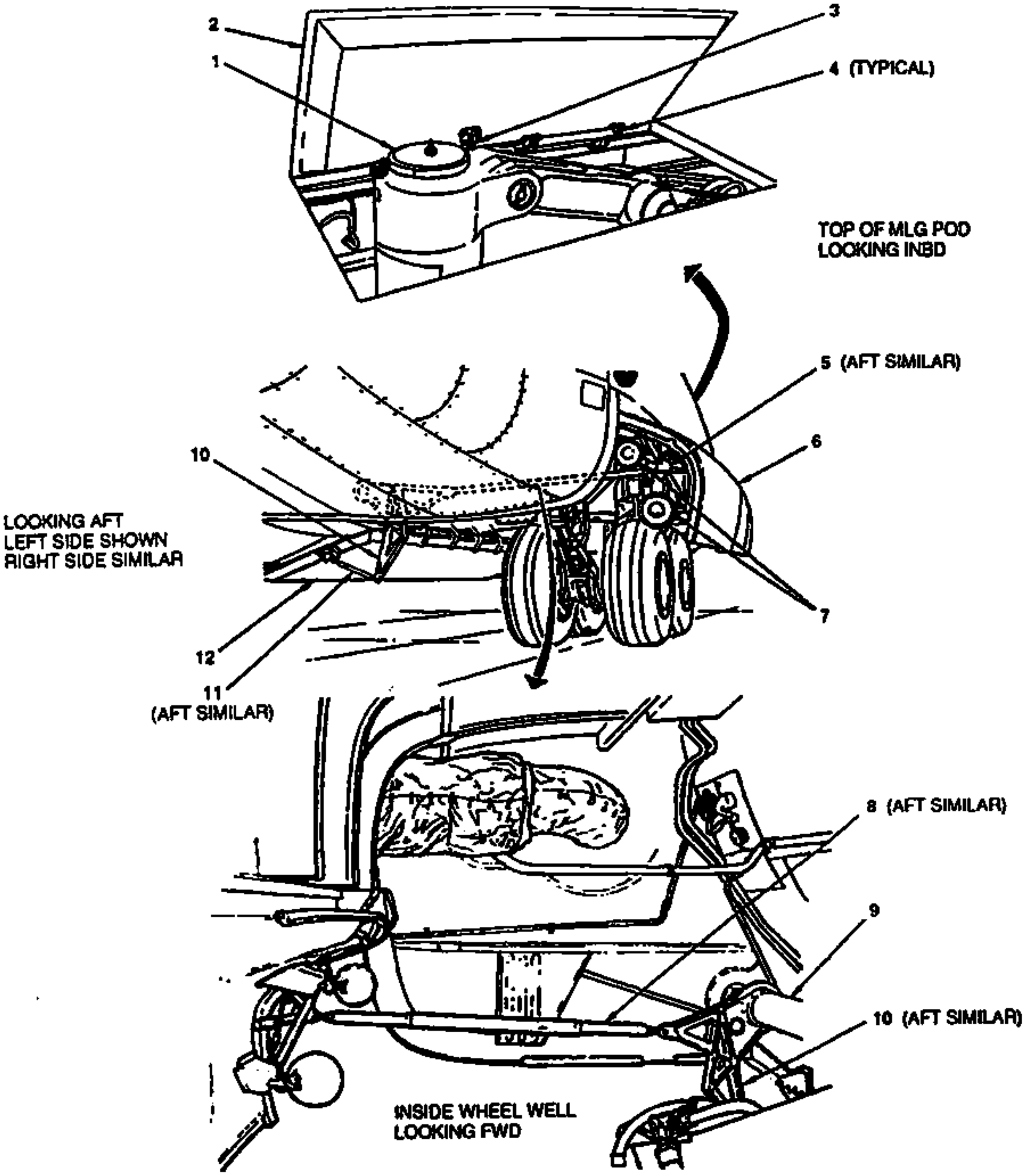
Figure 1-197. Nose Landing Gear (Sheet 1 of 2)



1. RIGHT NLG CRANK
2. UP/DOWN LOCK ACTUATOR
3. NLG POSITION SWITCH NO. 2
4. NLG POSITIVE DOWNLOCK SWITCH
5. LEFT NLG CRANK
6. UP/DOWN LOCK PUSHROD
7. UP/DOWN LOCK LEVER
8. UP/DOWN LOCK EMERGENCY RELEASE HANDLE
9. FILLER VALVE
10. DRAG BRACE ASSEMBLY
11. SPHERICAL BEARING
12. BEARING
13. NLG TRUNNION
14. BEARING
15. DISCONNECT PINS
16. TORQUE ARM ASSEMBLIES
17. NLG ACTUATOR
18. SPHERICAL BEARING
19. SHOCK STRUT TRUNNION
20. SHOCK STRUT
21. NLG UP/DOWN LOCK SWITCH

Figure 1-197. Nose Landing Gear (Sheet 2 of 2)

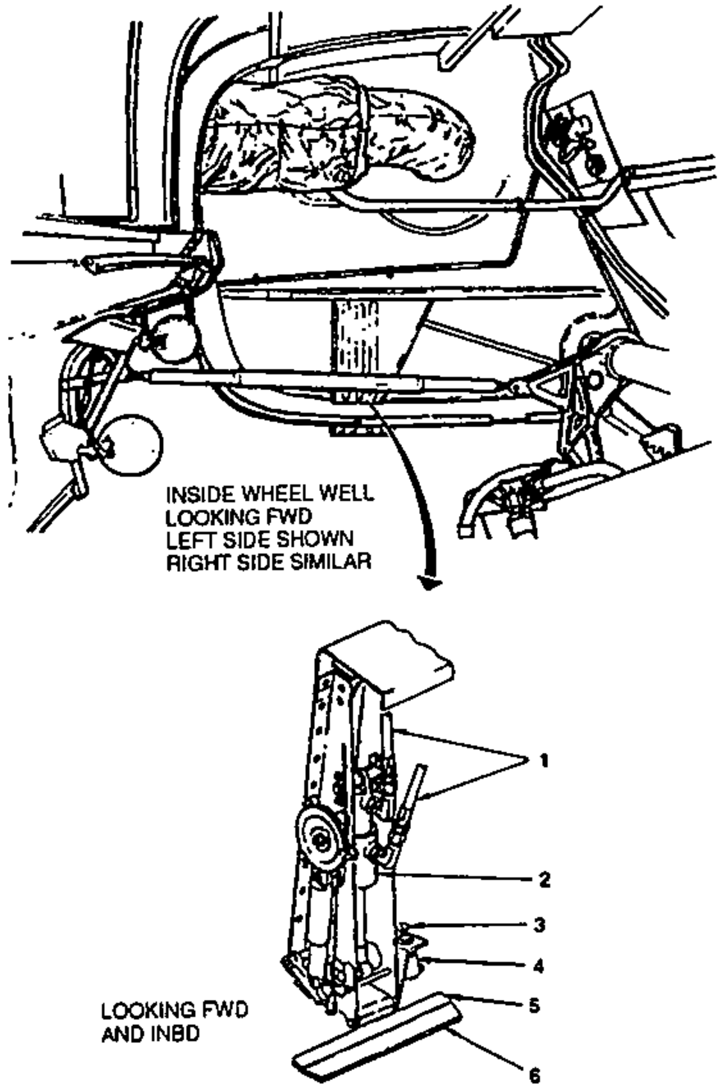
MAIN LANDING GEAR DOORS



1. SHOCK STRUT
2. OLEO DOOR
3. OLEO DOOR PUSHROD
4. HINGE
5. BRACKET
6. OUTBOARD DOOR
7. TAXI LIGHTS
8. OUTBOARD DOOR DRIVE PUSHROD
9. TORQUE TUBE ASSEMBLY
10. FORWARD BELLCRANK
11. INBOARD DOOR DRIVE PUSHROD
12. INBOARD DOOR

Figure 1-198. Main Landing Gear Doors

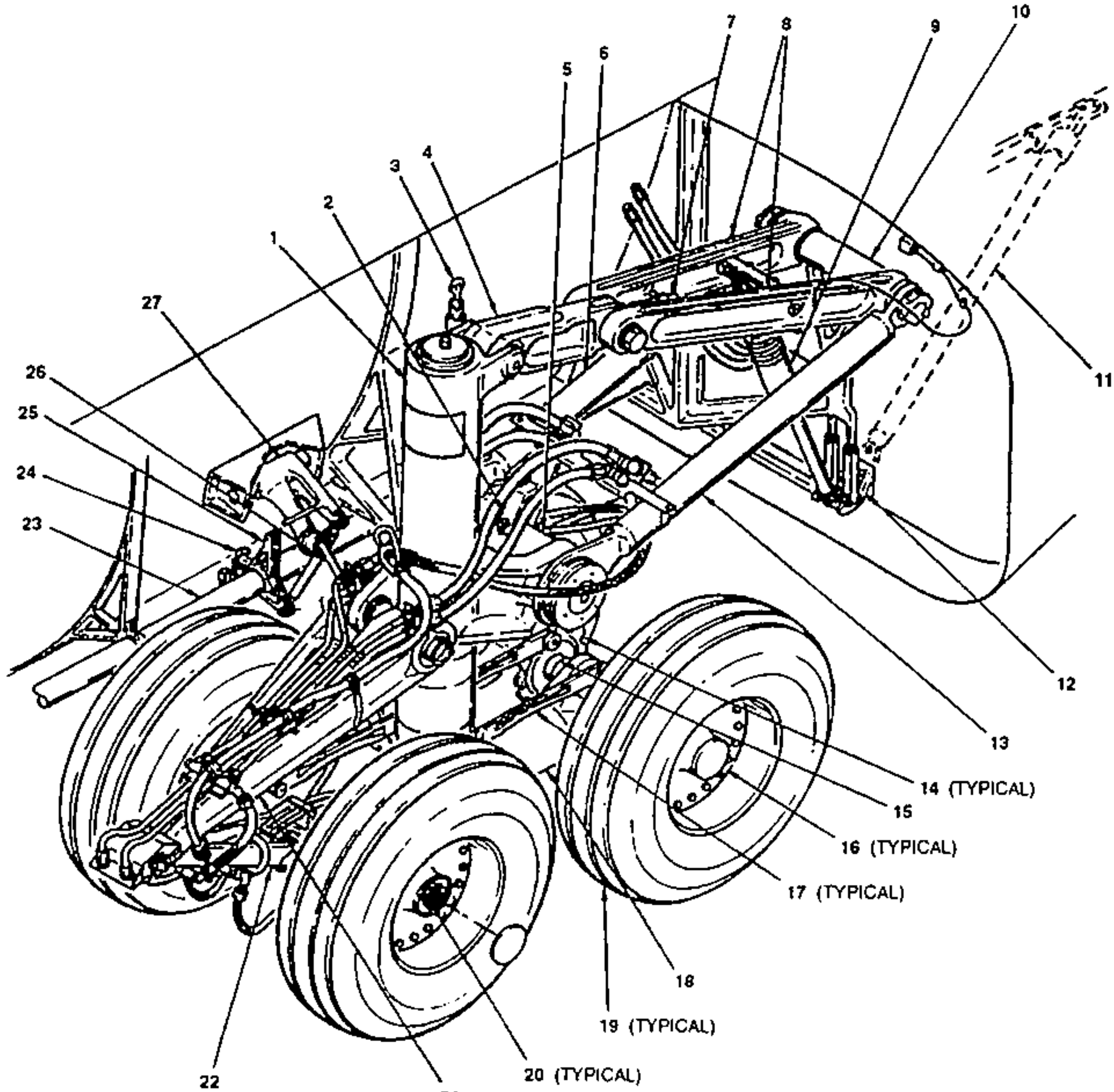
MAIN LANDING GEAR FLAPPER DOOR



1. HYDRAULIC LINES
2. UPLOCK LATCH ACTUATOR
3. STRIKER ARM
4. FLAPPER OVER-CENTER LOCK SWITCH
5. UPLOCK CATCH (FLAPPER DOOR)
6. BUMPER

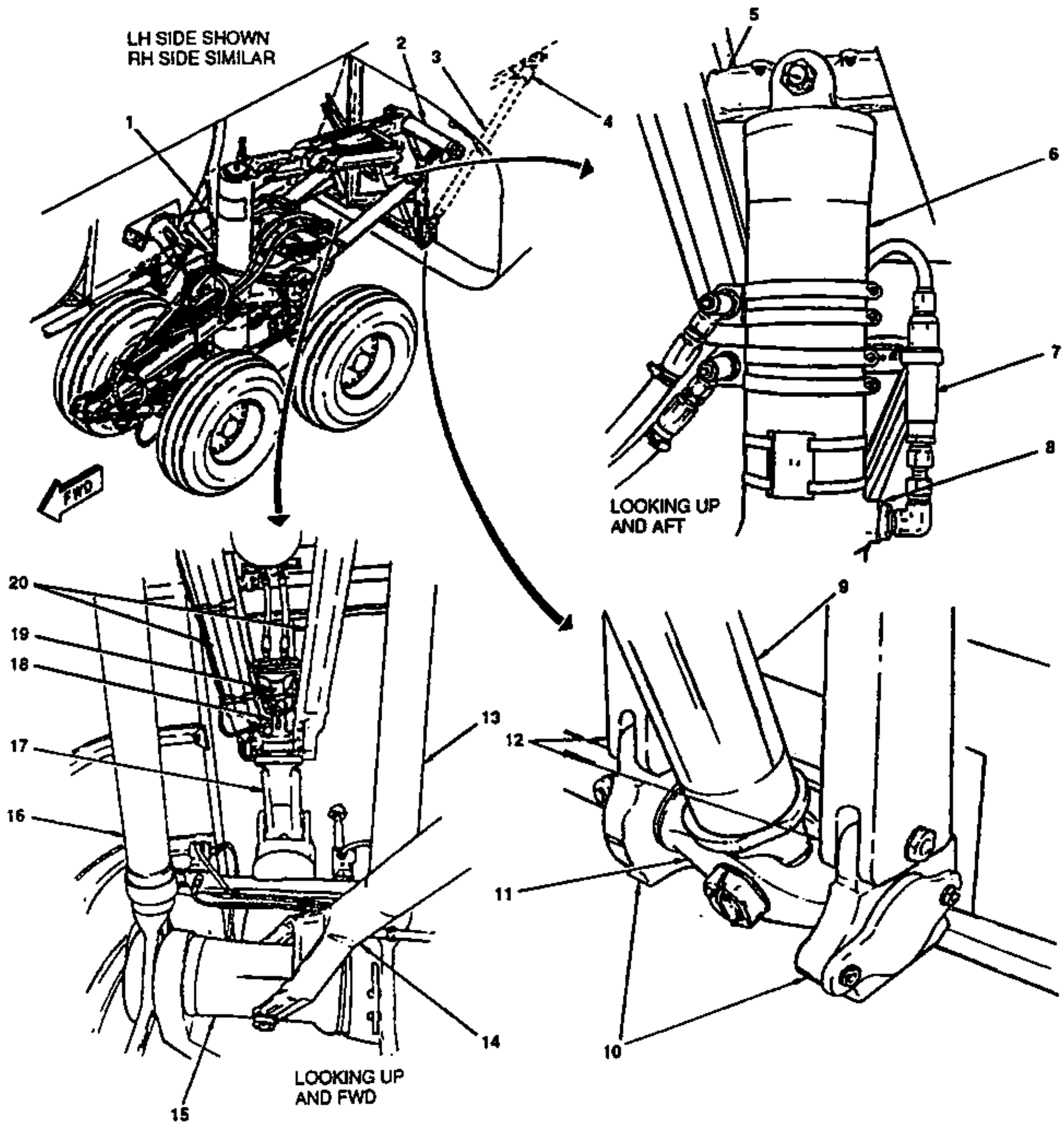
Figure 1-199. Main Landing Gear Flapper Door

MAIN LANDING GEAR



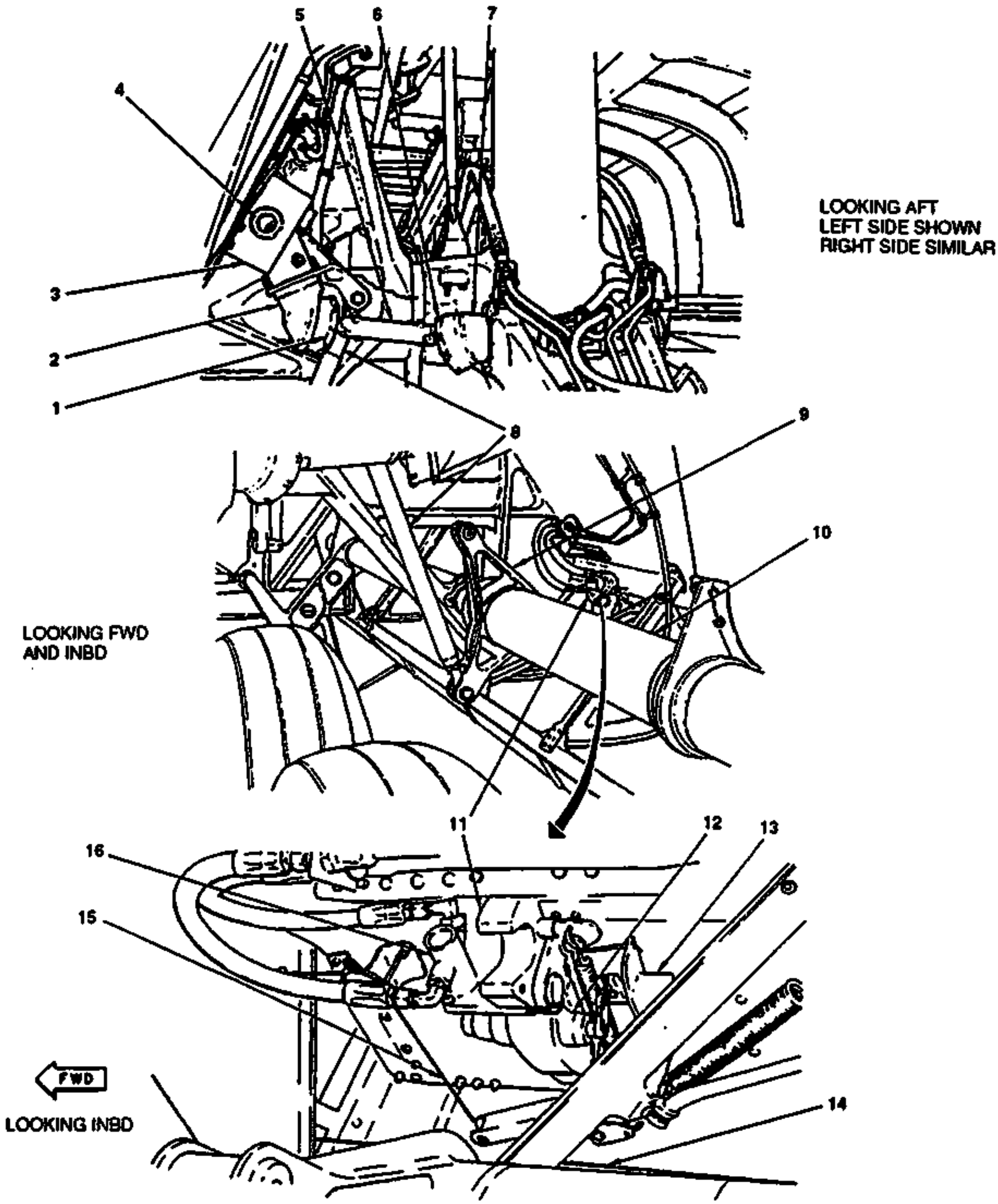
1. SHOCK STRUT
2. LOWER DRAG BRACE
3. OLEO DOOR PUSHROD
4. FORWARD UPPER DRAG BRACE
5. TRUNNION SHAFT
6. INBOARD LOWER DRAG BRACE
7. DOWNLOCK ACTUATOR
8. AFT UPPER DRAG BRACE
9. MLG ACTUATOR
10. ATTACH LINK LINK ASSEMBLY
11. TUBE BRACE
12. YOKE
13. OUTBOARD LOWER DRAG BRACE
14. BRAKE ASSEMBLY
15. AFT AXLE
16. WHEEL ASSEMBLY
17. BRAKE TORQUE LINK
18. AXLE BEAM
19. TIRE
20. ANTI-SKID DETECTOR
21. UPPER TORQUE ARM
22. LOWER TORQUE ARM
23. TORQUE TUBE
24. UPLOCK ASSEMBLY
25. UPLOCK BELLCRANK
26. BELLCRANK DRIVE BALLJOINT ASSEMBLY
27. BELLCRANK ASSEMBLY

Figure 1-200. Main Landing Gear (Sheet 1 of 3)



1. SHOCK STRUT
2. ATTACH LINK ASSEMBLY
3. TUBE BRACE
4. FITTING
5. TRUNNION-TYPE FITTING
6. MLG ACTUATOR CYLINDER
7. FLOW REGULATOR
8. BOTTOM INLET PORT
9. MLG ACTUATOR PISTON ROD
10. YOKE
11. TRUNNION
12. BRACE STRUTS
13. INBOARD LOWER DRAG BRACE
14. LOWER DRAG BRACE
15. TRUNNION SHAFT
16. OUTBOARD LOWER DRAG BRACE
17. FORWARD UPPER DRAG BRACE
18. DOWNLOCK LEVER
19. DOWNLOCK ACTUATOR
20. AFT UPPER DRAG BRACE

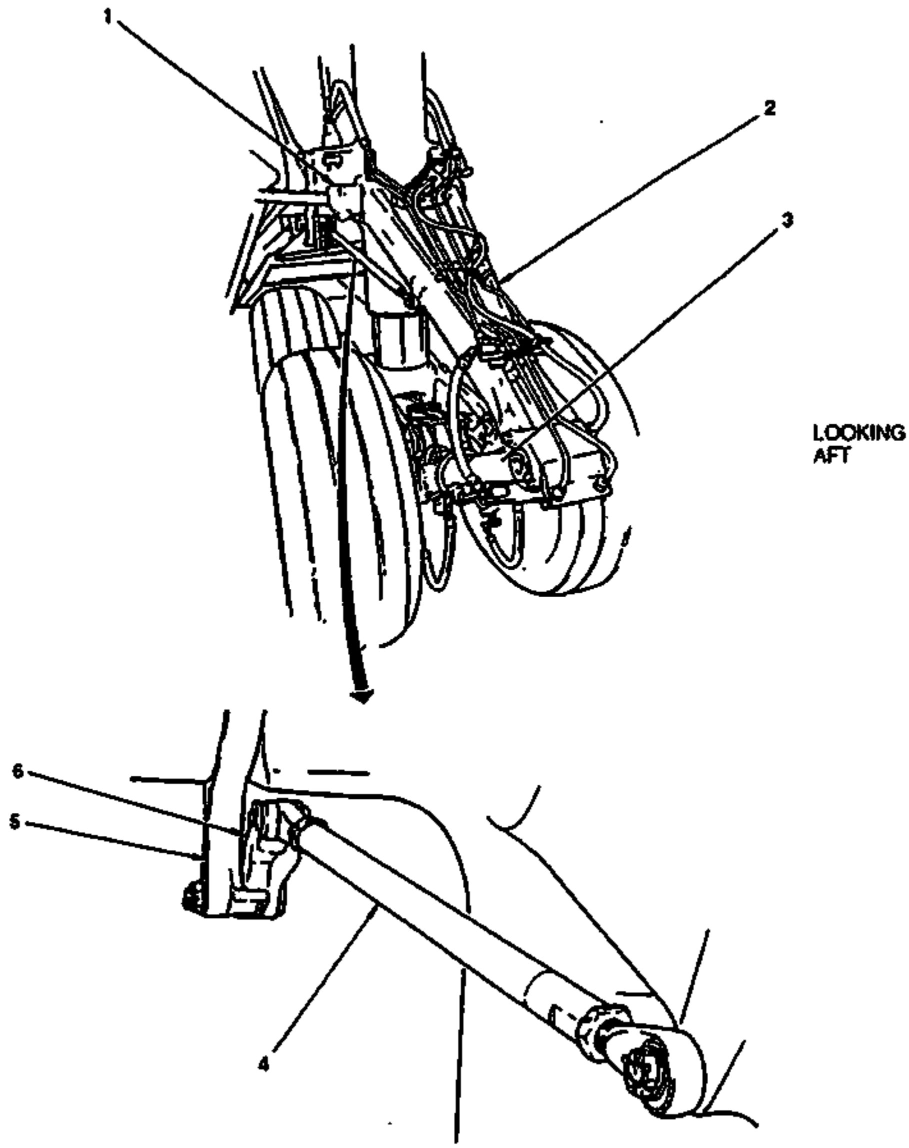
Figure 1-200. Main Landing Gear (Sheet 2 of 3)



1. INBOARD BALLJOINT NUT
2. BELLCRANK ASSEMBLY
3. BRACKET
4. BUSHING
5. BELLCRANK DRIVE BALLJOINT ASSEMBLY
6. OUTBOARD BALLJOINT NUT
7. ROOT PIN
8. PUSHROD
9. UPLOCK BELLCRANK
10. TORQUE TUBE ASSEMBLY
11. UPLOCK HOOK
12. UPLOCK ASSEMBLY
13. UPLOCK SWITCH
14. CABLE ASSEMBLY (STEP 1 HANDLE)
15. CABLE ASSEMBLY (STEP 2 HANDLE)
16. UPLOCK ACTUATOR

Figure 1-200. Main Landing Gear (Sheet 3 of 3)

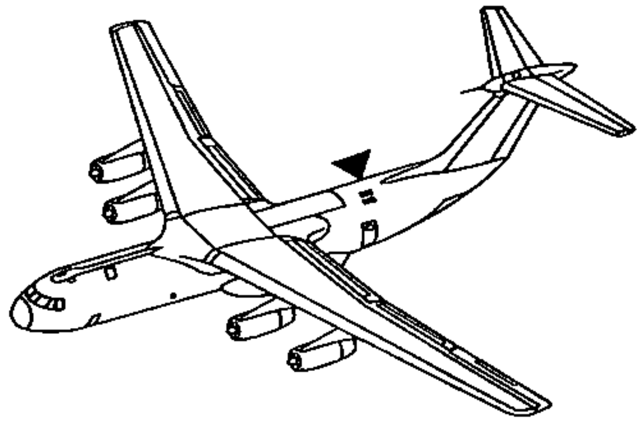
MAIN LANDING GEAR LEVELER ROD



1. ROOT PIN
2. UPPER TORQUE ARM
3. LOWER TORQUE ARM
4. LEVELER ROD
5. LOWER DRAG BRACE
6. PIVOT ARM

Figure 1-201. Main Landing Gear Leveler Rod

COCKPIT VOICE RECORDER/ DIGITAL FLIGHT DATA RECORDER



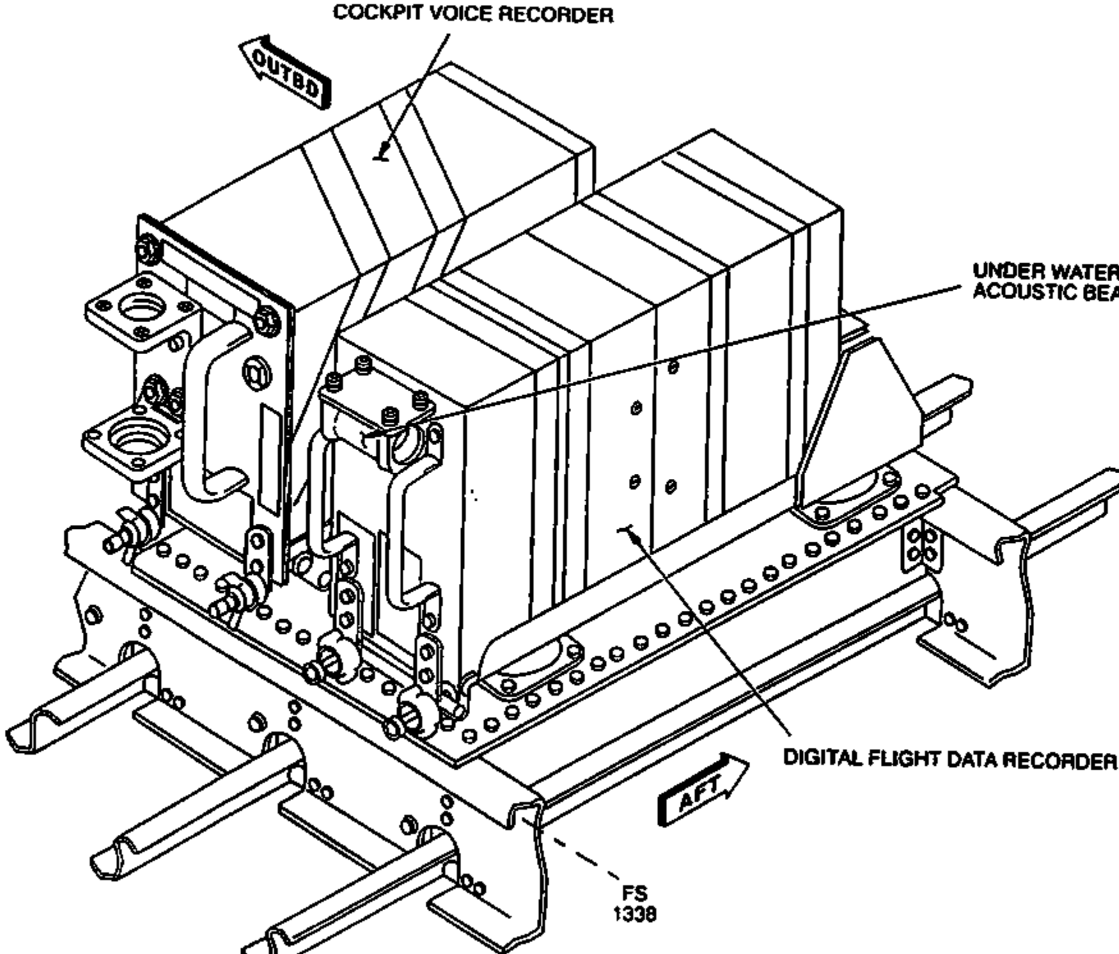
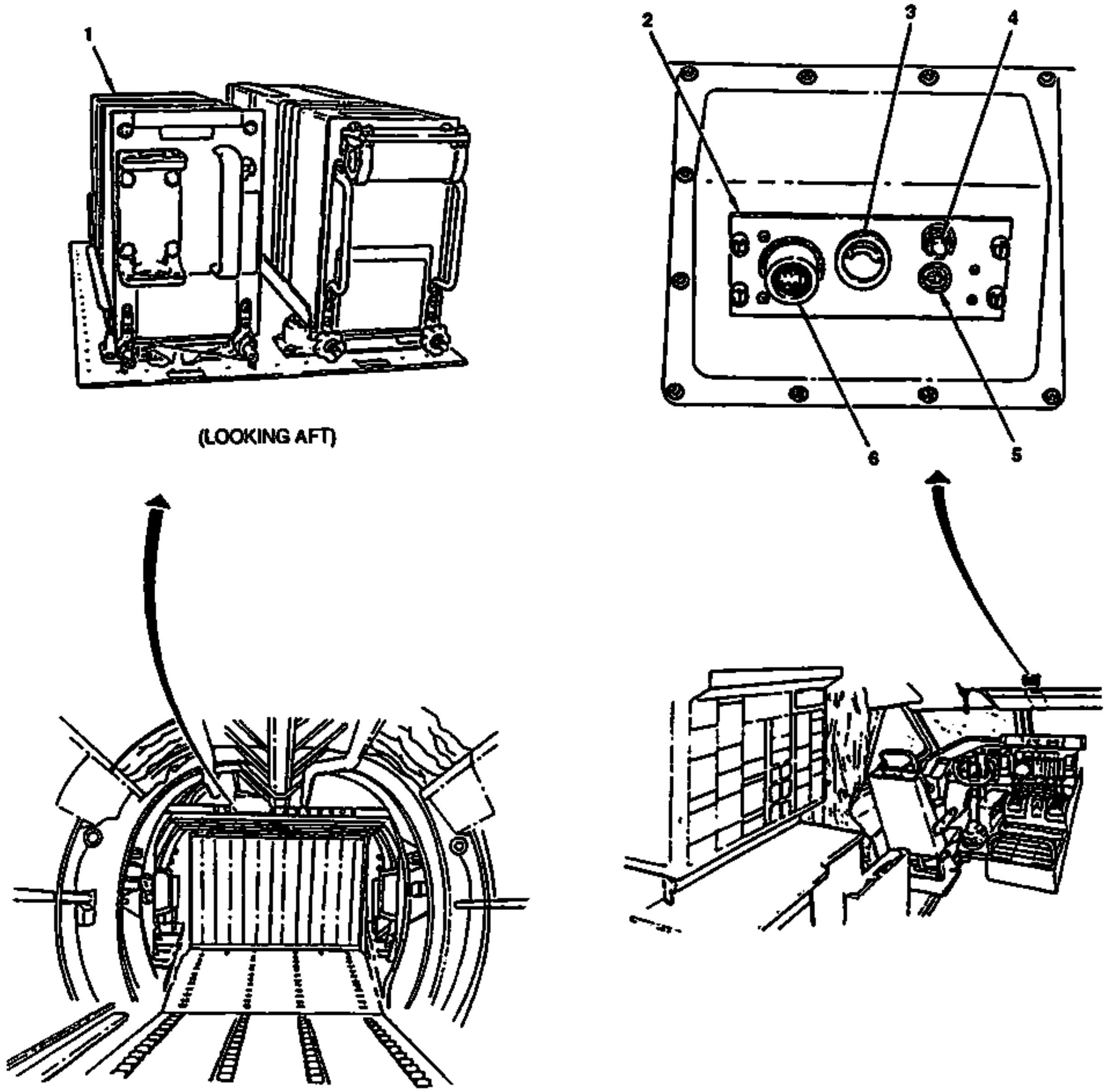


Figure 1-202. Cockpit Voice Recorder/Digital Flight Data Recorder

CVR COMPONENT LOCATIONS

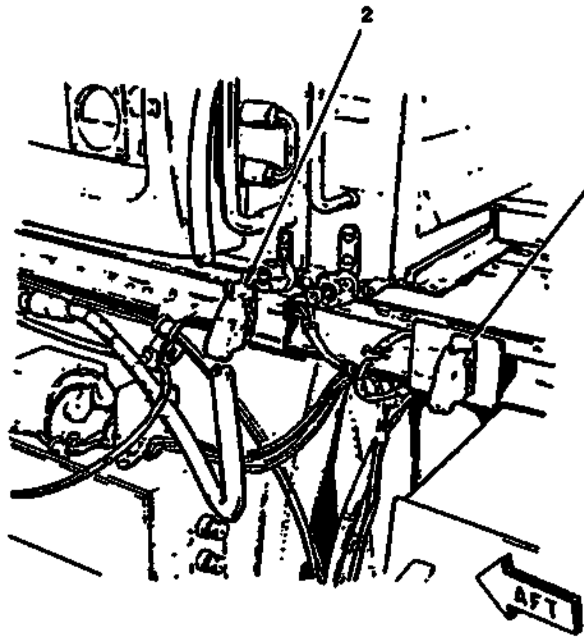


CARGO COMPARTMENT
(LOOKING AFT)

1. COCKPIT VOICE RECORDER (CVR)
2. CONTROL UNIT
3. MONITOR METER
4. TEST SWITCH
5. HEADSET MONITOR JACK
6. AREA MICROPHONE

Figure 1-203. CVR Component Locations

CVR AND DFDR TEST SWITCH LOCATIONS



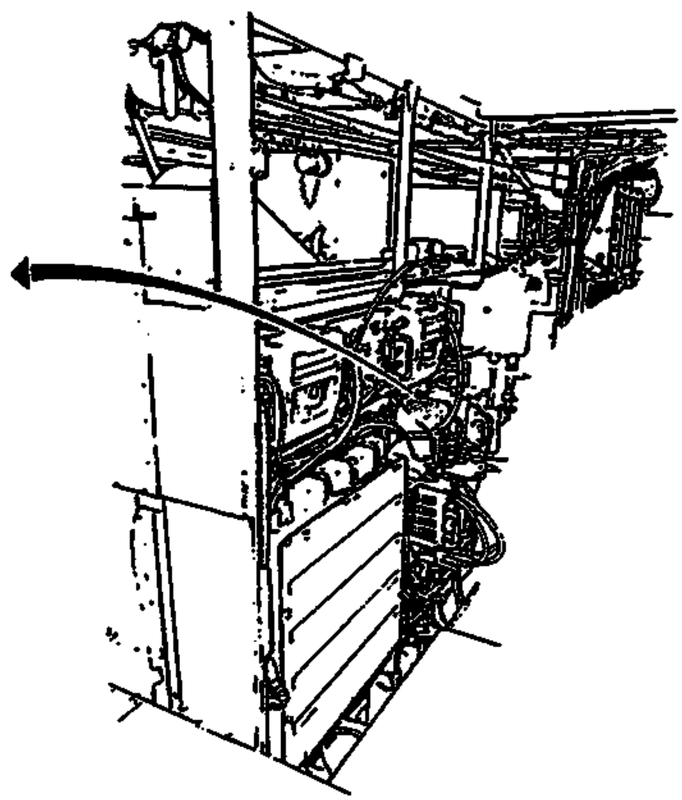


Figure 1-204. CVR and DFDR Test Switch Locations

TABLE OF COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

NAME	DESIGNATION	FUNCTION
INTERPHONE	A1C-18	CREW INTERCOMMUNICATION
PUBLIC ADDRESS	A1C-13	ONE-WAY COMMUNICATION TO CARGO AREA
HF COMM	AN/ARC-190(V) ACS	TWO-WAY VOICE COMMUNICATION
HF REM CONT 2 5	Z-AKW/Z-ANH	TWO-WAY SECURE VOICE COMMUNICATION
HF REM CONT 2 5	Z-AKV/Z-ANG	TWO-WAY SECURE VOICE COMMUNICATION
HF SELECTIVE 7 CALL	SELCAL	ALERTS CREW OF NEED TO COMMUNICATE
VHF COMM	AN/ARC-186(V)	TWO-WAY VOICE COMMUNICATION
VHF REM CONT 3	Z-ANP(KY-58)	TWO-WAY SECURE VOICE COMMUNICATION
UHF COMM	ARC-164(V)	TWO-WAY VOICE COMMUNICATION
UHF REM CONT 3	Z-ANP(KY-58)	TWO-WAY SECURE VOICE COMMUNICATION
ADF RADIO	ADF-73	HOMING & BEARING RECEIVE VOICE OR CODE SIGNALS
VHF NAV	AN/ARN-147(V)	LOCALIZER AND VOR NAV SIGNALS
GLIDE SLOPE	AN/ARN-147(V)	GLIDE PATH SIGNALS
MARKER BEACON	AN/ARN-147(V)	RECEIVES LOCATION MARKER SIGNALS
TACAN	ARN-21C, ARN-118	RECEIVES BEARING & DISTANCE SIGNALS
RADAR	APS-133	WEATHER & NAVIGATION RADAR
IFF	APX-64/72	IDENTIFIES AIRCRAFT AND REPORTS ALT, TO GRND FACILITY
RADAR ALTIMETER	AN/APN-232(V)	INDICATES ALTITUDE ABOVE TERRAIN
STATION KEEPING	AN/APN-169C 1	PROVIDES STATION KEEPING CAPABILITY AND PERMITS OPERATION WITH GROUND BASED ZONE MARKER
SCADC	CPU-141/A	PROVIDES TRUE AIRSPEED, ALTITUDE, MACH NO.
AFCS	AN/AYW-1(V)2	PROVIDES DUAL AUTOPILOT, AUTOTHROTTLES, AUTOLAND, AWLS, FLIGHT DIRECTOR, STALL WARNING, AND YAW DAMPER FUNCTION. INTERFACES WITH FMS.
AHRS		PROVIDES GUIDANCE
CONTROL DISPLAY SYSTEM (CDS)	AN/ASQ-219	DISPLAYS FLIGHT INSTRUMENTATION, NAVIGATION INFORMATION, WARNINGS AND CAUTIONS.
FLIGHT MANAGEMENT SYSTEM (FMS)	AN/ASN-[illegible]	PROVIDES ENHANCED NAVIGATION CAPABILITIES THAT INCLUDE A GLOBAL DATA BASE AND DUAL GPS, LATERAL AND VERTICAL GUIDANCE TO THE AUTOPILOT AND CDS SELECTED. DETERMINES OPTIMUM FLIGHT CONTROL SETTINGS FOR MAXIMUM FUEL EFFICIENCY.
TCAS	AN/APN-244 INTERROGATION TRANSPONDER SET	THE PURPOSE OF MODE S IFF SET IS TO PROVIDE INFOIRMATION BASED ON THE TYPE (MODE) OF INTERROGATION RECEIVED. THE TRANSPONDER PROVIDES COOPERATIVE IDENTIFICATION FRIEND OR FOE (IFF) CAPABILITY, AS WELL AS MODE SELECTION (MODE S) CAPABILITY. IN ADDITION, MODE S OPERATION PROVIDES INTERFACE CAPABILITY WITH THE AIRCRAFT'S TCAS.
TAWS		THE TERRAIN AWARENESS AND WARNING SYSTEM (TAWS) PROVIDES THE FLIGHT CREW WITH WARNING OF IMPENDING CONTROLLED FLIGHT INTO TERRAIN, APPROACHING OBSTACLES, AND UNSAFE FLIGHT CONDITIONS AND SEVERE WINDSHEAR.
INS	C-IV	PROVIDES ANALOG ATTITUDE AND HEADING DATA TO THE AUTOPILOT AND CDS. PROVIDES RAW POSITION DATA TO THE FMS.
AMPLIFIER, RF PART OF USTS ANTENNA SUBSYSTEM	AM-7388/A 4	RECEIVES AND AMPLIFIES UHF SATCOM RF SIGNALS FROM ONE OF TWO SELECTABLE SATCOM ANTENNA PORTS. SWITCHES RF TRANSMISSIONS TO ONE OF TWO SELECTABLE SATCOM ANTENNA PORTS.
L-BAND SATCOM 6	TT-3024A	TWO WAY ELECTRONIC COMMUNICATION

1 AIRCRAFT MODIFIED BY TCTO 520

2 AIRCRAFT MODIFIED BY TCTO 636

3 AIRCRAFT MODIFIED BY TCTO 637

Figure 1-205. Table of Communications and Associated Electronic Equipment (Sheet 1 of 2)

CREWMEMBER	RANGE	LOCATION OF CONTROLS
ALL	AIRCRAFT INTERIOR	ALL FLIGHT POSITIONS
PILOT & LOADMASTER	AIRCRAFT INTERIOR	FLIGHT ENGINEER'S POSITION
PILOT, COPILOT AND NAV	100 TO 2,500 MILES	PEDESTAL AND NAVIGATOR'S POSITION
PILOT & COPILOT AND NAV	100 – 2,500 MILES	NAVIGATOR'S POSITION
PILOT & COPILOT AND NAV	100 – 2,500 MILES	PILOT'S & COPILOT'S SIDE CONSOLE
ALL WITH RADIO CAPABILITY	100 – 2,500 MILES	COPILOT'S SIDE CONSOLE
PILOT & COPILOT	LINE OF SIGHT	PEDESTAL
PILOT & COPILOT	LINE OF SIGHT	PILOT'S & COPILOT'S SIDE CONSOLE
PILOT & COPILOT	LINE OF SIGHT	PEDESTAL
PILOT & COPILOT	LINE OF SIGHT	PILOT'S & COPILOT'S SIDE CONSOLE
PILOT, COPILOT AND NAV	20 – 200 MILES	PEDESTAL (2) NAVIGATOR (2)
PILOT & COPILOT	45 MILES AND 200 MILES	PEDESTAL
PILOT & COPILOT	15 MILES	COMBINES WITH VHF NAV
PILOT & COPILOT	ANY ALTITUDE	PILOTS' INST. PANEL
PILOT & COPILOT	TO 250 MILES	PEDESTAL
PILOT OR NAVIGATOR	5 – 300 MILES	PILOTS' OR NAVIGATOR'S POSITION
PILOT & COPILOT	LINE OF SIGHT	PEDESTAL
PILOT & COPILOT	0 – 50,000 FEET	PILOTS' CENTER INSTRUMENT PANEL
PILOT, COPILOT AND NAV	0 – 10 NAUTICAL MILES	PILOT'S, COPILOT'S AND NAVIGATOR'S POSITIONS
PILOT & COPILOT	650 KCAS, 1.0 MACH 60,000 FT	TEST SWITCH - PILOT & COPILOT SIDE CONSOLE
PILOT & COPILOT	UNLIMITED	PEDESTAL
PILOT, COPILOT & NAV	UNLIMITED	COPILOT'S SIDE PANEL
PILOT & COPILOT		PILOT'S AND COPILOT'S GLARE SHIELDS, PEDESTAL
PILOT, COPILOT & NAV	UNLIMITED	PEDESTAL AND NAVIGATOR PANEL
PILOT, COPILOT		PILOT'S AND COPILOT'S INSTRUMENT, MFD
PILOT, COPILOT		PILOT'S AND COPILOT'S INSTRUMENT, MFD
PILOT, COPILOT & NAV	UNLIMITED	PEDESTAL AND NAVIGATOR PANEL
PILOT, COPILOT AND NAV	LINE OF SIGHT	USTS INTERFACE PANEL
NAVIGATOR & SCANNER	LINE OF SIGHT	NAVIGATOR'S TABLE

4 AIRCRAFT MODIFIED BY TCTO 530

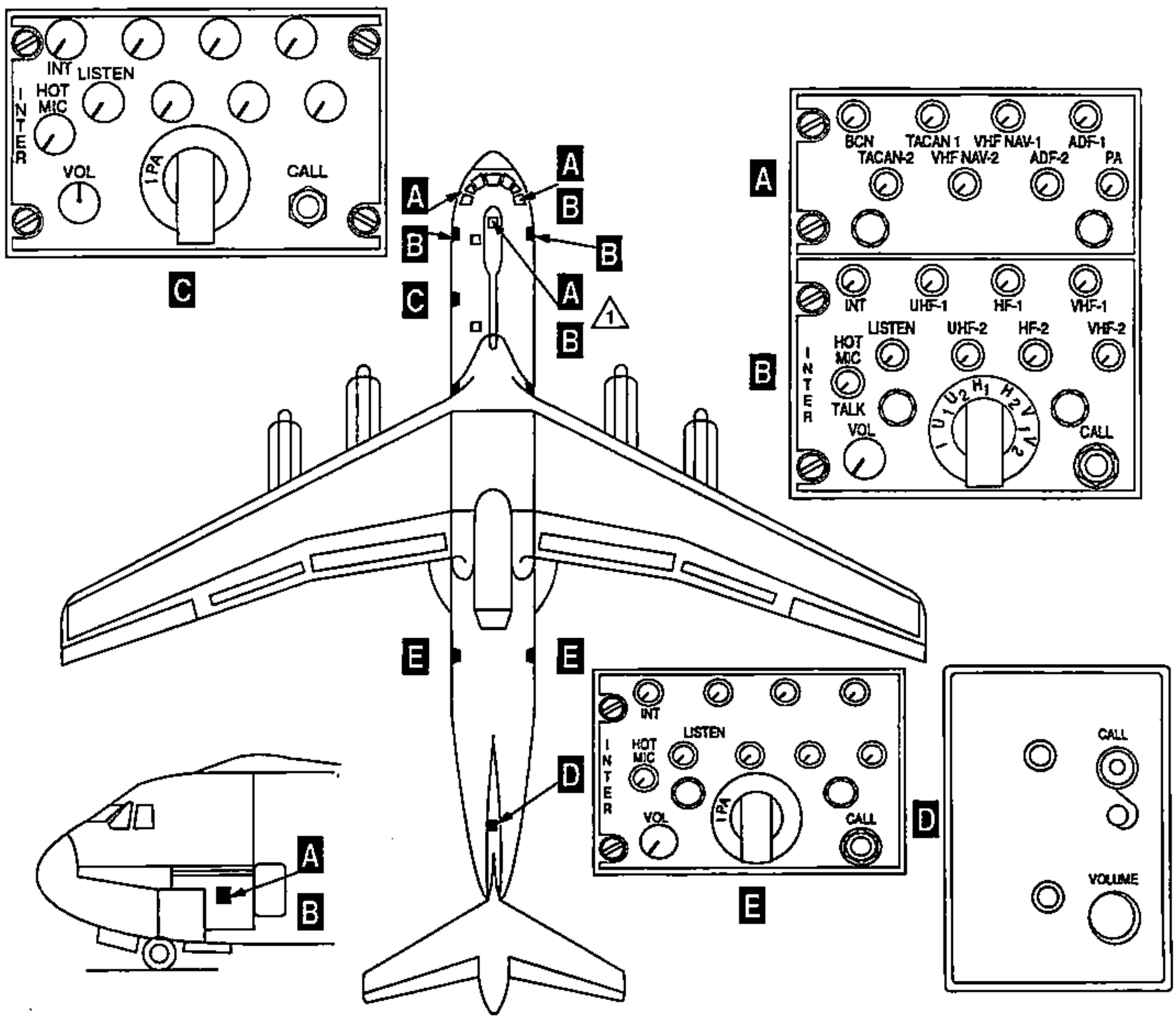
5 AIRCRAFT MODIFIED BY TCTO 550

6 AIRCRAFT MODIFIED BY TCTO 555

7 AIRCRAFT MODIFIED BY TCTO 576

Figure 1-205. Table of Communications and Associated Electronic Equipment (Sheet 2 of 2)

INTERPHONE PANEL LOCATIONS



1 AIRCRAFT MODIFIED BY TCTO 536.

Figure 1-206. Interphone Panel Locations

PUBLIC ADDRESS SYSTEM CONTROLS (TYPICAL)

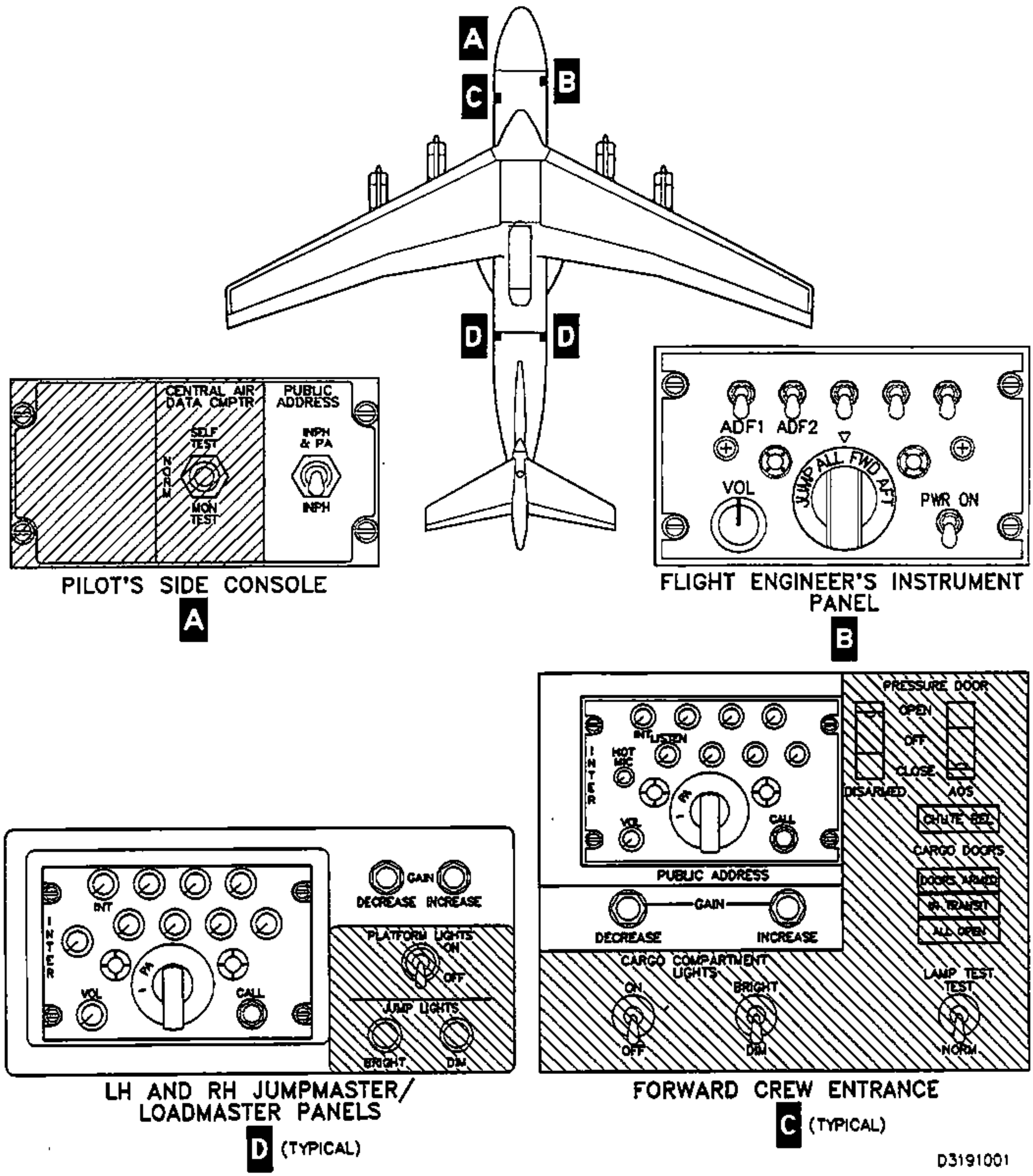


Figure 1-207. Public Address System Controls (Typical)

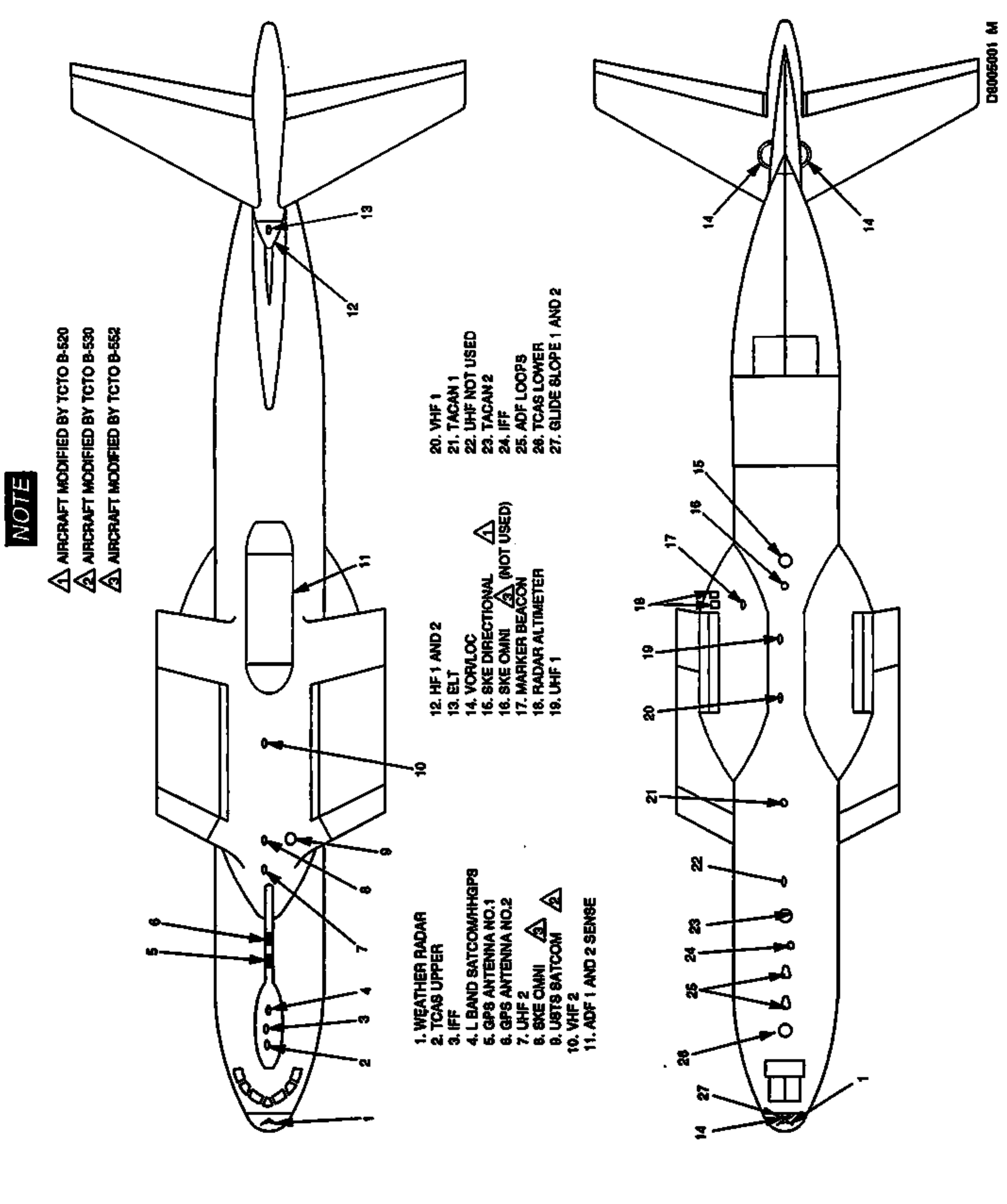
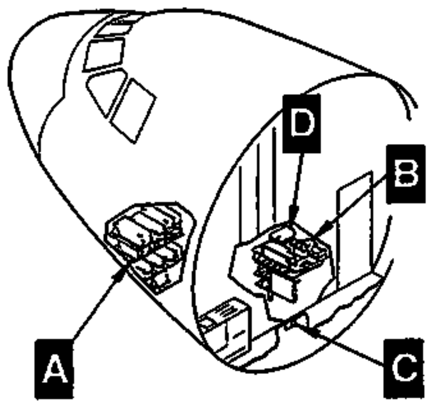
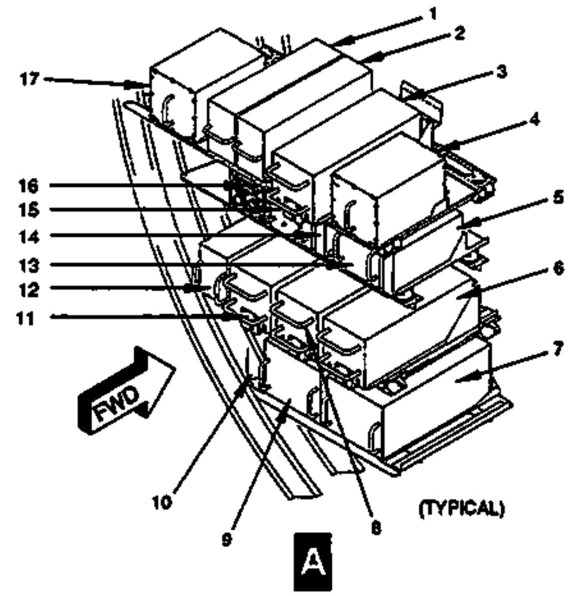


Figure 1-208. Antenna Locations

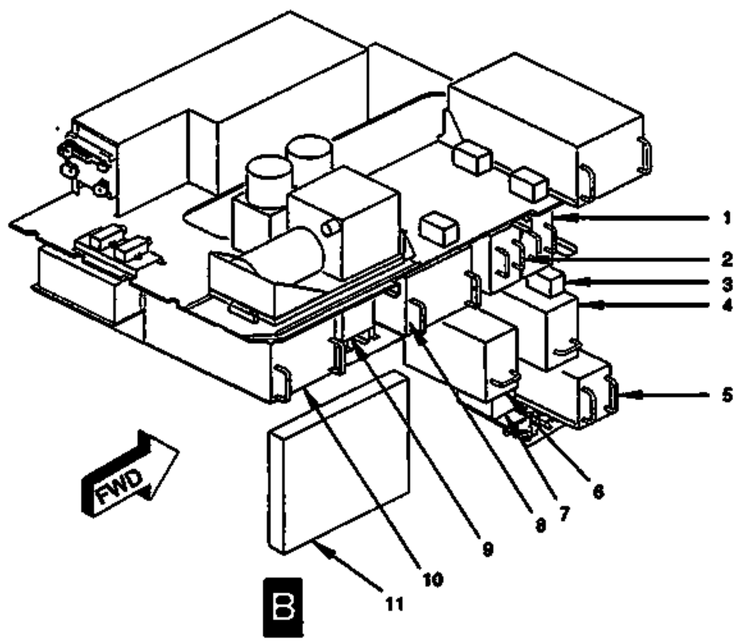
UNDERDECK ELECTRONIC EQUIPMENT





(TYPICAL)

1. HF1 COMMUNICATION PROCESSOR
2. HF2 COMMUNICATION PROCESSOR
3. DISPLAY PROCESSOR UNIT (DPU), CDS NO. 2
4. NAVIGATION PROCESSOR, FMS NO. 2
5. TACAN NO. 2 D/A CONVERTER
6. AUTOMATIC FLIGHT CONTROL PROCESSOR (AFCP), AFCS NO. 2
7. NAVIGATION UNIT NO. 2
8. AFCP, AFCS NO. 1
9. NAVIGATION UNIT NO. 1
10. INS JUNCTION BOX NO. 2
11. DPU, CDS NO. 1
12. STANDARD CENTRAL AIR DATA COMPUTER NO. 1
13. TACAN NO. 2 RCVR-XMTR ARN-118
14. TACAN NO. 1 D/A CONVERTER
15. TACAN NO. 1 RCVR-XMTR ARN-118
16. TCAS PROCESSOR
17. NAVIGATION PROCESSOR, FMS NO. 1



1. BATTERY UNIT NO. 2
2. BATTERY UNIT NO. 1
3. ELECTRONIC TEST EQUIPMENT POWER OUTLET
4. FLIGHT DATA AQUISITION UNIT
5. STANDARD CENTRAL AIR DATA COMPUTER NO. 2 (TYPE CPU-141/A)
6. AUXILIARY INTERFACE UNIT (AIU)
7. AIR DATA UNIT (ADU)
8. HF NO. 1 RCVR-XMTR (TYPE RT-1341(V)3/ARC-190)
9. IFF RCVR-XMTR (APX-64 OR APX-72)

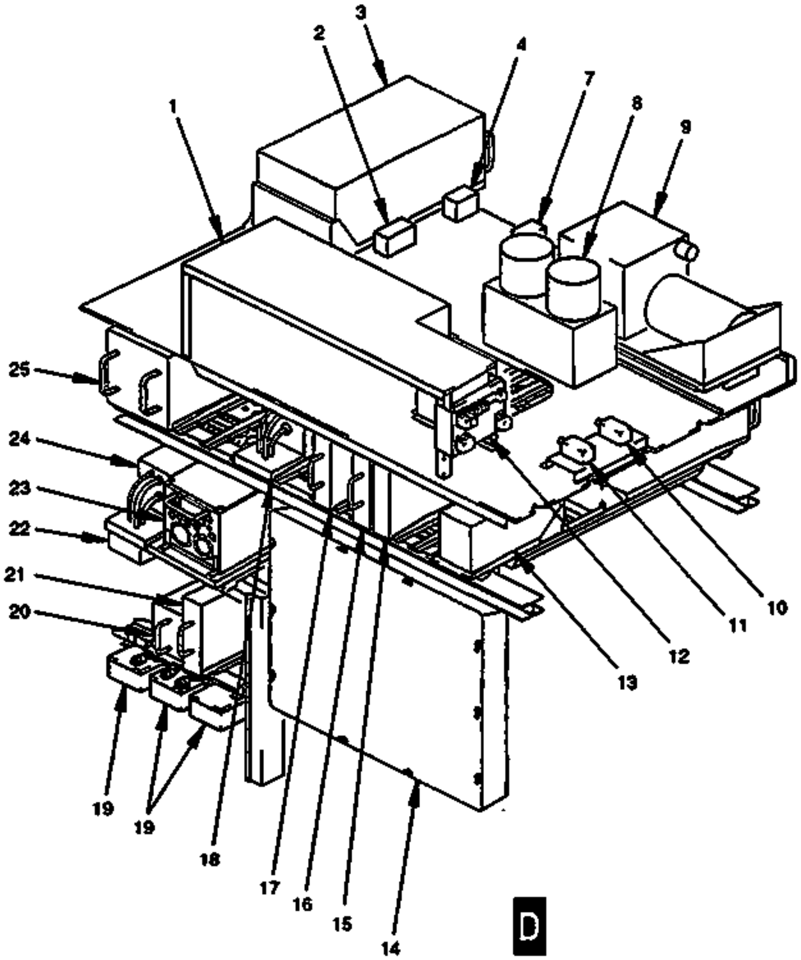
9A. RADAR DATA PROCESSOR (RDP)

10. HF NO. 2 RCVR-XMTR (TYPE RT-1341(V)3/ARC-190)
11. INTERPHONE JUNCTION BOX

1. ELECTRIC COOLING VALVE OVERRIDE HANDLE
2. INSTRUCTION PLATE

D8005501 H

Figure 1-209. Underdeck Electronics Equipment (Sheet 1 of 3)

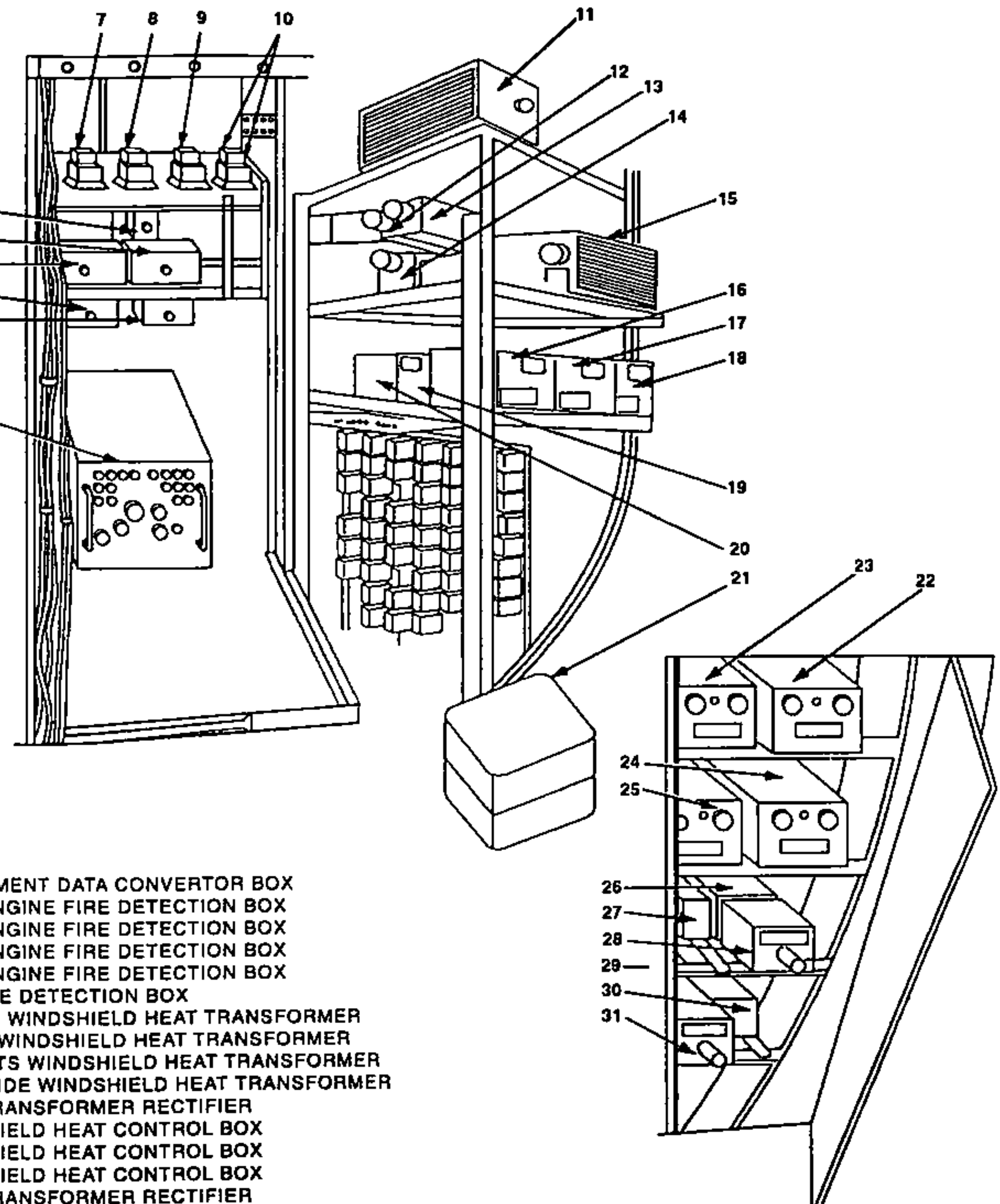


1. NAVIGATION SELECTOR JUNCTION BOX
2. AUDIO AMPLIFIER APN-169
3. WEATHER RADAR RCVR-XMTR
4. ARTIFICIAL FEEL COMPARATOR
5. DELETED
6. DELETED
7. INDICATOR-COUPLER APN-169B
8. COOLING AIR BLOWER/ARC-190(V)
9. DISPLACEMENT GYROSCOPE ASSEMBLY
10. NO. 1 LONGITUDINAL ACCELEROMETER
11. NO. 2 LONGITUDINAL ACCELEROMETER
12. FMS RELAYS
13. VOR/ILS/MB RECEIVER NO. 1 (TYPE R-2325 (V) 1/ARN-147(V))
14. AUTOPILOT JUNCTION BOX
15. L-BAND SATCOM TRANSCEIVER (TT-3024A)
16. AMPLIFIER POWER SUPPLY NO. 2
17. AMPLIFIER POWER SUPPLY NO. 1
18. VHF NO. 1 TRANSCEIVER
19. PUBLIC ADDRESS AMPLIFIERS
20. VOR/ILS/MB RECEIVER NO. 2 (TYPE R-2325 (V) 1/ARN-147(V))
21. TAWS COMPUTER
22. ELECTRONIC TEST EQUIPMENT OUTLET
23. MODE S/IFF TRANSPONDER
24. VHF NO. 2 TRANSCEIVER
25. DISPLAY INTERFACE UNIT (DIU)

⚠1 AIRCRAFT MODIFIED BY TCTO 729.
⚠2 AIRCRAFT MODIFIED BY TCTO 757.

D8005502 F

Figure 1-209. Underdeck Electronics Equipment (Sheet 2 of 3)



1. INSTRUMENT DATA CONVERTOR BOX
2. NO. 2 ENGINE FIRE DETECTION BOX
3. NO. 4 ENGINE FIRE DETECTION BOX
4. NO. 3 ENGINE FIRE DETECTION BOX
5. NO. 1 ENGINE FIRE DETECTION BOX
6. APU FIRE DETECTION BOX
7. CENTER WINDSHIELD HEAT TRANSFORMER
8. PILOTS WINDSHIELD HEAT TRANSFORMER
9. COPILOTS WINDSHIELD HEAT TRANSFORMER
10. LH/RT SIDE WINDSHIELD HEAT TRANSFORMER
11. NO. 1 TRANSFORMER RECTIFIER
12. WINDSHIELD HEAT CONTROL BOX
13. WINDSHIELD HEAT CONTROL BOX
14. WINDSHIELD HEAT CONTROL BOX
15. NO. 2 TRANSFORMER RECTIFIER
16. VOLTAGE REGULATOR NO. 2
17. VOLTAGE REGULATOR NO. 3
18. VOLTAGE REGULATOR NO. 4
19. VOLTAGE REGULATOR NO. 1
20. AUX GEN. VOLTAGE REGULATOR
21. BATTERY
22. GENERATOR PROTECTION PANEL NO. 2
23. GENERATOR PROTECTION PANEL NO. 1
24. GENERATOR PROTECTION PANEL NO. 4
25. GENERATOR PROTECTION PANEL NO. 3
26. NO. 3 LOAD CONTROLLER
27. AUX. GEN. PROTECTION PANEL
28. NO. 4 LOAD CONTROLLER
29. NO. 1 LOAD CONTROLLER (Not Shown)
30. BUS PROTECTION PANEL
31. NO. 2 LOAD CONTROLLER

Figure 1-209. Underdeck Electronics Equipment (Sheet 3 of 3)

USTS ANTENNA SUBSYSTEM

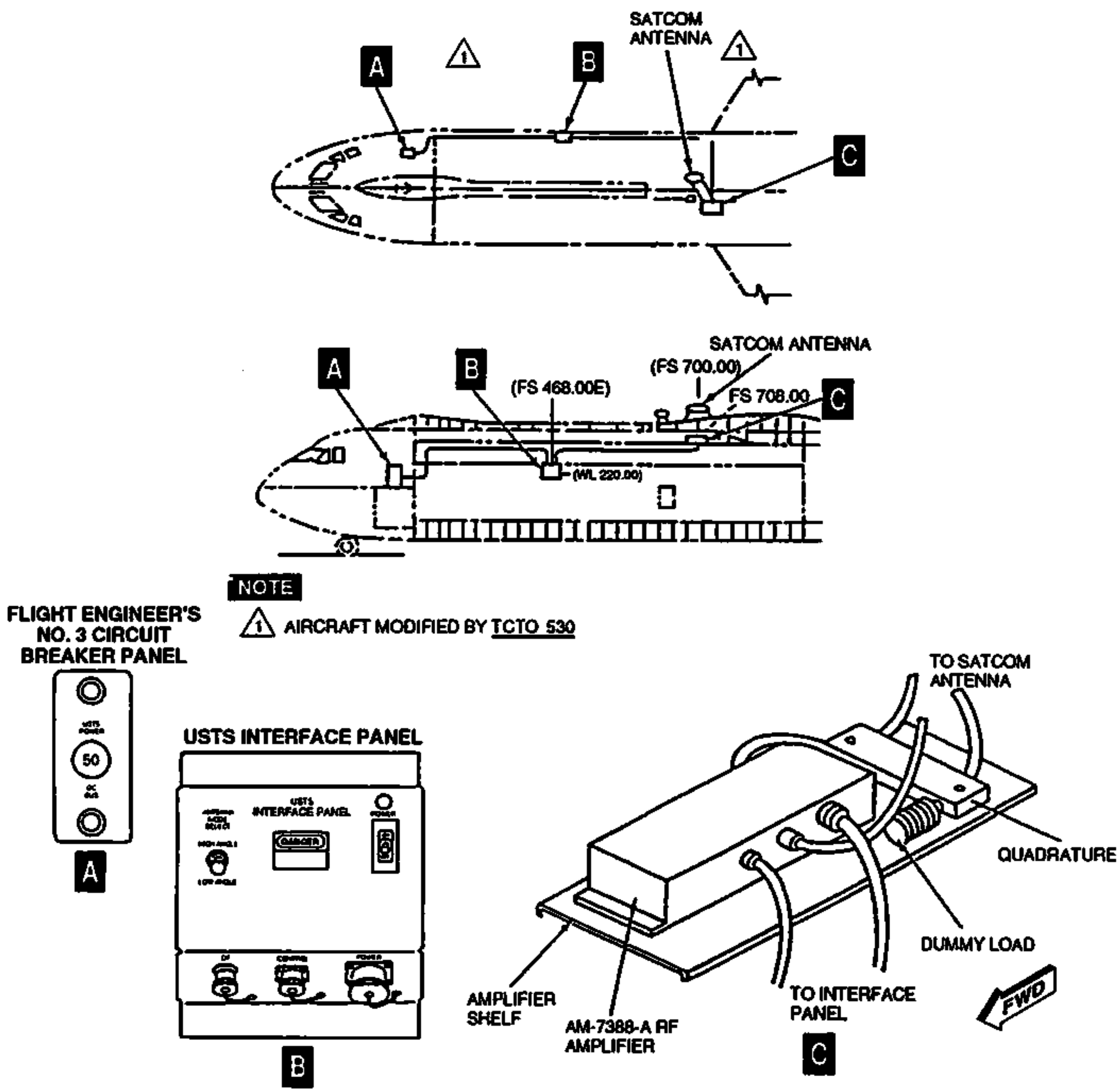


Figure 1-210. USTS Antenna Subsystem (Sheet 1 of 2)

USTS ANTENNA SUBSYSTEM

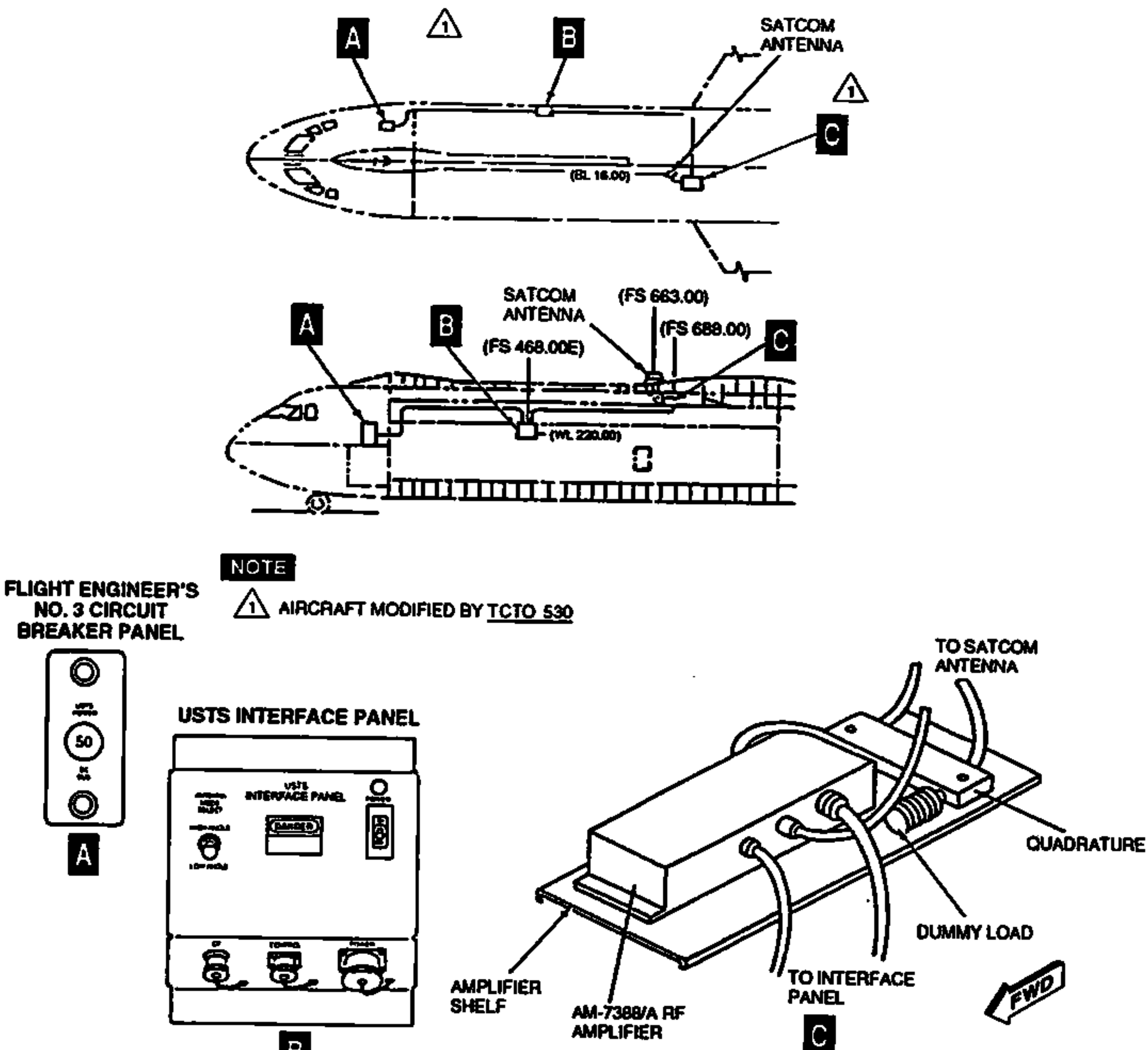
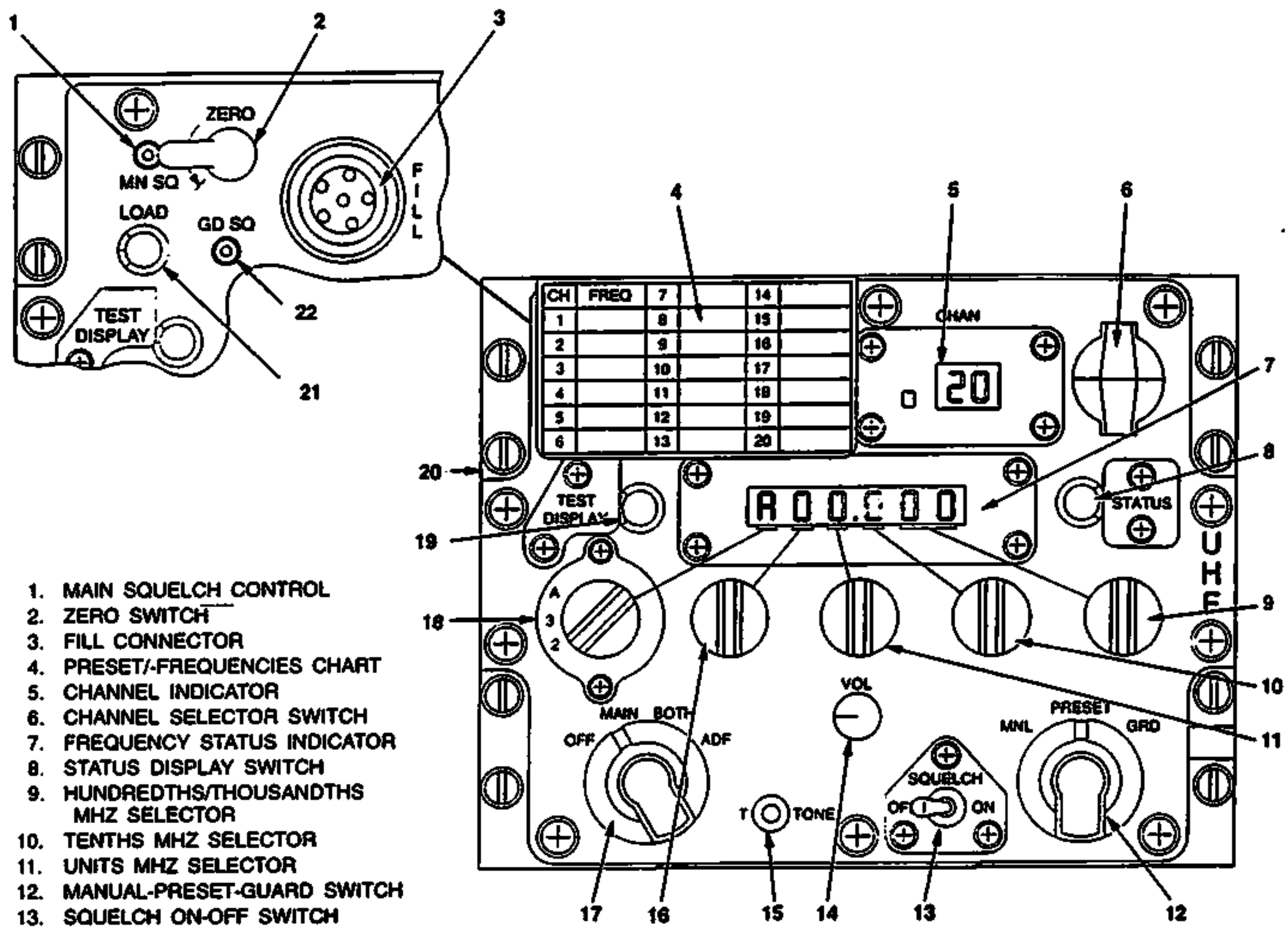


Figure 1-210. USTS Antenna Subsystem (Sheet 2 of 2)

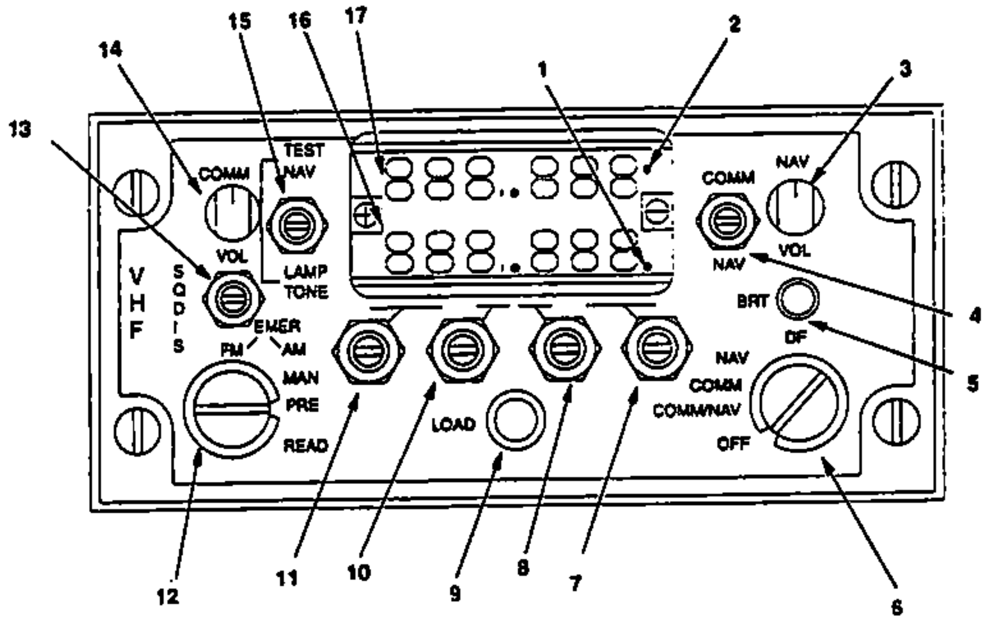
UHF RADIO AN/ARC-164(V) DIGITAL



1. MAIN SQUELCH CONTROL
2. ZERO SWITCH
3. FILL CONNECTOR
4. PRESET/-FREQUENCIES CHART
5. CHANNEL INDICATOR
6. CHANNEL SELECTOR SWITCH
7. FREQUENCY STATUS INDICATOR
8. STATUS DISPLAY SWITCH
9. HUNDREDTHS/THOUSANDTHS MHZ SELECTOR
10. TENTHS MHZ SELECTOR
11. UNITS MHZ SELECTOR
12. MANUAL-PRESET-GUARD SWITCH
13. SQUELCH ON-OFF SWITCH
14. VOLUME CONTROL
15. T-TONE SWITCH
16. TENS MHZ SELECTOR
17. FUNCTION SWITCH
18. 2-3-A/FREQUENCY SWITCHES
19. TEST DISPLAY SWITCH
20. UHF TRANSCEIVER
21. LOAD SWITCH
22. GUARD SQUELCH CONTROL

Figure 1-211. UHF Radio AN/ARC-164(V) Digital

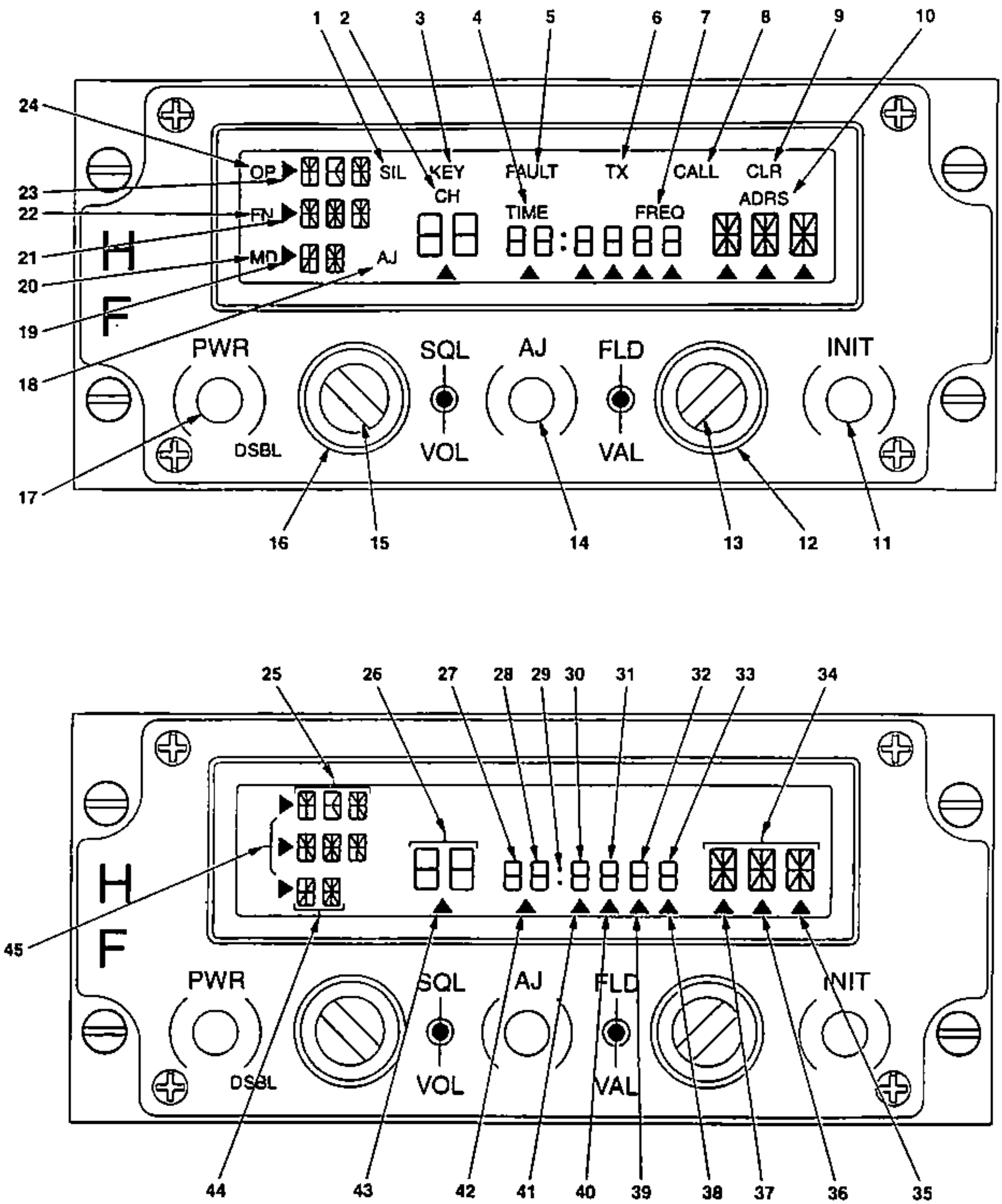
VHF RADIO AN/ARC-186(V)



1. NAV SLEW SWITCH ACTIVE/INACTIVE INDICATOR
2. COMM SLEW SWITCH ACTIVE/INACTIVE INDICATOR
3. NAV VOLUME CONTROL
4. SLEW ENABLE SELECT SWITCH
5. DISPLAY BRIGHTNESS CONTROL
6. MODE SELECT SWITCH
7. HUNDREDTHS/THOUSANDTHS PRESET CHANNEL SLEW SWITCH
8. TENTHS SLEW SWITCH
9. MEMORY LOAD SWITCH
10. UNITS SLEW SWITCH
11. TENS/HUNDREDS SLEW SWITCH
12. COMM MODE CONTROL SWITCH
13. SQUELCH DISABLE/TONE SELECT SWITCH
14. COMM VOLUME CONTROL
15. NAV LAMP SWITCH
16. NAV DISPLAY
17. COMM DISPLAY

Figure 1-212. VHF Radio AN/ARC-186(V)

HF RADIO AN/ARC-190(V)



HF ACS CONTROLS

Figure 1-213. HF Radio AN/ARC-190(V) (Sheet 1 of 2)

1.	SILENT (SIL) INDICATOR
2.	CHANNEL (CH) INDICATOR
3.	KEY INDICATOR
4.	TIME INDICATOR
5.	FAULT INDICATOR
6.	TRANSMIT (TX) INDICATOR
7.	FREQUENCY (FREQ) INDICATOR
8.	CALL INDICATOR
9.	CLEAR (CLR) INDICATOR
10.	ADDRESS (ADRS) INDICATOR
11.	INITIATE (INIT) PUSHBUTTON
12.	FIELD (FLD) SLEW SELECTOR (OUTER KNOB)
13.	VALUE (VAL) SLEW SELECTOR (INNER KNOB)
14.	ANTIJAN (AJ) PUSHBUTTON
15.	VOLUME (VOL) SWITCH (INNER KNOB)
16.	SQUELCH (SQL) SWITCH (OUTER KNOB)
17.	POWER (PWR) PUSHBUTTON
18.	ANTIJAM (AJ) INDICATOR
19.	MODE CURSOR
20.	MODE (MD) INDICATOR
21.	FUNCTION CURSOR
22.	FUNCTION (FN) INDICATOR
23.	OPERATION CURSOR
24.	OPERATION (OP) INDICATOR
25.	OPERATION DISPLAY FIELD
26.	CHANNEL DISPLAY FIELD
27 – 33.	TIME/FREQUENCY DISPLAY FIELD
27 – 28.	LQA (0 TO 18) DISPLAY FILED
30 – 33.	ADDRESS PROTECTION KEY DISPLAY FIELD
31 – 33.	MESSAGE NIBBLE NUMBERS DISPLAY FIELD
32 – 33.	ADDRESS INDEX NUMBERS DISPLAY FIELD
34.	ADDRESS DISPLAY FIELD
35 – 37.	ADDRESS CURSORS
38 – 42.	TIME/FREQUENCY CURSORS
43.	CHANNEL CURSOR
44.	MODE DISPLAY FIELD
45.	FUNCTION DISPLAY FIELD

HF ACS CONTROL LEGEND

Figure 1-213. HF Radio AN/ARC-190(V) (Sheet 2 of 2)

HF RADIO ACS KEYFILL PANELS

NOTE

SPECIFIC COMPONENT LOCATIONS MAY VARY DUE TO MISSION CONFIGURATION.

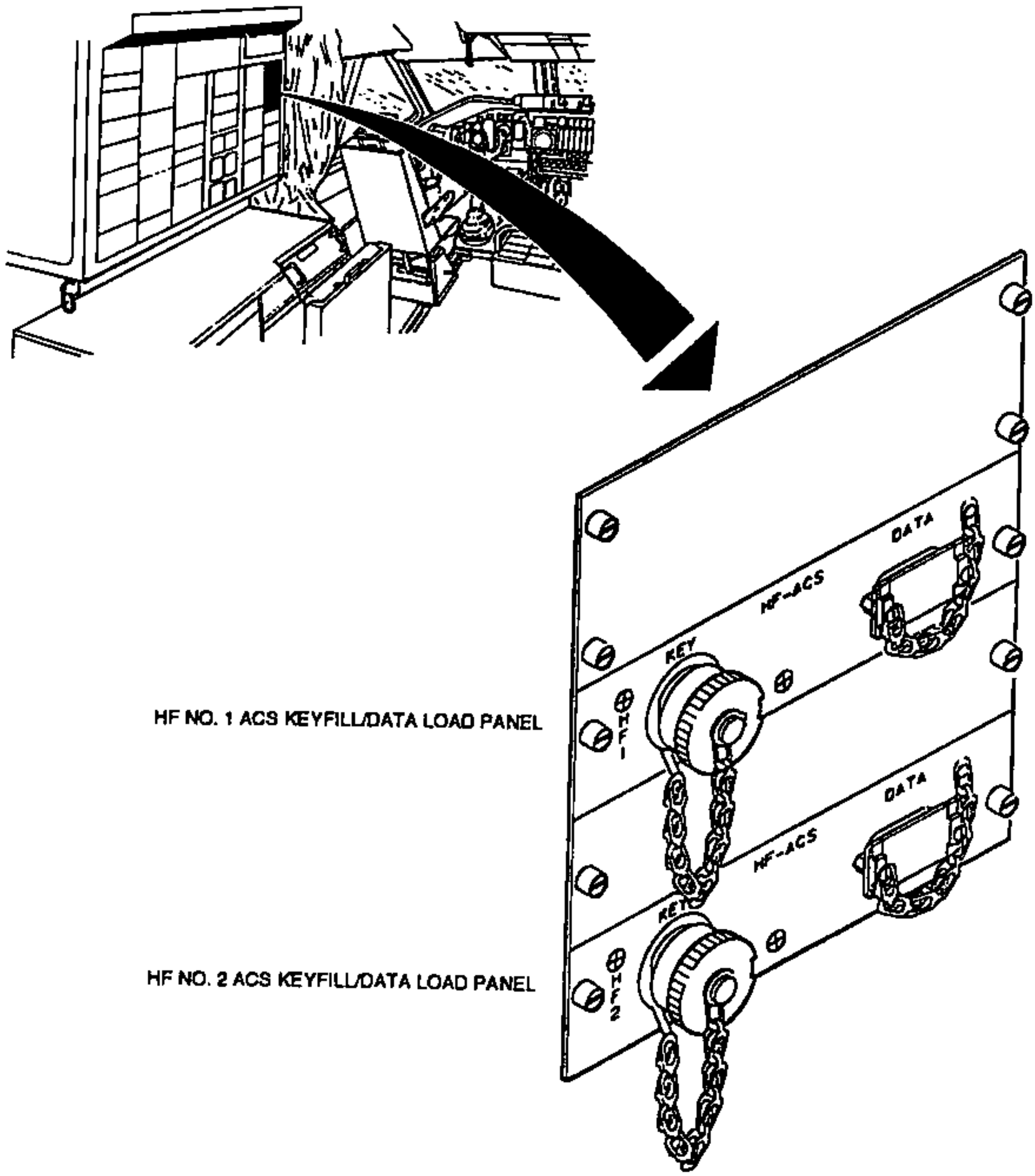


Figure 1-214. HF Radio ACS Keyfill Panels

MULTIPLE RADIO TRANSMIT PANEL

NOTE

SPECIFIC COMPONENT LOCATION MAY VARY DUE TO MISSION CONFIGURATION.

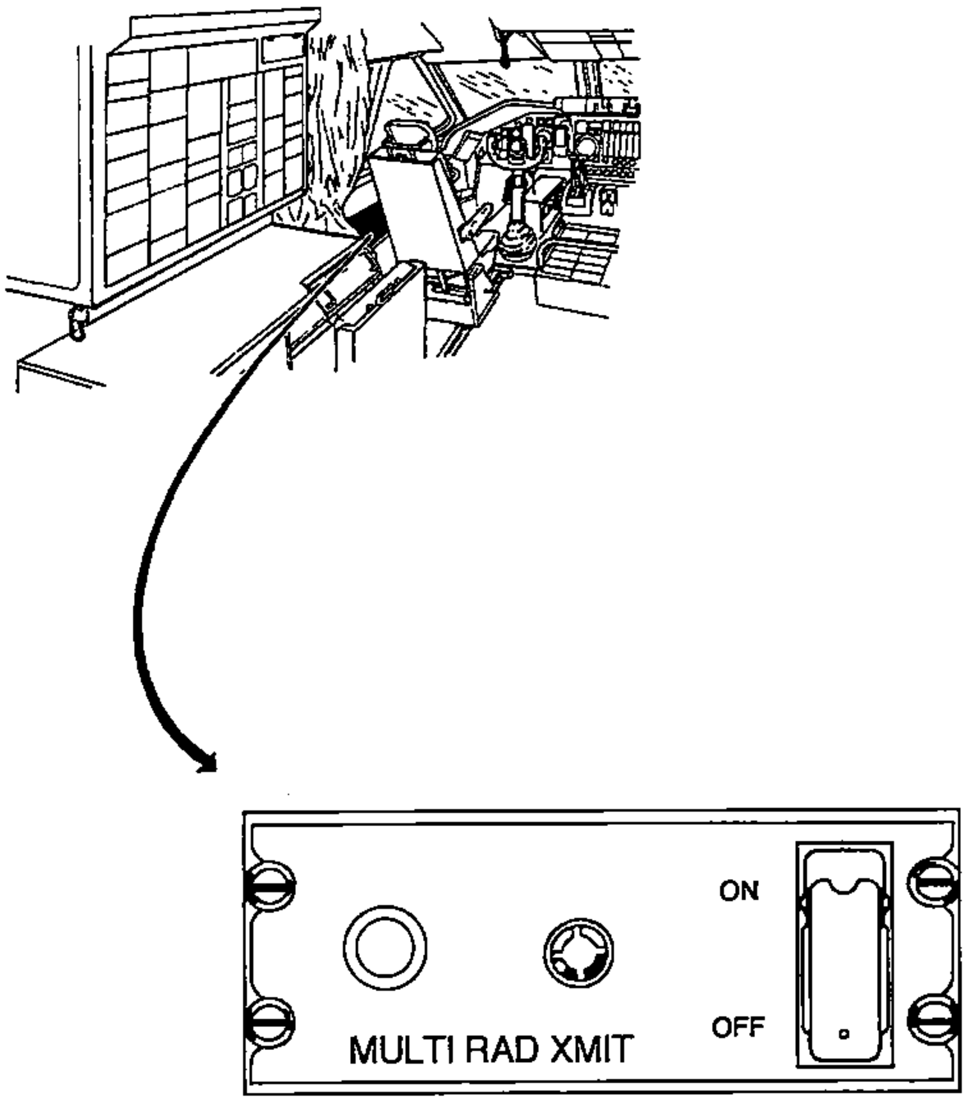
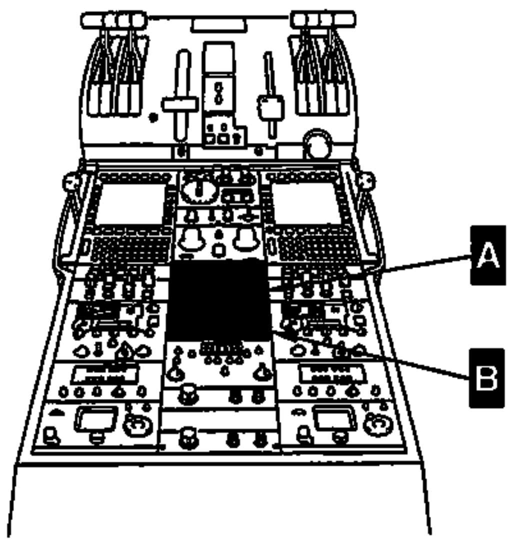
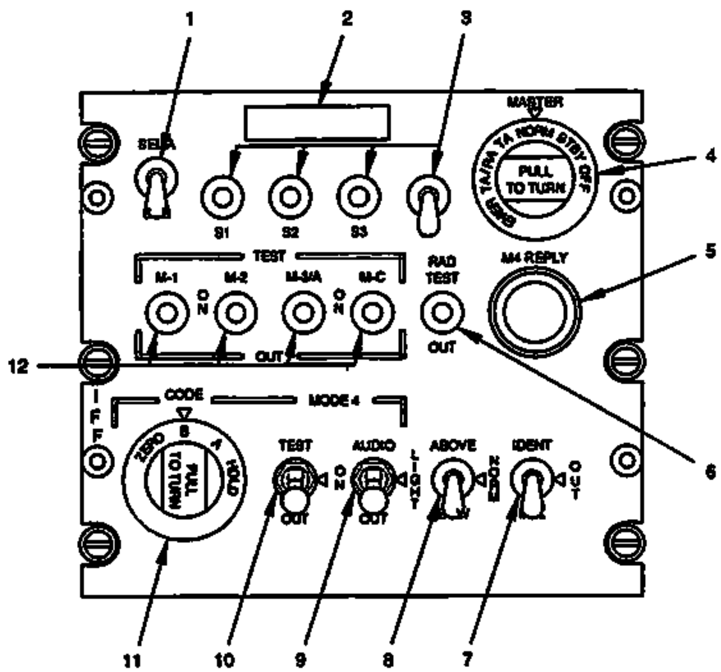


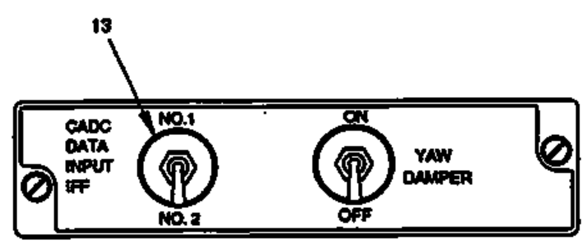
Figure 1-215. Multiple Radio Transmit Panel

IFF PANELS





A

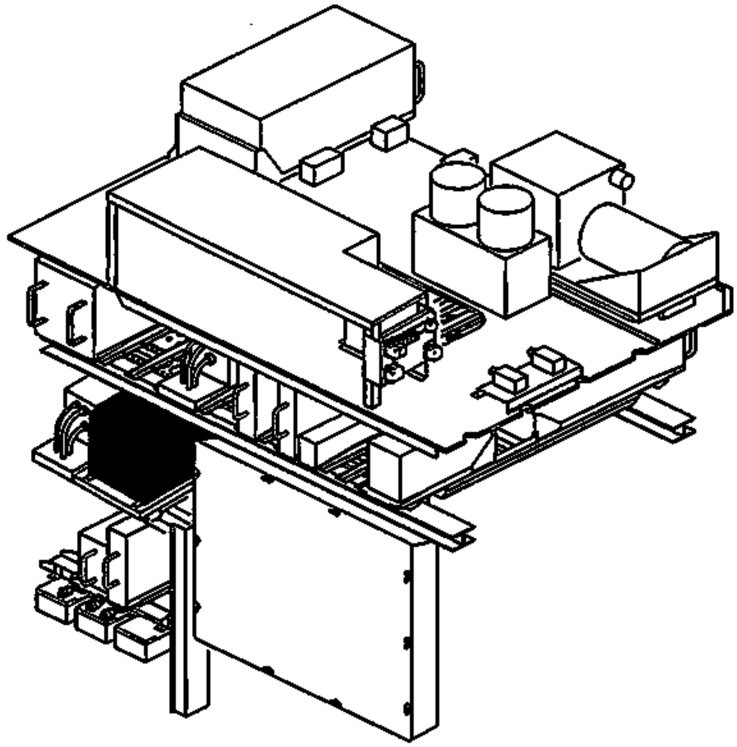


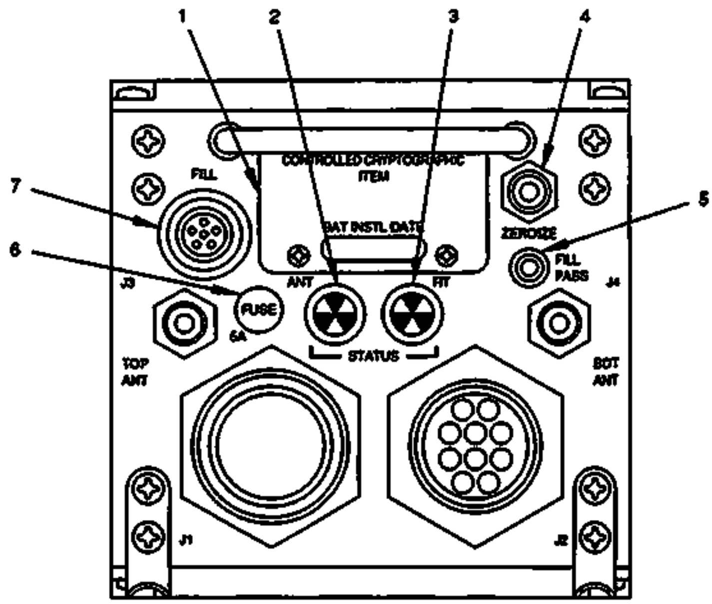
B

1. SEL A/SEL B-Spring loaded three-position switch.
2. EIGHT CHARACTER DISPLAY.
3. S1,S2,S3,S4-Spring loaded three-position switches.
4. MASTER-six-position, pull to turn,rotary switch.
5. MODE 4 REPLY-indicator.
6. RAD TEST-Spring loaded two-position switch.
7. IDENT/OUT/MIC-three-position switch.
8. ABOVE/NORM/BELOW (Altitude Select) Switch-three-position switch.
9. MODE 4 AUDIO/LIGHT/OUT-three-position switch.
10. MODE 4 TEST/ON/OUT-three-position switch.
11. MODE 4 CODE ZERO/B/A/HOLD PULL TO ZERO-four-position rotary switch.
12. M-1,M-2,M-3/A,M-C TEST/ON/OUT-three position switches.
13. CADC DATA INPUT IFF SWITCH.

D8033901 F

Figure 1-216. IFF Panels (Sheet 1 of 2)





1. BATTERY COVER
2. ANTENNA STATUS INDICATOR
3. RT (TRANSPONDER) STATUS INDICATOR
4. ZEROIZE - PUSH BUTTON
5. FILL PASS - INDICATOR
6. FUSE 5A
7. FILL CONNECTOR

D8033902 C

Figure 1-216. IFF Panels (Sheet 2 of 2)

KY-58 COMPONENT LOCATION

NOTE

SPECIFIC COMPONENT LOCATIONS MAY VARY DUE TO MISSION CONFIGURATION

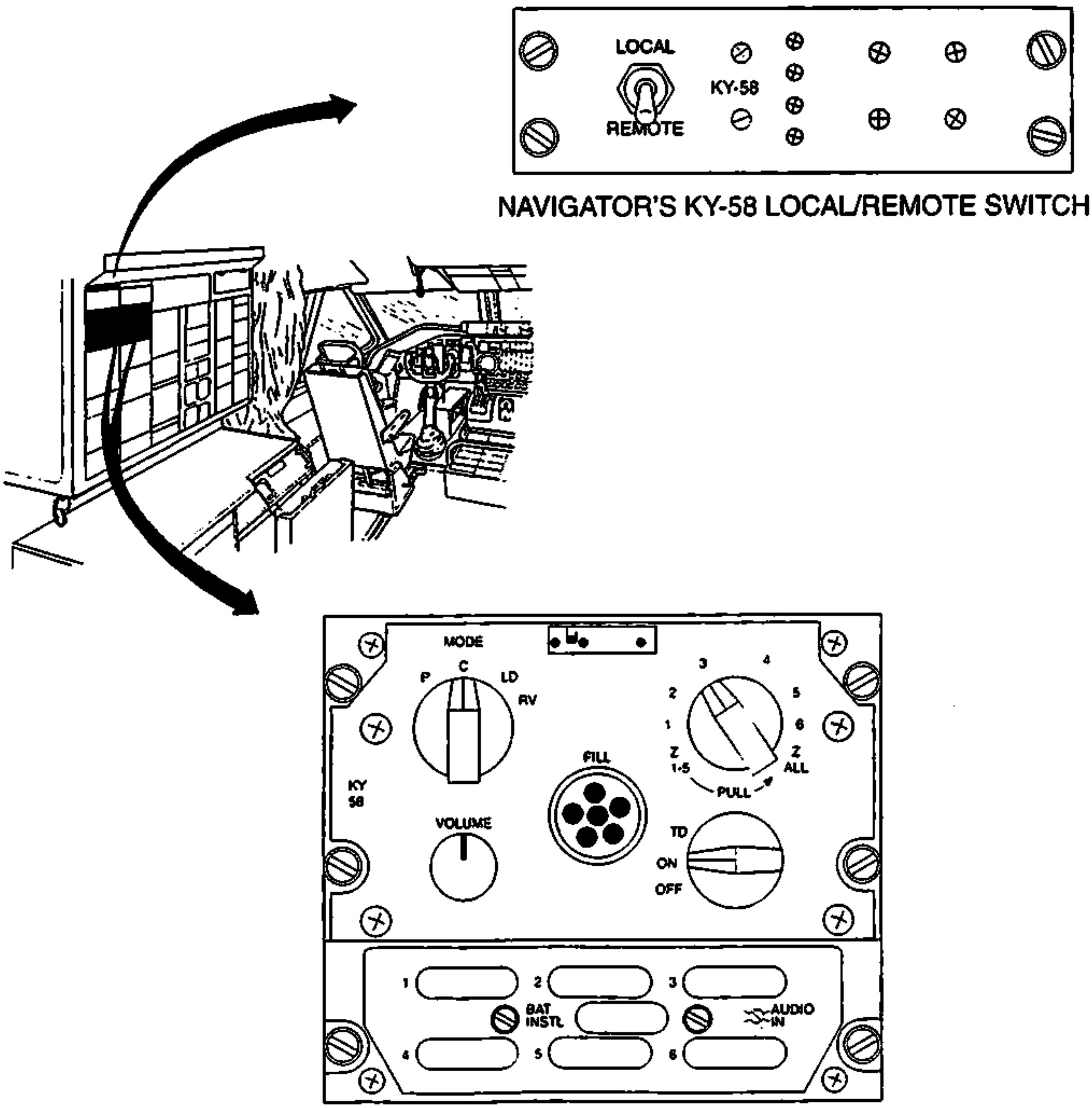
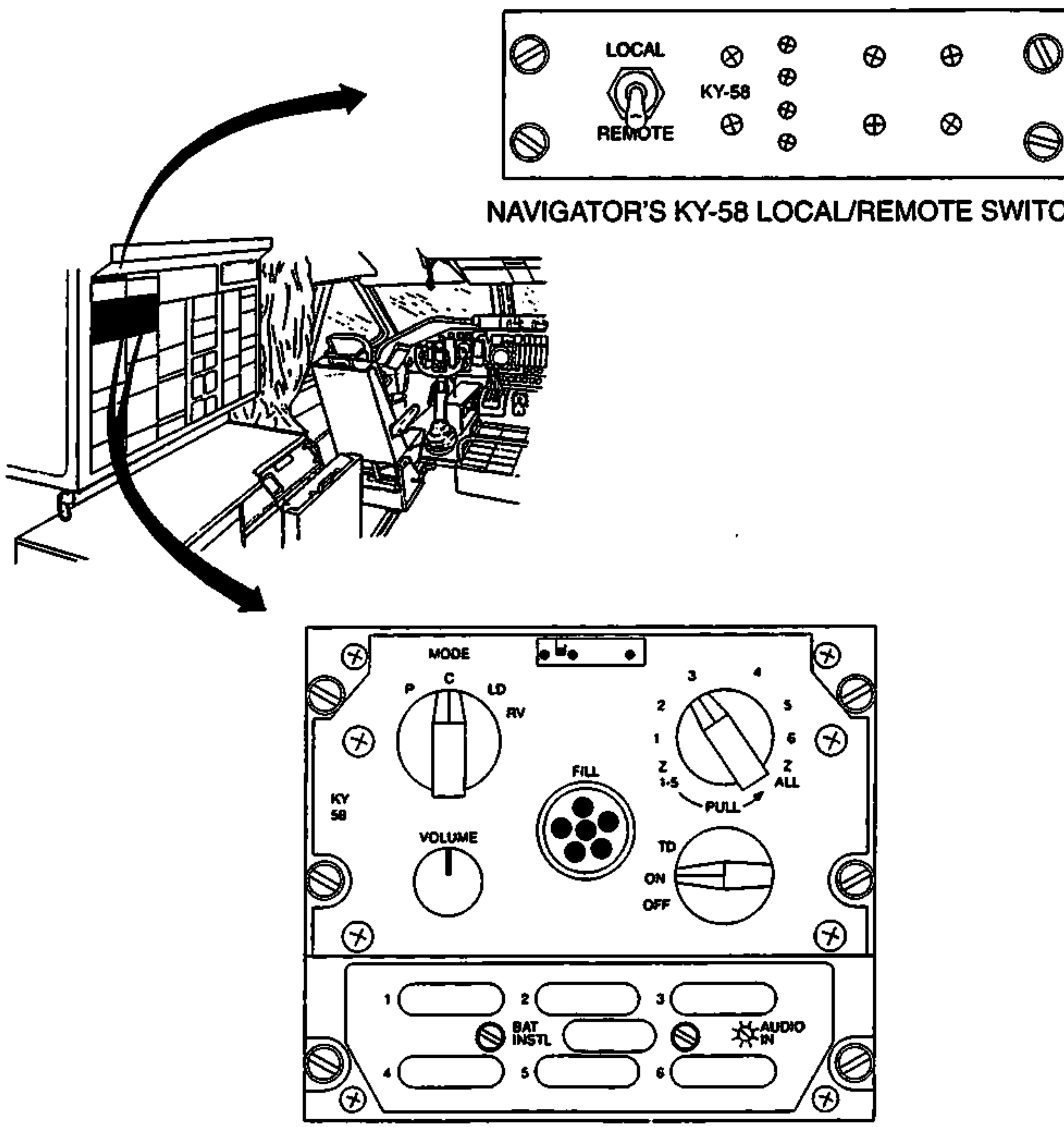


Figure 1-217. KY-58 Component Location (Sheet 1 of 2)

KY-58 COMPONENT LOCATION

NOTE

SPECIFIC COMPONENT LOCATIONS MAY VARY DUE TO MISSION CONFIGURATION



NAVIGATOR'S KY-58 LOCAL/REMOTE SWITCH

NAVIGATOR'S KY-58 PROCESSOR

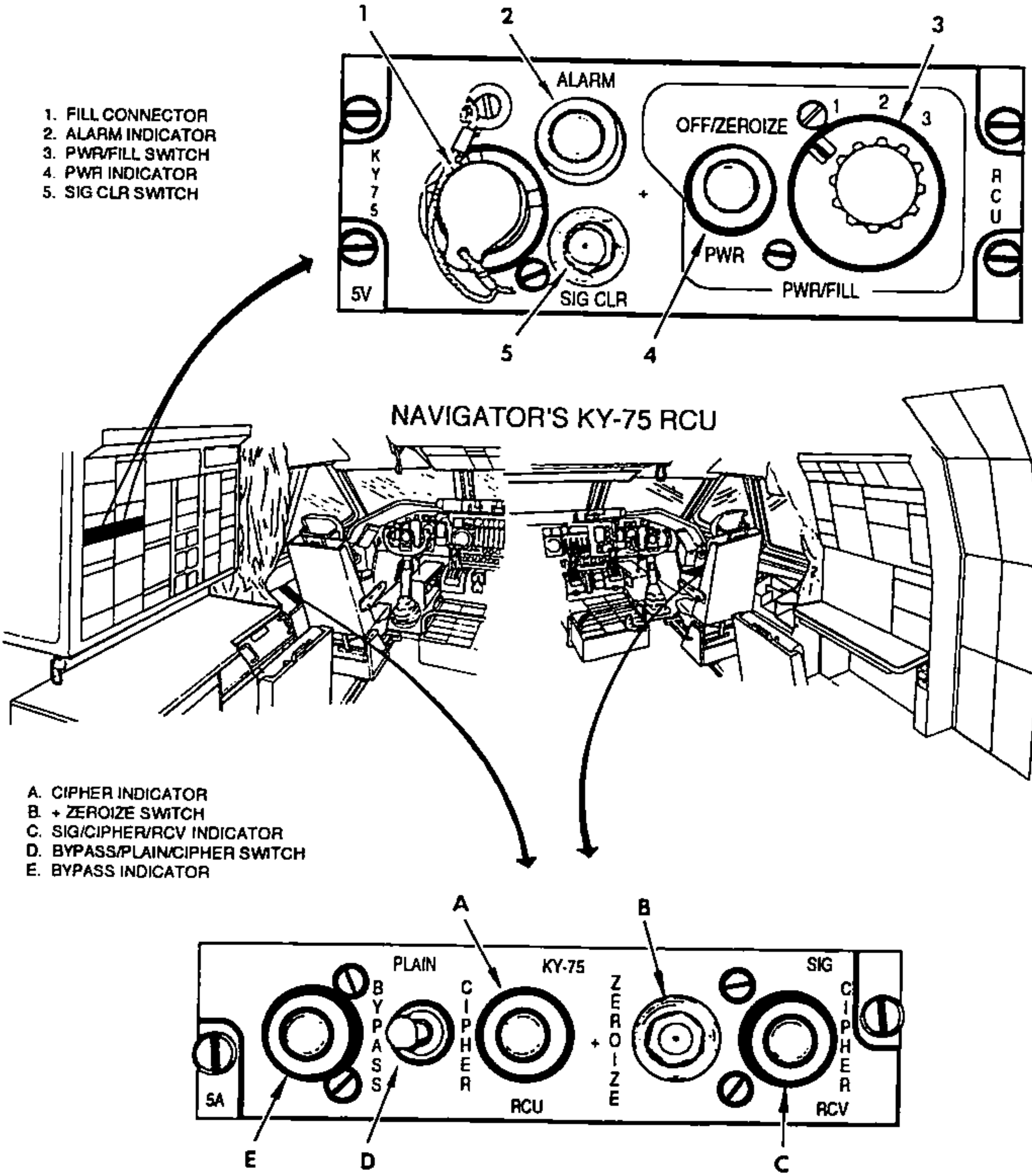
Figure 1-217. KY-58 Component Location (Sheet 2 of 2)

KY-75 COMPONENT LOCATION

NOTE

SPECIFIC COMPONENT LOCATIONS MAY VARY DUE TO MISSION CONFIGURATION.

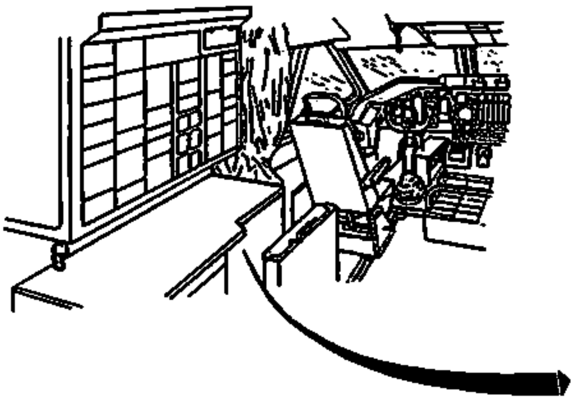
1. FILL CONNECTOR
2. ALARM INDICATOR
3. PWR/FILL SWITCH
4. PWR INDICATOR
5. SIG CLR SWITCH

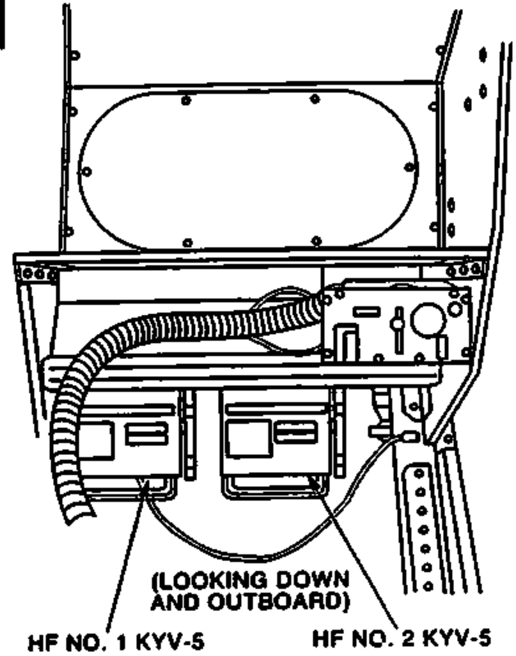


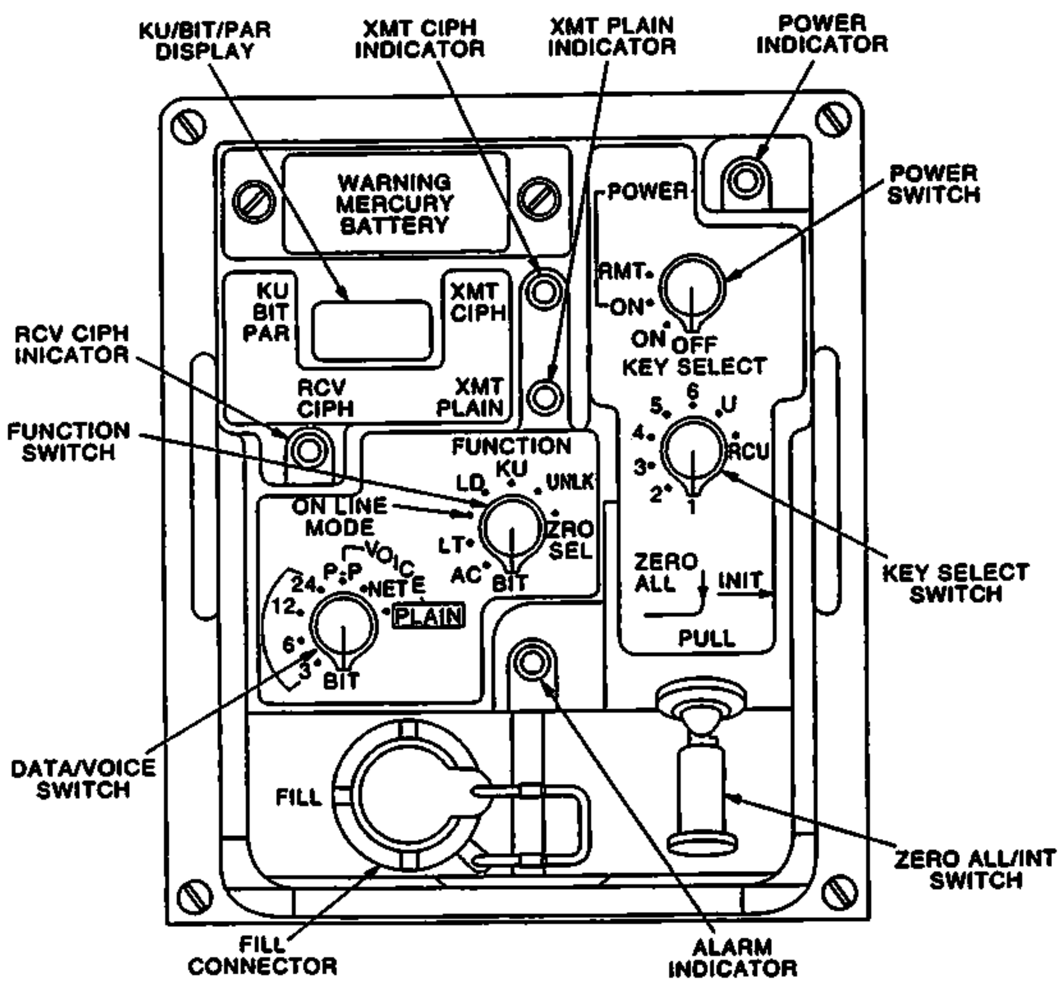
A. CIPHER INDICATOR
B. + ZEROIZE SWITCH
C. SIG/CIPHER/RCV INDICATOR
D. BYPASS/PLAIN/CIPHER SWITCH
E. BYPASS INDICATOR

Figure 1-218. KY-75 Component Location

KYV-5 COMPONENT LOCATIONS





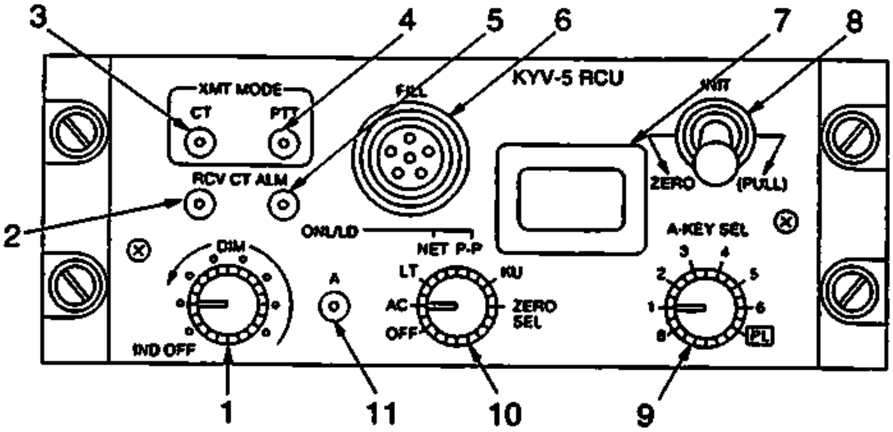


KYV-5 COMSEC MODULE (CM)

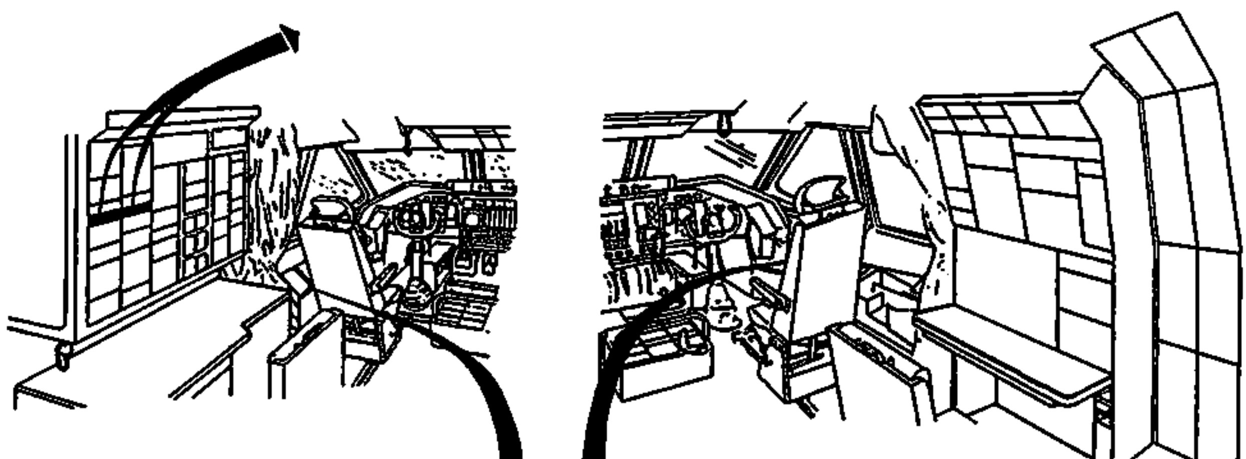
Figure 1-219. KYV-5 Component Locations (Sheet 1 of 2)

KYV-5 COMPONENT LOCATIONS

1. IND OFF/DIM SWITCH
2. RCV LIGHT
3. XMT MODE CT LIGHT
4. XMT MODE PT LIGHT
5. ALM LIGHT
6. FILL CONNECTOR
7. NUMERIC DISPLAY
8. INIT/ZERO (PULL) SWITCH
9. A-KEY SELECT SWITCH
10. FUNCTION SWITCH
11. A INDICATOR



NAVIGATOR'S KYV-5 RCU-IIA



A. DIM SWITCH
B. LT PUSH BUTTON
C. XMT MODE PT LIGHT
D. XMIT MODE CT LIGHT

E. NET/P-P SWITCH
F. RCV CT LIGHT
G. B INDICATOR
H. BYPASS/ANDVT/ZERO (PULL) SWITCH

PILOT'S & COPILOT'S KYV-5 RCU-IIB

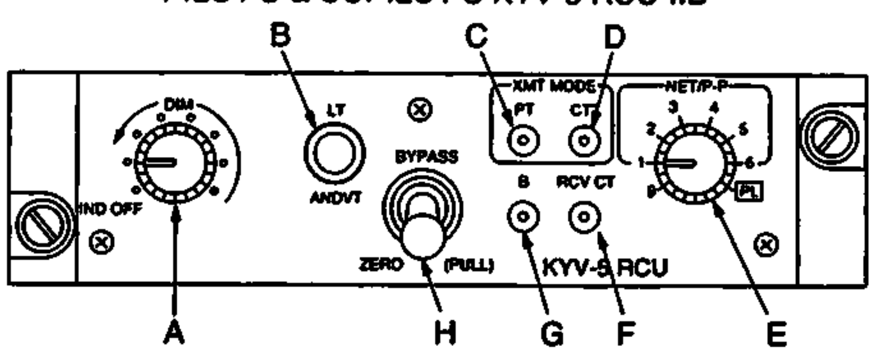


Figure 1-219. KYV-5 Component Locations (Sheet 2 of 2)

HAND HELD GPS (HHGPS)

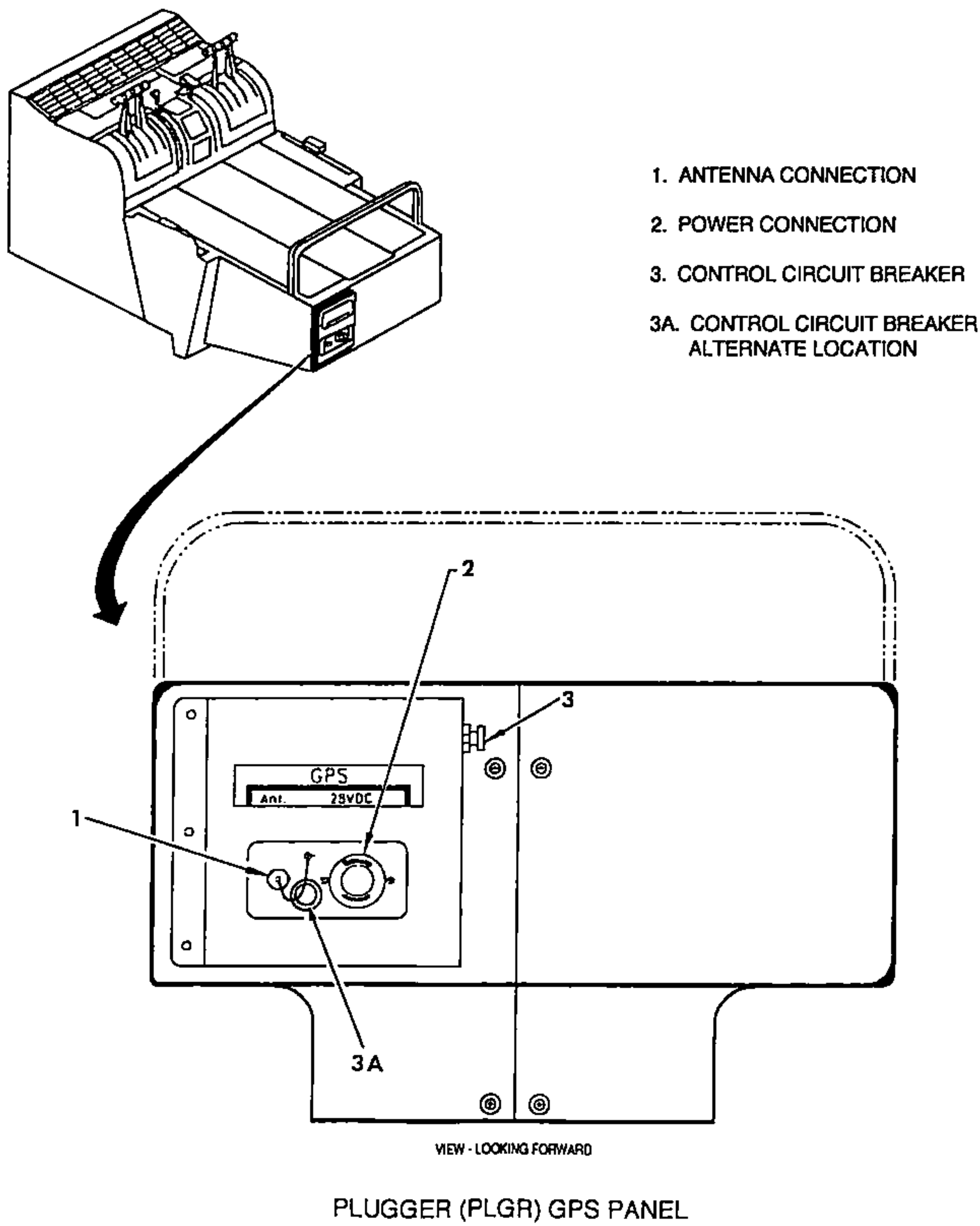


Figure 1-220. Hand Held GPS (HHGPS)

L-BAND SATCOM COMPONENTS

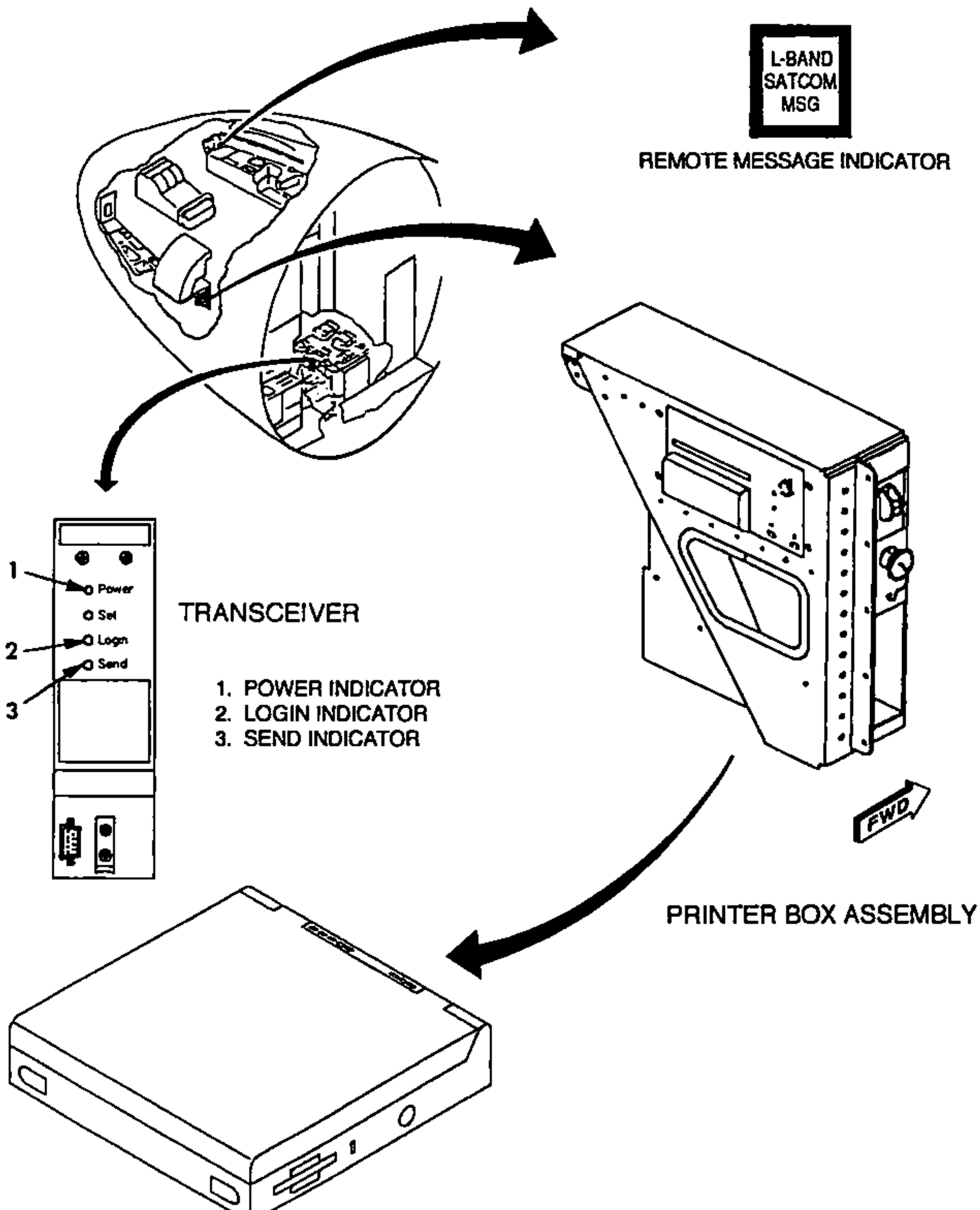


Figure 1-221. L-Band SATCOM Components (Sheet 1 of 2)

L-BAND SATCOM COMPONENTS

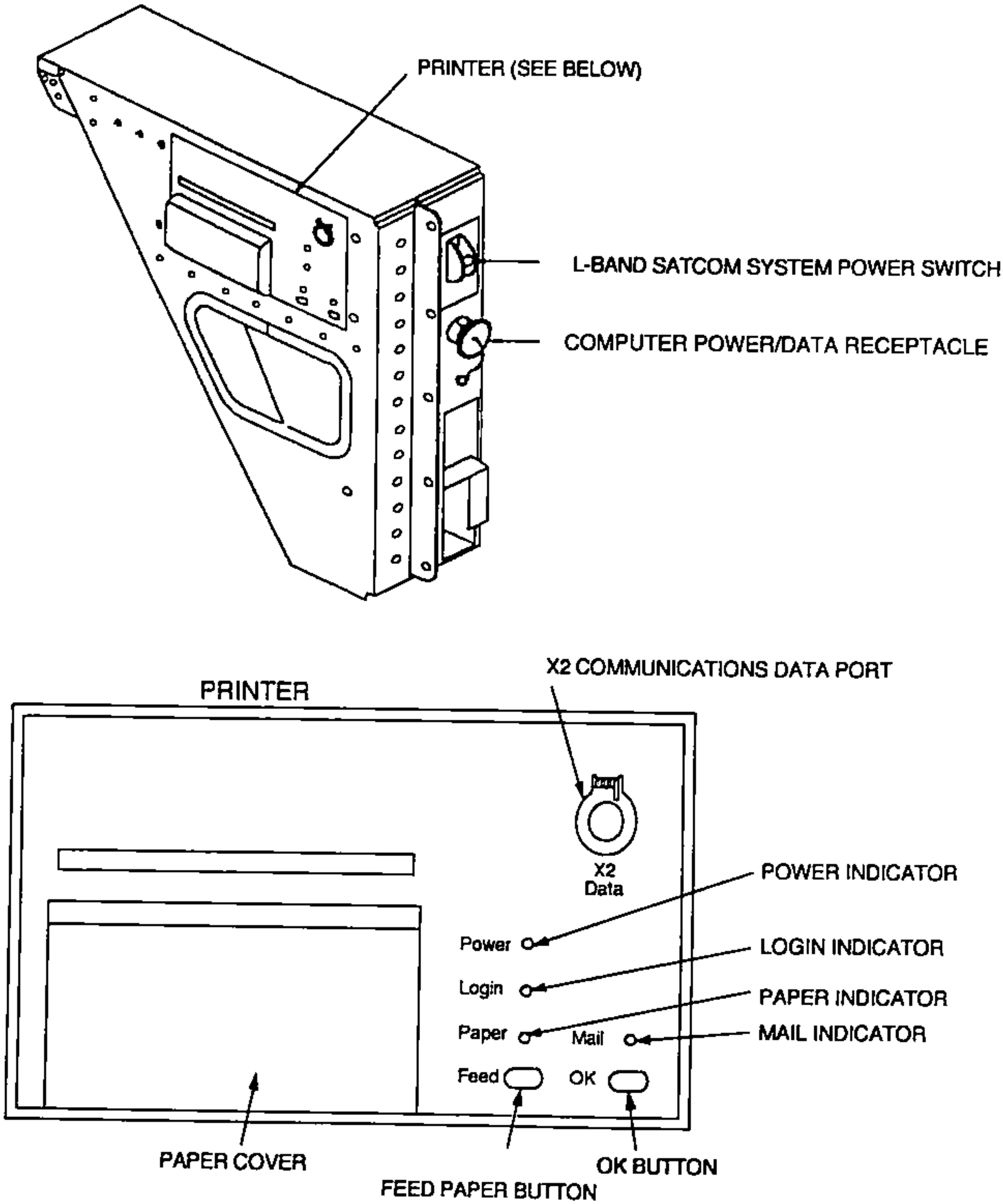
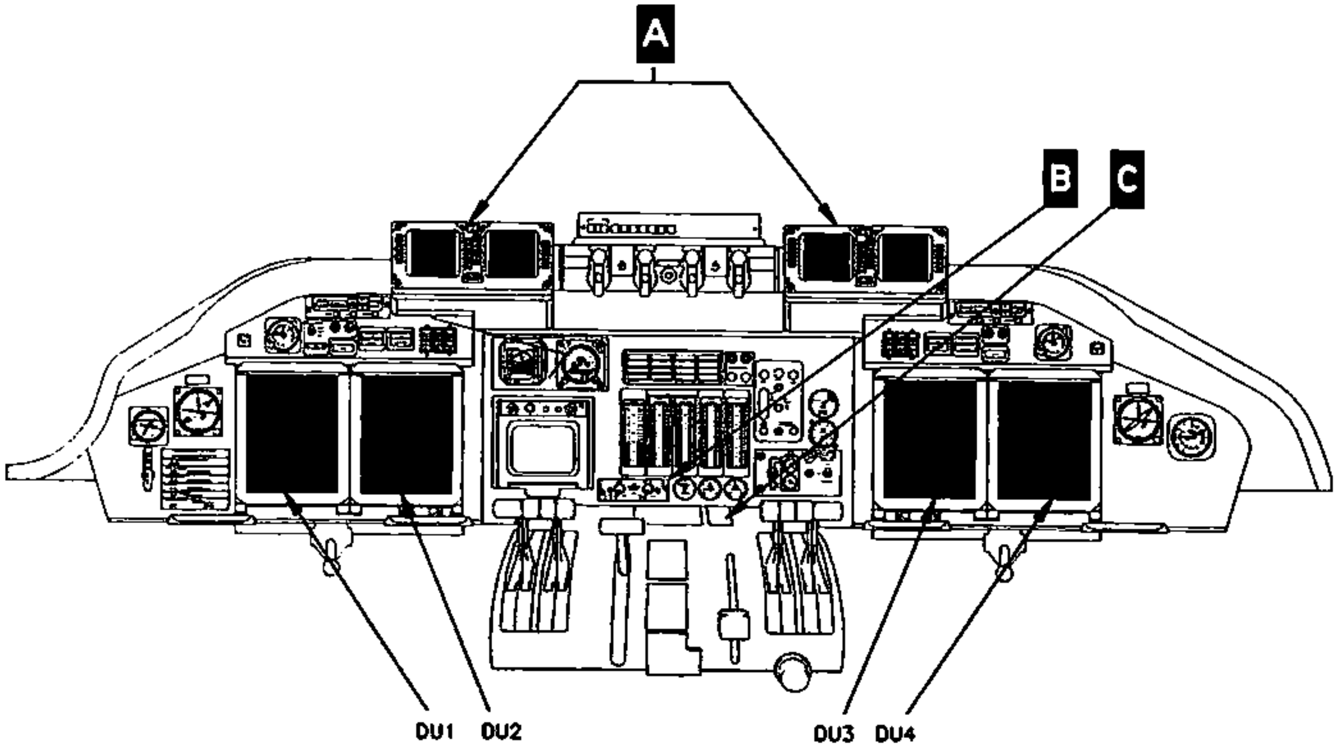
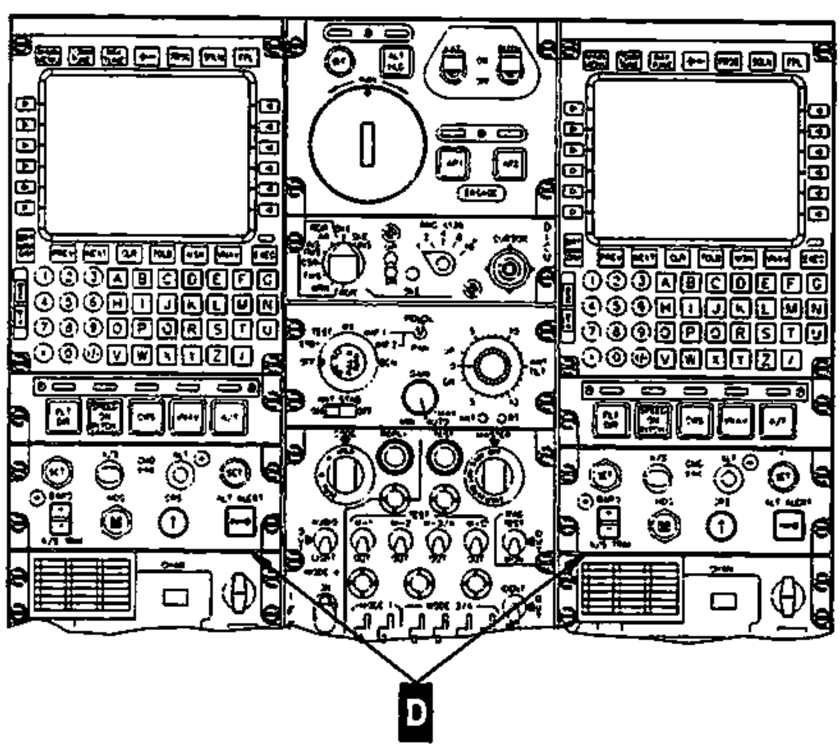


Figure 1-221. L-Band SATCOM Components (Sheet 2 of 2)

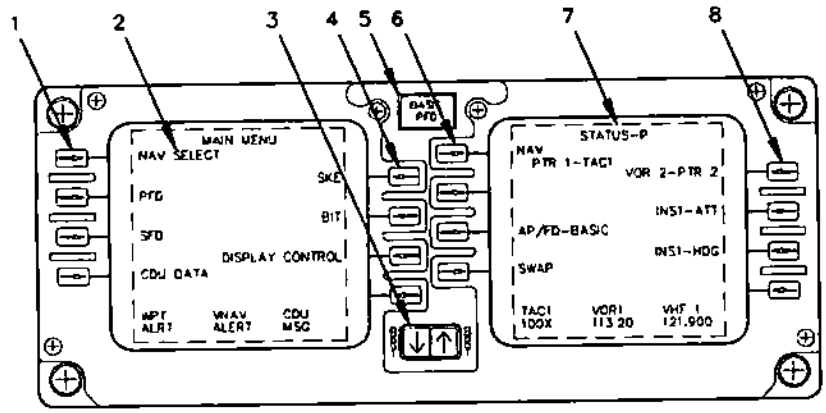
CONTROL DISPLAY SYSTEM





D302290¹ H

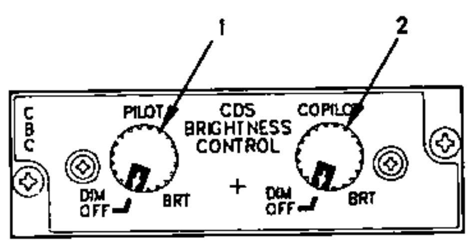
Figure 1-222. Control Display System (Sheet 1 of 3)



1. LINE SELECT KEYS 1, 3, 5 AND 7
2. LEFT DISPLAY SCREEN
3. BRIGHTNESS UP-DOWN SWITCH
4. LINE SELECT KEYS 2, 4, 6 AND 8
5. BASIC PFD KEY
6. LINE SELECT KEYS 1, 3, 5 AND 7
7. RIGHT DISPLAY SCREEN
8. LINE SELECT KEYS 2, 4, 6 AND 8

A

DISPLAY AVIONICS MANAGEMENT UNIT (DAMU)
POWER-UP DISPLAY (TYPICAL)
MAIN MENU (LEFT SCREEN) – STATUS MENU (RIGHT SCREEN)



B

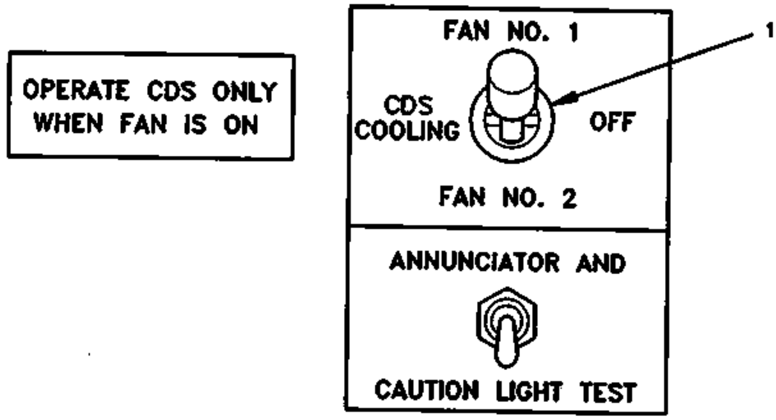
CDS BRIGHTNESS CONTROL

1. PILOT'S DIM/BRIGHT SWITCH
2. COPILOT'S DIM/BRIGHT SWITCH

NOTE: "OFF" FUNCTION IS ONLY ACTIVE DURING GROUND MAINTENANCE ACTIONS.

03022903 C

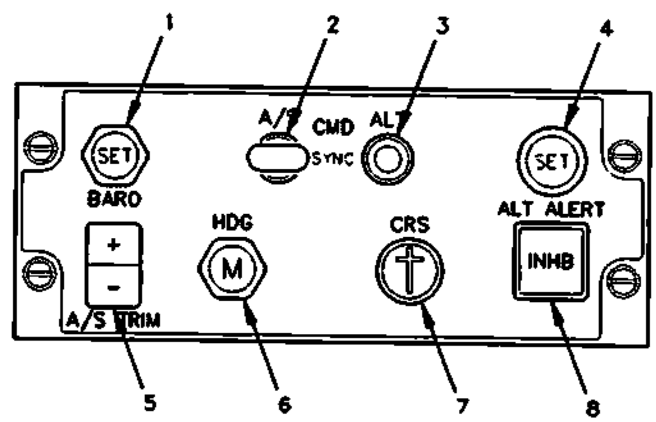
Figure 1-222. Control Display System (Sheet 2 of 3)



1. FAN NO.1/FAN NO.2 SELECT SWITCH

C

CDS COOLING SYSTEM FAN SELECT SWITCH



REFERENCE SET PANEL

1. BAROMETRIC REFERENCE SET KNOB
2. COMMAND AIRSPEED SLEW SWITCH
3. COMMAND ALTITUDE SLEW SWITCH
4. ALTITUDE ALERT SET KNOB
5. AIRSPEED TRIM SWITCH
6. HEADING SELECT KNOB
7. COURSE SELECT KNOB
8. ALTITUDE ALERT INHIBIT PUSHBUTTON SWITCH

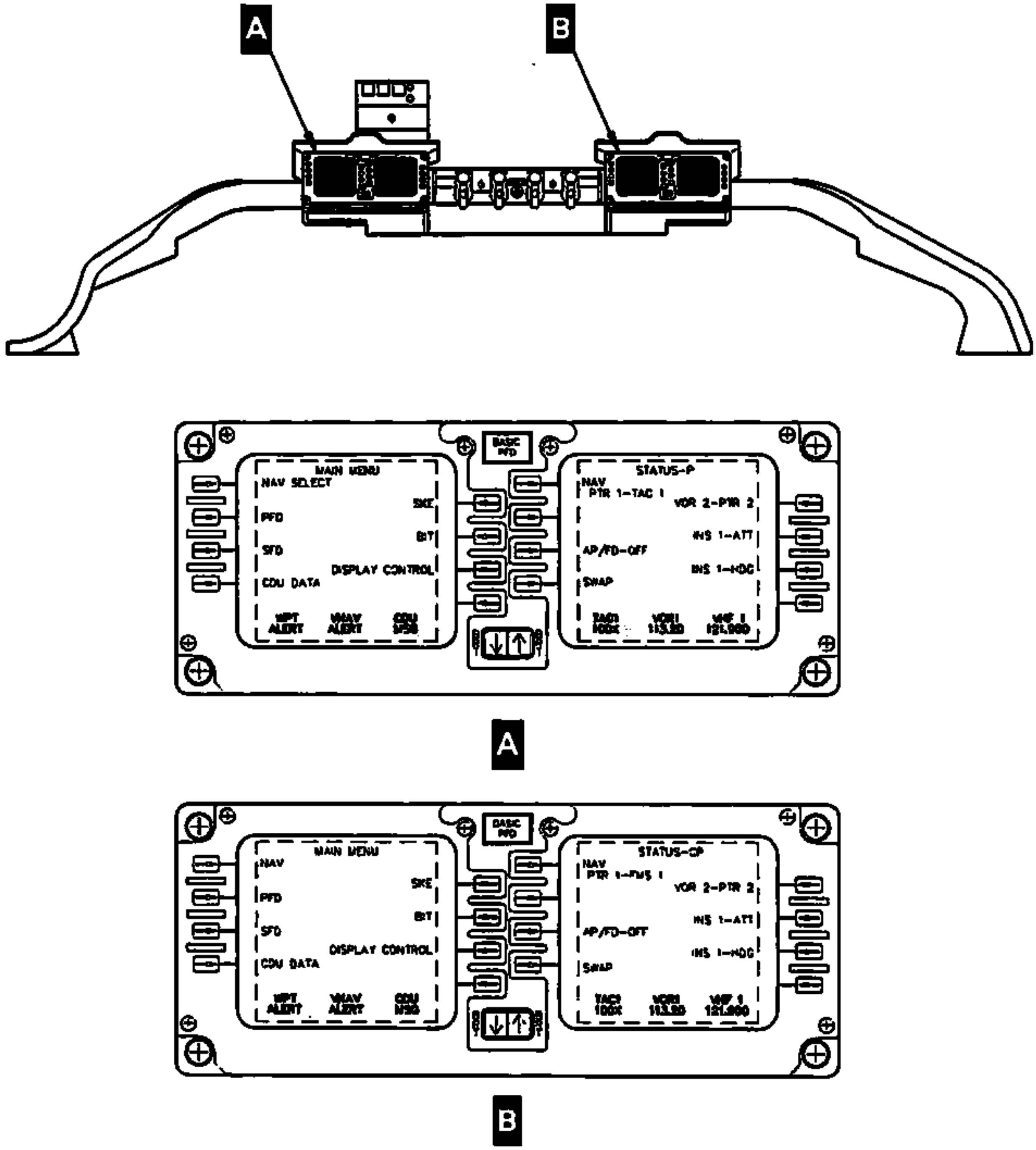
D

REFERENCE SET PANEL (RSP)

D3022917 E

Figure 1-222. Control Display System (Sheet 3 of 3)

DISPLAY AVIONICS MANAGEMENT UNITS

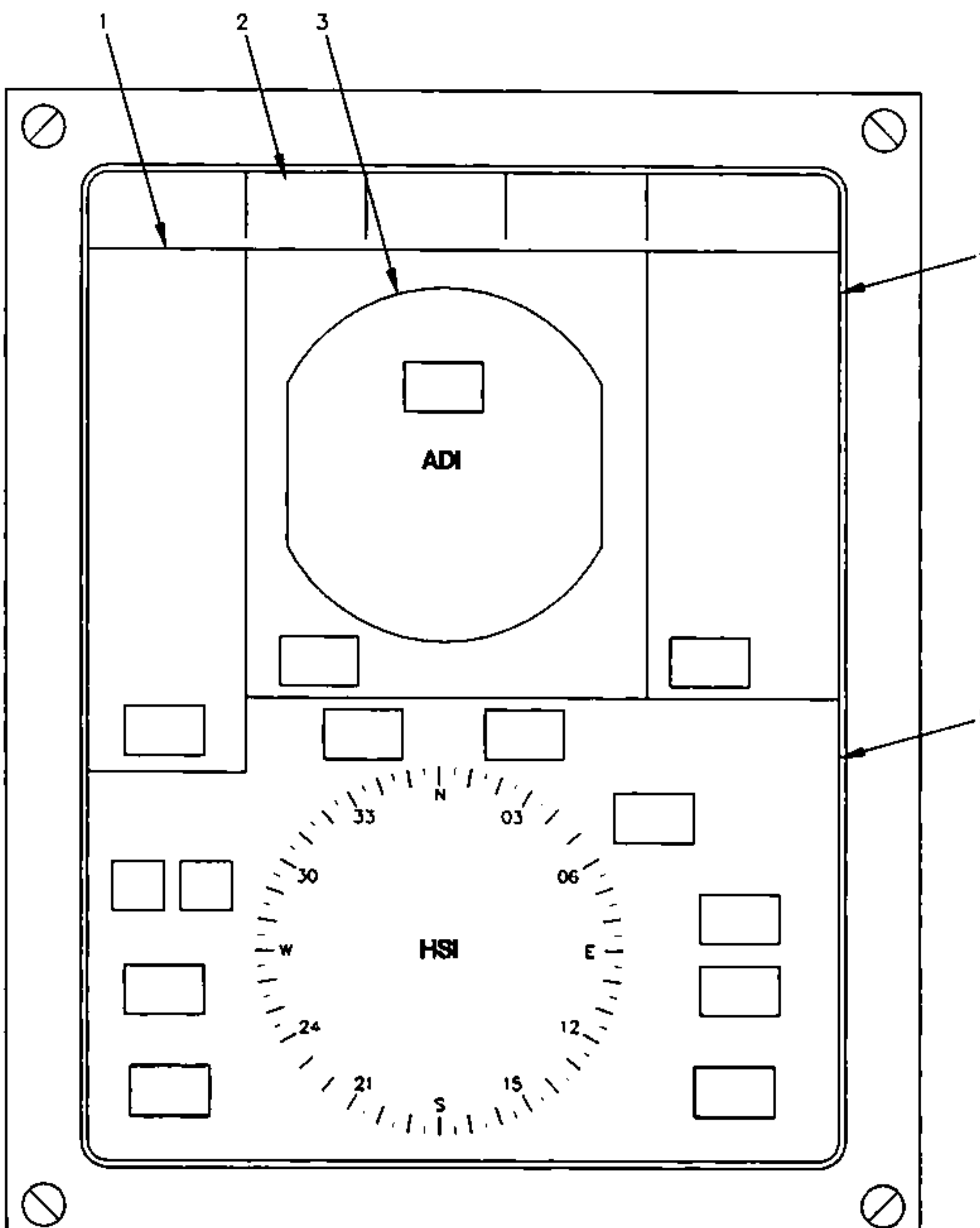


SHADED AREAS INDICATE CONDITIONAL DISPLAY

D3022701H

Figure 1-223. Display Avionics Management Units

PRIMARY FLIGHT DISPLAY LAYOUT

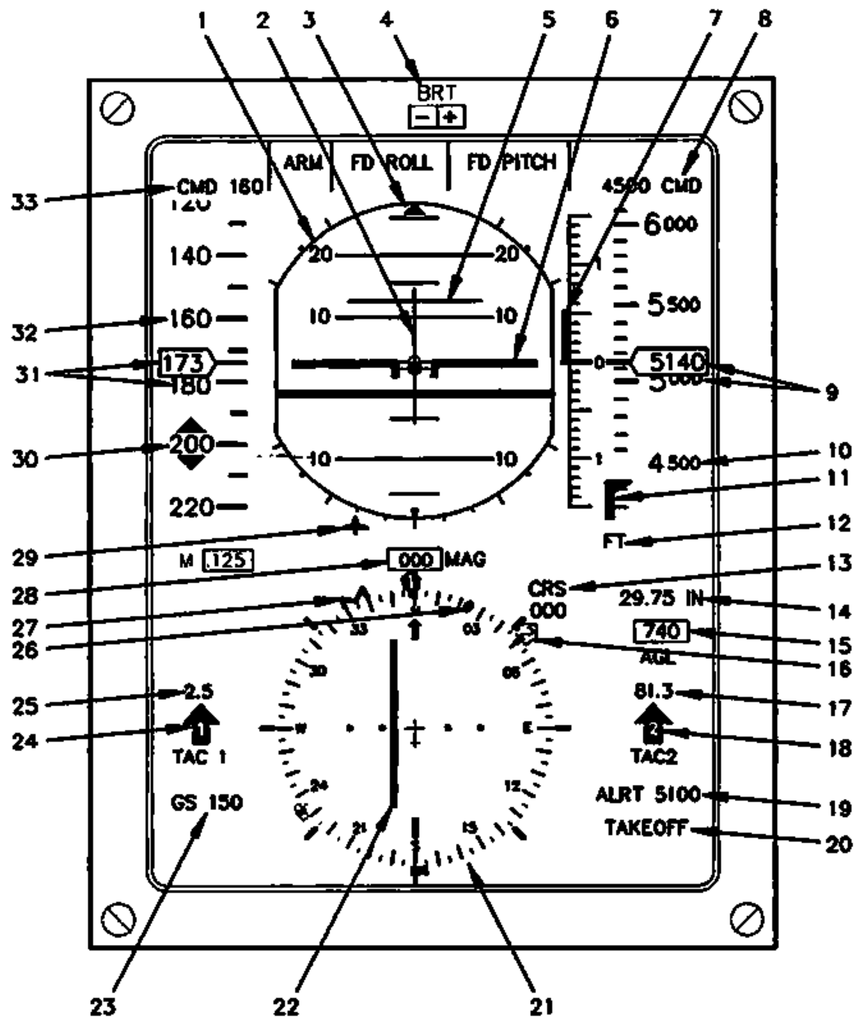


1. AIRSPEED AREA
2. MODE ANNUNCIATOR AREA
3. ADI AREA
4. ALTITUDE AREA
5. HSI AREA

D3094401D

Figure 1-224. Primary Flight Display Layout

PRIMARY FLIGHT DISPLAY

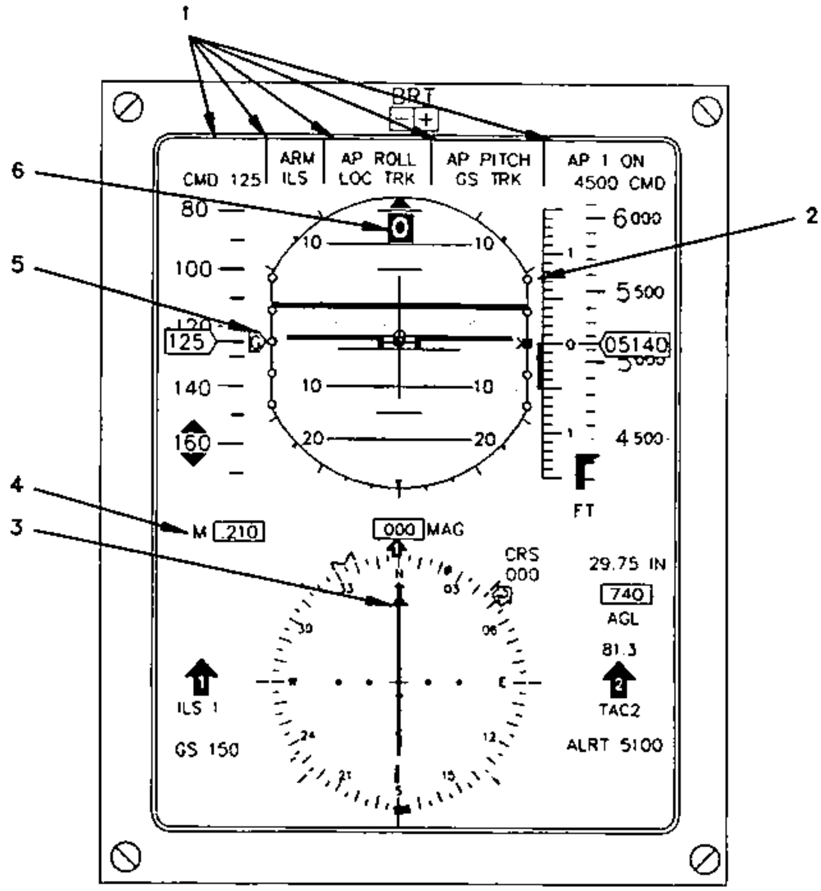


PFD – TAKEOFF (TYPICAL)

1. ATTITUDE SPHERE (ADI)
2. ROLL BAR
3. (BANK) SKY POINTER
4. INDIVIDUAL DU BRT CONT
5. PITCH BAR
6. FIXED AIRCRAFT SYMBOL
7. VERTICAL SPEED INDICATOR
8. ALTITUDE COMMAND READOUT
9. BARO ALTITUDE TAPE AND READOUT
10. ALTITUDE COMMAND MARKER
11. RADAR ALTITUDE THERMOMETER
12. BARO ALTITUDE UNITS
13. SELECTED COURSE READOUT
14. BAROMETRIC PRESSURE SETTING
15. RADAR ALTITUDE (ABOVE GOUND LEVEL)
16. BEARING POINTER NO.
17. DISTANCE TO TACAN STATION
18. BEARING POINTER NO.2 IDENTIFIER
19. ALTITUDE ALERT READOUT
20. TAKEOFF ANNUNCIATOR
21. COMPASS CARD
22. COURSE DEVIATION BAR (CDI)
23. GROUND SPEED READOUT
24. BEARING POINTER NO. 1 IDENTIFIER
25. DISTANCE TO TACAN STATION
26. HEADING/DRIFT ANGLE DIAMOND
27. HEADING SELECT MARKER
28. HEADING READOUT
29. RISING RUNWAY
30. AIRSPEED TRIM INDICATOR
31. AIRSPEED TAPE AND READOUT
32. AIRSPEED COMMAND MARKER
33. COMMAND AIRSPEED READOUT

D3094701F

Figure 1-225. Primary Flight Display (Sheet 1 of 4)

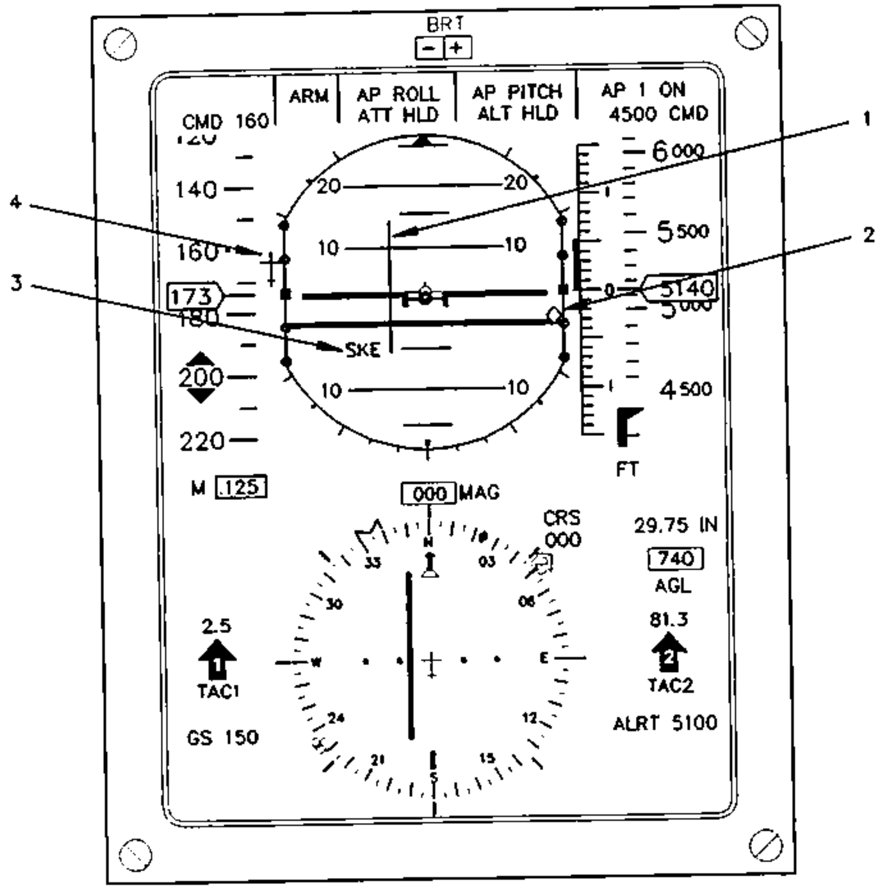


PFD – CRUISE/APPROACH (TYPICAL)

1 MODE ANNUNCIATORS
2. FMS VERTICAL DEVIATION
3. TO/FROM INDICATOR
4. MACH NUMBER READOUT
5. GLIDE SLOPE DEVIATION POINTER AND SCALE
6. MARKER BEACON ANNUNCIATION
(O OUTER, M MIDDLE, I INNER)

D3094702 H

Figure 1-225. Primary Flight Display (Sheet 2 of 4)

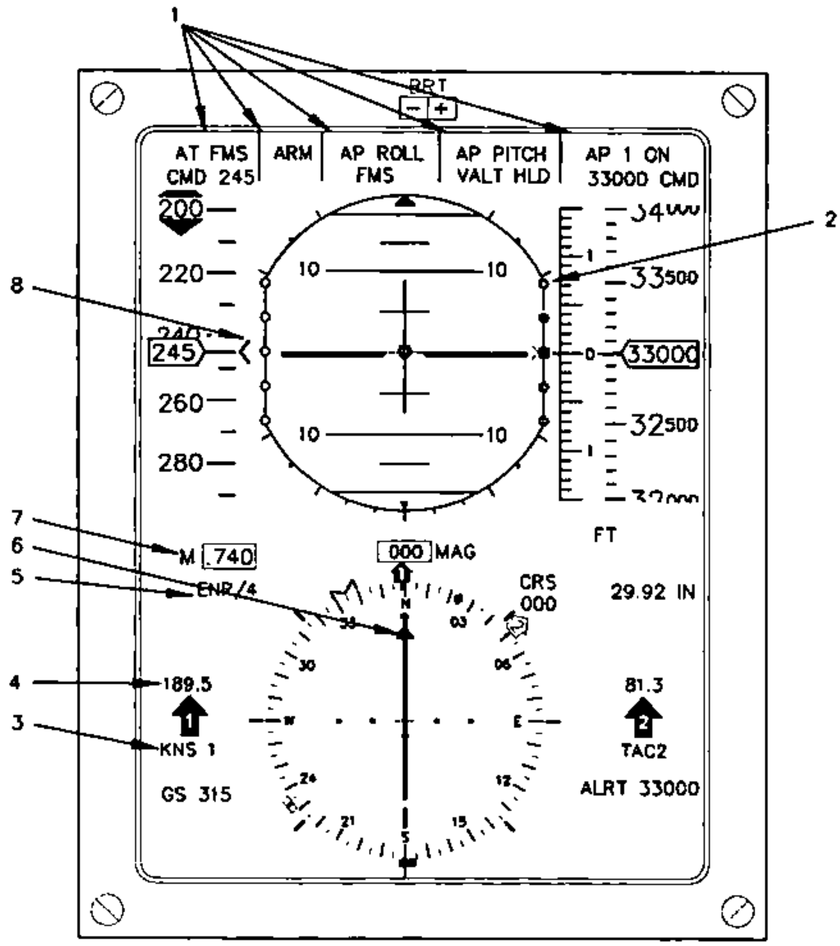


PFD – SKE MODE (TYPICAL)

1. SKE CROSS TRACK DEVIATION (FD BAR)
2. SKE VERTICAL DEVIATION DIAMOND
3. SKE MODE ANNUNICATOR
4. SKE RELATIVE RANGE

D3094703 D

Figure 1-225. Primary Flight Display (Sheet 3 of 4)



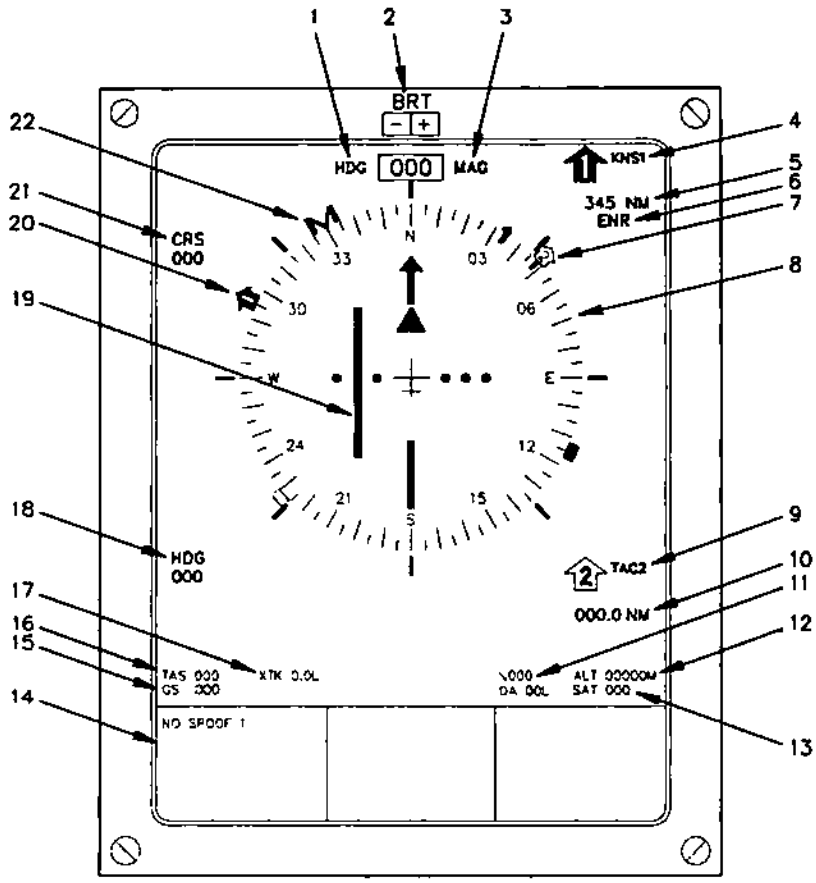
PFD – FMS ENROUTE (TYPICAL)

1. MODE ANNUNCIATORS
2. FMS VERTICAL DEVIATION
3. NAV SOLUTION
4. DISTANCE TO WAYPOINT
5. CDI SCALING AND FACTOR
6. TO/FROM INDICATOR
7. MACH NUMBER READOUT
8. AUTOTHROTTLES AIRSPEED CARET

D3094704 G

Figure 1-225. Primary Flight Display (Sheet 4 of 4)

SECONDARY FLIGHT DISPLAY

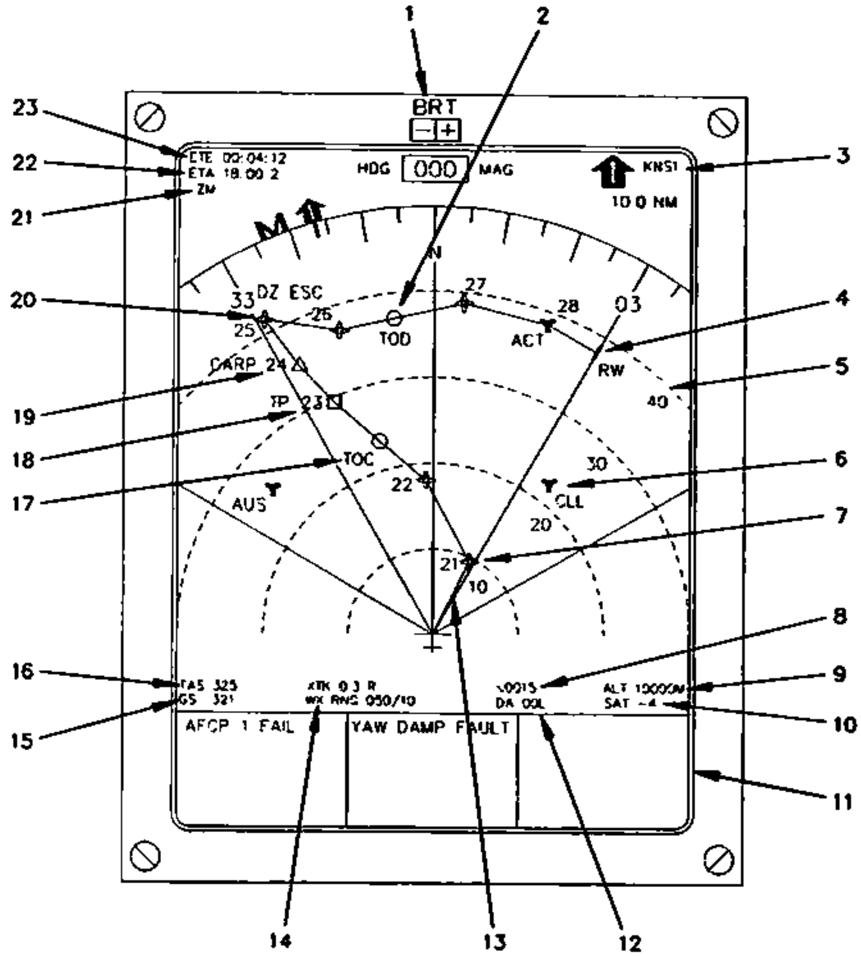


SFD – EXPANDED HSI MODE (TYPICAL)

1. HSI MODE
2. INDIVIDUAL DU BRT CONT
3. MAGNETIC/TRUE READOUT
4. BEARING POINTER NO. 1 IDENTIFIER
5. TACAN/DME DISTANCE/DISTANCE TO WAYPOINT
6. CDI SCALING
7. BEARING POINTER NO. 2
8. COMPASS CARD
9. BEARING POINTER NO. 2 IDENTIFIER
10. TACAN DME DISTANCE
11. WIND SPEED/DIRECTION AND DRIFT ANGLE
12. ALTITUDE
13. STATIC AIR TEMPERATURE
14. CAUTION/WARNING ADVISORY DATA
15. GROUND SPEED
16. TRUE AIRSPEED
17. CROSS TRACK DEVIATION
18. SELECTED HEADING
19. COURSE DEVIATION INDICATOR (CDI)
20. NAV PTR 1
21. COURSE READOUT
22. HEADING SELECT MARKER

D3094801H

Figure 1-226. Secondary Flight Display (Sheet 1 of 4)

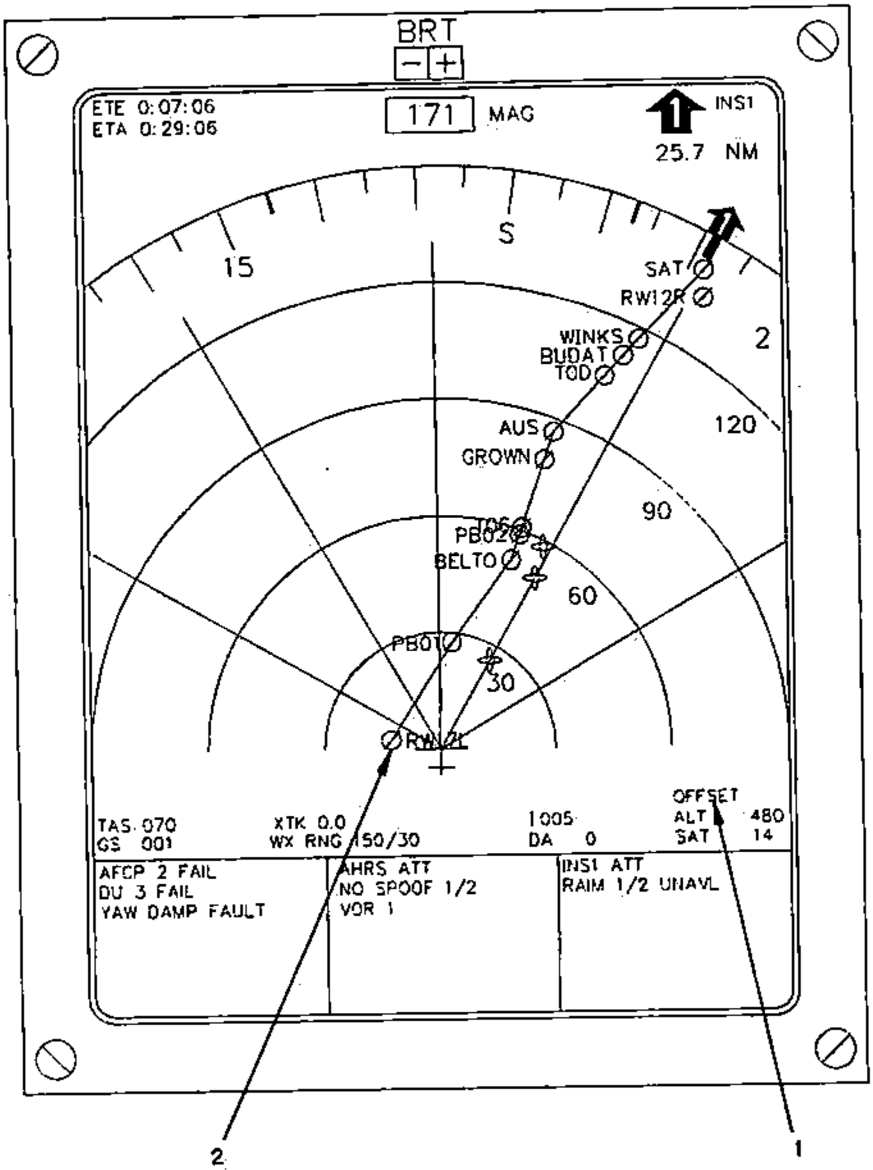


SFD – MAP MODE (TYPICAL)

1. INDIVIDUAL BRT CONT
2. TOP OF DESCENT SYMBOL
3. BARING POINTER#1, IDENTIFIER, AND RANGE
4. RUNWAY WAYPOINT SYMBOL AND IDENTIFIER
5. MAP RANGE RING AND INDICATORS
6. TACAN STATION SYMBOL E AND IDENTIFIER
7. NORMAL WAYPOINT SYMBOL AND IDENTIFIER
8. WIND ARROW AND SPEED READOUT
9. ALTITUDE READOUT
10. STATIC AIR TEMPERATURE
11. CAUTION/WARNING/ADVISORY DATA
12. DRIFT ANGLE READOUT
13. COURSE LINE (WHITE)
14. COURSE CROSS TRACK READOUT
15. GROUND SPEED READOUT
16. TRUE AIRSPEED READOUT
17. TOP OF CLIMB SYMBOL AND IDENTIFIER
18. TURN POINT SYMBOL AND IDENTIFIER
19. CARP WAYPOINT SYMBOL AND IDENTIFIER
20. DZ ESC WAYPOINT AND IDENTIFIER
21. ZONE MARKER IDENTIFIER
22. ESTIMATED TIME OF ARRIVAL
23. ESTIMATED TIME ENROUTE

D3094802 E

Figure 1-226. Secondary Flight Display (Sheet 2 of 4)

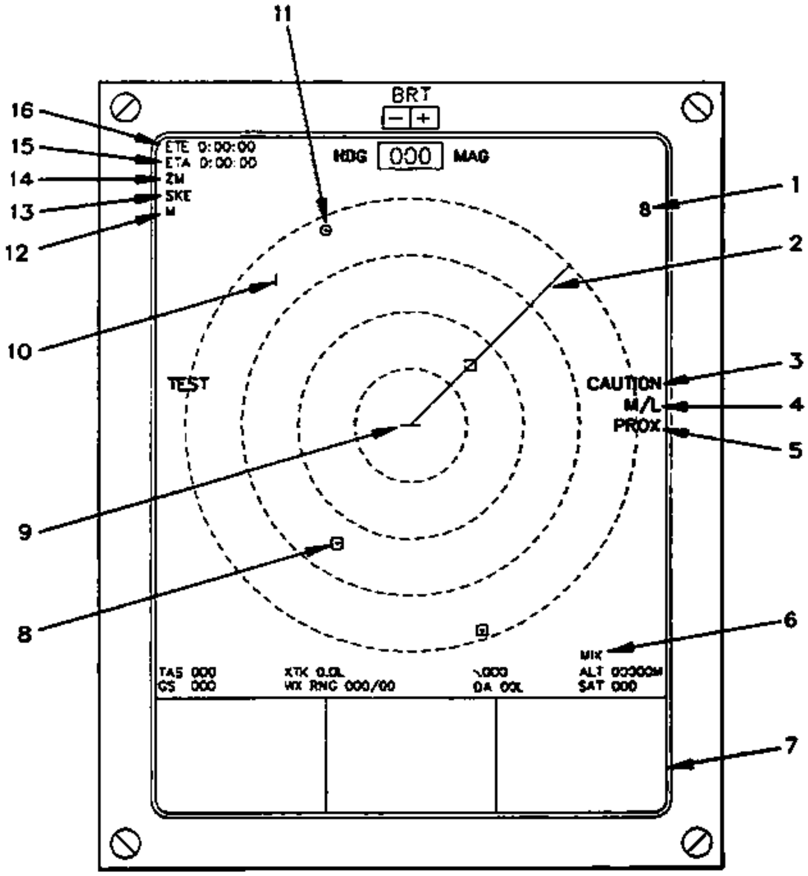


SFD – FMS OFFSET (TYPICAL)

1. OFFSET IDENTIFIER
2. OFFSET WAYPOINT

D3219001B

Figure 1-226. Secondary Flight Display (Sheet 3 of 4)



SFD - SKE MODE (TYPICAL)

1. SKE RANGE READOUT (X1000)
2. PROXIMITY WARNING LINE
3. CAUTION INDICATOR
4. MASTER LOST INDICATOR
5. PROXIMITY WARNING INDICATOR
6. MIX ANNUNCIATOR
7. CAUTION/WARNING ADVISORY DATA
8. FOLLOWER AIRCRAFT
9. SKE OWN AIRCRAFT
10. SKE ZONE MARKER
11. SKE LEADER AIRCRAFT
12. MASTER INDICATOR
13. SKE INDICATOR
14. ZONE MARKER INDICATOR
15. ESTIMATED TIME OF ARRIVAL
16. ESTIMATED TIME ENROUTE

D3094803 F

Figure 1-226. Secondary Flight Display (Sheet 4 of 4)

CDS MENU HIERARCHY

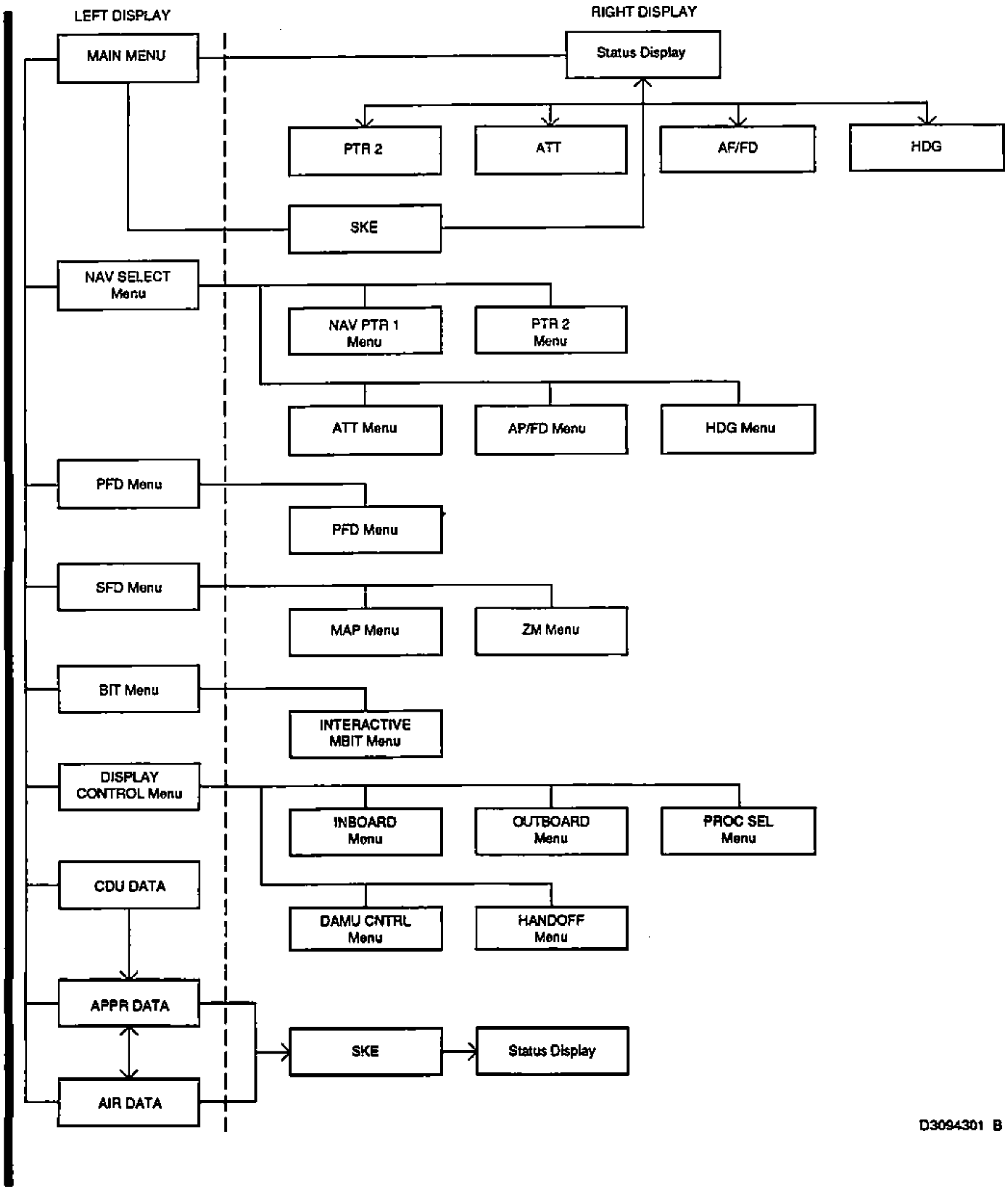


Figure 1-227. CDS MENU Hierarchy

AUTOPILOT CONTROLS AND INDICATORS

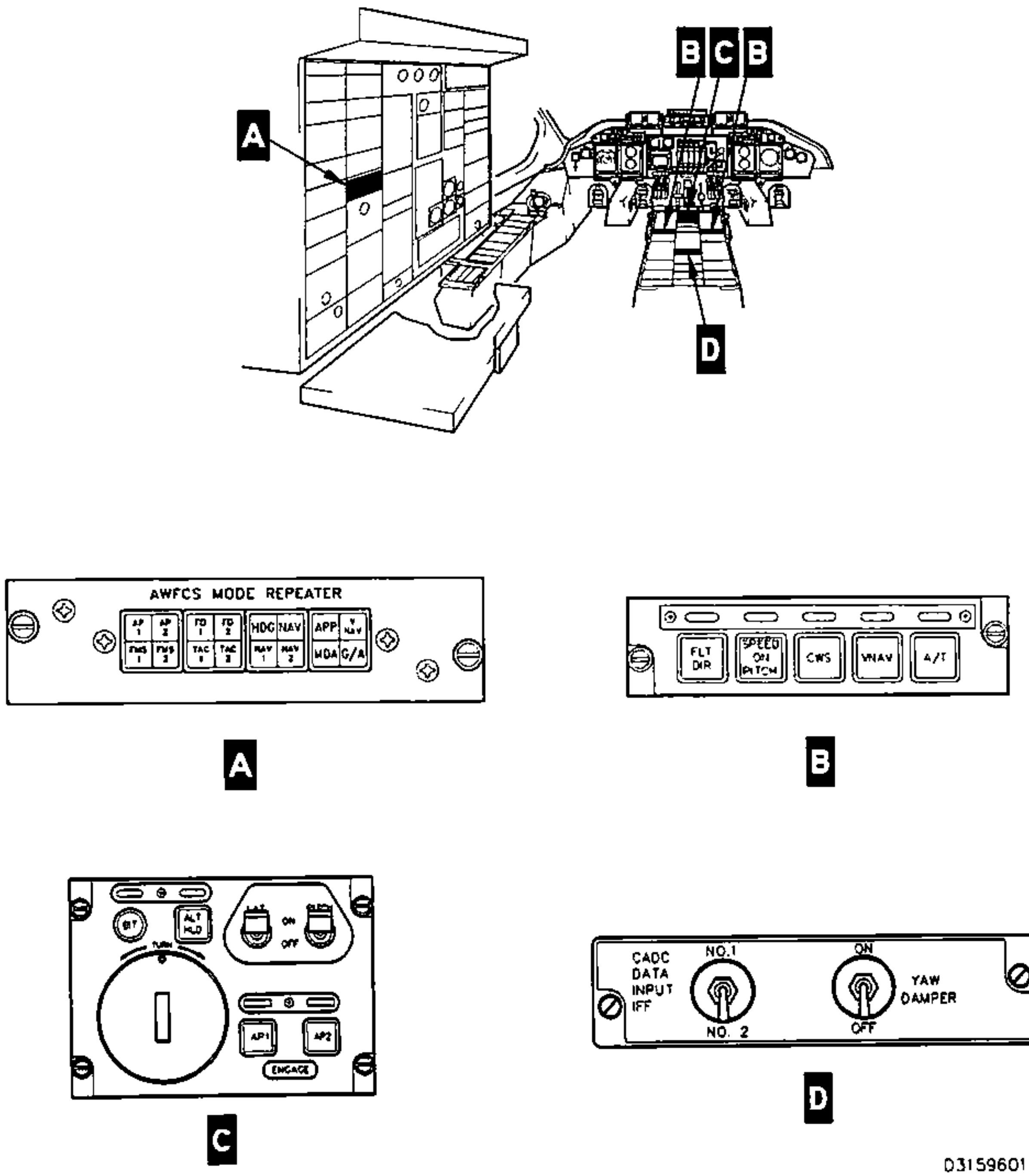


Figure 1-228. Autopilot Controls and Indicators

ATTITUDE HEADING REFERENCE SYSTEM (AHRS)

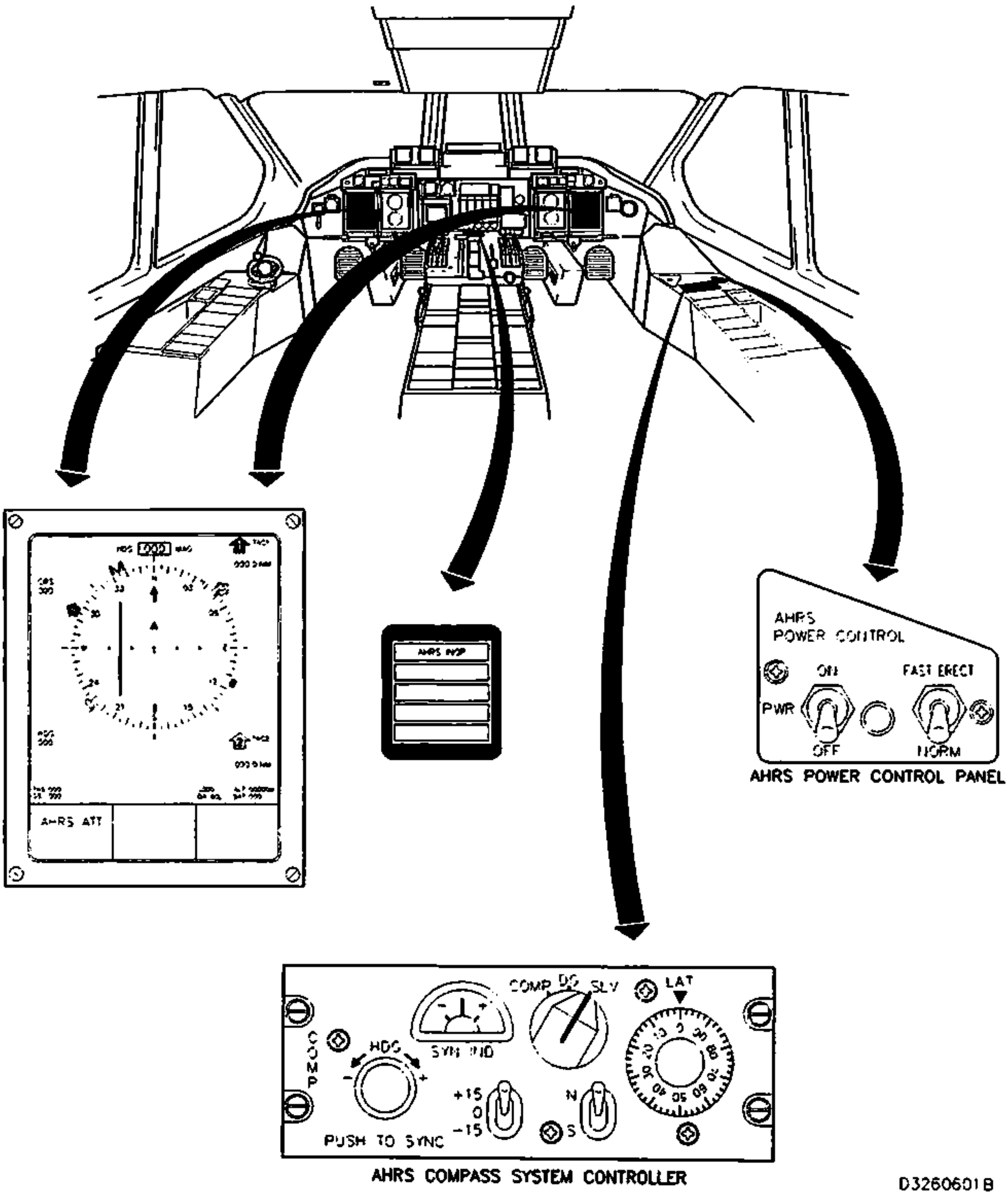


Figure 1-229. Attitude Heading Reference System (AHRS)

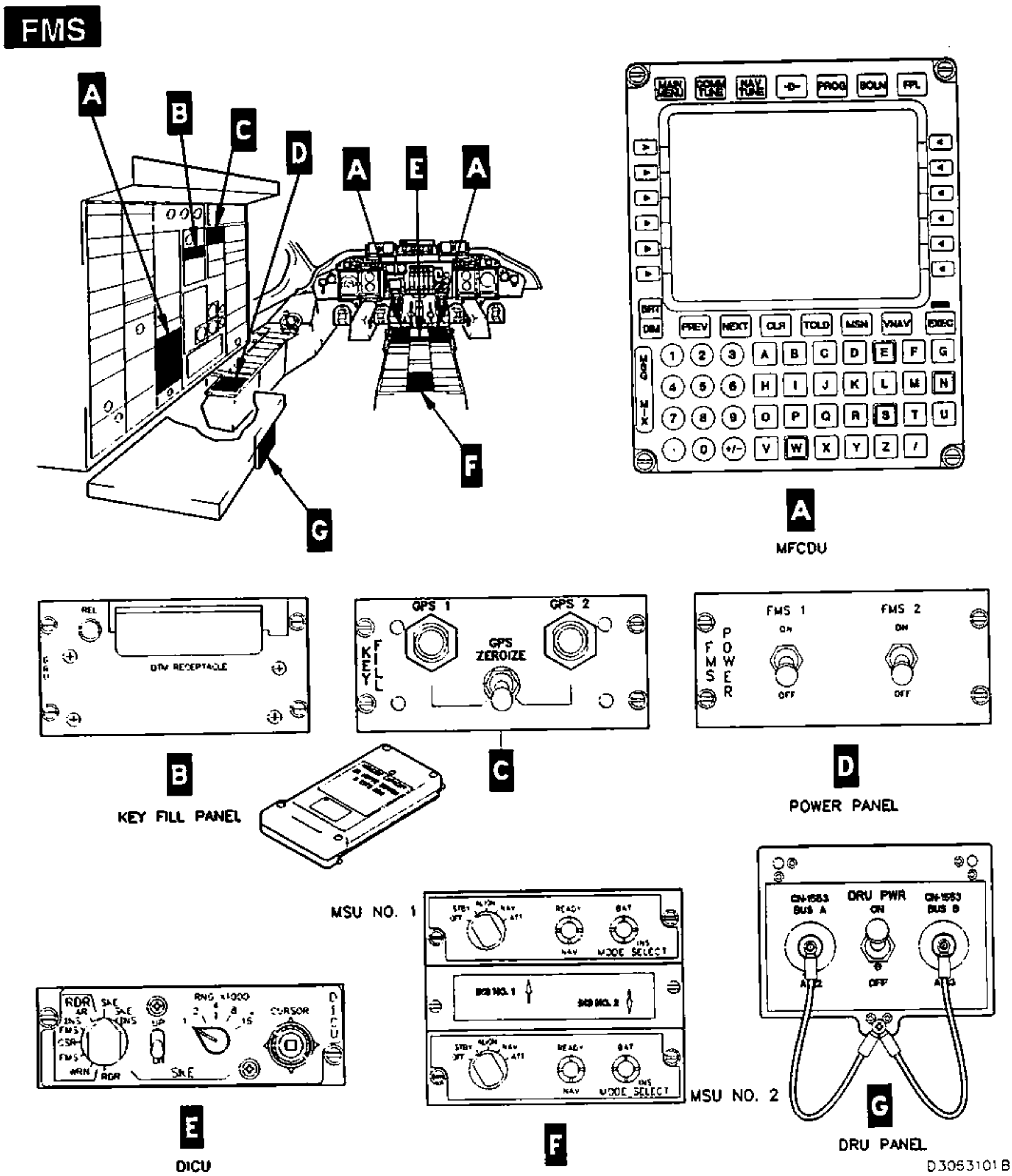


Figure 1-230. Flight Management System Components

MFCDU

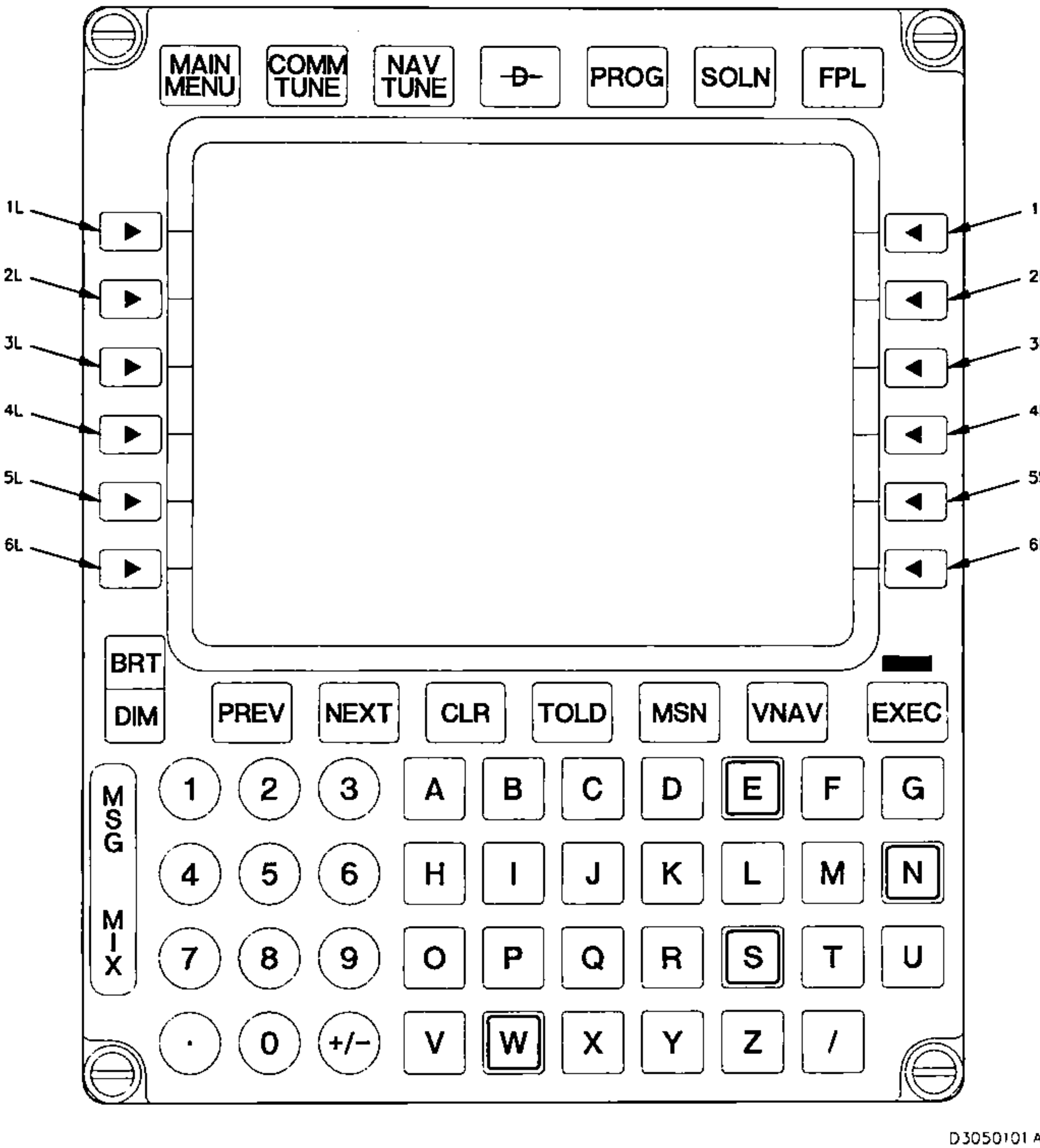


Figure 1-231. MFCDU

FMS INTERFACE DIAGRAM

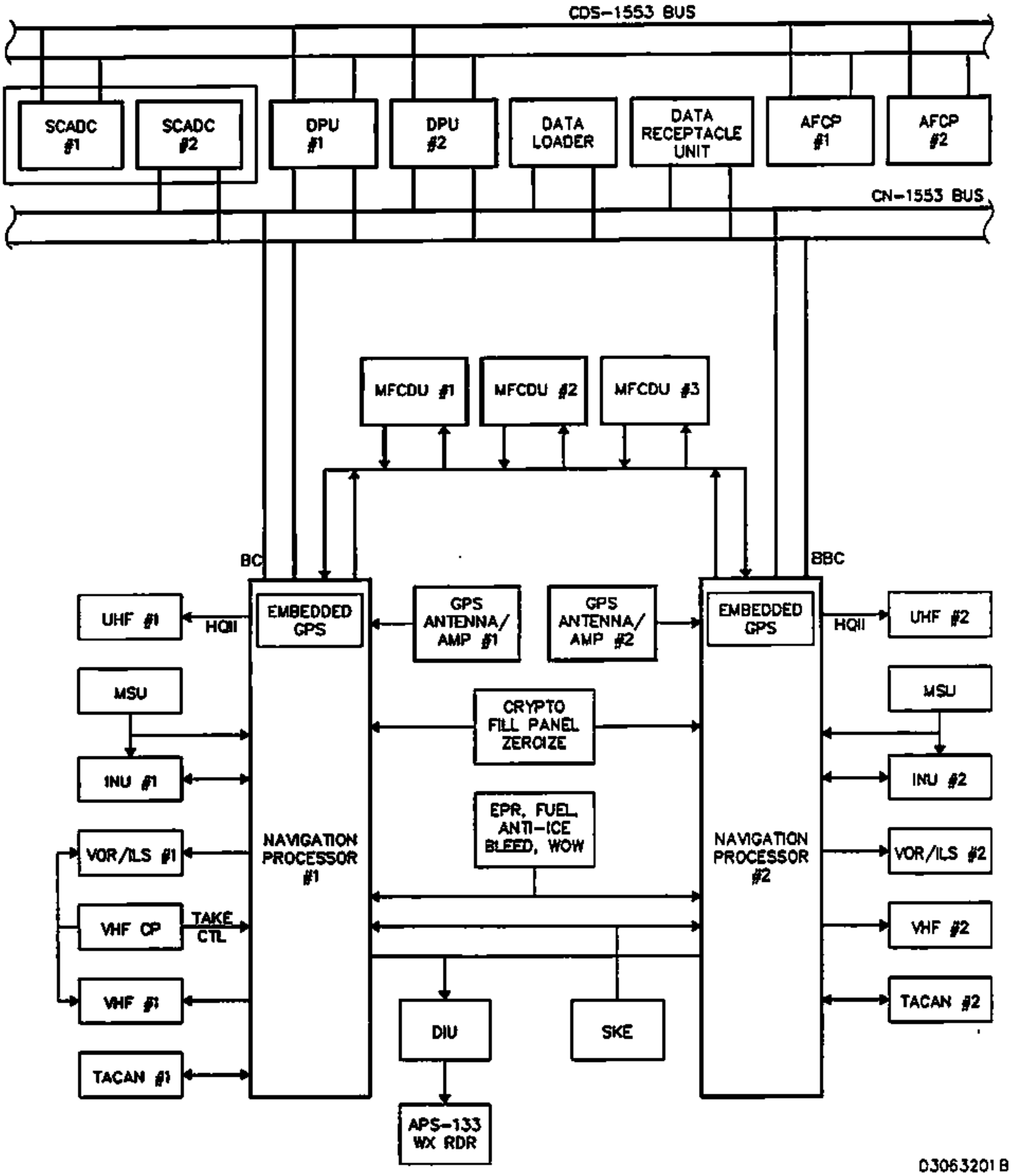


Figure 1-232. FMS Interface Diagram

CARP

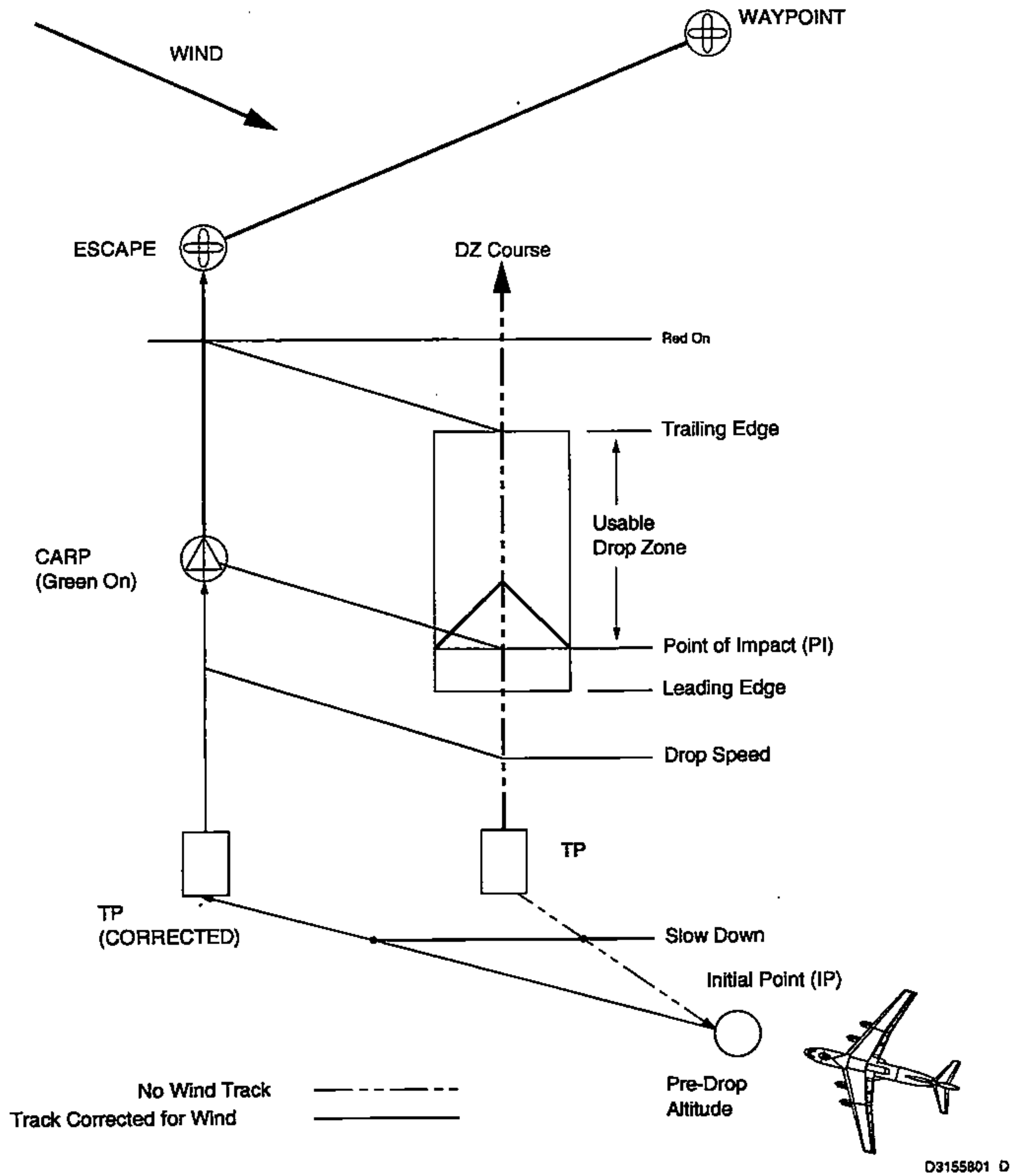
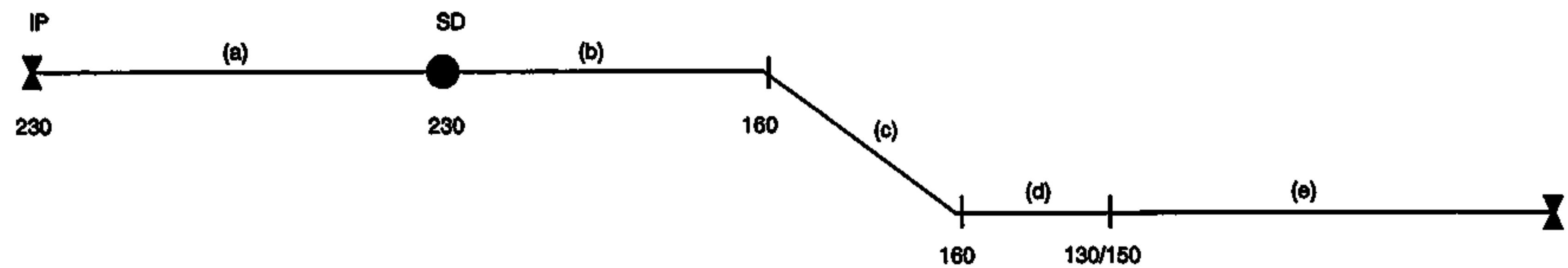


Figure 1-233. CARP (Sheet 1 of 2)



VERTICAL PROFILE

(a) Time and distance from defined IP to slowdown (SD) at 230kts.

(b) Time and distance to decelerate from 230 to 160.

(c) Time and distance to climb/descend from pre-drop altitude to drop altitude at 160kts. (Will be dependent on altitude difference at 1000ft/min)

(d) Time and distance to decelerate from 160 to drop speed (130 or 150).

(e) Time and distance at drop speed.

D3155802 D

Figure 1-233. CARP (Sheet 2 of 2)

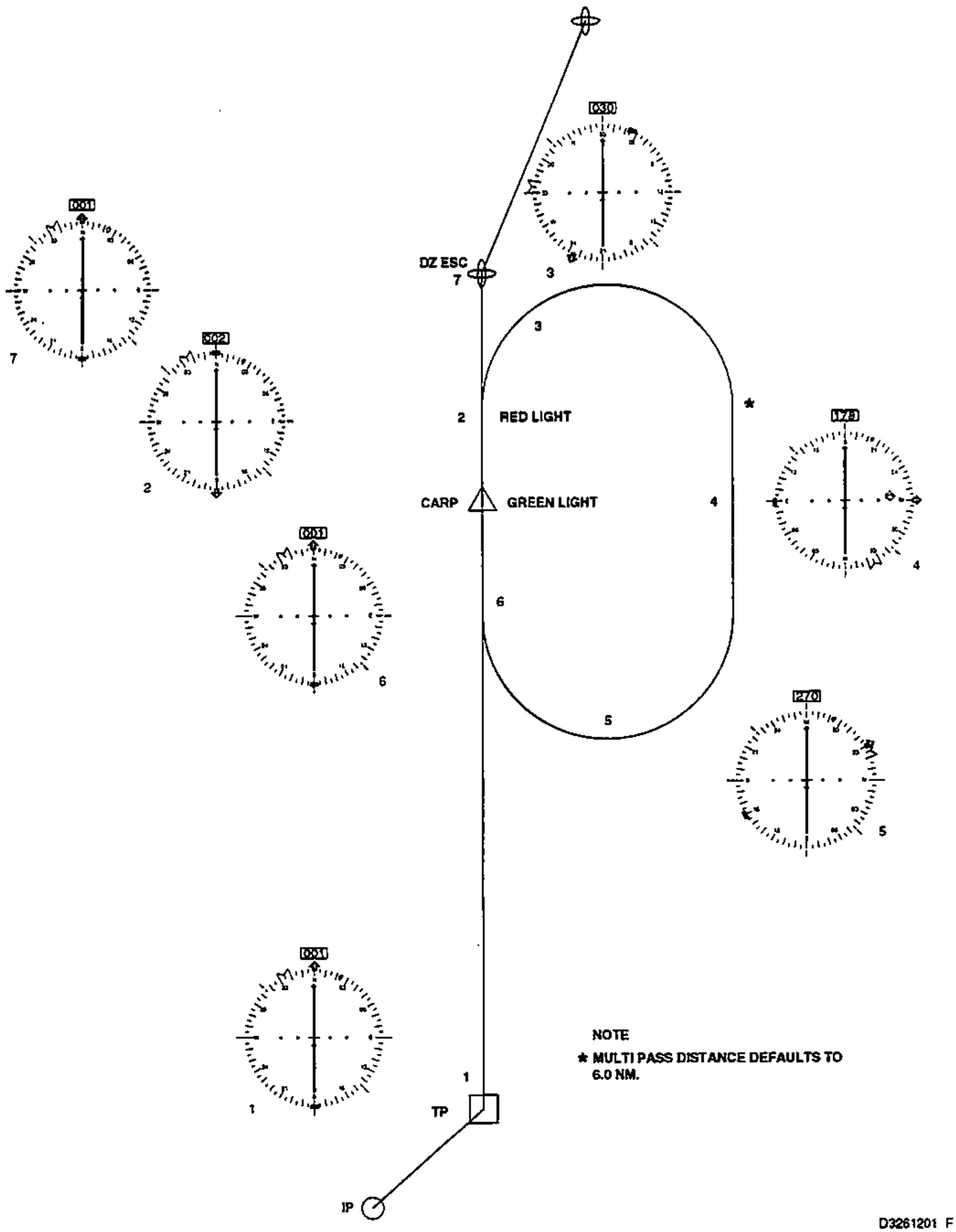


Figure 1-234. Multiple Run CARP Indications

CADC TEST SWITCHES

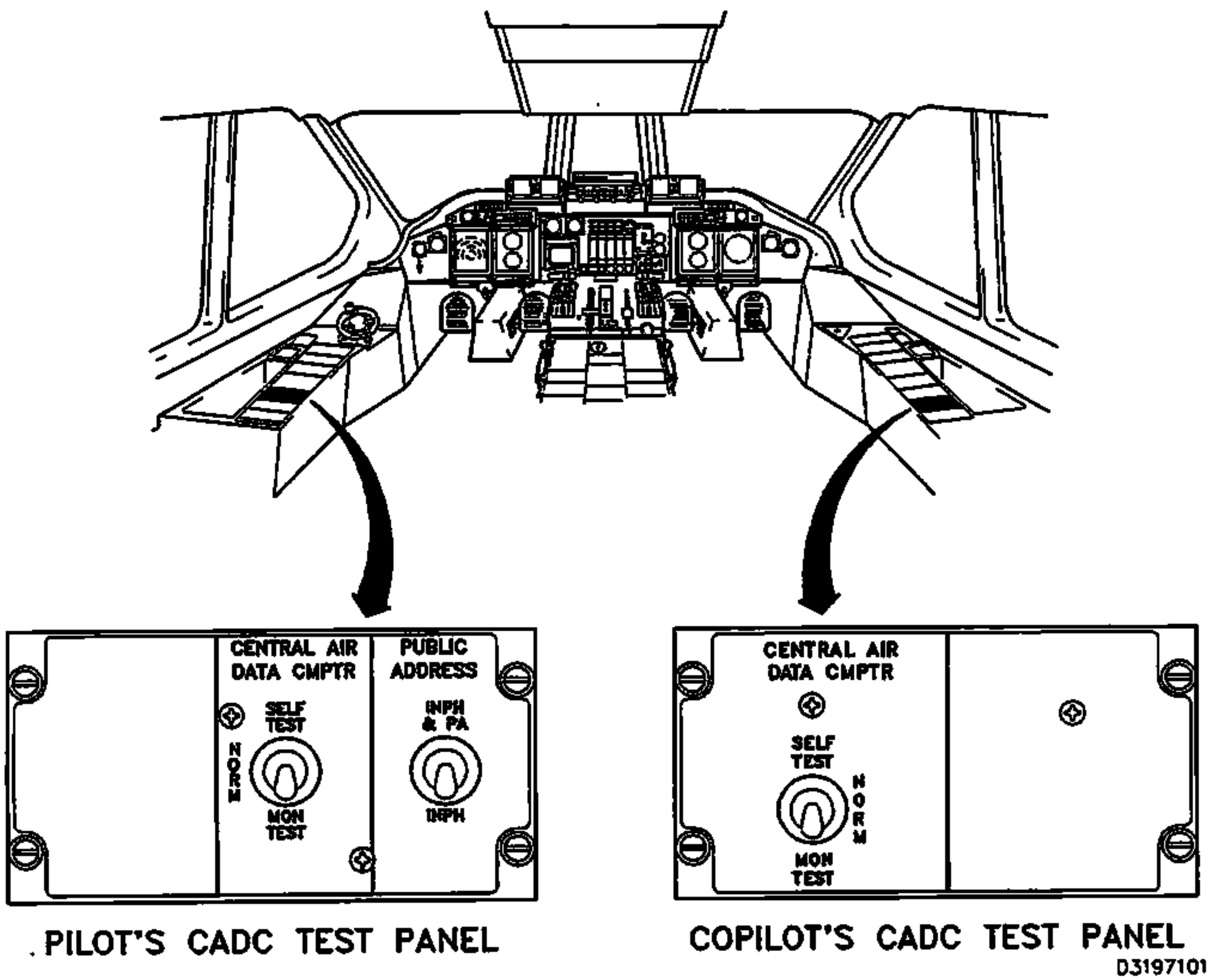
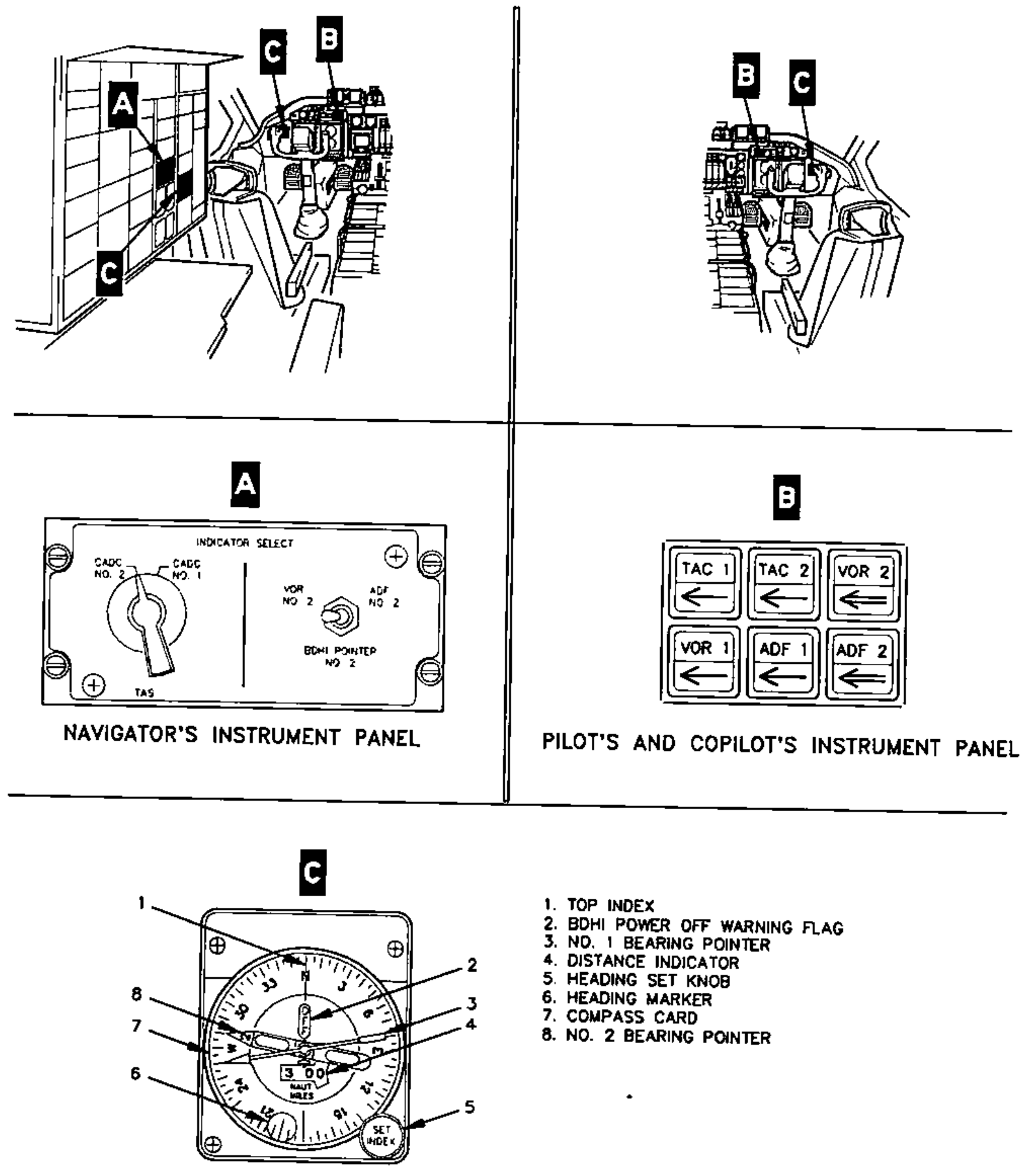


Figure 1-235. CADC Test Switches

BDHI SYSTEM INDICATORS AND SELECTOR SWITCHES



1. TOP INDEX
2. BDHI POWER OFF WARNING FLAG
3. NO. 1 BEARING POINTER
4. DISTANCE INDICATOR
5. HEADING SET KNOB
6. HEADING MARKER
7. COMPASS CARD
8. NO. 2 BEARING POINTER

Figure 1-236. BDHI System Indicators and Selector Switches

COMBINED ALTITUDE RADAR ALTIMETER (CARA) SYSTEM

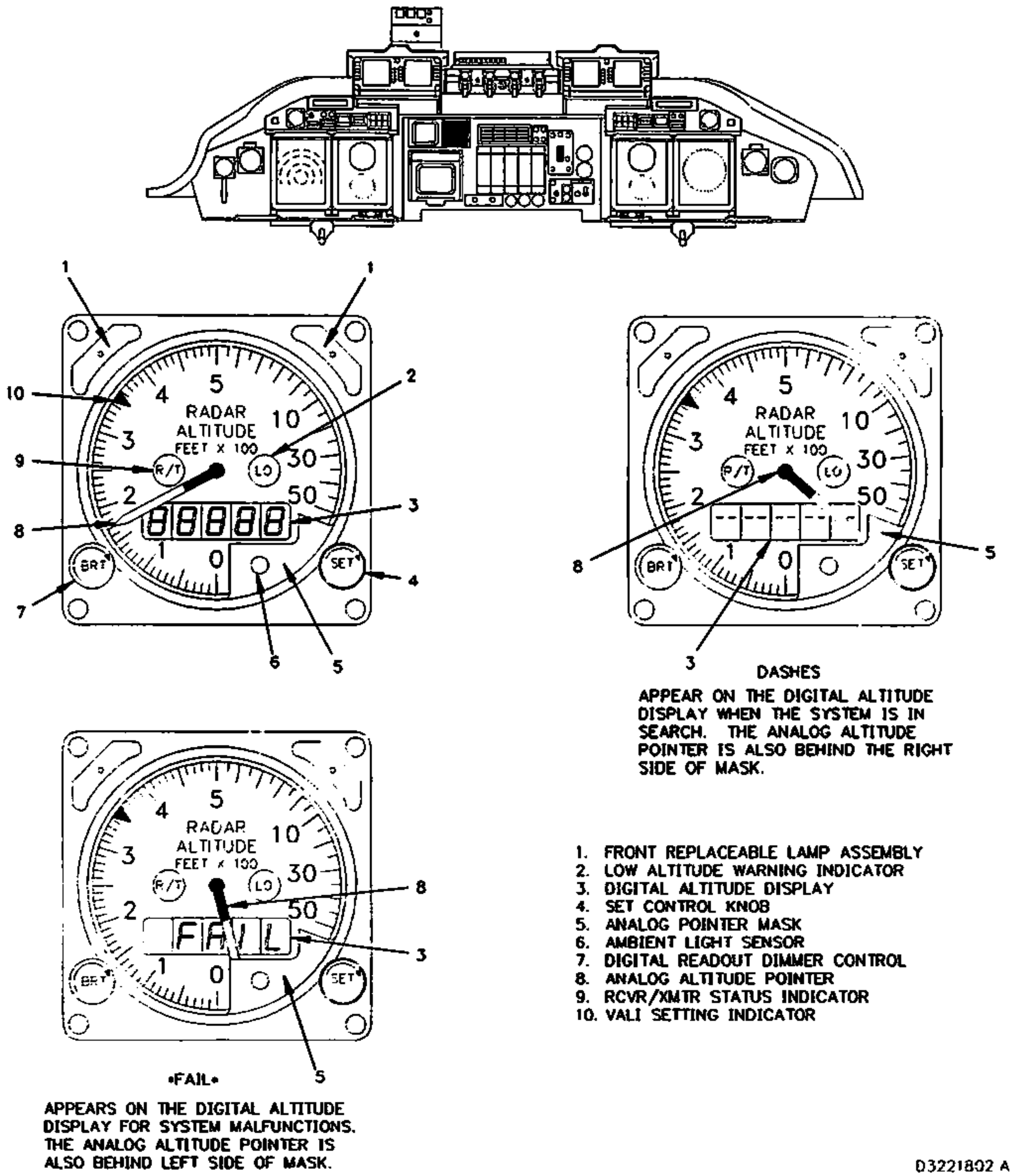


Figure 1-237. Combined Altitude Radar Altimeter (CARA) System

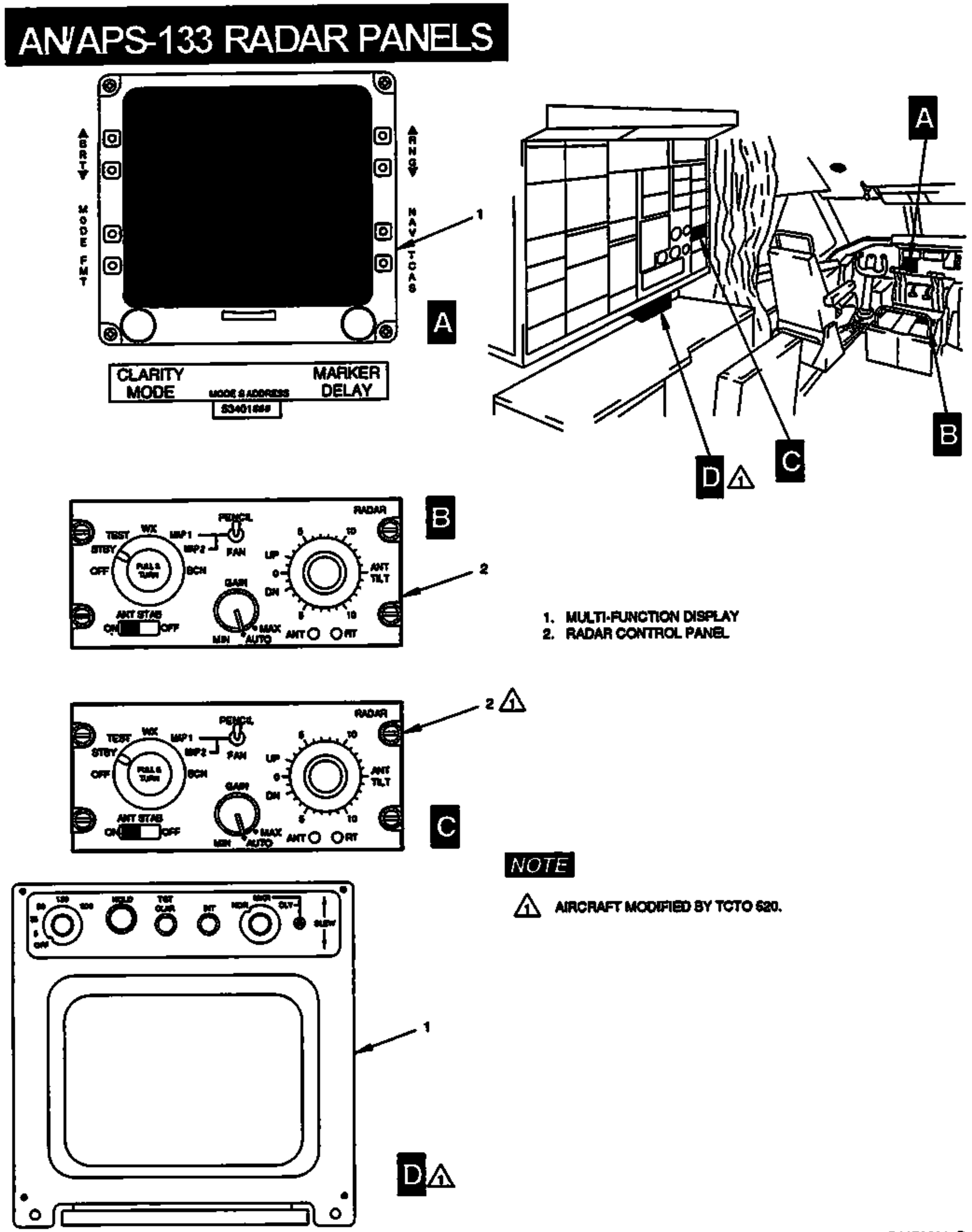
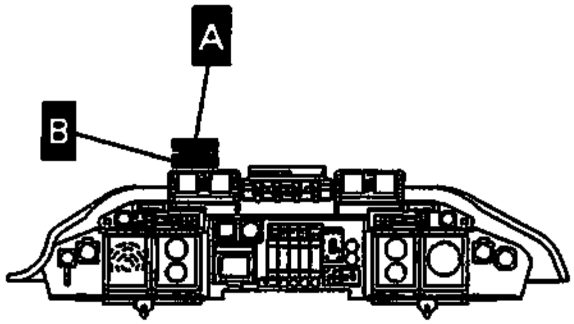
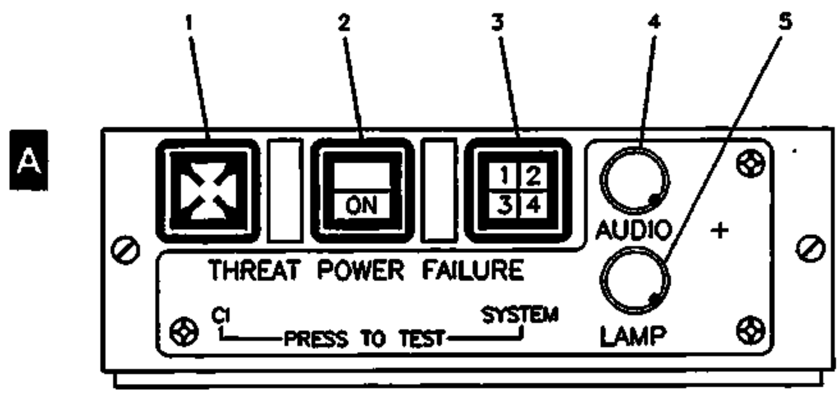


Figure 1-238. AN/APS-133 Radar Panels

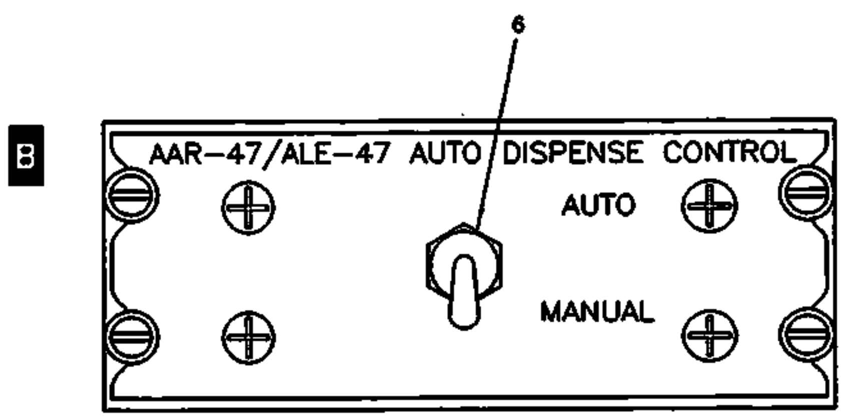
PILOT'S DEFENSE SYSTEM PANELS



1. THREAT INDICATOR AND CONTROL INDICATOR PRESS TO TEST SWITCH
2. POWER INDICATOR AND ON/OFF SWITCH
3. FAILURE INDICATOR AND SYSTEM PRESS TO TEST SWITCH
4. AUDIO CONTROL
5. LAMP INTENSITY CONTROL
6. COUNTERMEASURES AUTO DISPENSE SWITCH



MISSILE WARNING CONTROL INDICATOR

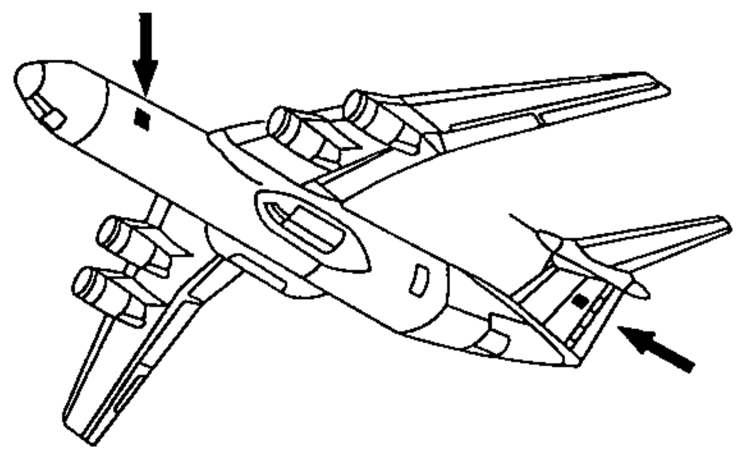


AAR–47/ALE–47 AUTO DISPENSE CONTROL PANEL

D3260501

Figure 1-239. Pilot's Defense System Panels

MISSILE WARNING OPTICAL SENSOR UNIT LOCATION



LEFT SIDE SHOWN, RIGHT SIDE SIMILAR

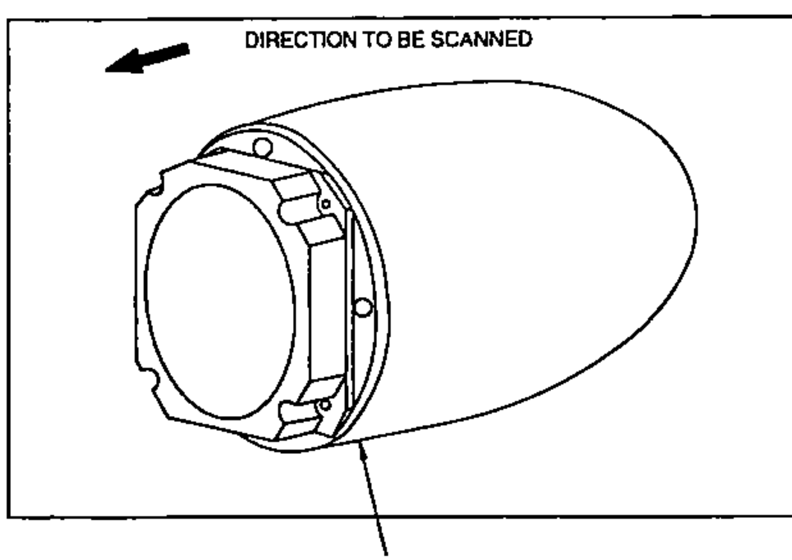
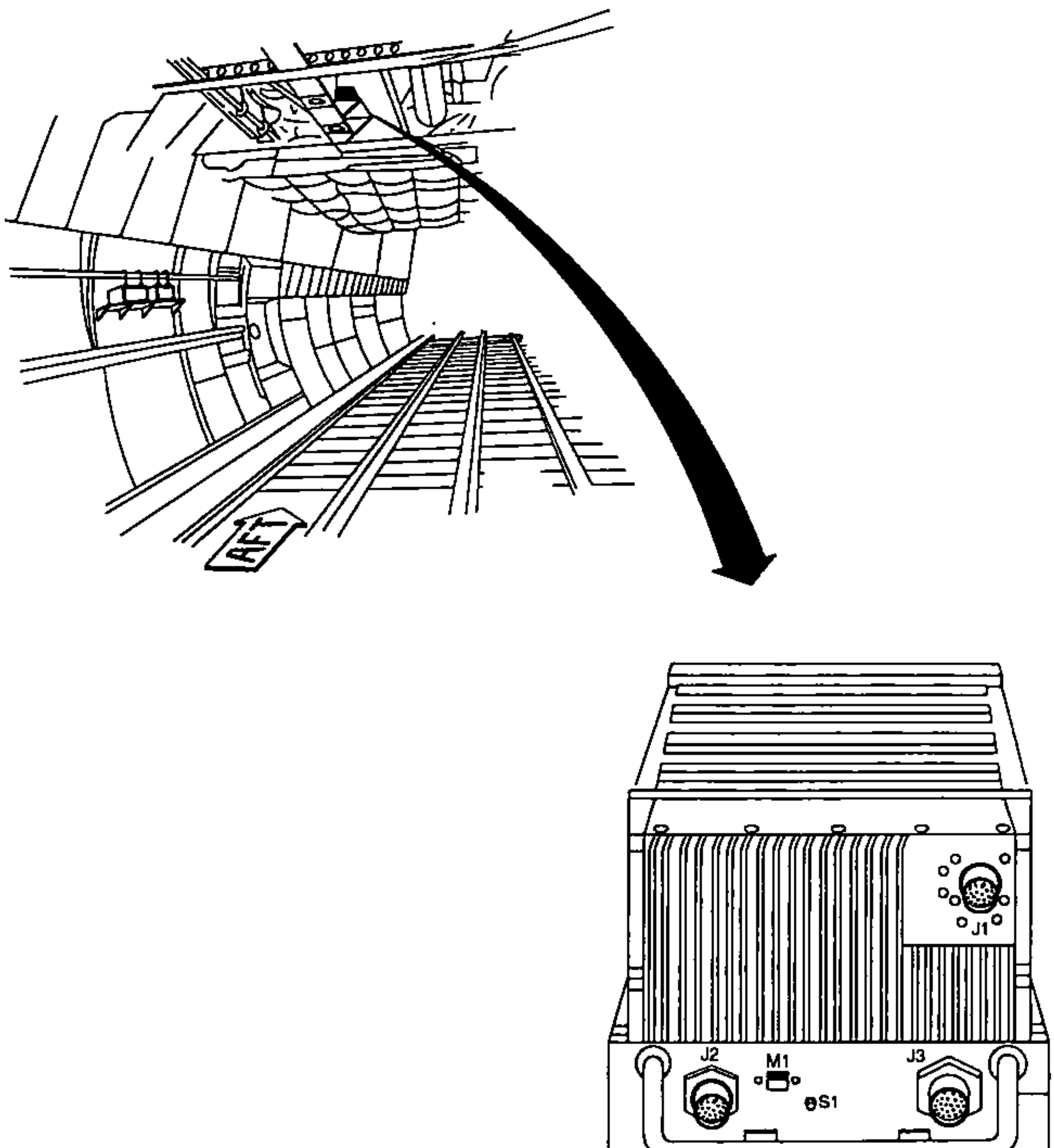


Figure 1-240. Missile Warning Optical Sensor Unit Location

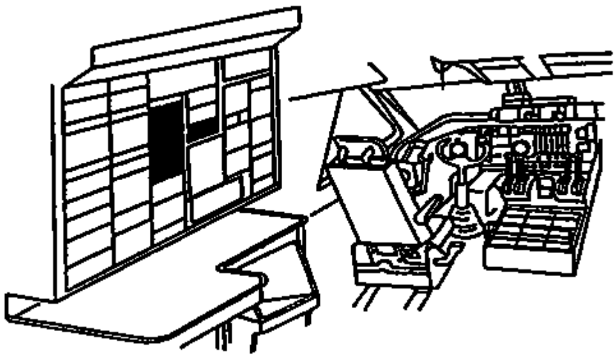
MISSILE WARNING CPU LOCATION

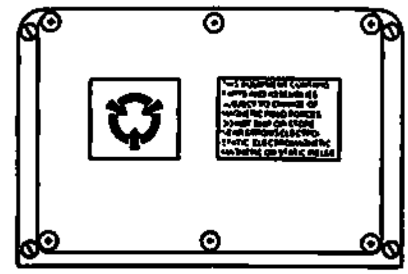


COMPUTER PROCESSOR UNIT

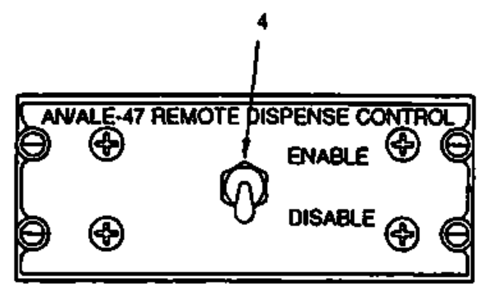
Figure 1-241. Missile Warning CPU Location

NAVIGATOR'S ALE-47 DS PANELS

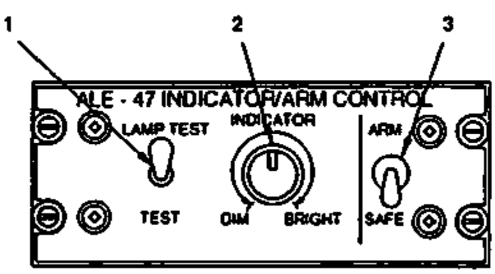




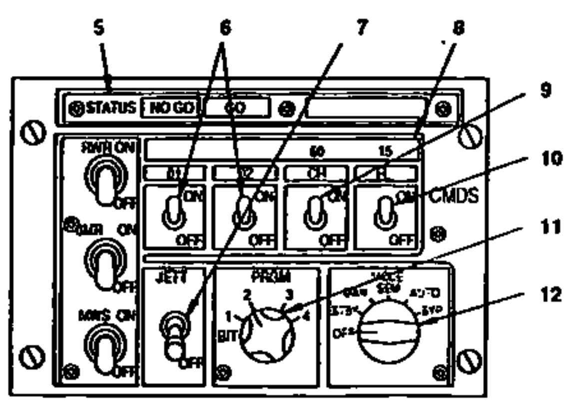
PROGRAMMER



REMOTE DISPENSE CONTROL PANEL



INDICATOR/ARM CONTROL PANEL



CONTROL DISPLAY UNIT

1. ANNUNCIATOR TEST SWITCH
2. ANNUNCIATOR BRIGHTNESS CONTROL
3. SYSTEM ARM/SAFE SWITCH
4. DISPENSE CONTROL ENABLE/DISABLE SWITCH
5. SYSTEM STATUS INDICATOR
6. "OTHER" ENABLE SWITCHES
7. FLARE JETTISON SWITCH
8. INVENTORY STATUS INDICATOR
9. CHAFF ENABLE SWITCH
10. FLARE ENABLE SWITCH
11. PROGRAM SWITCH
12. MODE SWITCH

Figure 1-242. Navigator's ALE-47 DS Panels

COUNTERMEASURES DISPENSER LOCATIONS

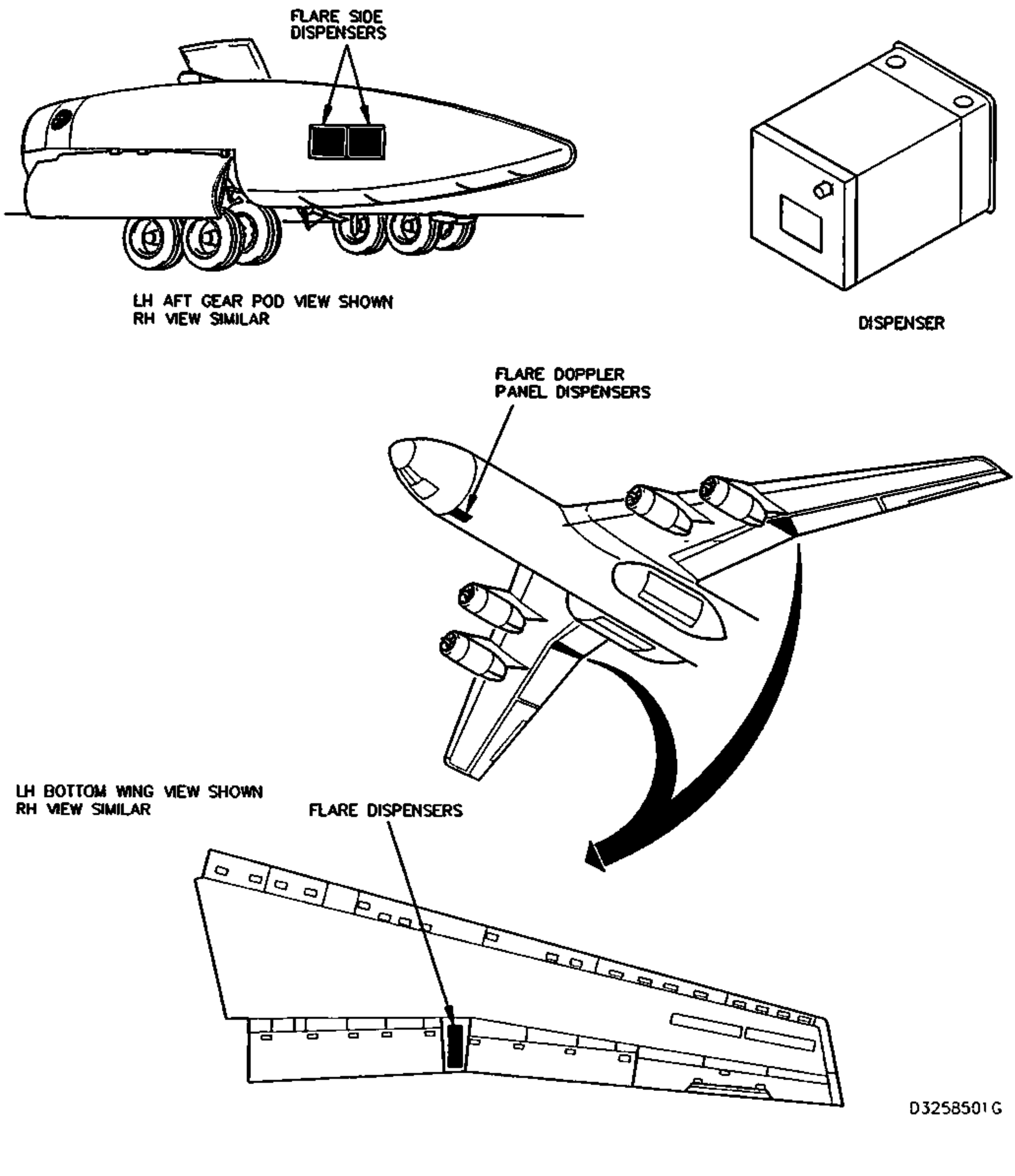


Figure 1-243. Countermeasures Dispenser Locations

SAFETY SWITCH LOCATIONS

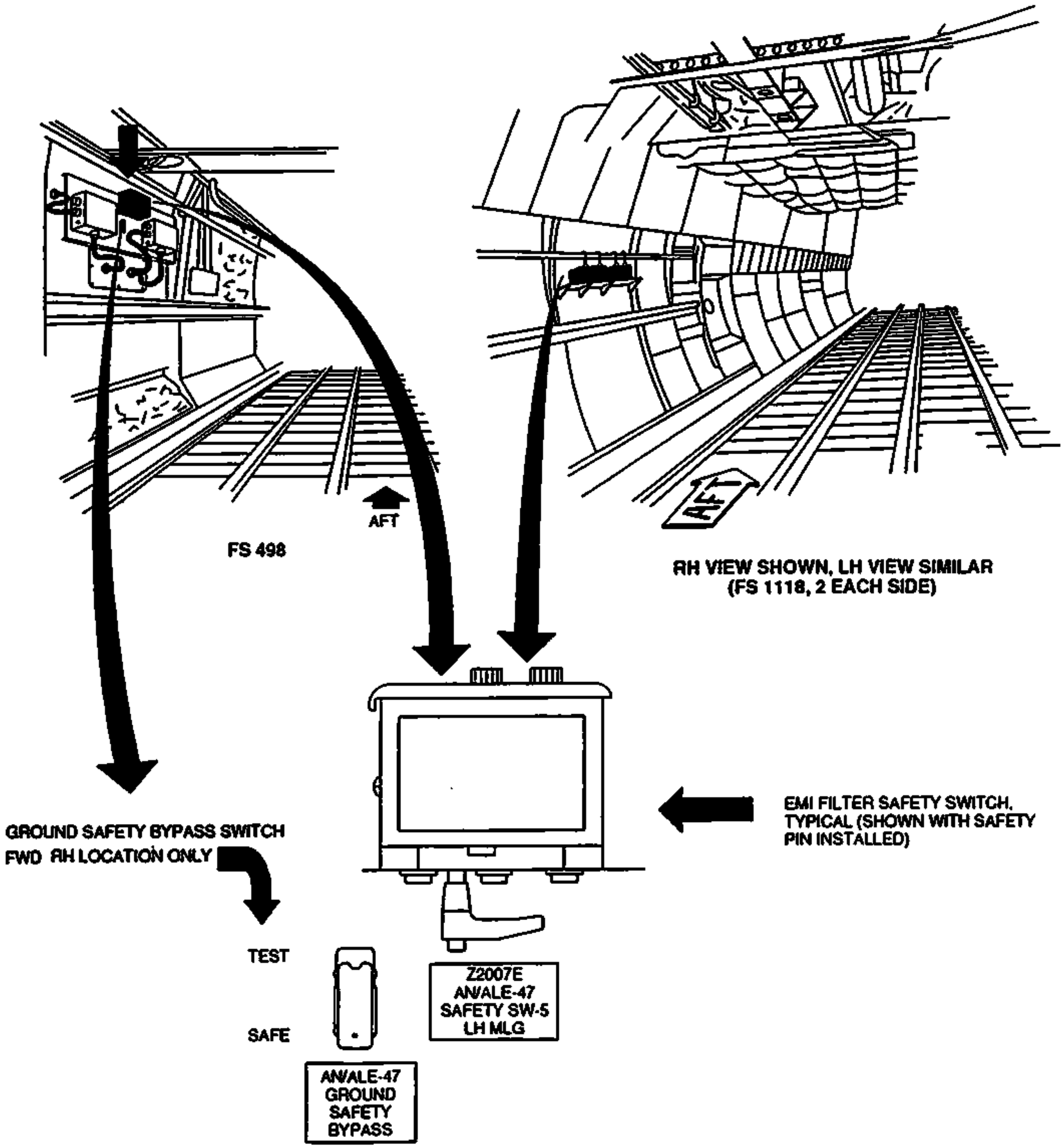
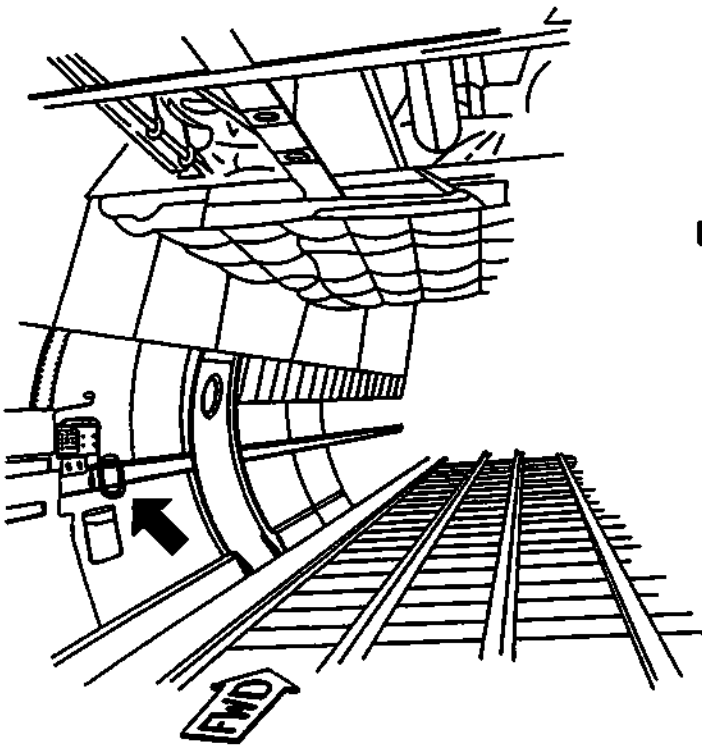
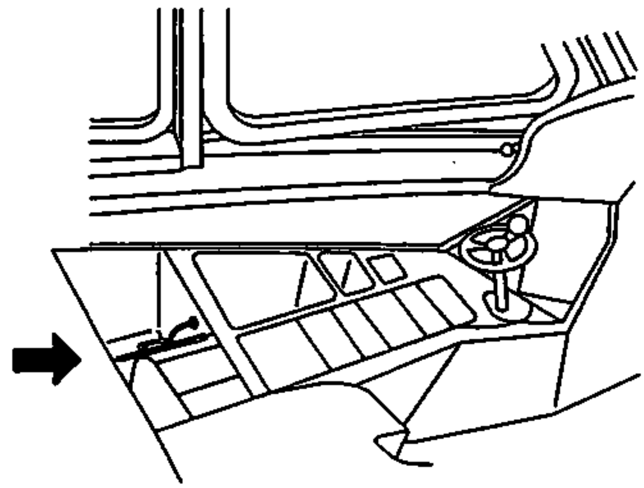


Figure 1-244. Safety Switch Locations

REMOTE DISPENSE SWITCH LOCATIONS



LH VIEW SHOWN, RH VIEW SIMILAR
(1 EACH SIDE)



PILOT SIDE CONSOLE

REMOTE DISPENSE PUSHBUTTON

Figure 1-245. Remote Dispense Switch Locations

SKE SYSTEM CONTROLS

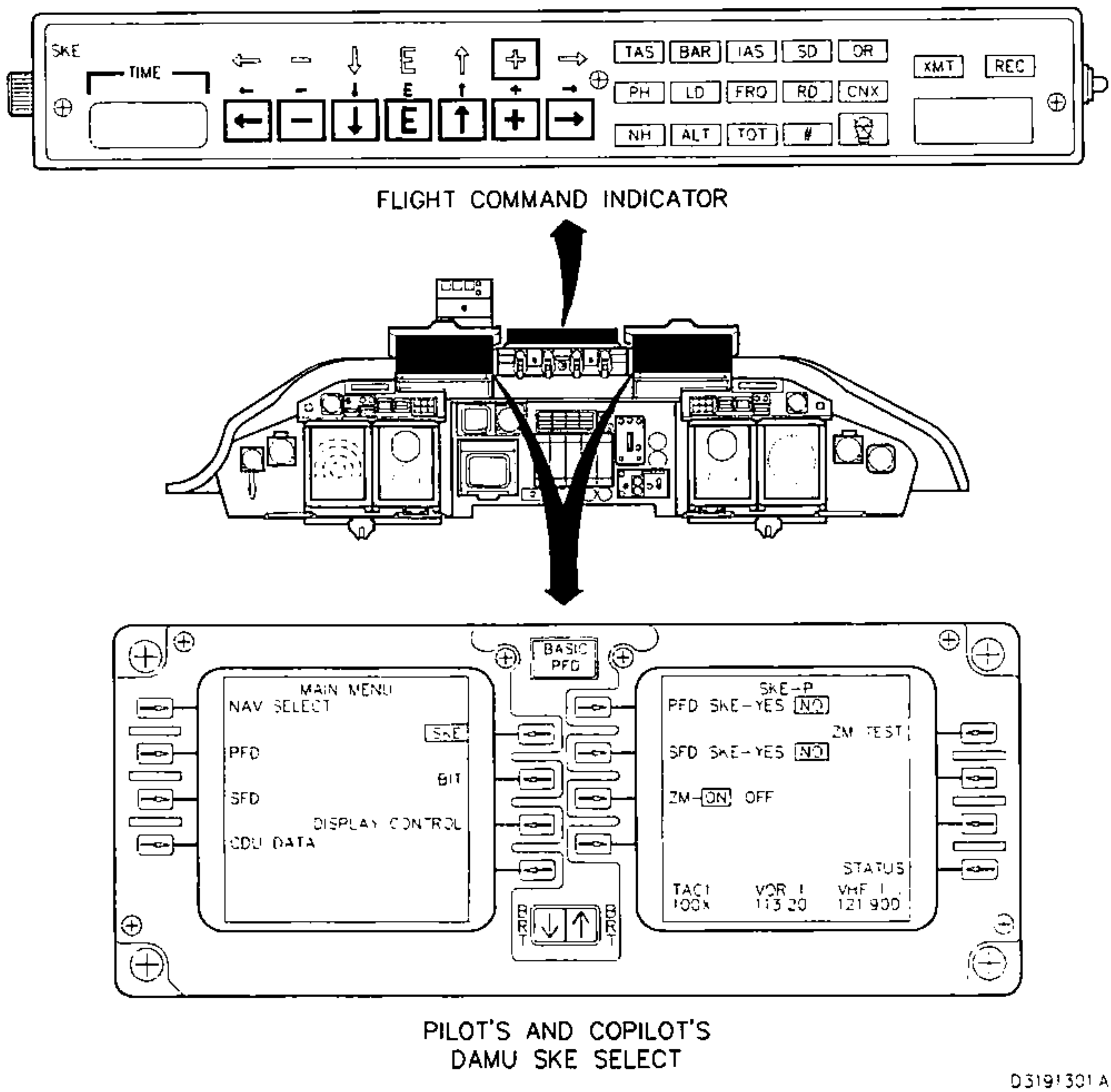
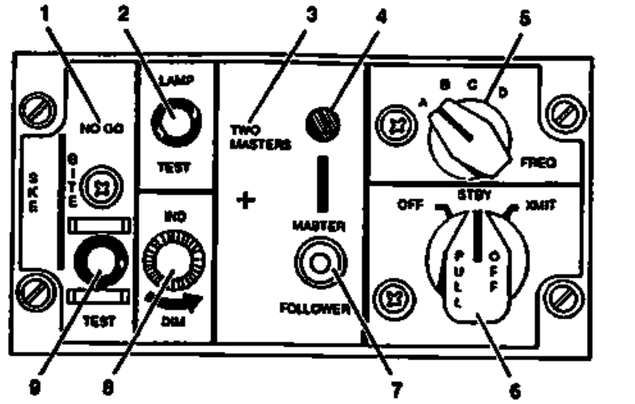
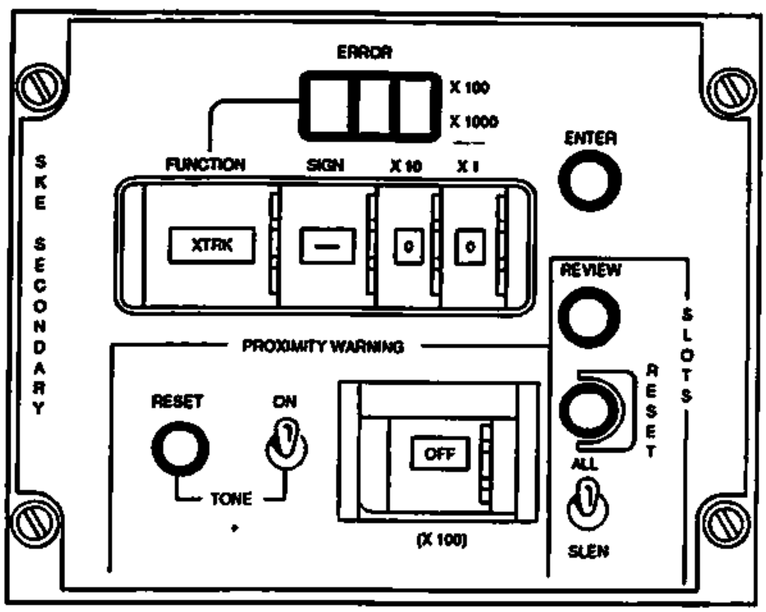


Figure 1-246. SKE System Controls (Sheet 1 of 2)

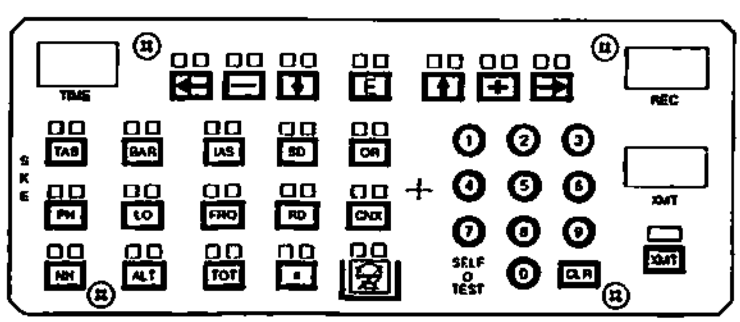


1. NO GO INDICATOR
2. LAMP TEST SWITCH
3. TWO MASTERS INDICATOR
4. MASTER INDICATOR
5. FREQ A/B/C/D SWITCH
6. OFF/STBY/XMIT SWITCH
7. MASTER/FOLLOWER SWITCH
8. IND DIM SWITCH
9. BITE TEST SWITCH

PRIMARY CONTROL



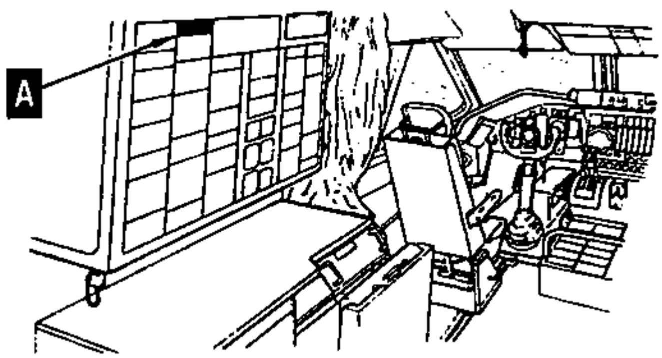
SECONDARY CONTROL



FLIGHT COMMAND INDICATOR

Figure 1-246. SKE System Controls (Sheet 2 of 2)

EMERGENCY LOCATOR TRANSMITTER (ELT) PANEL



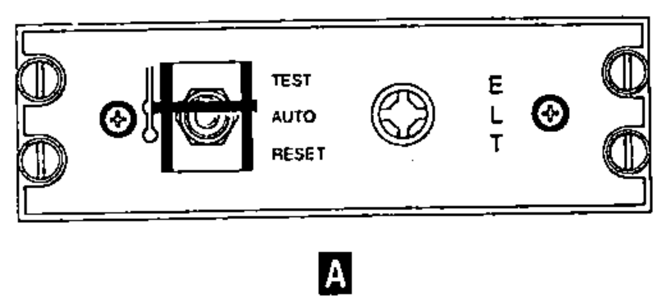
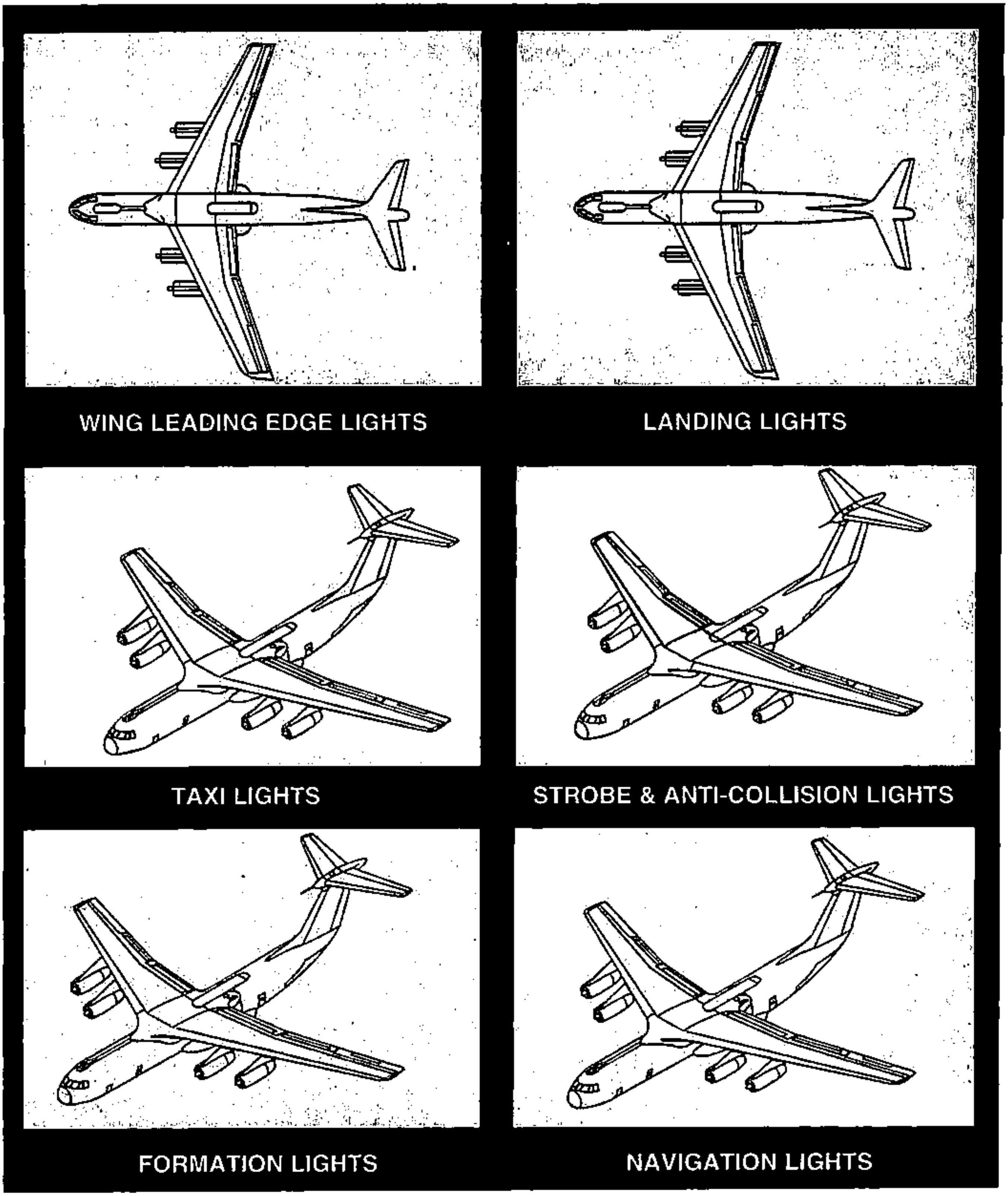


Figure 1-247. Emergency Locator Transmitter (ELT) Panel

EXTERIOR LIGHTS LOCATIONS

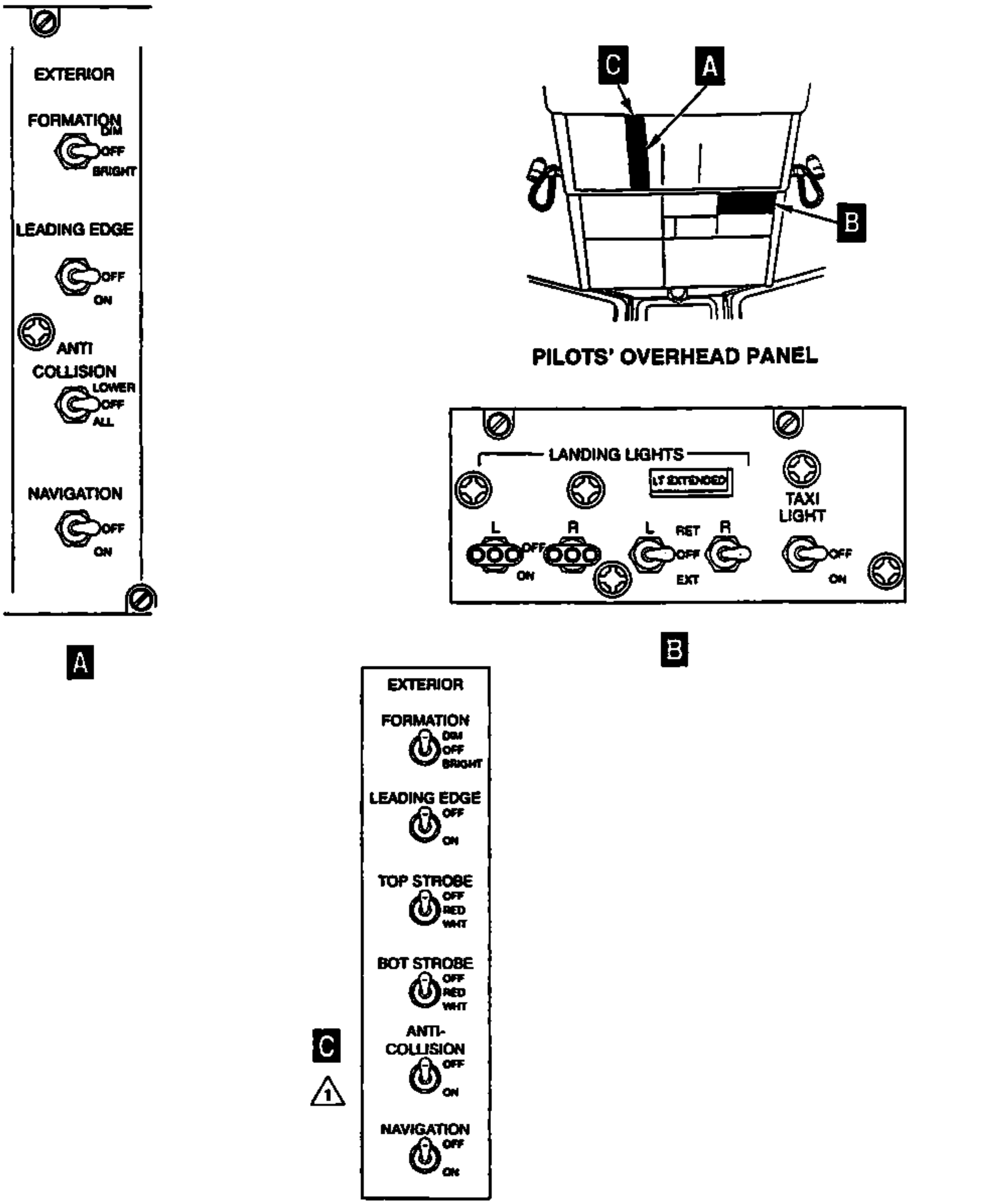


NOTE

THE WING LEADING EDGE LIGHTS ALSO COME ON WHEN THE TAXI LIGHTS ARE TURNED ON.

Figure 1-248. Exterior Lights Locations

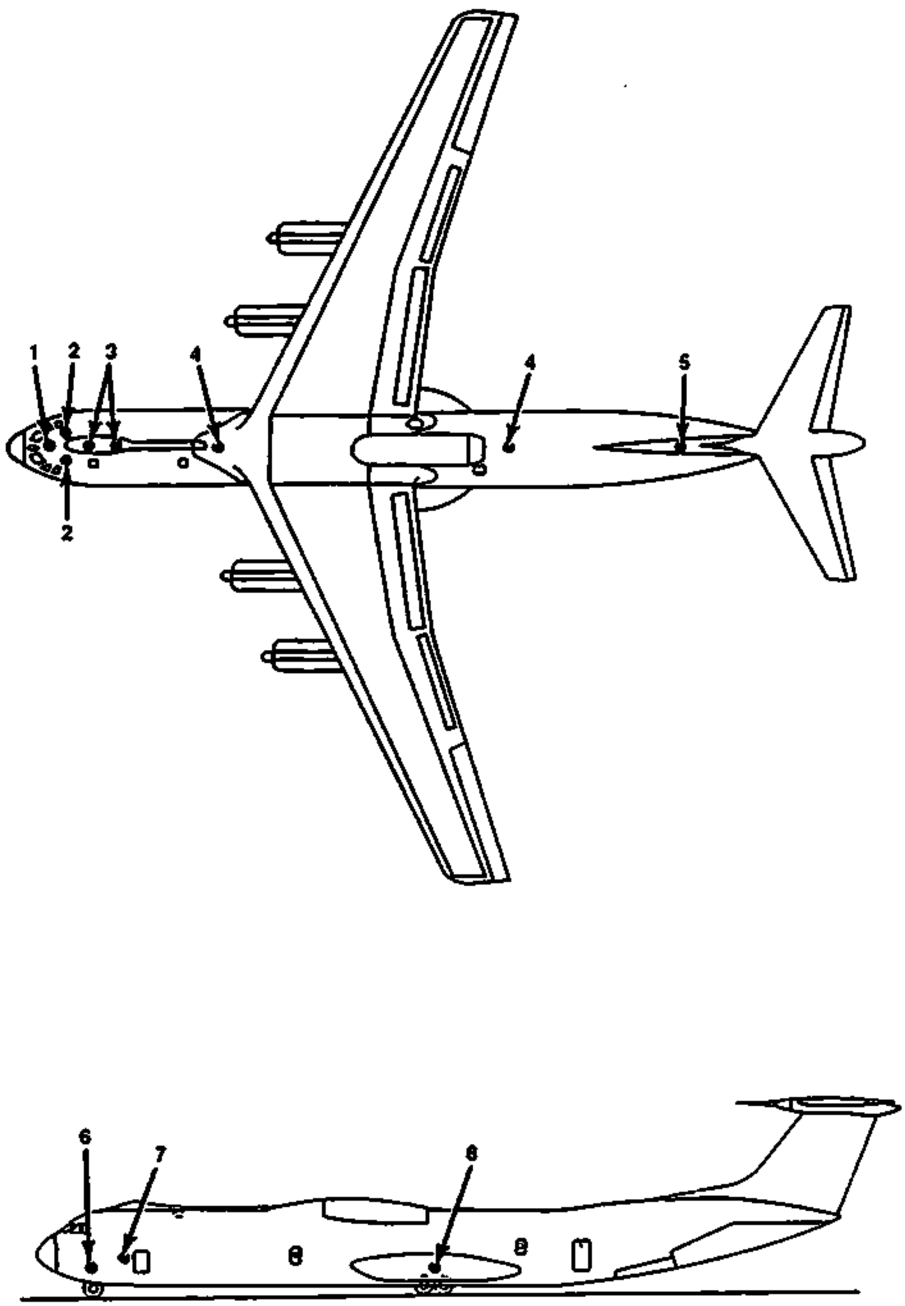
EXTERIOR LIGHTING CONTROL PANELS



⚠1 AIRCRAFT MODIFIED BY TO 531

141B-1-X0/0-073

Figure 1-249. Exterior Lighting Control Panels



INTERIOR LIGHTS

1. **PILOT'S AREA**

   Thunderstorm Lights
   Instrument Panel Lights
   Instrument Panel Flood Lights
   Overhead Panel Lights
   Overhead Panel Flood Lights
   Utility Lights
   Letdown Chart Lights
   Master Caution Lights
   Dome Lights

2. **FLIGHT ENGINEER AND NAVIGATOR AREA**

   Instrument Panel Lights
   Instrument Lights
   Flood Lights
   Worktable Lights
   Utility Lights

3. **RELIEF CREW AREA**

   Reading Lights
   Lavatory Light
   Galley Light

4. **CARGO COMPARTMENT**

   Flight Station Entrance Lights
   White Dome Lights
   Red Dome Lights
   Paratroop Platform Lights
   Cargo Ramp Loading Lights
   Emergency Exit Lights
   (11 emergency exit doors)

5. **AFT CRAWLWAY AND VERTICAL STABILIZER**

   Aft Crawlway Lights
   Vertical Stabilizer Lights

6. **NOSE WHEEL WELL**

   Downlock Inspection Light

7. **ELECTRONICS RACKS**

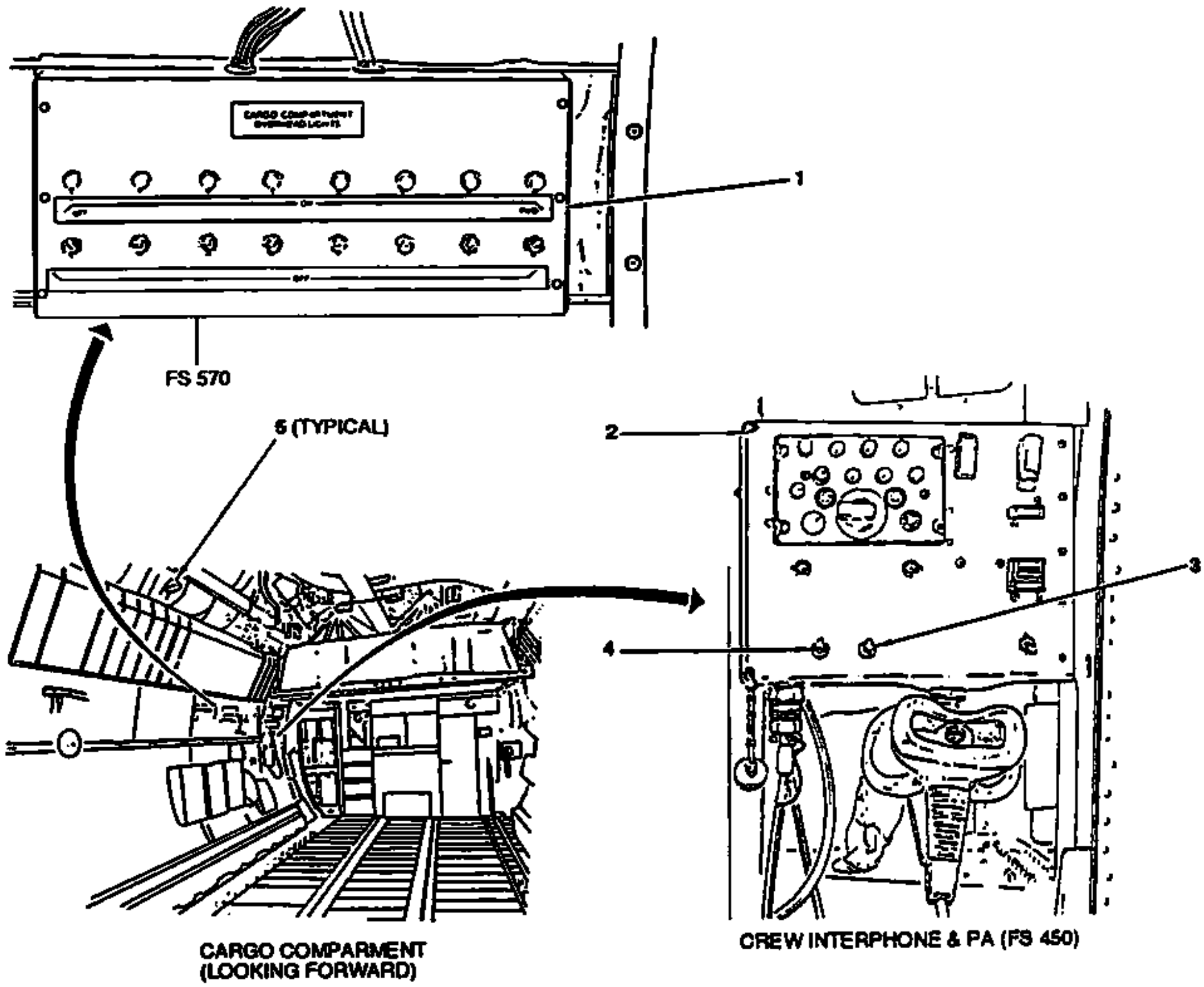
   Under Flight Deck Rack Lights

8. **MAIN WHEEL WELLS**

   Downlock Inspection Lights

Figure 1-250. Interior Lights

CARGO COMPARTMENT LIGHTING CONTROLS



1. CARGO COMPARTMENT OVERHEAD LIGHTS PANEL
2. FORWARD CREW INTERPHONE AND PA PANEL
3. CARGO COMPARTMENT LIGHTS BRIGHT/DIM SWITCH
4. CARGO COMPARTMENT LIGHTS ON/OFF SWITCH
5. TYPICAL CARGO COMPARTMENT WHITE DOME LIGHT

Figure 1-251. Cargo Compartment Lighting Controls (Sheet 1 of 2)

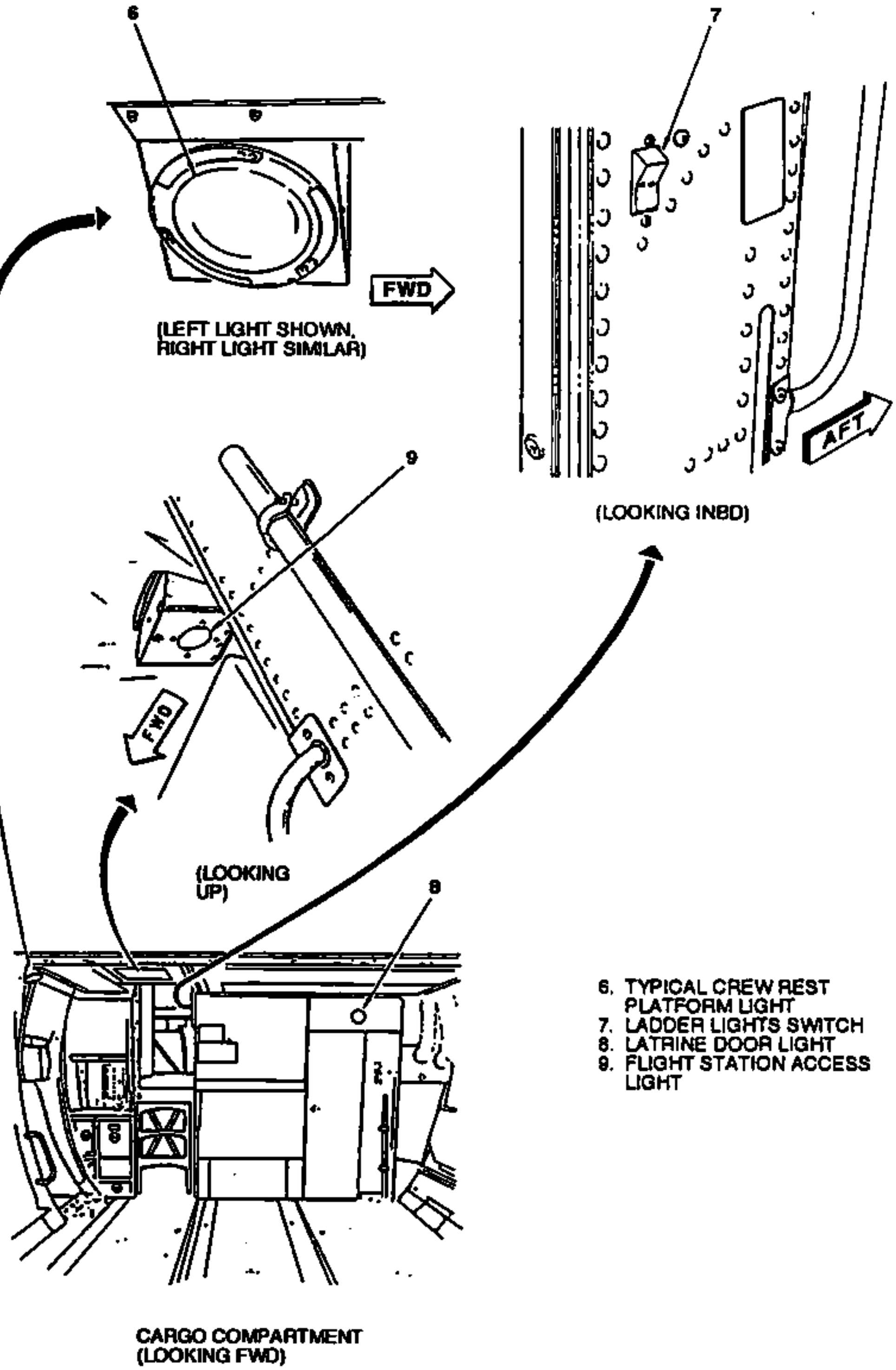
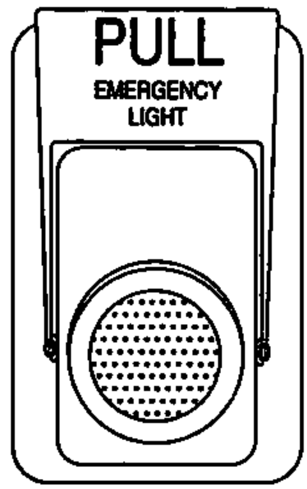


Figure 1-251. Cargo Compartment Lighting Controls (Sheet 2 of 2)

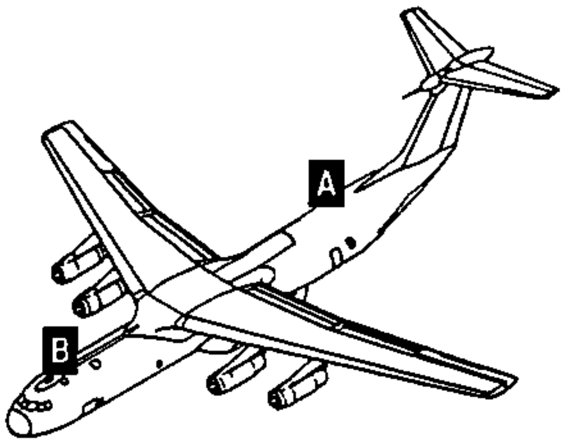
EMERGENCY EXIT LIGHT

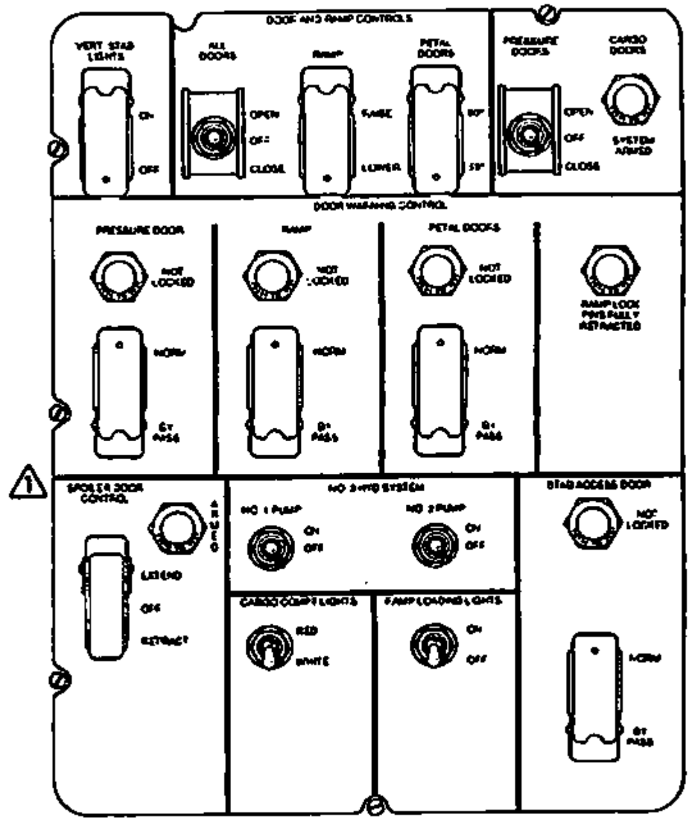


141A-1-X3/0-075

Figure 1-252. Emergency Exit Light

CARGO DOOR AND RAMP CONTROL PANELS

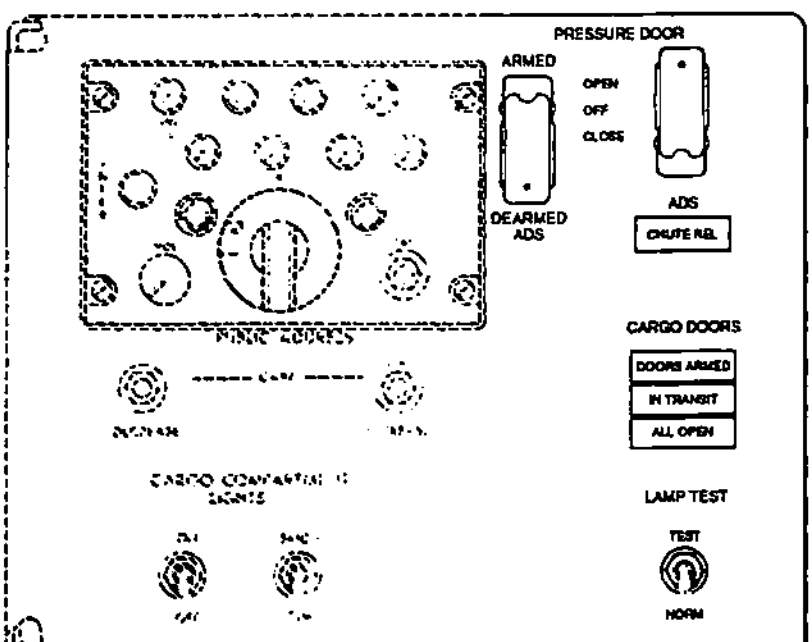




CARGO DOOR CONTROL PANEL
A (TYPICAL)

NOTE

1. TERMINOLOGY USED THROUGHOUT THE FLIGHT MANUAL IS "AIR DEFLECTORS" IN LIEU OF "SPOILERS".



FORWARD CREW DOOR INTERPHONE AND PA CONTROL PANEL
B (TYPICAL)

Figure 1-253. Cargo Door and Ramp Control Panels

CARGO RAMP MANUAL LOCK PINS

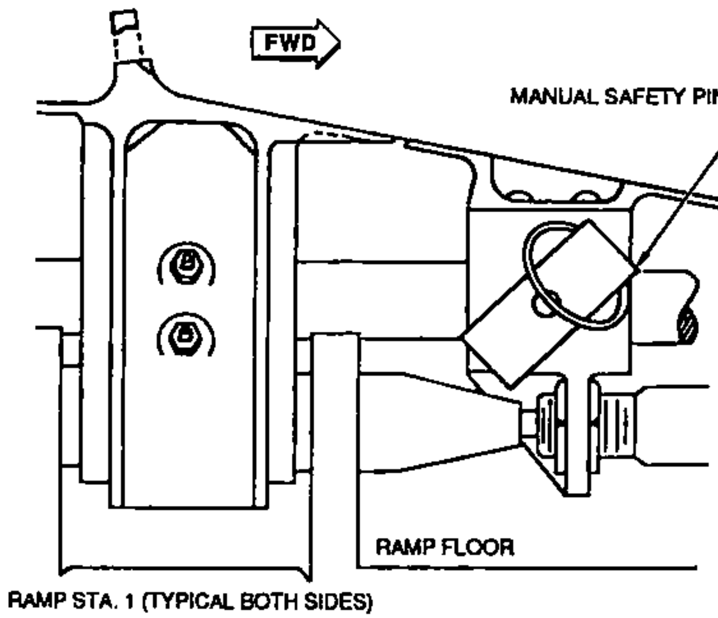


Figure 1-254. Cargo Ramp Manual Lock Pins

CARGO DOOR CONTROL VALVE PANEL

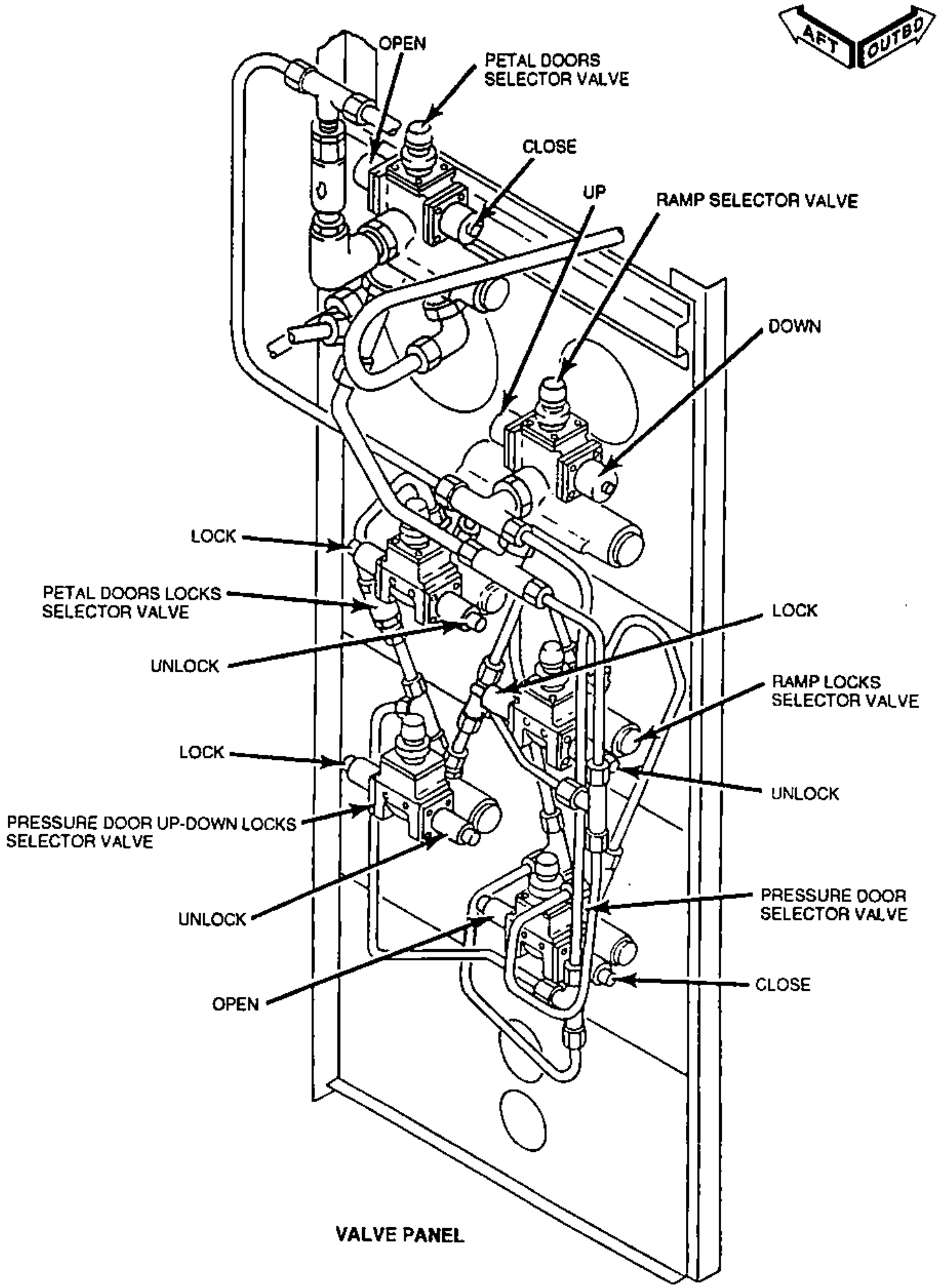
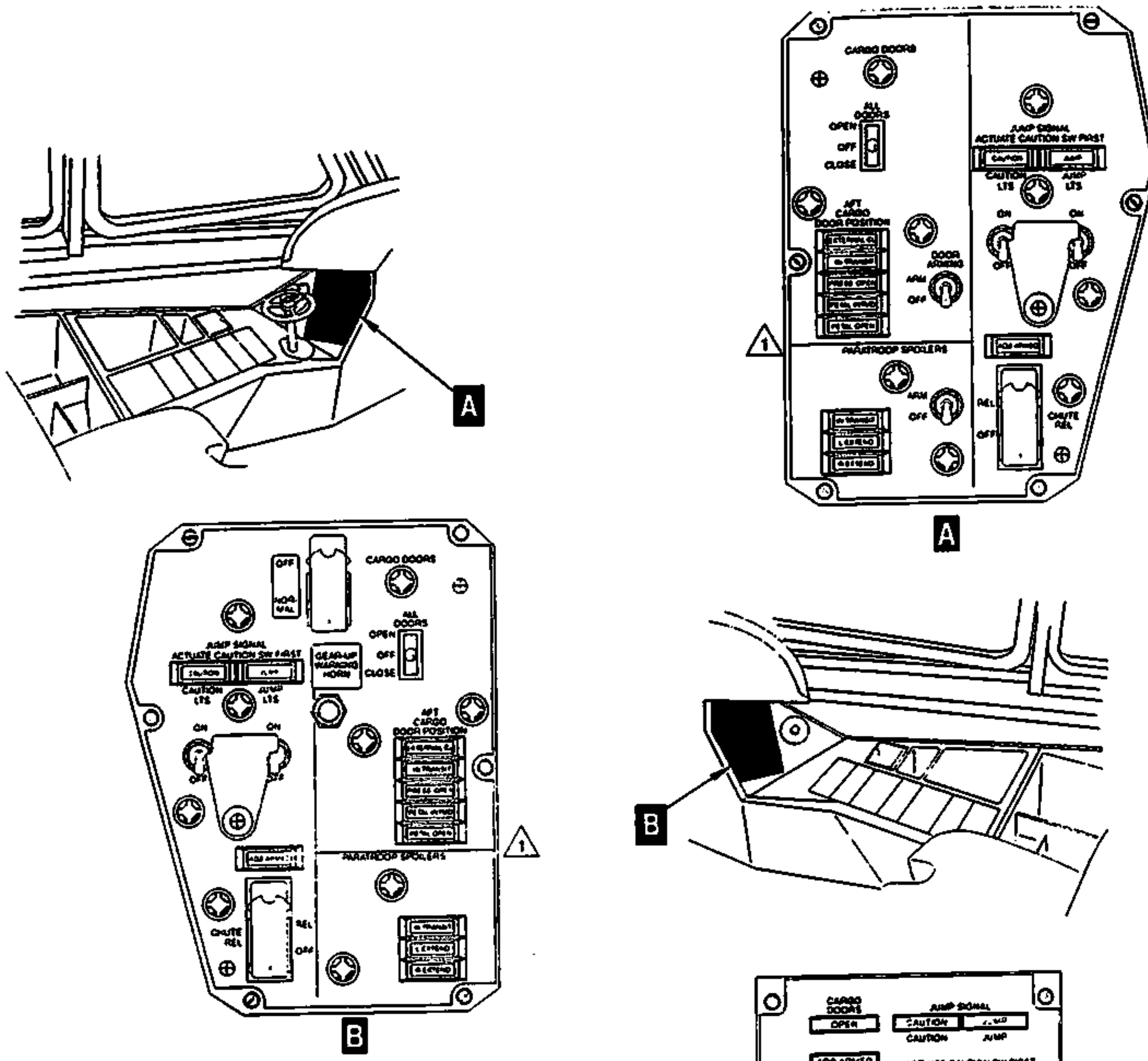
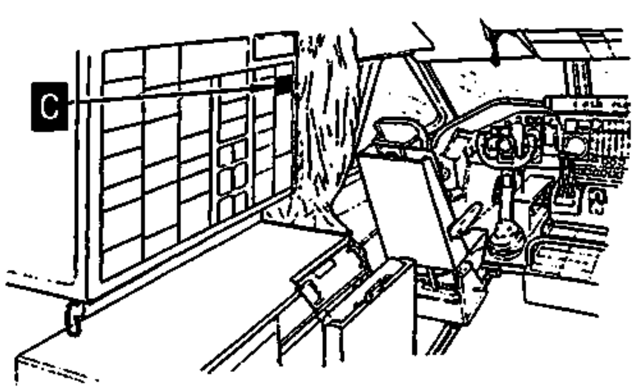
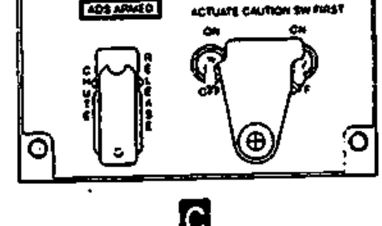


Figure 1-255. Cargo Door Control Valve Panel

ADS PANELS







NOTE

⚠1 TERMINOLOGY USED THROUGHOUT THE FLIGHT MANUAL IS "AIR DEFLECTORS" IN LIEU OF "SPOILERS".

Figure 1-256. ADS Panels

LOADMASTER/JUMPMASTER PANEL (TYPICAL)

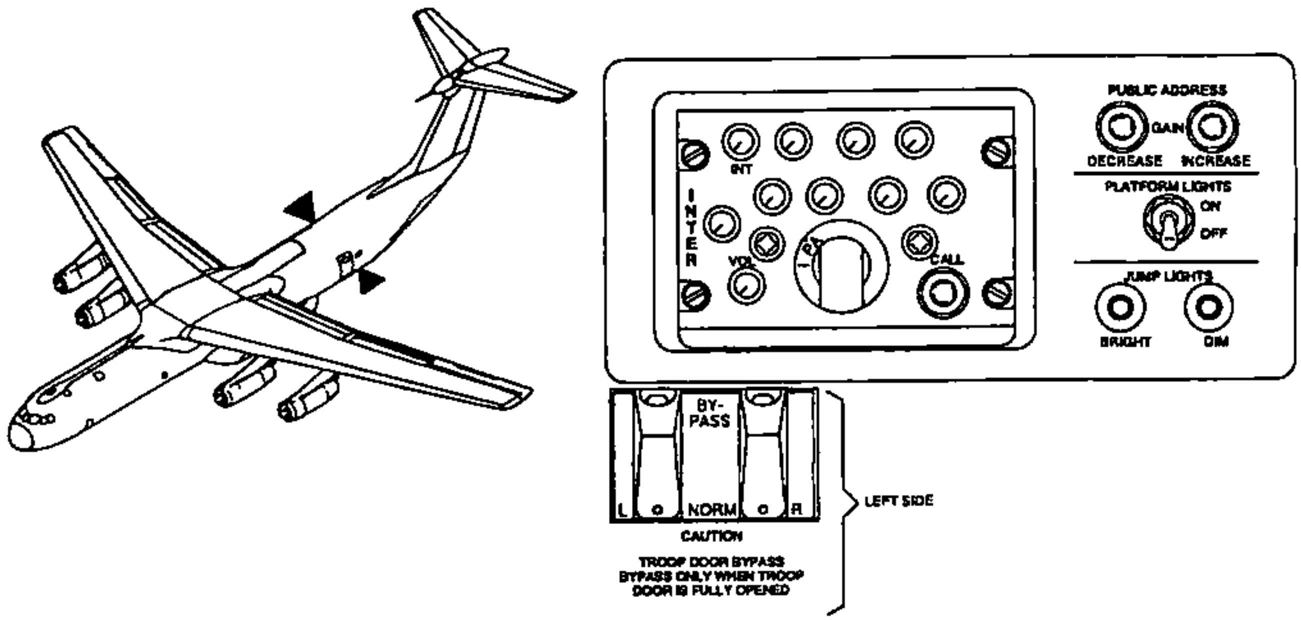


Figure 1-257. Loadmaster/Jumpmaster Panel (Typical)

STATIC LINE RETRIEVER WINCH CONTROL HANDLE

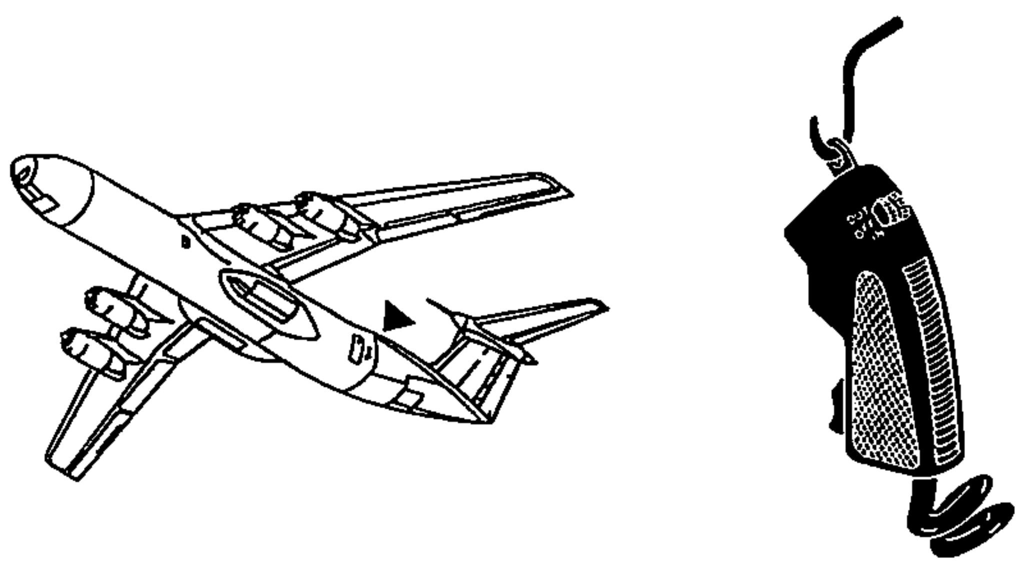
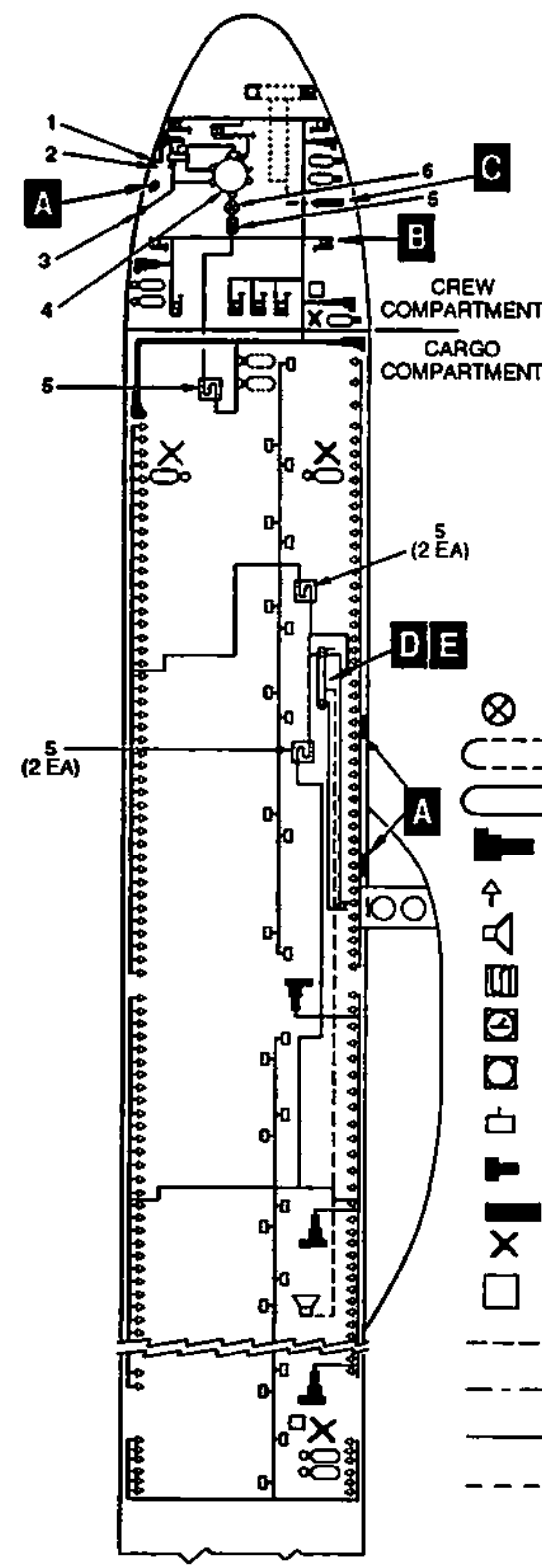
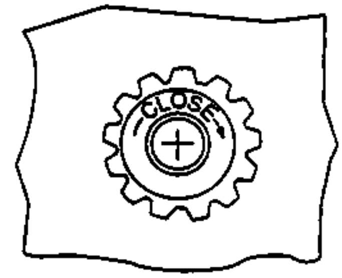


Figure 1-258. Static Line Retriever Winch Control Handle

OXYGEN SYSTEM





A

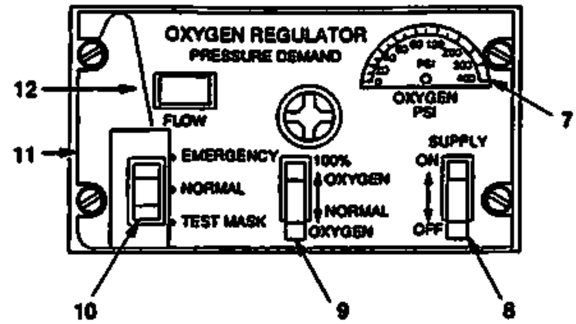
MANUAL SHUTOFF VALVE HANDLE

1. FILLER
2. COMBINATION FILL-BUILDUP-VENT VALVE
3. OVERBOARD VENT
4. LIQUID OXYGEN CONVERTER
5. HEAT EXCHANGER
6. MANUALLY OPERATED SHUTOFF VALVE

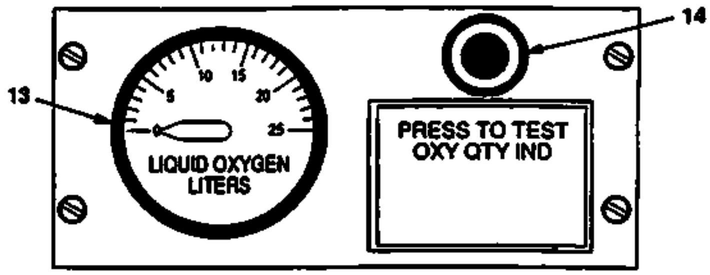
LINE VALVE
PORTABLE UNIT STOWING PROVISIONS
PORTABLE UNIT
PORTABLE UNIT RECHARGER
MASK PLUG-IN OUTLET
WARNING HORN (LOW OXYGEN QUANTITY WARNING AND BAILOUT SIGNAL).
HEAT EXCHANGER (WARMING COIL)
REGULATOR
LOW QUANTITY WARNING LIGHT
QUICK DISCONNECT
MASK REGULATOR TUBING
THERAPEUTIC OXYGEN BOX
EMERGENCY ESCAPE BREATHING DEVICE (EEBD)
SMOKE MASK
ELECTRICAL LINE
FILLER LINE
DISTRIBUTION LINE
WIRE BUNDLE, CONVERTER TO QUANTITY INDICATOR

141A-1-XX/0-082-1

Figure 1-259. Oxygen System (Sheet 1 of 2)

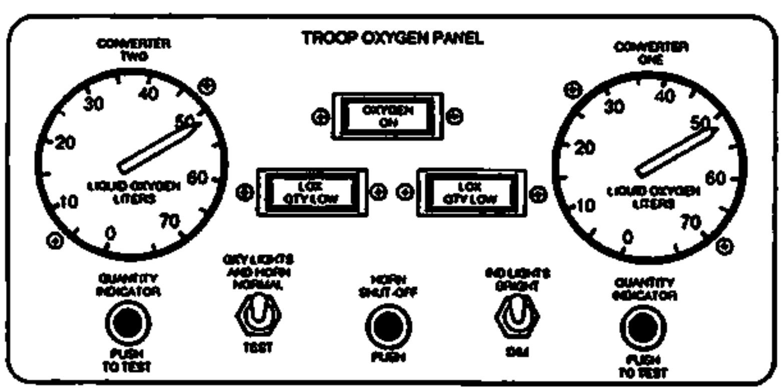


B OXYGEN REGULATOR (TYPICAL 9 PLACES)

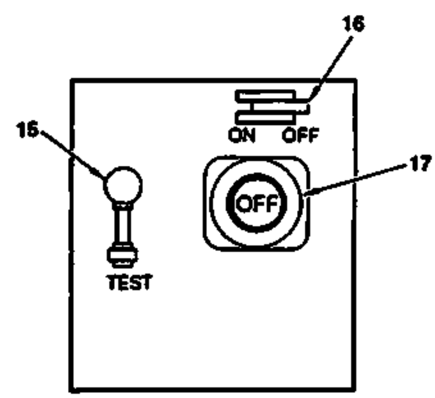


C LIQUID OXYGEN QUANTITY INDICATOR PANEL

7. PRESSURE GAGE
8. SUPPLY LEVER
9. DILUTER LEVER
10. EMERGENCY TOGGLE LEVER
11. SHEETMETAL GUARD
12. VISUAL FLOW INDICATOR
13. LIQUID OXYGEN QUANTITY INDICATOR
14. PRESS-TO-TEST BUTTON
15. CABIN ALTITUDE TEST OUTLET
16. REGULATOR ON-OFF LEVER
17. REGULATOR INDICATOR



D TROOP OXYGEN PANEL



E TROOP OXYGEN REGULATOR

NOTE

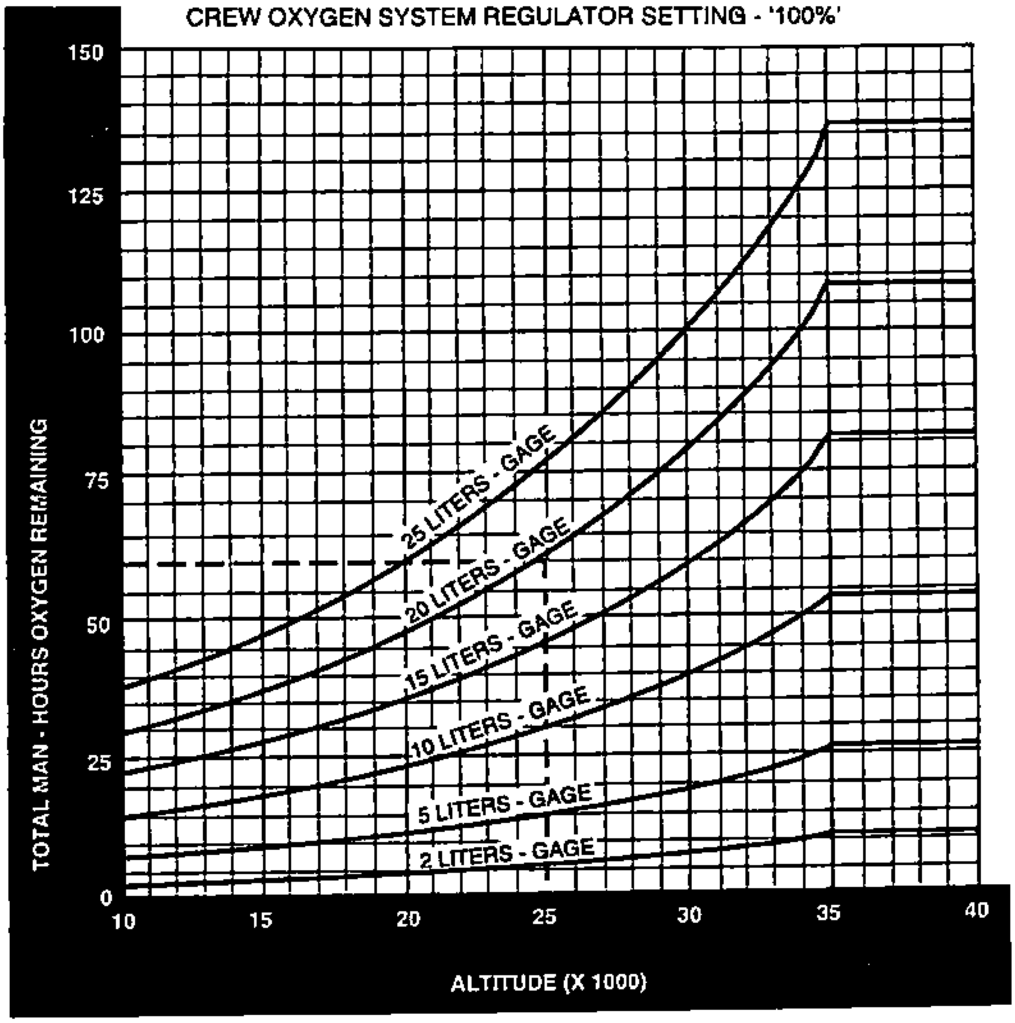
THREE ADDITIONAL PORTABLE THERAPEUTIC OXYGEN BOTTLE RECHARGER OUTLETS ARE INSTALLED ON THE RIGHT HAND SIDE OF THE FUSELAGE, AFT OF THE TROOP OXYGEN PANEL.

Figure 1-259. Oxygen System (Sheet 2 of 2)

OXYGEN DURATION

NOTE

THE MINIMUM QUANTITY OF OXYGEN ABOARD THE AIRCRAFT BEFORE TAKE-OFF MUST BE SUFFICIENT TO ACCOMPLISH THE PLANNED FLIGHT FROM EQUAL TIME POINT (ETP) SHOULD OXYGEN BE REQUIRED.



EXAMPLE

GIVEN:

CREW OF 8 MEN
ALTITUDE = 25,000 FT (AFTER DESCENT)
OXYGEN INDICATOR READING = 20 LITERS GAGE

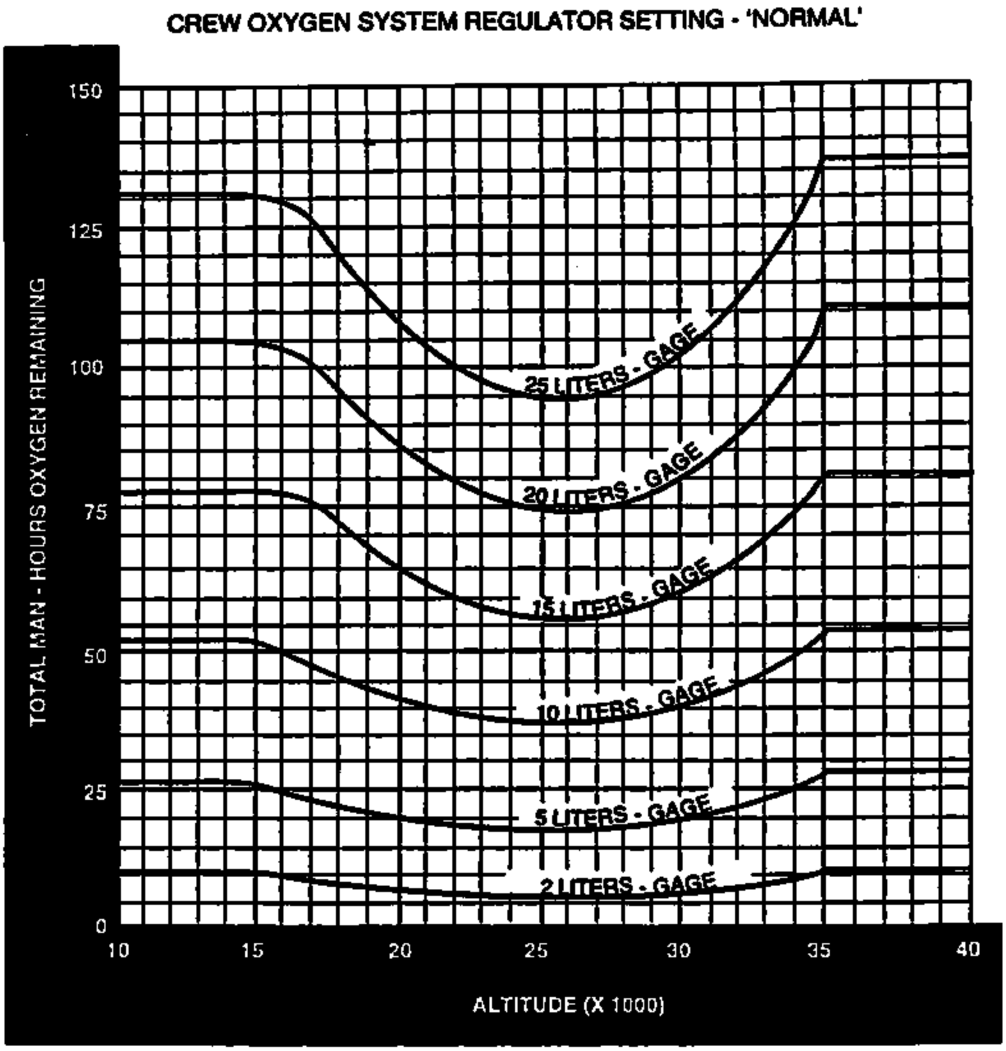
FIND:

OXYGEN DURATION

SOLUTION:

ENTER CHART AT 25,000 FT AND PROCEED VERTICALLY TO THE 20 LITERS-GAGE CURVE. READ TO THE LEFT ON TOTAL MAN-HOURS OXYGEN REMAINING = 62 TOTAL MAN-HOURS. DIVIDE TOTAL MAN-HOURS BY THE NUMBER OF CREW MEMBERS = 7.0 HOURS 45 MINUTES OXYGEN DURATION.

Figure 1-260. Oxygen Duration (Sheet 1 of 3)



NOTE

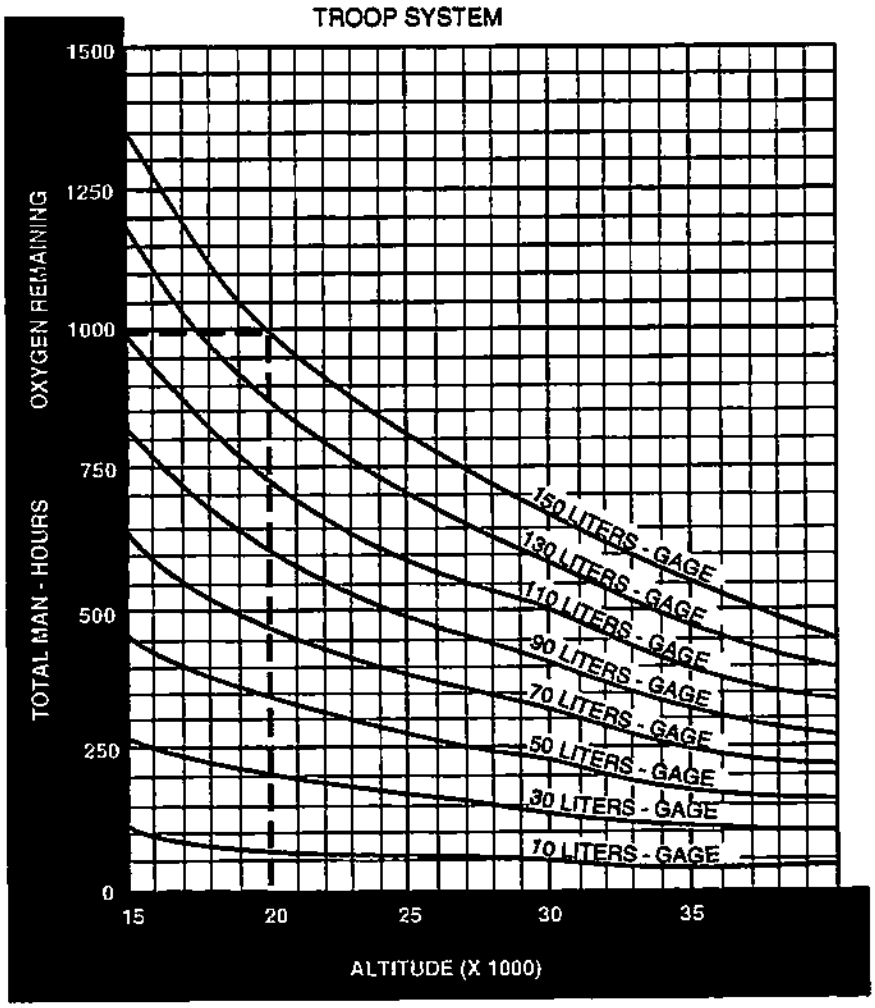
CURVES ARE FOR TOTAL HOURS OXYGEN SUPPLY PER GAGE READING. SEE EXAMPLE PROBLEM ON SHEET 1 FOR OXYGEN DURATION SAMPLE PROBLEM.

141A-1-X3/0-083-2

Figure 1-260. Oxygen Duration (Sheet 2 of 3)

NOTE

THE MINIMUM QUANTITY OF OXYGEN ABOARD THE AIRCRAFT BEFORE TAKE-OFF MUST BE SUFFICIENT TO ACCOMPLISH THE PLANNED FLIGHT FROM THE EQUAL TIME POINT (ETP) SHOULD OXYGEN BE REQUIRED.

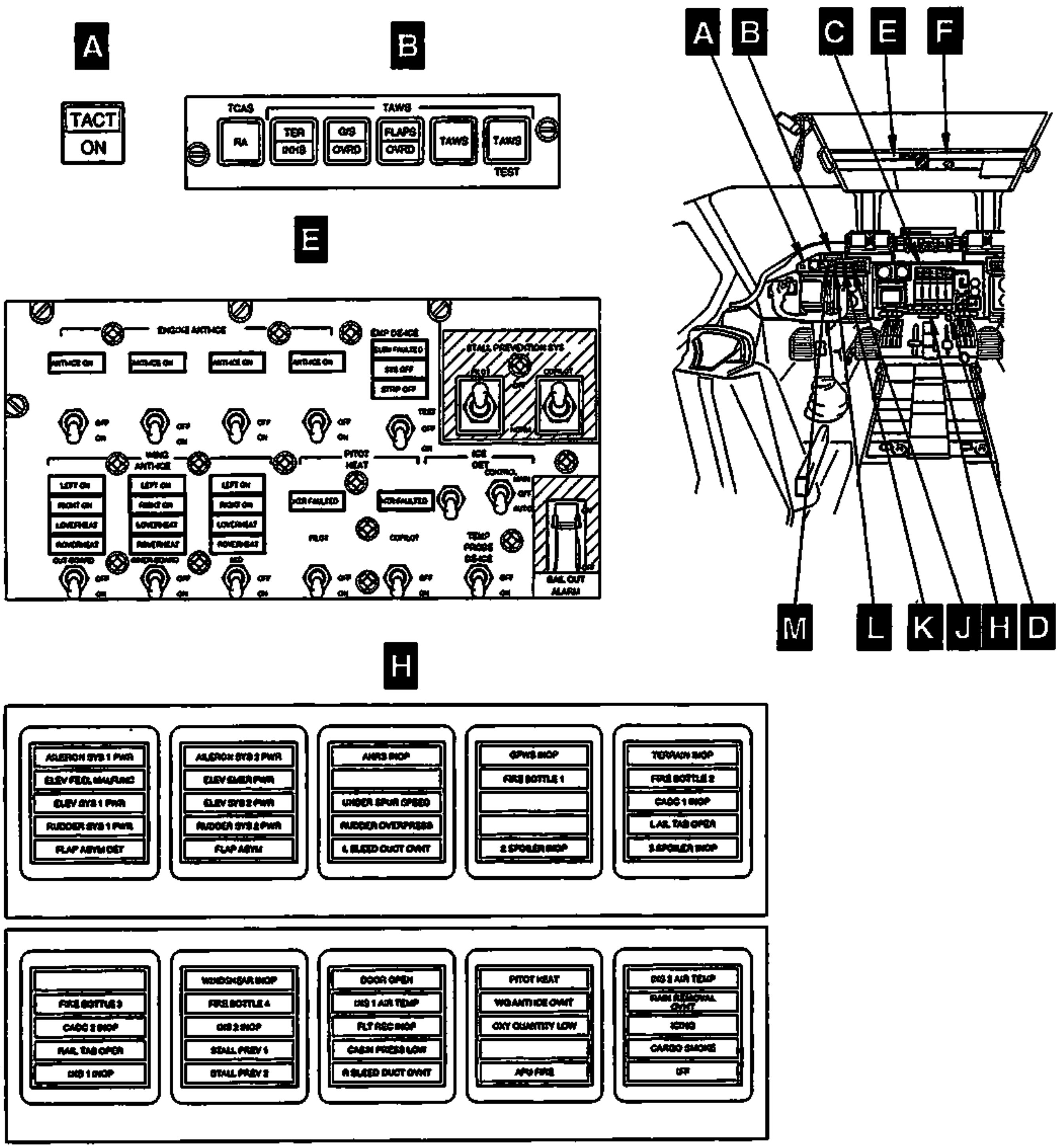


EXAMPLE

GIVEN:
143 PASSENGERS
ALTITUDE = 20,000 FT (AFTER DESCENT)
OXYGEN INDICATOR READING = 75 LITERS EACH CONVERTER
FIND:
OXYGEN DURATION
SOLUTION:
ENTER CHART AT 20,000 FT AND PROCEED VERTICALLY TO THE 150 LITERS-GAGE CURVE. READ TO THE LEFT ON THE TOTAL MAN-HOURS BY THE NUMBER OF PASSENGERS = 7.0 HOURS OXYGEN DURATION.

Figure 1-260. Oxygen Duration (Sheet 3 of 3)

SYSTEM CONDITION LIGHTS



D8052501 B

Figure 1-261. System Condition Lights (Sheet 1 of 2)

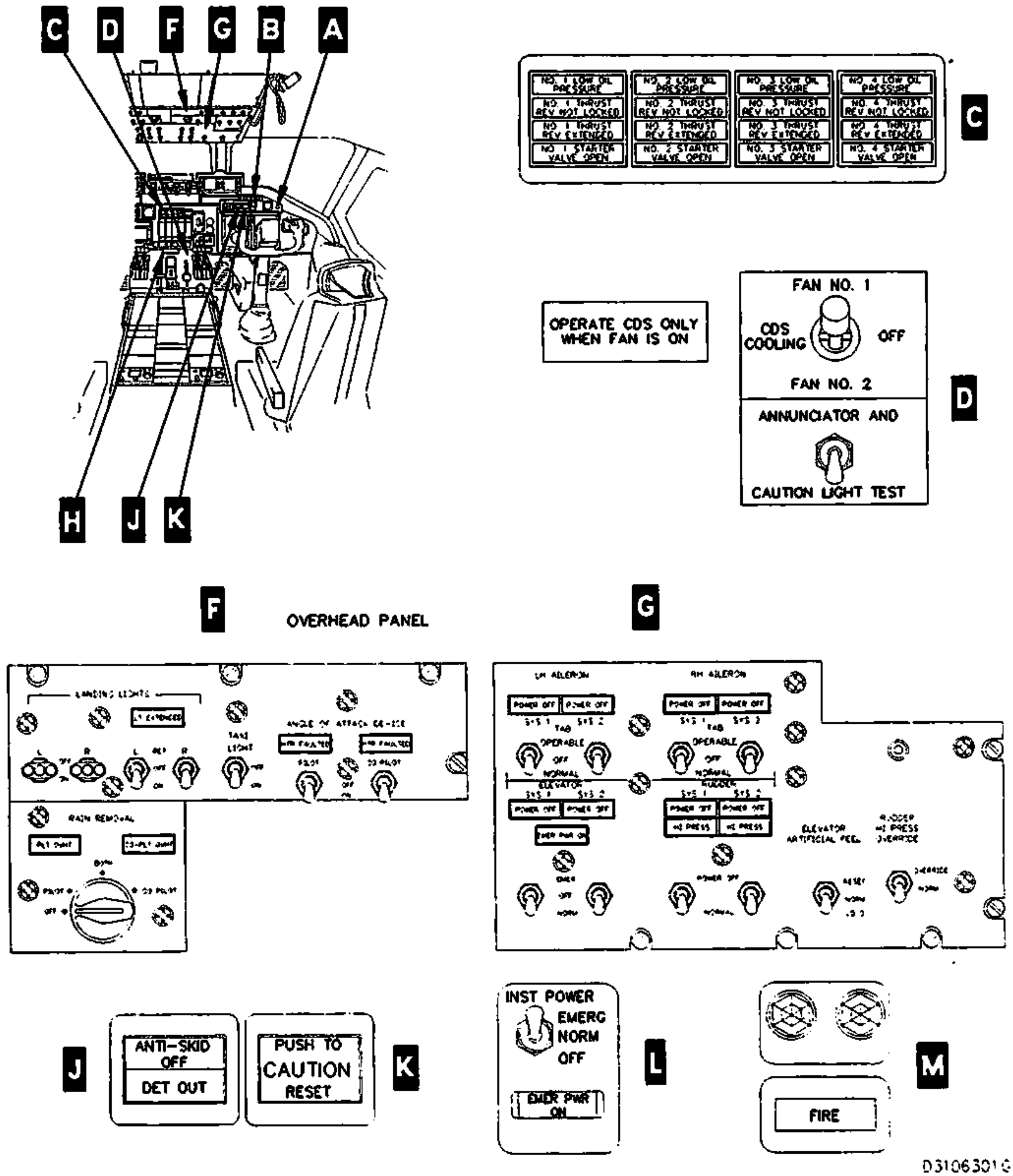
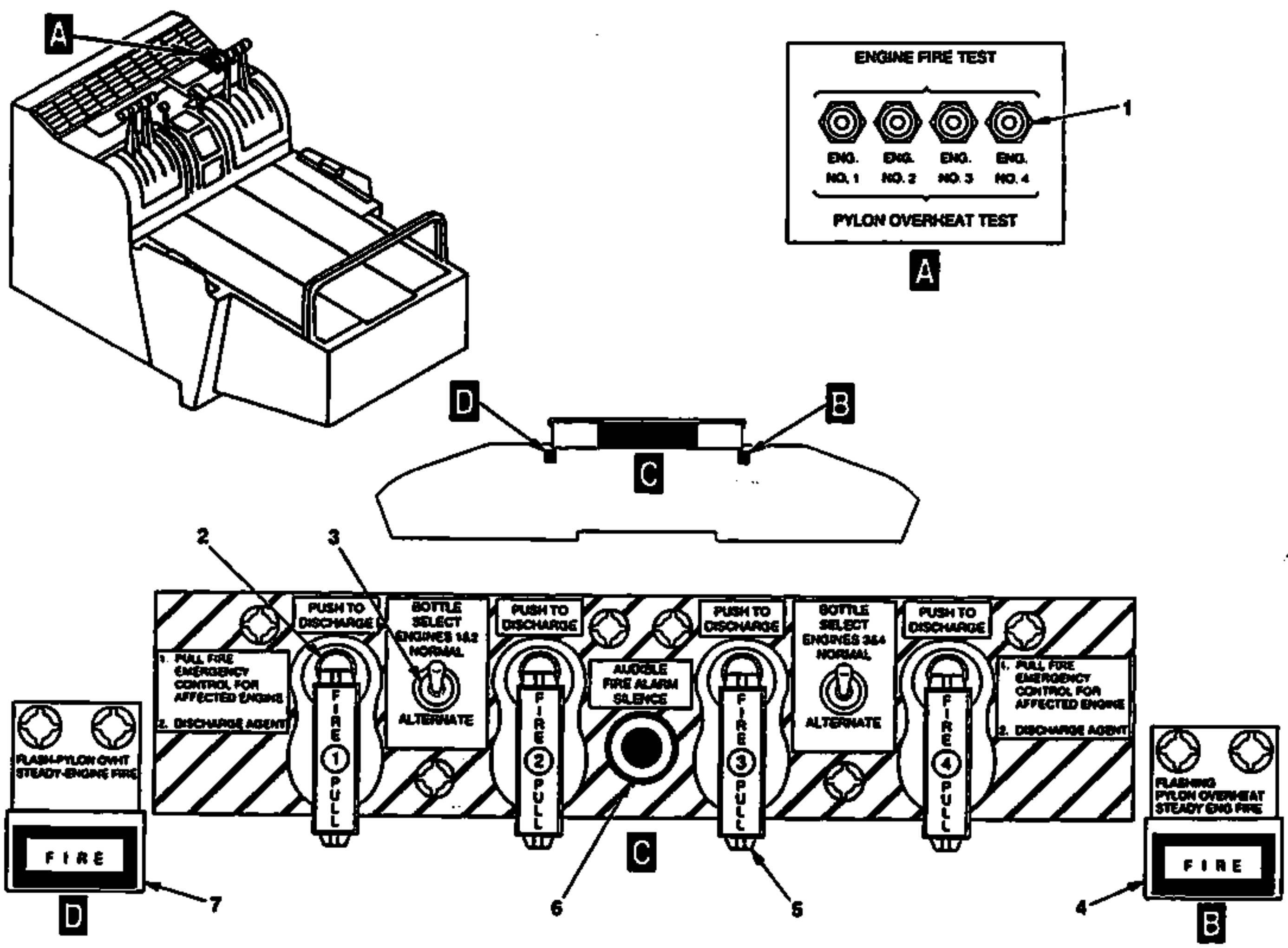


Figure 1-261. System Condition Lights (Sheet 2 of 2)

FIRE WARNING & EXTINGUISHING SYSTEM CONTROLS & INDICATORS



1. FIRE TEST & OVERHEAT TEST SWITCH
2. PUSH TO DISCHARGE BUTTON
3. NORMAL & ALTERNATE BOTTLE SELECT SWITCH
4. COPILOT'S OVERHEAT & FIRE WARNING LIGHT
5. ENGINE FIRE EMERGENCY CONTROL HANDLE
6. AUDIBLE FIRE ALARM SILENCE BUTTON
7. PILOT'S OVERHEAT & FIRE WARNING LIGHT

Figure 1-262. Fire Warning & Extinguishing System Controls & Indicators

TYPICAL BLOWER INSTALLATION MOUNTING PROVISIONS

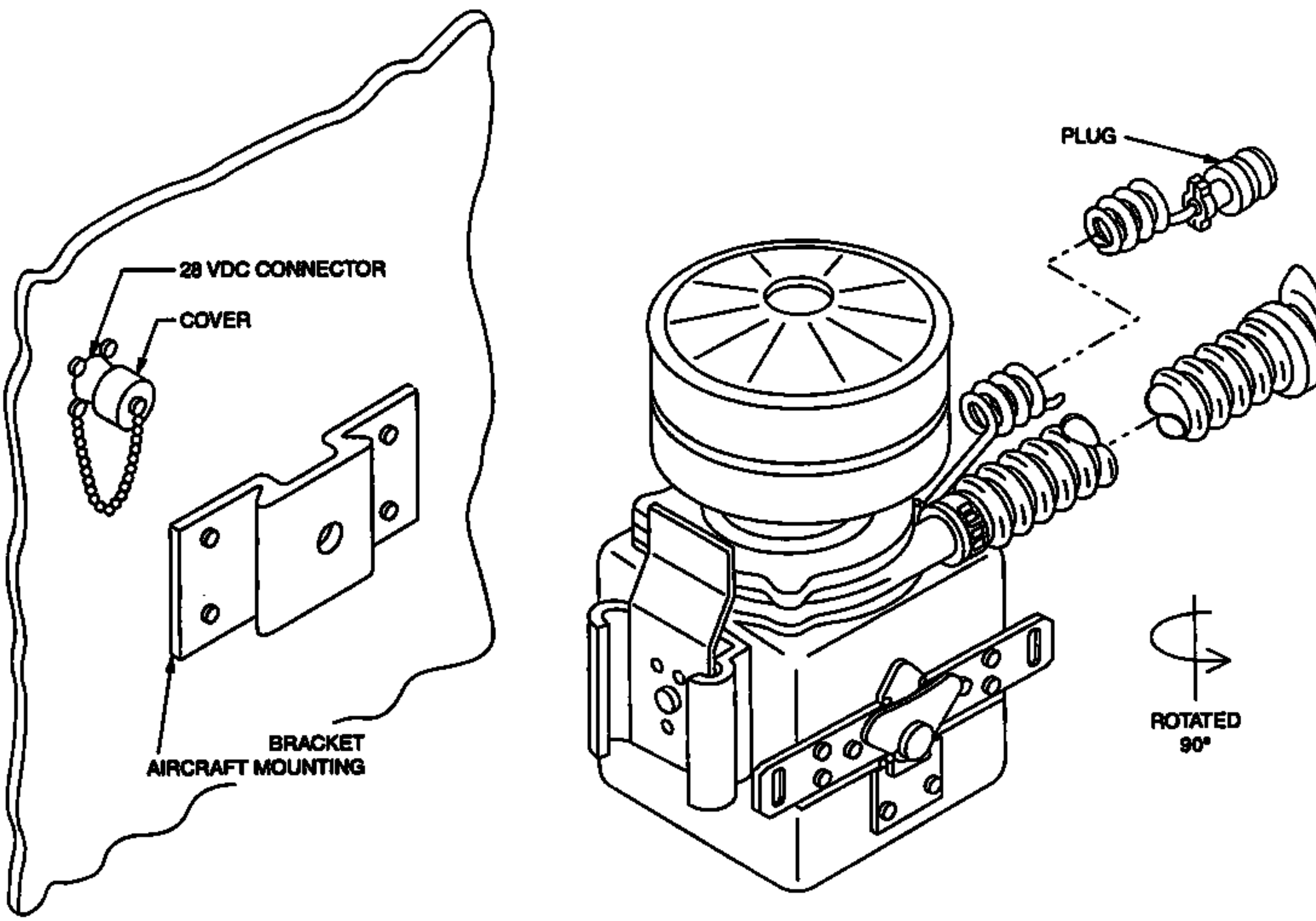
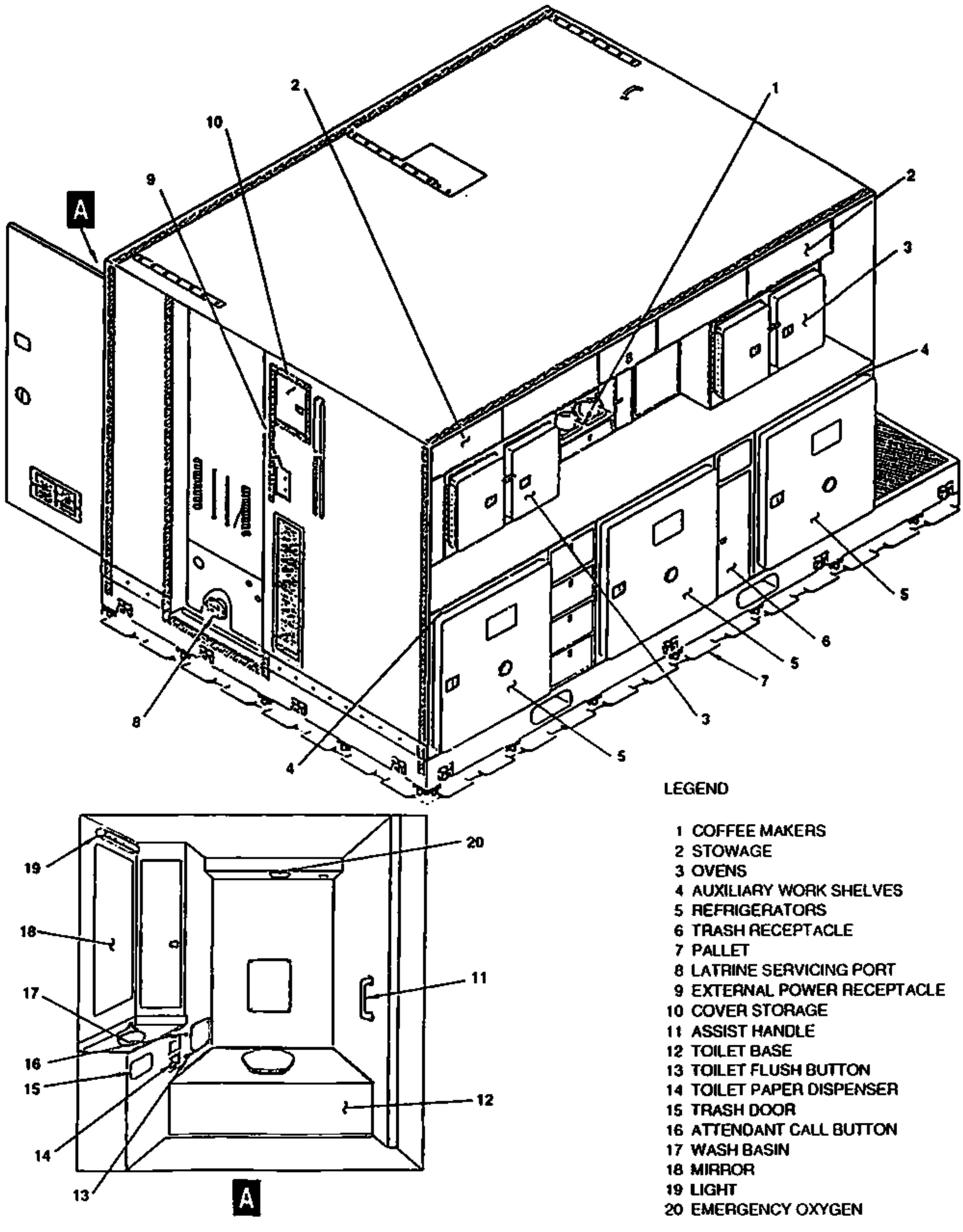


Figure 1-263. Typical Blower Installation Mounting Provisions

AIR TRANSPORTABLE GALLEY/LAVATORY



LEGEND

1 COFFEE MAKERS
2 STOWAGE
3 OVENS
4 AUXILIARY WORK SHELVES
5 REFRIGERATORS
6 TRASH RECEPTACLE
7 PALLET
8 LATRINE SERVICING PORT
9 EXTERNAL POWER RECEPTACLE
10 COVER STORAGE
11 ASSIST HANDLE
12 TOILET BASE
13 TOILET FLUSH BUTTON
14 TOILET PAPER DISPENSER
15 TRASH DOOR
16 ATTENDANT CALL BUTTON
17 WASH BASIN
18 MIRROR
19 LIGHT
20 EMERGENCY OXYGEN

Figure 1-264. Air Transportable Galley/Lavatory

PILOT'S ACCELEROMETER

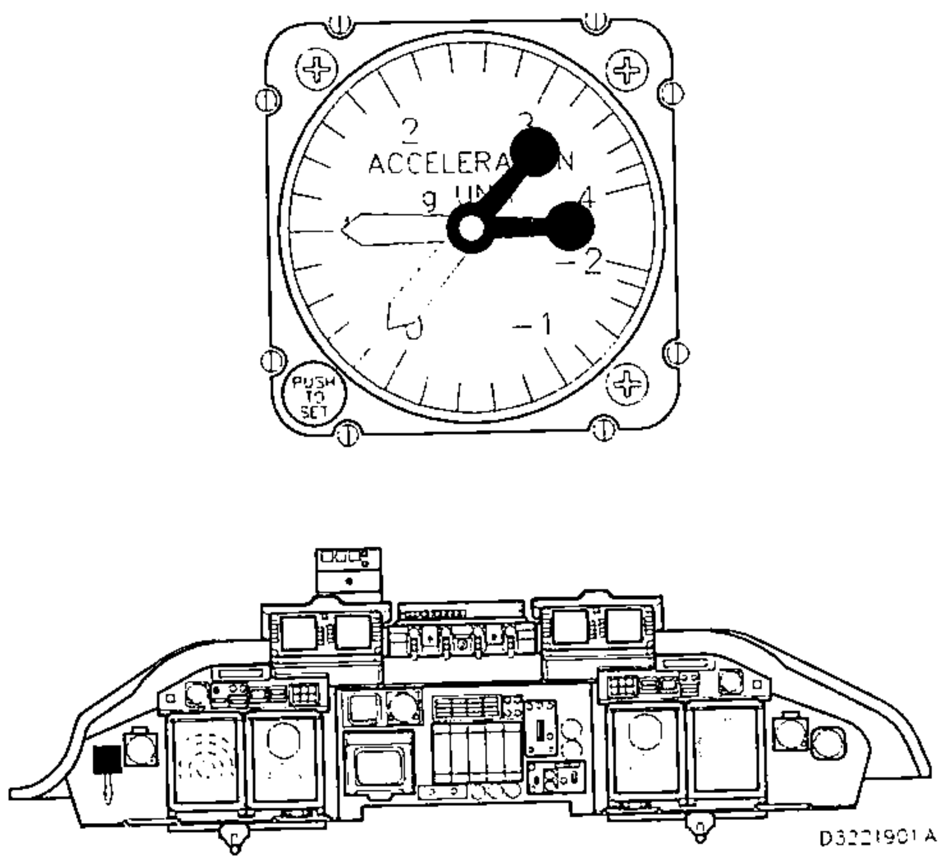


Figure 1-265. Pilot's Accelerometer

MAGNETIC STANDBY COMPASS

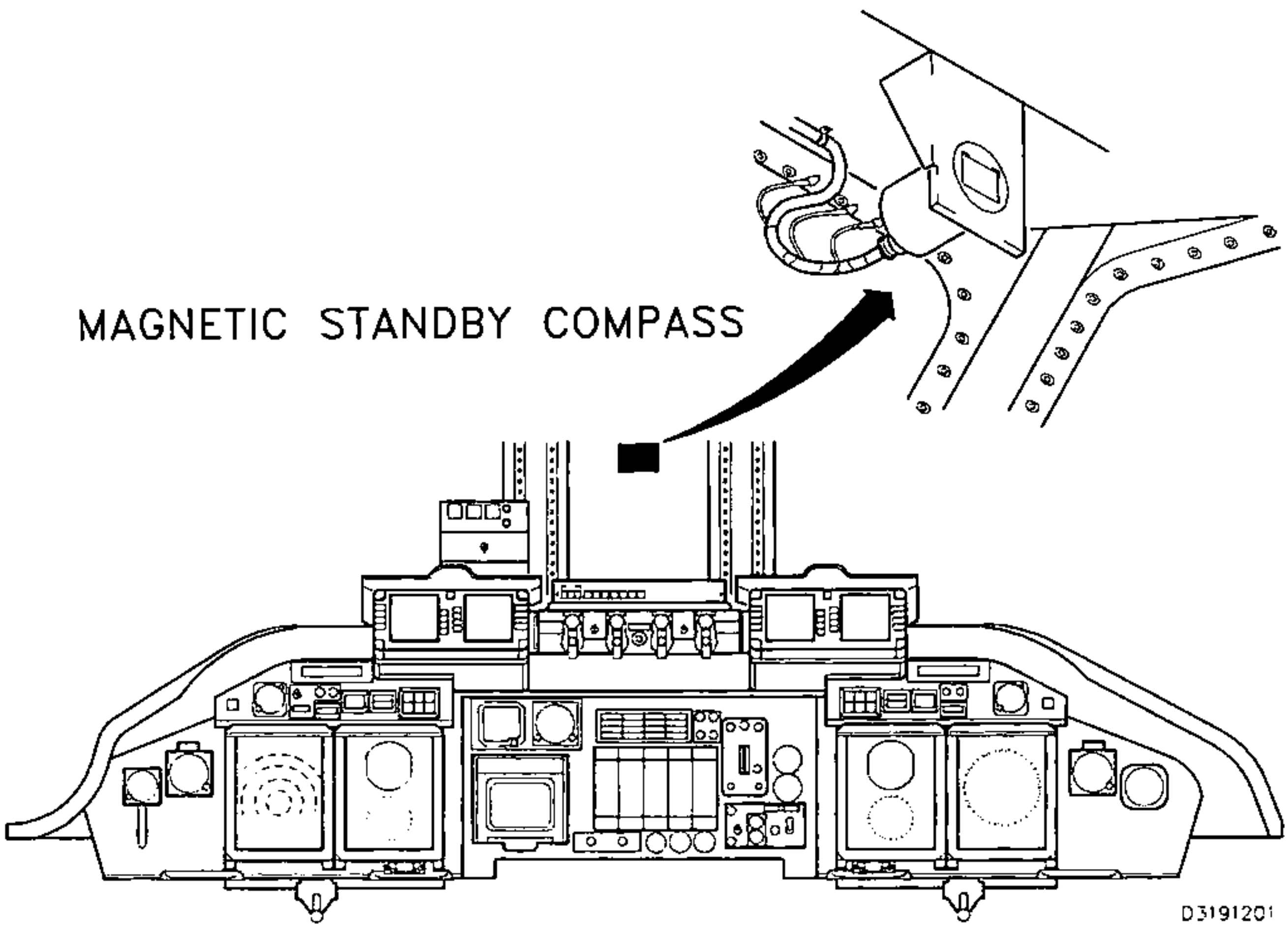


Figure 1-266. Magnetic Standby Compass

NAVIGATOR'S TRUE AIRSPEED INDICATOR

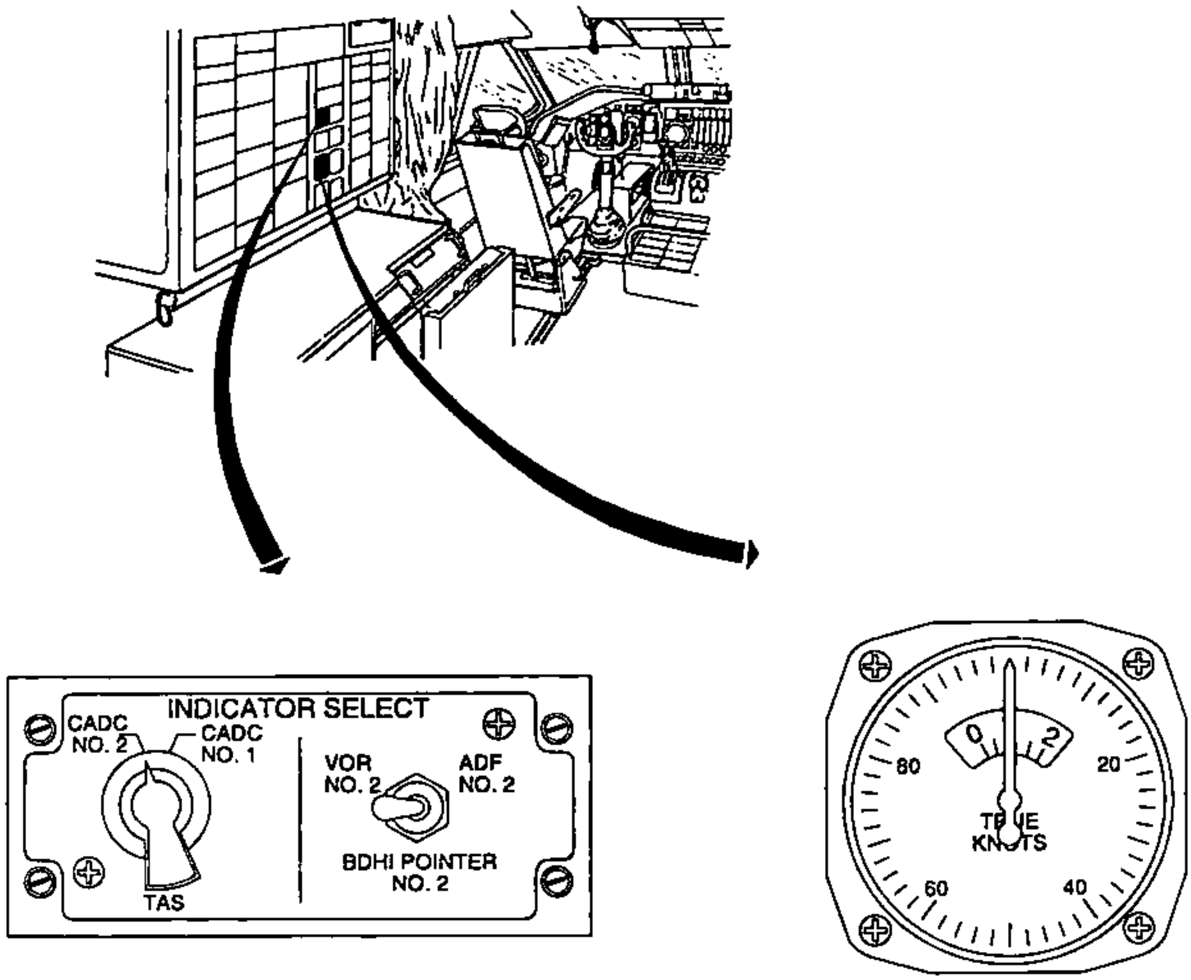


Figure 1-267. Navigator's True Airspeed Indicator

FLIGHT ENGINEER'S AND NAVIGATOR'S ALTIMETERS

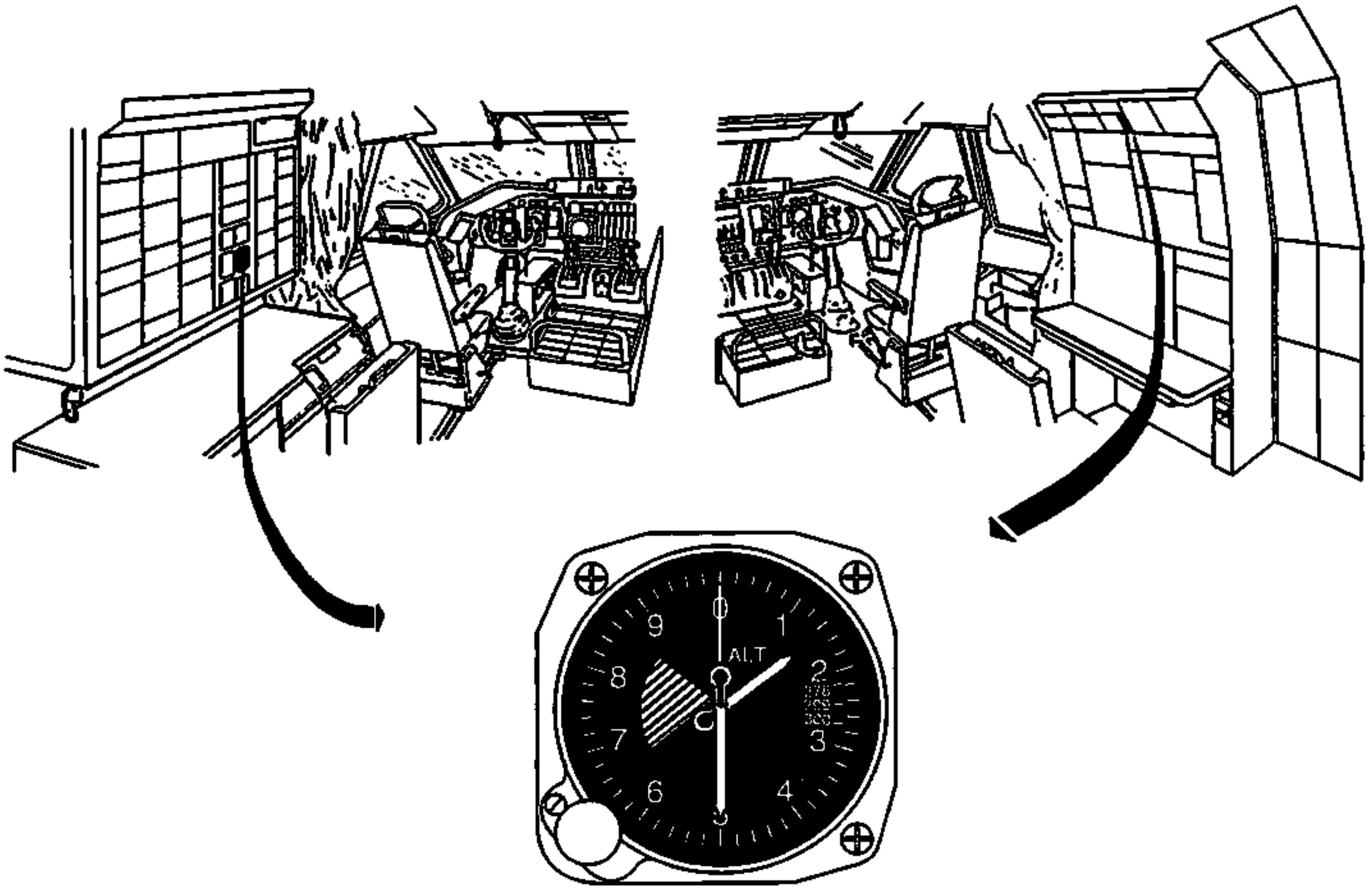


Figure 1-268. Flight Engineer's and Navigator's Altimeters

TOTAL AIR TEMPERATURE INDICATOR

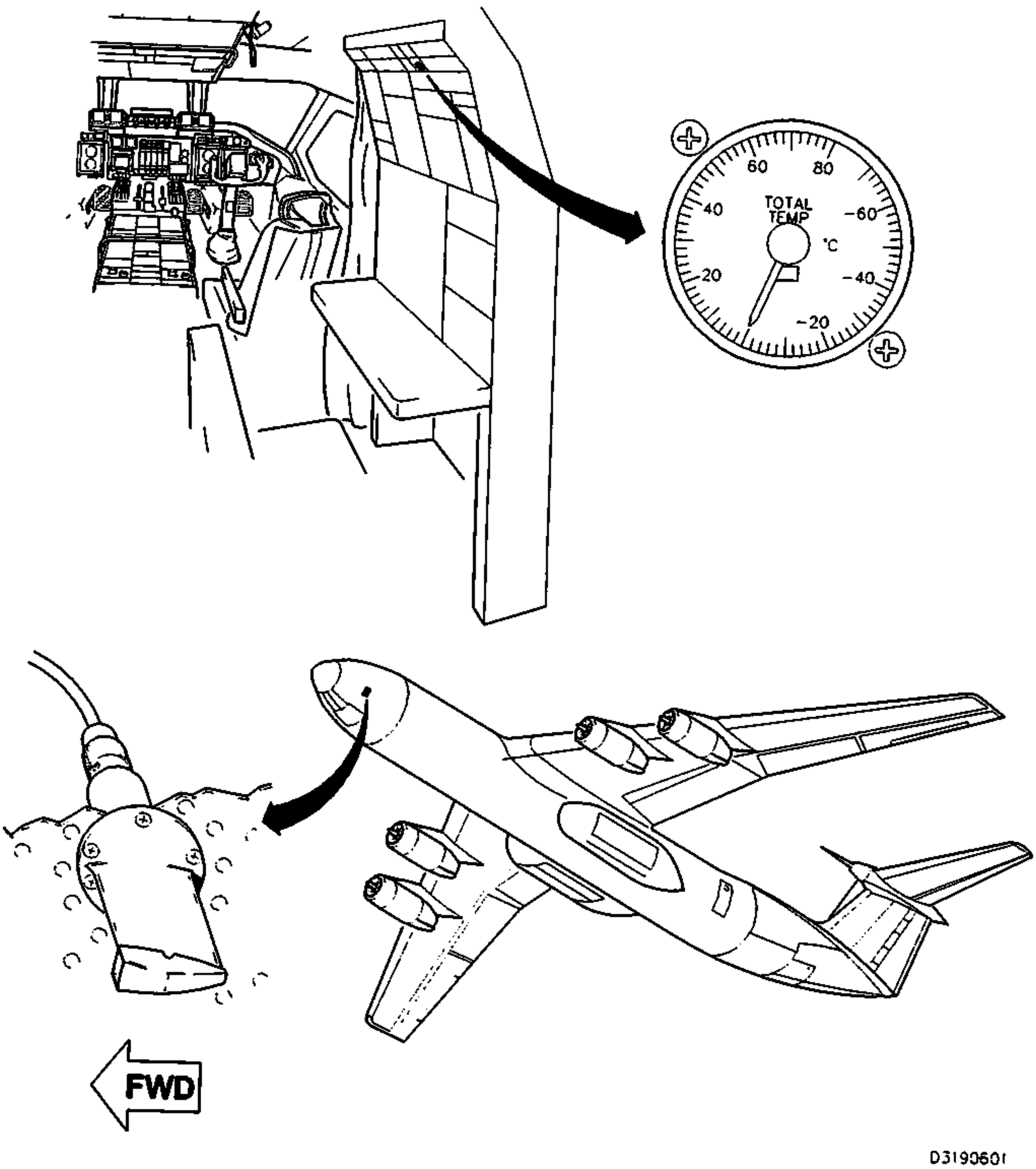
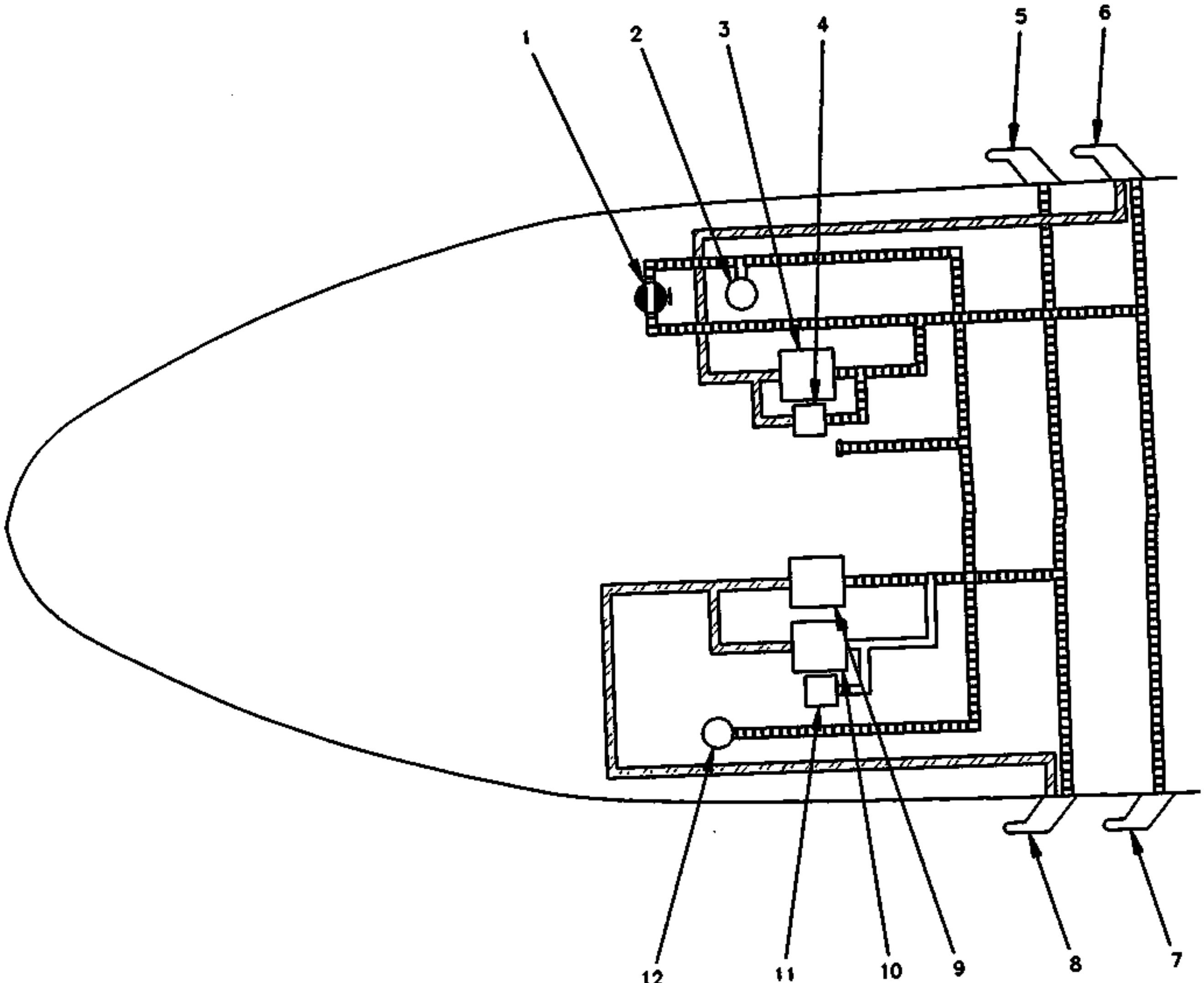


Figure 1-269. Total Air Temperature Indicator

PITOT-STATIC SYSTEM

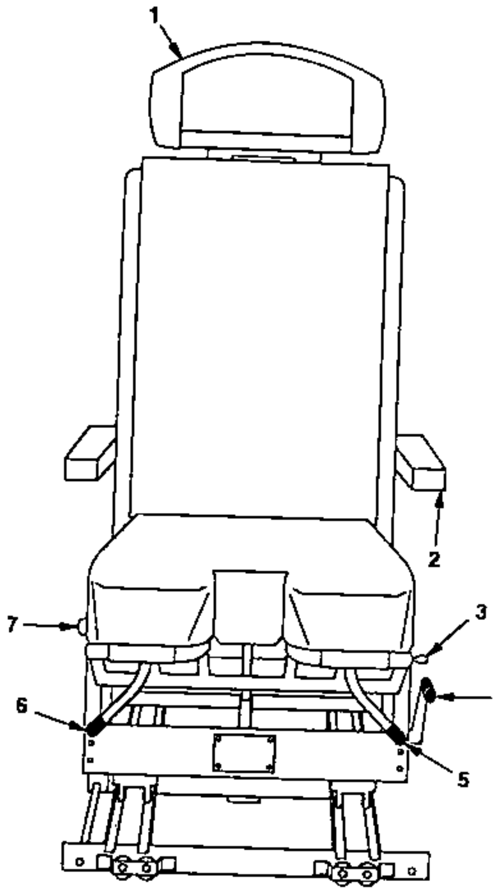


1. MANUAL SHUTOFF VALVE
2. FLIGHT ENGINEER'S ALTIMETER
3. COPILOT'S STANDARD CENTRAL AIR DATA COMPUTER (SCADC)
4. AIR DATA UNIT
5. PILOT'S PITOT-STATIC TUBE (UPPER LOCATION)
6. COPILOT'S PITOT-STATIC TUBE (LOWER LOCATION)
7. COPILOT'S PITOT-STATIC TUBE (UPPER LOCATION)
8. PILOT'S PITOT-STATIC TUBE (LOWER LOCATION)
9. PILOT'S SCADC
10. ALTITUDE/AIRSPEED TRANSDUCER ⚠1
11. CABIN DIFFERENTIAL PRESSURE TRANSDUCER ⚠1
12. NAVIGATOR'S ALTIMETER

NOTE: ⚠1 AIRCRAFT EQUIPPED WITH LIFE HISTORY RECORDER

Figure 1-270. Pitot-Static System

FLIGHT CREW SEATS



COPILOT'S SEAT
(PILOT'S SEAT TYPICAL)

1. HEADREST
2. ARMREST CONTROL (BENEATH ARMREST)
3. SHOULDER HARNESS LOCK LEVER
4. LATERAL ADJUSTMENT LEVER
5. FORE & AFT ADJUSTMENT LEVER
6. VERTICAL ADJUSTMENT LEVER
7. RECLINE ADJUSTMENT LEVER

NOTE

SEAT BELTS AND SHOULDER HARNESS NOT SHOWN.

ENGINEER'S AND
NAVIGATOR'S SEAT

1. HEADREST
2. RECLINE ADJUSTMENT LEVER
3. SHOULDER HARNESS LOCK LEVER
4. FORE & AFT ADJUSTMENT LEVER
5. SWIVEL ADJUSTMENT LEVER
6. VERTICAL ADJUSTMENT LEVER
7. ARMREST CONTROL

NOTE

SEAT BELTS AND SHOULDER HARNESS NOT SHOWN.

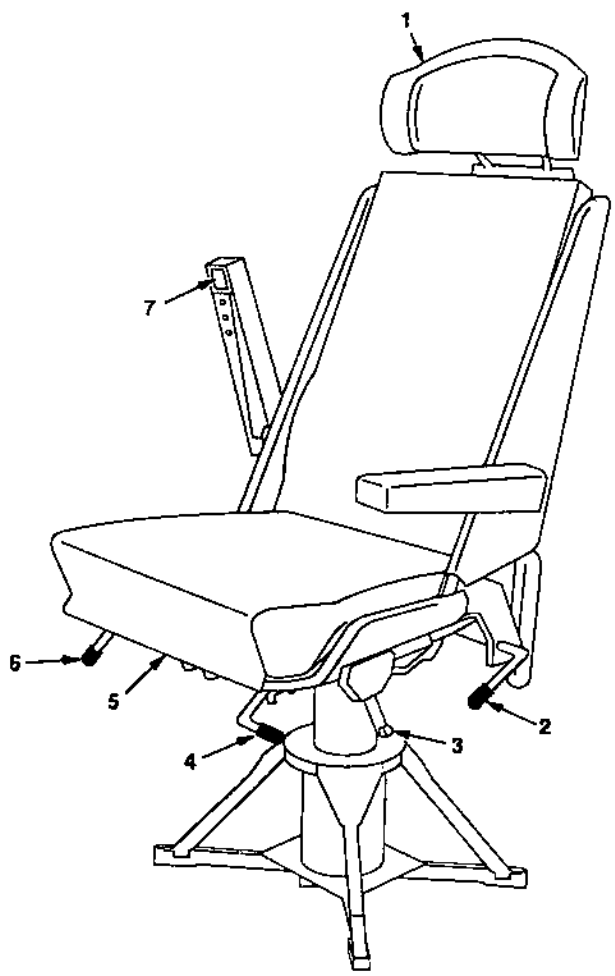


Figure 1-271. Flight Crew Seats

SECTION II
NORMAL PROCEDURES
TABLE OF CONTENTS

TEXT	PAGE
PREPARATION FOR FLIGHT	**2-3**
CHECKLISTS AND PROCEDURES REQUIRING COORDINATED ACTIONS	2-3
FLIGHT RESTRICTIONS	2-3
FLIGHT PLANNING	2-3
PERFORMANCE DATA WORKSHEET/AIR DROP DATA	2-3
WEIGHT AND BALANCE	2-3
PREFLIGHT CHECKS	**2-3**
AIRCREW VISUAL INSPECTION REQUIREMENTS	2-4
ELECTRICAL POWER-OFF (FLIGHT ENGINEER AND SCANNER)	**2-4**
ELECTRICAL POWER-ON (FLIGHT ENGINEER AND SCANNER)	**2-6**
EXTERIOR INSPECTION (SCANNER)	**2-31**
CARGO COMPARTMENT (SCANNER)	**2-34**
WALK-AROUND INSPECTION (SCANNER)	**2-36**
COUNTERMEASURES DISPENSING AND DEFENSIVE SYSTEMS PREFLIGHT	**2-37**
PILOTS' AVIONIC PREFLIGHT	**2-38**
BEFORE STARTING ENGINES	**2-39**
STARTING ENGINES	**2-41**
ABNORMAL START INDICATIONS	**2-44**
CLEAR ENGINE PROCEDURE	2-44
BEFORE TAXI	**2-44**
BEFORE TAKE-OFF	**2-46**
LINEUP	**2-51**
TAKE-OFF	**2-51**
FMS TAKE-OFF	2-52
STANDING TAKE-OFF	2-52
ROLLING TAKE-OFF	2-52
TAKE-OFF GUST CORRECTION	2-52
WIND SHEAR ON TAKE-OFF	2-52
INSTRUMENT TAKE-OFF	2-53
CLIMBOUT	2-53
OBSTACLE CLIMBOUT	2-53
FMS CLIMB MODES	2-53
PILOT DUTIES	2-53
AUTOPILOT ENGAGED PROCEDURES	2-53
AUTOPILOT DISENGAGED PROCEDURES	2-54
AFTER TAKE-OFF, CLIMB	**2-54**
CRUISE	**2-55**
DESCENT PROCEDURES	**2-56**
ENROUTE DESCENT	2-56
PENETRATION	2-56
EMERGENCY DESCENT	2-56
HOLDING	2-56
DESCENT	2-56
FMS DESCENT	2-57
FMS HOLDING PATTERNS	2-57
RENDEZVOUS	2-57
DESCENT	**2-57**
APPROACH	**2-59**
APPROACH PROCEDURES	**2-60**
PRACTICE MANEUVERS WITH ONE OR MORE ENGINES INOPERATIVE	2-60
INSTRUMENT APPROACHES	2-60
LOW ALTITUDE INSTRUMENT APPROACHES	2-61
CIRCLING APPROACH	2-61
MISSED APPROACH	2-61
CATEGORY II APPROACHES	2-61
BEFORE LANDING	**2-62**
FINAL APPROACH AND LANDING	**2-64**
APPROACH SPEED	2-64
EFFECT OF GUST	2-64
REFERENCE GROUND SPEED	2-64

TEXT	PAGE
WIND SHEAR	2-64
RAW DATA ILS APPROACH	2-65
LANDING	2-65
GO-AROUND	**2-67**
GO-AROUND AFTER TOUCHDOWN	2-67
AFTER LANDING	**2-67**
ENGINE SHUTDOWN	**2-70**
BEFORE LEAVING AIRCRAFT	**2-71**
AIRCREW REFUELING PROCEDURES	**2-74**
NORMAL/CONCURRENT REFUELING CHECKLIST	**2-77**

ITEM	FIG	PAGE
CARGO COMPARTMENT INSPECTION	2-2	2-86
DANGER AREAS	2-3	2-87
EXTERIOR INSPECTION	2-1B	2-85
SERVICING DIAGRAM	2-13	2-100
TAWS TEST PATTERN	2-1A	2-39
TCAS TEST PATTERN	2-1	2-38.2
TURNING RADIUS AND GROUND CLEARANCE	2-4	2-89
TYPICAL CAT II APPROACH	2-11	2-96
TYPICAL HIGH ALTITUDE PENETRATION APPROACH FOUR AND THREE ENGINE CONFIGURATION	2-7	2-92
TYPICAL LANDING AND GO-AROUND PATTERN	2-12	2-98
TYPICAL LOW ALTITUDE APPROACH FOUR AND THREE ENGINE APPROACH	2-8	2-93
TYPICAL MONITORED APPROACH	2-10	2-95
TYPICAL RADAR APPROACH FOUR AND THREE ENGINE CONFIGURATION	2-9	2-94
TYPICAL TAKE-OFF AND CLIMB	2-5	2-90
TYPICAL TAKE-OFF AND OBSTACLE CLIMB	2-6	2-91

PREPARATION FOR FLIGHT.

CHECKLISTS AND PROCEDURES REQUIRING COORDINATED ACTIONS.

The flight manual contains only amplified procedures. The abbreviated and scroll checklists have been issued as separate technical orders. The scroll checklists will be utilized at the copilot's and flight engineer's stations and will include normal operating procedures from the BEFORE STARTING ENGINES checklist through the BEFORE LEAVING AIRCRAFT checklist. Line items in the manual, flight crew and scroll checklists are identical. The flight crew checklists are designed for use with binders having plastic envelopes. The scroll checklists are designed for use with scroll checklist holders. The checklist binders and flight deck coordinators are available through normal Air Force supply channels. For the TO numbers and dates applicable to the checklists, refer to the back of the title page.

When a checklist item is followed by a crew position designation, i.e., (P), (CP), (E), etc., that crewmember takes the action and, if the action is in quotes, reports that action to the person reading the checklist. When a checklist item requires a response by more than one crewmember, the crewmember will state the response and crew position. If the action is not in quotes, complete the action and remain silent. During accomplishment of the checklist, AS REQUIRED or STATE SETTING will not be used as a response; instead, the actual position or setting of the unit and/or item will be stated.

Each flight crewmember is required to use and refer directly to the appropriate checklist during aircraft ground and flight operations except during starting engines, taxi, takeoff, emergencies, or when specifically allowed by the amplified portion of the checklist. In the latter instances direct reference to checklist items will be made before performing them, or afterward as a cleanup reference. Initiation of scroll or emergency checklist actions will occur only when the pilot calls for a specific checklist except as indicated in the narrative introduction to that checklist. The copilot will read the pilots' Before Starting Engines, Starting Engines, Before Taxi, Engine Shutdown, and Before Leaving Aircraft checklists. The flight engineer will read all the other pilots' checklists. Other checklists not included in the above shall be accomplished in accordance with specific instructions pertaining to that checklist.

To prevent undue complications, this section will include only normal procedures applicable to the pilot, copilot, flight engineer, and scanner. Procedures for other crewmembers will be included only when their coordination is required. For duties of other crewmembers, refer to Section IV. The following codes are used:

P - Pilot
CP - Copilot
E - Flight Engineer
N - Navigator
S - Scanner
LM - Loadmaster

FLIGHT RESTRICTIONS.

Refer to Section V of this manual for information concerning the restrictions imposed on the aircraft.

FLIGHT PLANNING.

Flight planning data needed to complete the assigned mission should be determined. Refer to TO 1C-141B-1-1 for necessary performance data.

PERFORMANCE DATA WORKSHEET/AIRDROP DATA.

Prior to each flight, the flight engineer will compute Takeoff and Landing data based on current conditions. Utilize AMC Form 141, C-141B Performance Data Worksheet. Emergency return data will be based on Brake Release Gross Weight. For abnormal situations such as Gross Weight limited by CFL, obstacle, or spoilers not fully operational, compute the data using the performance manual. Another flight engineer or pilot will verify the conditions from sources other than the performance data worksheet. A pilot or engineer will also verify the computations using the performance manual or HP-41. If possible, use a method other than the one used by the engineer computing the data. Airdrop data will be validated by another flight engineer using the performance manual prior to passing it to the pilot.

WEIGHT AND BALANCE.

Before each flight ensure that the aircraft's weight and balance is within limits by completing DD Form 365-4 IAW TO 1-1B-40, the "Manual of Weight and Balance". Refer to Section V of TO 1C-141C-1 for the weight limitations of the aircraft.

PREFLIGHT CHECKS.

NOTE

The flight crew inspection procedures assume that maintenance personnel have completed the preflight inspection in TO 1C-141B-6. Duplicate inspection and operational checks of systems by flight crewmembers have been eliminated, except for certain items required in the interest of flying safety.

AIRCREW VISUAL INSPECTION REQUIREMENTS.

It is the responsibility of the aircraft commander to ensure that all crewmembers have accomplished their individual inspection.

The aircrew preflight inspection is required for the first training mission of the day, all operational mission home station departures, or when the aircraft ground time exceeds 48 hours (sealed alert aircraft up to 72 hours.) The preflight inspection requires the completion of all items. EXCEPTION: The air refueling system preflight items are only required for home station and enroute departures when air refueling operations are planned.

A flight engineer and scanner through flight inspection (asterisk items and those items on which maintenance was performed) will be accomplished when an aircrew preflight inspection is not required.

During intermediate operational stops when no crew change occurs, the through flight inspection is not required except those items on which maintenance was performed, and the doors, if opened.

Ground time, as used in this section, is the period between landing time recorded in the Aircraft Forms and when the outbound flight engineer arrives at the aircraft to begin departure activities.

ELECTRICAL POWER-OFF (FLIGHT ENGINEER AND SCANNER).

This checklist will be accomplished prior to applying power unless power has already been applied by maintenance.

FLIGHT ENGINEER

* 1. Aircraft Forms - CHECKED

* 2. Landing Gear Lever - DOWN

* 3. CDS Brightness Control Switches - OFF

* 4. CDS Fan Switch - ON (No. 1)

* 5. Flap Lever - AS REQUIRED

NOTE

The flap lever should be set to agree with flap position.

6. Spoiler EREO Switch - NORMAL

7. Spoiler Lever - CLOSED

8. Instrument Power Switch - NORMAL

* 9. Engine and Wing Anti-Ice Switches - OFF

* 10. Fuel and Start Ignition Switches - STOP

11. Continuous Ignition Switch - OFF

12. Fuel Enrichment Switch - OFF

* 13. Flight Control Power Switches - NORMAL

* 14. MSU 1 and 2 - OFF

* 15. Yaw Damper - OFF

* 16. Radar - OFF

* 17. FMS 1 and 2 PWR Switches - OFF

SCANNER

* 1. Aircraft Exterior - CHECKED

a. Chocks and Landing Gear Pins - INSTALLED

b. Exterior Plugs and Covers - REMOVED

c. Flare Dispenser Panels - AS REQUIRED

Ensure all flare dispensers have covers installed unless defensive systems are required.

d. APU Drains and Vents - CLEAR

e. APU Fire Ext Bottle Pressure - CHECKED

2. APU Fire Control Handle (Cargo Compt) - IN

* 3. Ground Safety By Pass Switch - SAFE

* 4. EMI Filter Units - CHECKED

Ensure safety pins are installed.

5. Hyd System No. 3 Accumulators - CHARGED

6. Hyd Quantity - CHECKED

Check No. 1, 2 and 3 system reservoirs for proper fluid level.

* 7. Hyd Interconnect Valve - CLOSED

* 8. Aircraft Forms - CHECKED

* 9. Oxygen - CHECKED (Refer to Section I)

* 10. Pitot Covers (4) - CHECKED

FLIGHT ENGINEER

* 18. MFSI Switch - ON
* 19. L-Band SATCOM - OFF (TCTO 555)
* 20. All Flight Station Circuit Breakers and Emergency Pressurization Switches - AS REQUIRED

Ensure Stall Prevent No. 1 CB (35R) and Stall Prevent No. 2 CB (40R) - OPEN

CAUTION

Failure to OPEN the Stall Prevent No. 1 and No. 2 Circuit Breakers will cause failure of the STALL PREVENTION RELAYS during Power On BIT test.

* 21. Defensive System - CHECKED
  a. Navigator's Panel ALE-47 CMDS CDU - SET
    (1) Remote Dispense Control Switch - DISABLE
    (2) CMDS CDU Mode Knob - OFF
    (3) Indicator/Arm Control Switch - SAFE
    (4) Flare JETT Switch - OFF
  b. Pilot's Glare Shield Auto Dispense Control Switch - MANUAL
  c. Pilot's Side Console Remote Dispense Pushbutton - SECURED
* 22. No. 3 Hyd Pump Switches - OFF
* 23. MFSI - CHECKED

NOTE

If electrical power was previously applied, turn off.

  a. Power Selector Switch - OFF
  b. Battery Switch - OFF

Ensure that the MFSI remains on.

* 24. Battery Switch - ON/VOLTAGE CHECKED

Check battery voltage by checking isolated DC bus voltage.

NOTE

To prevent aircraft battery discharge, place the battery and the MFSI SYS Switch to the OFF position if no APU or external power is available for an extended period of time.

SCANNER

FLIGHT ENGINEER | **SCANNER**

* 25. Electrical Control Panel - SET

a. CSD Disc Switches - NORMAL

b. Engine Generator Control Switches - OFF

c. Auto-Load Disc Switches - OVERRIDE

d. Bus Tie Switches - NORMAL

e. Power Selector Switch - AS REQUIRED

If power was on prior to initiation of preflight, reap-ply power, otherwise leave the switch in the OFF position.

f. Bus Power Disc Switches - NORMAL

* 26. Fuel Panel - SET

a. Air Refuel Master Switch - OFF

b. Air Refuel Mode Select Switch - NORM

c. Air Refuel Isolation Valve Switches - CLOSE

d. Boost Pump Switches - OFF

e. Refuel Switches - CLOSE

f. Ground Isolation Valve Switch - CLOSE

g. Fuel Line Drain Switch - OFF

h. Jettison Switches - OFF

* 27. Slipway Door - AS REQUIRED

Ensure that slipway door corresponds with slipway door handle position.

ELECTRICAL POWER-ON (FLIGHT ENGINEER AND SCANNER).

FLIGHT ENGINEER

* 1. Electrical Power - CHECKED/ON

READY Light ON, Voltage and Frequency within limits.

SCANNER

* 1. Electrical Power - CONNECTED

FLIGHT ENGINEER

SCANNER

CAUTION

A flight engineer or loadmaster will remain within an area where they can monitor the ground power unit at all times when it is required by the aircrew and maintenance personnel are not present.

* 2. Flight Engineer's Caution Lights - CHECKED

Hold caution light test switch in the TEST position and check illumination of all warning lights on the navigator's ADS panel and on the flight engineer's panel (except APU START).

* 3. AHRS - ON

* 4. CDS Brightness Control - ON/SET

* 5. CDS Cooling Fans - CHECKED No. 1/OFF/No. 2/No. 1

Ensure CDS AIR FAIL CWA comes on when switch is in the OFF position.

* 6. MFSI - CHECKED

a. BAT BUS MFSI-2 CB (33L) - OPEN

Ensure there is no display interruption and the MFSI does not re-initialize.

b. BAT BUS MFSI-2 CB (33L) - CLOSED

NOTE

Steps a and b may be accomplished immediately after power application.

c. MFSI CB (9B) - OPEN

Ensure there is no display interruption and the MFSI does not re-initialize.

d. MFSI CB (9B) - CLOSED

Ensure that no failure modes are displayed.

* 7. FMS 1 and 2 PWR Switches - ON

* 8. FMS MFCDUs - CHECKED

a. Pilot's MFCDU POWER UP Page - ANNUNCIATES 1 in upper left

b. Copilot's and NAV's MFCDU POWER UP Page - ANNUNCIATES 2 in upper left

FLIGHT ENGINEER

SCANNER

* 9. FMS MFCDU POWER UP Page - SET

NOTE

Steps a through c may set on either MFCDU.

a. CPIN Number - CHECKED

NOTE

Check CPIN number to ensure it is the latest version. If it is not, comply with command guidance.

b. MSTR AV ON - SELECTED (4R)

(1) Pilot's DAMU

(a) TAC 1 - CHECKED

(b) VOR 1 - CHECKED

(c) VHF 1 - CHECKED

(2) Copilot's DAMU

(a) TAC 2 - CHECKED

(b) VOR 2 - CHECKED

(c) VHF 2 - CHECKED

c. NAV DB - CHECKED/CURRENT SELECTED

NOTE

Toggle to the current database. If there is no current database, inform the pilots.

* 10. FMS COMM TUNE Page - SET/ CHECKED

* 11. Radios - ON/CHECKED

Perform radio check, and obtain QNH, leave radio tuned to tower/ground control frequency.

* 12. Pilot's, Copilot's and MFSI Altimeters - SET

Set QNH (Sta. barometric pressure). Observe that all indicated altitudes are within 75 feet of each other and within 75 feet of field elevation.

FLIGHT ENGINEER

* 13. Pilot's and Copilot's DAMU - SET/CHECKED

a. STATUS menu:

(1) ATT - AHRS - STATUS

(2) HDG - AHRS - STATUS

b. Observe AHRS BOTH is annunciated on both PFDs.

14. No. 3 Hyd Pumps - CHECKED/OFF

CAUTION

Simultaneous operation of the radar and No. 3 Hydraulic System pumps from an external power unit may damage the radar due to power surges.

NOTE

Two-second time delay on No. 2 pump.

a. No. 1 Pump - ON/CHECKED/OFF

b. No. 2 Pump - ON/CHECKED/OFF

The flight engineer will ensure that the APU is clear prior to starting. This will normally be accomplished by the scanner, without the use of interphone.

15. APU Clear - "APU CLEAR" (S)

CAUTION

When external power is not available, the APU fire warning lights are inoperative until the APU generator is supplying power.

16. APU - START

CAUTION

The flight engineer or scanner will remain within an area where the audible APU Fire Warning System can be monitored at all times when the APU is required by the aircrew.

SCANNER

2. APU Clear - "APU CLEAR" (S)

FLIGHT ENGINEER

SCANNER

17. APU Fire Warning Test Switch - TEST

Check that the lights in the APU fire control handle on the engineer's panel and in the APU fire control handle in the cargo compartment illuminate, the APU fire light on the annunciator panel illuminates, and that the audible fire warning signal sounds.

18. Auxiliary Generator Control Switch - ON

Check voltage and frequency.

19. Power Selector Switch - AS REQUIRED

AUX position will be selected to check operation of the cockpit voice recorder and to accomplish the A/R fuel system preflight (when required).

NOTE

The MFCDUs may display a "GPS X FAIL" after power transfer. If the message clears within approximately 50 seconds, the system is operating normally. If the message remains, from the GPS STATUS page(s), reset the receiver(s) (5R). Should the message persist, call maintenance.

20. Cockpit Voice Recorder - CHECKED

NOTE

See Section I for Operational Checkout. If the APU is inoperative, the Voice Recorder Test Switch in the right underdeck area will be used to remove power interlock and power the CVR from an external power source. Ensure test switch is returned to the "OFF" position after checkout.

21. Air Conditioning Panel - SET

a. Flt Sta and Cargo Compt Temp Control Switches - AS REQUIRED

b. Flt Sta Airflow Switch - NORMAL

c. Floor OVHT Test Switch - RESET

d. Cabin Alt Limit Override Switch - NORMAL

e. Air Cond Master Switch - OFF

f. Sys Shutoff Switches - OPEN

FLIGHT ENGINEER

SCANNER

g. Engine Bleed Valve Switches - OPEN

Check all bleed valve CLOSED lights extinguished.

h. Floor Heat Switch - OFF

i. Wing Isolation Switch - NORMAL

j. L and R Wing Pylon & Air Cond Compt Test Switches - RESET

k. Emer Depress Switch - NORMAL

22. Bleed Air and Overheat System - CHECKED

a. Bleed Valves - CLOSED

Check all bleed valve CLOSED lights illuminate.

b. Bleed Valves - OPEN

Check all bleed valve CLOSED lights extinguish.

c. Air Cond Master Switch - APU

While positioning the selector switch, a pause (2 to 5 seconds) will be made when passing through the RIGHT position to prevent "duct rumble."

Check all bleed valve CLOSED lights illuminate, manifold and regulator pressures zero, ejector lights off.

d. APU Bleed Load and Flow Control Valve - OPEN

Check for indication of both regulator pressures and manifold pressure.

e. Flt Sta Air Flow Switch - CHECKED

Close the right system shutoff valve and allow regulated pressure to stabilize. Select MAX to ensure that airflow in the flight deck increases, then return switch to NORM. Open the right system shutoff valve.

f. Floor Ovht System - TEST/RESET

Check OVERHEAT light on, manifold pressure drops to zero, and both regulated pressures drop to zero.

g. L Wing Pylon & Air Cond Compt - TEST/ RESET

Move switch to TEST and check that LEFT OVHT lights illuminate on both the environmental system panel and annunciator panel and the right regulated pressure drops to 0. Move switch to RESET and check that right regulated pressure increases.

FLIGHT ENGINEER

h. R Wing Pylon & Air Cond Compt - TEST/ RESET

Move switch to TEST and check that RIGHT OVHT lights illuminate on both the environmental system panel and annunciator panel and the right regulated pressure drops to 0. Move switch to RESET and check that right regulated pressure increases.

i. Air Cond Master Switch - ENG START

Check all bleed valve CLOSED lights extinguished and that both regulated pressures drop to 0.

j. L and R Wing Pylon & Air Cond Compt - TEST/RESET

Move both switches to TEST and check all bleed valve CLOSED lights illuminate. Move both switches to RESET and check that all CLOSED lights extinguish.

k. APU Bleed Load and Flow Control Valve - CLOSED

Check that the time for manifold pressure to bleed down from 30 PSI to 15 PSI is not less than 20 seconds.

23. Air Refueling Manifold - CHECKED

NOTE

Accomplish this item when air refueling operations are planned.

a. APU - AS REQUIRED

b. External Power - AS REQUIRED

WARNING

If APU is operational, external power will be disconnected prior to preflight of the aerial refueling manifold. If the APU is not available and external power unit must be used, the scanner will be stationed at the external power unit on interphone to monitor the A/R vent system and to shut power off if a leak should occur.

c. Ctr Sep Valve - OPEN

d. No. 3 Crossfeed Valve - OPEN

e. No. 3 Main Tank Primary Fuel Boost Pump - ON

SCANNER

FLIGHT ENGINEER

Check for fuel pressure to be within limits.

f. L.H. Air Refuel Iso. Valve - MOMENTARY OPEN/CLOSE

Open the L.H. Air Refuel Iso. Valve and observe a pressure drop, then close the valve. The pressure should return to normal.

g. R.H. Air Refuel Iso. Valve - OPEN

Open the R.H. Air Refuel Iso. Valve. Observe that the pressure drops then slowly builds up to the initial pressure level as the air refueling manifold becomes full.

h. Line Drain Switch - A/R

Pressure should drop approximately 4 PSI.

i. R.H. Air Refuel Iso. Valve - CLOSE

Observe that the fuel pressure increases and remains at normal limits.

j. Ctr Sep Valve - CLOSED

k. External Power - AS REQUIRED (S)

Reconnect external power if it was disconnected.

24. Fuel System - PRESSURIZED

a. Crossfeed Valves - CLOSED

b. Main Primary Boost Pumps - ON

c. Line Drain Switch - A/R

25. Power Select Switch - AS REQUIRED

26. APU Control Switch - AS REQUIRED

Shut down the APU if external power is to be used and air conditioning is not required.

27. Exterior Lights - CHECKED

a. Leading Edge and Anti-Collision Lights - ON/OFF

SCANNER

3. External Power - AS REQUIRED (S)

If external power was disconnected for the A/R preflight, reconnect it on the flight engineer's command.

WARNING

Ensure that fuel is not leaking from A/R drains or vents prior to reconnecting external power.

4. Exterior Lights - CHECKED

FLIGHT ENGINEER | **SCANNER**

b. Strobe Lights - RED/WHT/OFF

WARNING

Ensure personnel are clear of immediate vicinity of the strobe lights before operating.

c. Navigation Lights - ON

d. Landing Lights - EXTENDED/ON, RETRACTED/OFF

e. Taxi Lights - ON/OFF

* 28. Annunciator and Caution Lights - CHECKED

a. Brake Selector Switch - NORMAL

b. Anti-Skid Switch - ON

c. Angle of Attack De-Ice Switches - ON

d. Lights - TEST

e. Brake Selector Switch - EMER

f. Angle of Attack De-Ice Switches - OFF

g. FLT REC INOP Light - ILLUMINATED

NOTE

The FLT REC INOP light should be illuminated with ground power applied. If the light is not illuminated, check the TEST switch to ensure it is in the NORMAL position. If the switch is in the NORMAL position, visually check to ensure the DFDR is installed.

* 29. AHRS INOP Light and AHRS ATT CWA - EXTINGUISHED

30. Controls Clear - "CLEAR" (S)

5. Controls Clear - "CLEAR" (S)

The flight engineer will confirm that the area is clear for the control and trim checks and will inform the scanner of each particular check to be performed prior to actuating the controls. The flight engineer will observe indications in the cockpit and check for proper movement. DO NOT bang the flight controls against the stops. The scanner will report actual control movement during each check except electrical pitch trim, AFCS/CDS preflight BIT, and AFCS basic autopilot checks. If water is evident, control displacement will be maintained until completely drained.

FLIGHT ENGINEER | **SCANNER**

31. Aileron Tabs - CHECKED

NOTE

When returning either Left Aileron Power Switches to OFF or NORMAL position, the No. 3 Hydraulic System pumps may momentarily shut off and come back on due to transfer of control power to No. 3 hydraulic pumps relay.

a. Left Aileron Power Switches - TAB OPERABLE

Place Left Aileron Power Switches to TAB OPERABLE. Observe that the No. 3 hydraulic system pumps come on as the second switch is actuated, and that the L AIL. TAB OPER light on the annunciator panel illuminates.

b. Right Aileron Power Switches - TAB OPERABLE

Place Right Aileron Power Switches to TAB OPERABLE. Observe that the R AIL. TAB OPER light illuminates.

c. Aileron Control - FULL LEFT/CHECKED, FULL RIGHT/CHECKED

Move the aileron control wheel full left and right. Check that aileron tabs move in proper direction.

d. Left Aileron Power Switches - NORMAL

Return Left Aileron Power Switches to NORMAL. Observe that the No. 3 hydraulic system pumps remain on and the L AIL. TAB OPER light extinguishes.

e. Right Aileron Power Switches - NORMAL

Return the Right Aileron Power Switch for hydraulic system No. 1 to NORMAL. Observe that the No. 3 hydraulic pumps shut off and the R AIL. TAB OPER light extinguishes. Return the Right Aileron Power Switch for No. 2 system to NORMAL.

32. Elevator Emergency System - CHECKED

NOTE

If the ELEV FEEL MAL light on the pilot's annunciator panel is illuminated, place the ELEVATOR ARTIFICIAL FEEL switch to RESET to extinguish the light, and then back to NORMAL.

FLIGHT ENGINEER | **SCANNER**

a. No. 1 Sys Elevator Power Switch - EMER

Observe that the No. 3 system hydraulic pumps come on and that the EMER POWER ON light illuminates.

b. No. 2 Sys Elevator Power Switch - EMER

c. No. 1 Sys Elevator Power Switch - OFF

Observe that the No. 3 system hydraulic pumps remain on and that the EMER POWER ON light remains illuminated.

d. Elevator Control - FULL UP/ CHECKED, FULL DOWN/CHECKED

Check that both control columns simultaneously move an equal amount.

e. No. 2 Sys Elevator Power Switch - NORM

Observe that the No. 3 system hydraulic pumps shut off and that the EMER POWER ON light extinguishes.

33. Hydraulic System No. 1 Flight Control Switches - OFF

Place the hydraulic system No. 1 switches to OFF for the rudder and both ailerons.

34. No. 3 Hydraulic System Automatic Operation - CHECKED

a. Move spoiler handle out of CLOSED and check that No. 3 hydraulic pumps come on.

b. Spoiler Lever - CLOSED/DISARMED

Check No. 3 hydraulic system pumps are OFF.

35. No. 3 Hyd Pumps - ON

36. Flaps - APPROXIMATELY 10 PERCENT

CAUTION

Do not operate the wing flaps with the hydraulic interconnect open or when both Hydraulic System No. 3 pumps are not operating. To do so may cause damage to the flap motor brakes.

FLIGHT ENGINEER

* 37. No. 3 Hyd Pumps - OFF

CAUTION

Bleed brake pressure to zero.

38. Air Refuel Door Control Handle - PULLED

WARNING

Ensure that the slipway door area is clear before moving the T-handle or applying hydraulic pressure.

NOTE

Accomplish this item when air refueling operations are planned.

a. A/R Master Switch - ON

b. DOOR UNLOCK and READY lights - ON

c. Air Refueling Fairing, Slipway, and Leading Edge Lights - ON/ CHECKED/OFF

d. Induction Coil - CHECKED

e. Rollers - CHECKED

Ensure coil is free of corrosion.

* 39. Hydraulic Interconnect - "OPEN" (S)

* 40. No. 3 Hyd Pumps - ON

Check that No. 2 hydraulic suction boost pump pressure light is extinguished.

41. Air Refueling System - CHECKED

NOTE

Accomplish this item when air refueling operations are planned. Check for correct indications at the pilot's, copilot's and flight engineer's stations.

a. Air Refuel Door Control Handle - CLOSED

WARNING

Ensure that the slipway door area is clear before moving the T-handle or applying hydraulic pressure.

SCANNER

* 6. Hydraulic Interconnect - "OPEN" (S)

FLIGHT ENGINEER **SCANNER**

b. Air Refuel Door Control Handle - PULLED

Check DOOR UNLOCKED and READY lights ON.

c. Air Refuel MODE SELECT Switch - ORIDE

Check OVERRIDE, DOOR UNLOCKED, and READY lights ON.

d. Pilot's Disconnect Switch - DISCONNECT

Check DISCONNECT lights ON, READY lights OFF.

e. Reset Switch - RESET

Check DISCONNECT lights OFF, READY lights ON.

f. Copilot's Disconnect Switch - DISCONNECT

Check DISCONNECT lights ON, READY lights ON.

g. Reset Switch - RESET

Check DISCONNECT lights OFF, READY lights ON.

h. Air Refuel MODE SELECT Switch - NORM

Check OVERRIDE lights OFF.

i. Air Refuel Door Control Handle - CLOSED

Check all lights OFF.

j. Air Refuel Master Switch - OFF

42. Spoilers - CHECKED

a. Spoiler Lever - CLOSED/ARMED

b. Test Panel Arm Switch - ARM

c. EREO Switch - EMER OFF

d. Spoiler Lever - GROUND

Observe that the 2 SPOILER INOP and 3 SPOILER INOP lights illuminate and the spoilers do not extend. Return spoiler lever to the CLOSED position.

FLIGHT ENGINEER

e. EREO Switch - NORMAL/HANDLE RESET

Observe that the 2 SPOILER INOP and 3 SPOILER INOP lights extinguish.

f. Spoiler Lever - GROUND

Observe that the DET 2 and DET 3 lights illuminate momentarily.

g. EREO Switch - EMER RETRACT/CHECKED

Observe that the spoilers close and the 2 SPOILER INOP and 3 SPOILER INOP lights illuminate.

NOTE

The spoiler lever may "creep" toward the CLOSED position.

h. Spoiler Lever - CLOSED/RESET

Observe that the 2 SPOILER INOP and 3 SPOILER INOP lights extinguish.

i. Spoiler Auto Retract Defeat Switch - DEFEAT

j. Spoiler Lever - GROUND

k. Advance throttles No. 2 and No. 3 to the take-off position.

Spoilers should remain extended.

l. Spoiler Auto Retract Defeat Switch - NORMAL

Observe that the 2 SPOILER INOP and 3 SPOILER INOP lights illuminate and the spoilers close and lock. Observe that the DET 2 and DET 3 lights illuminate steadily after the spoilers are closed.

m. Test Panel Arm Switch - OFF

n. Throttles - IDLE START

o. Spoiler Lever - CLOSED/RESET/DISARMED

43. Electrical Pitch Trim - CHECKED

a. Pitch Trim Reset Switch - ELEC/ELEC HYD

b. Pitch Trim Switches - CHECKED

Actuate the trim switches, one at a time for approximately 10 seconds in each direction. No trim change should occur.

c. Pitch Trim Switches - NOSE UP

Trim should move in the proper direction.

SCANNER

FLIGHT ENGINEER

SCANNER

d. Pilot's Disc Button - CHECKED

Actuate the pitch trim disc button on the pilot's control wheel; trim should be inoperative.

e. Pitch Trim Reset Switch - ELEC/ ELEC HYD

Reset the pitch trim by placing the pitch trim reset switch in the ELEC and ELEC HYD positions, then release the switch. Pitch trim should be available.

f. Pitch Trim Switches - NOSE DOWN

Trim should move in the proper direction.

44. Hydraulic Pitch Trim - CHECKED

a. Pilot's Handle - NOSE UP

No trim change should occur until the control lever switch is depressed, at which time the stabilizer should move down. Release the switch. Movement should stop.

b. Copilot's Handle - NOSE DOWN

No trim change should occur until the control lever switch is depressed, at which time the stabilizer should move up. Release the switch. Movement should stop. Return control lever to neutral. Depress control lever switch. No trim change should occur.

45. Electrohydraulic Pitch Trim - CHECKED

a. Copilot's Trim Switches - CHECKED

Actuate the trim switches, one at a time. No trim change should occur.

b. Copilot's Trim Switches - NOSE UP

Trim should move in the proper direction.

c. Copilot's Disc Button - CHECKED

Actuate the pitch trim disc button. Trim should be inoperative.

d. Pitch Trim Reset - ELEC HYD/ELEC

Reset the pitch trim by placing the pitch trim reset switch in the ELEC HYD and ELEC positions, then release the switch. Pitch trim should be available.

e. Copilot's Trim Switches - NOSE DOWN

Trim should move in the proper direction.

f. Pilot's Trim Switches - CHECKED

FLIGHT ENGINEER

Actuate the trim switches, one at a time. No trim change should occur.

g. Pilot's Trim Switches - FULL NOSE UP

Trim should move to the full nose up position.

h. Pilot's Trim Switches - FULL NOSE DOWN

Trim should move to the full nose down position.

i. Pilot's Trim Switches - NEUTRAL/ CHECKED

The scanner will visually check that the stabilizer is in the neutral position.

46. Aileron Trim - CHECKED

Move each aileron trim switch individually. No trim change should occur.

Move both aileron trim switches to LOWER LEFT WING. Control wheels should rotate left, left aileron move up, right aileron move down. Move both aileron trim switches to LOWER RIGHT WING. Control wheels should rotate right, left aileron move down, right aileron move up. Return aileron trim to neutral. Control wheels and aileron should be neutral.

NOTE

It may be necessary to apply slight force to assist the control wheel in reaching the new feel spring neutral position.

47. Aileron Control - CHECKED

Move aileron control wheel full left and full right, checking that both control wheels simultaneously move an equal amount. Check for proper response and that tabs are locked neutral.

* 48. Ailerons Streamlined - CHECKED

NOTE

Check ailerons for streamlined position with hydraulic power applied to the ailerons with trim and control wheel centered. If deflection is greater than 3/4 of an inch, inspection of the aileron structure in the area of hinge plate attachments is required prior to flight.

49. Rudder Trim - CHECKED

Move each rudder trim switch individually. No trim change should occur.

SCANNER

FLIGHT ENGINEER

Move both switches to NOSE LEFT. Check for proper rudder pedal movement and that the rudder moves to the left. Move both switches to NOSE RIGHT. Check for proper rudder pedal movement and that the rudder moves to the right. Return rudder trim to neutral.

50. Rudder Control - CHECK FULL LEFT/FULL RIGHT

Hold the nose steering wheel steady while checking rudder directional travel. Check that steering wheel tries to turn while moving rudder pedals.

51. Elevator Control - CHECK FULL UP/FULL DOWN
52. AFCS/CDS Preflight BIT - CHECKED
    a. Yaw Damper Switch - ON
    b. Radar Altimeter - ON/SET above zero

Verify the GCAS INOP light extinguishes and ALT light illuminates on the GCAPs, MDA or DH annunciates on Pilot's and Copilot's PFDs, and the MDA light illuminates on the Mode Repeater.

    c. From DAMU-MAIN menu select:
        (1) BIT
        (2) From the BIT menu - PREFLT BIT
    d. Verify the FCP BIT annunciator bar illuminates.
    e. During the BIT sequence, verify that all lights on the FCP, both MSPs and AWFCS Mode Repeater have illuminated. The altitude alert, stall warning, and "AUTOPILOT" will sound. The rudder will move slightly right and then left at two different times.
    f. Verify that the DAMU annunciates PREFLT BIT-GO and the FCP BIT annunciator bar extinguishes at the end of the PFBIT.

NOTE

- A PREFLT BIT-NO GO indicates a failed PFBIT.
- If the AP1/AP2 annunciator bar flashes after PFBIT, press, momentarily hold and then release the associated pushbutton. If the annunciator bars continue to flash, attempt to engage AP 1 or AP 2. If the AP engages, disengage and rerun PFBIT. If AP will not engage, maintenance action is required.

SCANNER

FLIGHT ENGINEER

g. Both master CAUTION lights should illuminate. YAW DAMP FAULT and YAW DAMP INOP annunciate on the pilot's and copilot's CWA.

h. Reset the Yaw Damper Switch - OFF/ON

i. Reset the master CAUTION

53. AFCS/Basic Autopilot - CHECKED

a. Engage AP1.

b. On FCP, slowly rotate TURN RING to the left and then to the right from detent and observe that the control wheels follow TURN RING rotation.

c. On FCP, return TURN RING to center detent.

d. On FCP, slowly rotate PITCH WHEEL forward and then aft and observe that the control columns follow PITCH WHEEL rotation.

e. Depress the pilot's AP DISC button. Observe that the Autopilot disengages, AP OFF flashes on the PFDs, and the aural "Autopilot" annunciation sounds.

f. Depress copilot's AP DISC button. Observe that the AP OFF annunciation clears.

g. Engage AP2 and repeat steps b. through f.

When testing AP2, disconnect the AP using the copilot's AP DISC button and use the pilot's AP DISC button to clear the annunciation.

h. YAW DAMPER Switch - OFF

SCANNER

FLIGHT ENGINEER

54. Brakes - CHECKED

Operate emergency brakes, normal brakes, and antiskid switch. Brake disk movements will be confirmed by the scanner for each main landing gear in turn as the flight engineer observes DET OUT and ANTI-SKID OFF Lights. Brake check will commence on right brakes. When applying brakes, ensure rudder pedals do not move.

a. Brake Selector Switch - EMER

b. Brakes - APPLIED/RELEASED

c. Brake Selector Switch - NORM

d. Anti-Skid Switch - OFF

NOTE

- Ensure a 3-second delay prior to step e to allow the anti-skid control box to reset.
- Do not hold Anti-Skid Switch in the GND TEST position after completion of ground test. This may cause flashing of the DET OUT lights which is an indication for maintenance test purposes only.

e. Brakes - APPLIED

f. Anti-Skid System - CHECKED

Place the Anti-Skid Switch in GND TEST and observe that the brakes release. After approximately four seconds the DET OUT lights illuminate. Approximately one second later, the brakes should reapply and the ANTI-SKID OFF lights illuminate. Release brakes.

g. Repeat steps d, e, and f for left side.

h. Brake Selector Switch - EMER

i. Brakes - APPLIED/RELEASED

j. Anti-Skid Switch - ON

Illumination of DET OUT and ANTI-SKID OFF lights, other than during the above test, indicates a fault in the electrical portion of the system. ANTI-SKID OFF light should be illuminated during the entire emergency brake check.

* 55. Hydraulic Interconnect - "CLOSED" (S)

SCANNER

7. Brakes - CHECKED

The scanner will report "APPLIED" or "RELEASED", so that movement of all brake disks is confirmed in conjunction with the checks made by the flight engineer.

* 8. Hydraulic Interconnect - "CLOSED" (S)

FLIGHT ENGINEER

56. Flaps - TAKE OFF/APPROACH

CAUTION

Under single flap motor operation, flaps should not be operated more than one complete cycle every five minutes.

* 57. No. 3 Hyd Pumps - AS REQUIRED

Flight engineer will clear scanner off interphone at this time. Scanner will proceed with Exterior Inspection.

58. Copilot's Central Air Data Comptr Switch - MON TEST.

Observe that the copilot's PFD annunciates red hash marks on the airspeed and altitude tapes and the Mach readout box turns red.

59. Copilot's Side Console - SET

   a. All Doors Switch - OFF

   b. Jump Signal Switches - OFF

   c. Chute Rel Switch - OFF

   d. Oxygen Regulator - 100%/OFF

   e. Aldis Lamp - STOWED and UN-PLUGGED

* 60. Oxygen Quantity/Pressure - CHECKED

NOTE

Quantity will not be less than 5 liters for local and stateside missions.

Depress the press to test button and check for the quantity low light. Release button and ensure the oxygen quantity returns to the original reading.

* 61. Overhead Control Panel - SET/ CHECKED

   a. No Smoking/Seat Belt Switches - ON

   b. Emer Depr Switch - NORMAL

   c. Engine Anti-Ice Switches - OFF

SCANNER

FLIGHT ENGINEER

SCANNER

d. Emp De-Ice System - CHECKED

CAUTION

If the STRIP OFF light fails to come on when the Emp De-Ice Switch is positioned to TEST, immediately open the three Emp De-Ice PWR circuit breakers on the No. 1 circuit breaker panel.

e. Wing Anti-Ice Switches - OFF

f. Pilot's and Copilot's Pitot Heat - CHECKED/OFF

g. Total Temp Probe De-Ice Switch - OFF

h. Ice Det Cont Switch - MAN

i. Ice Det Test Switch - TEST

Observe that the icing annunciator light illuminates.

j. Bailout Alarm - CHECKED

NOTE

Bailout alarm will not be sounded on Air Evac/Passenger missions or when animals are on board.

k. Rain Removal Switch - OFF

l. Windshield Heat Switches - OFF

m. Flight Control Power Switches - NORMAL

* 62. Fire Emergency Control Handles and Bottle Selectors - IN/NORMAL

* 63. Engine Fire Warning System - CHECKED

Hold each switch in the FIRE TEST position, one at a time, check lights for steady light, silence horn.

* 64. Pylon Fire/Overheat Warning System - CHECKED

Hold each switch in OVERHEAT TEST position. One at a time, check lights for flashing on and off with no audible warning.

* 65. Landing Gear Warning Light and Horn - CHECKED

FLIGHT ENGINEER

66. Pilot's Side Console - SET

    a. All Doors Switch - OFF

    b. Door Arming Switch - AS REQUIRED

    c. Paratroop Spoiler Switch - OFF

    d. Jump Signal Switches - OFF

    e. Chute Rel Switch - OFF

    f. Oxygen Regulator - 100%/OFF

67. Pilot's Central Air Data Comptr Switch - MON TEST.

Observe that the pilot's PFD annunciates red hash marks on the airspeed and altitude tapes and the Mach readout box turns red.

* 68. Manual Oxygen Shutoff Valve - OPEN

Turn valve toward closed position to ensure freedom of movement, then back to open.

* 69. Hydraulic Control Panel - SET

    a. Eng Valves Switches - NORM

    b. Suct Pumps - CHECKED/OFF

70. Engine Vibration Indicating System - CHECKED

Depress and release the individual indicator test buttons and observe that the scale indicators move to approximately 3.5 mils and then return to original reading.

* 71. Fuel Heater Valves - CHECKED/OFF

72. Fuel Boost Pumps and Line Drain Switch - OFF

SCANNER

FLIGHT ENGINEER

SCANNER

73. Fuel Quantity/Temperature Indicators - CHECKED

Press the TEST button for each indicator. The digital readout will decrease to zero pounds. Continue holding the TEST button until the indicator displays all segments. Release the TEST button and observe that the indicator continues to display all segments for approximately 4 seconds followed by the indicator blanked out for approximately 4 seconds. The indicator should display the original fuel quantity with no fault codes displayed.

Check inboard and outboard fuel temperatures.

74. Fuel Pumps/Valves - CHECKED

NOTE

While checking the fuel pumps, it is permissible for the FIL BY-PASS and PUMP OUT lights to momentarily flash/extinguish.

All pumps should check within the following block line pressure limits:

Mains .... 13-22 PSI

Auxiliary & Extended Range .... 30-45 PSI

a. All Crossfeed Valves - CLOSED

b. Left, Ctr and Right Separation Valves - OPEN

c. No. 1 Main PRI Boost Pump - ON

Indication of pressure indicates crossfeed valve leaking. Allow approximately 5 seconds for pressure to build up.

The pump PRESS LOW light should extinguish.

d. No. 1 Crossfeed Valve - OPEN

The pump pressure indication should be within specified limits after the crossfeed valve switch is opened.

FLIGHT ENGINEER

e. Boost Pump - OFF

Relieve pressure in fuel manifold by placing the Refuel Switch for the associated extended range tank in the REFUEL position momentarily.

NOTE

If all tanks are full, open Grd Isol Valve to release manifold pressure. Drain SPR manifold for two minutes.

Repeat steps c and e for the secondary pump of main tank No. 1. Repeat steps c, d, and e for each primary pump and steps c and e for each secondary pump of No. 2, 3, and 4 main tanks, using their respective switches.

Check pressure and relieve for each pump/valve. After closing any separation valve and relieving pressure, allow approximately 5 seconds to check for leakage.

f. No. 4 Aux Sec Boost Pump - CHECKED

g. No. 4 Aux Pri Boost Pump - CHECKED

h. RH Ext Range Outbd Boost Pump - ON

i. Right Separation Valve - CLOSE

j. RH Ext Range Outbd Boost Pump - OFF

k. RH Ext Range Inbd Boost Pump - CHECKED

l. No. 3 Aux Sec Boost Pump - CHECKED

m. No. 3 Aux Pri Boost Pump - ON

n. Ctr Sep Valve - CLOSE

o. No. 3 Aux Pri Boost Pump - OFF

p. No. 1 Aux Pri Boost Pump - CHECKED

q. No. 1 Aux Sec Boost Pump - CHECKED

r. LH Ext Range Outbd Boost Pump - ON

s. Left Separation Valve - CLOSE

t. LH Ext Range Outbd Boost Pump - OFF

u. LH Ext Range Inbd Boost Pump - CHECKED

v. No. 2 Aux Pri Boost Pump - CHECKED

w. No. 2 Aux Sec Boost Pump - CHECKED

SCANNER

FLIGHT ENGINEER

SCANNER

75. PA System - ON/ALL

* 76. Oxygen - CHECKED

This check may be accomplished prior to this checklist item. (Refer to Section I.)

77. Navigator's Panel - SET

This item is not required when a Navigator is aboard.

a. ADS Chute Release Switch - OFF

b. Nav/Jump Seat Oxygen Regulators - 100%/ OFF

* 78. Portable Oxygen Bottles - SERVICED/ SECURED

* 79. First Aid Kits - CHECKED

* 80. Emergency Exit Light - CHECKED

Check that light is charging.

* 81. Escape Rope - ATTACHED/STOWED

* 82. Life Raft Release Handles - IN

* 83. Crash Axe - SECURED

* 84. Portable Fire Extinguisher - CHECKED

Check for proper installation and servicing.

* 85. Personnel Restraining Harness (2) - CHECKED

* 86. Deactivation Kit - CHECKED

a. Thrust Reverser Locks (8) - CHECKED

b. Brake Caps (2) - CHECKED

c. Welder's Gloves - CHECKED

d. TR Pump Pad and Plugs - CHECKED

e. Spoiler Bolt Down Kit - CHECKED

* 87. Overwater Emergency Equipment - AS REQUIRED

* 88. Fuel Identaplate/AIR Card - ABOARD

Ensure the Fuel Identaplate/AIR Card has been replaced after refueling.

* 89. Required Fuel - CHECKED

* 90. Defensive Systems - AS REQUIRED

If defensive systems are required, accomplish a preflight of the aircraft system using the procedures outlined in Countermeasures Dispensing and Defensive System Preflight, this section.

EXTERIOR INSPECTION (SCANNER).

It is impractical to list all items on the aircraft exterior in this inspection. Therefore, only those items affecting safety and aircraft operation are listed. However, this does not relieve the scanner of the obligation to make a visual inspection of all items on the aircraft exterior for general condition and security.

NOTE

The scanner should follow the physical sequence depicted in Figure 2-1 rather than attempt to follow the written sequence of the expanded checklist.

* 1. Nose Gear Well - CHECKED

a. Nose Gear Doors and Actuating Arms - DAMAGE AND SECURITY

b. Scissor Disconnect PINS - ENGAGED

CAUTION

A physical check of the pins will be made to ascertain that adequate spring tension is available.

c. Tires - CONDITION

d. Strut - FLUID LEAKS, PROPER INFLATION, AND CRACKS AT THE BASE OF THE OUTER CYLINDER

e. Hydraulic Lines - DAMAGE AND LEAKS

f. Nose Gear Steering Paddles - CONDITION

* 2. Nose Area - CHECKED

a. Exterior Surface - CONDITION

b. Total Temperature Probes - CONDITION

c. Access Doors - CLOSED

d. Ice Detector Probe - CONDITION

e. Radome - CONDITION

f. Battery Vent - OBSTRUCTION

g. Latrine Service Doors - CLOSED

* 3. Forward Fuselage, Right Side, and Bottom - CHECKED

a. Doppler Panel - CHECKED

On DS aircraft check that flares are installed or check for security of magazine covers.

b. Pitot Static Masts - OBSTRUCTION AND CONDITION

c. Angle of Attack Vane - CONDITION

d. AAR-47 Sensors - CLEAN AND UNDAMAGED (DS Aircraft)

e. Wing Leading Edge Light - CONDITION

f. Emergency Exit - CLOSED

g. Antennas - CONDITION

h. Air Conditioning Louvers and Panels - CONDITION

i. Wing Leading Edge and Blowout Doors - SECURED

* 4. Right Wheel Pod and Center Fuselage - CHECKED

a. Hydraulic Drain - OBSTRUCTION

b. Oxygen Vent - OBSTRUCTION

c. Access Doors - CLOSED

d. Taxi Lights - SECURE AND UNDAMAGED

e. Hydraulic Ground Test Connections, Lines and Fitting - LEAKS AND SECURITY

f. Tires and Brakes - CONDITION

g. MLG Leveler Rod - CHECKED

Check the leveler rod to ensure that it is straight, properly connected, and secured. Check the leveler rod cam roller for cracks, proper installation, and freedom of movement.

h. Strut and Bogie Position Accumulator - CRACKS, FLUID LEAKS AND PROPER INFLATION

i. Main Gear Doors and Actuating Arms - DAMAGE AND SECURITY

j. Scissors and Bogie Switches - DAMAGE AND SECURITY

k. Fuel Manifold/SPR Drain Valves - OPEN/CLOSED

Check to see if the manifold is drained.

NOTE

Accumulations of up to eight ounces of residual fuel in a two-hour period is acceptable.

l. Single Point Refueling Caps - INSTALLED/SECURED

Physically attempt to remove the caps. If they can be removed, they must be installed correctly or removed prior to flight.

m. Countermeasures Dispensers Panels - AS REQUIRED

If flares are not installed check security of magazine covers.

WARNING

- Do not stand in front of or under loaded dispensers except for inspections. Flares are dispensed by explosive squibs and can be dangerous. When flare dispensers are not loaded, covers will be installed. If there is a flare cartridge in a dispenser or magazine that should be empty, call authorized personnel for unloading.
- If an end cap is missing on an unexpended cartridge and the cartridge is protruding, clear area and call EOD. Failure to comply may result in damage to aircraft and/or injury or death to personnel.

n. Top of Right Pod - CONDITION

* 5. Right Lower Wing Surface and Flap Well - CHECKED

a. Flaps, Flap Carriages, and Jack Screws - CONDITION

b. Spoiler Panels - CONDITION

c. Flap Position and Asymmetry Drive Chains - CONDITION

d. Landing Light - CONDITION

e. Underwing Area and Flap Well - LEAKS/CONDITION

f. Countermeasures Dispensers Panels - AS REQUIRED

If flares are not installed check security of magazine covers.

WARNING

- Do not stand in front of or under loaded dispensers except for inspections. Flares are dispensed by explosive squibs and can be dangerous. When flare dispensers are not loaded, covers will be installed. If there is a flare cartridge in a dispenser or magazine that should be empty, call authorized personnel for unloading.
- If an end cap is missing on an unexpended cartridge and the cartridge is protruding, clear area and call EOD. Failure to comply may result in damage to aircraft and/or injury or death to personnel.

* 6. No. 3 and No. 4 Engine Areas - CHECKED

a. Exhaust Section - CONDITION

b. Fluid Leaks - CHECKED

c. Thrust Reversers - CLOSED

d. Fuel and Hydraulic Drain - OBSTRUCTION

e. Cowling and Blowout Doors - CLOSED

f. Engine Intake - CONDITION

g. Pt_0 Probe - CONDITION

h. Access Doors - CLOSED

i. Fire Extinguisher Discharge Disc (No. 4 Pylon) - IN PLACE

* 7. Right Wing - CHECKED

a. Exterior Surface - FLUID LEAKS

b. Access and Blowout Door - CLOSED

c. Wing Tip Lights and Static Eliminators - ON/CONDITION

d. Fuel Jettison and Fuel Vent Masts - OBSTRUCTION/CONDITION

e. Aileron, Spoiler and Flap Surfaces - CONDITION

* 8. Aft Fuselage and Empennage - CHECKED

a. Emergency Exit - CLOSED

b. Bottom of Fuselage - CONDITION

c. Petal Doors and Ramp - CONDITION

d. AAR-47 Sensor (2) - CLEAN & UNDAMAGED (DS Aircraft)

e. Top of Wings - VISUALLY SCANNED

f. Exterior Surface - FLUID LEAKS

g. Tail Lights - ON/CONDITION

h. Antenna (ELT) - CONDITION

i. Emergency Exit - CLOSED

* 9. Left Wing - CHECKED

a. Exterior Surface - FLUID LEAKS

b. Aileron, Spoiler and Flap Surfaces - CONDITION

c. Fuel Jettison and Fuel Vent Masts - OBSTRUCTION/CONDITION

d. Wing Tip Lights and Static Eliminators - ON/CONDITION

e. Access and Blowout Doors - CLOSED

* 10. No. 1 and No. 2 Engine Areas - CHECKED

a. Fire Extinguishing Discharge Disc (No. 1 Pylon) - IN PLACE

b. Access Doors - CLOSED

c. Engine Intake - CONDITION

d. Pt_0 Probe - CONDITION

e. Cowling and Blowout Doors - CLOSED

f. Fuel and Hydraulic Drain - OBSTRUCTION

g. Thrust Reversers - CLOSED

h. Exhaust Section - CONDITION

i. Fluid Leaks - CHECKED

* 11. Left Lower Wing Surface and Flap Well - CHECKED

a. Landing Light - CONDITION

b. Flaps, Flap Carriages and Jack Screws - CONDITION

c. Spoiler Panels - CONDITION

d. Flap Position and Asymmetry Drive Chains - CONDITION

e. Underwing Area and Flap Well - LEAKS/ CONDITION

f. Countermeasures Dispensers Panels - AS REQUIRED

WARNING

- Do not stand in front of or under loaded dispensers except for inspections. Flares are dispensed by explosive squibs and can be dangerous. When flare dispensers are not loaded, covers will be installed. If there is a flare cartridge in a dispenser or magazine that should be empty, call authorized personnel for unloading.

- If an end cap is missing on an unexpended cartridge and the cartridge is protruding, clear area and call EOD. Failure to comply may result in damage to aircraft and/or injury or death to personnel.

* 12. Left Wheel Pod and Center Fuselage - CHECKED

a. Top of Left Pod - CONDITION

b. Countermeasures Dispensers Panels - AS REQUIRED

If flares are not installed check security of cover magazines.

WARNING

- Do not stand casually in front of or under loaded dispensers except for inspections. Flares are dispensed by explosive squibs and can be dangerous. When flare dispensers are not loaded, covers will be installed. If there is a flare cartridge in a dispenser or magazine that should be empty, call authorized personnel for unloading.

- If an end cap is missing on an unexpended cartridge and the cartridge is protruding, clear area and call EOD. Failure to comply may result in damage to aircraft and/or injury or death to personnel.

c. Scissors and Bogie Position Switches - DAMAGE AND SECURITY

d. Main Gear Doors and Actuating Arms - DAMAGE AND SECURITY

e. MLG Leveler Rod - CHECKED

Check the leveler rod to ensure that it is straight, properly connected, and secured. Check the leveler rod cam roller for cracks, proper installation, and freedom of movement.

f. Struts and Bogie Position Accumulator - CRACKS, FLUID LEAKS AND PROPER INFLATION

g. Tires and Brakes - CONDITION

h. Hydraulic Ground Test Connections, Lines and Fitting - LEAKS AND SECURITY

i. No. 3 System Hydraulic Pumps - LEAKAGE

j. Taxi Lights - SECURE

k. Access Doors - CLOSED

l. Hydraulic Drains - OBSTRUCTION

* 13. Forward Fuselage, Left Side and Bottom - CHECKED

a. Wing Leading Edge and Blowout Doors - SECURED

b. Air Conditioning Louvers and Panels - CONDITION

c. Antennas - CONDITION

d. Emergency Exit - CLOSED

e. Wing Leading Edge Light - CONDITION

f. AAR-47 Sensors - CLEAN AND UNDAMAGED (DS Aircraft)

g. Angle of Attack Vane - CONDITION

h. Pitot Static Masts - OBSTRUCTION & CONDITION

* 14. Stabilizing Struts and Access Doors - STOWED/ CLOSED

This item may be accomplished prior to this time, provided on/off loading operations are complete.

CARGO COMPARTMENT (SCANNER).

It is impractical to list all items within the cargo compartment in this inspection. Therefore, only those items affecting safety and aircraft operation are listed. However, this does not relieve the scanner of the obligation to make a visual inspection of all items within this compartment.

NOTE

- The scanner should follow the physical sequence depicted in Figure 2-2 rather than attempt to follow the written sequence of the expanded checklist.
- At each emergency exit, check that the emergency exit light is charging. The light will be burning dimly.

* 1. Cargo Compartment, Forward Left Side - CHECKED

a. Crew Entrance Door Not Locked Override Switch - NORMAL

b. Forward Crew Door Interphone and PA Panel - AS REQUIRED

c. Portable Fire Extinguisher - CHECKED FOR PROPER INSTALLATION AND SERVICING

d. First Aid Kits - CHECKED

e. Pitot Static Drain Line Caps - SECURED

f. Portable Oxygen Bottle - SERVICED/ SECURED

g. EEBD - CHECKED

h. Escape Ladder Release Handle - IN

i. No. 2 Hatch - SECURED

Ensure torque tube scribe marks are aligned, check arm in proper position and copper safety wire is intact. Also ensure the hinge attachment pins are installed through both hinge halves, the washer and cotter pins are properly in place.

WARNING

Improper installation of hatch may cause an explosive decompression.

NOTE

Installation or removal of the SATCOM/No. 2 hatch will be accomplished by a certified technician (Crew Chief or Flight Engineer).

j. Rope and Ladder - SECURED

k. Emergency Exit and Escape Rope - SECURED

l. Refueling Checklist - ABOARD

Will be aboard for all missions including local training missions.

* 2. Left Hydraulic Service Centers - CHECKED

a. No. 3 Hydraulic System Reservoir - SERVICED

b. No. 3 Hydraulic Handpump Handle - STOWED

c. Manually Operated Interconnect Valve - CLOSED

If No. 2 and No. 3 hydraulic system reservoirs are not equalized, open the interconnect valve, allow reservoirs to equalize, and then close the interconnect valve.

d. No. 2 Hydraulic System Reservoir - SERVICED

e. Emergency Generator Control Box Circuit Breakers - CLOSED

* 3. Cargo Compartment, Aft Left Side - CHECKED

a. Wing Life Raft - CHECKED

b. MLG Inspection Window - SECURED

c. MLG Door Lock and MLG Uplock Emergency Release Handles - SAFETIED

d. MLG Downlock Handle Pin - INSTALLED

e. Emergency Exit and Escape Rope - SECURED

f. EMI Safety Pins - INSTALLED

g. Portable Fire Extinguisher - CHECK FOR PROPER INSTALLATION AND SERVICING

h. Escape Ladder Release Handle - IN

i. Troop Door Not Locked Override Switch - NORMAL

j. Troop Door - AS REQUIRED

k. No. 4 Hatch - SECURED

l. Rope and Ladder - SECURED

m. First Aid Kit - CHECKED

n. Countermeasures Remote Dispense Pushbutton - STOWED

o. Public Address and Platform Light Controls - AS REQUIRED

p. Life Raft Release Handle - IN

q. Petal Door Crank Handle - STOWED

r. Spare Hydraulic Fluid - CHECKED

s. Crew Chief Ladder - SECURED

* 4. Cargo Compartment, Aft Right Side - CHECKED

a. Spare Engine Oil - AS REQUIRED

b. Life Raft Release Handle - IN

c. Portable Oxygen Bottles - CHECKED/ MASK CONNECTED

Ensure a smoke mask, or quick don mask with goggles, is installed on the lower oxygen bottle.

d. Public Address and Platform Light Controls - AS REQUIRED

e. Countermeasures Remote Dispense Push Button - STOWED

f. First Aid Kit - CHECKED

g. EEBD - CHECKED

h. Troop Door - AS REQUIRED

i. Troop Door Not Locked Override Switch - NORMAL

j. Wing Life Raft Release Handles - IN

k. Emergency Exit and Escape Rope - SECURED

l. Escape Ladder Release Handle - IN

m. No. 3 Hatch - SECURED

n. Wing Life Raft Release Handles - IN

o. Rope Ladder - SECURED

p. EMI Safety Pins - INSTALLED

q. MLG Inspection Window - SECURED

r. MLG Door Lock and MLG Uplock Emergency Release Handles - SAFETIED

s. MLG Downlock Handle Pin - INSTALLED

t. Wing Life Raft - CHECKED

u. Center Fuselage Junction Box - CHECKED

* 5. No. 1 Hydraulic Service Center and Reservoir - CHECKED/SERVICED

* 6. Troop Oxygen Manual Shutoff Valves - OPEN

Turn valves toward closed position to ensure freedom of movement, then back to open. Ensure shutoff valve compartment is clean of any accumulation of hydraulic fluid, grease, or dirt.

NOTE

Forward handle is for No. 2 converter and aft handle for No. 1 converter. Scanner performs this check if loadmaster is not aboard.

* 7. Portable Fire Extinguisher - CHECKED FOR PROPER INSTALLATION AND SERVICING

* 8. Troop Oxygen Regulator Panel - CHECKED

NOTE

Scanner performs this check when loadmaster is not aboard.

a. Dimming Rheostats - DIM

b. Troop Oxygen Quantity Indicators - CHECKED

c. Indicator Lights Bright/Dim Switch - BRIGHT

d. Oxygen Lights and Horn Test Switch - TEST

Oxygen ON and two LOX QTY Low lights will illuminate, the warning horn will sound, and cargo compartment dome lights will come to full bright.

e. Low Oxygen Quantity Light(s) - TEST

Push test button(s) and observe that LOX QTY light(s) illuminate(s) below 7.5 liters and extinguish(es) above 7.5 liters.

f. Therapeutic Oxygen Valve - CHECKED/SET

Valve will be opened for a period of sufficient duration to determine that distribution lines are pressure tight. This can be accomplished by listening for escaping pressure at the therapeutic oxygen panels or by observing continuing oxygen quantity loss. Close valve after this check is completed.

g. Dimming Rheostats - AS REQUIRED

* 9. Cargo Compartment, Forward Right Side - CHECKED

a. Emergency Exit and Escape Rope - SECURED

b. Portable Oxygen Bottle - SERVICED/SECURED

c. EEBD - CHECKED

d. Pitot Static Drain Line Caps - SECURED

e. Fuel Tank Drain Tube/Bottle - SECURED

f. MLG Pry Bar and Ledge Protector - SECURED

g. EMI Safety Pins - INSTALLED

* 10. Right Underdeck Area - CHECKED

a. Portable Oxygen Bottle - CHECKED/MASK CONNECTED

Ensure a smoke mask, or quick don mask with goggles, is installed on the oxygen bottle.

b. EEBD - CHECKED

c. NLG Emergency Selector Valve - NORMAL

d. NLG Inspection Window - SECURED

e. NLG Pump Handle and NLG Pin - STOWED

f. NLG Emergency Extension System Reservoir - SERVICED

g. Equipment Racks and Batteries - CHECKED

* 11. Left Underdeck Area - CHECKED

a. Electronic Cooling Air Valve Manual Override - NORMAL

b. Interphone Panel - AS REQUIRED

c. Nose Landing Gear Emergency Access Door - SECURED

d. NLG Selector Valve - CHECKED

e. Equipment Racks - CHECKED

* 12. Fuel Dipstick - SECURED

* 13. Crew Loft - CHECKED AND SECURED

NOTE

Scanner performs this check when Loadmaster is not aboard.

a. Gunbox - CHECKED

b. Portable Oxygen Bottles - CHECKED AND SECURED

c. Miscellaneous Equipment - SECURED

* 14. Ramp, Petal Doors and Pressure Door - CLOSED AND CHECKED.

This check may be accomplished prior to this checklist item depending on loading operations.

See Section I for cargo door closing procedures.

WALK-AROUND INSPECTION (SCANNER).

Immediately prior to establishing interphone contact to execute the Before Starting Engines checklist, the scanner will visually inspect the aircraft exterior to ensure that:

- All access doors, hatches and SPR caps are secured.
- All ground wires and pitot covers are removed.
- The area is clear of all obstructions.

Ensure the security of the wheel wells has not been breached and maintain constant vigilance until cleared to board the aircraft during the Before Taxi checklist.

NOTE

The scanner will use the interphone receptacle located below the pilot's window when passengers are on board.

COUNTERMEASURES DISPENSING AND DEFENSIVE SYSTEMS PREFLIGHT.

If mission requirements dictate the use of aircraft dispensing and defensive systems, a qualified pilot, navigator or flight engineer will complete this preflight prior to departure. This section contains the preflight requirements for the defensive system available on the C-141C.

WARNING

For any malfunction in the following steps the defensive systems may be unreliable. Have maintenance performed on the system.

DEFENSIVE SYSTEMS.

1. Navigator's ALE-47 CMDS Control Display Unit - SET/CHECKED

   a. JETT Switch - OFF

   b. FL Switch - ON

   c. Mode Knob - STBY

OFP and MDF messages will appear momentarily and GO message will illuminate steady.

WARNING

If NO GO message illuminates steady, have maintenance performed on the system.

   d. Flare (FL) Payload Quantity - CHECKED

Full load consists of 120 MJU-7 1" X 2" cartridges.

   e. PRGM Knob - 1

2. Navigator's Indicator/Arm Control - SET

   a. Indicator Rheostat - ADJUSTED

   b. Lamp Test Switch - CHECKED

   c. Indicator/Arm Control Switch - SAFE

3. Navigator's ALE-47 CMDS CDU Mode Knob - OFF

4. Pilot's Missile Warning System (MWS) Control Indicator (CI) - CHECKED

   a. Power Button - DEPRESS/ON

Lights illuminate and missile warning audio occurs.

   b. AUDIO and LAMP Rheostats - ADJUSTED

   c. Threat Button - DEPRESS/CHECKED

Threat lights remain on for two seconds after the button is released.

WARNING

If a threat indicator remains illuminated or fails to illuminate, the CI is inoperative. Have maintenance performed on the system; the system is unusable.

   d. Failure Button - DEPRESS/CHECKED

Failure lights illuminate during the 5 to 10 second test. At the end of the test, the threat indicator illuminates for two seconds.

WARNING

If the failure indicator(s) remains on, the indicated sensor(s) has failed. If all indicators remain illuminated, the central processor has failed. In either case, have maintenance performed on the system; the system is unusable.

   e. Power Button - DEPRESS/OFF

PILOTS' AVIONIC PREFLIGHT.

This inspection will normally be performed by the pilots prior to the Before Starting Engines checklist. Asterisked items will be performed for each flight.

* 1. FMS POWER Switches - ON

*1A. MFD - ON

* 2. MFSI SYS Switch - ON/CHECKED

* 3. CDS COOLING FAN Switch - FAN No. 1

FAN No. 1 desired, connected to EMER AC BUS. Use FAN No. 2 if FAN No. 1 is inoperative.

* 4. CDS Brightness Controls - ON/SET

* 5. AHRS - CHECKED

    a. Mode Switched - Slaved

    b. Latitude - SET

    c. Syn Indicator - CENTERED Push Sync Button to sync MH to aircraft heading.

    d. Variation Switch - Positioned

        (1) Variation 8°E to 8°W = 0°

        (2) Variation over 8°E = –15°

        (3) Variation over 8°W = +15°

* 6. MSU I and 2 - STANDBY

* 7. FMS - PROGRAMMED/CHECKED

NOTE

Detailed procedures will be found in Section I.

    a. Pilot's MFCDU displays 1 in upper left corner.

NOTE

Normally, NP1 is the master navigation processor (1 in inverse video). NP2 may be selected as the master during normal operation.

    b. Copilot's and Navigator's MFDCUs display 2 in upper left corner.

The 2 will be in inverse video if NP2 is master.

    c. MFCDU POWER UP Page - CHECK/SET

Verify that the pilot's DAMU displays the TAC 1, VOR 1, and VHF 1 tuned channel frequency. Verify that the copilot's DAMU displays the TAC 2, VOR 2, and VHF 2 tuned channel frequency.

WARNING

Unintentional selection of map datums other than WGS-84 will result in gross navigational errors.

NOTE

- Ensure that VOR/VHF 1 manual control switch is off.
- If the Nav Data Base is about to expire, select or load a new Nav Data Base after aligning the INSs.

    d. Present Position - ENTERED/CHECKED

WARNING

Present position must be accurate within 0.5 nautical mile of true position. Present position loaded by one crewmember will be verified by both pilots to minimize the possibility of operator error.

NOTE

- Compare GPS and Reference Position with surveyed coordinates to determine the best alignment coordinates.
- After the INU completes alignment state 8, a minimum of 51 seconds, ALIGN changes to ALIGN. No further present position entries will be accepted by the INUs.
- If incorrect present position data are inserted, set mode selector to STBY and then back to ALIGN and reinsert correct present position.

    e. MSU 1 and MSU 2 - ALIGN

    f. SOLN - CHECKED/SET

NOTE

Select desired NAV Source and AUTO/MAN as desired.

    g. ROUTE - ENTERED

NOTE

- Route may be entered manually or, if loaded, retrieved as a stored route.
- If a new mission database was loaded in step c, all previously stored routes have been erased.
- To retrieve a stored route, enter the route identifier and up select by pressing 2L.

- If the identifier is not found in the database, the scratch pad will display NOT IN DATABASE .
- If identifier is improperly entered, the scratch pad will display INVALID ENTRY .

(1) ACTIVATE Route - 6R PRESSED

(2) EXEC Key - PRESSED

Verify that the RTE page TITLE changes to ACT RTE.

h. PERF INIT Page - ENTERED

i. TOLD INIT RTE Page - DATA ENTERED/ CHECKED

j. COMM TUNE Page - CHECKED/SET

k. NAV TUNE Page - CHECKED/SET

l. LZ INIT Pages 1/2 and 2/2 - AS REQUIRED

* 8. Pilot's and Copilot's DAMU - SET/CHECKED

Ensure that DPU 1 and 2 function in both positions.

STATUS Menu:
ATT - AHRS
HDG - AHRS

Both PFDs annunciate BOTH AHRS.

* 9. BDHIs and Mag Compass - CHECKED

Check for proper indication.

* 10. Radios, Radar, and Radar Altimeter - ON, STANDBY

* 11. Navigation Radios - CHECKED

* 12. Communications Radios - CHECKED

At least one communications radio will be checked. A Secure Voice System (SVS) will be checked if its use is anticipated. Additionally, an HF radio will be checked if needed to accomplish the mission.

Check take control capability of VHF1 manual control.

* 13. Mode S/IFF - CHECKED/STANDBY

a. MODE S/IFF Control Panel - CHECKED/SET

(1) MASTER - OFF

(2) M-1, M-2, M-3/A, and M-C switches - ON

(3) MODE 4 CODE - A

(4) MODE 4 CODE TEST/ON/OUT - OUT

(5) MODE 4 CODE AUDIO/LIGHT/OUT - OUT

(6) IDENT/OUT/MIC - OUT

(7) ABOVE /NORMAL/BELOW Switch - AS REQUIRED

b. MASTER switch - STBY

CAUTION

To prevent damage to the switch, pull outward on the MASTER switch before turning it from STBY to OFF, and before turning it from TA/RA to EMER. Release the switch after the new position (OFF or EMER) is selected.

(1) Observe the display and verify the following items are displayed in sequence:

(a) Testing_

(b) CP Pass

(c) M3 (code)

Observe Mode 3/A code (M3 XXXX) is displayed.

(d) STBY

NOTE

Upon completion of power-on sequence, the control panel alternately displays M3 (CODE) and STBY approximately every 15 seconds.

(2) Allow 2 minutes for warm-up (cold weather).

c. MASTER switch - NORM

d. M-1 switch - TEST (momentarily)

(1) Display Message - M1 PASS

e. M-2 switch - TEST (momentarily)

(1) Display Message - M2 Pass

f. M-3/A switch - TEST (momentarily)

(1) Display Message - M3 Pass, MS TEST, M S PASS

(2) Observe that the TCAS test pattern (figure 2-1) is displayed on MFD as follows:

(a) "TCAS TEST" appears in the 9 o'clock position on the MFD.

(b) TRAFFIC appears in red in upper right corner.

(c) Resolution Advisory (RA) red square appears at 3 o'clock, range 2 miles, 1000 feet below and level.

(d) Traffic Advisory (TA) yellow round target appears at 9 o'clock, range 2 miles, 200 feet below with arrow up.

(e) Proximity traffic, solid white diamond appears at 1 o'clock, range 3.6 miles, 200 feet above with arrow down.

(f) Non-threat traffic, open white diamond appears at 11 o'clock, range 3.6 miles, 1000 feet above and level.

(g) VSI appears on the right side of the MFD. A red command bar extends from 0 through -6,000 and +2,000 through +6,000. A green bar extends from 0 to approximately 300.

(h) Observe that after approximately 12 seconds "TCAS SYSTEM TEST OK" is heard over the TCAS speaker and pilot's and copilot's headsets.

g. M-3/A switch - AS REQUIRED

NOTE

If RT FAIL or SER FAIL is displayed, with MASTER switch in STBY, press and hold SEL A/SEL B switch to SEL B position until RT TYPE is displayed. If RT-1157 is displayed, press S1, S2, S3, or S4 switch to change display to RT-1717.

h. M-C switch - TEST (momentarily)

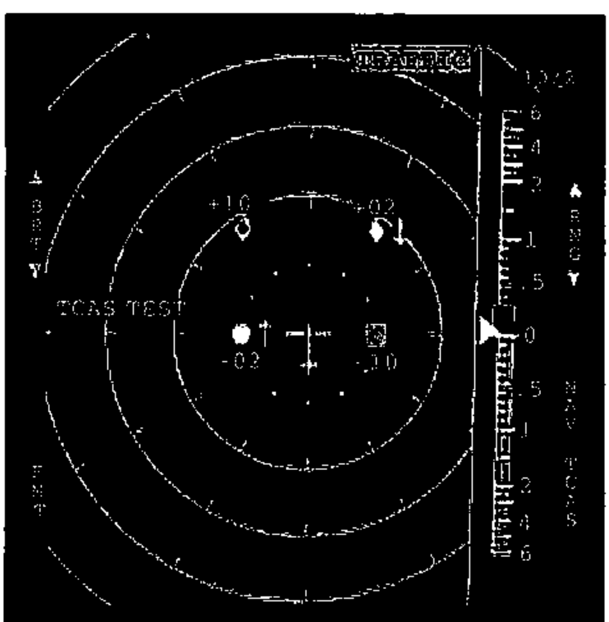


Figure 2-1. TCAS Test Pattern DK0HX031

NOTE

Switch M3/A must be in the "ON" (center) position.

(1) Display Message - M-C Pass

i. Select the code assigned for use in Mode 1 by toggling SEL A/SEL B switch to SEL A until M1 is displayed. Verify Mode 1 code is properly set. If the Mode 1 code needs to be modified, perform the following:

(1) With Mode 1 code displayed, press S1 switch up to increment or down to decrement the first number (most significant number) of the code.

(2) With Mode 1 code displayed, press S2 switch up to increment or down to decrement the second number (least significant number) of the code.

NOTE

S3 and S4 are disabled in Mode 1.

(3) With desired Mode 1 code displayed, momentarily set SEL A/SEL B switch to SEL A.

j. Select the code assigned for use in Mode 3/A by toggling SEL A/SEL B switch to SEL A until M3 is displayed. Verify Mode 3/A code is properly set. If the Mode 3/A code needs to be modified, perform the following:

(1) With Mode 3/A code displayed, press S1, S2, S3, or S4 switch up to increment or down to decrement the corresponding number of the code.

(2) With desired Mode 3/A code displayed, momentarily set SEL A/SEL B switch to SEL A.

k. To modify display intensity, perform the following:

(1) Toggle SEL A/SEL B switch to SEL B until DISP (100) is displayed.

(2) With DISP (100) displayed, press S1, S2, S3, or S4 switch to up position to increase display intensity or to down position to decrease display intensity.

NOTE

To set display for night vision operation, set display intensity to 0.1 or 0.05.

l. Select the code assigned for use in Mode 2 by pressing SEL A/SEL B switch to SEL B until M2 is displayed. Verify Mode 2 code is properly set. If the Mode 2 code needs to changed, perform the following:

(1) With Mode 2 code displayed, press S1, S2, S3, or S4 switch up to increment or down to decrement the corresponding number of the code.

(2) With desired Mode 2 code displayed, momentarily set SEL A/SEL B switch to SEL A.

m. Mode S is enabled upon initial power on condition. If it is desired to disable or re-enable Mode S, perform the following:

(1) MASTER switch to STBY, hold SEL A/SEL B switch to SEL B until MODE S is momentarily displayed, then DISABLE (or ENABLE) is displayed.

(2) MASTER switch to NORM, with MODE S DISABLE (or ENABLE) displayed, momentarily press S1, S2, S3, or S4 switch until MODE S ENABLE (or DISABLE) is displayed.

n. To verify the Mode S address, enable Mode S (described above), then hold SEL A/SEL B switch to SEL B until MS ADDR is displayed. Verify Mode S information is properly set. If the Mode S information needs to be modified, perform the following:

(1) Press S4 switch to move cursor to the right or S1 switch to move cursor to the left.

(2) Momentarily set S2 or S3 switch to up position to increment characters or to down position to decrement characters. Holding S2 or S3 in up or down position will enable continuous increment/decrement.

NOTE

- If an invalid Mode S address is entered, an "ADDR BAD" indication will be momentarily displayed immediately after the invalid address is entered.
- A Mode S address that has been entered via the Maintenance Menu will have precedence over the hard-wired address until power is removed. Upon power-on, the Mode S address will default to the hard-wired address.

(3) Once the desired Mode S information is displayed, momentarily set SEL A/SEL B switch to SEL A.

o. Press on the M4 REPLY indicator to test for proper illumination. Rotate indicator to achieve desired illumination (counterclockwise brightens indicator).

* 14. TAWS - CHECKED

a. Pilot's DAMU

(1) ATT - AHRS

(2) HDG - AHRS

b. On any MFCDU, press the SOLN function key and the NEXT KEY, and select AUTO (5L).

c. On MFD, increase brightness to an acceptable level.

d. Observe: ARC display
10-mile range
no overlays

e. WXR - STBY

WXR may be placed in TEST mode.

f. Ensure the TERR INHB switch is OFF. Lower half of TERR INHB on TCAP is unlit

g. Select TERR Mode on MFD. TERR will appear in white letters in the upper left corner

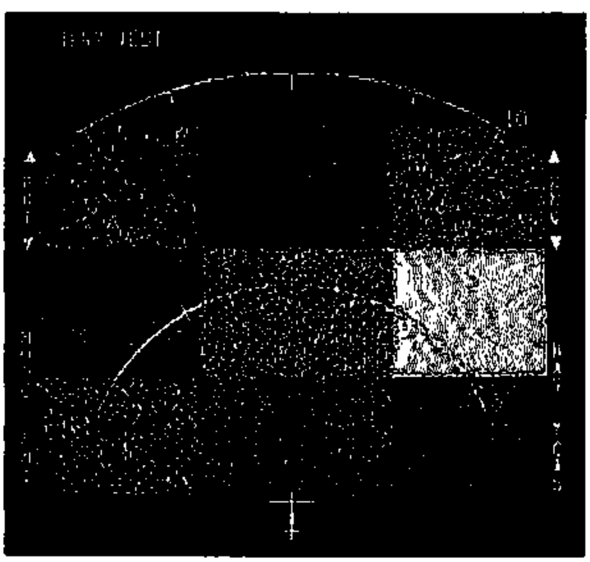
h. MFD - Set 40-Mile Range. Range scale will change to 40 Miles.

i. TAWS TEST button - PRESSED

Press for less than 2 seconds

Observe:

Aural Alert	Visual Alert
	GPWS INOP flashes on Master Caution Panel (MCP)
	WINDSHEAR INOP flashes on MCP
	TERRAIN INOP flashes on MCP
	TERRAIN TEST annunciates on MFD
	TACT light illuminates for 1 second
	FLAPS OVRD light on TCAP illuminates for 1 second
Glide Slope	TAWS Alert Light - ON for 1 second
	G/S OVRD Light - ON for 1 second
Pull Up, Pull Up	TAWS Warning Light ON & FLASHING for 1 second
Siren, Windshear, Windshear, Windshear	TAWS Warning Light ON & FLASHING for 1 Second
Terrain Terrain Pull Up	TAWS Caution Light on for 1 second
	Test Pattern appears on MFD
	After 12 seconds GPWS INOP, TERRAIN INOP, and WINDSHEAR INOP extinguish on MCP.



D8077701

Figure 2-1A. TAWS Test Pattern

15. Radar Altimeter - TEST
* 16. Flight Displays - CHECKED

Check for proper indications.

* 17. Radar - CHECKED/OFF
* 18. Defensive Systems - AS REQUIRED

BEFORE STARTING ENGINES.

This checklist may be accomplished by the copilot, flight engineer, and scanner, in advance when directed by the aircraft commander, provided the checklist for all three positons is accomplished simultaneously and these crewmembers maintain continuous watch on interphone at respective crew positions after completion of the checklist.

The APU power portions of the checklist may be delayed until just prior to the starting engine check. In this case, the engineer will report "CHECK COMPLETED, APU OFF" after completing the BEFORE STARTING ENGINES checklist. When ready to start the APU, refer to the APU checklist items.

The aircraft commander will ensure that a stowaway check is completed in accordance with current directives.

PILOTS

1. APU Clear - "APU CLEAR" (S)

If APU is running, this step is not required.

2. Forms - "CHECKED" (P)
   a. Aircraft Forms
   b. Form 365-4
   c. Form 1896 (Jet Fuel Identaplate)/AIR Card
3. Brake Selector -"EMERGENCY" (CP)

Check pressure normal and PRESS ON Light illuminated.

4. Anti-Skid - "ON" (CP)
5. Parking Brake - "SET" (P)
6. Remove Exterior Equipment - "REMOVING" (S)
7. Oxygen - "CHECKED AND ON, ____________ LITERS" (CP), "CHECKED AND ON" (P)

This oxygen check may be performed prior to calling for this checklist.

8. Cockpit Windows - "CLOSED AND LOCKED" (CP, P)
9. Yaw Damper - "OFF" (CP)
10. Pitch Trim - "RESET" (P)

Reset both electrical and electrohydraulic trim.

11. Autopilots - "OFF" (P)

Depress the autopilot disconnect button. Do not engage autopilot until after take-off.

12. Autothrottles - "OFF" (P)
13. Throttles - "IDLE START" (P)
14. Windshield Heat - "NORMAL" (CP)

FLIGHT ENGINEER

1. Battery Switch - ON
2. No. 3 Hyd Pump Switches - ON

If external power is available, place No. 3 Hyd Pump switches ON at this time.

NOTE

If the APU is off, perform steps 3 through 9 after scanner reports "APU CLEAR."

3. APU Door Switch - OPEN
4. APU Control Switch - START/RUN
5. APU Bleed Load and Flow Control Valve - OPEN
6. Air Conditioning Master Switch - AS REQUIRED
7. Auxiliary Generator Control Switch - ON AND CHECKED
8. No. 2 Bus and No. 3 Bus Auto Load Disc Switches - OVERRIDE
9. Power Selector Switch - AS REQUIRED
10. External Power - "REMOVE EXTERNAL POWER" (E), "REMOVING" (S)

External power (when available) should be connected as a standby power source on air evac missions or when determined necessary by the aircraft commander.

11. No. 3 Hyd Pump Switches - ON
12. Hyd Engine Valves - NORMAL
13. Suction Boost Pump Switches - ON
14. Main Gen Cont Switches - OFF

SCANNER

1. APU Clear - "APU CLEAR" (S)

If APU is running, this step is not required.

2. Remove Exterior Equipment - "REMOVING" (S)
   a. Pitot Covers - Remove and Stow
   b. Stabilizer Struts - Stow
   c. Gear Pins - Remove and Stow
   d. Wheel Chocks - Remove and Stow

If the aircraft will not be taxied, the response will be "WHEEL CHOCKS IN PLACE."

3. External Power - "REMOVE EXTERNAL POWER" (E), "REMOVING" (S)

PILOTS

15. Stall Prevention Switches - "NORMAL" (CP)
16. Navigation and Anti-Collision/Strobe Lights - "ON" (CP)

On aircraft equipped with strobes, turn the Anti-Collision switch on and the top strobe to red.

17. Seat Belt Switch - "ON" (P)
18. INS 1 and 2 - "NAV MODE" (CP, P)
    a. Place MSU 1 and 2 to NAV.
    b. Check status.
19. Engineer's Report - "CHECK COMPLETED" (E)
20. Scanner's Report - "CHECK COMPLETED" (S)
21. Before Starting Engines Check - "COMPLETED" (CP)

FLIGHT ENGINEER

15. Fuel Panel - SET
    a. Main Tank Boost Pumps - ON
    b. Aux and Extended Range Tank Boost Pumps - OFF
16. Oxygen - ON

Ensure that all personnel occupying crew stations other than primary are notified to have oxygen regulator 100%/ON.

17. Cargo Doors - CLOSED AND LOCKED

NOTE

If another crewmember closes and locks the cargo doors, the flight engineer must receive a verbal report.

18. Engineer's Report - "CHECK COMPLETED" (E)

SCANNER

4. Scanner's Report - "CHECK COMPLETED" (S)

STARTING ENGINES.

Normally engines will not be started until the troop briefing is completed. The normal starting sequence will be 1, 2, 3, 4. See figure 2-3 for engine and exhaust danger areas and the Noise Exposure Danger Areas table for recommended ear protection.

PILOTS

1. Clear to Start Engines - "ENGINES CLEAR TO START" (S), "STARTING No. ____ " (P)

Prior to starting each engine, the pilot will state, "STARTING No.____"

   a. Starter Button - IN

FLIGHT ENGINEER

1. Air Conditioning Master Switch - ENG START

As each engine is started, monitor:

   a. Engine Instruments - NORMAL

SCANNER

1. Clear to Start Engines - "ENGINES CLEAR TO START" (S)

The scanner will report any malfunction

PILOTS

b. Fuel and Start Ignition - RUN at 15% N_2 RPM.

c. Engine Instruments and Warning Light - CHECKED

NOTE

If the engine fails to start and circumstances dictate, proceed to the Engine Shutdown and the Before Leaving Aircraft checklists.

FLIGHT ENGINEER

NOTE

If the low oil pressure light does not extinguish after 2 minutes of operation with the oil temperature at approximately 40°C and the oil pressure within limits, shut down the engine and have maintenance performed.

b. Hydraulic Pressure - CHECKED

Check that the hydraulic pressure is within limits and that the low pressure light for the respective pump is out.

c. Main Generator Control Switch - ON (at or above 50% N_2 RPM).

d. GEN OUT light - OFF

e. BUS TIE OPEN light - ON

SCANNER

NORMAL START SEQUENCE	PILOT INDICATIONS	ENGINEER INDICATIONS
a. Starter Button - IN	N_2 RPM N_1 RPM within 20 sec	Bleed Air - 30-52 PSI Oil Pressure within 20 sec
b. Fuel and Ignition Run at 15% N_2 RPM	Fuel flow indication EGT within 20 sec	
c. Starter Popout at 35-45% N_2 RPM	Starter Valve Open Light extinguished	
d. N_2 RPM	54-58% within 2 minutes after EGT	

2. Power Selector Switch - OFF

Turn the power selector switch off after all engines have been started, check that all bus tie lights extinguish.

CAUTION

Do not change source of electrical power while starter is engaged, since starter shaft may be sheared.

PILOTS | **FLIGHT ENGINEER** | **SCANNER**

NOTE

- The MFCDUs may display a "GPS X FAIL" after power transfer. If the message clears within approximately 50 seconds, the system is operating normally. If the message remains, from the GPS STATUS page(s), reset the receiver(s) (5R).
- If the MFCDUs return to the POWER UP page after a power swap, the NPs have performed a cold start. In this case PERF INIT will have to be reloaded, the flight plan will have to be activated and executed, and a NAV source will have to be selected. Information displayed on the LEGS 1 page will tell the operator what, if anything, has changed as a result of the power swap. If the flight plan has not been activated and executed, ACT is not shown in the page header. If dashes are shown as the desired track to the first waypoint, a nav source has not been selected. If the predictions for time and altitude are all dashes, PERF INIT data has not been entered.
- The BDHI bearing pointer select buttons are powered in the select position. When power is removed, depending on the duration of the power interrupt, they may revert to the non-selected position.

PILOTS

2. Continuous Ignition - "AS REQUIRED" (P)

Continuous ignition should be ON when icing conditions are present or expected during climbout, visible moisture is present, standing water is on the runway or during formation take-offs.

3. Engine Anti-Ice - "AS REQUIRED" (P)

When visible moisture is present, engine anti-icing will be used at temperatures of 8°C or below. Engine anti-ice will be turned ON after all four engines are started to prevent ice buildup during ground operation.

CAUTION

Continuous use of the engine anti-ice system above 10°C could cause deterioration in this system.

4. Ice Detect Switch - "MANUAL" (P)
5. Engineer's Report - "CHECK COMPLETED" (E)
6. Starting Engines Check - "COMPLETED" (CP)

FLIGHT ENGINEER

3. Remove External Power - "REMOVING" (S), "EXTERNAL POWER REMOVED" (S)

After the Power Selector Switch is placed OFF, direct the scanner to REMOVE EXTERNAL POWER/AIR if they were used for start. If not used for start, this step is not required.

4. No. 2 Bus and No. 3 Bus Auto Load Disc Switches - NORMAL
5. Fuel Panel - SET
6. Engineer's Report - "CHECK COMPLETED" (E)

SCANNER

2. Remove External Power - "REMOVING" (S), "EXTERNAL POWER REMOVED" (S)

ABNORMAL START INDICATIONS.

1. No rotation.
2. No N_1 RPM within 20 seconds of start initiation.
3. No ignition within 20 seconds of fuel and start ignition being placed to RUN.
4. Hot start. (Abnormally high fuel flow may cause a hot start.)
5. Hung start.
6. No oil pressure within 20 seconds of start initiation.
7. Any limitation exceeded.
8. N_2 RPM below 54% after two minutes.

CLEAR ENGINE PROCEDURE.

1. If any crewmember notes an abnormal start indication, announce "STOP START."
2. Fuel and start ignition switch - STOP.
3. If starter is engaged, allow engine to motor 15 seconds, then pull starter button out.
4. Do not attempt a restart until N_2 has stopped rotating because the starter shaft could shear.
5. If the starter button does not pop out at 45% N2 RPM, pull it out. If the starter valve open light remains on, pull the fire handle.
6. Observe starter duty cycle limitations.

BEFORE TAXI.

Refer to figure 2-4 for minimum turning radius and ground clearance.

PILOTS

1. Ground Clearance - "ALL CLEAR" (S)
2. Thrust Reversers - "CHECKED" (P), "SCAN CLOSED" (S)

Position the thrust reversers to reverse idle and observe that all THRUST REV NOT LOCKED and THRUST REV EXTENDED Lights illuminate and extinguish normally.

WARNING

Do not attempt take-off if any abnormal thrust reverser indication is encountered. If the condition cannot be corrected, the thrust reverser shall be locked out.

FLIGHT ENGINEER

1. Air Conditioning Master Switch - AS REQUIRED
2. APU - AS REQUIRED

The APU may be shut down at the crew's option if not required for crew/pax comfort.

3. STALL PREVENT NO. 1 CB (35R) AND NO. 2 CB (40R) - CLOSED

CAUTION

Do not close the Stall Prevent No. 1 and No. 2 circuit breakers prior to this step. If they are closed during power interuptions, the Power On Bit will cause the shaker to momentarily operate resulting in failure of the Stall Prevention Relays.

SCANNER

1. Ground Clearance - "ALL CLEAR" (S)

Check that the aircraft is clear of obstructions and that engine blast will not cause damage.

2. Thrust Reversers - "SCAN CLOSED" (S)

Visually observe the thrust reversers for proper operation and then scan closed after completion of check.

PILOTS

CAUTION

Do not use reverse thrust on engines that are over unpaved surfaces.

3. Clear to Board - "BOARDING AIRCRAFT" (S)
4. Radar ANT STAB Switch - "ON" (CP, N)
5. Radar - "STBY" (CP, N)
6. Flight Controls - "CHECKED" (P)

The pilot will move all flight controls slowly through full travel, holding the nose steering wheel steady while checking rudder travel.

Do not bang the flight controls against the stops. When visibility permits, pilot and copilot will check for positive movement and possible water drainage from the ailerons. If water is evident, control displacement will be maintained until complete drainage.

WARNING

There should be no play or lag between movements of control columns.

7. DAMU PROC SEL - "DPU 2" (CP), "DPU 1" (P)
8. Flight Displays - "CHECKED" (CP, P)
   a. Select ATT and HDG to desired source on DAMUs.

NOTE

For the remainder of the flight, INS 1 should be the attitude and heading source for the pilot's displays and INS 2 should be the attitude and heading source for the copilot's displays.

FLIGHT ENGINEER

SCANNER

3. Clear to Board - "BOARDING AIRCRAFT" (S)

PILOTS

b. PFD/SFD - SET FOR DEPARTURE

c. Pilot's MFCDU - CHECK/SET NP 1

d. Copilot's MFCDU - CHECK/SET NP 2

9. ADS Panel - "SET" (CP, P)

All ADS switches should be off.

10. Door Open Light - "OFF" (CP)

11. Brake Selector - "NORMAL" (CP)

12. Loadmaster's Report - "READY TO TAXI, ________ PERSONNEL ON BOARD" (LM)

13. Scanner's Report - "READY TO TAXI" (S)

14. Engineer's Report - "CHECK COMPLETED"

15. Before Taxi Check - "COMPLETED" (CP)

FLIGHT ENGINEER

4. Engineer's Report - "CHECK COMPLETED" (E)

SCANNER

4. Scanner's Report - "READY TO TAXI" (S)

Ensure that the cargo compartment is secure for taxiing. Coor-dinate with the loadmaster to ensure the troops and cargo are secure and all cargo compartment hatches are closed.

NOTE

Ensure that the No. 1 Escape Hatch is properly installed and secured. This hatch can be installed backwards on some aircraft. Checking this hatch should not interfere with the "READY TO TAXI" checklist response.

5. NAV Station Radar - AS REQUIRED (SKE Aircraft)

BEFORE TAKE-OFF.

This checklist should be performed in an uncongested area.

PILOTS

1. Brakes - "CHECKED" (P)
2. SKE - "AS REQUIRED" (CP, P)
3. Flight Displays - "CHECKED" (CP, P)
   a. Ensure Compasses move properly during turns.
   b. ADIs - proper indications

FLIGHT ENGINEER

1. Brakes - "CHECKED" (P)
2. SKE - "AS REQUIRED" (CP, P) (SKE Aircraft)
3. Flight Displays - "CHECKED" (CP, P)

SCANNER

1. Oxygen - 100%/ON

PILOTS	FLIGHT ENGINEER	SCANNER
c. The copilot will set the altitude alert to the take-off clearance altitude or other altitude as appropriate for departure.		
4. Altimeters - "STATE SETTING AND READING" (CP, P, N, E)	4. Altimeters - "STATE SETTING AND READING" (CP, P, N, E)	
The pilot will also SET/CHECK the MFSI altimeter.		
5. Flaps - "SET FOR TAKE-OFF" (CP, P)	5. Flaps - "SET FOR TAKE-OFF" (CP, P)	
6. Spoilers - "CLOSED AND ARMED" (CP)	6. Spoilers - "CLOSED AND ARMED" (CP)	
Check the spoiler position indicator closed. Ensure LOCK/UNLOCKED window is locked and the Spoiler Handle is CLOSED.		
7. Stabilizer, Rudder, and Aileron Trim - "SET" (CP, P)	7. Stabilizer, Rudder, and Aileron Trim - "SET" (CP, P)	
a. Copilot will set pitch trim.		
b. Rudder and aileron trim will be neutral.		
8. Thrust Reverse Limiter - "SET" (CP)	8. Thrust Reverse Limiter - "SET" (CP)	
9. Crew Briefing - "COMPLETED" (P/CP)	9. Crew Briefing - "COMPLETED" (P/CP)	
The pilot flying will brief those items applicable to the departure. As a minimum, the briefing will include:	**NOTE** Items 10 through 16 may be accomplished at this time to expedite Departure Checklist.	
a. Type of take-off/climb.		
b. Type of departure.	10. Cabin Pressurization - SET	
c. Command Markers.	a. Cabin Pressure Manual Control - AUTO	
d. Terrain/obstacle hazards.	b. Cabin Altitude and Rate - SET	
e. Emergency Intentions.	Set cabin altitude 500 feet above field pressure altitude.	
f. FMS Mode.		

PILOTS

NOTE

- The command airspeed marker for the pilot flying will be set on V_{ROT}. The command airspeed marker for the pilot not flying will be set on V_{GO}. Altitude command markers will be set on the most logical position for take-off.
- For convenience, the crew briefing may be accomplished prior to this time.
- Unusual circumstances may dictate emphasis of special briefing items for the take-off, e.g., high gross weights, short runway, go-rotate.

FLIGHT ENGINEER

11. Fuel Panel - SET

Use fuel heat if necessary.

12. Hydraulic Pressures - CHECKED
13. APU Shutdown - OFF/SECURED
    a. APU Generator Switch - OFF
    b. APU Bleed Load and Flow Control Valve Switch - CLOSED
    c. APU Control Switch - OFF
14. Air Conditioning System - SET
15. Wing Isolation and Bleed Valves - CHECKED
    a. No. 1 and 2 bleed valves closed, left pressure should drop to zero.
    b. No. 3 and 4 bleed valves closed, right pressure should drop to zero.
    c. All bleed valves - OPEN

WARNING

Do not take-off if a bleed valve will not close or if the wing isolation valve is open.

16. Emergency Generator - CHECKED
    a. Place the DC Volt Select Switch and the AC Volt Select Switch to the EMER POWER position.
    b. Hold the Emergency Power Test Switch in the TEST position. Rotate the Phase Select Switch to each position, checking that voltage and frequency of each phase is within limits.

SCANNER

PILOTS

10. FMS - "SET FOR DEPARTURE" (CP, P, N)

11. Radios, Radar, and Radar Altimeter - "SET" (CP, P, N)

Normally, only VHF/UHF command radio, guard and interphone will be monitored by the pilot and copilot. The copilot will advise the crew any time the primary radio is changed. The pilot flying will brief on any changes to NAV radio set up for departure. Pilot and copilot will check their BDHI and PFD for proper NAV selection and indications. Perform a radar confidence check and adjust as required. Set VALI on the radar altimeter to HAT or HAA for emergency return.

12. Yaw Damper - "CENTERED" (P), "ON" (CP)

WARNING

The yaw damper must not be engaged unless the rudder is powered and centered.

13. TAKEOFF and Warning Lights - "CHECKED" (CP, P)

All caution and annunciator lights will be checked for proper indication. Illuminated annunciator warning lights will not be extinguished until directed by the aircraft commander.

FLIGHT ENGINEER

c. Release the Emergency Power Test Switch and place the DC Volt Select Switch and the AC Volt and Freq Select Switch as desired.

17. FMS - "SET FOR DEPARTURE" (CP, P, N)

18. Radios, Radar, and Radar Altimeter - "SET" (CP, P, N)

19. Yaw Damper - "CENTERED" (P), "ON" (CP)

20. TAKEOFF and Warning Lights - "CHECKED" (CP, P)

21. APU Door Switch - CLOSED/OFF

SCANNER

2. NAV Station Radar - AS REQUIRED (SKE Aircraft)

3. L-Band SATCOM Computer - OFF/SECURED.

Ensure L-Band SATCOM Computer is OFF and secured below 10,000 feet.

PILOTS	FLIGHT ENGINEER	SCANNER
If the PFDs annunciate A/P OFF or AT OFF, depress the autopilot disconnect button or A/T disconnect button respectively.		
Depress the button on the manual pitch trim lever. If the TAKEOFF annunciator does not illuminate, or cannot illuminate, refer to Section III.	**NOTE** Items 22 through 28 are accomplished only if defensive systems are required immediately after take-off.	
14. Auto Dispense Control Switch - "MANUAL" (P)	22. Auto Dispense Control Switch - "MANUAL" (P)	
15. MWS CI Power Button - "ON" (P)	23. MWS CI Power Button - "ON" (P)	
	24. Indicator/Arm Control Switch - "ARMED" (N/S)	4. Indicator/Arm Control Switch - "ARMED" (N/S)
	25. Remote Dispense Control Switch - "ENABLED" (N/S)	5. Remote Dispense Control Switch - "ENABLED" (N/S)
	26. CMDS CDU Mode Control Knob - "MAN" (N/S)	6. CMDS CDU Mode Control Knob - "MAN" (N/S)
		GO light illuminates indicating the system is operating normally.

NOTE

PROG mode might be used based on the threat and the Mission Data File (MDF).

PILOTS	FLIGHT ENGINEER	SCANNER
	27. EMI Safety Pins - "REMOVED" (LM/S)	7. EMI Safety Pins - "REMOVED" (LM/S)
16. Defense Systems Armed - "ACKNOWLEDGED" (CP, P, N, S, LM)	28. Defense Systems Armed - "ACKNOWLEDGED" (CP, P, N, S, LM)	8. Defense Systems Armed - "ACKNOWLEDGED" (CP, P, N, S, LM)
	29. Seat Belt and Shoulder Harness - FASTENED	9. Seat Belt and Shoulder harness - FASTENED
	Ensure that all personnel in the flight deck are secured as required.	
	30. Cabin Report - "SECURED" (LM/S)	10. Cabin Report - "SECURED" (LM/S)
	31. Before Take-off Check - "COMPLETED" (E)	

NOTE

After take-off and prior to entering the threat envelope, set the auto dispense control switch to "AUTO" if automatic dispensing of countermeasures is required.

LINEUP.

This checklist will be accomplished just prior to taxiing onto, while taxiing onto, or when in position on the runway.

WARNING

If freezing precipitation is present, a final visual check of the aircraft/wing surfaces will be made just before take-off (within 5 minutes) by opening the No. 1 hatch and scanning the top of the wings to determine if the surfaces are still free of ice. Crews will assume the condition of the horizontal stabilizer surface is the same as the condition of the wing flight control surfaces. The hatch will be properly secured immediately after completion of the check.

PILOTS

1. Spoilers - "CLOSED AND ARMED" (CP, P)

Check Indicator and Spoiler Lever - CLOSED/ARMED

2. IFF - "SET" (CP)
3. Continuous Ignition - "AS REQUIRED" (CP)
4. Engine Anti-Ice - "AS REQUIRED" (CP)
5. Anti-Collision/Strobe Lights - "SET" (CP)

On aircraft equipped with strobes, position top and bottom strobe lights to "WHT" position. Use "RED" position for formation flights.

6. Pitot Heat and Temp Probe De-Ice - "ON" (CP)
7. Angle of Attack De-Ice - "ON" (CP)
8. TAKEOFF Annunciator - "CHECKED" (P)

FLIGHT ENGINEER

1. Spoilers - "CLOSED AND ARMED" (CP, P)
2. IFF - "SET" (CP)
3. Continuous Ignition - "AS REQUIRED" (CP)
4. Engine Anti-Ice - "AS REQUIRED" (CP)
5. Anti-Collision/Strobe Lights - "SET" (CP)
6. Pitot Heat and Temp Probe De-Ice - "ON" (CP)
7. Angle of Attack De-Ice - "ON" (CP)
8. TAKEOFF Annunciator - "CHECKED" (P)
9. Lineup Check - "COMPLETED" (E)

TAKE-OFF.

For a Typical Take-off and Climb, refer to figure 2-5. For a Typical Take-off and Obstacle Climb, refer to figure 2-6. Take-offs may be made with TRT-EPR or reduced EPR using rolling or standing techniques. A reduced EPR take-off is the preferred method, conditions permitting. A TRT take-off shall be made when gross weight is limited by critical field length, obstacle clearance, three-engine climb, windshear, or gust front from a thunderstorm or CB is anticipated. Set TRT prior to brake release when gross weight is limited by critical field length or obstacle clearance.

WARNING

Do not take-off unless all engines achieve computed take-off power settings.

FMS TAKE-OFF.

The TAKE-OFF page displays all information needed to complete the take-off. The take-off calculations are for either a reduced (RED) or take-off rated thrust (TRT) take-off. A set take-off rated thrust before brake release (MAX) is also calculated when a RED or a TRT take-off cannot be performed.

STANDING TAKE-OFF.

1. While holding brakes, the pilot flying will slowly advance the throttles to 70% N_1 RPM.

2. The pilot flying will release brakes and smoothly advance the throttles to take-off EPR. The pilot not flying will make the final power adjustment. The pilot flying will maintain primary control of the throttles throughout the take-off and initial climb. Full throttle will not normally be required. Do not take-off if an engine fails to reach take-off EPR.

3. The pilot will use nose wheel steering until take-off EPR is set and then transition to the yoke.

   a. If the pilot is performing the take-off, the copilot will maintain wings level and a slight forward pressure on the yoke until the pilot takes control of the yoke.

   b. If the copilot is performing the take-off, the procedures remain the same except the copilot retains control throughout the take-off.

4. The pilot not flying will check the airspeed indicators and the pitch trim indicator for movement during take-off roll.

WARNING

- The pilot not flying must monitor the SFD CWA and PFD annunciations and advise the pilot flying immediately.
- When the center of gravity is aft of 25% MAC and a runaway pitch trim to the full nose-up limit (10.0 degrees) goes undetected, pitch control problems will be encountered. Considerable forward pressure will be required on the yoke for extreme nose-up trim settings. Approximately 8 degrees nose-up trim is the maximum that can be controlled in a wings-level attitude.

5. If any crewmember notes an unsafe condition before GO speed, state "REJECT". The final decision to reject shall be made by the aircraft commander.

6. If GO speed is rotate, the pilot not flying will state "GO, ROTATE". If GO speed is less than ROTATE speed, the pilot not flying will state "GO" at GO speed followed by "ROTATE" at ROTATE speed.

7. At rotation speed, rotate smoothly approximately 6 to 8 degrees.

ROLLING TAKE-OFF.

The rolling take-off procedure is the same as the standing procedure except that the pilot flying will not hold the brakes while applying power for take-off. Align the aircraft with the runway centerline at slow speed and prior to advancing power for take-off. Refusal speed must be equal to or greater than rotation speed.

Rolling take-offs may be accomplished from the right seat after the aircraft is aligned on the runway, stopped, and control transferred to the copilot.

TAKE-OFF GUST CORRECTION.

If surface winds are gusting, increase rotation speed by the amount of the gust up to a maximum of 10 knots. If GO speed is based on rotation speed, it will also be increased. GO speed must never be increased above refusal speed, maximum braking speed, or 147 KCAS. Reset pilot and copilot command markers accordingly.

WIND SHEAR ON TAKE-OFF.

Forecast wind shear must be carefully analyzed prior to attempting a take-off. Take-off wind shear may be associated with frontal passage, thunderstorm activity, low level jet stream, or microburst phenomena. Pilots should be aware of this activity and delay take-off, if necessary.

WARNING

- Do not take-off if evidence of a microburst is reported or observed.
- Make a TRT take-off if wind shear or microburst phenomena are forecast or likely to occur. An increasing tailwind during take-off roll may invalidate a precomputed refusal speed. Closely monitor aircraft performance on climbout.

If severe wind shear is inadvertently encountered on take-off, a rapid uncommanded change in airspeed and/or flight path will occur. Maintain pitch attitude at or slightly above take-off attitude and use maximum engine thrust. If approach to stall is indicated, make small pitch adjustments to eliminate indications.

WARNING

Decreasing pitch attitude in an attempt to regain airspeed during initial shear encounter may prevent successful recovery.

INSTRUMENT TAKE-OFF.

Select the navigation aids to be used for the departure and set the desired course in the course selection window. The heading marker may be set to the runway heading or the initial departure heading, whichever is most logical.

After aligning the aircraft on the runway, check the heading. Complete the Lineup checklist and make a standing or rolling take-off. Maintain runway alignment by visual means as long as possible.

CLIMBOUT.

WARNING

When a GCAS warning is received, take immediate action to ensure terrain clearance.

1. After a positive rate of climb, the pilot flying will state "GEAR UP." The pilot not flying will acknowledge if the gear and bogie position indicators are normal. The copilot will then place the landing gear lever UP. If the gear or bogie position indicators are not normal before retraction, refer to landing gear malfunctions, Section III. If the gear does not retract, advise the pilot flying. When the gear indicates up, the pilot not flying will state, "GEAR IS UP".

2. The copilot will DISARM the spoiler lever when flight station duties permit.

NOTE

If defensive systems are required immediately after take-off, have the engineer accomplish item 2 of the After Take-Off, Climb Checklist.

3. Maintain a pitch attitude that will give a rate of climb of approximately 1,000 FPM and accelerate to flap retract speed. The pilot flying will state "FLAPS UP." The pilot not flying will acknowledge and raise the flaps. When the flaps are retracted, the pilot not flying will state, "FLAPS ARE UP."

WARNING

To ensure an adequate margin above stall is maintained, do not exceed 10 degrees of bank if flaps are retracted at minimum flap retract speed. If an increased angle of bank is required (not to exceed 30 degrees), airspeed shall be increased to a minimum of 20 knots above flap retract speed prior to flap retraction.

4. Maintain approximately 1,000 FPM and accelerate to 250 KCAS. The pilot flying will set climb power or state "CLIMB POWER" (approximately 92% N_1 RPM). The pilot not flying will acknowledge and set climb power. The flight engineer will compute a corrected EPR setting for climb. After passing 10,000 feet, accelerate to 280 KCAS.

NOTE

If low altitude maneuvering is required, maintain 200 knots.

OBSTACLE CLIMBOUT.

This climbout will be used anytime obstacle clearance is a factor. Set TRT prior to brake release. After take-off, maintain approximately 1,000 FPM until reaching V_{MFR}. Climb at V_{MFR} with flaps approach until clearing the obstacle. Retract the flaps, maintain approximately 1,000 FPM and accelerate to climb airspeed. Normal climb procedures then apply.

FMS CLIMB MODES.

Engine-out, Maximum Angle, Selectable Speed, ECON (Economy), CLB DIR modes can be used as advisory or as coupled operation.

PILOT DUTIES.

Regardless of the level of automation in use, the pilot flying and pilot not flying will maintain situational awareness. Never hesitate to select a lower level of automation (i.e., basic or autopilot off) if uncomfortable with the current level of autopilot performance. At no time will both pilots simultaneously become involved with "heads down" center console tasks during critical phases of flight.

When operating in VMC, automated tasks should never interfere with outside traffic watch. Pilots should consider using the autopilot in high-density areas and lower altitudes, thus reducing workload and increasing external vigilance. On approach, the pilot not flying will monitor and announce any changes to the PFD Mode Annunciator and the CWA (Caution/Warning Advisory) portions of the DU.

AUTOPILOT ENGAGED PROCEDURES.

The pilot flying will normally control his/her DAMU/FCP/RSP/MSP and announce all engagements/changes in autopilot and autothrottle status. Because the DAMU AP/FD page is slaved with an autopilot on, the pilot not flying will not normally make any changes to the AP/FD page unless directed by the pilot flying (this will prevent inadvertent control inputs by the pilot not flying).

When ATC assigns a new altitude, the pilot flying will set the new altitude in the ALT ALRT function of the RSP, then announce the new altitude to the crew (this will prevent an inadvertent VNAV climb/descent by the pilot not flying until the pilot flying is ready). When the situation dictates (i.e., SID/STAR/approach with multiple altitude restrictions), the pilot flying may direct the pilot not flying to set the next altitude restriction.

AUTOPILOT DISENGAGED PROCEDURES.

The pilot flying will normally call for desired changes to the center console/RSP/MSP and the pilot not flying will make the requested changes. When ATC assigns a new altitude, the pilot not flying will set the ALT ALRT function of the RSP. The pilot flying will wait until the new altitude is set, verify it on the PFD, then state the new assigned altitude to the crew.

AFTER TAKE-OFF, CLIMB.

If this checklist is omitted or delayed and the use of defensive systems is required immediately after take-off, accomplish the applicable Defensive System step (Flight Engineer step 2) as mission directives dictate or as directed by the pilot.

Whenever an FMS Mode is engaged or changed, it should be announced to the crew. Do not engage the autopilot below 400 feet AGL on departure. Do not call for this checklist until the flaps are retracted and cockpit duties permit (noncritical phase of flight). This checklist may be omitted for immediate returns or for flights of 60 minutes or less. If it is omitted, the CRUISE and DESCENT checks may also be omitted. Items on this checklist may be performed as necessary or when directed by the aircraft commander. This checklist will be accomplished as a cleanup reference. If this checklist is omitted, the Landing Gear Warning Horn Cut-Out Switch may be turned off, if the GCAS is on and operating. After the scanner's walk-around inspection, the Flight Station door should remain closed when not in use.

PILOTS

1. Spoilers - "CLOSED AND DISARMED" (CP)
2. Auto Dispense Control Switch - "AS REQUIRED" (P)

   NOTE

   Select AUTO upon entering the threat envelope or as mission directive dictates.

3. Landing Gear Warning Horn Cut-Out Switch - "OFF" (CP)
4. Exterior Lights - "AS REQUIRED"(CP)
5. No Smoking Switch - "AS REQUIRED" (P)

FLIGHT ENGINEER

1. Spoilers - "CLOSED AND DISARMED" (CP)
2. Auto Dispense Control Switch - "AS REQUIRED" (P)
3. Landing Gear Warning Horn Cut-Out Switch - "OFF" (CP)
4. Exterior Lights - "AS REQUIRED" (CP)
5. No Smoking Switch - "AS REQUIRED" (P)
6. Pressurization - CHECKED

   Set the cabin alt knob to the desired cabin altitude (normally cruise altitude plus 500 feet).

7. Floor Heat - AS REQUIRED

SCANNER

1. Scanner's Report - SCAN OKAY

   The scanner will make a walk-around check of the aircraft scanning the engines, load and equipment. Examine the aft pressure door and ramp when the cabin pressure differential reaches approximately 4.0 PSID for the following:

   a. Pressure door auxil-iary latch system for security and that all links are loose.

   b. Ensure that the ramp is properly locked.

If no discrepancies exist, report, "SCAN OKAY," normally without interphone.

NOTE

This item may be accomplished by the loadmaster if the pilot requires the scanner to remain on the flight deck.

PILOTS

FLIGHT ENGINEER

8. Fuel Panel - SET

NOTE

Transfer 3,500 lbs. of fuel to the extended range tanks from the auxiliary tanks only. After 10 minutes, have the Scanner check for fuel leaks and then resume normal fuel management. If a fuel leak is observed, refer to Section III.

9. No. 3 Hyd Pump Switches - OFF
10. Air Refueling Slipway Door - AS REQUIRED

Cycle aerial refueling door to prevent freezing if moisture was present on the ground and an air refueling mission is planned.

11. After Take-Off, Climb Check - "COMPLETED" (E)

SCANNER

CRUISE.

The flight engineer will provide KCAS, Mach, and target EPR prior to reaching cruise altitude. The pilot flying will fly the computed KCAS to maintain the desired Mach. FMS CRUISE Modes are Economy, Long Range, Selectable Speed, Engine-out, and TOA (Time of Arrival). Each CRUISE Mode is capable of being coupled to an autopilot.

PILOTS

1. Cabin Altitude and Oxygen Quantity - "___ FEET ___ LITERS" (CP)
2. Anti-Ice/De-Ice - "AS REQUIRED" (P)
3. Continuous Ignition -"AS REQUIRED" (P)
4. Seat Belt Switch - "AS REQUIRED" (P)
5. Altimeters - "STATE SETTING" (CP, P, N, E)
6. Radar - "AS REQUIRED" (P, N)

FLIGHT ENGINEER

1. Cabin Altitude and Oxygen Quantity - "___ FEET ___ LITERS" (CP)
2. Anti-Ice/De-Ice - "AS REQUIRED" (P)
3. Continuous Ignition - "AS REQUIRED" (P)
4. Seat Belt Switch - "AS REQUIRED" (P)
5. Altimeters - "STATE SETTING" (CP, P, N, E)
6. Radar - "AS REQUIRED" (P, N)
7. Cruise Check - "COMPLETED" (E)

SCANNER

1. NAV Station Radar - AS REQUIRED (SKE Aircraft)

DESCENT PROCEDURES.

ENROUTE DESCENT.

Enroute descents are accomplished by retarding throttles with the landing gear up, flaps and spoilers retracted, and descending at 0.74 or 0.767 Mach until reaching 300 KCAS at which time 300 KCAS may be maintained to 10,000 feet. Maintain 250 KCAS below 10,000 feet.

PENETRATION.

1. Complete the descent and approach checklists prior to beginning the penetration.

2. Begin the penetration from the initial approach fix with the gear and flaps up and throttles at idle start. Deploy the spoilers as required to maintain 4,000 to 6,000 FPM and an airspeed of 230 to 250 knots.

NOTE

It may be necessary to advance symmetrical throttles slightly to maintain pressurization. If distance versus altitude loss is critical, the spoilers may be deployed immediately departing altitude. A sizable altitude loss will occur while the aircraft is accelerating to normal penetration airspeed.

3. Begin level off approximately 1,000 feet above published penetration altitude by decreasing vertical velocity by half. Allow the airspeed to decrease toward approach plus 10 knots. Retract the spoilers, if extended, and extend the flaps to approach prior to slowing below minimum flap retract speed plus 20 knots. Extend the landing gear, and accomplish the Before Landing checklist.

4. After passing the final approach fix, low altitude procedures apply.

5. Refer to figure 2-7 for penetration depiction.

EMERGENCY DESCENT.

Refer to Section III, Part 1.

HOLDING.

Holding will be conducted in a clean configuration at 200 KCAS, at gross weights of 257,500 pounds and below. At gross weights above 257,500 pounds, hold at 220 KCAS. If endurance holding is required, hold at best endurance speed plus 10 knots. When fuel is not a factor, low altitude holding may be conducted with the gear down and flaps APPROACH at approach speed plus 30 knots.

WARNING

If holding is required at altitudes higher than the maximum endurance altitude, hold at best endurance speed plus 10 KCAS or stall speed (30° angle of bank) plus 25 KCAS, whichever is higher.

DESCENT.

The descent check should be completed prior to departing cruise altitude. The flight engineer will compute the landing data based on the anticipated landing weight and weather. Forecast data may be used for flights of three hours or less, but it will be confirmed prior to landing. The pilot flying should complete the crew briefing prior to descent.

FMS DESCENT.

FMS DESCENT modes are: ECON (Economy), Rapid, Selective Speed, and Descent Direct. Each DESCENT mode (except Rapid) may be coupled to the autopilot.

The FMS computes and displays descent speed targets and distance to go in descent to provide a fuel efficient descent performance for any selected speed schedule. Descent mode computations are automatically adjusted for the effects of wind and any mission-imposed speed or altitude constraints that may apply.

NOTE

> If the FMS VNAV mode is fully engaged (Autopilot and autothrottles) in cruise, autothrottles will disengage after sequencing Top Of Descent. If the Rapid Descent mode is selected the autopilot will disengage.

FMS HOLDING PATTERNS.

FMS holding patterns can be located at a waypoint or at the aircraft present position (PPOS HOLD). The width of the holding pattern is resized each time the holding fix is crossed based on a nominal 25-degree bank angle and expected ground speeds. The size of the holding pattern is limited to remain within the allowed holding airspace.

The MFCDU HOLD page displays detailed information about selected holding patterns. There are actually two HOLD pages, one for Route 1 and one for Route 2. The title data field displays the route number to which the HOLD page applies.

Selection of the HOLD prompt on the WAYPOINT DATA page 1/2 results in display of the HOLD page. Selection of the PPOS HOLD prompt from the MISSIONS page displays the HOLD page for the active route.

NOTE

> Before PPOS HOLD can be activated, the cross track error of the Master NP has to be <0.25 NM, LNAV is not in a transition state, and there is an active "TO" waypoint.

RENDEZVOUS.

The RENDEZVOUS page allows definition of a target's position, time, groundspeed, track and in-trail distance, and then computes an intercept position and time with the target, the course and distance to the intercept position, and the target's current bearing and range.

Refer to PPOS HOLD, HOLD AT A WAYPOINT, or RENDEZVOUS under NORMAL OPERATION OF THE FLIGHT MANAGEMENT SYSTEM in Section I.

DESCENT.

PILOTS	FLIGHT ENGINEER	SCANNER
1. Altimeters - "STATE SETTING" (CP, P, N, E) The pilot will set QNH on the MFSI. The crew will remain on 29.92 until cleared below transition level and descent is started. The pilot not flying the aircraft will advise the crew of the proper altimeter setting and receive acknowledgment of the setting prior to descending through the transition level.	1. Altimeters - "STATE SETTING" (CP, P, N, E)	
2. Radar - "AS REQUIRED" (P, N)	2. Radar - "AS REQUIRED" (P, N)	1. NAV Station Radar - AS REQUIRED (SKE Aircraft)

PILOTS

3. Crew Briefing - "COMPLETED" (P/CP)

The briefing will include those items the crew feels are significant. As a minimum, the briefing will include:

a. Expected Route of Flight

b. Minimum Safe Altitude/ Emergency Safe Altitude

c. Terrain/Obstacle Hazards (Night/IMC)

d. Type of Approach

(1) DH/MDA, RVR/VIS

(2) Nav Radios

(3) Flap Setting

(4) Command Markers

WARNING

When making an instrument approach in cold weather (0°C or below), reference the Temperature Correction Chart in the Flight Information Handbook, and adjust altitude command markers accordingly.

(5) Missed Approach/ Climb Out Instructions

Pilot's and copilot's command airspeed markers will be set to final approach speed. The pilot flying the approach will set the altitude command marker to Decision Height (DH)/Minimum Descent Altitude (MDA) and the pilot monitoring the approach will set 100 feet above that altitude.

e. Type of Landing

(1) Configuration

(2) Runway Length

(3) Touchdown Point

FLIGHT ENGINEER

3. Landing Data - COMPUTED/CHECKED

4. Crew Briefing - "COMPLETED" (P/CP)

SCANNER

2. L-Band SATCOM Computer - OFF/SECURED

Ensure L-Band SATCOM Computer is off and secured below 10,000 feet.

PILOTS	FLIGHT ENGINEER	SCANNER
(4) Landing/Stopping Distance		
Anti-ice/de-ice and ERO should only be covered if applicable.		
4. Radar Altimeter - "SET" (P)	5. Radar Altimeter - "SET" (P)	
Set VALI to HAA, HAT, or RA for the approach to be flown.		
5. Continuous Ignition - "AS REQUIRED" (P)	6. Continuous Ignition - "AS REQUIRED" (P)	
6. Seat Belt Switch - "ON" (P)	7. Seat Belt Switch - "ON" (P)	
7. Seat Belt and Shoulder Harness - "ADJUSTED" (CP, P)	8. Seat Belt and Shoulder Harness - "ADJUSTED" (CP, P)	
	9. Pressurization - SET	
	Set cabin altitude 500 feet above field pressure altitude.	
	10. Hydraulic Pressure - CHECKED	
	11. Descent Check - "COMPLETED" (E)	

APPROACH.

Accomplish the Approach checklist prior to initiating the approach. It need not be reaccomplished for a subsequent series of patterns or approaches, for touch-and-go landings, missed approaches, taxi backs, or a full stop landing at the same airport or at different airports within the same terminal area where enroute flight time between airports makes accomplishing the checklist impractical. If the After Take-off, Climb checklist was run, the Cruise, Descent, Approach, and Before Landing checklists will be accomplished. If Descent check was completed, only asterisked items need be accomplished.

WARNING

Do not engage autopilot after Flight Director is in AWLS glide slope capture or track in IMC, due to abrupt pitch changes and the possibility of unusual attitude.

PILOTS	FLIGHT ENGINEER	SCANNER
1. Crew Briefing - "COMPLETED" (P/CP)	1. Crew Briefing - "COMPLETED" (P/CP)	1. Seat Belt/Shoulder Harness - FASTENED
A complete briefing will be given prior to each full stop landing and the first touch-and-go landing.		
* 2. FMS Landing Data - "PROGRAMMED" (CP)	* 2. FMS Landing Data - "PROGRAMMED" (CP)	
* 3. Thrust Reverser Limiter - "SET" (CP)	* 3. Thrust Reverser Limiter - "SET" (CP)	
* 4. Radios/Radar - "SET" (CP, P, N)	* 4. Radios/Radar - "SET" (CP, P, N)	2. NAV Station Radar - AS REQUIRED (SKE Aircraft)
Confirm proper nav selection.		
5. Continuous Ignition - "AS REQUIRED" (P)	5. Continuous Ignition - "AS REQUIRED" (P)	

PILOTS	FLIGHT ENGINEER	SCANNER
* 6. No Smoking Switch - "ON" (P)	* 6. No Smoking Switch - "ON" (P)	
* 7. Altimeters - "STATE SETTING" (CP, P, N, E)	* 7. Altimeters - "STATE SETTING" (CP, P, N, E)	
* 8. Landing Lights - "AS REQUIRED" (CP)	* 8. Landing Lights - "AS REQUIRED" (CP)	
	* 9. No. 3 Hyd Pump Switches - ON, PRESSURE CHECKED Observe AC loadmeter fluctuation when starting each pump.	
	* 10. Floor Heat - OFF	
	* 11. Seat Belt and Shoulder Harness - ADJUSTED Ensure all crewmembers on flight deck are secured as required.	
	* 12. Cabin Report - "SECURED" (LM/S)	3. Cabin Report - "SECURED" (LM/S)
	* 13. Approach Check - "COMPLETED" (E)	

APPROACH PROCEDURES.

PRACTICE MANEUVERS WITH ONE OR MORE ENGINES INOPERATIVE.

Engine failure can be simulated for practice by retarding a throttle to idle start. This does not exactly duplicate an engine failure but the reduction in thrust will provide control and maneuverability problems essentially the same as a complete loss of thrust.

WARNING

- When simulating the loss of two engines on the same side of the aircraft, power and trim adjustments must be made carefully and the airspeed must be maintained well above minimum control speed. Allowing the speed to decrease below minimum control speed can result in loss of control of the aircraft.
- Do not practice engine-out maneuvers simultaneously with flight control system failure. This could result in an uncontrollable condition.

INSTRUMENT APPROACHES.

Limit all turns to standard rate, except during two-engine operation when minimum bank angles should be used. The angle of bank should not exceed 30 degrees. The figures in this section depict typical approaches and penetrations and apply to four and three-engine operations. The procedures listed on the figures are general in nature due to the many variables encountered during an instrument approach. Normally, they will be accomplished as depicted on the figures. The procedures and techniques outlined in current directives should be followed when flying the aircraft on instruments.

WARNING

- Spoilers shall not be used at any time during the final approach phase of landing because high sink rates can result.
- When at night or in IMC, a GCAS aural or visual warning is received, immediately rotate the aircraft and simultaneously add power to alter the aircraft's flight path sufficiently to stop the warning. Continue the approach only after verifying terrain clearance, sink rate, and configuration (gear and flaps), and whether the altered flight path will still allow a safe approach and landing. If on approach, past the final approach fix, and the approach cannot be safely continued, execute a missed approach. EXCEPTIONS: For a "too low flaps" warning, the approach may be continued if configuration is confirmed. For a wind shear warning, the approach may be continued if normal wind shear procedures subsequently silence the warning.

LOW ALTITUDE INSTRUMENT APPROACHES.

Conduct low altitude approaches in accordance with the appropriate approach charts and as described below. Aircraft configuration and airspeeds should be established in accordance with the procedures and typical instrument approach illustrations contained in this section (figures 2-8 through 2-12). Instrument flight procedures will be accomplished in accordance with current Air Force instrument flying manuals.

1. Cross the Initial Approach Fix (IAF) at or below 200 KCAS. Lower flaps to approach position, lower the gear, complete the Before Landing checklist, and reduce airspeed to approach speed plus 30 knots. If configuration is delayed, do not allow airspeed to decrease below minimum flap retract speed plus 20 knots.

NOTE

If the approach and landing are to be accomplished with zero flaps, do not allow airspeed to decrease below approach plus 20 knots until inbound to the Final Approach Fix (FAF). At high gross weights, care must be taken not to exceed tech order limitations for lowering the landing gear.

2. When inbound to the FAF, allow airspeed to decrease to approach speed plus 10 knots.

3. Side-step Maneuver. ATC may authorize an approach which serves either one of parallel runways that are separated by 1,200 feet or less, followed by a straight-in landing on the adjacent runway. Pilots are expected to commence the side-step maneuver when the runway or runway environment is in sight. Remain at or above side-step MDA, with flaps at final setting, at approach speed, until intercepting a normal glidepath to the landing runway.

NOTE

Maintain approach plus 30, 20, and 10 knots as specified. If required for mission accomplishment or directed by ATC, higher speeds may be flown if intentions are briefed. Do not exceed aircraft limitations.

4. Make final flap setting at the FAF or just prior to glide slope intercept and establish approach speed.

CIRCLING APPROACH.

The circling approach will be made with landing gear down, spoilers closed, flaps in approach position, and airspeed at approach plus 10 knots. During the turn to final, make final flap setting and reduce airspeed to approach speed. Cross the threshold at approach speed minus 10 knots.

MISSED APPROACH.

Execute the missed approach as published or as directed using normal go-around procedures. If the gear and flaps are retracted, maneuver at 200 knots. If the gear and flaps are left down, maintain at least approach speed plus 30 knots. If a subsequent approach is flown, the Before Landing checklist will be accomplished.

NOTE

Approach speed plus 30 knots should be maintained. If required for mission accomplishment or directed by ATC, higher speeds may be flown if intentions are briefed. Do not exceed aircraft limitations.

CATEGORY II APPROACHES.

The radar altimeter, both ILS receivers and both CDSs must be operational before attempting a CAT II AWLS approach. For a coupled approach, both autopilots must be operational.

Aircraft Equipment Requirements.

1. Dual operational AFCPs.

2. Dual operational ILS receivers/Flight Directors (verified by green ILS annunciation).

3. Operational Radar altimeter.

4. Dual operational CDS. Exception: To continue the approach below 300 feet, 3 Display Units (two Primary Flight Displays (PFDs) and one Secondary Flight Display (SFD)), one Display Processor Unit (DPU) and one DAMU are required.

5. Rain removal system (only if required by weather).

6. Dual Autopilots (coupled approaches).

Restrictions.

1. Category II coupled approaches and autoland must be performed with both autopilots engaged (verified by AWLS (green) annunciation in upper right corner of the PFD).

2. Autopilot must be engaged prior to GS TRK, or sudden pitch changes could occur.

3. Intercept localizer at not less than $V_{APP} + 20$.

4. Localizer must be intercepted before glide slope is captured.

5. Automatic landing must be accomplished in the AWLS mode and must be monitored with normal outside visual reference below decision height.

6. Autopilots must be disengaged immediately after touchdown.

Approach.

In addition to those procedures required during a CAT I ILS approach, during a CAT II approach, the pilot not flying will:

1. Announce illumination of any CWA or abnormal PFD annunciation.

WARNING

During coupled AWLS landings, below decision height, the pilot not flying must monitor the SFD CWAs and PFD annunciations closely and advise the pilot flying immediately to disconnect the autopilot if a failure occurs in the autopilot pitch or roll axis.

2. Cross-check barometric and radar altimeter.

3. Make altitude call "100 ABOVE," off the radar altimeter, when reaching 100 feet above DH.

NOTE

Tolerances for continuation of the approach from 100 feet above DH to DH are airspeed ± 5 KCAS of computed final approach speed, and deviation from glide slope and localizer not to exceed one-half dot.

4. From 100 feet above to CAT II DH, the pilot not flying will concentrate primarily on outside references to determine if visual cues will be sufficient to complete the landing visually.

5. Announce "LAND" or "GO-AROUND" at DH. DH has been reached when DH annunciates on the PFDs. The statement "LAND" indicates outside references are sufficient to complete the approach and landing visually, and that the flight station is within, and tracking to remain within, the lateral confines of the runway extended. The statement "GO-AROUND" indicates that either the tolerances have not been maintained, or outside references are not sufficient to continue visually.

Malfunctions.

The AWLS has been designed into both the AFCS and CDS so that any malfunction affecting minimums is displayed on both the pilot's and copilot's PFDs.

The following rules concerning malfunctions apply during a Category II approach:

1. If PFD displays ARM CAT I (yellow), then the system is capable of CAT I approaches only.

a. If CARA fails above 300 feet, the system remains engaged and PFD annunciates CAT I (yellow).

b. If CARA fails below 300 feet, the system disconnects and PFD annunciates CAT I (yellow).

2. With the loss of a single autopilot:

a. CAT II capability is regained by disconnecting both autopilots (confirm operative Flight Directors).

b. After CAT II DH, the approach may be continued to autoland.

3. If an autopilot or CAT II capability is lost at or below 300 feet radar altitude, a missed approach will be performed unless visual cues are sufficient to complete the approach and landing.

BEFORE LANDING.

Pilot flying will command the extension of the flaps and landing gear. The pilot flying will state "GEAR DOWN, BEFORE LANDING CHECKLIST," and the pilot not flying will acknowledge the command. The copilot will then extend the gear, and the engineer will accomplish the checklist. If the gear is already down, the pilot flying need only state, "BEFORE LANDING CHECKLIST." During a series of approaches, the pilot flying will revise the crew briefing as necessary prior to the FAF.

CAUTION

The flaps and landing gear should not be operated simultaneously due to insufficient No. 2 hydraulic flow at low power settings and the resultant drop in pressure.

PILOTS

1. Landing Gear Warning Horn Cut-Out Switch - "NORMAL" (CP)
2. Landing Gear - "DOWN" (CP), "DOWN AND CENTERED" (P)

During the extension cycle, the copilot will check the NOSE LANDING GEAR indicator to ensure that the in-transit position pauses in view during the extension cycle. If the in-transit position is not viewed, a visual scan of the nose landing gear will be accomplished by the scanner prior to landing.

Both copilot and pilot shall ensure:

a. The LANDING GEAR lever is down.

b. The LANDING GEAR and BOGIE indicators show down and level.

c. The WARNING LIGHT in the LANDING GEAR lever is off.

d. The pilot shall also ensure that the NOSE-WHEEL POSITION INDICATOR is within the white center-position index mark.

3. Command Markers - "SET" (CP, P)
4. Brake Pressure and Release Light - "NORMAL AND ON" (CP)

a. Brake pressure normal.

b. BRAKE REL light on.

c. No anti-skid warning lights.

5. Spoilers - "CLOSED AND ARMED" (CP)
6. TAWS - "SET" (CP)
7. PFD SKE - "OFF" (CP, P)

This item is only required when flying SKE formation.

FLIGHT ENGINEER

1. Fuel Panel - SET
2. Landing Gear Warning Horn Cut-Out Switch - "NORMAL" (CP)
3. Landing Gear - "DOWN" (CP), "DOWN AND CENTERED" (P)

Check that the landing gear lever is down and light in handle is off.

4. Command Markers - "SET" (CP, P)
5. Brake Pressure and Release Light - NORMAL AND ON" (CP)
6. Spoilers - "CLOSED AND ARMED" (CP)
7. TAWS -"SET" (CP)
8. PFD SKE - "OFF" (CP, P)

PILOTS

8. Auto Dispense Control Switch - "AS REQUIRED" (P)

Switch to MANUAL prior to landing as mission dictates. This disconnects the receiver from the dispense unit and terminates automatic ejection of flares as threats are detected. Flares can still be dispensed by depressing the remote dispense pushbuttons.

FLIGHT ENGINEER

9. Auto Dispense Control Switch - "AS REQUIRED" (P)

NOTE

This item is only required when using defensive systems.

10. Before Landing Check - "COMPLETED" (E)

FINAL APPROACH AND LANDING.

APPROACH SPEED.

Approach speed is calculated using TO 1C-141B-1-1.

EFFECT OF GUST.

It is generally better to maintain a slightly higher airspeed throughout the landing phase in gusty wind conditions. Therefore, touchdown speed, threshold speed and final approach speed should be increased by the reported gust increment, not to exceed 10 knots. Resetting the Command Marker is not required.

REFERENCE GROUND SPEED.

Reference ground speed is the expected ground speed on final at approach speed in a no-shear condition.

Reference ground speed is computed by subtracting the surface headwind component or adding the tailwind component to approach true airspeed. When actual ground speed differs from reference ground speed, wind change or shear will occur during the approach.

WIND SHEAR.

Forecast wind shear, thunderstorm, or gust front activity must be carefully analyzed prior to starting an approach. Wind shear conditions occurring at low altitudes may be hazardous to aircraft on final approach. Pilots must be alert to the possibility of wind shear or microbursts on all approaches. Wind shear may be recognized by a sudden uncommanded change in airspeed and/or rapid uncommanded change in flight path. The comparison of actual ground speed and reference ground speed during an approach is a proven procedure for detecting and coping with low level wind shear.

Reference ground speed is the expected ground speed on final at approach speed in a no-shear condition.

If actual ground speed exceeds reference ground speed, expect a decreasing tailwind condition or shear during the approach.

If actual ground speed is less than reference ground speed, expect a decreasing headwind condition or shear during the approach.

WARNING

- The severity of the shear will be dependent on the altitude and magnitude of the wind change. Severe wind shear should be avoided whenever possible.
- A normal go-around pitch attitude may be insufficient to recover the aircraft. A pitch attitude greater than normal and the use of maximum engine thrust may be required. Decreasing pitch attitude in an attempt to regain airspeed during an initial shear encounter may prevent a successful recovery.

Procedure.

The following wind shear detection procedures will be followed on all approaches with FMS equipped aircraft:

1. Compute reference ground speed. Reference ground speed is computed by subtracting the surface headwind component from, or adding the tailwind component to, approach true airspeed. When actual ground speed differs from reference ground speed, wind change or shear will occur during the approach.

2. Verify ZFW, FUEL, FOVHD, and landing data loaded.

3. On either DAMU select AIR DATA (figure 1-19) to display the following data:

   a. Ground Speed (GS)

   b. Reference Ground Speed (REF GS)

   c. Cross Track (XTK)

   d. Wind

   e. Drift Angle (DA)

If a SHEAR of 15 knots or greater is indicated and the approach is made, apply headwind or tailwind procedures.

Decreasing headwind example: Approach speed = 125 KCAS. Reference ground speed = 115 knots. Actual ground speed is 95 knots. Accelerate to 145 knots KCAS initially to maintain 115 knots ground speed. Maintaining the reference ground speed provides the necessary energy to penetrate the shear safely or go around.

WARNING

If flap limit airspeed will be exceeded by maintaining reference ground speed, the approach should be abandoned.

Decreasing tailwind example: Approach speed = 125 KCAS. Reference ground speed = 115 knots. Actual ground speed is 160 knots. If the shear is abrupt, airspeed will increase by 45 knots. Maintain approach speed of 125 KCAS and monitor actual ground speed. Be aware that once the shear occurs, the power required will increase; resist the temptation to pull off power.

RAW DATA ILS APPROACH.

RAW DATA ILS APPROACH is an approach where a VOR/ILS receiver is properly tuned and selected, both autopilots are disengaged, and both flight directors are deactivated. When flying a raw data approach, smart altitude callouts and "MINIMUMS - MINIMUMS" callouts will annunciate.

LANDING.

Normal Landings (Flaps 75 To 100%).

CAUTION

Due to aft body clearance, minimize landing flare angles and avoid touchdown speeds less than the recommended touchdown speeds including corrections for gust increments. Failure to do so may cause inadvertent tail scrape.

The final approach should normally be flown with landing flaps (100%). Situations when an approach flap landing may be considered are extreme forward CG, high crosswinds, and actual or forecast wind shear.

1. Determine approach speed for the appropriate flap setting from TO IC-141B-1-1. Fly a normal glidepath with close airspeed control.

NOTE

If flaps are set to less than 75%, the GCAS "TOO LOW FLAPS" annunciation will occur. Press the FLAP OVRD switch on either GCAP after final configuration is established.

2. Approaching the threshold, reduce power to cross the threshold at approach speed minus 10 knots.

WARNING

The landing gear warning horn can be manually silenced, even though the gear is not down and locked, when landing with less than landing flaps.

3. Make a normal flare. Touchdown speed is approach speed minus 20 knots. Do not slow below recommended touchdown speed.

4. When the main landing gear is firmly on the runway, the pilot flying will place all four throttles to the REV IDLE position. After achieving a three-point attitude, the pilot flying will state "SPOILERS" and the pilot not flying will deploy the spoilers. Monitor spoiler needles during deployment for any extreme differential. Maintain forward pressure on the yoke to prevent pitch-up during spoiler deployment.

WARNING

- Aerodynamic braking will not be used to decelerate the aircraft during landing ground roll. This technique invalidates performance data computations and can result in the aircraft becoming inadvertently airborne in a nose high attitude.
- If the flight limit stop fails to retract for any reason, the landing distance will increase because the spoilers will not deploy to the ground position.

5. Primary directional control will be rudder, aileron, nose wheel steering, and differential braking, in that order. The copilot will assist with aileron control during the landing roll as directed by the pilot. The rudder should be used primarily at the higher speeds and on wet and icy runways.

Do not apply brakes until wheel spin-up has occurred.

6. After the nose wheel is on the runway, move all throttles to the desired reverse position. The pilot not flying will call 80 knots. At 80 knots, slowly advance all throttles toward REV IDLE to have all throttles at REV IDLE by 60 knots.

WARNING

An uncontrollable or overspeeding engine may result in loss of directional control. If an engine overspeeds or is uncontrollable during thrust reverser operation, it should be shut down before returning the throttle to forward idle.

CAUTION

Exercise caution in the rate of application of reverse thrust as asymmetrical conditions may develop.

7. The pilot not flying will observe that all four THRUST REV EXTENDED lights are illuminated and announce any light that is not illuminated.

8. After slowing to taxi speed, all throttles may be returned to IDLE START. For ground emergency, all throttles may be left in full reverse position at any speed.

Normal Brake Operation.

NORMAL BRAKING.

1. Take full advantage of the length of the runway. Use spoilers and thrust reversers.

2. Anti-skid systems are intended to prevent skidding at high speeds under light wheel loads. Brakes may be applied immediately after touchdown, but this should be done only when maximum performance stops are required.

3. Do not drag brakes while taxiing. If possible, avoid using brakes for turning the aircraft on the ground.

MAXIMUM STOPPING.

When a short landing roll is required, a single smooth application of the brakes with constantly increasing pedal pressure up to skid control cycling will result in optimum braking.

Landing With Flaps Less Than 75%.

Prior to landing without full flaps, special consideration will be given to the following:

1. Available runway length and surface conditions.
2. Weather.
3. Landing gross weight.
4. Brake limits.
5. Missed approach capability.

A wider than normal visual approach pattern should be flown because of the higher airspeeds in consideration of higher stall speeds.

Landing with flaps less than 75% will be flown the same as normal landings with the following exceptions:

NOTE

If flaps are set to less than 75%, the GCAS "TOO LOW FLAPS" annunciation will occur.

1. On either GCAS Control Annunciator Panel, press the FLAP OVRD switch (annunciator illuminates yellow).

2. Power management after crossing the threshold and flare requirements will vary depending on flap setting. Power should be reduced early for zero flaps (and proportionately later as flap setting is increased). No flare is required for zero flaps while, as flap settings increase, flare requirements proportionately increase in order to slow the sink rate. Touchdown speed is approach speed minus 15 knots. Do not slow below recommended touchdown speed.

3. Do not exceed 5 degrees of bank at touchdown to preclude dragging a wingtip.

4. When the main landing gear is firmly on the runway, the pilot flying will place all four throttles to the REV IDLE position. After achieving a three-point attitude, the pilot flying will state "SPOILERS" and the pilot not flying will deploy the spoilers. Monitor spoiler needles during deployment for any extreme differential. Maintain forward pressure on the yoke to prevent pitchup during spoiler deployment.

WARNING

If the flight limit stop fails to retract for any reason, the landing distance will increase because the spoilers will not deploy to the ground position.

CAUTION

Failure to lower the nose gear to the runway prior to spoiler deployment may result in the aft fuselage contacting the runway.

5. Do not exceed the spoiler FLT LIMIT until below 147 KCAS.

Crosswind Landing.

On final approach, use wing down or crab technique. Approaching the threshold, maintain a slight wing down attitude and remove the crab prior to touchdown. Three degrees of bank should compensate for any wind in the normal zone of the crosswind chart. Land on centerline and do not allow the upwind wing to rise above wings level. After the main landing gear is firmly on the runway, follow normal landing procedures. Deploy the spoilers as quickly as possible after nose gear is on the runway. These procedures also apply when landing with flaps less than 75%.

Heavyweight Landing.

Normal landing techniques should be used for heavyweight landings. Touchdown smoothly. Refer to the rate of sink limitations at weights greater than 257,500 pounds.

Touch-And-Go Landing.

Touch-and-go landings will be made only when authorized by the Major Air Command. These landings introduce a significant element of danger because of the many rapid actions which must be executed while rolling on the runway at high speed. See figure 2-12 for Typical Landing and Go-Around Pattern.

The following fuel load and gross weight limits apply for landings during training:

1. Full stop landings will not be made at a fuel weight above 75,000 pounds or 257,500 pounds gross weight.

2. Touch-and-go landings with fuel loads in excess of 75,000 pounds, not to exceed 257,500 pounds gross weight, may be made not to exceed two landings per hour.

3. AWLS coupled landings will not be made at fuel weights above 75,000 pounds or 257,500 pounds gross weight.

When staying in the traffic pattern for a series of touch-and-go landings, the gear and flaps may be retracted after each take-off or left extended.

The specific procedures will be as follows:

1. The pilot flying will state in the crew briefing, "THIS WILL BE A TOUCH-AND-GO LANDING."

2. After touchdown, the instructor pilot, unless otherwise briefed, will reset the flaps to the TAKE OFF/APPROACH position, reset the trim for take-off, and state, "FLAPS AND TRIM SET."

3. The pilot flying will then smoothly advance the throttles toward 90% N_1 RPM, not to exceed go-around EPR. The pilot not flying will back up the throttles and make the final adjustment of power. The pilot flying will retain primary control of the throttles. Normal take-off procedures will be followed from that point.

GO-AROUND.

When the decision to go-around has been made, the pilot flying will advance the throttles toward go-around EPR. The pilot not flying will back up the throttles and make the final power adjustment to go-around EPR. The pilot flying will direct the pilot not flying to retract flaps to approach, retract the gear when a positive rate of climb has been established. Continue climbing to desired altitude using normal or obstacle climbout procedures as applicable. If the gear and flaps are not retracted, maneuver at approach speed plus 30 knots.

GO-AROUND AFTER TOUCHDOWN.

Emergency go-around after touchdown has proven to be the most dangerous maneuver for any aircraft. In many cases it may be preferable to accept the consequences of completing the landing rather than attempting to become airborne again. If an emergency go-around from the runway is necessary, use normal go-around procedures.

WARNING

- Do not rotate below VMCO. Do not rotate until go-around EPR is set.
- If the spoilers fail to automatically retract when the throttles are advanced past the 54-degree position, place the EREO switch to "EMER RETRACT".

AFTER LANDING.

This check may be accomplished on the runway or after clearing the runway when the aircraft has slowed to taxi speed and when good judgment dictates that it can be accomplished safely.

After clearing the runway, the pilot may shut down symmetrical engines to preclude excessive braking, FOD and for fuel conservation.

When taxiing back for take-off, IFF, radios, radar, and radar altimeter may be left in standby, normal, or on.

PILOTS	FLIGHT ENGINEER	SCANNER
	1. Hydraulic Pressure - CHECKED Do not select ramp control until chocked.	
1. Radar - "AS REQUIRED" (CP, N)	2. Radar - "AS REQUIRED" (CP, N)	1. NAV Station Radar - AS REQUIRED (SKE Aircraft) This step may be accomplished prior to landing.
2. Anti - Collision/Strobe Lights - "SET" (CP) On aircraft with strobe lights position top strobe to "RED" and bottom strobe to "OFF".	3. Anti - Collision/Strobe Lights - "SET" (CP) NOTE If countermeasures are/were loaded on the aircraft accomplish steps 4 through 11.	

PILOTS

3. Auto Dispense Control Switch - "MANUAL" (P)
4. MWS CI Power Button - "OFF" (P)

FLIGHT ENGINEER

4. CMDS CDU Mode Control Knob - "OFF" (N/S)
5. Auto Dispense Control Switch - "MANUAL" (P)
6. MWS CI Power Button - "OFF" (P)
7. Indicator/Arm Control - "SAFE" (N/S)
8. Remote Dispense Switches - "DISABLE" (N/S)
9. EMI Safety Pins - "AS REQUIRED" (LM/S)

SCANNER

2. CMDS CDU Mode Control Knob - "OFF" (N/S)
3. Indicator/Arm Control - "SAFE" (N/S)
4. Remote Dispense Switches - "DISABLE" (N/S)
5. EMI Safety Pins - "AS RE QUIRED" (LM/S)

NOTE

If performing an Engines Running Off/On-load followed by an immediate take-off, installation of countermeasure (EMI) safety pins is at the discretion of the aircraft commander. This step may be accomplished prior to landing. Five EMI safety pins are required.

FLIGHT ENGINEER

10. Flare Quantity - "CHECKED" (N/S)

SCANNER

WARNING

Do not place the EMI Filter Switches to "RE-SET". This resets the system back to the first countermeasure.

6. Flare Quantity - "CHECKED" (N/S)

NOTE

Record the number of remaining flares in the aircraft forms.

WARNING

- If any flares have been dispensed or the flare counters indicate less than before take-off accomplish the following: Stop the aircraft and deplane the scanner who will then inspect all countermeasure dispensers for hung munitions. A hung flare is one that has penetrated or is protruding from the magazine. If an end cap is missing on an unexpended cartridge and the cartridge is protruding, clear area and call EOD. Failure to comply may damage aircraft and injure personnel.
- The scanner will not be deplaned until the defensive system has been reported SAFE in this checklist. If practical, notify the controlling command and control to have ground personnel remain clear of the aircraft until the defensive system is reported SAFE.

PILOTS

5. Defensive Systems Safe - "ACKNOWLEDGED" (CP, P, N, S, LM)
6. Wing Anti-ice and Empennage De-ice - "OFF" (CP)

FLIGHT ENGINEER

11. Defensive Systems Safe - "ACKNOWLEDGED" (CP, P, N, S, LM)
12. Wing Anti-ice and Empennage De-ice - "OFF" (CP)

SCANNER

7. Defensive Systems Safe - "ACKNOWLEDGED" (CP, P, N, S, LM)

PILOTS

7. Engine Anti-Ice - "AS REQUIRED" (CP)
8. Pitot Heat and Temp Probe De-ice - "OFF" (CP)
9. Angle of Attack De-ice - "OFF" (CP)
10. Rain Removal - "AS REQUIRED" (CP)
11. IFF - "AS REQUIRED" (CP)

STANDBY for a taxi-back. OFF if terminating.

12. Yaw Damper - "OFF" (CP)
13. Spoilers - "CLOSED AND DISARMED" (CP)
14. Flaps - "SET FOR TAKE-OFF" (CP)
15. Radar Altimeter - "AS REQUIRED" (P)
16. A/T Annunciator - "OFF" (CP)
17. Door Arming Switch - "AS REQUIRED" (P)

CAUTION

Do not operate doors with brake selector in EMERGENCY.

FLIGHT ENGINEER

13. Engine Anti-Ice - "AS REQUIRED" (CP)
14. Pitot Heat and Temp Probe De-ice - "OFF" (CP)
15. Angle of Attack De-ice - "OFF" (CP)
16. Rain Removal - "AS REQUIRED" (CP)
17. IFF - "AS REQUIRED" (CP)
18. Yaw Damper - "OFF" (CP)
19. Spoilers - "CLOSED AND DISARMED" (CP)
20. Flaps - "SET FOR TAKE-OFF" (CP)
21. Radar Altimeter - "AS REQUIRED" (P)
22. A/T Annunciator - "OFF" (CP)
23. Door Arming Switch - "AS REQUIRED" (P)

NOTE

It is not necessary to accomplish items 24 through 30 if taxiing back for another take-off. Items 24 through 31 may be delayed until just prior to block in.

24. APU Door - OPEN
25. APU Control Switch - START/RUN
26. APU Bleed Load and Flow Control Valve - OPEN
27. Auxiliary Generator Control Switch - ON
28. No. 2 and No. 3 Bus Auto Load Disc Switches - OVERRIDE
29. Air Conditioning Master Switch - AS REQUIRED

SCANNER

PILOTS	FLIGHT ENGINEER	SCANNER
	30. Stall Prevent No. 1 CB (35R) and Stall Prevent No. 2 CB (40R) - OPEN **CAUTION** Failure to open the Stall Prevent No. 1 and No. 2 circuit breakers will cause failure of the Stall Prevention Relays during the Power On Bit test. 31. Power Selector Switch - AS REQUIRED **CAUTION** SKE OFF/STBY/XMIT Switch must be OFF prior to power transfers for all aircraft modiifed with Staition Keeping Equipment (SKE) 32. After Landing Check - COMPLETED" (E)	

ENGINE SHUTDOWN.

The pilot may accomplish item 1 prior to calling for the checklist.

PILOTS	FLIGHT ENGINEER	SCANNER
1. Parking Brake - "SET" (P) 2. Door Arming Switch - "OFF" (P) 3. Brake Selector - "EMERGENCY" (CP) **CAUTION** Do not operate doors with brake selector in EMERGENCY. 4. Engine Anti-Ice and Ice Detect Switches - "OFF" (P) 5. Fuel and Start Ignition "STOP" (P) **NOTE** • If the APU is not running and external power is to be used, one engine with operative generator must remain running until external power is connected and selected by the flight engineer.	1. Power Selector Switch - AS REQUIRED 2. Fuel Boost Pumps - OFF 3. Fuel Valves - CLOSED 4. Hydraulic Suction Boost Pump Switches - OFF	

PILOTS	FLIGHT ENGINEER	SCANNER
• If an engine has been operated above 85% N_2 RPM for one minute during the five minutes preceding shutdown, allow the engine to idle at least five minutes before shutdown. This idling period allows the engine to cool slowly to prevent possible damage resulting from rapid temperature changes.		
6. Continuous Ignition - "OFF" (P)		
7. Scanner Cleared to Depart Aircraft - "DEPARTING AIRCRAFT" (S)		1. Scanner Cleared to Depart Aircraft - "DEPARTING AIRCRAFT" (S)
8. Anti-Collision/Strobe Lights - "OFF" (CP)		
9. Windshield Heat - "OFF" (CP)		
10. Seat Belt Switch - "OFF" (P)		
11. Engineer's Report - "CHECK COMPLETED" (E)	5. Engineer's Report - "CHECK COMPLETED" (E)	
12. Engine Shutdown Check - "COMPLETED" (CP)		

BEFORE LEAVING AIRCRAFT.

PILOTS	FLIGHT ENGINEER	SCANNER
1. Oxygen - "100% AND OFF" (CP, P)	1. Bleed Manifold - CHECKED	
Masks should be covered.	a. Air Conditioning Master Switch - ENGINE START	
2. AHRS - "AS REQUIRED" (CP)	b. APU Bleed Load and Flow Control Valve Switch - CLOSED	
Turn OFF unless aircraft is on a short ground time.	The time for manifold pressure to bleed down from 30 PSI to 15 PSI should not be less than 20 seconds.	
3. Trim Disconnect - "DISCONNECTED" (CP)	2. Air Conditioning Master Switch - OFF	

PILOTS

4. Scanner's Report - "CHOCKS AND GEAR PINS IN PLACE" (S)

5. Parking Brake - "OFF" (P)

6. Door Arming Switch - "AS REQUIRED" (P)

7. Interior, Exterior Lights - "AS REQUIRED" (CP, P)

Copilot will extinguish emergency exit lights, if required.

8. Engineer's Report - "CHECK COMPLETED" (E)

FLIGHT ENGINEER

While positioning the selector switch, a pause (2 to 5 seconds) will be made passing through the RIGHT position to preclude "duct rumble."

Do not proceed to item 3 until after Scanner's Report.

3. No. 3 Hyd Pump Switches - AS REQUIRED

NOTE

If ON/OFF loading is required, select RAMP CONTROL.

4. Power Selector Switch - AS REQUIRED

5. Auxiliary Generator Control Switch - AS REQUIRED

6. Main Generator Control Switches - OFF

7. APU - AS REQUIRED

8. Battery Switch - AS REQUIRED

9. Oxygen - 100% AND OFF.

Ensure that all non-primary crew station oxygen regulators are 100% and OFF and masks are covered.

NOTE

This item need not be accomplished if the aircraft is on an Operational Stop/ Short Ground time.

10. Engineer's Report - "CHECK COMPLETED" (E)

SCANNER

1. Scanner's Report - "CHOCKS AND GEAR PINS IN PLACE" (S)

WARNING

Do not report chocks and gear pins in place until personnel are clear of the landing gear.

2. Aircraft Exterior - CHECKED

The Scanner will visually check the exterior of the aircraft for obvious damage or discrepancies. Follow the physical sequence as depicted in figure 2-1. Those found will be entered in the aircraft forms. Ensure that engine and CSD oil servicing is checked/recorded anytime an oil leak is suspected/indicated, or when the next mission leg or prior accumulative flight time exceeds five hours.

If no maintenance capability exists, raise the flaps and ensure that pitot covers and ground wires are installed/connected. Install engine covers prior to entering crew rest.

PILOTS

9. INS 1 and 2 - "CHECKED/AS REQUIRED" (CP, P)

   a. The present position of both systems will be compared to the actual ramp location (not required for local flights).

   b. Mode Selector Switch - AS REQUIRED

Mode Selector Switch will be placed to OFF unless the aircraft is on an Operational Stop/Short Ground time and a pilot, navigator, or engineer remains on the flight deck. In this case, the switch should be placed to ALIGN.

CAUTION

Damage to the NU may occur if power is not removed.

10. GPS Zeroized - "AS REQUIRED" (CP, P, N)

11. MFD and FMS 1 and 2 PWR Switches - "AS REQUIRED" (P)

The MFD and FMS PWR switches will be placed to OFF unless the aircraft is on an operational stop/short ground time with power on the aircraft.

Verify that pilot's and copilot's DAMUs display no frequencies.

12. MFSI SYS - "OFF" (P)

13. Radios and IFF - "OFF, CODES REMOVED" (CP)

Remove classified codes.

14. CDS Brightness Control "OFF" (CP)

15. Before Leaving Aircraft Check - "COMPLETED" (CP)

FLIGHT ENGINEER

CAUTION

Under certain wind velocity, aircraft gross weight and surface conditions it may be necessary to head the aircraft into the wind and/or moor.

NOTE

- Engine Cycles will be logged in the aircraft forms using the following criteria:

  During normal operation, a cycle is defined as any flight consisting of one take-off and landing. Touch-and-go landing is considered a one-half cycle.

- Ensure discrepancies have Fault Codes entered in each block in accordance with the Fault Reporting Manual (FRM).

SCANNER

AIRCREW REFUELING PROCEDURES.

This checklist is intended for the use of aircrew personnel only. This checklist is designed for use by qualified flight engineers knowledgeable in basic directives and technical orders governing aircraft servicing and ground handling. Applicable directives include: AFI 11-218, AFOSH 91-66, AFOSH 127-39, TO 00-25-172, TO 1C-141C-1, TO 1C-141B-2-00GE-00-1, TO 1C-141B-2-12JG-10-1 and -2, TO 15X-1-1, and TO 42B6-1-1. TO 1C-141B-2-12JG-10-1 (Normal) and/or TO 1C-141B-2-12JG-10-2 (Concurrent) servicing guides may be used if they are available. See figure 2-13.

NOTE

MAJCOM guidelines concerning flight engineer refueling qualification will be followed. MAJCOM, local host agreements/base policies and guidelines concerning normal and concurrent servicing operations will also be followed before conducting these operations.

DEFINITIONS.

Aircraft Fuel Servicing - The movement of fuel to or from an external source to or from the aircraft. Non-essential aircraft electrical systems, including radar, shall not be activated on the aircraft during servicing operations unless absolutely required for servicing. During servicing, only those personnel actually required for the servicing operation shall remain in the fuel servicing safety zone. Non-essential personnel and equipment will be evacuated from the aircraft during normal fuel servicing operations. The power-off portion of aircrew walkaround inspections may be performed in order to meet established operational turnaround requirements.

Aircraft Servicing Supervisor (SS) - A fully qualified flight engineer responsible for the aircraft fuel servicing operation and for aircrew purposes, is responsible for on-site supervision of all aspects of concurrent servicing operations. The Servicing Supervisor will be located at the nose of the aircraft and in a position to observe the aircraft, servicing operation, and provide general directions.

Concurrent Servicing - The simultaneous servicing of fuel or oxygen with either passengers/patients on board or the performance of minor maintenance, fleet servicing, or baggage or cargo loading/unloading. The power-on portion of aircrew inspections may be performed in order to meet established operational turnaround requirements.

WARNING

Simultaneous fuel and oxygen servicing is NOT authorized.

Concurrent Servicing Area - The area within an imaginary circle around the aircraft that extends at least 10 feet outboard of the wing tips, nose and tail.

Chief Servicing Supervisor (CSS) - A fully qualified flight engineer responsible for on-site supervision of all aspects of concurrent servicing operations. For aircrew purposes, this term has the same meaning as the term Servicing Supervisor (SS) and the term SS will be used.

Explosives-Loaded Aircraft - An aircraft is considered "explosives-loaded" when munitions or explosives are carried either internally or externally (including nuclear weapons). The term does not include pyrotechnics installed in survival and rescue kits. Aircraft should normally be refueled before being loaded with either nuclear or non-nuclear munitions and be downloaded, if practical, before defueling to reduce the severity of a mishap. Aircraft loaded with transportation-configured explosives may be refueled at aircraft explosive cargo parking areas (hot cargo pad).

Fuel Servicing Safety Zone (FSSZ) - An area within 50 feet of a pressurized fuel carrying servicing component; i.e., servicing hose, fuel nozzle, single point receptacle (SPR), hydrant hose cart, ramp hydrant connection point, etc., and 25 feet around aircraft fuel vent outlets.

WARNING

During fuel servicing, fuel vapors are forced out of the vents by the incoming fuel. An explosive vapor-air mixture normally exists in the vicinity of the aircraft fuel vents. Special care must be taken that no active ignition source is in, or enters into, this area.

The FSSZ is established and maintained during pressurization and movement of fuel. Laptop computers, cellular telephones and radios can be operated in the FSSZ. However, no battery changes for laptop computers, cellular telephones or radios are allowed within the FSSZ. Only intrinsically safe radios can be operated within 10 feet of aircraft fuel vent outlets, open port refueling receptacles, fuel spills, or fuel trucks being filled (bottom loading or from aircraft defueling). The cargo compartment is not part of the fuel servicing safety zone.

CAUTION

The troop door and side emergency escape hatches on the right (SPR) side of the aircraft must be closed during concurrent servicing operations to isolate the cargo compartment from the fuel servicing safety zone.

Multiple Source Refueling - A situation when multiple-truck or truck and hydrant servicing is concurrently accomplished. C-141 aircraft are authorized multiple source refueling operations with R-11 fuel tank trucks only.

WARNING

- Multiple source fuel servicing adds an additional risk due to the increased complexity of the operation and additional personnel and equipment required to perform the operation.
- Refueling operators must continuously monitor refueling flow meters for correct indication of fuel flow. If back flow is detected, immediately stop all refueling operations.

CAUTION

When dispensing fuel from multiple vehicles and hydrants, ensure that the aircraft refueling isolation valve is in the OPEN position.

Refuel Panel Operator (RPO) - A qualified flight engineer/maintenance person responsible for the operation of the fuel management panel during servicing operations.

Single Point Receptacle Monitor (SPRM) - An aircrew member/maintenance person responsible for the operation of the Single Point Receptacle (SPR) during fuel servicing operations. This individual will be thoroughly briefed on their duties and supervised during servicing operations by the Servicing Supervisor. The SPRM will be located at the SPR and in a position to observe the right side of the aircraft, the servicing operation, and relay general directions and instructions between the Servicing Supervisor, RPO and the Fuels Equipment Operator (FEO) (i.e., fuel truck/hydrant operator). The SPRM will assist the FEO in reeling and stowing the hose on the vehicle or equipment and/or disconnect and stow the hydrant hose.

AUTHORIZED ACTIVITIES.

1. Powered vehicles may be driven on and off during concurrent servicing if equipped with spark and flame arrestors.

2. Winching of cargo and/or movement of nonpalletized self-propelled vehicles/equipment into or out of aircraft during concurrent servicing operations.

NOTE

Passengers will not be allowed in the cargo compartment while winching of rolling stock or pallets is being accomplished.

3. Cargo ramp may be positioned and lowered to the ground during concurrent servicing operations.

4. INS and FMS may remain energized and can be programmed during concurrent servicing.

5. Jacking of aircraft for single main gear wheel or dual nose wheel changes during concurrent servicing.

6. The APU may be used for single point refueling/de-fueling during emergencies, combat conditions, simulated combat exercises requiring quick turnaround, or at locations where no external power is available. The APU can be running, but must be started and running in a stabilized condition prior to pressurizing the refueling hose or pantograph. A flight engineer shall remain at the APU control panel at all times during fuel servicing operations. If the APU fire extinguishing system is inoperative, one individual shall remain outside the aircraft within 20 feet of the APU exhaust with a 150-pound Halon 1211 fire extinguisher.

WARNING

When APU is used, the wing flaps must be fully retracted. The SS will be positioned to observe APU operation and possible fuel spillage or leakage. If the APU must be started during servicing, fuel flow will be stopped until APU is on speed.

7. Defueling during concurrent servicing operations only when using the SPR manifold.

8. Maintenance in the aircraft wheel well areas shall be limited to tire changes during concurrent servicing.

NOTE

Maintenance and servicing of unpressurized hydraulic systems during concurrent servicing operations is authorized

PROHIBITED ACTIVITIES.

CAUTION

The 40-K loader open flame heater will not be used in the concurrent servicing area.

1. Do not apply de-icing fluid during any fuel servicing operation.

2. Transmitting on aircraft HF radios and L-Band SATCOM, or operating radar, radar altimeter, or SKE equipment.

3. Power on maintenance of electrical equipment on the exterior of the aircraft inside the FSSZ during concurrent operations.

4. Use of the winch during concurrent servicing - defueling operations.

5. Do not start the APU during fuel servicing operations.

6. Cargo containing explosives, oxygen, or flammable gases or liquids shall not be loaded/unloaded during concurrent servicing operations. Under combat conditions or simulated combat exercises, loading and unloading cargo containing explosives or munitions shall be accomplished according to TO 11A-1-33. Loading/unloading and maintenance on chaff/flare systems is prohibited during servicing operations.

7. Power tools shall not be used during concurrent servicing operations or when bulk shipments of explosives, oxygen, or flammable gasses or liquids are being loaded/unloaded.

8. Maintenance or repair of the aircraft or engine fuel systems which require the opening of fuel lines, fuel tanks, or replacement of plug-in components.

9. No flammable fluid carrying lines will be broken during concurrent servicing unless equipped with quick disconnects.

DO NOT START AND TERMINATE OPERATIONS ALREADY IN PROGRESS WHEN:

1. Lightning advisory has been issued, or observed lightning is within five miles of the servicing area.

2. Winds reach velocities hazardous to the aircraft servicing operation.

3. Fire in the vicinity is generating hot ashes.

4. If an aircraft crash/fire occurs at the same airfield, all servicing operations already underway will be stopped and fuel servicing equipment disconnected. Servicing will not start until authorized by the Fire Chief.

5. In the event of an In-flight Emergency (IFE) or crash warning, servicing operations already underway may be completed. No new servicing operations may be started until authorized by the Fire Chief or the IFE or crash warning has been canceled.

6. Immediately cease all servicing operations if glowing or crackling fuel is noted when servicing the aircraft.

7. Fuel quantity indicator malfunction occurs, a fuel boost pump circuit breaker opens, refueling valve failure, or a fuel leak or spill occurs.

WARNING

If a fuel boost pump circuit breaker is open or opens during refueling, it shall not be closed until cause of malfunction is corrected.

CAUTION

A malfunction of any component in the aircraft fuel system will require immediate shut down of the operation until the malfunction is corrected.

8. Interphone Communications are normally required.

WARNING

If the aircraft intercom system is inoperative and cannot be used to maintain voice communications, portable hand-held radios may be used to provide voice contact subject to restrictions listed in the FSSZ description above. Concurrent servicing will not be conducted if interphone contact cannot be established.

SERVICING OPERATION - PREPARATIONS.

1. **Power Unit.** The electrical power cables shall be of sufficient length to permit parking of the power unit at least 50 feet away, preferably upwind, from pressurized fuel carrying components and at least 25 feet from aircraft fuel vent outlets. Ensure the unit is at least 10 feet from any portion of the aircraft.

2. **Fire Extinguishers/Fire-Fighting Equipment.** All references to fire extinguisher refer to the Halon 1211, 150-pound wheeled extinguisher.

a. **Normal fuel servicing, multiple source refueling, concurrent servicing without passengers** - one Halon 1211 located between the power unit and the SPR.

b. **Concurrent servicing with passengers (commercial airports exempt)** - one Halon 1211 located between the power unit and the SPR. Additionally, when servicing the aircraft with JP-4 or Jet B fuel, a major aircraft rescue and fire-fighting vehicle will be positioned at the aircraft.

c. **Concurrent servicing of aeromedical evacuation flights with passengers/patients** - one Halon 1211 located between the power unit and the SPR. Additionally, when servicing the aircraft with JP-4 or Jet B fuel, a major aircraft rescue and fire-fighting vehicle will be positioned at the aircraft.

d. **APU operation** - one Halon 1211 located between the power unit and the SPR, provided the APUs integral fire extinguishing system is operational.

e. **APU operation without integral fire extinguishing** - one Halon 1211 located between the power unit and the SPR. One additional Halon 1211 positioned outside the aircraft within 20 feet of the APU exhaust with an individual manning the extinguisher.

3. **Concurrent servicing.** Notify the fire department at least 15 minutes prior to starting any concurrent servicing operation.

NOTE

- If patients/passengers are on board, the number of patients/passengers will be given to the fire department.
- If hazardous cargo is involved, the fire department will also be notified of its type and quantity.

When passengers are onboard, a passenger service representative or loadmaster will be on headset located in the cargo compartment to monitor the passengers and assist in evacuation if it becomes necessary. When concurrent servicing an aeromedical evacuation aircraft with patients/passengers onboard, a passenger service representative or loadmaster will be on headset and located in the cargo compartment. Two qualified aeromedical crewmembers will also remain in attendance in the aircraft to assist in the evacuation of patients/passengers in the event of an emergency.

4. **Chocks.** Positioned a minimum of 2 inches from the tires for all refueling operations.

5. **Gear Struts.** Using hydraulic fluid, clean polished surfaces of all landing gear struts.

6. **Bond/Grounding.** Ground the aircraft if grounding points are available. As a minimum, bond the aircraft to prevent static electricity discharge and equalize the polarity of servicing vehicles.

7. **Aircraft Exterior.** Workstands, ladders, and any other equipment, or cellular telephones, not required for servicing, shall be kept clear of the aircraft.

CAUTION

The fuel added during servicing, and cargo during concurrent operations, may cause the aircraft to settle.

NOTE

Crew ladders that do not present an interference problem or would not cause damage to the aircraft in case of strut deflation may remain installed on the aircraft during normal refueling.

8. **Aircraft Fuel Sumps and SPR Drains.** Recoverable products resulting from servicing operations will be handled IAW federal, state, and local pollution control laws. If fuel samples/fuel draining products cannot be disposed of properly, they will not be performed. Make an AFTO Form 781A entry documenting when aircraft fuel sumps and/or SPR drains are not accomplished.

WARNING

Fuel is flammable and an irritant to skin, eyes, and respiratory tract. Avoid repeated or prolonged skin contact. Handle only in well-ventilated areas. Keep away from sparks, open flames, or other sources of ignition.

CAUTION

Do not drain sumps located on the left side of the aircraft when the APU is operating.

NORMAL/CONCURRENT REFUELING CHECKLIST.

This checklist contains both normal and concurrent servicing procedures. Items marked with an asterisk are identified to simplify this checklist when the use of more than one truck is required to complete the refueling operation. The servicing supervisor will perform or direct and supervise the SPRM in performing all exterior duties.

SERVICING SUPERVISOR

1. Servicing Crew Briefing - COMPLETED (SS)

NOTE

This briefing may be delayed until the start of actual fueling operations (step 13).

The SS will conduct a safety briefing with all personnel who supervise portions of the operation; i.e., aerial port supervisor, maintenance team supervisor, fleet service supervisor, aircrew and aeromedical evacuation medical crew director. Ensure all personnel involved in concurrent operations are briefed on total requirements of servicing prior to commencing operations. This briefing will cover a general overview of the operation and emergency procedures. As a minimum, it will cover the following:

- Authorized and Prohibited Activities.
- Conditions for Termination of Servicing.
- Duties and Responsibilities of all Personnel.
- Fire/Emergency Evacuation Procedures.
- Passenger/Patient Movement Restrictions.
- Passenger/Patient Briefing Requirements.

2. Ground Wires - AS REQUIRED
3. Chocks - POSITIONED
4. Gear Struts - CLEANED
5. SPR Fuel Drain Valve & SPR Pump Drain Valve - CLOSED
6. Fire Extinguisher(s) - POSITIONED
7. Power Unit - POSITIONED
8. EMI Safety Pins - INSTALLED

REFUEL PANEL OPERATOR

1. Parking Brake - SET
2. Radios - AS REQUIRED

Aircraft radios, except HF and L-Band SATCOM, may be operated during fuel servicing operations. SATCOM radios may be operated in the transmit mode if the antenna beam is pointed at least 10° above the horizon.

NOTE

Ensure communications to the fire department through command post or base operations are immediately available and operational when conducting concurrent servicing operations.

3. Radar Altimeter Circuit Breaker (23B/28B) - OPEN
4. Upper and Lower Anti-collision/Strobe Light Circuit Breakers (17L, 21L) - OPEN
5. Flaps - AS REQUIRED
6. Hyd Sys No. 3 Pump Switches - AS REQUIRED

For normal refueling the No. 3 system pump switches will be placed in the OFF position. For concurrent servicing the No. 3 hydraulic may be operated as required.

7. Fuel Quantity Indicators - CHECKED
8. Fuel Panel - SET

Perform IAW engineer's preflight item No. 23.

9. Fuel Pumps/Valves - CHECKED
   a. Crossfeed Valves - CLOSED
   b. Left, Ctr, Right Separation Valves - OPEN
   c. Main Tank Pri Boost Pumps - ON/OFF

Turn main tank primary boost pump switches to ON for 2 minutes and then OFF.

SERVICING SUPERVISOR | **REFUEL PANEL OPERATOR**

9. Fuel Sumps - DRAINED AS REQUIRED

WARNING

Do not drain sumps if the use of emergency eye wash equipment, access to shower facilities, or mission time constraints do not allow for their use. Fuel is flammable and an irritant to skin, eyes, and respiratory tract. Avoid repeated or prolonged skin contact.

Drain the fuel sumps as follows:

a. Insert tip of pogo stick in drain valve opening. Push tube until sump drain valve poppet opens.

b. Drain fluid for several seconds into pogo jar, then slightly lower pogo tube to close sump drain valve.

c. Wait several seconds, then repeat steps a and b as necessary to drain all condensates.

d. Repeat for each fuel tank.

* 10. Fuel Cart/Refueling Truck - POSITIONED

a. Refueling Truck:

(1) For normal refueling, position refueling truck 10 feet from nearest point on aircraft and 20 feet from SPR receptacles and fuel vents.

(2) For concurrent servicing, position refueling truck 10 feet from nearest point on aircraft and 25 feet from SPR receptacles and the fuel vents.

b. Position servicing cart near hydrant and SPR manifold.

c. Ground truck/cart to earth ground if available.

d. Bond truck/cart to aircraft.

* 11. Fuel Nozzle - CHECKED AND CONNECTED

a. Bond nozzle to aircraft, if equipped.

SERVICING SUPERVISOR

b. Remove fuel nozzle cover and inspect locking mechanism locking pins/lugs and seal for serviceability.

c. Remove the SPR cap and connect nozzle to SPR.

* 12. Fuel Nozzle Valve - OPEN/CHECKED/ CLOSED

Open fuel nozzle valve and then attempt to rotate and disconnect nozzle from SPR receptacle.

NOTE

Check the strainer coupling quick disconnect device for positive locking. Prior to pressurizing the hose, be sure the nozzle is securely locked to the aircraft by attempting to remove the nozzle with the nozzle valve handle in the open position. Any nozzle that can be disconnected from the SPR with the nozzle valve in the OPEN position is defective and must be removed from service immediately.

* 13. Interphone Communications - ESTABLISHED

* 14. Ground Iso Valve Switch - "OPEN" (RPO)

* 15. Refuel Valves (appropriate tanks) - "OPEN" (RPO)

* 16. Fuel Nozzle Valve - "OPEN" (SS)

Direct the SPRM to open the fuel nozzle valve.

* 17. Direct the SPRM to Start Refueling - DIRECTED

Maintain vigilant observation over the refueling operation. Observe left and right wing fuel vents for fuel venting. Maintain area security for unauthorized entry of personnel and equipment and control the placement and bonding of authorized equipment. Control and monitor all concurrent operations to include cargo/baggage loading/unloading, maintenance, fuel or oxygen servicing, and fleet servicing. Ensure all personnel coordinate their actions through the SS. Maintain continuous intercom contact with fuel servicing team members during the entire servicing operation (excluding the REO). When passengers/patients are onboard, remain in constant voice contact with the loadmaster or passenger representative.

REFUEL PANEL OPERATOR

* 10. Interphone Communications - ESTABLISHED

* 11. Ground Iso Valve Switch - "OPEN" (RPO)

* 12. Refuel Valves (appropriate tanks) - OPEN (RPO)

NOTE

Use OPEN PRI position on odd-numbered days and OPEN SEC on even-numbered days to equalize wear of valve solenoids.

* 13. Fuel Panel - MONITOR

Observe fuel quantity indicators for fuel flow. Observe fuel pressure is within limits. Notify the refueling team of fuel pressure and fuel flow.

CAUTION

- Do not exceed 55 PSI refueling pressure as indicated at the refueling source.
- Stop refueling operation if fuel does not flow into tanks. Do not restart until condition has been corrected.

SERVICING SUPERVISOR

18. Fuel System Prechecks - "COMPLETED" (RPO)

19. Required Fuel - "LOADED" (RPO)

    a. When the RPO indicates the total fuel load is within 2,000 pounds, direct SPRM to signal the FEO to prepare to stop.

    b. When the RPO indicates the total fuel load has been reached, direct SPRM to signal the FEO to stop the fueling operation.

    c. Direct SPRM to confirm the FEO has stopped the fueling operation.

REFUEL PANEL OPERATOR

14. Fuel System Prechecks - "COMPLETED" (RPO)

    a. Place applicable refuel switch to CLOSED and observe the fuel quantity indicator indicates no flow.

NOTE

Fuel pressure will increase when refuel switches are placed in CLOSED position.

    b. Return Refuel Switch to open position and observe the fuel quantity indicator indicates fuel flow.

    c. Repeat steps a and b for remaining tanks.

NOTE

If any automatic fuel shutoff valve fails to operate properly, discontinue single point refueling.

* 15. Required Fuel - "LOADED" (RPO)

Observe fuel quantity indicators during the refueling and place each refuel switch to CLOSE when tank fuel level reaches desired amount. Advise refueling team whenever a refuel valve is opened or closed. Note when total fuel quantity is within 2,000 lbs of desired fuel load.

WARNING

Do not exceed the maximum indicated fuel load of 153,352 pounds.

When fueling is stopped, advise team of stop of fuel flow and zero fuel pressure.

CAUTION

Do not exceed 8,000 pounds fuel weight difference between wings.

SERVICING SUPERVISOR

REFUEL PANEL OPERATOR

NOTE

- If erroneous readings are suspected during single point refueling, check actual fuel quantities by using fuel quantity dipstick.
- When temperatures exceed 80° F and the take-off is not within 3 hours, the following procedures apply:
  a. Do not exceed 7,500 lbs in No. 1 and No. 4 main tanks. Do not exceed 13,500 lbs in the No. 2 and No. 3 main tanks.
  b. Balance the extra 500 lbs into the No. 1 and No. 4 auxiliary tanks. If auxiliary tanks are full, place the fuel in the left and right extended range tanks.
  c. When maximum fuel load is required, the main tanks will be filled to normal limits.

* 22. Ground Iso Valve Switch - "CLOSED" (RPO)

* 16. Ground Iso Valve Switch - "CLOSED" (RPO)

* 21. Fuel Nozzle Valve - "CLOSED" (SS)

Direct the SPRM to CLOSE the fuel nozzle valve.

* 22. Line Drain Switch - "SPR/OFF" (RPO)

* 17. Line Drain Switch - "SPR/OFF" (RPO)

Operate the SPR pump for 5 minutes and then place the line drain switch OFF. Notify the refuel team when complete.

WARNING

Failure to operate SPR drain pump prior to disconnecting the fuel nozzle from the SPR could result in personal injury/damage to aircraft.

NOTE

If additional truck(s) are required to complete the refueling, proceed to item 10 and accomplish asterisk items only. When the refueling is completed, accomplish all the remaining items below.

SERVICING SUPERVISOR

*23. Fuel Nozzle - "DISCONNECT" (SS)

Direct the SPRM to disconnect the fuel nozzle from the SPR and disconnect the ground wires from the aircraft to the fuel cart/truck. The SPRM will assist the REO in stowing the hose and ground wires. The REO will disconnect the cart/truck from the earth ground, if available.

NOTE

If additional truck(s) are required to complete the refueling, only accomplish the remaining asterisk items below and then proceed to item 9. When refueling is complete, accomplish all the remaining items below.

24. SPR Cap - "INSTALLED" (SS)

Direct the SPRM to install the SPR adapter cap.

*25. Fuel Cart/Refueling Truck - DEPARTED AREA

Complete and receive fuel paperwork. Ensure aircraft clearance as equipment leaves area.

26. Chocks - "REPOSITIONED" (SS)

27. SPR Fuel Drain & SPR Pump Drain - DRAINED/AS REQUIRED

WARNING

Do not drain the SPR manifolds if the use of emergency eye wash equipment, access to shower facilities, or if mission time constraints do not allow for their use. Fuel is flammable and an irritant to skin, eyes, and respiratory tract. Avoid repeated or prolonged skin contact.

Open the drain valves, one at a time, to drain remaining fuel into a suitable container. When draining is complete, close the valves.

28. Fuel Sumps - DRAINED/AS REQUIRED

Drain the fuel sumps (see item 9).

REFUEL PANEL OPERATOR

18. Left, Ctr, and Right Separation Valves - CLOSED

19. Main Tank Pri Boost Pumps - ON/OFF

Turn main tank primary boost pump switches to ON for 2 minutes and then OFF.

20. Radar Altimeter Circuit Breaker (23B/28B) - AS REQUIRED

21. Upper and Lower Anti-collision/Strobe Light Circuit Breakers (17L, 21L) - AS REQUIRED

22. Parking Brake - AS REQUIRED

CAUTION

Do not accomplish this item until the chocks are reported to be "REPOSITIONED".

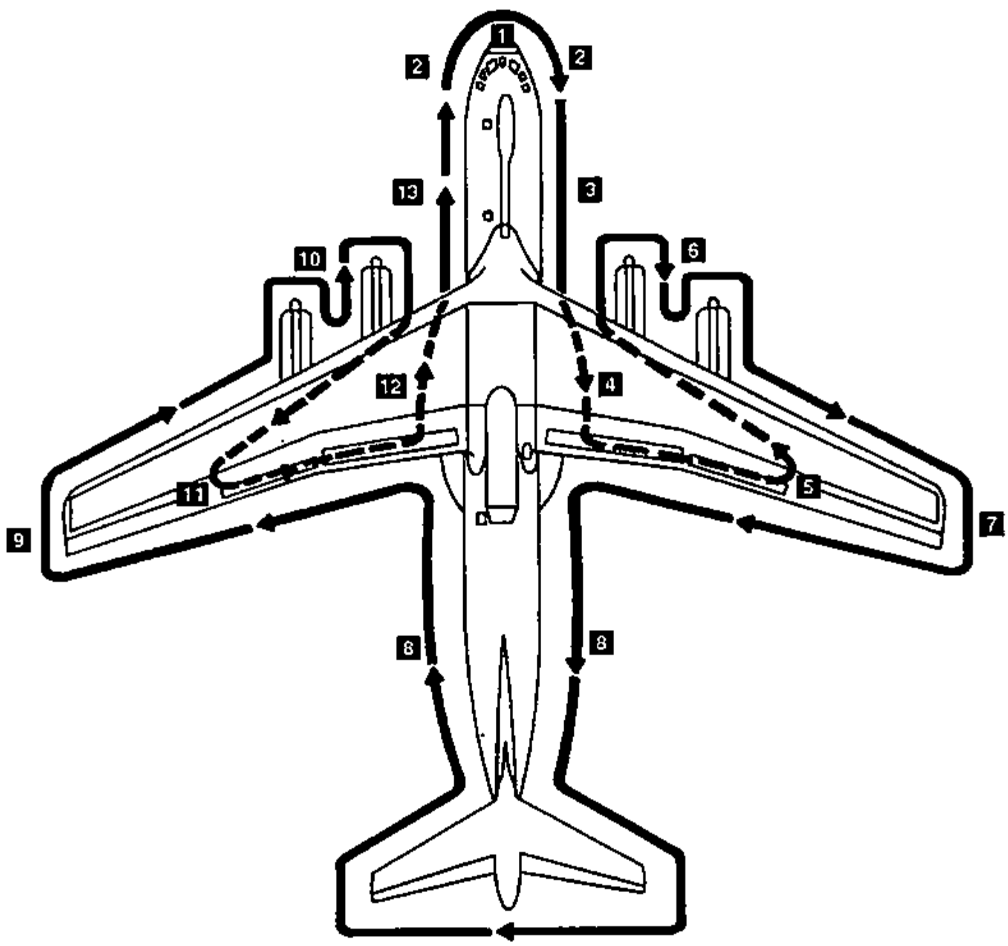
23. Radios - AS REQUIRED

24. Aircraft Servicing - RECORDED

Make appropriate AFTO Forms 781A and H, and AF Form 664 fuel entries.

THIS PAGE INTENTIONALLY LEFT BLANK

EXTERIOR INSPECTION

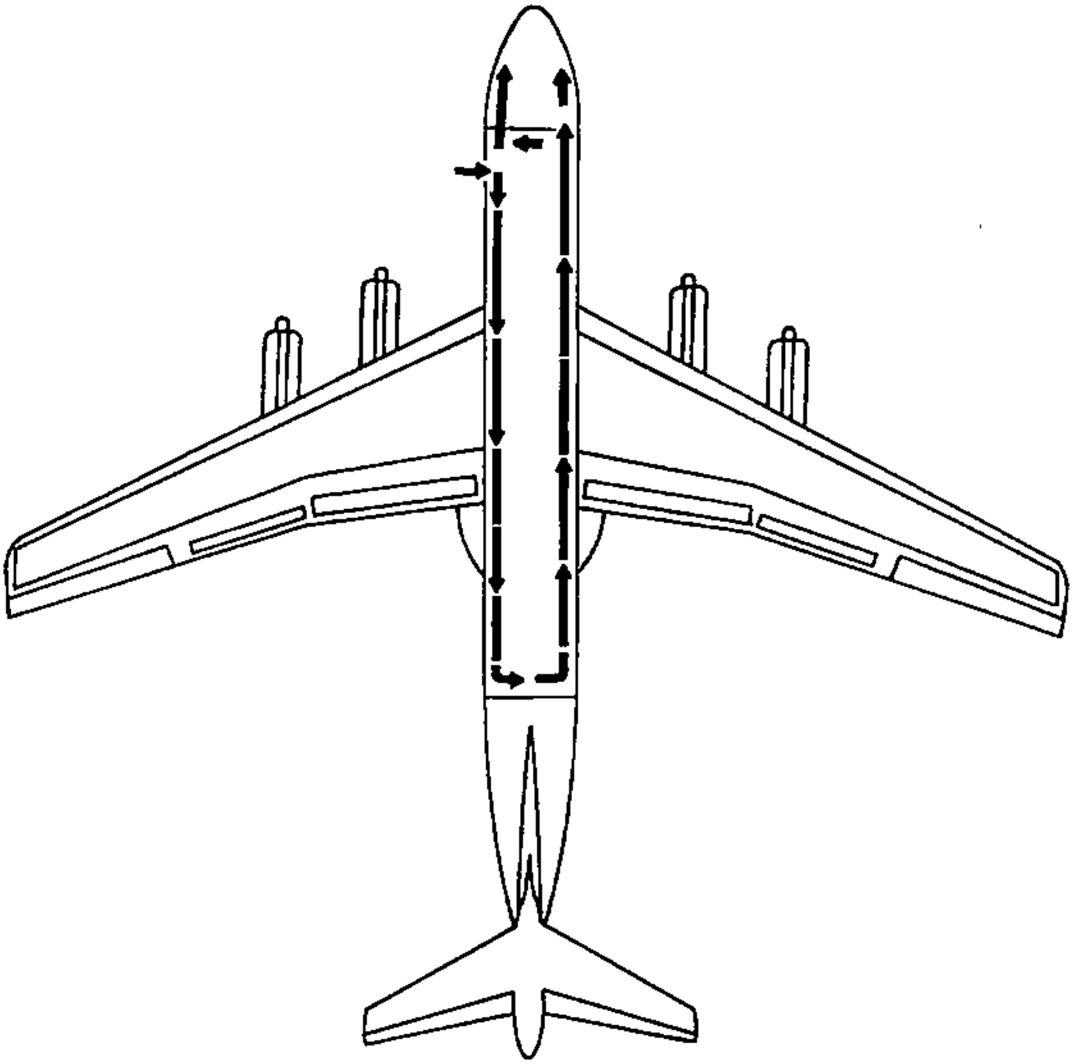


1. NOSE GEAR WELL
2. NOSE AREA
3. FORWARD FUSELAGE, RIGHT SIDE AND BOTTOM
4. RIGHT WHEEL POD AND CENTER FUSELAGE
5. RIGHT LOWER WING SURFACE AND FLAP WELL
6. NO. 3 AND NO. 4 ENGINE AREAS
7. RIGHT WING
8. AFT FUSELAGE AND EMPENNAGE
9. LEFT WING
10. NO. 1 AND NO. 2 ENGINE AREAS
11. LEFT LOWER WING SURFACE AND FLAP WELL
12. LEFT WHEEL POD AND CENTER FUSELAGE
13. FORWARD FUSELAGE, LEFT SIDE AND BOTTOM

141A-1-X3/0-101

Figure 2-1B. Exterior Inspection

CARGO COMPARTMENT INSPECTION

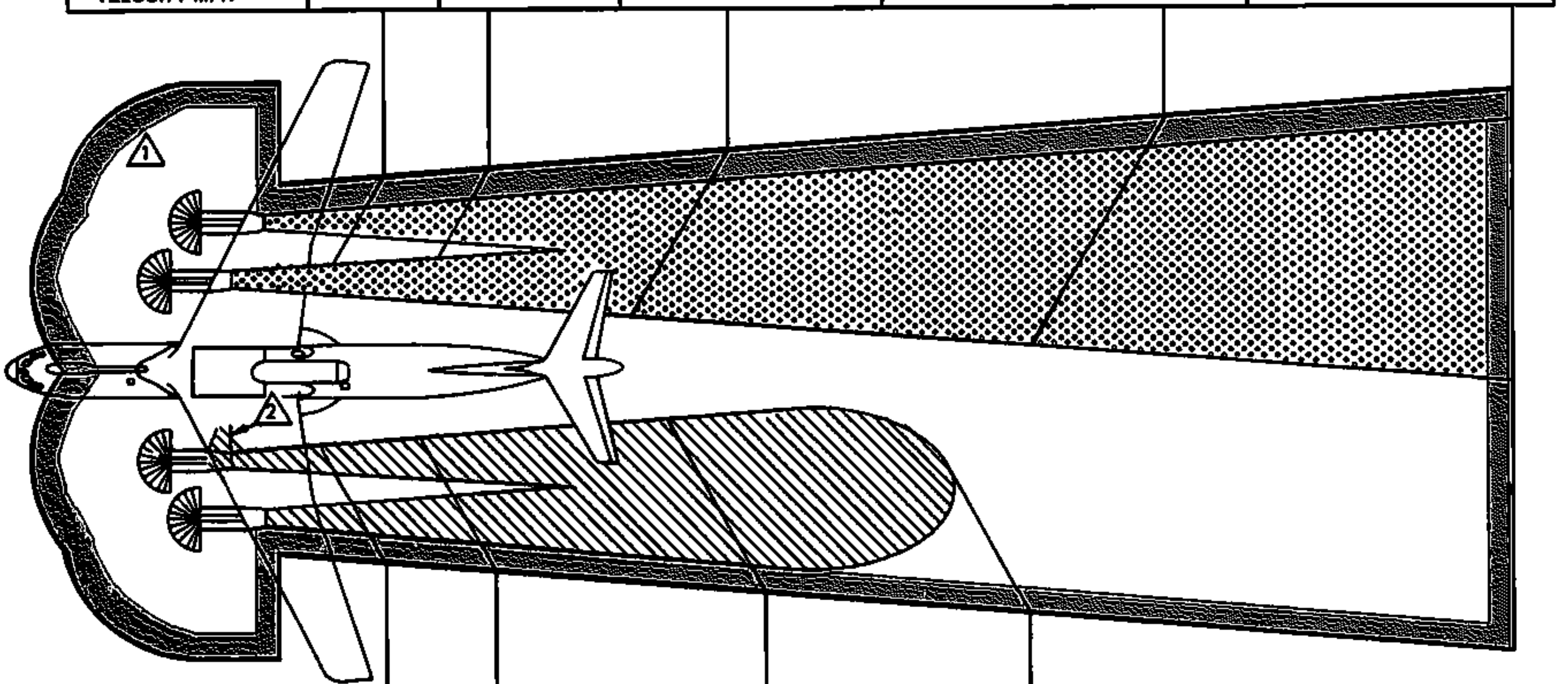


141A-1-X3/0-102

Figure 2-2. Cargo Compartment Inspection

DANGER AREAS ENGINES AND APU

DISTANCE FROM EXHAUST-FEET	20	45	100	200	300
MAXIMUM THRUST VELOCITY-MPH	1,000	500	200	100	50
IDLE THRUST VELOCITY-MPH	135	40			



DISTANCE FROM EXHAUST-FEET	15	40	100	150
MAXIMUM THRUST TEMPERATURE °F	920	400	200	150
IDLE THRUST TEMPERATURE °F	420	195		

1. ENGINE INTAKE DANGER AREA - 25 FEET MINIMUM WITH ENGINES AT MAXIMUM THRUST.
2. APU EXHAUST DANGER AREA.

Figure 2-3. (Sheet 1 of 2)

NOISE EXPOSURE DANGER AREAS

PERSONNEL MUST NOT APPROACH THE ENGINES MORE CLOSELY THAN THE DISTANCES TABLULATED BELOW

	*FOUR ENGINES IDLE	**ONE ENGINE TRT	**FOUR ENGINES TRT
WITHOUT EAR PROTECTION	150 FT	300 FT	700 FT
WITH HEADSET		50 FT	100 FT
WITH MUFF PROTECTOR			50 FT

*BASED ON 30 MINUTES EXPOSURE TIME

** BASED ON 5 MINUTES EXPOSURE TIME

RADAR ANTENNA RADIATION PATTERN

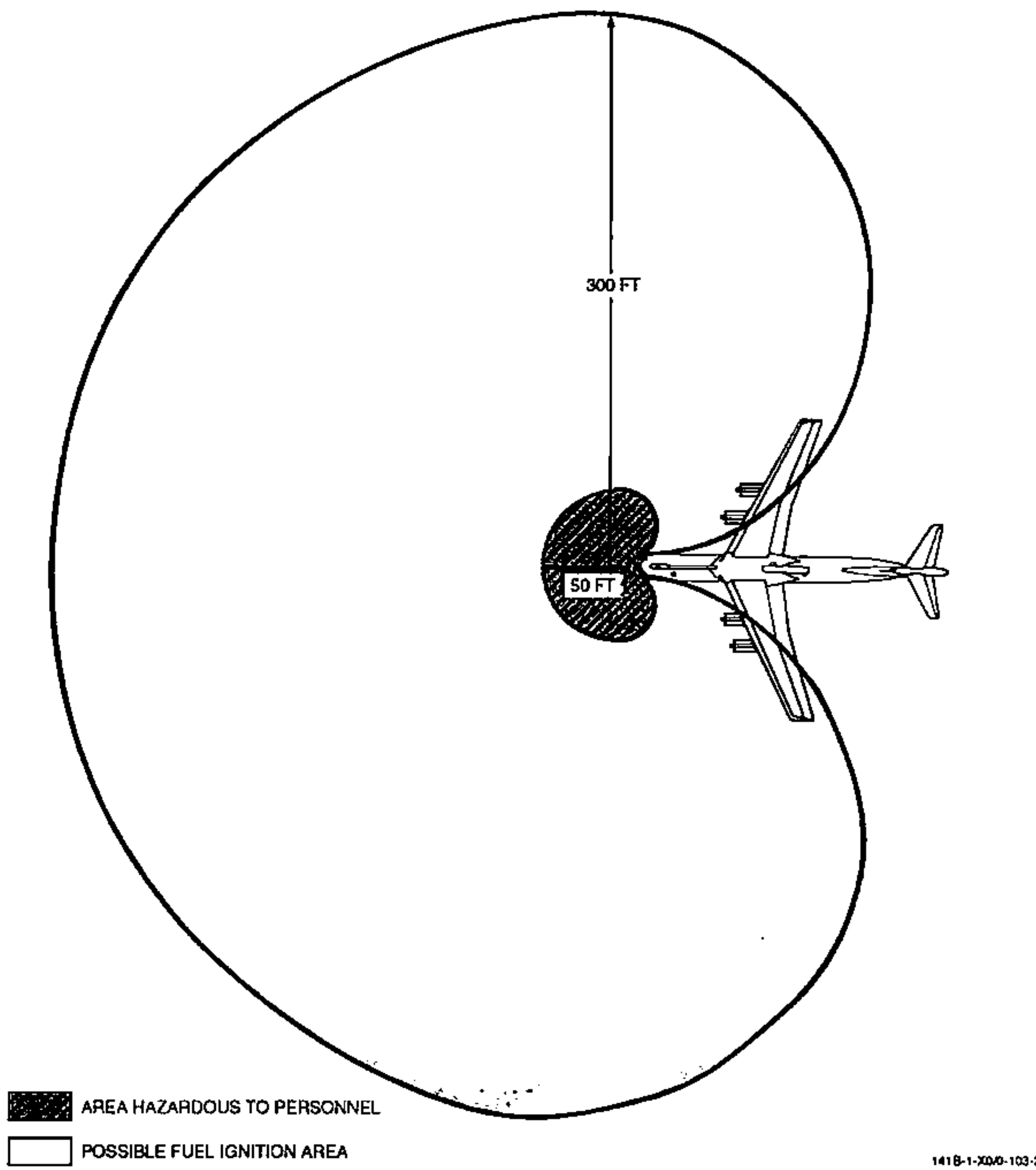
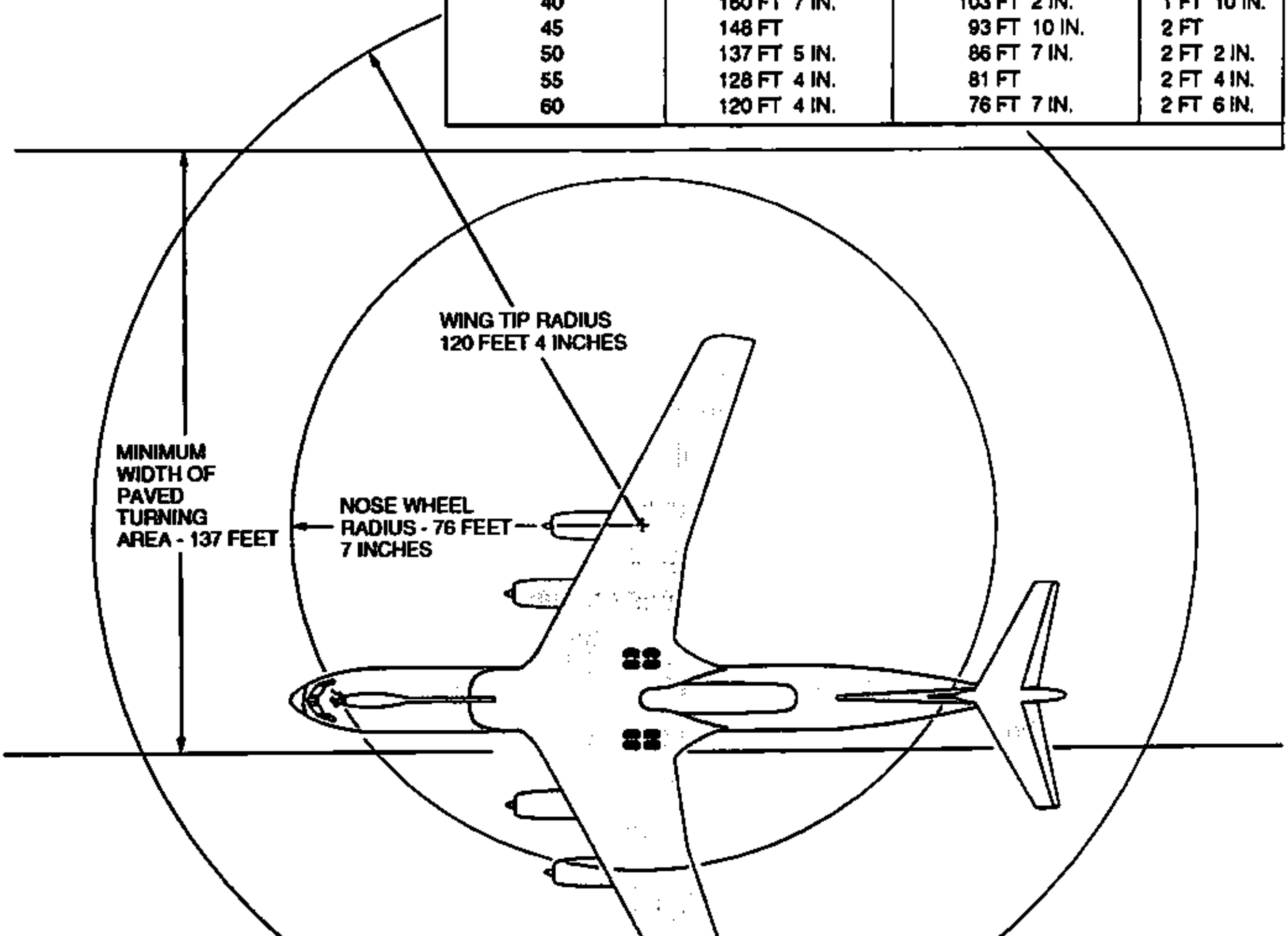


Figure 2-3. (Sheet 2 of 2)

TURNING RADIUS AND GROUND CLEARANCE

NOSE GEAR TURN IN DEGREES	WING TIP RADIUS	NOSE WHEEL RADIUS	WING TIP GROWTH
30	196 FT 1 IN.	132 FT 8 IN.	1 FT 6 IN.
35	176 FT 1 IN.	115 FT 8 IN.	1 FT 8 IN.
40	160 FT 7 IN.	103 FT 2 IN.	1 FT 10 IN.
45	148 FT	93 FT 10 IN.	2 FT
50	137 FT 5 IN.	86 FT 7 IN.	2 FT 2 IN.
55	128 FT 4 IN.	81 FT	2 FT 4 IN.
60	120 FT 4 IN.	76 FT 7 IN.	2 FT 6 IN.



VERTICAL CLEARANCE (EMPTY)

TOP FUSELAGE.. 17' 9"

VERTICAL STABILIZER:

a. STABILIZER TRIM FULL UP.................... 40' 7"

b. STABILIZER TRIM NEUTRAL.................. 39' 3"

MINIMUM GROUND CLEARANCE	CONDITIONS AND CLEARANCE	
	FULL FUEL LOAD AND MAX AIRCRAFT GROSS WT	EMPTY AIRCRAFT
	MANEUVER LOAD FACTOR 1.0g	MANEUVER LOAD FACTOR 1.0g
WING TIP	8'9"	11'
OUTBOARD NACELLE	3'9"	4'5"
LOWEST POINT OF FUSELAGE (VHF #1 ANTENNA)	8.5"	

WARNING

Maximum nose wheel deflection is restricted, by stops, to 60 degrees left or right. Forcing nose wheel steering past the 60 degree stops may result in complete loss of nose wheel steering

CAUTION

Outboard wing tip on sweptwing aircraft "grows" in turns. Deplane Scanner to act as wing walker when clearance is questionable. 141B-1-X0/0-104

Figure 2-4. Turning Radius And Ground Clearance

TYPICAL TAKE-OFF AND CLIMB

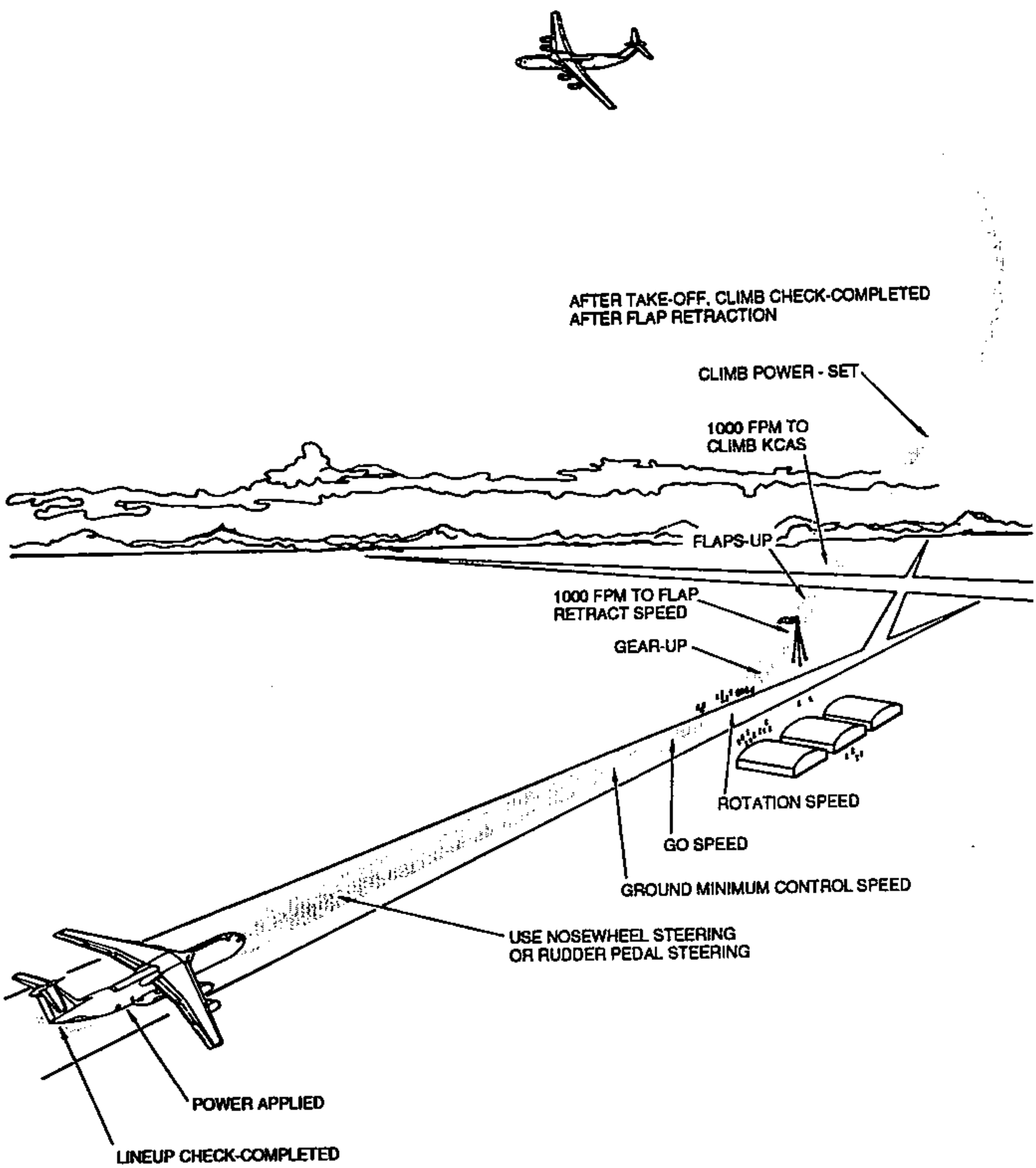


Figure 2-5. Typical Take-off And Climb

TYPICAL TAKE-OFF AND OBSTACLE CLIMB

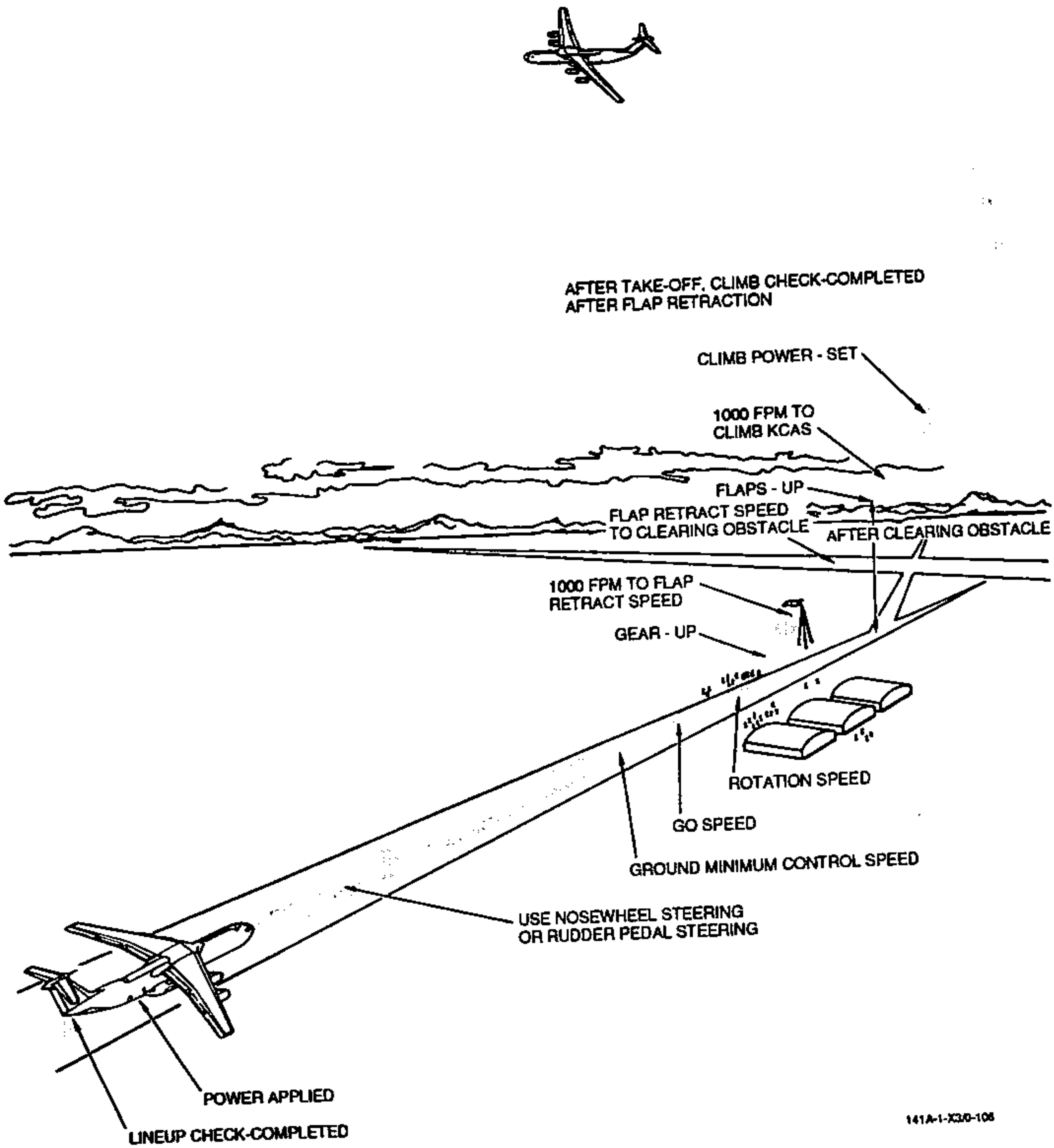
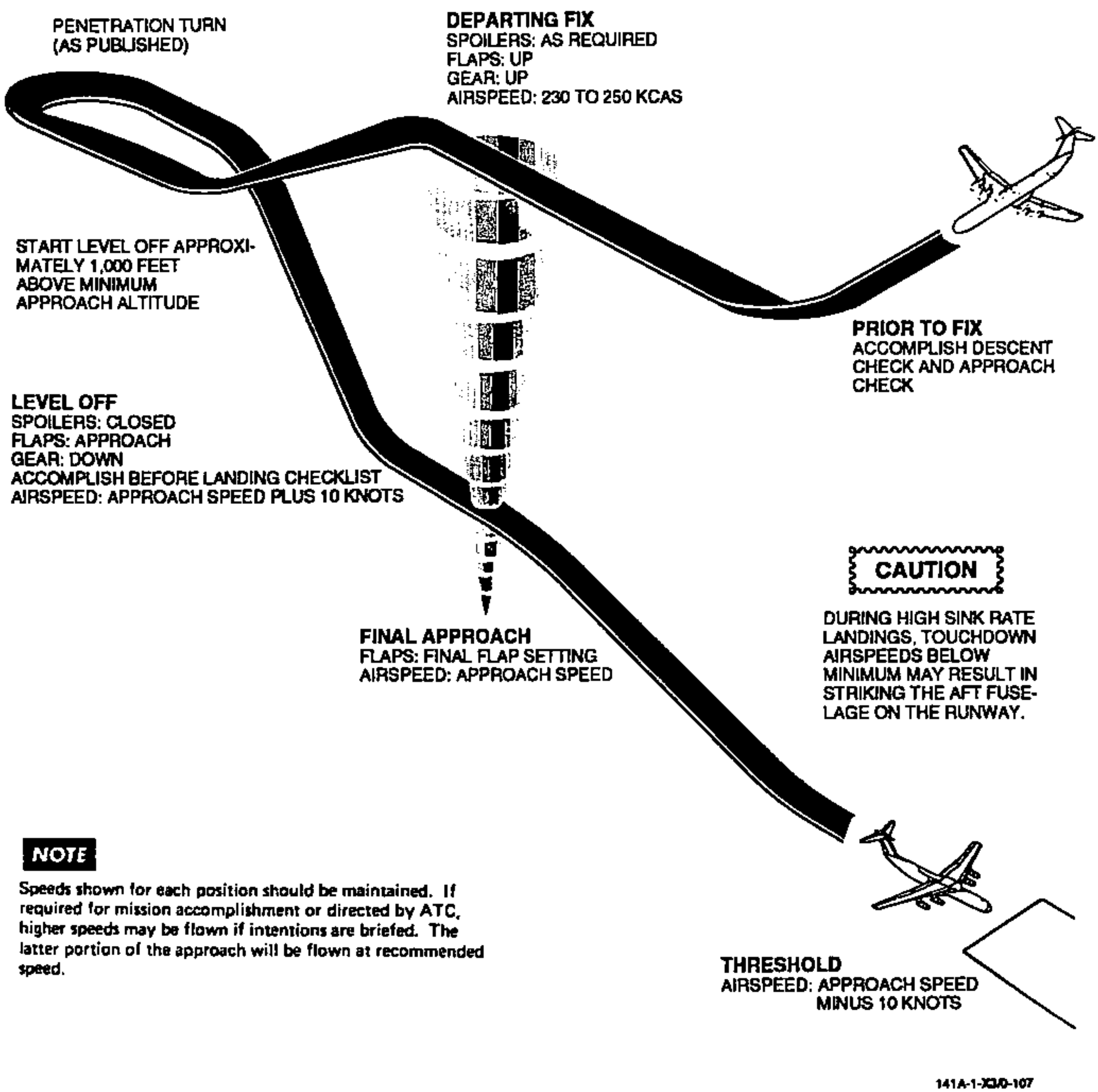


Figure 2-6. Typical Take-off And Obstacle Climb

TYPICAL HIGH ALTITUDE PENETRATION APPROACH FOUR AND THREE ENGINE CONFIGURATION



CAUTION

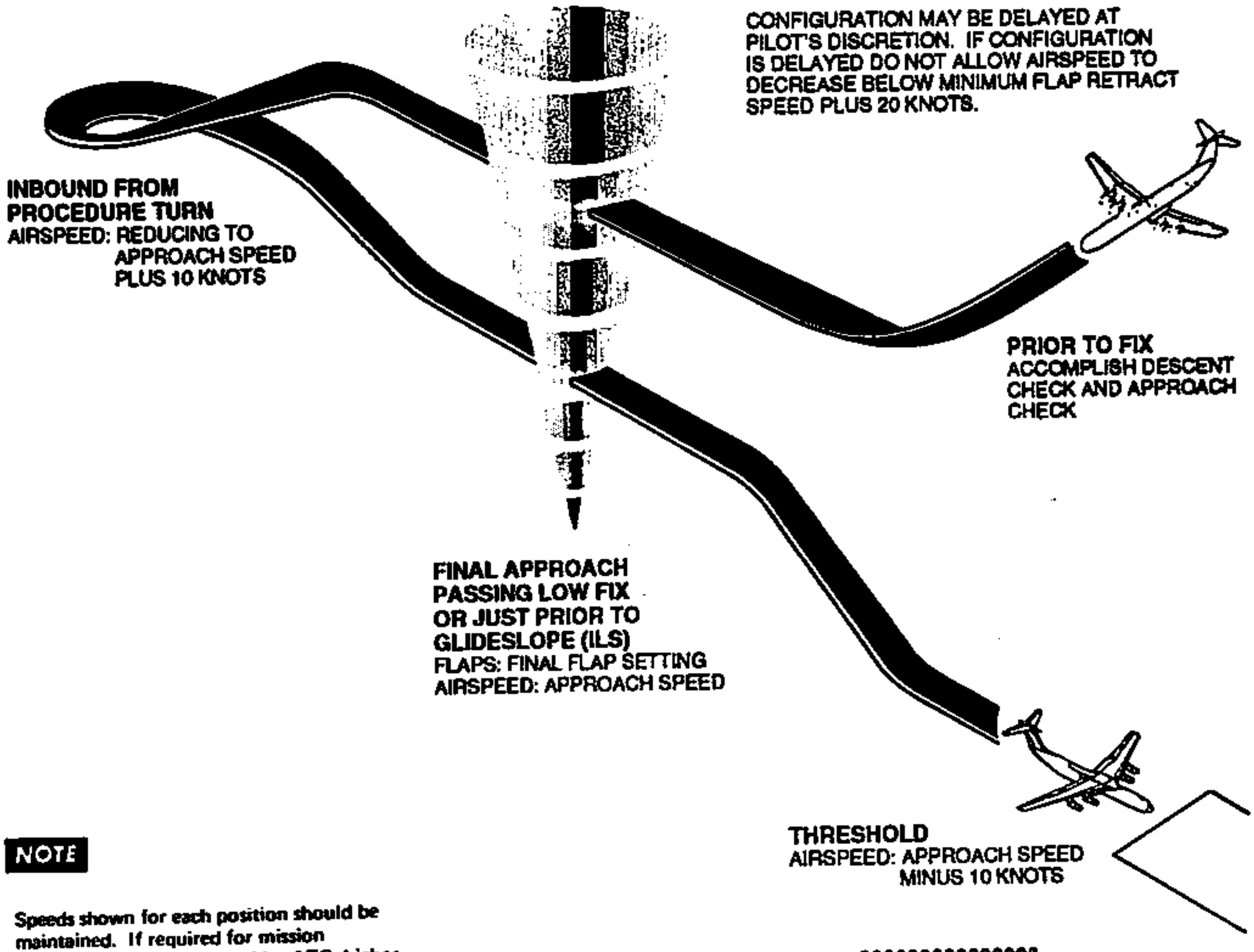
DURING HIGH SINK RATE LANDINGS, TOUCHDOWN AIRSPEEDS BELOW MINIMUM MAY RESULT IN STRIKING THE AFT FUSELAGE ON THE RUNWAY.

NOTE

Speeds shown for each position should be maintained. If required for mission accomplishment or directed by ATC, higher speeds may be flown if intentions are briefed. The latter portion of the approach will be flown at recommended speed.

Figure 2-7. Typical High Altitude Penetration Approach Four And Three Engine Configuration

TYPICAL LOW ALTITUDE APPROACH FOUR AND THREE ENGINE CONFIGURATION



NOTE

Speeds shown for each position should be maintained. If required for mission accomplishment or directed by ATC, higher speeds may be flown if intentions are briefed. The latter portion of the approach will be flown at recommended speed.

CAUTION

DURING HIGH SINK RATE LANDINGS, TOUCHDOWN AIRSPEEDS BELOW MINIMUM MAY RESULT IN STRIKING THE AFT FUSELAGE ON THE RUNWAY.

141A-1-X3/0-100

Figure 2-8. Typical Low Altitude Approach Four And Three Engine Approach

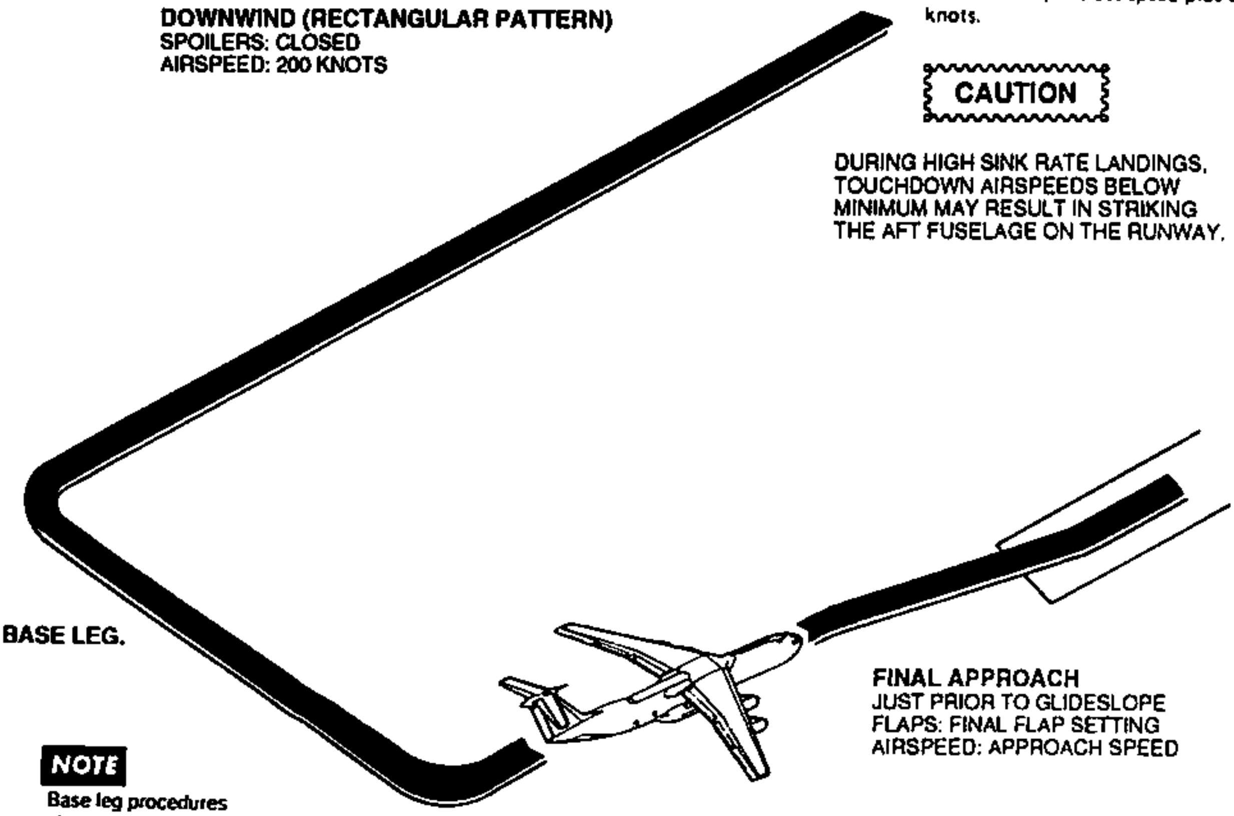
TYPICAL RADAR APPROACH FOUR AND THREE ENGINE CONFIGURATION

NOTE

Normal low altitude maneuvering airspeed is 200 knots. When maneuvering in a clean configuration, do not allow airspeed to decrease below minimum flap retract speed plus 20 knots.

CAUTION

DURING HIGH SINK RATE LANDINGS, TOUCHDOWN AIRSPEEDS BELOW MINIMUM MAY RESULT IN STRIKING THE AFT FUSELAGE ON THE RUNWAY.



NOTE

Base leg procedures also apply to dog leg.

Spoilers: Closed
Flaps: Approach
Gear: Down
Accomplish Before Landing Checklist
Airspeed: Reducing to Approach speed plus 20 knots.

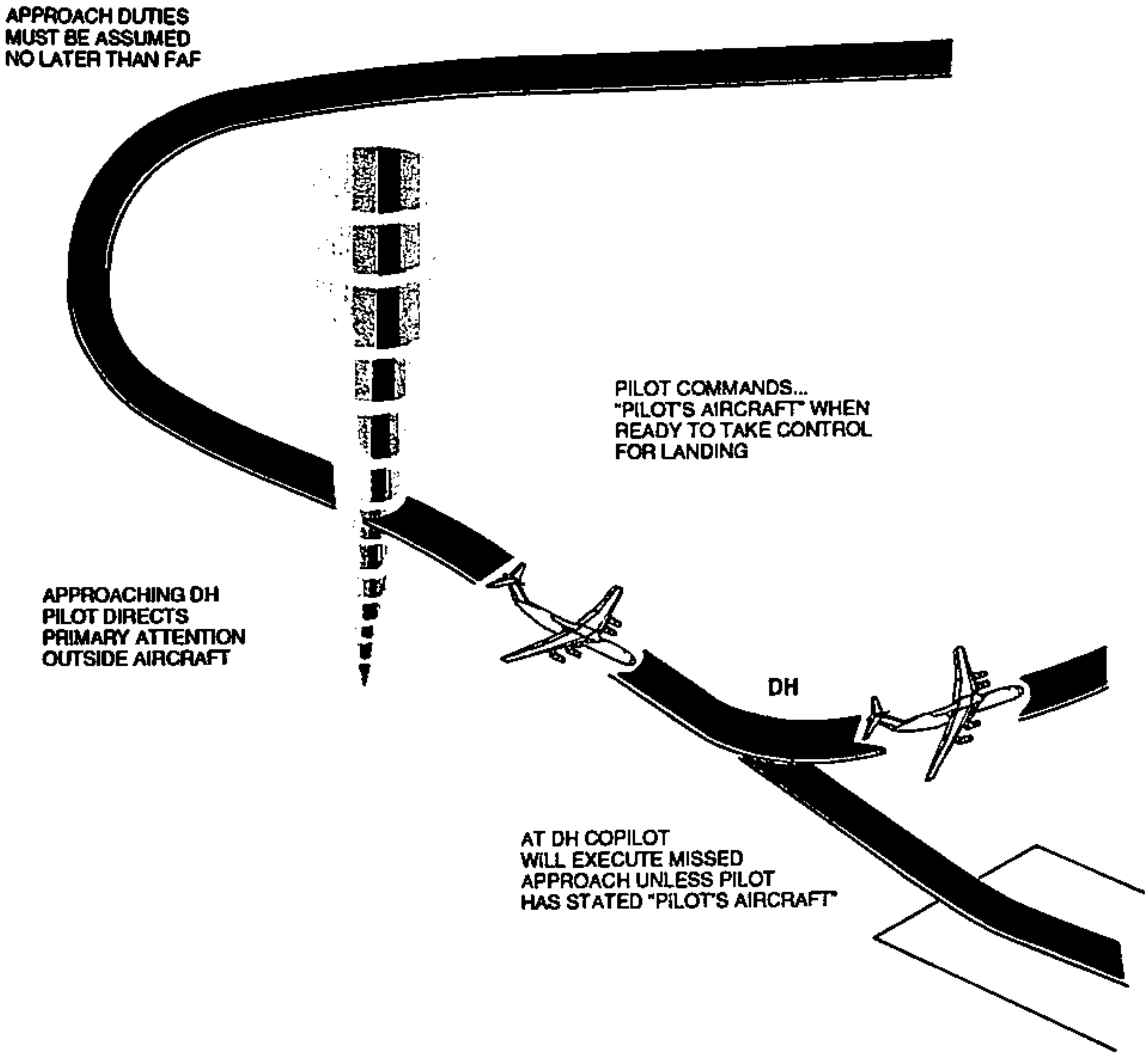
NOTE

Speeds shown for each position should be maintained. If required for mission accomplishment or directed by ATC, higher speeds may be flown if intentions are briefed. The latter portion of the approach will be flown at recommended speed.

Figure 2-9. Typical Radar Approach Four And Three Engine Configuration

TYPICAL MONITORED APPROACH

THIS TYPE OF APPROACH IS OPTIONAL. IT IS PARTICULARILY EFFECTIVE WHEN RVR IS 4000 FEET OR LESS OR WHEN CEILING IS LESS THAN 400 FEET.



CONCEPT – Copilot will fly approach head down, with the intention of making a missed approach. The pilot will monitor the approach and assume control and land the aircraft following visual transition.

1. The pilot is in command and must assume control any time the situation requires such action.
2. Recommended procedure is coupled autopilot with or without autothrottles.
3. Below 400 feet or 100 feet above DH, the pilot's primary attention becomes "head up" for visual cues.
4. When adequate visual reference is obtained, the pilot will announce "pilot's aircraft".
5. If visual reference is not obtained, or if the pilot does not announce "pilot's aircraft", the copilot will execute the missed approach at DH.
6. After the pilot assumes control, the copilot's primary attention continues to be head down, to monitor instruments and call out deviations.

Figure 2-10. Typical Monitored Approach

TYPICAL CAT II APPROACH

NOTE:

- If AP and ATS are not used the procedures and illustrations depict a typical manual approach.

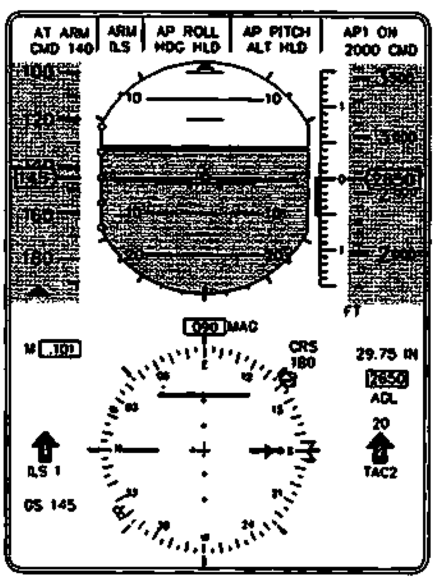
1

Down Wind Leg

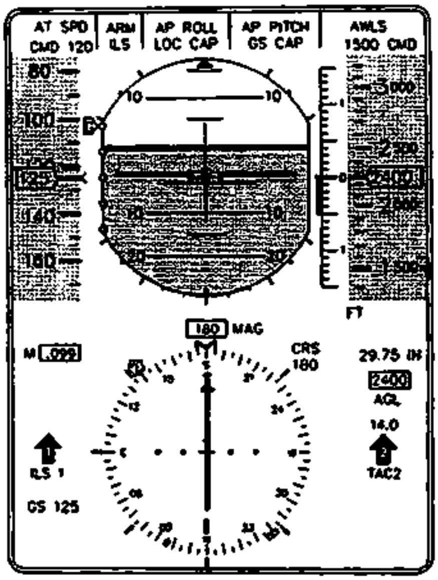
- Normal low altitude maneuvering airspeed is 200 knots. When maneuvering in a clean configuration, do not allow airspeed to decrease below minimum flap retract speed plus 20 knots.
- Radar altimeter set to Decision Height (DH).

Base Leg

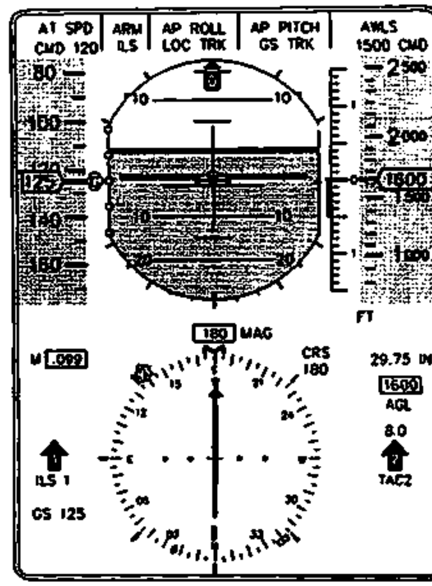
- Configuration – set flaps and lower landing gear.
- Autopilot/CDS set for intercept.
- LNAV or AWLS selected on DAMU.
- AT ARM (Y) and ARM ILS (G), annunciates on PFD (G) – Green and (Y) – Yellow.



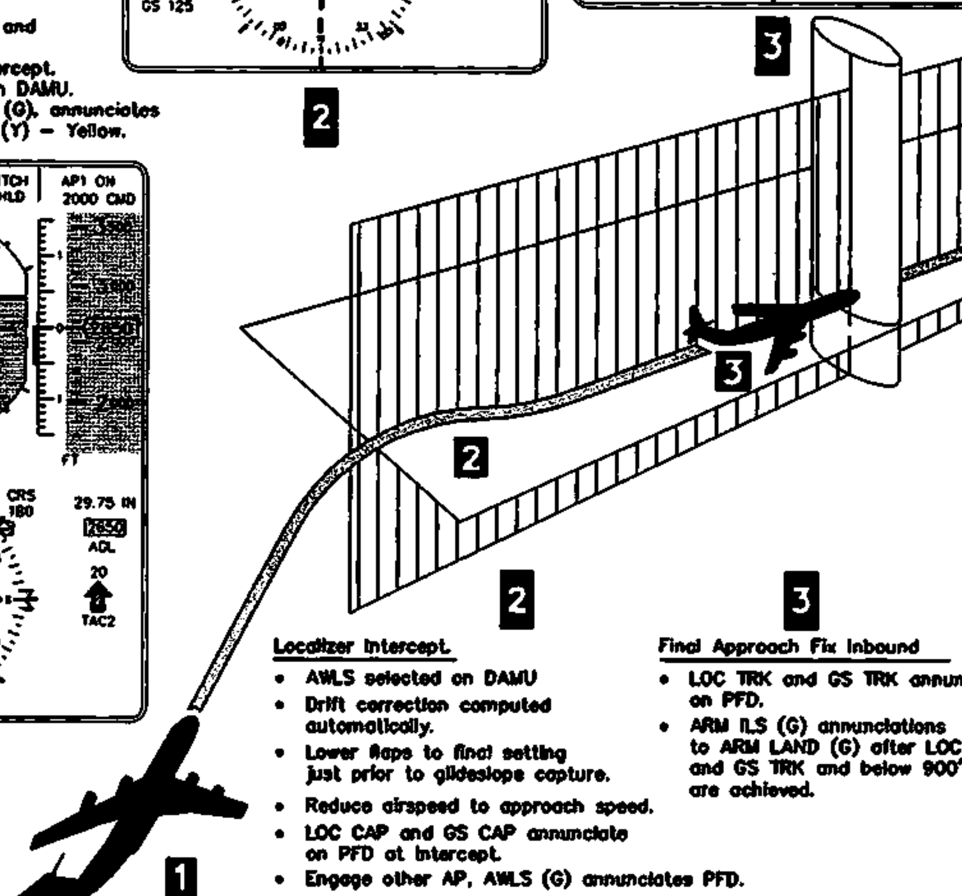
1



2



3



2

Localizer Intercept.

- AWLS selected on DAMU
- Drift correction computed automatically.
- Lower flaps to final setting just prior to glideslope capture.
- Reduce airspeed to approach speed.
- LOC CAP and GS CAP annunciate on PFD at intercept.
- Engage other AP, AWLS (G) annunciates PFD.
- Engage AT, AT ARM (Y) annunciation on PFD changes to AT SPD (G).
- Select AWLS.

3

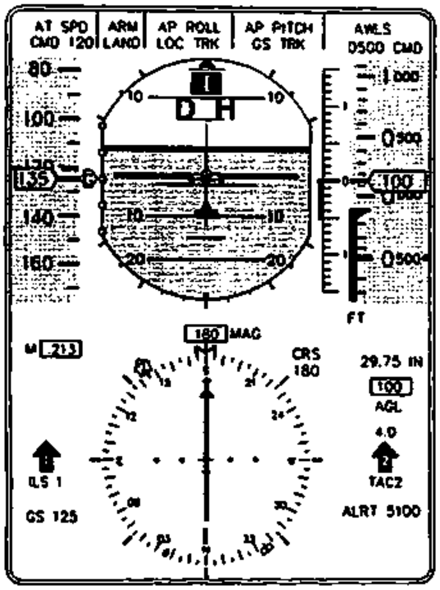
Final Approach Fix Inbound

- LOC TRK and GS TRK annunciate on PFD.
- ARM ILS (G) annunciations to ARM LAND (G) after LOC TRK and GS TRK and below 900' AGL are achieved.

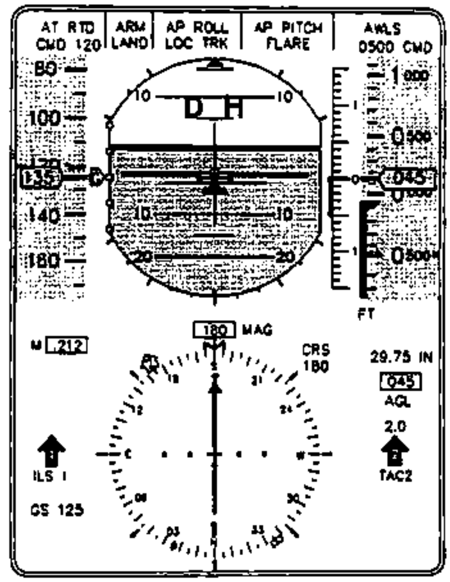
D3179101D

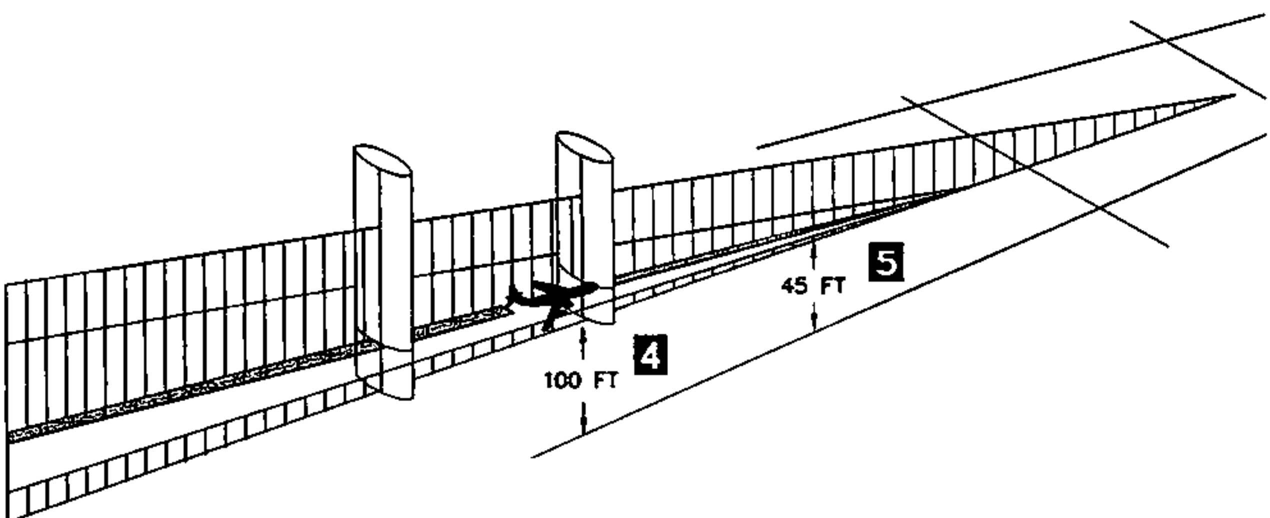
Figure 2-11. Typical CAT II Approach (Sheet 1 of 2)

4



5





4

Decision Height

- When DH annunciates on PFD, aircraft is at DH.
- Visual cues must be sufficient to determine that the aircraft is within, and tracking to remain within, the lateral confines of the runway extended. If cues are sufficient, the pilot may continue (automatic or manual). If cues are insufficient, execute missed approach.

5

Landing

- If approach is continued, AT RTD and FLARE annunciates on PFD.
- The pilot may allow the autopilot to remain engaged to touchdown. At touchdown depress the rotation go-around button twice on the control wheel and complete roll out manually.

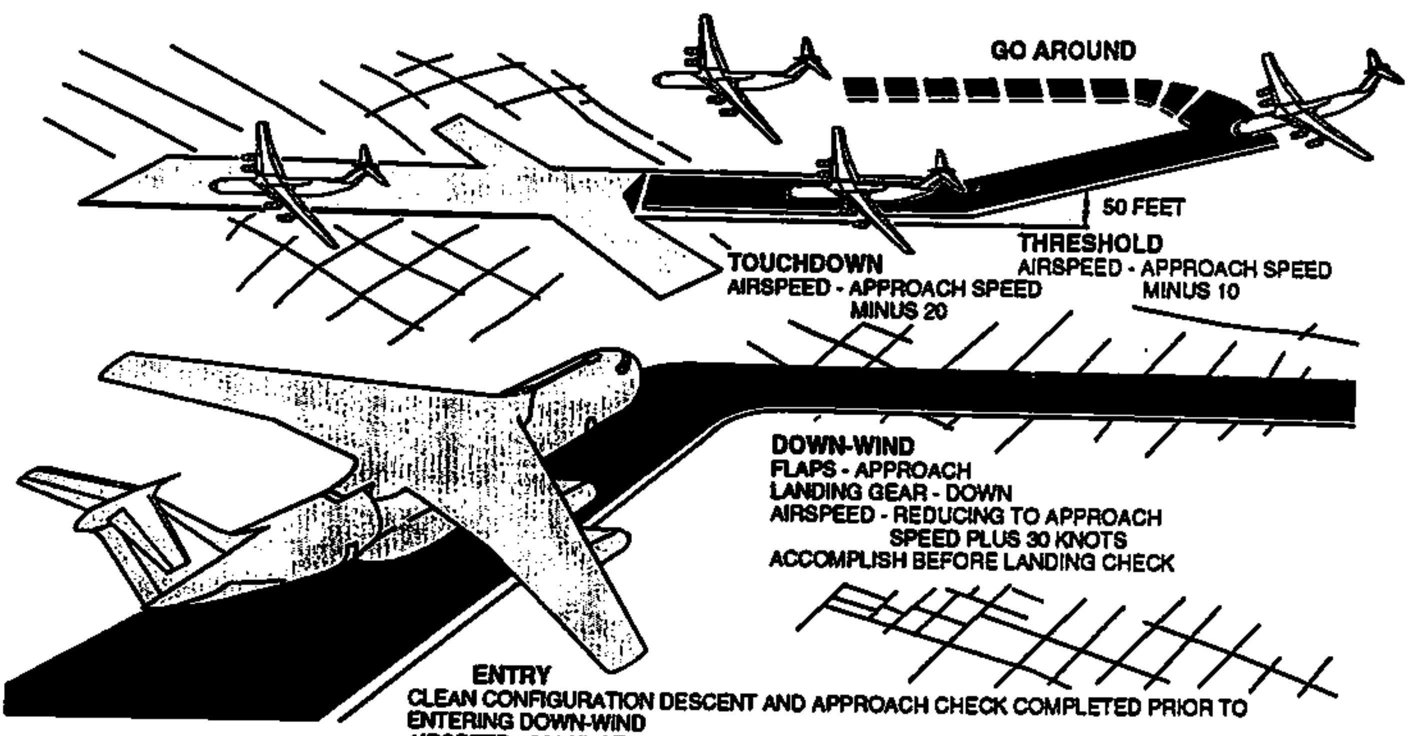
D3179102 B

Figure 2-11. Typical CAT II Approach (Sheet 2 of 2)

TYPICAL LANDING AND GO-AROUND PATTERN

NOTE

THE BANK ANGLE SHOULD NOT NORMALLY EXCEED 30 DEGREES IN A TURN. IF A BANK ANGLE IN EXCESS OF 30 DEGREES IS REQUIRED, REFER TO THE STALL SPEED CHART.



NOTE

- SPEEDS SHOWN FOR EACH POSITION SHOULD BE MAINTAINED. IF REQUIRED FOR MISSION ACCOMPLISHMENT OR DIRECTED BY ATC, HIGHER SPEEDS MAY BE FLOWN IF INTENTIONS ARE BRIEFED. THE LATTER PORTION OF THE APPROACH WILL BE FLOWN AT RECOMMENDED SPEED.
- NORMAL LOW ALTITUDE MANEUVERING AIRSPEED IS 200 KNOTS. WHEN MANEUVERING IN A CLEAN CONFIGURATION, DO NOT ALLOW AIRSPEED TO DECREASE BELOW MINIMUM FLAP RETRACT SPEED PLUS 20 KNOTS.

141A-1-X3/0-112-1

CAUTION

DURING HIGH SINK RATE LANDING, TOUCHDOWN AIRSPEEDS BELOW MINIMUM MAY RESULT IN STRIKING THE AFT FUSELAGE ON THE RUNWAY.

Figure 2-12. Typical Landing And Go-Around Pattern (Sheet 1 of 2)

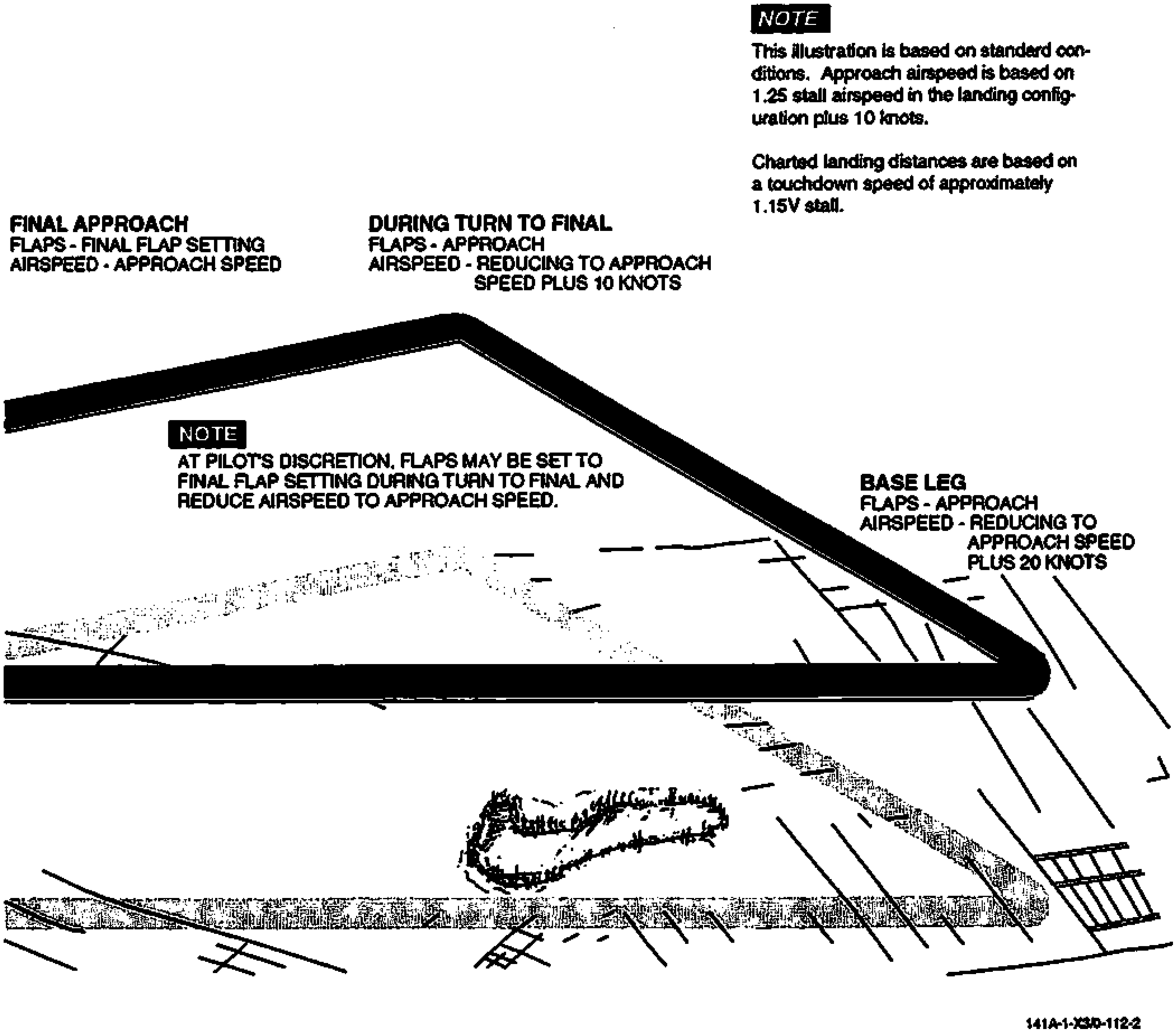
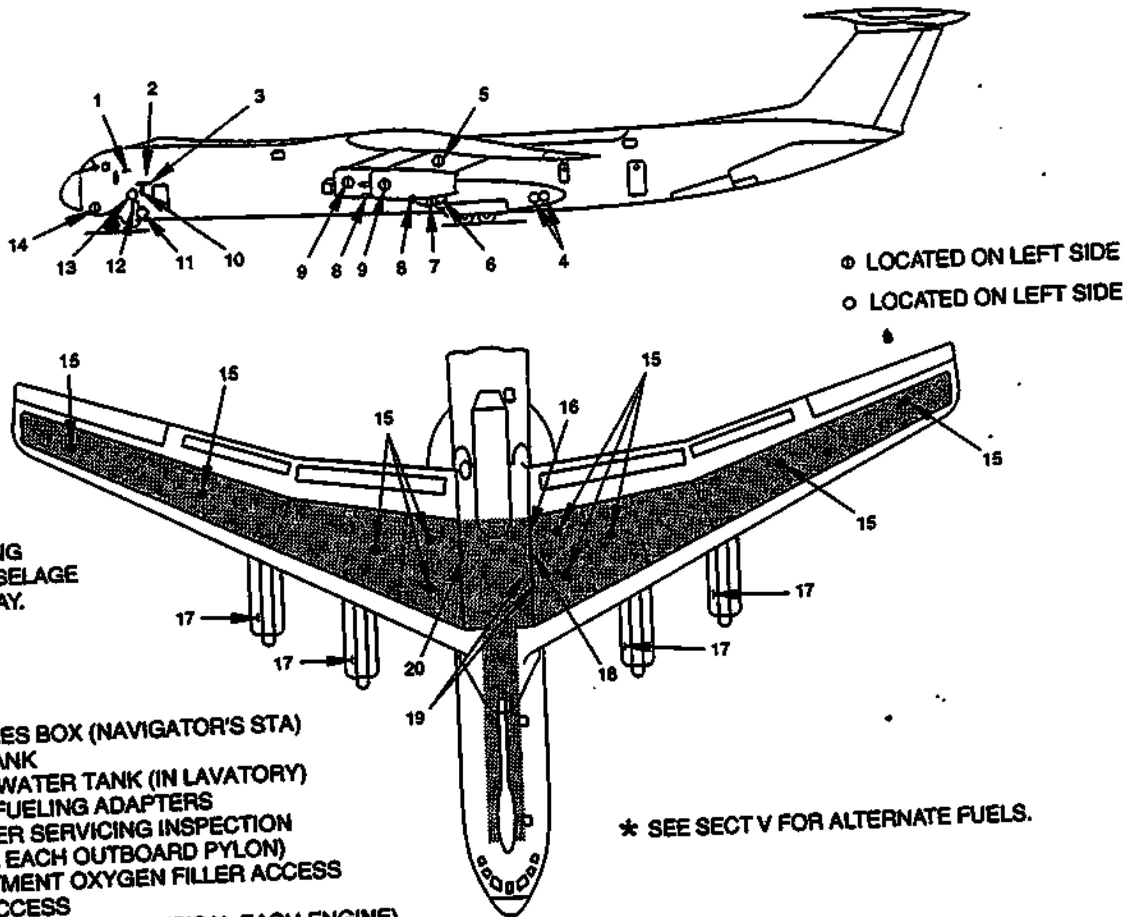


Figure 2-12. Typical Landing And Go-Around Pattern (Sheet 2 of 2)



NOTE

GRAY AREA ON WING AND FORWARD FUSELAGE INDICATES WALKWAY.

* SEE SECT V FOR ALTERNATE FUELS.

1. ELECTRICAL SPARES BOX (NAVIGATOR'S STA)
2. GALLEY WATER TANK
3. LAVATORY WASH WATER TANK (IN LAVATORY)
4. SINGLE POINT REFUELING ADAPTERS
5. FIRE EXTINGUISHER SERVICING INSPECTION ACCESS (TYPICAL EACH OUTBOARD PYLON)
6. CARGO COMPARTMENT OXYGEN FILLER ACCESS
7. APU OIL FILLER ACCESS
8. STARTER OIL FILLER ACCESS (TYPICAL EACH ENGINE)
9. CSD AND THRUST REVERSER OIL FILLER (TYP EACH ENG)
10. NLG EMER EXT HYD SYS RESERVOIR (IN RH UNDERDECK AREA)
11. LAVATORY SERVICING CART CONNECTION
12. BATTERY AND SUMP JAR (IN RH UNDERDECK RACK)
13. EXTERNAL POWER RECEPTACLE
14. CREW OXYGEN FILLER ACCESS
15. OVERWING FUEL FILLER OPENINGS
16. NO. 2 HYDRAULIC SYSTEM RESERVOIR (IN CARGO COMPT)
17. ENGINE OIL FILLER ACCESS
18. NO. 3 HYDRAULIC SYSTEM RESERVOIR (IN CARGO COMPT)
19. NO. 3 HYDRAULIC SYSTEM ACCUMULATORS (IN CARGO COMPT)
20. NO. 1 HYDRAULIC SYSTEM RESERVOIR (IN CARGO COMPT)

FLUID SPECIFICATION			NATO SYMBOL
	NO. OF TANKS		
FUEL * (ALTERNATE)	10	MIL-DTL-5624 JP-4	F-40
ENGINE OIL ⚠1	4	MIL-PRF-23699	O-156
ENGINE STARTER OIL		MIL-PRF-23699	O-156
CSD AND THRUST REVERSER OIL	4	MIL-PRF-23699	O-156
APU OIL	1	MIL-PRF-23699	O-156
HYDRAULIC FLUID	4	MIL-PRF-83282	H-537
OXYGEN		MIL-PRF-27210 TYPE II	NONE AVAILABLE

NOTE

⚠1 Emergency servicing. In case of emergency, engine lubricating oils NATO symbols 0-148 (MIL-PRF-7808) and 0-156 (MIL-PRF-23699) may be mixed. The amount of emergency oil added should not exceed one-half of the oil tank capacity. At the first opportunity thereafter, the oil shall be drained and the engine serviced with the proper lubricating oil. (MIL-PRF-23699).

F1018401

Figure 2-13. Servicing Diagram

SECTION III
EMERGENCY PROCEDURES
PART I
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	**3-5**
GENERAL	3-5
EMERGENCY ENTRANCES AND EXITS	3-5
EMERGENCY SIGNALS	3-5
GROUND OPERATIONS	**3-6**
AUXILIARY POWER UNIT FIRE - CREW NOT IN PLACE CHECKLIST	3-6
FIRE ON THE GROUND	3-7
FUSELAGE FIRE - CREW NOT IN PLACE CHECKLIST	3-6
TAKE-OFF	**3-8**
ABORT PROCEDURES	3-8
BRAKE LIMITATIONS	3-9
IN-FLIGHT	**3-10**
AIR START CHECKLIST	3-13
BAILOUT	3-37
BLEED AIR SMOKE CHECKLIST	3-20
BLEED DUCT OVERHEAT CHECKLIST	3-21
BRAKE SYSTEM FAILURE	3-43
CARGO JETTISON	3-35
DOOR OPEN WARNING LIGHT ILLUMINATION	3-31
ELECTRICAL FIRE CHECKLIST	3-23
EMERGENCY ENGINE SHUTDOWN CHECKLIST	3-11
EMERGENCY FLARE JETTISON CHECKLIST	3-37
ENGINE FAILURE DURING CLIMB	3-10
ENGINE FAILURE DURING CRUISE	3-10
ENGINE FAILURE/FIRE DURING TAKE-OFF	3-10
ENGINE MALFUNCTIONS	3-11
ENGINE SHUTDOWN CONDITIONS	3-10
FAILURE OF NOSE LANDING GEAR WHEELS TO CENTER UPON EXTENSION	3-41
FUEL JETTISON CHECKLIST	3-34
FUSELAGE CRACKS	3-32
IN-FLIGHT EMERGENCY FLARE JETTISON	3-36
LANDING GEAR ELECTRICAL MALFUNCTION CHECKLIST	3-38
LANDING GEAR EMERGENCIES	3-38
LANDING GEAR EMERGENCY EXTENSION CHECKLIST	3-39
LANDING GEAR WARNING LIGHT ILLUMINATED	3-42
MAIN LANDING GEAR BOGIE MALFUNCTIONS	3-42
MLG STEP 2 HANDLE FAILURE	3-41
RAPID DECOMPRESSION	3-34
REPOSITIONING OF PALLETIZED CARGO/AIRPDROP PLATFORMS	3-36
SMOKE AND FUME ELIMINATION CHECKLIST	3-15
THRUST REVERSER FAILURE	3-14
WING ANTI-ICE OVERHEAT	3-22
WING FIRE CHECKLIST	3-19
LANDING	**3-44**
CONTROLLABILITY CHECK	3-44
DITCHING	3-52
GO-AROUND WITH ONE OR MORE ENGINES INOPERATIVE	3-45
LANDING WITH FLAT TIRE	3-47
LANDING WITH NOSE GEAR RETRACTED	3-46
LANDING WITH ONE OR MORE ENGINES INOPERATIVE	3-44
LANDING WITH ONE OR MORE MAIN GEARS RETRACTED OR MISSING	3-45
TOUCHDOWN RELAY MALFUNCTIONS	3-46
WHEELS UP LANDING	3-48
SYSTEMS	**3-59**
AILERON HYDRAULIC POWER CONTROL FAILURE	3-73
AILERON TAB MALFUNCTIONS	3-74
ANNUNCIATOR PANELS	3-59
AUTOTHROTTLES MALFUNCTION	3-63
BATTERY LIGHT ILLUMINATED	3-69
CDS CAUTIONS, WARNINGS, AND ADVISORIES (CWA)	3-62

TEXT	PAGE
CDS/FMS EQUIPMENT FAILURES/ MULTIPLE FAILURES MATRIX	3-64
CMDS (AN/ALE-47) ABNORMAL OPERATING PROCEDURES	3-64.2
ELECTRICAL POWER SYSTEM FAILURE	3-65
ELEVATOR HYDRAULIC POWER CONTROL FAILURE	3-74
ENVIRONMENTAL SYSTEM MALFUNCTIONS	3-72
FLAP SYSTEM FAILURE	3-76
FLIGHT CONTROL MALFUNCTIONS	3-73
FREE FLOATING STABILIZER	3-77
FUEL SYSTEM FAILURES	3-79
HYDRAULIC SYSTEM FAILURE	3-80
JAMMED AILERON CHECKLIST	3-73
LOSS OF ALL GENERATORS CHECKLIST	3-66
LOSS OF NORMAL DC POWER (AC POWER NORMAL)	3-69
PITCH TRIM MALFUNCTIONS	3-75
RADAR MALFUNCTION	3-83
RUDDER HYDRAULIC POWER CONTROL FAILURE	3-77
SCADC FAILURE	3-83
SPOILER SYSTEM FAILURE	3-78
UNCOMMANDED YAW IN-FLIGHT	3-78
WINDSHIELD IMPAIRMENT	3-84
YAW DAMPER FAILURE	3-79

ITEM	FIG	PAGE
EMERGENCY DESCENT	3-1	3-33
MFD FAULT INDICATIONS	3-1A	3-64.1

PART II

TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	3-85
BATTERY START CHECKLIST	3-85
FIRE HANDLE START CHECKLIST	3-86
PUSH-BACK/TOW PROCEDURES	3-87
BACKING THE AIRCRAFT	3-88
TAKEOFF WARNING ANNUNCIATION MALFUNCTION	3-89
THREE-ENGINE TAKE-OFF PROCEDURE	3-90
ZERO FLAP TAKE-OFF PROCEDURE	3-91
FUEL TANK EMPTY OUT OF SEQUENCE	3-92

ITEM	FIG	PAGE
DITCHING	3-21	3-117
EMERGENCY ENTRANCES AND EXITS (TYPICAL)	3-2	3-93
EMERGENCY EQUIPMENT AND EXITS	3-3	3-94
ENGINE FAILURE AFTER GO SPEED	3-4	3-98
HIGH ALTITUDE PENETRATION AND APPROACH (TWO ENGINE CONFIGURATION)	3-18	3-114
HYDRAULIC SYSTEM NO. 2 SERVICE CENTER	3-12	3-108
LANDING GEAR MANUAL CONTROLS	3-6	3-100
LATERAL STABILITY	3-22	3-119
LOW ALTITUDE PENETRATION AND APPROACH (TWO ENGINE CONFIGURATION)	3-19	3-115
MAIN LANDING GEAR DOOR LOCK SELECTOR VALVE	3-13	3-109
MAIN LANDING GEAR DOWN-LOCK SELECTOR VALVE	3-15	3-111
MAIN LANDING GEAR SELECTOR VALVE	3-14	3-110
MAXIMUM LOAD PROFILE	3-5	3-99
MLG DOWNLOCK PAWL	3-9	3-105
MLG STEP 2 HANDLE FAILURE CHOPPING AREA	3-17	3-113
NLG UPLOCK EMERGENCY ACCESS	3-10	3-106
NLG UPLOCK EMERGENCY RELEASE	3-11	3-107
NOSE LANDING GEAR SELECTOR VALVE	3-16	3-112
PRYING MLG DOWNLOCK	3-8	3-104
PRYING MLG DRAG LINK	3-7	3-102
TYPICAL RADAR APPROACH TWO ENGINE CONFIGURATION	3-20	3-116

PART III

TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	3-120
AEROMEDICAL EVACUATION CREW MEMBER (AECM) ABBREVIATIONS	3-120
EMERGENCY SIGNALS	see 3-5
GROUND OPERATIONS	3-121
GROUND EVACUATION - CREW NOT IN PLACE CHECKLIST	3-121
FIRE ON THE GROUND	3-121
IN-FLIGHT	3-122
DOOR OPEN WARNING LIGHT ILLUMINATION	3-122
RAPID DECOMPRESSION	3-122
SMOKE AND FUME ELIMINATION CHECKLIST	3-122
LANDING	3-123
DITCHING AND WHEELS UP LANDING	3-123
DITCHING CHART (PLANNED)	3-124
Medical Crew Director	3-124
Flight Nurse	3-126
Charge Medical Technician	3-128
Second Aeromedical Evacuation Technician	3-130
Third Aeromedical Evacuation Technician	3-132
WHEELS UP LANDING CHART (PLANNED)	3-135
Medical Crew Director	3-135
Flight Nurse	3-137
Charge Medical Technician	3-139
Second Aeromedical Evacuation Technician	3-141
Third Aeromedical Evacuation Technician	3-143

ITEM	FIG	PAGE
C-141 AEROMEDICAL EVACUATION DITCHING PLAN	3-23	3-134

INTRODUCTION.

GENERAL.

This section contains what experience has shown to be the best procedures in meeting the various emergencies which may be encountered. These procedures will ensure maximum safety for the crew and/or aircraft until a safe landing or other appropriate action is accomplished. Multiple emergencies may require modification of these procedures. The CRITICAL items (ALL CAPITAL BOLDFACE LETTERS) contained in the various EMERGENCY procedures are those steps which must be performed without reference to written checklists. These critical steps shall be committed to memory. All other items are considered non-critical and contribute to an orderly sequence of events after the emergency is under control. After the pilot, copilot, and engineer complete the BOLDFACE ITEMS and the pilot calls for the emergency checklist, the engineer will review the entire checklist ensuring that all items are accomplished. Only challenge and response items and items requiring clarification will be called out on interphone. All other crewmembers will review the BOLDFACE items on their checklist as a cleanup reference when completing their checklist. EMERGENCY checklist items will be called for and accomplished in sequence.

When an airborne emergency occurs, the following rules apply:

1. Maintain aircraft control. It is desirable for one pilot to fly the aircraft and not be directly involved in the emergency actions.

2. Analyze the situation. Emergency procedures, BOLD print included, should be accomplished only after the crewmember has positively identified the malfunctioning system and considered the effect of emergency-related actions on aircraft performance.

3. Take coordinated corrective action. Although many in-flight emergencies require immediate corrective action, difficulties can be compounded by the tempo of the pilot's commands and hurried execution by the crew. Commands must be clear and concise, allowing time for acknowledgment of each command prior to issuing further instructions. The pilot must exercise positive control of the crew by allowing time for acknowledgment and execution. The other crewmembers must be certain their reports to the pilot are clear and concise, neither exaggerating nor understating the nature of the emergency. This eliminates confusion and ensures efficient, effective, and expeditious handling of the emergency.

4. Study the aircraft's configuration and land as the situation dictates. A controllability check may be advisable.

EMERGENCY SIGNALS.

When an emergency arises, the crew will be notified of the nature of the emergency and intended action. If passengers are carried, they should be notified when appropriate. The following warning horn signals are used when abandoning the aircraft or during a crash landing or ditching.

1. Ground evacuation - One long, sustained blast.

2. Ditching or crash landing immediately after takeoff - One long, sustained blast.

3. Prepare for ditching or crash landing - Six short blasts.

4. Brace for impact - One long, sustained blast.

5. Prepare to bail out - Three short blasts.

6. Bail out - One long, sustained blast.

7. For immediate bailout, the pilot will sound the warning horn and transmit "BAIL OUT, BAIL OUT, BAIL OUT", over the PA system.

EMERGENCY ENTRANCES AND EXITS.

WARNING

> If it becomes necessary to open or reinstall any hatch in-flight, extreme care should be exercised to prevent the hatch from entering the slipstream. Failure to comply may result in injury to personnel and damage to equipment.

Emergency entrances and exits (figures 3-2 and 3-3) are provided on the top and both sides of the fuselage.

SIDE ESCAPE HATCHES - Can be opened from the inside by rotating the release handles. Can be opened from the outside by pushing the handle release button and rotating release handles.

No. 1 ESCAPE HATCH (CREW HATCH) - Can be opened from the inside by rotating the release handle. Can be opened from the outside by pulling the release ring adjacent to the hatch. Aircraft modified by TCTO 711 have an additional handle to facilitate removal and installation of the hatch in-flight.

No. 2 ESCAPE HATCH - Can be opened from the inside by rotating the release handle. Can be opened from the outside by pulling the release ring adjacent to the hatch. The hatch is hinged on the forward edge and swings open outward.

No. 3 ESCAPE HATCH - Can be opened from the inside by rotating the release handle. Can be opened from the outside by striking the rectangular bump plate located above and inboard of the hatch; it is placarded EXIT RELEASE PUSH.

No. 4 ESCAPE HATCH - This hatch can be opened from the inside by pulling down on the ditching stop handle and then rotating the release handle. This allows the hatch to open inward and rest on the ditching stop. To completely open the hatch, push up on the ditching stop handle. This disengages the ditching stop and releases the hatch.

WARNING

Keep clear of the swinging arc of the No. 4 hatch when releasing it from its ditching stop position. The hatch swings down and inward and may strike the person standing on the rope ladder.

The hatch can be opened from the outside by pulling the release ring adjacent to the hatch. The release ring is attached to the hinge pins by cable mechanical linkage. When the release ring is pulled, the hatch hinge pins are disengaged and the hatch falls slightly outboard, then to the cargo deck inside the aircraft.

CREW ENTRANCE AND TROOP DOORS - Can be opened from the inside by rotating the release handle pulling inboard, and sliding up in the tracks. Can be opened from the outside by pulling and rotating the release handle, pushing the door in, and sliding up in the tracks. The cargo doors may be opened for emergency exit as may the pilot's and copilot's side windows.

GROUND OPERATIONS.

AUXILIARY POWER UNIT FIRE - CREW NOT IN PLACE CHECKLIST.

FLIGHT ENGINEER

1. APU FIRE HANDLE - PULLED
2. AGENT - DISCHARGED
3. POWER SELECT SWITCH - AS REQUIRED

Attempt to power the aircraft from any available source.

4. CREW/TOWER - NOTIFIED

Notify the available personnel to use portable fire extinguishers as necessary. If communications are available with the tower, notify them of the nature of the emergency, aircraft number, and location.

SCANNER

1. GROUND EXITS - OPEN
2. TROOPS/CREW - EVACUATE

LOADMASTER

1. Ground Exits - OPEN
2. Troops/Crew - EVACUATE

FUSELAGE FIRE - CREW NOT IN PLACE CHECKLIST.

FLIGHT ENGINEER

1. CREW/TOWER - NOTIFIED

Notify the available personnel to use fire extinguishers as necessary. If communications are available with the tower, notify them of the nature of the emergency, aircraft number, and location.

SCANNER

1. GROUND EXITS - OPEN
2. TROOPS/CREW - EVACUATE

NOTE

If practical, close the troop oxygen manual shutoff valves prior to evacuation.

LOADMASTER

1. CREW/TOWER - NOTIFIED

Notify the available personnel to use fire extinguishers as necessary. If communications are available with the tower, notify them of the nature of the emergency, aircraft number, and location.

FLIGHT ENGINEER

2. POWER - OFF

APU, power selector switch, the MFSI, the battery switch, and MSU 1 and 2 will be turned off.

NOTE

If practical, close the crew oxygen manual shutoff valve prior to evacuation.

SCANNER

LOADMASTER

2. POWER - OFF

Power selector switch, the MFSI, the battery switch, and MSU 1 and 2 will be turned off.

3. GROUND EXITS - OPEN

4. TROOPS/CREW - EVACU ATE

NOTE

If practical, close the troop oxygen manual shutoff valves prior to evacuation.

FIRE ON THE GROUND.

If a fire occurs or if aircraft evacuation is required while on the ground, accomplish the applicable BOLD PRINT items, then call for and complete the Fire On The Ground checklist. If an engine or APU fire is reported or fire indication is observed while the aircraft is on the ground, accomplish all of the BOLD PRINT items, call for and complete the Fire On The Ground checklist. Because of the complex combinations of power sources and requirements that may exist during ground operations, care must be taken to fully analyze problem before corrective action is taken. The copilot will silence the audible fire alarm when activated.

PILOTS

1. BRAKE SELECTOR - "EMERGENCY" (P, CP)

2. FIRE HANDLE - "PULLED" (P, E)

If a fire is indicated, the pilot will pull the engine fire handle or direct the engineer to pull the APU fire handle.

3. AGENT - "DISCHARGED" (P, E)

If fire indication persists, the pilot will discharge the agent to the engine or direct the engineer to discharge the agent to the APU. If fire persists, move bottle select switch to ALTERNATE and discharge agent.

4. Parking Brake - "SET" (P)

5. Ground/Flight Crew - "NOTIFIED" (P, CP)

FLIGHT ENGINEER

1. Brake Selector - EMERGENCY (P, CP)

2. Fire Handle - "PULLED" (P, E)

Pull the APU fire handle on the pilot's command. For engine fire, ensure the correct fire handle was pulled.

3. Agent - "DISCHARGED" (P, E)

Discharge the agent to the APU on the pilot's command. For engine fire, ensure the agent was discharged, if needed.

4. Parking Brake - "SET" (P)

5. Ground/Flight Crew - NOTIFIED" (P, CP)

SCANNER/LOADMASTER

PILOTS

The pilot will notify the flight and ground crews of the emergency. If a fire occurs in the fuselage or aircraft compartment, the pilot will direct all crewmembers not engaged in required duties to fight the fire. The copilot will notify ground/tower of the nature of the emergency, aircraft number, and aircraft location.

6. Ground Exits - "OPEN" (P), "OPENING" (S/LM/MCD)

Direct the Scanner/Loadmaster to open ground exits as required.

7. Fire Handles - "AS REQUIRED" (P, E)

Pull all remaining fire handles prior to A/C evacuation.

8. Troops/Crew - "AS REQUIRED" (P)

Direct evacuation if necessary.

9. MFSI - "AS REQUIRED" (P)

10. INS 1 and 2 - "AS REQUIRED" (P)

NOTE

If practical, close the crew oxygen manual shutoff valves prior to evacuation.

FLIGHT ENGINEER

8. All Boost Pumps - OFF

9. Crossfeeds - CLOSED

6. Ground Exits - "OPEN" (P), "OPENING" (S/LM/MCD)

7. Fire Handles - "AS REQUIRED" (P, E)

Pull APU fire handle on pilot's command.

8. Troops/Crew - "AS REQUIRED" (P)

9. MFSI - "AS REQUIRED" (P)

10. INS 1 and 2 - "AS REQUIRED" (P)

11. Power Select Switch - AS REQUIRED

12. Battery - AS REQUIRED

SCANNER/LOADMASTER

1. Ground Exits - "OPEN" (P), "OPENING" (S/LM/MCD)

Open the ground exits as directed by the pilot.

2. Troops/Grew - "AS REQUIRED" (P)

If the pilot directs evacuation, acknowledge and evacuate the troops.

NOTE

It practical, close the troop oxygen manual shutoff valves prior to evacuation.

TAKE-OFF.

ABORT PROCEDURES.

If the take-off must be aborted, use the following procedures:

1. Retard all throttles to REV IDLE, and state "SPOILERS."

The copilot will place the spoiler lever to the GROUND position.

2. Use symmetrical reverse thrust as required.

CAUTION

Do not apply asymmetrical engine power unless absolutely necessary.

3. Apply brakes as required.

4. After rollout, determine reason for abort, and take necessary corrective action.

5. Refer to brake limits chart in Section V.

6. Accomplish After Landing Checklist.

BRAKE LIMITATIONS.

Taxi.

Tires generate heat when in motion regardless of braking. During operation, this heat rise is expected and can be formidable depending on several factors: taxi speed, taxi distance, number of turns, ambient temperature, and correct tire inflation pressure.

NOTE

The brake limit chart in this TO and TO 1C-141B-1-1 does not take into account taxi distances.

Aborted Take-off, No Braking.

If brakes are not used, a second take-off may be initiated.

WARNING

Before a second take-off is attempted, the possibility of a second rejected takeoff must be considered. Published RTO distances no longer apply since the wheels and brakes will probably have been subjected to a long duration taxi operation.

Aborted Take-off, With Braking, or Braked Landings.

If the brakes are used, determine the amount of kinetic energy absorbed by the brakes from figure 5-10. If this does not exceed 6 million foot-pounds per brake, another take-off may be attempted provided the reason for the rejected take-off is corrected. If the kinetic energy absorbed exceeds 6 million foot-pounds, comply with the limitations of figure 5-10. If taxiing back for a second take-off and brakes are reported between 6 and 18 million foot-pounds, taxi time will not be included as part of the cooling time. Taxiing or setting the parking brake invalidates charted cooling time. In an emergency situation, when the aircraft must be evacuated from a forecasted hazardous weather area or forward combat area and the kinetic energy exceeds 6 million foot-pounds but is less than 18 million foot-pounds, a take-off may be made. Leave the landing gear down after lift-off for two minutes for each one million foot-pounds above 6 million foot-pounds.

WARNING

If a second rejected take-off is made, heat buildup will invalidate figure 5-10. The brake energy limits may be exceeded causing blown fuse plugs and fire. Practice rejected take-offs shall not be accomplished.

High Energy Aborted Take-offs or Braked Landings.

Any braking effort between 18 to 27 million foot-pounds must be handled with caution.

WARNING

If excessive braking has been used during an emergency stop and the brakes are reported overheated, the aircraft should not be taxied any more than necessary to clear the runway. Maneuver the aircraft into an uncongested area, chock the nose gear, and release the parking brake for the prescribed cooling. Taxi time will not be included in cooling time calculations. Do not approach overheated brakes for 45 minutes.

Braking efforts above 27 million foot-pounds may cause damage to the brakes, blown fuses, or fire. Braking efforts significantly above 39.4 million foot-pounds will melt wheel and brake assemblies and probably cause damage to landing gear structure. Approach only from front or rear for fire fighting. Hydraulic fluid fire may be imminent. Use dry chemical fire extinguisher if possible. However, if other extinguishers must be used, apply as fog or foam and do not spray directly on wheels. After brakes have cooled, they should be removed and replaced.

IN-FLIGHT.

ENGINE FAILURE/FIRE DURING TAKE-OFF.

If an engine failure/fire occurs after passing go speed, the take-off should be continued (figure 3-4).

Loss of an outboard engine during take-off requires immediate and positive corrective action to maintain directional control. Rapidly establish a bank angle of at least 5 degrees (7 degrees of bank and/or 50 percent of wheel throw with two engines out on the same side) away from the dead engine before reaching full rudder input. Both motions should occur almost simultaneously so that directional control can be maintained.

Climb performance may be marginal at heavy gross weights. The landing gear should be retracted when a positive rate of climb is observed. If obstacle clearance is a factor or additional climb performance is required, climb at Vmco until reaching at least 1,000 feet AGL and clear of the obstacle.

WARNING

Do not exceed 15 degrees of bank when climbing at Vmco with flaps at TAKE OFF/APPROACH.

Accelerate to Vmfr, retract flaps, then accelerate to 3-engine/2-engine climb schedule or a maneuvering speed of 200 KCAS.

If safe altitude cannot be maintained with available thrust, jettison fuel and land as soon as possible. Refer to the Fuel Jettison checklist.

Loss of Two Engines.

Consideration should be given to selecting rudder pressure override and autopilot control to ease pilot workload. Experience has shown that a flap setting of 40% has allowed heavy-weight aircraft to take advantage of the maximum lift over drag coefficient. This 40% setting produced enough lift while giving the aircraft time, with the least amount of drag, to first climb above terrain and then accelerate to a better margin above stall speed. Changing flap setting under these conditions must be accomplished slowly and judiciously.

ENGINE FAILURE DURING CLIMB.

Engine failure during climb is not considered critical provided the recommended climb speed schedule is maintained. The recommended three-engine climb speed is 250 knots until reaching 10,000 feet, then 260 knots until reaching 0.65 Mach, then 0.65 Mach up to cruise altitude. The recommended two-engine climb speed is 220 KCAS until reaching 0.45 Mach, then 0.45 Mach up to cruise altitude.

ENGINE FAILURE DURING CRUISE.

Failure of an engine during cruise will not appreciably affect directional control, but will result in a slower cruise speed and decrease the optimum altitude. The type cruise procedure being flown will dictate whether a climb to optimum cruise altitude or descent is required. Overall range will be reduced appreciably with the loss of an engine. If loss of thrust is experienced on one or more engines while flying above the 3- or 2-engine cruise ceiling, begin descent and set NRT. When the descent is established, drift-down will be accomplished using the cruise KCAS being flown prior to engine failure. It will be maintained until the appropriate cruise altitude is approached, then transition to cruise airspeed/Mach, as required.

ENGINE SHUTDOWN CONDITIONS.

The following conditions require immediate engine shutdown:

1. Engine fire.
2. Engine disintegration.
3. Extreme engine vibration.

WARNING

When an engine fails or is shut down for engine fire, disintegration, or extreme vibration, the other engine, wing, landing gear, and fuselage on the side of the failed engine may have suffered significant collateral damage. Instrument readings on the other engine may indicate normal operation after sustaining substantial damage. Upon landing shut down the remaining engines as soon as possible. Inspect all engines as soon as possible. Inspect the entire aircraft for collateral damage prior to continued operation.

The following malfunctions may not require immediate engine shutdown:

1. Oil pressure out of limits.
2. High oil temperature.
3. Low oil quantity.
4. Excessive EGT.
5. Starter disintegration.
6. Clogged fuel filter.
7. CSD will not disconnect.
8. High EVI.

ENGINE MALFUNCTIONS	
INDICATIONS	**RECOMMENDED ACTION**
Oil pressure above 60 PSI	Shut down if not needed for flight.
Oil pressure 35-40 PSI or 55-60 PSI	Monitor until completion of flight.
Oil pressure below 35 PSI	Shut down if not needed for flight.
Oil pressure below 35 PSI during deceleration	Acceptable if pressure returns to 35 PSI or higher within 10 minutes.
Oil temperature high	Advance throttle for cooling.
Oil temperature over 120°C	Shut down if not needed for flight.
LOW OIL QTY light	Advisory, shut down only if temperature or pressure goes out of limits.
LOW OIL PRESSURE light	Either low oil pressure or clogged filter indicated; shut down if not needed for flight.
STARTER VALVE OPEN light	Shut down if not needed for flight, only if starter disintegration has occurred.
Excessive Vibration	Do not shut down based solely on EVI. Attempt to isolate cause to engine driven accessory. Shut down if failure is confirmed by abnormal engine indications or vibration in the throttles or airframe.

EMERGENCY ENGINE SHUTDOWN CHECKLIST.

If an engine fire indication occurs (steady light with an audible warning), pylon fire/overheat indication occurs (flashing light), or an engine malfunction occurs that requires shutting an engine down, accomplish the boldface items and call for the Emergency Engine Shutdown checklist. Retarding the throttle to IDLE START prior to accomplishing the boldface is permissible.

NOTE

In bright sunlight, it is possible that the warning lights in the fire handles may not be visible. If an audible fire alarm should sound, shading the handles may be required to determine which one is illuminated.

PILOTS	FLIGHT ENGINEER	SCANNER
1. "No. _ FIRE HANDLE - PULLED" (P)	1. No. _ Fire Handle - PULLED (P)	
Confirm the proper fire handle identified.	Ensure the proper fire handle is pulled.	
2. AGENT - "AS REQUIRED" (P)	2. Agent - AS REQUIRED (P)	
If an engine fire indication persists after the fire handle is pulled, discharge the agent. If fire continues after first bottle, move Bottle Selector switch to ALTERNATE position, and discharge the agent.	Ensure the agent was discharged, if needed.	

PILOTS	FLIGHT ENGINEER	SCANNER
WARNING • When fire indication extinguishes, test fire/overheat warning system to ensure proper operation. • If an engine fire has been extinguished by using one bottle only, do not move the Bottle Select Switch for that wing to its alternate position. A bottle will then be available if a fire should occur in the other engine on that side.		
3. No. _ Throttle - "No. _ IDLE START" (P)	3. No. _ Throttle - "No. _ IDLE START" (P)	
4. No. _ Fuel and Ignition - "No. _ STOP" (P)	4. No. _ Fuel and Ignition - "No. _ STOP" (P)	
5. Engine/Pylon Scan - "AS REQUIRED" (P/CP, S)	5. Engine/Pylon Scan - "AS REQUIRED" (P/CP, S)	1. Engine/Pylon Scan - "AS REQUIRED" (P/CP, S)
	6. Boost Pumps - OFF Affected engine.	
	7. Crossfeed - CLOSED	
	8. Bleed Valve - CLOSED	
	9. Generator - OFF	
6. No. _ Engine Anti-Ice - "OFF" (P)	10. No. _ Engine Anti-Ice - "OFF" (P)	
	11. Performance Data - AS REQUIRED If applicable, provide 3-engine altitude, NRT, and fuel remaining to the pilot.	
	12. Emergency Engine Shutdown Check - "COMPLETED" (E)	

AIR START CHECKLIST.

If multiple engines flame out for other than mechanical reasons, improved air start capability will result if the Fuel and Start Ignition Switch is placed to AIR START before an appreciable reduction in RPM has occurred. If engine failure is due to improper operating technique or fuel starvation, an air start can usually be accomplished to restore normal engine operation. If the engine failure was caused by mechanical failure, an air start should not be attempted. The scanner will be in the cargo compartment on interphone to scan the engine during air start.

CAUTION

Do not attempt to restart an engine that was shut down because of fire or mechanical failure unless, in the opinion of the aircraft commander, a greater emergency exists. A recurrence of the emergency could be more serious than the first occurrence.

PILOTS

1. Continuous Ignition - "ON" (P)
2. Throttle - "IDLE START" (P)
3. Fire Handle - "IN" (P)
4. Fuel Enrichment Switch - "ON" (P)
5. Airspeed Between 178 and 350K/0.825M - "WITHIN LIMITS" (P)
6. Fuel and Ignition - "AIR START" (P)

NOTE

Fuel and Start Ignition Switch must be held in AIR START until start indications are observed.

A start should occur within 30 seconds as indicated by increase in RPM and EGT. If the air start is unsuccessful, place the Fuel and Start Ignition Switch to STOP. (Place the fuel enrichment switch to OFF and accomplish the Emergency Engine Shutdown checklist.)

FLIGHT ENGINEER

1. Main Generator Control Switch - OFF
2. Continuous Ignition - "ON" (P)
3. Continuous Ignition Circuit Breaker - OPEN (Affected engine)
4. Throttle - "IDLE START" (P)
5. Fire Handle - "IN" (P)
6. Main Boost Pump - ON
7. Fuel Enrichment Switch - "ON" (P)
8. Airspeed Between 178 and 350K/0.825M - "WITHIN LIMITS" (P)
9. Fuel and Ignition - "AIR START" (P)
10. Oil Pressure - CHECKED
11. Engine Instruments - CHECKED
12. Bleed Valve - OPEN
13. Generator - ON

NOTE

Turn the main generator switch on after the engine has accelerated to approximately 50% N_2 RPM.

14. Continuous Ignition Circuit Breaker - CLOSE (Affected engine)

PILOTS

NOTE

- If initial restart attempt is unsuccessful, consider changing altitude to increase outside air temperature for subsequent attempt(s).
- If the engine has been cold soaked, the low oil pressure light may remain illuminated for two minutes after the oil temperature reaches 40 degrees centigrade at idle RPM. Advise the flight engineer to monitor the engine oil pressure closely for proper indications.

7. Engine Anti-Ice - "AS REQUIRED" (P)
8. Fuel Enrichment Switch - "OFF" (P)

FLIGHT ENGINEER

15. Engine Anti-ice - "AS REQUIRED" (P)
16. Fuel Enrichment Switch - "OFF" (P)
17. Fuel Management - AS REQUIRED
18. Air Start Check - "COMPLETED" (E)

THRUST REVERSER FAILURE.

Thrust Reverser Pressure On Light Illuminated.

Assume that the actuator is pressurized and ensure maintenance after landing.

Thrust Reverser Unlocked Indication.

CAUTION

If no aircraft yaw is experienced, do not rapidly retard the throttle to IDLE START, as this may cause the thrust reverser to open.

1. Throttle - IDLE START (P)
2. THRUST REV POS IND & THRUST REV PRESS VALVE PWR circuit breakers - CLOSED (E)
3. Affected Engine - SCAN (S)

If thrust reverser scans closed, continue at normal cruise speed. Maintain a periodic scan of the engine to verify it remains closed.

If thrust reverser scans not closed:

4. Begin descent to 20,000 feet or less. Conditions permitting, consider slowing to 200 KCAS in the descent. This should minimize the yaw effects of a thrust reverser gaping open.

Thrust reverser retraction may be attempted at higher altitudes, but the pilot must check:

a. Stall speed in the clean and approach configuration.
b. Flap retract speed.

5. Airspeed - Extend flaps to approach and reduce to 135 KCAS.

NOTE

Increasing thrust on the affected engine may aid in closing the thrust reverser.

6. If the thrust reverser retracts, land as soon as possible.
7. If the thrust reverser cannot be retracted, aircraft performance may be seriously degraded. Do NOT open the THRUST REV POS IND or THRUST REV PRESS VALVE PWR circuit breakers. This action may result in loss of pressure to the thrust reverser actuators causing the thrust reverser to further extend, increasing the drag. Perform a controllability check if conditions allow and land as soon as possible.

CAUTION

Following a thrust reverser opening in-flight, TO IC-141B-6 pylon inspection requirements will be accomplished prior to next flight.

SMOKE AND FUME ELIMINATION CHECKLIST.

All odors, smoke or fumes will be considered toxic. If the pressurized area is rapidly filling with smoke from a fuselage fire, it is essential that action be initiated to protect the crew and passengers from potentially dangerous smoke. Ventilate the aircraft to suppress the fire or smoke.

PILOTS	NAVIGATOR	FLIGHT ENGINEER	SCANNER/ LOADMASTER
1. **OXYGEN MASK AND GOGGLES - ON/100%**	1. **OXYGEN MASK AND GOGGLES - ON/100%**	1. **OXYGEN MASK AND GOGGLES - ON/100%**	1. **OXYGEN MASK - ON/100%**
Pilot will direct all crewmembers not engaged in control of aircraft to assist as necessary.			Don goggle/smoke mask if required. The scanner and loadmaster will have their oxygen mask connected to the aircraft oxygen system or to a portable oxygen bottle as the situation dictates.

PILOTS	FLIGHT ENGINEER	SCANNER/LOADMASTER
	2. **FLIGHT STATION AIR FLOW SWITCH - MAX**	
	3. **AIR CONDITIONING MASTER SWITCH - AS REQUIRED** • Both packs operational - Select BOTH • One pack inoperative - Select Operating Pack • Both packs inoperative - Select RAM **NOTE** If origin of smoke, fumes or fire can be isolated to the electrical system after steps 1 through 3 have been accomplished, discontinue this checklist and accomplish the Electrical Fire checklist starting with step 2.	

PILOTS	FLIGHT ENGINEER	SCANNER/LOADMASTER
2. CDS Cooling Fan Switch - "AS REQUIRED" (P, CP) **WARNING** If smoke/fumes are entering the cockpit from the underdeck areas, place the CDS Cooling Fan Switch to OFF.	4. CDS Cooling Fan Switch - "AS REQUIRED" (P, CP)	
3. Autopilot - "AS REQUIRED" (P). Use the autopilot, when feasible, to help control the aircraft.	5. Autopilot - "AS REQUIRED" (P)	
4. Flight Station Door - "AS REQUIRED" (P, S)	6. Flight Station Door - "AS REQUIRED" (P, S) **WARNING** With smoke/fumes on the flight deck, open the door.	2. Flight Station Door - "AS REQUIRED" (P, S)
5. Pressurization - "AS REQUIRED" (P)	7. Pressurization - "AS REQUIRED" (P) If not suppressing fumes, and smoke is not clearing, depressurize. Cargo fumes created by gases evolved from liquids may be reduced by using maximum cabin pressurization and turning the floor heat off. If the problem still exists, descend to a lower altitude and consider cargo jettison. a. Cabin Altitude Limit Override Switch - ORIDE	

PILOTS

6. No. 1 Hatch - "AS REQUIRED" (P, S)

FLIGHT ENGINEER

b. Use auto or manual controller as the situation dictates.

WARNING

Do not place the system shutoff switches to OFF, air conditioning master switch to OFF, wing pylon and air conditioning compartment overheat switches to TEST, or emergency depressurization switches to DEPRESS. This will cause the flight compartment to rapidly fill with smoke/fumes.

8. Floor Heat Switch - OFF

9. No. 1 Hatch - "AS REQUIRED" (P, S)

If there is an immediate need to clear the flight deck or if the cargo area fire is out and further ventilation is required, consideration should be given to opening the No.1 hatch once depressurized.

SCANNER/LOADMASTER

3. Troop Oxygen Regulators - AS REQUIRED (S/LM)

WARNING

If fire is being fed by oxygen from the troop system, consideration should be given to turning system off using manual shutoff valves until fire is suppressed.

4. Therapeutic Oxygen Manual Shutoff Valve - AS REQUIRED (S/LM)

5. Assist Passengers to Don Oxygen Masks (S/LM)

NOTE

Putting a wet towel or handkerchief over the nose and mouth, or over the oxygen mask when utilized, affords better protection from smoke and fumes. Relocate the passengers as necessary.

6. No.1 Hatch - "AS REQUIRED" (P, S)

WARNING

- The flight deck will momentarily fill with smoke being drawn forward from the underdeck or cargo compartment area.
- The flight station door must be open prior to opening No. 1 hatch. It will take approximately 70 pounds of pull at 200 KCAS to remove the No. 1 hatch when unpressurized.

PILOTS	FLIGHT ENGINEER	SCANNER/LOADMASTER
7. No. 4 Hatch - "AS REQUIRED" (P, S/LM)	10. No. 4 Hatch - "AS REQUIRED" (P, S/LM) If additional ventilation is required, open No. 4 hatch to assist in venting smoke/fumes.	7. No. 4 Hatch - "AS REQUIRED" (P, S/LM)

When smoke, fumes, or the fire emergency is resolved, consideration may be given to restoring aircraft to normal configuration as follows:

PILOTS	FLIGHT ENGINEER	SCANNER/LOADMASTER
8. No. 4 Hatch - "AS REQUIRED" (P, S/LM)	11. No. 4 Hatch - "AS REQUIRED" (P, S/LM) No. 4 hatch may be closed in-flight with little effort.	8. No. 4 Hatch - "AS REQUIRED" (P, S/LM)
9. No. 1 Hatch - "AS REQUIRED" (P, S)	12. No. 1 Hatch - "AS REQUIRED" (P, S)	9. No. 1 Hatch - "AS REQUIRED" (P, S)
	13. Floor Heat Switch - AS REQUIRED	10. Troop Oxygen Regulators - AS REQUIRED (S/LM)
10. CDS Cooling Fan Switch - "AS REQUIRED" (P, CP)	14. CDS Cooling Fan Switch - "AS REQUIRED" (P, CP)	11. Therapeutic Oxygen Manual Shutoff Valve - AS REQUIRED (S/LM)
11. Pressurization - "AS REQUIRED" (P)	15. Pressurization - "AS REQUIRED" (P)	
	16. Air Conditioning Master Switch - AS REQUIRED **WARNING** Do not position cabin altitude limit override switch to NORMAL until cabin altitude is below 13,000 feet. Repressurize to the desired cabin altitude with auto or manual controller.	
	17. Flight Station Air Flow Switch - AS REQUIRED	
	18. Smoke and Fume Elimination Check - "COMPLETED" (E)	

WING FIRE CHECKLIST.

PILOTS

1. Wing Scan - "AS REQUIRED" (P/CP, S)

The pilot will direct the scanner to visually check affected wing for exact location of fire and for structural damage.

If the fire cannot be extinguished, land as soon as possible, prepare to abandon the aircraft, crash land, or ditch. Increasing airspeed will sometimes aid in extinguishing the fire.

2. Flight Control Switches - "SET" (P, CP)

FLIGHT ENGINEER

1. Wing Scan - "AS REQUIRED" (P/CP, S)
2. Affected Wing:
    a. Crossfeeds - CLOSED
    b. Boost Pumps - OFF
    c. Generators - OFF
    d. Bleed Valves - CLOSED
    e. Hydraulic System Valves and Suction Boost Pump Switches - OFF
3. Flight Control Switches - "SET" (P, CP)
4. Center Separation Valve - CLOSED
5. Wing Isolation Valve - NORMAL

SCANNER

1. Wing Scan - "AS REQUIRED" (P/CP, S)

If the fire extinguishes, perform the following if required:

FLIGHT ENGINEER

6. Boost Pumps - AS REQUIRED

Do not use boost pumps that were operating at time of fire.

7. Generators - AS REQUIRED

Turn generators ON only if needed.

8. Bleed Valves - AS REQUIRED

Open bleed valves only if needed.

9. Hydraulic System - AS REQUIRED
    a. Suction Boost Pump - ON
    b. Hydraulic System Valves - NORMAL

PILOTS	FLIGHT ENGINEER	SCANNER
	Actuate one at a time, and monitor appropriate hydraulic system quantity and pressure.	
3. Flight Control Switches - "AS REQUIRED" (P, CP)	10. Flight Control Switches - "AS REQUIRED" (P, CP)	
	11. Wing Fire Check - "COMPLETED" (E)	

BLEED AIR SMOKE CHECKLIST.

Any system suspected of causing smoke or fumes should be isolated first; i.e., if smoke comes from flight station gaspers, isolate the left pack.

PILOTS	NAVIGATOR	FLIGHT ENGINEER	SCANNER/ LOADMASTER
1. **OXYGEN MASK AND GOGGLES - ON/100%**	1. **OXYGEN MASK AND GOGGLES - ON/100%**	1. **OXYGEN MASK AND GOGGLES - ON/100%**	1. **OXYGEN MASK - ON/100%**
		2. Bleed Valves (Suspected Side) - CLOSED	Don goggles/smoke mask if required. The scanner/loadmaster will have their oxygen connected to the aircraft oxygen system or to a portable oxygen bottle as the situation dictates.
		3. Wing Isolation Valve - OPEN	

IF SMOKE STOPS

4. Isolation Valve - NORMAL
5. Bleed Valves (Suspected Side) - Open to identify malfunctioning engine. Once identified, leave bleed valve closed.

NOTE

With one bleed valve closed, open the wing isolation valve when wing anti-icing is required.

IF SMOKE CONTINUES

4. Isolation Valve - NORMAL
5. Air Conditioning Master Switch - Operating Pack
6. Bleed Valves - OPEN

NOTE

Report the system status/configuration to the pilot.

BLEED DUCT OVERHEAT CHECKLIST.

Following a bleed duct overheat, the bleed valves will either be both OPEN, or both CLOSED. If a bleed valve fails to close normally in item 4 or fails to open in item 7, the remaining bleed valve will be closed also. EXCEPTION: If unable to exit icing conditions and in the opinion of the pilot a greater emergency exists, the following procedure may be used to remove ice from the wing: Periodically cycle all wing anti-ice switches and the good bleed air valve shutoff switch on the affected side to ON and OPEN for 15 seconds.

PILOTS

1. Wing Scan - "AS REQUIRED" (P, CP, S)

The pilot will direct the scanner to visually check both wings for evidence of fire or structural damage.

FLIGHT ENGINEER

1. Wing Scan - "AS REQUIRED" (P, CP, S)

Continue with the checklist while the wing scan is being accomplished.

2. System Shutoff Switch - CLOSED

SCANNER

1. Wing Scan - "AS REQUIRED" (P, CP, S)

NOTE

If evidence of fire is discovered, discontinue this checklist and accomplish the Wing Fire checklist starting with flight engineer's step 2.

PILOTS

2. Wing Anti-Ice Switches - "OFF" (P)

FLIGHT ENGINEER

3. Wing Anti-Ice Switches - "OFF" (P)
4. Bleed Valves - CLOSED Affected side only.

If a bleed air valve remains open, reduce power and attempt to close valve. If the valve does not close, shut down the engine if not needed for flight.

5. Wing Isolation Valve - NORMAL
6. Wing, Pylon, and Air Conditioning Compartment Switch - RESET

If bleed air is needed for aircraft pressurization or wing anti-icing, the following steps can be used to regain the system. If bleed air is not needed, proceed to step 10.

CAUTION

If the overheat light illuminates during any of the following items, return the system to the configuration in the preceding item.

PILOTS	FLIGHT ENGINEER	SCANNER
	7. Bleed Valves - OPEN	
	If one failed to close normally and the procedure was used in item 4, do not attempt to open it. Leave the remaining bleed valve closed.	
	8. System Shutoff Switch - OPEN	
3. Wing Anti-Ice - "AS REQUIRED" (P)	9. Wing Anti-Ice - "AS REQUIRED" (P)	
	If a bleed duct overheat recurs during activation of any wing anti-ice switch, position the affected switch off. Operation of the other wing anti-ice sections is permissible.	
	10. Air Conditioning Master Switch - AS REQUIRED	
	11. Bleed Duct Overheat Check - "COMPLETED" (E)	

WING ANTI-ICE OVERHEAT.

If the wing anti-ice overheat light illuminates and wing anti-icing is necessary:

1. Appropriate Wing Anti-Ice Switch - "OFF" (P)

Begin timing overheat duration.

2. Wing Scan - "AS REQUIRED" (P, S)

The pilot will direct the scanner to visually check the affected wing for evidence of fire or structural damage. Continue with the checklist while the scan is being accomplished. If evidence of fire is discovered, discontinue this checklist and accomplish the Wing Fire checklist starting with flight engineer's step 2.

If the overheat light extinguishes within 30 seconds:

Periodically cycle affected wing anti-ice switch from OFF to ON for approximately 15 seconds to provide symmetrical de-icing.

If the overheat light does not extinguish within 30 seconds:

3. Wing Anti-Ice Switches - "OFF" (P)
4. Wing Isolation Switch - NORMAL
5. Bleed Air Shutoff Switches (Affected Side) - CLOSED
6. Air Conditioning Master Switch - OPERATING SIDE

During remainder of icing condition, periodically cycle all wing anti-ice switches and one bleed air shutoff switch on the affected side to ON and OPEN for 15 seconds.

ELECTRICAL FIRE CHECKLIST.

When an electrical fire occurs, attempt to isolate the faulty circuit. If the faulty circuit cannot be quickly identified, this checklist will be accomplished item by item until the faulty circuit has been isolated. Accomplish the portion "When the fire goes out" after the fire stops.

The following units/equipment remain powered throughout this checklist:

Main AC Distribution Center
Generator Protection Panels
Emer Gen Power & Test
INSs on INS Battery Power
All Voltage Regulators
Top Half of Engineer's Elec Panel (Freq and Volt Meters)
MFSI

WARNING

Following power changes, the INSs may fault, displays turn red, accompanied by INS 1/2 - INOP annunciator lights. Normal operation may be restored by clearing the INS Action/Malfunction Codes.

PILOTS

1. **OXYGEN MASK AND GOGGLES - ON/100%**

The pilot will direct all crewmembers to don oxygen/smoke masks/goggles (as appropriate) and to select 100% oxygen.

As directed by the pilot, all crewmembers not engaged in control of the aircraft will proceed to fight the fire.

2. CDS Cooling Fan Switch - "AS REQUIRED" (P, CP)

WARNING

If Smoke/fumes are entering the cockpit from the underdeck areas, place the CDS Cooling Fan Switch to OFF.

NAVIGATOR

1. **OXYGEN MASK AND GOGGLES - ON/100%**

FLIGHT ENGINEER

1. **OXYGEN MASK AND GOGGLES - ON/100%**

2. CDS Cooling Fan Switch - "AS REQUIRED" (P, CP)

SCANNER/ LOADMASTER

1. **OXYGEN MASK - ON/100%**

Don goggles/smoke mask if required. The scanner and loadmaster will have their oxygen mask connected to the aircraft oxygen system or to a portable oxygen bottle as the situation dictates.

PILOTS

3. INS and Battery Units - "CHECKED" (P, S)

If the source of the electrical fire is in the underdeck area, check MFCDU scratch pad for INS ACTION CODES. If present, check the associated INS STATUS page to determine if an INU failure is indicated.

NAVIGATOR

FLIGHT ENGINEER

3. INS and Battery Units - "CHECKED" (P, S)

If the source of the electrical fire is in the underdeck area, the engineer will direct the scanner to check the INS and INS battery units because they remain powered throughout this checklist.

4. Crossfeeds - CLOSED

WARNING

Removing electrical power from the fuel boost pumps while the fuel crossfeed valves are in the crossfeed position will cause engine flameout as the fuel in the fuel manifold and crossfeed lines from the auxiliary and extended range tanks become depleted.

SCANNER/ LOADMASTER

2. INS and Battery Units - "CHECKED" (P, S)

If the source of the electrical fire is in the underdeck area, check the INS and INS battery unit for the source of the fire/ smoke.

3. Troop Oxygen Regulators - AS REQUIRED (S/LM)

WARNING

If fire is being fed by oxygen from the troop system, consideration should be given to turning system off using manual shutoff valves until fire is suppressed.

4. Therapeutic Oxygen Manual Shutoff Valve - AS REQUIRED (S/LM)

5. Assist Passengers to Don Oxygen Masks (S/LM)

NOTE

Putting a wet towel or handkerchief over the nose and mouth, or over the oxygen mask when utilized, affords better protection from smoke and fumes. Relocate the passengers as necessary.

PILOTS

4. VHF No. 1 Control Panel - "AS REQUIRED" (CP)
5. Inst Power Switch - "EMERGENCY" (P)
6. Emergency Pressurization Switches (Emergency DC Bus) - "EMERGENCY" (P)
7. Yaw Damper - "CHECKED" (P)

WARNING

If the yaw damper remains inoperative, descend to a lateral stability Zone 1 altitude (figure 3-22).

NOTE

Verify that the annunciator bar above AP1 pushbutton is not flashing. If it is, reset AFCP1 by pressing and momentarily holding the AP1 pushbutton.

If the SFD annunciates YAW DAMP INOP, reset the yaw damper.

8. Attitude and Heading - "AHRS" (P, CP)

FLIGHT ENGINEER

5. VHF No. 1 Control Panel - "AS REQUIRED" (CP)
6. Inst Power Switch - "EMERGENCY" (P)
7. Emergency Pressurization Switches (Emergency DC Bus) - "EMERGENCY" (P)
8. Yaw Damper - "CHECKED" (P)
9. Attitude and Heading - "AHRS" (P, CP)

WARNING

To prevent overload of the emergency generator, perform the following two steps.

CAUTION

If necessary for safety of flight, DU No. 4 and UHF No. 1 may be powered for five minutes out of every 30 minutes. This may cause the emergency generator to operate above continuous rated capacity.

PILOTS

9. DU No. 4 CB (11C) - "OPEN" (P)

NOTE

If DU No. 2 is inoperative, DU No. 4 may remain powered. DU No. 2 CB may be opened in lieu of DU No. 4 CB.

10. UHF No. 1 - "OFF" (CP)

FLIGHT ENGINEER

10. DU No. 4 CB (11C) - "OPEN" (P)
11. UHF No. 1 - "OFF" (CP)

PILOTS

11. Bus Disconnects - "OFF" (P, E)

The pilot will direct the engineer to turn OFF the first three bus power disconnect switches. If the fire continues, turn off the fourth disconnect switch.

FLIGHT ENGINEER

12. Bus Disconnects - "OFF" (P, E)

WARNING

- All four bus power disconnect switches should not be turned OFF unless the pilot considers the fire a greater hazard than the loss of electrical power.
- When the first three disconnect switches are OFF, ISOL AC and DC, ISOL Avionics AC and DC, and EMER AC and DC buses remain powered. AHRS heading information will be displayed after an 18-second delay.
- When all four disconnect switches are OFF, only the EMER AC and DC buses are powered. AHRS heading information is unavailable.

PILOTS

FLIGHT ENGINEER

With the emergency buses powered, the equipment that is still powered includes:

Operational Equipment with Emergency AC and DC Buses

AERP
AHRS (attitude only)
CADC No. 1
CDS Fan Control
CDS Fan No. 1
DAMU No. 1
DPU No. 1
DU No. 2
DU No. 4 (unless circuit breaker is open)
Emergency Power Control
Interphone (P, E only)
MFSI
Pilot Instrument Flood
Pilot Pitot Heat
Pressurization
Yaw Damper, via AP1

With the Isolated Buses Powered as well as the Emergency AC and DC Buses

UHF No. 1

VHF Comm No. 1
VOR No. 1

Emergency AC Bus

AFCP No. 1
AHRS Attitude #2 Exc - RSP 1 & 2 EXC (26V)
- AHRS
- AFCP No. 1
- AFCP No. 2
- DPU No. 1
- DPU No. 2
- RSP No. 1
- RSP No. 2

AHRS Prime Power
CADC No. 1
CDS Fan No. 1
Pitot Static Heater Head
PLT Pitot Static Head
26V AC Emerg Inst Trans
- CADC Airspeed Group No. 1 Exc
- CADC Alt Group No. 1 Exc
- Pitch Rate Adapter Exc AFCP No. 1

Emergency DC Bus

AERP Cargo Compartment
AERP FLT STA
AFCP No. 1
Cargo Compartment Warning Horn
CDS Fan Control
DAMU No. 1
DPU No. 1/CBC
DU No. 2
DU No. 4
Emer Press Switch LH & RH
Emergency Power Control
FCP/MSP No. 1
HF No. 1 ACS
HF No. 2 ACS
IJB No. 1/AHRS Control
Interphone System
Isolated Bus OFF Warning
LH and RH Air Pressure Regulator Valves
LH System Temp and Press Ind
MFSI SYS
Pitot EPR & Angle of Attack De-Ice
Pilot's Instrument Flood Lights
Rt Primary Heat Exchanger Temp Indicator
Rudder Servo No. 1

13. Bus Disconnects - "NORMAL" (P, E)

PILOTS | FLIGHT ENGINEER

NOTE

If the fire stops after any bus disconnect is turned off, attempt to isolate the faulty component. If the component cannot be identified and electrical power is needed on the other buses, all circuit breakers on the faulty buses may be opened, power restored, and circuit breakers closed one at a time until the faulty component is identified.

If the electrical fire persists: After turning off all four bus disconnect switches, the source of the fire is probably on the emergency AC or DC buses. Continue Flight Engineers' column checklist items 13 through 41.

PILOTS

12. Bus Disconnects "NORMAL" (P, E)
13. Emergency Pressurization Switches - "NORMAL" (P)
14. Inst Power Switch - "OFF" (P)
15. Attitude and Heading - "INS 2" (P, CP)

WARNING

Following power changes, the INSs may fault, displays turn red, accompanied by INS 1/2 INOP annunciator lights. Normal operation may be restored by clearing the INS Action/Malfunction codes.

NOTE

FD 2 and AP 2 should be operational at this time. Set copilot's PFD as desired by the aircraft commander.

16. Pilot's DU No. 1 - "SET" (P)

    Pilot's DAMU Display Control menu:

    a. Select - OUTBOARD

    b. Select - PFD

FLIGHT ENGINEER

13. Bus Disconnects - "NORMAL" (P, E)

CAUTION

Bus power disconnects will be returned to normal from right to left.

14. Emergency Pressurization Switches - NORMAL" (P)
15. Inst Power Switch - "OFF" (P)
16. Attitude and Heading "INS 2" (P, CP)
17. Pilot's DU No. 1 - "SET" (P)

PILOTS

Yaw Damper - "CHECKED" (P)

WARNING

If the yaw damper remains inoperative, descend to a lateral stability Zone 1 altitude. (See figure 3-22.)

NOTE

Verify that the annunciator bar above AP1 pushbutton is not flashing. If it is, reset AFCP1 by pressing and momentarily holding the AP1 pushbutton.

ıe SFD annunciates YAW DAMP INOP, reset yaw damper.

Pilot/Engineer Interphone Sources - "SWITCHED" (P, E)

t will switch to the jump seat cord.

CDS Fan No. 2 CB - "AS REQUIRED" (P, E)

WARNING

If smoke/fumes are entering the cockpit from the underdeck areas, OPEN the CDS Fan No. 2 CB.

Emer AC Bus Power Feeder CBs - "OPEN" (P, E)

Emer DC Bus Power Feeder CB - "OPEN" (P, E)

Depressurization - "AS REQUIRED" (P, E)

FLIGHT ENGINEER

18. Yaw Damper - "CHECKED" (P)

19. Pilot/Engineer Interphone Sources - "SWITCHED" (P, E)

Engineer will switch to navigator's cord.

20. CDS Fan No. 2 CB (13C) - "AS REQUIRED" (P, E)

21. Emer AC Bus Power Feeder CBs (13R, 14R, 15R) - "OPEN" (P, E)

22. Emer DC Bus Power Feeder CB (30L) - "OPEN" (P, E)

Review units/equipment that remain powered throughout the checklist if the fire has not gone out at this point.

23. Depressurization - "AS REQUIRED" (P, E)

If depressurization is required, the pilot and engineer will coordinate as to the method to be used. Use Auto or Manual Controller as the situation dictates.

WARNING

Do not turn off conditioned air as this will cause the flight station to rapidly fill with smoke.

PILOTS	FLIGHT ENGINEER

When the fire goes out:

After the faulty component or bus has been identified, restore electrical power to the operational buses as follows:

PILOTS	FLIGHT ENGINEER
	24. Cabin Limit Override - AS REQUIRED
23. Cabin Pressure Controller - "AS REQUIRED" (P, E) Pilot will state pressurization requirements.	25. Cabin Pressure Controller - "AS REQUIRED" (P, E)
	26. Emer AC Bus Power Feeder CBs - "CLOSED" (E)
	27. Emer DC Bus Power Feeder CB - "CLOSED" (E)
	28. Bus Disconnects - "NORMAL" (E)
24. Inst Power Switch - "NORMAL" (P)	29. Inst Power Switch - "NORMAL" (P)
25. Emergency Pressurization Switches - "NORMAL" (P)	30. Emergency Pressurization Switches - "NORMAL" (P)
26. CDS Fan No. 2 CB - "AS REQUIRED" (P, E)	31. CDS Fan No. 2 CB (13C) - "AS REQUIRED" (P, E)
27. CDS Cooling Fan Switch - "AS REQUIRED" (CP)	32. CDS Cooling Fan Switch - "AS REQUIRED" (CP)
28. DU No. 4 CB (11C) - "CLOSED" (P)	33. DU No. 4 CB (11C) - "CLOSED" (P)
29. Attitude and Heading - "AS REQUIRED" (P, CP)	34. Attitude and Heading - "AS REQUIRED" (P, CP)
30. UHF No. 1 - "ON" (CP)	35. UHF No. 1 - "ON" (CP)
31. AFCS/Yaw Damper - "CHECKED" (P)	36. AFCS/Yaw Damper - "CHECKED" (P)

WARNING

If the yaw damper remains inoperative, descend to a lateral stability Zone 1 altitude (figure 3-22).

NOTE

Verify that the annunciator bar above AP1 pushbutton is not flashing. If it is, reset AFCP1 by pressing and momentarily holding the AP1 pushbutton.

If the SFD annunciates YAW DAMP INOP, reset the yaw damper.

PILOTS

32. Pilot/Engineer Interphone Sources - "AS REQUIRED" (P, E)

33. VHF No. 1 Control Panel - "AS REQUIRED" (CP)

34. Flight Displays - "SET" (CP, P)

    a. DPUs

    b. Bearing Pointers

    c. Flight Director

    d. BDHIs

35. FMS - "CHECKED/REPROGRAMMING" (CP, P, N)

NOTE

The Navigator may perform these steps as directed.

    a. POWER UP Page - CHECKED/SET

    b. ROUTE - CHECKED/REACTIVATED

    c. PERF INIT Page - SET

    d. COMM/NAV Radios - CHECKED/ON

FLIGHT ENGINEER

37. Pilot/Engineer Interphone Sources - "AS REQUIRED" (P, E)

38. VHF No. 1 Control Panel - "AS REQUIRED" (CP)

39. Flight Displays - "SET" (CP, P)

40. FMS - "CHECKED/REPROGRAMMING" (CP, P, N)

PILOTS	FLIGHT ENGINEER	SCANNER/LOADMASTER
	41. Fuel Management - AS REQUIRED	6. Troop Oxygen Regulators - AS REQUIRED (S/LM)
	42. Electrical Fire Check - "COMPLETED" (E)	7. Therapeutic Oxygen Manual Shutoff Valve - AS REQUIRED (S/LM)

DOOR OPEN WARNING LIGHT ILLUMINATION.

1. Oxygen Masks - AS REQUIRED

Ensure troops are seated and on oxygen if necessary.

2. Therapeutic Oxygen Manual Shutoff Valve - AS REQUIRED

3. Descend - AS REQUIRED

4. Malfunctioning Door - IDENTIFIED

WARNING

A parachute or personnel restraining harness will be worn when inspecting the pressure door or ramp.

5. Take Appropriate Action

If the door open light extinguishes during depressurization and it cannot be determined what caused the light to illuminate, the flight may be continued at the discretion of the pilot with the aircraft pressurized below the point where the light illuminates.

If all doors are secured and it can be positively determined that the door open light illuminated because of a limit switch, the aircraft may be fully pressurized.

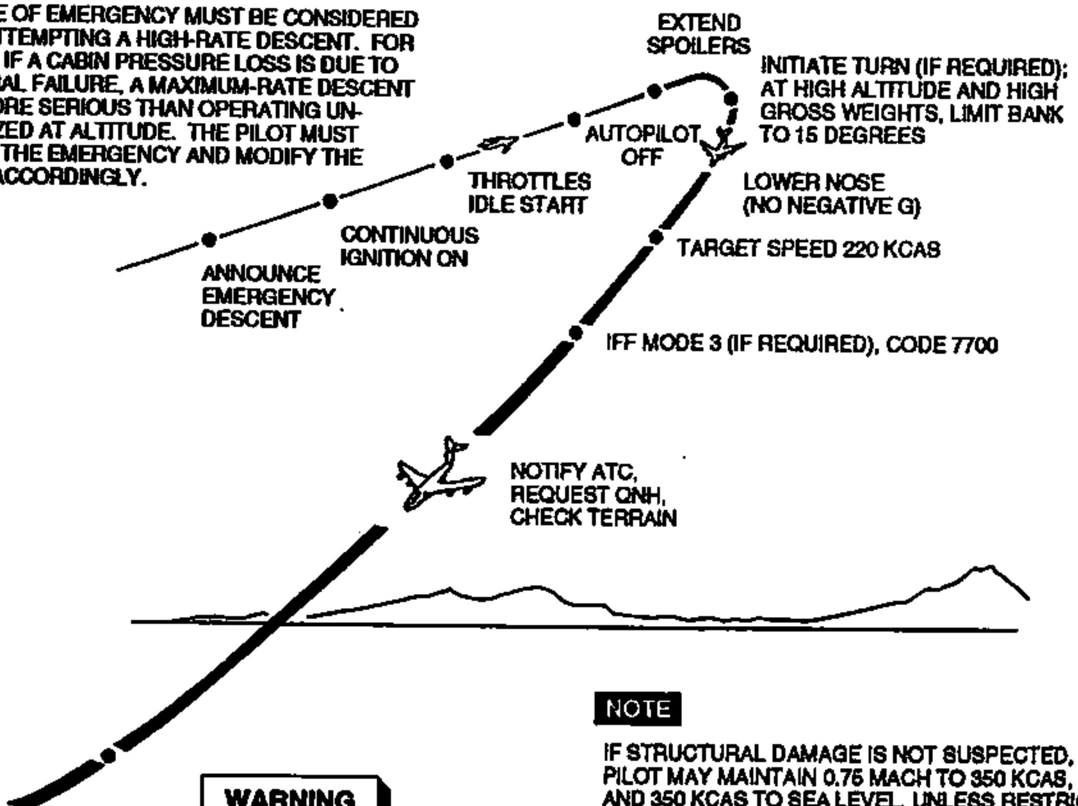
DOOR	ACTION
Stab Access	Do not exceed 280 KCAS; M = 0.75. Complete mission. Place door warning control switch to BY PASS.
Troop, Crew Entrance	Verify closed and locked. Place appropriate door warning control switch BY PASS. Do not attempt to unlock door.
Petal	1. Do not exceed 200 KCAS/0.48 Mach. 2. No. 3 Hydraulic System - ON 3. Door Arming Switch - OFF 4. Depress and hold the UNLOCKED side of petal door lock selector valve. 5. Depress and hold the CLOSED side of petal door selector valve. 6. Release the UNLOCKED side of petal door lock selector valve and depress the LOCKED side of petal door lock selector valve. If petal doors lock, continue mission. If petal doors do not lock, observe petal door limiting speeds and land as soon as practical.
Ramp (Pressurization Holding)	1. Inspect Ramp Safety Pins If OK: 2. Door Warning Control Switch - BY PASS If Abnormal: 3. Proceed with Pressurization Being Lost procedure.
Pressure (Pressurization Holding)	1. Inspect Aux Latches If Loose: 2. Door Warning Control Switch - BY PASS If Tight: 3. Proceed with Pressurization Being Lost procedure.
Ramp, Pressure (Pressurization Being Lost)	1. Depressurize 2. Air Conditioning Master Switch - OFF 3. Floor Heat - OFF 4. Cam Jacks - REMOVED 5. No. 3 Hydraulic System - ON 6. Door Arming Switch - ARMED 7. All Doors Switch - CLOSED If door will not close from the ADS panel, continue this procedure. 8. Door Arming Switch - OFF 9. Ramp/Pressure Door Selector Valve(s) - AS REQUIRED

FUSELAGE CRACKS.

If unexplained loud noises/bangs are heard by any crewmember, skin, window frame, or fuselage failure should be suspected. The aircraft should immediately be depressurized to 4.0 PSID maximum for the remainder of flight.

EMERGENCY DESCENT

THE CAUSE OF EMERGENCY MUST BE CONSIDERED BEFORE ATTEMPTING A HIGH-RATE DESCENT. FOR INSTANCE, IF A CABIN PRESSURE LOSS IS DUE TO STRUCTURAL FAILURE, A MAXIMUM-RATE DESCENT MAY BE MORE SERIOUS THAN OPERATING UNPRESSURIZED AT ALTITUDE. THE PILOT MUST CONSIDER THE EMERGENCY AND MODIFY THE DESCENT ACCORDINGLY.



NOTE

IF STRUCTURAL DAMAGE IS NOT SUSPECTED, THE PILOT MAY MAINTAIN 0.75 MACH TO 350 KCAS, AND 350 KCAS TO SEA LEVEL, UNLESS RESTRICTED BY SECTION V, PARTS IIIA, IIIB, IIIC, OR IV.

WARNING

TO REDUCE POSITIVE "G" LOADINGS ON THE EMPENNAGE, SPOILERS SHOULD BE RETRACTED SLOWLY, WITH POSSIBLE ADDITION OF ENGINE POWER. RAPID SPOILER RETRACTION DURING RECOVERY FROM A TRIMMED HIGH SPEED DESCENT WILL CONSIDERABLY INCREASE THE "G" LOADINGS ON THE EMPENNAGE.

Figure 3-1. Emergency Descent

RAPID DECOMPRESSION.

1. Oxygen Mask - ON/100% (ALL) Loadmaster will assist passengers in donning oxygen masks.

2. Crew and Troops - NOTIFIED

3. Emergency Warning Horn - OFF

4. Therapeutic Oxygen Manual Shutoff Valve - OPENED

5. Seat Belts - FASTENED (ALL) Loadmaster will ensure all passengers are seated with seat belts fastened.

6. Emergency Descent - AS REQUIRED. If passengers/patients are aboard, a maximum rate of descent should be initiated immediately, structural integrity permitting. Flight rules governing cargo-passenger aircraft require immediate descent to 25,000 feet altitude or below upon complete loss of cabin pressure.

7. Radar - AS REQUIRED

CAUTION

Set radar to STANDBY if cabin altitude exceeds 20,000 feet, and on aircraft modified by TCTO 520, (SKE equipped aircraft), turn NAV MFD OFF.

8. Scanner's/Loadmaster's Report - AS REQUIRED

9. Air Traffic Control - NOTIFIED

NOTE

Hydraulic System No. 1 suction boost pump PRESS. LOW light may illuminate due to the rapid change in differential pressure. If the indication is not accompanied by the engine system PRESS. LOW lights, the system should be left on.

FUEL JETTISON CHECKLIST.

The pilot will advise the engineer when to jettison and how much fuel to retain. The engineer will acknowledge and proceed with the fuel jettison checklist. The engineer will advise the pilot when jettison is complete.

WARNING

When the possibility of damaged or ruptured Fuel Dump valves or lines exists, the effect of jettisoning fuel from any tank must be carefully evaluated. If a fire exists, suspend fuel jettison operations by closing all dump valves and turning OFF all applicable boost pumps,

The scanner will verify and advise:

1. Both sides are jettisoning
2. Termination of jettisoning on both sides
3. No fuel fumes in cargo compartment.

The following precautions should be observed:

Do not jettison close to the ground.

Do not jettison in a circular, descending pattern.

Do not smoke during jettison.

WARNING

On aircraft equipped with defensive systems, ensure the CCU Jettison Arming switch is in the "SAFE" position and EMI Safety Pins are installed.

FLIGHT ENGINEER

1. Boost Pumps - ON

2. Crossfeeds - CLOSED

3. Left Separation Valve - OPEN

4. Center Separation Valve - CLOSED

5. Right Separation Valve - OPEN

6. Jettison Switches - JETTISON

CAUTION

While jettisoning fuel, maintain an amount of fuel in the outboard main tank and outboard auxiliary tank equal to fuel in the inboard main tank.

When desired amount of fuel has been jettisoned.

7. Applicable Boost Pumps - OFF

8. Jettison Switches - NORMAL

9. Left Separation Valve - CLOSED

10. Right Separation Valve - CLOSED

11. Fuel Management - AS REQUIRED

12. Report - "FUEL JETTISON COMPLETED" (E)

CARGO JETTISON.

Cargo should be jettisoned if altitude cannot be maintained and/or fuel requirements dictate.

Flight Deck Procedure:

WARNING

Return aircraft to a zero-degree deck angle prior to repositioning palletized cargo or airdrop platforms. Attempting to reposition pallets/platforms with the aircraft in a nose up/down deck angle may result in loss of control of the pallets/platforms.

NOTE

When cargo jettison is required under controlled conditions (i.e., gear separation, etc.), the flap setting and airspeed restrictions will be attained from TO 1C-141B-1-1. Compute the flap setting for approximately 2 degrees nose up deck angle, or 5 degrees nose up deck angle if required.

1. Altitude - 20,000 FEET MAXIMUM
2. Oxygen - AS REQUIRED
3. Pressurization - DEPRESSURIZE
4. No. 3 Hydraulic System - ON
5. Flaps - SET
6. Airspeed - 160 KCAS (Recommended)
7. Rudder Hi Press Override Switch - OVERRIDE (if two engines out on one side)

Loadmaster/Scanner Procedures:

Review restrictions at end of this section prior to jettisoning.

1. Aircraft Flight Limits - CALCULATED

WARNING

Palletized cargo/airdrop platforms may be repositioned in-flight in cases of extreme emergencies. Calculations will be made to ensure that aircraft CG limits are not exceeded during and after cargo jettison.

NOTE

For rigged ADS platforms, use normal airdrop procedures.

2. Passengers - BRIEFED/SECURED
3. Passenger Oxygen Masks - AS REQUIRED
4. Parachute/Restraint Harness - OBTAINED
5. Personal Oxygen Mask - AS REQUIRED

WARNING

Periodically check/refill oxygen bottle.

6. Therapeutic Oxygen Valve - AS REQUIRED
7. Right Rail Locks - ENGAGED/LOCKED

Retract and secure left rail retractable lips in pallet position No. 12.

8. Ramp Pallet - PREPARE TO JETTISON

Ensure right rail locks are engaged. Retract and secure all retractable lips. Retract aft lock, left side.

9. Pressure Door Cam Jacks and Aux Latches - REMOVED AND STOWED

CAUTION

Will not be accomplished until aircraft is depressurized.

10. Ramp Manual Safety Pins - REMOVED AND STOWED
11. Left Rail Locks - RETRACTED

Retract and secure left rail retractable lips in pallet position No. 12. Retract all left rail locks on the main cargo floor.

12. Parachute/Restraint Harness - DONNED/CONNECTED

WARNING

When aft of FS 1313, the restraint harness will be connected at or forward of FS 1313. Connect restraint harness to seat belt attachment ring secured with nut and bolt or to a restraint rail ring.

13. Doors and Ramp - CLEAR

Clear pilot to open doors.

14. Door Arming Switch - ARMED (P)
15. All Doors Switch - OPEN (P)

Airspeed less than 200 KCAS.

16. Doors and Ramp - OPEN

Notify pilot when fully opened to the airdrop position and ready to jettison.

17. Clear to Jettison - ACKNOWLEDGED
18. Ramp Pallet - JETTISONED

Retract forward left lock.

19. Remaining Pallets - JETTISONED

Release right rail lock tabs for pallet to be jettisoned.

WARNING

Fast sequential or salvo type of jettisoning is not recommended because loads may jam in the side rails or against each other.

20. Jettison - COMPLETED

21. Cargo Doors and Ramp - CLEAR (LM), AS REQUIRED (P)

Type of emergency will dictate door configuration.

22. Pressure Door - AS REQUIRED

23. Pressurization - AS REQUIRED

24. Nonjettisonable Cargo - SECURED

Restrictions:

1. Refer to figure 3-5 to determine maximum height.

2. Spanning loads:

   a. Max weight 2 pallets - 20,000 lbs.

   b. Max weight 3 pallets - 30,000 lbs.

   c. The CG of the unit should be forward of the middle and not over the break between the pallets.

3. Wheeled vehicles, nonpalletized, should not be jettisoned. To do so may cause structural damage.

4. Do not jettison pallets weighing less than 2,500 lbs. Lash a lightweight pallet to one that weighs 2,500 lbs or more and jettison as a combined load.

5. Small articles may be jettisoned from troop doors or over ramp.

6. If an explosive device cannot be jettisoned, damage will be kept to a minimum if it is placed on the floor next to the right troop door.

REPOSITIONING OF PALLETIZED CARGO/AIRDROP PLATFORMS:

1. Aircraft Flight Limits - CALCULATED

WARNING

Palletized cargo/airdrop platforms may be repositioned in-flight in cases of extreme emergencies. Calculations will be made to ensure that aircraft CG limits are not exceeded.

2. Cargo Doors and Ramp - CLOSED

Repositioning of Cargo Forward (Steps 3, 4, 5, and 9):

3. Left and Right Rail Locks - EXTENDED

Extend all left and right locks forward of the desired position.

4. Pallet/Platform - REPOSITIONED

Reposition pallet/platform against first set of extended locks and secure.

5. Remaining Pallet(s)/Platform(s) - SECURED

Secure each remaining pallet/platform in position as required.

Repositioning of Cargo Aft (Steps 6 through 9):

WARNING

Do not reposition aft of FS 1351 (locks 26 left and right).

6. Left and Right Rail Locks - EXTENDED

Extend and lock one set of locks at the desired location.

7. Pallet/Platform - REPOSITIONED

Reposition pallet/platform against the extended locks and secure.

8. Remaining Pallet/Platform - SECURED

Secure each remaining pallet/platform in position as required.

9. Cargo Jettison Checklist - AS REQUIRED

Reaccomplish appropriate items of Cargo Jettison checklist as required.

IN-FLIGHT EMERGENCY FLARE JETTISON.

During a planned crash landing, landing with a main or nose gear retracted, a wheels up landing or ditching, the possibility exists that loaded flares may be ignited from impact shock and friction. For this reason, it is recommended that flares be jettisoned if conditions permit. Time available, aircraft performance, fuel remaining, etc., are all considerations in the decision to jettison flares. Flares should be jettisoned over open water or isolated land areas; preferably at an altitude above the terrain that can give a reasonable expectation that the flares should burn out and cool to the point that they will produce no collateral fire damage. The minimum recommended altitude for jettisoning flares over land is 2,000 feet AGL. When the decision to jettison flares is made, follow the In-Flight Emergency Flare Jettison checklist below.

WARNING

- Do not attempt to jettison flares while the aircraft is on the ground.
- Do not jettison flares and fuel simultaneously. The effect of jettisoning flares must be carefully evaluated when the possibility of damaged or ruptured fuel tanks/lines exists.
- The squib power relays are powered through the touchdown relays. When experiencing touchdown relay malfunctions, it may be necessary to place the GROUND SAFETY BYPASS switch to "TEST" in order to bypass the touchdown relays.

NOTE

- During flare jettison, as each flare leaves the aircraft, crewmembers can expect a bright flash that is visible within the crew compartments. These flashes will be most noticeable at night or during IFR conditions. However, the flashes are discernible even during day VFR conditions.
- Jettison capability is inoperative with an actual loss of Main DC power.
- A full package of flares should jettison within four to six seconds.

EMERGENCY FLARE JETTISON CHECKLIST.

1. AN/AAR-47 and ALE-47 CMDS Circuit Breakers (24/25R) - CLOSED (E)
2. EMI Safety Pins (5) - "REMOVED" (LM/S)
3. Indicator Arm Control Panel ARM/SAFE Switch - "ARM" (N/S)
4. CMDS Mode Select Switch - "MANUAL" (N/S)
5. CDU JETT Switch - "JETT" (N/S)

Once jettisoning is activated, it cannot be stopped. The flare counter should decrease to "LO 0".

6. CDU JETT Switch - "OFF" (N/S)
7. CMDS Mode Selector Switch - "OFF/MANUAL" (N/S)

The CMDS CDU mode selector knob must be turned "OFF" and then to any mode to get the counter to reset to the actual number of flares that remain in the dispensers.

8. Inventory Status Indicator - "CHECKED" (N/S)

NOTE

The flare counter should indicate "LO 0". If the counter indicates that flares are still installed, make one additional attempt to jettison them. Re-accomplish the checklist starting with step 5 above. If jettison is successful, or the additional attempt to jettison the remaining flares is unsuccessful, proceed with the next step.

9. CMDS Mode Select Switch - "OFF" (N/S)
10. Indicator Arm Control Panel ARM/SAFE Switch - "SAFE" (N/S)
11. EMI Safety Pins (5) - "INSTALLED" (LM/S)
12. AN/AAR-47 and ALE-47 CMDS Circuit Breakers (24/25R) - OPEN (E)
13. Emergency Flare Jettison Checklist - "COMPLETED" (E)

Report status of jettisoning to pilot.

BAILOUT.

1. Give the bailout warning over the public address system and sound three short blasts on the warning horn.
2. Reduce airspeed to a minimum consistent with the conditions causing the emergency. If possible, descend to an altitude where supplemental oxygen is not required.
3. Depressurize the aircraft.
4. Head the aircraft toward an isolated area and engage the autopilot.
5. Open the troop doors. Extend the air deflectors, if installed.

It is possible to open the troop doors at airspeeds above the placarded airspeeds if required.

6. Give the abandon aircraft signal over the public address system and sound one long blast on the warning horn.
7. Evacuate the aircraft.

WARNING

Bailout should not be attempted from the crew entrance door at airspeeds above 200 KCAS because of the possibility of striking the main landing gear pod.

LANDING GEAR EMERGENCIES.

The gear may be recycled to get an UP indication if the crew determines it is safe to do so.

WARNING

- For any gear malfunction, visually inspect nose and main gear units because the indicators may not be connected properly.
- If any damage is observed, do not recycle the gear to obtain an UP indication.
- If a malfunction is encountered while lowering the gear, do not recycle the gear.
- For any gear malfunction, check the Landing Gear Control circuit breaker (30R). If open, attempt to reset. If it will not reset, or the problem appears to be an electrical malfunction, proceed with the Landing Gear Electrical Malfunction checklist. All other gear malfunctions will be handled by the Landing Gear Emergency Extension checklist.
- Uncommanded cycling/movement may be a complete cycle of the affected gear, or may be rapid (or periodic) movement of the gear between an in-transit and an "UP" or "DOWN" position. If uncommanded cycling/movement of the landing gear is encountered, open the Landing Gear Control CB (30R). If cycling stopped, proceed with the Landing Gear Electrical Malfunction checklist. If cycling continues, depressurize hydraulic system No. 2, proceed with the Landing Gear Emergency Extension checklist.

LANDING GEAR ELECTRICAL MALFUNCTION CHECKLIST.

1. Airspeed - "WITHIN LIMITS" (P)
2. Landing Gear Lever - "DOWN" (P, CP)
3. Landing Gear Control Circuit Breaker (30R) - "OPEN" (E)
4. Aircraft Pressurization - "AS REQUIRED" (P, E)

NOTE

If at low altitude with low fuel quantity, consider depressurizing the aircraft electrically to expedite removal of the NLG safety pin access window.

5. Pilot's Interphone - "SET" (P, CP)

NOTE

- To avoid distractions, the pilots may select Hot Mic Talk and Listen, push in the interphone monitor button, and place the Transmission Selector Switch in other than interphone.
- If malfunction is main gear only, proceed to item 7.

6. NLG Selector Valve - "DEPRESSED" (S)

NOTE

Momentarily depress the extend button. Do not hold the button in. If the NLG does not extend, terminate this checklist and proceed with the Landing Gear Emergency Extension Checklist.

7. NLG Indicator - "DOWN AND LOCKED" (E)
8. NLG Safety Pin - "INSTALLED" (S)

NOTE

If malfunction is nose gear only, proceed to item 12.

9. MLG Door Lock Selector Valve - "DEPRESSED" (S)

10. MLG Selector Valve - "DEPRESSED" (S)

NOTE

Momentarily depress the extend side of the valve. Do not hold the button in. If the MLG does not extend, terminate this checklist and proceed with the Landing Gear Emergency Extension Checklist.

11. MLG Down Lock Selector Valve - "DEPRESSED" (S)
12. MLG Down Lock Pawls - "CHECKED" (S)
13. MLG Indicators - "DOWN AND LOCKED" (E)
14. MLG Safety Pins - "INSTALLED" (S)
15. Landing Gear Electrical Malfunction Checklist - "COMPLETED" (E)

LANDING GEAR EMERGENCY EXTENSION CHECKLIST.

1. Airspeed - "WITHIN LIMITS" (P)
2. Landing Gear Lever - "DOWN" (P, CP)
3. Landing Gear Control Circuit Breaker (30R) - "OPEN" (E)
4. Aircraft Pressurization - "AS REQUIRED" (P, E)

NOTE

If at low altitude with low fuel quantity, consider depressurizing the aircraft electrically to expedite removal of the NLG safety pin access window.

5. No. 2 Hydraulic System - "OFF" (P, E)
6. Flight Control Switches - "SET" (P, CP)
7. Pilot's Interphone - "SET" (P, CP)

NOTE

- To avoid distractions, the pilots may select Hot Mic Talk and Listen, push in the interphone monitor button, and place the Transmission Selector Switch in other than interphone.
- If malfunction is main gear only, proceed to item 8.c.

8. Nose Gear Emergency Extension
   a. Emergency NLG Selector Valve - "EMERGENCY" (S)

CAUTION

Do not reposition the valve to normal unless directed to in item 8.b.(1).

   b. NLG Emergency Hand Pump - "EXTEND NOSE GEAR" (S)

NOTE

The hand pump may have to be operated for a three to five minute period before the nose gear indicates Down and Locked. If the NLG indicates Down and Locked, proceed to item c. If there is no result, proceed with items (1) through (5).

(1) Emergency NLG Selector Valve - "NORMAL" (S)
(2) NLG Access Panel - "REMOVED" (S)
(3) NLG Uplock Emergency Release Handle - "PULLED" (S)

WARNING

When manually extending the nose gear with a tiedown strap, do not secure the strap to the body or the aircraft structure.

(4) NLG Emergency Selector Valve - "EMERGENCY" (S)

WARNING

Do not reposition the valve to normal.

(5) NLG Emergency Hand Pump - "EXTEND NOSE GEAR" (S)

c. Nose Gear Indicator - "DOWN AND LOCKED" (E)

d. NLG Safety Pin - "INSTALLED" (S)

NOTE

If malfunction is nose gear only, proceed to item 9.d.

9. Main Gear Emergency Extension.

a. MLG Step One Handles - "PULLED" (S)

CAUTION

A six-inch pull is all that is required. Do not use excessive force when pulling these handles.

b. MLG Step Two Handles - "PULLED" (S)

NOTE

If a failure of the MLG step two handle is experienced at this point, and all other attempts to lower the gear have failed, see MLG Step 2 Handle Failure procedure.

c. MLG Step Three Handles - "AS REQUIRED" (S)

d. MLG Downlock Pawls - "CHECKED" (S)

WARNING

It is possible to insert the MLG safety pin with the downlock pawls retracted. If the pawls are not in the fully extended position, the gear is not locked. The MLG pry bar may be used to assist the spring action to extend the pawl.

e. MLG Indicators - "DOWN AND LOCKED" (E)

f. MLG Safety Pins - "INSTALLED" (S)

NOTE

With the loss of No. 2 hydraulic system or if MLG fuse failure is indicated, proceed to item 14.

10. Scanner In Position - "POSITIONED" (S)

11. No. 2 Hydraulic System - "ON" (E)

12. Check For NLG/MLG Movement - "CHECKED" (S)

WARNING

The scanner will immediately notify the engineer if the gear moves and holds in the retract position. If the gear stays in the retract position, immediately depressurize No. 2 system.

13. Flight Control Switches - "SET" (P, CP)
14. Brake Selector Switch - "EMERGENCY" (P, CP)

WARNING

Normal brakes are inoperative. Nose wheel steering may be inoperative.

CAUTION

After landing, if emergency brakes are selected and the spoilers do not deploy, make only one additional attempt to deploy them. Continued attempts to deploy the spoilers may place an excessive demand on the No. 3 Hydraulic System to the point where emergency brakes are ineffective.

15. Review Loss of No. 2 Hydraulic System - "AS REQUIRED" (P, E)
16. Review Performance Data - "AS REQUIRED" (E, S)
17. Landing Gear Emergency Extension Checklist - "COMPLETED" (E)

MLG STEP 2 HANDLE FAILURE.

NOTE

MAJCOM approval should be obtained, if time permits, prior to accomplishing this procedure.

If a failure of the MLG Step 2 Handle is experienced during the Landing Gear Emergency Extension checklist, and all other attempts to lower the gear have failed, the gear in question may be unlocked from the UP position by chopping a hole in the aircraft fuselage (see figure 3-17). The MLG trunnion cap is located under the catwalk on the 998 main frame and is a good reference point to the fuselage panel that will be chopped out. This approximately 14-inch long and 4-inch high hole will be located forward of FS 998, below the catwalk, by knocking out the fuselage panel closest to the floor. Access can then be gained to the MLG Uplock assembly through the hole (see figure 3-17).

WARNING

Be careful of jagged metal around the cutout and of the swing of the Uplock Bellcrank when it is released from the Uplock Hook.

FAILURE OF NOSE LANDING GEAR WHEELS TO CENTER UPON EXTENSION.

If the nose landing gear wheels fail to center upon nose gear extension, failure of the centering or steering mechanism is indicated.

1. Visually confirm, by using the NLG inspection window, that nose gear wheels are in fact turned.
2. If nose gear wheels are confirmed to be other than centered but NLG is down and locked, insert nose gear safety pin.

3. Disconnect the electrical cannon plug from the nose gear selector valve, located in left underdeck equipment compartment area.

4. Momentarily depress the UP side of the nose gear selector valve. This will isolate nose wheel steering and abnormal brakes from No. 2 hydraulic system. Nose gear wheels should now center due to centering cam action and slipstream.

CAUTION

Nose wheel steering and normal brakes are inoperative. Do not taxi in any congested area.

5. Select emergency brakes for landing.

CAUTION

After landing, if emergency brakes are selected and the spoilers do not deploy, make only one additional attempt to deploy them. Continued attempts to deploy the spoilers may place an excessive demand on the No. 3 Hydraulic System to the point where emergency brakes are ineffective.

6. If the nose gear is not centered after step 4, depressurize No. 2 hydraulic system. Nose gear wheels should now center due to centering cam action and slipstream. Accomplish procedures for loss of No. 2 hydraulic system.

LANDING GEAR WARNING LIGHT ILLUMINATED.

If the landing gear warning light remains illuminated after the landing gear is retracted, all throttles are forward of the 49.9 degree position, and all landing gear indicate UP, one of the following conditions exists:

1. One or more of the main landing gear doors are not fully closed.

2. One or more of the main landing gear door uplocks are not engaged.

3. One or more of the main landing gear door uplock microswitches have malfunctioned.

4. Throttle microswitch has malfunctioned in the closed position.

Position the A/R MASTER switch to ON.

If the light goes out, a throttle microswitch is the cause of the malfunction.

The A/R MASTER switch may then remain in the ON position to keep the light extinguished with the following effect on aircraft systems:

- The light will again illuminate if any malfunctions occur in the previously mentioned items 1, 2 or 3.
- The autothrottle disconnect switches are deactivated.
- The engineer controls the leading edge lights.
- The landing gear warning light will function normally when the gear lever is placed down.

The following conditions apply if the A/R MASTER switch is turned OFF:

- The landing gear warning light will remain on.
- The crew will be unaware if any of the previously mentioned malfunctions in items 1, 2 or 3 should occur.

If the light remains illuminated, accomplish the following:

1. Decrease airspeed below 200 KCAS or 0.48 Mach.

2. Scan the main landing gear doors. If they are not fully closed, or if the position of the doors cannot be determined, proceed to a suitable recovery airfield at 200 KCAS or less. If a higher airspeed is necessary due to high gross weight, turbulence, etc., the gear may be extended and the airspeed increased to 235 KCAS or Mach 0.55, whichever is lower.

3. If it can be determined that the doors are closed, open the Landing Gear Control circuit breaker (30R).

   a. If all landing gear remain retracted, the main landing gear door uplock or associated microswitch has malfunctioned. Close the Landing Gear Control circuit breaker (30R) and continue to destination at normal cruise airspeed. The malfunction must be repaired prior to the next flight.

   b. If any landing gear extends when the circuit breaker is opened, a malfunction in the gear uplock system is indicated. Place the gear lever down and close the Landing Gear Control circuit breaker (30R).

MAIN LANDING GEAR BOGIE MALFUNCTIONS.

If a MLG bogie indicates a malfunction, scan the gear for possible broken or damaged components. If damage is evident, do not retract the gear. If no damage is evident, the gear may be retracted and the flight continued. Normal landing procedures apply.

BRAKE SYSTEM FAILURE.

Brake Malfunction.

At the first indication of brake malfunction, or if brakes are suspected to be overheated, the aircraft should be maneuvered off the active runway and stopped. The aircraft should not be taxied into a crowded parking area and the parking brakes should not be set. Overheated wheels and brakes will be cooled before the aircraft is towed or taxied. Peak temperatures in the wheel and brake assembly are not attained until some time after a maximum braking operation is completed. In extreme cases, heat buildup can cause the wheel and tire to fail with explosive force or be destroyed by fire if proper cooling is not effected. Taxiing at low speeds to obtain air cooling of overheated brakes will not reduce temperatures and can actually cause additional heat build-up.

WARNING

If any abnormal brake pressure is observed during ground operation, check the Anti-Skid Power, Emergency Brakes, Normal and Emergency Brake Pressure circuit breakers. If open, reset and check brake pressure. If abnormal pressure is still observed, insert landing gear safety pins from inside of aircraft. No further troubleshooting will be attempted.

CAUTION

- After landing, if emergency brakes are selected and the spoilers do not deploy, make only one additional attempt to deploy them. Continued attempts to deploy the spoilers may place an excessive demand on the No. 3 Hydraulic System to the point where emergency brakes are ineffective.
- Use the brakes cautiously when anti-skid is inoperative.

If the normal brake pressure is low, place the Brake Selector Switch to EMER.

Check that the No. 3 hydraulic system PRESS. ON light is illuminated.

If complete hydraulic system failure occurs, approximately 10 brake applications can be made with both accumulators in No. 3 system fully charged.

Anti-Skid System Failure.

If the DET OUT light illuminates or flashes while taxiing, the scanner will be deplaned to determine if a wheel brake has locked. If no locked wheel is detected, operation should be normal. Should the ANTI-SKID OFF light illuminate, the Anti-Skid Switch should be placed to OFF to prevent possible erratic operation.

Anti-Skid Off Brake Application.

After the aircraft has touched down, the proper brake application is a smooth firm pressure, steadily increasing until desired braking action is obtained. Braking action must be judged by sensing the deceleration of the aircraft while applying pedal pressure. Maximum braking action will occur when the wheels are in a rolling skid. Increasing the pressure above this value will cause breakdown of the tire surface, which acts as a lubricant, and uncontrolled skidding or locking of the wheels will occur. This results in extreme loss of braking action and possible difficulties in directional control. To relieve such a condition, brake pressure must be released until the wheels come up to speed. The brakes may then be reapplied with more caution.

Brake Released Light Failure (Normal Brake Pressure).

If the BRAKES REL light does not illuminate prior to landing, there will be no locked wheel protection at touchdown and the pilot should ensure a positive touchdown prior to applying brakes. If DET OUT and/or ANTI-SKID OFF lights do not illuminate, the anti-skid system should function normally after main landing gear wheels spin-up above 15 knots.

Brake Released Light Failure (Abnormal Brake Pressure).

If the BRAKES REL light does not illuminate, accomplish the following.

1. Open the Landing Gear Control circuit breaker (30R). This should restore normal ground operation. If the BRAKES REL light illuminates, normal anti-skid operation should be available. Install all landing gear pins.

2. If normal brake pressure is still abnormal, remove the cannon plugs from the nose and main selector valves. Manually position the nose and main landing gear selector valves to the down position. If normal pressure returns, install all landing gear pins.

3. If normal brake pressure does not return within limits, nose wheel steering and normal brakes are inoperative. Select emergency brakes, and install all landing gear pins.

LANDING.

CONTROLLABILITY CHECK.

A controllability check is conducted to determine the minimum safe airspeed to maintain during approach and landing following in-flight structural damage, fuel imbalance, differential airspeed readings, or in-flight control malfunctions. Ordinarily, the check should be conducted in landing configuration at 10,000 - 15,000 feet altitude. Minimum airspeed obtained at higher altitudes will be excessive because of compressibility effects.

Care should be exercised in progressing to the landing configuration. All speed and configuration changes should be made slowly, taking note of any excessive control requirements produced. With the aircraft in the desired configuration, the airspeed is gradually decreased while evaluating the control and trim capabilities. Any impending control problem is indicated by an excessive rolling, yawing, or pitching movement. The airspeed is gradually decreased until the desired approach speed is obtained or an undesirable control problem is approached.

WARNING

The speed must never be decreased to the point at which full control deflection is required about any axis since there may be no recovery capability beyond this point.

The landing flare requirements can be decreased by making a low flat landing approach. The speed must never be allowed to decrease below the minimum safe speed as determined from the check.

LANDING WITH ONE OR MORE ENGINES INOPERATIVE.

One Engine Inoperative.

Rudder trim requirements and reversing techniques are the only basic differences from a four-engine approach and landing. The pilot should not exceed REV IDLE except with symmetrical power.

Two Engines Inoperative.

(Refer to figures 3-18, 3-19, and 3-20.)

Asymmetrical Engines.

If conditions and time allow, the recommended landing gross weight with two-engine asymmetric thrust is between 220,000 and 240,000 lbs. The actual landing weight must take into consideration factors such as collateral damage, available systems, aircraft handling characteristics, final configuration, available runway, ability to jettison cargo, and zero fuel weight vs. fuel on board. Landing weights from 220,000 to 240,000 lbs give the aircraft a threshold speed (two-engine approach speed minus 10 knots) that is normally above two-engine Vmca. Gross weights approaching 240,000 lbs will allow a closer to normal approach and landing speed schedule that is above two-engine Vmca.

Approach speeds with gross weights below 220,000 lbs will generally be governed by two-engine Vmca. Approaches at these weights allow no margin for error with speed control and thrust application. Key to a successful approach and landing will be flying the planned configuration and adhering to the speed schedule based on that configuration. Last minute, unplanned changes in either the configuration or speeds may have unseen consequences. The aircraft's ability to accelerate, or maintain flight, with the available thrust is more difficult as gross weights increase and/or when the aircraft's configuration changes.

Symmetrical Engines.

Aircrews experiencing two-engine symmetric thrust conditions may have greater options, conditions and time permitting, to plan landing weights below 220,000 lbs. Problems with aircraft control are reduced while operating with symmetric engines; however, follow the recommended speeds closely. A momentary hesitation or compressor stall between engines on thrust application, if applied near, at, or below two-engine Vmca, may prevent a successful recovery.

Two-Engine Procedure.

1. Approach speed for approach flaps will be computed. Two-engine approach speed will be approach speed or two-engine Vmca, whichever is greater.

2. The flight engineer will compute and have available for the pilot, two-engine Vmca and two-engine Vmfr.

WARNING

If two-engine approach speed is based on two-engine Vmca, decreasing below the two-engine Vmca could result in loss of aircraft control.

NOTE

- Recommended flap setting for a two-engine approach is 75% unless runway length becomes a factor.
- When operating at a speed below 200 KCAS, the RUDDER HI PRESS switch should be placed to OVERRIDE.

3. Final approach will be flown at two-engine approach speed plus 20 knots and flaps up until approaching the descent point. Flaps will then be lowered to APPROACH setting and the aircraft slowed to two-engine approach speed. RUDDER HI PRESS switch should be placed to OVERRIDE. Landing flaps may be used when landing is assured.

NOTE

The term Landing Assured will be interpreted as follows: On final approach with runway or approach lights in sight, within one mile of the runway, and in a position to complete the landing safely.

4. The threshold will be crossed at two-engine, approach speed minus 10 knots.
5. When the nose gear is on the ground, retard all throttles to REV IDLE. Spoilers and brakes will be the primary means of stopping the aircraft. Reverse thrust under asymmetric conditions should be limited to use of the inboard engine and only if absolutely necessary.

WARNING

Upon landing, shut down the remaining engines as soon as possible. Inspect all engines for collateral damage prior to continued operation.

GO-AROUND WITH ONE OR MORE ENGINES INOPERATIVE.

WARNING

Do not perform missed approaches or go-arounds with autopilot and/or autothrottles engaged.

Three-Engine Go-around.

The decision to go-around with one engine inoperative must be made as early as possible due to the reduced thrust available. The normal go-around procedure will be followed.

NOTE

If increased climb capability is needed, climb out at Vmco.

Two-Engine Go-around.

Always plan a two-engine approach so that a go-around will not be required. If a go-around is required, it should be started before slowing below two-engine-out air minimum control speed. With No. 1 and No. 2 engines inoperative, the landing gear cannot be retracted during a go-around and will result in extremely marginal performance. A go-around with asymmetrical engines operating should be accomplished similar to a normal go-around; however, maintain minimum climbout speed or air minimum control speed, whichever is higher, with the flaps at APPROACH settings until a safe maneuvering altitude is reached. If further climbout is required in clean configuration, it should be done at 220 knots or 0.45 Mach, whichever is lower.

NOTE

If an approach is made with the flaps at less than normal (75%), use the charted minimum climbout speed for the selected or lesser charted flap setting (i.e., flaps at 60%, use 50% chart). Compare this with two-engine Vmca and use the greater value.

LANDING WITH ONE OR MORE MAIN GEARS RETRACTED OR MISSING.

Consideration should be given to landing in that configuration. Proceed as follows:

1. Landing gear handle down.
2. Insert nose landing gear pin.
3. Landing Gear Warning Horn Circuit Breaker - OPEN (32R)
4. GCAC Circuit Breaker - OPEN (22B).

WARNING

All GCAS modes and aural annunciations/ tones are disabled when GCAC circuit breaker is opened.

5. Review Touchdown Relay Malfunctions.

6. Accomplish the appropriate items of the Wheels-Up Landing procedure.

TOUCHDOWN RELAY MALFUNCTIONS.

The thrust reversers, spoilers, brakes, rudder pedal steering, flaps, landing gear systems, and APU are affected by a touchdown relay malfunction. The exact problems that will be encountered is determined by the position of the relays at the time of the malfunction/failure. If the Touchdown Relay circuit breaker (31R) opens, be prepared to encounter the following total, partial, or any combination of the below malfunctions to exist:

NOTE

Due to the complexity of the wiring of different landing gear touchdown systems, effects listed below are worst case.

1.	Thrust Reversers	- All thrust reversers inoperative.
2.	Spoilers	- High force detent will be engaged.
		- Deployment will require over-riding high force detent.
		- Deployment to flight limit only.
3.	Brakes	- Brake release light will not illuminate.
		- Anti-skid will be inoperative with no locked wheel protection.
4.	Rudder Pedal	- Rudder pedal steering will be inoperative.
5.	Flaps	- High force detent will be engaged.
6.	Landing Gear Handle	- Lock release lever engaged.
7.	APU	- Inoperative.
8.	Defensive Systems	- Armed on the ground.

LANDING WITH NOSE GEAR RETRACTED.

If the nose landing gear cannot be extended, a landing on the main landing gears can be made and the nose lowered onto the runway as speed decreases. Smooth nose contact with the runway is important. The horizontal stabilizer should be used for more effective elevator control at the slower speeds. Some nose-up pitch trim may be applied during the final landing phase before initial touchdown; however, pitch up due to spoiler deployment should be considered.

Consideration should be given to jettison defensive system flares if installed on the aircraft. Refer to the Flare Jettison checklist. Excess fuel should be jettisoned to decrease the landing gross weight and permit lower touchdown speed. If possible, cargo should be shifted aft for a more favorable aft CG configuration.

WARNING

If cargo is required to be shifted, see Repositioning of Palletized Cargo/Airdrop Platforms.

The following procedure is recommended for landing with the nose gear retracted:

1. Accomplish the applicable items of the Wheels-up Landing procedure.

2. Complete Before Landing checklist.

3. Perform a normal approach for landing. Ensure that the Landing Gear Handle is DOWN and the nose gear selector valve is in the DOWN position, which can be determined by checking normal brake pressure indication.

CAUTION

If the nose gear selector valve is not in the DOWN position, normal anti-skid braking will not be available and emergency brakes must be used.

4. Prior to Approach and Landing:

   a. Crew Entrance Ladder - REMOVE

   b. Landing Gear Warning Horn Circuit Breaker (32R) - OPEN

   c. Emergency Exit Light Charge and Arm Circuit Breaker (37R) - OPEN

d. GCAC Circuit Breaker - OPEN (22B).

WARNING

All GCAS modes and aural annunciations/tones are disabled when GCAC circuit breaker is opened.

NOTE

Consideration may be given to closing the crew manual oxygen shutoff valve before landing if desired.

5. At touchdown, trim nose up to hold the nose off.

6. After touchdown, the pilot should:

a. Hold the nose off. Use reverse thrust if possible for deceleration.

b. At approximately 90 KCAS, smoothly lower the nose. Contact the nose at approximately 80 KCAS.

c. Upon nose contact, move all four throttles to REV IDLE.

d. Maintain directional control with brakes. Asymmetric reverse thrust may also be used.

e. Apply maximum braking to stop the aircraft.

LANDING WITH FLAT TIRE.

Nose Gear Tire Flat.

CAUTION

Do not hold the nose gear off the runway until elevator control is lost. Severe nose gear contact will likely blow the remaining tire.

Relocate cargo and equipment to move the CG as near the aft limit as possible. Make a normal approach and touchdown. After touchdown, hold the nose gear off the runway as long as possible. Use minimum brakes. Stop the aircraft on the runway and have it towed to a parking area.

WARNING

If cargo is required to be shifted, see Repositioning of Palletized Cargo/Airdrop Platforms.

One or More Tires on One Main Gear Flat.

Dump unnecessary fuel. Relocate cargo and equipment forward to apply more weight on the nose wheel and thus provide more positive steering after touchdown. Make a normal approach and landing. Be prepared for possible drag from the gear with the bad tire. Expect more effective braking from the gear with good tires. Use ailerons to hold the weight off the flat tires as much as possible. If at least one tire on each axle of main gear is inflated, it should be possible to cautiously taxi clear of the runway. Except under extreme circumstances, further taxi should be avoided.

WARNING

If cargo is required to be shifted, see Repositioning of Palletized Cargo/Airdrop Platforms.

CAUTION

Should a tire fail and there is reported or suspected damage to the aircraft, the aircraft commander should consider stopping the aircraft straight ahead and conduct a thorough visual inspection of the aircraft system and structure. The aircraft commander should only continue to move the aircraft when ensured that no further damage to the aircraft will occur and that movement can be controlled.

WHEELS UP LANDING.

Consideration should be given to jettison defensive system flares if installed on the aircraft. Refer to the Flare Jettison checklist.

The Pilot Will:	The Engineer Will:	The Loadmaster/Scanner Will:
1. Direct the crew and troops to prepare for crash landing.		1. Prepare for Crash Landing - ACKNOWLEDGED
2. Brief the crew on procedures to be followed prior to and during the crash landing.		2. Flight Station Door - SECURED Secure the flight station door open.
3. Descend to an altitude not requiring oxygen (if applicable).		3. Passenger/Troops - BRIEFED
4. Direct engineer to depressurize the aircraft if required.	1. Depressurize on pilot's command.	
5. Direct loadmaster/scanner to jettison cargo as required.	2. No. 3 Hyd System as required.	4. Cargo Jettison - AS REQUIRED Jettison cargo using the Cargo Jettison checklist.
6. Pressure door, petal door and ramp - OPEN AS REQUIRED. **NOTE** The pressure door should be opened, the petal doors should be opened to the flight position, and the ramp should be up and locked.		5. Cargo Doors - AS REQUIRED If cargo doors are opened, retract ramp to CLOSED position and lock by means of the manual override. If cargo doors are NOT opened, pilot will open doors and ramp. Retract ramp to CLOSED position and lock by means of the manual override. **NOTE** Use manual override to raise and lock the ramp after the opening sequence has ended. The Door Arming switch must be in the OFF position and remain OFF before selecting manual override.

The Pilot Will:

7. Emergency Escape Hatches and Troop Doors - OPEN AS REQUIRED

NOTE

All doors and hatches should be removed/ opened prior to landing.

8. When appropriate, jettison fuel to minimum required for approach and landing (approx 10,000 lbs).

The Engineer Will:

3. Jettison fuel on pilot's command.

4. Close crossfeed and separation valves.

5. Flight Station - SECURED

NOTE

The flight crew seat head rests should be installed on the pilot's, copilot's, navigator's and engineer's seats.

The Loadmaster/Scanner Will:

6. Troop Doors - OPENED

WARNING

Extreme caution must be used when opening other exits with the petal doors open due to the wind blast.

7. No. 3 Hatch - REMOVED/SECURED

Release/secure escape rope ladders adjacent to No. 3 hatch. Remove and secure hatch.

8. Aft Side Emergency Escape Hatches - OPENED/ SECURED

9. Troop Oxygen Manual Shutoff Valves - CLOSED.

WARNING

Do not attempt to deplete the troop oxygen system. Doing so could produce a dangerously high oxygen-rich environment.

10. Forward Side Escape Hatches - OPENED/ SECURED

WARNING

When the forward side escape hatches are removed and the engines are reversed, debris, engine flame, and exhaust fumes enter the cabin which can be harmful to occupants in the cargo compartment in close proximity to these open escape hatches. When feasible, passengers should be moved aft to preclude possible injury.

The Pilot Will:

The Engineer Will:

The Loadmaster/Scanner Will:

11. No. 2 Escape Hatch - OPENED

Release/secure escape rope ladders adjacent to No. 2 hatch. Open hatch.

12. Personnel - SEATED/ SECURED

Ensure personnel are seated and secured. Ensure aft-facing seats are raised to upright position.

13. Cargo Compartment - PREPARED

Notify pilot when cargo compartment is prepared for crash landing.

Prior To Approach And Landing (Approx 10 minutes).

The Pilot Will:

9. Six short blasts on horn if time or circumstances do not permit the passengers/ patients to be notified by the public address system or voice.
10. Landing Gear Warning Horn Circuit Breaker - OPEN
11. GCAC Circuit Breaker - OPEN

WARNING

All GCAS modes and aural annunciations/ tones are disabled when GCAC circuit breaker is opened.

12. Direct all personnel to assume crash positions.

The Engineer Will:

6. Landing Gear Warning Horn Circuit Breaker (32R) - OPEN
7. Emergency Exit Lts. Charge and Arm Circuit Breaker (37R) - OPEN
8. GCAC Circuit Breaker (22B) - OPEN
9. Assume crash position.

The Pilot Will:	The Engineer Will:	The Loadmaster/Scanner Will:

13. Manual Oxygen Shutoff Valve - CLOSED.

WARNING

When landing with one or more main gear retracted or missing, align the aircraft on the side of the runway with the extended main gear. The wing on the side of the missing gear should be held up as long as aileron control permits. After the outboard engine contacts the ground, brakes on the remaining gear should provide adequate directional control.

NOTE

Approach and landing of the aircraft should be accomplished using normal speeds and configuration.

14. Sound one long blast on warning horn prior to touchdown.
15. Fire Handles - PULLED

After touchdown, the copilot will pull No. 1 and No. 4 fire handles. The pilot will maintain directional control and wings level with ailerons, rudder and nose gear steering (if available). Just prior to coming to a stop, the copilot will pull No. 2 and No. 3 Fire Handles. The engineer will turn OFF the battery and the pilot will ensure INS 1 and 2 are OFF.

16. MFSI - OFF

The Pilot Will:	The Engineer Will:	The Loadmaster/Scanner Will:
17. Evacuate aircraft.	10. Evacuate aircraft.	14. Direct evacuation. Evacuate aircraft.

DITCHING.

The pilot must decide to ditch or bail out based on such factors as:

1. Survival equipment available.
2. Proximity to land/vessels.
3. Sea conditions.
4. Probability of control loss.

Consideration should be given to jettison defensive system flares if installed on the aircraft. Refer to the Flare Jettison checklist.

The landing gear should be up for any ditching. The pilot should ditch parallel to the primary swell, touching down on the crest or backside of the swell. Ditching heading should take advantage of any wind.

WARNING

Do not stall the aircraft during ditching. The loss of control during the stall will greatly increase the possibility of digging a wing into the sea and cartwheeling the aircraft. Instruct personnel to remain braced and strapped in until the aircraft has come to rest. There may be several severe impacts.

Power On Ditching.

The final approach should be flown with LANDING flaps, at approach speed minus 10 knots and at the lowest possible rate of descent. When the ditching point is determined, reduce airspeed to contact the water approximately 20 knots below the approach speed. At night, maintain approach speed minus 10 knots until contact with water.

Power Off Ditching.

Maintain 178 KCAS or higher so that adequate windmilling hydraulic pressure is available for flight controls and emergency generator. Flaps should be extended cautiously while at high engine windmilling speeds so that flight control and instrumentation is not lost. Flap extension, trimming, and major maneuvering should be above 1,000 feet. The pilot should slow the aircraft cautiously so that the flight controls remain powered. The last part of the approach should be a trimmed, straight path requiring only small amounts of elevator and aileron for flare. Establish a slight nose high attitude and a low sink rate, and maintain until touchdown.

At touchdown, hold the nose off as long as possible to delay digging the nose into the swells.

Ditching Characteristics.

Ditching may result in one of three cases (see figure 3-21). Case I occurs when the pressure cabin is not ruptured. The aircraft will assume a slight nose-up attitude with side emergency hatches usable if seas are not too high.

Case II is the most probable case. It occurs when the pressurized cabin is ruptured and the cabin flooded to the cargo floor, which is intact. Again, a slight nose-up attitude occurs. The aft side hatches may be usable if sea conditions permit. The side hatches will not be usable when seas are two to five feet or more in height.

From Case II, the aircraft will sink to Case III, with a nine-degree nose-down attitude and the wings floating on the water. In this case, only the two aft overhead hatches will be usable. The length of time to sink from Case II to Case III will depend on the amount of damage to the ramp area. The procedures discussed are based on the assumption that Case II will be experienced during the ditching.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	AFTER DITCHING
PILOT			
1. Warn crew to prepare for ditching, giving approximate time remaining.	1. Orders copilot to give ditching signal No. 1, if time or facilities do not permit the passengers/patients to be notified by use of the public address system or voice.	1. Flashlight and first aid kit.	1. Exit through No. 1 hatch.
2. Direct flight engineer to depressurize the aircraft when altitude permits.	2. Orders copilot to send final distress signal.		
3. Inhibit GCAS.			
4. If required, direct flight engineer to jettison fuel and loadmaster to jettison cargo.	3. Orders all on board to secure themselves in ditching position.		
5. Don life vest.	4. Immediately prior to ditching, gives "BRACE FOR IMPACT" warning over interphone.		
6. Fasten seat belt and shoulder harness.			

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	AFTER DITCHING
COPILOT 1. IFF to emergency, transmit MAYDAY followed by emergency on HF, UHF, and VHF. (Use normal frequencies if possible) 2. Obtain DF service on normal ground frequency if possible. 3. Don life vest. 4. Fasten seat belt and shoulder harness. 5. Continue the radio emergency procedure every 10 minutes.	1. On pilot's orders, sound ditching signal No. 1: Six short blasts of the warning horn. 2. Send final MAYDAY position, altitude, course, speed, and pilot's intentions. 3. When pilot gives "BRACE FOR IMPACT" warning over interphone, sound one long blast of the warning horn. 4. Assist pilot in ditching the aircraft.	1. Flashlight and classified documents.	1. Exit through the No. 1 hatch.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
FLIGHT ENGINEER				
1. Compute gross weight and ditching speeds. Pass this information to copilot. 2. Don life vest. 3. Install seat headrests to pilot, copilot, navigator, and flight engineer crew seats. 4. Open the "LANDING GEAR WARNING" circuit breaker (32R). 5. Continue duties as directed by pilot.	1. Fasten seat belt and shoulder harness. 2. Lower seat to extreme lower position and face seat forward. 3. Immediately after impact, turn off generators and battery.	1. Flashlight, first aid kit, and emergency transceiver radio, if stowed on flight deck.	Engineer's seat, facing forward.	1. Pull life raft release handles next to No. 1 hatch. 2. Exit through No. 1 hatch.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
NAVIGATOR				
1. Prepare emergency message for transmission by copilot to include: Position, time, altitude, heading (true or mag), true airspeed, number of personnel on board, nature of distress and intentions of pilot.	1. Assist pilot as directed.	1. Flash-light and emergency container.	Navigator's seat, facing forward.	1. Exit through No. 1 hatch.
2. Stow essential navigation equipment and survival items in suitable container.	2. Fasten seat belt and shoulder harness.			
3. Don life vest.	3. Lower seat to extreme lower position and face seat forward.			

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
<u>LOADMASTER</u>				
1. Instruct troops in ditching procedures and duties.	1. Rebrief troops and ensure that they are properly seated and secured.	1. Flashlight, water container, and first aid kit.	Troop seat near troop door, right side.	1. Pull wing life raft release handles located forward of the right troop door.
2. Jettison cargo and loose equipment.	2. Don life vest.			2. Push up on the ditching stop handle to disengage the ditching stop which then releases the hatch.
3. Secure all doors and exits.	3. Notify pilot when cargo compartment is secured.			3. Launch life rafts, as required.
4. Release and secure escape rope ladder No. 4 hatch. Pull down the ditching stop handle to engage the ditching stop. Open No. 4 hatch.	4. Fasten seat belt.			4. Assist troops to evacuate the aircraft.
5. Release and secure escape rope ladder No. 3 hatch, remove and stow No. 3 hatch.				5. Pass out water containers and exit through No. 4 hatch.
6. Release and secure escape rope ladder for No. 2 hatch and unlatch No. 2 hatch.				
7. Reposition and secure life rafts as required.				
8. Secure cargo/equipment that cannot be jettisoned.				

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
SCANNER 1. Assist the loadmaster in securing the cargo compartment. 2. Secure the flight station door open. 3. Don life vest.	1. Fasten seat belt.		Relief crew seat.	1. Launch life raft through No. 2 hatch. 2. Exit through No. 2 hatch.

SYSTEMS.

ANNUNCIATOR PANELS.

LIGHT	CONDITION	USUAL PILOT RESPONSE
AILERON SYS 1 PWR	LT or RT PCA internal pressure below 1,500 PSI.	Place AIL PWR control switch to TAB OPERABLE for PCA with POWER OFF light illuminated.
ELEV FEEL MALFUNC	SCADC and elevator artificial feel servo in disagreement.	Stabilize the airspeed at approximately 224 KCAS or 0.53 Mach and place the elevator artificial feel selector switch to LOQ, then back to NORM. If the light does not go out, place the switch to LOQ just prior to approach. Above 224 KCAS or 0.53 Mach, operate the autopilot only in the pitch off mode.
ELEV SYS 1 PWR	System pressure 1,500 PSI or less.	Place Sys 1 Elevator power control switch to EMER.
RUDDER SYS 1 PWR	System pressure 1,500 PSI or less.	Place Sys 1 Rudder power control switch to POWER OFF.
FLAP ASYM DET	Loss of power to asymmetry detection system.	Extend/retract flaps slowly; Closely monitor the flap position indicator.
AILERON SYS 2 PWR	LT or RT PCA internal pressure below 1,500 PSI.	Place AIL PWR control switch to TAB OPERABLE for PCA with POWER OFF light illuminated.
ELEV EMER PWR	Emergency elevator pressure 1,500 PSI or less.	Place related elevator power control switch to OFF.
ELEV SYS 2 PWR	System pressure 1,500 PSI or less.	Place sys 2 elevator power control switch to EMER.
RUDDER SYS 2 PWR	System pressure 1,500 PSI or less.	Place sys 2 rudder power control switch to POWER OFF.
FLAP ASYM	Flaps locked in position.	Plan landing with flaps as indicated unless broken cable detection can be reset.
AHRS INOP	Possible AHRS failure.	Crosscheck AHRS with INS attitude and heading. If failure is indicated, turn AHRS OFF.
YAW DAMPER FAULT	See CDS CWAs.	See CDS CWAs.
UNDER SPLR SPEED	Stall signal in stall prevention system circuit.	Avoid use of spoilers.
RUDDER OVERPRESS	At least one system in rudder PCA in high press mode.	Place rudder power control switch to OFF for system with HI PRESS lights illuminated. If both HI PRESS lights are illuminated, turn either switch OFF, avoid abrupt rudder inputs.
L BLEED DUCT OVHT	Overheat condition in left wing leading edge or left air conditioning compartment.	Call for Bleed Duct Overheat Checklist.

LIGHT	CONDITION	USUAL PILOT RESPONSE
GPWS INOP	TAWS Inoperative	Advisory: Open and Close TAWS circuit breaker.
FIRE BOTTLE 1	Pressure below 225 PSIG.	Advisory: Only one bottle available for engines 1 & 2.
2 SPOILER INOP	Hydraulic system No. 2 asymmetry control circuit has tripped.	Attempt to reset the asymmetry system.
TERRAIN INOP	BIT TEST NO PRESENT POSITION TAWS COMP INOP	Advisory: Check FMS. Open and close TAWS circuit breaker. VERIFY NAV SOLUTION SELECTED
FIRE BOTTLE 2	Pressure below 225 PSIG.	Advisory: Only one bottle available for engines 1 & 2.
CADC 1 INOP	SCADC malfunctioning.	SCADC unreliable. Check associated systems, turn the related stall prevention system OFF, and select CADC No. 2 on the CADC Data Input IFF Switch.
L AIL. TAB OPER	Tab unit is operable.	Advisory: Tab positioned for manual operation.
3 SPOILER INOP	Hydraulic system No. 3 asymmetry control circuit has tripped.	Attempt to reset the asymmetry systems.
FIRE BOTTLE 3	Pressure below 225 PSIG.	Advisory: Only one bottle available for engines 3 & 4.
CADC 2 INOP	SCADC malfunctioning.	SCADC unreliable. Check associated systems, turn the related stall prevention system OFF, and select CADC No. 1 on the CADC Data Input IFF Switch.
R AIL. TAB OPER	Tab unit is operable.	Advisory: Tab positioned for manual operation.
INS-1 INOP	Possible INS failure.	Select INS-1 STATUS page on any MFCDU. Comply with action codes. If failure is indicated, turn MSU 1 OFF.
WINDSHEAR INOP	CADC INOP RAD ALT OFF/INOP ATT SORCE INVALID TAWS COMP INOP	Advisory: Check CADC Check RAD ALT. Check attitude source. Open and close TAWS circuit breaker.

LIGHT	CONDITION	USUAL PILOT RESPONSE
FIRE BOTTLE 4	Pressure below 225 PSIG.	Advisory: Only one bottle available for engines 3 & 4.
INS-2 INOP	Possible INS failure.	Select INS-2 STATUS page on any MFCDU. Comply with action codes. If failure is indicated, turn MSU 2 OFF.
STALL PREV 1	See CDS CWAs.	See CDS CWAs.
STALL PREV 2	See CDS CWAs.	See CDS CWAs.
DOOR OPEN	Any door in the door warning circuit not locked.	Refer to In-flight door warning procedure.
INS-1 AIR TEMP	Insufficient air volume over INU 1.	First check to see if the INS 1 fans are operating. If not, and if on the ground, turn MSU 1 OFF. If airborne, turn MSU 1 OFF if not needed for flight, or continue to operate until action code appears.
FLT REC INOP	1. Tape has malfunctioned. 2. Loss of power.	Advisory.
CABIN PRESS. LOW	Cabin press above 10,000 (± 1000) ft.	Decrease altitude or prepare to use oxygen mask.
R BLEED DUCT OVHT	Overheat condition in right wing leading edge or right air conditioning compartment.	Call for Bleed Duct Overheat Checklist.
PITOT HEAT	Pitot heat inoperative.	Check PITOT HEAT circuit breaker. Avoid icing conditions.
WG ANTI-ICE OVHT	Overheat condition in either wing leading edge.	Refer to wing Anti-ice Overheat procedure.
OXY QUANTITY LOW	Oxygen has reached 2.5 liters remaining level.	Advisory. Check oxygen regulators for leaks and limit altitude as necessary.
APU FIRE	Temperature in APU compartment has reached 232 degrees C.	Flight engineer APU fire procedure.
INS-2 AIR TEMP	Insufficient air volume over INU 2.	First check to see if the INS 2 fans are operating. If not, and if on the ground, turn MSU 2 OFF. If airborne, turn MSU 2 OFF if not needed for flight, or continue to operate until action code appears.
RAIN REMOVAL OVHT	Windshield temperature has reached 71 degrees C.	Turn system off for affected windshield.
ICING	Outside air conditions are conducive to icing.	Actuate ice protection.
CARGO SMOKE	Possible fire in cargo compartment or in the underdeck area.	Determine source and fight fire using appropriate checklist.
IFF	1. No Code in Mode 4. 2. No Mode 4 reply to interrogation.	1. Code computer if Mode 4 operation is necessary. 2. Advisory.

CDS CAUTIONS, WARNINGS, AND ADVISORIES (CWA).

CWA	CONDITION	USUAL PILOT RESPONSE
CWA	Indicates messages exist when CWA - OFF is selected on the DAMU.	None.
DU 1/2/3/4	Indicates a failure of Display Unit 1/2/3/4.	Acknowledge, reconfigure remaining DUs as necessary.
DPU 1, 2 or 1/2 FAIL	Indicates a failure of Display Processor 1, 2, or both 1 and 2.	Acknowledge.
DAMU 1/2 FAIL	Indicates a failure of the Pilot's or Copilot's DAMU.	Acknowledge.
PFD REPEAT	Indicates that the Primary Flight Display is in the repeat mode.	None.
SFD REPEAT	Indicates that the Secondary Flight Display is in the repeat mode.	None.
INS 1 ATT	Indicates that attitude fails the DPU or AFCP validity test (comparisons, validity reasonableness).	Acknowledge. On DAMU, select INS 2 or AHRS.
INS 2 ATT	Indicates that attitude fails the DPU or AFCP validity test (comparisons, validity reasonableness).	Acknowledge. On DAMU, select INS 1 or AHRS.
AHRS ATT	Indicates that attitude fails the DPU or AFCP validity test (comparisons, validity reasonableness).	Acknowledge. On DAMU, select INS 1 or INS 2.
GS 1	Glideslope 1 signal not present after the glideslope/localizer has been tuned.	Acknowledge. On DAMU, assign VOR/ILS 2 to PTR 1.
GS 2	Glideslope 2 signal not present after the glides lope/localizer has been tuned.	Acknowledge. On DAMU, assign VOR/ILS 1 to PTR 1.
LOC 1	Localizer 1 signal not present after the glideslope/localizer has been tuned.	Acknowledge. On DAMU, assign VOR/ILS 2 to PTR 1.
LOC 2	Localizer 2 signal not present after the glideslope/localizer has been tuned.	Acknowledge. On DAMU, assign VOR/ILS 1 to PTR 1.
VOR 1	No VOR 1 signals with VOR 1 selected on PTR 1.	Acknowledge. On DAMU, assign VOR 2 to PTR 1.
VOR 2	No VOR 2 signals with VOR 2 selected on PTR 1.	Acknowledge. On DAMU, assign VOR 1 to PTR 1.
TACAN 1	No TACAN 1 signal with TACAN 1 selected on PTR 1.	Acknowledge. On DAMU, assign TAC 2 to PTR 1.
TACAN 2	No TACAN 2 signal with TACAN 2 selected on PTR 1.	Acknowledge. On DAMU, assign TAC 1 to PTR 1.
RAD ALT FAIL	Indicates a failure of the CARA.	Acknowledge.
SKE FAIL	Indicates a failure of the SKE function, if selected.	Acknowledge.
AFCP 1 FAIL	Indicates a failure of AFCP 1.	Acknowledge. Select opposite system.

CWA	CONDITION	USUAL PILOT RESPONSE
AFCP 2 FAIL	Indicates a failure of AFCP 2.	Acknowledge. Select opposite system.
AFCP 1/2 FAIL	Indicates a failure of both AFCPs.	Acknowledge. Perform Section III, YAW DAMPER FAILURE procedures.
AP 1 FAIL	Indicates a failure AFCS 1, AFCP 1 OK	Acknowledge. Select AP 2.
AP 2 FAIL	Indicates a failure AFCS 2, AFCP 2 OK	Acknowledge. Select AP 1.
AP TRIM FAILURE	Indicates a failure of the Autopilot Trim function in the AFCP when AP is engaged.	Acknowledge. Select opposite system.
AT FAIL	Indicates a failure of Autothrottle function in an AFCP.	Acknowledge. Disengage.
YAW DAMP FAULT*	Indicates a failure of one yaw damper.	Acknowledge. Reset system if desired.
YAW DAMP INOP*	Indicates a failure of both yaw dampers.	Acknowledge. Reset the system. Perform appropriate Section III procedures.
STALL 1 FAIL	Loss of the stall warning function within AFCP 1.	Acknowledge. Place Pilot stall prevention switch to OFF.
STALL 2 FAIL	Loss of the stall warning function within AFCP 2.	Acknowledge. Place Copilot stall prevention switch to OFF.
CDS AIR FAIL	Loss of a CDS cooling fan.	Acknowledge. Select opposite CDS Cooling Fan.
NP 1/2 FAIL	Indicates a navigation processor failure.	Reset power if desired.
CDU 1/2/3 FAIL	Indicates a MFCDU failure.	Advisory.
NO SPOOF 1/2	Loss of GPS code, L_2, or P code.	Advisory. Reload GPS codes.
GPS 1/2 FAIL	Indicates loss of GPS receiver in the navigation processor.	Advisory. From the GPS STATUS - Reset if desired.
RAIM 1/2 UNAVL	Do not have sufficient redundant measurement to independently determine GPS integrity.	Advisory.
RAIM 1/2 ALERT	Determined that one or more NAV solution is invalid.	Advisory.

NOTE* To reset a transient YAW DAMP FAULT annunciation, cycle the YAW DAMPER switch to OFF, then ON. The SFD will annunciate YAW DAMP INOP. Pressing either MASTER CAUTION light should clear the annunciation.

AUTOTHROTTLES MALFUNCTION.

If autothrottles will not disconnect, the throttles can be overpowered using normal force. In the event of a catastrophic failure, a force of up to 65 pounds may be required to over power the throttles. To deactivate the autothrottle servo, open the A/T SERVO circuit breaker (13-D) on the avionics circuit breaker panel.

CDS/FMS EQUIPMENT FAILURES/MULTIPLE FAILURES MATRIX.

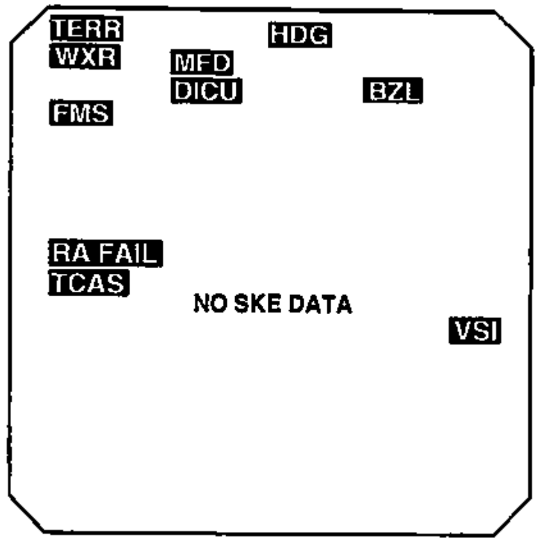
In the event a DPU and/or Nav Processor fails, the following equipment remains available to the pilots:

FAILURE		NP 1	NP 2
		FMS 2 VOR 1 [1] VOR 2 TACAN 2 ILS 1 [1] ILS 2 VHF 1 [1] VHF 2	FMS 1 VOR 1 TACAN 1 ILS 1 VHF 1
DPU 1	INS 2 and AHRS HDG to DU FMS 1 FMS 2 VOR 2 TACAN 2 ILS 1 ILS 2 VHF 1 VHF 2	INS 2 and AHRS HDG to DU FMS 2 VOR 2 TACAN 2 ILS 1 [1] ILS 2 VHF 1 [1] VHF 2	INS 2 and AHRS HDG to DU FMS 1 ILS 1 VHF 1
DPU 2	INS 1 and AHRS HDG to DU FMS 1 FMS 2 VOR 1 TACAN 1 ILS 1 ILS 2 VHF 1 VHF 2	INS 1 and AHRS HDG to DU FMS 2 VOR 1 ILS 1 [1] ILS 2 VHF 1 [1] VHF 2	INS 1 and AHRS HDG to DU FMS 1 VOR 1 TACAN 1 ILS 1 VHF 1

NOTE

[1] Available through the VHF Backup Control Panel only.

MFD FAULT INDICATORS



D8066001 D

ANNUNCIATION	CONDITION	USUAL PILOT RESPONSE
BZL	Stuck Key Fault	Advisory: Check MFD keys.
DICU	DICU or Wiring Fault	Advisory: Check DICU connector.
FMS	FMS System Failure	Advisory: Check FMS
HDG	No Heading Selected	Advisory: Select heading source.
MFD	Internal MFD Fault	Advisory: Reset MFD power switch. View MFD status page.
NO SKE DATA	No Data Being Received SKE System Failure	Advisory: Check SKE.
RA FAIL	429 Message Error	Advisory.
TCAS	TCAS System Failure	Advisory: Open and close TCAS circuit breaker.
TERR	BIT Test No Present Position TAWS System Failure	Advisory: Check FMS. Open and close TAWS circuit breaker.
VSI	SCADC NO. 1 Failure	Advisory: Open and close SCADC circuit breaker. Check Pilot's TEST Switch.
WXR	Weather Radar System Failure	Advisory: Check WEATHER RADAR and RDP.

Figure 3-1A. MFD Fault Indicators

CMDS (AN/ALE-47) ABNORMAL OPERATING PROCEDURES (TCTO 542).

If a CDU or Programmer failure occurs, placing the CDU MODE switch to "BYP" position will activate a dispense program that is loaded into each sequencer when power is applied to the system. Dispense signals then bypass the CDU and Programmer, and are applied directly to the sequencers. Manual and automatic dispensing are both available in the BYP mode. The CDU display is blank in this mode.

The following is a list of error codes and corrective actions for various system malfunctions.

CMDS CDU DISPLAY	CORRECTIVE ACTION
PROG FAIL GO BYP	CDU MODE knob to "BYP"
PROG FAIL CHK BYP	CDU MODE knob to "BYP"
PROG FAIL DEG	CDU MODE knob to "BYP"
CCU FAIL GO BYP	CDU MODE knob to "BYP"
DISP LAY DEGR ADED	None (Loss of Display)
SEQ ## INV DEG	None (Flare Magazine Fault)
SEQ ## BYP DEG	CDU MODE knob to "MAN" ("BYP" Dispense Loss)
SEQ ## BYP FAIL	CDU MODE knob to "MAN" (Loss of Bypass Function)

CMDS CDU DISPLAY	CORRECTIVE ACTION
SEQ ## JETT FAIL	CDU MODE knob to "MAN" (Loss of Bypass Jettison)
SEQ ## FAIL	None (Loss of Control I/O Function)

WARNING

Do not place the GROUND SAFETY BYPASS switch to "TEST" while the airplane is on the ground with countermeasures loaded. Accidental discharge of countermeasures may occur causing injury to personnel and damage to aircraft.

If countermeasures cannot be dispensed from either the MAN or BYP modes, the GROUND SAFETY BYPASS switch can be placed to "TEST" in order to send squib power to the sequencers. Placing the switch to "TEST" bypasses the touchdown relays.

ELECTRICAL POWER SYSTEM FAILURE.

CSD Failures.

CAUTION

Since a CSD cannot be reconnected in-flight, do not disconnect more than two CSDs for reasons stated in items 1 or 2 below.

NOTE

Engines must be at stabilized power while performing the following steps.

1. If one AC loadmeter fluctuates greater than one scale division relative to the others or if system frequency drops, test each generator. If the frequency is fluctuating greater than plus or minus two cycles per second in the green meter range, disconnect the CSD.

2. If a generator out light illuminates, check associated CSD with the generator switch in the test position. If frequency fluctuation is greater than plus or minus two cycles per second, immediately disconnect the CSD.

CSD Overheat Light.

The CSD OVERHT light indicates the loss of oil pressure or high case oil temperature. If the CSD OVERHT light illuminates, disconnect the CSD. If the CSD will not disconnect, shut down the engine if not needed for flight.

NOTE

The CSD may operate at oil temperatures in the 135 to 180 degree range. Placing the generator to OFF may cool the CSD oil temperature. If operating within the caution range, isolate and monitor generator for remainder of flight. Above 180 degrees, disconnect.

Main Generator Failures.

Generator Fail Light.

1. If a GEN FAIL light illuminates momentarily or comes on steady, check the frequency and voltage of the generator. While in the test position, if any fluctuation is observed, disconnect the CSD.

2. If no fluctuation is observed, place generator to ON and isolate the generator by placing the respective bus tie switch OPEN and monitor for the remainder of the flight.

Generator Out Light.

1. If a GEN OUT light illuminates, place the generator control switch in the OFF position. If the light remains illuminated, a differential fault has occurred. Disconnect the CSD.

WARNING

If a CSD is disconnected due to a differential fault, do not reconnect until maintenance action is accomplished.

2. If the GEN OUT light illuminates with the switch in the TEST position with no frequency or voltage indication, check for an open GLC circuit breaker. If the circuit breaker is closed, disconnect the CSD. This is an indication of internal failure or an overspeed.

3. If the light remains out in the TEST position, check the generator for the following: Voltage in the green meter range and frequency within 8 CPS of system frequency. If voltage is not in the green meter range, turn the generator OFF. If the frequency reads low, hold the generator switch in TEST for one minute. If the frequency remains low, place the generator switch OFF. If frequency returns to normal, place the generator switch ON. If voltage is normal, and

frequency is fluctuating greater than plus or minus two CPS, disconnect the CSD.

During the preceding steps, if all indications were normal and the system is placed back into operation, should the GEN OUT light illuminate again, make no further attempt to return generator to the line.

Bus Tie Open Light.

If the bus tie OPEN light illuminates, observe that the frequency is within 8 CPS of system frequency and the voltage is in the green meter range. If within limits, reset the bus tie contactor by placing the bus tie switch to OPEN, then to NORMAL. If frequency and voltage are not within limits, turn the generator control switch OFF and reset the bus tie contactor. If the bus tie contactor does not reset, check the bus tie contactor circuit breaker. If closed, no further attempt should be made to reset the bus tie.

LOSS OF ALL GENERATORS CHECKLIST.

WARNING

Following power changes, the INSs may fault, displays turn red, accompanied by INS 1/2 - INOP annunciator lights. Normal operation may be restored by clearing the INS Action/Malfunction codes.

PILOTS

1. VHF No. 1 Control Panel - "AS REQUIRED" (CP)

FLIGHT ENGINEER

If a malfunctioning CSD will not disconnect, the engine should be shut down if not essential to maintain flight.

1. CROSSFEEDS - CLOSED

WARNING

Loss of electrical power to the fuel boost pumps while the fuel crossfeed valves are in the crossfeed position will cause engine flameout.

2. VHF No. 1 Control Panel - "AS REQUIRED" (CP)
3. Bus Tie Switches - OPEN

Open all bus tie relays to prevent recurrence of the complete electrical failure if the malfunctioning generator(s) is reactivated.

NOTE

The Bus Tie OPEN, GEN OUT and GEN FAIL lights will not be operable until at least one generator is powering a transformer-rectifier.

4. Generator Control Switches - OFF

PILOTS | FLIGHT ENGINEER

5. One Generator Control Switch - TEST, CHECK FOR PROPER VOLTAGE AND FREQUENCY, THEN ON

If the voltage and frequency are not steady and within limits, do not place generator control switch to ON, but proceed to another generator control switch. Activating one generator will restore power to an Essential AC Bus and a significant portion of power to the aircraft.

6. Repeat item 5 for generator on the opposite side of the aircraft.

This item will restore power to all systems except the Main AC Buses for the generators that have not been activated.

7. Repeat item 5 for remaining generators.

If power from one generator is restored, go to POWER RESTORED column. If generator power cannot be restored, go to POWER NOT RESTORED column.

WARNING

- If the malfunctioning generator(s) has been identified while operating in the isolated mode, use appropriate procedures. Then close all Bus Tie Switches to resume normal operations.
- If the malfunctioning generator(s) has not been identified, leave the Bus Tie Switches in OPEN and monitor all four generators for abnormal indications.

NOTE

Unless one generator is off or has been disconnected, all buses will be powered by the isolated mode of generator operation.

POWER NOT RESTORED

PILOT

2. Generator Power - "NOT RESTORED" (E)

3. Yaw Damper - "CHECKED" (P)

FLIGHT ENGINEER

8. Generator Power - "NOT RESTORED" (E)

9. Yaw Damper - "CHECKED" (P)

POWER RESTORED

PILOT

2. CDS/AFCS - "CHECKED/SET" (P)

3. Yaw Damper - "CHECKED" (P)

FLIGHT ENGINEER

8. CDS/AFCS - "CHECKED/SET" (P)

9. Yaw Damper - "CHECKED" (P)

WARNING

If the yaw damper remains inoperative, descend to a lateral stability Zone 1 altitude (figure 3-22).

NOTE

Verify that annunciator bar above AP1 pushbutton is not flashing. If it is, reset AFCP1 by pressing and momentarily holding the AP1 pushbutton.

POWER NOT RESTORED — PILOT

4. Attitude and Heading - "AHRS" (P)

POWER NOT RESTORED — FLIGHT ENGINEER

10. Attitude and Heading - "AHRS" (P)

WARNING

To prevent overload of emergency generator, perform the following two steps.

CAUTION

DU No. 4 and UHF No. 1 may be powered for five minutes out of every 30 minutes.

POWER RESTORED — FLIGHT ENGINEER

10. Crossfeeds - AS REQUIRED

POWER NOT RESTORED

PILOT	FLIGHT ENGINEER
5. DU No. 4 CB (11C) - "OPEN" (P) **NOTE** If DU No. 2 is inoperative, DU No. 4 may remain powered.	11. DU No. 4 CB (11C) - "OPEN" (P)
6. UHF No. 1 - "OFF" (CP)	12. UHF No. 1 - "OFF" (CP)
7. Emergency Pressurization Switches - "EMERGENCY" (P)	13. Emergency Pressurization Switches - "EMERGENCY" (P)
8. Loss of all Generators Checklist - "COMPLETED" (E)	14. Loss of all Generators Checklist - "COMPLETED" (E)

POWER RESTORED

PILOT	FLIGHT ENGINEER
4. VHF No. 1 Control Panel - "AS REQUIRED" (CP)	11. VHF No. 1 Control Panel - "AS REQUIRED" (CP)
5. Flight Displays - "SET" (CP, P) a. DPUs b. Bearing Pointers c. Flight Director d. BDHIs	12. Flight Displays - "SET" (CP, P)
6. FMS - "CHECKED/ REPROGRAMMING" (CP, P, N) **NOTE** The Navigator may perform these steps as directed. a. POWER UP Page - CHECKED/SET b. ROUTE - CHECKED/ REACTIVATED c. PERF INIT Page - SET d. COMM/NAV Radios - CHECKED/ON	13. FMS - "CHECKED/ REPROGRAMMING" (CP, P, N)
7. Loss of all Generators Checklist - "COMPLETED" (E)	14. Loss of all Generators Checklist - "COMPLETED" (E)

BATTERY LIGHT ILLUMINATED.

If the BATTERY light illuminates, check the voltage difference between the main DC bus and the isolated or emergency DC bus. If voltage reads normal, a battery warning indication system malfunction is indicated. Monitor the isolated or emergency DC bus voltage for the remainder of the flight. If bus voltage differs, refer to the Loss Of Normal DC Power (AC Power Normal) procedure.

LOSS OF NORMAL DC POWER (AC POWER NORMAL).

If the battery light illuminates and a voltage difference exists between the main DC bus and the isolated or emergency DC bus, or the BATTERY light is accompanied by two main DC bus OFF warning lights, the battery is supplying power to the isolated and emergency DC buses.

PILOTS

1. VHF No. 1 Control Panel - "AS REQUIRED" (CP)
2. Inst Power Switch - "EMERGENCY" (P)

NOTE

This will cause the emergency generator to come on and supply power to the isolated and emergency DC buses. Regardless of the manner in which the emergency generator is placed into operation, the navigation AC bus No. 1 will be without power.

3. Yaw Damper - "CHECKED" (P)

WARNING

If the yaw damper remains inoperative, descend to a lateral stability Zone 1 altitude (figure 3-22).

NOTE

Verify that annunciator bar above AP1 pushbutton is not flashing. If it is, reset AFCP1 by pressing and momentarily holding the AP1 pushbutton.

4. Attitude and Heading - "AHRS" (P)

WARNING

To prevent overload of the emergency generator, perform the following two steps.

CAUTION

DU No. 4 and UHF No. 1 may be powered for five minutes out of every 30 minutes.

5. DU No. 4 CB (11C) - "OPEN" (P)

NOTE

If DU No. 2 is inoperative, DU No. 4 may remain powered. DU No. 2 CB may be opened in lieu of DU No. 4 CB.

6. UHF No. 1 - "OFF" (CP)
7. Emerg Power Control CB (9A) - "OPEN" (P)
8. Emergency Pressurization Switches - "AS REQUIRED" (P)

FLIGHT ENGINEER

1. VHF No. 1 Control Panel - "AS REQUIRED" (CP)
2. Inst Power Switch - "EMERGENCY" (P)
3. Yaw Damper - "CHECKED" (P)
4. Attitude and Heading - "AHRS" (P)
5. DU No. 4 CB (11C) - "OPEN" (P)
6. UHF No. 1 - "OFF" (CP)
7. Emerg Power Control CB (9A) - "OPEN" (P)
8. Emergency Pressurization Switches - "AS REQUIRED" (P)

PILOTS

9. Inst Power Switch - "NORMAL" (P)

NOTE

- Placing the Instrument Power Switch to NORMAL will ensure that the emergency AC bus remains powered in all configurations of the electrical system. Emergency AC and Emergency DC bus lights will extinguish.
- Following power transfer flight displays require reselection.

10. Loss of Normal DC Power Checklist - "COMPLETED" (E)

FLIGHT ENGINEER

9. Inst Power Switch - "NORMAL" (P)

10. Loss of Normal DC Power Checklist - "COMPLETED" (E)

Effect on Systems.

In case of an actual loss of normal DC power (BATTERY light, 2 main DC bus OFF lights), the right air conditioning system may be restored by placing the right EMERGENCY PRESSURIZATION SWITCH to EMERG. This will connect the system pressure regulating and shutoff valve to the emergency DC bus.

NOTE

If operating the air conditioning system in RIGHT, the aircraft will depressurize when the cabin control fan comes on. The flight engineer will return the air conditioning master switch to BOTH. This will prevent the cabin pressurization control fan from operating, and will ensure that pressurization remains available while the electrical problem is being resolved.

WARNING

With an actual loss of normal DC power, the effect on the following systems must be taken into consideration.

1. Fuel System:

Everything is inoperative except for main tank boost pumps, the main tank quantity indicators, the fuel pressure indicator, the crossfeed and separation valves, and the fuel totalizer.

2. Flight Controls:

a. Rudder - Reverts to the high pressure mode-use with caution above 160 KCAS.

b. Pitch Trim - INOPERATIVE except for manual hydraulic trim.

c. Flaps - Asymmetry protection and position indicator are INOPERATIVE. High force detent is ENGAGED.

d. Spoilers - INOPERATIVE.

e. Ailerons and Rudder- Power control switches INOPERATIVE.

f. Autopilot - AP 1 and AP 2 INOPERATIVE.

(1) Yaw Damper - FAULT.

(2) Stall Warning - INOPERATIVE.

(3) Flight Director - INOPERATIVE.

3. Hydraulic Systems:

a. System 1 and 2 - Electric suction boost pumps are INOPERATIVE.

b. System No. 3 - INOPERATIVE.

4. Landing Gear System

a. Anti-skid - INOPERATIVE.

b. Emergency Brakes - INOPERATIVE, SELECT NORMAL BRAKES.

c. Rudder Pedal Steering - INOPERATIVE.

5. FMS - INOPERATIVE

a. NP 1/2 - INOPERATIVE

b. MFCDU 1, 2, 3 - INOPERATIVE.

NOTE

INS attitude and reference may be available if selected until INS battery failure.

6. CDS - DEGRADED

a. DAMU No. 2 - INOPERATIVE.

b. DPU No. 2 - INOPERATIVE.

c. DU No. 1, No. 3 - INOPERATIVE.

7. Other Systems:

a. CSD Overheat and Disconnect Switches - INOPERATIVE.

b. Generator Warning Lights - INOPERATIVE.

c. Communications - INOPERATIVE except for UHF No. 1 and VHF No. 1.

NOTE

VHF No. 1 Control Panel must be turned on and tuned. VHF No. 1 Comm and Nav should be available.

d. Defensive Systems - INOPERATIVE.

e. All adverse weather (anti-icing, de-icing) systems - INOPERATIVE.

f. IFF/TCAS – INOPERATIVE

Emergency Generator Operation.

With the Inst Power Switch in the NORM position, the emergency generator normally will be turned on and will supply AC and DC power to the isolated and emergency buses when essential AC Bus No. 1 power fails.

If the emergency generator does not come on automatically in the event of a power failure on the essential AC Bus No. 1, the generator may be turned on manually by placing the Inst Power Switch in the EMERG position. If the emergency generator still does not start up, open the Emerg Power Control circuit breaker (9A) on the emergency DC bus.

ENVIRONMENTAL SYSTEM MALFUNCTIONS

The following procedures are intended as a guide for coping with environmental malfunctions.

NOTE

Anytime an air conditioning pack is inoperative or shut down because of a system malfunction, aircraft pressurization will be degraded.

MALFUNCTION	POSSIBLE INDICATIONS	SUGGESTED CORRECTIVE ACTION
PHE Overheat	PHE temp above 280°C and/or applicable system regulator pressure indicating zero.	Turn OFF applicable system shutoff valve and select operating pack. **NOTE** If overheat occurred during climbout, you may be able to regain pack at cruise altitude under the reduced power setting.
Secondary Heat Exchanger Over Heat	Sound of pack surging, fluctuating rate of climb, loss of airflow (Verification of faulty A/C system can be made by gasper airflow).	Select operating pack. First check for rate of climb changes, could be faulty floor heat mod valve, turn OFF floor heat before shutting down packs. Turn floor heat OFF to eliminate the floor heat modulating valve as a possible cause. If indications continue, turn floor heat back ON. Select operating pack.
Faulty High Limit Sensor	Fluctuating or no regulated pressure indicated, PHE temp indicator normal.	Place appropriate emergency pressurization switch to emergency. The system shutoff valve is now powered open through the emergency DC bus and the automatic O/H Protection feature is inoperative.
System Over Pressure Regulating Valve failed.	System Pressure Relief Valve Light on, regulated pressure excessive.	If regulated pressure is excessive, place appropriate system shutoff switch to CLOSE. If light remains illuminated and regulated pressure is still indicating excessive, ensure wing isolation switch is in NORMAL and place both bleed air shutoff switches on affected side to CLOSE. **NOTE** For pressurization purposes, consideration may be given to operating with bleed valves open when a reduced power setting is established provided regulated pressure does not exceed 70 PSI.

FLIGHT CONTROL MALFUNCTIONS.

This section contains information on many specific types of flight control malfunctions. Not every conceivable malfunction is listed; therefore, the following general guidance is offered should a flight control malfunction occur:

1. Maintain/regain aircraft control. Return aircraft to safe flight conditions (not necessarily straight and level).

2. Prevent control deterioration. If the malfunction changed with altitude, climb/descend to improve control.

3. Carefully analyze indications and then take corrective actions. Consider use of alternate controls (trim, spoilers, asymmetric power, etc.) if situation warrants.

4. After the malfunction is resolved, perform a controllability check if in other than a normal flight control configuration.

Jammed Flight Controls.

The primary flight control system incorporates four shear rivets. One shear rivet each is located in the aileron system and elevator system interconnect rods and one each in the aileron and rudder system feel spring cartridges. On aircraft not modified by TCTO 716/808 an additional shear rivet is located in the elevator artificial feel mechanism.

If the aileron controls are jammed in the flight station area, the pilot's and copilot's systems can be separated by the pilots exerting sufficient force shear the interconnect rod rivet. Disengage the autopilot. If possible, reduce airspeed before shearing pins, and always turn both control wheels toward the aircraft centerline to minimize control overshoot and prevent overstressing the airframe.

If the elevator controls are jammed, disengage the autopilot and reduce airspeed. Trim as needed. Perform shear-out with minimal overshoot to prevent excessive stress on the airframe.

Partial control can be obtained using the freed system. Since the controls are also tied together at their respective input quadrants, completely free operation will not be obtained.

Jams of the artificial feel springs are considered highly improbable but a jammed feel spring can be removed from the system by exerting sufficient force to shear the feel spring rivet. Since feel spring force is lost subsequent to shearing the rivet, it is recommended that the aircraft be slowed down if feasible before freeing the system, in order to avoid violent maneuvers and high aircraft loadings. The freed control system will necessitate exercising caution to avoid overcontrolling.

AILERON HYDRAULIC POWER CONTROL FAILURE.

NOTE

> If the Flight Control Malfunctions procedure was used, the annunciator will remain illuminated and will not flash again if the unaffected aileron POWER OFF light illuminates; therefore, periodically monitor the unaffected aileron POWER OFF light.

If two POWER OFF lights associated with a power control assembly illuminate, position the corresponding power control switches to TAB OPERABLE to manually operate the aileron. Increased pilot effort will be required.

NOTE

> Considerably more force will be necessary to maintain wings level flight when only one aileron is placed in tab operable.

If one power off light associated with a power control assembly illuminates, position the corresponding aileron power control switch to TAB OPERABLE.

JAMMED AILERON CHECKLIST.

Hydraulic jamming and certain types of mechanical jamming may be corrected by the following checklist:

1. Aileron Scan - "AS REQUIRED" (P, S)

The scanner will be positioned to visually observe the aileron throughout the following procedure. Interphone contact will be maintained between the pilot and scanner.

2. Jammed Aileron - "IDENTIFY" (P)

Normal Indications are:

Yoke Left -	Left Aileron UP
	Right Aileron DOWN
Yoke Right -	Left Aileron DOWN
	Right Aileron UP

WARNING

> It is imperative that the aileron which is jammed be identified prior to moving either aileron power control switch to the OFF or TAB OPERABLE position. Selecting OFF or TAB OPERABLE on the operative aileron could degrade control capability to a point where aircraft roll cannot be controlled. Experience has shown that aircraft control deteriorates rapidly with an aileron jammed full down and airspeed 180 KCAS or less.

3. Aileron System 1 (Jammed Aileron) - "TAB OPERABLE" (P)

NOTE

If aileron frees and aircraft control returns to normal, it is not necessary to reposition system No. 2 switch. Proceed to item 5.

4. Aileron System 2 (Jammed Aileron) - "TAB OPERABLE" (P)

The aileron should position itself aerodynamically when hydraulic pressure is removed. The aircraft will roll as the aileron floats upward to position itself aerodynamically.

NOTE

- Because the malfunction may be limited to system No. 2, consider returning system No. 1 switch to normal. This would allow normal operation of the aileron and provide better aircraft control. If the jammed aileron condition recurs, reposition the system No. 1 switch to TAB OPERABLE.
- Considerably more force will be necessary to maintain wings level flight when only one aileron is placed in tab operable.
- If an aileron remains in tab operable, the remaining flight should be planned to avoid large aileron inputs and high crosswinds (see Section VI).

5. Aileron Scan - "AS REQUIRED" (P, S)

6. Jammed Aileron Check - "COMPLETED" (P, S)

AILERON TAB MALFUNCTIONS.

If an aileron tab has been unlocked and will not return to the locked out position, or if an aileron tab inadvertently unlocks while the aileron remains powered, leave the aileron power control switches in the normal position and continue flight. Roll control will be reduced slightly compared to the normal powered aileron because of the tab motion. No further attempt to extinguish the light or lock out the aileron tab will be made. Scan the affected aileron with the power control switches in normal to determine if the aileron tab is operable.

ELEVATOR HYDRAULIC POWER CONTROL FAILURE.

If hydraulic system No. 1 or No. 2 pressure is lost to the power control assembly, place the related elevator power control switch to EMER.

WARNING

Never remove hydraulic pressure from the elevator by placing both elevator power switches to the OFF position simultaneously. A pitch up or pitch down may be encountered as the elevator floats to a neutral hinge moment position.

Elevator Artificial Feel Centering Spring Failure. (Aircraft Not Modified By TCTO 716/808)

If the artificial feel centering spring fails, the control column will slowly move forward. Approximately 17 pounds of pressure will be required to hold the yoke centered; this pressure cannot be trimmed out. If the autopilot is engaged, the control column will move full forward and the trim will go full up. The resulting mistrimmed condition will probably stall out the electrohydraulic and hydraulic pitch trim.

If this condition occurs, the pilot should manually fly the aircraft. The control column position should be normal. Trim will not relieve control column pressure; it should be used only to approximate nominal values for each phase of flight.

Elevator Artificial Feel Malfunction. (Aircraft Modified By TCTO 716/808)

1. If the pilot is applying pressure to the yoke at the time of an elevator feel clevis bolt failure, the yoke will move in the direction of the applied force due to the lack of resistance from the spring. The amount and rapidity of the movement are solely dependent upon the amount of elevator pressure being applied at the time. Failure will result in sensitive elevator control when hand flying the aircraft. The centering function of the feel system is lost which may lead to mistrimming the aircraft. Use the autopilot or set the pitch trim to a setting appropriate for that and subsequent phases of flight.

a. Do not confuse this with other malfunctions that may result in uncommanded pitch up or down movements such as runaway pitch trim. Runaway pitch trim can be verified by observing uncommanded trim indicator movement.

b. If excessive nose down trim is present and trim appears to be stalled out, the malfunction may be misinterpreted as a free floating stabilizer. Attempt to use the higher torque capability offered by electric pitch trim to overcome airloads and return trim to normal settings.

2. If no force is being applied to the yoke when the clevis bolt fails, the elevator should remain in the same relative position.

3. If the autopilot is engaged, elevator control should be normal with no sudden movements. Coupled approaches are suggested. If flying a non-coupled approach, pay particular attention to ensure elevator trim settings match those normally associated with approach and landing.

4. If clevis bolt failure is suspected, perform a controllability check if time and circumstances permit, again monitoring pitch trim to ensure it remains appropriate for the regime of flight.

5. Aircraft not modified by TCTO 716/808 may be flown without restriction.

PITCH TRIM MALFUNCTIONS.

Pitch trim malfunctions fall into three categories: runaway trim, inoperative trim and stalled trim.

Runaway Pitch Trim.

Runaway pitch trim requires immediate corrective action. The following guidance will aid in aircraft control:

Nose Up Runaway: If unable to stop pitch-up with control wheel pressure or if nose-up attitude is extreme (above 15 degrees), roll the aircraft into a bank. If full nose up trim is encountered, a 45- to 60-degree bank may be required to lower the nose of the aircraft. Bottom rudder will also aid in lowering the nose.

Nose Down Runaway: Hold positive back pressure on the control wheel, maintain wings level and reduce power as necessary.

When Runaway Pitch Trim Is Recognized:

1. Disconnect the electric and electrohydraulic pitch trim. Simultaneously apply manual hydraulic pitch trim in the opposite direction of the runaway.

NOTE

Ensure Pitch Trim Disengage C/B (39R) is closed.

If trim movement stops, continue with step 4.

If trim movement continues:

2. Direct the flight engineer to depressurize hydraulic system No. 2 and the copilot to select EMER on the ELEVATOR SYS 2 power control switch.

3. Stabilize aircraft attitude.

- Take-off configuration - rotate speed will provide the most effective elevator.
- Clean - 200 KCAS will improve elevator effectiveness.
- Cruise - maintain cruise speed.
- For nose down runaway, spoiler deployment will provide additional nose up movement.

4. Electric or Electrohydraulic Pitch Trim - Reset.

The electric or electrohydraulic pitch trim system may be reset one at a time while watching closely for another runaway. It is desirable to reset the electric pitch trim first because of the slower rate and the fact that the autopilot is available. Once the faulty system is identified, leave it disconnected for the remainder of flight. If the No. 2 hydraulic system remains depressurized, reposition the appropriate flight control switches and follow the procedures in Section III for loss of hydraulic system No. 2.

NOTE

With No. 2 hydraulic system depowered, the gear will be lowered manually utilizing the Landing Gear Emergency Extension checklist. This checklist requires the opening of the Landing Gear Control C/B (30R). While this C/B is open, nose wheel steering will remain inoperative. As soon as practical after landing, close the Landing Gear Control C/B (30R) and repressurize hydraulic system No. 2 to regain nose wheel steering.

If unable to return any of the pitch trim systems to normal operation, refer to Inoperative Pitch Trim procedures.

Inoperative Pitch Trim.

Inoperative trim is the failure of one or more trim systems resulting in an inability to move the trim from the previously selected position.

1. If the pitch trim is stuck at a cruise setting or an excessive nose down setting with 25% CG or more aft:

   a. The final approach should be flown with APPROACH FLAPS at an airspeed of 140 percent of approach flap stall speed, but not less than 140 KCAS.

   b. A power on touchdown should be planned at approximately 125 percent of approach flap stall speed, but not less than 125 KCAS. A power reduction will require additional up-elevator.

2. Excessive nose down trim, CG forward of 25%.

   a. Plan to fly a no-flap approach.

   b. Perform a controllability check. If elevator control is inadequate:

      (1) Reposition cargo aft, if possible, to improve controllability.

WARNING

Palletized cargo/airdrop platforms may be repositioned in-flight in cases of extreme emergency. See the Repositioning of Palletized Cargo/Airdrop Platforms procedures in this section.

      (2) Place the Spoiler Auto Retract Defeat switch to DEFEAT.

      (3) If unable to reposition cargo aft, spoiler deployment and additional thrust may improve controllability. In a no-flap condition, partial or full flight spoilers may be used to improve elevator control. Spoilers should be deployed as necessary to attain proper attitude when commencing final approach. (Do not exceed the flight limit.)

WARNING

Ensure that the Spoiler Auto Retract Defeat switch is in DEFEAT prior to placing the landing gear handle down.

3. Excessive Nose Up Trim Position.

   a. Use landing flaps and normal approach speeds. Considerable forward pressure will be required on the yoke for extreme nose up trim settings. (Approximately 8 degrees nose up is the maximum that can be controlled in a wings-level attitude.)

   b. Reposition cargo forward, if possible, to improve controllability.

Stalled Hydraulic Pitch Trim.

If the hydraulic pitch trim stalls, the electric pitch trim should be used to take advantage of its increased torque.

FLAP SYSTEM FAILURE.

WARNING

- The spoilers shall not be deployed in-flight under any circumstances if the flaps are not fully retracted.
- When operating the flaps without asymmetry protection, the flap lever should be moved in small increments to prevent an uncontrollable condition should asymmetrical extension or retraction occur.

CAUTION

Operation of the flaps with only one electric pump in the No. 3 hydraulic system operating (No. 2 hydraulic system on or off) may damage the flap pack.

If the wing flap lever high force detent is engaged, and flap operation is necessary, check that the spoilers are closed and locked, then press the flap lever stop position indicator pin.

Hydraulic Leaks.

Close the manual shutoff valve on the wing flap gearbox to shut off hydraulic pressure to the flaps.

NOTE

The shutoff valve can be turned on to extend the flaps for landing. It should be turned off after the flaps are extended. If a hydraulic leak at or around the wing flap drive motor can be determined to be from Hydraulic System No. 3, the No. 3 hydraulic system may be isolated from the flap drive motor by using the isolation valve (T-handle) located to the right of the flap drive motor in the center wing section.

Flap Asymmetry.

If the FLAP ASYM light was caused by a broken cable detector, proceed as follows:

CAUTION

Make no attempt to override the asymmetry system.

1. Remove spring and secure broken cable detection switch to OPEN.
2. Close the manual shutoff valve located on the flap drive gearbox.
3. Place the flap handle to the indicated flap position.
4. Reset the solenoid operated shutoff valve located near the flap drive gearbox.

CAUTION

If the FLAP ASYM light does not go out when the solenoid operated shutoff valve is reset, do not attempt to move the flaps since normal hydraulic pressure may move the flaps and damage the torque tube brakes.

NOTE

If the torque tube brakes have not tripped, the FLAP ASYM light on the annunciator panel should go out and the flaps can be manually positioned.

5. Manually position the flap servo flow control valve to the LANDING (full aft) position.
6. Open the manual shutoff valve.

WARNING

Failure to comply with this procedure may result in severe injury due to close proximity of flap drive torque tube.

NOTE

Close coordination with the copilot is required.

7. Close the manual shutoff valve when flaps reach TAKE OFF/APPROACH.
8. Place the flap handle to the indicated flap position.

FREE FLOATING STABILIZER.

A free-floating stabilizer may aerodynamically position itself against the 4.5 degree mechanical stop (full nose-down trim position).

1. In cruise, reduce airspeed to approximately 200 KCAS to improve control. Deploy spoilers slowly as needed.

WARNING

Do not oppose nose pitch up due to spoiler deployment. Positive back pressure on the control wheel is desirable to maintain continuous contact between the stabilizer and the mechanical stop.

2. If a spoiler underspeed warning occurs and continued spoiler use is necessary, the warning horn may be silenced by opening the Stall Prevent No. 1 circuit breaker (35R).
3. Place the Spoiler Auto Retract Defeat switch to DEFEAT.

WARNING

Ensure that the Spoiler Auto Retract Defeat switch is in DEFEAT prior to placing the landing gear handle down.

4. For landing, refer to Inoperative Pitch Trim procedure in this section.

RUDDER HYDRAULIC POWER CONTROL FAILURE.

If a POWER OFF light illuminates, turn the related rudder power control switch OFF.

Rudder High-Pressure Select System.

If the rudder does not switch to the high-pressure mode when the airspeed is reduced to a minimum of 150 KCAS, place the rudder Hi-Press Override switch in the OVERRIDE position.

WARNING

When operating the rudder system in the high-pressure mode above 160 KCAS, exercise extreme caution since full rudder deflection could cause structural damage. With the rudder system over-pressure light illuminated, operate the rudder power control unit with one actuator turned off.

SPOILER SYSTEM FAILURE.

Spoilers Indicate Unlocked In-Flight.

If the spoiler LOCKED/UNLKD indicator fails to indicate locked when the spoilers are closed, check that the Spoiler SOV and Pos Ind circuit breaker (36R) is closed.

If the circuit breaker is closed, place the EREO switch to EMER RETRACT. If spoilers lock, no additional action is required.

If EMER RETRACT does not lock the spoilers, place EREO switch to EMER OFF. Descend to FL 250 or below (fuel permitting) if passengers are aboard. Compute all performance data based on spoilers inop. Place the EREO switch to NORM after touchdown, reset, then deploy the spoilers.

WARNING

If any complete bank of spoiler panels (i.e., LH inboard, LH outboard, RH inboard, or RH outboard) fails to close and lock, the flaps shall not be extended under any circumstance.

Loss of Electrical Power.

The spoilers are inoperative, with loss of DC power.

Spoiler Asymmetry.

If one of the SPOILER INOP lights illuminates, spoilers will continue to be operational. If both SPOILER INOP lights illuminate, the spoilers will automatically retract. Position the spoiler lever to RESET in either case.

UNCOMMANDED YAW IN-FLIGHT.

The following procedure applies to uncommanded yaw conditions caused by rudder power pack, autopilot, or yaw damper malfunctions.

WARNING

Do not use rudder pedals to control the uncommanded yaw input. Use roll control only for recovery.

If severe, uncontrollable yaw occurs, proceed as follows:

1. Hold rudder pedals in neutral
2. Rudder Power Switches (both) - OFF
3. Continuous Ignition - ON
4. Descend to Zone 1 of figure 3-22.

NOTE

LAT Autopilot may remain engaged to help damp dutch roll.

The following procedure may be used to restore rudder power prior to landing:

1. Altitude - Below 20,000 feet
2. Yaw Damper - OFF
3. Rudder Pedals - NEUTRAL
4. Either Rudder Power Switch - ON

If yaw does not return, land with rudder powered from one system. If yaw returns, place this rudder power switch OFF and place the other ON. If yaw still persists, place both rudder power switches OFF and land with the rudder depowered.

WARNING

If rudder is depowered, Vmca is no longer valid. A go-around attempt with asymmetric power could lead to loss of control.

CAUTION

With rudder depowered, maximum crosswind for landing is 10 knots.

YAW DAMPER FAILURE.

Complete yaw damper failure will annunciate as YAW DAMP INOP on both SFDs. Reset MASTER CAUTION and attempt to reset yaw damper by momentarily placing the YAW DAMPER ON - OFF switch to OFF and acknowledge. Operations may be conducted in accordance with the lateral stability chart.

CAUTION

- Failure of both DPUs will result in the loss of the yaw damper. Operations may be conducted in accordance with the Lateral Stability Chart, figure 3-22.
- If the YAW DAMP INOP annunciation does not clear, conduct operation in accordance with the lateral stability chart, figure 3-22.

NOTE

Verify that annunciator bar above AP1 pushbutton is not flashing. If it is, reset AFCP1 by pressing and momentarily holding the AP1 pushbutton and attempt to reset the yaw damper.

FUEL SYSTEM FAILURES.

The aircraft fuel system will permit normal engine operation after a single fuel system component failure or loss of one source of electrical Power.

Fuel Quantity Indicator Failure.

WARNING

Do not reset any fuel quantity indicator circuit breaker that was opened in the following steps until proper inspection and repair has been accomplished.

The fuel quantity indicators are designed to prevent the application of dangerous currents into their associated fuel tanks. This is true even with a malfunctioning fuel quantity indicator.

WARNING

As a safety precaution, if a fuel quantity indicator fails to indicate or displays a catastrophic failure code(s) of 01, 02, or 03, or a secondary fault code(s) of 11, 12, 21, 22, 31, 32, 41, or 42, open the associated fuel quantity indicator circuit breaker.

If a digital fuel quantity indicator displays a secondary fault code (04, 05, 06, 07, 13, 14, 23, 24, 33, 34, 43, or 44) and is still providing useful information, the indicator may be left operating for the duration of that flight until repairs can be implemented. Refer to Section I for information regarding catastrophic and secondary failures and their associated failure codes.

Boost Pump Failure.

WARNING

- If a fuel boost pump circuit breaker opens, do not reset the circuit breaker. Turn OFF the switch for that pump and open the remaining circuit breakers. The switch shall not be turned ON or the circuit breakers reset until proper inspection and repairs have been performed, unless a fuel emergency exists.
- For any known or suspected fuel boost pump failure, place the corresponding boost pump switch to OFF and open A, B, and C phase circuit breakers to prevent inadvertent operation of the defective pump.

If a boost pump fails in an extended range tank, place the corresponding boost pump switch OFF. The corresponding separation valve switch should be placed OPEN so the remaining extended range tank boost pump will supply both engines on that side of the aircraft.

If the primary boost pump fails in an auxiliary tank, place its switch OFF and turn ON the secondary boost pump.

If a main tank boost pump fails, place its switch OFF and turn ON the tank's remaining boost pump. If that pump fails, place the associated boost pump switch OFF.

The extended range or auxiliary tanks will continue to supply fuel to the engine under positive pressure until empty. Fuel can then be suction fed from the main tank containing the inoperative boost pump(s) providing the crossfeed valves are closed. Engine operation will be normal when using suction feed, except at high thrust settings above critical altitude. The amount of unusable fuel in a main tank is increased when complete boost pump failure occurs in that tank.

Crossfeed Valve Failure.

If a crossfeed valve fails closed, normal fuel usage can be maintained only by transferring fuel from the extended range tank and then the auxiliary fuel tank into the main tank in which the crossfeed valve failed.

WARNING

Take-off shall not be attempted with a crossfeed valve failed in the OPEN position.

Fuel Filter Bypass Light On/Clogged Filter.

Illumination of the FIL BY-PASS light indicates fuel is bypassing the related engine fuel filter, which has been clogged either by icing or solid contaminants. Solid contaminants in the fuel control unit can result in fuel flow fluctuation, unstable engine operation or flameout. To eliminate icing as a possible cause of filter clogging, place the related fuel heater ON for one minute. The light should extinguish within 30 seconds. If the light remains on after one minute, shut down the engine if it is not needed for safe flight. If the engine is not shut down and low fuel temperatures exist, continue to operate the fuel heater for one minute every 30 minutes.

Fuel Heater Control Valve Failure.

If a fuel heater control valve fails in the open position, maintain 1,500 PPH fuel flow or above, if possible until landing. The malfunction must be corrected prior to the next flight.

Engine-Driven Pump Failure.

Illumination of a PUMP OUT light indicates failure of the engine-driven pump. A PUMP OUT light accompanied by normal engine operation indicates failure of the first stage of the engine-driven pump only. Normal engine operation can be maintained by using tank boost pump pressure to that engine.

NOTE

Under the above conditions, fuel is bypassing the fuel heater and filter. Engine instruments must be monitored for unstable engine operation or flameout.

Sump Low Warning Light Illuminated.

The SUMP LOW warning lights should illuminate when fuel quantity in the applicable surge box drops below approximately 125 gallons for the outboard main tanks and below approximately 60 gallons for the inboard main tanks with the aircraft in level flight. If a SUMP LOW warning light illuminates with a large quantity of fuel remaining in the tank, assume a level flight attitude to allow the sump to refill.

Fuel Leaks.

Fuel leaks may result from ruptured fuel lines, faulty fittings, or the structural failure of a fuel tank. Fuel leaks may be indicated by abnormally high or low fuel flow, illumination of one or more PRESS. LOW lights, or a rapidly decreasing fuel quantity indication. The following causes should be considered when these indications are present:

High fuel flow - This can result from a leak between the flowmeter and fuel nozzles. A leak can be distinguished from a faulty fuel flow indication by an accompanying rapid quantity decrease.

Simultaneous illumination of PRESS. LOW lights - This can result from a break any place in the system, simultaneous failure of boost pumps, or exhausted fuel supply.

Rapidly decreasing quantity indications - This can result from a break any place in the fuel system, a ruptured fuel tank, or a faulty indicating system.

A leak in the fuel system near an engine will usually require the engine be shut down to prevent a fire.

However, a leak in some parts of the fuel system may be isolated by manipulation of the crossfeed valves, separation valves, or boost pumps. The effects of a leak resulting from a ruptured fuel tank can be minimized by operating all engines from that tank or by transferring the fuel to other tanks.

Fuel leaks can occur with engines exposed to JP-4 for long periods of time and then switched to JP-8. If this problem occurs, maintenance action is required before flight.

HYDRAULIC SYSTEM FAILURE.

Loss of Hydraulic Fluid.

Loss of hydraulic fluid in the No. 1 or No. 2 system will be indicated by illumination of both engine pump PRESS. LOW lights and a zero pressure indication or by visual observation. If a fluid loss is experienced in either system, turn OFF the suction boost pump and both engine-driven pumps for that system. A loss of fluid in the system No. 3 will be indicated by the PRESS. ON light extinguishing and a zero pressure indication or by visual observation. If fluid is lost in system No. 3, place both pump switches to the OFF position.

WARNING

A hydraulic system failure that results in misting/fogging should not be repressurized unless, in the opinion of the pilot, a greater emergency exists. Possible fire/explosion may occur if hydraulic fluid mist/fog is present. Do not turn on the troop oxygen system unless, in the opinion of the pilot, a greater emergency exists.

Engine-Driven Pump Failure.

Failure of an engine-driven pump will be indicated by illumination of the associated PRESS. LOW light. If an engine-driven pump fails, place its engine valve switch to OFF to prevent system contamination.

No. 3 Hydraulic System Pump Failure.

If continued operation of the No. 3 hydraulic system is necessary with a single pump inoperative, the flap manually operated isolation shutoff valve (T-Handle) should be closed. This is to prevent "dragging" the flap shaft locking brakes.

CAUTION

Operation of the flaps with only one electric pump in the No. 3 hydraulic system operating (No. 2 hydraulic system on or off) may damage the flap pack.

Hydraulic System High Pressure.

If the hydraulic system pressure should increase above 3,400 PSI, isolate the defective pump and operate on the remaining pump.

Electric Suction Boost Pump Failure.

The hydraulic suction boost pump PRESS. LOW light may illuminate on the No. 1 or No. 2 system for the following reasons:

1. The pressure switch fails.
2. Hydraulic leak occurs.
3. The electric suction boost pump fails on the No. 1 system or both the electric and hydraulic suction boost pumps fail on the No. 2 system.

When the light illuminates, turn OFF the suction boost pump and system shutoff valves for the affected system, and direct the scanner to check the system hydraulic quantity. If the quantity is low, service the system and continue with hydraulic troubleshooting. If the No. 2 system electric suction boost pump fails and the hydraulic boost pump is operating, the system will continue to operate from the hydraulic suction boost pump.

Hydraulic Suction Boost Pump Failure.

If an excessive pressure drop is noted in the No. 2 hydraulic system during high system demands, place the suction boost pump switch to OFF and observe the PRESS. LOW light. Illumination of the PRESS. LOW light indicates failure of the hydraulic suction boost pump. System No. 2 will continue to operate from the electric suction boost pump but at reduced power during high system demand.

HYDRAULIC SYSTEMS				
SYSTEM	1	2	3	NOSE LANDING GEAR EMERGENCY EXTEND SYSTEM
Rudder	•	•		
Aileron	•	•		
Elevator	•	•	*	
Pitch Trim		•		
Flaps		•	•	
Spoilers		•	•	
Spoiler Cable Servo		•	•	
Brakes		•	* △1	
Main Gear		• △3		
Nose Gear		• △3		*
Nose Gear Steering		•		
Emergency Generator		•		
Aileron Tab Lockout			•	
Pressure Door			• △2	
Ramp			• △2	
Petal Doors			• △2	
APU Start			• △1	
Air Refueling Door		•		

• Primary system.

* Alternate provisions.

△1 The emergency brakes and APU starter can be operated from the charged accumulators.

△2 The pressure door, ramp, and petal doors can be operated by pressure from the handpump.

△3 If No. 2 hydraulic system is depressurized, install gear pins prior to landing.

WARNING

If a hydraulic leak is detected or suspected in the landing gear system, the aircrew should remain well clear, chock the nose/main gear depending on location of leak, release the parking brake as soon as possible, and evacuate and secure the aircraft. Serious injuries may occur if personnel come in contact with high pressure leaks that may not be readily visible.

CAUTION

- If No. 3 hydraulic system is lost and the accumulators are charged, do not activate the No. 3 hydraulic system pumps because accumulator pressure will be lost through the solenoid-operated shutoff valves. To prevent actuation of the system, open the No. 3 hydraulic system main DC pump circuit breakers.
- After landing, if emergency brakes are selected and the spoilers do not deploy, make only one additional attempt to deploy them. Continued attempts to deploy the spoilers may place an excessive demand on the No. 3 Hydraulic System to the point where emergency brakes are ineffective.

SCADC FAILURE.

If an SCADC INOP light illuminates, the following systems may be affected, depending on the extent of failure:

SCADC 1 FAILS	DUAL FAILURE	SCADC 2 FAILS
	AP1 and AP2 Artificial Feel Overspeed Warning Rudder Overpress Warn Rudder Press Reducer Nav TAS IFF Mode "C" Control Display System (CDS) Autothrottles Stall Warning TAWS FMS Spoiler Underspeed Warning Yaw Damper	
	Plus	
TCAS Pilot Airspeed and Altitude Data Pitch Rate Adapter Left-hand ejector INS 1 Artificial Feel	← →	Copilot Airspeed and Altitude Data Right-hand ejector INS 2 Artificial Feel

RADAR MALFUNCTION.

Operation Without Antenna Stabilization.

Failure of the antenna stabilization will cause a portion of the display to be blanked out while in level flight or cause targets to fade during roll or pitch movements of the aircraft. If antenna stabilization fails, set ANT STAB Switch on RADAR Control panel to "OFF". This switch disables antenna stabilization and locks the antenna so that 0-degree tilt is the present plane of the aircraft.

Operation Without Pressurization.

The AN/APS-133 Radar R/T Unit and Wave Guide are pressurized by aircraft cabin pressure. The radar system may be operated without pressurization up to 20,000 feet cabin pressure. The multifunction display (MFD) units are designed to operate in a pressurized environment.

CAUTION

- If cabin pressurization is lost above 20,000 feet, the function selector switch must be placed to "STBY" to prevent arc-over in the magnetron.
- On aircraft modified by TCTO 520 (SKE equipped aircraft), turn the NAV's MFD OFF above 20,000 feet cabin altitude to prevent possible electrical arcing and equipment damage.

WINDSHIELD IMPAIRMENT.

Structural Integrity of Electrically Heated Windshields and Windows.

Windshield and window glass will withstand pressures two to three times that required for normal operation. The glass will remain structurally safe for pressurized flight even though cracks are present. Glass that is cracked so badly that vision is impaired is still sound enough to meet the requirements of pressurized flight.

Due to the structural integrity of the glass, an aircraft form entry should not be made because of a small area of delamination or a minor crack. Taken individually, such conditions are not critical enough to require replacement.

Replacement Criteria for Electrically Heated Windshields or Windows.

1. Evidence of vinyl interlayer bubbling indicating that the glass has been severely overheated.

2. Evidence of severe electrical arcing within a delaminated area.

3. Extensive delamination affecting the principal viewing area.

4. Shattered or extensively deteriorated glass.

5. Distortion to such a degree that a flying hazard exists.

SECTION III

EMERGENCY PROCEDURES

PART II

ABNORMAL PROCEDURES

TEXT	PAGE
INTRODUCTION	3-85
BATTERY START CHECKLIST	3-85
FIRE HANDLE START CHECKLIST	3-86
PUSH-BACK/TOW PROCEDURES	3-87
BACKING THE AIRCRAFT	3-88
TAKEOFF WARNING ANNUNCIATION MALFUNCTION	3-89
THREE-ENGINE TAKE-OFF PROCEDURE	3-90
ZERO FLAP TAKE-OFF PROCEDURE	3-91
FUEL TANK EMPTY OUT OF SEQUENCE	3-92

INTRODUCTION.

This section contains procedures for abnormal operations caused by equipment malfunction, emergency evacuation, or unique requirements at remote locations.

BATTERY START CHECKLIST.

To make an engine start with external air but no electrical power, the following procedures will be followed:

Electrical power must be conserved as much as possible. The main wheel chocks will remain installed. The pilot and the scanner must review the visual signals to be employed. Engine fire extinguishers will be available and the engine fire detector circuits will be operative. A radio-equipped vehicle should be standing by in the event of an uncontrollable engine fire.

The Battery Start checklist will be accomplished in lieu of the normal Before Starting Engines checklist. The flight engineer will read the checklist.

Check the source of the pneumatic supply to determine that sufficient pressure (30-52 PSI) is available. Additionally, ensure No. 3 hydraulic system is charged to normal system pressure. Start the No. 1 engine first so that the No. 2 hydraulic system will be available for brakes. Visual contact will be maintained between the pilot and scanner until the interphone is operational. When the pilot is ready to start, call for the Battery Start checklist. The scanner should signal rotation and the copilot check the time. After 15 seconds, the pilot will place the Fuel and Start Ignition switch to RUN. After 30 seconds, the engineer will place the generator ON to obtain electrical power.

NOTE

The Before Starting Engine checklist will be accomplished after starting the first engine.

1. Forms - "CHECKED" (P)
2. All Electrical Equipment - "OFF" (CP, P)
3. Throttles - "IDLE START" (P)
4. Instrument Power Switch - "OFF" (P)
5. Brake Selector - "EMERGENCY" (CP)
6. Parking Brake - "SET" (P)
7. No. 1 Bleed Valve - OPEN
8. Air Conditioning Master Switch - ENG START
9. Hydraulic Engine Valves - NORMAL
10. No. 1 Boost Pumps - OFF
11. No. 1 Crossfeed - CLOSED
12. No. 1 Generator Switch - OFF

13. Scanner Signal - "READY" (P) (The pilot will check the scanner for starting clearance)

14. Battery Switch - "ON" (E)

15. Start No. 1 Engine - "STARTING" (P)

16. No. 1 Generator Switch - ON (30 seconds after start is initiated)

a. No. 2 and No. 3 Bus AUTO LOAD DISC Switches - OVERRIDE

b. Fuel Boost Pump Switch (operating engine) - ON

c. Suction Boost Pump Switch (operating system) - ON

d. No. 3 Hyd Pump Switches - ON

17. Instrument Power Switch - "NORMAL" (P) (after normal electrical power is available)

18. Battery Start Check - "COMPLETED" (E)

FIRE HANDLE START CHECKLIST.

When an engine has been shut down with the Fire Handle due to an inoperative fuel control shutoff valve and the aircraft is at a location where maintenance is not available or mission priorities prevent a repair, the following procedure will be used to start the engine.

Accomplish the Before Starting Engines checklist. The engine which is to be started with the Fire Handle will be started first using the Fire Handle Start procedures.

CAUTION

- If the engine has to be shut down for any reason, it will take longer to shut down once the Fire Handle is pulled due to the failed fuel control shutoff valve. Do not advance the throttle, as this may cause the fuel line to collapse.
- Ensure there is no fuel in the tailpipe prior to initiating the start.

1. Fuel and Start Ignition Switch - "STOP" (P)
2. Fire Handle - "PULLED" (P)
3. Air Conditioning Master Switch - ENG START
4. Emergency Shutdown Relay Circuit Breaker – OPEN
5. Bleed Air Shutoff Switch - OPEN
6. Bleed Air Valve Circuit Breaker - OPEN (The engineer will ensure the Bleed Valve opens)
7. Emergency Shutdown Relay Circuit Breaker - CLOSED

The engineer will notify the pilot that all items are accomplished and the engine is ready to start.

The pilot will verify with the scanner that the engine is clear to start.

8. "Starting No. ______" (P)

9. At 15% N_2 RPM, the pilot will first place the Fuel and Start Ignition Switch to RUN, then push the Fire Handle in.

CAUTION

- The Fuel and Start Ignition Switch will be placed to RUN prior to pushing the Fire Handle in.
- If a hung or hot start occurs, allow the engine to motor for at least 45 seconds after the Fire Handle is pulled. Then pull out the Starter Button.

10. At approximately 40% N_2 RPM, Bleed Air Valve Circuit Breaker - CLOSED

CAUTION

The Bleed Air Valve Circuit Breaker must be closed in order to ensure proper Bleed Valve operation when activated by the Bleed Air Shutoff Switch, Fire Handle or automatic operation.

11. Continue with normal starting limitations.

12. Fire Handle Start Check - "COMPLETED" (E)

Accomplish the Starting Engines checklist and start the remaining engines.

PUSH-BACK/TOW PROCEDURES.

Push-back/tow may be required at some locations. Push-back with engines running is the preferred method. Ramp gross weight shall not exceed 325,000 pounds.

If an engine-running push-back is required, accomplish all checklists through Starting Engines checklist.

If a push-back/tow without engines running is required, complete the Before Starting Engines checklist except for the nose gear pin. The push-back/tow procedures will then be initiated by the pilot and read by the flight engineer.

WARNING

It is possible for the nose gear to unlock (drag link come overcenter) if No. 2 hydraulic system is unpressurized and the nose gear pin is removed.

PILOTS | **FLIGHT ENGINEER** | **SCANNER**

FLIGHT ENGINEER

1. Remove External Power "REMOVING" (S) "EXTERNAL POWER REMOVED" (S)

2. Disconnect Scissors and Connect Tow Bar - "DISCONNECTING" (S) "CONNECTED" (S)

WARNING

The lower torque arm should be secured in the elevated position allowing approximately 14 inches of clearance between nose strut and top of torque arm.

NOTE

Step 2 may be accomplished prior to the initiation of this checklist.

The nose gear should not be turned with aircraft static.

3. Ground Clearance - "ALL CLEAR" (S)

SCANNER

1. Removing External Power "REMOVING" (S) "EXTERNAL POWER REMOVED" (S)

Direct or remove ground power unit.

2. Disconnect Scissors and Connect Tow Bar - "DISCONNECTING" (S) "CONNECTED" (S)

Direct or disconnect nose gear scissors and connect tow bar.

3. Ground Clearance - "ALL CLEAR" (S)

The scanner will advise pilot when aircraft repositioning has been completed.

PILOTS	FLIGHT ENGINEER	SCANNER
1. Parking Brake - "OFF, CLEARED TO TOW" (P) At this time, responsibility for aircraft damage rests with the towing crew. **WARNING** The brakes should not be applied until the tow vehicle brings the aircraft to a stop.	4. Parking Brake - "OFF, CLEARED TO TOW" (P)	
2. Parking Brake - "SET" (P)	5. Parking Brake - "SET" (P)	
	6. Disconnect Tow Bar, Connect Scissors - "DISCONNECTED" (S) "CONNECTED" (S)	4. Disconnect Tow Bar, Connect Scissors - "DISCONNECTED" (S) "CONNECTED" (S) The scanner will direct or disconnect tow bar and connect nose gear scissors.
	7. Remove Nose Gear Pin - "REMOVED" (S) **NOTE** Initiate the appropriate checklist.	5. Remove Nose Gear Pin - "REMOVED" (S)

BACKING THE AIRCRAFT.

The aircraft may be backed using reverse thrust during certain conditions, when no other means of moving the aircraft is available.

These conditions are limited to combat, contingency situations, and necessary operations at isolated locations. This procedure will not be used to prevent delays when towing equipment is available or when other aircraft equipment can be moved to provide adequate taxi clearance.

The following procedures will apply:

1. The pilot will ensure that a marshaller is positioned in front of the aircraft (out of the exhaust fumes envelope) and in complete view at all times.
2. Ensure that the area behind the aircraft is clear before and will remain clear while backing.
3. Follow the marshaller's signals while backing.
4. The gross weight should not exceed 240,000 pounds.
5. Set the thrust reverser limiter.
6. Shut down the APU.
7. Turn off the air conditioning system.
8. Retract flaps, close spoilers, ramp and petal doors.
9. Maintain a firm grip on the nose gear steering wheel.
10. Apply the minimum reverse thrust necessary to start the aircraft rolling.
11. Closely monitor EGT to prevent overtemperature. Limit application of the reverse thrust above idle to 30 seconds maximum and then close thrust reversers for cooling. Allow 15 minutes for cooling between applications. If an engine stall or surge occurs, come out of reverse.
12. Use forward thrust to stop. Rapid brake application may cause the aircraft to rock on its tail.

TAKEOFF WARNING ANNUNCIATION MALFUNCTION.

If the TAKEOFF warning annunciators fail to illuminate, check the following items to ensure the aircraft is in the proper configuration for take-off:

1. Check to see if the Take-off Warning circuit breaker (38C) and the Takeoff Warn Ind circuit breaker (45R) are closed.

2. Isolated AC Avionics Bus - POWERED

Check that the FLT REC INOP light is extinguished.

3. Isolated AC Bus - POWERED

Check that the EPR indicators are operational.

4. Main DC 1, Main DC 2 and Isolated DC Buses - POWERED

Test the flight engineer's caution lights; if they all test properly the buses are powered.

5. Spoilers - CHECKED

a. Deploy the spoilers to the GROUND position and ensure the high force detent is removed.

b. Close and lock the spoilers. Ensure the 2 and 3 SPOILER INOP lights are extinguished.

NOTE

The TAKEOFF annunciators will not illuminate if one or both the SPOILER INOP light(s) are illuminated.

c. ARM the spoiler lever.

6. Thrust Reversers - CLOSED AND LOCKED

Ensure the Thrust Rev Pos Ind Pwr and the Press Valve Pwr circuit breakers (26R, 27R, 28R & 29R) are in the proper position.

WARNING

Thrust reversers will be cycled and all indicator lights checked. Do not attempt take-off if any abnormal thrust reverser indication or condition exists. Correct the condition or lock out the symmetrical thrust reversers prior to flight.

7. Flaps - TAKE OFF/APPROACH

NOTE

The switch that senses the Take Off/Approach position of the flaps for the TAKEOFF annunciator is located on the left inboard flap, not in the center console.

8. Autopilot - OFF

NOTE

Ensure that AP1 and AP2 annunciators are extinguished.

9. Doors (Door Warning Circuit) - CLOSED AND LOCKED

NOTE

If a door is unlocked and the Door Warning switch is in BYPASS, the TAKEOFF annunciator will illuminate.

10. Hydraulic Pitch Trim Lever - CHECKED

Move the hydraulic pitch trim lever without depressing the lever switch. No trim change should occur.

NOTE

If the stabilizer moves without depressing the lever switch, check the Hyd/Elec Pt Cont circuit breaker (38R). If the circuit breaker is found OPEN and will not reset, DO NOT TAKE-OFF.

11. Either Hydraulic Pitch Trim Lever Switch - DEPRESS AND RELEASE

The TAKEOFF annunciators should illuminate at this time unless a known condition, i.e., the thrust reversers pinned out, Zero flap take-off, etc., is preventing the annunciators from illuminating.

NOTE

- It is possible to activate the TAKEOFF warning annunciators by actuating the electrohydraulic pitch trim switches; however, this is not recommended since a trim change will occur.
- If the light in the landing gear handle illuminates while depressing the trim lever switch, DO NOT TAKE-OFF.

THREE-ENGINE TAKE-OFF PROCEDURE.

A three-engine ferry flight may become necessary in an emergency situation when the aircraft must be evacuated out of a forecast hazardous weather area or from a forward combat area. MAJCOM approval should be obtained if time permits.

NOTE

The aircraft should be loaded to the most practical forward center of gravity.

Before Electrical Power-on Check.

Prior to beginning the Before Electrical Power-On check, accomplish the following:

Aircraft Forms - Check inoperative engine status. Ensure work reported in the maintenance briefing is recorded in the form. Maintenance personnel will make an entry stating that the inoperative engine is either immobilized or free to rotate in-flight.

Before Starting Engines.

On the Inoperative Engine:

Fuel and Start Ignition - STOP

Bleed Air Shut-Off Switch - CLOSED

Engine Valve Switch (Hyd Sys) - OFF

Continuous Ignition Circuit Breaker - OPEN

Before Take-off.

Air Conditioning Master Switch - OFF

Rudder Trim - NEUTRAL

Rudder High Pressure Override Switch - OVERRIDE

Take-off.

1. Line up on the side of the runway opposite the inoperative engine. The copilot will hold the control column in a full nose down position and maintain wings level.

2. While holding brakes, set throttles on the symmetrical engines to TRT. The copilot will ensure that the symmetrical engine throttles are held at TRT.

3. Release brakes. The pilot will use nose gear steering and rudder as required to maintain directional control. The pilot should transition from the nose gear steering wheel to the yoke as soon as directional control will permit. The yoke must be held forward during the entire take-off roll keeping the nose wheel firmly on the runway for directional control.

NOTE

The nose wheel will skip if more than 6 degrees of nose wheel steering is used.

4. The pilot will smoothly advance power on the third engine as directional control becomes available. The copilot will monitor the EPR setting as power is applied to ensure TRT is not exceeded. TRT should be reached after Vmcg. If directional control difficulty is encountered and runway length permits, a setting of 92% N_1 RPM on the third engine may be maintained until take-off. This reduces control problems significantly with very little increase in take-off distance. Large amounts of aileron may be required to keep wings level.

NOTE

- Wet or icy runway and aft CG will reduce nose wheel steering effectiveness and slower power application for the third engine will be required.
- This procedure assumes that an outboard engine is inoperative. If an inboard engine is inoperative, the take-off performance will be considerably improved.

5. The pilot should rotate normally. Large amounts of rudder may be necessary to compensate for the loss of nose wheel steering effect.

After Take-off/Climb.

The landing gear should be retracted when a positive rate of climb is observed. If obstacle clearance is a factor or additional climb performance is required, climb at Vmco until reaching at least 1,000 feet AGL and clear of the obstacle.

CAUTION

Do not exceed 15 degrees of bank when climbing at Vmco with flaps at TAKE OFF/APPROACH.

Accelerate to Vmfr, retract flaps, then accelerate to 3 engine climb schedule or a maneuvering speed of 200 KCAS.

The following items will be performed in addition to the normal After Take-Off, Climb checklist:

Hydraulic Interconnect - CLOSED (S)

Rudder High Pressure Override Switch - NORM (if not required for two-engine operation)

Air Conditioning Master Switch - BOTH

The remainder of the flight should be conducted in accordance with procedures for one or more engines inoperative.

Engine Failure During Take-off - Take-off Aborted.

If an engine fails or a system emergency occurs prior to GO speed, the take-off shall be aborted. The pilot will immediately retard all throttles to REV IDLE and apply maximum brakes. The copilot will deploy spoilers.

If number one and two engines are inoperative, the copilot will select Emergency Brakes.

CAUTION

Braking without anti-skid will require moderate brake application to avoid blowing tires. Nose wheel steering will be lost and directional control will have to be maintained by brakes, rudder, and engine power. Use of the emergency brake system will invalidate V_R speed for runway available.

Engine Failure - Take-off Continued.

If an engine fails after GO, the take-off should be continued.

If failure of the second engine causes loss of No. 2 hydraulic system and this occurs before landing gear retraction, hydraulic pressure furnished by the windmilling engine is not sufficient to retract the landing gear. Leave the gear extended and land as soon as practical.

CAUTION

Two-engine gear down performance data for enroute climb and cruise flight is not available.

If it is necessary to continue the flight gear down with the No. 2 hydraulic system inoperative, the pilot must make the decision to continue with the landing gear extended or retract the gear using the hydraulic interconnect valve to augment No. 2 system operation with the No. 3 hydraulic system.

WARNING

If contamination of the No. 2 system is suspected, use of the interconnect valve could result in cross system contamination. Also, a leak in No. 2 or No. 3 hydraulic system could cause loss of fluid in both systems if interconnect is open.

The scanner will monitor the No. 2 and No. 3 hydraulic reservoir quantity gauges if the interconnect valve is used. The interconnect valve will be closed immediately if:

1. Sudden hydraulic fluid loss occurs.
2. Sudden and abnormal No. 2 or No. 3 hydraulic system pressure drop occurs.

Engine Failure During Climb.

If the flight must be continued and engine failure has occurred before reaching flap retraction speed, accelerate to minimum flap retraction speed. After retracting flaps, continue acceleration to 220 KCAS. Climb at this airspeed until reaching Mach 0.45.

NOTE

Two-engine enroute climb data is not available. Final range determination should be computed upon reaching initial two-engine cruise climb or step climb altitude.

ZERO FLAP TAKE-OFF PROCEDURE.

Take-off Data.

Do not exceed 257,500 pounds brake release gross weight.

The "Maximum Recommended Take-off Gross Weight, Three-Engine Climb Performance" will always exceed a 3.25 Climb Gradient. Therefore, data is not provided.

Revised data for "One Engine Out, Air Minimum Control Speed" is not provided since the one engine out air minimum control speed does not become a consideration until the gross weight becomes less than 147,000 pounds.

CAUTION

If refusal/rotation speed exceeds 147 KCAS (maximum ground spoiler speed), then "GO" speed is 147 KCAS. If ground minimum control speed (Vmcg) is greater than 147 KCAS, the take-off will not be attempted.

Preflight.

Preflight check of the following items on the Flight Engineer's/Scanner's Preflight check will not be possible if the wing flaps cannot be positioned out of the UP position unless the spoilers are opened:

1. Lower Wing Surface and Flap Well - CHECKED.

Before Take-off.

The TAKEOFF annunciators will not be functional. Refer to TAKEOFF Warning Annunciation Malfunction Procedure.

Take-off Technique.

1. The pilot will advance the throttles to TRT prior to brake release.

2. At Vrot, smoothly rotate the nose of the aircraft to approximately five degrees nose up and allow the aircraft to fly off the runway. There may be a tendency to over-rotate.

CAUTION

If the aircraft is over-rotated to 8 to 10 degrees, the aft end of the fuselage may be scraped.

Accelerate to 250 KCAS and continue with normal climb procedures.

FUEL TANK EMPTY OUT OF SEQUENCE.

WARNING

When the inboard auxiliary tanks are empty and fuel is present in the extended range tanks, gravity flow of fuel through the ejector system from the extended range tank to its respective inboard auxiliary tank is uncontrollable.

CAUTION

It is necessary that fuel sequencing be observed. The aircraft should not be flown with any other fuel sequence except as an emergency measure. Operation is permissible under certain limitations with any one fuel tank empty out of normal sequence. This procedure is allowed for aircraft recovery to a station where maintenance capability exists.

Limitations.

1. Do not exceed a sink rate of 360 feet per minute at landing impact.

2. Empty Outboard Main Tank.

   a. Max gross weight - 230,000 pounds.

   b. Max zero fuel weight - 185,000 pounds.

   c. Roll factor 1.67 "G's" or 53 degrees bank.

   d. Opposite wing tank will contain a minimum of 2,000 lbs and a maximum of 2,700 lbs.

WARNING

Failure to ensure that the opposite main tank contains a minimum of 2,000 lbs. will result in a loss of two engines if the aircraft experiences a loss of all generators.

3. Empty Outboard Aux tank.

   a. Max gross weight - 270,000 pounds.

   b. Max zero fuel weight - 185,000 pounds.

   c. Roll factor 1.67 "G's" or 53 degrees bank.

   d. Opposite wing tank empty.

4. For any other single tank empty out of normal sequence, there are no weight or roll load factor limitations. Normally, the opposite wing tank will be empty.

WARNING

These limits apply only when structural integrity has not been compromised by damage of structural members.

EMERGENCY ENTRANCES AND EXITS (TYPICAL)

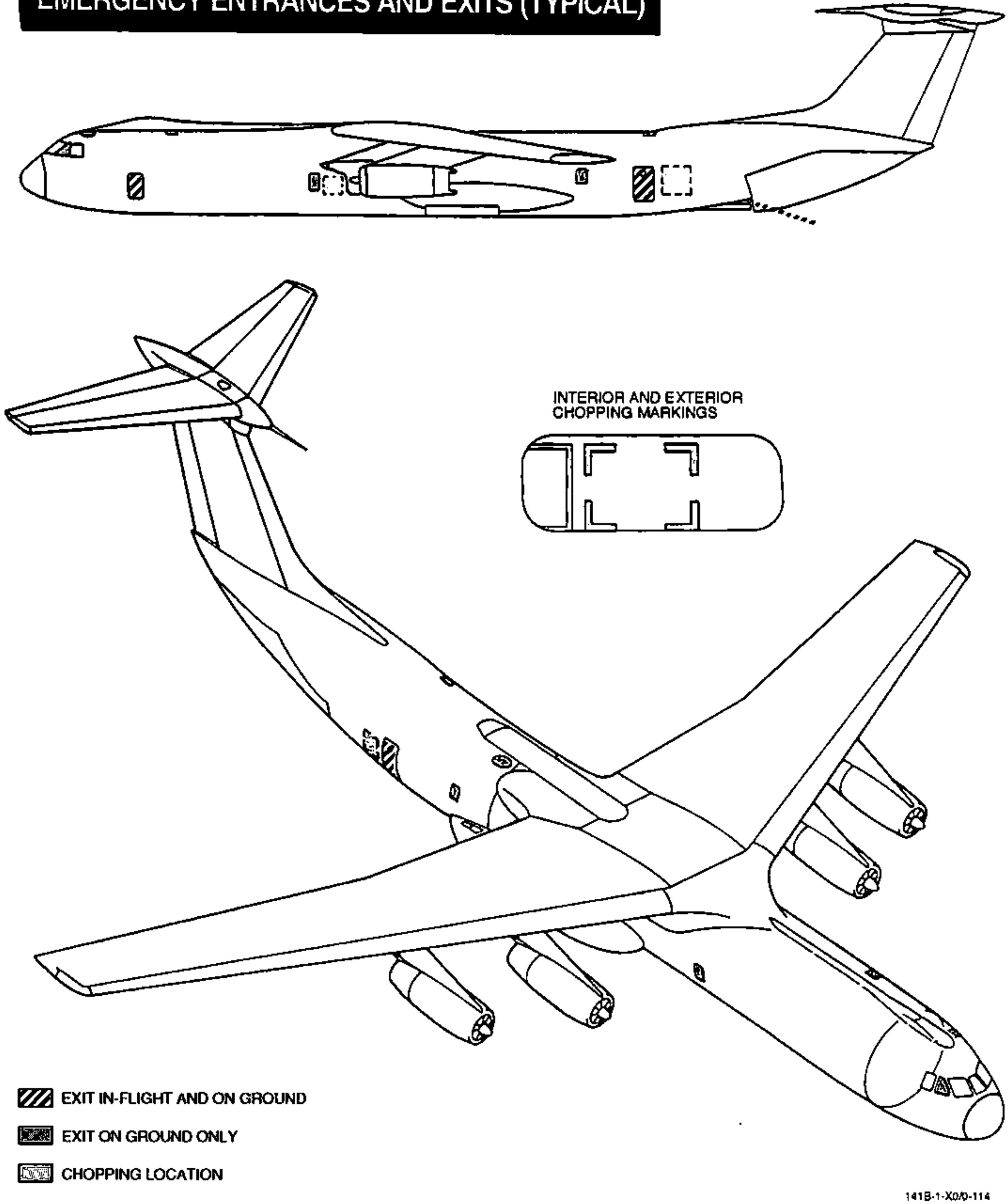


Figure 3-2.

EMERGENCY EQUIPMENT AND EXITS

1. OXYGEN MASK STOWAGE (9 PLACES)
2. SMOKE MASK STOWAGE (2 PLACES)
3. CREW ESCAPE LADDER
4. CRASH AXE
5. PORTABLE FIRE EXTINGUISHER (6 PLACES)
6. ⚠2 LIFERAFT AND SURVIVAL KIT STOWAGE
7. RELEASE HANDLE, ROPE ESCAPE LADDER (3 PLACES)
8. ESCAPE LADDER STOWAGE FIXTURE (3 PLACES)
9. WARNING HORN
10. LIFERAFT RELEASE HANDLE
11. ⚠3 FIRST AID KIT STOWAGE (26 PLACES)

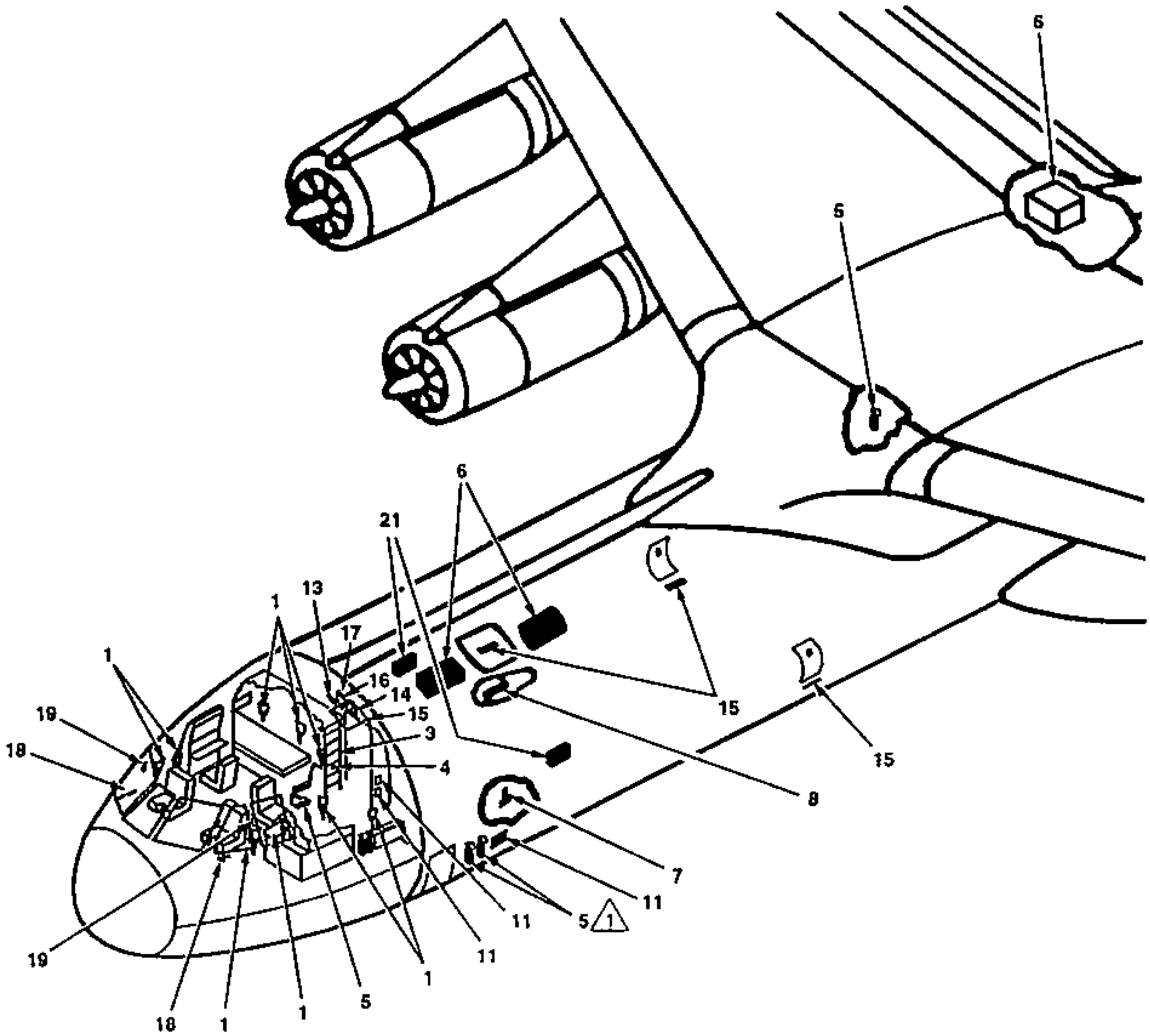
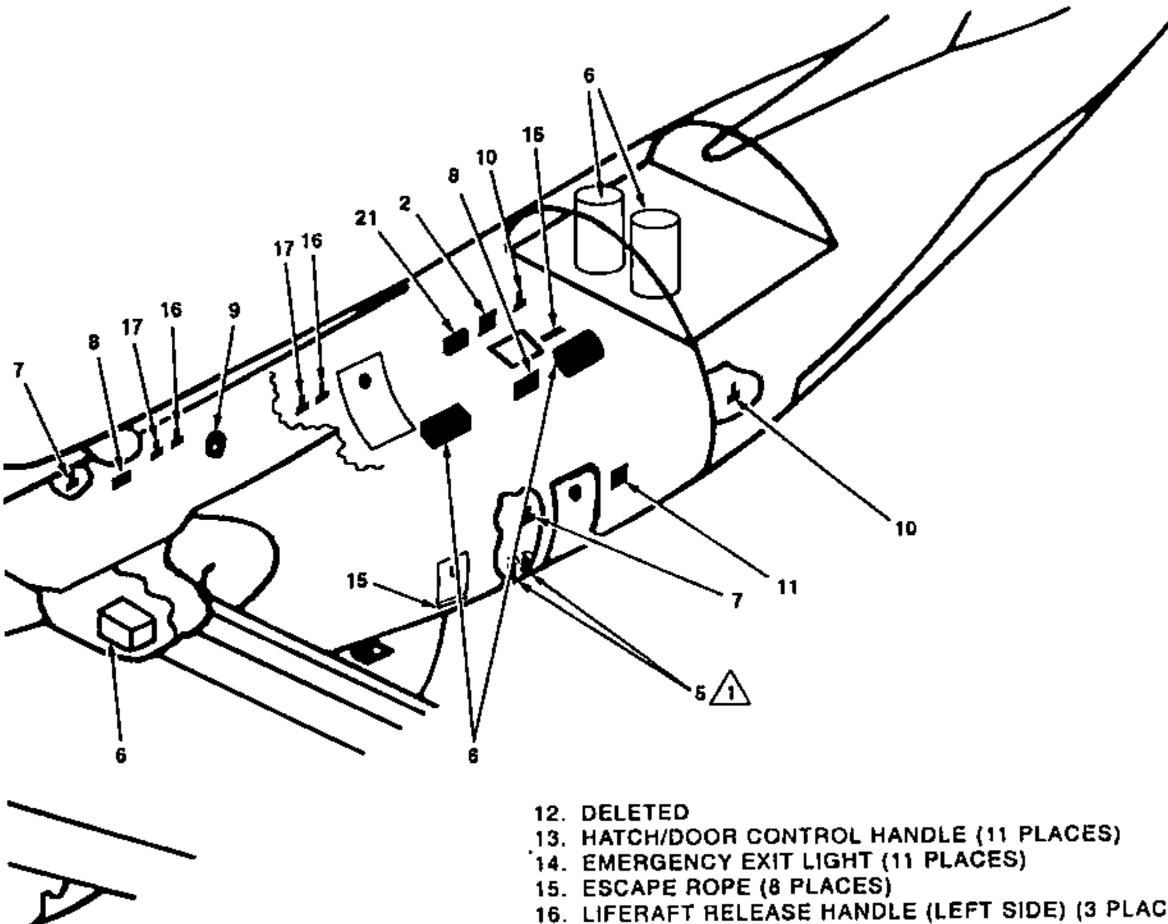


Figure 3-3. Emergency Equipment and Exits (Sheet 1 of 4)



12. DELETED
13. HATCH/DOOR CONTROL HANDLE (11 PLACES)
14. EMERGENCY EXIT LIGHT (11 PLACES)
15. ESCAPE ROPE (8 PLACES)
16. LIFERAFT RELEASE HANDLE (LEFT SIDE) (3 PLACES)
17. LIFERAFT RELEASE HANDLE (RIGHT SIDE) (3 PLACES)
18. SIDE WINDOW HANDLE
19. SIDE WINDOW LOCK
20. DITCHING STOP HANDLE
21. EMERGENCY ESCAPE BREATHING DEVICE (4 PLACES)

NOTE

1. THERE ARE 2 FIRE EXTINGUISHERS INSTALLED AT THIS POSITION.
2. IN ADDITION TO THE STOWAGE LOCATIONS SHOWN, STRUCTURAL FACILITIES ARE PROVIDED FOR STOWAGE OF ONE 20-MAN LIFERAFT IMMEDIATELY FORWARD OF THE NO. 2 ESCAPE HATCH AND ONE AFT OF NO. 4 ESCAPE HATCH. STOWAGE OF ONE SURVIVAL KIT IMMEDIATELY AFT OF NO. 2 ESCAPE HATCH AND ONE FORWARD OF NO. 4 ESCAPE HATCH.
3. IN ADDITION TO THE SIX STOWAGE LOCATIONS SHOWN, STOWAGE FACILITIES ARE PROVIDED FOR FIVE FIRST AID KITS IMMEDIATELY AFT OF EACH EMERGENCY SIDE EXIT.

Figure 3-3. Emergency Equipment and Exits (Sheet 2 of 4)

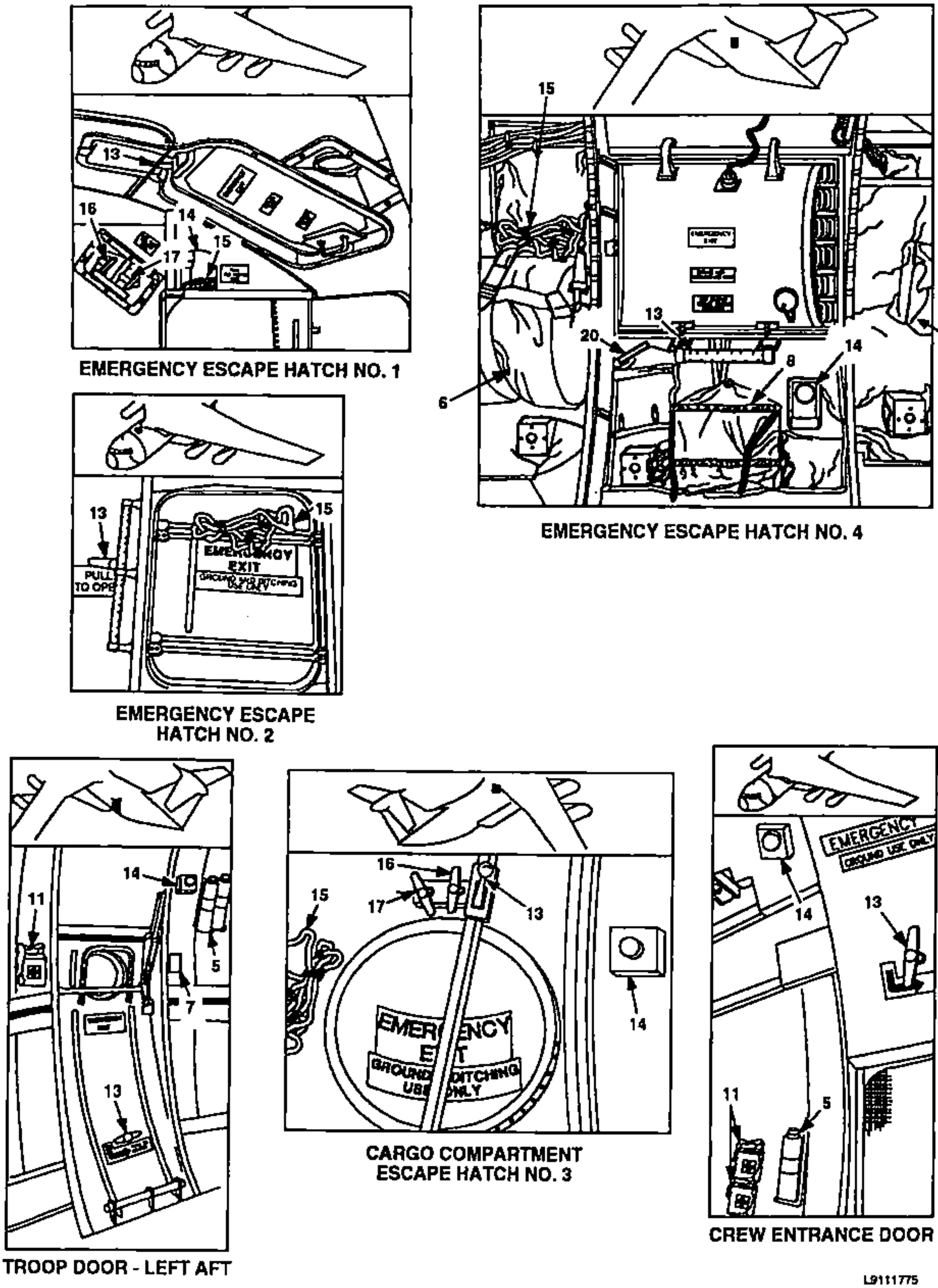


Figure 3-3. Emergency Equipment and Exits (Sheet 3 of 4)

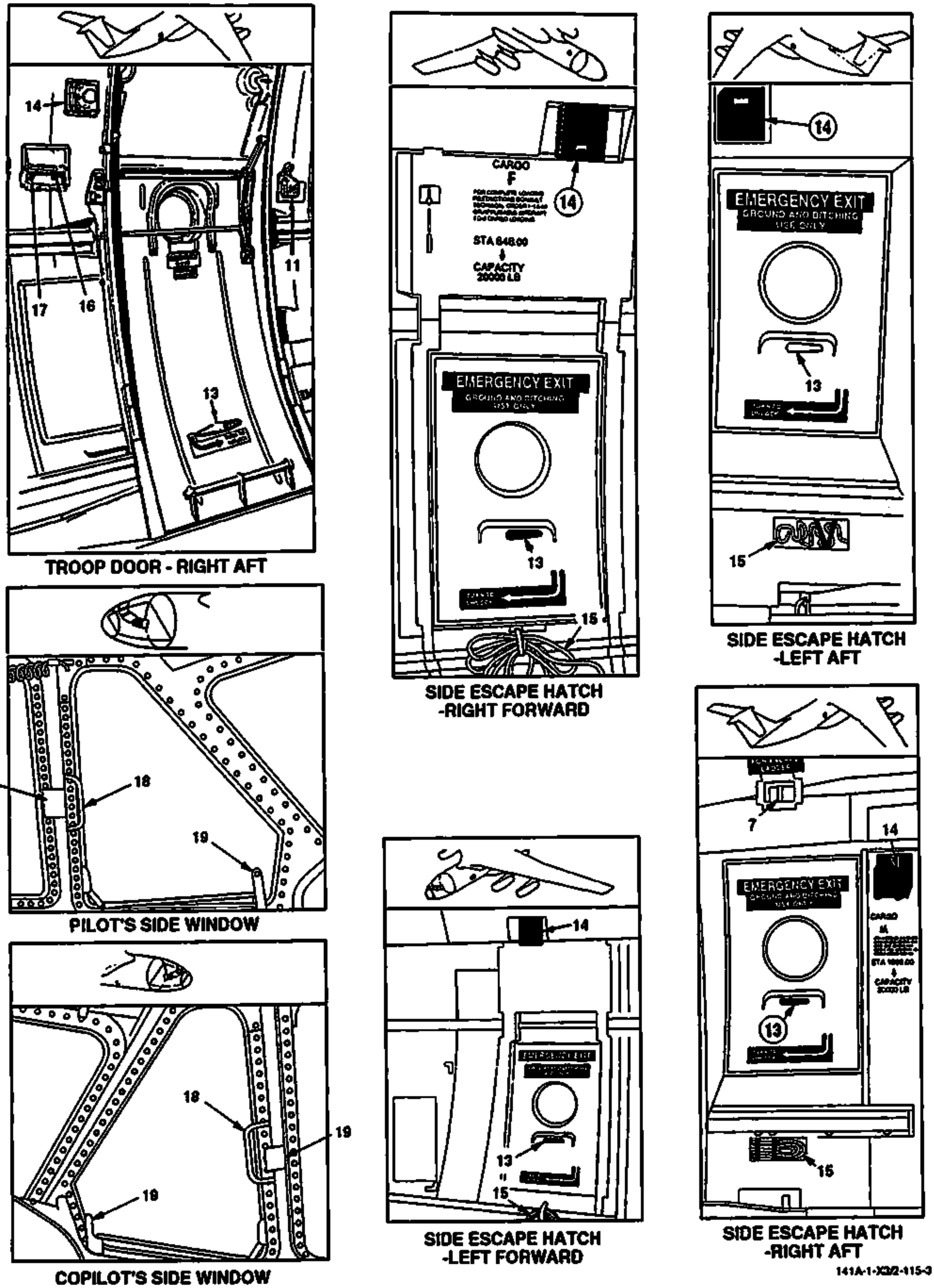


Figure 3-3. Emergency Equipment and Exits (Sheet 4 of 4)

ENGINE FAILURE AFTER GO SPEED

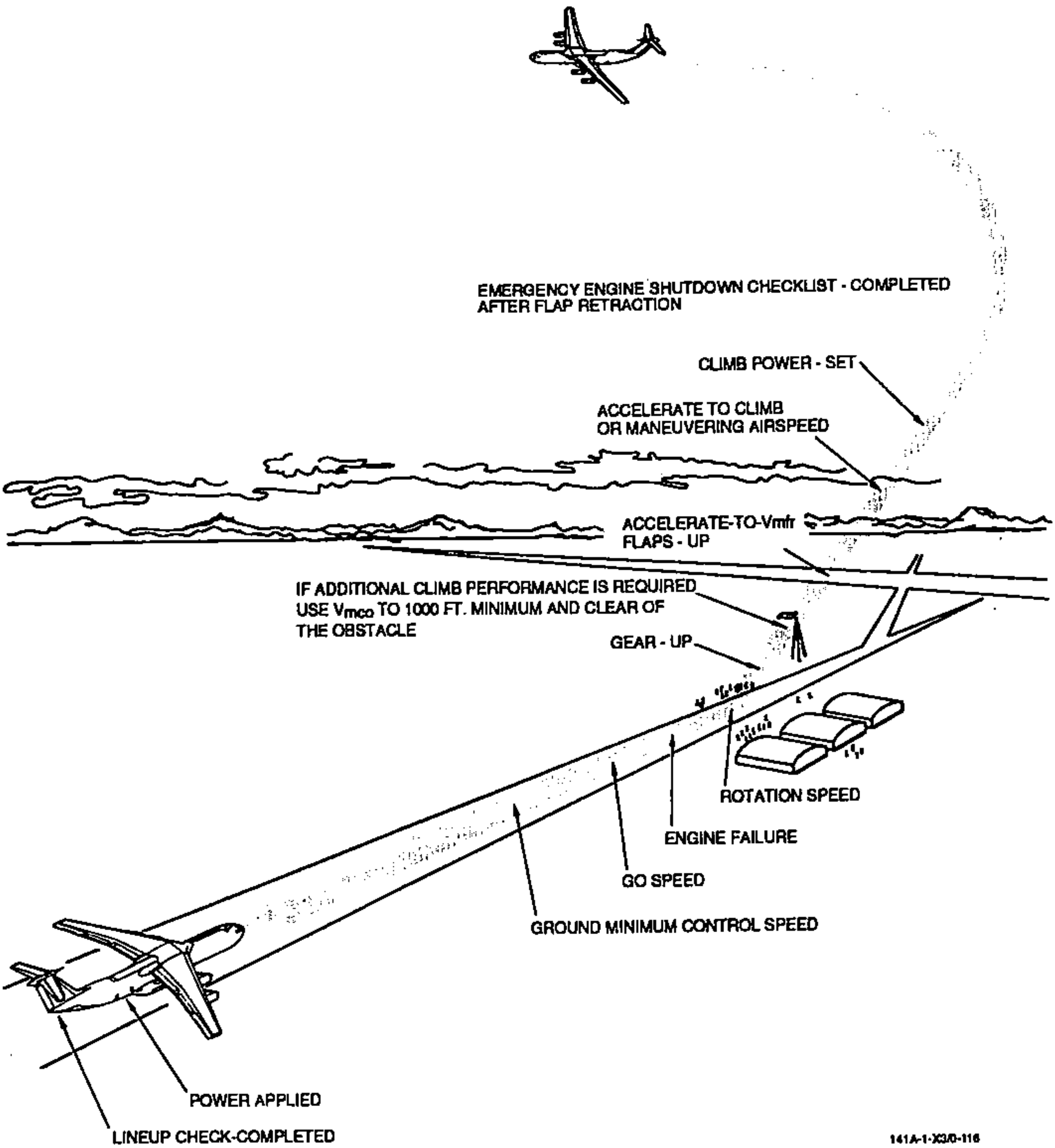


Figure 3-4. Engine Failure After Go Speed

MAXIMUM LOAD PROFILE FOR JETTISON LOADS

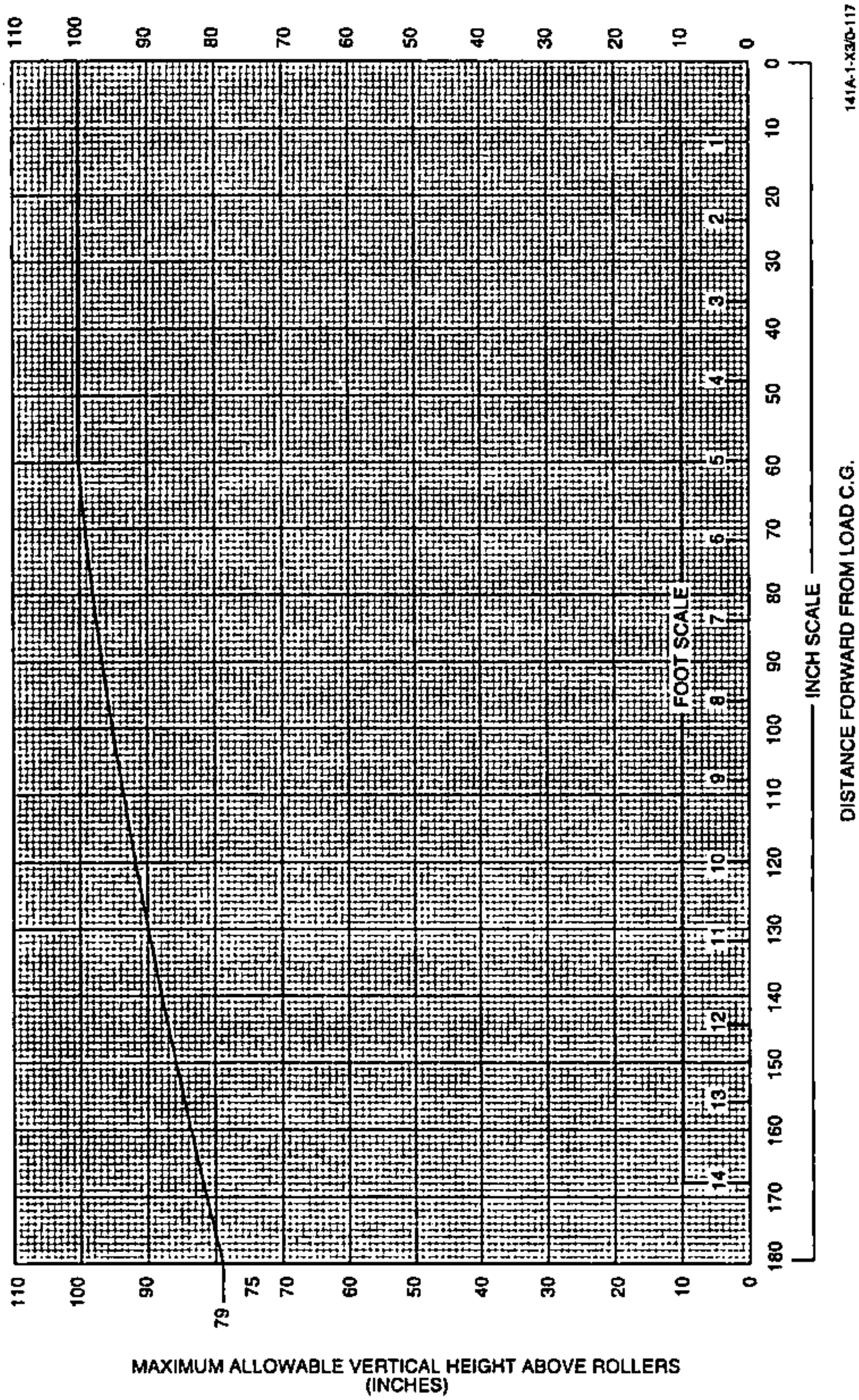


Figure 3-5. Maximum Load Profile

LANDING GEAR MANUAL CONTROLS

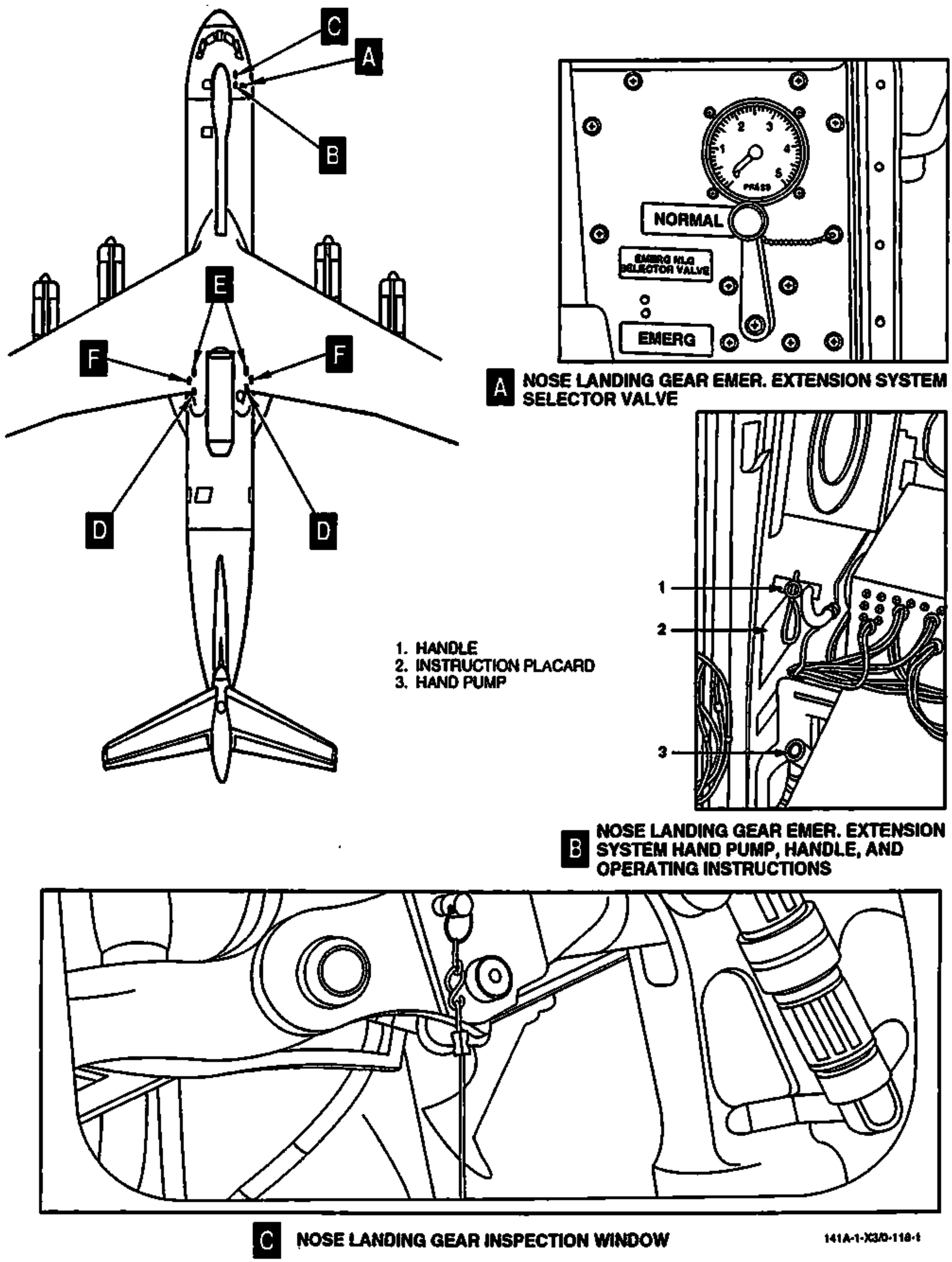
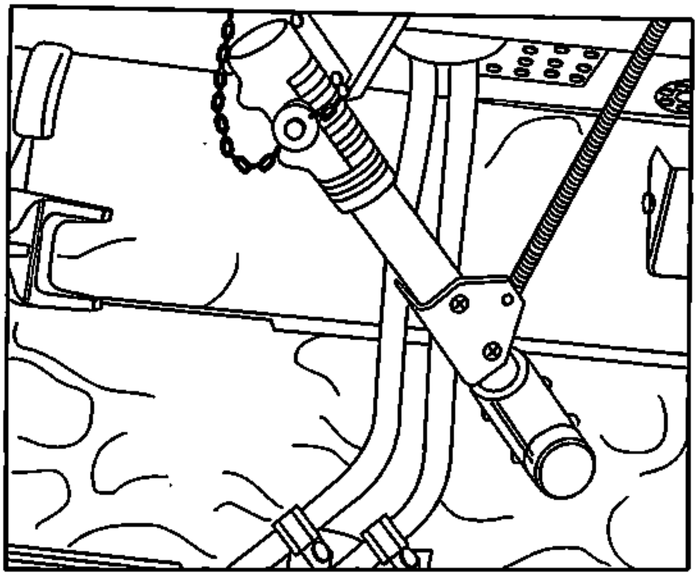
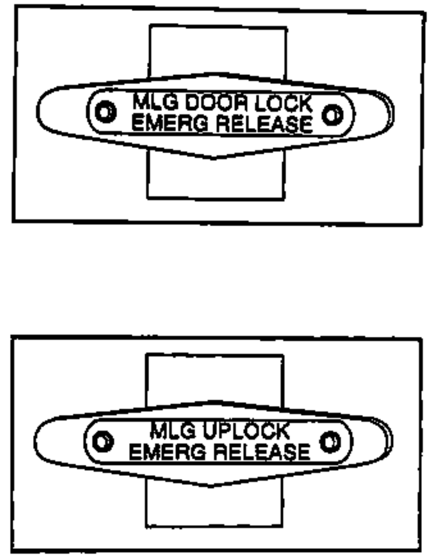


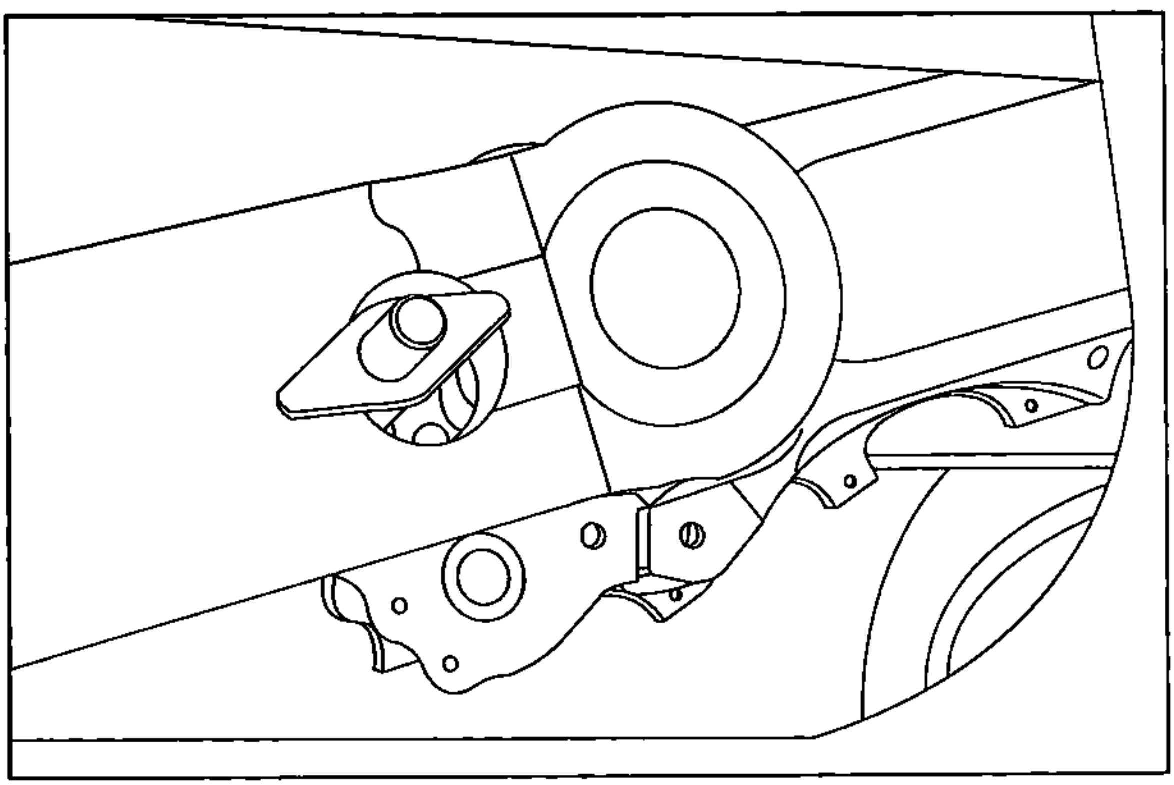
Figure 3-6. Landing Gear Manual Controls (Sheet 1 of 2)



D MAIN LANDING GEAR DOWNLOCK HANDLE



E MAIN LANDING GEAR EMERGENCY RELEASE

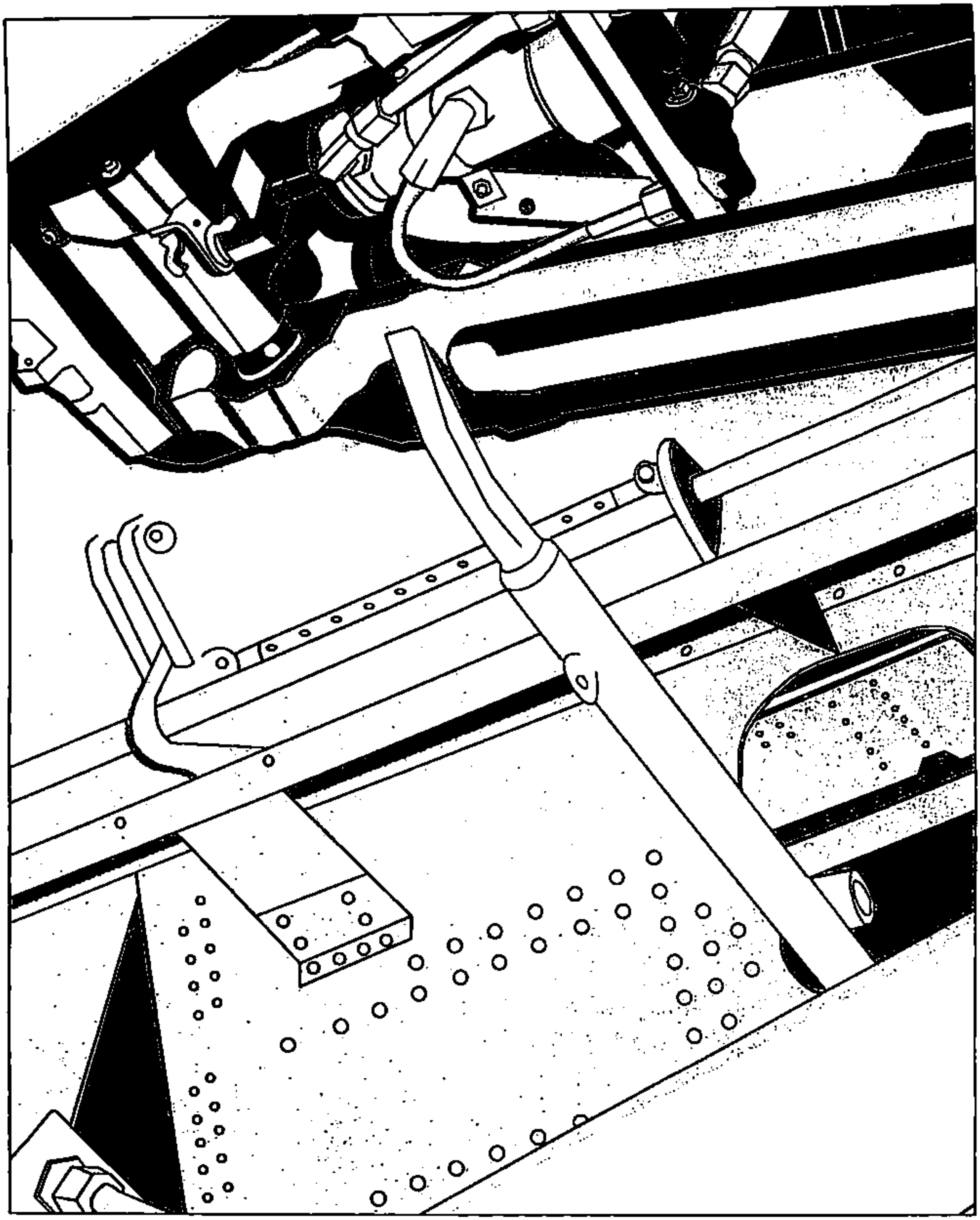


F MAIN LANDING GEAR INSPECTION WINDOW

141A-1-x3/0-118-2

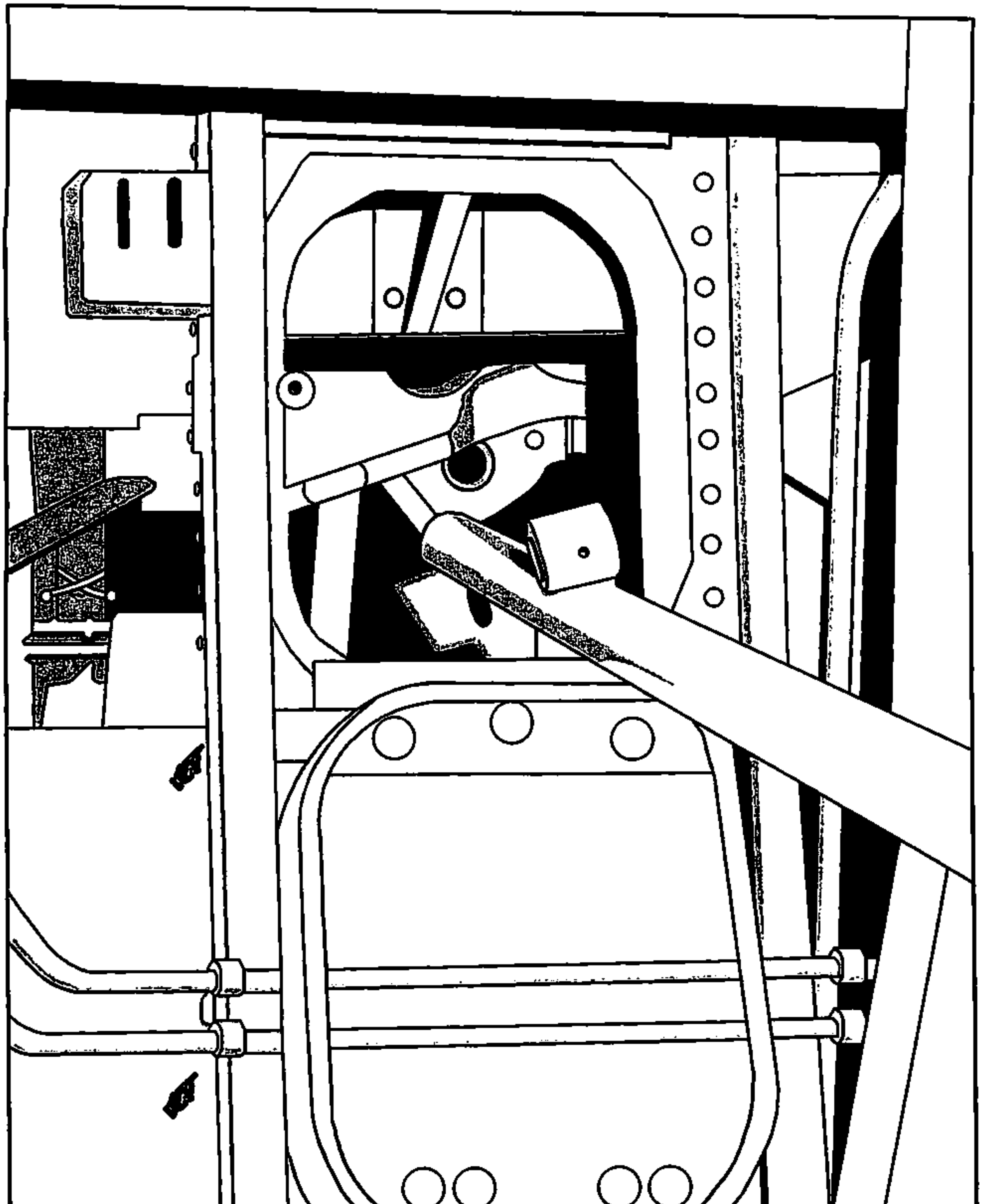
Figure 3-6. Landing Gear Manual Controls (Sheet 2 of 2)

PRYING MLG DRAG LINK



141A-1-X3/0-119-1

Figure 3-7. Prying MLG Drag Link (Sheet 1 of 2)



141A-1-X3/0-119-2

Figure 3-7. Prying MLG Drag Link (Sheet 2 of 2)

PRYING MLG DOWNLOCK

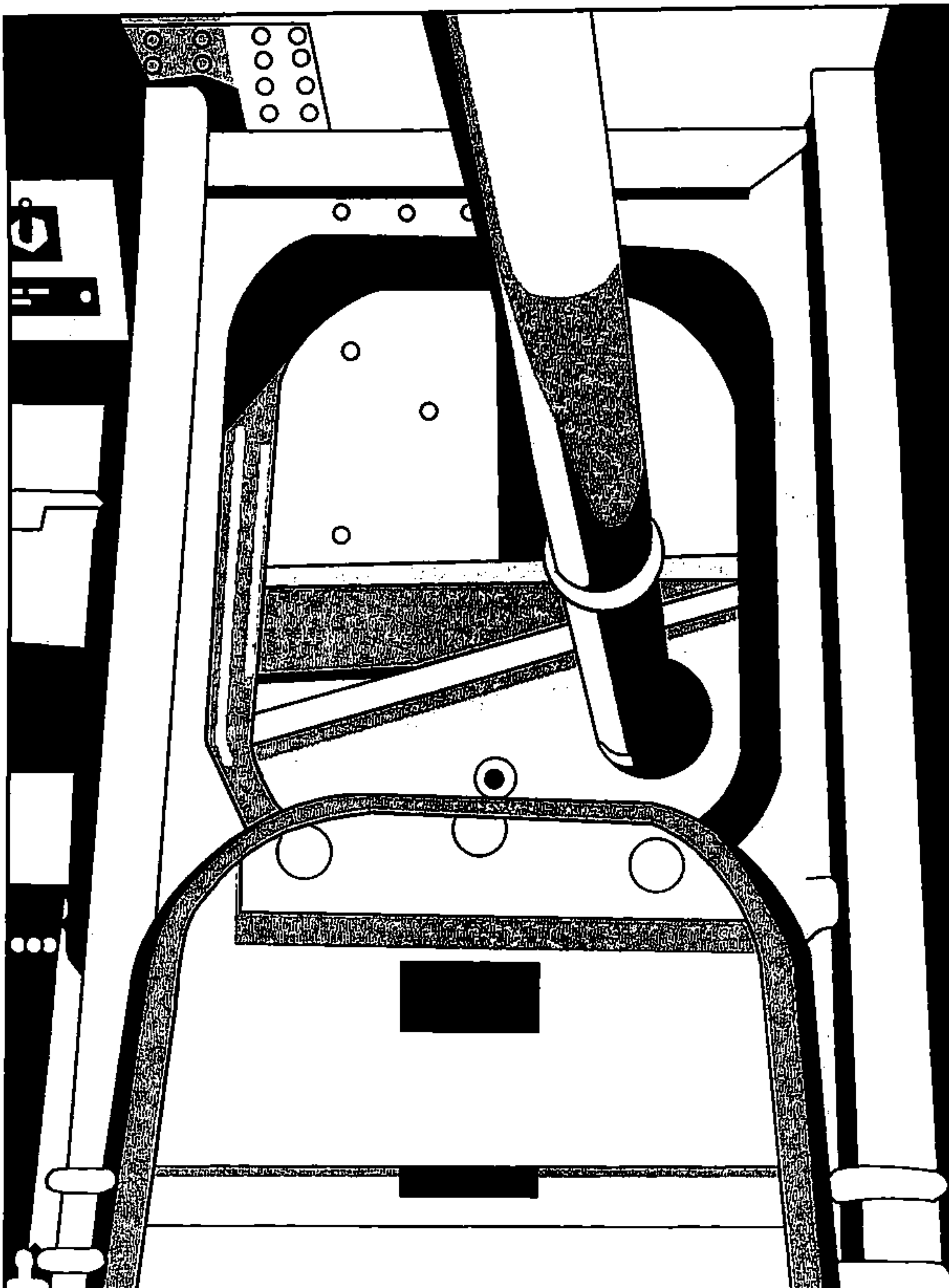
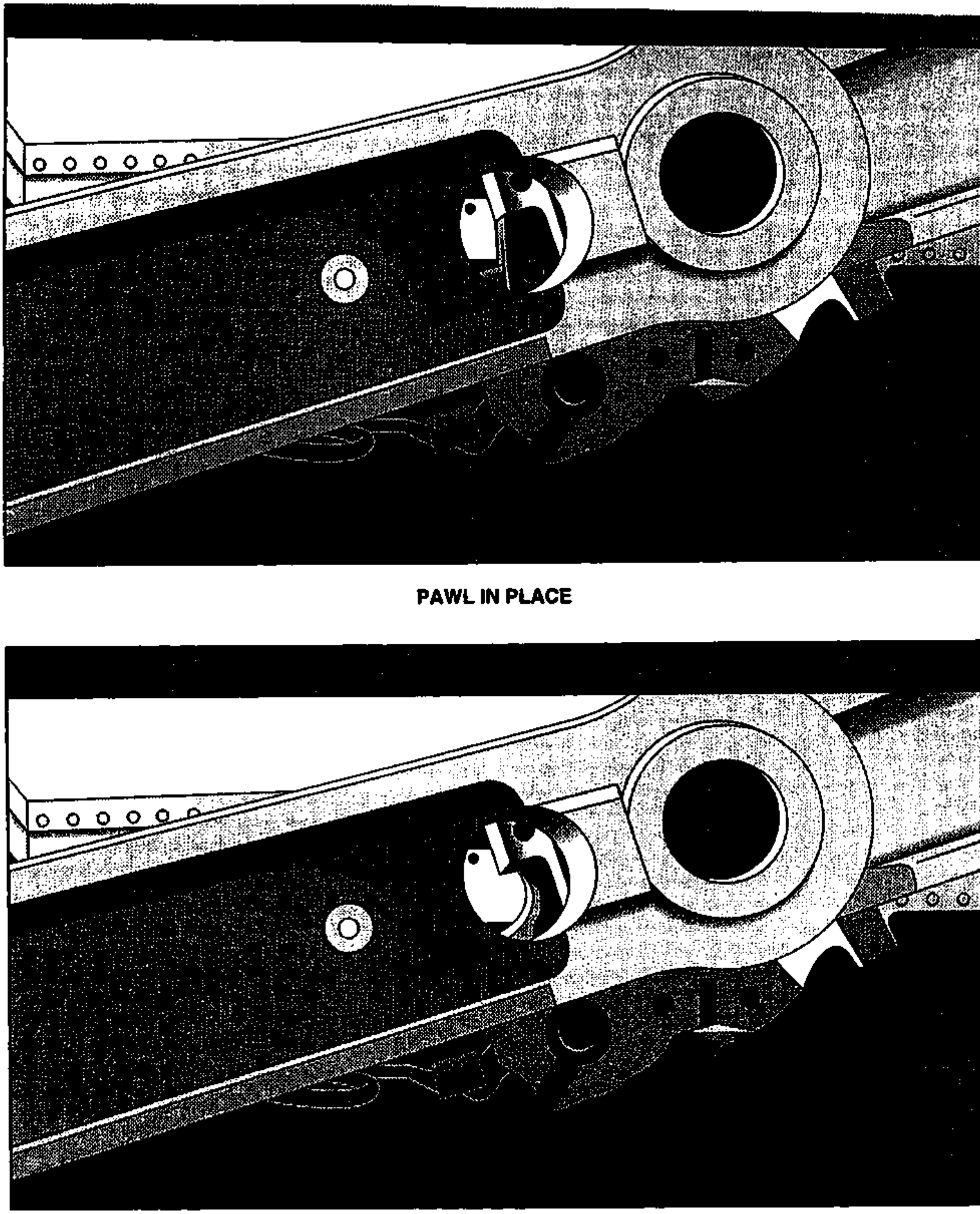


Figure 3-8. Prying MLG DownLock

MLG DOWNLOCK PAWL



PAWL IN PLACE

PAWL NOT IN PLACE

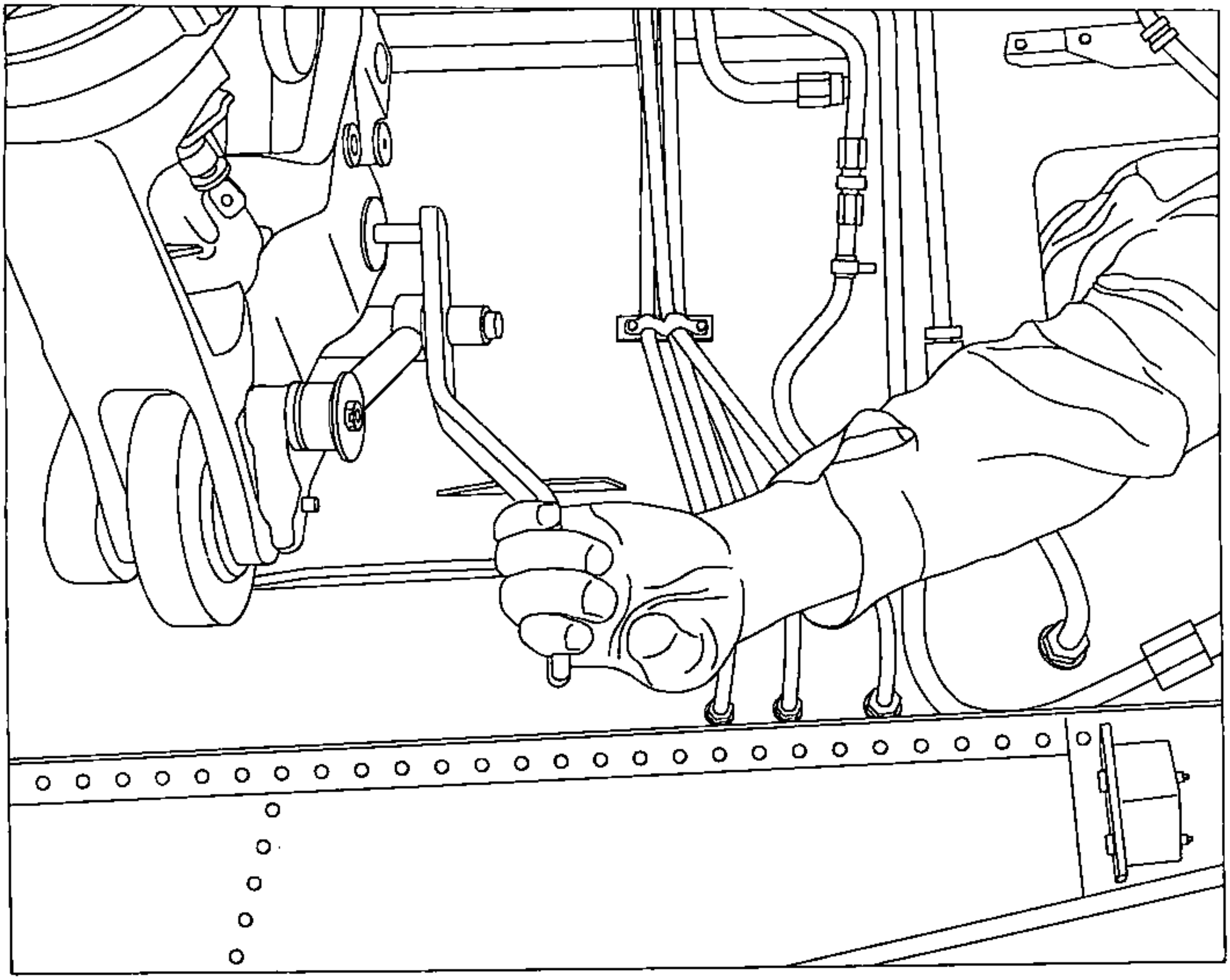
141A-1-X3/0-121

Figure 3-9. MLG DownLock Pawl

NLG UPLOCK EMERGENCY ACCESS

Figure 3-10. NLG UPLock Emergency Access

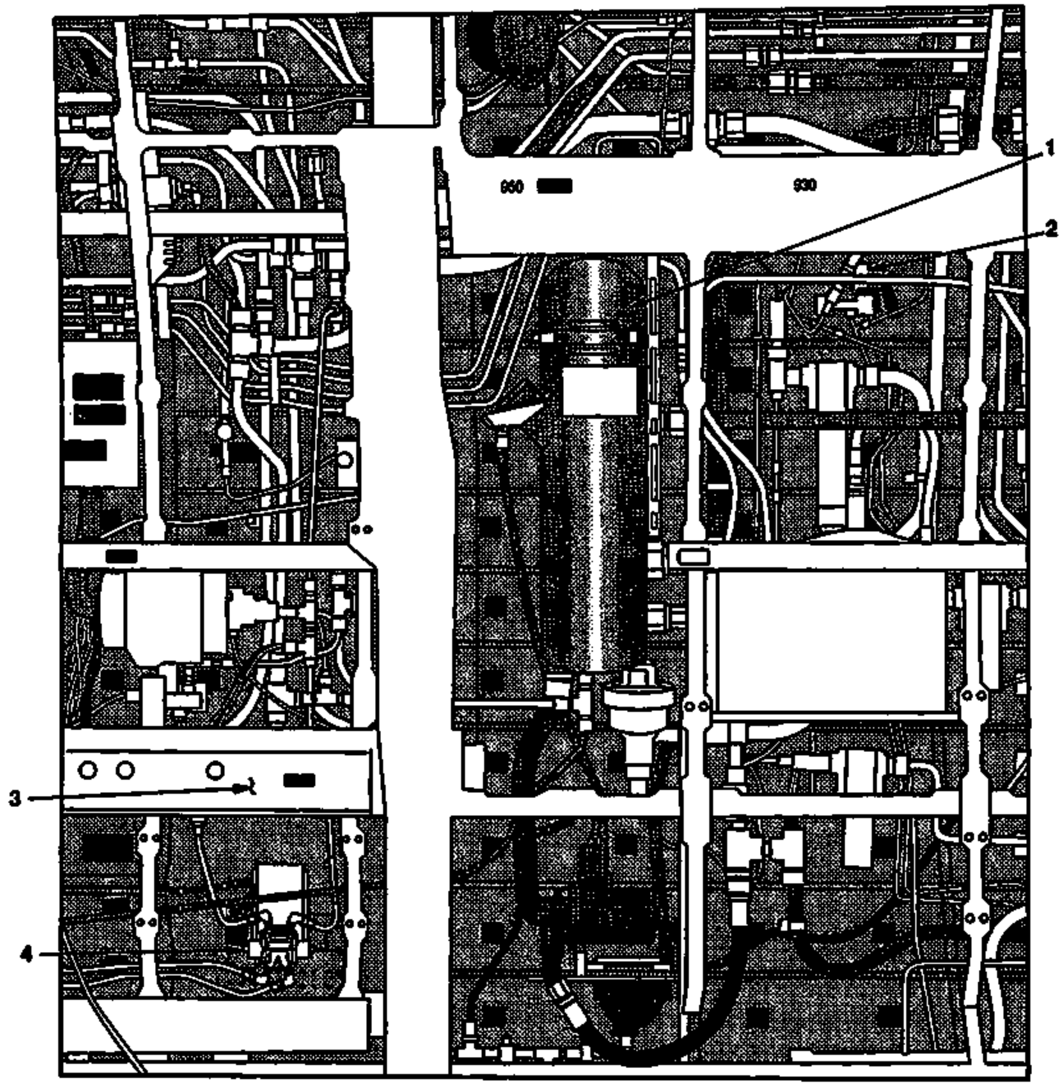
NLG UPLOCK EMERGENCY RELEASE



141A-1-X3/0-123

Figure 3-11. NLG UPLock Emergency Release

HYDRAULIC SYSTEM No. 2 SERVICE CENTER



1. NO. 2 HYDRAULIC SYSTEM RESERVOIR.
2. MAIN LANDING GEAR DOOR LOCK SELECTOR VALVE (FIGURE 3-13).
3. MAIN LANDING GEAR SELECTOR VALVE (FIGURE 3-14). (LOCATED BEHIND SUPPORT STRUCTURE).
4. MAIN LANDING GEAR DOWNLOCK SELECTOR VALVE (FIGURE 3-15).

141A-1-X3/5-201

Figure 3-12. Hydraulic System No. 2 Service Center

MAIN LANDING GEAR DOOR LOCK SELECTOR VALVE

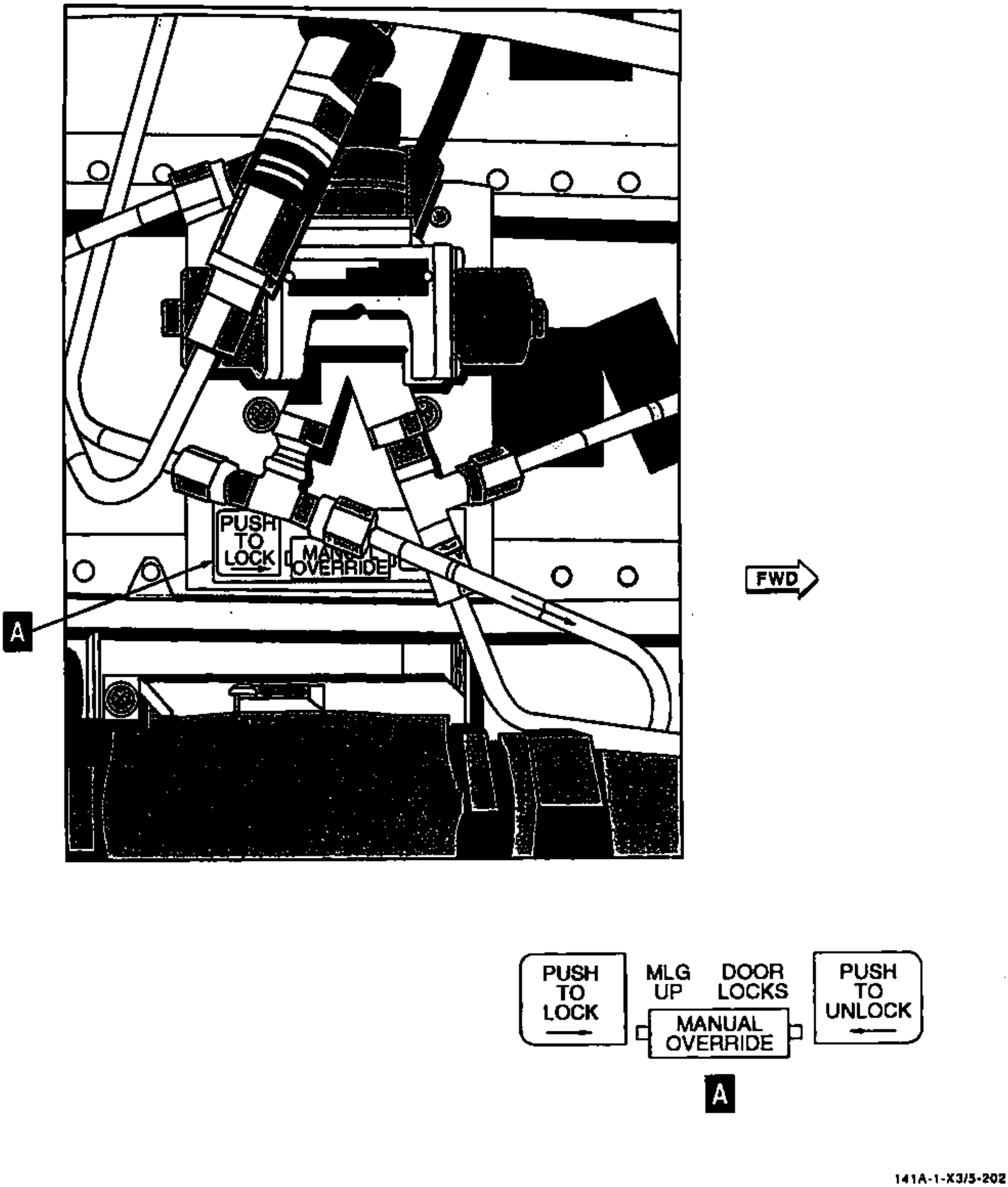


Figure 3-13. Main Landing Gear Door Lock Selector Valve

MAIN LANDING GEAR SELECTOR VALVE

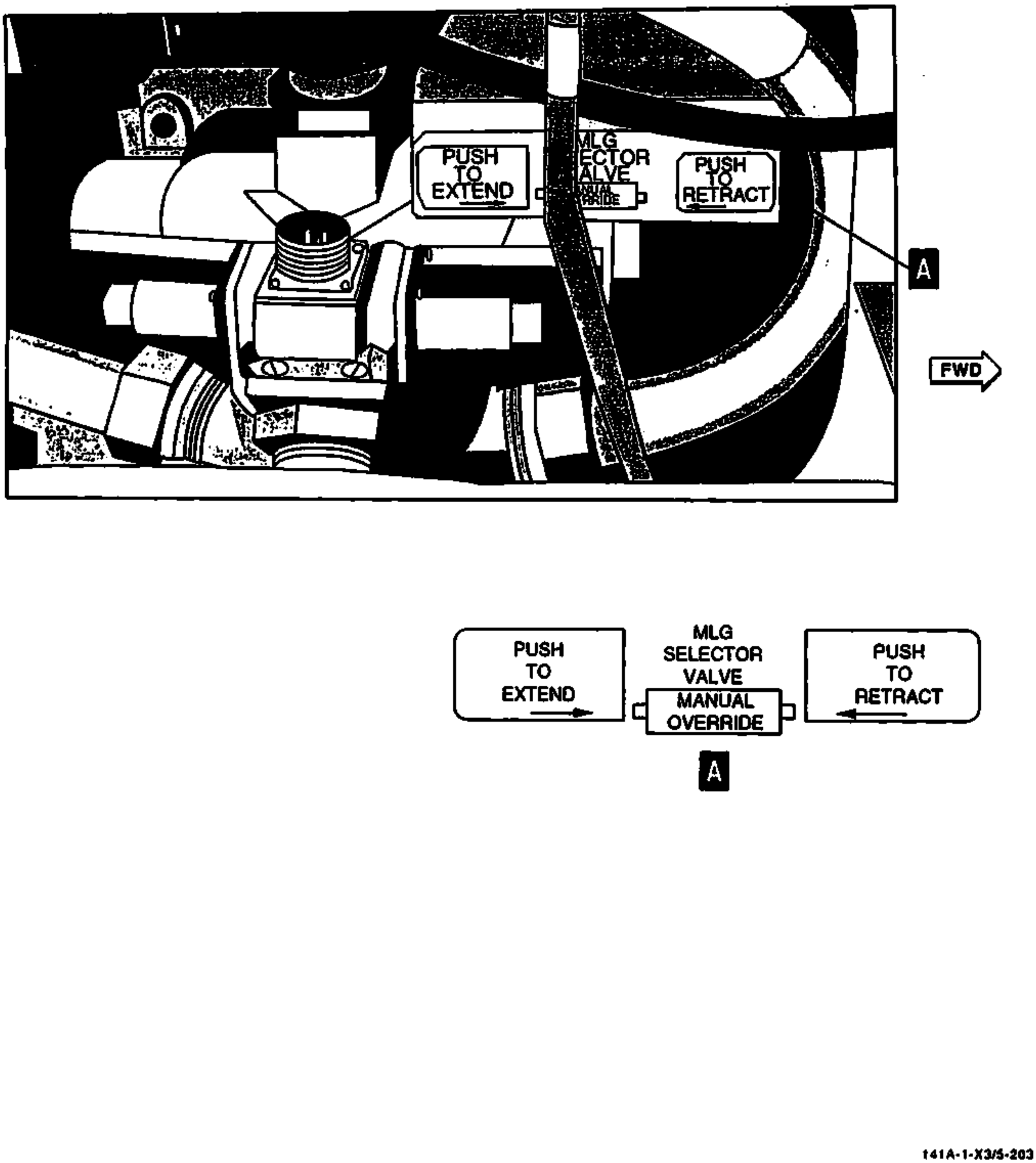


Figure 3-14. Main Landing Gear Selector Valve

MAIN LANDING GEAR DOWNLOCK SELECTOR VALVE

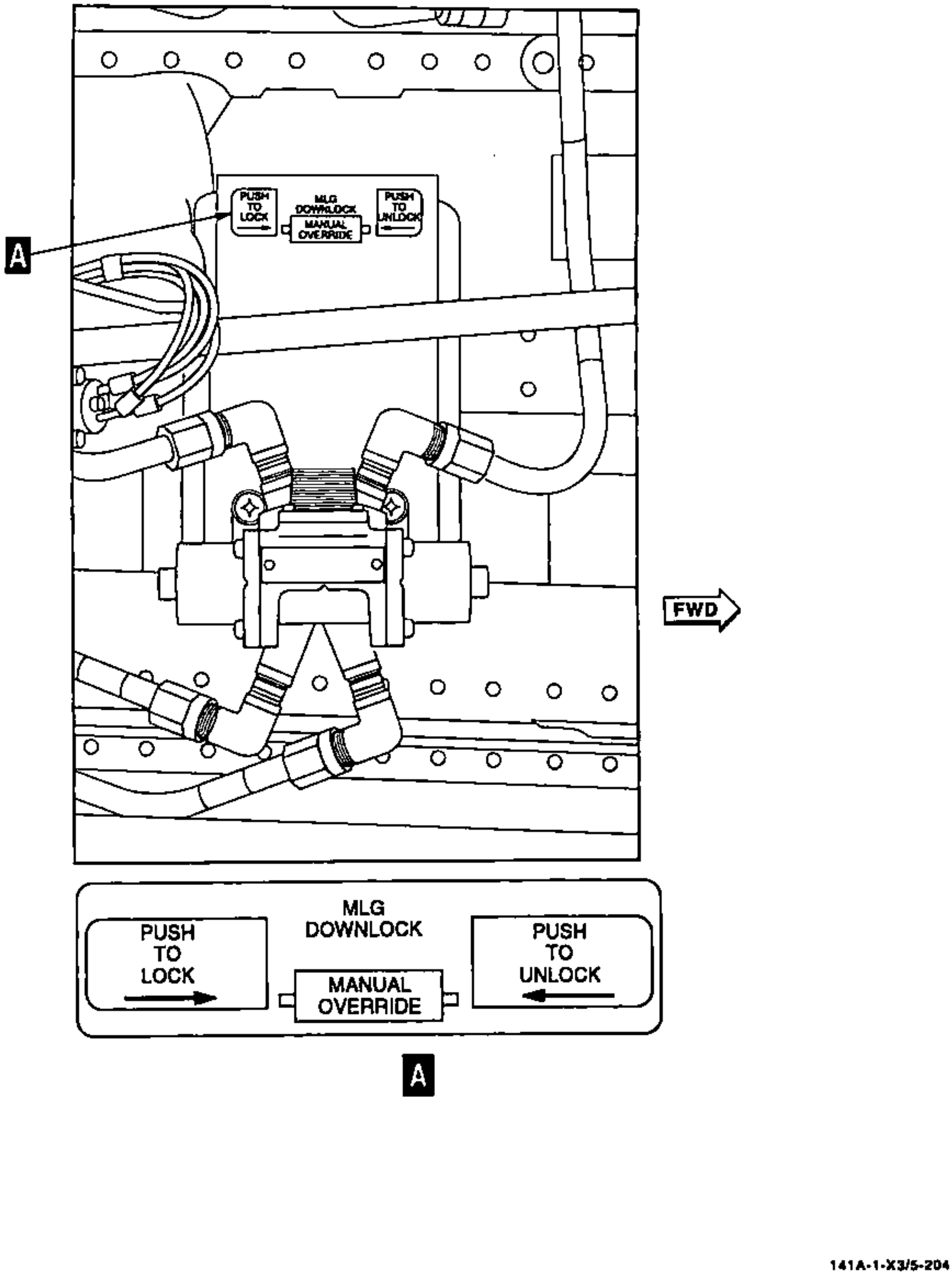
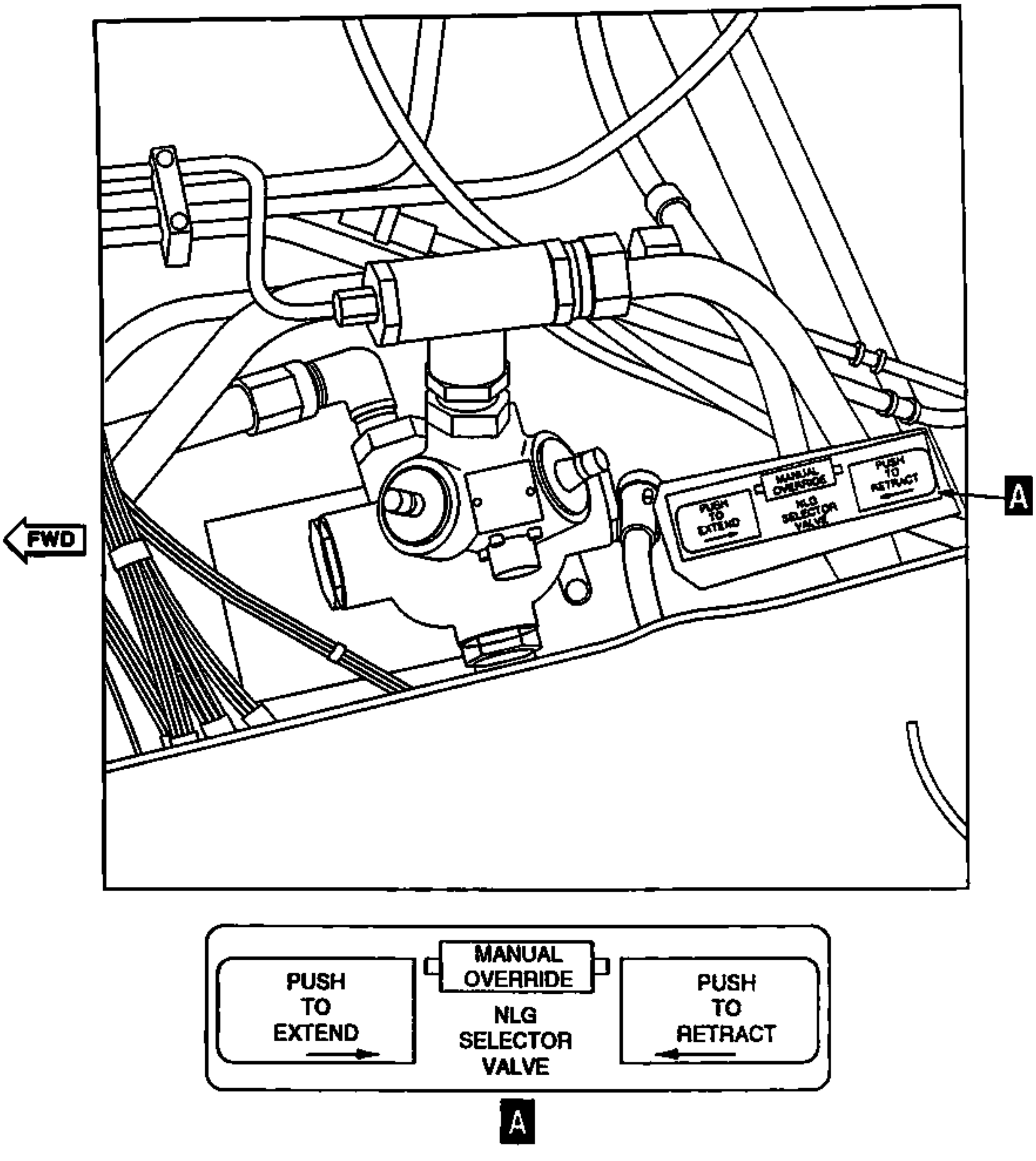


Figure 3-15. Main Landing Gear DownLock Selector Valve

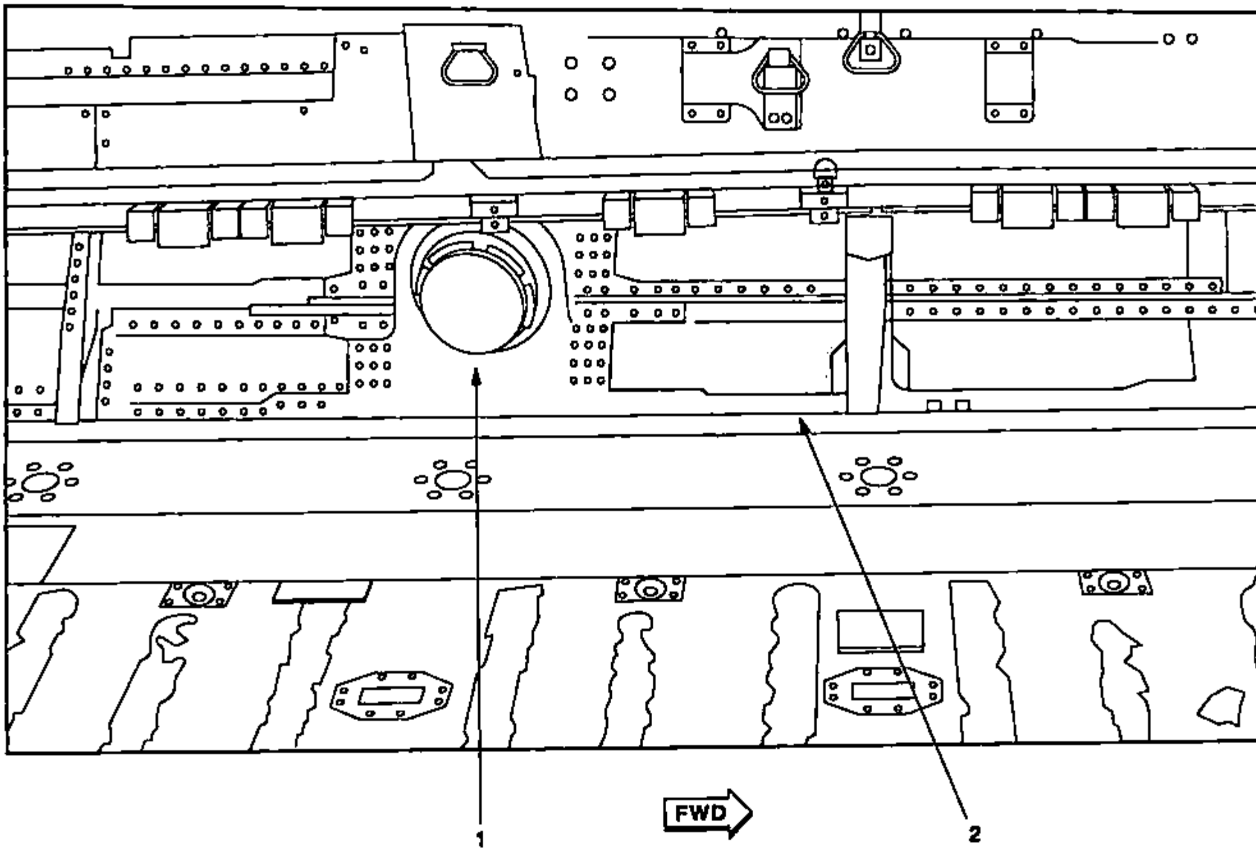
NOSE LANDING GEAR SELECTOR VALVE



141A-1-X3/5-205

Figure 3-16. Nose Landing Gear Selector Valve

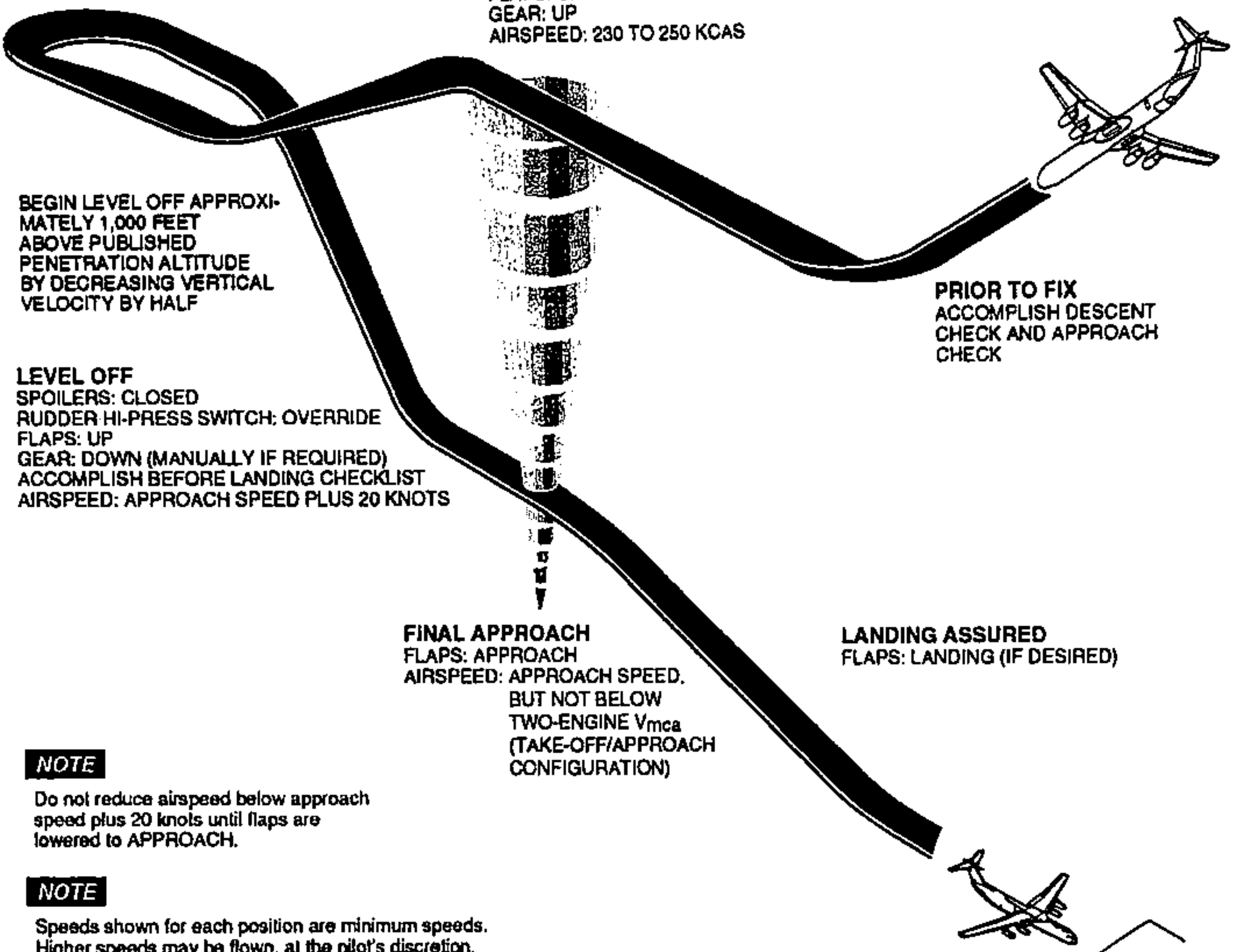
MLG STEP 2 HANDLE FAILURE CHOPPING AREA



1. TRUNNION CAP
2. CHOPPING LOCATION

Figure 3-17.

HIGH ALTITUDE PENETRATION AND APPROACH (TWO ENGINE CONFIGURATION)



NOTE

Do not reduce airspeed below approach speed plus 20 knots until flaps are lowered to APPROACH.

NOTE

Speeds shown for each position are minimum speeds. Higher speeds may be flown, at the pilot's discretion, not to exceed aircraft or air traffic control limitations. Of prime importance is that the latter portion of the approach be flown at recommended speed.

NOTE

The two-engine approach speed is charted approach speed for 75% flaps or two-engine V_{mca} which ever is greater.

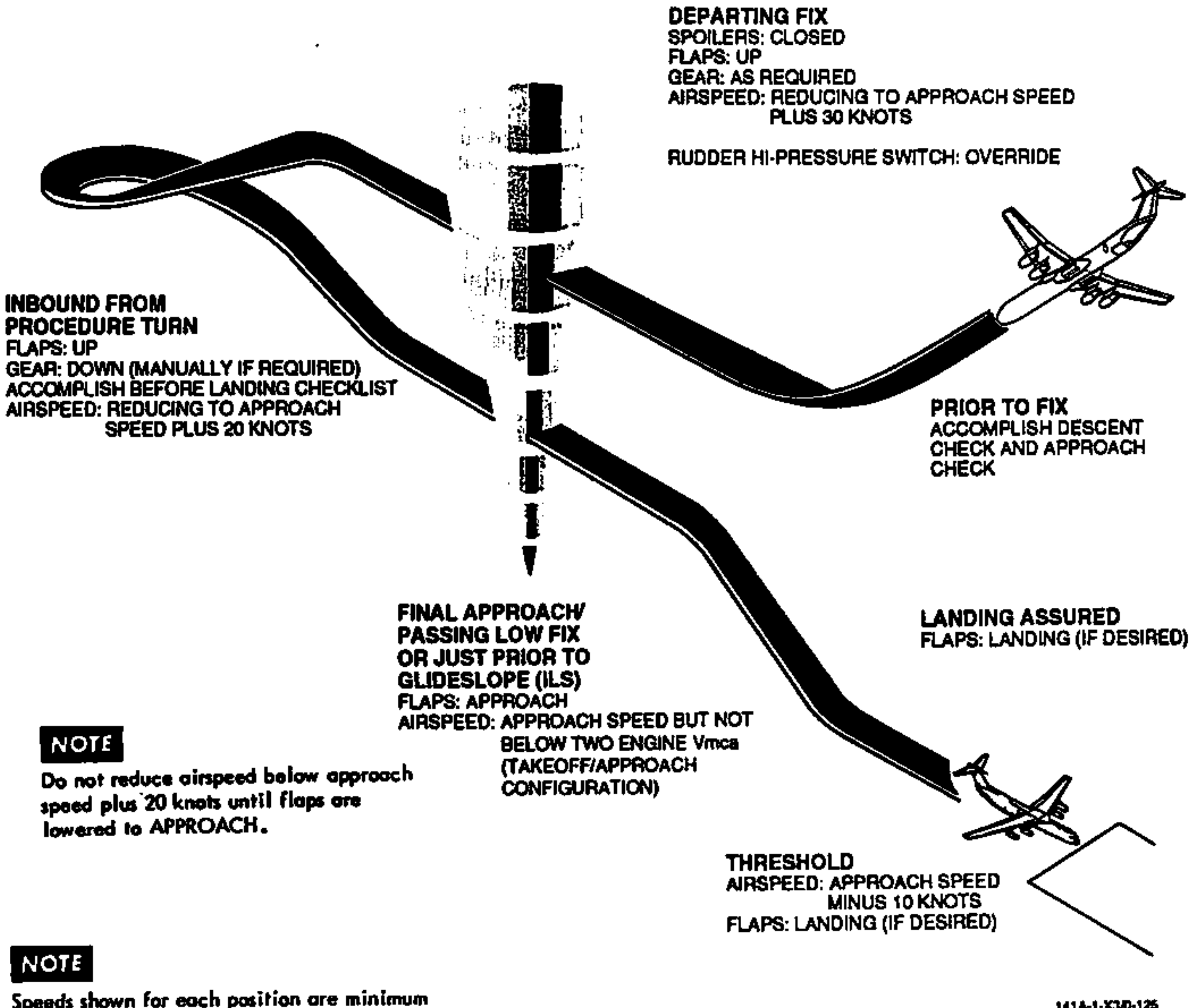
Set airspeed command markers to two-engine approach speed.

NOTE

The term "landing assured" shall be interpreted as follows: On final approach with runway or approach lights in sight, within one mile of runway and in a position to complete the landing safely.

Figure 3-18. High Altitude Penetration and Approach (Two Engine Configuration)

LOW ALTITUDE PENETRATION AND APPROACH (TWO ENGINE CONFIGURATION)



NOTE

Do not reduce airspeed below approach speed plus 20 knots until flaps are lowered to APPROACH.

NOTE

Speeds shown for each position are minimum speeds. Higher Speeds may be flown, at the pilot's discretion, not to exceed aircraft or air traffic control limitations. Of prime importance is that the latter portion of the approach be flown at recommended speed.

NOTE

The term "landing assured" shall be interpreted as follows: On final approach with runway or approach lights in sight, within one mile of runway and in a position to complete the landing safely.

NOTE

The two-engine approach speed is charted approach speed for 75% flaps or two-engine V_{mca} whichever is greater. Set airspeed command markers to two-engine approach speed.

Figure 3-19. Low Altitude Penetration and Approach (Two Engine Configuration)

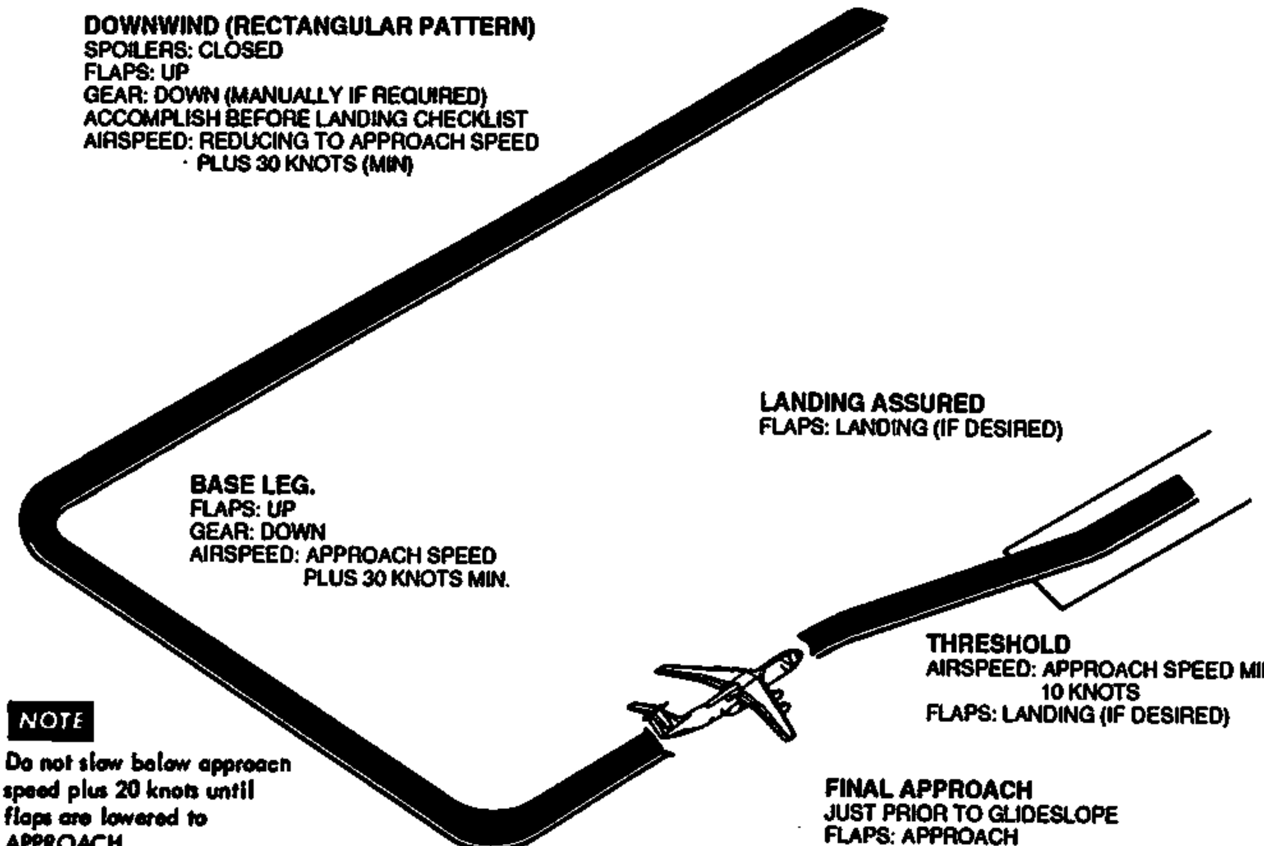
TYPICAL RADAR APPROACH TWO ENGINE CONFIGURATION

NOTE

1. Descent and approach checklists will be completed prior to FAF.
2. Place RUDDER HI PRESS. OVERRIDE switch in "OVERRIDE" after slowing below 200 knots, but prior to slowing to approach speed plus 30 knots.

NOTE

Speeds shown for each position are minimum speeds. Higher speeds may be flown, at the pilot's discretion, not to exceed aircraft or air traffic control limitations. Of prime importance is that the latter portion of the approach be flown at recommended speed.



NOTE

Do not slow below approach speed plus 20 knots until flaps are lowered to APPROACH

NOTE

The term "landing assured" shall be interpreted as follows: On final approach with runway or approach lights in sight, within one mile of runway and in a position to complete the landing safely.

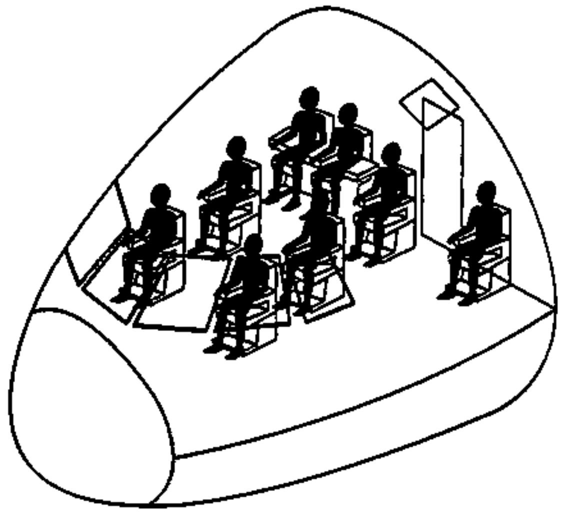
NOTE

The two-engine approach speed is charted approach speed for 75% flaps or two-engine V_{mca} whichever is greater. Set airspeed command markers to two-engine approach speed.

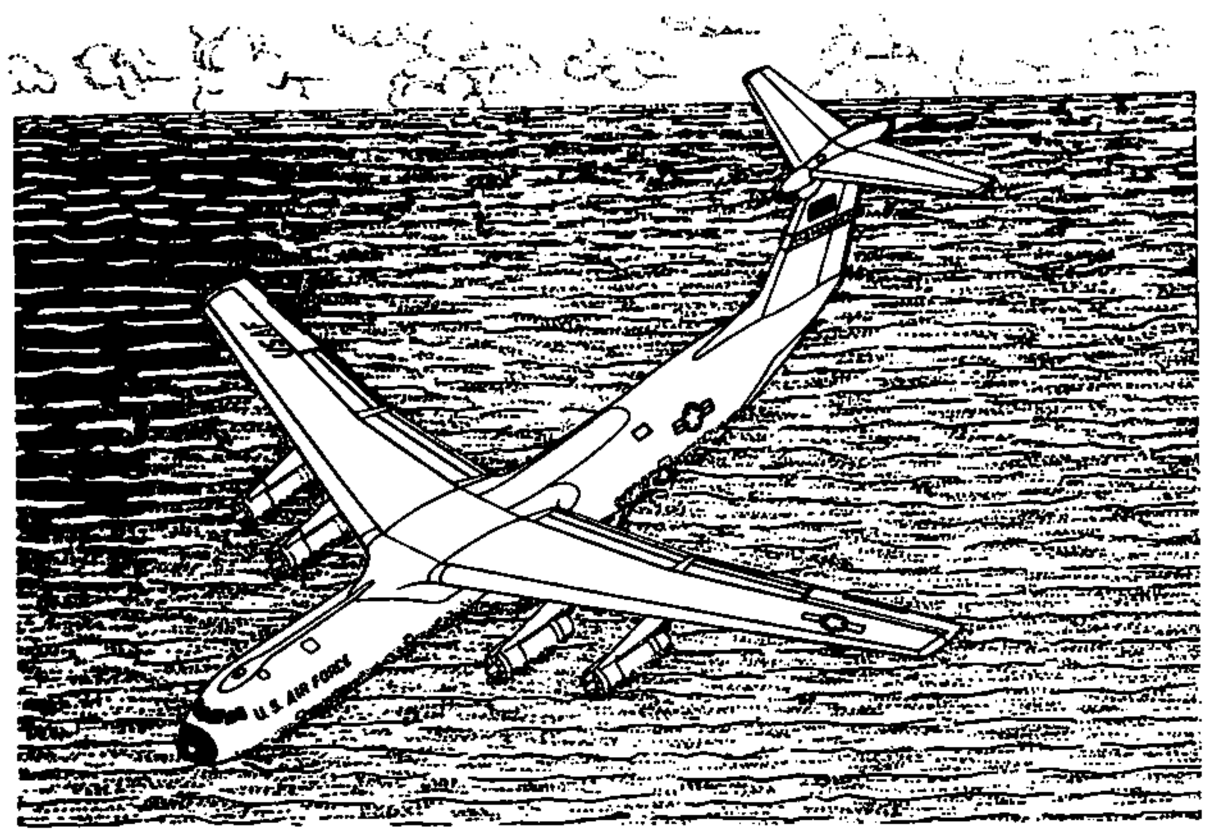
141A-1-X3/0-126

Figure 3-20. Typical Radar Approach Two Engine Configuration

DITCHING



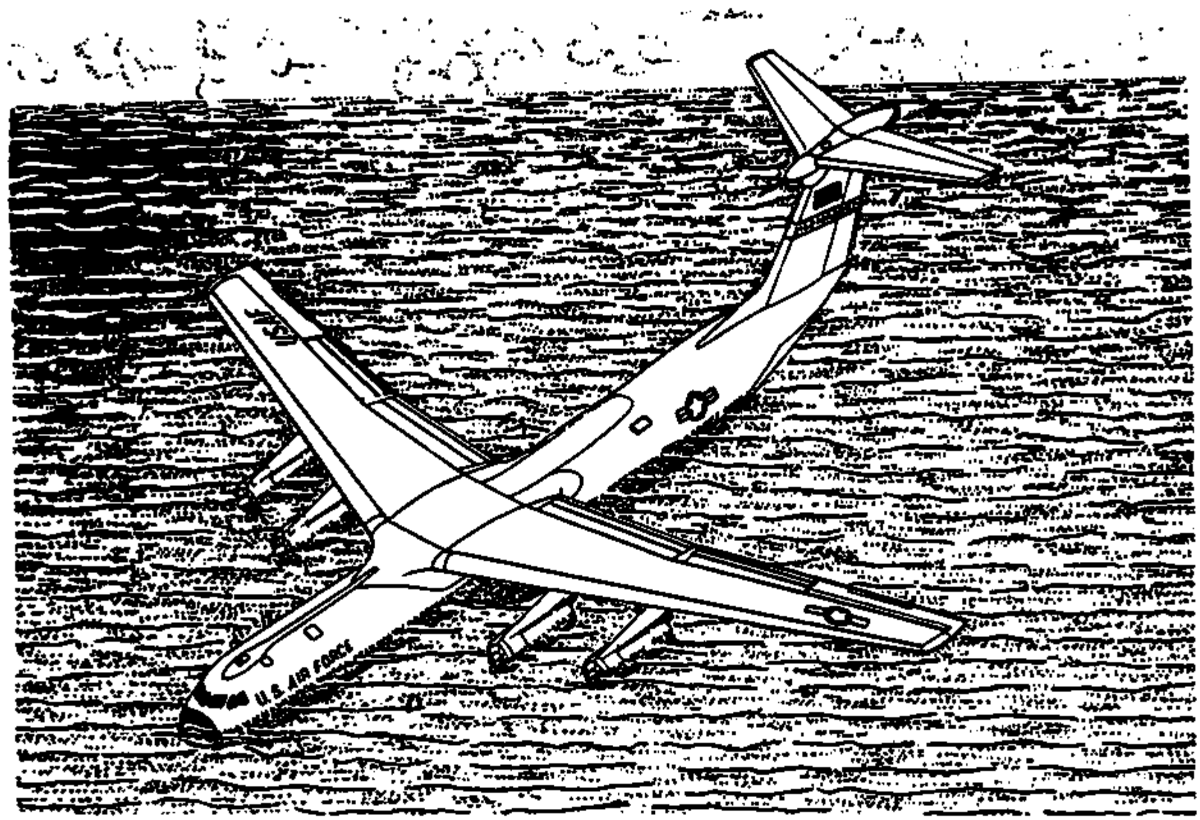
CREW POSITION DURING DITCHING



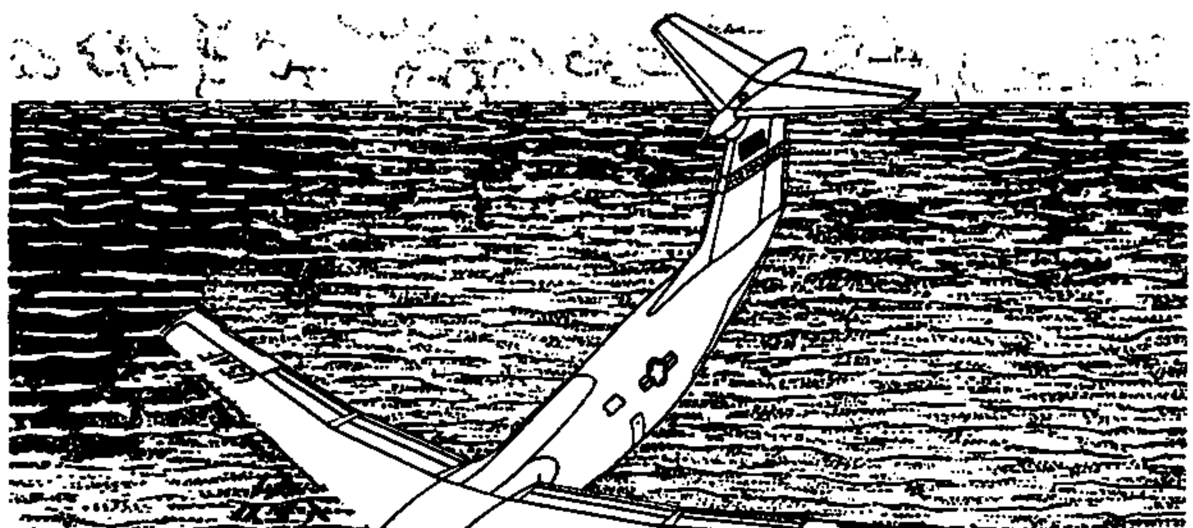
CASE I

141A-1-X3/0-127-1

Figure 3-21. Ditching (Sheet 1 of 2)



CASE II



CASE III

Figure 3-21. Ditching (Sheet 2 of 2)

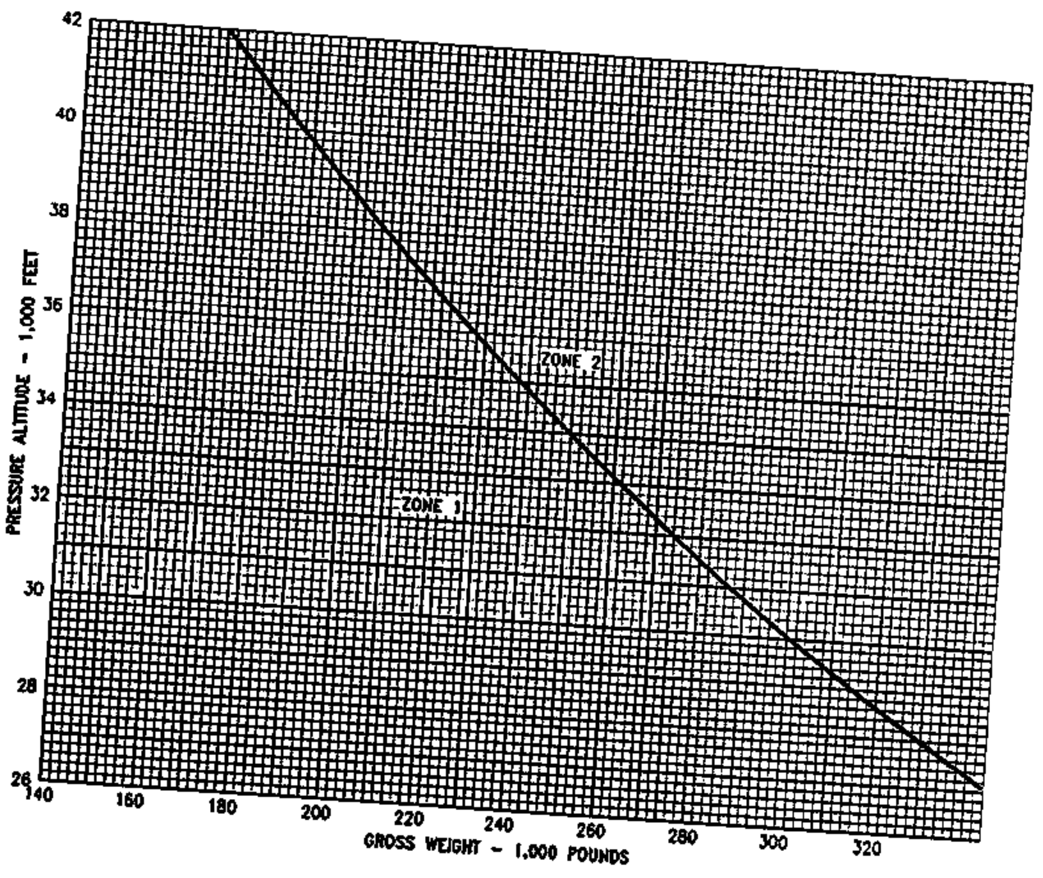
LATERAL STABILITY

MODEL: C-141B
TF33-P-7 ENGINES

DATE: MARCH 1980
DATA BASIS:
C-141B CATEGORY II
FLIGHT TEST

NOTE (Aircraft modified by TO 1C-141-768)

1. Operation is limited to Zone I if the YAW Damper is inoperative.
2. Operation is unrestricted if the YAW Damper is fully operational.
3. This chart is based on cruise Mach up to .78m



D3177001E

Figure 3-22. Lateral Stability

SECTION III

EMERGENCY PROCEDURES

PART III

AEROMEDICAL EVACUATION CREW

TEXT	PAGE
INTRODUCTION	3-120
AEROMEDICAL EVACUATION CREW MEMBER (AECM) ABBREVIATIONS	3-120
EMERGENCY SIGNALS	see 3-5
GROUND OPERATIONS	3-121
GROUND EVACUATION - CREW NOT IN PLACE CHECKLIST	3-121
FIRE ON THE GROUND	3-121
IN-FLIGHT	3-122
DOOR OPEN WARNING LIGHT ILLUMINATION	3-122
RAPID DECOMPRESSION	3-122
SMOKE AND FUME ELIMINATION CHECKLIST	3-122
LANDING	3-123
DITCHING AND WHEELS UP LANDING	3-123
DITCHING CHART (PLANNED)	3-124
Medical Crew Director	3-124
Flight Nurse	3-126
Charge Medical Technician	3-128
Second Aeromedical Evacuation Technician	3-130
Third Aeromedical Evacuation Technician	3-132
WHEELS UP LANDING CHART (PLANNED)	3-135
Medical Crew Director	3-135
Flight Nurse	3-137
Charge Medical Technician	3-139
Second Aeromedical Evacuation Technician	3-141
Third Aeromedical Evacuation Technician	3-143

INTRODUCTION.

This section contains procedures for Aeromedical Evacuation Crewmembers caused by equipment malfunction, emergency evacuation, or unique requirements at remote locations.

AEROMEDICAL EVACUATION CREW MEMBER (AECM) ABBREVIATIONS.

The following abbreviations are used in this section to identify specific Aeromedical Evacuation aircrew and their duties:

(AEC)	Aeromedical Evacuation Crew (applies to entire aeromedical evacuation crew)
(MCD)	Medical Crew Director
(FN)	Flight Nurse
(CMT)	Charge Medical Technician
(2AET)	Second Aeromedical Evacuation Technician
(3AET)	Third Aeromedical Evacuation Technician
(AET)	Aeromedical Evacuation Technician (CMT, 2AET, and 3AET)

EMERGENCY SIGNALS.

See page 3-5.

GROUND OPERATIONS.

GROUND EVACUATION - CREW NOT IN PLACE CHECKLIST.

If a fire occurs or if aircraft evacuation is required while on the ground, then call for and complete the Ground Evacuation checklist.

1. **GROUND, AEC, AND FLIGHT CREW - NOTIFIED**

If a fire occurs in the fuselage or aircraft compartment, direct all crewmembers not engaged in evacuating patients/passengers to fight the fire until aircraft is evacuated.

2. **GROUND EXITS - OPEN**
3. **TROOPS/CREW - EVACUATE**
   a. Direct and assist evacuation of patients/passengers. Ambulatory first, followed by litters.

   NOTE

   If practical, close the troop oxygen manual shutoff valves prior to evacuation.

   b. Direct patients and passengers away and upwind from aircraft.
   c. Accomplish a head count and provide numbers to MCD or senior ranking survivor.

FIRE ON THE GROUND.

If aircraft evacuation is directed by the pilot, complete the Fire on the Ground checklist.

1. Ground, AEC, and Flight Crew - NOTIFIED

If a fire occurs in the fuselage or aircraft compartment, the pilot will direct all crewmembers not engaged in required duties to fight the fire.

2. Ground Exits - "OPEN" (P), "OPENING" (S/LM/MCD)

Open available ground exits as directed by the pilot/LM or per egress plan.

3. Troop/Crew - "AS REQUIRED" (P)
   a. If the pilot directs evacuation, acknowledge. Direct and assist evacuation of the patients/passengers. Ambulatory first, followed by litters.

   NOTE

   If practical, close the troop oxygen manual shutoff valves prior to evacuation.

   b. Direct patients and passengers away and upwind from aircraft or as directed by the pilot.
   c. Accomplish a head count and provide numbers to pilot/MCD/or senior ranking survivor.

IN-FLIGHT.

DOOR OPEN WARNING LIGHT ILLUMINATION.

1. Oxygen Masks - AS REQUIRED

If oxygen is required, the pilot/loadmaster will direct all crewmembers to don oxygen mask.

2. Crew - NOTIFIED

Ensure all crewmembers are aware of nature of emergency.

3. Patients/Passengers - SECURED

Ensure patients/passengers are secured and on oxygen if necessary.

4. Crewmembers - SECURED

Assume assigned seat and fasten seat belt.

RAPID DECOMPRESSION.

1. **OXYGEN MASK - ON/100%**

Immediately don nearest available oxygen mask.

2. Crewmembers (As Required) - SECURED

If structural damage or aircraft flight maneuvers preclude personal safety without a seat belt, aeromedical evacuation crewmembers will make every effort to secure themselves in any available seat until it is safe to move about the cabin. If rapid decompression is not accompanied by unusual aircraft movements continue the checklist.

3. Patients/Passengers - ASSIST AS NECESSARY

   a. When it is safe to move about, check patients/passengers and assist them with their oxygen source.

   b. Ensure all patients/passengers are secured.

SMOKE AND FUME ELIMINATION CHECKLIST.

All odors, smoke or fumes will be considered toxic. If the pressurized area is rapidly filling with smoke from a fuselage fire, it is essential that action be initiated to protect the crew, patients, and passengers from potentially dangerous smoke.

1. **OXYGEN MASK - ON/100%**

NOTE

Emergency Passenger Oxygen System (EPOS) may be used.

2. Crew - NOTIFIED

Notify pilot/loadmaster (if origin of fire is in cabin) and aeromedical evacuation crew of nature of emergency.

3. Fire - COMBAT AS DIRECTED

The pilot/loadmaster will direct crewmembers to fight the fire as required. Crewmembers not directly involved with combating the fire will proceed with their emergency procedure checklist.

4. Patients/Passengers - ASSIST AS NECESSARY

   a. Assist patients/passengers in donning emergency oxygen equipment.

   b. Relocate patients/passengers.

   c. Secure patients/passengers in preparation for smoke and fumes removal procedures.

NOTE

If aircraft is equipped with Emergency Passenger Oxygen System (EPOS) give consideration to its use as required. If EPOS is not available, putting a wet towel or handkerchief over the nose and mouth, or over the oxygen mask when utilized, affords better protection from smoke and fumes.

LANDING.

DITCHING AND WHEELS UP LANDING.

This section contains the entire Ditching and Wheels Up Landing checklist procedures for AEC. AECMs are required to be familiar with the entire checklist and to refer directly to their abbreviated flight crew checklist when accomplishing these procedures. For ditching characteristics, see Section III, Part I and II.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
MEDICAL CREW DIRECTOR 1. Acknowledge pilot's order to prepare for ditching. Coordinate egress with pilot and LM. 2. Brief AEC. a. Any special instructions from pilot. b. Select able-bodied ambulatory patients and passengers to assist with egress (as required). c. Coordinate which litter patients will be moved to seats. 3. Don life preserver. 4. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on left side of aircraft. Assist with launching life rafts. Inflate LPU 6/P (Infant Cot) life preservers prior to evacuating aircraft (as required). 5. Brief patients on left side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which to evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 6. Prepare and secure litter and ambulatory patients on left side of aircraft. a. Assist CMT with positioning patients, checking litter straps and litter support systems on left side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing.	1. Check patients on left side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume ditching position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. Flashlight.	1. Troop or passenger seat forward of left troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits and deploy life rafts as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through No. 4 hatch or as directed by LM, ambulatory followed by litter. **WARNING** Brief patients and passengers to inflate life preservers after leaving the aircraft. 4. Evacuate aircraft through No. 4 hatch. 5. Board assigned life raft. a. The first crewmember into the life raft will secure the clamp on the equalizer tube.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
MEDICAL CREW DIRECTOR (CON'T) (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits). b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress. e. Assist patients in donning life preservers. **WARNING** Brief patients to inflate life preservers **after** leaving the aircraft. **NOTE** The LPU 6/P is the **only** life preserver that can be inflated inside the aircraft. 7. Distribute medical supplies, medications, and equipment to assigned assistants and crewmembers for removal from aircraft upon evacuation. As a minimum collect narcotics, oral airways, and BVM resuscitator for removal from aircraft. 8. Secure cabin. a. Secure patients and passengers on left side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 9. Receive cabin secured report from FN/CMT. 10. Report cabin secured to LM/pilot.				b. Assist patients and passengers into the life rafts. c. Group life rafts together (if possible).

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
FLIGHT NURSE 1. Don life preserver. 2. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on right side of aircraft. Assist with launching life rafts. Inflate LPU 6/P (Infant Cot) life preservers prior to evacuating aircraft (as required). 3. Brief patients on right side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which they will evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats – grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 4. Prepare and secure litter and ambulatory patients on right side of aircraft. a. Assist 2AET with positioning patients, checking litter straps and litter support systems on right side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits). b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces.	1. Check patients on right side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume ditching position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. Flashlight.	1. Troop or passenger seat forward of right troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits and deploy life rafts as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through No. 3 hatch or as directed by LM, ambulatory followed by litter. **WARNING** Brief patients and passengers to inflate life preservers **after** leaving the aircraft. 4. Evacuate aircraft through No. 3 hatch. 5. Board assigned life raft. a. The first crewmember into the life raft will secure the clamp on the equalizer tube. b. Assist patients and passengers into the life rafts.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
<u>FLIGHT NURSE</u> (CON'T) d. Remove IV lines, catheters, etc. that may impede egress. e. Assist patients in donning life preservers. **WARNING** Brief patients to inflate life preservers **after** leaving the aircraft. **NOTE** The LPU 6/P is the **only** life preserver that can be inflated inside the aircraft. 5. Distribute medical supplies, medications, and equipment to assigned assistants and crewmembers for removal from aircraft upon evacuation. As a minimum collect narcotics, oral airways, and BVM resuscitator for removal from aircraft. 6. Secure cabin. a. Secure patients and passengers on right side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 7. Report cabin secured to MCD.				c. Group life rafts together (if possible).

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
CHARGE MEDICAL TECHNICIAN 1. Don life preserver. 2. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on left side of aircraft. Assist with launching life rafts. Inflate LPU 6/P (Infant Cot) life preservers prior to evacuating aircraft (as required). 3. Brief patients on left side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which they will evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 4. Prepare and secure litter and ambulatory patients on left side of aircraft. a. Assist MCD with positioning patients, checking litter straps and litter support systems on left side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits). b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress.	1. Check patients on left side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume ditching position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. First aid kit. 3. Flashlight.	1. Troop or passenger seat forward of left troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits and deploy life rafts as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through No. 4 hatch or as directed by LM, ambulatory followed by litter. **WARNING** Brief patients and passengers to inflate life preservers after leaving the aircraft. 4. Evacuate aircraft through No. 4 hatch. 5. Board assigned life raft. a. The first crewmember into the life raft will secure the clamp on the equalizer tube. b. Assist patients and passengers into the life rafts.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
<u>CHARGE MEDICAL TECHNICIAN</u> (CON'T) e. Assist patients in donning life preservers. **WARNING** Brief patients to inflate life preservers **after** leaving the aircraft. **NOTE** The LPU 6/P is the **only** life preserver that can be inflated inside the aircraft. 5. Receive medical supplies, medications, and equipment from MCD for removal from aircraft upon evacuation. 6. Secure cabin. a. Secure patients and passengers on left side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 7. Report cabin secured to MCD.				c. Group life rafts together (if possible).

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
SECOND AEROMEDICAL EVACUATION TECHNICIAN 1. Don life preserver. 2. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on right side of aircraft. Assist with launching life rafts. Inflate LPU 6/P (Infant Cot) life preservers prior to evacuating aircraft (as required). 3. Brief patients on right side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which they will evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 4. Prepare and secure litter and ambulatory patients on right side of aircraft. a. Assist FN with positioning patients, checking litter straps and litter support systems on right side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits). b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress.	1. Check patients on right side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume ditching position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. First aid kit. 3. Flashlight.	1. Troop or passenger seat forward of right troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits and deploy life rafts as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through No. 3 hatch or as directed by LM, ambulatory followed by litter. **WARNING** Brief patients and passengers to inflate life preservers after leaving the aircraft. 4. Evacuate aircraft through No. 3 hatch. 5. Board assigned life raft. a. The first crewmember into the life raft will secure the clamp on the equalizer tube. b. Assist patients and passengers into the life rafts.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
SECOND AEROMEDICAL EVACUATION TECHNICIAN (CON'T) e. Assist patients in donning life preservers. **WARNING** Brief patients to inflate life preservers after leaving the aircraft. **NOTE** The LPU 6/P is the **only** life preserver that can be inflated inside the aircraft. 5. Receive medical supplies, medications, and equipment from FN for removal from aircraft upon evacuation. 6. Secure cabin. a. Secure patients and passengers on right side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 7. Report cabin secured to CMT.				c. Group life rafts together (if possible).

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
THIRD AEROMEDICAL EVACUATION TECHNICIAN 1. Don life preserver. 2. Brief assigned assistants to remain in aircraft to assist in evacuation of ambulatory patients and passengers in forward portion of cargo compartment. Assist with launching life rafts. Inflate LPU 6/P (Infant Cot) life preservers prior to evacuating aircraft (as required). 3. Brief patients in forward portion of cargo compartment in evacuation procedures. a. Identify emergency exits to be used and order in which they will evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. 4. Prepare and secure ambulatory patients in forward portion of cargo compartment. a. Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. b. Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. c. Assist ambulatory patients/passengers in donning life preservers.	1. Check ambulatory patients/passengers are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume ditching position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. First aid kit. 3. Flashlight.	1. Troop or passenger seat in forward portion of cargo compartment.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits and deploy life rafts as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through No. 2 hatch or as directed by LM, ambulatory followed by litter. **WARNING** Brief patients and passengers to inflate life preservers after leaving the aircraft. 4. Evacuate aircraft through No. 2 hatch. 5. Board assigned life raft. a. The first crewmember into the life raft will secure the clamp on the equalizer tube. b. Assist patients and passengers into the life rafts.

DITCHING CHART (PLANNED)

FIRST ACTIONS	DITCHING IMMINENT (10 MINUTES LEFT)	PROVIDE	POSITION	AFTER DITCHING
<u>THIRD AEROMEDICAL EVACUATION TECHNICIAN</u> (CON'T) **WARNING** Brief patients to inflate life preservers after leaving the aircraft. **NOTE** The LPU 6/P is the only life preserver that can be inflated inside the aircraft. 5. Receive medical supplies, medications, and equipment from FN for removal from aircraft upon evacuation. 6. Remove restraints from psychiatric patients. 7. Secure cabin. a. Secure patients and passengers in ambulatory section of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 8. Report cabin secured to CMT.				c. Group life rafts together (if possible).

C-141 AEROMEDICAL EVACUATION DITCHING PLAN

OVERHEAD EXITS (3)

GROUND ESCAPE EXITS (7)

NOTE

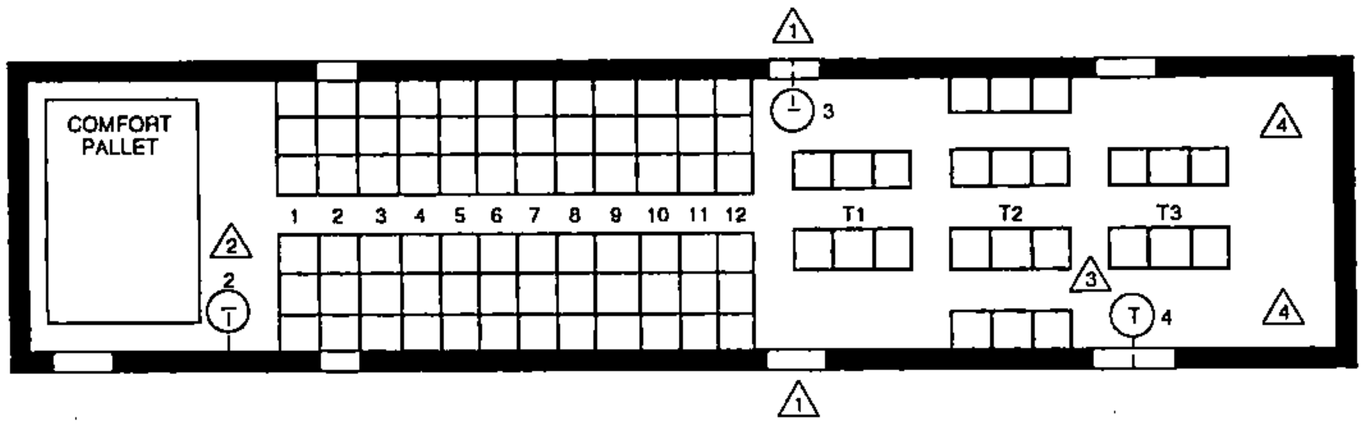
THIS DITCHING PLAN WILL BE USED FOR THE LARGE OR SMALL LOAD PLAN OR SIMPLY OMITTING T-1 OR ROW 10-11-12 FOR THE SMALL LOAD PLAN.

LIFE RAFT LOCATIONS

1. WING FILLET COMPARTMENTS.
2. ADJACENT TO NO. 2 HATCH.
3. ADJACENT TO NO. 4 HATCH.
4. OVERHEAD COMPARTMENT AFT OF TROOP DOORS.

LIFE RAFT ASSIGNMENTS

AEROMEDICAL EVACUATION TECHNICIAN	4	LITTER AMBULATORY PATIENTS PASSENGERS
FLIGHT NURSE	1	LITTER AMBULATORY PATIENTS PASSENGERS



LIFE RAFT ASSIGNMENTS

AEROMEDICAL EVACUATION TECHNICIAN	2	LITTER AMBULATORY PATIENTS PASSENGERS
ADDITIONAL CREW MEMBER	1	LITTER AMBULATORY PATIENTS PASSENGERS

NOTE

FLIGHT CREW PERSONNEL (P, CP, N, E, S, LM) WILL EXIT THROUGH ASSIGNED EXITS AND THE AIRCRAFT COMMANDER RETAINS RESPONSIBILITY FOR RAFT ASSIGNMENTS AFTER THE CREWMEMBERS HAVE EXITED THE AIRCRAFT.

LIFE RAFT ASSIGNMENTS

AEROMEDICAL EVACUATION TECHNICIAN	4	LITTER AMBULATORY PATIENTS PASSENGERS
FLIGHT NURSE	3	LITTER AMBULATORY PATIENTS PASSENGERS

141A-1-X3/0-130

Figure 3-23. Ditching Plan

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
MEDICAL CREW DIRECTOR 1. Acknowledge pilot's order to prepare for emergency landing. Coordinate egress with pilot and LM. 2. Brief AEC. a. Any special instructions from pilot. b. Select able-bodied ambulatory patients and passengers to assist with egress (as required). c. Coordinate which litter patients will be moved to seats. 3. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on left side of aircraft. 4. Brief patients on left side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which to evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 5. Prepare and secure litter and ambulatory patients on left side of aircraft. a. Assist CMT with positioning patients, checking litter straps and litter support systems on left side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual.	1. Check patients on left side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. Flashlight.	1. Troop or passenger seat forward of left troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through left troop door or as directed by LM, ambulatory followed by litter. 4. Evacuate aircraft through left troop door. 5. Direct patients and passengers away from aircraft. a. Direct patients and passengers to meet upwind of the aircraft or as directed by the pilot. b. Accomplish a head count and provide numbers to pilot or senior ranking survivor.

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
<u>MEDICAL CREW DIRECTOR</u> (CON'T) (3) Position litter patients in seats and evacuate as ambulatory (if condition permits). **WARNING** When the forward side emergency escape hatches are removed and the inboard engines are reversed, debris, engine flame, and exhaust fumes enter the cabin which can be harmful to occupants in the cargo compartment in close proximity to these open escape hatches. When feasible, passengers should be moved aft to preclude possible injury. b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress. 6. Distribute medical supplies, medications, and equipment to assigned assistants and crewmembers for removal from aircraft upon evacuation. As a minimum collect narcotics, oral airways, and BVM resuscitator for removal from aircraft. 7. Secure cabin. a. Secure patients and passengers on left side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 8. Receive cabin secured report from FN/CMT. 9. Report cabin secured to LM/pilot.				

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
FLIGHT NURSE 1. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on right side of aircraft. 2. Brief patients on right side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which to evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 3. Prepare and secure litter and ambulatory patients on right side of aircraft. a. Assist 2AET with positioning patients, checking litter straps and litter support systems on right side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits).	1. Check patients on right side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. Flashlight.	1. Troop or passenger seat forward of right troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through right troop door or as directed by LM, ambulatory followed by litter. 4. Evacuate aircraft through right troop door. 5. Direct patients and passengers away from aircraft. a. Direct patients and passengers to meet upwind of the aircraft or as directed by the pilot. b. Accomplish a head count and provide numbers to pilot/MCD/or senior ranking survivor.

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
<u>FLIGHT NURSE</u> (CON'T) **WARNING** When the forward side emergency escape hatches are removed and the inboard engines are reversed, debris, engine flame, and exhaust fumes enter the cabin which can be harmful to occupants in the cargo compartment in close proximity to these open escape hatches. When feasible, passengers should be moved aft to preclude possible injury. b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress. 4. Distribute medical supplies, medications, and equipment to assigned assistants and crewmembers for removal from aircraft upon evacuation. As a minimum collect narcotics, oral airways, and BVM resuscitator for removal from aircraft. 5. Secure cabin. a. Secure patients and passengers on right side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 6. Report cabin secured to MCD.				

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
CHARGE MEDICAL TECHNICIAN 1. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on left side of aircraft. 2. Brief patients on left side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which to evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 3. Prepare and secure litter and ambulatory patients on left side of aircraft. a. Assist MCD with positioning patients, checking litter straps and litter support systems on left side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits).	1. Check patients on left side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. First aid kit. 3. Flashlight.	1. Troop or passenger seat forward of left troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through left troop door or as directed by LM, ambulatory followed by litter. 4. Evacuate aircraft through left troop door. 5. Direct patients and passengers away from aircraft. a. Direct patients and passengers to meet upwind of the aircraft or as directed by the pilot. b. Accomplish a head count and provide numbers to pilot/MCD/or senior ranking survivor.

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
CHARGE MEDICAL TECHNICIAN (CON'T) **WARNING** When the forward side emergency escape hatches are removed and the inboard engines are reversed, debris, engine flame, and exhaust fumes enter the cabin which can be harmful to occupants in the cargo compartment in close proximity to these open escape hatches. When feasible, passengers should be moved aft to preclude possible injury. b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress. 4. Receive medical supplies, medications, and equipment from MCD for removal from aircraft upon evacuation. 5. Secure cabin. a. Secure patients and passengers on left side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 6. Report cabin secured to MCD.				

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
SECOND AEROMEDICAL EVACUATION TECHNICIAN 1. Brief assigned assistants to remain in aircraft to assist in evacuation of patients on right side of aircraft. 2. Brief patients on right side of aircraft in evacuation procedures. a. Identify emergency exits to be used and order in which to evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seats (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. (3) Litters - lie flat, grasp sides of litter tightly. 3. Prepare and secure litter and ambulatory patients on right side of aircraft. a. Assist FN with positioning patients, checking litter straps and litter support systems on right side of aircraft. (1) Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. (2) Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual. (3) Position litter patients in seats and evacuate as ambulatory (if condition permits).	1. Check patients on right side are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. First aid kit. 3. Flashlight.	1. Troop or passenger seat forward of right troop door.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through right troop door or as directed by LM, ambulatory followed by litter. 4. Evacuate aircraft through right troop door. 5. Direct patients and passengers away from aircraft. a. Direct patients and passengers to meet upwind of the aircraft or as directed by the pilot. b. Accomplish a head count and provide numbers to pilot/MCD/or senior ranking survivor.

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
<u>SECOND AEROMEDICAL EVACUATION TECHNICIAN</u> (CON'T) **WARNING** When the forward side emergency escape hatches are removed and the inboard engines are reversed, debris, engine flame, and exhaust fumes enter the cabin which can be harmful to occupants in the cargo compartment in close proximity to these open escape hatches. When feasible, passengers should be moved aft to preclude possible injury. b. Apply extra padding and litter straps to litter patients. c. Move litters to lower tier spaces. d. Remove IV lines, catheters, etc. that may impede egress. 4. Receive medical supplies, medications, and equipment from FN for removal from aircraft upon evacuation. 5. Secure cabin. a. Secure patients and passengers on right side of aircraft; check seat belts. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 6. Report cabin secured to CMT.				

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
THIRD AEROMEDICAL EVACUATION TECHNICIAN 1. Brief assigned assistants to remain in aircraft to assist in evacuation of ambulatory patients and passengers in forward portion of cargo compartment. 2. Brief patients in forward portion of cargo compartment in evacuation procedures. a. Identify emergency exits to be used and order in which to evacuate. b. Position to assume at the "Brace for Impact" signal (one long sustained blast on warning horn). (1) Aft facing seats - grasp arm rests and apply pressure, feet flat on floor with head braced against headrest. (2) Troop seat (side facing seats) - lean forward, place hands behind neck and pull head to knees; elbows should be outside of knees. 3. Prepare and secure ambulatory patients in forward portion of cargo compartment. **WARNING** When the forward side emergency escape hatches are removed and the inboard engines are reversed, debris, engine flame, and exhaust fumes enter the cabin which can be harmful to occupants in the cargo compartment in close proximity to these open escape hatches. When feasible, passengers should be moved aft to preclude possible injury. a. Remove sharp objects, high heels, ties; loosen collars, tight fitting clothing. b. Place sharp objects and loose items in large plastic bag and secure. Remove eyeglasses and dentures; pad and secure on individual.	1. Check ambulatory patients/ passengers are properly secured and assuming "Brace for Impact" position. 2. Take assigned seat. 3. Fasten seat belt. 4. Assume position at "Brace for Impact" signal.	1. Medical supplies, medications, equipment. 2. First aid kit. 3. Flashlight.	1. Troop or passenger seat in forward portion of cargo compartment.	1. Remain seated until aircraft has come to a complete stop. 2. Open exits. Open available exits as directed per egress plan or by LM. 3. Direct and assist patient and passenger egress through crew entrance door or as directed by LM, ambulatory followed by litter. 4. Evacuate aircraft through crew entrance door. 5. Direct patients and passengers away from aircraft. a. Direct patients and passengers to meet upwind of the aircraft or as directed by the pilot. b. Accomplish a head count and provide numbers to pilot/MCD/or senior ranking survivor.

WHEELS UP LANDING CHART (PLANNED)

FIRST ACTIONS	PRIOR TO APPROACH AND LANDING (Approx 10 Minutes)	PROVIDE	POSITION	AFTER CONTACT
<u>THIRD AEROMEDICAL EVACUATION TECHNICIAN</u> (CON'T) 4. Receive medical supplies, medications, and equipment from FN for removal from aircraft upon evacuation. 5. Remove restraints from psychiatric patients. 6. Secure cabin. a. Secure patients and passengers in forward portion of cargo compartment. b. Secure small children with extra litter straps and pad with pillows and blankets as required. c. Secure all loose articles and equipment. 7. Report cabin secured to CMT.				

SECTION IV
CREW DUTIES
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	**4-3**
INTERPHONE PROCEDURES AND PHRASEOLOGY	**4-3**
PILOT	**4-3**
COPILOT	**4-3**
FLIGHT ENGINEER	**4-3**
NAVIGATOR	**4-4**
NORMAL PROCEDURES	4-4
INTERIOR INSPECTION	4-4
BEFORE STARTING ENGINES	4-11
BEFORE TAXI	4-11
BEFORE TAKE-OFF	4-12
AFTER TAKE-OFF, CLIMB	4-12
CRUISE	4-12
DESCENT	4-12
APPROACH	4-13
AFTER LANDING	4-13
BEFORE LEAVING AIRCRAFT	4-14
INS MODE UPDATES	4-14
GRID CHECKLIST	4-16
GRID ENTRY ENROUTE	4-17
HEADING REFERENCE CHANGE-OVER	4-18
GRID EXIT ENROUTE	4-19
POLAR GRID CHECKLIST	4-19
BEFORE TAKE-OFF (POLAR AREAS)	4-19
LINEUP (POLAR AREAS)	4-20
AFTER TAKE-OFF, CLIMB (POLAR AREAS)	4-20
CRUISE (POLAR AREAS)	4-20
DESCENT (POLAR AREAS)	4-20
APPROACH (POLAR AREAS)	4-21
SCANNER	**4-21**
NORMAL PROCEDURES	4-22
LOADMASTER	**4-22**
NORMAL PROCEDURES	4-22
EXTERNAL POWER CONNECT/ ELECTRICAL POWER-OFF	4-22
EXTERNAL POWER CONNECT/ ELECTRICAL POWER-ON	4-24
EXTERNAL POWER DISCONNECT	4-24
INITIAL PREFLIGHT	4-25
AIR TRANSPORTABLE GALLEY/ LAVATORY (ATGL) PREFLIGHT	4-29
PORTABLE LAVATORY	4-32
AIRCRAFT PREPARATION FOR PASSENGER/AIR EVAC LOADING/EMERGENCY AIRLIFT OF PERSONNEL	4-33
AIRCRAFT PREPARATION FOR PALLETIZED/FLOOR LOADING CARGO	4-33
PRIOR TO LOADING GENERAL	4-34
LOADING	4-35
AFTER LOADING GENERAL	4-35
BEFORE TAXI	4-36
BEFORE TAKE-OFF	4-37
AFTER TAKE-OFF, CLIMB	4-37
CRUISE	4-37
DESCENT	4-38
APPROACH	4-38
AFTER LANDING/BEFORE LEAVING AIRCRAFT	4-38
ATGL POSTFLIGHT	4-39
ATGL WINTERIZATION (ORIGINAL)	4-40
ATGL WINTERIZATION (MODIFIED)	4-42
AIRCRAFT PREPARATION FOR PARATROOP LOADING	4-43
AIRCRAFT PREPARATION FOR EQUIPMENT AIRDROP	4-46
AIRCRAFT PREPARATION FOR CONTAINER DELIVERY SYSTEM (CDS) AIRDROP	4-49
PRIOR TO LOADING AIRDROP EQUIPMENT	4-51
AFTER LOADING AIRDROP EQUIPMENT (PLATFORM[S])	4-52
AFTER LOADING AIRDROP EQUIPMENT (CDS)	4-53
AEROMEDICAL EVACUATION CREW	**4-54**
MEDICAL CREW DIRECTOR	4-54
FLIGHT NURSE	4-54
CHARGE MEDICAL TECHNICIAN	4-54

TEXT	PAGE
AEROMEDICAL EVACUATION TECHNICIANS	4-54
CREW DUTIES - MEDICAL CREW DIRECTOR (MCD), FLIGHT NURSE (FN) CHECKLIST	4-54
CREW DUTIES - CHARGE MEDICAL TECHNICIAN (CMT), AEROMEDICAL EVACUATION TECHNICIANS (2AET/3AET) CHECKLIST	4-54
MCD/FN CHECKLIST PROCEDURES	**4-55**
INTERIOR INSPECTION	4-55
ENPLANING	4-55
BEFORE TAXI	4-56
BEFORE TAKE-OFF	4-57
IN-FLIGHT	4-57
DESCENT	4-58
DEPLANING	4-59
BEFORE LEAVING AIRCRAFT	4-59
CMT/2AET/3AET CHECKLIST PROCEDURES	**4-60**
INTERIOR INSPECTION	4-60
ENPLANING	4-62
BEFORE TAXI	4-63
BEFORE TAKE-OFF	4-63
IN-FLIGHT	4-64
DESCENT	4-64
DEPLANING	4-65
BEFORE LEAVING AIRCRAFT	4-66

INTRODUCTION.

The purpose of this section is to supplement Section II. All crew duties not necessary for the operation of the aircraft and engines are covered here.

INTERPHONE PROCEDURES AND PHRASEOLOGY.

The navigator and flight engineer will monitor the primary radio during ground and flight operation in the departure and terminal areas. The copilot will notify all crewmembers over interphone which radio is primary, i.e., "Crew V1, primary." The loadmaster/scanner will remain on interphone, if duties permit, during engine start and ground operations when the engines are running.

NOMENCLATURE.

In the interest of standardization of crewmember identification, the following terms will be used:

1. Pilot: The occupant of the left seat in the flight station.
2. Copilot: The occupant of the right seat in the flight station.

NOTE

> During training, the instructor pilot may occupy the right seat, but will be referred to as copilot.

3. Navigator: The crewmember seated at the navigator's station.
4. Flight Engineer: The crewmember seated at the flight engineer's station.
5. Scanner: The crewmember designated to perform interior and exterior scanner duties.
6. Loadmaster: The crewmember designated for aircraft configuration, weight and balance computation, and cargo/troop handling.

IDENTIFICATION.

The crewmember who is being called will be identified first, followed by the identification of the crewmember making the call (i.e., "engineer . . . pilot").

SEQUENCE.

Crewmembers will always state the unit to be actuated first, and then state action to be taken second; for example, gear - UP; flaps - APPROACH.

TERMINOLOGY.

In the interest of clarity and comprehension, the terminologies contained in this publication will be used as applicable.

ACKNOWLEDGMENT.

Prior to execution, every command will be repeated by the receiver to ensure proper understanding of the transmission. An exception to the above rule may be made during the final approach of a GCA letdown; here, the pilot may direct the other crewmembers not to acknowledge commands in order to prevent interphone transmissions. If a command is not clearly understood, the crewmember will request that the command be repeated stating, "SAY AGAIN"; the pilot will then repeat the original transmission. After initial contact has been established, it is not necessary during subsequent transmissions in the same conversation to identify the crewmembers being called.

HOT MIC PROCEDURE.

The use of HOT MIC, TALK, and LISTEN will be coordinated by the pilot.

PILOT.

The pilot is responsible for the inspection and preparation of the aircraft for the mission. Prior to engine start, the pilot should brief the crew on the mission, duration of flight, emergency procedures, any unusual condition such as enroute weather. The pilot should ensure that each crewmember has the proper personal equipment.

COPILOT.

The copilot will aid the pilot as directed to accomplish the assigned mission and must be thoroughly familiar with emergency procedures and copilot duties.

FLIGHT ENGINEER.

The flight engineer will perform a complete preflight or thru-flight inspection and report to the pilot the condition of the aircraft. The engineer will operate and monitor the various systems to include current altimeter, assigned altitudes, minimum altitudes, etc.

NAVIGATOR.

The Navigator will be responsible for the navigation of the aircraft and be thoroughly familiar with the navigator's challenge items in Section II and the Navigator's Emergency Procedures. Items identified by an asterisk (*) are required to be checked during the thru-flight inspections. If radar controls are located at the pilot's station, navigator's radar items and responses are not applicable.

NORMAL PROCEDURES

INTERIOR INSPECTION.

* 1. Aircraft Forms - CHECKED

* 2. Fuel Quantity - CHECKED

Coordinate with the flight engineer on the fuel required/fuel on board.

* 3. Avionics Circuit Breaker Panel - CHECKED

4. Interphone Selector Switch - INTERPHONE

* 5. Oxygen System - CHECKED

* 6. Aircraft Power - CHECKED

7. Lights - CHECKED
8. Radar - ON/CHECKED/OFF

WARNING

Before placing the function switch in WX, MAP 1, MAP 2, or BCN, make sure that all personnel are clear of the antenna radiation hazard area. Avoid directing the energy beam toward inhabited structures, personnel groupings, or areas where aircraft are being refueled/defueled.

CAUTION

Operation of the radar system and the No. 3 Hydraulic System pumps and/or the winch system simultaneously, from an external power unit, may damage the radar system due to power surges. Coordinate with the flight engineer and loadmaster prior to checking operation of the radar.

9. SKE Bite Test - AS REQUIRED
10. FMS GPS Keys - AS REQUIRED

NOTE

GPS receiver crypto variables may be loaded with aircraft power on or off. Detailed procedures will be found in Section I.

* 11. MSU 1/MSU 2 - STBY

*12. FMS - PROGRAMMED/CHECKED

NOTE

Detailed procedures will be found in Section I.

a. Pilot's MFCDU displays 1 in upper left corner.

NOTE

Normally, NP1 is the master navigation processor (1 in inverse video). NP 2 may be selected as the master during normal operation.

b. Copilot's and Navigator's MFCDUs display 2 in upper left corner.

The 2 will be in inverse video if NP 2 is master.

c. MFCDU POWER UP PAGE - CHECK/SET

Verify that the pilot's DAMU displays the TAC 1, VOR 1, and VHF 1 tuned channel 1 frequency. Verify that the copilot's DAMU displays the TAC 2, VOR 2, and VHF 2 tuned channel 1 frequency.

NOTE

- **MSTR AV ON** changes to **MSTR AV ON** when power is supplied to VHF 1, VHF 2, TAC 1, TAC 2, VOR 1, and VOR 2.
- If the Nav Database is about to expire, load a new Nav Database after aligning the INSs.
- After the INU completes alignment mode 8, ALIGN changes to ALIGN. No further present position entries will be accepted by the INUs unless power is removed and then restored.

d. Present Position - ENTERED

WARNING

Present position must be accurate within 0.5 nautical mile of true position. Present position loaded by one crewmember will be verified by both pilots to minimize the possibility of operator error.

NOTE

- Compare GPS and Reference Position with surveyed coordinates to determine the best alignment coordinates.
- After the INU completes alignment mode 8, a minimum of 51 seconds, ALIGN changes to ALIGN. No further present position entries will be accepted by the INUs unless power is removed and then restored.
- If incorrect present position data is inserted, set mode selector to STBY and then back to ALIGN and reinsert correct present position.

e. MSU 1 and MSU 2 - ALIGN

f. SOLN - CHECKED/SET

g. Route - ENTERED

NOTE

- A route may be entered manually or, if loaded, retrieved as a stored route.
- If a new mission database was loaded in step c, all previously stored routes have been erased.
- To retrieve a stored route, enter the route identifier and upselect by pressing 2L.
- If the identifier is not found in the database, the scratch pad will display NOT IN DATA BASE
- If the identifier is improperly entered, the scratch pad will display INVALID ENTRY

(1) ACTIVATE Route - PRESSED (6R)

(2) EXEC Key - PRESSED

Verify that the RTE page TITLE changes to ACT RTE.

h. PERF INIT - ENTERED

i. LZ INIT pages 1/2 and 2/2 - AS REQUIRED

j. MISSION DATA page - ENTERED (N)

(1) NAVs MFCDU

(a) MAIN MENU key - PRESSED

(b) NEXT Key - PRESSED

(2) CUSTOM DATA page - 2R PRESSED

(a) Mission ident (five characters) - ENTERED AND UPSELECTED BY PRESSING 1L

(b) On Mission ident CUSTOM DATA page:
ENTER POINT OF IMPACT LAT/LONG - UPSELECTED BY PRESSING 2L
ENTER ELEVATION OF POINT OF IMPACT - UPSELECTED BY PRESSING 3L

k. NAVs MFCDU - MSN key - PRESSED

l. MISSION page - SET/CHECKED

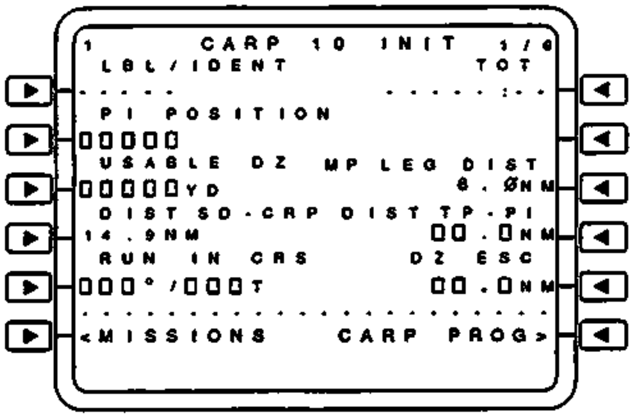
CAUTION

Mission data must be entered/loaded after the complete route of flight has been entered. Mission data entered prior to route completion could possibly result in an erroneous defined IP computation.

(1) ROUTE 1/2 - SELECT ROUTE

(2) CARP INIT - NUMBER ENTERED AND UPSELECTED BY PRESSING 2L

m. On CARP (*) INIT page 1/6:



D3193902 C

NOTE

* Indicates selected CARP 1 through 10.

(1) MISSION IDENT - ENTERED AND UPSELECTED BY PRESSING 1L

(2) PI POSITION - VERIFIED

(3) USABLE DZ (in yards) - ENTERED AND UPSELECTED BY PRESSING 3L

(4) DISTANCE SLOWDOWN TO CARP (in NM) - ENTERED AND UPSELECTED BY PRESSING 4L

NOTE

If the default slowdown distance is overwritten, the NP will use the entered value. If the default slowdown distance is used, the NP will calculate the slowdown on the leg inbound to the IP.

(5) RUN IN COURSE (in MAG, TRUE, or GRID) - ENTERED AND UPSELECTED BY PRESSING 5L

(6) Time Over Target - ENTERED AND UPSELECTED BY PRESSING 1R

(6A)Enter or verify MP LEG DIST (3R)

(7) DIST TP-PI - ENTERED AND UPSELECTED BY PRESSING 4R

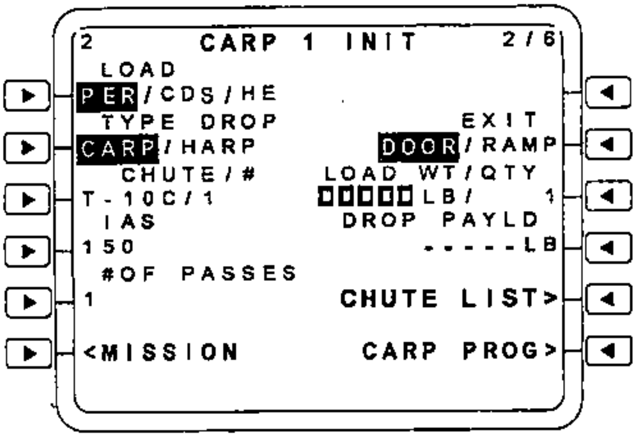
NOTE

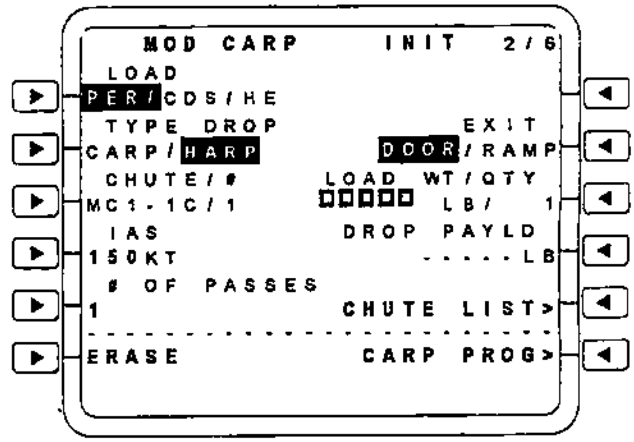
The TP-PI distance is the point where the CDI transitions to NPA (airdrop) mode. At the TP the sensitivity of the CDI changes to 0.15 NM (300 yards) per dot. At the DZ ESCAPE the CDI transitions from NPA to Enroute mode.

(8) DZ ESCAPE (distance in NM) - ENTERED AND UPSELECTED BY PRESSING 5R

n. NEXT key - PRESSED

o. ON CARP (*) INIT page 2/6





(1) Payload type - SELECTED BY PRESSING 1L

(2) Type of drop - SELECTED BY PRESSING 2L

(3) Branch to CHUTE LIST - 5R PRESSED

(a) Select chute type - DOWNSELECT TO SCRATCH PAD BY PRESSING ADJACENT LSK

(b) Branch back to CARP INIT 2/6 - PRESS 6L

NOTE

If a chute is transferred from AFMSS/PFPS via the DTM, all permanent chutes resident on the chute list will be over written. Only the transferred chutes will be displayed and selectable on the chute list.

(4) Chute Identifier - ENTERED AND UPSELECTED BY PRESSING 3L

(5) Verify drop indicated airspeed (IAS) is displayed (4L).

(6) Verify number of passes (5L).

(7) Load fuselage station (CDS ONLY) - ENTERED AND UPSELECTED BY PRESSING 1R

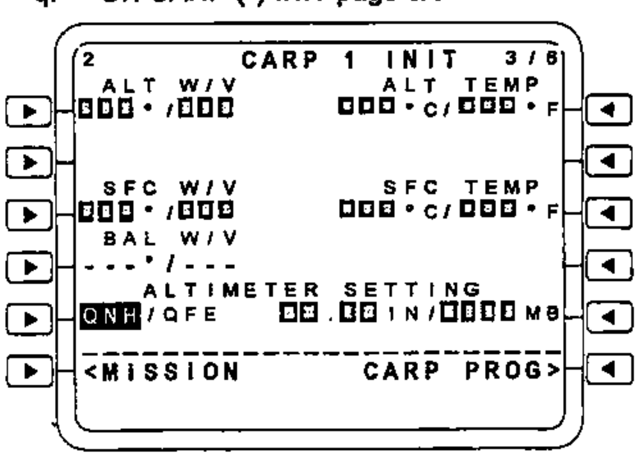
(8) Load EXIT - SELECTED BY PRESSING 2R

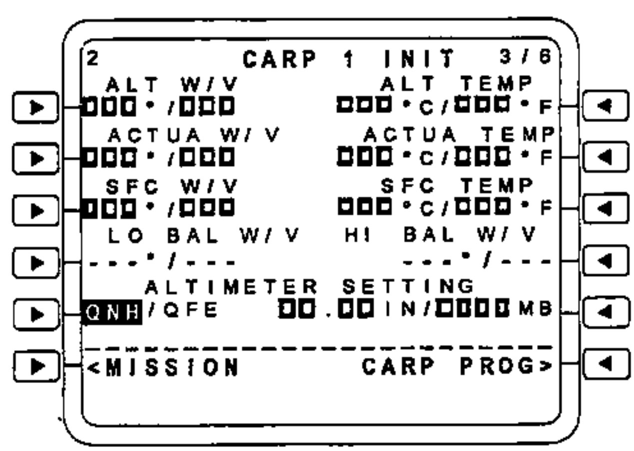
(9) Load WEIGHT/QUANTITY - ENTERED AND UPSELECTED BY PRESSING 3R

(10) Verify Drop Pay Load Weight is displayed (4R).

p. NEXT Key - PRESSED

q. ON CARP (*) INIT page 3/6





(1) Drop Altitude Wind Direction/Speed - ENTERED AND UPSELECTED BY PRESSING 1L

(2) Surface Wind Direction/Speed - ENTERED AND UPSELECTED BY PRESSING 3L

(3) Verify Ballistic Wind Bearing/Speed is displayed (4L).

NOTE

Entry of an ALT W/V and SFC W/V results in a BAL W/V derived from a 50 – 50 average of the entered winds. The NP will re-compute the CARP using the entered SFC W/V and the actual W/V on the run-in to the DZ. If a BAL W/V is manually entered on CARP INIT 3/6, the CARP will be based solely on the entered value.

(4) Altimeter Setting Type - SELECTED BY PRESSING 5L

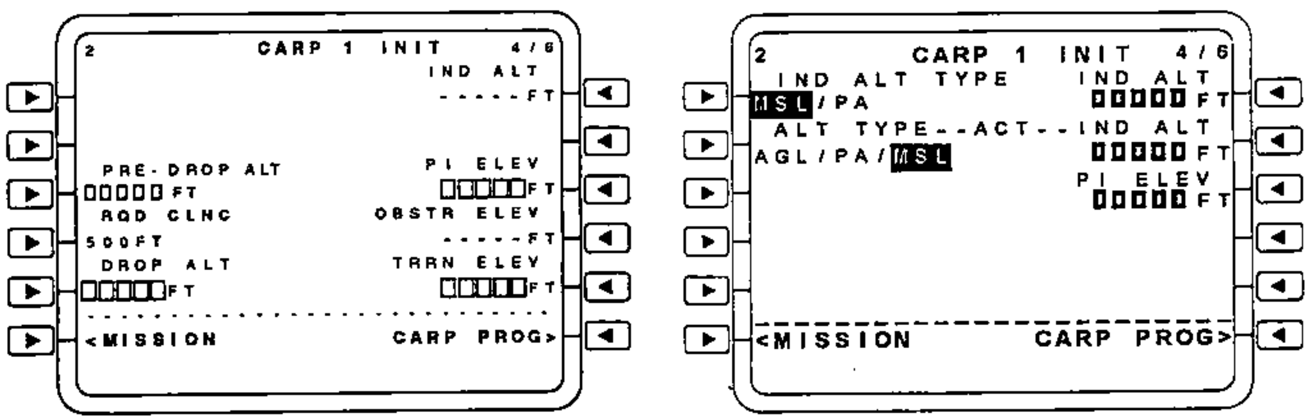
(5) Altitude Temperature - ENTERED AND UPSELECTED BY PRESSING 1R

(6) SFC Temperature - ENTERED AND UPSELECTED BY PRESSING 3R

(7) Altimeter Setting - ENTERED AND UPSELECTED BY PRESSING 5R

r. NEXT key - PRESSED

s. ON CARP (*) INIT page 4/6



D3194202 E

(1) PRE-DROP ALT - ENTERED AND UPSELECTED BY PRESSING 3L

(2) Enter or verify required clearance (4L)

(3) Drop Altitude (in feet AGL) - ENTERED AND UPSELECTED BY PRESSING 5L

(4) PI Elevation (in feet above MSL) - ENTERED AND UPSELECTED BY PRESSING 3R

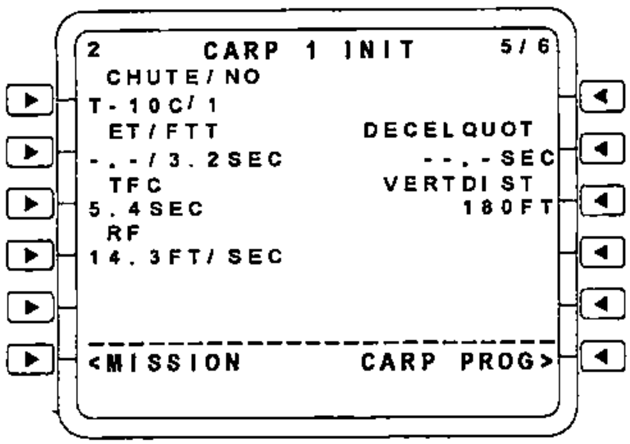
(5) Obstruction Elevation (in feet above MSL) - ENTERED AND UPSELECTED BY PRESSING 4R

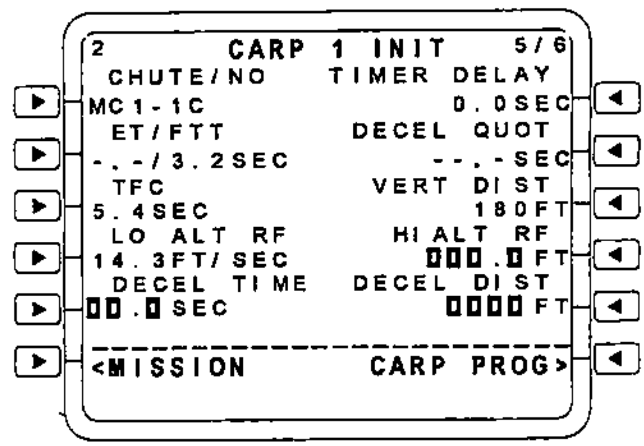
(6) Terrain Elevation (in feet above MSL) - ENTERED AND UPSELECTED BY PRESSING
5R

(7) Verify Indicated Altitude (for CARP only) (1R)

t. NEXT key - PRESSED

u. ON CARP (*) INIT page 5/6





(1) CARP INIT 5/6 is automatically filled out when a chute from the CHUTE LIST is selected. Verify the following:

(a) Parachute Identifier/ # of parachutes (1L)

(b) Exit Time/Forward Travel Time (2L)

(c) Time to Fall Constant (3L)

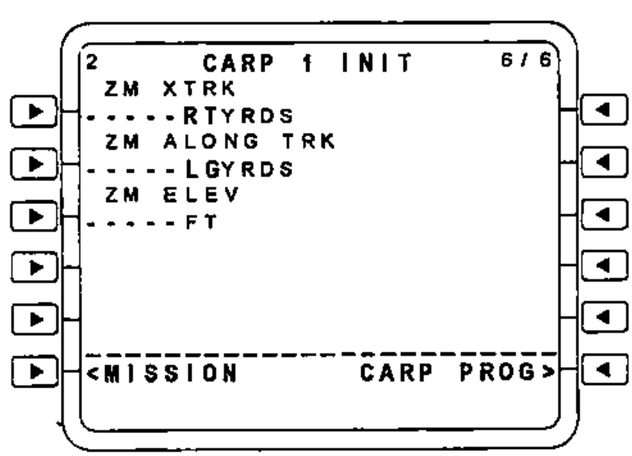
(d) Rate of Fall (4L)

(e) Deceleration Quotient (2R)

(f) Vertical Distance (3R)

v. NEXT key - PRESSED

w. ON CARP (*) INIT page 6/6



NOTE

Page 6/6 needs to be completed for SKE operations only.

(1) Zone marker cross track distance and direction - ENTERED AND UPSELECTED BY PRESSING 1L

(2) Zone marker along track distance and direction - ENTERED AND UPSELECTED BY PRESSING 2L

(3) Zone marker elevation - ENTERED AND UPSELECTED BY PRESSING 3L

x. CARP PROG - CHECK CARP DATA

y. EXEC Key - PRESSED

* 13. Defensive Systems - AS REQUIRED

If the defensive system is required, accomplish a preflight of the system, using the procedures outlined in Countermeasures Dispensing and Defensive Systems Preflight in Section II.

BEFORE STARTING ENGINES.

1. Interphone/Radios - MONITOR
2. Oxygen System - 100% AND ON

BEFORE TAXI.

1. Radar ANT STAB Switch - "ON" (CP, N)
2. Radar - "STBY" (CP, N)

NOTE

For SKE operations perform steps 3 through 7.

3. SKE OFF/STBY/XMIT Switch - STBY
4. SKE Frequency - SET
5. SKE Secondary Control Panel - SET

   a. OWN SLOT # - ENTER

   b. LEADER # - ENTER

   c. SLEN SLOTS - ENTER

   d. XTRK - ENTER

   e. ITRK - ENTER

   f. ALT # - ENTER

   g. ALL/SLEN - AS REQUIRED

   h. PROX WARN Range - SET

6. SKE OFF/STBY/XMIT Switch - XMIT
7. SKE Master/Follower Switch - SET
8. Seat Belt and Shoulder Harness - FASTENED

BEFORE TAKE-OFF.

1. Altimeters - "STATE SETTING AND READING" (CP, P, N, E)
2. BDHI - CHECKED
   a. Check that compass card rotates.
   b. Compare INS/AHRS heading, while pilots are accomplishing flight instrument checks.
3. FMS - "SET FOR DEPARTURE" (CP, P, N)
   a. Data - INSERTED/CHECKED
   b. Waypoint Selection - COORDINATED
4. Radios, Radar and Radar Altimeter - "SET" (CP, P, N)

NOTE

Item 4 may be accomplished prior to this time. Ensure the radar antenna pattern for personnel and fuel ignition area is clear prior to accomplishing item 4.

5. Indicator/Arm Control - "ARMED" (N/S)
6. Remote Dispense Control Switch - "ENABLED" (N/S)
7. CMDS CDU Mode Control Knob - "MAN" (N/S)

GO light illuminates indicating the system is operating normally.

8. Defensive Systems Armed - "ACKNOWLEDGED" (CP, P, N, S, LM)

NOTE

After take-off and prior to entering the threat envelope, set the Auto Dispense Control switch to "AUTO" if automatic dispensing of countermeasures is required.

AFTER TAKE-OFF, CLIMB.

1. Departure and Climb - MONITOR

CRUISE.

1. Altimeters - "STATE SETTING" (CP, P, N, E)
2. Radar - "AS REQUIRED" (P, N)

DESCENT.

1. Altimeters - "STATE SETTING" (CP, P, N, E)
2. Radar - "AS REQUIRED" (P, N)
3. Descent Route/Altitudes - MONITOR

APPROACH.

1. Seat Belt and Shoulder Harness - FASTENED
* 2. Radios/Radar - "SET" (CP, P, N)

Confirm proper nav selection.

* 3. Altimeters - "STATE SETTING" (CP, P, N, E)
4. Approach Route/Altitudes - MONITOR

AFTER LANDING.

1. Radar - "AS REQUIRED" (CP, N)

Unless another take-off is required prior to engine shutdown, the radar will be turned OFF.

NOTE

If countermeasures were loaded on the aircraft, accomplish steps 2 through 7.

2. CMDS CDU Mode Control Knob - "OFF" (N/S)
3. Indicator/Arm Control - "SAFE" (N/S)
4. Remote Dispense Switch - "DISABLE" (N/S)
5. Flare Quantity - "CHECKED" (N/S)

NOTE

Record the number of remaining flares in the aircraft forms.

WARNING

- If any flares have been dispensed or the flare counters indicate less than before take-off, accomplish the following: After exiting the runway, the engineer will acomplish flight engineer items 4 through 11. The aircraft will be stopped and the scanner deplaned to inspect all countermeasure dispensers for hung munitions. A hung flare is one that has penetrated or is protruding from the magazine. If an end cap is missing on an unexpended cartridge and the cartridge is protruding, clear area and call EOD. Failure to comply may damage aircraft and injure personnel.
- The scanner will not be deplaned until the defensive system has been reported SAFE in this checklist. If practical, notify the controlling command and control to have ground personnel remain clear of the aircraft until the defensive system is reported SAFE.

6. Defensive Systems Safe - "ACKNOWLEDGED" (CP, P, N, S, LM)
7. SKE OFF/STBY/XMIT Switch - AS REQUIRED

Do not turn to STBY or OFF until last aircraft has landed.

CAUTION

SKE OFF/STBY/XMIT Switch must be OFF prior to power transfers for all aircraft modified with Station Keeping Equipment (SKE) (TCTO 520).

BEFORE LEAVING AIRCRAFT.

1. Oxygen System - 100% AND OFF/MASK COVERED
2. NAV Accuracy - AS REQUIRED
3. GPS Zeroized - "AS REQUIRED" (CP, P, N)
4. Lights - OFF

INS MODE UPDATES.

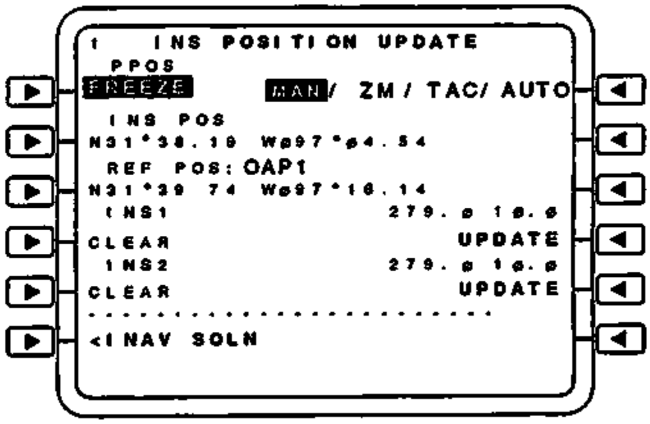
NOTE

INS MODE update refers to the process that occurs to INS data within the FMS Nav Processors. The CIV INS itself, once placed in the NAV mode, cannot be updated while airborne.

1. On MFCDU SOLN key - PRESSED
   a. INS 1 and INS 2 - SELECTED
   b. Select UPDATE - PRESSED (6R)
2. MANUAL UPDATE
   a. On INS POSITION UPDATE page:
      (1) Select MAN - 1R TOGGLED AS REQUIRED
      (2) INS POS - CHECKED (2L)
      (3) Enter REF POS identifier - UPSELECTED (3L) PRESSED
      (4) Select FREEZE - PRESSED (1L)
      (5) Direction and Distance for INS 1 update (offset) - CHECKED
      (6) UPDATE INS 1 - PRESSED (4R)
      (7) Direction and Distance for INS 2 update (offset) - CHECKED
      (8) UPDATE INS 2 - PRESSED (5R)

NOTE

Upon INS update, UPDATE changes to small font, inversely the corresponding CLEAR changes to large font.



D3186902 B

3. ZM UPDATE (SKE equipped aircraft)

NOTE

- ZM update is allowed only when flying a CARP and the TP has been sequenced.
- ZM reception is indicated by a flashing mix annunciator on each MFCDU.
- Once armed and activated, the ZM update will MIX until the CARP is exited or deselected.

a. On INS POSITION UPDATE page:

(1) Select ZM 1R TOGGLED AS REQUIRED

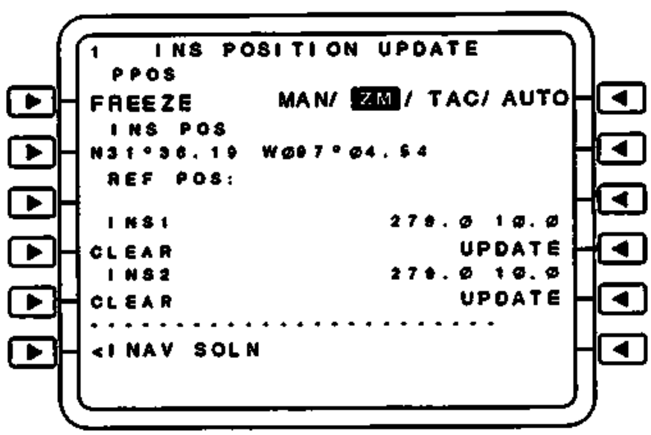
(2) INS POS - CHECKED (2L)

(3) Direction and Distance for INS 1 update (offset) - CHECKED

(4) UPDATE INS 1 - PRESSED (4R)

(5) Direction and Distance for INS 2 update (offset) - CHECKED

(6) UPDATE INS 2 - PRESSED (5R)



D3186903 C

4. TACAN UPDATE

NOTE

- The INSs may be updated using one or two TACANs. However, two TACAN updates are more accurate.
- Before performing a TACAN update, the station IDENT as well as the frequency must have been entered on the appropriate page.
- TACAN update is indicated by a steady MIX annunciator on each MFCDU.

a. On INS POSITION UPDATE page:

(1) Select TAC - 1R TOGGLED AS REQUIRED

(2) INS POS - CHECKED (2L)

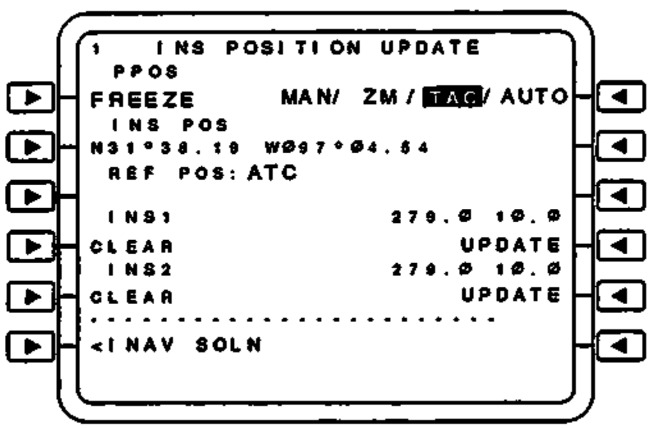
(3) REF POS Identifier - TACAN IDENTIFIERS CHECKED

(4) Bearing and DME for INS 1 update (offset) - CHECKED

(5) UPDATE INS 1 - PRESSED (4R)

(6) Bearing and DME for INS 2 update (offset) - CHECKED

(7) UPDATE INS 2 - PRESSED (5R)



D3186904 C

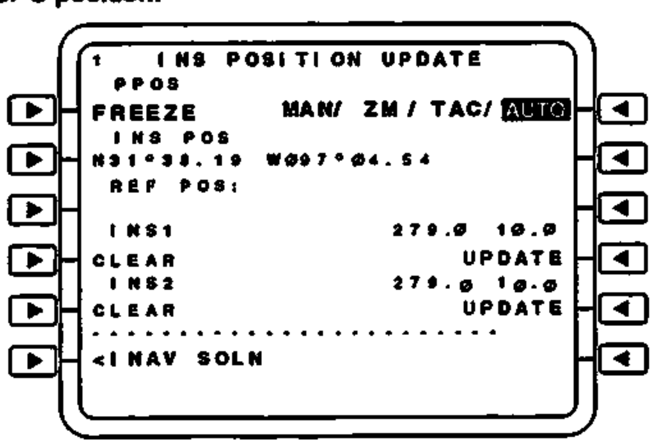
5. AUTO UPDATE

a. On the INS POSITION UPDATE page:

(1) Select AUTO - 1R TOGGLED AS REQUIRED

NOTE

- AUTO is the default selection.
- When AUTO is selected, the INS position will automatically be updated with the selected KNS or GPS position.



D3186901 E

GRID CHECKLIST.

WARNING

When NO NAV is displayed, the NP GRID function is inoperative. If the annunciation is a result of a power transient, reset the MASTER CAUTION, reselect NAV source, and reenter the GRID FACTOR to restore operation.

The purpose of these checks is to provide the navigator with procedures (in proper sequence) which will permit use of the INS/AHRS while using USAF Grid Navigation procedures.

NOTE

When a magnetic bearing entry is attempted and the current PBD or PBPB WAYPOINT is in a polar region (FP WAYPOINT LATITUDE is greater than 72.0 N or less than 59.0 S) that MFCDU will annunciate a "BEARING MUST BE IN TRUE" message. Ensure that the aircraft position is less than 72.0 N or greater than 59.0 S before switching from grid to mag.

GRID ENTRY ENROUTE (AHRS - INOPERATIVE).

1. Grid Heading - COMPUTED
2. Convergence Factor - INSERTED
   a. MFCDU MAIN MENU key - PRESSED
   b. SYS CONTROL - 2L PRESSED
   c. GRID FACTOR - ENTERED

NOTE

Ensure the autopilot is not coupled in LNAV mode prior to selecting grid.

3. Convergence Angle - SET

NOTE

The Convergence Angle is the Convergence Angle for the NAV aid (TACAN/VOR) to be flown with INS 1/2 HDG selected.

   a. MFCDU SOLN key - PRESSED
   b. NEXT key - PRESSED
   c. INS 1 - 3L PRESSED

Enter Convergence Angle into the scratch pad.

   d. MAG VAR - UPSELECTED (5L)

Verify Convergence Angle after 7-8 Seconds.

   e. INS 2 - 6L PRESSED

Enter Convergence Angle into the scratch pad.

   f. MAG VAR - UPSELECTED (5L)

Verify Convergence Angle after 7-8 seconds.

4. Pilot's DAMU
   a. NAV SELECT menu
      (1) NAV PTR 1 - FMS1
      (2) ATT - INS 1
      (3) HDG - INS1

b. PFD menu

(1) HDG - MAG - GRID

Verify grid heading displayed on pilot's PFD/SFD cross-checks with navigators computed grid heading.

Verify pilot's MFCDU displays grid courses on LEGS page.

5. Copilot's DAMU

a. NAV SELECT menu

(1) NAV PTR 1 - FMS 2

(2) ATT - INS 2

(3) HDG - INS 2

b. PFD menu

(1) HDG - MAG - GRID

Verify grid heading displayed on copilot's PFD/SFD cross-checks with navigators computed grid heading.

Verify copilot's MFCDU displays grid courses on LEGS page.

6. Heading - CROSS CHECKED

GRID EXIT ENROUTE.

1. Pilot's DAMU

   a. NAV SELECT menu

      (1) NAV PTR 1 - AS REQUIRED

      (2) ATT - INS 1

      (3) HDG - INS 1

   b. PFD menu

      (1) HDG - MAG - GRID - TRUE

2. Copilot's DAMU

   a. NAV SELECT

      (1) NAV PTR 1 - AS REQUIRED

      (2) ATT - INS 2

      (3) HDG - INS 2

   b. PFD menu

      (1) HDG - MAG - GRID - TRUE

3. AHRS Controller - SLV MODE

4. AHRS Controller - SET LOCAL LATITUDE

5. AHRS Controller - CHECK SYNCHRONIZED

6. AHRS Controller - CHECK MAG VAR SWITCH

7. Heading - CROSS CHECKED

POLAR GRID CHECKLIST.

When USAF Polar Grid Procedures are used for takeoff and/or landing, replace the applicable normal checklists with the following:

BEFORE TAKE-OFF (POLAR AREAS).

1. Altimeters - "STATE SETTING AND READING" (CP, P, N, E)

2. BDHI - CHECKED

3. FMS - "SET FOR DEPARTURE" (CP, P, N)

4. Convergence Factor - INSERTED

   a. MFCDU MAIN MENU key - PRESSED

b. SYS CONTROL - 2L PRESSED

c. GRID FACTOR - ENTERED

5. Pilot's DAMU

a. NAV SELECT menu

(1) NAV PTR 1 - FMS 1

(2) ATT - INS 1

(3) HDG - AHRS

b. PFD menu

(1) HDG - MAG - GRID - TRUE

6. Copilot's DAMU menu

a. NAV SELECT menu

(1) NAV PTR 1 - FMS 2

(2) ATT - INS 2

(3) HDG - AHRS

b. PFD menu

(1) HDG - MAG - GRID - TRUE

7. AHRS Controller - DG MODE
8. AHRS Controller - SET LOCAL LATITUDE
9. AHRS HDG/SYNC KNOB - SLEW COPILOT'S BDHI TO GRID HEADING
10. Heading - CROSS CHECKED

NOTE

Upon taking the active runway, advise the pilot to visually align the aircraft with the runway heading and come to a complete stop. Complete the lineup checklist.

11. Radios, Radar, and Radar Altimeter - "SET" (CP, P, N, E)

LINEUP (POLAR AREAS).

1. Copilot's DAMU

a. NAV SELECT menu

(1) HDG - AHRS

2. Pilot's DAMU

a. NAV SELECT menu

(1) HDG - AHRS

3. AHRS HDG/SYNC Knob - SLEW COPILOT'S BDHI TO RUNWAY POLAR GRID HEADING

AFTER TAKE-OFF, CLIMB (POLAR AREAS).

1. Departure and Climb - MONITOR

CRUISE (POLAR AREAS).

1. Altimeters - "STATE SETTING" (CP, P, N, E)
2. Radar - "AS REQUIRED" (P, N)

DESCENT (POLAR AREAS).

1. Altimeters - "STATE SETTING" (CP, P, N, E)
2. Radar - "AS REQUIRED" (P, N)
3. Descent Route/Altitudes - MONITOR

APPROACH (POLAR AREAS).

1. Seat Belt and Shoulder Harness - FASTENED
2. Radar - "AS REQUIRED" (P, N)
3. Altimeters - "STATE SETTING" (CP, P, N, E)
4. Pilot's DAMU
   a. NAV SELECT menu
      (1) HDG - AHRS
5. Copilot's DAMU
   a. NAV SELECT menu
      (1) HDG - AHRS
6. Approach Route/Altitudes - MONITOR

APPROACH (POLAR AREAS - AHRS INOPERATIVE)

1. Seat Belt and Shoulder Harness - FASTENED
2. Radar - "AS REQUIRED" (P, N)
3. Altimeters - "STATE SETTING" (CP, P, N, E)
4. Pilot's DAMU
   a. NAV SELECT menu
      (1) HDG - INS 1
5. Copilot's DAMU
   a. NAV SELECT menu
      (1) HDG - INS 2
6. Approach Route Altitudes - MONITOR

SCANNER.

The scanner will be designated by the Major Command and may be used to relieve the flight engineer during periods of prolonged flight. Normally, the scanner will occupy a seat on the flight deck during take-off or landing. If in the cargo compartment during take-off or landing, the scanner will occupy a seat with seat belt fastened and be on interphone. If a navigator is occupying the navigator's station, scanner checklist items pertaining to the navigator station need not be performed. Maintain periodic observations of the wings, engines, and control surfaces throughout flight. Assist the loadmaster to ensure that troops, cargo and equipment are secure prior to take-off and landing. Perform a brief exterior inspection during an engine running crew change prior to assuming scanner duties.

NORMAL PROCEDURES.

The scanner is responsible for the following in addition to duties outlined in Sections II and III:

1. Assist the flight engineer in a complete visual inspection prior to starting engines.

2. Perform exterior duties during engine starts, clearing engines, removing chocks, landing gear pins, and external power when directed by the pilot/flight engineer.

3. Observe aircraft and engines for evidence of fuel leaks or malfunctions before take-off and during climb. Report observations to the pilot or flight engineer.

4. Perform defensive system checkout and operation as required in the absence of a navigator.

5. Perform exterior duties during securing of the aircraft.

6. Perform other duties as directed by the pilot. While occupying the jump seat, monitor terrain clearance, current altimeter, assigned altitude, minimum altitudes, etc.

LOADMASTER.

The loadmaster is responsible for the proper knowledge and use of all loading and tiedown equipment, the ability to use the weight and balance manual, and must be thoroughly versed in the unit load capabilities of the cargo floor.

NOTE

For other than flight procedures, refer to TO 1C-141B-9.

NORMAL PROCEDURES.

NOTE

- The initial preflight inspection shall be accomplished prior to departure from home station. Those items identified by an asterisk shall be inspected prior to flight after a crew change or enroute crew rest (thru-flight). During intermediate stops when no crew change occurs, the thru-flight inspection is not required. Prior to any flight, loadmasters will perform a functional inspection of equipment where maintenance has been performed to include proper installation, serviceability, and operation. Perform appropriate aircraft preparation checklist for configuration changes.
- For airdrop operations, asterisk items will be inspected prior to flight after a prolonged stopover (crew rest). Exception: If an actual drop was not accomplished, i.e., no drop, or if multiple lifts are accomplished during the same crew duty day.

EXTERNAL POWER CONNECT/ELECTRICAL POWER-OFF.

NOTE

If external power is already applied to the aircraft, proceed to the Initial Preflight checklist.

Flight Deck.

1. Aircraft Forms - CHECKED

Prior to applying external power, review aircraft forms to be sure no conditions exist which would prohibit application of power.

2. Landing Gear Lever - DOWN

3. CDS Brightness Control Switches (PILOT & COPILOT) - OFF

4. Flap Lever - CHECKED

NOTE

The flap lever should be set to agree with flap position.

5. Spoiler Lever - CLOSED

6. Fuel and Start Ignition Switches - STOP

7. INS Mode Select No. 1 & 2 - OFF

8. FMS PWR Switches - OFF

9. Radar - OFF

10. External Power Circuit Breakers - CLOSED

Ensure the External Power Circuit Breakers on the A/C Power Distribution Center circuit breaker panel are closed (lower two circuit breaker rows behind and above lower crew bunk).

11. Hydraulic System No. 3 Pump Switches - OFF

12. Power Selector Switch - OFF

13. Bus Tie Switches - NORMAL

14. Bus Power Disconnect Switches - NORMAL

15. Fuel Panel - SET

    a. Boost Pump Switches (20) - OFF

    b. Line Drain Switch - OFF

    c. Jettison Switches (2) - OFF

Cargo Compartment.

16. Ground Safety Bypass Switch - SAFE

17. EMI Safety Pins - INSTALLED

18. Hydraulic System No. 3 Quantity - CHECKED

The hydraulic fluid is adequate for cargo door operation if fluid level is visible at any point on the reservoir sight gage.

19. Hydraulic Interconnect - CLOSED

Exterior.

20. Chocks and Landing Gear Pins - INSTALLED

21. Fire Extinguisher - IN PLACE

Ensure fire extinguisher is available and located near the nose of the aircraft.

22. External Power Unit - POSITIONED

Position the external power unit a full cable length from the aircraft. Maintain a 50-foot minimum distance between the power unit, fuel source, aircraft fueling points, and/or vents.

NOTE

- Fuel vents are located on the underside of the wings outboard of the No. 1 and 4 engines just forward of the fuel jettison masts.
- The external power unit must be capable of supplying 200/115 volts, 3-phase, 400 Hz power with a minimum capacity of 50 KVA. Phase rotation is A-B-C.

23. External Power Unit - CHECKED/CONNECTED TO AIRCRAFT/STARTED

Follow external power unit operating instructions. Start power unit and ensure proper voltage and frequency indication.

24. Aircraft Exterior - CLEAR

Ensure personnel/equipment on or around flight control surfaces will not interfere when applying power.

EXTERNAL POWER CONNECT/ELECTRICAL POWER-ON.

Flight Deck.

1. Ready Light - CHECKED

Observe that the READY light is on.

2. AC Volts & Freq Select Switch - EXT POWER

Rotate AC VOLTS & FREQ SELECT switch to EXT PWR, observe Frequency meter indicates 400 ±6 CPS (caution areas 380-394 and 406-420) and the AC voltage meter indicates 115 ±5 AC volts when the PHASE SELECT switch is rotated to A, B, and C positions.

CAUTION

If AC voltage is under 110 or over 120 volts, do not position the power select switch to EXT.

3. Power Selector Switch - EXT

CAUTION

The loadmaster(s) will remain within an area where they can monitor the ground power unit at all times if the flight engineer/scanner or maintenance personnel are not present.

NOTE

Should the No. 3 Pump activate when power is applied, check the following:

- LEFT AILERON & RIGHT AILERON Power Control Switches (4) - NORMAL
- ELEVATOR Power Control Switches (2) - NORM
- Flight Engineer's No. 4 Circuit Breaker Panel rows 36R and 45R - CLOSED

4. Leading Edge/Navigation Lights - ON/AS REQUIRED

Turn on leading edge and navigation lights during periods of darkness.

5. Radio - ON AND CHECKED

Perform UHF/VHF radio checks and leave radio tuned to tower/ground control frequency.

6. External Power Connect Check - COMPLETED

EXTERNAL POWER DISCONNECT.

Flight Deck.

1. Radios - OFF

2. Battery Switch - ON

3. Power Selector Switch - OFF

4. Emer Exit Light Switch - EXTING

Located on pilot's aft overhead control panel. This is a momentary position.

5. Battery Switch - OFF

Exterior.

6. External Power Unit - SHUTDOWN/DISCONNECTED

Follow external power unit shutdown procedures. Disconnect power unit cable. Close and secure the access door.

7. External Power Disconnect Check - COMPLETED

INITIAL PREFLIGHT.

Exterior Inspection.

* 1. Aircraft Location - CHECKED

Aircraft parked in a designated hazardous cargo loading area. Check airfield parking restrictions when transporting Class 1 Explosives (Division 1.1, 1.2, or 1.3), nuclear weapons, and toxic chemical ammunition.

* 2. Aircraft Electrically Grounded - CHECKED

* 3. Main Gear Wheel Chocks - IN PLACE

4. Stabilizer Struts - CHECKED

CAUTION

Improperly serviced cargo loading stabilizer struts may retract under load. If any indication of fluid leakage is noted on the struts, they should be re-serviced in accordance with the appropriate TO prior to loading or off-loading cargo.

NOTE

The stabilizer struts shall be extended during all cargo loading and off-loading operations from the aircraft ramp except for single pallets or single units of cargo 2,500 pounds or less.

Interior Inspection.

Flight Deck.

* 5. Aircraft Forms - CHECKED

Check Aircraft Forms for status of the aircraft.

* 6. Interphone and Public Address System - ON

Check interphone power switch ON and speaker selector switch to ALL.

* 7. No. 3 Hydraulic System Switches - AS REQUIRED

Position both switches to ramp control if cargo doors are to be operated.

* 8. Door Arming/Pilot's PA Switch - AS REQUIRED

Position door arming switch to ON if cargo doors are to be operated. Set pilot's selector switch to INTERPHONE.

* 9. Personnel Warning Signs - AS REQUIRED

When installed, turn NO SMOKING, FASTEN SEATBELT and OXYGEN MASK switches ON. Check for proper operations and return to OFF position.

10. Guarded Cargo Compartment Dome Light Switch - OFF

Cargo Compartment.

Forward.

* 11. Crew Galley - CHECKED

Main power switch ON; check for operation, security and cleanliness of oven and hot cup. Check waste container and ice box for cleanliness.

* 12. Cargo Compartment Light Switch - ON

* 13. Cargo Compartment Dim/Bright Switch - DIM

Each light will be checked for proper operation. This may be accomplished while completing the preflight.

14. Winch - CHECKED

Ensure winch compartment contains no foreign objects. Check for security of mount and that the main power cable is connected.

Electrically operate the winch and align the oil level sight gage to the 5 o'clock position and ensure oil is visible. Check winch for electrical operation. Maintain cable tension at all times. Inspect condition of roller, cable, and hook. Cable hook and snatch block shall be equipped with operable spring clips.

* 15. Crew Lavatory Compartment - CHECKED

Turn lavatory Light ON. Check wash water tank for servicing and that the spigot line and overflow vent are connected. Ensure that spigot and drain are working properly, and that waste water tank is empty. Check toilet for proper operation and servicing. Ensure refuse container is empty. Check for cleanliness and supplies.

Left Side.

16. Interphone and Public Address System - CHECKED

Functionally test the interphone and public address system and set the volume at the desired level.

17. Cargo Compartment Vent - CHECKED

Check plug installed and nozzle stowed as required.

18. Whiffletree Snatch Blocks - CHECKED

Check for number (2), condition, and stowage.

19. Cargo Compartment Vent - CHECKED

Check plug installed or stowed as required.

* 20. EMI Safety Pins - INSTALLED

21. Center Aisle Stanchions - SECURED

When stanchions are stowed in overhead rack, ensure both ends are properly stowed.

22. Troop Door - CHECKED

Check door and door warning light for proper operation in the open and closed position.

23. Interphone and Public Address System - CHECKED

Functionally test the interphone and public address system and set the volume at the desired level.

24. Cargo Compartment Dome Light Switch - CHECKED

Check red/white dome lights. Set switch in WHITE position.

25. Ramp Loading Lights - CHECKED

26. Auxiliary Loading Ramp - CHECKED

Check for proper condition, inspection due date, and correct stowage.

Right Side.

27. Auxiliary Loading Ramp - CHECKED

Check for proper condition, inspection due date, and correct stowage.

28. Cargo Compartment Curtain - STOWED

29. Interphone and Public Address System - CHECKED

Functionally test the interphone and public address system, and set the volume at the desired level.

30. Troop Door - CHECKED

Check door and door warning light for proper operation in the open and closed position.

* 31. EMI Safety Pins - INSTALLED

32. Cargo Compartment Vent - CHECKED

Check plug installed and nozzle stowed as required.

* 33. Dimming Rheostats - DIM POSITION

* 34. Oxygen Manual Shutoff Valves - OPEN

Turn valves toward CLOSED position, to ensure freedom of movement, then back to OPEN. Ensure shutoff valve compartment is clean of any accumulation of hydraulic fluid, grease or dirt.

* 35. Troop Oxygen Regulator Panel - CHECKED

a. Troop Oxygen Quantity Indicators - CHECKED

b. Indicator Lights Bright/Dim Switch - BRIGHT

c. Oxygen Lights and Horn Test Switch - TEST

Oxygen ON and two LOX QTY Low lights will illuminate; warning horn will sound, and cargo compartment dome lights will come to full bright.

NOTE

Warning Horn will not be sounded on Air Evac/Passenger mission or when animals are on board.

d. Low Oxygen Quantity Light(s) - TEST

Push test button(s) and observe that LOX QTY light(s) illuminate(s) below 7.5 liters and extinguish(es) above 7.5 liters.

e. Therapeutic Oxygen Valve - CHECKED/SET

Valve will be opened for a period of sufficient duration to determine that distribution lines are pressure tight. This can be accomplished by listening for escaping pressure at the therapeutic oxygen panels or by observing continuing oxygen quantity loss. Close valve if system is not to be used.

CAUTION

Coordinate with the Medical Crew Director prior to setting the therapeutic oxygen supply valve.

f. Troop Oxygen Regulator - AS REQUIRED

Either No. 1 or No. 2 regulator will be turned ON for a period of sufficient duration to ensure that the centerline distribution lines are pressure tight. This procedure will be accomplished on preflight from home station or when center seat/litter stanchions are installed or removed.

* 36. Oxygen Masks/EPOS - INSTALLED AND CONNECTED/CHECKED

Ensure that an oxygen mask is installed and connected for each occupied seat or litter position. Masks may be left installed and connected when seat/litters are not occupied.

WARNING

Ensure oxygen lines and fittings are free of any grease, oil, or hydraulic fluid. Oxygen coming in contact with these substances may cause an explosion.

37. Restraint Rail End Bumpers - CHECKED

Check for quantity (2) and condition. If they are not required for desired configuration, ensure that they are properly stowed.

38. Cargo Compartment Vent - CHECKED

Check plug installed and nozzle stowed as required.

* 39. Forward EMI Safety Pin - INSTALLED

* 40. Ground Safety Bypass Switch - SAFE

* 41. Cargo Compartment Dim/Bright Switch - BRIGHT

GENERAL.

*42. Protective Clothing Kit - CHECKED/STOWED

*43. Crew Loft - CHECKED AND SECURED

*44. Life Support Equipment - CHECKED AND SECURED

Review AFTO Form 46 for mission number, configuration, and certifying official. Check for proper type and amount of life rafts, life vests, and parachutes to satisfy mission requirements.

*45. Fleet Service Equipment - CHECKED AND SECURED

Review AMC Form 12 for mission number, configuration, and certifying official. Check Fleet Service equipment aboard aircraft and ensure sufficient quantities are available to satisfy mission requirements.

*46. Tiedown Equipment - CHECKED AND SECURED

Review AF Form 4069 for mission number, configuration, and certifying official. Ensure sufficient quantities of tiedown chains, devices, and straps are available to satisfy mission requirements.

*47. Dash 21 Equipment - CHECKED AND INSTALLED/SECURED

Review AF Form 4076 for mission number, configuration, and certifying official. Ensure sufficient quantities of 10K and 25K tiedown fittings are available to satisfy mission requirements.

48. Cargo Compartment Floor - CLEARED

All loose equipment not required for the specific loading operation will be removed from the floor and stowed.

CAUTION

All tiedown fitting receptacles must be free of water, solvents, dirt, and other foreign matter. Water freezing in floor receptacles during flight when tiedown fittings are installed can cause damage to the receptacle or prevent later removal of the fitting. Frozen fittings must not be forced from the floor.

*49. Personal Oxygen Mask - CHECKED

Inspect the mask, face cup, hose, and connections for condition. Attach the mask to a fully serviced walk-around bottle, don the mask and check for proper fit and operation. Connect mask assembly to a headset and aircraft interphone system and check microphone for proper operation. Ensure clip is attached and strap is properly adjusted. Check inspection due date.

*50. Exterior and interior Inspection - COMPLETED

If ATGL (comfort pallet) or portable lavatory is not aboard, proceed to that portion of the checklist dealing with aircraft preparation for the type of mission. When comfort pallet or portable lavatory is aboard, complete the comfort pallet check or portable lavatory check, as appropriate, before proceeding.

AIR TRANSPORTABLE GALLEY/LAVATORY (ATGL) PREFLIGHT.

NOTE

Those items identified by an asterisk shall be inspected prior to flight, after a crew change, or enroute crew rest (thruflight).

* 1. ATGL Maintenance Status - CHECKED

Review AFTO Form 244/245.

* 2. Pallet - SECURED

Ensure right and left detents are engaged and locked, tiedown chain and restraint rail bumpers are installed and secure. Check that all four roller conveyors are up and locked. Ensure ATGL pallet J-Bolts are secured.

CAUTION

Accomplish a *hands-on* inspection of all pallet J-Bolts. If more than one is loose, they will be retorqued to 45 inch-pounds prior to flight. This restriction also applies to ATGLs transported as cargo. The ATGL will not be used if more than one bolt is damaged, missing, or cannot be retorqued or replaced. To facilitate movement of the ATGL to repair facilities, secure the ATGL with 5,000-pound tiedown straps. Do not use the tiedown rings attached to the lower edge of the ATGL.

* 3. Flush Line and Access Door - CAPPED, CLOSED, SECURED

* 4. Overhead Vent Line - INSTALLED

Ensure outboard 45° vent nozzle is facing aft.

* 5. Water Tank - SERVICED

Ensure filler cap is secured.

* 6. Aircraft Circuit Breakers - CLOSED

Circuit breakers are located on the Flight Engineers No. 1 circuit breaker panel, rows 8, 9, and 10.

* 7. ATGL No. 1 & 2 MAIN Circuit Breakers - CLOSED

Ensure No. 1 and 2 MAIN lights illuminate.

* 8. ATGL Circuit Breakers - CLOSED/AS REQUIRED

* 9. Water System - CHECKED

Ensure water system circuit breaker(s) is/are closed. Bleed air from water system by checking hot and cold water buttons on *both* coffee dispensers and depressing water faucet in *both* lavatories. Check for signs of leakage while completing remainder of checklist.

* 10. Refrigerators - CHECKED

Ensure cooling fan vents located above the catwalk are running and unobstructed. Initially set temperature control to 43° F. Adjust as required once initial temperature has been reached.

CAUTION

Refrigerator food racks will remain in the refrigerators at all times. Removal of racks to store large items may cause damage to the cooling/ventilation system. Always store meals with the racks installed.

11. Ovens - CHECKED

Inspect ovens for cleanliness and foreign objects. Set heat switches to 350° and oven timer to 5 minutes. Power and heater indicator lights will illuminate. Check heating and fan operation.

WARNING

Food trays and oven doors are extremely hot during operation. Gloves or other means of protection must be used to avoid serious burns.

12. Coffee Makers - CHECKED

Turn power switch to ON. Power light will illuminate.

NOTE

If the LOW WATER light is on, there is a no or low water condition in the brewer reservoir. Ensure water supply is connected to brewer. The heaters will not come on unless the reservoir is filled up to the tip of the low water sensor.

13. Equipment - CHECKED

Check all ATGL equipment for quantity and condition.

* 14. Galley Cleanliness - CHECKED

Inspect entire galley for cleanliness.

* 15. Trash Receptacles - EMPTIED, CLEANED, SECURED

Check security of rubber vibration pads/strips.

* 16. Lavatories - CHECKED AND SERVICED

Check lights, vent fans, door locks, water faucets, sink drains, and flushing mechanism for proper operation. Flush *both* toilets again and ensure the amber light on the right side of the ATGL remains illuminated. If amber light blinks, or is not illuminated, the system needs to be serviced with additional water/detergent. Activate the Emergency Call Button and ensure the emergency light above the lavatory door and emergency light on the circuit breaker panel illuminates.

NOTE

Lavatory door lock receptacle must be engaged to ops check electrical components in the lavatory. Insert pen or pencil into lock receptacle to engage microswitch.

* 17. Supplies - CHECKED and STOWED

Ensure lavatories and galley supplies are checked and stowed in applicable compartments.

* 18. Oxygen Generators/Masks - CHECKED

Ensure generator compartment window indicator is blue. Any other color indicates the oxygen generator is unusable. Check the seal and ensure it does not interfere with the mask door.

* 19. Catwalk Extensions - INSTALLED

20. ATGL Preflight - COMPLETED

PORTABLE LAVATORY.

* 1. Lavatory Maintenance Status - CHECKED

Review AFTO Form 244 located in a bag affixed to the inside of the lavatory vanity door.

2. Lavatory - SECURED

Ensure lavatory is secured to the aircraft floor utilizing existing aircraft floor fittings and appropriate items of hardware furnished in the pocket under the sink. When the unit is located between the seat tracks, the tiedown rings will be placed in the same locations as if cargo was being tied down (Yellow Dots).

CAUTION

Cargo straps or chains will not be placed on or around the lavatory. If the unit is properly secured to the aircraft floor, there is no requirement to add additional tiedown.

NOTE

The lavatory may be placed at any suitable location on the cargo floor (except ramp) that will provide free access and allow the door to fully open.

3. Electrical Power/Circuit Breaker - CHECKED/CLOSED

Check electrical cable and ensure it is properly connected to an appropriate outlet. Ensure circuit breaker is closed. If power is not obtained, check Flight Engineer's circuit breaker panel to ensure the applicable electrical circuit breakers are closed.

* 4. Lavatory Equipment - CHECKED

Check light, door lock and bowl flush for proper operation. Ensure water faucet and sink drain are operational. Ensure trash receptacle is empty and inspect area for cleanliness. Waste water tank will be empty and sink water tank will be full.

CAUTION

If lavatory is to remain inactive during cold weather (below freezing) the water supply line should be disconnected at water tank and hand pump cycled several times to discharge water from pump assembly. Empty waste and supply water tanks.

NOTE

- For extreme cold weather operation, charge toilet with 50/50 mixture of ethylene glycol and water.
- Check sight gauge to determine if the toilet needs servicing. Water should be at Charge Level (c) on the indicator lens.

* 5. Supplies - CHECKED

Ensure adequate toilet paper, soap, paper towels, and deodorant are in place.

* 6. Oxygen - CHECKED

Ensure that an oxygen mask is positioned inside the lavatory and that it is connected to an oxygen bottle. Check bottle pressure and security. Also check oxygen mask and inspection due date.

7. Portable Lavatory Check - COMPLETED

When portable lavatory check is complete, proceed to that portion of the checklist dealing with aircraft preparation for type of mission.

AIRCRAFT PREPARATION FOR PASSENGER/AIR EVAC LOADING/EMERGENCY AIRLIFT OF PERSONNEL.

1. Restraint Rails - UP AND SECURED

Hinged and removable restraint rails secured to their normal stowage positions as required.

2. Roller Conveyors - DOWN AND LOCKED
3. Seats and Safety Belts - AS REQUIRED

For Passenger/Air Evac Loading, check each seat and safety belt for condition/security. Seat belts will be extended. If aft facing seats are installed, check each seat for availability and cleanliness of metal food trays.

4. Litters - CHECKED

Check for proper installation of centerline and sidewall stanchions, litter clamps, straps, and restraint cables.

5. Tiedown Rings/Straps - AS REQUIRED

For Emergency Airlift ensure 10,000 or 25,000 pound capacity tiedown rings are installed in rows A and G from the crew entrance door to the aft end of the cargo ramp. Install tiedown rings at each 20-inch fuselage station. Position and install tiedown straps along the A row tiedown rings provided.

6. Oxygen Masks - POSITIONED AND INSTALLED

For Passenger/Air Evac loading ensure that an oxygen mask is available for each seat or litter position. Ensure mask hose is connected to an oxygen distribution outlet.

7. Life Preservers Positioned - AS REQUIRED

A life preserver will be positioned at each seat, if required.

8. Aircraft Preparation for Passenger/Air Evac Loading/Emergency Airlift of Personnel - COMPLETED

When aircraft preparation is complete, proceed to Prior To Loading General checklist.

AIRCRAFT PREPARATION FOR PALLETIZED/FLOOR LOADING CARGO.

1. Roller Conveyors - AS REQUIRED

For palletized cargo check all roller conveyors for condition and ensure they are properly installed. Conveyor sections with damaged or missing rollers will be replaced.

2. Restraint Rails - AS REQUIRED

For palletized cargo all restraint fittings will be installed. Check area for foreign objects and loose equipment such as control rod couplings, tiedown equipment, etc. Ensure that all rail fittings are removed from the face of the rail. For floor loading secure the hinged and removable restraint rails to their normal stowed position.

3. Restraint Rail End Bumpers - AS REQUIRED

When the number one rail sections are down, whether required for load restraint or not, the end bumpers will be installed. When the comfort pallet is positioned, the left bumper may be stowed if the crew entrance door ladder cannot be properly stowed.

4. Restraint Rail Detents - AS REQUIRED

For palletized loading check each mechanism for manual operation and ensure detent is retracted. For right rails, ensure detent and pawl are retracted and adjust control for maximum aft restraint.

CAUTION

Do not step on mechanisms.

Individual mechanism controls will be operated by hand only. If the detent or detent pawl of the right rail mechanism protrudes inboard of the rail face, locking mechanisms will be damaged during loading. Detent will not be used to prevent overtravel of pallets or platforms.

5. Retractable Lips - RETRACTED

For palletized loading check all lips for operation and availability of pip pins. Secure lips in retracted position.

6. Hinged Walkways - AS REQUIRED

Walkways will be extended and pinned when the restraint rails are in the down position. Extension will be accomplished prior to any loading. Exception: For cargo airdrop and when stacks of empty HCU-6/E Pallets are carried or if straps/chains/chain gates are required, the walkway extension may be in the down position where the tiedown is required.

7. Tiedown and Floor Fittings - AS REQUIRED

If tiedown requirements are known, repositioning of tiedown and fittings should be accomplished at this time.

8. Doors and Hatches - AS REQUIRED

WARNING

Sufficient doors and hatches will be opened to provide adequate ventilation for dispersion of fumes when loading self propelled vehicles.

9. Auxiliary Loading Ramps - AS REQUIRED

If auxiliary loading ramps are required for loading cargo, they will be prepositioned at this time.

10. Aircraft Preparation for Palletized/Floor Loading Cargo - COMPLETED

When aircraft preparation is complete, proceed to Prior To Loading General checklist.

PRIOR TO LOADING GENERAL.

1. Pressure Door Aux Latches, Cam Jacks, and Ramp Manual Safety Pins - REMOVED AND STOWED
2. Cargo Doors and Ramp - OPEN

Open pressure door and ramp. Open petal doors to the ground loading position.

CAUTION

Prior to opening ramp and doors, ensure opening area is free of all obstacles.

3. Stabilizer Struts - AS REQUIRED

NOTE

The stabilizer struts shall be extended during all cargo loading and off-loading operations from the aircraft ramp except for single pallets or single units of cargo weighing 2,500 pounds or less.

4. Manifest - CHECKED

Check manifest against personnel/cargo for correct amount(s) and weight. Note personnel or cargo requiring special handling. Hazardous materials must be checked for compatibility.

5. Special Loading Equipment - AS REQUIRED

6. Aircraft Brakes - AS REQUIRED

Set brakes prior to all on/off loadings that involve cargo winching operations. (Only qualified personnel will operate the aircraft brakes.)

LOADING.

Refer to TO 1C-141B-5, TO 1C-141B-9, TO 1C-141B-16, and TO 1C-141B-9CL-1 for loading instructions. Detailed information related to cargo handling and loading may be found in the publications listed under REFERENCES in TO 1C-141B-9.

AFTER LOADING GENERAL.

1. Cargo - CHECKED

Check for fumes, leaks, placement of cargo, and location of special handling cargo.

2. Load Restraint - CHECKED

Ensure all tiedown devices are secure. When restraint rails are used, ensure rails are secured to the floor at all attachment points, all required detents are engaged, and all required retractable lips are extended and pip pins installed. If sufficient detents cannot be engaged to provide restraint, additional tiedown will be used.

3. Auxiliary Loading Ramps - STOWED AND SECURED

4. Stabilizer Struts - RETRACTED AND STOWED

5. Cargo Doors and Ramp - CLOSED

CAUTION

Prior to closing ramp and doors, ensure closing area is free of all obstacles.

6. Fuel Load - CHECKED

Obtain total fuel load from flight engineer.

7. Weight and Balance - COMPUTED

Form 365-4 completed.

8. Manifest, Weight and Balance Manual and Custom Forms - ABOARD

9. Food and Beverages - CHECKED AND STOWED

10. Baggage - SECURED

11. Loose Equipment - STOWED

Ensure all equipment and supplies are secured for flight. Check crew rest facility for the presence and condition of the gunbox and portable oxygen bottles. Check the security of all equipment and supplies.

12. Personnel Seating - COMPLETED

Ensure all personnel are seated and secured.

13. Life Preservers Positioned - AS REQUIRED

Ensure the proper life preserver is positioned for each seat or litter.

14. Passenger Briefing - COMPLETED

Ensure all passengers and unqualified ACMs have been briefed. Notify aircraft commander when briefing is complete.

NOTE

If time does not permit completion of the briefing prior to APU/engine start, it will be delayed until all doors are closed.

15. Aircraft Commander - BRIEFED

Submit Form 365-4 to aircraft commander for signature. Brief aircraft command and flight engineer on total number of people in the cargo compartment. If airdrop of equipment is involved, brief aircraft commander on load weight and any special item (i.e., emergency jettison).

16. Loadmaster Coordination Briefing - AS REQUIRED

The primary loadmaster will coordinate ground and in-flight emergency duties with loadmaster counterpart(s), AECMs and ACMs.

17. Form 365-4 - SUBMITTED

Ensure that signed copy of Form 365-4 is submitted to responsible ground personnel.

BEFORE TAXI.

1. Stowaway Check - COMPLETED

Physically inspect all accessible interior areas, i.e., flight deck, crew rest facility, left forward underdeck area crew latrine to include the right forward underdeck area, comfort pallet latrines, main cargo compartment, aft cargo compartment upper deck area, and the cargo ramp area to ensure no unauthorized persons are aboard.

NOTE

This check may be completed prior to this point provided all loading is complete and all doors, with the exception of the crew entrance door, are closed and a crewmember maintains surveillance of the aircraft to prevent unauthorized entry.

2. Doors and Hatches - CLOSED AND LOCKED

3. Headset - DONNED

4. Loadmaster's Report - "READY TO TAXI,___PERSONNEL ON BOARD" (LM)

The loadmaster will confirm total number of personnel (passengers and crew) on board. This report also signifies to the aircraft commander that the stowaway check has been accomplished.

BEFORE TAKE-OFF.

1. Aircraft Sprayed - AS REQUIRED

Spray the flight deck, cargo compartment and other space accessible within the aircraft. Spraying will be accomplished after all personnel are onboard and all doors and hatches are closed.

NOTE

Accomplish items 2 and 3 if defensive systems are required immediately after take-off.

2. EMI Safety Pins - REMOVED (LM/S)

If defensive systems are to be armed, remove the safety pins.

3. Defensive Systems Armed - "ACKNOWLEDGED" (CP, P, N, S, LM)

4. Seat Belt - FASTENED

Loadmaster will visually check all passenger seat belts to ensure that they are properly fastened and adjusted. Aeromedical crewmembers performing duties on air evacuation missions are not required to use seat belts during ground operation except immediately prior to and during take-off. The loadmaster will advise the medical crew director immediately prior to take-off that seat belts are required. In unusual cases, patient care may require additional delay in aeromedical personnel fastening seat belts. These isolated cases will be coordinated between the aircraft commander, the loadmaster and medical crew director. The loadmaster will advise the medical crew director when seat belts may be removed after take-off (normally when the After Take-off, Climb checklist is accomplished). During cruise conditions, aeromedical personnel should observe the "FASTEN SEAT BELT" sign since it will be illuminated only during severe weather, emergencies or turbulent air penetrations.

5. Cabin Report - "SECURED" (LM/S)

This report signifies to the aircraft commander that personnel/cargo are secure, all doors and hatches are closed and locked, cargo compartment is secure for take-off, and that the loadmaster is seated with seat belt fastened.

AFTER TAKE-OFF, CLIMB.

1. Interphone Clearance - OBTAINED

Request permission from aircraft commander to go off interphone.

2. Cargo/Restraint - CHECKED

Check restraint and tiedowns for tension and security of attachment. Check for leakage and fumes.

CRUISE.

1. Passengers - BRIEFED

2. Passenger Comfort/Meal Service - AS REQUIRED

Offer beverages, food, etc., if available. Ensure complimentary snacks/beverages are not consumed by aircrews or ground support personnel.

3. Load Information - AS REQUIRED

Prepare off/through load information (special handling hazardous material, etc.) for aircraft commander.

4. Oxygen - CHECKED

Periodically check walk-around bottles and troop oxygen quantity.

5. Cargo - CHECKED

Check cargo periodically for leakage, fumes and other unusual conditions.

6. Customs, Immigrations, Agriculture, and Public Health Requirements - COMPLETED

Distribute required forms to crew. After completion assemble required forms for delivery to appropriate officials.

7. Load Planning - COMPLETED

Complete planning for off-load and, where applicable, on-load.

DESCENT.

1. Personnel - AWAKENED AND BRIEFED

Awake passengers in sufficient time prior to descending to allow them to use the restroom, etc. Ensure all personnel are seated, secured, and briefed. The loadmaster will visually check all passenger seat belts to ensure that they are properly fastened and adjusted. Aeromedical crewmembers performing duties on air evacuation missions are not required to use seat belts during descent and before landing except immediately prior to landing. The loadmaster will advise the medical crew director when seat belts must be on. In unusual cases, patient care may require additional delay in aeromedical personnel fastening seat belts. These isolated cases will be coordinated between the aircraft commander, loadmaster, and medical crew director.

2. Cargo/Restraint - CHECKED

Check restraints and tiedowns for tension and security of attachments. Check for leakage and fumes.

3. Loose Equipment - SECURED

4. Aircraft Forms - DISCREPANCIES ENTERED

5. Refuse - COLLECTED/STOWED

Place all refuse, etc., in suitable disposal containers.

6. Headset - DONNED

APPROACH.

1. Seat Belt - FASTENED

2. Cabin Report - "SECURED" (LM/S)

This report indicates that all passengers/troops are seated with seat belt fastened. Loadmasters will be seated with seat belt fastened upon completion of required duties and prior to landing.

AFTER LANDING/BEFORE LEAVING AIRCRAFT.

1. EMI Safety Pins - "AS REQUIRED" (LM/S)

2. Defensive Systems Safe - "ACKNOWLEDGED" (CP, P, N, S, LM)

3. Aircraft Location - CHECKED

Aircraft parked in a designated hazardous materials loading area as required. Check airfield parking restrictions when transporting Class 1 Explosives (Division 1.1, 1.2, or 1.3), nuclear weapons, and toxic chemical ammunition.

4. Required Customs, Immigration, Agricultural, and Health Clearance - OBTAINED

5. Personnel - OFF-LOADED

Ensure that departing personnel are accompanied off and away from the aircraft by a passenger agent or air crewmember.

6. Aircraft Electrically Grounded - CHECKED

7. Main Gear Wheels - CHOCKED

8. Stabilizer Struts - AS REQUIRED

9. Cargo Doors and Ramp - AS REQUIRED

10. Off-loading Crew Duties - ASSIGNED

11. Cargo Off-loaded - AS REQUIRED

12. Oxygen Mask/Bottle - STOWED

Oxygen mask and bottle will be returned to correct stowage location.

13. ATGL Postflight - AS REQUIRED

14. Inventory of Equipment - COMPLETED

15. External Power - AS REQUIRED

If external power is to be removed, refer to the External Power Disconnect checklist.

16. Aircraft - SECURED

ATGL POSTFLIGHT.

1. Winterization - AS REQUIRED

CAUTION

> The ATGL will be winterized anytime the aircraft remains overnight (crew rest) when the forecast temperature will be 0°C (32°F) or less. For enroute quick stops, the ATGL will be winterized if the cargo compartment temperature cannot be maintained above freezing (0°C/32°F). Severe damage to the ATGL will occur if it is not winterized for freezing conditions.

2. Forms - COMPLETED

Annotated all ATGL discrepancies in AFTO Form 244/245. If winterization procedures were accomplished, make an enty in the aircraft AFTO Form 781 and AFTO Form 244/245 stating the ATGL has been "winterized" and will require operational and leak checks.

3. ATGL No. 1 and 2 MAIN Circuit Breakers - OPENED

ATGL WINTERIZATION (ORIGINAL).

CAUTION

- The ATGL will be winterized anytime the aircraft remains overnight (crew rest) when the forecast temperature will be 0°C (32°F) or less. For enroute quick stops, the ATGL will be winterized if the cargo compartment temperature cannot be maintained above freezing (0°C/32°F). Severe damage to the ATGL will occur if these procedures are not accomplished for freezing conditions.
- Do not purge the plumbing with compressed air. Severe damage to the check valves and hoses could occur.

NOTE

- Step identified with a + can best be accomplished via the right lavatory access panel.
- See Section I for illustration of ATGL systems and components.

1. ATGL Electrical Power - ON
2. Water System Circuit Breakers - OPENED
3. Trash Access Panel - REMOVED
4. Trash Container - REMOVED
5. Right Lavatory Access Panel - REMOVED

+6. Potable Water Tank - DRAINED

Option 1 - Extend potable *water drain hose* through right lavatory access panel. Open the drain hose shut-off valve. Drain water into toilet waste tank or suitable container. Close shut-off valve when drained.

Option 2 - Drain the water tank into the igloos using the *igloo filler hose* or other suitable container.

WARNING

Do not use igloo filler hose to drain the potable water into the toilet. Keep this hose clean and sanitized. Failure could result in contamination of potable water system.

NOTE

- If toilet waste tank cannot be drained, do not drain potable water into the toilet waste tank because it will reduce passenger carrying capacity.
- If potable water is needed for the next day's mission, fill igloos using the igloo filler hose.

7. Water System Circuit Breakers - CLOSED

Close Water System Circuit Breakers to engage the water pump.

8. Residual Water - DRAINED

Drain residual water from igloo filler hose. Leave igloo filler hose valve open.

9. Water System Circuit Breakers - OPENED

10. Coffee Brewers - DRAINED

Remove the coffee pot to access drain valve. Pull the drain valve lever to the front. Water drains from the bottom of the brewer through a scupper into the waste tank. Close drain valve.

11. Water Heater - DRAINED

Drain the 2-gallon water heater by either (1) removing the brass plug, or (2) opening the brass valve. Both are located below the water heater on a brass T-fitting. Use a coffee pot or jug to catch draining water. Reinstall brass plug.

NOTE

- A 3/8-inch or larger crescent wrench is needed to remove the brass plug.
- Disconnect water line supply to left lavatory sink. This will release any vacuum in the water heater and allow residual water to drain.

+12. Water *Filter* Canister - DRAINED

Depress the RED pressure relief button located on the top of the water filter housing. Remove water filter canister by turning clockwise. Empty the canister. Reinstall canister ensuring O-Ring is installed on top rim.

CAUTION

Water filter canister needs to be only hand tight.

NOTE

There is a plastic (oil filter type) wrench attached with velcro next to the filter to assist in removal.

13. Water *Strainer* Canister - DRAINED

Adjacent to water pump. Remove water strainer canister from water strainer housing by turning clockwise. Empty the canister. Reinstall canister ensuring seal is installed on the upper inside rim of strainer housing.

CAUTION

Water strainer canister needs to be only hand tight.

14. Igloo Filler Hose Valve - CLOSED
15. Igloo Filler Hose and Potable Water Drain Hose - STOWED
16. Lavatory Access Panel - INSTALLED
17. Trash Container - INSTALLED
18. Trash Access Panel - INSTALLED
19. Waste Tank - DRAINED/AS REQUIRED
20. ATGL Winterization - COMPLETED

Continue with ATGL Post Flight Checklist.

CAUTION

- If the ATGL is to be used for a follow-on mission ***with water in the potable water tank,*** ensure all equipment is reconnected and coffee brewer drain valves are closed. Close Water System circuit breakers and check system for leaks.
- If the ATGL is to be used for a follow-on mission ***without water in the potable water tank,*** both Water System circuit breakers will remain OPEN and tagged "DO NOT OPERATE - WATER TANK EMPTY". Coffee brewers and lavatory water faucets will be inoperative.

ATGL WINTERIZATION (MODIFIED).

GENERAL. There are basically three depot modifications to the ATGL: (1) a redesigned water system for easier drainage. (The water filter and strainer are repositioned to self-drain and the *igloo filler hose* is relocated to left side of trash compartment to accommodate an additional potable *water drain hose* on the right side of trash compartment), (2) Enlarged trap storage doors, and (3) The 3-amp water pump fuse has been changed to a 3-amp circuit breaker on the ATGL circuit breaker panel next to the Water System circuit breaker.

CAUTION

- The ATGL will be winterized anytime the aircraft remains overnight (crew rest) when the forecast temperature will be 0°C (32°F) or less. For enroute quick stops, the ATGL will be winterized if the cargo compartment temperature cannot be maintained above freezing (0°C/32°F). Severe damage to the ATGL will occur if these procedures are not accomplished for freezing conditions.
- Do not purge the plumbing with compressed air. Severe damage to the check valves and hoses could occur.

1. ATGL Electrical Power - ON
2. Trash Access Panel - REMOVED
3. Trash Container - REMOVED
4. Potable Water Tank - DRAINED

Extend potable water drain hose located on **right side** of trash compartment. Open potable water drain valve located on the hose. Drain water into toilet waste tank, outside the aircraft, or suitable container. Let drain until flow stops.

WARNING

Do not use igloo filler hose to drain the potable water into the toilet. Keep this hose clean and sanitized. Failure could result in contamination of potable water system.

NOTE

- If toilet waste tank cannot be drained, do not drain potable water into the toilet waste tank because it will reduce passenger carrying capacity.
- If potable water is needed for the next day's mission, fill igloos using the igloo filler hose. This hose is located on the **left side** of the trash compartment.

5. Water System Circuit Breakers - OPENED
6. Coffee Brewers - DRAINED

Remove the coffee pot to access drain valve. Pull the drain valve lever to the front. Water drains from the bottom of the brewer through a scupper into the waste tank. Close drain valve.

7. Left Lavatory Sink Water Supply Hose - DISCONNECTED

Disconnect water line supply to left lavatory sink. This will release any vacuum in the water heater and allow residual water to drain.

NOTE

Prior to disconnecting hose, relieve pressure from system by depressing sink faucet handle in either lavatory.

8. Left Lavatory Sink Water Supply Hose - CONNECTED
9. Igloo Filler Hose and Potable Water Drain Hose Valves - CLOSED
10. Igloo Filler Hose and Potable Water Drain Hose - STOWED
11. Trash Container - INSTALLED
12. Trash Access Panel - INSTALLED
13. Waste Tank - DRAINED/AS REQUIRED
14. ATGL Winterization - COMPLETED

Continue with ATGL Post Flight Checklist.

CAUTION

- If the ATGL is to be used for a follow-on mission ***with water in the potable water tank,*** ensure all equipment is reconnected and coffee brewer drain valves are closed. Close Water System circuit breakers and check system for leaks.
- If the ATGL is to be used for a follow-on mission ***without water in the potable water tank,*** both Water System circuit breakers will remain OPEN and tagged "DO NOT OPERATE - WATER TANK EMPTY". Coffee brewers and lavatory water faucets will be inoperative.

AIRCRAFT PREPARATION FOR PARATROOP LOADING.

1. Forward Support Beam - CHECKED

* 2. Jump Signal Lights - CHECKED

Lights will be operated from the copilot position. Check bright and dim circuits. Turn cargo compartment lights to RED for dim circuit check.

* 3. Air Deflector Switch - ARMED

Air Deflector Switch on Pilot ADS Panel must be armed to operate air deflector electrically.

* 4. Retriever Winch - INSTALLED

Check each winch for security of mount.

5. Anchor Cables - INSTALLED/CHECKED

Check for proper positions, attachment points, safetied turnbuckles and for condition of cables.

CAUTION

Up to six broken wires are allowed per inch provided no broken wires are detected in the next consecutive inch. Any cable not within the above specified limits shall be considered unserviceable and must be replaced. The maximum number of broken wires shall not occur in any two consecutive inches of cable.

6. Restraint Rails - UP AND SECURED

7. Roller Conveyors - DOWN AND LOCKED

* 8. Seats and Safety Belts - CHECKED

a. Disconnect seat support tubes and unzip the seat bottoms at fuselage stations 518, 718, 958, 1158, and 1278.

b. Ensure seat belts are fully extended and straps and clips used to secure seat in raised position are attached.

c. Life preservers as required.

d. Safety forward end of support tubes adjacent to side emergency exits with 80-lb tape (one turn doubled).

* 9. Oxygen Masks - AS REQUIRED

Ensure that an oxygen mask is available for each seat position. Ensure mask hose is connected to an oxygen distribution outlet.

*10. Intermediate Anchor Cable Supports - CHECKED

Ensure supports are installed correctly and anchor cables secured. Check that correct size pip pins are used.

*11. Aft Anchor Cable Supports - CHECKED

When aft anchor cable supports are required, check for proper installation of anchor cables.

*12. Retriever Winches - CHECKED

Check winches for out and in operation. Maintain tension on cable when operating.

*13. Retriever Winch Cables - CHECKED/INSTALLED

Check cables for condition. Ensure all components of retriever cable system are available for anticipated mission (yoke assemblies, cable extensions, quick disconnect fittings, and cargo winch cable adapter). Safety the retriever spools, and install correct retriever cable configuration.

CAUTION

Up to three broken wires are allowed per inch provided no broken wires are detected in the next consecutive inch. Any cable not within the above specified limits shall be considered unserviceable and must be replaced. The maximum number of broken wires shall not occur in any two consecutive inches of cable.

* 14. Air Deflectors - CHECKED

Check for security of mount. Extend and retract deflectors electrically. Ensure deflector does not contact exterior of fuselage or that hinge does not contact fuselage frame. Ensure brake release knob is tightened and safetied.

* 15. Air Deflector Bypass Switches - CHECKED

Bypass switches will be checked electrically. Located below the left troop door interphone panel. Activate the left bypass switch. Activate the air deflector switch, the air deflector will start to extend. Repeat this step with the right bypass switch. Retract both air deflectors and raise both troop doors.

CAUTION

Ensure the air deflectors do not contact the troop doors.

* 16. Jump Platforms and Platform Lights - CHECKED

Check both platforms for alignment, proper operation, and security. Check platform lights.

CAUTION

Ensure both forward and aft rub strips are properly positioned in the door track. Rub strips prevent wear of the inboard fuselage skin material.

17. Paratroop Retriever Bar - STOWED

NOTE

Each retriever bar will be inserted into the appropriate receptacles for each troop door to ensure all required equipment functions properly.

* 18. Jump Area - CHECKED

Check that the floor is clear of grease, water, dirt, etc.

WARNING

Nonskid material must be installed adjacent to troop doors including roller conveyors.

* 19. Aircraft Preparation for Paratroop Loading - COMPLETED

When aircraft preparation is complete, proceed to Prior To Loading General checklist.

AIRCRAFT PREPARATION FOR EQUIPMENT AIRDROP.

Aerial Delivery System Ground Checkout Procedures.

* 1. Jump Signal Lights - CHECKED

Lights will be operated from the copilot position.

* 2. Restraint Harness Attachment Rings - CHECKED

Ensure attachment rings at FS 1313 right and left are installed.

WARNING

When aft of FS 1313, the restraint harness will be connected at or forward of FS 1313. Connect the restraint harness to seat belt attachment ring secured with nut and bolt or to a restraint rail ring.

* 3. Extraction Line Restraint Fitting/Pendulum Nose Assembly - INSTALLED/CHECKED

Check for installation of restraint fitting and spring clip on pendulum nose assembly. Ensure the extraction line restraint fitting raised tang is pointed aft. Two washers must be installed under the fitting.

* 4. Pressure Door Aux Latches, Cam Jacks, and Ramp Manual Safety Pins - REMOVED AND STOWED

* 5. Extraction Parachute Holder Hooks - CLOSED

Close the extraction parachute hooks and ensure that the holder is locked in position in the overhead structure.

NOTE

Prior to raising extraction parachute hanger, allow hanger to hang freely and relieve any twisting action in the cable. Place the unlock lever in the "LOCKED" position before raising the extraction parachute holder to the overhead structure. The indicator will retract into the overhead structure when the holder is locked in place. Do not overtighten winch cable.

* 6. Extraction Parachute Release Manual Control Handle - RELEASE

Pull manual release handle from the SAFE to RELEASE position. (A click can be heard when the end hooks open.) Return handle to SAFE position.

* 7. Cargo Doors - AS REQUIRED

CAUTION

Prior to opening doors and ramp, coordinate for ground clearance.

8. Ramp End Cover - AS REQUIRED

When required and pressure door is to be used, ensure ramp end cover is onboard and secured until ready for installation. Install the ramp end cover (alternate mission kit No. 11) using the single restraint fittings supplied with the kit, by placing these fittings in ramp tiedown receptacles at Butt Line 40, left and right.

CAUTION

The airdrop of platform(s) weighing from 25,001 to 42,000 pounds shall be accomplished only on aircraft that have a ramp end cover installed.

9. Ramp Skid Blocks - AS REQUIRED

When required, ensure that the two skid blocks (alternate mission kit No. 12) are installed at BL 20, left and right, with wide ends of blocks positioned aft. (Refer to Section II of TO 1C-141B-9.)

CAUTION

The airdrop of platform(s) weighing from 25,001 to 42,000 pounds shall be accomplished only on aircraft that have ramp skid blocks installed.

* 10. Roller Conveyors - UP AND LOCKED

Check all roller conveyors for condition and ensure they are up, properly seated, and locked.

WARNING

Conveyor sections with damaged or missing rollers will be replaced for aerial delivery operations.

NOTE

When inspecting the ramp roller convey or channels (4), ensure the gap distance between guide assembly and channel assembly does not exceed 3/16 inch.

Left Restraint Rail Operational Check.

11. Restraint Rail End Bumper - INSTALLED
* 12. Remote Control Handle - SET ON "0"

Ensure that index pointer is set at the "0" position.

* 13. Restraint Rails and Mechanisms - CHECKED

   a. Check mechanisms for freedom of movement by rotating the local control handle.

   b. Retract detent.

   c. Check for excessive vertical play in the control handle.

   d. Apply pressure to detent for checking proper engagement of the sear.

   e. Ensure detent clears inboard face of the rail.

   f. Manually lock all detents and set selector arms. Set locks 1 and 2 at No. 9. Set locks 3 through 6 at No. 4. Set locks 7 through 13 at No. 3. Set locks 14 through 20 at No. 2. Set locks 21 through 27 at No. 1.

   g. Ensure all rail sections are secured and push pull rods are connected.

   h. Check rail face for obstructions.

   i. Check area for foreign objects and loose equipment.

* 14. Remote Control Handle - UNLOCKED

* 15. Mechanisms - UNLOCKED

Operate the forward remote control handle to ensure retraction is achieved for each lock setting used.

* 16. Remote Control Handle - SET ON "0"

Operate the forward remote control handle until all detents are extended and locked. Ensure that the control rod is positioned at the zero index.

CAUTION

LOCK/UNLOCK Pawl must be in "UNLOCK" position to stow control handle; attempting to stow handle with pawl in "LOCK" position will result in damage to the control housing.

* 17. Remote Control Handle - UNLOCKED/STOWED

NOTE

If no other adjustments or movements are made to the control rod position or the LOCK/UNLOCK pawl, the control handle will release all locks set on "1" when it is pulled.

* 18. Detents - RETRACTED/SECURED

CAUTION

Detents will not be used to prevent overtravel-of pallets or platforms. Manually retract all detents. Detents on ramp rail section will be secured with 1/4-inch cotton webbing (80-lb tape).

* 19. Vertical Restraint Lips - RETRACTED/SECURED

Right Restraint Rail Operational Check.

20. Restraint Rail End Bumper - INSTALLED
* 21. Scribe Mark - ALIGNED

Cycle the remote control handle to align the scribe mark on the push-pull rod with the stationary mark on the rail section. This places the push-pull rod in the emergency release position.

* 22. Remote Control Handle - STOWED

Ensure pawl is in the unlocked position.

* 23. Restraint Rails and Mechanisms - CHECKED

a. Check the mechanism for freedom of movement by retracting/releasing detent.

b. Check the locking mechanism by engaging/releasing the slide link tab from the catch handle.

c. Check to ensure screws on the indicator gauge are sealed and the indicator is set at "4".

d. Ensure detent/detent pawl is extended and locked.

e. Ensure all rail sections are secured and push pull rods are connected.

f. Check rail face for obstructions.

g. Check area for foreign objects and loose equipment.

* 24. Emergency Release - CHECKED

Pull the control handle one full stroke. Ensure that each catch handle has released the slide link tabs. Check each detent by pressing in manually.

* 25. Remote Control Handle - LOCKED

Place the pawl on the remote control handle to the "LOCK" position.

* 26. Scribe Mark - REALIGNED

Cycle the remote control handle to align the scribe mark on the push-pull rod with the stationary mark on the rail section. This places the push-pull rod in position for emergency release of detent locks, provided no other adjustments or movement to the rod are made.

* 27. Remote Control Handle - UNLOCKED/STOWED

Place the pawl on the remote control handle to the "UNLOCK" position. Place the control handle in the stowed position.

* 28. Detents - RETRACTED/SECURED

Manually retract all detents. Ensure detent pawls do not extend into face of rail. Detents on ramp rail sections will be secured with 1/4-inch cotton webbing (80-lb tape).

* 29. Vertical Restraint Lips - RETRACTED/SECURED

AIRCRAFT PREPARATION FOR CONTAINER DELIVERY SYSTEM (CDS) AIRDROP.

1. Forward Support Beam - CHECKED

* 2. Jump Signal Lights - CHECKED

Lights will be operated from the copilot position.

* 3. Retriever Winch - INSTALLED

Check each winch for security of mount.

4. Anchor Cables - INSTALLED/CHECKED

Check for proper positions, attachment points, safetied turnbuckles and for condition of cables.

* 5. Retriever Winch Remote Control Assembly - INSTALLED

* 6. Retriever Winches - CHECKED

Check winches for out and in operation from both the retriever winch remote control assembly and the winch control assembly (pistol grip). Maintain tension on cable when operating.

* 7. Retriever Winch Cables - CHECKED

Check cables for condition. Ensure all components of retriever cable system are available for the anticipated mission.

* 8. Pressure Door Aux Latches, Cam Jacks, and Ramp Manual Safety Pins - REMOVED AND STOWED

* 9. Anchor Cable Hooks - DISCONNECTED

* 10. Pressure Door - OPEN

* 11. Aft Anchor Cable Supports - CHECKED

Ensure actuators have extended the aft supports. Check for proper anchor cable installation.

* 12. Static Line Stops - INSTALLED

Secure stops to anchor cables at FS 1470 right and FS 1490 left and tape.

* 13. Ramp and Petal Doors - AS REQUIRED

CAUTION

Prior to opening doors and ramp, coordinate for ground clearance.

* 14. Restraint Harness Attachment Rings - CHECKED

Ensure attachment rings at FS 1313 right and left are installed.

WARNING

When aft of FS 1313, the restraint harness will be connected at or forward of FS 1313. Connect the restraint harness to seat belt attachment ring secured with nut and bolt or to a restraint rail ring.

Restraint Rails And Roller Conveyors.

15. Restraint Rail End Bumpers - AS REQUIRED

When the No. 1 rail section is down, end bumpers will be installed.

* 16. Restraint Rails - CHECKED

    a. Ensure all rail sections are secured.

    b. Ensure all detents are retracted. Detents on ramp rail section will be secured with 1/4-inch cotton webbing (80-pound tape).

    c. Check rail face for obstructions.

    d. Ensure all vertical restraint lips are retracted/secure.

* 17. Roller Conveyors - UP AND LOCKED

Check all required roller conveyors for condition and ensure they are up, properly seated, and locked.

WARNING

Conveyors sections with damaged or missing rollers will be replaced for aerial delivery operations.

NOTE

When inspecting the ramp roller conveyor channels (4), ensure the gap distance between guide assembly and channel assembly does not exceed 3/16 inch.

* 18. Roller Conveyor Bridges - INSTALLED

* 19. Buffer Stop Assembly - INSTALLED/CHECKED

Check condition of assembly.

PRIOR TO LOADING AIRDROP EQUIPMENT.

1. Side Facing Seats - SECURED

Secure all seats adjacent to and aft of platform/containers with CGU-1/B cargo straps.

2. Joint Airdrop Inspection Form - CHECKED

NOTE

Do not accept loads for airdrops unless accompanied by a properly accomplished and certified joint airdrop inspection form from the agency providing the loads for airdrop.

3. Critical Factors - CHECKED

NOTE

For A-22 containers only the total weight of the load, parachute, skidboard condition, ties and allowable dimensions needs to be checked.

a. Load Data Tag - CHECKED

Ensure the data tag includes the rigged weight, center of gravity location, load dimensions, extraction parachute size, and extraction line plies.

b. Applicable Rigging Manual - AS REQUIRED

The applicable rigging manual for each airdrop load will be made available by the transported forces representative or aerial port inspector when the load is presented to the aircraft loadmaster for loading aboard the aircraft.

c. Type and Dimensions - CHECKED

Type V in 8, 12, 16, 20, 24, 28 and 32-foot lengths.

d. Weight of Rigged Load - CHECKED

Platform weights shall be checked to ensure total rigged weight on the load data tag does not exceed extraction parachute limitation.

e. Extraction Parachute - CHECKED

Type, diameter and unreefed condition.

f. Extraction Line - CHECKED

Proper type, length, number of loops, and plies.

g. Accompanying Loads - AS REQUIRED

Any accompanying loads must be provided for in the applicable rigging manual and must be within the weight and dimension ranges specified.

h. Platform Rails - CHECKED

Side rails shall not be bent, twisted, or bowed. Check for bowing due to load-to-platform tiedown. The platform must be in contact with the outboard roller conveyors.

4. Loading Sequence - DETERMINED

Plan on-load for airdrop sequence. Emergency jettison should also be a planning factor in loading sequence.

WARNING

- Prior to airdrop of single/sequential platform(s) calculations will be made to determine the aircraft's CG after each platform(s) has exited. Ensure that CG flight limits are not exceeded.
- Prior to container airdrop, calculations will be made to ensure the aircraft CG flight limits are not exceeded for any release of containers at CARP.
- Platforms or containers will not be repositioned in-flight except in cases of extreme emergency.

NOTE

For certain special missions, these calculations are not required. Authority for this exception is vested in the MAJCOM.

5. Aircraft Brakes - AS REQUIRED

Set aircraft brakes prior to all on/off loadings that involve cargo winching operations. (Only qualified personnel will operate the aircraft brakes.)

6. Prior to Loading Airdrop Equipment Checklist - COMPLETED

AFTER LOADING AIRDROP EQUIPMENT (PLATFORM[S]).

1. Left Restraint Rail

   a. Detents Between and Aft of Platforms - RETRACTED/SET

NOTE

Ensure the sear has fully engaged the disengagement arm in the unlock position. Retract detents and set selector arms at "9".

   b. Detents Restraining Platforms - LOCKED/SET

NOTE

Do not place any more than seven selector arms on any one setting.

Ensure detents are extended and locked and that selector arms are set for the required unlocking sequence.

   c. Detents Forward of Platforms - LOCKED/SET

Extend detents and ensure detent locks are engaged. Set mechanisms, selector arms at "9".

2. Right Restraint Rail

   a. Detents Forward of Platforms - EXTENDED/LOCKED

For detents located forward of platforms, extend the detents and ensure that the catch handle slot has engaged the slide link tab.

   b. Detents Restraining Platforms - EXTENDED/LOCKED/SET

Set the required amount of aft restraint. Ensure that the detent and detent pawl are fully extended and that the catch handle slot has fully engaged the slide link (yellow) tab.

c. Detents Aft, Adjacent, and Between Platforms - RETRACTED/SET

For detents located between platforms, aft of platforms, and adjacent to platforms (not being used), engage the slide link tab and rotate the adjustment knob until the catch handle releases the slide link tab. The detent and detent pawl should remain in the retracted position.

3. Extraction System - INSTALLED/RIGGED

This step includes all rigging procedures for a single/sequential platform(s) IAW TO 1C-141B-9, Section VII.

4. Load Inspection - COMPLETED

5. Roller Conveyors - DOWN/LOCKED

All roller conveyors not required for airdrop should be down and locked.

6. Emergency Aft Restraint - POSITIONED

See TO 1C-141B-9, Section 7B, for application of restraint.

CAUTION

Ensure all emergency aft restraint equipment is positioned in such a manner that it will not interfere with rail mechanisms, control rods or platform(s). When single restraint fittings have been replaced with combination fittings, the single fitting(s) will be stowed in the forward right-hand chain stowage locker.

7. Airdrop After Loading Check - COMPLETED

When all preceding items of the After Loading Equipment Airdrop checklist have been completed, proceed with the After Loading General checklist and accomplish the required items.

AFTER LOADING AIRDROP EQUIPMENT (CDS).

1. CDS Release Gate(s) - INSTALLED

Position containers as tight as possible against the forward barrier and install Type XXVI nylon release gate(s).

2. Overhead Pulley(s) - INSTALLED

NOTE

Litter strap attach brackets at FS 1218 and 1298 will not be used to attach suspension webs. Tiedown rings at FS 1208 will be used in lieu of litter strap brackets at FS 1218; litter strap brackets at FS 1318 will be used in lieu of litter strap brackets at FS 1298.

3. Retriever Cable Knife Assembly - INSTALLED/SAFETIED

Check that guillotine knife and cable extension are properly attached and knife is sharp. Safety knife.

4. Tiedown Restraint - INSTALLED

Install vertical restraint and additional forward and aft restraint, if required.

5. Static Lines - CONNECTED

6. Load Inspection - COMPLETED

Inspect the load using the Joint Airdrop Inspection Form.

7. Anchor Cable Hooks - CONNECTED

CAUTION

Ensure cable is in recess slot.

8. Roller Conveyors - DOWN/LOCKED

All roller conveyors not required for airdrop should be down and locked.

9. Emergency AFT Restraint Strap - CHECKED

Position strap for easy access.

10. Airdrop After Loading Check - COMPLETED

When all preceding items of the After Loading Airdrop Equipment (CDS) checklist have been completed, proceed with the After Loading General checklist and accomplish the required items.

AEROMEDICAL EVACUATION CREW.

MEDICAL CREW DIRECTOR.

The Medical Crew Director (MCD) ensures the aircraft is acceptable and configured for the assigned AE mission. The MCD supervises the nursing care and management of patients and is responsible for managing the AEC assigned to the mission. The MCD will advise and/or coordinate all pertinent aspects of the mission with the pilot.

FLIGHT NURSE.

The Flight Nurse (FN) will assist the MCD as required.

CHARGE MEDICAL TECHNICIAN.

The Charge Medical Technician (CMT) is responsible for the supervision and management of Aeromedical Evacuation Technicians (AETs) assigned to perform duties on the AE mission. It will be the responsibility of the CMT to ensure that medical supplies and equipment are on the aircraft and installed equipment is operable. The CMT will normally receive directions from and be responsible to the MCD or their assistant and will also assist the pilot if requested.

AEROMEDICAL EVACUATION TECHNICIANS.

The Aeromedical Evacuation Technician(s) (AET) (2AET and 3AET) will assist the CMT as required.

CREW DUTIES - MEDICAL CREW DIRECTOR (MCD), FLIGHT NURSE (FN) CHECKLIST.

AECMs are required to use and refer directly to this publication when accomplishing their abbreviated flight crew checklist duties. The abbreviated flight crew checklist will be used during all phases of the mission. If the checklist is accomplished by one flight nurse, accomplish all MCD and FN duties. When aircraft preparation and loading are accomplished by a ground support crew, the items with an "*" WILL be briefed by ground support personnel prior to the flight crew assuming responsibility. Interior inspection/enplaning duties and procedures may have to be modified as the situation dictates. Items with an "!" WILL be completed prior to take-off for contingency/combat missions. Resume the applicable section of the checklist, once in-flight. When crew duties permit, AECMs will make every effort to assist the loadmaster (LM) in accomplishing their passenger related duties.

CREW DUTIES - CHARGE MEDICAL TECHNICIAN (CMT), AEROMEDICAL EVACUATION TECHNICIANS (2AET/3AET) CHECKLIST.

AECMs are required to use and refer directly to this publication when accomplishing their abbreviated flight crew checklist duties. The abbreviated flight crew checklist will be used during all phases of the mission. If the checklist is accomplished by one or two AETs, accomplish all CMT/2AET/3AET duties. Duties may be delegated by the CMT. When aircraft preparation and loading are accomplished by a ground support crew, the items with an "*" WILL be briefed by ground support personnel prior to the flight crew assuming responsibility. Interior inspection/enplaning duties and procedures may have to be modified as the situation dictates. Items with an "!" WILL be accomplished prior to take-off for contingency/combat missions. Resume the applicable section of the checklist, once in-flight. When crew duties permit, AECMs will make every effort to assist the LM in accomplishing their passenger related duties.

MCD/FN CHECKLIST PROCEDURES.

INTERIOR INSPECTION.

The interior inspection will be accomplished by using the abbreviated flight crew checklist.

* 1. Aircraft Forms - CHECKED (CMT)

*! 2. Oxygen Mask/MA-1 Bottle/Goggles/LPU/EPOS/PBE - CHECKED (AEC)

a. Check content (minimum of 290 psi) of MA-1 bottle.

b. Attach mask to MA-1 bottle and check operation via PRICE check.

c. Ensure unit is properly secured at duty station.

d. Check for currency of PBE/LPU/EPOS.

e. Secure all personal equipment and set up work area.

*! 3. Cabin Preparation - CHECKED/COMPLETED (AEC)

a. Rollers flipped and secured in aircraft floor (as required).

b. Configure aircraft for patient requirements per configuration plan, TO 1C-141B-9 and AFI 11-2C-141, Volume 3, Addenda A. (AET)

c. Infection control/isolation area set up per established procedures. (FN)

*! 4. Medical Supplies/Equipment - CHECKED/SECURED (AEC)

a. Secure medications (patient, emergency, and narcotics). (FN)

b. Secure medical supplies and equipment. (AET)

c. Ensure all special medical supplies are available and secured. (FN/AET)

d. Report discrepancies to MCD. (FN/CMT)

*! 5. Survival Equipment - CHECK WITH LM (CMT)

Ensure appropriate numbers and types of LPUs, EPOS available for patients/passengers.

* 6. Meals/Service Items - AVAILABLE/CHECKED (CMT/3AET)

7. Aircraft Acceptability/Discrepancies - REPORTED (AEC)

a. Report duties accomplished/aircraft acceptance to MCD. (FN)

b. Receive report from FN/CMT on aircraft acceptability. (MCD)

c. Report discrepancies to the LM (as required). (MCD)

ENPLANING.

1. Aircraft Ready for Enplaning - COORDINATED (CMT)

a. Auxiliary loading ramps installed, if necessary. (CMT)

b. Crew stations assumed for enplaning.

! 2. Engine Running Onload (ERO) Preparations (As Required) - COMPLETED (AEC)

a. Coordinate ERO activities with the LM.

b. At en route stops, prepare cabin for ERO operations after departing the active runway (as required).

*! 3. Patient Report/Records/Medication/Supplies/Anti-Hijacking Statement - RECEIVED (MCD)

Receive patient clinical update, medical records, X-rays, medications, passports, anti-hijacking statement, etc., from Medical Treatment Facility (MTF)/Aeromedical Staging Flight (ASF)/Mobile Air Staging Facility (MASF) personnel.

* 4. Anti-hijacking Procedures (As Required) - ACCOMPLISHED (AEC)

a. Verify anti-hijacking procedures were accomplished by MTF/ASF/MASF personnel. (CMT)

b. Perform anti-hijacking procedures if not already accomplished by MTF/ASF/MASF personnel (as required). (CMT)

c. Check psychiatric litter patients for sharp objects. (FN)

* 5. Hearing Protection - DISTRIBUTED (FN)

*! 6. Patients - ENPLANED (AEC)

a. Coordinate/direct patient enplaning procedures with CMT and MTF/ASF/MASF personnel per patient positioning plan. (MCD)

b. Assist with enplaning litter patients.

c. Supervise/assist with enplaning of ambulatory patients/attendants. Inform MCD if leaving aircraft. (FN)

d. Notify MCD of any change in patient status.

e. Correct manifest(s) and revise patient positioning plan to reflect cancellations/add-on patients and correct number of souls on board. (MCD)

f. Assist LM (crew duties permitting) with enplaning of passengers (as required). Inform MCD if leaving aircraft. (FN)

! 7. Patient/Passenger Briefing Demonstration - COMPLETED (AEC)

a. Assist LM with demonstration of oxygen masks, LPUs, EPOS to ambulatory patients/passengers.

b. Identify emergency exits.

c. Provide individual briefings to litter patients and other individual patient briefings (as required).

BEFORE TAXI.

1. Patients/Passengers - SECURED (AEC)

a. Assist CMT with securing litter patients on left side of aircraft. (MCD)

b. Assist 2AET with securing litter patients on right side of aircraft. (FN)

c. Ensure all ambulatory patients and passengers are seated with seat belts securely fastened, seat backs in full upright position (if applicable). (3AET)

WARNING

If the AEC is not ready for taxi, the MCD will immediately notify the LM, providing estimated delay time, so the pilot will not begin taxi of aircraft.

2. Souls on Board - REPORTED TO MCD (FN)

3. Souls on Board - REPORTED TO LM/AEC (MCD)

BEFORE TAKE-OFF.

! 1. Patient Care - COMPLETED (AEC)

a. Direct/assist in pre-departure patient care.

b. Check condition/comfort of patients.

c. Notify the MCD if a potential delay will occur due to patient needs.

! 2. Cabin Secure - RECEIVED/REPORTED (AEC)

a. Ensure all supplies/equipment/baggage are secured.

b. Report cabin secure status to MCD. (FN/CMT)

c. Receive cabin secure report from FN and CMT. (MCD)

d. Take assigned seat and report cabin secure to LM. (MCD)

WARNING

MCD will immediately notify the LM if the cabin is not secure for take-off.

NOTE

Notify the LM if AECMs must stand during take-off.

IN-FLIGHT.

1. Patient Check - COMPLETED (AEC)

a. Observe patients during ascent.

b. Check each patient's condition when notified it is safe to move about the cabin.

2. Patient Care - ADMINISTERED (AEC)

a. Assess patients' needs, perform patient care and document.

b. Direct AEC in management/performance of patient care requirements. (MCD)

c. Administer/document patient medications and treatments. (FN)

d. Direct and supervise AEC in their duties. (MCD)

3. In-Flight Meal Service - COMPLETED (AEC)

a. Coordinate meal service with CMT. (MCD)

b. Assist in distribution of meals.

c. Assist patients who cannot feed themselves and/or require help to eat.

NOTE

Recommend meal service in the following order: special diets, litter patients, ambulatory patients.

4. Administrative Duties - COMPLETED (AEC)

   a. Complete all patient records and other mission paperwork.

   b. Separate patient paperwork and medications according to destination medical facility. (MCD/FN)

   c. Prepare AFTO Form 781, Aircrew/Mission Flight Data Document and provide to flight engineer. (MCD)

   d. Provide pilot written offload message indicating any special ground support requirements a minimum of 3 hours (dependent on length of flight) prior to estimated time of arrival. (MCD)

   e. Coordinate agriculture, border clearance, customs, and immigration requirements with LM (as required). (3AET)

5. Cabin Cleanliness - MAINTAINED (AEC)

6. Medical Inventory - COMPLETED (AEC)

NOTE

Perform inventory during last sortie of the day.

DESCENT.

1. Patients - PREPARED FOR LANDING (AEC)

   a. Wake patients prior to descent.

   b. Assist AET in securing patients.

2. Enplaning/Deplaning/Special Procedures - COORDINATED (AEC)

Coordinate tentative enplaning/deplaning procedures and any special procedures at en route stop and/or final destination.

3. Cabin Secure - RECEIVED/REPORTED (AEC)

   a. Secure all supplies/equipment/baggage prior to landing.

   b. Report cabin secure status to MCD. (FN)

   c. Receive cabin secure report from FN and CMT. (MCD)

   d. Take assigned seat and report cabin secure to LM. (MCD)

WARNING

MCD will immediately notify the LM if the cabin is not secure for landing.

NOTE

Notify the LM if AECMs must stand during landing.

   e. Observe patients during descent.

DEPLANING.

1. Deplaning Coordination - COMPLETED (MCD)

   a. Coordinate/direct deplaning procedures with CMT/LM.

   b. Ensure all patients have special supplies/equipment and personal belongings in their possession. (AEC)

   c. Coordinate with customs, immigrations, and agriculture (as required). (MCD)

   d. Provide ground support personnel with paperwork (as required). (MCD/FN)

2. Patient Report - COMPLETED (MCD)

   a. Provide clinical update to MTF/ASF/MASF personnel. (MCD/FN)

   b. Obtain signature for patient records, X-rays, medications, supplies, and equipment being offloaded.

3. Patients - DEPLANED (AEC)

   a. Coordinate/direct patient deplaning procedures with MTF/ASF/MASF. (MCD)

   b. Assist with deplaning litter patients.

   c. Deplane ambulatory patients/attendants. Inform MCD if leaving aircraft. (FN)

   d. Assist LM (crew duties permitting) with deplaning passengers (as required). Inform MCD if leaving aircraft.

NOTE

Medical equipment remains onboard until all patients have deplaned.

BEFORE LEAVING AIRCRAFT.

1. Discrepancies - REPORTED (AEC)

   a. Receive mission/aircraft discrepancy report from FN/CMT. (MCD)

   b. Report patient care related discrepancies to the MCD. (FN)

   c. Report aircraft discrepancies to the flight engineer/LM for documentation on aircraft forms. (MCD)

2. Aircraft Flying Time Forms - OBTAINED (MCD)

Obtain certified "extract" copy of AFTO Form 781 (as required).

3. Equipment/Supplies - REMOVED/STOWED (AEC)

   a. Identify and tag all inoperable AE equipment.

   b. Properly repack all medical equipment/supplies.

   c. Remove all medical equipment/supply kits.

   d. Remove all professional gear and personal bags per local policy.

CMT/2AET/3AET CHECKLIST PROCEDURES.

INTERIOR INSPECTION.

The interior inspection will be accomplished by using the abbreviated flight crew checklist.

* 1. Aircraft forms - CHECKED (CMT)

*! 2. Oxygen Mask/MA-1 Bottle/Goggles/LPU/EPOS/PBE - CHECKED (AEC)

   a. Check content (minimum of 290 PSI) of MA-1 bottle.

   b. Attach mask to MA-1 bottle and check operation via PRICE check.

   c. Ensure unit is properly secured at duty station.

   d. Check for currency of PBE/LPU/EPOS.

   e. Secure all personal equipment and set up work area.

*! 3. Cabin Preparation - CHECKED/COMPLETED (AEC)

   a. Rollers flipped and secured in aircraft floor (as required).

   b. Ensure aircraft is configured for AE mission per TO 1C-141B-9 and AFI 11-2C-141, Volume 3, Addenda A. (AET)

      (1) Litter stanchions/restraint cables (do not over-tighten) and straps/brackets installed per mission requirements.

      (2) Seats are properly secured to the aircraft and seat belts are attached.

      (3) Divider curtains, weather curtain, oxygen manifolds, hose assemblies, and masks in containers.

      (4) Check and adjust litter brackets according to patient positioning plan.

   c. Report aircraft cabin and equipment acceptability to MCD. (CMT)

   d. Report discrepancies to the MCD (as required). (CMT)

*! 4. Troop Oxygen System - CHECKED (CMT/2AET)

Check for oxygen flow at the bottom mask outlet at each stanchion. Check connections.

*! 5. Therapeutic Oxygen System - CHECKED (CMT/2AET)

   a. Open therapeutic valve to clear the line.

   b. Attach oxygen regulator(s) and check proper operation.

   c. Check oxygen quantity.

*! 6. Electrical System(s) - CONNECTED/SECURED (AET)

a. Connect Electrical Cable Assembly Set (ECAS) to aircraft following established procedures, ensuring cord(s) are attached to appropriate outlet(s).

b. Connect electrical frequency converters to aircraft following established procedures (as required).

c. Medical equipment plugged in (as required).

WARNING

Estimate total equipment draw from electrical system prior to connecting any electrical equipment, to prevent overload of the electrical frequency converters.

*! 7. Suction/Bag-Valve-Mask (BVM) - OPERABLE/SECURED (2AET)

a. Ensure suction equipment is set up and available for immediate use.

b. Ensure (BVM) manual resuscitator is set up for immediate use.

c. Report discrepancies to CMT.

*! 8. Medical Supplies/Equipment - CHECKED/SECURED (AEC)

a. Ensure medical equipment is accessible and operable. (2AET)

b. Ensure supplies are accessible and secured, including special supplies/equipment.

c. Report discrepancies to MCD. (CMT)

*! 9. Survival Equipment - CHECK WITH LM (CMT)

a. Ensure appropriate numbers and types of LPUs, EPOS available for patients/passengers.

b. Ensure required number of casualty life vests are available and secured on each side of the cargo compartment.

c. Ensure infant cot and adult/child life vests are available and secured near patients (as required).

*! 10. Seats - CHECKED (CMT)

a. Check food serving tray inserts, air sickness bags, seat belts and life vests.

b. Check that seats are properly secured.

* 11. Aircraft Service Items - CHECKED (CMT)

Check with AEOO/LM to ensure drinking cups, drinking water, ice, cream, sugar, coffee, juice, accessory packages, soap, air sickness bags, paper towels, and toilet tissue are on the aircraft in ample quantities.

* 12. Meals/Service Items - AVAILABLE/CHECKED (CMT/3AET)

a. Check with LM on availability/quantity. (3AET)

b. Verify the number of regular/special diets required for the mission. Spot check meals to ensure they are frozen and to ensure date currency. (3AET)

c. Coordinate with LM on meal service requirements. (3AET)

d. Report discrepancies to CMT.

* 13. Comfort Pallet - CHECKED (CMT)

Check with AEOO/LM for operation of ovens, lavatories, and to ensure hot plate, coffee maker, oxygen masks, oxygen bottles, and trash receptacles are available.

14. Passageway - CLEAR (CMT)

Ensure passageway between comfort pallet and right bulkhead is clear.

15. Aircraft Acceptability/Discrepancies - REPORTED (AEC)

   a. Report duties accomplished/aircraft acceptance to CMT. (2AET/3AET)

   b. Report discrepancies to CMT. (2AET/3AET)

   c. Report discrepancies to MCD. (CMT)

ENPLANING.

* 1. Crash/Fire/Rescue (CFR) Vehicle (As Required) - AVAILABLE (CMT)

Ensure CFR vehicle is available and properly positioned (as required).

NOTE

Not applicable if AEOO is on station.

! 2. Engine Running Onload (ERO) Preparations (As Required) - COMPLETED (AEC)

   a. Coordinate ERO activities with LM.

   b. At en route stops, prepare cabin for ERO operations after departing the active runway (as required).

3. Auxiliary Loading Ramps (As Required) - INSTALLED (CMT)

   a. Coordinate with LM for loading configuration and vehicle movement when enplaning patients via the cargo ramp (as required).

   b. Ensure auxiliary loading ramps are installed when enplaning patients via the cargo ramp (as required).

* 4. Anti-hijacking Procedures (As Required) - ACCOMPLISHED (AEC)

   a. Verify anti-hijacking procedures were accomplished by MTF/ASF/MASF personnel. (CMT)

   b. Perform anti-hijacking procedures if not already accomplished by MTF/ASF/MASF personnel (As Required). (CMT)

   c. Check psychiatric litter patients for sharp objects. (FN)

* 5. Hearing Protection - DISTRIBUTED (FN)

*! 6. Patients - ENPLANED (AEC)

   a. Coordinate/direct enplaning procedures with MCD and AEOO. (CMT)

   b. Assist with enplaning litter patients.

   c. Notify MCD of any change in patient status.

   d. Assist LM (crew duties permitting) with enplaning of passengers (as required). Inform MCD if leaving aircraft.

* 7. Baggage Loading - COMPLETED/SECURED (3AET)

   a. Manifest passenger baggage (as required).

b. Sign for baggage on appropriate forms (as required).

c. Assist LM with the loading/securing of patient/passenger and crew baggage.

! 8. Patient/Passenger Briefing Demonstration - COMPLETED (AEC)

a. Assist LM with demonstration of emergency oxygen masks, LPUs, EPOS to ambulatory patients/passengers.

b. Identify emergency exits.

c. Provide individual briefings to litter patients and special patient briefings (as required).

BEFORE TAXI.

1. Patients/Passengers - SECURED (AEC)

a. Ensure all litter patients on left side of aircraft are secured. (CMT)

b. Ensure all litter patients on right side of aircraft are secured. (2AET)

c. Ensure all ambulatory patients and passengers are seated with seat belts securely fastened, seat backs in full upright position (if applicable). (3AET)

WARNING

If the AEC is not ready for taxi, the MCD will immediately notify the LM, providing estimated delay time, so the pilot will not begin taxi of aircraft.

2. Souls on Board Report - RECEIVED (AEC)

BEFORE TAKE-OFF.

! 1. Patient Care - COMPLETED (AEC)

a. Perform pre-departure patient care as directed by MCD/FN.

b. Check condition/comfort of patients.

c. Notify the MCD if a potential delay will occur due to patient needs.

! 2. Cabin Secure - RECEIVED/REPORTED (AEC)

a. Ensure all supplies/equipment/baggage are secured.

b. Report cabin secure status to CMT. (2AET/3AET)

c. Receive cabin secure report from 2AET/3AET. (CMT)

d. Take assigned seat and report cabin secure to MCD. (CMT)

WARNING

MCD will immediately notify the LM if the cabin is not secure for take-off.

NOTE

Notify the LM if AECMs must stand during take-off.

IN-FLIGHT.

1. Patient Check - COMPLETED (AEC)

   a. Observe patients during ascent.

   b. Check patients' condition when notified it is safe to move about the cabin.

2. Patient Care - ADMINISTERED (AEC)

   a. Assess patients' needs, perform patient care, and document.

   b. Direct AEC in management of patient care. (MCD)

   c. Administer/document patient medications and treatments. (FN)

   d. Distribute comfort items (i.e., warm washcloths, etc.) and provide fluids every two hours if not contraindicated.

3. In-Flight Meal Service - COMPLETED (AEC)

   a. Coordinate meal service with MCD. (CMT)

   b. Assist LM with meal briefing (crew duties permitting). (3AET)

   c. Assist in distribution of meals.

   d. Assist patients who cannot feed themselves and/or require help to eat.

NOTE

Recommend meal service in the following order: special diets, litter patients, ambulatory patients.

4. Administrative Duties - COMPLETED (AET)

   a. Complete all patient records. Ensure all vital signs and intake and output results are documented.

   b. Complete baggage manifest for off load station. (3AET)

   c. Coordinate agriculture, border clearance, customs, and immigration requirements with LM (as required). (3AET)

5. Cabin Cleanliness - MAINTAINED (AEC)

Collect garbage after meals and prior to descent. (AET)

6. Medical Inventory - COMPLETED (AEC)

NOTE

Perform inventory during last sortie of the day.

DESCENT.

1. Patients - PREPARED FOR LANDING (AEC)

   a. Wake patients prior to descent.

   b. Ensure lavatories are vacant. (3AET)

c. Assist in securing patients.

(1) Ensure all litter patients are secured on left side. (CMT)

(2) Ensure all litter patients are secured on right side. (2AET)

(3) Ensure all ambulatory patients/passengers have seat belts fastened, seat backs in full upright position (if applicable), and hand-carried baggage stowed. (3AET)

2. Enplaning/Deplaning/Special Procedures - COORDINATED (AEC)

Coordinate tentative enplaning/deplaning procedures and any special procedures at en route stop and/or final destination.

3. Cabin Secure - RECEIVED/REPORTED (AEC)

a. Secure all supplies/equipment/baggage prior to landing.

b. Report cabin secure to CMT. (2AET/3AET)

NOTE

The 3AET will make a final check of the ambulatory patients during the LM's descent brief.

c. Receive cabin secure report from 2AET/3AET. (CMT)

d. Take assigned seat and report cabin secure to MCD. (CMT)

WARNING

MCD will immediately notify the LM if the cabin is not secure for landing.

NOTE

Notify the LM if AECMs must stand during landing.

e. Observe patients during descent.

DEPLANING.

1. CFR Vehicle (As Required) - AVAILABLE (CMT)

Ensure CFR vehicle is available and properly positioned near aircraft (as required).

NOTE

Not applicable if AEOO is on station.

2. Baggage Offloading - COMPLETED (3AET)

Assist LM with baggage offloading (as required).

3. Auxiliary Loading Ramps (As Required) - INSTALLED (CMT)

a. Coordinate with LM for vehicle movement when deplaning patients via the cargo ramp (as required).

b. Ensure auxiliary loading ramps are installed when deplaning patients via the cargo ramp (as required).

4. Patients - DEPLANED (AEC)

a. Coordinate/direct deplaning procedures with MCD. (CMT)

b. Ensure all patients have special supplies/equipment and personal belongings in their possession.

c. Assist with deplaning litter patients.

d. Deplane ambulatory patients/attendants. Inform MCD if leaving aircraft. (FN)

e. Assist LM (crew duties permitting) with deplaning passengers (as required). Inform MCD if leaving aircraft.

NOTE

Medical equipment remains onboard until all patients have deplaned.

BEFORE LEAVING AIRCRAFT.

1. Discrepancies - REPORTED (AEC)

   a. Report aircraft and patient care related discrepancies to CMT. (2AET/3AET)

   b. Report aircraft and patient care related discrepancies to MCD. (CMT)

2. Equipment/Supplies - REMOVED/STOWED (AEC)

   a. Identify and tag all inoperable AE equipment.

   b. Properly repack all medical equipment/supplies.

   c. Remove all medical equipment/supply kits.

   d. Remove all professional gear and personal bags per local policy.

SECTION V
OPERATING LIMITATION
PART I - GENERAL
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	5-2
SPECIFIC LIMITATIONS	5-2
MINIMUM CREW REQUIREMENTS	5-2
INSTRUMENT MARKINGS	5-2
ENGINE LIMITATIONS	5-2
WEIGHT LIMITATIONS	5-2
MAT RUNWAY LIMITATIONS	5-2
CENTER OF GRAVITY LIMITATIONS	5-3
CARGO LOADING LIMITATIONS	5-3
WIND GUST LIMITATIONS	5-3
STARTING LIMITATIONS	5-3
TAXIING LIMITATIONS	5-3
FUEL SYSTEM LIMITATIONS	5-4
FUEL GRADE PROPERTIES AND LIMITATIONS	5-4
AIRSPEED LIMITATIONS	5-5
ACCELERATION LIMITATIONS	5-6
BRAKE LIMITATIONS	5-7
AERIAL REFUELING LIMITATIONS	5-7

CHARTS		PAGE
FIGURE 5-1	INSTRUMENT MARKINGS	5-15
FIGURE 5-2	ENGINE OPERATING LIMITATIONS	5-19
FIGURE 5-3	ZERO FUEL WEIGHT CHART	5-20
FIGURE 5-4	SINK RATE CHART	5-22
FIGURE 5-5	CENTER OF GRAVITY	5-23
FIGURE 5-6	CARGO LOADING LIMITS	5-24
FIGURE 5-7	FUEL GRADE PROPERTIES AND LIMITS	5-25
FIGURE 5-8	MAXIMUM FLIGHT SPEED VS ALTITUDE CHART-CLEAN	5-26
FIGURE 5-9	MAXIMUM FLIGHT SPEED VS ALTITUDE CHART-SPOILERS EXTENDED	5-27
FIGURE 5-10	BRAKE LIMITS	5-28
FIGURE 5-11	MAXIMUM FLIGHT SPEED VS ALTITUDE CHART-CLEAN	5-32
FIGURE 5-12	MAXIMUM FLIGHT SPEED VS ALTITUDE CHART-SPOILERS EXTENDED	5-33
FIGURE 5-13	FLAP POSITION FOR AIRDROP OF CARGO	5-34
FIGURE 5-14	OPERATING ENVELOPE FOR PARATROOP AIRDROP	5-35

INTRODUCTION.

Section V covers all important limitations that must be observed during normal operation of the aircraft and engines. It is not to be construed that Section V contains ALL limitations, as some limitations are covered in sections dealing with that particular specialized phase of flight. Conversely, the instrument markings illustrated should be closely studied for area of normal operation and limitations, as these limitations may not be mentioned in other sections of the book.

SPECIFIC LIMITATIONS.

Part II of Section V contains additional and/or specific limitations that must be observed when transporting special or outsized type cargo. Part III contains airdrop limitations. Where instructions and limitations contained in Part II or III differ from the procedures and limitations contained in Part I, the Part II or III limitations shall apply.

MINIMUM CREW REQUIREMENTS.

The minimum flight crew complement to fly the aircraft under normal conditions is a pilot, copilot, flight engineer, and scanner. Additional crew members will be added at the discretion of the commander.

INSTRUMENT MARKINGS.

(See figure 5-1 for instrument markings.)

ENGINE LIMITATIONS.

ENGINE OPERATING LIMITATIONS.

(See figure 5-2 for engine operating limitations.)

WEIGHT LIMITATIONS.

The weight limitations chart (figure 5-3) shows the allowable cargo and fuel combinations for varying operating weights. The operating weight includes the crew, trapped fuel, trapped oil, usable oil and standard equipment; it does not include cargo or usable fuel.

Normal Landing Fuel Weight (75,000 pounds) and Normal Landing Weight (257,500 pounds) should not be routinely exceeded, but fuel need not be jettisoned solely to achieve these values. When landing at higher gross weights and fuel loads, refer to the sink rate schedule (figure 5-4) and observe proper taxi speeds and braking procedures.

CONDITION	LIMITATION (POUNDS)
NORMAL PLANNING	
Max Ramp Weight ⚠1	325,000
Max Flight Weight	323,100
Max Landing Weight ⚠1 ⚠2	323,100
Max Zero Fuel Weight ⚠1	218,725

NOTE

The aircraft may be operated in excess of the above weights up to emergency war planning limits when authorized by MAJCOM.

NORMAL OR EMERGENCY WAR PLANNING	
Normal Landing Weight ⚠1 ⚠2	257,500
Normal Landing Fuel Weight	75,000
Maximum Fuel ⚠1	153,352
Maximum Fuel For Flight (after taxi and take-off fuel burnoff)	151,452
EMERGENCY WAR PLANNING (EWP)	
Max Ramp Weight ⚠1 ⚠2	344,900
Max Flight Weight	343,000
Max Landing Weight ⚠1 ⚠2	343,000
Max Zero Fuel Weight ⚠1	239,000

⚠1 See Figure 5-3.

⚠2 See Figure 5-4 for allowable sink rates.

NOTE

Main landing gear strut and tire pressures must be serviced according to the following paragraph.

MAIN LANDING GEAR STRUT AND TIRE INFLATION PRESSURES FOR EWP GROSS WEIGHTS.

Prior to increasing ramp gross weights above 325,000 pounds, main landing gear tire pressures must be increased to 210 PSI and the main landing gear strut pressures must be increased to maintain a 3-inch static strut extension. Inflation instructions are given on the identification plate located on the main landing gear and must be followed explicitly to obtain the 3-inch strut extension. For a gross weight of 344,900 pounds, the estimated strut inflation pressure is 2,560 PSI.

MAT RUNWAY LIMITATIONS.

WEIGHT LIMITATIONS.

When operating on aluminum mat covered runways the following weight limitations apply:

Maximum Ramp Weight ⚠1	257,500 lbs
Maximum Landing Weight ⚠1 ⚠2	257,500 lbs

⚠1 See figure 5-3.

⚠2 See figure 5-4 for allowable sink rates.

RUNWAY SURFACE CONDITIONS.

Aircraft operations shall be limited to mat runways with surface smoothness comparable to standard runways. The sub-grade should be sufficiently compact to provide a minimum California Bearing Ratio (CBR) of 9 to a depth of 18 inches. The mat runway grade (undulations) should be limited to 1.5 percent per 200 feet.

TIRE PERFORMANCE.

Aircraft operations on an aluminum mat runway will increase the frequency of tire tread damage and wear. Making taxi turns at slow speeds and small turning angles will reduce scrubbing of the nose tires.

CAUTION

Avoid passing over damaged mat panels or sections whenever possible. Damaged panels or sections could cause tire damage, or strike the aircraft, equipment, or personnel in the area.

CENTER OF GRAVITY LIMITATIONS.

The center of gravity for any gross weight configuration, must fall within the percent of the mean aerodynamic chord (MAC) shown in the center of gravity limitations chart (figure 5-5). These limitations represent combined structural, stability, and control limitations that must be observed to obtain safe and effective aircraft performance. Two center of gravity envelopes are shown on the center of gravity chart. The solid line represents the allowable CG range during all flight conditions, while the dotted line shows the allowable CG for ground operations. The aircraft may be loaded to the limits for ground operation, provided the fuel burnoff during taxi does not shift the overall aircraft CG outside the range allowed by the solid line. The allowable cargo loading limits compatible with this CG range are shown on the cargo limits chart. When the cargo load fails inside the range of the cargo limits chart (figure 5-6), and standard fuel management is followed, the aircraft center of gravity should normally not exceed the allowable limits under any allowable flight conditions or attitudes.

During aerial refuel operations, the normal fuel sequence may not be maintained. All tanks may receive fuel simultaneously but to avoid exceeding the center of gravity limits, pitch attitude must not exceed 8 degrees nose-up or nose-down until the refueling operation is terminated and the fuel has been transferred to normal sequence. See figure 5-6 △3 for information concerning flight operations with a forward center of gravity during refuel operation.

CARGO LOADING LIMITATIONS.

Cargo loading limitations are shown in figure 5-6. Details concerning the loading of cargo are contained in "Cargo Loading Instructions Manual", TO 1C-141B-9, TO 1C-141B-16 and TO 1-1B-40.

WIND GUST LIMITATIONS.

The aircraft was designed to withstand 70-knot gusts from any direction, the tail-on gust being the most severe. Above 70 knots, control damage may occur if the aircraft is not headed into the wind since design limits can be exceeded.

The aircraft should be evacuated to a safe weather area if winds in excess of 70 knots are expected. If that is impossible, the aircraft will be moored.

CAUTION

Have the control surfaces and points of attachment checked per guidance in TO 1C-141B-2-00GE-00-1 before flight if the aircraft has been subjected to wind velocities exceeding:

- 70 knots with the flight control switches in the normal position.
- 25 knots with the flight control switches in the OFF position.
- At isolated locations, consult the mooring instructions contained in TO 1C-141B-2-00GE-00-1 to determine if aircraft mooring is required.

The use of engines to maneuver the aircraft during high wind is not recommended and should be avoided except under extreme circumstances. Foreign object damage (FOD) to the engines is highly probable.

STARTING LIMITATIONS.

The starter may be operated for 1.5 minutes ON, 5 minutes OFF for any number of duty cycles. The OFF time, must be observed regardless of ON time.

TAXIING LIMITATIONS.

Taxiing is limited to prepared taxi strips and/or prepared runways of established air bases.

CAUTION

- When possible, avoid braking to a stop in turns from any taxi speed, since damage to the nose landing gear and/or supporting structure may result.
- Before opening or closing the petal doors while taxiing, the aircraft commander must evaluate the taxi conditions. If the taxi surface grade varies excessively, the petal doors may contact the ground.
- Do not taxi with the cargo ramp below the horizontal position.
- Do not proceed aft of FS 1412 (ramp hinge) while the cargo doors are open and the aircraft is taxiing.

Limitations above 318,000 pounds:

Taxiing.

1. Smooth pavement only.
2. Use brakes as sparingly as possible.
3. Use shortest taxi distance possible.

4. Pivoting not allowed. (No severe nonsymmetrical braking allowed.)

5. Avoid abrupt or symmetric braking during turns.

6. Use low taxi speeds and/or shallow steering angle for turns.

FUEL SYSTEM LIMITATIONS.

MAXIMUM ALLOWABLE FUEL WEIGHTS.

Do not exceed the following amounts of usable fuel:

No. 1 or No. 4 Main Tanks	8,000 lb/tank
No. 2 or No. 3 Main Tanks	14,100 lb/tank
No. 1 or No. 4 Aux. Tanks	16,700 lb/tank
No. 2 or No. 3 Aux. Tanks	11,000 lb/tank
LH or RH Extended Range Tanks	26,800 lb/tank

MAXIMUM ALLOWABLE FUEL UNBALANCE.

The maximum allowable fuel unbalance between opposite pairs of tanks (other tanks remain balanced) is:

Extended Range Tanks	6,500 pounds
Outboard Aux. Tanks	4,000 pounds
Outboard Main Tanks	2,700 pounds
Inboard Main and Aux. Tanks	16,000 pounds

CAUTION

Fuel should be balanced before a landing is attempted. The unbalances shown above are the maximum unbalances, for each pair of tanks individually, that can be trimmed to 1.2 Vs (landing configuration).

FUEL GRADE PROPERTIES AND LIMITATIONS.

The specified fuel for the C-141 is JP-4/Commercial Jet B. Alternate fuels are defined as fuels which may be substituted for the specified fuel with possible restriction to airplane performance. Alternate fuels will not cause permanent damage to the engine or fuel systems; however, they may require engine retrim. Figure 5-7 lists properties and limitations of alternate grade fuels.

Approved kerosene type alternate fuels will not adversely affect engine performance. The full take-off rating will be more readily available with the denser kerosene type fuels; range will be at least as good as with JP-4.

CAUTION

Alternate fuels may not contain icing inhibitor additives. See Figure 5-7. Precautions should be taken to avoid flight conditions where fuel temperature is lower then 6 degrees centigrade above the freeze point of the fuel.

The fuel temperature must not be lower than 6° C (10° F) above the freeze point of the fuel. In general, fuel temperatures will follow total air temperature, but with a considerable time lag. When the total air temperature reaches six degrees above the fuel freeze point and remains there or at a colder temperature for two hours, use fuel from No. 1 and No. 4 main tanks. Transfer from the auxiliary tanks as necessary to keep the No. 1 and No. 4 main tank fuel above 5,000 pounds until normal sequencing is possible. Engine bleed air fuel heaters provide protection for engine components from waxy iced fuel; however, to ensure boost pump and engine fuel feed system performance the preceding precaution should be observed.

OPERATIONS WITH JP-8 FUEL.

JP-8 is a heavier (denser) fuel. JP-8 fuel weights range from 6.45 lbs per gal, to 7.0 lbs per gal at 15 degrees Celsius (59 degrees Fahrenheit). For JP-8 fuel loading, use 6.75 lbs per gal. Use fuel conversion charts in TO 1C-141B-2-00GE-00-1 as applicable.

1. Fuel quantity indicating system accuracy should not be affected.

2. While the BTUs per pound for JP-8 (18,577) are lower than that of JP-4 (18,706), the range and performance charts were created using a baseline of 18,400 BTU/LB. Therefore, current flight/fuel planning procedures will be adequate.

Engine starting difficulty will increase with decreasing ambient temperature. At colder temperatures, starting times may exceed starter duty cycle limits, or become impossible. Ground preheating of engines is recommended at ambient temperatures below zero (0) degrees Fahrenheit to improve starting performance and reliability.

NOTE

Current starter duty cycle limitations in this section will be observed.

3. Engine emissions will include more smoke and visible mist. Engine emissions may reduce visibility at lower temperatures. Increased safety awareness by personnel inside and outside the aircraft will be required.

4. Frequency of engine torching may increase with decreasing ambient temperature. Torching may be more intense and/or produce more visible flame. Monitor starting EGT closely.

5. Fuel puddling in the engine turbine and exhaust cone sections and/or on the ground may increase with decreasing ambient temperature.

NOTE

If fuel puddling is present or suspected, motoring the engine should aid in dissipating the fuel and fumes. Use Clear Engine procedures in Section II. More than 15 seconds may be required to resolve fuel puddling. Do not exceed starter duty cycle limits.

6. Air start envelope should not be reduced, however use of fuel enrichment may be needed at higher altitudes even if engine is not cold-soaked.

NOTE

If initial restart attempt is unsuccessful, consider changing altitude to increase outside air temperature for subsequent attempt(s).

7. Starting engine exhaust gas temperature (EGT) may be higher. Observe current engine temperature-time limitations in this section.

8. Marginally performing ignition systems which will light JP-4 fuel may have trouble igniting JP-8 at temperatures below 40 degrees Fahrenheit. Replacing the faulty ignition system component should fix the problem.

9. No special procedures need be taken for mixing different fuel types except as already noted in this manual.

The rate of climb should be restricted to the values shown in the following table, depending on the fuel used and the fuel temperature. (All figures estimated.)

TYPE OF FUEL	FUEL TEMPERATURE, START OF MISSION	RATE OF CLIMB
JP-4	Up to 125° F (52° C)	Not Restricted
	125° F to 135° F (52° to 57° C)	Max rate of climb to 29,000 feet. Above 29,000 feet, 300 ft/min.
JP-5	Up to 135° F (57° C)	Not Restricted
JP-8	Up to 135° F (57° C)	Not Restricted

AIRSPEED LIMITATIONS.

The airspeed limits are shown in figures 5-8 and 5-9.

CONFIGURATION	LIMITATION	SPEED
Clean - Landing Light/Aux Landing Light Extended	Do not exceed	350 KCAS or Mach = 0.53
Landing Gear Extended	Do not exceed	235 KCAS or Mach = 0.55
Landing Gear Operation	Do not operate landing gear above	200 KCAS or Mach = 0.48
DOORS ⚠1	Do not exceed	200 KCAS or Mach = 0.48
Petal Door Open		
Ramp Door Open		
Troop Doors Open		
Air Deflectors		
Air Refueling Door	Do not exceed	350 KCAS or Mach = 0.825
Stabilizer Access Door	Do not exceed	280 KCAS or Mach = 0.75
Take-off/Approach ⚠2 Flaps	Do not exceed	200 KCAS or Mach = 0.48
Landing Flaps ⚠2	Do not exceed	185 KCAS or Mach = 0.45
Any Configuration	Do not exceed	174 knots Ground speed at Touch-down (maximum demonstrated in tire test)
Any Configuration	Do not exceed	147 KCAS is the maximum Speed for Extension Of The Spoilers To the Ground Position (Not To Be Used In-flight.)

⚠1 Limitations on specific doors are independent of other door positions.

⚠2 These limitations also apply while flaps are being extended to or retracted from this position.

ACCELERATION LIMITATIONS.

The aircraft is designed to the following limit load factors for intentional maneuvers.

Do not exceed the load factors listed below.

CONFIGURATION AND GROSS WEIGHT	APPLIES	ZERO FUEL/FUEL WEIGHT LIMITS *	SYMMETRICAL POSITIVE	SYMMETRICAL NEGATIVE	UNSYMMETRICAL POSITIVE	UNSYMMETRICAL NEGATIVE
Clean up to 316,100 lb. G.W.	Up to recommended airspeed	Area A Area B	2.5 2.25	-1.0 0.0	2.0 1.80	1.0 1.0
Clean 316,100 to 323,100 lb. G.W.	Up to recommended airspeed	Area A Area B	2.5 2.25	-1.0 0.0	1.80 1.80	1.0 1.0
Clean 323,100 to 343,000 lb. G.W.	Up to recommended airspeed	Area B	2.25	0.0	1.67	1.0
Clean up to 316,100 lb. G.W.	Above recommended airspeed	Area A Area B	2.5 2.25	0.0 0.0	1.0 1.80	1.0 1.0
Clean 316,100 to 323,100 lb. G.W.	Above recommended airspeed	Area A Area B	2.5 2.25	0.0 0.0	1.80 1.80	1.0 1.0
Clean 323,100 to 343,000 lb. G.W.	Above recommended airspeed	Area B	2.25	0.0	1.67	1.0
Spoilers Extended up to 316,100 lb. G.W.	Up To Spoiler Limit Speed	Area A Area B	2.5 2.25	-1.0 0.0	2.0 1.8	1.0 1.0
Spoilers Extended 316,100 to 323,100 lb. G.W.	Up To Spoiler Limit Speed	Area A Area B	2.5 2.25	-1.0 0.0	1.80 1.80	1.0 1.0
Spoilers Extended 323,100 to 343,000 lb. G.W.	Up To Spoiler Limit Speed	Area B	2.25	0.0	1.67	1.0
Flaps Extended	Up To Flap Limit Speed	Area A Area B	2.0 1.8	0.0 0.0	1.0 1.0	— —
Aerial Delivery	Up To Petal Door Limit Speed	Area A Area B	2.0 1.8	0.0 0.0	1.0 1.0	— —

The symmetrical limitations listed above apply to wings-level maneuvers and coordinated turns.

The unsymmetrical limitations apply to rolls.

*Reference Weight Limitations Chart, Figure 5-3.

Never exceed the structurally safe maneuver load factor for the applicable flight conditions and for the aircraft load distribution.

The aircraft can be safely maneuvered to the load factors applicable for the configuration shown without structural damage, provided reasonable pilot judgment is exercised and the specified bank angles are not exceeded. As is true of all large aircraft which utilize powered or power-boosted control systems, more control power is available at high speed than is actually required to attain the allowable load factor. It is therefore possible, through abrupt control application, to initiate an aircraft motion which requires an immediate movement of the control in the opposite direction and of approximately the same magnitude and rate in order to keep the aircraft response within the defined limitations of load factor, bank angle, sideslip angle, etc. At lower speeds, such abrupt control application may result in airflow separation, buffet, and/or an accelerated stall condition. Such maneuvers are not recommended since excessive loadings may be imposed upon the aircraft structure. Abrupt rudder input combined with rolling maneuvers or lateral gust can cause vertical tail loads to exceed design limit strength. Large loads can occur as a result of returning the rudder abruptly past neutral while rolling out of a turn. Flying in turbulence, especially at low altitude, also adds to the load. Moderate loads from several sources combine to cause large vertical tail loads. Other vertical tail loads occur due to cyclic deflection of the rudder, resulting in amplified aircraft yaw response. To minimize vertical tail loads:

1. Minimize abrupt rudder inputs particularly when flying in turbulence and/or when the aircraft is rolling.

WARNING

Use of asymmetrical thrust to increase yaw angle is prohibited as excessive vertical tail loads can result if the aircraft is also yawed with rudder.

2. Do not abruptly return rudder pedals past neutral. All deflections should be smooth and coordinated. Do not swap rudder pedals.

DESCENTS.

The design limit rate of descent is 20,000 feet per minute.

PROHIBITED MANEUVERS.

Aerobatics of any kind, intentional spins, excessively nose high stalls, steep dives and any other maneuvers resulting in excessive accelerations are strictly prohibited. Do not exceed a 60-degree angle of bank for any configuration. Do not exceed a 30-degree angle of bank at speeds above 0.825 Mach or 350 KCAS, since recovery may result in exceeding the maximum speed or acceleration limits.

BRAKE LIMITATIONS.

Refer to Section III, Part I for Brake Limitations.

AERIAL REFUELING LIMITATIONS.

During and immediately after aerial refueling, nonstandard fuel distributions will occur. The nonstandard fuel distributions cause increased structural loads due to both inboard and forward shifts in the wing fuel center of gravity. In order to minimize the impact on the loads which contribute to structural fatigue, it is recommended that aerial refueling begin prior to burnoff of fuel from the outboard main tanks, which corresponds to a standard sequence fuel weight of approximately 33,000 pounds. However, aerial refueling is permissible at any beginning fuel weight.

As soon as possible after refueling is completed, the fuel should be pumped back into standard sequence so that normal operation of the aircraft can be resumed. The following restrictions apply while the fuel is in a nonstandard sequence:

Do not exceed 350 KCAS/Mach = 0.825.

Maintain steady symmetrical flight with minimal control deflections as required to maintain trim.

ACCELERATIONS.

Do not exceed the limit load factors listed below.

WEIGHT REGIME *	CONFIGURATION	SYMMETRICAL	UNSYMMETRICAL
Area A	Clean or Spoilers Ext.	2.0	1.4
Area B	Clean or Spoilers Ext.	1.8	1.4
Areas A and B	Flaps Extended	1.7	1.0

* Reference Weight Limitations Chart, Figure 5-3.

LANDING RATE OF SINK.

In ordinary operations the fuel will be transferred back to a normal sequence prior to landing impact. However, if it becomes necessary to land the aircraft while the fuel is in a nonstandard sequence, do not exceed a rate of sink of 360 feet per minute at landing impact.

GROUND HANDLING.

Follow limitations above 318,000 pounds presented in paragraph "Fuel System Limitations".

SECTION V
OPERATING LIMITATIONS
PART II - AIRDROP LIMITATIONS
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	5-8
AIRDROP LIMITATIONS	5-8
PARATROOP AIRDROP LIMITATIONS	5-9

INTRODUCTION.

This part of Section V provides limitations that must be observed while performing airdrops. These limitations assume that the aircraft is properly configured, and are to be used in conjunction with those contained in Part I of this section.

AIRDROP LIMITATIONS.

1. For platform loads between 25,000 and 42,000 pounds, the ramp skid blocks and the ramp end cover must be installed (alternate mission kit No. 11 and No. 12).

2. For platform loads of 2,500 to 42,000 pounds, refer to TO 1C-141B-1, ADS Speed Envelope, for the aircraft speed envelope and minimum aircraft gross weight.

3. The aircraft has the capability to airdrop from 130 KCAS to 200 KCAS; however, 180 KCAS is the maximum recommended airspeed.

NOTE

- When conducting airdrop missions at airspeeds above 180 KCAS, limit flight in airdrop configuration to a minimum time commensurate with mission requirements.

- Refer to figure 5-13 and TO 1C-141B-1-1 (for airdrop of platforms) to determine the proper flap setting for the aircraft gross weight within the speed regime specified above. This flap setting will give a deck angle of approximately two degrees nose-up.

- Refer to TO 1C-141B-1-1 to determine the proper flap setting for the aircraft gross weight and drop altitude for Container Delivery System drops at airspeeds within the regime specified above. This flap setting will give a deck angle of approximately five degrees nose-up. Whenever possible, the drop will be performed at an airspeed which will provide at least a 30% margin above stall; however, when aircraft gross weight and drop altitude requirements will not permit using the speed with 30% stall margin, the drop speed providing a 25% margin above stall may be used to complete the mission. TO 1C-141B-1-1 provides a quick reference for determination of maximum gross weights (at drop time) at 1.3 Vs/1.25 Vs drop speeds and various drop altitudes. All of the airdrop charts are based on the aircraft at zero degrees of bank.

4. The single platform load limits are 2,500 minimum to 42,000 pounds maximum. Refer to Section VII of TO 1C-141B-9 for detailed platform limits.

5. The minimum airdrop altitude is 300 feet above the terrain.

6. The maximum speed for opening the doors (petal, troop, air deflector and jump platforms) is 200 KCAS.

7. Airdrop operations should not be attempted in severe turbulence. If flight through severe turbulence occurs with the petal doors open an aircraft form entry is required for structural inspection.

WARNING

- Using abrupt elevator control to prevent pitchup may result in horizontal tail and aft body damage.
- Speeds above 180 KCAS in the airdrop configuration are not recommended. Long periods of flight at these speeds should be avoided due to considerable buffeting and vibration throughout the airplane. This buffeting is very pronounced during opening and closing of the petal doors.
- At speeds below 160 KCAS, large sideslip angles become available due to added rudder boost pressure.
- Avoid use of excessive sideslip angles since petal door damage may result at angles in excess of 10 degrees.

Flap-speed relationships during airdrop configuration must not exceed the following:

KCAS	MAXIMUM FLAPS
180-200	50%
165-179	70%
BELOW 165	88%

WARNING

Prior to airdrop of single/sequential platform(s) calculations will be made to determine the aircraft's CG after each platform(s) has exited to ensure that CG flight limits are not exceeded. Prior to container airdrop, calculations will be made to ensure that the aircraft CG flight limits are not exceeded for any release of containers at CARP.

NOTE

For certain special missions, these calculations are not required. Authority for this exception is vested in the MAJCOM.

PARATROOP AIRDROP LIMITATIONS.

Conditions or limits for paratroop airdrops are as follows (figure 5-14):

1. Airspeeds of 128 to 135 KCAS will be used.

2. Flaps will be extended from 75% to 90% to obtain a 0- to 3.5-degree deck angle. An airspeed of 130 KCAS with 75% flaps is recommended.

3. No static line jumps will be made over the cargo ramp.

4. No jumps through the troop doors will be made unless the petal doors are closed, jump platforms are locked in place, and the air deflectors are extended.

WARNING

Normally the troop doors should not be opened when the ramp and petal doors are open. If it becomes absolutely necessary to open the troop doors in this configuration, use extreme caution to prevent personal injury.

5. No more than 45 paratroops may be dropped from any single anchor cable.

HALO PARATROOP AIRDROP (RAMP).

Halo paratroop drops may be made over the ramp provided the troop doors are closed and static lines are not used.

SECTION V

OPERATING LIMITATIONS

PART IIIA - SSCBM AND MINUTEMAN MISSILE/TRIDENT MISSILE

TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	5-10
WEIGHT LIMITATIONS	5-10
CENTER OF GRAVITY LIMITATIONS	5-10
AIRSPEED LIMITATIONS	5-10
ACCELERATION LIMITATIONS	5-11

INTRODUCTION.

This part of Section V provides interim limitations that must be observed when transporting the SSCBM and Minuteman Missile/Trident Missile. These limitations are to be used in conjunction with those contained in Part I of this section. Aircraft 50227 through 50258 are the only aircraft that can transport the SSCBM and Minuteman Missile/Trident Missile.

WEIGHT LIMITATIONS.

The following weight limitations must be observed when transporting the Minuteman Missile/Trident Missile:

CONDITION	WEIGHT LIMITATION (POUNDS)
Maximum Ramp	318,000
Maximum Flight	317,723
Maximum Landing ⚠1	317,723
Normal Landing ⚠2	257,500
Maximum Zero Fuel	239,558
SSCBM and Minuteman Maximum Weight	92,000
SSCBM and Minuteman Minimum Weight	81,687
Trident Missle Maximum Weight	92,000
Maximum Fuel Load-Ramp ⚠3	84,235
Maximum Fuel Load-Ramp ⚠4	78,442
Maximum Fuel Load-Flight ⚠3	83,950
Maximum Fuel Load-Flight ⚠4	78,065

⚠1 Allowable sinking speed 6 FPS (360 ft/min.)

⚠2 Allowable sinking speed 8.5 FPS (510 ft/min.)

⚠3 Cargo load up to and including 86,207 lb.

⚠4 Cargo load over 86,207 lb.

CENTER OF GRAVITY LIMITATIONS.

The CG of SSCBM and Minuteman/Trident must be kept between fuselage stations 918 and 940. Figure 5-5 reflects the allowable center of gravity envelope for an aircraft transporting the SSCBM and Minuteman Missile/Trident Missile.

CONFIGURATION	APPLIES
Clean	Up to 410 KCAS/Mach = 0.89
Spoilers Extended	Up to Recommended Speed
Flaps Extended	Up to Flap Limit Speed

AIRSPEED LIMITATIONS.

Figure 5-11 and 5-12 reflect the limiting airspeeds when transporting the SSCBM and Minuteman Missile/Trident Missile.

RECOMMENDED TURBULENT AIR PENETRATION.

The following airspeeds are recommended when operations are necessary in turbulence and thunderstorms:

CONFIGURATION	APPLIES
Clean-Rough Air	240 KCAS or Mach = 0.75
Spoilers Extended	225 KCAS or Mach = 0.75

ACCELERATION LIMITATIONS.

The aircraft is designed to the following limit load factors for intentional maneuvers.

Do not exceed:

SYMMETRICAL MAXIMUM/MINIMUM		UNSYMMETRICAL MAXIMUM/MINIMUM	
2.25	0	1.8	1.0
2.25	0	1.8	1.0
1.8	0	1.0	1.0

SECTION V
OPERATING LIMITATIONS
PART IIIB - POSEIDON MISSILE
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	5-12
WEIGHT LIMITATIONS	5-12
CENTER OF GRAVITY LIMITATIONS	5-12
AIRSPEED LIMITATIONS	5-12

INTRODUCTION.

This part of Section V provides limitations that must be observed on all aircraft when transporting the Poseidon Missile Airlift Support (with Short or Long Missile in Liner). These limitations are to be used in conjunction with those contained in Part I and II of this section.

WEIGHT LIMITATIONS.

The following weight limitations shall be observed when transporting the Poseidon Missile Airlift Support with Short or Long Missile in Liner:

CONDITION	WEIGHT LIMITS (POUNDS)
Maximum Ramp	309,900
Maximum Flight	308,000
Maximum Landing ⚠1	308,000
Normal Landing ⚠2	257,500
Maximum Zero Fuel Poseidon Missle Airlift Support and Missle	220,000
Maximum Weight	82,000
Maximum Fuel Load-Ramp	89,900
Maximum Fuel Load-Flight	88,000

⚠1 Allowable sinking speed 5 FPS (300 ft/min.)

⚠2 Allowable sinking speed 8.5 FPS (510 ft/min.)

CENTER OF GRAVITY LIMITATIONS.

Figure 5-5 reflects the allowable center of gravity envelope for an aircraft transporting the Poseidon Missile Airlift Support with Missile.

AIRSPEED LIMITATIONS.

Normal Flight Speeds apply except when aircraft gross weight is below 232,000 pounds due to fuel burnoff, then:

Maximum	340 KCAS or Mach = 0.825

RECOMMENDED TURBULENT AIR PENETRATION.

The following airspeeds are recommended when operations are necessary in turbulence and thunderstorms:

CONFIGURATION	LIMITING SPEED
Clean-Rough Air	240 KCAS or Mach = 0.75
Spoilers Extended - Rough Air	225 KCAS or Mach = 0.75

NOTE

In the clean configuration for operation in severe turbulence, do not exceed:

250 KCAS to 37,100 FT: Mach = 0.775 above.

SECTION V

OPERATING LIMITATIONS

PART IIIC - DEEP SUBMERGENCE RESCUE VEHICLE

TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	5-13
WEIGHT LIMITATIONS	5-13
CENTER OF GRAVITY LIMITATIONS	5-13
AIRSPEED LIMITATIONS	5-13

INTRODUCTION.

This part of Section V provides limitations that must be observed on all aircraft when transporting the Deep Submergence Rescue Vehicle (DSRV) which is carried on Aircraft No. 1 of the complete DSRV System which requires three aircraft. These additional limitations are applicable only to the aircraft with the DSRV. The other two aircraft (Nos. 2 and 3) shall use the normal limitations as reflected in Part I of Section V. These limitations are to be used in conjunction with those contained in Part I of this section.

WEIGHT LIMITATIONS.

The following weight limitations shall be observed when transporting the Deep Submergence Rescue Vehicle (DSRV):

CONDITION	WEIGHT LIMITS (POUNDS)
Maximum Ramp	318,000
Maximum Flight	316,100
Maximum Landing ⚠1	316,100
Normal Landing ⚠1	257,500
Maximum Zero Fuel	215,000
DSRV Maximum Weight	73,000

⚠1 Allowable touchdown velocity (sinking speed) Figure 5-4

CENTER OF GRAVITY LIMITATIONS.

Figure 5-5 reflects the allowable center of gravity envelope for an aircraft transporting the DSRV.

AIRSPEED LIMITATIONS.

Normal Flight Speeds apply.

RECOMMENDED TURBULENT AIR PENETRATION.

Normal recommended turbulent air penetration procedures and airspeeds apply.

SECTION V
OPERATING LIMITATIONS
PART IV - 74% DESIGN LIMIT LOAD
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	5-14
WEIGHT LIMITATIONS	5-14
AIRSPEED LIMITATIONS	5-14
MANEUVER LOAD FACTOR LIMITATIONS	5-14
OTHER LIMITATIONS	5-14

INTRODUCTION.

This part of Section V provides limitations that must be observed on aircraft as directed by the C-141 System Program Office (SPO). These are intended to ensure that the maximum load experienced by the airframe is 74% of the design limit load, and will be directed as necessary by the SPO. These are to be used in conjunction with those contained in Parts I and II of this manual.

WEIGHT LIMITATIONS.

The following weight limitations will be followed when 74% restrictions have been mandated by the SPO:

CONDITION	WEIGHT LIMITS (POUNDS)
Maximum Ramp	325,000
Maximum Flight	323,100
Maximum Zero Fuel	205,000

AIRSPEED LIMITATIONS.

CONDITION	AIRSPEED LIMITS
Maximum Cruise	305 KCAS/0.75 Mach
Absolute Maximum Velocity	410 KCAS/0.80 Mach
Take-off/Approach Configuration	190 KCAS/0.48 Mach
Severe Turbulence	230 KCAS

MANEUVER LOAD FACTOR LIMITATIONS.

1. In clean configuration up to max cruise velocity: The maximum acceleration in symmetrical maneuvers is 2.0G and the minimum is -1.0G; the maximum unsymmetrical maneuver acceleration is 1.44G and the minimum is 1.0G; the maximum bank angle is 46 degrees.

2. In clean configuration from maximum cruise velocity to absolute maximum velocity: The maximum acceleration in symmetrical maneuvers is 1.8G and the minimum is 0.0G; the maximum in unsymmetrical maneuvers is 1.0G and the minimum is 1.0G; the maximum bank angle is 0 degrees.

3. In flaps extended configuration: The maximum acceleration in symmetrical maneuvers is 1.7G and the minimum is 0.0G; the maximum in unsymmetrical maneuvers is 1.44G and the minimum is 1.0G; the maximum bank angle is 46 degrees.

OTHER LIMITATIONS.

1. Avoid areas of known or forecasted severe turbulence.

2. Aerial refueling training shall be performed with zero cargo weight.

3. For missions with flight segments below 6,000 feet AGL (excluding normal take-off and approach) the following restrictions also apply:

   a. Missions with segments below 1,000 feet AGL shall be performed with zero cargo weight. Airdrop missions may be performed below 1,000 feet AGL to a minimum of 600 feet AGL, providing aircraft is configured for airdrop prior to descending below 1,000 feet AGL.

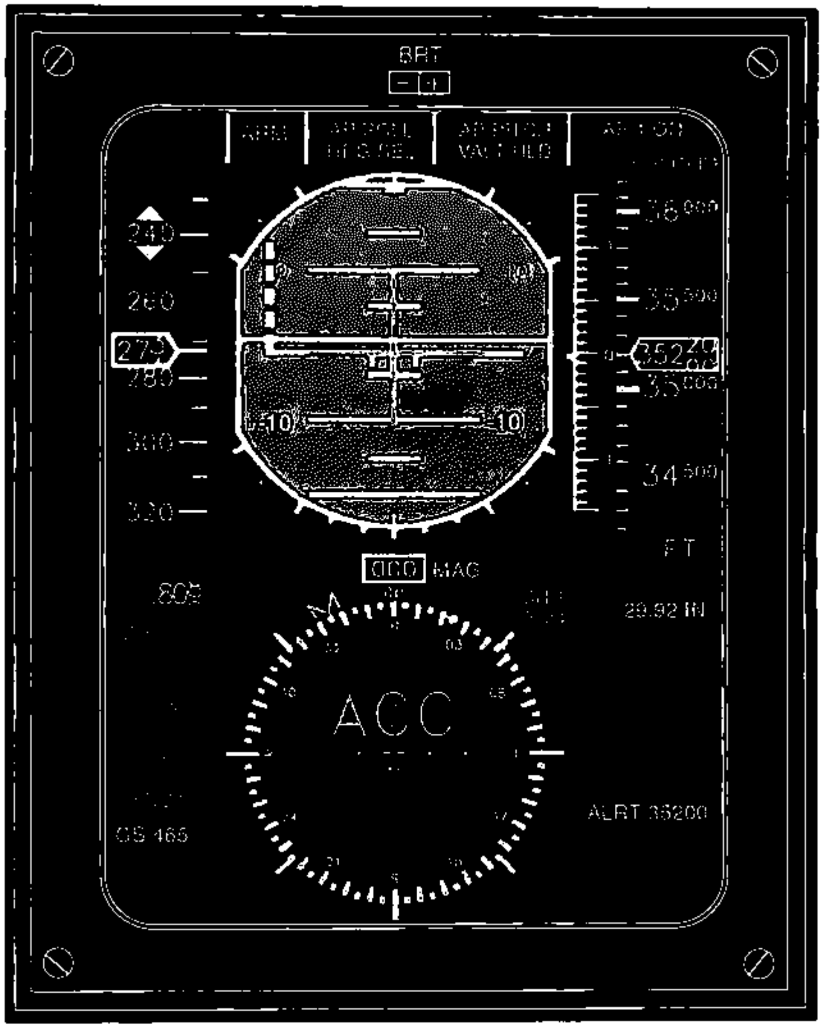
   b. Maximum velocity below 2,000 feet AGL and above 1,000 feet AGL shall be 230 KCAS.

   c. Maximum velocity below 1,000 feet AGL shall be 200 KCAS.

4. Avoid abrupt or large control inputs.

INSTRUMENT MARKINGS

ALL APPROVED FUEL GRADES



AIRSPEED TAPE – COLOR WHITE, RANGE 50 TO 500 KNOTS, DISPLAY 100 KNOT (± 50KTS) IN NUMBERED IN 20 KT INTERVALS.

COMMAND AIRSPEED MARKER – COLOR MAGENTA. RANGE 70 TO 500 KNOTS.

AIRSPEED DEVIATION WORM, COLOR WHITE, FROM –25 TO +25 KNOTS IN 5 KNOT INTERVALS.

200 — NORMAL LOW ALTITUDE MANEUVERING AIRSPEED.

M .400 MACH DISPLAY RANGE .400 TO .999 MACH. MACH DISPLAY COLORS ARE:

VERTICAL VELOCITY SCALE – COLOR VALID = WHITE, INVALID =RED. INDICATES RATE OF CLIMB OR DESCENT. SCALE NORMALLY SHOWS RANGE OF ± 1.5 X 1000 FEET PER MINUTE.

VERTICAL VELOCITY THERMOMETER – COLOR WHITE. RANGE –1.5 TO +1.5 (X1000 fpm).

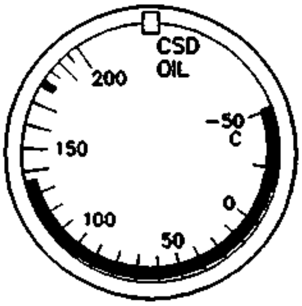
1.6 VERTICAL VELOCITY UPPER/LOWER READOUT ± 1.5 TO 9.9 (X1000 fpm)

MACH	BOX COLOR	READOUT COLOR
MACH = ≤ 0.78	WHITE	WHITE
MACH = > 0.78 ≤0.80	YELLOW	YELLOW
MACH = > 0.80 ≤0.825	RED	YELLOW
MACH = > 0.825	RED	RED

D31070010

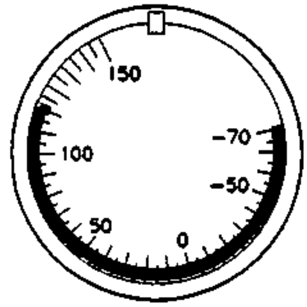
Figure 5-1. Instrument Markings (Sheet 1 of 4)

INSTRUMENT MARKINGS — ALL APPROVED FUEL GRADES



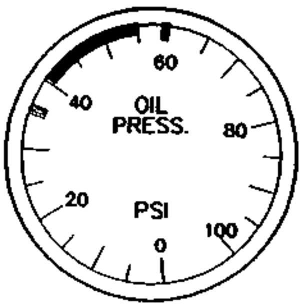
CONSTANT SPEED DRIVE OIL TEMPERATURE INDICATOR

- -50 TO 135°C – NORMAL
- 135 TO 180°C – CAUTION
- 180°C – MAXIMUM



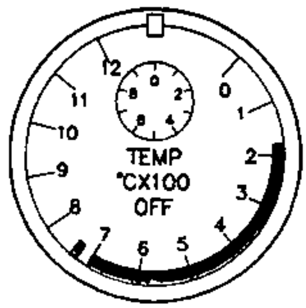
ENGINE OIL TEMPERATURE INDICATOR

- -70 TO 120°C – NORMAL
- 120°C – MAXIMUM



ENGINE OIL PRESSURE INDICATOR

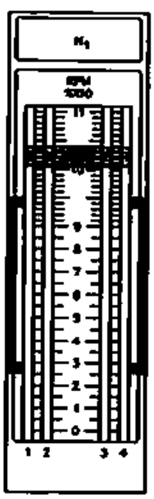
- 35 PSI – MINIMUM
- 35 TO 40 PSI – CAUTION
- 40 TO 55 PSI – NORMAL
- 55 TO 60 PSI – CAUTION
- 60 PSI MAXIMUM



APU EXHAUST GAS TEMPERATURE INDICATOR

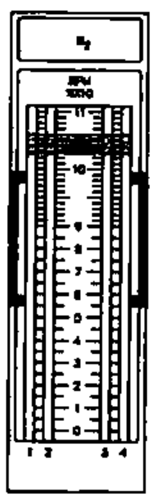
- 170 TO 700°C – NORMAL OPERATION
- 700 TO 730°C – CAUTION
- 730°C – MAXIMUM

PERCENT RPM



ENGINE TACHOMETER (N_1)

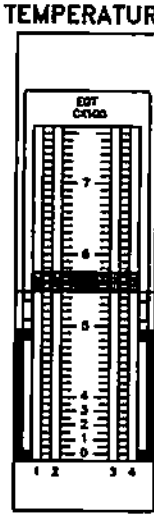
- 25 TO 93% – NORMAL OPERATION
- 101% – MAXIMUM



ENGINE TACHOMETER (N_2)

- 54 TO 99% – NORMAL OPERATION
- 104% – MAXIMUM

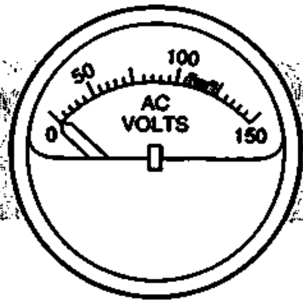
EXHAUST GAS TEMPERATURE



- 0° TO 485°C – NORMAL OPERATION
- 485° TO 555°C – CAUTION
- 555°C – MAXIMUM

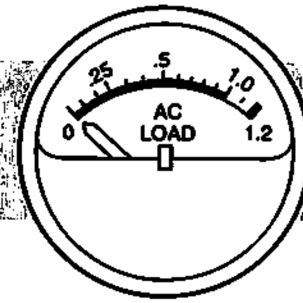
D3186101

Figure 5-1. Instrument Markings (Sheet 2 of 4)



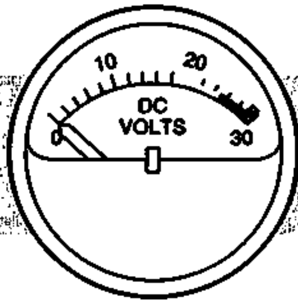
AC VOLTMETER

- 110 Volts - Minimum
- 110 To 120 Volts - Normal
- 120 Volts - Maximum



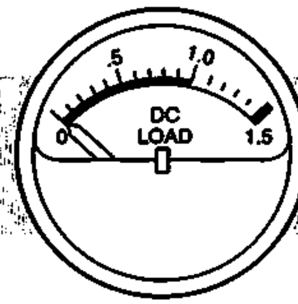
AC LOADMETER

- 0 To 1.0 - Normal
- 1.0 To 1.2 - Caution
- 1.2 - Maximum



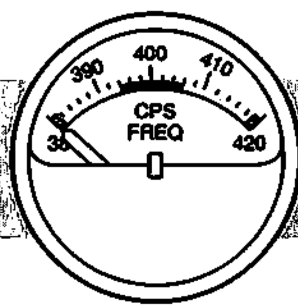
DC VOLTMETER

- 20 Volts - Minimum
- 20 To 25 Volts - Caution
- 25 To 30 Volts - Normal
- 30 Volts - Maximum



DC LOADMETER

- 0 To 1.0 - Normal
- 1.0 To 1.5 - Caution
- 1.5 - Maximum



NOTE

With emergency generator selected the limits under No Load conditions are:

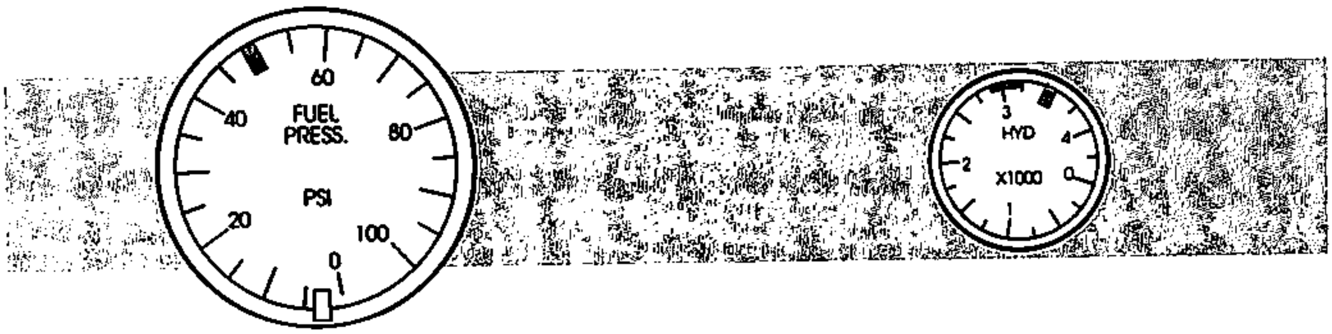
AC Voltmeter 116 ± 3 VAC
DC Voltmeter 28 ± 3 VDC
Frequency Meter 411 ± 8 CPS

FREQUENCY METER

- 380 CPS - Minimum
- 380 To 394 CPS - Caution
- 394 To 406 CPS - Normal
- 406 To 420 CPS - Caution
- 420 CPS - Maximum

141A-1-X3/0-131-2

Figure 5-1. (Sheet 3 of 4)



FUEL PRESSURE INDICATOR

50 PSI - Maximum

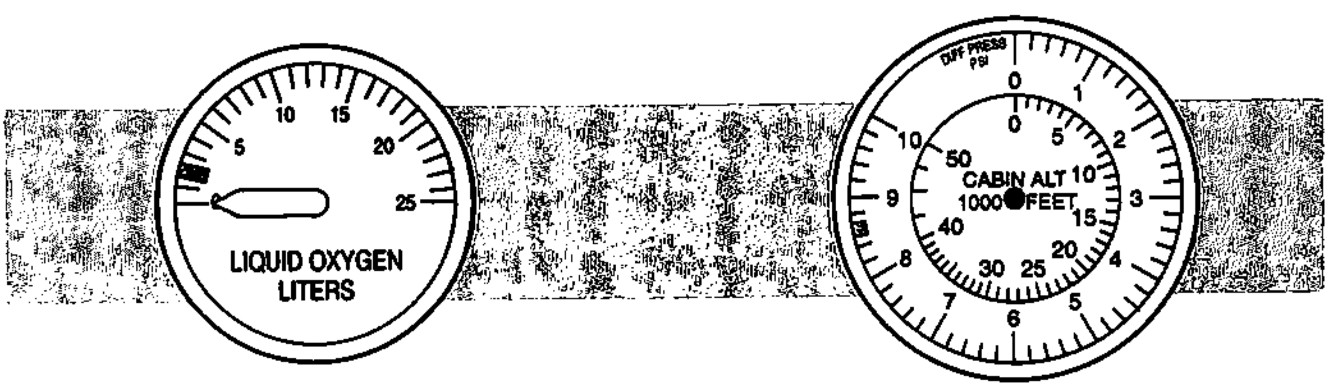
NOTE

THERMAL EXPANSION NOT CONSIDERED.

HYDRAULIC PRESSURE INDICATOR

2850 To 3150 PSI - Normal

3400 PSI - Maximum



LIQUID OXYGEN QUANTITY INDICATOR

2.5 LITERS - DANGER
(OXYGEN SUPPLY ALMOST DEPLETED)

CABIN ALTITUDE AND DIFFERENTIAL PRESSURE INDICATOR

8.6 PSI - Maximum

141A-1-X3/0-131-3

Figure 5-1. (Sheet 4 of 4)

ENGINE OPERATING LIMITS

TF33-P-7

FUEL GRADE JP-4

OPERATING CONDITION		OPERATING LIMITS		
THRUST SETTING	(MINUTES)	MAXIMUM OBSERVED EXHAUST GAS TEMPERATURE (°C) ②	OIL PRESSURE (PSIG) NORMAL ④	MAXIMUM OIL TEMPERATURE (°C) ③
TRT EPR GO-AROUND EPR REDUCED EPR	5	555	40-55	120
MILITARY	30 ⑥	510	40-55	120
NORMAL RATED	CONTINUOUS ⑤	485	40-55	120
IDLE	CONTINUOUS	340 ①	35 MINIMUM	120
STARTING	-	455	- - -	-
ENGINE ACCELERATION		555	40-55	120
REVERSE		555	40-55	120

① THIS TEMPERATURE IS NOT A LIMIT. IT IS GIVEN AS A GUIDE TO INDICATE THE EGT, WHICH, IF EXCEEDED, MAY SIGNIFY AN ENGINE MALFUNCTION. THE EGT LIMITS FOR THROTTLE SETTINGS BELOW NORMAL RATED THRUST ARE THE SAME AS THE TEMPERATURE LIMIT FOR NORMAL RATED THRUST.

② WHENEVER THE EGT EXCEEDS 565° C FOR ANY TIME, EITHER THE ENGINE SHOULD BE SHUT DOWN OR A LANDING SHOULD BE MADE AS SOON AS POSSIBLE. WHEN SHUTTING THE ENGINE DOWN FOR THIS REASON, ALLOW A COOLING PERIOD OF 5 MINUTES AT IDLE PRIOR TO SHUTDOWN IF ENGINE CONDITIONS AND FLIGHT CIRCUMSTANCES PERMIT.

③ PROVIDING ENGINE OPERATION IS OTHERWISE NORMAL, NO MINIMUM OIL INLET TEMPERATURE NEED BE OBSERVED BEFORE COMMENCING TAKE-OFF.

④ THE MINIMUM OIL PRESSURE AT IDLE IS 35 PSI. ON DECELERATION, OIL PRESSURE MAY DROP TO 30 PSI WITH WARNING LIGHT ON. THIS IS ACCEPTABLE PROVIDED OIL PRESSURE RETURNS TO 35 PSI OR ABOVE WITHIN TEN MINUTES OF STABILIZED OPERATION. NORMAL OIL PRESSURE LIMITS FOR CONTINUOUS ENGINE OPERATION AT POWER SETTING ABOVE IDLE RPM IS 40 TO 55 PSI. OIL PRESSURE (ABOVE IDLE RPM) FROM 35 TO 40 PSI AND 55 TO 60 PSI ARE UNDESIRABLE AND SHOULD BE TOLERATED ONLY FOR THE COMPLETION OF THE FLIGHT PREFERABLY AT A REDUCED THROTTLE SETTING. OIL PRESSURE BELOW 35 PSI OR ABOVE 60 PSI IS UNSAFE AND REQUIRES THAT THE ENGINE BE SHUT DOWN OR A LANDING BE MADE AS SOON AS POSSIBLE, USING MINIMUM THRUST REQUIRED TO SUSTAIN FLIGHT.

NOTE

MOMENTARY OIL PRESSURE INDICATIONS BETWEEN 55 AND 60 PSI FOLLOWING RAPID ADVANCE OF THROTTLES TO TAKE-OFF OR GO-AROUND POWER IS PERMISSIBLE PROVIDED PRESSURE RETURNS TO BETWEEN 40 AND 55 PSI DURING CLIMBOUT.

⑤ ANY POWER SETTING ABOVE NRT WILL BE LIMITED TO 30 MINUTES.

⑥ ANY POWER SETTING ABOVE MRT WILL BE LIMITED TO 5 MINUTES.

Figure 5-2. Engine Operating Limits

ZERO FUEL WEIGHT CHART

SAMPLE PROBLEM

1. Given: Operating Weight = 150,000 pounds

   Fuel Weight = 140,000 pounds

2. Find: Maximum cargo and maximum ramp gross weight for normal operations (2.5G) and emergency war operations (2.25G).

3. Solution:

a. Enter the Zero Fuel Weight (ZFW) chart at 140,000 pounds of fuel. Read up to the Normal Operations (2.5G) line, then across to a ZFW of 185,000 pounds.

b. For normal operations:

Maximum Cargo = ZFW - Operating Weight

= 185,000 - 150,000 = 35,000 pounds

Maximum Ramp Gross Weight= ZFW + Fuel

= 185,000 + 140,000 = 325,000 pounds

c. Again enter the ZFW chart at 140,000 pounds of fuel. Read up to the Emergency War Operations (2.25G) line, then across to a ZFW of 204,900 pounds.

d. For emergency war operations:

Maximum Cargo = ZFW - Operating Weight

= 204,900 - 150,000 = 54,900 pounds

Maximum Ramp Gross Weight= ZFW + Fuel

= 204,900 + 140,000 = 344,900 pounds

Figure 5-3. Zero Fuel Weight Chart (Sheet 1 of 2)

ZERO FUEL WEIGHT

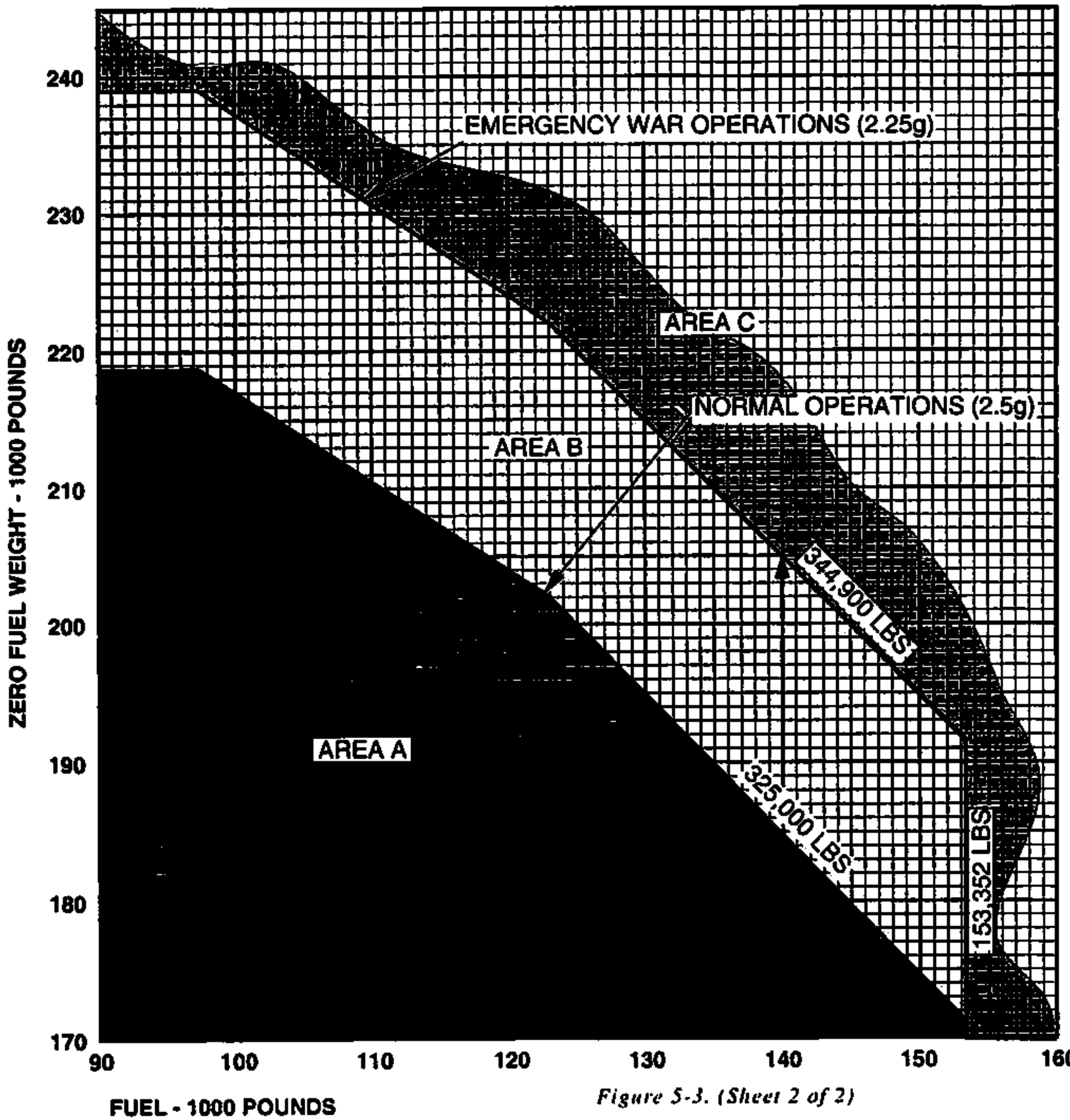


Figure 5-3. (Sheet 2 of 2)

NOTES:

1. FOR FUEL WEIGHTS LESS THAN 97,375 LB. THE MAXIMUM ZERO FUEL WEIGHTS ARE 239,000 LB (EMERGENCY WAR), 218,725 LB (NORMAL).
2. MAX CARGO = ZERO FUEL WEIGHT – OPERATING WT.
3. MAX RAMP WT = ZERO FUEL WEIGHT + FUEL WT.
4. SUBTRACT 1900 LB FROM RAMP GROSS TO DETERMINE THE TAKE-OFF GROSS WEIGHT FOR ENTRY ON DD FORM 365-4 LIMITATION BLOCK.
5. ZERO FUEL WEIGHT FROM CHART WILL BE ENTERED ON DD FORM 365-4 LIMITATION BLOCK (LIMITING WING FUEL).

RECOMMENDED (AREA A)

CAUTIONARY - (AREA B) PERMISSIBLE AT LOAD FACTOR LIMITS 0.0G TO 2.25G

NOT RECOMMENDED (AREA C)

SINK RATE CHART

ALLOWABLE TOUCHDOWN VELOCITY (SINKING SPEED)

NOTE

1. Use the lower touchdown speed allowed after consideration of both aircraft weight and fuel weight.
2. Adherence to normal landing procedures will preclude exceeding limit sink speeds at any gross weight or fuel loading. It should be understood, however, that the life of the landing gear and parts of the airframe are influenced by a percentage of available strength used during landing. For this reason landing at high gross weights and/or high fuel weights should not be planned as a routine procedure.
3. The accelerometer is designed to monitor in-flight parameters only and is not to be used for hard landing determinations.

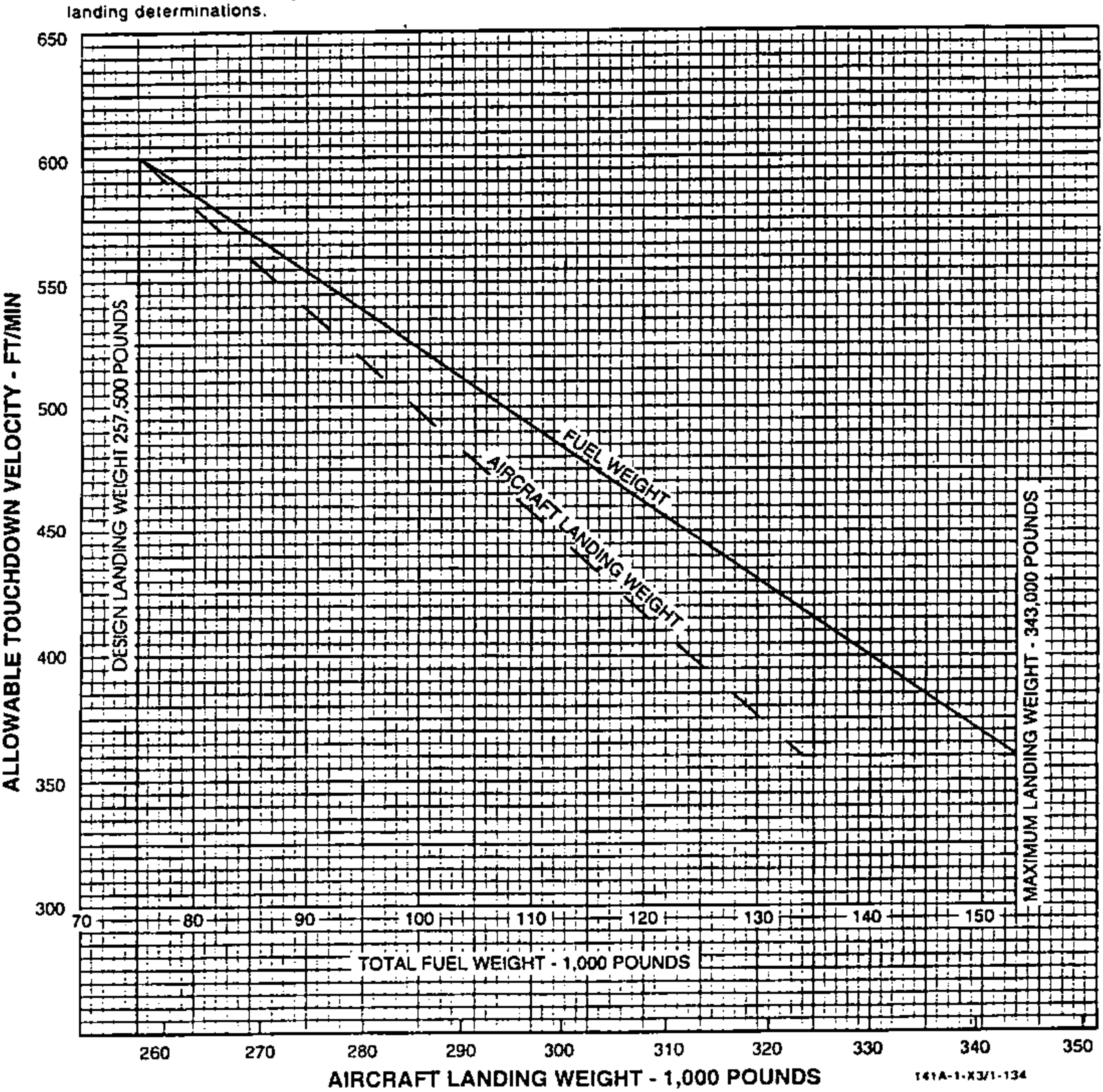


Figure 5-4. Sink Rate Chart

CENTER OF GRAVITY (CG)

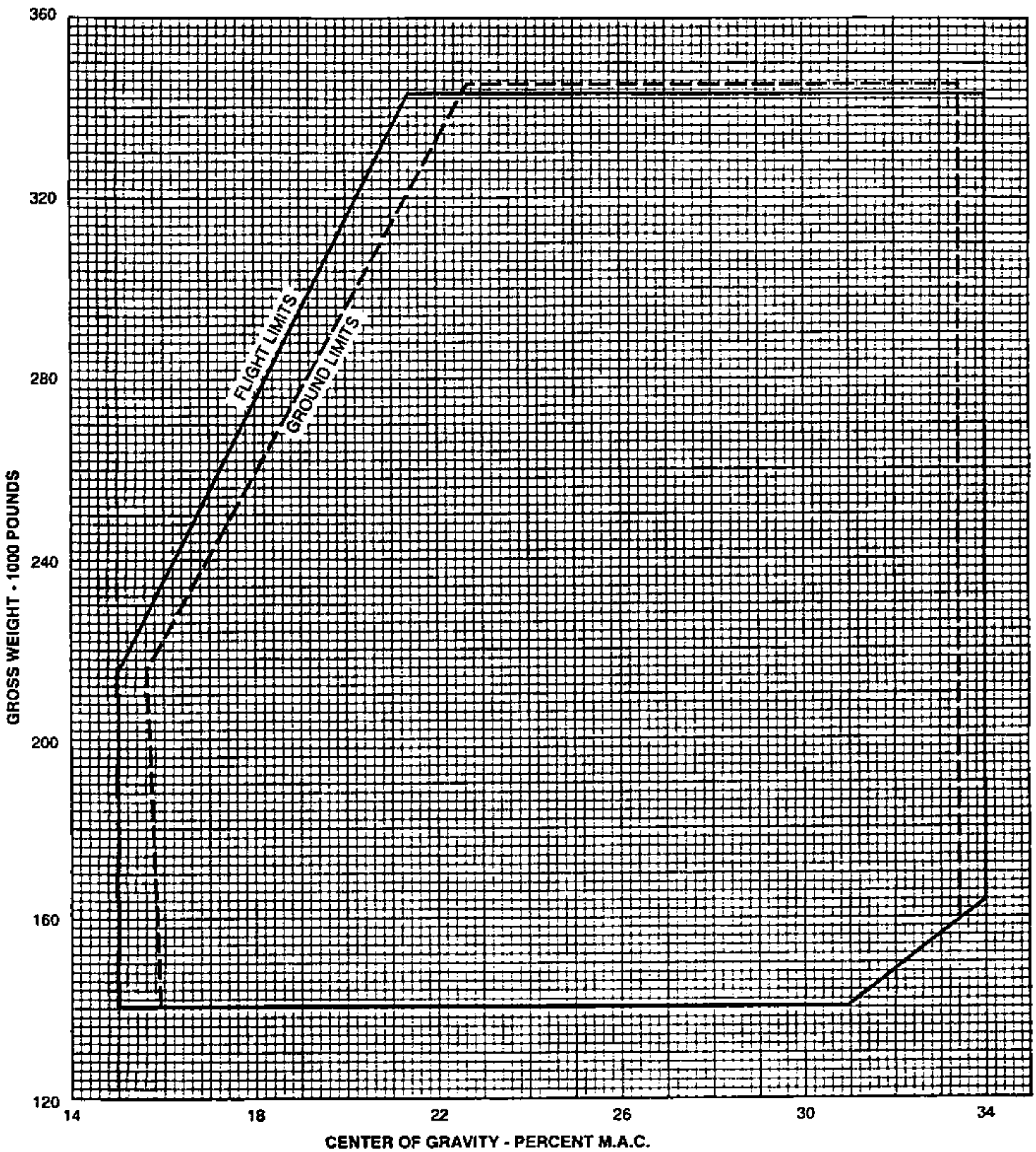


Figure 5-5. Center of Gravity

CARGO LOADING LIMITS

NOTE

1. The C.G. of the cargo load should fall within the limits shown in the chart. Final loading must be checked for the particular aircraft using the weight and balance data, TO 1-1B-40.

2. Details concerning the loading of cargo are contained in "Cargo Landing Manual" TO 1C-141B-9.

⚠3 Loadings forward of this line may result in higher than normal stick force gradient during aerial refuel operations until the fuel is redistributed to normal sequences.

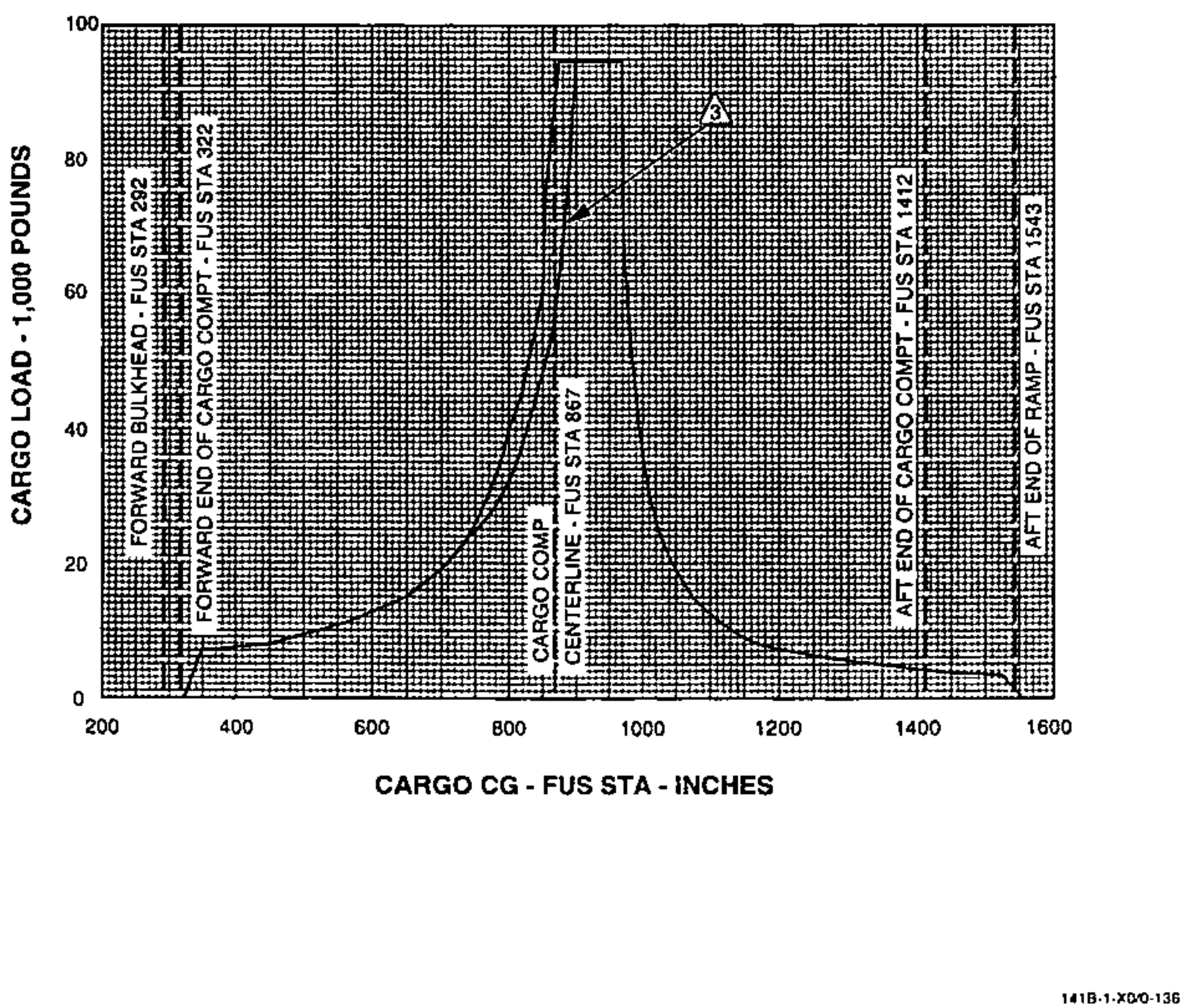


Figure 5-6. Cargo Loading Limits

FUEL GRADE PROPERTIES AND LIMITS

USE	FUEL TYPE	GRADE	NATO SYMBOL	U.S. MIL SPEC	UNITED KINGDOM SPEC & COMMERCIAL	SPECIFIC GRAVITY (MAX-,IN AT 60° F)	FREEZE POINT °C (°F)	LIMITS
Specified Fuel	Wide Cut Gasoline	JP-4	F-40	MIL-DTL-5624	DERD 2486	0.802-0.751	-58 (-72)	
		Commercial Jet B			ASTM D1655-59T	0.802-0.751	-50(-58)	1 2 3
Alternate Fuel	Kerosene	JP-5	F-44	MIL-DTL-5624	DERD 2498	0.845-0.788	-46 (-51)	1
		JP-5B	F-42		DERD 2488	0.845-0.788	-40 (-40)	1
		JP-8	F-34	MIL-DTL-83133	DERD 2494	0.840-0.775	-47 (-53)	1 2
		Commercial Jet A-1	F-34		DERD 2494 ASTM D1655-59T	0.840-0.775	-50(-58)	1 2 4
		Commercial Jet A	F-30		DERD 2482 ASTM D1655-59T	0.840-0.775	-40 (-40)	1 2 3

(1) Avoid flying at altitudes where indicated fuel temperature is lower than 6° C above the freeze point of the fuel.

(2) Prior to using commercial fuel, obtain freeze point from vendor or airline supplying the fuel, then follow limit 2 above. The aircraft commander should exercise caution if he suspects or observes improper fuel handling procedures. If there is any indication that cleanliness is not up to standard, a fuel sample should be taken in a glass container and observed for fogginess, presence of water or rust.

(3) Does not include icing inhibitor additives.

(4) May not contain icing inhibitor additives, confirm presence or absence with fuel source.

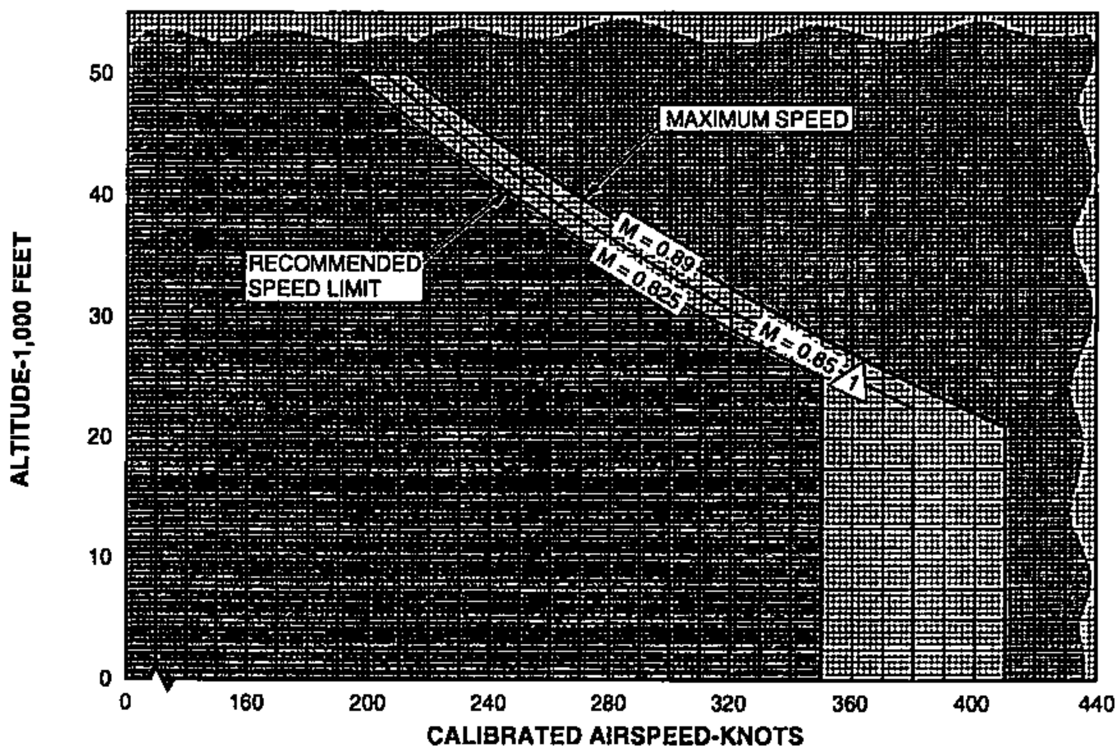
Figure 5-7. Fuel Grade Properties and Limits

MAXIMUM FLIGHT SPEED VS ALTITUDE CHART-CLEAN

STANDARD DAY

NOTE

1. Speeds in excess of those represented by this line are not recommended due to buffet boundary and lateral control limitations.
2. For operation in severe turbulence, do not exceed 270 KCAS or M = 0.825, refer to Section VII for recommended procedure.



MANEUVER LOAD FACTOR LIMITS ARE –1.0G TO 2.5G FOR GROSS WEIGHTS WITHIN AREA A OF FIGURE 5-3. LOAD FACTOR LIMITS ARE 0.0G TO 2.25G FOR GROSS WEIGHTS WITHIN AREA B OF FIGURE 5-3. OPERATION IN THIS AREA IS PERMISSIBLE IN MODERATE TURBULENCE.

MANEUVER LOAD FACTOR LIMITS ARE 0.0G TO 2.5G FOR GROSS WEIGHTS WITHIN AREA A OF FIGURE 5-3. LOAD FACTOR LIMITS ARE 0.0G TO 2.25G FOR GROSS WEIGHTS WITHIN AREA B OF FIGURE 5-3. OPERATION IN THIS AREA IS PERMISSIBLE IN LIGHT TURBULENCE EXCEPT AS LIMITED BY 1. OPERATION IN MODERATE TO SEVERE TURBULENCE MAY RESULT IN EXCESSIVE GUST LOADS.

PROHIBITED.

141B-1-X0/0-138

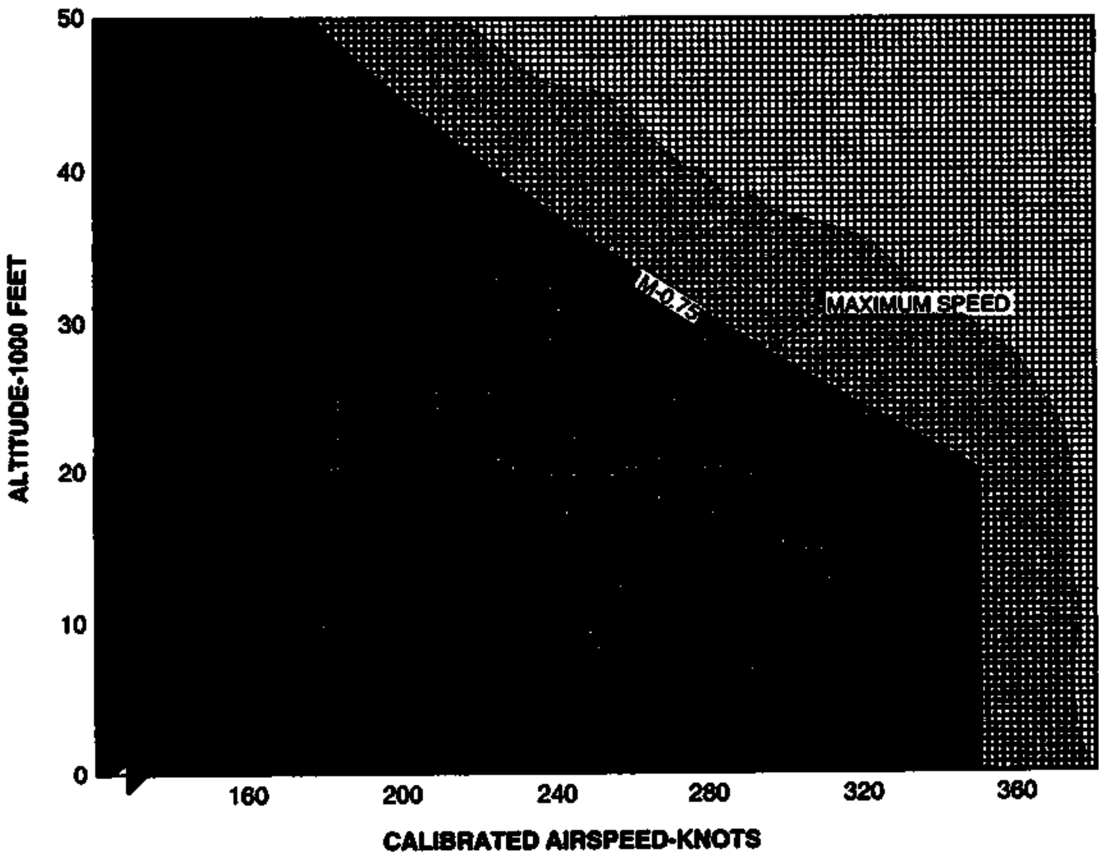
Figure 5-8.

MAXIMUM FLIGHT SPEED VS ALTITUDE CHART - SPOILERS EXTENDED

STANDARD DAY

NOTE

For operation in severe turbulence, do not exceed 270 KCAS or M = 0.75.
Refer to Section VII for recommended procedure.



MANEUVER LOAD FACTOR LIMITS ARE –1.0G TO 2.5G FOR GROSS WEIGHTS WITHIN AREA A OF FIGURE 5-3. LOAD FACTOR LIMITS ARE 0.0G TO 2.25G FOR GROSS WEIGHTS WITHIN AREA B OF FIGURE 5-3. OPERATION IN THIS AREA IS PERMISSIBLE IN MODERATE TURBULENCE.

PROHIBITED.

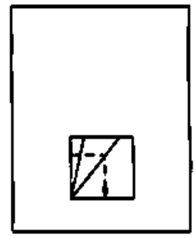
141B-1-X0/0-139

Figure 5-9.

MODEL: C-141B
TF33-P-7 ENGINES

DATE: FEBRUARY 1968
DATA BASIS: ESTIMATED

BRAKE LIMITS
MINIMUM BRAKE COOLING TIME



CAUTION ZONE
6 TO 18 MILLION FT-LB

1. If stop does not exceed 6 million ft-lbs, no special procedure is required.
2. If stop exceeds 6 million ft-lbs, delay subsequent take-off 8 minutes for each one million ft-lb in excess of 6 million.
3. If stop exceeds 6 million ft-lb and an immediate take-off is mandatory, there may not be sufficient brake energy to make a rejected take-off should it become necessary. If the take-off is made, the brakes should be cooled as prescribed in note 5 on sheet 3.

CAUTION ZONE
18 TO 27 MILLION FT-LB

1. Clear runway; do not set brakes.
2. Request fire fighting equipment. Hydraulic fluid fire and blown fuse plugs are possible.
3. Chock nose gear.
4. Evacuate aircraft by moving forward from the main crew entrance to avoid main wheels.
5. Leave immediate vicinity.
6. Do not approach aircraft for 3/4 hour.
7. Enter KE/Brake in Aircraft Forms.
8. Inspect for tire bead seat damage IAW TO 4T-1-3 and check for hydraulic leaks.
9. Delay subsequent take-off for 2 hours or until hand can be held on brake housings.

DANGER ZONE
OVER 27 MILLION FT-LB

1. Clear runway; do not set brakes.
2. Request fire fighting equipment. Hydraulic fluid fire and blown fuse plugs are imminent.
3. Chock nose gear.
4. Evacuate aircraft by moving forward from the main crew entrance to avoid main wheels.
5. Leave immediate vicinity.
6. Enter KE/Brake in Aircraft Forms.
7. After brakes have cooled, have inspected per TO 4B1-2-373.
8. Have tires removed and checked per TO 4T-1-3.

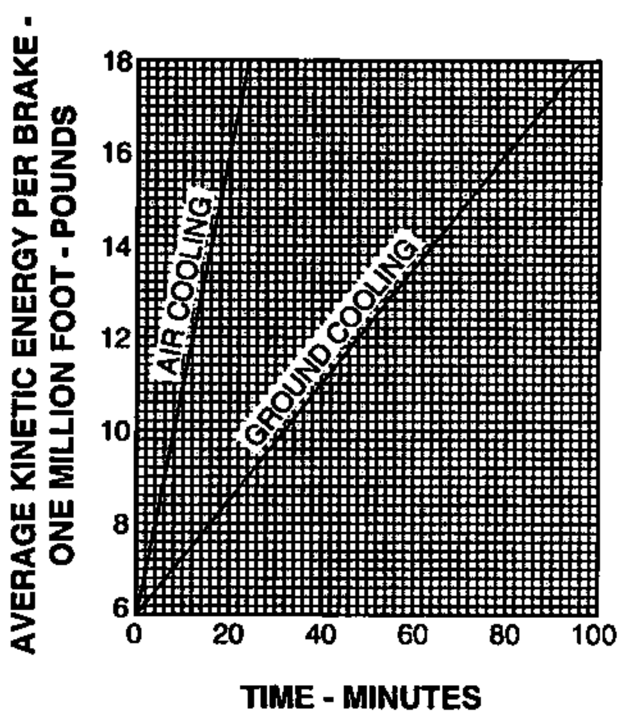
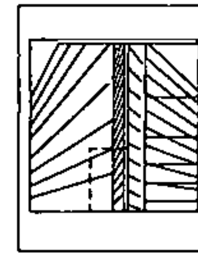


Figure 5-10. (Sheet 1 of 4)



MODEL: C-141B
TF33-P-7 ENGINES

DATE: JANUARY 1968
DATA BASIS: ESTIMATED

- DANGER ZONE (OVER 27 MILLION FT-LB)
- CAUTION ZONE (18 TO 27 MILLION FT-LB)
- CAUTION ZONE (6 TO 18 MILLION FT-LB)
- NORMAL ZONE (0 TO 6 MILLION FT-LB)

BRAKE LIMITS

ZERO FLAPS

NOTE

1. To obtain brake application speed: Subtract full value of headwind component; and full value, of tailwind component.
2. Spoilers deployed.
3. Maximum anti-skid braking.
4. Take-off cooling procedure: Make normal take-off. After lift-off, landing gear should remain extended for a cooling period equal to 2 minutes for each one million ft-lb in excess of 6 million ft-lb. Leaving gear in extended position for cooling results in reduced obstacle clearance capabilities.
5. Use actual number of brakes.

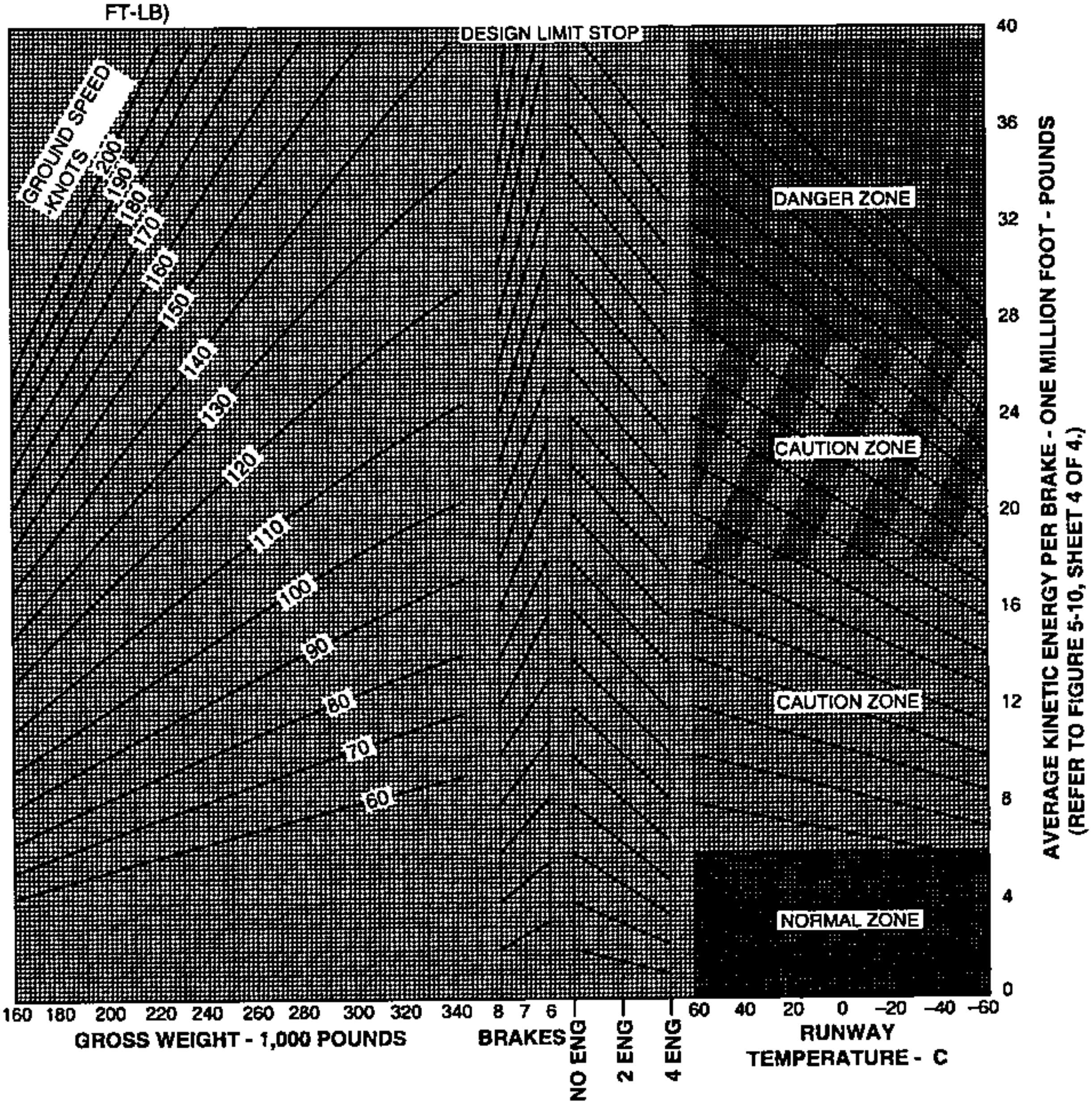
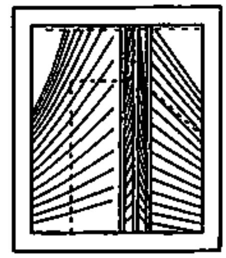


Figure 5-10. (Sheet 2 of 4)

MODEL: C-141B
TF33-P-7 ENGINES

DATE: FEBRUARY 1968
DATA BASIS: ESTIMATED

BRAKE LIMITS



NOTE

1. Flaps "take-off/approach" or "landing".
2. Spoilers deployed.
3. Maximum anti-skid braking.
4. To obtain brake application speed: Subtract full value of headwind component, add full value of tailwind component.
5. Take-off cooling procedure:
   (A) Make normal take-off
   (B) After lift-off, landing gear should remain extended for a cooling period equal to 2 minutes for each one million ft-lb in excess of 6 million ft-lb.
   (C) Leaving gear in extended position for cooling per (B) results in reduced obstacle clearance capabilities.
6. Use actual number of brakes.

DANGER ZONE (OVER 27 MILLION FT-LB)

CAUTION ZONE (18 TO 27 MILLION FT-LB)

CAUTION ZONE (6 TO 18 MILLION FT-LB)

NORMAL ZONE (0 TO 6 MILLION FT-LB)

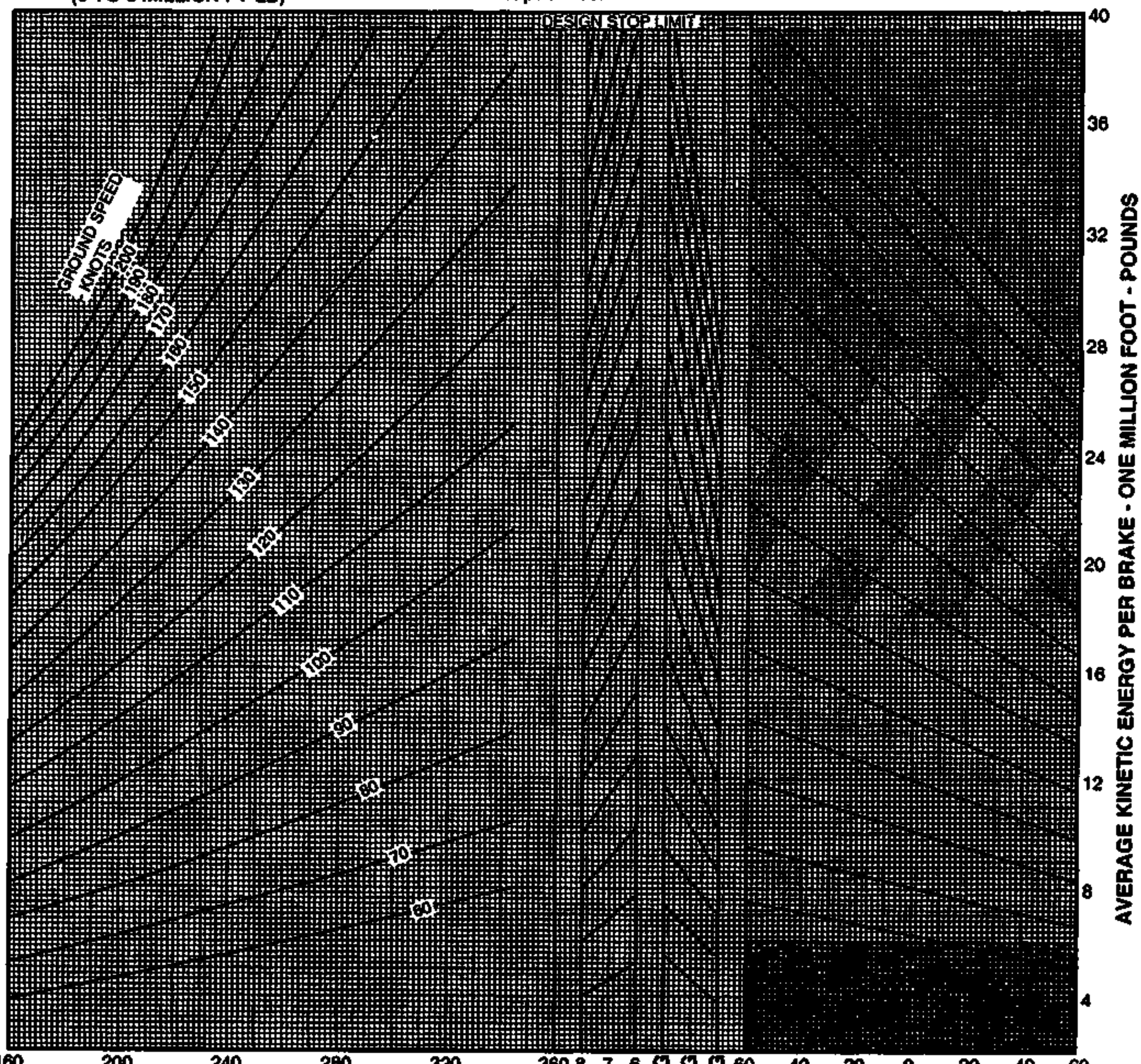
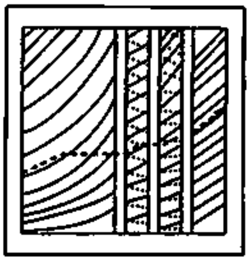


Figure 5-10. (Sheet 3 of 4)

BRAKE LIMITS



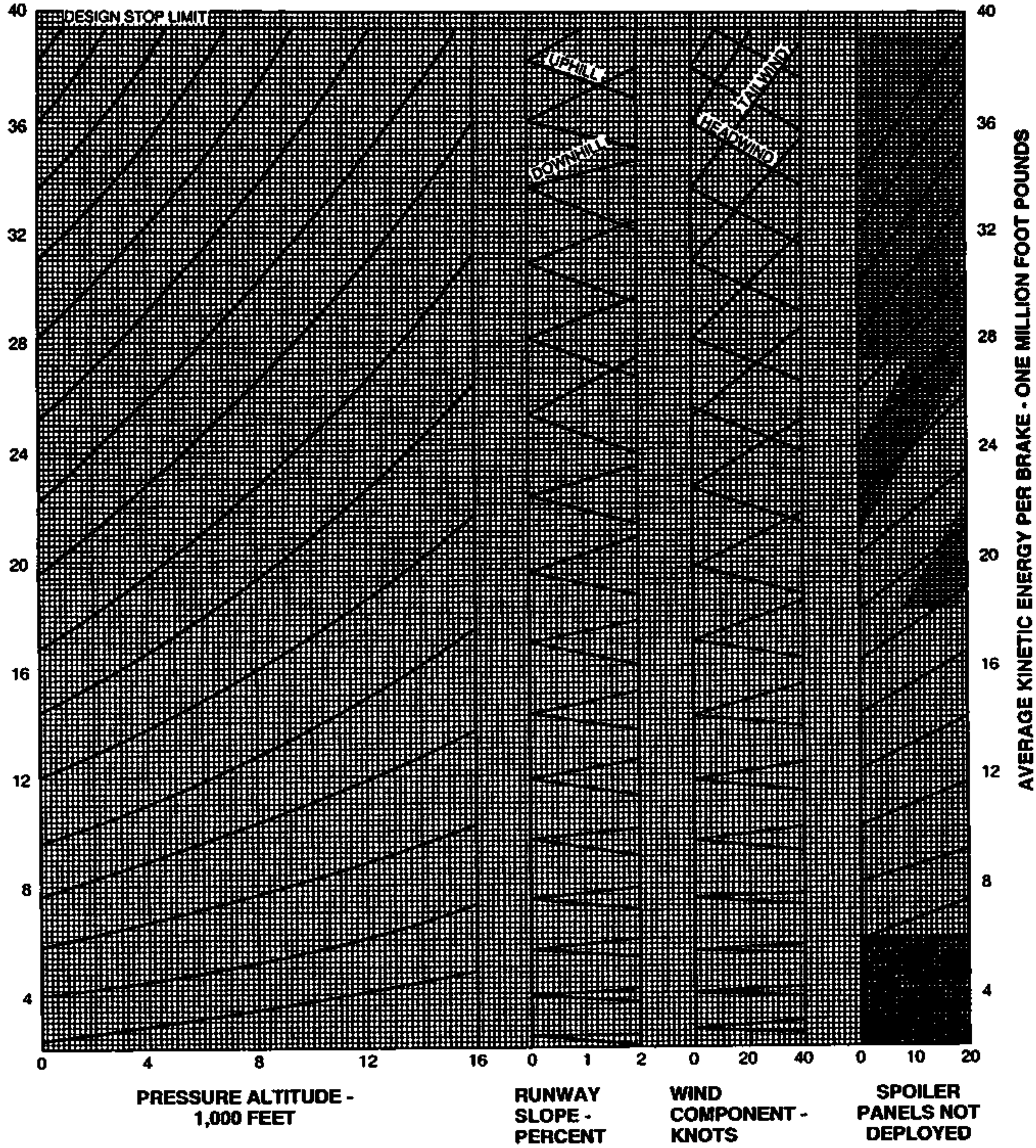


Figure 5-10. (Sheet 4 of 4)

MAXIMUM FLIGHT SPEED VS ALTITUDE CHART-CLEAN

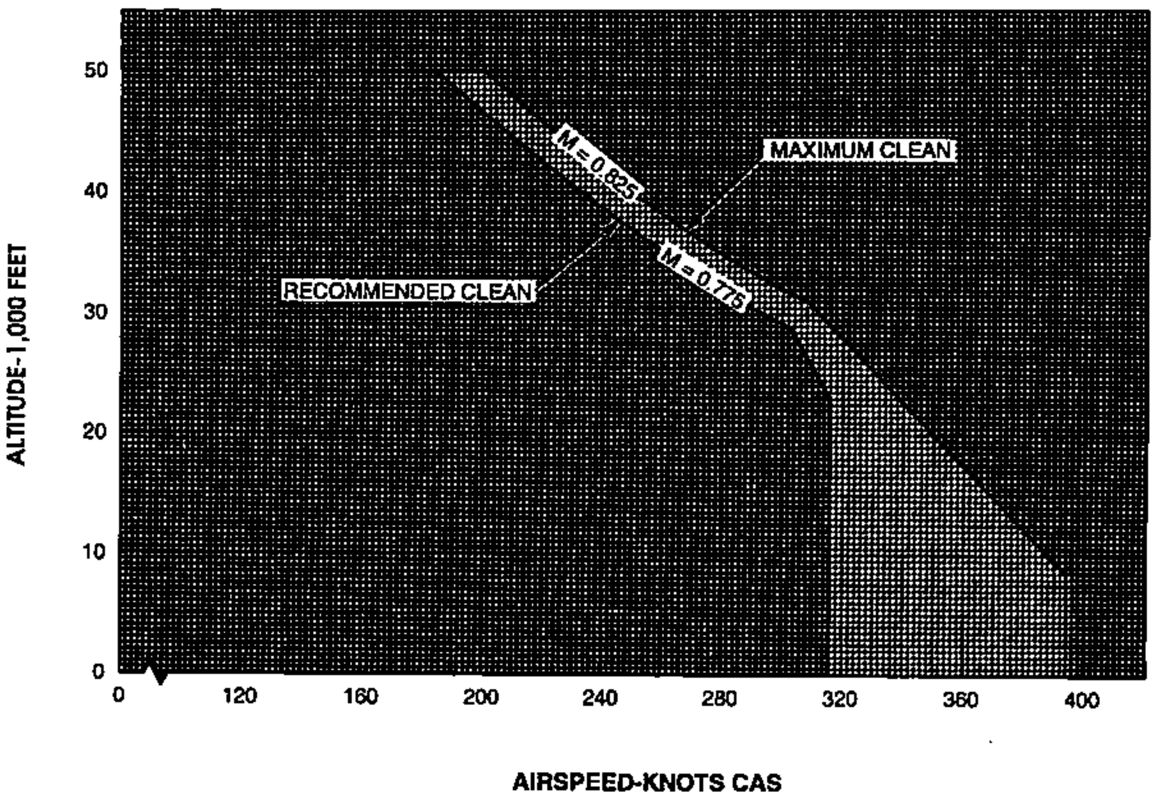
AF65-227 THRU 65-258 LOADED WITH THE SSCBM AND MINUTEMAN MISSILE/TRIDENT MISSILE STANDARD DAY

DATA BASIS: ESTIMATED

DATE: FEBRUARY 1966
C-141A
TF33-P-7

NOTE

IN THE CLEAN CONFIGURATION FOR OPERATION IN SEVERE TURBULENCE, DO NOT EXCEED. 250 KCAS TO 37,100 FT; M = 0.775 ABOVE



MANEUVER LOAD FACTOR LIMITS ARE 0.0G TO 2.25 G. OPERATION IN THIS AREA IS PERMISSIBLE IN MODERATE TURBULENCE.

NOT RECOMMENDED.

MANEUVER LOAD FACTOR LIMITS ARE 0.0G TO 2.25 G. OPERATION IN THIS AREA ABOVE THE RECOMMENDED SPEED LIMIT IS PERMISSIBLE IN MILD TURBULENCE, BUT MAY RESULT IN EXCESSIVE GUST LOADS IN MODERATE TO SEVERE TURBULENCE.

141A-1-X3/3-141

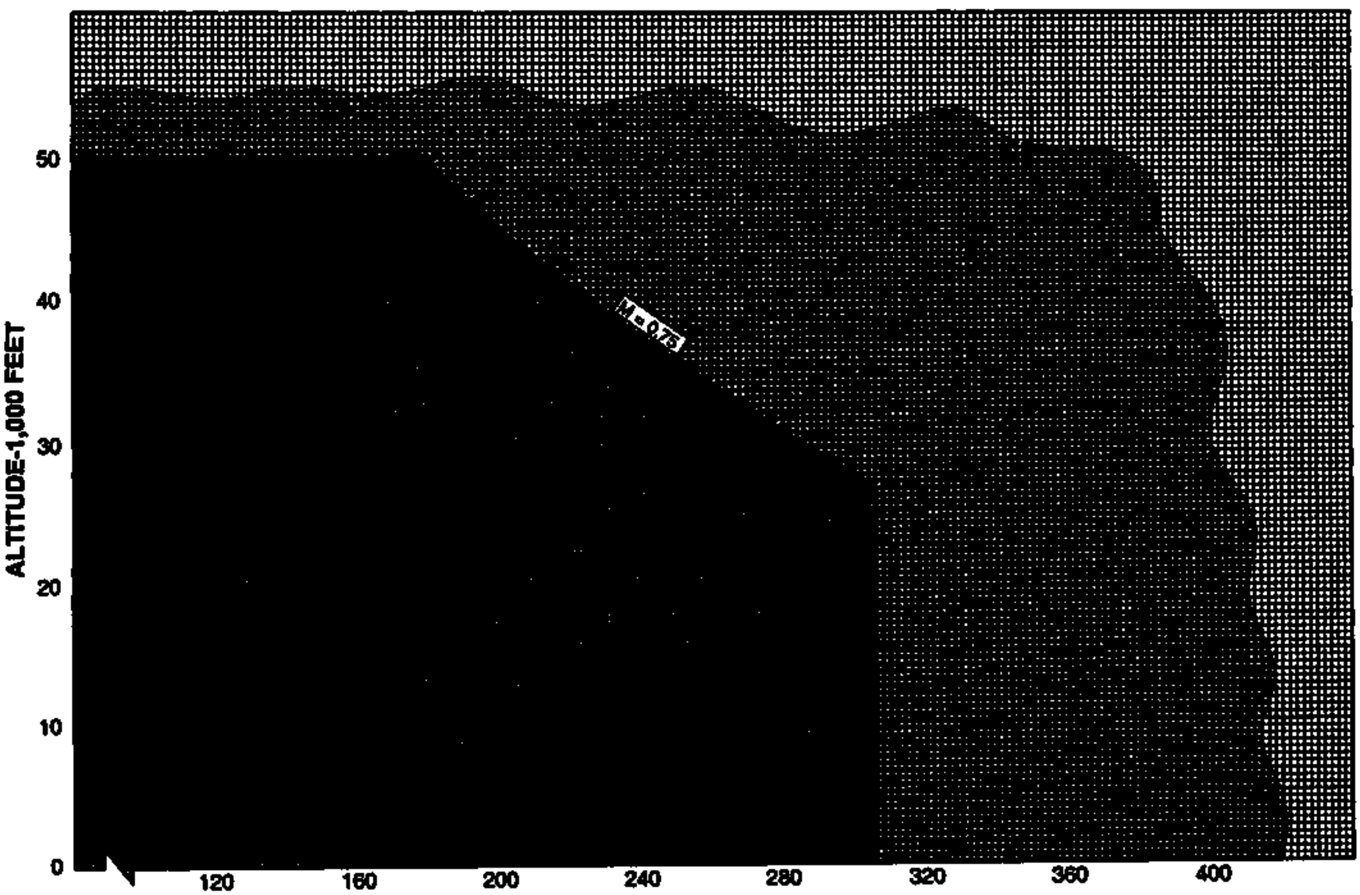
Figure 5-11.

MAXIMUM FLIGHT SPEED VS ALTITUDE CHART - SPOILERS EXTENDED

DATA BASIS: ESTIMATED

AF65-227 THRU 65-258 LOADED WITH THE SSCBM AND MINUTEMAN MISSILE/TRIDENT MISSILE STANDARD DAY

DATE: FEBRUARY 1966
C-141A
TF33-P-7



NOTE

IN THE SPOILER CONFIGURATION FOR OPERATION IN SEVERE TURBULENCE, DO NOT EXCEED 230 KCAS TO 39,100 FT: M = 0.75 ABOVE.

MANEUVER LOAD FACTOR LIMITS ARE 0.0G TO 2.25 G. OPERATION IN THIS AREA IS PERMISSIBLE IN MODERATE TURBULENCE.

NOT RECOMMENDED.

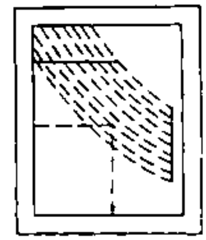
141A-1-X3/3-142

Figure 5-12.

MODEL: C-141B
TF33-P-7 ENGINES

DATE: OCTOBER 1968
DATA BASIS:
C-141A CATEGORY II
FLIGHT TEST

FLAP POSITION FOR AIRDROP OF CARGO



NOTE
1. This data provides at least a 30 percent margin above stall speed
2. This will give approximately 2° nose up deck angle.
3. Flap speed relationships during airdrop configuration must not exceed the following: 1

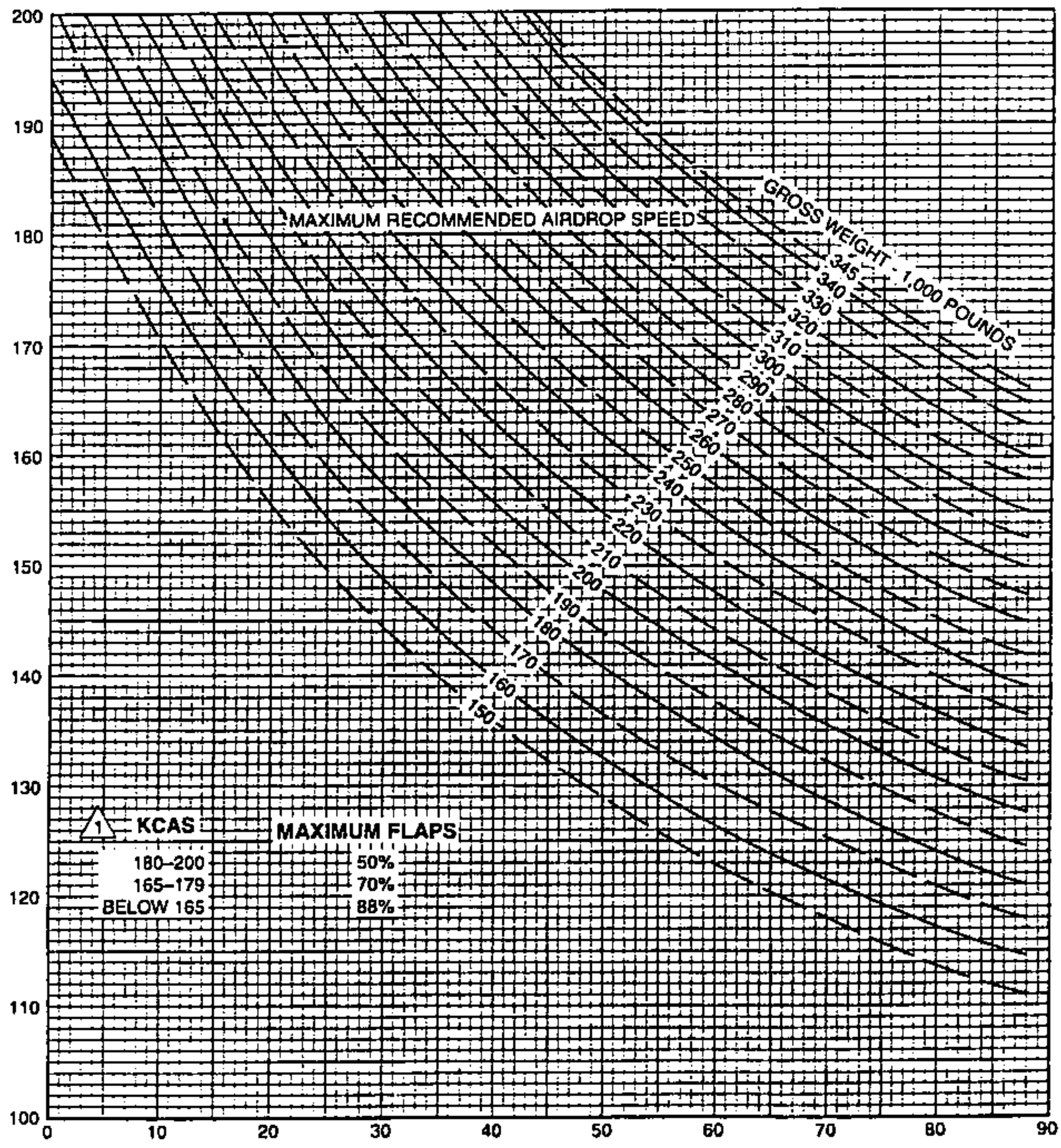
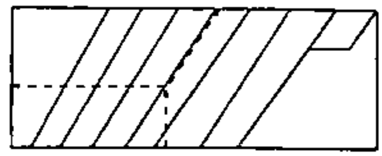


Figure 5-13. Flap Position for Airdrop of Cargo

OPERATING ENVELOPE FOR PARATROOP AIRDROP

DATA BASIS: FLIGHT TEST
DATE: AUGUST 1980
C-141B
TF33-A-7



NOTE

1. THE FLAP LIMIT LINES ON THE LEFT SIDE OF THE CHART REPRESENT THE SPEEDS FOR THE ASSOCIATED GROSS WEIGHTS THAT WILL GIVE A DECK ANGLE OF APPROXIMATELY 0°.

2. THE FLAP LIMIT LINES ON THE RIGHT SIDE OF THE CHART REPRESENT THE SPEEDS FOR THE ASSOCIATED GROSS WEIGHTS THAT WILL NEVER BE LESS THAN 1.3V STALL THESE SPEEDS WILL GIVE A NOSE UP ANGLE OF APPROXIMATELY 3° TO 3 1/2°.

3. 0° TO 3° LINES ARE BASED ON 75% FLAPS. 3° TO 3 1/2° WILL REQUIRE AN INTERMITTENT FLAP SETTING UP TO THE 90% FLAP LIMIT.

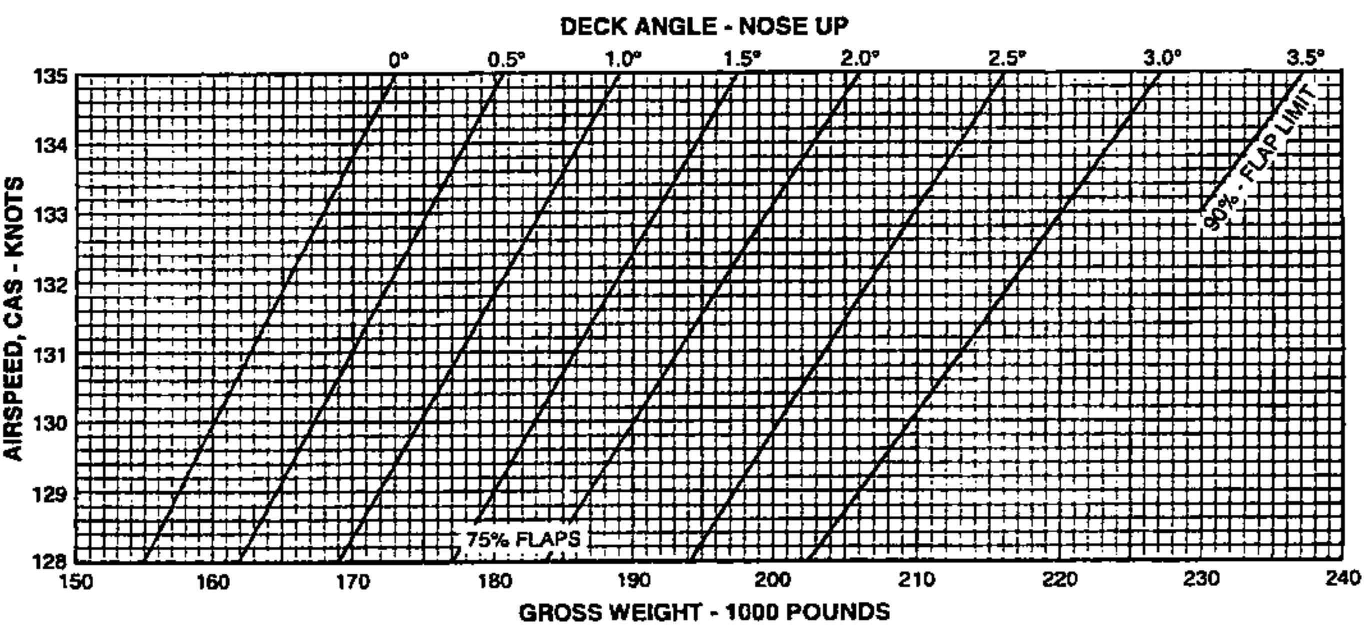


Figure 5-14. Operating Envelope for Paratroop Airdrop

SECTION VI
FLIGHT CHARACTERISTICS
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	6-1
STALLS	6-1
WAKE TURBULENCE	6-2
SPINS	6-2
DUTCH ROLL	6-2
BUFFET BOUNDARY	6-3
FLIGHT CHARACTERISTICS	6-3
UNCOMMANDED YAWING MOTIONS (SMALL)	6-3
LATERAL CONTROL	6-3
FLIGHT CHARACTERISTICS WITH SPOILERS	6-3
FLIGHT CHARACTERISTICS - AILERON TAB LOCKOUT SYSTEM	6-3
FLIGHT CHARACTERISTICS - FREE-FLOATING STABILIZER	6-4
FLIGHT CHARACTERISTICS - RUNAWAY TRIM	6-4

INTRODUCTION.

The aircraft is designed for high-speed, high altitude flight. A satisfactory level of stability and control is experienced throughout the airspeed and altitude range. Aerobatic flight is prohibited.

STALLS.

Refer to TO 1C-141B-1-1 for stall speed charts.

STALL CHARACTERISTICS.

During an approach to a straight flight stall, light buffet onset will be encountered prior to stick shaker actuation. At the angle of attack for buffet onset, lateral control is adequate. Without the wing vortex generators, the initial stall of the wing is an airflow separation over the upper surface between the pylons. At angles of attack for shaker stall warning and greater, the loss of lift is not always symmetrical on both wings; therefore, the ability to maintain wings level becomes more difficult since roll control is less effective. Use of rudder will aggravate this lateral control problem and may result in a large bank upset during recovery. Timely use of aileron control after buffet or shaker onset will prevent excessive roll excursions.

In turning-flight stalls, the aircraft exhibits a natural tendency to roll out of the turn at the stick shaker onset point. If this tendency is resisted or the turn tightened, the aircraft will show a tendency to roll under with an increase in buffet level. This tendency is best corrected by applying roll control and rolling out of the turn during recovery of airspeed.

WARNING

Do not tighten a turn or resist the aircraft tendency to roll to wings level when an inadvertent turning flight stall is encountered.

STALL WARNING.

Shaker onset has been demonstrated to occur at speeds ranging from 2 knots to as high as 24 knots above calculated stall speed at altitudes of 10,000 to 12,000 feet and 24,000 to 26,000 feet. At 33,000 to 35,000 feet, shaker onset has been demonstrated to occur at speeds ranging from 15 to 33 knots above calculated stall speed. The speed at which shaker onset occurs is influenced by gear and flaps, gross weight, and center of gravity. For a given configuration, the number of knots above calculated stall speed at which shaker onset occurs will increase as the calculated stall speed increases. Insufficient flight data exists to plot onset curves.

PRACTICE STALLS.

Intentional stalls are strictly prohibited. Approach to stalls may be practiced during training to the stick shaker onset point under the supervision of an instructor pilot. When practice approach to stalls are undertaken, the aircraft should be trimmed at 1.4 times the computed stall speed for the aircraft configuration. Once the trim has been established, this setting should not be changed. Practice approach to stalls should be accomplished at idle or with small amounts of power. Deceleration during the approach to stall should be gradual (approximately one knot per second) until the stick shaker activates.

High altitude practice approach to stalls may be practiced from the cruise configurations only. The approach to stall should be accomplished in turning flight from speeds above Mach 0.55. The speed should be decreased steadily at one knot per sec. until shaker has actuated.

CAUTION

Practice approach to stalls will not be accomplished unless both Stall Warning systems are operable. The pilot should not carry the stall beyond a point of heavy aircraft buffet in case the stall warning system fails to operate properly.

STALL RECOVERY.

The stall recovery on the C-141 is conventional for this type of airplane. At stick shaker onset, the relaxation of the elevator or a moderate push on the control column accompanied by an increase in engine thrust will produce a recovery with minimum loss of altitude. Ailerons should be used for lateral control during recovery. Use of rudder will delay recovery and could produce large bank angle upsets.

WAKE TURBULENCE.

Every aircraft generates wake turbulence in-flight. Wingtip vortices are the most hazardous component of this wake. A wingtip vortex is a highly rotational mass of disturbed high energy air created by an airfoil as it produces lift. The strength of the vortex is governed by the angle of attack and shape of the aircraft wing. The greatest vortex occurs when the generating aircraft is HEAVY, CLEAN, and SLOW, i.e., high angles of attack. If an aircraft encounters wake turbulence, induced rolling moments caused by the wingtip vortex can roll the airplane sharply, and may exceed flight control authority. In this situation, aileron input alone may not be sufficient for recovery. A timely application of power and coordinated flight control inputs may be necessary to escape the severe upward and downward forces.

WAKE TURBULENCE AVOIDANCE PROCEDURES.

Avoid the area below and behind the generating aircraft, especially at low altitude where even a momentary wake encounter can be hazardous. In all phases of flight, pilots should consider the wake turbulence generated by their aircraft or preceding aircraft and plan or adjust their flight paths to minimize wake turbulence exposure to their own aircraft or wingmen. The amount of flight control input and the amount of time required to recover will depend on the severity of the wake turbulence encountered. At the first indication of encountering wake turbulence take immediate steps to recover:

1. Immediately apply power.
2. Pull up using elevator control, then apply rudder and aileron inputs.
3. When out of wake turbulence, normal flight control authority will be regained enabling complete recovery of aircraft control.

SPINS.

Spins are a prohibited maneuver. If a spin is entered accidentally, a normal recovery should be effective.

Reduce power to idle, apply full rudder (opposite to needle indication on the turn and slip indicator) and ailerons against the spin. Without changing the trim setting of the horizontal stabilizer, hold elevator control forward of the neutral position. When rotation stops, immediately return rudder and aileron to neutral. Perform dive recovery.

CAUTION

Excessive aircraft structural loads or a secondary stall may result from an abrupt pullout during dive recovery.

DUTCH ROLL.

Dutch Roll is a combination of yawing and rolling motion that is characteristic of sweptwing aircraft. These yawing and rolling motions are interrelated, in that the Dutch Roll cannot exist without both roll and yaw. Large rolling/yawing motions may become dangerous unless properly dampened. The Dutch Roll in this aircraft can be stable, neutral, or unstable and is a function of gross weight, altitude, and airspeed. The Dutch Roll oscillations are less stable with increased altitude, increased weight, and low airspeed.

Dutch Roll can be induced by turbulence, aileron inputs, rudder inputs, or any combination of these conditions.

DUTCH ROLL RECOVERY PROCEDURES.

The primary means of stopping Dutch Roll is the yaw damper. In addition, the autopilot lateral axis will dampen the Dutch Roll under all conditions.

Manual recovery is accomplished with aileron control inputs. The yawing and rolling motion of the Dutch Roll is interrelated but the rolling motion is more noticeable. Stopping the rolling motion with ailerons will also dampen the yawing motion. The period of the Dutch Roll is approximately 5 to 7 seconds; therefore, the initial pilot action is to analyze the rolling motion. The rolling motion of the Dutch Roll will reverse direction every 3 to 4 seconds. The rolling motion to the left requires right aileron, and conversely a rolling motion to the right requires left aileron. Maintain a wings-level flight attitude.

WARNING

The use of rudders either singly or in conjunction with aileron to dampen the Dutch Roll is difficult and should not be attempted. There is a high probability of aggravating the Dutch Roll condition.

The Dutch Roll is well damped at all altitudes and gross weights at 0.79 Mach and above. Increasing the Mach number to 0.79 - 0.80 by accelerating/descending will dampen the Dutch Roll with no lateral directional control inputs; however, increasing airspeed with large yaw/Dutch Roll oscillations may cause aircraft structural damage.

BUFFET BOUNDARY.

At speeds in excess of Mach 0.85 with wings level, buffet intensity is such that deliberate operation is not recommended. It is possible to fly fast enough to cause a progressive airflow separation over the wing which results in aircraft buffet. At speeds above 0.84 Mach, natural aircraft buffet is experienced at all altitude and gross weight conditions with wings level. As bank angle is introduced, buffet onset occurs at proportionally lower Mach numbers as shown on the Buffet Boundary Limitation chart, figure 1-13 in TO 1C-141B-1-1.

FLIGHT CHARACTERISTICS.

The range between slow-speed and high-speed flight is unusually large, but stability and control are normal for any trimmed condition.

UNCOMMANDED YAWING MOTIONS (SMALL).

The C-141C exhibits small yawing motions at speeds greater than 200 KCAS. These motions are characterized primarily by their small (barely noticeable) magnitude and, because of the small magnitude, affect neither the handling characteristics nor the flight path of the aircraft. These motions are an inherent aerodynamic characteristics of the airframe and are not associated with any of the control systems of the aircraft, either automatic or manual.

These motions are not continuous yawing oscillations. They are small changes in the yaw angle of the aircraft. The change is about one degree. The new yaw angle is held steady for a time ranging from several seconds to several minutes, then abruptly releases. It may repeat in several seconds or may not repeat for 15 or 20 minutes. Extensive flight tests have shown this phenomenon to be more prevalent at altitudes below FL200 but it has occurred at all altitudes. Some aircraft may not exhibit this characteristic on every flight and some may not exhibit it at all.

LATERAL CONTROL.

Intentional operation in the speed range between 380 and 410 KCAS is not recommended since a substantial reduction in aileron control effectiveness is experienced. Positive lateral control is still available with full aileron control deflection; partial aileron control deflections may be ineffective. An increased roll rate will be obtained if full rudder, as well as full aileron, is utilized to recover from large lateral upsets at these high speeds.

During recovery from high speed upsets at speeds approaching maximum, a loss of aileron effectiveness will be noted. If this should occur, full aileron throw will provide a positive roll rate. The rudder is an effective roll control device at these high speeds and must be properly coordinated to obtain adequate roll response. An increased roll rate will be obtained if full rudder, as well as aileron, is used to recover from large lateral upsets at high speeds. When operating at maximum speeds, positive pilot input to the rudder should be used when lateral correction is required, thus overcoming opposite yaw created by momentary yaw damper operation.

FLIGHT CHARACTERISTICS WITH SPOILERS.

Spoiler deployment results in wing buffeting and pitch up tendency. The spoilers should be deployed or retracted slowly while in-flight to prevent sudden upsets from trimmed condition. Rapid spoiler retraction during recovery from a trimmed high speed descent will considerably increase the pilot effort due to pitch down tendency.

The minimum allowable speed with spoilers deployed can be determined using the appropriate figure in TO 1C-141B-1-1. An audible and visual under spoiler speed indication will occur at this minimum speed. If this warning should occur, retract the spoilers or increase speed immediately.

WARNING

Do not intentionally accelerate into a stall with spoilers extended. The spoiler under speed warning system may not provide adequate warning when accelerating into a stall.

FLIGHT CHARACTERISTICS - AILERON TAB LOCKOUT SYSTEM.

The aileron tab lockout system provides a backup source of lateral control should an aileron lose hydraulic power. Roll rate is significantly reduced in this configuration and response time is increased.

WARNING

Level flight can be maintained using the aileron tabs, but the landing capability during gusting or crosswind conditions is unknown but probably hazardous. Therefore, the aileron tab lockout system is not to be used for landing except in emergency conditions.

NOTE

Considerably more force will be necessary to maintain wings level flight when only one aileron is placed in tab operable.

FLIGHT CHARACTERISTICS - FREE-FLOATING STABILIZER.

A free-floating stabilizer will move in a direction opposite to the elevator deflection. Airplane nose-up elevator causes the stabilizer to move airplane nose down and conversely, due to aerodynamic loading aft of the hinge point.

FLIGHT CHARACTERISTICS - RUNAWAY TRIM.

With gear down, TAKE OFF/APPROACH flaps, and the center of gravity not more aft than 25 percent, the elevator deflection available will control a full nose-up runaway and produce a trim speed of 1.2 Vs, with wings level. At 1.2 Vs, bank angles up to 35 degrees can be used to reduce control forces without encountering stall buffet or shaker onset. At speeds less than 1.2 Vs, with wings level, the control forces will be lower but if bank angle is used it must be proportionately reduced at the lower speeds to avoid stall buffet/shaker onset. As the center of gravity moves aft of 25 percent MAC, increasing the bank angle will be required to stop the pitchup; use of bottom rudder in the bank will also aid in lowering the nose. Extending the flaps to the landing position will reduce the out-of-trim condition and required control force.

SECTION VII
ADVERSE WEATHER OPERATIONS
TABLE OF CONTENTS

TEXT	PAGE
INTRODUCTION	7-1
WEATHER INTERPRETATION AND AVOIDANCE	7-1
TURBULENCE AND THUNDERSTORMS	7-5
WIND SHEAR	7-6
MICROBURST	7-6
ICING AND COLD WEATHER OPERATIONS	7-7
RAIN AND HYDROPLANING	7-12
HOT WEATHER AND DESERT OPERATIONS	7-13
NIGHT FLYING	7-14

ITEM	FIG	PAGE
WEATHER RADAR DISPLAY, NAV'S POSITION	7-1	7-15
MFD DISPLAYS	7-2	7-16

INTRODUCTION.

This section contains only those procedures that are in addition to the normal operating instructions contained in Section II and emergency procedures in Section III, except where repetition is necessary for emphasis, clarity, or continuity of thought. Section II provides the procedures for normal instrument flight.

WEATHER INTERPRETATION AND AVOIDANCE.

The AN/APS-133 radar set provides information which can be used to recognize and avoid areas of turbulence associated with storms and heavy precipitation. The primary use of this radar set is to aid the pilot in avoidance of, rather than penetration of, weather associated turbulence.

WEATHER PRESENTATION.

The weather radar detects and displays precipitation as three separate colors: red, yellow, and green. Alphanumerics, fixed range markers, and azimuth cursors are automatically generated and displayed in blue. Figure 7-1 shows typical displays.

Color Significance.

When the radar set function selector switch is in the "WX" position and the GAIN control is in "AUTO", the sensitivity time control (STC) is activated. This normalizes the display out to approximately 80 nautical miles (NM) so that the red, green, and yellow represent three distinct precipitation levels.

1. The red areas represent a contour or storm cell area equivalent to a rainfall rate of greater than 12mm of rain per hour. This is the strongest of the three levels of echoes and indicates the hard core of the thunderstorm. Severe turbulence in this and adjacent areas is capable of destroying an aircraft. The red areas should always be avoided.

2. The yellow areas represent intermediate level (equivalent to 4 to 12mm of rainfall per hour) of echo being received. Turbulence associated with this level should be considered severe and, therefore, should also be avoided.

3. The green areas represent the lowest level of echo strength being received (equivalent to I to 4 mm of rainfall per hour). Though lower in rainfall level, severe turbulence could be expected in these areas and they should also be avoided.

Precipitation Gradients.

Precipitation gradients are as important as the precipitation levels within the storm area. Thin yellow and/or green bands adjacent to red areas indicate a sharp gradient from no precipitation (blank scope) to heaviest precipitation (red). Areas near such narrow storm edges are usually associated with more severe turbulence. Therefore, these areas should always be avoided.

Storm Growth.

It is important to remember that the red, yellow, and green accurately show true precipitation levels only within the STC range (to approximately 80 NM). The echo returns from even heavy precipitation at long ranges may be too weak to be displayed in red or yellow. Therefore, a storm at long range may initially be displayed as a small area of green which is actually the core of the storm. As the range decreases and the echo strength increases, the green may increase in size with the center changing to yellow or red surrounded by yellow. Therefore, any weather detected at ranges beyond 100 NM is probably much larger and more severe than initially presented.

WEATHER PATTERNS.

The shape of the storm display, particularly the patterns, that appear along the edges, is as significant as the precipitation levels and gradients. These patterns include scalloped edges, protrusions from the main mass, and indentations into the main mass. Certain combinations of shapes and patterns seem to be associated with specific types of storms. These patterns may appear quite suddenly along any edge of the storm display, singly or in various combinations. The intensity (color level) and shape may also change rapidly, sometimes in a single scan. Therefore, careful monitoring of the weather display is essential.

Hail.

Hail shafts have been associated with four different storm shapes:

1. U-shaped indentations
2. Thin, protruding fingers
3. Scalloped edges on the storm outline
4. Hooks

It must be noted that weak or intermittent projections are not normally associated with hail; however, such echoes should be watched closely for signs of rapid intensification. The shorter ranges (25 or 50 miles) are generally best for hail detection, and with occasional up-tilt to check for fresh hail fall from above, good results are obtained.

Tornadoes.

There is not yet a positive method of detecting tornadoes with airborne radar. However, evidence collected to date indicates that tornadoes may be present if the following are observed:

1. A hook-shaped pendant which may be 5 or more miles long and in the general shape of the numeral "6" strongly suggests the presence of a major tornado, especially if the pendant is red or yellow and projects from the southwest quadrant of a major thunderstorm moving eastward. The pendant may be lost in ground clutter when viewed on the scope and in some cases might not be much more than a blunt projection or scallop at the edge of the parent thunderstorm echo.

2. A crescent-shaped indentation on the side of a major thunderstorm echo 3 to 7 miles long is another possible identifier of an active or potential tornado in the vicinity.

The best procedure is to make wider than usual detours around sharp-edged thunderstorms and especially those which show projections or crescent shaped indentations.

Snow.

Dry snowfall has not been detected with any success on weather radar. However, under the right atmospheric conditions, certain patterns of green (lowest level) returns can indicate the presence of moderate to heavy wet snow. Such echoes are not readily obvious and require experience with the display before they can be readily identified.

Icing.

There is no reason to believe that radar will be of assistance in locating areas of heavy icing conditions. Under a given set of conditions, with ideal temperatures for the formation of aircraft icing, weather radar has not yet proved its ability to distinguish between supercooled water droplets and ice crystals, since both are usually quite small. Needless to say, the operational problem in each case would be different. In the first case, an icing hazard would definitely exist but in the second case the pure crystals would offer no danger.

1. It should be remembered, however, that supercooled water and ice crystals can coexist. In each case the radar echo would be small or even nil due to the minute size of the free water particles. At this time, it appears fairly certain that radar is not going to give warning of cloud icing unless it happens to be involved with active precipitation at the time. Where precipitation is occurring, however, the areas of maximum ice exposure would appear as the lightest shade.

2. An icing condition that radar might possibly detect is the intermittent moderate or heavy icing condition associated with unstable air lifted by frontal action or orographic effects. In this situation the cumulus cells are hidden by surrounding cloud layer but could be spotted by radar. This

would be of assistance in avoiding the moderate to heavy icing which occasionally occurs in cumulus clouds.

Lightning and Static.

Lightning and static discharges could scatter the display momentarily. However, the general presentation is unaffected and returns to normal within one scan.

AVOIDANCE ROUTES.

The following information should be considered when planning routes to avoid severe weather.

Plan Early.

The weather radar detects and displays only areas of precipitation, not turbulence. Storm associated turbulence can extend several thousand feet above the precipitation areas and outward more than 20 miles. Therefore, simply skirting the edge of a storm cell is not sufficient. A wide margin should be allowed around all storm cells. Also, storm cells at long range may be displayed at lower than actual intensity. Any storm cell detected at ranges beyond 100 miles will likely be severe enough to require avoidance. Planning for storm avoidance early will allow an efficient flight path and prevent sharp doglegs.

Allow Sufficient Clearance.

Because severe turbulence can extend up to 20 miles from a storm cell, the avoidance path should not include flight between cells separated by less than 40 miles. Remember, this is 40 miles between outer fringes of adjacent storm areas, not 40 miles between centers.

Allow for Wind.

Storm cells will be moving downwind. Also, severe weather is much more likely to occur on, and extend farther from, the downwind edge of a storm. Therefore, the avoidance path should be planned for the upwind edge of a storm. If the avoidance path must be downwind, be sure that wind effect is included in planning.

OPERATION PRIOR TO DEPARTURE.

Prior to departing the airport, the weather radar should be checked for proper operation. Then the weather pattern in the airport vicinity can be checked.

WARNING

Before placing function selector switch in "WX", "MAP 1", "MAP 2", or "BCN" position, make sure all personnel are clear of the antenna radiation hazard area (figure 2-3). Avoid directing the beam toward inhabited structures, personnel, or areas where aircraft are being refueled/defueled.

Radar Set Test.

To test the radar set, adjust the ANT TILT control for 0 degrees, set the function selector switch to "TEST", and set the range selector on the radar indicator to "150." When the three-minute initial warmup delay has expired, a test pattern should be displayed (figure 7-1). Confirmation of the test pattern display indicates a functional radar set. Discrepancies from normal pattern (figure 7-1) or lighting of either the ANT or RT fault lamps indicates a system fault. After verifying proper TEST operation, place function selector switch to "OFF".

NOTE

The radar set may safely be operated in TEST regardless of proximity to personnel or hazard areas because in TEST position the transmitter energy is fed to the system dummy load and no energy is radiated from the antenna.

Confidence Check.

The radar confidence check is performed by displaying ground echoes to ensure the radar is operational. This can be done by selecting the 5NM range and WX function with downward antenna tilt until ground echoes appear on the top of the display. Observe radar antenna radiation hazard areas (figure 2-3).

Weather Check.

To check weather patterns in the airport vicinity, set function selector switch to "WX" and range as desired, normally 25 NM. Then slowly adjust antenna tilt from 0 degrees to +14 degrees and back to 5 to 7 degrees nose up while observing display. If any weather formations are detected during this scan, adjust ANT TILT control to provide best presentation. This will provide information to plan weather avoidance prior to take-off. During level flight, readjust ANT TILT to approximately 0 degrees. At altitudes above 20,000 feet, a slight down (DN) tilt will be required.

ENROUTE OPERATION.

The following information will aid in detection and avoidance of enroute weather.

Tilt Control.

Proper management of the ANT TILT control is one of the most important considerations in the operation of the weather radar. An improper tilt setting can result in valuable information not being displayed.

Early Detection.

The following sequence will ensure early detection of enroute weather:

1. Upon reaching cruise altitude, place range selector to 300.

2. Adjust ANT TILT control until a solid band of ground targets are displayed.

3. Slowly increase ANT TILT control setting until ground returns just disappear.

NOTE

This establishes the line-of-sight range to the radar horizon which varies with altitude as shown on the following chart. Additional adjustments of ANT TILT control will be required to examine the vertical profile of weather cells. Adjust ANT TILT control in increments of approximately 1/2 degree and wait for one full azimuth scan after each adjustment.

ALTITUDE (FEET)	LINE-OF-SIGHT RANGE (NM)
5,000	70
10,000	100
15,000	122
20,000	141
25,000	158
30,000	173
35,000	187
40,000	200

4. If a target is detected at or beyond the line-of-sight range, the chances are good that it is a weather target.

5. Any storm cells detected beyond 75 NM are areas of substantial rainfall; do not wait for full contouring. Plan and execute evasive action quickly to minimize "doglegging."

CAUTION

If a complete detour is impractical and penetration is required, avoid adjacent cells by at least 20 miles.

Separation of Targets.

One of the most difficult tasks when using airborne weather radar is separating weather targets from ground targets. This is especially true because the maximum return from a storm cell occurs when the radiated beam is centered on the rainfall shaft. In many cases, this shaft may be no higher than 5,000 feet and some degree of antenna down tilt will be required to observe the shaft. This down tilt will cause the radiated beam to intersect the ground, thus masking the storm cloud with ground returns. Proper adjustment of the ANT TILT control will assist in target separation.

NOTE

Significant weather will show at a higher color than ground returns at shallow tilt angles. Weather targets will show as a continuous and regular mass, while mountains will show as rougher masses with gaps behind the peaks. Raising the antenna tilt will cause the weather target to separate from ground returns. The displayed range of the ground returns will increase as the tilt is raised.

Target Resolution.

Target resolution defines the ability of a radar set to display two closely spaced targets as separate returns on the indicator scope. Resolution is limited in range by a combination of transmitted pulse width and display range and in azimuth primarily by antenna beam width.

Range Resolution.

The radar set transmits a 5.0-microsecond pulse in WX and 0.5-microsecond in MAP. Therefore, the minimum range resolution is 0.4 NM in WX and 0.04 NM in MAP. However, the range resolution of the radar indicator is 1/256 times the display range. Therefore, the combined range resolution is as listed in the following chart. Targets must be separated by at least the range listed to be displayed as two targets. Also, weather cells or bodies of water such as rivers or lakes must be at least that wide for the system to resolve them in range.

DISPLAY RANGE	RESOLUTION	
	WX	MAP
5	0.4	0.02
25	0.4	0.1
50	0.4	0.2
150	0.6	0.6
300	1.2	1.2

Azimuth Resolution.

The antenna beam is 2.9 degrees wide in azimuth. Therefore, targets must be separated by at least this angle to be resolved. The width of the beam in nautical miles is a function of range to the target, as listed in the following chart. Targets separated by less than the beam width (at target distance) will appear as one target on the indicator.

TARGET RANGE (NM)	BEAM WIDTH (NM)
5	0.25
10	0.5
25	1.25
50	2.5
100	5.0
200	10.0
300	15.0

TURBULENCE AND THUNDERSTORMS.

When weather conditions indicate a likelihood of encountering turbulence, or when flight through moderate to severe turbulence becomes necessary, the following procedures shall be followed.

WARNING

Flight through thunderstorms, cumulonimbus clouds, or other conditions of extreme turbulence must be avoided whenever possible.

CAUTION

The CONTINUOUS IGNITION switch shall be "ON" for flight in known or anticipated turbulent air.

1. AIRSPEED. Use 260 KCAS or 0.74 Mach, whichever is lower, when operating above 15,000 feet. Use 230 KCAS to 250 KCAS when operating at or below 15,000 feet. Do not exceed 270 KCAS or 0.825 Mach for operation in severe turbulence.

2. ALTITUDE. The maximum cruise altitude should be one flight level (4,000 feet) below the 300 fpm cruise ceiling for penetrating moderate to severe turbulence.

NOTE

A reduction in altitude has an appreciable effect on improving buffet and controllability margins. Where there is any doubt as to controllability, altitude reductions greater than 4,000 feet should be carefully considered.

3. TRIM. Trim the airplane to zero stick force for the penetration altitude and airspeed. This trim setting should not be changed once it is set. Retrimming the aircraft to maintain attitude could produce an excessive nose low/high condition that could cause severe pitch changes when opposite direction vertical drafts are encountered. If turbulence is encountered before penetration speed can be established, the method below should be used.

4. ATTITUDE. Concentrate on the attitude indicator as the primary control reference. Do not attempt to control attitude by reference to airspeed, altimeter, or vertical velocity, since these instruments may give false and misleading information on pitch attitude. Do not attempt to maintain pitch attitude rigidly. For level flight at turbulent air penetration speed, the pitch attitude will normally be between zero to two degrees nose up. In a climb, it will obviously be higher, and in a descent, lower. Whatever the nominal value is, attempt to remain within ± 10 degrees pitch attitude rather than trying to hold an absolutely constant attitude. Allow the aircraft to "ride with the gusts", assisting with elevator inputs as necessary to keep the attitude within this band. Do not attempt to control attitude with stabilizer trim. Avoid unnecessary maneuvering. An increase of bank will increase the stress and the possibility of a stall.

5. ENGINE POWER. Set thrust as required to maintain penetration airspeed and do not vary unless airspeed and altitude variations are large and persistent.

6. AUTOPILOT. The autopilot may be used and, in some cases, is desirable. Altitude hold or Speed On Pitch (SOP) should not be engaged. Do not help the autopilot by applying inputs on the control column because the possibility of mistrim will be increased. Make as few changes with the autopilot pitch wheel as practical. With a fixed pitch control knob position, the autopilot will attempt to maintain a constant attitude, and this is the desired goal. Be alert for inadvertent autopilot disconnects. The yaw damper should be ON.

NOTE

When flying at night in the vicinity of thunderstorms, the thunderstorm lights should be turned on to preclude momentary blinding effects of lightning.

CAUTION

- Under normal conditions, the hydraulic pitch trim actuator cannot be stalled at calibrated airspeeds below 300 knots. If difficulties are encountered at higher airspeeds, the electric stabilizer trim system should be used to take advantage of the increased torque.
- During recovery from high speed upsets at speeds approaching maximum, a loss of aileron effectiveness will be noted. If this should occur, full aileron throw will provide a positive roll rate. The rudder is an effective roll control device at these high speeds and must be properly coordinated to obtain adequate roll response. An increased roll rate will be obtained if full rudder, as well as aileron, is used to recover from large lateral upsets at high speeds. When operating at maximum speeds, positive input

to the rudder should be used when lateral correction is required. This will avoid possible adverse roll created by independent yaw damper operation.

WIND SHEAR.

Severe wind shear conditions occurring at low altitudes are hazardous to aircraft encountering them during final approach and take-off. When an aircraft is flying only slightly above stall speed, a major change in wind velocity can lead to a loss of lift. If the loss is great enough that the power response is inadequate, it results in a high rate of descent. The altitude at which the encounter occurs, the pilot reaction time, and the aircraft response capability determine if the descent can be slowed in time to prevent an accident.

The following conditions indicate the possibility of significant wind shear and should be considered by the pilot during weather briefings/analyses:

1. Thunderstorms and associated gust fronts.
2. Frontal passage.
3. Temperature inversion.
4. PIREPS.

APPROACH AND LANDING.

The following types of shear can significantly affect an approach:

1. Decreasing headwind. The power required is higher than normal, vertical velocity is less than planned, and actual ground speed is less than expected ground speed (TAS minus runway headwind component). When the shear is encountered, the aircraft reaction is a drop in airspeed and a loss of altitude. The pilot must be ready to add power when indicated airspeed starts to decrease. Once speed and glide path are regained, however, prompt reduction of thrust is necessary. It will now require less thrust and a greater rate of descent to maintain the proper profile in the decreased headwind. If the initial corrections of increased thrust and pitch are not promptly removed after regaining glide path and airspeed, a long landing at high speed may result. Be prepared for a go-around.

2. Decreasing tailwind. The power required is less than normal, the vertical velocity is more than planned for the approach, and actual ground speed is more than the expected ground speed (TAS plus runway tailwind component). When the shear is encountered, aircraft reaction is an increase in airspeed and a gain in altitude. The pilot's natural reaction to this condition is to lower the nose to regain glide path and reduce thrust to regain airspeed. However, be prepared to raise the nose and add thrust promptly once speed and glide path are regained. It will now require more thrust and a decreased rate of descent to maintain the proper profile in the increased headwind. Be very cautious in making the initial reductions of thrust and pitch to avoid the low-power, high-sink condition which could lead to correction through the glide path from which a recovery cannot be made. Be prepared for a go-around.

The following techniques may assist the pilot in coping with wind shear on approach:

1. Be alert for the possible need for additional airspeed or power on final approach when a decreasing headwind (increasing tailwind) shear is anticipated.

2. If necessary, delay the approach until the shear situation has subsided or divert to a suitable alternate.

3. If wind shear is encountered on final approach, do not hesitate to go-around if the approach profile and airspeed become destabilized and cannot be re-stabilized.

4. When wind shear is encountered, pass this information, including magnitude of airspeed change and altitude encountered, to ATC so that other aircraft may be informed.

TAKE-OFF.

If a wind shear or gust front from a thunderstorm/CB is anticipated, it is important to penetrate the shear at a relatively high airspeed. A TRT take-off with a normal climb will be made. A departure route that will provide the most favorable wind condition (generally a headwind) should be used. Delay take-off until shear situation subsides.

MICROBURST.

Microbursts are concentrated downdrafts that can occur anywhere convective weather conditions exist (thunderstorms, rain showers, virga, etc.). Downdrafts associated with microbursts are typically only a few hundred to 3,000 feet across and usually dissipate within 10-20 minutes. When the vertical winds contact the ground, they may form one or more horizontal vortex rings. This outflow region is usually 6,000 to 12,000 feet across and may extend over 2,000 feet AGL. Evidence of a microburst striking the ground includes rings of blowing dust, flailing trees, strong localized winds or aerodrome windshear alerts. Wind speed and/or direction can vary greatly at either end of the runway. Pilots can request this information from the tower.

Traversing the microburst may result in a rapidly decreasing tailwind (performance gain) followed by a rapidly decreasing headwind (performance loss). In areas of convective activity, a significant performance gain may be a pilot's first indication of a microburst. If a microburst is inadvertently encountered, resist the initial tendency to decrease pitch attitude to regain airspeed. Maximum power and pitch attitude control are critical for controlling flight path. Lower than normal airspeeds and unusual yoke forces may have to be tolerated until the condition can be flown through. If approach to stall is indicated, reduce pitch attitude in small increments to eliminate indications.

WARNING

Decreasing pitch attitude in an attempt to regain airspeed during initial shear encounters may prevent a successful recovery.

ICING AND COLD WEATHER OPERATIONS.

CDS COOLING FAN COLD WEATHER OPERATION.

If the temperature in the cockpit drops below 15 (±5)°F, the selected fan automatically turns off. When the fan is automatically turned off, no fan failures are annunciated.

CDS HEAT.

The DAMUs and DUs require heat at cabin temperatures below 32°F (0°C) to stabilize displays. DAMUs and DUs will display when their internal heaters reach operating temperature.

TCAS/IFF

During cold weather operation allow a 2 minute system warmup before placing the MASTER switch in the NORM position.

ICING.

WARNING

Under no circumstances will flights be planned through forecast or known severe icing conditions to include freezing rain or freezing drizzle.

If flight through icing conditions is necessary, the engine and wing anti-icing systems should be turned on before entering the condition. These are anti-icing systems, and they must be used before ice buildup occurs.

The empennage de-ice system should be turned on after entering icing conditions.

ENGINE ICING.

Engine icing can occur without wing icing. A jet engine operating in an air mass with an ambient temperature that is below 8° C may experience engine icing; this is caused by the temperature drop associated with the reduction in pressure between that of the air mass and the pressure at the first stages of the compressor. As air is drawn into the engine, moisture condenses into droplets. These droplets, due to their inertia, cannot follow the air around the fan blades and guide vanes. Instead, they strike the metal parts and freeze. This can happen in clear air if the temperature is near or below freezing and the relative humidity is near saturation. The ice detection system may not detect these conditions. The APU is also affected.

CAUTION

The CONTINUOUS IGNITION switch shall be "ON" for flight in known or anticipated icing conditions.

Ice buildup on the nacelle leading edge or nose cone will have little effect on engine performance unless more than 1/2-inch of ice is allowed to accumulate. These ice buildups present a potential hazard as engine stall will occur and compressor damage may result when the ice is ingested into the engine.

ENGINE PRESSURE PROBE ICING.

If the engine pressure probe becomes plugged with ice, the EPR will indicate higher than actual. During icing conditions, cross-check all engine instruments and if EPR probe icing is suspected, make primary power setting with N_1 RPM. Cross-check with engine operating temperatures and fuel flow of other engines.

PITOT ICING.

The aircraft is equipped with a pitot mast and head heating element for each pitot system. This system is adequate to prevent pitot icing in moderate and severe icing conditions.

If any heating element malfunctions in the pilot's or copilot's pitot system, immediate action should be taken, where practical, to get out of icing conditions. (Refer to Section I and Section III for systems affected by loss of No. 1 and No. 2 CADCS.) Since the pitot tubes supply both pitot and static pressure, all pitot static instruments, CADCS, and the flight data recorder will be affected by pitot icing.

NOTE

If CADC failure occurs due to pitot system icing, turn the related stall prevention system off.

STRUCTURAL ICING.

Windshield.

The "NORMAL" position of the windshield heat switches will provide satisfactory anti-icing of the windshield. All of the heated portions of the windshield will be kept clear of ice. Approximately four inches along the lower portion of the windshield glass is unheated, as is the edge of the windshield around the frame. In moderate to heavy icing, these portions of the windshield will not be kept clear by the windshield heat in "NORMAL" or in "HIGH." If improved visibility is desired through the lower portion of the windshield, actuation of the rain removal system will clear the complete lower section.

Radome.

Since the radome is not de-iced, flight in icing conditions will allow ice to build up on the radome. If this occurs the radar picture will deteriorate, and must be adjusted to provide a satisfactory picture.

Wing.

The wing anti-icing system should satisfactorily clear ice from the heated sections within five minutes with engine power set at cruise or higher. If a section of the wing will not de-ice properly because of a malfunction in that section, increasing speed and/or lowering altitude enough to obtain a total indicated temperature of +10° C or higher will provide enough heat to shed the wing of ice. Ice dissipation by this method will begin within five minutes. For accumulations up to 1 1/2 inches, as much as 15 minutes may be required. Flexing the wings by applying "g's" will greatly aid this procedure (refer to Section V for limitations).

NOTE

During three-engine operation if wing anti-icing is required, open the wing isolation valve.

BEFORE ENTERING THE AIRCRAFT.

The flight crew should make a number of checks in addition to those in Section II.

Check engines for internal ice by checking the bottom section of the front stator blades for evidence of ice, and see that the compressor rotates freely. Check pitot tubes, static ports, total temperature probe, and angle of attack vanes for ice. Check that tires are not frozen to the ground.

CAUTION

- Engine heat on shutdown melts ice accumulated during flight, and the resulting moisture will refreeze in the lower sections of the front stator and rotor blades. Attempted engine start may result in starter failure. If the engine is not free to rotate, external heat must be applied to forward engine sections. Start the engines as soon as possible after the application of heat to remove all moisture before refreezing can occur.
- Remove snow from top of fuselage. Melting snow and ice on top of fuselage may form ice in the vicinity of the pitot heads, static ports, angle of attack vanes, and clear vision windows.

Check that aircraft exterior surface is free of ice, snow, and frost. Under conditions of blowing snow or where aircraft has been exposed to unusual freezing conditions that require the use of de-icing fluid (Specification MIL-A-8243) or heat on the exposed surfaces, the control surfaces shall be visually inspected for evidence of snow or ice accumulations. All accumulations of snow, ice, and frost must be removed from the control surfaces. Do not chip or scrape ice from the surfaces. After completion of de-icing, check the control surfaces for freedom of movement.

WARNING

- Accumulations of snow, ice, and frost must be removed from the control surfaces prior to flight. Snow or ice accumulation can increase take-off distances and adversely affect climbout performance, stalling speed, and handling characteristics. In-flight structural damage can result from vibrations induced by unremoved accumulations.
- If snow is left on the radome it may blow back on the windshield during takeoff, restricting visibility during this critical period.

CAUTION

If de-icing fluid containing alcohol is used, care should be taken to prevent it from coming in contact with plexiglas or plastic, since it will tend to craze or soften these materials.

Check that exposed parts of shock struts and pistons are clear of ice. Check bogie positioners for proper servicing. Check that landing gear downlock pins can be removed. If frozen, apply external heat to free pin lock mechanism.

ON ENTERING THE AIRCRAFT.

If ground heaters are not available, start the APU as soon as possible, and use the aircraft's heating system to preheat both the flight station and cargo compartment.

WARNING

Under no circumstances will the aircraft APU or engines be started until all de-icing operations are complete. De-icing fluid in contact with engine exhaust could cause an extremely dangerous fire situation.

NOTE

APU starting in cold weather can be accomplished, if the No. 3 hydraulic system accumulators are properly serviced and charged to 3,000 PSI and the battery voltage is 21 volts or better. In extreme temperatures external power and operation of the No. 3 hydraulic system pumps may be required for starting the APU.

BEFORE STARTING ENGINES.

The windshield heat control system will not function if the temperature of the windshield glass is below –43° C. The COLD START switches must be used to heat the windshield to the normal operating range. Operation of the COLD START switches should be accomplished only while the WINDSHIELD HEAT switches are in "NORMAL." Touch windshields with bare hand to check that heat is being applied.

CAUTION

Do not exceed the operating duty cycle of five seconds on, ten seconds off, when operating the COLD START switches.

Just before engine start, when ice or snow is continually accumulating, ice accumulation may be kept to a minimum by the application of cold concentrated de-icing fluid to the previously de-iced surfaces. The cold de-icing fluid has greater viscosity and will tend to remain longer on the surfaces, affording a longer time period of protection from ice accumulation.

Ice may form on the engine inlet guide vanes and fan stages during ground operation. In order to keep this ice buildup to a minimum, engine start should be delayed until the takeoff can be accomplished within approximately ten minutes.

If the aircraft surfaces are cleared of ice after preflight, check spoiler operation.

STARTING ENGINES.

The indicated oil pressure will rise rapidly to the normal operating range and may exceed 55 PSI when starting a cold soaked engine during very cold weather (–40° C). The throttle should remain in "IDLE" until the oil pressure is within the normal operating range. A sudden loss of oil pressure in cold weather is usually due to a broken line or damaged seal. If oil pressure drops to zero, shut down the engine.

NOTE

- A characteristic of the oil filter differential pressure switch may cause the low-pressure warning light to illuminate at pressures greater than 50 PSI.
- If the engine has been cold soaked, the low oil pressure light may remain illuminated for two minutes after the oil temperature reaches 40° C at idle RPM. The engineer will monitor the engine oil pressure closely for proper indications.
- An additional characteristic during engine operation with alternate grade fuels in very cold weather is to produce varying intensities of white smoke during engine start and warmup.
- Below - 12 degrees C (10 degrees F), let engine warmup at idle for 1 minute or until low oil pressure light extinguishes prior to turning on the generator control switch.

If OAT is 8° C or below with visible atmospheric moisture present, the engine anti-icing should be turned on after engines are started.

CAUTION

When ambient temperature is above 10° C (50° F), do not operate engine anti-ice more than 10 seconds. This is to avoid deterioration of rubber compound used in center bay of inlet guide vanes. This does not preclude checking the anti-icing system at temperatures above 10° C for less than 10 seconds.

WARMUP AND GROUND TESTS.

Inspect instruments for normal operation and monitor wing flap operation.

WARNING

- In cold weather, make sure all instruments have warmed up sufficiently to ensure normal operations. Check for sluggish instruments during taxiing.
- In cold weather with an OAT of –40° C or below, aircraft serviced with MIL-PRF-83282 hydraulic fluid have shown flight controls to be sluggish and may require five to ten minutes of system operation prior to obtaining normal control response. The aircrew will exercise the flight controls with engines running to ensure normal operation prior to departure.

CAUTION

When operating the wing flaps at low temperatures, the flap position indicator should be closely observed for positive movement. If the flaps should stall, immediately place the flap lever in the position shown on the flap indicator to prevent damage to the mechanism.

If visible atmospheric moisture is present and the OAT is 8° C or below, the engines should be operated at high thrust setting for 10 seconds every 10 minutes to prevent ice buildup on the engine inlet components. Symmetrical engines should be advanced slowly to a thrust setting as high as possible dependent on surface conditions. If surface conditions preclude advancing engines to at least 70% N_2 RPM to eliminate the ice buildup, do not take-off. Shut down the APU as soon as practical after engine start.

TAXI.

Thrust requirements for initial aircraft movement in low temperature and in snow or slush will be greater than normal. Use thrust as necessary to initiate aircraft movement and achieve taxi speed. Thrust requirements during taxiing will vary, depending upon surface conditions in low temperatures; that is, whether moving on cleared hard surface, hard packed snow, loose snow in varying depths, or slush. Use throttles and wheel brakes to maintain desired taxi speed.

CAUTION

> Care must be exercised when using thrust reversers during loose snow or ice fog conditions to avoid a reduction of visibility due to the redirected airflow.

Nose wheel steering should be used to maintain directional control. The outboard engines may be used differentially as an aid to the nose wheel steering when making turns in uncongested areas.

NOTE

> The nose wheel steering must be used with care or nose wheel skidding will occur on all types of surfaces. This problem is accentuated on surfaces with low RCR readings. Turns must be entered with low taxi speeds and very moderate rates of steering input. Turns can be performed with a maximum nose wheel deflection of 60 degrees; however, the rate of steering input must be moderate and closely monitored to avoid nose wheel skidding.

Taxi at reduced speed, and increase interval between aircraft in relation to the RCR of the taxi area. Be especially careful maneuvering near other aircraft.

The exhaust from their engines can cause significant ice on the ramp. Avoid taxiing in deep snow or slush because taxiing will be more difficult and the brakes and gear may freeze after take-off.

CAUTION

> Use extreme caution when taxiing on ice covered taxiways and runways, since braking action is much less effective on ice. Directional control in high crosswinds and in turns may become marginal.

BEFORE TAKE-OFF.

The FUEL HEATER switches should be placed ON for one minute prior to take-off whenever the fuel temperature is 0° C or below, but should not be used during take-off.

TAKE-OFF CONSIDERATIONS.

Ice and light coverings of powdery snow have little effect on take-off distance. Slush and water can increase ground-run distances significantly due to the increased rolling resistance. Wet, dense slush sometimes results when packed snow partially melts. This presents the worst take-off condition, primarily because the water is prevented from draining off the runway surface. Water alone would present the same problem of increased rolling resistance if it were retained on the surface. Normally the crowned runway design allows water to drain away quickly. Slush, however, is a variable semiliquid that stays in place on the runway. Taking off in slush may produce two effects. First is the possibility of the aircraft not attaining rotation speed before running off the end of the runway. Actual data on the specific increases in ground run distances are difficult to establish due to the differences in type, density, and depth of slush.

WARNING

> Take-off will not be attempted with over 1/2-inch of wet snow, slush and/or water, or 3 inches of dry snow on the runway. When slush or puddles are less than 1/2-inch in depth, take-off distances may increase up to 15 percent.

The second effect is possible damage from slush striking the aircraft.

CAUTION

> Slush and water puddles on the runway can cause significant structural damage to the aircraft, particularly at high speeds.

TAKE-OFF.

WARNING

> If freezing precipitation is present, a final visual check of the aircraft/wing surfaces will be made just before take-off (within 5 minutes) by opening the #1 hatch and scanning the top of the wings to determine if the surfaces are still free of ice. Crews will assume the condition of the horizontal stabilizer surfaces is the

same as the condition of wing flight control surfaces. The hatch will be properly secured immediately after completion of the check.

Turn the engine anti-ice on during the Lineup checklist if visible atmospheric moisture is present and the OAT is 8° C or below, if icing conditions are present, or if icing conditions are anticipated before climb power is set. Wing anti-ice should not be turned on for take-off.

Adjust take-off EPR for engine anti-ice as specified in TO 1C-141B-1-1.

Prior to brake release, slowly advance the throttles toward 70% N_2 for 10 seconds to shed ice from the engine inlet components. If ice remains visible at inlet guide vanes, do not take-off.

If skidding occurs before 70% N_1 RPM, release brakes immediately and begin take-off run. Normal procedures will be used.

Initially, maintain directional control with nose wheel steering. Nose wheel steering has reduced effectiveness on wet or icy runways. When the rudder becomes effective, it should be used to aid nose wheel steering. Further assistance may be obtained by use of ailerons.

If performance permits, consider delaying gear retraction to prevent snow or slush freezing in the wheel wells.

Wing anti-ice should be turned on after take-off in icing conditions. If TRT EPR is used for take-off, adjust throttles to maintain 0.045 below take-off EPR. If reduced EPR is used, adjust throttles to maintain take-off EPR.

ENROUTE.

Operate with the ice detector switch in the MANUAL position.

Turn continuous ignition on before turning engine anti-ice on.

If icing is anticipated, turn on all anti-ice systems prior to encountering icing conditions. Additionally, during all phases of flight, if the aircraft enters clouds/visible moisture at temperatures between 8° C and -42° C OAT, turn on all anti-ice systems whether the ice detect system indicates icing conditions or not. Adjust EPR if NRT or MRT is being used.

The wing and engine anti-ice should be turned on prior to entering icing conditions. Adjust EPR if NRT or MRT is being used.

Empennage de-ice should be turned on after entering icing conditions.

Ice accumulation may be detected early by visual inspection of structural members.

If engine anti-ice is not on before entering icing conditions, ice will accumulate on the engine nose dome, nacelle lips, auxiliary air inlet doors, inlet guide vanes, and PT_2 probe. When the accumulations exceed 1/2 inch, pieces will break off and enter the engine inlet. This will be accompanied by engine stalls. The engine stall recovery is rapid and, if the thickness of ice is not more than 1/2 inch, no engine damage should occur.

For accumulation of ice that exceeds 1/2 inch, manually actuate the engine anti-icing system one engine at a time, and be alert for the engine stall that will occur when the ice sheds and is ingested into the engine. As the engine is de-iced and becomes stabilized, actuate the anti-icing systems on the remaining engines in a similar manner. If practical, a reduction of thrust on the engine being de-iced is desirable. This will reduce the severity of the engine stall when the ice sheds.

If out of icing conditions, structural icing may be dissipated by increasing airspeed until total temperature is +10° C or higher. This should only be accomplished if all engine surfaces (such as engine duct lip and nose dome) are free of all ice. Ice formations will begin to dissipate within 5 minutes with a total temperature of +10° C or higher. Lower total temperatures will require a longer time for ice to dissipate.

The rain removal system is very effective for removing ice from the windshield. Therefore, if windshield heat is not adequate, use the rain removal system.

AIRDROP.

CAUTION

The petal doors should not be opened in icing conditions. If the petal doors are opened during in-flight icing conditions, inspect closing surfaces for possible ice accumulation prior to closing. If ice accumulation is noted on the actuator, locking mechanisms, or door mating surfaces, closing of the doors in this condition is at the discretion of the pilot.

DESCENT.

If moderate icing is expected, turn on engine and wing anti-ice approximately 10,000 feet above the expected icing level. Adjust at least one throttle on each wing to 70% N_2 RPM to maintain adequate bleed air for anti-icing.

Wing and engine anti-ice and empennage de-ice systems should be turned off after departing icing conditions. To preclude overheating of elements during landing or taxi, wing anti-ice and empennage de-ice systems should be turned off prior to landing unless icing conditions are expected during the landing.

LANDING.

Ice formations on the aircraft will increase the stalling speed. If significant ice accumulations exist, a controllability check should be performed to establish the proper approach speed.

WARNING

The aircraft should not be landed with ice in excess of 1/2-inch on an outer wing section, because lateral control of the aircraft will deteriorate.

Check TO 1C-141B-1-1 to ensure that computed landing distance does not exceed runway available. Establish a normal approach with strict adherence to correct approach speeds and proper positioning.

Always try to land in the center of the runway. This will keep the aircraft on the reported RCR area, eliminate runway crest effect, and allow more positive braking action and nose wheel steering.

After touchdown, directional control is maintained primarily with rudder, assisted by aileron, especially on slippery runways. Follow normal landing procedures.

Do not use reverse thrust below 50 knots because loose ice and snow will be blown forward, restricting vision.

On runways with reduced RCR, the aircraft will not respond as readily to normal turning forces. Therefore, if large steering corrections are necessary, a slower rate of turn should be made to produce the best results.

ENGINE SHUTDOWN.

Use normal procedures. If possible, park the aircraft so that towing will not be necessary, because towing the aircraft at gross weights above 200,000 pounds is extremely difficult on snow-packed parking areas.

POSTFLIGHT.

Chock wheels and release parking brake. If moisture has entered the brake assemblies, releasing the parking brake prevents the brakes from freezing in position.

Service toilet facilities.

Remove all water, coffee, and other liquids which might freeze.

Install engine inlet and exhaust protective covers, pitot tube covers, and air conditioning inlet covers.

Close APU door.

Install windshield cover if freezing rain, sleet, or hail is forecast.

Remove ice and dirt from shock struts.

Remove battery if it is expected to be exposed to temperatures colder than -40° C for 12 hours or more. Cold soaking reduces battery output and prevents satisfactory charging until the battery is warmed. Always store in a warm place.

Do not leave aft doors open for extended periods of time. Prior to closing the aft doors, remove any appreciable accumulation of ice and snow from the ramp surface which would hinder the closing, locking or actuation of the switches.

RAIN AND HYDROPLANING.

RAIN.

Operation in rain presents no problem unless visibility becomes restricted. To ensure unrestricted visibility, turn the rain removal system on.

CAUTION

The windshield rain removal system should be operated only momentarily on a dry windshield. Failure to observe this caution can result in overheat damage.

HYDROPLANING.

When the aircraft lands or takes off on a wet or damp runway, hydroplaning may be encountered. Hydroplaning is a condition where the landing gear tire is either partially or totally supported by a thin layer of water or slush covering the runway surface. If hydroplaning occurs, the pilot may have difficulty stopping the aircraft and/or maintaining directional control.

There are three types of hydroplaning: dynamic, viscous, and reverted rubber. Dynamic hydroplaning will occur at high ground speeds and water depths as small as 0.10 inch. Given the necessary speed, tire pressure, and water depth, hydroplaning will occur and continue until aircraft speed is reduced to a point that the water pressure between the tire and runway no longer equals the tire pressure. At this point, tire spin up will begin and traction will increase.

For viscous hydroplaning to occur, a much thinner water film (0.03 inch) will cause viscous hydroplaning to occur on smooth runway surfaces at speeds lower than those in the dynamic situation. This type of hydroplaning may perpetuate itself at low speeds if the thin water layer is not broken by an irregular surface. In this type of hydroplaning also, there is very little the pilot can do except try to maintain directional control and decelerate with aerodynamic surfaces until the airplane has slowed to a point where traction returns.

The third type, reverted rubber, is very much like a dry skid and can occur on a damp runway with no visible standing water. Reverted rubber hydroplaning is caused by the tremendous heat from over braking; the tire rubber changes properties and closes the tire grooves, trapping the moisture under the tire, and reducing the contact with the pavement. However, proper braking procedures can essentially prevent this type of hydroplaning.

HOT WEATHER AND DESERT OPERATIONS.

High temperatures, alone or coupled with high humidity or blowing sand and dust, will complicate normal operations. Proper protection and inspection of the aircraft while it is on the ground, and observance of the precautions covered in this section will assure you of the most successful operation. Examine TO 1C-141B-1-1 critically to determine the adverse effects of high temperature on aircraft performance.

BEFORE ENTERING THE AIRCRAFT.

Cool the pressurized compartment with a portable air conditioner if one is available. Inspect more closely tires and shock struts for proper inflation and accumulators for proper air charge. Be alert for hydraulic leaks. Clean dust and sand from struts and other hydraulic pistons and from limit switches. Inspect hatch and door seals for deformation and damage due to high temperatures. Remove all protective covers and dust plugs. Be sure that the aircraft is positioned to avoid sandblasting other equipment during start.

AFTER ENTERING THE AIRCRAFT.

Check instruments and electrical equipment for excessive moisture due to high humidity. If operating in a dusty location, check for accumulated dust at control, instrument, and electronic equipment areas inside the aircraft.

CDS COOLING FAN HOT WEATHER OPERATION.

When the cockpit temperature is above 30 ($\pm$5)°F, the selected fan provides cooling air to the DAMUs and DUs. If the fan fails, CDS AIR FAIL annunciates on the SFD and the MASTER CAUTION indicator illuminates. The CDS COOLING FAN switch must be manually set to the other fan and the MASTER CAUTION reset.

CAUTION

The DUs and DAMUs are specified to work up to 131° F. If cooling air is disrupted and the unit's operating temperature exceeds 131° F, they are subject to fail.

STARTING ENGINES.

Use normal starting procedures. Expect the engines to accelerate to idle more slowly than on a normal or cold day because the air is less dense.

TAXIING.

Use the brakes as little as possible during taxiing since brake cooling is retarded by high ambient temperatures. Keep sufficient distance between aircraft to prevent sand and dust from blowing into the engines.

TAKE-OFF.

Strict adherence to recommended take-off and climbout speeds is necessary during extreme high temperature operations because aircraft performance decreases as temperature increases. Take-off distances can increase significantly.

CLIMB.

Use the normal climb procedure.

NOTE

Temperatures above standard day conditions will decrease overall aircraft performance. Rate of climb will decrease while climb time, climb fuel, and climb range increase.

DURING FLIGHT.

Avoid flying through dust or sand storms. To determine the effects of temperature on range and endurance, refer to TO 1C-141B-1-1.

APPROACH AND LANDING.

During extremely high temperatures, anticipate longer ground rolls. Use care during braking operations to avoid overheating the brakes.

CAUTION

Check maximum tire speeds for high temperature and/or high pressure altitudes.

ENGINE SHUTDOWN.

Use normal procedures. Install wheel chocks as soon as possible and release the parking brakes to aid in brake cooling. After maximum performance landings or excessive braking, personnel should stay clear of the main landing gear areas as much as possible until the brakes have cooled.

BEFORE LEAVING THE AIRCRAFT.

Have all protective plugs and covers installed. Except in dusty or rainy weather, leave all doors and side hatches open for ventilation.

NOTE

In dusty locations, if it is necessary to leave hatches or doors opened, all equipment inside the aircraft should be protected with dustproof covers where possible to keep out blowing dust and sand.

NIGHT FLYING.

Lights should be as dim as possible so the crew member's ability to see at night will not be greatly affected. Before take-off, turn off all unnecessary interior lights, and turn landing lights on. After take-off, the lights will be used as the aircraft commander directs.

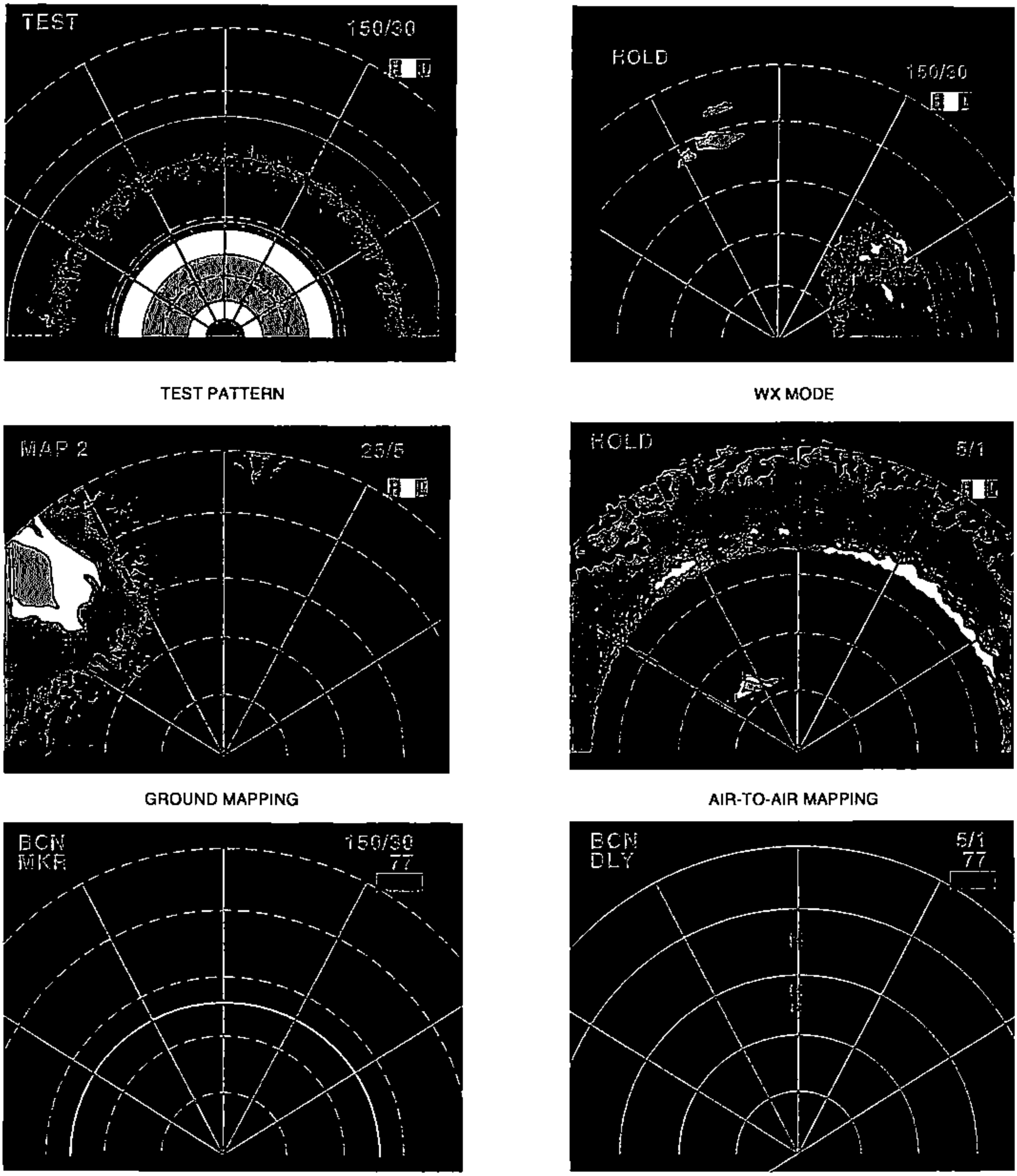
The leading edge lights may be used to inspect wings and engine inlets. If a night landing is to be made after flight in icing conditions, the landing lights can be turned on early in the final approach to de-ice themselves. Landing and taxi lights will be used as the aircraft commander directs.

MAT COVERED RUNWAY OPERATIONS.

Type AM-2, XM-18B, XM-18C, and XM-19 mats are coated with a medium to medium dark olive drab anti-skid surface. Runways, when covered with the mats offer very little contrast with the surrounding terrain during night operation. When standard tactical assault airfield lighting is employed, adequate runway illumination is provided.

WEATHER RADAR DISPLAY, NAV'S POSITION

(If Installed, Aircraft Modified by TCTO 520)



TEST PATTERN

WX MODE

GROUND MAPPING

AIR-TO-AIR MAPPING

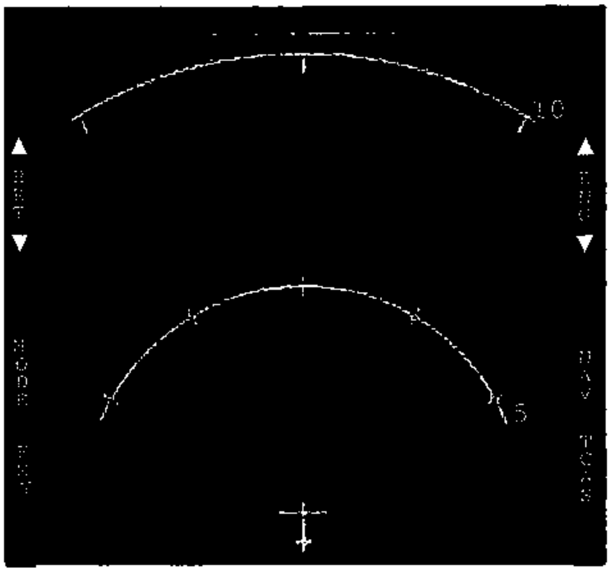
BEACON MODE

EXPANDED RANGE

Figure 7-1.

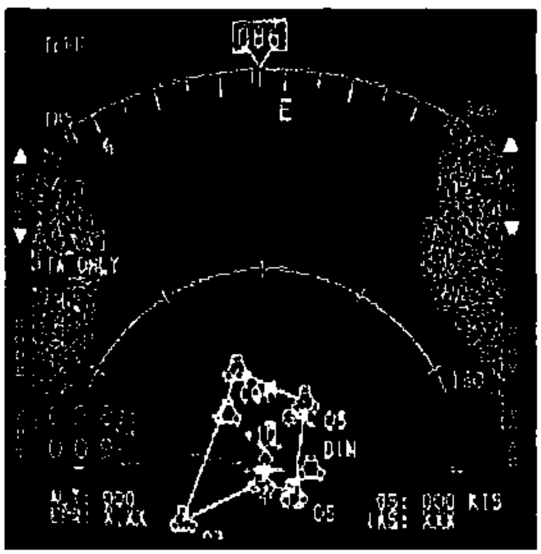
141B-1-X0/0-700

MFD DISPLAYS (TYPICAL)



D8060701

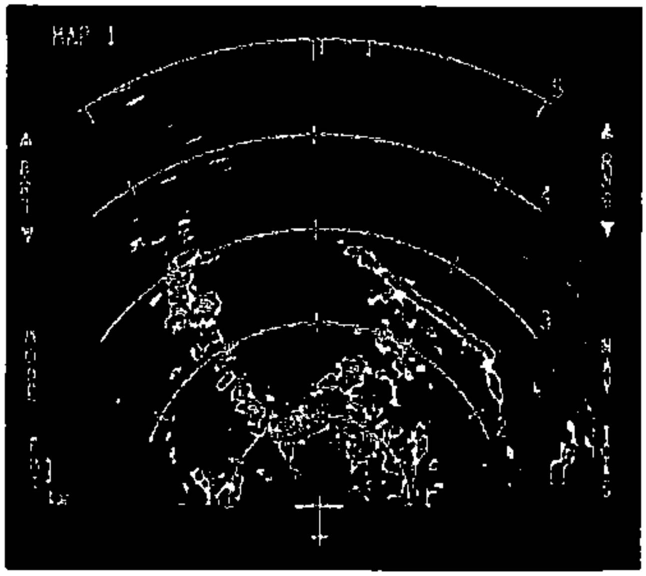
POWER UP DEFAULT



D8082801

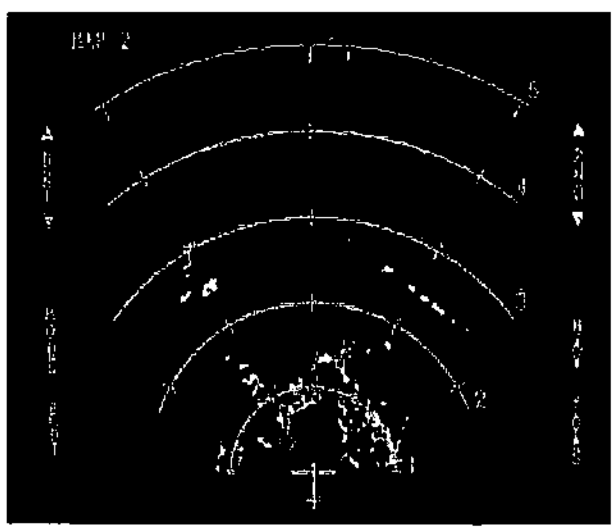
NAV (WITH TCAS/TAWS)

Figure 7-2. MFD Displays (Typical) (Sheet 1 of 4)



D8080901

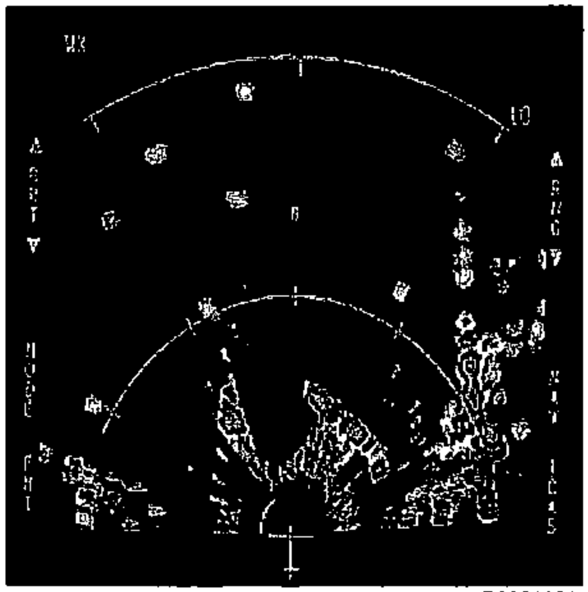
RADAR MAP 1



D8061001

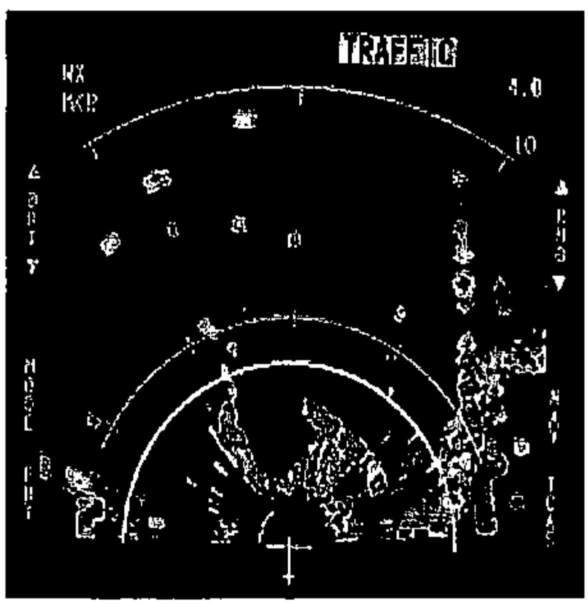
RADAR MAP 2

Figure 7-2. MFD Displays (Typical) (Sheet 2 of 4)



D8081101

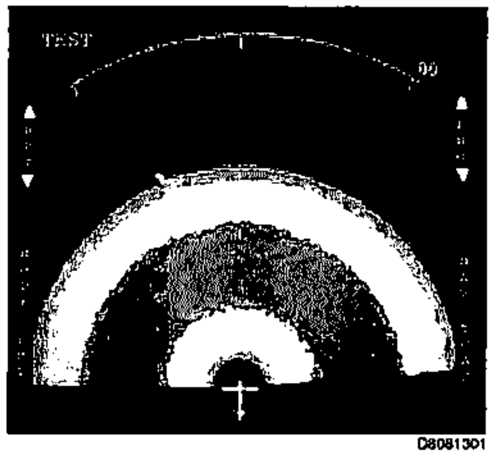
RADAR



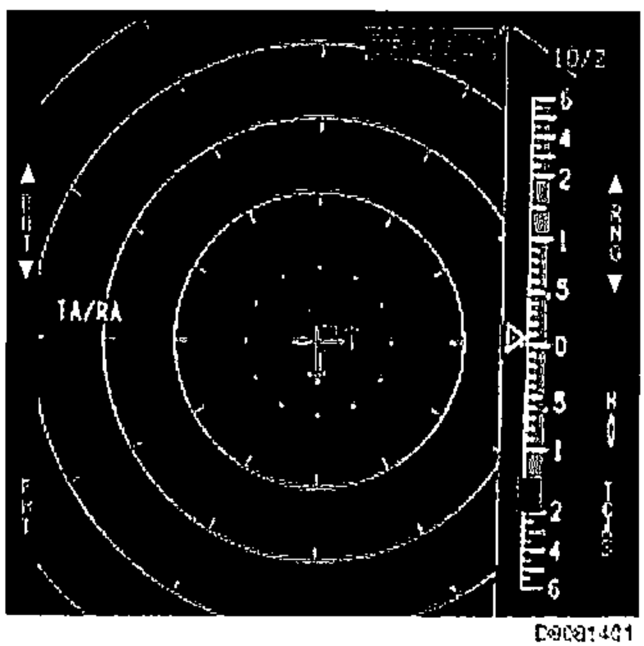
D8081201

MARK

Figure 7-2. MFD Displays (Typical) (Sheet 3 of 4)



TEST MODE



TCAS

Figure 7-2. MFD Displays (Typical) (Sheet 4 of 4)

INDEX

A

Abnormal Operating Procedures 1-341
  Loss of Range Marks 1-341
  Loss of Targets Only 1-341
Abnormal Start Indications 2-43
Abort Procedures 3-8
AC Electrical System Controls 1-27
  APU Generator Control Switch and the Power Selector Switch 1-27
  Auto-Load Disconnect Switches 1-27
  Bus Tie Switches 1-27
  Engine Generator Control Switches 1-27
AC Electrical System Emergency Controls .. 1-27
  Bus Power Disconnect Switches 1-27
  CSD Disconnect Switches 1-27
  Emergency Power Test Switch 1-28
  Instrument Power Switch 1-27
AC Electrical System Indicators 1-28
  AC Loadmeters 1-28
  AC Voltmeter, Frequency Meter, and Selector Switches 1-28
  Bus Tie Open Light 1-28
  CSD Oil Temperature Gauges 1-28
  CSD Overheat Light 1-28
  Emergency AC Bus and Isolated AC Bus Lights 1-28
  Emergency Power On Light 1-28
  Essential Bus No. 1 and Essential Bus No. 2 Lights 1-28
  External Power On Light 1-29
  External Power Ready Light 1-28
  Generator Fail Light 1-28
  Generator Out Light 1-28
  Main Bus Off Lights 1-28
AC Power Distribution *1-426
AC Power Supply System 1-26
  Constant Speed Drive (CSD) Units 1-26
  Emergency Generator 1-26
  Engine Driven Generators 1-26
  External/APU Generator Power Sources .. 1-26
AC Power System *1-424
AC System Buses 1-27
Acceleration Limitations 5-6, 5-11
Accelerations 5-7
Accessory Assembly 1-16
ADF Systems (ADF-73) 1-94
  ADF Controls 1-94
ADS Controls and Indicators 1-355
  ADS Armed Indicator 1-355
  ADS Extraction Parachute Holder 1-355
  Chute Release Switch 1-355
  Extraction Parachute Manual Release ... 1-355
ADS Panels *1-579
Advanced Narrowband Digital Voice Terminal (ANDVT) 1-83
  Basic Terminal Unit (CV-3591) 1-83
  COMSEC Module (KYV-5) 1-83
  COMSEC Module Controls and Displays .. 1-83
  Interconnecting "Y" Cable 1-87
  KYV-5 Operational Procedures 1-87
  KYV-5 RCU-IIA Controls and Indicators .. 1-85
  KYV-5 RCU-IIA Numeric Display 1-85
  KYV-5 RCU-IIB Controls and Indicators .. 1-87
  Navigator's KYV-5 RCU-IIA 1-85
  Pilots' KYV-5 RCU-IIB 1-87
  Secure Interlock Relay 1-87
  Split Remote Control Unit (SRCU) 1-85
  SRCU Functions 1-85
Aerial Refuel Slipway Door Control Handle *1-418
Aerial Refuel System 1-24
Aerial Refuel System Controls 1-24
  Aerial Refuel Disconnect Switches 1-25
  Aerial Refuel Isolation Valve Switches 1-25
  Aerial Refuel Master Switch 1-24
  Aerial Refuel Mode Select Switch 1-24
  Aerial Refuel Slipway Door Control Handle 1-25
  Fuel Line Drain Switch 1-25
Aerial Refuel System Indicators 1-25
  Aerial Refuel Disconnect Lights 1-25
  Aerial Refuel Door Unlocked Light 1-25
  Aerial Refuel Latched Lights 1-25
  Aerial Refuel Override Lights 1-25
  Aerial Refuel Ready Lights 1-25
Aerial Refueling Exterior Lights 1-25
  Fairing Lights 1-25
  Slipway Lights 1-26
  Wing Leading Edge Lights 1-26

* Denotes Illustration

Aerial Refueling Indicator Lights *1-419
Aerial Refueling Lights Control Panel *1-420
Aerial Refueling Limitations 5-7
Aerial Refueling System *1-416
Aeromedical Evacuation Crew 4-54
Aeromedical Evacuation Technicians 4-54
Charge Medical Technician 4-54
Crew Duties - Charge Medical Technician (CMT), Aeromedical Evacuation Technicians (2AET/3AET) Checklist 4-54
Crew Duties - Medical Crew Director (MCD), Flight Nurse (FN) Checklist 4-54
Flight Nurse 4-54
Medical Crew Director 4-54
Aeromedical Evacuation Crew Member (AECM) Abbreviations 3-120
AFCS Cautions, Warnings, and Advisories (CWAs) 1-148
Acknowledge Procedure 1-148
AFCS Mode/Status Annunciations 1-146
After Landing 2-67
After Take-Off, Climb 2-54
AHRS Operating Modes 1-154
Compass (COMP) 1-155
Directional Gyro (DG) 1-154
Slave (SLV) 1-154
AHRS Power Control Panel 1-154
Aileron Hydraulic Power Control Failure ... 3-73
Aileron System 1-43
Aileron Power Control Switches 1-43
Aileron System 1 Power and Aileron System 2 Power Lights 1-43
Aileron System Power Off Lights 1-43
Aileron Tab Operable Lights 1-43
Aileron Trim Control Switches 1-43
Aileron Trim Position Indicator 1-43
Aileron Tab Malfunctions 3-74
Air Conditioning Master Switch Position Chart *1-478
Air Conditioning Systems 1-31
Air Conditioning Systems Controls 1-32
Air Conditioning Master Switch 1-32
Cabin Temperature Control Switches 1-32
Cargo Compartment Temperature Control Switch 1-32
Cargo Compartment Temperature Selector 1-32
Flight Station Airflow Switch 1-32
Flight Station Temperature Control Switch 1-32
Air Conditioning Systems Indicators 1-33
Cargo Compartment Temperature Indicator 1-33
EJECTOR ON Lights 1-33
Primary Heat Exchanger Temperature Indicators 1-33
Regulated Bleed Air Pressure Indicator ... 1-33
Air Conditioning Units 1-31
Air Flow Sources 1-31
Air Start Checklist 3-13
Air Transportable Galley/Lavatory *1-590
Aircraft 1-9
Aircraft Dimensions 1-9
Aircraft Electrical System *1-422
Aircraft Gross Weight 1-9
Aircrew Eye And Respiratory Protection System (AERP) 1-377
Aircrew Refueling Definitions 2-74
Aircrew Refueling Procedures 2-74
Aircrew Visual Inspection Requirements 2-4
Airdrop 7-11
Airdrop Limitations 5-8
Airdrop System (ADS) 1-355
Airspeed Limitations .. 5-5, 5-10, 5-12, 5-13, 5-14
All Weather Landing System (AWLS) 1-141
AWLS Mode Annunciations 1-142
Altitude Alert Warning 1-362
AN/APS-133 Radar Panels *1-559
AN/APS-133 Weather Radar Indicator Displays *7-1
Analog Status *1-293
Angle-of-Attack Vanes Anti-icing Systems 1-38
Angle-of-Attack Vanes Anti-icing Systems Controls 1-38
Angle-of-Attack Vanes Anti-icing Systems Lights 1-38
Annunciator Panels 3-59
Antenna Locations *1-514
Antenna Stabilization 1-316
Mechanical Limits 1-316
Anti-Icing And De-Icing Systems 1-37
Anti-Icing Systems Control Panel *1-481
Anti-Skid System 1-52
Anti-Skid Control Switch 1-53
Anti-Skid Detector Out Light 1-53
Anti-Skid Off Light 1-53

* Denotes Illustration

Brakes Released Light 1-53
Approach 2-59
Approach And Landing 7-6
Approach Procedures 2-60
Approach Speed 2-64
APU Control Panels *1-411
APU Controls 1-16
APU Accumulator Selector Switch 1-16
APU Control Switch 1-16
APU Door Controls 1-17
APU Fire Handle 1-17
Bleed Load and Flow Control Valve 1-17
APU Fire Detection And Warning System . 1-362
APU Fire Extinguishing System 1-362
APU Fire Agent Discharge Switches 1-362
APU Fire Handles 1-362
APU Fire Warning Test Switch 1-362
APU Fuel System 1-16
APU Indicators 1-17
APU Door Warning Light 1-17
On Speed Light 1-17
Start Light 1-17
APU Oil System 1-16
APU Operating Instructions 1-17
Loading Operation 1-18
Starting the APU 1-17
Stopping the APU 1-18
APU Speed Control 1-16
APU Starting System 1-16
ARRIVAL RWYS *1-288
ARRIVAL STARS *1-288
ARRIVAL TRANS *1-289
Attitude Heading Reference System (AHRS) 1-154, *1-550
Audio Alarm Speaker 1-331
Authorized Activities 2-75
Automatic Flight Control System (AFCS) . 1-134
Automatic Flight Control System (AFCS) Operation 1-148
Altitude Hold Mode 1-149
Autopilot Limitations 1-148
Autothrottles 1-150
AWLS CAT I Coupled Approach (Typical) 1-151
AWLS CAT II Coupled Approach (Typical) 1-152
AWLS CAT II Flight Director Approach (Typical) 1-151
Back Course Localizer Approach 1-153
Basic Autopilot Mode 1-149
Before Engaging the Autopilot 1-149
Control Wheel Steering 1-149
Engine Out Condition 1-148
Go-Around 1-153
Heading Mode 1-150
Lateral Navigation/Localizer Mode 1-150
Rotation Mode 1-149
Speed on Pitch Mode 1-149
Autopilot 1-135
Autopilot Disconnect Button 1-137
Autopilot Disengagement 1-138
Autopilot Engagement 1-137
Autopilot Operating Modes 1-138
AWFCS Mode Repeater 1-136
Column/Wheel Force Sensor (CWFS) 1-137
Flight Control Panel (FCP) 1-135
Mode Select Panel (MSP) 1-136
Autopilot Controls and Indicators *1-549
Autopilot Disengaged Procedures 2-54
Autopilot Engaged Procedures 2-53
Autothrottle System (A/T) 1-142
Annunciations 1-143
Operation 1-143
Restrictions 1-143
Autothrottles Malfunction 3-63
Auxiliary Loading Ramps 1-348
Auxiliary Power Unit *1-410
Auxiliary Power Unit (APU) 1-16
Auxiliary Power Unit Fire - Crew Not In Place Checklist 3-6
Avoidance Routes 7-3
Allow for Wind 7-3
Allow Significant Clearance 7-3
Plan Early 7-3

B

Backing The Aircraft 3-88
Bailout 3-37
Bailout Alarm/Warning System 1-363
Battery Start Checklist 3-85
BDHI System Indicators and Selector Switches *1-557
Bearing Distance Heading Indicator System (ID 798/ARN) 1-95

* Denotes Illustration

Before Entering The Aircraft 7-8
Before Landing 2-62
Before Leaving Aircraft.................... 2-71
Before Starting Engines 7-9
Before Starting Engines 2-39
Before Take-Off........................... 7-10
Before Take-Off........................... 2-46
Before Taxi 2-44
Blackout Curtains 1-378
Bleed Air Smoke Checklist 3-20
Bleed Air System Controls 1-30
Bleed Air Shutoff Switches 1-30
System Shutoff Switches 1-30
Wing Isolation Switch 1-30
Wing, Pylon, and Air Conditioning Compartment Overheat Switches 1-30
Bleed Air System Indicators 1-30
Bleed Air Shutoff Valve Lights 1-30
Manifold Bleed Air Pressure Indicator 1-31
System Pressure Relief Valve Lights 1-30
Wing, Pylon, and Air Conditioning Bleed Air Overheat Lights 1-30
Bleed Duct Overheat Checklist 3-21
Brake Limitations 5-7
Brake Limitations 3-9
Aborted Take-off, No Braking 3-9
Aborted Take-off, With Braking, or Braked Landings 3-9
High Energy Aborted Take-offs or Braked Landings 3-9
Taxi 3-9
Brake Limits *5-28
Brake Pressure Indicators 1-52
Brake Pressure Selector Switch 1-52
Brake System 1-52
Brake System Failure 3-43
Anti-Skid Off Brake Application 3-43
Anti-Skid System Failure 3-43
Brake Malfunction 3-43
Brake Released Light Failure (Abnormal Brake Pressure) 3-43
Brake Released Light Failure (Normal Brake Pressure 3-43
Buffet Boundary 6-3

C

Cabin Airflow Regulation 1-32
Cabin Pressure Altitude Chart *1-480
Cabin Pressure Control System *1-479
Cabin Temperature Regulation 1-31
CADC Test Switches *1-556
CARA Controls and Indicators 1-133
Ambient Light Sensor 1-133
Analog Altitude Pointer and Dial 1-133
BRT Knob 1-133
Digital Altitude Display 1-133
Low Altitude Warning Indicator (LO) ... 1-133
R/T Status Indicator 1-133
SET Knob 1-133
Variable Altitude Limit Index (VALI) 1-133
CARA Operation 1-134
CARA Test 1-133
Cargo and Service Compartment Lighting . 1-346
Aft Crawlway and Vertical Stabilizer Inspection Lights 1-347
Cargo Compartment Dome Lights 1-347
Cargo Compartment Overhead Lights ... 1-347
Cargo Ramp Loading Lights 1-347
Emergency Exit Lights 1-347
Flight Station Access Light 1-346
Lavatory Light 1-347
Main Wheel Well Lights 1-347
Nose Wheel Well Light 1-347
Paratroop Platform Lights 1-347
Under Flight Deck Rack Lights 1-347
Cargo Compartment (Scanner) 2-34
Cargo Compartment Controls and Indicators 1-349
Cargo Compartment Door Warning System 1-350
Cargo Compartment Floor Heat System 1-35
Cargo Compartment Floor Heat System Controls 1-35
Cargo Compartment Floor Heat System Overheat Light 1-36
Floor Heat Switch 1-35
Floor Overheat System Switch 1-36
Cargo Compartment Inspection *2-86
Cargo Compartment Lighting Controls ... *1-573
Cargo Compartment Recirculation Fan 1-32
Cargo Door And Ramp System Controls and Indicators 1-349
Copilot's Controls and Indicators 1-349
Navigator's Indicator 1-349
Pilot's Control and Indicators 1-349
Cargo Door And Ramp Control Panels ... *1-576
Cargo Door And Ramp System 1-348

* Denotes Illustration

Cargo Door Control Valve Panel *1-578
Cargo Jettison 3-35
Flight Deck Procedure 3-35
Loadmaster/Scanner Procedures 3-35
Restrictions 3-36
Cargo Loading Equipment 1-348
Cargo Loading Limitations 5-3
Cargo Loading Limits *5-24
Cargo Loading Stabilizing Struts 1-348
Cargo Ramp 1-349
Cargo Ramp Manual Lock Pins *1-577
Cargo Winch 1-348
CARP *1-554
CARP END OF RUN *1-244
CARP INIT 1/6 .... *1-233
CARP INIT 2/6 .... *1-235
CARP INIT 3/6 .... *1-236
CARP INIT 4/6 .... *1-238
CARP INIT 5/6 .... *1-239
CARP INIT 6/6 .... *1-242
CARP PROGRESS *1-242
Casualty-Carrying Equipment 1-355
Category II Approaches 2-61
Aircraft Equipment Requirements 2-61
Approach 2-62
Malfunctions 2-62
Restrictions 2-61
CDS Brightness Control 1-99
CDS Cautions, Warnings, and Advisories (CWA) 3-62
CDS Cooling Fan Cold Weather Operation 7-7
CDS Cooling Fan Hot Weather Operation 7-13
CDS Cooling System 1-98
CDS Heat 1-98, 7-7
CDS Menu Hierarchy *1-548
CDS/FMS Equipment Failures/Multiple Failures Matrix 3-64
Center of Gravity *5-23
Center Of Gravity Limitations 5-3, 5-10, 5-12, 5-13
Checklist Holders 1-379
Checklists and Procedures Requiring Coordinated Actions 2-3
CHUTE LIST 1/2 .... *1-245
CHUTE LIST 2/2 .... *1-245
Circling Approach 2-61
Circuit Breaker Index *1-442
Circuit Breaker Panels (Typical) 1-433
Clear Engine Procedure 2-44
CLIMB 1/2 .... *1-256
Climb Altitude Target Vertical Profile *1-248
Climbout 2-53
CMDS (AN/ALE-47) Abnormal Operating Procedures 3-64
CMT/2AET/3AET Checklist Procedures 4-60
Before Leaving Aircraft 4-66
Before Take-Off 4-63
Before Taxi 4-63
Deplaning 4-65
Descent 4-64
Enplaning 4-62
In-Flight 4-64
Interior Inspection 4-60
Cockpit Voice Recorder 1-54
Cockpit Voice Recorder/Digital Flight Data Recorder *1-507
Cockpit Voice Recorder System Operational Checkout 1-54
Coder-Decoder (KY-889/APN-169) 1-331
Combined Altitude Radar Altimeter (CARA) System 1-133, *1-558
Comfort Pallets 1-379
COMM TUNE Menu Hierarchy *1-192
COMM TUNE VHF *1-193
Communication Management 1-192
COMM TUNE INDEX Page 1-192
COMM TUNE VHF Page 1-193
VHF Radio Control 1-192
VHF Radio Tuning 1-192
Communication Systems 1-54
Compass System Controller 1-154
HDG/PUSH TO SYNC Control 1-154
LAT Control 1-154
MAG VAR Switch 1-154
Mode Switch 1-154
N/S Switch 1-154
SYN IND Indicator 1-154
Compressor Assembly 1-16
Compressor Surge Bleed System 1-10
Continuous Ignition System 1-12
Continuous Ignition Switch 1-12
Control Display System *1-535
Control Display System (CDS) 1-98
Control Display System Operation 1-113
CDS Cooling System Operation 1-113

* Denotes Illustration

Normal Operation Mode 1-113
Power-Up Mode 1-113
System Interface 1-113
Test Mode 1-133
Control Pedestal *1-394
Control Wheel *1-490
Controllability Check 3-44
Copilot 4-3
Copilot's Instrument Panel *1-393
Copilot's Side Panel *1-389
Copilot's Station (Typical) *1-387
Countermeasures Dispenser Locations ... *1-564
Countermeasures Dispensing And Defensive Systems Preflight 2-37
Countermeasures Dispensing System (CMDS) (AN/ALE-47) 1-324
AAR-47/ALE-47 AUTO DISPENSE CONTROL Panel 1-325
ALE-47 INDICATOR/ARM CONTROL Panel 1-325
CMDS Abnormal Operating Procedures 1-326
CMDS Normal Operating Procedures ... 1-326
CMDS Shutdown 1-326
Control Display Unit (CDU) 1-325
Dispenser Assemblies 1-324
GROUND SAFETY BYPASS Switch 1-325
Programmer 1-324
REMOTE DISPENSE CONTROL Panel 1-325
Remote Dispense Pushbuttons 1-325
Safety Switches 1-324
Sequencers 1-324
Crash Axe 1-377
Crew Bunk 1-379
Crew Entrance Door 1-379
Crew Movement and Compartment Diagram *1-384
Crew Oxygen System 1-357
Flight Crew Quick-Don Oxygen Masks .. 1-358
Heat Exchanger Units 1-357
Liquid Oxygen Converter 1-357
Liquid Oxygen Quantity Indicator 1-357
Low Oxygen Quantity Warning Light ... 1-357
Manual Shutoff Valve 1-357
Oxygen Regulators 1-357
Cruise *1-261, 2-55
Custom Data *1-279
Custom Data List *1-280
CVR and DFDR Test Switch Locations 1-509
CVR Component Locations 1-508

D

DAMU - Air Data (Left Screen) *1-132
DAMU - Approach Data (Left Screen) *1-132
DAMU BIT *1-123
DAMU Display Control (Left Screen) - DAMU Control (Right Screen) *1-130
DAMU Display Control (Left Screen) - Handoff (Right Screen) *1-131
DAMU Display Control (Left Screen) - Inboard (Right Screen) *1-127
DAMU Display Control (Left Screen) - Outboard (Right Screen) *1-128
DAMU Display Control (Left Screen) - Processor Select (Right Screen) *1-129
DAMU Main Menu (Left Screen) - AP/FD (Right Screen) *1-118
DAMU Main Menu (Left Screen) - ATT (Right Screen) *1-117
DAMU Main Menu (Left Screen) - HDG (Right Screen) *1-119
DAMU Main Menu (Left Screen) - PTR-1 (Right Screen) *1-115
DAMU Main Menu (Left Screen) - PTR-2 (Right Screen) *1-116
DAMU Main Menu (Left Screen) - SKE (Right Screen) *1-120
DAMU Main Menu (Left Screen) - Status (Right Screen) *1-114
DAMU PFD *1-121
DAMU SFD (HSI) (Left Screen) - ZM (Right Screen) *1-124
DAMU SFD (Left Screen) - MAP (Right Screen) *1-125
DAMU SFD (SKE) (Left Screen) - ZM (Right Screen) *1-126
Danger Areas *2-87
Data Loader System (DLS) Management .. 1-181
Data Transfer Page 1-181
Upload Status Display 1-182
Data Transfer *1-181
DC Electrical Supply System 1-29
Battery 1-29
DC System Buses 1-29
Emergency DC Power 1-29
TR Units 1-29
DC Electrical System Controls And Indicators 1-29
Battery Switch 1-29

* Denotes Illustration

DC Voltmeter and Source Selector Switch . 1-29
Emergency DC Bus Lights 1-29
Isolated DC Bus Lights 1-29
Main DC Bus No. 1 and No. 2 Off Lights .. 1-29
DC Power Distribution *1-430
Defensive Systems 2-37
Defensive Systems Aircraft (AN/AAR-47 MWS, AN/ALE-47 CMDS) 1-323
DEP/ARR INDEX *1-284
Departure Arrival Tree *1-283
DEPARTURE RWYS *1-285
DEPARTURE SIDS *1-285
DEPARTURE TRANS *1-286
Descent *1-265, 2-56, 2-57, 7-11
Descent Altitude Target Vertical Profile .. *1-248
Descent Forecast *1-266
Descent Procedures 2-56
Descents 5-7
Direct/Intercept *1-216
Direct To Menu Hierarchy *1-215
Direct To Waypoint *1-200
Direct-To 1-213
Course Intercept Resolution 1-214
Course Intercepts 1-214
Direct to an Alternate Route Waypoint .. 1-216
Direct to an Off-path Waypoint 1-216
Direct to Down-path (Non-alternate) Waypoint 1-216
Direct-To Computed Waypoint Data 1-214
Direct-To the Alternate 1-215
Direct/Intercept 1-215
Insert Direct-To Computed Waypoint ... 1-214
Intercept Computed Waypoint 1-215
Intercept Computed Waypoint Definition 1-215
Invalid Direct-To 1-213
Not on Intercept Processing 1-215
Off Flight Plan Direct-To 1-214
Off Flight Plan Intercept 1-215
On Flight Plan Direct-To 1-213
On Flight Plan Direct-To Processing 1-214
On Flight Plan Intercept 1-214
On Flight Plan Intercept Processing 1-214
Discrete Status *1-292
Display Avionics Management Units *1-538
Display Avionics Management Unit (DAMU) 1-98
Display Interface Control Unit (DICU) 1-318
Display Processor Unit (DPU) 1-98
Display Unit (DU) 1-100
Display Unit Brightness Control 1-100
Distribution Ducting 1-31
Ditching 3-52, *3-117
Ditching Characteristics 3-52
Power Off Ditching 3-52
Power On Ditching 3-52
Ditching and Wheels Up Landing 3-123
Ditching Chart (Planned) 3-53, 3-124
Ditching Plan *3-134
Do Not Start And Terminate Operations Already In Progress When 2-76
Door Open Warning Light Illumination 3-31
Door Open Warning Light Illumination ... 3-122
Door Warning System 1-363
Dutch Roll 6-2
Dutch Roll Recovery Procedures 6-2

E

Effect Of Gust 2-64
Electrical Fire Checklist 3-23
Electrical Power System Failure 3-65
Bus Tie Open Light 3-66
CSD Failures 3-65
CSD Overheat Light 3-65
Generator Fail Light 3-65
Generator Out Light 3-65
Main Generator Failures 3-65
Electrical Power-off (Flight Engineer And Scanner) 2-4
Electrical Power-on (Flight Engineer And Scanner) 2-6
Electrical System 1-26
Electronic Cooling System 1-36
Electronic Cooling System Cooling Fan Failure Light 1-37
Electronic Cooling System Manual Handle 1-36
Electronic Cooling System Operation 1-37
Elevator Hydraulic Power Control Failure .. 3-74
Elevator Artificial Feel Centering Spring Failure 3-74
Elevator Artificial Feel Malfunction 3-74
Elevator System 1-44
Elevator Artificial Feel Selector Switch ... 1-45
Elevator Artificial Feel System 1-44

* Denotes Illustration

Elevator Emergency Power Light 1-45
Elevator Emergency Power On Lights 1-45
Elevator Feel Malfunction Light 1-45
Elevator Hydraulic Power Control Switches 1-45
Elevator System 1 Power and Elevator System 2 Power Lights 1-45
Elevator System Power Off Lights 1-45
ELT System Operational Check 1-342
Emergency Descent 2-56, *3-33
Emergency Engine Shutdown Checklist 3-11
Emergency Entrances and Exits 3-5, *3-93
Emergency Equipment 1-377
Emergency Equipment and Exit *3-94
Emergency Escape Breathing Device (EEBD) 1-377
Emergency Exit Light *1-575
Emergency Flare Jettison Checklist 3-37
Emergency Locator Transmitter (ELT) Panel *1-569
Emergency Locator Transmitter (ELT) System 1-342
Emergency Passenger Oxygen System (EPOS) 1-377
Emergency Procedures 3-1
Emergency Signals 3-5
Empennage De-icing System 1-39
Empennage De-ice Indicator Lights 1-39
Empennage De-ice Switch 1-39
Empennage De-icing System Normal Operation 1-40
Empennage De-icing System Test Procedures 1-39
Engine *1-403
Engine Anti-icing System 1-40
Engine Anti-icing System Controls 1-40
Engine Anti-icing System Indicators 1-40
Engine Bleed Air Systems 1-29
Engine Controls, Normal Operation *1-405
Engine Failure After Go Speed *3-98
Engine Failure During Climb 3-10
Engine Failure During Cruise 3-10
Engine Failure/Fire During Take-off 3-10
Loss of Two Engines 3-10
Engine Fire And Pylon Fire/Overheat Detection And Warning System 1-363
Audible Fire Alarm Silence Button 1-363
Engine Fire Detection System 1-363
Fire Warning Test Switches 1-363
Master Fire and Overheat Warning Lights 1-363
Pylon Fire/Overheat Detection System .. 1-363
Engine Fire Extinguisher System 1-363
Engine Fire Handles 1-364
Fire Bottle Discharge Buttons 1-364
Fire Bottle Low Pressure Warning Lights 1-364
Fire Bottle Pressure Gauges 1-364
Fire Bottle Select Switches 1-364
Engine Fuel Flow *1-404
Engine Fuel System 1-10
Engine Fuel Enrichment System 1-11
Engine Fuel System Indicator Lights 1-11
Engine Fuel System Temperature Indicator and Selector Switch 1-11
Engine-Driven Fuel Pumps 1-10
Fuel Bypass 1-11
Fuel Control System 1-10
Fuel Heater 1-11
Fuel Heater Operation 1-11
Fuel Heater Switch 1-11
Fuel Manifolds 1-10
Fuel Pressurizing and Dump Valve 1-10
Engine Icing 7-7
Engine Instruments 1-13
Engine Pressure Ratio (EPR) Indicator ... 1-13
Engine Vibration Indicating System 1-13
Exhaust Gas Temperature (EGT) Indicator 1-13
Fuel Flow Indicator 1-13
N_1 and N_2 RPM Indicators 1-13
Engine Instruments/Indicators *1-407
Engine Limitations 5-2
Engine Operating Limitations 5-2
Engine Operating Limits *5-19
Engine Operation 1-14
Engine Compressor Stall 1-15
Engine Turbine Blade Creep 1-15
False or Hung Start 1-15
Flameout 1-16
Hot Start 1-15
No Start 1-15
Normal Engine Starting Sequence 1-14
Rollback 1-16
Engine Pressure Probe Icing 7-7
Engine Ram Pressure Probe Anti-icing System 1-38
Engine Ram Pressure Probe Anti-icing System Controls 1-38

* Denotes Illustration

Engine Shutdown 2-70, 7-12
Engine Shutdown Conditions 3-10
Engine Thrust 1-10
Engine Thrust Reverser System 1-14
THRUST REVERSE LIMITER Knob 1-14
THRUST REVERSE LIMITER Operation 1-14
Thrust Reverser System Indicator Lights . 1-14
Thrust Reverser System Operation 1-14
Enroute 7-11
Enroute Descent 2-56
Enroute Operation 7-3
Azimuth Resolution 7-4
Early Detection 7-3
Range Resolution 7-4
Separation of Targets 7-4
Target Resolution 7-4
Tilt Control 7-3
Environmental Control Panel *1-473
Environmental System Malfunctions 3-72
Environmental, Engine Bleed Air and Anti-Icing System *1-474
Equal Time Points *1-219
EQUIPMENT HIST *1-291
Equipment Status *1-292
Escape Ladders 1-377
Escape Ropes 1-377
Exterior Inspection 2-85
Exterior Inspection (Scanner) 2-31
Exterior Lighting Control Panels *1-571
Exterior Lights 1-343
Anti-Collision Lights 1-343
Anti-Collision, Strobe Lights 1-343
Formation Lights 1-343
Landing Lights 1-343
Navigation Lights 1-343
Taxi Lights 1-343
Wing Leading Edge Lighting 1-343
Exterior Lights Locations *1-570

F

Failure of Nose Landing Gear Wheels to Center Upon Extension 3-41
Final Approach and Landing 2-64
Fire Extinguishers 1-377
Fire Handle Start Checklist 3-86
Fire On The Ground 3-7, 3-121
Fire Warning & Extinguishing System Controls & Indicators *1-588
Firefighters Smoke Masks 1-378
First Aid Kits 1-378
FIX INFO *1-276
Flap Asymmetry System 1-47
Flap Asymmetry Detector Light 1-47
Flap Asymmetry Light 1-47
Flap Asymmetry Test Panel 1-47
Flap Position for Airdrop of Cargo *5-34
Flap System *1-491
Flap System Failure 3-76
Flap Asymmetry 3-77
Hydraulic Leaks 3-77
Flare/Land 1-143
Flight Characteristics 6-3
Flight Characteristics - Aileron Tab Lockout System 6-3
Flight Characteristics - Free-Floating Stabilizer 6-4
Flight Characteristics - Runaway Trim 6-4
Flight Characteristics With Spoilers 6-3
Flight Command Indicator (APN-169C) ... 1-329
Flight Command Repeater 1-330
TIME Display 1-331
Transmit/Receive Display 1-331
XMT and RCV Legends 1-331
Flight Control Malfunctions 3-73
Jammed Flight Controls 3-73
Flight Control Systems 1-43, *1-486
Flight Crew Seats *1-597
Flight Engineer 4-3
Flight Engineer's and Navigator's Altimeters *1-594
Flight Engineer's Electrical Panel *1-421
Flight Engineer's Panel *1-409
Flight Engineer's Station (Typical) *1-399
Flight Management System (FMS) 1-155
Flight Management System Components *1-551
Flight Plan Management 1-198
Flight Planning 1-198
Flight Plans 1-199
LEGS HISTORY Page 1-207
LEGS PRIMARY Page 1-208
LEGS TO ALTERNATE Page 1-211
PRIMARY ROUTE Page 1-205
ROUTE and LEGS Pages 1-202

* Denotes Illustration

ROUTE PLAN Page 1-202
ROUTE TO ALTERNATE Page 1-206
WAYPOINT DATA 1/2 Page 1-211
WAYPOINT DATA 2/2 Page 1-212
Flight Planning 2-3
Flight Recorder 1-53
Flight Restrictions 2-3
FMS Caution, Warning and Advisory (CWA) Messages 1-295
Execute Annunciator 1-303
FMS Caution and Advisory Messages 1-296
FMS Operational Advisory Messages 1-301
FMS System Advisory Messages 1-296
Mix Lamp Annunciation 1-303
Operational Advisory Message Deactivation 1-303
FMS Climb Modes 2-53
FMS Components 1-155
Data Receptacle Unit (DRU) 1-157
GPS Antenna 1-155
GPS Key Fill Panel 1-157
Multi-Function Control Display Unit (MFCDU) 1-157
Navigation Processor (NP) 1-155
FMS Descent 2-57
FMS Holding Patterns 2-57
FMS Interface Diagram *1-553
FMS Take-off 2-52
Free Floating Stabilizer 3-77
FROM/TO *1-280
Fuel Boost Pumps 1-19
Fuel Dipstick 1-19
Fuel Ejectors 1-19
Fuel Grade Properties And Limitations 5-4
Fuel Grade Properties and Limits *5-25
Fuel Jettison Checklist 3-34
Fuel Jettisoning 1-19
Fuel Management Panel *1-412
Fuel Quantity Data Table *1-413
Fuel Supply System 1-18, *1-414
Fuel Supply System Controls 1-19
Boost Pump Switches 1-19
Center, Left, and Right Separation Switches 1-19
Crossfeed Switches 1-19
Jettison Switches 1-19
Fuel Supply System Indicators 1-20
Fuel Pressure Indicator 1-21
Fuel Quantity Indicators 1-20
Fuel Supply System Indicator Lights 1-22
Boost Pump Low Pressure Lights 1-22
Fuel Jettison Stop Pump Lights 1-22
Main Tank Sump Low Warning Lights ... 1-22
Fuel System Failures 3-79
Boost Pump Failure 3-79
Crossfeed Valve Failure 3-80
Engine-Driven Pump Failure 3-80
Fuel Filter Bypass Light On/Clogged Filter 3-80
Fuel Heater Control Valve Failure 3-80
Fuel Leaks 3-80
Fuel Quantity Indicator Failure 3-79
Sump Low Warning Light Illuminated ... 3-80
Fuel System Limitations 5-4
Fuel Tank Empty Out Of Sequence 3-92
Limitations 3-92
Fuel Tank Venting 1-18
Fuel Tanks 1-18
Fuel Usage Sequence 1-22
Fuselage Cracks 3-32
Fuselage Fire - Crew Not In Place Checklist 3-6
Fusible Plugs 1-52

G

Galley Equipment 1-379
Galley Operating Controls 1-379
GCAS Block Diagram *1-372
General Arrangement Diagram (Typical) *1-382
Glide Slope System 1-93
Go-Around 2-67
Go-Around After Touchdown 2-67
Go-Around With One Or More Engines Inoperative 3-45
Three-Engine Go-Around 3-45
Two-Engine Go-Around 3-45
GPS STATUS 1/2 .... *1-190
GPS STATUS 2/2 .... *1-190
Ground Collision Avoidance System (GCAS) 1-364
GCAS Built-In-Test 1-374
GCAS Controls and Annunciators 1-370
GCAS Operating Procedures 1-374

* Denotes Illustration

GCAS Operational Limitations 1-374
GCAS Tactical Mode Operation 1-375
Initiated BIT Test Procedure 1-375
Message Priorities 1-374
Mode 1 - Excessive Sink Rate 1-365
Mode 2A - Excessive Terrain Closure Rate, Flaps Up 1-365
Mode 2B - Excessive Terrain Closure Rate, Flaps Down 1-365
Mode 3 - Negative Climb Rate or Altitude Loss 1-366
Mode 4A - Minimum Terrain Clearance, Gear Up 1-366
Mode 4B - Minimum Terrain Clearance . 1-367
Mode 4C - Insufficient Terrain Clearance for Airspeed 1-367
Mode 5 - Excessive Descent Below Glide Slope 1-368
Mode 6A - Descent Below Set Minimum Height 1-368
Mode 6B - Descent Below Set Minimum Height, Tactical Mission Mode 1-369
Mode 6C - Altitude Callouts 1-369
Mode 7 - Wind Shear 1-369
Mode 8 - Excessive Bank Angle 1-369
Mode 9 - Improper Flap Position on Takeoff 1-370
Pseudo Altitude Mode 1-370
Summary of System Visual/Aural Alerts and Warnings 1-373
Ground Evacuation - Crew Not In Place Checklist 3-121
Ground Handling 5-7
Ground Operation Of The Cargo Door And Ramp System 1-350
Ground Operations 3-6, 3-121
Ground Or Low Airspeed Operation 1-31

H

Halo Paratroop Airdrop (Ramp) 5-9
Hand Held GPS (HHGPS) 1-532
Hand Held Global Positioning System (HHGPS) 1-94
HF Radio AN/ARC-190(V) Automatic Communications System (ACS) 1-65
Description 1-66
HF Antenna 1-78
HF SELCAL Operational Mode 1-67
HF Selective Call (SELCAL) Operation ... 1-77
HF-ACS Automatic (AUT) Operation 1-72
HF-ACS Calling Options 1-76
HF-ACS Channel (CHN) Operation 1-71
HF-ACS Controls 1-66
HF-ACS Data Messages 1-76
HF-ACS Datafill 1-67
HF-ACS Default Mode - Direct Control (DC) 1-73
HF-ACS Manual (MAN) Operation 1-70
HF-ACS Normal Operational Modes 1-67
HF-ACS Operation 1-68
HF-ACS Power Turn Off 1-78
HF-ACS Power-Up 1-69
HF-ACS Preliminary Setup 1-69
HF-ACS Scan List Selection 1-72
HF-ACS SELCAL Annunciator 1-67
HF-ACS SELCAL Pre-Flight Setup 1-68
HF-ACS Silent (SIL) Operation 1-73
HF-ACS Tri-Service Anti-jam Mode 1-73
HF-ACS Tri-Service Anti-jam Operation 1-76
HF-ACS Tri-Service Anti-jam Preflight Setup 1-73
HF-ACS Zeroizing Keys 1-76
Selective Call (SELCAL) Annunciator 1-78
HF Radio ACS Keyfill Panels *1-524
HF Radio AN/ARC-190(V) *1-522
High Altitude Penetration and Approach (Two Engine Configuration) *3-114
High-Pressure ID Bleed Air System 1-30
High-Pressure OD Bleed Air System 1-30
HOLD *1-228
Holding 2-56
Horizontal Stabilizer Trim System 1-45
Electrical and Electrohydraulic Pitch Trim Reset Switch 1-46
Electrical Pitch Trim Disconnect Buttons 1-46
Electrical Pitch Trim Switches 1-46
Electrohydraulic Pitch Trim Switch 1-46
Horizontal Stabilizer Trim Position Indicator 1-46
Hydraulic Pitch Trim Lever 1-46
Hot Weather And Desert Operations 7-13
Hydraulic System Controls 1-42
Controls Which Automatically Actuate Hydraulic System No. 3 Pumps 1-42
Engine Valve Switches 1-42
No. 1 and No. 2 Pump Switches 1-42

* Denotes Illustration

Suction Boost Pump Switches 1-42
Hydraulic System Failure 3-80
Electric Suction Boost Pump Failure 3-81
Engine-Driven Pump Failure 3-81
Hydraulic Suction Boost Pump Failure ... 3-81
Hydraulic System High Pressure 3-81
Loss of Hydraulic Fluid 3-80
No. 3 Hydraulic System Pump Failure 3-81
Hydraulic System Indicators 1-42
Accumulator Pressure Indicators 1-42
Hydraulic Pressure Indicators 1-42
Hydraulic Reservoir Quantity Gauges 1-42
Pressure Low Lights 1-42
Pressure On Light 1-42
Hydraulic System No. 1 1-41
Hydraulic System No. 2 1-41
Hydraulic System No. 2 Service Center .. *3-108
Hydraulic System No. 3 1-41
Hydraulic Systems 1-41, *1-482
Hydraulic Systems Control And Indicator Panel *1-485
Hydroplaning 7-12

I

IBIT Results *1-294
Ice Detection System 1-37
Ice Detection Controls 1-37
Ice Detection System Icing Warning Light 1-37
Icing 7-7
Icing And Cold Weather Operations 7-7
IFF Panels *1-526
IFF Radar(APX-64)/(APX-72) 1-78
CADC Data Input IFF and Yaw Damper Power Panel 1-80
IFF Panel 1-78
IFF Self-Test Procedures 1-80
Normal Operation of IFF 1-80
Ignition System 1-12
Fuel and Start Ignition Switch 1-12
In-Flight 3-10, 3-122
In-Flight Emergency Flare Jettison 3-36
In-Flight Operation of Crew Oxygen System 1-358
In-Flight Operation Of The Cargo Door And Ramp System 1-352
INAV CTRL INDEX 2/2 .... *1-189
Inertial Navigation System (INS) 1-303
Unit Descriptions 1-303
Initial Power-Up 1-178
BIT PASS Page 1-178
Power-Up 1-178
POWER UP Page 1-179
TIMEOUT Page 1-178
WAYPOINT SELECT Page 1-180
INITIATED BIT *1-294
INS MAINT *1-293
INS STATUS *1-191
Instrument Approaches 2-60
Instrument Markings 5-2, *5-15
Instrument Take-off 2-53
Instruments 1-379
Accelerometer 1-379
Clocks 1-379
Flight Engineer's Altimeter 1-379
Magnetic Compass 1-379
Navigator's Altimeter 1-379
Navigator's True Airspeed Indicator 1-379
Total Air Temperature Indicator 1-379
Interior Arrangement 1-9
Interior Lighting - Flight Station 1-343
Annunciator and Caution Lights 1-345
Center Console Lighting 1-345
Center Instrument Panel Lighting 1-345
Copilot's Instrument Panel Floodlighting 1-345
Copilot's Instrument Panel Lighting 1-345
Copilots' Side Console Lighting 1-345
Flight Engineer's Instrument Lights 1-346
Flight Engineer's Main Circuit Breaker Panel Lights 1-346
Flight Engineer's Panel Lighting 1-346
Flight Engineer's White Flood and Workable Lights 1-346
Flight Station Dome Lights 1-346
Master Caution Light System 1-345
Master Caution, Annunciator and Caution Lights 1-346
Navigator's Instrument Lights 1-346
Navigator's Panel Lighting 1-346
Navigator's White Flood, Workable, and Utility Lights 1-346
NVIS Lighting 1-344
Pilot's and Copilot's Letdown Chart Lights 1-345

* Denotes Illustration

Pilot's and Copilot's Utility Lights 1-345
Pilot's Instrument Panel Floodlighting and Standby Compass Light 1-345
Pilot's Instrument Panel Lighting 1-344
Pilot's Side Console Lighting 1-344
Pilots' Overhead Floodlighting 1-344
Pilots' Overhead Panel Lighting 1-344
Reading Lights 1-346
Thunderstorm Lighting 1-344
Interior Lights *1-572
Interphone Panel Locations 1-512
Interphone Procedures And Phraseology 4-3
Interphone System (AN/AIC-18) 1-54
Altitude Alert 1-55
Auxiliary Interphone Panel 1-56
Cockpit Voice Recorder Interface 1-55
Flight Station Loudspeaker 1-55
Ground Collision Avoidance System (GCAS) Interface 1-55
Interphone Monitor Panels 1-56
Interphone Panels 1-55
Microphone Switches 1-55
Secure Interphone 1-55

J

Jammed Aileron Checklist 3-73

K

KEYBOARD ECHO TEST *1-295
KY-58 Component Location *1-527
KY-75 Component Location *1-529
KYV-5 Component Locations *1-530

L

L-Band SATCOM Components *1-533
L-Band Satellite Communications System (L-Band SATCOM) 1-90
L-Band SATCOM Components 1-91
L-Band SATCOM Controls 1-91
L-Band SATCOM Operation 1-91
Printer Indicator Lights 1-91
Landing 2-65, 3-44, 3-123
Normal Brake Operation 2-66
LANDING DATA 1/2 .... *1-272
LANDING DATA 2/2 .... *1-273
Landing Gear Controls 1-50
Landing Gear Down Lock Release 1-50
Landing Gear Lever 1-50
Main Landing Gear Door Uplock Latch Emergency Release Handles 1-50
Main Landing Gear Emergency Downlock Engage Handles 1-50
Main Landing Gear Emergency Uplock Release Handles 1-50
Main Landing Gear Pry Bar 1-50
Nose Landing Gear Emergency Extension Hydraulic System Hand Pump 1-50
Selector Valves Manual Controls 1-50
Landing Gear Electrical Malfunction Checklist 3-38
Landing Gear Emergencies 3-38
Landing Gear Emergency Extension Checklist 3-39
Landing Gear Indication 1-50
Bogie Position Indicator 1-50
Landing Gear Position Indicators 1-50
Nose Landing Gear Emergency Extension Hydraulic System Pressure Gauge 1-50
Landing Gear Manual Controls *3-100
Landing Gear System 1-49
Landing Gear System Legend *1-495
Landing Gear Warning Light Illuminated .. 3-42
Landing Gear Warning Systems 1-51
Horn Silence Button 1-51
Landing Gear Warning Horn 1-51
Landing Gear Warning Horn Cutout Switch and ON/OFF Light 1-51
Landing Gear Warning Light 1-51
Landing Gear Warning Light and Horn Test Button 1-51
Landing Rate Of Sink 5-7
Landing With Flat Tire 3-47
Nose Gear Tire Flat 3-47
One or More Tires on One Main Gear Flat 3-47
Landing With Nose Gear Retracted 3-46
Landing With One Or More Engines Inoperative 3-44
Asymmetrical Engines 3-44
One Engine Inoperative 3-44
Symmetrical Engines 3-44
Two Engines Inoperative 3-44
Two-Engine Procedure 3-44
Landing With One Or More Main Gears Retracted Or Missing 3-45

* Denotes Illustration

LANDING ZONE INIT 1/2 .... *1-231
LANDING ZONE INIT 2/2 .... *1-232
Lateral Control 6-3
Lateral Stability *3-119
Lavatory Facilities 1-380
LEGS HISTORY *1-216
LEGS PAGE PROCEDURE DISPLAY ... *1-209
LEGS PRIMARY *1-208
LEGS TO ALTERNATE *1-211
Letdown Chart Holder 1-380
Life Raft Provisions 1-378
  Life Raft Release Handles 1-378
  Wing Life Raft Release Handles 1-378
Life Vest Stowage Provisions 1-378
Lighting System 1-343
Lineup 2-51
Loadmaster 4-22
  After Landing/Before Leaving Aircraft ... 4-38
  After Loading Airdrop Equipment (CDS) . 4-53
  After Loading Airdrop Equipment (Platform[s]) 4-52
  After Loading General 4-35
  After Take-Off, Climb 4-37
  Air Transportable Galley/Lavatory (ATGL) Preflight 4-29
  Aircraft Preparation for Container Delivery System (CDS) Airdrop 4-49
  Aircraft Preparation for Equipment Airdrop 4-46
  Aircraft Preparation for Palletized/Floor Loading Cargo 4-33
  Aircraft Preparation for Paratroop Loading 4-43
  Aircraft Preparation for Passenger/Air EVAC Loading/Emergency Airlift of Personnel 4-33
  Approach 4-38
  ATGL Postflight 4-39
  ATGL Winterization (Modified) 4-42
  ATGL Winterization (Original) 4-40
  Before Take-Off 4-37
  Before Taxi 4-36
  Cruise 4-37
  Descent 4-38
  External Power Connect/Electrical Power Off 4-22
  External Power Connect/Electrical Power On 4-24
  External Power Disconnect 4-25
  Initial Preflight 4-25
  Loading 4-35
  Normal Procedures 4-22
  Portable Lavatory 4-32
  Prior to Loading Airdrop Equipment 4-51
  Prior to Loading General 4-34
Loadmaster/Jumpmaster Panel (Typical) . *1-580
Loss Of All Generators Checklist 3-66
  Effect On Systems 3-71
  Emergency Generator Operation 3-72
Loss of Normal DC Power (AC Power Normal) 3-69
Low Altitude Instrument Approaches 2-61
Low Altitude Penetration and Approach (Two Engine Configuration) *3-115

M

Magnetic Standby Compass *1-592
Main Instrument Panel *1-390
Main Landing Gear *1-503
Main Landing Gear Bogie Malfunctions 3-42
Main Landing Gear Door Lock Selector Valve *3-109
Main Landing Gear DownLock Selector Valve *3-111
Main Landing Gear Leveler Rod *1-506
Main Landing Gear Selector Valve *3-110
Main Landing Gear Strut And Tire Inflation Pressures For EWP Gross Weights 5-2
MAIN MENU 1/2 .... *1-274
MAIN MENU 2/2 .... *1-274
Main Menu Tree *1-273
MAINTENANCE INDEX *1-291
Maintenance Index Tree *1-291
Maneuver Load Factor Limitations 5-14
Manual Operation Of The Cargo Door And Ramp System 1-353
  Control Valve Electrical Failure 1-354
  Hydraulic Pump Failure (Both Pumps in No. 3 System) 1-353
Manual Pressurization Procedure 1-35
Map Datum 1-182
  Definition 1-182
  MAP DATUMS 1/5 Page 1-183
  Selection 1-182
  USER DEFINED DATUM Page 1-183
  USER DEFINED Page 1-183
MAP DATUMS 1/5 .... *1-183

* Denotes Illustration

MARK LIST *1-281
MARK POSITION *1-275
Master Caution System 1-376
  Annunciator and Caution Lights Test Switches 1-376
  Caution Lights Dimming Switch 1-376
MAT Runway Limitations 5-2
Maximum Allowable Fuel Unbalance 5-4
Maximum Allowable Fuel Weights 5-4
Maximum Flight Speed vs. Altitude Chart - Spoilers Extended *5-27, *5-33
Maximum Flight Speed vs. Altitude Chart-Clean *5-26, *5-32
Maximum Load Profile *3-99
Maximum Speed Warning System 1-376
MCD/FN Checklist Procedures 4-55
  Before Leaving Aircraft 4-59
  Before Take-Off 4-57
  Before Taxi 4-56
  Deplaning 4-59
  Descent 4-58
  Enplaning 4-55
  In-Flight 4-57
  Interior Inspection 4-55
MFCDU *1-552
MFCDU BIT PASS *1-178
MFCDU Display Test *1-295
MFSI *1-96
Microburst 7-6
Minimum Crew Requirements 5-2
Miscellaneous Equipment 1-378
Missed Approach 2-61
Missile Warning CPU Location *1-562
Missile Warning Optical Sensor Unit Location *1-561
Missile Warning System (AN/AAR-47) 1-323
  Computer Processing Unit (CPU) 1-324
  Control Indicator (CI) 1-323
  MWS Built-in-Test 1-323
  Optical Sensor-Converters 1-324
Mission Flight Parameters 1-221
  Airdrop Multiple Runs 1-226
  CARP END OF RUN Page 1-244
  CARP INIT 1/6 Page 1-233
  CARP INIT 2/6 Page 1-234
  CARP INIT 3/6 Page 1-236
  CARP INIT 4/6 Page 1-238
  CARP INIT 5/6 Page 1-239
  CARP INIT 6/6 Page 1-241
  CARP PROGRESS Page 1-242
  CHUTE LIST Page 1-245
  Computed Air Release Point (CARP) 1-223
  Flight Plan Approach 1-221
  HOLD Page 1-228
  Holding Patterns/Refueling Orbits 1-226
  HSI Behavior 1-226
  LANDING ZONE INIT 1/2 Page 1-231
  LANDING ZONE INIT 2/2 Page 1-232
  MISSIONS Page 1-227
  RENDEZVOUS Page 1-230
  Rendezvous/Intercept Waypoints 1-226
MISSION Procedure Identifiers *1-209
Mission Tree *1-227
MISSIONS *1-227
MLG DownLock Pawl *3-105
MLG Step 2 Handle Failure Chopping Area 3-113
Mode 1 - Inner Boundary *1-365
Mode 1 - Outer Boundary *1-365
Mode 2A *1-365
Mode 2B *1-366
Mode 2B - Cutoff *1-366
Mode 3 .... *1-366
Mode 4A *1-366
Mode 4B - Gear Down *1-367
Mode 4B - Gear Down/Up *1-367
Mode 4B - Tactical *1-367
Mode 4C *1-368
Mode 5 - Inner Boundary *1-368
Mode 5 - Outer Boundary *1-368
Mode 7 .... *1-369
Mode 8 .... *1-370
Multi-Function Display 1-317
  Hold Pushbutton 1-317
  INT Control 1-318
  NOR-MKR-DLY Switch 1-318
  Range Selector 1-317
  TGT Clar Control 1-317
Multi-Function Display Controls 1-327
  SKE System Modes 1-327
  SKE System Warnings and Status Annunciators 1-328
Multi-Function Standby Instrument (MFSI) System 1-96
  Multi-Function Standby Instrument (MFSI) System Operation 1-97

* Denotes Illustration

Multi-Function Standby Instrument (MFSI) 1-96
Multiple Radio Transmit 1-78
Multiple Radio Transmit Panel *1-525

N

NAV DATA *1-277
NAV INHIBIT *1-278
NAV TUNE Menu Hierarchy *1-195
NAV TUNE TAC *1-197
NAV TUNE VOR *1-197
Navigation Systems 1-91
Navigator 4-4
After Landing 4-13
After Take-Off, Climb 4-12
After Take-Off, Climb (Polar Areas) 4-21
Approach 4-13
Approach (Polar Areas) 4-21
Before Leaving Aircraft 4-14
Before Starting Engines 4-11
Before Take-Off 4-12
Before Take-Off (Polar Areas) 4-19
Before Taxi 4-11
Cruise 4-12
Cruise (Polar Areas) 4-21
Descent 4-12
Descent (Polar Areas) 4-21
Grid Checklist 4-16
Grid Entry Enroute 4-17
Grid Exit Enroute 4-19
Heading Reference Change-Over 4-18
INS Mode Updates 4-14
Interior Inspection 4-4
Lineup (Polar Areas) 4-20
Normal Procedures 4-4
Polar Grid Checklist 4-19
Navigator's ALE-47 DS Panels *1-563
Navigator's Instrument Panel *1-400
Navigator's Radar Display Select Panel ... 1-318
Navigator's True Airspeed Indicator *1-593
Night Flying 7-14
NLG UpLock Emergency Access *3-106
NLG UpLock Emergency Release *3-107
Normal Fuel Management 1-22
Before Leaving Aircraft 1-24
Climb and Cruise 1-23
Engine Start 1-22
Landing 1-23
Taxi, Engine Run-up, and Take-off 1-22
Touch-and-Go Landing/Go-Around 1-24
Normal Operation Of Air Conditioning Systems 1-33
Normal Operation Of Pressurization System 1-35
After Take-off, Climb, and Cruise 1-35
Before Take-off 1-35
Descent 1-35
Normal Operation of the Flight Management System 1-306
Air Refueling 1-315
In Flight 1-312
Post Flight 1-315
Preflight 1-306
Normal Procedures 1-332
In-Flight Procedures 1-339
Master/Follower Aircraft Information Operation 1-339
Operation with Zone Marker 1-341
Preflight Procedures 1-332
Sending FCI Commands and Data 1-339
Shut Down Procedures 1-341
TWS Coordinated Turns 1-340
TWS Turns for a Follower 1-340
Normal/Concurrent Refueling Checklist 2-77
Nose Gear Steering System 1-51
Nose Landing Gear *1-499
Nose Landing Gear Emergency Extend System *1-498
Nose Landing Gear Selector Valve *3-112

O

Obstacle Climbout 2-53
Oil System 1-11
Low Oil Pressure Warning Light 1-12
Low Oil Quantity Lights 1-12
Oil Pressure Indicator 1-11
Oil Temperature Indicators 1-12
On Entering The Aircraft 7-8
Operating Envelope for Paratroop Airdrop *5-1
Compass (COMP) 1-155
Directional Gyro (DG) 1-154
Slave (SLV) 1-154
Air-to-Air Mapping 1-321

* Denotes Illustration

Beacon Interrogation 1-322
Long Range Terrain Mapping 1-320
Mapping Interpretation 1-321
Medium (MAP 1) or Short (MAP 2) Range Terrain Mapping 1-320
Radar Turn Off 1-323
System Test 1-318
Weather Avoidance Operation 1-319
Operation Prior To Departure 7-3
Confidence Check 7-3
Radar Set Test 7-3
Weather Check 7-3
Operations With JP-8 Fuel 5-4
Other Limitations 5-14
Oxygen Duration *1-583
Oxygen Mask Provisions 1-378
Oxygen Preflight Check 1-358
Oxygen System 1-357, *1-581
Oxygen System Postflight Procedures 1-359

P

Paratroop Airdrop Limitations 5-9
Paratroop Equipment 1-355
Air Deflector Doors 1-356
Anchor Cables 1-356
Jump Signals 1-356
Seats 1-356
Static Line Retriever 1-356
Static Line Retriever Controls 1-356
Troop Doors 1-356
Troop Jump Platforms 1-356
Parking Brake Handle 1-52
Penetration 2-56
PERF INIT RTE X *1-268
Performance Data Worksheet/Airdrop Data .. 2-3
Performance Management 1-252
Atmospheric Model 1-254
CLIMB Page 1-255
Climb Page Title Line 1-256
CRUISE Page 1-259
Cruise Page Title Line 1-260
DESCENT FORECAST Page 1-266
DESCENT Page 1-264
FMS Flight Phases 1-252
FMS VNAV Modes 1-253
Fuel and Weight Management 1-255
Performance Predictions 1-255
Reference Data 1-254
Speed Envelope Protection 1-254
Speed Target Generation 1-253
Thrust Management 1-255
Time Navigation 1-255
Permanently Installed Oxygen Distribution System 1-361
Oxygen Distribution Kits 1-361
Personnel Protective Armor 1-380
Personnel Warning Signs 1-380
Personnel Warning Sign Switches 1-380
Petal Doors 1-349
Pilot 4-3
Pilot Duties 2-53
Pilot's Accelerometer *1-591
Pilot's Defense System Panels *1-560
Pilot's Side Console *1-388
Pilot's Station (Typical) *1-386
Pilots' Avionic Preflight 2-38
Pilots' Center Instrument Panel *1-392
Pilots' Instrument Panel *1-391
Pilots' Overhead Control Panels *1-398
Pilots' Overhead Control Panels (Typical) *1-397
Pitch Trim Malfunctions 3-75
Inoperative Pitch Trim 3-76
Runaway Pitch Trim 3-75
Stalled Hydraulic Pitch Trim 3-76
Pitot Icing 7-7
Pitot-Static System *1-596
Pitot-Static System 1-380
Manual Shutoff Valve (Static Pressure) .. 1-380
Pitot-Static Operated Instruments 1-380
Pitot-Static Tubes Anti-icing Systems 1-37
Pitot-Static Tubes Anti-icing Systems Controls 1-37
Pitot-Static Tubes Anti-icing Systems Lights 1-38
Portable Oxygen Bottle 1-359
Postflight 7-12
Power Turbine Assembly 1-16
POWER UP *1-179
Power-Up Menu Hierarchy *1-178
Power-Up Condition 1-160
Active Route 1-160
Display/Entry Conventions 1-161
Erase/EXEC 1-160

* Denotes Illustration

NP Source Indication 1-160
Route States 1-160
Selection, Entry and Deletion 1-161
Practice Maneuvers with One or More Engines Inoperative 2-60
Practice Stalls 6-1
Preflight Checks 2-3
Preparation For Flight 2-3
Pressure Door 1-348
Pressurization System 1-33
Pressurization System Controls 1-34
Automatic Cabin Pressure Control 1-34
Cabin Attitude Limit Override Switch 1-34
Cabin Pressure Manual Control 1-34
Emergency Depressurization Switches ... 1-34
Emergency Pressurization Switches 1-34
Pressurization System Indicators 1-35
Cabin Altimeter and Differential Pressure Indicators 1-35
Cabin Rate-of-Climb Indicator 1-35
Low Pressurization Lights 1-35
Primary Control (APN-169C) 1-328
Primary Flight Display *1-540
Primary Flight Display (PFD) 1-100
Airspeed Area 1-102
Altitude Area 1-102
Attitude Director Indicator (ADI) Area .. 1-101
Horizontal Situation Indicator (HSI) Area 1-102
Mode/Status Annunciator Area 1-101
TAKEOFF Annunciator 1-106
Warning Annunciation 1-106
Primary Flight Display Layout *1-539
PRIMARY ROUTE *1-205
PROGRESS - ETP 3/3 .... *1-220
PROGRESS 2/3 .... *1-218
PROGRESS Pages 1-217
PROGRESS 1/3 Page 1-217
PROGRESS 2/3 Page 1-218
PROGRESS ETP 3/3 Page 1-219
Prohibited Activities 2-75
Prohibited Maneuvers 5-7
Protective Covers 1-380
Prying MLG DownLock *3-104
Prying MLG Drag Link *3-102
Public Address System (AN/AIC-13) 1-56
Public Address Switch 1-56
Public Address System Auxiliary Panel ... 1-56
Public Address System Main Panel 1-56
Public Address System Controls (Typical) *1-513
Push-Back/Tow Procedures 3-87

R

Radar Control Panel 1-317
ANT and RT Indicators 1-317
ANT Stab Switch 1-317
ANT Tilt Control 1-317
Function Selector Switch 1-317
Gain Control 1-317
Pencil-Fan Switch 1-317
Radar Malfunction 3-83
Operation Without Antenna Stabilizer ... 3-83
Operation Without Pressurization 3-83
Radar Receiver-Transmitter (APN-169C) .. 1-331
Radar Set (AN/APS-133) 1-316
Radar Set (AN/APS-133) Operation 1-318
Air-to-Air Mapping 1-321
Beacon Interrogation 1-322
Long Range Terrain Mapping 1-320
Mapping Interpretation 1-321
Medium (MAP 1) or Short (MAP 2) Range Terrain Mapping 1-320
Radar Turn Off 1-323
System Test 1-318
Weather Avoidance Operation 1-319
Radar Set Controls and Indicators 1-317
Radar Set Modes of Operation 1-316
Radar System - Standby 1-323
Radio Navigation Management 1-194
NAV TUNE INDEX Page 1-195
NAV TUNE TAC Page 1-197
NAV TUNE VOR Page 1-196
TACAN Transceiver Control 1-195
TACAN Transceiver Tuning 1-194
VOR Receiver Control 1-195
VOR Receiver Tuning 1-195
Rain 7-12
Rain And Hydroplaning 7-12
Ram Air Ventilation 1-31
Rapid Decompression 3-34, 3-122
Raw Data ILS Approach 2-65
Recommended Turbulent Air Penetration 5-11, 5-12, 5-13
Reference Ground Speed 2-64

* Denotes Illustration

Reference Set Panel (RSP) 1-99
A/S (AIRSPEED) TRIM Switch 1-99
A/S (CMD AIRSPEED SLEW) Switch ... 1-100
ALT (CMD ALTITUDE SLEW) Switch .. 1-100
ALT ALERT (ALTITUDE ALERT) SET Knob 1-100
ALT ALERT INHB (ALTITUDE ALERT INHIBIT) Pushbutton 1-100
BARO SET Knob 1-99
CRS (COURSE SELECT) Knob 1-100
HDG (HEADING SELECT) Knob 1-100
Relative Range Indicator (APN-169A) 1-331
Remote Dispense Switch Locations *1-566
RENDEZVOUS *1-230
Rendezvous 2-57
Repositioning of Palletized Cargo/Airdrop Platforms 3-36
Repositioning of Cargo Aft 3-36
Repositioning of Cargo Forward 3-36
Rolling Take-off 2-52
Rotation/Go-Around Function 1-143
Autopilot Mode 1-144
Flight Director Mode 1-144
Operation 1-143
ROUTE and LEGS Pages Menu Hierarchy *1-201
ROUTE PLAN *1-203
ROUTE TO ALTERNATE *1-207
Rudder Hydraulic Power Control Failure ... 3-78
Rudder High-Pressure Select System 3-78
Rudder Pedal Steering System 1-51
Rudder Pedal Steering System Operation . 1-51
Rudder System 1-43
Rudder High Pressure Override Switch ... 1-44
Rudder Hydraulic Power Control Switches 1-44
Rudder Pedals 1-43
Rudder System 1 Power and Rudder System 2 Power Lights 1-44
Rudder System High Pressure Lights 1-44
Rudder System Overpressure Light 1-44
Rudder System Power Off Lights 1-44
Rudder Trim Control Switches 1-44
Rudder Trim Position Indicator 1-44
Runway Surface Conditions 5-2

S

Safety Switch Locations *1-565
SCADC *1-191
SCADC Failure 3-83
Scanner 4-21
Normal Procedures 4-22
Seats 1-381
Auxiliary Crew Seats 1-381
Crew Bunk Seat Backs 1-381
Engineer's and Navigator's Seats 1-381
Jump Seat 1-381
Pilots' Seats 1-381
Secondary Control (APN-169C) 1-328
Secondary Flight Display *1-544
Secondary Flight Display (SFD) 1-108
Cautions, Warnings, and Advisories (CWA) Area 1-111
Common SFD Mode Annunciations 1-108
SKE Mode Page 1-109
SFD Warning Annunciation 1-110
Unique SFD Expanded HSI Mode Annunciations 1-108
Unique SFD MAP Mode Annunciations 1-108
Secure Voice System (KY-58/TSEC) Vinson . 1-80
Controls for the Secure Voice System (KY-58/TSEC) 1-80
KY-58 Controls 1-80
Loading Secure Voice Systems (KY-58/TSEC) 1-80
Operation in the Cipher Text Mode 1-81
Operation in the Cipher Text Only Mode . 1-82
Operation in the Plain Text Mode 1-81
Operation of the Secure Voice System (KY-58/TSEC) 1-81
Z-ANP Controls 1-80
Zeroizing Procedures 1-82
Secure Voice System (KY-75/TSEC) Park-Hill 1-82
Controls for the Secure Voice System (KY-75/TSEC) 1-82
Loading Secure Voice Systems (KY-75/TSEC) 1-82
Operation in the Cipher Text Mode 1-83
Operation in the Plain Text Mode 1-83
Operation of the Secure Voice System (KY-75/TSEC) 1-83
Z-AKV and Z-AKW Controls 1-82
Zeroizing Procedures 1-83

* Denotes Illustration

Sensor Management ... 1-184
Attitude/Heading Selection ... 1-185
Coordinate Systems ... 1-186
Display Data Resolution ... 1-186
Fault Detection ... 1-186
GPS Acquisition and Tracking ... 1-184
GPS Management ... 1-184
GPS STATUS 1/2 Page ... 1-189
GPS STATUS 2/2 Page ... 1-190
INAV CTRL INDEX Page ... 1-189
INAV CTRL SOLN Page ... 1-187
INS Managment ... 1-184
INS POSITION UPDATE Page ... 1-188
INS STATUS Page ... 1-191
Integrated Navigation ... 1-184
Navigation Accuracy ... 1-186
Navigation Data Display ... 1-186
SCADC Management ... 1-184
SCADC Page ... 1-191
Sensor Data Checking ... 1-184
Servicing Diagram ... *2-100
Servicing Operation - Preparations ... 2-76
SID REVIEW ... *1-287
Signal Light Stowage ... 1-381
Single Point Refueling And Defueling System ... 1-24
Single Point Refueling and Defueling System Controls ... 1-24
Ground Isolation Valve Switch ... 1-24
Refuel Switches ... 1-24
Sink Rate Chart ... *5-22
SKE Antenna System ... 1-332
SKE System Controls ... *1-567
SKE Test ... *1-336
SKE/Weather Radar System Interface ... 1-327
Signal Data Converter (CV-3838/AP Auxiliary Interface Unit) (AIU) ... 1-327
Smoke And Fume Elimination Checklist ... 3-15, 3-122
Smoke Detector System ... 1-376
Smoke Detector Warning Lights And Test Switches ... 1-376
SOLUTION Menu Hierarchy ... *1-187
Specific Limitations ... 5-2
Spins ... 6-2
Spoiler Operation In-Flight ... 1-49
Spoiler Operation on Ground ... 1-49
Spoiler System Failure ... 3-78
Loss of Electrical Power ... 3-78
Spoiler Asymmetry ... 3-78
Spoilers Indicate Unlocked In-Flight ... 3-78
Stall Characteristics ... 6-1
Stall Recovery ... 6-2
Stall Warning ... 6-1
Stall Warning System ... 1-144
Angle of Attack (AOA) Vanes ... 1-144
Audible Stall Warning ... 1-145
Stall Warning Fault Indications ... 1-144
Stall Warning Operation ... 1-145
Stall Warning System Inhibit Switches .. 1-144
Stall Warning Test ... 1-145
Visual Stall Warning ... 1-145
Stalls ... 6-1
Standard Central Air Data Computer (SCADC) System ... 1-95
SCADC Test Switch ... 1-96
Standing Take-off ... 2-52
STAR REVIEW ... *1-290
Starting Engines ... 2-41, 7-9
Starting Limitations ... 5-3
Starting System ... 1-12
Starter Button ... 1-12
Starter Valve Light ... 1-13
Static Line Retriever Winch Control Handle ... *1-580
Station Keeping Equipment (SKE) ... 1-326
STORED ROUTE LIST ... *1-276
Structural Icing ... 7-7
Radome ... 7-8
Windshield ... 7-7
Wing ... 7-8
System Condition Lights ... *1-586
SYSTEM CONTROL ... *1-275
Systems ... 3-59

T

Table of Communications and Associated Electronic Equipment ... *1-510
TACAN Systems (AN/ARN-118(V)) ... 1-93
Antennas ... 1-93
Automatic Self-Test of TACAN System(s) . 1-94
Manual Self-Test of TACAN System(s) ... 1-94
Normal Operation of the TACAN System(s) ... 1-93
Take-off ... 2-51, 3-8, 7-6, 7-10

* Denotes Illustration

Take-off Considerations 7-10
Take-off Gust Correction 2-52
Take-off Warning System 1-376
Takeoff and Landing Data 1-267
ANALOG STATUS Page 1-292
ARRIVAL RWYS Page 1-287
ARRIVAL STARS Page 1-288
ARRIVAL TRANS Page 1-289
CUSTOM DATA LIST Page 1-280
CUSTOM DATA Page 1-279
DEP/ARR INDEX Page 1-283
DEPARTURE RWYS Page 1-284
DEPARTURE SIDS Page 1-285
DEPARTURE TRANS Page 1-286
DISCRETE STATUS Page 1-292
EQUIPMENT HIST Page 1-291
EQUIPMENT STATUS Page 1-292
FIX INFO Page 1-276
FROM/TO Page 1-280
IBIT RESULTS Page 1-294
INITIATED BIT Page 1-293
INS MAINT Page 1-293
KEYBOARD ECHO TEST Page 1-295
Landing Data Computations 1-268
LANDING DATA RTE X 1/2 Page 1-272
LANDING DATA RTE X 2/2 Page 1-273
MAIN MENU 1/2 Page 1-273
MAIN MENU 2/2 Page 1-274
MAINTENANCE INDEX Page 1-291
MARK LIST Page 1-281
MARK POSITION Page 1-275
MFCDU DISPLAY TEST Page 1-295
NAV DATA Page 1-277
NAVAID INHIBIT Page 1-278
PERF INIT RTE X Page 1-268
Selected Flaps Position 1-267
SID REVIEW Page 1-287
STAR REVIEW Page 1-290
STORED ROUTE LIST Page 1-275
SYSTEM CONTROL Page 1-274
TAKEOFF DATA 1/2 Page 1-271
TAKEOFF DATA 2/2 Page 1-272
TIMERS Page 1-281
TOLD Airfield 1-267
TOLD INIT 1/3 Page 1-269
TOLD INIT 2/3 Page 1-270
TOLD INIT 3/3 Page 1-270
TOLD Initialization Data Source 1-267
TOLD Obstacle 1-267
TOLD Wind 1-267
ZEROIZE Page 1-282
TAKEOFF DATA 1/2 .... *1-271
TAKEOFF DATA 2/2 .... *1-272
Takeoff Warning Annunciation Malfunction 3-89
Taxi 7-10
Taxiing Limitations 5-3
Therapeutic Oxygen System 1-362
Three-Engine Take-Off Procedure 3-90
After Take-Off/Climb 3-90
Before Electrical Power-On Check 3-90
Before Starting Engines 3-90
Before Take-Off 3-90
Engine Failure - Take-Off Continued 3-91
Engine Failure During Climb 3-91
Engine Failure During Take-Off - Take-Off Aborted 3-91
Take-Off 3-90
Throttle Positions *1-406
Throttles 1-13
Thrust Reverser Failure 3-14
Thrust Reverser Pressure On Light Illuminated 3-14
Thrust Reverser Unlocked Indication 3-14
Tiedown Chains 1-348
Tiedown Devices 1-348
Tiedown Fittings 1-348
TIMEOUT *1-178
TIMERS *1-282
Tire Performance 5-3
TOLD INIT 1/3 .... *1-269
TOLD INIT 2/3 .... *1-270
TOLD INIT 3/3 .... *1-270
Total Air Temperature Indicator *1-595
Total Temperature Probes De-icing System 1-37
Temperature Probe De-ice Switch 1-37
Touchdown Relay Malfunctions 3-46
Troop Oxygen Masks 1-378
Troop Oxygen System 1-359
Converter Pallet Assembly 1-359
Regulator Panel Assembly 1-359
Troop Oxygen Panel 1-361
Troop-Carrying Equipment 1-355

* Denotes Illustration

Turbofan Engines 1-9
Turbulence And Thunderstorms 7-5
Turning Radius And Ground Clearance ... *2-89
Typical Blower Installation Mounting Provisions *1-589
Typical CAT II Approach *2-96
Typical High Altitude Penetration Approach Four And Three Engine Configuration *2-92
Typical Landing And Go-Around Pattern .. *2-98
Typical Low Altitude Approach Four And Three Engine Approach *2-93
Typical Monitored Approach *2-95
Typical Radar Approach Four And Three Engine Configuration *2-94
Typical Radar Approach Two Engine Configuration *3-116
Typical Take-off And Climb *2-90
Typical Take-off And Obstacle Climb *2-91

U

UHF Frequency Card Holders 1-381
UHF Radio AN/ARC-164(V) 1-56
Alternate - MWOD Erase 1-60
Anti-Jam Operational Procedures 1-58
Description 1-57
Frequency Managed A-Nets 1-62
Frequency Managed Training (FMT) Nets 1-62
Guard Operation 1-58
Multiple WOD Loading 1-59
MWOD Loading Using a KYK-13/TSEC Keyfill Device 1-59
Net Numbers 1-62
Operation of the AN/ARC-164(V) 1-58
Single WOD Loading 1-60
System Operation 1-57
Time of Day 1-61
Time of Day (TOD) and TOD Update Reception 1-61
TOD Emergency Clock Start 1-61
TOD Transmission 1-61
Training Nets 1-62
UHF AN/ARC-164(V) Controls 1-57
UHF Antennas 1-62
Verifying an MWD is Loaded 1-60
WOD Erase 1-60
WOD Loading 1-59
Word of Day (WOD) 1-58
UHF Radio AN/ARC-164(V) Digital *1-520
UHF Satellite Terminal System (USTS) Antenna Subsystem 1-62
USTS Subsystem Operation 1-63
Uncommanded Yaw In-Flight 3-78
Uncommanded Yawing Motions (Small) 6-3
Under Spoiler Speed Warning System 1-49
Underdeck Electronics Equipment *1-515
Underwater Acoustic Beacon System 1-343
USER DEFINED DATUM *1-183
USTS Antenna Subsystem *1-518

V

Vertical Navigation (VNAV) 1-245
Alert Altitude Reset Conditons 1-251
Altitude and Airspeed Target Determination In Climb Flight Phase 1-249
Altitude Target Determination In Cruise Flight Phase 1-249
Altitude Target Determination In Descent Flight Phase 1-249
Top of Climb (TOC) 1-251
Vertical Guidance Altitude Target 1-247
Vertical Guidance Availability/ Engagement 1-246
Vertical Guidance Dual Operation Considerations 1-252
Vertical Guidance Operation In Holding Patterns 1-251
Vertical Guidance Sequencing in Dual ... 1-252
Vertical Guidance Terminology/ Definitions 1-246
Vertical Track Alert 1-251
VNAV Characteristics 1-250
VNAV Modes 1-245
VHF AM/FM Radio AN/ARC-186(V) 1-63
Normal Operations 1-63
VHF 1 Backup Control and Operation 1-64
VHF Antennas 1-65
VHF Control 1-63
VHF Radio AN/ARC-186(V) *1-521
VOR/ILS/MB Navigation Systems (AN/ARN -147(V)) 1-91
Backup Operation of the VHF NAV System 1 1-92
Marker Beacon 1-92
Normal Operation of the VHF Navigation System 1-92

* Denotes Illustration

VOR/Marker Beacon Self-Test 1-92

W

Wake Turbulence 6-2
Wake Turbulence Avoidance Procedures 6-2
Walk-Around Inspection (Scanner) 2-36
Warmup And Ground Tests 7-9
Warning Indications 1-341
  Caution 1-342
  Master Lost 1-342
  Proximity Warning 1-341
  Two Masters 1-342
Warning Systems 1-362
WAYPOINT DATA 1/2 .... *1-211
WAYPOINT DATA 2/2 .... *1-212
WAYPOINT SELECT *1-180
Weather Curtain 1-381
Weather Interpretation And Avoidance 7-1
Weather Patterns 7-2
  Hail 7-2
  Icing 7-2
  Lightning And Static 7-3
  Snow 7-2
  Tornadoes 7-2
Weather Presentation 7-1
  Color Significance 7-1
  Precipitation Gradients 7-2
  Storm Growth 7-2
Weight And Balance 2-3
Weight Limitations ... 5-2, 5-10, 5-12, 5-13, 5-14
Wheels Up Landing 3-48
Wheels Up Landing Chart (Planned) 3-135
Whiffletree Snatch Blocks 1-348
Wind Gust Limitations 5-3
Wind Shear 7-6
Wind Shear 2-64
  Procedure 2-64
Wind Shear On Take-off 2-52
Windshield Heating System 1-41
  Windshield Heat Switches 1-41
Windshield Impairment 3-84
  Replacement Criteria for Electrically Heated Windshields or Windows 3-84
  Structural Integrity of Electrically Heated Windshields and Windows 3-84
Windshield Rain Removal System 1-36
Windshield Rain Removal System Controls and Indicators 1-36
  Windshield Rain Removal System Overheat Lights 1-36
  Windshield Rain Removal System Selector Switch 1-36
Windshield Rain Removal System Operation 1-36
Wing Anti-Ice Overheat 3-22
Wing Anti-icing System 1-38
  Normal Operation of Wing Anti-icing System 1-38
  Wing Anti-icing System Lights 1-38
  Wing Anti-icing System Switches 1-38
Wing Fire Checklist 3-19
Wing Flap System 1-46
  Flap Lever Stop Position Indicator 1-47
  Flap Position Indicator 1-47
  Wing Flap Lever 1-46
Wing Spoiler Asymmetry System 1-47
  Wing Spoiler System Indicators 1-48
  Wing Spoiler System Controls 1-47
Wing Spoiler System 1-47, *1-492

Y

Yaw Damper Failure 3-79
Yaw Damping System 1-145
  Yaw Damper Switch 1-145
  Yaw Damper System Fault Indications .. 1-145
  Yaw Damper Test 1-146

Z

Zero Flap Take-Off Procedure 3-91
  Before Take-Off 3-91
  Preflight 3-91
  Take-Off Data 3-91
  Take-Off Technique 3-92
Zero Fuel Weight Chart *5-20
ZEROIZE *1-282

* Denotes Illustration