A-6A, B, C/KA-6D/A-6E

AIRCRAFT

Grumman Aerospace Corporation

N0as59-0259C
N00019-74C-0006

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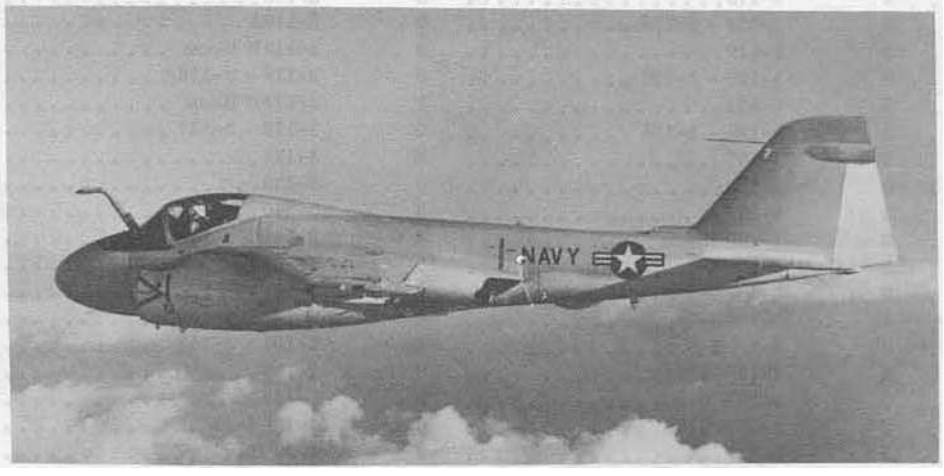

ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER THE DIRECTION OF THE COMMANDER, NAVAL AIR SYSTEMS COMMAND

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1 August 1974

Change 2 1 October 1975

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LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

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xvi Blank	0
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1-9	2
1-10	0
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1-24	2
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1-27	2
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1-40	2
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FO-48 Blank	2

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INTERIM CHANGE SUMMARY

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The following Interim Changes have been canceled or previously incorporated in this manual:

INTERIM CHANGE NUMBER(S)	REMARKS PURPOSE
A-6A, B, C 1 thru 62	Previously incorporated or canceled.
KA-6D 1 thru 19	Previously incorporated or canceled.
A-6E 1 thru 15	Previously incorporated or canceled.

The following Interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE
63	Modify limitations, Section I, Part 4

Interim Changes Outstanding - To be maintained by the custodian of this manual:

INTERIM CHANGE NUMBER	ORIGINATOR/DATE (or DATE/TIME GROUP)	PAGES AFFECTED	REMARKS/PURPOSE

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

1 August 1974

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach toward improving combat readiness and achieving a substantial reduction in the aircraft accident rate. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative, but rather to aid the Commanding Officer in increasing his unit's combat potential without reducing his command prestige or responsibility.

2. This manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory except as authorized herein. In order to remain effective, NATOPS must be dynamic and stimulate rather than suppress individual thinking. Since aviation is a continuing, progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously evaluated and incorporated if proven to be sound. To this end, Commanding Officers of aviation units are authorized to modify procedures contained herein, in accordance with the waiver provisions established by OPNAVINST 3510.9 series, for the purpose of assessing new ideas prior to initiating recommendations for permanent changes. This manual is prepared and kept current by the users in order to achieve maximum readiness and safety in the most efficient and economical manner. Should conflict exist between the training and operating procedures found in this manual and those found in other publications, this manual will govern.

3. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made and may be carried in Naval Aircraft for use therein. It is forbidden to make copies of this entire publication or major portions thereof without specific authority of the Chief of Naval Operations.

W.D. Houser

W.D. HOUSER
Vice Admiral, USN
Deputy Chief of Naval Operations
(Air Warfare)

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* SEE SUPPLEMENTAL NATOPS FLIGHT MANUAL NAVAIR 01-85ADA-1A FOR ADDITIONAL DATA

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FOREWORD

SCOPE

The NATOPS Flight Manual is issued by the authority of the Chief of Naval Operations and under the direction of Commander, Naval Air Systems Command in conjunction with the Naval Air Training and Operating Procedures Standardization (NATOPS) Program. This manual contains information on all aircraft systems, performance data, and operating procedures required for safe and effective operations. However, it is not a substitute for sound judgment. Compound emergencies, available facilities, adverse weather or terrain, or considerations affecting the lives and property of others may require modification of the procedures contained herein. Read this manual from cover to cover. It is your responsibility to have a complete knowledge of its contents.

APPLICABLE PUBLICATIONS

The following applicable publications complement this manual:

- NAVAIR 01-85ADA-1A (Supplemental Natops Flight Manual)
- NAVAIR 01-85ADA-1B (Checklist)
- NAVAIR 01-85ADA-1F (Functional Check Flight Checklist)
- NAVAIR 01-85ADA-1T (Tactical Manual)
- NAVAIR 01-85ADA-1T(A) (Supplemental Tactical Manual)
- NAVAIR 01-85ADA-1T(B) (Tactical Pocket Guide)

HOW TO GET COPIES

AUTOMATIC DISTRIBUTION

To receive future changes and revisions to this manual or any other NAVAIR aeronautical publication automatically, a unit must be established on an automatic distribution list maintained by the Naval Air Technical Services Facility (NATSF). To become established on the list or to change existing NAVAIR publication requirements, a unit must submit a Mailing List Request for Aeronautic Technical Publications (NAVAIR Form 5605/3, Part II) to NATSF, 700 Robbins Ave., Philadelphia, Pa. 19111, listing requirements or changes thereto in accordance with the instructions contained on the request form. For additional information, refer to NAVAIRINST 5605.4 series and NAVSUP Publication 2002, Section VIII, Part C.

ADDITIONAL COPIES

Additional copies of this manual and changes thereto may be procured by submitting Form DD 1348 to Naval Publications and Forms Center, Philadelphia in accordance with NAVSUP Publication 2002, Section VIII, Part C.

UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, NATOPS review conferences are held in accordance with OPNAVINST 3510.11 series.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAVINST 3510.9 series.

Routine change recommendations are submitted directly to the Model Manager on OPNAV Form 3500-22 shown on the next page. The address of the Model Manager of this aircraft is:

Commander
Medium Attack Wing One
Naval Air Station Oceana
Virginia Beach, Virginia 23460

Change recommendations of an URGENT nature (safety of flight, etc.) should be submitted directly to the NATOPS Advisory Group Member in the chain of command by priority message.

YOUR RESPONSIBILITY

NATOPS Flight Manuals are kept current through an active manual change program. Any corrections, additions, or constructive suggestions for improvement of its content should be submitted by routine or urgent change recommendation, as appropriate, at once.

NATOPS FLIGHT MANUAL INTERIM CHANGES

Flight Manual Interim Changes are changes or corrections to the NATOPS Flight Manuals promulgated by CNO or NAVAIRSYSCOM. Interim Changes are issued either as printed pages, or as a naval message. The Interim Change Summary page is provided as a record of all interim changes. Upon receipt of a change or revision, the custodian of the manual should check the updated Interim Change Summary to ascertain that all outstanding interim changes have been either incorporated or canceled; those not incorporated shall be recorded as outstanding in the section provided.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, adjacent to the affected text, like the one printed next to this paragraph. The change symbol identifies the addition of either new information, a changed procedure, the correction of an error, or a rephrasing of the previous material. NEW

NATOPS/TACTICAL CHANGE RECOMMENDATION
OPNAV FORM 3500/22 (5-69) 0107-722-2002

DATE

TO BE FILLED IN BY ORIGINATOR AND FORWARDED TO MODEL MANAGER

FROM (originator)	Unit
TO (Model Manager)	Unit

Complete Name of Manual/Checklist	Revision Date	Change Date	Section/Chapter	Page	Paragraph

Recommendation (be specific)

☐ CHECK IF CONTINUED ON BACK

Justification

Signature	Rank	Title

Address of Unit or Command

TO BE FILLED IN BY MODEL MANAGER (Return to Originator)

FROM	DATE

TO

REFERENCE
(a) Your Change Recommendation Dated .....

☐ Your change recommendation dated ..... is acknowledged. It will be held for action of the review conference planned for ..... to be held at .....

☐ Your change recommendation is reclassified URGENT and forwarded for approval to ..... by my DTG .....

(S) ..... MODEL MANAGER ..... AIRCRAFT

A-ODG-4

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "WARNINGS", "CAUTIONS", and "NOTES" found through the manual.

WARNING

An operating procedure, practice, or condition, etc., which may result in injury or death, if not carefully observed or followed.

CAUTION

An operating procedure, practice, or condition, etc., which may result in damage to equipment if not carefully observed or followed.

Note

An operating procedure, practice, or condition, etc., which is essential to emphasize.

WORDING

The concept of word usage and intended meaning which has been adhered to in preparing this Manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

"Should" has been used only when application of a procedure is recommended.

"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicate futurity, never to indicate any degree of requirement for application of a procedure.

AIRCRAFT CONFIGURATION

A-6A/B/C

CONFIG-URATION	EFFECTIVITY NUMBER	SERIAL NUMBER	CONFIG-URATION	EFFECTIVITY NUMBER	SERIAL NUMBER
200	27	149941	373	373	155642
A-6B MOD 1	30	149944		374	155643
A-6B	35	149949		375	155644
A-6B MOD 1	41	149955		376	155645
A-6B	43	149957		377	155646
A-6B	45	151558	A-6C	379	155648
A-6B	49	151562	373	380	155649
A-6B	51	151564		382	155651
A-6B	52	151565	A-6C*	384	155653
200	55	151568	373	385	155654
A-6B MOD 1	78	151591		386	155655
A-6B MOD 1	128	151820		387	155656
200	153	152600		389	155658
200	159	152606		390	155659
A-6B MOD 1	170	152617	A-6C*	391	155660
200	172	152619	373	392	155661
310	248	152939	A-6C*	393	155662
	263	152954	373	395	155664
	266	154126		396	155665
	270	154130	A-6C	398	155667
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	277	154137		400	155669
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	299	154159	373	402	155671
	303	154163		403	155672
	309	154169	373	406	155675
	310	154170	A-6C*	407	155676
	311	154171	373	409	155678
	315	155584		410	155679
	316	155585		411	155680
	323	155592	A-6C	412	155681
	326	155595	373	413	155682
	327	155596		414	155683
	330	155599	A-6C*	415	155684
	331	155600	373	416	155685
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	346	155615		422	155691
	351	155620		423	155692
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	354	155623		426	155695
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	367	155636		439	155708
	368	155637		441	155710
			451	442	155711

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	447	155716		472	157013
	448	155717		473	157014
	449	155718		475	157016
	450	155719		476	157017
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	456	156997		482	157023
	459	157000		483	157024
	460	157001		484	157025
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	462	157003		486	157027
	464	157005		488	157029
	465	157006			

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EFFECTIVITY NUMBER	SERIAL NUMBER	EFFECTIVITY NUMBER	SERIAL NUMBER
CONTRACTOR MODIFIED			
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K-2	151579	K-31	151821
K-3	151589	K-32	151792
K-4	151570	K-33	151801
K-5	151566	K-34	151809
K-6	152592	K-35	151789
K-7	151791	K-36	151810
K-8	152934	K-37	152911
K-10	151583	K-38	152921
K-11	152618	K-39	152611
K-12	149945	K-40	151823
K-13	151793	K-41	152919
K-14	149942	K-42	149952
K-15	151783	K-43	152632
K-16	149954	K-44	151813
K-18	151826	K-45	152906
K-20	151827	K-46	152628
K-21	152894	K-47	151808
K-22	151824	K-48	151787
K-23	151576	K-49	152914
K-24	151575	K-50	152920
K-26	152910	K-52	152896
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K-28	151795		
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AIRCRAFT CONFIGURATION CONT'D

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M3	151592	M45	152596	M87	154158
M4	151804	M46	152620	M88	152947
M5	152607	M47	152642	M89	152942
M6	149948	M48	152930	M90	154151
M7	152906	M49	149943	M91	154167
M8	151807	M50	155635	M92	152953
M9	152923	M51	152645	M93	154146
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M11	152584	M53	155581	M95	154161
M12	152621	M54	155590	M96	154134
M13	152928	M55	152936	M97	154148
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M16	152895	M58	152912	M100	154124
M17	152904	M59	155604	M101	154144
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M19	152933	M61	152902	M103	154131
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M36	152630	M78	152599		
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M42	155588	M84	155617		

*TRAM AIRCRAFT

F-ADA1-749-3

AIRCRAFT CONFIGURATION CONT'D

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11	158051	52	159312
12	158052	54	159313
13	158528	56	159314
14	158529	58	159315
15	158530	59	159316
16	158531	60	159317
17	158532	53	159567
18	158533	55	159568
19	158534	57	159569
20	158535	61	159570
21	158536	62	159571
22	158537	63	159572
23	158538	64	159573
24	158539	65	159574
25	158787	66	159575
26	158788	67	159576
28	158790	68	159577
29	158791	69	159578
30	158792	70	159579
31	158793	*71	159895
32	158794	72	159896
33	158795	73	159897
34	158796	74	159898
35	158797	75	159899
36	158798	76	159900
37	159174	77	159901
38	159175	78	159902
39	159176	79	159903
40	159177	80	159904
41	159178	81	159905
42	159179	82	159906

*TRAM AIRCRAFT

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AIRCRAFT CONFIGURATION - CONTINUED

A-6E MOD

EFFECTIVITY NUMBER	SERIAL NUMBER	EFFECTIVITY NUMBER	SERIAL NUMBER
M49	149943	M61	152902
M32	149946	M17	152904
M6	149948	M7	152905
M34	149950	M1	152907
M2	149956	M52	152908
M20	151573	M58	152912
M3	151592	M43	152915
M31	151593	M18	152916
M56	151782	M27	152918
M67	151784	M9	152923
M38	151790	M69	152924
M22	151802	M60	152925
M4	151804	M13	152928
M8	151807	M29	152929
M23	151811	M48	152930
M25	151812	M66	152931
M28	151814	M19	152933
M74	152583	M21	152935
M11	152584	M55	152936
M26	152585	M37	152948
M10	152587	M75	152950
M30	152591	M71	154140
M41	152593	M33	154142
M45	152596	M72	154156
M35	152603	M44	154162
M5	152607	M53	155581
M68	152610	M40	155583
M70	152614	M39	155586
M46	152620	M42	155588
M12	152621	M65	155589
M24	152623	M54	155590
M36	152630	M59	155604
M14	152635	M57	155616
M15	152640	M64	155619
M73	152641	M62	155633
M47	152642	M50	155635
M51	152645	M63	155657
M16	152895		

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AIRCRAFT CONFIGURATION - CONTINUED

A-6E PROD

EFFECTIVITY CODE	SERIAL NUMBER	EFFECTIVITY CODE	SERIAL NUMBER
1	158041	36	158798
2	158042	37	159174
3	158043	38	159175
4	158044	39	159176
5	158045	40	159177
6	158046	41	159178
7	158047	42	159179
8	158048	43	159180
9	158049	44	159181
10	158050	45	159182
11	158051	46	159183
12	158052	47	159184
13	158528	48	159185
14	158529	49	159309
15	158530	50	159310
16	158531	51	159311
17	158532	52	159312
18	158533	54	159313
19	158534	56	159314
20	158535	58	159315
21	158536	59	159316
22	158537	60	159317
23	158538	61	159570
24	158539	62	159571
25	158787	63	159572
26	158788	64	159573
27	158789	65	159574
28	158790	66	159575
29	158791	67	159576
30	158792	68	159577
31	158793	69	159578
32	158794	70	159579
33	158795	71	159580
34	158796	72	159581
35	158797		

F-ADA1-749-6

GLOSSARY

A

ac	Alternating Current
ACLS	Automatic Carrier Landing System
ACU	Armament Control Unit
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADL	Armament Datum Line
AFC	Airframe Change Automatic Frequency Control
AFCS	Automatic Flight Control System
AMCS	Airborne Missile Control System
AMTI	Airborne Moving Target Identification
AOA	Angle of Attack
APC	Approach Power Compensator
AVC	Automatic Velocity Correct Avionics Change

B

BIT	Built-In Test
BNCB	Bombardier Navigator's Control Box

C

C°	Centigrade
CA	Contact Analog
CAINS	Carrier Aircraft Inertial/Navigation System
CAS	Calibrated Airspeed
C/B	Circuit Breaker
CCA	Carrier-Controlled Approach
CCU	Computer Control Unit
cg	Center of Gravity
COP	Computer Optical Positioning
CSD/S	Constant-Speed Drive/Starter
CVA	Aircraft Carrier (Attack)

D

DA	Drift Angle
dc	Direct Current
DC	Drift Corrected
DDU	Digital Display Unit
DG	Directional Gyro
DMI	Discrete Message Indicator
DR	Dead Reckoning
DRO	Discrete Readout
DRS	Detection and Ranging Set
DVRI	Direct View Radar Indicator

E

ECM	Electronic Countermeasures
EGT	Exhaust Gas Temperature

F

F°	Fahrenheit
FAC	Forward Air Controller
FCLP	Field Carrier Landing Practice
FF	Fuel Flow
FLIR	Forward-Looking Infrared

G

g	Acceleration Due to Gravity
GCA	Ground-Controlled Approach
GCBS	Ground-Controlled Bombing System
GLO	Ground Lock-On
GS	Groundspeed

H

HSI	Horizontal Situation Indicator

I

ICS	Intercommunications
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules
INS	Inertial Navigation System
IMN	Indicated Mach Number
IMU	Inertial Measurement Unit
ISA	International Standard Atmosphere
ITA	Initial Turn Angle

K

KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed

L

LASER	Light Amplification by Simulated Emission of Radiation
LAWS	Low-Altitude-Warning System
LGB	Laser Guided Bomb
LO	Lock-On
LOX	Liquid Oxygen
LRD	Laser Rangefinder Detector
LSD	Least Significant Digit
LSO	Landing Signal Officer

M

MAC	Mean Aerodynamic Chord
max	Maximum
MSD	Most Significant Digit
MSL	Mean Sea Level
MTV	Moving Target Velocity
MVC	Manual Velocity Correct

N

NATOPS	Naval Air Training and Operating Procedures
NFO	Naval Flight Officer
nmi	Nautical miles
NTDS	Naval Tactical Data System

GLOSSARY

O

OAP	Offset Aimpoint
OAT	Outside Air Temperature
ORT	Operational Readiness Test

P

PA	Power Approach
PCB	Pilot's Control Box (Pilot's Control Panel)
PCU	Pedestal Control Unit
PHD	Pilot's Horizontal Display
PPI	Plan Position Indicator
prf	Pulse Repetition Frequency
psi	Pounds per Square Inch
PSU	Power Supply Unit

R

RA	Radar Altimeter
RAT	Ram-Air Turbine
RHU	Right-Hand Unit
rpm	Revolutions per Minute
RS	Roll Summed

S

SAC	System Analysis Code
SIF	Selective Identification Feature
SINS	Ship's Inertial Navigation System
SL	Sea Level
SRTC	Search Radar Terrain Clearance
SRTT	Search Radar Target Tracking

T

TACAN	Tactical Air Navigation
TAS	True Airspeed
TC	Terrain Clearance
TDTA	Target Data Terrain Avoidance
TH	True Heading
TILT	Missed Message
T/R	Transformer Rectifier
TRAM	Target Recognition Attack Multisensor
TSP	Turret Stabilized Platform
TV	Television

U

uhf	Ultrahigh Frequency
UTM	Universal Test Message

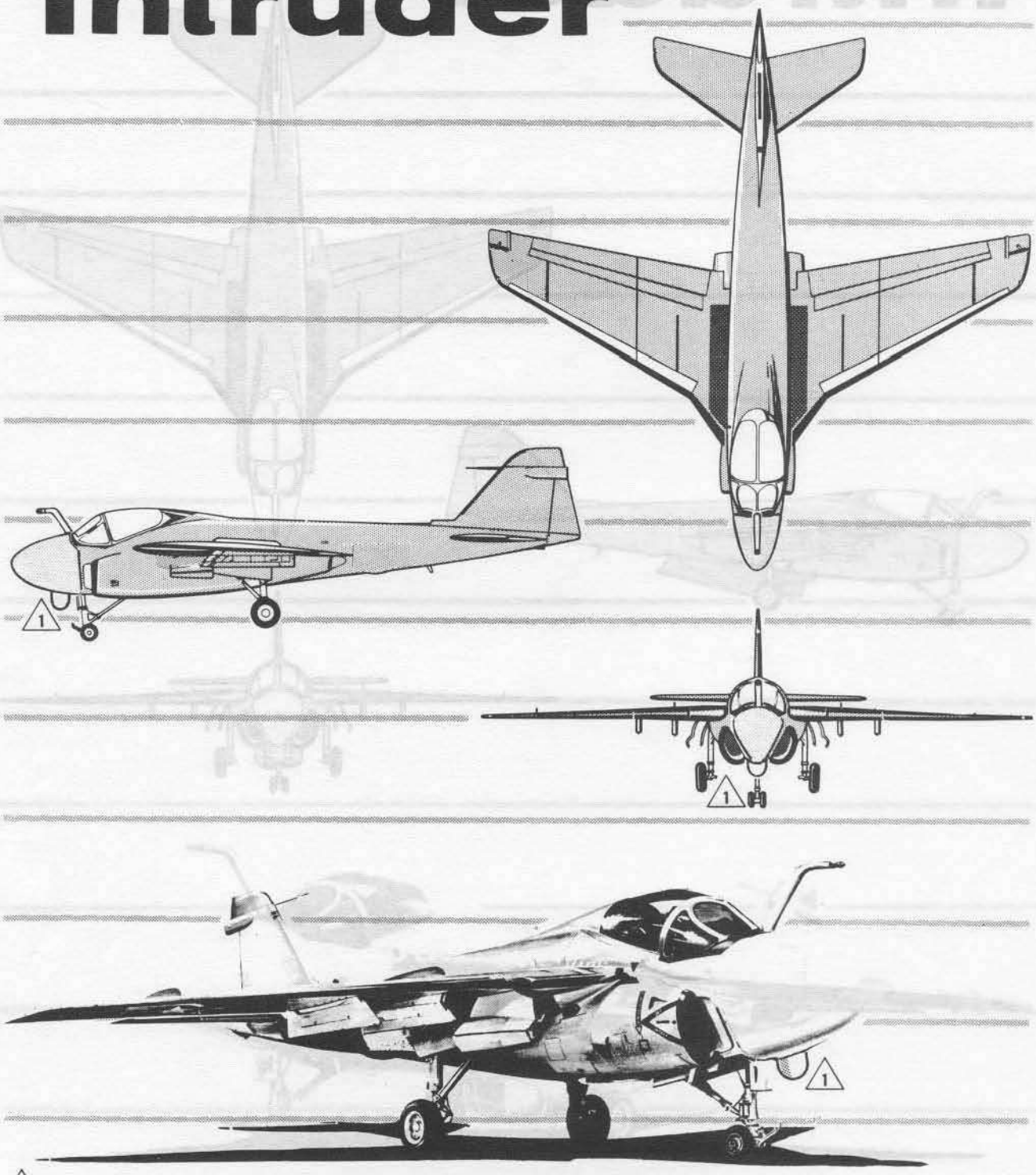
V

VFR	Visual Flight Rules
VGI	Vertical Gyro Indicator
VDI	Vertical Display Indicator
VSI	Vertical Speed Indicator
VTR	Video Tape Recorder

W

WRA	Weapon Replaceable Assembly
WST	Weapons System Trainer

A-6A / A-6B / A-6E Intruder



1 A-6E 159895 AND ON AND A-6E MOD 121 AND ON

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A-6C Intruder

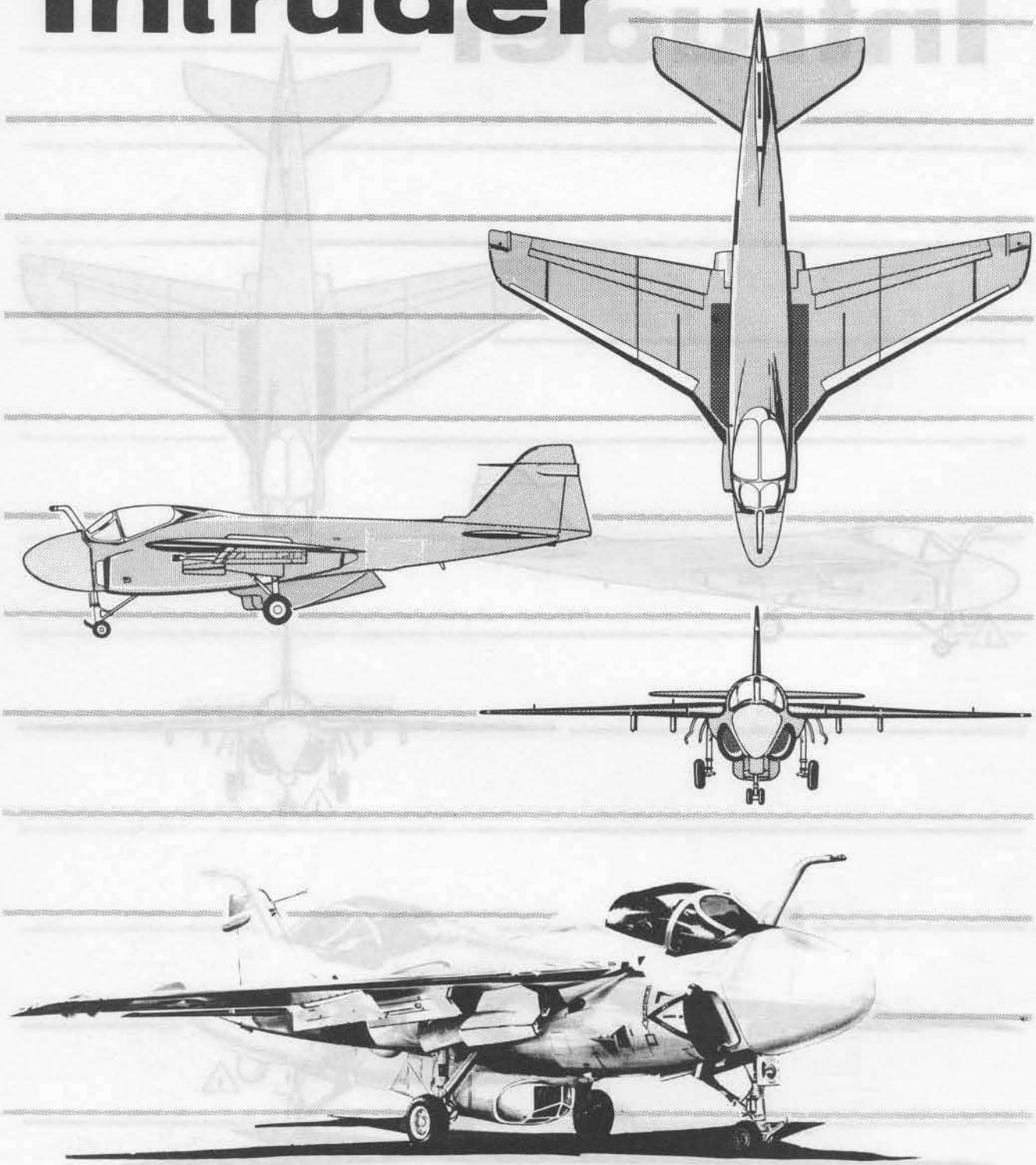

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Figure 1-0 (Sheet 2)

KA-6D TANKER

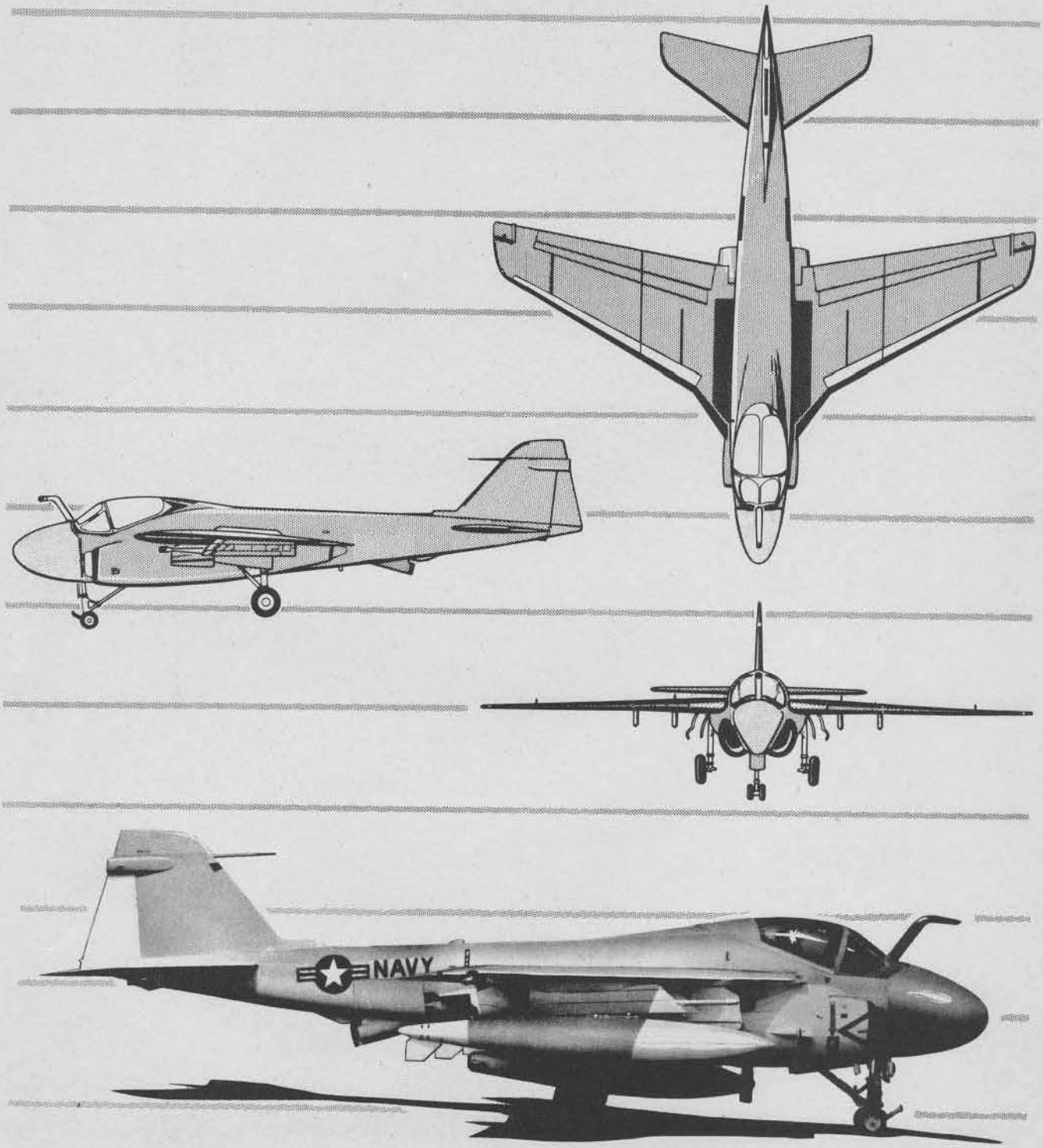

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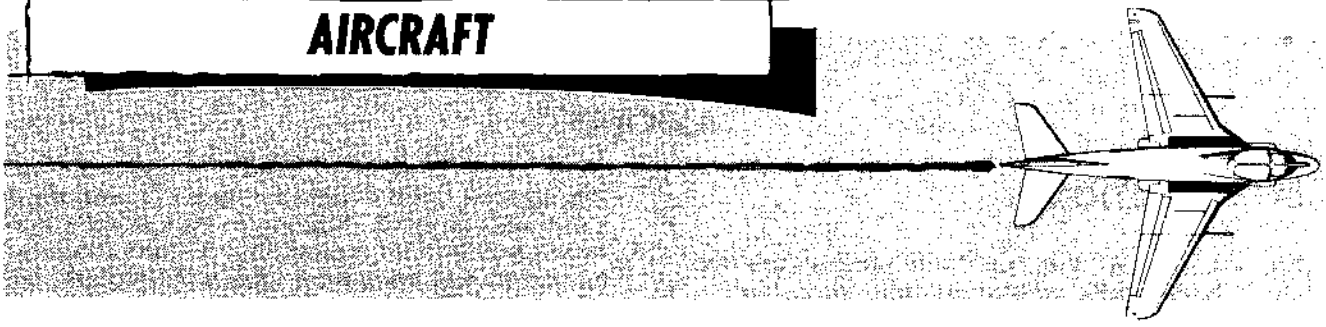
Figure 1-0 (Sheet 3)

section I
AIRCRAFT



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AIRCRAFT

INTRODUCTION

The A-6A, A-6B, A-6C and A-6E Intruders are two-place, twin-engine, subsonic midwing monoplanes manufactured by the Grumman Aerospace Corporation, Bethpage, Long Island, New York. The aircraft are designed for true all-weather attack and can carry a payload of 8 1/2 tons. A wide variety of weapons can be delivered without the crew ever having seen the ground or the target. The aircraft can be air-refueled and the A-6A, A-6B, and A-6E can be used as a tanker. The KA-6D aircraft is a modified A-6A that retains the basic A-6 structure, powerplant, and associated airframe systems, without the all-weather weapons delivery systems. The KA-6D has a primary mission of refueling, while retaining a secondary capability of visual attack bombing. The aircraft is capable of transferring large quantities of fuel at a rapid rate.

The principal differences between the A-6A and the A-6B are in the equipment installed for navigation and weapon delivery and in the primary weapons delivered. The A-6C differs from the A-6A in that it has additional sensors and a centerline pod. Refer to Section VIII, NAVAIR 01-85ADA-1A, Supplemental NATOPS Flight Manual for a detailed listing of differences. The principal differences between the A-6E and A-6A are the installation in the A-6E of an improved computer that is faster and has a greater memory capacity; a search radar with track capabilities; and an improved weapon release system. The equipment-cooling system has been revised to accommodate the improved avionics, and a closed-circuit equipment-pressurization system installed. Two 30 kVA generators supply electrical power. The A-6E TRAM configured aircraft (A-6E 159895 and ON and A-6E Mod M121 and ON) represents further improvements over the A-6E, including added memory capability in the computer, the addition of provisions for a forward-looking infrared sensor and a laser detection and ranging set, and an additional air-conditioning turbine for equipment cooling. In addition, these aircraft have been equipped with a new inertial navigation system, complete mode 1 automatic carrier landing capability, an improved communications, navigation, identification system, and provisions for the Condor missile system. See figure 1-2.

The A-6 Series aircraft is powered by two Pratt Whitney, axial-flow, turbojet engines, and is characterized by a large nose radome and sweptback wings. The aircraft has arrested-landing capabilities, and, for a jet aircraft, has a relatively slow approach and landing speed. A single-point ground refueling capability shortens turnaround time and eases the normal fueling process.

The aircraft, from a flight standpoint, is essentially a hydraulic aircraft. Generally, the hydraulic systems are controlled electrically; the major departures from this being the actuation of the flight control servo-actuators, manual canopy operation, emergency landing-gear actuation, and wheel-brake operations. In these operations, the hydraulic selector valves and servo-actuators are directly positioned by the pilot.

The change of complete loss of essential functions due to battle damage or system malfunction is minimized in the electrical and hydraulic systems by the use of automatic isolation of less important electrical loads, redundant hydraulic power systems, and tandem actuators.

GENERAL ARRANGEMENT

Figure FO-1 represents the general placement of the components within the aircraft.

AIRCRAFT WEIGHT

The zero fuel/zero store weight of the A-6A and A-6B is approximately 28,300 pounds. A-6E 158041 thru 159574 weigh approximately 27,800 pounds, 159575 thru 159579 approximately 27,400 pounds and the TRAM provisioned A-6E weighs approximately 28,300 pounds. The A-6C weights approximately 30,000 pounds and the KA-6D approximately 27,300 pounds. Consult the applicable Handbook of Weight and Balance for exact weight of any series aircraft.

COCKPIT LAYOUT

The aircraft accommodates a two-man crew consisting of the pilot and bombardier/navigator in a staggered side-by-side seating arrangement. Aircraft without AFC 119 are equipped with two MK GRU-5 ejection seats. Aircraft incorporating AFC 119 are equipped with two MK GRU-7 rocket-assisted ejection seats. Figures FO-2 and FO-3 provide typical cockpit layout.

WEAPON/STORE STATIONS

The A-6A, A-6B, KA-6D, and A-6E are configured with four wing pylons and a centerline store station for a total of five external store stations. The A-6C is limited to the use of the four wing pylons due to the pod on the centerline. The necessary electrical connections, fuel lines, and valves are housed in the pylons and the centerline store station. The wing pylons are fitted with AERO 7A ejector racks and the centerline store is fitted with either an AERO 7A or an AERO 7B ejector rack. These racks are capable of being loaded with a variety of weapons, adapters, launchers, bomb racks, and ejector racks.

The AERO 7A is capable of carrying weights up to 3500 pounds; the AERO 7B is capable of carrying weights up to 3600 pounds. Refer to Section VIII for a description of the weapon release system and to NAVAIR 01-85ADA-1T and -1TA A-6A Tactical Manual and Supplemental Tactical Manual for details of the various weapons that can be carried.

The A-6B also can carry the Standard ARM on a LAU-77A/A ejector launcher, which is loaded on the AERO-7A racks on the wing stations. Refer to Section VIII, NAVAIR 01-85ADA-1A, Supplemental NATOPS Flight Manual for details.

TECHNICAL DIRECTIVES

Figure 1-1 is a form to be used to show those technical directives (AFC, AVC, etc.) that apply to the aircraft and that have been incorporated in this manual. As changes are made to the aircraft, those that affect aircraft operation or pilot-bombardier/navigator need-to-know information will be entered on this form.

MAIN DIFFERENCES

For main differences between A-6A, A-6B, A-6C, KA-6D, A-6E and A-6E TRAM, see figure 1-2.

AIRCRAFT DIMENSIONS

See figure 1-3 for aircraft dimensions.

SUMMARY OF APPLICABLE TECHNICAL DIRECTIVES

AFC NUMBER	CLASS	TITLE	INCORPORATED	VISUAL MEANS OF IDENTIFICATION
102	R	External Power Monitor	15 Apr 1968	Reset switch on external power panel
119	U	Rocket-Assisted Ejection Seat	1 July 1971	MK GRU-7 seat
126A	U	KD-2 Camera	1 Apr 1970	Modified DVI hood
137	U	Ram-Air Turbine Frequency Monitor	15 Apr 1968	-
148	U	Key Light Control Modification	15 Apr 1968	Three-position pylon light switch
161	R	Automatic Carrier Landing System	1 Oct 1975	ACLS controls
171	R	APR-25 Installation	15 Sept 1968	APR-25 panel
175	U	Search Radar-Target Tracking	15 Mar 1969	SR track switch
183	R	Backup Flight Controls Hydraulic System	15 Mar 1969	Backup hydraulic test switch
185	U	Canopy Actuation System Improvement	15 Mar 1969	Three-position canopy switch
195	U	A-6B Mod 1	15 Sept 1971	TIAS controls
197	U	ALE-29A Chaff Dispenser Set	15 Mar 1969	ALE-29 panel
199	R	Approach Power Compensator System	15 Mar 1969	APCS switch and light
206	R	Flush-Mounted Refueling Receptacle	1 Sept 1969	Flush receptacle
209	U	AN/ALQ-100 Destruct System Modifications	1 Sept 1969	-
230	U	Automatic Carrier Landing System	1 Dec 1972	ACLS panel and indicator

Figure 1-1 (Sheet 1)

SUMMARY OF APPLICABLE TECHNICAL DIRECTIVES Contd.

AFC NUMBER	CLASS	TITLE	INCORPORATED	VISUAL MEANS OF IDENTIFICATION
244	U	Increased Carrier Landing Gross Weight	1 July 1971	
256	U	LB-31A Strike Camera Circuitry	1 Dec 1972	Camera control
263	U	ECM Update	1 Mar 1972	ALR-45/50 panel and lights
264	U	WSHLD AIR (Rain Removal) Caution Light	1 Mar 1972	Added caution light
268	U	Bleed-air isolation Valves and CNI Auxiliary Blower	1 Mar 1972	Bleed-air switches
269	U	Relocation of MA-1 Compass Gyroscope and Modification of Cabin Dump Panel	1 Aug 1974	Cabin dump panel
279	R	Video Tape Recorder Installation	1 Dec 1972	Recorder panel
281	U	ALE-29 Safing Pin and Flag	1 Mar 1972	Flagged pin aft of pilot's boarding ladder
287	U	ECM Update	1 Dec 1972	New ECM panel
296	U	D-704 Overpressurization Protection	1 Aug 1974	-
298	U	Response Valve Circuit Logic	1 Aug 1974	-
299	R	Relocation of D-704 Control Panel	1 Aug 1974	Observer's instrument panel
332	R	Side-Pylon Mounted Sidewinder	1 Aug 1974	COOL/FIRE switch
352	R	Modification of Fuel Dump Circuit	1 Aug 1974	DUMP/WG VENT circuit breaker
368	U	ALE-39 Countermeasures Dispenser	1 Mar 1975	ALE-39 panel
391	R	ADC Power Interrupt	1 Oct 75	CNI MASTER switch
AVC NUMBER				
658	U	Search Radar AMTI Improvement	15 Apr 1968	Operation of AMTI control
758	U	ASQ-61 Power Supply Overheat Cutout	15 Apr 1968	Operation of computer
1105	U	AN/APS-107B Modification	15 Sept 1970	-
1342	R	Reduction of Carrier Alignment Time	1 Dec 1972	-
AAC NUMBER				
592	R	AWW-1 Fuze Function Control Change	1 Aug 1974	-

A-ODG-3-2

Figure 1-1 (Sheet 2)

MAIN DIFFERENCES TABLE

	A-6A	A-6B	A-6C	KA-6D	A-6E	A-6E TRAM (1)
ECM EQUIPMENT	FOR ECM DIFFERENCES REFER TO NAVAIR (01-85ADA-1A)					
20 KVA GENERATORS	X	X	X	–	–	–
30 KVA GENERATORS	–	MOD 1	–	X	X	X
MK-GRU-5 EJECTION SEATS	X	X	X	X	–	–
MK-GRU-7 EJECTION	AFC 119	AFC 119	AFC 119	AFC 119	X	X
BACK-UP HYDRAULIC SYSTEM	AFC 183	AFC 183	X	AFC 183	X	X
THREE POSITION CANOPY SWITCH	AFC 185	AFC 185	AFC 185	AFC 185	X	X
APCS AN/ASN-54 (V)	AFC 199	–	X	AFC 199	X	X
ACLS AN/ASW-25 (MODE II)	AFC 230	–	AFC 230	AFC 230	–	–
BALLISTICS COMPUTER AN/ASQ-61A	X	MOD 1	X	–	–	–
GENERAL PURPOSE COMPUTER AN/ASQ-133	–	–	–	–	X	–
SEARCH RADAR AN/APQ-92	X	X	X	–	–	–
SEARCH RADAR AN/APQ-148	–	–	–	–	X	–
TRACK RADAR AN/APQ-112	X	X	X	–	–	–
INERTIAL NAVIGATION SYSTEM AN/ASN-31	X	X	X	–	X	–
NAVIGATION COMPUTER AN/ASN-41	–	–	–	X	–	–
VIDEO TAPE RECORDER AN/USH-17 (V)	–	–	AFC 279	–	X	X
PROVISIONS FOR LB-31A STRIKE CAMERA	AFC 256	–	AFC 256	–	–	–
TIAS	–	MOD 1	–	–	–	–
DIRECTION FINDER AN/ASD-4	–	–	X	–	–	–
INFRARED DETECTING AN/AAS-28	–	–	X	–	–	–
TELEVISION CAMERA AN/AXD-4	–	–	X	–	–	–
OPTICAL SENSOR PLATFORM	–	–	X	–	–	–
ADDITIONAL AIR CONDITIONING	–	–	–	–	–	X
ACLS (MODE I)	–	–	–	AFC 161	–	X
RECONFIGURED CNI	–	–	–	–	–	X
CAINS AN/ASN-92	–	–	–	–	–	X
GENERAL PURPOSE COMPUTER AN/ASQ-155	–	–	–	–	–	X
SEARCH RADAR AN/APQ-156	–	–	–	–	–	X
DRS AN/AAS-33 PROVISIONS	–	–	–	–	–	X
CONDOR AGM-53	–	–	–	–	AFC 344	X

(1) A-6E 159895 AND ON AND A-6E MOD M121 AND ON

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Figure 1-2

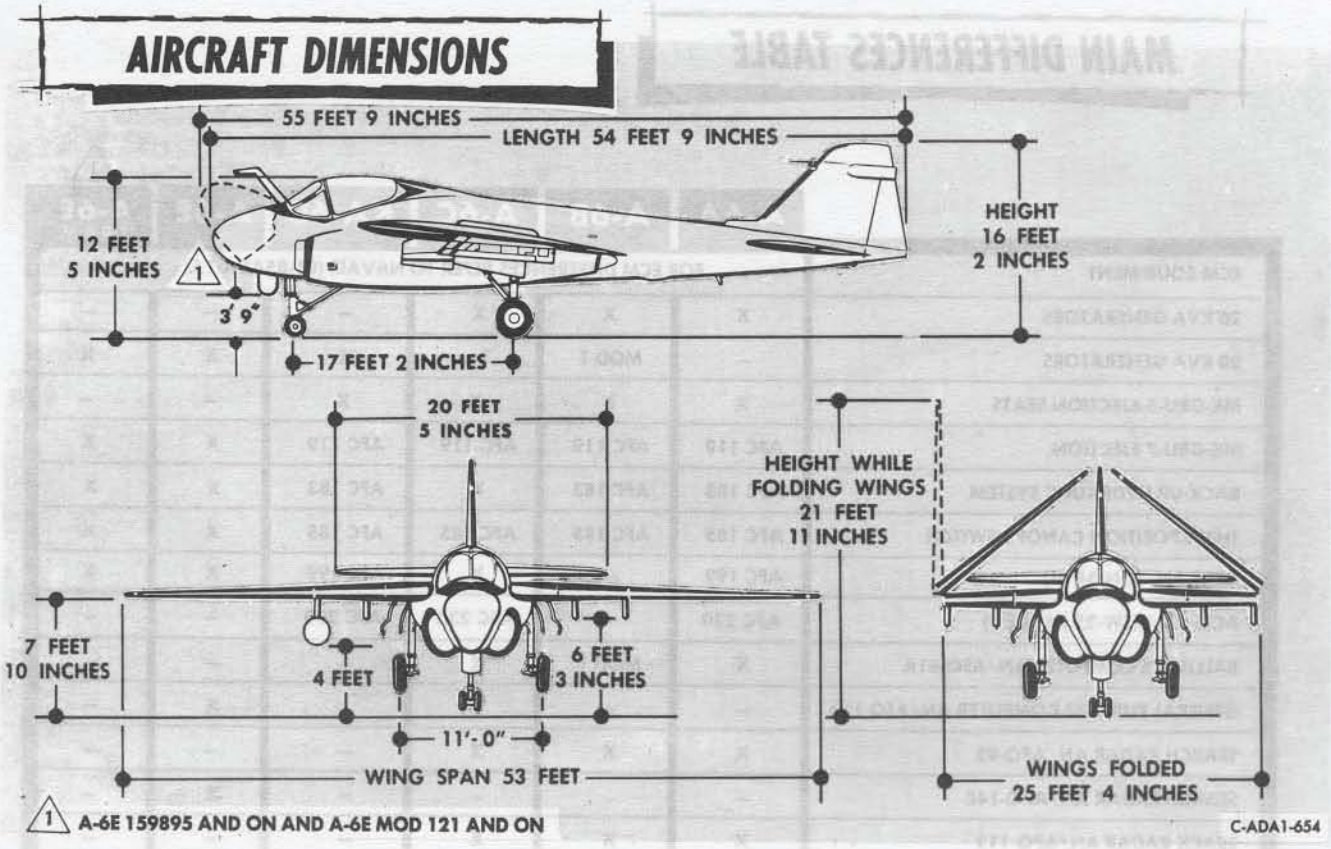

Figure 1-3

ENGINE

The aircraft is powered by two J52 P-8A/B, non-afterburning, axial-flow, turbojet engines (figure 1-4). At sea level (installed), the J52 P-8 engine develops approximately 7,700 pounds normal static thrust and 8,700 pounds military rated static thrust. The engines have a split, twelve-stage, axial-flow compressor, and a unit can-annular combustion chamber, and a split two-stage turbine. An engine bleed control system minimizes the possibility of compressor stall by automatically unloading any unusable air conditions encountered in the compressor. The compressed air supply for the aircraft is bled from the twelfth stage of the compressor. After initial start, part of this compressor air is used to drive the constant-speed drive starter (CSD/S) for starting the second engine. Twelfth-stage compressor bleed air is also used for CSD/S oil cooling on the ground, CSD/S generator function, air conditioning, engine vortex-removal jets, rain removal, and hydraulic tank pressurization. The rpm of the high-pressure turbine is governed by the engine fuel control. For a description of engine operation, refer to Section IV of this manual.

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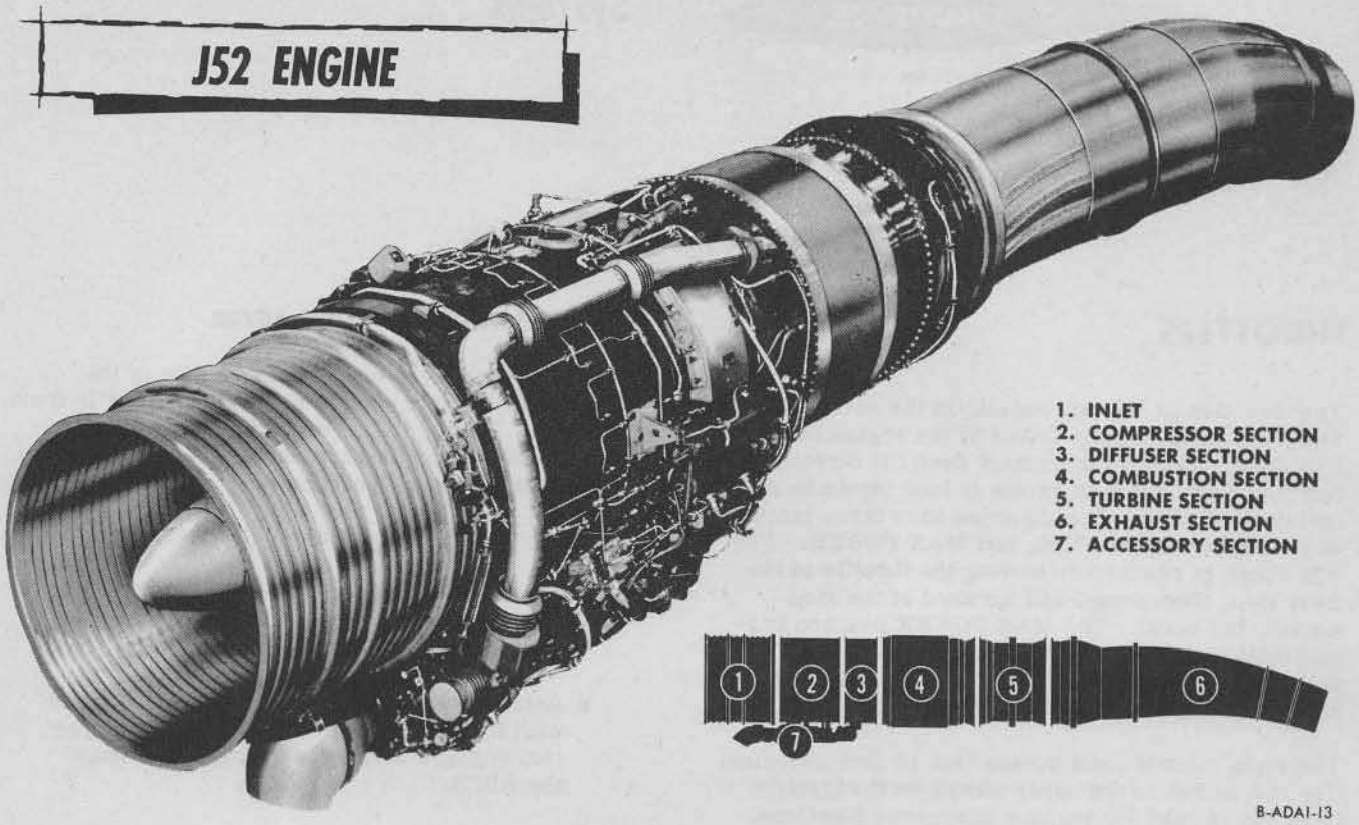

Figure 1-4

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part 2 **Systems**

POWER PLANT SYSTEMS

THROTTLES

The throttles on the left console in the cockpit (figure 1-5), are mechanically linked to the engine fuel control units. Throttle movement does not directly affect fuel flow, but acts as one of four inputs to the fuel control units. The throttles have three placarded positions: OFF, IDLE, and MAX POWER. The idle range is reached by moving the throttle to the first stop, then around and forward of the stop (around the horn). The MAX POWER position corresponds to military thrust, and is the forward stop position of the throttles. The OFF position cuts off fuel to the engines.

The right throttle head houses four or five switches. The ICS switch is the upper switch on the throttle head and is used for various interphone functions. The speed-brakes switch is in the semicircular protrusion on the inboard face of the throttle head. Underneath the speed-brakes switch is the mike button, which is used for radio communications. In aircraft with the ALE-29A chaff dispenser, a chaff-dispense button is on the forward face of the right throttle. An air-start switch is on the aft face of both throttle heads, and is used for engine starts when airborne.

CAUTION

No provision is made in the fuel control for stabilized engine rpm in the event the throttle linkage becomes disconnected from the fuel control. If a disconnection occurs, vibration may cause the fuel control for the respective engine to assume any power setting between cutoff and military power.

Note

The APCS electromechanical actuators are located on the engines, and the throttle linkage failure may have occurred between an electromechanical actuator and the throttle. If so, the APCS switch may be held in the ENGAGE position and the desired throttle position obtained by varying AOA and releasing the APCS switch when set. Desired throttle positions may be set in this manner throughout the flight for all portions of the profile. The APCS should also be available for a normal landing approach.

THROTTLE FRICTION LOCK LEVER

A friction lock lever on the inboard side of the throttle quadrant is used to prevent the throttle from creeping. Moving the lever forward increases friction and moving it aft reduces friction. The full aft position is the off position.

Note

- The approach power compensator system will not operate unless the throttle friction lock lever is in the off position.
- Activation of the throttle friction lock lever with the approach power compensator system engaged will automatically disengage the APCS.

IGNITION SYSTEM

Each engine is provided with a dual ignition exciter unit for ground start, and for airborne continuous and air-start ignition. The ground start continuous ignition exciter unit is powered by the primary 115 V ac bus and provides high-energy (20-joule) ignition. When cranking an engine for starting, high-energy ignition is provided through igniter plugs in number 4 and 7 cans when the throttle is moved from OFF to IDLE. When the engine starts and accelerates to approximately 48% rpm, ignition automatically cuts out.

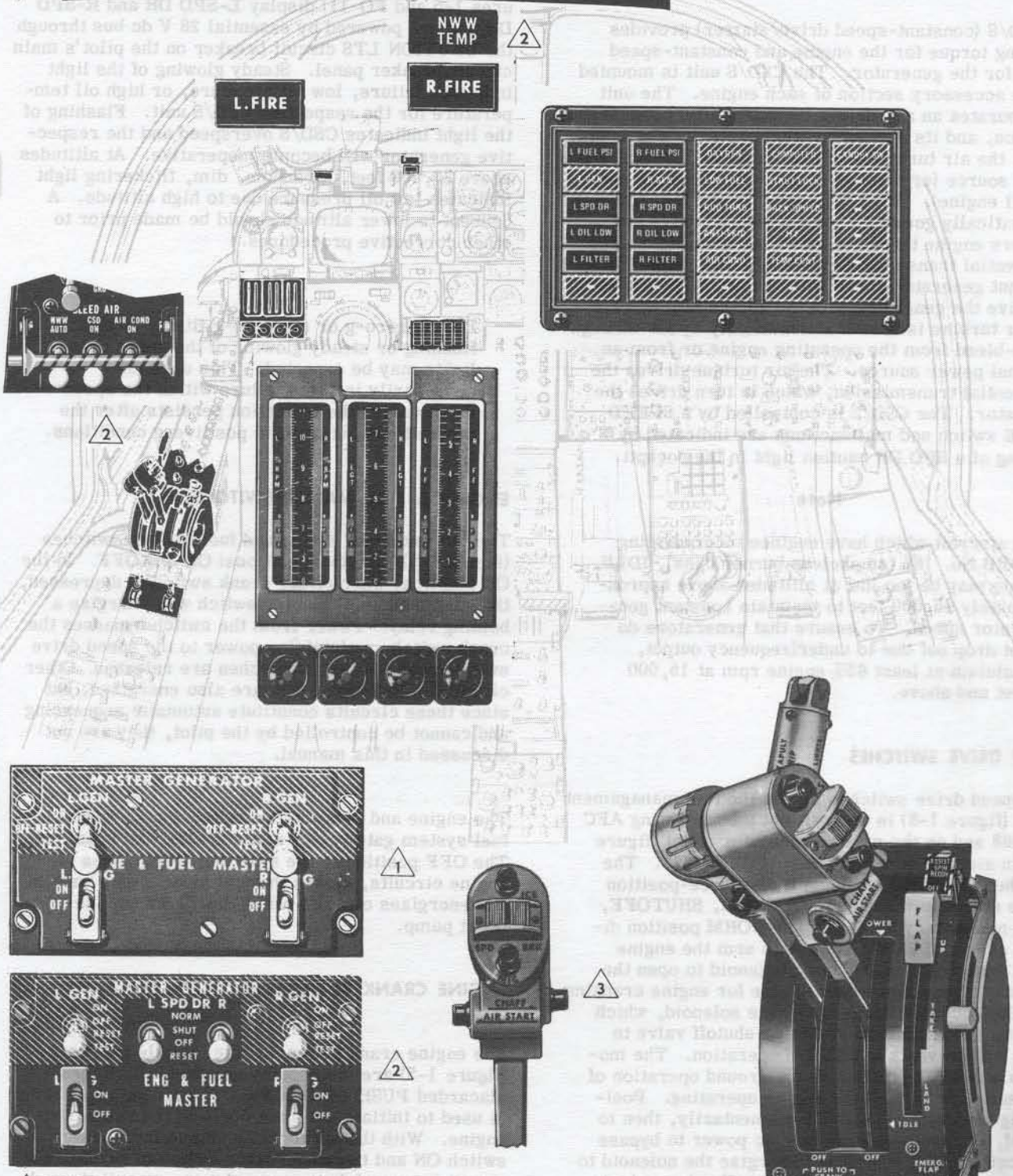
AIR - START BUTTONS

The air start buttons on the aft face of each throttle grip (figure 1-5) provides high-energy ignition to the respective engine for air start. When either button is held depressed, essential 115 V ac power, through the L or R EMERG IGN circuit breaker on the pilot's left circuit breaker panel, is provided to the ignition exciter unit, which in turn provides high-energy ignition through the igniters in burner cans number 4 and 7.

WARNING

Essential ac power must be available for air-start ignition.

ENGINE CONTROLS AND INDICATORS



1 AIRCRAFT NOT INCORPORATING AFC NO. 268

2 A-6E 158533 AND ON AND AIRCRAFT INCORPORATING AFC 268

3 A-6A, B, C 155703 AND ON AND AIRCRAFT INCORPORATING AFC NO. 197
A-6E 158041 AND ON AND A-6E MOD M1 AND ON

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Figure 1-5

CONSTANT-SPEED DRIVE/ STARTER SYSTEM

A CSD/S (constant-speed drive/starter) provides starting torque for the engine and constant-speed drive for the generator. The CSD/S unit is mounted on the accessory section of each engine. The unit incorporates an air-driven turbine, differential transmission, and its own lubrication system. For engine start, the air turbine is driven from an external pneumatic source (or through cross-bleed from an operational engine). After the engine is started, the unit automatically goes into constant-speed drive and delivers engine torque to drive the generator. The differential transmission automatically maintains a constant generator speed with varying engine speed. To drive the generator with the engine shut down, the air turbine is driven automatically by air through cross-bleed from the operating engine or from an external power source. The air turbine drives the differential transmission, which in turn drives the generator. The CSD/S is controlled by a SPEED DRIVE switch and malfunctions are indicated by lighting of a SPD DR caution light in the cockpit.

Note

In aircraft which have engines incorporating IPPB No. 185 (smokeless burner cans), IDLE rpm may be too low at altitudes above approximately 15,000 feet to maintain constant generator speed. To ensure that generators do not drop out due to underfrequency output, maintain at least 65% engine rpm at 15,000 feet and above.

SPEED DRIVE SWITCHES

The speed drive switches are on the fuel management panel (figure 1-8) in aircraft not incorporating AFC No. 268 and on the master generator panel (figure 1-5) in aircraft incorporating AFC No. 268. The switches identified as L and R are three-position toggle switches with positions NORM, SHUTOFF, and a momentary RESET. The NORM position directs essential 28 V dc power to arm the engine crank switch and energizes a solenoid to open the pneumatic regulator shutoff valve for engine cranking. The OFF position deenergizes the solenoid, which permits the pneumatic regulator shutoff valve to close and prevents any CSD/S operation. The momentary RESET position is for ground operation of the generator without the engine operating. Positioning the switch to RESET momentarily, then to NORM, directs essential 28 V dc power to bypass the engine crank switch and energize the solenoid to open the pneumatic regulator shutoff valve, which permits air pressure to be used exclusively for driving the generator.

If both generators become inoperative in flight, the standby battery will keep the solenoid valve energized open and the generators engaged.

SPEED DRIVE LIGHTS

The speed drive lights on the annunciator panel (figures 1-5 and FO-11) display L-SPD DR and R-SPD DR and are powered by essential 28 V dc bus through the CAUTION LTS circuit breaker on the pilot's main circuit breaker panel. Steady glowing of the light indicates failure, low oil pressure, or high oil temperature for the respective CSD/S unit. Flashing of the light indicates CSD/S overspeed and the respective generator will become inoperative. At altitudes above 20,000 feet, a random, dim, flickering light indicates low oil pressure due to high altitude. A descent to lower altitude should be made prior to other corrective procedures. NEW

Note

During zero-g or negative-g flight, either flashing or steady glowing of the speed drive lights may be expected. This does not necessarily indicate failure within the speed drive unless the indication persists after the aircraft has returned to positive-g conditions.

ENGINE & FUEL MASTER SWITCHES

The left and right engine and fuel master switches (figure 1-5) have two positions: ON and OFF. In the ON position, when either crank switch is depressed, the engine and fuel master switch will energize a holding relay. Power from the switch bypasses the crank switch, maintaining power to the speed drive switch after the crank switches are released. Other circuits in the start cycle are also energized, but since these circuits constitute automatic sequencing and cannot be controlled by the pilot, they are not discussed in this manual.

The engine and fuel master switches also open the fuel system gate valves and start the fuel boost pump. The OFF position of the switches deenergizes the engine circuits, closes the fuel system gate valves, and energizes circuits which shut down the fuel boost pump.

ENGINE CRANK BUTTONS

The engine crank buttons on the throttle quadrant (figure 1-5) are momentary pushbutton switches placarded PUSH TO CRANK. The left or right button is used to initiate the start cycle in the respective engine. With the appropriate engine fuel master switch ON and the speed drive switch in NORM, depressing a crank button completes a circuit through the gear/hook circuit breaker and opens the pressure regulator shutoff valve on the respective CSD/S unit. This allows air pressure to drive the CSD/S unit for engine start. After engine start, the crank circuit is deenergized. Both engines cannot be started simultaneously; however, either engine can be started first.

ENGINE OIL SYSTEM

Each engine is provided with a self-contained, hot-tank, high-pressure oil system for lubrication of the engine bearings and accessory drives. Oil from the tank, which has a usable capacity of 3.4 gallons, flows to the pressure pump in the accessory drive gearbox. The oil, at 45±5 psi pressure, is filtered and directed to the fuel-oil cooler and the oil nozzles in the bearing compartments. Oil will bypass the fuel-oil cooler, or the filter, if either becomes blocked. Five scavenger pumps pick up the used oil and return the oil to the tank. Air in the oil tank and bearing compartments is de-oiled at the centrifuge in the accessory drive gearbox, and excess internal pressure is vented overboard. Refer to Servicing Data, figure 1-39. Maximum oil consumption is .28 gallon per hour in a 10-hour period.

OIL QUANTITY INDICATING SYSTEM

The oil quantity indicating system is used to warn the aircrew of low oil, which could cause engine failure due to oil starvation. The system consists of two oil-level sensor probes installed in each engine oil tank, left and right low-oil caution lights on the annunciator panel, and press-to-test buttons on the master test panel. For oil system failure procedures, refer to Section V.

OIL LOW WARNING LIGHTS

During press-to-test, lighting of an OIL LOW warning light on the annunciator panel indicates oil quantity from 5 to 12 1/2 quarts ±1 quart. If the light comes on other than during press-to-test, the usable oil quantity is less than 5 ±1 quart.

OIL QUANTITY PRESS-TO-TEST BUTTONS

Oil quantity can be checked either airborne or during ground operations by depressing the LOX/FUEL/OIL test buttons on the master TEST panel. When the button is depressed, the OIL LOW lights on the annunciator panel come on to indicate oil quantity between 5 and 12 1/2 quarts in the respective oil tank. No light on, with the test button depressed, indicates oil quantity above 12 1/2 quarts. If the light comes on without depressing the button, there is less than 5 quarts in the indicated tank. The OIL LOW lights can be checked by depressing the FIRE/OIL test button, which applies power directly to the lights on the annunciator panel, through the amplifier, bypassing the sensors and sensor relays.

Note

- Oil quantity below 12 1/2 quarts ±1 quart requires engine servicing and should be reported as a discrepancy and corrected before the next takeoff.

- The LOW OIL warning light is valid only after engines scavenge.

OIL-PRESSURE INDICATOR

The oil pressure instrument is a synchro-repeater-type instrument that receives its signals from an engine-mounted oil pressure transmitter. The instrument is marked in units from 0 to 10 with a multiplier of 10, giving a range of 0 to 100 psi. The range between 35 and 50 is the normal oil pressure range: 35 psi is a minimum for ground idle conditions. Normal flight pressure is 40 to 50 psi, and is marked by a wider band and the letter N.

CAUTION

In addition to low oil quantity warning lights, a pressure dropdown by the indicators is also warning of an impending engine failure from oil starvation.

Aircraft maneuvers producing positive g or negative and zero g may cause engine oil pressure to deviate above or below the accepted operating range. This should be considered a normal response provided that the oil pressure returns to normal following completion of the maneuver. See prohibited maneuvers Section I Part 4 for zero/negative g time limitations.

ENGINE BLEED-AIR SYSTEM

The bleed-air system (figure 1-6) supplies high-temperature, high-pressure air from the twelfth compressor stage of the engines to the environmental control system, vortex-removal system, anti-g system, canopy seal system, hydraulic reservoir pressurization system, the fuel-cell pressurization system, and in A-6E 159895 and ON and A-6E Mod M121 and ON, the aft refrigeration unit. The functional control of the bleed air is initiated by the requirements of each individual system and the flow, temperature, and pressure are regulated by the system. Normally both engines supply air for the operation of these systems, but when necessary, single-engine operation supplies sufficient air for their operation. The system ducting is insulated to protect the airframe structure from heat radiation. Check valves in the ducting prevent back flow into the nonoperating engine during starting and single-engine operation. In A-6E 158533 and subsequent and those aircraft incorporating AFC 268, a break in the bleed-air ducting can be isolated by dividing the system into three sectors and stopping the air supply with the isolation valves, engine shutdown, or a combination of both. Temperature sensors in each sector provide warning in the event of a break.

BLEED-AIR ISOLATION VALVES

In aircraft incorporating AFC 268, three motor-driven butterfly bleed-air isolation valves divide the bleed-air system into three isolated sectors. An additional high-temperature sensor is included in the nosewheel well area. In aircraft with an aft refrigeration unit, high temperature sensors are also located in the aft equipment bay. Three switches to control these valves are on the bottom of the fuel management

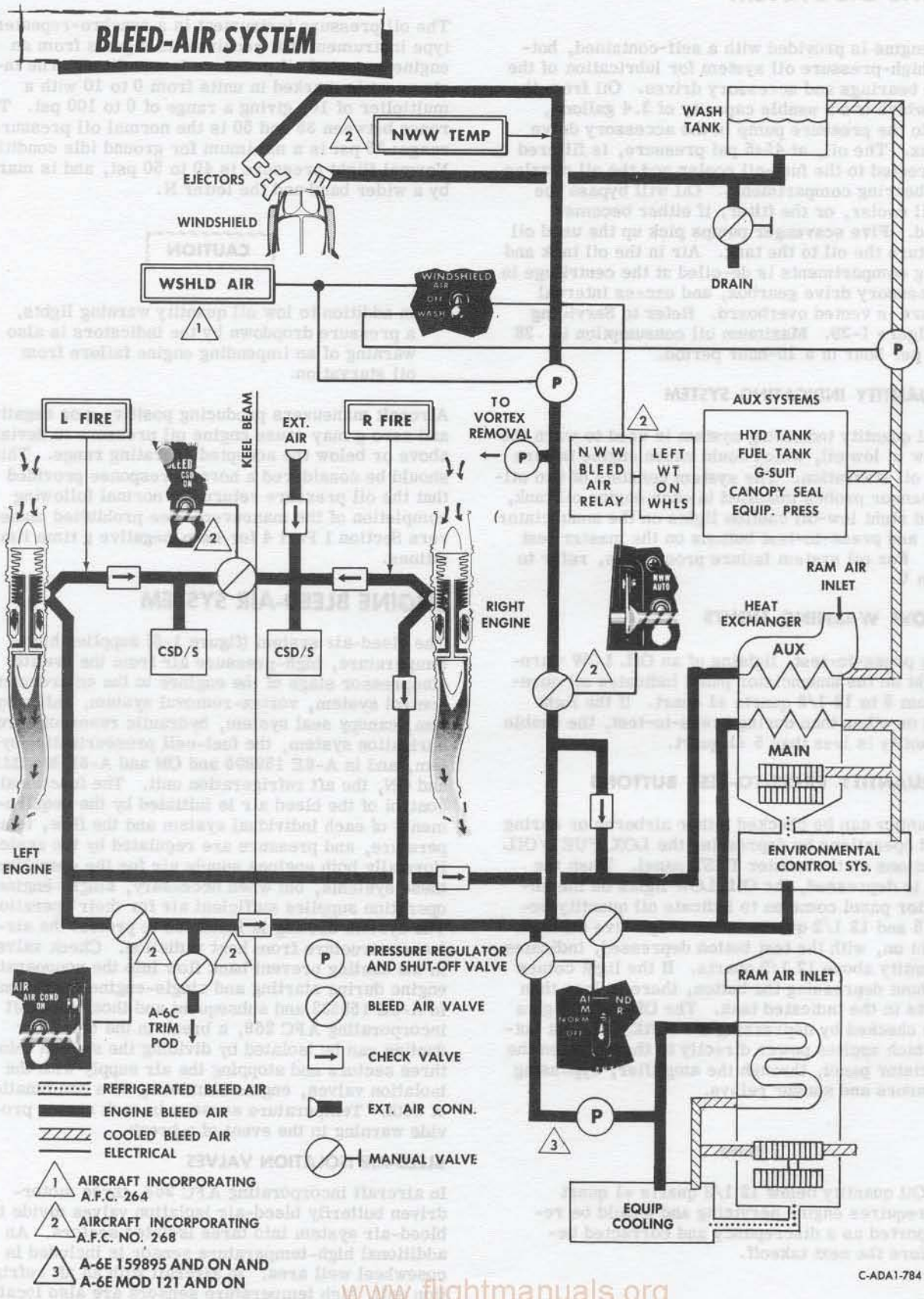

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Figure 1-6

control panel (figure 1-8) and are supplied electrical power from the 115 V ac essential bus through the BLEED AIR circuit breaker on the B/N's circuit breaker panel.

CAUTION

Allow 5 seconds between actuations of the bleed-air isolation valves to permit the valve motors to cool.

BLEED-AIR SYSTEM CONTROLS AND INDICATORS

NWW Switch/TEMP Light

The NWW switch controls the nosewheel well bleed-air isolation valve in the forward right engine bay. The NWW valve blocks all bleed air from the nosewheel well in the event of a break in that area as indicated by lighting of the NWW TEMP light. When airborne with the NWW switch in the AUTO position, 115 V ac power from the BLEED-AIR circuit breaker through the nosewheel well bleed-air relay opens the NWW bleed-air isolation valve whenever the WINDSHIELD switch on the AIR CONDITIONING panel is in the AIR position. On the ground in the AUTO position, the valve is open through the left weight-on-wheels switch to supply the vortex-removal system and the rain-removal system when selected. The OFF position overrides any other commands and closes the valve.

CSD Switch

The CSD switch controls the CSD bleed-air isolation valve on the left side of the keel beam in the cross-bleed manifold between the CSD/S's. If a break occurs in the cross-bleed manifold, it allows isolation of the two sources of bleed air so that shut-down of the affected engine will remove the supply of air to the leak.

AIR COND Switch

The AIR COND switch controls the air-conditioning bleed-air isolation valve in the left engine bay, and in A-6E 159895 and ON and A-6E Mod M121 and ON, the aft bleed-air shutoff valve in the right engine bay. If a break occurs in the ducting to the environmental control system, it allows isolation of the two sources of bleed air so that shutdown of the affected engine will remove the supply of air to the leak.

AFT TEMP Caution Light

In A-6E 159895 and ON and A-6E Mod M121 and ON, temperature-sensing elements, similar to those in the engine compartments and nosewheel well, follow the routing of hot engine bleed-air lines in the aft equipment bay. When an overtemperature condition exists, a signal is generated that lights the AFT TEMP caution light on the pilot's center instrument panel. The light, when on, indicates a possible leak in the hot engine bleed-air ducting. Airflow can be shut down by placing the AIR COND bleed-air switch on the fuel management panel to OFF. The detection system and caution light are tested by depressing the FIRE/OIL TEST switch.

ENGINE INSTRUMENTS

All the engine instruments are grouped together to the left of the horizontal display. The % RPM, EGT, and FF indicators are parallel-tape instruments. The power trim and oil-pressure instruments are circular indicators, mounted below the engine instrument group. All the instruments are marked white against black background. When cockpit lights are used, the markings appear red against a black background.

ENGINE RPM INDICATOR

A signal is developed by a tachometer generator and is compared with dc voltage from a reference potentiometer. The signal is amplified and used to drive a motor generator, which positions a white tape on the face of rpm indicators. The indicator reads percent of standard (12,052) engine rpm. The scale on the indicator is marked in 10% increments from 0% to 70%, and 1% increments, on an expanded scale, from 70% to 110%.

EXHAUST GAS TEMPERATURE INDICATOR

Exhaust gas temperature is sensed by thermocouples, which compare the generated dc signal with a reference current. The difference signal is converted to alternating current and used to drive a motor generator. As in the % RPM indicator, the motor generator drives a tape across the EGT scale. The indicator is marked in 50° C increments from 0° to 400° and 700° to 900°, and in 10° increments from 400° to 700°.

POWER TRIM INDICATOR

The power trim indicator for each engine (figure 1-5) displays temperature-corrected pressure ratio. The face of each indicator is marked PT and accommodates a single pointer. A gray arc with the extremities marked H and L is centered at the 9-o'clock position. When the pointer indicates within the arc during the MAX POWER check prior to takeoff, the engine pressure ratio is satisfactory for takeoff. Indications beyond the arc in the H or L area indicate the engine is over- or undertrimmed. Exhaust gas pressure transmitters on each engine, the total air-temperature probe, and the air data computer provide signals through the power trim computer to the indicators. The system is powered by the monitored 28 V dc bus. In flight (weight off wheels), the indicators are inoperative and the pointers out of sight behind masks.

Note

On aircraft 155599 and ON, the pointer on the power trim indicator will rotate under the following conditions:

1. When engines are off and electrical power is applied to the indicator at ambient temperatures below 75° F.
2. When engines are running and rpm is:
   - Below 80% with ambient temperature between -40° and +10° F.
   - Below 75% with ambient temperature between 20° and 30° F.
   - Below 70% with ambient temperature between 40° and 50° F.
   - Below 10% with ambient temperature above 70°.

These power trim indicators are accurate in the usable range when the pointer provides a steady indication.

ENGINE FUEL CONTROL SYSTEM

The engine fuel control system (figure 1-7) is identical for both engines and schedules fuel from the engine-driven fuel pumps to the combustion chambers. The amount of fuel metered is measured at the fuel flow transmitter, which is coupled electrically to the fuel flow indicator on the pilot's instrument panel (figure FO-2, Sheets 1, 2 and 3). Caution lights for each engine on the annunciator panel indicate when low fuel pressure or filter bypass conditions exist.

ENGINE FUEL CONTROL

The engine fuel control can be divided into a computing and metering section. The computing section monitors throttle position, burner pressure, engine speed, and compressor inlet temperature. This is translated into a fuel demand that is relayed to the metering section, which meters the correct amount of fuel from the engine fuel pump to the fuel-pressurizing and dump valve.

FUEL PRESSURIZING-AND-DUMP VALVE

The fuel pressurizing and dump valve senses fuel pressure and directs fuel to the primary and secondary fuel nozzles in the combustion chamber. Both primary and secondary fuel nozzles are used when the engine is in the operating range and fuel pressure is normal. During engine starts, low starting fuel pressure is directed to the primary fuel nozzle only. When the throttles are retarded to OFF, the pressurizing-and-dump valve stops the fuel flow from the engine fuel control and drains the primary fuel manifold overboard.

FUEL HEATER

The fuel heater is an automatically controlled unit that prevents ice from forming in the engine fuel system. This is accomplished by maintaining the minimum temperature of the fuel entering the fuel pump filter at 10° C. The fuel heater is on the bottom of the diffuser case, just forward of the pressurizing-and-dump valve and is accessible when the forward engine access door is open. The main parts of the heater are: the heat exchanger, fuel bypass valve, air-regulator valve, and the override valve. Fuel leaving the impeller stage of the engine-driven fuel pump flows around the heat exchanger core over the temperature-sensing elements of the air regulator and servo override valves, and reenters the fuel pump at the filter inlet. If the fuel passages around the heat exchanger core become restricted, a bypass valve in the heater housing opens to allow fuel flow to the engine.

FUEL FILTER LIGHT

The fuel filter lights on the annunciator panel (figure 1-8) displays L FILTER and R FILTER and are powered by the 28 V dc essential bus through the CAUTION LTS circuit breaker on the main circuit breaker panel. Lighting of either light indicates the fuel filter for the respective engine is obstructed. A pressure switch completes a circuit to the light when a minimum of 5 psi differential pressure exists between the inlet and outlet of the fuel filter.

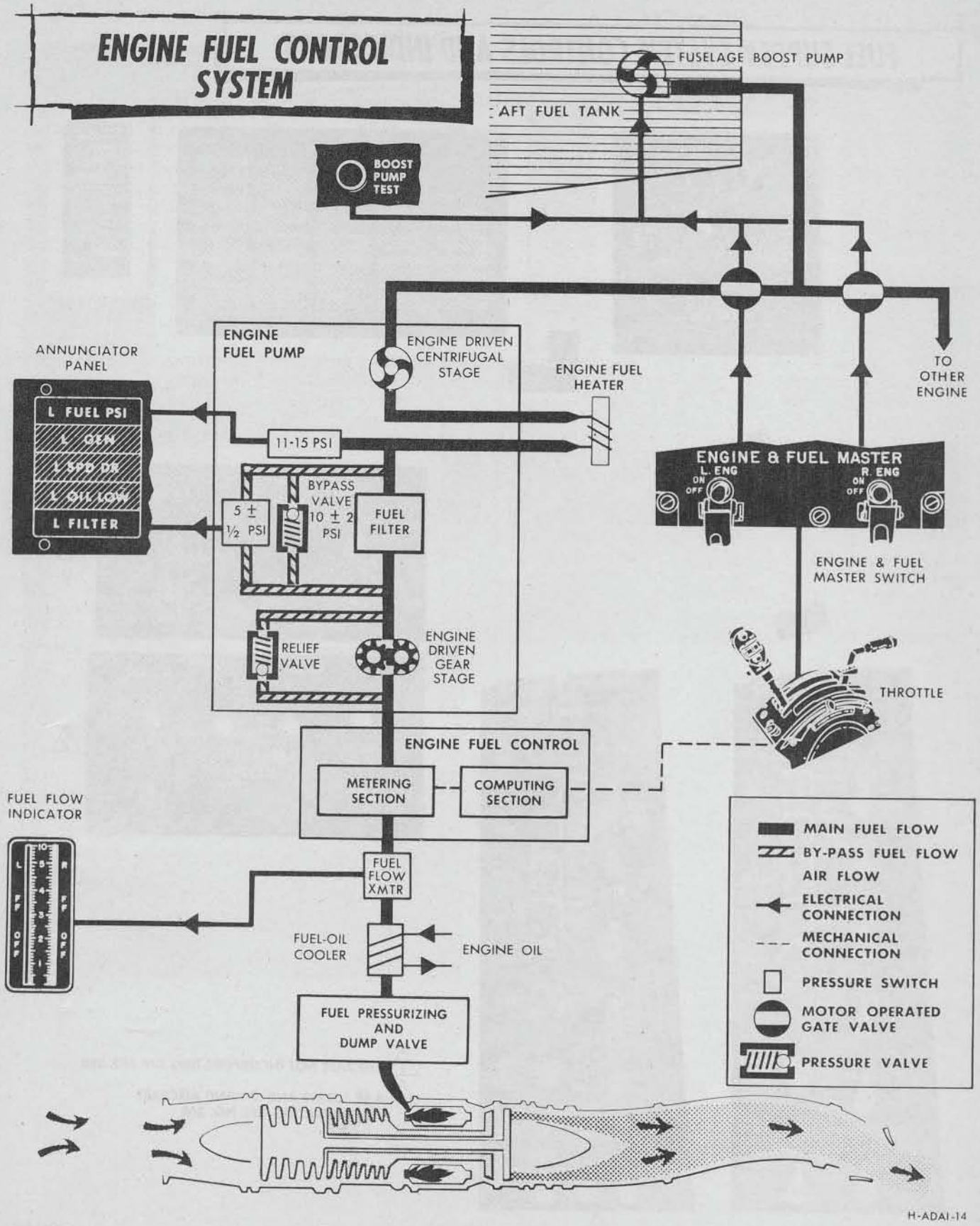

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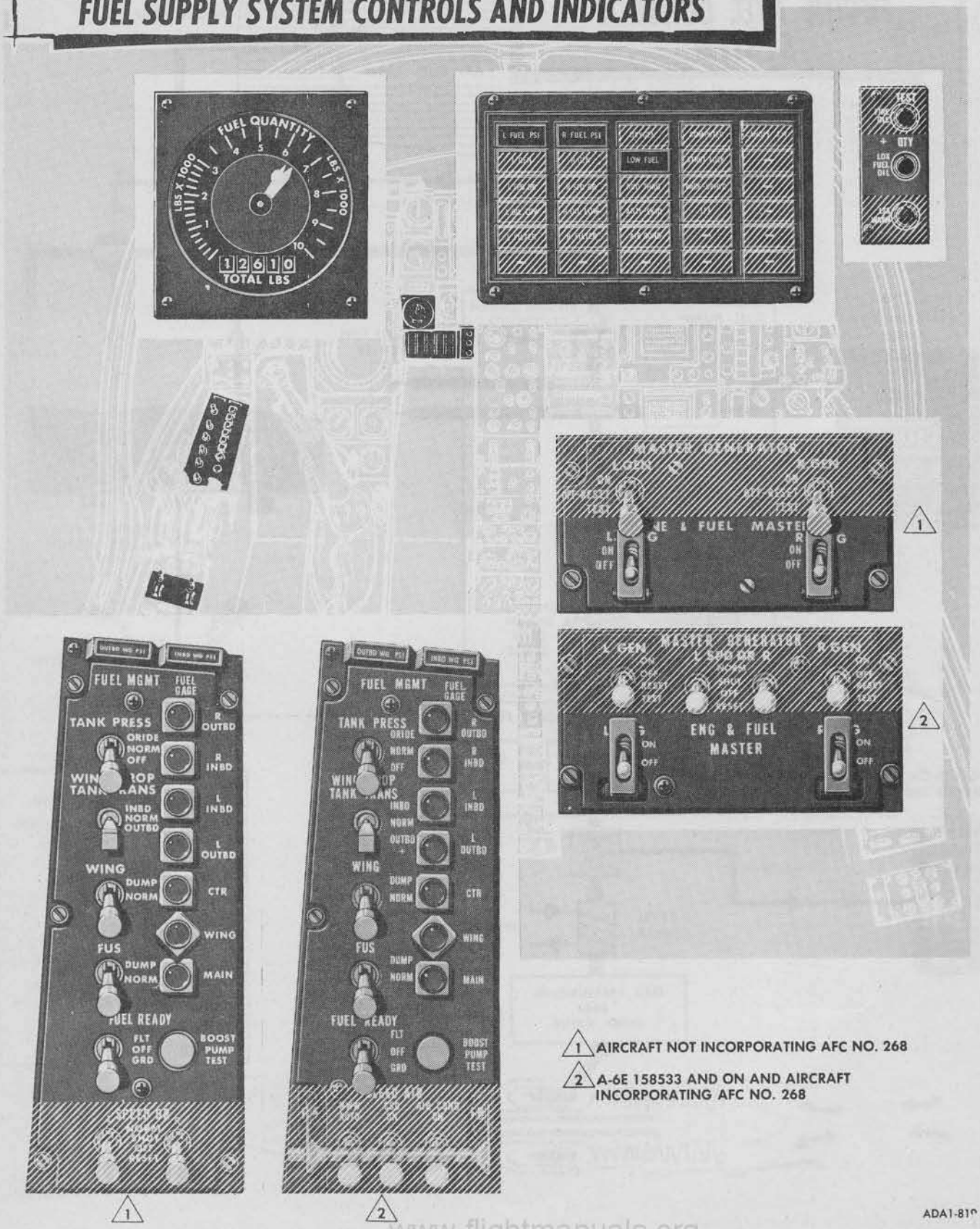
Figure 1-7

FUEL SUPPLY SYSTEM CONTROLS AND INDICATORS



1 AIRCRAFT NOT INCORPORATING AFC NO. 268

2 A-6E 158533 AND ON AND AIRCRAFT INCORPORATING AFC NO. 268

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Figure 1-8

PRIMARY AIRCRAFT SYSTEMS

AIRCRAFT FUEL SUPPLY SYSTEM

The aircraft fuel supply system (figure FO-4) provides JP-4 or JP-5 fuel to the engine-driven fuel pumps and can be replenished in flight or used to refuel another aircraft. Refueling is accomplished through a single-point pressure refueling nozzle on the ground, or the air-refueling probe located at the aircraft centerline forward of the windshield.

The fuselage tanks include forward and aft self-sealing cells and a bladder-type mid cell. Manifolds integrate the fuselage cells and allow gravity fuel flow to the aft cell.

The wing tanks include two outboard wet tanks, one in each outer wing panel, and an inboard wet wing tank spanning from wingfold to wingfold. Transfer from all wing tanks is simultaneous and is controlled by the tank pressurization switch on the fuel management panel. See figure 1-9 for fuel tank capacities.

FUEL MGMT CONTROL PANEL

The fuel management control panel on the pilot's left console (figure 1-8) provides controls for pressurization and transfer of wing and drop-tank fuel, selectors for fuselage, wing and drop-tank fuel quantity indications, switches for fuel dumping, ground and air-refueling, and a boost pump test button.

Fuel Ready Switch

The FUEL READY switch on the fuel management panel (figure 1-8) is a three-position toggle switch with positions placarded FLT, OFF, and GRD that is used for receiving fuel in flight or for ground fueling. Placing the switch in FLT stops internal transfer of fuel by venting wing and drop tanks (or air-refueling store) to permit the aircraft to receive fuel during air-refueling operations. Fuel is taken on as it is during single-point ground fueling. In OFF, the valves return to their normal configuration. The GRD position permits the aircraft to be fueled with the single-point refueling system.

CAUTION

The normal flight position for this switch is OFF. Wing and drop-tank fuel will not transfer if the FUEL READY switch is in the FLT position or GRD position. Wing and drop tank fuel will not transfer if the FUEL READY switch is in the GRD position with the ground refueling power switch in FUEL or DEFUEL position.

ENGINE FUEL FEED SYSTEM

The aft cell of the fuselage tanks supplies fuel through a service tank boost pump and motor-operated gate valves to the engine fuel pumps. The aft cell is divided into two compartments by a baffle and inverted flight check valves. The check valves allow fuel to flow into the bottom part of the cell, which is essentially a service tank. The boost pump that supplies fuel to the engine pumps is in the service tank, ensuring fuel supply to the engine for a limited time for any one flight maneuver. Fuel from the forward and mid fuselage cells is gravity-fed to the lower part of the service tank through a one-way check valve. Fuel under bleed-air pressure is fed from wing and drop tanks to the forward fuselage tanks.

The service tank boost pump is controlled by the engine and fuel master switches on the master generator panel (figure 1-8). When either switch is placed ON, a relay deenergizes, closing a circuit to the boost pump. In this way, a relay failure in the aircraft will not affect boost pump operation. The engine and fuel master switches also control motor-operated gate valves. There is one gate valve for each engine in the manifold to the engine-driven fuel pump. The OFF position of the engine and fuel master switch electrically closes the valve; the ON position drives the valve open. If there is a power failure, the valve will remain in the last selected position.

Boost Pump Test Button

The boost pump test button on the fuel management control panel (figure 1-8) placarded BOOST PUMP TEST is for ground checking the operation of the main tank boost pump and the centrifugal element of the engine-driven boost pumps. When the button is depressed, primary 115 V ac power is removed from the main tank boost pump, shutting it off. Before engine start, the main tank boost pump test circuit is checked by depressing the button, shutting off the electrically driven main tank boost pump.

CAUTION

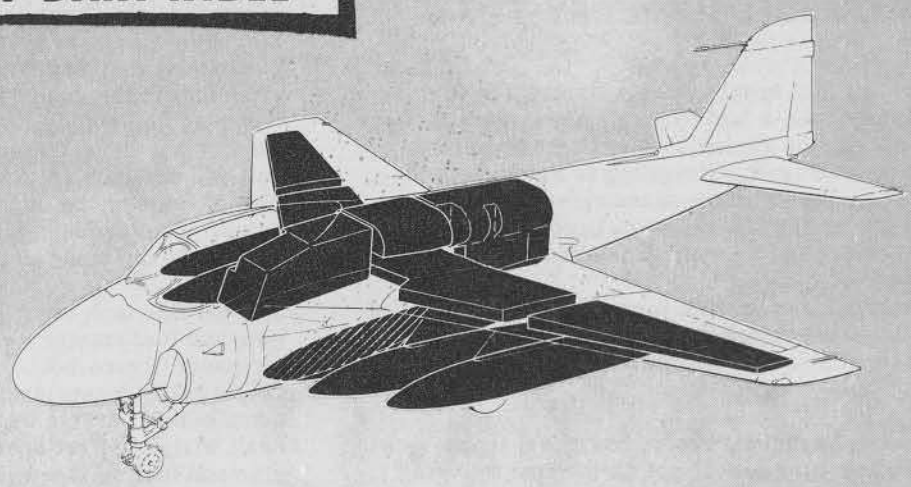
To preclude an engine fire, if an engine flames out during this test, the appropriate engine fuel master switch should be positioned to OFF before releasing the fuel boost pump test button.

Lighting of the L and R LOW FUEL PRESS lights indicates that the main tank boost pump test circuit did in fact shut off the boost pump. After engines are started, the centrifugal stage of the engine-driven fuel boost pump is checked by depressing the button, shutting off the electrically driven main tank boost pump. Lighting of either the L or R LOW FUEL PRESS lights indicates failure of the centrifugal stage of the respective engine-driven fuel boost pump by its failure to maintain fuel pressure.

CAUTION

DO NOT DEPRESS BOOST PUMP TEST BUTTON IN FLIGHT as an engine will flame out if the centrifugal stage of an engine-driven boost pump has failed.

FUEL QUANTITY DATA TABLE



DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

TANKS	TOTAL CAPACITY		APPROX. USEABLE FUEL IN LEVEL FLIGHT	
	GALLONS	POUNDS	GALLONS	POUNDS
FUSELAGE (MAIN) TANKS	1,326	9,016	1,309	8,900
INTERNAL WING TANKS	1,018	6,923	1,010	6,868
TOTAL FUSELAGE PLUS INTERNAL WING	2,344	15,939	2,319	15,768
EACH DROP TANK OR AIR REFUELING STORE	300	2,040	295.5	2,009

NOTE

TOTAL AIRCRAFT FUEL READ ON THE FUEL QUANTITY GAGE TOTALIZER EXCLUDES THE AIR REFUELING STORE.

WEIGHTS ARE BASED ON 6.8 POUNDS PER GALLON OF JP-5 FUEL, STANDARD DAY CONDITIONS.

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Figure 1-9

ENGINE FUEL PUMP

A two-stage fuel pump on the accessory drive gearbox supplies boosted fuel pressure to the engine fuel control. The pump consists of a positive-displacement gear-type pumping element and an impeller booster. If the fuel filter, between the pumping element and the impeller, becomes blocked, fuel will be directed around the filter automatically by the filter bypass. Two pressure switches, which control the low fuel-pressure and filter bypass caution lights, are also located between the pump stages.

LOW FUEL PRESSURE LIGHTS

The low fuel-pressure lights on the annunciator panel (figure 1-8) display L FUEL PSI and R FUEL PSI and are powered by the essential 28 V dc bus through the CAUTION LTS circuit breaker on the main circuit breaker panel. A pressure switch downstream of the centrifugal stage of the engine-driven pump completes a circuit to the light when the pressure is below approximately 12 to 14 PSI. At lower altitudes (below 20,000 feet), the centrifugal stage of an engine-driven pump or the main tank boost pump alone can maintain sufficient fuel pressure for engine operation and keep the light out. At higher altitudes (above 20,000 feet), failure of the centrifugal stage of an engine-driven pump will turn on the light for its respective engine, and failure of the main tank boost pump will turn on the lights for both engines. A reduction in power and descent to lower altitude should turn off the light and prevent an engine flameout.

FUEL FLOW INDICATOR

A fuel flow transmitter, powered by essential 115 V ac, 400-Hz current, translates fuel flow into an electrical signal. The signal is fed to the transformer and stepped up to drive a motor generator. The motor generator, in turn, drives a tape across the FF indicator. The fuel flow indicator reads pounds per hour (PPH) and is marked in 100-PPH increments up to 5,000 PPH. Above 5,000 PPH and up to 10,000 PPH, the scale is marked in 1,000-PPH increments and is compressed into a smaller linear distance.

FUEL PRESSURIZATION, TRANSFER, AND VENT SYSTEM

Fuselage Tanks

The fuselage fuel cells are maintained at a positive pressure of 1.25 to 2.0 psi above ambient pressure by ram air inducted through an inlet scoop on the upper aft fuselage. This pressurization ensures a head pressure to the fuselage boost pump and prevents cell collapse.

Wing and Drop Tanks

Under normal flight conditions, gear up and locked, the integrated pressurization transfer-and-vent features of the fuel supply system function automatically. Pressurization is furnished by cooled bleed air from the engines twelfth-stage compressor. In the event of double engine failure and the FUEL READY switch is in other than OFF, place the switch OFF prior to ejection. The wing tanks are pressurized to 7 psi and the drop tanks to 25 psi. Without pressurization, fuel cannot be transferred. Low wing-tank pressure is indicated by the wing-tank pressure caution lights on the fuel management panel. When going from unpressurized to pressurized tanks, there is a slight delay before the low wing-tank pressure caution lights go out because of the time needed to cycle the tank relief valves and pressurize the tanks. Limited control over the pressurization, transfer, and vent system is possible through the use of the tank pressurization switch, wing drop-tank transfer switch, and ship tank switch.

Tank Pressurization Switch

This switch is on the fuel management panel (figure 1-8) and has three positions: ORIDE, NORM, and OFF. In ORIDE, wing pressure-relief valves will close regardless of landing gear position and the pressure regulators will open to pressurize the tanks. With gear down, aircraft on the deck, and ORIDE selected, wing-tank pressurization is 7 psi. With aircraft airborne, gear up or down, and ORIDE selected, wing tanks are pressurized to 12 psi. The OFF position of the tank pressurization switch will prevent pressure buildup by holding the vent relief valve open under all flight conditions. With the switch in the NORM position and the landing gear up and locked, tank pressurization is regulated automatically. The tank pressurization switch is primarily for preflight check of fuel transfer capability.

CAUTION

During ground operation, if the tank pressure switch is actuated to ORIDE when the air-conditioning master switch is OFF, hot engine bleed air will be pumped into the wing tanks. This will damage the O-ring seals in the zero-leak check valves, permitting fuel to flow into the auxiliary heat exchanger, the hydraulic tank, vent suit, canopy seal, and electronic equipment in the nosewheel well as well as the engine bleed air lines. However, this situation will not occur while airborne due to sufficient ram air cooling.

Note

With landing gear down, wing and drop-tank fuel cannot be transferred or dumped unless the tank pressurization switch is set to ORIDE.

Outbd/Inbd WG PSI Lights

The wing-tank pressure lights on the fuel management panel (figure 1-8) display OUTBD WG PSI and INBD WG PSI and are powered by the essential 28 V dc bus. Lighting of either or both lights indicates

air pressure in the respective wing tanks is below approximately 6 psi and fuel is not transferring, or is transferring at a reduced rate. The light circuit is completed by pressure switches in the respective wing tanks.

Wing Drop-Tank Transfer Switch

The wing-drop tank transfer switch (figure 1-8) on the fuel management panel has three positions: INBD, OUTBD, and NORM. The INBD position closes shutoff valves in the outboard drop tanks and the centerline tank and allows fuel to transfer from the inboard tanks. With the switch in the OUTBD position, the inboard and centerline shutoff valves are closed and fuel is transferred from the outboard tanks. Fuel transfers simultaneously from all the drop tanks with the switch in the NORM position. All drop-tank fuel transfers to the forward fuselage cell, except when dumping wing-tank fuel.

CAUTION

Tests have indicated that possible overpressurization of the fuselage fuel tanks may occur if all four drop tanks empty simultaneously. No reported instances have occurred to date; however, the following mandatory drop-tank selection procedure must be adhered to in flight for those affected aircraft:

1. Place wing-drop-tank transfer switch on INBD until inboard drop tanks empty.
2. After inboard drop tanks have emptied, place switch in NORM for remainder of flight.
3. If configured with four or more drop tanks, and only two are fueled, then NORM should be selected since only the two will empty simultaneously.
4. Three conditions exist during which drop tank transfer switch is to be placed in NORM when all drop tanks contain fuel:
   a. When fuel is being dumped.
   b. When aircraft is serving as a tanker and fuel is being transferred to receiver aircraft.
   c. Fewer than four drop tanks are installed.

Note

In aircraft not incorporating AFC No. 158, with the tank pressurization switch set to OFF, or the landing gear down, fuel will syphon from the fuselage tank to the drop tanks if inboard tanks are configured and the wing-tank transfer switch is set to OUTBD, or if outboard tanks are configured and the wing-tank transfer switch is set to INBD.

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity indicating system consists of fuel capacitance sensor units mounted in the fuel tanks, a fuel quantity gage, fuel quantity selector buttons, and an indicator test button and an independent low fuel quantity caution light. The capacitance sensor units compensate for changes in fuel density and present a signal to the gage proportional to fuel quantity in pounds. The system is powered by essential 28 V dc power through the TURN/SLIP circuit breaker on the main circuit breaker panel and essential 115 V ac power through the LOX/FUEL QTY circuit breaker on the pilot's left console circuit breaker panel. NEW

Fuel Quantity Gage

The fuel quantity gage (figure 1-8) on the pilot's instrument panel displays three simultaneous indications of fuel quantity. A digital totalizer in the lower part of the instrument face provides a continuous indication of total pounds of fuel on board. Two rotating needles indicate on a circular scale that is graduated in increments of 200 pounds up to 3,000 pounds and 500-pound increments from 3,000 to 10,000 pounds. The main needle indicates pounds of fuel in the main tank. The selectable needle indicates pounds of fuel in the main, wing, or any of the five drop tanks as selected by buttons on the fuel management panel. For fuel quantity gage tolerance scale, see figure 1-10. NEW NEW NEW

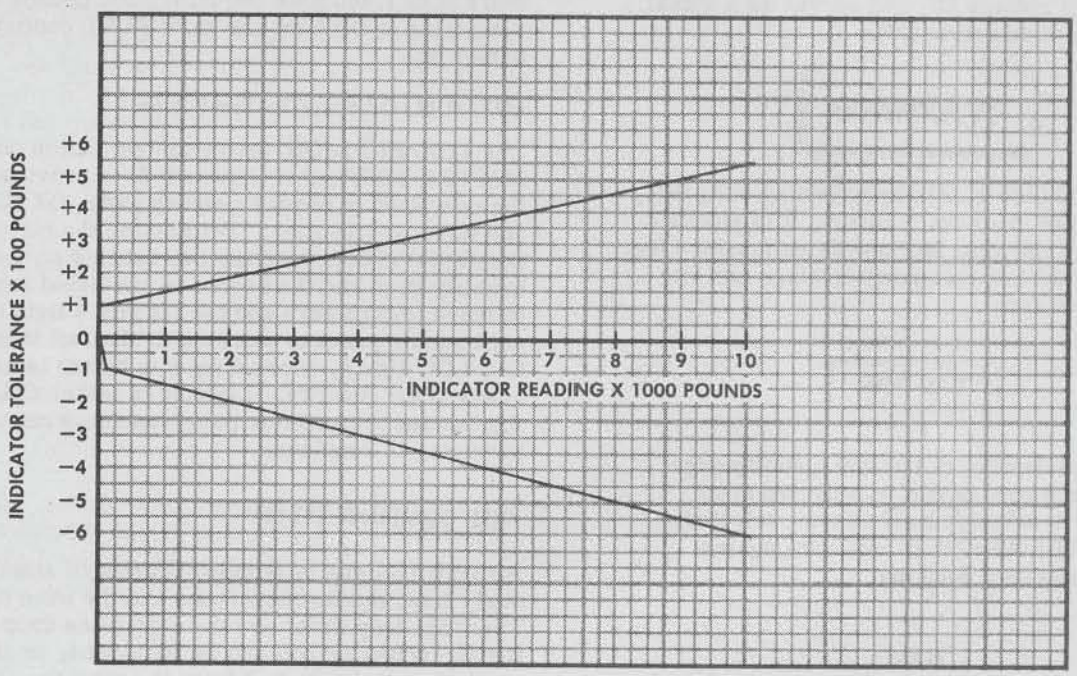
Note

Unreliable totalizer and selectable needle indications should not be construed as a complete failure of the fuel quantity indicating system. The main needle can continue to be reliable and should be closely monitored to ensure proper fuel transfer. NEW NEW NEW

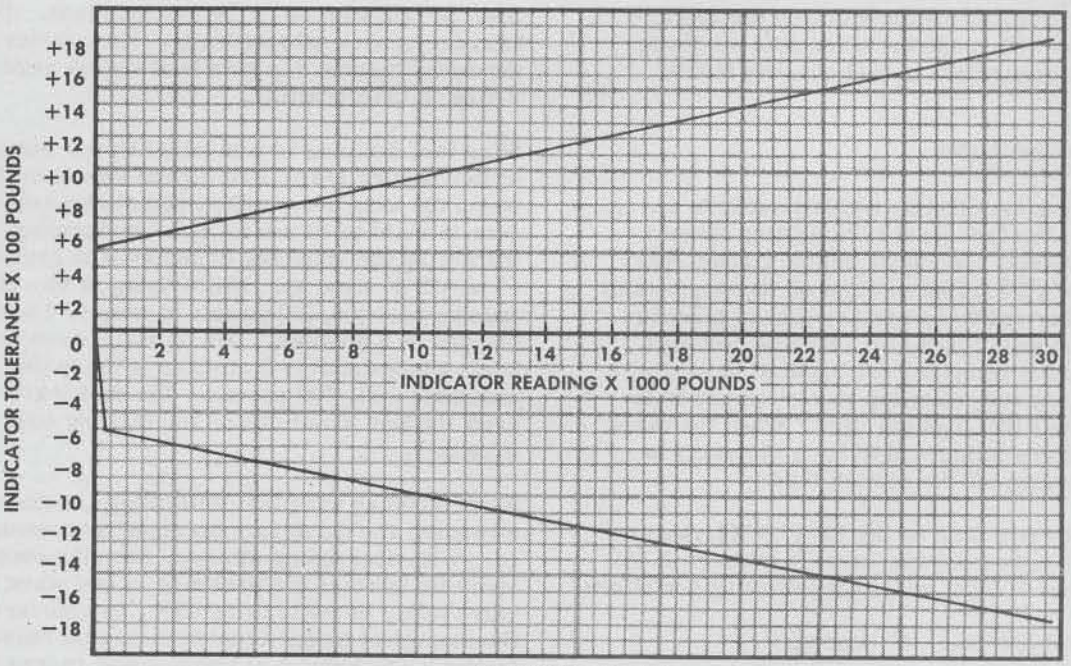
Fuel Gage Selector Buttons

Seven FUEL GAGE selector buttons on the fuel management control panel (figure 1-8) are placarded R

FUEL QUANTITY GAGE TOLERANCE SCALE



MAIN AND SELECTABLE NEEDLE



TOTALIZER COUNTER

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Figure 1-10

OUTBD, R INBD, L INBD, L OUTBD, CTR, WING, and MAIN. Depressing a particular button cancels the previous selection and selects that particular tank for presentation of fuel quantity on the fuel quantity indicator by the selectable needle. The depressed button rotates 45° and serves as a visual indication of the selected tank.

WARNING

If the selectable needle is reflecting wing fuel, and wing fuel does not transfer, it is possible to misread the wing fuel needle as fuselage fuel quantity, and not recognize fuselage fuel decreasing to zero.

CAUTION

To prevent damage to the fuel quantity gage, a selector button should be selected at all times. If a selector button is not selected, the gage will continue to motorize against the zero stop and burn out.

Note

Unless Accessory Change 86 is incorporated depressing the center store selector button with an in-flight refueling store on the centerline station will cause the selectable needle to go to zero regardless of fuel quantity in the store.

Low Fuel Caution Light

The low fuel caution circuit is highly reliable and is independent of the fuel quantity indicating system. A separate thermal resistance bridge circuit energizes the LOW FUEL caution light on the annunciator panel. The thermal resistors are part of a liquid-level sensor mounted in the aft fuselage fuel tank. When the thermal resistors are exposed to air, a relay is deenergized, allowing electrical power to reach the LOW FUEL caution light. When the thermal resistors are immersed in fuel, the relay is energized, turning off the caution light.

The thermistor will turn on the LOW FUEL caution light when the remaining fuel level is between 1,360 to 1,660 pounds of fuel, under the following conditions:

1. Aircraft attitude - 4° nose up
2. Fuel flow (maximum range cruise at 10,000 feet) - 1,460 lb/hour/engine
3. Aircraft weight - 30,000 pounds

Under these conditions, 80 pounds of fuel will remain in the forward fuselage tank, and 1,380 pounds of fuel will remain in the aft tank. Since the thermistor is in the aft tank, an increase in nose-up attitude that permits all the fuselage fuel to flow to the aft tank will delay a low-fuel indication until there is only 1,380 pounds of fuel remaining. This is 80 pounds below the 1,460 plus 200 minus 100 pounds desired. A decrease in the 4° nose up attitude will result in more than 1,460 plus 200 minus 100 pounds of fuel remaining at the time the LOW FUEL caution light comes on.

LOX/FUEL/OIL Press-To-Test Button

The LOX/FUEL/OIL press-to-test button on the MASTER TEST panel (figure 1-8) is provided to test the operation of oxygen quantity gage, OXYGEN light, and fuel quantity gage. Depressing the button causes the digital counter and the two needles on the fuel quantity gage and the needle on the liquid oxygen gage to move toward zero and the OXYGEN light on the annunciator panel to come on. In aircraft incorporating OIL LOW lights, depressing this button is also a check of oil quantity. Lighting of either OIL LOW light on the annunciator panel indicates engine oil servicing is required.

FUEL DUMPING SYSTEM

Aircraft fuel can be dumped overboard simultaneously from the fuselage tanks and the wing tanks. The wing drop tanks and the centerline drop tank or the air-refueling pod can be jettisoned, or if the tanks are to be retained, fuel from the wing drop tanks must be transferred to the outboard wing tanks. The centerline drop tank or the air-refueling store fuel must be transferred to the fuselage tank. Drop tank transfer occurs automatically. To transfer fuel from the refueling pod, the ship tank switch must be in the FROM STORE position.

Wing fuel dumping is controlled by the wing dump switch (figure 1-8). Placing the switch in DUMP opens the wing dump valves and allows tank pressure to build to 12 psi for quicker dumping. Optimum wing fuel dumping is achieved at cruise attitude, 4° to 4 1/2° nose up. While flying in this attitude, approximately 6,300 pounds of wing fuel can be dumped in 5 minutes. Due to drain-down time, it takes approximately 3 minutes to dump the remaining dumpable fuel, 554 pounds. The fuel leaves the aircraft through manifolds on the trailing edge of each wingtip.

When dumping wing fuel while flying at nose-down attitudes, the dump rate becomes increasingly slower. With decreasing attitude, dumping becomes sporadic because air pressure is lost when the dump valve inlet, in the trailing edge, is uncovered and the amount of trapped fuel becomes increasingly larger. The amount of trapped fuel ranges from approximately 140 gallons trapped at 0° flight attitude to the total wing fuel (1,018 gallons) at 10° nose down.

Flight test has shown that the disturbance in the airflow over the wing caused by the wing-tip speed brakes when they are extended is sufficient to significantly disrupt the pattern of fuel flowing from the wings during dump. For this reason, wing fuel should be dumped with the wing-tip speed brakes closed.

Fuselage fuel dumping is selected with the fuselage (FUS) dump switch. The transfer-and-dump pumps in the forward and aft cells operate to increase the dump rate. With fuselage cells full, dumpable fuel is pumped overboard in 3.5 to 4 minutes. Due to the location of the transfer-and-dump pump in the forward cell and the standpipe in the aft cell, a certain amount of fuel remains in the fuselage tank after dumping is completed. At cruise attitude (4 1/2° nose up or 12 1/2 units on the AOA indicator), approximately 3600 pounds remain in the A-6A, B, C, and A-6E, and approximately 2700 pounds in the KA-6D. A slight dive will increase fuel remaining. A slight climb, an airspeed change, or any other maneuver resulting in an increased angle of attack during dump will decrease the fuel remaining to a minimum of 2400 pounds. The fuselage fuel is dumped through a dump vent outlet at the lower aft end of the fuselage.

Purging of fuel vapor from the wing tanks is automatic. No purging is provided for the drop tanks.

Fuselage Dump Switch (FUS)

The DUMP position of the two-position fuselage switch on the fuel management panel (figure 1-8) starts the forward and aft fuel transfer pumps and opens the fuselage dump gate valve. Power to drive the forward pump comes from the monitored 115 V ac bus. The rear pump is powered by 115 V ac from the primary ac bus. The NORM position of the switch cuts electrical power to the transfer pumps and drives the fuselage dump gate valve closed.

CAUTION

Place the fuselage dump switch to NORM after dumping fuselage fuel to prevent the transfer pumps from overheating.

Wing-Dump Switch

The wing dump switch has two positions: DUMP and NORM. When DUMP is selected, power is supplied to the wing dump valves, the wing tank gate valves, and the wing tank pressure regulators. The regulators boost pressure to 12 psi in the wing tanks for dumping. The wing gate valves are powered closed, preventing fuel transfer to the fuselage tanks. Leaving the switch in DUMP will hold the wing dump valves open. The NORM position of the wing dump switch powers the wing dump valves closed, and allows the wing-tank pressure regulator to pressure the tanks at 7 psi with the landing gear retracted.

Note

- When refueling in flight at a low fuel state, placing the WING DUMP switch to the DUMP position will allow all received fuel to enter the fuselage cells and centerline tank if installed where it is immediately available to the engines.
- Return wing dump switch to NORM prior to landing to prevent dumping fuel on deck.

AIR REFUELING SYSTEM

The aircraft can receive fuel in flight from a drogue-equipped tanker, or serve as a tanker and deliver fuel in flight to a probe-equipped receiver aircraft. Air-refueling flight procedures are found in Section IV, Part 4, of this manual, and the Air Refueling NATOPS manual. Air-refueling charts are available in Section XI, Part 3. A description of the air-refueling tanker system is presented in Section VIII.

AIR REFUELING (RECEIVER)

During air-refueling, fuel flows through the receiver aircraft probe nozzle under pressure and is distributed to each tank in the same manner as it is through the single-point refueling (system) receptacle. The amount of fuel flow is determined by the number of empty or partially full receiver tanks. As each tank is filled, float-operated shutoff valves stop the flow of incoming fuel.

Fuel flow rates vary in accordance with the fueling pressure at the refueling-probe nozzle and the number of tanks filling. The maximum rate is approximately 325 gpm when all tanks are filling. The refueling shutoff valves are designed to withstand surge pressures that current tankers produce.

Air Refueling Probe Light

A red air-refueling probe light is installed to illuminate the air-refueling probe for night operation. The light is forward of the cockpit canopy and left of the aircraft centerline and is aimed a the tip of the refueling probe. Placing the TAXI/PROBE light switch on the master light control panel (figure 1-36) to ON directs electrical power to the probe light when the landing gear are up and locked.

Refueling Valve Manual Control Handle

A refueling valve manual control handle is provided to open or close the refueling gate valve (figure FO-4) manually in the event of electrical failure. Located between the pilot and B/N, the handle is mounted in a slotted guide on the bulkhead adjacent to the right side of the main circuit breaker panel. The handle is placarded REFUELING VALVE MANUAL CONTROL and has two detented positions marked OPEN (up) and CLOSE (down).

Note

In-flight actuation of the REFUELING VALVE MANUAL CONTROL HANDLE in the event of complete electrical failure will permit refueling of fuselage tanks only. The wing tanks will still remain pressurized.

If operated with electrical valve failure only (not total electrical failure), all tanks will be filled.

ELECTRICAL POWER SUPPLY SYSTEM

The normal electrical power supply in the A-6A, A-6B/Mod 0/1 and A-6C (figure FO-5) is provided by the two engine-driven 115/200 V ac generators (alternators) rated at 20 kVA. In the A-6B Mod 1, KA-6D, and A-6E, the engine-driven generators are rated at 30 kVA. Transformer/rectifiers convert 115 V ac to 28 V dc for aircraft electrical requirements. Normally each engine drives one generator by a pneumatic mechanical constant-speed drive/starter unit (CSD/S). If an engine fails, bleed air from the operating engine (rpm above 75%) will automatically be directed to the CSD/S of the inoperative engine. Each generator is controlled by a switch on the master generator panel (figure FO-2). The CSD/S is controlled by a speed drive switch on the fuel management control panel (figure FO-2) in aircraft not incorporating AFC 268 and on the master generator panel (figure FO-2) in aircraft incorporating AFC 268.

Note

In aircraft that have engines incorporating IPPB 185 (smokeless burner cans), idle rpm may be too low at altitudes above approximately 15,000 feet to maintain constant generator speed. To ensure that generators do not drop out due to underfrequency output, maintain at least 65% engine rpm at 15,000 feet and above.

The system is protected by supervisory control panels that sense abnormal voltage conditions and automatically deenergize the affected generator. A battery is provided as an auxiliary source of dc power for the CSD/S and the assist-spin recovery system. If both generators fail, an emergency electrical power system (ram-air turbine generator) is available to provide power for the operation of essential equipment. An external power receptacle is provided for starting engines or operating electrical systems by ground power.

CIRCUIT BREAKERS

Circuit breaker panels are located in the cockpit (figure 1-11 Sheets 1 thru 4) and external throughout the aircraft (figure 1-12 Sheet 1 thru 9). Panels particular to the A-6B or A-6C as well as A-6A panels modified for the A-6B or A-6C are shown in figure 1-13 Sheets 1 and 2). In the cockpit, the main and bombardier/navigator's circuit breaker panels are installed in an inverted position to facilitate reading the placards. Key cockpit circuit breakers are shown in figure 1-14.

Pushbutton-type circuit breakers protect the electrical supply system and associated components from an overloaded circuit. The appropriate circuit breaker will pop and isolate a circuit or component that draws too much current, thus preventing equipment damage and possible fire.

The numeral on the button indicates the amperage (amp) rating. The three-phase or gang-bar circuit breakers can be set so that two phases only are engaged. To prevent equipment malfunction, ensure all three phases of the gang bar are engaged.

CAUTION

Do not hold in circuit breakers that repeatedly pop out. Forceably holding the circuit breaker in may result in irreparable damage to the equipment or possible fire.

Note

In the event of equipment malfunction, it is recommended that the applicable circuit breaker be disengaged until qualified maintenance personnel have repaired the defective equipment.

EXTERNAL POWER

External three-phase power is supplied to the ac power distribution system through a standard six-pin receptacle on the right side of the fuselage. The electrical systems are protected against incorrect phase-sequenced ground power by a phase-sensing relay In A-6A, B, C 154170 and ON and aircraft incorporating AFC 102, the phase-sensing relay is replaced by an external power monitor, which protects the systems against over- and undervoltage, over- and underfrequency, and incorrect phase rotation in the ground power supply. The two-position external power monitor control switch labeled RESET, NORMAL is on the external power panel.

ELECTRICAL POWER DISTRIBUTION

Electrical power is distributed to the various electrical components through a series of buses. The buses are arranged to group equipment of equivalent significance. In this way, any failure in the system can be automatically directed toward the areas of least importance. Generally, the essential buses power all the equipment necessary to fly the aircraft, the primary buses power equipment necessary to complete the mission, and the monitored bus powers the convenience circuits.

When both generators are operating, the right generator supplies the primary ac buses and, through the emergency power transfer relay, supplies the essential ac buses. The left generator, through its line contactor, energizes the monitored transformer/rectifier (T/R) and the 115 V ac monitored bus. The T/R, in turn, powers the 28 V dc monitored buses. The right generator through its line contactor, energizes the primary T/R and the primary and essential ac buses.

The primary T/R supplies power to the dc primary and through the dc emergency transfer relay to the

COCKPIT CIRCUIT BREAKER PANELS

A-6A/B/C TYPICAL

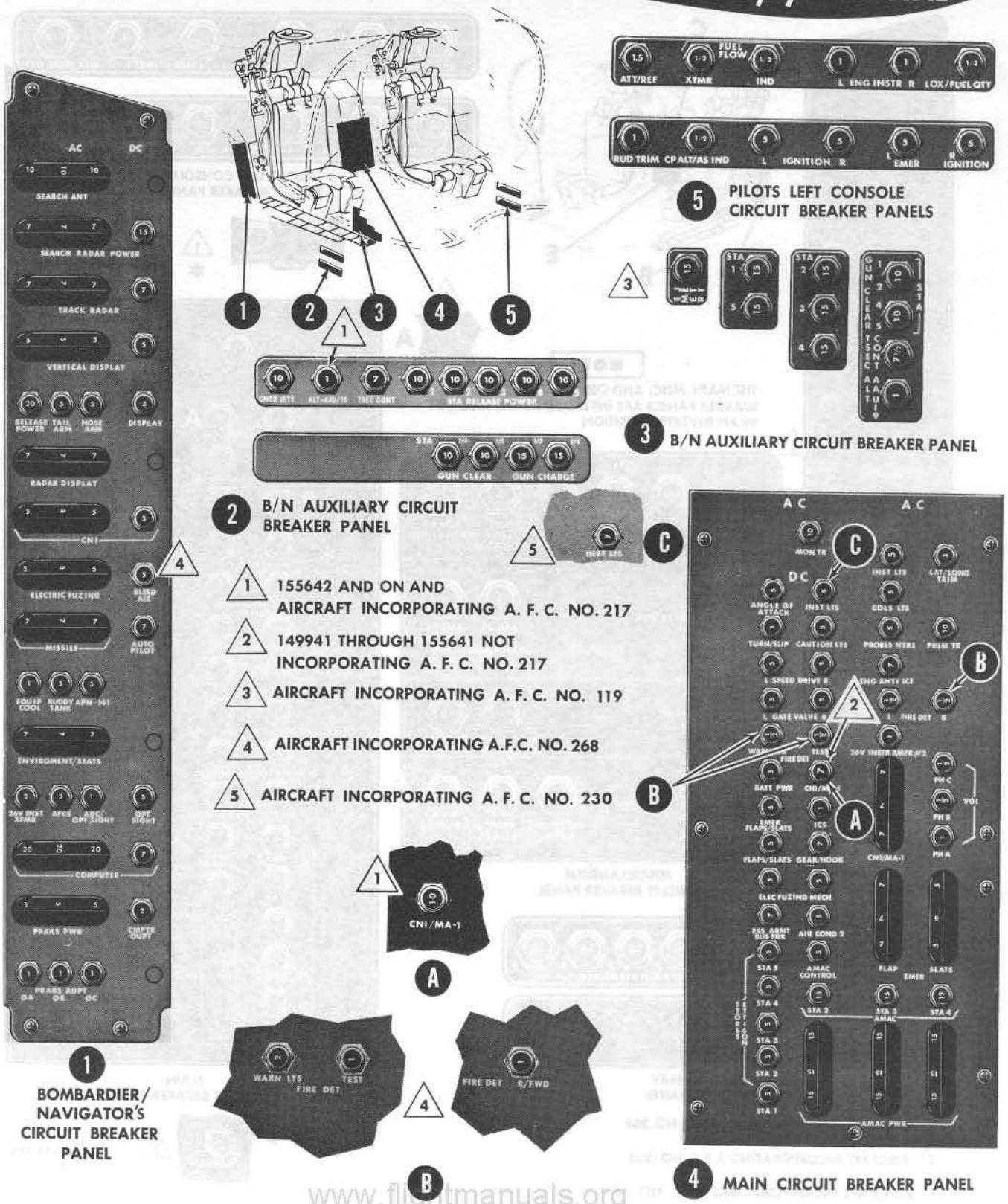

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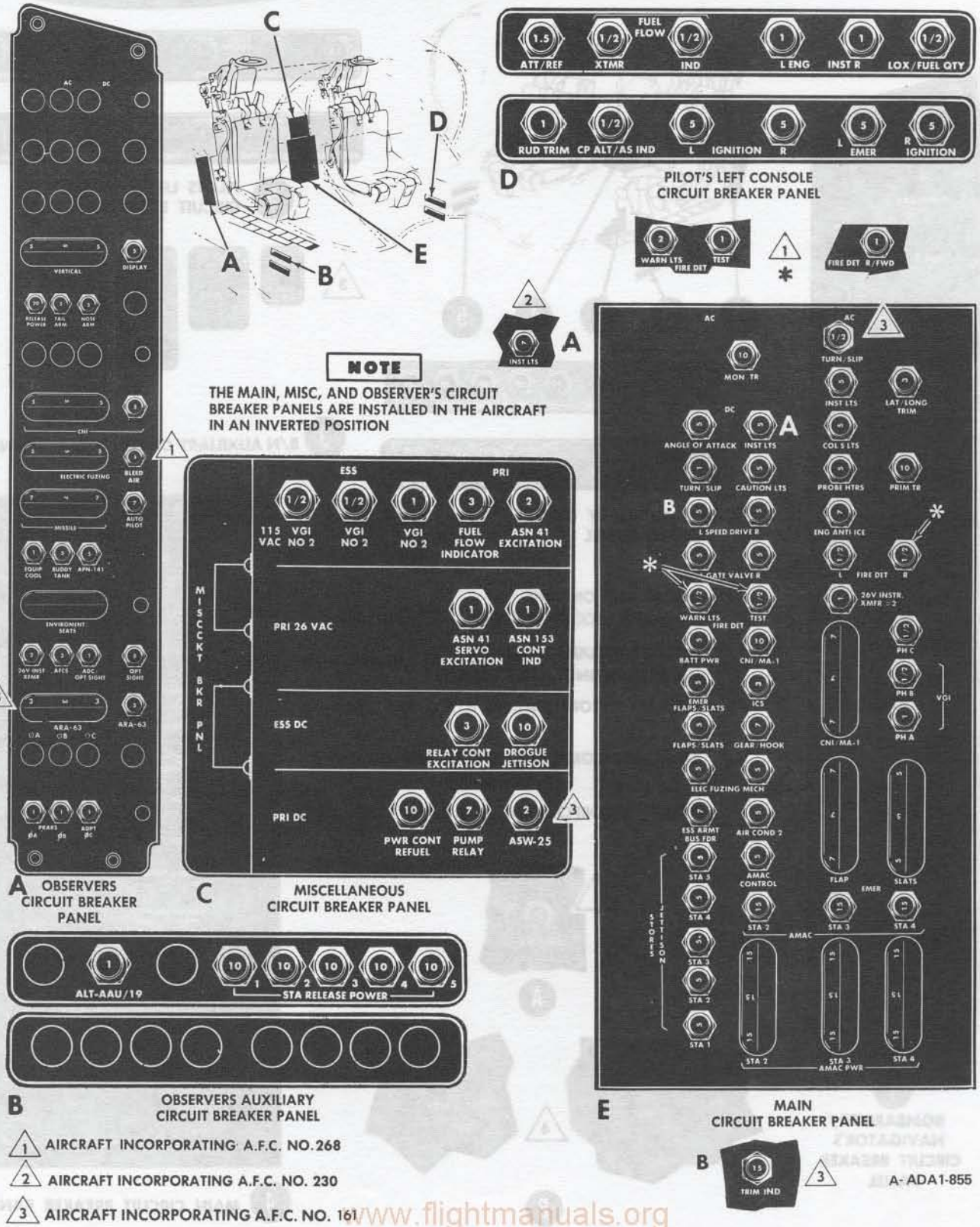
Figure 1-11 (Sheet 1)

COCKPIT CIRCUIT BREAKER PANELS — KA-6D



1 AIRCRAFT INCORPORATING A.F.C. NO. 268

2 AIRCRAFT INCORPORATING A.F.C. NO. 230

3 AIRCRAFT INCORPORATING A.F.C. NO. 161

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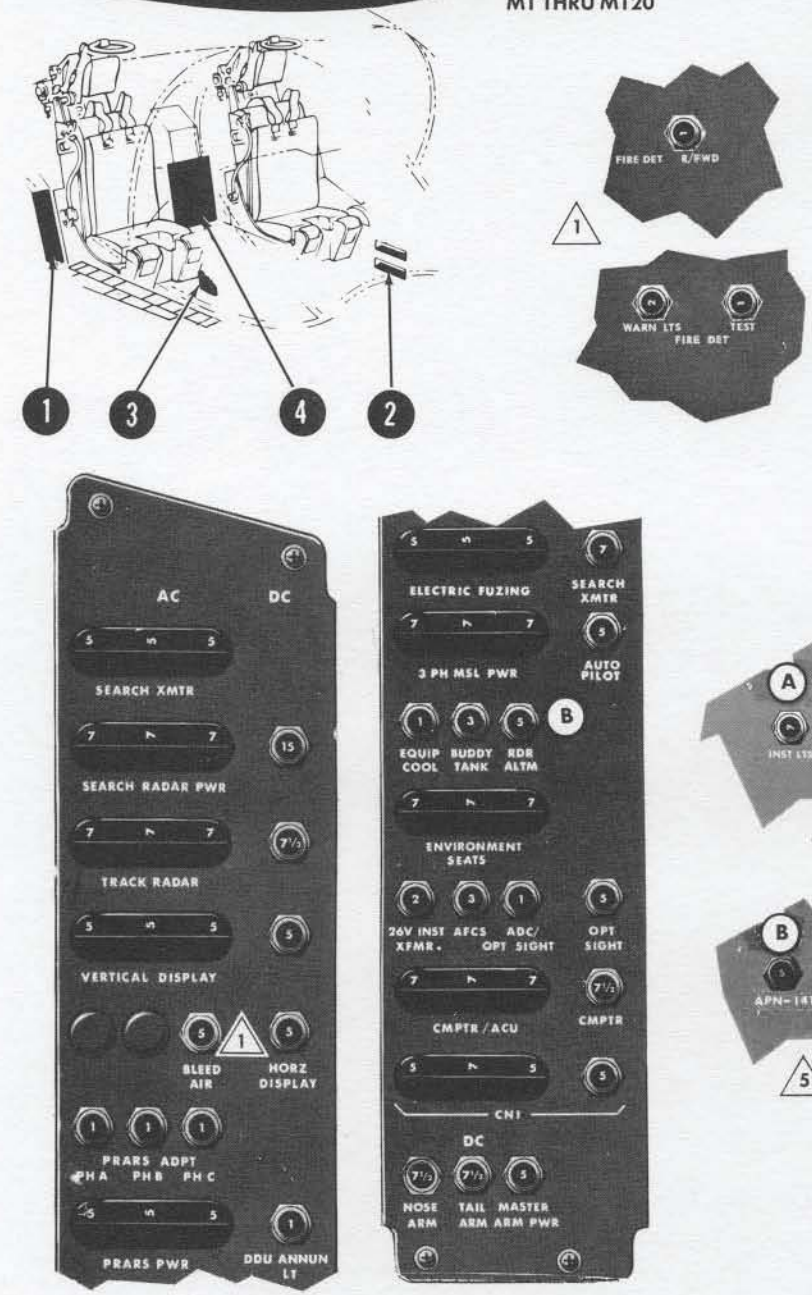
Figure 1-11 (Sheet 2)

COCKPIT CIRCUIT BREAKER PANELS

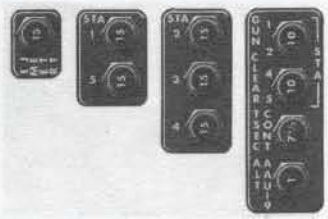
A-6E

158041 THRU 159579 AND
M1 THRU M120

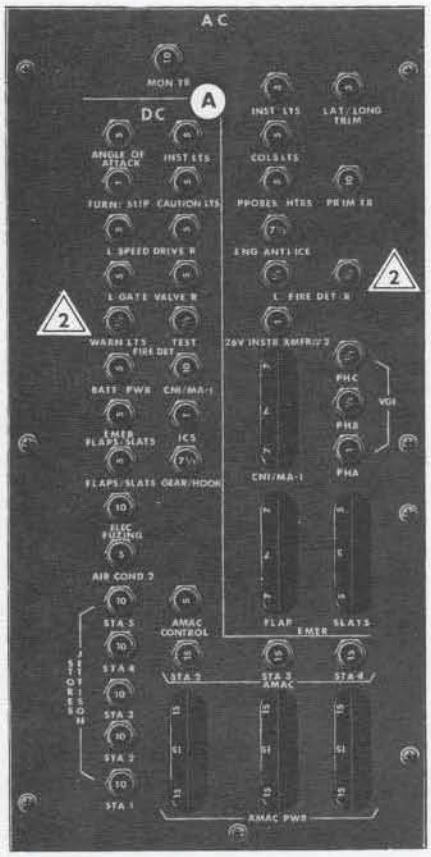


1 BOMBADIER NAVIGATORS CIRCUIT BREAKER PANEL

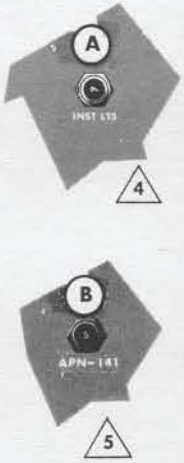
2 PILOT'S LEFT CONSOLE CIRCUIT BREAKER PANELS



3 B/N AUXILIARY CIRCUIT BREAKER PANEL



4 MAIN CIRCUIT BREAKER PANEL



1 158533 AND ON AND THOSE INCORPORATING A.F.C.NO. 268

2 158041 THRU 158532 NOT INCORPORATING A.F.C.NO. 268

3 158535 AND SUBSEQUENT

4 AIRCRAFT INCORPORATING A.F.C.NO. 230

5 AIRCRAFT INCORPORATING APN-141

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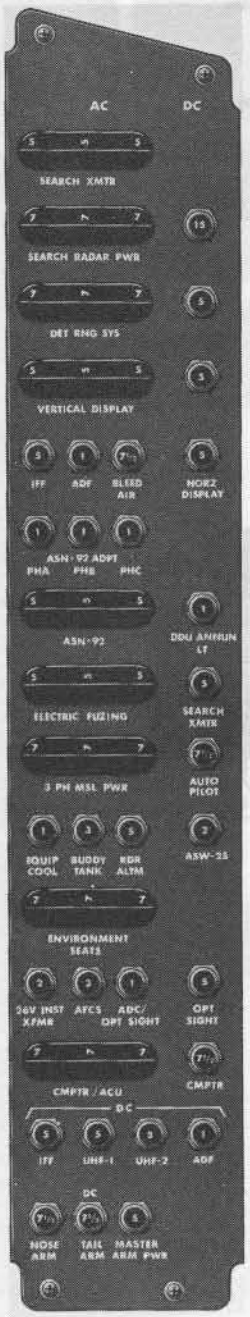
Figure 1-11 (Sheet 3)

COCKPIT CIRCUIT BREAKER PANELS CONT.

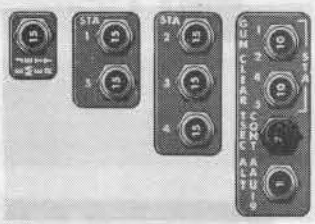
A-6E

159895 AND ON AND M121 AND ON

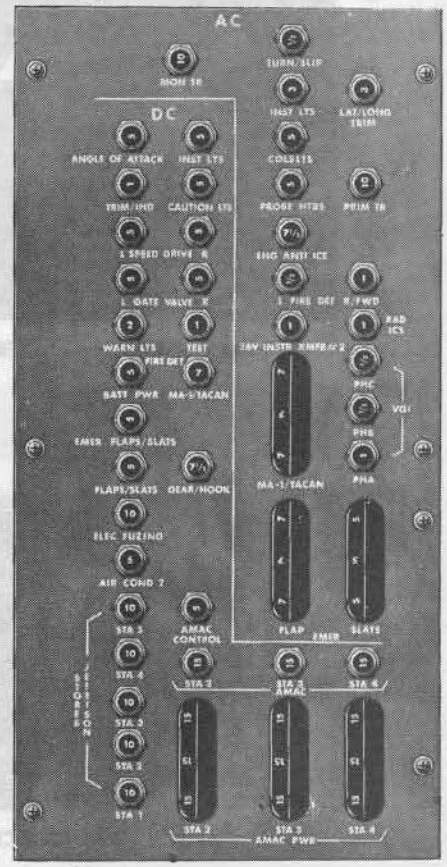


1 BOMBADIER NAVIGATORS CIRCUIT BREAKER PANEL

2 PILOT'S LEFT CONSOLE CIRCUIT BREAKER PANELS



3 B/N AUXILIARY CIRCUIT BREAKER PANEL



4 MAIN CIRCUIT BREAKER PANEL

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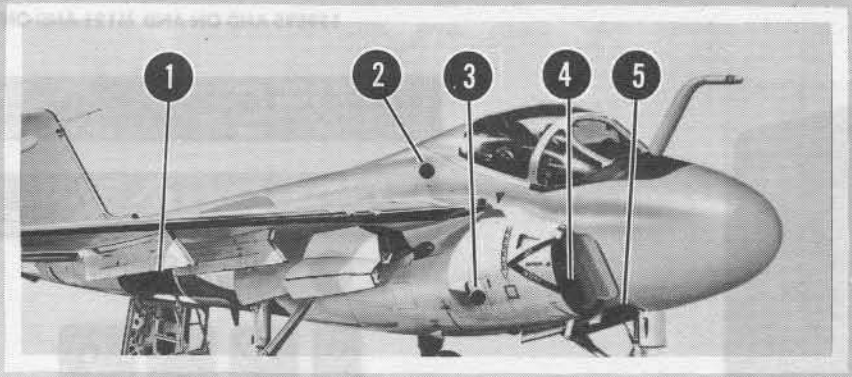
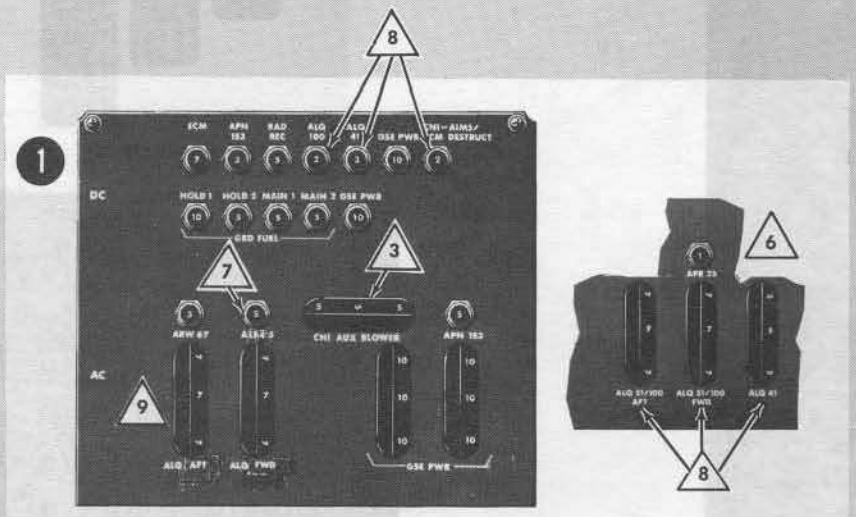
Figure 1-11 (Sheet 4)

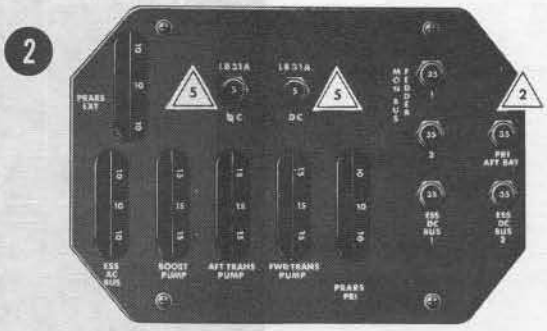
EXTERNAL CIRCUIT BREAKER PANELS

A-6A/B/C TYPICAL





AFT BAY CIRCUIT BREAKER PANEL



AC - DC POWER CIRCUIT BREAKER PANEL

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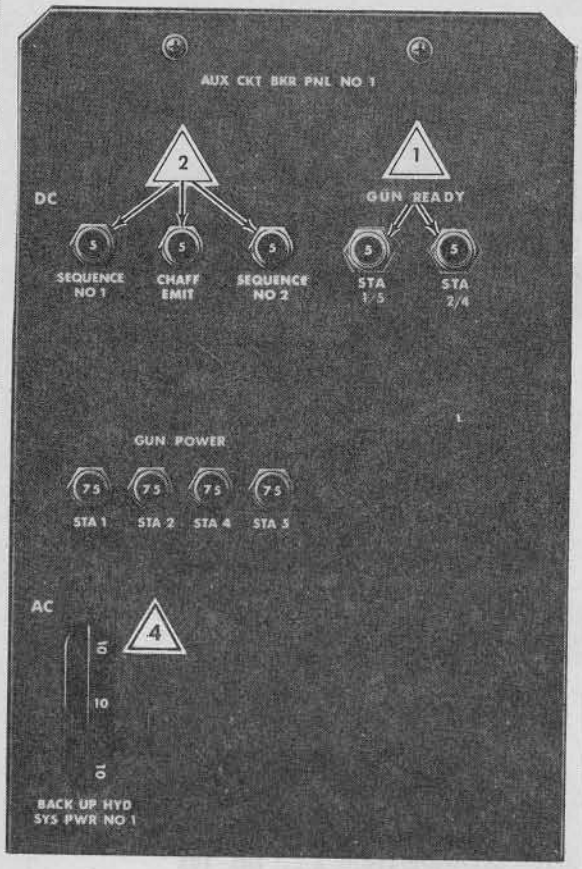
Figure 1-12 (Sheet 1)

EXTERNAL CIRCUIT BREAKERS CONT.

A-6A/B/C TYPICAL

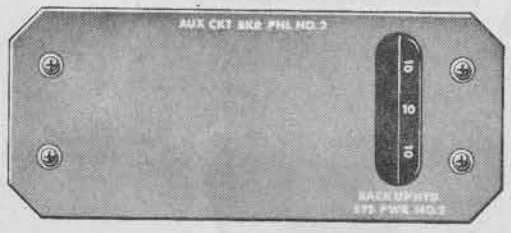
1



AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 1 (LEFT SIDE) 155640 AND ON AND AIRCRAFT INCORPORATING A. F. C. NO 183

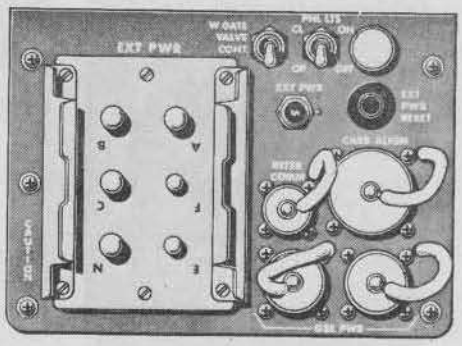
1. 155642 AND ON INCORPORATING A.F.C. NO. 119
2. 155703 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 197
3. AIRCRAFT WITHOUT A.F.C. NO. 183 INCORPORATING A.F.C. NO. 268
4. AIRCRAFT WITH A.F.C. NO. 183 AND INCORPORATING A.F.C. NO. 268
5. AIRCRAFT INCORPORATING A.F.C. NO. 256
6. AIRCRAFT NOT INCORPORATING A.F.C. 263
7. AIRCRAFT INCORPORATING A.F.C. NO. 263
8. AIRCRAFT NOT INCORPORATING AFC NO. 287
9. AIRCRAFT INCORPORATING A.F.C. NO. 287

1



AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 2 (RIGHT SIDE) 155640 AND ON AND AIRCRAFT INCORPORATING A. F. C. NO. 183

3



EXTERNAL POWER RECEPTACLE

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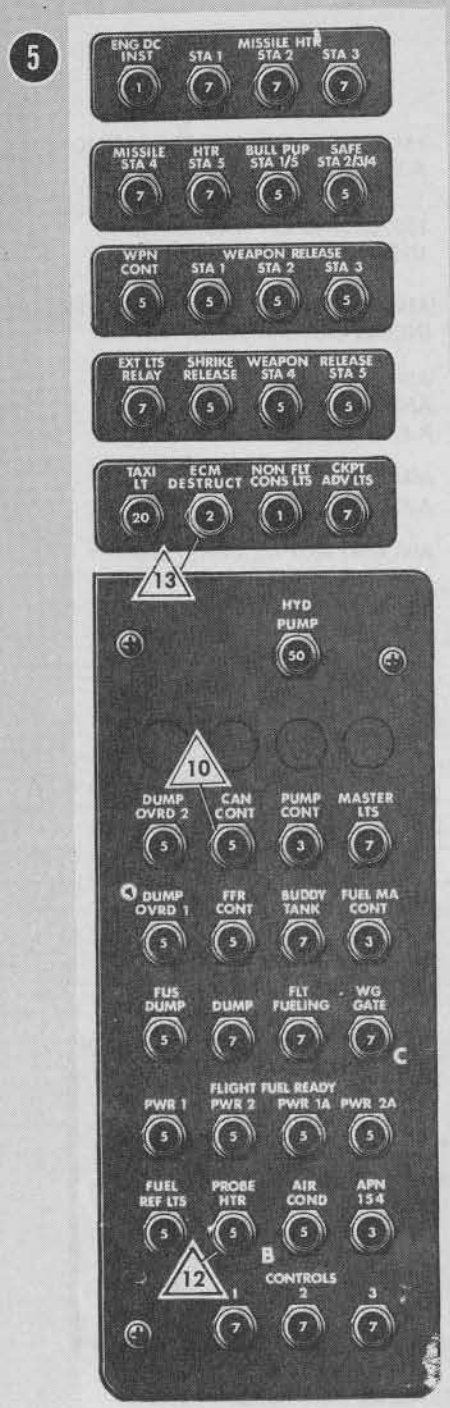
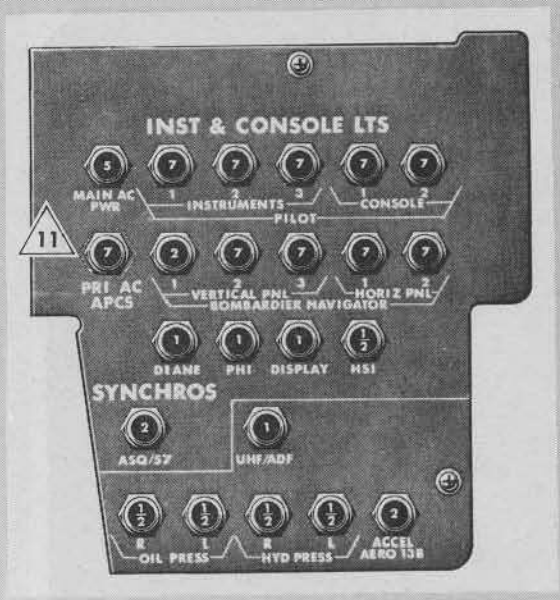
Figure 1-12 (Sheet 2)

EXTERNAL CIRCUIT BREAKERS CONT.

A-6A/B/C TYPICAL





10 155703 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 185

11 155642 AND ON AND THOSE INCORPORATING A.F.C. NO. 199

12 149941 THROUGH 155641 NOT INCORPORATING A.F.C. NO. 199

13 155721 THRU 157029 NOT INCORPORATING A.F.C. NO. 287

14 AIRCRAFT INCORPORATING A.F.C. NO. 352

D-ADA1-128-3

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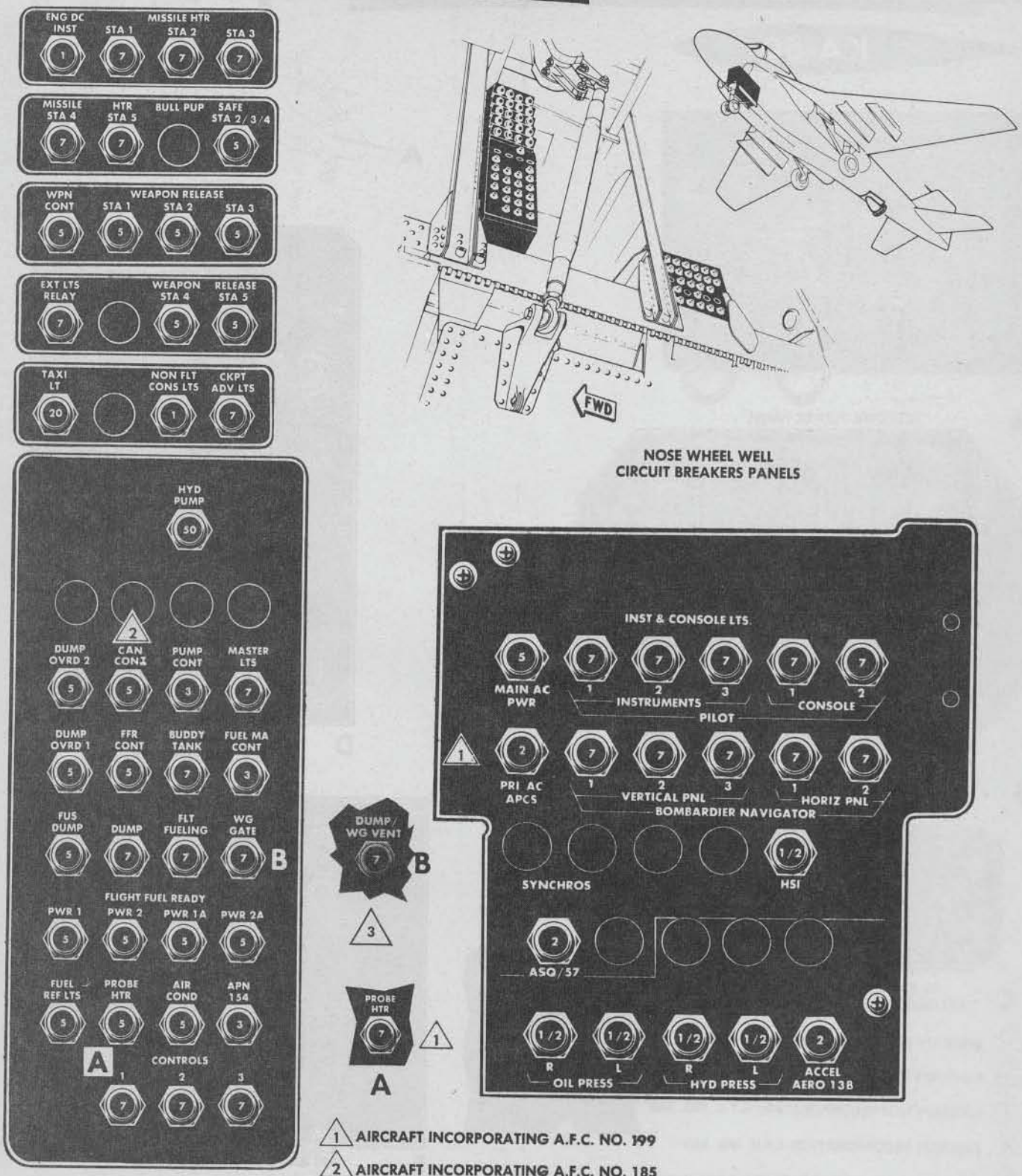
Figure 1-12 (Sheet 3)

EXTERNAL CIRCUIT BREAKER PANELS

KA-6D



1 AIRCRAFT INCORPORATING A.F.C. NO. 199

2 AIRCRAFT INCORPORATING A.F.C. NO. 185

3 AIRCRAFT INCORPORATING A.F.C. NO. 352

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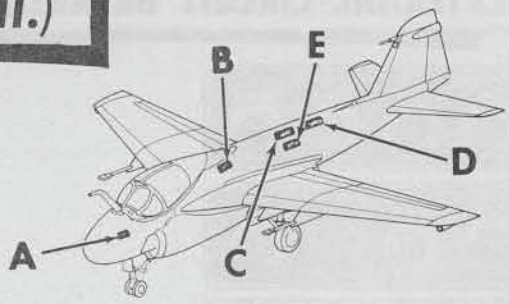
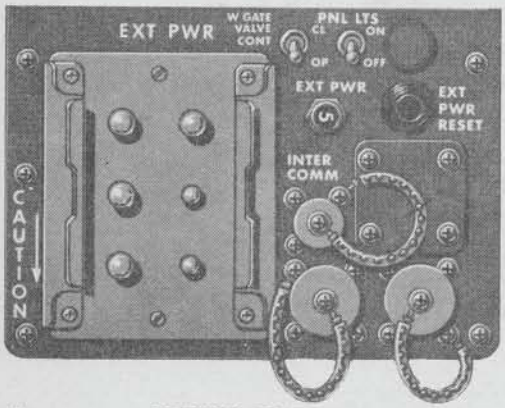
Figure 1-12 (Sheet 4)

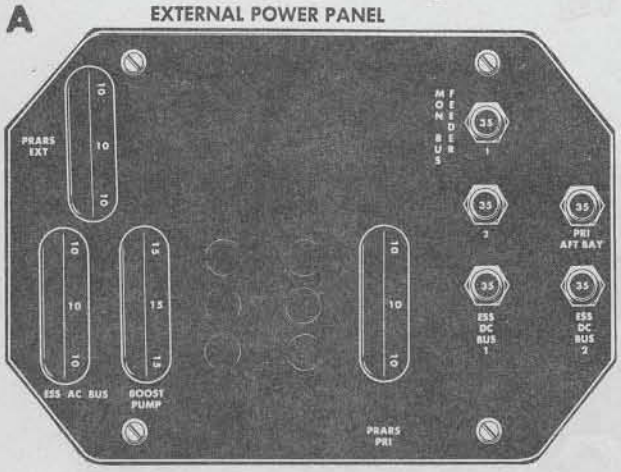
EXTERNAL CIRCUIT BREAKER PANELS (CONT.)

KA-6D

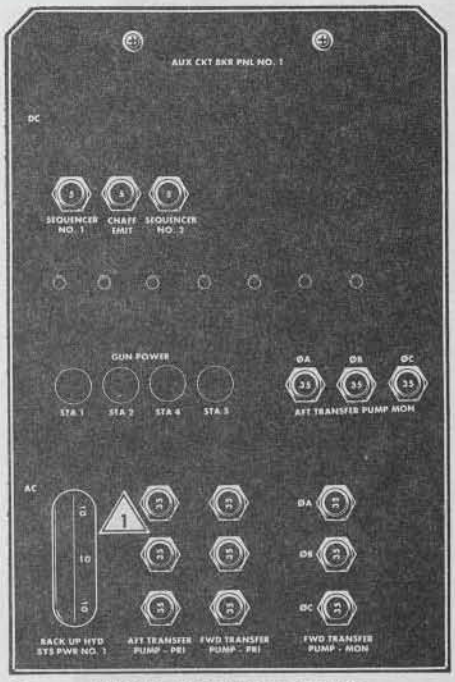




A EXTERNAL POWER PANEL

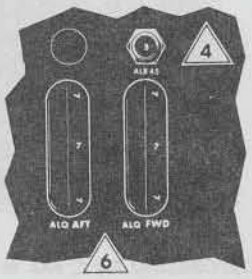


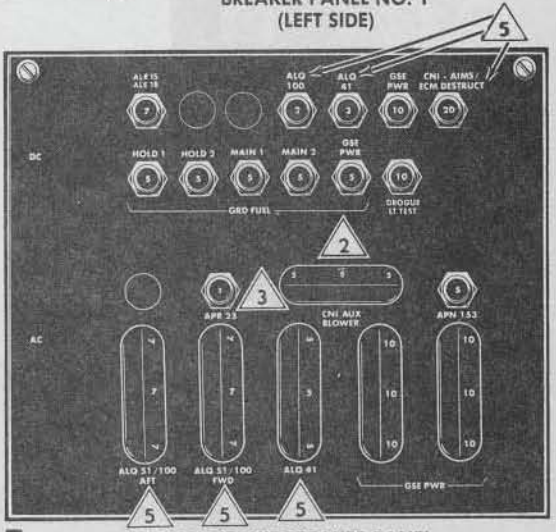
B AC/DC POWER CIRCUIT BREAKER PANEL



D AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 1 (LEFT SIDE)

C AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 2 (RIGHT SIDE)





E AFT BAY CIRCUIT BREAKER PANEL

1. AIRCRAFT INCORPORATING A.F.C. NO. 183
2. AIRCRAFT INCORPORATING A.F.C. NO.268
3. AIRCRAFT NOT INCORPORATING A.F.C. NO. 263
4. AIRCRAFT INCORPORATING A.F.C. NO. 263
5. AIRCRAFT NOT INCORPORATING A.F.C. NO. 287
6. AIRCRAFT INCORPORATING A.F.C. NO. 287

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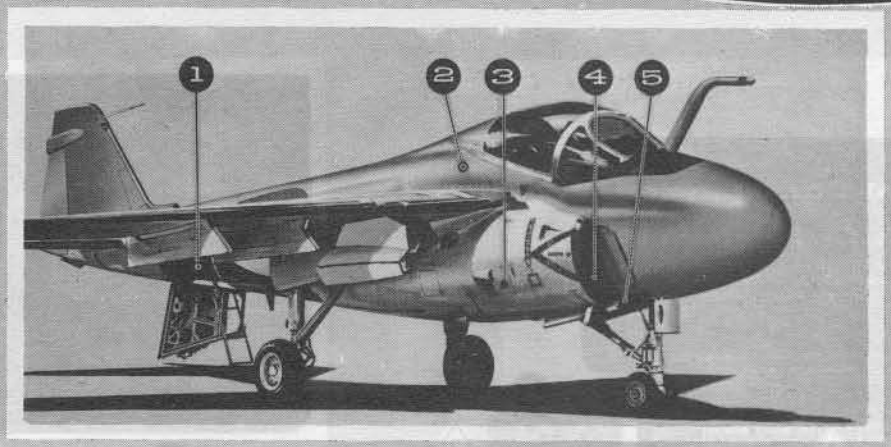
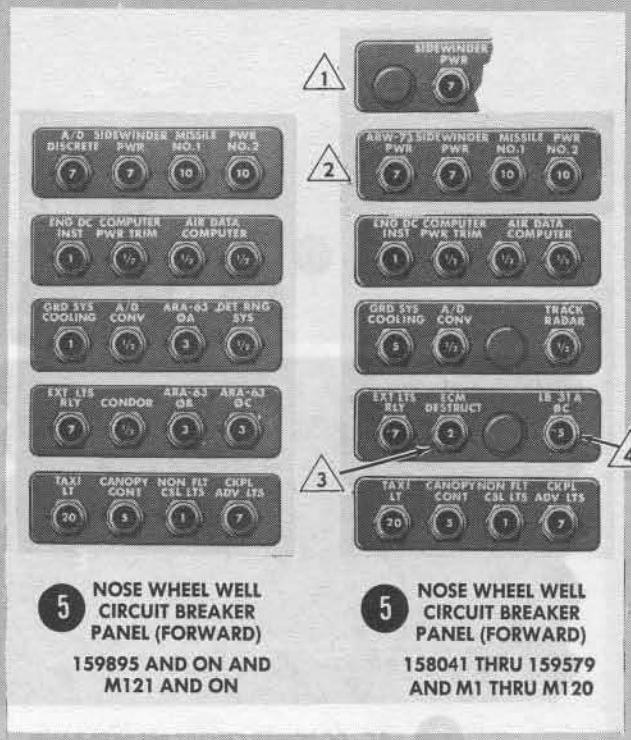
Figure 1-12 (Sheet 5)

EXTERNAL CIRCUIT BREAKER PANELS

A-6E





5 NOSE WHEEL WELL CIRCUIT BREAKER PANEL (FORWARD)

159895 AND ON AND M121 AND ON

5 NOSE WHEEL WELL CIRCUIT BREAKER PANEL (FORWARD)

158041 THRU 159579 AND M1 THRU M120

1 158041 THRU 158052

2 158528 AND ON

3 158041 THRU 158538 NOT INCORPORATING A.F.C. NO. 287

4 AIRCRAFT INCORPORATING A.F.C. NO. 256

5 159895 AND ON, M121 AND ON, AND AIRCRAFT INCORPORATING A.F.C. NO. 352

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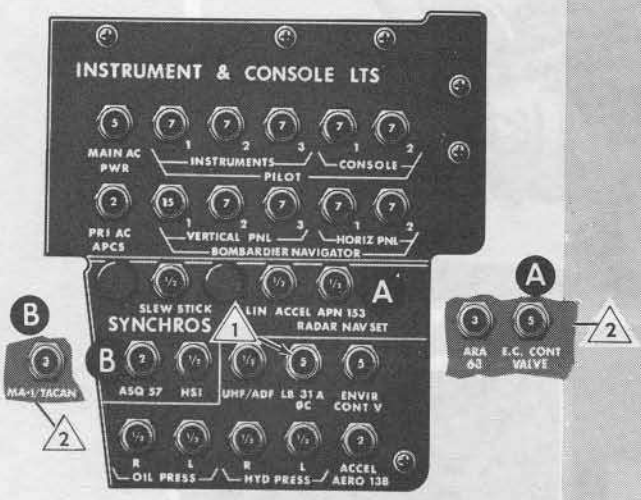
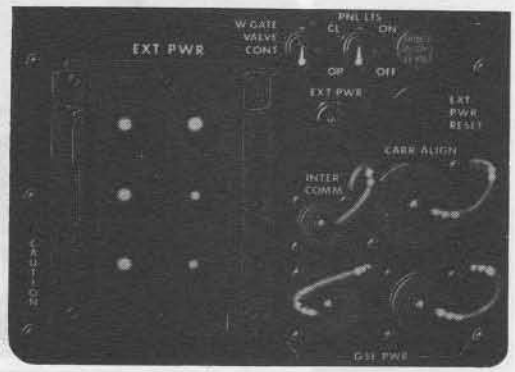
Figure 1-12 (Sheet 6)

EXTERNAL CIRCUIT BREAKERS (CONT)

A-6E

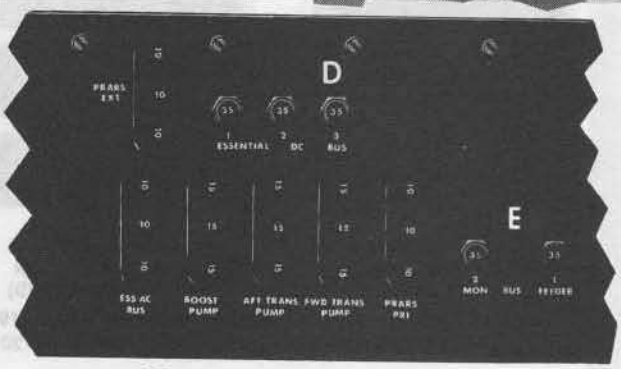


4 NOSE WHEEL WELL CIRCUIT BREAKER PANEL (AFT)



3 EXTERNAL POWER PANEL

4 GROUND BLOWER PANEL



2 AC - DC POWER CIRCUIT BREAKER PANEL

1 AIRCRAFT INCORPORATING A.F.C. NO. 256

2 159895 AND ON AND M121 AND ON

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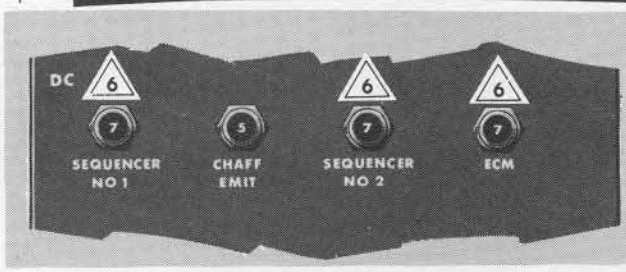
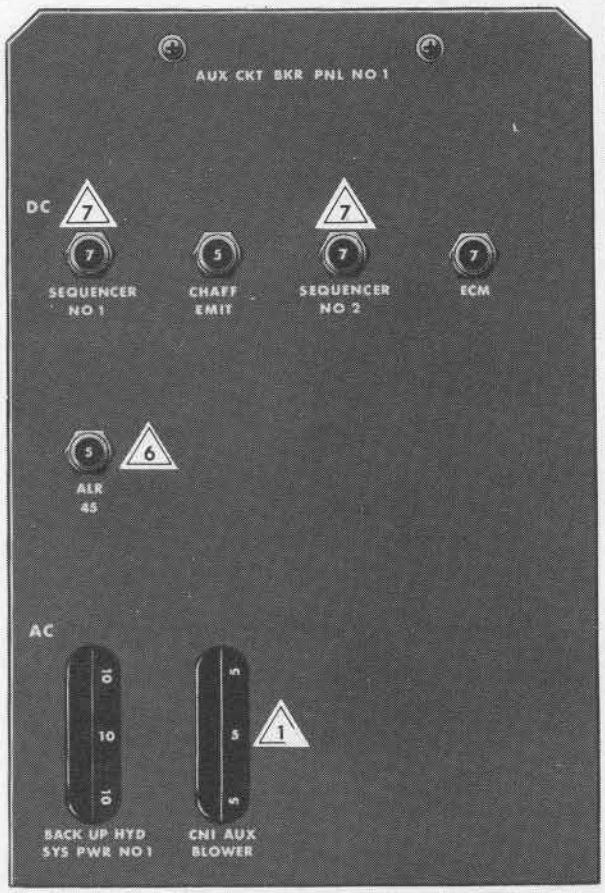
Figure 1-12 (Sheet 7)

EXTERNAL CIRCUIT BREAKERS (CONT)

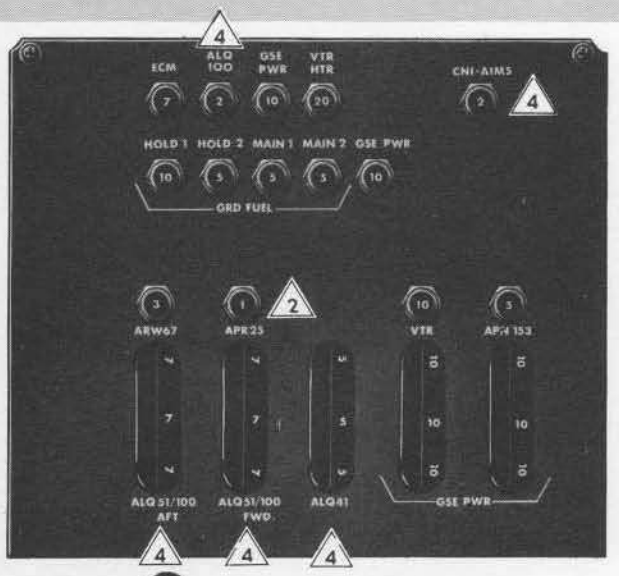
A-6E





1 AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 1 (LEFT SIDE)
159579 AND PRIOR, M120 AND PRIOR

1 AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 2 (RIGHT SIDE)
158041 AND ON, M1 AND ON



1 AFT BAY CIRCUIT BREAKER PANEL
159579 AND PRIOR, M120 AND PRIOR

1 158533 AND ON, MOD M1 AND ON, AND THOSE INCORPORATING A.F.C. NO. 268

2 158041 THRU 158538 NOT INCORPORATING A.F.C. NO. 263

3 158539 THRU 159316, MOD 1 THRU M84, AND THOSE INCORPORATING A.F.C. NO. 263

4 158041 THRU 158538 NOT INCORPORATING A.F.C. NO. 287

5 158539 AND ON, MOD 1 AND ON, AND THOSE INCORPORATING A.F.C. NO. 287

6 159317 THRU 159579 AND MOD M85 THRU MOD 120 INCORPORATING A.F.C. NO. 368

7 158041 THRU 159316 AND MOD 1 THRU M84 NOT INCORPORATING A.F.C. NO. 368

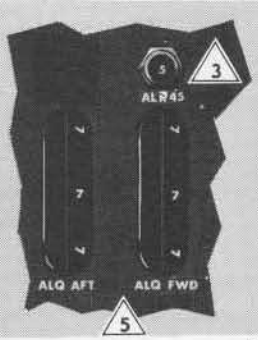


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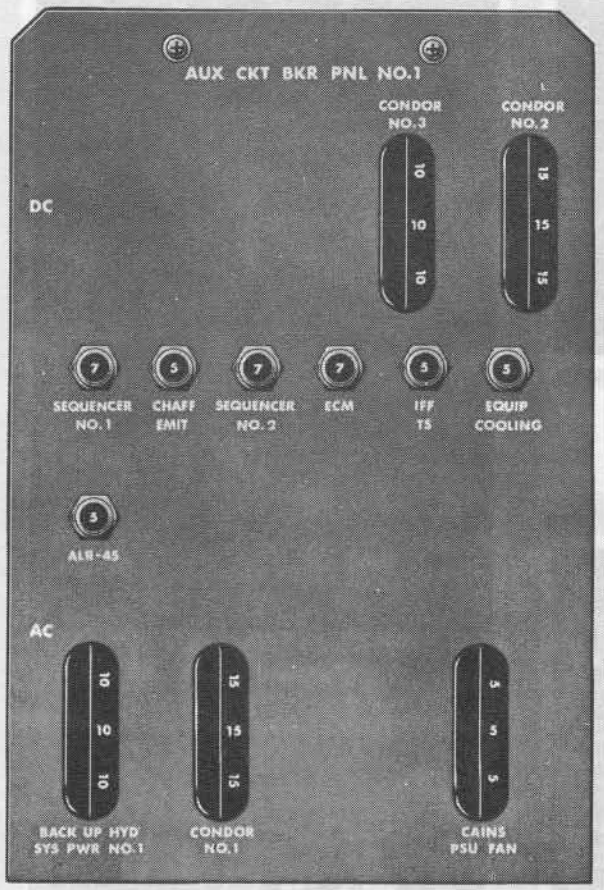
Figure 1-12 (Sheet 8)

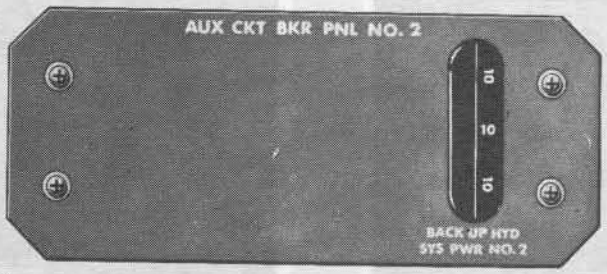
EXTERNAL CIRCUIT BREAKERS (CONT)

A-6E

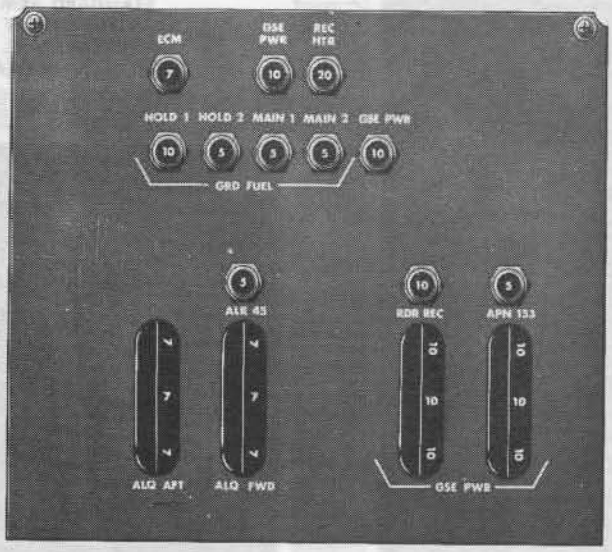
159895 AND ON AND A-6E MOD M121 AND ON



1 AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 1 (LEFT SIDE)



1 AUXILIARY AFT BAY CIRCUIT BREAKER PANEL NO. 2 (RIGHT SIDE)



1 AFT BAY CIRCUIT BREAKER PANEL

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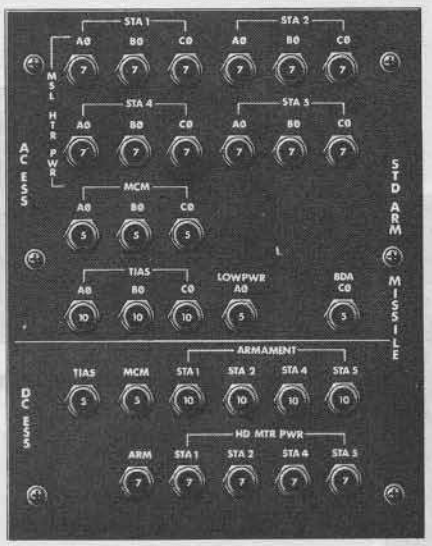
Figure 1-12 (Sheet 9)

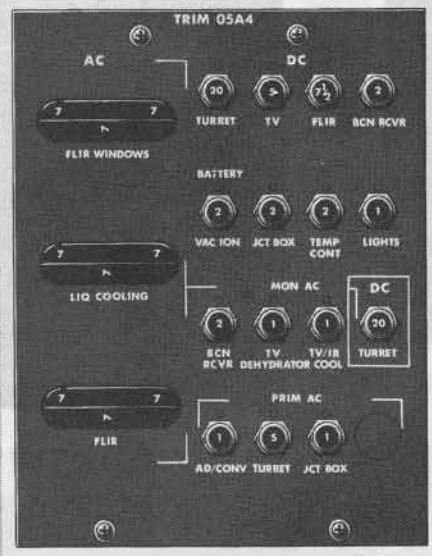
CIRCUIT BREAKER PANELS

A-6 B/C PECULIAR

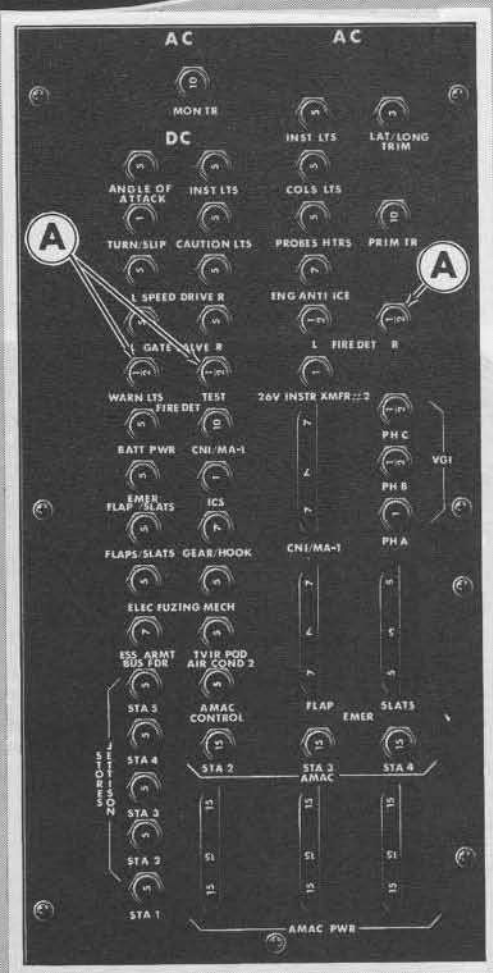
BOMBARDIER NAVIGATORS CIRCUIT BREAKER PANEL (A-6B)



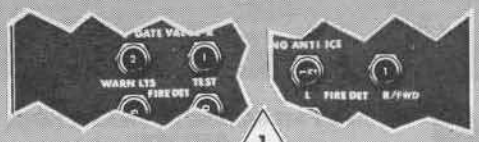
STANDARD ARM MISSILE CIRCUIT BREAKER PANEL (RIGHT SHOULDER) (A-6B)



TRIM CIRCUIT BREAKER PANEL (AFT BAY) (A-6C)



MAIN CIRCUIT BREAKER PANEL (A-6C)



1 A

1 AIRCRAFT INCORPORATING A.F.C. NO. 268

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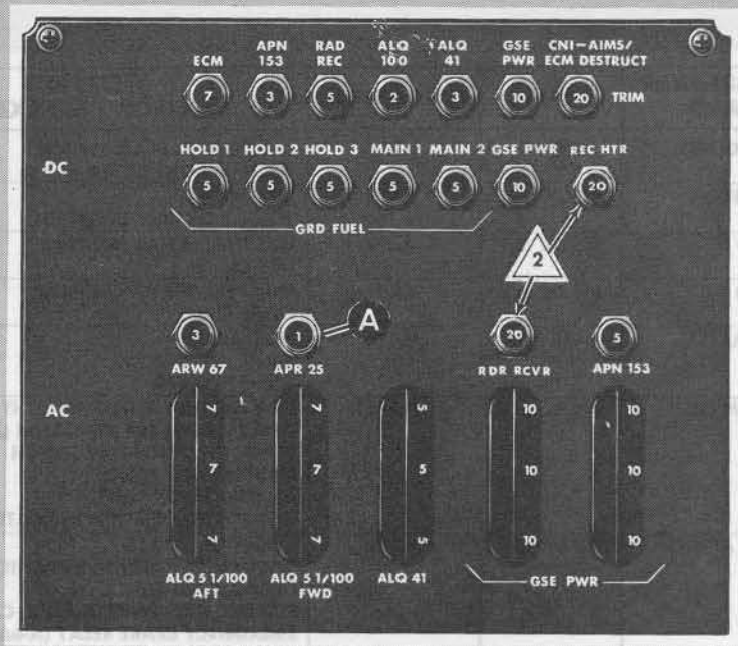
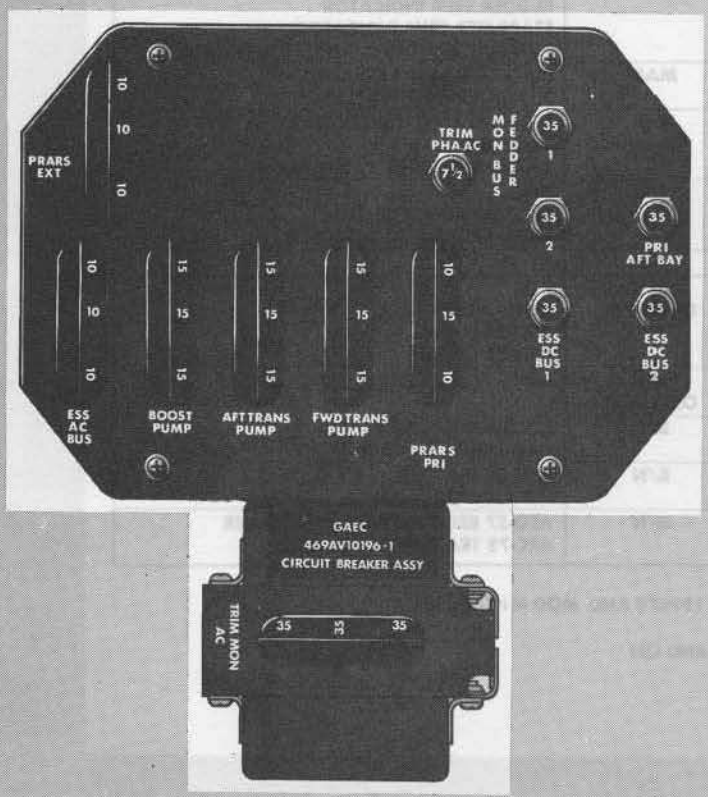
Figure 1-13 (Sheet 1)

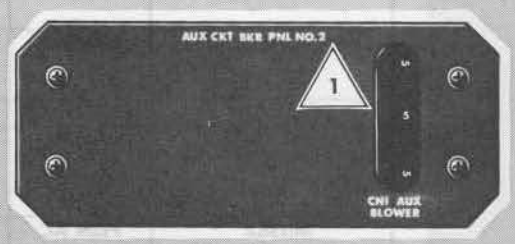
A-6B/C PECULIAR



AFT BAY CIRCUIT BREAKER PANEL (A-6C)



AC - DC POWER PANEL AND TRIM MONITOR AC CIRCUIT BREAKER PANEL (A-6C)



AUX AFT BAY CIRCUIT BREAKER PANEL NO. 2 (A-6B)

1 AIRCRAFT INCORPORATING A.F.C. NO. 268

2 AIRCRAFT INCORPORATING A.F.C. NO. 279

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Figure 1-13 (Sheet 2)

KEY COCKPIT CIRCUIT BREAKERS

CIRCUIT BREAKER PLACARD	BUS	LOCATION	ITEMS ON CIRCUIT BREAKER
LAT/LONG TRIM	ESS AC	MAIN	AIR COND RAM AIR SWITCH AIR NAV COMPUTER(A-6A)
GEAR/HOOK	ESS DC #1	MAIN	SPIN ASSIST WEIGHT ON WHEELS SWITCH
L. SPD DR	ESS DC #1	MAIN	LEFT ENGINE FUEL MASTER LEFT CSD/S
R. SPD DR	ESS DC #1	MAIN	RIGHT ENGINE FUEL MASTER RIGHT CSD/S
CNI/MA-1 (1)	ESS AC	MAIN	HSI (TACAN) MA-1 ASQ-57 POWER
CAUTION LTS	ESS DC #1	MAIN	LOW ALTITUDE WARNING LIGHT (A-6E) APN-141/APN-194 INDICATOR (A-6E) WARNING LIGHTS TEST SWITCH MASTER LIGHT PANEL ANNUNCIATOR PANEL INTEGRATED POSITION INDICATOR
ANGLE OF ATTACK	ESS DC #1	MAIN	ANGLE OF ATTACK INTEGRATED POSITION INDICATOR (A-6A,B,C/KA-6D) ELECTRIC FLAP DRIVE (A-6A, B, C/KA-6D) EMERGENCY BRAKE RELAY (A-6A, B, C/KA-6D) WHEELS WARNING SWITCH (A-6E)
INST LTS	ESS AC ESS DC #1	MAIN	INSTRUMENT LIGHTS ACLS (3)
TURN/SLIP-(1) (2) TRIM/IND	ESS DC #1	MAIN	TURN AND SLIP INDICATOR RUDDER TRIM INDICATOR STABILIZER TRIM INDICATOR LOW FUEL CAUTION LIGHT IF C/B POPPED
26V INST XMFR #2	ESS AC	MAIN	MA-1 COMPASS AND CARD EGT/FF/RPM INDICATORS
26V INST XMFR	PRIM AC	B/N	L/R HYDRAULIC PRESSURE INDICATORS SEARCH RADAR RADAR RECORDER
ADC/OPT SIGHT	PRIM AC	B/N	ADC OPTICAL SIGHT CONTROL SPEED BRAKE NULL DETECTOR
TSEC CONT	ESS DC #1	B/N	KY-28
AUTO PILOT	PRIM DC	B/N OBSERVER	ADC AUTO PILOT ASQ-61 (A-6A) ASN-31 (A-6A)
MISSILE (A-6A, B, C/KA-6D)	PRIM AC	B/N OBSERVER	ICS
3 PH MSL PWR (A-6E)	PRIM AC	B/N	ICS JUNCTION BOX ARMAMENT PANEL (AWE)
PRARS ADPT PH A (1)	PRIM AC	B/N	A/D CONVERTER INS ADAPTER (A-6E)
CNI (1)	ESS AC	B/N	ASQ-57 RECEIVER AMPLIFIER POWER ARC-75 TRANSMITTER (A-6E)

(1) A-6, B, C/KA-6D AND A-6E 158041 THRU 159579 AND MOD M1 THRU M120

(2) A-6E 159895 AND ON, A-6E MOD M121 AND ON

(3) AIRCRAFT WITH A F C 230

D-ADA1-782

Figure 1-14

essential dc buses and the monitored T/R supplies power to the dc monitored bus. When only one T/R is operating, the monitored bus is isolated from the system and only the essential and primary buses are energized through the transfer relay and the monitored bus is deenergized. If the right generator is inoperative, power is transferred to the essential and primary buses through the transfer relay and the monitor bus is deenergized. Ac emergency power from the ram-air turbine generator supplies the ac essential buses only and the emergency dc power through a 50-ampere emergency T/R.

AC ELECTRICAL POWER

The ac power system supplies 115/200 V, three-phase, 400-Hz, constant frequency ac power from two nonparalleled generators.

Generator Switches

The generators are controlled by two three-position toggle switches on the master generator panel (figure 1-5) and placarded ON, OFF-RESET, and TEST. The ON position supplies 28 V dc for initial generator excitation through the supervisory control panels and connects the generators to the buses after operating voltage is available. The OFF-RESET position disconnects the generator from the buses and opens the generator exciter field circuit to shut down the generator. If a generator is disconnected by overvoltage or undervoltage conditions, an attempt to reset the generator may be made by cycling the switch to OFF-RESET then ON. In the spring-loaded TEST position, the generators are energized but are not connected to the buses. The TEST position is primarily for maintenance use but can be used in flight as a trouble-shooting procedure to verify generator output.

Generator Warning Lights

The generator warning lights on the annunciator panel (figure FO-11), placarded L GEN and R GEN, come on, indicating the respective generator in inoperative. Operating power is from the essential 28 V dc bus through the CAUTION LTS circuit breaker on the main circuit breaker panel.

Note

If both generators are inoperative, the generator lights will not come on unless the RAT is extended and operating.

DC ELECTRICAL POWER

Two nonparalleled, 100-ampere transformer/rectifiers (T/R) convert ac electrical power to 28 V dc electrical power for aircraft requirements. Since the dc system is dependent on the ac system, any ac system malfunction affects the dc system.

Battery

A 22.7-volt, nickel-cadmium 11-ampere-hour battery is on the right side of the fuselage in the center wing section. In addition to providing power to the spin recovery and CSD/S and ECM destruct when installed, this battery provides power for the electric-motor-driven auxiliary hydraulic pump for ground operation (weight on wheels) of the canopy, radome, extensible equipment platform, and charging the brake accumulator. Power for generator reset is provided directly to the CSD/S through the engine fuel master switches and CSD/S battery power relay. This battery is charged from the dc monitored bus and is protected by the BATT PWR circuit breaker on the main circuit breaker panel.

EMERGENCY ELECTRICAL POWER (RAT)

The emergency electrical system energizes the ac and dc essential buses. The system is powered by a ram-air-turbine-driven ac generator which, in turn, energizes a 50-ampere transformer-rectifier for the 28 V dc power. The emergency system is energized by pulling the ram-air turbine (RAT) handle (figure FO-2) on the pilot's left console. When the handle is pulled, the ram-air turbine is hydraulically positioned into the airstream above the left wing. A variable-pitch prop controls turbine speed and consequently regulates generator frequency. The emergency generator will be placed on the line automatically. If either generator becomes operative, the emergency generator will be taken off the line automatically, and the corresponding generator caution light will go out. The emergency generator is retracted by pushing down the RAT handle. The minimum operating airspeed for the RAT is 110 KIAS.

In A-6A, B, C 154170 and on and aircraft incorporating AFC No. 137, there is an underfrequency relay to delay power transfer to the aircraft electrical system until the ram-air turbine generator reaches approximately 90% of its normal speed.

Note

If the number one essential dc circuit breaker on the external port shoulder AC/DC power circuit breaker panel pops, the entire number one essential dc bus will be lost even though both main generators remain operative and power the primary and monitored buses. To restore essential dc power, the RAT must be extended. If the essential bus is not energized by RAT deployment, it will then be necessary to secure both main generators to regain essential bus power.

HYDRAULIC POWER SUPPLY SYSTEM

The aircraft hydraulic system (figure FO-6) is composed of two primary systems (the flight and combined), backup and auxiliary hydraulic systems. The four systems are independent of each other even though both the combined and flight systems power the tandem-type flight control actuators and flight control pressure determines the position of the isolation valve, which divides the combined systems into primary and secondary circuit. NEW NEW

Both the combined and flight systems are powered by two 3,000 psi engine-driven hydraulic pumps (one pump on each engine).

Both the combined and flight systems are supplied with hydraulic fluid under 40-psi pressure from a piston-type reservoir, which is pressurized by engine compressor bleed air. If hydraulic power carts are attached for ground operation, the reservoirs must be pressurized from an external source.

HYDRAULIC PRESSURE GAGES

Four hydraulic pressure gages are incorporated in a single unit on the pilot's instrument panel and receive power from the 26 V ac (instrument) bus. The upper two gages, side by side, and identified as FLT, are for the two engine-driven pumps for the flight hydraulic system. The lower two gages, side by side, and identified as COMB, are for the two engine-driven pumps for the combined hydraulic system. Each indicator scale is a 120° arc with increment markers 30° apart. Each increment marker represents 1,000 psi. The 3,000 psi marker is accentuated. Pressure transmitters sense the hydraulic pressure of each pump and transmit electric signal to position the needles on the scale of the respective indicators.

FLIGHT HYDRAULIC SYSTEM

The flight hydraulic system powers one side of the tandem-type flight control actuators and the flaperon autopilot actuator. Should the combined hydraulic system fail, the flight hydraulic system is capable of delivering sufficient power to maneuver the aircraft throughout the flight envelope. At high IMN (above approximately 0.70 mach) diminished control effectiveness can be expected. Hydraulic system pressure is shown on the pressure indicators (figure FO-2 sheets 1 and 2) on the left side of the pilot's instrument panel. The top dials indicate the pressure output of the left and right engine-driven flight system pumps.

CAUTION

In aircraft not incorporating the backup flight control hydraulic system, there are no hydraulic pressure warning lights. A pressure drop in the indicator is the only warning of failure in the flight or combined systems. In aircraft incorporating the backup flight control hydraulic system, lighting of the BACK UP HYD caution lights is indication of failure of either the flight or combined system. Lighting of both the BACK UP HYD and the RUD THRO caution lights is indication of complete normal hydraulic failure.

Flight Hydraulic System Power Distribution

The flight hydraulic system powers the flight controls and AFCS.

COMBINED HYDRAULIC SYSTEM

The combined hydraulic system powers the second side of the tandem-type flight control actuators and, in addition, all other hydraulic power auxiliary devices in the aircraft (figure FO-6). In order to prevent a fluid leak in any of the auxiliary devices from draining the system and thus leaving only a single system for powering flight controls, an isolation valve is added to divide the combined system into a primary circuit supplying the flight controls and a secondary circuit supplying auxiliary equipment. The hydraulic pressure indicators indicate the pressure output of the left and right engine-driven combined system pumps.

Primary Combined Hydraulic System

The primary combined hydraulic system powers the flight controls, RAT accumulator, and retract, spin recovery, speed brakes, TRIM pod (A-6C), air-refueling system (KA-6D) and DRS turret (A-6E 159895 and ON and A-6E Mod M121 and ON i.e., TRAM configured aircraft).

Secondary Combined Hydraulic System

The secondary combined hydraulic system powers the canopy, flaps, slats, landing gear, flaperon pop-up, wing fold, antiskid, nosewheel steering, hook (retract), strut lock, and normal wheel brakes.

Isolation Valve and Switch

The isolation valve divides the combined system into primary and secondary circuits, and is both automatically and manually controlled. Manual pilot control is by the two-position switch on the landing-gear handle (figure 1-18). In the LDG position, the combined secondary system is pressurized in addition to the primary system and all auxiliary hydraulic devices are operated. In the FLT position, only the primary flight controls, speed brakes, spin recovery, AFCS, RAT, TRIM pod (A-6C), air-refueling system (KA-6D) and DRS turret (A-6E TRAM) are powered.

Note

- After takeoff and when landing gear, flaps, and slats have been fully retracted, the pilot should select the FLT position on the switch.
- Either the combined primary or the flight hydraulic system alone will power the flight controls throughout the flight envelope except at high IMN.

A bar on the landing-gear handle pushes the isolation valve switch to the LDG position when the landing gear handle is placed DN. If the pilot has not selected FLT after takeoff, and the flight hydraulic system fails, the isolation valve is spring-loaded to automatically cut off pressure to the combined secondary hydraulic system. If electrical power is lost to the valve with normal flight hydraulic pressure available, the valve will open, allowing the secondary circuit to be pressurized.

Note

A flight system failure will deenergize the isolation valve to close off the combined secondary system. It will then be necessary to use emergency landing gear, emergency flaps/slats, and auxiliary brakes to land the aircraft.

COMBINED SYSTEM AUXILIARY PUMP OPERATION

A handpump in the combined hydraulic system is available to operate the canopy, wheel brakes, the extensible equipment platform, and the radome when the engine-driven pumps are not operating. An electrically driven hydraulic pump is also provided which will power the same equipment as the handpump during ground operation.

The handpump can be operated from either the cockpit or the nosewheel well. The electrically driven pump may be operated from the cockpit, nosewheel well, or for canopy operation from either boarding-ladder well. Operation of the canopy from the nosewheel well is limited to handpump operation. The handpump and the electrically driven hydraulic pump will deliver 3000 psi at very low flow rates. The handpump will charge the brake accumulator at any time, but the electric pump is operative only with weight on wheels. Charging rate is reduced if any additional hydraulic operation is being performed. Pressure to operate the canopy is controlled by the manual selector handle in the cockpit and nosewheel well. The nose radome and the aft extensible equipment platform are also operated through manual selector valves in the nosewheel well. Should the wheel-brake accumulator be depleted, it must be charged before other equipment can be operated.

Note

Excessive loss of combined system hydraulic fluid will render the auxiliary hydraulic pumps inoperative. Wheel-brake applications will be limited to cycles indicated on the brake cycle gage and canopy operation will then be hydraulically inoperative.

Auxiliary Hydraulic Pumps

The auxiliary hydraulic pumps operate the canopy, brake accumulator, radome, extensible equipment platform (A-6A, B, C, and A-6E), and refueling-reel access door (KA-6D).

NEW NEW NEW NEW

WARNING

Ensure hydraulic pressure is applied to the retract side of the extensible equipment platform prior to unlatching and lowering.

BACK UP FLIGHT CONTROLS HYDRAULIC SYSTEM

NEW

The backup flight controls hydraulic system is incorporated in A-6E and A-6A, B, C 155640 and on and aircraft incorporating AFC No. 183. This system provides limited hydraulic power to the rudder and stabilizer actuators should both the flight and combined hydraulic systems fail. With a complete hydraulic failure, rudder will shift to full authority (35°). The system does not provide for flaperon operation.

The backup hydraulic pump motor package is powered by 115 V ac through circuit breakers on the aft bay auxiliary circuit breaker panels.

WARNING

The backup flight control hydraulic system is provided to allow a damaged aircraft to leave the combat area. With full rudder authority (35°) available, extreme caution should be exercised in executing rudder deflections. Airspeed should be reduced to less than 0.80M, since dihedral effect begins to reverse at approximately that airspeed.

Note

Loss of the generators prevents use of the backup hydraulic system. The backup hydraulic system will not operate from the RAT.

A failure in either the flight or combined system will activate its pressure switch as the pressure drops below 800±100 psi, energizing the backup motor pump and isolating a small portion of the combined system fluid. When the motor pump pressure exceeds 1000 psi, the BACK UP HYD caution lights on the annunciator panel will come on. If, in addition to the BACK UP HYD caution light, the RUD THRO light comes on, it indicates a complete hydraulic failure of both normal systems with flight controls then limited to rudder and stabilizer.

Note

- When operating on one hydraulic system only, rapid cycling of the controls will cause the BACK UP HYD light to go out momentarily, indicating that the capacity of the backup pump has been exceeded. To avoid excessive demands on the backup pump, control inputs should be kept smooth.
- When operating on the backup system only, rapid control inputs exceeding pump capacity may cause some lag in surface response against opposing loads. When the pump output pressure drops below 800 psi, the pump pressure switch opens momentarily, turning off the BACK UP HYD caution light, Therefore, monitoring this light while operating on the backup hydraulic system will indicate when pump capacity has been exceeded.

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BACK UP HYD SYS TEST Switch

In aircraft incorporating the backup flight controls hydraulic system, a backup hydraulic test switch is provided on the pilot's left console. The switch enables the pilot to check the operation of the flight system pressure switch (FLT) and the combined system pressure switch (COMB) individually before starting engines and with external electrical power connected. The switch also provides checking the hydraulic backup motor pump operation. The switch is spring-loaded to the center (OFF) position.

NEW

Note

The secondary power monitor relay prevents the back up hydraulic system from coming on with external power plugged in.

NEW

Placing the switch in either the FLT or COMB position energizes the hydraulic backup motor pump which, in turn, turns on the BACK UP HYD caution light. While testing either system, it is possible to check rudder and stabilizer movement for several cycles.

With engine running, the switch in the OFF position and both generators on the line, the BACK UP HYD caution light remaining out indicates that both pressure switches have returned to their normally open (hydraulic pressure on) position.

CAUTION

Ground operation of the backup hydraulic system should be limited only to testing of the system.

BACK UP HYD Caution Light

The BACK UP HYD caution light on the annunciator panel comes on when one hydraulic system is depressurized and the backup pump is delivering 1000 psi. The light will go out when the backup pump output pressure goes below 800 psi.

FLIGHT CONTROLS

The flight control surfaces consist of a slab stabilizer, a rudder, and upper wing surface spoilers called flaperons. The control stick and rudder pedals are linked directly to their corresponding surface actuators by a system of pushrods, bellcranks, and cables. In each case, control surface deflection is held in a fixed relationship to pilot control deflection by a proportional followup linkage. Each surface is powered by an irreversible actuator, which is controlled by an input slide valve, and which, in turn, is positioned by the pilot's control. Each control actuator is of the tandem type, and is powered by both the flight and combined primary hydraulic systems.

To provide for additional control with flaps extended, or for spin recovery, extended rudder and stabilizer travel is provided. The integrated position indicator, (figures FO-2 sheets 1, 2 and 3) on the left side of the pilot's instrument panel, indicates the condition of the stabilizer and rudder throws in addition to the configuration of the flaps/slats and speed brakes, and the landing gear. Flight controls and indicators are shown in figure 1-15. NEW

Note

Either the combined primary or the flight hydraulic system alone will power the flight controls throughout the flight envelope. At high IMN (above approximately 0.70 mach) diminished control effectiveness can be expected. NEW

CAUTION

Do not actuate the assist-spin recovery switch with the flaps down or lower flaps with the spin recovery system on. The spin recovery system is to be operated only with the flaps up. Operation of the system with flaps down can result in damage that will prevent reselection of cruise control throws.

ARTIFICIAL FEEL

The irreversible control actuators require that artificial feel be provided to the pilot for all three flight control systems. This feel is obtained entirely through the use of mechanical devices, and does not require mach or g-sensing to be fed in by electronic equipment.

Longitudinal System

Artificial feel is provided by the following devices:

STATIC FORCE FEEL - Is provided by a double-acting bungee that produces a greater breakout force gradient near stick neutral, and a lower gradient to full deflection. Breakout forces exceed the 1 1/4-pound autopilot stick switches.

FLIGHT CONTROLS AND INDICATORS

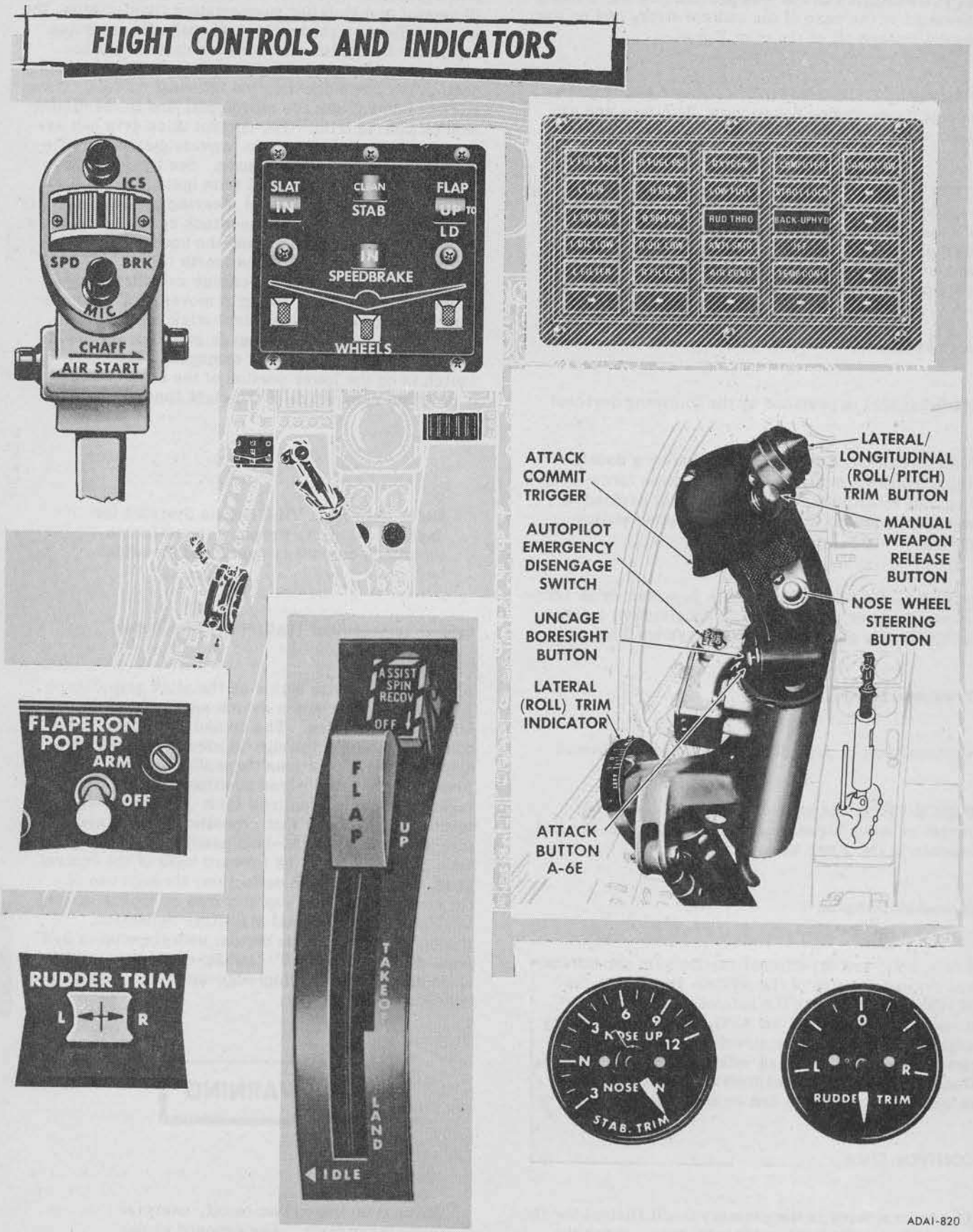

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Figure 1-15

MANEUVERING FORCE - Is provided by a g-sensing bobweight at the base of the control stick, and on the control linkage aft of the pilot's seat.

DYNAMIC PITCH DAMPING - Is provided by pitch acceleration-sensing bobweights, both fore and aft of the center of gravity.

STICK RATE DAMPING - Is provided by a leaf spring and eddy-current damper. The eddy current damper is a magnetic-mechanical device that produces a resisting torque proportional to stick velocity. If a damper fails, a clutch can be overridden for control system operation.

Lateral System

Artificial feel is provided by the following devices:

STATIC FORCE FEEL - Is provided by a double-acting bungee similar to, but with lower force level than, the longitudinal bungee. Control preload at neutral is equal to the AFCS force cutout switch settings.

LATERAL RATE DAMPING - Is provided by an eddy-current damper identical to the longitudinal damper, except for the gear train into the system linkage.

Directional System

Artificial feel is provided by the following device:

FORCE FEEL - Is provided by a double-acting bungee of much higher preload and rate than the feel bungees in the other axis.

Three-Axis Damping

Pitch, roll, and directional oscillations are minimized through the use of the AFCS. By placing the on/off switch ON with the automatic stability augmentation switch in STAB AUG, automatic stability augmentation inputs are directed to the hydraulic power actuators in series with the pilot's command. Because the inputs to the hydraulic actuators are in series, they are not felt by the pilot.

CONTROL STICK

The control stick is the primary flight control for the aircraft's longitudinal and lateral axis. Since the flight controls are hydraulically powered, an artificial feel system is used to simulate in-flight stick loads. In manual and stability augmentation flight modes, the stick applies a mechanical input to the flaperon and stabilizer hydraulic actuators for control surface movement. Refer to the discussion on flight controls, Section IV, for more detailed information relating the stick to control surface movement, and to the discussion on lateral trim. The control stick grip has several switches and buttons to provide maximum efficiency is mission performance. See figure 1-15. The lateral and longitudinal trim button, weapon release button, and nosewheel steering button are easily operated by the thumb. The attack commit trigger is actuated by the forefinger and the uncage boresight button can be actuated by the fourth finger. The 1.1±0.2-pound autopilot-disengage switches are located in the column. The grip moves to a slight degree independent of the control stick. When this occurs, the autopilot-disengage switches are actuated. Although the autopilot emergency disengage switch is on the lower portion of the control stick, it is within easy reach of the right hand.

Note

Refer to Section VII Weapons Systems for description of the weapon release button, the attack commit trigger, and the attack button.

Lateral/Longitudinal (Roll/Pitch) Trim Button

The roll/pitch trim button on the stick grip (figure 1-15) is a five-position switch spring-loaded to the off (center) position. The up and down positions control pitch trim through an electromechanical actuator that repositions the stabilizer feel device (bungee) to a new no-load position. The left and right positions control roll trim through an electromechanical actuator that repositions the flaperon feel device to a new no-load position. The lateral trim indicator is on the forward base of the control stick. Total flaperon deflection, through use of the trim button, is 9° up at a rate of approximately 0.8° per second. Total stabilizer deflection, through use of the trim button; with flaps up is 3/4° leading-edge-up to 9.5° leading-edge-down; with flaps down, 1/2° leading-edge-up to 22° leading-edge-down. NEW NEW

WARNING

If the trim button comes off, exercise extreme caution. The exposed probe will produce a severe shock.

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Note

In the event of a trim button malfunction, occasional use of the AFCS AUTO MODE will assist the pilot in overcoming excessive trim requirements due to attitude, configuration, and/or airspeed changes.

Autopilot Emergency Disengage Switch

This normally closed pushbutton switch (figure 1-15) provides emergency release of the AFCS. It is mounted on the junction box beneath and to the right of the pilot stick grip. The pushbutton is marked AUTOPILOT OFF and is coded with yellow and black barber pole stripes. Depressing this pushbutton disengages all AFCS control functions and returns all controller switches to their disengaged position.

Nose-Wheel Steering Button

The spring-loaded nosewheel steering button on the pilot's control stick grip must be depressed to keep nosewheel steering (figure 1-15). It is used to engage normal nosewheel steering. When the nosewheel steering circuit is energized, the nosewheel steering selector valve is positioned to direct combined hydraulic system pressure to the steering control valve.

Lateral (Roll) Trim Indicator

The lateral (roll) trim indicator on the forward side of the stick grip adapter (figure 1-15) indicates the trimmed position of the flaperons. The scale is calibrated in three units left and right of zero (neutral) and is mechanically operated.

FLAPERONS

Flaperons are used for lateral control. Stick movement to the left of neutral results in the left flaperon being raised with the right flaperon remaining neutral. Conversely, stick movement to the right of neutral results in the right flaperon being raised and the left flaperon remaining neutral. Maximum flaperon deflection is 51°.

The flaperons are divided on each wing at the wing fold. A mechanical interlock prevents the wing-fold system from being unlocked unless the flaperons are near neutral. Conversely, when the wing-fold handle is actuated, a mechanical stop prevents the flaperons from being actuated.

Flaperon Pop-Up Switch

A flaperon pop-up feature is available for decreasing ground roll after landing. The flaperon will pop up to the 39±3° position. The flaperon pop-up switch on the pilot's left console (figure 1-15) is a two-position switch that provides control over flaperon pop-up. The OFF position deactivates pop-up. The ARM position electrically arms the flaperons for pop-up. In order to complete the circuit, the left weight-on-wheels switch must be actuated, the throttles retarded to idle, and the wings spread and locked.

Note

Control stick movement is limited laterally to 1 inch left and right when flaperons are popped up.

Flaperon Autopilot Actuator

The flaperon autopilot actuator is a hydraulic servo unit that receives inputs from the control stick and the autopilot. The input information is converted to a mechanical movement, which, in turn, actuates the flaperons.

Note

In the event of actuator malfunction, there is a ball lock detent that permits disengagement of the actuator.

HORIZONTAL STABILIZER

Longitudinal control is provided by the horizontal stabilizer. To provide maximum control and help prevent overstress under all flight conditions, actuation of the flaps results in an increase in stabilizer travel. The normal travel range of the stabilizer is 1.5° leading-edge-up to 9.5° leading-edge-down; with flaps down, the range is increased to 1.5° leading-edge-up to 24° leading-edge-down.

In aircraft incorporating the backup flight controls hydraulic system, stabilizer operation and control is available if both the flight and combined hydraulic systems are inoperative.

Note

Backup system control rate for stabilizer operation is approximately 10% of normal.

Stabilizer Position Indicator

The stabilizer position indicator on the integrated position indicator on the main instrument panel (figure 1-15) indicates available stabilizer travel by presenting a symbol of a stabilizer for full travel, and the word CLEAN for restricted travel. The indicator is powered by the essential 28 V dc bus through the CAUTION LIGHTS circuit breaker on the right circuit breaker panel.

CAUTION

Restricted stabilizer travel at low speed could result in inadequate pitch control and full stabilizer travel at high speed could cause structural failure.

Horizontal Stabilizer Trim

The stabilizer is trimmed by actuating the trim button on the control stick grip (figure 1-15). The button controls a two-speed irreversible electromechanical actuator, which varies the neutral position of the feel bungee. For manual operation, high trim speed is used, giving approximately 1° per second rate of stabilizer displacement. During autopilot operation, the slow speed is used, producing a stabilizer change at the rate of approximately 1/20° per second. With flaps up, the trim limits are 3/4° leading-edge-up to 9.5° leading-edge-down; flaps down 1/2° leading-edge-up and 22° leading-edge-down.

Horizontal Stabilizer Trim Gage

The stabilizer trim gage (figure 1-15) indicates horizontal stabilizer trim position from 3 units nose down to 12 units nose up. The letter N on the gage represents the neutral position of the stabilizer surface (3° leading-edge-down) in flaps down position. A signal is generated by a position transmitter that drives a dc motor that positions the pointer.

Horizontal Stabilizer Hydraulic Power Actuator

The hydraulic power actuator for the horizontal stabilizer is unique in reference to the primary flight control actuators. The actuator has provisions for a parallel mode of operation in conjunction with the AFCS.

RUDDER

Directional control is provided by a single rudder. Similar to the design features of the longitudinal controls, the lowering of the flaps mechanically provides additional rudder travel. With the flaps up, rudder travel is 4° either side of neutral; with the flaps down, rudder travel is 35° either side of neutral. The rudder is controlled by rudder pedal displacement or by AFCS input.

The rudder actuator linkage is protected from high winds when the aircraft is parked by an arrangement that permits full 35° rudder travel when the flight and combined hydraulic systems are depressurized. Full 35° rudder travel is available when both the flight and combined hydraulic systems are inoperative.

Note

Backup system control rate for the rudder is approximately 30% of normal.

Rudder Pedals

Conventional rudder pedals, with toe-action braking, are used in the aircraft. Moving the rudder pedals transmits a mechanical input to the rudder actuator. The actuator, in turn, utilizes hydraulic power to deflect the rudder.

In addition to providing manual directional control, the pedals are also used for steering the aircraft on the ground. The nosewheel steering feature is actuated manually by depressing the nosewheel steering button (figure 1-15) and automatically when the weight-on-wheels switches are closed and the arresting hook is down.

The rudder pedals are adjustable a total of 9 inches fore and aft, in 1-inch increments.

Rudder Trim Switch

The rudder trim switch on the pilot's left console controls an irreversible electromechanical actuator that varies the neutral position of the mechanical linkage, for directional trim. Full trim corresponds to 4° of rudder travel either side of neutral, flaps up and 7° either side of neutral, flaps down.

Rudder Trim Gage

The rudder trim gage (figure 1-15) indicates rudder position from four units left to four units right. A signal generated by a position transmitter drives the pointer on the indicator.

ASSIST-SPIN RECOVERY SWITCH

The assist-spin recovery switch (ASSIST-SPIN RECOV) enables the pilot to select extended rudder and stabilizer throw for maximum control surface deflection without lowering the flaps. The switch, which is on the forward right edge of the throttle quadrant (figure 1-15), is guarded, and has two positions. The aft (guarded) position is OFF. The forward position electrically energizes a selector valve to port hydraulic fluid to a shift cylinder. This cylinder mechanically shifts the tail control surfaces into an extended throw condition (±35° rudder, 1 1/2° to 24° stabilizer). Power for the cylinder is supplied by the combined primary hydraulic system.

CAUTION

- Do not actuate the assist-spin recovery switch with the flaps down or lower flaps with the spin recovery system on. The spin recovery system is to be operated only with the flaps up. Operation of the system with flaps down can result in damage that will prevent reselection of cruise control throws.
- Reselection of cruise control throws after spin recovery should be done below 300 KIAS while anticipating a nose-down pitch change.

Rudder Throw Caution Light

The RUD THRO caution light on the annunciator panel comes on whenever extended rudder travel is actuated in the clean configuration, or the assist-spin recovery switch is actuated.

NEW In A-6E, A-6A, B, C, 155640 and on and aircraft incorporating AFC No. 183 (backup flight controls hydraulic system), lighting of both the RUD THRO caution light and the BACKUP HYD caution light indicates that both the flight and combined hydraulic systems are inoperative. Under these circumstances, flight control is limited to rudder and stabilizer only.

WING FLAPS AND SLATS

The wing flaps are semi-Fowler type slotted flaps and work in conjunction with the wing slats to provide additional lift during takeoff and landing. Both the flaps and the slats are divided at wing-fold and cannot be actuated unless the wing lockpin switch is energized. Power for driving the flaps and slats in normal operation is supplied by the combined secondary hydraulic system.

There are two flap actuators for each flap panel. The actuators are mechanically linked to a central gearbox in the right wing root. The hydraulic brake of the gearbox maintains the position of the flap panel regardless of air loads. A planetary gear arrangement in the gearbox, working with the hydraulic brake, permits the flap actuators to be driven from hydraulic or electrical (emergency) power sources.

The rudder and stabilizer shift mechanisms for increasing control surface movement are also actuated through the flap gearbox. The stabilizer is shifted by a cable wound on a cable drum that is mounted on NEW a shaft extending from the gearbox. The rudder shift cable is routed through the stabilizer shaft sector, and is reloaded as the stabilizer shifts to the dirty configuration. Relaxed cable tension permits springs to withdraw the rudder cam step and allow full (±35°) rudder deflection.

Note

If the stabilizer shift cable parts, the stabilizer and rudder shift will be spring-loaded to either the clear or dirty configuration depending on location of shift sector (less or more than halfway shifted) prior to cable failure.

As in the flap system, the slat main gearbox transforms hydraulic power to mechanical power through a hydraulic motor driven by the combined hydraulic system. There is one slat actuator for the inner slat panel and two for the outer slat panel for a total of six actuators. Interconnecting pins ensure equal slat extension on both wings.

Flap Lever

A three-position flap lever to the right of the throttles (figure 1-15) controls the operation of the flaps and slats. Positioning the flaps handle to the LAND position actuates a switch, powered by the 28 V dc essential bus. This completes a circuit to the solenoid-operated hydraulic selector and flap brake valves. The brake in the gearbox releases and the selector valve directs hydraulic pressure to the down side of the flap hydraulic motor. Similarly, actuation of the flap handle closes the slat switch, completing a circuit to a solenoid-operated selector and slat brake valves. The brake in the gearbox releases and the selector valve directs hydraulic pressure to the down side of the slat hydraulic motor. The flaps will extend to 40° down, and the slats will extend to 27.5° down (full down). Limit switches open the electrical circuits to the flat and slat selector and to the brake valve solenoids. Both brakes are spring-loaded to the locked position as a fail-safe feature.

When the flap lever is moved to the TAKE-OFF position, an electric circuit is completed to the solenoid selector and to the brake valve to direct hydraulic pressure to either the extend or retract side of the flap hydraulic motor and releases the flap brake. If the flaps are down, the retract side of the hydraulic motor is energized. When the flaps reach 30°, a limit switch deenergizes the solenoid selector valve and the brake valves, stopping retraction. If the flaps are up, the extend side of the hydraulic motor is energized. The solenoid selector valve and the brake valve are deenergized by the 30° limit switch when the flaps reach 30° down. With the flaps initially full down and the flap lever moved to TAKE-OFF, the slats remain full down. If the flaps are initially UP, a circuit is completed to the slat solenoid selector valve and brake valve. The brake is released and hydraulic pressure is directed to the extend side of the flap motor.

Positioning the flap lever to UP, with flaps and slats extended, actuates flap and slat switches, which energize the respective solenoid selector valves. The selector valves then direct hydraulic pressure to the retract side of the hydraulic motors. When the flaps reach full up, limit switches deenergize the selector valve solenoids and the hydraulic motors stop.

WARNING

The pilot must ensure that the flap lever is fully seated in the desired detent and aircraft flap and/or slat configuration is confirmed with the integrated position indicator. Flaps and/or slats may be positioned to the TAKE-OFF or UP position without the flap lever being seated in the detent selected. Any move ment of the flap lever to a position between the UP and TAKEOFF detents may cause the flaps and/or slats to assume a position not intended.

Note

The maximum recommended airspeeds for flap normal extension are:

TAKEOFF	250 KIAS for 30° flaps
LAND	200 KIAS for 40° flaps

Emergency Flap Switch

The emergency flap switch on the throttle quadrant (figure 1-5) is a three-position, square toggle switch with positions placarded UP, OFF, and DN. The emergency flap switch provides flap and slat operation when the flight or combined hydraulic systems fail. Making a selection with the emergency flap switch will override the flap lever selection. When the switch is placed down (DN), power is supplied by the 28 V dc essential bus to the hydraulic brake selector valves, ensuring hydraulic brake lock configuration. Simultaneously, circuits are completed to the 115 V ac primary emergency flap and slat motors. As these electric motors are energized, the electric brakes are released, permitting emergency flap and slat operation. Cam-operated limit switches deenergize the emergency motors when the flaps and slats reach the fully extended position. For retracting the flaps and slats, the emergency flap switch is placed in the UP position. Again, the hydraulic brake selector valves are energized, ensuring hydraulic brake lock configuration, and the electric brake locks are released, permitting emergency flaps and slat operation. The phasing of the emergency ac motors is changed, reversing the motors, and retracting the flaps and slats. The motors will be deenergized when the cam-operated upper limit switches are actuated. The OFF position opens the circuits to the emergency motors and stops emergency flap and slat operation.

CAUTION

- Emergency extension of the flaps to the terminal (LAND) position above 160 KIAS may result in a burned-out clutch in the gear box and complete loss of flap operation. It is permissible to commence flap extension by the emergency flap switch at any speed up to the structural limitation (200 KIAS for LAND position) of the flaps; however, airspeed deceleration to below 160 KIAS must be continued as the flap extension process continues toward LAND position.
- The emergency flap switch should not be used for normal flap operations. The flap and slat motors may be damaged by continuous use.
- Activation of the emergency flaps/slats switch is independent of the wing-fold interlock. Inadvertent operation of the switch can therefore produce damage to the slats when the wings are not fully spread and locked. NEW
- Allow 3 minutes rest between emergency flap switch actuation. If it is necessary to cycle the emergency flap switch repeatedly, limit use to five cycles. One cycle is defined as 45 seconds extension, 3 minutes rest, 45 seconds retraction, 3 minutes rest. Abuse of motors will result in loss of the emergency actuating system.
- The emergency flap/slat switch should be returned to OFF when the flaps have reached the desired position. NEW

Note

- Insure that the position of the flap lever corresponds with the desired flap position before engaging the emergency switch. If hydraulic power should be restored, the flaps would be driven to the position selected by the flap lever. Regardless of the position of the flaps, making a selection with the emergency flaps switch overrides the flap lever selection.
- Emergency extension of the flaps to T/O may result in extension beyond the T/O position. An attempt to return to the T/O position will result in retraction of the slats during the period that the emergency flap switch is activated, resulting in a partially retracted slat condition.

Flap and Slat Indicators

The flap and slat indicating windows are on the integrated position indicator on the pilot's instrument panel (figure 1-15). The flap window indicator shows that the flaps are 30° or 40° down by using position lines and a flap outline. When the flaps are in transition or power is OFF, a barber pole will appear in the window.

Note

Above 180 KIAS (approximately), the flaps may not fully extend to the TAKE-OFF position. Above 140 KIAS (approximately) the flaps may not fully extend to the LAND position. In either situation, the flap indicator will display a barber pole until airspeed is reduced.

The slat window displays a slat when the slats are 27.5° down. As in the flap window, a barber pole will appear when the slats are in transition or power is OFF. The indications are identical for normal or emergency operations. NEW

AUXILIARY AIRCRAFT SYSTEMS

AUTOMATIC FLIGHT CONTROL SYSTEM

The automatic flight control system (AFCS) is an electromechanical system that provides three-axis stability augmentation, three-axis attitude control, and mach hold or altitude hold, as selected by the pilot. A-6E 159895 and ON and A-6E Mod M121 and ON and aircraft with AFC 161 have the AN/ASW-40 AFCS. All other aircraft have the AN/ASW-16.

STABILITY AUGMENTATION MODE (STAB AUG)

The stability augmentation mode (STAB AUG) provides improved control of the aircraft by automatically damping oscillations about the pitch, roll, and yaw axes. In this mode, the stabilizer flaperons, and rudder are actuated proportionately in response to pitch, roll, and yaw rates respectively. Movement of the control surfaces is not transmitted to the control stick or rudder pedals. The only evidence of STAB AUG action is improved aircraft stability.

STAB AUG is considered the manual mode of AFCS operation in that the pilot manually flies the aircraft with stick and rudder pressure.

AUTO MODE

The pilot relief mode (AUTO) is the basic hands-off operating mode of the AFCS. Mode selection is made by placing the AUTO/STAB AUG switch in the AUTO position. The AFCS will remain engaged only if the pitch and roll modules are properly aligned with the attitude reference selected by the compass switch and the ac operating voltage of the AFC is within limits.

Note

- The AFCS should either be secured or placed in the STAB AUG mode before switching into or out of MAG/VGI (A-6A, B, C, and A-6E) or REF 1/REF 2 (KA-6D) to prevent abrupt or unexpected attitude changes during a change in reference signals to the AFCS.
- In AUTO mode, the manual trim button on the control stick grip is deactivated and its functions are performed automatically. Manual rudder trim is available in all modes. If, in the AUTO mode of operation, the stick is grasped, the system reverts to STAB AUG operation, during which manual trim may be accomplished. AUTO mode is resumed when the stick is released.

In the AUTO mode, the AFCS provides pitch attitude hold and heading hold. If AUTO is selected at bank angles in excess of 5°, it will hold a constant bank angle. The system will hold any bank angle between 5° and 60°. If the 60° limits are exceeded, the AFCS will automatically return the aircraft to 60°. Automatic heading hold may be inhibited in A-6E 159895 and ON and A-6E Mod M121 and ON by selecting HDG OFF. In addition, heading command from the attack/navigation system is available in the AUTO MODE in these aircraft by selecting ROLL CMD.

Pitch limits are 25° nose up and 60° nose down. If these limits are exceeded, the AFCS will automatically return the aircraft to the nearest limit of the pitch range. When forces of 1.1±0.2 pounds are applied to the control stick, the AFCS reverts to the STAB AUG mode. When control stick pressure is released, AUTO mode is reengaged and the aircraft will again hold a constant pitch attitude and a constant heading or bank, depending on bank angle existing when control stick pressure is released. If the bank angle is less than 5°, the AFCS will level the aircraft and hold a constant heading. If the bank angle is greater than 5° when stick pressure is released, the AFCS will hold the existing bank angle.

Additional pilot relief functions incorporated in AUTO mode are described below.

ALTITUDE HOLD

When altitude hold (ALT) is selected, the pitch attitude of the aircraft is controlled by pressure altitude signals from the air data computer. The AFCS retains its fully automatic features and in addition maintains the aircraft at an altitude corresponding to the barometric pressure existing at the time ALT is selected. Control stick pressure interrupts altitude hold and the system reverts to the STAB AUG mode. When control stick pressure is released, altitude hold is reengaged and the aircraft will again maintain a constant altitude.

Note

- It is recommended that the aircraft be in approximately level flight before engaging the altitude control. Using the altitude hold feature to level off from climbs or descents in excess of 1000 feet per minute will probably result in an error in the level-off altitude. Repeated use of altitude hold at high vertical speeds will result in wearing of the clutch in the altitude hold module of the air data computer.
- Selecting ALT when the aircraft is on the deck will result in an apparent pitch trim runaway. This is characteristic of the AFCS and does not indicate a malfunction.

MACH HOLD

The mach hold function maintains the mach number existing at the time of mach hold engagement. In this mode, a signal from the air data computer commands a pitch-up or pitch-down whenever the airspeed is

above or below the selected mach number. Mach hold and altitude hold cannot be selected simultaneously. Selection of either function automatically disengages the other.

Longitudinal pressure on the control stick interrupts mach hold. When pressure on the control stick is released, the AFCS returns to mach hold and will again hold the existing mach number.

Note

- Mach hold should not be engaged until mach number is stabilized.
- During extended periods of mach hold operation at a constant throttle setting, the aircraft will climb slowly due to weight loss through fuel consumption. This is normal and can be corrected by reducing thrust.
- Selecting MACH when the aircraft is on the deck will result in an apparent pitch trim runaway. This is characteristic of the AFCS and does not indicate a malfunction.

ROLL COMMAND

The roll command function is available in the ASW-40 AFCS. This function allows the digital computer to command the AFCS to fly the aircraft to a heading to make good a selected target or track. Fully automatic hands-off control of the aircraft in roll is achieved by the AFCS in response to computer steering error inputs in the form of bank commands. The roll command function is energized when ROLL CMD is selected, but the switch is mechanically latched into the ROLL CMD position only as long as a computer roll command discrete is present and the AFCS is in AUTO.

AUTOPILOT CONTROL PANEL - AN/ASW-16

The autopilot control panel, placarded AUTOPILOT, is on the center console (figure 1-16). The controls consist of three solenoid-held toggle switches, two solenoid-held pushbuttons, and one momentary-on pushbutton. The toggle switches are placarded ON/OFF, AUTO/STAB AUG, and CMD ON/OFF. Pushbutton switches are placarded ALT, MACH, and RETURN TO LEVEL. The RETURN TO LEVEL and CMD ON/OFF switches are currently inoperative. The other controls and their functions are discussed under the description of the various operating modes available to the pilot.

Autopilot Switch

This two-position, solenoid-held toggle switch is interlocked with the AUTO/STAB AUG switch, which is spring-loaded to the STAB AUG position. In its normal operating position (ON), the switch engages the three-axis damper function of the STAB AUG mode. This switch must be engaged to permit selection of any of the automatic functions.

(A-6E 159895 AND ON AND A-6E MOD M121 AND ON) D-ADAI-68

Figure 1-16

Note

- After positioning AUTOPILOT ON/OFF switch to ON, and thereby engaging STAB AUG mode, wait at least 30 seconds before engaging either of the AUTO mode functions, to permit the gyros to reach operating speed.
- In order to engage the AFCS with a minimum of transients, the lateral position of the pilot's control stick should be neutral when the autopilot switch is set to ON and it should be left in neutral for 3 to 6 seconds after the AFCS is engaged to permit the servo ram to engage completely.

AUTO/STAB AUG Switch

This two-position, solenoid-operated toggle switch is placarded AUTO and STAB AUG. It is interlocked with the ON/OFF switch and is spring-loaded to the STAB AUG position. It can be placed in the AUTO position only when the ON/OFF switch is engaged. With AUTO selected, the ALT or MACH functions may be engaged.

ALT Button

The solenoid-held ALT button is used when the AFCS is in the AUTO mode, to select the altitude hold

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function, permitting the pitch attitude of the aircraft to be controlled in response to pressure altitude signals from the air data computer to maintain the barometric pressure existing at selection. Deselection of AUTO causes the button to disengage.

MACH Button

The solenoid-held MACH button is used when the AFCS is in the AUTO mode, to select the MACH hold function, permitting the pitch attitude of the aircraft to be controlled in response to mach signals from the air data computer to maintain the mach number existing at selection. Deselection of AUTO causes the button to disengage.

AUTOPILOT CONTROL PANEL - AN/ASW-40

The autopilot control panel, placarded AUTOPILOT, is on the center console (figure 1-16). The controls consist of four three-position, solenoid-held toggle switches and two two-position solenoid-held toggle switches. The three-position toggle switches are placarded ACL/OFF/PCD, ALT/OFF/MACH, HDG OFF/NORM/ROLL CMD, and MAG VGI/COMP IN/COMP OUT. The two-position switches are placarded ON/OFF and AUTO/STAB AUG.

Autopilot Switch

This two-position, solenoid-held toggle switch placarded ON/OFF is interlocked with the AUTO/STAB AUG switch, which is spring-loaded to the STAB AUG position. In its normal operating position (ON), the switch engages the three-axis damper function of the STAB AUG mode. This switch must be ON to engage any of the automatic functions of the AFCS.

Note

- After positioning the AUTOPILOT ON/OFF switch to ON, and thereby engaging STAB AUG mode, wait at least 30 seconds before engaging any of the AUTO mode functions, to permit the gyros to reach operating speed.
- In order to engage the AFCS with a minimum of transients, the lateral position of the pilot's control switch is set to ON and it should be left in neutral for 3 to 6 seconds after the AFCS is engaged to permit the servo ram to engage completely.

AUTO/STAB AUG Switch

This two-position, solenoid-operated toggle switch is placarded AUTO and STAB AUG. It is interlocked with the ON/OFF switch and is spring-loaded to the STAB AUG position. It can be placed in the AUTO position only when the ON/OFF switch is engaged. With AUTO selected, the ALT, MACH, or ROLL CMD functions may be engaged.

ACL/OFF/PCD Switch

This three-position, solenoid-held toggle switch is used with AUTO selected to enable response to pitch and roll commands from the ACLS. In the ACL position, the AFCS is coupled to and receives pitch and roll signals through the AN/ASW-25 Data Link. With ACL selected, the AFCS is in the parallel mode of operation. In this mode, the autopilot input signal will result in a maximum stabilizer travel of ±7.8° together with corresponding control stick travel. When the pilot applies a force of 10 pounds in pitch or 7 pounds in roll to the control stick, the AFCS reverts to the STAB AUG mode. When control stick pressure is released, the AFCS remains in STAB AUG.

Note

- If either the AFCS fails to revert to STAB AUG or the control stick fails to move with pilot pitch inputs or both, ACL can be disengaged and normal control stick movement restored by application of rapid fore and aft input of approximately 50 pounds at the stick grip. Turn off the AFCS and continue the flight in manual.
- ACL may also be disengaged by use of the AFCS emergency disconnect switch.

Automatic disengagement of the ACL mode occurs when autopilot command signals exceed normal operating inputs or when the stabilizer actuator servo ram receives a hard over signal causing the main ram to actuate a rate switch. Either disengagement causes the AFCS to revert to STAB AUG. In the OFF position, the data link interface is disengaged. The PCD position is not operational.

ALT/OFF/MACH Switch

This three-position solenoid-held toggle switch is used with AUTO selected to engage either the altitude-hold or the mach-hold function of the AFCS. When the ALT position is selected, the pitch attitude of the aircraft is controlled in response to pressure attitude signals from the air data computer to maintain the barometric pressure existing at selection. Selecting MACH permits aircraft pitch attitude to be controlled in response to mach inputs from the air data computer to maintain the mach number existing at selection. Deselection of AUTO causes the switch to move to OFF.

HDG OFF/NORM/ROLL CMD Switch

This three-position solenoid-held toggle switch is used with AUTO selected, to disable heading hold or to enable response to roll command signals from the digital computer AN/ASQ-155.

When HDG OFF is selected, the AFCS provides only pitch attitude hold in the AUTO mode. Selecting

NORM enables the heading hold function of the AUTO mode.

Selecting ROLL CMD permits the AFCS roll axis to respond to heading commands from the digital computer, with bank angle authority limited to ±30°.

Attitude Reference Switch

This three-position, toggle switch is placarded MAG/VGI, COMP IN, and COMP OUT. Functions of the switch are described in Section VIII of this manual.

AFCS Out Light

The AFCS OUT caution light on the approach indexer comes on with ACL selected when the autopilot has reverted to the STAB AUG mode.

AFCS EMERGENCY DISCONNECT

The AFCS emergency disconnect switch is on a junction box immediately below and to the right of the control stick grip. The switch is marked AUTO PILOT OFF and is coded with yellow and black barber-pole stripes. When the disconnect is actuated momentarily, electric power is disconnected from all AFCS circuits. Any switches or pushbuttons on the AFCS control panel that are engaged automatically return to the OFF position.

Note

In the event of any unusual vibrations or oscillations in the flight controller or if a malfunction is suspected, actuate the emergency disconnect to eliminate the AFCS as a cause. Any AFCS switches or pushbuttons that do not return to the OFF positions after actuating the emergency disconnect should be positioned to OFF manually or the autopilot circuit breaker on the bombardier/navigator's circuit breaker panel should be pulled, or both.

APPROACH POWER COMPENSATOR SYSTEM

The approach power compensator system (APC) AN/ASN-54(V) is installed in A-6E, A-6A 155642 and on an aircraft incorporating AFC No. 199. The primary purpose of the APC is to maintain an airspeed that will result in a constant average angle of attack. The system consists of the approach power control set, angle-of-attack transmitter, stabilizer position transducers, control switches, and a warning light.

When engaged, the APC automatically sets the throttles at the calculated thrust, regardless of previous setting needed to maintain the aircraft at the proper angle of attack. The precise throttle setting will depend upon aircraft gross weight, bank angle, flight path angle, and temperature setting selected. The APC uses acceleration measured perpendicular to the glide path, angle-of-attack error, and stabilizer position inputs to control throttle movement. If the pitch angle is changed to achieve a desired glide path, the throttles will automatically move as required to correct for the change in aircraft attitude. However, engine speed will not increase above 99% rpm or decrease below 75%. Furthermore, the system is damped to prevent excessive throttle movement when flying through heavy turbulence.

Manual throttle operation is available with the system turned off, and an emergency override feature allows the pilot to manually disengage the system by applying a forward or aft force of 10 to 12 pounds to the throttles. The system may also be disengaged by moving the throttle friction lock lever forward out of the off position, by selecting OFF or STBY with the APC power switch, or actuating the weight-on-wheels switch. Therefore, the pilot is assured final override authority if the system malfunctions or when a missed wire (bolter) occurs during carrier landing.

Note

- After disengaging the APC, the pilot will have to manually reselect ENGAGE with the APC power switch.
- If the throttles do not come free after attempting to disengage the APC by the normal methods, a force of 35 to 55 pounds applied to the throttles manually disengages the system. This emergency procedure damages the APC actuators, which must be repaired before the system is used again.

APC POWER SWITCH

The APC power switch on the ANTI-SKID/FLAPERON POP UP panel, is a three-position toggle switch placarded OFF, STBY, and ENGAGE. In the OFF position, all power to the system is removed and the throttles must be manually positioned. In the STBY position, power is supplied to the throttle computer. However, the control amplifier is not active and the throttles must be manually positioned. In the ENGAGE position, the system will automatically control the engine thrust by varying throttle position. The power switch is held in the ENGAGE position by a holding coil. If a malfunction causes a disengagement, the power switch will automatically move to STBY position and the APCS STANDBY light will come on.

WARNING

It is possible to engage the APC in any configuration. Engaging the APC at high power settings in the clean configuration will cause a rapid retardation of power to less than 75% rpm.

Note

- The APC will not engage unless the throttle friction lock lever is in the OFF position, full aft.
- STBY should be selected 60 seconds prior to ENGAGE to allow the throttle computer to adjust its output to a predicted level and thereby reduce throttle transients when ENGAGE is selected. Selecting ENGAGE without stopping at STBY is not harmful to the system. However, the pilot should anticipate increased throttle transients and a longer time before the desired thrust setting is established.

AIR TEMPERATURE SWITCH

The air-temperature switch is a three-position toggle switch placarded COLD, STD, and HOT. It allows the pilot to change the computer gain as a function of outside temperature. Since thrust developed for any given throttle setting varies with outside air temperature, the correct gain should be selected before engaging the APCS. The COLD position will be used when temperature is below 40°F (+4°C) and the HOT position when the temperature is above 80°F (+26°C). When the temperature is between 40°F and 80°F (+4°C and +26°C), the STD position is used.

Note

Selecting the wrong gain may degrade APC performance; however, the system will compensate and maintain stable operation.

APCS STANDBY LIGHT

The APCS STANDBY light on the approach indexer illuminates when the system is disengaged and is in the STBY position. The light can be extinguished by engaging the system or by turning the system off. The primary purpose of the light is to warn the pilot that the APC has disengaged and returned to the standby position. Depressing the LTS WARN press-to-test button on the pilot's master test panel will check for operating circuitry of the light.

AUTOMATIC CARRIER LANDING SYSTEM

The automatic carrier landing system (ACLS) is installed in A-6E 159895 and ON, A-6E Mod M121 and ON in KA-6D aircraft with AFC 161, and, with a lesser capability in aircraft incorporating AFC 230. The ACLS consists of an airborne subsystem and a shipboard subsystem with most of the required equipment being aboard ship.

TAKEN OUT OF KA-6D

AIRBORNE SUBSYSTEM

The airborne subsystem in all ACLS-equipped aircraft includes the AN/ASW-25B Data Link receiver and associated controls and indicators. In addition, the aircraft with full capability have a modified APN-154 Radar Beacon, the AN/ASW-40 AFCS, and the AN/ARA-63 ILS Receiver. See figures 1-17 and 1-17A.

SHIPBOARD SUBSYSTEM

The shipboard subsystem is composed of an AN/SPN-10/42 Computer interfaced with the naval tactical data system (NTDS), AN/SPN-10/42 Radar, and data link transmitter. A shore-based AN/SPN-42T1 is used for indoctrinating pilots in ACLS procedures and is identical to the shipboard system except for ship stabilization and deck motion compensation.

APPROACH MODES

Several ACLS approach modes are available depending on aircraft modifications. These modes are as follows:

- Mode I Approach - Automatic coupled AFCS approach from acquisition to touchdown on the carrier flight deck.

Hands-off capability is accomplished by interfacing the data link with the automatic flight control system and the approach power compensator (figure 1-17B).

The carrier's landing radar system (AN/SPN-42) tracks the aircraft and the radar computer compares aircraft position with desired aircraft position. The aircraft's position is then corrected to fly the desired glide path by commands from the naval tactical data system (NTDS). These commands are transmitted over the UHF data link to the aircraft's AN/ASW-25 Data Link receiver, which then directs pitch and roll commands to the automatic flight control system.

In addition to carrier control of the aircraft, discrete messages are transmitted and displayed on the pilot's discrete message indicator. These messages provide the pilot information relative to the progress of the landing approach and direct actions required of the flight crew. The carrier's AN/SPN-42 also transmits azimuth and elevation glide slope error

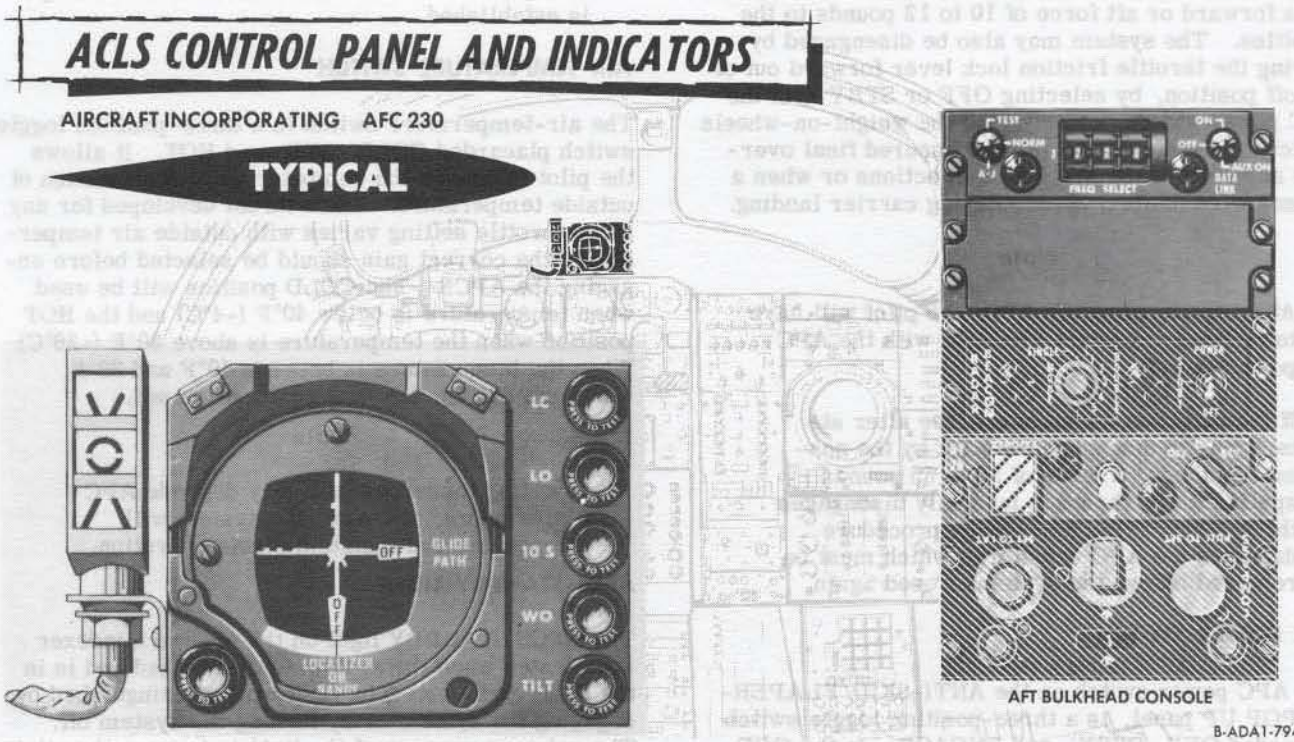

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Figure 1-17

AUTOMATIC CARRIER LANDING SYSTEM CONTROLS AND INDICATORS

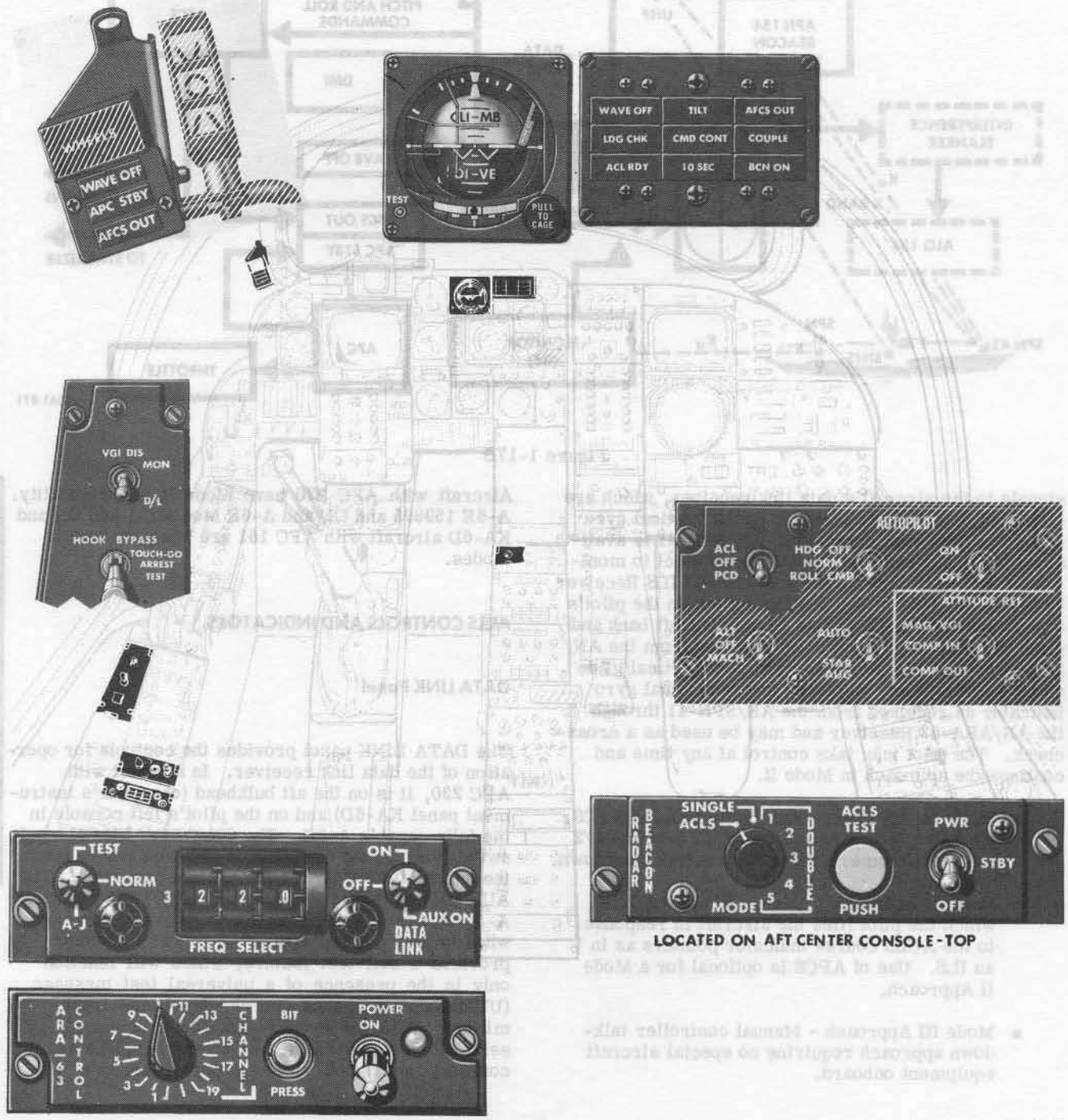

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Figure 1-17A

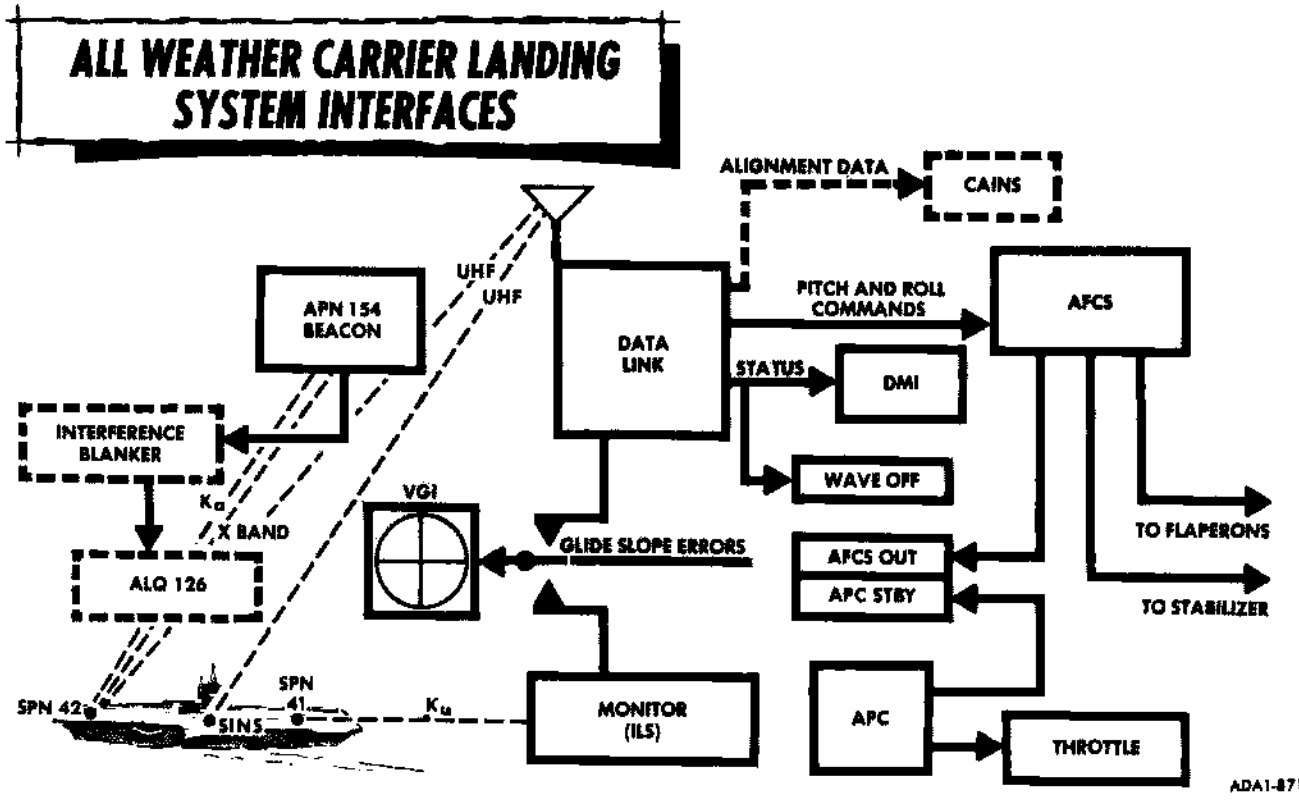

Figure 1-17B

signals to the aircraft's data link receiver, which are displayed by the cross pointers on the vertical gyro indicator. When an operational AN/SPN-41 is available aboard the carrier, the pilot may elect to monitor the approach through the AN/ARA-63 ILS Receiver by selecting MON on the VGI DIS switch on the pilot's miscellaneous panel. In this case, aircraft bank and pitch commands continue to be received from the AN/SPN-42, while independant lateral and vertical glide slope deviations are displayed on the vertical gyro indicator as received from the AN/SPN-41 through the AN/ARA-63 Receiver and may be used as a cross-check. The pilot may take control at any time and continue the approach in Mode II.

- Mode IA Approach - Automatic coupled AFCS approach from acquisition to 200 feet and 1/2 mile minimums; manual approach to touchdown.
- Mode II Approach - Uncoupled approach in which the pilot flies the aircraft in response to the ACLS course indicator pointers as in an ILS. Use of APCS is optional for a Mode II Approach.
- Mode III Approach - Manual controller talk-down approach requiring no special aircraft equipment onboard.

Aircraft with AFC 230 have Mode II and capability. A-6E 159895 and ON and A-6E Mod M121 and ON and KA-6D aircraft with AFC 161 are equipped for all modes.

ACLS CONTROLS AND INDICATORS

DATA LINK Panel

The DATA LINK panel provides the controls for operation of the data link receiver. In aircraft with AFC 230, it is on the aft bulkhead (observer's instrument panel KA-6D) and on the pilot's left console in the fully capable A-6E. The ON/OFF/AUX ON toggle switch when in the ON position provides power from the essential 28 V dc bus for system operation. The AUX ON position is inoperative. The TEST/NORM/A-J mode switch provides normal system operation when in the NORM position. The TEST position provides a self-test feature, which will function only in the presence of a universal test message (UTM) from a ground- or carrier-based transmitter. With the proper data link frequency selected on the FREQ SELECT switches, the ACLS course pointers will cycle every 6 seconds

from fly-up-and-right to a fly-down-and-left, indicating proper data link operation. As the pointers cycle down and left, the WO (wave-off) light on the discrete message indicator panel will come on. The A-J position is inoperative.

ACLS Course Indicator

The ACLS course indicator (ID-351) horizontal and vertical pointers present glide path and azimuth errors (actual displacement from approach path) in relation to aircraft position represented by a miniature aircraft in the center of the instrument. The vertical and horizontal pointer OFF flags will be displayed and the needles will show a zero glide slope and centerline error whenever AN/SPN-10/42 Radar is not locked on the aircraft.

The vertical gyro indicator ID-1791(figure 1-17A), on the pilot's center instrument panel, in A-6E 159895 and ON and A-6E Mod M121 and ON, and KA-6D with AFC 161, provides the pilot pitch and roll indications with respect to an artifical horizon. In addition, vertical (azimuth) and horizontal (glide slope) pointers are super-imposed across the face of the instrument to indicate lateral (heading) and vertical (glide slope) errors during carrier approach. The instrument is self-contained with respect to pitch and roll indications. Glide slope and heading error indications are transmitted from the shipboard AN/SPN-42 or AN/SPN-41 to deflect the pointers toward the desired track. Either the data link or AN/ARA-63 Receiver may be used to control the cross pointers, by means of the VGI DIS switch on the pilot's miscellaneous panel. When the switch is placed in D/L, the cross pointers are driven through the data link receiver. When the switch is placed in MON, the pointers are driven through the AN/ARA-63 Receiver.

The cross pointers are activated through the data link when the ON-OFF-AUX ON switch on the data link control panel is set to ON, the proper frequency is set, the TEST-NORM-AJ switch is in the NORM or AJ position, and the data link receives a valid label 6 message from the AN/SPN-42 with no TILT and no WAVEOFF discretes. The cross pointers are activated through the ARA-63 Receiver when the power switch on the ARA-63 control is set to ON and the shipboard AN/SPN-41 is locked on. When not activated, the cross pointers are driven out of view behind masks at the bottom and right side of the instrument.

A system test is provided by means of the TEST-NORM-AJ switch on the data link control panel. To conduct the test, a universal test message (UTM) must be transmitted from land- or carrier-based equipment. When the switch is held in the TEST position, cycling of the cross pointers from fly-up-and-right to fly-down-and-left every 6 seconds indicates the system is operational.

A conventional turn-and-slip indicator is provided at the base of the instrument. The turn needle is powered by a remote rate gyro. A test pushbutton is at the base of the instrument. Depressing the pushbutton causes the turn needle to indicate a double-needle-width turn and drives the cross pointers into view to show zero azimuth and glide slope error.

Discrete Message Indicator Panel

The discrete message indicator panel in aircraft with AFC 230 (figure 1-17) contains five lights, which provide the pilot with additional information during an ACLS approach. The LC (landing check) light comes on when the proper aircraft address has been inserted in the SPN-10/42 by the controller and indicates the pilot should perform the landing check. The LO light indicates the radar is locked on. At this time, the horizontal and vertical OFF flags disappear and the horizontal and vertical pointers on the ACLS course indicator present aircraft relative position from glide slope and centerline. The flashing WO (wave-off) light indicates an unsatisfactory approach path or carrier equipment failure. WO signals may also be initiated by the final controller (between lock-on and touchdown), PRI-FLY (between 9 seconds and 1.5 seconds from touchdown), and the LSO (between 1 mile and touchdown). The 10-S (10-second) light comes on approximately 10 seconds from touchdown and indicates deck motion compensation is being added to glide path commands. The TILT (missed message) light comes on within 2 seconds after the last valid flight path command message is received. The TILT light will also be on prior to aircraft address insertion by the controller and will go out when the LC light comes on.

In A-6E 159895 and ON and A-6E Mod M121 and ON and KA-6D with AFC 161, the discrete message indicator contains nine indicator lights, which provide the pilot with information necessary to complete or abort a carrier approach. The function of each light is as follows:

WAVE OFF (flashing red)	-	Indicates the aircraft has deviated beyond limits from the azimuth or glide slope path or that there has been a failure of the carrier approach equipment. It also may be triggered by the LSO for conditions he considers unsafe.
LDG CHECK (yellow)	-	Lights when the proper aircraft address has been inserted in the carrier's AN/SPN-42 by the controller and indicates that the pilot should complete the landing checklist.
ACL READY (yellow)	-	Indicates that the aircraft has arrived at the radar acquisition window and the radar is locked on. The signal, which is transmitted automatically by the shipboard AN/SPN-42, indicates that azimuth and glide slope errors are being transmitted.

TILT (red)	-	Alerts the pilot to any loss of current command inputs to the data link. If steering commands received by the data link are not updated for any 2-second period during the approach, the TILT light comes on. This discrete automatically disengages the AFCS if it is coupled. The TILT light will also be on prior to the time the shipboard controller inserts the proper aircraft address in the AN/SPN-42 and will go out when the LDG CHECK light comes on.
CMD CONT (yellow)	-	Indicates the AN/SPN-42 is transmitting pitch and bank commands.
10 SEC (yellow)	-	Lights approximately 12.5 seconds prior to touchdown to indicate that ship's motion has been added to glide slope information and D/L commands.
AFCS OUT (red)	-	Indicates the autopilot has uncoupled from the data link mode. Light will go out when AFCS is recoupled or after 20 seconds have elapsed.
COUPLE (yellow)	-	Indicates the pilot can couple the autopilot to data link commands.
BCN ON (yellow)	-	Indicates cockpit beacon switch is on and Ka/X band loop is closed.

VGI DIS Switch

The two-position VGI DIS toggle switch on the pilot's miscellaneous panel is provided on A-6E 159895 and ON and A-6E Mod 121 and ON to permit the pilot to select the source of course and glideslope signals driving the VGI pointers. With the switch at the D/L position, the pointers will be positioned by error signals from the ship's SPN-42 radar. With MON selected, independent course and glideslope signals received by the ARA-63 will be displayed, permitting a cross check of a Mode I approach or as an alternate source for a Mode II approach.

RADAR BEACON AUGMENTOR RECEIVER

In A-6E 159895 and ON and A-6E Mod M121 and ON and KA-6D with AFC 161, the APN-154 Radar Beacon is provided with a Ka-Band augmentor receiver to enable the APN-154 to reply to and extend the tracking capability of the ship's SPN-42 radar. The augmentor is turned on by setting the mode selector switch to ACLS. The augmentor receiver may be tested by depressing and holding the ACLS TEST button/light on the radar beacon panel (figure 1-17A). If the augmentor tests good, the light in the button comes on.

AN/ARA-63 ILS RECEIVER

The ILS receiver is used with the carrier-based AN/SPN-41 (C-scan) transmitters for manual instrument and landing approaches or an independent monitor (figure 1-17B) during ACLS approaches. The system operates in the K_u band, between 15.4 and 15.7 GHz, on any of 20 channels selected by the pilot. Channel selection is made on the ARA-63 control panel (figure 1-17A) on the left console.

The aircraft system receives and decodes glide slope, azimuth and elevation signals, which are displayed on the VGI if the VGI DIS switch is set to MON. Operating range is approximately 20 miles and warmup time is a minimum of 1 minute. Electrical power requirements are 28 V dc and three-phase 115 V ac from the primary bus through ARA-63 circuit breakers on the forward and aft nosewheel well circuit breaker panels (A-6E) and the observer's circuit breaker panel (KA-6D).

ARA-63 Control Panel

The ARA-63 control panel provides all the controls for operating the ILS receiver.

CHANNEL Selector - A rotary selector switch permitting any of 20 channels to be tuned.

BIT Button - A momentary-action pushbutton permitting self-test of the ARA-63 when the button is pressed and held. A valid test is indicated on the VGI (when the VGI DIS switch is at MON) by the vertical pointer slowly oscillating on the right side of the display, then on the left side. The horizontal pointer remains stationary in the center of the VGI.

POWER switch - A two-position lever-lock switch marked ON and OFF. With OFF selected, the ARA-63 is turned off.

Indicator Light - Comes on when ARA-63 is on and receiving.

SPEED BRAKES

The wing-tip speed brakes consist of a set of split trailing-edge surfaces at the tip of each wing, outboard of the flaps. When fully deflected, the brakes open to an included angle of 120° (60° per each half). The individual brake surfaces are approximately 2 ft. x 4 ft. panels making a total of 32 sq. ft. total braking area for the airplane. The lower speed brake is attached to the wing by two external fixed hinges. The upper surface is attached to the wing by two adjustable tension links at the same wing station as the lower hinges. The surfaces are interconnected at three points. This configuration has been optimized to yield symmetric deflection of the upper and lower brake surfaces. The primary consideration affecting the overall design of the speed brakes controls has been to obtain close synchronization between left- and right-hand wing brakes. This consideration led to the incorporation of flow regulators and electrical transmitters. Essentially the actuation is as follows:

The pilot operates a momentary switch in the cockpit, which selects a position of the solenoid-controlled

hydraulic slide valve. Power is then transmitted to the speed-brake surfaces by single tandem-type hydraulic cylinders in each wing tip via the flow regulators. (This power is from the combined hydraulic system.) Consequently, primary synchronization is initially provided by the flow regulators, which control rate and position of the surfaces within 10%.

Fail-safe features have been added at several levels. If for any reason the surfaces become asymmetric by more than 8°, an electrical synchronization system will actuate to retract the surfaces. This would close the surfaces in 2 1/2 seconds from full open. Pilot operation of wing-tip speed brakes can be regained by cycling the wing-tip speed-brake control switch to retract. In the event of loss of electrical or hydraulic power or both, the system will go to a closed selection. The pilot has the option of selecting closed at all times. Whenever the surfaces are in the closed position, ball locks in the speed-brake actuation cylinder hold the surfaces even with loss of hydraulic pressure.

The flow regulators in the hydraulic system have been selectively fitted to provide good control of synchronization and minimize the transients during all failure conditions. The normal speeds of operation are 5.0 seconds out and 2.5 seconds in.

SPEED-BRAKE POSITION INDICATOR

The speed-brake position indicator, part of the integrated position indicator on the pilot's instrument panel, indicates position of the speed brakes. The word IN appears when the speed brakes are stowed. Barber poles appear whenever the brakes are in transition, partially extended, or the indicator loses electrical power. Fully extended wing-tip speed brakes are indicated by black dots on a white background. The indicator is supplied by the essential 28 V dc bus and protected by the CAUTION LTS circuit breaker on the main circuit breaker panel.

FAIL-SAFE PROVISIONS

Fail-safe provisions exist at several levels. If electrical power is lost, the system will go to a closed selection. Whenever the speed brakes are closed, ball locks in the speed-brake actuation cylinder hold the brakes closed, even if hydraulic pressure is lost.

Note

The speed brakes must be fully closed to permit engagement of the ball locks. A hydraulic failure with brakes extended will result in the brakes closing to a trial position which is not sufficiently closed for the locks to engage. It is recommended that the speed-brake selector switch be left in the retract position when not in use.

For most types of system failure, the electrical asymmetry sensors will react and retract the brakes. It is noted that there is no practical protection for either a mechanically jammed speed-brake surface or jammed hydraulic selector valve. The sizable airloads on the speed brakes will tend to close them against any but the most severe interference. Extensive experience has not produced any failure of this type.

Note

Normal operation of the stability-augmentation yaw damper will provide an increased margin of safety for yaw transients induced by asymmetric wing-brake deflections.

SPEED-BRAKE SWITCH

A three-position thumb switch with retract, neutral, and momentary extend positions is in the right throttle head, and controls actuation of the speed brakes. Positioning the switch forward retracts the speed brakes; holding it aft extends them. Momentary operation of the switch produces partial extension and will show a barber pole on the integrated position indicator. In the center (temporary hold) position, return flow of hydraulic fluid is blocked from both the extend and retract sides of the speed-brake cylinders, hydraulically locking the speed brakes.

Note

The normal position of the three-position switch is retract.

SPEED-BRAKE TEST SWITCH

The speed-brake test switch is a toggle switch on the left console placarded NORM and TEST. The switch is spring-loaded in the NORM position. The TEST position provides a check of the speed-brake null-detector system and is selected prior to takeoff.

To make the speed-brake test, proceed as follows:

1. Speed-brake switch aft to extend speed brakes.
2. Select TEST position - brakes should retract immediately.

LANDING GEAR SYSTEM

LANDING GEAR CONTROLS AND INDICATORS

The aircraft has a fully retractable tricycle landing gear. When the gear is up and locked, the wheel wells are covered flush to the aircraft with the landing gear doors. The system is electrically controlled by the 28 V dc essential bus and is powered to the extend and retract position by the secondary circuit of the combined hydraulic system. A pneumatic system powered by four air bottles charged to 2,450 psi provide a one-shot extend cycle in the event of a hydraulic failure. A number of indicators are provided to warn of unsafe landing gear operation.

Note

The landing gear is structurally capable of withstanding being extended into the slipstream up to 250 KIAS. However it will not necessarily lock down at this speed. The design of power requirements to drive the gear and doors to the down and locked position against airloads is based on the selection to down being made at 200 KIAS or less.

Wheels Warning Light

The WHEELS warning light on the windshield bow (figure 1-18) will flash any time all three landing gear are not down and locked with both throttles retarded to less than 24 1/2° above idle (approximately 82.5%), and the flaps are not retracted.

Note

Whe WHEELS warning light will flash on the approach to landing with the landing gear down and locked if only RAT power is available. This is normal operation since the landing gear downlock relay is powered from the primary dc bus.

NEW NEW NEW

Wheels Transition Light

The wheels transition light to the right of the landing gear handle (figure 1-18) will glow any time the landing gear handle is first selected UP or DOWN, and will continue to glow until the position of all three gears agree with the position of the handle, and all three gears are either up or down and locked.

Landing Gear Position Indicator

The integrated position indicator on the left side of the pilot's instrument panel (figure 1-18) displays the position of each landing gear as follows:

GEAR UP - The word up appears in the appropriate window when the main gear uplock switches and the forward door switches are closed; nose gear uplock switch closed.

GEAR DOWN - A picture of a wheel appears in the appropriate window when the main gear and the nose gear are down and locked.

GEAR TRANSITION - A barber-pole indication will appear in the appropriate window when the uplock or downlock switches, or the main gear forward door switch is not closed.

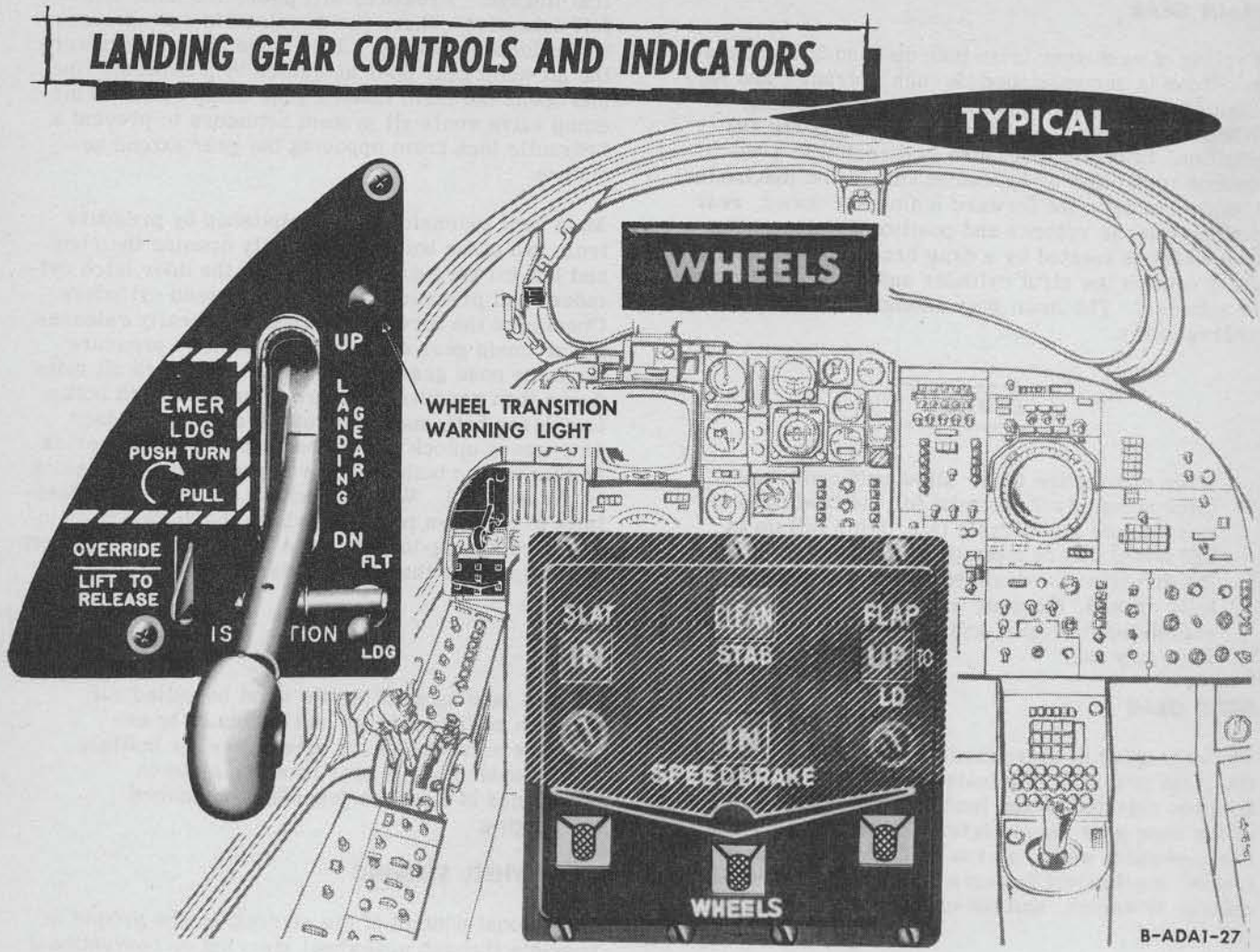

Figure 1-18

Note

The approach light indexer will not light until all gear are down and locked.

Landing Gear Handle

The landing gear handle (figure 1-18) is on the left side of the pilot's instrument panel. The wheel-shaped handle actuates a switch that electrically positions the landing-gear selector valve to the selected position.

CAUTION

Dump cabin pressure before lowering the landing gear above 8,000 feet. Automatic pressurization begins at this altitude, and the possibility of jamming the nose-gear door exists when the gear is actuated with the aircraft pressurized. The cabin may be repressurized after the nose gear has been extended.

Inadvertent gear-up selection, when the aircraft is on the deck, is prevented by the left nutcracker weight-on-wheels switch, which energizes a landing-gear handle lock solenoid. This solenoid throws a latch, which mechanically locks the landing-gear handle in the DN position. If the lock remains in place after takeoff, it can be mechanically repositioned by lifting the override lever to the left of the landing-gear handle.

Note

If the gear is raised by overriding the gear-handle downlock latch, the flaperon pop-up should be disarmed to prevent its inadverent actuation while airborne if the throttles are fully retarded. The left weight-on-wheels switch, which controls the gear-handle down latch, is a series link in the flaperon pop-up arming circuit.

NEW

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MAIN GEAR

Cycling of each gear from both up- and downlocked positions is accomplished through hydraulic and mechanical actuation of the main gear mechanism. When the landing gear handle is placed in the DN position, hydraulic pressure is directed in a sequence controlled by hydraulic valves and mechanical linkage, to open the forward main gear dooes, rear doors, release uplocks and position the downlocks. The wheel is rotated by a drag brace that mechanically rotates the strut cylinder and wheel as the gear is actuated. The main gear extends and retracts hydraulically.

CAUTION

When cycling the gear, allow sufficient time (approximately 7 seconds) for the landing gear to complete a half cycle (i. e. from full up to full down) before attempting a reversal. If the direction is reversed before the door is fully opened, the gear linkage will not have completed its travel and the forward gear door may fail.

NOSE GEAR

The nose gear is hydraulically interconnected with the main gear and is actuated hydraulically to the position selected on the landing gear handle. Motion of the nose gear during retraction is aft and up into the nosewheel well. As the nose gear extends or retracts, mechanical linkages actuate the nosewheel uplock, downlock, and the nosewheel well doors.

NEW NEW NEW

CAUTION

Upon lowering the gear handle, if an immediate nose gear indication is received, a failed gear down Micro Switch is indicated and the reading is unreliable. A visual nose-gear-down confirmation prior to landing is recommended.

EMERGENCY LANDING GEAR EXTENSION

Emergency air bottles furnish the power necessary to lower the landing gear in the event of a hydraulic or electrical failure. This one-shot system is powered by nitrogen pressure (2, 450 psi) stored in four compressed nitrogen bottles. Pushing in, rotating 90° clockwise, and pulling out the landing gear control handle at least 2 to more than 3 inches to the overcenter position actuates the emergency gear-down valve (release valve) on the bottle in the nosewheel well. Pressure from the nosewheel well bottle, in turn, discharges the three other bottles. All bottles are manifolded on the fill side for single-point pressurizing. However, each bottle has a seperate function during the extension cycle.

The nose gear actuator is pressurized to extend, thus opening the uplock and opening the doors by a mechanical linkage. Pressure will power the nose strut to full extension, where the downlock is spring-loaded to the locked position. This same air bottle powers the aft main gear door actuators by a separate line, and opens the main landing gear dump valve. This dump valve vents all system actuators to prevent a hydraulic lock from opposing the gear extend sequence.

Main gear extension is accomplished by pressure from two other bottles separately opening the right and left forward doors by opening the door latch cylinders and pressurizing the door extend cylinders. Opening of the forward doors mechanically releases the aft main gear doors to be opened by pressure from the nose gear bottle. Opening of both aft main doors then permits pressure from the fourth bottle to release both main gear uplocks. The aft door emergency uplock timer check valves are in series so that unless both doors are opened, neither uplock is pressurized. When unlocked, the main gear freefalls to the down position, where the downlock cylinders are spring-loaded to the lock position. Cockpit indications are the same as during normal gear extension.

Note

The landing gear handle must be pulled out with sufficient force and extension to ensure actuation of the emergency air bottles. Extension of the gear handle may be in excess of 3 inches depending on control rigging.

NOSE-WHEEL STEERING

Directional control of the aircraft on the ground is possible through nosewheel steering or conventional differential braking action. Shimmy damping is available in either mode of operation through the use of restrictors in the steering mechanisms. The nosewheel steering will power the lower strut barrel up to approximately 56° and return to center. To permit tighter turns with differential braking, the lower strut will disengage a spring-loaded lock-pin (tog-lock) at approximately 63° of lower strut rotation. The lower strut is now free to swivel and will remain so until the tog-lock is realigned and reengages the upper strut detent.

Nosweheel steering is engaged when the steering button on the control stick grip is depressed and the weight-on-wheels switch on the main landing gear is closed. Steering is also engaged automatically when the arresting hook is extended and the weight-on-wheels switch is closed. When selected, steer unit rotation is proportional to rudder pedal deflection, full pedal begin required to obtain full 56° steering. Since full rudder travel is obtained only with flaps extended, there will be rudder pedal force buildup with flaps up (steering limits are unaffected).

When the nosewheel steering button is depressed, the nosewheel steering selector valve is energized, allowing hydraulic fluid from the secondary circuit of the combined hydraulic system to pressurize the

steering control valve and position an internal shuttle valve. The steering control valve is mechanically linked to the rudder pedals. When the rudder pedals are actuated, hydraulic fluid is directed through the control valve, around the shuttle valve, and into the appropriate side of the power chamber. The power chamber is mechanically linked to the nosewheel; therefore, rotation of the output shaft in the power chamber turns the nosewheel. When hydraulic pressure is cut off, a centering spring on the nosewheel strut centers the nosewheel and repositions the internal shuttle valve. Check valves provide a closed circuit between the power chamber and a restrictor in the shuttle valve. This closed hydraulic circuit effectively dampens any shimmy. It should be noted that steering unit deflection will follow pedal deflection only so long as the steering switch is depressed. When the steering button is released, or when aircraft power is lost, the lower strut will remain at approximately the same angle since there is little centering with the weight on the wheels. When reengaging, the transient will be mild if the pedals and the steering unit are at the same rotation angle as the lower strut. If however, the pedals have been centered, the lower strut will produce a moderate jolt when the steering switch is selected on.

When the tog-lock has been disengaged by turning past 63°, the steering switch will have no effect as long as the lower strut is free swiveling. The reengaging jolt will again be mild or severe when the tog lock reengages the detent, depending on the relative position of the lower strut and the upper steering unit. Braking will sometimes be necessary to center the lower strut sufficiently to reengage the tog-lock. If the nosewheel steering is deflected when the main wheels leave the ground, a centering spring will center the nosewheel, providing the tog-lock is engaged.

CAUTION

Failure of the tog-lock to reengage will result in a free swiveling nosewheel, which can produce a nose-gear jam when the gear is retracted.

Nose-Wheel Steering Button

The spring-loaded nosewheel steering button on the pilot's control stick grip (figure 1-15) must be depressed to keep nosewheel steering (figure 1-44). It is used to engage normal nosewheel steering. When the nosewheel steering circuit is energized, the nosewheel steering selector valve is positioned to direct combined hydraulic system pressure to the steering control valve.

NOSE-GEAR LAUNCH SYSTEM

NEW The components necessary for a catapult launch are on the nose gear. A launch bar (figure 1-19) mounted forward of the nose gear serves the dual purpose of guilding the aircraft to the shuttle from the lead-in track and attaching the aircraft to the shuttle. A bellcrank, aft of the nose-gear strut, attaches the aircraft to the catapult through an attachable holdback bar and release element. The release element will fail at 53,000 pounds of tension. A lifter spring is compressed by the bellcrank as a thrust moment is exerted by the aircraft to engage the launch bar and shuttle. After the release element is broken, the spring applies a force to a lifter pushrod through the holdback bellcrank, repositioning the launch bar when the aircraft clears the shuttle.

To stow the launch bar within the nosewheel well after landing gear retraction, a second launch bar retraction stage is needed to raise the launch bar to the full up position. This is done by mechanical linkage from the nose-gear drag brace to the launch bar. When the gear is extended, the linkage is moved out of the way and the launch bar drops to its intermediate position.

If the launch bar fails to reach its intermediate position after launch, retraction of the landing gear will move the launch bar through the secondary retraction stage in a position to engage the launch bar uplatch.

CATAPULT GRIP

The nose strut oleo is locked during a launch to provide clearance between large centerline stores and the deck hardware, and to minimize strut loads. This

NOSE GEAR LAUNCH BAR

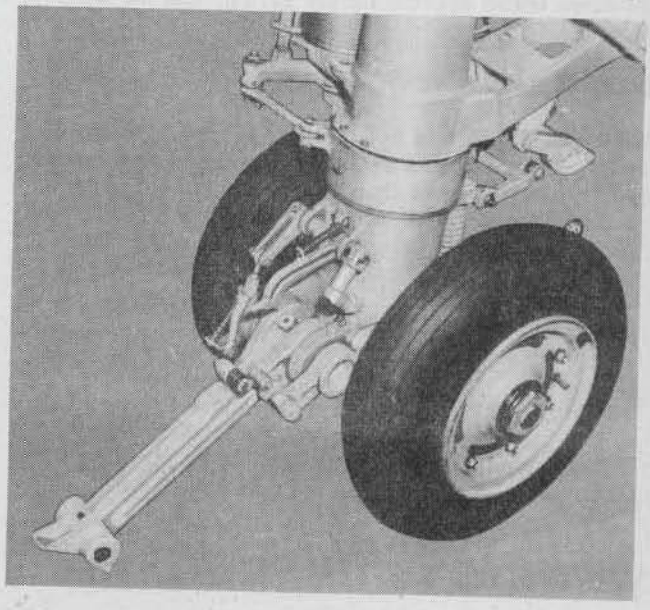

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Figure 1-19

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is accomplished by actuating the catapult grip (figures FO-2 sheets 1, 2 and 3) forward of the throttles. With the shuttle engaged and the throttles advanced to takeoff, the catapult grip is rotated 90° to the right and pulled up. A strut-lock switch is actuated by the catapult grip. This switch electrically positions the strut-lock valve. Hydraulic pressure is directed to the strut, positioning the collar over the bleed holes of the shock strut. This locks the strut for launch. After launch, the catapult grip, which is spring-loaded, is released, opening the strut-lock switch. The strut-lock selector valve is actuated, venting the strut-lock line to return. This allows the collar to uncover the bleed holes for normal strut operation.

CAUTION

NEW The catapult grip must be used (pulled out and up) for all catapult launches, since proper grip position is required for nose-strut stiffening. Failure to use the catapult grip will result in catapulting with a soft nose strut and may cause structural damage to the aircraft or the centerline stores.

NOSE STRUT INDICATOR

NEW When the aircraft launch bar is lowered to engage the catapult, the launch bar switch will arm the strut annunciator light. When the throttle is advanced past normal cruise position to full power, and the catapult grip is not positioned, the strut-lock light (figure FO-11) will come on. Positioning the catapult grip will lock the strut (hard position) and turn off the strut-lock warning light. When the gear is extended, the lock light will come on, through the weight-on-wheels relay, with the flaps DOWN, the throttles below approximately 82.5%, and the nose strut HARD.

LAUNCH BAR INDICATOR

NEW When the aircraft is in flight (no weight on wheels) and the launch bar is not up and latched, or the nose gear is cocked more than 8°, the nosewheel window on the integrated indicator will read TOW LINK, and the indexer and exterior approach lights will flash.

CAUTION

NEW With a cocked nose gear, the normal launch bar procedure of recycling the landing gear may result in structural damage by jamming the nose-gear wheel in the nosewheel well.

WING-FOLD SYSTEM

The combined secondary hydraulic system supplies the power for wing folding. The flight hydraulic system must also be pressurized to hold the combined system isolation valve open.

A double locking device at the wing-fold selection control is integrated with the wing fold handle and flight controls to prevent inadvertent damage to control surfaces spanning the wing fold line. If the control stick is not in a neutral position, a mechanical flaperon interlock will prevent the wing-fold handle from being actuated. The wing-fold handle in turn, must be actuated to position the mechanism on the lock cylinder to allow retraction of the hydraulically operated wing lockpins. A wing lockpin switch controls the operation of a selector valve, which directs hydraulic pressure to the lockpins. However, if the flaps and slats are extended, the electric circuit to the wing lockpin selector valve is opened, overriding the UNLOCK position of the wing lockpin switch. Conversely, the flap, slat, and flaperon pop-up circuits are opened when the wings are unlocked. When the wing-fold handle is not stowed, the control stick is restricted laterally by the wing-fold interlock.

WING-FOLD HANDLE

The wing-fold handle (figures FO-2 sheets 1, 2 and 3) is mounted flush in the center console. The arm of the handle extends forward and down the right side of the console, where it is attached to a pivot point. Actuation of the wing-fold handle occurs in steps and is tied in with the wing lockpin switch.

CAUTION

If the wing lockpin switch is in the lock position, actuation of the wing-fold handle to the down position is not possible.

WING LOCKPIN SWITCH

The wing lockpin switch is under the wing-fold handle in the center console. The switch has two positions: UNLOCK and LOCK.

WING-FOLD OPERATION

The wing-fold handle rotates the mechanical lock to a position that enables the hydraulic lockpins to be actuated, and positions the wing-lock warning flaps on each wing. The wing lockpin switch actuates a solenoid-operated hydraulic selector valve, which directs combined system pressure to the four lockpin cylinders at the wing-fold joint, and opens the flap, slats, and flaperon pop-up electrical circuits. The hydraulic pressure at the lock cylinder retracts the wing lockpins. As the lockpins retract, they remove the mechanical stops of the wing-fold handle. The wing-fold handle can now be moved to the full forward position. By moving the wing-fold handle full forward the wing-fold selector valves are positioned by mechanical linkage, directing combined hydraulic system pressure to the wing-fold actuating cylinders. The wings are folded by the two opposed actuating cylinders in each wing acting on a bellcrank at the wing-fold joint.

CAUTION

Wing-tip speed brakes, slats, and flaperons should be checked visually for retraction before folding the wings.

WING-SPREAD OPERATION

The reverse sequence of events occurs in spreading the wings. Squeeze the wing-fold handle and move it aft to the first stop, and wait for all spread motion to cease. The wing-fold selector valve directs hydraulic pressure to retract the wing-fold actuating cylinders. When the wings are fully spread and all spread motion has ceased, the wing lockpins switch should be actuated to LOCK. In the LOCK position, the wing lockpin selector valves direct flow to the wing-spread timer check valves (one in each wing). When the wings reach the fully spread position, the wing-fold timers open, pressurizing the wing lockpin cylinders. Simultaneously, the structural wing fittings release the mechanical detents that prevent lockpin extension until the lockpins and holes are aligned. When the lockpin holes are aligned, the pins extend. This locks the wings and removes the mechanical stops of the wing-fold handle. Moving the handle flush to the console mechanically locks the hydraulic lockpin and stows the wing-fold warning flags. If any of the lockpins fail to go home, the flags will remain up and the wing-fold handle cannot be stowed.

WHEEL BRAKE SYSTEM

The main wheel brakes are hydraulically powered, multiple disk brakes. An artificial feel system is provided to simulate pedal forces: A brake selector handle is provided for pilot selection of normal, auxiliary, or emergency/park brake operation. The normal brakes are powered by the combined secondary hydraulic system. The auxiliary and emergency/park brakes are powered by a hydraulic brake accumulator. The accumulator is pressurized by the handpump and, in aircraft incorporating, it the electrically operated auxiliary hydraulic pump will also pressurize the accumulator. Accumulator pressure is displayed on a brake cycle gage in number of brake cycles remaining. An antiskid system is available only with normal brakes.

BRAKE SELECTOR HANDLE

The brake selector handle (figure 1-20) is a T-shaped handle displaying BRAKE that is used to select the mode of brake operation. The handle mechanically positions a three-way valve for the brake modes.

Normal Braking

With the brake selector handle in (full forward) and vertical, the brake selector valve ports combined secondary hydraulic system pressure to the brake control valves. The brake control valves actuated by the pilot's feet on the toe brakes meter hydraulic pressure to the wheel brakes. The antiskid system may be employed with normal braking.

CAUTION

After heavy or repeated brake applications, such as encountered in practice landings, a 5- to 10-minute cooling period should be permitted in the air, with the gear extended between landings.

Auxiliary Braking

With the brake selector handle in (full forward) and horizontal (rotated 90° clockwise), the brake selector valve ports brake accumulator hydraulic pressure to the brake control valves. The brake control valves actuated by the pilot's feet on the toe brakes meter hydraulic pressure to the wheel brakes. Brake pedal feel will be the same as normal breaking without antiskid. The antiskid system will be inoperative even if it is switched on. Auxiliary brake applications are limited by the capacity of the accumulator and a priority valve. A fully charged accumulator will provide approximately fifteen auxiliary brake applications. The priority valve reserves the last four to seven applications exclusively for emergency/park brake applications.

Emergency/Park Brakes

When the brake selector handle is out (pulled aft) in either the vertical or horizontal position, the brake selector valve ports brake accumulator hydraulic pressure directly to the wheel brakes, locking the wheels. With the selector valve in this position, if the hydraulic handpump is actuated, pressure will be applied directly to the wheel brakes.

Note

Pull the brake selector handle AFT with a clockwise motion. Pulling the handle AFT with a slight counterclockwise movement may cause the handle to bind and prevent brake actuation.

CAUTION

- If the brakes are overheated by prolonged or repeated braking, application of the emergency/park brakes may fuse the brakes and lock the wheels.
- When releasing the emergency/parking brake, ensure that the brake selector handle does not bind and remains vertical after positioning the handle in by applying counterclockwise motion. Failure to do so may prevent complete relief of parking brake pressure, resulting in dragging brakes. Taxi shall not be attempted if the handle binds or rotates clockwise from the vertical position.

WHEEL BRAKE CONTROLS AND INDICATOR

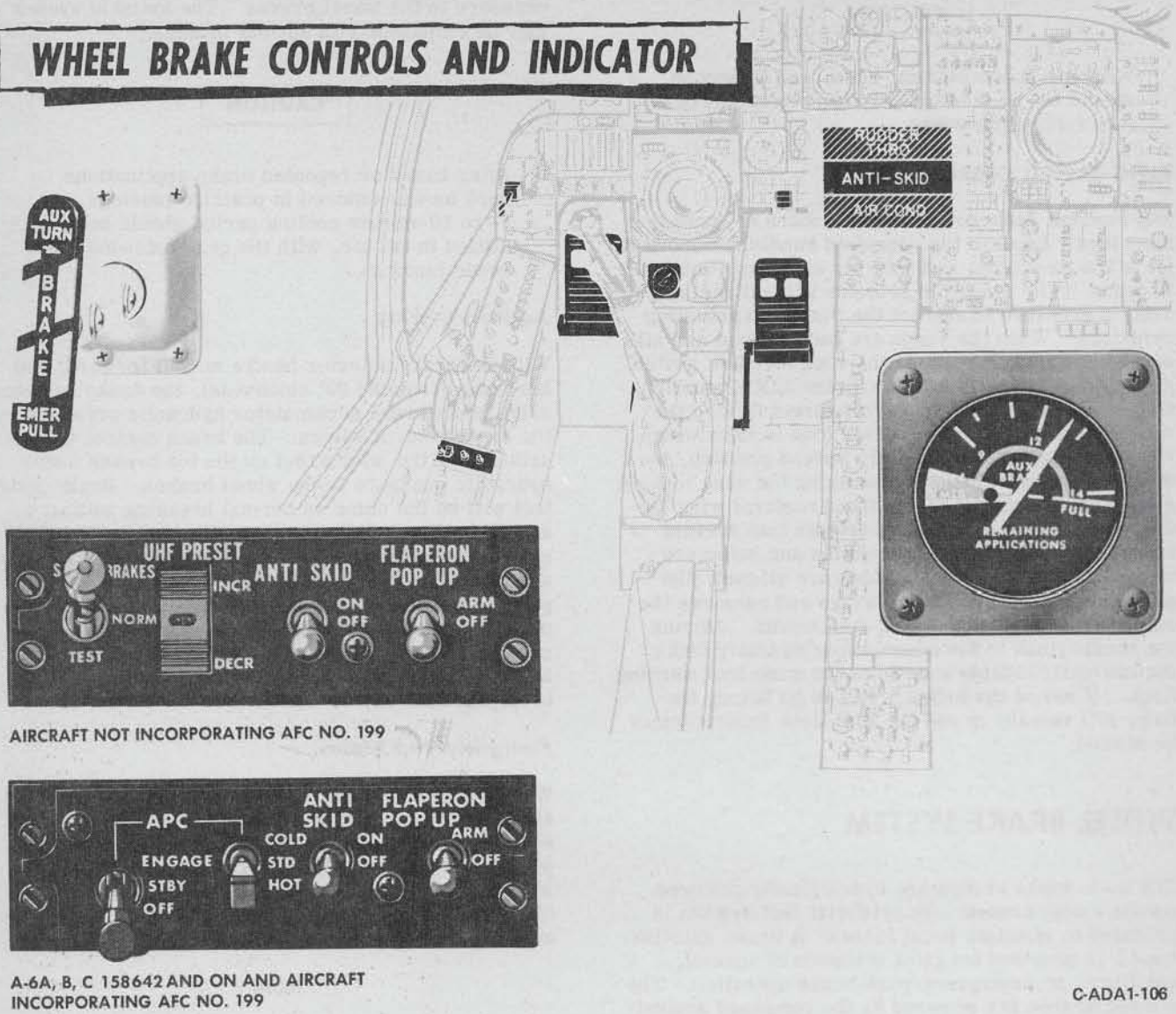

Figure 1-20

Brake Cycles Gage

The brake cycles gage on the main instrument panel (figure 1-20) is a direct-reading pressure gage connected to the brake accumulator. The scale is calibrated in number of brake cycles (applications) remaining. The red area below 4, marked EMER, is reserved exclusively by a priority valve for emergency/park brake operation and is not available for auxiliary brake operation.

Note

The number of brake cycles indicated on the gage is an approximation. When auxiliary brakes are selected, avoid pumping brakes, as each reduction in brake pressure depletes the accumulator. A smooth application of the brakes with constantly increasing pedal pressure will result in optimum braking.

ANTI SKID SYSTEM

The antiskid system used in conjunction with the normal brake system increases high-speed braking efficiency. The system, through the right weight-on-wheels switch, prevents landing with brakes locked and permits application of full brake pedal force before touchdown for obtaining minimum stopping distances. The possibility of tire blowout is minimized and tire life and wheel balance is prolonged.

Note

Normal braking is not available with antiskid selected until the right weight-on-wheels switch is actuated.

The system is selected by a pilot-operated toggle switch and powered by the primary 28 V dc bus.

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The major components are skid detectors in each wheel axle, an antiskid control box, and an antiskid control valve between each brake control valve and its respective wheel brake. The skid detectors sense wheel rotation speed and send proportional signals to the antiskid control box. An incipient skid is detected as a difference in wheel rpm. Under this condition, the antiskid valve for the slow-turning wheel relieves hydraulic pressure permitting the wheel to rotate freely; then the pressure is reapplied over a short time interval (approximately 2 seconds). A locked wheel is detected when one wheel is not turning, and the other is turning above 150 rpm (approximately 11 knots). Under this condition, the brake pressure to the locked wheel is released, then reapplied at a slightly power pressure. If a brake release signal exceeds 3.5 seconds, the antiskid system will become inoperative and the antiskid light in the cockpit will come on.

ANTI-SKID Switch

The ANTISKID switch (figure 1-20) is a two-position toggle switch with positions placarded ON and OFF. The ON position provides primary 28 V dc power to energize the system provided the brake selector handle is in the NORMAL position. The OFF position deenergizes the system. If the ANTISKID light comes on, the system may be energized again by cycling the switch to OFF, then ON.

Note

- Antiskid is available only when normal brakes are selected.
- Antiskid does not operate below 11 knots.
- Antiskid is inoperative when the ANTISKID light is lit.
- Erratic antiskid brake operation may indicate overheated brakes and impending brake lock.
- Use antiskid for normal takeoff and landings only. For taxiing, the antiskid switch should be OFF.

ANTI-SKID Light

The ANTI-SKID light on the annunciator panel (figure 1-20) displays ANTI-SKID and is powered by the essential 28 V dc bus through the CAUTION LTS circuit breaker on the main circuit breaker panel. Lighting of the light indicates that the antiskid system is inoperative as a result of a brake release signal exceeding 3.5 seconds, the brake selector handle being out or rotated, the antiskid toggle switch being off, or a failure of the antiskid system.

ARRESTING-HOOK SYSTEM

The arresting-hook system provides carrier landing capability and arrested landing capability on runways equipped with arresting gear. It may also be used for aborted takeoff on suitably equipped runways. The hook is released from the up position by a cable operated up-hook release. A fail-safe feature automatically releases the hook if the release cable parts. When released, the hook is extended to the trail position by dashpot pressure assisted by gravity. The dashpot also dampens hook bounce and acts as a shock absorber during cable engagement. The system incorporates hook retraction ability and a hook transition indicator light.

Note

When the arresting hook is extended, the nosewheel steering system is armed and will engage on landing when the main gear weight-on-wheels switches are actuated.

HOOK-RELEASE HANDLE

The hook-release handle on the pilot's instrument panel (figure FO-2 Sheet 1, 2 and 3) is marked ARG HOOK PULL and is shaped to be grasped by the fingers from the bottom. Pulling the handle aft pulls a cable that releases the hook uplock. (The aft position of the handle also disarms the hook lift switch circuit.) The hook is extended by dashpot pressure assisted by gravity. When the handle is released, it is reset by spring action and the hook-lift switch is rearmed.

There is no emergency operation of the arresting-hook system as such, but a fail-safe feature automatically releases the hook if the hook-release cable snaps. To stow the hook when the automatic release feature is actuated, pressurize the combined secondary hydraulic system and momentarily depress the hook-lift button. By cycling the hook to the stowed position, hydraulic pressure will be maintained to the lift cylinder until the hook-release handle is pulled or power is taken off the aircraft. The hook-release handle must be in its normal flight position before the hook can be retracted. A switch in the release handle closes a circuit to the hook-lift button when the release handle is stowed. Normal operation of the indicating circuits is not affected by a failure of the release cable.

HOOK-LIFT BUTTON

The hook-lift button on the pilot's instrument panel (figure FO-2 Sheets 1, 2 and 3) is placarded HOOK LIFT and incorporates an integral hook transition light. Depressing the button momentarily when the hook is extended energizes a solenoid valve that ports combined secondary hydraulic pressure to the arresting-hook lift cylinder, which retracts the hook. Electric power is provided by the essential 28 V dc bus through the GEAR/HOOK circuit breaker on the main circuit breaker panel. A holding relay keeps the valve energized until the hook-down switch, located behind the hook-release handle, is deenergized during the first 1/8-inch of handle travel. NEW

CAUTION

Do not depress the HOOK LIFT button while the hook is engaged in the arresting gear. Doing so may break the hook bumper cable.

Note

A short-circuit condition in the hook-lift circuitry can result in a continuous hook-lift signal to the solenoid controlling the hook-lift cylinder. As long as the hydraulic system isolation valve switch is in the flight position, hydraulic pressure is not available to the hook-lift cylinder, and the hook will lower normally. However, when the isolation valve switch is moved to the landing position by lowering the landing gear or placing the switch to the landing position, the arresting hook will raise since hydraulic pressure is now available to the hook-lift cylinder. The arresting hook can be lowered by pulling the gear/hook circuit breaker on the center console circuit breaker panel and then pulling the hook-release handle. This procedure does not affect hydraulic pressure to the landing gear after the gear is ascertained to be down and locked. Under these conditions, the approach lights and angle-of-attack indexer will flash. Positioning the hook bypass switch to the touch-and-go position will prevent a flashing approach light and indexer.

Hook Transition Light

The hook transition light is incorporated in the hook-lift button (figure FO-2 Sheets 1, 2 and 3) and powered by the primary 28 V dc bus through the CKPT ADV LTS circuit breaker on the nosewheel circuit breaker panel. The light comes on during hook transition on both extension and retraction.

HOOK BYPASS SWITCH

The HOOK BYPASS switch on the pilot's left console (figure FO-2 Sheets 1, 2 and 3) is a three-position toggle switch with position placarded TOUCH-GO, ARREST, and TEST. The TOUCH-GO position, used for non-arrested landings, bypasses the flashing feature of the approach lights and indexer when the aircraft is in a landing configuration with the hook retracted. The ARREST position, used for arrested landings, arms the flashing feature of the approach lights and indexer for appropriate operation when a landing configuration is established. The flashing will continue until the hook is released. The TEST position tests the flashing circuit of the approach lights and indexer.

Dashpot Pressure Gage

The dashpot pressure on the left side of the aft fuselage is a direct-reading gage that presents the pneumatic pressure in the hook dashpot. The gage is divided into three increments; low, normal, and high. Normal preflight indication, with hook up, should be in the normal range. NEW

FLIGHT INSTRUMENTS AND INDICATOR LIGHTS

ANGLE-OF-ATTACK SYSTEM

The angle-of-attack system (figure 1-21) measures the angle between the longitudinal axis of the aircraft and the relative wind. A sensor on the right side of the fuselage forward of the wings consist of a probe that lines up with the airstream, and a potentiometer pickoff that converts the position of the probe to electrical signals. The signals are compared to a rebalance potentiometer and the error signal is used to drive a servomotor in the angle-of-attack instrument. The servomotor drives the instrument pointer and rotates a series of cam-actuated switches that control the visual presentations of angle-of-attack and approach indexer to the pilot and the approach light to the LSO. Sensor heat for icing conditions is controlled by the pitot heat switch in the cockpit.

ANGLE-OF-ATTACK INDICATOR

The angle-of-attack indicator is on the upper left side of the pilot's instrument panel (figure 1-21). The pointer is driven by a servomotor and rotates over a card graduated from 0 to 30 units. Optimum angle-of-attack for landing approach is marked by a light area of the 3-o'clock position on the instrument. The units do not reflect angle-of-attack in degrees. A readout window on the instrument face will indicate OFF if there is no power to the servomotors.

APPROACH LIGHTS

The approach lights are controlled by switches actuated by the angle-of-attack indicator cam, and give qualitative information on angle-of-attack to the LSO. The lights are on the forward nose wheel door, and are green (high angle-of-attack), amber (optimum angle-of-attack), and red (low angle-of-attack).

During an arrested landing, with the hook bypass switch in ARREST, the approach light will flash when the arresting hook is not in trail and the landing gear is down and locked.

APPROACH INDEXER

The cam-operated switches in the angle-of-attack indicator also control the approach indexer left of the pilot's windscreen (figure 1-21). In aircraft incorporating AFC No. 230, a second indexer is attached to the ACLS course indicator (ID-351). NEW Three lamps glow red through apertures on the face of the indexer, giving approach information. The upper arrow is for high angle-of-attack, the lower arrow for low angle-of-attack, and the circle is for optimum angle-of-attack. When both an arrow and circle appear, an intermediate position is indicated. During an arrested landing, with the hook bypass switch in ARREST, the approach indexer will flash

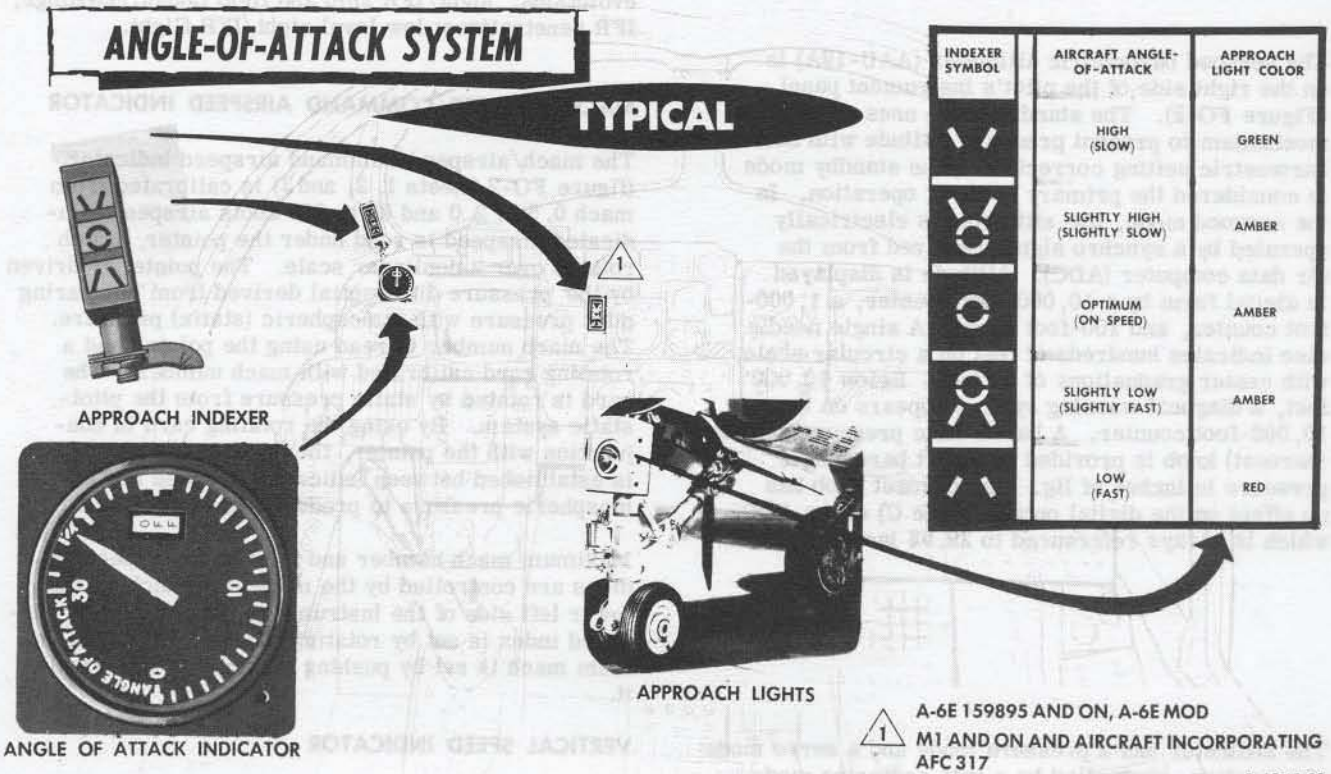

Figure 1-21

when the arresting hook is not in trail and the gear is extended. To ensure that the approach index lights are operating, depress the lights warning button on the master test panel. Intensity of the approach indexer lights is adjustable using the thumbwheel on the master lights panel.

Note

The approach lights and approach indexer are disabled until all gear are down and locked.

PITOT-STATIC SYSTEM

The pitot-static boom is on the vertical stabilizer. Pitot pressure is impact air pressure developed as the result of the relative wind velocity and is measured at the opening in the forward end of the sensor. Static pressure, which is a function of altitude and temperature, is measured through a series of small openings on the side of the sensor. Pitot pressure is used in the air data computer and the mach airspeed/command/airspeed indicator. Static pressure is used in the air data computer, servoed barometric altimeter, mach/airspeed/command airspeed indicator, and vertical velocity indicator. To prevent or eliminate icing, the pitot-static sensor is electricall heated.

Note

- In A-6E 159895 and ON and A-6E Mod M121 and ON, the air data computer receivers power only if the MA-1/ADC switch on the cabin dump panel is at ON.
- In A-6E incorporating AFC 391, the CNI MASTER switch must be in other than the OFF position for the ADC to operate.

PITOT HEAT SWITCH

The pitot heat switch, on the air-conditioning control panel (figure 1-33), is a two-position switch marked ON and OFF. Placing the switch ON allows the electrical power to be supplied from the 28 V dc primary bus to a conventional heater in the pitot tube. It also allows, through the left weight-on-wheels switch, heat to be provided to the angle-of-attack probe, and the total-temperature probe.

SERVOED BAROMETRIC ALTIMETER

The servoed barometric altimeter (AAU-19A) is on the right side of the pilot's instrument panel (Figure FO-2). The standby mode uses an aneroid mechanism to present pressure altitude with normal barometric setting correction. The standby mode is considered the primary mode of operation. In the servoed mode, the altimeter is electrically operated by a synchro signal received from the air data computer (ADC). Altitude is displayed in digital form by a 10,000-foot counter, a 1,000-foot counter, and 100-foot drum. A single needle also indicates hundreds of feet on a circular scale, with center graduations of 50 feet. Below 10,000 feet, a diagonal warning symbol appears on the 10,000-foot counter. A barometric pressure setting (baroset) knob is provided to insert barometric pressure in inches of Hg. The baroset knob has no effect on the digital output (Mode C) of the ADC, which is always referenced to 29.92 inches Hg.

The altimeter has a pressure mode and a servo mode of operation, controlled by a self-centering mode switch placarded STBY and RESET respectively. In the pressure mode of operation, the altimeter displays altitude directly from the static system (uncorrected for position error) and operates as a standard pressure altimeter. In the servo mode, the altimeter displays altitude, corrected for position error, from the synchro output of the ADC altitude module. A dc-powered internal vibrator is automatically energized while in the STBY mode to minimize errors due to friction in the display mechanism.

The servo mode of AAU-19A operation is selected by placing the mode switch to RESET for 1 to 3 seconds, with ac power on. During STBY operation, a red STBY flag appears on the dial face. The altimeter will automatically switch to STBY operation when there is an electrical interuption longer than 3 seconds, an electrical failure in the altimeter or ADC, or significant differences exist between indicated and actual altitude. The altimeter automatically switches to STBY to protect system components and this should not be construed or relied upon as a fail-safe feature. The STBY mode of operation may be selected manually by placing the mode switch in STBY. During STBY operation, it is possible for the transponder to continue to transmit altitude information (corrected for position error) on Mode C, while the altimeter is displaying altitude uncorrected for position error.

The altimeter should agree within ±75 feet of field elevation in both modes, and the servoed and standby reading shall agree within ±75 feet. In addition, the allowable difference between servoed mode reading of two AAU-19 altimeters is 75 feet at all altitudes.

The standby modes should be used for critical flight evolutions: night/IFR ship and field takeoff/landings; IFR penetrations; low level night/IFR flight.

MACH/AIRSPEED/COMMAND AIRSPEED INDICATOR

The mach/airspeed/command airspeed indicator (figure FO-2 Sheets 1, 2, and 3) is calibrated from mach 0.5 to 2.0 and 80 to 650 knots airspeed. Indicated airspeed is read under the pointer, which rotates over a nonlinear scale. The pointer is driven by the pressure differential derived from comparing pitot pressure with atmospheric (static) pressure. The mach number is read using the pointer and a rotating card calibrated with mach number. The card is rotated by static pressure from the pitot-static system. By using the rotating card in conjunction with the pointer, the necessary relationship is established between indicated airspeed and atmospheric pressure to produce a mach number.

Maximum mach number and minimum airspeed indices are controlled by the mach limit knob on the lower left side of the instrument. The minimum airspeed index is set by rotating the knob and the maximum mach is set by pushing the knob in and rotating it.

VERTICAL SPEED INDICATOR

A standard vertical velocity indicator (figure FO-2 Sheets 1, 2, and 3) is mounted on the right side of the pilot's instrument panel. The instrument operates on a pressure differential. Static pressure from the pitot system enters the diaphragm inside the instrument case. The instrument case itself contains static air, which passes through a restriction. Because of the restrictor, change in altitude causes the air pressure in the diaphragm to increase or decrease more rapidly than air pressure in the instrument case. The resulting difference in pressure is converted to a vertical velocity and is displayed as feet per minute up or down on the instrument face. The needle is damped to minimize oscillation and is mechanically stopped at the extreme travel limits. The range of the instrument is from 0 to 6,000 feet per minute up or down, with the first 1,000 feet graduated in 100-foot increments and the remainder in 500-foot increments.

RADAR ALTIMETER SYSTEM

Note

In A-6E 158041 thru 158792, and MOD M 1 thru M 12, the AN/APN-141 radar altimeter is installed. A-6E 158792 and ON, and MOD M 13 and subsequent have provisions for incorporation of either the AN/APN-141 or the AN/APN-194 radar altimeter.

The radar altimeter is a low-altitude, pulsed, range-tracking radar that measures the surface or terrain

clearance below the aircraft. Altitude information is developed by radiating a short-duration rf pulse from the transmit antenna to the earth's surface, and measuring the time interval until rf energy returns through the receiver antenna and is detected in the receiver. The altitude information is continuously presented to the pilot, in feet of altitude, on the dial of an indicator (figure 1-22).

The radar altimeter has two modes of operation. In the search mode, the system successively examines increments of range until the complete altitude range is searched for a return signal. When a return signal is detected, the system switches to the track mode and tracks the return signal, giving continuous altitude information. When the radar altimeter drops out of the track mode of operation, the OFF flag appears and the indicator will drop behind a mask at the base of the instrument. The altimeter remains inoperative until a reliable signal is received from the receiver-transmitter, at which time the altimeter will again indicate the actual altitude above the terrain.

Reliable system operation in the altitude range of 10 to 5,000 feet for the APN-141 and 0 to 5,000 feet for the APN-194 permits close altitude control at minimum altitudes. The system is inoperative in banks of more than 30°, in climbs or dives of more than 50° and when the reflected signal is otherwise too weak.

The system includes the height indicator and warning light (figure 1-22) mounted on the pilot's instrument panel, a low-altitude aural warning tone (LAWS), the radar receiver-transmitter installed on the rudder actuator access door, and two antennas (transmit and receive) mounted in the rudder actuator access door and in the aircraft skin just forward of the same access door.

RADAR ALTIMETER HEIGHT INDICATOR

This indicator is on the pilot's instrument panel (figure 1-22) and contains the only operating control in the system. The indicator displays radar altitude above the earth's surface on a single-turn dial that is calibrated from 0 to 5,000 feet in increasing increments. This permits greater definition at lower altitudes.

POWER/SELF-TEST/POSITIONING CONTROL

This control is located in the lower left corner of the indicator. This control is a combination power switch, self-test switch, and positioning control for the low-altitude limit index (limit bug). The adjustable limit index outside the calibrated scale can be preset to a desired altitude and used as reference for flying at fixed altitudes. By depressing and holding the indicator control knob in flight, the self-test circuit is energized and the indicator will read 5±5 feet on the APN-141 and 100±10 feet on the APN-194 radar altimeter. During self-test, the green light on the face of the APN-194 will also light. Normal operation is resumed by releasing the control knob.

OFF Flag

The OFF flag in the middle of the indicator is actuated either electronically or mechanically. It is energized electronically when the altitude signal becomes unreliable and exceeds a threshold voltage. Mechanical actuation of the OFF flag is accomplished when the altitude pointer rotates beyond 5,000 feet and actuates the OFF flag switch (figure 1-22).

LOW-ALTITUDE WARNING SYSTEM (LAWS)

The low-altitude warning system provides a low-altitude warning light and low-altitude aural alarm tone available to the pilot. The system is activated when the aircraft descends below the height set on the limit index of the height indicator, and should be used as an aid to search radar terrain clearance.

In addition, an aural tone and a radar altimeter failure light provide warning of radar altimeter unreliability.

Note

In order for the B/N to hear the aural tone, the pilot must select ALT 1 on his ICS control panel.

Low-Altitude Aural Warning

The low-altitude aural warning alarm provides a 2-second tone through the pilot's headset and the B/N's headset if the pilot has ALT 1 selected on his ICS control panel. The tone is audible if the aircraft descends below the height set on the limit index of the height indicator.

The low-altitude signal alternates between 700 and 1700 Hz at a 2-Hz rate while the unreliable signal alternates between 700 and 1700 Hz at an 8 Hz rate. The volume of the tone must be set prior to flight, since there is no external control that can be adjusted during flight.

Low-Altitude Warning Lamp

The red low-altitude warning lamp is below the radar altimeter. The low-altitude warning lamp will light whenever the aircraft altitude falls below the pilot's preset limit indexer.

Radar Altimeter Failure Light

A radar altimeter failure light glows RA in black letters on a red background in the lower half of the vertical bar on the right side of VDI. When the output of the radar altimeter is less than 1 volt (20 feet) or greater than 26.5 volts (5000 feet) the light will be lit. Circuitry may be tested by depressing the LTS WARN button on the master test panel.

LAWS PREFLIGHT CHECK

1. The intercommunications set must be on and operating for the signals to be heard through the pilot's headset.

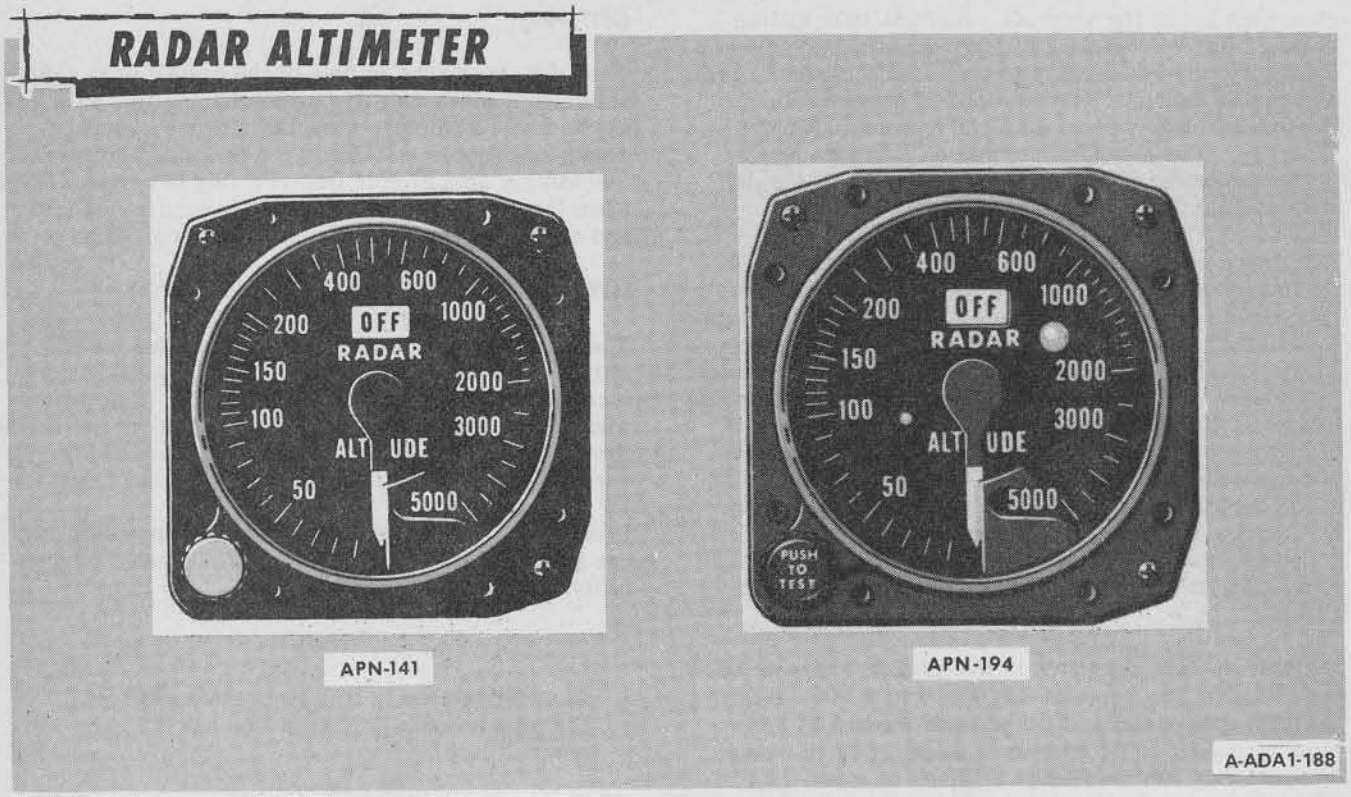

Figure 1-22

2. Turn the radar altimeter on and set the altitude limit index at 25 feet. On initial turn-on, the OFF flag appears and the pointer moves behind the mask. Check that the radar altimeter failure light (RA) is on and the radar altitude curtain on the VDI is not in view.

3. After warmup (1 to 5 minutes) the OFF flag disappears and the pointer moves from behind the mask to an altitude between 0 and 10 feet. As the pointer passes the preset limit index altitude, the low-altitude signal is heard in the pilot's headset and the low-altitude warning light comes on. At this time, the radar altimeter failure light comes on and the altitude curtain disappears.

ATTITUDE INSTRUMENTS

VERTICAL DISPLAY INDICATOR (VDI)

The vertical display indicator (VDI), referred to as the ADI in the A-6C (analog display indicator or attitude directional indicator) is the primary attitude reference indicator. The display (contact analog) is a television-like picture of artifically generated ground and sky texture which meet to form the reference horizon. A video bank angle marker with a fixed index mark, fixed pitch attitude markers, and movable video pitch trim markers are provided. The viewing area is approximately 30° in elevation and 50° in azimuth and simulates the view through the front cockpit window, enabling the pilot to fly the aircraft during all visibility conditions. Additional symbology provided on the contact analog display and the terrain avoidance display (A-6A, B, C, and A-6E) are described in Section VIII.

VERTICAL DISPLAY CONTROL

The vertical display control panel (figure 1-23) on the pilot's left console (KA-6D) contains all the controls for operation of the vertical display indicator. In the A-6A, B, C, and A-6E the controls are located on the pilot's control panel on the pilot's instrument panel. Additional controls on the pilot's control panel are described in Section VIII.

Brightness/Contrast Controls

The BRIGHTNESS/CONTRAST controls are used to vary the brightness and contrast of the display. The BRIGHTNESS knob controls the overall brightness of the display. The CONTRAST knob controls the relative video contrast of the greys and blacks on the display scope.

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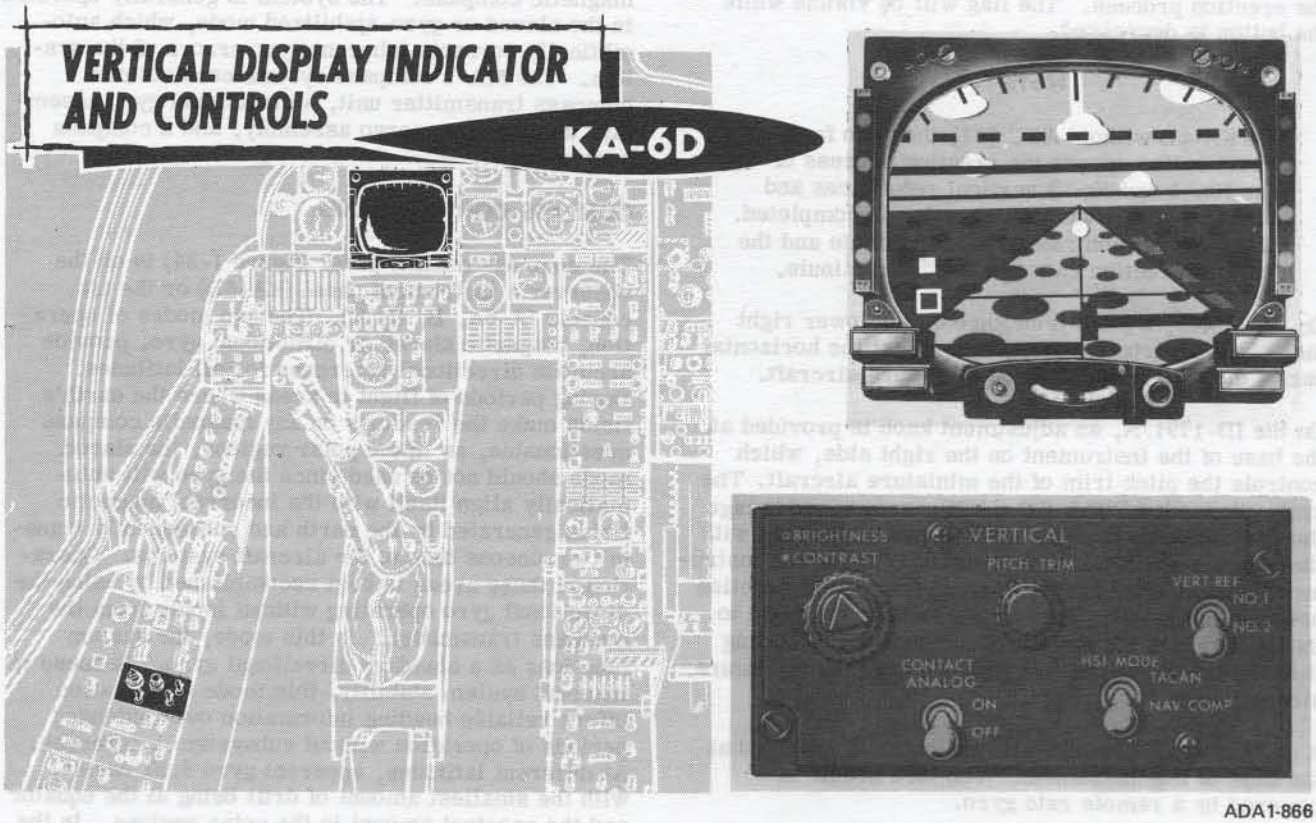

Figure 1-23

Pitch Trim Knob

The PITCH TRIM knob controls the vertical position of the elevation cursors.

Display Selector Buttons (A-6A,B,C,E)

The DISPLAY selector buttons allow a choice of contact analog (CONT ANALOG) and search radar terrain clearance (TC) displays. The standby button (STBY) keeps the vertical display in readiness for a mode selection. The TC CAL button selects the terrain clearance calibration display. With the OFF position selected, no power is supplied to a vertical display system.

Contact Analog Switch (KA-6D)

The contact analog switch is a two-position toggle switch marked ON and OFF. Placing the switch to ON presents the contact analog display on the VDI.

VERT REF Selector (KA-6D)

The VERT REF selector is a two-position toggle switch marked No. 1 and No. 2. The No. 1 position selects No. 1 vertical reference for the VGI and No. 2 vertical reference for the ADI. The No. 2 position selects No. 2 vertical reference for the VGI and No. 1 vertical reference for the ADI.

HSI Mode Switch (KA-6D)

The HSI mode switch is a two-position toggle switch marked TACAN and NAV COMP. The TACAN position displays range and bearing information to the selected TACAN station on the HSI. The NAV COMP position displays range and bearing information to the selected station (D_1 or D_2) on the HSI.

VERTICAL GYRO INDICATOR (VGI)

The VGI MM-3 (figure FO-2 sheets 1, 2, and 3) or ID-1791/A (figure FO-3 sheet 4) indicates to the pilot the flight attitude of the aircraft. Pitch and roll indications are displayed by a sphere in relation to a fixed minature aircraft symbol. The sphere is light-colored above the artificial horizon bar, black below the bar, and is marked in 5° pitch increments in both directions, beginning at the horizon bar. Roll indications are given by a marker that moves around the periphery of the sphere. The marker moves across a linear scale that is graduated in 10° increments to 30° and then in 30° increments to 90°.

The sphere is positioned by servomechanisms that receive signals from a remote, independent gyro reference. Rolls through 360° are possible without tumbling the gyro. The gyro will flip 180° at 90° of pitch from straight and level flight, but will return to normal after passing through the extreme pitch angles. A warning flag will appear whenever there is no power to the indicator, and will remain displayed for approximately 1 minute (MM-3) or 30 seconds (ID-1791/A) after initial power is applied. The flag does not indicate the condition of the instrument. On the MM-3, a gyro fast-erect button (figure FO-2) to the lower left of the instrument speeds up

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the erection process. The flag will be visible while the button is depressed.

Note

On KA-6D without AFC 161, the gyro fast-erect button speeds the erection process of the No. 1 and No. 2 vertical references and must be held down until erection is completed. The fast erection rate is 5° per minute and the normal erection rate is 1 1/2° per minute.

On the MM-3, a pitch trim knob on the lower right face of the instrument is used to adjust the horizontal bar of the sphere to the fixed miniature aircraft.

On the ID-1791/A, an adjustment knob is provided at the base of the instrument on the right side, which controls the pitch trim of the miniature aircraft. The knob, placarded PULL TO CAGE, is also used to cage the gyroscope so that the horizon line is parallel with the wings of the miniature aircraft. Caging the instrument momentarily during warmup speeds the erection process somewhat. Turning the knob to the right to its limit raises the miniature aircraft 5°. Rotating it to the left to its limit of travel moves the miniature aircraft down 10°.

A conventional turn-and-slip indicator is provided at the base of the instrument. The turn needle is powered by a remote rate gyro.

The glide slope and azimuth pointers of the ID-1791/A are activated when the ON/OFF/AUX ON switch and the TEST/NORM/AJ switch on the data link control panel are turned respectively to ON and NORM and the shipboard AN/SPN-42 Radar is locked on. At all other times, the pointers are driven out of view behind masks at the bottom and right side of the instrument.

A test pushbutton is at the base of the instrument. Depressing the pushbutton causes the turn needle to indicate a double-needle-width turn and drives the cross pointers into view to show zero azimuth and glide slope error.

TURN-AND-SLIP INDICATOR MD-1

The turn and slip indicator (figure FO-2 Sheets 1, 2, and 3) gives the pilot information on the rate of turn of the aircraft around its vertical axis and the turn coordination. The driving mechanism for the pointer is a permanent-magnet type, dc, governor-controlled gyro motor. A needle-width deflection of the pointer will produce a 360° turn in 4 minutes. Pointer motion is damped by an air dashpot and is deflected in the direction of the turn. The inclinometer portion of the instrument contains damping fluid and a ball that moves from center in an uncoordinated turn.

COMPASS SYSTEM MA-1

The MA-1 compass system may be used as a directional gyro corrected for apparent drift due to the earth's rotation, or as a directional, gyro-stabilized, magnetic compass. The system is generally operated in the slaved or gyro-stabilized mode, which automatically corrects inherent gyro errors of the system. The MA-1 compass system consists of a compass transmitter unit, a directional gyro assembly, an amplifier servo assembly, and a compass control panel.

COMPASS CONTROL PANEL

The compass control panel (figure 1-24) is on the observer's instrument panel (KA-6D) or the aft console (A-6A, B, C, E). The two modes of operation, magnetic slaved or directional gyro, provide accurate directional reference for all latitudes. During periods of flight in areas where the earth's fields make the readings on any magnetic compass questionable, as in the polar regions, the slaved mode should not be used since the gyro will automatically align itself with the incorrect magnetic fields generated by the earth and subsequently transmit erroneous data to the aircraft systems. Operation in these areas is best accomplished by using the directional gyro operating without inputs from the compass transmitter. In this mode, the system functions as a standard directional gyro. Beacuse of inherent system stability, this mode of operation offers reliable heading information over extended periods of operation without subsystem references. At different latitudes, apparent gyro drift varies, with the smallest amount of drift being at the equator and the greatest amount in the polar regions. In the directional gyro mode, with the proper latitude selection made on the control panel, the gyro is made to precess at a rate required to overcome gyro drift at the selected latitude.

The compass system is actuated by power being applied to the essential bus. A power failure indication or a hold indication in the form of a red flag labeled OFF is displayed in the control panel synchronizer window above the selected switch. During normal operation, this flag will disappear 10 seconds after application of power. After 3 minutes warmup, the selector switch should be positioned to the mode of operation required to accomplish the mission.

Note

- In A-6A, B, C, and KA-6D aircraft incorporating AFC 253, when ground power is applied, the MA-1 compass is disabled until one of the following occurs:
  1. At least one aircraft generator is on the line
  2. The MA-1 switch on the AC/DC relay panel is activated.
- On A-6E 158795 thru 159579; MOD M21 thru M120 and aircraft incorporating AFC 269 or AFC 391, the CNI MASTER switch must be in other than the OFF position for MA-1 compass system operation.
- On A-6E 159895 and ON and MOD M121 and ON, the MA-1/ADC switch must be at ON to operate the MA-1 compass system.

Compass Selector Switch

This three-position rotary switch on the compass panel has positions for FREE S LAT, SLAVED, and FREE N LAT. In the SLAVED positions, the compass is supplied with inputs from the compass transmitter, relative to the earth's magnetic field. In the FREE S LAT and FREE N LAT positions, the information supplied by the compass transmitter is considered unreliable and the system operates as a directional gyro precessing at a rate required to compensate earth's normal rotation.

Pull-To-Set Control

This control permits realignment of the radio-magnetic indicator unit. The spring-loaded control is pulled out and rotated until the desired heading appears under the indicator cursor.

Note

During reset operation, the autopilot will be automatically disconnected while this knob is pulled out, permitting normal aircraft operation when introducing heading change information.

Figure 1-24

Latitude Select Control

The latitude selector knob marked SET TO LAT on the compass control panel is used to rotate a circular dial at the base of the knob. The dial is numbered from 0° to 90° of latitude. The latitude selector control is operative in the FREE N LAT and FREE S LAT selector switch positions only, and is used to select the latitude in which the aircraft is operating.

Synchronizer Window

This indicator is on the compass control panel and affords readout indications as to system operation. During periods of system power malfunction, warm-up, and shutdown, a red flag appears in the window to denote that the system is inoperative. During normal operation, the red flag is retracted and a white bar aligns itself with the fixed arrow marker above the indicator window. Positioning of the bar under the arrow indicates satisfactory system alignment only during the SLAVED mode operation.

COMPASS SYSTEM OPERATION

Gyro Operation (SLAVED)

1. Selector switch - SLAVED (requires 3 munutes warmup).
2. Pull-to-set knob - OUT
   Rotate control until approximate magnetic heading of aircraft is under radiomagnetic indicator cursor.
3. Pull-to-set knob - RELEASE
   When pull-to-set knob is released, indicator should align itself with exact magnetic heading of aircraft. A visual indication of system alignment is given when white bar is below arrow on indicator window. Oscillation of white bar during slaved mode is a normal condition and indicates satisfactory operation of system.

Note

There are two null positions of the knob 180° apart. An indication of the correct null position is movement of the white bar in the same direction that the knob is turned.

Gyro Operation (UNSLAVED)

1. Selector switch - FREE N LAT or FREE S LAT as required.
2. Pull-to-set knob - OUT
   Rotate control until desired heading of aircraft is set under cursor of radio-magnetic indicator.

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3. Latitude selector control - ADJUST
   Set this control to reflect degrees latitude at which aircraft will be flying. This affords automatic compensation for apparent drift of gyro due to earth's rotation.

Note

During free gyro operation, the synchronizer indicator window has no significance. If free gyro operation must be used for extended periods, reset the gyro whenever an accurate heading reference can be determined.

HORIZONTAL SITUATION INDICATOR

The horizontal situation indicator (HSI) (figure 1-25), on the pilot's instrument panel, provides range and bearing information, and course deviation. TACAN bearing (azimuth) information is provided by the small needle head (bug) that moves around the perimeter of the compass card. The HSI needles are identified by the difference in shape: the TACAN needle is a solid triangular indicator; the UHF needle is a broken triangular indicator. When the command radio is in the ADF mode the UHF indicator reflects the magnetic bearing to the selected UHF transmitter. The TACAN indicator reflects the magnetic bearing to the selected TACAN station. The displacement of the UHF or TACAN needle indicates the heading of the aircraft with respect to the individual ground installation. The course bar on the HSI shows the direction of the ground site with respect to the aircraft.

With a power loss, a red OFF flag appears in the window on the face of the instrument and a mask covers the distance counter. The distance counter is also covered when the TACAN is in REC or with a loss of DME when T/R is selected. A range display in the upper left corner shows the number of nautical miles away from the station. When the radio signal is not readable, a mask covers the numerals. An arrow will simultaneously indicate a TO or FROM direction, depending on whether the aircraft is flying toward or away from the ground station. If the power to the azimuth ceases, the TO/FROM arrow will disappear from view. The heading set knob manually adjusts the heading marker. With the course set (CRS SET) knob, the pilot can set in the desired course. Loss of 115 V ac essential power to the TACAN will cause the red OFF flag to show in the indicator face. With air-to-air TACAN ranging selected, the TACAN bearing pointer provides no valid indications.

WARNING

The UHF/ADF (APR-48) antenna is on the under side of the starboard engine intake beneath the B/N boarding ladder. With landing gear extended, the UHF/ADF magnetic bearing indication displayed on the HSI may be up to 40° in error.

STANDBY COMPASS

A conventional standby compass is above the center of the aircraft instrument panel. It is a semifloat-type compass suspended in compass fluid. A pair of magnets attached to the compass card align with the earth's magnetic field to present magnetic heading indications. Extraneous magnetic fields are minimized by built-in permanent magnets. A compass correction card containing corrections for instrument error for various headings is found above the standby compass.

MISCELLANEOUS INSTRUMENTS

ACCELEROMETER B-6

The B-6 accelerometer (figure FO-2 Sheets 1, 2, 3, and 4) is a direct-reading instrument used to measure the accelerations of the aircraft along its vertical axis. The dial is graduated in g units from -5g to +10g. The normal reading of the instrument at rest is +1g. The instrument has three pointers. The main pointer gives a continuous indication of the vertical acceleration of the aircraft. The other two pointers stop at the maximum positive acceleration and maximum negative acceleration reached during any specific maneuver. These pointers will remain fixed until reset to +1g by depressing the knob on the lower left corner of the instrument.

G METER

The g meter (figure FO-2 Sheets 1, 2 and 3) displays the magnitude of normal accelerations in g units. A sensor unit in the left wheel well transmits potentiometer pickoff information from the position of a spring-loaded mass to a servomotor. The servomotor positions the instrument marker, which moves vertically across the instrument face. The range of the instrument is -5g to +10g.

Note

This instrument is not included in A-6E 159895 and ON and MOD M121 and ON or KA-6D with AFC 161.

CLOCKS

Two mechanical, integrally lighted 8-day clocks with 12-hour elapsed-time capability are provided. The winding and setting knob is in the lower left corner of the instrument; the elapsed-time setting knob is in the upper right. Successive depressions of the elapsed-time setting knob will start, stop, and reset the sweep second hand and elapsed-time hand to the 12-o'clock position.

OUTSIDE AIR TEMPERATURE INDICATOR

The outside air-temperature indicator (OAT) on the lower right corner of the bombardier/navigator's instrument panel has a single pointer dial calibrated in 5° increments from -50°C to +75°C. The temperature bulb aft of the right intake duct is a resistance-type sensor. The bulb and indicator are powered by the 28 V dc monitor bus through the ENG DC INST circuit breaker in the nosewheel well.

CAUTION, WARNING, AND ADVISORY LIGHTS

The caution, warning, and advisory lights (figure FO-11) include the pilot's indicator lights and the bombardier/navigator's indicator lights. Lighting of a particular light is applicable to the system and a condition associated with it. The description and function of each light is incorporated under the applicable system.

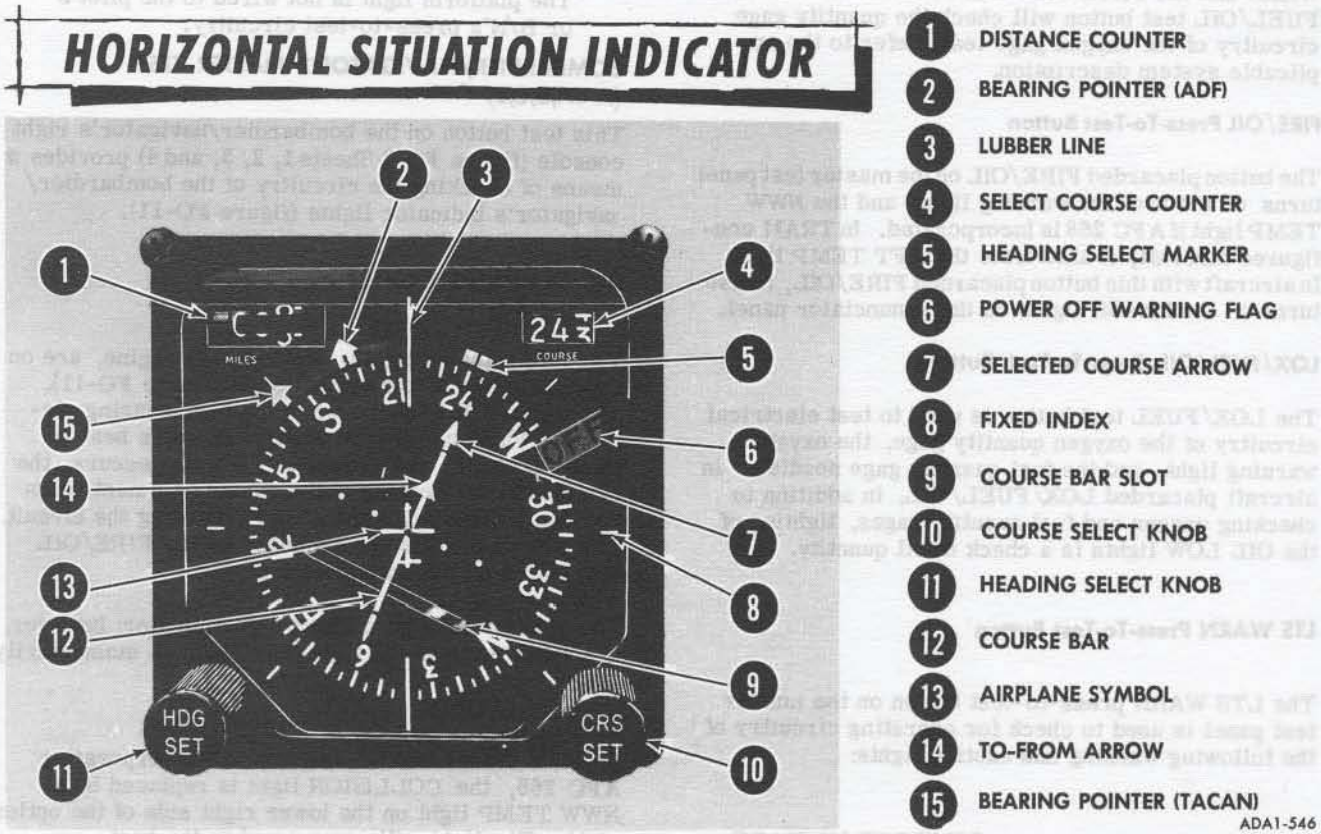

Figure 1-25

ANNUNCIATOR PANEL

The annunciator panel (figure FO-11) on the lower center portion of the pilot's instrument panel provides caution lights for the various aircraft systems. Lighting of a particular light advises of a malfunction or emphasizes a particular condition of the applicable system, and will cause the master caution lights to flash. When the master caution lights are reset, the annunciator light will remain on until the discrepancy is corrected.

The lights are powered by the essential 28 V dc bus through the CAUTION LTS circuit breaker on the main circuit breaker panel.

MASTER CAUTION LIGHT AND RESET BUTTON

The master caution light on the left of the optical sight (figure FO-2 Sheets 1, 2 and 3), and the other at the top center of the bombardier/navigator's instrument panel (figure FO-3 Sheets 1, 2, 3, and 4). will give a flashing indication whenever a caution light on the annunciator panel comes on. The master caution reset button will turn the master caution light off, and rearm the circuit for any subsequent caution lights.

CAUTION

Due to the proximity of the emergency stores jettison button, care should be exercised to prevent inadvertent stores jettisoning (figure FO-2 Sheets 1, 2, 3, and 4).

Note

In A-6E 159895 and ON and A-6E Mod M121 and ON, the master caution circuitry is reset by pressing the light.

MASTER TEST PANEL

The master test panel (figure FO-2 Sheets 1, 2, and 3) is in the center of the pilot's instrument panel adjacent to the annunciator panel, and contains three press-to-test buttons. The primary purpose of the master test panel is to check the circuitry of the

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warning and caution lights by means of the LTS WARN and the FIRE/OIL test buttons. The LOX/FUEL/OIL test button will check the quantity gage circuitry of the oxygen gage test; refer to the applicable system description.

FIRE/OIL Press-To-Test Button

The button placarded FIRE/OIL on the master test panel turns on the two fire warning lights and the NWW TEMP light if AFC 268 is incorporated. In TRAM configured aircraft, it also tests the AFT TEMP light. In aircraft with this button placarded FIRE/OIL, it also turns on the low-oil lights on the annunciator panel.

LOX/FUEL/OIL Press-To-Test Button

The LOX/FUEL test button is used to test electrical circuitry of the oxygen quantity gage, the oxygen warning light, and the fuel quantity gage needles. In aircraft placarded LOX/FUEL/OIL, in addition to checking oxygen and fuel quantity gages, lighting of the OIL LOW lights is a check of oil quantity.

LTS WARN Press-To-Test Button

The LTS WARN press-to-test button on the master test panel is used to check for operating circuitry of the following warning and caution lights:

ATTACK	DISCRETE MESSAGE INDICATOR
MASTER CAUTION	HOOK LIFT
COLLISION	OUTBD WG PSI
APPROACH INDEXER	INBD WG PSI
ANNUNCIATOR PANEL	RADAR ALTIMETER
ARM WEAPON	FAILURE
APCS STBY	TERRAIN CLEARANCE
AFCS OFF	RESELECT (A-6E)
WAVE OFF	COMPLETE (A-6E)
WHEELS WARNING	
WHEELS TRANSITION	

Note

The platform light is not wired to the pilot's or B/N's press-to-test circuitry.

BOMBARDIER/NAVIGATOR'S MASTER TEST (A-6A,B,C,E)

This test button on the bombardier/navigator's right console (figure FO-3 Sheets 1, 2, 3, and 4) provides a means of checking the circuitry of the bombardier/navigator's indicator lights (figure FO-11).

FIRE WARNING LIGHTS

Two fire warning lights, one for each engine, are on opposite sides of the optical sight (figure FO-11). The lights will come on when the heat-sensing elements, which are placed where excessive heat is likely to occur, are grounded. If a fire occurs, the semiconductor section of the sensing element heats up, decreasing resistance, and grounding the circuit. The circuit can also be grounded by the FIRE/OIL test button on the master test panel.

The system includes a short discriminator; however, if a short occurs, the light may flash on momentarily.

NWW TEMP LIGHT

In A-6E 158533 and ON and aircraft incorporating AFC 268, the COLLISION light is replaced by a NWW TEMP light on the lower right side of the optical sight. The light will come on when the heat-sensing element array placed near the bleed-air ducting in the nosewheel well and radome areas senses excessive heat. The light is tested by the FIRE/OIL press-to-test button.

COLLISION LIGHT

The collision light, located on the lower right side of the optical sight, has no operational function. AFC 268 replaces the collision light with the NWW TEMP light.

CANOPY

The aircraft canopy is operated by hydraulic pressure and can be controlled externally or from the cockpit. It can also be jettisoned or manually released from the cockpit or through external controls for crash rescue.

CANOPY OPERATION

CANOPY SELECTOR VALVE

In A-6A, B, C 149941 thru 155702 and KA-6D aircraft not incorporating AFC 185, the canopy selector valve is a two-position, detented, solenoid-operated selector valve positioned by the cockpit canopy switch, the boarding ladder switches, or the manual selector handles in the cockpit and nosewheel well. In A-6A 155703 and ON, and aircraft incorporating AFC 185, the canopy selector valve is a three-position, spring-loaded return-to-neutral, open-center, solenoid-operated selector valve positioned by the cockpit canopy switch, the boarding ladder switches, or the manual selector handles in the cockpit and nosewheel well.

When the canopy selector valve is positioned to open, hydraulic pressure from the combined system is initially directed to the canopy seal selector valve, dumping air pressure from the canopy seal so that the canopy can be opened. Pressure is then directed to the open side of the canopy actuating cylinder, opening the canopy. When the valve is positioned to close, the sequence is reversed and the canopy is closed and the seal is inflated.

When the engines are running, combined system pressure is provided by the engine-driven pumps. Otherwise, an external source of hydraulic pressure may be used, or combined system fluid can be pressurized by means of the handpump or the electrically driven auxiliary hydraulic pump.

In aircraft with the three-position selector valve, the valve must be held in the selected position manually or electromechanically until the desired action has been completed or it will return to the neutral position, releasing the pressure to the canopy actuating cylinder and stopping the action of the canopy.

CANOPY SWITCH

The CANOPY switch (figure 1-26) on the right side of the pilot's instrument panel is used for normal operation of the canopy.

AFC No. 185 Not Incorporated

In aircraft with the two-position canopy selector valve, the CANOPY switch is a two-position toggle switch marked OPEN and CLOSE. When aircraft primary dc electrical power on line, moving the switch energizes a solenoid on the canopy selector valve, positioning the valve and permitting hydraulic pressure to move the canopy to the selected position. CANOPY switch position does not affect selector valve position with external electrical power connected.

WARNING

Ensure that personnel are clear of the canopy while disconnecting external power.

Note

Before applying aircraft electrical power, the CANOPY switch should be positioned to agree with the position the canopy to prevent inadvertent canopy actuation.

AFC No. 185 Parts 1 and 3 Incorporated

In aircraft with the three-position canopy selector valve, the CANOPY switch (figure 1-26) is a three-position, spring-loaded, return-to-neutral toggle switch marked OPEN and CLOSE. With aircraft electrical power on the line, moving the switch to the desired position actuates a solenoid on the canopy selector valve, permitting hydraulic pressure to move the canopy to the selected position as long as the switch is held in the desired position. A magnetic holding feature holds the canopy switch in the close position and is activated approximately 1/2 inch prior to the canopy reaching its fully closed position. The canopy switch will remain the closed position until aircraft electrical power drops off the line or the switch is repositioned manually. With the aircraft on external power, the canopy switch must be held in either the open or close position to expect canopy action.

AFC No. 185 Part 1 Incorporated

In aircraft with AFC 185 Part 1 only incorporated, the canopy switch is a three-position, spring-loaded, return-to-neutral toggle switch marked OPEN and CLOSE. With external electrical power on the line, moving the switch to either the OPEN or CLOSE position actuates a solenoid on the canopy selector valve, permitting hydraulic pressure to move the canopy to either the OPEN or CLOSED position as long as the switch is held in that position. Release of the switch will return it to neutral and stop canopy action. On aircraft power, the switch must be held open to activate the canopy open.

WARNING

On aircraft power, the CANOPY switch is held in the CLOSE position, when selected, and the canopy will complete its travel to the CLOSE position unless the CANOPY switch is manually repositioned OFF.

Canopy Switch Caution Light

In aircraft with the three-position canopy selector valve, a light on the annunciator panel shows CANOPY SW any time aircraft primary dc electrical power is on the line and the CANOPY switch is not at CLOSE.

MANUAL CANOPY HANDLE

Two manual selector handles, one on the pilot's pedestal (figure 1-26) and one in the nosewheel well, are used to position the canopy selector valve when aircraft electrical power is not on the line. From the cockpit, pushing the handle full in moves the valve to close and pulling the handle to full out moves the valve to open

In aircraft with the two-position canopy selector valve, the electrically selected position of the valve can be overridden by the manual handle, but when aircraft electrical power is put on the line, the valve will assume the position electrically selected by the CANOPY switch.

WARNING

Actuating the manual canopy selector handle to the closed position after engine shutdown will close the canopy if engines are still windmilling. Serious injury can result from premature closing of the canopy before aircrewmen are clear of the cockpit area.

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CANOPY CONTROLS AND INDICATORS

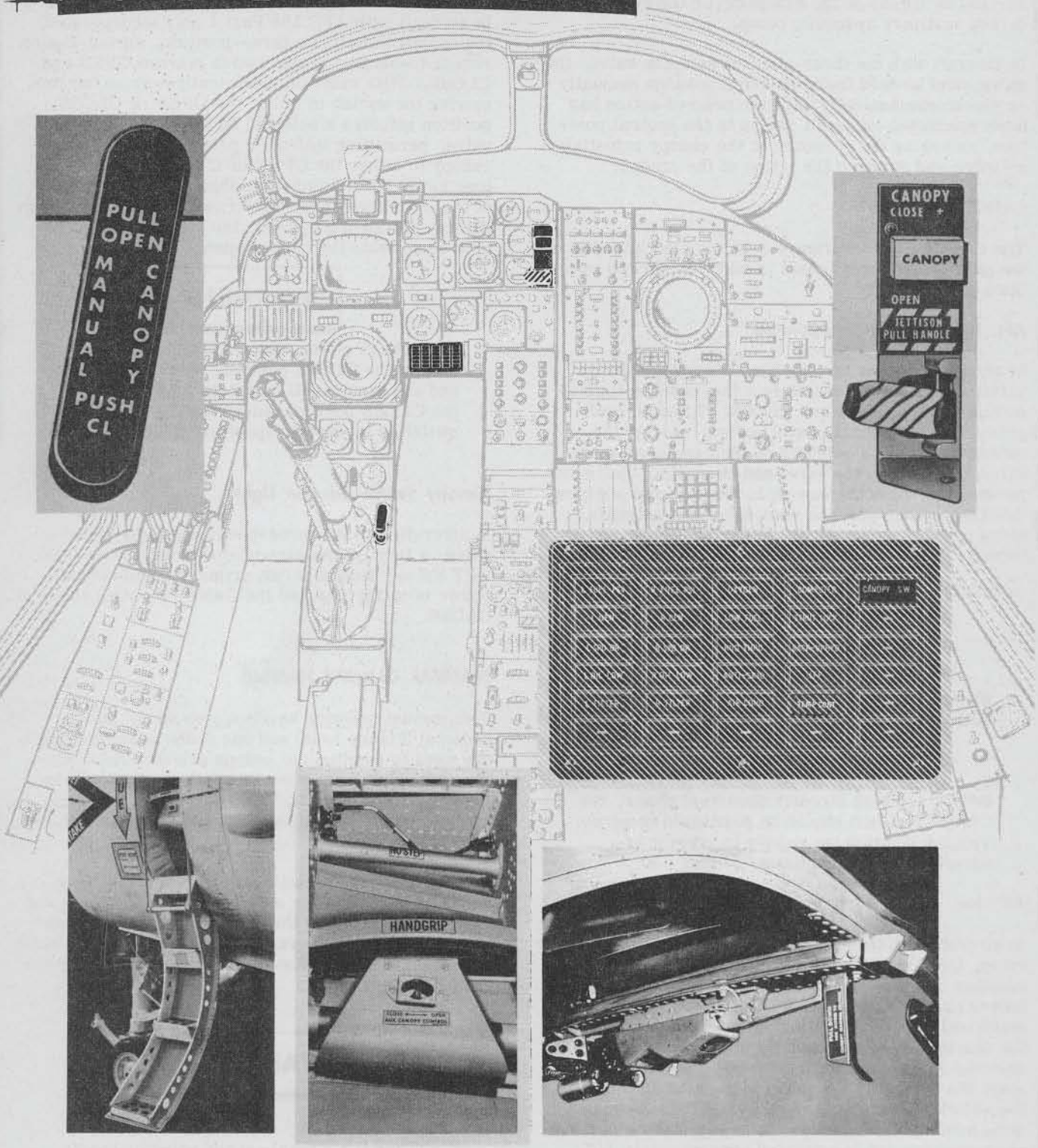

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Figure 1-26

Note

If the manual canopy selector handle is actuated while operating on aircraft electrical power, the position of the cockpit electrical switch will determine the canopy position when the handle is released.

In aircraft with the three-position canopy selector valve, the manual handle must be held in position until the canopy reaches the desired position.

BOARDING-LADDER SWITCHES

Two three-position, spring-loaded, return-to-neutral switches, one in each boarding-ladder well, are provided for external operation of the canopy. These switches are placarded AUX CANOPY CONTROL. Holding either switch in the OPEN or CLOSE position actuates the canopy selector valve and operates the electric-motor-driven pump to move the canopy to the selected position.

NEW

WARNING

Ensure canopy area is clear before actuating boarding-ladder switches.

NEW

AUXILIARY HYDRAULIC PUMPS

When the engines are secured, combined system fluid can be pressurized to operate the canopy by means of the handpump or the battery-powered electric-motor-driven pump. The canopy selector valve is positioned by the manual canopy handle or the boarding-ladder switches.

Hand Pump

Two handles, one in the nosewheel well and one in the cockpit on the left side of the center console, are used to operate the handpump, which provides combined system pressure to operate the canopy.

Electric-Motor-Driven Pump

The electric-motor-driven pump provides combined system pressure for canopy operation on the ground and is operated by a pushbutton switch in the cockpit placarded AUX HYD PUMP MOTOR, or by the boarding-ladder switches. In aircraft with the two-position canopy selector valve, the pushbutton switch is on the pilot's pedestal in the upper left corner. In aircraft with the three-position canopy selector valve, the push-button switch is on the handpump handle stop on the left side of the center console.

Note

Ensure that personnel are clear of the canopy while connecting or disconnecting external power.

CANOPY REMOVAL (MANUAL)

If the canopy seal has first been deflated, the canopy can be removed manually by pulling the manual release handle on the canopy beam (figure 1-26) (or the external T-handles on the aft end of the canopy) disconnecting the canopy from the hydraulic actuating piston. The canopy can then be slid off the tracks and removed.

The canopy seal is best deflated by cracking the canopy slightly with the hydraulic handpump or the electric-motor-driven pump. This opens the canopy seal selector valve, dumping air pressure from the seal and frees the canopy for opening.

CAUTION

Do not attempt to operate the canopy hydraulically after the manual release handle has been pulled until the actuating piston has been reconnected.

In an emergency, if the seal cannot be deflated by the normal means and it is inpractical or impossible to jettison the canopy, the seal may be deflated by puncturing it with a knife. Cutouts for this purpose are provided in the seal retainer on both sides of the cockpit at a location approximately even with the B/N's backrest.

CAUTION

Manual canopy removal is not intended as a normal method of egress and if used, should be entered in the yellow sheet (OPNAV FORM 3760-2) to ensure corrective action or appropriate inspection is completed.

EMERGENCY CANOPY JETTISON

The emergency canopy jettison system uses pressure from a precharged air bottle to fire an explosive charge placed in the canopy actuating cylinder. When the charge is fired, a rod within the piston rod will drive the canopy and its retaining mechanism off the canopy track.

Note

Although canopies have safely separated from the aircraft above 220 KIAS, no flight test data are available on jettisoning the canopy above this airspeed.

Canopy Jettison Handle

The canopy jettison handle (figure 1-26), on the right side of the pilot's instrument panel is used to jettison the canopy. Pulling the handle releases air from a precharged bottle to pneumatically activate an explosive charge in the canopy actuating cylinder. The canopy jettison handle is guarded with a safety pin, which is removed prior to flight. For detailed procedures on escape, see Section V of this manual.

ESCAPE SYSTEM

Safe escape from the aircraft is by individually controlled MK GRU-5 ejection seats or by MK GRU-7 rocket-assisted ejection seats for each crewmember. The seats are not interlocked with the canopy and may be ejected through the canopy. The seat catapult guns are equipped with rain seals, which will permit underwater ejection in extreme emergency. NEW

The MK GRU-7 seats are capable of safe ejection on the deck at zero airspeed; the MK GRU-5 can provide safe ground-level ejection at speeds in excess of 100 knots. Either type provides safe escape in straight-and-level flight throughout the operational envelope of the aircraft.

WARNING

At speeds in excess of 500 KIAS, straight-and-level flight, a minimum altitude of 100 feet is necessary for safe ejection with the MK GRU-5 seat.

Capabilities of the seat are shown in Section V. Preflight procedures and location of safety pins are shown in Section III. Ejection procedures are discussed in Section V.

EJECTION SEAT MK-GRU 5

The seat (figure 1-27) consists of a main beam assembly composed of two vertical and three horizontal members, plus the following components and assemblies: a drogue parachute container assembly with headrest, primary firing mechanism, and attached face curtain, drogue gun, time-release mechanism, shoulder-harness reel mechanism and dual attached leg-restraint cord assemblies, emergency oxygen bottle, ventilated parachute back pad, ventilated seat pan, PK-2 pararaft kit and lap belt assembly, and the seat bucket vertical and tilt adjustment actuators. Ejection of either seat sets the IFF/SIF modes 1 and 3 to emergency and actuates the equipment destruct system when installed. NEW NEW

EJECTION SEAT OPERATION

The ejection sequence (figure 1-28) is started by pulling the face-curtain firing handle or the lower ejection handle. When either firing handle is pulled, the catapult sear is withdrawn and shoulder-harness reel locks in its present position. When the catapult gun fires, the expanding gases drive the catapult tubes upward and eject the seat and occupant from the aircraft. As the seat rises, the occupant's legs are pulled back into the leg pads and the restraint cords are pulled tight. As the seat continues to rise, tension shears rivets (securing the cords to the deck), freeing the cords from the aircraft. The occupant's legs remain secured to the seat by snubbers wedging against the restraint cord, preventing any flailing of the occupant's legs. The occupant's legs remain secured to the seat until the time-release mechanism actuates a plunger, freeing the occupant's legs before separation from the seat. While the seat is going up the rail, the following events occur: NEW

- The drogue-gun trip rod is pulled.
- The time-release mechanism trip rod is pulled.
- The emergency oxygen bottle is activated.
- The IFF/SIF emergency code is activated.

One second after the drogue-gun trip rod is pulled a small controller drogue chute is drawn from the pack by a metal piston fired from the drogue gun. The controller drogue chute then pulls the stabilizer chute out of its container. The stabilizer chute is secured to the seat by a scissor shackle until released by the time-release mechanism. During ejection, the occupant is held in the seat by upper restraint straps, lap belt, and leg-restraint cords. NEW NEW

Deployment of the personnel parachute and separation of the occupant from the seat are delayed by the time-release mechanism until the occupant has descended from the upper atmosphere or until expiration of a 2.0-second time delay. When the seat is below an altitude of 10,000 to 14,500 feet (barostat setting of particular model seat), the time-release mechanism starts a 2.0-second time delay, after which the time-release mechanism releases the drogue parachute from the scissors shackle, allowing the drogue chute to pull out the personnel parachute withdrawal line and deploy the personnel parachute. At the same time, the harness restraints, lap belt, leg restraints, survival kit, upper block of the personnel services disconnect, and face curtain are unlocked. The occupant is then free to be pulled from the seat sticker clips by the line stretch of the main parachute as the seat rotates away. When the occupant is free from the seat, he makes a normal parachute descent with his survival kit connected to him by the lap belt/harley buckle. NEW NEW NEW

MANUAL SEAT SEPARATION

If the time-release mechanism fails, the crewmember can manually separate from the seat by pulling up and aft on the emergency restraint release (front right side of seat bucket). Rotating the emergency restraint release releases the lap belt, the leg-line straps, parachute container, survival kit, and personnel services disconnect. The occupant must push free of the seat and manually deploy the personnel parachute by locating and pulling the parachute ripcord. NEW NEW NEW

WARNING

The personnel parachute must be deployed manually if the harness emergency restraint release has been pulled. NEW

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EJECTION CONTROLS

Face-Curtain Handle

The automatic ejection sequence is initiated by pulling the face-curtain handle located immediately aft and above the occupant's head (figure 1-27). When the face-curtain handle is pulled, the firing mechanism is actuated and the primary cartridge is detonated.

Note

The seat is fired after approximately 13 inches of face-curtain travel.

Lower Ejection Handle

The lower ejection handle is on the front of the seat bucket, between the occupant's legs (figure 1-26).

The sequence of personnel parachute deployment remains the same, since both the face-curtain handle and the lower ejection handle initiate seat firing by extracting the sear from the ejection-gun firing mechanism.

WARNING

If the face-curtain firing handle does not actuate the ejection seat, the face-curtain handle should be held while the lower ejection handle is actuated, to prevent the possibility of entanglement with the drogue gun when it fires.

Note

The seat is fired after approximately 2 1/2 inches of lower ejection handle travel.

PARACHUTE

The parachute is in a rectangular back pack aft of the occupant. The parachute pack is attached to the seat by two retention straps that run from the seat bucket locks, through the parachute pack, and to the shoulder-harness reel mechanism, where they attach. On ejection, the straps are automatically released at both points by the time-release mechanism. The parachute pack is attached to the occupant by two straps connected to the Koch fittings of the integrated torso harness.

Time-Release Mechanism

The time-release mechanism is on the right side of the ejection-seat headrest and is armed upon ejection by a time-release mechanism trip rod which is secured to the trip rod bracket.

The time-release mechanism comprises a g-controller to prevent both the deployment of the personnel parachute and occupant separation from the seat at high g forces, and an altitude-sensing barostat, to prevent premature deployment of the parachute at high altitudes. Between 10,000 and 14,500 feet depending on model of seat and at deceleration of 4.5 g's or less, the time-release mechanism releases the drogue parachute from the shackle scissor, and through the personnel parachute withdrawal line deploys the pilot's personnel parachute. At the same time, the harness restraints, leg restraints, upper blocks of the personnel services disconnects, and face curtain are released. The occupant is then free to be pulled from the seat sticker clips by the opening shock of the main parachute.

PARACHUTE WITHDRAWAL LINE

The parachute withdrawal line is connected from the personnel parachute to the seat drogue parachute. In normal ejection, this line is pulled out by the drogue parachute after the time-release mechanism activates to deploy the personnel parachute.

EMERGENCY RESTRAINT RELEASE

This control is the black-and-yellow striped handle forward on the right side of the seat bucket (figure 1-27). In the forward and down (locked) position, the occupant and his personal equipment are secured to the seat. When the emergency restraint release is lifted and rotated to the aft and up (unlocked) position, the occupant and his personal equipment are disconnected from the seat except for the sticker clips and the personnel parachute withdrawal line. The emergency restraint release simultaneously releases the lap-belt harness locks, shoulder harness reel straps, dual leg-restraint cords, the right and left personnel services disconnects. The face-curtain handle and lower ejection handle are automatically locked and ejection cannot be accomplished.

WARNING

The emergency restraint release may be manually repositioned to the unactuated position, which will:

1. Enable the occupant to unlock the face curtain handle.

2. Automatically unlock the lower ejection handle.

In this situation the lap belt harness locks and shoulder harness reel straps, dual leg-restraint cords, and right and left personnel services disconnects will remain released. Ejection in this condition would be extremely hazardous and is not recommended.

This control will normally be in the forward position. Emergencies such as ditching, over-the-side bailout, or failure of the time-release mechanism will require operation of this control. For detailed information regarding specific use of the emergency restraint release, refer to Section V of this manual.

Shoulder Harness Lock Lever

This control is on the left side of the seat. In the forward position, forward movement of the occupant is restricted and any slack created by rearward

EJECTION SEAT

MK GRU-5 SEAT

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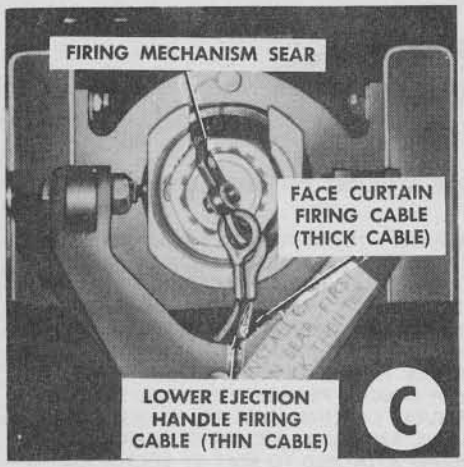
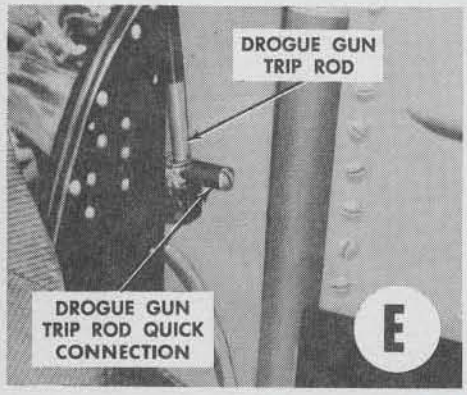
Figure 1-27 (Sheet 1)





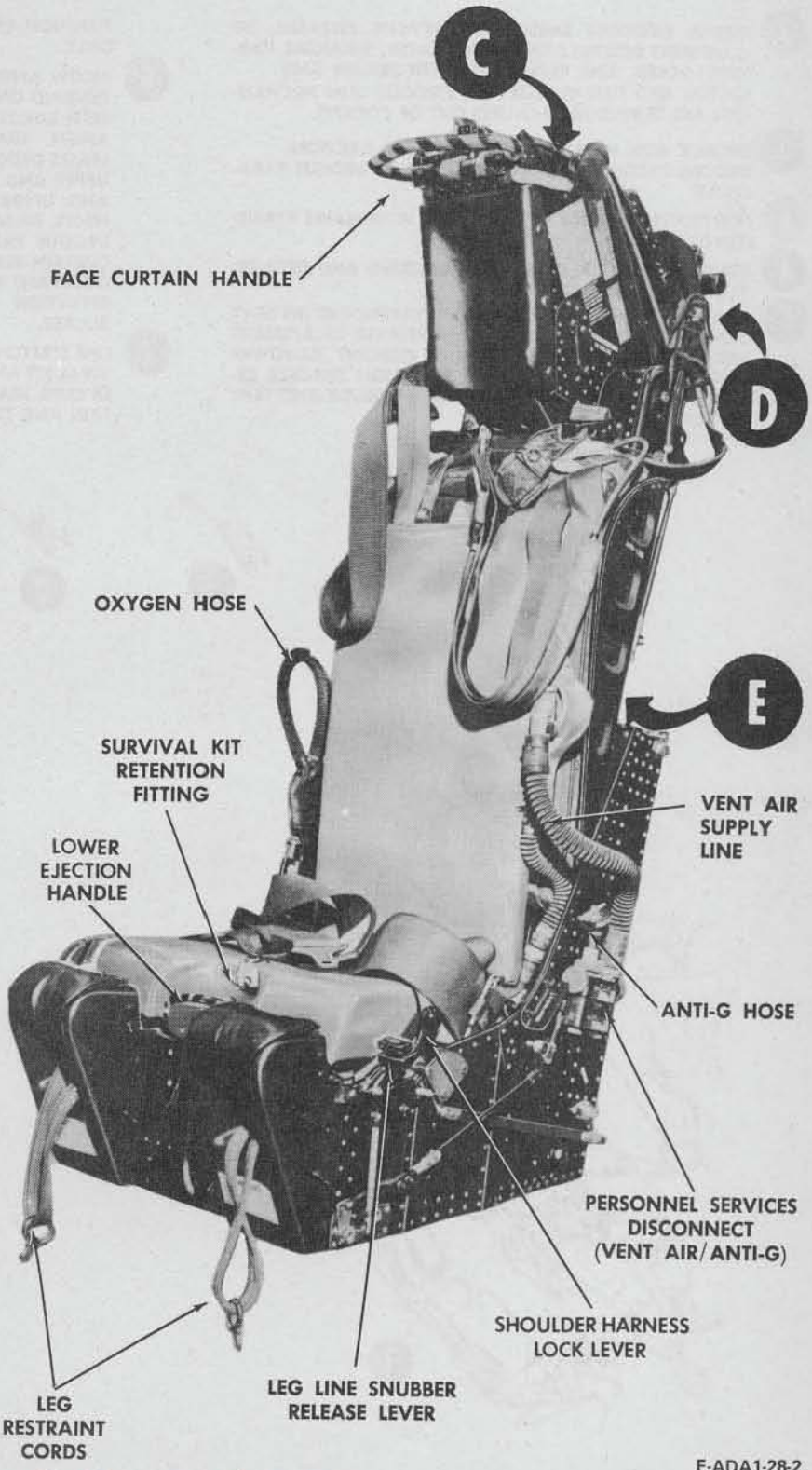


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Figure 1-27 (Sheet 2)

EJECTION SEQUENCE

MK GRU-5

1. INITIAL EJECTION: EMERGENCY OXYGEN RELEASED, IFF EQUIPMENT DESTRUCT SWITCH ACTUATED, SHOULDER HARNESS LOCKED, LEG RESTRAINTS WITH DRAWN AND LOCKED AND TIME RELEASE AND DROGUE GUN MECHANISMS ARE TRIPPED AS SEAT LIFTS OUT OF COCKPIT.
2. DROGUE GUN FIRES ONE SECOND AFTER EJECTION; DROGUE PISTON WITHDRAWS CONTROLLER DROGUE PARACHUTE.
3. CONTROLLER DROGUE DEPLOYS AND WITHDRAWS STABILIZER DROGUE.
4. STABILIZER DROGUE DEPLOYS, STABILIZING AND DECELERATING SEAT AND OCCUPANT.
5. ABOVE 13,000 FEET OR 14,500 FEET (DEPENDING ON SEAT MODEL): BAROSTAT SECURES TIME RELEASE ESCAPEMENT MECHANISM UNTIL COMPLETION OF DESCENT TO LOWER ALTITUDE, DROGUE PARACHUTE RETENTION SHACKLE REMAINS LOCKED TO SEAT BY RESTRAINT SCISSOR AND SEAT AND OCCUPANT DESCEND. THROUGH HIGHER ALTITUDES ON DROGUE PARACHUTES ONLY.
6. BELOW APPROXIMATELY 10,000 FEET OR 11,500 FEET (DEPENDING ON SEAT MODEL) AND DECELERATION OF 4.5g OR LESS: BAROSTAT FREES TIME RELEASE ESCAPEMENT MECHANISM. TIME RELEASE MECHANISM SUBSEQUENTLY RELEASES DROGUE SHACKLE RESTRAINT SCISSOR, OCCUPANT'S UPPER AND LOWER HARNESS RESTRAINT, LEG RESTRAINTS AND UPPER BLOCKS OF PERSONNEL SERVICES DISCONNECTS. RELEASE OF SHACKLE PERMITS CONTINUED PULL OF DROGUE PARACHUTES ON LINK LINES TO RELEASE FACE CURTAIN RESTRAINT, AND MAIN PERSONNEL PARACHUTE. OCCUPANT REMAINS ATTACHED TO SEAT BY STICKER CLIP RETENTION OF LOWER RESTRAINT HARNESS ON SEAT BUCKET.
7. LINE STRETCH OF MAIN PARACHUTE PULLS OCCUPANT, SURVIVAL KIT AND LOWER RESTRAINT HARNESS FREE OF STICKER CLIPS. SEAT FALLS FREE. OCCUPANT DISCARDS FACE CURTAIN AND CONTINUES NORMAL PARACHUTE DESCENT.

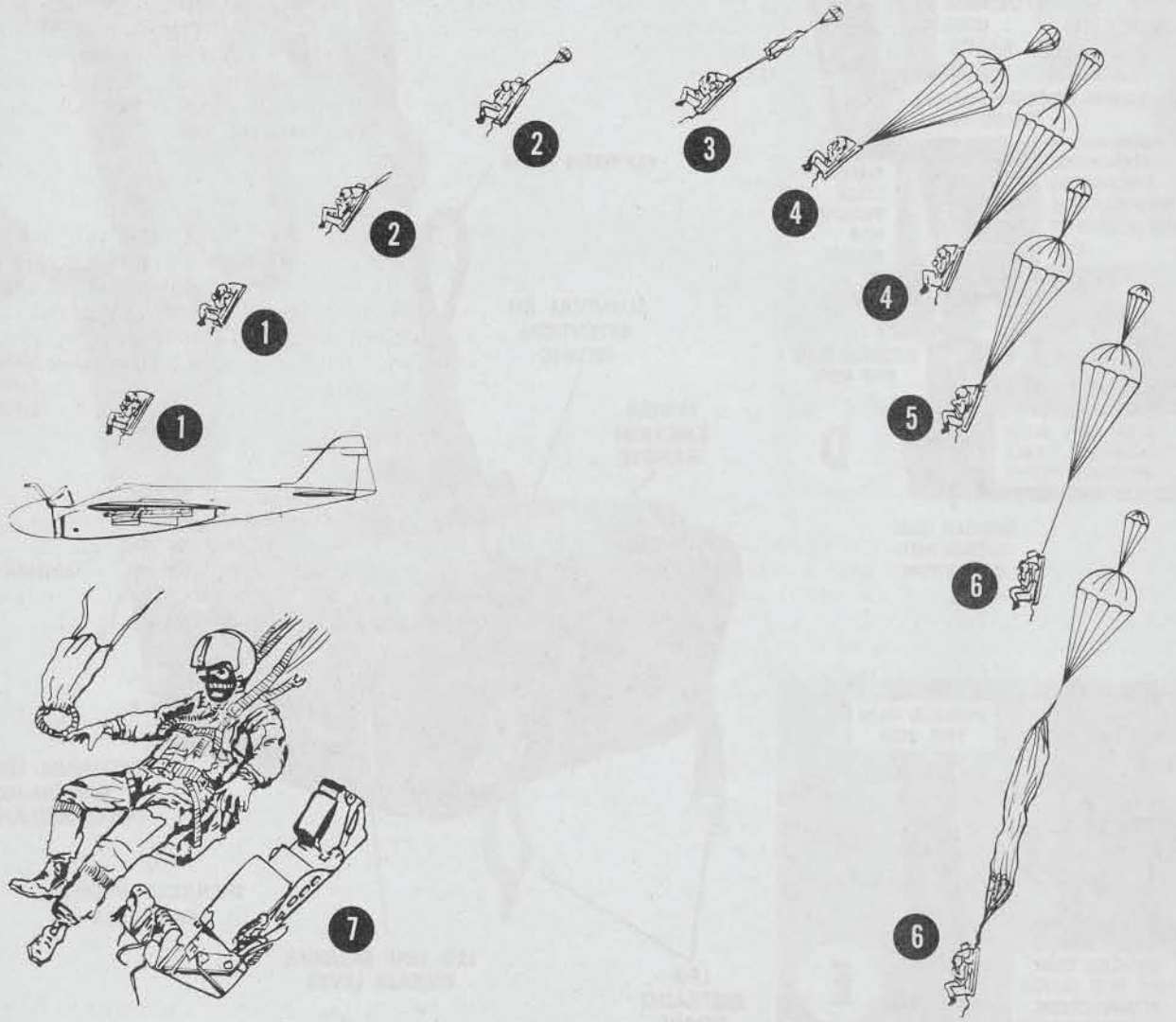

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Figure 1-28

movement is taken up by the shoulder-harness reel. The control is locked in this position by using the detent. Once unlocked with manual control, the spring-loaded center position, the occupant can move forward freely, unless the reel locks owing to excessive forward velocity. When the forward velocity decreases, the shoulder straps must be released by repositioning the control. Both straps feed from the same shaft and it is impossible for one to lock without the other. If the reel is locked manually, the control must be positioned full aft to the unlock position to allow forward movement.

LEG GARTER

The leg garter and leg-restraint cords keep the occupant's legs firmly against the leg rests during ejection. The garter is placed around the leg above the calf and below the knee. It should be tight enough so it does not slip down over the calf.

The leg-restraint cords are attached to the aircraft deck and routed through the snubber box seat structure. They are then passed through garter rings and snapped into the leg-line locks. The garter rings are snapped into the bayonet fitting when strapping in.

Leg-Line Snubber Release Lever

The leg-line snubber-release lever is forward on the left side of the seat bucket. When moved forward, this control provides slack in the dual leg-restraint cords.

WARNING

If this lever is jammed in the forward position, manual or automatic separation from the seat is unlikely.

EMERGENCY OXYGEN

An emergency oxygen bottle (1,800 psi) attached to the right side of the ejection seat is automatically actuated on ejection. When the seat rises during ejection a lever on the bottle is tripped by a striker arm, which opens the oxygen valve. The oxygen flows through the seat-mounted regulator, where it is metered through the normal oxygen inlet line.

Note

The emergency oxygen supply will last approximately 10 minutes. The duration will depend upon altitude and breathing rate.

Emergency Oxygen Actuator

The emergency oxygen actuator is the green handle on the right side of the seat, immediately aft of the emergency restraint-release (figure 1-27). This control is used to actuate the emergency oxygen system if the normal system fails.

LR-1 PARARAFT

The LR-1 pararaft kit (figure 1-29) is attached to the lap belt and stowed in the seat bucket. The LR-1 pararaft survival kit contains a one-man life raft, and additional survival equipment as listed and/or required in the latest directives or regulations, or both.

Note

The LR-1 pararaft kit has a quick-disconnect fitting that must be released to open the raft.

PERSONNEL SERVICES DISCONNECT

Oxygen/Communications Disconnect

The oxygen/communications disconnect is mounted on the right side of the seat and serves both the oxygen and communications lines. The seat occupant's personnel oxygen and communication equipment terminates in a block that is plugged and locked into the seat. The aircraft oxygen and communications lines also terminate in this block. This block is unlocked by the time-release mechanism and pulled free when the occupant separates from the seat upon deployment of the personnel parachute, or actuation of emergency restraint release.

Vent/Air/Anti-G

A vent line (exposure suit/back pack pad) and anti-g line personnel services disconnect is mounted on the left side of the seat. The disconnect is unlocked by the time-release mechanism and pulled free when the occupant separates from the seat upon deployment of the personnel parachute, or actuation of emergency restraint release.

SEAT ADJUSTMENT

Seat adjustment is controlled by two three-position, momentary-contact switches (figure 1-27) on the right side of the right thigh support. The direction of switch movement corresponds to the direction of seat movement. Seat adjustment is limited to 5 inches of vertical movement and 10° of tilt.

WARNING

Head and neck injury may occur during ejection or canopy jettison if the seat is not adjusted properly. Do not allow the top of the helmet to project above the level of the face curtain.

CAUTION

The seat height-adjustment actuator motors are intermittent-duty motors. The height actuator motor has a duty cycle of 30 seconds on and 10 minutes off. The tilt actuator motor has a duty cycle of 1 minute on and 15 minutes off.

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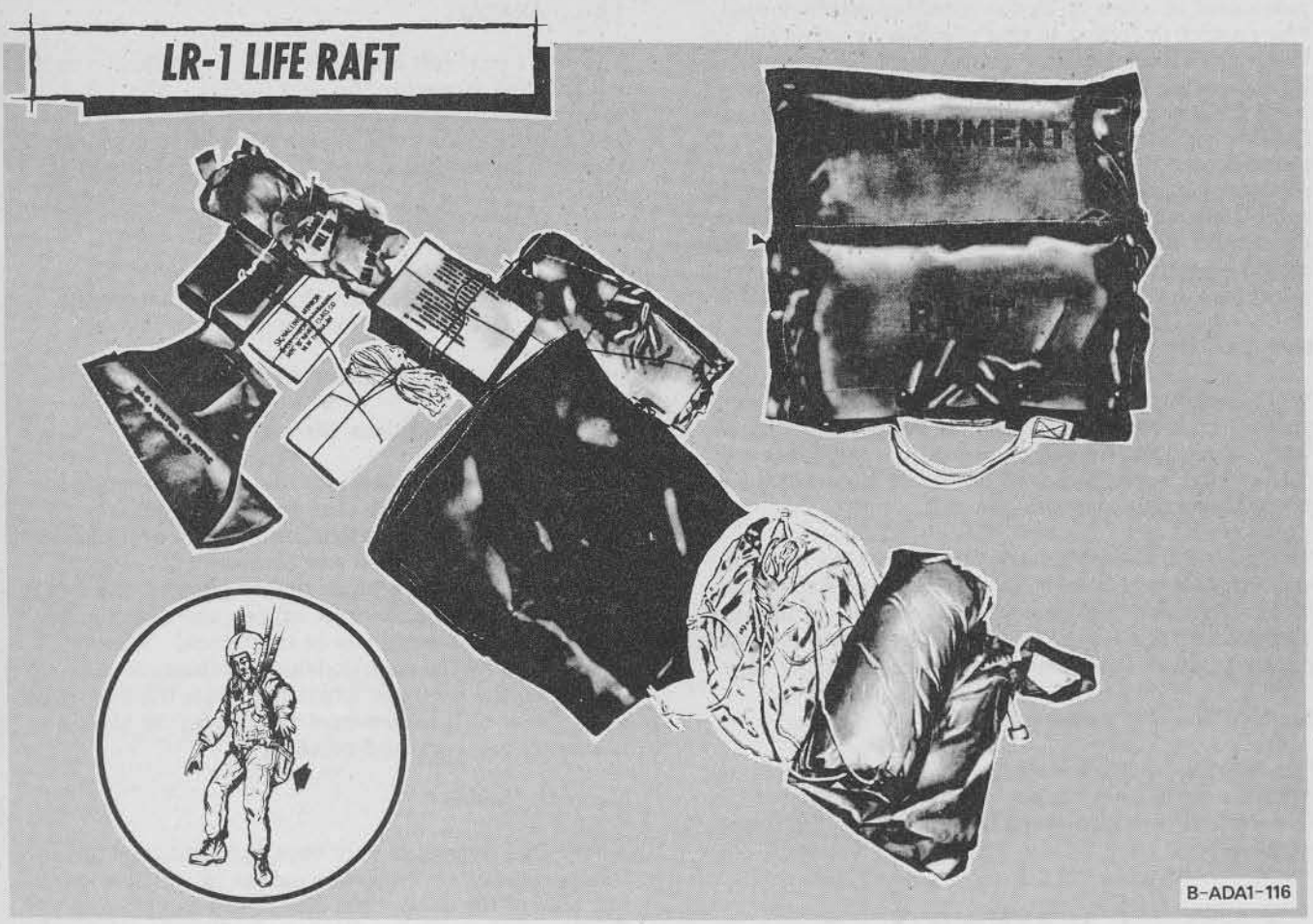

Figure 1-29

LAP BELTS

The lap belt is attached to the seat bucket by two lap belt locks and two sticker clips. The LR-1 pararaft kit is attached to the lap belt and stowed in the seat bucket.

SEAT HARNESS

The seat harness is compatible with a modified integrated torso harness and consists of an adjustable back pad, seat pan, LR-1 pararaft kit, lap belt, two shoulder-harness-reel straps, and two parachute retention straps. The reel straps attach to the occupant's parachute risers. On ejection, they are automatically released by the time-release mechanism. Dual leg-restraint cords hold the occupant's legs securely against the thigh rest extensions on the front face of the bucket assembly. The leg garters are attached to the restraint cords by bayonet ring fittings.

EJECTION SEAT MK-GRU 7

The seat (figure 1-30) consists of a main beam assembly composed of two vertical beams and three horizontal members plus the following components and assemblies: a seat-stabilizer drogue-parachute container assembly with headrest; firing mechanism and attached face curtain and lower ejection handle; parachute withdrawal line guillotine; drogue gun; time-release mechanism; powered shoulder harness-reel mechanism; and attached leg-restraint cord assemblies; ventilated parachute back pad; ventilated seat cushion; RSSK-7 survival kit with emergency oxygen bottle; and the seat bucket actuators. Each seat contains an emergency restraint release, a 28-foot personnel parachute and container, and a rocket motor that is triggered by a gas-generating initiator.

A powered retraction shoulder-harness reel that is actuated by the face-curtain handle or the lower ejection handle ensures that the occupant is pulled back into the seat during ejection. Ejection of either seat sets

the IFF/SIF modes 1 and 3 to emergency and actuates the equipment destruct system when installed.

EJECTION SEAT OPERATION

The ejection-seat operation sequence (figure 1-31) is initiated by pulling the face-curtain handle or the lower ejection handle. When either firing handle is pulled, the catapult sear and shoulder-harness reel sear are withdrawn. The powered shoulder-harness reel pulls the occupant back into the seat to an upright position. When the catapult gun fires, the expanding gases drive the catapult tubes upward and eject the seat and occupant from the aircraft. As the seat rises, the leg-restraint cords are pulled tight, pulling the occupant's legs back into the leg pads. As the seat continues to rise, tension built up shears rivets (securing the cords to the deck), freeing the cords from the aircraft. The occupant's legs remain secured to the seat by snubbers wedging against the restraint cord, preventing any flailing of the occupant's legs. The occupant's legs remain secured to the seat until the time-release mechanism actuates, freeing the occupant's legs prior to separation from the seat. While the seat is going up the rails, the following events occur:

- The drogue-gun trip rod is pulled.
- The time-release mechanism trip rod is pulled.
- Personnel services disconnect lanyard is pulled.
- The emergency oxygen bottle is activated.
- The IFF/SIF emergency code is activated.
- The rocket-motor initiator lanyard is pulled.

When fully extended, the rocket-motor initiator lanyard fires the rocket motor under the seat.

One-half second after the drogue-gun trip rod is extracted, a small controller drogue chute is drawn from the pack by a metal piston fired from the drogue gun. The controller drogue chute then pulls the stabilizer chute out of its container. The stabilizer chute is secured to the seat by a scissor shackle until released by the time-release mechanism.

During ejection, the occupant is held in the seat by upper restraint straps, lap restraints, and leg-restraint cords. Deployment of the personnel parachute and separation of the occupant from the seat are delayed by the time-release mechanism until the occupant has descended from the upper atmosphere or until expiration of a 2.0-second time delay.

When the seat is below an altitude of 11,500 to 14,500 feet (barostat setting), the time-release mechanism starts a 2.0-second time delay, after which the time-release mechanism releases the drogue parachute from the scissors shackle, allowing the drogue chute to pull the personnel parachute withdrawal line out of the guillotine and deploy the personnel parachute. At the same time, the shoulder harness restraints, leg restraints, survival kit, and face curtain are unlocked. The occupant is then free to be pulled from the seat sticker clips by the line stretch of the main parachute as the seat rotates away. When the occupant is free from the seat, he makes a normal parachute is free from the seat, he makes a normal parachute descent with his (RSSK-7) survival kit connected to him by the integrated torso harness.

MANUAL SEAT SEPARATION

If the time-release mechanism fails, the crewmember can manually separate from the seat by pulling up and aft on the emergency restraint-release (front right side of seat bucket). Rotating the emergency restraint-release up and aft fires the guillotine severing the personnel parachute withdrawal line and releasing the shoulder-harness restraint straps, the lower restraint, the leg-line straps, parachute container, and survival kit. The occupant must push free of the seat and manually deploy the personnel parachute by locating and pulling the parachute rip-cord.

WARNING

The personnel parachute must be deployed manually if the emergency restraint-release has been pulled.

EJECTION CONTROLS

Face-Curtain Handle

The automatic ejection sequence is initiated by pulling the face-curtain handle immediately aft and above the occupant's head. When the face-curtain handle is pulled, the firing mechanism sear and the powered shoulder harness reel sear are mechanically withdrawn and the primary and shoulder harness reel cartridges are fired. As the seat rises, the drogue-gun and time-release mechanism sears are extracted by trip rods and the emergency IFF and equipment destruct (when installed) are activated.

Note

The seat is fired after approximately 7 inches of face-curtain travel.

Lower Ejection Handle

The lower ejection handle is on the front of the seat bucket, between the occupant's legs. The sequence of operation remains the same.

WARNING

If the face-curtain handle does not actuate the ejection seat, the face-curtain handle should be held while the lower ejection handle is actuated, to prevent the possibility of entanglement with the drogue gun when it fires.

EJECTION SEAT

MK GRU 7

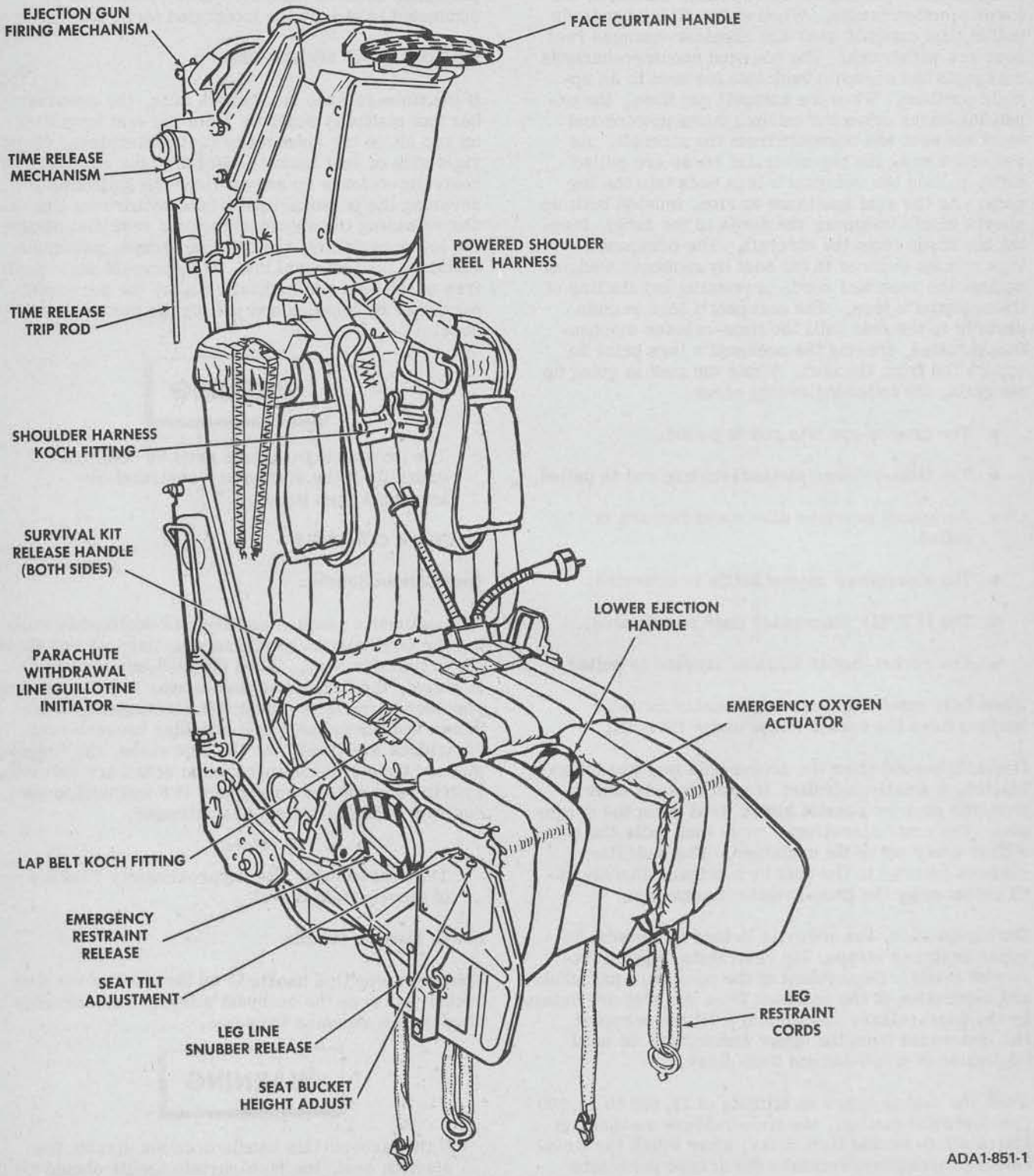

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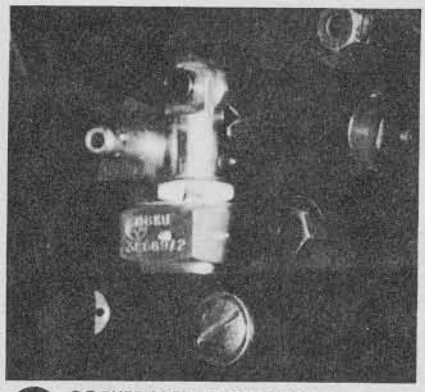
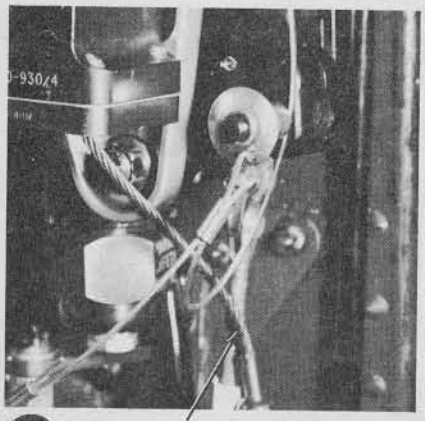
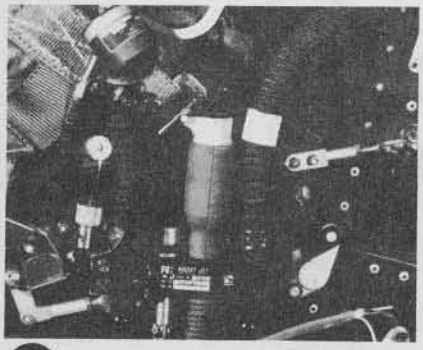
Figure 1-30 (Sheet 1)



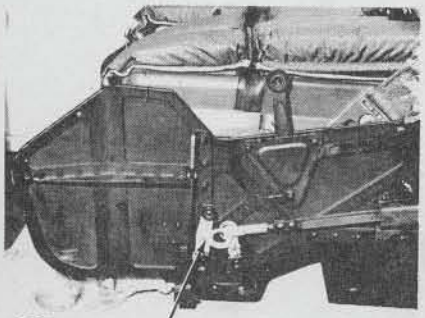
A ROCKET MOTOR INITIATOR (FAIRING REMOVED FOR CLARITY)



B ROCKET MOTOR INITIATOR STATIC LINE



C PERSONNEL DISCONNECT LINES



D SURVIVAL KIT FRONT LOCK RELEASE LEVER

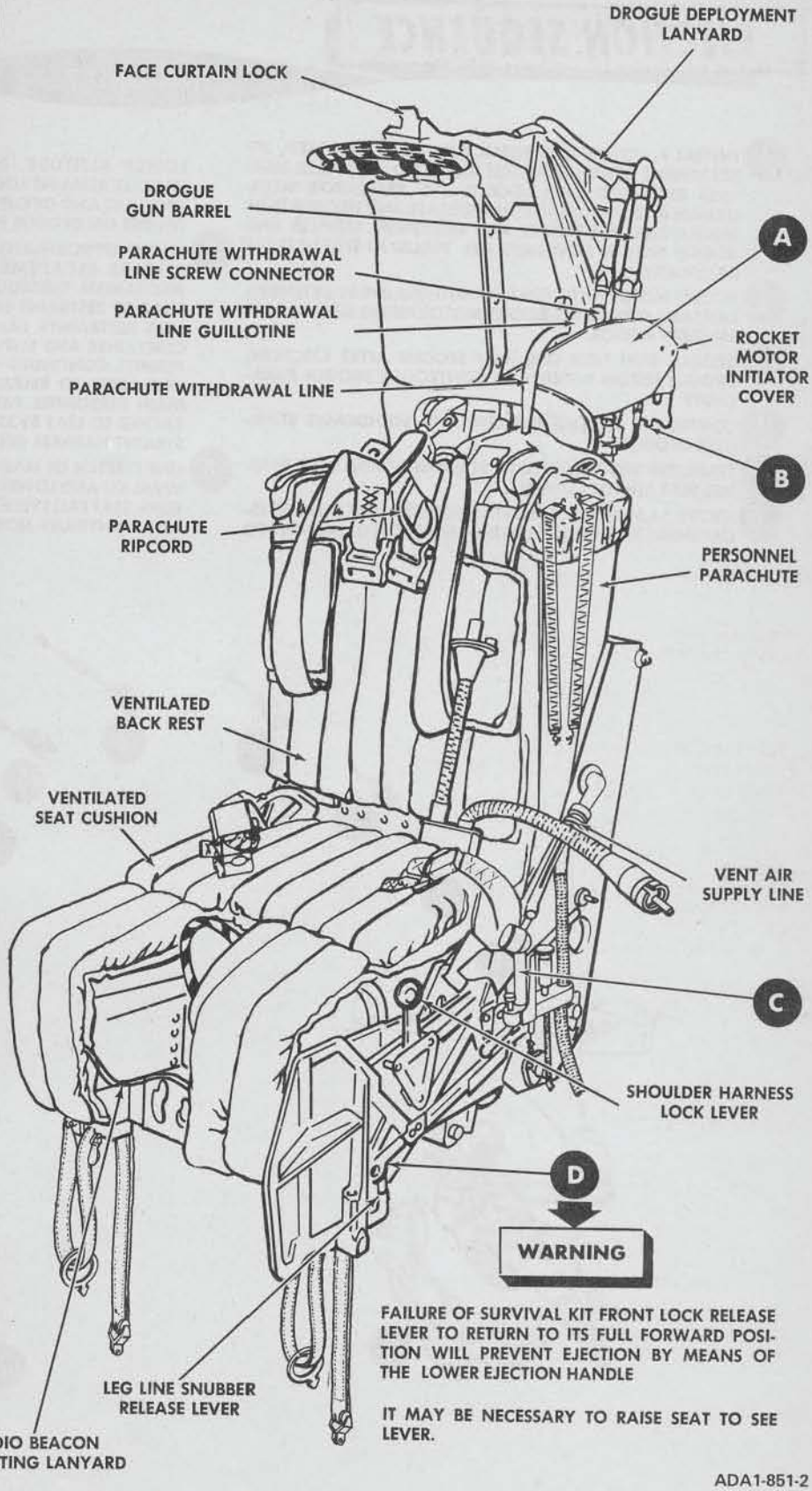


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Figure 1-30 (Sheet 2)

EJECTION SEQUENCE

MK GRU-7

1. INITIAL EJECTION: EMERGENCY OXYGEN RELEASED, IFF, EQUIPMENT DESTRUCT SWITCH ACTUATED, SHOULDER HARNESS RETRACTED AND LOCKED, LEG RESTRAINTS WITHDRAWN AND LOCKED AND TIME RELEASE AND DROGUE GUN MECHANISMS ARE TRIPPED AND PERSONNEL SERVICES AND ROCKET MOTOR LANYARDS ARE PULLED AS SEAT LIFTS OUT OF COCKPIT.
2. ROCKET MOTOR INITIATOR SEAR WITHDRAWN BY EXTENDED LANYARD, GAS DRIVES ROCKET MOTOR FIRING MECHANISM, IGNITING MOTOR.
3. DROGUE GUN FIRES ONE HALF SECOND AFTER EJECTION; DROGUE PISTON WITHDRAWS CONTROLLER DROGUE PARACHUTE.
4. CONTROLLER DROGUE DEPLOYS AND WITHDRAWS STABILIZER DROGUE.
5. STABILIZER DROGUE DEPLOYS, STABILIZING AND DECELERATING SEAT AND OCCUPANT.
6. ABOVE 14,500 FEET: BAROSTAT SECURES TIME RELEASE ESCAPEMENT MECHANISM UNTIL COMPLETION OF DESCENT TO LOWER ALTITUDE, DROGUE PARACHUTE RETENTION SHACKLE REMAINS LOCKED TO SEAT BY RESTRAINT SCISSOR AND SEAT AND OCCUPANT DESCEND THROUGH HIGHER ALTITUDES ON DROGUE PARACHUTES ONLY.
7. BELOW APPROXIMATELY 11,500 FEET: BAROSTAT FREES TIME RELEASE ESCAPEMENT MECHANISM. TIME RELEASE MECHANISM SUBSEQUENTLY RELEASES DROGUE GUN SHACKLE RESTRAINT SCISSOR, OCCUPANT'S SHOULDER HARNESS RESTRAINTS, LAP BELT, LEG RESTRAINTS, PARACHUTE CONTAINER AND SURVIVAL KIT. RELEASE OF SHACKLE PERMITS CONTINUED PULL OF DROGUE PARACHUTES ON LINK LINES TO RELEASE FACE CURTAIN RESTRAINT AND MAIN PERSONNEL PARACHUTE. OCCUPANT REMAINS ATTACHED TO SEAT BY STICKER CLIP RETENTION OF LOWER RESTRAINT HARNESS ON SEAT BUCKET.
8. LINE STRETCH OF MAIN PARACHUTE PULLS OCCUPANT, SURVIVAL KIT AND LOWER RESTRAINT HARNESS FREE OF STICKER CLIPS. SEAT FALLS FREE. OCCUPANT DISCARDS FACE CURTAIN AND CONTINUES NORMAL PARACHUTE DESCENT.

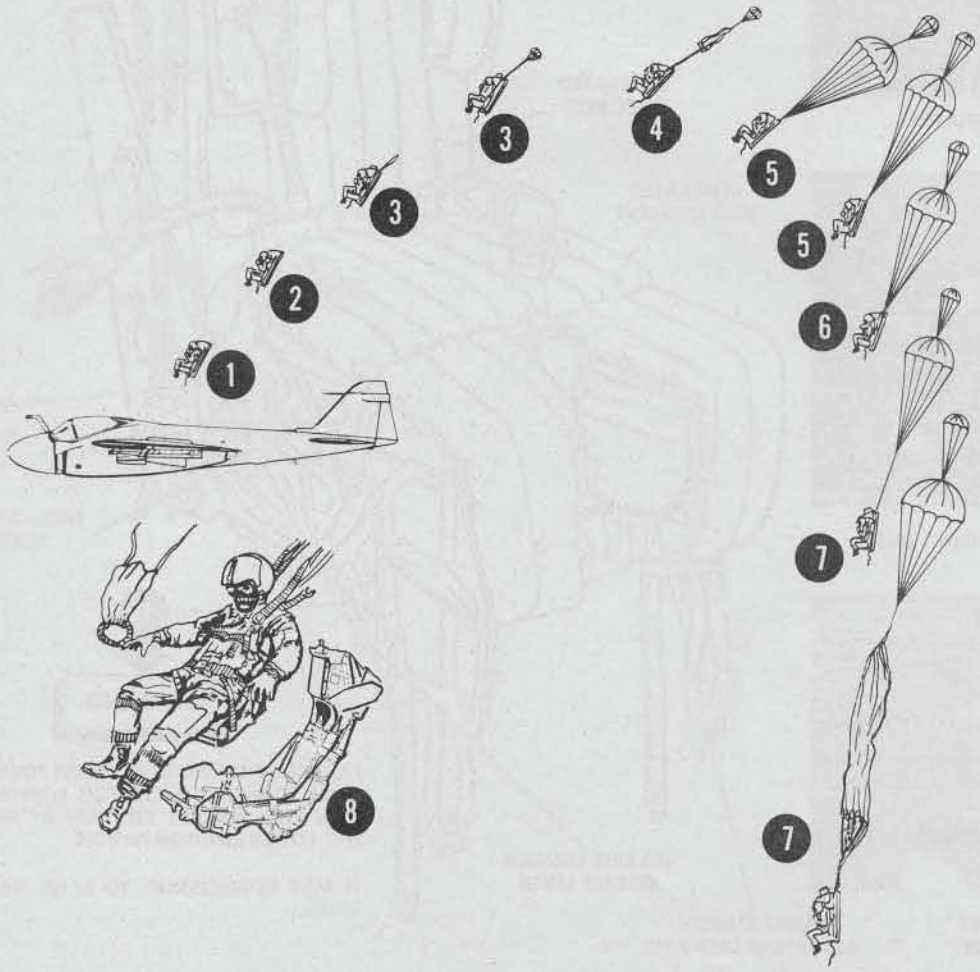

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Figure 1-31

Note

The seat is fired after approximately 2 inches of lower ejection handle travel.

PARACHUTE

The personnel parachute is contained in a rectangular back pack aft of the occupant. The parachute pack is attached to the seat by two lock-in fittings. On ejection, the locks are automatically released by the time-release mechanism at both points. The parachute pack is attached to the occupant by two risers connected to the top Koch-fittings of the integrated torso harness.

Time-Release Mechanism

The time-release mechanism is on the right side of the ejection-seat headrest and is armed upon ejection by a time-release mechanism trip rod, which is secured to the trip-rod bracket.

The time-release mechanism contains an altitude-sensing barostat to prevent premature deployment of the parachute at high altitudes. At approximately 13,000 (±1,500) feet or less, the time-release mechanism releases the drogue parachute from the scissors shackle, pulling the personnel parachute withdrawal line from the guillotine and deploying the occupant's personnel parachute. At the same time, the shoulder-harness restraints, lower restraints, leg restraints, parachute container, survival kit, and face-curtain are released.

The occupant is then free to be pulled from the seat sticker clips by the line stretch of the main parachute.

Parachute Withdrawal Line

The parachute withdrawal line is connected from the personnel parachute to the seat drogue parachute. In normal ejection, this line is pulled out by the drogue parachute after the time-release mechanism actuates to deploy the personnel parachute. The line is routed through a gas-operated guillotine that severs the line for manual seat separation.

Guillotine

The guillotine on the left side of the seat is fired by the initial travel of the emergency restraint-release. The guillotine initiator is mounted on the right aft side of the seat bucket. The guillotine severs the personnel parachute from the seat and drogue parachute; the personnel parachute must then be manually deployed by pulling the parachute ripcord.

EMERGENCY RESTRAINT RELEASE

This control is the black-and-yellow-striped handle forward on the right side of the seat bucket. In the forward and down (locked) position, the occupant and his personal equipment are secured to the seat. When the emergency restraint release is lifted and rotated to the aft and up (unlocked) position, the occupant and his personal equipment are disconnected from the seat. The initial travel of this handle fires the parachute withdrawal-line guillotine, severing the personnel parachute from the seat and drogue parachute. The personnel parachute must be manually deployed by pulling the parachute ripcord.

The emergency restraint-release simultaneously releases the lower restraint locks, personal parachute-container retention fittings, survival-kit attachment lugs and sticker clips, shoulder-harness reel straps, and leg-restraint cords.

WARNING

When the emergency release is actuated, the face-curtain handle and lower ejection handle are automatically locked and ejection cannot be accomplished. There is no provision for resetting this control in flight.

This control will normally be in the forward and down position. Emergencies such as ditching, bailout, or failure of the time-release mechanism will require operation of this control. For detailed information regarding specific use of the emergency restraint release, refer to Section V.

POWERED SHOULDER HARNESS REEL

Each seat has a powered shoulder harness reel that is fired when ejection is initiated. The initiator is fired by mechanically extracting the sear that positions the occupant to an upright position during ejection with minimum shock. The shoulder-harness reel straps are connected to the parachute risers and the upper torso harness.

Shoulder Harness Lock Lever

This control is on the left side of the seat. In the forward position, forward movement of the occupant is restricted and any slack created by rearward movement is taken up by the reel. The control is locked in this position by using the detent. In the spring-loaded center position, the occupant can move forward freely, unless the reel locks owing to excessive forward velocity. Upon releasing tension on the straps following automatic lock-up, the straps are released without the necessity of repositioning the manual control. Both straps feed from the same shaft and it is impossible for one to lock without the other. If the reel is locked manually, the control must be positioned full aft to the unlock position to release the straps.

LEG GARTER

The leg garter and leg-restraint cords are used to keep the occupant's legs firmly against the leg rests during ejection. The leg garter is placed around the leg above the calf and above the ankle. It should be tight enough so it does not slip down over the calf.

NEW

CAUTION

The lower strap should contain the release fitting.

The leg-restraint cords are attached to the aircraft deck and routed through the snubber box seat structure. They are then passed through garter rings and snapped into the leg-line locks. The garter rings are snapped into the bayonet fitting when strapping in. Leg-line snubbers are released by pulling the release lever on the forward side of each snubber box. NEW

EMERGENCY OXYGEN

An emergency oxygen system in the survival kit is actuated during ejection by a cable connected from the personnel services disconnect to the automatic emergency oxygen actuator. The cable is disconnected from the survival kit after oxygen release and the oxygen flows through the occupant's personnel oxygen regulator to mask.

Note

The emergency oxygen supply will last approximately 15 minutes. The duration will depend upon altitude and breathing rate.

NEW

Emergency Oxygen Actuator

The emergency oxygen system actuator is a green ring on the top left thigh support of the survival kit. This control is provided to actuate the emergency oxygen system if the normal system fails.

SURVIVAL KIT

NEW

The survival kit is packed in a rigid two-piece container (RSSK-7) (figure 1-32) stowed in the seat bucket. The RSSK-7 survival kit contains a one-man life raft, and additional survival equipment as listed and/or required in the latest directives and/or regulations.

PERSONNEL SERVICES DISCONNECTS

Supply lines from the aircraft for the oxygen, communications, anti-g, and ventilation systems terminate at the personnel services disconnect, which is attached to the left side of the seat bucket by a quick-release pin. Quick-disconnect fittings connect the supply lines to the lines in the seat, which serve the occupant. The oxygen and communications lines connect to a distribution point in the left rear corner of the survival kit. The emergency oxygen lanyard is also attached to the personnel services disconnect. When the seat is ejected, a lanyard pulls the pin securing the personnel services disconnect to the seat. This releases the disconnect and further upward travel of the seat causes the supply lines to be disconnected at their quick-release fittings and the emergency oxygen lanyard to be pulled, actuating the emergency oxygen supply.

SEAT ADJUSTMENT

Seat adjustment is controlled by two three-position, momentary-contact switches on the right side of seat bucket. The direction of switch movement to adjust the seat is marked near the switches. Seat adjustment is limited to 5 inches of seat bucket vertical movement and 10° of tilt.

WARNING

Head and neck injury may occur during ejection or canopy jettison if seat is not adjusted properly. Do not allow the top of the helmet to project above the level of the face curtain. NEW

CAUTION

The seat-tilt and height-adjustment actuator motors are intermittent-duty motors. The tilt actuating motor has a duty cycle of 1 minute on and 15 minutes off. The height actuating motor has a duty cycle of 1 minute on and 10 minutes off. NEW NEW

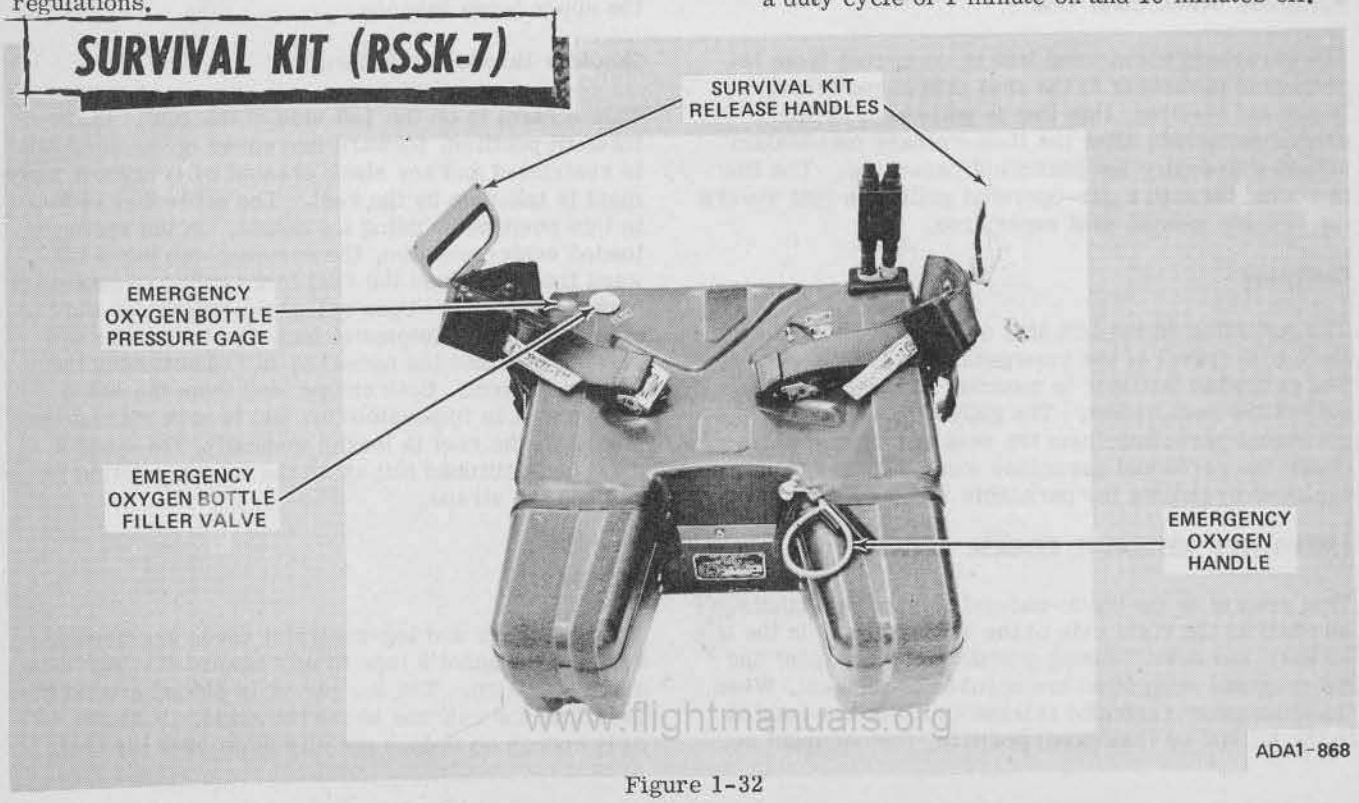

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Figure 1-32

ENVIRONMENTAL CONTROL SYSTEM

The environmental control system (figure FO-7) regulates the environment of the crew and the electronic equipment. The system provides cockpit air-conditioning and pressurization, windshield and canopy defogging, electronic equipment cooling and pressurization, and windshield-washing, de-icing, seat cushion ventilation, and rain-removal. In addition, pressurized air is furnished for auxiliary systems such as canopy seal inflation, operation of the anti-g suit bladders, and suit or seat-cushion ventilation as well as hydraulic reservoir and fuel-tank pressurization. In TRAM provisioned aircraft (A-6E 159895 and ON and A-6E Mod 121 and ON), the existing air-cycle refrigeration unit has been augmented by the addition of a second unit in the aft equipment bay. The additional unit is required for the cooling of electronic equipment that has been incorporated in these aircraft.

High-pressure hot bleed air is taken from the twelfth stage of each engine compressor and is passed through the main bleed-air shutoff valve to the air-cycle refrigeration unit, which cools it. On A-6E 158533 and ON and aircraft incorporating AFC 268, the hot bleed air is passed through the air-conditioning bleed-air isolation valve and the main bleed-air shutoff valve to the air-cycle refrigeration unit which cools it. In TRAM aircraft, bleed air from the air-conditioning bleed-air isolation valve also is passed through the aft bleed-air shutoff valve to the aft air-cycle refrigeration unit, where it is cooled. Bleed-air check valves permit system operation with only one engine running.

Bleed air entering the forward air-cycle refrigeration unit passes through the main and auxiliary heat exchanges, where ram air, entering through the right wing intake scoop, is circulated around the fins of the heat exchangers to cool the bleed air and then is dumped overboard. The cooled bleed air passes through the mass flow-control valve to drive the cooling turbine. Since energy is extracted to drive the turbine, this further cools the air. The cooling turbine drives the ram-air exhaust fan.

In TRAM aircraft, high-pressure hot bleed air is taken from the twelfth stage of each engine compressor and is ducted to the main and auxiliary sections of the forward air-cycle refrigeration unit heat exchanger, the aft bay air-cycle refrigeration unit heat exchanger, and directly to the rain-removal system. Bleed air entering the forward and aft refrigeration units passes through the heat exchangers, where ram air circulates around the fins of the heat exchangers to cool the bleed air and is then dumped overboard. In both the forward and aft systems, the cooled bleed air passes through a mass flow-control valve to drive the cooling turbine. Since energy is extracted to drive the turbines, the air is cooled further. The cooling turbine drives the ram-air exhaust fans. The forward unit provides air for cockpit air-conditioning and pressurization; DRS turret pressurization; canopy defogging; anti-g; vent-suit cooling; and hydraulic reservoir, fuel tank, canopy seal, and windshield-wash pressurization. Exhaust air from the cabin provides cooling for equipment in the nose radome. The aft unit provides cooling air for electronic equipment in the aft equipment compartment, right and left shoulder compartments, nosewheel well, cockpit, and nose radome.

COCKPIT AIR-CONDITIONING AND PRESSURIZATION SYSTEM

The cockpit air-conditioning and pressurization system either automatically or manually maintains cockpit temperature and pressure within the limits of crew safety and comfort. To accomplish this, the system forces a mixture of dehumidified refrigerated bleed air and hot engine bleed air into the cockpit. In the automatic mode, a temperature-control system, consisting of temperature switches, selectors, sensors and associated valves, and an electronic controller automatically maintain the mixture temperature after temperature selection is made. Correct cockpit pressure is controlled by a pressure regulator and a safety valve. All controls for operating the system are on the AIR CONDITIONING control panel (figure 1-33), except for the cabin dump switch on the CABIN DUMP panel (figure 1-33).

AUTOMATIC COCKPIT AIR-CONDITIONING

In the automatic mode, the cockpit is furnished temperature-controlled air by the environmental control system. For proper temperature control, both hot engine bleed air and refrigerated, dehumidified bleed air are provided. Thus the temperature of the cockpit air is regulated by a mixture of hot and refrigerated air. These are mixed by means of a dual temperature-control valve in the hot line and in the cold line. The action of the mass flow-control valve assists in stabilizing cabin air at the temperature selected on the AIR CONDITIONING control panel. For example, if the cabin temperature decreases with the dual temperature-control valve at full cold, the portion of the valve in the cold line begins to close. As this occurs, the mass flow controller, downstream of the cooling turbine, senses a pressure increase and begins to close the mass flow-control valve. This results in a decreased flow through the cooling turbine, increasing the temperature of air delivered to the dual temperature-control valve.

MANUAL COCKPIT AIR-CONDITIONING

The dual temperature-control valve can be operated manually by a toggle switch on the AIR CONDITIONING control panel. If the air-conditioning system fails or shuts down, ram air, ducted from the heat exchanger inlet scoop, can be selected for ventilation and limited pressurization of the cockpit.

ENVIRONMENTAL CONTROL SYSTEM CONTROLS AND INDICATORS

TYPICAL

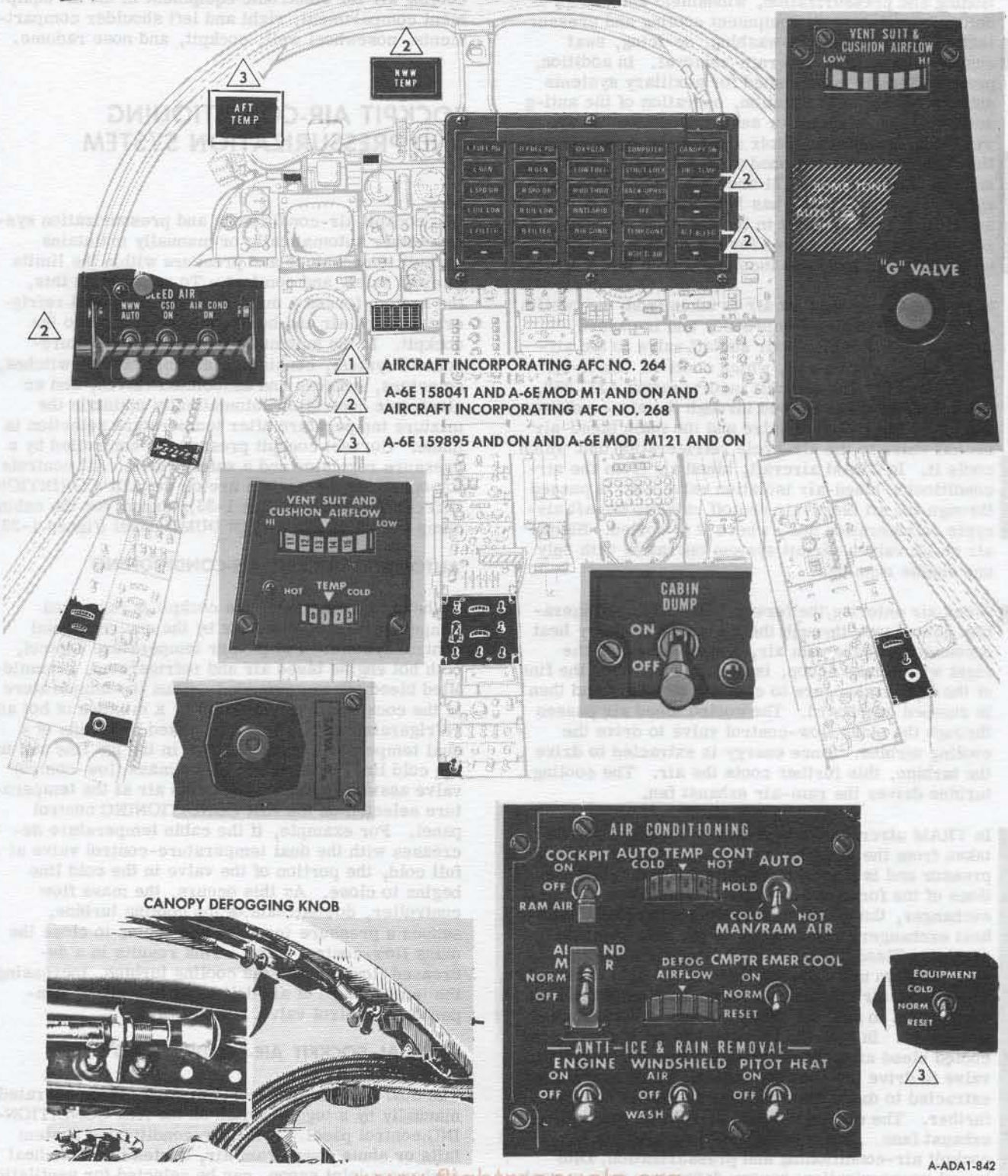

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Figure 1-33

COCKPIT PRESSURIZATION

Air from the refrigeration unit enters the cockpit under sufficient pressure to provide adequate cockpit pressurization. Cockpit pressurization, automatically initiated at 8,000 feet, is controlled by the cabin air-pressure regulator. The regulator controls the discharge rate of the air from the cockpit. After the aircraft reaches 8,000 feet, the regulator valve partially closes and maintains a cockpit altitude pressure of 8,000 feet until an aircraft altitude of 23,000 feet has been reached. Above an altitude of 23,000 feet, the regulator maintains 5 psi pressure differential. (See figure 1-34.) The regulator discharge air assists in cooling various electronic equipment in the nose compartment and nosewheel well. If the regulator should fail, the cockpit air-pressure safety valve automatically dumps when the cockpit pressure differential exceeds 5.5 psi. The safety valve is also capable of negative pressure relief to prevent excessive negative pressure during dives, when the ambient pressure is increasing faster than cockpit pressure is increasing. The safety valve, which dumps into the atmosphere, may also be operated manually by the crew, if desired.

AIR-CONDITIONING CONTROL PANEL

Air-Conditioning Master Switch

The air-conditioning master switch is a two-position (NORM and OFF) toggle switch on the AIR CONDITIONING control panel (figure 1-33). The switch is guarded to the NORM position. With the canopy switch closed (or open with AFC 185 installed), placing the switch to NORM deenergizes the electrical circuit to the main bleed-air shutoff valve, permitting the valve to open if the engine is providing air at 8 psi or more, and the air-conditioning caution light (AIR COND) to go off. Hot engine bleed air is now available for operation of the various environmental systems. Placing the switch to the OFF position allows electrical power to close the shutoff valve, thus shutting off the supply of hot engine bleed air to the environmental system.

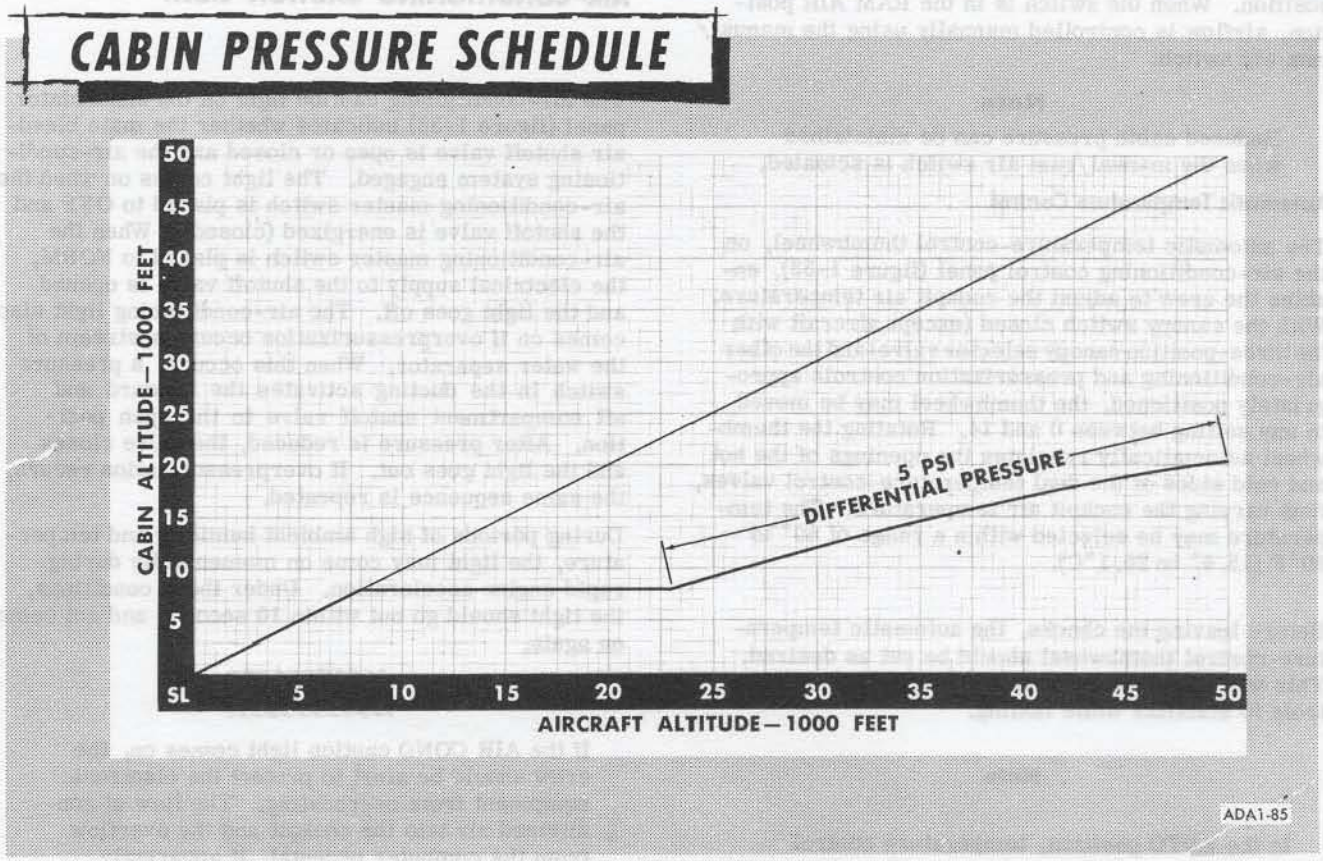

Figure 1-34

CAUTION

Fuel tank and anti-g suit pressurization lines bypass the main bleed-air shutoff valve. During ground operations, do not actuate either the g-valve test button or the ORIDE position of the tank pressure switch unless the air-conditioning master switch is in the NORM position and, in TRAM aircraft, the air-conditioning cockpit switch is in the ON position. Heat damage to O-ring seals in the fuel check valves may occur. Damage to these seals will permit fuel to flow into the auxiliary heat exchanger, the hydraulic tank, vent suit, canopy seal, and electronic equipment in the nose and nosewheel well as well as the engine bleed-air lines.

Note

The hot engine bleed-air line to the rain-removal system bypasses the main bleed-air shutoff valve. The system may still be operated with the air-conditioning master switch at OFF.

A spring-loaded guard over the air-conditioning master switch prevents inadvertent operation of the switch to OFF. Before placing the switch to OFF, the guard must be lifted.

Air-Conditioning Cockpit Switch

The cockpit switch, on the AIR CONDITIONING control panel (figure 1-33) is a three-position toggle switch marked ON, OFF, and RAM AIR. With an engine running, the canopy switch closed, (except in aircraft with the three-position canopy selector valve) and the air-conditioning master switch at NORM, placing the cockpit switch ON engages the air-conditioning and pressurization system by energizing the dual temperature-control valve and deenergizing (opening) the cabin shutoff valve. Depending upon the setting on the automatic temperature-control thumbwheel, conditioned air flows into the cockpit.

CAUTION

In TRAM aircraft, during ground operation of the air-conditioning system with an engine running, the air-conditioning cockpit switch must be kept at ON to ensure sufficient airflow to prevent hot engine bleed air from entering the environmental systems serviced by the forward unit.

Placing the cockpit switch OFF energizes (closes) the cabin shutoff valve, and drives the dual temperature-control valve to the full hot position. This prevents any airflow to the cockpit. The RAM AIR position closes the cabin shutoff valve and drives the dual temperature-control valve to the full hot

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position. When the switch is in the RAM AIR position, airflow is controlled manually using the manual/ram air switch.

Note

Reduced cabin pressure can be maintained when the manual/ram air switch is actuated.

Automatic Temperature Control

The automatic temperature-control thumbwheel, on the air-conditioning control panel (figure 1-33), enables the crew to adjust the cockpit air temperature. With the canopy switch closed (except aircraft with the three-position canopy selector valve) and the other air-conditioning and pressurization controls appropriately positioned, the thumbwheel may be moved to any setting between 0 and 14. Rotating the thumbwheel automatically regulates the openings of the hot and cold sides of the dual temperature-control valves, thus varying the cockpit air temperature. The temperature may be selected within a range of 60° to 80°F (15.6° to 26.1°C).

Before leaving the chocks, the automatic temperature-control thumbwheel should be set as desired. This will allow the automatic air-conditioning controls to stabilize while taxiing.

Note

In the AUTO position, temperature control should be set at the maximum cold position while the engines are at idle power.

Manual Ram Air Switch (Man/Ram Air)

The manual ram-air switch on the air-conditioning control control panel (figure 1-33) is a four-position toggle switch marked AUTO, HOLD, COLD, and HOT. The AUTO position is selected to place the dual temperature-control system in the automatic mode and thus allow control of the cockpit air temperature as selected by the automatic temperature-control thumbwheel. Placing the switch to HOLD removes the dual temperature-control valve from automatic control. The switch is spring-loaded to HOLD when AUTO is not selected. Momentarily holding the switch in COLD or HOT alters the positions of the hot and cold sides of the dual temperature-control valves accordingly, to change the cockpit air temperature. When released, the switch springs back to HOLD and the dual temperature-control valve remains fixed. The COLD and HOT positions should be toggled intermittently to avoid overshooting the desired position.

With RAM AIR selected on the air-conditioning cockpit switch, airflow is controlled manually through the MAN/RAM switch, which opens and closes the ram-air valve. The temperature of the air from an external refrigerated source can be controlled manually through this switch.

AIR-CONDITIONING CAUTION LIGHT

The air-conditioning caution light on the annunciator panel (figure 1-33) indicates whether the main bleed-air shutoff valve is open or closed and the air-conditioning system engaged. The light comes on when the air-conditioning master switch is placed to OFF and the shutoff valve is energized (closed). When the air-conditioning master switch is placed to NORM, the electrical supply to the shutoff valve is opened and the light goes off. The air-conditioning light also comes on if overpressurization occurs upstream of the water separator. When this occurs, a pressure switch in the ducting activates the forward and aft compartment shutoff valve to the open position. After pressure is reduced, the valve closes and the light goes out. If overpressurization recurs, the same sequence is repeated.

During periods of high ambient humidity and temperature, the light may come on momentarily during rapid engine acceleration. Under these conditions, the light should go out within 10 seconds and not come on again.

CAUTION

If the AIR COND caution light comes on, the crew should be alert to protect the electronic equipment from overheating. The flow of conditioned air into the cockpit and the overflow from the computer pedestal, if apparently normal both quantitatively and qualitatively and whether or not the COMPUTER overheat light is lit, may serve as a indication of an otherwise adequately functioning system. An arbitrary reflex decision to shut down essential gear predicated solely upon lighting of the subject light may be neither desirable nor necessary.

Note

The AIR COND caution light may come on momentarily when the throttles are advanced. This is a normal indication unless the light remains on.

CABIN DUMP SWITCH

The cabin dump switch (figure 1-33) is on the CABIN DUMP panel on the center console and allows the crew to manually dump cabin pressure. Placing the switch ON allows electrical power to energize the cabin dump solenoid. This, in turn, causes the safety valve to open and the cockpit pressure to be dumped. With the switch OFF, the cabin dump solenoid is de-energized, the valve is closed, and normal cockpit pressurization is obtained.

NORMAL OPERATION

Note

Except in aircraft with the three-position canopy selector valve, the canopy must be closed to energize the air-conditioning and pressurization system. It is recommended that this be done before leaving the chocks while engines are at idle setting.

1. Air-conditioning master switch - NORM
2. Cockpit air-conditioning switch - ON
3. MAN/RAM AIR switch - AUTO
4. Automatic temperature-control thumbwheel - SET at 0

   Initially set temperature controls as desired. After the system stabilizes, select desired setting.

MANUAL OPERATION

Note

Except in aircraft with the three-position canopy selector valve, the canopy must be closed to energize the air-conditioning and pressurization system.

1. Air-conditioning master switch - NORM
2. Cockpit air-conditioning switch - ON
3. MAN/RAM AIR switch - TOGGLE AS DESIRED, then HOLD

AUXILIARY ENVIRONMENTAL SYSTEMS

The environmental control system provides hot bleed air and refrigerated, dehumidified bleed air for anti-exposure suit or seat-cushion ventilation and for anti-g suit operation. Personnel services disconnects are provided in both seats for these purposes.

ANTI-EXPOSURE SUIT AND SEAT CUSHION VENTILATION

The pilot and the bombardier/navigator receive a mixture of dehumidified refrigerated air and engine bleed air to ventilate their anti-exposure suits or seat cushions. The controls for the suit and seat cushions are on the vent suit and cushion control panel (figure 1-33). The bombardier/navigator has no temperature control; however, he will receive air at the temperature selected by the pilot. The pilot's airflow thumbwheel must be moved toward HI to receive temperature-controlled air.

Vent Suit and Cushion Airflow Control

The pilot's airflow thumbwheel on the vent suit seat cushion control panel (figure 1-33) controls the amount of airflow to the pilot's ventilated anti-exposure suit or seat cushion. With the air-conditioning master switch at NORM, rotating the thumbwheel toward HI energizes (opens) the flow-control valve and activates the temperature-control system. This allows a mixture of hot engine bleed air from the refrigeration unit to pass to the pilot's and bombardier/navigator's cushion. The bombardier/navigator has a similar control on the right console but it has provisions only for regulating airflow and cannot start the system operating.

Vent Suit and Cushion Temperature Control

The temperature (TEMP) thumbwheel on the vent suit and cushion panel (figure 1-32) controls the temperature of the airflow to the pilot's and bombardier/navigator's ventilated anti-exposure suits or seat cushions. With the air-conditioning master switch at NORM, rotating the temperature thumbwheel to HOT or COLD sets the temperature, which the vent suit temperature-control system maintains.

Normal Operation of Vent Suit and Cushion

1. Air-conditioning master switch - NORM
2. Airflow thumbwheel - TOWARD HI
3. Temperature thumbwheel - AS DESIREI

ANTI-G SUITS

Cooled engine bleed air from the auxiliary heat exchanger is piped to the anti-g valves in the left and right consoles. The anti-g valves regulate pressure to the anti-g suits to a maximum of 10 psi and allow the suits to be inflated under varying pressures in proportion to the amount of g force exerted on the aircraft and occupants. As the g force decreases, the anti-g valves register a corresponding decrease in the pressure admitted to the suits. Excess pressure is exhausted into the cockpit. Air from each anti-g valve reaches its suit through personnel services disconnects in the respective seat. The suit bladders may be inflated at any time by depressing the button on top of the valve. Releasing the button allows the valve to close and the pressure in the suit to be exhausted.

G Valve Test

The g valve test buttons on the pilot's left console (figure 1-33, immediately aft of the vent suit and cushion airflow control and the bombardier/navigator's right console, aft on the outboard side (figure 1-33) provide means of testing the proper operation of anti-g suits.

Depressing the g-valve test button provides the necessary air pressure to inflate the anti-g suit bladder. Releasing the button will automatically stop further airflow to the suit and permit the anti-g suit bladder to deflate.

WARNING

Ensure that the air-conditioning master switch is in the NORM position and in TRAM aircraft, the air-conditioning cockpit switch is at ON, prior to depressing the g-valve test button. Hot engine bleed air will be pumped through the anti-g suit if the test button is depressed when the air-conditioning master switch (or, in TRAM aircraft, the air-conditioning cockpit switch) is OFF and the aircraft is on the deck.

DEFOGGING

A mixture of engine compressor bleed air, and air cooled by the main section of the refrigeration unit heat exchanger can be directed to the inside surfaces of all transparent cockpit areas to prevent fog formation. The amount of defog air is monitored by the defog pressure regulator, which is controlled by the defog airflow thumbwheel. The temperature-control valve automatically maintains the defogging air at a temperature of 115°C (240°F) within a tolerance of ±2.8°C (±5°F) for any stabilized flight conditions, and at a tolerance of ±5.6°C (±10°F) while the aircraft is experiencing varying flight conditions.

CANOPY DEFOGGING

The defog airflow is directed to the windshield and side panels any time the system is operating. To direct defog airflow to the canopy, the canopy defog knob must be moved forward (ON). Before descending after prolonged cold-soaking, the defog airflow thumbwheel should be actuated toward HI and the defog knob should be moved to full ON (figure 1-33).

Defog Airflow Thumbwheel

The defog airflow thumbwheel on the air-conditioning control panel (figure 1-33) allows the crew to engage the defogging system and regulate the pressure of the defog air to the transparent cockpit areas. With the canopy closed and the air-conditioning master switch at NORM, turning the thumbwheel to the right engages the defogging system. The defog pressure-regulator shutoff valve becomes energized, opens the valve, and allows temperature-controlled air to flow through the system to the cockpit diffusers. As the thumbwheel relation is continued, the flow of air to the transparent areas is increased. Conversely rotating the thumbwheel to the left decreases the flow of air to these areas. The air supply to the canopy is automatically shut off when the canopy is opened.

Canopy Defog Knob

A manual canopy defog knob (figure 1-33), on the upper center structure of the canopy, permits the crew to modulate, or shut off completely, portions of total defogging flow delivered to the canopy diffusers. This is accomplished by means of a pushpull cable connected to a butterfly valve. Moving the knob aft (OFF) decreases airflow to the canopy and increases windshield airflow.

OPERATION OF DEFOGGING

1. Air-conditioning master switch - NORM
2. Defog airflow thumbwheel - AS DESIRED
3. Canopy defog knob - AS DESIRED.

WINDSHIELD SWITCH

The windshield switch on the air-conditioning control panel (figure 1-33) has positions marked AIR, OFF, and WASH, and is spring-loaded from WASH to OFF (spring-loaded to OFF from either position with AFC 264). See figure 1-6 for a functional diagram. Electrical power for the windshield switch comes from the 28 V dc primary bus through the AIR COND circuit breaker on the nosewheel well circuit breaker panel.

CAUTION

- Placing the WINDSHIELD switch to AIR on the ground at high power settings may cause the windshield to crack.
- Allow 5 seconds between actuations of the WINDSHIELD switch to permit cooling of the nosewheel well bleed-air isolation valve motor.

Note

- In aircraft incorporating AFC 264, the WSHLD AIR light will come on when the WSHLD AIR switch is placed in the AIR position.
- In A-6E 158533 and ON and aircraft incorporating AFC 268, the nosewheel well bleed-air isolation valve will open if the NWW bleed-air switch on the fuel management panel is in AUTO.

WINDSHIELD WASH

Placing the WINDSHIELD switch to the WASH position electrically energizes the windshield-washing regulator and dump valve. The valve allows bleed-air, cooled by the auxiliary heat exchanger, to pressurize the 1 1/2-gallon fluid tank. The 50-50 water-methanol mixture from the tank is forced through five nozzles onto the pilot's windshield as long as the switch is held to WASH. When released to OFF, the valve shuts off the bleed-air and dumps the pressure in the tank.

Operation of Windshield Wash

1. Windshield switch . . . . . WASH
2. Windshield switch . . . . . AIR

RAIN REMOVAL (ANTI-ICE)

Placing the windshield switch to the AIR position electrically energizes the rain-removal pressure-regulator shutoff valve; the WSHLD AIR light (AFC 264) on the annunciator panel; and if AUTO is selected on the NWW switch (AFC 268), the nose-wheel well bleed-air isolation valve. Bleed-air passes from the isolation valve through the regulator in the rain-removal valve, is mixed with ambient air by two ejectors, and then directed in a broad stream across the pilot's windshield.

Operation of Rain Removal (Anti-Ice)

1. Windshield switch . . . . . WASH
2. Windshield switch . . . . . AIR

CAUTION

Operation of the rain-removal system is not recommended on a dry windshield or above 200 KIAS. Operation on the ground at high power settings may cause the windshield to crack.

EQUIPMENT COOLING

The equipment-cooling system employs ram air, refrigerated air, and a controlled mixture of refrigerated air and hot engine bleed air to cool electronic equipment in various sections of the aircraft. With an engine running, operation of the equipment-cooling system is automatic. In A-6A, B, C, KA-6D, A-6E through 159579, and A-6E Mod through M120, the air-conditioning master switch must be on for the equipment-cooling system to operate. In A-6E 159895 and ON and A-6E Mod M121 and ON, operation of the system is independent of the air-conditioning master switch requiring only that the air-conditioning bleed air switch be at ON.

Airflow is controlled by a combination of temperature sensors and flow-control valves, by sonic venturis, and by the equipment-cooling pressure regulator. (See figure FO-7.)

COMPUTER EMERGENCY COOLING (A-6A, B, C, E) THRU 159579 AND A-6E MOD THRU M120)

If the computer inlet air temperature exceeds 150°F, the computer thermal switch will deenergize, automatically completing a circuit to the COMPUTER overheat caution light and computer cooling shutoff valve. The computer shutoff valve will then close, preventing hot bleed air from flowing and allowing cooled bleed air to be ducted to the ballistics computer.

When duct temperature drops below 150°F, the computer overheat caution light will go out; however, the computer shutoff valve will remain closed. To restore automatic computer cooling, the computer emergency cooling (CMPTR EMER COOL) switch on the AIR CONDITIONING control panel (figure 1-33) must be actuated to RESET.

Computer Emergency Cooling Switch

The computer emergency cooling switch on the AIR CONDITIONING control panel (figure 1-33) is a three-position toggle switch placarded ON, NORM, and RESET. In the NORM position, automatic temperature control of computer air is provided, or in the event of temperature-control malfunction, unregulated cooled air is directed to the computer.

The RESET position is used to restore automatic computer cooling in the event of automatic temperature-control malfunction (COMPUTER overheat light coming on momentarily, then going off).

The ON position is used if continuous unregulated cooling airflow is desired.

The computer emergency cooling switch is inoperative in the KA-6D.

COMPUTER Overheat Light (A-6A, B, C)

The COMPUTER overheat caution light is on the annunciator panel (figure 1-33). In A-6A, B, C, a momentary light (on and then off), indicates a shift of computer cooling from regulated to unregulated temperature control. A steady light indicates failure of temperature-control regulation and a failure of the emergency cooling system. Setting the computer emergency cooling switch to ON should select unregulated cooling airflow and turn off the light.

CAUTION

- If the COMPUTER caution light on the annunciator panel remains on, secure the computer.
- If the COMPUTER caution light remains on after the computer is secured, a computer temperature control valve failure is indicated. To prevent damage to the computer and possible smoke and fumes in the cockpit, the AIR COND MASTER switch should be set to OFF. Unnecessary electronic equipment should be secured to prevent damage.

The A-6E COMPUTER light on the annunciator panel comes on when the temperature of the computer has exceeded a safe level.

CAUTION

If the COMPUTER light comes on, the computer should be secured immediately to prevent damage.

The COMPUTER overheat caution light is inoperative in the KA-6D.

Temperature Control Light (A-6E)

The TEMP CONT caution light is on the annunciator panel (figure 1-33). A momentary light (on and then off), indicates a shift of computer cooling from regulated to unregulated temperature control. A steady light indicates failure to temperature-control regulation and a failure of the emergency cooling system. Setting the computer emergency cooling switch to ON should select unregulated cooling airflow and turn off the light.

CAUTION

If the TEMP CONT caution light remains on, a computer temperature control valve failure is indicated. To prevent damage to the computer and possible smoke and fumes in the cockpit, the AIR COND MASTER switch should be set to OFF. The COMPUTER light may be expected to come on. The computer and any unnecessary electronic equipment should be secured to prevent damage.

COMPUTER PURGE (A-6A,B,C)

In aircraft incorporating AFC 135, a high-temperature air purge system is provided to aid in eliminating moisture from the computer units and raise their temperature to prevent condensation in and on them. This purge operates automatically when the computer, search radar, and track radar are turned off with air-conditioning on.

EQUIPMENT COOLING (A-6E TRAM CONFIGURED)

In A-6E 159895 and ON and A-6E Mod M121 and ON (TRAM configured aircraft) the equipment-cooling system provides properly conditioned air to specially cooled electronic equipment in the aft equipment compartment, left and right shoulder compartments, cockpit, nose radome, and nosewheel well. The system uses hot bleed air from the engines and refrigerated bleed air from the aft air-cycle refrigeration unit in the aft equipment compartment. Engine bleed air flow to the equipment-cooling system is controlled by the aft bleed-air shutoff valve. This valve is controlled by the AIR COND BLEED AIR switch on the fuel management panel and thermal switches in the equipment-cooling system. The AFT BLEED caution light on the annunciator panel comes on when this valve is closed. Hot engine bleed air flows to the air-cycle refrigeration unit to be cooled and through the aft equipment cooling temperature-control valve to a mixing chamber, where it is mixed with refrigerated air to provide air of the proper temperature.

Refrigerated air from the aft air-cycle refrigeration unit is also used to cool the aft equipment compartment if ram-air temperature is excessive. When the ram-air thermal switch is activated by a temperature of 125° ± 5°F, the normally closed aft equipment compartment shutoff valve is opened, permitting refrigerated air to flow to the compartment.

Should the temperature in the equipment-cooling duct exceed 150°F, a thermal switch opens, causing the TEMP CONT caution light to come on and the equipment-cooling temperature-control valve to close, blocking the flow of hot bleed air to the mixing chamber, thus providing only refrigerated air to the system. When the temperature is reduced to below 150°, the TEMP CONT light goes out; however, the equipment-cooling temperature-control valve remains closed until the EQUIPMENT switch on the AIR CONDITIONING control panel is momentarily actuated to reset.

AFT BLEED Caution Light

The AFT BLEED caution light on the annunciator panel comes on when the aft bleed-air shutoff valve in the main bleed-air duct in the right engine compartment is closed. If this light is lit, electronic equipment must be shut down to prevent overheat damage.

EQUIPMENT Switch

The EQUIPMENT switch is a three-position toggle switch on the AIR CONDITIONING control panel marked COLD, NORM, and RESET. In the NORM position, automatic temperature control of equipment cooling air is provided, or in the event of temperature-control malfuction, unregulated cooled air is provided. The RESET position is used to restore automatic operation of the system after the TEMP CONT light has gone off. The COLD position closes the equipment-cooling temperature-control valve, directing unregulated refrigerated air to the system.

COMPUTER Overheat Light

The COMPUTER light on the annunciator panel comes on when the temperature of the computer has exceeded a safe level.

CAUTION

If the COMPUTER light comes on, the computer should be secured immediately to prevent damage.

TEMP CONT Caution Light

The TEMP CONT caution light on the annunciator panel comes on when an overtemperature in the equipment-cooling system has caused the equipment-cooling temperature-control valve to close, directing only refrigerated air to the system. The light remains on until the temperature in the equipment cooling duct is reduced to less than 150°F. The light should go out in approximately 30 seconds, the time required for the valve to close. If the light remains on for more than 30 seconds, a failure of the thermal switch or the equipment-cooling temperature-control valve is indicated. If the thermal switch has failed, setting the EQUIPMENT switch to COLD should close the valve and turn off the light.

CAUTION

If the TEMP CONT light remains on more than 30 seconds after selecting COLD, a failure of the equipment-cooling temperature-control valve is indicated. To prevent overheat damage, set the AIR COND BLEED shutoff valve to OFF and secure electronic equipment.

TRIM POD ENVIRONMENTAL CONTROL SYSTEM (A-6C)

A separate environmental control system is provided in the TRIM pod, which uses engine bleed air to produce conditioned air for pod heating, cooling, pressurization, and window defogging. The turret air temperature is maintained by an additional liquid cooling unit (powered through the TV/IR POD AIR COND 2 circuit breaker on the main circuit breaker) and air circulating fans.

CAUTION

In aircraft incorporating AFC 268, the TRIM pod environmental control system is inoperative with the left engine shut down or with the AIR COND bleed-air isolation valve closed.

TV/IR Cooling Switch

The TV/IR COOLING switch is a three-position toggle switch on the center console marked OFF, NORM, and RESET, which controls the engine bleed-air valve and turns on the POD CLG light. Selecting

OFF closes the engine bleed-air valve. The NORM position permits automatic operation of the engine bleed-air valve. The RESET position is used to reset the valve for automatic operation in the event of malfunction. There is no provision for manual operation of the engine bleed-air valve.

Pod Cooling Light

The POD CLG light on the annunciator panel comes on steady to indicate that the engine bleed-air valve is closed, the liquid coolant temperature exceeds 150°F, or coolant pressure is below 2 psi. When the POD CLG light comes on, the pod environmental control system is shut down, but the sensors remain on. The light flashes if the system is dead-ended.

CAUTION

If the POD CLG light comes on and cannot be reset, the TV and IR sensors should be shut down to prevent equipment damage.

The operation of the light may be tested by depressing the pilot's LTS WARN button.

Turret Hot Light

The TUR HOT light on the annunciator panel comes on to indicate that the air temperature in the turret that houses the optical sensor platform and FLIR and LLLTV receivers is above 135°. When the light comes on, the TV and IR sensors are secured automatically. The ECS remains on. The operation of the light may be checked by depressing the pilot's master test button. If the TV/IR POD AIR COND 2 circuit breaker becomes disengaged, power will be lost to the liquid cooling pump. The air-cycle machine will continue to run, but the TUR HOT light as well as the COMPUTER light will come on. If the POD CLG light was on, it will go out.

GROUND COOLING SYSTEM (A-6E)

The ground cooling system provides cooling air for specially cooled electronic equipment when operating on external power.

GROUND COOLING (A-6E 158041 THRU 159579 AND MOD M1 THRU M120)

The ground cooling system automatically provides cooling air to components of the computer, radar, INS, and CNI. The ground blower operates to draw in outside air when the right generator is OFF, external power is applied, and either the search radar POWER switch, the COMPUTER power switch on the DDU, or the CNI MASTER switch is set ON.

CAUTION

When the right generator is on the line, the ground blower is automatically turned OFF and equipment-cooling air is supplied by the engines. During ground operation with engines running and the ground blower OFF, the radar units in the nose radome are cooled by cabin discharge air. Operation of the radar with the canopy OPEN and the ground blower OFF must be limited to no more than 5 minutes.

Provisions are made to connect external cooling air when ambient temperature exceeds 103°F or when the aircraft is in an enclosed, poorly ventilated area.

Equipment protection circuits are provided to warn of overheating in the computer and to shut down both the sensitive electronic equipment and the ground blower. When temperatures in the pedestal control unit exceed 176°F, or temperatures exceed 230°F in the computer or analog-to-digital converter, the COMPUTER light comes on and power to the computer, the analog-to-digital converter, the radar, and the CNI package is interrupted. The light will remain on until the equipment cools to below the overheat temperature. After sufficient cooling, power may be restored by depressing the RESET button on the ground cooling panel in the nosewheel well.

Ground Cooling Switch

The ground cooling toggle switch on the ground cooling panel in the nosewheel well has three positions marked TEST, AUTO, CART. The TEST position is used to test the operation of the ground blower. The CART position permits use of the ground cooling system with external cooling air. The ground blower does not operate when CART is selected. The normal AUTO position permits the system to operate in the automatic mode.

Note

The ground cooling switch automatically returns to the AUTO position when external electric power is turned off.

GROUND COOLING (A-6E 159895 AND ON AND MOD M121 AND ON)

The ground cooling system automatically provides cooling air to components of the radar; inertial navigation system (CAINS); communications, navigation, and identification (CNI); detection and ranging set (DRS); and computer. Automatic operation of the system occurs when external electrical power is applied, any of the above systems are operating, and the AUTO/TEST switch on the ground blower panel in the nosewheel well is set to AUTO.

The system contains two cooling fans: a ground blower in the nosewheel well, and the CAINS PSU

fan in the left shoulder compartment. External cooling air may be applied when ambient temperature is excessive or the aircraft is in an enclosed, poorly ventilated area. In this case, a low-pressure switch downstream of the ground cooling inlet turns the cooling fans off when pressure of the external cooling air is applied. The pressure switch turns the fans on when external air is shut off.

If an overtemperature condition occurs in any of the specially cooled electronic equipment during ground operation, power to all of the specially cooled electronic systems will be cut off. After the affected equipment has cooled below operating limits, the specially cooled electronic equipment can be enabled by momentarily placing the RESET switch on the ground blower panel in the RESET position.

The TACAN has a separate fan, which operates whenever the TACAN is on.

Ground Cooling Panel

The ground cooling panel in the nosewheel well contains the circuit protection and controls for the ground cooling system.

TEST/AUTO switch - Selecting TEST operates the ground cooling fans with no equipment operating. Selecting AUTO enables automatic operation of the system.

RESET switch - Momentarily selecting RESET restores electrical power to specially cooled equipment if the equipment has cooled sufficiently after an overtemperature has caused a power interruption.

ENGINE ANTI-ICING

An independent system for preventing or removing ice at the engine inlet guide vanes is provided on each engine. Hot air, taken directly from the compressor, is ducted to the vane area when the pilot anticipates icing conditions. The engine anti-ice switch controls the engine anti-ice system. (See figure 1-33.)

ENGINE ANTI-ICE SWITCH

The engine anti-ice switch is a two-position toggle switch (ON and OFF) on the AIR CONDITIONING control panel (figure 1-33). Placing the switch ON allows electrical power to energize the anti-icing air shutoff valve, which opens to allow hot engine bleed air to be distributed to the guide vanes.

CIRCUIT PROTECTION

Several circuit breakers protect the components of the environmental control system. The AIR COND circuit breaker in the nosewheel well provides 28 V dc from the primary bus while 28 V dc from the essential bus goes through the AIR COND 2 circuit breaker on the main circuit breaker panel. Power from the 115 V ac essential bus is provided through the LAT LONG TRIM circuit breaker on the main circuit breaker panel. The ENVIRONMENT SEATS and EQUIP COOL circuit breakers on the bombardier/navigator's circuit breaker panel provide 115 V ac from the primary bus. The BLEED AIR circuit breaker on the B/N's circuit breaker panel supplied 115 V ac from the essential bus to the bleed-air isolation valves. On non-TRAM A-6E aircraft, the CNI AUX BLOWER circuit breaker on the auxiliary aft bay circuit breaker panel supplies 115 V ac from the primary bus to the CNI auxiliary cooling blower. On TRAM configured A-6E, the EQUIP COOLING circuit breaker and the CAINS PSU FAN circuit breaker on the auxiliary aft bay circuit breaker panel provide 28 V dc and 115 V three-phase ac from the primary bus.

PITOT HEAT

The pitot heat switch, on the AIR CONDITIONING control panel (figure 1-33), is a two-position switch marked ON and OFF. Placing the switch ON allows electrical power to be supplied from the 28 V dc primary bus to a conventional heater in the pitot tube. It also allows, through the left weight-on-wheels switch, heat to be provided to the angle-of-attack and total-temperature probes when airborne.

OXYGEN SYSTEM

The liquid oxygen system delivers gaseous oxygen to the crew to enable them to operate above 10,000 feet altitude and to maintain peak body efficiency at altitudes above 5,000 feet. In the MK GRU-5 ejection seat, the system delivers oxygen mixed with cockpit ambient air up to an altitude of approximately 30,000 feet; however, 100% oxygen is available at any time. Above 30,000 feet, an aneroid device in the system automatically closes off the entrance of ambient air. In the MK GRU-7 ejection seat, 100% oxygen is provided at all times. The oxygen source of the system is a supply of liquid oxygen stored in a 10-liter oxygen converter in the aft equipment compartment. In addition, the converter installation has provision for the installation of a second similar converter for use during long-range missions. System pressure is maintained at 70 to 100 psi by pressure-opening and pressure-closing valves on the converter and by a system relief valve. See figure 1-35 for oxygen duration.

Liquid oxygen is converted into gaseous oxygen and is delivered through a single line to the heat exchanger and plenum assemblies on the aft sloping bulkhead of the cockpit. In the plenum, temperature-conditioned oxygen is stored before being delivered through the shutoff valves to the seat-mounted personnel services disconnects. On the MK GRU-7 seat, a line from the personnel services disconnect goes to a distribution point in the left rear corner of the survival kit. The emergency oxygen supply also connects to this point. The oxygen regulators, one for each crewmember, govern the pressure and flow of gaseous oxygen to the face mask of the seat occupant.

OXYGEN QUANTITY GAGE

The oxygen quantity gage (figure FO-2 sheets 1, 2 and 3) at the top right side of the pilot's instrument panel indicates the quantity of liquid oxygen in the converter. The gage reads 20 liters maximum, so as to be usable when two converters are used.

OXYGEN CAUTION LIGHT

The oxygen caution light on the annunciator panel (figure FO-11) indicates that sufficient pressure is not being maintained, or that the liquid oxygen indicator is 2 liters or less. When the oxygen pressure drops below 50 psi, a pressure switch, attached to one of the oxygen pressure lines, is closed. This allows electrical power to turn on the oxygen warning light.

LOX/FUEL/OIL Press-To-Test Button

Pressing the LOX/FUEL/OIL press-to-test button on the master test panel causes the oxygen quantity gage to drop to zero and the oxygen warning light to come on.

SEAT MOUNTED OXYGEN REGULATOR

In aircraft incorporating the MK GRU-5 ejection seat, a diluter-demand oxygen regulator (Bendix 29255 series) in the right side of each ejection seat (figure 1-27) allows the pilot and the bombardier/navigator to direct oxygen flow to their face masks as desired.

The regulator automatically provides positive-pressure breathing above a cabin pressure altitude of approximately 35,000 feet and during ejection above that ambient altitude.

Oxygen Regulator Selector Knob

This control is on the top of the regulator assembly (figure 1-27) and is used to position the internal valve assembly and the aneroid. The knob is rotated counterclockwise to the full UP position to get diluter-demand operation of the regulator. Rotating the knob clockwise repositions the valve, permitting 100% oxygen flow to the mask.

WARNING

During in-flight emergencies such as cockpit or electrical fires, the oxygen regulator selector valve should be positioned for 100% oxygen flow to prevent smoke and fumes from being inhaled.

PERSONAL OXYGEN REGULATOR

In aircraft incorporating the MK GRU-7 ejection seat, each crewmember is provided with a personal-issue oxygen regulator that is compatible with his mask and the aircraft oxygen system.

OXYGEN SUPPLY LEVERS

The oxygen levers on the pilot's left console and bombardier/navigator's right console are two-position lever switches marked ON and OFF and are used to engage the crew's oxygen system. Lifting the lever handle out against the pressure of the lever handle spring disengages the lever from its notch and allows it to be placed ON. This opens the pilot's oxygen shutoff valve, permitting oxygen under pressure to flow through the valve. Placing the lever OFF closes the valve and stops all oxygen flow through the valve.

EMERGENCY OXYGEN SUPPLY

In aircraft incorporating the MK GRU-5 seat, each ejection seat is equipped with a cylinder of compressed oxygen capable of supplying emergency oxygen for approximately 10 minutes (figure 1-27). Each seat is equipped with a pull-type lanyard for switching to emergency oxygen operation.

Since the emergency oxygen supply is attached to the MK GRU-5 seat, oxygen will not be available subsequent to seat separation during an ejection sequence. Therefore, the oxygen mask must be disconnected from the helmet at that time to permit normal effortless breathing. This is particularly important before water entry to avoid inhalation of water.

In aircraft incorporating the MK GRU-7 ejection seat, each survival kit is provided with a cylinder of compressed oxygen capable of supplying emergency oxygen for approximately 15 minutes. A manual control is provided to actuate the emergency supply in the event the aircraft system fails or is depleted.

OXYGEN DURATION CHART

MAN HOURS OF OXYGEN REMAINING-100%

CABIN ALTITUDE	LITERS LIQUID O_2										LESS THAN 1
	10	9	8	7	6	5	4	3	2	1	
35,000 FEET and above	32.2	29.0	25.7	22.6	19.3	16.1	12.9	9.6	6.4	3.2	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
30,000 FEET	25.5	23.0	20.4	17.9	15.3	12.8	10.2	7.6	5.1	2.5	
25,000 FEET	20.5	18.4	16.4	14.3	12.3	10.2	8.2	6.1	4.1	2.0	
20,000 FEET	16.5	14.8	13.2	11.5	9.9	8.2	6.7	4.9	3.3	1.6	
15,000 FEET	13.4	12.1	10.7	9.4	8.0	6.7	5.3	4.0	2.6	1.3	
10,000 FEET	11.0	9.9	8.8	7.7	6.6	5.5	4.4	3.3	2.2	1.1	
8,000 FEET	10.3	9.3	8.2	7.2	6.2	5.1	4.1	3.1	2.1	1.0	
5,000 FEET	9.2	8.3	7.4	6.5	5.5	4.6	3.7	2.8	1.8	.9	
SEA LEVEL	7.6	6.8	6.0	5.3	4.5	3.8	3.0	1.9	1.5	.7	

NOTE

- WHEN TWO PERSONS ARE USING OXYGEN, DIVIDE THE NUMBER OF HOURS REMAINING BY TWO.
- DURATION DATA SHOULD BE USED AS A GUIDE ONLY SINCE OXYGEN CONSUMPTION VARIES WITH THE INDIVIDUAL.
- CONVERSION OF LIQUID O_2 TO GASEOUS O_2 IS 860 LITERS OF GASEOUS TO 1 LITER OF LIQUID O_2
- CONSUMPTION RATES ARE BASED ON MIL 1-19326B
- CONSUMPTION RATES SHOWN ARE FOR 1 MAN.

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Figure 1-35

Since the emergency oxygen supply is in the survival kit, oxygen is available during the parachute descent; however, the mask should be removed after the parachute opens to prevent suffocation after the oxygen supply is depleted.

Emergency Oxygen Manual Control

In aircraft incorporating the MK GRU-5 ejection seat, a ring attached to the individual emergency oxygen bottle through a cable and linkage assembly on the right side of each ejection seat (figure 1-27) allows the pilot and bombardier/navigator to actuate an emergency oxygen supply. Pulling the ring opens a valve, allowing oxygen to pass through the regulator and on to the mask.

In aircraft incorporating the MK GRU-7 ejection seat, the emergency oxygen supply is actuated manually by pulling a green ring on the inside left thigh of the survival kit. When the ring is pulled, a cable opens the valve on the emergency oxygen cylinder allowing oxygen to flow to the regulator. The ring and cable come free when the valve opens.

Note

The emergency oxygen supply is automatically actuated when the Martin-Baker seat is ejected.

LIGHTING SYSTEMS

INTERIOR LIGHTING

The interior lighting system provides maximum controlled lighting for the instrument panels and consoles, and consists of the pilot's lighting system, bombardier/navigator's lighting system, and the aft equipment bay dome light and switch.

The pilot's lighting system consists of the flight instrument lights, console lights, indexer light, floodlights, kneeboard light, utility light, and daylight floodlights. The system provides the pilot with complete control over the lighting of his instrument panel and consoles as well as the intensity of all caution and advisory lights.

The bombardier/navigator's lighting system consists of the bombardier/navigator's instrument panel lights, bombardier/navigator's console lights, and the utility light. The system provides the bombardier/navigator with complete control over the lighting of his instrument panel and console.

The aft equipment bay dome light and switch system is on the top of the aft equipment bay and provides lighting of the bay for maintenance personnel. This light can be turned on only when external electrical power is supplied to the aircraft.

Electrical power for lighting of all flight instruments is supplied by the 28 V dc and 115 V ac essential buses, and power for lighting of all other instruments comes from the 28 V dc and 115 V ac monitored buses. Power for the utility light is supplied by the essential bus. All controls for operation of the pilot's internal lighting system except the kneeboard, utility, and daylight floodlights are on the master light panel, and those used for the bombardier/navigator's lighting system are on the internal lights panel.

Daylight Floodlights

Four daylight floodlights are mounted on the canopy bow to minimize the possibility of flash blinding due to lighting or to nuclear blast (with or without the radiation shield). Two 40-watt lamps are oriented to illuminate the pilot's and the bombardier/navigator's instrument panels. Two 20-watt lamps illuminate the left and right consoles. The lights are controlled by a three-position switch on the aft side of the canopy bow. The positions of the switch are BRIGHT (forward), OFF (center), and DIM (aft).

Utility Lights

There are three utility lights in the cockpit. Two of the lights are on either side of the cockpit on the cockpit longerons. The third light is overhead on the canopy bow. Each light has an individual ON/OFF switch, a rheostat control, and the option of red or white filter and flood or spot illumination. Alligator clips and swivel mountings allow the lights to be placed in any convenient location for maximum use.

Pilot's Kneeboard Light

The pilot's kneeboard light (figure 1-36) is on the canopy bow and directs a beam of light to the pilot's right knee. The light is controlled by an individual ON/OFF switch mounted on the light.

Bombardier/Navigator's Map Light

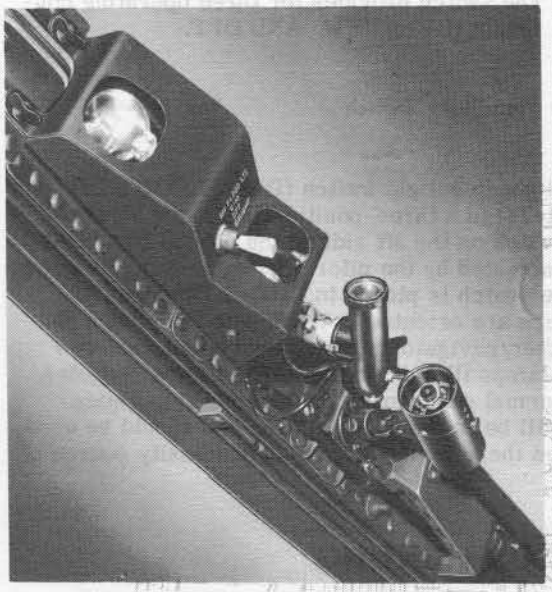
The bombardier/navigator's map light is on the lower right side of the canopy. An ON/OFF rheostat switch is used to place the light on or off.

PILOT'S INTERIOR LIGHT CONTROLS

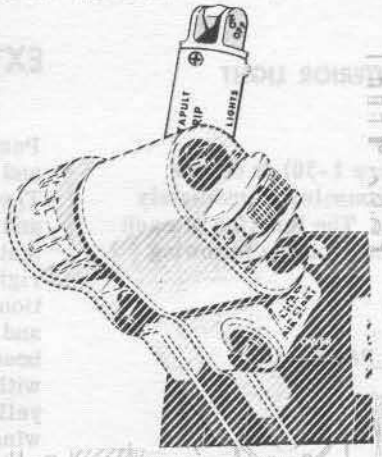
Flight Instrument Lights Control

The pilot's flight instrument lights thumbwheel is on the master light panel (figure 1-36) and controls the lighting of the flight instruments on the pilot's instrument panel and the caution and advisory lights. Rotating the flight instrument thumbwheel to dim lights the instruments at a low intensity, whereas with the thumbwheel at bright, they will light with maximum intensity. Provisions are incorporated into the pilot's flight instrument lighting circuitry so that the flight instrument lights must be lit before nonflight instruments may be lighted. This control also actuates the warning light dimming circuits. The warning lights are dim when the instrument thumbwheel is in the full bright position and bright when the thumbwheel is in the dim position.

LIGHTING CONTROLS



OVERHEAD UTILITY AND FLOODLIGHTS



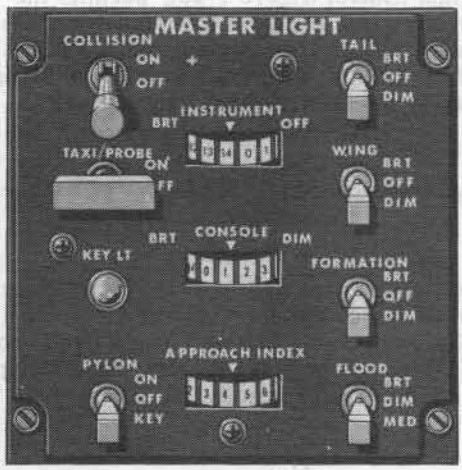


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Figure 1-36

Console Lights Control

The pilot's console lights control on the master light panel (figure 1-36), controls the illumination of the pilot's left and center consoles and the optical sighthead elevation thumbwheel. With the flight instrument thumbwheel set at either dim or bright, rotating the console thumbwheel to dim lights the instruments on the pilot's left and center consoles at a low intensity. Conversely, rotating the thumbwheel to bright lights the instruments at maximum intensity.

Approach Indexer Light Control

The indexer light thumbwheel on the master light panel (figure 1-36) controls the lighting of the approach light indexer. With the flight instrument thumbwheel set at either dim or bright, rotating the indexer thumbwheel to dim lights the indexer at a low intensity. Conversely, rotating the thumbwheel to bright lights the indexer at maximum intensity.

BOMBARDIER/NAVIGATOR'S INTERIOR LIGHT CONTROLS

The lighting control panel (figure 1-36) is on the bombardier/navigator's right console, immediately aft of the oxygen control panel. The function of each of the control switches is provided in the following paragraphs.

INTERIOR LIGHTING CONTROL PANEL

Panel Light Control

The panel light control (figure 1-36), permits the bombardier/navigator to adjust the intensity of the control panel lighting. The control has OFF and bright (BRT) positions, with intermediate positions offering varying degrees of panel light intensity.

Console Light Control

The console light control (figure 1-36) permits the bombardier/navigator to adjust the right console lighting. The control has DIM and bright (BRT) positions, with intermediate positions offering varying degrees of console light intensity.

Note

The console cannot be lighted until the panel light control has first been rotated ON.

Floodlight Control Switch

The floodlight control switch (FLOOD) (figure 1-36) is a three-position toggle switch that controls the floodlights below the canopy sill and below the glare shield. The switch provides for three operating conditions: bright (BRT), DIM, AND OFF.

Daylight Floodlight Switch

The daylight floodlight switch (DAY FLOOD LTS) (figure 1-36) is a three-position (BRT, OFF, and DIM), switch on the aft side of the canopy bow, that may be actuated by the pilor or bombardier/navigator. When the switch is placed to BRT or DIM, two 40-watt lamps are oriented to illuminate the pilot's and bombardier/navigator's instrument panels and two 20-watt lamps illuminate the left and right consoles. Under normal conditions, the daylight floodlights switch will be in the OFF position and should be used only when there is need for a high-intensity source of light.

EXTERIOR LIGHTING

Position, formation, anticollision, refueling probe, and taxi lights make up the aircraft exterior lighting. The position lights are in the leading edge of the right and left wings, in the trailing edge of the pylons at stations 1 and 5, and in the tail of the aircraft. The right-wing position light is green, the left-wing position light is red, the pylon position lights are amber, and the tail position light is white. Provisions have been made to permit the pilot to send visual code with the pylon lights. The formation lights are: a yellow light on either side of the fuselage (aft of the wing trailing edge), a red light on the left wing tip, and a green light on the right wing tip. Each of the wing tip formation lights contains two lenses: one in the upper portion of the wing tip and the other in the lower portion. Two anticollision lights, one on the vertical stabilizer and one on the nose-gear door fairing, are used on the aircraft. The nose-gear light automatically goes off when the nose gear is extended. Each of the anticollision lights contains two rotating lamps and a red lens. (For tanker missions a green lens is substituted.) The taxi is on the nose-gear door fairing. All controls for the exterior lights are on the master light panel (figure 1-36), except the exterior lights master switch pushbutton, which is on the catapult grip.

Anticollision Light Switch

The anticollision light switch controls the anticollision lights on the vertical stabilizer and on the nosegear door fairing. On A-6E 159895 and ON, and A-6E Mod M121 and ON, the anticollision lights are on the vertical stabilizer and on bottom of each engine cowling. The switch is a two-position toggle switch on the master light panel (figure 1-36) and has positions marked ON and OFF. Placing the collision light switch ON directs 115 Vac power from the primary bus to the anticollision lights.

When the landing gear is extended, the anticollision light relay becomes energized and the anticollision light on the nose-gear door fairing goes off. In the KA-6D, the anticollision lights are generally green for identification purposes.

Exterior Lights Master Switch

The exterior lights master switch is a two-position toggle switch on the end of the catapult grip marked ON/OFF. With the exception of the anticollision lights, no external lights can be turned on until the exterior lights master switch has been set to ON.

Pylon Light Controls

The pylon position lights may be operated from the master light control panel by a momentary KEY pushbutton switch or pylon toggle switch marked ON, OFF, and KEY, when the external lights master switch on the catapult grip is ON.

In aircraft with the momentary pushbutton switch, power is applied to the pylon position lights whenever the button is depressed, permitting them to be keyed to send visual code. As an aid to signalling, the KEY LT indicator light glows whenever the pylon lights are on.

In aircraft with the toggle switch, holding the switch to the momentary KEY position causes the pylon lights and the KEY LT indicator light to come on, permitting the pylon lights to be keyed to send visual code. Selecting the OFF position removes power from the pylon lights. The lights may still be operated by means of the air-refueling control panel master switch when the pylon switch is off. Selecting the ON position applies power to the pylon lights, permitting their use as position lights.

Wing Light Switch

The wing light switch, on the master light panel (figure 1-36). controls the position lights on the right and left wings. The switch is a three-position toggle switch marked BRT, OFF, and DIM. With the exterior lights master switch pushbutton actuated to ON, placing the wing position light switch to BRT turns the wing position lights on bright, using 28 V dc power from the monitored bus. Placing the switch to DIM puts a resistor in series with the lights and dims them.

Tail Light Switch

The tail light switch controls the position light on the tail. The switch is a three-position toggle switch on the master light panel (figure 1-36) and is placarded BRT, OFF, and DIM. With the exterior lights master switch actuated to ON, placing the tail position light switch to BRT turns the tail position light on bright, using 28 V dc power from the monitored bus. Placing the switch to DIM turns on the light at a dimmed intensity.

Key Light and Key Pushbutton

The KEY light and KEY pushbutton on the master light panel (figure 1-36) allows the crew to signal with the pylon position lights. Depressing the key pushbutton causes the pylon position lights to come on. The key light reproduces the signal being displayed by the pylon position light. The master lights switch on the catapult grip must be on for the above operation.

Formation Light Switch

The formation light switch on the master light panel (figure 1-36) is a three-position toggle switch marked BRT, OFF, and DIM. The switch controls the formation lights on either side of the fuselage and at the left and right wing tips. With the external lights master switch pushbutton actuated to ON, placing the formation light switch to BRT connects 28 V dc power from the monitored bus to all formation lights. Selecting the DIM position of the switch dims the lights by putting a resistor in series with them.

Taxi Light Switch

The taxi light switch on the master light control panel (figure 1-36) is a two-position, bar-type switch placarded ON and OFF. The switch controls the taxi light on the nose-door fairing. Placing the switch-ON directs electrical power to turn on the taxi light when operating with landing gear down and locked.

In aircraft with the switch placarded TAXI/PROBE, it also controls the air-refueling probe light on the forward fuselage. Placing the switch ON directs electrical power to turn on the air-refueling probe light when landing gear is up and locked. With the landing gear down and locked, the taxi light is lit.

MISCELLANEOUS EQUIPMENT

ARMOR PLATE

Armorplate is located on the engine access door below the engine accessory sections, below the fuel shutoff valves, below the elevator and rudder hydraulic actuators, on the wings below the flaperon actuators, and below the ECM equipment in the tail section (figure 1-37).

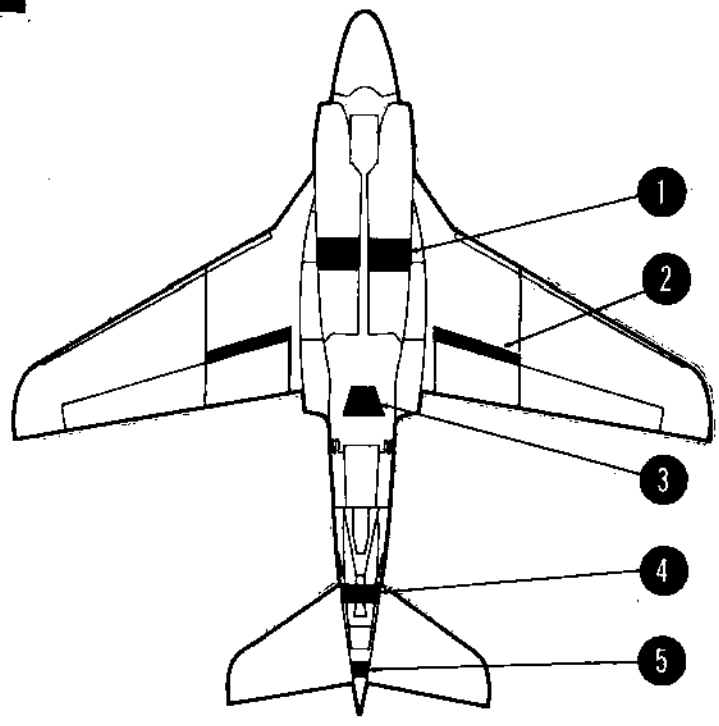
FLAK CURTAINS

The aircraft has provisions for installation of flak curtains or small arms shields. Canopy curtains are installed in the lower left and right sides of the sliding canopy. A slide fastener along the top forward edge may be zippered open and the curtain folded down to improve visibility (figure 1-38). Additional protection is installed against the fuselage

ARMOR PLATE

INSTALLATION OF ARMOR PLATE FOR VULNERABLE FLIGHT CONTROL AREAS

1. **FUEL CONTROLS**
   (External plates over engine access doors)
2. **FLAPERON ACTUATORS**
   (External plates below each wing)
3. **FUEL VALVES**
   (Internal plates wishbone area)
4. **ECM EQUIPMENT**
   (Internal plates)
5. **ELEVATOR and RUDDER ACTUATORS**
   (External plates)



VIEW LOOKING UP

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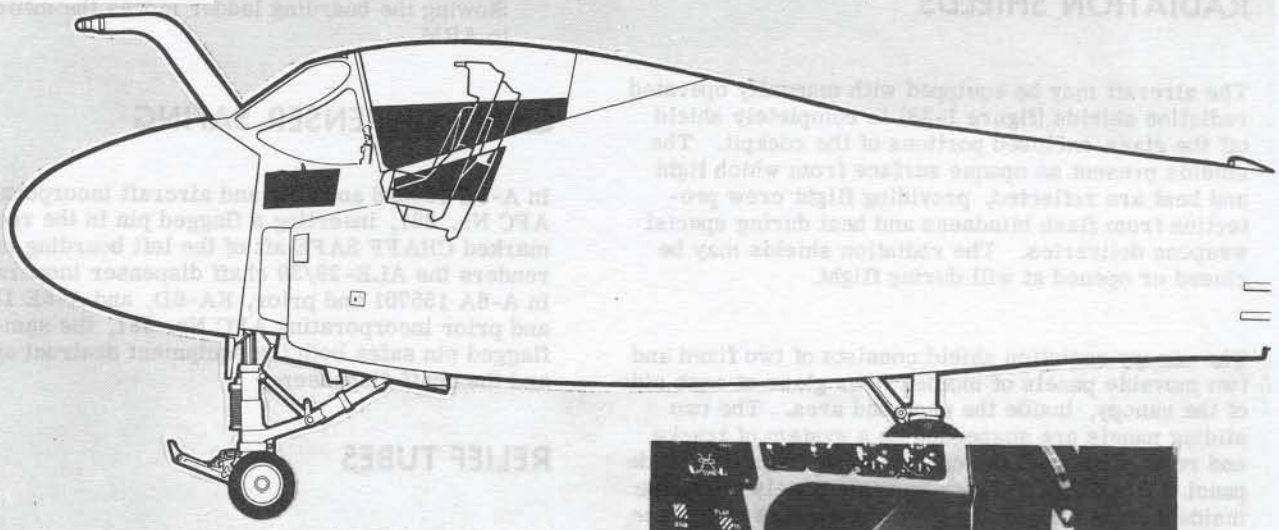
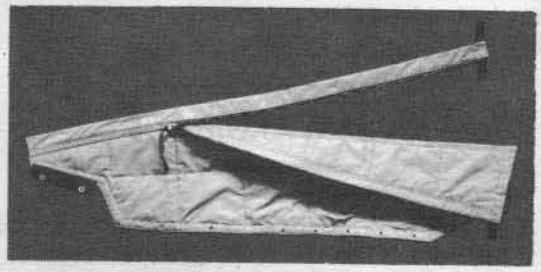
Figure 1-37

FLAK CURTAINS AND RADIATION SHIELD

FLAK CURTAINS

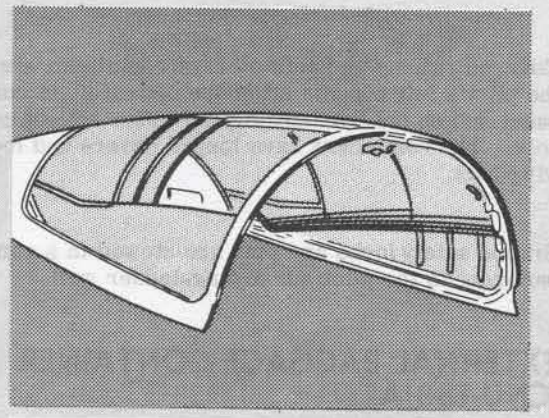




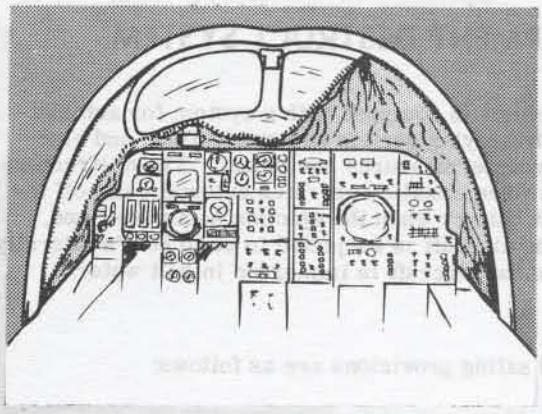
CANOPY FLAK CURTAIN (TYPICAL)

LEFT RUDDER SCUFF PLATE SHIELD

RADIATION SHIELDS



EXTEND TELESCOPING SECTIONS



ZIP-UP FORWARD LINING

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Figure 1-38

above the pilot's and bombardier/navigator's consoles. A flak shield is also available for installation on the pilot's left rudder scuff plate (figure 1-38).

RADIATION SHIELDS

The aircraft may be equipped with manually operated radiation shields (figure 1-38) to completely shield off the glass-enclosed portions of the cockpit. The shields present an opaque surface from which light and heat are reflected, providing flight crew protection from flash blindness and heat during special weapons deliveries. The radiation shields may be closed or opened at will during flight.

The canopy radiation shield consists of two fixed and two movable panels of molded fiber glass at each side of the canopy, inside the enclosed area. The two sliding panels are suspended on a system of tracks and rollers between the canopy spine and a fixed side panel. When stowed, both movable panels telescope inside a fixed aft panel. When the shields are in use, they extend forward to the canopy bow, completely blanking out the canopy. The shield assemblies in each side of the canopy move independently of each other and must be manually unlocked and positioned by the pilot and bombardier/navigator. The forward movable panel automatically locks when moved to the full open, half open, or full closed (canopy arch) position.

The windshield radiation shield is an aluminized fiber glass cloth that is attached to the glare shield mounted on top of the instrument panel underneath the windshield. A zipper assembly attached along the entire inner surface of the windshield bow permits the curtain to be drawn up to this position when zippered up by the bombardier/navigator and by the pilot. When closed, it completely shields off the windshields.

EQUIPMENT DESTRUCT SYSTEM

The aircraft is equipped with a system for automatically destroying certain communications and electronic countermeasures equipment. The destruction system when installed operates automatically off the aircraft battery when the ejection seats are fired, when the aircraft is subjected to 60 to 80 g's laterally, or when the aircraft is immersed in salt water.

Ground safing provisions are as follows:

- In aircraft not incorporating AFC No. 281, inserting a flagged pin in the receptacle marked ECM SAFE aft of the left boarding ladder renders the destruct system inoperative.
- In A-6A 155702 and ON, and A-6E 158528 and ON incorporating AFC No. 281, a guarded two-position ECM maintenance safe toggle switch marked ARM and SAFE is in the left boarding-ladder well. When the boarding ladder is down, the switch may be set to SAFE for maintenance. Stowing the boarding ladder moves the switch to ARM.

CHAFF DISPENSER SAFING

In A-6E 158528 and ON, and aircraft incorporating AFC No. 281, inserting a flagged pin in the receptacle marked CHAFF SAFE aft of the left boarding ladder renders the ALE-29/39 chaff dispenser inoperative. In A-6A 155701 and prior, KA-6D, and A-6E 158052 and prior incorporating AFC No. 281, the same flagged pin safes both the equipment destruct system and the chaff dispenser.

RELIEF TUBES

The pilot and bombardier/navigator are provided with individual relief tubes. The relief tubes are stowed beneath the crewmembers' seats (MK GRU-5) or on the right side of the crewmember's seats (MK GRU 7).

WARNING

Failure to properly stow the relief tube (MK GRU-5 only) on the clamp provided could result in inadvertent firing of the ejection seat or jamming of the emergency harness-release mechanism.

STOWAGE CONTAINERS

Covered rations and data storage containers are on the pilot's left console aft of the optical sight control panel and on the bombardier/navigator's right console. The containers have hinged covers and locking wing nuts.

Ground safety locks and pins are stowed in a compartment in the pilot's boarding-ladder well.

EXTERNAL BAGGAGE CONTAINER (CNU-188/A)

The external baggage container is a modified Aero-1C fuel tank, containing two shelves, mounted center and aft. For external baggage container limitations, see A-6 Tactical Manual NAVAIR 01-85ADA-1T. For detailed loading instructions, see NAVAIR 11-1-CNU-188A-1.

part 3 Aircraft Servicing

AIRCRAFT SERVICING

The following servicing data is provided to lend assistance if the aircraft lands at a strange field or the maintenance crews are unfamiliar with the aircraft. See figure 1-39 for servicing diagram.

Note

When operating in and out of military airfields, consult the current DOD IFR Supplement for compatible servicing units, fuel, etc.

AIRCRAFT FUELING

The aircraft can be fueled and defueled on the ground through a single-point pressure adapter (figure 1-39). The ground fueling and defueling operation is controlled at the fueling station control panel (figure 1-39). The switches on the fueling station control panel operate shutoff valves in the aircraft fuel system, thereby controlling fuel flow into or out of the internal fuel cells of the fuselage, integral wing tanks, and air-refueling store. The aircraft can be fueled with wings folded or spread; however, in order to empty the outboard wing tanks, the wings must be spread during defueling operations.

PNEUMATIC PRESSURES

1. Ram-air turbine accumulator. . . . . 500 psi
2. Combined hydraulic accumulator . . 2,000 psi
3. Flight hydraulic accumulator. . . . 2,000 psi
4. Wheel-brake accumulator. . . . . 800±50 psi
5. Canopy jettison pressure . . . . 2450±100 psi bottle
6. Arresting-hook dashpot pressure. . 1,000 psi (dry nitrogen)
7. Emergency landing gear bottles (dry nitrogen) 2,450 ± 100 psi
8. Landing-gear strut pressures
   a. Nose gear . . . . . 350 psi (dry nitrogen)
   b. Main gear . . . . . See strut nameplates
9. Pneumatic starting compressor. . . 100 lb at 50 psi
10. Equipment pressure . . . . . 600-2800 psi
11. Surge suppressor . . . 70 psi (dry nitrogen) (KA-6D)

DANGER AREAS

See figures 1-40 and 1-41.

TURNING RADIUS AND GROUND CLEARANCE

See figure 1-42.

POWER REQUIREMENTS

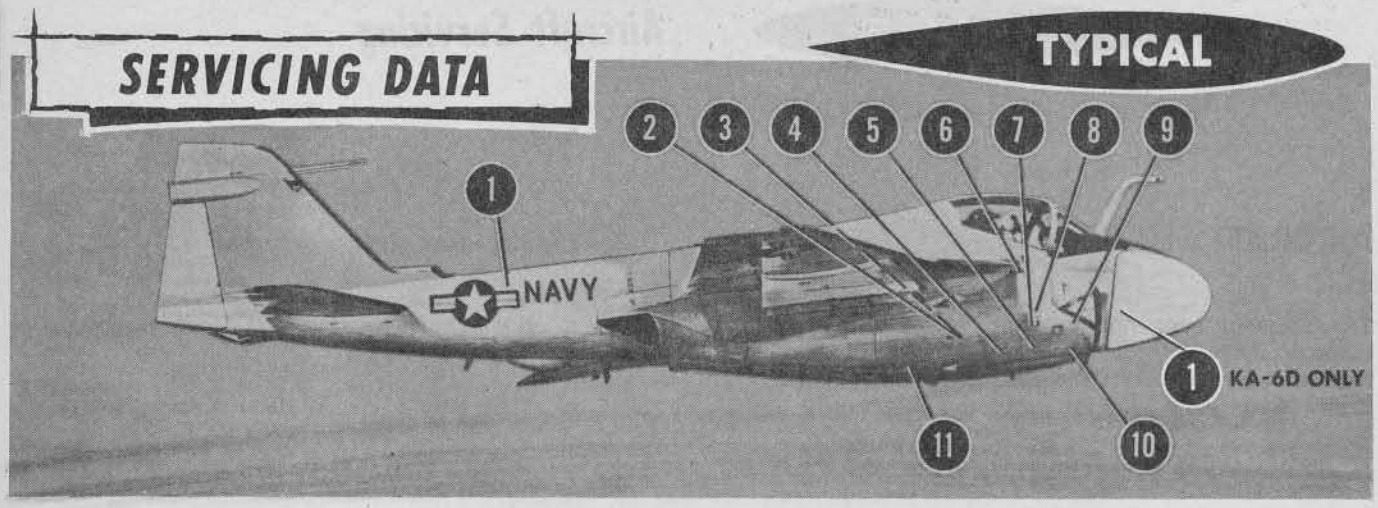
Power requirements for shipboard and shore-based operations are as follows (figure 1-43):

1. Pneumatic starting and electrical power - 23 kVA
2. BACE (all black boxes) - 21 kVA
3. Air Force power units providing 28 V dc require the use of an adapter.

RESERVOIR CAPACITIES

Reservoir capacities are as follows:

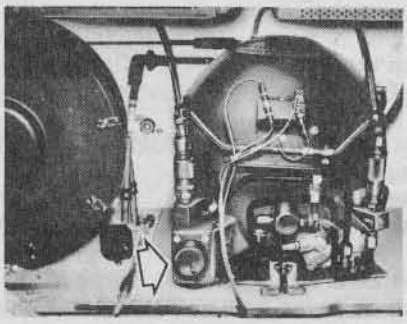
1. Flight hydraulic system reservoir - 0.74 gallon.



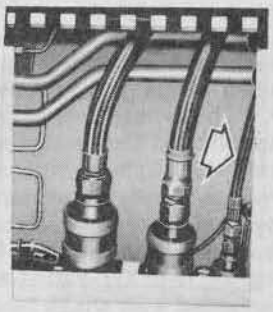
* FUEL GRADE SELECTOR ON ENGINE FUEL CONTROL MUST BE SET FOR GRADE OF FUEL USED

** OIL MIL-L-7808 SHOULD BE USED WHEN GROUND TEMPERATURES ARE - 40°C (- 40°F) AND BELOW IN WHICH COLD STARTING CAN BECOME A PROBLEM

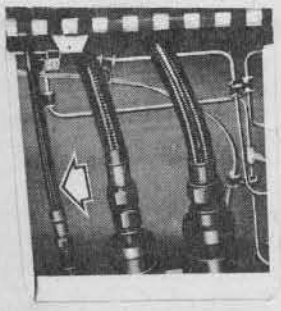
* FUEL	MIL-J-5624 (JP-5 OR JP-4)
HYDRAULIC FLUID	MIL-H-5606
LIQUID OXYGEN	MIL-O-27210 (TYPE II)
OIL	MIL-L-23699 ** MIL-L-7808
WINDSHIELD WASH METHANOL	MIL-O-M-232D



1 LIQUID OXYGEN FILLER VALVE



2 FLIGHT HYDRAULIC SYSTEM FILLER LINE (RIGHT SIDE)



3 COMBINED HYDRAULIC SYSTEM FILLER LINE (LEFT SIDE)

4 ENGINE STARTING RECEPTACLE

5 CSD/S FILLER

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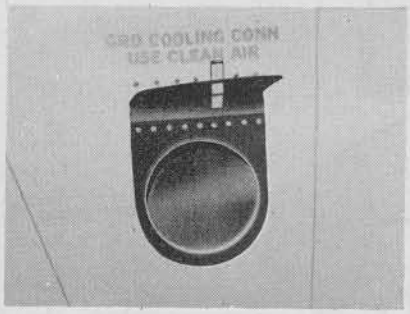
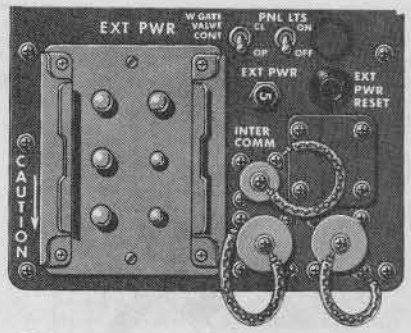
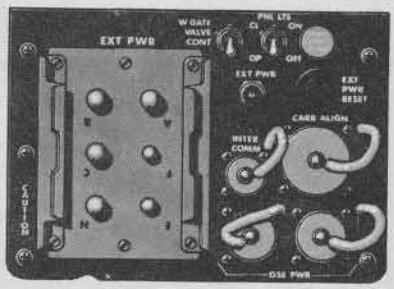
Figure 1-39 (Sheet 1)



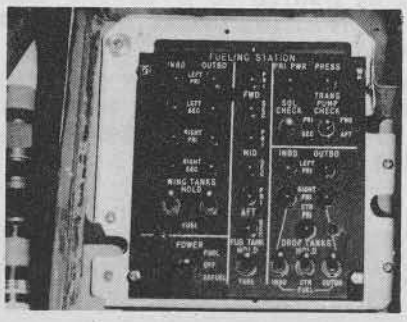
6 EXTERNAL COOLING AIR CONNECTION



7 KA-6D EXTERNAL ELECTRICAL RECEPTACLE

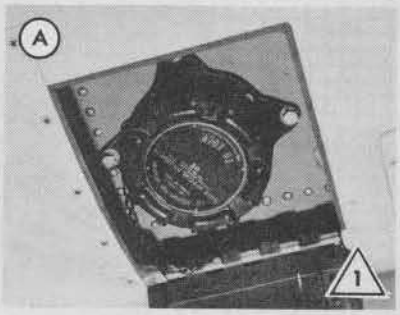


7 A-6A,B,C/A-6E EXTERNAL ELECTRICAL RECEPTACLE

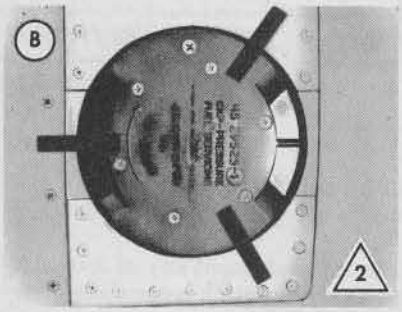


8 REFUELING STATION CONTROL PANEL

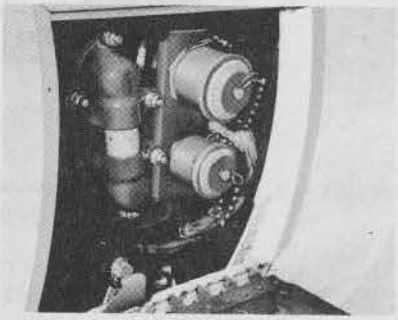
9 WINDSHIELD WASH TANK FILLER



10 AIRCRAFT FUELING RECEPTACLE



10 AIRCRAFT FUELING RECEPTACLE



11 OIL SYSTEM FILLER

1 A6A,B,C 155719 AND PRIOR AND KA6D

2 A6A,B,C 155720 AND SUBSEQUENT

NOTE

FOR SERVICING THE A-6C TRIM POD REFER TO NAVAIR 01-85ADA-2-1 GENERAL INFORMATION AND SERVICING

G-ADA1-30-2

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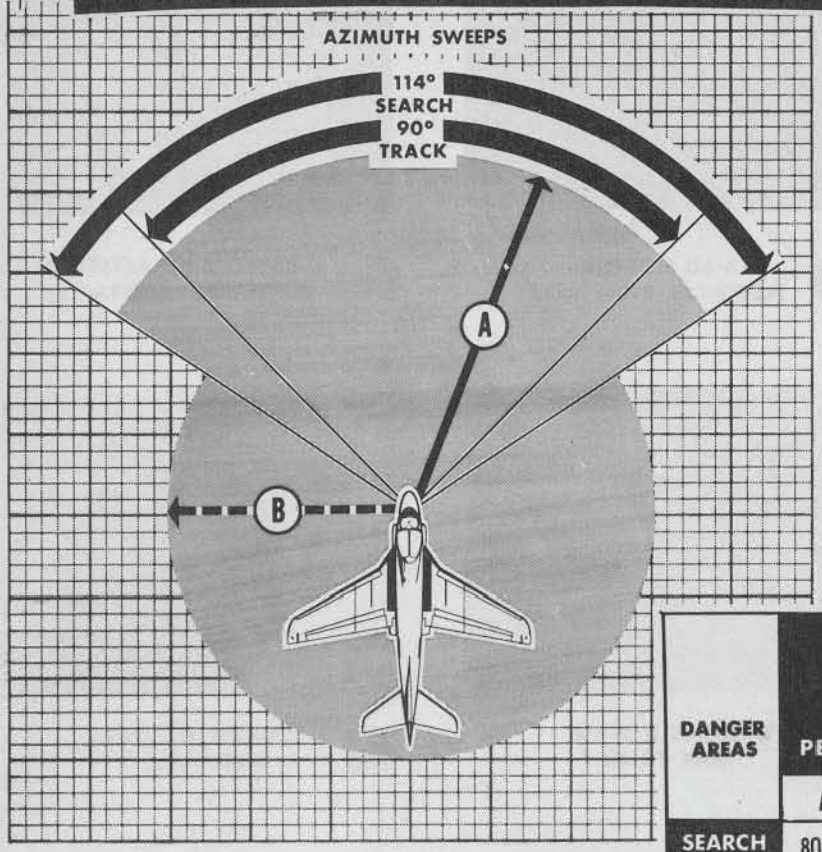
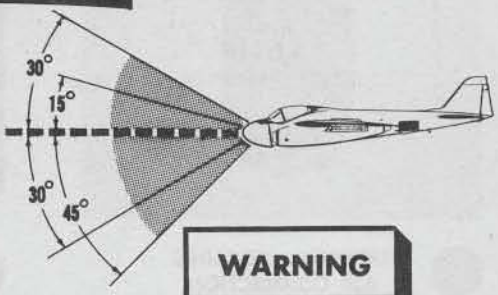
Figure 1-39 (Sheet 2)

RADAR TRANSMISSION DANGER AREAS





WARNING

- **RADAR TRANSMISSION ABOARD CARRIERS SHALL BE LIMITED TO OVER-THE-SIDE OPERATION AT THE DISCRETION OF THE COMMANDER**
- **DO NOT PLACE THE XMIT/SILENT SWITCH TO THE XMIT POSITION UNTIL ALL PERSONNEL HAVE BEEN CLEARED FROM THE RADIATION DANGER AREA.**

DANGER AREAS	PERSONNEL		UNARMED AIRCRAFT VEHICLES BUILDINGS		FUELING		ARMED AIRCRAFT EXPLOSIVE DEVICES ARMAMENTS	
	A	B	A	B	A	B	A	B
SEARCH	80 FT		120 FT		120 FT	100 FT	120 FT	100 FT
TRACK	40 FT		60 FT		100 FT	100 FT	100 FT	100 FT

C-ADA1-119

Figure 1-40

2. Combined hydraulic system reservoir - 3.34 gallons.
3. Oxygen converter - 10 liters
4. Auxiliary oxygen converter - 10 liters
5. Smoke abatement tank - 0.9 gallon

TIRES

Tires sizes for the aircraft are:

Main - 36x11-24 P.R. Type VII

Nose - 20x5.5-12 P.R. Type VII or 20x5.5-14 P.R.

Note

Do not mix 12 P.R. and 14 P.R. 20x5.5 tires on nosewheel.

Minimum Tire Inflation Pressure

Main - 230 psi (carrier) - As shown in figure 1-41 (land)

Nose - 290 psi (carrier) - 175 psi (land)

NEW GEAR STOWAGE IN A-6 SERIES AIRCRAFT

The following procedure will apply to stowage of gear in A-6 aircraft.

1. No gear shall be stowed aft of extensible equipment platform in A-6 series aircraft.
2. Gear stowed in aft equipment bay of A-6 aircraft shall be secured within extensible equipment platform or, for KA-6D, forward of extensible platform in area around LOX converters. Any gear stowed within extensible platform shall be stowed in such a manner that no portion of gear protrudes above ladder rails on platform, when platform is in stowed position.
3. Gear may be stowed in forward deck section of observer's side of cockpit in KA-6D.

All gear stowed in the aforementioned areas of the aircraft shall be securely tied.

CAUTION

Care will be taken to insure gear does not restrict movement, damage, or impede the normal operation of any of the aircraft's equipment, nor is tied to an aircraft system actuator (i.e. flight control actuator, etc.).

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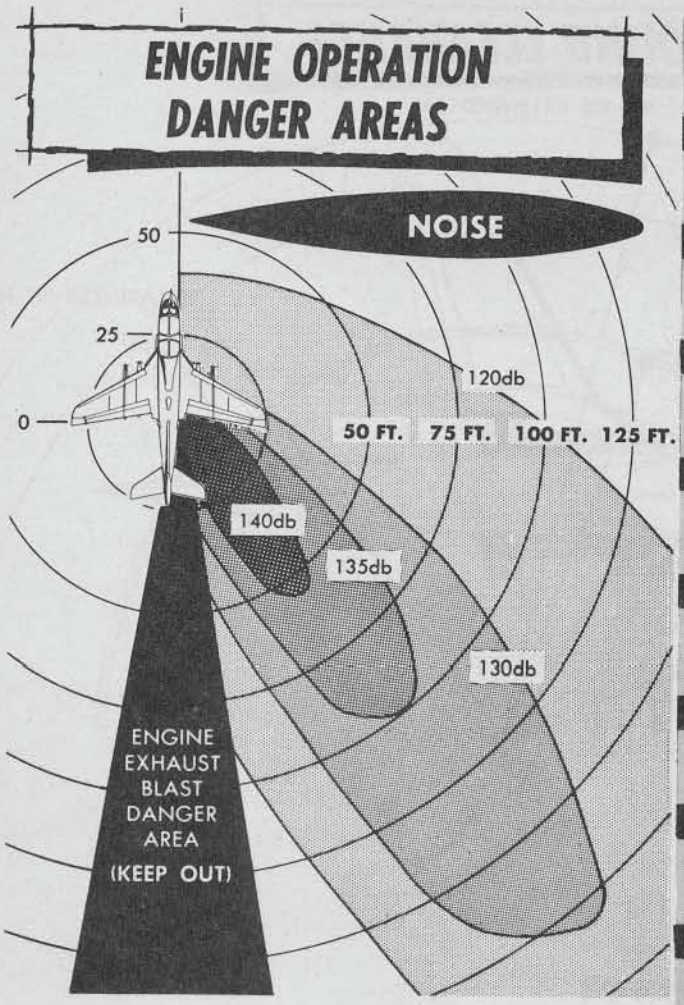
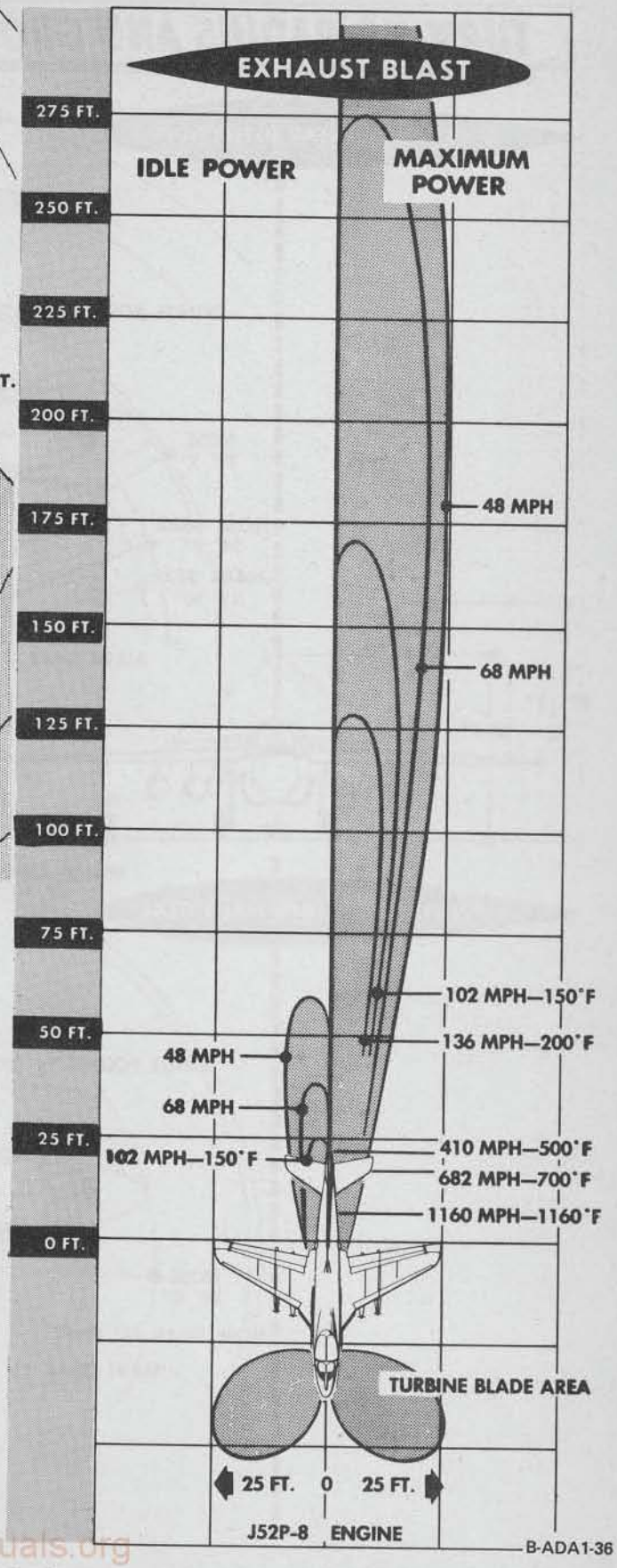
ENGINE OPERATION DANGER AREAS





NOTE

NOISE DANGER AREAS SYMMETRICAL ABOUT ENGINE CENTERLINES DURING DUAL ENGINE OPERATION AT MAXIMUM POWER.

CAUTION

IF ENGINES ARE RUN UP IN FRONT OF BLAST REFLECTOR, SOUND IS REFLECTED TO SIDES RESULTING IN A DISTORTION OF PATTERN ILLUSTRATED.

DAMAGE RISK CRITERIA

EAR PROTECTION NECESSARY	EXPOSURE TIME DURATION PER DAY				
	5 Minutes	15 Minutes	30 Minutes	1 Hour	2 Hours
NO PROTECTION	120db	115db	112db	109db	106db
EARPLUGS WITH AVERAGE SEAL	132db	127db	124db	121db	118db
EARPLUGS AND EARMUFFS	140db	135db	132db	129db	126db

REF. WADC TN 55-355 TO DAMAGE RISK CRITERIA

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Figure 1-41

TURNING RADIUS AND GROUND CLEARANCE

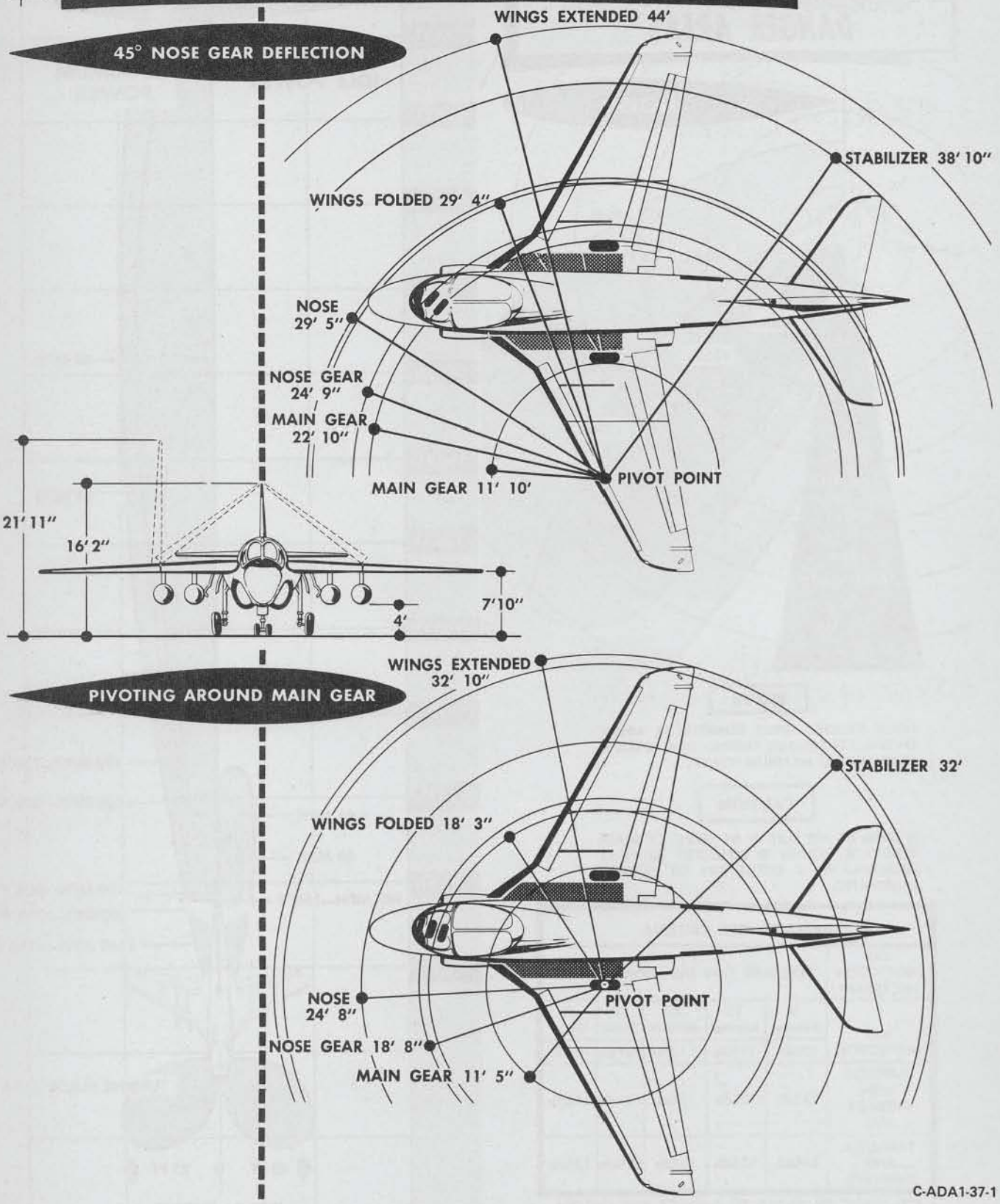

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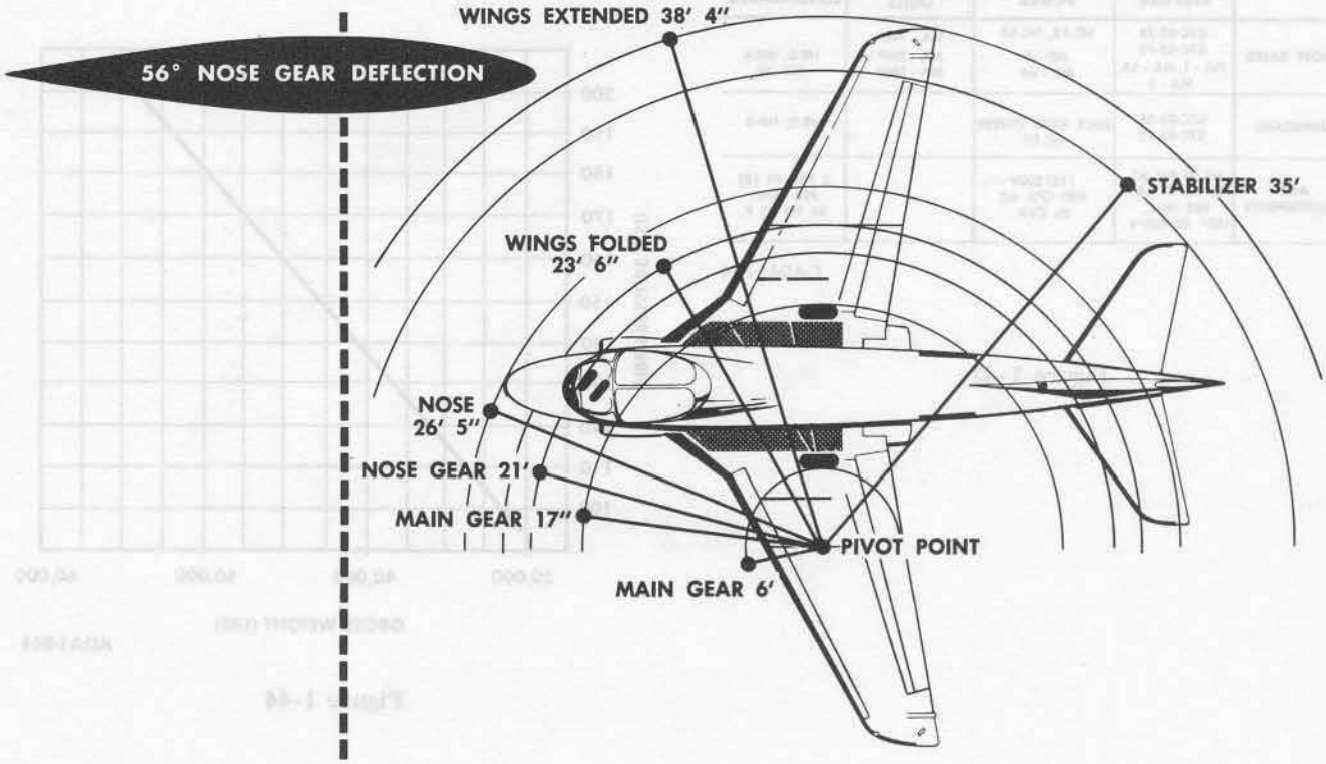
Figure 1-42 (Sheet 1)

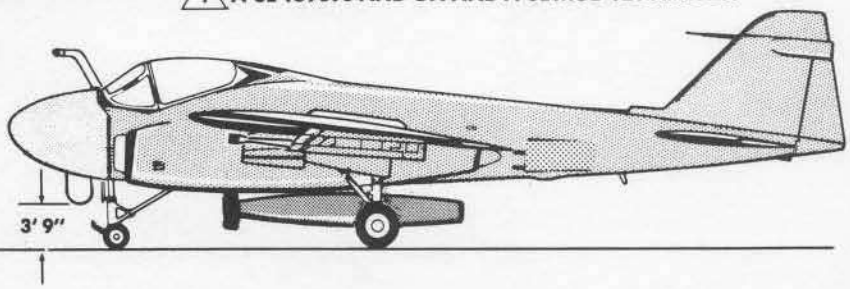
TURNING RADIUS AND GROUND CLEARANCE



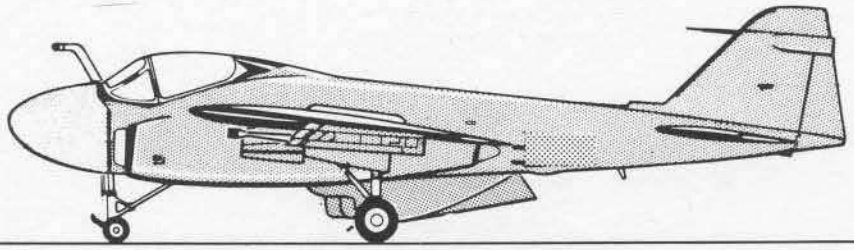
CENTERLINE CLEARANCES

1 A-6E 159895 AND ON AND A-6E MOD 121 AND ON

A-6A, A-6B / KA-6D / A-6E / 1 A-6E TRAM
D-704 REFUELING STORE
CATAPULTING (59,000)
AERO – 7A : 9″, AERO – 7B : 11″
LANDING
AERO – 7A : 9¼″, AERO – 7B : 11½″
STATIC (53,000)
AERO – 7A : 13¼″, AERO – 7B : 15½″



A-6C



TRIM POD

CATAPULTING (59,000)	8¼″
LANDING	8¾″
STATIC (53,000)	12¾″

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Figure 1-42 (Sheet 2)

POWER UNITS				
	PNEUMATIC STARTING	ELECTRICAL POWER	COMBINATION UNITS	AIR CONDITIONING
SHORE BASED	GTC-85-28 GTC-85-72 MA - 1, MA - 1A MA - 2	NC-12, NC-10 MD - 3 MD - 3A	MA - 1MP MA - 2MP MA - 3MP	NR-3, NR-4 NR - 10
SHIPBOARD	GTC-85-28 GTC-85-72	DECK EDGE POWER NC-10		NR-3, NR-5
AGE REQUIREMENTS	40-50 PSI AT 90 TO 91 LBS. PER MIN., 100° TO 425°F.	115/200V 400 CPS. AC 23 KVA.		3 PSI, 45 LBS PER MIN., 35 TO 50 F.

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Figure 1-43

TIRE PRESSURE CHART

LAND OPERATION—MAIN WHEELS

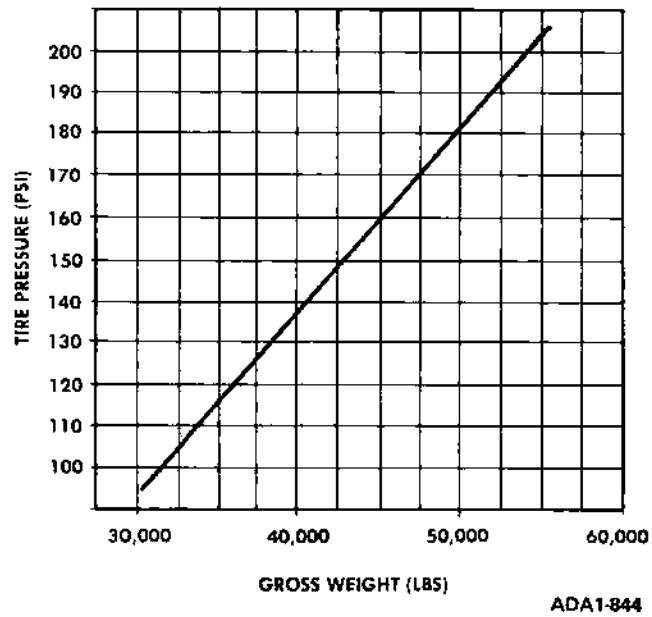


Figure 1-44

part 4 Aircraft Operating Limitations

INTRODUCTION

This section includes the aircraft and engine limitations that must be observed during normal operation. Instrument markings giving various operation limitations are shown in figure 1-45. Some markings that are self-evident are not discussed in the text.

Note

The limitations in this section apply to A-6 series aircraft unless otherwise noted.

ENGINE LIMITATIONS

Engine limitations are shown in figure 1-46. Additional information is given in the following paragraphs.

ENGINE OVERSPEED

Should the engine overspeed limit of 102.5% on the J52-P-8 engine be exceeded the engine must be inspected for damage. Log the condition on the yellow sheet (OP-NAV Form 3760-2) to insure inspection. Should the maximum permissible engine overspeed limit of 102.9% rated rpm be exceeded on the J52-P-8 engine, the engine must be changed.

ENGINE IDLE

CAUTION

- A minimum speed of 65% should be maintained during idle letdown to insure that the generators will continue to produce required output while under high electrical loads. This may require advancement of the throttle(s) off the IDLE stop.
- A minimum engine speed of 75% should be maintained during glide/reduced power bombing runs and during high-g or high-speed maneuvers to minimize the possibility of hung accelerations/burner can blowout.

ENGINE OIL PRESSURE

Normal oil pressure is 40 to 50 psi with a minimum of 35 psi at idle. Oil pressures between 35 and 40 psi are undersirable and should be tolerated only for the completion of the flight, preferable at a reduced throttle setting. Oil pressures below normal should be reported as an engine discrepancy and should be corrected before the next flight. Oil pressures below 35 psi are unsafe and require that either the engine be shut down or a landing be made as soon as possible, using the minimum thrust required for safe flight.

ENGINE EXHAUST GAS TEMPERATURE

The engine exhaust gas temperatures (EGT) are given in figure 1-46 for starting and acceleration conditions. They are time-limited to momentary for starting and 8 minutes for acceleration. Momentary is considered a period not to exceed 15 seconds.

AIR STARTS

Refer to Air Start Envelope, Section V.

AIRSPEED LIMITATIONS

MAXIMUM AIRSPEEDS

The maximum permissible indicated airspeed in smooth or moderately turbulent air for the aircraft in the basic configuration is the maximum attainable; i.e., the aircraft is drag-limited.

The maximum permissible airspeeds for the A-6C are as follows:

Optical sensor platform stowed	.70 IMN
Optical sensor platform deployed	.88 IMN
Optical sensor platform rotation	250 KIAS

Note

Basic configuration is landing gear and flaps retracted, and canopy closed.

For A-6B/Standard ARM airspeed and maneuvering restrictions, refer to Supplemental NATOPS Flight Manual NAVAIR 01-85ADA-1A.

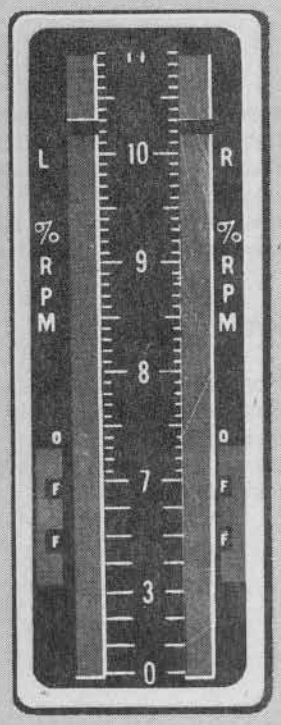
Landing Gear

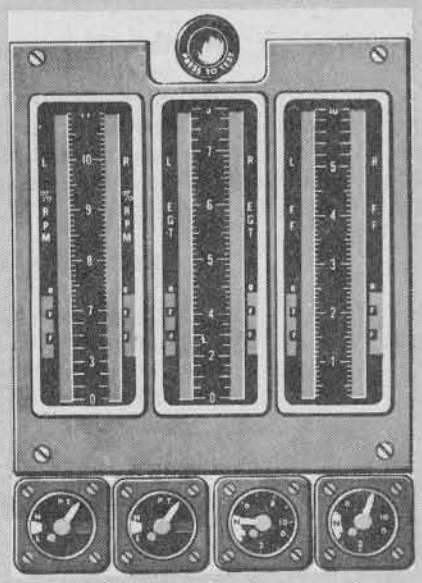
Extended	250 KIAS
Entending	250 KIAS
Retracting	200 KIAS
Emergency extension	150 KIAS

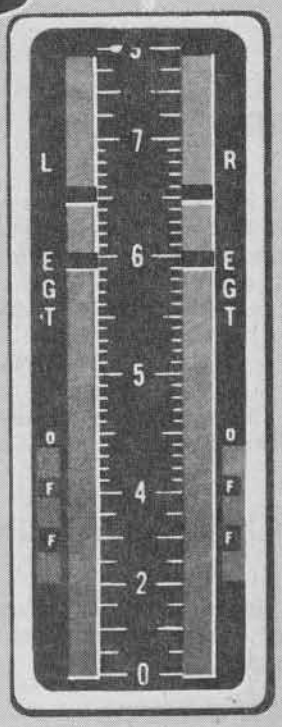
INSTRUMENT MARKINGS

ENGINE J52—P-8

BASED ON JP-5 FUEL





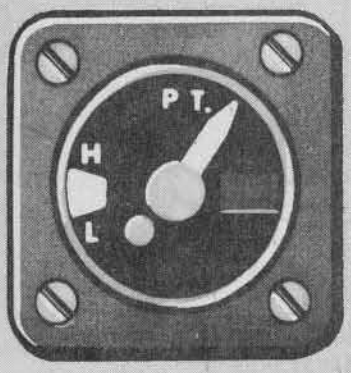


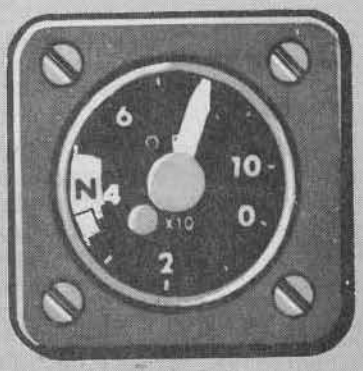
TACHOMETER

102.9% — MAXIMUM OVERSPEED

EXHAUST TEMPERATURE

650°C — MILITARY POWER
594°C — NORMAL RATED





POWER TRIM

NORMAL RANGE

OIL PRESSURE

35 PSI — MINIMUM (GROUND IDLE)
35-40 PSI — CAUTION
40-50 PSI — CONTINUOUS
50 PSI — MAXIMUM

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Figure 1-45

ENGINE OPERATING LIMITS

J-52 - P-8 ENGINES

OIL: MIL-L-23699

FUEL: MIL-J5624D
GRADE: JP-5 or JP-4

EGT LIMITS	ANY EGT LIMITS EXCEEDED SHOULD BE REPORTED AS A DISCREPANCY AND MAXIMUM TEMPERATURES REACHED AND LENGTH OF TIME NOTED.	
THRUST SETTING	MAXIMUM OBSERVED EGT (°C)	TIME LIMIT (MINUTES)
ACCELERATION	677°	8 MINUTES
MILITARY	650°	30 MINUTES (ACCELERATION TIME INCLUDED)
NORMAL RATED	594°	CONTINUOUS
90% NORMAL RATED (CRUISE)		
75% NORMAL RATED		
IDLE		
STARTING	455°	MOMENTARY

RPM LIMITS ANY OVERSPEED LIMIT EXCEEDED SHOULD BE REPORTED AS A DISCREPANCY AND MAXIMUM RPM NOTED.	OIL PRESSURE LIMITS MIL-L-23699
52 to 60% RPM - IDLE 102.5% RPM - OVERSPEED, Engine inspection required. 102.9% RPM - OVERSPEED, Engine change required.	35 PSI - MINIMUM AT GROUND IDLE RPM 40 PSI - MINIMUM 50 PSI - MAXIMUM

NOTES

(1) NORMAL OIL PRESSURE IS 40 TO 50 PSI. EXCEPT AT IDLE, OIL PRESSURES BETWEEN 35 AND 40 PSI ARE UNDESIRABLE AND SHOULD BE TOLERATED ONLY FOR THE COMPLETION OF THE FLIGHT, PREFERABLY AT A REDUCED THROTTLE SETTING. OIL PRESSURES BELOW NORMAL SHOULD BE REPORTED AS AN ENGINE DISCREPANCY AND SHOULD BE CORRECTED BEFORE THE NEXT TAKE-OFF. OIL PRESSURES BELOW 35 PSI ARE UNSAFE AND REQUIRE THAT EITHER THE ENGINE BE SHUT DOWN OR A LANDING BE MADE AS SOON AS POSSIBLE, USING THE MINIMUM THRUST REQUIRED FOR SAFE FLIGHT.

(2) (OIL MIL-L-7808 SHALL BE USED WHEN CONTINUOUS GROUND COLD SOAK TEMPERATURES BELOW −40°F. ARE ANTICIPATED).

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Figure 1-46

Flaps/Slats

Takeoff position or less	250 KIAS
Land position	200 KIAS

WARNING

- Extreme caution should be exercised during flap retraction under heavy gross weight conditions. To avoid aircraft stall or settling due to flap retraction, do not retract the flaps below 170 KIAS for weights up to 50,000 pounds and not below 185 KIAS for weights above 50,000 pounds. At the heavier weights and under high ambient temperature conditions, acceleration and climb performance are marginal and it may be impossible to reach 185 KIAS. If 185 KIAS cannot be reached, it is recommended that external store weight be reduced in order to permit acceleration to 185 KIAS prior to flap retraction.
- If a barber-pole indication on slat/flap retraction should occur after takeoff, power must be maintained at military and airspeed controlled within limits (170 KIAS or 185 KIAS as applicable) by adjusting aircraft attitude. Power reduction or diversion of attention must not be attempted until reaching safe operating altitudes.

CAUTION

If a wave-off is initiated with flaps in the LAND position (40°), ensure that they are retracted to the TAKE-OFF position (30°) before reaching 200 KIAS in order to prevent structural failure to the flap actuating mechanism. The flap drive system does not provide a blowback feature.

Flaps/Slats Emergency (40° LAND)

CAUTION

Emergency extension of the flaps to the terminal (LAND) position above 160 KIAS may result in a burned-out clutch in the gear box and complete loss of flap operation. It is permissible to commence flap extension by the emergency flap switch at any speed up to the structural limitation (200 KIAS for LAND position) of the flaps; however, airspeed decleration to below 160 KIAS must be continued as the flap extension process continues toward LAND position.

Canopy

Opened	250 KIAS
Opening	200 KIAS
Closing	150 KIAS
Jettisoning (maximum recommended)	220 KIAS

Note

Although canopies have safely separated from the aircraft above 220 KIAS, no flight test data are available on jettisoning the canopy above this airspeed.

Ram-Air Turbine

	Maximum Airspeeds
Extension	
A-6C	.88 IMN
Retraction	475 KIAS
A-6C	475 KIAS/.88IMN

Note

The minimum recommended airspeed to ensure full electrical output is 110 KIAS.

Speed Brakes

	Maximum Airspeeds
Partial or Full Extension	
A-6C	.88 IMN

Rain-Removal System

Operating	200 KIAS

Internal Air Refueling Store (KA-6D)

Refueling/Drogue Extension	220-320 KIAS/.80 IMN
Drogue Retraction	220-280 KIAS/.72 IMN
Altitude	SL - 35,000 ft.
Hose Jettison	220-320 KIAS
Response Test	220-275 KIAS/.68 IMN

Air Refueling Store

Drogue Extension	300 KIAS
Drogue Retraction	250 KIAS
Drogue Unfeathering	300 KIAS
Refueling Store Jettison	300 KIAS

CAUTION

Use of an external air-refueling store on the KA-6D is prohibited unless IAFC No. 296 or AFC No. 296 is incorporated in the aircraft. If IAFC No. 296 or AFC No. 296 is installed and it is decided to transfer fuel utilizing the D-704, the TO STORE switch on the centerline refueling store panel shall remain in the OFF position until the fuel quantity in the centerline refueling store is less than 500 pounds. When the fuel in the centerline refueling store reaches 500 pounds or less, move the centerline refueling store switch to the TO STORE position to replenish the store. Monitor fuel quantity indicator closely so that switch may be returned to the OFF position as soon as the fuel quantity indicates 1500 pounds. If the tanker fuel transfer/dump pump starting relay is malfunctioning, the fuel transfer rate to the refueling centerline store could be fast enough to cause store failure if the indicated fuel in the store is permitted to go above 1,500 pounds.

EQUIPMENT COOLING

CAUTION

- Without the engines running or ground cooling applied, cooling air is not available. In addition, with the engines running with the canopy open, adequate cooling air for equipment in the radome area is not available. Operation without cooling of any electronic equipment requiring forced cooling should be limited to 5 minutes to prevent failure from overheating.
- In the A-6E, without engines running or ground cooling applied, ground blower operation is automatic when external electrical power is applied and the search radar, computer, or CNI systems are turned on. When the right generator is on the line, the ground blower is automatically turned OFF and equipment-cooling air is supplied by the engines. During ground operation with engines running and the ground blower OFF, the radar units in the nose radome are cooled by cabin discharge air. Operation of the radar with the canopy OPEN and the ground blower OFF must be limited to no more than 5 minutes.
- In the A-6E, electronic equipment should not be operated without aircraft air conditioning or external cooling air applied when ambient air temperature exceeds 103° F or when the aircraft is located in an enclosed, poorly ventilated area.
- The CNI equipment, which is normally force-cooled, is provided with an auxiliary cooling blower in aircraft incorporating AFC No. 268. The blower operates any time the AIR COND MASTER switch is OFF or the AIR COND bleed-air isolation switch is OFF.
- Do not operate the A-6C TV or IR sensors or the TRIM pod environmental control system on the ground unless engines are running and aircraft air conditioning is on or ground air conditioning is applied to the pod. In aircraft incorporating AFC No. 268, the left engine must be running and the AIR COND bleed-air switch must be ON to operate the TRIM pod environmental control system.

ACCELERATION LIMITATIONS

A-6A,B,C,E

CAUTION

Aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.

Except that moderate and heavy buffeting shall be avoided, the maximum permissible accelerations for flight with wing-tip speed brakes retracted are (figure 1-47 and 1-48):

Symmetrical flight . . . . . -2.4 to +6.5g
Asymmetrical flight . . . . . -1.0 to +5.2g

With wing-tip speed brakes extended, the maximum permissible accelerations are (figure 1-49 and 1-50):

Symmetrical flight . . . . . -2.4 to +6.0g
Asymmetrical flight . . . . . -1.0 to +4.8g

Whenever a MER installed on any aircraft wing station has stores loaded asymmetrically fore and aft, observe the following carriage limits:

Rack Asymmetry (LB)	Acceleration (G)
600 to 1,200	-1.0 to +4.5
1,200 to 1,800	-1.0 to +3.5
1,800 or greater	-1.0 to +2.5

ACCELERATION LIMITATIONS

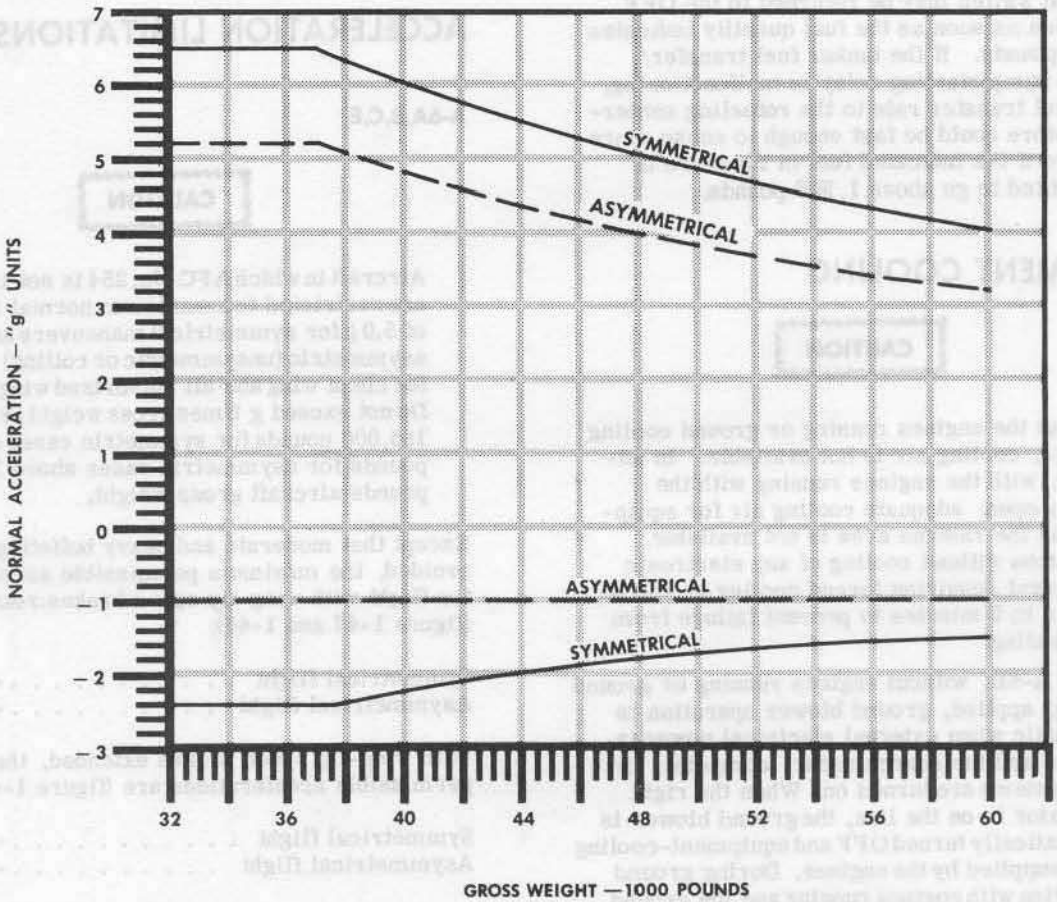
WING TIP SPEED BRAKES RETRACTED

AIRCRAFT CONFIGURATION:
WING TIP SPEED BRAKES RETRACTED

DATE: 1 FEB 1972
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GA



CAUTION

- **A-6A, B, C/KA-6D aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.**
- **Full acceleration limits do not routinely apply to the KA-6D. See KA-6D Acceleration Limitations paragraph this section.**

E-ADA1-122

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Figure 1-47

OPERATING FLIGHT STRENGTH DIAGRAM

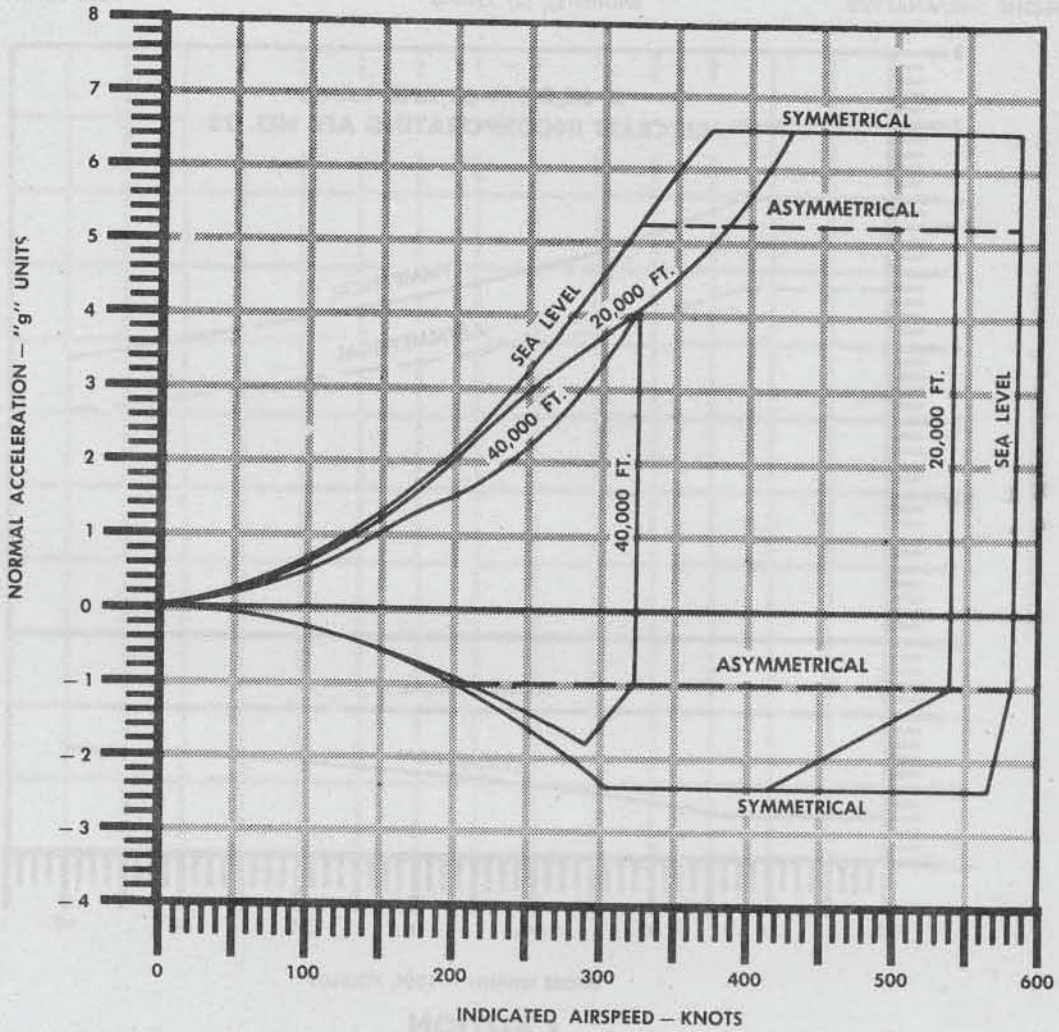
WING TIP SPEED BRAKES RETRACTED

AIRCRAFT CONFIGURATION:
FOR GROSS WEIGHTS
OR 37,000 LB. OR LESS

DATE: 1 FEB 1972
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



CAUTION

- A-6A, B, C/KA-6D aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.
- Full acceleration limits do not routinely apply to the KA-6D. See KA-6D Acceleration Limitations paragraph this section.

E-ADA1-123

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Figure 1-48

ACCELERATION LIMITATIONS

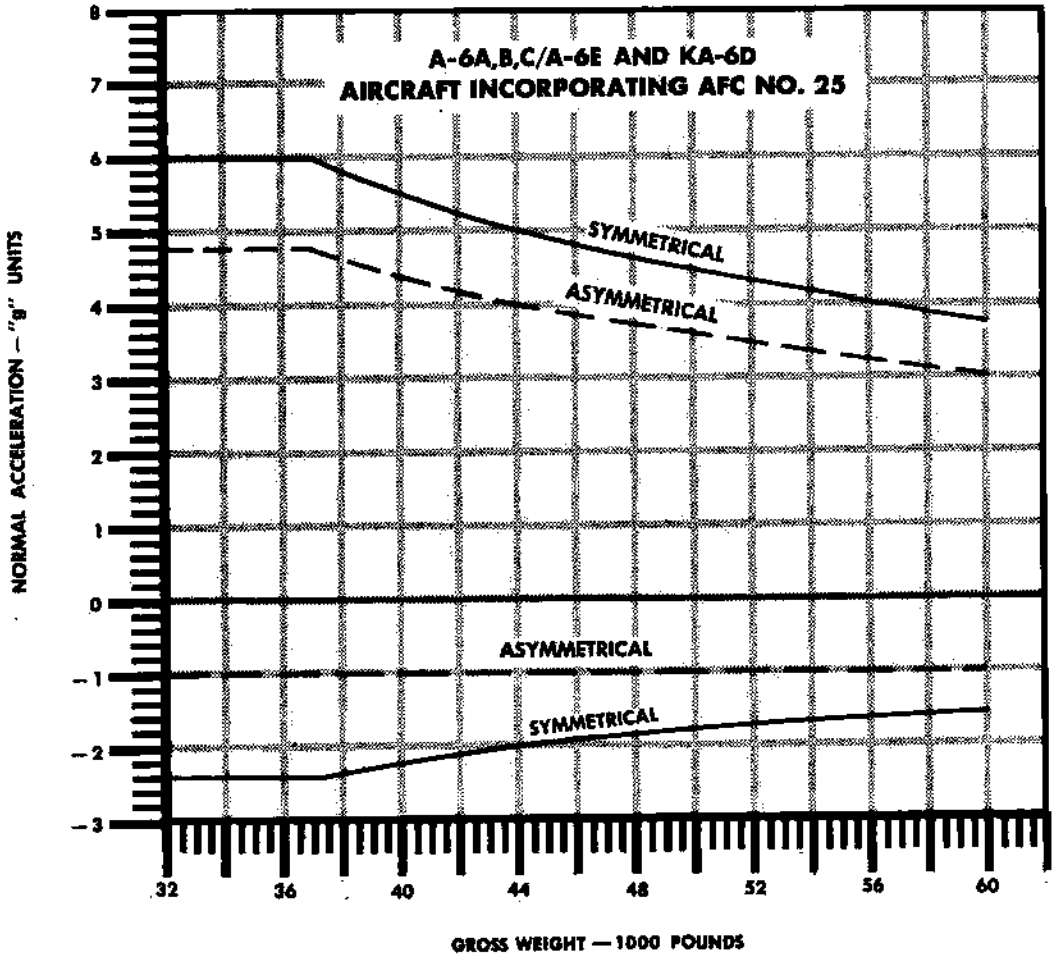
WING TIP SPEED BRAKES EXTENDED

AIRCRAFT CONFIGURATION:
WING TIP SPEED BRAKES
EXTENDED

DATE: 1 FEB 1972
DATA BASIS: FLIGHT TEST/ANALYSIS

REMARKS
ENGINE(S): (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



CAUTION

- A-6A, B, C/KA-6D aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.
- Full acceleration limits do not routinely apply to the KA-6D. See KA-6D Acceleration Limitations paragraph this section.

B-ADA1-126

Figure 1-49

OPERATING FLIGHT STRENGTH DIAGRAM

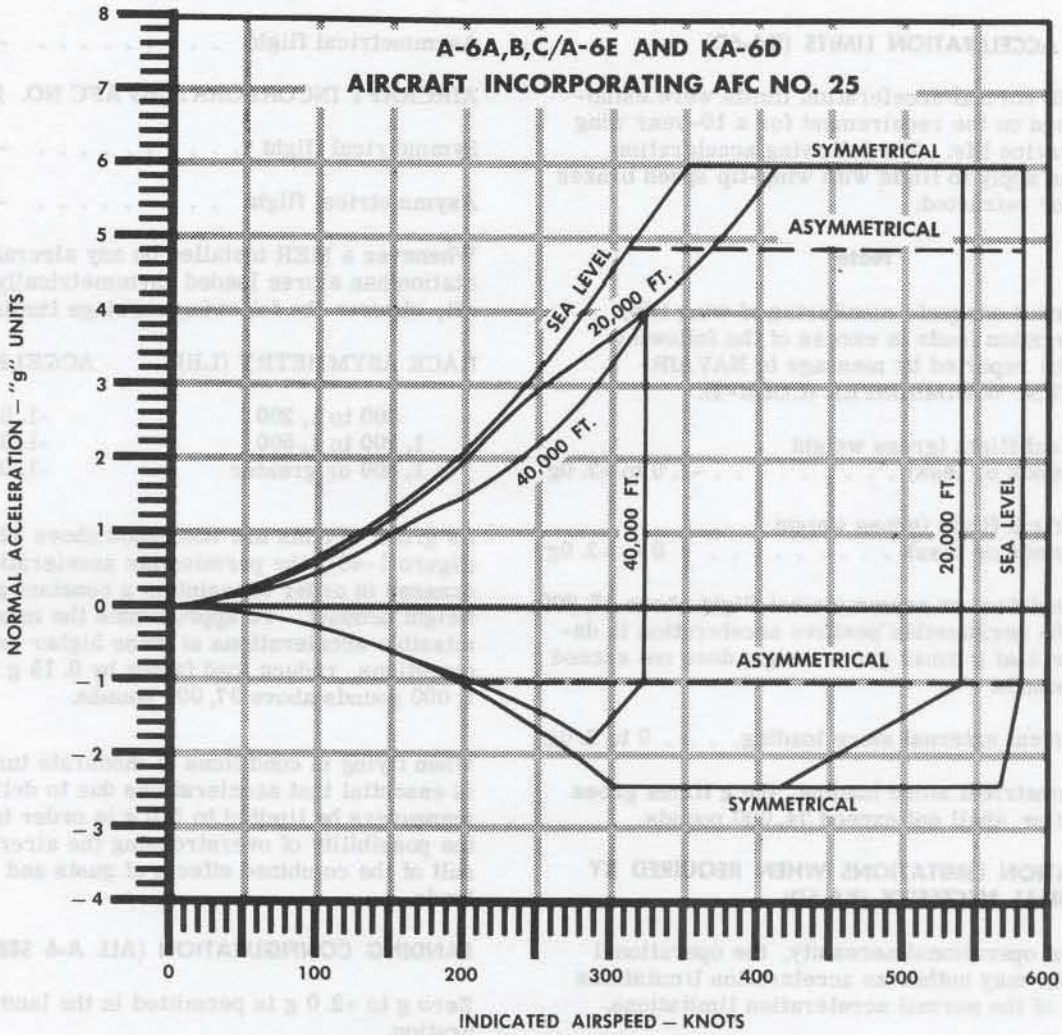
WING TIP SPEED BRAKES EXTENDED

AIRCRAFT CONFIGURATION:
FOR GROSS WEIGHTS
OR 37,000 LB. OR LESS

DATE: 1 FEB 1972
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



CAUTION

- A-6A, B, C/KA-6D aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.
- Full acceleration limits do not routinely apply to the KA-6D. See KA-6D Acceleration Limitations paragraph this section.

C-ADA1-125

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Figure 1-50

As gross weights are increased above 37,000 pounds (figure 1-50), the permissible accelerations are decreased in order to maintain a constant g x gross weight product. To approximate the maximum permissible accelerations at these higher gross weight conditions, reduce load factor by 0.15 g for every 1,000 pounds above 37,000 pounds.

When flying in conditions of moderate turbulence, it is essential that accelerations due to deliberate maneuvers be limited to 5.0 g in order to minimize the possibility of overstressing the aircraft as a result of the combined effects of gusts and maneuvering loads.

NORMAL ACCELERATION LIMITS (KA-6D)

The KA-6D normal acceleration limits were established based on the requirement for a 10-year wing fatigue service life. The following acceleration limitations apply to flight with wing-tip speed brakes extended or retracted:

Note

To permit adequate monitoring of wing life, acceleration loads in excess of the following shall be reported by message to NAVAIR-DEVCEN, WARMINISTER (CODE-2).

Symmetrical flight (gross weight 37,000 pounds or less) . . . . . -1.0 to +3.0g

Asymmetrical flight (gross weight 37,000 pounds or less) . . . . . 0 to +2.0g

For symmetrical or asymmetrical flight above 37,000 pounds, the permissible positive acceleration is decreased so that g times gross weight does not exceed 111,000 pounds.

Asymmetrical external store loading. . . . 0 to 2.0g

For asymmetrical store loading, the g times gross weight factor shall not exceed 74,000 pounds.

ACCELERATION LIMITATIONS WHEN REQUIRED BY OPERATIONAL NECESSITY (KA-6D)

In cases of operational necessity, the operational commander may authorize acceleration limitations in excess of the normal acceleration limitations.

Note

To permit adequate monitoring of wing life, acceleration loads in excess of the normal acceleration limitations shall be reported by message to NAVAIR-DEVCEN, WARMINISTER (CODE-2).

Except that moderate and heavy buffeting shall be avoided, the maximum permissible accelerations for flight with wing-tip speed brakes retracted are (figure 1-47 and 1-48):

Symmetrical flight . . . . . -2.4 to +6.5g

Asymmetrical flight . . . . . -1.0 to +5.2g

With wing-tip speed brakes extended, the maximum permissible accelerations are (figure 1-49 thru 1-52):

AIRCRAFT NOT INCORPORATING AFC NO. 25

Symmetrical flight . . . . . -2.4 to +5.2g

Asymmetrical flight . . . . . -1.0 to +4.2g

AIRCRAFT INCORPORATING AFC NO. 25

Symmetrical flight . . . . . -2.4 to +6.0g

Asymmetrical flight . . . . . -1.0 to +4.8g

Whenever a MER installed on any aircraft wing station has stores loaded asymmetrically fore and aft, observe the following carriage limits:

RACK ASYMMETRY (LB)	ACCELERATION (G)
600 to 1,200	-1.0 to +4.5
1,200 to 1,800	-1.0 to +3.5
1,800 or greater	-1.0 to +2.5

As gross weights are increased above 37,000 pounds (figure 1-40), the permissible accelerations are decreased in order to maintain a constant g x gross weight product. To approximate the maximum permissible accelerations at these higher gross weight conditions, reduce load factor by 0.15 g for every 1,000 pounds above 37,000 pounds.

When flying in conditions of moderate turbulence, it is essential that accelerations due to deliberate maneuvers be limited to 5.0 g in order to minimize the possibility of overstressing the aircraft as a result of the combined effects of gusts and maneuvering loads.

LANDING CONFIGURATION (ALL A-6 SERIES)

Zero g to +2.0 g is permitted in the landing configuration.

CENTER-OF-GRAVITY LIMITATIONS

MAXIMUM FORWARD C.G.

Gear Up . . . . . 20.5% MAC
Gear Down (Landing) . . . . . 20.5% MAC
Gear Down (Takeoff) . . . . . 23.0% MAC

MAXIMUM AFT C.G.

Gear Up . . . . . 28.7% MAC
Gear Down (Landing and Takeoff) . . . 29.0% MAC

ACCELERATION LIMITATIONS

KA-6D

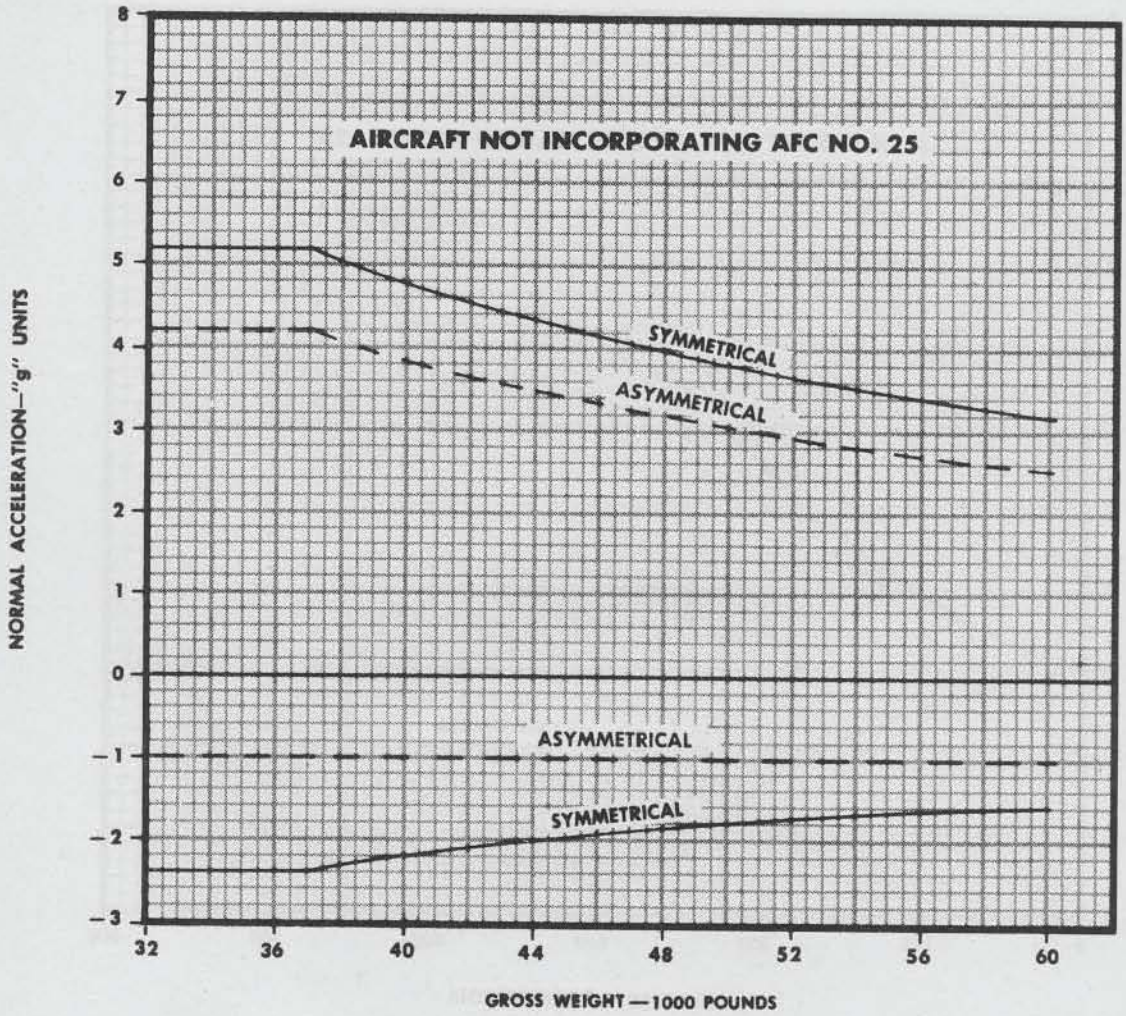
AIRCRAFT CONFIGURATION:
WING TIP SPEED BRAKES EXTENDED

WING TIP SPEED BRAKES EXTENDED

DATE: 18 OCT 1965
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



CAUTION

- Aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.
- Full acceleration limits do not routinely apply to the KA-6D. See KA-6D Acceleration Limitations paragraph this section.

ADA1-845

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Figure 1-51

OPERATING FLIGHT STRENGTH DIAGRAM

KA-6D

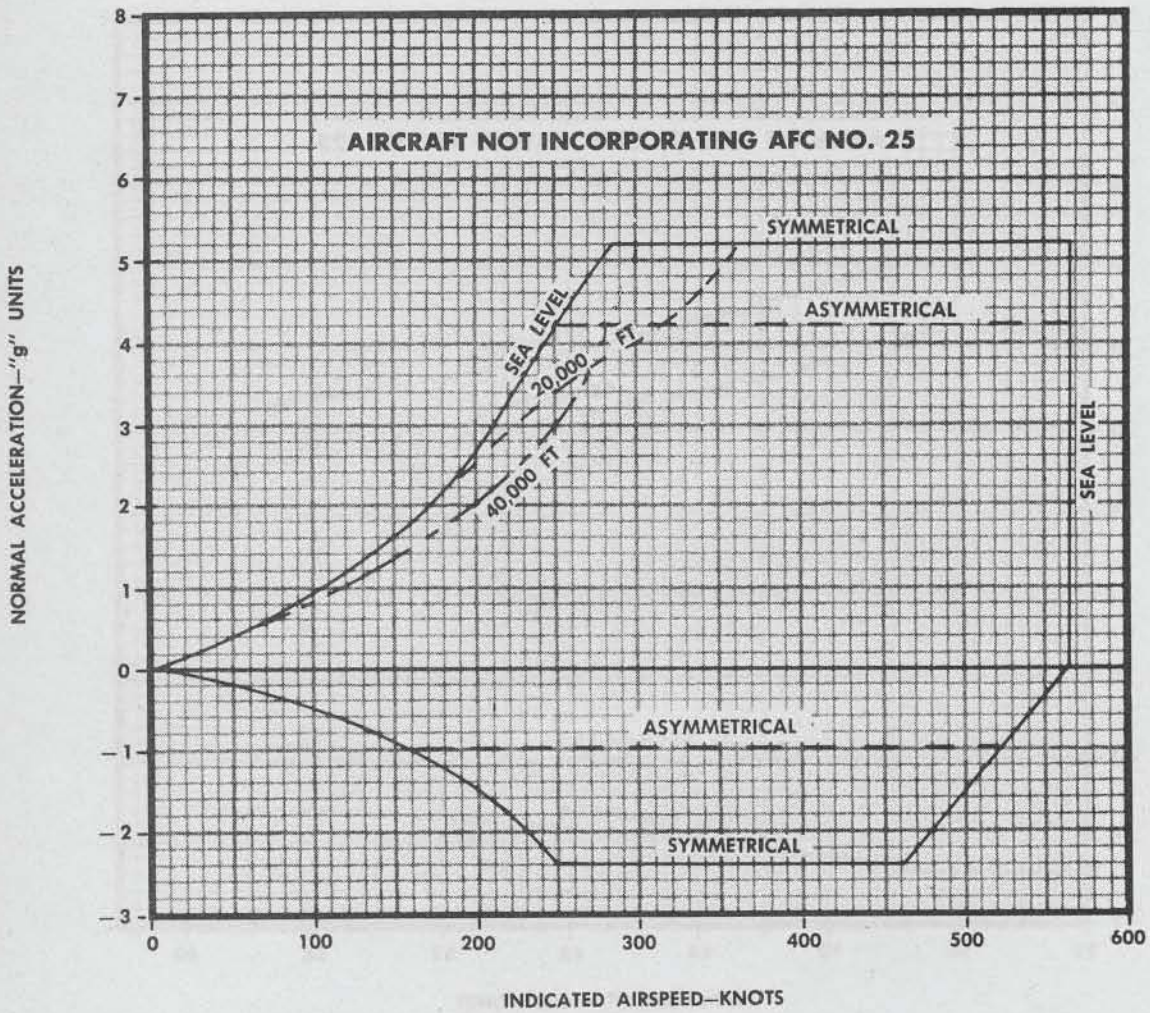
WING TIP SPEED BRAKES EXTENDED

AIRCRAFT CONFIGURATION
FOR GROSS WEIGHTS
OR 37,000 LB. OR LESS

DATE: 18 OCT 1965
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



CAUTION

- A-6A, B, C/KA-6D aircraft in which AFC No. 254 is not incorporated are restricted to a maximum normal acceleration of 5.0 g for symmetrical maneuvers and 4.0 g for asymmetric (unsymmetric or rolling) maneuvers for clean wing and all authorized wing store loads. Do not exceed g times gross weight product of 185,000 pounds for symmetric cases or 148,000 pounds for asymmetric cases above 37,000 pounds aircraft gross weight.
- Full acceleration limits do not routinely apply to the KA-6D. See KA-6D Acceleration Limitations paragraph this section.

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Figure 1-52

GROSS WEIGHT LIMITATIONS

A-6A, A-6B, A-6C, KA-6D, A-6E

Field takeoff	60,400 pounds
Field landing (minimum rate of descent)	45,000 pounds
Field landing (other than minimum rate of descent)	36,000 pounds
Catapulting	58,600 pounds
Barricade engagement	
Shipboard	36,000 pounds
SATS (M-21)	45,000 pounds
Field arrestment	See Section V
Carrier landing and carrier arrestments (using MK 7 Mod 2 or Mod 3 arresting gear)	36,000 pounds
Carrier landing and carrier arrestments (using MK 7 Mod 1 arresting gear)	
A-6C and A-6A, A-6B with AFC No. 244	36,000 pounds
A-6A, A-6B without AFC No. 244	33,500 pounds

CAUTION

- Landings other than field landings (minimum rate of descent) are not permitted if the total weight of external stores (excluding pylons with Aero-7 but including racks), on stations 1, 2, 4, and 5 exceeds 4,000 pounds or if the sum of the weight of stores on aircraft stations 1 and 2 or on stations 4 and 5 exceeds 2,000 pounds. For asymmetric external store loadings, the static moment shall not exceed 21,150 foot-pounds.

- If the total weight of external stores (excluding pylons with Aero-7, but including racks), loaded symmetrically or asymmetrically, exceeds 800 pounds on either aircraft station 1 or 5, landings other than field landings (minimum rate of descent) should be made at a gross landing weight of 33,500 pounds or less if operating requirements permit. This will decrease the moment of inertia in roll and thereby increase the safety margin in case of high rate-of-sink, one wing low, or hard carrier landings.

- The maximum recommended gross weight for carrier landings is 33,500 pounds. A-6B Standard Arm and A-6C TRIM configurations will require increased weight to insure adequate fuel reserves. Carrier landings should be made at the minimum gross weight consistent with operational requirements. Arrested landings with fuel in internal wing tanks is not permitted except in an emergency.

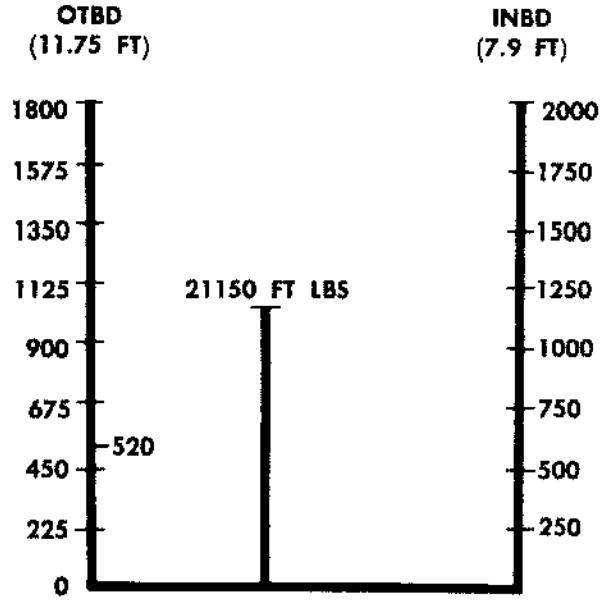
CARRIER LIMITATIONS

1. CATAPULTING WITH PARTIALLY FULL INTERNAL INBOARD WING TANKS, OUTBOARD WING PANEL TANKS, OR EXTERNAL TANKS IS NOT PERMITTED.

2. CATAPULT LAUNCH AND ARRESTED LANDINGS ARE NOT PERMITTED WITH ASYMMETRIC EXTERNAL STORE LOADING IN EXCESS OF 21,150 FOOT-POUNDS OF STATIC MOMENT. THE ASYMMETRIC LOAD AT THE OUTBOARD WING STATIONS (1 OR 5) X 11.75 PLUS THE ASYMMETRIC LOAD AT THE INBOARD WING STATIONS (2 OR 4) X 7.9 SHALL NOT EXCEED 21,150 FOOT-POUNDS.

WING MOMENT NOMOGRAM

(CATAPULT & ARREST)



3. AERO-1D FUEL TANKS MUST BE EMPTY FOR OTHER THAN FLARED, NON-ARRESTED, FIELD LANDINGS EXCEPT IN AN EMERGENCY.

NOTE

FOR ADDITIONAL LIMITATIONS, REFER TO THE CURRENT A-6 LAUNCH AND RECOVERY BULLETINS.

A-ADA1-780

Figure 1-53

EXTERNAL STORE LIMITATIONS

Only the external stores listed in the A-6A Tactical Manual NAVAIR 01-85ADA-1T may be carried and released, singly or in combination to the limits shown. Operating limitations for flight, catapulting, and arrested landings with external stores are the same as the basic aircraft unless otherwise noted.

MANEUVERS

Note

For A6B/Standard ARM airspeed and maneuvering restrictions, refer to Supplemental NATOPS Flight Manual NAVAIR 01-85ADA-1A.

RUDDER MANEUVERS

Clean Configuration (Gear and Flaps Retracted/4° Rudder)

Full pedal sideslips are permitted to the limits of the flight envelope.

Extended Rudder Throw (35° Rudder)

Extended rudder throw can be obtained in the following modes of operation:

- Flaps extended
- Assist-spin recovery switch ON
- Flight and combined hydraulic systems depressurized (backup flight controls hydraulic system activated)

Restrictions applicable to these configurations are outlined in the following paragraphs.

Gear and Flaps Extended

Full pedal sideslips are permitted to 190 KIAS with flaps at TAKEOFF (30°) or LAND (40°).

BACKUP FLIGHT CONTROLS HYDRAULIC SYSTEM ACTIVATED

Rudder maneuvers are permitted to the limits presented in figure 1-54.

ASSIST-SPIN RECOVERY SWITCH ON

CAUTION

- The assist-spin recovery switch should be actuated only to effect recovery from a spin. Operation of the switch may impose an additional acceleration, which during an accelerated maneuver may overstress the aircraft or when operating at minimum airspeeds may pitch the aircraft up into a stall or heavy buffet.
- After spin recovery is accomplished, the limitations presented in figure 1-54 must be observed until the assist-spin recovery switch is moved to OFF.
- Positioning the switch to OFF after sprin recovery should be done below 300 KIAS while anticipating a sharp nose-down trim change.

ROLLING MANEUVERS

Gear and Flaps Extended

Full stick 60° banks are permitted up to 250 KIAS with flaps at TAKEOFF (30°) and to 200 KIAS with flaps at LAND (40°).

Gear and Flaps Retracted

Full abrupt flaperon rolls and rolling pullouts are permitted up to the acceleration limits shown in figure 1-47 and 1-48 and to the maximum speed attainable and within the following additional restrictions:

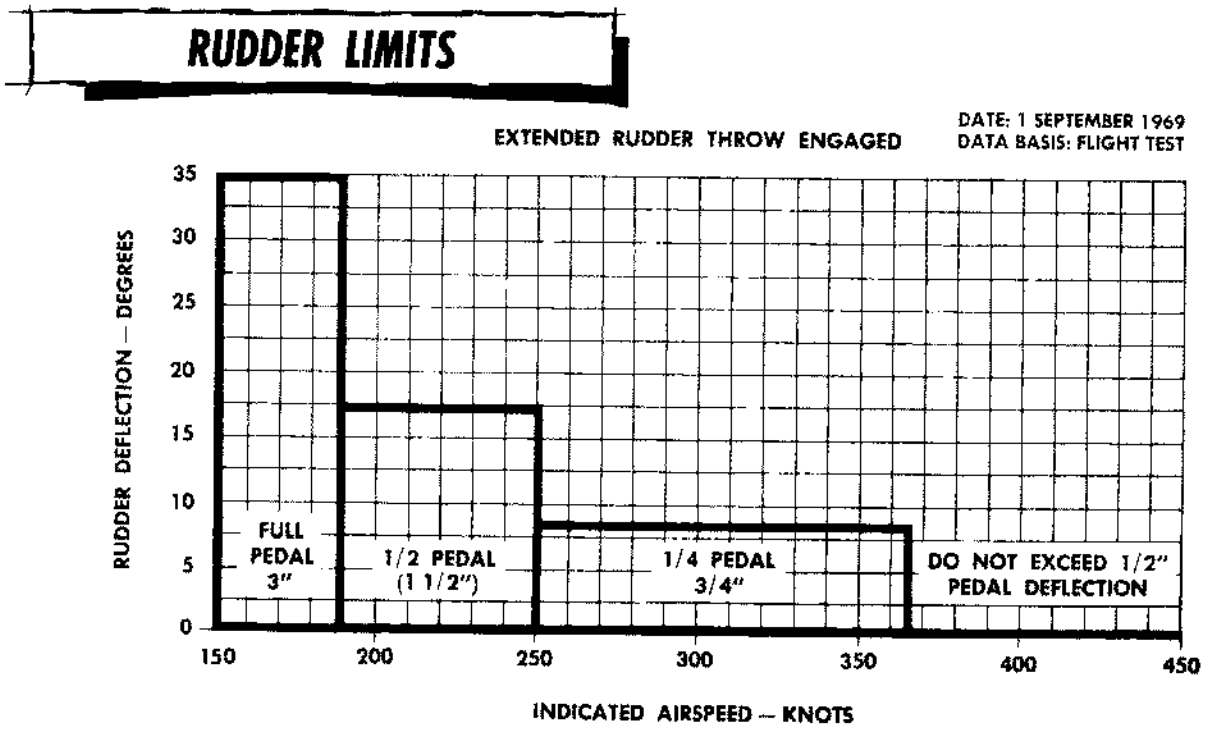


Figure 1-54

a. Not to exceed 360°.

b. With more than 1,500 pounds of fuel in an external fuel tank at stations 1 and/or 5, and/or with a full or partially full D-704 air-refueling store at station 3, lateral control motion is limited to 1/2 deflection at airspeeds in excess of 450 KIAS.

c. With the A/A37B-5 TER or A/A37B-6 MER loaded with more than 1,500 pounds of bombs at station 1 and/or 5, lateral control motion is limited to 1/2 full deflection at airspeeds in excess of 350 KIAS or 0.65 IMN, whichever is less.

d. When a MER installed on an aircraft wing station is asymmetrically loaded with stores, additional rolling limitations are imposed. A rack asymmetrical loading condition exists:

- When the total weight of stores loaded forward does not equal the total weight of stores loaded aft, or
- When the total weight loaded on rack stations 3 and 4 does not equal the total weight loaded on stations 5 and 6.

When either of the above asymmetrical loading conditions occurs, observe the lateral control motion limits shown in figure 1-55.

CAUTION

Exercise caution when deflecting the flaperons, as an increase in normal acceleration will result.

PROHIBITED MANEUVERS

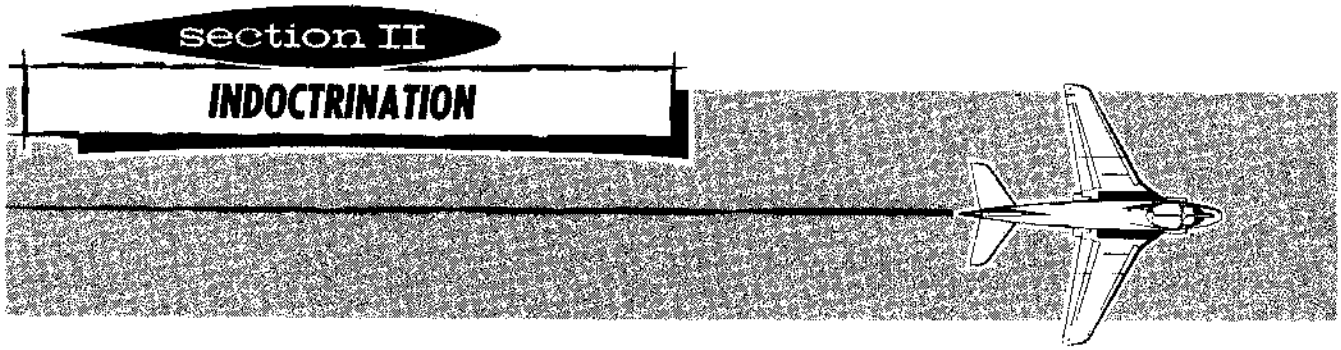
1. Large abrupt control reversals
2. Intentional spins
3. Negative g flight in excess of 30 seconds
4. Zero g flight in excess of 10 seconds
5. Nonejected releases from MER/TER racks using curvilinear tracking runs (commonly called pipper on target tracking).

ASYMMETRICAL LOADING, ROLL LIMITS

RACK ASYMMETRY (LB)		MAX STICK DEFLECTION
A/C STATION 2 OR 4	A/C STATION 1 OR 5	
600 TO 1,200	400 TO 600	¾ THROW ABOVE 350 KIAS/ .65 IMN
1,200 OR GREATER	600 TO 1,200	½ THROW ABOVE 350 KIAS/ .50 IMN
	1,200 OR GREATER	COORDINATED TURNS ONLY.

ADA1-847

Figure 1-55



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GROUND TRAINING SYLLABUS

MINIMUM GROUND TRAINING

The ground training syllabus sets forth the minimum ground training that must be satisfactorily completed prior to operating the A-6. The ground training syllabus for each activity will vary according to local conditions, field facilities, requirements from higher authority, and the immediate unit commander's estimate of the squadron's readiness. The minimum ground training syllabus for the pilot and bombardier/navigator is set forth below.

Minimum Ground Training Requirements

NEW The minimum ground training requirements for the A-6 pilot and bombardier/navigator, which shall be successfully completed prior to flight, are as follows:

1. NAMTD A-6 flight crew familiarization course or equivalent
2. Preflight check of the aircraft
3. Cockpit check and familiarization
4. Bailout, ditching procedure, safety, and survival equipment checkout
5. Weapons System Trainer Flight Syllabus (if available)
6. Locally prepared written examination covering appropriate emergency procedures.

The minimum ground training requirements for the A-6 observer, which shall be successfully completed prior to flight, are as follows: NEW

1. Flight physiology training required by OPNAVINST 3710.7 series.
2. Bailout, ditching procedures, safety, and survival equipment checkout. NEW
3. Lookout responsibilities and procedures.
4. Emergencies evaluation and use of emergency procedures checklist.
5. Hand signals (ground and flight).

FLIGHT TRAINING SYLLABUS

The flight training syllabus is designated to effect the orderly and expeditious qualification of pilots and bombardier/navigators in flying the A-6 as an aircraft, as a weapons system, and as a tanker from both carrier- and shore-based installations. NEW

CEILING/VISIBILITY REQUIREMENTS

In general, the following pilot ceiling/visibility minimums for time-in-model apply.

Time-in-Model (hr)	Ceiling/Visibility (ft) (mi)
0 to 10	VFR (remain clear of clouds)
10 to 20	800/2; 900/1-1/2; 1,000/1
20 to 45	700/1; 600/2; 500/3
45 and above	OPNAV minimums

Where adherence to these minimums unduly hampers pilot training, Commanding officers may waive time-in-model requirements for actual instrument flight, provided pilots meet the following criteria:

1. Have a minimum of 10 hours in model.
2. Completed two simulated instrument sorties.
3. Completed two actual or simulated TACAN penetrations to field minimums.

INITIAL QUALIFICATION AND CURRENCY REQUIREMENTS

Initial flight qualification shall be obtained by satisfactory completion of the required course of instruction at a formal USN/USMC A-6 replacement training squadron training syllabus. Minimum requirements to maintain currency after initial qualification shall be established by the unit commanding officer but will involve as a minimum 10 hours of first pilot time and 2 takeoffs and landings in A-6 aircraft in the previous 90 days for pilots and annual NATOPS evaluation with the grade of at least conditionally qualified for pilots and B/N's. Requalification of those crewmembers whose currency has lapsed shall include appropriate ground training followed by a familiarization flight phase to include NATOPS requalification.

REQUIREMENTS FOR VARIOUS FLIGHT PHASES

Solo Flight

Solo flight is prohibited.

Night

Not less than 10 hours in model.

Cross-Country

1. Have a minimum of 25 hours in model.
2. Have a valid instrument card.
3. Have completed at least one night familiarization flight.
4. Have completed a locally prescribed aircraft servicing checkout.
5. Must be current in model.

Ferry

Ferry requirements are contained in OPNAVINST 3710.6 series.

For members of ferry squadrons, training requirements, checkout procedures, evaluation procedures, and weather minima shall be governed by the provisions contained in OPNAVINST 3710.6 (series).

REQUIREMENTS FOR NIGHT/INSTRUMENT FLIGHT

Aircraft instrumentation requirements for night and instrument flight are specified in OPNAV 3710.7 series instructions. In addition, a vertical display indicator, radar altimeter, and aligned inertial platform are required for night and instrument flight. The VDI and the inertial platform are the primary attitude reference.

CARRIER LANDING QUALIFICATIONS

Carrier landing qualifications will be in accordance with LSO NATOPS manual

MINIMUM CREW REQUIREMENTS

In the A-6A/B/C/E, the minimum crew requirements for flight shall consist of a qualified pilot and NFO. A qualified observer, when authorized by competent authority, may occupy the B/N seat during nonsystem flights.

The minimum crew in the KA-6D is a qualified pilot. However, solo flight is prohibited. The KA-6D is designed to be crewed by a pilot and an additional crewman, in order to fullfill the entire mission spectrum of the aircraft. The existing cockpit layout allows the pilot to perform all of the in-flight refueling functions and continue to maneuver the aircraft. The in-flight refueling mission therefore can be completed with a NON-NFO in the right seat. VIP/ORIENTATION flights can be performed while executing the in-flight refueling mission. Due to the myriad of possible problems and emergencies that can arise in any high-performance aircraft, right seat flights by untrained personnel should be minimized.

VIP/ORIENTATION FLIGHTS

VIP/orientation flight requirements are contained in OPNAVINST 3710.7 series.

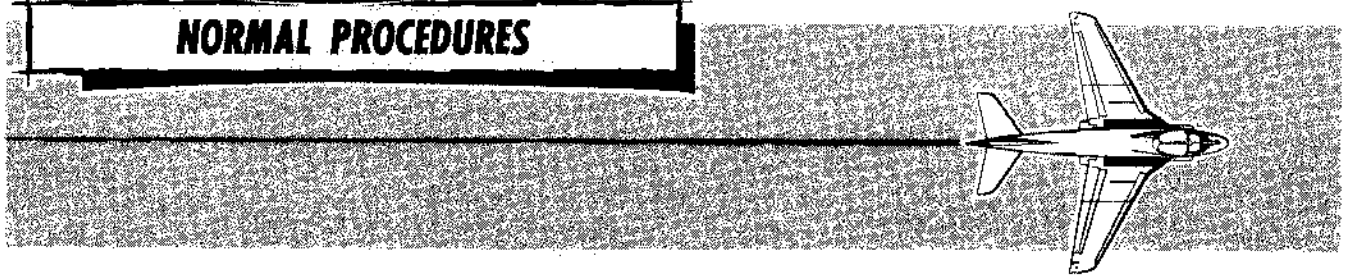
PERSONAL FLYING EQUIPMENT

The minimum requirement for personal flying equipment is contained in OPNAVINST 3710.7 series. NEW

In addition, the latest available flight safety and survival equipment as authorized by Aviation Crew Systems Manual, Volume 7 (Aircrew Personal Protective Equipment), NAVAIR 13-1-6.7, shall be used by crewmen for flight in A-6 aircraft. NEW

section III

NORMAL PROCEDURES



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part 1 Briefing/Debriefing

BRIEFING/DEBRIEFING RESPONSIBILITIES

The Commanding Officer shall ensure that every flight crew is properly and adequately briefed on all facets of the assigned mission. Through the Operations Officer, he shall assign the appropriate personnel to brief each flight, according to the mission and anticipated conditions.

BRIEFING OFFICER

The Briefing Officer assigned on the Flight Schedule shall have the overall responsibility for coordinating and conducting a proper and adequate briefing of the flight. This responsibility will be assumed by the flight leader if a Briefing Officer has not been assigned.

PILOT-IN-COMMAND/MISSION COMMANDER

NEW

Each Pilot-in-Command/Mission Commander shall ensure that an adequate briefing has been obtained, and that his crew is fully prepared for the scheduled mission.

OPERATIONAL BRIEFING

Flight crews shall be given complete, comprehensive briefings on all operations. The briefing officer shall work in conjunction with the operations officer, Air Intelligence Officer, and other officers concerned, in preparing the necessary information. He shall make optimum use of all graphic presentation devices, maps, charts, etc., which are available.

PREOPERATIONAL BRIEFING

Immediately prior to all operations of appreciable complexity and duration, a general information brief shall be given to familiarize personnel with the overall nature of the operation. The following topics shall be included:

1. The mission and objectives of the operation, and the part the squadron will play in carrying them out

2. A brief chronological breakdown of how the operation will be conducted.

3. The geographical area in which the operations will be conducted including but not limited to the following:

   (1.) BINGO FIELDS

   a. Instrument approach facilities.
   b. Runway length and arresting gear.
   c. Local terrain and obstructions.

   (2.) EMERGENCY FIELDS

   a. Fields suitable for landing but without required support equipment.
   b. Instrument approach facilities.
   c. Runway length and arresting gear.
   d. Terrain and obstructions.

   (3.) SAR FACILITIES

   a. Type.
   b. Frequencies.
   c. Locations.

4. The forces involved, both friendly and enemy, and how they will be deployed

5. The rules of engagement set down by the governing operation order

6. Search and rescue, EMCOM, and other special communications procedures which will be used, including explanation of shackles and authenticators

7. A discussion by the Briefing Officer of the principal attack tactics to be employed

PREFLIGHT BRIEFING

These briefs are presented immediately before the launching of scheduled flights, and therefore must be carried out in the most expeditious manner. It is imperative that all pilots and bombardier/navigators be in flight gear and otherwise ready for the briefing at the designated time. The brief shall include, but not be limited to the following:

Note

Information marked with an asterisk (*) shall be displayed on a status board in the briefing or ready room, and should be copied by pilots before commencement of the briefing.

1. General.

   a. Aircraft assigned, call signs, and event number.*
   b. Fuel load, stores, and aircraft gross weight.
   c. Engine start, taxi and takeoff times.
   d. Line and taxi procedures.
   e. Takeoff distance and speed, rendezvous instructions, and visual signals.

2. Mission.

   a. Primary.
   b. Secondary.
   c. Operating area.
   d. Time on station or over target.
   e. IP (Radar/Visual).
   f. Review of target and procedures.

3. Communications.

   a. Channels and frequencies.*
   b. Controlling agencies.
   c. Navigational aids.*
   d. Radio procedures and discipline.
   e. Reports required.
   f. Authenticators, IFF/SIF procedures.
   g. ADIZ procedures.
   h. EMCON conditions.

4. Participating units.

   a. Voice calls and side numbers.*
   b. Disposition.
   c. Utilization.
   d. Friendly subs and surface units.

5. Navigation and flight planning.

   a. Duty runway/predicted foxtrop corpen for launch and recovery.
   b. Takeoff.
   c. Climb-out.
   d. Mission route including planned use of all navigation systems, check point (radar/visual) restricted or danger areas.
   e. Fuel/oxygen management including bingo fuel.
   f. Marshal holding.
   g. Penetration procedures.
   h. GCA or CCA procedures.
   i. Recovery time and recovery order.*

6. Operations.

   a. Instructions for coordinating other units.

7. Weapons.

   a. Type/quantity.*
   b. Preflight.
   c. Special routes with ordnance aboard.
   d. Pattern including airspeeds and altitudes.
   e. Restrictions on use.
   f. Armament switches/arming.
   g. Minimum release/pullout altitudes.
   h. Duds, hung ordnance, dearming, and jettison procedures.
   i. Safety.

8. Weather - base, enroute, and target.

   a. Wind: direction and velocity at surface and at applicable altitudes (jet streams and contrails).*
   b. Cloud coverage: present and forecast.*
   c. Visibility.*
   d. Sea state.*
   e. Water and air temperature (cold weather).*
   f. Target weather.
   g. Divert weather.

9. Emergencies.

   a. Takeoff.
   b. Radio failure.
   c. Loss of NAV aids/system.
   d. Loss of visual contact with flight.
   e. SAR procedures.
   f. System failure.

10. Air intelligence and special instructions.

    a. Friendly/enemy force disposition.
    b. Current situation.
    c. Targets.
    d. Safety precautions.
    e. Reports and authentication.
    f. Escape and evasion.

11. Miscellaneous.

    a. Other units in the area.
    b. Current NOTAMS, bulletins, and safety-of-flight information.
    c. SAR - participating units and procedures.

part 2 Mission Planning

MISSION PLANNING

Detailed preflight planning is essential for the success of any attack mission, consistent with the time available and the nature of the assignement.

NUCLEAR WEAPONS

Mission planning for nuclear weapons delivery shall be in accordance with NAVAIR 01-85ADA-1T, A-6A Tactical Manual.

CONVENTIONAL WEAPONS

Conventional weapons deliveries fall generally into two types:

1. Preplanned strikes on specific targets
2. Close air support, call fire, or armed reconnaissance

Preplanned Strikes

Preplanned strikes on specific targets shall be planned in the same manner as special weapons deliveries.

Close Air Support, Call Fire, and Armed Reconnaissance Strikes

Due to the tactical nature of these missions, detailed preplanning is unrealistic. Preplanning shall concentrate primarily on target area familiarization and review of weapons check list and fuel planning aids.

part 3 Shore Based Procedures

Note

- Refer to Supplemental NATOPS Flight Manual NAVAIR 01-85ADA-1A for A-6B-peculiar procedures.
- A-6C-peculiar procedures may be found in this part following the A-6 common procedures. The appropriate place in the A-6 common procedures for completing an A-6C-peculiar procedural step is indicated by A-6C in boldface type followed by the applicable step number. Eg.:

A-6C 1.

PREPARATIONS FOR FLIGHT

When both crewmembers are present, it is recommended that a thorough briefing be conducted concerning normal and emergency procedures, crew coordination, and cooperation through the planned mission. Refer to Section IX, Flight Crew Coordination. NEW

FLIGHT RESTRICTIONS

Refer to Section I, Part 4, Aircraft Operating Limitations, and Section XI, Performance Data.

FLIGHT PLANNING

Refer to Section XI, Performance Data, to determine fuel consumption, airspeeds, power settings, and altitude required for the intended flight mission.

ACCEPTANCE OF AIRCRAFT

Review current OPNAV form 3760-2 (yellow sheet) for status and servicing of aircraft.

WEIGHT AND BALANCE

Refer to Section I, Part 4, for Aircraft Operating Limitations.

For loading information, refer to the Handbook of Weight and Balance Data, AN-01-1B-40.

CHECKLISTS

The placarded takeoff and landing checklist (figure 3-1) located in the aircraft cockpit serve as reminders for the orderly check of certain essential aircraft functions. The pilot is responsible for the completion of the checklist and acknowledgement by the bombardier/navigator is mandatory prior to takeoff or landing.

ACCESS TO COCKPIT

See figure 3-2 for normal entry into the cockpit.

Figure 3-1

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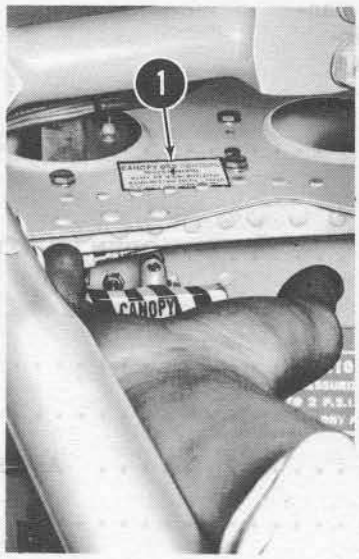
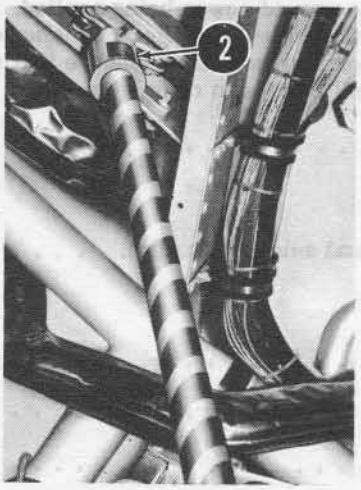
EXTERNAL CANOPY OPERATION

MANUAL OPERATION FROM NOSE WHEEL WELL





CONNECT HAND PUMP HANDLE TO HAND PUMP (45 CYCLES TO FULLY OPEN CANOPY)

1. CANOPY SELECTOR GROUND OPERATION "PUSH UP" TO OPEN—"PULL DOWN" TO CLOSE

NOTE

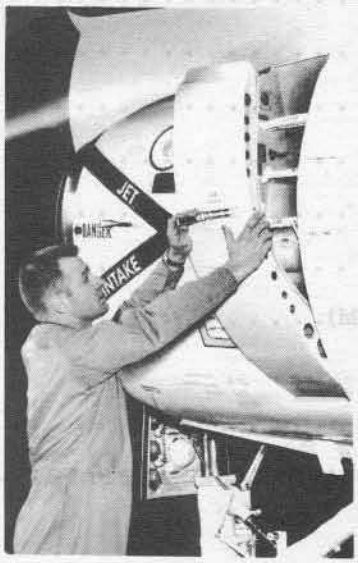
A-6E, A-6A 155703 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 185. CANOPY SELECTOR HANDLE MUST BE HELD IN DESIRED POSITION TO OPERATE CANOPY.

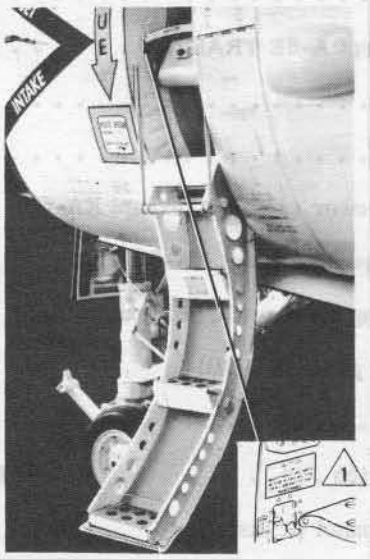
2. HAND PUMP AND HANDLE

NOTE

BEFORE ENTERING COCKPIT OR INITIATING COCKPIT CHECKS ENSURE THAT BOTH COCKPIT CANOPY SWITCH AND MANUAL SELECTOR HANDLE ARE OPEN OR NEUTRAL

CANOPY OPERATION—BOARDING LADDER SWITCHES





TYPICAL BOTH SIDES OF AIRCRAFT

1 A-6E 158041 THROUGH 158538 AND A-6A 155720 THROUGH 157029 NOT INCORPORATING A.F.C. NO. 287.

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Figure 3-2

CREW PREFLIGHT CHECK

BEFORE EXTERIOR INSPECTION

CAUTION

Prior to ground power being applied, it is mandatory that either qualified maintenance personnel or a crewmember ensure that steps 1 through 3 have been completed.

1. Fire extinguishing . . . . . AVAILABLE

A-6C 1.

2. Cockpit canopy switch and manual selector handle . . . . . OPEN OR NEUTRAL

3. Cockpit check

   a. Oxygen switches. . . . . OFF

   b. Emergency flap switch . . . . . OFF

   c. FUEL READY switch . . . . . AS DESIRED

   d. Wing and fuselage dump switches . . . . . OFF

   e. Landing-gear handle . . . . . DOWN

   f. Trim button . . . . . SECURE

   g. VDI and PHD . . . . . OFF

   h. Armament switches . . . . . OFF/SAFE

   i. Pitot heat switch . . . . . OFF

   j. CNI MASTER switch (except A-6E TRAM) . . . . . OFF

   k. ECM . . . . . OFF

   l. 1CIR COOLING switch . . . . . OFF

   m. BNCB SEARCH/TRACK power switches (except KA-6D) . . . . . OFF

   n. Inertial platform control panel (except KA-6D) . . . . . OFF

   o. Ground-controlled bombing system (GCBS) (except A-6E TRAM) . . . . . OFF

   p. Internal system refueling panel (KA-6D)

      (1) POWER switch . . . . . OFF

      (2) DROGUE jettison switch . . . . . SAFE/GUARD CLOSED AND SAFETY-WIRED

   q. External refueling store panel (if installed)

      (1) Master/power switch . . . . . OFF

      (2) JETTISON switch. . . . . NORM

   r. Doppler power switch . . . . . OFF

CONTINUED ON NEXT PAGE

CREW PREFLIGHT CHECK–CONTINUED

4. External power . . . . . CONNECTED
5. Integrated position indicator . . . . . MATCHES AIRCRAFT CONFIGURATION
6. Annunciator panel RUD THRO light . . . . . ON

WARNING

If the RUD THRO light is not lit prior to start, a rudder linkage failure may have occurred.

7. Fuel, oil, and oxygen quantity . . . . . CHECK
8. Platform (Except KA-6D) . . . . . STBY (5 MINUTES MINIMUM)

8A. NAVIGATION panel (A-6E TRAM)

a. MODE button . . . . . LEVEL

b. SINS DATA switch . . . . . OFF

EXTERIOR INSPECTION

Perform exterior inspection as outlined below: (refer to figure 3-3)

Ⓐ NOSE AREA

1. Armament safety override switch . . . . . OFF
2. Canopy air bottle . . . . . 2450 PSI ±100 PSI

EXTERIOR INSPECTION

GENERAL CHECKS

THE FOLLOWING GENERAL CHECKS SHOULD BE PERFORMED THROUGHOUT THE EXTERIOR INSPECTION: CRACKS, DISTORTIONS, LOOSE FASTENERS; COVERS REMOVED; FUEL, OIL, HYDRAULIC LEAKS; ACCESS DOORS AND PANELS SECURELY FASTENED; AND EXTERNAL STORES SECURE.

NOTE

THE EXTERIOR INSPECTION NORMALLY BEGINS AT THE PILOT'S COCKPIT BOARDING LADDER AND PROGRESSES IN A CLOCKWISE DIRECTION AROUND THE AIRCRAFT. AFTER COMPLETION OF THE "AFT FUSELAGE AREA" CHECKS. REPEAT THE "CENTER FUSELAGE AND WING AREA" CHECKS FOR THE LEFT SIDE INSPECTION.

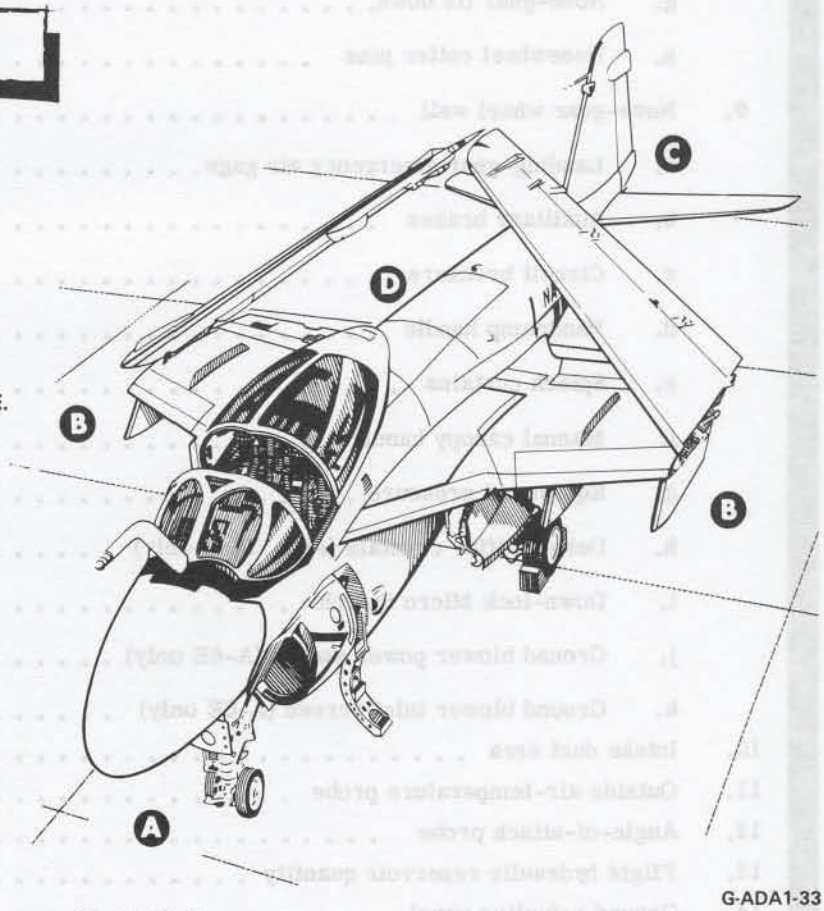

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Figure 3-3

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CREW PREFLIGHT CHECK—CONTINUED

3. Canopy jettison bleeder valve plunger . . . . . DEPRESS
   If air escapes a leak in one of the canopy jettison bottles is indicated. This could result in unintentional jettison of the canopy
4. Total-temperature probe . . . . . CHECK
5. Intake duct area . . . . . CLEAR
6. Radome . . . . . SECURE
7. Air-refueling probe . . . . . CHECK VISUALLY FOR DAMAGE
8. Nose gear . . . . . CHECK
   a. Approach, anticollision, and taxi lights . . . . . CHECK
   b. Tires and shockstrut . . . . . PROPERLY INFLATED
   c. Nose-gear ground safety lock . . . . . INSTALLED
   d. Nose-gear shimmy damper . . . . . CHECK
   e. Nose-gear steering linkage . . . . . CHECK
   f. Nose-gear door linkage . . . . . CHECK
   g. Nose-gear tie down . . . . . CHECK AS REQUIRED
   h. Nosewheel cotter pins . . . . . INSTALLED
9. Nose-gear wheel well . . . . . CHECK
   a. Landing-gear emergency air gage . . . . . 2450 ±100 PSI
   b. Auxiliary brakes . . . . . 800 PSI MINIMUM PRELOAD
   c. Circuit breakers . . . . . IN
   d. Handpump handle . . . . . SECURE
   e. Splash curtains . . . . . SECURE
   f. Manual canopy handle . . . . . UP (OPEN)
   g. Equipment pressure . . . . . 600-2800 PSI
   h. Dehumidifier crystals (A6A, B, C only) . . . . . CHECK (BLUE IN COLOR)
   i. Down-lock Micro Switch . . . . . SECURE
   j. Ground blower power switch (A-6E only) . . . . . AUTO
   k. Ground blower inlet screen (A-6E only) . . . . . CLEAR
10. Intake duct area . . . . . CHECK
11. Outside air-temperature probe . . . . . CHECK
12. Angle-of-attack probe . . . . . CHECK
13. Flight hydraulic reservoir quantity . . . . . CHECK (THEN SECURE ACCESS PANEL)
14. Ground refueling panel . . . . . CHECKED

CONTINUED ON NEXT PAGE

CREW PREFLIGHT CHECK—CONTINUED

a. FWD/AFT transfer and dump pump . . . . . CHECK
b. Power switch . . . . . OFF

15. Air-conditioning inlet . . . . . CLEAR

(B) CENTER FUSELAGE AND WING AREA

1. Forward engine access doors . . . . . FLUSH WITH FUSELAGE
   a. Latch handles (6) . . . . . STOWED AND LOCKED
   b. Locking pins (8) . . . . . FULLY SEATED
      Check through visual inspection ports
2. Main-gear wheel well . . . . . CHECK
3. Main gear . . . . . CHECK
   a. Tire and shock strut . . . . . PROPERLY INFLATED
   b. Main landing-gear dump valve . . . . . CHECK IN
   c. Main-gear ground safety lock . . . . . INSTALLED
   d. Main-gear tie down . . . . . CHECK AS REQUIRED
   e. Jack pads . . . . . STOWED
4. Center pylon . . . . . SECURE
5. Wing pylon . . . . . SECURE
6. Wing slat . . . . . SECURE
7. Fuel ram-air inlet . . . . . CLEAR
8. Wing-tip speed brakes . . . . . CLOSED
   Ensure speed-brake ground safety lock removed.
9. Position and formation lights . . . . . CHECK
10. Wing fuel dump-vent line . . . . . CLEAR
11. Wing flap and flaperon . . . . . SECURE
    Ensure cotter pins and safety wires installed
12. Exhaust area . . . . . CLEAR
13. A-6C TRIM pod . . . CHECK FOR HYDRAULIC LEAKS AND GENERAL SECURITY, POD STOWED
14. Air-refueling store (if installed)
    a. Store propeller . . . . . CHECK
    b. Hydraulic fluid level . . . . . CHECK
    c. Pod fuel quantity . . . . . CHECK
    d. Drogue . . . . . CHECK
    e. Electrical hookup . . . . . CHECK

(C) AFT FUSELAGE AREA

1. Rudder and stabilizer . . . . . CHECK
2. Fuselage fuel dump-vent line . . . . . CLEAR
3. Arresting hook . . . . . SECURE
4. Arresting-hook ground safety lock . . . . . REMOVED
5. Extensible equipment platform . . . . . SECURE

WARNING

Aircrews will ensure that items stowed in the aft equipment bay are properly secured to prevent damage or interference with critical components.

6, Dashpot pressure . . . . . (HOOK UP) NORMAL
(HOOK DOWN) LOW
7. Liquid oxygen vent (Except KA-6D) . . . . . CLEAR
8. Doppler radome (Except KA-6D) . . . . . SECURE
9. Chaff dispenser . . . . . CLEAR/SECURE

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CREW PREFLIGHT CHECK–CONTINUED

Ⓓ TOP FUSELAGE, WING, TAIL AREA

1. Fuel ram air inlet . . . . . CLEAR
2. Aft compartment air inlet . . . . . CLEAR
3. Anti collision light . . . . . CHECK
4. Ram-air turbine . . . . . CHECK
   Check Cannon plug for security
5. Pitot tube . . . . . COVER REMOVED

Note

Before entering cockpit ensure that both the cockpit canopy switch and the canopy manual selector handle are in the open position.

6. Canopy manual disconnect pin and eccentric bushing . . . . . CHECK
   Check that eccentric bushing is in horizontal position with pins inserted and locked and T-handles stowed in clips provided. See figure 3-4.

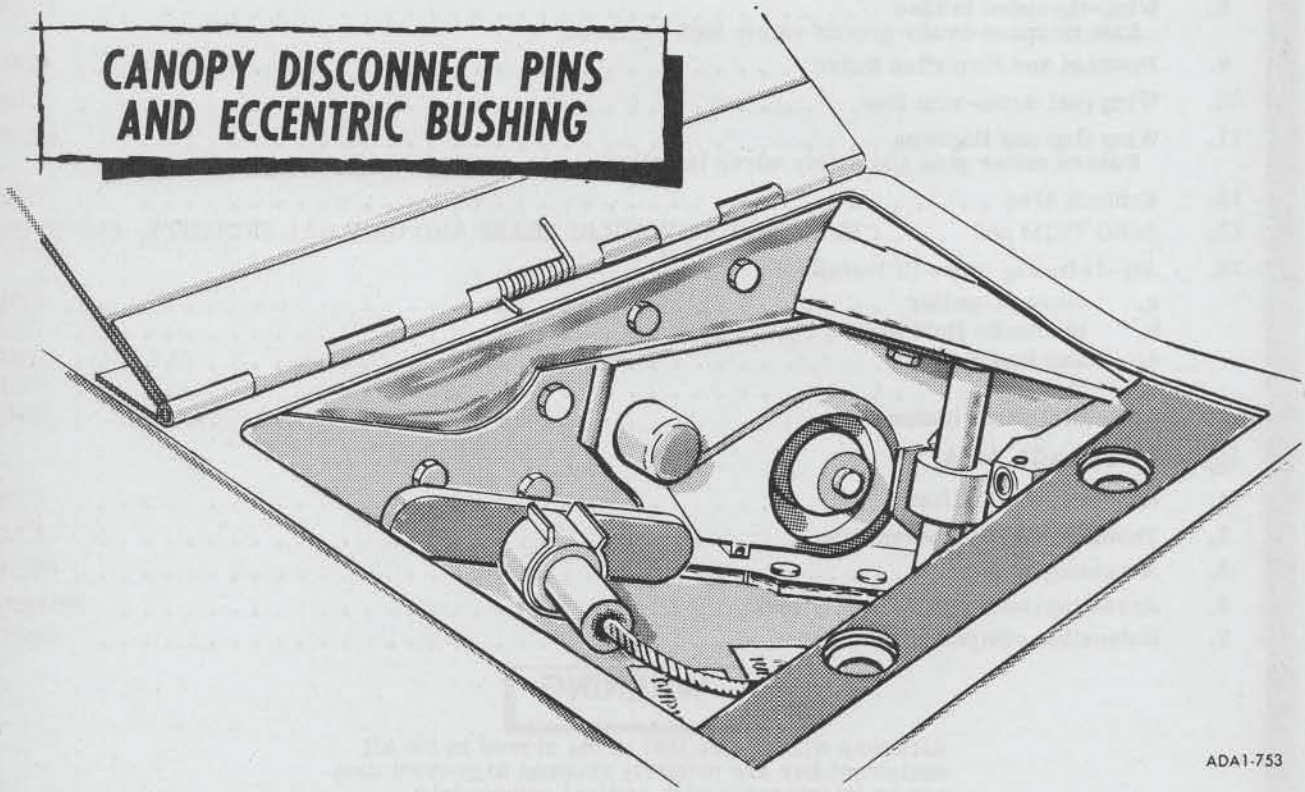

Figure 3-4

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CREW PREFLIGHT CHECK—CONTINUED

7. Canopy jettison air bottle pin . . . . . CHECK REMOVED

WARNING

If pin is difficult to remove, it may indicate the bottle has discharged and the canopy will be jettisoned unless the pressure is bled off.

8. Pitot/static lines (2) . . . . . CHECK FOR PROPER CONNECTION NEW

EJECTION SEAT CHECK

WARNING

To prevent inadvertant firing of the ejection seat or jamming of the emergency restraint release, ensure that the relief tube is properly stowed in the clamps provided. NEW NEW NEW

MK GRU-5 SEAT

Note

Before entering the cockpit or initiating other cockpit checks, ensure that both the cockpit canopy switch and the manual selector handle are in the open position.

1. Face-curtain lock and lower ejection handle guard . . . . . UP (LOCKED POSITION)
2. Ejection-seat ground safety pins . . . . . IN
3. Firing cables . . . . . CONNECTED (THIN ON TOP - THICK ON BOTTOM)
4. Top latch mechanism indicator . . . . . LOCKED NEW
   Check that top latch mechanism plunger and indicator dowel are both flush with or slightly recessed from end of top latch mechanism housing.
5. Drogue-gun cocking indicator . . . . . EXTENDED
6. Drogue-gun trip rod bolt . . . . . INSERTED (NUT ATTACHED)

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EJECTION SEAT SAFETY PINS

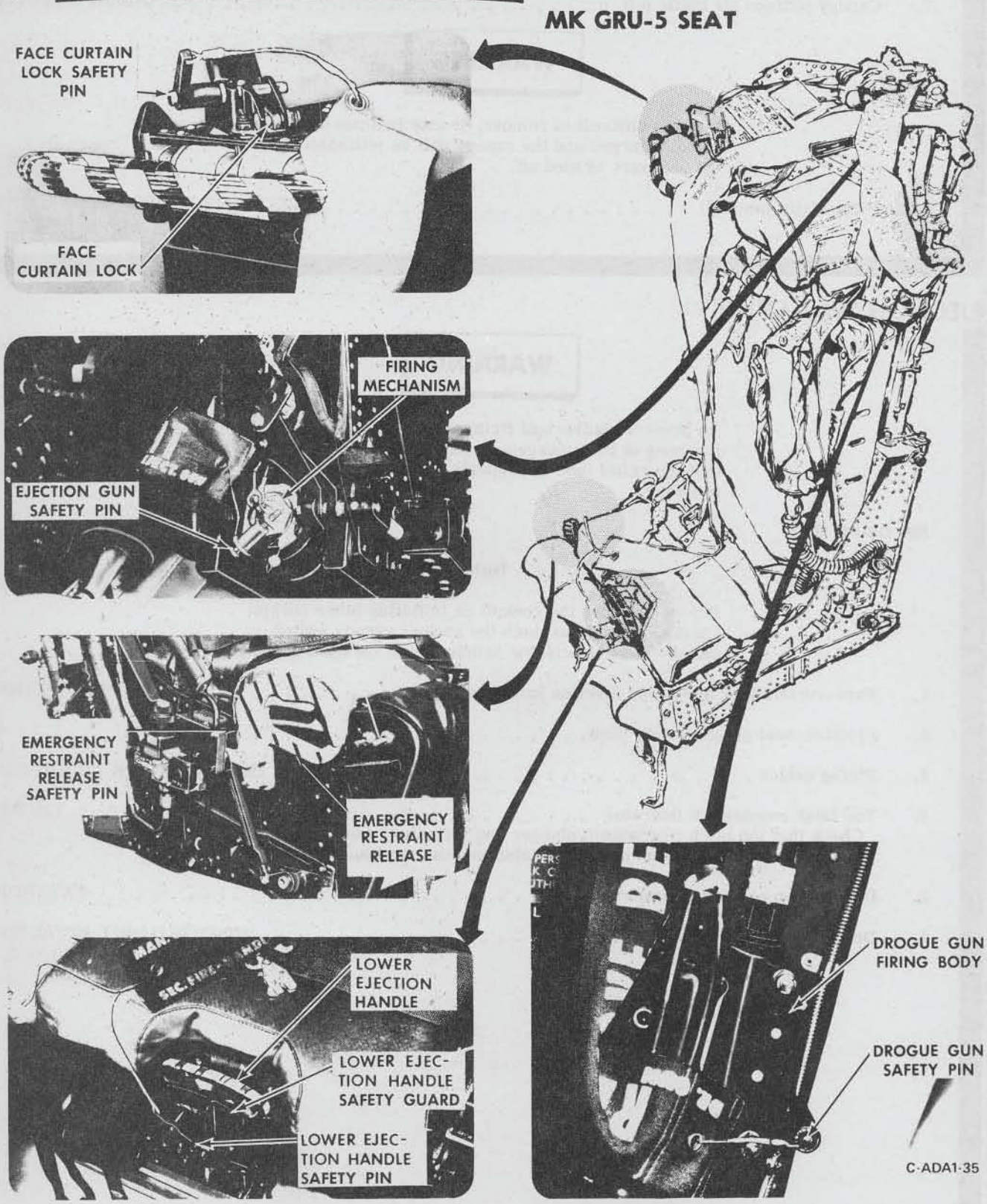

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Figure 3-5

EJECTION SEAT CHECK – CONTINUED

7. Drogue gun . . . . . LOCKWIRED AND SEALED

8. Auxiliary ejection seat cartridges, firing mechanism and retaining ring . . . . . LOCKWIRED AND SEALED

9. Slide disconnect static line cable . . . . . CONNECTED
   Check that slide disconnect static line cable is connected to retention lug by link line pin.

WARNING

If the slide disconnect static line cable is not connected, manual separation from the seat with the personnel parachute is not possible.

10. Time-release mechanism . . . . . LOCKWIRED AND SEALED

11. Time-release mechanism trip rod bolt . . . . . INSERTED (NUT ATTACHED)
    Check that time-release mechanism trip rod bolt is inserted through emergency oxygen actuator with trip lever in UP position, and that nut is attached.

12. Emergency oxygen bottle . . . . . 1,800 PSI

13. Left- and right-hand personnel services blocks . . . . . CONNECTED

14. Personnel parachute withdrawal-line screw connector . . . . . CHECK
    Check that personnel parachute withdrawal-line screw connector is secured and that withdrawal line is positioned over firing cables.

WARNING

If the personnel parachute withdrawal line is not securely connected, automatic deployment of the occupant's personnel parachute will not occur after ejection.

15. Parachute attachment . . . . . HARD PULL NEW

16. Back and seat pads . . . . . CHECK FOR PROPER POSITIONING

17. Lap belt and shoulder harness . . . . . SECURE (HARD PULL)
    Pull on lap belt and shoulder harness to check if firmly attached.

18. Leg-line snubber-release lever . . . . . LOCKED (AFT)

WARNING

If the leg-line snubber-release lever is jammed in the UNLOCKED (forward) position, manual or automatic seat separation may not be possible.

19. Leg restraint . . . . . ATTACHED TO DECK

20. Ejection-seat ground safety pins . . . . . REMOVE (5 PINS) AND STOW

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EJECTION SEAT PREFLIGHT

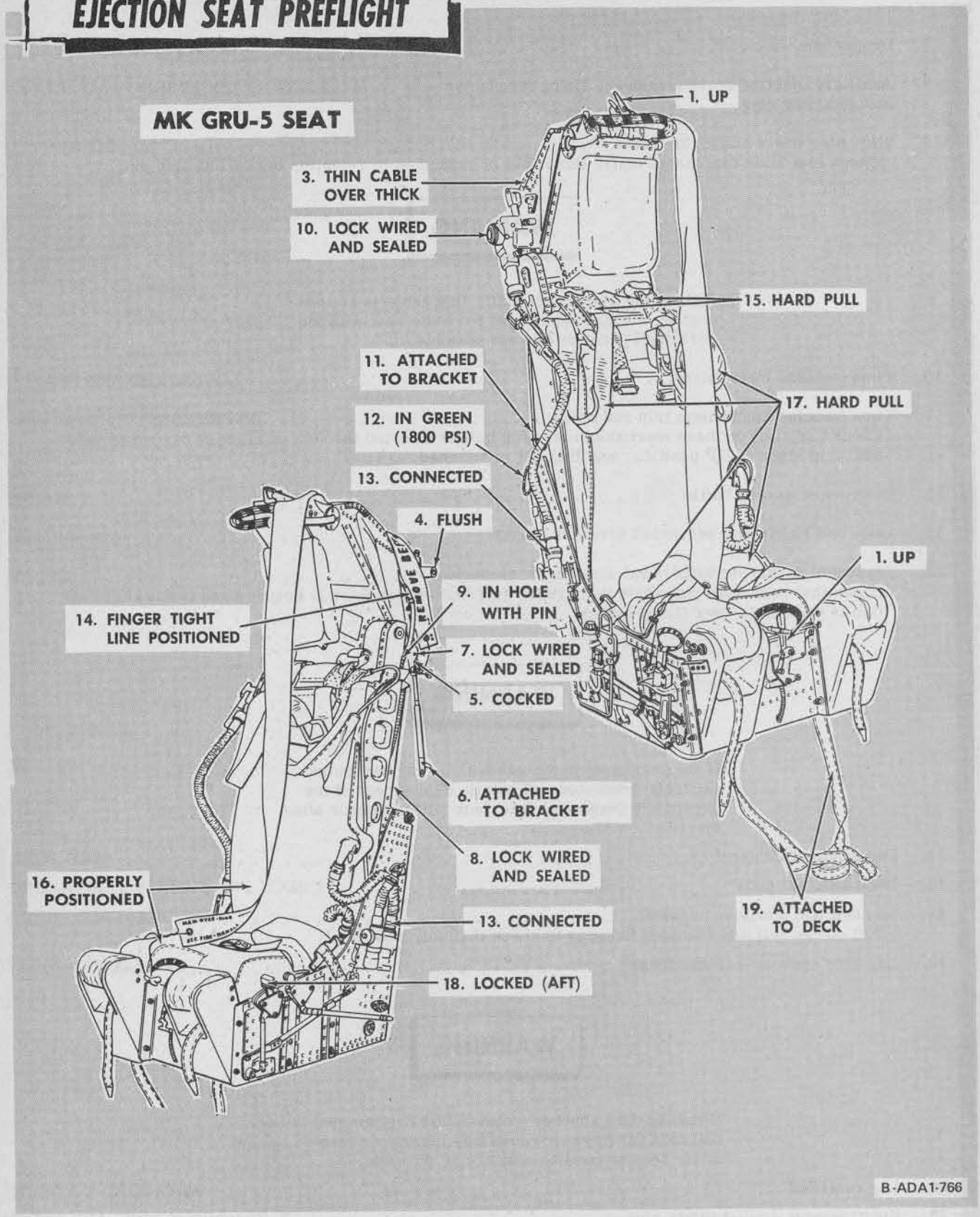

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Figure 3-6

EJECTION SEAT CHECK—CONTINUED

MK GRU-7 Seat

1. Face-curtain lock and lower ejection handle guard . . . . . UP (LOCKED POSITION)
2. Ejection-seat ground safety pins (6) (7 in seats with ACC 271) . . . . . INSTALLED
3. Ejection-gun firing linkage . . . . . CONNECTED
   Check through the windows that the face-curtain cables are connected to the firing linkage.
4. Top latch mechanism . . . . . LOCKED
   Check that top latch mechanism plunger and indicator dowel are both flush with or slightly recessed from end of top latch mechanism housing.
5. Drogue-gun trip rod . . . . . SECURED
   Check that the drogue-gun trip rod is secured to the fixed ejection-gun bracket with the red painted portion covered by the trip rod outer barrel.
6. Rocket motor initiator sear extraction lanyard . . . . . ATTACHED
   Check that the rocket motor initiator sear extraction lanyard is attached to the sear actuating link and the drogue gun trip rod.
7. Drogue gun . . . . . LOCKWIRED AND SEALED
8. Shoulder harness reel actuating link . . . . . CONNECTED
9. Parachute withdrawal line . . . . . ROUTED THROUGH GUILLOTINE
10. Parachute withdrawal-line connector . . . . . CONNECTED

WARNING

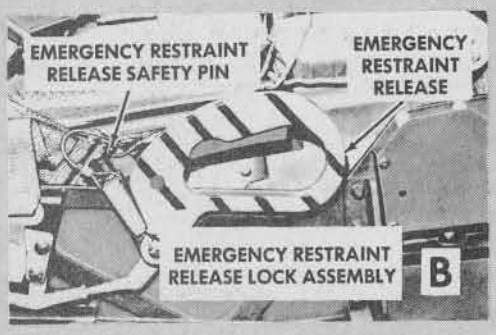
If the personnel parachute withdrawal line is not securely connected, automatic deployment of the parachute will not occur after ejection.

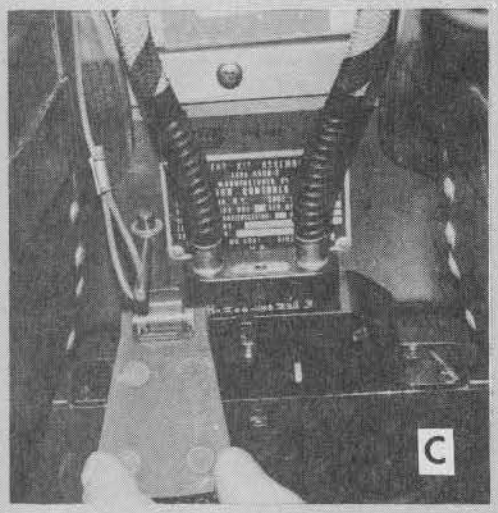
11. Rocket motor initiator . . . . . LOCKWIRED AND SEALED
12. Parachute . . . . . HARD PULL
13. Shoulder-harness reel straps and leg-restraint cords . . . . . HARD PULL
14. Leg-restraint cords . . . . . ATTACHED TO DECK
15. Emergency oxygen
    a. Emergency oxygen bottle . . . . . 1,800 PSI
    b. Emergency oxygen actuator . . . . . PROPERLY STOWED
16. Personnel services disconnect lanyard . . . . . SECURED TO DECK
17. Survival-kit front lock release lever . . . . . FULL FORWARD

CONTINUED ON NEXT PAGE

EJECTION SEAT SAFETY PINS

MK GRU 7





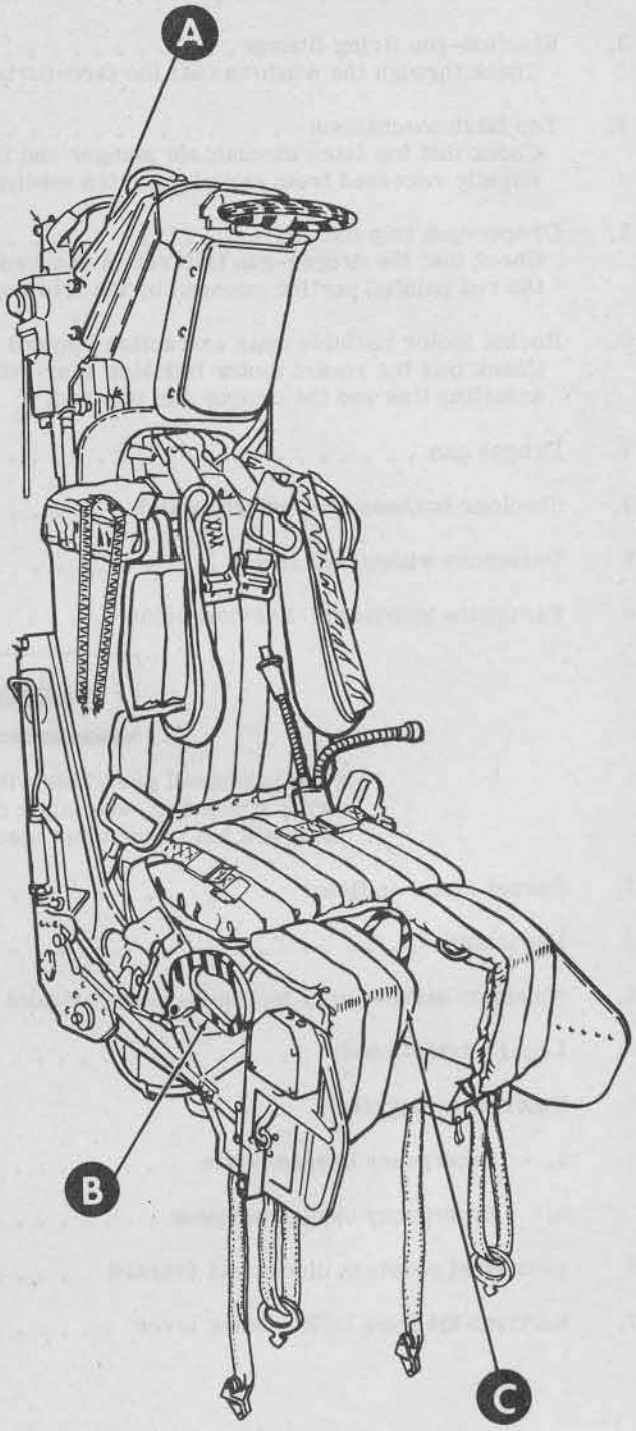


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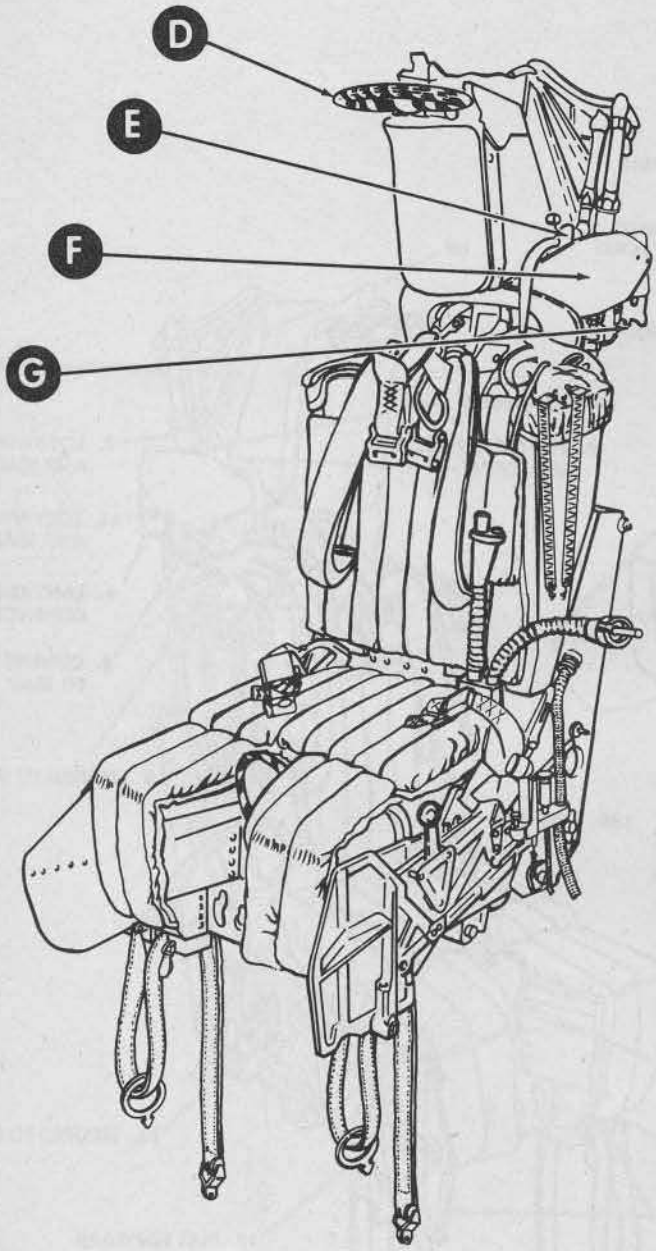
Figure 3-7 (Sheet 1)



1 SEATS INCORPORATING ACC271

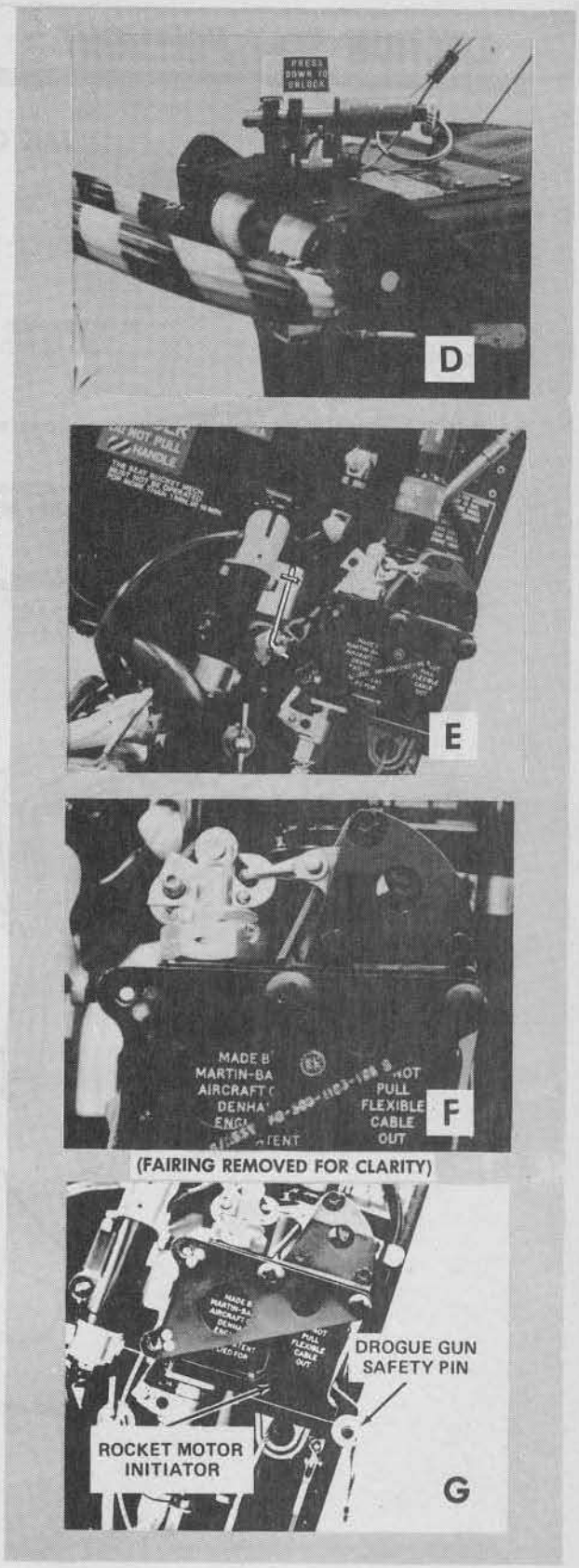


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Figure 3-7 (Sheet 2)

EJECTION SEAT PREFLIGHT

MK GRU 7

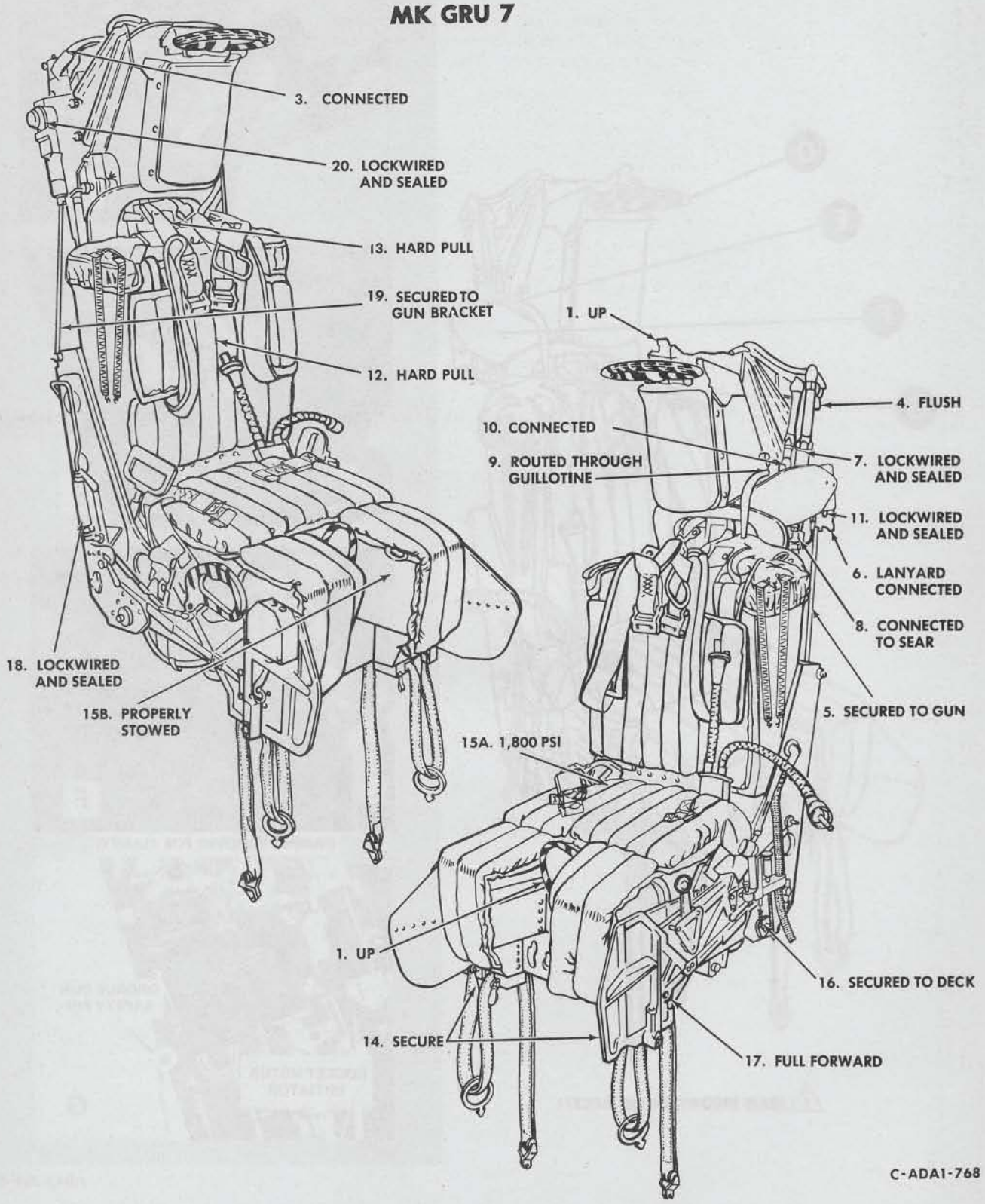

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Figure 3-8

EJECTION SEAT CHECK—CONTINUED

WARNING

Failure of survival-kit front lock release lever to return to its full forward position will prevent ejection by means of the lower ejection handle.

Note

It may be necessary to raise the seat to see the lever.

18. Guillotine initiator . . . . . LOCKWIRED AND SEALED

19. Time-release mechanism trip rod . . . . . SECURED
    Check that the time-release mechanism trip rod is secured to the fixed ejection-gun bracket with the red painted portion covered by the trip rod outer barrel.

20. Time-release mechanism . . . . . LOCKWIRED AND SEALED

21. Ejection-seat ground safety pins (6) (7 in seats with ACC 271) . . . . . REMOVE AND STOW

PILOT PRESTART PROCEDURES EXTERNAL POWER ON

UPON ENTERING COCKPIT

1. Harnessing . . . . . FASTEN

WARNING

If the survival-gear lanyard is connected (GRU-5 only), the survival equipment will hinder rapid evacuation of the cockpit during a ground emergency or ditching.

2. Helmet . . . . . ON

3. Oxygen mask, communication connections, and anti-G suit/anti-exposure suit . . . . CONNECTED

4. Seat . . . . . ADJUST

   a. Assume ejection position, sit erect, buttocks against backrest, head firmly against headrest, spine straight, thighs against seat pan.

   b. With left hand, reach up and touch face-curtain handle.

   c. Adjust seat height so that top of helmet just clears underside of face-curtain handle.

Note

Above procedure ensures proper positioning for ejection.

5. Rudder pedals . . . . . ADJUST

CONTINUED ON NEXT PAGE

PILOT PRESTART PROCEDURES EXTERNAL POWER ON—CONTINUED

6. Backup flight control hydraulic system . . . . . TEST
   Place backup hydraulic test switch to FLIGHT position. BACKUP HYD light will go on. Cycle rudder and stabilizer (response indicated by plane captain's signals). Repeat for COMBINED position of switch. This test verifies operation of pressure-sensing switches in flight and combined hydraulic systems and operation of backup hydraulic motor/pump.

CAUTION

If the RUD THRO caution light goes out during the backup hydraulic system check, terminate the test immediately as there is no fluid in the backup hydraulic pump and pump cavitation will result.

7. Selective stores jettison switch (Except A-6E) . . . . . SAFE
8. RAT handle . . . . . MATCHING RAT POSITION
9. Interior and exterior lighting. . . . . AS DESIRED
10. Anticollision light switch. . . . . ON
11. UHF auxiliary receiver (except A-6E TRAM) . . . . . SET AS DESIRED
12. ICS (except A-6E TRAM) . . . . . AS DESIRED
12A. RAD/ICS panel (A-6E TRAM) . . . . . AS DESIRED
12B. Data link (A-6E TRAM) . . . . . OFF
12C. ACLS (A-6E TRAM) . . . . . PROPER FREQ AND OFF
13. Vent suit and cushion airflow . . . . . AS DESIRED
14. Optical sight unit switches (except A-6E TRAM) . . . . . AUTO/MAN

CAUTION

Do not leave AUTO/OFF/MAN switch OFF during taxi or flight operation.

15. Oxygen . . . . . CHECK
    O_2 on, with mask away from face, depress ICS then O_2 off.
16. Contact analog switch (KA-6D) . . . . . OFF
17. HSI mode switch (KA-6D). . . . . TACAN
18. Vertical reference switch (KA-6D). . . . . NO. 1
19. Rudder trim . . . . . SET TO ZERO
20. Hook bypass switch . . . . . AS DESIRED
20A. VGI DIS switch (A-6E TRAM, KA-6D with APC-161) . . . . . D/L
21. Engine and fuel master switches . . . . . ON
    Check annunciator panel to ensure that low-fuel-pressure caution lights are out, indicating fuel boost pump operation.
22. Boost pump test button . . . . . DEPRESS
    Check that LOW FUEL PRESSURE lights come on.
23. Right engine and fuel master switch . . . . . OFF

CONTINUED ON NEXT PAGE

PILOT PRESTART PROCEDURES EXTERNAL POWER ON—CONTINUED

24. Generator switches . . . . . OFF

25. Speed drive switches . . . . . NORM

26. Approach power compensator (when installed). . . . . OFF

27. Antiskid switch. . . . . OFF

28. Flaperon pop-up switch . . . . . OFF

29. Speed-brake test switch . . . . . NORM

30. Emergency flap switch . . . . . OFF

31. Throttles . . . . . OFF AND FRICTION ADJUSTED

32. Flap lever. . . . . MATCHING FLAP POSITION

33. Assist-spin recovery switch . . . . . OFF AND GUARDED

34. Bleed-air isolation valves (AFC No. 268)

    a. NWW . . . . . AUTO
    b. CSD. . . . . OFF
    c. AIR COND . . . . . ON

35. Fuel quantity . . . . . CHECK

36. Fuel-ready switch . . . . . OFF

37. Fuselage dump switch . . . . . NORM

38. Wing dump switch. . . . . NORM

39. Wind drop-tank transfer switch . . . . . AS REQUIRED

40. Tank pressurization . . . . . NORM

41. Brake selector handle . . . . . OUT AND VERTICAL

42. Landing-gear handle . . . . . DOWN (DN)

43. Integrated position indicator . . . . . CHECK FOR PROPER INDICATIONS

44. Radar altimeter . . . . . OFF

45. ECM (KA-6D) . . . . . OFF

45A. Optical sight unit switches (A-6E TRAM) . . . . . AUTO/MAN

CAUTION

Do not leave AUTO/OFF/MAN switch OFF during taxi.

45B. HDG SEL switch (A-6E TRAM) . . . . . ~~ADF~~ CMP

46. AOA indicator . . . . . OFF, FLAG NOT SHOWING

47. Auxiliary brakes cycle gage . . . . . 15 CYCLES

48. PHD/VDI security . . . . . CHECK

CONTINUED ON NEXT PAGE

PILOT PRESTART PROCEDURES EXTERNAL POWER ON–CONTINUED

WARNING

The VDI shall have three Phillips-head screws securing it to the mounting bracket. The PHD shall have three hex-head bolts securing it to the mounting bracket.

49. Pressure altimeter (AAU-19) . . . . . CHECK AND SET TO STBY

50. Airspeed indicator . . . . . CHECK AT ZERO

51. VGI . . . . . SET TO HORIZON

52. Clock . . . . . SET

53. VSI . . . . . CHECK AT ZERO

54. Canopy switch . . . . . OPEN OR NEUTRAL

55. Canopy safety pin . . . . . REMOVE

56. All instruments . . . . . CHECK FOR SECURITY

57. Fire/oil warning system . . . . . TEST
Depress FIRE/OIL test button and check lighting of left and right fire warning lights, NWW light, AFT TEMP light (A-6E TRAM) and right and left OIL LOW warning lights.

58. LOX/FUEL/OIL button . . . . . TEST
Depress LOX/FUEL/OIL test button. Check that oxygen quantity gage drops to zero and oxygen warning light comes on at approximately 2 liters. Pointer on fuel quantity gage moves toward zero, which is a functional test of fuel quantity indicating system. This is not a test of low-fuel warning light. Low-oil warning light check is valid only after oil scavenging.

59. Lights warning . . . . . TEST
Check following lights: Landing gear transition, wheels warning, hook transition annunciator panel, master caution, angle-of-attack indexers, complete and reselect (A6E), and in-flight refueling panel lights (KA-6D).

60. Manual canopy selector handle (AFC 185 not incorporated) . . . . . CHECK UP

61. VDI (Except A-6C, KA-6D) . . . . . STANDBY FOR 5 MINUTES

A-6C 2, 3, 4

62. ECM panel (except A-6E TRAM) . . . . . OFF

63. Station selector switches . . . . . OFF AND LOCKED

64. Master armament switch . . . . . OFF AND LOCKED

65. Gun switch . . . . . OFF/SAFE

66. Mechanical and electrical fuzing switches . . . . . SAFE

67. Selective jettison button (A-6E) . . . . . OUT AND GUARDED

CONTINUED ON NEXT PAGE

PILOT PRESTART PROCEDURES EXTERNAL POWER ON—CONTINUED

68. Nuclear selector buttons (3) . . . . . OFF AND LOCKED

69. ASN-41 Navigation computer (KA-6D) . . . . . STBY

70. Autopilot switch . . . . . OFF

70A. ATTITUDE REF switch (A-6E TRAM) . . . . . COMP IN

71. UHF radios . . . . . ON (T/R G)

72. APN-153 Doppler (KA-6D) . . . . . STBY

73. TACAN . . . . . ON-T/R

Note

In KA-6D, for normal TACAN operation ensure that the HSI mode selector is at TACAN.

74. IFF . . . . . STANDBY

75. SIF . . . . . AS REQUIRED

76. Air conditioning cockpit switch . . . . . ON

77. Automatic temperature control thumbwheel . . . . . SET AT ZERO

78. MAN/RAM air switch . . . . . AS DESIRED

79. Computer emergency cooling switch (EQUIPMENT switch, A-6E TRAM) . . . . . NORM
(Inoperative in KA-6D)

80. DEFOG AIRFLOW thumbwheel . . . . . OFF

81. Air conditioning master switch . . . . . NORM

82. Engine anti-ice switch . . . . . OFF

83. Windshield rain-removal switch . . . . . OFF

84. Pitot heat switch . . . . . OFF

85. Wing-fold handle . . . . . MATCHING WINGS

CAUTION

If wings are folded, ensure that the wing-fold handle is in the full forward position; otherwise the wings may spread as soon as hydraulic pressure is applied either during engine start or ground-rig operation.

86. Radio mixer control box (except A-6E TRAM) . . . . . SET-UP AS DESIRED

87. ECM tone controls (except A-6E TRAM) . . . . . AS DESIRED

88. Cabin dump . . . . . OFF

89. Antenna select switches (except A-6E TRAM) . . . . . AS DESIRED

90. CNI master (except A-6E TRAM) . . . . . AS REQUIRED

CONTINUED ON NEXT PAGE

PILOT PRESTART PROCEDURES EXTERNAL POWER ON—CONTINUED

Note

On aircraft BUNO 158795 and subsequent; MOD M 21 and subsequent; and aircraft incorporating AFC No. 269, the CNI MASTER switch must be in other than the OFF position for MA-1 compass system operation.

90A. MA-1/ADC switch (A-6E TRAM) . . . . . ON

91. Circuit breakers (incl. C/B's under pilot's left console) . . . . . IN

92. MA-1 compass . . . . . CHECK SYNC AND SLAVED

93. Speech security equipment . . . . . OFF

94. Radar beacon . . . . . STANDBY (AS REQUIRED)

95. ACLS (when installed) (except A-6E TRAM) . . . . . PROPER FREQ AND OFF

96. Fueling valve manual control . . . . . CHECK

97. Hose-reel ground test switch (KA-6D) . . . . . OFF

98. No. 2 UHF radio (KA-6D) . . . . . ON (T/R + G)

STARTING ENGINES

The engines cannot be started simultaneously; however, either engine can be started first. This procedure established starting the left engine (No. 1) first to allow checking the operation of the air-conditioning bleed-air isolation valve (AFC 268 incorporated).

CAUTION

If any of the following indications occur during an attempted engine start, a malfunction is indicated and immediate action on the part of the pilot is required:

- Abnormal engine noise or sound
- Wet start (no light-off within 10 seconds after placing throttle to idle)
- Hot start (EGT exceeds 455°C)
- Hung start (RPM will not accelerate to idle)
- Oil pressure fails to rise to 35 PSI within 30 seconds of operation
- Fire warning light comes on, or other indication of fire
- Speed-drive caution light remains ON above 40% RPM

1. Ground turbine compressor (GTC) . . . . . ON

2. GTC start air . . . . . AVAILABLE
   50 PSI indicated available from ground crew

CONTINUED ON NEXT PAGE

STARTING ENGINES—CONTINUED

CAUTION

If the wings are folded, grasp the wing-fold handle and ensure that the mechanical lock is unlocked and maintain positive forward pressure on the wing-fold handle until flight and combined systems indicate normal pressure.

3. Left crank switch . . . . . DEPRESS, THEN RELEASE
   (In aircraft with AFC No. 268 only, no rotation should be obtained, indicating that the CSD bleed-air isolation valve is actually closed.

4. CSD bleed-air isolation valve (Aircraft with AFC No. 268 only.). . . . . ON

5. Left crank switch . . . . . DEPRESS, THEN RELEASE
   Rotation should now begin, indicating that the CSD bleed-air isolation valve has opened. Steps 3 through 5 provide a functional check of the CSD bleed-air isolation valve.

6. At 18% RPM, left throttle . . . . . IDLE

7. Fuel flow . . . . . 700 TO 800 POUNDS PER HOUR

8. Exhaust temperature . . . . . UNDER 455°

CAUTION

A hot start can be anticipated by observing a greater than normal fuel flow and exhaust temperature increase. Normally, the EGT tape will ride evenly or slightly below the RPM tape during a start. Whenever the EGT exceeds the RPM, a hot start can be anticipated. It is essential that the engine be shut down immediately.

9. Oil pressure . . . . . 35 to 50 PSI

10. Idle RPM . . . . . STABILIZED
    Check idle rpm stabilized at approximately 52% to 60% rpm depending upon ambient conditions.

11. Hydraulic pressure . . . . . NORMAL

12. External compressed-air source. . . . . DISCONNECT

13. Landing gear ground safety locks . . . . . REMOVE
    Check visually with ground crewman. Ground crewman will carefully remove nose-gear ground safety lock, with entry into and exit from nosewheel well being made from starboard side of aircraft.

14. AIR COND bleed-air isolation valve (Aircraft with AFC No. 268 only). . . . . CHECK
    Check AIR COND bleed-air isolation valve OFF and note that cabin airflow stops, indicating that valve actually closed. Reopen valve.

15. Hook lift button . . . . . DEPRESS

16. RAT. . . . . RETRACT (IF EXTENDED)

CONTINUED ON NEXT PAGE

STARTING ENGINES – CONTINUED

17. Right engine and fuel master switch . . . . . ON
18. Left throttle. . . . . ADVANCE TO 75% RPM.
19. Start right engine as per items 5 through 11.
20. Left throttle. . . . . IDLE (AFTER RIGHT ENGINE AT IDLE SPEED)
21. Right generator . . . . . ON (CHECK CAUTION LIGHT OUT)
22. Left generator . . . . . ON (CHECK CAUTION LIGHT OUT)
23. External electrical power . . . . . DISCONNECT

POST START

1. Anti-g valve. . . . . PRESS TO TEST
2. Vent suit/cushion airflow. . . . . ADJUST
3. Oxygen switch . . . . . ON
4. Oxygen mask . . . . . ATTACHED
5. Oxygen regulator (GRU-5 only) 100%
6. Contact analog switch (KA-6D only) . . . . . ON
7. Rain removal (aircraft NOT incorporating AFC No. 268). . . . . CHECK

CAUTION

The rain-removal system shall be checked by actuating the windshield switch to the AIR position and by holding your hand over the top of the windscreen to feel the hot air. Turn the windshield air off as soon as possible to prevent cracking the windshield. If unable to turn off the hot air, secure the engines as soon as possible.

8. NWW bleed-air isolation valve (Aircraft incorporating AFC No. 268 only.) . . . . . CHECK
   Place windshield switch to AIR position, check for hot air by holding your hand over top of windscreen, and for WSHLD AIR light (AFC No. 264) on. Close NWW bleed-air isolation valve and note that hot air stops. Return NWW switch to AUTO and note that hot air is reapplied; return windshield switch to OFF and note that hot air stops.
9. Engine-driven fuel boost pump . . . . . CHECK

CAUTION

To preclude an engine fire, if an engine flames out during this test, the appropriate engine fuel master switch should be positioned to OFF before releasing the fuel boost pump test button.

CONTINUED ON NEXT PAGE

POST START—CONTINUED

10. Radar altimeter . . . . . ON AND SET

11. Canopy . . . . . CLOSED

WARNING

Prior to actuating the canopy switch to the closed position, ensure that both boarding ladders are clear, that no one is on the aircraft, and that the B/N is aware that the canopy will be closed.

CAUTION

Cooling air is not available to the search/track radar while operating on internal power for more than 5 minutes with the canopy open.

12. VDI . . . . . ON AND ADJUST

Note

Elevation calibration of the horizon line can be checked by going to the TEST position. When in TEST, the horizon line should match the fiducial markers.

13. Air-conditioning master switch . . . . . OFF AND BACK TO NORMAL

Note

Check that ducted air to the cabin ceases and the air conditioning light comes on.

14. CNI MASTER switch . . . . . ON

15. Platform (Except KA-6D) . . . . . VERIFY OPERATE

16. ECM . . . . . AS DESIRED

CAUTION

To preclude inadvertent chaff dispensing, before turning on ECM power, ensure that the GEAR/HOOK circuit breaker is properly seated and there are no indications of a weight-on-wheels switch failure (AOA indexer on/approach light on).

17. For carrier operations, complete the following additional steps.
    a. Tank pressure switch . . . . . ORIDE
       Check wing-tank pressure lights out.
    b. Tank pressure switch . . . . . NORMAL

CAUTION

To prevent damage to the aircraft during catapult launches, ensure that the wing tank pressure switch is returned to normal before taxi.

CONTINUED ON NEXT PAGE

ORDNANCE

When carrying ordnance, refer to and complete the appropriate NAVAIR checklist for type of ordnance carried. Capability and type of ordnance carried on the A-6A can be found in NAVAIR 01-85ADA-1T.

BEFORE TAXIING

1. Ordnance ground safety locks . . . . . REMOVED
   Check visually with ground crewmen

2. Boarding ladders . . . . . STOWED

CAUTION

The pilot and bombardier/navigator should visually check their respective boarding ladders up to avoid airframe damage in flight.

3. Chocks . . . . . REMOVE

4. Brake selector handle . . . . . CHECKED, IN AND VERTICAL
   Push brake handle in to release parking brakes. Check handle for freedom of push/pull movement and with handle in for vertical position by applying counterclockwise rotation.

CAUTION

If the handle binds or does not remain in the vertical position when pushed in (brake release), taxi shall not be attempted.

5. Brakes . . . . . TEST
   After initial roll, apply normal brakes and test operation.

6. Nosewheel steering . . . . . ENGAGE
   Engage nosewheel steering to minimize brake wear.

WING SPREAD

1. Wing-fold handle . . . . . AFT, TO FIRST STOP
   (Wait for all spread motion to cease.)

2. Wing lockpin switch . . . . . LOCK

3. Wing-fold handle . . . . . STOW
   Move wing-fold handle aft and down flush with center console smartly with palm of hand.

4. Wing-fold warning flags . . . . . CHECK RETRACTED

NEW

CONTROL CHECKS

1. Flight controls . . . . . CYCLE SMOOTHLY AND CHECK FOR NORMAL THROW AND DIRECTION

WARNING

Takeoff shall not be attempted if stabilizer shift indicator flickers/barberpoles when the controls are rapidly cycled. The BACK-UP HYD light may flicker in aircraft incorporating AFC 183 and aircraft serial number 155640 and subsequent showing normal operation of the backup hydraulic system.

CAUTION

To prevent damage to the hydraulic pumps from cavitation, do not permit hydraulic pressure to go below 2000 psi during control checks.

2. Wing fuel pressure . . . . . ORIDE AND CHECK LIGHTS OUT

CAUTION

Ensure that the air-conditioning master switch is in the NORM position. Hot engine bleed air will be pumped into the wing tank if the tank pressure switch is actuated to ORIDE when the air-conditioning master switch is OFF.

3. Flaps/slats . . . . . TAKEOFF/DOWN
   While flaps/slats are in transit, observe flaperon for pop-up.

WARNING

If flaperon pop-up occurs during flap/slat operation, a pop-up valve failure is indicated and takeoff should not be attempted.

4. Speed brakes . . . . . EXTEND
5. Autopilot . . . . . CHECK, THEN OFF

Note

- Wait at least 30 seconds after application of power before engaging any function to permit the gyros to reach operating speed. If STAB AUG will not engage, move the control stick through full lateral throw to ensure that the AFCS is in detent.
- In aircraft with the ASW-40 if when checking ACL disengagement the AFCS fails to revert to STAB AUG or the control stick fails to move with pilot pitch inputs or both, ACL can be disengaged and normal control stick movement restored by application of rapid fore and aft inputs of approximately 50 pounds at the stick grip. Turn off the AFCS and do not use it for flight.

6. Speed brakes . . . . . RETRACT

CONTINUED ON NEXT PAGE

CONTROL CHECKS—CONTINUED

Note

If the wing-tip speed brakes do not retract utilizing the speed-brake test switch, DO NOT extend the speed brakes in flight.

8. Wing fuel pressure . . . . . NORMAL

9. Flight controls . . . . . CYCLE SMOOTHLY AND CHECK FOR EXTENDED THROW AND DIRECTION
   During control stick cycling, hold stick in full aft and full forward positions.
   If stabilizer does not achieve full travel, secure engines and investigate.

10. Trim . . . . . CYCLE AND SET FOR TAKEOFF
    Adjust pitch trim so that stabilizer leading edge aligns with takeoff trim reference mark painted on aft fuselage. Note pitch trim position indicator reading for future reference.

11. Flight instruments . . . . . CHECK

REFUELING SYSTEM GROUND CHECK KA-6D

1. Refueling power switch . . . . . ON

2. Pounds scheduled . . . . . SET (SOME QUANTITY)

3. Drogue switch . . . . . EXT
   Spring in drogue canister ejects drogue 1 to 2 feet.
   HYD PRESS light goes out.
   STOW/TRAIL indicator shows barberpole.

4. Hose-reel ground test switch . . . . . FULL TRAIL
   Hold until indicator shows TRAIL and READY light comes on.
   HYD PRESS light remains out. With AFC 298 installed, indicator continues to show barber pole and READY light comes on.

NEW

5. Fuel transfer switch . . . . . AUTO

NEW

6. Hose-reel ground test switch . . . . . FUEL RANGE
   Hold until VALVE OPEN light comes on. READY light stays on: Indicator shows TRAIL on aircraft not incorporating AFC No. 298 and barber pole on aircraft incorporating AFC No. 298.

7. Reel response switch . . . . . TEST
   Hold for about 15 seconds and release. Drogue will retract.

Note

The drogue is retracted when the reel response switch is released from the TEST position. Premature actuation of the drogue switch to RET will preclude the drogue from fully seating.

8. Drogue switch . . . . . RET
   Indicator shows STOW, READY light goes out, HYD PRESS light comes on.

9. FUEL TRANS switch . . . . . OFF

10. Refueling power . . . . . OFF

ATTITUDE GYRD CHECK KA-6D

VERTICAL DISPLAY INDICATOR TEST

After warmup:

1. Contrast and brightness . . . . . ADJUST
2. Symbol display . . . . . CHECK
   Sky texture, ground texture, roll index, pitch index.
3. Pitch trim marker . . . . . ADJUST, CHECK

VERTICAL REFERENCE CHECK

1. Vertical reference switch . . . . . NO. 1
2. VGI attitude indicator approximately 3° nose up. . . . . CHECK
3. Vertical reference switch . . . . . NO. 2
4. VDI horizon shift . . . . . LESS THAN 0.2 INCH
5. Roll index movement . . . . . LESS THAN 2

BEFORE TAKEOFF

Before takeoff, the takeoff checklist (figure 3-1) must be completed.

1. Wings.. . . . . SPREAD AND LOCKED
2. Trim . . . . . CHECKED
   a. Rudder . . . . . 0°
   b. Flaperon . . . . . 0°
   c. Stabilizer . . . . . 6 UNITS NOSE UP
3. Flaps . . . . . TAKEOFF
   a. Slats . . . . . DOWN
   b. Stabilizer . . . . . SHIFTED
   c. Speed brakes . . . . . IN

WARNING

The pilot must ensure that the flap lever is fully seated in the desired detent and aircraft flap slat configuration is confirmed with the integrated position indicated.

NEW NEW

4. Fuel
   a. Quantity . . . . . CHECKED
   b. Tank pressure switch . . . . . NORMAL
   c. Wing pressure lights . . . . . LIT
   d. Fuel ready switch . . . . . OFF
5. Controls . . . . . UNRESTRICTED

NEW

CONTINUED ON NEXT PAGE

BEFORE TAKEOFF—CONTINUED

6. Seats . . . . . ADJUSTED AND ARMED
   a. Face-curtain guard. . . . . DOWN (UNLOCKED)
   b. Lower ejection handle guard . . . . . ROTATE CLEAR (UNLOCKED)

7. Harness . . . . . LOCKED

8. Flaperon pop-up . . . . . ARM

Note

Check that the flaperons go down when each throttle is moved out of the IDLE position.

9. Antiskid switch . . . . . ON

10. Auxiliary brakes . . . . . 15 CYCLES

TAKEOFF (ASHORE)

After taxiing to the runup area, allow the aircraft to roll straight ahead to insure nose alignment. Apply brakes and complete the following checks:

1. Pitot heat switch . . . . . AS REQUIRED
   Set pitot heat switch as required for existing weather conditions.

2. Engine anti-ice switch . . . . . AS REQUIRED
   Set engine anti-ice switch as required for existing weather conditions

3. RAT . . . . . AS REQUIRED

CAUTION

Ingestion of a significant amount of water into the generator cooling scoop may result in the loss of the generator(s). Deployment of the RAT will preclude the loss of electrical power above 110 KIAS.

4. IFF/SIF . . . . . AS REQUIRED

5. AFCS . . . . . OFF UNTIL SAFELY AIRBORNE

6. ICS . . . . . HOT

7. Engines . . . . . CHECK
   Advance throttle to MAX POWER, flaperons in normal configuration, allow engine RPM to stabilize: observe that EGT, fuel flow, oil pressure, and hydraulic pressure gages are within operating limits. Check cockpit power trim indicators to insure engines are developing proper takeoff thrust.
   In the absence of reliable power trim indications, the following may be used as indication of normal engine performance.

   RPM - 97% to 100%
   EGT - 640°C to 660°C
   Fuel flow - 6500 pph to 8500 pph.

CONTINUED ON NEXT PAGE

TAKEOFF (ASHORE)—CONTINUED

Note

Engine thrust is a critical factor in heavy gross weight takeoffs under high ambient air-temperature conditions. Under these conditions, if the power trim indicators show less than the desired engine power outputs, the decision to elect takeoff must be carefully weighed against such critical factors as runway available, density altitude, critical field length and other indications of engine performance.

8. Throttle stagger 1/2 inch maximum mismatch with engines in sync at maximum power; 1/4 inch maximum mismatch at 86% rpm.

9. Controls . . . . . CYCLED
   Controls shall be cycled rapidly while engines are operating at sufficient rpm to preclude hydraulic pump cavitation (above 75%). If any unusual airframe vibrations are experienced, takeoff shall not be attempted.

WARNING

Takeoff shall not be attempted if the stabilizer shift indicator flickers/barberpoles when the controls are rapidly cycled. The BACK-UP HYD light may flicker showing normal operation of the backup hydraulic system.

10. Nose-wheel steering . . . . . ENGAGE

11. All caution and warning lights . . . . . OUT

12. Bombardier/navigator . . . . . CHECK READY FOR TAKEOFF

13. Brakes . . . . . RELEASE

14. Nose-wheel . . . . . CENTERED
    Use nose-wheel steering for directional control until rudder effective at approximately 80 knots.

TAKEOFF TECHNIQUE

Refer to Section XI, for rotation speeds at various gross weights. A positive climb attitude at a moderate rate of climb (1,000 to 1,500 FPM) must be established before the landing gear is retracted. Flaps/slats are raised prior to 250 KIAS. Maintain a moderate climb attitude until scheduled climb speed is attained. Refer to Section XI, for recommended maximum rate of climb. Minimum run takeoff is the same as for normal takeoff, except that the nose is raised at speeds recommended for minimum takeoff ground run; airspeed is then held constant.

CROSSWIND TAKEOFF

The use of the nose-wheel steering and normal flight control are adequate for crosswind takeoffs up to a crosswind component of 90° and 20 knots. See Section XI for chart.

AFTER TAKEOFF—CLIMB

When the aircraft is definitely airborne:

1. Landing gear . . . . . UP (BELOW 200 KIAS)
   Check that wheels transition light comes on and then goes out. Check that OUT'BD WING TK PRESS and INBD WING TK PRESS caution lights are out.

CAUTION

The landing gear should be completely up and locked before exceeding 200 KIAS.

2. Flaps . . . . . UP
   Retract flaps before reaching 250 KIAS. Check integrated position indication for flap UP and slat IN, and stabilizer shift indications.

WARNING

- Extreme caution should be exercised during flap retraction under heavy gross weight conditions. To avoid aircraft stall or settling due to flap retraction, do not retract the flaps below 170 KIAS for weights up to 50,000 pounds and not below 185 KIAS for weights above 50,000 pounds. At the heavier weights and under high ambient temperature conditions, acceleration and climb performance are marginal and it may be impossible to reach 185 KIAS. If 185 KIAS cannot be reached, it is recommended that external store weight be reduced in order to permit acceleration to 185 KIAS before flap retraction.

- If a barberpole indication on slat/flap retraction should occur after takeoff, power must be maintained at military and airspeed controlled within limits (maximum of 250 KIAS and minimum of 170 KIAS or 185 KIAS as applicable) by adjusting aircraft attitude. Power reduction or diversion of attention must not be attempted until reaching safe operating altitudes.

Note

Remedial action for barberpoled slats may include any or all of the following at speeds above the minimum for slat retraction and up to a maximum of 250 KIAS.

(1.) With flap lever in retracted position, apply a slight negative g.
(2.) Momentarily acutate flap lever to takeoff position and as slats begin to extend, immediately return lever to up position.
(3.) Momentarily actuate emergency flap switch to DOWN and as slate begin to extend, immediately set switch to UP and then OFF.
(4.) While maintaining airspeed above minimum retraction speed, extend flaps/slats partially closed then retract. As slats approach fully closed position, momentarily apply slight negative g.

CONTINUED ON NEXT PAGE

AFTER TAKEOFF–CLIMB–CONTINUED

3. Isolation valve switch . . . . . FLT
   After landing gear, flaps, and slats have been fully retracted, place isolation valve switch to FLT position.

4. Accelerate to best climb speed.

CRUISE

Cruise control data for various weights and configurations are contained in Section XI.

FLIGHT CHARACTERISTICS

See Section IV, for information on the flight characteristics of this aircraft.

DESCENT

Before descent, and after prolonged cold-soaking at high altitudes, the cockpit temperature should be increased and the defogging control turned ON. Normal penetration (letdown), as reflected in the descent charts, is in Section XI, and is normally accomplished with approximately 80% rpm at a descent speed of 250 KIAS. Speed brakes are extended and descent speed is maintained by adjusting the rate of descent.

For maximum-range glide, see Section V, Emergency Procedures. The descent speed (200 KIAS) is maintained without the use of speed brakes. Before all descents, the following checks should be performed:

1. Defog . . . . . ON
2. Refile . . . . . AS REQUIRED NEW
3. Fuel . . . . . CHECK

Note

Inform the bombardier/navigator when dumping fuel.

4. Weather . . . . . CHECK
5. Pressure altimeter . . . . CHECK AND SET NEW
6. Radar altimeter . . . . . ON AND CHECKED BELOW 5,000 FEET AGL NEW

CAUTION

Do not actuate the landing gear above 8,000 feet unless the cabin is depressurized.

7. Engine anti-ice . . . . . AS REQUIRED NEW
8. Pitot heat . . . . . AS REQUIRED

BEFORE LANDING

The landing checklist must be completed prior to landing.

1. Harness . . . . . LOCKED
2. Armament. . . . . ALL SWITCHES OFF/SAFE NEW
3. Flaperon pop-up . . . . . ARM
4. Antiskid . . . . . ON
5. Hook . . . . . AS REQUIRED
   (Isolation switch to LAND)
6. Wheels . . . . . DOWN
7. Flaps . . . . . TAKEOFF
   (Check stabilizer shifted, slats down, and speed brakes extended.)

CONTINUED ON NEXT PAGE

BEFORE LANDING—CONTINUED

WARNING

The pilot must ensure that the flap lever is fully seated in the desired detent and aircraft flap/slat configuration is confirmed with the integrated position indicator.

Note

Approximately 180 KIAS and above, the flaps may not fully extend to TAKEOFF position (30°). Above 140 KIAS (approximately), the flaps may not fully extend to the LAND position. In either case, the flap indicator will display a barber pole until the airspeed is reduced.

8. Fuel . . . . . CHECK
   Check quantity compute correct approach airspeed, check fuel dumps NORM and wing PSI lights ON.
9. Autopilot . . . . . OFF or STAB AUG (AS DESIRED)
10. ICS . . . . . HOT
11. AUX BRAKES . . . . . CHECKED 15 CYCLES

LANDING (ASHORE)

Upon touchdown

1. Throttles . . . . . IDLE
2. Nose-wheel steering (below 80 KIAS) . . . . . ENGAGE AS NECESSARY
3. Brakes . . . . . APPLY AS REQUIRED

CAUTION

Overinflation of struts may prevent the steering weight-on-wheels switch on the right main strut from closing. If any difficulty is experienced with braking or steering, set the antiskid switch OFF.

TYPICAL LANDING

For a typical landing, enter the traffic pattern conforming to existing course rules. In the break, reduce power to 75% (minimum), extend the speed brakes, and transition to the landing configuration below 250 KIAS.

Complete the landing checklist (figure 3-1) by the abeam position. Reduce airspeed to appropriate speed and check for optimum AOA indications, and commence approach to landing.

Note

- Check indicated airspeed against optimum AOA. An optimum AOA indication is equal to 105 KIAS plus 2 knots for each 1000 pounds over 28,000 pounds gross weight. If external stores are carried add 2 knots.
- If a discrepancy exists between the two indications, fly the instrument showing the first optimum speed indication.
- For additional information see figure 3-9.

Use the angle-of-attack indexer and maintain the on-speed indication. Maintaining final approach power of approximately 87% at sea level rpm, and a 3° to 3 1/2° glide-slope angle will provide a normal rate of descent (approximately 700 fpm).

Upon touchdown, retard throttles to idle for flaperon pop-up operation to hold aircraft firmly on the runway. For minimum rollout distance, drop the nose and use antiskid braking. Use the rudder and nose-wheel steering for directional control of the aircraft on the landing roll. Rudder control is effective on landing roll down to speeds of 50 KIAS. Aerodynamic braking may be employed to minimize brake wear.

CAUTION

If heavy braking is used during landing or taxi, do not use the parking brakes until the brake disks have cooled. Avoid prolonged brake applications to prevent the brake disks fuzing.

REDUCING BRAKING REQUIREMENTS

If it is suspected that heavy or repeated braking will result in overheated brakes, residual thrust during taxi back to the chocks can be reduced by securing the left engine using the following procedures:

1. Left throttle . . . . . OFF

2. Left engine and fuel master switch . . OFF

Note

The output from the monitored buses will be lost when either engine is shut down. This will generally make the above procedures undesirable during night operations.

CROSSWIND LANDING

When the crosswind component is greater than 10 knots, take a longer interval and land on the upwind side of the runway. If the crab technique is used, line the aircraft up with the runway just before touchdown. The crabbing technique may produce lateral drift or skid, the amount varying with the pilot's ability to line the aircraft up at touchdown. Retard the throttles to IDLE. Rudder control is effective down to 50 knots. Do not use aerodynamic braking. Aerodynamic braking may cause the loss of directional control in a crosswind. The flaperon pop-up will hold the aircraft firmly on the runway. Nose-wheel steering can be used after the right weight-on-wheels switch has actuated.

Note

Neutralize rudder pedals before engaging nose-wheel steering.

HEAVY GROSS WEIGHT LANDINGS

As landing gross weight increases, the landing pattern should be expanded, and the approach and touchdown speeds will be increased as necessary to maintain donut on-speed indication. For gross weights above 36,000 pounds, the final approach speed should be planned for a minimum sink-rate landing.

WET RUNWAY LANDING

The procedure to be followed when landing on a wet runway is essentially the same as that for a normal landing. However, if standing water is evident or suspected, and the crosswind is not greater than 10 knots, aerodynamic braking should be employed.

WAVE-OFF

The decision to wave off should be made as early as possible. If decision to wave off is made, proceed as follows:

1. Throttles . . . . . MAX POWER
   (Establish a positive rate of climb.

Speed brakes . . . . . RETRACTED

CAUTION

If a wave-off is initiated with flaps in the LANDING position, ensure that they are retracted before reaching 200 KIAS to prevent structural failure of the flap-actuating mechanism. The flap drive system does not have a blowback feature.

AFTER LANDING

After aircraft has slowed to taxi speed:

1. IFF/SIF . . . . . OFF

Note

Ensure that Mode 4 is in hold before securing the IFF/SIF.

2. Lower ejection - handle guard . . . . . UP (LOCKED POSITION)
3. Face-curtain guard . . . . . UP (LOCKED POSITION)
4. Pitot heat switch . . . . . OFF
5. Windshield air switch . . . . . OFF
6. Engine anti-ice switch . . . . . OFF
7. AFCS (STAB AUG) . . . . . OFF
8. Flaps . . . . . UP
9. Speed brakes . . . . . IN
10. Antiskid switch . . . . . OFF

Note

The antiskid switch should be turned OFF for any taxiing maneuvers.

11. Flaperon pop-up switch . . . . . OFF
12. Wing fold . . . . . AS REQUIRED

CAUTION

Do not fold wings while taxiing. Taxiing with wings folded should be avoided when possible.

13. Radar altimeter . . . . . OFF
14. VDI . . . . . STDBY/OFF
15. Oxygen switch . . . . . OFF
16. ECM . . . . . OFF
17. ASN-41 navigation computer (KA-6D) . . . . . OFF
18. Doppler power switch (KA-6D) . . . . . OFF

WING FOLD

1. Wing flaps/slats/flaperon/wing-tip speed brakes . . . . . RETRACTED/CHECKED VISUALLY
2. Control stick . . . . . NEUTRAL
3. Wing-fold handle . . . . . FORWARD TO FIRST DETENT
   Check wing-fold warning flags extended at wing fold.
4. Wing lockpin switch . . . . . UNLOCK
5. Wing-fold handle . . . . . FULL FORWARD

HOT REFUELING

WARNING

Do not refuel with wings folded, because of the proximity of the wing dump valves to the hot engine exhaust.

1. Wings . . . . . SPREAD

WARNING

During carrier operations, it may be necessary to hot refuel with the wings folded. Do not hot refuel the outboard wing panels with the wings folded.

2. Fire extinguisher equipment . . . . . AVAILABLE
3. All emitters . . . . . OFF/STBY
4. Canopy . . . . . CLOSED
5. Ejection seats
   a. GRU-5: shoulder harness, lap belt, leg restraints/ejection seat . . . . . UNFASTEN/SAFE
   b. GRU-7: ejection seat (remain strapped in) . . . . . SAFE
6. Air-conditioning master switch . . . . . CHECK ON
7. Tank pressure override switch . . . . . NORM
8. Fuel-ready switch . . . . . GROUND
9. Monitor appropriate frequency.
10. Boarding ladders . . . . . DOWN

POST HOT-SEAT CHECKLIST

1. Harness/leg restraints . . . . . FASTEN
2. Fuel-ready switch . . . . . OFF
3. Engine-driven fuel pump . . . . . CHECK
4. Radar altimeter . . . . . ON AND SET
5. Fire/oil warning system . . . . . TEST
6. LOX/FUEL/OIL button . . . . . TEST
7. LIGHTS WARN button . . . . . TEST
8. VDI . . . . . ON AND ADJUST
9. CNI equipment . . . . . CHECK AND SET
10. Ordnance ground safety locks . . . . . REMOVE
11. Boarding ladders . . . . . STOWED
12. Platform (except KA-6D) . . . . . VERIFY IN OPERATE

ENGINE SHUTDOWN

1. Wheels . . . . . CHOCKED
   (Get signal from ground crew that wheels are chocked.)

2. Ordnance ground safety locks . . . . . INSTALLED

3. CNI master switch . . . . . OFF

4. Canopy . . . . . OPEN

5. Oil level . . . . . CHECK
   Depress LOX/FUEL/OIL test button. Lighting of either and/or both OIL-LOW lights on the annunciator panel indicates oil quantity from 5 to 12 1/2 quarts.

6. Throttles . . . . . IDLE, 3 to 5 MINUTES
   (Idle rpm stabilizes engine temperature)

7. Throttles . . . . . 75% RPM for 30 SECONDS
   (75% rpm for 30 seconds scavenges oil)

8. Transfer relay and left generator phase . . . . . CHECK
   Check proper operation of transfer relay and correct phase of left generator as follows:

   a. Right generator switch . . . . . OFF

Note

Ensure that the left generator assumes the electrical load, the VGI provides proper indications, and seat adjustment operates correctly.

   b. Right generator switch . . . . . ON
   (CHECK CAUTION LIGHT OUT)

9. Throttles . . . . . OFF

10. Engine and fuel master switches . . . . . OFF

CAUTION

Ensure the engine fuel master switches are turned off immediately after securing the throttles to ensure the fuel system gate valves close before the generators fall off the line.

11. Generator switches (after generators fall off line) . . . . . OFF

12. Landing-gear ground safety locks . . . . . INSTALLED

CAUTION

Install ground safety locks immediately after engine windmill. Do not move the aircraft until landing-gear ground safety locks are installed, as the gear may accidently collapse.

part 4 Carrier-Based Procedures-Pilot

FIELD MIRROR LANDING PRACTICE

PREFLIGHT INSPECTION

A normal preflight inspection (figure 3-3) will be conducted with specific attention being given to the struts and tire condition. Check that the hook bypass switch is in the touch-and-go position.

PATTERN ENTRY

Call "Paddles" prior to pattern entry to confirm Charlie time. Enter the break at 250 KIAS, at 800 feet above the terrain. When cleared to break and the proper interval of the aircraft ahead is assured, roll into a 60° banked turn, extend wing-tip speed brakes, reduce power to a minimum of 75%, slow to 250 KIAS, extend gear, place flaps to TAKE OFF (below 250 KIAS), and maintain 800 feet until intercepting the downwind leg. On the downwind leg, descend to 600 feet above the terrain. Slow to appropriate airspeed for gross weight and check airspeed against the angle-of-attack indicator to ensure proper calibration of the indicator and the indexer. At the 180° position, the angle-of-attack indicator should indicate "on speed." Aircraft in formation will take a 10-second break interval. Complete the landing checklist before reaching the 180° position.

PATTERN

180° Position

Begin approach by turning 15 seconds past the abeam position in order to have a 1 1/2 mile wings-level groove. Commence a slight descending turn to final, maintaining optimum angle-of-attack.

90° Position

Maintain optimum angle-of-attack at approximately 450 feet. Final adjustment to longitudinal trim should be made.

Final

At approximately 1 1/4 miles, the meatball will appear in the center of the mirror. Reduce power as necessary to establish a rate of descent that will keep the meatball centered. Glide slope corrections should be made early by smooth changes in power and stick position as required to maintain a centered meatball and optimum angle-of-attack. Control altitude with the throttle and angle-of-attack (airspeed) with the stick. Once established on the glide slope, keep the scan going, cross-checking meatball, lineup, and angle-of-attack, and make positive corrections, immediately but smoothly.

Landing

Keep the aircraft on the glide slope and centerline all the way down. Do not flare. When touchdown is made, add full power immediately and utilize the bolter technique described under Wave-off/Bolter Pattern. Climb straight ahead until reaching 300 feet. Turn downwind for the next pass when the aircraft ahead is approximately in the 10 o'clock position on the downwind leg.

Wave-Off

The pilot must initiate a wave-off whenever he believes his aircraft to be in an unsafe position. Any time a wave-off is received, either by the wave-off lights or by radio, it is mandatory and will be answered with FULL MILITARY POWER speed brakes, and a transition to climbing attitude to prevent further loss of altitude.

Bingo Fuel

Recovery at home field will be with no less than 1,450 pounds of fuel remaining.

Note

With the landing gear down, wing and drop-tank fuel cannot be transferred or dumped unless the tank pressurization switch is set to ORIDE.

NIGHT PATTERN

The night pattern and approach technique are generally the same as the day pattern with the following exceptions:

1. The pattern will be flown on instruments until visual acquisition of the meatball is made.

2. A straight-in CCA-type approach at 600 feet above the terrain will be made by extending the downwind leg 30 to 45 seconds past the normal abeam position used in the day pattern.

3. For ACLS, the pattern if flown at 1200 feet or as assigned. A level turn to final is commenced 3 miles past the abeam position until a positive lock-up is achieved, then radar controlled approach to landing.

CARRIER BASED PROCEDURES

The CVA/CVS NATOPS manual and LSO NATOPS manual are the governing sources for carrier-based procedures.

PREFLIGHT

Day

A normal preflight inspection should be made with particular attention given to the landing gear, tires, hook, and underside of the fuselage for possible damage.

Occasionally, the aircraft assigned will be manned on the hangar deck. Unless the aircraft is already spotted on the elevator, it will be towed or pushed for access to the flight deck. The signal to stop a plane that is being moved by other than its own power is a whistle blast. Leave the hardhat off. Any whistle blast signifies an immediate stop. If the plane director is lost from view, stop. The aircraft will be raised to the flight deck level and either respotted or started on the elevator.

Note

Brake cycles remaining should be kept at 12 or higher by use of the auxiliary hydraulic pumps.

Night

External preflight will be made using a flashlight. In addition to normal cockpit preflight, ensure that external light switches are positioned to dim for post start light check. The master exterior lights, anticollision, and taxi light switches should always be in the OFF position before start. Set the cockpit and approach indexer lights as desired.

POST START

Day

Engines will normally be started 20 minutes before launch, and the customary functional checks will be performed. Do not let the plane directors hurry these checks. When ready, signal the plane director with a thumbs up. Chocks and tiedowns will be removed upon signal by the plane director. Hold footbrakes regardless of parking-brake position, when tiedowns and removed.

Night

After normal system checks are completed, perform exterior lights check. When ready, signal the plane director with a vertical motion of the flashlight, meaning checks are completed and the aircraft is up. If the aircraft is down, make a horizontal motion with the flashlight.

Note

Complete wing and drop-tank pressurization checks as described under POST START procedures, Section III.

TAXI

Day

Only emergency stop signals are used. Any signal from the plane director given from above the waist is intended for the pilot. Any signal given from below the waist is intended for deck-handling personnel. While taxiing, careful attention must be given to the director and his signals shall be followed explicity. Nosewheel steering permits the use of minimum power while taxiing. Taxi speed shall be slow at all times, expecially on wet decks and approaching the catapult area. Be prepared to use the emergency brake should normal braking fail.

Night

During night carrier-deck operations, the tempo of operations, both in volume and speed, is considerably reduced from day operations. Slow and careful handling of aircraft by both plane directors and pilots is mandatory. If the pilot has any doubt as to the plane director's signals, stop.

LAUNCH PROCEDURES

Day

Proper positioning on the catapult is easily accomplished if the entry is made with only enough power to maintain forward motion and the plane director's signals are followed explicity. All functional checks will be performed before taxiing into the shuttle. After the tow link is dropped to the

deck and the trail bar has been attached to the aircraft and checked by squadron maintenance personnel, the aircraft shall be taxied up to the mouth of the lead-in track. The catapult director will then direct the pilot to approach the catapult track using nosegear steering and brakes. Release nosewheel steering upon signal in the track, and as the aircraft rolls forward the tow bar will drop into the shuttle and the aircraft will stop in position for shuttle tension-up.

Night

Maneuvering the aircraft for catapult hookup at night is identical to that used in day operations; however, it is difficult to determine your speed or motion over the deck. The pilot must rely upon, and follow closely, the plane director's signals.

CATAPULT LAUNCH

Day

NEW The Pilot's ICS control will be positioned to HOT mike for all catapult launches. Ensure that the take-off checklist is completed before entering the nose-tow approach ramp. Aircraft trim should be set to recommended setting for expected excess end airspeed. Refer to current Aircraft Launching Bulletins for A-6 aircraft. The flashing indexer warning system for tow link/cocked nosewheel indication is only valid with the hook bypass switch in the touch-and-go position after launch. Flaperon pop-up and anti skid should be OFF.

NEW NEW NEW NEW Upon receipt of the "tension up and release brakes" signal, advance the throttles to full military power, engage throttle friction, and engage the strut lock. Check all engine and flight instruments for normal indications and operation, check the STRUT LOCK light extinguished, and perform a smooth, but rapid cycle of flight controls. Ensure the B/N is ready, place the head firmly against the headrest, chin down; and render an exaggerated hand salute to the Catapult Officer. There will be a 2- to 4-second delay before catapult firing due to sequence followed by the catapult crew.

CAUTION

The catapult grip must be used (rotated inboard and pulled up) for all catapult launches, since proper positioning is necessary for nose-strut stiffening. Maximum centerline store clearance is attained when the engines are operating at maximum thrust, brakes released, and catapult grip moved to the strut-lock position. Air crews should monitor the annunciator panel for STRUT LOCK warning light out before catapult launch. Failure to use the catapult grip will result in catapulting with a soft nose strut and may cause structural damage to the aircraft or centerline stores.

Catapult launches should be planned for a 10- to 15-knot excess end airspeed. Excess end airspeed is an arbitrary safety factor added to the minimum airspeed required to effect a safe but not optimum catapult launch. The minimum airspeed was determined during shipboard carrier suitability trials and is applicable for specific gross weight and ambient temperature/wind conditions. Recommended elevator trim settings for variations in end airspeed will result in optimum climb attitude off the catapult. Launch bulletins recommend a "lightly held control stick" catapult technique be used.

After leaving the catapult, allow the aircraft to rotate to the pitch attitude (10° to 12°) resulting from the elevator trim setting. The resulting climbing attitude is the optimum for aircraft weight and, once attained, should be maintained with stick positioning and trim. The angle of attack (AOA) indicator should indicate approximately 3 o'clock. Initial climbing attitude information is also available on the VDI. After launch, maintain optimum AOA and pitch angle and monitor the airspeed and altimeter for increasing values. Retract the landing gear after becoming airborne. Retract the flaps at the recommended flaps-up airspeed for launch gross weight.

Note

The right flaperon will raise due to a reaction to the catapult's acceleration and will result in a slight right clearing turn off the catapult stroke. This should be prevented by the pilot with lateral stick input during the catapult stroke.

CAUTION

Extreme caution should be exercised during flap retraction under heavy gross weight conditions. To avoid aircraft stall or setting due to flap retraction, do not retract the flaps below 170 KIAS for weights up to 50,000 pounds and not below 185 KIAS for weights above 50,000 pounds. At the heavier weights and under high ambient temperature conditions, acceleration and climb performance are marginal and it may be impossible to reach 185 KIAS. If 185 KIAS cannot be reached, it is recommended that external store weight be reduced in order to permit acceleration to 185 KIAS before flap retraction.

Instrument scan after launch should include all flight instruments. Initial pitch attitude is immediately indicated on the VDI, VGI, and AOA. Wing position is displayed on VDI, VGI, and by the HSI if turning. Airspeed information is available and can be monitored during the catapult stroke. Vertical speed lags slightly but may be used after leaving the catapult. The altimeter, like the VSI, lags and accurate information is not immediately available. The radar altimeter is available for use immediately after launch. It must be emphasized that the most important requirement after capapult launch is the necessity to climb.

CAUTION

Use of the vertical gyro instrument (VGI) as a primary attitude reference following catapult launches is not recommended. Due to the inherent inaccuracies and possibility of failure of the VGI, this instrument should be used for backup/emergency situations only.

Night

The procedures for catapult launch at night are basically the same as for day launches. When ready to launch, signal the Catapult Officer by placing the external light master switch to ON. The launch technique discussed under the DAY procedures is applicable. The bombardier/navigator should monitor the flight instruments until climbing through 2,500 feet.

AIRCRAFT OR CATAPULT MALFUNCTION

If it is determined that the aircraft is down after establishing military power, signal the catapult officer by shaking the head from side to side. Transmit to Pri-Fly, "Suspend (catapult number)." Never raise a hand into the catapult officer's view to give a thumbs down signal for it may be misinterpreted as a salute and the catapult fired. At night, do not turn the master light switch on. The catapult officer will relay a no-go situation to the deck edge catapult operator by crossing his forearms over his head. He will then give the release tension signal and walk in front of the wing to give the throttle back signal. Then, and only then, reduce the throttle from military power to idle and remove the head from headrest. The same signals will be used to signify a catapult malfunction.

CAUTION

Leave the throttle at military power until the catapult officer walks in front of the wing and signals for power to be reduced to idle.

RECOVERY

Procedures for arrival, marshal, and approach shall be in accordance with the CVA/CVS NATOPS Manual.

PATTERN (VFR)

Pattern entry shall be in accordance with the CVA/CVS NATOPS Manual. At the break, the leader shall break smartly to 60° of bank, extend wing-tip speed brakes, reduce power to a minimum of 75%, slow to 250 KIAS, extend the landing gear, flaps to TAKE OFF below 250 KIAS, and maintain 800 feet until intercepting the downward leg. Then descend to 600 feet and slow to the appropriate airspeed for gross weight and compare airspeed and angle-of-attack indicators for proper indications. At the 180° position, at 1 mile abeam the angle-of-attack should be on-speed. Subsequent aircraft on the flight shall break at 17-second intervals. Complete the landing check list before the 180° position (flaperon pop-up, and antiskid switches OFF). See figure 3-9.

APPROACH

Begin the approach by turning at the 180° position in order to have an approximate 35-second groove. Establish a 25° to 35° bank and descend to no lower than 450 feet. Meatball acquisition at 450 feet will occur near the 45° position; reduce power as necessary to maintain a rate of descent that will keep the meatball centered.

Glide slope corrections should be made early by smooth changes in power and stick position as required to maintain a centered meatball and normal angle of attack (figure 3-10). Twenty-one units may be set when operating on larger class carriers to enhance visibility during the approach. Control altitude with the throttle and angle-of-attack (airspeed), with the stick. Once established on the glide slope, keep the scan going, cross-checking meatball, line-up and angle of attack, and make positive corrections, immediately but smoothly. During the approach, cross-check meatball, angle of attack, and line-up down to touchdown. Add full power and retract speedbrakes immediately upon touchdown in anticipation of a bolter.

WAVE-OFF/BOLTER PATTERN

Day

Wave-offs will be straight up the angle deck when given close in. Pilots must bear in mind that a late wave-off is critical in that the chance of an inflight engagement is great. Therefore, the pilot will, upon receiving a wave-off signal either by radio or the wave-off lights, immediately add full military power, retract speedbrakes and transition to a climbing attitude to prevent any further loss of altitude.

A wave-off to the right will be made only when overshooting the landing line to the extreme, or for other safety considerations.

Climb straight ahead on a wave-off or a bolter, then turn to parallel the ship's recovery course on the port side. Do not cross the bow while flying upward. Be alert for other aircraft launching or entering the pattern from the break. The aircraft ahead will have priority for the turn downwind.

Night

On a wave-off or bolter, climb straight ahead on final bearing. The downwind turn will be at 1200 feet or as assigned by CCA, not exceeding 30° bank. The night pattern should be flown entirely on instruments until in a position to acquire the meatball visually. However, it is prudent to remain alert to the transmission of other aircraft and to make a brief visual check when it becomes apparent another aircraft is in close proximity.

CARRIER LANDING PATTERN

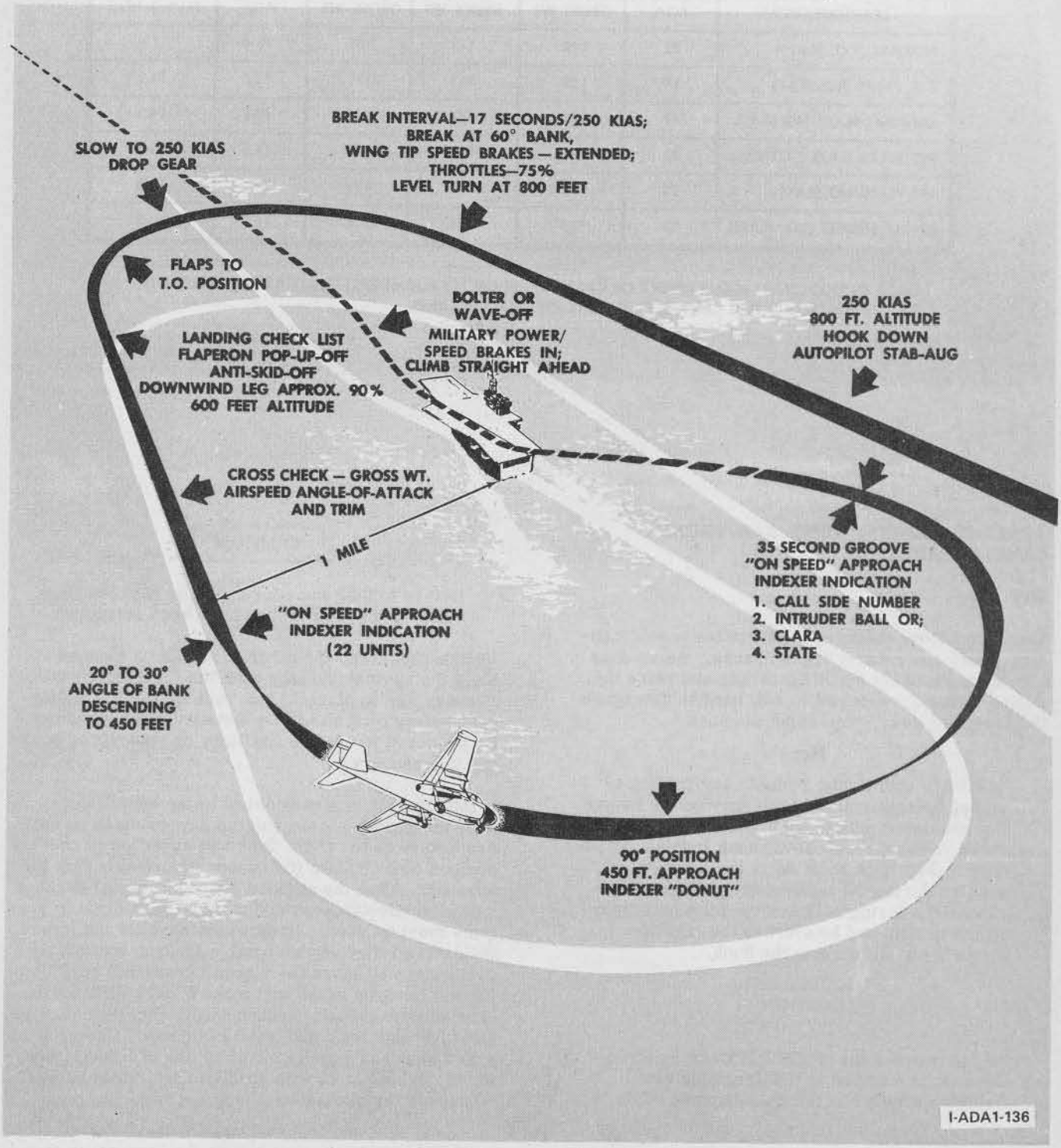

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Figure 3-9

CARRIER APPROACH SUMMARY

		APPROACH AIRSPEED, KCAS			HOOK-TO-EYE DISTANCE, FT	
CONFIGURATION	OPTIMUM AOA	36,000 LB GROSS WT	33,500 LB GROSS WT	28,000 LB GROSS WT	OPTIMUM AOA	OPTIMUM AOA PLUS 1 UNIT
NORMAL (T.O. FLAPS)	22	120	115	105	15.4	15.9
T.O. FLAPS/NO. SLATS	19	126	121	111	13.7	14.2
LANDING FLAPS/NO SLATS	19	122	117	107	13.7	14.2
NO FLAPS/SLATS EXTENDED	22	148	142	130	15.4	15.9
NO FLAPS/NO SLATS	20	152	147	134	14.2	14.8
SINGLE ENGINE (T.O. FLAPS)	21	123	118	108	14.8	15.3

DATA IN THIS CHART IS THE RESULT OF CARRIER SUITABILITY FLIGHT TEST EVALUATION CONDUCTED BY THE NAVAL AIR TEST CENTER, PATUXENT RIVER, MARYLAND.

A-ADA1-867

Figure 3-10

ARRESTED LANDING AND EXIT FROM LANDING AREA

Day

Upon touchdown, advance the throttles to full military power and retract speed brakes. As soon as arrested, place the throttles to idle and raise the flaps. Allow the aircraft to roll back to disengage the arresting gear, then raise the hook.

Note

On CVA's with a long rollout, any holding of brakes or application of military power longer than absolutely necessary to ensure safety will result in the aircraft being hung in the gear. The hook must be in the lowered position during the subsequent pullback. Additionally, during pullback the pilot must stay off the brakes and be alert to the taxi director's signal to raise the hook.

CAUTION

Do not depress the HOOK LIFT button while the hook is engaged in the arresting gear. Doing so may break the hook bumper cable.

CAUTION

Before folding the wings, ensure that the flaps, slats, and speed brakes have been retracted.

Before shutdown, the aircraft should be cleaned up. Keep the engines running until the director signals "chocks are in place", and "cut engine". Landing-gear safety pins should be installed after shutdown. Be prepared to use the auxiliary or emergency braking if necessary.

If the aircraft is struck below to the hangar deck, keep the canopy closed and the oxygen mask on until dropped from the flight deck and signalled to shut the engines down. Open the canopy before securing the engines. After the engines are cut, normal braking will lose effectiveness and the auxiliary braking systems must be used. Remove the hardhat and follow the aircraft director's signal. Aircraft handling personnel will move the aircraft from this point. Engine rundown noise will make it very difficult to hear whistle signals; consequently, the pilot must be alert for both hand and whistle signals. Keep rolling speed slow and under control by use of brakes, keeping the cycles at 12 with auxiliary hydraulic pumps. Whenever the plane director is not in sight, stop.

Night

The same procedures for day operations should be used at night, except that immediately following arrestment, place the master exterior light switch to OFF. Taxi out to the landing area slowly. Do not stare fixedly at the plane director's wands, but use them as the center of the scan pattern.

CARRIER-CONTROLLED APPROACH

Carrier-controlled approaches shall be conducted in accordance with the CVA/CVS NATOPS Manual. A typical approach is illustrated in figure 3-11.

Holding

Aircraft will normally hold individually at 230 KIAS with the arresting hook down. Five minutes before penetration, the defog should be turned on and maximum comfortable cabin temperature should be maintained to prevent possible fogging on the windscreen and canopy.

Penetration

The aircraft will depart holding allowing approximately 700 pounds of fuel for the penetration and approach. Penetration will be accomplished as follows:

1. Throttles . . . . . RETARD TO 80%
2. Nose over to establish a 4,000 foot per minute rate of descent.
3. Airspeed. . . . ACCELERATE TO 250 KIAS
4. Speed brakes . OUT, ADJUST THROTTLES
5. Call PLATFORM at 5,000 feet and reduce rate of descent to 2,000 feet per minute

At level-off altitude:

6. Speed brakes . . . . . IN
7. Throttles . . . . . ADJUST POWER TO MAINTAIN 250 KIAS

Final Approach

The pilot will continue to fly on instruments until the meatball is intercepted. The bombardier/navigator will normally maintain a visual lookout and will call meatball to the pilot on the ICS.

AUTOMATIC CARRIER LANDING SYSTEM

Automatic carrier landing system (ACLS) approaches apply to properly modified ASW-25 data link equipped aircraft using carrier- or shore-based SPN-10, SPN-42 or MPN-T1 ACLS facilities. Four modes of approach are available; however, use of specific modes is dependent on aircraft modifications. In mode 1 approaches, data-link-transmitted ACLS control signals are coupled to the autopilot after ACLS radar lock-on and control the aircraft until touchdown. Mode 1A approaches differ from mode 1 approaches in that data link/ACLS control signals are uncoupled 1/2 mile (approximately 200 feet altitude) from touchdown. Mode 2 approaches are pilot-controlled approaches using the data link/ACLS signals to present the pilot with the aircraft's glide slope and final bearing situation on a cockpit course indicator. Mode 3 approaches are simply a controller talk-down approach and require no special aircraft equipment onboard.

ACLS MODE 1 APPROACHES

An ACLS Mode 1 approach is illustrated in figure 3-11A. In a Mode 1 approach, the pilot flies the aircraft manually up to the point where the autopilot is coupled to the ACLS. The ACL-PCD switch on the AUTO PILOT control panel should be placed in the ACL position. To monitor the approach on the ARA-63, the ARA-63 power switch is set to PWR, the briefed channel is selected, and the DIS switch on the pilot's miscellaneous panel is set to MON.

1. Position the following controls as indicated to prepare the aircraft for data link ACL signals:
   a. Autopilot . . . . . ON
   b. AUTO-STAB AUG switch . . STAB AUG
   c. Data link power switch . . . . . ON
   d. TEST-NORM-AJ switch . . . . . NORM
   e. Frequency select dials . . . . As briefed
   f. ARA-63 power switch . . . . . ON
   g. ARA-63 channel select control . . . . . As briefed
   h. Radar beacon power switch . . . . . ON
   i. Radar beacon mode selector . . . ACLS

When the above controls are set, the discrete message indicator will indicate missed message (TILT).

2. Before or while in marshal, check the data link system for proper operation by the universal test message (UTM) check. The UTM is conducted by holding the TEST-NORM-AJ switch in the TEST position with the VGI DIS switch in the D/L position. The VGI cross pointers should drive into view and cycle between the following indications at 6-second intervals:

	Sequence 1	Sequence 2
Pitch Bar	Down	Up
Bank Bar	Left	Right
DMI	Wave Off	No lights

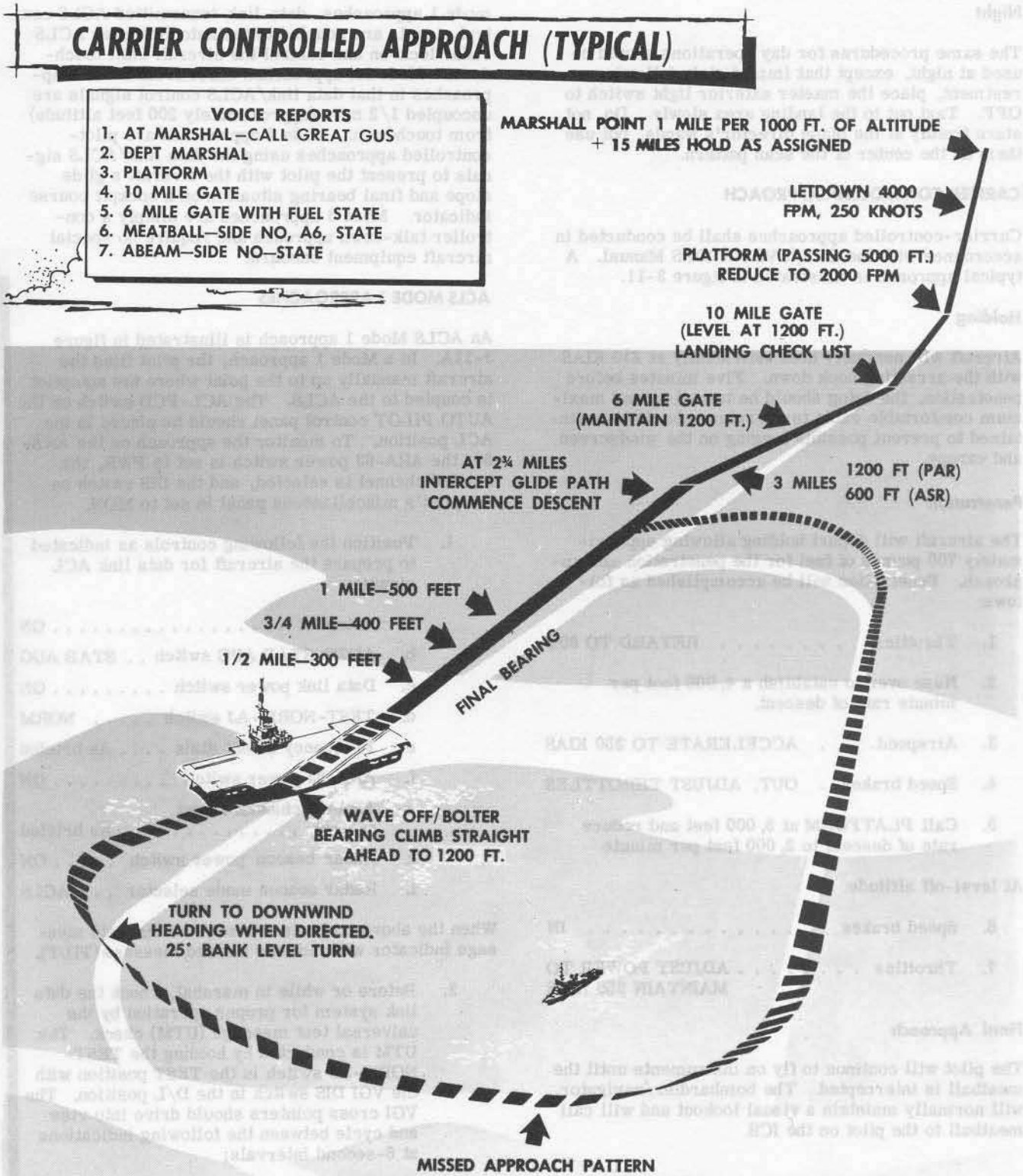

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Figure 3-11

AUTOMATIC CARRIER LANDING SYSTEM MODE 1 APPROACH

BEFORE REACHING SIX MILE GATE

MARSHAL
1 UNIVERSAL TEST MESSAGE ..... CHECK
2 AFCS
AUTO/STAB AUG SWITCH ..... STAB AUG
ACL/PCD SWITCH ..... OFF
3 DATA LINK POWER SWITCH ..... ON
4 TEST—NORM—AJ SWITCH .... NORM OR TEST
5 D/L FREQUENCY SELECT ..... AS BRIEFED
6 ARA-63 POWER SWITCH ..... ON
7 ARA-63 CHANNEL SELECT ..... AS BRIEFED
8 RADAR BEACON ..... ON
9 APN 154 MODE SEL. ..... ACLS

DEPARTING MARSHAL
1. REPORT
- CALL SIGN
- DEPARTING
- STATE

PLATFORM
1. SLOW DESCENT TO 2000 FPM
2. AIRSPEED 250 KIAS
3. REPORT

10 MILE GATE 1200 FEET
1. TRANSITION TO LANDING CONFIGURATION
2. REPORT

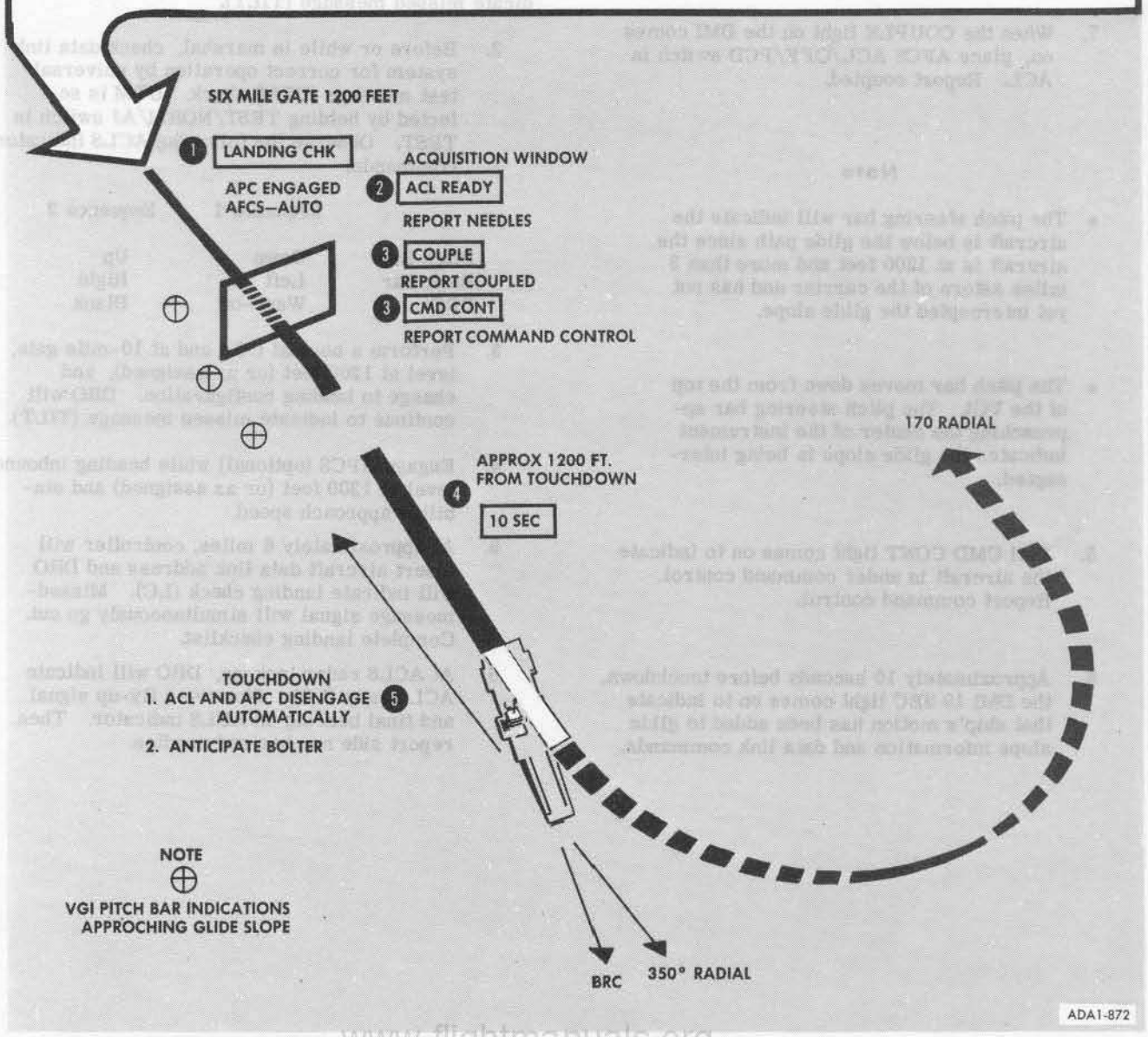

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Figure 3-11A

3. Perform a normal CCA and at the 10-mile gate, level at 1200 feet or as assigned. Change to landing configuration when the DMI LDG CHECK light comes on or earlier.

4. Engage APCS while heading inbound at 1200 feet or assigned altitude and adjust to approach airspeed.

5. At approximately 6 miles, the controller will insert the aircraft address. The LDG CHECK light comes on at this time and the TILT light goes off. The pilot should confirm landing checklist complete and report gear down.

6. At ACLS radar lock-on, the DMI will indicate ACL READY and the VGI cross pointers are driven into view. At this time, report side number and needles.

7. When the COUPLE light on the DMI comes on, place AFCS ACL/OFF/PCD switch in ACL. Report coupled.

Note

- The pitch steering bar will indicate the aircraft is below the glide path since the aircraft is at 1200 feet and more than 3 miles astern of the carrier and has not yet intercepted the glide slope.

- The pitch bar moves down from the top of the VGI. The pitch steering bar approaching the center of the instrument indicates the glide slope is being intercepted.

8. DMI CMD CONT light comes on to indicate the aircraft is under command control. Report command control.

9. Approximately 10 seconds before touchdown, the DMI 10 SEC light comes on to indicate that ship's motion has been added to glide slope information and data link commands.

ACLS MODE 2 APPROACHES

An ACLS mode 2 approach is illustrated in figure 3-12. In a mode 2 approach, the ACLS indicator (ID-351) pitch-and-bank steering bars present vertical and lateral glide-slope errors respectively in relation to the aircraft. The pilot flies the aircraft toward the steering bars as in an ILS approach. Discrete readout (DRO) panel light lighting and going out are noted in the following procedural steps.

1. Position the following controls as indicated to prepare aircraft for data link/ACLS signals:

   a. Data link power switch . . . . . ON
   b. Message selector switch . . . . . NORM
   c. Frequency-select dials . . AS BRIEFED

When the controls are selected, the DRO will indicate missed message (TILT).

2. Before or while in marshal, check data link system for correct operation by universal test message (UTM) check. UTM is selected by holding TEST/NORM/AJ switch in TEST. Observe the following ACLS indicator commands:

	Sequence 1	Sequence 2
Pitch Bar	Down	Up
Bank Bar	Left	Right
DRO	Wave-off	Blank

3. Perform a normal CCA and at 10-mile gate, level at 1200 feet (or as assigned), and change to landing configuration. DRO will continue to indicate missed message (TILT).

4. Engage APCS (optional) while heading inbound level at 1200 feet (or as assigned) and stabilize approach speed.

5. At approximately 6 miles, controller will insert aircraft data link address and DRO will indicate landing check (LC). Missed-message signal will simultaneously go out. Complete landing checklist.

6. At ACLS radar lock-on, DRO will indicate ACL ready (LO). Observe a fly-up signal and final bearing on ACLS indicator. Then report side number and needles.

Note

- The pitch steering bar indicates erroneous information if level at 1200 feet and further than 3 miles aft of the carrier.

- Hold altitude as the pitch steering bar moves down from the top of the ACLS indicator. As the pitch steering bar approaches the center of the indicator, ease the nose over to intercept glide slope. Fly on glide slope and centerline by keeping the indicator needles centered.

7. At 1/2 mile astern or sooner (pilot's discretion), transfer to standard visual approach and make ball call.

8. If console operator does not unlock radar, 10 second will light 10 seconds prior to touchdown.

9. If aircraft exceeds ACLS limits or experiences a system malfunction, flashing wave-off (WO) light on DRO will alert pilot.

ACLS MODE 2 APPROACH (TYPICAL)

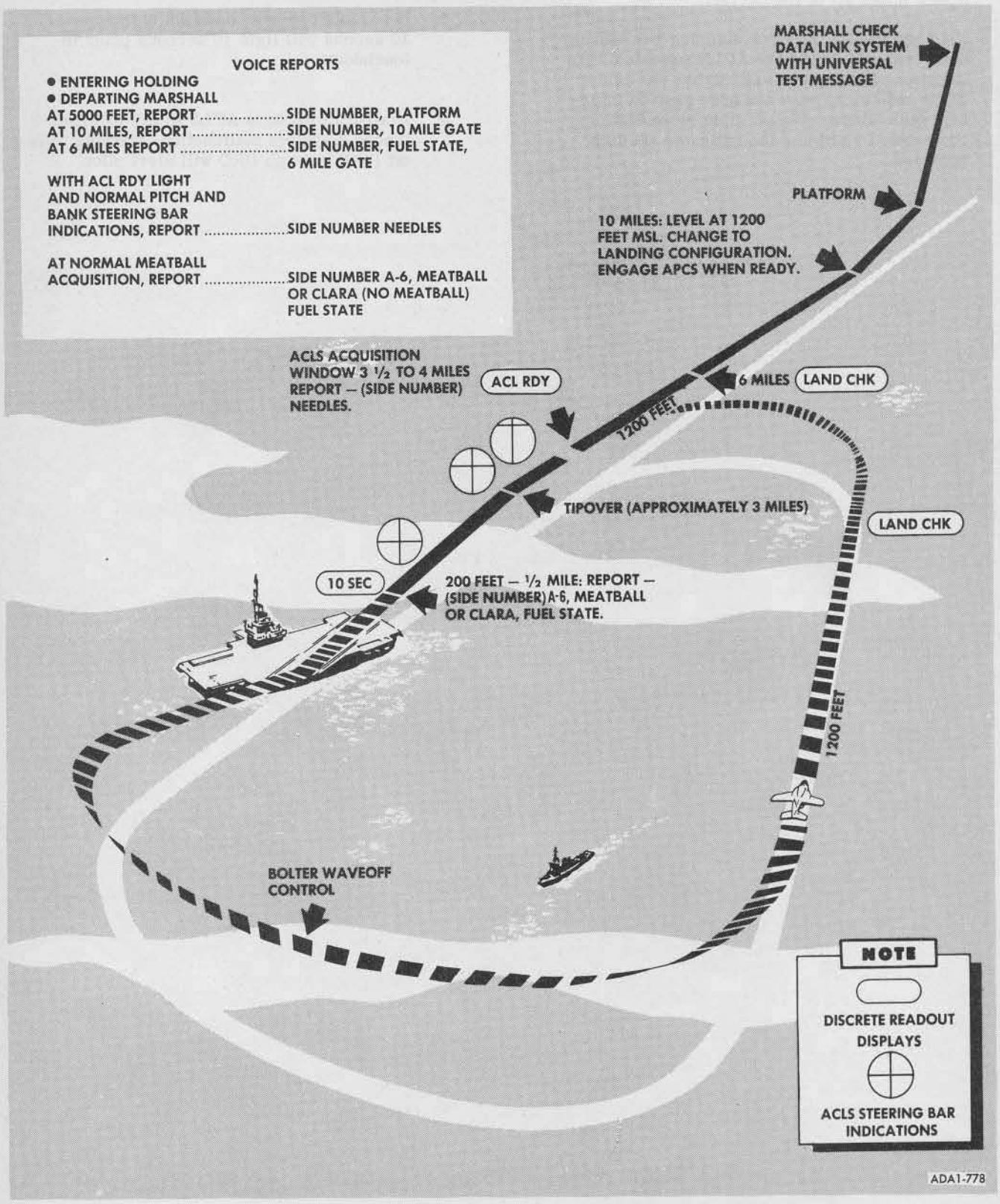

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Figure 3-12

part 5 Shore Based Procedures (B/N)

B/N PRESTART PROCEDURES

1. Preflight checklist . . . . . COMPLETED
2. Harnessing . . . . . FASTEN

WARNING

If the survival-gear lanyard is connected (GRU-5 only) the survival equipment will hinder rapid evacuation of the cockpit during a ground emergency or ditching.

3. Helmet . . . . . ON
4. Oxygen mask, communications, and anti-g suit/anti-exposure suit . . . . . CONNECTED
5. Seat . . . . . ADJUST
   a. Assume ejection position, set erect, buttocks against backrest, head firmly against headrest, spine straight, thighs against seat pan.
   b. With left hand, reach up and touch face-curtain handle.
   c. Adjust seat height so that top of helmet just clears underside of face-curtain handle.

Note

Above procedure ensures proper positioning for ejection.

6. Inertial platform alignment (as applicable) . . . . . COMMENCED
7. Oxygen switch . . . . . ON
   0_2 on, with mask away from face, depress ICS, then 0_2 off.
8. Oxygen mask . . . . . ATTACK TO HELMET
9. Oxygen regulator (GRU-5 only) 100%
10. Inertia reel . . . . . CHECK
11. Vent suit-seat cushion controls . . . . . AS DESIRED
12. Hose-reel ground test switch (KA-6D) . . . . . OFF
13. No. 2 UHF radio (KA-6D) . . . . . ON (T/R + G)
14. B/N circuit breaker panel . . . . . ALL CIRCUIT BREAKERS IN
15. Chaff programmer panel . . . . . AS DESIRED
16. RADIO control panel (RAD/ICS panel, A-6E TRAM) . . . . . AS DESIRED
17. BOMB TONE switch . . . . . AS DESIRED
18. Interior lights . . . . . AS DESIRED
19. Advisory lights . . . . . TEST
    Test all advisory lights except those on ARMAMENT panel by depressing B/N MASTER TEST BUTTON.
20. B/N's auxiliary circuit breaker panel . . . . . ALL CIRCUIT BREAKERS IN

CONTINUED ON NEXT PAGE

B/N PRESTART PROCEDURES—CONTINUED

A-6A, B, C

Pilot's Control Box (PCB)

21.	Mode selector switch	SRCH
22.	Brightness control	OFF (CCW)
23.	Contrast control	OFF (CCW)
24.	Persist control	OFF (CCW)
25.	PHD power switch	STBY
26.	Range marker knob	CCW
27.	Azimuth line knob	CCW
28.	Clearance switch	AS DESIRED
29.	Clearance range marker control	OFF (CCW)
30.	Flight line control	OFF (CCW)
31.	Display scale switch	AS DESIRED
32.	Display/track/boresight switch	DISPLAY
33.	MRI control	OFF (CCW)
34.	Receiver gain control	OFF (CCW)

Left Hand Panel

35.	Desired attack mode selector button	DEPRESS
36.	Intervalometer	SET
37.	Desired g-selector button	DEPRESS
38.	Release mode switch	AS DESIRED
39.	SALVO/TRN/STEP switch	AS DESIRED
40.	Rocket mode switch	AS DESIRED

Flight Mode Selector Panel

41.	Flight mode button	OFF
42.	Nav checkpoint/normal switch	NORM

CONTINUED ON NEXT PAGE

B/N PRESTART PROCEDURES—CONTINUED

43. Navigation mode button . . . . . UNSTAB-NO STEER
44. Navigation transfer switch . . . . . LEFT

Attack Navigation Panel (RHU))

45. Error code switch . . . . . READ
46. Data select switch . . . . . AS DESIRED
47. Release advance button . . . . . OUT

Navigation Control Panel

48. Magnetic variation switch . . . . . AS REQUIRED
49. Navigation data switch . . . . . DATA
50. Navigation mode selector switch . . . . . INERL
51. Manual range control . . . . . AS DESIRED
52. Computer/manual/stop scan switch . . . . . CMPTR
53. Fixed/moving (target) switch . . . . . FIXED
54. Track receiver tune control . . . . . AFC
55. Search receiver tune control . . . . . AFC
56. Meter select button . . . . . ANT PAT
57. Search trigger switch . . . . . PRI
58. Search radar track switch . . . . . OFF
59. Sync set/echo check/off switch . . . . . OFF
60. XMIT/SIL switch . . . . . SIL
61. Search magnetron reset button . . . . . OUT
62. Brightness control . . . . . CCW
63. Contrast control . . . . . CCW
64. Video gain control . . . . . CCW
65. Receiver gain control . . . . . CCW
66. STC slope control . . . . . CCW
67. STC depth control . . . . . CCW
68. Range/azimuth marker brightness control . . . . . CCW
69. Diff gain control . . . . . AREA (CCW)
70. Scan rate control . . . . . SLOW

CONTINUED ON NEXT PAGE

B/N PRESTART PROCEDURES--CONTINUED

71. AMTI control . . . . . OFF
72. Azimuth stabilization control . . . . . OFF
73. Scan angle control . . . . . FULL CW
74. Display select button . . . . . PPI
75. PPI RANGE switch . . . . . 30-5 NM

WEAPON SYSTEM PREFLIGHT

CAUTION

- During preflight operations, the bombardier/navigator will ensure that the radiation danger area is clear of personnel, equipment, and other aircraft before placing the transmit/silent switch to the XMIT position.
- In the A-6A, B, C, cooling air is not available to the search radar or track radar without the engines running or ground cooling applied, and radar operation may result in failure.
- In the A-6A, B, C, E sufficient cooling air is not available to equipment in the radome area for more than 5 minutes operation with canopy open.

TURN-ON/PREFLIGHT A-6A,B,C

Note

- In aircraft Serial No. 154170 and subsequent and aircraft incorporating AVC No. 758, the ballistics computer is protected against overheating of the power supply. If the power supply overheats, the computer is automatically shut down. After the overtemperature condition has ceased to exist, the computer must be recycled by the bombardier/navigator to restore operation.
- In aircraft incorporating AFC No. 135, to reduce high humidity and to warm the equipment, turn-on of search and track radars and the computer should be delayed for 5 minutes with the canopy closed and the engine running

NEW NEW

Bombardier/Navigator's Slew Control Panel

1. Velocity-correct switch . . . . . OFF-SAVE or OFF-ERASE

Note

All radar transmissions shall conform to current Hazards of Electromagnetic Radiation to Ordnance (HERO) restrictions.

2. FLIGHT mode selector button . . . . . FLIGHT
3. Search radar power switch . . . . . STBY
4. Track radar power switch . . . . . STBY

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

Note

The track radar/search radar and VDI require 5 minutes warmup in the STBY position.

5. CMPTR EMER COOL switch . . . . . RESET

6. Computer error indicator . . . . . CHECK

7. Address key release bar . . . . . DEPRESS
   Release bar must be momentarily depressed to release any depressed address key prior to selecting another address key.

8. Address key . . . . . DEPRESS PRES LOCA
   Depress present location address key and enter latitude, longitude, and altitude data for present position.

Note

The computer error indicator light should be on. The computer is in a digital computer off (DCO) condition and the platform is receiving correction signals from the erection controller.

9. Navigation data switch . . . . . PRE POS
   Check readout windows for proper entries.

10. Address key release bar . . . . . DEPRESS

11. Address key . . . . . DEPRESS BASE
    Depress base address key and enter latitude, longitude, and altitude data for base.

12. Navigation mode selector . . . . . BASE - NO AP

13. Navigation data switch . . . . . ON CALL
    Check tape dials for proper entry and check range and bearing on DVI and PHD.

14. Address key release bar . . . . . DEPRESS

15. Address key . . . . . DEPRESS TARGET
    Depress TARGET address key and enter latitude, longitude, and altitude data for target.

16. Navigation mode selector . . . . . PRES TGT - NO AP
    Check tape dials for proper entry and check range and bearing on DVI and PHD.

17. Address key release bar . . . . . DEPRESS

18. Address key . . . . . DEPRESS CHECK POINT
    Depress checkpoint address key and enter latitude, longitude, and altitude data.

19. Nav checkpoint/normal switch . . . . . NAV CHK PT
    Check tape dials for proper entry and check range and bearing on DVI and PHD.

20. Navigation checkpoint/normal switch . . . . . NORM

21. Address key release bar . . . . . DEPRESS

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

22. Address key . . . . . REL ADV
Depress release advance key and enter N-00000. Note reading of release advance in attack-navigation panel window C5. Release advance button must be engaged to read the value set.

23. Address key release bar . . . . . DEPRESS

24. Navigation mode selector button . . . . . UNSTAB-NO STEER
Check range readout on DVI and PHD.

Note

In aircraft with the P8. 6 program, the NOMATS code, UNSTAB NO STEER range, and temperature should be entered as desired, at this time.

25. Antenna pattern switch . . . . . CHECK AND SET
Momentarily actuate antenna pattern switch in both directions. Observe corresponding increase and decrease reading on the meter. Decrease until meter reads zero.

26. Meter selector button . . . . . MAG FREQ-CHECK

27. Meter selector button . . . . . XTAL CUR-CHECK

28. Meter selector button . . . . . MAG CUR

29. Search radar brightness control . . . . . ADJUST
Adjust brightness control until PPI sweep is just visible on bombardier/navigator's DVI.

30. Search radar contrast control . . . . . 3/4 to full CW

31. Search radar video gain control . . . . . 2/3 CW

32. Search radar receiver gain control . . . . . 3/4 CW

33. Marker brightness controls . . . . . ADJUST (CW)
Adjust both marker brightness controls until range markers and azimuth line are visible. Check that there are two range markers visible at 10 nmi intervals.

TURN-ON/PREFLIGHT A-6E

Bombardier/Navigator's Control Panel

Note

Before turning the search radar POWER switch to STBY, ensure that the nosewheel well area is clear.

1. TRANSMIT switch . . . . . SIL

2. Search radar POWER switch . . . . . STBY

Note

The search radar requires 4 to 7 minutes warmup in STBY.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

3. BRT control ..... CW UNTIL SWEEP
4. CONTRAST control ..... CW
5. VIDEO/DIF gain control ..... CCW
6. RCVR gain control ..... CW
6A. BEACON control (A-6E TRAM) ..... OFF
7. DISPLAY ..... PPI (APPROXIMATELY 27.5 MILES)
8. RNG MKR/AZ MKR controls ..... CW TO DESIRED SETTING
   Check for two 10-mile range marks.
9. STC SLOPE/DEPTH controls ..... SET CCW
9A. RCVR TUNE control (A-6E TRAM) ..... MAN
10. SCAN RATE control ..... SLOW SCAN
11. AMTI control ..... OFF
12. SCAN STAB switch ..... ADL
13. SCAN ANGLE control ..... SET AS DESIRED
14. BEACON control (except A-6E TRAM) ..... OFF
14A. AZ RANGE TRKG switch (A-6E TRAM) ..... OFF
15. FREQ AGILITY switch ..... OFF
16. ELEV TRKG switch ..... OFF
17. RCVR TUNE control (except A-6E TRAM) ..... MAN
18. Cursor control switch ..... MAN
19. MAN RANGE setting 30,780
20. METER toggle switch ..... RIGHT
21. FAULT ISLN switch ..... OFF (CENTER)
22. TEST MODE toggle switch ..... OFF (CENTER)
23. TEST MODE button ..... BIT
24. TRACK POWER switch (except A-6E TRAM) ..... OFF
25. MODE switch (except A-6E TRAM) ..... TRACK

Note

Manual test procedures step 26 through 37 may be accomplished prior to engine start and computer ORT.

26. TEST MODE toggle ..... LEFT
    Note GO light.
27. Test mode - SRCH ..... ADJUST FOR VIDEO
    Note GO light.
28. Display ..... ARE 30

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

29. MAN RNG ..... ADJUST TO VIDEO
    Note range 30, 775±100

30. TEST MODE toggle ..... RIGHT

31. Test mode ..... ELEV TRACK
    Note GO light.

32. Test mode ..... TWS
    Adjust MAN RNG for GO light 30, 780±100

33. TEST MODE toggle ..... LEFT

34. Test mode ..... SRCH

35. COMPT/MAN ..... COMPT

36. RCVR tune ..... AFC

Note

The following check may be made only if current hazards of electronic radiation to ordnance (HERO) and EMCON conditions permit.

37. Radar POWER ..... ON
    a. DISPLAY ..... PPI
    b. MAG CUR 8
    c. All PRF's ..... CHECK
    d. XTAL CUR ..... ABOUT .6
    e. All PRF's ..... CHECK
    f. MAG FREQ 5
    g. ANT PATT ..... NEAR
    h. Check XMTR PWR ..... .4 to .8
    i. Check RCVR SENS at .5 to .8 with full RCVR gain
    j. METER toggle-right ..... ANT PATT
    k. Display ..... ARE 30

Digital Display Unit

1. Navigation mode select switch ..... INERL
2. Navigation data switch ..... DATA
3. DATA SELECT switch ..... A

Armament Control Unit

1. STA readouts (STA 1-5) ..... AS DESIRED
2. RELEASE mode select button ..... AS DESIRED

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT–CONTINUED

3. ATTACK mode select button . . . . . AS DESIRED
4. TIME thumbwheel . . . . . AS DESIRED
5. QUANTITY thumbwheel . . . . . AS DESIRED
6. INTERVAL thumbwheel . . . . . AS DESIRED

Pilot's Control Panel

1. VDI BRT/CONTRAST controls . . . . . CCW
2. PITCH TRIM control . . . . . CCW
3. OFFSET IMP PT/PATH BRT controls . . . . . CCW
4. PHD BRT/CONTRAST controls (except A-6E TRAM) . . . . . CCW
5. PHD power switch (except A-6E TRAM) . . . . . STBY
6. RNG MKR/AZ MKR controls (except A-6E TRAM) . . . . . CCW

CAUTION

During preflight operations, the bombardier/navigator will ensure that the radiation danger area is clear of personnel, equipment, and other aircraft before moving the TRANSMIT switch from SIL.

Note

All radar transmissions shall conform to current Hazards of Electromagnetic Radiation to Ordnance (HERO) restrictions.

COMPUTER TURN-ON/TEST PROCEDURES A-6E (E 1.5 PROGRAM)

CAUTION

The AAU-19 altimeter should remain in STBY until the A/D converter tests have been completed.

Note

Turning on the right generator with the computer on may cause the computer to revert to the initial power-up test sequence.

1. COMPUTER switch . . . . . ON
   a. COMPT ERROR light: lit 4 seconds
      ATTACK light: lit 4 seconds
      DDU windows: all 0's
      TEMPORARY STORAGE window: all dashes
   b. CLEAR button . . . . . DEPRESS
      All windows: 3's
   c. CLEAR button . . . . . DEPRESS
      G/S/LONG window: S77777
      WIND SPEED/LAT window: S7777
      TEMPORARY STORAGE window: S777777
      All other windows: 7's
   d. CLEAR button . . . . . DEPRESS
      G/S/LONG window: 11111

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT–CONTINUED

Note

- All switch discretes to the computer may be checked at this time by selecting the switch and reading the corresponding code in the TEMP STORE window.
- Operational requirements may dictate that the flight program be entered at this point; however, it is recommended that the ORT be completed through the A/D converter checks on internal power. The complete computer check will be accomplished by maintenance personnel during daily checks.
- Before commencing the A/D converter checks, ensure that the VDI is in CONT ANALOG.

e. CLEAR button . . . . . DEPRESS
Depressing clear button starts analog-to-digital (A/D) converter test.

G/S/LONG window first reads:	012000
then	011900
then	010600

If no failures are present between 011900 and 010600:

then decreases by 100's	3400
then reads	111111

- ATTACK light lit: ADC out of tolerance/failed.
- COMPT ERROR light lit: normal accelerometer failure.

Note

- The A/D converter test is completely automatic and requires approximately 3 minutes to complete.
- Any failure during the A/D converter test stops the test and the readout in the G/S/LONG window indicates which test was failed. Depressing the CLEAR button permits the rest of the tests to be completed unless readout 120, 119, 118, 117, 064, or 063. Refer to A/D Converter Tests in Section VIII for mission impact of test failures.

2. COMPT MODE switch . . . . . ENTER
3. ADDRESS key . . . . . PRES LOC
   Enter present position data:
   a. Latitude and longitude of departure using POS ACTION key.
   b. Pressure altitude of departure using ALT ACTION key.
4. Navigation mode select switch . . . . . DR
5. Velocity-correct switch . . . . . OFF ERASE, THEN OFF SAVE
6. RELEASE bar . . . . . DEPRESS
7. ADDRESS key . . . . . UNSTAB
   Enter desired cursor initialization range in miles.
8. RELEASE bar . . . . . DEPRESS
9. COMPT MODE switch . . . . . STEER

Digital Display Unit

10. Navigation data select switch . . . . . PRES POS
    Read correct present position entries of latitude, longitude and altitude to confirm keyboard entries.
11. Navigation data select switch . . . . . ON CALL
    Depress UNSTAB key and read correct cursor initialization range to confirm keyboard entry.

WEAPON SYSTEM PREFLIGHT—CONTINUED

Note

The inertial platform may be placed in OPER at any time during the ORT if necessary. However, a complete evaluation of alignment accuracy requires that the computer be operating in the flight program.

COMPUTER TURN-ON/TEST (E100 PROGRAM)

Pedestal Control Unit

1. COMPT MODE switch . . . . . STEER or TEST

   Turning the computer on in STEER enables only the automatic tests; in TEST enables the complete ORT.

2. Velocity correct switch . . . . . OFF SAVE

3. Azimuth-Range switch . . . . . ON

Digital Display Unit

1. DATA SELECT switch . . . . . A

2. NAVIGATION data switch . . . . . PRES POS

3. MAG VAR . . . . . SET LOCAL VARIATION

4. COMPUTER switch . . . . . ON

   Note the following automatic sequence of test indications requiring approximately 40 seconds:

   - COMPT error light comes on for approximately 4 seconds, then goes out.
   - ATTACK light comes on for approximately 4 seconds, then COMPT ERROR light comes on. Both lights remain on for approximately 4 seconds, then go out.
   - TEMP STORE windows display several test indications, then
   - TEMP STORE windows read dashes (-).
   - All DDU windows read 0.
   - All DVRI and PAIP windows read 0.

Note

- At this time, a failed test may be repeated by pressing the SAC key on the PCU, or if TEST had been selected, the computer ORT may be continued by depressing the PCU CLEAR button.
- If STEER had been selected, at the successful completion of the automatic test, the COMPT ERROR light will come on, DDU window A5 will display the 001 SAC, and the alignment program may be entered.

Pedestal Control Unit

1. COMPT MODE switch . . . . . ENTER
2. PRES LOC ADDRESS key . . . . . DEPRESS
3. Present position latitude, longitude and altitude . . . . . ENTER
4. SAC key - DEPRESS - Note that COMPT ERROR light goes out, DDU window A5 displays 0's.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

Pilot's Control Panel

1. DISPLAY button ..... CONT ANALOG
2. RANGE MILES button 3
3. BRT/CONTRAST control ..... ADJUST FOR NORMAL PICTURE

NAVIGATION Control Panel

1. MODE select button ..... ALIGN
   Note that the ALIGN light comes on ~~after 45 seconds~~.

Note

During IMU alignment, the balance of the computer entries may be made.

Pilot's Auxiliary Indicator Panel

1. HDG SEL switch ..... CMD

If the computer ORT was selected initially, proceed as follows:

1. CLEAR button ..... DEPRESS
   All windows read: 3's
2. CLEAR button ..... DEPRESS
   G/S LONG window reads: S 77777
   WIND SPEED/LAT window reads: S 7777
   TEMP STORE window reads: S 777777
   All other windows read: 7's
3. CLEAR button ..... DEPRESS
   G/S LONG window reads: 111111
4. CLEAR button ..... DEPRESS
   Depressing the CLEAR button starts the A/D converter tests requiring approximately 3 minutes. Observe the following:
   - G/S/LONG window first reads: 012100 then counts down by 100's
   - Movement of VDI symbols, actuation of lights during countdown
   - Actuation of DVRI and NAVIGATION control panel lights during countdown

If no failures:

- G/S/LONG window reads: 111111
- COMPT ERROR and ATTACK lights - OFF
- DVRI: ATTACK, RESELECT, ELEVATION, AZ-RANGE, and COMPUTER lights ..... ON
- VDI: ATTACK, PLATFORM, COMPUTER, IN RANGE, and breakaway lights ..... ON
  All other lights ..... FLASH
- VDI: Target symbol ..... ON
  steering symbol, pathway and release marker ..... OFF
  Impact point ..... FLASH

If G/S LONG window countdown stops before reaching 111111, see Section VIII for failure definition. Failed tests considered nonessential may be bypassed by depressing the CLEAR button.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

RADAR TEST PROCEDURES A-6E

Note

The following tests are to be accomplished after computer flight program has been entered.

1. CMPT MODE ..... STEER AND UNSTAB
2. AZ/RNG switch ..... DISLODGE
3. Position range line on video with slew stick 30, 780±100
4. BEACON ..... FULL CW
   a. RCVR gain ..... CCW
      Test video disappears.
   b. BEACON ..... FULL CW
      Readjust range line to video note approximately 150 feet difference.
   c. BEACON ..... OFF
   d. RCVR gain ..... CW
      Test video reappears.
   e. RCVR tune ..... AFC
5. ELEV TRK ..... ON
6. CMPT steer ..... OPT TGT
   Position range line on video with slew stick 30, 780±100. ELEVATION light ON.
7. Azimuth-range switch ..... ENABLE (AFT)
   Note RNG 30, 780±100. AZ-RANGE/ELEVATION lights ON, check slew inhibited.

Note

Range accuracy data obtained by ranging on the BIT video is considered accurate enough to preclude ground transmission.

8. Azimuth-range switch ..... DISLODGE (FORWARD)
9. Test mode ..... AMTI
   GO light, AMTI CW/then OFF. Note video dropout just out of detent, then fills in as control is rotated CW.
10. PCB ..... TC
    Observe antenna pattern goes to FAR.
11. Test mode ..... TC
    GO light, check TC fail light on VDI ..... OFF

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

12. RCVR tune ..... MAN THEN AFC
    Observe TC fail light on then OFF.

13. PCB ..... TEST
    Observe proper display. Select RNG 2.

14. PCB ..... TC CAL
    Observe proper display with RNG 2 and 1.5 coded.

15. PCB ..... CONT ANALOG

16. POWER switch ..... STBY

17. Test mode ..... OFF

18. CMPT steer ..... UNSTAB

19. DISPLAY ..... PPI

Note

All fault isolation operations must be conducted in accordance with appropriate maintenance publications and are not flight crew procedures.

Video Tape Recorder

1. Function ..... STBY
2. Power ..... ON
3. Test ..... LAMP
4. Test ..... BIT
   Wait at least 1 minute prior to checking for any failure lights.
5. Power ..... OFF

OPTICAL SIGHT CHECK PROCEDURES A-6E

Sight Unit Control Panel

1. AUTO/OFF/MAN switch ..... AUTO
2. Fixed and moving reticles ..... ON
3. In range and breakaway displays ..... TEST

Computer Control Unit Keyboard Panel

4. COMPT MODE switch ..... STEER
5. UNSTAB key ..... DEPRESS
   Observe that fixed and moving reticles are superimposed (within 1 1/2 to 2 mils).

COMPUTER ENTRY PROCEDURES A-6E

Computer Control Unit Keyboard Panel

1. COMPT MODE switch ..... ENTER

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

2. ADDRESS key ..... TGT 1
   Enter data for first target as follows:
   a. Latitude and longitude, using POS ACTION key.
   b. MSL altitude ortarget, using ALT ACTION key.
3. ADDRESS key ..... OAP 1
   Enter data for target 1 offset aimpoint 1 as follows:
   a. True bearing from target to aimpoint, using BRG ACTION key.
   b. Distance from target to aimpoint in feet, using DIST ACTION key.

Note

- In aircraft with the E1.5 program, the OAP 1 offset distances for TGT 1 through 4 and the OAP 2 offset distances for TGT 1 through 3 are entered in feet. The OAP 2 offset distance for TGT 4 is entered in X and Y coordinates in meters.
- In aircraft with the E100 program, OAP distances for targets 1-3 are entered in feet, and OAP bearing for targets 1-3 is entered as true bearing from target to aimpoint. OAP data for target 4 is entered as follows:

  OAP 1 - TGT 4 distance in meters, direction is entered as true bearing from OAP to target, but displayed as the reciprocal;

  OAP 2 - TGT 4 offset distance entered in meters in X and Y coordinates.

E100 & CUB OAP ALT IS REFERENCED TO MSL

   c. Altitude difference in feet from target to aimpoint, using ALT ACTION key.
4. ADDRESS key ..... OAP 2
   Enter data for target 1 offset aimpoint 2 in the same manner as OAP 1.
5. Release bar ..... DEPRESS
6. Data for targets 2, 3, and 4 ..... ENTER
   Enter data for additional targets and offsets as noted above.
7. Release bar ..... DEPRESS
8. ADDRESS key ..... NAV XPT
   Enter data for the navigation checkpoint as follows:
   a. Latitude and longitude of checkpoint using POS ACTION key.
   b. MSL altitude of checkpoint, using ALT ACTION key.
9. RELEASE bar ..... DEPRESS
10. ADDRESS key ..... GRD TRK
    Enter blast clearance altitude for ordnance carried using ALT ACTION key. If ground track bombing is to be used, enter ground track using BRG ACTION key.

    BLAST CLEARANCE NON-FUNCTIONAL E100
11. RELEASE bar ..... DEPRESS
12. ADDRESS key ..... MAN
    Enter temperature in degrees F using TEMP ACTION key.

Note

Temperature displayed will be corrected so will not necessarily be the number entered.

13. RELEASE bar ..... DEPRESS
14. ADDRESS key ..... REL ADV
    Enter desired release advance distance or zeros using DIST ACTION key.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT–CONTINUED

15. COMPT MODE switch . . . . . STEER

Digital Display Unit

16. Navigation data select switch . . . . . ON CALL

Computer Control Unit Keyboard Panel

17. ADDRESS keys . . . . . DEPRESS
Depress each address key for which data was entered one at a time and read correct entries in windows in lower section of DDU.

Note

Entries for the address key depressed on the lowest row of the CCU keyboard panel will be displayed.

18. ADDRESS key . . . . . UNSTAB

Digital Display Unit

19. Navigation data select switch . . . . . DATA

ASN-41 NAVIGATION COMPUTER CHECK KA-6D

1. HSI mode switch . . . . . NAV COMP

2. Computer function selector switch . . . . . TEST
Windspeed counter should read 231±3 knots.
Wing direction counter should read 91±1.
Present position latitude indicator should show South integration.
Present position longitude indicator should show East integration.
HSI bearing pointer No. 2 should read 30° right.

3. Computer function selector switch D2
Set destination 2 latitude and longitude

4. Computer function selector switch D1
Set destination 1 latitude and longitude

5. Computer function selector switch . . . . . STBY

6. Magnetic variation . . . . . SET
Set magnetic variation to local value

7. Windspeed and direction . . . . . SET
Set in surface windspeed and direction

8. Present position latitude and longidude . . . . . SET

APN-153 DOPPLER RADAR CHECK A-6E/KA-6D

CAUTION

Ensure a minimum warmup period of 5 minutes in STBY before going to TEST.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—CONTINUED

1. Mode selector . . . . . STBY
2. DA (drift angle) knob . . . . . SET 20° L or R
3. GS (groundspeed) knob . . . . . SET 350 KNOTS
4. Mode selector . . . . . TEST
5. Within 35 seconds (maximum), GND SPEED window should read 121±5 knots and . . . . . DRIFT arrow should read 0°±2°.

PRE-TAXI PROCEDURES

1. Platform selector button . . . . . OPER
2. Error code switch (A-6A, B, C)/SAC key (A-6E) . . . . . CYCLE/DEPRESS
   Cycle error code switch/depress SAC key. Check that computer error light is out. Computer is now fully operational and is sending correction signals to platform.
3. Navigation data switch . . . . . DATA

Note

Moving the aircraft or checking nosewheel steering before going to OPER will seriously degrade platform alignment.

4. G valve test button . . . . . MOMENTARILY DEPRESS
5. ECM . . . . . AS DESIRED

CAUTION

Prior to turning on the ECM power switch, ensure the gear/hook circuit breaker is properly seated and there is no indication of weight-on-wheels switch failure (angle-of-attack indexer and approach light on).

6. Doppler . . . . . REFERENCE CHECK
7. Mission recorder
   a. Power switch . . . . . ON
   b. Function switch . . . . . STBY

TAXI PROCEDURES

1. Monitor inertial heading on DVI and velocities in tape dial readouts.
   Wind direction should read aircraft heading ±180° on RHU, windspeed and groundspeed should approximate taxi speed.

WEAPON SYSTEM PREFLIGHT–WHEN IN RADAR TURN-UP AREA A-6A,B,C

After 5-Minute Warmup

CAUTION

During preflight operations, the bombardier/navigator will ensure that the radiation danger area is clear of personnel, equipment, and other aircraft before placing the XMIT/SIL switch to the XMIT position.

1. XMIT/SIL switch . . . . . XMIT
2. Search radar power switch . . . . . ON
3. Scan rate control . . . . . FAST
   Position scan rate switch to fast position. Observe scan rate on DVI increase by a factor of two.
4. Scan angle control . . . . . CCW
   Rotate scan angle control counterclockwise and observe that sweep angle on DVI decreases correspondingly.

Note

Check MAG CUR at PPI-30, 75 and 150 settings. Adjust meter reading to 0.8 at PPI setting that gives highest meter reading before adjustment. Insure MAG current never exceeds 0.8 at any time.

5. PPI range switch 75
   Observe change in sweep length on display, and that there are two range markers at 25 nmi intervals.
6. PPI range selector control 150
   Observe change in sweep length on display, and that there are five range markers at 25 nmi intervals. Antenna scan rate will be reduced by one half.
7. PPI range switch 5
8. Slew activate switch . . . . . DEPRESS
   Move slew stick and note corresponding movement of indicator bug and search radar cursors.
9. DISPLAYS select button WAC/ARE-50
   Switches to SECT display when range cursor drives to less than 44 NMI; switches to ARE-50 at 27.5 nmi.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—WHEN IN RADAR TURN-UP AREA A-6A,B,C—CONTINUED

10. DISPLAYS select button SECT/ARE-25
    Switches to ARE-25 when range cursor drives to less than 27.5 NMI.

11. DISPLAYS select button ..... PPI

12. Receiver gain control ..... ADJUST

13. Video gain control ..... ADJUST

14. Contrast control ..... ADJUST

15. Brightness control ..... ADJUST

16. Meter select button ..... MAG FREQ
    Use increase/decrease switch to adjust frequency as desired.

17. Meter select button ..... XTAL CUR
    Note absence of needle sweep, indicating AFC lock-on.

18. PHD power switch ..... ON

19. PHD BRIGHTNESS control ..... ADJUST

20. PHD CONTRAST control ..... ADJUST

21. PHD PERSIST control ..... ADJUST

22. PHD RANGE MKRS and AZ LINE Controls ..... ADJUST

23. Track radar power switch ..... ON

24. Meter select button ..... TRACK MAG CUR
    Check that track radar magnetron current reads 0.8. If adjustment is necessary, use track MAG CUR control on BNCB. This control may be locked in position after adjustment.

25. Meter select button ..... TRACK XTAL CUR
    Note absence of needle sweep, indicating AFC lock-on.

26. Sync set/echo check switch ..... SYNC SET
    Check for proper displays on DVI/PHD

27. Sync set control knob ..... ROTATE/LOCK
    Rotate control knob until proper synchronization is indicated. Lock knob in proper position.

Note

A sync set performed immediately after radar turn-on may not be valid during later portions of the flight. Whenever the track radar will be used for either discrete or ground lock-on tracking, the sync set should be rechecked while airborne.

28. Sync set procedure ..... COMPLETE
    Complete either procedure below

    Sync Set - Targets Not Available

    a. Track radar power switch ..... STBY

    b. XMIT/SIL switch ..... SIL

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT–WHEN IN RADAR TURN-UP AREA A-6A,B,C–CONTINUED

c. Range cursor . . . . . SUPERIMPOSE OVER 10NM FIXED RANGE LINE

d. Track radar power switch . . . . . CYCLE
Cycle track radar power switch between STBY and ON, observing any change in position of range cursor.

e. Sync set control knob . . . . . ADJUST/LOCK
While cycling track radar power switch between STBY and ON, adjust sync set control as necessary (which moves range cursor when track radar power switch is on) until there is no visual difference in range between STBY and ON positions. Lock knob in proper position.

Sync Set-Targets Available

a. Track radar power switch . . . . . STBY

b. Dislodge switch . . . . . DISLODGE

c. Locate close-in fixed target in search radar PPI 30.

d. ARE-25 . . . . . SELECT
Adjust display for sharp target video and thin, sharp range cursor.

e. Slew control . . . . . ADJUST CURSORS
Position cursors so that range cursor is under and against target.

f. Track radar power switch . . . . . ON
Note any relative motion between range cursor and target video.

g. Sync set control knob . . . . . ADJUST/LOCK
Adjust sync set control knob so that there is no change in position of range cursor with respect to target when track radar is on.

29. Sync set/echo check switch . . . . . ECHO CHK
Note number of horizontal lines on DVI.

30. Sync set/echo check switch . . . . . OFF

31. Track radar power switch . . . . . STBY

Aircraft 19 through 309 and Aircraft Not Incorporating AVC No. 658

32. AMTI control . . . . . ROTATE CW AND NOTE FIXED TARGET CANCELLATION.

33. AMTI control . . . . . OFF

Aircraft 310 and Subsequent and Aircraft Incorporating AVC 658

32. AMTI control . . . . . ROTATE CW.
Observe display sweep background noise disappears and no spoking or spurious signals are present. Note fixed target cancellation.

33. AMTI control . . . . . OFF

All Aircraft

34. STC slope control . . . . . ADJUST

35. STC depth control . . . . . ADJUST
Increase STC slope and depth controls (CW) observing proper reduced gain effect at near ranges.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—WHEN IN RADAR TURN-UP AREA A-6A,B,C—CONTINUED

36. Differential gain control . . . . . ADJUST
    Adjust differential gain control, noting sharpening of target returns.

37. Search trigger switch . . . . . SEC
    There should be little or no change in display sweep.

38. Search trigger switch . . . . . PRI

39. PPI range knob 30

40. Computer/manual switch . . . . . MAN

41. Azimuth cursor switch . . . . . SLEW CW AND CCW
    Check clockwise and counterclockwise slewing of azimuth cursor

42. Manual range control knob . . . . . CHECK AND SET
    Return computer/manual switch to CMPTR

Pilot's Control Box

43. Track mode selector switch . . . . . DISPLAY

44. Mode selector switch . . . . . E-SCAN

45. Clearance/range marker control . . . . . ADJUST

46. Flight line control . . . . . ADJUST

47. Display miles scale switch 5
    Observe display for markers and sweep.

48. Display miles scale switch 10
    Observe display for change in range and markers.

49. Mode selector switch . . . . . SRCH

Bombardier/Navigator's Control Panel

50. Mode selector switch . . . . . TCPPI

Pilot's Control Box

51. Clearance/range marker control . . . . . ADJUST
    Observe display on PHD/DVI for proper presentation.

52. Display miles scale switch 5
    Observe presentation for range shift.

53. Displays selector button . . . . . EMER SRCH

Bombardier/Navigator's Slew Grip:

54. Elevation slew switch . . . . . ACTUATE FOR VIDEO

Pilot's Control Box

55. Receiver gain/MRI controls . . . . . ADJUST FOR OPTIMUM DISPLAY

56. Display miles scale switch 10
    Observe display for range shift.

CONTINUED ON NEXT PAGE

WEAPON SYSTEM PREFLIGHT—WHEN IN RADAR TURN-UP AREA A-6A,B,C—CONTINUED

57. Track radar power switch . . . . . STBY

58. XMIT/SIL switch . . . . . SIL

CAUTION

The XMIT/SIL switch should not be manipulated when the track radar power switch is in the ON position.

ADDITIONAL SYSTEM GROUND CHECKS ON SURVEYED RADAR REFLECTOR (If Available)

1. Taxi to radar turn-up spot, point aircraft ADL at surveyed reflector

2. Preparatory steps . . . . . COMPLETE
   a. Track radar power switch . . . . . STBY
   b. Track radar dislodge switch . . . . . DISLODGE (FORWARD)
   c. Track radar DISPLAY/TRACK/BORESIGHT switch . . . . . TRACK

3. Locate surveyed target on search radar

4. Record search radar range and bearing to target

5. Track radar power switch . . . . . ON

6. Perform sync set. Acquire ground lock-on. Record TROT/COP check.

7. Track radar dislodge switch . . . . . DISCRETE (AFT)

8. Acquire discrete lock-on. Record TROT/COP check, radar range and bearing to target, and cursor position with respect to target.

Note

The above ground checks can provide valuable preflight and post flight troubleshooting information.

PRETAKEOFF PROCEDURES

1. Complete Takeoff Checklist with pilot using challenge and reply.

2. Check inertial heading and MA-1 heading

When aligned with runway and ready for takeoff:

3. Navigation data switch (Aircraft with ASN-31) . . . . . DATA
   Check velocities 0 to 3 knots

4. Steering mode . . . . . AS DESIRED

5. ICS . . . . . HOT

6. Report to pilot . . . . . READY FOR TAKEOFF

A-6C 1.

TAKEOFF PROCEDURES

1. Monitor pilot's instruments.

2. Monitor inertial velocities.

AIRBORNE

AFTER TAKEOFF PROCEDURES

A-6C 1, 2, 3, 4, 5

1. Flight mode selector button . . . . . AS DESIRED

2. Search radar power switch . . . . . ON

3. Radar XMIT/SIL switch . . . . . XMIT

4. Adjust search radar for optimum PPI display

5. Doppler LAND/SEA/REF SIG switch (A6A, B, C) . . . . . AS DESIRED

6. Velocity correct switch . . . . . OFF SAVE

7. Navigation select switch (A-6A, B, C, E) . . . . . DR

7A. Navigation select switch (A-6E TRAM) . . . . . INERL

8. Doppler select switch . . . . . ON-LAND/SEA (A-6E/KA6D) OR XMIT

9. Monitor Doppler groundspeed and drift angle in windows A3 and A4 (A-6A, B, C), or in DDU or Doppler panel (A-6E)

If Doppler Groundspeed and Drift Angle Are Valid:

10. Navigation select switch (except A-6E TRAM) . . . . . INERL

10A. Doppler valid code (A-6E TRAM) . . . . . ENTER

CONTINUED ON NEXT PAGE

AIRBORNE — CONTINUED

If Doppler Groundspeed and Drift Angle Are Not Valid:

11. Doppler select switch . . . . . SILENT/STBY

12. Repeat steps 7-10 after 5 minutes.

BEFORE LANDING

1. Complete landing checklist with pilot using challenge and reply.
2. ICS . . . . . HOT
3. ECM . . . . . STBY/OFF
4. Doppler power switch . . . . . STBY/SILENT
5. Radars . . . . . STBY

A-6C 1, 2, 3

AFTER LANDING

1. Complete after landing checklist with pilot using challenge and reply.

A-6C 1, 2, 3

IN CHOCKS

1. Copy data.
2. PHD power switch . . . . . OFF
3. Radar power switch(es) . . . . . OFF
4. Inertial platform selector button . . . . . OFF

A-6C 1, 2

5. Doppler power switch . . . . . OFF
6. Computer switch . . . . . OFF
7. Panel/console lights . . . . . OFF
8. ECM power switches . . . . . OFF

A-6C PREFLIGHT

1. External airconditioning (if available) . . . . . APPLIED TO POD
2. VDI selector button . . . . . CONT ANALOG
3. TV/IR cooling switch . . . . . RESET (6 SEC) THEN NORM

CAUTION

Without engines running or external air conditioning on, do not set the TV/IR cooling switch to NORM and do not move the IR power switch from OFF.

4. IR power switch . . . . . STBY (OFF if external air conditioning is not available)

Selecting STBY starts IR cool-down.

CAUTION

If external air conditioning is not applied to the pod, leave the TV/IR cooling switch and the IR power switch at OFF until after engines are running and aircraft air conditioning is on.

Note

IR cool-down time is normally 30 minutes. The IR HOT light on the TRIM panel will remain on until cool-down is completed.

5. TV power switch . . . . . OFF
6. Optical platform power switch . . . . . STOW/OFF
7. Optical platform NORM/OVRD switch . . . . . NORM
8. DF power switch . . . . . OFF

Indicator Azimuth Range Multisensor:

9. IARM filter selector . . . . . AS DESIRED

DF Control Panel:

10. DF POWER switch . . . . . STBY
11. DF AUDIO switch . . . . . ON

Note

For the pilot to hear DF audio, the B/N must select ALT 1.

12. DF THRESHOLD and AUDIO GAIN controls . . . . . ADJUST
    Adjust THRESHOLD and AUDIO GAIN controls for a comfortable level of audio in headset.

Bombardier/Navigator's Control Panel

13. Display selector switch . . . . . RADAR (LEFT)
14. Display select button . . . . . PPI
15. PPI RANGE switch . . . . . 5 MILES

A-6C PREFLIGHT—CONTINUED

IN RADAR TURN-UP AREA

16. Search radar power switch . . . . . ON

17. Track radar power switch . . . . . STBY

18. XMIT/SIL switch . . . . . XMIT

DF Control Panel:

19. DF POWER switch . . . . . BIT

20. DF THRESHOLD control . . . . . ADJUST (100)

21. DF video and audio . . . . . CHECK

    a. Observe a DF flag displayed at 10° and 1 1/2 miles on IARM and PHD

    b. Note 150 pps audio in B/N's and pilot's headsets.

22. DF AUDIO and VIDEO GAIN controls . . . . . ADJUST
    Adjust AUDIO GAIN control for a comfortable level in headsets and VIDEO GAIN for a suitable level on IARM and PHD.

Note

It may be necessary to adjust the RANGE MKRS control on the pilot's control panel to obtain a suitable video level.

23. BEACON light . . . . . FLASHING
    BEACON light on IARM should flash once per second.

24. DF POWER switch . . . . . STBY

Bombardier/Navigator's Control Panel

25. XMIT/SIL switch . . . . . SIL

26. Search radar power switch . . . . . STBY

TRIM Control Panel:

27. OSP NORM/OVRD switch . . . . . OVRD

28. OSP power switch . . . . . FWD

29. TV power switch . . . . . ON

Bombardier/Navigator's Control Panel:

30. Display selector switch . . . . . TRIM (RIGHT)

31. Display select button . . . . . TEST
    Observe a test pattern on IARM

32. Display zoom . . . . . CHECK

    a. DIS ZOOM button . . . . . DEPRESS
    Observe that center set of bars on IARM test pattern is expanded 2:1, demonstrating a 1000- line resolution capability on IARM.

CONTINUED ON NEXT PAGE

A-6C PREFLIGHT—CONTINUED

b. ZOOM light . . . . . ON

c. DIS ZOOM button . . . . . DEPRESS
Observe that test pattern returns to normal

d. ZOOM light . . . . . OUT

33. TV/IR BRIGHTNESS and CONTRAST controls . . . . . ADJUST
Adjust for an optimum display on IARM.

Pilot's Control Box

34. VDI selector button . . . . . TEST

35. VDI BRIGHTNESS and CONTRAST controls . . . . . ADJUST
Adjust for an optimum display on VDI.

36. Inverted T positioning . . . . . CHECK

a. Enter GLIDE PATH N03000 ALT on keyboard.
Note that inverted T moves vertically from zero position.

b. Enter GLIDE PATH N00000 on keyboard.
Note that inverted T returns to zero.

37. VDI selector button . . . . . TV
Observe a television display on VDI.

Bombardier/Navigator's Control Panel

38. Display selector button . . . . . TV
Observe a television display on IARM.

TRIM Control Panel:

39. IR HOT light . . . . . OUT

40. IR power switch . . . . . ON

Note

IR cool-down normally requires 30 minutes. The IR HOT light will remain on until cool-down is completed. The IR power switch may not be set to ON until the light is out.

Bombardier/Navigator's Control Panel

41. Display select button . . . . . IR BLK
Observe a display of IR targets with hot targets black.

42. IR GAIN control . . . . . ADJUST
Adjust for optimum display of IR targets.

Indicator Azimuth Range Multisensor:

43. IR BLK light . . . . . ON

TRIM Control Panel:

44. IR INTENSITY control . . . . . ADJUST
Adjust for optimum IR video contrast.

CONTINUED ON NEXT PAGE

A-6C PREFLIGHT – CONTINUED

45. TV/IR elevation marker brightness control . . . . . ADJUST
    Adjust for a suitable brightness at elevation marker on left side of IARM display.

46. IR reticle brightness control . . . . . ADJUST
    Adjust for a suitable brightness of reticle.

47. Display select button . . . . . IR WHT
    Observe a display of IR targets with hot targets white.

Indicator Azimuth Range Multisensor:

48. IR WHT light . . . . . ON

Pilot's Control Box

49. VDI selector button . . . . . IR
    Observe an IR display on VDI.

50. VDI BRIGHTNESS/CONTRAST controls . . . . . ADJUST
    Adjust for an optimum display on VDI.

Bombardier/Navigator's Control Panel

51. IR ZOOM button . . . . . DEPRESS
    Observe change to narrow field of view and 4:1 magnification on IARM and VDI.

52. IR FOCUS switch . . . . . ADJUST
    Adjust for a sharp display on IARM and VDI.

Note

- The IR FOCUS switch functions only when IR ZOOM has been selected.
- The focus of the IR ZOOM optics is more easily adjusted before takeoff.

Indicator Azimuth Range Multisensor:

53. IR ZOOM light. . . . . ON

Bombardier/Navigator's Control Panel

54. IR ZOOM button . . . . . DEPRESS
    Observe that display returns to wide field of view and IR ZOOM light goes out.

55. Display selector switch . . . . . RADAR (LEFT)

Pilot's Control Box

56. VDI selector button . . . . . CONT ANALOG

TRIM Control Panel:

57. IR power switch . . . . . STBY
58. TV power switch . . . . . OFF
59. Optical platform power switch . . . . . STOW/OFF
60. Optical platform NORM/OVRD switch . . . . . NORM

CONTINUED ON NEXT PAGE

A-6C PRETAKEOFF PROCEDURES

1. OSP indication . . . . . STOWED

A-6C AIRBORNE

AFTER TAKEOFF PROCEDURES

1. Optical platform power switch . . . . . FWD

Note

When switching from STOW/OFF to FWD there is a 14-second time delay before the turret will rotate to the front. An additional 14 seconds are required for the stowpins to extend.

2. TV power switch . . . . . ON

CAUTION

Do not operate the LLL-TV with the sensor pointing into an intense light source.

3. IR HOT light . . . . . OUT

Note

The IR HOT light on the TRIM control panel should go out after the FLIR system has been in STBY for approximately 30 minutes.

4. IR power switch . . . . . ON
   Do not turn the IR on if the IR HOT light is on.
5. Optical platform power switch . . . . . OPERATE

Note

When switching from FWD to OPERATE, there is a 40-second time delay before the turret can be slewed in azimuth and elevation.

A-6C BEFORE LANDING

1. TV power switch . . . . . OFF
2. IR power switch . . . . . STBY
3. OSP power switch . . . . . STOW/OFF

A-6C IN CHOCKS

1. IR power switch . . . . . OFF
2. TV/IR cooling switch . . . . . OFF

CAUTION

Do not operate the TV or IR or the TRIM pod environmental control system on the ground without engines running and aircraft air conditioning on or external air conditioning applied to the pod.

ASN-31 INERTIAL PLATFORM ALIGNMENT

GROUND ALIGNMENT (COMPASS IN) A-6A, B, C

1. Platform selector button . . . . . STBY (5 MIN)
2. MA-1 compass . . . . . SYNC AND SLAVE
3. COMPASS switch . . . . . IN
4. Doppler SILENT/XMIT switch . . . . . SILENT
5. Polar mode switch . . . . . AS REQUIRED
6. AUTO/MAN switch . . . . . MAN
7. Carrier HEAD/LAT/LONG/SPEED . . . . . SET
8. Local MAG VAR . . . . . SET
9. Platform selector button (start elapsed-time clock) . . . . . ALIGN
10. Monitor alignment on VDI, PLATFORM control panel indicator lights, and align progress meter.
11. Platform selector button . . . . . OPER

Note

- To ensure normal alignment operation of the inertial navigation system, a minimum of 5 minutes warmup is required in the STBY position. For cold weather, allow 10 minutes for warmup.
- The FINE ALIGN light should go on approximately 1 minute after selecting ALIGN. If alignment was started with the COMPASS switch at OUT, select IN or MAG/VGI before gyro-compassing begins. This will shorten the time required for alignment; however, the COMPASS switch should be kept at OUT when gusty winds or buffeting of the aircraft occur.

GROUND ALIGNMENT (COMPASS OUT) A-6A, B, C

1. Platform selector button . . . . . STBY (5 MIN)
2. COMPASS switch . . . . . OUT
3. Doppler SILENT/XMIT switch . . . . . SILENT
4. Polar mode switch . . . . . AS REQUIRED
5. AUTO/MAN switch . . . . . MAN
6. Carrier HEAD/LAT/LONG/SPEED . . . . . SET
7. Local MAG VAR . . . . . SET
8. Platform selector button (start elapsed-time clock) . . . . . ALIGN

CONTINUED ON NEXT PAGE

ASN-31 INERTIAL PLATFORM ALIGNMENT—CONTINUED

9. Monitor alignment on VDI, PLATFORM control panel indicator lights, and align progress meter.

10. Platform selector button . . . . . OPER

PRE-SET ALIGNMENT A-6A, B, C, E

Provided the aircraft has not been moved and the COMPASS switch has not been in MAG/VGI:

1. Platform selector button . . . . . STBY (5 MIN)
2. Platform selector button . . . . . PRESET ALIGN
   (Update erection controller if necessary)
3. FINE ALIGN and READY lights . . . . . LIT
4. Platform selector button . . . . . OPER

IN-FLIGHT ALIGNMENT (FULL TERM, COMPUTER ON) A-6A, B, C

Note

In-flight alignment is not available with a failure of the left weight-on-wheels switch.

The following checks should be made prior to commencing an in-flight alignment:

1. Computer is navigating correctly with Doppler or velocity-correct inputs (Doppler preferred).
2. Platform selector button . . . . . STBY
3. Auto pilot . . . . . OFF
4. Compass switch . . . . . MAG/VGI
5. MA-1 compass . . . . . SYNC
6. Man/auto switch . . . . . MAN
7. Polar/norm switch . . . . . NORM
8. MAG VAR . . . . . LOCAL VARIATION SET
9. Norm/gyrocomp switch . . . . . NORM

CONTINUED ON NEXT PAGE

ASN-31 INERTIAL PLATFORM ALIGNMENT—CONTINUED

10. Auto pilot . . . . . ON
11. Erection controller panel . . . . . .UPDATE LAT, LONG, CARR HEAD AND SPEED (÷10)
    Carrier heading is aircraft true heading, speed is aircraft groundspeed in 10-knot increments.
12. Navigation mode selector . . . . . EMER DOP or DR
13. Platform selector button . . . . . IN-FLIGHT ALIGN (START ELAPSED-TIME CLOCK)
    Observe fine align light after 55 seconds. Observe align progress meter to null shortly thereafter, indicating that platform heading is slewed to MA-1 compass. Observe Doppler and inertial velocities to converge after approximately 5 minutes.
14. Erection controller panel . . . . . UPDATE LAT & LONG
15. Autopilot . . . . . OFF
16. Compass switch . . . . . IN
17. Navigation select switch . . . . . .INERL
    Check VDI for proper attitude display and DVI compass rose for approximate true heading and monitor velocities in right-hand unit until readout dials (data position).
18. Auto pilot . . . . . ON
19. Norm/gyrocomp switch . . . . . GYROCOMP
    Fine align and ready light will go out. Alignment will be indicated after approximately 20 minutes by a null indication on align progress meter, stable inertial velocities, proper VDI attitude, and DVI compass rose approximating true heading.

Note

Platform azimuth alignment is suspended (SA) when the aircraft turns at a rate of 30°/minute or when the Doppler is in XMIT and memory. SA causes the align progress meter to null.

20. Present position . . . . . CORRECT
21. Platform selector switch . . . . . .OPER

IN-FLIGHT ALIGNMENT (SHORT TERM COMPUTER ON) A-6A, B, C

For a short-term computer on inflight alignment, perform steps 1 through 17 of the procedure for full-term alignment and the following two steps:

18. Update computer present position.
19. Platform selector button . . . . . OPERATE

Note

- Platform level should be accurate and the velocities and heading information will be only as accurate as the MA-1 compass and the MAGVAR setting.
- A computer-off alignment is accomplished by following the same procedures as those listed above for a computer-on alignment.
- A computer-off alignment will provide attitude reference only.
- Prior to selecting OPER, the VDI should be monitored to check the progress of the platform leveling.

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ASN-31 INERTIAL PLATFORM ALIGNMENT—CONTINUED

GROUND ALIGNMENT (COMPASS IN) A-6E

1. Platform selector button . . . . . STBY (5 MIN MINIMUM)
2. ATTITUDE REF switch . . . . . COMP IN
3. CNI MASTER switch (AFC No. 269 incorporated) . . . . . MA-1 ONLY
4. MA-1 compass selector switch . . . . . SLAVED (3 MIN MINIMUM)
5. ALIGN switch . . . . . OFF
6. Polar mode switch . . . . . AS REQUIRED
7. AUTO/MAN switch . . . . . MAN
8. Carrier HEAD/LAT/LONG/SPEED . . . . . SET
9. Local MAG VAR . . . . . SET
10. MA-1 compass . . . . . SYNC
11. VDI selector button . . . . . CONT ANALOG
12. Platform selector button (start elapsed-time clock) . . . . . ALIGN
13. Monitor alignment on VDI. PLATFORM control panel indicator lights, and align progress meter.
14. Platform selector button . . . . . OPERATE

Note

- To insure normal alignment operation of the inertial navigation system, a minimum of 5 minutes warmup is required in the STBY position. For cold weather, allow 10 minutes for warmup.
- The fine align light should go on approximately 1 minute after selecting ALIGN. If alignment was started with altitude reference switch at COMP OUT, select COMP IN or MAG VGI before gyro compassing begins. This will usually shorten the time required for alignment; however, the attitude reference switch should be kept at COMP OUT when gusty winds or buffeting of the aircraft occurs.

GROUND ALIGNMENT (COMPASS OUT) A-6E

1. Platform selector button . . . . . STBY (5 MIN MINIMUM)
2. ATTITUDE REF switch . . . . . COMP OUT
3. ALIGN switch . . . . . OFF
4. Polar mode switch . . . . . AS REQUIRED
5. AUTO/MAN switch . . . . . MAN
6. Carrier HEAD/LAT/LONG/SPEED . . . . . SET
7. Local MAG VAR . . . . . SET

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ASN-31 INERTIAL PLATFORM ALIGNMENT—CONTINUED

8. Platform selector button (start elapsed-time clock) . . . . . ALIGN

9. Monitor alignment on VDI, PLATFORM control panel indicator lights, and align progress meter.

10. Platform selector button . . . . . OPERATE

IN-FLIGHT ALIGNMENT (FULL TERM, COMPUTER ON) A-6E

1. Computer is navigating correctly with Doppler or velocity-correct inputs (Doppler preferred).

2. Platform button . . . . . STBY

3. Auto pilot . . . . . STAB AUG OR OFF

4. ATTITUDE REF switch . . . . . MAG/VGI

5. MA-1 compass . . . . . SYNC

6. Erection controller MAN/AUTO switch . . . . . MAN

7. MAG VAR . . . . . LOCAL VARIATION SET

8. ALIGN switch . . . . . OFF

9. Autopilot . . . . . AUTO

10. Erection controller panel . . . . . UPDATE LAT, LONG, CARR HEAD, AND SPEED (±10)
Carrier heading is aircraft true heading, speed is aircraft groundspeed in 10-knot increments.

11. Navigation mode selector . . . . . EMER DOP OR DR

12. Platform button . . . . . ALIGN (START ELAPSED-TIME CLOCK)
Observe fine align light after 55 seconds. Observe align progress meter to null shortly thereafter, indicating that platform heading is slewed to MA-1 compass. Observe Doppler and inertial velocities to converge after approximately 5 minutes.

13. Erection controller panel . . . . . UPDATE LAT & LONG

14. Autopilot . . . . . STAB AUG OR OFF

15. ATTITUDE REF switch . . . . . COMP IN

16. Navigation select switch . . . . . INERL
Check VDI for proper attitude display and DVRI compass rose for approximate true heading; monitor velocities in digital display unit readout dials (data position).

17. Autopilot . . . . . AUTO

18. ALIGN switch . . . . . GYROCOMP
Fine align and ready light will go out. Alignment will be indicated after approximately 20 minutes by a null indication on align progress meter, stable inertial velocities, proper VDI attitude, and DVRI compass rose approximating true heading.

Note

Platform azimuth alignment is suspended (SA) when the aircraft turns at a rate of 30°/minute or when the Doppler is on and in memory. SA causes the align progress meter to null.

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ASN-31 INERTIAL PLATFORM ALIGNMENT—CONTINUED

19. Computer present position . . . . . UPDATE

20. Platform selector switch . . . . . OPER

IN-FLIGHT ALIGNMENT (SHORT TERM, COMPUTER ON) A-6E

For a short-term, computer-on in-flight alignment, perform steps 1 through 16 of the procedure for full-term alignment and the following two steps:

21. Update computer present position

22. Platform selector button . . . . . OPER

Note

- Platform level should be accurate and the velocities and heading information will only be as accurate as the MA-1 compass and the MAGVAR setting.
- A computer-off alignment is accomplished by following the same procedures as those listed above for a computer-on alignment.
- A computer-off alignment will provide attitude reference only.
- Before selecting OPER, the VDI should be monitored to check the progress of the platform leveling.

ASN-92 INERTIAL MEASUREMENT UNIT ALIGNMENT

IMU GROUND ALIGNMENT

Note

Before commencing IMU alignment, check the following preconditions:

- HDG SEL switch - CMD TRUE or CMD MAG
- SINS DATA switch - OFF
- VDI - ON, CONTACT ANALOG
- Computer - ON: PRESENT POSITION LATITUDE, LONGITUDE, ALTITUDE ENTERED

1. MODE selector button . . . . . ALIGN
   Note ALIGN light on.

Note

While ALIGN is selected, the VDI PLATFORM light flashes, the landing mode pathway is displayed, the steering symbol and target symbol display the characteristic alignment program motion, and the optical sight moving reticle moves in a 25-mil circle about the fixed reticle.

SLOW PLAT LITE FIRST 4 SEC (UNTIL IMU READY SIGNAL)

2. Monitor:
   - Elapsed time in DDU window A1 & PAIP TIME
   - ~~Alignment progress in DDU window A8 and on ADF needle of HSI~~
   - Heading in G/S/LONGITUDE window
   - IMU pitch angle in DDU window B2
   - IMU roll angle in DDU window B4
3. INS and breakaway lights . . . . . ON
   The INS and the breakaway lights will come on along with the ALIGN light within 10 minutes, indicating completion of alignment. The INS light will come on in approximately 1 1/2 minute. OPER may be selected at that time, however, remaining in ALIGN until there is a null ~~of the HSI ADF needle~~ IN HEADING will improve the alignment.
4. MODE selector button . . . . . OPER
   Note that ALIGN and INS lights go off.

Note

- If it is necessary to move the aircraft before completion of the alignment (INS light on), select OPER. This will light the TAXI light and suspend the alignment. When the aircraft is parked, the alignment can be recommenced by selecting ALIGN.
- The INS light will flash if the navigation mode selector switch is in a position other than INERL.

CONTINUED ON NEXT PAGE

ASN-92 INERTIAL MEASUREMENT UNIT ALIGNMENT—CONTINUED

IMU IN-FLIGHT ALIGNMENT

1. Computer is navigating correctly with updated present position and velocity correct or Doppler inputs.
2. MODE selector button . . . . . OFF (IF GYRO CAGING REQUIRED)
3. Autopilot . . . . . STAB AUG OR OFF
4. ATTITUDE REF switch . . . . . MAG/VGI
5. Local MAG VAR . . . . . SET
6. Autopilot switch . . . . . AUTO
7. Navigation mode selector switch . . . . . DR (OR EMER DOP)
8. MODE selector button . . . . . ALIGN
   Note that ALIGN light comes on after 45 seconds.
9. INS light . . . . . ON
   The INS light will come on after leveling is complete (approximately 4 minutes).
10. MODE selector button . . . . . OPER
11. Navigation mode selector switch . . . . . INERL
12. ATTITUDE REF switch . . . . . COMP IN

FIXED TARGET GROUND/DISCRETE LOCK-ON TRACKING A-6A,B,C

Note

Those aircraft not incorporating AVC No. 523 (-11 DPU) should perform a track radar optical tracking (TROT) calibration check before using the ground lock-on mode of operation to ascertain the accuracy of the track radar in this mode.

1. Track radar DISPLAY/TRACK/BORESIGHT switch . . . . . DISPLAY
2. Track radar power switch . . . . . ON
3. Track radar mode selector switch . . . . . SELECT A TRACK RADAR DISPLAY ON PHD

Note

If lock-ons are to be attempted, it is recommanded that the track radar be operated in a display mode for a minimum of 5 minutes before attempting a lock-on.

4. Sync set . . . . . CHECK
5. Locate fixed target on search radar in PPI 30.
6. Slew control . . . . . POSITION CURSORS OVER TARGET
7. ARE 50/25 . . . . . SELECT (IF DESIRED)

CONTINUED ON NEXT PAGE

FIXED TARGET GROUND/DISCRETE LOCK-ON TRACKING A-6A,B,C—CONTINUED

8. Fixed/moving target switch . . . . . FIXED

9. Track radar tone volume control . . . . . ADJUST

10. Display/track/boresight switch . . . . . TRACK

11. Search radar track switch (RTT) . . . . . ON

12. Dislodge switch . . . . . DISLODGE

13. Track radar antenna . . . . . POSITIONED AUTOMATICALLY
The track radar antenna should be automatically positioned in azimuth and elevation; however, small adjustments with elevation slew switch may be necessary to obtain a ground lock-on (GLO) light. A valid GLO is achieved when both GLO light and TRACK light are lit and steady.

If lock-on does not occur:

14. Track radar power switch . . . . . CYCLE
Cycle switch from ON to STBY to ON. If there is still no GROUND LOCK light, and TRACK light is on, search-radar-derived altitude data are valid. Proceed, using search radar tracking procedures.

When lock-on is acquired:

15. Tone . . . . . B/N WILL HEAR 1200-CYCLE TONE

16. GROUND lock-on and TRACK lights . . . . . LIT

17. Fixed/moving target switch . . . . . MOVING

18. Velocity correct until target walk-down begins.

Note

If excessive steering wander is noted on the VDI, moving the velocity correct switch to MEMORY POINT will improve steering by added filtering.

If discrete lock-on is desired:

19. Dislodge switch . . . . . AFT

20. DISCRETE and GROUND lock-on and TRACK lights . . . . . LIT

21. Slew grip . . . . . SLEWING IS INHIBITED, CURSORS AUTOMATICALLY TRACK TARGET

To break lock if a new target acquisition is desired:

22. Dislodge switch . . . . . FORWARD

23. Slew grip . . . . . ACTIVATE AND REPOSITION CURSORS OVER DESIRED TARGET

24. Dislodge switch . . . . . AFT

25. DISCRETE and GROUND lock-on and TRACK lights . . . . . LIT

MOVING TARGET DETECTION AND ACQUISITION A-6A

1. Search radar display button . . . . . PPI
2. Search sweep range . . . . . 15 NMI
3. Navigation mode selector button . . . . . AS DESIRED
4. Trigger switch . . . . . PRIMARY
5. Antenna pattern . . . . . ADJUST FOR MAXIMUM RETURN
6. Scan angle . . . . . SET ±30.
7. Scan rate switch . . . . . SLOW
8. STC controls . . . . . AS REQUIRED
9. Receiver gain control . . . . . FULL CW
10. AMTI control . . . . . CW FOR OPTIMUM DISPLAY
    Rotating control just out of detent provides maximum cancellation of stationary targets. If display was good before turning AMTI on, no further control adjustments should be necessary, beyond setting AMTI control for an optimum display.

MOVING TARGET DISCRETE LOCK-ON AND TRACKING A-6A

1. Fixed/moving target switch . . . . . MOVING
2. Track radar power switch . . . . . ON
3. Sync set . . . . . CHECK
4. NAV mode selector button . . . . . UNSTAB NO STEER
5. Locate moving target on search radar.
6. Slew control . . . . . CURSORS OVER MOVING TARGET
7. Computer steering mode button . . . . . OPPORT TGT
8. ARE 50/25 . . . . . SELECT (IF DESIRED)
9. Display/track/boresight switch . . . . . TRACK

CONTINUED ON NEXT PAGE

MOVING TARGET DISCRETE LOCK-ON AND TRACKING A-6A–CONTINUED

10. Track radar antenna . . . . . AUTOMATICALLY POSITIONED IN AZIMUTH AND ELEVATION.
    Small adjustments with elevation slew switch may be necessary to obtain a lock-on.

11. Slew grip . . . . . MANEUVER CURSORS UNTIL MOVING SIGNAL IS DETECTED
    Moving target signal is audible in headset.

12. DISCRETE lock-on and TRACK lights . . . . . LIT
    Monitor moving target velocity in right-hand unit.

13. Slew grip . . . . . SLEWING IS INHIBITED, CURSORS AUTOMATICALLY TRACK TARGET, MOVING TARGET AUDIO SIGNAL WILL BE STRONG IN HEADSET

To break moving target lock-on:

14. Dislodge switch . . . . . DISLODGE

15. Slew grip . . . . . ACTUATE AND REPOSITION CURSORS OVER DESIRED TARGET

16. Dislodge switch . . . . . AFT

17. DISCRETE and GROUND lock-on and TRACK lights . . . . . LIT

SEARCH RADAR TRACKING PROCEDURES (RTT) A-6A

1. Locate target on search radar in PPI 30

2. Slew control . . . . . POSITION CURSORS OVER TARGET

3. TRACK light . . . . . ON
   TRACK light goes on to indicate that search radar is providing valid target data.

4. ARE 50/25 . . . . . SELECT
   For best accuracy, ARE 25 should be used.

5. Track radar power switch . . . . . STBY OR OFF

6. S/R track switch . . . . . ON

CONTINUED ON NEXT PAGE

SEARCH RADAR TRACKING PROCEDURES (RTT) A-6A–CONTINUED

7. Velocity correct on run to target.

Note

Velocity corrects should not be made after target starts to walk down the display; however, cursor positioning may be improved with the memory point switch at OFF SAVE down to 9,000 feet range to target.

VELOCITY CORRECT PROCEDURES A-6A,B,C

AUTOMATIC CALCULATION OF VELOCITY ERROR

Automatic velocity correct is performed whenever a discrete lock-on is obtained provided that the velocity correct switch is in the MEMORY POINT position. Corrected velocity will stabilize in 12 to 18 seconds.

SEARCH RADAR OR GROUND LOCK-ON TRACKING ONLY

1. Position search radar cursors centered on target in azimuth and just below target in range.

2. Observe cursors for drift for a minimum of 10 seconds

3. Velocity correct switch . . . . . MEMORY POINT

4. Slew control . . . . . ACTIVATE
   Utilizing slew grip, reposition cursors over target. Repeat as necessary to cancel drift within 120 second time span.

5. Velocity correct switch . . . . . OFF SAVE
   Stop velocity correct procedure at target walk down

TRACK RADAR OPTICAL TRACKING (TROT) PROCEDURE (P-7B TRIM)

Overall system tracking accuracy may be determined by making use of the movable reticle of the pilot's optical sight.

1. Acquire a ground lock on a target identifiable both with search radar and visually.

2. Slave pilot's optical sight movable reticle to track radar antenna by depressing pilot's attack commit trigger to the first detent.

3. Establish aircraft in a stable glide so that movable reticle is about 50 miles below fixed reticle.

4. As target becomes visible, read position of movable reticle with respect to target.

Note

- Any mil error in azimuth or elevation should be noted and reported at system debrief.
- Any cursor drift would normally be due to system velocity errors.

CONTINUED ON NEXT PAGE

COMPUTER OPTICAL POSITIONING (COP) PROCEDURE (P-8.6)

1. B/N: Position radar cursors on a visually recognizable target in desired tracking mode.

2. Pilot; Depress attack commit trigger to first detent and observe position of optical sight movable reticle in relation to target.

Note

If a COP check is performed on the ground, only azimuth indications are valid.

BORESIGHT MODE

P-7B TRIM

If possible, a velocity-correct should be accomplished within 10 minutes of the time a boresight attack is to be made.

1. Release mode switch . . . . . AUTO
2. Track radar power switch . . . . . STBY
3. Fixed/moving target switch . . . . . MOVING
4. PHD power switch . . . . . ON
5. Optical sight fixed and movable reticles . . . . . ON
6. Optical sight switch . . . . . AUTO
7. Display/track/boresight switch . . . . . BORESIGHT
8. Target altitude . . . . . ENTER
9. Flight mode selector button . . . . . BASE NO AP, PRES TGT NO AP, OR OPPORT TGT
10. Attack mode selector button . . . . . GENERAL OR STRAIGHT
    A general attack with a dive toss release is recommended since it is not required to level off immediately after uncaging to obtain an in-range indication. A straight path attack requires a pitch-up to a more level attitude immediately after uncaging to obtain in-range.
11. G select button 4G
12. Station select switches . . . . . AS DESIRED
13. Fuzing . . . . . AS BRIEFED
14. MASTER ARM switch . . . . . ON
15. Dislodge switch . . . . . DISLODGE
16. Range and azimuth cursor . . . . . PLACE IN TARGET AREA
17. Track radar power switch . . . . . ON
    Ground lock-on should occur automatically as aircraft approaches target. Attack may be be completed on keyboard information if ground lock-on is not acquired.

CONTINUED ON NEXT PAGE

BORESIGHT MODE–CONTINUED

18. Fixed reticle . . . . . PLACE ON TARGET
Pilot maneuvers aircraft into a dive, positioning fixed reticle on target or follows steering to align aircraft with predicted target position as shown by movable reticle. Positioning of movable reticle may be updated by momentarily uncaging, then caging again with fixed reticle on target if range to target is less than 48,000 feet.

Note

Reticle alignment should be maintained for a minimum of 1 second above uncaging.

19. Uncage boresight button . . . . . DEPRESS
Null azimuth steering error. B/N call slant range to pilot.

20. Attack commit trigger . . . . . DEPRESS

21. Automatic release . . . . . OBSERVE
Observe indications of automatic weapon release.

Note

In aircraft incorporating AVC No. 523 (-11 DPU), when making a boresight attack on a waterborne target, the track radar should be detuned for zero crystal current if the sea state is smooth.

(P-8.6)

If possible, a velocity-correct should be accomplished within 10 minutes of the time a boresight is to be made. Present position should be checked and updated as necessary.

1. Release mode switch . . . . . AUTO
2. Track radar POWER switch . . . . . STBY
3. FIXED/MOVING switch . . . . . AS DESIRED
4. PHD power switch . . . . . ON
5. Optical sight fixed and movable reticles . . . . . ON
6. Optical sight mode switch . . . . . AUTO
7. DISPLAY/TRACK/BORESIGHT switch . . . . . BORESIGHT
8. Target altitude . . . . . ENTER
9. NAV MODE selector button . . . . . BASE NO AP, PRES TGT NO AP, OR OPPORT TGT
10. ATTACK mode selector button . . . . . GENERAL OR STRAIGHT
GENERAL is recommanded with a dive toss release.
11. G select button 4G
12. Station select switches . . . . . AS BRIEFED
13. Fuzing . . . . . AS BRIEFED
14. MASTER ARM switch . . . . . ON
15. Dislodge switch . . . . . DISLODGE
16 Range and azimuth cursors . . . . . PLACE IN TARGET AREA
17. Track radar POWER switch . . . . . ON
18. Prior to roll-in . . . . . STEP INTO ATTACK
19. Movable reticle . . . . . PLACE ON TARGET
Pilot maneuvers into a dive, positioning the movable reticle over target. When moving reticle is on target, pilot should move commit trigger to commit position, pausing momentarily at COP position.

CONTINUED ON NEXT PAGE

BORESIGHT MODE – CONTINUED

20. Attack commit trigger . . . . . DEPRESSED

21. Automatic release . . . . . OBSERVE
B/N should call altitude and track radar information to pilot throughout run.

TRACK RADAR DISPLAYS A-6A,B,C

E-SCAN

1. PHD power switch . . . . . ON
2. Display/track/boresight switch . . . . . DISPLAY
3. Pilot's horizontal display mode selector switch . . . . . E-SCAN
4. Track radar power switch . . . . . ON
5. Clearance switch . . . . . AS DESIRED
6. Range marker brightness controls . . . . . AS DESIRED
7. Clearance range markers . . . . . ADJUST
8. Flight line control . . . . . ADJUST
9. Track receiver gain control . . . . . ADJUST
10. MRI control . . . . . ADJUST
11. Display scale miles switch . . . . . 5 or 10

TCPPI

1. PHD power switch . . . . . ON
2. Display/track/boresight switch . . . . . DISPLAY
3. Pilot's horizontal display mode selector switch or . . . . . TCPPI
B/N's display selector button
4. Track radar power switch . . . . . ON
5. Display scale miles switch . . . . . 5 or 10
6. Track receiver gain control . . . . . ADJUST
7. MRI control . . . . . ADJUST
8. Range marker brightness control . . . . . AS DESIRED

EMERGENCY SEARCH

1. PHD power switch . . . . . ON
2. Pilot's horizontal display mode selector switch . . . . . SRCH
3. Display/track/boresight switch . . . . . DISPLAY

CONTINUED ON NEXT PAGE

TRACK RADAR DISPLAYS A-6A,B,C—CONTINUED

4. Bombardier/navigator's display selector button . . . . . EMER SRCH
5. Track radar power switch . . . . . ON
6. Display scale miles switch . . . . . 5 or 10
7. Track receiver gain control . . . . . ADJUST
8. MRI control . . . . . ADJUST
9. Elevation slew switch . . . . . ADJUST TO CONTROL ELEVATION ANGLE

ATTACK PROCEDURES A-6A,B,C

Note

The attack procedures below are only those required to execute the attack selected, and must be used in conjunction with the procedures for the use of multiple release and for the release of weapons from multiple ejector racks and triple ejector racks.

LAB IP ATTACK PROCEDURES

At any point en route to the initial point (IP), the following settings may be accomplished:

1. Attack mode selector button . . . . . LAB IP
2. Station select switches . . . . . AS DESIRED
3. Fuzing . . . . . AS BRIEFED
4. Release mode switch . . . . . AUTO
5. SALVO/TRN/STEP switch . . . . . SALVO
   Placing SALVO/TRN/STEP switch in SALVO will release all selected weapons simultaneously.
6. Intervalometer/timer . . . . . SET
7. MASTER ARM switch . . . . . ON

When aircraft is over initial point (IP), perform the following procedures:

8. Pilot depress and hold commit switch. This starts timer counting down. When timer reaches zero, bomb tone comes, pilot starts 4-g pullup. Store is automatically released at preset angle. At release, bomb tone goes off and station selector flag drops.

LAB TGT ATTACK PROCEDURES

At any point enroute to the target, the following settings may be accomplished:

1. Attack mode selector button . . . . . LAB TGT
2. Station select switches . . . . . AS DESIRED
3. Fuzing . . . . . AS BRIEFED
4. Release mode switch . . . . . AUTO

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C–CONTINUED

5. SALVO/TRN/STEP switch . . . . . SALVO

6. Intervalometer/timer . . . . . SET AS BRIEFED

7. MASTER ARM switch . . . . . ON

When aircraft is over target, perform the following procedures:

8. Pilot depress and hold commit switch - Begin 4-g pullup. Store is automatically released at preset angle and station selector flag drops.

Note

Bomb tone comes on when timer reaches zero or the pilot commits, as applicable, and goes off when the weapon is released.

ROCKET ATTACK PROCEDURES

At any point en route to the target, the following settings may be accomplished:

1. Attack mode selector button . . . . . ROCKET

2. Station select switches . . . . . ROCKET

3. Release mode switch . . . . . AUTO

4. SALVO/TRN/STEP switch . . . . . AS DESIRED

5. Rocket mode switch . . . . . RPPL or SNGL (AS DESIRED)
   Placing switch to RPPL permits release power to be applied to selected aircraft stations along ripple fire line. Placing switch to SNGL permits release power to be applied to selected aircraft stations along single fire line. RESET position controls operation of weapon release relay, resetting it for a new release cycle.

Note

Unless the jumper cable is installed when a rocket launcher with a stepping switch is loaded, improper use of the rocket mode switch may result in the inadvertent firing of a rocket. Place the MASTER ARM switch to OFF before selecting either RPPL or SNGL.

6. MASTER ARM switch . . . . . ON

7. Attack or uncage button . . . . . DEPRESS
   Depressing attack button on slew grip or uncage button on stickgrip places computer in attack mode.

8. Reselect light . . . . . OFF
   Check that RESELECT light is off. If light comes on, it indicates that no attack solution can be generated because of some incompatible setting of armament switches.

9. Attack light . . . . . ON
   If attack light remains off, it indicates that ballistics computer has not entered attack mode.

10. In-range lights . . . . . ILLUMINATE AT MAXIMUM RANGE

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C—CONTINUED

11. Zero steering both horizontally and vertically.

Note

Release is obtained by the pull-through or line-up techniques. See NAVAIR 01-85ADA-1T.

12. Attack commit trigger . . . . . DEPRESS
When pilot depresses attack commit trigger on his control stick, it informs ballistic computer to fire if within in-range limits and within ±8 mils vertically of electronic center of VDL

Note

- It is possible to commit out of range.
- When firing rockets, there will be a flag drop with ripple fire, and no flag drop on a single fire. The ripple position of the rocket mode switch uses one computer release pulse to fire rockets at the ripple rate of the package and the system must be reset after each firing.
- After a rocket attack, ensure that the MASTER ARM switch is OFF prior to deselecting the weapon station. Turning the station select switch OFF with the MASTER ARM switch ON may result in the inadvertent jettison of the rocket pod.
- For the release of empty rocket launchers or CBU's from MER/TER, set the station-select switch to BOMBS, and release the units as if they were bombs.
- Vertical steering must be nulled to ±4 mils on the electronic center of the VDL

HI LOFT ATTACK PROCEDURES

At any point en route to the target, the following settings may be made.

1. Attack mode selector button . . . . . HI LOFT
2. Station-select switches . . . . . AS DESIRED
3. Fuzing . . . . . AS BRIEFED
4. Release mode switch . . . . . AUTO
5. G select buttons. . . . . DESIRED G
6. SALVO/TRN/STEP switch . . . SALVO
Placing SALVO/TRN/STEP switch in SALVO will release all selected weapons simultaneously.
7. MASTER ARM switch . . . . . ON

After steps 1 through 7 have been accomplished and the aircraft is within 25 nautical miles of the target, the following procedures must be accomplished:

8. Attack button . . . . . DEPRESS
Depressing attack button on slew grip places computer in attack mode.
9. Reselect light . . . . . OFF
Check that reselect light is off. If light comes on, it indicates that no attack solution can be generated because of some incompatible setting of armament switches.
10. Attack light . . . . . ON
If attack light remains off, it indicates that ballistics computer has not entered attack mode.
11. In-range lights . . . . . ON AT MAXIMUM RANGE - HI LOFT PULLUP POINT

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C–CONTINUED

12. Attack commit trigger . . . . . PILOT DEPRESS AND HOLD

13. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN WEAPON IS RELEASED

STRAIGHT PATH ATTACK PROCEDURES

At any point en route to the target, the following settings may be made.

1. Attack mode selector button . . . . . STRAIGHT
2. Station-select switches . . . . . AS DESIRED
3. Fuzing . . . . . AS BRIEFED
4. Release mode switch . . . . . AUTO
5. SALVO/TRN/STEP switch . . . . . AS DESIRED
6. Intervalometer timer . . . . . SET (AS DESIRED)
7. Release advance button . . . . . ENGAGED (AS DESIRED)

Note

Desired release advance should be reinserted into the ballistics computer before the attack run to insure that the computer is using the proper value.

8. Desired slant range at release . . . . . INSERTED
   Insert desired slant range at release in cruise altitude address with the altitude action key.
9. G select button . . . . . DEPRESS
   Selected g will be used for TDTA computations.
10. MASTER ARM switch . . . . . ON

After steps 1 through 10 have been accomplished and the aircraft is within 25 nautical miles of the target, the following procedures must be accomplished:

11. Attack button . . . . . DEPRESS
    Depressing attack button on slew grip places computer in attack mode.
12. Reselect light . . . . . OFF
    Check that reselect light is off. If light comes on, it indicates that no attack solution can be generated because of some incompatible setting of armament switches.
13. Attack light . . . . . ON
    If attack light remains off, it indicates that ballistics computer has not entered attack mode.
14. In-range lights . . . . . SHOULD LIGHT APPROXIMATELY 9 NMI BEFORE RELEASE
15. Attack commit trigger . . . . . PILOT DEPRESS AND HOLD
16. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN WEAPON IS RELEASED

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C–CONTINUED

GENERAL ATTACK PROCEDURES

1. Attack mode selector button . . . . . GENERAL
2. Station-select switches . . . . . AS DESIRED
3. Fuzing . . . . . AS BRIEFED
4. Release mode switch . . . . . AUTO
5. G select buttons . . . . . DESIRED G
6. SALVO/TRN/STEP switch . . . . . AS DESIRED
7. Intervalometer timer . . . . . SET (AS DESIRED)
8. Release advance button . . . . . ENGAGED (AS DESIRED)

Note

Desired release advance should be reinserted in the ballistics computer before the attack run to insure that the computer is using the proper value.

9. MASTER ARM switch . . . . . ON

After steps 1 through 9 have been accomplished and the aircraft is within 25 nautical miles of the target, the following procedures must be accomplished:

10. Attack button . . . . . DEPRESS
    Depressing attack button on slew grip places computer in attack mode.
11. Reselect light . . . . . OFF
    Check that reselect light is off. If light comes on, it indicates that no attack solution will be generated because of some incompatible setting of armament switches.
12. Attack light . . . . . ON
    If attack light remains off, it indicates that ballistics computer has not entered attack mode.
13. In-range lights . . . . . ON AT MAXIMUM RANGE LOFT PULLUP POINT
14. Attack commit trigger . . . . . PILOT DEPRESS AND HOLD
15. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN WEAPON IS RELEASED.

Note

- With conventional stores, the computer solves a low-loft release with a forced commit at 8°.
- With special weapons, the computer solves a low-loft and high-loft in that order.

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C–CONTINUED

SYSTEM LAYDOWN BOMBING PROCEDURES

At any point en route to the target, the following settings may be made:

1. Attack mode selector button . . . . . STRAIGHT
2. Station-select switches . . . . . AS DESIRED
3. Fuzing . . . . . AS BRIEFED
4. Release mode switch . . . . . AUTO
5. SALVO/TRN/STEP switch . . . . . AS DESIRED
6. Intervalometer timer . . . . . SET (AS DESIRED)
7. Auxiliary armament panel power selector switch . . . . . REL DELAY
8. Release delay . . . . . SET
   Set desired release delay on the auxiliary intervalometer timer.
9. MASTER ARM switch . . . . . ON

After steps 1 through 9 have been accomplished and the aircraft is at the selected commit point, the following procedures must be accomplished:

10. Attack commit trigger . . . . . PILOT DEPRESS AND HOLD
    Depressing commit trigger starts auxiliary intervalometer timer.
11. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN WEAPON IS RELEASED

    Weapon is automatically released at end of selected delay.

GUNNERY ATTACK PROCEDURES

At any point enroute to the target the following settings may be made:

1. Gun switch . . . . . READY
   Placing the switch to READY charges all the guns.
2. Station-select switches . . . . . ROCKETS/GUNS
   Set the desired station select switches to ROCKETS/GUNS. If BOMBS is selected on a station with a gun pod loaded, pod will be ejected when manual release button is depressed.
3. Optical sight AUTO/OFF/MAN switch . . . . . MAN
4. Optical sight movable reticle switch . . . . . OFF

When ready to begin the attack:

5. MASTER ARM switch . . . . . ON
6. Attack commit trigger . . . . . DEPRESS
   When lined up on target, depress attack commit trigger to fire guns.

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C—CONTINUED

Note

Firing or clearing the guns will not produce a flag drop indication.

Just before landing or when ready to secure guns (weight must be off wheels):

7. MASTER ARM switch . . . . . OFF
8. Gun switch . . . . . CLEAR, then SAFE

CAUTION

Moving the gun pod switch to the momentary CLEAR position renders the guns inoperative for the remainder of the flight. Do not select READY after selecting CLEAR, as this will result in a jam of the ammunition belt links.

MINING PROCEDURES (P-7B TRIM)

1. Attack mode selector button . . . . . STRAIGHT
2. Station-select switches . . . . . BOMBS
3. Release mode switch . . . . . AUTO
4. SALVO/TRN/STEP switch . . . . . STEP
5. Rocket mode switch. . . . . SNGL
6. Shrike intervalometer or auxiliary intervalometer/timer. . . . . SET
   Set desired interval less 1.5 second.
7. Multiple release quantity select switch . . . . . OFF

Note

With mining mode selected, the multiple release quantity select switch must always be at OFF to get the desired releases.

8. Shrike power switch . . . . . ON
   or
   Power selector switch . . . . . SHRIKE
9. MASTER ARM switch . . . . . ON
10. Mining mode . . . . . SELECT
    a. Aircraft with Shrike panel:
       Target reject button . . . . . DEPRESS
    b. Aircraft with auxiliary armament panel:
       Shrike mode switch . . . . . REJECT, THEN NORM

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C–CONTINUED

11. Attack commit trigger . . . . . PILOT DEPRESS/HOLD

12. Pilot's manual release button . . . . . DEPRESS
First release is initiated when release button is depressed and subsequent releases occur in sequence at interval selected plus 1.5 second. Commit trigger and release button need not be held after first release.

Note

- One release pulse will be generated for each selected station.
- To reset the weapon release system from the mining mode after releases are completed, either the MASTER ARM switch or the Shrike power switch/power selector switch must be cycled to OFF.

MINING PROCEDURES (P-8.6)

1. Attack mode selector button . . . . . STRAIGHT
2. Station select switches . . . . . AS BRIEFED
3. Release mode switch . . . . . AUTO
4. SALVE/TRN/STEP switch . . . . . AS BRIEFED
5. ROCKET switch . . . . . SNGL
6. Shrike power . . . . . OFF
7. Intervalometer . . . . . SET
8. Multiple release switch . . . . . SET AS BRIEFED
9. Computer information . . . . . ENTERED
10. Compute NAV mode . . . . . LAND/GTB
11. MASTER ARM switch . . . . . ON
12. Computer . . . . . IN ATTACK
13. Attack commit trigger . . . . . PILOT DEPRESS/HOLD
14. Release . . . . . OBSERVED
15. MASTER ARM switch . . . . . OFF
B/N must step computer out of attack after last release.

SPECIAL SIDEWINDER FIRING PROCEDURES (AIRCRAFT INCORPOATING AFC NO. 332 AND AVC NO. 1433)

1. 1C I-R switch . . . . . COOL/FIRE
2. Station select switch . . . . . ROCKETS/GUNS
3. Release mode switch . . . . . MAN
4. Optical sight AUTO/OFF/MAN switch . . . . . MAN

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6A,B,C—CONTINUED

5. Optical sight movable reticle switch . . . . . OFF
6. 1C I-R tone volume . . . . . AS DESIRED
7. Center fixed reticle on target.
8. Pilot's manual release button . . . . . DEPRESS

Note

The above procedure does not constitute authority for carriage or launch. Only those stores listed in the A-6 Tactical Manual, NAVAIR 01-85ADA-1T may be carried and released, singly or in combination to the limits shown.

AN/AWW-1 ELECTRICAL FUZING PROCEDURES

In-flight, enroute to the target, the AN/AWW-1 system should be checked as follows:

Note

- In aircraft incorporating AAC No. 592, the rf fuzing capability has been permanently removed and the system has been redesignated AN/AWW-8.
- The following check should be made no sooner than 20 minutes and no later than 5 minutes before weapon release. Energizing the AN/AWW-1 circuitry in excess of 20 minutes may result in the fuzes charging at options other than that selected. Energizing the AN/AWW-1 circuitry for less than 5 minutes may result in inadequate circuit stabilization.

1. MASTER ARM switch . . . . . ON
2. Fuzing power switch . . . . . RDY
3. Electrical fuzing button . . . . . DESIRED OPTION (A through H)
4. After 30 seconds, note HV DC CHECK button light comes on. (Light must remain on.)
5. Before release, insure that light remains lit, indicating system readiness.

Note

If the light is not lit at weapon release, dud bombs must be anticipated. Duds can also be anticipated if the manual release button is not depressed and held throughout the release sequence.

6. Make desired armament switch selection as listed for attack mode selected.

After weapon release:

7. MASTER ARM switch . . . . . OFF
8. Fuzing power switch . . . . . SAFE

TARGET TRACKING PROCEDURES A-6E

CURSOR INTERSECTION TRACKING

1. MODE switch . . . . . TRACK
2. ELEV TRKG switch . . . . . OFF
3. Azimuth-range switch . . . . . DISLODGE (FORWARD)
4. FREQ AGILITY switch . . . . . AS DESIRED
5. Locate fixed/moving target in PPI and proceed as follows:
   a. DISPLAYS button . . . . . PPI OR ARE
   b. PPI RANGE switch . . . . . APPROXIMATELY 20 NMI
   c. Antenna pattern . . . . . ADJUST FOR MAXIMUM RETURN
   d. SCAN ANGLE control . . . . . NARROW (±10°)
   e. SCAN RATE switch . . . . . SLOW
   f. STC SLOPE/DEPTH controls . . . . . ADJUST
   g. AMTI control (for moving target) . . . . . ON, CANCELLATION AS REQUIRED
   h. RCVR gain control . . . . . ADJUST
   j. VIDEO gain control . . . . . ADJUST FOR OPTIMUM DISPLAY
6. Cursors . . . . . SLEW OVER TARGET
7. DISPLAY button . . . . . ARE 60 OR ARE 30
8. Velocity-correct (manual) . . . . . AS REQUIRED

ELEVATION TRACKING

1. MODE switch . . . . . TRACK
2. ELEV TRKG switch . . . . . ON
3. Azimuth-range switch . . . . . DISLODGE (FORWARD)
4. FREQ AGILITY switch . . . . . AS DESIRED
5. Locate fixed/moving target in PPI.
   If moving targets are to be tracked, proceed as follows:
   a. DISPLAY button . . . . . PPI OR ARE
   b. PPI RANGE switch . . . . . APPROXIMATELY 20 NMI
   c. Antenna pattern . . . . . ADJUST FOR MAXIMUM RETURN
   d. SCAN ANGLE control . . . . . NARROW (±10°)
   e. SCAN RATE switch . . . . . SLOW
   f. STC SLOPE/DEPTH controls . . . . . ADJUST
   g. AMTI control . . . . . ON, CANCELLATION AS REQUIRED

CONTINUED ON NEXT PAGE

TARGET TRACKING PROCEDURES A-6E–CONTINUED

h. RCVR gain control . . . . . ADJUST

j. VIDEO gain control . . . . . ADJUST FOR OPTIMUM DISPLAY

6. Cursors . . . . . SLEW OVER TARGET

7. DISPLAYS button . . . . . ARE 60 OR ARE 30 (IF DESIRED)

8. ELEVATION light (under 60,800 feet maximum) . . . . . ON

9. Velocity-correct (manual) . . . . . AS REQUIRED

AZIMUTH RANGE TRACKING

1. MODE switch . . . . . TRACK

2. ELEV TRKG switch . . . . . OFF

3. Azimuth-range switch . . . . . DISLODGE (FORWARD)

4. FREQ AGILITY switch . . . . . AS DESIRED

5. Locate fixed/moving target in PPI and proceed as follows:

   a. DISPLAYS button . . . . . PPI OR ARE

   b. PPI RANGE switch . . . . . APPROXIMATELY 20 NMI

   c. Antenna pattern . . . . . ADJUST FOR MAXIMUM RETURN

   d. SCAN ANGLE control . . . . . NARROW (±10°)

   e. SCAN RATE switch . . . . . SLOW

   f. STC SLOPE/DEPTH controls . . . . . ADJUST

   g. AMTI control (for moving target) . . . . . ON, CANCELLATION AS REQUIRED

   h. RCVR gain control . . . . . ADJUST

   j. VIDEO gain control . . . . . ADJUST FOR OPTIMUM DISPLAY

6. DISPLAYS button . . . . . ARE 60 OR ARE 30

7. Cursors . . . . . SLEW OVER TARGET

8. Azimuth-range switch . . . . . ENABLE (AFT)

9. AZ-RANGE light . . . . . ON
   Slewing is inhibited. Cursors automatically track target.

10. Velocity correct (AUTO) . . . . . AS REQUIRED
    If cursors track target, set velocity-correct switch to MEM PT. If cursors unstable, proceed with steps 11 and 12.

To Break Lock:

11. Velocity correct switch (if velocity good) . . . . . OFF SAVE

12. Velocity correct switch (if velocity bad) . . . . . OFF ERASE

13. Azimuth-range switch . . . . . DISLODGE (FORWARD)

CONTINUED ON NEXT PAGE

TARGET TRACKING PROCEDURES A-6E–CONTINUED

TRACK-WHILE-SCAN TRACKING

Note

The azimuth-range switch should be left in the forward position until an azimuth-range lock-on is desired.

1. MODE switch ..... TRACK
2. Locate fixed/moving target in PPI/ARE and proceed as follows:
   a. DISPLAY button ..... PPI OR ARE
   b. PPI-RANGE switch ..... APPROXIMATELY 20 NMI
   c. Antenna pattern ..... ADJUST FOR MAXIMUM RETURN
   d. SCAN ANGLE control ..... NARROW (±10°)
   e. SCAN RATE switch ..... SLOW
   f. STC SLOPE/DEPTH control ..... ADJUST
   g. AMTI control (for moving target) ..... ON, CANCELLATION AS REQUIRED
   h. RCVR gain control ..... ADJUST
   j. VIDEO gain control ..... ADJUST FOR OPTIMUM DISPLAY
3. FREQ AGILITY switch ..... AS REQUIRED
4. Cursors ..... SLEW OVER TARGET
5. DISPLAYS button ..... ARE 60 OR ARE 30 (IF DESIRED)
6. Azimuth-range switch ..... ENABLE (AFT)
7. AZ-RANGE light ..... ON
   Slewing is inhibited. Cursors automatically track target.
8. ELEV TRKG switch ..... ON
9. ELEVATION light ..... ON
10. Velocity-correct switch ..... MEMORY POINT

To Break Lock:

11. Velocity-correct switch (if velocity good) ..... OFF SAVE
12. Velocity-correct switch (if velocity bad) ..... OFF ERASE
13. Azimuth-range switch ..... DISLODGE (FORWARD)

VELOCITY CORRECT PROCEDURES A-6E

AUTOMATIC VELOCITY CORRECT

Automatic velocity-correct is performed when the VELOCITY CORRECT switch is at MEMORY POINT and an azimuth-range or track-while-scan lock-on exists. Corrected velocity will stabilize in 12 to 18 seconds.

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VELOCITY CORRECT PROCEDURES A-6E–CONTINUED

MANUAL VELOCITY CORRECT (CURSOR INTERSECTION OR ELEVATION TRACKING)

1. Position cursors with azimuth cursor centered on target and range cursor just touching leading edge of target.
2. Observe cursors for drift off target (10 seconds minimum).
3. VELOCITY CORRECT switch ..... MEMORY POINT
4. Cursors ..... REPOSITION OVER TARGET
   Slew cursors to their original position and observe for drift. Repeat as necessary to cancel drift.
5. VELOCITY CORRECT switch ..... OFF SAVE

COMPUTER OPTICAL POSITIONING (COP) CHECK A-6E

1. B/N - Position radar cursors on a visually recognizeable target in desired tracking mode.
2. Pilot - Depress attack commit trigger to first detent and observe position of optical sight movable reticle in relation to the target.

Note

- The aircraft should be in a stable dive attitude of 10° to 12° when a COP check is performed for optimum results.
- If a COP check is performed on the ground, only azimuth indications are valid.

ATTACK PROCEDURES A-6E

Note

- The attack procedures below are only those required to execute the attack selected, and must be used in conjunction with the procedures for the release of weapons from multiple ejector racks and triple ejector racks.
- The MASTER ARMT switch should be set to OFF before making any changes to switch selection on the armament control unit.

ROCKET ATTACK PROCEDURES

At any point en route to the target, the following settings may be made:

1. ATTACK mode button ..... ROCKET
2. Station select switches ..... ROCKETS/MISSILES (DOWN)
3. RELEASE mode button ..... ROCKET SALVO

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6E–CONTINUED

4. INTERVAL/QUANTITY/TIME wheels . . . . . AS DESIRED

5. MASTER ARMT switch . . . . . ON (UP)

6. BOMB TONE switch . . . . . AS DESIRED

7. Attack button . . . . . DEPRESS
   Depressing attack button on slew grip places computer in attack mode.

8. RESELECT light . . . . . OFF
   Check that RESELECT light is off. If light goes on, it indicates that no attack solution can be generated because of some incompatible setting of armament switches.

9. ATTACK light . . . . . ON
   If ATTACK light remains off, it indicates that computer has not entered attack mode.

10. In-range lights . . . . . ON AT MAXIMUM RANGE

11. Zero steering both horizontally and vertically.

Note

Release is obtained by the pull-through or line-up techniques.

12. Attack commit trigger . . . . . COMMIT (SECOND DETENT) AND HOLD
    When pilot depresses attack commit trigger on his control stick, computer is directed to fire if within in-range limits and within ±4 mils vertically of electronic center of VDI. Bomb tone comes on at commit and goes off when COMPLETE light comes on.

Note

- It is possible to commit out of range.
- For the release of empty rocket launchers or CBU's from MER/TER, set the station select switch to BOMBS/GUNS, and release the units as if they were bombs.

HI LOFT ATTACK PROCEDURES

At any point en route to the target, the following settings may be made:

1. ATTACK mode button . . . . . HI LOFT
2. Station select switches . . . . . UP AS DESIRED
3. Fuzing/arming . . . . . AS BRIEFED
4. RELEASE mode button . . . . . BOMB SALVO OR BOMB TRAIN
5. INTERVAL/QUANTITY/TIME wheels . . . . . SET
6. MASTER ARMT switch . . . . . ON (UP)
7. BOMB TONE switch . . . . . AS DESIRED

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ATTACK PROCEDURES A-6E–CONTINUED

After steps 1 through 7 have been accomplished and the aircraft is within 32 nautical miles of the target, the following procedures must be accomplished:

8. Attack button . . . . . DEPRESS
   Depressing attack button on slew grip places computer in attack mode.

9. RESELECT light . . . . . OFF
   Check that RESELECT light is off. If light goes on, it indicates that no attack solution can be generated because of some incompatible setting of armament switches.

10. ATTACK light . . . . . ON
    If ATTACK light remains off, it indicates that computer has not entered attack mode.

11. In-range lights . . . . . ON AT MAXIMUM RANGE - HI LOFT PULLUP POINT

12. Attack commit trigger . . . . . COMMIT (SECOND DETENT) AND HOLD

13. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN COMPLETE LIGHT COMES ON

STRAIGHT PATH ATTACK PROCEDURES

At any point en route to the target, the following settings may be made:

1. ATTACK mode button . . . . . STRAIGHT
2. Station select switches . . . . . UP AS DESIRED
3. Fuzing/arming . . . . . AS BRIEFED
4. RELEASE mode button . . . . . BOMB SALVO OR BOMB TRAIN
5. INTERVAL/QUANTITY/TIME wheels . . . . . SET (AS DESIRED)
6. REL ADV key . . . . . DEPRESS (AS DESIRED)
7. MASTER ARMT switch . . . . . ON (UP)
8. BOMB TONE switch . . . . . AS DESIRED

After steps 1 through 8 have been accomplished and the aircraft is within 32 nautical miles of the target, the following procedures must be accomplished:

9. Attack button . . . . . DEPRESS
   Depressing attack button on slew grip places computer in attack mode.

10. RESELECT light . . . . . OFF
    Check that RESELECT light is off. If light goes on, it indicates that no attack solution can be generated because of some incompatible setting of armament switches.

11. ATTACK light . . . . . ON
    If ATTACK light remains off, it indicates that computer has not entered attack mode.

12. In range lights . . . . . SHOULD LIGHT BEFORE RELEASE

13. Attack commit trigger . . . . . COMMIT (SECOND DETENT) AND HOLD

14. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN COMPLETE LIGHT COMES ON

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ATTACK PROCEDURES A-6E–CONTINUED

GENERAL ATTACK PROCEDURES

1. ATTACK mode button . . . . . GENERAL
2. Station select switches . . . . . UP AS DESIRED
3. Fuzing/arming . . . . . AS BRIEFED
4. RELEASE mode button . . . . . BOMB SALVO OR BOMB TRAIN
5. INTERVAL/QUANTITY/TIME wheels . . . . . SET (AS DESIRED)
6. REL ADV key . . . . . DEPRESSED (AS DESIRED)
7. MASTER ARMT switch . . . . . ON (UP)
8. BOMB TONE switch . . . . . AS DESIRED

After steps 1 through 8 have been accomplished and the aircraft is within 32 nautical miles of the target, the following procedures must be accomplished:

9. Attack button . . . . . DEPRESS
   Depressing attack button on slew grip places computer in attack mode.
10. RESELECT light . . . . . OFF
    Check that RESELECT light is off. If light goes on, it indicates that no attack solution will be generated because of some incompatible setting of armament switches.
11. ATTACK light . . . . . ON
    If ATTACK light remains off, it indicates that computer has not entered attack mode.
12. In-range lights . . . . . ON AT MAXIMUM RANGE LOFT PULLUP POINT
13. Attack commit trigger . . . . . COMMIT (SECOND DETENT) AND HOLD
14. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN COMPLETE LIGHT COMES ON

Note

- With convential stores, the computer solves a low-loft release with a forced commit at 8°.
- With special weapons, the computer solves a low-loft and high-loft in that order.
- If pull-up steering commands are not followed, the computer solves for and provides a level release.

VISUAL ~~BORESIGHT~~ TARGET ACQUISITION AND ATTACK (E 1.5 PROGRAM)

If possible, velocity-correct within 10 minutes of making a boresight attack.

1. COMPT MODE switch . . . . . STEER
2. ADDRESS key . . . . . AS DESIRED
   Select any steering mode.
3. Optical sight switch . . . . . AUTO
4. MODE switch . . . . . BORESIGHT

CONTINUED ON NEXT PAGE

ATTACK PROCEDURES A-6E–CONTINUED

5. ATTACK mode button ..... GENERAL OR STRAIGHT OR HI LOFT
   When BORESIGHT is selected, computer uses a general attack regardless of ATTACK button depressed.

6. Station select switches ..... UP AS DESIRED

7. Fuzing/arming ..... AS BRIEFED

8. RELEASE mode button ..... BOMB SALVO OR BOMB TRAIN

9. INTERVAL/QUANTITY/TIME wheels ..... SET (AS DESIRED)

10. MASTER ARMT switch ..... ON (UP)

11. BOMB TONE switch ..... AS DESIRED

12. Attack button ..... DEPRESS
    Depressing attack button on slew grip places computer in attack mode.

13. RESELECT light ..... OFF
    Check that RESELECT light is out. If light goes on it indicates that no attack solution will be generated because of some incompatible setting of armament switches.

14. ATTACK light ..... ON
    If ATTACK light remains off, it indicates that computer has not entered attack mode.

15. Dislodge switch ..... FORWARD

16. ELEV TRKG ..... ON
    Elevation track lock-on should occur when validity parameter of ±53° bank angle and 2°/second pitch rate are met. Attack may be completed on baro-inertial information if elevation track lock-on is not acquired.

17. In-range lights ..... FLASHING
    Flashing of in-range lights indicates that computer is using elevation tracking data.

18. Movable reticle ..... PLACE ON TARGET
    Pilot maneuvers aircraft into a dive, positioning movable reticle on target. Movable reticle represents aircraft inertial velocity vector and is 20 mils below ADL.

Note

Initial reticle alignment should be maintained for a minimum of 1/8 second before designating. Subsequent designates require 1/2 second of reticle alignment.

19. Attack commit trigger ..... DESIGNATE (FIRST DETENT)
    To designate a second time, release trigger, and reactuate.

20. Attack commit trigger ..... COMMIT (SECOND DETENT)

21. Azimuth and elevation steering ..... NULL

22. Bomb tone ..... COMES ON AT COMMIT AND GOES OFF WHEN COMPLETE LIGHT COMES ON

Note

Flashing of the breakaway lights is the only visual cue provided to the pilot when terrain avoidance pullup is indicated in a visual attack.

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ATTACK PROCEDURES A-6E—CONTINUED

VISUAL TARGET ACQUISITION AND ATTACK (E100 PROGRAM)

If possible, velocity-correct and update system altitude within 10 minutes of making a visual attack.

1. COMPT MODE switch ..... STEER
2. ADDRESS key ..... AS DESIRED
   Select any steering mode
3. Optical sight switch ..... AUTO
4. ATTACK mode button ..... GENERAL
5. Station select switches ..... UP AS DESIRED
6. Fuzing/arming ..... AS BRIEFED
7. RELEASE mode button ..... BOMB SALVO OR BOMB TRAIN
8. INTERVAL/QUANTITY/TIME thumbwheels ..... SET (AS DESIRED)
9. MASTER ARMT switch ..... ON
10. BOMB TONE switch ..... AS DESIRED
11. Pilot's attack button ..... DEPRESS
    Depressing the pilot's attack button on the stick grip steps the computer into attack and selects the visual mode of target acquisition and attack.
12. RESELECT light ..... OUT
13. ATTACK light ..... ON
14. ELEV TRKG switch ..... ON
15. Movable reticle ..... PLACE ON TARGET
    Pilot maneuvers aircraft into a dive, positioning the movable reticle on the target.

Note

Initial reticle alignment should be maintained for a minimum of 1/6 second before designating. Subsequent designates 2/3 second of reticle alignment.

16. ELEV TRKG light ..... ON
17. IN-RANGE lights ..... FLASHING
    This indicates valid elevation tracking data.
18. Attack commit trigger ..... DESIGNATE (FIRST DETENT)
    To designate a second time, release trigger and reactuate.
19. Attack commit trigger ..... COMMIT (SECOND DETENT)
20. Azimuth and elevation steering ..... NULL
21. Bomb tone ..... ON AT COMMIT, OFF WHEN COMPLETE LIGHT COMES ON

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ATTACK PROCEDURES A-6E–CONTINUED

LAB IP ATTACK PROCEDURES

At any point en route to the initial point (IP), the following settings may be made:

1. ATTACK mode button ..... LAB IP
2. Station select switches ..... UP AS DESIRED
3. Fuzing/arming ..... AS BRIEFED
4. RELEASE mode button ..... BOMB SALVO OR BOMB TRAIN
5. INTERVAL/QUANTITY/TIMER wheels ..... SET
6. MASTER ARMT switch ..... ON (UP)
7. BOMB TONE switch ..... AUTO

When the aircraft is over the initial point (IP), perform the following procedures:

8. Attack commit trigger ..... COMMIT (SECOND DETENT) AND HOLD
   Pilot depress and hold attack commit trigger. Bomb warning tone comes on for 1/2 second 2 seconds before time countback reaches 0. When time reaches 0, bomb tone comes on, pilot starts 4-g pullup. Stores are automatically released at preset release angle and station release indicators set. When release is complete, COMPLETE light comes on and bomb tone goes off. COMPLETE light goes off when pilot releases attack commit trigger.

LAB TGT ATTACK PROCEDURES

At any point en route to the target, the following settings may be made:

1. ATTACK mode button ..... LAB TGT
2. Station select switches ..... UP AS DESIRED
3. Fuzing/arming ..... AS DESIRED
4. RELEASE mode button ..... BOMB SALVO OR BOMB TRAIN
5. INTERVAL/QUANTITY/TIME wheels ..... SET
6. MASTER ARMT switch ..... ON (UP)
7. BOMB TONE switch ..... AUTO

When aircraft is over the target, perform the following procedures:

8. Attack commit trigger ..... COMMIT (SECOND DETENT) AND HOLD
   Pilot begins a 4-g pullup when bomb tone comes on. Stores are automatically released at preset release angle and station release indicators set. When release is complete, COMPLETE light comes on and stays on until pilot releases attack commit trigger.

Note

- Bomb warning tone comes on for 1/2 second 2 seconds before time countback reaches 0 if INTERVAL is set to 02.0 or greater. If INTERVAL is set between 02.0 and 01.5, warning tone duration depends on INTERVAL setting. If less than 01.5 is set, there is no warning tone.
- Bomb tone comes on when time countback reaches 0 and goes off when the COMPLETE light comes on.

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ATTACK PROCEDURES A-6E–CONTINUED

DELAY BOMBING PROCEDURES

At any point en route to the target, the following settings may be made:

1. ATTACK button . . . . . DELAY
2. Station select switches . . . . . UP AS DESIRED
3. FUZING . . . . . AS BRIEFED
4. RELEASE button . . . . . BOMB SALVO OR BOMB TRAIN
5. INTERVAL/QUANTITY/TIME wheels . . . . . SET (AS DESIRED)
6. MASTER ARMT switch . . . . . ON (UP)
7. BOMB TONE switch . . . . . AUTO

After steps 1 through 7 have been accomplished and the aircraft is at the selected commit point, the following procedures must be accomplished:

8. Attack commit trigger . . . . . COMMIT (SECOND DETENT) AND HOLD
   Depressing commit trigger starts ACU timer.
9. Bomb tone . . . . . COMES ON WHEN ATTACK COMMIT TRIGGER IS DEPRESSED AND GOES OFF WHEN COMPLETE LIGHT COMES ON
   Weapon is automatically released at end of selected delay.

GUNNERY ATTACK PROCEDURES

At any point enroute to the target, the following settings may be made:

1. RELEASE mode button . . . . . GUNS
2. GUN switch . . . . . READY
   Placing switch to READY charges all guns.
3. Optical sight AUTO/OFF/MAN switch . . . . . MAN
4. Optical sight movable reticle switch . . . . . OFF

When ready to begin the attack:

5. Station select switches . . . . . BOMBS/GUNS (UP)
6. MASTER ARMT switch . . . . . ON (UP)
7. Attack commit trigger . . . . . DEPRESS (SECOND DETENT)
   When lined up on target, depress attack commit trigger to fire guns.

Note

Firing the guns will produce a release indication on the stations selected.

Just before landing or when ready to secure the guns (weight must be off wheels):

7. MASTER ARMT switch . . . . . OFF
8. Gun switch . . . . . CLEAR, (DOWN) THEN SAFE

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ATTACK PROCEDURES A-6E—CONTINUED

CAUTION

Moving the gun pod switch to the momentary CLEAR position renders the guns inoperative for the remainder of the flight. Do not select READY after selecting CLEAR as this will result in a jam of the ammunition belt links.

MINING PROCEDURES

1. ATTACK mode button ..... STRAIGHT
2. Station select switches ..... BOMBS/GUNS (UP)
3. RELEASE mode button ..... BOMB TRAIN
4. INTERVAL/QUANTITY/TIME wheels ..... AS DESIRED
5. MASTER ARMT switch ..... ON (UP)
6. BOMB TONE switch ..... AS DESIRED
7. Steering ..... SELECT TARGET AND GRD TRK
8. Attack commit trigger ..... COMMIT (SECOND DETENT) AND HOLD
9. Bomb tone ..... COMES ON AT COMMIT AND GOES OFF WHEN COMPLETE LIGHT COMES ON

part 6 Carrier-Based Procedures (B/N)

CARRIER ALIGNMENT (AUTOMATIC) A-6A,B,C

1. Electrical power on the aircraft and SINS cable connected.

2. SINS ICS switch . . . . . AS DESIRED

Note

The SINS ICS switch must be ON to communicate with SINS personnel on ICS.

Doppler/platform panel:

3. Platform selector button . . . . . STBY (allow 5 minutes for warmup)

4. Compass switch . . . . . OUT

Right-hand unit:

5. MAG VAR . . . . . SET
   Set magnetic variation to angle between aircraft and carrier true heading. If aircraft heading is to the left of carrier heading, set in a west reading. If aircraft heading is to right of the carrier heading, set in an east heading.

Note

The time required to complete the alignment is dependent upon an accurate spotting angle being inserted in the MAG VAR window before starting alignment.

Platform in-flight alignment panel:

6. NORM/GYROCOMP switch . . . . . NORM

Erection controller panel:

7. Polar mode switch . . . . . NORMAL

8. AUTO/MAN switch . . . . . AUTO

9. Latitude switch . . . . . SET LOCAL LATITUDE

Doppler/platform panel:

10. Platform selector button . . . . . ALIGN

Erection controller panel:

11. Observe CARR SPEED AND CARR HDG readouts correspond to carrier's speed and handling.

12. Observe that LATITUDE window is updated to carrier's latitude as alignment progresses.

13. Fine align indicator — LIGHTS APPROXIMATELY 1 MINUTE AFTER GOING TO ALIGN.

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CARRIER ALIGNMENT (AUTOMATIC) A-6A,B,C—CONTINUED

15. Ready light . . . . . LIGHTS BETWEEN 10 AND 20 MINUTES (9 TO 14 MINUTES WITH AVC NO. 1342) AFTER GOING TO ALIGN

16. Align progress meter . . . . CHECK THAT INDICATOR IS AT A NULL ± ONE DIVISION FOR 30 SECONDS.

Note

The ready light in item 15 above is not required provided the following criteria have been met:

- The align progress meter indicates a null ±1 unit for at least 55 seconds before going to operate.
- At least 15 minutes (10 minutes with AVC No. 1342) have been spent in align.
- Actual carrier velocities (within 3 knots) are read out in the right-hand unit after going to operate and no velocity drift is observed.

Additional time will be required for optimum alignment if needle is not at or near a null.

17. Platform selector button . . . . . OPERATE

Note

Accurate present position latitude must be inserted into the ballistics computer for proper systems operation.

18. Compass switch . . . . . IN

Note

A better alignment can be obtained by aligning the inertial platform sufficiently early in order to be in OPER before the ship maneuvers into position before launch.

19. MAG VAR . . . . . SET TO LOCAL MAGNETIC VARIATION
Set local magnetic variation at any time after FINE ALIGN light is lit.

CARRIER ALIGNMENT (MANUAL) A-6A,B,C

A manual carrier alignment may be performed in the same manner as an automatic alignment with the following exceptions:

1. Electrical power . . . . . CONNECT
2. SINS ICS switch . . . . . ON

Note

The SINS cable must be connected and the SINS ICS switch ON to communicate with SINS personnel on ICS.

3. Auto/man switch . . . . . MAN

CONTINUED ON NEXT PAGE

CARRIER ALIGNMENT (MANUAL) A-6A,B,C–CONTINUED

12. Manually set in carrier speed and heading.

Note

- Continue updating of carrier speed and heading from the SINS center is necessary for an accurate alignment.
- Turns of the carrier of 30°/minute or more will suspend the alignment and cause the align progress meter to indicate a null when the SINS cable is not connected.
- The ready light criteria for manual alignments are the same as for automatic with the addition of the requirements that the 15-minute (10-minute with AVC No. 1342) alignment time must be exclusive of suspend-align time and there must be positive indication that a suspend-align condition is not existing during the 55-second meter null.

CARRIER ALIGNMENT (AUTOMATIC) A-6E

ASN-31 INS

1. Electrical power on aircraft and SINS cable connected.

2. ALIGN switch . . . . . SINS ICS

3. Platform selector button . . . . . STBY (allow 5 minutes for warmup)

4. ATTITUDE REF switch . . . . . COMP OUT

5. MAG VAR . . . . . SET
   Set magnetic variation to angle between aircraft and carrier true heading. If aircraft heading is to left of carrier heading, set in a west reading. If aircraft heading is to right of carrier heading, set in an east reading.

Note

The time required to complete the alignment is dependent upon an accurate spotting angle being inserted in the MAG VAR window prior to starting alignment.

6. AUTO/MAN switch . . . . . AUTO

CONTINUED ON NEXT PAGE

CARRIER ALIGNMENT (AUTOMATIC) A-6E–CONTINUED

7. Latitude switch . . . . . SET LOCAL LATITUDE

8. Platform button . . . . . ALIGN

9. Observe CARR SPEED AND CARR HDG readouts correspond to carrier's speed and heading.

10. Observe that LATITUDE window is updated to carrier's latitude as the alignment progresses.

11. Fine align light . . . . . GOES ON APPROXIMATELY 1 MINUTE AFTER GOING TO ALIGN

12. Ready light. . . . . GOES ON BETWEEN 10 and 20 MINUTES (9 to 14 minutes with AVC No. 1342) AFTER GOING TO ALIGN

13. Align progress meter . . . . . CHECK THAT INDICATOR IS AT A NULL ± ONE DIVISION FOR 30 SECONDS

Note

The ready light in item 12 above is not required provided the following criteria have been met:

- The align progress meter indicates a null ±1 unit for at least 55 seconds prior to going to operate.
- At least 15 minutes (10 minutes with AVC No. 1342) have been spent in align.
- Actual carrier velocities (within 3 knots) are read out in the DDU after going to operate and no velocity drift is observed.

Additional time will be required for optimum alignment if needle is not at or near a null.

14. Platform selector button . . . . . OPER

CONTINUED ON NEXT PAGE

CARRIER ALIGNMENT (AUTOMATIC) A-6E–CONTINUED

Note

Accurate present position latitude must be inserted into the computer for proper inertial operation.

15. ATTITUDE REF switch . . . . . COMP IN

Note

A better alignment can be obtained by aligning the inertial platform sufficiently early in order to be in OPER prior to the ship maneuvering into position before launch.

16. MAG VAR . . . . . SET TO LOCAL MAGNETIC VARIATION
    Local magnetic variation may be set at any time after FINE ALIGN light is lit.

ASN-92 IMU

Note

The computer must be operating for either an automatic or a manual carrier alignment.

1. COMPT MODE switch . . . . . STEER
2. Navigation mode selector switch . . . . . AS DESIRED
3. Data link . . . . . ON, FREQ SET
4. SINS ICS switch . . . . . AS DESIRED
5. SINS DATA switch . . . . . D/L
6. HDG SEL switch . . . . . CMD TRUE OR CMD MAG
7. MODE selector button . . . . . ALIGN
   Note that ALIGN light comes on. Flashing of the D/L light indicates that the data link was not turned on; a steady D/L light indicates data link failure.

Note

While ALIGN is selected, the VDI PLATFORM light flashes, the steering symbol and target symbol display the characteristic alignment program motion, and the optical sight moving reticle moves in a 25-mil circle about the fixed reticle.

8. Confirm that SINS data are being received. These data may be read out in the DDU.
9. Monitor:
   - Elapsed time in DDU window A1
   - ~~Alignment process in DDU window A3 and on ADI needle of HSI~~
   - IMU pitch angle in DDU window B2
   - IMU roll angle in DDU window B4

CONTINUED ON NEXT PAGE

CARRIER ALIGNMENT (AUTOMATIC) A-6E—CONTINUED

10. INS and breakaway lights . . . . . ON
    The INS and breakaway lights will come on along with the ALIGN light indicating a completed alignment. The INS light will come on in approximately 4 1/2 minutes. OPER may be selected at that time; however, remaining in ALIGN until there is a null of the HSI ADF needle will improve the alignment.

11. MODE selector button . . . . . OPER
    Note that the ALIGN and INS lights go off.

Note

- If it is necessary to move the aircraft before completion of the alignment (INS light on), select OPER. This will light the TAXI light, and suspend the alignment. When the aircraft is parked, the alignment can be recommended by selecting ALIGN.
- The INS light will flash if the navigation mode selector switch is at a position other than INERL.

CARRIER ALIGNMENT (MANUAL) A-6E

ASN-31 INS

1. Electrical power . . . . . CONNECT
2. ALIGN switch . . . . . SINS ICS
3. Platform selector button . . . . . STBY (allow 5 minutes for warmup)
4. ATTITUDE REF switch . . . . . COMP OUT
5. MAG VAR . . . . . SET
   Set magnetic variation to angle between aircraft and carrier true heading. If aircraft heading is to left of carrier heading, set in a west reading. If aircraft heading is to right of carrier heading, set in an east heading.

Note

The time required to complete the alignment is dependent upon an accurate spotting angle being inserted in the MAG VAR window prior to starting alignment.

6. AUTO/MAN switch . . . . . MAN
7. Latitude switch . . . . . SET LOCAL LATITUDE
8. Platform button . . . . . ALIGN
9. Manually set in carrier speed and heading.

Note

- Continuous updating of carrier speed and heading is necessary for an accurate alignment. SINS information is preferred.
- Turns of the carrier of 30°/minute or more will suspend the alignment and cause the align progress meter to indicate a null when the SINS cable is not connected.

10. Fine align light . . . . . GOES ON APPROXIMATELY 1 MINUTE AFTER GOING TO ALIGN

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11. Ready light . . . . . GOES ON BETWEEN 10 and 20 MINUTES (9 to 14 minutes with AVC No. 1342) AFTER GOING TO ALIGN

12. Align progress meter . . . . . CHECK THAT INDICATOR IS AT A NULL ± ONE DIVISION FOR 30 SECONDS

Note

The ready light in item 12 above is not required provided the following criteria have been met:

- The align progress meter indicates a null ±1 unit for at least 55 seconds with positive indication that a suspend align condition is not existing prior to going to operate.
- At least 15 minutes (10 minutes with AVC No. 1342) have been spent in align exclusive of suspend align time.
- Actual carrier velocities (within 3 knots) are read out in the DDU after going to operate and no velocity drift is observed.

Additional time will be required for optimum alignment if needle is not at or near a null.

13. Platform selector button . . . . . OPER

Note

Accurate present position latitude must be inserted into the computer for proper inertial operation.

14. ATTITUDE REF switch . . . . . COMP IN

Note

A better alignment can be obtained by aligning the inertial platform sufficiently early in order to be in OPER prior to the ship maneuvering into position before launch.

15. MAG VAR . . . . . SET TO LOCAL MAGNETIC VARIATION
Local magnetic variation may be set at any time after FINE ALIGN light is lit.

ASN-92 IMU

1. SINS ICS switch . . . . . ON
2. SINS DATA switch . . . . . MAN
3. Navigation mode selector switch . . . . . AS DESIRED
4. COMPT MODE switch . . . . . ENTER
5. Alignment data . . . . . ENTER
Keyboard entries are required for present position latitude and longitude as well as carrier heading and speed entered as present position bearing and velocity. Longitudinal and athwartship lever arms may be entered in feet in PRES LOC/DIST.
6. HDG SEL switch . . . . . CMD TRUE or CMD MAG

CONTINUED ON NEXT PAGE

CARRIER ALIGNMENT (MANUAL) A-6E—CONTINUED

7. MODE selector button ..... ALIGN
   Note that ALIGN light comes on.

Note

While ALIGN is selected, the VDI PLATFORM light flashes, the steering symbol and target symbol display the characteristic alignment program motion, and the optical sight moving reticle moves in a 25-mil circle about the fixed reticle.

8. Monitor:

   - Elapsed time in DDU window A1
   - Alignment process in DDU window A3 and on ADF needle of HSI
   - IMU pitch angle in DDU window B2
   - IMU roll angle in DDU window B4

9. INS light ..... ON
   The INS light will come on along with the ALIGN light indicating a completed alignment in approximately 4 1/2 minutes. OPER may be selected at that time; however, remaining in ALIGN until there is a null of the HSI ADF needle will improve the alignment.

10. MODE selector button ..... OPER
    Note that the ALIGN and INS lights go off.

Note

- If it is necessary to move the aircraft before completion of the alignment, select OPER. This will light the TAXI light, and suspend the alignment. When the aircraft is parked, the alignment can be recommended by selecting ALIGN.
- Changes to the ship's heading will somewhat degrade the alignment; a new heading is calculated. However if the ship's speed changes a new entry should be made.
- The INS light will flash if the navigation mode selector switch is in a position other than INERL.

part 7 Degraded System Operating Procedures (A-6A,B,C)

INTRODUCTION

Since the weapons system is integrated, (that is, one in which all components are interdependently united to accomplish the various navigation and attack solutions) it is evident that failure in any one component must necessarily degrade the overall effectiveness of the system. In order to still be able to accomplish the mission, various backup modes have been included for use in the event of in-flight failure of one or more of these components. Inasmuch as circumstances surrounding such failures may vary widely depending on the type of mission, and the stage at which the failure occurs, hard and fast procedures cannot be set down which will fit every case. It is the purpose of this section merely to point out the existing backup modes and recommended procedures.

SEARCH RADAR FAILURE

If the search radar should fail, the BNCB meter is the most convenient means of troubleshooting, as both MAG CUR and XTAL CUR can be monitored.

AUTOMATIC FREQUENCY CONTROL (AFC) FAILURE

Procedure for Manual Tuning of the Search Radar

Under normal operation, the AFC/MAN RCVR TUNE selector is in the AFC position. With the search radar ON and the METER XTAL CUR button depressed, proper tuning will be indicated by a peak meter reading, generally .6 to .8 on the meter. If the meter needle is sweeping, or if there has been a loss of target returns as a result of zero XTAL CUR, the following procedures are necessary to manually tune the radar:

1. Place AFC/MAN RCVR TUNE selector to MAN.
2. Depress meter XTAL CUR button.
3. Select ECHO CHK.
4. Operate INCR/DECR toggle switch for maximum echo check return, (remember this is coarse tuning only).
5. Turn off echo check and use fine tuning knob (inside control of the AFC/MAN selector) to adjust for optimum video.

Note

When using the INCR/DECR toggle switch to acquire the echo check presentation, adjust in small increments.

Procedure for Manual Tuning of the Track Radar

Under normal operation, the track radar AFC/MAN RCVR TUNE selector is in the AFC position. With the track radar on and the TRACK METER XTAL CUR button depressed, proper tuning will be indicated by a peak meter reading, generally .6 to .8 on the meter. If the needle is sweeping or if there is no video due to a zero XTAL CUR reading, the following procedures will be necessary to manually tune the radar:

1. Select EMER SRCH display. (E-SCAN or TCPPI may also be used, however, EMER SRCH will prove to be the easiest on which to obtain video.)

2. Place track AFC/MAN RCVR TUNE selector to MAN.

3. Depress TRACK XTAL CUR button.

4. Operate inside control of track AFC/MAN RCVR TUNE selector until a peak meter reading is obtained.

5. Operate inside control of track AFC/MAN RCVR TUNE control until maximum video return is observed on scope, or maximum audio is heard on track tune circuitry.

Note

The MRI and tone volume controls must be adjusted to appropriate levels in order to accomplish step 5.

MAGNETRON RESET BUTTON-SEARCH/TRACK

Each pushbutton switch merely overrides protection circuitry provided to protect the magnetron. Momentarily engaging the reset button will bypass the protection circuitry and allow the magnetron to fire. If the malfunction is temporary, momentarily depressing the switch will restore performance. In an emergency or when operation of the radar is necessary, disregarding the possible damage incurred by the equipment from bypassing the protection circuitry, the button may be locked in by depressing and rotating clockwise. This procedure should be reserved for circumstances when the safety of the crew or the outcome of an important mission is dependent on the operation, even temporary, of the radar. (Such as during the final phase of a mission bombing run, or on a penetration when other navigation equipment is inoperative.) It should be kept in mind that there is no way of determining in advance how long the system will continue to function in the override condition. Complete failure of the magnetron may be imminent. Moreover, the radar picture available may be degraded in quality in this condition.

An internal light in the MAG RESET button comes on when the button is depressed, and remain lit while the button is locked in.

CAUTION

It should be remembered that operation in this condition may result in damage to the equipment over extended periods of time. The system should be returned to normal operation, using the protection features of the reset buttons as soon as practicable, to prevent equipment damage.

Note

In aircraft incorporating the search radar track switch, the track magnetron reset button is deleted. The track radar magnetron may be reset by cycling the track radar power switch to STBY. There is no override capability in these aircraft.

TRACK RADAR EMERGENCY SEARCH OPERATION (EMER SRCH)

In the event of complete failure of the search radar equipment, the track radar may be utilized to accomplish an emergency search function. This is done by using a limited track display.

In the emergency search mode of operation, the track radar operates essentially as a backup search radar system if the search radar system fails. In this mode, the system is used to display approximately 30° of azimuth scan, with antenna elevation angle manually controlled by the B/N. The positioning of the antenna assembly and ground area being scanned by the antenna is adjusted with the track radar elevation slew switch on the slew grip.

LIMITS TO USE OF EMERGENCY SEARCH MODE OF OPERATION

Because of the backup nature of this display, the resulting scope presentations are somewhat limited both as to coverage and degree of definition. Figure 3-13 represents a typical emergency search radar display.

EMERGENCY SEARCH MODE CHARACTERISTICS

In the emergency display, the presentation affords approximately 30° PPI presentation of the target area in a somewhat distorted presentation. This distortion is created by the increase in the transmitted beam width to approximately twice that of the search radar. However, as indicated in the display, the presentations still afford adequate definition for tracking of the prominent points, i. e., bridges, rivers, land water contrast, and small towns. During operation in the emergency search mode, it should be remembered that a number of previously available functions no longer are operative. These include:

1. Moving target detection and tracking

2. Automatic fixed target tracking

3. Selection of either E-Scan or TCPPI by the pilot will override emergency search selection, as the modes are not compatible and cannot be displayed simultaneously.

In addition, the presentation is limited as follows:

1. Range is limited to 5 or 10 nautical miles.

EMERGENCY SEARCH RADAR PRESENTATION

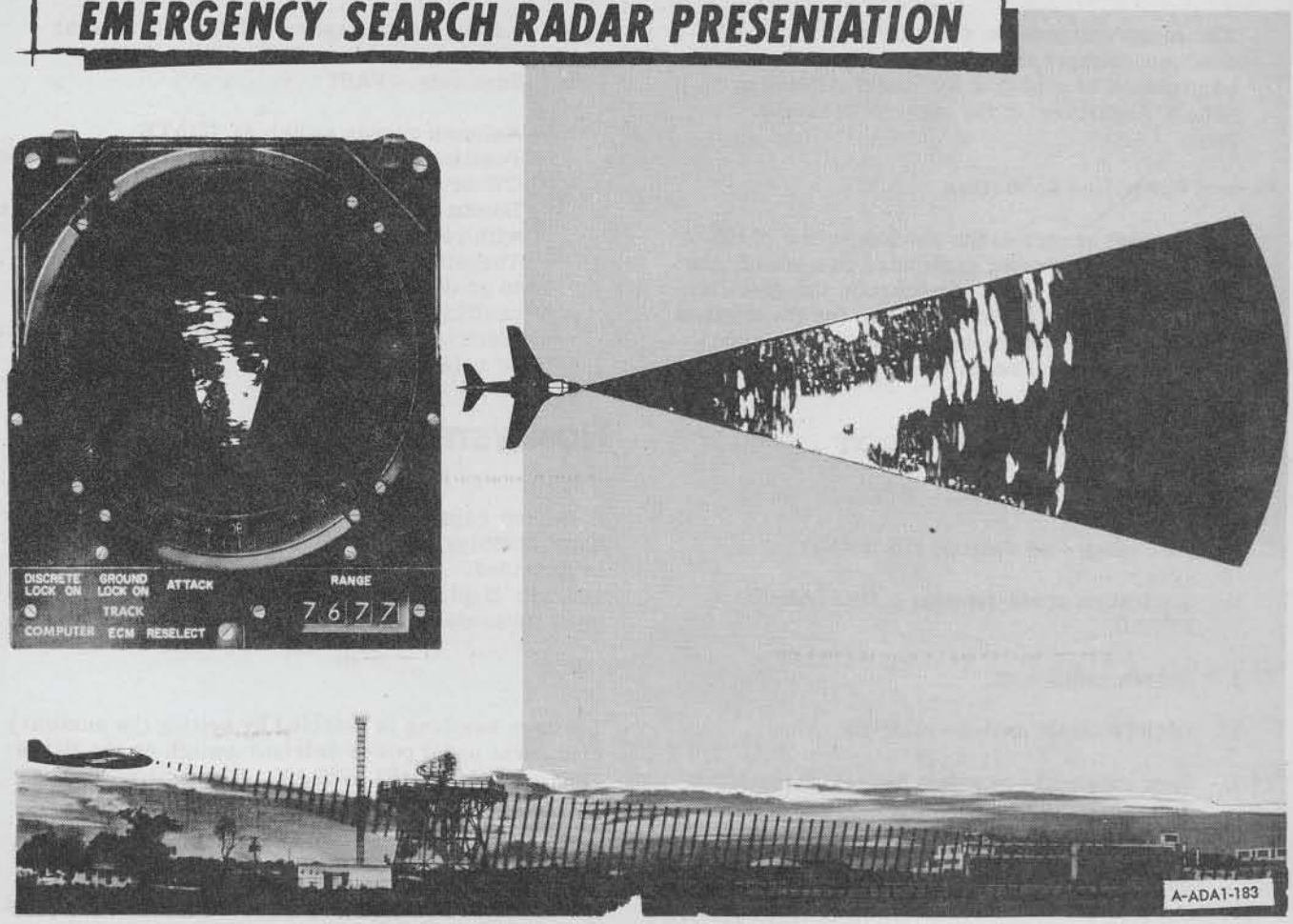

Figure 3-13

2. Antenna azimuth scan is automatically centered about the aircraft armament datum line modified by drift angle.
3. No cursors are displayed.
4. When the digital computer is off, the antenna scan is centered about the ADL of the aircraft.
5. Azimuth slew is not available, however elevation slew may be accomplished by use of the slew stick elevation thumbwheel. Release of the thumbwheel will return the antenna to its original position.

WEAPON DELIVERY IN MANUAL MODE

If, during the mission, it becomes evident that the computer has failed entirely, navigation and target acquisition may be accomplished by means of manually controlled search radar. This will thereby provide the B/N with the basic information necessary to successfully conclude the delivery of the assigned weapon. The bombardier/navigator's control panel includes the necessary controls and indicators required to establish the navigation, target acquisition, and weapon delivery functions.

When a computer malfunction demands that the delivery be accomplished manually, and providing the search radar equipment is operating, the B/N will place the computer/manual (CMPTR/MAN) switch on the bombardier/navigator's control panel to the MAN position. The inputs from the computer components are disabled, and the information developed for delivery uses search radar and platform adapter inputs for the display. To accomplish the actual weapon delivery, the bombardier/navigator will crank into the range readout window on the bombardier/navigator's control panel the slant range from release point to the target for the particular weapon being delivered. NEW

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Note

The range information will vary with different weapons, airspeeds, and altitudes, and should be provided as a part of the mission briefing before departure of the aircraft from the base.

Manual Range Line Calibration

Due to inherent errors in the mechanization of the manual range counter and associated equipment, the bombardier/navigator should ascertain the specific values to be read in the range window for the desired range calculation for each weapon on board the aircraft. Manual range line calibration procedures are as follows:

1. Flight mode selector - FLIGHT
2. Search radar displays - PPI
3. PPI range - as desired (30-5 NMI)
4. Navigation mode selector - UNSTAB-NO STEER
5. Search radar - ON
6. CMPTR/MAN switch - CMPTR
7. Slew range line to within 50 feet of computed release/pullup range.
8. Insert computer release/pullup range into range window by use of manual range knob.
9. Switch CMPTR/MAN switch to MAN, noting range line displacement on DVI.
10. Adjust manual range knob so as to make the two range lines coincident when CMPTR/MAN switch is cycled.
11. Note new readout on range counter and direction of movement of last manual range knob adjustment (cw or ccw).

Procedures For Manual Radar Delivery

1. Insert precalculated release or pullup slant range. This range is inserted into range readout window using manual range knob (MAN RANGE) on bombardier/navigator's control panel.
2. Computer/manual switch - MAN
3. Station select switches - BOMB
4. Armament panel set for manual release, LAB IP, or LAB TGT.
5. Locate target on search radar PPI display.
6. MASTER ARM switch - ON
7. Azimuth scan angle - CCW (narrow scan)
8. Scan rate - FAST

   Azimuth cursor switch ACTUATE
   Position azimuth cursor dead ahead by moving CW or CCW.
   Bombardier/navigator start and stop all turns with verbal instructions to pilot.
   Target will move down azimuth line as range to go decreases, maintain target's left-right position.
   When target reaches range line, initiate pullup or release as applicable.

NONSYSTEM LAYDOWN BOMBING

A backup capability for nonsystem automatic laydown bombing against nonradar-significant targets is provided. Use of this mode does not permit azimuth displacement; therefore, run-in heading must coincide with IP/target heading.

Laydown bombing is selected by setting the auxiliary armament panel power selector switch on the B/N's right console to REL DELAY. The desired release delay is set on the timer on the auxiliary armament panel.

With the master arm switch ON, and the release mode switch set to AUTO, when the pilot commits, a release pulse is sent to the selected store stations at the end of the delay set on the timer.

Weapon delivery may be made using either a visual or radar IP. If visual techniques are used, the delay set should be the time from the visual IP to the computed release point. If a radar delivery is used, release slant range should be set on the manual range line and the time from the radar IP to the target should be set on the auxiliary armament panel timer.

PROCEDURES FOR RADAR DELIVERY

1. Insert precalculated release slant range. This range is inserted in range readout window by manual range knob (MAN RANGE) on bombardier/navigator's control panel.
2. Computer/manual switch - MAN
3. Station select switches - BOMB or BOMBS/GUNS
4. Armament panel set for automatic release
5. Locate IP on search radar PPI display
6. MASTER ARM switch - ON
7. Auxiliary armament panel power select switch - REL DELAY

8. Computed release delay - SET
9. Azimuth scan angle - CCW (narrow scan)
10. Scan rate - FAST

    Azimuth cursor switch - ACTUATE

    Positive azimuth cursor dead ahead by moving cw or ccw

    Bombardier/navigator start and stop all turns with verbal instructions to pilot.

    IP will move down azimuth line as range-to-go decreases, maintain IP's left-right position.

    When IP reaches range line, commit. Tone comes on if selected, and at end of selected delay, release is initiated, and tone stops.

WEAPON DELIVERY WITH LOSS OF AIR DATA (EMERGENCY STRAIGHT PATH) (P-7B TRIM)

Loss of air data due to airspeed, pressure altitude, temperature probe, or angle-of-attack probe will not prevent a computer delivery of weapons. A straight path level attack can be made by manually entering altitude and mach number.

When it is determined that air data is faulty and the backup mode of attack is elected, aircraft true altitude (bombing altitude) is entered through the keyboard under present location and a command mach number is set into the computer by depressing the G buttons in accordance with the following schedule:

G Button	Mach
3.0	.60
3.5	.65
4.0	.70
4.5	.75
5.0	.80

The TAS window on the bombardier/navigator's attack-navigation panel and the command airspeed index on the pilot's mach/airspeed/command airspeed indicator will read the true airspeed for the mach number and altitude selected. For a successful attack, the aircraft must be flown at the altitude and mach number selected.

ATTACK PROCEDURES WITH LOSS OF AIR DATA

1. Flight mode button - PRE FLT
2. Error code switch - ERASE

   Note

   The error code 999 will appear in the DOPPLER GROUND VELOCITY window when the backup bombing mode is selected, the data select switch is at C, and the system is in attack. In addition, the VDI pathway changes to a three-line type as in the landing mode.

3. Mach number - SELECT

   Select desired mach number by depressing appropriate G button.

4. Address key - DEPRESS PRESS LOCA

   Enter aircraft true altitude under present location.

5. Armament panel - SET

   Set armament panel for a straight path level attack for either bombs or rockets.

   Note

   Rockets may be fired at a low grazing angle by selecting a rocket attack rather than a straight path attack.

Bombardier/navigator perform procedures for straight path attack. All tracking functions are available.

Pilot fly the aircraft to obtain selected indicated mach number and maintain altitude entered in the computer, ignoring vertical steering commands generated by the vertical position of the steering symbol.

For accurate bombing in the backup mode, it is more important to maintain a constant airspeed than precisely maintain the selected mach number. Variations in airspeed late in the run due to chasing the selected mach number may introduce transients into the solution that will adversely affect accuracy.

Acquisition of a discrete or ground lock-on will improve the bombing altitude and therefore the accuracy of the release. A track lock-on will eliminate the necessity for accuracy in entering aircraft altitude and target altitude.

WEAPON DELIVERY WITH SELECTIVE DATA REPLACEMENT (NOMATS) (P-8.6)

NEW

Loss of sensor input data due to mach (M), angle-of-attack (A), temperature (T), or static pressure (S) failure will not prevent a computer release of weapons. A straight path level attack can be made by selective replacement of failed sensor data. A failure of all these sensors can be accomplished by selecting EMERGENCY BOMB on the FLT MODE selector panel.

Procedures for replacing data for a failed sensor may be found in Section VIII, Weapons Systems.

LAB IP AND LAB TARGET DELIVERY

Two automatic loft deliveries are provided for release of store at preset release angles from 0° to 90° (LAB IP) (figure 3-14) and 90° to 135° (LAB TGT). These angles are preset in the platform adapter. The angles to be used for a nuclear weapon or Shrike missile can be found in the A-6A Tactical Manual and supplement. Whereas the LAB IP and LAB TGT modes of delivery for the Shrike missile are primary modes of delivery and are discussed in detail in the A-6 Tactical Manual, the LAB IP and LAB TGT modes are degraded modes of delivery when used in conjunction with nuclear and conventional weapons. Procedures for target acquisition and steering commands are the same as for manual laydown, but the range set in the manual range window will now correspond to pullup range for a medium angle loft (LAB IP). For LAB TGT, where pullup is initiated over or beyond the target, range may be set at zero only if the target can be acquired visually. Otherwise, range must be

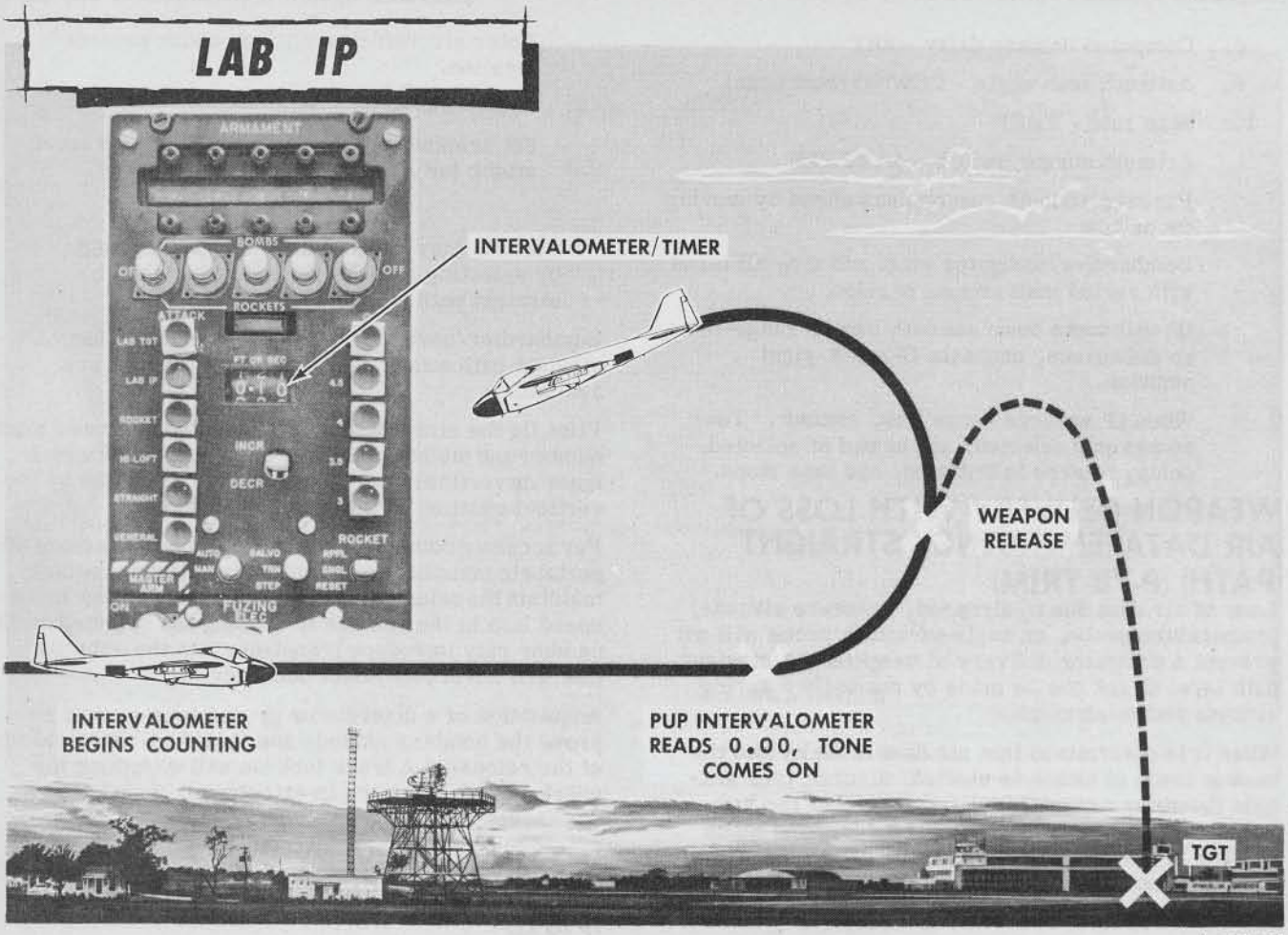

Figure 3-14

set at some distance that will allow the B/N to acquire the target on radar. During either of these maneuvers, the intervalometer timer may be used to establish a pullup for release at the optimum preset release angle. In either of these modes, the range readout window reflects the ground range from pullup point to the target or IP, and represents the directional/range index for this particular release (see figure 3-14).

When executing a LAB IP or LAB TGT maneuver, the weapon can be released either automatically or manually, depending upon the position of the release mode switch. With the switch set at AUTO, the weapon will be released automatically upon arriving at the preselected release angle set in the platform adapter provided that the station-select and MASTER ARM switches have been set and the pilot has depressed the attack commit trigger. A manual release can be accomplished by either the pilot or the bombardier/navigator.

With the release mode switch set to MAN, the pilot can release the weapon by depressing the manual release button when the aircraft reaches the desired release point. A manual release may be obtained with the release mode switch in AUTO; however, the attack commit trigger must be depressed for release.

With the release mode switch set to AUTO and the pilot depressing the manual release button, but not the attack commit trigger, the bombardier/navigator can release the weapon by switching the release mode switch from AUTO to MAN when the aircraft reaches the desired release point.

In aircraft equipped with the Mk-4 gun pod controls, the release mode switch is deleted but the pilot still has the option of selecting either manual or automatic release. With the MASTER ARM switch at ON, and a station selected, the pilot may obtain a manual release at any time by depressing the manual release button on the stick grip or he may select an automatic release by depressing the attack commit trigger on the stick grip. He may override an automatic release by depressing the attack commit trigger and the manual release button.

VALID DATA INTERPRETATION AND USE

Mechanization of valid data logic throughout the attack run acts as a master caution for the system and thereby increases the probability of a successfully executed automatic release since:

1. System failure or inability to release accurately is determined before run-in allowing system analysis and alternate attack mode selection.

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2. Positive protection against improper attack geometry is provided.
3. Long-term warning for use of manual override is more adequately displayed.

Preattack run assessment of automatic drop accuracy and reliability is obtained by the vertical display indication of pathway on or off. After attack is selected, there is no computer error light test since all of the basic quantities required for successful weapon release are directly or indirectly checked in the valid data logic. Pathway-off indication means that the computer is incapable of an accurate release due to system malfunction or improper attack conditions.

Common causes of sustained path-off indication due to improper attack conditions are:

1. Underdiving the target in straight path attack.
2. Violent jinking or erratic maneuvering (including turbulence).
3. Large changes of cursor position late in the run.

In a straight path attack, a pull-through (accelerated maneuver) will yield unpredictable results. Valid data indication is designed to remind the pilot, before pull out, that underdiving the target is invalid and the run is impossible. The logic is such that the pilot can judge the amount of maneuvering he can use on the run-in and still obtain accurate weapon release; i.e. he must revert to stabilized flight before release and pathway-on indicates an acceptable stabilized condition.

A discrete lock, over flat terrain, or at low grazing angles, will sometimes result in erroneous or erratic elevation angle data. In either case, valid data logic will indicate the need for alternate target data technique, or alternate attack geometry; i.e. ground lock or cursor intersection data, or higher dive angle.

Common causes of pathway-off due to system malfunctions are:

1. Erroneous vertical velocity.
2. Normal accelerometer failure (except in straight path).
3. Air data computer failure.
4. Almost any encoder failure.

In practice, the pilot is afforded an early assessment of any of these possible failures by selection of attack before entering the target area, thus avoiding an aborted run in heavily defended areas. His alternatives in case of valid data logic are:

1. Assess the vertical display symbol position and motion for failure clues, isolate the failure source, and take appropriate action.
2. Assume the valid data indication is the result of momentary failure and use manual override at release indication.
3. Select alternate attack mode; i.e. emergency straight path.

A series of momentary losses of pathway is usually not serious during the initial run-in and can be considered to be a caution; it should not constitute a down weapon system. Pilot communication of momentary valid data occurrence to the bombardier/navigator under these conditions serves to alert the bombardier/navigator to possible troubles in somewhat the same way that a master caution light functions for the pilot.

SEARCH RADAR DELIVERY

All navigation and attack modes can be accomplished without using the track radar. In all attack modes, the degradation is loss of radar ranging, target depression angle, and target velocity to the ballistics computer. However, these inputs from the track radar are replaced by others, namely, slant range and ground range from the search radar. Search radar, altitude and vertical velocity from the inertial platform, and target velocity are computed as wind by the use of the velocity-correct feature of the ballistics computer. The landing mode is accomplished by using the offset capability on a known fixed target near the landing runway.

COORDINATES SYSTEM BOMBING

If the search and track radars are lost on the mission, weapon delivery may still be accomplished on a preplanned target, provided the inertial or Doppler navigation system and computer are functioning properly.

BOMBING PROCEDURES

The procedures for a coordinate system delivery are as follows:

1. Establish aircraft on known line of latitude or longitude intersecting a release point.
2. Fly cardinal course to release point.
3. Navigation data switch - PRES POS
4. Steering mode - AS DESIRED
5. Enroute - CHECK PRESENT POSITION LATITUDE AND LONGITUDE WHEN TRANSITING A KNOWN VISUAL CHECKPOINT FOR NAVIGATIONAL ACCURACY. UPDATE POSITION IF REQUIRED.
6. Set armament panel for automatic release.
7. Monitor present position tape dial readouts.
8. Attack button - DEPRESS AT 10 MILES TO GO.
9. Attack commit trigger - DEPRESS WHEN IN RANGE.

Note

If track radar only is available, the bombardier/navigator may first locate the target using emergency search, then attempt to make a lock-on using the 1,200-cycle tone. Without lock-on, this is the least accurate means of delivery available, and should be used as a last resort means of mission completion navigation.

RELEASE OVERRIDE

In order to provide the pilot with a fast and positive override in case of automatic release failure, manual

release with the release mode switch in AUTO can be made by simultaneously depressing the commit trigger and the manual release button.

In aircraft equipped with the Mk-4 gun pod controls, the release mode switch is deleted but the pilot still has the option of selecting either manual or automatic release. With the master arm switch at ON, and a station selected, the pilot may obtain a manual release at any time by depressing the manual release button on the stick grip or he may select an automatic release by depressing the attack commit trigger on the stick grip. If the computer is in attack, manual override may be accomplished by depressing the attack commit trigger and the manual release button.

Care must be taken in the use of the release override capability to avoid spurious or wild release or premature override of a legitimate automatic release. Pilot assessment of the VDI situation for credibility and continuity is all improtant. If, for example, the attack has progressed smoothly up to the point of release, but release does not occur, the pilot should override. On the other hand, if the position of the release marker is erratic or if steering is not smooth, then use of override is likely to produce unpredictable results.

ALTERNATE MODES OF NAVIGATION AND STABILIZATION

There are several alternate or degraded modes of navigation, heading, and stabilization within the weapons system. The subsystems concerned here are: the inertial system, Doppler radar, MA-1 compass, VGI, air data computer, and the ballistics computer and its velocity-correct feature. (See figure 3-15).

Beginning with a full system as pertains to navigation and stabilization, the following procedures apply.

LOSS OF INERTIAL PLATFORM VELOCITIES

Shift to emergency Doppler navigation mode and continue to use the platform for heading and stabilization. Under these conditions, the Doppler is used for navigation and will continue to damp the platform for heading and stabilization utilization.

1. Altitude input will be provided by the air data computer (ADC). The velocity-correct function of the computer (figure 3-15) does not affect horizontal velocities (wind and groundspeed) when operating in the emergency Doppler mode. With a track radar lock-on, the velocity correct function will apply corrections to vertical velocity (altitude), an especially critical function in attack and/or terrain clearance situations.

2. In the DR navigation mode of computer operation, the automatic correct function (track lock-on) will introduce corrections to the computer in both horizontal and vertical axes (groundspeed, wind, and altitude). Velocity-correct (automatic or manual) is, in DR, a requirement for accurate navigation and attack.

3. Even though horizontal velocities may appear valid without further corrections, present position altitude should be monitored, and automatic velocity-correct performed, if necessary, for vertical input.

LOSS OF INERTIAL AND DOPPLER NAVIGATION VELOCITIES

Shift to DR navigation mode and continue to use the platform for heading and stabilization. Use the velocity-correct feature of the ballistics computer to maintain accurate wind information in the computer. This information will be used with the air data system to generate groundspeed and drift. The DR velocity will also be used to damp the platform for heading and stabilization utilization.

LOSS OF INERTIAL PLATFORM VERTICAL VELOCITY (ALT)

Shift to emergency Doppler or DR navigation mode as applicable. This removes the inertial vertical velocity from the system and uses air data altitude information instead.

LOSS OF INERTIAL PLATFORM

Shift to the MAG/VGI mode of operation for heading and stabilization information. Shut the platform off, and shift the navigation mode to emergency Doppler or DR (velocity-correct) as applicable.

Note

- The magnetic variation switch on the navigation control panel must be kept updated in the MAG/VGI mode to provide accurate true heading information to the ballistics computer.

- If the platform is lost during flight and is to be shut down, place platform selector switch to ALIGN for 10 seconds before going to OFF to prevent system damage.

LOSS OF ALL STABILIZATION AND HEADING INFORMATION TO THE COMPUTER

If all stabilization and heading information to the computer is lost:

1. Platform selector button - OFF

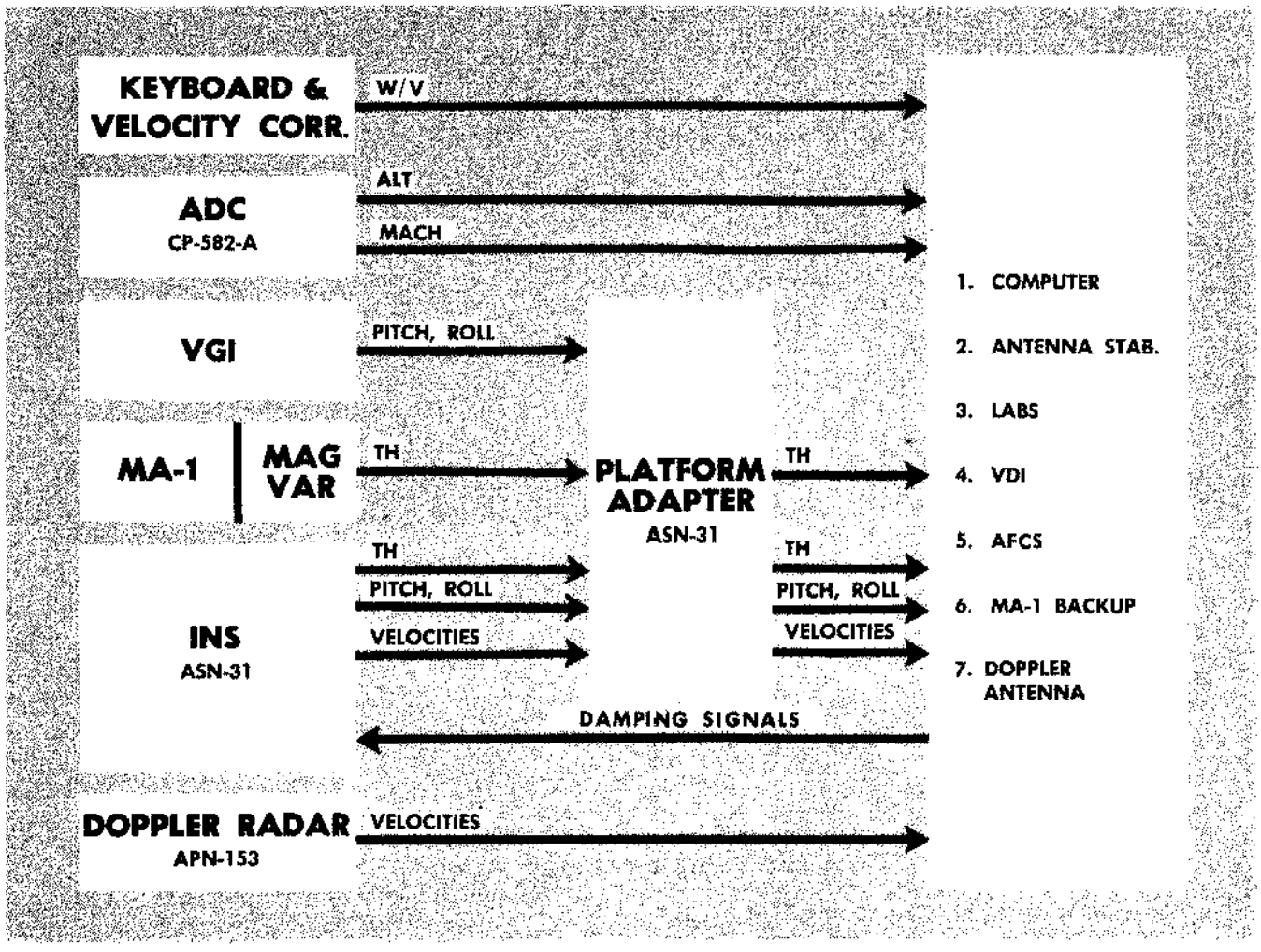
2. Compass switch - MAG/VGI

DR navigate to target area using search radar, (fixed antenna method), and the MA-1 compass. Use emergency straight path or manual mode for weapons delivery.

Note

Search radar presentation will be degraded or lost if aircraft wings are not level.

NAV, HDG, & STABILIZATION INPUTS



HEADING/STABILIZATION SOURCES

HEALING/STABILIZATION SOURCES									
		EQUIPMENT							
Compass Switch Position		VDI	DVI & PHD	VGI	HSI	AFCS	S/R	T/R	DOPP
OUT	HDG	INS	INS	-	INS/MV	INS	INS	INS	-
	STAB	INS	-	VGI	-	INS	INS	INS	INS
IN	HDG	INS	INS	-	MA-1	INS	INS	INS	-
	STAB	INS	-	VGI	-	INS	INS	INS	INS
MAG/VGI	HDG	MA-1 /MV	MA-1 /MV	-	MA-1	MA-1 /MV	MA-1 /MV	MA-1 /MV	-
	STAB	VGI	-	VGI	-	VGI	VGI	VGI	VGI

E-ADA1-158

Figure 3-15

part 8 Air Refueling Procedures

AIR REFUELING PROCEDURES KA-6D

Note

Air-refueling shall be conducted in accordance with the NATOPS Air-Refueling Manual.

INTERNAL AIR REFUELING SYSTEM OPERATION

Before Refueling

1. AFCS . . . . . AUTO NOT ENGAGED
2. Drogue jettison switch . . . . . SAFE
   On ground, drogue jettison switch is deactivated through left weight-on-wheels switch. When airborne, drogue jettison switch is deactivated when drogue is stowed and DROGUE RET/EXT switch is in RET position with refueling POWER switch in ON position.
3. Drogue switch . . . . . RET
4. Refueling power switch . . . . . ON
   Placing refueling power switch on pressurizes wing tanks to 12 psi and opens aft fuselage fuel tank shutoff valve.
   a. Hose-reel position indicator . . . . . STOW
   b. HYD PRESS low warning light . . . . . ON
      The HYD PRESS low warning light indicates hydraulic pressure is less than 1800 psi.
5. Pounds scheduled counter . . . . . SET
   When quantity of fuel to be transferred to receiver aircraft is set on LBS SCHED counter, internal switching is set to provide fuel flow transmitter information.
6. Pounds delivered counter . . . . . RESET
   Set pounds delivered counter to zero.
7. Lights switch. . . . . BRT(Day) DIM(Night)
8. External refueling panel . . . . . CHECK
   a. Ship tank switch . . . . . FROM STORE
   b. Drogue position indicator . . . . . RET
   c. Hose jettison switch . . . . . NORM
   d. Transfer switch . . . . . OFF
   e. Hose extend/retract switch . . . . . RET
   f. Refueling master switch . . . . . OFF

CONTINUED ON NEXT PAGE

AIR REFUELING PROCEDURES KA-6D—CONTINUED

9. Drogue switch . . . . . EXT

   a. HYD PRESS low warning light . . . . . OUT
   Placing drogue switch to extend pressurizes hose-reel hydraulic system to extend hose. Hydraulic pressure in excess of 1800 psi causes HYD PRESS low warning light to go out.

   b. Hose-reel position indicator . . . . . BARBER POLE
   Hose reel position indicator shows barber pole while hose is in transit from fully retracted to fully extended position.

   c. Hose-reel position indicator . . . . . TRAIL
   When hose reel reaches full extended position, hose reel position indicator shows TRAIL.

   d. READY light . . . . . ON
   READY light will come on 5 seconds after TRAIL indication.

10. Fuel transfer switch . . . . . AUTO

WARNING

Tanking operations should not be attempted without a READY light unless special procedures in Section V are followed.

Note

Tanking operations (as a tanker) with the AFCS in the AUTO mode is not recommended. Due to attitude reference source difference in the KA-6D, continuous corrections by the AFCS in the AUTO mode causes excessive hose/drogue movement and increases the number of off-center engagements.

Response Test

In order to properly complete the response test, steps 1-10 of Before Refueling must be completed.

1. Response switch . . . . . TEST
   Hold response switch in TEST position for 5 seconds and release. This action initiates a rewind signal to hose-reel hydraulic motor, causing a rapid hose rewind, which checks response mode of operation.

   a. Hose-reel position indicator:

      (1) Aircraft not incorporating AFC No. 298 . . . . . TRAIL
      Hose-reel position indicator continues to show TRAIL when hose leaves full trail position.

      (2) Aircraft incorporating AFC No. 298 . . . . . BARBER POLE
      Hose-reel position indicator shows barber pole when hose leaves full trail position.

   b. READY light . . . . . OUT
   READY light will go out between 5 and 25 feet from full trail.

CONTINUED ON NEXT PAGE

AIR REFUELING PROCEDURES KA-6D—CONTINUED

c. HYD PRESS light . . . . . REMAINS OUT

d. VALVE OPEN light . . . . . ON
VALVE OPEN light comes on in refueling range when refueling shutoff valve opens. Transfer-and-dump pumps come on.

2. Response switch . . . . . RESET
Hold response switch in RESET position for a minimum of 5 seconds and release. This action establishes a new hydraulic reference pressure and hose and drogue extend to full trail.

a. Hose-reel position indicator . . . . . TRAIL

b. READY light . . . . . ON
READY light will come on 5 feet from full trail after 5 seconds.

WARNING

Do not actuate REEL RESPONSE switch unless receiver aircraft is positively clear of area aft of drogue.

Note

A response test is required for functional check flights.

During Refueling

After the receiver aircraft is cleared to engage by the tanker pilot:

1. Engagement and fuel transfer.
Response action of hose reel due to receiver aircraft engagement causes hose to rewind to refueling range. On aircraft not incorporating AFC No. 298, hose reel position indicator will continue to show TRAIL. On aircraft incorporating AFC No. 298 hose reel position indicator will show barber pole when hose leaves full trail position.

a. Refueling range 5 to 25 feet from full trail.

b. READY light out.
READY light will go out between 5 and 25 feet from full trail.

c. VALVE OPEN light on.
Refueling shutoff valve opens and both transfer-and-dump pumps are energized.

d. FUEL FLOW light on.
Opening of refueling shutoff valve allows fuel flow to commence, actuating fuel flow transmitter internal switch, causing FUEL FLOW light to come on.

e. FUEL FLOW and VALVE OPEN lights out.
Fuel flow continues until forward and aft transfer-and-dump pumps are shut down by one of the following: pounds delivered equaling pounds scheduled, which actuates fuel flow internal transmitter switch to OFF position; drogue traveling outside 5 to 25 foot refueling range, positioning refueling range switch to not-fueling position or placing FUEL TRANS switch OFF.

CONTINUED ON NEXT PAGE

AIR REFUELING PROCEDURES KA-6D–CONTINUED

2. Advisory lights . . . . . MONITOR

3. Pounds delivered counter . . . . . MONITOR

OVERRIDE/Manual Mode

The override/manual mode of operation is the same as automatic except that placing the FUEL TRANS switch to OVRD manually opens the refueling shutoff valve, starts both fuel cell transfer-and-dump pumps, and energizes the fuel flow transmitter to operate the counters in the fuel flow totalizer. THE VALVE OPEN and FUEL FLOW lights will come on. The LBS SCHED counter must be monitored to stop fuel transfer to the receiver aircraft when required LBS SCHED is delivered. The FUEL TRANS switch is then placed at OFF, closing the refueling shutoff valve and stopping the fuel transfer-and-dump pumps. The VALVE OPEN and FUEL FLOW lights will go out.

CAUTION

The receiver aircraft should never attempt a disconnect while green fuel flow lights are on, as exceptionally high disconnect forces will be experienced.

After Refueling is Complete

1. Receiver aircraft . . . . . DISCONNECT
   Receiver aircraft action causes hose to trail back to full trail position (46 feet extended) and causes it to become disconnected from drogue. READY light will come on.

2. Fuel transfer switch . . . . . OFF

3. Drogue switch . . . . . RET
   Hose and drogue will retract.

   a. READY light . . . . . OUT

   b. Hose-reel position indicator will show barber pole while hose and drogue are retracting and STOW when retraction is complete and reel drum is locked in stowed position.

   c. HYD PRESS low warning light . . . . . ON
      Hydraulic pressure low warning light will come on when drogue is fully retracted.

4. Refueling power switch . . . . . OFF
   When refueling power switch is placed at OFF, HYD PRESS light goes out and hose-reel position indicator displays barber pole.

5. Offload report . . . . . AS REQUIRED

Note

If refueling system malfunctions are encountered, refer to Air-Refueling Emergency Procedures in Section V.

AIR REFUELING (TANKER) PROCEDURES D-704 STORE

CAUTION

In the KA-6D the use of an external air refueling store is prohibited unless IAFC No. 296 or AFC No. 296 is incorporated in the aircraft. If IAFC No. 296 or AFC No. 296 is installed and it is decided to transfer fuel utilizing the D-704, the TO STORE switch on the centerline refueling store panel shall remain in the OFF position until the fuel quantity in the centerline refueling store is less than 500 pounds. When the fuel in the centerline refueling store reaches 500 pounds or less, move the centerline refueling store switch to the TO STORE position to replenish the store. Monitor fuel quantity indicator closely so that switch may be returned to the OFF position as soon as the fuel quantity indicates 1,500 pounds. If the tanker fuel transfer/dump pump starting relay is malfunctioning, the fuel transfer rate to the refueling centerline store could be fast enough to cause store failure if the indicated fuel level in the store is permitted to go above 1,500 pounds.

BEFORE TAKE-OFF

1. Ship tank switch . . . . . OFF
2. Drogue position switch . . . . . RET
3. Refueling master switch . . . . . OFF
4. Fuel transfer switch . . . . . OFF
5. Light switch . . . . . (Day) BRT
   (Night) DIM
6. Gallons delivered 000
7. Hose jettison switch . . . . . OFF

DROGUE EXTENSION

1. Refueling master switch . . . . . ON
2. Airspeed . . . . . 300 KIAS or less
3. Drogue switch . . . . . EXT
   Drogue indicator will read EXT when drogue reaches full trail position.
4. SHIP TANK switch . . . . . TO STORE

CONTINUED ON NEXT PAGE

AIR REFUELING (TANKER) PROCEDURES D-704 STORE–CONTINUED

RECEIVER HOOKUP AND REFUELING

After the receiver aircraft engages and moves forward in relation to the tanker enough to turn off the amber lights on the store, the drogue position indicator will read TRA. The bombardier/navigator then places the fuel transfer switch to TRANS to start the flow of fuel.

Stopping Fuel Transfer

Fuel transfer may be stopped at any time by placing the fuel transfer switch to OFF. Refueling will stop if the receiver aircraft backs off enough for the amber light to come on or if the probe disengages, in either case, the drogue position indicator windows will change from TRA to EXT.

CAUTION

Refueling cannot be stopped by placing the refueling master switch in the OFF position. Lack of hydraulic pressure will cause whiplash to occur in the refueling hose.

To stop transfer to the store, turn the SHIP TANK switch to OFF.

If hose tensioning or reel-in features are inoperative, the hookup should be discontinued immediately and the cause determined. If the hose does not reel in properly, a recycling of the hose by the tanker may remedy the malfunction.

DROGUE RETRACTION

1. Fuel transfer switch . . . . . OFF
2. Airspeed . . . . . 250 KIAS OR LESS

WARNING

Field arrestment or carrier landing with drogue extended is not recommended. Guillotine drogue in clear or uninhabited area.

3. Drogue switch . . . . . RET

Note

If the drogue cannot be fully retracted at about 250 KIAS, reducing airspeed to 230 KIAS or less should permit full retraction.

CONTINUED ON NEXT PAGE

AIR REFUELING (TANKER) PROCEDURES D-704 STORE–CONTINUED

4. When drogue position indicator reads RET, place refueling master switch to OFF.

TRANSFER FROM STORE TO TANKER

If it is desired to transfer fuel from the refueling store to the tanker, place the ship tank switch to FROM STORE.

BEFORE LANDING

1. SHIP TANK . . . . . OFF
2. Drogue switch . . . . . RET
3. Drogue position indicator . . . . . RET
4. Refueling master switch . . . . . OFF
5. Fuel transfer switch . . . . . OFF

JETTISONING REFUELING STORE

The air-refueling store may be jettisoned electrically in the same manner as other external stores.

CAUTION

Do not jettison refueling stores above 300 KIAS.

Tanker Safety Precautions

WARNING

- Do not start the turbine or extend or retract the drogue when over populated areas or when other aircraft are close abeam or behind.
- Do not extend the drogue when a store hydraulic leak has been observed.
- Do not actuate the speed brakes during any part of the refueling operation.
- Once the hose jettison switch is actuated, do not return it to the OFF, position. In advertent cycling of this switch will cause a dangerous condition in the store.

CAUTION

Do not jettison refueling stores above 300 KIAS.

AIR REFUELING STORE LIMITATIONS

1. Maximum speed for unfeathering is 300 KIAS. For extension of drogue and refueling, maximum speed is 300 KIAS or 0.80 IMN.
2. Maximum speed for drogue retraction is 250 KIAS.

CONTINUED ON NEXT PAGE

AIR REFUELING (TANKER) PROCEDURES D-704 STORE–CONTINUED

3. The air refueling store must be empty for catapult launches if it is suspended from the AERO 7A rack. Catapult launches with a full store are permissible if the AERO 7A rack is used.

4. Maximum gross catapult weight with an air refueling store on the AERO 7A rack is 52, 500 pounds due to possible trail bar slap.

5. The air refueling store must be empty for arrested landings.

WARNING

- When the SHIP TANK switch is placed to FROM STORE to empty the air-refueling store prior to carrier arrestment, do not select landing gear down until the SHIP TANK switch is placed from FROM STORE to OFF. When the landing gear is lowered, the air-refueling store depressurizes and, if FROM STORE is selected, the shutoff valve remains open, allowing reverse flow back into the air-refueling store. Fuel flow to store will be accelerated if FUSELAGE DUMP is also selected.

- When receiving fuel from a KC 135, the drop tanks may be filled but the maximum internal fuel shall not exceed 14, 000 pounds of JP-4 or 15, 000 pounds of JP-5. The A-6 has no surge relief provisions between the probe and the refueling gate valve; therefore, the receiver aircraft must discontinue fueling by disengaging from the refueling drogue.

part 9 SATS Procedures

SATS LIMITATIONS

In addition to the aircraft limitations given in Section I, part 4 of this manual, the following restrictions are applicable for A-6A SATS catapult launches:

a. CG limits: 23% MAC to 29% MAC

b. Gross weight: 30,000 lb to 54,000 lb

c. The D-704 refueling store may not be carried on the fuselage station.

d. No fuselage stores may be carried on multiple stores racks

e. Density altitude between -2320 to +3000 feet

f. Crosswind not to exceed 15 kts

WARNING

Failure to adhere to the above restrictions will result in damage to the catapult, aircraft, or both.

PREFLIGHT

DAY

A normal preflight inspection should be made with particular attention given to the landing gear, tires, hook, and underside of the fuselage for previous damage. The aircraft gross weight and drag count should be determined and written (grease pencil, etc.) in a place visible to the catapult crew.

CAUTION

SATS launch end airspeeds are functions of aircraft gross weight and drag count. These parameters must be known if a safe launch is to be accomplished.

NIGHT

In addition to the normal cockpit preflight, ensure that external light switches are positioned to dim, the taxi light is definitely off, and that interior lights are prepositioned as desired.

TAXI

Taxiing on duty SATS matting is analagous to taxiing on any dry, hard surface area with the exception that the matting will give slightly under heavy loads. Taxiing into or out of revetted areas presents no difficulties except that particular attention to plane director's signals is required due to the small clearances provided.

Taxiing on wet or oily SATS matting is hazardous at best due to a greatly reduced coefficient of friction. Keep speed under control at all times by judicious use of the brakes. At light gross weights, it may be advisable to use only one engine, starting the other just before positioning for takeoff.

LAUNCH PROCEDURES

Proper positioning on the SATS catapult requires particular attention to the plane director's signals. All functional checks must be performed before taxiing into the catapult. Assure that the following is done:

FLAPS:	TAKE-OFF
TRIM:	RUDDER: O
AILERON:	O
LONGITUDINAL:	4 units aircraft nose-up

Use nosewheel steering for initial positioning as required. Approximately 80% to 90% rpm will be required to taxi over the arrester ropes and up the dolly ramp. Once the ground handling crew has lowered the launch bar and it is engaged in the lead-in track, release the nose-gear steering and refrain from differential braking. Taxi forward slowly to avoid engaging the launch bar retract mechanism and overstressing the tension bar.

Before launch verify that the takeoff checklist has been completed. Upon receipt of the "tension-up and release brakes" signal, release brakes and watch the catapult officer for two-finger turn-up signal. When this signal is received, advance power to military, grasp and extend the catapult grip, check flight and engine instruments, and when satisfied that the aircraft is ready, give an exaggerated salute to the catapult officer.

CAUTION

If the catapult grip is not extended throughout the launch cycle, the nose strut will not be stiffened and unsatisfactory airplane pitch oscillations may develop during the launch.

After the salute and prior to launch, ensure that the head is back against the headrest and that the control stick is held in a neutral position. Normally, there will be a 2- to 6-second delay before the catapult actually fires. During the actual launch, observe the green cutoff light changes to amber. Upon perceiving the amber light, initiate normal aft stick movement and rotate the airplane to a takeoff attitude.

The front section of the launch dolly will pitch up during the power stroke, causing the aircraft to assume a nose-up attitude. At the end of the programmed launch sequence, as the tow force decays, the front section of the dolly will drop back onto the matting and the aircraft nose-up attitude will decrease. The dolly will be first on the deck and the launch bar will separate from the dolly at approximately the same time the cutoff light changes to amber.

WARNING

Do not apply brakes during launch. Do not use nosewheel steering during launch.

The aircraft will leave the catapult at or near the optimum airspeed for flight. Avoid overrotation but establish a positive rate of climb at 6° to 10° nose-up, cross reference with AOA, vertical speed, and indicated airspeed. Retract the landing gear when safely airborne and flaps below 250 KIAS.

WARNING

Extreme caution should be exercised during flap retraction at heavy gross weights. Do not retract the flaps below 170 KIAS for weights,up to 50,000 lb. At heavy gross weights under high ambient temperature conditions, acceleration and climb performance are marginal and it may be impossible to reach 185 KIAS. If 185 KIAS cannot be obtained, reduce external store weight in order to accelerate to 185 KIAS before flap retraction.

NIGHT

Taxi onto the catapult with external lights off. When ready to launch, place the external light master switch on. As in daytime launches, closely monitor AOA, airspeed, vertical speed, and nose and wing position after launch.

CATAPULT EMERGENCIES

If the launch bar separates from the dolly prematurely, the pilot will feel a sudden loss of acceleration but the dolly will continue to accelerate and move ahead of the aircraft. As soon as the dolly can be seen in front of the aircraft, the pilot should maneuver to the side of the matting to avoid contacting the rebounding dolly. If abort or takeoff is not possible and speed of 100 KIAS has been attained, EJECT.

A cold shot can result from a catapult malfunction. If the dolly moves ahead of the airplane, maneuver to the side of the matting so as to avoid contact with the rebounding dolly. If abort or takeoff is not possible and a speed of 100 KIAS has been attained, EJECT.

RECOVERY

SATS traffic and landing approach patterns are generally in accordance with the procedures outlined for normal landings in section III, Part 3 of this manual. Maximum arrested landing weight is 36,000 lb. Begin the approach by turning approximately 5 to 8 seconds past the arresting-gear position in order to have a 1-mile wings-level groove. Report the 180° position with side number and fuel state, and hung ordnance as appropriate.

At approximately the 90° position, 450 feet of altitude, the meatball will appear in the center of the lens: correct the rate of descent as required to keep the meatball centered. Glide slope corrections should be made smoothly with combined power and attitude changes so as to maintain optimum approach AOA and a centered meatball. Pay particular attention to line-up, correcting for cross-wind as required so as to land in the center of the runway.

Upon landing, apply full military power and retract the speed brakes. As soon as arrested, place the throttle to idle and raise the flaps. Allow the aircraft to roll back to disengage the arresting gear, then raise the hook when signalled to do so.

CAUTION

Do not raise the tailhook while engaged so to prevent damage to the hook bumper cable.

WAVE-OFF/BOLTER

Wave-offs and bolters are readily accomplished by application of full military power, retraction of speed brakes, and rotation to a fly-away attitude. To preclude any possibility of engaging the terminal and dolly arrested ropes, retract the tailhook immediately after becoming airborne or safely stopping the rate of descent.

WARNING

Inadvertent engagement of the dolly arrester ropes will result in extensive damage to the aircraft and catapult.

part 10 Functional Check Flight Procedures

FUNCTIONAL CHECKFLIGHT REQUIREMENTS

Checkflights will be performed when directed by, and in accordance with, OPNAVINST 4790.2 series and the directions of NAVAIRSYSCOM Type Commanders, or other appropriate authority. Functional checkflight requirements and applicable minimums are described below. Functional checkflight checklists are promulgated separately.

CONDITIONS REQUIRING CHECKFLIGHTS

Checkflights are required under the following conditions (after the necessary ground check and prior to release of the aircraft for operational use):

A. At the completion of aircraft rework and all aircraft acceptances (all checkflight items required are prefixed A).

B. After the installation of an engine, or engine fuel control, or any components which cannot be checked in ground operation (minimum required are prefixed B).

C. When fixed or movable flight surfaces or flight control system components have been installed or reinstalled, adjusted, or rerigged, and improper adjustment or replacement of such components could cause an unsafe operating condition (minimum required are prefixed C).

CHECKFLIGHT PROCEDURES

The items which follow provide detailed descriptions of the functional checks, sequenced in the order in which they should be performed. In order to complete the required checks in the most efficient and logical order, a flight profile has been established for each checkflight condition and identified by the letter corresponding to the purpose for which the checkflight is being flown; i.e., A, B, or C, as shown above. The applicable letter identifying the profile prefixes each check both in the following text and in the Functional Checkflight Checklist. Checkflight personnel will familiarize themselves with these requirements prior to each flight. NATOPS procedures will apply during the entire checkflight unless specific deviation is required by the functional check to record data or ensure proper operation within the approved aircraft envelope. A daily inspection is required before each checkflight.

PRETAKEOFF

TAXI CHECKS

Before Taxi

PROFILE	
AC	1. Wing-Fold System - SPREAD WINGS. Check that WING FOLD control handle is locked out when control stick is not in neutral. Control stick is laterally restricted when WING FOLD handle is not stowed (except when autopilot is engaged). Flaps, slats, and flaperon pop-up circuits are open with wings unlocked. Wings cannot be cycled with flaps and slats extended and control stick out of neutral. Wings spread smoothly in approximately 20 seconds.
AC	2. Flight Controls - CHECKED. a. Flaperons: Check for smooth lateral control stick movement and flaperon operation. Check mutual lock-out of flaperon and wing-fold mechanism. Position FLAPERON POP UP switch to ARM; flaperons should pop up. Check for limited lateral control stick movement. Return FLAPERON POP UP switch to OFF; flaperons should return to normal; check trim operation three units left and right. Full travel in 11 1/4 seconds. b. Horizontal Stabilizer: Check for smooth operation with flaps up. STAB position indicator should show CLEAN indicating normal stabilizer throw. Lower flaps and recheck. Position indicator will show a symbol of a stabilizer indicating that extended throw is available. Check full travel of trim operation (3 units nose down to 12 units nose up).

PRETAKEOFF–CONTINUED

PROFILE

c. Rudder: With flaps down, check for smooth rudder pedal movement. Extended rudder throw should be available. Raise flaps and recheck; rudder throw available should return to normal (4° either side of neutral). Check full travel of trim operation (4 units left and right).

d. Assist-Spin Recovery: Activate assist-spin recovery system. RUD THRO caution light should light and extended rudder and horizontal stabilizer throw should be available. Return ASSIST SPIN RECOV switch to OFF; controls should revert to normal throw and caution light should go out.

e. Wing Flaps and Slats: Select LAND; flaps extend to 40° down and slats to full down 27.5°. Select UP; flaps return to full up and slats return to full up. Select TAKEOFF; flaps extend to 30° down and slats to full down. Cycle times, flaps 10 to 12 seconds, and slats 6 to 8 seconds.

f. Wing Flap and Slat Indications: FLAP window indicates UP position; displays 30° and 40° flap positions, barber pole when flaps are in transition or power is OFF, SLAT window displays slat when slats fully extended and IN when slats are retracted; barber pole when slats are in transition or power is OFF.

g. Emergency Operation of Flaps and Slats: Emergency switch in desired position, electric operation shall have priority over hydraulic operation. Electric emergency switch shall be actuated only with wings spread and locked.

h. Wing-Tip Speed Brakes: Operate smoothly during fully closed to fully open (120°) operation and incremental partial extension.

AC 3. Automatic Flight Control System - CHECKED.
Check for engagement in all modes and for positive disengagement. With AUTOPILOT switch OFF, deflect control stick through full lateral throws.

AB 4. Air Conditioning - CHECKED.
Check air conditioning maintains constant temperature and airflow. Check HOT and COLD switch positions - (Auto and Manual). Check for proper equipment cooling, no warning lights.

AB 5. Vent Suit or Cushion Airflow - CHECKED.
Check for constant temperature and airflow, and controlability.

AB 6. Anti-G System - CHECKED.
Press g-suit test button. Pressurization shall commence immediately.

AB 7. A-6C: Check for proper operation of pod air conditioning, no warning lights.

AB 8. Windshield-Washing System - CHECKED.
Check that spray is even on windshield.

AB 9. Rain-Removal (Anti-Ice) System - CHECK BRIEFLY.
Reach over top of windshield; check temperature and airflow.

A 10. Lighting Systems - CHECKED.
Satisfactory illumination control on all lighting systems.

A 11. Oxygen System - CHECKED.
Check quantity gage; oxygen for flight in accordance with NATOPS Flight Manual for altitude and duration of flight. Check LOX/FUEL press-to-test and proper operation including caution light. Supply satisfactory regulated between 100% O_2 and diluter-demand (GRU-5). Supply satisfactory (GRU-7).

PRETAKEOFF–CONTINUED

PROFILE

A

12. Communication, Navigation, Identification equipment (with CNI master switch at ON except A-6E TRAM) - CHECKED.

    a. Intercommunications Set (ICS): Operates satisfactorily in all modes. COLD position of MIC SEL (ICS/MIC, A-6E TRAM) switch allows transmission only when ICS switch is depressed. HOT position allows transmission at any time.

    b. UHF: Operates satisfactorily; channel and frequency-select all functions smoothly. KA-6D and A-6E TRAM: Same check for UHF No. 1 and UHF No. 2.

    c. NAV Beacon sidetone - CHECKED.

    d. AUX UHF: (Except A-6E TRAM): Operates satisfactorily; large needle on HSI indicates magnetic bearing (±10°) to station unless UHF - ADF is selected.

    e. TACAN (Except A-6E TRAM): Controls satisfactorily. With SEL switch in REC position, bearing displayed. With SEL switch in T/R, both bearing and range are indicated. Identification signal is heard in headsets when selected and volume is controllable. Range and bearing displayed on HSI with no undersirable excursions. With antenna select switch in any position, lock-on occurs within 30 seconds of station selected. KA-6D: Ensure TACAN is selected on VDI control panel. TACAN (A-6E TRAM): BIT

    f. Bomb Tone: Check satisfactory tone quality. Except A-6E TRAM, place TRAN SEL switch to U, TONE switch to BOMB, and BOMB TONE switch to MAN. A-6E TRAM, place BOMB TONE switch to MAN, check tone with TRANSMIT switch at BOMB TN 1 and BOMB TN 2.

    g. ECM Warning Tone - CHECKED.

    h. IFF/SIF: Proper response to interrogation signal in each mode. I/P provides identification transmission when switch is actuated plus an additional 15 to 30 seconds after switch release. MIC same as I/P switch but answers interrogation when microphone button is depressed.

A

13. Vertical Display Indicator - CHECKED.

    a. Contrast/Brightness: (Except KA-6D.) Acceptable variable control.

    b. Impact Point: (Except KA-6D.) Approximately circular and located near or at center of scope (minimum drift and angle of attack). Bright shading and thick black line on right edge of symbol.

    c. Target Symbol: (Except KA-6D) Solid white 1/4-inch square.

    d. Steering Symbol: (Except KA-6D) Hollow white 5/8-inch square.
    A-6B Mod 1: Not displayed in TIAS mode.

    e. Pullup Marker: (Except KA-6D) Black line extending from left outline of path to middle of path when visible.

    f. Release Marker: (Except KA-6D) Horizontal black bar ended by short vertical bar extending to right side of display. Left edge of symbol shall be right of center of display. Horizontal member, located at vertical display center in test, is visible only when IN RANGE light is on or in test.

    g. Flight Path: (Except KA-6D) Perspective black vertical lines converging at a point on indicator, A-6A, B, C Centering is equidistant between the two-lines during takeoff mode.
    A-6B Mod 1: Not displayed in TIAS mode.

    h. Horizon: Interface between ground shading and sky shading. Dark shading at horizon becoming lighter at bottom of raster.

    i. -30° Pitch Line: Line parallel to horizon and extending across display approximately midway between horizon and bottom of raster; black shading.

PRETAKEOFF–CONTINUED

PROFILE

j. +30° Pitch Line: Line parallel to display horizon and extending across display above horizon; black shading.

k. +60° Pitch Line: Line parallel to display horizon and extending across display above +30° pitch line; black shading. Line is approximately twice thickness of -30° and +30° pitch lines.

l. +90° Pitch Line: Dashed line (3 to 6 dashes) parallel to display horizon and extending across display above +60° pitch line; black shading. Line is same thickness as +60° pitch line.

m. Clouds: Semiflattened, irregularly curved outline, and black lines on right edges. Bright shading against medium light sky.

n. Ground Texture: Rows of ellipses emanating from horizon line constant in size and rate of movement. Dark shading on background.

o. Electronic Roll Marker: White line extending approximately 3/4 inch down from top of screen perpendicular to horizon line; bright shading.

p. Pitch Trim Markers: Two movable vertical lines extending in approximately 3/4 inches from sides of display and parallel to horizon line; bright shading.

q. Command Heading Lines: Three black lines minimum, four maximum. Apparent convergence point shall be approximately 3/8 inch above path apex. Apparent point of convergence shall be centered horizontally within 3/16 inch of path apex point.

r. Roll Index: Centered on roll pointer ±2°.

s. KA-6D: MA-1 Compass slaved; observe lateral motion of clouds and ground texture.

A 14. KA-6D: Vertical Gyros - CHECKED.
Switch VERT REF from No. 1 to No. 2 and observe attitude input to VGI and VDI.

A 15. KA-6D: Navigation Computer ASN-41 - CHECKED.

a. Function selector switch - STBY

b. Function selector switch - D2 (set destination 2 latitude and longitude)

c. Function selector switch - D1 (set destination 1 latitude and longitude)

d. Function selector switch - STBY (set present position latitude and longitude)

e. Local magnetic variation - SET

f. HSI mode switch - NAV COMP

g. Function selector switch - D1 (check correct bearing and distance)

h. Function selector switch - D2 (check correct bearing and distance)

i. Function selector switch - TEST
Wind direction should read 91° ±1° and windspeed should read 231±3 knots.

A 16. Search Radar Terrain Clearance (SRTC) Presentation - CHECKED.

A 17. Internal In-Flight Refueling System - CHECKED.

a. Refueling power switch - ON

b. Pounds scheduled - SET (some quantity)

PRETAKEOFF–CONTINUED

PROFILE

c. Drogue switch - EXT
Drogue ejects 1 to 2 feet and STOW/TRAIL indicator shows barber pole.

d. Hose-reel ground test switch - FULL TRAIL
Hold until STOW/TRAIL indicator shows TRAIL and READY light comes on.

e. Fuel transfer switch - AUTO

f. Hose-reel ground test switch - FUEL RANGE
Valve open and fuel flow lights come on and pounds scheduled decreases.

g. Reel response switch - TEST (hold for 5 seconds)
Drogue retracts.

h. Drogue switch - RET
STOW/TRAIL indicator shows STOW.

i. FUEL TRANS switch - OFF

j. Refueling power switch - OFF

A 18. A-6C: TRIM TV Presentation - CHECKED.

a. Reticle: Open center cross in center of field of view, brightness is controllable.

b. Inverted T: White symbol, 0.63 in. wide, 0.63 in. high.

c. Vertical Speed Chevron: White inverted or upright chevron 0.63 in. wide, 0.63 in. high. During taxi, climb, or dive, no chevron may be displayed.

d. Horizon Line: A broken white line 6 in. long consisting of two 2 in. segments separated by a 2 in. space.

e. +30° Pitch Line: A dashed white line (three dashes) 2 inches long parallel to the horizon line extending across the middle third of the display above the horizon line.

f. -30° Pitch Line: A white line 2 inches long parallel to the horizon line extending across the middle third of the display below the horizon line.

g. -60° Pitch Line: A white line 4 inches long parallel to the horizon line extending across the middle two thirds of the display below the -30° pitch line.

A 19. Pilot's Horizontal Display - CHECKED.

a. Command Steering Bug: Functions smoothly and is positioned dead ahead ±0.5° in UNSTAB/NO STEER and agrees with electronic azimuth cursor within ±2°.

b. Tape Dials: Windows show range and bearing to cursor intersection.

c. Variable Filter Installation: Satisfactory day/night control.

d. Controls: Satisfactory brightness, contrast, persist, and marker control. Persist shall be capable of holding through two full scans on all search displays. Adjustment for blooming may be necessary to obtain usable display.

e. One Scan: While in silent display, one scan of video on next left-to-right sweep.

f. Erase: Momentary display similar to no-persist.

PRETAKEOFF— CONTINUED

PROFILE

A 20. Optical Sight - CHECKED.

a. Accuracy: Align movable reticle to fixed reticle. Elevation wheel must be within +3 mils of zero. Fixed and movable reticle lines must not be displaced by more than one line width.

b. Controls: In-range and breakaway brightness control operate satisfactorily. FIL 1 and FIL 2 control operate satisfactorily in fixed and movable reticles.

c. Test: In-range and breakaway displays are present.

d. Elevation Thumbwheel: Functions satisfactorily.

e. Displays: Fixed reticle has satisfactory display with manual control of masking. Movable reticle has satisfactory display of steering information.

f. Parallax: Maximum allowable at 0.0 lead angle is ±3 mils.

A 21. A-6E: Complete search radar/computer turn-on and BIT checks.

A 21A. A-6E TRAM, KA-6D with AFC 161: Complete ARA-63 and ASW-25 BIT checks.

During Taxi

A 22. Brakes - CHECKED.
Check wheel brakes for smooth operation and no pulling tendencies.

A 23. Nosewheel Steering - CHECKED.
Check steering just after leaving chocks, for smooth operation and satisfactory shimmy damping.

A 24. Antiskid - CHECKED.
Check antiskid system for proper functioning. ANTI-SKID caution light shall light if a brake release signal exceeds 3.5 seconds.

A 25. Auxiliary Brake System - CHECKED.
Auxiliary brake cycle gage shall indicate and hold 14 cycles.

A 26. INS - CHECKED.

a. A-6E: Taxi speed in window A1 approximates aircraft speed.
A-6A, B, C: Bearing = Aircraft true heading +180° ±3°.

b. Altitude holds steady (+32 feet) during taxi run.

c. Velocities go to zero to 3 knots when aircraft comes to a stop.

d. Note heading, velocity, and altitude.

A 27. Doppler Radar
A-6E, KA-6D:
After 5-minute warmup in STBY: Set 20° L or R drift angle and 350 knots groundspeed.

a. Mode Selector Switch - TEST
Groundspeed should read 121±5 knots and drift 0° ±2°.

b. Return mode selector to STBY.

A-6A, B, C

a. VEL: Reference signal on and XMIT/SILENT/OFF switch at XMIT, windspeed shall read 116 to 126 knots.

b. BRG: Wind direction shall read aircraft true heading +177 to 183°.

PRETAKEOFF— CONTINUED

PROFILE

Note

Computer must be on.

A

28. Search Radar - CHECKED.
A-6A, B, C

a. ANT. PATT.: Smooth and in phase with switch; meter can be driven to zero.

b. MAG. FREQ.: Check for smooth transition in phase with switch.

c. MAG. CUR.: It should not take more than 7 minutes or less than 4.5 minutes for magnetron current to time in. Check that it adjusts with INC-DEC switch to 0.8; adjust to 0.7 at 2,400 prf and must not vary by more than ±0.2 as prf is varied.

d. XTAL CUR.: Adjusts with INC-DEC switch in manual mode. Check that it can be coarse-tuned for target at any MAG. FREQ. in manual mode. It shall be locked and stable with prf change in AFC mode within two antenna sweeps.

e. Echo Check: Check that there are at least three pulses visible.

f. AZ STAB.: ON - Sweep follows AZ cursor: OFF - Sweep stabilized about ADL.

g. XMIT/SIL: Reduction of video (clutter) when switched from XMIT to SIL and no TC video in silent.

h. Video: Check that there is uniform focus, and noise and spoking are at acceptable level.

i. SRCH TRIG: No change or loss of video when switch is cycled from PRI to SEC. Switch shall be cycled to STBY before switching from SEC to PRI.

j. DIFF GAIN: Satisfactory control.

k. STC SLOPE/DEPTH: Reduces gain of close-in targets and allows display optimization.

l. PPI Display: All modes must be operationally functional.

m. PPI-150: Range markers at approximately every 25 nmi (five or six range markers may be visible). Sweep length approximately 140 to 160 nmi. AZ line may shift slightly from sweep to sweep but must not interfere with mission performance.

n. PPI-75: Range markers at approximately 25 and 50 nmi. Sweep length approximately 70 to 80 nmi. Radar mapping shall be in excess of 30 miles. AZ line may shift slightly from sweep to sweep but must not interfere with mission performance.

o. PPI-30: Range marker on both sides of AZ line, less than half total scan width at approximately 10 and 20 nmi. Sweep length at 26 to 29 nmi. Radar mapping shall be 25 miles. AZ line shall be a single, sharp, clear, and continuous uniform line.

p. Rubber Range: Check that it varies display smoothly from at least 29 nmi to 5 nmi with PPI range control.

q. Expanded Displays: Switching Criteria - When in WAC, switch to SECT automatically occurs when range cursor drives to less than 44 nmi; then automatically switching to ARE-50 at 27.5 nmi. When in SECT, switch to ARE-25 automatically occurs at 27.5 nmi. Manual switching performs satisfactorily. In ARE-50 Video and Display - Operationally functional with quality equal to PPI-30. In WAC Video and Display - Operationally functional with quality equal to PPI-150.

PRETAKEOFF – CONTINUED

PROFILE

r. DVRI indicator lights: Satisfactory operation.

s. DVRI bug: Operates smoothly and drives dead ahead ±1/2° in UNSTAB/NO STEER and agrees with electronic AZ Cursor within ±2°.

A 29. A-6C: DF Set Bit - CHECKED.
Set DF POWER switch to BIT and observe proper indications.

A 30. A-6C: Optical Sensor Platform Operation - CHECKED.

a. Set OSP mode selector switch to OVRD and OSP power switch to FWD. Platform position indicator will display a barberpole indication immediately and will change to a forward chevron in 14 seconds.

b. Set CMPTR/MAN switch to MAN and note that OSP can be slewed in azimuth with azimuth cursor switch. Note that OSP can be slewed in elevation by means of elevation slew switch on slew stick.

A 31. A-6C: FLIR Receiver - CHECKED.

a. IR cool-down normally requires 30 minutes. After cool-down is complete, IR HOT light will go out and system can be checked.

b. IR BLK display: Observe proper display.

c. IR WHT display: Observe proper display.

d. IR intensity: Acceptable variable control.

e. IR gain: Acceptable variable control.

f. Depress IR ZOOM button, observe 4:1 magnification.

g. IR focus: Acceptable variable control when IR ZOOM is engaged. Depress IR ZOOM button, normal display returns.

h. TV/IR brightness/contrast: Acceptable variable control.

A 32. A-6C: OSP landing gear interlock control - CHECKED.
Set NORM/OVRD switch to NORM, displays will go blank and OSP position indicator will display a barber pole, than an aft chevron in 14 seconds.

A 33. Computer - CHECKED.

A-6A, B, C:

a. Depress UNSTAB/NO STEER button, cursors go to dead ahead at range selected on the six buttons.

A-6E:

a. Depress UNSTAB button, cursors go to dead ahead at range entered in keyboard.

A 34. A-6A, C: Track Radar - CHECKED.

a. Track MAG CUR: It shall not take more than 7 minutes nor less than 4.5 minutes for magnetron current to time in. Adjustable and stabilized at 0.8.

b. RCVR Tune: AFC will lock on within two sweeps of BNCB meter in track XTAL CUR. Man adjustable by B/N for peak video plus stable operation.

c. SYNC Set: Adjust until cursor position is constant with T/R in both STANDBY and ON in UNSTAB/NO STEER mode.

d. Slew Control: Satisfactorily controls track antenna AZ and EL.

PRETAKEOFF — CONTINUED

PROFILE

e. Fixed Target Track: Lock and track to gimbal limits good point target at more than 14 nmi. With a good lock, maintain steady tone to gimbal limits. Ground lock, discrete lock, and lock-on indications functioning satisfactorily. AZ cursor shall remain approximately centered on target. Slew capability inhibited after discrete lock. TROT, 5 mil or better circular track accuracy on a point source target at less than 5 mils.

f. TCPPI: Range marker shall be sharp at 2.5 nmi. Video shall present from close range to 5 nmi and shall not shift in AZ from scan to scan.

g. Emergency Search: Video is present from close range to greater than 5 nmi. Video does not shift in AZ from scan to scan.

A — 35. A-6B Mod 1: TIAS - CHECKED.
Initiate TIAS in accordance with NATOPS procedures. Press SCP TEST button. PHD and DVI shall display correct test pattern and a go indication.

A — 36. Inertial Navigation System (INS) - CHECKED.
Note velocity and altitude.

A — 37. Communication, Navigation Identification equipment - CHECKED.

a. Intercommunications Set (ICS): Operates satisfactorily in all modes. COLD position of MIC SEL (ICS/MIC, A-6E TRAM) switch allows transmission only when ICS switch is depressed. HOT position allows transmission at any time.

b. Bomb Tone: Activated upon commit, indicates release of weapon in ATTACK and OFF at release. Satisfactory tone quality during check.

A — 38. ECM Test - CHECKED.

IN-FLIGHT

TAKEOFF CHECKS

Before Takeoff

PROFILE

A — 39. Compass System - CHECKED. (Except KA-6D)

a. Standby compass shall be accurate to ±5° MAG HEAD when compared to corrected true heading from DVRI.

b. MA-1 compass shall be accurate to ±2° when compared to corrected true heading from DVRI.

ABC — 40. Complete Before Takeoff Checklist.

AB — 41. Throttle stagger 1/2 inch maximum mismatch with engines in sync at MAX POWER; 1/4 inch maximum mismatch at 86% RPM.

AB — 42.

Engine	P-8A, P-8B
RPM%	98.5 ±1.5
EGT	640° to 660° C
Fuel Flow	6,500 to 8,500 pph
Oil Pressure	40 to 50 psi
Power Trim	(In Band)
Hydraulic Pressure	(In Band)

IN-FLIGHT—CONTINUED

After Takeoff

PROFILE	
AB	43. Monitor engine RPM and EGT.
A	44. Counter-pointer/servo barometric altimeter: Operates smoothly; 0 to 500±50 feet, 500 to 1,000±75 feet, and 1,000 to 5,000±150 feet.
AC	45. Check for proper retraction of main gear, nose gear, flaps, slats, and stabilizer (including transition lights, warning lights, and integrated position indicators).

10,000—FOOT CHECKS (LEVEL CRUISE)

A	46. Flight Indicators - CHECKED.
	a. Angle-of-Attack Indicator: Operating smoothly; OFF indication when no power to indicator. Calibration - read 9.5 to 10 units with clean aircraft at 350 knots.
	b. Mach/Airspeed Indicator: Operating smoothly; 10,000 feet, 0.63 IMN at 340 to 360 KIAS.
	c. Rate of Climb Indicator: Operates smoothly and indicates in zero band in level flight.
	d. MD-1 Turn-and-Bank indicator (Except A-6E TRAM, KA-6D with AFC 161): Operates smoothly; needle width deflection produces 360° of turn in 4 minutes.
	e. ID-1791/A Turn-and-Slip Indicator (A-6E TRAM, KA-6D with AFC 161): Operates smoothly; needle width deflection produces 360° of turn in 4 minutes.
	f. B-6 Accelerometer: Operates smoothly; the two telltale pointers shall remain at maximum readings until reset (±10% tolerance).
	g. G-Meter (Except A-6E TRAM): Operates smoothly (±10% tolerance).
	h. Horizontal Situation Indicator: Operates smoothly with no excessive excursions.
A	47. IFF/SIF (all modes) - Proper response to interrogation in each mode. I/P provides identification transmission when switch is actuated plus an additional 15 to 30 seconds after switch release. MIC same as I/P switch but answers interrogation when microphone button is depressed.
AB	48. Pressurization - Check at minimum rpm at which level flight can be maintained and with defog OFF. Cabin pressure should be 8,000±750 feet.
AB	49. Air Conditioning - Auto air conditioning operates smoothly, manual maintains selected position.
A	50. Doppler Radar - Checked.
	a. Memory: Memory light goes out when Doppler is within ±10% of inertial groundspeed. Out of memory within 2 minutes in flight.
	b. Attitude Limits: Roll - remains out of memory up to +33°. Pitch - remains out of memory up to 20° (NU) minimum and -24° (ND) minimum.
	c. Accuracy: Groundspeed and windspeed agree to within ±7 knots of known good inertial velocities. Wind direction agrees within ±5° of known good inertial wind direction provided windspeed is greater than 15 knots.
A	51. Computer - CHECKED.
	a. Steering Presentation: Steering presentation shall be free of perturbations on all displays. Movable reticle, steering symbol, and PHD shall all display compatible steering to preselected targets.

IN—FLIGHT—CONTINUED

PROFILE	
	b. Computer Errors: No error codes or lights observed in navigation or attack.
A	52. Search Radar - CHECKED.
	a. All Displays: All modes must be operationally functional.
	b. One Scan: While in silent display, one scan of video on next left-to-right sweep.
	c. Erase: Momentary display similar to no-persist.
A	53. A-6C: TRIM DISPLAYS - CHECKED.
	a. DF Set: Operates satisfactorily; BEACON light flashes, target flag, (1/8 in. wide 1/2 in. high) displayed on IARM and PHD when target received.
	b. FLIR: Operates satisfactorily; IR WHT and IR BLK displays are satisfactory on IARM and VDI; brightness, contrast satisfactory and controllable. TRIM symbols operate properly. Display ZOOM and IR ZOOM function correctly.
	c. LLLTV: Operates satisfactorily; TV display satisfactory on IARM and VDI, brightness, contrast satisfactory and controllable. TRIM symbols operate properly. Display zoom functions correctly.
A	54. A-6C: OSP positioning - CHECKED.
	a. OSP position responds to slew stick inputs in azimuth and elevation when CMPTR/MAN switch is at CMPTR. Slew rates are satisfactory, movement is smooth. OSP position responds to movement of AZIMUTH CURSOR switch and elevation slew switch when CMPTR/MAN switch is at MAN.
	b. With a track radar lock-on, OSP tracks target in azimuth and elevation.
AC	55. Control trim check (After excessive loads in flight or on landing)
	a. With directional and lateral trim in takeoff position, wings held at level attitude, airspeed increased in 50 knot increments from 250 to 550 knots, maintaining 10,000 feet. Note ballwidths off-center from turn and slip indicator at each 50-knot increment. Ballwidths off-center must be 3/4 or less.
	b. Maximum lateral stick force to hold wings level is 3 pounds.
	40,000—FOOT CHECKS (LEVEL CRUISE)
AB	56. Pressurization - Check at minimum rpm at which level flight can be maintained and with defog OFF. Cabin pressure should be 15,850 to 17,690 feet.
AB	57. Defogging System - Check proper operation.
AB	58. Engines - CHECKED.
	a. Full Power:
	(1) RPM - Note 94% to 98% rpm
	(2) EGT - Note 630° to 660° C maximum
	(3) Fuel Flow - Note 2,300 to 2,700 pph

IN—FLIGHT—CONTINUED

PROFILE

b. Idle (for two engines without PPC 185) (Check engines alternately):

(1) RPM - Note

(2) EGT - Note

(3) Fuel Flow - Note

c. Low engine speed (for engines with PPC 185) (75% RPM):

(1) RPM - Note

(2) EGT - Note

(3) Fuel Flow - Note

A 59. Mach Airspeed Indicator - CHECKED.
Operates smoothly; 40,000 feet, 0.84 IMN at 255 to 265 KIAS.

A 60. Search Radar Maximum Range - Note

20,000—FOOT CHECKS (LEVEL CRUISE)

A 61. AUX UHF (Except A-6E TRAM) - CHECKED.
Operates satisfactorily; large needle on HSI indicates magnetic bearing (±10°) to station unless UHF-ADF is selected.

A 62. TACAN - CHECKED.
Controls operate satisfactorily with SEL switch in REC position, bearing data are displayed. With SEL switch in T/R, both bearing and range are indicated. Identification signal is heard in headsets when selected and volume is controllable. Range and bearing displayed on HSI with no undesirable excursions. With antenna select switch in any position, lock-on occurs within 30 seconds of station selected.

AC 63. Automatic Flight Control System - CHECKED.

a. Stability Augmentation (300 KIAS): Check for proper operation. Engage and disengage trim shifts not to exceed ±6°/sec in pitch or roll. Rate damping satisfactory about all axes. Engage transient shall be nonobjectionable in nature.

b. Roll Attitude-Hold (ASW-40: HDG OFF): Tolerance ±1° limited by readability. Effective from 3° to 7° to 60° +3°, -6° from left and right bank. If engaged beyond 60° +3°, -6° limit, the aircraft will return to 60° +3°, -6°. Control stick disconnect-automatic reengage after release of lateral stick commands.

c. Pitch Attitude Hold: Tolerance ±1° limited by readability. Effective from -60° +6°, -1° to +25° +1°, -4°. Out-of-limit engagements will return aircraft to stated limits. Control stick disconnect-automatic reengage after release of longitudinal stick commands.

d. Heading Hold (ASW-40 - Heading Switch in NORM): Automatic whenever roll attitude is less than 3° to 7°. Tolerance ±1/2° limited by readability. Control stick disconnect-automatic reengage after release of lateral stick commands.

IN-FLIGHT-CONTINUED

PROFILE

e. Altitude Hold: Altitude hold shall not be engaged with climb or dive rates in excess of 1,000 feet/min. Tolerance for bank angles less than 30°, ±45 feet. With 5% rpm change, note that altitude hold conforms to the above tolerance. Period of oscillation shall not be greater than 30 seconds. Control stick disconnect-automatic reengage after release of longitudinal stick commands.

f. Mach Hold: Stable flight engage-hold aircraft within ±0.02 mach of that mach that existed at engagement (for bank angles less than 30°). Flight check - from cruise to idle descent from 20,000 feet. Change in mach number shall be ±0.02 mach and stable in descent. Control stick disconnect - automatic reengage after release of longitudinal stick commands.

g. Roll Command (ASW-40; N/A KA-6D): Accepts computer-derived roll angle command to null steering. Limited to 30° left and right banks.

h. Automatic Carrier Landing (ASW-40): Engages smoothly. Control stick disconnect - reverts to STAB AUG after manual input of 10 pounds fore-and-aft or 7 pounds laterally.

A 64. Mach/Airspeed Indicator - CHECKED.
Operates smoothly; 20,000 feet, 0.54 IMN at 245 to 255 KIAS.

AB 65. Anti-G - CHECKED.
Automatic inflation of g-suit for test; suit begins at 2.2 g's.

A 66. Search Radar - CHECKED.

a. SEARCH TRIG: No change or less of video when switch is cycled from PRI to SEC. Switch shall be cycled to STBY before switching from SEC to PRI (A-6A, B, C).

b. RNG: Satisfactory control.

A 67. Fuel System - CHECKED.

a. Totalizer: Reads ±300 lb +2% of actual fuel except that totalizer shall never read less than zero. The preceding criteria apply only when selectable needle is set on a station that has a fuel tank attached. When selectable needle is set to an external station that does not have a fuel tank attached, the following criteria will apply: (±600 lb +4% of the actual fuel), except that totalizer should never read less than zero.

b. Fuel Quantity Gage: Large pointer reads quantity in main tanks. Small needle indicates quantity of fuel in tanks selected on fuel management panel.

c. Transfer: Capable of transfer of all wing fuel. When main tank drops below 6,500 to 7,500 lb, automatic transfer begins raising the quantity in main tank between 7,000 lb and 8,000 lb. Uneven transfer rates will be allowed to maximum of one mark wing heaviness.

d. Fuel Dump: Briefly check wing dump and fuselage dump.

5,000-FOOT CHECKS (LEVEL CRUISE)

A 68. KA-6D: Internal In-Flight Refueling System - CHECKED.

a. Refueling power switch - ON

b. Drogue switch - EXT
STOW/TRAIL indicator shows barber pole in transit and TRAIL when fully extended. Hydraulic pressure light will go out and READY light will come on.

c. Fuel transfer switch - AUTO

d. Pounds scheduled - SET (some quantity above 100 pounds)

IN-FLIGHT - CONTINUED

PROFILE

e. Reel response switch - TEST (hold for 5 seconds)
READY light will go out, and valve open light and fuel transfer light will come on. On K1 thru K52 not incorporating AFC No. 298, STOW/TRAIL indicator continues to shown TRAIL, on K53 and on and those incorporating AFC No. 298, STOW/TRAIL indicator shows barber pole when hose leaves full trail position.

f. Reel response switch - RESET
Fuel flow and valve open lights go out, and fuel READY light comes on.

g. Drogue switch - RET
Hose retracts, indicator shows barber pole when in transit and STOW when retracted. Hydraulic pressure light will come on.

h. Refueling power switch - OFF.

A 69. Ram-Air Turbine (RAT) - CHECKED.
A maximum force of 70 lb is acceptable for operation of the ram-air turbine control.

AC 70. TRIM - CHECKED.
Tolerance from TRIM indicator zero reference - lateral ±1/2 unit and rudder ±1/8 unit.

A 71. Angle-of-Attack Indicator - CHECKED.
Operates smoothly - reads to ±1/2 units. In a (power approach) landing configuration (takeoff flaps), 4,000 lb fuel, 84% rpm, AOA reads 20 units at 111 ±3 KIAS. For every 500 lb of fuel, add or subtract .84 KIAS.

A 72. Search Radar - CHECKED.

a. STC SLOPE/DEPTH: Reduces gain of close-in targets and allows display optimization.

b. SRTT: (A-6A, B, C): Lock-on at 5 nmi - track light SR on, track switch on, and track radar power switch on.

A 73. A-6A, C: Track Radar - CHECKED.

a. Fixed Target Track: Lock and track to gimbal limits good point target at more than 14 nmi. With a good lock, maintain steady tone to gimbal limits. Ground lock, discrete lock, and lock-on indications functioning satisfactorily. AZ cursor should remain approximately centered on target. Slew capability inhibited after discrete lock. TROT, 5 mil or better circular track accuracy on a point source target at less than 5 mils.

A 74. Computer - CHECKED.

a. Attacks: Check for satisfactory performance, including COP check.

b. Bomb tone in manual.

c. PPI displays

d. Expanded displays

e. Lock-ons.

A 75. AMTI: MAX range check and tracking.

IN-FLIGHT – CONTINUED

500—FOOT AGL CHECKS

PROFILE

A — 76. AAU-19 Altimeter and Radar Altimeter - CHECKED.
With AAU-19 altimeter in STANDBY and a corrected barometric setting, maximum allowable difference compared with radar altimeter at 500 feet and 300 KIAS is 85 feet. Attitude limits for radar altimeter determined over flat terrain are: roll ±30° and pitch ±50°.

A — 77. SRTC - CHECKED.

a. Ten shades of grey.

b. Ten range contours.

c. Clearance accuracy.

d. Selectable range coding.

A — 78. E-Scan - CHECKED.

a. Video: It shall be possible to adjust the pilot's control so as to provide a clean, continuous video return between 1/8 inch and 1/4 inch from minimum slant range, out to a range of 5 nmi or more.

b. Flight Line: Sharp usable dotted line extending across the display.

c. Range Markers: Clean and sharp - one at every 2.5 nmi (the range markers occurring at start and end may not be visible).

d. Controls: All display controls operate satisfactorily.

A — 79. TCPPI - CHECKED.

a. Range Marker: Sharp at 2.5 nmi.

b. Display: ±15° and centered on CRT.

c. Control: MRI and RCVR gain control satisfactory.

d. Video: Present from close range to 5 nmi. Video does not shift in azimuth from scan to scan.

e. Qualitative Check: Video is lost when aircraft is pitched up and returns when aircraft is pitched down (scans about aircraft velocity vector).

A — 80. Low Altitude Warning System (LAWS) - CHECKED.
Whenever aircraft radar altitude penetrates the low limit index (set on radar altimeter) a 2 +1.0, -.25 second tone alternating at 1.5 to 2.5 cps between approximately 700 and 1,700 cps will be heard.

AB — 81. Approach Power Compensator System (APCS) - CHECKED.

a. System Engagement: Place aircraft in approach configuration. Place throttle friction lever to OFF. Set RH and LH engines to approach speed. Place temperature switch in appropriate position for ambient temperature (HOT - temperature greater than 80° F/26.7° C; STANDARD - temperature between 80° F/26.7° C and 40° F/4.4° C; COLD - temperatures less than 40° F/4.4° C). Set control switch to STBY. Note that APCS STBY light is lit. Engage system. Upon release of control switch, switch shall remain in ENGAGE position and APCS STBY light should be out. Engagement of system can be checked by making pitch changes and noting throttle movement. (A micro switch on friction lever shall cut out APCS when friction lever is advanced in increase friction direction.)

IN—FLIGHT — CONTINUED

PROFILE

b. System Disengage: Place control switch to STBY. Throttles shall be free for manual use and APCS STBY light shall come on.

c. Override Check: Manually override system by opening each throttle individually. Control switch shall drop to STBY and STBY light shall come on. Manual override forces should be 8 to 12 lb.

d. Off Speed Engagement: Engage system at 5 knots indicated airspeed above and below referenced AOA (22 units) airspeed. Temperature switch to appropriate outside air temperature. Airspeed shall return to within 2.0 KIAS of approach speed within 4 seconds after engagement.

e. Limit Checks: Perform pullups to hold AOA greater than 22 units. Throttles shall drive to maximum stop 96 to 100% rpm. Perform pushover to hold AOA less than 22 units. Throttles shall drive to minimum stop 71 to 79% rpm.

f. Approach: Observe APCS capability to maintain reference AOA 22 units during FCLP approach. Observe disengagement of touchdown.

A 82. INS NAV accuracy, check the following:

a. INS VEL

b. MVC VEL

c. AVC VEL

d. DOPPLER VEL

A 83. Present Position Update - CHECKED.
A-6A, B, C: Encoder Check if Required - CHECKED.

a. Pitch

b. Roll

c. Heading

LANDING

LANDING CHECKS

PROFILE

AC 84. Landing Gear - CHECKED.

a. Warning Lights: WHEELS warning light flashes when all three gears are not down and locked and both throttles are less than 85% and flaps are extended. Wheels transition light shall light during all gear transitions until all landing gears are locked.

b. Position Indicator: UP in window when all gears are up and locked and doors closed. Picture of wheel appears when all gears down and locked. Barber pole when gear is not locked or door is not closed. Nose-gear indication will indicate TOW LINK if tow link is down or nose gear is cocked (indexer will flash).

c. Arresting Gear: Hook transition warning light shall be on when hook is cycling between stow and trail or trail and stow positions. Approach lights and approach light indexer will flash until hook is released to trail position with landing gear down and hook bypass switch in ARREST.

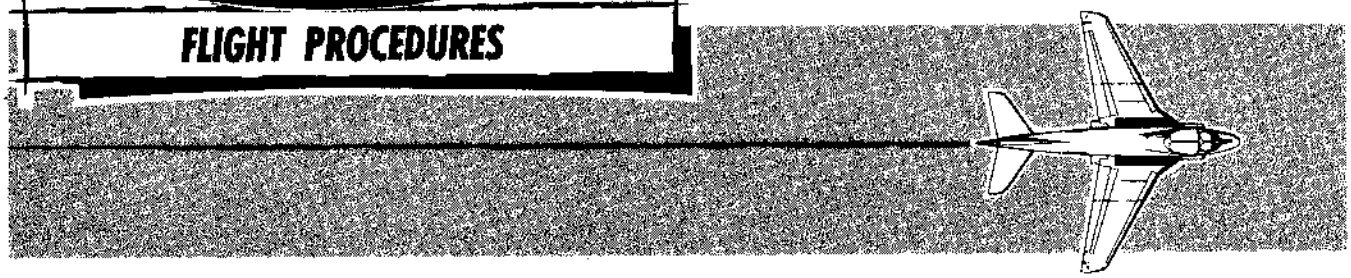
d. Flaperon Pop-Up - CHECKED.

LANDING — CONTINUED

PROFILE	
	e. Wing Flaps and Slats - CHECKED.
	f. Wing-Tip Speed Brakes - CHECKED.
	g. Antiskid - CHECKED.
A	85. Landing Mode - CHECKED.
	a. Steering: Check that accurate vertical and horizontal steering commands are provided.
	b. OAP: Check steering with OAP selected.
	PRIOR TO SHUTDOWN
A	86. INS - CHECKED.
	a. Altitude: Holds steady during taxi run.
	b. Velocities: Note when aircraft comes to a stop, after OFF ERASE selected.

section IV

FLIGHT PROCEDURES



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part 1 Operating Techniques

INTRODUCTION

The information for this section was supplied by flight observations of test pilots. As an overall assessment of the flight characteristics of aircraft, the aircraft is fully controllable in all normal speeds and maneuvers. The stall warnings are generally characteristic of slower, conventional aircraft, and landing speed is relatively slow. The A-6 is adequately powered, which is reflected in its takeoff and climb acceleration, and in its ability to carry a substantial external stores load, safely.

FAMILIARIZATION AND TRANSITION

Procedures for the accomplishment of transition and familiarization training are promulgated by the Unit Commander through the Operations Officer. The amount of time required to complete transition and familiarization will vary, depending upon the experience level within each crew category. The training of each crew and each squadron should be directed toward improving crew coordination in the complete mission system.

The training syllabus will be in accordance with the outline in Section II.

ENGINE OPERATION

COMPRESSOR STALLS

Compressor stalls result when one or all of the compressor blades are operating at too high an angle of attack. Normally, the compressor blades are kept in a desirable angle of attack by maintaining air velocity in proportion with engine rpm. Hence, anything that would affect inlet air velocity or engine rpm will either increase or decrease the possibility of compressor stall. In the J-52 P-8A/B engine, compressor stalls are minimized automatically by the compressor bleed system and the fuel control system, but pilot technique can also directly affect the possibility of a compressor stall.

Stall Warnings

Compressor stall warnings vary greatly in degree and intensity. Pulsations through the airframe and retorts from the engine are the most obvious warnings. The noises from the engine can vary from low-intensity pops to loud bangs. The most subtle indication is the inability of the engine to respond to forward throttle movement.

Minimizing Compressor Stalls

The engine bleed control system is used to maintain a desirable angle of attack on the compressor blades by maintaining a proper relationship between inlet air velocity and engine rpm.

When the bleed control senses an unstable pressure ratio, twelfth-stage compressor bleed air pressure is transmitted to a series of 15 intercompressor bleed valves, opening the bleed valves. Air from the low compressor discharge section is then dumped into the engine compartment, tending to restore the air inlet velocity/rpm relationship. The bleed override control automatically locks out any signal from the pressure ratio bleed control below approximately 0.5 IMN, allowing the compressor bleed valves to remain closed. Another automatically operated safeguard against a compressor stall is contained in the engine fuel control system. Since the engine is more susceptible to compressor stalls at low inlet-air temperature and at certain rpm's, it is necessary to limit acceleration fuel flow schedules to avoid a stall. If fuel is introduced at a rate that will increase pressure before the inlet pressure, air flow, and rpm increase, the burner pressure will increase to a point where airflow in blocked through the engine, causing the compressor to stall. The engine fuel control senses the condition of rpm and inlet temperature and schedules a correct amount of fuel.

It would seem that these automatic functions for preventing a compressor stall would be enough to eliminate a stall. However, the engine was set up only for normal operation. One variable not covered by engine adjustments is pilot technique. When operating in conditions marginal for compressor stalls, the responsibility remains with the pilot to aid the automatic functions rather than to rely on them. The flight conditions which can cause a compressor stall must be kept in mind and erratic or abrupt throttle movements must be avoided. An in-flight refueling hookup is a good example where throttle technique could be overlooked. During flight attitudes that affect air inlet flow, throttle technique is even more important due to the added factor of distortion at the air inlet. If poor throttle technique, marginal flight attitudes, and uncoordinated flight are combined, the conditions are ideal for a compressor stall.

Lessening the Stall Effect

Several techniques can be employed to reduce a compressor stall effect. If a rising EGT accompanies an rpm drop, this is an indication of a stall. Retard the throttle to prevent engine damage. If the stall is eliminated, then slowly advance the throttle to the desired thrust level. Avoid erratic throttle movements. If the stall resulted from excessive distortion of airflow at the air inlet, and a drop in rpm without a rising EGT is observed, increasing the thrust setting to about 90%, or increasing the airspeed by decreasing rate of climb, or by dropping the nose will usually eliminate the stall. Be especially careful to maintain coordinated flight. If the stall is uncontrollable, shut down the engine. Although a compressor stall is not normally dangerous, if the stall continues, it could cause engine damage.

ENGINE RATINGS

Engine ratings were not set up as limits which, if exceeded, would result in the engine falling apart. Overall engine life for a particular installation is first determined. This life is broken down into percentages which reflect the time used at different thrust settings. With this information, allowable limits are set. In normal engine life, when engine time is used up, the engine is ready for overhaul. The overhaul times are used to plan logistical support of the aircraft. If premature breakdowns occur, this can seriously affect squadron strength by causing shortages of necessary items. A better understanding of engine ratings will prevent a pilot from inadvertently exceeding engine limits and will bring into focus the real reason engine limits are set.

EXHAUST GAS TEMPERATURE

Excessive temperature causes deformation of sheet metal parts and, if allowed to persist, will result in sagging and subsequent structural failure. Consequently, exhaust gas temperature (EGT) is the most important factor in engine durability. This does not mean that EGT is to be used as a limit in place of a time at maximum thrust settings. However, always reduce a thrust setting to maintain an EGT limit.

In its normal function, the exhaust gas temperature conveys information on how well the engine is performing at a desired thrust setting. Normally, EGT will be kept within limits by the fuel control. If temperatures still increase or stabilize at too high a temperature, retard the throttle. Whenever the EGT becomes uncontrollable, shut down the engine. Excessive temperatures should be noted for maximum reached and for the length of time at the overtemperature. The temperature should be reported as a discrepancy for appropriate maintenance action.

CAUTION

The J52 P-8A/B engine fuel control will not maintain EGT within limits above 35,000 feet at military power. It is therefore necessary that pilots monitor EGT carefully under these conditions and maintain EGT within limits by retarding the throttle.

Exhaust Gas Temperature and Inlet Icing

Exhaust gas temperature will begin to increase in an icing condition usually as a result of decreased airflow through the engine. The decreased airflow is sensed by the fuel control, resulting in an increased fuel flow to the combustion chamber. This causes the EGT to rise. Since a rise in EGT follows the buildup of ice, EGT is a reliable indication of the beginning of ice formation at the air inlet.

FLAMEOUT

A single-engine flameout is not normally a dangerous situation. Nevertheless, the cause of the flameout should be ascertained to prevent a similar occurrence at critical altitudes and airspeeds. A flameout usually occurs if the fuel-air-ratio is either too rich, or too lean to maintain combustion. The fuel control unit automatically responds to varying conditions; however, severe changes in normal flight conditions, such as those which result in compressor stalls, heavy moisture ingestion, or excessive throttle movements at altitude, can exceed the fuel control's ability to react, and will probably result in a flameout.

Indications of a flameout are a loss of thrust, dropping EGT, and dropping rpm; an air start should be initiated as soon as possible while engine rpm is still high. Attempt to avoid the conditions that set up the flameout initially. If the flameout occurs during an icing condition, or during moisture ingestion, use the air start switches and anti-icing for the duration of the condition. However, the starting ignition should not be used indiscriminately, because premature breakdown of the igniter plugs will result. If it is determined that the flameout resulted from an engine malfunction, shut down the engine.

BURNER CAN BLOWOUT

Burner can blowout is an engine condition where one or more nozzles of the four-nozzle cluster have been blown out and failed to relight. One or more burner cans may be affected.

This condition may occur in aircraft with PPC No. 185 incorporated. During idle power, slow-speed descents (below 250 KIAS) or idle power, constant-altitude aircraft decelerations, the burner can blowout condition is characterized by an idle droop. This may result in engine hangups of up to 10 seconds duration during subsequent engine acceleration. NEW

Burner can blowout may also occur during high-speed (in excess of 350 KIAS) idle power descents. In this case, the engine may enter a sub-idle

condition (20%-30% rpm), which will require shutdown and subsequent relight in order to regain normal operation. If the engine does not enter a sub-idle condition, acceleration hangups may still occur; however, they will probably clear within 3-5 seconds. There will be no warning of burner can blowout or of an impending sub-idle condition during a high-speed descent.

COOLING BEFORE SHUTDOWN

Before shutdown (except for emergency or operational necessity), the engines should be operated at idle for 3 to 5 minutes to allow engine temperature to stabilize, and then at 75% rpm for 30 seconds to permit oil scavenging.

Note

If operating conditions preclude oil scavenging at 75%, no damage will result; however, the possibility of oil overflow from the accessory gear box exists.

SMOKE AFTER SHUTDOWN

If smoke is emitted from the engine after shutdown, determine the cause. White vapor indicates fuel vaporization. This does not harm the engine, but is potentially dangerous because of the fire hazard in the immediate area. If heavy black smoke is emitted, this is indicative of burning oil or fuel. If the GTC is available, crank the affected engine. If the smoke persists, use firefighting equipment to extinguish the fire.

FUEL MANAGEMENT

Since fuel transfer occurs as the result of differential air pressure within the fuel tanks and gravity flow, fuel management is directly related to pressure regulation. Overall fuel management is handled automatically when the wing drop-tank transfer switch is in the normal position. It has been found however, that by controlling fuel from the drop tanks, the range of the aircraft can be increased.

By using fuel from two drop tanks at a time, and then jettisoning the empty tanks, the aircraft reaches a cleaner configuration in the shortest time. The wing drop-tank transfer switch (WING DROP TANK TRANS) selects the transfer from the wing drop tanks. Fuel can be selectively transferred from either the outboard or inboard tanks, or all drop tanks simultaneously.

CAUTION

Tests have indicated that possible overpressurization may occur if all four drop tanks empty simultaneously.

Through the use of the wing-tank pressure switch on the fuel management panel, the wing and drop tanks can be pressurized on the ground or transfer can be stopped in flight. The switch positions and their functions are covered in Section I.

WING-TANK PURGING SYSTEM

Wing tanks may be purged by placing the wing dump switch to DUMP. Purging will continue as long as the wing switch remains in DUMP.

Spring-loaded, zero-leak check valves are used for purging. The valves are set to open at 0.5 psi pressure differential. When air is sensed in the wing-tank shutoff valves, a signal is sent to the wing-tank pressure regulator, shuttling off pressure to the wing tanks. When the check valve sense the preset pressure differential, the valves open, purging the tanks. The fuel vapors are evacuated through the wing dump valves, which are electrically opened when the wing dump switch is actuated.

AERODYNAMIC BRAKING

After touchdown and flaperon pop-up activation, raise the nose to 21 units angle of attack and allow the aircraft to decelerate. As indicated airspeed approaches 80 knots, smoothly lower the nose to the runway and commence normal braking as necessary to slow aircraft to taxi speed.

APPROACH POWER COMPENSATOR TECHNIQUE

The technique required for an APC (aircraft incorporating AFC No. 199) approach differs from a manual approach in that all glide slope corrections are made by changing aircraft attitude. Since this technique violates the basic rule that altitude is primarily controlled by throttle, practice is required to develop the proper control habits necessary to use APC. For the APC to perform satisfactorily, smooth attitude control is essential. Large abrupt attitude changes result in excessive thrust changes. Close-in corrections are very critical. A large attitude correction for a high-in-close condition will produce an excessive power reduction and can easily result in a hard landing. If a high-in-close situation develops, the recommended procedure is to stop meatball motion and not attempt to recenter it. A low-in-close condition is difficult to correct with APC and usually results in an over-the-top bolter. It may be necessary to manually override APC in order to safely recover from a low-in-close condition. Throughout the approach, the pilot should keep his hand on the throttles in the event it is necessary to manually override the APC.

part 2 Flight Characteristics

CLIMB CHARACTERISTICS

A typical climb schedule for the basic aircraft is 310 KIAS to .70 IMN. For best fuel consumption, military power should be maintained during a climb. Longitudinal stability is positive throughout the climb regime.

STALLS

NORMAL STALLS

The following stall description is applicable to normal 1-g stalls approached at a deceleration rate of approximately 1 to 2 knots per second. At greater deceleration rates, pilot perceptibility of stall warning buffet as well as the time available for reaction to prevent the stall is reduced and stall penetration tends to be deeper. Stall characteristics do not appreciably change with the addition of wing and/or fuselage stores or as a result of assymmetrical power, speed brake position, or STAB AUG engagement.

Stall warning in flaps/slats down configurations (takeoff, wave-off, power approach, and land) occurs 10 to 15 knots prior to stall and is characterized by light buffet at onset, increasing to moderate buffet as stall is approached. Flaperon effectiveness decreases as stall is approached; however, sufficient control authority is available to maintain wings-level flight up to the stall. Rudder is effective for roll control during the approach to the stall and at stall. The use of the flaperons alone to maintain wings-level flight during the approach to the stall may induce a lateral oscillation due to high roll inertia and decreasing lateral control effectiveness. This characteristic is particularly noticeable when carrying wing stores. Stall in the flaps/slats down configuration is defined by a loss of longitudinal control characterized by the aircraft breaking in and out of stall while holding aft stick. In the takeoff and wave-off configurations with military power, a mild longitudinal pitch-up is experienced at stall; however, this phenomenon is only momentary and does not create a dangerous situation.

Stall warning in flaps/slats up configurations (power, cruise, and glide) is characterized by wing rock and a gradual loss of lateral control effectiveness beginning approximately 20 to 25 knots prior to stall followed by light buffet at 7 to 10 knots prior to stall. Stall in the flaps/slats up configurations is defined by a complete loss of lateral control with the aircraft in a sideslip and roll maneuver. Stall recovery in either the flap/slats up or down configuration is immediate and is achieved by applying forward stick to reduce angle of attack and increase airspeed. No excessive altitude loss is encountered during recovery except in the high gross weight/high drag loadings where slow aircraft acceleration increases the time and altitude required to effect a safe recovery.

WARNING

During NATC flight testing under controlled conditions and using optimum recovery technique, up to 2,000 feet of altitude was required for recovery from land configuration stalls in the heavy gross weight/high drag loadings.

DEEP STALL PENETRATION

Three factors combine to make the aircraft highly susceptible to deep stall penetration and progressive stalls during the recovery:

a. With power reduction or nose-up attitude change, rapid deceleration occurs at heavy gross weight/high drag loadings. In addition to the rapid deceleration, the stall speed increases approximately 12 knots with power reduction from military to idle rpm.

b. Good longitudinal control effectiveness (pitch response with longitudinal control stick movement). This is particularly evident with extended control travel.

c. At stall, light longitudinal stick forces induce a tendency to overcontrol aircraft attitude prior to attaining sufficient airspeed for recovery.

Note

To prevent entering a progressive stall, the angle-of-attack indicator should be used as the primary stall recovery instrument.

Stall airspeeds for various configurations are plotted as a function of gross weight in figures 4-1 through 4-4.

ACCELERATED STALLS

Accelerated stalls are preceded by light airframe buffet 30 to 40 knots prior to stall, increasing progressively to moderate buffet at stall. Lateral instability in the form of wing rocking is coincident

STALL SPEEDS

P-8 ENGINE

SEA LEVEL

AIRCRAFT CONFIGURATION:
ALL EXTERNAL STORES

DATE:15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY
STALL SPEEDS CORRESPOND TO FIN BOOM AIRSPEED SYSTEM

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

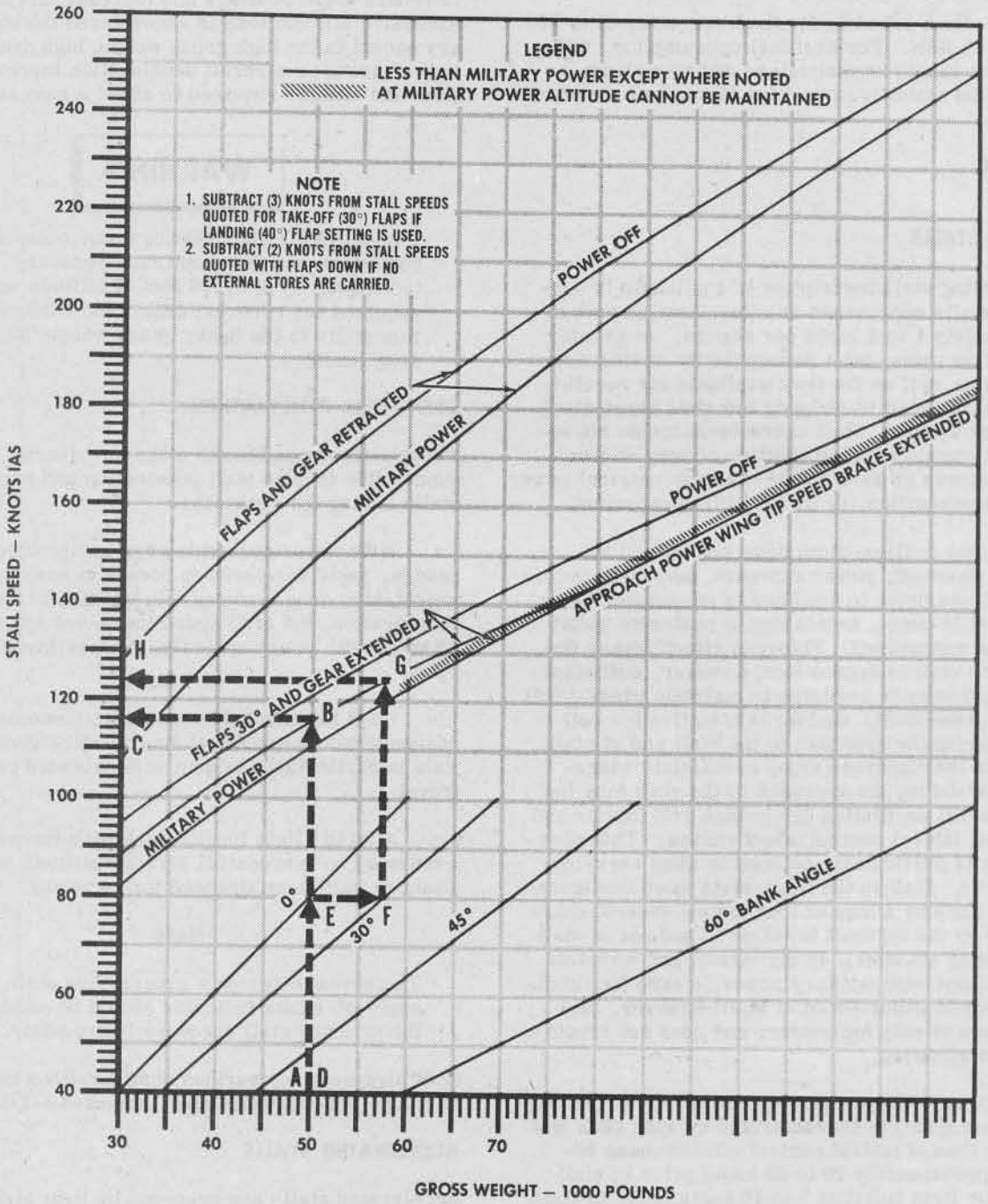

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Figure 4-1

STALL SPEEDS

P-8 ENGINE

A-6C

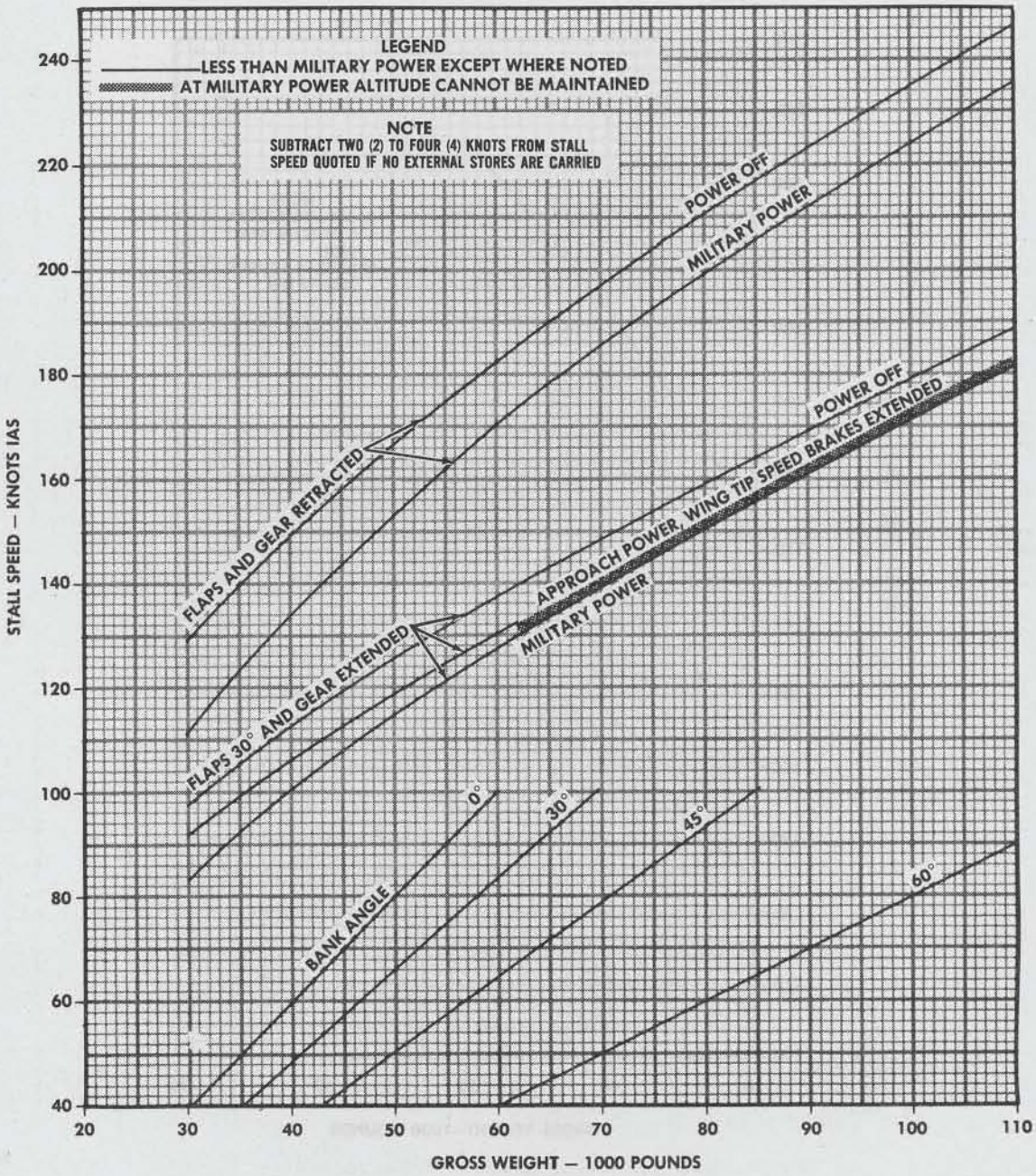
SEA LEVEL

AIRCRAFT CONFIGURATION:
ALL EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY
STALL SPEEDS CORRESPOND TO FIN BOOM AIRSPEED SYSTEM

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



A-ADA1-588

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Figure 4-2

STALL SPEEDS

P-8 ENGINES

NO EXTERNAL STORES
5000 FEET

POWER OFF

AIRCRAFT CONFIGURATION:
FLAPS UP, GEAR UP

DATE: 18 OCTOBER 1965
DATA BASIS: FLIGHT TEST

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

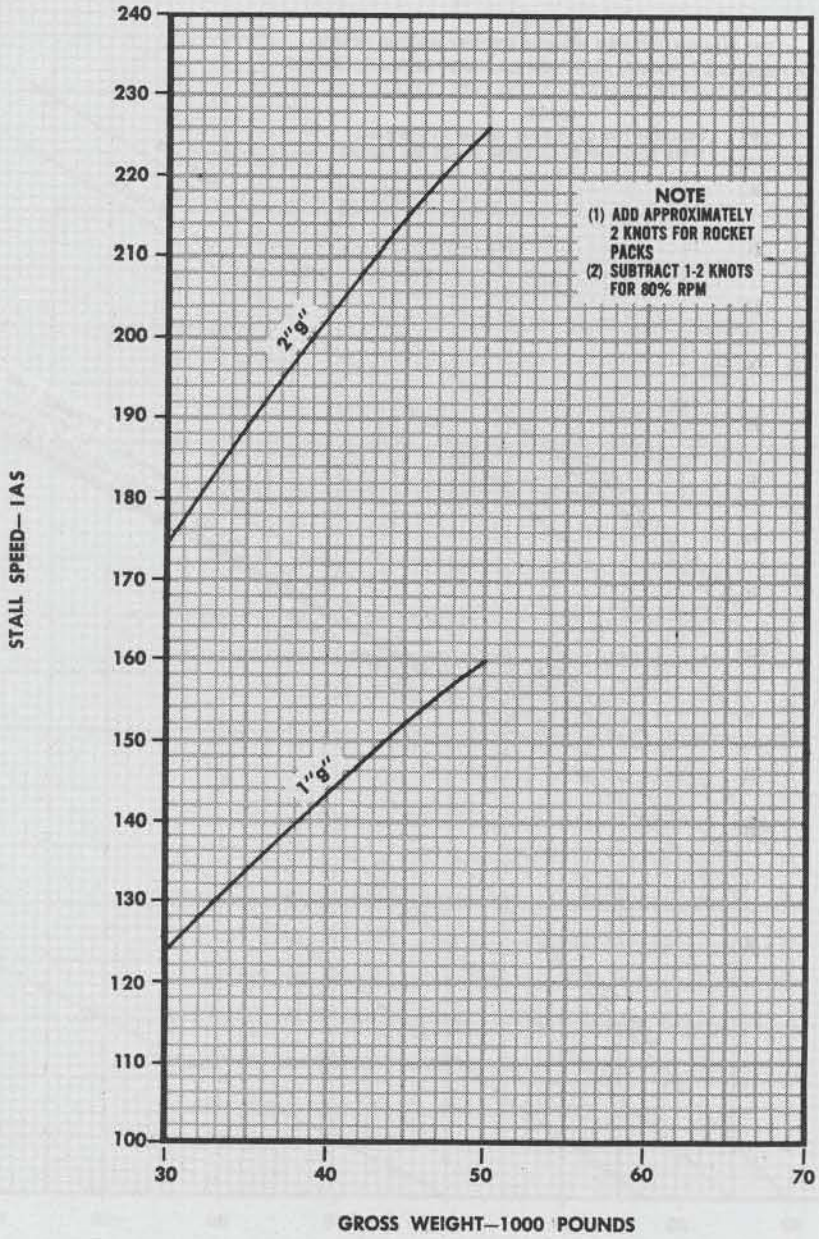

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Figure 4-3

STALL SPEEDS

P-8 ENGINE

A-6C

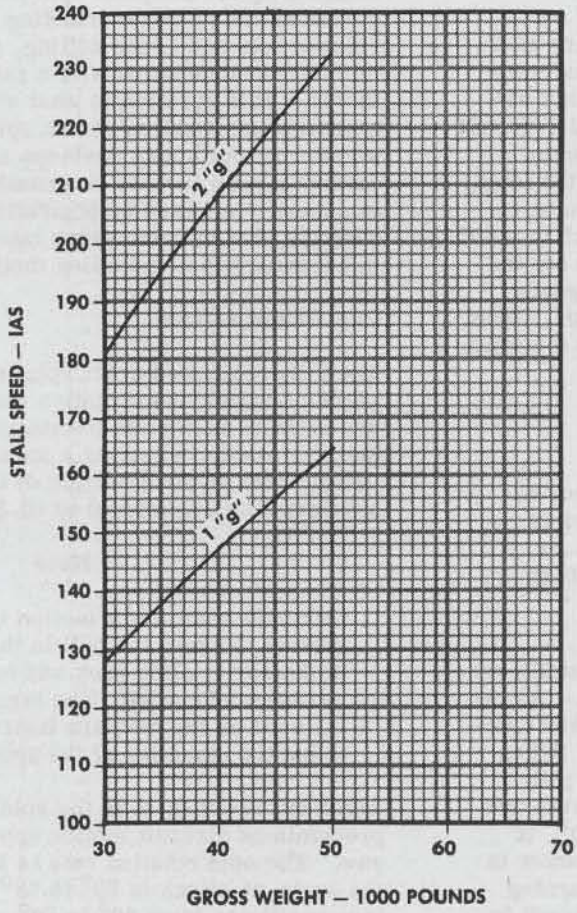
NO EXTERNAL STORES
5000 FEET
POWER OFF

AIRCRAFT CONFIGURATION:
FLAPS UP, GEAR UP

DATE: 1 APRIL 1970
DATA BASIS: FLIGHT TEST

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE
(1) ADD APPROXIMATELY TWO (2) KNOTS FOR EXTERNAL STORES

A-ADA1-587

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Figure 4-4

with airframe buffet but remains at a low level and is correctable with flaperons. In a gradual approach to a 2-g accelerated stall, a decrease in lateral control effectiveness beginning approximately with onset of stall warning buffet provides additional warning of a near-stall condition. However, during high-g high angle-of-attack maneuvering, later control loss will most likely not be noticed and normal prestall airframe buffet will be the primary warning of an impending accelerated stall. If stall warning is not recognized or normal acceleration is not reduced, the aircraft will enter an accelerated stall characterized by a yawing and rolling maneuver. Increasing the rate of aft stick displacement will increase the magnitude and rate of yaw at the stall. Stall recovery is instantaneous and is achieved by applying forward stick to reduce aircraft angle-of-attack and increase airspeed.

POST STALL GYRATIONS

The aircraft exhibits excellent stall recovery characteristics, and post stall gyrations commonly experienced in other swept wing aircraft are not displayed. However, following either a normal 1-g stall or an accelerated stall, if angle of attack is not reduced by releasing back stick pressure, the longitudinal and lateral oscillations will increase in amplitude and the aircraft will roll and pitch to a 50° to 60° dive angle. Pitching then decreases but the lateral oscillations increase varying from gentle rolls to snap rolls as the airspeed builds up. These lateral oscillations will continue as long as the stick is held aft.

Note

The aircraft does not exhibit any tendency to spin from a normal 1-g stall or an accelerated stall. However, application of spin recovery technique during post stall gyrations will induce a spin.

Post stall gyrations entered from vertical stalls are preceeded by wing rocking and a back slide. As the aircraft stalls, it pitches down to a 70° to 80° dive angle with the airspeed increasing rapidly. When the aircraft is stalled with a vertical flight path angle less than 90°, it pitches nose down erect and when the flight path angle is greater than 90°, it pitches down inverted. The negative load factor in the inverted maneuver causes the CSD/S warning lights (L or R SPD DR) on the annunciator panel to come on. These lights will go out when the load factor becomes positive. The aircraft exhibits the same post stall characteristics as those experienced in normal 1-g stalls and accelerated stalls with the stick held full aft.

Note

The aircraft will not spin from a vertical stall unless pro-spin controls (full aft stick, full rudder, and neutral flaperons) with extended throws are applied.

SPINS

The aircraft is not prone to enter unintentional spins. To attain a spin, the controls must be intentionally held in the pro-spin positions (full aft stick, full rudder, and neutral flaperons). During spin testing at NATC, erect spins induced with cruise control throws were achieved only on 12.5% of the attempts. These spins were all from normal 1-g stall entries. Erect spins could not be induced from vertical, inverted, or accelerated stall entries with cruise control throws. Erect spins were induced on 95% of the spin attempts using extended control throws in vertical and 1-g entries.

ERECT SPINS

The erect spin requires approximately 1 1/2 turns to become fully developed. The initial 1 1/2 turns comprising the incipient spin phase (or post stall gyration) are more disorienting than the fully developed spin due to the rolling, pitching, and yawing motions in conjunction with a rapidly changing load factor. This gyration is what will be experienced in most instances rather than a spin and is the same whether or not a spin develops and regardless of the control throws (cruise or extended) used. Recovery is normally effected by neutralizing or releasing all controls, but in some cases lateral stick deflection is necessary to stop rolling motion.

Spin Characteristics

The fully developed erect spin is a low-speed, high angle-of-attack, autorotative spin characterized by the airspeed indication fluctuating around 100 KIAS, the turn needle indicating a steady full needle deflection turn in the direction of the spin, and the accelerometer showing 0 to +0.3 g.

Note

Aircraft oscillatory motion in the spin is sufficient to cause the ball in the turn-and-slip indicator to slide back and forth and to be of no use to the pilot. The turn needle should be used as the primary instrument to determine the direction of the spin.

Airframe buffet level in the spin is very low and the predominant aircraft motion apparent to the pilot is yaw. The spin rotation rate is 3.5 to 4.0 sec/turn, the angle-of-attack is 60° to 65°, and the pitch attitude oscillates from 30° to 50° nose down once during each turn. The forces exerted on the pilot are mild and an erect spin with the shoulder-harness inertia reel unlocked presents no problems. All cockpit switches can be easily reached and full cockpit control throws can be accomplished.

During the fully developed spin, engine compressor stalls at the rate of approximately 10 per second are audible, and EGT will increase rapidly to over 700°C if engine rpm is greater than 88% to 90%. The engine rpm will drop to below flight idle, resulting in loss of the aircraft electrical system if engine rpm

is less than 80%. The ram-air turbine will not operate in an erect spin. The automatic flight control system, speed-brake position, or aircraft CG location do not noticeably affect the spin characteristics. However, asymmetrical power assists in inducing erect spins. The approximate 6° cant of the exhaust nozzles out from the fuselage centerline results in an addition to the spin moment when the engine on the inside of the spin is developing more thrust than the one on the outside. Erect spins, with the exception of asymmetrical power spins, are recoverable with cruise control throws but may require up to three turns to effect.

WARNING

The aircraft will not recover from an erect spin with assymmetrical power using cruise control throws for recovery.

An assist-spin recovery switch has been provided to permit the attainment of the landing configuration control throws (+35° rudder and 24° stabilizer leading edge down) while in the clean configuration. Use of extended control throws provide a recovery in 1 to 1 1/2 turns from all spins.

CAUTION

- Operation of the assist-spin recovery switch may impose an additional acceleration which, during an accelerated maneuver, may overstress the aircraft, or when operating at minimum airspeeds may pitch the aircraft up into stall or heavy buffet conditions.
- Reselection of cruise control throws after spin recovery should be done below 300 KIAS while anticipating a nose-down pitch change.
- The assist-spin recovery switch should not be activated with the flaps down. Activation can cause damage to the extended throw mechanism.

The altitude lost in the fully developed erect spin is 1,300 to 1,500 feet per turn. The altitude lost from the initiation of recovery to level flight is approximately 9,000 feet with 2.5 to 3.0 g roundout.

ERECT SPIN RECOVERY

The first step in recovery from all spins is to determine if the aircraft is in a spin. Since post stall gyration can be extremely disorienting, it is relatively easy to assume the aircraft is in a spin when in fact it is not. Application of spin recovery technique during post stall gyration may force the aircraft into a spin. Upon entering a post stall gyration, controls should be neutralized to effect recovery. If it is determined that the aircraft is in a spin, determine the direction of the spin by reference to the turn needle; then initiate recovery according to the following sequence:

1. Apply full rudder pedal deflection in direction opposite to spin (rudder opposite direction that turn needle is indicating).
2. Hold control stick full aft and neutral laterally.
3. Simultaneously with application of spin recovery controls, or as soon as possible, select extended control throws with assist spin recovery switch.
4. Adjust throttles to provide 80% to 85% rpm. Adjusting throttles to a point where they are parallel to pilot's vertical axis results in desired power setting without requirements to monitor rpm indicator.
5. When rotation ceases, immediately neutralize rudder and move control stick forward to at least neutral position. Failure to neutralize controls as soon as spin rotation has ceased will result in violent lateral snaps, causing the aircraft to assume a steeper nose-down position and require more altitude for recovery to level flight.
6. Return assist spin recovery switch to cruise control throw position after return to level flight and at or below 300 KIAS.

Recovery will occur in 1 to 1 1/2 turns at a 70° or greater nose-down attitude. If turn reversals are encountered while neutralizing the controls, release the controls and the aircraft will fly itself out. The flaperons are not effective during erect spins.

WARNING

Wind tunnel tests on spin characteristics of swept wing aircraft have shown that asymmetrical loads on the order of 10,000 to 12,000 foot-pounds or higher produce an undesirable flattening of the spin. A-6 spin characteristics with asymmetrical stores have not been tested. If a spin occurs with asymmetrical stores, use the emergency jettison button to jettison all stores.

INVERTED SPINS

Inverted spins have been unobtainable (contractor demonstration and NATC tests) with the normal cruise control throws, but have been induced by using the extended control throws. The inverted spin requires 1 to 1 1/2 turns to become fully developed. Recovery from the initial 1 to 1 1/2 turns, the incipient spin phase, is effected by neutralizing or releasing the controls, but in some cases lateral stick deflection is necessary to stop the rolling motion.

The fully developed inverted spin is a low-speed high negative angle-of-attack, autorotative spin characterized by the airspeed indication fluctuating from less than 80 KIAS up to 100 KIAS, the turn needle indicating a steady full needle deflection turn in the direction of the spin, the ball remaining in the side of the cage opposite to the direction indicated by

the turn needle, and the accelerometer indicating a steady -1.0 g. In the fully developed inverted spin, airplan pitch attitude oscillates from 0° to 35° below the horizon once very turn, the spin rotation rate is 3.5 to 4.0 sec/turn, the aircraft angle-of-attack in a steady -55°, and airframe buffet is nonexistent. The main force felt by the pilot is the negative load factor. If the seat belt is not tight and/or the seat is raised, difficulty may be experienced in reaching and actuating the assist spin recovery switch. With the seat belt properly secured, all cockpit switches can be reached and full cockpit control throws accomplished. Yaw, pitch, and roll rates are relatively steady, resulting in a physically comfortable spin. Determination of spin direction by observing the terrain traverse in the windscreen is difficult due to disorientation. However, spin direction can be immediately determined by referring to the turn needle. Engine compressor stalls occur as described for erect spins. The ram-air turbine will operate satisfactorily in inverted spins. All inverted spins are recoverable with cruise control throws but may require up to 3 1/2 turns. Use of extended control throws provides recovery in 1/2 to 1 turn. The altitude lost during a fully developed inverted spin is 1,000 to 1,300 feet per turn. The altitude lost from the initiation of recovery to level flight is approximately 9,000 feet with a 2.5 to 3.0 g roundout.

INVERTED SPIN RECOVERY

Determine the spin direction by reference to the turn needle, then take the following steps:

1. Apply full rudder pedal deflection in direction opposite to spin.
2. Hold control stick full forward and neutral laterally.
3. Simultaneously with application of spin recovery controls, or as soon as possible, select extended control throws with assist-spin recovery switch.
4. Adjust throttles to 80% to 85% rpm.
5. Neutralize controls as soon as spin rotation ceases.
6. Return assist spin recovery switch to cruise control throw position after return to level flight and at or below 300 KIAS.

Recovery will occur in about one turn in a 70° to 90° nose-down attitude. Turn reversals have not been encountered during forward stick recoveries from inverted spins. The flaperons are not effective during inverted spins. The CSD/S warning lights on the annunciator panel will go on during the spin but will go out following spin recovery without corrective action being taken.

SPIN RECOVERY ON INSTRUMENTS

Recovery on instruments from erect and inverted spins can be effected using the following technique:

1. Determine direction of spin by reference to turn needle. Determine if spin is inverted or erect by reference to the angle of attack. If the angle of attack is pegged upward, the spin is erect. If the angle of attack is pegged downward (low angle of attack), the spin is inverted.
2. Apply full rudder pedal deflection in direction opposite to turn needle.
3. Apply full aft stick for recovery from an erect spin and full forward stick for recovery from an inverted spin.
4. Simultaneously with application of recovery controls, or as soon as possible, select extended control throws.
5. Adjust throttles to 80% to 85% rpm.
6. Hold spin recovery controls for a count of 3, or 3 seconds; then release controls to neutral. Monitor airspeed, turn needle, accelerometer, and gyro horizon for indication of spin recovery.
7. Return to level flight using gyro horizon and turn needle for attitude reference.
8. Select cruise control throws after return to level flight and at or below 300 KIAS.

Recovery from all inverted spins will normally occur when the controls are released to neutral. The recovery from all erect spins will occur within one turn after release of the controls to neutral.

After activating the assist spin recovery switch, the flight controls must be held in the spin recovery position for a count of 3, or 3 seconds, and then released to neutral because the inherent lag in the turn-and-slip indicator is too great for it to be used to determine when spin rotation has ceased. Holding the spin recovery controls for 3 seconds provides about one spin recovery turn, which is enough to cause the spin recovery to progress to a point where the aircraft will recover hands-off within an additional one-half turn. Waiting until the turn needle begins to move toward the centered position before neutralizing the controls results in a series of reversals and the aircraft will not recover due to the late neutralization of the flight controls.

A momentary loss of electrical power will not adversely affect the performance of the gyro horizon or the turn-and-slip indicator. The turn needle will continue to indicate the correct direction of turn for 9 seconds after electrical power failure.

FLIGHT CONTROLS

A movable slab stabilizer, flaperon wing spoiler, and a conventional rudder provide effective control over the operational range of the aircraft. The control surfaces are positioned by irreversible hydraulic actuators linked to the stick and rudder pedals by a proportional followup linkage. Control force feel is provided entirely by mechanical devices such as bungees and bobweights, and requires no mach or "q" compensation. Control trim is accomplished electrically by shifting the feel system neutral position in each system.

The stabilizer travel is increased for flaps-down flight in a programmed manner so that trim change with flap deflection is minimized. Stabilizer shift is accomplished by a cable drive from the flap motor and is designed to remain at either full flaps down or flaps up gearing, should the shift cable fail. Stabilizer travel is 1.5° leading-edge-up, to 9.6° leading-edge-down in the flaps-up configuration, and 1.5° leading-edge-up to 24° leading-edge-down for flaps-down operation, with full stick travel. Selection of the assist-spin recovery drives the same shift mechanism.

CAUTION

Operation of the assist-spin recovery switch may impose additional acceleration, which during an accelerated maneuver may overstress the aircraft, or when operating at minimum airspeeds may pitch the aircraft up into a stall or heavy buffet condition. Reselection of cruise control throws after spin recovery should be done below 300 KIAS, while anticipating a nose-down pitch change.

NEW Rudder travel either side of neutral is increased for flaps-down flight by withdrawing stops in the rudder control linkage. Rudder travel is reduced to 4° with flaps up, and increases to 35° flaps down, or with the assist-spin recovery selected. Rudder travel is proportional to rudder pedal deflection in each case.

The rudder stops shift to full open if the cable fails. Selection of the assist-spin recovery switch accomplishes the stop withdrawal by the same mechanism as (full) flap extension.

After landing, the flaperon pop-up feature, as well as the flaps and slats, act together to effectively kill lift and increase drag to decrease landing roll.

LEVEL FLIGHT

No unusual characteristics will be noted in level flight. Control response is excellent. Longitudinal stability is positive up to .84 IMN, where a reverse stability regime is gradually entered. This transonic trim change of tuck-under is common to swept wing jets of this type and is considered mild and completely controllable. Positive stability is regained at .92 IMN and above.

Loss of either engine will not compromise control or stability. Engine thrust lines pass close to aircraft cg, and minimum single-engine control speeds are within 3 to 5 knots of the normal two-engine stall speeds. Single-engine control speed is limited by prestall buffet, slight lateral and longitudinal oscillations, and nearly full lateral and directional control deflections. NEW

Note

When operating under single-engine conditions, ensure that the speed brakes have been retracted.

CAUTION

Restricted stabilizer travel at low speed could result in inadequate pitch control and full stabilizer travel at high speed could cause structural failure.

PILOT INDUCED LATERAL OSCILLATION

With the AFCS operating in STAB AUG at airspeeds in excess of 450 KIAS, moderately abrupt lateral stick displacement or reversal may induce an oscillation in roll of 20° to 30° per second. This oscillation is sustained by the pilot displacing the stick and may be stopped immediately by neutralizing the stick. The lateral oscillation increases in intensity from 450 KIAS to limit speed but is not divergent or destructive throughout the flight envelope. The oscillation will not normally be experienced in maneuvering flight.

DIVES

Dive entries may be either pushovers or split-s type. In either case, transition through the transonic trim changes will be rapid. At about .90 IMN, reduced lateral control effectiveness and slightly negative dihedral effect will be encountered. The latter phenomenon will not be noted unless rudder deflections are made. The basic airframe is not restricted in dive angle or maximum speeds but certain store configurations may require limits. Dive recoveries may be made either clean or with speed brakes. Trim changes with speed brakes are slight, but it should be remembered that as speed is reduced, trim changes and/or gusts may add to the existing g's during pullouts at the bottom of the dives. See figures 4-5 through 4-8.

SPEED BRAKE BLOWBACK

The speed-brake system is so designed that the speed brakes will blow back when the speed-brake actuator load is equal to 20,300 pounds. This is equal to the 3,400 psi cracking pressure of the relief valve, or 3,560 psi at full flow, with the speed brakes positioned at 55°. The wing-tip speed brakes will blow back at .80 IMN, level flight.

SINGLE ENGINE OPERATION

SINGLE-ENGINE FLIGHT CHARACTERISTICS

For all flight configurations ample lateral and directional control is available for achieving and maintaining straight flight with maximum asymmetrical engine thrust. Minimum single-engine control speeds are defined by attaining the full maximum trimmed lift coefficient of the aircraft. Single-engine stall characteristics are essentially the same as those obtained in normal operation with similar flap settings. NEW

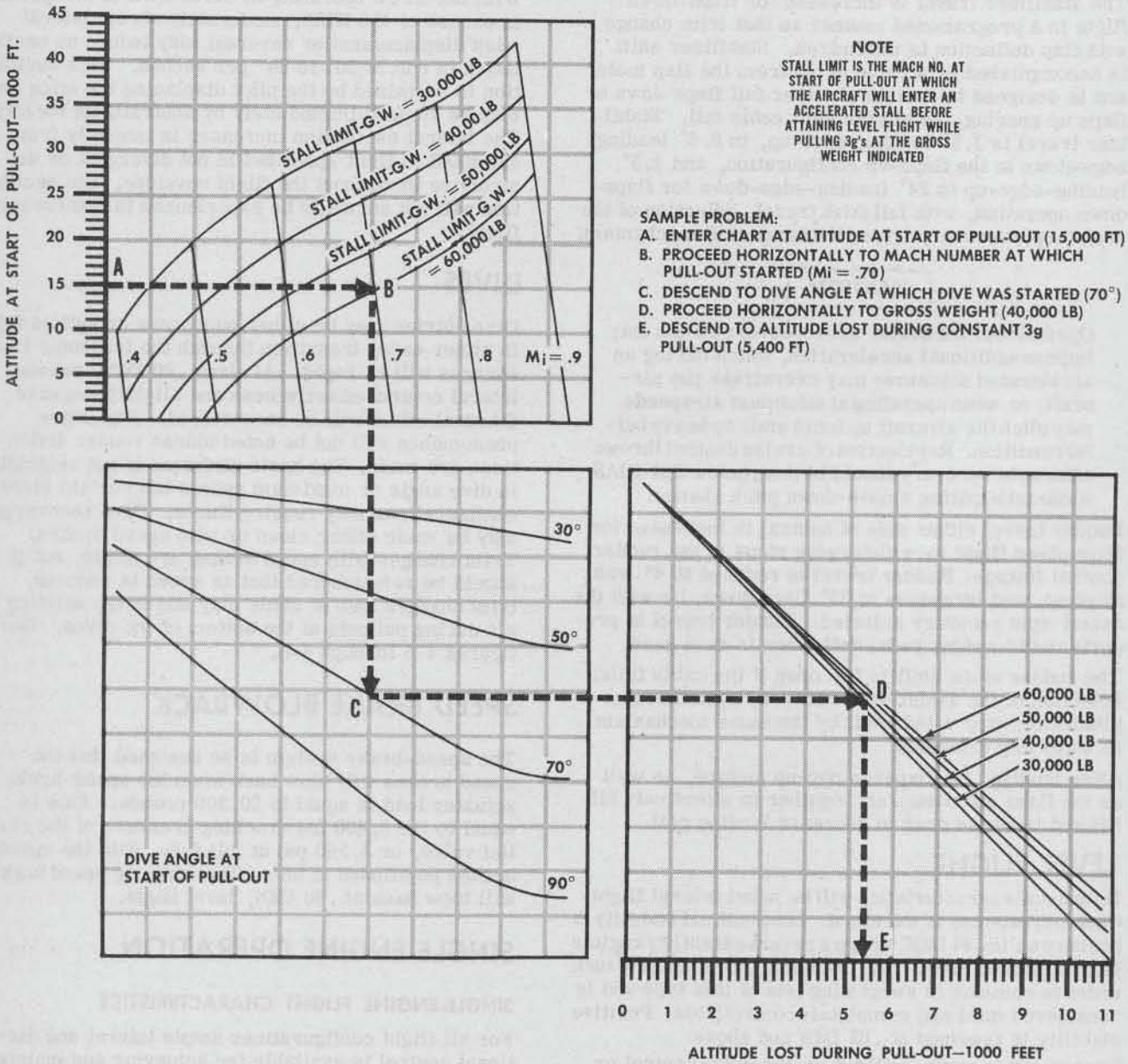
DIVE RECOVERY CHART - 3g

CONFIGURATION: NO EXTERNAL STORES

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
WING TIP SPEED BRAKES EXTENDED
80% RPM
ENGINE (S) : (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE
STALL LIMIT IS THE MACH NO. AT START OF PULL-OUT AT WHICH THE AIRCRAFT WILL ENTER AN ACCELERATED STALL BEFORE ATTAINING LEVEL FLIGHT WHILE PULLING 3g's AT THE GROSS WEIGHT INDICATED

SAMPLE PROBLEM:
A. ENTER CHART AT ALTITUDE AT START OF PULL-OUT (15,000 FT)
B. PROCEED HORIZONTALLY TO MACH NUMBER AT WHICH PULL-OUT STARTED (Mi = .70)
C. DESCEND TO DIVE ANGLE AT WHICH DIVE WAS STARTED (70°)
D. PROCEED HORIZONTALLY TO GROSS WEIGHT (40,000 LB)
E. DESCEND TO ALTITUDE LOST DURING CONSTANT 3g PULL-OUT (5,400 FT)

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Figure 4-5

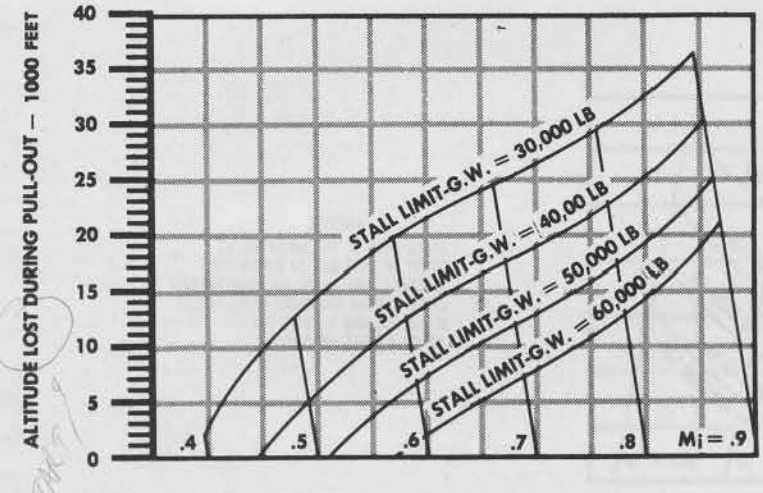
DIVE RECOVERY CHART - 4 g

CONFIGURATION:
NO EXTERNAL STORES

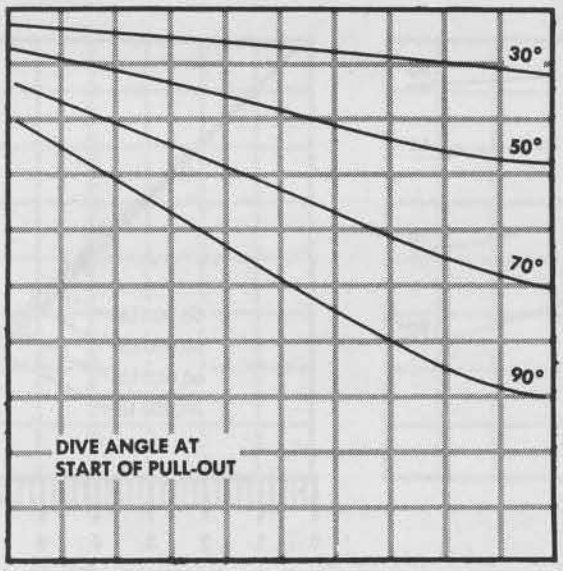
DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
WING TIP SPEED BRAKES EXTENDED
80% RPM
ENGINE (S) : (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE
STALL LIMIT IS THE MACH NO. AT START OF PULL-OUT AT WHICH THE AIRCRAFT WILL ENTER AN ACCELERATED STALL BEFORE ATTAINING LEVEL FLIGHT WHILE PULLING 4 g's AT THE GROSS WEIGHT INDICATED.



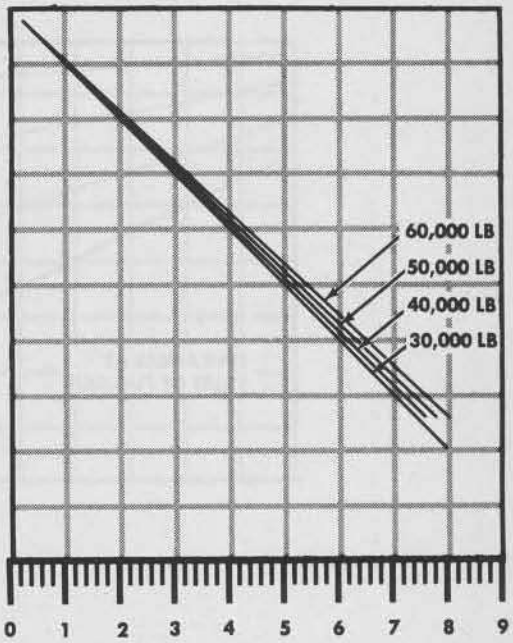


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Figure 4-6

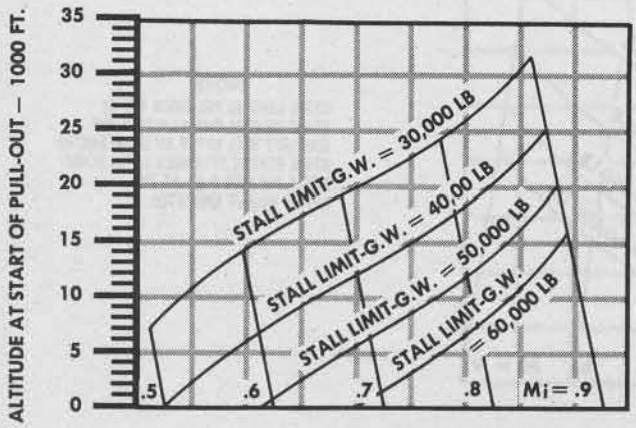
DIVE RECOVERY CHART - 5g

CONFIGURATION: NO EXTERNAL STORES

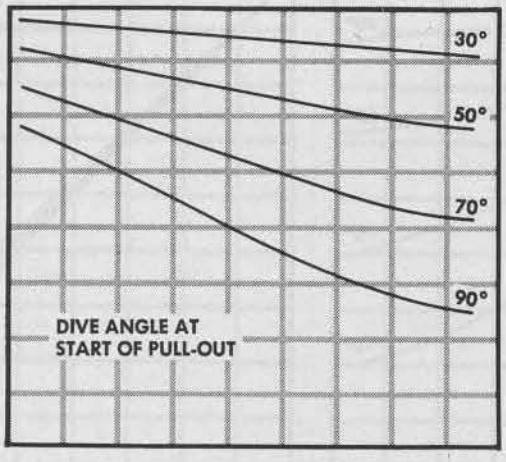
DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
WING TIP SPEED BRAKES EXTENDED
80% RPM
ENGINE (S) : (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE
STALL LIMIT IS THE MACH NO. AT START OF PULL-OUT AT WHICH THE AIRCRAFT WILL ENTER AN ACCELERATED STALL BEFORE ATTAINING LEVEL FLIGHT WHILE PULLING 5 g's AT THE GROSS WEIGHT INDICATED.



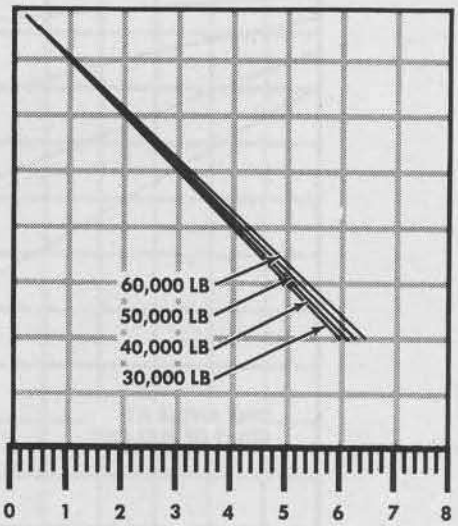


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Figure 4-7

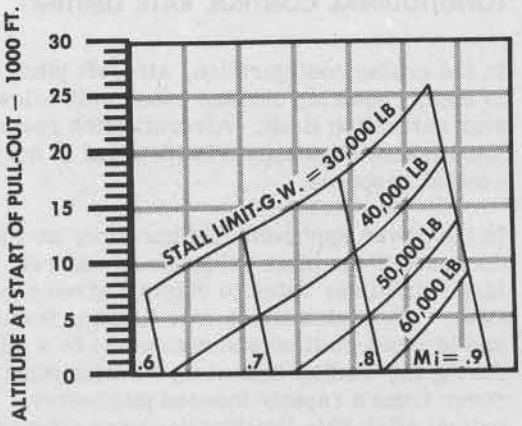
DIVE RECOVERY CHART - 6.5g

CONFIGURATION: NO EXTERNAL STORES

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

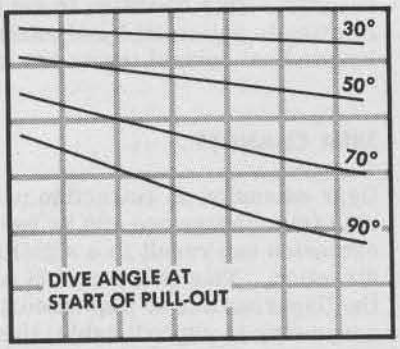
REMARKS
WING TIP SPEED BRAKES EXTENDED
80% RPM
ENGINE (S) : (2) J52-P-8

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE

STALL LIMIT IS THE MACH NO. AT START OF PULL-OUT AT WHICH THE AIRCRAFT WILL ENTER AN ACCELERATED STALL BEFORE ATTAINING LEVEL FLIGHT WHILE PULLING 6.5 g's AT THE GROSS WEIGHT INDICATED.



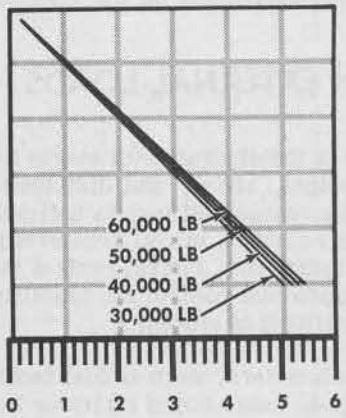


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Figure 4-8

The only flap setting for single engine operation is 30° (T/O). The single-engine rate of climb as a function of gross weight, pressure altitude, and temperature is presented in Section XI.

CAUTION

Extension of the speed brakes drastically reduces performance.

SINGLE ENGINE FLIGHT PERFORMANCE

Refer to Section XI, for qualitative single-engine performance information.

WARNING

An engine failure will produce a rate of descent in excess of 700 fpm in takeoff configuration at maximum operational takeoff weight: 60,400 pounds sea level standard day. Upon failure of an engine, the pilot should immediately jettison all external stores to reduce gross weight and drag sufficiently for positive rate of climb. The landing gear and flaps can be retracted and excess fuel dumped if desired. Refer to Section XI.

Note

External stores cannot be jettisoned until 70% of the aircraft weight is off the wheels.

FLIGHT WITH EXTERNAL LOADS

Handling qualities of the aircraft with stores loaded vary with their weight, shape, and distribution. Spanwise loading increases roll inertia noticeably, with accompanying reduction in roll acceleration. For all store configurations, lateral control is still satisfactory. Longitudinal control and stability is least affected by addition of stores.

Stores with large diameters, such as fuel tanks and the air-refueling pod, cause added airframe buffet during flight above normal cruise speeds, and during increased g loads.

BACKUP FLIGHT CONTROLS HYDRAULIC SYSTEM

In aircraft 371 and subsequent and aircraft incorporating AFC No. 183, upon complete hydraulic failure, a backup flight control system is activated, which provides horizontal stabilizer control through longitudinal stick movement and rudder control through pedal movement. Flaperon control is not provided.

The backup flight control hydraulic system provides the capability of unusual attitudes recovery, and, under optimum conditions, field landings. Refer to Section V for recommended flight procedures using the backup flight control system.

Flight on the backup flight controls hydraulic system may be simulated by using only rudder for roll control with STAB AUG at OFF. Training should include cruising flight, recovery from unusual attitudes, and no-flap landings, all without the use of flaperons.

LONGITUDINAL CONTROL RATE LIMITING

In the cruise configuration, aircraft pitch response is high, requiring surface rates well below the actuator saturation limit. Aircraft pitch response to longitudinal stick inputs is identical to normal flight control response.

In the power approach configuration, as the speed decreases, the pitch response is reduced, requiring large stabilizer rates to obtain a given g per unit time. Aft stick surface rate limiting occurs first and is more critical and noticeable to a pilot who, during the landing approach, is attempting to recover from a rapidly induced pitch-over. Longitudinal stick rate limiting becomes apparent at about 150 knots and increases in severity as the speed decreases. This condition is not hazardous if rate limiting is anticipated and moderate, unexcessive longitudinal control inputs are effected.

TRIM CHANGES

Gear extension or retraction produces no appreciable trim change and can be easily controlled. Flap extension can result in a significant roll-off in either direction. This is a result of assymetric floating of the flaperons due to flap extension. The degree of assymetry is unpredictable; therefore, it is recommended that the flaps not be extended when controlling the aircraft with the backup system only.

DIHEDRAL EFFECT

Attempts to yaw the airplane with rudder will produce roll in the same direction as yaw. This dihedral effect becomes more pronounced at high angles of attack. The use of rudder inputs to produce yaw and in turn generate roll, with provide the highest attainable roll rates at high angles of attack. The rudder must be used judiciously, however, since excessive rudder inputs will induce excessive yaw.

part 3

Formation and Tactics

FORMATION TAKEOFF

All aspects of the takeoff must be prebriefed by the flight leader such as use of nosewheel steering, power changes, power settings, and signals for landing gear and flaps.

Section takeoff will not be performed with dissimilar type aircraft, nor with a crosswind component in excess of 10 knots. The section leader will position his aircraft on the port side of the runway. Aircraft will line up on a parade bearing with enough lateral clearance to provide separation between aircraft in case the leader experiences a blown tire, or is required to abort the takeoff. When the section is in position, the B/N of the lead aircraft will give a two-finger turn-up signal at the command of the flight leader. Next, both pilots will turn up to military power and make all final checks from the check list. The lead B/N will carefully check the second for leaks, trim settings, flap settings, and flaperon position, at which time the second aircraft pilot will make the same checks of the lead aircraft. After airframe and instrument requirements are met by both aircraft, the lead B/N and wingman will show a raised hand to indicate they are both ready for takeoff. At the command of the lead pilot, the lead B/N will drop his hand smartly out of view to signal brake release and commencement of takeoff roll. The lead pilot will reduce his power approximately 2% on each engine before giving the brake release command. The wingman will adjust his power to maintain relative position through the takeoff roll. Normal takeoff techniques will be utilized with respect to the nosewheel steering and lift-off speed.

When the section is comfortably airborne and has established a positive rate of climb, the lead B/N at the command of the lead pilot will signal for the landing gear to be raised. When the section has attained safe altitude and airspeed, the lead B/N will give the appropriate signal and the flaps will be raised (again at the command of the lead pilot).

Turns into the wingman will not be made at altitudes of less than 500 feet AGL. The first section must be airborne before the second section commences its takeoff roll. See visual communication procedures in Section VII.

CAUTION

- In the event of an aborted takeoff, the aircraft aborting must immediately notify the other aircraft. The aircraft not aborting should add maximum power and accelerate ahead and out of the way of the aborting aircraft. This will allow the aborting aircraft to steer to the center of the runway and engage the arresting gear.
- It is imperative that the wingman always be alert for an overrunning situation and take timely steps to preclude such an occurrence. Should an overrunning/overshooting situation develop after becoming airborne, the wingman should immediately move laterally away from the lead and, if feasible, reduce power in order to maintain wing position. Safe flight of both aircraft must not be jeopardized in an attempt to maintain formation. The leader should detach the wingman if he is experiencing loss of thrust and flying speed. The wingman should detach and add power if unable to maintain a safe wing position on the lead.

RENDEZVOUS

TURNING RENDEZVOUS

The turning rendezvous is made at 300 KIAS (unless otherwise briefed). After all aircraft are in a loose-trail position, the leader commences a 180° turn, using 30° of bank. Each member of the flight waits until the aircraft ahead passes through a 30° bearing from his 12-o'clock position, and then rolls into a 45° banked turn to the inside of the leader's turn. When the leader bears 40° relative to the joining aircraft, wingmen ease turn as necessary to maintain the 45° bearing until joined either on the preceding aircraft or the flight. Wingmen may add power to gain no greater than a 10-knot speed advantage over the leader, to avoid overshooting. As the aircraft approach the leader, the closure rate is adjusted so as to join on the man ahead or on the inside of the leader's turn. After joining on the inside of the leader, a crossunder is made to the outside, assuming normal wing positions.

CIRCLING RENDEZVOUS

A circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals. The pattern is normally a port, nonstandard orbit, using 30° of bank around a geographic fix. Altitude must be specified and airspeed will be 300 KIAS (unless otherwise briefed). Upon arrival, each aircraft flies directly over the fix, slightly below the rendezvous altitude, to provide altitude separation upon entry into the pattern. The first aircraft to arrive should establish the orbit. Subsequent aircraft should be able to sight other aircraft in the circle from directly over the fix. When sighted, a hard turn in the direction of the orbit turn should be made to establish a 45° bearing relative to the joining aircraft. Vary the bank as necessary to maintain the bearing until joined. Do not use an airspeed advantage in excess of 15 knots. As the leader is closed, check closure rate so as to stop on the inside of the turn; then cross under to a normal wing position on the outside (figure 4-9.)

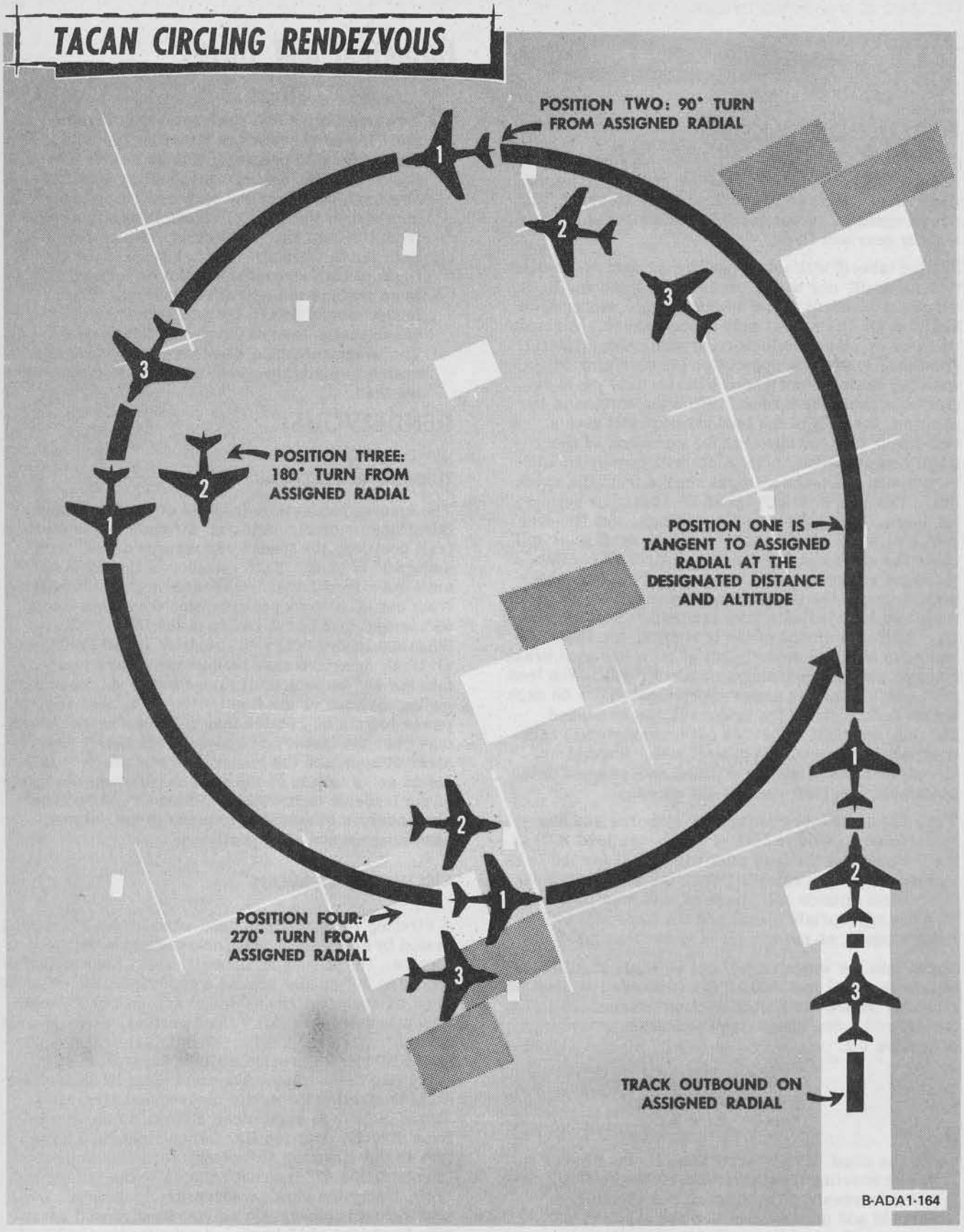

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Figure 4-9

TACAN CIRCLING RENDEZVOUS

A TACAN circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals and it is not possible to use a geographic fix (at sea or above an overcast). The pattern will be a starboard orbit tangent to the designated TACAN radial, at a specified distance and altitude. Normally, each pilot flies outbound on the assigned radial, maintaining the briefed climb schedule or rendezvous speed. Upon reaching the join-up circle, each pilot commences a starboard orbit, using 30° of bank (or more) until visual contact is made with the flight leader. If necessary, request for the leader's position. The leader will state his position around the orbit, using figures 1, 2, 3, or 4, corresponding to 000°, 090°, 180° and 270°, respectively, relative to the designated radial, as shown in figure 4-9. Each pilot then plans his turn to cut across the orbit for rendezvous. ARA-25 may be used to assist in picking up the leader.

RUNNING RENDEZVOUS

A running rendezvous is effected by closing from the rear on a prebriefed heading or radial. This rendezvous should be accomplished with the leader climbing at 300 KIAS and approximately 95% (unless otherwise briefed). If it is to be made level, the leader should normally be at 300 KIAS at the designated altitude.

ADF RUNNING RENDEZVOUS

The ARA-25 rendezvous is useful for joining aircraft under all conditions, and particularly during a straight course running rendezvous. The procedure to be used for the latter is as follows:

1. Trailing aircraft select ADF position on UHF control.

2. The flight leader will transmit a short count every minute, and when climbing, include passing altitude.

3. Trailing aircraft will position themselves so that as leader transmits short counts, No. 1 needle points 5° left or right of nose position. The No. 2 aircraft will hold leader to his left, No. 3 to his right, etc.

4. As trailing aircraft approach flight leader, they will turn to keep him 5° (left or right respectively) off nose position. The amount of turn required to maintain leader in this position will increase as separation is reduced. Continue until visual sighting is obtained.

ADF CIRCLING RENDEZVOUS

If a circling rendezvous is to be made, the flight leader will maintain prebriefed airspeed, 30° of bank, a specified altitude, and broadcast a short count and heading every minute. The trailing aircraft will correct heading to keep the No. 1 needle on the nose when the leader transmits. From the change in azimuth of the No. 1 needle between short counts, approaching aircraft will be able to determine their proximity to the lead aircraft. Approaching the flight leader, the needle will change more degrees in azimuth between counts, requiring larger corrections to keep the leader on the nose. At this time, the leader can probably be detected visually and a standard rendezvous completed.

LOW VISIBILITY RENDEZVOUS/RENDEZVOUS ON DIFFERENT MODEL AIRCRAFT

This type of rendezvous should be performed in emergency situations only when directed by higher authority or when the urgency of the mission dictates. The rendezvous aircraft should be flown at a safe maneuvering airspeed. The initial procedures will be as previously described for standard rendezvous. However, the latter stages should be modified as outlined below.

1. Establish radio contact, if possible, and determine indicated airspeed and intended flight path of aircraft to be joined.

2. Place all lights on BRIGHT (if applicable).

3. Rendezvous about 1,000 feet out, slightly aft of abeam (4 or 8 o'clock) lead aircraft.

4. Cautiously close, while assuring constant nose-to-tail clearance. Maintain a constant relative bearing. Changes in relative bearing will cause foreshortening or lengthening of aircraft fuselage and make determination of closure rate difficult.

5. A rendezvous on a different model aircraft and or in low-visibility conditions is extremely conductive to vertigo. A high degree of caution and good judgment must be exercised throughout the rendezvous. At no time should a rapid-closing situation be allowed to develop.

SAFETY RULES FOR RENDEZVOUS

1. During all rendezvous, safety shall be the prime consideration.

2. Keep all aircraft ahead constantly in view and join in order.

3. During rendezvous, only enough step-down should be used to ensure vertical clearance on aircraft ahead.

4. When necessary, a wingman should abort rendezvous by leveling his wings, sighting all aircraft ahead, and flying underneath them to outside of formation. He should then remain on outside until all other aircraft have joined.

5. To avoid overshooting, all relative motions should be stopped when joining on an inside wing position. A crossunder to outside may then be made.

6. During a running rendezvous, use caution in the final stage of join-up, as relative motion is difficult to discern when approaching from astern.

FORMATION

FREE CRUISE FORMATION (4 AIRCRAFT DIVISION)

This formation (figure 4-10) will normally be employed for all operations away from home base, unless another formation is signaled. Within each section, the wingman's position is 45° aft the section leader's beam, with sufficient distance abeam to clear the wingtips, and sufficient distance astern to clear the tail of the lead aircraft.

The vertical step-down of the wingman will be sufficient to clear the leader's aircraft and jet wash. The second section leader's position is approximately 45° abaft the division leader's beam and slightly stepped down. The second section leader must maintain a distance out on the assigned bearing line which will provide clearance with the lead section wingman and which will also permit visual communications between division and section leader. During steep turns or hard maneuvering, the second section and wingmen within each section are free to slide as necessary to avoid large power changes.

PARADE FORMATION

This formation (figure 4-10) will normally be employed when the flight is operating in the vicinity of home base and in conditions of low visibility. The parade formation position is obtained by the wingmen and sections leader maintaining a position slightly stepped down with 3 to 5 feet of lateral clearance between wingtips on a bearing matching the sweep back of the wing leading edge. Sliding during turns is not permitted.

FORMATION INSTRUMENT APPROACH

1. Wingman follows all configuration changes of the leader.

2. When runway OLS is sighted, leader signals lead change to wingman. When wingman considers he can safely continue approach unaided, he accepts lead.

3. After passing lead, the leader turns away from wingman, and then back to final approach heading and observes wingman's progress.

4. In case of a wave-off or bolter, and a VFR pattern is not feasible, the wingman rejoins leader for another approach.

FORMATIONS

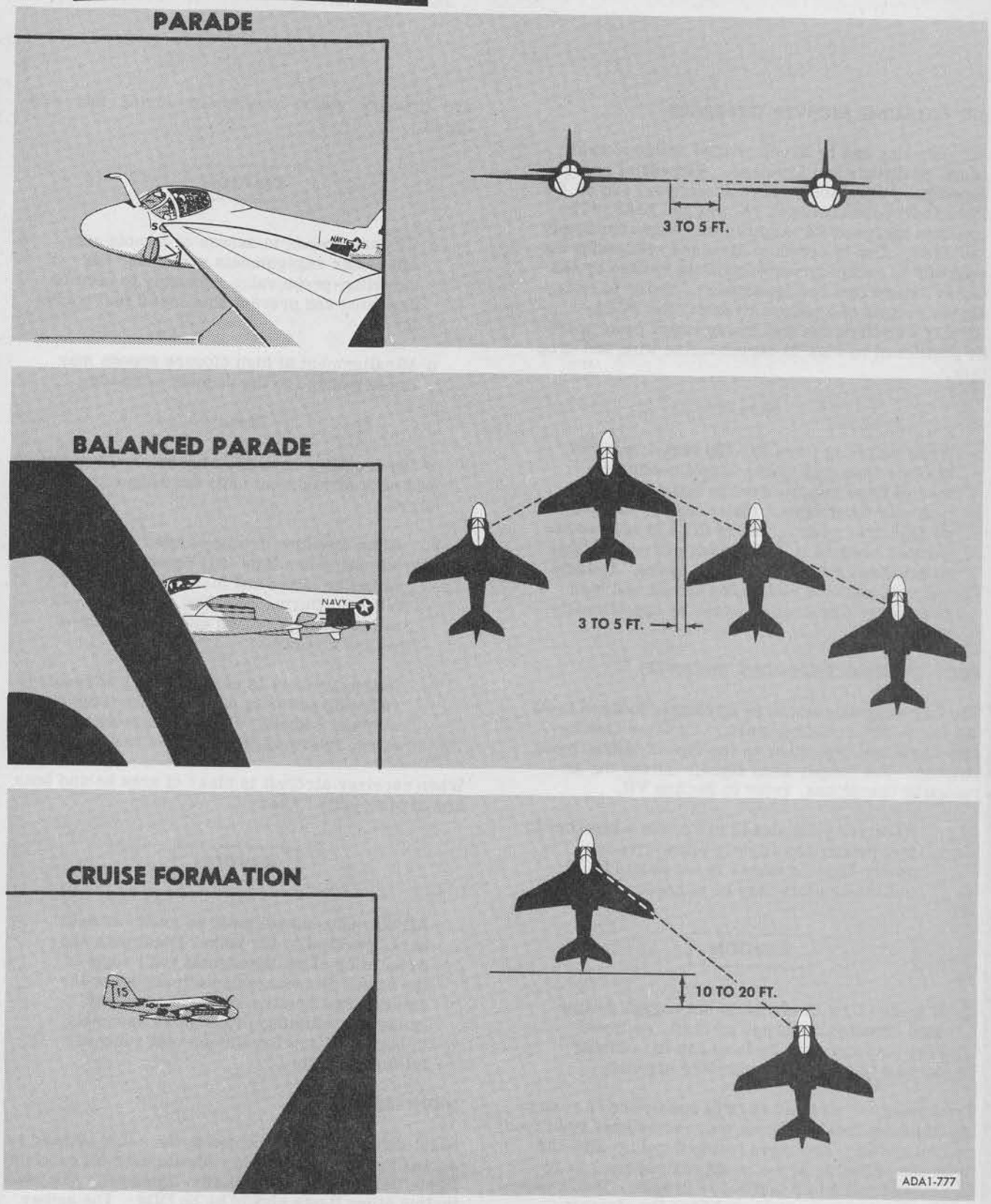

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Figure 4-16

part 4 Air Refueling

AIR REFUELING RECEIVER TECHNIQUE

Air refueling can be accomplished within a wide range of altitude and airspeed. Successful engagements have been made between sea level and 35,000 feet at airspeeds between 190 and 300 KIAS. The optimum airspeed for engagement is approximately 230 KIAS. Use of optimum airspeed will assist the receiver in escaping heavy buffeting caused by the tanker slipstream and jet exhaust. Prior to engaging the drogue of a tanker aircraft, the FUEL READY switch on the fuel management panel must be positioned to FLT to depressurize wing and drop tank.

Note

When refueling from KC-130 tanker aircraft, at other than high gross weight conditions, takeoff flaps may be used to maintain position with the drogue. Under high gross weights or high drag counts, use of flaps is not recommended because it will reduce power available to establish sufficient closure speed. Refueling with extreme high gross weight and high drag count combination would be operationally unfeasible.

PILOT TANKING TECHNIQUE (RECEIVER)

The following discussion is applicable to the KA-6D and the D-704 refueling store. All other tanking evolutions are dependent on the type of tanker being utilized. For proper hand signals during the air-refueling operations, refer to Section VII.

1. Receiver pilot should move into a position 20 feet behind and slightly below drogue. The amber light on tanker store should be lit, indicating store may be engaged.

CAUTION

If amber light is not lit do not engage drogue until signaled by tanker aircraft, as hose-reel response may be inoperative, causing damage to tanker and receiver aircraft.

Trim receiver aircraft slightly nose-down to remove any slack or breakout force from horizontal stabilizer control system, and move forward and up until the tip of the refueling probe is approximately 5 to 10 feet behind and 2 to 3 feet below drogue. Pause momentarily, long enough to stabilize the aircraft. Then add enough power to close and engage the drogue at a closure speed of 3 knots. Probe and drogue are primary visual references during this evolution.

CAUTION

- o Closure speeds in excess of 5 knots and off-center engagements may cause the refueling-probe valve assembly to become distorted and prevent successful fuel transfer.
- o Misalignment at high closure speeds may cause damage to the radome or canopy.

Note

If the drogue is missed, stay below the drogue and back straight out until the drogue is in sight.

2. After engaging drogue, amber light goes out and green light will come on when in refueling range and fuel is being transferred. During refueling, maintain a position directly behind and slightly below tanker aircraft.

3. Disengagement is accomplished by receiver reducing power in order to open from tanker at about 3 knots. Back straight away and down, following flight path of tanker.

When receiver aircraft is clear of area behind hose and drogue, call "Clear".

CAUTION

All disengagements must be made straight back, parallel to the tanker flight path and descending along the natural trail angle of the hose. Disengagements from below the natural trail position of the drogue may cause the refueling-probe valve assembly to become distorted and prevent successful fuel transfer.

NIGHT REFUELING

Night refueling is performed in the same manner as during the day. The tanker should have all exterior lights DIM and the anticollision lights off. The centerline store lights should be on DIM. The amber lights on the outboard pylons of the tanker aircraft are used for reference during night refueling. A

white light in the under side of the tanker fuselage will illuminate the refueling hose.

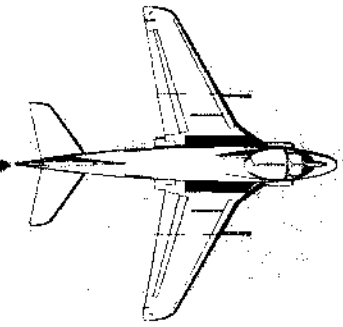
Prior to assuming position for approach to the drogue, receiver aircraft may turn on the probe light. Take up an initial position on the tanker and use the same procedures described in this section for day refueling. When in position aft of the drogue, correct altitude can be determined by referring to the amber pylon lights. The receiver aircraft lights should be on BRIGHT and the anticollision light ON.

The tendency in night in-flight refueling is to start the approach too far aft. This makes it very difficult to judge relative motion and usually results in a high closure rate.

CAUTION

Do not engage the AUTO mode of the AFCS during air-refueling.

section V
EMERGENCY PROCEDURES



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INTRODUCTION

Knowledge of the aircraft and emergency procedures must be reviewed on a regular basis to insure that the crew will take the correct course of action when faced with difficulties. The initial training should be thorough in this respect. Above all, the crew must recognize and admit the emergency situation, then take positive steps in accordance with recommended procedures and good airmanship. Due to the many situations that can arise concerning emergencies, it is impossible to set an absolute policy. The crew must weigh all the factors of a given situation and then take appropriate action for the particular situation. This manual discusses and preplans some likely courses of action and the recommended way of handling certain emergencies. The emergency procedure section should be referred to on a continuing basis. Reference to emergency procedures promulgated in NWP-41 is also required.

Note

As soon as possible, the pilot should notify the bombardier/navigator of the emergency and discuss the intended action.

part 1 Ground Emergencies

EMERGENCY ENTRANCE

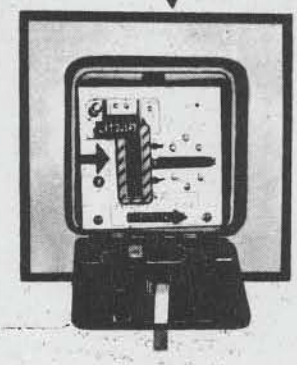
NOTE

IF CANOPY CANNOT BE OPENED, USING MANUAL RELEASE OR JETTISON, BREAK CANOPY AFT OF CREW SEATS WITH AXE OR HEAVY INSTRUMENT. SPRAYING THE CANOPY WITH CO_2 WILL CAUSE THE CANOPY TO BECOME EXTREMELY BRITTLE AND EASY TO BREAK.

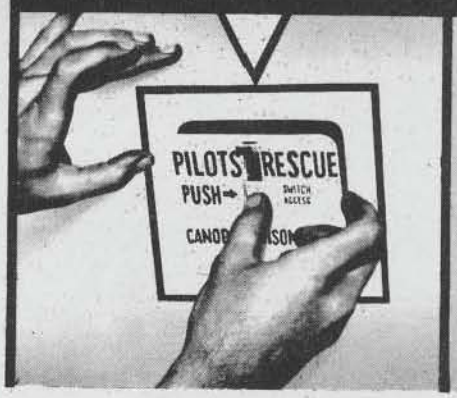
WARNING

WHEN REMOVING CREW FROM AIRCRAFT, DO NOT PULL THE FACE CURTAIN HANDLE OR LOWER EJECTION HANDLE. ACTUATING EITHER HANDLE WILL EJECT THE SEAT FROM THE AIRCRAFT.

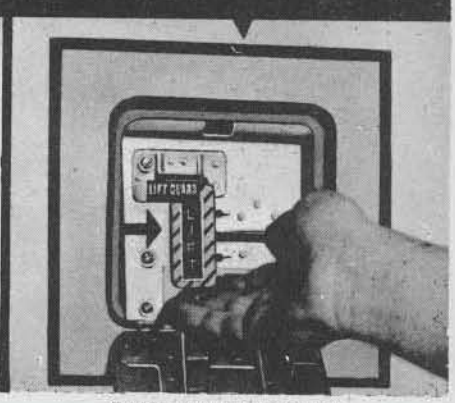
TO JETTISON CANOPY



LOCATED ON BOTH SIDES OF FUSELAGE-COCKPIT AREA



OPEN DOOR



RAISE HANDLE GUARD PULL HANDLE

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Figure 5-1

For emergency entrance to aircraft, see figure 5-1.

ENGINE STARTING MALFUNCTIONS

If any of the following indications occur during an engine start, a malfunction exists and immediate action is required.

- Wet start (no light-off within 10 seconds of placing throttle to IDLE)
- Hot start (EGT exceeds 455° C)
- Hung start (rpm fails to accelerate to IDLE)

Proceed as Follows:

1. Throttle (affected engine) . . . . . OFF
2. Allow engine to continue cranking for 30 seconds minimum if starter mode is still engaged. CSD starter mode automatically disengages at 48% to 50% rpm NEW

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Note

If CSD/S starter mode has disengaged, it may be reengaged when rpm has decreased to 10% or below.

Note

Hot Start - Engine windmill should continue until EGT is stabilized. If the maximum start EGT peak of 455°C has not been exceeded, attempt restart only if cause is determined to be other than an engine malfunction.

Wet Start - As much as 5 min. or more of engine windmill may be required to clear fuel from engine/tailpipe after a wet start.

3. Engine/Fuel Master Switch . . . . . OFF

4. Prior to attempting restart, an engine/tailpipe inspection should be accomplished by qualified ground crew.

EMERGENCY ENGINE SHUT DOWN

In an emergency, i.e. fire or fire warning indications or if any of the following indications occur during engine start, the engines should be shut down expiditiously.

- Abnormal engine noise or sound
- Oil pressure fails to rise to 35 psi within 30 seconds
- No hydraulic pressure on respective engine
- Speed drive light remains on above 40% rpm

Proceed as Follows:

1. Throttles. . . . . OFF

2. Engine/Fuel Master Switches . . . . . OFF

part 2 Takeoff Emergencies

The takeoff phase of flight is critical in that it affords the pilot a very short period of time in which to decide whether to continue or abort the takeoff. The crew must have fixed firmly in mind the best course of action to be taken in any given situation. Before each flight the crew should know:

1. Lift-off airspeed and takeoff ground roll
2. Refusal speed and distance; line check speeds and distances
3. Single-engine performance
4. Availability and location of arresting/abort gear
5. Surrounding terrain and obstructions

NEW

WARNING

During any takeoff emergency where a safe abort cannot be accomplished and takeoff is impossible, ground-level ejection is possible at any speed (GRU-7). GRU-5, ejection is possible above 100 KIAS. NEW

ABORTED TAKEOFF ARRESTMENTS

NEW Where the aircraft takeoff must be aborted, a roll-in type engagement of all arresting gear is recommended to prevent overrun. The aircraft is cleared up to the maximum takeoff gross weight specified in the Aborted Takeoff column of figure 5-12. Additionally, the data provided in the Long Field Landing column may be used for lightweight aborted takeoff, where applicable. NEW

ENGINE FIRE/FAILURE—TAKEOFF ABORTED

NEW If a fire warning light comes on or if either engine fails during the takeoff run, abort immediately if sufficient runway is available.

1. Throttles/speed brakes . . . IDLE/EXTEND
2. NEW Brakes . . . . . APPLY
3. Bleed-air isolation valves (aircraft incorporating AFC No. 268)
   a. NWW . . . . . } GANG-BAR OFF
   b. CSD . . . . . } GANG-BAR OFF
   c. AIR COND . . . } GANG-BAR OFF
4. Throttle (affected engine) . . . . . OFF

Note

Use caution when securing the right engine to prevent inadvertent shutdown of both engines. If both engines are secured, antiskid, nosewheel steering, flaperon pop-up, and normal braking will be lost.

5. Engine and fuel master switch (affected engine) . . . . . OFF
6. Nosewheel steering . . . . . ENGAGE
7. Emergency calls. . . . . ACCOMPLISH

If an Arrested Rollout is To Be Made:

8. Arresting hook . . . . . DOWN
9. Steer for center of runway/engage arresting gear parallel to the centerline

FIRE WARNING LIGHT/TAKEOFF CONTINUED

If a warning light comes on immediately after takeoff, without other visual or audible confirmation, the pilot's first concern is to maintain safe flight.

The fire warning light is reliable.

Before each flight, it is essential that the crew know the single-engine climb speed for his configuration.

If this speed has not been attained, the following steps are considered optimum for continuing safe flight.

1. Engines . . . . . MAX. THRUST
2. LANDING GEAR. . . UP, AFTER AIRBORNE NEW
3. External stores . . . . . JETTISON (IF NECESSARY) NEW
4. a. Bleed-air isolation valves (aircraft incorporating AFC No. 268)

NWW . . . .
CSD . . . . } GANG-BAR . . . OFF
AIR COND . .

4. b. Air-conditioning master switch (aircraft not incorporating AFC No. 268) . . . . . OFF

5. Establish single-engine climb . 22 units AOA

6. Wing and fuselage fuel . . . . . DUMP

7. Throttle (affected engine) . . . . . OFF

8. Engine and fuel master switch (affected engine) . . . . . OFF

9. Climb to safe altitude: DO NOT ATTEMPT restart on affected engine

10. Fly straight ahead. Attempt no turns until a safe airspeed and altitude are attained (terrain permitting).

11. Flaps. . . . . UP
(after safe airspeed/altitude is attained)
See Takeoff and Climb Charts, Section XI, Part 2.

12. If fire indications are positive . . . . EJECT
Some positive indications might be explosion, vibration, abnormal engine instrument readings, smoke or fumes in the cockpit, burning odor in oxygen mask, trailing smoke, or verification from another aircraft or control tower.

13. If fire indications are not positive . . . . . LAND AS SOON AS POSSIBLE
(Refer to Single Engine Landing Procedures)

ENGINE FAILURE/TAKE OFF CONTINUED

The pilot's reaction and his ability to maintain directional control, altitude, or climb depends upon the gross weight of the aircraft, air density, ambient temperature, and the thrust of the good engine. Prior to each flight it is essential that the crew know the single-engine climb speed for their aircraft configuration. The following steps are considered optimum to maintain safe flight:

1. Operating engine . . . . . MAX THRUST

2. Landing gear. . . . UP, AFTER AIRBORNE

3. External stores .JETTISON (IF NECESSARY)

4. Establish single-engine climb. .22 units AOA

5. Wing and fuselage fuel . . . . . DUMP

6. Failure other than mechanical. . . . ATTEMPT AN AIR START

7. Fly straight ahead. Attempt no turns until safe airspeed and altitude are attained (terrain permitting).

8. Flaps . . . . . UP
(after safe airspeed/altitude is attained)
See Takeoff and Climb charts Section XI, Part 2.

For Obvious Mechanical Failure

9. Throttle (failed engine) . . . . . OFF

10. Engine and fuel master switch (failed engine) . . . . . OFF

11. Climb to safe altitude; land as soon as practicable. (Refer to Single-Engine Landing Procedures.)

STORES JETTISON

EMERGENCY JETTISON

WARNING

Prior to emergency stores jettison of nuclear stores, ensure that the safe button on the fuzing control panel has been depressed (safe light on and air and ground buttons locked). This prevents the possibility of jettisoning an armed store.

To Jettison All Stores Simultaneously:

1. Emergency stores jettison button. . DEPRESS
Hold button down for 1 second, or until separation is felt.

Note

- When jettisoning stores with the emergency jettison button, it is possible to avoid unnecessary expenditure of drop tanks and other salvable stores by first pulling the respective stores jettison circuit breakers on the main panel between the crewmembers.
- 70% of the weight must be off the wheels for emergency jettisoning of external stores.

Selective Jettison:

1. Fuzing . . . . . SAFE

2. Appropriate station select switches . . . . . BOMBS/GUNS

3. SEL JETT button (A-6E) . . . . . DEPRESS

4. Master ARM switch . . . . . ON

5a. Manual weapons release button (A-6E) . . . . . DEPRESS

b. Selective stores jettison switch (A-6A/B/C/KA-6D) . . . . JETTISON

Note

NEW The port forward main landing-gear door must be closed before stores will be released using SEL JETT system.

STRUT LOCK LIGHT

If the STRUT LOCK light comes on with the landing gear down, this indicates that the nose strut is still locked. The landing gear may be safely retracted. NEW During the landing phase, a minimum rate of descent field landing is preferred.

LAUNCH BAR DOWN/NOSE GEAR COCKED

- Tow link in nose-gear window.
- Flashing indexer (hook bypass in touch-and-go or hook bypass in arrest with hook in down position) NEW

1. Obtain a visual check

If Nose Wheel Cocked:

2. Do not retract gear. Make a normal carrier landing or normal field landing. Use aerodynamic braking and then place nose firmly on deck. NEW

If Launch Bar is Down and Nose Wheel is Straight:

3. Gear handle . . . . . RAISE

part 3 Inflight Emergencies

ENGINE FAILURE

See figure 5-2 for velocity required for maximum glide.

SINGLE-ENGINE FLIGHT CHARACTERISTICS

WARNING

At certain gross weights and ambient temperatures, the aircraft will NOT fly on one engine in the takeoff or landing configuration. The applicable single-engine graphs should be referred to before each flight.

Because of the location of the engines relative to the centerline of the aircraft, only a slight rudder deflection is required to prevent a yaw toward the failed engine at normal speeds. Minimum single-engine control speed varies with gross weight, flap setting, and the landing-gear position. The aircraft is designed so that no one system (hydraulic, bleed-air, electrical, etc.) is dependent on a specific engine. Therefore, loss of an engine will not result in a loss of any complete system. Refer to Section XI for single-engine performance data.

SINGLE-ENGINE FAILURE DURING FLIGHT

It is possible to inadvertantly lose an engine due to a malfunction of the fuel control system or to incorrect technique used during certain critical flight conditions. If engine failure can be attributed to some obvious nonmechanical failure, proceed as follows:

1. Positively determine failed engine
2. Attempt air start if feasible. (See Air Start procedure.)

If No Relight:

3. Throttle and engine/fuel master switch (affected engine) . . . . . OFF
4. Land as soon as practicable (Refer to Single-Engine Landing procedures.)

DOUBLE-ENGINE FAILURE DURING FLIGHT

The possibility of a double-engine failure during flight is very remote; however, if such a situation should occur, proceed as follows:

1. Convert excess airspeed to altitude.

WARNING

If both engines fail below 1,500 feet AGL and 250 KIAS . . . . . EJECT

2. RAT handle . . . . . PULL
3. EMER IGN circuit breakers . . . CHECK IN
4. Attempt air start - (see air start procedure).

WARNING

150 KIAS must be maintained to ensure adequate engine windmill rpm for hydraulic pressure.

If repeated relight attempts are not successful between 20,000 and 10,000 feet, eject by 10,000 feet AGL.

If still on first or second relight attempt when passing through 10,000 feet AGL and it appears that a relight is likely, air start attempt may be continued to a minimum of 5000 feet AGL.

If both engines are still flamed out below 10,000 feet AGL, zoom to convert excess airspeed to altitude. Attempt a normal air start as time permits. If the peak altitude is 5000 feet AGL and the air start attempt is not successful, eject no lower than 5000 feet AGL. If the peak altitude is below 5000 feet AGL and an air start attempt is made during the zoom and there is no evidence of a relight, eject at the peak altitude. If no air start attempt is made, eject at the peak altitude.

If the decision to eject is made at high altitude, it is recommended that the aircrew eject at a minimum of 10,000 feet AGL.

VELOCITY REQUIRED FOR MAXIMUM GLIDE

AIRCRAFT CONFIGURATION
(1) D-704 + (4) 300 GALLON TANKS

DATE: 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

NOTE
GLIDE RATIO WITH BOTH ENGINES WINDMILLING — 12:1
GLIDE RATIO WITH ONE ENGINE WINDMILLING AND ONE ENGINE AT IDLE POWER — 13:1

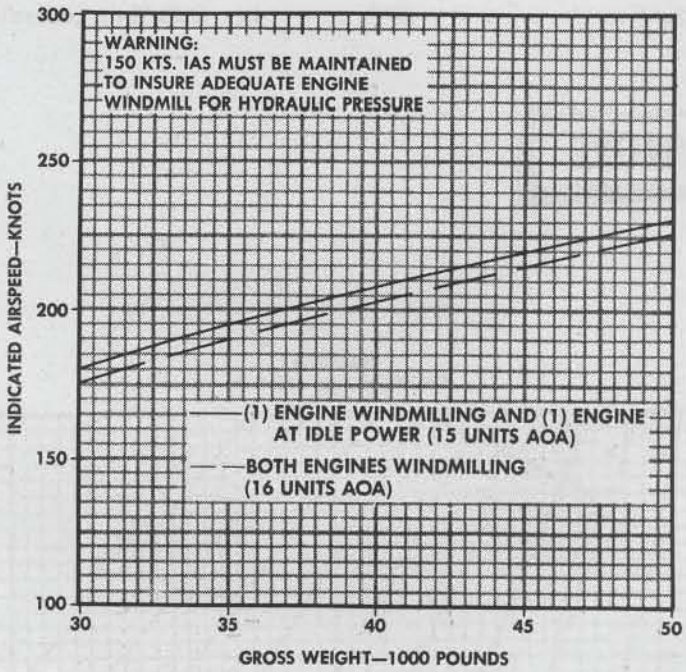

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Figure 5-2

AIR STARTS

In general, air start capability is increased by higher airspeeds and lower altitudes. Refer to figure 5-3. No damage will occur to the engine if starts are attempted outside the envelope. However, unsatisfactory starts on the low-speed side of the envelope may result in an increase in EGT towards the start limit (455°C) due to a hung start. Care should be taken not to exceed this limit.

Do not delay in the air start attempts.

NEW **If Less Than 10 Seconds Have Elapsed:**

1. Air start button . . . . DEPRESS AND HOLD
   With air start button depressed, wait for indication of a start by monitoring RPM, EGT, and fuel flow.

If More Than 10 Seconds Have Elapsed:

2. Throttle (failed engine) . . . . . OFF
3. EMER IGN circuit breakers. . . . CHECK IN NEW
4. Air start button . . . . DEPRESS AND HOLD
5. Throttle (failed engine) . . . . . IDLE
   Go around the horn with air start button held depressed; wait 60 seconds for indication of a start monitoring RPM, EGT, and fuel flow.

FIRE

FIRE/BLEED AIR SYSTEM FAILURE NEW

A fire warning light accompanied by any or all of the following are indications of a probable bleed-air system failure:

a. Loss of hydraulic pressure indications
b. CSD/S or generator failure

AIR START ENVELOPE

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS

FUEL DENSITY: 6.8 LB/GAL
FUEL GRADE: JP-5

DATE: 1 JANUARY 1967
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-8

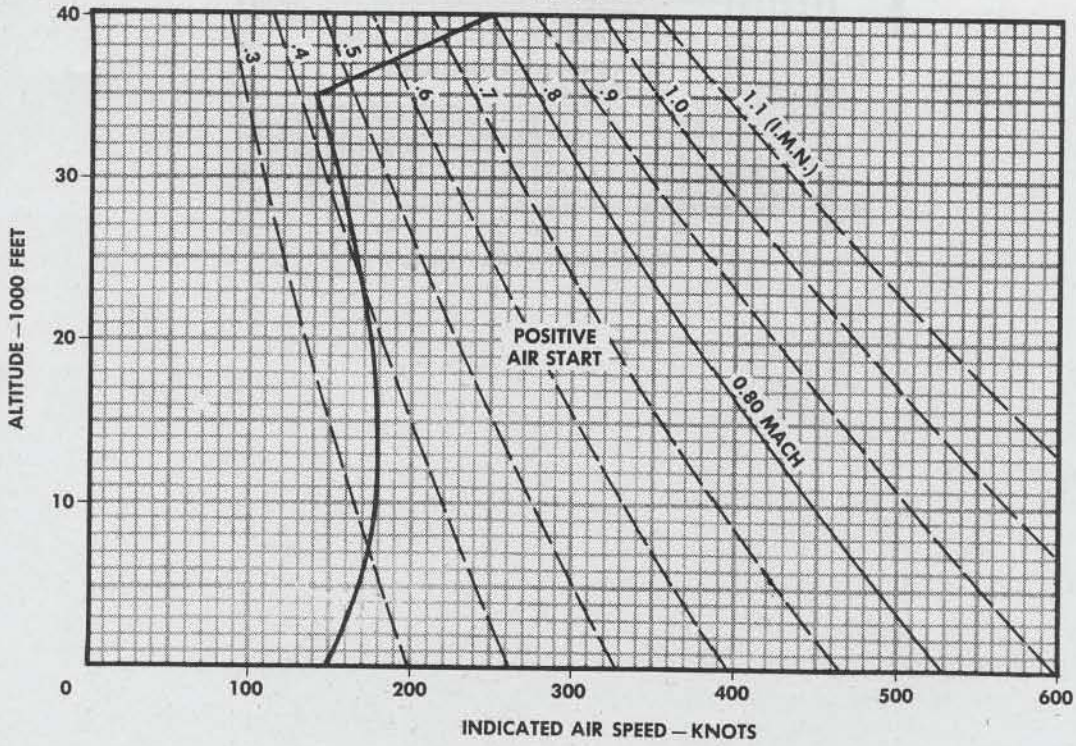

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Figure 5-3

c. Unsafe nose gear

d. Noticeable thump at time of failure

e. Loss of wing pressurization

f. Multiple unrelated electrical failures

g. Unusual odors in the cockpit

FIRE WARNING LIGHT LIT

1. Throttle (affected engine) . . . . . OFF

2. Engine and fuel master switch (affected engine) . . . . . OFF

3. a. Bleed-air isolation valves (aircraft incorporating AFC NO. 268):

NWW . . . .
CSD . . . . . } GANG BAR . . . OFF
AIR COND . .

3. b. Air-conditioning master switch aircraft not incorporating AFC NO. 268) . . . . OFF

Note

If fire warning light is extinguished by securing the air conditioning system, the fire indicator may have been caused by a bleed air leak from the environmental system into the starboard engine bay only.

4. If fire indications are positive . . . . EJECT
Some positive indications might be explosion, vibration, abnormal engine instrument readings, smoke or fumes in the cockpit, burning odor in oxygen mask, trailing smoke, or verification from another aircraft or control tower.

5. If fire indications are not positive . . . . . LAND AS SOON AS POSSIBLE (Refer to Single Engine Landing Procedures.)

WARNING

- If the fire warning light goes out, DO NOT ATTEMPT restart of affected engine or reopen bleed-air system isolation valves, UNLESS windshield air is required for landing in heavy precipitation. Then the NWW switch must be placed in AUTO to enable windshield air. This should be done only during the final phase of the landing approach and the NWW switch should be repositioned to OFF as soon as possible after landing. This procedure is hazardous and should be performed only if absolutely essential.
- Possible substantial loss of thrust from the remaining engine will result in marginal or no wave-off capability. A BARRICADE is REQUIRED FOR SHIPBOARD RECOVERY.
- A wave-off is extremely hazardous due to minimum rate of climb available and increased possibility of fire damage.
- In the event of unsafe gear indications, perform emergency landing-gear extension procedures on final approach and LAND on the FIRST PASS regardless of landing gear indication.

Note

In aircraft incorporating AFC 268, if the fire warning light goes out, consideration should be given to the systems lost as a result.

Right Engine Shut Down—Systems Lost:

- Right Generator
- Air Conditioning
- Rain Removal
- TRIM POD Cooling (A-6C only)
- Aft (equipment cooling) Air Cycle Unit (A-6E TRAM)

No equipment cooling will soon cause overheating of all electronic equipment, except (in aircraft thru A-6E 159579 and A-6E Mod M120) the CNI equipment, which is provided with an alternate cooling blower. Therefore, unless absolutely needed for flight, all electronic equipment except the CNI equipment should be turned off. In A-6E 159895 and ON and A-6E Mod M121 and ON, the UHF radios are cooled by cabin air, the TACAN has a cooling blower, and the IFF transponder has no alternate cooling.

Left Engine Shut Down—Systems Lost:

- Left Generator
- Rain Removal
- TRIM POD Cooling (A-6C only)
- Aft (Equipment Cooling) Air Cycle Unit (A-6E TRAM)

NWW TEMP LIGHT LIT (AIRCRAFT INCORPORATING AFC 268)

Lighting of the NWW TEMP light indicates a leak in the bleed-air ducting in the nosewheel well or radome areas. Therefore, damage to electrical/electronic and hydraulic components in those areas should be suspected, even if the NWW isolation valve was closed promptly. With the NWW isolation valve closed, the rain-removal and vortex-removal systems have been lost.

1. NWW bleed-air isolation valve . . . . . OFF

2. Windshield rain removal . . . . . OFF

If NWW TEMP Light Goes Out:

3. LAND AS SOON AS POSSIBLE

If NWW TEMP Light Remains On:

4. Bleed-air isolation valves:

CSD . . . . . } GANG BAR . . . . . OFF
AIR COND . . }

5. Right throttle . . . . . OFF

6. Right engine and fuel master switch . . OFF

7. If positive indications of fire exist. . . EJECT

If NWW TEMP Light Goes Out:

8. Land as soon as possible.

AFT TEMP LIGHT LIT (A-6E TRAM AIRCRAFT)

Lighting of the AFT TEMP light indicates a possible leak in the bleed air ducting to the aft equipment bay area. Damage to electrical/electronic and hydraulic components in the area should be suspected even if the AIR COND isolation valve was closed promptly. With the AIR COND isolation valve closed, all air conditioning and equipment cooling have been lost; therefore, unless absolutely needed for flight, all electronic equipment should be turned off. The UHF radios are not specially cooled; they receive cockpit air through louvres in the side of the center console, and may be safely operated. The TACAN has a cooling blower; however, its location in the aft equipment bay indicates restricted operation in this case.

1. AIR COND bleed-air isolation valve . . OFF

IF AFT TEMP Light Goes Out:

2. LAND AS SOON AS POSSIBLE

IF AFT TEMP Light Remains On:

3. Bleed-air isolation valves:

   CSD. . } BANG BAR . . . . . OFF
   NWW . }

4. Right throttle . . . . . OFF

5. Right engine and fuel master switch . . OFF

6. If positive indications of fire exist. . . EJECT

IF AFT TEMP Light Goes Out:

7. LAND AS SOON AS POSSIBLE

TEMP CONT (A-6E)/COMPUTER OVERHEAT LIGHT (A-6A,B,C)

1. Check computer pedestal area for hot air-flow around pedestal base or excessive heating of pedestal area.

If Excessive Heat is Detected:

2. CMPTR EMER COOL switch . . . . . ON

2A. EQUIPMENT switch (TRAM aircraft). . COLD

TEMP CONT/COMPUTER Overheat Light Remains On and if Pedestal Area Remains Hot:

3. Computer . . . . . OFF

4. AIR COND master . . . . . OFF

CAUTION

Operation of avionics system (radar, etc.) requires air conditioning. Operating with air conditioning off for periods in excess of 5 minutes may damage equipment.

Note

(A-6E) In addition to the TEMP CONT light, the COMPUTER light may be expected to come on.

5. Land as soon as practicable.

STEADY COMPUTER LIGHT, NO TEMP CONT LIGHT (A-6E)

This indicates an overheat condition, greater than 230°F, which may be occurring in components in or outside the cockpit.

1. Computer . . . . . OFF

2. Land as soon as practicable.

Note

Cooldown period required to turn the COMPUTER light off may be more than 1 hour.

AFT BLEED LIGHT LIT (A-6E TRAM)

Lighting of the AFT BLEED light with the AIR COND bleed-air switch at on indicates that the aft bleed-air shutoff valve has closed due to an overheat condition in the duct to the aft air-cycle refrigeration unit, shutting off the equipment-cooling system. All electronic equipment except the UHF radios, which are cooled by cockpit air, and the TACAN, which has a cooling blower, should be shut off to prevent damage.

1. Electronic equipment . . . . . OFF

2. Land as soon as practicable.

ELECTRICAL FIRE/SMOKE OR FUMES IN COCKPIT

To eliminate smoke and fumes from the cockpit, proceed as follows:

1. Oxygen . . . . . Insure ON/100%

2. Air-conditioning COCKPIT switch . . RAM AIR

3. MAN/RAM AIR switch . . . . . COLD

4. Descend to below 25,000 feet

5. CABIN DUMP switch . . . . . ON

If the cause of the malfunction cannot be immediately determined, further steps may be necessary. These will depend on the intensity of the smoke and the circumstances under which the aircraft is operating.

Should symptoms of an electrical fire occur, and the cause cannot be determined, proceed as follows:

6. Computer, search radar, track radar, VDI, and PHD . . . . . OFF

7. AIR CONDitioning MASTER switch . . . . . OFF

8. Unnecessary electrical equipment . . . . OFF

If Symptoms of Fire Persist:

9. RAT handle . . . . . PULL

10. GENerators . . . . . OFF

Note

The possibility exists that the RAT may be inoperative, and may not assume that electrical load of the essential bus. The best indication of this is failure of the generator caution lights to come on.

11. AIR CONDitioning MASTER switch . . . ON

The possibility exists that smoke and fumes symptomatic of an electrical fire may have originated in the air-conditioning system.

12. Necessary electrical equipment . . . . . ON

13. Circuit breaker (affected equipment). . . . . PULL IF AVAILABLE

14. GENerators . . . . . ON

CAUTION

Do not attempt to reset the affected equipment circuit breaker until the cause of the fire has been determined and corrected by qualified maintenance personnel.

15. Land as soon as practicable.

CAUTION

Without AFC No. 268 incorporated, operation of the CNI package requires air conditioning. If operated with air conditioning off for periods in excess of 5 minutes, equipment may be damaged.

AIR CONDITIONING FULL HOT

If cabin temperature goes full hot, perform the following immediately:

1. ENVIRONMENT/SEATS circuit breakers. . . . . IN

2. MAN/RAM AIR switch . . . . . FULL COLD

If Temperature Remains Hot:

3. AIR CONDITIONING COCKPIT switch . . . . . RAM AIR

4. MAN/RAM AIR SWITCH. . . . . FULL COLD

5. AIR COND MASTER switch . . . . . OFF

If Temperature Remains Hot:

6. a. In aircraft incorporating AFC No. 268

   1. AIR COND bleed-air switch . . . . OFF

   2. Right throttle . . . . . OFF

   3. Right engine and fuel master switch . . . . . OFF

6. b. In aircraft without AFC No. 268

   CABIN DUMP switch . . . . . ON

7. Canopy. . . . . OPEN OR JETTISON (AS NECESSARY)

WARNING

The canopy must be fully closed or jettisoned before ejection.

8. Foot heat control . . . . . CLOSED

9. All unnecessary electrical equipment. . OFF

10. Land as soon as possible.

Note

Ram air will provide sufficient cooling for wing-tank pressurization system in flight.

OIL SYSTEM FAILURES

An oil system failure is recognized by a decrease of, or a complete loss of oil pressure. If an oil system malfunction has caused prolonged oil starvation of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as condition of bearings prior to the starvation, operating temperatures of bearings, and bearing loads. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration. When the vibration becomes moderate to heavy, complete seizure will occur in seconds. In order to minimize engine damage and conserve remaining operating time for possible emergencies, the affected engine should be shut down upon first recognition of an oil system failure.

Note

Normal oil pressure is 40 to 50 PSI. Except at idle, oil pressures between 35 and 40 PSI are undesirable and should be tolerated only for the completion of the flight, preferably at a reduced throttle setting. Oil pressures below normal should be reported as an engine discrepancy and should be corrected before the next takeoff. Oil pressures below 35 PSI are unsafe and require that either the engine be shut down or a landing be made as soon as possible, using the minimum thrust required for safe flight.

Upon first recognition of sustained oil system failure (above or below oil pressure limits), perform the following:

LOSS OF OIL PRESSURE

1. Throttle (affected engine) . . . . . OFF

2. Engine and fuel master . . . . . OFF (affected engine)

3. Land as soon as practicable. (Refer to Single Engine Landing Procedures.)

HIGH OIL PRESSURE

1. Reduce power on affected engine.

If unable to maintain oil pressure within limits:

2. Throttle (affected engine) . . . . . OFF

3. Engine/fuel master (affected engine) . . . . . OFF

Note

If the engine is secured for oil pressure malfunctions, it may be desirable to relight the engine for use during critical flight evolutions e.g. carrier landings, etc.

4. Land as soon as practicable.

LOW-OIL WARNING LIGHT

CAUTION

Consideration should be given to securing the engine. If engine is allowed to run until oil pressure starts to fall, severe engine bearing damage will result. The engine may be relit for critical flight evolutions e.g. carrier landing, etc.

IF NORMAL PRESSURE CANNOT BE MAINTAINED

1. Throttle (affected engine) . . . . . OFF

2. Engine and fuel master (affected engine) . . . . . OFF

3. Land as soon as practicable. (Refer to Single Engine Landing Procedures.)

FUEL SYSTEM FAILURE

ENGINE FUEL PUMP FAILURE

Failure of the entire two-stage engine fuel pump will result in engine flameout due to fuel starvation. Gear stage (high-pressure pump) failure will result in a flameout; failure of the centrifugal stage (low-pressure engine boost pump) alone will have little or no effect on performance, and will not be evident to the pilot since the fuselage boost pump will continue to supply adequate pressure to the inlet side of the high-pressure pump except at higher altitudes (above 20,000 feet). At higher altitudes, failure of the centrifugal stage may reduce pressure at the inlet of the gear stage to below 12-14 psi, lighting its respective FUEL PSI light. Should either FUEL PSI light come on, either power reduction on affected engine or descent to a lower altitude is recommended.

CAUTION

DO NOT DEPRESS BOOST PUMP TEST BUTTON IN FLIGHT, as an engine will flame out if the centrifugal stage of an engine-driven fuel pump has failed.

FUSELAGE BOOST PUMP FAILURE

If the electrically driven fuselage boost pump fails, fuel will still be supplied to the engine fuel pump by suction feed (below 20,000 feet). If the fuel flow demands of the engines cannot be met by suction feed, loss of thrust may result when above 20,000 feet. Insufficient pressure will be indicated by the L and R FUEL PSI lights coming on when pressure to the inlet of the gear stage of the engine fuel pump drops to 12-14 psi. Power reduction or descent is recommended to restore engine performance.

TRANSFER PUMP FAILURE

Failure of one transfer pump will result in a 50% reduction of fuel flow for either fuselage fuel transfer to the air refueling store or fuselage fuel dumping. If both transfer pumps fail, fuselage dumping and fuselage fuel transfer to the air refueling store cannot be accomplished.

FUEL TRANSFER FAILURE (WING/DROP TANK PRESSURIZATION)

For fuel to transfer from the drop and wing tanks, the drop tank shutoff valves and wing-tank fueling and transfer and shutoff valves must be in the open position. These valves are energized to the closed position by primary 28 V DC power with WING DUMP selected, the FUEL READY switch in FLIGHT, FUEL RDY in GROUND with the ground refueling panel in FUEL or DEFUEL positions, or the landing gear extended. In the event of a total electrical failure, fuel will transfer normally from the drop and wing tanks.

If Fuel Transfer Does Not Occur, Proceed as Follows:

1. FUEL READY Switch . . . . . CHECK OFF

If unable to affect fuel transfer of wing and drop-tank fuel through normal or override pressurization and wing pressure lights are still on, and if fuel considerations dictate:

2. RAT handle . . . . . PULL

3. Right and left generators . . . . . OFF

Monitor for fuel transfer.

CAUTION

Shutting down the generators is not recommended under IFR conditions unless absolutely necessary. If the RAT is inoperative, securing both generators will result in the loss of all attitude and navigation systems.

Note

If pressurization indications are normal but fuel is not transferring, a non-modulating pilot valve failure may be suspected. Attempt to free the valve by applying positive and negative g.

If Fuel Still Does Not Transfer:

4. Right and left generators . . . . . ON

5. Land as soon as possible

Note

In the event the transfer failure is electrically caused, the RAT may be stowed with both generators secured, in VFR conditions. This ensures opening of the drop-tank and wing fuel transfer and shutoff valves. Fuel transfer may then be monitored by redeploying the RAT or turning on a generator periodically until safe landing is assured.

FUEL FILTER LIGHT LIT

Lighting of the Left or Right fuel FILTER light indicates that the fuel filter for the respective engine is contaminated. Proceed as follows:

1. Throttle (affected engine) . . . . . RETARD

2. Avoid large or unnecessary throttle movements.

3. Land as soon as practicable.

FUEL/AIR ADAPTER MALFUNCTION

Malfunction of fuel/air adapters can lead to loss of drop-tank fuel transfer or fuel leaks in the area of the adapters. To stop the fuel leak, proceed as follows:

1. WING DROP TANK TRANSfer switch . . . INBD OR OUTBD AS REQUIRED TO SECURE DROP TANK PRESSURE

If jettisoning of the drop tank/store is required for landing, proceed as follows:

2. Insure fuel leak has stopped. . . . . OBTAIN VISUAL CHECK

3. Selectively jettison affected tank/store.

WARNING

Jettison of a tank/store with fuel still leaking from the area of the fuel/air adapter may result in an in-flight fire.

EMERGENCY FUEL DUMPING (RAT ONLY POWER)

A/C Without AFC 352 Incorporated:

If the situation necessitates fuel dumping with double generator failure and the ram-air turbine is operating, it is possible to dump only from the outboard wing panels.

Wing drop tanks and the centerline drop tank or air-refueling store can be jettisoned. Fuselage and inboard wing fuel dumping is not possible and any weight reduction of remaining fuel must be through burn-down.

A/C With AFC 352 Incorporated:

When dumping fuel with a double generator failure and the ram-air turbine is operating, it is possible to dump the inboard and outboard wing panels and the wing drop tanks. Fuselage and center line drop tank fuel dumping is not possible and any weight reduction of fuselage and centerline drop-tank fuel must be through burn-down.

THROTTLE LINKAGE FAILURE

No provisions are incorporated for automatic positioning of the fuel control in the event of throttle linkage failure. The affected engine may stabilize at any rpm between cutoff and military power. If this should occur proceed as follows:

1. Land as soon as practicable.

Note

The APCS electromechanical actuators are located on the engines, and the throttle linkage failure may have occurred between an electromechanical actuator and the throttle. If so, the APCS switch may be held in the ENGAGE position and the desired throttle position obtained by varying AOA and releasing the APCS switch when set. Desired throttle positions may be set in this manner throughout the flight for all portions of the profile. The APCS should also be available for a normal landing approach.

CAUTION

During a wave-off or bolter, the APCS will be disengaged and a rapid power change on the affected engine may occur.

Prior to Entering Landing Pattern:

2. Dump/burn down to single-engine approach gross weight.

3. Make a normal or single-engine approach as necessary (depending on engine power available).

Note

Engine rpm may change with any change in fuel control vibration. If necessary, due to fluctuating or excessively high power, shut the affected engine down prior to the approach.

After Landing:

4. Throttle (affected engine) . . . . . OFF

5. Engine and fuel master switch (affected engine) . . . . . OFF

ELECTRICAL SYSTEM FAILURE

See figure 5-4 for emergency power distribution

See figure FO-11 for annunciator caution lights.

See figure 5-5 for key cockpit circuit breakers.

SINGLE GENERATOR FAILURE

Failure of one generator will be noted by lighting of either the L-GEN or R-GEN caution light on the annunciator panel. The light will indicate which generator has failed. Failure of either generator will result in loss of the monitor bus power. If a generator fails, proceed as follows:

1. Affected generator switch . RESET, then ON

Note

Repeated attempts may be made to reset generator. In flight at a reduced power setting, resetting the CSD/S may enable the resetting of the failed generator.

If Generator Caution Light Remains Lit:

2. Affected generator switch . . . . . OFF
3. AFCS (KA-6D). . . . . DISENGAGED FOR REFUELING
4. Land as soon as practicable.

For instrument/night approach,

5. RAT handle . . . . . PULL
   The extended RAT ensures the reliability of electric power supply to the essential busses.

WARNING

Do not engage AFCS during single generator refueling operations. Voltage transients may induce abrupt control deflection.

EMERGENCY POWER DISTRIBUTION

SINGLE GENERATOR FAILURE (LOSS OF MONITORED BUS) EQUIPMENT LOST		
INSTRUMENTS OAT ACCELEROMETER SYS. "G" METER —⚠1 POWER TRIM	**AVIONICS** ECM VTR (A-6C/A-6E) GCB DOPPLER DATA LINK	**EXTERIOR LIGHTS** DROGUE LIGHTS POSITION LIGHTS FORMATION LIGHTS PYLON LIGHTS TAXI/PROBE LIGHTS
FUEL & OIL FWD. TRANS. PUMP (EXCEPT KA-6D)		**INTERIOR LIGHTS** CONSOLE LIGHTS DVRI LIGHTS
DOUBLE GENERATOR FAILURE (ESSENTIAL BUS ONLY) EQUIPMENT REMAINING		
ENGINE INSTRUMENTS FUEL QUANTITY FUEL FLOW EGT OIL PRESSURE % RPM	**FLIGHT CONTROLS** LAT. TRIM LONG. TRIM RUD. TRIM FLAPS/SLATS (NOR.) FLAPER POP-UP SPIN ASSIST	T-375 WEAPONS MONITOR & CONTROL ESS ARM FEEDER MAN WEAP RELEASE GUN CLEAR
FLIGHT INSTRUMENTS ALTIMETER (BAR) HSI MA-1 COMPASS VGI AOA INT. POS. IND. APPR. INDEXER TURN & SLIP A/S	**RADIO** ICS CNI	**AIR COND** RAM AIR CABIN DUMP VALVE BLEED-AIR ISOL. VALVES
	ENGINE CONTROL AIR START CSD/S	**LIGHTS** FIRE WARNING & TEST FLIGHT INSTRUMENT ANNUNCIATOR PANEL APPROACH LIGHTS FLOOD LIGHTS UTILITY LIGHTS MAP LIGHT PILOT'S SPOTLIGHT B/N INSTRUMENT ESS ENG INSTR CAUTION DIMMING WHEELS WARNING WHEELS TRANSITION
LANDING AND ARRESTING GEAR LANDING GEAR ARRESTING HOOK	**FUEL** DUMP (OTBD WG. ONLY/ WG. & WG. DROPS WITH AFC 352) AIR REFUEL (MAN) NORMAL TRANS.	
	ARMAMENT MECH FUZING STORES JETTISON ELEC. FUZING (A-6E)	

⚠1 EXCEPT A-6E 159895 AND ON, A-6E MOD M121 AND ON

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Figure 5-4

CAUTION

KA-6D Only - Utilizing the air-refueling system package is not recommended. (See refueling with single generator.)

DOUBLE GENERATOR FAILURE

When both generators fail, both generator caution lights will be out and all ac power will be lost. All dc power except battery power will also be lost. Upon the loss of both generators, immediately perform the following:

1. RAT handle . . . . . PULL
2. Check GEN caution lights lit
3. Generator switches . . . . RESET, Then ON
4. COMPASS/ATT REF switch (A-6A, B, C, E only) . . . . . MAG/VGI
   Check heading and attitude instruments for proper indications.

If the GEN caution lights remain lit:

5. Land as soon as practicable.

CAUTION

As the fuselage boost pump in inoperative under RAT only power, possible thrust loss may be experienced above 20,000 feet.

Note

- Minimum airspeed to maintain RAT power is 110 KIAS.
- With a double generator failure, when operating on RAT only power, the WHEELS warning light will continue to flash during approach with gear down, and the hydraulic indicators and backup hydraulic pump will not function.

LOSS OF ESSENTIAL DC BUS

If the external number one essential dc bus circuit breaker pops, the entire number one essential dc bus will be lost even though both main generators remain operative and power the primary and monitor buses. Major items lost include: speed brakes, normal and emergency flaps/slats, normal gear operation, AOA, integrated position indicator, CNI package including ICS, annunciator lights, MA-1 compass system, weapons release, normal and emergency stores jettison, approach indexer, fuel-gate valve, cabin dump, emergency flap brake, flight instrument lights, turn and slip, and master caution and warning lights. If it is suspected that the number

KEY COCKPIT CIRCUIT BREAKERS

CIRCUIT BREAKER PLACARD	BUS	LOCATION	ITEMS ON CIRCUIT BREAKER
LAT/LONG TRIM	ESS AC	MAIN	AIR COND RAM AIR SWITCH AIR NAV COMPUTER(A-6A)
GEAR/HOOK	ESS DC #1	MAIN	SPIN ASSIST WEIGHT ON WHEELS SWITCH
L. SPD DR	ESS DC #1	MAIN	LEFT ENGINE FUEL MASTER LEFT CSD/S
R. SPD DR	ESS DC #1	MAIN	RIGHT ENGINE FUEL MASTER RIGHT CSD/S
CNI/MA-1 (1)	ESS AC	MAIN	HSI (TACAN) MA-1 ASQ-57 POWER
CAUTION LTS	ESS DC #1	MAIN	LOW ALTITUDE WARNING LIGHT (A-6E) APN-141/APN-194 INDICATOR (A-6E) WARNING LIGHTS TEST SWITCH MASTER LIGHT PANEL ANNUNCIATOR PANEL INTEGRATED POSITION INDICATOR
ANGLE OF ATTACK	ESS DC #1	MAIN	ANGLE OF ATTACK INTEGRATED POSITION INDICATOR (A-6A,B,C/KA-6D) ELECTRIC FLAP DRIVE (A-6A, B, C/KA-6D) EMERGENCY BRAKE RELAY (A-6A, B, C/KA-6D) WHEELS WARNING SWITCH (A-6E)
INST LTS	ESS AC ESS DC #1	MAIN	INSTRUMENT LIGHTS ACLS (3)
TURN/SLIP-(1) (2) TRIM/IND	ESS DC #1	MAIN	TURN AND SLIP INDICATOR RUDDER TRIM INDICATOR STABILIZER TRIM INDICATOR LOW FUEL CAUTION LIGHT IF C/B POPPED
26V INST XMFR #2	ESS AC	MAIN	MA-1 COMPASS AND CARD EGT/FF/RPM INDICATORS
26V INST XMFR	PRIM AC	B/N	L/R HYDRAULIC PRESSURE INDICATORS SEARCH RADAR RADAR RECORDER
ADC/OPT SIGHT	PRIM AC	B/N	ADC OPTICAL SIGHT CONTROL SPEED BRAKE NULL DETECTOR
TSEC CONT	ESS DC #1	B/N	KY-28
AUTO PILOT	PRIM DC	B/N OBSERVER	ADC AUTO PILOT ASQ-61 (A-6A) ASN-31 (A-6A)
MISSILE (A-6A, B, C/KA-6D)	PRIM AC	B/N OBSERVER	ICS
3 PH MSL PWR (A-6E)	PRIM AC	B/N	ICS JUNCTION BOX ARMAMENT PANEL (AWE)
PRARS ADPT PH A (1)	PRIM AC	B/N	A/D CONVERTER INS ADAPTER (A-6E)
CNI (1)	ESS AC	B/N	ASQ-57 RECEIVER AMPLIFIER POWER ARC-75 TRANSMITTER (A-6E)

(1) A-6, B, C/KA-6D AND A-6E 158041 THRU 159579 AND MOD M1 THRU M120

(2) A-6E 159895 AND ON, A-6E MOD M121 AND ON

(3) AIRCRAFT WITH A F C 230

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Figure 5-5

one essential dc bus circuit breaker is disengaged, proceed as follows:

1. RAT handle . . . . . PULL

If power is not restored to essential flight instruments and equipment by this action:

2. Both generators . . . . . OFF

Note

- Unless absolutely necessary, do not secure main generators if not in VFR conditions. If the RAT is inoperative, securing both main generators will result in loss of all attitude and navigation systems.
- Minimum airspeed to maintain RAT power is 110 KIAS.

COMPLETE ELECTRICAL FAILURE

If both generators fail, and electrical power to the essential bus is not restored when the RAT is deployed, proceed as follows:

Night/IFR

Maintain controlled flight if possible, or attempt to gain and maintain outside visual reference. If unable to maintain controlled flight . . . . . EJECT

Note

Instruments remaining are the vertical speed indicator (VSI), airspeed indicator, pressure altimeter, cabin pressure altimeter, standby compass, and auxiliary brake gage.

VFR

Attempt to join another aircraft, and use HEFOE signals to indicate extent of problems. Use PRC emergency radio if available.

Note

- If failure occurs on takeoff, it will be impossible to raise the landing gear and flaps or jettison stores.
- Landing gear must be lowered by emergency method (visual check by LSO/tower/wingman is desirable).
- Fuel state must be estimated using power setting, airspeed, altitude, and time (fuel quantity gage pointers will freeze at the last fuel indications before power loss).
- Flaps/slats, antiskid, flaperon pop-up, trim, and nose-wheel steering will not be available. Normal wheels brakes WILL be available.
- If available, plan to make field arrested landing.
- Battery-powered spin assist may be selected before landing, to gain extended rudder throw for additional directional control.

WARNING

Extreme caution must be used when utilizing normal braking without anti-skid at high landing speeds.

SPEED DRIVE FAILURE

Lighting of the L or R-SPD DR light on the annunciator panel indicates a failure of the constant-speed drive/starter (CSD/S). A steady light indicates high oil temperature, low oil pressure, or CSD/S failure in aircraft with 30 kVA generators. A bright flashing light (2 to 3 second interval) indicates CSD/S overspeed. A random, dim, flickering light at altitudes above 30,000 feet indicates low oil pressure due to altitude. If the constant-speed drive starter malfunctions perform the following:

If SPD DR Light Steady/Flashing

1. Reduce rpm - Reset SPD DR

If Light Remains On Steady/Flashing:

2. SPD DR switch (affected CSD/S). . . . . OFF

If at High Altitude and SPD DR Light Flashes Brightly (2-3 sec. int.):

1. Reduce both engine rpm's to 75% - Reset SPD DR.

Note

Attempts to reset the CSD/S at high engine rpm and high altitude may cause undamped CSD/S overspeed.

If SPD DR Light Continues to Flash Brightly:

2. Descend to lower altitude - Reset SPD DR

If SPD DR Light Continues to Flash Brightly:

3. SPD DR switch (affected CSD/S) . . . . OFF

SPD DR Light Flickers Dimly:

1. Descend to lower altitude.

Note

If the SPD DR light is allowed to continue flickering, loss of CSD/S control and generators may result.

LOSS OF TRIM BUTTON

1. LAT/LONG TRIM circuit breaker. . . . . PULL

WARNING

Should the trim button become dislodged, human contact with the exposed probe with electrical power on can result in incapacitation/unconsciousness.

Note

Pulling LAT/LONG TRIM circuit breaker de-energizes the ram air switch. Should ram air be desired, reset the LAT/LONG TRIM circuit breaker long enough to select RAM AIR.

HYDRAULIC SYSTEM FAILURE

SINGLE HYDRAULIC PUMP FAILURE

The loss of any one hydraulic pump will be indicated on the hydraulic pressure indicator and will not present any flight control problems.

CAUTION

Failure of one pump may result in failure of the other pump in the same system.

1. Land as soon as practicable.

FLIGHT OR COMBINED HYDRAULIC SYSTEM FAILURE

Loss of either the flight or combined hydraulic system allows the one operating system to assume full control of the stabilizer, rudder, and flaperons.

Note

Either the combined primary or the flight hydraulic system alone will power the flight controls throughout the flight envelope except at high IMN; above approximately 0.70 IMN, diminished control effectiveness can be expected.

The internal refueling package (KA-6D) is operated from the combined hydraulic system. The maximum extension limit of the refueling hose is maintained by creating a hydraulic lock in the associated combined system lines. Should the hose be pulled beyond this limit during refueling, a failure of the combined system is likely to occur. To minimize the possibility of a complete hydraulic failure, refueling using the internal refueling package should not be attempted following failure or malfunction of the flight hydraulic system.

WARNING

In the event of flight hydraulic system failure or malfunction, immediately discontinue refueling operations using the internal refueling package. A subsequent malfunction of the refueling package that causes complete loss of the combined system fluid will result in a complete hydraulic failure.

With a failure of either hydraulic system, hydraulic operation of the following systems will not be available:

*Canopy	*Landing Gear
*Wing Slats	Nose-wheel Steering
*Wing Flaps	Antiskid
Flaperon Pop-Up	*Normal Brakes
Wing Fold	Arresting Hook
Strut Lock	(retraction)

*Alternate means of actuation available

With a flight hydraulic system failure, the AFCS will also be inoperative.

With a combined hydraulic system failure, the following will also be inoperative.

Speed Brakes
Assist Spin Recovery
RAT Retraction
KA-6D Hose-Reel Assy Operation
A-6C TRIM Pod Operation

If Either Flight or Combined Hydraulic System Fails, Proceed as Follows:

1. Land as soon as practicable.

Note

Advise tower of intentions prior to landing.

Just Prior to Landing:

2. Fuel . . . . . DUMP TO APPROPRIATE LANDING WEIGHT
3. Slow to 180 KIAS
4. Flap lever . . . . . TAKE OFF DETENT
5. Flaps/Slats . . . . . EXTEND ELECTRICALLY TO TAKE-OFF (30°) POSITION, THEN OFF

WARNING

Emergency extension of the flaps to takeoff may result in extension beyond the T/O position. Due to time differential between flap and slat retraction, an attempt to return to T/O position will result in a partially or fully retracted slat condition. Accept whatever flap indication exists following the initial extension to obtain takeoff (30°) flaps.

6. Slow to 150 KIAS

7. Landing gear. . . . LOWER BY EMERGENCY SYSTEM

8. Brake selector handle . . . . . TURN 90° CW

9. Auxiliary brake gage. . CHECK AT 15 CYCLES

Note

Except with complete loss of combined hydraulic system fluid, the brake accumulator can be recharged. Availability of fluid may readily be determined by operating the handpump and noting an increase on the brake pressure gage or back pressure on the pump handle. The bombardier/navigator shall assist the pilot in this operation.

10. Arresting hook . . . . . AS REQUIRED
A short field arrestment is recommended.

11. Make a normal landing approach.

After Landing (No Arrestment):

12. If there is less than a 10-knot crosswind, use aerodynamic braking to decelerate.

13. Use minimum number of brake applications. (Bombardier/navigator actuate auxiliary hydraulic pump to replenish brake accumulator as necessary.)

14. Clear runway, DO NOT attempt to taxi.

15. Insert landing gear ground safety locks prior to securing engines.

LOSS OF FLIGHT AND COMBINED HYDRAULIC SYSTEM (AFC 183 BACKUP HYD SYSTEM ONLY)

Failure of either flight or combined hydraulic system will energize the backup hydraulic pump and light the BACKUP-HYD caution light.

Note

The backup hydraulic pump is not available on RAT only power.

If the RUD THRO caution light also lights, this indicates loss of normal hydraulic system pressure in both systems with flight controls limited to rudder and stabilizer using the backup flight control system. This provides rudder control through rudder pedal movement and horizontal stabilizer control through longitudinal stick movement. Flaperon control is not provided.

In cruising flight, nose attitude is easily maintained by normal stick control. Straight flight and gentle turns can be performed by the use of smooth rudder input.

Recovery From Unusual Nose-High Attitudes:

1. Maintain angle of attack below 20 units.

2. Gently roll the aircraft upright using only as much rudder as necessary.

WARNING

Full rudder authority (35°) is provided automatically upon loss of flight and combined hydraulic system pressure. Use of excessive rudder at low speeds and high angles of attack may induce a spin.

Recovery From Unusual Nose-Low Attitudes:

1. Reduce power to idle.

2. Use rudder gently to roll the aircraft upright.

3. As soon as bank angle is less than 90°, apply aft stick to raise nose to horizon. Continue to roll aircraft to wings-level attitude.

WARNING

Full rudder authority (35°) is provided automatically upon loss of flight and combined hydraulic system pressure. Use of excessive rudder deflection above 190 KIAS should be avoided because resulting loads on the vertical stabilizer may exceed available strength. If rudder is used at speeds above 200 KIAS, observe the following limits to prevent possible catastrophic failure:

Full pedal to 190 KIAS
One half pedal (1 1/2 inch) to 250 KIAS
One quarter pedal (3/4 inch) to 365 KIAS
One eighth pedal (3/8 inch) above 365 KIAS

In addition, apparent dihedral effect (the ability to roll the aircraft with rudder) is sharply reduced to zero above .84 MACH. If airspeed exceeds .80 MACH, lateral control on backup hydraulic power using rudder or assymetrical thrust is severely limited.

Under optimum conditions, field landings are possible using the backup flight control system.

If a Field Landing is to be Attempted:

1. Lower landing gear at safe altitude using emergency method.

2. Leave flaps and slats . . . . . UP

WARNING

Asymmetrical flaperon float exists when the flaps are lowered in flight following complete hydraulic failure. Asymmetry may cause uncontrollable rolling moment in either direction.

3. Conduct slow flight at safe altitude using 18 units angle of attack, 150 KIAS, or minimum controllable speed, whichever is higher.

4. Plan for a straight-in approach using speed determined in step 3.

Note

- If fuel permits, one or more practice approaches may be made prior to landing.
- For go-around, avoid rapid large longitudinal control inputs. The bombardier/navigator should monitor the BACK-UP HYD light and alert the pilot if the light goes out, indicating pump capacity has been exceeded.
- Longitudinal control rate limiting (decreased pitch response) may occur in the power approach configuration while using the backup hydraulic system.

NEW

5. Brake selector handle. . . . . TURN 90° CW

6. Plan arrested landing since flaperon pop-up and antiskid braking will not be available.

7. Use smooth control movements; do not attempt to damp the aircraft dutch roll.

COMPLETE HYDRAULIC SYSTEM FAILURE

If complete hydraulic system failure occurs, all normal flight controls will be inoperative. Upon initial detection of hydraulic pressure loss or gage fluctuation, the pilot shall reduce airspeed and attempt to establish level flight. If aircraft is uncontrollable, EJECT.

SPEED BRAKE SYSTEM FAILURE

If an electrical system failure occurs with the speed brakes extended, they will be automatically retracted by combined hydraulic system pressure. If a combined hydraulic system failure occurs, the speed brakes will be retracted by air loads when the speed-brakes switch is moved forward. When the electrical and combined hydraulic systems both fail, the speed brakes will retract by air loads.

FLAP/SLAT MALFUNCTIONS

FLAPS/SLATS FAIL TO RETRACT

If a Barberpole Indication Should Occur on The Flaps/SLATS Indicator:

1. Climb to a safe operating altitude (do not exceed flap extension limit of 250 KIAS).

2. Maintain a safe airspeed/angle of attack and a high thrust setting.

WARNING

Extreme caution should be exercised during flap retraction under heavy gross weight conditions. To avoid aircraft stall or settling due to flap retraction, do not retract the flaps below 170 KIAS for weights up to 50,000 pounds and not below 185 KIAS for weight above 50,000 pounds. At the heavier weights and under high ambient temperature conditions, acceleration and climb performance are marginal and it may be impossible to reach 185 KIAS. If 185 KIAS cannot be reached, it is recommended that external store weight be reduced in order to permit acceleration to 185 KIAS prior to flap retraction.

Note

Remedial action for barberpoled flaps/slaps may include any or all of the following steps at speeds above the minimum for flap/slat retraction and up to a maximum of 250 KIAS.

3. Place flap lever to the TAKEOFF position. After flaps/slats have extended, place flap lever . . . . . UP

4. If the indicator barberpoles, apply 0 g momentarily.

5. If it still barberpoles, momentarily actuate the flap lever to TAKEOFF. As the flaps/slats begin to extend, immediately return the lever to UP.

6. If it still barberpoles, momentarily actuate the emergency flap switch to DN. As the slats begin to extend, immediately set the switch to UP and then OFF.

7. If it still barberpoles, maintain airspeed above the minimum retraction speed and extend the flaps/slats partially and then retract. As the flaps/slats approach the fully closed position, momentarily apply slight negative g.

8. If it still barberpoles, return to base and land.

FLAPS/SLATS FAIL TO EXTEND NORMALLY (FAILURE OTHER THAN HYDRAULIC)

Above 180 KIAS (approximately), the flaps may not extend to the TAKEOFF (30°) position. Above 140 KIAS (approximately), the flaps may not extend to the full down or LAND position. In either situation, the flap indicator may indicate a barberpole situation until the airspeed is reduced.

Note

Flaps and slats may fail to extend normally as a result of hydraulic or electric malfunctions. If the cause is determined to be hydraulic, follow procedures as outlined for flight or combined hydraulic system failure. If the malfunction is not hydraulic, proceed as follows:

1. FLAP/SLAT circuit breaker . . . . . PULL

Pulling the flap/slat circuit breaker isolates the normal flap/slat position switches, allowing any flap position to be selected electrically. If the circuit breaker is not pulled, TAKEOFF flaps cannot be selected electrically, since the flaps may return to the up position hydraulically as soon as the emergency flap switch is repositioned to OFF.

2. Slow to 180 KIAS
3. Flaps/slats . . . . . EXTEND FLAPS ELECTRICALLY TO TAKEOFF (30°) POSITION, THEN OFF.

WARNING

Emergency extension of the flaps to TAKE-OFF may result in extension beyond the T/O position. Due to time differential between flap and slat retraction, an attempt to return to T/O position will result in a partially or fully retracted slat condition. Accept whatever flap indication exists following the initial extension to obtain TAKE-OFF (30°) flaps.

Note

After landing, and the flaps and slats have been raised, the FLAP/SLAT circuit breaker must be reset, the flaps/slats visually checked up, and the normal flap handle checked in the UP position prior to folding the wings.

FLAPERONS POP UP IN FLIGHT

1. Throttles . . . . . MILITARY
2. External stores . . . . . JETTISON (AS NECESSARY)
3. Flaperon pop-up switch . . . . . OFF

Note

Turn flaperon pop-up OFF to preclude pop-up if failure is due to a weight-on-wheels switch malfunction. If pop-up is required for cross-wind or short field landing, it may be armed shortly after touchdown.

4. Return flap lever to original position if applicable.

Note

If the flaperons pop up at the start of flap/slat transit (from up or down), and did not retract with application of power, the failure is then of a hydraulic check valve, which ports fluid to the pop-up valve any time the flaps/slats are in transit up or down.

LANDING IF FLAPERONS HAVE POPPED UP IN FLIGHT

If flaperons popped up in flight due to a failure of the weight-on-wheels switch, then make a normal landing insuring the flaperon pop-up switch is OFF.

If landing with a suspected check valve failure, proceed as follows:

1. Landing gear. . . . . EXTEND NORMALLY

CAUTION

Actuation of the flaps/slats hydraulically may cause re-activation of flaperon pop-up.

2. Slow to 180 KIAS, leaving flap handle up.
3. FLAPS/SLATS circuit breaker . . . . PULL
4. Flaps/Slats . . . EXTEND ELECTRICALLY TO TAKE-OFF (30°) POSITION, THEN OFF.

WARNING

Emergency extension of the flaps to takeoff may result in extension beyond the T/O position. Due to time differential between flap and slat retraction, an attempt to return to T/O position will result in a partially or fully retracted slat condition. Accept whatever flap indication exists following initial extension to obtain TAKEOFF (30°) flaps.

5. Flap lever . . . . . TAKEOFF DETENT

Note

After landing, the FLAPS/SLATS circuit breaker must be reset prior to folding wings.

WEIGHT-ON-WHEELS SWITCH FAILURE

LEFT WEIGHT-ON-WHEELS SWITCH

Failure of the left weight-on-wheels switch to actuate to the in-flight position may be readily identified in the cockpit by the landing-gear handle lock remaining engaged. Additional systems affected are as follows:

- Flaperon pop-up enabled
- AOA indexer lights/approach lights disabled
- AOA/total temperature probe heat disabled
- Power trim indicators remain unmasked
- Radar altimeter indicating a constant value between 0 and 10 feet
- Emergency jettison disabled
- Gun charging and clearing disabled
- Refueling store hose-jettison disabled
- Tow link and strut-lock indications disabled
- ALE-29/39 Sequencer disabled
- Electric fusing disabled
- Step solenoid for wing-tank pressurization disabled
- Approach power compensator disabled
- Shrike guidance disabled (NA KA-6D)
- In-flight alignment disabled (NA KA-6D)
- NWW valve remains open (AFC No. 268 only)

The landing-gear handle can be released by lifting the override lever.

RIGHT WEIGHT-ON-WHEELS SWITCH

Failure of the right weight on wheels switch to actuate to the in-flight position will cause no in-flight losses. Failure of the switch to actuate to the on-deck position will cause the loss of nosewheel steering and antiskid braking.

CAUTION

With anti-skid selected and the right weight-on-wheels switch failed to actuate to the on-deck position, normal braking is not available. To regain normal braking, deselect anti-skid.

AIRSPEED INDICATOR FAILURE

Figure 5-6 presents angle of attack for various flight conditions for use in the event of airspeed indicator failure.

DAMAGED AIRCRAFT

Loss of structural integrity may result from a mid-air collision, exceeding structural limits, bird strikes, canopy losses, or battle damage. The following procedure generally applies:

1. Determine whether adequate control of the aircraft is available; if not EJECT.
2. If at low altitude, ZOOM to convert airspeed to altitude. Maintain airspeed as required.
3. If FOD damage is suspected:
   a. TO ONE ENGINE - Secure the engine.
   b. TO BOTH ENGINES - Reduce power to minimum required for maintaining level flight or a slow climb.
4. If practicable, climb to at least 10,000 feet and proceed to an uninhabited area in the vicinity of intended landing.
5. When possible, obtain a visual inspection by another aircraft to assist in evaluating the damage.
6. Cabin pressurization . . . . . DUMP (if above 8,000 feet)
7. Landing-gear handle . . . . . DOWN
8. Flaps/Slats . . . . . TAKEOFF/DOWN
9. Perform slow flight to determine minimum safe airspeed to be used during landing approach. If insufficient lateral control is available, flaps and slats down, or if flaps or slats fail to extend fully, make a flaps/slats up landing. (Refer to No Flaps/No Slats Landing Procedure.)
10. Approach speed should be the minimum speed obtained on slow flight check plus 10 knots.

LANDING GEAR SYSTEM MALFUNCTIONS

LANDING GEAR HANDLE CANNOT BE RAISED

Note

If the landing-gear handle cannot be raised, it may be due to failure of the landing-gear handle lock solenoid, the left weight-on-wheels, switch or a popped GEAR/HOOK circuit breaker.

1. Flaperon pop-up . . . . . OFF

To raise the landing gear:

2. Landing-gear OVERRIDE lever . . . . . LIFT
3. Landing-gear handle . . . . . RAISE

AIRSPEED INDICATOR FAILURE

FLIGHT CONDITION	ANGLE OF ATTACK (UNITS)
CATAPULT	
TRANSITION FROM CATAPULT (30° FLAPS, GEAR DOWN)	22
L/D_{MAX} DIRTY	
30° FLAPS/SLATS DOWN DRAG INDEX=0	19
30° FLAPS/SLATS DOWN DRAG INDEX = 100	21
L/D_{MAX} CLEAN	
DRAG INDEX = 0	15
DRAG INDEX = 100	16
MILITARY POWER CLIMB	
30° FLAPS/SLATS DOWN GEAR UP	17
FLAPS/SLATS AND GEAR UP — DRAG INDEX = 0 . . . SEA LEVEL	10
COMBAT CEILING	14
DRAG INDEX = 100 . . . SEA LEVEL	13
COMBAT CEILING	16
MAX RANGE CRUISE AT ALTITUDES BELOW 20,000 FT. (ALL GROSS WEIGHTS)	
DRAG INDEX = 0	12
DRAG INDEX = 100	14
MAX RANGE CRUISE AT OPTIMUM CRUISE ALTITUDE	
DRAG INDEX = 0	12
DRAG INDEX = 100	13
ENDURANCE AT OPTIMUM ENDURANCE ALTITUDE	
DRAG INDEX = 0	15
DRAG INDEX = 100	16
DESCENTS (LOW TO MEDIUM GROSS WEIGHTS)	
MAX. RANGE DESCENT (IDLE POWER)	18
NORMAL DESCENT (80% RPM, WING TIP SPEED BRAKES OPEN)	14
GEAR AND FLAP EXTENSION	
SAFE GEAR EXTENSION (WITH FLAPS UP)	15
SAFE 30° FLAP EXTENSION (WITH FLAPS/SLATS UP)	15
STALL WARNING	
FLAPS/SLATS UP	21
FLAPS 30°/SLATS DOWN (WITHOUT AFC 287/WITH AFC 287)	26/27
STALL	
FLAPS UP, GEAR UP	25
FLAPS 30°/SLATS DOWN GEAR DOWN WITHOUT A.F.C. 287/WITH A.F.C. 287	28/30 PLUS
APPROACH (FINAL ON SPEED APPROACH)	
GEAR DOWN, FLAPS 30°, WING TIP SPEED BRAKES OPEN	22
GEAR DOWN, FLAPS UP/SLATS DOWN	22
GEAR DOWN, FLAPS/SLATS UP	20
WAVE OFF	
SINGLE ENGINE	23
NO FLAP/NO SLAT	20
BOLTER	
SINGLE ENGINE	20
NO FLAP/NO SLAT	20

NOTE

- DUE TO THE BASIC INACCURACY OF SETTING UP FLIGHT CONDITIONS (OTHER THAN LANDING APPROACH) BY REFERENCE TO THE ANGLE OF ATTACK INDICATOR, THE INFORMATION INCLUDED IN THIS TABLE SHOULD BE USED ONLY IN AN EMERGENCY SITUATION.
- THE ANGLES SHOWN FOR ANGLE OF ATTACK VERSUS DRAG INDEX, WHILE NOT ENTIRELY LINEAR, MAY BE INTERPOLATED LINEARLY FOR PRACTICAL PURPOSES.

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Figure 5-6

LANDING GEAR HANDLE UP, INDICATES UNSAFE

With the landing-gear handle in the UP position, if the wheels transition light comes on, and/or the integrated position indicator displays a barber pole for any of the three landing gear, the unsafe indication may be due to electrical or mechanical failure. Such a failure will normally first be observed when the landing gear is raised immediately after takeoff; cycling the gear may correct the problem. Repeated cyclings are not recommended. Observe 200 KIAS limit for gear retraction.

1. Obtain a visual check if possible.
2. If both flight and combined hydraulic system pressure is available, isolation valve switch - LDG.
3. Landing gear handle . . . . . RECYCLE

CAUTION

- When cycling the gear from the up position, allow sufficient time (approximately 7 seconds) for the landing gear to complete a half cycle (i. e. from full up to full down) before attempting a reversal. If the direction is reversed before the door is fully opened, the gear linkage will not have completed its travel and the forward gear door may fail.
- If either flight or combined hydraulic system pressure is not available, or gear continues to indicate unsafe with the isolation valve in the LDG position - Observe gear extension speed limit (250 KIAS).

LANDING GEAR HANDLE DOWN, INDICATES UNSAFE

Gear extension failures may be due to electrical, hydraulic, mechanical, or cabin pressurization malfunctions. The gear will not extend normally if combined secondary hydraulic system pressure or 28 V dc essential bus electrical power is not available. Without 28 V dc power, the wheel transition light will be inoperative and the wheel position indicator will show a barberpole unsafe condition. Whenever the landing-gear handle is selected down and all the wheels do not extend and indicate positively down and locked, accomplish the following as necessary:

1. Gear/hook circuit breaker . . . . CHECK IN
2. Cabin dump switch . . . . . ON
3. Reduce-airspeed to 200 KIAS.
4. Landing gear. . . CYCLE AS NECESSARY TO OBTAIN DOWN INDICATION
   Leave gear handle DOWN after completion of landing-gear cycling.

CAUTION

When cycling the gear, allow sufficient time (approximately 7 seconds) for the landing gear to complete a half cycle (i. e. from full up to full down) before attempting a reversal. If the direction is reversed before the door is fully opened, the gear linkage will not have completed its travel and the forward gear door may fail.

5. With flaps up, accelerate to a maximum of 250 KIAS and apply positive and negative g, and yaw the aircraft.

Note

For NOSE GEAR unsafe indications, the tradeoff between increased airloads and g available must be accepted.

CAUTION

In the flaps/slats down configuration g is limited to 2 positive g, zero negative g.

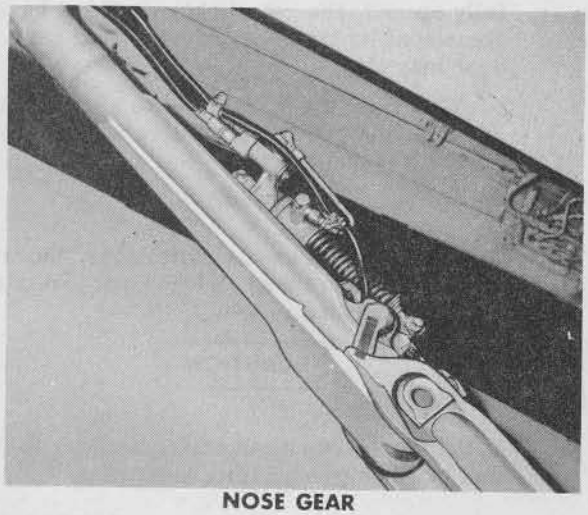
6. Flap/Slats . . . . . TAKEOFF/DOWN
7. Have a visual gear position check made by another aircraft or by the tower on a fly-by. (See figure 5-7.)

Note

- If a landing gear indicates unsafe and is visually checked down after executing the above procedures, a short field arrested landing or carrier arrestment is recommended.
- The nose gear indicator in the integrated position indicator, the wheels warning light, the nose gear door anti-collision light (out), and the approach indexer/approach lights all sample the nose gear down and locked Micro Switch. Since all of these indicating systems are subject to malfunctions of their own, their activation, singly or collectively, does not necessarily constitute an unsafe nose gear situation.
- Valid mechanical down and over center for the landing gear can be ascertained using index tapes (if installed) or by close visual inspection of the respective over center mechanism. See figure 5-7.

8. If the indicating system is suspect, make a normal carrier arrestment/field arrestment, pinning the gear prior to further aircraft movement.

NOSE AND MAIN LANDING GEAR OVER CENTER MECHANISM



NOSE GEAR

MAIN GEAR

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Figure 5-7

9. If one or more gear are still unsafe, steps 4, 5, 6, and 7 may be repeated, and the following steps commenced:

10. Reduce airspeed to 150 KIAS.

Note

- The alternative of landing aboard ship with one or more gears not down, vice proceeding to a suitable divert airfield, must be considered prior to attempting gear extension by the emergency means, since the possibility exists that the offending gear may remain not down after such action is taken, and any feasible divert fields attainable in a clean configuration may then be beyond range.
- The landing gear, once extended by the emergency means, cannot be retracted while airborne.

11. With gear handle DOWN (any configuration), push handle in, rotate 90° clockwise, then pull out.

Note

- The landing gear handle must be pulled out with sufficient force and extension to ensure actuation of the emergency air bottles. Entension of the gear handle may be in excess of 3 inches depending on control rigging.
- When it is necessary to lower the landing gear by the emergency extension system (for other than a hydraulic failure/malfunction), there is no loss of the full operation of normal braking, anti-skid, flaperon pop-up, or nosewheel steering. NEW NEW

12. If necessary, steps 5, 6, and 7 may be repeated.

Note

After landing, pin gear prior to further aircraft movement if unsafe indication still exists. NEW NEW NEW NEW

13. When landing with any gear unsafe, figure 5-8 provides recommended courses of action. These recommendations are based on available information and experience to date. They are subject to operational and pilot/crew consideration existing at the time.

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LANDING GEAR EMERGENCY

FINAL CONFIGURATION	CARRIER LANDING APPLICABLE NOTES	FIELD LANDING APPLICABLE NOTES
ALL GEAR UNSAFE	3, 4, 5, 6, 8, 9, 10, 16, 17, 18, 19	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 17, 19
NOSE GEAR UNSAFE	3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19,20	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,17,19,20
ONE MAIN UNSAFE	3, 4, 5, 6, 7, 8, 9, 10, 17, 18	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 17
BOTH MAINS UNSAFE	3, 4, 5, 6, 7, 8, 9, 10, 17, 18	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 17
ONE MAIN NOSE GEAR UNSAFE	3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 17, 19

NOTES

1. Request Foam on Runway.
2. Utilize Arresting Gear and LSO, If Available.
3. Lighten Aircraft by Dumping and Burning Off Excess Fuel.
4. Retain External Tanks, If Empty.
5. Jettison Other External Stores (If the Gear Has Been Lowered the Emergency Jettison System Must Be Used to Jettison Stores. Pull Appropriate Emergency Stores Jettison Circuit Breakers to Retain Empty Drop Tanks).
6. Flaps Down, If Available.
7. Arresting Hook Down.
8. Canopy Closed.
9. Wingtip Speedbrakes Out, If Available.
10. Flaperon Popup Off.
11. Fly Reduced Rate of Descent Utilizing LSO If Available. Do Not Let The Nose Fall Through.
12. Touch-Down Short of the Arresting Gear on Runway Centerline with Power On. Maintain 90 KIAS Nose High Attitude with Aft Stick Until Arresting Gear is Engaged.
13. If Arresting Gear Is Not Available, Land on Side of Runway Opposite the Failed or Unsafe Main Gear.
14. Touch-Down Just Short of the Arresting Gear on Runway Centerline.
15. Touch-Down Just Short of Arresting Gear on Runway Centerline with Power On. Maintain Flying Speed (105-115 KIAS) Until Arresting Gear Is Engaged. Be Prepared to Go Around If Arresting Gear Is Missed.
16. Hook Up Landing Is Recommended to Prevent Possible Crew Injuries As the Result of Excessive Nose Slapdown Loads.
17. Throttles and Engine Master Switches Off (After Engaging Arresting Gear, or After Touchdown, If No Arresting Gear Is Available).
18. Barricade Required.
19. Tank Pressurization Switch OFF.
20. Touch-and-Go Permitted to Achieve a Gear Down Indication.

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Figure 5-8

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part 4 Air Refueling Emergencies

Note

- If any emergency condition occurs with a receiver aircraft in the refueling or pre-contact position, the tanker pilot will immediately inform the receiver to move to the observation position to insure adequate separation of aircraft.
- Refueling operations shall not commence or be reinitiated unless the pilot can ascertain that NATOPS safety procedures will not be compromised.

WARNING

- Any emergency that may affect the ability to fly formation, such as loss of an engine or flight control malfunction, requires an immediate breakaway before initiating any other emergency procedures.
- In the breakaway, the tanker aircraft climbs straight ahead at maximum power to the top of the refueling block. The receiver descends to the bottom of the block. Both aircraft attempt to maintain visual contact during the breakaway. Notify controlling agency of intentions as soon as practicable.

REFUELING EMERGENCIES

REFUELING WITH SINGLE GENERATOR

Actuation of the air refueling system package with only one generator operating is not, in itself, inherently dangerous. However, such utilization is not recommended and should be tempered with an assessment of the reliability of the remaining generator. The following procedures apply:

1. RAT handle . . . . . PULL
2. FUEL TRANSFER switch . . . . . check OFF

CAUTION

Simultaneous actuation of fuel transfer pumps and reel response circuits may overload the remaining generator, causing it to drop off the line with subsequent loss of reel response, and possible damage to receiver aircraft.

3. Receiver aircraft . .ENGAGE DROGUE (when cleared in)
4. FUEL TRANSFER switch . . . . . .AUTO

HOSE REEL DRIVE FAILURES

Failures of the hose-reel drive and their corrective actions are shown in figure 5-9.

FUEL LEAKING FROM AFT BAY DURING REFUELING

1. Terminate refueling; receiver disconnects.
2. FUEL TRANSFER switch . . . . . OFF
3. RET/EXT switch . . . . . RET
4. Refueling power panel switch . . . . . OFF
5. Secure all unnecessary electrical equipment.
6. Land as soon as practicable.

FUEL LEAKING FROM AFT BAY DURING REFUELING, HOSE WILL NOT RETRACT

1. Terminate refueling, receiver disconnects.
2. FUEL TRANSFER switch . . . . . OFF
3. Secure all unnecessary electrical equipment.
4. Land with hose trailing, as soon as practicable.
5. Do not guillotine hose since pyrotechnics may cause explosion or ignite fuel/fumes.
6. Bingo if fuel state permits. If an arrested landing is absolutely necessary, yaw aircraft before lowering tail hook in order to prevent hose-hook interference. An arrested landing could cause hose to whip forward, damaging aircraft.

HOSE FAILS TO RETRACT

1. Reduce airspeed to decrease drag on drogue and attempt retraction.

If Hose Fails to Retract:

2. HOSE JETTISON switch. . . . . JETTISON

If Hose Fails to Jettison:

3. A field arrested landing is recommended.

CAUTION

A shipboard arrestment with a trailing air refueling hose is not recommended.

HOSE REEL DRIVE SYSTEM FAILURES

FAILURE	EFFECT	CORRECTIVE ACTION IN FLIGHT
Loss of one engine or engine-driven hydraulic pump.	Slight reduction in response rate.	No corrective action required.
Reel arming valve failed closed.	No operation of reel system.	None, use D-704 if available.*
Reel arming valve failed open.	None, except reel lock will not engage.	After retraction of hose, leave refueling panel power ON and EXT/RET switch in RET for remainder of flight and landing.
Failure of reel drive motor or servo valve.	No operation of reel system.	None, use D-704 if available.*
Electrical failure of power supply to reel system.	No operation of reel system.	None, use D-704 if available.*

*AIRCRAFT INCORPORATING A.F.C. No. 296

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Figure 5-9

COMBINED HYDRAULIC SYSTEM FAILURE, HOSE EXTENDED

Note

The hose cannot be retracted if the combined hydraulic system fails.

1. Refueling panel power . . . . . OFF
2. Airspeed 220 - 320 KIAS
3. HOSE JETTISON switch. . . . . JETTISON
   If hose fails to jettison, refer to Failure of Hose to Retract, step 3.

CAUTION

An arrested landing is recommended with the hydraulic failure. A shipboard landing with a trailing hose is not recommended.

4. Leave refueling panel switches in their present positions.
5. Follow procedure for combined hydraulic system failure.

HOSE BREAK/LOSS OF MA-2 COUPLING AND DROGUE

1. Refueling panel power . . . . . OFF
   Immediately place power OFF in order to snub hose and prevent severed end from damaging interior of aft bay. Hose reel will make scheduled number of turns regardless of length of hose remaining.

Jettison remaining hose.

2. Hose Jettison switch . . . . . JETTISON

Note

Integral electrical/hydraulic provisions will shut down the hydraulic and fuel systems.

HOSE BREAK AT COUPLING ON REEL

Note

The STOW/TRAIL indicator shows TRAIL until hose-coupling failure, then shows barber pole. The READY light will go out. Response is not possible. The hose will be snubbed in the guillotine.

1. FUEL TRANSFER switch . . . . . OFF

2. EXT/RET switch . . . . . EXT

3. Refueling panel power . . . . . OFF

NO READY LIGHT OR FUEL TRANSFER FAILURE

Failure of the READY light may be due to a response failure or to a failure in the ready light circuitry.

1. FUEL TRANSFER switch . . . . . AUTO

WARNING

Before attempting refueling with no READY light or with a fuel transfer failure, ensure that receiver pilots are briefed to engage and disengage the drogue only when cleared by the tanker pilot. Should the receiver aircraft attempt to disengage while the fuel transfer switch is in OVRD, both aircraft may be damaged.

2. Receiver aircraft . . . . ENGAGE DROGUE (when cleared)

If No Fuel Transfer:

3. FUEL TRANSFER switch . . . . . OVRD

After Transfer Complete:

4. FUEL TRANSFER switch . . . . . OFF

5. Receiver aircraft . . . DISENGAGE DROGUE (when cleared)

REFUELING HOSE JETTISONING

Internal Refueling System

1. POWER switch. . . . . OFF

2. Airspeed. . . . . 220 to 320 KIAS

3. DROGUE JETT switch. . . . . JETT

WARNING

If the hose has been jettisoned, moving the DROGUE JETT switch from the JETT position with the POWER switch ON will restore power to the hose-reel assembly and the severed hose seal may be broken.

External Refueling Store

1. Refueling master switch. . . . . OFF

2. Airspeed. . . . . 300 KIAS (MAX.)

3. Hose jettison switch . . . . . CUT

WARNING

Once the CUT position has been selected, do not return the switch to NORM, as the turbine will unfeather and cause the hose to be pulled from the guillotine crimper, spilling fuel in the store and creating a fire hazard.

part 5 Landing Emergencies

If the situation necessitates an approach speed above normal, or affects slowing or control of the aircraft after landing, an arrested landing shall be considered. Satisfactory field and carrier approaches can be made in abnormal approach configurations. For optimum angles of attack for various approach configurations, see figure 5-10.

EMERGENCY APPROACH CONFIGURATION AOA/ AIRSPEED

CONFIGURATION	OPTIMUM AOA (UNITS)	OPTIMUM APPROACH SPEEDS GROSS WEIGHT 33,500 KIAS
FLAPS UP SLATS OUT	22	141
FLAPS 30° SLATS IN *	19	118
FLAPS UP SLATS IN	20	147
SINGLE ENGINE FLAPS 30° SLATS OUT	21	113

NOTES

1. FOR EACH 1000 LBS ADDED TO ABOVE GROSS WEIGHTS, ADD 2 KIAS TO OPTIMUM APPROACH SPEED.
2. DATA IN ABOVE CHART IS THE RESULT OF CARRIER SUITABILITY FLIGHT TEST EVALUATION CONDUCTED BY THE NAVAL AIR TEST CENTER, PATUXENT RIVER, MARYLAND.

* WARNING

- DO NOT ATTEMPT TO FLARE THE LANDING. THIS MAY RESULT IN A SEVERE PITCH UP.
- DURING WAVEOFF OR BOLTER IN THIS CONFIGURATION, OVERROTATION MUST BE AVOIDED DUE TO PITCHUP OCCURING AT 20 TO 22 UNITS AOA.

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Figure 5-10

SINGLE ENGINE LANDING

A single-engine landing is basically the same as a normal landing, except that the pattern is expanded slightly to avoid steep turns. Performance at high gross weights and high ambient temperatures is critical. Single-engine landing, wave-off, or bolter may be accomplished safely up to gross weight and temperature limits as shown in figure 5-11.

WARNING

Do not use LAND flaps for single-engine landing.

During wave-off, the optimum technique is to select military thrust, and rotate to 23 units AOA. After wave-off, decrease AOA to 18 units to provide adequate excess thrust margin for maneuvering flight. Bolter techniques consist of selecting military thrust, rotating to 20 units AOA. During acceleration, decrease AOA to 18 units. External fuel tanks have a negligible affect on thrust required and need be dropped only if necessary for gross weight considerations.

Single Engine Landing Proceed as Follows:

1. Fuel . . . . . DUMP/BURN DOWN to minimum acceptable level
2. External stores . . JETTISON (as necessary)

WARNING

High weight/drag stores will considerably reduce wave-off and bolter capability.

3. Speed brakes . . . . . IN
4. Landing gear . . . . . DOWN
5. Flaps/slats . . . . . TAKEOFF/DOWN
6. Maintain a shallow, slightly fast approach speed (21 units) AOA
7. Make a normal touchdown and roll out.

SINGLE ENGINE CARRIER LANDING

GROSS WEIGHT VS TEMPERATURE

DATE: 15 MARCH 1969
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

REMARKS
SINGLE ENGINE OPERATION
INOPERATIVE ENGINE WINDMILLING

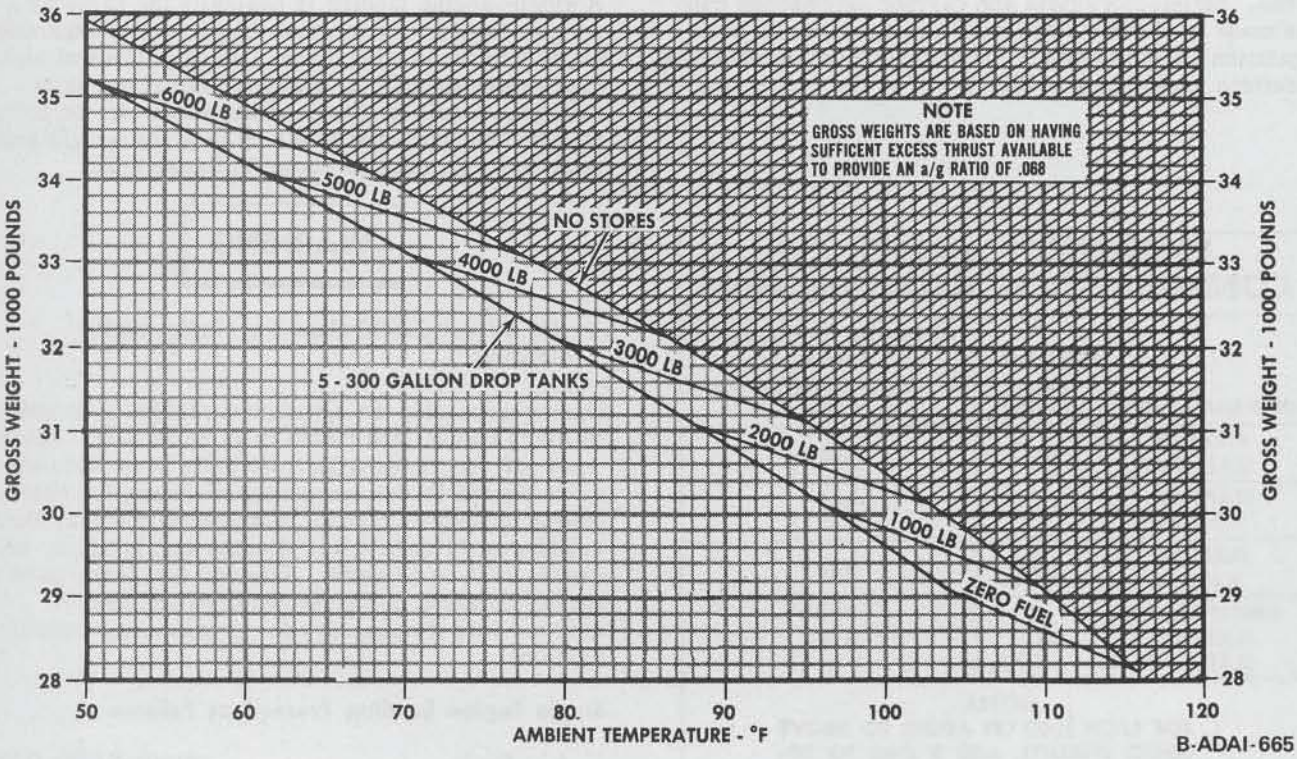

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Figure 5-11

SINGLE ENGINE LANDING (COMPOUNDED BY HYDRAULIC FAILURE)

Use same procedures as listed under flight or combined hydraulic failure, noting the following.

1. Ensure use of takeoff flaps for single engine landing.
2. Ensure speed brakes are in for approach.
3. Maintain a shallow, slightly fast approach speed (21 units AOA).

FLAP/SLAT MALFUNCTIONS

If normal flap/slat operation has malfunctioned, utilize emergency flaps/slats observing airspeed limitations in an attempt to achieve a normal configuration. If normal and emergency flaps/slats operation fails, utilize the following procedures for these final unalterable configurations:

NO FLAPS/NO SLATS LANDING

A no flaps/no slats landing is basically the same as a normal landing. However, the pattern is expanded, approach speeds are higher, stall warning is reduced, and due to reduced drag, power is back in a range of reduced responsiveness.

1. Fuel . . . . . DUMP/BURN DOWN (to minimum acceptable level)
2. Straight in approach preferred.
3. Flap lever . . . . . UP DETENT.

Note

With flaps fully retracted, extended rudder and stabilizer throws are not required for landing in the clean configuration.

4. Fly slightly fast approach. Maintain 20 units AOA.

FLAPS TAKEOFF/SLATS UP LANDING

A no flaps/no slats landing is preferred. If the flaps cannot be retracted, proceed as follows:

1. Fuel . . . . . DUMP/BURN DOWN (to minimum acceptable level)
2. Fly traffic pattern slightly wider than normal.
3. Flap lever . . . . . TAKEOFF DETENT

Note

- Extension of the flaps only will produce a characteristic of strong alternate wing-dropping and abrupt pitch-up error to stall.
- Extension of either flaps or slats will reduce stall speed approximately 10 knots below the clean stall speed.

4. Fly slightly faster approach. Maintain 19 units AOA.

WARNING

- Do not attempt to flare the landing. This may result in a severe pitch-up.
- During wave-off or bolters in this configuration, do not exceed 22 units AOA. Overrotation must be avoided due to pitch-up occurring at 21 to 22 units AOA.

FLAPS UP/SLATS DOWN LANDING

A slats only landing is basically the same as a normal landing, except power response will be different due to reduced drag, and approach speed, at optimum AOA, will be faster.

1. Fuel . . . . . DUMP/BURN DOWN (to minimum acceptable level)
2. A straight-in approach is preferred.
3. Flap lever . . . . . TAKEOFF DETENT
4. Maintain 22 units AOA

CAUTION

The stabilizer may not shift if the flaps do not extend, and horizontal stabilizer authority will be reduced.

STABILIZER SHIFT FAILURE

If the stabilizer does not shift upon flap/slat actuation the problem may be a broken shift cable, failure in the shift mechanism, or an indication problem.

WARNING

With flaps and/or slats extended, reduced stabilizer authority may be insufficient for adequate control (i. e. WAVEOFF/BOLTER).

Proceed as follows:

1. Flap lever . . . . . UP DETENT
2. Make no flaps/slats landing.

CAUTION

- Structural damage may occur if spin assist is activated and the stabilizer is already shifted to full authority. Damage to the stabilizer shift mechanism does not have a derogatory effect on stabilizer control or flight characteristics.
- If engagement speed or runway length dictate, a normally configured landing, utilizing spin assist is warranted.

ARRESTING-HOOK MALFUNCTION

In the event that the hook does not extend by the normal method or the hook retracts when the combined hydraulic secondary system is pressurized:

1. Ensure that landing gear is down and locked.

2. GEAR/HOOK circuit breaker . . . . . PULL

3. Hook-release handle . . . . . PULL

Note

To prevent a flashing approach light-and-indexer, place the hook bypass switch in the TOUCH-GO position.

BARRICADE ARRESTMENT

If a barricade arrestment is required, the following procedures are recommended:

NEW

1. Jettison stores if possible except for empty drop tanks. Stores will not hamper successful barricade engagement, but may possibly be torn loose and present a hazard to flight-deck personnel.

2. Normally, tailhook should be lowered, if possible, to permit engagement of a cross-deck pendant, which will minimize barricade engagement speed and damage to aircraft, and also help to keep aircraft on deck at barricade entry.

3. Fly a normal pattern and approach; on speed, centerline, and meatball.

4. Barricade entry must be with three gear on deck to ensure that refueling probe passes under upper load straps.

5. Anticipate loss of meatball for a short period of time during approach. Barricade stanchions may obscure meatball.

6. Keep canopy closed.

FIELD ARRESTING GEAR

There are several types of field arresting gear. These types include the anchor chain cable, water squeezer, and Morest-type equipment. All of these types require engagement of the arresting hook in a cable pendant rigged across the runway. Location of the pendant in relation to the runway will classify the gear as follows:

1. Midfield gear. - Located near the halfway point of the runway. Usually requires prior notification in order to rig for arrestment in the direction desired.

2. Abort gear. - Located 1500 to 2500 feet short of the upwind end of the duty runway and usually will be rigged for immediate use.

3. Overrun gear. - Located shortly past the upwind end of the duty runway. Usually will be rigged for immediate use.

Some fields will have all of these types of gear, others none. For this reason, it is imperative that all pilots be aware of the type, location, and compatibility of the gear in use with the aircraft, and the policy of the local air station with regard to which gear is rigged for use and when.

The approximate maximum permissible engaging speed, gross weight, and off-center engagement distance for field arrestment of aircraft are listed in figure 5-12.

EMERGENCY FIELD ARRESTMENT DATA

A-6C/A-6E AND A-6A/A-6B AIRCRAFT INCORPORATING AFC NO. 244

TYPE OF ARRESTING GEAR	MAXIMUM ENGAGING SPEED—KNOTS (a)											MAXIMUM OFF CENTER ENGAGEMENT
	GROSS WEIGHT X 1000 POUNDS											
	SHORT FIELD LANDING (c, d)				LONG FIELD LANDING (e)			ABORTED TAKEOFF (h)				
	27	30	33.5	36	40	43	45	49	53	57	60.4	
M-2	113	109	104	100	96	94	92	88	85	83	81	20
E-14-1	160	160	160	160	160	160	160	160	147	138	132	50
E-27	160	157	153	151	147	144	142	137	133	129	125	35
E-15 200′ SPAN	164 (g)	164 (g)	164 (g)	164 (g)	179 (b)	178 (b)	178 (b)	176 (b)	174	171	168	35
E-15 300′ SPAN	164 (g)	164 (g)	164 (g)	164 (g)	180	180	180	180	180	177	173	50
M-21	150	150	150	150	125	125	125	125	125	120	120	10
E-28	164 (g)	164 (g)	164 (g)	164 (g)	162 (b)	162 (b)	162 (b)	156 (b)	156 (b)	156 (b)	156 (b)	40
E-5 STD CHAIN	150	150	150	150	150	146	144	139	135	131	128	(f)
E-5-1 STD CHAIN	164 (g)	164 (g)	160	156	150	146	144	139	135	131	128	(f)
E-5 HVY CHAIN	150	150	150	150	150	150	150	150	150	150	150	(f)
E-5-1 HVY CHAIN	164 (g)	164 (g)	164 (g)	164 (g)	165	165	165	165	165	160	156	(f)
BAK-6	160	160	160	156	153	150	149	146	144	139	135	15
BAK-9	160	160	160	160	160	160	160	160	153	144	136	30
BAK-12	160	160	160	160	160	160	160	160	160	160	156	50

(a) Except where noted, all engaging speeds limited by arresting gear capacity.

(b) Maximum engaging speed limited by aircraft arresting hook strength.

(c) Maximum of 3.0 degree glide slope.

(d) Consult appropriate section for recommended approach speed.

(e) Flared or minimum rate of descent landing.

(f) Off-center engagement may not exceed 25% of the runway span.

(g) Maximum engaging speed limited by landing gear strength.

(h) Data provided in the aborted take-off columns may be used for emergency high gross weight arrestments.

NOTE

At low gross weight and in the 100 KIAS speed range the tail hook may lift from the runway; this can be corrected by a slight amount of back pressure on the stick.

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Figure 5-12 (Sheet 1)

EMERGENCY FIELD ARRESTMENT DATA

KA-6D AND A-6A/A-6B AIRCRAFT NOT INCORPORATING AFC NO. 244

TYPE OF ARRESTING GEAR	MAXIMUM ENGAGING SPEED—KNOTS (a) GROSS WEIGHT X 1000 POUNDS											MAXIMUM OFF CENTER ENGAGEMENT
	SHORT FIELD LANDING (c, d)				LONG FIELD LANDING (e)			ABORTED TAKEOFF (h)				
	27	30	33.5	36	40	43	45	49	53	57	60.4	
M-2	113	109	104	100	96	94	92	88	85	83	81	20
E-14-1	160	160	160	160	160	159 (b)	157 (b)	156 (b)	147	138	132	50
E-27	160	157	153	151	147	144	142	137	133	129	125	35
E-15 200′ SPAN	164 (g)	164 (g)	164(bg)	163 (b)	162 (b)	161 (b)	160 (b)	159 (b)	158 (b)	157 (b)	156(b)	35
E-15 300′ SPAN	164 (g)	164 (g)	164 (g)	164 (g)	180	180	180	180	180	177	173	50
M-21	145 (b)	145 (b)	145 (b)	145 (b)	125	125	125	115 (b)	115 (b)	115 (b)	115 (b)	10
E-28	160 (b)	160 (b)	160 (b)	160 (b)	155 (b)	155 (b)	155 (b)	148 (b)	148 (b)	148 (b)	148 (b)	40
E-5 STD CHAIN	150	150	150	150	150	146	144	139	135	131	128	(f)
E-5-1 STD CHAIN	161 (g)	161 (g)	160	156	150	146	144	139	135	131	128	(f)
E-5 HVY CHAIN	150	150	150	150	150	150	150	150	150	150	150	(f)
E-5-1 HVY CHAIN	161 (g)	161 (g)	161 (g)	165	165	165	165	165	165	160	156	(f)
BAK-6	160	160	160	156	153	150	149	146	144	139	135	15
BAK-9	160	160	160	160	160	160	160	160	153	144	136	30
BAK-12	160	160	160	160	160	160	160	160	160	160	156	50

(a) Except where noted, all engaging speeds limited by arresting gear capacity.

(b) Maximum engaging speed limited by aircraft arresting hook strength.

(c) Maximum of 3.0 degree glide slope.

(d) Consult appropriate section for recommended approach speed.

(e) Flared or minimum rate of descent landing.

(f) Off-center engagement may not exceed 25% of the runway span.

(g) Maximum engaging speed limited by landing gear strength.

(h) Data provided in the aborted take-off columns may be used for emergency high gross weight arrestments.

NOTE

At low gross weight and in the 100 KIAS speed range the tail hook may lift from the runway; this can be corrected by a slight amount of back pressure on the stick.

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Figure 5-12 (Sheet 2)

WARNING

- Under no circumstances should a pilot's decision to abort a takeoff be delayed because of knowledge that an emergency arresting gear is available at the end of the runway. Decision to abort should be based on the usual parameters of remaining runway and distance required for stopping, using wheel brakes. The arresting gear will then serve as an assist to stop the aircraft from rolling off the runway onto unprepared surfaces.

- If off center, just before engaging the arresting gear, do not attempt to go for the center of the runway. Continue straight ahead parallel to the centerline.

As various modifications to the basic types of arresting gear are used, exact speeds will vary accordingly. Certain aircraft service changes may also affect engaging speed and weight limitations. Severe damage to the aircraft is usually sustained if an engagement into the chain gear is made in the wrong direction.

The following recommendations are made; however, depending upon the existing emergency condition, runway conditions, weather, time, fuel remaining, and other considerations, it may be impractical or impossible to adhere strictly to the following general recommendations.

In an emergency situation, first determine the extent of the emergency by whatever means are possible (instruments, other aircraft, LSO, RDO, tower, or other ground personnel). Next, determine the most advantageous arresting gear available and the type of arrestment to be made under the conditions which prevail. Whenever deliberate field arrestment is intended, notify control tower personnel as much in advance as possible and state estimated landing time in minutes. If gear is not rigged, it will probably require 10 to 20 minutes to prepare it for use. If foaming of the runway or area of arrestment is required or desired, it should be requested by the pilot at this time.

In general, the arresting gear is engaged on the centerline at as slow a speed as possible. Burn down to 6500 pounds of fuel/stores or less. While burning down, make practice passes to accurately locate the arresting gear. Engagement should be made with feet off the brakes, shoulder harness locked, and with the aircraft in a 3-point attitude. If the nose is held firmly on the deck (either by brake pressure or by forward stick) and when at a relatively high airspeed, the hook point can be off the ground. At low gross weight and in the 100 KIAS speed range, the tail hook may lift from the runway; this can be corrected by a slight amount of back pressure on the stick. Use caution when applying either forward or aft stick pressure just prior to engagement to prevent raising the hook or flying over the arresting gear. On runways with centerline lights, the aircraft should be lined up slightly off centerline to prevent hook skip. The centerline lights can cause the hook point to bounce over the arresting gear. After engaging the gear, good common sense and existing conditions now dictate whether to keep the engines running or to shut it down and abandon the aircraft.

SHORT-FIELD ARRESTMENTS

If at any time prior to landing, it is known that a directional control problem exists or a minimum rollout is desired, a short field arrestment should be made and the assistance of an LSO requested. He should be stationed near the touchdown point and equipped with a radio. Inform the LSO of the desired touchdown point. A constant glide slope approach to touchdown is permitted (mirror or Fresnel Lens Landing Aid utilized) with touchdown on centerline at or just prior to the arresting wire with the hook extended. The hook should be lowered while airborne and a positive hook-down check should be made, if possible. If midfield gear or Morest type is available, it should be used. If neither are available, use abort gear. Use an approach speed commensurate with the emergency experienced. Landing approach power will be maintained until arrestment is assured or a wave-off is taken. Be prepared for a wave-off if the gear is missed. After engaging the gear, retard the throttle to IDLE or secure engine and abandon aircraft, depending on existing conditions.

LONG-FIELD ARRESTMENTS

The long field arrestment is used when a stopping problem exists with insufficient runway remaining (i. e., aborted takeoffs, icy or wet runways, loss of brakes after touchdown, etc.). Lower the hook, allowing sufficient time for it to extend fully prior to engagement. Line up the aircraft on the runway centerline. On runways with centerline lights, the aircraft should be lined up slightly off centerline to prevent hook skip. The centerline lights can cause the hook point to bounce over the arresting gear. Inform the control tower of your intentions to engage the arresting gear, so that aircraft landing behind you may be waved off.

ABORTED TAKEOFF ARRESTMENTS

Where an aircraft takeoff must be aborted, a roll-in type engagement of all arresting gear is recommended to prevent overrun. The aircraft is cleared up to the maximum takeoff gross weight specified in the Aborted Takeoff column of figure 5-12. Additionally, the data provided in the Long Field Landing column may be used for lightweight aborted takeoff, where applicable.

Note

The taxi light may be of use in locating arresting/abort gear at night.

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BLOWN TIRE

A situation may occur when the pilot must land with a blown tire, or the fire may rupture during ground roll. A blown tire at high speed will require immediate control action to keep the aircraft aligned with the runway. The following procedures are applicable:

1. Use field arresting gear if available.

If Arresting Gear is Not Available:

1. Antiskid . . . . . OFF
2. Flaperon pop-up . . . . . OFF
3. Make normal approach.
4. Land on side of runway opposite blown tire.
5. Lower nose gear to runway and use nosewheel steering for directional control.
6. Use light opposite braking to slow aircraft.

If Fire Equipment is Available:

7. Engines . . . . . SHUT DOWN

If possible, do not shut down engines until adequate firefighting equipment is available.

CAUTION

The damaged wheel may be either on fire or very hot, and fuel drained overboard after engine shutdown could contact the hot wheel, causing fire.

WHEEL BRAKE SYSTEM FAILURE

WHEEL BRAKE ANTI-SKID SYSTEM FAILURE

NEW If normal braking is lost, erratic braking is experienced, or the antiskid annunciator light is lit, proceed as follows:

1. Antiskid switch . . . . . OFF

CAUTION

The brakes should be released before the antiskid system is disengaged to prevent the possibility of skidding.

Note

Loss of antiskid braking may be due to an overserviced strut, which prevents the right weight-on-wheels switch from closing. Such a loss would be accompained by a loss of nose-wheel steering. Braking can be restored in this case by turning anti-skid off. Differential braking must be used for steering.

BRAKE SYSTEM EMERGENCY OPERATION

If braking action is lost, the aircraft can be stopped by using auxiliary or emergency braking.

1. Brake selector handle. TURN 90° CLOCKWISE. Check that auxiliary brakes cycle gage indicates approximately 15 cycles. If gage indication is considerably less than 15 cycles, manually pump with handpump or on aircraft. incorporating the electric-motor-driven pump, depress AUX HYD button. (The electric-motor-driven pump is not operative until 70% of aircraft weight is on the wheels.)

Note

The antiskid feature of the aircraft will be inoperative when the brake selector handle is not in and vertical. Avoid pumping brakes. Each application of brakes will deplete brake accumulator pressure. NEW

2. Allow aircraft to decelerate, using aerodynamic braking. Delay using wheel brakes as long as safety will permit, thus allowing the aircraft to decelerate as much as possible; then apply brakes evenly, increasing brake pressure gradually.

If The Auxiliary Brake Applications are Exhausted:

3. Use abort gear if available:

If Arrestment is Unsuccessful:

4. Brake selector handle . . . . . PULL OUT
   Cycling of brake selector handle will provide approximately four to seven emergency brake applications. NEW

Note

- Pull the brake selector handle aft with a clockwise motion. Pulling the handle aft with a slight counterclockwise movement may cause the handle to bind and prevent brake actuation.
- When combined hydraulic system fluid is available, it is possible to recharge the brake accumulator during rollout. Recharging can be accomplished by means of the auxiliary hydraulic pump motor or by operating the handpump. On some early aircraft, only the handpump is available for recharging.

HOT BRAKES

NEW If heavy braking is used during the landing or taxiing, overheated brakes will result. Avoid prolonged brake applications to prevent brake disk fusing. Do not use the parking brakes until the brake disks have cooled. To prevent overheated brakes, braking requirements can be reduced by securing the left engine as follows:

WARNING

Do not secure an engine after suspected hot brakes. Fuel dumped near the wheel area when the throttle is shut off, creates a fire hazard.

NEW

1. Left throttle . . . . . OFF
2. Left engine and fuel master switch . . . OFF

Note

Lights powered by the monitored buses will be lost when either engine is cut. This will generally make the above procedures undesirable during night operations.

FORCED LANDING

It is not recommended that a landing on unprepared surfaces be attempted with this aircraft. The crew should EJECT.

WARNING

It is recommended that forced landings be made with the landing gear extended, regardless of the terrain. A greater injury hazard is present whenever emergency landings are made with the landing gear retracted. Increased airspeed or nose-high angle of impact during landings with the landing gear retracted contributes greatly to crew injuries and aircraft damage. The nose-high attitude causes the aircraft to slap the ground, which subjects the crew to possible spinal injuries. Less injury and less aircraft damage will result with the gear extended.

If a Forced Landing is Unavoidable, Proceed as Follows:

1. RAT handle . . . . . PULL (IF REQUIRED)
2. If time and conditions permit, dump and burn down to 800 pounds fuel.
3. Emergency calls. . . . . COMPLETED
4. IFF . . . . . EMERGENCY
5. External stores . . . . . JETTISON IF NECESSARY NEW
6. Landing gear . . . . . DOWN AND LOCKED
7. Flaps/slats . . . . . TAKEOFF/DOWN
   Use emergency flaps/slats if necessary.
8. Helmet . . . . . VISOR DOWN, CHIN STRAP TIGHT
9. Lap belt . . . . . TIGHT
10. Shoulder harness . . . . . LOCKED
11. Make shallow approach.
12. Canopy . . . . . CLOSED OR JETTISON NEW
    If canopy is to be jettisoned, jettison prior to touchdown.

Upon Touchdown:

13. Throttles. . . . . OFF
14. Engine and fuel master switches . . . . OFF
15. Abandon aircraft.

DITCHING

Ditching the aircraft should be the crew's last choice. All survival equipment is carried by the crewmembers and ejection is therefore advisable. However, if altitude and situation demand ditching, the procedures set forth on the ditching chart (figure 5-13) are the fastest and safest way of evacuating the cockpit.

DITCHING CHART

MK GRU-5 SEAT

CREW MEMBER	DUTIES BEFORE IMPACT	DUTIES AFTER IMPACT CANOPY OUT OF WATER	DUTIES AFTER IMPACT AIRCRAFT SINKING WITH CANOPY UNDER WATER
PILOT	1. B/N—ALERT. 2. External stores—JETTISON. 3. Landing Gear—UP. 4. Flap lever—LAND. 5. Arresting hook—DOWN. 6. Helmet visor—DOWN. 7. Oxygen regulator selector valve—100% O_2. 8. Oxygen mask—TIGHTEN. 9. Shoulder harness—LOCKED. 10. Lap belt—TIGHTEN. 11. Connect survival kit yellow lanyard to harley buckle. 12. Canopy—JETTISON. 13. Fly parallel to swell pattern. 14. Attempt touchdown along wave crest. 15. When arresting hook contacts water—SHUT DOWN ENGINES.	1. Canopy—JETTISON (if not jettisoned before impact). 2. Shoulder harness KOCH fittings—RELEASE. 3. Emergency restraint release —PULL UP & AFT. 4. See that B/N is clear of aircraft. 5. Oxygen mask—REMOVE. 6. Stand UP with survival kit. 7. Abandon aircraft and swim clear. Inflate life preserver. 8. Attach survival kit retention fitting to integrated harness survival kit retention strap. 9. Lap belt—OPEN. 10. Release quick-disconnect fitting on forward face of survival kit container and pull out survival kit. 11. Inflate life raft and secure emergency equipment. 12. Tie rafts together.	Underwater ejection should be attempted only if no other means exist. 1. Same as duties after impact canopy out of water. NOTE One side of canopy glass will implode approximately 15 feet under water if cockpit remains watertight.
B/N	1. Acknowledge pilot's ditching order. 2. Make radio distress call. 3. IFF—EMERGENCY. 4. B/N work table—STOW. 5. Helmet visor—DOWN. 6. Oxygen regulator selector valve—100% O_2. 7. Oxygen mask—TIGHTEN. 8. Shoulder harness—LOCKED. 9. Lap belt—TIGHTEN. 10. Connect survival kit yellow lanyard to harley buckle. 11. Seat recline—FULL AFT.	1. Shoulder harness KOCH fittings—RELEASE. 2. Emergency restraint release —PULL UP & AFT. 3. See that pilot is clear of aircraft. 4. Oxygen mask—Remove. 5. Stand up with survival kit. 6. Abandon aircraft and swim clear. Inflate life vest. 7. Attach survival kit retention fitting to integrated harness survival kit retention strap. 8. Lap belt—OPEN. 9. Release quick-disconnect fitting on forward face of survival kit container and pull out survival kit. 10. Inflate life raft and secure emergency equipment. 11. Tie rafts together.	G-ADA1-45-1

Figure 5-13 (Sheet 1)

MK GRU-7 SEAT

CREW MEMBER	DUTIES BEFORE IMPACT	DUTIES AFTER IMPACT CANOPY OUT OF WATER	DUTIES AFTER IMPACT AIRCRAFT SINKING WITH CANOPY UNDER WATER
PILOT	1. B/N—ALERT. 2. External stores—JETTISON. 3. Landing Gear—UP. 4. Flap lever—LAND. 5. Arresting hook—DOWN. 6. Helmet visor—DOWN. 7. Oxygen mask—TIGHTEN. 8. Shoulder harness—LOCKED. 9. Lap belt—TIGHTEN. 10. Canopy—JETTISON. 11. Fly parallel to swell pattern. 12. Attempt touchdown along wave crest. 13. When arresting hook contacts water—SHUT DOWN ENGINES.	1. Emergency Oxygen—Actuate (if breathing difficult) 2. Canopy—Jettison (if not jettisoned before impact). 3. Shoulder harness KOCH fittings—RELEASE. 4. Emergency restraint release —Pull up and aft. 5. See that B/N is clear of aircraft. 6. Stand up with survival kit. 7. Abandon aircraft and swim clear—Inflate life preserver. 8. Actuate survival kit release handle. 9. Inflate life raft and enter. 10. Tie rafts together.	1. Emergency Oxygen—Actuate if breathing difficult. 2. Oxygen Mask—Tighten as much as possible. NOTE Underwater breathing is possible if chest mounted 100% oxygen regulator is near mask level. Exhaling is difficult when regulator is lower than mask. Conversely, inhalation is difficult when regulator is above mask. Water incursion between mask and face will also occur when regulator is above mask. 3. Jettison canopy if canopy prevents egress. NOTE One side of canopy glass will implode approximately 15 feet under water if cockpit remains watertight. 4. Egress Cockpit as detailed in (Canopy out of water) procedure.
B/N	1. Acknowledge pilot's ditching order. 2. Make radio distress call. 3. IFF—EMERGENCY. 4. B/N work table—STOW. 5. Helmet visor—DOWN. 6. Oxygen mask—TIGHTEN. 7. Shoulder harness—LOCKED. 8. Lap belt—TIGHTEN. 9. Seat recline—FULL AFT.	1. Emergency Oxygen—Actuate (if breathing difficult) 2. Canopy—Jettison (if not jettisoned before impact). 3. Shoulder harness KOCH fittings—RELEASE. 4. Emergency restraint release —Pull up and aft. 5. See that pilot is clear of aircraft. 6. Stand up with survival kit. 7. Abandon aircraft and swim clear—Inflate life preserver. 8. Actuate survival kit release handle. 9. Inflate life raft and enter. 10. Tie rafts together.	**UNDERWATER EJECTION PILOT AND B/N** Underwater ejection should be attempted only if no other means exist. 1. Body Position—Move outboard (laterally) in seat as water incursion will push seat and occupant into center canopy beam. 2. Eject with face curtain handle assembly. 3. Immediately after ejection Pull up and aft on Emergency restraint release.

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Figure 5-13 (Sheet 2)

part 6 Ejection/Bailout

MK GRU-5 SEAT

Escape from the aircraft in flight should be made with the ejection seat. The ejection capabilities of the ejection seat are presented in figure 5-14, and the ejection procedure in figure 5-15.

WARNING

If the first crewman ejects through the canopy, the other crewmember must also eject through the canopy. Any attempt to jettison the canopy after one crewmember has ejected may either catch the crewmember as he is penetrating the canopy or arrest the canopy on the telescoped ejection gun of the ejected seat. Either event would result in severe personal injury and/or significantly alter the ejection trajectory, adversely affecting system performance.

EJECTION CAPABILITY CHART

The chart in figure 5-14 presents the capability of the ejection seat for level flight, level dives, various bank angles, and high sink rates. The curves include reaction time and provide the minimum altitudes at which ejection must have been initiated for the various conditions presented.

To determine minimum ejection altitude for a level dive, select the dive attitude curve with desired reaction time, enter at the selected dive angle, proceed vertically to the selected airspeed reflector line, and project horizontally to the minimum altitude. NEW

To find minimum ejection altitude for conditions of high sink rate, select the stall conditions curve with desired reaction time, enter at the selected sink rate, proceed vertically to the selected airspeed reflector line, and project horizontally to the minimum altitude. NEW

To find minimum altitude for high bank angles, enter the adverse attitude curve at the selected angle of bank, proceed vertically to the selected airspeed reflector line, and project horizontally to the minimum altitude. NEW

LOW-ALTITUDE EJECTION

Ejection at low altitudes is accomplished by pulling the nose of the aircraft above the horizon (zoom up maneuver). This maneuver affects the trajectory of the ejection seat and provides a greater increase in altitude than if ejection is performed in a level flight attitude. If the aircraft is in a descending attitude and cannot be pulled out, ejection should not be delayed. When circumstances permit, slow the aircraft before ejection to reduce the forces exerted on the body.

HIGH-ALTITUDE EJECTION

For a high-altitude ejection the basic ejection sequence (figure 5-15) is applicable. The zoom-up maneuver is still useful to slow the aircraft to a safer ejection speed, or to provide more time and more distance, as long as an immediate ejection is not mandatory.

If normal seat separation and personnel parachute deployment does not occur between 10,000 and 14,000 feet, actuate the emergency restraint release, push away from the seat, and pull the parachute ripcord. NEW

MANUAL BAILOUT

WARNING

It is not recommended that manual bailout be considered below 2,000 feet.

Manual bailout from high-performance aircraft is extremely hazardous, even under the most favorable conditions (level flight, slow airspeeds, and optimum altitude), and is considered a last ditch method of escape. However, if the seat cannot be ejected and ditching is not feasible, the following bailout procedures are suggested:

1. Canopy . . . . . JETTISON
2. Trim aircraft for nose-down attitude and pull stick back to establish climbing attitude. Roll inverted maintaining positive g load until inverted.

WARNING

If the aircraft is not controllable, attempt bailout over the side.

3. Emergency restraint release. PULL AND SEPARATE FROM SEAT NEW
4. Once inverted . . . . . RELEASE STICK

When Clear of the Aircraft and Below 10,000 Feet:

5. Parachute ripcord . . . . . PULL

WARNING

If bailout is essential over 10,000 feet, a free fall is a must until an altitude below 10,000 feet is reached, since the emergency oxygen bottle is attached to the seat and oxygen will not be available. As a rule of thumb, 3 to 4 seconds are required to free-fall 1,000 feet.

NORMAL PARACHUTE DESCENT

After Parachute Deployment:

1. Oxygen mask . . . . . REMOVE
2. Attach survival-kit retention fitting to integrated harness survival-kit retention strap.
3. Connect survival-kit yellow lanyard to helicopter hoist ring on integrated torso harness.
4. Life preserver (if water) landing anticipated) . . . . . .INFLATE
5. Upon landing. DISCONNECT BOTH SHOULDER-HARNESS KOCH FITTINGS SIMULTANEOUSLY TO RELEASE PARACHUTE.

Water Landing:

1. Upon landing. DISCONNECT BOTH SHOULDER-HARNESS KOCH FITTINGS SIMULTANEOUSLY TO RELEASE PARACHUTE.
2. Lap belt . . . . . OPEN
3. Survival kit. . . RELEASE AND PULL OUT
   Release survival-kit quick-disconnect fitting on forward face of survival-kit container and pull out survival kit.
4. Life rate (secure emergency equipment). . . . . INFLATE

MK GRU-7 SEAT

Escape from the aircraft in flight should be made with the ejection seat. The ejection capabilities of the ejection seat are presented in figure 5-16 and the ejection procedure in figure 5-17.

WARNING

If the first crewmember ejects through the canopy, the other crewmember must also eject through the canopy. Any attempt to jettison the canopy after one crewmember has ejected may either catch the crewmember as he is penetrating the canopy or arrest the canopy on the extended ejection gun of the ejected seat. Either event would result in severe personal injury and/or significantly alter the ejection trajectory, adversely affecting system performance.

EJECTION CAPABILITY CHART

The chart in figure 5-16 presents the capability of the MK GRU-7 ejection seat for level flight, level dives, various bank angles, and high sink rates. The curves include reaction time and provide the minimum altitudes at which ejection must have been initiated for the various conditions presented.

To determine minimum ejection altitude for a level dive, select the dive attitude curve with desired reaction time, enter at the selected dive angle, proceed vertically to the selected airspeed reflector line, and project horizontally to the minimum altitude. NEW

To find minimum ejection altitude for conditions of high sink rate, select the stall conditions curve with desired reaction time, enter at the selected sink rate, proceed vertically to the selected airspeed reflector line, and project horizontally to the minimum altitude. NEW

To find minimum altitude for high bank angles, enter the adverse attitudes curve at the selected angle of bank, proceed vertically to the selected airspeed reflector line, and project horizontally to the minimum altitude. NEW

LOW-ALTITUDE EJECTION

Ejection at low altitudes is accomplished by pulling the nose of the aircraft above the horizon (zoom-up maneuver). This maneuver affects the trajectory of the ejection seat and provides a greater increase in altitude than if ejection is performed in a level flight altitude. If the aircraft is in a descending attitude and cannot be pulled out, ejection should not be delayed. When circumstances permit, slow the aircraft prior to ejection to reduce the forces exerted on the body. See figure 5-16 for ejection capabilities.

HIGH-ALTITUDE EJECTION

For a high-altitude ejection, the basic ejection procedure (figure 5-17) is applicable. The zoom-up maneuver is still useful to slow the aircraft to a safer ejection speed, or to provide more time and more distance, as long as an immediate ejection is not mandatory.

If normal seat separation and personnel parachute deployment does not occur between 11,500 and 14,500 feet, actuate the emergency restraint release, push away from the seat, and pull the personnel parachute ripcord. NEW

MANUAL BAILOUT

WARNING

It is not recommended that manual bailout be considered below 2,000 feet.

Manual bailout from high-performance aircraft is extremely hazardous, even under the most favorable conditions (level flight, slow airspeeds, and optimum

EJECTION CAPABILITY

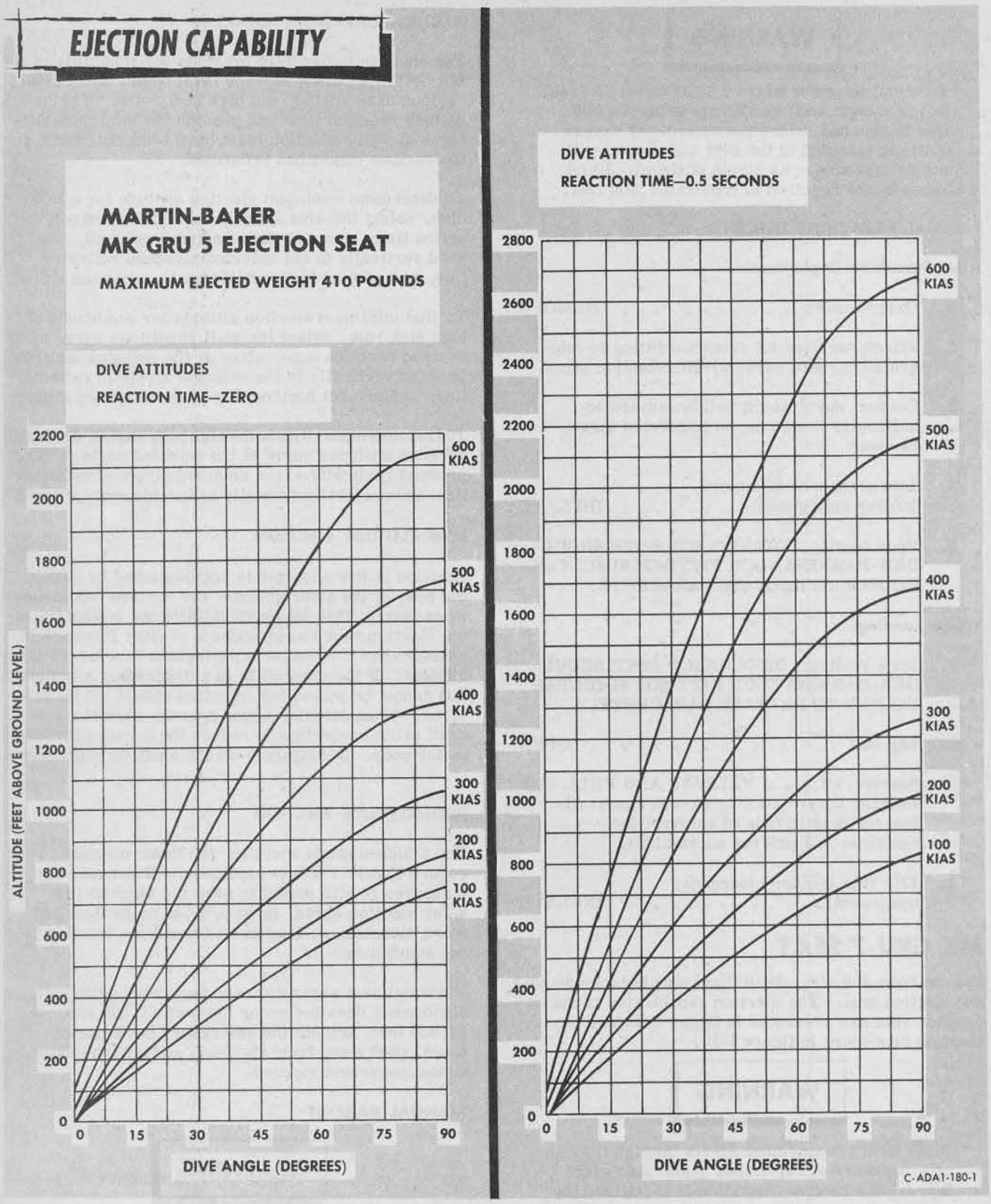

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Figure 5-14 (Sheet 1)

EJECTION CAPABILITY CONT'D

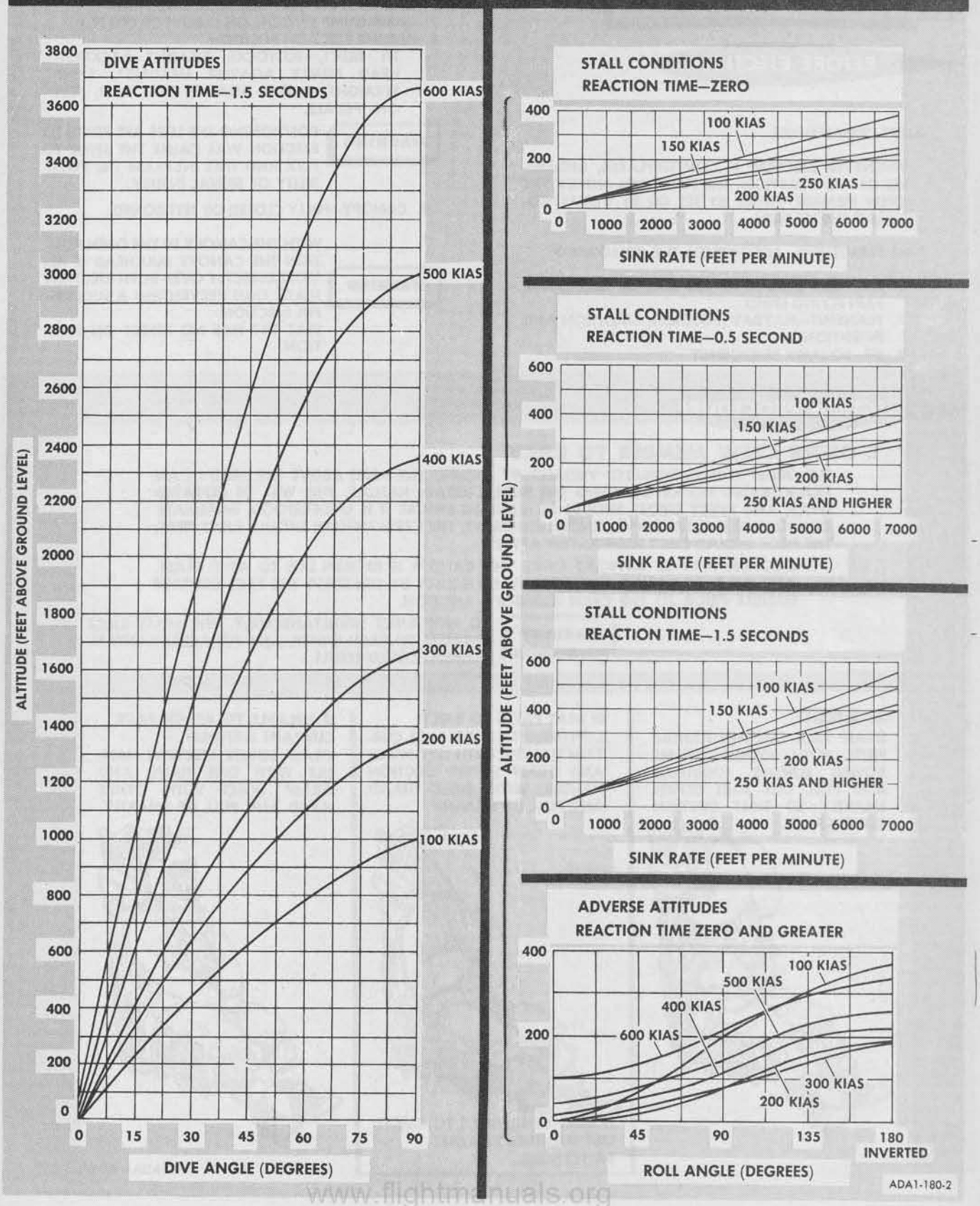

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Figure 5-14 (Sheet 2)

EJECTION

BEFORE EJECTION

ALERT CREW MEMBER.

WHENEVER EJECTION IS CONTEMPLATED, REGARDLES OF THE SITUATION, THE PILOT WILL NOTIFY THE CREW MEMBER, EITHER BY ICS OR BY VISUAL SIGNALS IF THE ICS FAILS.

TIME PERMITTING, ACCOMPLISH THE FOLLOWING:

1. AIRSPEED—REDUCE TO 220 KIAS OR LESS, MAINTAIN FLYING SPEED
2. TRANSMIT—MAYDAY (POSITION, SITUATION AND INTENTION)
3. IFF—SQUAWK EMERGENCY
4. HELMET, CHIN STRAPS—TIGHT, VISOR—DOWN
5. OXYGEN MASK—TIGHT
6. HARNESS PROPERLY ADJUSTED AND TIGHT
7. CABIN DUMP SWITCH—ON (ABOVE 30,000 FT.)
8. ASSUME EJECTION POSITION
   SIT ERECT, BUTTOCKS AGAINST BACKREST, HEAD FIRMLY AGAINST HEADREST, SPINE STRAIGHT, THIGHS AGAINST SEAT PAN, FEET ON PEDALS.

WARNING POSITIONING THE LEGS AFT PRIOR TO EJECTION WILL CAUSE THE SPINE TO FLEX AND WILL INCREASE THE POSSIBILITY OF SPINAL INJURY.

9. CANOPY—FULLY CLOSED OR JETTISONED.

WARNING WITH THE CANOPY IN THE OPEN POSITION THE CANOPY BULKHEAD IS ALMOST DIRECTLY OVER BOTH EJECTION SEATS, THUS PREVENTING A SUCCESSFUL EJECTION.
SEAT TILT HAS NO EFFECT ON EJECTION.

EJECTION PROCEDURE

1. ORDER CREW MEMBER TO EJECT.

THE ORDER WILL BE SIGNALED VISUALLY BY RAISING THE ARMS ABOVE THE HEAD IN AN EXAGGERATED ACT OF GRASPING THE FACE CURTAIN HANDLE. THIS WILL BE REPEATED TWICE, AND EVERY EFFORT SHOULD BE MADE TO ENSURE IT IS UNDERSTOOD. IMMEDIATE COMPLIANCE IS SUFFICIENT ACKNOWLEDGEMENT. THE CREW MEMBER SHOULD EJECT FIRST; THE PILOT SHOULD EJECT IMMEDIATELY AFTER.

EJECTION MAY BE DIFFICULT ONCE THE CANOPY IS BROKEN DUE TO WIND BLAST, AND THE PILOT SHOULD MINIMIZE THIS DIFFICULTY BY GRASPING THE FACE CURTAIN HANDLE PRIOR TO THE CREW MEMBER'S EJECTION.

WARNING DO NOT EJECT SIMULTANEOUSLY. THE SEATS EJECT PARALLEL TO EACH OTHER, AND PARACHUTE ENTANGLEMENT COULD RESULT.

2. EJECT

GRASP FACE CURTAIN HANDLE WITH BOTH HANDS (PALMS DOWN) ELBOWS TOGETHER, AND PULL OUT AND DOWN SMARTLY SO THAT CURTAIN COVERS FACE.

IF SEAT FAILS TO EJECT:
CONTINUE TO HOLD FACE CURTAIN HANDLE WITH LEFT HAND AND GRASP LOWER EJECTION HANDLE WITH RIGHT HAND AND PULL UP SMARTLY.

IF SEAT STILL FAILS TO EJECT:
USE MANUAL BAILOUT PROCEDURE.

IF UNABLE TO REACH FACE CURTAIN HANDLE:
GRASP LOWER EJECTION HANDLE WITH ONE HAND AND GRASP WRIST WITH OTHER HAND AND PULL UP SMARTLY.

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Figure 5-15 (Sheet 1)

AFTER EJECTION

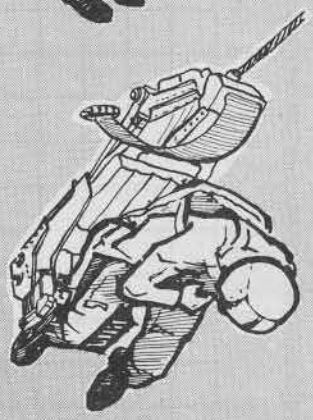
MK GRU-5 SEAT

IF SEAT FAILS TO SEPARATE:

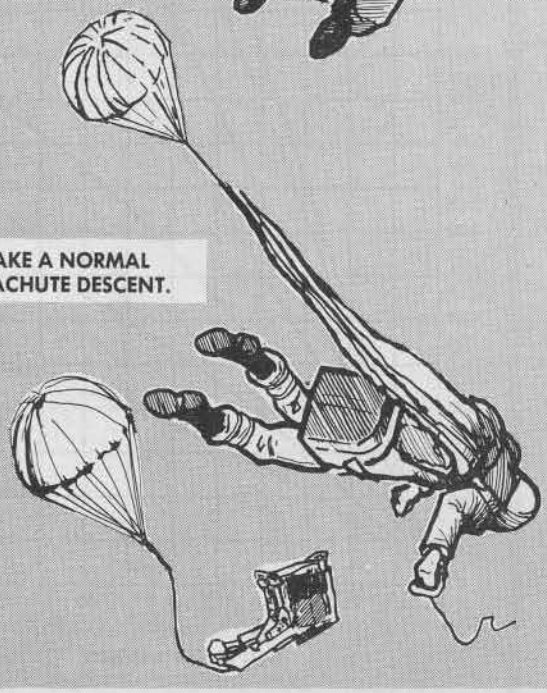
1. RIGHT HAND: GRASP EMERGENCY RESTRAINT RELEASE —PULL UP AND AFT.

2. THROW FACE CURTAIN UPWARD AND REARWARD.

3. PLACE HANDS ON SIDE OF SEAT BUCKET AND PITCH FORWARD AND DOWNWARD OUT OF SEAT, PUSHING SEAT CLEAR IF NECESSARY.



4. RIGHT HAND: GRASP PARACHUTE RIPCORD—PULL DOWNWARD AND TO RIGHT SIDE OF BODY.



5. MAKE A NORMAL PARACHUTE DESCENT.

NORMAL PARACHUTE DESCENT

1. OXYGEN MASK—REMOVE.
2. ATTACH SURVIVAL-KIT RETENTION FITTING TO INTEGRATED HARNESS SURVIVAL KIT RETENTION STRAP.
3. CONNECT SURVIVAL-KIT YELLOW LANYARD TO HELICOPTER HOIST RING ON THE INTEGRATED TORSO HARNESS.
4. INFLATE LIFE PRESERVER (IF WATER LANDING ANTICIPATED.
5. DISCONNECT KOCH FITTINGS AFTER LANDING.

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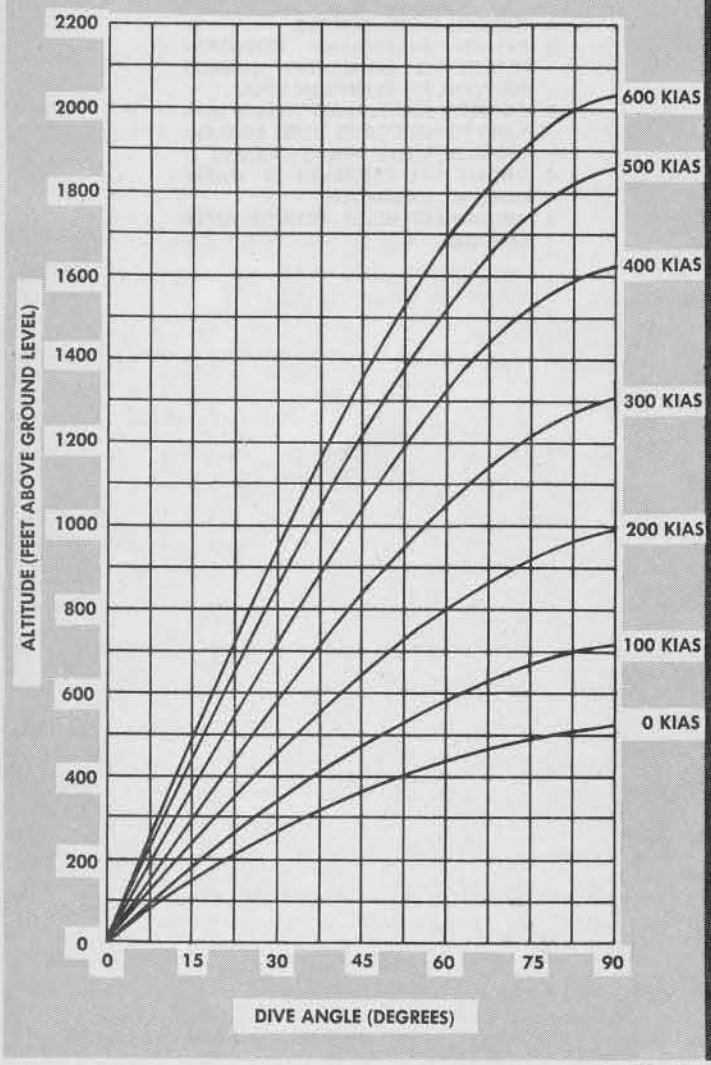
Figure 5-15 (Sheet 2)

EJECTION CAPABILITY

MARTIN-BAKER
MK GRU-7 EJECTION SEAT

MAXIMUM EJECTED WEIGHT 475 POUNDS
CREW MEMBERS UNCLOTHED
WEIGHT 205 POUNDS

DIVE ATTITUDES
REACTION TIME—ZERO



NOTE

THESE CURVES INCLUDE THE EFFECTS OF ROCKET MOTOR DIVERSIONS. ZERO SPEED CURVES DO NOT ACCOUNT FOR THE EFFECTS OF GROUND WIND

DIVE ATTITUDES
REACTION TIME—0.5 SECOND

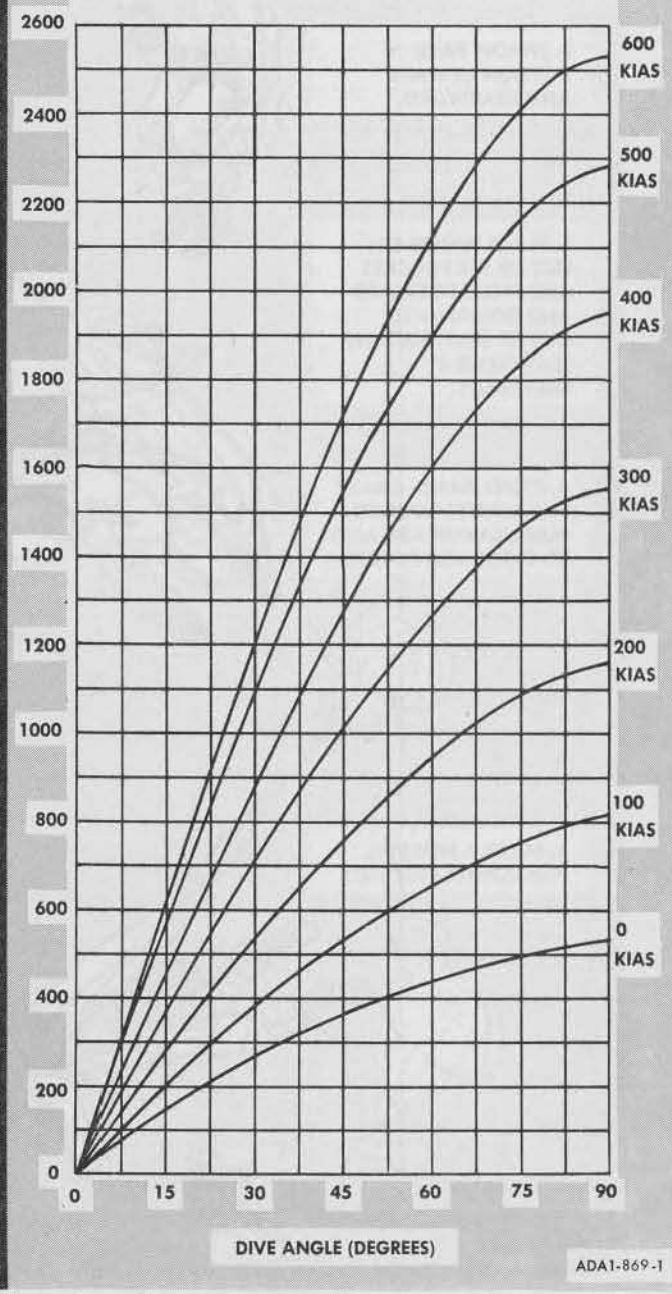


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Figure 5-16 (Sheet 1)

EJECTION CAPABILITY CONT'D

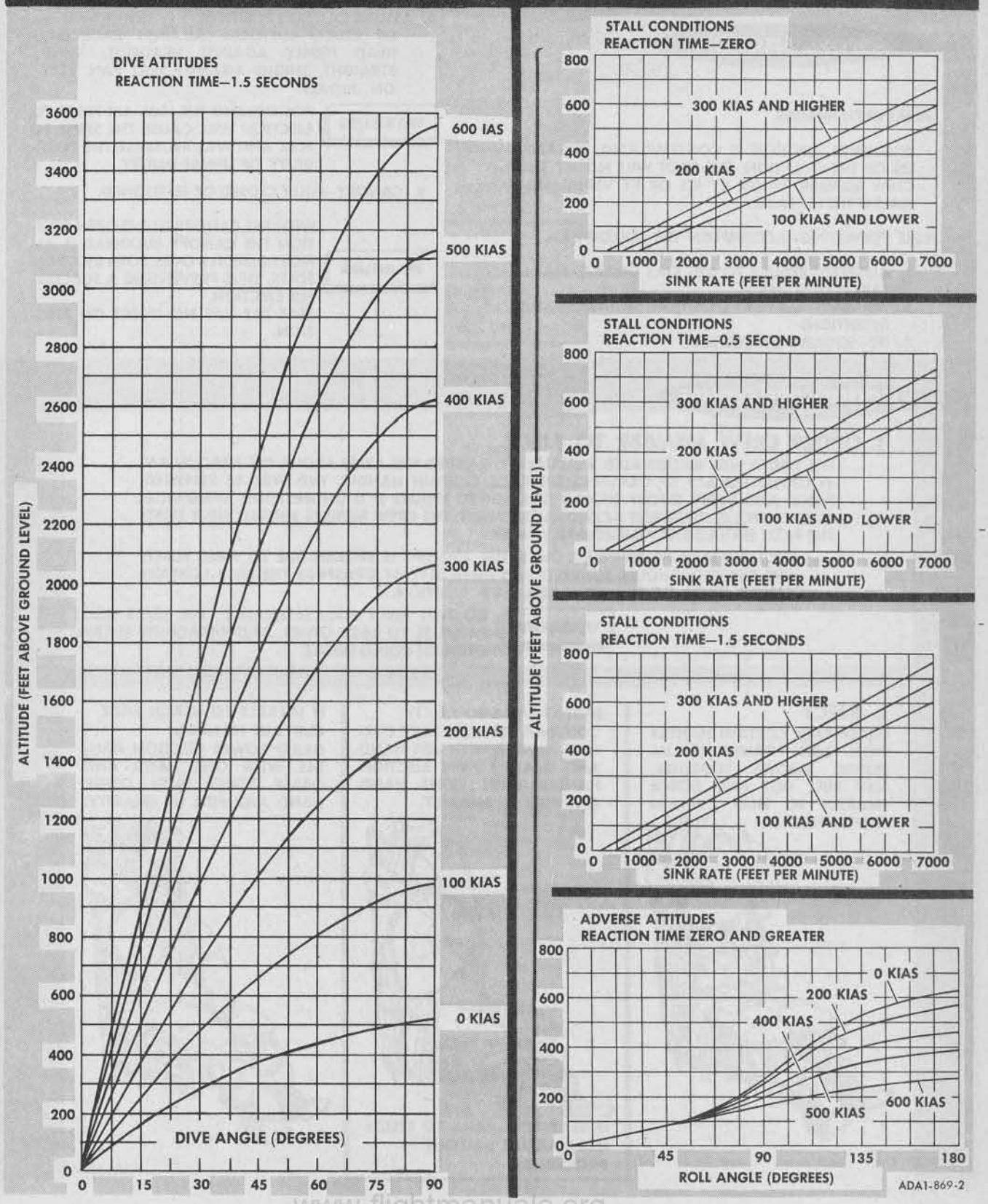

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Figure 5-16 (Sheet 2)

EJECTION

BEFORE EJECTION

ALERT CREW MEMBER.

WHENEVER EJECTION IS CONTEMPLATED, REGARDLES OF THE SITUATION, THE PILOT WILL NOTIFY THE CREW MEMBER, EITHER BY ICS OR BY VISUAL SIGNALS IF THE ICS FAILS.

TIME PERMITTING, ACCOMPLISH THE FOLLOWING:

1. AIRSPEED—REDUCE TO 220 KIAS OR LESS, MAINTAIN FLYING SPEED
2. TRANSMIT—MAYDAY (POSITION, SITUATION AND INTENTION)
3. IFF—SQUAWK EMERGENCY
4. HELMET, CHIN STRAPS—TIGHT, VISOR—DOWN
5. OXYGEN MASK—TIGHT
6. HARNESS PROPERLY ADJUSTED AND TIGHT
7. CABIN DUMP SWITCH—ON (ABOVE 30,000 FT.)
8. ASSUME EJECTION POSITION
   SIT ERECT, BUTTOCKS AGAINST BACKREST, HEAD FIRMLY AGAINST HEADREST, SPINE STRAIGHT, THIGHS AGAINST SEAT PAN, FEET ON PEDALS.

WARNING POSITIONING THE LEGS AFT PRIOR TO EJECTION WILL CAUSE THE SPINE TO FLEX AND WILL INCREASE THE POSSIBILITY OF SPINAL INJURY.

9. CANOPY—FULLY CLOSED OR JETTISONED.

WARNING WITH THE CANOPY IN THE OPEN POSITION THE CANOPY BULKHEAD IS ALMOST DIRECTLY OVER BOTH EJECTION SEATS, THUS PREVENTING A SUCCESSFUL EJECTION.
SEAT TILT HAS NO EFFECT ON EJECTION.

EJECTION PROCEDURE

1. ORDER CREW MEMBER TO EJECT.

THE ORDER WILL BE SIGNALED VISUALLY BY RAISING THE ARMS ABOVE THE HEAD IN AN EXAGGERATED ACT OF GRASPING THE FACE CURTAIN HANDLE. THIS WILL BE REPEATED TWICE, AND EVERY EFFORT SHOULD BE MADE TO ENSURE IT IS UNDERSTOOD. IMMEDIATE COMPLIANCE IS SUFFICIENT ACKNOWLEDGEMENT. THE CREW MEMBER SHOULD EJECT FIRST; THE PILOT SHOULD EJECT IMMEDIATELY AFTER.

EJECTION MAY BE DIFFICULT ONCE THE CANOPY IS BROKEN DUE TO WIND BLAST, AND THE PILOT SHOULD MINIMIZE THIS DIFFICULTY BY GRASPING THE FACE CURTAIN HANDLE PRIOR TO THE CREW MEMBER'S EJECTION.

WARNING DO NOT EJECT SIMULTANEOUSLY. THE SEATS EJECT PARALLEL TO EACH OTHER, AND PARACHUTE ENTANGLEMENT COULD RESULT.

2. EJECT

GRASP FACE CURTAIN HANDLE WITH BOTH HANDS (PALMS DOWN) ELBOWS TOGETHER, AND PULL OUT AND DOWN SMARTLY SO THAT CURTAIN COVERS FACE.

IF SEAT FAILS TO EJECT:
CONTINUE TO HOLD FACE CURTAIN HANDLE WITH LEFT HAND AND GRASP LOWER EJECTION HANDLE WITH RIGHT HAND AND PULL UP SMARTLY.

IF SEAT STILL FAILS TO EJECT:
USE MANUAL BAILOUT PROCEDURE.

IF UNABLE TO REACH FACE CURTAIN HANDLE:
GRASP LOWER EJECTION HANDLE WITH ONE HAND AND GRASP WRIST WITH OTHER HAND AND PULL UP SMARTLY.

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Figure 5-17 (Sheet 1)

AFTER EJECTION

MK GRU-7 SEAT

IF SEAT FAILS TO SEPARATE:

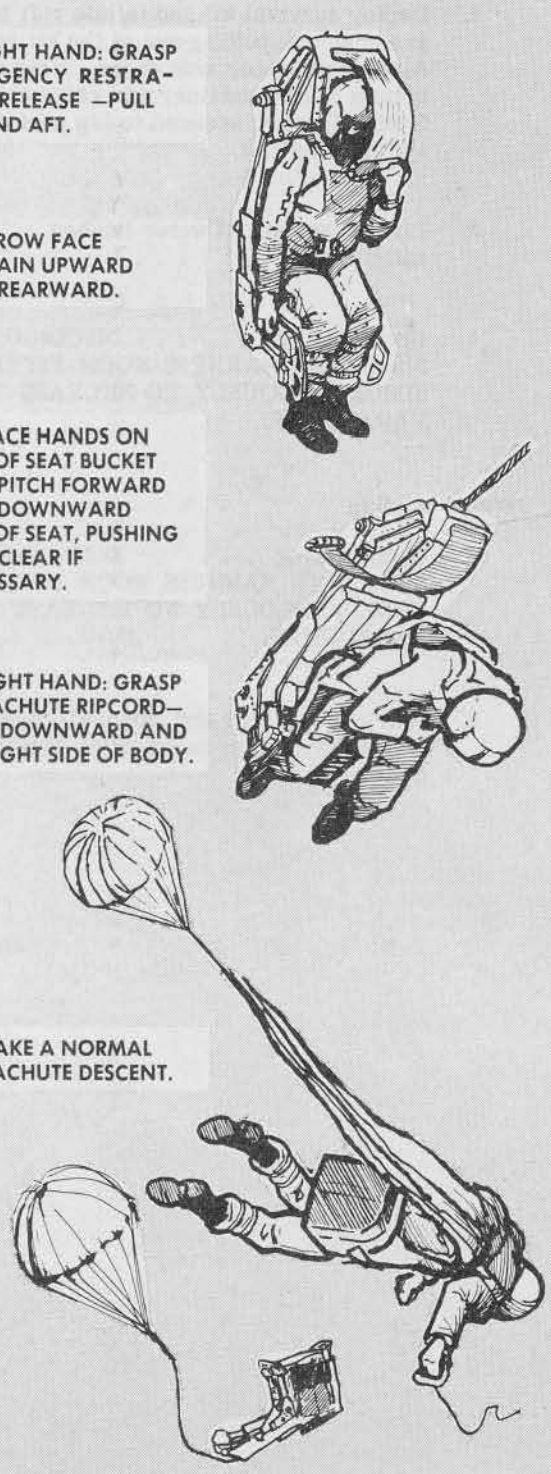
1. RIGHT HAND: GRASP EMERGENCY RESTRAINT RELEASE —PULL UP AND AFT.

2. THROW FACE CURTAIN UPWARD AND REARWARD.

3. PLACE HANDS ON SIDE OF SEAT BUCKET AND PITCH FORWARD AND DOWNWARD OUT OF SEAT, PUSHING SEAT CLEAR IF NECESSARY.

4. RIGHT HAND: GRASP PARACHUTE RIPCORD—PULL DOWNWARD AND TO RIGHT SIDE OF BODY.

5. MAKE A NORMAL PARACHUTE DESCENT.



NORMAL PARACHUTE DESCENT

1. OXYGEN MASK—REMOVE IF DESIRED.
2. DEPLOY SURVIVAL KIT AND INFLATE RAFT BY PULLING RELEASE HANDLE ON EITHER SIDE IF DESIRED
3. INFLATE LIFE PRESERVER (IF WATER LANDING ANTICIPATED).
4. DISCONNECT KOCH FITTINGS AFTER LANDING.

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Figure 5-17 (Sheet 2)

altitude), and is considered at last-ditch method of escape. However, if the seat cannot be ejected and ditching is not feasible, the following bailout procedures are suggested.

1. Canopy . . . . . JETTISON

2. Trim aircraft for nose-down attitude and pull stick back to establish climbing attitude. Roll inverted maintaining positive g load until inverted.

WARNING

If the aircraft is not controllable, attempt bailout over the side.

3. Emergency restraint release . . . PULL AND SEPARATE FROM SEAT

4. Once inverted . . . . . RELEASE STICK/ PUSH CLEAR OF AIRCRAFT

When Clear of the Aircraft and Below 10,000 Feet:

5. Parachute ripcord . . . . . PULL

WARNING

If bailout is essential over 15,000 feet, a free fall should be made until an altitude below 15,000 feet is reached, since parachute opening shock increases with altitude. As a rule of thumb, 3 to 4 seconds are required to free fall 1,000 feet.

NORMAL PARACHUTE DESCENT

After Parachute Deployment

1. Oxygen mast . . . . REMOVE AS DESIRED

2. Deploy survival kit and inflate raft by grasping and pulling one of the kit release handles on either side of kit. This releases bottom of kit container and raft, which hang from a lanyard secured to top part of kit, and inflates raft.

3. Life preserver (if water landing anticipated) . . . . . INFLATE

4. Upon landing . . . . . DISCONNECT BOTH SHOULDER HARNESS KOCH FITTINGS SIMULTANEOUSLY TO RELEASE THE PARACHUTE.

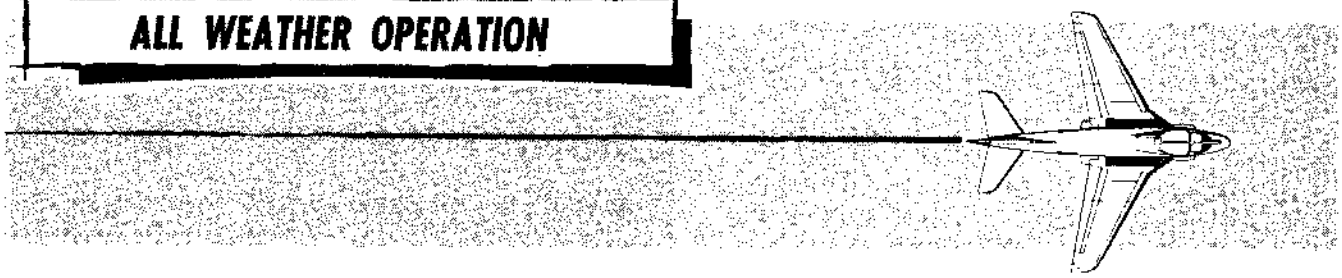
Water Landing

1. Upon landing . . . . . DISCONNECT BOTH SHOULDER HARNESS KOCH FITTINGS SIMULTANEOUSLY TO RELEASE THE PARACHUTE.

2. Retrieve life raft and survival-kit container bottom by pulling on retention lanyard, and board raft.

section VI

ALL WEATHER OPERATION



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Cold Weather Procedures 6-7
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INSTRUMENT FLIGHT PROCEDURES

In accordance with the OPNAV instruction 3710.7 series, the A-6 is considered a multipiloted aircraft for instrument flight, provided both seats are occupied by currently qualified A-6 flight crewmembers.

The following procedures are general approach techniques which are modified to reflect the specific techniques used for this aircraft. Standard navigational aids include TACAN and UHF-ADF. IFF and SIF are used for radar identification. An automatic flight control system can be used to alleviate pilot fatigue.

FLIGHT PLANNING

Clearance delays, prolonged operation at low altitudes and low airspeeds, and holding and stacking, demand a more critical approach to flight planning than would be necessary to VFR conditions. Particular attention should be paid to flight information publication and NOTAMS, and you should be thoroughly familiar with the weather and its possible changes at your destination and alternates.

Before entering the aircraft, a thorough preflight should be performed emphasizing any particular procedures needed for the existing weather conditions. If in icing conditions or if icing is anticipated, turn pitot heat and engine anti-icing on. Icing can occur in haze conditions. Engine anti-icing causes a negligible loss of engine thrust.

INSTRUMENT TAKEOFF

Before Taxi

1. Determine that UHF communications channels are preset for tower control, departure control, FAA frequencies, etc.

NEW 2. Check TACAN for proper channel operation.

Before Instrument Takeoff

Steps 1 and 2 are performed if climb-out through precipitation or clouds is anticipated.

1. Engine anti-ice switch - ON
2. Pitot heat switch - ON
3. Rain-removal system - CHECK

Note

The rain removal system may be checked by actuating the windshield switch to the AIR position or by holding your hand over the top of the windscreen to feel the hot air. Turn the windshield air off as soon as possible to prevent cracking the windshield. If unable to turn off hot air, secure the engines as soon as possible.

4. Attitude references - ADJUST
5. Proper checkpoints are inserted in computer
6. HSI heading set and course set - AS REQUIRED
7. Takeoff check list - COMPLETE

Instrument Takeoff and Transition

1. Align aircraft with runway and check VDI and HSI
2. Computer - AS DESIRED
3. Use nosewheel steering until 70 KIAS.
4. At lift-off speed, rotate aircraft approximately 8° to 10° nose up.

5. Establish a positive rate of climb and raise landing gear.
6. Maintain positive rate of climb as flaps are raised (above 170 KIAS).
7. Upon flaps/slats retraction, rotate to 8° to 12° nose-up attitude.

Note

- If possible, turns should be avoided until 250 KIAS, or 1,000 feet is reached. All turns should be limited to 30° of bank.
- If local course rules dictate an immediate turn after takeoff, make a flaps down turn commencing not lower than 300 feet AGL.

INSTRUMENT CLIMB

Depending on FAA, and other operating restrictions, a simplified climb schedule as outlined below may be used. However, for accurate climb schedules versus gross weight and aircraft configuration, refer to the climb charts in Section XI, Performance Data.

1. Maintain 8° to 12° nose-up attitude until reaching 310 KIAS.
2. Vary pitch attitude as necessary to maintain 310 KIAS until reaching cruise mach.
3. Vary pitch attitude as necessary to maintain cruise mach to cruise altitude.

For best fuel economy, military power should be used throughout the climb. Mach number should be closely monitored to preclude the necessity for adverse pitch changes due to mach effect (.84 to .92 IMN).

When in the clear, or on top:

4. Engine anti-ice switch - OFF
5. Pitot heat switch - OFF

INSTRUMENT CRUISING FLIGHT

After leveling off from climb:

1. Establish cruise mach number.
2. Adjust power.
3. Adjust VDI pitch trim markers for level flight.

Turns

Instrument turns should be limited to 30° of bank. Store loading will effect the response characteristic of the aircraft in turns; however, awareness of this characteristic is sufficient to eliminate any over-controlling. Half-standard rate turns, (approximately 30° angle of bank), are recommended above 19,000 feet.

Steep turns should be avoided if possible. If a steep turn is necessary, anticipation of the aircraft reaction becomes most important to retaining precise control. Bear in mind that the gyro may precess in steep turns and that airspeed and pitch should be closely monitored throughout.

HOLDING

Holding patterns may be flown at most altitudes at approximately 230 KIAS. For more accurate holding speeds, refer to the maximum endurance charts in Section XI. Turns should be limited to 30° bank (one needle width) in the pattern.

INSTRUMENT DESCENT

1. Destination WX . . . . . CHECK
2. Altimeter . . . . . CHECK AND RECORD
3. Refile. . . . . AS NECESSARY
4. Penetration check list
   a. Defog (5 min prior to descent) . . . . . ON
   b. Engine anti-ice/ pitot heat . . . . . ON (AS NECESSARY)
   c. Fuel. . . . . DUMP AS NECESSARY
   d. Altimeter . . . . . SET PASSING FL 180

INSTRUMENT APPROACHES

Typical patterns on instrument approaches appear in figures 6-1 through 6-5. Adjust final approach speeds as necessary for a safe approach. Airspeed and configuration should be set up prior to descent on final. Do not begin lowering the gear or the flaps/slats above 250 KIAS. Lower the gear first, followed by the flaps/slats, allowing the airspeed to drop off to 150 KIAS after flaps/slats extension. If it becomes necessary to use engine anti-ice during the approach, allow for the slight reduction of power, which results because of tapping compressor bleed air for the anti-ice system. The aircraft handles well through all speeds in the approach with adequate stall warning if a stall condition should arise. In the event of a missed approach, apply military thrust, retract the speedbrakes and retract the gear as soon as level-off is achieved. When the airspeed reaches 170 knots, retract the flaps. Continue the missed approach as directed, being careful not to exceed the missed approach altitude or to build up excessive airspeed. Establish a climb at 250 KIAS and limit turns to 30° of bank.

GCA APPROACHES

1. Descend to GCA pickup altitude and maintain 250 KIAS. With gear and flaps down, fly pattern at 18 units angle of attack (3:30 position on indicator).

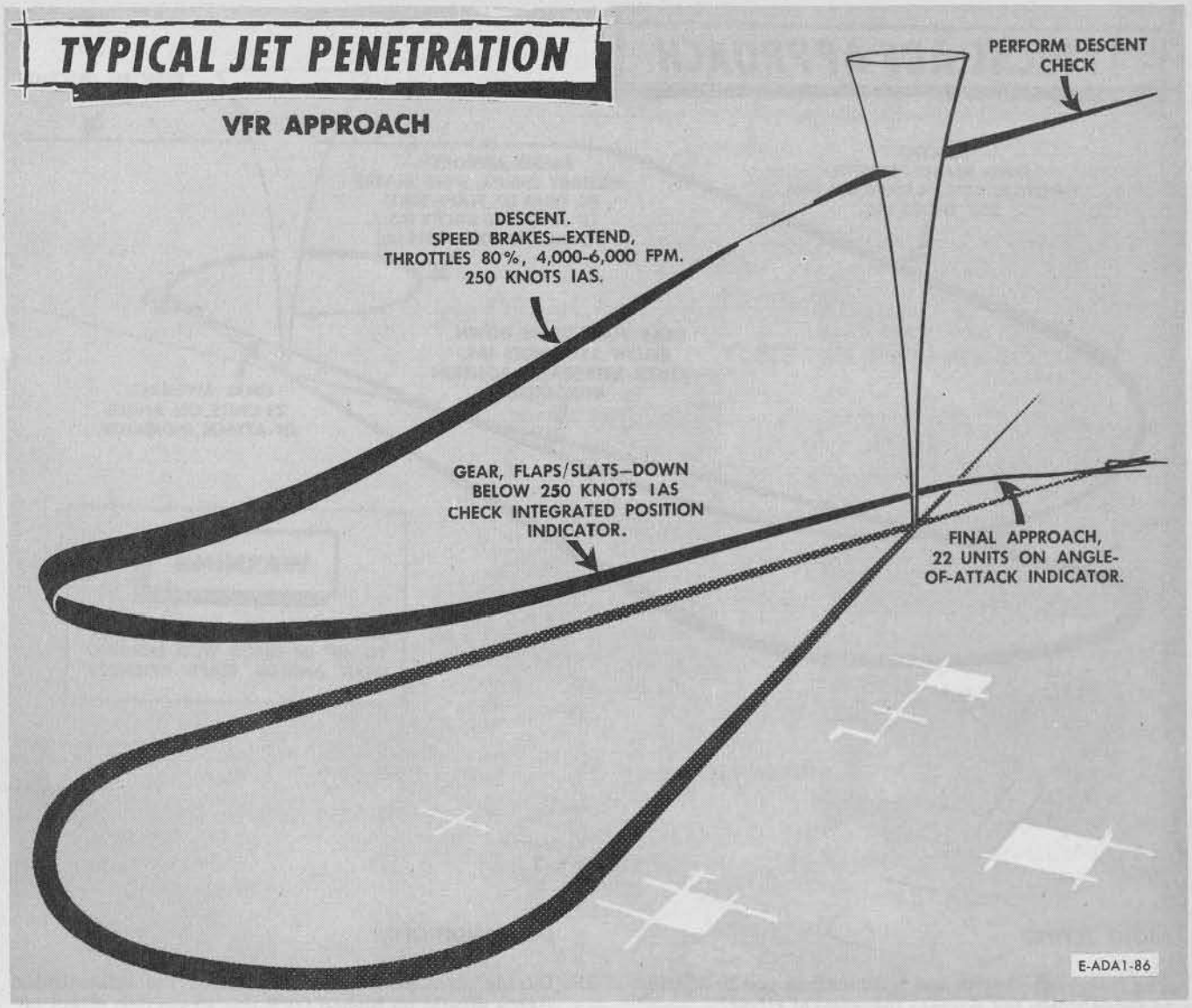

Figure 6-1

2. Execute all turns at full standard rate (not to exceed 30° angle of bank) except when on final, then do not exceed 15° angle of bank.

3. Maintain 22 units angle of attack or donut airspeed (as computed for aircraft gross weight) on final approach. Approaching glide path, reduce power and adjust speedbrakes as necessary to maintain 500 to 700 fpm rate of descent.

NEW

LANDING MODE APPROACHES (TYPICAL RADAR RECOVERY)

1. The optimum starting point for a landing mode approach is at 1500 feet above field elevation 4 nmi from touchdown. This effects a 3 1/2° glide slope. Arrival at the 4-mile point can be varied to suit terrain and/or circumstances, but the pilot must have completed the transition to a landing configuration and the B/N should have acquired a lock-on prior to this point.

2. Maintain a donut on angle-of-attack indicator.

3. Fly the aircraft to the desired point in space by following the VDI.

4. When VDI pathway is the proper width, retard power to establish a rate of descent to keep the aircraft on the glide slope.

5. Adjust power as necessary to fly the VDI presentation.

NEW

A straight-in radar or TACAN penetration followed by a CGA or LANDING mode approach will require approximately 700 pounds of fuel. A missed approach, followed by a second final approach requires approximately 800 pounds of fuel. See figure 6-4 for typical radar recovery.

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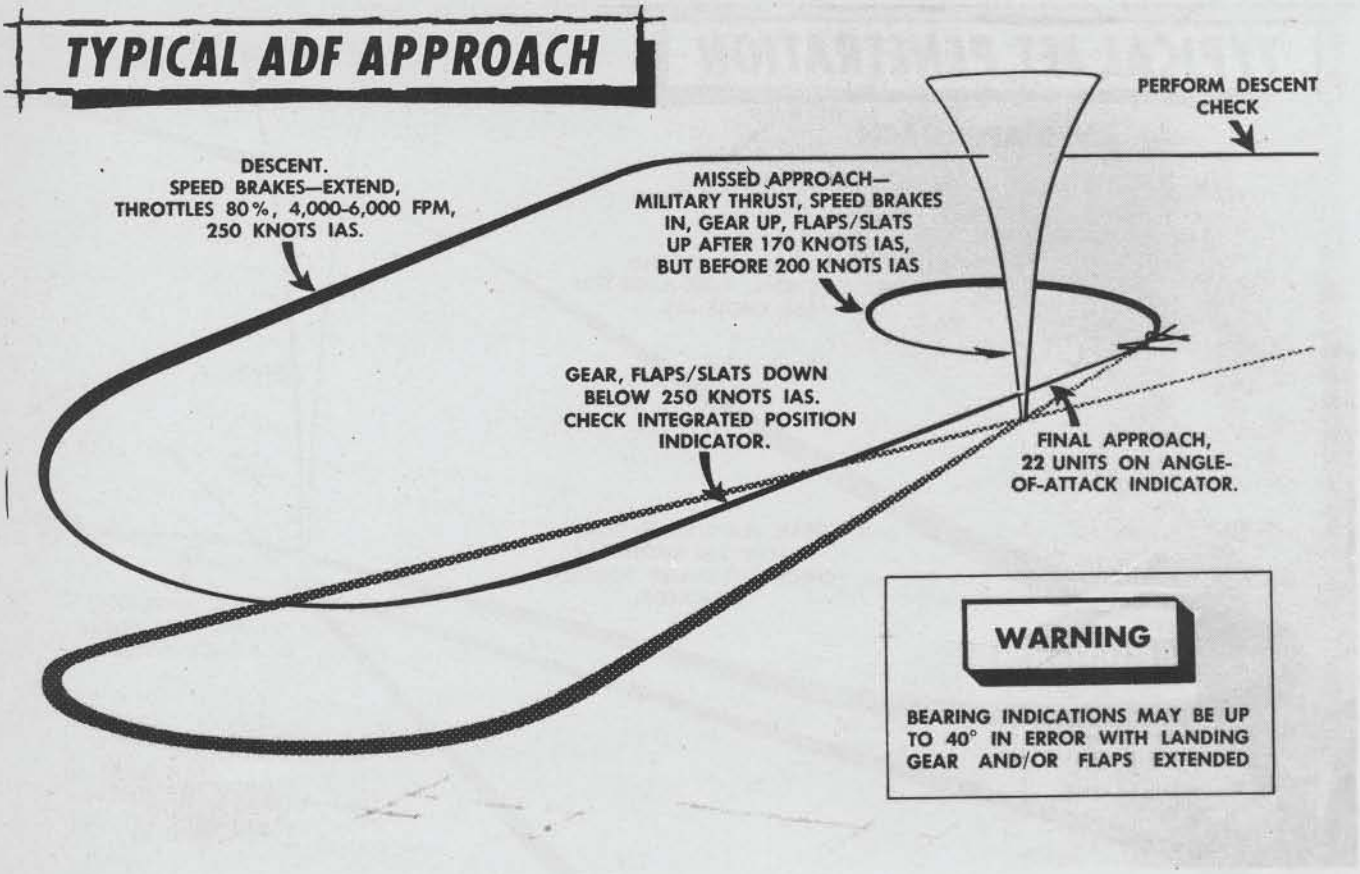

Figure 6-2

NIGHT FLYING

The following checks and information are in addition to those given for normal instrument flight.

On entering aircraft:

1. Interior lighting - ADJUST

Note

For night catapult launches, place instrument panel emergency floodlights to DIM to provide instrument panel lighting if normal instrument lights fail.

2. Emergency floodlights - CHECK
3. Navigation and exterior lights - CHECK
4. Flashlight - CHECK

VFR CONDITIONS

1. Exterior lights - BRIGHT
2. Anticollision lights - ON

During formation flights, set lights as desired.

IFR CONDITIONS

During night instrument conditions, the anticollision lights should be turned OFF due to vertigo effect of flashing light reflections from surrounding clouds.

ICE AND RAIN

ICING

Icing conditions should be avoided whenever possible. Before flight, check freezing levels and areas of probable icing from weather service. If ice starts to form on the windshield or wing leading edge, proceed as follows:

1. Pitot heat switch . . . . . ON
2. Engine anti-ice switch. . . . . ON
3. Defog switch . . . . . ON
4. Altitude . . . . . CHANGE AS REQUIRED

   Climb or descend to an altitude where icing does not exist.

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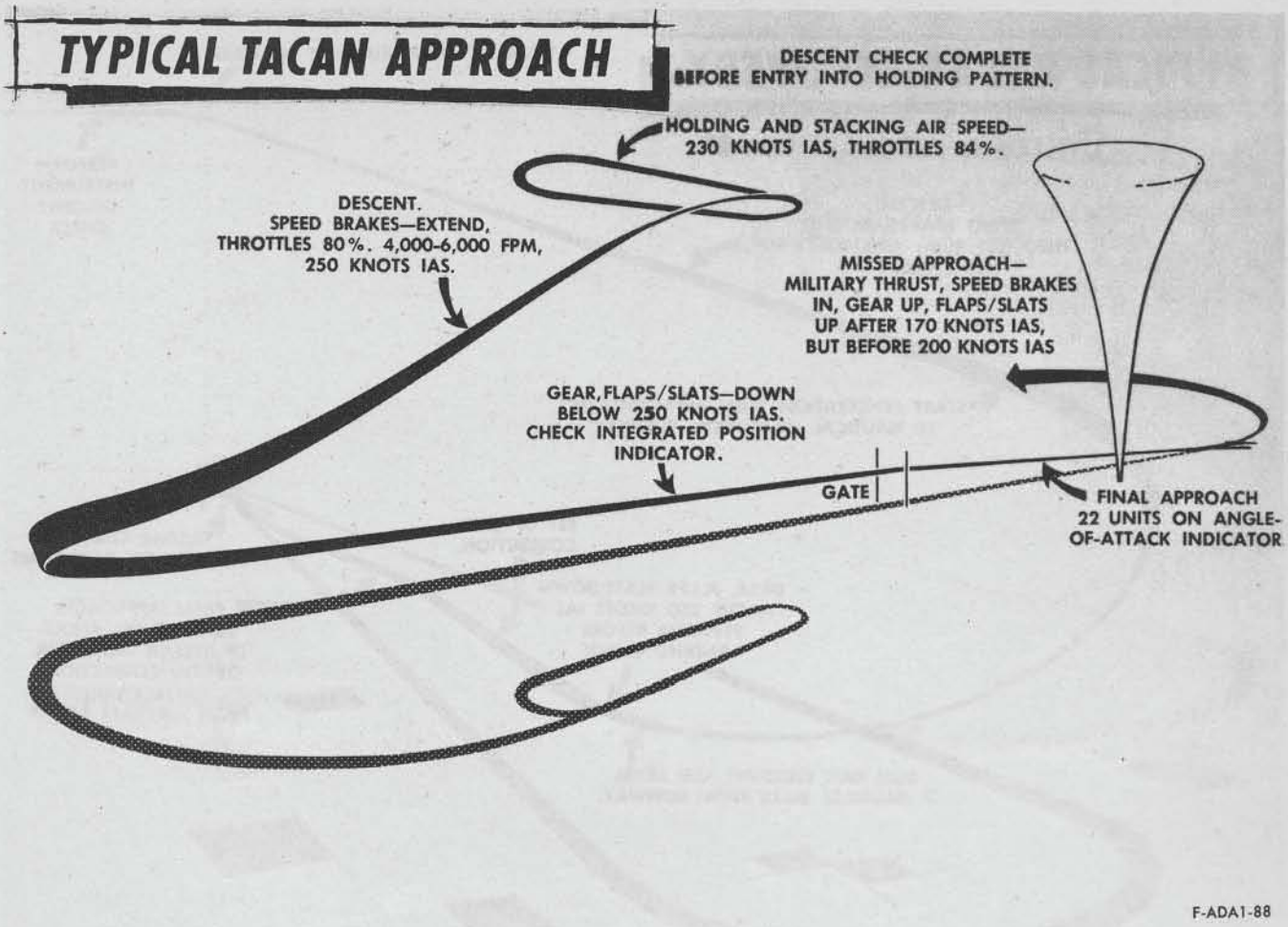

Figure 6-3

NEW NEW

Note

When a descent through severe icing conditions becomes necessary, the descent should be accomplished with the aircraft held at mach 0.80 and the throttles adjusted to 90% or greater (engine anti-ice on).

5. Engine instruments. . MONITOR FREQUENTLY

   Carefully monitor tachometer and exhaust temperature indicator, as a reduction of rpm or an increase in exhaust temperature accompanied by a loss of thrust is an indication of engine icing.

Note

If exhaust temperature increases with loss of thrust, the throttle should be retarded as a low airspeed and high engine speed are conductive to engine icing.

A low approach into an area of icing should be considered an emergency approach. If there is any ice accumulation on the aircraft, an effort should be made to eliminate the ice before descending. Remember that using the engine anti-ice system results in a slight power loss due to a compressor bleed tap, which furnishes air for the system. An approach flown with an ice accumulation plus a slight power loss becomes doubly critical. You should be aware of these factors affecting flight.

Note

Engine anti-ice should be used whenever operating in conditions of visible moisture in the outside air.

RAIN

Whenever rain is encountered and icing is possible, use engine and pitot anti-ice as necessary.

WINDSHIELD RAIN REMOVAL

CAUTION

Operation of the rain-removal system is not recommended on a dry windshield. Use of the system on a dry windshield could result in:

1. Foreign materials being baked on the glass.
2. Above 200 KIAS, windshield distortion and failure.

Windshield rain removal has been found to be marginal when flying through moderate to heavy

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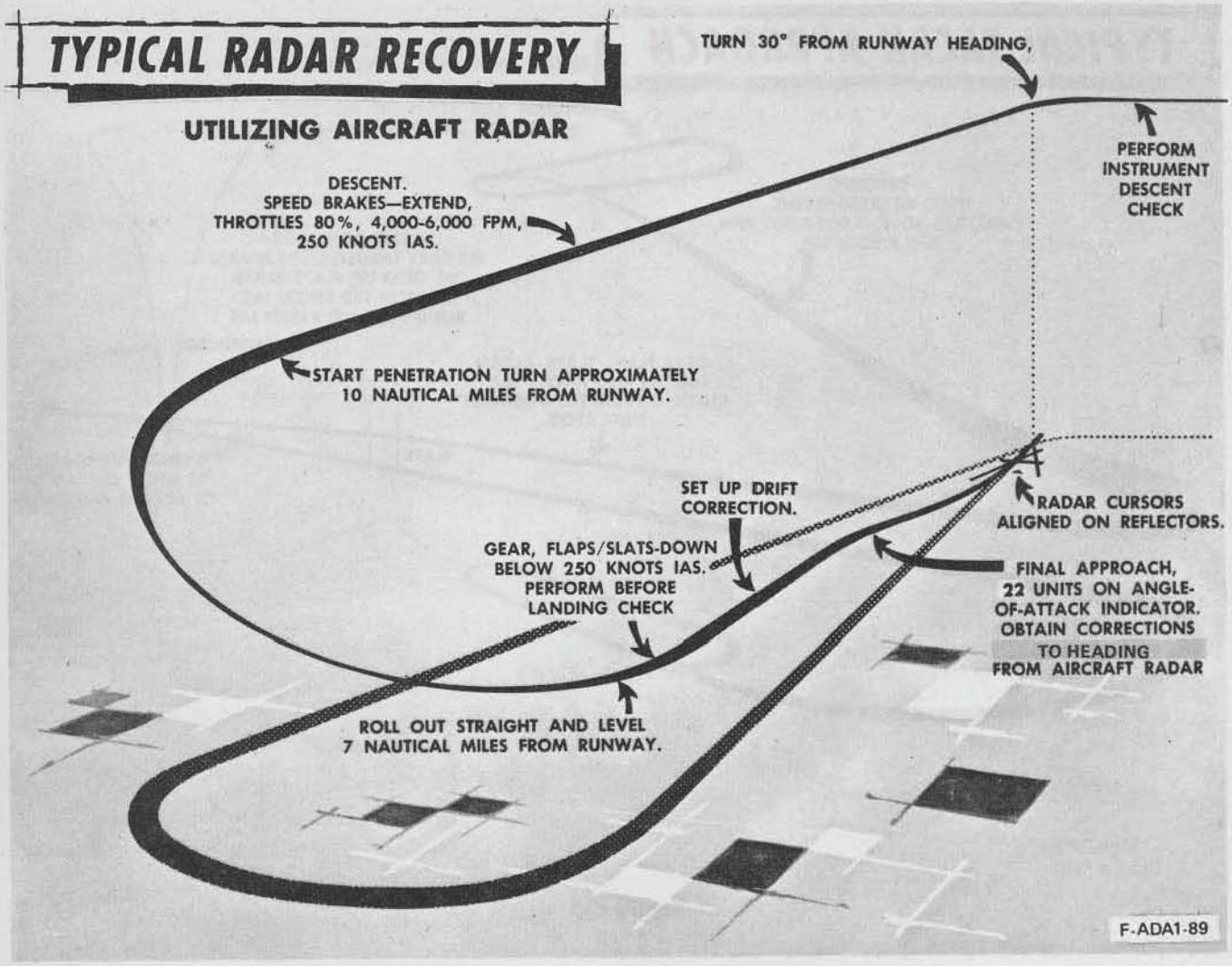

Figure 6-4

precipitation. Rain removal during ground taxiing operations is satisfactory. The windshield rain-removal system is somewhat effective in deicing the windshield.

FLAMEOUTS

Flights through heavy rains have not resulted in flameouts. However, if a flameout should occur, commence air start procedures and attempt to get out of the rain area. In the event of compressor stalls due to ice ingestion or ice buildup, adjust throttles to 85%-90% and turn on engine anti-ice.

LANDING IN RAIN

The AIR position of the windshield switch controls a blast of air that blows rain off the windshield. Be aware of the possibility of a flameout in a heavy rain and of reduced braking action due to a wet runway. Refer to Section III, Wet Runway Landing Procedures.

TURBULANCE AND THUNDER STORMS

Intentional flight through thunderstorms should be avoided, unless the urgency of the mission precludes a deviation from course, due to the high probability of damage to the airframe and components by impact of ice, hail, and lightning. Flameouts, due to water ingestion, or compressor stalls due to rapidly changing flight attitudes, could also occur. The radar provides a means of navigation between or around storm cells. If circumnavigating the storm is impossible, penetrate the thunderstorm in the lower third of the storm cell, away from the leading edge of the storm cloud if possible. It is recommended that the STAB AUG mode of the AFCS be used. The AUTO mode should not be used. Damage to the controls could result with the automatic functions operating.

If necessary to penetrate a thunderstorm, proceed as follows:

1. Slow to between 230 to 280 KIAS.
2. Pitot heat switch . . . . . ON

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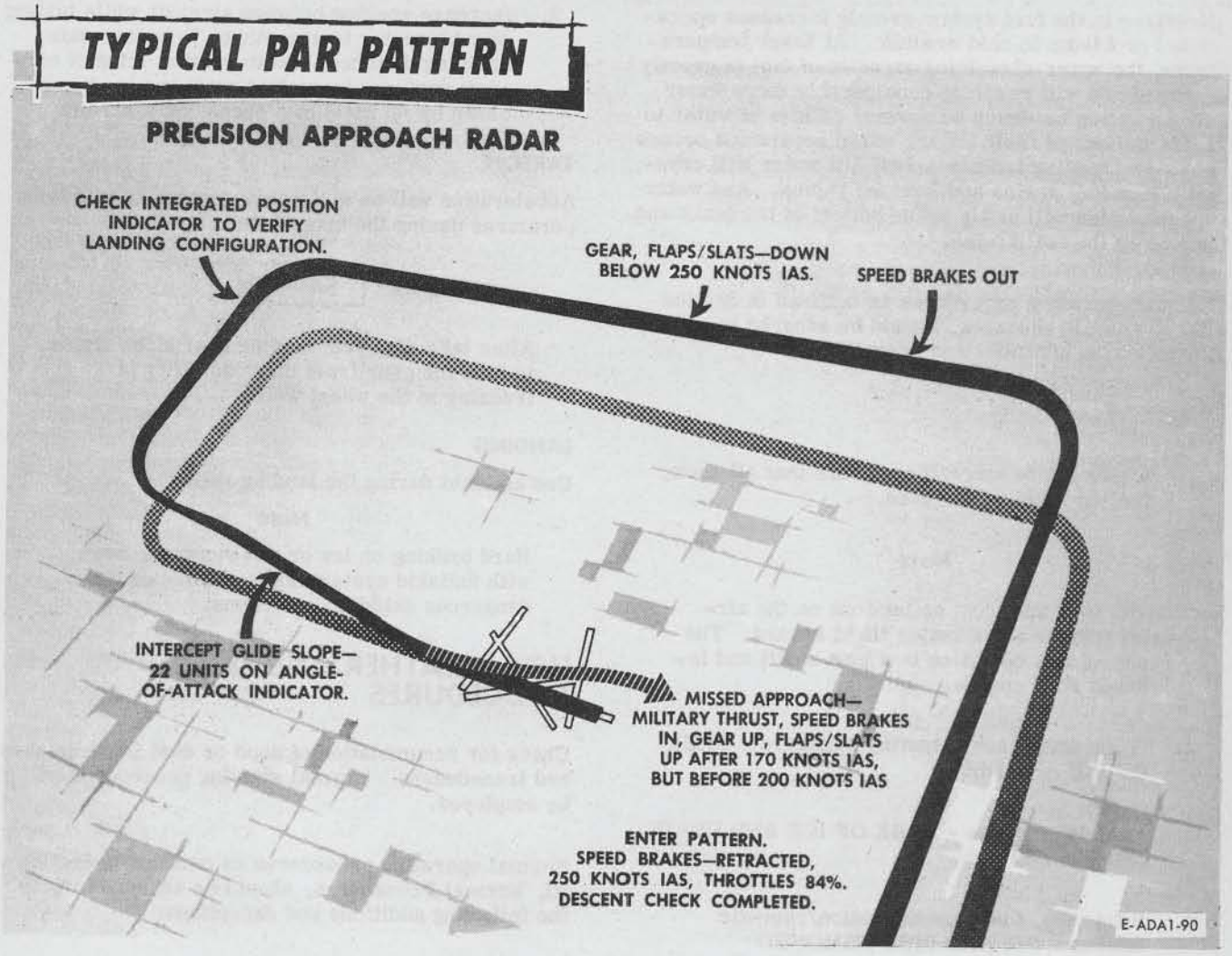

Figure 6-5

3. Engine anti-ice switch . . . . . ON
4. Loose equipment . . . . . SECURED
5. Tighten lap belts and lock shoulder harness.
6. Cockpit lights . . . . . ON BRIGHT
7. Fly attitude and heading indicators primarily while in extreme turbulence, because altimeter and airspeed will fluctuate.

Note

During severe icing conditions, the pilot can expect to lose airspeed indications even with the pitot heat on. GCI stations, if available, can aid the pilot with tracking assistance through thunderstorm areas.

Severe turbulent air at high altitudes may cause the inlet airflow distribution to exceed acceptable limits of the engine, thereby inducing compressor stalls. To avoid compressor stalls during flight through turbulent air, maintain 230 to 280 KIAS at all altitudes.

Severe compressor stalls can result in engine flameout. If severe stalls are encountered, proceed as follows:

1. Throttles . . . . . .IDLE
2. Airspeed. . . .INCREASE BY LOWERING NOSE

Compressor stalls are generally accompanied by increased exhaust gas temperature. If temperature exceeds allowable limits, perform shutdown procedure and accomplish an air start as soon as practical.

COLD WEATHER PROCEDURES

A careful preflight will eliminate many potential hazards found in cold weather operations. Inspect engine intakes for accumulation of ice and snow. If possible, preheat the engine, for easier engine starts. When removing ice and snow from the aircraft surfaces, be careful not to damage the aircraft. Also, use precautions not to step on any no-step surfaces which could be covered with ice or snow. Check the pitot-static tube for ice as well as the fuel pressurization/ram-air intakes, and yaw, pitch, and angle-of-attack transducers.

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Moisture in the fuel system greatly increases operational problems in cold weather. At lower temperatures, the water-dissolving capacity of fuel is greatly reduced and will result in considerably more water accumulation (as much as several gallons of water to 1,000 gallons of fuel). If the water separation occurs at below freezing temperatures, the water will crystallize on fuel drains and internal valves. Any water accumulation will settle to the bottom of the tanks and freeze up the fuel drains.

Normal operating procedures as outlined in Section III, Normal Procedures, should be adhered to with the following additions and exceptions:

PREFLIGHT

1. Check entire aircraft to ensure that all snow, ice, or frost is removed.

Note

Snow, ice, and frost collections on the aircraft surface are a major flight hazard. The result of this condition is a loss of lift and increased stall speeds.

2. Shock struts and actuating cylinders - FREE OF ICE AND DIRT

3. Fuel drain cocks - FREE OF ICE AND DRAIN CONDENSATION

4. Pitot tube, fuel pressurization/ram-air intakes - ICE AND DIRT REMOVED

5. Exterior protective covers - REMOVED

WARMUP AND GROUND CHECK

Be sure that the aircraft is adequately chocked before engine start. Normal starting procedures will start the engines in cold weather.

In severely cold weather, allow a short time for warmup before increasing rpm out of the idle range. If oil pressure is low or fails to come up in a reasonable length of time, shut down. Attempt another start after heating the engines.

CAUTION

If abnormal sounds or noises are present during starting, discontinue starting and apply intake duct preheating for 10 to 15 minutes.

TAXIING

1. Avoid taxiing in deep or rutted snow since frozen brakes will likely result.

2. Increase spacing between aircraft while taxiing at subfreezing temperatures to ensure safe stopping distance, and to prevent icing of aircraft surfaces by melted snow and ice being blown by jet blast of a preceding aircraft.

TAKEOFF

Acceleration will be noticeably greater in cold temperatures during the takeoff run.

CAUTION

After takeoff, cycle landing gear a few times to free the gear from the possibility of freezing in the wheel wells.

LANDING

Use antiskid during the landing roll.

Note

Hard braking on ice or wet runways, even with antiskid system on, could result in dangerous skidding conditions.

HOT WEATHER AND DESERT PROCEDURES

Check for accumulation of sand or dust in the intakes and transducers. Normal starting procedures will be employed.

Normal operation procedures as outlined in Section III, Normal Procedures, should be adhered to with the following additions and exceptions:

1. Expect higher temperatures than normally obtained in operating ranges.

2. Engine ground operation should be minimized as much as possible.

CAUTION

Do not attempt takeoff or engine operation in a sand storm or dust storm, if avoidable. Park aircraft crosswind to prevent sand or dirt from blowing into the intake and exhaust ducts, and subsequently causing engine damage.

TAKEOFF

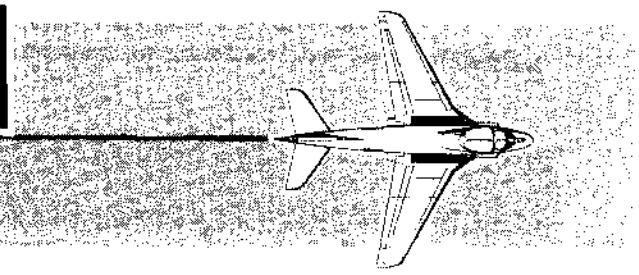
The takeoff distances are increased as ambient temperature increases. Check required takeoff distance charts in Section XI.

LANDING

Anticipate a slightly longer landing distance and the possibility of turbulence due to thermal action of the air close to the ground. Use the defogger, if necessary, in warm, humid weather.

section VII

COMMUNICATION EQUIPMENT AND PROCEDURES



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COMMUNICATION, NAVIGATION, AND IDENTIFICATION (CNI) SYSTEM

The communication, navigation, and identification system includes intercommunication equipment, UHF voice communication radios with secure voice facilities, radio navigation equipment, and an identification (IFF) radar transponder. See figure 7-1. A-6A, B, C, KA-6D, A-6E 158041 thru 159579 and A-6E MOD M1 thru M120 are equipped with the AN/AIC-14 Intercommunication Set (ICS) and the AN/ASQ-57 Integrated Electronic Central, which integrates UHF, TACAN, and IFF equipments. A-6E 159895 and ON and MOD M121 and ON include a new ICS, two AN/ARC-159 UHF communication radios, the AN/ARN-84 TACAN, and the AN/APX-72 IFF Transponder.

Operating power is supplied from the 28 V dc essential bus, the 28 V dc primary bus, the 115 V ac essential bus, and the 115 V ac primary bus.

CAUTION

In aircraft with the ASQ-57, the CNI equipment is normally force-cooled and must not be operated without cooling longer than 5 minutes or equipment damage may result. In aircraft with AFC 268 incorporated, a CNI auxiliary blower operates to supply cooling air any time it is not available from the environmental system. On the ground without engines running or ground cooling applied, ground blower operation is automatic when external electrical power is applied and the CNI equipment is turned on.

Note

In aircraft with the ASQ-57, the CNI MASTER switch on the CABIN DUMP panel (figure 7-2) must be placed to ON or BOTH before communication/navigation/identification equipments can be operated. On A-6E 158795 and subsequent; A-6E Mod M 21 and subsequent and those aircraft incorporating AFC 269, the MA-1 compass system is activated by the CNI MASTER switch On A-6E 158041 thru 158794 and A-6E Mod M 1 thru M 20 not incorporating AFC 269, the MA-1 compass system operates continuously whenever the electrical system is energized. In A-6E incorporating AFC 391, the CNI MASTER switch also activates the air data computer.

INTERCOMMUNICATION SET AN/AIC-14

Intercommunication Set AN/AIC-14 (ICS) is a two-station transistorized system which provides amplification of microphone signals for intercommunication and radio transmission, and amplification of selected audio signals from the radios, ECM equipment, and the attack-navigation system. Operating power is provided from the 28 V dc essential bus through the ICS circuit breakers on the main circuit breaker panel.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

TYPICAL

EXCEPT A-6E 159895 AND ON AND A-6E MOD 121 AND ON

TYPE AND DESIGNATION		FUNCTION	RANGE	OPERATION	LOCATION OF CONTROLS
INTEGRATED ELECTRONIC CENTRAL (IEC)	UHF COMMUNICATIONS RADIO	RADIO COMMUNICATIONS BETWEEN AIRCRAFT AND SHIP, AIRCRAFT AND SHORE, BETWEEN AIRCRAFT.	LINE OF SIGHT. UP TO 350 MILES AIR-TO-AIR DEPENDING UPON ALTITUDE.	PILOT, B/N	CENTER CONSOLE
	SPEECH SECURITY EQUIPMENT	PERMITS SECURE UHF VOICE COMMUNICATIONS	—	PILOT, B/N	AFT CONSOLE CENTER CONSOLE
	AUXILIARY UHF RECEIVER	AUXILIARY UHF RECEIVER.	LINE OF SIGHT. UP TO 350 MILES AIR-TO-AIR DEPENDING UPON ALTITUDE.	PILOT, B/N	PILOT'S LEFT CONSOLE
	DIRECTION FINDER GROUP (ADF)	INDICATES BEARING OF, AND HOMES ON UHF SIGNAL SOURCES. WARNING BEARING INDICATION MAY BE UP TO 40° IN ERROR WITH LANDING GEAR AND/FLAPS EXTENDED.	LINE OF SIGHT. UP TO 350 MILES AIR-TO-AIR DEPENDING UPON ALTITUDE.	PILOT, B/N	CENTER CONSOLE
	IFF	IDENTIFIES AIRCRAFT AS FRIEND OR FOE. PROVIDES SPECIFIC IDENTIFICATION OF SEPARATE AIRCRAFT OR OF A SINGLE AIRCRAFT WITHIN A GROUP. PROVIDES AUTOMATIC ALTITUDE REPORTS. TRANSMITS CODED SIGNALS IN REPLY TO CODED INTERROGATIONS.	LINE OF SIGHT UP TO 200 MILES	PILOT, B/N	CENTER CONSOLE
	TACAN	INDICATES DISTANCE AND BEARING OF SUITABLE EQUIPPED GROUND STATIONS. DETERMINES IDENTITY OF BEACON AND INDICATES DEPENDABILITY OF BEACON.	LINE OF SIGHT. DISTANCES UP TO 196 MILES DEPENDING UPON ALTITUDE.	PILOT, B/N	CENTER CONSOLE
INTERPHONE AN/AIC-14		VOICE COMMUNICATIONS IN COCKPIT OR COCKPIT TO GROUND CREW PERSONNEL. MISCELLANEOUS WARNING TONES FROM WEAPONS, ECM, AND OBSTACLE AVOIDANCE SYSTEMS.	WITHIN THE AIRCRAFT AND GROUND CREW PERSONNEL.	PILOT, B/N, GROUND CREW PERSONNEL	PILOT'S LEFT CONSOLE. CENTER CONSOLE, B/N RIGHT CONSOLE, AND THE EXTERNAL POWER PANEL ON THE RIGHT NACELLE.

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Figure 7-1 (Sheet 1)

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT Cont'd

A-6E

159895 AND ON AND MOD M121 AND ON

TYPE AND DESIGNATION	FUNCTION	RANGE	OPERATION	LOCATION OF CONTROLS
UHF COMMUNICATIONS RADIO AN/ARC-159 (2 INSTALLED)	AIR-TO-AIR, AIR-TO-SURFACE RADIO COMMUNICATIONS	LINE OF SIGHT. UP TO 350 MILES AIR-TO-AIR DEPENDING ON ALTITUDE.	PILOT, B/N	CENTER CONSOLE
UHF/ADF ARA-50	PROVIDES VISUAL INDICATION OF BEARING TO UHF SIGNAL SOURCE. WARNING BEARING INDICATION MAY BE UP TO 40° IN ERROR WITH LANDING GEAR AND/OR FLAPS EXTENDED.	SAME AS UHF COMMUNICATIONS RADIOS.	PILOT, B/N	CENTER CONSOLE (ON UHF COMM PANEL)
SPEECH SECURITY EQUIPMENT KY-28	PERMITS SECURE UHF VOICE COMMUNICATIONS.	SAME AS UHF COMMUNICATIONS RADIOS.	PILOT, B/N	AFT BULKHEAD CONSOLE
IFF TRANSPONDER AN/APX-72	IDENTIFIES AIRCRAFT AS FRIEND OR FOE. PROVIDES SELECTIVE IDENTIFICATION OF SEPARATE AIRCRAFT OR SINGLE AIRCRAFT WITHIN A GROUP. PROVIDES AUTOMATIC ALTITUDE REPORTS. TRANSMITS CODED SIGNALS IN RESPONSE TO INTERROGATIONS.	LINE OF SIGHT UP TO 200 MILES.	PILOT, B/N	CENTER CONSOLE
INTERCOMMUNICATIONS SET	VOICE COMMUNICATIONS IN COCKPIT OR COCKPIT TO GROUND CREW PERSONNEL. MISCELLANEOUS WARNING TONES.	WITHIN AIRCRAFT OR GROUND CREW.	PILOT, B/N, GROUND CREW	LEFT CONSOLE; RIGHT CONSOLE; EXTERNAL POWER PANEL (RIGHT NACELLE)
TACAN AN/ARN-84	INDICATES SLANT RANGE AND BEARING TO GROUND STATION. SLANT RANGE TO SUITABLY EQUIPPED AIRCRAFT.	LINE OF SIGHT UP TO 300 MILES.	PILOT, B/N	CENTER CONSOLE

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Figure 7-1 (Sheet 2)

Control of voice communications with the SINS (ships inertial navigation system) center is provided through the SINS ICS switch (A-6A/B/C) or the ALIGN switch (A-6E) on the bombardier/navigator's right console. With the aircraft on the carrier deck, the CARRIER ALIGNMENT plug inserted, placing the SINS ICS switch to ON or ALIGN switch to SINS ICS permits two-way communication with the SINS center. Placing the switch to OFF or GYRO COMP removes the aircraft ICS from the SINS circuit.

The ICS is operated from the pilot's and B/N's control stations. Each control station includes an interphone amplifier, an isolation amplifier, a voice-operated (VOX) relay module, a sidetone attenuation circuit, and the various controls on the front panel.

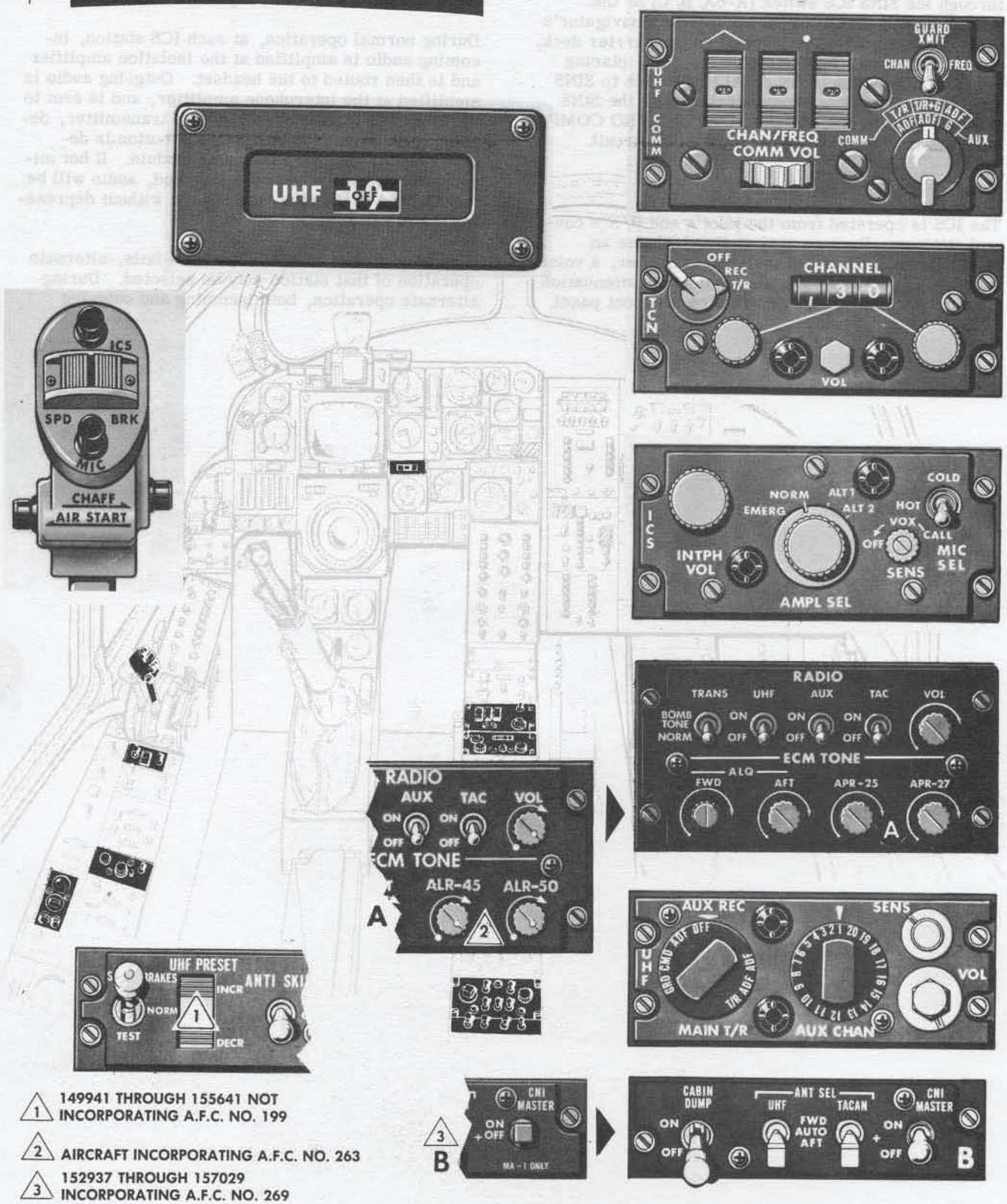
The pilot and B/N may select from among the audio signals available to each of them by means of controls on their radio control panels.

During normal operation, at each ICS station, incoming audio is amplified at the isolation amplifier and is then routed to the headset. Outgoing audio is amplified at the interphone amplifier, and is sent to the other ICS station or to the UHF transmitter, depending on whether the MIC or ICS button is depressed, through the VOX relay module. If hot microphone operation has been selected, audio will be transmitted to the other ICS station without depressing the ICS button.

If an amplifier at either ICS station fails, alternate operation of that station may be selected. During alternate operation, both incoming and outgoing

RADIO AND ICS CONTROLS

A-6A/B/C



1 149941 THROUGH 155641 NOT INCORPORATING A.F.C. NO. 199

2 AIRCRAFT INCORPORATING A.F.C. NO. 263

3 152937 THROUGH 157029 INCORPORATING A.F.C. NO. 269

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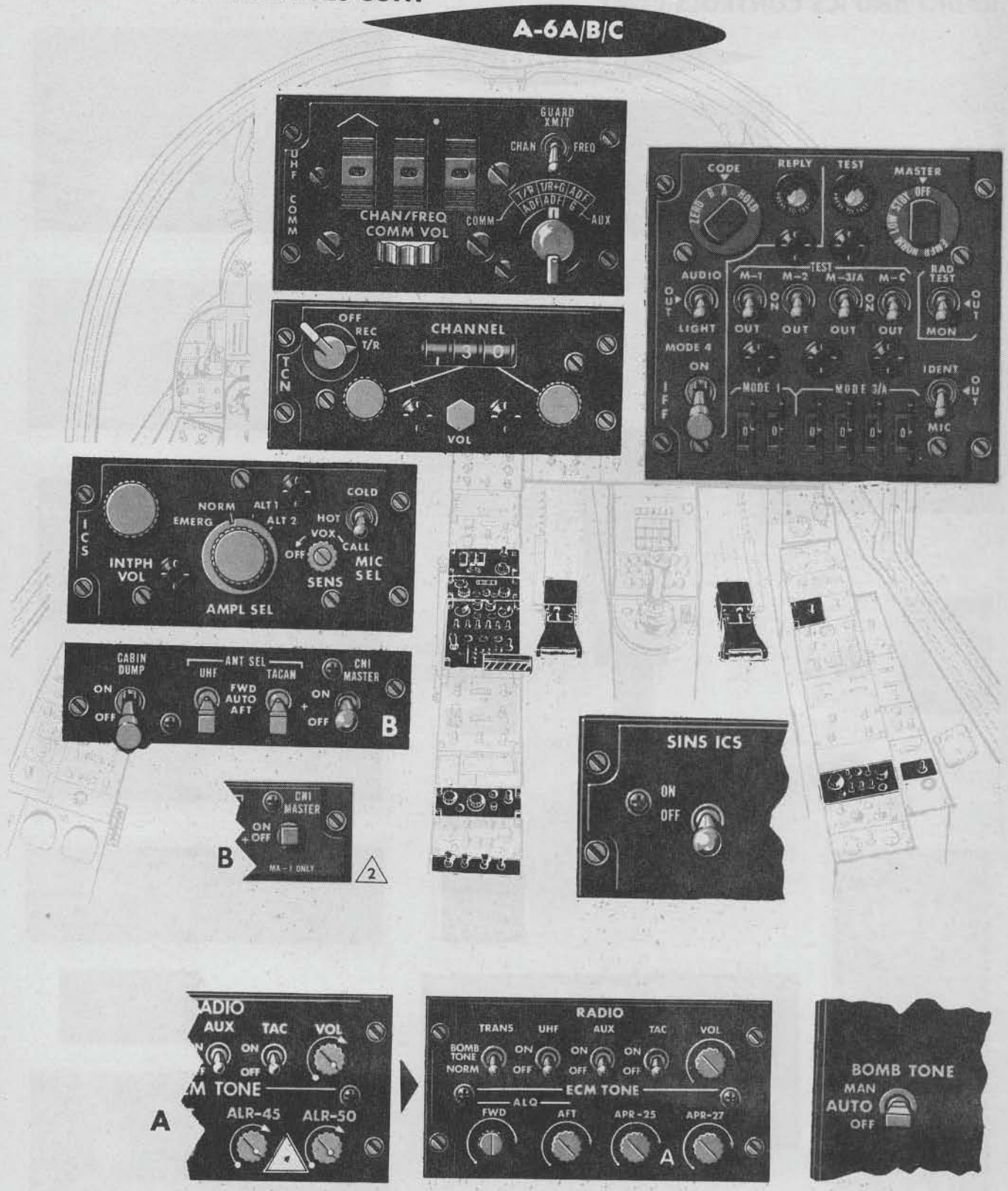
Figure 7-2 (Sheet 1)

RADIO AND ICS CONTROLS CONT



1 AIRCRAFT INCORPORATING A.F.C. NO. 263

2 152937 THROUGH 157029 INCORPORATING A.F.C. NO. 269

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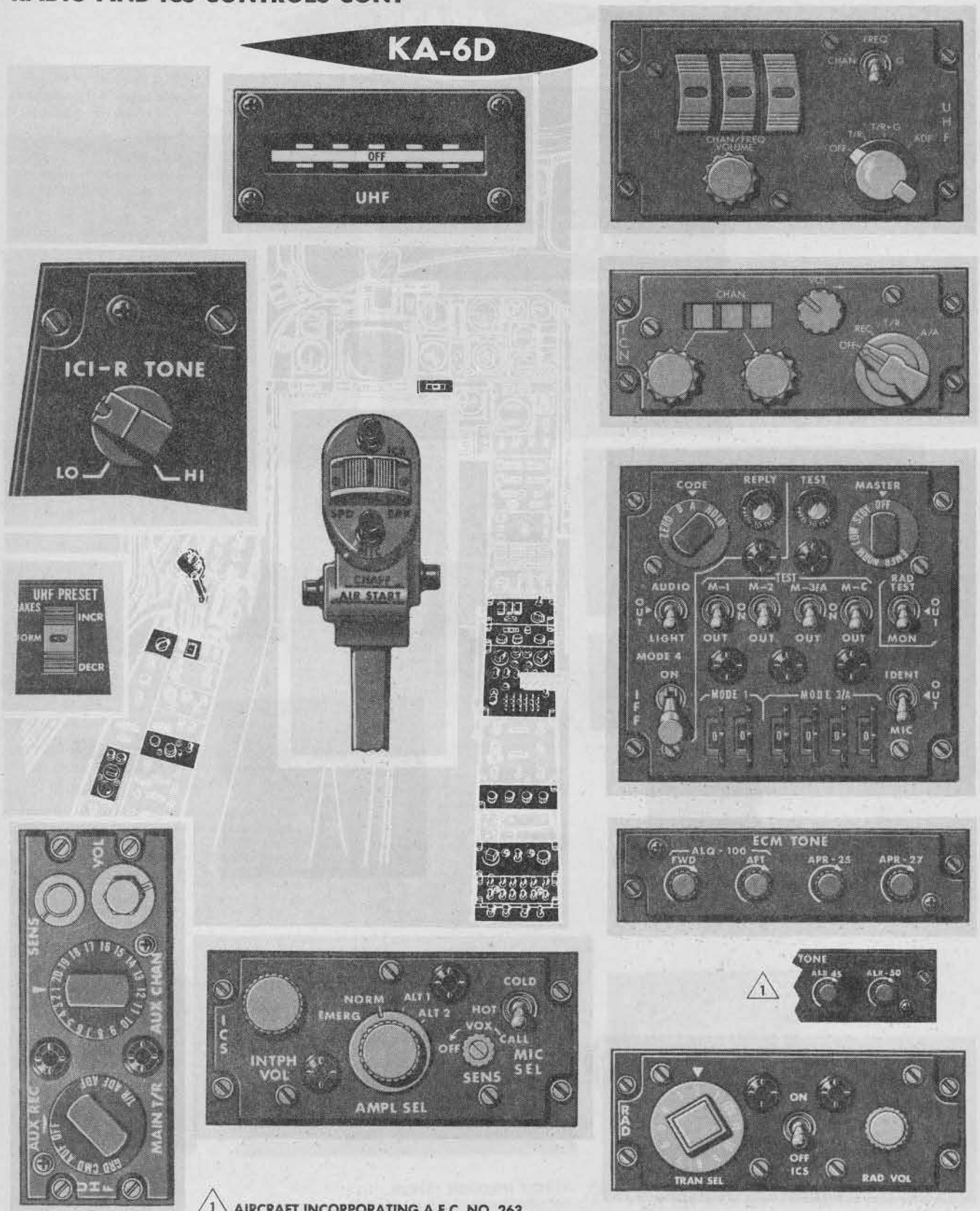
Figure 7-2 (Sheet 2)

RADIO AND ICS CONTROLS CONT



1 AIRCRAFT INCORPORATING A.F.C. NO. 263

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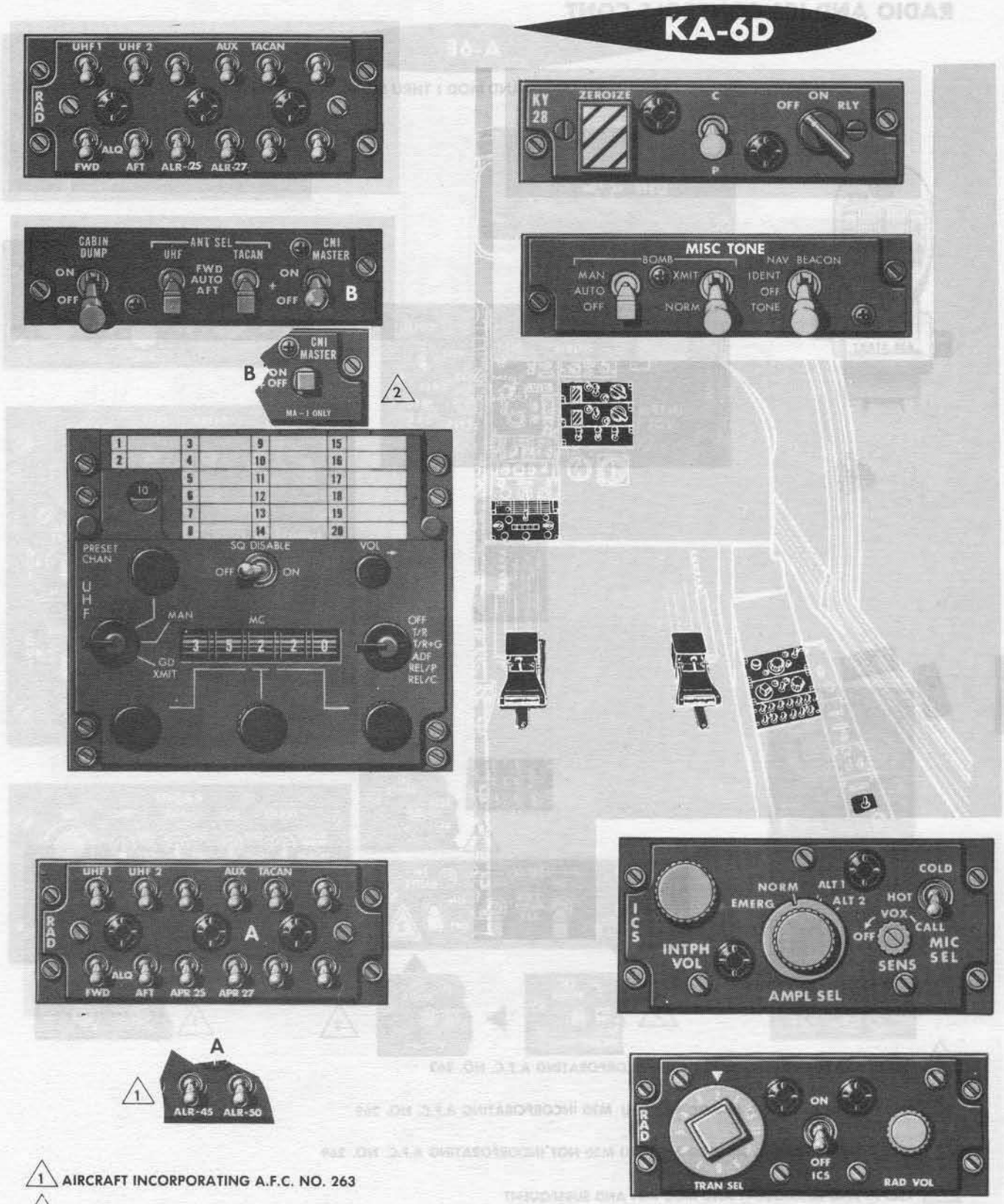
Figure 7-2 (Sheet 3)

RADIO AND ICS CONTROLS CONT



1 AIRCRAFT INCORPORATING A.F.C. NO. 263

2 AIRCRAFT INCORPORATING A.F.C. NO. 269

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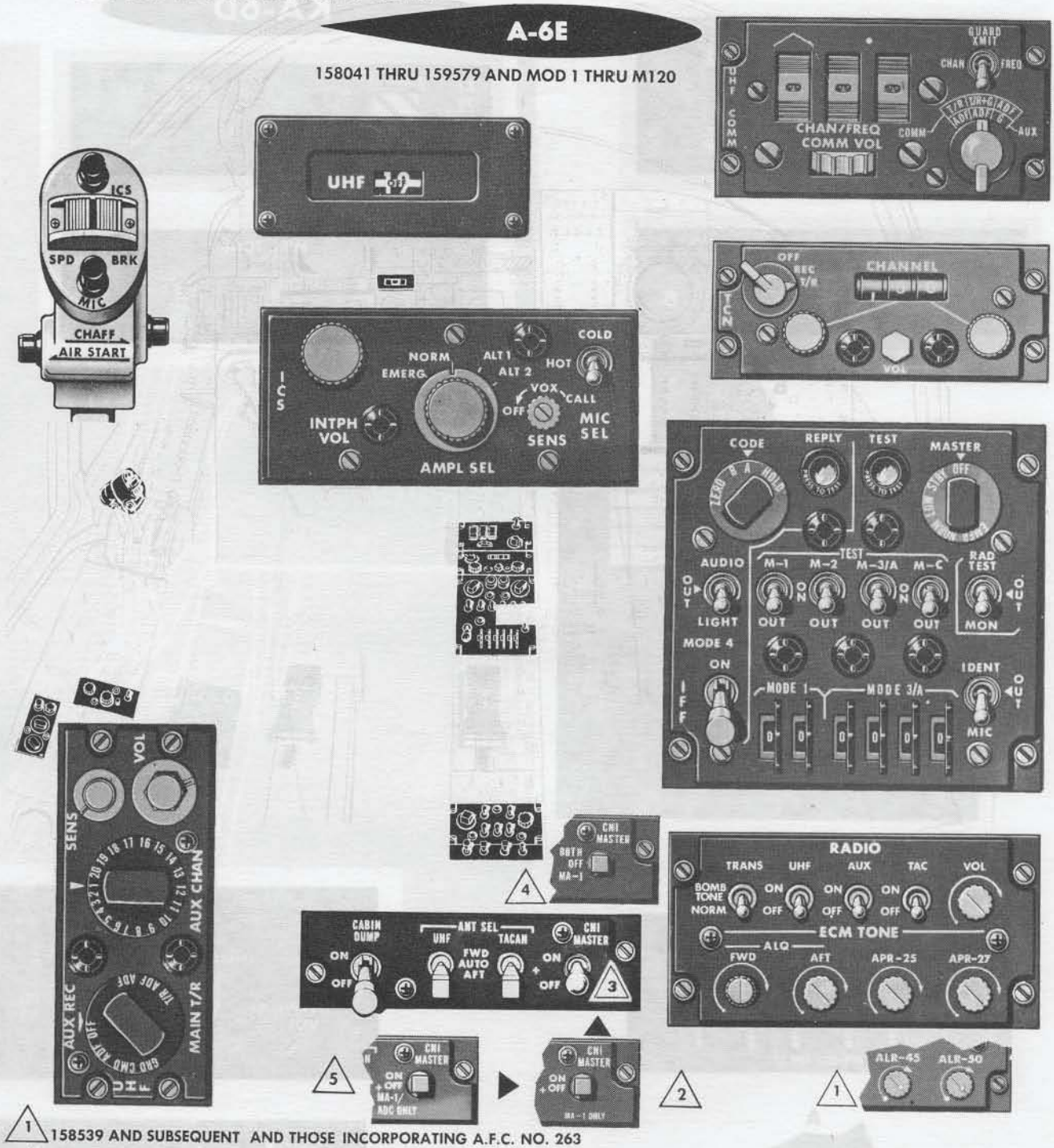
Figure 7-2 (Sheet 4)

RADIO AND ICS CONTROLS CONT

A-6E

158041 THRU 159579 AND MOD 1 THRU M120



1 158539 AND SUBSEQUENT AND THOSE INCORPORATING A.F.C. NO. 263

2 158041 THRU 158794 AND MOD M1 THRU M20 INCORPORATING A.F.C. NO. 269

3 159041 THRU 158794 AND MOD M1 THRU M20 NOT INCORPORATING A.F.C. NO. 269

4 158795 AND SUBSEQUENT AND MOD M21 AND SUBSEQUENT

5 AIRCRAFT INCORPORATING AFC NO. 391

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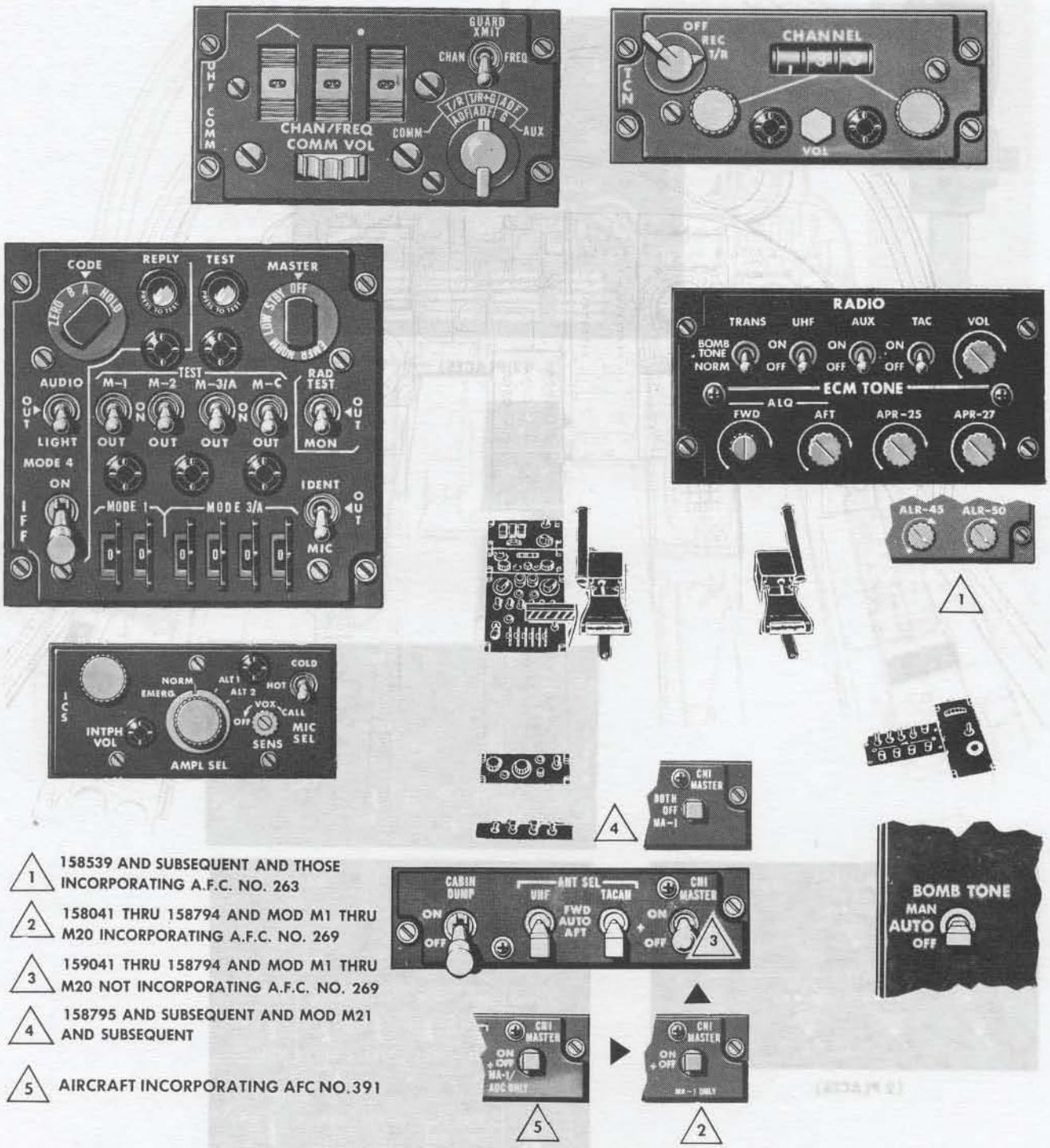
Figure 7-2 (Sheet 5)

RADIO AND ICS CONTROLS CONT

A-6E

158041 THRU 159579 AND M1 THRU M120



1. 158539 AND SUBSEQUENT AND THOSE INCORPORATING A.F.C. NO. 263
2. 158041 THRU 158794 AND MOD M1 THRU M20 INCORPORATING A.F.C. NO. 269
3. 159041 THRU 158794 AND MOD M1 THRU M20 NOT INCORPORATING A.F.C. NO. 269
4. 158795 AND SUBSEQUENT AND MOD M21 AND SUBSEQUENT
5. AIRCRAFT INCORPORATING AFC NO. 391

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Figure 7-2 (Sheet 6)

RADIO AND ICS CONTROLS CONT

A-6E

159895 AND ON, AND M121 AND ON

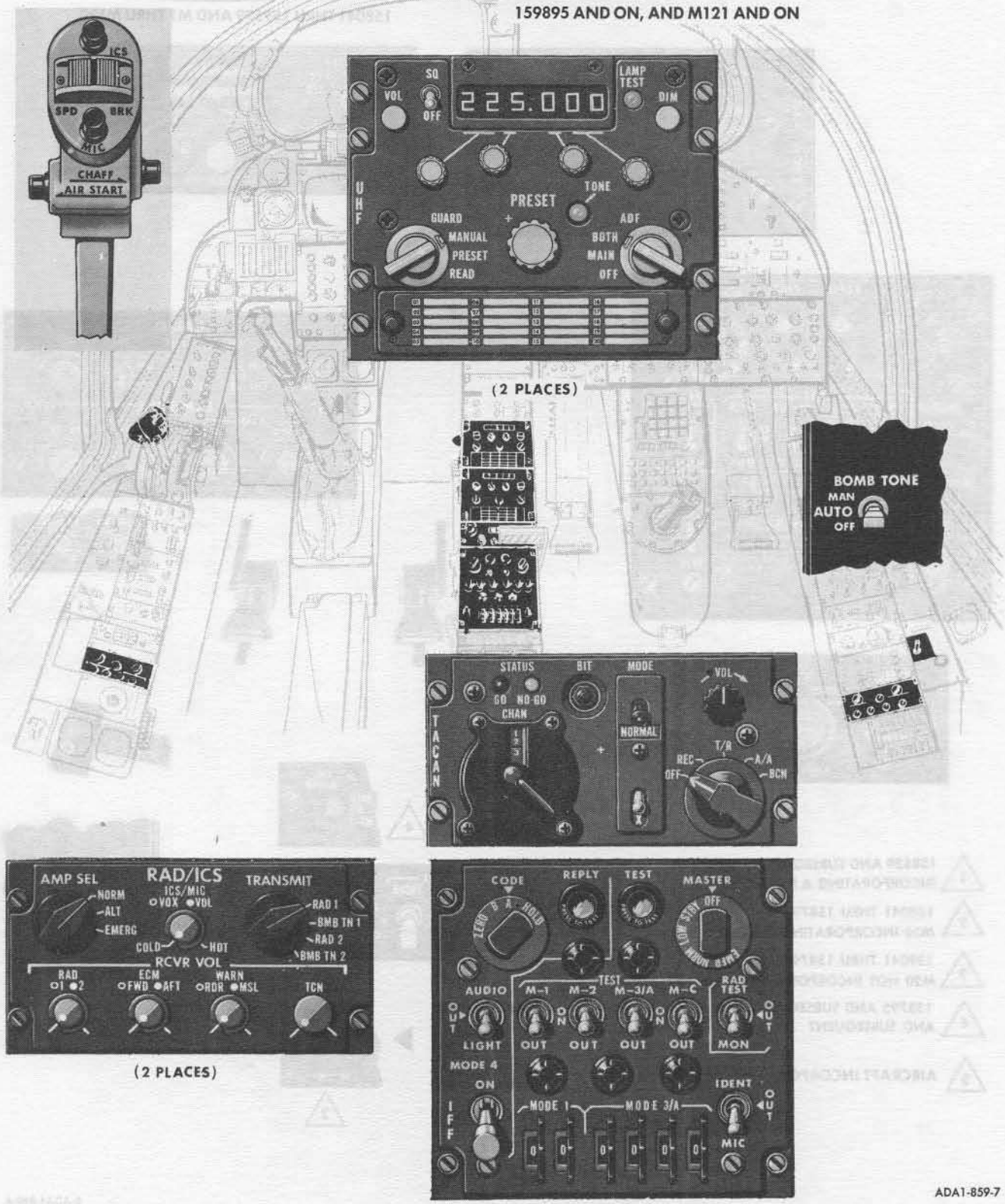

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Figure 7-2 (Sheet 7)

audio is amplified at the amplifier selected and is routed to the headset at that station and to the other ICS station or to the UHF transmitter through the VOX relay module. The sidetone level at the transmitting station increases when that station uses alternate operation, and the incoming interphone level at the receiving station also increases. When the transmitting station is in normal operation and the receiving station is in alternate operation, the sidetone level at the transmitting station is decreased.

To ensure that the interphone audio overrides any selected audio, when the ICS system is keyed, the level of incoming interphone audio is increased and the level of the selected audio is decreased.

Either crewmember may listen to audio from the UHF receiver, the auxiliary UHF receiver, TACAN, and the ECM receivers. In addition, a bomb tone and missile tones are available to the pilot.

By selecting alternate operation, either crewmember can route the audio he has selected to the other crewmember.

Note

Should both crewmembers select alternate operation, a cross-feed arrangement is set up and there is a possibility of feedback occuring. This feedback can be reduced or eliminated by reducing the interphone volume level.

ICS CONTROL PANEL

Two identical ICS control panels (figure 7-2) are provided. The pilot's control is on the pilot's left console; the B/N's is on the center or B/N's right console.

Interphone Volume Control

The interphone volume control marked INTPH VOL provides control over the audio level of incoming interphone signals and sidetones. Full clockwise rotation provides maximum volume; full counterclockwise rotation provides minimum volume. The volume of the selected audio is not affected by this control.

Amplifier Selector Switch

The amplifier selector (AMPL SEL) is a four-position rotary switch marked EMERG, NORM, ALT 1, and ALT 2. In the NORM position, received interphone and selected audio signals are routed to the headset through the isolation amplifier, and outgoing signals are routed through the interphone amplifier. In the ALT 1 position, both incoming and outgoing signals are routed through the isolation amplifier. In the ALT 2 position, both incoming and outgoing signals are routed through the interphone amplifier. In the EMERG position, there is no interphone signal available; the only audio available is sent unamplified directly from the UHF receivers, the TACAN receiver, and the UHF transmission sidetone. The crewmembers can communicate by UHF sidetone.

VOX Sensitivity Control

The VOX sensitivity control (VOX SENS) provides control over the voice operated relay. Full counterclockwise rotation to the OFF detent removes the VOX relay from the circuit. Clockwise rotation from OFF increases the sensitivity of the VOX relay so that it keys at a lower audio level.

Note

The operation of the VOX relay is independent of the mode of microphone operation. The VOX SENS control should be kept at OFF unless HOT microphone operation is selected.

Microphone Mode Selector Switch

The microphone mode selector (MIC SEL) switch is a three-position toggle switch marked COLD, HOT, and CALL, which controls the mode of operation of the microphone for interphone transmission only. UHF transmission is not affected. When the switch is at COLD, the ICS press-to-transmit switch must be depressed to transmit on interphone. Selecting HOT permits the user to transmit over interphone without using the press-to-transmit switch. The CALL position does not function.

PRESS-TO-TRANSMIT SWITCHES

Two press-to-transmit switches (figure 7-2) are provided for each crewmember. The pilot's switches, marked ICS and MIC, are on the inboard face of the right throttle. The ICS switch is above the speedbrake switch and the MIC switch is below it. The B/N is provided with foot switches. The left switch is marked UHF, the right switch is marked ICS. When the MIC SEL switch is at COLD, pressing the ICS switch permits ICS transmission. Pressing the MIC or UHF switch permits UHF transmission.

RADIO CONTROL PANEL

Each crewmember is provided with a RADIO control panel (figure 7-2), which permits him to select which of the available audio signals (figure 7-3) he will monitor, and to control their volume.

TRANS Switch

The TRANS switch is a two-position toggle switch marked BOMB TONE and NORM, which is active on the pilot's RADIO panel only. Selecting BOMB TONE permits the bomb tone to be transmitted over UHF. With the switch at NORM, the tone cannot be transmitted outside the aircraft.

Audio Selector Switches

The three audio selector switches marked UHF, AUX, and TAC are two-position ON, OFF toggles permitting the crewmember to select audio from the main UHF receiver, the auxiliary UHF receiver, or the TACAN receiver to be monitored in addition to the interphone audio. He may select any, all, or none of these signals.

TONE SELECTION

TONE	AUDIO SELECTION		REMARKS
	PILOT	B/N	
LAWS	HEARD WHEN PRESENT	PILOT MUST SELECT ALT 1 (1)	2 SECOND WARBLE TONE
TRACK RADAR (2)	B/N MUST SELECT ALT 1	HEARD WHEN PRESENT	LOCK ON ASSISTANCE.
WEAPON RELEASE	SELECT BOMB TONE ON RAD PANEL	PILOT MUST SELECT ALT 1 (1)	ENABLED BY BOMB TONE SWITCH ON B/N RIGHT CONSOLE.
SHRIKE	HEARD WHEN PRESENT	PILOT MUST SELECT ALT 1 (1)	SOURCE PRF TONE WITH MASTER ARM ON, SHRIKE STATION SELECTED. B/N CONTROLS VOLUME ON 1C I-R PANEL.
SIDE-WINDER	HEARD WHEN PRESENT	PILOT MUST SELECT ALT 1	CONSTANT FREQUENCY TONE--MASTER ARM ON, SIDEWINDER STATION SELECTED. B/N CONTROLS VOLUME ON 1C I-R PANEL.
APR-25 ALR-45	(3)	(3)	VARIABLE TONES DEPENDING ON WARNING.
ALQ-100 ALQ-126	(3)	(3)	SOURCE PRF TONES
APR-27 ALR-50	(3)	(3)	LOW OR HIGH FREQUENCY WARBLE WHEN WARNING PRESENT

NOTE

(1) NOT AVAILABLE TO B/N IN A-6E 159895 AND ON AND A-6E MOD M121 AND ON.

(2) NOT AVAILABLE IN A-6E.

(3) PILOT AND B/N HEAR TONES WHEN PRESENT AND RADIO PANEL AUDIO CONTROLS ARE TURNED CW

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Figure 7-3

VOL Control

The VOL knob is a rotary control providing adjustment of the volume level of the selected receiver audio signals. Full clockwise rotation provides maximum volume.

ECM TONE Controls

The tones generated by the ECM equipment are routed to the headsets of both crewmembers without selection whenever these tones are present. The four ECM TONE knobs permit the volume of these tones to be adjusted by each crewmember. Full clockwise rotation provides maximum volume; full counterclockwise rotation reduces the volume so that the tone cannot be heard.

MISSILE TONES

Certain missiles generate tones that are routed to the pilot's headset whenever they are present. Control of missile tone volume is provided by a knob on the armament control unit. Refer to Section VIII for a description of this control.

BOMB TONE

A bomb tone is provided to the pilot to assist in weapon delivery. The tone is routed to the pilot's headset without selection whenever the tone is present. Control of the bomb tone may be manual or automatic depending on the position of the bomb tone mode selector switch, and the tone may be transmitted over the UHF radio.

Note

In order to hear and/or transmit the bomb tone, the MASTER ARMT switch on the armament control unit must be at ON or PRAC.

BOMB TONE Mode Selector Switch

The BOMB TONE mode selector switch (figure 7-2) on the B/N's right console is a three-position toggle marked MAN, AUTO, and OFF. When the switch is at OFF, no bomb tone is available. With the switch at AUTO and the MASTER ARMT switch at ON or PRAC, the bomb tone goes on and off automatically according to the attack mode selected. The switch is spring-loaded from MAN to AUTO, and when held at MAN, with the MASTER ARMT switch at ON or PRAC, a continuous tone is produced.

INTERCOMMUNICATIONS SET (ICS) (A-6E TRAM CONFIGURED AIRCRAFT)

A-6E 159895 and ON and A-6E Mod M121 and ON are equipped with a revised ICS. The ICS provides normal, alternate, or emergency communications between crewmembers. It also combines and amplifies audio signals from the radios, ECM receivers, radar altimeter, IFF, missiles, and the attack/navigation system. Operating prower is provided from the 28 V dc essential bus and the 115 V ac essential bus through the ICS and RAD/ICS circuit breakers on the main circuit breaker panel.

The INTER COMM receptacle on the external power panel permits a ground crewmember to be connected to the ICS. The SINS ICS switch on the NAVIGATION control panel on the B/N's right console enables voice communication with the SINS (ship's inertial navigation system) center. With the aircraft on the carrier deck and the CARRIER ALIGNMENT plug inserted, placing the SINS ICS switch to ON permits two-way ICS communication with the SINS center.

Identical RAD/ICS control panels (figure 7-2) are on the pilot's left console and the B/N's right console. Each ICS station has a normal and an alternate amplifier. Incoming audio signals are routed through the normal amplifier to the headset. If the normal amplifier fails, the alternate amplifier may be selected with no loss of capability. Should both amplifiers fail, the station may be operated without amplification of incoming audio signals by selecting the emergency mode.

AUDIO SIGNALS

Both crewmembers receive audio signals from the two UHF radios and the TACAN and warning tone (figure 7-3) from the ECM equipment. Volume controls for these signals are provided on the RAD/ICS panels. In addition, the pilot hears the radar altimeter low-altitude warning tone, the IFF mode 4 interrogation signals, the Sidewinder tone, and the bomb tone. No volume control is provided for these signals.

BOMB TONE Mode Selector Switch

The BOMB TONE mode selector switch on the B/N's right console (figure 7-2) is a three-position toggle switch marked MAN, AUTO, and OFF. When the switch is at AUTO and the MASTER ARMT switch at ON or PRAC, the bomb tone goes on and off automatically according to the attack mode selected. The switch is spring-loaded from MAN to AUTO and when held in the MAN position with the MASTER ARMT switch at ON or PRAC, a continuous tone is provided.

RAD/ICS CONTROL PANEL

Identical RAD/ICS control panels (figure 7-2) are provided on the pilot's left console and the B/N's right console, providing each crewmember with independent control of audio volume at his station, independent selection of hot or cold microphone operation, and the capability of transmitting over eith UHF.

AMP SEL Switch

The AMP SEL switch is a three-position rotary selector switch marked NORM, ALT, and EMERG. When the switch is at NORM, incoming audio is routed through the normal amplifier to the headset; with ALT

selected, the alternate amplifier is used; and with EMERG selected, incoming signals are routed directly to the headset without amplification. Selection of EMERG renders the volume controls ineffective.

ICS/MIC Control

The ICS/MIC control is a dual, stacked rotary control. The inner knob, marked VOL, provides control over the audio level of incoming interphone signals and sidetones. Full clockwise rotation provides maximum volume; full counterclockwise rotation provides minimum volume. The outer knob, marked VOX, permits selection of either hot or cold microphone operation and control over the sensitivity of the voice operated relay. Rotation of the control fully counterclockwise to the COLD position selects cold microphone operation, and the press-to-transmit switch must be used. Rotation of the control clockwise out of the COLD position selects hot microphone operation, permitting transmission without the use of the press-to-transmit switch. Further rotation of the control toward the HOT position increases the sensitivity of the voice-operated relay so that it keys at a lower audio level.

TRANSMIT Selector Switch

The TRANSMIT selector switch is four-position rotary switch marked RAD 1, BMB TN 1, RAD 2, and BMB TN 2. Selection of RAD 1 or RAD 2 permits voice transmission on the selected UHF radio. Selection of BMB TN 1 or BMB TN 2 permits transmission of the bomb tone over the selected UHF radio. Since the bomb tone is routed only to the pilot's ICS station, selecting either BMB TN 1 or 2 by the B/N has no effect.

RCVR VOL Controls

Seven RCVR VOL controls permit selective adjustment of the audio level of incoming signals. Full clockwise rotation provides maximum volume; full counterclockwise rotation provides minimum volume. The RAD control adjusts the volume of both UHF 1 (outer knob) and UHF 2 (inner knob); the ECM control adjusts the signal volume from the FWD ALQ-126 (outer knob) and the AFT ALQ-126 (inner knob); the WARN control adjusts the tones from the ALR-45 (outer knob marked RDR) and the ALR-50 (inner knob marked MSL); and the TCN control adjusts the volume of TACAN audio.

UHF COMMUNICATIONS RADIO

In aircraft 159579 and earlier and A-6E Mod M120 and earlier, the UHF communications radio provides two-way voice communication in the frequency range of 225.0 to 399.9 MHz between aircraft and ground station or between aircraft. It also performs ADF (automatic direction finding) for visual presentation of bearing information.

One UHF radio is provided in A-6A, B, C, E aircraft and two UHF radios are provided in the KA-6D. Provisions are made for an automatic relay (middleman) operation in the KA-6D.

UHF COMMUNICATIONS CONTROL PANEL (A-6A,B,C,E)

The UHF communications control panel (A-6A, B, C, E) on the center console (figure 7-2) provides operation of any of 1,750 frequencies between 225.0 and 395.9 MHz. Twenty of these frequencies are preset as channels. In addition to the preset frequencies, a manual means of frequency selection is available.

Channel Frequency Switches

Three touch-tuning slewing switches (figure 7-2) marked CHAN FREQ on the UHF communications control panel, are used to manually adjust the operating frequency of the receiver-transmitter. Pressing on the forward portion of the rocker causes the UHF communications frequency to increase and the indicator to increase to the desired frequency. Releasing the touch-tuning slewing switch stops the slewing action. Pressing the switch or switches on the aft portion decreases the UHF communication frequency and the indication. The switch on the right selects the tenths-of-MHz, and the middle switch selects the MHz to be used and displayed on the frequency channel indicator. The switch on the left controls the tens and hundreds of MHz or the channel number, depending upon the position of the masking mode switch.

Masking Mode Switch

The masking mode (GUARD XMIT) switch (figure 7-2) is a three-position toggle switch on the forward right corner of the UHF communications control panel. When in the channel (CHAN) position, the frequency channel indicator displays the two-digit (tenths and units masked) channel number selected by the touch-tuning slewing switches. In the GUARD position, the frequency channel indicator displays a guard transmit mask over the digits, labeled GUARD. In the FREQ position, the frequency channel indicator displays one of 1,750 possible UHF communications frequencies between 225.0 and 399.0 MHz. To enter a selected channel (20 for example), position the masking mode switch to CHAN and press forward on the left slewing switch until 20 is read on the UHF frequency indicator on the pilot's instrument panel. To manually set any frequency between 225.0 and 399.9 MHz, place the guard transmit switch to FREQ and press the touch-tuning switches until the UHF frequency indicator shows the desired frequency.

Command Auxiliary Selector Switch

The command auxiliary selector switch, placarded COMM AUX (figure 7-2), is a three-position, double-row selector that selects the combination of functions to be performed by the main UHF communications receiver-transmitter and auxiliary receivers. The top row of positions indicates the function performed

by the UHF communications receiver-transmitter, while the bottom row indicates the functions of the auxiliary receiver. In the first position, T R-ADF, the main UHF communications receiver is in the usual transmit-receive function, while the auxiliary receiver is operating as an ADF receiver. In the T R-G-ADF position, the main UHF communications receiver-transmitter is operating normally with the additional operation of a guard receiver, and the auxiliary receiver is performing the ADF function. With the COMM AUX selector in the ADF/G position, the main UHF communications receiver is performing the ADF function while the auxiliary receiver is serving as a guard receiver.

UHF NO. 1 COMMUNICATIONS CONTROL PANEL (KA-6D)

The UHF No. 1 communications control panel on the center console (figure 7-2) provides operation on any one of 3,500 frequencies between 225.0 and 399.95 MHz. Twenty of these frequencies are preset as channels. In addition to the preset frequencies, a manual means of frequency channel selection is available.

Channel/Frequency Switches

Three touch-tuning slewing switches marked CHAN/FREQ on the UHF communications control panel are used to manually adjust the operating frequency of the receiver-transmitter. Pressing on the forward portion of the rocker causes the UHF communications frequency to increase and the indicator (figure 7-2) on the pilot's instrument panel to increase to the desired frequency. Releasing the touch-tuning slewing switch stops the slewing action. Pressing the switch or switches on the aft portion decreases the UHF communication frequency and the indication. The switch on the right selects the tenths-of-MHz, and the middle switch selects the MHz to be used and displayed on the frequency channel indicator. The switch on the left controls the tens and hundreds of MHz or the channel number, depending upon the position of the masking mode switch.

Masking Mode Switch

The masking mode switch is a three-position toggle switch on the forward right corner of the UHF communications control panel. When in the channel (CHAN) position, the frequency channel indicator displays the two-digit (tenths and units masked) channel number selected by the touch-tuning slewing switches. In the GUARD position, the frequency channel indicator displays a guard transmit mask over the digits, labeled GUARD. In the FREQ position, the frequency channel indicator displays one of 3,500 possible UHF communications frequencies, between 225.0 and 399.95 MHz. To enter a selected channel (20 for example), position the masking mode switch to CHAN and press forward on the left slewing switch until 20 is read on the UHF frequency indicator on the pilot's instrument panel (figure 7-2). To manually set any frequency between 225.0 and 399.95 MHz, place the guard transmit switch to FREQ and press the touch-tuning switches until the UHF frequency indicator shows the desired frequency.

Function Selector Switch

The function selector switch is a four-position rotary switch masked OFF, T/R, T/R & G, and ADF. In the OFF position, all power is removed from the UHF No. 1. The T/R position is used to transmit or receive on a selected channel or frequency. The TR & G position is the same as the T/R position with the addition of guard receiver operation. The ADF position selects the ADF mode of operation, and bearing to the selected station will be presented on the HSI.

Remote UHF Channel Switch

To provide greater flexibility for the pilot in selecting UHF channels, a switch placarded UHF PRESET is on the pilot's left console, aft of the throttle quadrant. This switch may be used to select a preset channel when the masking mode switch is in the channel (CHAN) position (figure 7-2).

UHF NO. 2 COMMUNICATIONS CONTROL PANEL (KA-6D)

The UHF No. 2 communications control panel on the observer's instrument panel (figure 7-2) provides operation on any one of 3,500 frequencies between 225.0 and 399.95 MHz. Twenty of these frequencies are preset as channels. In addition to the preset frequencies, a manual means of frequency channel selection is available. The UHF No. 2 control panel also provides the controls for automatic relay operation (middleman).

Mode Selector Switch

The mode selector switch is a three-position rotary switch marked PRESET CHAN, MAN, and GD XMIT. The PRESET CHAN position permits automatic selection of one of 20 preset channels with the preset channel knob. The selected channel is displayed on the preset channel indicator. The MAN position permits selection of any one of 3,500 frequencies using the three manual frequency selector knobs. The manually selected frequency will be displayed on the frequency counters. In the GD XMIT position with function selector switch at T/R, the preset guard frequency of 243.00 MHz for the transmitter and receiver is selected.

SQ Disable Switch

The ON position of the SQ DISABLE switch disables the squelch circuit. When at extreme reception ranges, disabling the squelch circuit may improve readability of weak signals at the expense of increased noise in the headsets.

Function Selector Switch

The function selector switch is a six-position switch marked OFF, T/R, T/R & G, ADF, REL/P, and REL/C. In the OFF position, all power is removed from the UHF no. 2. The T/R position is used to transmit or receive on a selected channel or frequency. The T/R & G position is the same as the T/R position with the addition of guard receiver operation. The ADF position selects the ADF mode of operation and bearing on the selected station will be presented on the HSI.

Note

No. 1 UHF takes priority over no. 2 UHF in the ADF mode of operation.

The REL/P position is used for automatic relay of plain UHF communications. The REL/C position is used for automatic relay of ciphered UHF communications. The UHF no. 1 and UHF no. 2 operate in conjunction during automatic relay operation.

AUXILIARY RECEIVER (UHF)

In aircraft 159579 and earlier and A-6E Mod M120 and earlier, an auxiliary receiver, which supplies dc power to the CNI system and operates in conjunction with the main receiver-transmitter under normal conditions, also operates as an emergency receiver if a failure occurs in the main receiver-transmitter. The auxiliary receiver is used as an ADF receiver in the frequency range of 265.0 to 284.9 MHz. The operating channels from 1 to 20 are selected on the AUX UHF communications control panel on the pilot's left console.

Note

The auxiliary channel (AUX CHAN) selector and the volume (VOL) control are the only operative controls on the UHF control panel. The function selector and the sensitivity (SENS) controls are inoperative.

AUXILIARY RECEIVER (UHF) CONTROL PANEL

The auxiliary UHF receiver control panel (figure 7-2) is on the pilot's left console outboard of the MASTER LIGHT control panel.

The rotary knob placarded VOL controls the volume of the auxiliary receiver. The rotary channel selector switch placarded AUX CHAN controls selection of 20 operating channels for the auxiliary receiver. Channel selection is made by matching the desired channel number with the triangular indexer.

ANTENNA SELECTOR SWITCH

Two antenna selector switches marked ANT SEL, are on the cabin dump panel (figure 7-2). These switches provide selection of either the forward UHF blade antenna or aft UHF/TACAN blade antenna and either the forward TACAN blade antenna or the aft UHF TACAN blade antenna during UHF (No. 1 in KA-6D) and TACAN reception and transmission. Each antenna selector switch operates a coaxial switch for selection of the desired antenna. There are three modes of operation:

Note

The UHF No. 2 in the KA-6D uses the UHF/IFF antenna for reception and transmission.

1. Forward antenna - FWD
2. Aft Antenna - AFT
3. Automatic - AUTO

In the FWD position, the pilot manually overrides the automatic mode and selects the forward blade antenna. In the AFT position, the pilot manually selects the aft blade antenna. In the AUTO mode, the forward and aft antennas are time-shared until lock-on. During the lock-on, the antenna producing the strongest signal is used. A memory function in the automatic antenna selector causes transmission on the antenna last used for reception.

Note

IAFC 300 removes automatic selection and uses only one antenna in the fin cap for UHF and one antenna on the nosewheel fairing door for TACAN.

UHF COMMUNICATIONS RADIO AN/ARC-159 (A-6E TRAM CONFIGURED AIRCRAFT)

A-6E 159895 and ON and A-6E Mod M121 and ON are equipped with two AN/ARC-159 UHF Communications Radios. The ARC-159, which has a frequency range extending from 225.0 MHz to 399.95 MHz, provides air-to-air and air-to-surface voice communications with an automatic direction finding (ADF) capability. The equipment allows transmission and reception on any one of 20 preset channels and guard frequency (243.0 MHz). Guard frequency may be monitored simultaneously with any other selected frequency. The ARC-159 may be manually tuned in 50 kHz steps, making 3,500 frequencies available, or it may be converted to permit tuning in 25 kHz steps up to 399.975 MHz, making 7000 frequencies available. The radio is a console-mounted, self-contained unit requiring no special cooling beyond louvers cut in the sides of the console. Operating power is 28 V dc from the no. 1 essential bus through the UHF-1 and UHF-2 circuit breakers on the B/N's circuit breaker panel.

UHF COMM CONTROL PANELS

Two UHF COMM control panels (figure 7-2) in the center console provide the operating controls, frequency/channel readouts, and the preset channel frequency cards.

Tuning Selector Switch

The tuning selector switch is a four-position rotary switch marked GUARD, MANUAL, PRESET, and READ. When the switch is at GUARD, the main transceiver is tuned to 243.0 MHz, permitting transmission and reception on guard frequency. With MANUAL selected, the frequency tuning knobs are used to tune the main transceiver to any frequency within its range. The frequency selected is displayed electronically in the readout window. When the switch is at PRESET, the PRESET knob is used to tune the transceiver to any of 20 preset channels, and the number of the channel selected is displayed in the readout window. When the switch is at the spring-loaded READ position, the frequency of the preset channel selected is displayed in the readout window. A frequency card is available to record channel frequencies. The frequency or channel tuned on UHF no. 1 may be read in a remote indicator window on the pilot's instrument panel.

Function Switch

The function switch is a four-position rotary switch marked OFF, MAIN, BOTH, and ADF. Selecting OFF secures the radio. When MAIN is selected, the main transceiver is energized, permitting normal transmission and reception. Selecting BOTH energizes both the main transceiver and the guard receiver. When ADF is selected, the automatic direction finding function is energized. Both main and guard receivers are enabled. Direction information is supplied from the main receiver. If ADF is selected on both radios, UHF no. 1 takes precedence.

Frequency Tuning Knobs

The four frequency tuning knobs are used to tune the transceiver when the tuning selector switch is at MANUAL. The left knob controls hundreds and tens digits, the second knob controls units, the third controls tenths, and the right knob controls hundredths and thousandths (if the radio has been set up for 25 kHz channel spacing).

TONE Button

Depressing the TONE button causes a steady tone to be transmitted on the frequency or channel selected.

Dim Knob

The DIM knob controls brightness of the frequency or channel readout window. Full counterclockwise rotation provides the dimmest display.

LAMP TEST Button

Depressing the momentary LAMP TEST button lights the frequency or channel display for test.

SQ Disable Switch

The SQ disable switch is a two-position toggle marked OFF and ON. At OFF, the squelch circuit is operational and background noise is reduced by automatically reducing receiver gain. Setting the switch to ON disables the squelch circuit, restoring the receiver to full gain.

Volume Control

The VOL control provides adjustment of the level of the audio signal provided to the ICS. Full counterclockwise rotation provides minimum volume.

SPEECH SECURITY EQUIPMENT (KY-28)

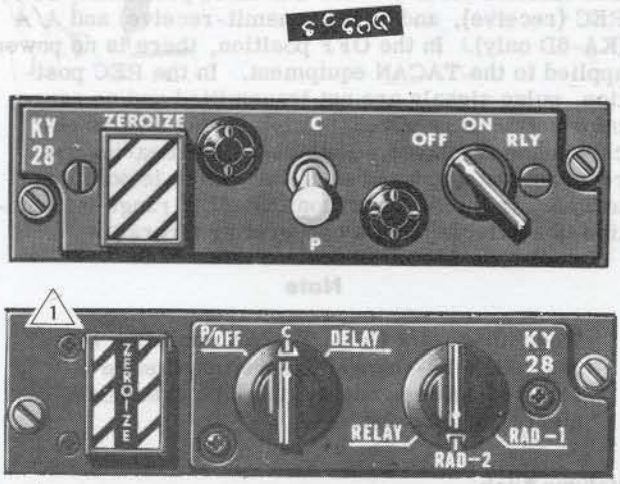
The aircraft is provided with TSEC KY-28 speech security equipment for cipher and plain-language operation for the UHF radio. Two identical KY-28's are provided in the KA-6D. A-6E 159895 and ON and A-6E Mod M121 and ON are provided with a KY-28 control panel permitting selection of either UHF radio for cipher operation. With KY-28 installed, preset codes are set by qualified personnel to enable the cipher mode. A jumper is provided to enable the UHF radio when the KY-28 is removed.

TSEC/KY-28 speech security equipment theory of operation, function, and tactical operation are found in the applicable operation manual KAO-124B TSEC.

KY-28 CONTROL PANEL

The KY-28 control panel (figure 7-4) on the aft console provides the cockpit controls for operating the UHF receiver/transmitter in cipher or plain-language modes.

KY-28 CONTROL PANEL



1 A-6E 159895 AND ON AND A-6E MOD M121 AND ON

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Figure 7-4

Power Switch

The power switch is a three-position rotary selector placarded OFF, ON, and RLY. The RLY (relay) position is not used. OFF removes power from the system and prevents use with the UHF radio. ON applies operating voltage to the KY-28 system.

Cipher-Plain Switch

The cipher-plain switch is a two-position toggle switch placarded C and P. In the P position, the UHF radio is used as a plain-language receiver/transmitter. The C position is used to transmit and receive voice secure communications over the UHF radio in accordance with the preset codes.

Note

To permit operation of the UHF radio after the KY-28 has been operated in the cipher position, set the cipher-plain switch to P before setting the power switch to OFF.

Zeroize Switch

The ZEROIZE switch is a guarded, two-position, spring-loaded toggle switch. When placed to the ZEROIZE (up) position, the preset codes are erased, and must be reset by qualified personnel before being used in the cipher (C) mode.

KY-28 OPERATION

Prelaunch

1. Determine that proper code has been set by qualified personnel in KY-28 equipment on extensible equipment platform.
2. UHF radio and CNI master switch ON.
3. Power switch - ON.
4. Cipher-plain switch to P.
5. If a ground test of equipment is desired, after a 2-minute warmup, establish two-way plain-text UHF radio communications with a suitable ground station and request an equipment check.
6. Cipher-plain switch to C.
   a. Listen for a steady, unbroken tone in headset, followed by
   b. A double-pitched broken tone.
7. Depress MIC button, hold for approximately 2 seconds, and release. Double-pitched broken tone will cease and no sound will be heard.
8. Depress MIC button and hold. A single beep tone will be heard in approximately 1 1/2 seconds. When this tone is heard, equipment is ready to cipher transmission.
9. After beep tone is heard, establish two-way cipher UHF communications with cooperating ground station and check for readability and signal strength.
10. Set cipher-plain switch in accordance with tactical situation.

Note

If a ground check is not practical, the above procedure may be used to perform an in-flight check of the equipment.

Prelaunch (A-6E 159895 and ON, and A-6E Mod M121 and ON)

1. Determine that proper code has been set by qualified personnel in KY-28 equipment.
2. UHF radios - ON
3. Power-mode switch - C
4. Radio selector - RAD-1 or RAD-2
5. If a ground test of equipment is desired, establish two-way plain-text UHF radio communications on the selected radio with a suitable ground station and request an equipment check.

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6. After a 2-minute warmup, on the selected radio listen for a steady, unbroken tone in the headset followed by a double-pitched broken tone.

7. With the appropriate radio selected for transmission, depress MIC button, hold for approximately 2 seconds and release. Double-pitched broken tone will cease and no sound will be heard.

8. Depress MIC button and hold. A single beep tone will be heard in approximately 1 1/2 seconds. When this tone is heard, the equipment is ready to cipher transmission.

9. After the beep tone is heard, establish two-way cipher UHF communications with a cooperating ground station and check for readability and signal strength.

10. Set power-mode and radio selector switches in accord with the tactical situation.

Note

If a ground check of the equipment is not practical, the above procedures may be used to perform an in-flight check.

Post Launch

The speech security equipment will be operated as directed by appropriate authority.

After Landing

1. ZEROIZE switch - ZEROIZE (as briefed) Zeroize code as directed by appropriate authority.

2. Power switch - OFF.

A-6E 159596 and ON; Mod M121 and ON:

2. Power-mode switch - P/OFF

TACTICAL AIR NAVIGATION (TACAN)

The TACAN equipment of the CNI system consists of a short-range navigation radio that converts radio signals into visual displays of azimuth and range. The azimuth and range signals are displayed on the horizontal situation indicator (HSI) on the pilot's instrument panel. The receiver-transmitter is used in conjunction with a receiver-transmitter located at a ground site or aboard ship. The signals used for azimuth measurement originate at the surface beacon, are radiated by a rotating antenna, and are displayed on the HSI. A pulse signal from the TACAN transmitter in the aircraft triggers a responding pulse from the ground station; the time lapse between the initial pulse and response pulse is translated into distance and displayed in nautical miles on the HSI.

The maximum range of TACAN is approximately 195 nautical miles; however, bearing information is accurate beyond this range under most conditions. All controls for the equipment are on the TACAN control panel (figure 7-2).

TACAN CONTROL PANEL

Function Selector Knob

The function selector knob has three positions: OFF, REC (receive), and T/R (transmit-receive) and A/A (KA-6D only). In the OFF position, there is no power applied to the TACAN equipment. In the REC position, pulse signals are not transmitted and no range information is received. Only bearing data is received and displayed. Both range and bearing are received and displayed when the switch is positioned to T/R. In the A/A position (KA-6D), range information is available from a cooperating aircraft.

Note

When air-to-air (A/A) TACAN operation is desired, a 63-channel difference must be selected between cooperating aircraft. Both aircraft must select A/A.

Volume Knob

This control adjusts the volume of the station identification signal heard in the pilot's and bombardier/navigator's headsets. The signal is transmitted in international Morse code, with a three-letter designation representing the station's call letters.

Channel Selector Knobs

The desired operating TACAN channel is selected by two selector knobs. The left knob selects the first two digits of the desired channel, and the right knob selects the last digit. All digits are displayed through the channel digit display window.

TACAN Light (KA-6D)

The TACAN light on the windshield bow will be on only when the HSI mode selector switch is in the NAV COMP position and the navigation computer is OFF or inoperative.

Note

The HSI will display the information selected when the HSI MODE selector switch is in the TACAN or NAV COMP position, except in the above case, where the TACAN light indicates that the display on the HSI is TACAN and not NAV COMP information as selected.

TACTICAL AIR NAVIGATION (TACAN) AN/ARN-84

A-6E 159895 and ON and A-6E Mod M121 and ON are equipped with the AN/ARN-84 TACAN, which provides continuous indications on the HSI of slant range (to 0.1 nmi) and magnetic bearing (to 0.5°) to any selected surface station. Slant range to suitably equipped aircraft is available with A/A selected. Operating range is line-of-sight to approximately 300 nautical miles.

The ARN-84 can provide 126 operating channels in each of two modes; however, present installation permits operation only in the NORMAL/X mode. The Y mode is reserved for future development of an additional 126 channels.

When operating in T/R or REC, the ARN-84 can receive valid signals from a surface station simultaneously with 99 other aircraft, and when operating in A/A it is capable of transponding with each of five different aircraft, providing slant range information to each; however the system will interrogate and lock onto only one. To use A/A, a 63-channel difference must be selected between cooperating aircraft, and both must select A/A.

A memory feature prevents interruption of tracking by a momentary signal loss. A range signal that has been tracked for at least 10 seconds will be retained by memory for 8 to 12 seconds after loss of signal, and a bearing signal lost will be retained by memory for 3 to 8 seconds if it has been tracked for at least 15 seconds.

Power is provided from the 115 V ac essential bus and the 28 V dc essential no. 1 bus through MA-1/TACAN circuit breakers on the main circuit breaker panel and from the 26 V ac bus through the MA-1/TACAN circuit breaker on the aft nosewheel well circuit breaker panel.

TACAN BUILT-IN TEST (BIT)

The ARN-84 contains built-in test circuits, which provide continuous automatic monitoring and a 22-second interruptive self-test, which is indicated by a pushbutton on the control panel.

Two STATUS lights on the control panel provide indication of BIT results. A failure condition either during the continuous monitor function or the self-test lights the amber NO-GO light. Successful completion of the self-test lights the green GO light for 6 to 18 seconds.

Normal BIT sequence is as follows:

1. Set function switch to T/R; allow 2 minutes for warmup.
2. Press and hold BIT button
   a. Both STATUS lights go on (lamp test)
   b. HSI range OFF flag appears
   c. HSI TACAN bearing needle rotates ccw.
3. Release BIT button. Both lights go out, self-test starts.
   a. After 5 to 6 seconds, range reads 2 nmi, bearing reads 4°, a tone sounds in ICS.
   b. After 22 seconds, if good, GO light comes on; if bad, NO-GO light comes on.

TACAN CONTROL PANEL

The TACAN control panel (figure 7-2) on the center console contains all controls for the ARN-84 TACAN.

CHAN Selector

The CHAN selector is a dual, stacked control. The outer control selects the first two digits of the channel; the inner control selects the last digit. The selected channel number is displayed in a window adjacent to the control.

MODE Selector Switches

The two MODE selector switches are two-position toggles marked INVERSE, NORMAL, X, and Y. The switches are provided for future capability and are presently locked in the NORMAL and X positions.

Function Switch

The function switch is a five-position rotary selector marked OFF, REC, T/R, A/A, and BCN. With OFF selected, power is removed from the equipment. Selecting REC enables receiver operation, but inhibits the transmitter, making bearing to the surface station available but no range information. When the switch is at T/R, both the receiver and transmitter are operational, making both range and bearing to the selected surface station available. With either REC or T/R selected, the station identifier audio may be heard in the headset via the ICS. Selecting A/A permits air-to-air ranging to cooperating aircraft that have selected the A/A function and a 63-channel separation.

VOL Control

The VOL control knob permits adjustment of the volume of the TACAN audio provided to the ICS. Full clockwise rotation provides maximum volume.

BIT Button

The BIT button is a momentary-action pushbutton switch used to initiate the interruptive self-test function of the built-in test circuitry.

STATUS Lights

The green GO and amber NO-GO STATUS lights indicate the results of built-in-test. Lighting of the green GO light indicates successful completion of the

Figure 7-5 Deleted

interruptive self-test. Lighting of the amber NO-GO light indicates either failure of the interruptive self-test or detection of a failure condition during the continuous monitoring function.

IDENTIFICATION RADAR (IFF – SIF)

The AIMS (IFF-SIF) transponder system is capable of automatically reporting coded identification and altitude signals in response to interrogations from surface or airborne stations so that the stations can establish aircraft identification, control air traffic, and maintain vertical separation. The system has five operational modes: 1, 2, 3/A, C, and 4. Modes 1 and 2 are IFF modes, mode 3 (civil mode A) and mode C (automatic altitude reporting) are primarily air traffic control modes, and mode 4 is the secure (encrypted) IFF mode.

The system consists of the following components:

- Basic AIMS components
  - Transponder control panel
  - Transponder

    A-6E 159895 and ON and A-6E Mod M121 and ON are equipped with the AN/APX-72 transponder. All other aircraft have the KY-533A/ASQ.
  - Transponder test set (only on aircraft with the AN/APX-72)
- Altitude reporting components
  - Air data computer
  - Servoed Altimeter AAU-19
- Secure IFF components
  - Transponder Computer KIT-1A/TSEC
  - IFF caution light
  - Landing-gear interlock.

The transponder test set provides self-test and monitor functions for modes 1, 2, 3/A, and C. It accomplishes the self-test function when actuated by interrogating the transponder and monitoring the replies. The monitor function is accomplished, when selected, by monitoring transponder replies to external interrogation. The KY-533A transponder has the self-test and monitor functions built in and does not require a test set.

TRANSPONDER CONTROL PANEL

The transponder control panel serves as a universal control for the IFF coder. The IFF coder control provides automatic selective identification reply to to selected secondary radar interrogation. The control panel (figure 7-2) is on the center console.

Master Control Switch

The MASTER control switch is a five-position rotary switch placarded OFF, STBY, LOW, NORM, and EMER. In the STBY position, power is applied to the IFF coder, but interrogations are blocked. The transponder should be warmed up in STBY for 2 minutes before selecting LOW or NORM. In the LOW position, the IFF coder is operational, but the receiver sensitivity is reduced. In the NORM position, the IFF coder is fully operational at normal receiver sensitivity. In the EMER position, the IFF coder transmits emergency replies to interrogations in any mode. To select the EMER position, the control must be pulled outward.

Note

The emergency mode is automatically selected when any crewmember ejects. However, if the IFF is off, it will take 80 seconds to warm up and reply.

IDENT/MIC/OUT Switch

The IDENT/MIC/OUT switch is a three-position toggle switch. Momentarily actuated (the switch has a spring-loaded return) to the IDENT position, an identification of position response is added to mode 1, 2, and 3/A replies for 15 to 30 seconds. In the MIC position, the identification of position response is activated for 15 to 30 seconds whenever the microphone switch is actuated. In the OUT position, the IDENT reply is disabled.

Mode 1-3/A Code Selectors

Six code-selector switches are provided for selection of mode 1 and mode 3 codes. Mode 1 has two thumbwheel selectors, which allow selection of 32 different codes. Mode 3 has four thumbwheel selectors, which provide the capacity of selecting 4,096 codes. The mode 3/A emergency reply also includes code 7700.

Mode C Operation

The KY533A/ASQ or AN/APX-72 IFF/SIF Transponder can transmit altitude information in reply to a ground stations's interrogation, when the air data computer (ADC) is installed.

Pitot-static information is provided to the ADC and to the AAU-19 servoed altimeter. The ADC converts this information to an altitude, including static defect corrections. The altitude, in the form of a digital signal, is sent to the transponder for transmission when interrogated and to each AAU-19 altimeter in the form of a synchro signal. Thus, the altitude read on the AAU-19 represents the same altitude being transmitted via the transponder, when the AAU-19 is set to 29.92. In the AAU-19, the barometric altitude is compared with the input from the ADC and, if the error is excessive, the altimeter will revert to the backup mode. (A flag on the AAU-19 indicates that it is in the backup mode.) In the ADC, an error

signal monitoring circuit will interrupt the altitude signal being sent to the transponder should the power fail, or the errors become excessive.

Mode Selector/Test Switches and Light

Four mode-selector/test-selector switches labeled M-1, M-2, M-3/A, and M-C have TEST, ON, and OUT positions. With the master control at NORM, in the momentary TEST position switches only, lighting of the TEST light indicates proper operation of the mode selected. The mode switches for the modes not being tested should be at OUT when testing on the ground to prevent unnecessary interference.

Note

The TEST light may flash once as each mode switch is released from TEST, and as the RAD TEST/MON switch is moved. This flash has no significance.

The OUT position for each switch disables its respective mode. The ON position for each switch enables the transponder to reply to interrogations for the mode selected. The M-C switch provides automatic coded attitude reporting for air-traffic control identification.

RAD TEST/MON Switch

The RAD TEST/MON switch is a three-position toggle switch spring-loaded to the OUT (center) position. The MON position is used to monitor the operation of modes 1, 2, 3/A, and C. When MON is selected, the TEST light will light for 3 seconds each time an acceptable response is made to an interrogation on a selected mode. The RAD TEST position enables mode 3/A or 4 responses to TEST mode interrogations from a ramp test set during ground maintenance testing.

Mode 4 Operation

The mode 4 controls and indicator light are grouped on the left side of the control panel. The MASTER rotary switch controls transponder operation in mode 4 as well as in the other modes of operation. Mode 4 will operate normally, when selected, in either the NORM or EMER positions, and at reduced receiver sensitivity in LOW position. The mode 4 function will be inoperative in either STBY or OFF positions.

With the transponder functioning, mode 4 operation is selected by placing the mode 4 ON-OUT toggle switch to ON. Placing the switch to OUT disables mode 4 operation.

The mode 4 CODE control selects either of the two (A or B) mode 4 codes. It has two additional positions, HOLD and ZERO. The switch is spring-loaded to return from HOLD to the A position. At a designated daily time and/or prior to the day's mission, maintenance or operations personnel mechanically set in the mode 4 code for the present code period in position A, and the code for the succeeding code period in position B, with a single insertion of the KIK-18/TSEC Code Changer Key. Both code settings will automatically zeroize when power is turned off or lost, providing the landing gear has been retracted (i. e., after initial takeoff). The transponder computer can be programmed to mechanically hold the code settings after landing and shutdown. This can only be done after aircraft has landed (landing gear must be down and locked) and before power is removed from the transponder. Place the mode 4 CODE control to HOLD, and release. Allow transponder power to remain on for at least 15 seconds, and then turn it off. The code setting is now mechanically latched and will be retained when aircraft power is turned off.

Note

- If power is removed from the transponder less than 15 seconds after selecting HOLD, either by turning the transponder off or by turning off aircraft electrical power, the code setting may not be mechanically latched and will zeroize.
- Mode 4 code settings should be manually zeroized if the aircraft does not make initial takeoff (i. e., gear was never raised), or if the hold function has been engaged and subsequent takeoff was not carried out.

With aircraft power on and the MASTER rotary switch in any position except OFF, both code settings can be zeroized at any time by placing the CODE switch to the ZERO position. Both code settings will also be zeroized, if the HOLD function has not been properly actuated before the MASTER switch is turned to OFF. (Inadvertent selection of OFF is prevented by switch design, which requires that the rotary knob be pulled out before it can be turned to OFF.) When the CODE switch is placed in the A position, the aircraft transponder will respond to mode 4 interrogations from an interrogator using the same code setting as that set into the aircraft's code A position. In the B position, interrogations from an interrogator using the same code setting as that set into the aircraft's code B position will be answered. The changeover time from code A to code B use is operationally directed.

The Mode 4 AUDIO-LIGHT switch selects the aircraft indication for Mode 4 replies. In the LIGHT position, the Mode 4 REPLY lamp (green) will light when Mode 4 replies are transmitted. In the AUDIO position, an audio signal in the pilot's headset indicates Mode 4 interrogations are being received and lightings on the Mode 4 REPLY light indicate when replies are transmitted. Mode 4 audio volume can be adjusted by the appropriate aircraft intercom audio volume control. In the OUT position, both light and audio indications are inoperative.

IFF CAUTION LIGHT

An IFF caution light, on the caution light panel, goes on whenever the IFF caution light circuitry detects an inoperative mode 4 capability, provided that the KIT-1A TSEC computer is installed, aircraft power is on, and the IFF MASTER switch is not OFF. Specific discrepancies monitored by the IFF caution light circuitry are: (1) Mode 4 codes zeroized, (2) Transponder failure to reply to proper interrogation, or (3) Automatic self-test function of the computer reveals a faulty computer. Lighting of the caution light indicates the equipment will not respond to mode 4 interrogations, and that operation in a known mode 4 interrogating environment should be avoided or, if already in one, take appropriate corrective or emergency action. To attempt correction, place the IFF MASTER control switch to NORM (if in STBY or LOW), check to see that the mode 4 ON-OUT toggle switch is ON, and that the proper A or B code has been selected for the current code time period. If the caution light remains lit, employ the applicable flight procedures that are operationally directed for an inoperative mode 4 condition.

Note

Since power for the caution light is routed through the KIT-1A/TSEC Transponder Computer, this unit must be installed in the aircraft to render the caution light operative.

VISUAL COMMUNICATIONS PROCEDURES

GROUND HANDLING SIGNALS

Communications between the aircraft and ground crew personnel are visual whenever practicable, if operations permit. The visual signals illustrated in figure 7-6 should be reviewed and practiced by all pilots and bombardier/navigators.

INFLIGHT VISUAL COMMUNICATIONS

Communications between aircraft are visual whenever practicable, if operations permit. Flight leaders shall ensure that all pilots in the formation receive and acknowledge signals when given. The visual communications section of NWP-41 must be reviewed and practiced by all pilots and bombardier/navigators. For ease of reference, common visual signals applicable to flight operations are contained in figure 7-7.

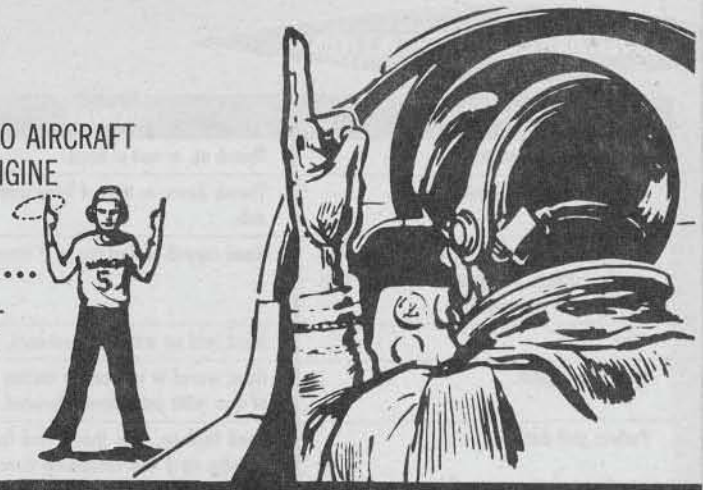
DECK/GROUND HANDLING SIGNALS

1 FINGER .... GTC START

2 FINGERS .... AIR PRESSURE AVAILABLE TO AIRCRAFT CLEAR TO START EITHER ENGINE

3 FINGERS .... CUT GTC - DISCONNECT

RESPONSE .... 3 FINGERS CLEAR TO START OTHER ENGINE



START ENGINES

LEFT INDEX FINGER TO THE NOSE, RIGHT HAND PALM OUT IN A "STOP" MOTION.

ENTERING "Y"
(STOP NOSE GEAR STEERING)

LAUNCH BAR IS LOWERED.

LAUNCH BAR LOWERED

LEFT ARM PULLED UP/DOWN ALONG LEFT SIDE.

RAM AIR TURBINE

CARRIER FLIGHT DECK PERSONNEL COLOR CODING

RED SHIRTS ..... ORDNANCE, AND CRASH CREW
PURPLE SHIRTS ..... FUEL HANDLING
YELLOW SHIRTS ..... PRI FLY, PLANE DIRECTORS, CATAPULT OFFICER AND ARRESTMENT OFFICER
BLUE SHIRTS ..... PLANE HANDLERS (PUSHERS CHOCK MEN, ETC.)
GREEN SHIRTS ..... AIRCRAFT MAINTENANCE, CATAPULT CREW, ARRESTMENT CREW
BROWN SHIRTS ..... PLANE CAPTAINS
WHITE SHIRTS ..... MEDICAL

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Figure 7-6

IN-FLIGHT VISUAL COMMUNICATIONS

GENERAL CONVERSATION

MEANING	SIGNAL	RESPONSE
Affirmative (I understand).	Thumb up, or nod of head.	
Negative (I do not know).	Thumb down, or turn of head from side to side.	
Question (repeat). Used in conjunction with another signal, this gesture indicates that the signal is interrogatory.	Hand cupped behind ear as if listening.	As appropriate.
Wait.	Hand held up with palm outward.	
Ignore last signal.	Hand waved in an erasing motion in front of face, with palm turned forward.	
Perfect, well done.	Hand held up, with thumb and forefinger forming an 0 and remaining three fingers extended.	
Numerals, as indicated.	With forearm in vertical position, employ fingers to indicate desired numerals 1 through 5. With forearm and fingers horizontal, indicate number which, added to 5, gives desired number from 6 through 9. A clenched fist indicates zero.	A nod of the head (I understand). To verify numerals, addressee repeats. If originator nods, interpretation is correct. If originator repeats numerals, addressee should continue to verify them until they are understood.
Take over communications.	Tap earphones, point to plane, and hold up one finger.	Execute.

CONFIGURATION CHANGES

MEANING	SIGNAL	RESPONSE
Lower landing gear.	Rotary movement of hand in cockpit, as if cranking wheels.	Execute.
Lower arresting gear hook.	Leader lowers hook.	Wingman lowers arresting gear hook. Leader indicates wingman's hook is down with thumb up signal.
Extend or retract flaps or speed brakes as appropriate.	Open and close four fingers and thumb.	

FUEL AND ARMAMENT

MEANING	SIGNAL	RESPONSE
How much fuel have you?	Raise fist with thumb extended in a drinking position.	Indicate fuel in tens of gallons or hundreds of pounds by finger numbers.
Arm or safety ordnance.	Pistol cocking motion with either hand.	Execute and return signal.
1—Arm or safety tanks as applicable; 2—how many tanks do I have? 3—I am unable to drop.	1 — Shaking fist; 2 — followed by question signal; 3 — followed by nose-held signal.	1—Execute and return signal; 2—indicate with appropriate finger numerals; 3—nod head (I understand).

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Figure 7-7 (Sheet 1)

FORMATION

MEANING	SIGNAL	RESPONSE
1—I have completed my take-off Check-off and am, in all respects ready for take-off; 2—I have completed my take-off check list and am, in all respects, ready for a section take-off; 3—take-off path is clear, I am commencing take-off.	1—Section take-off leader raises arm (either) over head; 2—wingman raises arm over head; 3—leader lowers arm.	1—Stands by for reply from wingman, holding arm over head until answered; 2—wingman lowers arm and stands by for immediate section take-off; 3—executes section take-off.
Leader shifting lead to wingman.	Leader pats self on head points to wingman. At night, leader A/C switches lights to bright, and turn anti-collision light on. In the event of an external light failure, leader shines flashlight on hard hat, then shines light on wingman.	Wingman pats head and assumes lead. At night, wingman puts lights on dim, and turns grimes light off when he accepts the lead. In the event of an external light failure, wingman shines flashlight at leader, then on his hard hat. Turns external lights to dim and assumes lead.
Leader shifting lead to division designated by numerals.	Leader pats self on head points to wingman and holds up two or more fingers.	Wingman relays signal; division leader designated assumes lead.
Take cruising formation.	Thumb waved backward over the shoulder.	Execute.
I am leaving formation.	Any pilot blows kiss.	Nod (I understand).
Aircraft pointed out leave formation.	Leader blows kiss and points to aircraft.	Execute.
Directs plane to investigate object or vessel.	Leader beckons wing plane, then points to eye, then to vessel or object.	Wingman indicated blows kiss and executes.
Refers to landing of aircraft, generally used in conjunction with another signal; 1—I am landing; 2—directs indicated aircraft to land.	Landing motion with open hand; 1—followed by patting head; 2—followed by pointing to another aircraft.	1—Execute; 2—execute.
a. Join up or break up, as appropriate. b. On GCA/CCA final: Leader has runway/ship in sight.	Flashing external lights.	a. Comply. b. Wingman repeats, indicating runway/ship in sight. Ship: Leader waves-off wingman lands. Field: When runway conditions preclude a safe section landing leader will wave-off.
I am going to dump fuel.	Make hand into cup shape and make repeated pouring motions.	Wingman nods moves clear of fuel dump vents and gives "thumbs up" when dumping commences.
I have stopped dumping fuel.	Slashing motion of index finger across throat.	Wingman gives "thumbs up" when dumping stops.

AIR REFUELING

MEANING	SIGNAL	RESPONSE
Extend Drogue.	Form cone-shape with hand, and move hand aft.	Tanker execute.
Retract Drogue.	Form cone-shape with hand, and move hand foward.	Tanker execute.
Secure Turbine.	One finger turn-up signal followed by cut signal.	Tanker execute.

FORMATION SIGNALS — MADE BY AIRCRAFT MANEUVER — COMBAT OR FREE CRUISE

MEANING	SIGNAL	RESPONSE
Single aircraft cross under in direction of wing dip.	Single wing dip.	Execute.
Section cross under.	Double wing dip.	Execute.
Close up.	Series of small zooms.	Execute.
Join up; join up on me.	Series of pronounced zooms.	Expedite join-up.

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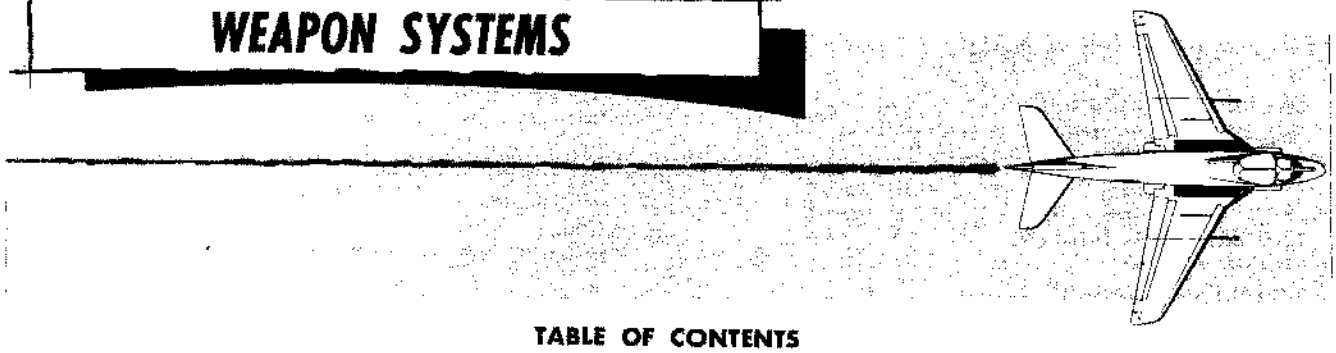
Figure 7-7 (Sheet 2)

section VIII
WEAPON SYSTEMS



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*Refer to NAVAIR 01-85ADA-1A

INTRODUCTION

The weapon system, which provides the crew with an all-weather attack capability, is composed of the airframe and flight-related systems, which are described in Section I, the communications systems, which are described in Section VII, and the mission-related systems, which are described in this section. The mission-related systems include the attack-navigation system, the KA-6D internal air-refueling system, and the defensive electronic countermeasures system. Part 2 A-6B Weapon System, Part 3 A-6C Weapon System, and Part 6 Electronic Countermeasures may be found in NAVAIR 01-85ADA-1A, Supplemental NATOPS Flight Manual.

part 1 A-6A Weapon System

INTEGRATED ATTACK – NAVIGATION SYSTEM

The A-6A is provided with an integrated attack-navigation system, the heart of which is a digital computer. The computer integrates inputs from various sensors including the track radar, the search radar, the Doppler radar, the air data computer, and the inertial platform. As selected by the crew, the computer provides steering commands and other readouts to the pilot and bombardier/navigator as well as a signal to the weapon release system for automatic release of weapons. See figure 8-1.

By using the integrated equipment, the A-6 crew can perform in any weather a wide variety of missions including high- and low-altitude attack, armed reconnaissance, and close support of ground troops. Rockets, missiles, bombs, and nuclear weapons can be delivered by a number of different methods either manually or automatically.

The design of the aircraft permits the crew to attack from extremely low altitudes by use of terrain clearance radar displays for the pilot and computer solution of the various weapon delivery problems based on radar-derived target data from automatic or B/N manually aided target tracking.

SENSORS

AIR DATA COMPUTER

The air data computer provides a means for gathering the necessary aerodynamic data concerning the aircraft flight altitude, and the surrounding atmosphere. The air data computer consists of 3 modules: impact pressure module, altitude module, and mach number module. The outputs, and their respective functions are described below:

MACH - The primary use of mach number in the ballistics computer is in the calculations of true airspeed. True airspeed is derived in the computer by correcting mach number for temperature and angle of attack.

True airspeed is in turn, used in the following areas:

1. Windspeed resolution in the inertial and Doppler modes of navigation.

2. In the DR mode of navigation, TAS is used in combination with windspeed and direction to determine groundspeed and track.

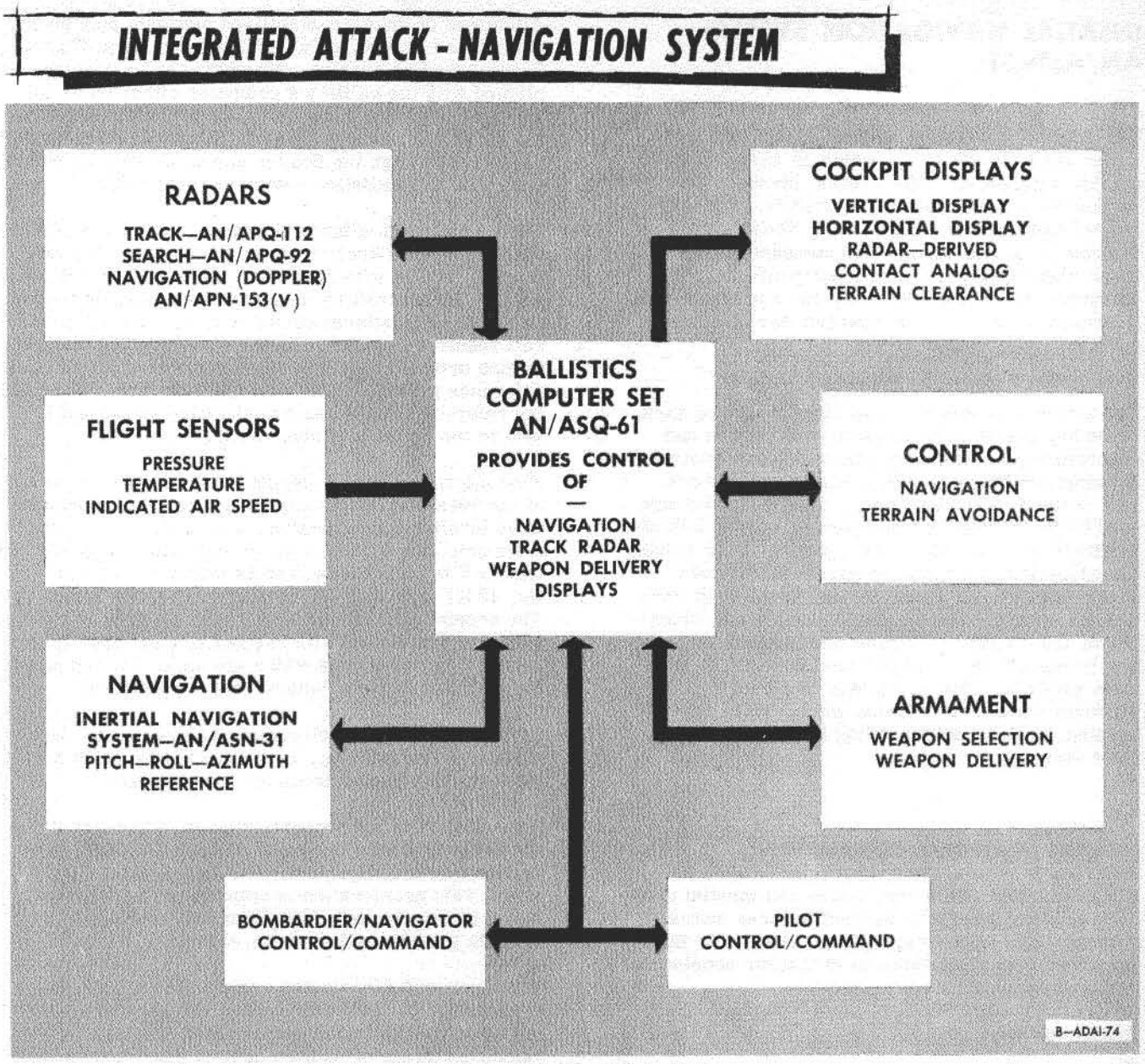

Figure 8-1

3. As a smoothing device for Doppler groundspeed and for vertical velocity in the DR and Doppler modes of navigation.

4. Windspeed corrections required in the ballistics solutions.

STATIC PRESSURE - static pressure is used in the derivation of air density, which is used to compute drag terms in the ballistics solutions for all weapons.

PRESSURE ALTITUDE - pressure altitude is used as the basic system altitude in all modes of operation. In the Doppler and DR modes of navigation, pressure altitude is used directly as true altitude after certain corrections are made. These corrections are for temperature and mach. Correction from MSL to local altitude is made by entering PRES POS altitude via the computer keyboard and vertical velocity corrections with a track lock-on or search data valid, memory point selected, and AMTI off. In the inertial mode, the true altitude is calculated by integrating inertial system vertical velocity for short-term altitude changes, weighted by air data computer pressure altitude for long-term altitude changes.

In aircraft 373 and on with the P8.6 program incorporated and aircraft incorporating the AIMS reporting system, the air data computer provides pressure altitude to the servoed barometric altimeter and an altitude encoded for transmission to the IFF system. NEW

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INERTIAL NAVIGATION SYSTEM AN/ASN-31

The inertial navigation system (INS) is an automatic aid to navigation, which is independent of outside reference. The system provides information on aircraft heading, attitude, and horizontal and vertical velocities. These data are derived from accelerometers mounted along three axes on a gyro-stabilized platform. Information from the INS may be combined with information from other sources for greater accuracy.

The accelerometers mounted along the three axes sense any variation in aircraft acceleration and generate acceleration signals, which are converted to velocities by the platform computers and are sent to the digital computer. The velocities are used by the ballistics computer to update latitude, longitude and altitude. By updating these values, the ballistics computer generates earth rate correction signals to be sent to the INS to keep it level with respect to local gravity and oriented to true north. Attitude and azimuth signals are generated by synchros mounted on the platform gimbals. These signals are sent to the platform adapter to provide pitch, roll, true heading, and magnetic heading to the other aircraft systems.

INERTIAL PLATFORM ORIENTATION

The orientation of the gyro-stabilized inertial platform is maintained with respect to three mutually perpendicular axes referred to as the X, Y, and Z axes, and it is about these axes that the accelerometers measure aircraft accelerations.

Orientation Axes

The Z-axis is coincident with the local vertical and the direction toward the center of the earth is considered to be positive. The X-axis is perpendicular to the Z-axis and lies in the plane of the local meridian. The positive direction of the X-axis defines north. The Y-axis is mutually perpendicular to the X- and Z-axes, and is positive toward the east.

Note

If the aircraft is to be operated at latitudes higher than 70°, it will be necessary to use MAG/VGI with the MA-1 compass unslaved.

ALIGNMENT

In order to establish the inertial navigation system as a valid reference, the platform must be initially leveled with respect to the local vertical and oriented to true north. This process is known as alignment and is accomplished in two phases: rough alignment and fine alignment.

Alignment of the gyro-stabilized platform may be accomplished ashore, on a carrier deck, or in-flight. Shore-based or carrier alignments can be accomplished with the ballistics computer either on or off. In-flight alignments are normally performed with the aid of the ballistics computer. However, it is possible to rough align the INS for use as an attitude reference with the ballistics computer turned off.

During the rough alignment phase, which lasts 50 seconds, the gyros are brought up to speed and the platform is leveled with respect to the elevation and roll axes of the aircraft by means of error signals transmitted to the platform gimbal motors from pitch and roll resolvers contained in the system. The platform is also oriented to within a few degrees of a true north reference provided from an outside source. The heading reference is used as a positioning signal and is sent to the azimuth gimbal motors.

Fine alignment, which begins automatically at the end of the 50-second rough alignment, consists of accurately leveling the gyro-stabilized platform and accurately orienting it to true north and requires approximately 9 to 20 minutes (9 to 14 minutes with AVC No. 1342) depending on the alignment mode selected. The accelerometers sense any displacement of the platform orientation with respect to local gravity and generate error signals which are applied to the platform gimbal motors, which level the platform.

Gyrocompassing, which commences during the latter portion of fine leveling, is the method by which the platform is oriented precisely to true north.

If the X-axis is not properly aligned, a portion of the acceleration due to the earth's angular velocity proportional to the alignment error is felt about the Y-axis. This acceleration is transmitted as an error signal to the azimuth gimbal motors, which turn the azimuth gimbal until no error exists.

The bombardier/navigator can monitor the alignment by means of the indicator lights, the align progress meter on the platform control panel, the inertial velocities on the navigation control panel and on the VDI.

Shore-Based Alignment

The inputs to the inertial navigation system required to perform ashore-based alignment are latitude and a true heading reference. Latitude is provided by means of the erection controller panel. When the COMPASS switch is set to IN or MAG/VGI, the true heading reference is derived from MA-1 compass heading ± the local magnetic variation set in the RHU MAG VAR window. With the COMPASS switch at OUT, the true heading reference is derived from magnetic heading set in the CARR HDG window on the ERECTION CONTROLLER ± local magnetic variation set in the RHU MAG VAR window. The above inputs are required for the 50-second rough alignment phase. Fine alignment normally takes 9 to 11 minutes with the COMPASS switch set to IN and 11 to 20 minutes (11 to 14 minutes with AVC No. 1342) with the switch set to OUT and requires no outside inputs.

Preset Alignment

Preset alignment is predicted upon two conditions; first, that the aircraft had a good alignment when the system was last turned off, and secondly, that the aircraft has not been moved since its last alignment. Given these conditions, a preset alignment can be made in approximately 3 minutes after the 5-minute warmup period by depressing the PRE-SET ALIGN button on the Doppler platform control panel. As in a normal ground alignment, rough alignment and fine alignment occur, but unlike other alignments, no gyrocompassing takes place. The true heading shaft of the platform adapter is locked in place until OPER is selected on the Doppler platform control panel. The READY light will come on approximately 3 minutes after selecting PRE-SET ALIGN, indicating that the level detection circuit in the platform computer has fired, and OPER may be selected. A preset alignment will result in an alignment no more accurate than the alignment that had been attained prior to the previous shutdown. Remaining in PRE-SET ALIGN will not improve the accuracy inasmuch as no gyrocompassing takes place.

Carrier Alignment

When the aircraft is on the deck of a moving carrier, the inertial navigation system requires inputs of latitude, a true heading reference and carrier velocity as initial conditions for rough alignment, which takes 50 seconds. If the system is to be aligned to a grid north reference, longitude and the polar region (north or south) in which the aircraft will be operating are also required. The true heading reference is derived from carrier true heading (COMPASS switch must be at OUT) and aircraft spotting angle, i.e., the difference between aircraft heading and the heading of the carrier. Aircraft spotting angle is manually set in the MAG VAR window. Spotting angles to the right of carrier heading are set as east variation; angles to the left of carrier heading are set as west variation. The inputs of carrier true heading and carrier speed may be set manually on the erection controller panel, or may be available automatically from the ship's inertial navigation system (SINS) through the receptacle on the external power panel on the right side of the fuselage. Latitude must be inserted manually but is automatically updated by the erection controller. Longitude is not required. The CARRIER ALIGNMENT receptacle also provides a two-way communications link with the SINS center. The SINS ICS switch (figure 8-2) must be set to ON for communications with the SINS center. The relative velocity computer modifies carrier velocity inputs to the INS as necessary depending upon the aircraft location with respect to the SINS. A turn rate detector in the aircraft suspends alignment if carrier heading changes at a rate of 30° per minute or greater unless automatic inputs are being provided. Latitude is manually set in the erection controller, and the erection controller latitude will be automatically updated during alignment. Fine heading alignment is accomplished by gyro-compassing. A full alignment requires 20 minutes (14 minutes with AVC No. 1342) to complete.

Figure 8-2

In-Flight Alignment (Full Term)

In-flight alignment requires initial inputs to the INS of true heading, aircraft velocity and the latitude of the alignment starting point. If the system is to be aligned using a grid north reference rather than true north, longitude at the start of alignment and the polar region in which the aircraft will be operating are also required. As in shore-based alignment, the source of the heading reference for rough alignment depends on the position of the COMPASS switch and may be MA-1 heading ± local variation as set on the navigation control panel or the heading set on the erection controller panel. Latitude and longitude are manually set on the erection controller panel. If the ballistics computer is operating, aircraft velocity data can be derived from that source, and by making use of Doppler velocities or velocity-correct.

Note

> If the ballistics computer is not operating, the inertial platform may be partially aligned in flight so as to provide attitude information only.

Fine alignment of attitude and velocity begins automatically after the approximately 50-second rough-alignment period and requires approximately 8 minutes (6 minutes with AVC No. 1342). If the bombardier/navigator moves the NORM/GYROCOMP (figure 8-2) switch to GYROCOMP at this time, fine heading alignment (gyrocompassing), which requires about 20 minutes, commences.

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In-Flight Alignments (Short-Term)

A short-term alignment can be made in flight that eliminates gyrocompassing. Alignment of the inertial platform may be less than optimum due to the limitation of heading information being derived from the MA-1 compass. Aircraft velocity inputs continue to be used during fine alignment. A turn-rate detector suspends alignment during turns of 30° per minute or greater. A normal short-term alignment following the procedures found in Section III of this manual will provide relatively accurate results, provided a fully operational system (i.e., INS, Doppler radar, ballistics computer, MA-1 compass, VGI, and search radar) is available.

The navigation capability after a short-term in-flight alignment will depend upon the quality of the heading information that the platform has aligned to and the velocity outputs of the system. Heading information from the MA-1 using correct magnetic variation should be within ±2°. Using this value, cross-track navigation errors will be close to 3% of distance. Along track navigation for the Doppler/inertial mode will depend upon the quality of the Doppler. Typical values are 1%.

PLATFORM CONTROL PANEL

This panel (figure 8-3) is combined physically with the Doppler control panel and contains the controls and indicators for the inertial navigation system.

Compass Switch

The compass switch on the Doppler platform control panel is a three-position toggle switch labeled OUT, IN, and MAG/VGI. The compass switch is used during platform alignments to select the source of azimuth information for the initial coarse alignment. After the platform has been aligned, the compass switch serves as a selector switch for determining whether heading and attitude reference is to be provided by the INS or the MA-1 compass and the VGI.

CAUTION

The AFCS should be placed in STAB AUG or secured prior to switching into or out of MAG/VGI to prevent abrupt or unexpected attitude changes due to a change in attitude reference signals to the AFCS.

In the compass OUT position, platform heading and attitude information is supplied to the ballistics computer, VDI, AFCS, Doppler, track and search radars, and other system components. The MAG VAR must reflect the correct variation for the HSI to read magnetic headings and bearings.

In the compass IN position, the same situation occurs except that MA-1 compass information is now provided to the HSI.

The MAG/VGI position provides an alternate source of heading and attitude information. In the MAG/VGI position, all heading information is derived from the

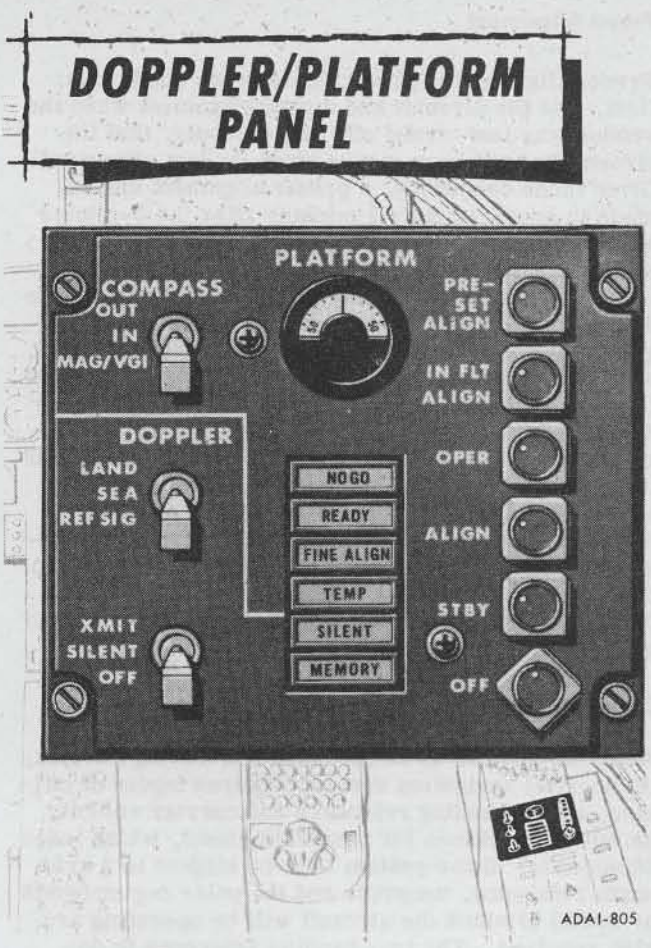

Figure 8-3

MA-1 compass (modified by MAG VAR) and all attitude information supplied to the ballistics computer and related systems is derived from the VGI. It is necessary to continuously update the MAG VAR on the navigation control panel in order to maintain a true heading reference. The MAG/VGI position is used for in-flight alignments.

Platform Selector Buttons

The six platform selector (figure 8-3) pushbuttons. select a phase or condition of system operation. When set from OFF to STBY (standby), power is applied to the platform temperature controls to bring the platform to proper temperature. When the selector is set to ALIGN, PRESET ALIGN, or if in flight, to IN FLT ALIGN, power is applied to the power supply, providing operating voltages to the platform units. The normal operating condition of the inertial navigation system is with the OPER (operate) position depressed, and all platform indicator lights out.

Note

The STBY button must be depressed to set information in the erection controller panel prior to alignment.

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Align Progress Meter

The align progress indicator is used in conjunction with the READY light during platform alignments. While the READY light will come on after a level detection circuit has sensed that a level condition has existed for 55 seconds (2 minutes with AVC No. 1342), a nulled align progress indicator (±1 unit) is the only true indication that the platform is ready to be switched to OPER. Any oscillations of the needle indicate that the inertial system has not finished gyrocompassing.

Note

- When making an automatic carrier alignment, a READY light is not required, provided following criteria have been met: the align progress meter indicates a null (± one unit) for at least 55 seconds prior to going to operate; at least 15 minutes (10 minutes with AVC No. 1342) have been spent in align; and actual carrier velocities are read out in the right-hand unit (within 3 knots) after going to operate and no velocity drift is observed.

- When making a manual carrier alignment, turns of the carrier of 30°/minute or more will suspend the alignment and cause the align progress meter to indicate a null. The same condition may occur during an automatic carrier alignment if the relative velocity computer is not used.

- When making a manual carrier alignment, the same criteria as for automatic carrier alignments apply with the additional requirements that the 15-minute (10-minute with AVC No. 1342) alignment time must be exclusive of suspend align time, and there must be positive indication that a suspend align is not existing during the 55-second meter null.

INS Failure/Unreliable Indications

Figure 8-4 illustrates the indications of failure or unreliability in the INS along with possible corrective actions for each of the various conditions.

Indicator Lights

The following platform indicator lights are provided on the Doppler platform control panel:

NO GO	Indicates a system malfunction. (Platform is disabled.)
READY	Indicates operations readiness and alignment of inertial navigation system.
FINE ALIGN	Indicates completion of rough alignment, and that fine alignment period has been started.
TEMP	When lit, this light indicates an abnormally high platform temperature, insufficient warmup time during the first minute of alignment, or loss of power to the platform. (Platform is disabled.) During the first 5 minutes of operation in STBY, on a cold system, the light may come on for up to 2 minutes.

ERECTION CONTROLLER PANEL

The erection controller panel (figure 8-5) provides erection and alignment information to the inertial navigation system for shore, carrier deck, or in-flight alignment and digital computer OFF operation. Information for the initial alignment can be set automatically in the display windows or inserted manually by the bombardier/navigator.

Note

The initial latitude must be manually set in the erection controller.

Mode Selector Switch

The mode selector switch is a two-position toggle switch marked AUTO and MAN. Setting the switch to AUTO permits automatic inputs of carrier heading and carrier speed to the erection controller panel from the ship's inertial navigation system through the carrier alignment plug on the external power panel on the right side of the fuselage. Setting the switch to MAN permits manual slewing of the counters on the erection controller panel.

Function Selector Switch

The function selector switch is a four-position toggle switch marked CARR HDG, LAT, LONG, and CARR SPEED. Selection of one of the positions enables slewing of the value in the respective window on the erection controller panel.

Increase/Decrease Slew Switch

The increase/decrease slew switch is a five-position toggle switch marked INCR F, INCR S, OFF, DCR F, and DCR S. Use of the switch increases or decreases the values in the windows marked CARR HDG (carrier heading), LATITUDE, LONGITUDE, and CARR SPEED (carrier speed) as determined by the position of the function selector switch. Slewing can be accomplished at the fast rate, 30 units per second, or the slow rate, 3 units per second.

Polar Mode Switch

The polar mode is inoperative and should be left in NORM.

INS FAILURE/UNRELIABLE INDICATIONS

INDICATION	CAUSE	CORRECTIVE ACTION
1. NO GO LIGHT ON (STEADY) 2. VDI PLATFORM LIGHT ON (FLASH)	IN OPER, NO GO CONDITION	REALIGN INS, OR SELECT MAG/VGI AND INS OFF (1)
VDI PLATFORM LIGHT ON (STEADY)	NOT IN OPER, COMPASS SW. AT IN OR OUT (A-6A,B,C), OR ATTITUDE REF SW. AT COMP IN OR COMP OUT (A-6E)	SELECT OPER IF READY LIGHT IS ON OR SELECT MAG/VGI
TEMP LIGHT ON (STEADY)	OVER TEMPERATURE (MORE THAN 3 MIN. IN ALIGN) (MORE THAN 1 MIN. IN OPER)	SELECT MAG/VGI AND INS OFF FOR DURATION OF FLIGHT INCLUDING LANDING
TEMP LIGHT ON (STEADY)	LOSS OF POWER IN STBY	1. CHECK CIRCUIT BREAKERS 2. REALIGN INS OR SELECT MAG/VGI AND INS OFF (1)
TEMP LIGHT ON (STEADY) NO GO LIGHT ON (STEADY)	LOSS OF POWER IN ALIGN	1. CHECK CIRCUIT BREAKERS 2. REALIGN INS OR SELECT MAG/VGI AND INS OFF (1)
1. NO GO LIGHT ON (STEADY) 2. TEMP LIGHT ON (STEADY) 3. VDI PLATFORM LIGHT ON (FLASH)	LOSS OF POWER IN OPER	1. CHECK CIRCUIT BREAKERS 2. REALIGN INS OR SELECT MAG/VGI AND INS OFF (1)
LOSS OF VDI PICTURE	LOSS OF ADAPTER 28V OR ADAPTER FILTERED 28V	1. CHECK THE ADAPTER CIRCUIT BREAKER 2. CONTINUE USE OF INS OR USE MA-1 AND VGI FOR HEADING AND ATTITUDE REFERENCE

(1) **CAUTION**

TO PROVIDE PROTECTION TO THE PLATFORM, THE INS SHOULD BE IN OPERATE OR ALIGN FOR ALL TAKEOFFS AND LANDINGS.

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Figure 8-4

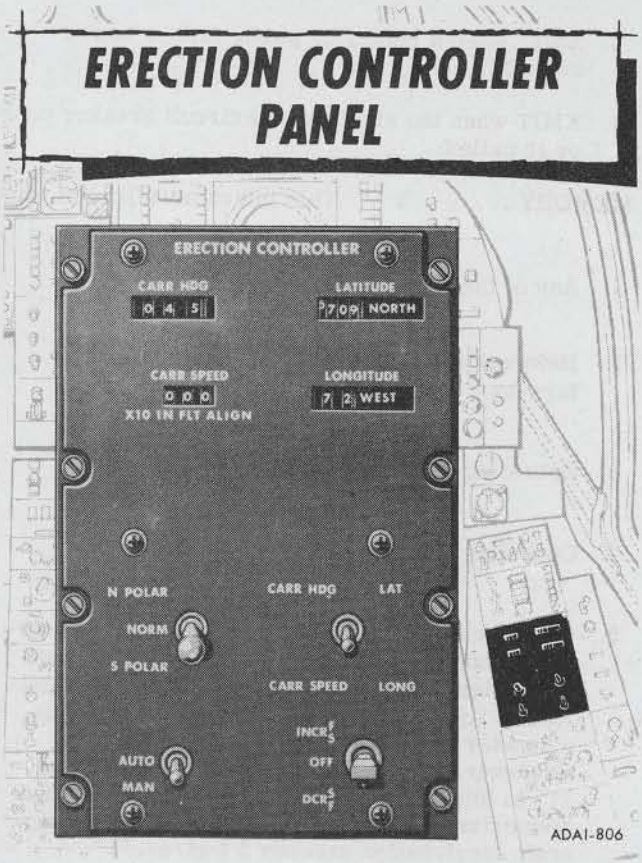

Figure 8-5

DOPPLER RADAR NAVIGATION SET AN/APN-153(V)

The Doppler Radar Navigation Set AN/APN-153(V) is an all-weather, self-contained airborne system. It automatically and continuously computes aircraft groundspeed and drift angle, completely independent of ground stations and wind estimates. The only auxiliary input this system requires is from the aircraft attitude reference system.

Doppler-derived groundspeed and drift angle analog signals are encoded and fed to the AN/ASQ-61A ballistics computer, where they are used as inputs for emergency Doppler navigation mode and for long-term damping of the inertial navigation system, depending upon the position of the navigation mode selector. When the EMER DOP mode of operation is selected, the groundspeed and drift angle are combined with true heading and true airspeed in the digital computer, with a resultant readout of wind velocity and direction. When the Doppler-inertial mode of operation is selected, the Doppler values are used to damp the Schuler frequency oscillations of the inertial platform.

The AN/APN-153(V) Doppler radar navigation set consists of three major functional units: a receiver-transmitter, an antenna assembly, and a signal data converter. It beams signals to the ground, receives echoes, and measures the frequency shift produced by the relative motion between the aircraft and the earth. The system is pulsed so that only two beams (diagonally opposite) are transmitted and received at a time. Aircraft motion shifts the forward beam up in frequency and the rearward beam down in frequency. The frequency shift sustained by each pair of beams is measured and compared. The analog voltage of the difference in frequency shift drives the antenna in azimuth until the frequency shift from each pair of beams is equal. When this occurs, the antenna is aligned with the aircraft's track over the ground. The drift angle indication is the resultant angle between the antenna axis and the aircraft axis. Once the antenna is aligned with the ground track of the aircraft, the measured frequency shift in received echoes is utilized to derive groundspeed. The Doppler-derived drift angle and groundspeed analog signals are transformed within the signal data converter to digital outputs that are subsequently provided to the digital ballistics computer.

When operating in the emergency Doppler or Doppler-inertial navigation modes, Doppler or Doppler-damped drift angle information can be obtained from the bombardier/navigator's direct view indicator, and the groundspeed and wind direction and velocity may be selected on the navigation panel tape dial. In addition to the aforementioned readouts, Doppler-derived groundspeed and Doppler-derived drift angle are displayed on the right-hand unit when the data select switch is in the A position and the computer is in the navigation mode.

When the AN/APN-153(V) Doppler radar is energized, it is in either a normal mode, or in a memory mode. In the normal mode, groundpseed and drift angle are measured automatically and simultaneously. In the memory mode, the MEMORY light is

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on, and the last derived groundspeed and drift angle continue to be sent to the digital ballistics computer until the radar can again acquire a usable return signal, or the equipment is turned to SILENT or OFF.

Doppler antenna stabilization power is provided by 28 Vdc through the AUTOPILOT circuit breaker on the B/N's circuit breaker panel.

Operating characteristics of the Doppler are:

Minimum Altitude:	40 feet above terrain
Maximum Altitude:	50,000 feet above sea level, over land or over water with sea state at least as rough as Beaufort 1
Groundspeed:	80-800 knots
Drift Angle:	25° left or right
Pitch Stabilization:	+29° to -17° (antenna mounted 6° nose down from ADL)
Roll Stabilization:	±30°
Transmitter Frequency:	13,325 MHz ±50 MHz
Pulse Repetition Frequency:	75 kHz nominal, modulated from 60 kHz to 90 kHz at 30 Hz

DOPPLER CONTROL PANEL

The Doppler control panel is combined physically with the platform control panel (figure 8-3) and contains the operational control and indicators for the Doppler Radar Set AN/APN-153(V).

Doppler Mode Switch

The Doppler mode switch is a three-position toggle switch marked LAND, SEA, and REF SIG. Placing the switch in LAND or SEA adjusts the set for the differences in reflective characteristics of land and water. Placing the switch to REF SIG energizes the test mode of operation. The test mode generates a simulated Doppler signal of 121 knots and 0° drift angle.

Indicator Lights

There are two flush-mounted rectangular indicator lights on the Doppler control panel. One light is marked SILENT and one is marked MEMORY. The conditions under which they operate are listed below:

SILENT . . . . . The indicator marked SILENT will light in:

1. SILENT
2. XMIT when timing-in has not been completed
3. XMIT when a cooler or power failure has occurred
4. XMIT when the single-phase circuit breaker pops or is pulled.

MEMORY . . . . . This indicator will light when

1. Any of the silent light conditions occur
2. Before a signal has been acquired on initial turn-up
3. Operating over extremely rough terrain
4. Operating over glassy smooth water
5. Coherence is lost due to the aircraft maneuvering beyond the pitch and roll limits of the Doppler antenna. Although the Doppler radar stabilization limits are not exceeded, the ballistics computer will memorize Doppler velocities whenever the aircraft exceeds 25° in roll and 21° in pitch. The ballistics computer will also memorize Doppler velocities whenever the aircraft acceleration exceeds 5 feet/sec^2.

Note

Whenever the ballistics computer is operating on memorized Doppler velocities because the foregoing limits have been exceeded, the memory indicator will not light until the Doppler radar shifts out of the track mode and a memory signal is supplied to the ballistics computer and Doppler control panel.

Transmit Silent Switch

The transmit/silent switch is a three-position toggle marked XMIT, SILENT and OFF. Placing the switch to OFF removes all power from the equipment. Setting the switch to SILENT provides power to all circuits except the high-voltage transmitter circuits. When the switch is in the XMIT position, the set is fully operational.

Note

During all ground operations, the transmit/silent switch should not be placed in the XMIT position.

SEARCH RADAR SET AN/APQ-92

Note

During all ground operation of the search radar, ensure that personnel and equipment are clear of the radiation danger areas before placing the transmit/silent switch to the XMIT position.

The Search Radar Set AN/APQ-92, in conjunction with other components of the system, functions to facilitate accurate navigation, weapon delivery, and terrain clearance. Displays are available to both the pilot and the bombardier/navigator (see figure 8-6). For characteristics of the search radar system, see the A-6 Supplemental NATOPS Flight Manual NAVAIR 01-85ADA-1A. The search radar can be tuned in flight to any frequency in its band, and in the one-scan mode of operation, can operate with a reduced amount of broadcasting time.

The controls for operation of the search radar are on the bombardier/navigator's control panel with the displays presented to the bombardier/navigator on the DVRI and to the pilot on the pilot's vertical and horizontal display indicators. Controls for the pilot's displays are on the pilot's control box (PCB) (figure 8-14).

SEARCH RADAR CONTROLS

POWER Switch

The POWER switch is a three-position lever-lock toggle switch marked OFF, STBY, and ON, which controls the application of aircraft power to the search radar. The search radar receives three-phase ac power from the primary 115 V ac bus and dc power from the 28 V dc bus through circuit breakers on the B/N's circuit breaker panel.

With OFF selected, no power is applied to the radar and the raster does not appear on the DVRI.

Positioning the switch to STBY provides low voltage only to all units and to tube filaments. The raster, fixed range marks, and cursors appear.

When ON is selected, high voltage is applied to the transmitter magnetron making the radar completely operational.

Note

There is a 5-minute time delay, starting from the time the switch is set to STBY from OFF, before high voltage is available to the magnetron.

The display consists of the raster, markers, and target video with ON selected. Video will not be displayed if the transmit switch is in SIL.

CAUTION

To prevent damage to the antenna, the POWER switch should be at a position other than OFF prior to taxi or flight.

Display Selector Buttons

The five display selector pushbuttons (figure 8-7) are on the extreme right corner of the bombardier/navigator's control panel. These select the desired search or track radar display to be presented on the display scopes. Selected display positions include TCPPI, EMER SRCH, PPI, WAC/ARE 50, and SECT/ARE 25. The selector buttons are of the square-coded type, and rotate 45° when actuated to advise the crewmembers of the selected positions.

TCPPI (TERRAIN CLEARANCE-PLAN POSITION INDICATOR)

The TCPPI display presents a 30° track radar PPI presentation of terrain centered about the aircraft's flight path. This display is available on both the pilot's horizontal display and the bombardier/navigator's direct view radar indicator.

EMER SRCH (EMERGENCY SEARCH)

The emergency search display is a 30° track radar PPI display similar to the TCPPI display, but with a variable depression angle selectable with the elevation slew switch (figure 8-25) on the bombardier/navigator's slew control panel. This display is available on both the pilot's horizontal display and the bombardier/navigator's direct view radar indicator.

PPI (PLAN POSITION INDICATOR)

This control provides for a standard PPI presentation affording three different search ranges. These displays are provided with range markers at various range intervals.

WAC/ARE 50 (WORLD AERONAUTICAL CHART)

The WAC/ARE 50 selector button provides a ground-stabilized display generated by the search radar system that is comparable to the presentation offered on the standard WAC charts in scale and relief. This mode offers a long-range search capability and permits selection of the target, or the target area, early in the mission.

RADAR DISPLAYS

	PRESENTATION	DISPLAYED ON	PRIMARY USE	SWEEP LENGTH (NM)	OPERATING RANGE (NM)	SCAN ANGLE (AZ)	FIXED RANGE MARKERS	REMARKS	
SEARCH RADAR	PPI-150	PHD/DVRI	NAVIGATION	150	0 - 150	20° - 114° MANUALLY VARIABLE	EVERY 25 MILES	WHEN PILOT SELECTS T/C, AUTOMATICALLY SWITCHES TO PPI - 30	
	PPI-75	PHD/DVRI	NAVIGATION	75	0-75	20°-114° (WITHOUT T/C) 60°-114° (WITH T/C)	EVERY 25 MILES	WHEN PILOT SELECTS T/C AUTOMATICALLY SWITCHES TO PPI - 30	
	PPI-30	PHD/DVRI	MEDIUM AND LOW ALTITUDE NAV AND ATTACK	VARIABLE 5-27.5	VARIABLE 0-27.5	20°-114° MANUALLY VARIABLE	EVERY 10 MILES		
	WAC (ONC) SCALE 1:000,000	PHD/DVRI	NAVIGATION	82	44-150	20°-114°	5 MILES ABOVE RANGE LINE	AUTOMATICALLY SWITCHES TO: A. SEC WHEN RANGE IS BETWEEN 27.5 AND 44 MILES B. ARE-50 WHEN RANGE IS LESS THAN 27.5 MILES C. PPI-30 WHEN PILOT SELECTS TC	
	SEC (TPC) SCALE 1:500,000	PHD/DVRI	NAVIGATION	41	27.5-150	20°-114°	5 MILES ABOVE RANGE LINE	AUTOMATICALLY SWITCHES TO ARE-25 WHEN RANGE IS LESS THAN 27.5 MILES	
	ARE-50	PHD/DVRI	ATTACK	1.5 OF RG UNDER 1.7 MILES 0.88 OF RSI OVER 1.7 MILES	0-27.5	20°-114° (WITHOUT T/C) 60°-114° (WITH TC)	1 MILE ABOVE RANGE LINE	DISPLAY IS VARIABLE 20°-50° IN AZIMUTH MINIMUM SWEEP LENGTH UNDER 1.7 MILES IS 1.5 MILES	
	ARE-25	PHD/DVRI	ATTACK	1.5 OF RG UNDER 3.4 MILES 0.44 OF RSI OVER 3.4 MILES	0-27.5	20°-114° (WITHOUT T/C) 60°-114° (WITH TC)	1 MILE ABOVE RANGE LINE	DISPLAY IS VARIABLE 20°-25° IN AZIMUTH MINIMUM SWEEP LENGTH UNDER 3.4 MILES IS 1.5 MILES	
	T/C	VDI	TERRAIN AVOIDANCE	8.5	0 - 8.5	60°-114° EL: +10° OR-15° OF FLIGHT PATH AXIS		ONLY PPI-30 OR ARE DISPLAYS AVAILABLE	
TRACK RADAR	E-SCAN	PHD	TERRAIN AVOIDANCE	5 OR 10	0-10	10° ABOVE TO 15° BELOW FLIGHT PATH	EVERY 2.5 MILES	PRESENTATION SHOWS CLEARANCE IN THE VERTICAL PLANE.	SCAN CENTER IS GROUND TRACK, WHEN COMPUTER IS OPERATING. IF COMPUTER IS OFF, NO DRIFT INFORMATION IS AVAILABLE AND SCAN CENTER IS ADL OF AIRCRAFT
	TCPPI	PHD/DVRI	TERRAIN AVOIDANCE	5 OR 10	0-10	30° AZIMUTH 1° FIXED DEPRESSION	2.5 MILES	RADAR SHOWS TERRAIN WHICH PROTRUDES ABOVE THE FLIGHT PATH.	
	EMERG SEARCH	PHD/DVRI	TERRAIN SEARCH	5 OR 10	0-10	30°	NONE	ANTENNA IS MANUALLY CONTROLLABLE IN ELEV.	

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Figure 8-6

B/N CONTROL PANEL

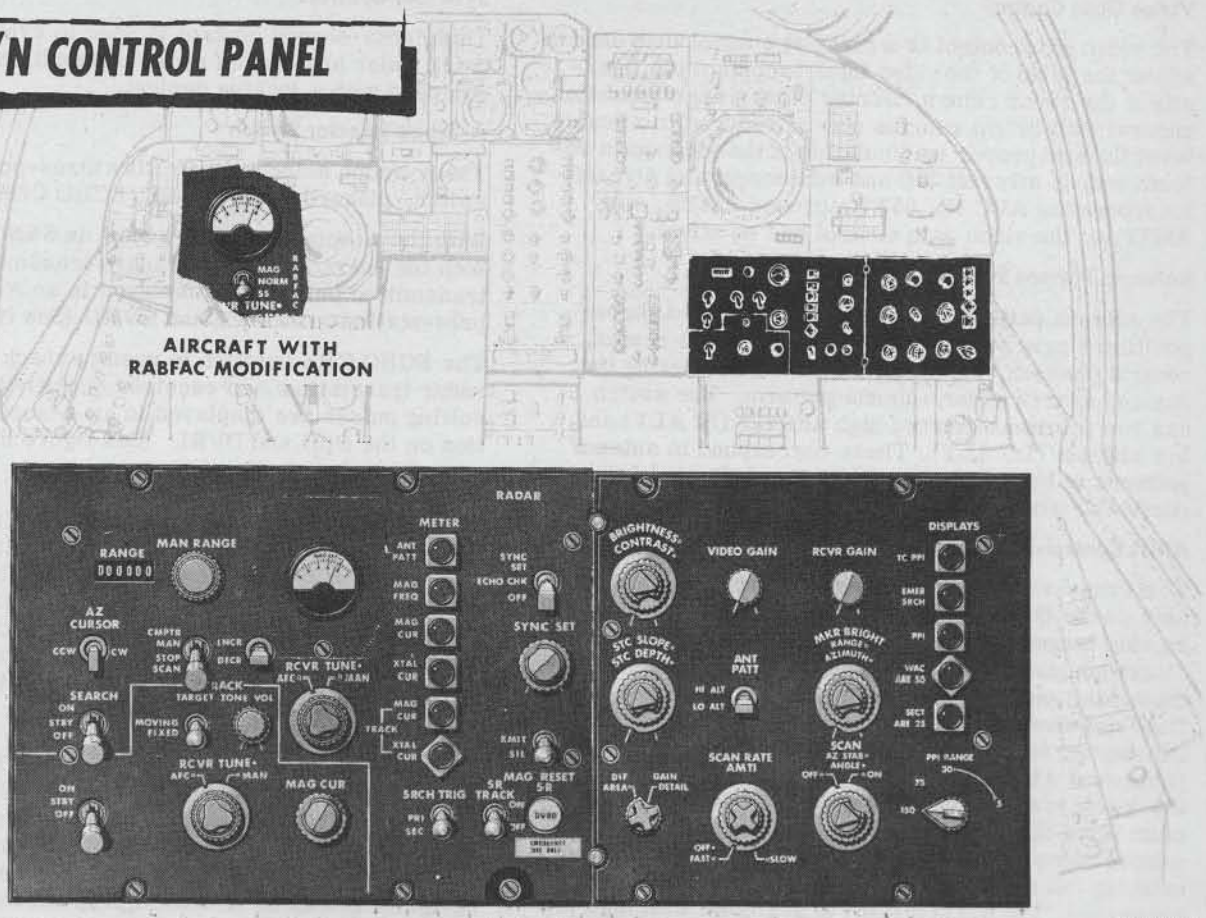

Figure 8-7

SECT/ARE 25

The SECT/ARE 25 selector button provides a ground-stabilized display generated from the search radar system that is comparable to the standard sectional charts. This display is considered the intermediate search mode and provides for a more detailed investigation of the target area. (This mode also incorporates the automatic-range-expansion feature for a better presentation of the immediate target area. This provides greatest definition at close range.)

PPI Range Selector Control

The PPI range selector control (PPI RANGE) (figure 8-7) is below the display selector buttons and provides optional range selection capabilities. The control incorporates a keyed knob, with control positions providing variable 5 to 30, fixed 75, and 150-nautical mile ranges.

Receiver Gain Control

The receiver gain control (RCVR GAIN), (figure 8-7) is a round, keyed control knob used to vary the gain of the search radar system receiver. This control finds extensive use in determining the target return with respect to increase background and noise clutter.

Marker Brightness Control

The marker brightness control (MKR BRIGHT-RANGE and AZIMUTH) (figure 8-7) is a dual potentiometer permitting adjustment of the range and azimuth cursor on the display. The outer portion of this control adjusts the intensity of the range cursor; the inner portion of the control is used to adjust the intensity of the azimuth cursor. Clockwise rotation of either control results in an increased cursor intensity.

Scan Control

The scan control (SCAN - AZ STAB and ANGLE) is a dual potentiometer, providing a means of selecting azimuth stabilization and varying the scan angle of the search radar antenna. The inner control is used to provide the variation of the antenna angle from 20° to 114°. When the terrain clearance mode has been selected, the scan angle is controllable from 60° to 114°. The outer portion of this potentiometer is used to stabilize the search radar antenna scan about the azimuth cursor when in the ON position.

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Video Gain Control

The video gain control is a circular control knob used to adjust the level of the video input to control the intensity of the radar return. During close-range operation, undesirably bright returns may be reduced to a usable level through proper manipulation of the video gain adjustment. In aircraft 310 and subsequent and aircraft incorporating AVC No. 658 (improved AMTI), with AMTI on, the video gain control has no effect.

Antenna Pattern Switch

The antenna pattern switch (ANT PATT) is a three-position toggle switch, spring-loaded to the center, neutral position, providing a means of selecting the desired search radar antenna pattern. The switch has two positions marked high altitude (HI ALT) and low altitude (LO ALT). These correspond to antenna patterns to be used under conditions indicated for a particular airborne operation.

AMTI Control-Scan Rate

This cross-shaped inner control adjusts the AMTI display on the DVRI. In the clockwise (AMTI) position, moving targets will be displayed; in the full counterclockwise position (OFF), AMTI is removed. Intermediate positions present varying relative intensities of fixed and moving target display. In aircraft 310 and subsequent and aircraft incorporating AVC No. 658 (improved AMTI circuitry), rotating the AMTI control clockwise to a position just out of detent provides maximum fixed target cancellation, and continued clockwise rotation provides progressively less cancellation until the full clockwise or minimum cancellation position is reached. The AMTI display is available with high prf when primary trigger has been selected. With AMTI out of detent, moving target filters are used when velocity correct is in OFF SAVE or OFF ERASE and a discrete lock-on exists; this enables the system to better track a moving target during a bombing run. The outer control determines search antenna scan rate at either SLOW (50°/sec) or FAST (100°/sec) position.

Brightness-Contrast Control

This outer control is used to adjust the DVRI brightness, which causes the brightness on search radar displays to vary in modes other than search terrain clearance. The inner control adjusts contrast on the DVRI.

STC Control

The sensitivity time control (STC) is a dual potentiometer. The outer knob controls STC slope and the inner triangular knob controls depth. These controls adjust the level from which receiver gain is increased with time after transmission. Slope is a function of sensitivity and depth is a function of time and therefore range.

Diff Gain Control

This cross-shaped control permits viewing of radar target outlines or entire target areas, as in the case of large land masses. When the control is in the AREA position (full CCW), the land mass will appear as a normal radar presentation. In the DETAIL position (full CW), only the outline of the land mass will appear. The intermediate positions will provide relative intensities of outline and total land mass.

Sync Set Control

This cross-shaped control is used to synchronize the track radar and search radar transmitters and is equipped with a locking device.

A-Scope Selector Switch

The A-scope selector switch is a three-position toggle switch, placarded SYNC SET, ECHO CHK, and OFF.

With the A-scope selector switch in SYNC SET and both the search and track radars transmitting, the transmitted pulses are displayed in an A-scope type presentation on the PHD and DVRI. (See figure 8-8.)

The ECHO CHK position is used to check the search radar transmitter and receiver sensitivity. The resulting pulses are displayed in an A-scope presentation on the PHD and DVRI. (See figure 8-8.)

Search Receiver Tune Selector

This two-position selector (figure 8-7), marked AFC (automatic frequency control) and MAN (manual), selects automatic or manual control of the search radar local oscillator frequency. Proper tuning will be indicated by a peak meter reading with the meter XTAL CUR button depressed. The manual (MAN) position is utilized when the AFC malfunctions.

Search Trigger Switch

The search trigger switch, marked SRCH TRIG, is a two-position toggle switch with primary (PRI) and secondary (SEC) positions. In the PRI position, the timing trigger from the AMTI unit is connected to all circuits. If the AMTI unit fails, the bombardier/navigator positions to SEC to drop out the AMTI and permit the search radar master multivibrator to supply the timing trigger functions.

Search Magnetron Reset Button

This pushbutton switch overrides the protection circuitry of the search radar equipment during periods of low pressure or voltage surges.

When a malfunction occurs, the bombardier/navigator will experience a complete loss of video presentation on the scope. An additional indication of magnetron failure will be provided by monitoring the bombardier/navigator's control panel meter.

If the malfunction is of a temporary nature, the magnetron can be retriggered by depressing the reset button. When depressed, the light in the reset button will be momentarily lit, and indicate the operation of the reset button. Rotating the button will cause the button to remain depressed.

Note

For information regarding emergency operation of the radar equipment magnetron reset button, refer to Section III, Part 7 of this manual.

Search Radar Track Switch

The search radar track (SR TRACK) switch (figure 8-7) is a two-position toggle switch marked ON and OFF.

Placing the switch to ON enables search radar tracking. The search radar goes to fast scan and a maximum scan angle of 60° is available. If AMTI is on, slow scan can not be selected. If SRTC has been selected, the scan sector is fixed at 60°.

SYNC SET AND ECHO CHECK PRESENTATIONS

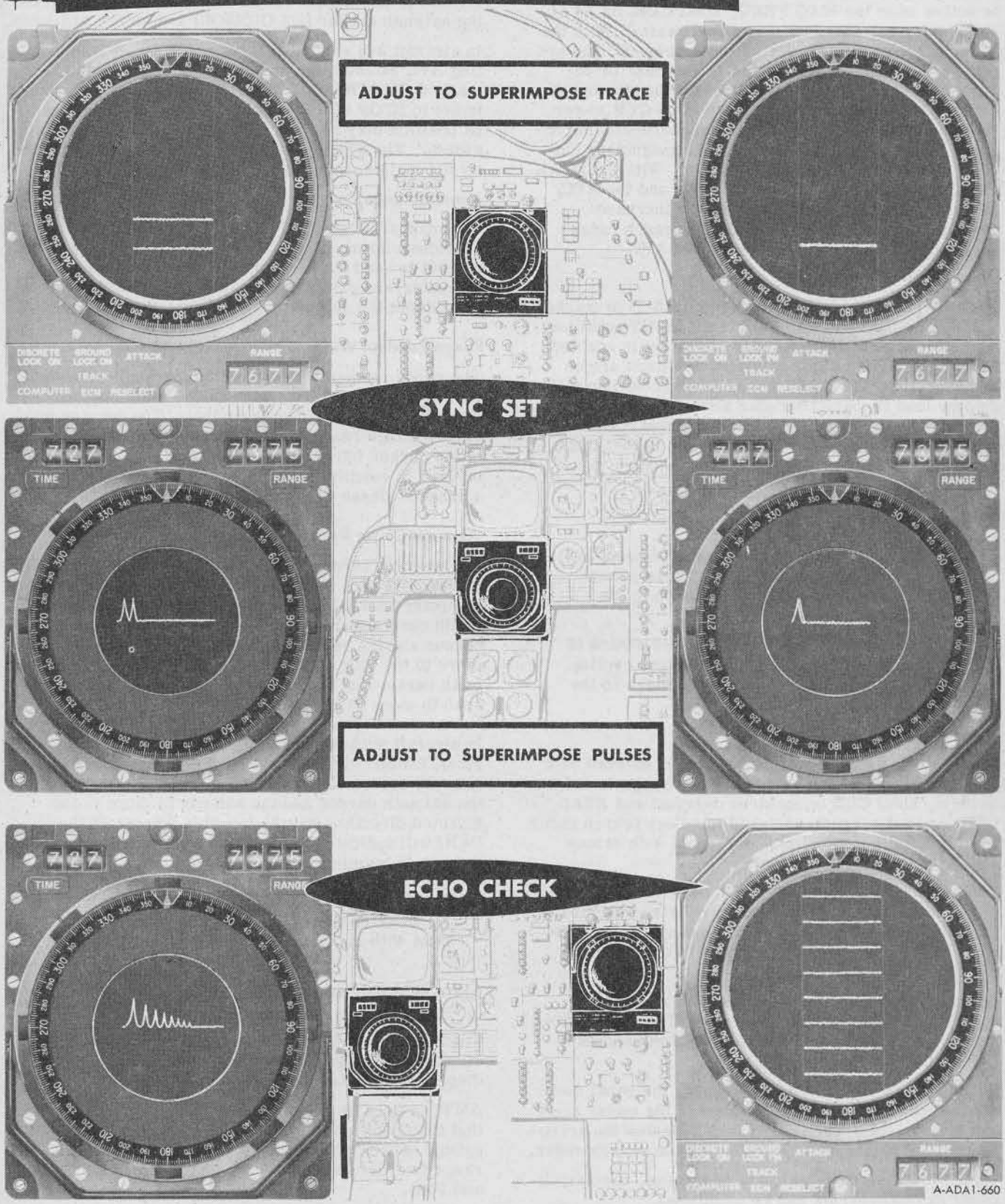

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Figure 8-8

Increase/Decrease Switch

This three-position momentary up-and-down toggle is active when the MAG FREQ, MAG CUR, or XTAL CUR meter selector buttons are depressed. With the MAG FREQ meter selector button depressed, the increase/decrease toggle is used to increase or decrease the search radar magnetron frequency, as indicated on the panel meter. With the MAG CUR meter selector button depressed, the increase/decrease toggle is used to adjust the search radar magnetron current, as indicated on the panel meter. With the XTAL CUR meter selector button depressed and the AFC/MAN switch in the MAN position, the increase/decrease toggle is used as a coarse search radar receiver tuning control during loss of AFC.

Transmit/Silent Switch

The two-position toggle switch (figure 8-7) is marked XMIT and SILENT. In the transmit (XMIT) position, normal search and track radar operation is enabled. In the SILENT position, if the transmitters are on and operating, the output power is directed into a dummy load to maintain radar silence. This position is used both for radar silence and ground checkout operation. When this switch is placed in the XMIT position, the system will transmit rf energy.

CAUTION

- Ensure that all personnel and equipment are clear of the radiation danger areas before placing the transmit/silent switch to the XMIT position.
- Ensure that the track radar power switch is in the STBY or OFF position before cycling the transmit/silent switch or damage to the track radar may result.

Search Meter Selector Buttons

Four selector pushbuttons (figure 8-7), marked ANT PATT (antenna pattern), MAG FREQ (magnetron frequency), MAG CUR (magnetron current) and XTAL CUR (crystal current) are used to select search radar functions to be monitored and checked with values displayed on the panel meter.

When depressed, the ANT PATT button allows the bombardier/navigator to check a relative measure of high or low search radar antenna beam pattern. The closer the antenna beam pattern is to the aircraft, the higher the meter reading.

The MAG FREQ button provides for a measure of search radar magnetron frequency. The meter circuit is set up to present the range of frequencies from minimum to full scale.

With the MAG CUR button depressed, the panel meter should read within the shaded area of the meter scale and is adjustable. The shaded area indicates the acceptable range of magnetron current for the search radar.

When the XTAL CUR button is depressed, the search radar crystal current can be monitored.

Computer/Manual Switch

The computer/Manual (CMPTR/MAN) switch (figure 8-7) is a two-position toggle that provides a means of switching from computer (CMPTR) operation to the backup mode of manual (MAN) operation. Manual operation of the manual range control (MAN RANGE) and the azimuth cursor (AZ CURSOR) switch are available.

In aircraft 246 and subsequent and aircraft incorporating AVC No. 600, the switch has three positions marked CMPTR/MAN/STOP SCAN. When the switch is set to STOP SCAN, antenna is stopped, and antenna position may be controlled with the azimuth cursor switch. The STOP SCAN position is intended primarily for maintenance purposes.

Manual Range Control

The manual range (MAN RANGE) control (figure 8-7) provides a means of positioning the range cursor. This control is used during a malfunction in the digital computer, and provides the capability of weapon delivery without the automatic range-determining facilities.

Range Readout Window

The range readout window on the bombardier/navigator's control panel (figure 8-8) is used in conjunction with the manual range control. The counter provides a range readout in feet (to the nearest 100 feet) to the cursor intersection. The variable range may be used to establish a pullup range from a target or a preset release range to a target.

Azimuth Cursor Switch

The azimuth cursor switch is a three-position center-off toggle switch marked CCW and CW. When the computer/manual switch is at MAN, setting the azimuth cursor switch to CCW causes the azimuth cursor and the center of the antenna azimuth scan to move to the left; and setting it to CW causes the azimuth cursor and the center of the antenna azimuth scan to move to the right.

In aircraft with the stop scan feature, when the computer/manual switch is at STOP SCAN, moving the azimuth cursor switch to either CCW or CW causes the azimuth cursor and the antenna to move in the selected direction and the movable pointer on the DVRI will indicate the direction toward which the antenna is pointing.

Note

No steering information is presented to the pilot with manual cursor control.

AMTI MOVING TARGET IDENTIFICATION (AMTI)

The AMTI feature of the search radar is designed to display moving surface targets while suppressing the display of fixed targets and ground return.

AMTI as used is a noncoherent type, which requires that the target must have motion with respect to ground clutter or permanent echoes at the same range in order to be processed as video on the DVRI and PHD.

The search antenna radiates rf energy in the form of a pulse, which illuminates an area that is determined by the antenna beamwidth in azimuth (1.4°), and the pulse width in range.

The rf energy reflected from the scanned area is composed of a large number of randomly phased components representing ground clutter, permanent echoes, fixed targets, and moving targets.

It is characteristic of moving surface targets to give returns which fluctuate in amplitude above the normal ground-return video. Moving target video will change amplitude from one pulse to the next while fixed target and ground-return video will appear to have maintained a constant amplitude in the interval between pulses. The moving target video changes amplitude (or modulates) because the phase of the radio frequency (rf) return from the moving target is constantly changing with respect to the rf return from the surrounding ground area. The return from a fixed target is of greater amplitude than the return from the surrounding ground area. Because the fixed target does not move relative to the ground, the amplitude of its radar return remains constant from one pulse to the next. The search AMTI detects the fluctuations of moving target returns and amplifies and displays them while suppressing or cancelling the constant amplitude returns of fixed targets and ground.

In AMTI operation, the returning search radar video is converted from an amplitude-modulated signal to a frequency-modulated signal, fed through both a delayed and a direct channel, and compared with the delayed signal from the previous pulse. By the manner in which the delayed and direct signals are compared, the frequency-stabilized fixed target and ground returns are cancelled, and the changing frequency representative of moving targets is amplified. Since the delayed pulse must be delayed by a very exact amount, a specially stabilized high prf trigger is generated for AMTI use. This is the search primary trigger. The search secondary trigger, available for the B/N's use, is not sufficiently stable to be used for AMTI operation.

The AMTI control on the BNCB (figure 8-7) controls the video mixer and allows the bombardier/navigator to select full moving target video, regular search radar video, or any mixture of the two. The design of the AMTI circuits is such that the return from a moving target is enhanced by being compared with or referenced to ground or fixed-target return. Therefore, in the absence of ground or fixed-target returns, moving targets are treated as fixed targets and are suppressed or completely cancelled. It could be expected that heavier ground return would optimize the moving target indications; however, rock outcrops and hard targets are usually not fully cancelled and tend to distract or confuse the B/N. If doubt exists as to whether a return is displayed as a moving target return or a fixed target return, the audio circuitry of the track radar can be helpful in determining whether the target is moving or fixed, and in the case of a moving target, the relative size and/or speed may be determined by the pitch (frequency) of the audio.

The amplitude fluctuations caused by a moving target are detectable for only the range component of target movement. For this reason, a target that is moving on a line perpendicular to the aircraft heading will not be detected. The detection range of a given moving target increases as the aircraft approach heading approximates the fore-and-aft axis of the target movement (head-on or tail-on approach). The relative approach angle (angle-off) between aircraft and target becomes most critical with slow moving targets. For example, a 10-mile per hour pickup truck and 4-mile per hour road grader, traveling the same road, could both be detected at the same range on a 0° angle-off run, but the detection range for the road grader would be half that of the truck on a 10° angle-off run.

Since the AMTI operates on the principle that a moving target causes amplitude fluctuations above the normal ground return, the AMTI circuits are extremely noise- and jitter-sensitive. Radar receiver noise or magnetron jitter can render the AMTI virtually useless. Experience has shown that a radar the B/N believes to be excellent in all other respects can, in fact, be practically useless for AMTI operation due to the noise. The only check the B/N can make is to check automatic frequency control (AFC) operation against manual frequency control (MAN) for maximum radar range or best land/water contrast. If MAN is significantly better than AFC, it should be used.

In aircraft 310 and subsequent and aircraft incorporating AVC No. 658, the AMTI circuits of the search radar have been extensively revised. The results apparent to the B/N will be an improved display that is easier to adjust and that maintains its adjustment longer. The effect of this change on operation of the AMTI control is discussed where the control is described.

AMTI NAVIGATION

Precise navigation is essential to successful road reconnaissance. The slower the target and the more tortuous the terrain, the more important (and the more difficult) it becomes to stay on the road.

Being off the road degrades acquisition somewhat, but not nearly so much as it degrades target retention in the final stages of a run, due to increasing angle-off near release.

If weather and lighting conditions permit, visual navigation should be used to allow the bombardier to utilize unstab-no steer, which provides the quickest acquisition-to-attack capability. Under most circumstances, however, base/target steering to the ends of road segments is recommended to provide precise navigation. The following crew techniques are recommended:

a. Get frequent updates.

b. On twisting roads, plan straight-line segments of a minimum of 10-mile length, even if it is necessary to skip a loop of road occasionally. Insert segments into base/target and preplan ground track bearing of the road segment.

c. To give the B/N maximum head-in-hood time, his only navigational responsibility should be to get updates and cycle steering to base/target. The pilot should maintain the aircraft on the road by aligning the steering PHD bug to achieve the planned track.

d. When road segments are short, plan I. P. to the first segment where possible to give as long a look as possible.

e. Reduce the B/N's type-in duties to a minimum to produce maximum in-scope time for short road segments.

(1) Use nav check point/op tgt to provide a third storable set of coordinates that can be entered prior to commencing the Recce. Use OAP 1+2 for updating.

(2) Cycle steering only to every other turnpoint. The pilot utilizes heading and PHD bug, TACAN-wise, for navigation.

(3) When the road winds so as to cycle repeatedly through any given latitude or longitude, select turnpoint coordinates so they fall on that particular latitude or longitude; then it is necessary only to type in the changing coordinate in going from turnpoint to turnpoint.

f. Carry the dislodge switch in dislodge - get ground lock-on first.

g. In terrain of varying elevation, use average height of TGT where possible (when actual elevation is within +250 feet of typed average).

SEARCH RADAR TARGET TRACKING

Search radar target tracking is a method of precisely determining the position of the aircraft relative to a selected target. This capability is a method of manually aided target tracking analogous to ground lock-on tracking with the track radar. The accuracy of elevation tracking that may be expected using search radar tracking is slightly less than that obtained with ground lock-on tracking. Search radar display characteristics and B/N control over the range and azimuth cursors are unaffected by this additional capability.

Note

Search radar tracking produces the best results if magnetron frequency is set to mid-range (0.4 on meter).

When search radar tracking is selected, target depression angle is measured for the area around the intersection of the range and azimuth cursors. The target-depression-angle sensor for search radar tracking is the search radar terrain clearance receiver. This receiver uses a phase interferometer technique to measure the depression angle of terrain relative to the aircraft. The output signal of the TC receiver is a video signal whose amplitude is proportional to the depression angle to the terrain as viewed by the scanning antenna. For search radar tracking, this output is gated so that depression angle is sampled for only a patch of terrain around the intersection of the range and azimuth cursors. The cursor positions are ground-stabilized within the ballistics computer through the use of velocity data. These positions are routed from the ballistics computer to the DVRI cursor generator and the target tracking phase gates simultaneously, enabling depression-angle-sensing from the ground patch at the intersection of the cursors.

The depression-angle data are averaged over the width of the gates for each scan of the antenna through the target. Between scans, this value is updated by integration of the angular rate provided by the ballistics computer in order to arrive at a continuous, updated signal available for sampling at any time by the ballistics computer.

The ballistics computer derives angular rate by combining the sampled depression angle with range and velocity data. The depression-angle-data input at each computer iteration is combined with range, azimuth, and aircraft attitude to derive three-axis range to the target. This data is converted to a ground-stabilized target coordinate system and averaged over ten iteration samples. The averaged target position is transformed into a weapon coordinate (wind axis) system for use in the attack solution of ballistics and release point.

Selecting search radar tracking automatically causes the search radar antenna to go to fast scan and a 60° or smaller sector. If SRTC is selected, the scan sector is fixed at 60°. If AMTI is on, slow scan can not be selected.

Before commencing an attack, a calibration check of search radar target tracking can be made by slewing the cursors to 19 miles and 27 miles and observing the readouts in windows C1 and C2. With the cursors at 19 miles, window C1 should read -15 and window C2 should read 396 to 796. With the cursors at 27 miles, window C1 should read 00 and window C2 should read 252 to 952.

Search radar target tracking data are considered valid in the ballistics computer provided the following conditions are met:

a. Search radar track switch must be at ON with the search radar antenna within stabilization limits and an adequate number of information samples available for the search radar to process.

b. Video must be present.

c. Range to target must be more than .8 mile and less than 5 miles (4,000 feet to 30,000 feet).

d. Depression angle input must be between +1° and -30°.

e. Angular rate output must be not greater than 2.3°/second.

f. Depression-angle valid discrete must be on.

g. Target relative bearing must be not greater than ±60°.

h. A track radar lock-on must not be present.

Provided that the GROUND LOCK ON and DISCRETE LOCK ON lights are out, lighting of the TRACK light indicates that the search radar data are valid.

Going out of a valid-data condition will not disturb the derivation of the vertical separation solution. The computer goes into a memory status, using the last, best, valid data source until all conditions of validity are again met. This memory status can be reset to keyboard values by cycling the steering switch or, if the track radar is not in transmit, by running the range to target beyond 5 miles.

The introduction of search radar tracking data into total system operation is based on the following priorities:

1. Track radar ground or discrete lock-on.

2. Search radar tracking.

3. Memory (last, best, valid data).

Note

The last, best, valid data will be keyboard target altitude if neither search nor track radar has yet been valid for a given run.

4. Keyboard target altitude.

The computer automatically accepts the valid source of information having the highest priority, switching down the list as necessary. The B/N may determine which source of data is being used by observing the configuration of the TRACK light and the GROUND LOCK-ON light. (See figure 8-9.) In addition, in attack, window C1 on the RHU displays the code 111 if search radar tracking data are being used and 000 if search radar tracking is not the data source being used.

Note

It must be emphasized that regardless of the state of the search radar tracking, if the track radar has acquired a ground lock-on, search radar tracking information is not processed for further solution.

TRACKING DATA SOURCE GUIDE

LIGHT		DATA SOURCE BEING USED
GROUND LOCK-ON	TRACK	
ON	ON	TRACK RADAR
ON	OFF	MEMORY (LAST BEST VALID SOURCE)
OFF	ON	SEARCH RADAR TRACKING
OFF	OFF	MEMORY (LAST BEST VALID SOURCE)

ADAI-75

Figure 8-9

SEARCH RADAR TERRAIN CLEARANCE MODE

The search radar terrain clearance display provided on the vertical display indicator affords a means of maintaining terrain clearance along the projected flight path of the aircraft. A 53° by 26° window of the terrain about the aircraft ADL is displayed on the VDI with the attack and navigation steering functions.

The display consists of a perspective plot of range and elevation angle vertically, and azimuth horizontally shown on the VDI (figure 8-10). Terrain clearance information is sensed by a dual-channel horn mounted on the search radar antenna receiver. This array receives ground returns from search radar transmissions (pulse-for-pulse with the search radar.)

The search radar antenna receiver derives range information from search radar timing, azimuth information from antenna position, and terrain elevation information from phase variations.

The display presentation provides 10 shaded increments starting with the lightest shade in the near ranges at the base of the display, and progressing to darker gray tones toward the horizon, or far ranges. These shades of gray each represent a specific range increment ahead of the aircraft. All symbols and

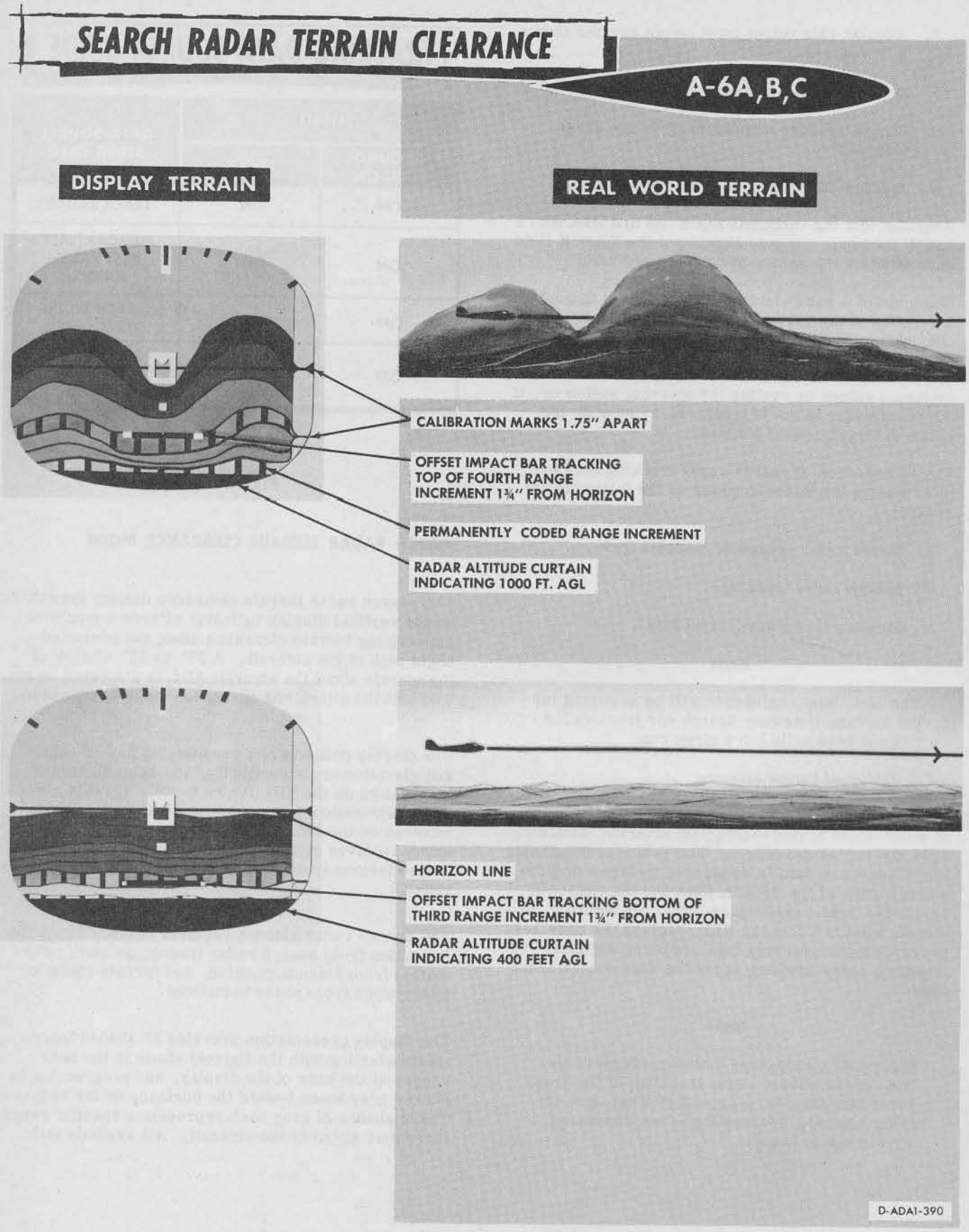

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Figure 8-10

markers are available on this display except for the ground and cloud texture elements and the pitch trim markers. These are removed to avoid unnecessary scope clutter. Phase video and terrain clearance amplitude video are processed through the terrain clearance processor. The radar data converter accepts the processed video and converts the signals to a television format acceptable to the VDI. A radar altitude curtain presents an analog of aircraft altitude AGL and is positioned by signals from the radar altimeter. Radar altitude signals are sent directly to the radar data converter. Calibration marks have been added to the display as an aid in determining the credibility of the display. A movable offset impact bar enables the pilot to select the clearance he wants.

Range Coding

A set of vertical code bars mark the first range and, at the option of the pilot, one of the 3rd, 4th, 5th, or 7th ranges can be coded as an aid to interpretation and provides a predetermined reference point for flying the display of terrain. The 10 range increments present specific range information as shown in figure 8-11.

SRTC Scaling

When the VDI is in contact analog (CA), the horizon and all symbols are computer-scaled to ±30°. With terrain clearance (TC) selected, the horizon and terrain are scaled in the radar data converter, while the VDI navigation and attack symbols are still computer-derived and scaled to ±30°. Terrain clearance video is scaled to approximately 27° (±13.5°) vertically, and 52° (±26°) horizontally.

The TC horizon is scaled to 30° in a climb (or pullup) and 15° in a dive. The change in scale occurs when the horizon is at the VDI vertical center. In most normal flight attitudes, or on the ground, there should be no change in the horizon position when selecting TC from contact analog. Tracking circuits provide for correct positioning of terrain for all attitudes within the pitch (±30°) and roll (60°) limits of the antenna.

The radar altitude curtain, which is positioned by a signal from the radar altimeter, presents an analog of aircraft altitude. The curtain, like the radar altimeter, operates between the altitudes of 20 feet and 5,000 feet. The position of the curtain between the horizon and the bottom of the scope varies with aircraft altitude, attitude, and the altitude scale factors, which are displayed below.

Altitude	Displacement Below Horizon Line
0 feet	0 inches
0 to 400 feet	175 feet/inch
400 to 5000 feet	1340 feet/inch

When the top of the radar altitude curtain is matched with the offset impact bar positioned 1 3/4 inches below the horizon line, the altitude of the aircraft is 275 to 325 feet AGL.

SRTC Operation

The following conditions MUST be met to use SRTC properly.

1. The search radar must be ON and in XMIT with AFC selected and a stable crystal current reading.
2. Except in aircraft with the modified SRTC mode, the radar altimeter must be on and operating with the aircraft below 5,000 feet above the terrain.
3. TC must be selected on the pilot's control panel.
4. Magnetron frequency set at midrange.

The following limitations will be imposed when TC is selected.

1. The only search radar display available will be PPI 30 or ARE display if computer range is less than 27 NMI.
2. Antenna scan angle to a minimum of 60°.
3. Fast scan only except with AMTI on.
4. Antenna pattern to LO ALT.

SRTC Calibration Procedures

1. Switch between CA and TC. The relative movement of the horizons in relation to each other should not exceed 1/8 inch in level flight. NEW
2. With aircraft aligned with runway centerline, observe video dropout (small depression near center of VDI) due to less reflection from asphalt or concrete surfaces than grass, trees etc. This depression should be centered on the VDI (±1/4 inch). The search radar scans about the aircraft ADL. This check tests the accuracy of the search radar.

   In addition, a check should be made for hystereses (movement of the depression from scan to scan of the search radar antenna). Movement of this depression due to video dropout should be less than ±1/4 inch.

SRTC OPERATING PARAMETERS

RANGE LINES	PHD CONTROL BUTTON	RANGE INCREMENT REPRESENTED	TERRAIN FEATURES	TRACKING POSITION OF OFFSET IMPACT BAR	RESULTANT CLEARANCE (FEET)
1		¼ to ½ (PERM. CODED)			
2	1	½ to ¾	FLAT PLAINS	BOTTOM OF FIRST SELECTABLE INCREMENT	400 to 600
3	1	¾ to 1	ROLLING PLAINS	TOP OF FIRST SELECTABLE INCREMENT	600 to 900
4	2	1 to 1½	HILLS	TOP OF SECOND SELECTABLE INCREMENT	900 to 1050
5	3	1½ to 2	HILLS	TOP OF THIRD SELECTABLE INCREMENT	1050 to 1600
6	4	2 to 2½	HILLS	BOTTOM OF FOURTH SELECTABLE INCREMENT	1600 to 2000
7	4	2½ to 3	HILLS	TOP OF FOURTH SELECTABLE INCREMENT	GREATER THAN 2000
8 9 10		3 to 4 4 to 6 6 to 8½			

NOTE

1. The offset impact bar is measured downward from the center of the VDI.
2. Hills are defined as terrain having a differential altitude of approximately 700 feet.
3. Increasing severity of terrain features will decrease the resultant clearance when using listed tracking positions.

A-ADA1-545

Figure 8-11

3. Check for adequate brightness, contrast, etc.

4. Rotate the path bright control counterclockwise. The brightness of the pathway should decrease as the control is rotated.

5. Stabilize the aircraft at 500 feet radar altitude over flat terrain. The first five range lines should conform to the following standards in relation to the horizon. The allowable tolerance for this check is 2.16° or 0.5 inches less.

RANGE LINE	POSITION
1	9.6° or 2.24 in.
2	6.38° or 1.49 in.
3	4.78° or 1.12 in.
4	3.18° or .74 in.
5	2.38° or .56 in.

6. Perform a level run-in at co-altitude at some prominent terrain feature (e.g. a hill). As the hill is approached, check that each individual range line does come up to the horizon.

7. With the aircraft in a 30° nose-up attitude and at a 15° nose-down attitude, the horizon should be at the display limits. This checks the scaling accuracy of the TC display (9.6°/inch - nose up, 4.8°/inch - nose down).

8. At low angles of attack (350 KIAS or greater), the impact point should be positioned on the TC horizon.

9. Select TEST on the pilot's control panel. Ten range lines should be displayed on the VDI.

10. Rotating the path bright control full counterclockwise to the OFF position will cause the pathway to disappear.

11. Flight below 20 feet or above 5,000 feet will result in the RA warning light being lit. Light indicates that output voltage from the radar altimeter is less than 1 volt or more than 26.5 volts. In either case, the radar altitude curtain will not be displayed on the VDI.

12. With the offset impact bar displaced 1.75 inches from the horizon and matched to the top or the radar altitude curtain, aircraft altitude above the ground should be approximately 300 feet.

13. Matching the offset impact bar with the radar altitude curtain should result in a 15° ±2° pitch attitude at 4,000 feet radar altitude. To perform this check, perform the following procedures.

    a. Set up 350 KIAS at slightly less than 5,000 feet radar altitude so that the radar altimeter is locked on and tracking.

    b. Set offset impact bar 1.75 inch from the horizon.

    c. Push over to match offset impact bar with radar altitude curtain.

    d. Set data select switch to position C, and at 4,000 feet read elevation angle in window #2 on the RHU attack-navigation panel.

    e. Elevation angle should read 15° ±2°.

Search Radar Terrain Clearance Flight Technique

The basic technique for flying the aircraft in response to the terrain displayed on the VDI is by matching the offset impact bar (1.75 in. from horizon) with a selected coded range.

The rules that apply to this technique are:

1. The range line selected for reference must be at or beyond the 1/2 to 3/4 NMI range line (bottom of the first selected coding). Do not track the first range line.

2. The range line selected for tracking must be kept at or below the offset impact bar.

3. Do not attempt to push over rapidly and directly to a range line off the bottom of the display.

4. Do not push over rapidly in an attempt to track a range line that is descending rapidly toward the bottom of the display.

5. Cross-calibration with track radar E-scan must be performed.

Match the offset impact bar with the top or the bottom of one of the selected coded range increments. The aircraft should be flown so as to maintain the entire offset impact bar at the selected position (top or bottom) on the desired range increment. What we are doing with this technique is maintaining a fixed angle (approximately 7.5°) with the terrain at the range increment being tracked. The range line selected for tracking will be dependent on the desired resultant clearance above the terrain. Figure 8-11 shows the recommended range line to be tracked for various conditions of terrain severity. For initial training in SRTC flying, it is recommended that one of the further out range increments (e.g. 1 1/2 to 2) be tracked with the resultant high terrain clearance. As pilot confidence and proficiency increases with the flying technique, a closer range line can be tracked with lower resultant terrain clearance.

A situation that can occur utilizing the technique of matching the offset impact bar with a selected range line is a premature pushover prior to hill crest clearance. This condition occurs when tracking a

close-in range line (1/2 to 3/4 NMI range line - bottom of first selected coding). The cause of this phenomenon is that the actual (and displayed) elevation angle to the hill crest decreases rapidly as the range to the hill crest decreases. The display of this event shows the tracked range line rapidly falling to the bottom of the scope, and a pushover to track this dropping range contour is potentially dangerous. If the desired range line to be tracked is dropping rapidly toward the bottom of the display or is off the bottom of the display, do not push over in an attempt to find it or track it. Maintain aircraft altitude or track a further-out range line until the radar altimeter has peaked low and started up again or the radar altitude curtain has peaked high and started down indicating the crest has been cleared. Then sequentially push over and step down in range lines until reaching the desired range line.

A significant fact in using any combinations of coded ranges and the offset impact bar is that as long as the coded range is not masked, i.e., there is coding always displayed, there are no known possible impact situations and the technique (but not necessarily the display) is foolproof. The result of using the wrong airspeed and coded range combination for a particular terrain is crest overshoot (ballooning or excessive g but not impact). If undesirable ballooning occurs or uncomfortable g levels are encountered, the use of a further range line or slower airspeed is indicated.

The SRTC display itself is not failure-protected and as such it should be cross-checked with track radar E-scan. E-scan is generated by use of the track radar scanning in a plane perpendicular to the horizon, but referenced to the aircraft velocity vector. Zero scan angle is therefore at the impact point as supplied by the digital computer.

A realistic check of SRTC and E-scan can be obtained by adjusting the offset impact bar 1.75 inches below the horizon. Terrain at this point is 7.5° below the aircraft velocity vector (if angle of attack is small). Likewise a horizontal line on the E-scan midway between the flight line and scan bottom represents a constant 7.5° below the velocity vector. If, for example, the top of the first selected coding is flown so as to keep it below the 7.5° mark on the VDI in near level flight, the radar altitude should not drop below 600 feet and E-scan should show video between 3/4 and 1.0 NMI crossing the 7.5° line. Therefore, except for the pitch angle to terrain angle scaling difference in SRTC, flying the top of the first coded range at a 7.5° angle is similar to flying so as to keep E-scan video to the right of the transition line.

Limitations of SRTC flying are:

1. Lack of tower or cable detection.
2. Lack of flat water and ice reflection characteristics.
3. Incomplete single-system fail-safe protection.
4. Uncertain ground calibration.

BEACON OPERATION

For a description and operating procedures for search radar in conjunction with a RABFAC beacon, refer to the A-6 Tactical Manual NAVAIR 01-85ADA-1T. N L W

TRACK RADAR SET AN/APQ-112

CAUTION

During all ground operation of the track radar, ensure that personnel and equipment are clear of the radiation danger areas before placing the transmit/silent switch to the XMIT position.

The Radar Set AN/APQ-112 (track radar) is used to track moving and fixed targets, and to provide vertical and horizontal terrain clearance information. In the tracking mode, the track radar provides azimuth, elevation, and range signals to the computer to solve weapon-release equations. In display modes, processed video signals are provided to generate cockpit displays.

For further information on the track radar, refer to the Supplemental NATOPS Flight Manual NAVAIR 01-85ADA-1A.

BOMBARDIER/NAVIGATOR'S TRACK RADAR CONTROLS

Transmit/Silent Switch

The two-position toggle switch (figure 8-7) is marked XMIT and SILENT. In the transmit (XMIT position, normal search and track radar operation is enabled. In the SILENT position, if the transmitters are on and operating, the output power is directed into a dummy load to maintain radar silence. This position is used both for radar silence and ground checkout operation. When this switch is placed in the XMIT position, the system will transmit rf energy.

Track Radar Power Switch

The track radar power switch (figure 8-7) is a three-position lever-lock switch with positions marked OFF, STBY, and ON. The switch is at the lower left side of the bombardier/navigator's control panel. Placing the switch to STBY applies warmup power to the track system: the track radar is energized but is not transmitting. When the switch is positioned ON, the track radar is energized and will transmit.

Moving the switch to STBY brings the antenna to the boresight position in both the attack and navigation computer modes.

Tone Control

The track radar tone volume control (TONE VOL) sets the volume level of the track radar audio to the B/N's headset for acquiring fixed or moving target lock-ons or for manual tuning. Clockwise rotation of the control increases the volume of the tone.

Track Receiver Tune Selector

The track receiver tune (RCVR TUNE) selector (figure 8-7) marked automatic frequency control (AFC) and manual (MAN) selects automatic or manual control of the track radar local oscillator frequency.

Track Magnetron Current Control

The magnetron current (MAG CUR) control (figure 8-7) is used by the bombardier/navigator to adjust the track radar magnetron current to 0.8 unit on the panel meter scale. It is equipped with a locking device.

Target Switch

This two-position toggle switch (figure 8-7), labeled FIXED and MOVING, is used to select the appropriate type target. The FIXED position activates circuitry to achieve a lock on a stationary target. The MOVING position is used for moving target lock-on and may be used to improve discrete or ground lock-on tracking of a fixed target.

Track Meter Selector Buttons

Two selector pushbuttons (figure 8-7) marked TRACK MAG CUR and TRACK XTAL CUR are used to select track radar functions to be monitored and checked with values displayed on the panel meter.

With the TRACK MAG CUR button depressed, the panel meter should read within the shaded area of the meter scale and is adjustable. The shaded area indicates the acceptable range of magnetron current for the track radar.

Depressing the TRACK XTAL CUR button causes a meter indication of the track radar crystal current.

Track Magnetron Reset Button

This pushbutton switch (figure 8-7) overrides the protection circuitry of the track radar during periods of low pressure or voltage surges. A magnetron malfunction will be indicated on the meter on the bombardier/navigator's control panel.

If the malfunction is of a temporary nature, the magnetron can be retriggered by depressing the reset button. When depressed, the light in the button is momentarily on and indicates the operation of the reset button. Rotating the button will cause it to remain depressed.

CAUTION

- With the track radar power switch at STBY and the magnetron reset button depressed, the track radar will transmit.
- Depressing the magnetron reset button before the 5-minute timing period can damage the track radar since this will bypass the delay and permit the radar to transmit before all the components are warmed up.

In aircraft incorporating the search radar track switch, the track radar magnetron reset button is deleted. The track radar magnetron may be reset by cycling the track radar power switch to STBY. There is no override capability in these aircraft.

Note

For information regarding emergency operation of the magnetron reset button, refer to Part 7 of Section III in this manual.

TRACKING DATA VALIDITY TESTS

Track radar target tracking data are considered valid in the ballistics computer provided the following conditions are met:

a. Sufficient video for a ground lock-on must be present.

b. Slant range to the target must be greater than 4000 feet.

c. Depression angle input must be between +13° and -43°.

d. Target relative bearing must not be greater than ±43°.

e. Angular rate of change (for both azimuth and elevation) must be less than .84°/second.

E-SCAN MODE

When elevation scan (E-SCAN) is selected, the track radar is used to provide a vertical display of terrain elevation along the aircraft flight path on the PHD. When the computer is on, the track radar antenna scans a sector in elevation of + 10° to - 15° relative to the flight path vector; the scan is oriented in azimuth to the ADL. When the computer is off, the antenna is oriented about the aircraft ADL in azimuth, and scans a sector in elevation of +10° to -15° relative to the aircraft ADL. Figure 8-12 depicts an E-scan display. The pilot can select a clearance line of 200, 500, or 1,000 feet and a range of either 5 or 10 miles. Range marks are displayed every 2.5 miles.

In aircraft 245 and earlier not incorporating AVC No. 593, when a portion of the terrain video appears above the clearance line, it indicates that the aircraft

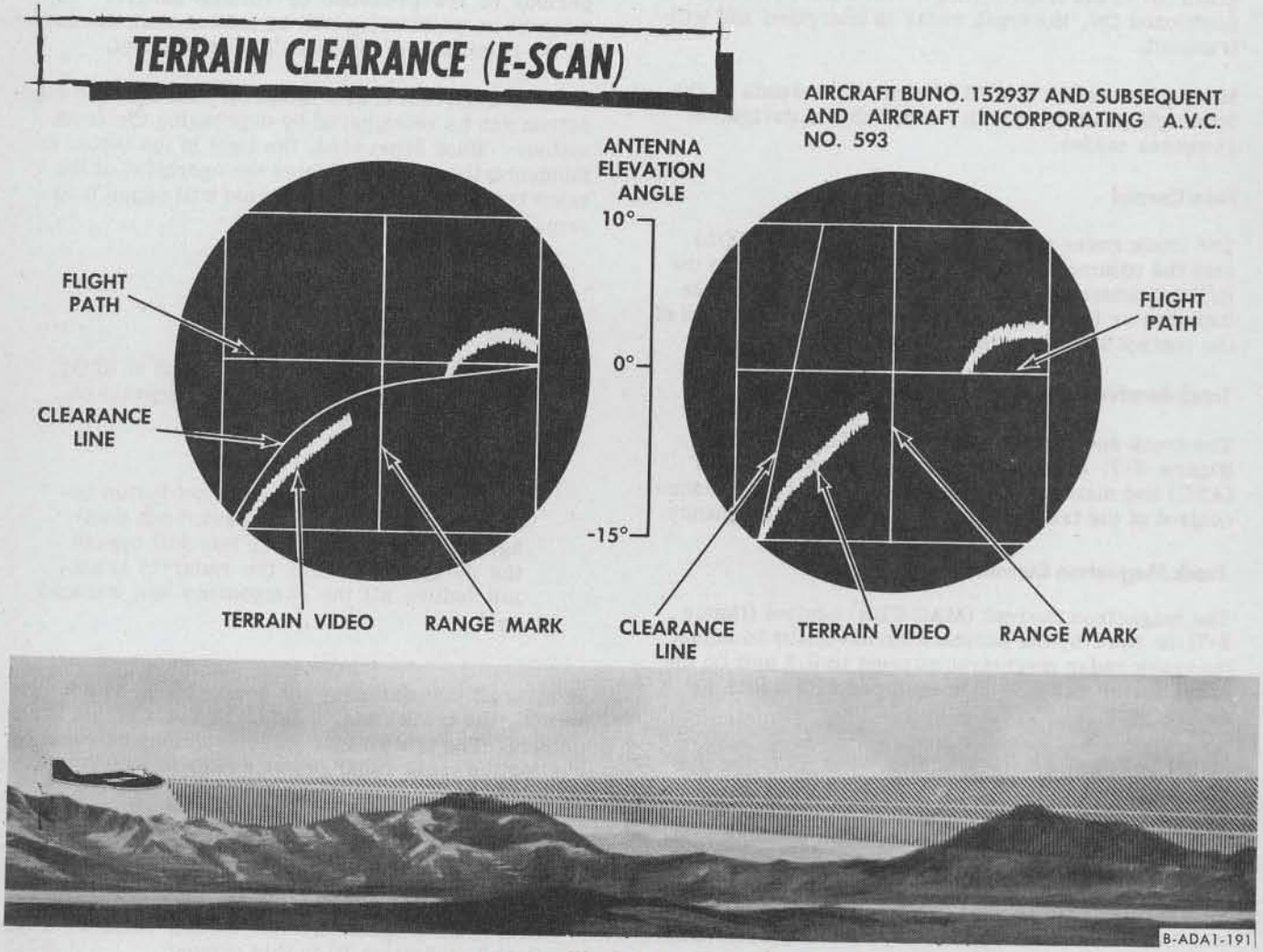

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Figure 8-12

will clear the obstacle by less than the antenna selected. Similarly, if terrain video projects above the flight line, the aircraft will collide with the obstruction unless the flight path is changed.

In aircraft 246 and on aircraft incorporating AVC No. 593, the clearance line is a display of the radius of curvature required to clear an obstruction by the amount selected. The line is defined by the clearance selected and an increase of 1g at 350 KIAS. Terrain video appearing to the left of this line will be cleared by less than the amount selected. If terrain video is to the left of the clearance line and above the flight line, the aircraft will collide with the obstruction unless the flight path is changed.

A flight technique for E-scan that has been found to be usable is one that is based on control of the aircraft velocity vector referenced to E-scan video patterns. An aid for accomplishing this control is a line on the display that approximates a desired speed and g combination or radius of curvature required to obtain a desired clearance altitude. The rule for this technique is to fly pitch control to keep E-scan video on or to the right of this transition line. The transition line here discussed is the clearance line displayed in aircraft with the modified E-scan. A method that proves to be practical for drawing the transition line on the display in aircraft not incorporating the modified E-scan is as follows:

1. Display the 5 nmi E-scan with a 500-foot clearance line.

2. Estimate the 1 nmi range at the top of the display and connect this point with the point at which the 500-foot clearance line intersects the bottom of the display scan.

TERRAIN CLEARANCE-PLAN POSITION INDICATOR

The terrain clearance plan position indicator (TCPPI) mode of operation of the track provides the pilot and the bombardier/navigator a depressed-center PPI display of terrain close to the flight path of the aircraft. The track radar scans an angle of approximately 30°. The displayed range of the presentation is either 5 or 10 miles, selectable with the display scale switch on the pilot's control panel. One range line is displayed at 2.5 miles. With the computer on, scan angle is centered about the aircraft ground track and is depressed 1° below the aircraft flight path vector in elevation. With the computer off, the scan angle is centered about the aircraft ADL in azimuth, and is depressed 1° below the aircraft ADL in elevation.

In figure 8-13, a typical TCPPI display is illustrated. Note that the aircraft is flying through an area dotted with terrain peaks at some height above the intended flight path of the aircraft. The aircraft can now be controlled so that a new flight path develops around or over the obstacles, as elected by the pilot.

EMERGENCY SEARCH

The emergency search (EMER SRCH) track radar display serves as a backup for the search radar in the event of search radar failure. The presentation is a depressed-center PPI display with approximately 30° of azimuth scan, with the antenna elevation angle manually controlled by the bombardier/navigator. Since the elevation angle determines the range at which the beam intersects the ground, the bombardier/navigator can vary the area being searchlighted by manipulating the track radar elevation slew switch on the slew control. The displayed range of the presentation is either 5 or 10 miles, selectable with the display scale switch on the pilot's control panel; however, unlike the TCPPI display, there is no range line on emergency search.

Limitations of Emergency Search Mode

The emergency search mode of operation has certain inherent limitations. In contrast to the search radar presentation, range and azimuth resolution are poor. Maximum range is 10 miles, and the illuminated area decreases with an increase in altitude. However, at low altitudes, the presentation still affords adequate definition for identification of prominent points; i.e., bridges, rivers, shore lines, and small towns.

Options for Selection

The emergency search display is presented on both the DVRI and PHD; however, it is selectable only by the bombardier/navigator. In addition, the horizontal display mode selector switch must be in SRCH in order for it to be displayed on the PHD. If the mode selector is placed to the TCPPI or E-SCAN position, the selected display will be presented on the PHD and the DVRI will no longer have an emergency search display even though it was selected on the bombardier/navigator's control panel. The selection of a track radar display on the PHD preempts the selection of an incompatible display on the DVRI.

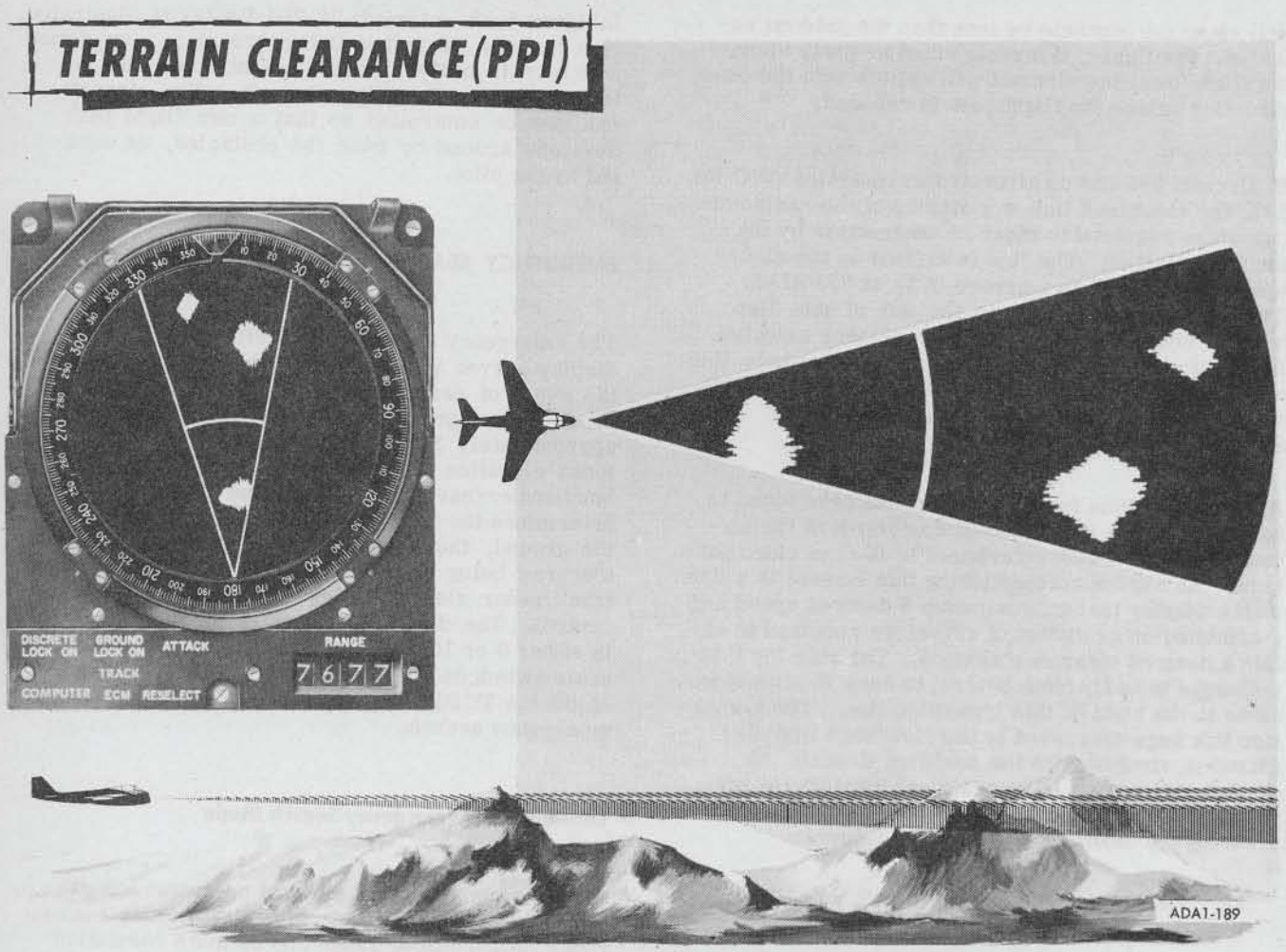

Figure 8-13

DISPLAY SYSTEMS

BOMBARDIER/NAVIGATOR'S DIRECT VIEW RADAR INDICATOR

The bombardier/navigator's DVRI (figure 8-14) is in the center of the bombardier/navigator's instrument panel and consists of a circular 7-inch cathode ray tube, centered in a rotating azimuth ring. The azimuth ring consists of a servo-driven rotating compass card that indicates true heading read against a fixed reference at the top of the azimuth ring. Graduations are in degrees, with 5° and 10° points accentuated. Heading information is derived from the inertial platform, or from a backup mode using the MA-1 compass. There is a movable pointer, or bug, that rotates within the compass rose and indicates the true bearing of the search radar azimuth line. The scope provides a means of displaying radar-developed information from either the search radar or the track radar. These displays include search radar, TCPPI, and emergency search options. The scope also has a range readout located on the scope face plate.

DVRI INDICATOR LIGHTS

The scope face plate includes a number of indicator lights, so positioned that they provide the bombardier/navigator with information regarding various operational aspects of the mission. These indicators are placed within the perimeter of the scope shield, so the bombardier/navigator can view these lights when under the hood. These indications include: ECM, reselect, computer, attack, ground lock-on, track, and discrete lock-on. All the indicators provide a red light effect when actuated. The particular conditions indicated are described below.

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Figure 8-14

ECM Light

This light provides visual indication of radar interrogations. When the aircraft has been illuminated by such interrogations, the advisory light is lit.

RESELECT Light

If this light is on, it indicates that some incompatible setting of the weapons system selector switches and the programmed delivery sequence exists. When this discrepancy has been corrected, the light will go out.

COMPUTER Light

This light is a repeater of the computer error light on the RHU.

ATTACK Light

The attack light advises the bombardier/navigator whether or not the computer is operating in the attack mode.

A duplicate light is provided on the RHU to insure that the information is made available to the bombardier/navigator when he is not working in the scope hood.

Note

Should this light go out during an attack, it will be necessary to reestablish the valid attack requirements to conclude the operation.

GROUND LOCK-ON Light

This light provides a visual signal that the track radar has established a ground-lock-on. This establishes within the system the necessary comparison signals for a discrete lock-on.

TRACK Light

The track light is lit when radar data derived from either the track radar or the search radar are valid and are being used by the ballistics computer. Unusable information causes the light to go out and the computer to revert to memory mode using the last valid radar data. If no valid radar data have been processed, target altitude is held at the keyboard value.

Lighting of the TRACK light in conjunction with a ground or discrete lock-on light indicates that data derived from the track radar are being accepted as valid and are being used by the ballistics computer. Lighting of the TRACK light with the ground and discrete lock-on lights both out indicates that the bombardier/navigator has selected search radar tracking and that data derived from that source are being accepted as valid and are being used by the ballistics computer.

DISCRETE LOCK-ON Light

This light provides visual indication that the target is being tracked, and that the system has established a discrete lock-on.

DVRI RANGE INDICATOR

The range indicator located on the DVRI face plate provides an indication of the range to the range cursor on the display whenever the computer is turned on and the computer/manual switch is set to CMPTR. The range readout is slant range to cursor intersection in tens of feet up to 16.5 nmi and ground range in nmi to cursor intersection beyond 16.5 miles. Range may be slewed into the counter by use of the bombardier/navigator's slew grip up to a range of 150 nmi provided the search radar power switch is in the ON position. Ranges beyond 150 nmi can be attained by use of preset target, base, and navigation checkpoint entries.

PILOT'S HORIZONTAL DISPLAY SYSTEM

HORIZONTAL DISPLAY (PHD)

The horizontal display (figure 8-15) can present E-scan, TCPPI, as well as all displays selected by the bombardier/navigator. The display scope is a 5-inch circular daylight viewing tube centered in a rotating

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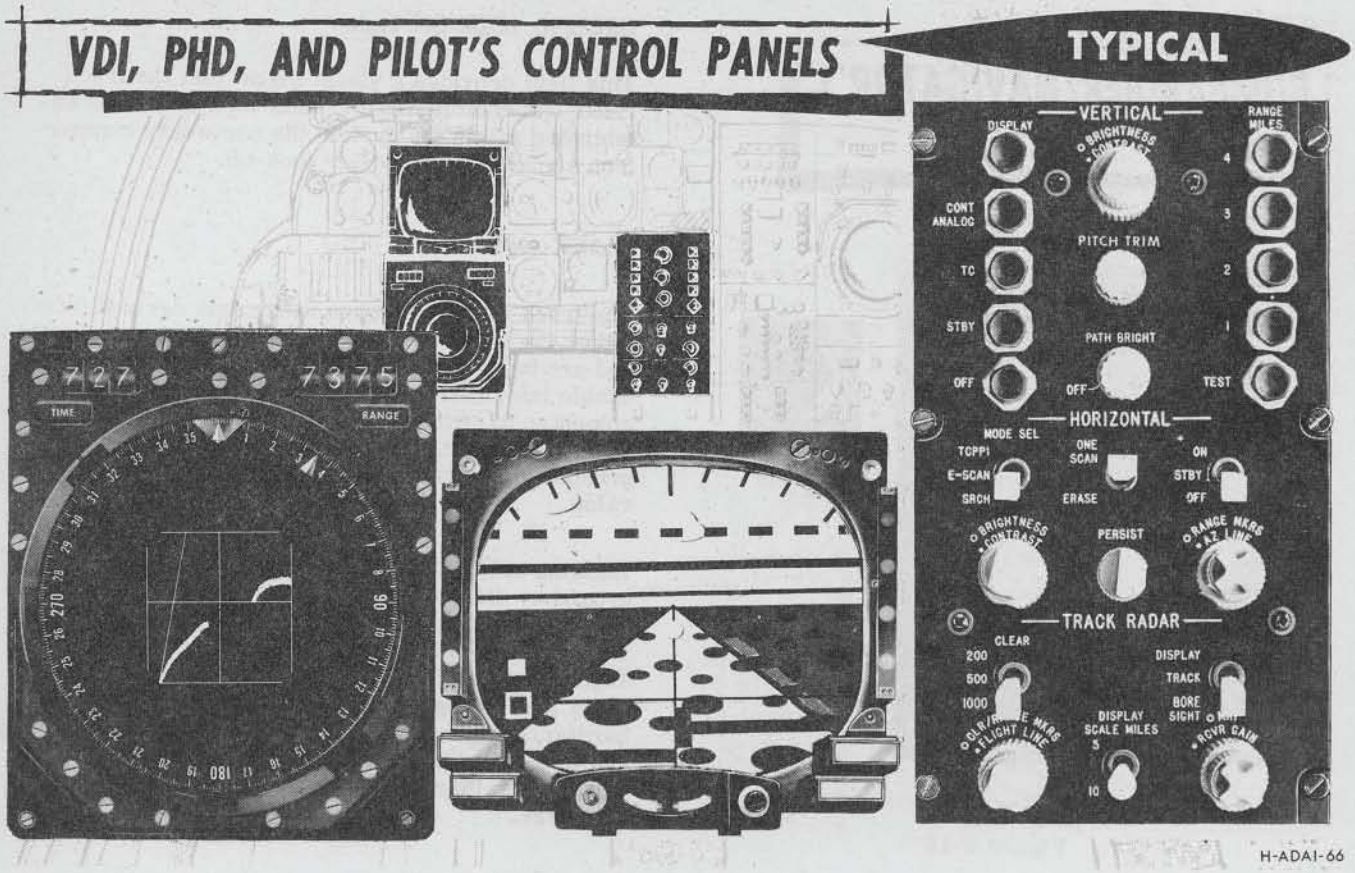

Figure 8-15

metal azimuth ring. Windows at the top of the display panel provide digital readouts of range in miles, and flight time in minutes to the intersection of the radar cursors, or to the target.

Azimuth Ring

The azimuth ring is a servo-driven rotating compass card that indicates true heading when read against a fixed reference at the top of the display. Graduations are in degrees, with 5° and 10° points accentuated. The azimuth ring circumscribes the periphery of the pilot's horizontal display and the bombardier/navigator's DVRI. To get heading information on the PHD, the PHD power switch must be at STBY or ON and either the search or track radar power switch must be at STBY or ON.

Command Heading Indicator (PHD Bug)

The command heading indicator (PHD bug) (figure 8-15) consists of a pointer that rotates independently around an azimuth ring. The pointer provides steering error information. In all flight modes, except the attack modes, the command heading indicator will be displaced from the true heading by an amount equal to drift-corrected steering error. In attack, the command heading indicator is proportional to roll-summed steering error (displays the same horizontal steering information as the weapons steering symbol and optical sight). Under normal conditions, the aircraft is steered to reduce the steering error to zero.

HORIZONTAL DISPLAY CONTROLS

The horizontal display controls are grouped in the center section of the pilot's control box (figure 8-15).

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Power Switch

A three-position ON/STBY/OFF toggle switch on the lower center section of the horizontal display control grouping supplies power for the horizontal display.

Note

This control will not operate unless the search/track radar power is STBY or ON.

Brightness/Contrast Control

A dual, concentric, brightness and contrast control adjusts the brightness of the horizontal display, and varies the relative intensity of the display and the display background.

Mode Selector Switch

A mode selector switch (MODE SEL) gives the option of selecting TCPPI, E-scan, or search (SRCH) for presentation on the horizontal display. The search position is a repeater of the bombardier/navigator's DVRI.

Persistence Control

The persistence control (PERSIST) varies the time that a presentation remains on the horizontal display. The control can hold the display up to 44 seconds.

ONE-SCAN/ERASE Switch

The ONE-SCAN/ERASE switch controls one-scan operation on the horizontal display when minimum radiation is desired in an ECM environment. The scan is initiated by placing the radar transmit switch in SIL and going to ONE-SCAN, which is a momentary position, then going back to normal. To erase the display, set the switch to ERASE, which is also a momentary position. The one-scan display will persist up to 44 seconds, depending on the setting of the PERSIST control.

Note

To operate in one-scan, ensure that the search radar is in the ON and SILENT positions.

Range Markers/Azimuth Line Control

A dual, concentric, range markers-azimuth line control (RANGE MKRS/AZ LINE) varies the width and intensity of the markers and azimuth line in the respective displays.

PILOT'S TRACK RADAR CONTROLS

Display/Track/Boresight Control

The track radar DISPLAY/TRACK/BORESIGHT control selects the track radar mode of operation. In the TRACK position, the track radar is used for tracking targets in azimuth, elevation, and range.

The DISPLAY mode is used for E-scan, TCPPI, and emergency search operation. The BORESIGHT mode locks the track radar antenna along the armament datum line if the computer is not in attack.

Display Scale Switch

The display scale switch has a 5- and a 10-mile position. The switch position corresponds to the displayed range.

Clearance Switch

The clearance switch (CLEAR) has three positions; 200, 500, and 1,000 feet. This switch provides a choice of distances between the aircraft flight path and the clearance line in E-scan operations.

Receiver Gain Control

The receiver gain control (RCVR GAIN) varies the strength of the video signal displayed.

Monopulse Resolution Improvement Control

The monopulse resolution improvement control (MRI) permits the pilot to shape the track radar beam to improve video definition. It is effective in E-scan in elevation only (3 1/2° to 1/2°), in TCPPI, both in azimuth and elevation, and in emergency search in azimuth only.

Uncage Boresight Button

The pilot's uncage boresight button on the control stick grip allows the pilot to uncage the track radar antenna and prepare for an attack by taking the computer out of the navigation mode and placing it in the attack mode. The uncage boresight button can be used with general, straight path, rocket, and hi-loft attack modes.

Note

Actuating the uncage boresight button will alternately step the system into and out of attack; the track radar antenna will alternately cage and uncage provided the DISPLAY/TRACK/BORESIGHT switch is at BORESIGHT.

RADAR RECORDING CAMERA KD-2

Aircraft incorporating AFC No. 126A have provisions for installing the KD-2 radar recording camera. The camera and its operating controls are contained in a specially modified hood (figure 8-16) which replaces the DVRI hood.

The KD-2 camera is a 35mm cassette-loading, radar-recording camera with a capacity for 70 exposures, which operates on 28 V dc from the search radar. Control voltages are also 28 V dc from the search radar. The camera mounts on top of the B/N's hood and the image on the DVRI tube face is reflected into the camera lens by means of a beam

Figure 8-16

splitter in the hood. The beam splitter is a 50:50 partially surfaced mirror mounted at a 45° angle to the CRT face and the camera film plane. The camera operates in two modes: ONE SHOT and TRAIN. The mode of operation is selected by means of a switch on the lower right side of the hood (figure 8-16).

CAMERA LOADING

Complete instructions for loading and rewind are provided on the cover plate if it is necessary for the crew to load or unload the camera.

CAMERA CONTROLS

All the operating controls are on the camera except for the mode selector switch, which is on the lower right side of the hood.

Frame Counter

The frame counter is a knurled knob marked from 0 to 70 exposures in increments of 5. The frame counter is set to the number of exposures remaining when the camera is loaded.

Note

The camera will not operate if the frame counter is set to 0 or is in the unmarked sector of the dial.

Sprocket Knob

The sprocket knob is rotated counterclockwise for loading and is depressed to permit rewind for unloading.

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Shutter Speed Control

The shutter speed control is a pointer which can be moved to provide exposure times of 1/5 to 1/100 second and a B (bulb) position.

Note

For proper operation, the shutter speed must be set at B to keep the shutter open during a full scan.

F Stop

The F stop control is a means of setting the lens opening by rotating a lever until it is at the desired number and is normally set for the type of film used when the camera is loaded.

Cassette Knob

The cassette knob, marked REWIND, is rotated clockwise to rewind the film into the cassette following exposure of a full roll.

Mode Control Switch

The mode control switch is a three-position toggle switch marked OFF, TRAIN, and ONE SHOT. When the switch is at OFF, no power is supplied to the camera. When the switch is set at TRAIN, the shutter opens at the start of the next left-to-right scan of the radar, exposing one frame, and remains open until the end of the scan. One frame is exposed every sixth left-to-right scan until the frame counter reaches 0 or the mode selector switch is set to OFF. When the switch is set to the momentary ONE SHOT position, the shutter is opened for the next left-to-right scan, exposing one frame.

OPERATING PROCEDURES

1. After loading film and closing the cover, ensure that the DVRI filter is removed. Operate the camera in ONE SHOT for four exposures and note counterclockwise rotation of the REWIND knob. Periodic checks of REWIND knob rotation should be made to assure proper camera operation.
2. Scope photograph will be overexposed and unusable unless the B/N maintains a light-tight seal with the hood.
3. For best results, slow scan of the search radar is recommended.
4. For proper operation, the mode control switch should be operated only on left-to-right scan and just before the sweep reaches the left side of the scope.
5. The mode control switch should be in the OFF position before securing the search radar to ensure the camera will not jam and become inoperative.

PILOT'S VERTICAL DISPLAY SYSTEM

VERTICAL DISPLAY INDICATOR (VDI)

The vertical display (figure 8-15) presents to the pilot contact analog and search radar terrain clearance. These displays simulate the view a pilot sees through the forward cockpit window whose dimensions allow viewing real-world angles of 60° in elevation and 50° in azimuth, and enable the pilot to maneuver the aircraft without reference to the real world during takeoff, landing, navigation, and attack.

The indicator lights described in the paragraphs below are mounted on the frame of the indicator around the viewing tube.

Computer Light

The COMPUTER light on the VDI (figure 8-15) is a rectangular legend light. It lights (blinks) when the computer error indicator on the bombardier/navigator's control panel lights and lights (steady) when the computer FLIGHT MODE select OFF button is depressed. NEW

Attack Light

The ATTACK light on the VDI (figure 8-15 is a rectangular legend light, indicating whether or not the computer is operating in the attack mode.

Note

Should this light go out during the attack sequence, it will be necessary to reestablish the valid attack requirements to conclude the operation.

This indicator is wired in parallel to the indicators mounted on the face plate of the bombardier/navigator's direct view radar indicator (DVRI) and on the RHU.

In-Range Light

The IN-RANGE light on the VDI (figure 8-15) is a rectangular legend light. It provides the same information as that displayed by the in-range lights on the optical sight. When flashing, this light indicates that the aircraft is within weapon release range of the selected target, as computed by the ballistics computer or that a release point has been selected by the computer in straight path attack.

Platform Light

The PLATFORM light on the VDI (figure 8-15) is a rectangular legend light. When the light is on, it indicates that the inertial platform is not operating or has malfunctioned and is providing unreliable attitude information. The light does not come on if the compass switch is in MAG/VGI. Failure of the VDI roll stabilization or loss of power to the INS will cause the PLATFORM light to flash.

Breakaway Lights

The breakaway lights are displayed by flashing red on the upper half of a vertical bar on each side of the VDI (figure 8-15). These breakaway lights are repeaters of the breakaway lights on the optical sight providing target data terrain avoidance and weapon-release pullup warning. The circuitry of the breakaway lights may be tested by selecting BREAKAWAY on the test switch on the optical sight control panel or with the LTS WARN button on the pilot's instrument panel.

Radar Altimeter Failure Light

A radar altimeter failure light displays RA in black letters on a red background in the lower half of the vertical bar on the right side of the VDI. When the output of the radar altimeter is less than 1 volt (20 feet) or greater than 26.5 volts (5000 feet), the light will be lit. Circuitry may be tested by depressing the LTS WARN button on the master test panel.

VDI Filters

The vertical display indicator is provided with a red filter for night use and a micromesh filter to reduce glare on the viewing screen during the day. The filters are stowed in the pouch provided on the right side of the cockpit when not in use and are easily installed and removed. They may be changed during flight.

VERTICAL DISPLAY CONTROLS

The vertical display controls are grouped on the upper section of the pilot's control box (figure 8-15).

Vertical Display Selector Buttons

The display selector buttons allow a choice of contact analog (CONT ANALOG) and search radar terrain clearance (TC) displays. The standby button (STBY) keeps the vertical display in readiness for a mode selection. With the OFF position selected, no power is supplied to the vertical display system.

Range Miles Buttons

The range miles buttons provide a choice of range contour coding (1, 2, 3, and 4), for use with the terrain clearance function.

TEST Button

All symbols and markers, except the command heading line, may be displayed on the VDI simultaneously (see figure 8-17) by depressing the TEST button on the pilot's control box (figure 8-15).

Brightness/Contrast Control

A dual, concentric, brightness and contrast control adjusts the brightness of the vertical display, and varies the relative intensity of the display and the display background.

Path Bright Control

The path brightness control is used to vary the brightness of the flight path appearing in the vertical display. The pathway may be turned off by turning the control full counterclockwise to the OFF position.

PITCH/TRIM/OFFSET IMPACT PT Control

The PITCH TRIM/OFFSET IMPACT PT control permits the pilot to adjust the position of the pitch trim markers on the VDI to any desired vertical distance from the center of the VDI when CA is selected and is also used to control the position of the offset impact bar in the SRTC display when TC is selected.

TEST PATTERN SYMBOLS

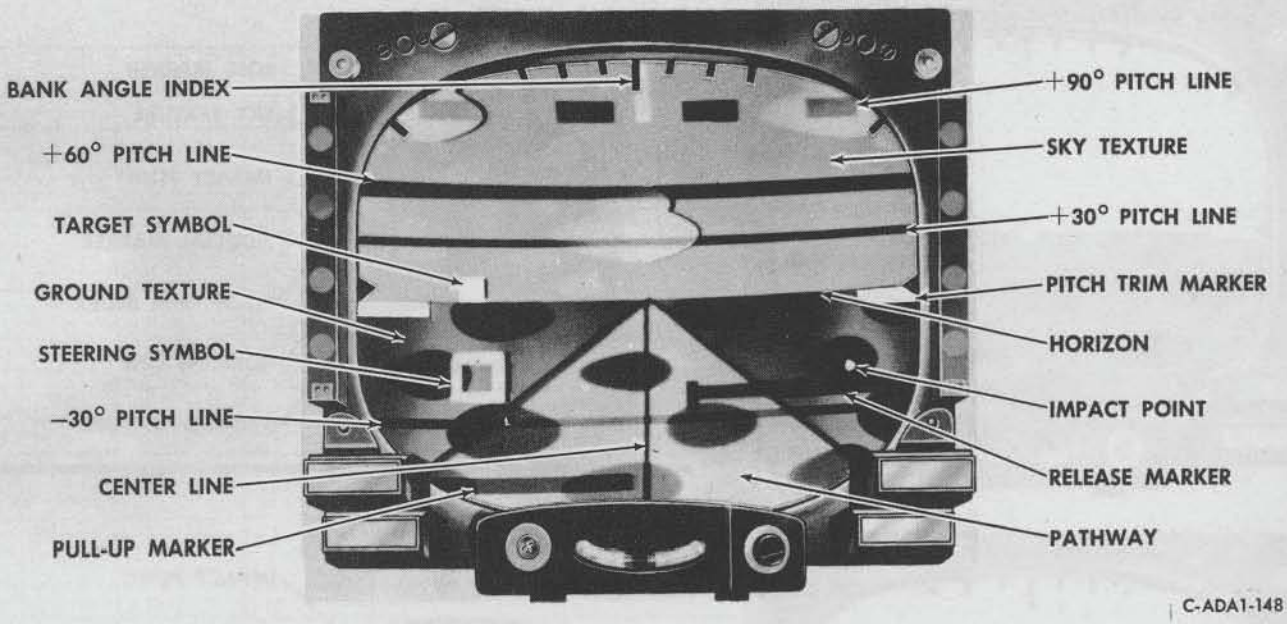

Figure 8-17

CONTACT ANALOG DISPLAY

The basic concept of the contact analog display is to present to the pilot a means of directing the aircraft through a prescribed mission regardless of the existing weather conditions. The basic contact analog display (figure 8-18) consists of a horizon line, pitch lines, pitch trim markers, fixed bank angle indices, video bank angle markers, ground texture elements, and cloud texture elements. The physical center of the scope represents the armament datum line (ADL) of the aircraft. In addition, there are two fixed fiducial markers at the sides of the scope, which mark the vertical center. The horizon line is presented as a ground-stabilized element and indicates the attitude of the aircraft. The principle is similar to the standard attitude gyro.

To indicate the various pitch angles for all the flight conditions, the display is provided with a series of pitch lines which are parallel to the horizon line. These lines are relative to the horizon line and when positioned in the center of the VDI, they represent aircraft pitch angles of 30° nose up or down, 60° nose up or 90° nose up (see figure 8-18). In addition, two pitch trim markers are provided to assist the pilot in maintaining a selected pitch attitude in flight. These are short, bright markers, which emanate from the sides of the scope and can be varied in elevation by the control on the pilot's vertical and horizontal display control box (figure 8-15), placarded PITCH TRIM. These markers will stay with the horizon line during rolls and constant bank angles provided the pitch angle is maintained.

Further assistance is provided to establish a consistent reference for bank angles. The scope is provided with a video bank angle marker and a series of fixed bank angle indices along the upper half of the scope display frame (see figure 8-18). The relationship of the marker and indices provides the pilot with a ready reference to the angle of bank of the aircraft.

On the display, the horizon line separates the ground texture elements and the cloud texture elements. The ground texture elements move at a constant rate toward the display bottom to simulate aircraft motion. Cloud texture elements provide additional real-world reference. The clouds move when the aircraft attitude is changed in pitch or heading, and remains fixed when maintaining a constant attitude. Eight rows of ground texture elements and four rows of cloud texture elements are staggered to produce a randomized effect.

SEARCH RADAR TERRAIN CLEARANCE (TC) DISPLAY

The search terrain clearance display can be selected by depressing the TC button on the pilot's control box. This display permits the pilot to maintain an altitude above the terrain by presenting to the pilot a real-world display on the VDI. The display is generated from inputs provided by the search radar. Further information on the SRTC mode may be found with the description of the search radar. NEW

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BASIC CONTACT ANALOG DISPLAYS

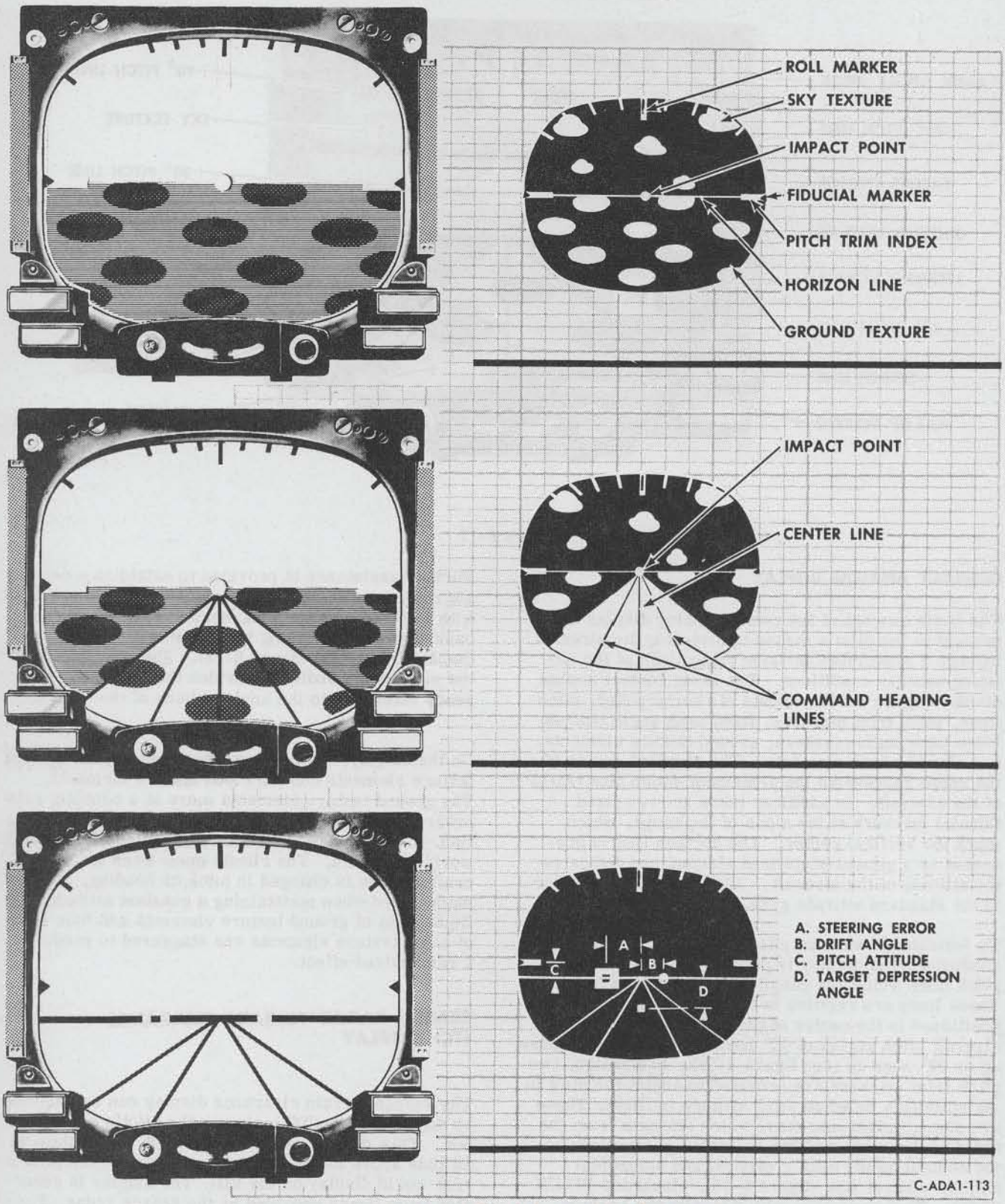

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Figure 8-18

DISPLAY SYMBOLS AND MARKERS

To provide a means of displaying attack-navigation system information, the VDI utilizes various symbols and markers added to the basic contact analog display (figure 8-19). These include the basic flight path, command heading lines, impact point, target symbol, pullup marker, release marker, steering symbol, and centerline (figure 8-19). All components of the display are represented in true perspective to afford the optimum degree of realism in the final presentation. To this end, the basic components have been shadowed to provide greater definition in the overall presentation.

In addition, calibration markers, offset impact bar, and a radar altitude curtain are provided for TC mode of operation.

Basic Flight Path

The basic flight path is formed by two perspective vertical lines converging on an imaginary line that passes through the ADL parallel to the horizon line. The path apex will always appear on this imaginary line and indicate steering error, except in a pullup situation. When 26° or more of steering error is present, the path apex will be at full azimuth deflection. The pilot may vary the path brightness by using the control, which is marked PATH BRIGHT, and is on the pilot's control panel.

Command Heading Lines

Command heading lines are parallel lines in perspective emanating from the path apex. These lines will appear to move left or right when a steering error exists. The command heading lines will not move in the navigation mode. The command heading lines will attain (in attack) the maximum rate of motion at about 3° of steering error. They will not be available during the takeoff and landing modes of operation.

Impact Point

The impact point is a solid white circle that represents an extension of the velocity vector of the aircraft. This corresponds to a projection of the aircraft flight path with reference to all immediate aircraft data. Displacement of the impact point from the ADL indicates drift and yaw in azimuth and angle of attack and vertical wind in elevation.

Target Symbol

The target symbol is a solid white square that represents the actual position of the target from the aircraft. Displacement of the symbol from the ADL will show depression angle of the target in elevation when at ranges of 150 nautical miles or less, and true bearing in azimuth to 26°.

Offset Impact Bar

The offset impact bar, displayed in the TC mode only, permits terrain following with selectable terrain clearance altitudes. For ease of identification, the offset impact bar is a black bar with white tips and easily distinguishable in any background (coded ranges). The offset impact bar is adjustable vertically from 1 1/2 inches to 4 inches below the impact point at zero angle of attack.

Calibration Markers

Whenever TC mode is selected, two horizontal calibration markers are superimposed on the right side of the viewing tube, spaced 1 3/4 inches apart. The first three range lines vector into the lower calibration marker, while the last five range lines vector into the top calibration marker, which is aligned with the horizon line. This feature provides a method for verifying system scale factor and resultant accuracy continuously in flight.

Radar Altitude Curtain

A black curtain indicating the radar altitude below the aircraft is superimposed on the display between 5000 feet and 20 feet AGL. The height of the curtain between the TC horizon and the bottom of the scope is dependent on the aircraft altitude, attitude, and curtain scale factor.

Pullup Marker

The pullup marker is used to indicate a command pullup given in the event of terrain avoidance command, or during a general or hi-loft attack sequence. The marker moves down the left side of the flight path (figure 8-18). When the marker reaches the bottom of the display, the pilot is advised that the necessary command pullup must be executed to achieve the desired results.

Release Marker

The release marker is used to indicate attack progress and in-range in all attack situations. In general and hi-loft attacks, it indicates angle-to-go to release. In rocket attack, however, the release marker indicates a rocket firing zone and is not related to actual release of the weapon. The marker moves up or down the right side of the display depending on the attack, denoting anticipation of release. When the marker reaches the bottom of the display, it indicates weapon release.

Steering Symbol

The steering symbol is a hollow white square that serves five distinct functions:

1. Roll-summed steering
2. Elevation steering (rocket lead angle)
3. G-command
4. Straight path glide pitch command
5. Shrike target directional indication

VERTICAL DISPLAY SYMBOLS AND MARKERS

SYMBOL DESIGNATION	DESCRIPTION	GRAYSCALE	MAX. DIM.	MIN. DIM.	MAX. DISPLAY ANGULAR RANGE HOR.	MAX. DISPLAY ANGULAR RANGE VER.
HORIZON LINE	A GROUND STABILIZED LINE WHICH SEPARATES GROUND AND CLOUD TEXTURE	BLACK				±30°
±30° PITCHLINE	THESE LINES DENOTE EITHER +30° OR −30° ELEVATION ANGLES WHEN IN DISPLAY CENTER.	BLACK	1/8" WIDE FIXED			60°
+60° PITCH LINE	A LINE DENOTING 60° ELEVATION ANGLE WHEN IN DISPLAY CENTER	BLACK	1/4" WIDE FIXED			60°
+90° PITCH LINE	A DASHED LINE WITH SIX SEGMENTS DENOTES 90° ELEVATION ANGLE IN DISPLAY CENTER	BLACK	1/4" WIDE FIXED			60°
PITCH TRIM MARKERS	PITCH ANGLE REFERENCE TO THE HORIZON	BRIGHT	1/4" WIDE	1/8" WIDE		±30°
BANK ANGLE MARKER	SINGLE REFERENCE LINE USED TO DENOTE DEGREE OF AIRCRAFT BANK	BRIGHT	1/4" WIDE	1/8" WIDE		
GROUND TEXTURE ELEMENTS	ELLIPTICAL ELEMENTS THAT EMANATE FROM THE HORIZON AND MOVE IN ACCORDANCE WITH A QUASI RANDOM GROUND PLANE	DARK GRAY	MAJOR AXIS 1-1/2"	MAJOR AXIS 1/2"		60°
CLOUD TEXTURE ELEMENTS	ANALOG OF CUMULUS CLOUDS; STATIONARY FOR FIXED A/C ATTITUDE AND MOVE WITH ATTITUDE CHANGE	LT. GRAY	MAJOR AXIS 1-1/2"	MAJOR AXIS 1/2"		60°
BASIC FLIGHT PATH	PERSPECTIVE VERTICAL LINES CONVERGING AT THE IMAGINARY LINE WHICH PASSES THROUGH THE ADL	BLACK	30° REAL WORLD	25° REAL WORLD	±26°	60°
COMMAND HEADING LINES	THREE LINES THAT RADIATE FROM THE PATH APEX AND ROTATE WITH HEADING ERROR	DARK GRAY	1/16" WIDE FIXED			
IMPACT POINT	A SOLID WHITE CIRCLE REPRESENTING AN EXTENSION OF THE FLIGHT PATH	BRIGHT	CIRCLE 5/32" DIA.		±26°	30°
1 TARGET SYMBOL	A SOLID WHITE SQUARE THAT INDICATES THE POSITION OF THE TARGET IN THE GROUND PLANE	BRIGHT	1/4" SQUARE FIXED		±26°	±30°
2 PULL UP MARKER	A HORIZONTAL BAR THAT MOVES DOWN THE PATH LEFT SIDE IN PERSPECTIVE AND DENOTES PULL UP WHEN AT THE BOTTOM OF THE DISPLAY	BLACK	1/4" WIDE	1/16" WIDE		−30°
3 RELEASE MARKER	A HORIZONTAL BAR ENDED BY A SHORT VERTICAL BAR MOVES DOWN THE RIGHT SIDE OF THE PATH	BLACK				±30°
4 STEERING SYMBOL	A HOLLOW WHITE SQUARE THAT DENOTES ROLL SUMMED STEERING AND ELEVATION STEERING	BRIGHT	5/8" SQUARE 1/8" LINE WIDTH FIXED		±26°	±30°
CENTER LINE	A LINE WHICH IN PERSPECTIVE BISECTS THE TAKE OFF AND LANDING PATHWAY	BLACK				

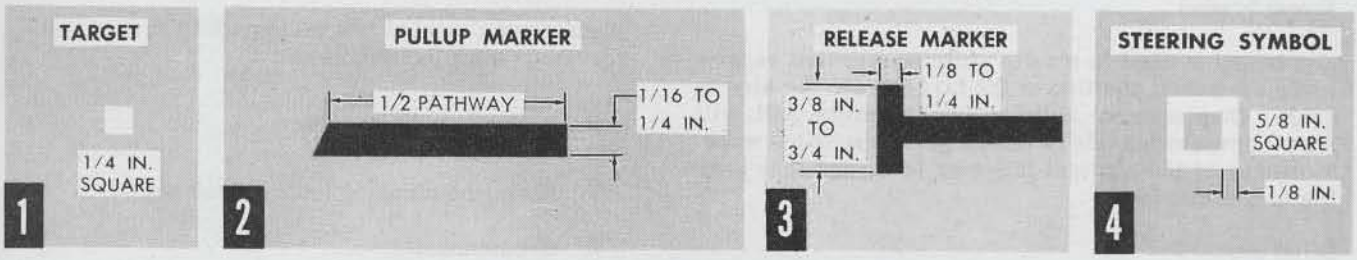

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Figure 8-19

During navigation and all attack modes of operation, the symbol acts to give the pilot roll-summed steering commands. The symbol will move horizontally between the fiducial markers with the symbol base parallel to the horizon line. During hi-loft and general attack sequences, the symbol provides g commands in addition to roll-summed steering. The symbol will then move horizontally to indicate azimuth errors, and vertically to indicate g requirements.

In the rocket attack mode, the symbol again provides roll-summed steering, combined with vertical steering, or rocket lead angle.

Note

To realize optimum system accuracy during all aircraft maneuvers, it is mandatory that the pilot fly the aircraft so that the steering symbol is centered in the VDI at all times.

In the straight path free-fall attack, roll-summed steering is combined with pitch commands. The symbol is also used to indicate g error when a terrain avoidance pullup is required.

In Shrike missile attacks, the missile direction-finding signals will position the symbol relative to received radar signals.

Note

With the optical sight control switch in the AUTO position, the optical sight moving reticle displays roll-summed steering in attack and may be used as a backup for VDI and PHD steering.

Centerline

The centerline is a dark line that bisects the basic flight path. It will remain in the perspective center of the pathway, regardless of path motion. The centerline will be available only when the computer is in the landing or takeoff modes of operation.

ATTACK-NAVIGATION SYSTEM STEERING COMMANDS

Figure 8-20 illustrates the various steering commands available to the pilot when the computer is the navigation mode or the attack mode.

DRIFT-CORRECTED STEERING

Drift-corrected steering is heading information which permits the pilot to fly the aircraft from its present position on a direct course to a specific checkpoint. A steering error exists when the aircraft is making a ground track that would not take it from its present position on a straight line (the commanded ground track), to the selected checkpoint. This steering error is conveyed to the pilot through the movable reticle, path apex, and the steering bug. The steering information has been corrected to account for any wind conditions that may cause the aircraft to drift off course while enroute to the checkpoint. When the present ground track matches the commanded ground track, the movable reticle will be centered in azimuth, the path apex will be in the center of the scope, and the steering bug will be located under the fixed index (see figure 8-21).

ROLL-SUMMED STEERING

During the flight mode, the computer provides the steering symbol (and the moving reticle, steering bug, and command heading lines in attack), with the bank angle required to eliminate 65% of steering error in 5 seconds in navigation, and 2 seconds in attack, minus the bank angle the aircraft is presently holding. In other words, roll-summed steering can be described as the command which tells the pilot how much bank angle is required to follow drift-corrected steering to fly the aircraft on a commanded ground track. It can be considered as an addition or summing of bank angle required and steering error to enable the pilot to reach a given point.

The steering symbol never commands more than 26° of bank angle. If the bank angle the pilot holds is less than 26° or greater than 26°, the steering symbol will be displaced from the center of the VDI.

The following example describes a roll-summed steering condition in attack. In figure 8-22, if an aircraft has a steering error to a commanded ground track of about 4° or more, the steering symbol will command a bank angle of 26° to correct back to this specific track. If a bank angle of greater than 26° is held, the steering symbol will limit approximately one-half the distance between the ADL and the fiducial marker on the side of the display that has the high wing, i.e., if a right bank angle of 27° is held,

STEERING INFORMATION INDEX

	NAVIGATION			ATTACK		
	TAKEOFF *	LANDING	NAVIGATION	STRAIGHT PATH	GENERAL/HI-LOFT	ROCKET
MOVABLE RECTICLE	PROVIDES NO MEANINGFUL INDICATIONS	STEERING TO SELECTED TGT	DRIFT CORRECTED STEERING ERROR/ TGT DEPRESSION ANGLE	ROLL SUMMED STEERING/TGT DEPRESSION ANGLE	ROLL SUMMED STEERING/ TGT DEPRESSION ANGLE/ AT PULL-UP-ROLL SUMMED STEERING AND "G" COMMAND.	ROLL SUMMED STEERING AND ROCKET LEAD ANGLE
STEERING SYMBOL		ROLL SUMMED STEERING/GLIDE SLOPE COMMANDS	ROLL SUMMED STEERING	ROLL SUMMED AND VERTICAL STEERING TO A PROGRAMMED RELEASE POINT	ROLL SUMMED STEERING/ AT PULL-UP ROLL SUMMED STEERING & "G" COMMAND	ROLL SUMMED STEERING AND ROCKET LEAD ANGLE
PATH APEX		DRIFT CORRECTED HEADING ERROR	DRIFT CORRECTED COARSE STEERING ERROR	DRIFT CORRECTED COARSE STEERING	DRIFT CORRECTED COARSE STEERING	DRIFT CORRECTED COARSE STEERING
COMMAND HEADING LINES		DO NOT APPEAR ON VDI	ZERO	ROLL SUMMED STEERING	ROLL SUMMED STEERING	ROLL SUMMED STEERING
CENTERLINE (NEAR END)		COURSE ERROR	—	—	—	—
PATH BASE WIDTH		GLIDE PATH ALTITUDE ERROR	—	—	—	—
COMMAND HEADING INDICATOR (STEERING BUG)		STEER TO SELECTED TGT	DRIFT CORRECTED STEERING ERROR	LIMITED ROLL SUMMED STEERING	LIMITED ROLL SUMMED STEERING	LIMITED ROLL SUMMED STEERING

* USE OF LANDING MODE IS RECOMMENDED FOR TAKEOFF STEERING

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Figure 8-20

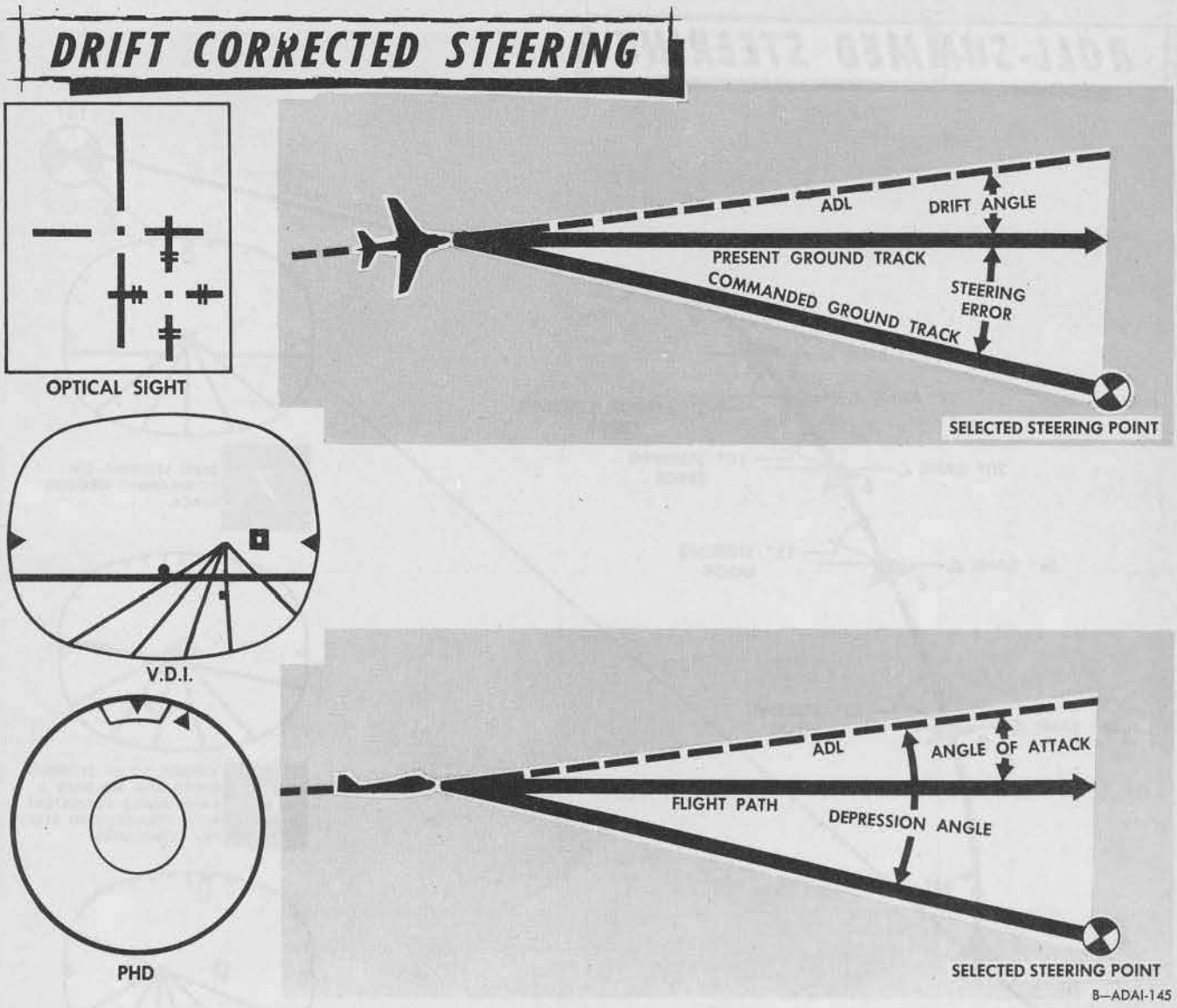

Figure 8-21

the steering symbol would start its movement to the limit point on the left side of the scope, indicating that the left wing should be lowered in order to decrease the angle of bank to 26°, which would put the steering symbol in the center of the scope. This condition will remain as long as a bank angle of 26° is held, until the aircraft is within approximately 4° of commanded ground track. At this point, the steering symbol will inch to the left (if in a right bank), indicating that the bank angle must be decreased to prevent overshooting the commanded track.

TARGET DATA TERRAIN AVOIDANCE (TDTA)

Target data terrain avoidance pullup is based upon the slant range along the present velocity vector. It is calculated using vertical separation from the target and depression angle of the velocity vector. It functions in attack or in navigation with boresight selected when the glide/dive angle is between 5° and 90°. This feature should not be relied upon unless a discrete or ground lock on has been acquired. The terrain avoidance indications on the VDI are, in all cases, the pullup marker and the pathway pitch-up.

Pullup is indicated when the pullup marker disappears off the bottom of the display and the pathway pitch-up occurs. The steering symbol and moving reticle will jump vertically to indicate command g, based upon the programmed 4-g pullup schedule.

For free-fall loft attacks (general or hi-loft), a terrain avoidance forced commit (TAFC) will occur when the time-to-go to terrain avoidance pullup reaches zero.

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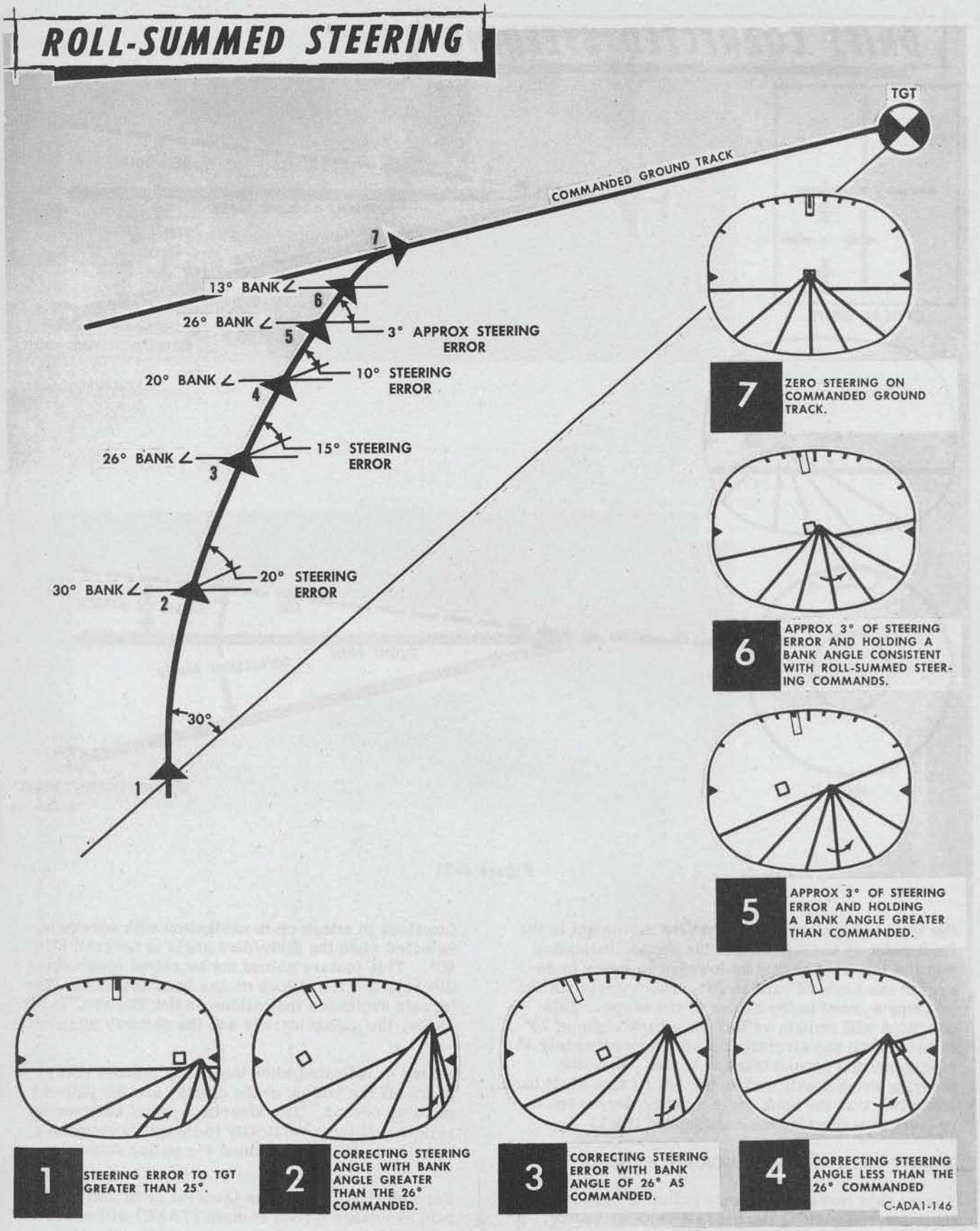

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Figure 8-22

The limitations of target data terrain avoidance indications are:

1. Inoperative in dive angles less than 5°.

2. Assumes target is along the velocity vector of the aircraft.

3. Provides no protection against obstacles between the airplane and the target.

4. No compensation for delayed or under-g pullup.

PILOT'S OPTICAL SIGHT SYSTEM

The lead-computing optical sight (figure 8-23) is above the pilot's instrument panel and is positioned parallel with the aircraft armament datum line. The optical sight provides the pilot with accurate information regarding target lead angle, and in-range and breakaway indications which will enable him to release a weapon at the precise time and heading that will result in destruction of the selected target. The primary function of the optical sight is accomplished by projecting four optical displays onto a reflector in the pilot's field of vision (figures 8-24 and 8-25). These displays include a fixed and a movable reticle and in-range and breakaway projections. The various functions available to the sighthead are adjusted by

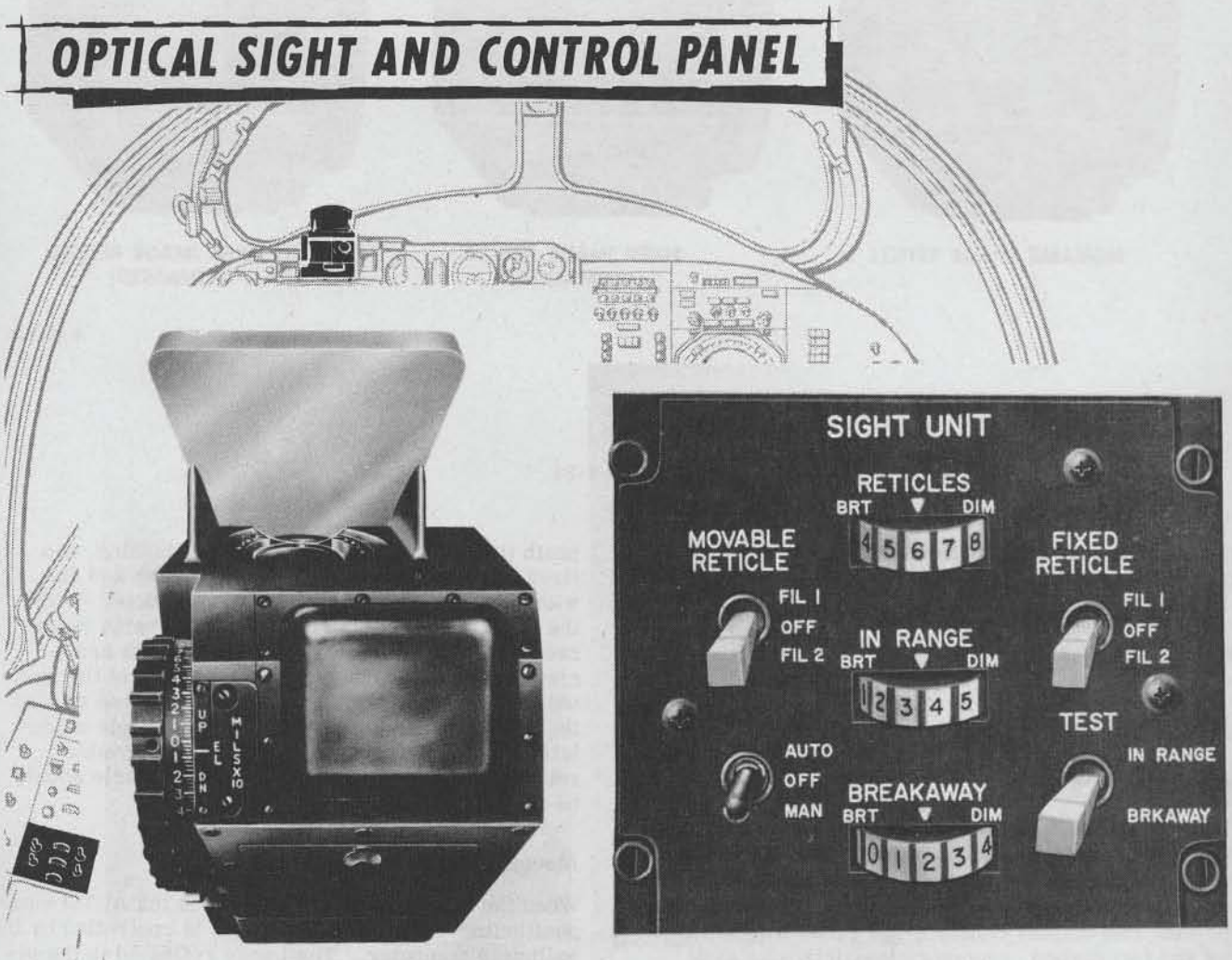

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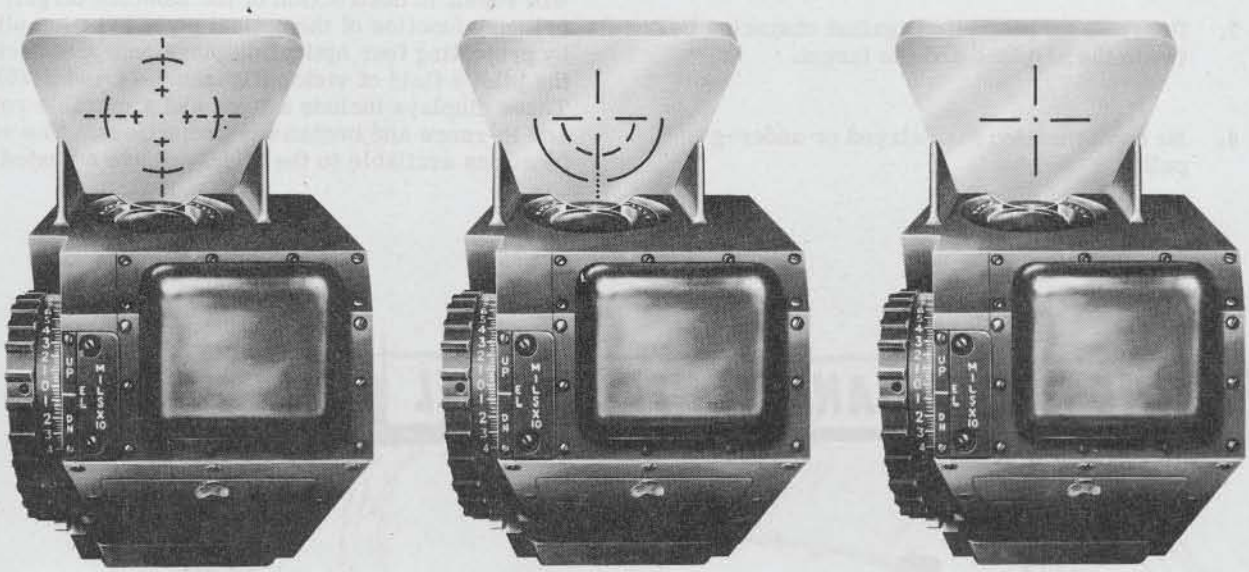
Figure 8-23

OPTICAL SIGHT DISPLAY MODES



MOVABLE IMAGE RETICLE

FIXED IMAGE RETICLE (UNMASKED)

FIXED IMAGE RETICLE (MASKED)

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Figure 8-24

controls on the optical sight control panel on the pilot's left console.

RETICLE DISPLAYS

The reticle displays are illustrated in figure 8-24.

Fixed Reticle

The fixed reticle display is permanently aligned with the armament datum line (ADL) of the aircraft and reflected into the pilot's field of view. The reticle forming this display consists of a cross with a center dot and two dashed, concentric semicircular arcs spaced 50 mils apart. Additional dots, spaced at 10-mil increments, are located directly between and beneath the semicircular arcs. With masking, the fixed image reticle appears as the cross and dot without dashed semicircular arcs and dots. With the mask removed, the fixed image reverts to the cross and dot configuration complete with semicircular arcs and dots. When operating in the manual (MAN) mode, the mask may be removed so that the arcs and dots can be used for lead angle calculations. When using mil lead, set the movable reticle in the manual mode; the fixed reticle should be turned off.

Movable Reticle

When the optical sight is operated in the AUTO mode, positioning of the movable reticle is controlled by the ballistics computer. The image reflected to the pilot's field of vision consists of a dashed cross and dot with short arcs at 25 and 50 mils.

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OPTICAL SIGHT ADVISORY DISPLAYS

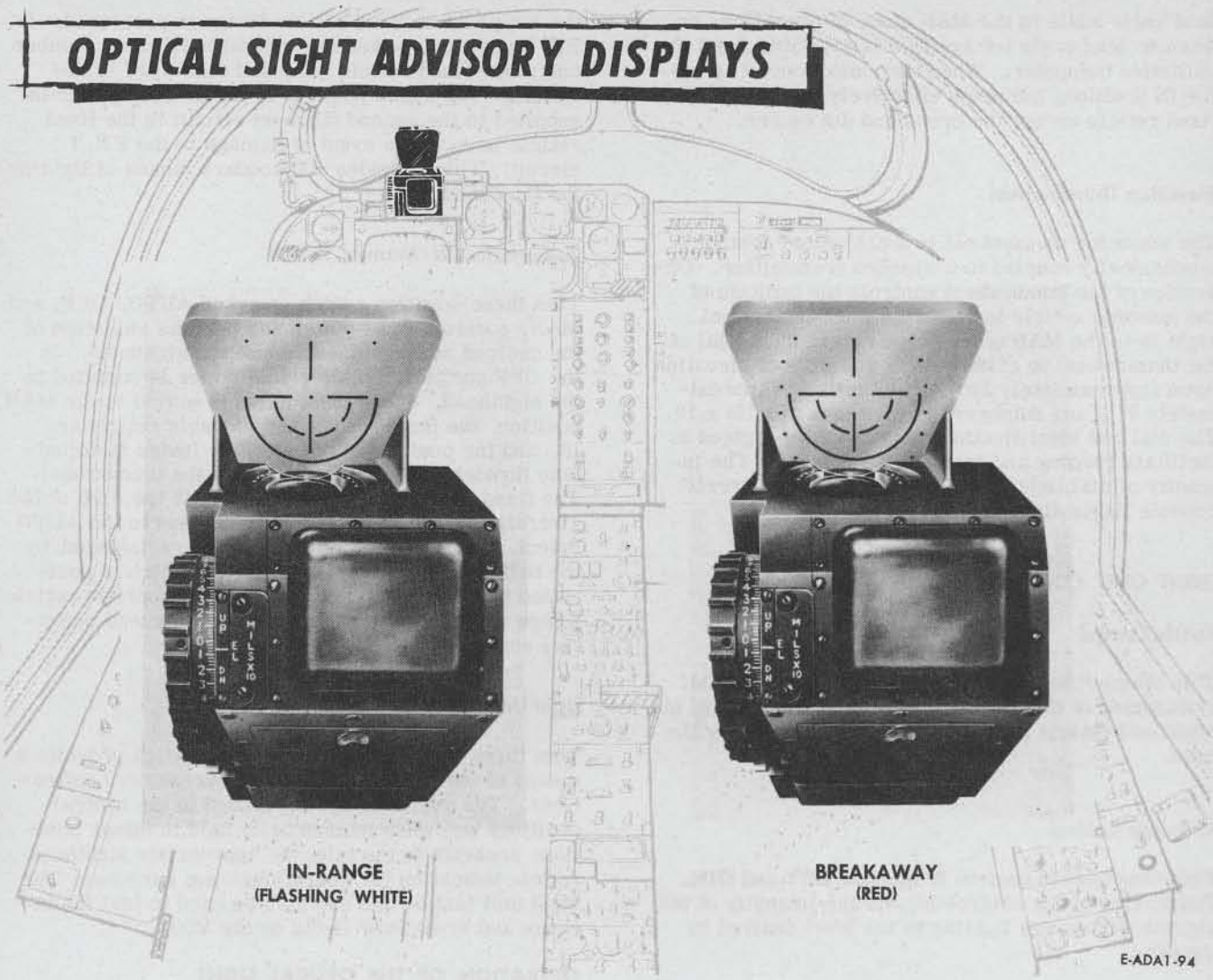

Figure 8-25

In-Range Display

The in-range optical display (figure 8-25) is a reflection of flashing white light. This display is generated by six small lamps within the sighthead and forms an arc reticle impression. When flashing, this light indicates that the aircraft is within weapon-release range of the selected target, as computed by the ballistics computer or that a release point has been selected by the computer in straight path attack.

Breakaway Display

The breakaway optical display (figure 8-25) provides the pilot with two distinct operational functions involving immediate alteration of aircraft altitude. The display consists of two parallel lines of flashing red lights reflected on the port and starboard edges of the sighthead reflector and the movable reticle indicates pullup based on selected g. When this display is seen, the pilot is advised that:

1. The computer has developed a target data terrain avoidance pullup based on computer present position altitude.
2. A pullup maneuver is required for a particular weapon release.

SIGHTHEAD OPERATING CONTROLS

The mask control and elevation thumbwheel are the only controls on the sighthead that are used in normal flight operation. All remaining operational controls are on the sight unit control panel (figure 8-23) on the pilot's left console.

Mask Control

This control is a lever mechanically coupled to a hinged mask that covers the concentric arcs on the lower portion of the fixed reticle. This mask controls the image exposure content generated by the fixed reticle and subsequently presented to the pilot's view. When the mask control is placed in the OUT position, the fixed reticle concentric arcs are projected in the pilot's view to enable him to determine

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lead angle while in the MAN mode of operation, or when no lead angle information is available from the ballistics computer. When the mask control is in the IN position, the mask effectively covers all the fixed reticle except the cross and dot center.

Elevation Thumbwheel

The elevation thumbwheel is a calibrated control mechanically coupled to a synchro transmitter. Operation of the thumbwheel controls the position of the movable reticle in elevation when the optical sight is in the MAN mode of operation. The dial of the thumbwheel is calibrated in 350 mils of elevation down (approximately 20°) and 88 mils up (approximately 5°), and numbered in divisions of mils x 10. The dial and identification plate are edge-lighted to facilitate reading and locating the control. The intensity of dial lighting is controlled by the aircraft console lights dimmer control.

SIGHT UNIT CONTROL PANEL

Reticle Control

This thumbwheel control is marked BRT and DIM. Positioning of this control adjusts the intensity of the sighthead reticle lighting to the level desired by the pilot.

In-Range Control

This thumbwheel control is marked BRT and DIM. Positioning of the control adjusts the intensity of the sighthead in-range lighting to the level desired by the pilot.

Breakaway Control

This thumbwheel control is marked BRT and DIM. Positioning of this control adjusts the intensity of the sighthead breakaway lighting to the level desired by the pilot.

Movable Reticle Switch

This three-position switch, marked FIL 1, OFF, and FIL 2, provides filament power to the movable reticle lamp. In the OFF position, no power is supplied to the lamp and no movable reticle image is presented. In FIL 1 position, power is supplied to filament number one of the movable reticle lamp and the image is reflected to the sighthead. The FIL 2 position of the switch provides for a second filament circuit in the movable reticle lamp in the event of damage to the FIL 1 circuit. This provides a secondary means of lighting the moving reticle.

Fixed Reticle Switch

This three-position switch, marked FIL 1, OFF, and FIL 2, provides filament power to the fixed reticle lamp. In the OFF position, no power is supplied to the lamp and no fixed reticle image is presented. In FIL 1 position, power is supplied to filament number one of the fixed reticle lamp and the image is reflected. The FIL 2 position of the switch, power is supplied to the second filament circuit in the fixed reticle lamp in the event of damage to the FIL 1 circuit. This provides a secondary means of lighting the fixed reticle.

Automatic/Off/Manual Switch

This three-position switch, marked AUTO, OFF, and MAN, controls input power and permits selection of the desired mode of operation of the sighthead. In the OFF position, no electrical power is supplied to the sighthead. When the control is moved to the MAN position, the fixed reticle and movable reticle are lit, and the position of the movable image is adjustable through pilot manipulations of the thumbwheel. The fixed reticle image coincides with the ADL of the aircraft. When the switch is positioned to the AUTO detent, all movable reticle inputs are initiated by the ballistics computer. When this switch is positioned to either AUTO or MAN the appropriate reticle image will be reflected, indicating sighthead operating condition.

Sight Unit Test Switch

This three-position, spring-loaded switch provides a means of testing the in-range and breakaway reflections. The switch is spring-loaded to the neutral positions and when momentarily held in either position, presents to the pilot the appropriate sighthead reticle indication for operational test purposes. The sight unit test switch can also be used to test the in-range and breakaway lights on the VDI.

OPERATION OF THE OPTICAL SIGHT

Note

Before engaging the optical sight AUTO-OFF-MAN switch, ensure that optical sight primary 28 VDC OPT-SIGHT circuit breaker and ADC/OPT SIGHT 115V/400 cycle circuit breaker on the bombardier/navigator circuit breaker panel are engaged.

1. Position AUTO/OFF/MAN switch as desired. The sight is now ready for automatic or manual operation within limits described in this section.

CAUTION

Do not leave AUTO/OFF/MAN switch OFF during taxi or flight operation.

2. Adjust reticle controls for optimum lighting.

3. Operate test control for in-range and breakaway lights.

BOMBARDIER/NAVIGATOR'S SLEW CONTROL PANEL

The bombardier/navigator's slew control panel (figure 8-26) provides the operator with a means of controlling the elevation of the track radar antenna, the search radar cursors, starting and stopping of the attack sequence, and the dislodge feature of the track radar. Control for the velocity-correct function is also on this panel.

SLEW GRIP

The slew grip (figure 8-26) controls the slewing of the search radar range and azimuth cursors on the pilot and bombardier/navigator's scope displays.

The grip is designed for left-hand operation. The slew grip is stowed within the computer pedestal. To release the grip for use, the release button on the top of the slew control panel is depressed, allowing the spring-loaded grip to pop up to the operating position. By pressing down on the head of the grip, the stock is stowed within the pedestal.

When the slew grip control is moved forward, the range cursor on the display is moved to indicate an increased range; when moved aft, the range cursor moves back along the display, indicating a decrease in range marker position. In the 0- to 30-nautical mile range display, the forward-aft motion of the slew control indirectly acts to position the track range gate.

Moving the slew grip to the left or right provides means of positioning the azimuth cursor on the display scopes. When the track radar is in the tracking mode, and the search display is in the 0- to 30-nautical mile range, lateral movement of the slew grip will also result in azimuth positioning of the track radar antenna. The azimuth cursor will then correspond to the track antenna azimuth position.

Note

Once the bombardier/navigator has established a discrete lock-on, movement of the slew control will not affect the position of the cursors.

Trigger Switch

The slew grip contains the trigger switches (figure 8-26), which are a pair of spring-loaded pushbutton switches on the front side of the slew grip. The trigger switches provide cursor slewing at variable rates. Depressing the lower trigger switch provides a slow cursor slew rate; depressing the upper switch provides a moderate slew rate; and depressing both switches provides a fast slew rate. Slew speed is proportional to slew grip deflection; that is, maximum deflection of the slew grip permits the fastest possible slew speed for the rate selected.

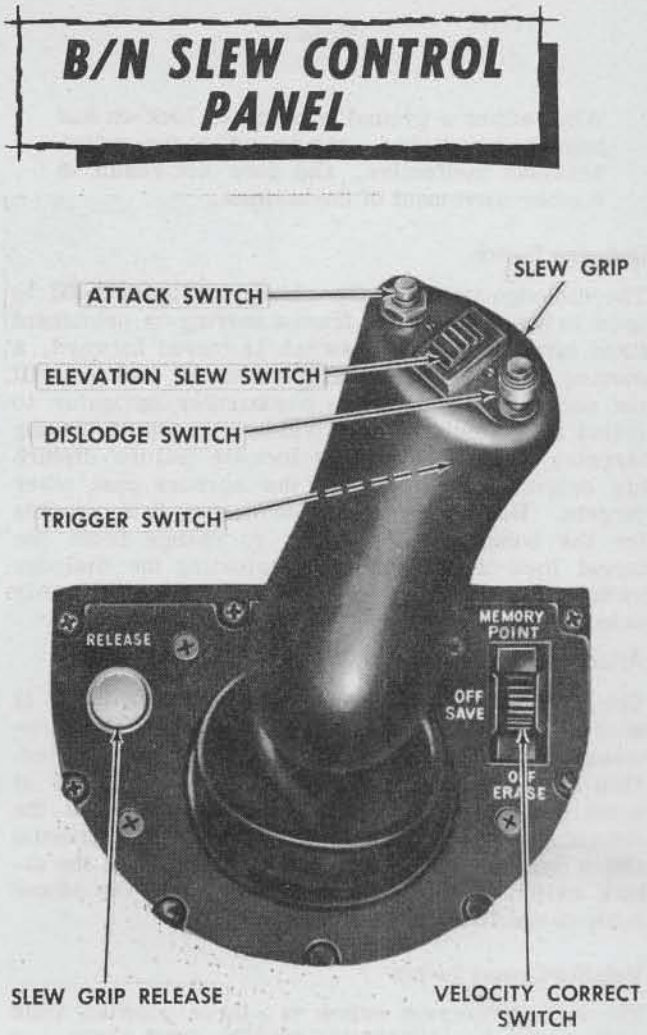

Figure 8-26

Elevation Slew Switch

The elevation slew switch on the top of the slew grip (figure 8-26) is used to adjust the elevation of the track radar antenna. The elevation angle of the track radar antenna is changed at a constant rate, up or down, depending on the switch position. The track radar antenna is automatically positioned in elevation for a ground lock-on after the bombardier/navigator positions the cursors in range and azimuth; however, automatic positioning may be overridden with the elevation slew switch.

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Note

When either a ground or discrete lock-on has been accomplished, movement of the switch becomes ineffective, and does not result in further movement of the antenna.

Dislodge Switch

The dislodge switch on the slew grip (figure 8-26) is used to break a lock-on from a moving or prominent fixed target. When the switch is moved forward, a moving target or fixed target discrete lock-on will not occur, permitting the bombardier/navigator to select a particular target within a group of moving targets, without having the lock-on feature disturb his selection as he moves the cursors past other targets. During the lock-on sequence, it is possible for the bombardier/navigator to change from one target lock-on to another by actuating the dislodge switch, and positioning the cursors to the newly selected target.

Attack Switch

The attack switch on the slew grip (figure 8-26) is used to start the computer solving the various release computations for the particular attack selected. This switch is depressed when the aircraft is at some distance from the target, and provides the computer the opportunity to develop the optimum attack and weapon-release equations. When the attack switch is depressed a second time, the attack mode of operation is terminated.

Velocity-Correct Switch

The velocity-correct switch is a three-position slide switch, marked MEMORY POINT, OFF SAVE and OFF ERASE, and is to the right of the slew grip on the slew control panel (figure 8-26). This switch is used in conjunction with the slew grip for correction of velocity values in the computer. The MEMORY POINT position allows the bombardier/navigator to introduce values of velocity correction proportional to radar cursor displacement with the slew grip. The range and azimuth cursors are positioned over a ground target in any ground-stabilized steering mode. If the cursors tend to drift off the target due to erroneous wind or aircraft velocities in the computer, repositioning the cursors by means of the slew grip will update the velocities in the form of corrected wind.

A velocity-correct performed with a track radar discrete lock-on is referred to as an automatic velocity-correct (AVC), whereas a velocity-correct performed without a track radar discrete lock-on is referred to as a manual velocity correct (MVC).

Velocity corrects may be repeated several times if necessary; however, a minimum time period of 10 seconds for cursor drift should be allowed without a track radar discrete lock-on. The velocity-correct switch should be returned to OFF SAVE before 120 seconds to ensure accurate velocity-correcting. When the cursors remain stabilized over the target automatically, without track lock-on, total velocity has been corrected.

With a track radar discrete lock-on, velocity correct is accomplished by placing the switch in MEMORY POINT. Total velocity is corrected in 12 to 18 seconds. A velocity correct should be discontinued at target walk-down.

When the switch is placed in the OFF SAVE position, the corrected velocity is memorized by the computer and applied to subsequent computations, depending on the position of the navigation select switch:

1. INERL. In this position, the velocities retained in OFF SAVE are used to correct present position and cursor position. (Velocity-corrections made in this position should be checked within 10 or 12 minutes to ascertain their validity.)

2. DR (Platform OPERATE or OFF). Velocity will be used for present position, cursor position, and for correct groundspeed.

3. DR (Platform-INFLIGHT ALIGN). Velocities will supply correction signals to the accelerometers and gyro-torquing motors of the inertial platform; used for present position, cursor, platform, and groundspeed calculations.

4. EMERGENCY DOPPLER. Wind, groundspeed, and corrections cannot be made when the computer is operating in the emergency Doppler mode. Vertical velocity-corrections will be introduced with a track radar lock-on.

Placing this switch in the OFF ERASE position erases the velocity corrections from the computer memory.

Manual velocity-correct can be obtained with AMTI on. Figure 8-27 depicts the various velocity-correct options available.

With AMTI on, moving the velocity-correct switch to MEMORY POINT causes the system to remember the last known target velocity and adds additional filtering from velocity correction (see figure 8-27).

After an AMTI run, it is necessary to set the AMTI to OFF and the velocity-correct switch to OFF ERASE to remove moving target velocities.

VELOCITY CORRECT OPTIONS

			TARGET DATA MODE: DISCRETE LOCK-ON (AVC)		GROUND LOCK-ON OR S/R TRACK (MVC)		SEARCH RADAR ONLY (MVC)	
MEMORY POINT			OFF	ON	OFF	ON	OFF	ON
NAVIGATION OPTION	INER AND DOP/INER	HOR.	MTV*	X	—	X	—	X
		VERT.	MTV*	—	—	—	—	—
	EMERGENCY DOPPLER	HOR.	MTV*	—	—	—	—	—
		VERT.	MTV*	X	—	X	—	—
	DEAD RECKONING	HOR.	MTV*	X	—	X	—	X
		VERT.	MTV*	X	—	X	—	—

* IF AMTI IS ON, MTV WILL BE DERIVED WHEN MEM PT SWITCH IS IN OFF SAVE OR OFF ERASE.

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Figure 8-27

Cycling steering with the velocity-correct switch at MEMORY POINT causes the error lights to come on and the code 088 to appear in window C3 on the RHU. Moving the error code switch to ERASE will cause the lights to flash. The cursor will slew to the selected point and will track normally and normal steering will be provided. To eliminate the error condition, move the velocity-correct switch to OFF SAVE or OFF ERASE and cycle the error code switch.

Manual Cursor Controls

Manual controls for operation of the cursors in the event of computer malfunction are on the bombardier/navigator's control box (figure 8-7). The position of the manual range cursor may be read in the readout window on the bombardier/navigator's control panel.

BALLISTICS COMPUTER SET AN/ASQ-61A

The ballistics computer is the center of the integrated attack-navigation system. The computer is a digital computer providing navigation data, steering commands, and various inputs necessary to the proper arming, fuzing, and release of the programmed weapons.

COMPUTER OPERATION

The computer receives signals from the major components of the system and translates these into information for subsequent operation. Specifically, the computer continuously evaluates the various inputs with respect to the solution of the ultimate bombing programs. It samples the settings of all weapons stations, and applies proper stores ballistics data and equations.

Computer outputs generate and control various displays available to the pilot and bombardier/navigator. These include contact analog, radar cursor positioning, steering bugs, optical, sight, and tape dial readouts, which provide information of various

types to the crewmembers. The system uses 115/200-volt, 400-Hz, three-phase power provided through the COMPUTER circuit breaker on the B/N's circuit breaker panel, and has internal power supplies generating the other voltages required for system operation.

Note

In aircraft 310 and subsequent and aircraft incorporating AVC No. 758, the ballistics computer is protected against overheating of the power supply. If the power supply overheats, the computer is automatically shut down. After the overtemperature condition has ceased to exist, the computer must be recycled by the bombardier/navigator to restore operation.

The variation input controls for the system are on the flight mode selector panel, the keyboard control panel, and the right-hand unit (RHU) consisting of the attack-navigation panel and the navigation control panel. The function and location of these panels and their associated controls are discussed in the following paragraphs.

COLD/HIGH HUMIDITY ENVIRONMENT

When the aircraft and system have been exposed to a cold or high-humidity environment for an extended period of time, computer, search radar, and track radar turn-on should be delayed for 5 minutes with canopy closed and engines running. In extremely adverse weather conditions, an additional 5 minutes with the computer in FLIGHT and the track and search radar in STBY or ON may be required to provide additional warming and dehumidifying to stabilize the computer cores.

Before post flight engine shutdown, 5 minutes with the canopy closed and the computer, search radar, and track radar off will aid in purging moisture from the computer.

COMPUTER PROGRAMS

The AN/ASQ-61A is a digital computer and therefore requires a set of operating instructions known as a program. This program is kept in permanent storage in the computer memory drum and may be changed only by means of a special drum-fill device. Changes to the program are made periodically to reflect changes made to the aircraft, to incorporate new weapons, or to add to the versatility of the weapon systems.

Throughout this manual, programs are identified by the letter P followed by a number which indicates the particular program's position in the order of development. Thus the P8 is a later program than the P7. Revisions to a program are designated by suffix letter or number, eg. P7A, P7B, P8.6.

Current programs and their effectivity are listed below:

P7B TRIM - This program is the P7B modified to accommodate the hardware changes made in the A-6C. This program is presently installed in some A-6A, and A-6B TIAS and on all A-6C aircraft.

P8.6 - This program is the production version of the P8 program superseding the P7B TRIM program in the A-6A and A-6B TIAS aircraft.

Certain of the computer readouts and the operation of various controls and indicators differ between computer programs. Separate descriptions of the operation of the computer controls and indicators and the readouts available are provided in the paragraphs following.

P7B TRIM COMPUTER PROGRAM

COMPUTER CONTROLS AND INDICATORS

FLIGHT NAVIGATION MODE PANEL

The flight navigation mode selector panel (figure 8-28) is on the bombardier/navigator's control panel. This panel contains the necessary controls for selecting the mode of operation of the computer and associated functional readouts for navigation purposes.

Flight Mode Selector Buttons

The computer selector buttons are six pushbuttons on the flight navigation mode panel, and are placarded TEST, OFF, PRE FLT, TAKE OFF, FLIGHT, and LAND. These buttons are used to select the type of data the computer is to provide, and require positioning prior to inserting mission data by the bombardier/navigator. The buttons are of the square-coded type, and are spring-loaded so that only one button

can be depressed at any one time. The buttons rotate 45° when depressed, to indicate the mode presently selected.

With the OFF button depressed, the system is inoperative, with no power applied to the computer components. The PRE FLT button is used to select the backup bombing mode and for ground maintenance. Selection of PRE FLT isolates the ASQ-61A correction signals from the ASN-31 inertial system.

Depressing the TAKE OFF button provides no usable steering commands. The TAKE OFF mode is inoperative and LAND should be used for takeoff steering. The FLIGHT mode is the normal operating mode. It is used to initialize the computer and for insertion of navigation and performance data before takeoff. It is activated again after takeoff and used during the navigational and attack portion of the mission.

Depressing the LAND button instructs the ballistics computer to present to the pilot landing information relative to either a carrier or runway. The basic information for this pathway is developed from data inserted into the computer. The TEST position on the flight navigation mode panel permits testing the various components of the computer to ensure proper operation, and is primarily a function of maintenance.

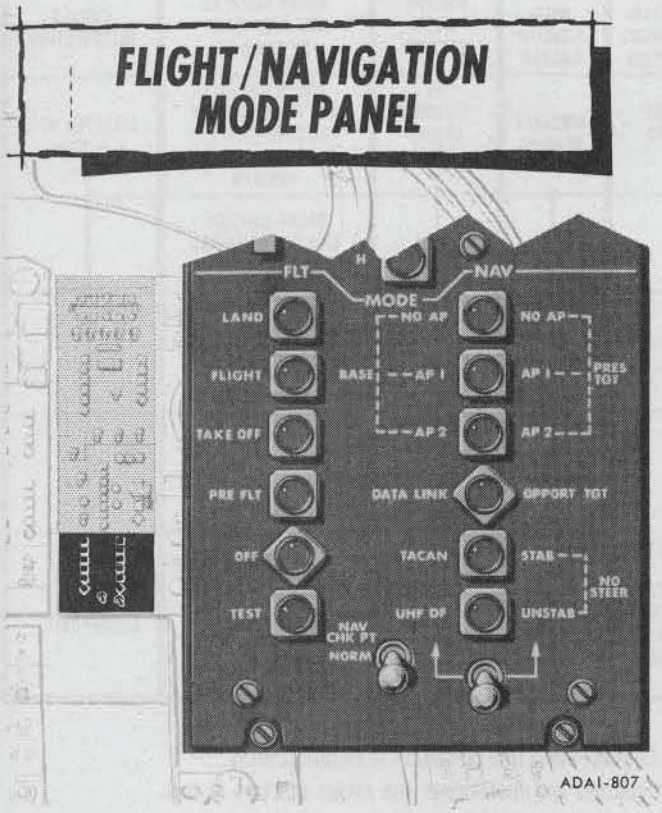

Figure 8-28

Navigation Mode Selector Buttons

Six selector pushbuttons on the flight navigation mode panel (figure 8-28) allow the bombardier/navigator to position the radar cursors over a preselected point. Steering information is provided for the pilot depending on the mode selected (figure 8-29).

There are two settings for each of the pushbuttons depending upon the position of the navigation transfer switch below the lower pushbutton (figure 8-28).

When the navigation transfer switch is positioned to the left, the following functions may be selected:

BASE - NO AP (Base - No Aimpoint)

Depressing the BASE - NO AP button instructs the computer to provide the necessary steering information to the pilot's displays and positions the radar cursors to the previously inserted latitude and longitude.

BASE - AP 1 (Base - Aimpoint 1)

Depressing the BASE - AP 1 button instructs the computer to provide the necessary steering information to the pilot's displays to direct the aircraft to the previously inserted latitude and longitude of the base, and simultaneously to position the radar cursors to an offset aimpoint of previously inserted range and bearing from the base.

BASE - AP 2 (Base - Aimpoint 2)

With this button depressed, the computer provides information as outlined in BASE - AP 1, except that the radar cursors are directed to a second location. When using this control in either position, the aimpoint is selected because of its better radar-return characteristics.

Note

Offset limits for BASE - AP1, BASE - AP2, PRES TGT-AP1, PRES TGT-AP2 are:

99,999 ft. horizontally
360° from true north
37,940 ft. vertically

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STEERING OPTIONS

P7B TRIM

STEERING OPTIONS	NAVIGATION PANEL "ON CALL" READOUT	PHD RANGE INDICATOR	RADAR CURSORS POSITION TO	PHD BUG POINTS TO	DVI BUG POINTS TO	VDI STEERING COMMANDS TO	REMARKS	* DVI RANGE INDICATOR
BASE NO AP	KEYBOARD INPUTS OF LAT, LONG, ALT OF BASE	GROUND RG TO BASE	COORDINATES OF BASE	DRIFT CORRECTED HEADING TO BASE	TRUE BRG TO BASE NO AP	COORDINATES OF BASE	RADAR CURSORS ARE POSITIONED BY THE COMPUTER, BUT CAN BE SLEWED BY THE B/N.	TO BASE
BASE AP1	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 1		AIMPOINT 1 BASE		TRUE BRG TO BASE AP1			TO AIMPOINT 1 UNDER 16.5 MILES TO BASE OVER 16.5 MILES
BASE AP2	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 2		AIMPOINT 2 BASE		TRUE BRG TO BASE AP2			TO AIMPOINT 2 UNDER 16.5 MILES TO BASE OVER 16.5 MILES
PRES TGT NO AP	KEYBOARD INPUTS OF LAT, LONG, ALT OF TGT	GROUND RG TO TGT	COORDINATES OF TARGET	DRIFT CORRECTED HEADING TO TGT	TRUE BRG TO TGT NO AP	COORDINATES OF TGT		TO TGT
PRES TGT AP1	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 1		AIMPOINT 1 TARGET		TRUE BRG TO TGT AP1			TO AIMPOINT 1 UNDER 16.5 MILES TO TARGET OVER 16.5 MILES
PRES TGT AP2	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 2		AIMPOINT 2 TARGET		TRUE BRG TO TGT AP2			TO AIMPOINT 2 UNDER 16.5 MILES TO TARGET OVER 16.5 MILES
OPT TGT	LAT, LONG OF CURSOR INTERSECTION; KEYBOARD, T/R OR S/R DERIVED TGT ALT	GROUND RG TO CURSOR INTERSECTION	POSITIONED BY SLEW CONTROL AND GROUND STABILIZED	DRIFT CORRECTED HEADING TO CURSOR INTERSECTION	ALIGNED WITH AZIMUTH CURSOR	CURSOR INTERSECTION	RADAR CURSORS ARE POSITIONED BY THE B/N	CURSOR INTERSECTION
UNSTAB NO STEER		VARIABLE WITH G BUTTONS	G BUTTON SELECTED SLANT RANGE ALONG AIRCRAFT ADL	AIRCRAFT HEADING **	AIRCRAFT HEADING	NO STEERING ORIENTATION **	RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT CAN BE SLEWED BY THE B/N	SELECTED WITH G BUTTON
STAB NO STEER	INOPERATIVE SELECTION RESULTS IN UNSTAB NO STEER						RADAR CURSORS CAN BE POSITIONED BY THE B/N	
TACAN							RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT CAN BE SLEWED BY THE B/N	
UHF-DF								
NAV CHK POINT	KEYBOARD INPUTS OF LAT, LONG, ELEV OF NAV CHECKPOINT	GROUND RG TO NAV CHECK POINT	COORDINATES OF CHECKPOINT	MEMORIZED DRIFT-CORRECTED HEADING TO TGT (OR BASE) ***	TRUE BRG TO CHECKPOINT	DRIFT CORRECTED STEERING TO TGT (OR BASE) ***	USED BY B/N TO CORRECT PRESENT POSITION INFORMATION WITHOUT AFFECTING PILOT'S COMMAND STEERING	NAV CHECKPOINT

NOTE

* DVI STEERING GROUND RANGE IN MILES IF OVER 16.5 NAUTICAL MILES; SLANT RANGE IS IN FEET UNDER 16.5 NAUTICAL MILES.

** IF COMPUTER IS STEPPED INTO ATTACK IN UNSTAB NO STEER, THE CURSORS ARE RE-STABILIZED AND ATTACK STEERING IS AUTOMATICALLY PROVIDED TO THE RELEASE POINT.

*** IF COMPUTER IS STEPPED INTO ATTACK IN NAV CHK POINT, ATTACK STEERING IS PROVIDED TO THE CHECKPOINT.

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Figure 8-29

DATA LINK

This mode is inoperative and selecting it results in UNSTAB-NO STEER.

TACAN

This mode is inoperative and selecting it results in UNSTAB-NO STEER.

UHF/DF

This mode is inoperative and selecting it results in UNSTAB-NO STEER.

When the navigation transfer switch is positioned to the right, the following functions may be selected:

PRES TGT - NO AP (Preset target - No Aimpoint)

Depressing the PRES TGT - NO AP button instructs the computer to provide the necessary steering information to the pilot's displays and positions the radar cursors to the previously inserted latitude and longitude.

The altitude entered for this location is also used by the computer when OPPORT TGT or UNSTAB-NO STEER is selected.

PRES TGT - AP 1 (Preset target - Aimpoint 1)

Depressing the PRES TGT - AP 1 button instructs the computer to provide the necessary steering information to the pilot's displays to direct the aircraft to the previously inserted latitude and longitude of the target and simultaneously to position the radar cursors to an offset aimpoint of previously inserted range and bearing from the target position.

PRES TGT - AP 2 (Preset target - Aimpoint 2)

With this button depressed, the computer provides information as outlined in PRES TGT - AP 1, except that the radar cursors are directed to a second location. When using either of these positions, the aimpoint is selected because of its better radar-return characteristics.

OPPORT TGT (Opportunity Target)

Depressing this button instructs the computer to present steering information toward the intersection of the radar cursors and to ground stabilize the cursors.

The altitude used by the computer with OPPORT TGT selected is that inserted for PRES TGT NO AP. This altitude may be changed by inserting a new altitude for PRES TGT NO AP. When OPPORT TGT is selected, the radar cursors track their previous position unless an offset aimpoint was being used. In this case, they will track the coordinates of the previous target. If NAV CHK PT is selected while in OPPORT TGT, the cursors go to the coordinates of the checkpoint and when the NAV CHK PT/NORM switch is returned to NORM, the cursors will track the checkpoint and steering is to the checkpoint.

The opportunity target steering mode is automatically selected if the computer is stepped into attack with the unstabilized - no steering mode selected.

STAB - NO STEER (Stabilized - No Steering)

This mode is inoperative and selecting it results in UNSTAB-NO STEER.

UNSTAB - NO STEER (Unstabilized - No Steering)

Depressing the UNSTAB - NO STEER, STAB - NO STEER, DATA LINK, TACAN, or UHF DF selects the unstabilized - no steering mode. Selecting this mode sets the relative bearing of all steering commands to 0° (along the aircraft ADL) and positions the range and azimuth cursors along the aircraft ADL at a range selectable with the G buttons on the armament control panel. The selectable ranges are:

G Button	Range
3.0	1.5 miles
3.5	3.0 miles
4.0	4.0 miles
4.5	4.5 miles
5.0	12.5 miles

To change from one range to another, the desired range must be selected and then steering must be cycled to one of the unstabilized selections. This will cause the range cursor to be set to the new range.

The cursors are unstabilized in azimuth and range but may be repositioned using the slew stick.

If steering is cycled with the navigation transfer switch from one unstabilized steering selection to another, the cursors will remain along the aircraft ADL at the selected range. If the cursors have been moved with the slew stick, cycling steering to another unstabilized selection will return to the last selected range along the aircraft ADL.

If NAV CHK PT is selected while in the unstabilized mode, the cursors will be positioned to the coordinates of the checkpoint, but will return to the aircraft ADL at the last selected range when the NAV CHK PT/NORM switch is set to NORM.

The altitude used by the computer with UNSTAB-NO STEER selected is that inserted for PRES TGT NO AP. This altitude may be changed by inserting a new altitude for PRES TGT NO AP.

Stepping the computer into attack with the UNSTAB-NO STEER selected causes the computer to switch to OPPORT TGT steering. After flag drop, steering automatically reverts to UNSTAB-NO STEER when the computer is stepped out of attack. If there is no flag drop, steering will remain in OPPORT TGT until the B/N cycles steering.

Navigation Transfer Switch

The navigation transfer switch is a two-position toggle switch below the lower pushbutton (figure 8-28). The switch has no placarded positions and, when moved to the left or right, enables selection of two groups of six ballistics computer navigational modes using the same six navigation mode selector buttons.

Navigation Checkpoint Switch

This two-position toggle switch (figure 8-28) placarded NAV CHK PT (navigation checkpoint) and NORM (normal) provides a means of suspending all instructions from the navigation mode selector buttons, except pilot's steering information.

When the switch is positioned to NAV CHK PT, the computer directs the radar range and azimuth cursors to the navigation checkpoint previously inserted into the computer regardless of the navigation mode selected. In this position, the computer steering information provided the pilot will not be interrupted; however, range information is to the checkpoint and steering is to an infinite range. The displays will continue to provide the pilot with the steering information for the selected navigation mode.

Note

To update information in this mode, the bombardier/navigator will position the cursors over the predetermined checkpoint and depress the CORRECT POS button on the navigation control panel. This will automatically correct all present position readouts, except altitude.

With the switch in the NORM position, the computer operates as directed by the navigation mode selector buttons.

KEYBOARD CONTROL PANEL

The keyboard control panel (figure 8-30) is used by the bombardier/navigator to insert data relative to the intended mission. The panel consists of the address keys, quantity keys, action keys, clear button, and a TEMPORARY STORAGE indicator.

Address Keys

The address keys consist of 12 pushbuttons and a release bar. These instruct the computer to establish quantity data as reference for subsequent application with a particular mission requirement.

Note

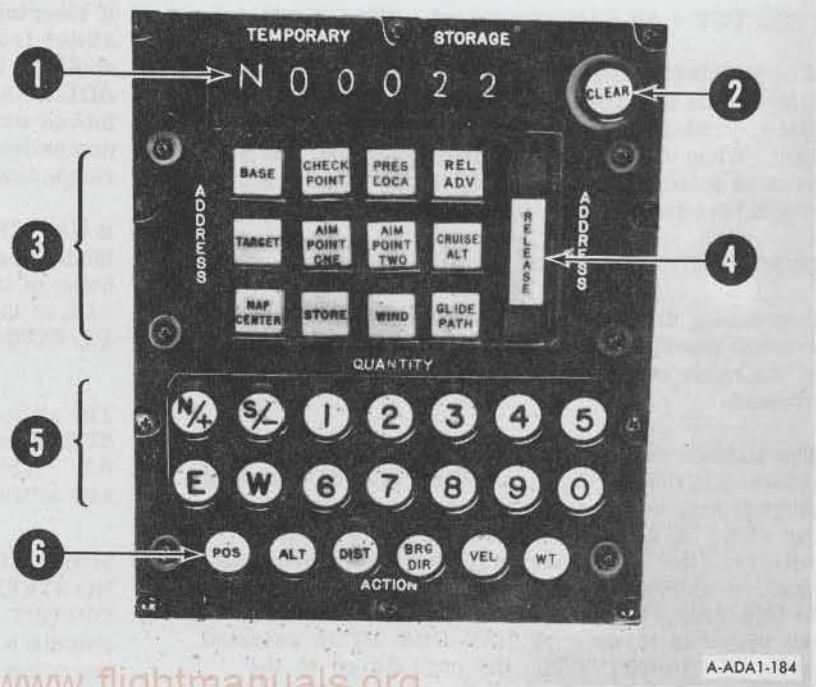
The address keys are not mechanically interlocked and two may be depressed at a time. Therefore, it is essential that the release bar be actuated after information concerning a given address has been entered.

Once a key has been depressed, it will remain depressed until the release bar is actuated. The function of each of the keys is given below.

BASE

This key is depressed to set in latitude and longitude coordinates during data insertion. Both coordinates are inserted as degrees and minutes, and altitude is inserted as feet.

COMPUTER KEYBOARD



1. TEMPORARY STORAGE INDICATOR
2. KEYBOARD CLEAR KEY
3. ADDRESS KEYS
4. ADDRESS KEY RELEASE BAR
5. QUANTITY KEYS
6. ACTION KEYS

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Figure 8-30

CHECK POINT

Depressing this key permits the insertions of the checkpoint latitude and longitude coordinates to degrees and minutes, and the altitude of the checkpoint in feet.

TARGET

This key is depressed to set in latitude and longitude coordinates during data insertion. Both coordinates are inserted as degrees and minutes, and altitude is inserted in feet.

AIM POINT ONE

This key is depressed to insert the location of preselected aimpoint one. The location is inserted with respect to specified coordinates and is programmed as a range and bearing offset from preset target or base coordinates. The bearing is addressed in degrees and minutes (360° 00') while distance is addressed in feet (99,999') with both measured from the target to the aimpoint. Aimpoint altitude is entered as differential altitude with respect to the specified coordinate elevation. If the aimpoint is higher than the target, the altitude is entered using the N/+ quantity key, and if the aimpoint is lower, the altitude is entered using the S/- quantity key.

AIM POINT TWO

This key is depressed to insert information similar to that outlined in aimpoint one, except that the information inserted is defined with respect to a second preselected aimpoint.

Note

Two offset bearings and distances are available for use with either base or target steering modes.

PRES LOCA (Present Location)

Depressing this key permits insertion of the latitude and longitude coordinates of the aircraft's present location, and the altitude of the location is also inserted in the computer.

CRUISE ALT (Cruise Altitude)

This key is depressed to insert the desired release slant range for STRAIGHT PATH free-fall attacks.

MAP CENTER

Presently inoperative.

REL ADV (Release Advance)

This key permits the bombardier/navigator to instruct the computer to send a release pulse at a selected distance in advance of the computed release point.

STORE (Store Weight)

Presently inoperative.

GLIDE PATH

This key is depressed to insert the true bearing of the runway or mine line in degrees and minutes.

WIND

This key is depressed to insert into the computer the wind velocity and direction. These are inserted in standard form; i.e., true direction in degrees and minutes and velocity in knots.

RELEASE

This bar is momentarily depressed to release any depressed address key.

Quantity Keys

The quantity keys (figure 8-30) consist of 14 momentary keys, marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, N/+, S/-, E, and W. These keys are used to insert the various quantity data with respect to the indicated address keys. The keys are depressed individually. Once the quantity key has been depressed, the corresponding figure will appear in the TEMPORARY STORAGE indicator readout window. This provides the bombardier/navigator with a means of checking to ensure that the correct information is being inserted into the computer.

The actual insertion sequence into the computer memory requires that the bombardier/navigator depress the appropriate address key, insert quantity data by depressing the correct quantity keys, checking the indicated value on the TEMPORARY STORAGE indicator, and finally, depressing the related action key to channel the data to the storage area within the computer memory drum.

If, during the keyboard insertion sequence, the bombardier/navigator accidentally actuates the wrong key or the information is changed, the data appearing on the TEMPORARY STORAGE indicator can be erased by depressing the CLEAR button (figure 8-30). This erases all of the information appearing in the TEMPORARY STORAGE indicator.

To insert data into the memory drum of the computer, it will be necessary that a total of six quantity keys be depressed, regardless of the number of significant digits in the basic information. The first key to be depressed will always be one of the N/+, S/-, E, or W keys for position, or the N/+, S/- keys for plus or minus quantities.

Note

When the N/+, or S/- key is depressed, the TEMPORARY STORAGE indicator will read N or S only, despite the condition being programmed. It will therefore be necessary for the bombardier/navigator to realize that the appropriate value is being designated, since the + or - signs do not appear in the readout window.

After the key has been depressed denoting the selected position or sign, the quantity can be inserted. If necessary, this is accomplished by prefixing the significant digits with the necessary number of zeros to result in a six-digit insert. For example, if the latitude to be inserted is N 40° 05', it will be necessary that the bombardier/navigator depress the N/+ key; followed by the 0 key, and then the 4, 0, 0, 5, keys. This will provide the necessary six-digit insertion. Failure to depress the necessary six digits will disable the action button and data cannot be inserted.

Note

To initiate the actual insertion, it will be necessary that the bombardier/navigator depress and hold the desired quantity key until the appropriate figure appears in the TEMPORARY STORAGE indicator.

Action Keys

The six action keys (figure 8-36) are located below the quantity keys, and are marked POS (position), ALT (altitude), DIST (distance), BRG DIR (bearing direction), VEL (velocity), and WT (weight). After the appropriate quantity keys have been depressed, the bombardier/navigator inserts the information into the computer memory drum by depressing the related action key. This action simultaneously clears the temporary storage indicator for additional information insert. The action keys function to program the computer for the information storage as indicated below:

POS (Position)

When this key is depressed, the computer is advised to store the information presented on the temporary storage indicator on the appropriate position track in the memory drum. This information will include the longitude and latitude of the base, target, present location, or checkpoint.

ALT (Altitude)

When this key is depressed, the computer is advised to transfer the information in the temporary storage indicator to the memory drum related to the altitude of the base, target, present location, checkpoint, or aimpoint, and the desired release slant range for straight path attack.

DIST (Distance)

When this key is depressed, it instructs the computer to store the information appearing in the temporary storage indicator regarding the distance to the aimpoint (aimpoints one and two) from the target and release advance distance.

BRG DIR (Bearing Direction)

This key advises the computer to transfer the information appearing in the temporary storage indicator to the memory drum of the computer. This information includes the true bearing from the target to the aimpoint. This control also provides a means of supplying the computer with the necessary information regarding the direction of the wind, and the orientation of the landing runway (glide path).

VEL (Velocity)

This key advises the computer to transfer to storage the information regarding the wind velocity indicated on the temporary storage indicator.

WT (Weight)

Presently inoperative.

TEMPORARY STORAGE Indicator

The TEMPORARY STORAGE indicator (figure 8-30) consists of a digital counter. The reading on the indicator is controlled by the selection of the quantity keys during the insertion sequence. The counter displays a five-digit number, prefixed by a control letter designator representing direction, or a plus or minus value. During all insertion sequences, the bombardier/navigator will continually refer to these readouts to ensure that the correct data is being inserted into the computer drum.

CLEAR Button

The CLEAR button is located beside the TEMPORARY STORAGE indicator (figure 8-30) and provides the bombardier/navigator with a means of erasing all information appearing in the TEMPORARY STORAGE window. This control will find application in correcting erroneous data punched on the keyboard, and updating information prior to its incorporation into the computer memory drum.

KEYBOARD DATA INSERTION

For the purposes of this procedure, let us assume that the mission planning data to be inserted is confined to the base location of the aircraft.

Aircraft's present location is:

Latitude 36° 49' North
Longitude 76° 02' West
Altitude 22 feet

Initially, it will be the responsibility of the bombardier/navigator to resolve this information into an acceptable format for the computer, that is, adding the necessary zeroes to complete the insertion requirements.

1. PRESS LOCA - DEPRESS

   Depress PRES LOCA key in address section.

2. Quantity keys - DEPRESS - N03649

   Depress quantity keys in order: N, 0, 3, 6, 4, 9

Note

Observe the readout N03649 on the temporary storage window.

3. Position (POS) key - DEPRESS

   Since this is a position category, POS key is depressed in order to insert latitude of present location into computer. Observe that temporary storage reading is erased, and that readout appears on navigation control panel in present position.

4. Quantity keys - DEPRESS - W07602

   Depress quantity keys in order: W, 0, 7, 6, 0, 2

Note

Observe the reading W07602 on the temporary storage window.

5. Position (POS) key - DEPRESS

   The longitude of present location will be transferred into computer. Observe that temporary storage reading is erased, and that reading appears on navigation control panel.

6. Quantity keys - DEPRESS - N00022

   Depress quantity keys in order: N, 0, 0, 0, 2, 2

Note

Observe the reading N00022 on the temporary storage window.

7. Altitude (ALT) key - DEPRESS

   Since this is an altitude category, altitude of present location is transferred into computer, temporary storage indicator is erased, and readout appears on navigation control panel.

The latitude, longitude, and altitude of the present location have now been entered into the memory drum of the computer. The inputs to be entered next into the memory of the computer consist of:

1. Latitude and longitude, in degrees and minutes altitude (MSL), plus or minus in feet, for base, checkpoint, and target.

2. True bearing, in degrees and minutes, from target; distance in feet from target; and differential altitude in feet for aimpoint one and aimpoint two.

3. True bearing, in degrees and minutes, velocity in knots for predicted or estimated wind.

4. True bearing, in degrees and minutes of runway heading or direction of intended landing or desired mine line.

5. Release slant range in feet entered under cruise altitude address and altitude quantity key. Used in straight path dive attacks to give pilot vertical steering indications.

6. Release advance - N00000

7. Stores weight in pounds.

COMPUTER ERROR CODES

When not in attack, the computer performs 18 diagnostic tests each iteration providing the error code switch is at READ.

Should one of these diagnostic tests be failed, the error lights will be turned on and the applicable code will appear in the number three window of the R H U upper panel. The data select switch must be at C to read the error codes.

The computer diagnostic tests and error codes are listed below:

CODE	FUNCTION
001	Read and restore core
002	Zero + Zero
003	C register + B register
004	CT selection
005	CT + RAB_1
006	CT + RAB_{10}
007	C register to B register
008	Absolute value
009	Left shift
010	Multiply
011	Nonaddressed input
012	Time Test
013	Core modification
014	RAB_{50}
015	Test VA-VG or excessive vertical velocity
016	Double precision multiplication
017	Divide
018	Square root
099	Auto reset
088	Steering cycled with velocity correct switch in MEMORY POINT

If the error code switch is in ERASE, the code 509 is displayed.

In attack, no error lights are generated and normal error codes are not displayed. If there is a failure of release valid data (indicated by pathway off on the VDI), the valid data code will be displayed only during the time when the path is off. When the pathway

reappears, the code will be erased from the tape dial automatically. The valid data codes are as follows:

CODE	TEST FAILED
111	Ballistic solution error, angle to release error, or computer integration time error.
222	True airspeed - inertial error (winds exceed 106 knots + .00325 X altitude in feet), or excessive vertical velocity.
333	Error in rate of change of elevation velocity vector or integration of normal acceleration.

RELEASE ADVANCE

Release advance permits the B/N to introduce a range offset value into the weapon release solution. In this way, by advancing the initial release point a predetermined distance, the B/N can straddle a target with a train release of bombs. Release advance may be used with rockets or bombs for compensating known range solution errors by advancing or retarding the release point.

Release advance information is inserted by means of the keyboard and is read in the VC/MTV data readout window (C5). The information is introduced into the solution by depressing the RELEASE ADVANCE button. Depressing the button a second time will remove the information from the solution. The computer can accept keyboard inputs of up to 9999 feet of release advance, and it is displayed in the computer data readout windows to the lowest 100 feet. The release advance entry is not displayed unless it is actually being used; i.e., zeros will be displayed unless the engage button is depressed and the light is on.

If the stored release advance information is disturbed in any way while the RELEASE ADVANCE button is engaged, the light in the button will go off, and the computer will no longer accept the information. To reintroduce the release advance data it is necessary to disengage the RELEASE ADVANCE button to remove the data and engage the button to introduce it. Recheck the value in the readout window to be sure that the proper data were entered.

There is a dual-channel input for release advance information when it is entered into the computer; one to the computer and the other to the readout. Therefore, it is possible to enter a number into the computer via the REL ADV address key, have it read correctly in window C5, and still have an erroneous value in the computer. It is good procedure to reenter the desired release advance whenever a computer error light or other transient condition occurs. Reentering the desired release advance just before the bombing run is also advisable to help ensure that the computer is using the correct value.

BALLISTICS COMPUTER DATA READOUTS

Data readouts are displayed to permit evaluation of system operation, malfunction analysis, and reconstruction of weapon release conditions so that weapon impact errors can be analyzed. Figure 8-31 shows the readouts available for the attack case and the navigation case.

ATTACK-NAVIGATION PANEL (RHU)

The attack-navigation panel in the right-hand unit (figure 8-32) contains the ballistic computer data readouts, the switches controlling them, and the release advance button.

Data Readout Windows

The data readout windows display values as shown in figure 8-31). The sign of all lateral data is positive to the right with respect to the reference direction. Roll is positive with right wing down. Aircraft elevation angle and track elevation are positive up with respect to the reference direction. Attack solution error is positive for a long impact, and release advance is positive for a short impact. Steering error is plus when the aircraft ground track is left of the correct ground track. The release angle output is the angle from horizontal (positive up) in all cases except general or high loft retarded weapons. In these cases the value indicated is the last computed angle to go in the iteration before release. Time of fall is the value from release to impact or burst height for bombs, and the value from motor burnout to impact for rockets. The following is a functional description of the values displayed.

NAVIGATION READOUTS

A1

Altitude solution error is a number x 10 representing the difference between the corrected air data computer pressure altitude and the ASQ-61 present position altitude. This difference is applied as a correction to the vertical velocity used in the present position calculation. This correction compensates for long-term, low-drift rates in INS vertical velocity or vertical true airspeed. At initial startup of the computer, with the platform in OPER, INERL selected and present position data entered, this readout will indicate +200 or -200 if there is an initial vertical velocity error of ±2 feet/second. A positive error in this readout indicates that inertial altitude is above pressure altitude. If a large value is displayed, a failure in the vertical loop should be suspected and the readouts in windows B3 and B5 (navigation), the pressure altimeter, the radar altimeter, and the OAT gage should be cross-checked.

A2

True airspeed is computed TAS using AOA, ADC mach and temperature.

COMPUTER DATA READOUTS

READOUT WINDOW MARKING	ATTACK MODE						NAVIGATION MODE						READOUT WINDOW MARKING
	DATA SELECT SWITCH POSITION						DATA SELECT SWITCH POSITION						
	A		B		C		A		B		C		
WINDOW #1	UNIT	ADD	UNIT	ADD	UNIT	ADD	UNIT	ADD	UNIT	ADD	UNIT	ADD	WINDOW #1
BALLISTIC ERROR	FEET	0	SECONDS	–	–	–	FEET	0	DEGREES	–	DEG x 1	–	ALTITUDE ERROR
	ALTITUDE SOLUTION ERROR		TIME OF FALL		ALTITUDE DATA SOURCE CODE		ALTITUDE SOLUTION ERROR		TRACK RADAR AZIMUTH GIMBAL ANGLE		± SEARCH RADAR DEPRESSION ANGLE		
WINDOW #2	KNOTS	–	KNOTS	–	DEGREES	–	KNOTS	–	DEGREES	–	DEG x .001	–	WINDOW #2
TAS	TRUE AIR SPEED		TOTAL INERTIAL SPEED		TRUE HEADING		TRUE AIR SPEED		TRACK RADAR ELEVATION GIMBAL ANGLE		SEARCH RADAR DEPRESSION ANGLE (ADD TO CI)		TAS
WINDOW #3	FEET	0	FT	OO	–	–	KNOTS	–	—	—	–	–	WINDOW #3
VERTICAL SEPARATION	VERTICAL SEPARATION		GROUND RANGE		VALID DATA INHIBIT CODE		DOPPLER GROUND VELOCITY		000		ERROR CODE		DOPPLER GROUND VELOCITY
WINDOW #4	DEGREES	–	FEET	00	I X G	–	DEGREES	–	DEGREES	–	DEGREES	0	WINDOW #4
RELEASE ANGLE	RELEASE ANGLE		COMPUTED BALLISTIC RANGE		NORMAL ACCELEROMETER INPUT		DOPPLER DRIFT ANGLE		ELEVATION ANGLE		ROLL ANGLE		DOPPLER DRIFT ANGLE
WINDOW #5	KNOTS	–	MILLS	–	FEET	00	KNOTS	–	DEG (C)	–	FEET	00	WINDOW #5
VC/MTV	VELOCITY CORRECTION OR MOVING TARGET VELOCITY		STEERING ERROR		RELEASE ADVANCE BEING USED		VELOCITY CORRECTION OR MOVING TARGET VELOCITY		TRUE TEMPERATURE (MACH CORRECTED)		RELEASE ADVANCE BEING USED		VC/MTV

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Figure 8-31

A3

Doppler ground velocity is the direct AN/APN-153 groundspeed in knots.

A4

Doppler drift angle is the direct AN/APN-153 drift angle in degrees. Right drift is positive; left drift is negative.

A5

Velocity correction or moving target velocity is displayed in knots. When the velocity-correct switch is in MEMORY POINT, velocity-correction is displayed. When the AMTI control is ON with a track radar discrete lock-on, target velocity is displaced. When velocity-correct and AMTI are both ON, velocity-correction is displayed. If a large velocity correction is displayed, sources of system velocity such as search or track radar, INS, TAS, etc., should be cross-checked to determine if a malfunction exists.

B1

Track radar azimuth gimbal angle is in azimuth position in degrees of the track radar antenna relative to the ADL. Right is positive and left is negative.

B2

Track radar elevation gimbal angle is the elevation position in degrees of the track radar antenna relative to the azimuth gimbal. Up is positive and down is negative.

B3

This window displays 000, in A-6A aircraft and optical sensor platform angle in A-6C aircraft.

B4

Elevation angle is aircraft elevation angle in degrees (angle between ADL and horizontal reference).

B5

True temperature is outside air temperature (mach-corrected) in degrees centigrade.

C1

Displays search radar depression angle in degrees (+ or -).

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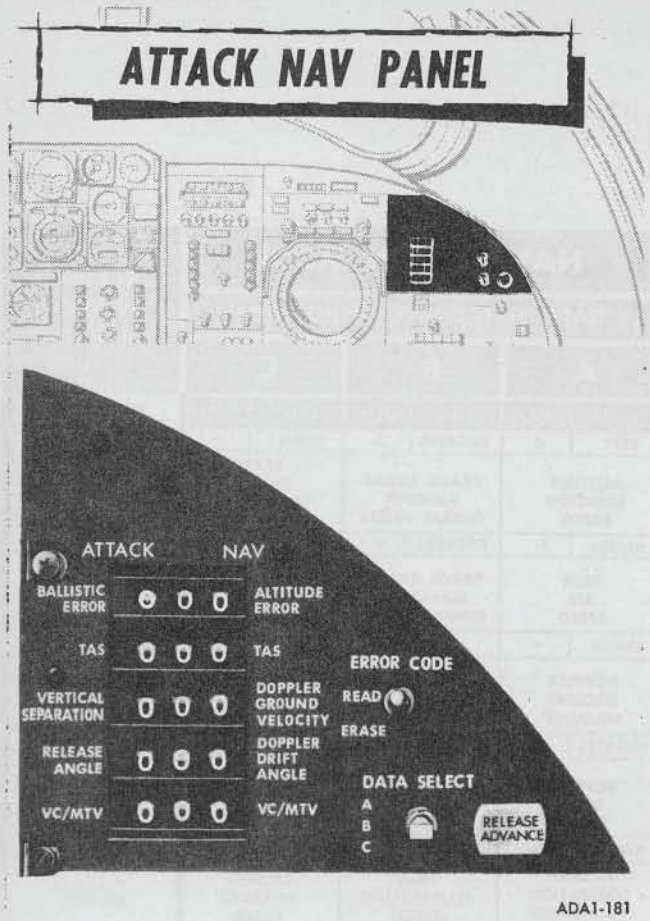

Figure 8-32

C2

Displays the fractional portion of search radar depression angle displayed in C1 to the nearest 0.001°. (Adds to readout in C1.)

C3

Error code is a number representing one of 21 computer errors.

C4

Roll angle is aircraft roll angle in degrees.

C5

Release advance is the amount in feet, of range offset that has been inserted into the solution. Offsets up to 9999 feet will be indicated to the lowest 100 feet. Values less than 100 feet read zero. The release advance entry is displayed only while the engage button is depressed and the light is on. Zeros are displayed at all other times.

ATTACK READOUTS

A1

Altitude solution error is the same as that displayed in window A1 in navigation.

A2

True airspeed is the same as that displayed in the navigation readouts.

A3

Vertical separation is altitude in feet x 10 above the target, and is derived from keyboard inputs or track radar. The readout is encoded above 9999 feet and is unusable above 19,999 feet.

The validity of the value of vertical separation displayed may be checked by performing a TROT check and cross-checking with the radar altimeter.

A4

Release angle is one of the following values:

1. For free-fall loft, the release angle in degrees.
2. For straight path free fall, the aircraft velocity vector in degrees.
3. For retarded bombs, the angle to go to release.
4. For 2.75 FFAR or Zuni rockets, the launch angle in degrees.
5. For Bullpup missiles, the aircraft depression angle in degrees.

A5

Velocity correction or moving target velocity is the same as that displayed in the navigation readouts.

B1

Time of fall is computed time of fall of bombs to impact or air burst point, or rocket time of flight after burnout. The time is displayed in seconds.

B2

Total inertial speed is total aircraft velocity in space in knots.

B3

Ground range x 100, ground range to cursor intersection computed from slant range and vertical separation ± release advance input.

B4

Computed ballistic range is the horizontal weapon travel from the aircraft to the target in feet x 100.

B5

Steering error is the azimuth steering error to the release point in mils. (Plus is left.)

C1

Displays altitude data source code. The readout displays 111 if search radar tracking data have been used and 000 if they have not been used in the solution.

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C2

True heading is displayed in degrees.

C3

Valid data inhibit codes are numerical designations of valid data tests. The appearance of these codes (111, 222, or 333) in conjunction with VDI pathway disappearance indicates failure of a valid data test as in the table below.

CODE	
111	Ballistic solution error, angle-to-release error, or computer iteration error.
222	True airspeed - inertial error (winds) exceed 106 knots + .00325 x altitude in feet), or excessive vertical velocity.
333	Error in rate of change of elevation velocity vector or integration of normal accelerometer.

C4

Normal accelerometer Input is the normal g force exerted on the aircraft in g x .1.

C5

Release advance is the same as that displayed in the navigation readouts. The release advance entry is displayed only while the engage button is depressed and the light is on. Zeros are displayed at all other times.

Error Code Switch

The error code switch is a two-position toggle switch marked READ/ERASE. In the READ position, error codes can be read in the number three window. When the switch is placed to ERASE, the error code appearing in the readout window will be erased and the computer error lights will go out. The switch should normally be left in READ.

Data Select Switch

The data select switch is a three-position toggle switch marked A/B/C. Placing the switch in one of its three positions causes the corresponding data to appear in the computer data readout windows.

RELEASE ADVANCE Button

The RELEASE ADVANCE button is used to enter release advance information into the computer's computations. When the button is engaged and the information is being accepted by the computer, the light in the button is on.

ATTACK DATA FREEZE

When the computer is in an attack condition, all the information available in the right-hand unit attack-navigation panel windows as well as some that is available in the navigation control panel windows is frozen at weapon release. The computer continues to operate normally, but the data in the windows remains unchanged until an action key on the keyboard is depressed. All values in attack-navigation panel windows may be read by moving the data select switch through its three positions. The information that is frozen in the navigation control panel windows depends on the position of the navigation data switch (figure 8-33). When the switch is in PRES POS or DATA at release, present position and data information will be frozen and may be read by making use of the navigation data switch. When the switch is in ON CALL at release, on-call and data information will be frozen.

NAVIGATION OPTIONS

The navigation problem is solved by the ballistics computer, which integrates the navigational data provided by other aircraft systems. This use of the computer makes available a number of navigation options (figure 8-34), depending on the navigation mode selected.

ATTACK DATA FREEZE

NAVIGATION CONTROL PANEL			
POSITION OF NAVIGATION DATA SWITCH	INFORMATION FROZEN AT RELEASE		
	DATA	PRESENT POSITION	ON CALL
DATA	✓	✓	
PRESENT POSITION	✓	✓	
ON CALL	✓		✓

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Figure 8-33

NAVIGATION OPTIONS

OPTION	NAV MODE SELECTOR	DOPPLER MODE	PLATFORM COMPASS	PANEL INS	NAVIGATION INFORMATION FLOW	SUMMARY
DOPPLER-INERTIAL	INERTIAL	XMIT	COMP IN OR COMP OUT	OPERATE	(1) ATTITUDE INFO FROM INS TO ASQ-61 FOR STABILIZING DOPPLER. (2) DOPPLER INFO THRU ASQ-61 TO INS FOR USE IN VELOCITY RATE CALCULATIONS. (3) THREE - AXIS VELOCITY RATES FROM INS TO ASQ-61. (4) TH FROM INS TO ASQ-61.	(1) FULL USE OF DOPPLER AND INS. (2) MA-1 & VGI FUNCTIONING, BUT NOT BEING USED BY THE ASQ-61. (3) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
PURE INERTIAL	INERTIAL	SILENT	COMP IN OR COMP OUT	OPERATE	(1) THREE - AXIS VELOCITY RATES FROM INS TO ASQ-61. (2) TH FROM INS TO ASQ-61.	(1) FULL USE OF INS. (2) MA-1 & VGI, FUNCTIONING, BUT NOT BEING USED BY ASQ-61. (3) USE IF DOPPLER BAD, OR DURING PERIODS OF ELECTRONIC SILENCE. (4) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
DOPPLER	EMERG-DOPP	XMIT	COMP IN OR COMP OUT	OPERATE	(1) DOPPLER INFO TO ASQ-61. (2) INS ATTITUDE INFO USED TO STABILIZE DOPPLER INFO. (3) TH FROM INS TO ASQ-61. (4) ALTITUDE INFO FROM ADC TO ASQ-61.	(1) FULL USE OF DOPPLER; LIMITED USE OF INS AND ADC. (2) MA-1, VGI FUNCTIONING BUT NOT BEING USED BY ASQ-61. (3) USE IF INS ATTITUDE INFO APPEARS GOOD BUT VELOCITY RATES BAD. (4) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
	EMERG-DOPP	XMIT	MAG/VGI	OPERATE	(1) DOPPLER INFO TO ASQ-61. (2) ATTITUDE INFO FROM VGI THRU ADAPTER TO ASQ-61 FOR USE IN STABILIZING DOPPLER DATA. (3) MAG HEADING, FROM MA-1, IS CORRECTED TO TH BY HAND-SET VARIATION AND SENT THRU INS ADAPTER TO ASQ-61.	(1) FULL USE OF DOPPLER; INS USED TO RELAY VGI DERIVED ATTITUDE INFO AND MA-1 DERIVED COMPASS INFO. (2) USE WHEN INS ATTITUDE AND VELOCITY RATES APPEAR BAD. (3) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
AUTOMATIC DEAD RECKONING	DR	SILENT	COMP IN	OPERATE	(1) ALTITUDE AND AIR SPEED DATA FROM ADC TO ASQ-61. (2) TH, ATTITUDE INFO FROM INS TO ASQ-61. (3) KEYBOARD INPUT: WIND DIR/VEL.	(1) LIMITED USE OF INS; ADC IS PRIMARY SOURCE OF NAV INFO. (2) USE IF DOPPLER BAD AND INS VELOCITY RATES BAD.
	DR	SILENT OR OFF	MAG/VGI	OPERATE	(1) ALTITUDE AND AIRSPEED DATA FROM ADC TO ASQ-61. (2) ATTITUDE INFO FROM VGI. (3) MAG HEADING, FROM MA-1, IS CORRECTED TO TH BY HAND - SET VARIATION AND SENT THRU INS ADAPTER TO ASQ-61. (4) KEYBOARD INPUT: WIND DIR/VEL.	(1) ADC IS PRIMARY SOURCE OF NAV INFO. (2) USE IF DOPPLER BAD, AND INS ATTITUDE INFO AND VELOCITY RATE INFO IS BAD.

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Figure 8-34

Navigation modes are selected on the navigation control panel and the Doppler platform control panel and are four in number. The modes include Doppler/inertial, emergency Doppler, and dead reckoning. In addition, the MA-1 compass system and the vertical gyro indicator may be used as sources of heading and attitude reference for the computer if the inertial navigation system fails to provide valid heading and attitude outputs.

DOPPLER/INERTIAL MODE

The Doppler/inertial mode makes full use of navigational equipment available on the aircraft. The inertial navigation system provides digital outputs of aircraft true heading, velocity along three axes (north-south, east-west and vertical), and pitch and roll attitude. The computer makes use of these inertial outputs in its solution of the navigation problem as well as in generating correction signals which are fed back to the INS to keep the platform level. The Doppler system provides unresolved inputs of drift angle and groundspeed. These Doppler inputs are used to damp the Schuler frequency oscillations inherent in the inertial velocities. Doppler damping of inertial velocities is available only when the Doppler memory light is out. The air data computer provides inputs of mach number, static pressure and pressure altitude, which are used by the computer in its solutions. Data from velocity correct techniques used by the bombardier/navigator are also available to the computer and the INS in this and the other navigation modes. The final result is more accurate navigational data than could be obtained from a single source alone.

INERTIAL MODE

The inertial mode differs from the Doppler/inertial mode in that the Doppler damping of inertial velocities is not available. This mode of operation can be selected by placing the Doppler transmit/silent switch in the SILENT position, or it is caused by a loss of Doppler signal to the computer or by the presence of the Doppler memory signal. All other system inputs are available to the computer.

EMERGENCY DOPPLER MODE

To select the emergency Doppler mode, the navigation mode selector switch on the navigation control panel must be set to EMER DOP. When this mode is used, inertial velocities are not used, and Doppler groundspeed and drift inputs are used directly in the computer's solutions. The emergency Doppler mode would be selected when inertial velocities appear to be invalid. The computer still generates leveling signals for the inertial platform, so the INS may be used as a source of heading and attitude reference. All other system inputs except horizontal velocity correct are available to the computer as in Doppler/inertial operation. In addition, vertical velocity correct is available. MAG/VGI reference may be used.

DEAD RECKONING MODE

To select the dead reckoning mode, the navigation mode selector switch on the navigation control panel must be set to the DR position. In this mode of operation, the computer is deprived of both inertial and Doppler velocities. The mode would be selected when both the inertial and Doppler velocities appear to be invalid. The computer still generates leveling signals for the inertial platform, so the INS may be used as a source of heading and attitude reference. Winds must be entered manually through the keyboard or by means of velocity correct. There is no provision for damping of inertial velocities by means of velocity correct in the DR mode with the platform in OPER. Other system inputs are still available to the computer. The MAG/VGI position of the compass switch may be used with this mode as with the other modes, but provides the least accurate data.

NAVIGATION CONTROL PANEL

The navigation control panel (figure 8-35) contains the controls and indicators required to monitor and control the navigation inputs to the computer. The information is displayed on the navigation control panel readouts.

CORRECT POSITION BUTTON

The correct position (CORRECT POS) button (figure 8-35) on the navigation control panel is used to update

Figure 8-35

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the present position when improved data are available. This is accomplished in the following manner: Acquire a ground point of known location with the search radar. Have the coordinates of this point inserted in the computer under one of three steering modes: BASE, PRES TGT, or CHK PT. While in the steering mode, slew the search radar cursors to the point and then depress the correct position button. This will update the latitude and longitude of the computer's present position, present position altitude will not be updated by use of the present position correct.

NAVIGATION MODE SELECTOR

This three-position toggle switch on the navigation control panel (figure 8-35) has positions marked INERL (inertial), EMER DOP (emergency Doppler), and DR. The INERL position provides the computer with direct velocity outputs from the inertial navigation system. If the Doppler controller is in the XMIT position, and not in memory, inertial velocities will be Doppler-damped. The weighted resultant is used for attack and navigation computations. Placing the switch to EMER DOP supplies the computer with groundspeed and drift angle from the Doppler radar. With the navigation mode selector in the DR position, the computer uses true airspeed, and will use either the keyboard-programmed wind velocity, or a memorized wind value to calculate groundspeed and drift.

NAVIGATION DATA SWITCH

The navigation data switch is a three-position toggle switch marked DATA/PRES POS/ON CALL and is used to select the information used for system navigation to be displayed in the navigation data indicator windows.

NAVIGATION DATA INDICATOR WINDOWS

The three navigation data indicator windows display information selected by the navigation data switch. With the switch set to DATA, windspeed in knots, groundspeed in knots and wind direction in degrees true are displayed.

With the switch set to PRESS POS, computer-derived aircraft present position is displayed. Latitude and longitude are displayed in degrees and minutes and altitude in feet.

With the switch set to ON CALL, the readouts displayed differ depending on whether the computer is in the navigation condition or has been stepped into attack.

In the navigation condition, with base or target steering selected, the windows display latitude and longitude in degrees and minutes and altitude in feet for the selected target; with navigation checkpoint selected, they display latitude, longitude, and altitude of the checkpoint. With aimpoint 1 or 2 selected, offset distance in feet, offset bearing in degrees and minutes, and keyboard altitude difference in feet between the target and the selected aimpoint are displayed. With opportunity target steering or unstabilized cursors selected, the windows display latitude and longitude in degrees and minutes of the cursor intersection and keyboard preset target altitude in feet.

In attack, the displays for base or target steering and navigation checkpoint are the same as for navigation. With aimpoint 1 or 2, opportunity target or unstabilized cursors selected, the latitude window displays angle of attack in degrees and minutes and the longitude window displays the weapon code. The altitude window readout with aimpoint 1 or 2 selected is the aimpoint altitude in feet above sea level, and for opportunity target steering or unstabilized cursors it is the same as for navigation.

Figure 8-36 illustrates the readouts available when the navigation data switch is set to ON CALL.

MAGNETIC VARIATION SWITCH

The magnetic variation (MAG VAR) switch on the navigation control panel is a five-position switch marked E-INC (east increase), and W-INC (west increase). In the E-INC position, magnetic variation in degrees, is slewed in at two rates; first position slow, second position - fast. The W-INC also has two positions (slow-fast).

MAGNETIC VARIATION COUNTER

The magnetic variation counter, marked MAG-VAR (figure 8-35), on the navigation control panel is used to display inserted magnetic variation. The E-INC (east increase) and W-INC (west increase) increases the magnetic variation counter from 0° to 180°.

ATTACK INDICATOR

The attack indicator is an amber advisory light on the navigation control panel (figure 8-35) that indicates to the bombardier/navigator whether or not the computer is operating in the attack mode.

Note

> Should this light be out during the attack sequence, it will be necessary to reestablish the valid attack requirements to conclude the operation.

This indicator is wired in parallel to another indicator mounted on the face plate of the bombardier/navigator's direct view indicator (DVI). This dual indicator allows monitoring of the attack light at all times.

COMPUTER ERROR INDICATOR

The computer error indicator is an amber advisory light (figure 8-35) on the navigation control panel, placarded ERROR. This indicator provides the bombardier/navigator with a visual means of monitoring operation of the computer and some associated subsystems. When the indicator is lit, the system has malfunctioned and corrective action should be taken. An indicator light for monitoring system operation is also on the bombardier/navigator's direct view indicator and on the pilot's vertical display indicator.

ON CALL READOUTS

STEERING SELECTED	LATITUDE WINDOW		LONGITUDE WINDOW		ALTITUDE WINDOW	
	NAVIGATION	ATTACK	NAVIGATION	ATTACK	NAVIGATION	ATTACK
BASE NO AIMPOINT	LATITUDE OF BASE	LATITUDE OF BASE	LONGITUDE OF BASE	LONGITUDE OF BASE	ALTITUDE OF BASE 1,2	ALTITUDE OF BASE 1,2
PRESET TARGET NO AIMPOINT	LATITUDE OF TARGET	LATITUDE OF TARGET	LONGITUDE OF TARGET	LONGITUDE OF TARGET	ALTITUDE OF TARGET 1,2	ALTITUDE OF TARGET 1,2
AIMPOINT 1 (BASE OR PRESET TARGET)	RANGE (FT X 10) TO AIMPOINT	ANGLE OF ATTACK	BEARING TO AIMPOINT	WEAPON CODE 6	ALTITUDE DIFFERENCE TO AIMPOINT	ALTITUDE OF AIMPOINT 3
AIMPOINT 2 (BASE OR PRESET TARGET)	RANGE (FT X 10) TO AIMPOINT	ANGLE OF ATTACK	BEARING TO AIMPOINT	WEAPON CODE 6	ALTITUDE DIFFERENCE TO AIMPOINT	ALTITUDE OF AIMPOINT 3
NAVIGATION CHECKPOINT	LATITUDE OF CHECKPOINT	LATITUDE OF CHECKPOINT	LONGITUDE OF CHECKPOINT	LONGITUDE OF CHECKPOINT	ALTITUDE OF CHECKPOINT	ALTITUDE OF CHECKPOINT
OPPORTUNITY TARGET UNSTAB-NO STEER * STAB-NO STEER * TACAN * UHF/DF * DATA LINK	LATITUDE OF CURSOR INTERSECTION	ANGLE OF ATTACK	LONGITUDE OF CURSOR INTERSECTION	WEAPON CODE 6	ALTITUDE OF TARGET 2,3,4	ALTITUDE OF TARGET 2,3,4

LANDING MODE

TOP STEERING BUTTON	LATITUDE OF CURSOR INTERSECTION	LONGITUDE OF CURSOR INTERSECTION	ALTITUDE OF BASE OR TARGET 1, 2
LOWER 5 STEERING BUTTONS	00000	SELECTED RUNWAY HEADING (DEGREES AND MINUTES)	SELECTED GLIDE SLOPE (DEGREES AND MINUTES)

* INOPERATIVE-SELECTION RESULTS IN UNSTAB—NO STEER

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Figure 8-36 (Sheet 1)

NOTE

1. KEYBOARDED VALUE OF BASE/TARGET ALTITUDE IS DISPLAYED; TRACK RADAR DERIVED ALTITUDE IS NOT DISPLAYED.

2. AFTER GROUND OR DISCRETE LOCK-ON IS ACQUIRED, TRACK RADAR DERIVED ALTITUDE (ABOVE MSL) IS MEMORIZED UNTIL TRACK RADAR POWER SWITCH IS TURNED TO STBY OR OFF. WITH SRTT ON, AFTER A SEARCH VALID INDICATION, SEARCH RADAR DERIVED ALTITUDE (ABOVE MSL) IS MEMORIZED UNTIL STEERING IS CYCLED OR RANGE TO TARGET EXCEEDS 5 NM (TRACK RADAR NOT IN XMIT). IF TRACK RADAR HAS A LOCK-ON, SEARCH RADAR DATA IS NOT PROCESSED.

3. AIMPOINT ALTITUDE ABOVE SEA LEVEL WILL BE DISPLAYED. WHEN A RADAR LOCK-ON HAS BEEN ACQUIRED, THE READOUT WILL BE RADAR DERIVED ALTITUDE ABOVE SEA LEVEL.

4. FOR OPPORTUNITY TARGET, PRESET TARGET ALTITUDE WILL BE DISPLAYED. WHEN A TRACK OR SEARCH LOCK-ON HAS BEEN ACQUIRED, THE READOUT WILL BE RADAR DERIVED ALTITUDE ABOVE SEA LEVEL.

5. FOR UNSTAB-NO STEER, COMPUTER TARGET ALTITUDE WILL BE DISPLAYED.

6. WEAPON CODE READOUT:
   A. WITH STRAIGHT PATH, GENERAL, OR HIGH LOFT ATTACK MODE SELECTED, THE FOLLOWING CODED READOUTS WILL VERIFY COMPUTER VALUES FOR BALLISTICS FOR THE SELECTED BOMB:

WEAPON SELECTED	ON CALL LONG	WEAPON SELECTED	ON CALL LONG
MK 61F	W06100	MK 20 MER	W02000
MK 57F	W05700	MK 15 MER	W01500
MK 43F	W04300	MK 116 MER	W11600
MK 28	W02800	MK 83 TER	W08333
MK 61R	W06150	MK 82 MER	W08200
MK 57R	W05750	MK 81 MER	W08100
MK 43R	W04350	82S MER F	W08211
CBU-3	W03203	81S MER F	W08111
CBU-1/2	W03212	MK 84	W08400
MK 106 X4D	W10600	MK 83	W08300
82S MER R	W08250	MK 79	W07900
81S MER R	W08150	MK 76 X4D	W07604

   B. WITH ROCKET ATTACK MODE SELECTED, THE FOLLOWING CODED READOUTS WILL VERIFY COMPUTER RECOGNITION OF BALLISTICS FOR THE SELECTED ROCKET:

WEAPON SELECTED	ON CALL LONG	WEAPON SELECTED*	ON CALL LONG
SHRIKE		D	
BULLPUP B	W12121	MK 4	
A	W11111	B	
2.75	W02750	A	W11111
ZUNI	W05550	BULLPUP B	W12121
		SHRIKE	
		2.75	W02750
		ZUNI	W05550

* AIRCRAFT 390 AND ON

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Figure 8-36 (Sheet 2)

The computer error indicators remain lit until the computer error switch is moved to ERASE, so that no errors will be inadvertently missed. In attack, the error indication function is transferred to the VDI pathway.

ATTACK-NAVIGATION SYSTEM COMPUTER MODES AND DISPLAYS

TAKEOFF MODE

Selection of TAKE OFF provides no useful indications. If an indication of horizontal and vertical steering commands during takeoff and climb is desired, proper switch selection permits the use of landing mode. Horizontal and vertical steering commands will be presented by the steering symbol.

Note

- The pathway will not be displayed since the aircraft will be below the landing mode minimum altitude.
- The pathway will appear on the VDI when the aircraft is approximately 200 feet above the differential altitude selected.

To use landing mode for takeoff steering, use the following procedure.

1. Runway true bearing - ENTER
2. Flight mode selector button - LAND
3. Align aircraft with runway centerline.
4. Navigation mode selector button - UNSTAB-NO STEER
5. G-select button - 3
6. Target altitude - ENTER FIELD ELEVATION + TARGET DIFFERENTIAL ALTITUDE FOR DESIRED CLIMB ANGLE

DESIRED CLIMB ANGLE	DIFFERENTIAL ALTITUDE WITH 3G SELECTED
4.5°	200 feet
6.0°	1900 feet
7.5°	3800 feet

7. Navigation mode selector button - OPPORT TGT
8. Begin takeoff roll.

When in level flight at altitude:

9. Flight mode selector button - FLIGHT

LANDING MODE

The landing mode provides the pilot with the basic information required to make a GCA- or CCA-type instrument landing. Glide path centerline, direction, and intended point of landing are selected by the bombardier/navigator by keyboard input of glide path altitude and runway true heading and selection of cursor intersection. Glide path slope angle is selectable by means of the G buttons.

Glide Path Slope Angle

Glide path slope angle is selected by considering the rate of descent desired for a nonflared landing, the desired approach airspeed, and wind over the deck (headwind component). A standard to follow in this respect is the one established for setting the mirror or lens angle. For instance, with a 3.5° glide slope angle selected, using a rotating reflector located at the approach end of the runway (no offset), at an approach groundspeed of 112 KIAS, the sink rate is 11 1/2 feet per second. For the same indicated airspeed, landing into a 10-knot wind reduces the sink rate to 10 feet per second.

The glide path slope indication provided to the pilot is in the form of vertical display variable pathway width. Within 1 nmi of touchdown, a full narrow pathway (figure 8-37) indicates that the aircraft is 300 feet or more above the desired glide slope. At a range greater than 1 nmi, this same indication represents 3° or more above desired glide slope. The full width pathway (figure 8-37) indicates that the aircraft is 50 feet or more below desired glide path slope. At ranges of greater than 1 nmi, the same indication represents 1/2° or more below the flight path.

Note

The sensitivity of the pathway width to altitude or glide slope angle error is considerably less above the glide slope than below. Altitude corrections should be made accordingly.

Glide Path Bearings

The bombardier/navigator selects cursor position or track radar lock-on in combination with appropriate keyboard offset data so as to describe the intended point of landing. Coupled with a keyboard input of glide path bearing (true heading in degrees and minutes), this information is used to establish the glide path horizontal position, or extension of the landing runway. Difference between radar-measured bearing to intended point of landing and desired glide path bearing is used to position the display near-point at ranges of 1 nmi or more. At closer ranges, the near-point is positioned by the computed distance, from the glide path center line.

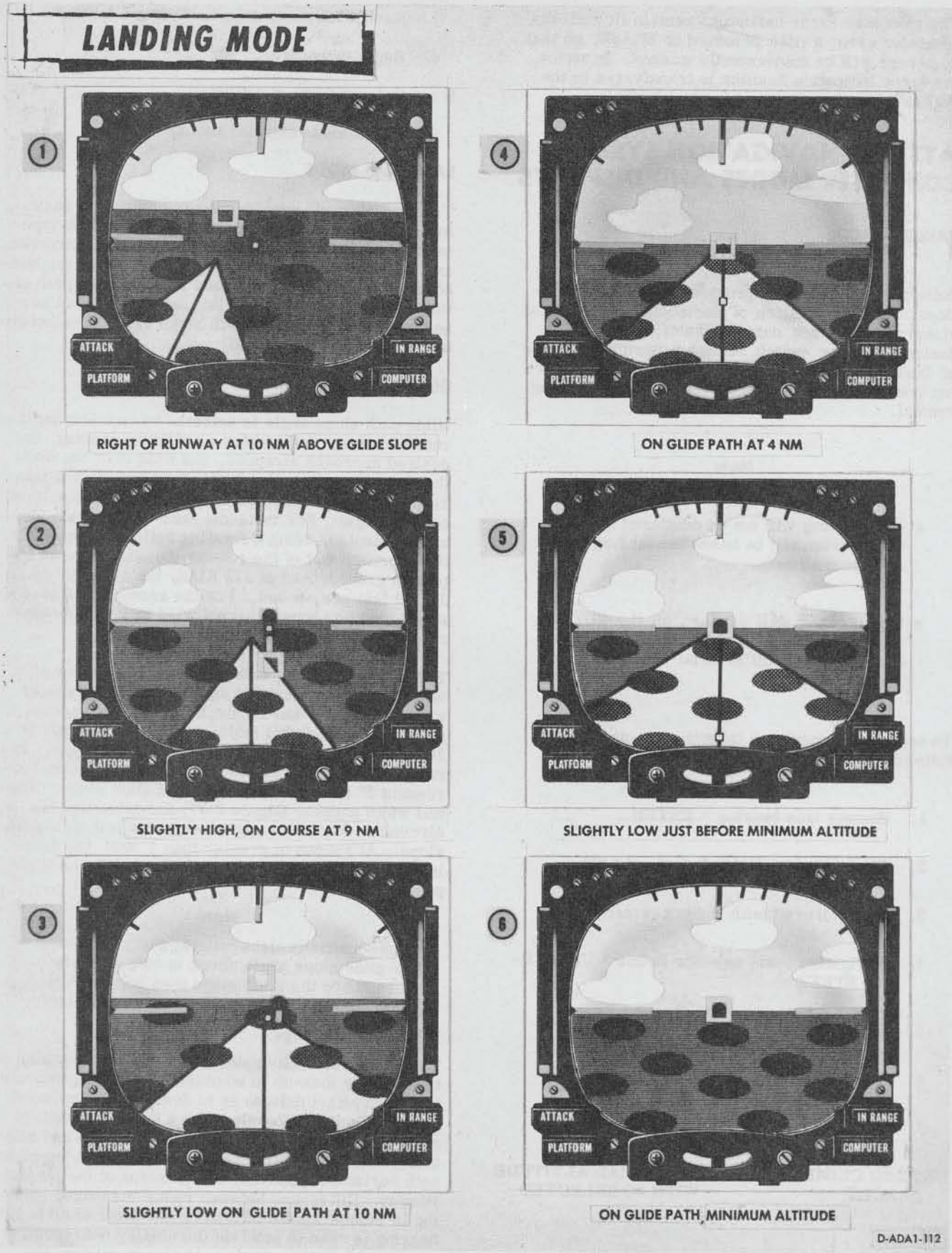

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Figure 8-37

With the aircraft centered on the selected glide path, the near-point of the vertical display pathway centerline appears to pass directly below the aircraft (figure 8-37). In wings-level flight, the near-point is therefore directly below display center. At ranges less than 1 nmi, full right or left displacement of the near-point (figure 8-37) indicates that the aircraft is 136 feet or more left or right of the intended glide path. At ranges greater than 1 nmi, this same indication represents about 1 1/2° or more left or right of intended glide path. This horizontal angular or distance scaling remains the same in all modes. If track lock-on exhibits a tendency to shift position, landing mode near-point appears to be erratic. A well-defined and unique radar target is thus required for optimum glide slope information.

Note

- Glide slope, near-point position, is particularly sensitive to small corrections in cursor repositioning if track lock-on is not available. Therefore, care should be used in selecting prominent radar targets for use in landing mode.
- The accuracy of landing mode glide slope displacement in offset or opportunity target modes is predicted on prior knowledge of exact bearing and altitude relationships between radar targets and the intended point of landing.

Pathway Vanishing Point

The keyboard input of glide path bearing is compared with computed aircraft ground track and the difference used to position the pathway vanishing point along a line through the display center and parallel with the display horizon. Twenty-seven degrees or more of difference causes full right or left displacement of the vanishing point.

Note

- A computer airspeed or groundspeed error will cause errors in computer ground track and erroneous near-point and vanishing point positions. Computed windspeed and direction should be monitored for accuracy during the landing.
- Changes in actual wind or aircraft airspeed during the descent will require the pilot to make continuous heading and displacement corrections.

USE OF LANDING MODE

Command steering and command glide angle are displayed by steering symbol position, circling orientation to the runway extension is automatically provided, and glide slope angle is selectable by means of the G buttons.

The use of the steering symbol in the landing mode is the same as its use in rocket or straight path attacks. Altitude command is based on range to the point of intended landing and selected glide slope angle. Glide slope angle is selected by depressing the G button corresponding to the angle desired. For example depressing the button marked 3.5 will result in a 3.5° glide slope and corresponds to an altitude of 370 feet per nautical mile of range. Command glide angle required to zero altitude error is displayed by the steering symbol vertical position. Thus with the steering symbol centered vertically, the aircraft will intercept the desired glide slope. The amount of altitude error is indicated by pathway width.

Steering command is displayed by the horizontal position of the steering symbol. Steering commands are programmed so that centering the steering symbol horizontally orients the aircraft position with respect to the runway centerline extension and allows transition to glide path intercept when within 30° of runway heading. Steering error is displayed by the position of the pathway vanishing point, and aircraft displacement from the extension runway centerline by the pathway near-point.

Maximum steering symbol commands are limited to 30° bank, 4° climb, and 6° descent. Due to these limits, the optimum range for selection of landing mode is from 4 to 10 nautical miles. Selection in this area will allow glide slope interception without overshooting and will keep orientation time to a minimum. A circling orientation is based on the smallest angle (the shortest way around) either left or right. Steering commands during orientation are programmed so that a constant-radius turn centered on the point of intended landing is flown until the aircraft is within 30° of the keyboard runway heading. With the steering symbol centered, a smooth transition from orientation to glide path command is made so as to cause the aircraft ground track to match the runway heading.

The PHD bug and optical sight moving reticle provide the same steering information as the pathway vanishing point.

Minimums for landing mode are indicated by pathway disappearance. The minimum as incorporated in the computer program is 200 feet. The minimum altitude with a track radar lock-on is track radar derived and with search radar is the computed difference between present position altitude and target keyboard altitude.

The actual ranges at which the pathway disappears for minimum altitude are shown in the table below:

Glide Slope	Range
3.0°	.63 NMI
3.5°	.54 NMI
4.0°	.47 NMI
4.5°	.42 NMI
5.0°	.38 NMI

Note

- Track radar landing mode is subject to low grazing angle/low altitude elevation errors with a discrete lock-on. Use of track radar for landing mode should be restricted to a discrete lock-on on a rotating reflector or a ground lock-on on well-defined fixed targets.
- A momentary pathway disappearance will occur when a ground or discrete lock-on is acquired.

ATTACKS

The computer-directed attack modes provide the flight crew with virtually unlimited flexibility in the direction of approach to a target, the dive or glide angle for delivery of the weapon, the airspeed for the selected delivery, and the point of release of the weapon once inside the range from which a weapon can reach the target.

Several system delivery modes are available to meet the desired effect and tactical situation. These are straight path, general, hi-loft, and rocket. During these attacks, the ballistics computer accepts target position data and aircraft velocity information from system sensors, continuously computes the point of weapon release, tells the pilot, via steering information, the required ground track for release, and sends a pulse to the selected store station at the point of release.

For further information on attacks, refer to the A-6 Tactical Manual NAVAIR 01-85ADA-1T.

P8.6 COMPUTER PROGRAM

COMPUTER CONTROLS AND INDICATORS

FLIGHT NAVIGATION MODE PANEL

The flight navigation mode selector panel (figure 8-38) is on the bombardier/navigator's control panel. This panel contains the necessary controls for selecting the mode of operation of the computer and associated functional readouts for navigation purposes.

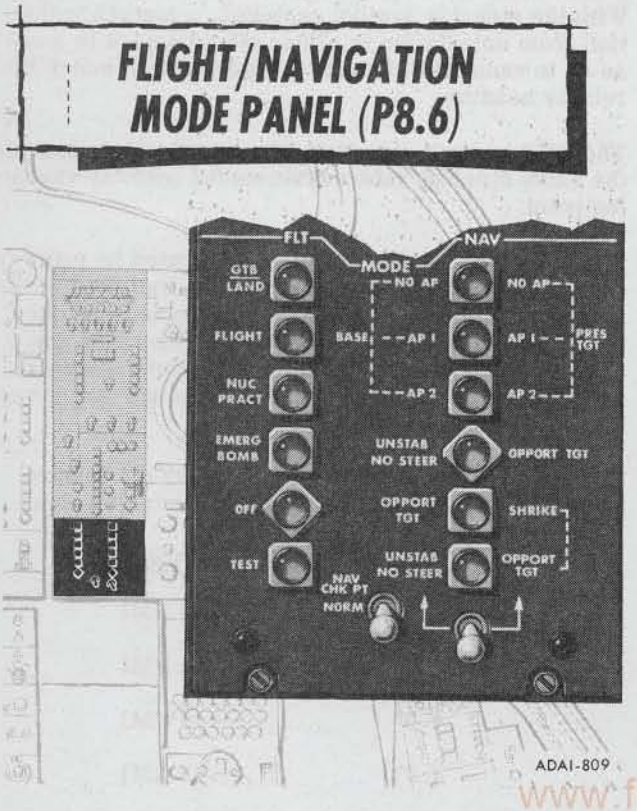

Figure 8-38

Flight Mode Selector Buttons

The computer selector buttons are six pushbuttons on the flight navigation mode panel, and are placarded the flight navigation mode panel, and are placarded TEST, OFF, EMERG BOMB, NUC PRACT, FLIGHT, and GTB (ground track bombing)/LAND. These buttons are used to select the type of data the computer is to provide, and require positioning prior to inserting mission data by the bombardier/navigator. The buttons are of the square-coded type, and are spring-loaded so that only one button can be depressed at any one time. The buttons rotate 45° when depressed, to indicate the mode presently selected.

With the OFF button depressed, the system is inoperative, with no power applied to the computer components.

With the OFF button depressed, the system is inoperative, with no power applied to the computer components. The TEST position on the flight navigation mode panel permits testing the various components of the computer to ensure proper operation and is primarily a function for maintenance.

The FLIGHT mode is the normal operating mode. It is used to initialize the computer and for insertion of navigation and performance data.

EMERG BOMB (formerly PREFLIGHT) is depressed to set all values of the NOMATS code to zero. Depending on the navigation mode being used, the B/N must insert wind and/or mach, target temperature, and a correct present position altitude. When utilizing the DR navigation mode, the aircraft will have to be flown at the command mach and altitude. If using INS or DOPPLER modes, present position altitude will be the only input and flight profile restriction. Upon reselection of FLIGHT after EMER BOMB, the computer will reset to the last NOMATS code prior to the selection of EMERG BOMB. The B/N should not rely on this automatic function and should make his desired entry again.

Depressing NUC PRACT (formerly TAKE OFF) allows a simulated nuclear delivery and computer sampling of ballistics control panel values while using MK76 ballistics.

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Depressing the GTB/LAND (formerly LAND) button instructs the computer in the navigation mode to present the pilot landing information relative to either a carrier or a runway. The basic information for this pathway is developed from data inserted into the computer. In the attack mode, ground track bombing (GTB) is available. This information is covered in the attack section.

Navigation Mode Selector Buttons

Six selector pushbuttons on the flight navigation mode panel (figure 8-38) allow the B/N to position the radar cursors over a preselected point. Steering information may be provided for the pilot depending on the mode selected (figure 8-39).

There are two settings for each of the pushbuttons, depending on the position of the navigation transfer switch below the lower pushbutton (figure 8-38).

BASE-NO AP (Base-No Aimpoint)

Depressing the BASE NO AP button instructs the computer to provide the necessary steering information to the pilot's displays and position the radar cursors to the previously inserted latitude and longitude.

PRES TGT-NO AP (Preset target - No Aimpoint)

Operates the same as BASE-NO AP.

BASE-AP 1 (Base Aimpoint 1)

Depressing the BASE AP 1 button instructs the computer to provide the necessary steering information to the pilot's displays to direct the aircraft to the previously inserted latitude and longitude of the base, and simultaneously to position the radar cursors to an offset aimpoint of a previously inserted range and bearing from the base.

BASE AP 2 (Base-Aimpoint 2)

With this button depressed, the computer provides information as outlined in BASE AP 1, except the radar cursors are directed to a second location.

Note

Offset bearing and distance are both measured from the BASE/TGT to the aimpoint. Altitude is differential altitude again measured from the BASE/TGT to the aimpoint. Offset limits for BASE-AP 1, BASE-AP 2, TGT-AP 1, TGT-AP 2 are:

99,999 ft. horizontally
360° from true north
37,940 ft. vertically

PRES TGT-AP 1 (Preset Target Aimpoint 1)

Operates the same as BASE-AP 1 in relation to PRES TGT-NO AP.

PRES TGT-AP 2 (Preset Target Aimpoint 2)

Operates the same as BASE-AP 2 in relation to PRES TGT-NO AP.

UNSTAB-NO STEER (Unstabilized-No Steering)

Formerly labeled DATA LINK and UHF DF. Depressing either UNSTAB-NO STEER buttons selects the unstabilized-no steering mode. Selecting this mode sets the relative bearing of all steering commands to 0° (along the aircraft ADL) and positions the range and azimuth cursors along the aircraft ADL at 12.5 NMI or the value as entered under MAP CENTER.

The cursors are unstabilized in azimuth and range but may be repositioned using the slew stick.

If steering is cycled with the navigation transfer switch from one unstabilized steering selection to another, the cursors will remain along the aircraft ADL at the selected range. If the cursors have been moved with the slew stick, cycling steering to another unstabilized selection will return to the last selected range along the aircraft ADL.

If NAV CHK PT is selected while in the unstabilized mode, the cursors will be positioned to the coordinates of the checkpoint, but will return to the aircraft ADL at the last selected range when the NAV CHK PT/NORM switch is set to NORM.

The altitude used by the computer with UNSTAB-NO STEER selected is that inserted for PRES TGT NO AP. This altitude may be changed by inserting a new altitude for PRES TGT NO AP.

Stepping the computer into attack with the UNSTAB-NO STEER selected causes the computer to switch to OPPORT TGT steering. After flag drop, steering automatically reverts to UNSTAB-NO STEER when the computer is stepped out of attack. If there is no flag drop, steering will remain in OPPORT TGT until the B/N cycles steering.

OPPORT TGT (Opportunity Target)

Formerly labeled TACAN, UNSTAB-NO STEER and OPPORT TGT. Depressing any of these three buttons with the corresponding position of the navigation transfer switch selects the opportunity target mode. Depressing this button instructs the computer to present steering information toward the intersection of the radar cursors and to ground stabilize the cursors.

The altitude used by the computer with OPPORT TGT selected is determined by switch positioning prior to entering OPPORT TGT. Base altitude will be used when cycling from BASE, BASE AP 1, or BASE AP 2 to OPPORT TGT. Target altitude will be used when cycling from TGT, TGT AP 1, TGT AP 2, or NAV CHK PT to OPPORT TGT.

If NAV CHK PT is selected while in OPPORT TGT, the cursors go to the coordinates of the checkpoint and when the NAV CHK PT/NORM switch is returned to NORM, the cursors will track the checkpoint and steering is toward the checkpoint.

The opportunity target steering mode is automatically selected if the computer is stepped into attack with the unstabilized-no steering mode selected.

SHRIKE

Formerly labeled STAB-NO STEER. Depressing the SHRIKE button with the navigation transfer switch to the right instructs the computer to present steering information to the cursor intersection and to ground-stabilize the cursors. Target altitude used for this mode is determined by switch positioning prior to entering SHRIKE. Base altitude will be used when cycling from BASE, BASE-AP 1, or BASE-AP 2 through OPPORT TGT to SHRIKE. In all other switch combinations, the computer will use keyboarded target altitude.

STEERING OPTIONS

P8.6 PROGRAM

STEERING OPTIONS	NAVIGATION PANEL "ON CALL" READOUT	PHD RANGE INDICATOR	RADAR CURSORS POSITION TO	PHD BUG POINTS TO	DVI BUG POINTS TO	VDI STEERING COMMANDS TO	REMARKS	* DVI RANGE INDICATOR
BASE NO AP	KEYBOARD INPUTS OF LAT, LONG, ALT OF BASE	GROUND RG TO BASE (NM)	COORDINATES OF BASE	DRIFT CORRECTED HEADING TO BASE	TRUE BRG TO BASE NO AP	COORDINATES OF BASE	RADAR CURSORS ARE POSITIONED BY THE COMPUTER, BUT CAN BE SLEWED BY THE B/N.	TO BASE
BASE AP1	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 1		AIMPOINT 1 BASE		TRUE BRG TO BASE AP1			TO AIMPOINT 1 UNDER 16.5 MILES TO BASE OVER 16.5 MILES
BASE AP2	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 2		AIMPOINT 2 BASE		TRUE BRG TO BASE AP2			TO AIMPOINT 2 UNDER 16.5 MILES TO BASE OVER 16.5 MILES
PRES TGT NO AP	KEYBOARD INPUTS OF LAT, LONG, ALT OF TGT	GROUND RG TO TGT (NM)	COORDINATES OF TARGET	DRIFT CORRECTED HEADING TO TGT	TRUE BRG TO TGT NO AP	COORDINATES OF TGT		TO TGT
PRES TGT AP1	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 1		AIMPOINT 1 TARGET		TRUE BRG TO TGT AP1			TO AIMPOINT 1 UNDER 16.5 MILES TO TARGET OVER 16.5 MILES
PRES TGT AP2	KEYBOARD INPUTS OF DIST., BEARING, DIFFERENTIAL ALTITUDE OF AIMPOINT 2		AIMPOINT 2 TARGET		TRUE BRG TO TGT AP2			TO AIMPOINT 2 UNDER 16.5 MILES TO TARGET OVER 16.5 MILES
OPT TGT	LAT, LONG OF CURSOR INTERSECTION; KEYBOARD, T/R OR S/R DERIVED TGT ALT	GROUND RG TO CURSOR INTERSECTION (NM)	POSITIONED BY SLEW CONTROL AND GROUND STABILIZED	DRIFT CORRECTED HEADING TO CURSOR INTERSECTION	ALIGNED WITH AZIMUTH CURSOR	CURSOR INTERSECTION	RADAR CURSORS ARE POSITIONED BY THE B/N	CURSOR INTERSECTION
UNSTAB NO STEER			SLANT RANGE ALONG AIRCRAFT ADL	AIRCRAFT HEADING **	AIRCRAFT HEADING	NO STEERING ORIENTATION **	RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT CAN BE SLEWED BY THE B/N	12.5 NM OR KEYBOARD ENTRY
SHRIKE			POSITIONED BY SLEW CONTROL AND GROUND STABILIZED	DRIFT CORRECTED HEADING TO CURSOR INTERSECTION	ALIGNED WITH AZIMUTH CURSOR	CURSOR INTERSECTION	RADAR CURSORS ARE POSITIONED BY THE B/N	CURSOR INTERSECTION
NAV CHK POINT	KEYBOARD INPUTS OF LAT, LONG, ELEV OF NAV CHECKPOINT		COORDINATES OF CHECKPOINT	MEMORIZED DRIFT-CORRECTED HEADING TO TGT (OR BASE) **	TRUE BRG TO CHECKPOINT	DRIFT CORRECTED STEERING TO TGT (OR BASE) **	USED BY B/N TO CORRECT PRESENT POSITION INFORMATION WITHOUT AFFECTING PILOT'S COMMAND STEERING	

NOTE

* DVI STEERING GROUND RANGE IN MILES IF OVER 16.5 NAUTICAL MILES; SLANT RANGE IS IN FEET UNDER 16.5 NAUTICAL MILES.

** IF COMPUTER IS STEPPED INTO ATTACK IN UNSTAB NO-STEER OR NAN CHK POINT, ATTACK STEERING WILL AUTOMATICALLY BE PROVIDED TO RELEASE.

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Figure 8-39

Navigation Transfer Switch

The navigation transfer switch is a two-position toggle switch below the lower pushbutton (figure 8-38). The switch has no placarded positions and, when moved to the left or right, enables selection of two groups of six ballistics computer navigational modes using the same six navigation mode selector buttons.

Navigation Checkpoint Switch

This two-position toggle switch (figure 8-38), placarded NAV CHK PT (navigation checkpoint) and NORM (normal provides a means of suspending all instructions from the navigation mode selector buttons, except pilot's steering information.

When the switch is positioned to NAV CHK PT, the computer directs the radar range and azimuth cursors to the navigation checkpoint previously inserted into the computer regardless of the navigation mode selected. In this position, the computer steering information provided the pilot will not be interrupted; however, range information is to be checkpoint and steering is to an infinite range. The displays will continue to provide the pilot with the steering information for the selected navigation mode.

Note

To update information in this mode, the bombardier/navigator will position the cursors over the predetermined checkpoint and depress the CORRECT POS button on the navigation control panel. This will automatically correct all present position readouts, except altitude.

With the switch in the NORM position, the computer operates as directed by the navigation mode selector buttons.

KEYBOARD CONTROL PANEL

The keyboard control panel (figure 8-40) is used by the bombardier/navigator to insert data relative to the intended mission. The panel consists of the address keys, quantity keys, action keys, clear button, and a TEMPORARY STORAGE indicator.

Address Keys

The address keys consist of 12 pushbuttons and a release bar. These instruct the computer to establish quantity data as reference for subsequent application with a particular mission requirement.

Note

The address keys are not mechanically interlocked and two may be depressed at a time. Therefore, it is essential that the release bar be actuated after information concerning a given address has been entered.

Once a key has been depressed, it will remain depressed until the release bar is actuated. The function of each of the keys is given below.

BASE

This key is depressed to set in latitude and longitude coordinates during data insertion. Both coordinates are inserted as degrees and minutes, and altitude is inserted as feet.

COMPUTER KEYBOARD

1. TEMPORARY STORAGE INDICATOR
2. KEYBOARD CLEAR KEY
3. ADDRESS KEYS
4. ADDRESS KEY RELEASE BAR
5. QUANTITY KEYS
6. ACTION KEYS

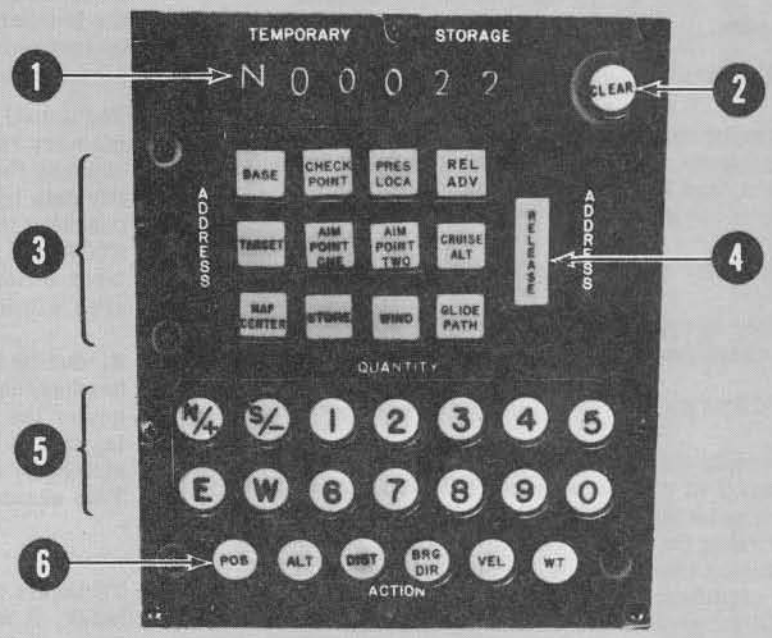

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Figure 8-40

CHECK POINT

Depressing this key permits the insertions of the checkpoint latitude and longitude coordinates to degress and minutes, and the altitude of the checkpoint in feet.

TARGET

This key is depressed to set in latitude and longitude coordinates during data insertion. Both coordinates are inserted as degrees and minutes, and altitude is inserted in feet.

AIM POINT ONE

This key is depressed to insert the location of preselected aimpoint one. The location is inserted with respect to specified coordinates and is programmed as a range and bearing offset from preset target or base coordinates. The bearing is addressed in degrees and minutes (360°00') while distance is addressed in feet (99,999'). Aimpoint altitude is entered as differential altitude with respect to the specified coordinate elevation. If the aimpoint is higher than the target, the altitude is entered using the N/+ quantity key, and if the aimpoint is lower, the altitude is entered using the S/- quantity key.

AIM POINT TWO

This key is depressed to insert information similar to that outlined in aimpoint one, except that the information inserted is defined with respect to a second preselected aimpoint.

Note

Two offset bearings and distances are available for use with either base or target steering modes.

PRESS LOCA (Present Location)

Depressing this key permits insertion of the latitude and longitude coordinates of the aircraft's present location, and the altitude of the location is also inserted in the computer.

CRUISE ALT (Cruise Altitude)

This key is depressed to insert the desired release slant range for STRAIGHT PATH free-fall attacks.

MAP CENTER

This key is depressed to enable selective data replacement of various sensors (NOMATS). Additionally, a selectable UNSTAB-NO STEER range is entered using the MAP CENTER address key and the POS action key with a W (west) prefix and the first three significant digits. Limits for UNSTAB-NO STEER range are 0 to 35.9 nautical miles. For example, entering W15000 will result in an UNSTAB-NO STEER range of 15 nautical miles.

REL ADV (Release Advance)

This key permits the bombardier/navigator to instruct the computer to send a release pulse at a selected distance in advance of the computed release point.

STORE (Store Weight)

Presently inoperative.

GLIDE PATH

This key is depressed to insert the true bearing of the runway or mine line in degrees and minutes for the landing and ground track bombing mode. In addition, this key addresses the temperature input when using NOMATS.

WIND

This key is depressed to insert into the computer the wind velocity and direction. These are inserted in standard form; i.e., true direction in degrees and minutes and velocity in knots.

RELEASE

This bar is momentarily depressed to release any depressed address key.

Quantity Keys

The quantity keys (figure 8-40) consist of 14 momentary keys, marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, N/+, S/-, E, and W. These keys are used to insert the various quantity data with respect to the indicated address keys. The keys are depressed individually. Once the quantity keys has been depressed, the corresponding figure will appear in the TEMPORARY STORAGE indicator readout window. This provides the bombardier/navigator with a means of checking to ensure that the correct information is being inserted into the computer.

The actual insertion sequence into the computer memory requires that the bombardier/navigator depress the appropriate address key, insert quantity data by depressing the correct quantity keys, checking the indicated value on the TEMPORARY STORAGE indicator, and finally, depress the related action key to channel the data to the storage area within the computer memory drum.

If, during the keyboard insertion sequence, the bombardier/navigator accidentally actuates the wrong key or the information is changed, the data appearing on the TEMPORARY STORAGE indicator can be erased by depressing the CLEAR button (figure 8-40). This erases all of the information appearing in the

To insert data into the memory drum of the computer, it will be necessary that a total of six quantity keys be depressed, regardless of the number of significant digits in the basic information. The first

key to be depressed will always be one of the N/+, S/-, E, or W keys for position, or the N/+, S/- keys for plus or minus quantities.

Note

When the N/+, or S/- key is depressed, the TEMPORARY STORAGE indicator will read N or S only, despite the condition being programmed. It will therefore be necessary for the bombardier/navigator to realize that the appropriate value is being designated, since the + or - signs do not appear in the readout window.

After the key has been depressed denoting the selected position or sign, the quantity can be inserted. If necessary, this is accomplished by prefixing the significant digits with the necessary number of zeros to result in a six-digit insert. For example, if the latitude to be inserted is N 40°05', it will be necessary that the bombardier/navigator depress the N/+ key; followed by the 0 key, and then the 4, 0, 0, 5, keys. This will provide the necessary six-digit insertion. Failure to depress the necessary six digits will disable the action button and data cannot be inserted.

Note

To initiate the actual insertion, it will be necessary that the bombardier/navigator depress and hold the desired quantity key until the appropriate figure appears in the TEMPORARY STORAGE indicator.

Action Keys

The six action keys (figure 8-40) are located below the quantity keys, and are marked POS (position), ALT (altitude), DIST (distance), BRG DIR (bearing direction), VEL (velocity), and WT (weight). After the appropriate quantity keys have been depressed, the bombardier/navigator inserts the information into the computer memory drum by depressing the related action key. This action simultaneously clears the TEMPORARY STORAGE indicator for additional information insert. The action keys function to program the computer for the information storage as indicated below:

POS (Position)

When this key is depressed, the computer is advised to store the information presented on the TEMPORARY STORAGE indicator on the appropriate position track in the memory drum. This information will include the longitude and latitude of the base, target, present location, or checkpoint. This key also enables storage of a desired UNSTAB-NO STEER range.

ALT (Altitude)

When this key is depressed, the computer is advised to transfer the information in the TEMPORARY STORAGE indicator to the memory drum related to the altitude of the base, target, present location, checkpoint, or aimpoint, and the desired release slant range for slant range for straight path attack. When using NOMATS, depressing this key enables storage of a value for target temperature.

DIST (Distance)

When this key is depressed, it instructs the computer to store the information appearing in the TEMPORARY STORAGE indicator regarding the distance to the aimpoint (aimpoints one and two) from the target and release advance distance.

BRG DIR (Bearing Direction)

This key advises the computer to transfer the information appearing in the TEMPORARY STORAGE indicator to the memory drum of the computer. This information includes the true bearing from the target to the aimpoint. This control also provides a means of supplying the computer with the necessary information regarding the direction of the wind, and the orientation of the landing runway (glide path).

VEL (Velocity)

This key advises the computer to transfer to storage the information regarding the wind velocity indicated on the TEMPORARY STORAGE indicator.

WT (Weight)

Presently inoperative.

TEMPORARY STORAGE Indicator

The TEMPORARY STORAGE indicator (figure 8-40) consists of a digtal counter. The reading on the indicator is controlled by the selection of the quantity keys during the insertion sequence. The counter displays a five-digit number, prefixed by a control letter designator representing direction, or a plus or minus value. During all insertion sequences, the bombardier/navigator will continually refer to these readouts to ensure that the correct data is being inserted into the computer drum.

CLEAR Button

The CLEAR button is located beside the TEMPORARY STORAGE indicator (figure 8-40) and provides the bombardier/navigator with a means of erasing all information appearing in the TEMPORARY STORAGE window. This control will find application in correcting erroneous data punched on the keyboard, and updating information prior to its incorporation into the computer memory drum.

KEYBOARD DATA INSERTION

For the purposes of this procedure, let us assume that the mission planning data to be inserted is confined to the base location of the aircraft.

Aircraft's present location is:

Latitude 36° 49' North
Longitude 76° 02' West
Altitude 22 feet

Initially, it will be the responsibility of the bombardier/navigator to resolve this information into an acceptable format for the computer, that is, adding the necessary zeroes to complete the insertion requirements.

1. PRESS LOCA - DEPRESS

   Depress PRESS LOCA key in address section.

2. Quantity keys - DEPRESS - N03649

   Depress quantity keys in order: N, 0, 3, 6, 4, 9

Note

Observe the readout N03649 on the TEMPORARY STORAGE WINDOW.

3. Position (POS) key - DEPRESS

   Since this is a position category, POS key is depressed in order to insert latitude of present location into computer. Observe that temporary storage reading is erased, and that readout appears on navigation control panel in present position.

4. Quantity keys - DEPRESS - W07602

   Depress quantity keys in order: W, 0, 7, 6, 0, 2

Note

Observe the reading W07602 on the TEMPORARY STORAGE window.

5. Position (POS) key - DEPRESS

   Longitude of present location will be transferred into computer. Observe that temporary storage reading is erased, and that reading appears on navigation control panel.

6. Quantity keys - DEPRESS - N00022

   Depress quantity keys in order: N, 0, 0, 0, 2, 2

Note

Observe the reading N00022 on the temporary storage window.

7. Altitude (ALT) key - DEPRESS

   Since this is an altitude category, altitude of present location is transferred into computer, temporary storage indicator is erased, and readout appears on navigation control panel.

The latitude, longitude, and altitude of the present location have now been entered into the memory drum of the computer. The inputs to be entered next into the memory of the computer consist of:

1. Latitude and longitude, in degrees and minutes altitude (MSL), plus or minus in feet, for base, checkpoint, and target.

2. True bearing, in degrees and minutes, from target; distance in feet from target; and differential altitude in feet for aimpoint one and aimpoint two.

3. True bearing, in degrees and minutes, velocity in knots for predicted or estimated wind.

4. True bearing, in degrees and minutes of runway heading or direction of intended landing or desired mine line.

5. Release slant range in feet entered under cruise altitude address and altitude quantity key. Used in straight path dive attacks to give pilot vertical steering indications.

6. Release advance - N00000

7. Selective data replacement - NOMATS.

Selective Data Replacement (NOMATS)

Selective data replacement is accomplished with the use of the NOMATS code. The Mach (M), Angle-of-Attack (A), Total Temp (T) and Static Pressure (S), can be selectively replaced or calculated by the computer. Using the MAP CENTER Address key, inserting a value of 1 indicates sensor is good and a value of 0 indicates sensor is bad. On turn-up, the computer automatically sets the NOMATS code to N01111 and gives a 066 error code. The NOMATS code is entered by depressing the POS action key.

When a NOMATS code of N00--- is entered, the computer requires a command mach (M) to be used. The command mach number is set into the computer by depressing the G button in accordance with the following schedule:

G BUTTON	MACH
3.0	.60
3.5	.65
4.0	.70
4.5	.75
5.0	.80

The TAS window of the B/N's attack-navigation panel and the command airspeed index on the pilot's airspeed indicator will read true air speed for the mach number at the altitude selected. For a selected attack, the aircraft must be flown at the command mach number selected.

When the NOMATS code of NO-0-- is entered, a calculated value for angle of attack is used from the computer.

When the NOMATS code of NO--0- is entered, the temperature is calculated at a standard lapse rate by

the computer. The bombardier/navigator can alter that temperature to make up for non-standard temperatures. This is accomplished by correcting local temperature for target altitude and temperature using a lapse rate of 3.6° F/1000 feet at turn-up. This temperature is entered in degrees Fahrenheit using the GLIDE PATH address key and the ALT action key.

When the NOMATS code of N0---0 is entered, the static pressure value from the ADC is set bad. The bombardier/navigator should update present position altitude using PRES LOCA address key and ALT action key.

COMPUTER ERROR CODES

When not in attack, the computer performs 18 diagnostic tests each iteration providing the error code switch is at READ.

Should one of these diagnostic tests be failed, the error lights will be turned on and the applicable code will appear in the number three window of the RHU upper panel. The data select switch must be at C to read the error codes.

The computer diagnostic tests and error codes are listed below:

CODE	FUNCTION
001	Zero + Zero
002	C register + B register
003	CT + RAB_1
004	CT selection
007	C register to B register
008	Absolute value of zero
009	Absolute value negative number
011	Nonaddressed input
013	Core modification
016	Left shift
017	Multiply
041	Double-precision multiplication
048	Divide
056	Square root
057	RAB_{50}
073	Test VA-VG or excessive vertical velocity
077	Tracking buffer test
080	Time Test
088	Steering cycled with velocity correct switch in MEMORY POINT
099	Auto reset
121	CT + RAB_{10}

If the error code switch is in ERASE, the code 508 is displayed.

In attack, no error lights are generated and normal error codes are not displayed. If there is a failure of release valid data (indicated by pathway off on the VDI), the valid data code will be displayed only during the time when the path is off. When the pathway reappears, the code will be erased from the tape dial automatically. The valid data codes are as follows:

CODE	TEST FAILED
111	Ballistic solution error
222	Angle to release error
333	Acceleration error
444	Total velocity error
666	Iteration error (080 in navigation)

RELEASE ADVANCE

Release advance permits the B/N to introduce a range offset value into the weapon release solution. In this way, by advancing the initial release point a predetermined distance, the B/N can straddle a target with a train release of bombs. Release advance may be used with rockets or bombs for compensating known range solution errors by advancing or retarding the release point.

Release advance information is inserted by means of the keyboard and is read in the VC/MTV data readout window (C5). The information is introduced into the solution by depressing the RELEASE ADVANCE button. Depressing the button a second time will remove the information from the solution. The computer can accept keyboard inputs of up to 9999 feet of release advance, and it is displayed in the computer data readout windows to the lowest 100 feet. The release advance entry is not displayed unless it is actually being used; i.e., zeros will be displayed unless the engage button is depressed and the light is on.

If the stored release advance information is disturbed in any way while the RELEASE ADVANCE button is engaged, the light in the button will go off, and the computer will no longer accept the information. To reintroduce the release advance data it is necessary to disengage the RELEASE ADVANCE button to remove the data and engage the button to introduce it. Recheck the value in the readout window to be sure that the proper data were entered.

There is a dual-channel input for release advance information when it is entered into the computer, one to the computer and the other to the readout. Therefore, it is possible to enter a number into the computer via the REL ADV address key, have it read correctly in window C5, and still have an erroneous value in the computer. It is good procedure to reenter the desired release advance whenever a computer error light or other transient conditions occurs. Reentering the desired release advance just before the bombing run is also advisable to help ensure that the computer is using the correct value.

BALLISTICS COMPUTER DATA READOUTS

Data readouts are displayed to permit evaluation of system operation, malfunction analysis, and

reconstruction of weapon release conditions so that weapon impact errors can be analyzed. Figure 8-41 shows the readouts available for the attack case and the navigation case.

ATTACK-NAVIGATION PANEL (RHU)

The attack-navigation panel in the right-hand unit (figure 8-42) contains the ballistic computer data readouts, the switches controlling them, and the RELEASE ADVANCE button.

Data Readout Windows

The data readout windows display values as shown in figure 8-41. The sign of all lateral data is positive to the right with respect to the reference direction. Roll is positive with right wing down. Aircraft elevation angle and track elevation are positive up with respect to the reference direction. Attack solution error is positive for a long impact, and release advance is positive for a short impact. Steering error is plus when the aircraft ground track is left of the correct ground track. The release angle output is the angle from horizontal (positive up) in all cases except general or high loft retarded weapons. In these cases the value indicated is the last computed angle to go in the iteration before release.

Time of fall is the value from release to impact or burst height for bombs, and the value from motor burnout to impact for rockets. The following is a functional description of the values displayed.

NAVIGATION READOUTS

A1

Altitude solution error is a number x 10 representing the difference between the corrected air data computer pressure altitude and the ASQ-61 present position altitude.

A2

True airspeed is computed TAS using AOA, ADC mach and temperature.

A3

Doppler ground velocity is the direct AN/APN-153 groundspeed in knots.

A4

Doppler drift angle is the direct AN/APN-153 drift angle in degrees. Right drift is positive; left drift is negative.

COMPUTER DATA READOUTS — P8.6 PROGRAM

READOUT WINDOW MARKING	ATTACK MODE — DATA SELECT SWITCH POSITION A		B		C		NAVIGATION MODE — DATA SELECT SWITCH POSITION A		B		C		READOUT WINDOW MARKING
WINDOW #1	UNIT	ADD	UNIT	ADD	UNIT	ADD	UNIT	ADD	UNIT	ADD	UNIT	ADD	WINDOW #1
BALLISTIC ERROR	FEET	0	SECONDS	—	—	—	FEET	0	DEGREES	—	DEGX 0.1	—	ALTITUDE ERROR
	ALTITUDE SOLUTION ERROR		TIME OF FALL		ALTITUDE DATA SOURCE CODE		ALTITUDE SOLUTION ERROR		TRACK RADAR AZIMUTH GIMBAL ANGLE		ANGLE OF ATTACK		
WINDOW #2	KNOTS	—	KNOTS	—	DEGREES	—	KNOTS	—	DEGREES	—	FEET	00	WINDOW #2
TAS	TRUE AIR SPEED		TOTAL INERTIAL SPEED		TRUE HEADING		TRUE AIR SPEED		TRACK RADAR ELEVATION GIMBAL ANGLE		ADC PRESSURE ALTITUDE		TAS
WINDOW #3	FEET	0	FT	00	—	—	KNOTS	—	DEGX 0.1	—	—	—	WINDOW #3
VERTICAL SEPARATION	VERTICAL SEPARATION		GROUND RANGE		VALID DATA INHIBIT CODE		DOPPLER GROUND VELOCITY		ELEVATION ANGLE		ERROR CODE		DOPPLER GROUND VELOCITY
WINDOW #4	DEGREES	—	FEET	00	I X G	—	DEGREES	—	DEGX 0.1	—	DEG (F)	—	WINDOW #4
RELEASE ANGLE	RELEASE ANGLE		COMPUTED BALLISTIC RANGE		NORMAL ACCELEROMETER INPUT		DOPPLER DRIFT ANGLE		RTT DEPRESSION ANGLE		TOTAL TEMPER-ATURE		DOPPLER DRIFT ANGLE
WINDOW #5	KNOTS	—	MILLS	—	FEET	00	KNOTS	—	DEGREES	—	FEET	00	WINDOW #5
VC/MTV	VELOCITY CORRECTION OR MOVING TARGET VELOCITY		STEERING ERROR		RELEASE ADVANCE BEING USED		VELOCITY CORRECTION OR MOVING TARGET VELOCITY		AIRCRAFT ROLL ANGLE		RELEASE ADVANCE BEING USED		VC/MTV

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Figure 8-41

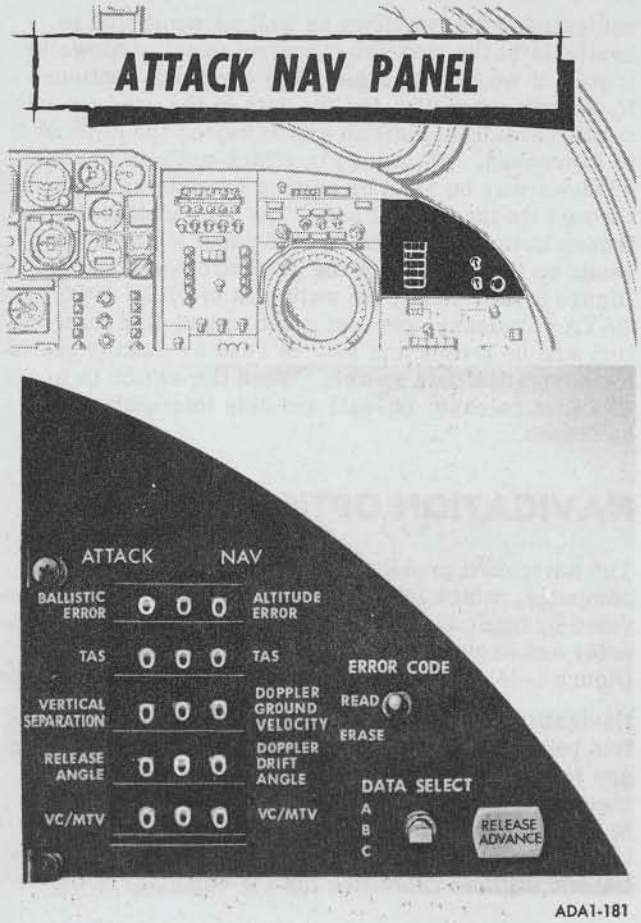

Figure 8-42

A5

Velocity-correction or moving target velocity is displayed in knots. When the velocity-correct switch is in MEMORY POINT, velocity-correction is displayed. When the AMTI control is ON with a track radar discrete lock-on, target velocity is displayed. When velocity-correct and AMTI are both ON, velocity-correction is displayed. If a large velocity correction is displayed, sources of system velocity such as search or track radar, INS, TAS, etc., should be cross-checked to determine if a malfunction exists.

B1

Track radar azimuth gimbal angle is in azimuth position in degrees of the track radar antenna relative to the ADL. Right is positive and left is negative.

B2

Track radar elevation gimbal angle is the elevation position in degrees of the track radar antenna relative to the azimuth gimbal. Up is positive and down is negative.

B3

Elevation angle is aircraft elevation angle in tenths of degrees (angle between ADL and horizontal reference).

B4

RTT depression angle in tenths of degrees.

B5

Aircraft roll measured in degrees. Left is negative and right is positive.

C1

Angle of attack in tenths of degrees from AOA probe. With AOA NOMATS set bad, angle displayed will be a computed value.

C2

ADC pressure altitude in hundreds of feet. With static pressure NOMATS bad, readout will be typed in present position altitude.

C3

Error code is a number representing one of 25 computer codes.

C4

Total temperature in degrees Fahrenheit. With NOMATS temperature set bad, readout will be computer-calculated total temperature.

C5

Release advance is the amount in feet, of range offset that has been inserted into the solution. Offsets up to 9999 feet will be indicated to the lowest 100 feet. Values less than 100 feet read zero. The release advance entry is displayed only while the engage button is depressed and the light is on. Zeroes are displayed at all other times.

ATTACK READOUTS

A1

Ballistic solution error in feet times ten.

A2

True airspeed is the same as that displayed in the navigation readouts.

A3

Vertical separation is altitude in feet times ten above the target, and is derived from keyboard inputs or track radar.

A4

Release angle in degrees.

A5

Velocity-correction or moving target velocity is the same as that displayed in the navigation readouts.

B1

Time of fall is computed time of fall of bombs to impact or air burst point, and is displayed in tenths of seconds.

B2

Total inertial speed is total aircraft velocity in space displayed in knots.

B3

Vertical angle error in tenths of degrees. Displayed value is the comparison of AOA probe and calculated AOA.

B4

Computed ballistic range is the downrange travel of the bomb from release to impact or air burst displayed in feet times ten.

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B5

Steering error is the azimuth steering error to the release point in mils. (Plus is left.)

C1

Target tracking code is the highest priority tracking code achieved during the bombing run.

000	Cursor Intersection
001	RTT
010	Ground lock ON
011	GLO used with RTT available as a backup
110	DLO
111	DLO used with RTT available as a backup

C2

True heading is displayed in degrees.

C3

Valid data inhibit codes are numerical designations of valid data tests. The appearance of these codes in conjunction with pathway disappearance indicates a failure of a valid data test for three successive iterations.

CODE	TEST FAILED
111	Ballistic solution error
222	Angle-to-release error
333	Acceleration error
444	Total velocity error
666	Iteration error (080 in NAV)

C4

Normal accelerometer input is the normal g force exerted on the aircraft in tenths of g.

C5

Release advance is the same as that displayed in the navigation readouts.

Error Code Switch

The error code switch is a two-position toggle switch marked READ/ERASE. In the READ position, error codes can be read in the number three window. When the switch is placed to ERASE, the error code appearing in the readout window will be erased and the computer error lights will go out. The switch should normally be left in READ.

Data Select Switch

The data select switch is a three-position toggle switch marked A/B/C. Placing the switch in one of its three positions causes the corresponding data to appear in the computer data readout windows.

Release Advance Button

The RELEASE ADVANCE button is used to enter release advance information into the computer's computations. When the button is engaged and the information is being accepted by the computer, the light in the button is on.

ATTACK DATA FREEZE

When the computer is in an attack condition, all the information available in the right-hand unit attack-navigation panel windows as well as some that is available in the navigation control panel windows is frozen at weapon release. The computer continues to operate normally, but the data in the windows remains unchanged until an action key on the keyboard is depressed. All values in attack-navigation panel windows may be read by moving the data select switch through its three positions. The information that is frozen in the navigation control panel windows depends on the position of the navigation data switch (figure 8-43). When the switch is in PRES POS or DATA at release, present position and data information will be frozen and may be read by making use of the navigation data switch. When the switch is in ON CALL at release, on-call and data information will be frozen.

NAVIGATION OPTIONS

The navigation problem is solved by the ballistics computer, which integrates the navigational data provided by other aircraft systems. This use of the computer makes available a number of navigation options (figure 8-44) depending on the navigation mode selected.

Navigation modes are selected on the navigation control panel and the Doppler platform control panel and are four in number. The modes include Doppler/inertial, emergency Doppler, and dead reckoning. In addition, the MA-1 compass system and the vertical gyro indicator may be used as sources of heading and attitude reference for the computer if the

ATTACK DATA FREEZE

NAVIGATION CONTROL PANEL			
POSITION OF NAVIGATION DATA SWITCH	INFORMATION FROZEN AT RELEASE		
	DATA	PRESENT POSITION	ON CALL
DATA	✓	✓	
PRESENT POSITION	✓	✓	
ON CALL	✓		✓

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Figure 8-43

NAVIGATION OPTIONS

OPTION	NAV MODE SELECTOR	DOPPLER MODE	PLATFORM COMPASS	PANEL INS	NAVIGATION INFORMATION FLOW	SUMMARY
DOPPLER-INERTIAL	INERTIAL	XMIT	COMP IN OR COMP OUT	OPERATE	(1) ATTITUDE INFO FROM INS TO ASQ-61 FOR STABILIZING DOPPLER. (2) DOPPLER INFO THRU ASQ-61 TO INS FOR USE IN VELOCITY RATE CALCULATIONS. (3) THREE - AXIS VELOCITY RATES FROM INS TO ASQ-61. (4) TH FROM INS TO ASQ-61.	(1) FULL USE OF DOPPLER AND INS. (2) MA-1 & VGI FUNCTIONING, BUT NOT BEING USED BY THE ASQ-61. (3) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
PURE INERTIAL	INERTIAL	SILENT	COMP IN OR COMP OUT	OPERATE	(1) THREE - AXIS VELOCITY RATES FROM INS TO ASQ-61. (2) TH FROM INS TO ASQ-61.	(1) FULL USE OF INS. (2) MA-1 & VGI, FUNCTIONING, BUT NOT BEING USED BY ASQ-61. (3) USE IF DOPPLER BAD, OR DURING PERIODS OF ELECTRONIC SILENCE. (4) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
DOPPLER	EMERG-DOPP	XMIT	COMP IN OR COMP OUT	OPERATE	(1) DOPPLER INFO TO ASQ-61. (2) INS ATTITUDE INFO USED TO STABILIZE DOPPLER INFO. (3) TH FROM INS TO ASQ-61. (4) ALTITUDE INFO FROM ADC TO ASQ-61.	(1) FULL USE OF DOPPLER; LIMITED USE OF INS AND ADC. (2) MA-1, VGI FUNCTIONING BUT NOT BEING USED BY ASQ-61. (3) USE IF INS ATTITUDE INFO APPEARS GOOD BUT VELOCITY RATES BAD. (4) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
	EMERG-DOPP	XMIT	MAG/VGI	OPERATE	(1) DOPPLER INFO TO ASQ-61. (2) ATTITUDE INFO FROM VGI THRU ADAPTER TO ASQ-61 FOR USE IN STABILIZING DOPPLER DATA. (3) MAG HEADING, FROM MA-1, IS CORRECTED TO TH BY HAND-SET VARIATION AND SENT THRU INS ADAPTER TO ASQ-61.	(1) FULL USE OF DOPPLER; INS USED TO RELAY VGI DERIVED ATTITUDE INFO AND MA-1 DERIVED COMPASS INFO. (2) USE WHEN INS ATTITUDE AND VELOCITY RATES APPEAR BAD. (3) AIR DATA COMPUTER (ADC) FUNCTIONING AND BEING USED.
AUTOMATIC DEAD RECKONING	DR	SILENT	COMP IN	OPERATE	(1) ALTITUDE AND AIR SPEED DATA FROM ADC TO ASQ-61. (2) TH, ATTITUDE INFO FROM INS TO ASQ-61. (3) KEYBOARD INPUT: WIND DIR/VEL.	(1) LIMITED USE OF INS; ADC IS PRIMARY SOURCE OF NAV INFO. (2) USE IF DOPPLER BAD AND INS VELOCITY RATES BAD.
	DR	SILENT OR OFF	MAG/VGI	OPERATE	(1) ALTITUDE AND AIRSPEED DATA FROM ADC TO ASQ-61. (2) ATTITUDE INFO FROM VGI. (3) MAG HEADING, FROM MA-1, IS CORRECTED TO TH BY HAND - SET VARIATION AND SENT THRU INS ADAPTER TO ASQ-61. (4) KEYBOARD INPUT: WIND DIR/VEL.	(1) ADC IS PRIMARY SOURCE OF NAV INFO. (2) USE IF DOPPLER BAD, AND INS ATTITUDE INFO AND VELOCITY RATE INFO IS BAD.

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Figure 8-44

inertial navigation system fails to provide valid heading and attitude outputs.

DOPPLER/INERTIAL MODE

The Doppler/inertial mode makes full use of navigational equipment available on the aircraft. The inertial navigation system provides digital outputs of aircraft true heading, velocity along three axes (north-south, east-west and vertical), and pitch and roll attitude. The computer makes use of these inertial outputs in its solution of the navigation problem as well as in generating correction signals which are fed back to the INS to keep the platform level. The Doppler system provides unresolved inputs of drift angle and groundspeed. These Doppler inputs are used to damp the Schuler frequency oscillations inherent in the inertial velocities. Doppler damping of inertial velocities is available only when the Doppler memory light is out. The air data computer provides inputs of mach number, static pressure, and pressure altitude, which are used by the computer in its solutions. Data from velocity correct techniques used by the bombardier/navigator are also available to the computer and the INS in this and the other navigation modes. The final result is more accurate navigational data than could be obtained from a single source alone.

INERTIAL MODE

The inertial mode differs from the Doppler/inertial mode in that the Doppler damping of inertial velocities is not available. This mode of operation can be selected by placing the Doppler transmit/silent switch in the SILENT position, or it is caused by a loss of Doppler signal to the computer or by the presence of the Doppler memory signal. All other system inputs are available to the computer.

EMERGENCY DOPPLER MODE

To select the emergency Doppler mode, the navigation mode selector switch on the navigation control panel must be set to EMER DOP. When this mode is used, inertial velocities are not used, and Doppler groundspeed and drift inputs are used directly in the computer's solutions. The emergency Doppler mode would be selected when inertial velocities appear to be invalid. The computer still generates leveling signals for the inertial platform, so the INS may be used as a source of heading and attitude reference. All other system inputs except horizontal velocity-correct are available to the computer as in Doppler/inertial operation. In addition, vertical velocity-correct is available. MAG/VGI reference may be used.

DEAD RECKONING MODE

To select the dead reckoning mode, the navigation mode selector switch on the navigation control panel must be set to the DR position. In this mode of operation, the computer is deprived of both inertial and Doppler velocities. The mode would be selected when both the inertial and Doppler velocities appear to be invalid. The computer still generates leveling signals for the inertial platform, so the INS may be used as a source of heading and attitude reference. Winds must be entered manually through the keyboard or by means of velocity-correct. There is no provision for damping of inertial velocities by means of velocity-correct in the DR mode with the platform in OPER. Other system inputs are still available to the computer. The MAG/VGI position of the compass switch may be used with this mode as with the other modes, but provides the least accurate data.

NAVIGATION CONTROL PANEL

The navigation control panel (figure 8-44A) contains the controls and indicators required to monitor and control the navigation inputs to the computer. The information is displayed on the navigation control panel readouts.

CORRECT POSITION BUTTON

The correct position (CORRECT POS) button (figure 8-44A) on the navigation control panel is used to update the present position when improved data are available. This is accomplished in the following manner: Acquire a ground point of known location with the search radar. Have the coordinates of this point inserted in the computer under one of three steering modes: BASE, PRES TGT, or CHK PT. While in the steering mode, slew the search radar cursors to the point and then depress the correct position button. This will update the latitude and longitude of the computer's present position; present position altitude will not be updated by use of the present position correct. Present position correct is available in all navigation and attack modes.

Figure 8-44A

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NAVIGATION MODE SELECTOR

This three-position toggle switch on the navigation control panel (figure 8-44A) has positions marked INERL (inertial), EMER DOP (emergency Doppler), and DR. The INERL position provides the computer with direct velocity outputs from the inertial navigation system. If the Doppler controller is in the XMIT position, and not in memory, inertial velocities will be Doppler-damped. The weighted resultant is used for attack and navigation computations. Placing the switch to EMER DOP supplies the computer with groundspeed and drift angle from the Doppler radar. With the navigation mode selector in the DR position, the computer uses true airspeed, and will use either the keyboard programmed wind velocity, or a memorized wind value to calculate groundspeed and drift.

NAVIGATION DATA SWITCH

The navigation data switch is a three-position toggle switch marked DATA/PRES POS/ON CALL and is used to select the information used for system navigation to be displayed in the navigation data indicator windows.

NAVIGATION DATA INDICATOR WINDOWS

The three navigation data indicator windows display information selected by the navigation data switch. With the switch set to DATA, windspeed in knots, groundspeed in knots and wind direction in degrees true are displayed.

With the switch set to PRES POS computer-derived aircraft present position is displayed. Latitude and longitude are displayed in degrees and minutes and altitude in feet.

With the switch set to ON CALL, the readouts displayed differ depending on whether the computer is in the navigation condition or has been stepped into attack.

In the navigation condition, with base or target steering selected, the windows display latitude and longitude in degrees and minutes and altitude in feet for the selected target; with navigation checkpoint selected, they display latitude, longitude, and altitude of the checkpoint. With aimpoint 1 or 2 selected, offset distance in feet, offset bearing in degrees and minutes, and keyboard altitude difference in feet between the target and the selected aimpoint are displayed. With opportunity target steering or unstabilized cursors selected, the windows display latitude and longitude in degrees and minutes of the cursor intersection and keyboard preset target altitude in feet.

In attack, the displays for base or target steering and navigation checkpoint are the same as for navigation. With aimpoint 1 or 2, opportunity target or unstabilized cursors selected, the latitude window displays angle of attack in degrees and minutes and the longitude window displays the weapon code. The altitude window readout with aimpoint 1 or 2 selected is the aimpoint altitude in feet above sea level, and for opportunity target steering or unstabilized cursors it is the same as for navigation.

Figure 8-45, illustrates the readouts available when the navigation data switch is set to ON CALL.

MAGNETIC VARIATION SWITCH

The magnetic variation (MAG VAR) switch on the navigation control panel is a five-position switch marked E-INC (east increase), and W-INC (west increase). In the E-INC position, magnetic variation in degrees, is slewed in at two rates; first position slow, second position - fast. The W-INC also has two positions (slow-fast).

MAGNETIC VARIATION COUNTER

The magnetic variation counter, marked MAG-VAR (figure 8-44A), on the navigation control panel is used to display inserted magnetic variation. The E-INC (east increase) and W-INC (west increase) increases the magnetic variation counter from 0° to 180°.

ATTACK INDICATOR

The attack indicator is an amber advisory light on the navigation control panel (figure 8-9) that indicates to the bombardier/navigator whether or not the computer is operating in the attack mode.

Note

Should this light be out during the attack sequence, it will be necessary to reestablish the valid attack requirements to conclude the operation.

This indicator is wired in parallel to another indicator mounted on the face plate of the bombardier/navigator's direct view indicator (DVI). This dual indicator allows monitoring of the attack light at all times.

COMPUTER ERROR INDICATOR

The computer error indicator is an amber advisory light (figure 8-44A) on the navigation control panel, placarded ERROR. This indicator provides the bombardier/navigator with a visual means of monitoring operation of the computer and some associated subsystems. When the indicator is lit, the system has malfunctioned and corrective action should be taken. An indicator light for monitoring system operation is also on the bombardier/navigator's direct view indicator and on the pilot's vertical display indicator.

The computer error indicators remain lit until the computer error switch is moved to ERASE, so that no errors will be inadvertently missed. In attack, the error indication function is transferred to the VDI pathway.

ATTACK-NAVIGATION SYSTEM COMPUTER MODES AND DISPLAYS

LANDING MODE

The landing mode provides the pilot with the basic information required to make a GCA- or CCA-type instrument landing. Glide path centerline, direction, and intended point of landing are selected by the bombardier/navigator by keyboard input of glide path altitude and runway true heading and selection of cursor intersection. Glide path slope angle is selectable by means of the G buttons.

ON CALL READOUTS

P8.6 PROGRAM

FLIGHT, NUC PRACT, OR EMERG BOMB MODE SELECTED

STEERING SELECTED	LATITUDE WINDOW ATTACK	LATITUDE WINDOW NAVIGATION	LONGITUDE WINDOW ATTACK	LONGITUDE WINDOW NAVIGATION	ALTITUDE WINDOW ATTACK	ALTITUDE WINDOW NAVIGATION
BASE NO AIMPOINT	LATITUDE OF BASE		LONGITUDE OF BASE		ALTITUDE OF BASE (1) (2)	
AIMPOINT 1 BASE OR PRESET TGT	NOMATS CODE (3) (4)	RANGE FROM BASE OR PRESET TARGET (FEET x 10)	WEAPON CODE (5)	BEARING FROM BASE OR PRESET TARGET (DEGREES)	CALCULATED AIMPOINT ALTITUDE (FEET MSL) (6)	DIFFERENTIAL ALTITUDE FROM BASE OR PRESET TARGET TO AIMPOINT (FEET)
AIMPOINT 2 BASE OR PRESET TGT						
PRESET TGT NO AIMPOINT	LATITUDE OF PRESET TARGET		LONGITUDE OF PRESET TARGET		ALTITUDE OF PRESET TARGET (1) (2)	
NAV CHK POINT	LATITUDE OF CHECKPOINT		LONGITUDE OF CHECKPOINT		ALTITUDE OF CHECKPOINT	
OPPORT TGT	NOMATS CODE (3) (4)	LATITUDE OF CURSOR INTERSECTION	WEAPON CODE (5)	LONGITUDE OF CURSOR INTERSECTION	CALCULATED OPPORTUNITY TARGET ALTITUDE (FEET MSL) (2) (6)	
UNSTAB-NO STEER						
SHRIKE						

LANDING MODE SELECTED

BASE NO AIMPOINT	LATITUDE OF BASE		LONGITUDE OF BASE		ALTITUDE OF BASE (1) (2)	
PRESET TGT NO AIMPOINT	LATITUDE OF PRESET TARGET		LONGITUDE OF PRESET TARGET		ALTITUDE OF PRESET TARGET (1) (2)	
NAV CHK POINT	LATITUDE OF CHECKPOINT		LONGITUDE OF CHECKPOINT		ALTITUDE OF CHECKPOINT	
ALL OTHER STEERING SELECTIONS	NOMATS CODE (3) (4)	00000	WEAPON CODE (5)	LAND MODE OR GROUND TRACK BOMBING COMMAND TRACK	CALCULATED OPPORTUNITY TARGET ALTITUDE (2)	G BUTTON SELECTED GLIDE SLOPE ANGLE

NOTE

1. KEYBOARDED VALUE OF BASE/TARGET ALTITUDE IS DISPLAYED; TRACK RADAR DERIVED ALTITUDE IS NOT DISPLAYED.
2. AFTER GROUND OR DISCRETE LOCK-ON IS ACQUIRED, TRACK RADAR DERIVED ALTITUDE (ABOVE MSL) IS MEMORIZED UNTIL TRACK RADAR POWER SWITCH IS TURNED TO STBY OR OFF. WITH SRTT ON, AFTER A SEARCH VALID INDICATION, SEARCH RADAR DERIVED ALTITUDE (ABOVE MSL) IS MEMORIZED UNTIL STEERING IS CYCLED OR RANGE TO TARGET EXCEEDS 5 NM (TRACK RADAR NOT IN XMIT). IF TRACK RADAR HAS A LOCK ON, SEARCH RADAR DATA IS NOT PROCESSED.

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Figure 8-45 (Sheet 1)

ON CALL READOUTS - continued

NOTE

3. N O M A T S CODE:

N	—	
O	—	
M	MACH NUMBER	0 = BAD 1 = GOOD
A	ANGLE-OF-ATTACK	
T	TEMPERATURE	
S	STATIC PRESSURE	

4. FOR STRAIGHT PATH ATTACK NOMATS CODE AND PHD TIME WILL NOT BE DISPLAYED IF:
   - TARGET ALTITUDE IS ABOVE AIRCRAFT PRESENT POSITION ALTITUDE
   - FLIGHT PATH VECTOR IS BELOW THE TARGET (VDI IMPACT POINT BELOW THE TARGET SYMBOL).

5. WEAPON CODE READOUT:
   A. WITH STRAIGHT PATH, GENERAL, OR HIGH LOFT ATTACK MODE SELECTED, THE FOLLOWING CODED READOUTS WILL VERIFY COMPUTER VALUES FOR BALLISTICS FOR THE SELECTED BOMB:

WEAPON SELECTED	ON CALL LONG	WEAPON SELECTED	ON CALL LONG
MK 61F	W06100	MK 20 MER	W02000
MK 57F	W05700	MK 15 MER	W04000
MK 43F	W04300	MK 116 MER	W11600
MK 28	W02800	MK 83 TER	W08333
MK 61R	W06150	MK 82 MER	W08200
MK 57R	W05750	MK 81 MER	W09401
MK 43R	W04350	825 MER F	W08211
CBU-3	W03203	815 MER F	W08111
CBU-1/2	W03212	MK 84	W08400
MK 106 X4D	W10600	MK 83	W08300
825 MER R	W08250	MK 79	W07701
815 MER R	W08150	MK 76 X4D	W07604

   B. WITH ROCKET ATTACK MODE SELECTED, THE FOLLOWING CODED READOUTS WILL VERIFY COMPUTER RECOGNITION OF BALLISTICS FOR THE SELECTED ROCKET:

WEAPON SELECTED	ON CALL LONG
D	—
MK 4	—
B	—
A	—
SHRIKE	W02755
2.75	W02750
ZUNI	W05555
MK 83	W03900

6. ALTITUDE ABOVE SEA LEVEL WILL BE DISPLAYED. WHEN A RADAR LOCK-ON HAS BEEN ACQUIRED, THE READOUT WILL BE RADAR DERIVED ALTITUDE ABOVE SEA LEVEL.

ADA1-812-2

Figure 8-45 (Sheet 2)

Glide Path Slope Angle

Glide path slope angle is selected by considering the rate of descent desired for a nonflared landing, the desired approach airspeed, and wind over the deck (headwind component). A standard to follow in this respect is the one established for setting the mirror or lens angle. For instance, with a 3.5° glide slope angle selected, using a rotating reflector located at the approach end of the runway (no offset), at an approach groundspeed of 112 KIAS, the sink rate is 11 1/2 feet per second. For the same indicated airspeed, landing into a 10-knot wind reduces the sink rate to 10 feet per second.

The glide path slope indication provided to the pilot is in the form of vertical display variable pathway width. Within 1 nmi of touchdown, a full narrow pathway (figure 8-46) indicates that the aircraft is 300 feet or more above the desired glide slope. At a range greater than 1 nmi, this same indication represents 3° or more above desired glide slope. The full width pathway (figure 8-46) indicates that the aircraft is 50 feet or more below desired glide path slope. At ranges of greater than 1 nmi, the same indication represents 1/2 or more below the flight path.

Note

The sensitivity of the pathway width to altitude or glide slope angle error is considerably less above the glide slope than below. Altitude corrections should be made accordingly.

Glide Path Bearing

The bombardier/navigator selects cursor position or track radar lock-on in combination with appropriate keyboard offset data so as to describe the intended point of landing. Coupled with a keyboard input of glide path bearing (true heading in degrees and minutes), this information is used to establish the glide path horizontal position, or extension of the landing runway. Difference between radar-measured bearing to intended point of landing and desired glide path bearing is used to position the display near-point at ranges of 1 nmi or more. At closer ranges, the near-point is positioned by the computed distance, from the glide path center line.

With the aircraft centered on the selected glide path, the near-point of the vertical display pathway centerline appears to pass directly below the aircraft (figure 8-46). In wings-level flight, the near-point is therefore directly below display center. At ranges less than 1 nmi, full right or left displacement of the near-point (figure 8-46) indicates that the aircraft is 136 feet or more left or right of the intended glide path. At ranges greater than 1 nmi, this same indication represents about 1 1/2° or more left or right of intended glide path. The horizontal angular or distance scaling remains the same in all modes. If track lock-on exhibits a tendency to shift position, landing mode near-point appears to be erratic. A well-defined and unique radar target is thus required for optimum glide slope information.

Note

- Glide slope, near-point position, is particularly sensitive to small corrections in cursor repositioning if track lock-on is not available. Therefore, care should be used in selecting prominent radar targets for use in landing mode.
- The accuracy of landing mode glide slope displacement in offset or opportunity target modes is predicated on prior knowledge of exact bearing and altitude relationships between radar targers and the intended point of landing.

Pathway Vanishing Point

The keyboard input of glide path bearing is compared with computed aircraft ground track and the difference used to position the pathway venishing point along a line through the display center and parallel with the display horizon. Twenty-seven degrees or more of difference causes full right or left displacement of the vanishing point.

Note

- A computer airspeed or groundspeed error will cause errors in computer ground track and erroneous near-point and vanishing point positions. Computed windspeed and direction should be monitored for accuracy during the landing.
- Changes in actual wind or aircraft airspeed during the descent will require the pilot to make continuous heading and displacement corrections.

USE OF LANDING MODE

Command steering and command glide angle are displayed by steering symbol position, circling orientation to the runway extension is automatically provided, and glide slope angle is selectable by means of the G buttons.

The use of the steering symbol in the landing mode is the same as its use in rocket or straight path attacks.

Altitude command is based on range to the point of intended landing and selected glide slope angle. Glide slope angle is selected by depressing the G button corresponding to the angle desired. For example depressing the button marked 3.5 will result in a 3.5° glide slope and corresponds to an altitude of 370 feet per nautical mile of range. Command glide angle required to zero altitude error is displayed by the steering symbol vertical position. Thus with the steering symbol centered vertically, the aircraft will intercept the desired glide slope. The amount of altitude error is indicated by pathway width.

Steering command is displayed by the horizontal position of the steering symbol. Steering commands are programmed so that centering the steering symbol horizontally orients the aircraft position with respect to the runway centerline extension and allows

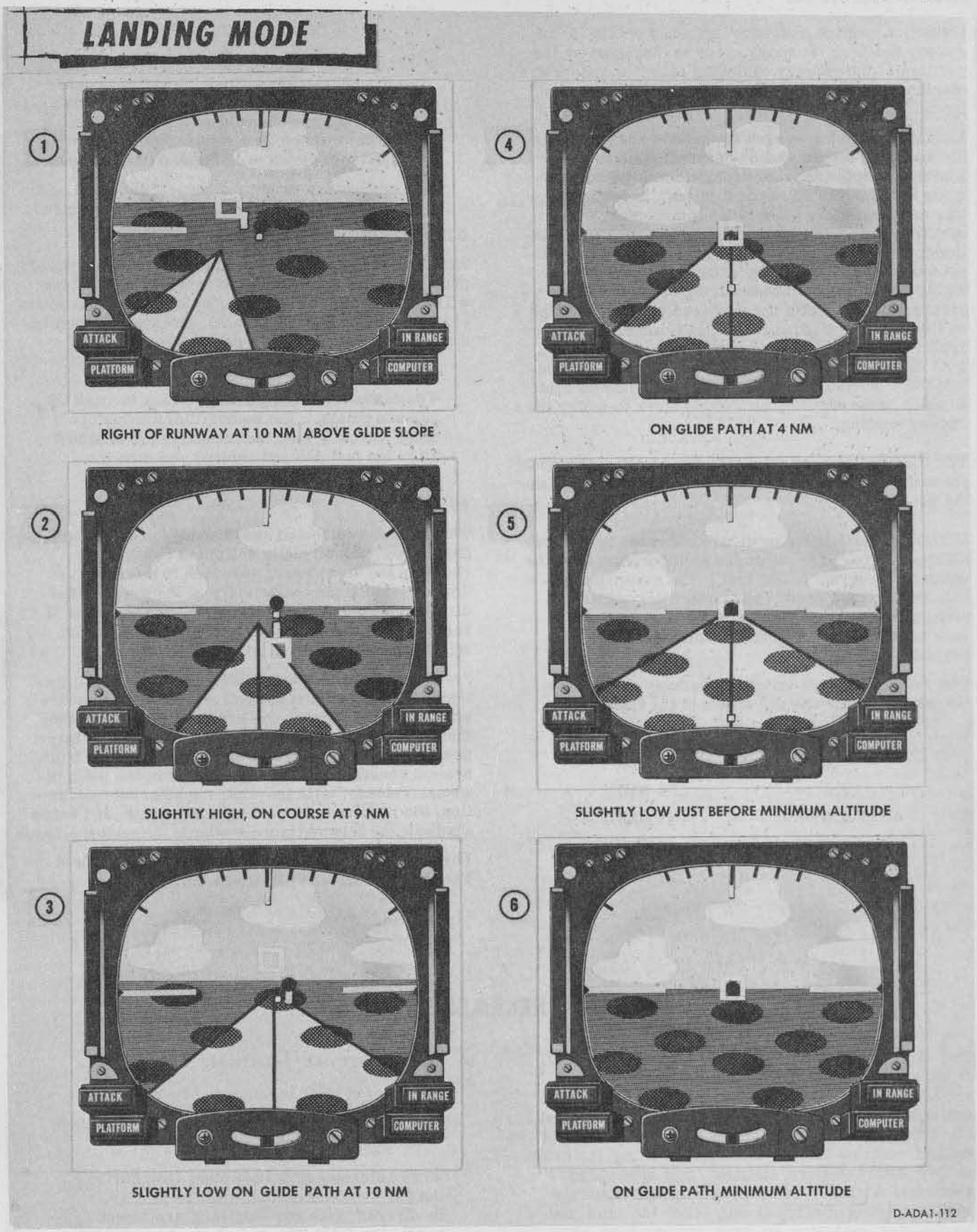

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Figure 8-46

transition to glide path intercept when within 30° of runway heading. Steering error is displayed by the position of the pathway vanishing point, and aircraft displacement from the extension runway centerline by the pathway near-point.

Maximum steering symbol commands are limited to 30° bank, 4° climb, and 6° descent. Due to these limits, the optimum range for selection of landing mode is from 4 to 10 nautical miles. Selection in this area will allow glide slope interception without overshooting and will keep orientation time to a minimum. A circling orientation is based on the smallest angle (the shortest way around) either left or right. Steering commands during orientation are programmed so that a constant-radius turn centered on the point of intended landing is flown until the aircraft is within 30° of the keyboard runway heading. With the steering symbol centered, a smooth transition from orientation to glide path command is made so as to cause the aircraft ground track to match the runway heading.

The PHD bug and optical sight moving reticle provide the same steering information as the pathway vanishing point.

Minimums for landing mode are indicated by pathway disappearance. The minimum as incorporated in the computer program is 200 feet. The minimum altitude with a track radar lock-on is track-radar-derived and with search radar is the computed difference between present position altitude and target keyboard altitude.

The actual ranges at which the pathway disappears for minimum altitude are shown in the table below:

Glide Slope	Range
3.0°	.63 NMI
3.5°	.54 NMI
4.0°	.47 NMI
4.5°	.42 NMI
5.0°	.38 NMI

Note

- Track radar landing mode is subject to low grazing angle/low altitude elevation errors with a discrete lock-on. Use of track radar for landing mode should be restricted to a discrete lock-on on a rotating reflector or ground lock-on on well-defined fixed targets.
- A momentary pathway disappearance will occur when a ground or discrete lock-on is acquired.

GTB (GROUND TRACK BOMBING) MODE

With the GTB/LAND button on the navigation control panel depressed, stepping the computer into attack will give the pilot attack steering to all release points along the desired ground track. Present position update is available with GTB selected.

Note

The computer will remain in attack through the release points. The bombardier/navigator must manually step the computer out of attack after the last desired release and turn the MASTER ARM OFF.

ATTACKS

The computer-directed attack modes provide the flight crew with virtually unlimited flexibility in choosing the direction of approach to a target, the dive or glide angle for delivery of the weapon, the airspeed for the selected delivery, and the point of release of the weapon once inside the range from which a weapon can reach the target.

Several system delivery modes are available to meet the desired effect and tactical situation. These are straight path, general, hi-loft, and rocket. During these attacks, the ballistics computer accepts target position data and aircraft velocity information from system sensors, continuously computes the point of weapon release, tells the pilot, via steering information, the required ground track for release, and sends a pulse to the selected store station at the point of release.

For further information on attacks, refer to the A-6 Tactical Manual NAVAIR 01-85ADA-1T.

WEAPON RELEASE SYSTEM

The aircraft weapon release system (figure 8-47) is capable of transporting and delivering a variety) of conventional weapons (bombs, rockets, cannons, and missiles) and special stores against air and surface targets. The system consists of cockpit controls and indicators, mounting facilities at five external store stations, and associated electrical wiring. The release system controls are completely electrical and allow the pilot and bombardier/navigator to arm and release various weapons, fire rockets and missiles, and to jettison weapons selectively or simultaneously.

CAUTION

When releasing ordnance other than Shrike, the Shrike power switch must be at OFF. In aircraft with the auxiliary armament panel, the PWR SEL switch must be at OFF or REL DELAY.

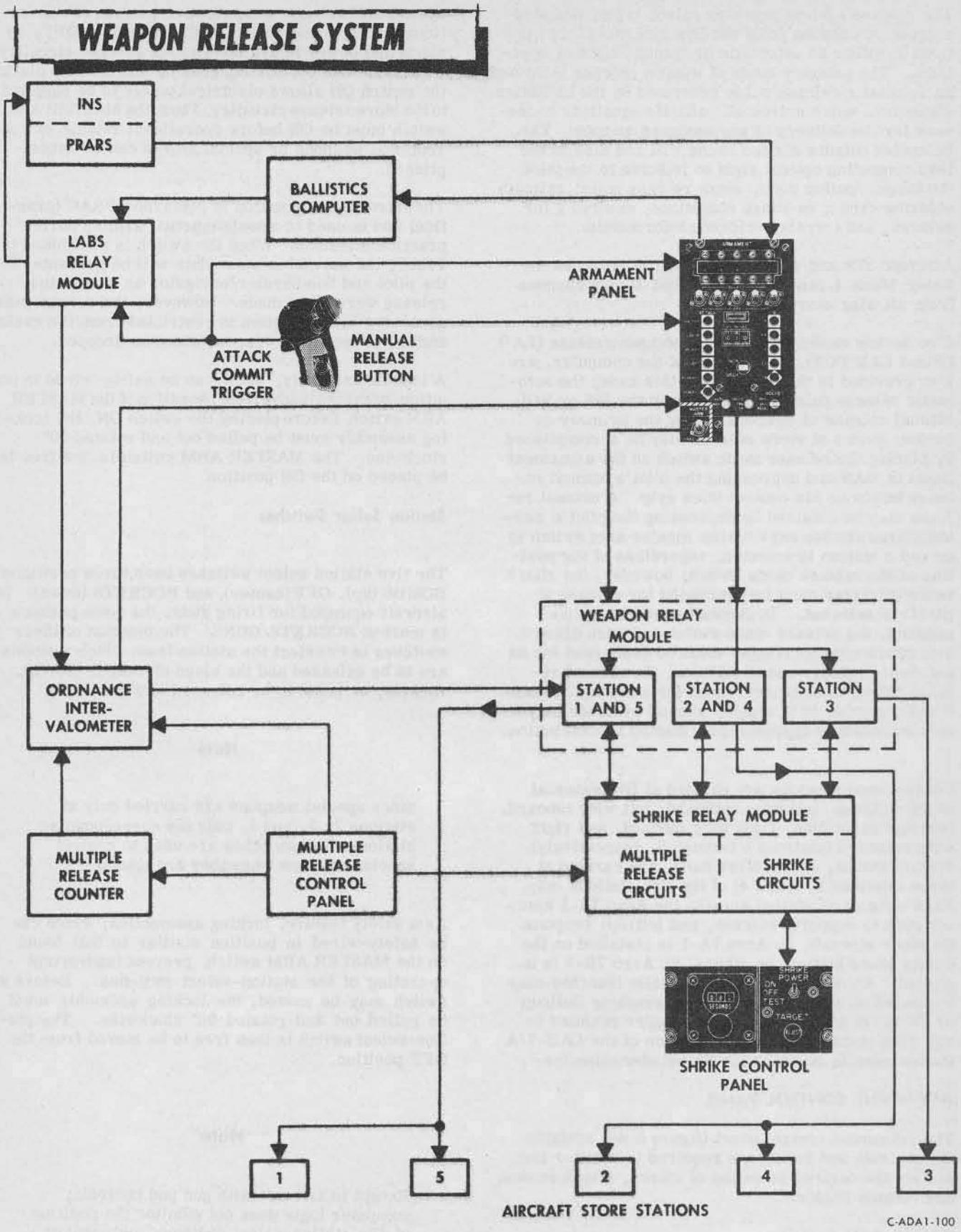

Figure 8-47

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The release system provides salvo, train, and step release of weapons from the five external store stations in either an automatic or manual mode of operation. The primary mode of weapon release is through an automatic release pulse generated by the ballistics computer, which solves all ballistic equations necessary for the delivery of any assigned weapon. The computer outputs are fed to the VDI and also to the lead computing optical sight to indicate to the pilot the target, pullup point, store release point, azimuth steering error, in-range conditions, desired g for release, and terrain avoidance information.

Aircraft 373 and subsequent provide controls for firing Mark 4 Mod 0 pod-mounted 20mm cannons from all wing store stations.

Two backup modes of automatic weapon release (LAB IP and LAB TGT), independent of the computer, are also provided in the system. In this case, the automatic release pulse is generated by the INS or VGI. Manual release of weapons during the primary or backup modes of store release may be accomplished by placing the release mode switch on the armament panel in MAN and depressing the pilot's manual release button on his control stick grip. A manual release may be obtained by depressing the pilot's manual release button any time the master arm switch is on and a station is selected, regardless of the position of the release mode switch; however, the attack commit trigger must be depressed for release if AUTO is selected. In aircraft equipped to fire cannons, the release mode switch has been deleted. The attack commit trigger must be depressed for an automatic release and in addition, the manual release button must be depressed for a manual release. If the computer is in attack, manual override may be accomplished by depressing the manual release button.

Conventional weapons are carried at five external store stations: left wing outboard, left wing inboard, fuselage centerline, right wing inboard, and right wing outboard (stations 1 through 5, respectively). Special stores, on the other hand, are carried at three (stations 2, 3, and 4) of the five stations only. Each wing store station accepts the Aero 7A-1 ejector rack to support, release, and jettison weapons. On some aircraft, an Aero 7A-1 is installed on the center store station; on others, an Aero 7B-1 is installed. An Aero 5A-1 guided missile launcher may be loaded on any wing station for launching Bullpup or Shrike missiles. A special adapter mounted on any wing station permits installation of the LAU-7/A guided missile launcher for Sidewinder missiles.

ARMAMENT CONTROL PANEL

The armament control panel (figure 8-48) contains the controls and indicators required to monitor and control the desired selection of stores, attack modes, and release modes.

MASTER ARM Switch

A three-position lever-lock MASTER ARM switch (figure 8-49) monitors the power supply necessary for operational release and selective jettison of conventional and special stores. With the switch OFF, no electrical power is available to the release circuitry. However, with the landing gear up and locked, placing the switch ON allows electrical power to be supplied to the store release circuitry. Thus, the MASTER ARM switch must be ON before operational release of conventional weapons or special stores can be accomplished.

The third switch position is placarded PRAC (practice) and is used to simulate actual arming during practice missions. When the switch is positioned to PRAC, the normal mission data will be presented to the pilot and bombardier/navigator as if an actual release were to be made. However, the release pulse generated by the system is restricted from the racks, and the preselected weapon cannot be dropped.

A locking assembly, which can be safety-wired in position, prevents inadvertent operation of the MASTER ARM switch. Before placing the switch ON, the locking assembly must be pulled out and rotated 90° clockwise. The MASTER ARM switch is now free to be placed on the ON position.

Station Select Switches

The five station select switches have three positions BOMBS (up), OFF (center), and ROCKETS (down). In aircraft equipped for firing guns, the down position is marked ROCKETS/GUNS. The function of these switches is to select the station from which weapons are to be released and the class of weapon (bombs, rockets, or guns) to be released or fired.

Note

Since special weapons are carried only at stations 2, 3, and 4, only the corresponding station-select switches are used to control special weapons when they are loaded.

As a safety feature, locking assemblies, which can be safety-wired in position similar to that found on the MASTER ARM switch, prevent inadvertent operating of the station-select switches. Before a switch may be moved, the locking assembly must be pulled out and rotated 90° clockwise. The station-select switch is then free to be moved from the OFF position.

Note

Except in aircraft with gun pod controls, computer logic does not monitor the position of the station-select switches, only that at least one station is selected. Improper positioning will result in the improper release of stores.

ARMAMENT PANEL

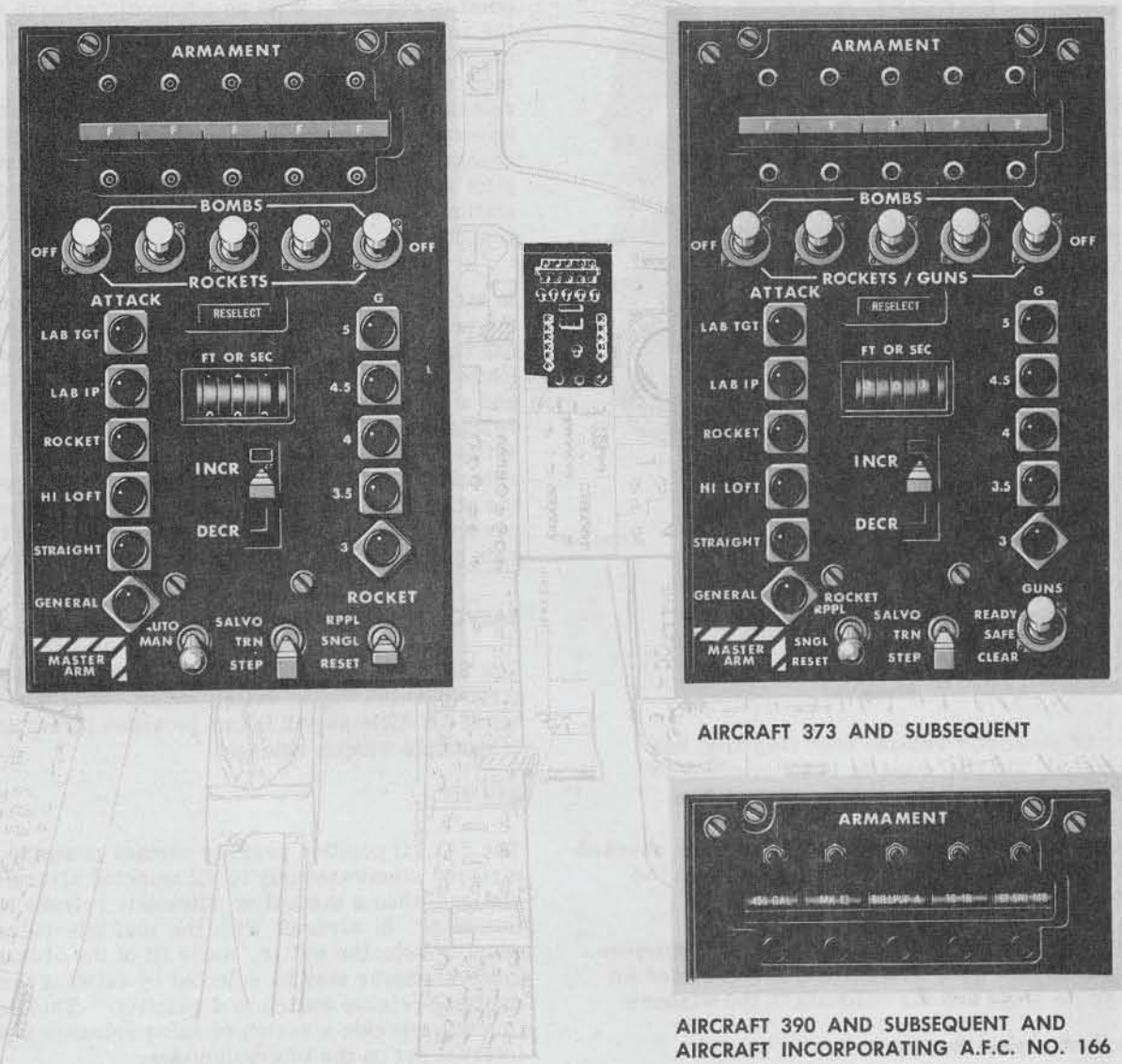

Figure 8-48

In aircraft with the Mk-4 gun pod controls, some protection is provided against improper positioning of the station select switches. With a rocket attack selected, and rockets in the weapon-loaded readout window, if any one of the station-select switches is at BOMBS, reselect logic inhibits automatic release and the reselect light will go on when the MASTER ARM switch is moved to ON.

Weapon-Loaded Readout Windows

A weapon-loaded readout window is located above each station-select switch. The readouts are used to select the programmed ballistics coefficients in the computer corresponding to the weapons actually loaded on the aircraft, by means of tape setting plungers located below the windows. In addition, a flag for each station drops to mask the tape readout to indicate that a release pulse has been directed to the station. On a rocket attack, the rocket mode switch must be in the RPPL position for flag drop to occur. The flags may be reset by using the tape reset plungers located above the readout windows.

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In aircraft equipped with guns, firing or clearing the guns does not cause a flag drop.

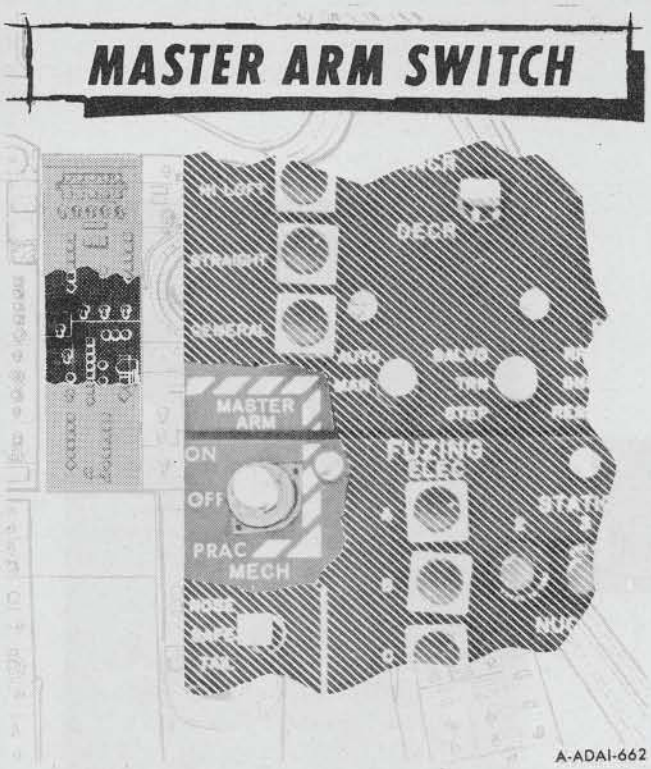

Figure 8-49

Note

For an automatic release once flag drop has occurred, the flag must be reset in order to direct subsequent release pulses to a station.

The weapon-loaded readout windows should be checked before takeoff to be sure that they agree with the weapons actually loaded.

In aircraft 390 and subsequent and aircraft incorporating A. F. C. No. 166, pushbuttons are provided for resetting the flags and the readouts in the windows.

Attack Mode Select Buttons

The attack mode selector buttons (figure 8-48) allow for selection of an attack mode and instruct the computer as to the particular attack mode to solve. The six pushbuttons are placarded GENERAL, STRAIGHT, HI-LOFT, ROCKET, LAB IP, and LAB TGT.

Release Mode Switch

Except in aircraft with MK-4 gun pod controls, a two-position release mode toggle switch (figure 8-48) allows selection of either of two modes of weapon release: manual (MAN) or automatic (AUTO). Placing the switch to MAN permits the pilot to release the stores manually by depressing the manual release button on the control stick grip. A manual release may be obtained regardless of the position of the release mode switch by depressing the pilot's manual release button on the control stick grip, provided the attack commit trigger is depressed. Placing the release mode switch to AUTO allows the store to be automatically released when the proper release point is reached. With an automatic release selected, the release signal is generated by the computer during the general, straight, rocket, and hi-loft attack modes. During LAB IP and LAB TGT attack, the release angle is preset in the platform adapter, which generates a release signal when the VGI or INS reaches the preset release angle, provided that the pilot's attack commit trigger is depressed and the station-select and MASTER ARM switches have been positioned.

In aircraft equipped with the Mk-4 gun pod controls, the release mode switch is deleted but the pilot still has the option of selecting either manual or automatic release. With the MASTER ARM switch at ON, and a station selected, the pilot may obtain a manual release at any time by depressing the manual release button on the stick grip or he may select an automatic release by depressing the attack commit trigger on the stick grip. If the computer is in attack, manual override may be accomplished by depressing the attack commit trigger and the manual release button.

SALVO/TRN/STEP Switch

The SALVO/TRN/STEP switch (figure 8-48) is a three-position toggle switch which, when the MASTER ARM switch is on, provides three modes of multiple weapon release.

SALVO

The SALVO position permits release power to be directed simultaneously to all selected aircraft stations when a manual or automatic release is initiated. In aircraft with the multiple-release quantity selector switch, mode III of the ordnance intervalometer may be selected by rotating the multiple-release switch to a quantity. This selection will provide a series of salvo releases at the interval set on the intervalometer.

TRN

The train position permits release power to be directed sequentially at the interval set on the ordnance intervalometer to all selected aircraft stations in 1, 5, 2, 4, 3 order when an automatic or manual release in initiated. In aircraft with the Snakeye multiple-release switch, mode I of the ordnance intervalometer is used, which provides a train of five release pulses. In aircraft with the multiple-release rotary quantity selector switch, when the multiple-release switch is off, mode I of the intervalometer is used; when the multiple-release switch is rotated to a quantity, mode III of the intervalometer is used, which provides the selected number of release pulses.

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STEP

The STEP position permits release power to be directed to one selected aircraft station each time a release is initiated, stepping to the next selected station in 1, 5, 2, 4, 3 sequence with each successive release pulse. Release may be manual or automatic; however, an automatic release will provide only one release pulse.

G Select Buttons

Since the computer uses a fixed 4-g value for all pullup commands, the five G pushbuttons marked 3, 3.5, 4, 4.5, and 5 have three functions, none of which relates to the g-schedule used by the computer. NEW In aircraft with the P7B TRIM program, the primary function of the G buttons is to select the ground range at which the cursor intersection is initialized with UNSTAB-NO STEER selected.

NEW In both P7B TRIM and P8.6 aircraft, in emergency straight path bombing, they are used to select the mach number to be flown and in the landing mode, they are used to select the desired glide path angle.

Ordnance Intervalometer

The ordnance intervalometer (figure 8-48) consists of the counter, the slew switch, and transistorized circuitry. The readout counter is a three-digit rotating drum type with a range from 000 to 999. The counter is set by a momentary five-position slew switch spring-loaded to the off (center) position and marked INCR (up) and DECR (down). Holding the switch in either extreme off-center position causes the counter to move at a fast rate. The two intermediate positions provide a slower slew speed. Three modes of operation are available: Modes I and III which are used with rocket, hi-loft, straight path, and general attack modes; and mode II, which is used with the LAB IP and LAB target attack modes. For mode I and III operation, the counter can be set to the nearest hundredth of a second; for mode II, to the nearest tenth of a second. To accommodate this difference in counter readout, a decimal point shift occurs when the mode is changed. The choice of mode is made when one of the attack mode switches on the armament panel is depressed.

Mode I of the intervalometer functions only when a train release is selected with the multiple-release switch off. In mode I operation, the counter is used to select the interval in seconds between succeeding pulses in a train of five pulses. The intervalometer has a range of from 0.06 to 2.00 seconds in 0.01-second steps. If the counter is set to a value outside this range, the intervals produced by the intervalometer will be at the nearest limit. Setting the SALVO/TRN/STEP switch to TRN allows the release signal (manual or automatic) to trigger the intervalometer. Once triggered, the intervalometer produces five release pulses.

For mode II operation, the counter is used to set LABS timing. The counter can be set from 00.0 seconds to 99.0 seconds in 00.1-second steps. When triggered by the pilot, the counter returns to zero at a real time rate.

Mode III functions only when the multiple-release switch is in a position other than OFF. For mode III operation the intervalometer will, when triggered by a release signal, emit the number of release pulses selected on the multiple-release rotary switch. The counter operates in the same manner and over the same range as for mode I. The system will be automatically reset at the end of each release cycle and the RESET indicator will light.

Weapons Reselect Light

The weapon reselect light (figure 8-48) is controlled by circuits within the ballistics computer. When lit, the reselect light indicates that no attack solution is, or will be generated. Failure of the computer to enter an attack mode results when the MASTER ARM switch is OFF and the attack or uncage switch is depressed, or when the MASTER ARM switch in ON and some incompatible setting of the armament switches exists. A duplicate reselect light is on the bombardier/navigator's DVI face plate.

Note

For conventional stores, the computer does not differentiate between those requiring electrical and mechanical fuzing. Regardless of the type required for the store, selection of either electrical or mechanical fuzing will satisfy the reselect logic of the computer, and cause the reselect light to go out, provided the remaining reselect logic conditions have been met.

In aircraft incorporating the auxiliary armament control panel, the position of the PWR SEL switch is monitored by reselect logic. If the switch is at REL DELAY, a computer release is inhibited and the reselect light will come on when the uncage boresight button on the control stick or the attack button on the slew grip is depressed. In aircraft incorporating gun pod controls, with the rocket attack button depressed and rockets in the weapon-loaded readout windows, if any of the station-select switches is at BOMBS, a computer release is inhibited and the reselect light will come on when the MASTER ARM switch is moved to on.

Rocket Mode Switch

The rocket mode switch (figure 8-48) is a three-position toggle switch marked RPPL/SNGL/RESET. Placing the switch to the RPPL position permits release power to be applied to the selected aircraft stations along the ripple fire line. Placing the switch to the SNGL position permits release power to be applied to the selected aircraft stations along the single fire line. Placing the switch to the RESET position causes the weapon release relay to be reset for a new release cycle.

With the rocket mode switch in the RPPL position, a manual or automatic release pulse applies release power to the selected aircraft stations. Release power remains on the selected stations until the rocket mode switch is repositioned to RESET or the MASTER ARM switch is set to OFF.

Note

Unless the jumper cable is installed when a rocket launcher with a stepping switch installed is loaded, improper use of the rocket mode switch may result in the inadvertent firing of a rocket. Place THE MASTER ARM switch to OFF before selecting either RPPL or SNGL.

With the rocket mode switch in the SNGL position, a manual or automatic release pulse applies release power to the selected aircraft stations. Release power remains on the selected stations for the duration of the automatic release pulse or until the pilot's manual release button is released.

GUN POD CONTROLS

Aircraft 373 and subsequent are equipped to fire pod-mounted 20mm cannons from all wing stations. The Mark 4 Mod 0 gun pod is designed to provide air-to-ground capability against area or point targets and has a secondary air-to-air capability. Each pod has a capacity of 750 rounds and may be fired at either 4000 or 700 rounds per minute as selected by the SLOW/FAST switch on the pod junction box. The pod has an automatic charging feature, which operates in the event of a dud or misfire. This automatic charging may be disabled by removing a jumper in the pod. Without automatic charging, the guns must be charged by the operator to return them to operation after a misfire. The gun pods are self-contained but require 28 V dc from the primary bus for charging, 28 V dc from the essential bus for clearing, and 115V 400-Hz ac from the primary bus for firing. The guns are controlled by means of the gun pod switch on the armament control panel and are fired by means of the attack commit trigger on the stick grip.

Gun Switch

The gun switch (figure 8-48) is a three-position toggle switch marked READY/SAFE/CLEAR. When the switch is at SAFE or the landing gear is not up and locked, no power is applied to the gun pods. With the landing gear up and locked, placing the switch to READY charges the guns in all pods. With the gun switch at READY, selecting ROCKETS/GUNS on the desired station-select switch, and setting the master arm switch to ON permits the pilot to fire the guns by depressing the attack commit trigger on the control stick grip.

Note

- When the gun switch is at READY, the function of the attack commit trigger is gun firing only.
- If BOMBS is selected on the station-select switches, depressing the attack commit trigger will not fire the guns.

With the landing gear up and locked, placing the switch to the momentary CLEAR position provides 28 V dc to clear all the guns. This voltage is provided for an additional 5 seconds after the gun switch is released from the CLEAR position. Clearing the guns renders them inoperative. The switch is provided with a lock to prevent inadvertent selection of CLEAR.

CAUTION

The guns cannot be fired again after they have been cleared. Placing the gun pod switch to READY after having placed it at CLEAR will result in a jam of the ammunition belt links.

FUZING CONTROL PANEL

The fuzing control panel (figure 8-50), below the armament control panel, contains the fuze function control and the T-375 monitor control system controls. The fuze function control system is used to arm conventional weapons, and consists of a fuze function power supply and electrical wiring to the five stations. The T-375 monitor control system monitors and controls the arming and diarming of the special stores. The system consists of the required cockpit controls and indicators and associated electrical wiring to the special stores, which can be loaded only at stations 2, 3, and 4.

Mechanical Fuzing Switch

The mechanical switch (MECH) (figure 8-50) is a three-position toggle switch marked NOSE, TAIL,

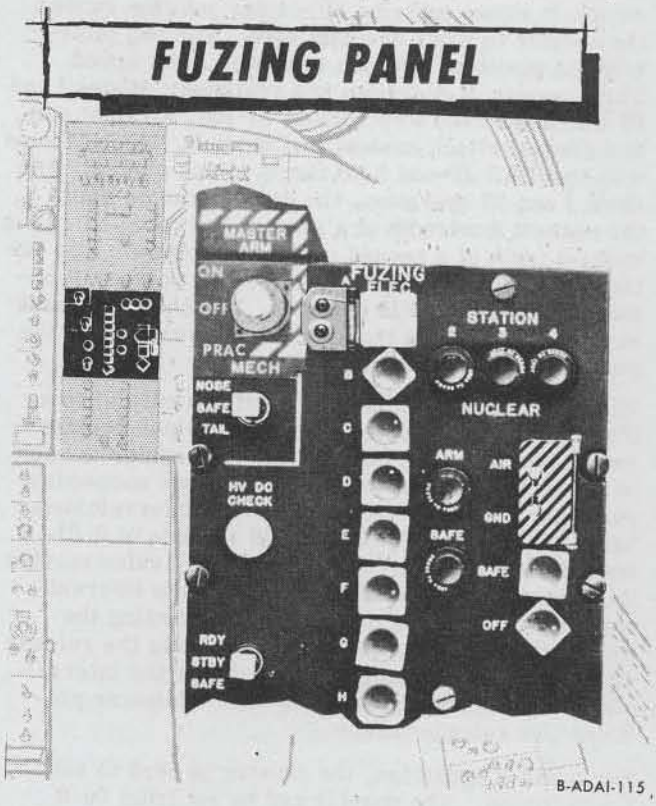

Figure 8-50

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and SAFE, and controls nose and tail arming of conventional weapons. Placing the switch to NOSE energizes both the nose and tail solenoids in the bomb racks so as to retain the arming wires that in turn are attached to the nose and tail mechanical fuzes of the weapon. With the switch placed to TAIL, only the tail solenoid is energized. Placing the switch to SAFE will cause either solenoid to be energized. Should a weapon be released with the switch in the SAFE position, both arming wires will fall free of the bomb rack, still attached to the weapon, thus preventing arming of either mechanical fuze. When the aircraft is equipped with MER-7 or TER-7 bomb racks (not set on SALVO), the mechanical fuzing switch performs the function of determining rack station sequence for successive release pulses when less than the maximum number of rack stations have been loaded. Placing the switch to TAIL will not cause the unloaded MER-7 TER-7 station to be bypassed, provided that the forward suspension hook of the unloaded station is opened.

AN/AWW-1 Controls

Fuzing Power Switch

This three-position toggle switch, marked SAFE, (STBY) standby, and (RDY) ready prepares the arming circuits for use. With the switch placed at SAFE, no electrical power is available to the system.

Note

Oscillator plug-in units and the retaining fuzing templates of the Fuze Function Control Set AN/AWW-1 should be removed from the aircraft when it is intended to employ electric fuzes only in the dc modes. This will prevent inadvertent selection of any available rf modes from resulting in possibly hazardous change in arming and/or functioning time.

Fuzing Select Buttons

Eight pushbuttons marked A through H (figure 8-50) are used to select one of 18 arming and impact delay combinations for charging both dc and rf type fuzes. The combinations used will be determined by fuzing templates installed in the fuze function control set in the aft equipment bay. Positions A through D are used to provide the options for charging rf type fuzes. Positions E through H are used to provide the options for charging dc type fuzes, such as the Bullpup missile, and other bomb fuzes that require no RF energy.

Note

- In aircraft incorporating AAC 592, the RF fuzing capability has been permanently disabled and the fuze function control set has been redesignated AN/AWW-8.
- For salvo release of electrically fuzes bombs, the reliability of electric fuzing diminishes with an increased number of bombs released. Inherent limitations of the AN/AWW-1 fuzing may result in duds during salvo release. The AWW-1 system provides arming energy for only 1 second following initial release signals. To provide positive arming of all weapons, the manual release button must be depressed and held throughout the entire release sequence.

HIGH-VOLTAGE CHECK BUTTON/LIGHT

The high-voltage dc check button and light marked HV DC CHECK (figure 8-50) is used to check the electrical continuity of the entire weapon fuzing system before a mission and weapon release.

T-375 CONTROLS

Nuclear Select Buttons

Four pushbuttons, OFF, SAFE, GND, and AIR control arming and safing of the special stores and allows for selection of either a ground (GND) or AIR burst.

Depressing the safe button releases the off button and directs 28-volt dc electrical power to the special store fuzing circuits. The normal off condition of corresponding station disagreement lights indicates that all stores are safe to carry or return, or are ready to be armed.

CAUTION

Never go directly from OFF to AIR or GND. The SAFE button must first be depressed for a period of 10 seconds (safe light lit).

A locking assembly over the GND and AIR buttons serves as a safety device and prevents inadvertent arming of the special stores. To arm the stores, the locking pins must first be compressed, and the guard over the pushbuttons lifted. The special stores being carried may now be armed by depressing either the GND or AIR button, depending upon the desired type of burst.

WARNING

- Do not depress the AIR or GND buttons under any circumstances when the aircraft is on the ground and special stores are loaded on the aircraft.
- When the AIR or GND buttons are depressed, all special stores being carried on the aircraft will assume an armed condition.

When the SAFE button is again depressed, following arming of the stores, the GND or AIR button is automatically released; the guard over these buttons must be returned to its former position and locked.

Note

The nuclear selector OFF button must be depressed before and during takeoff. Before landing, the OFF button must be depressed.

Safe Light

A press-to-test safe indicating light (figure 8-50) monitors the T-375 system circuits. The light comes on when the SAFE button is depressed to

indicate that the motorized switch in the aircraft is in the safe position. When the OFF, GND, or AIR button is depressed, the safe light is off.

Note

When the SAFE button is depressed, following arming of the stores, the ARM light will remain lit momentarily. This is normal. The ARM light will go off at completion of the safing operation.

The press-to-test feature of the light checks the indicator for continuity by supplying 28-volt dc electrical power from the essential bus.

Arm Light

A press-to-test ARM indicating light monitors the T-375 system circuits (figure 8-51). The light comes on when the GND or AIR button is depressed, indicating that the motorized switch in the T-375 relay module has reached the armed position. With either the OFF or SAFE buttons depressed, the ARM light is off.

Note

When the SAFE button is depressed, following arming of the stores, the ARM light will remain lit momentarily. This is normal. The ARM light will go off at completion of the safing operation.

The press-to-test feature of the ARM light checks it for lighting by supplying 28-volt dc electrical power from the essential but to the light.

Station Disagreement Lights

The red press-to-test station disagreement lights (figure 8-51) monitor the store and T-375 system circuits. The numerals 2, 3, and 4 above the lights refer to the respective store locations: left inboard wing, centerline, and right inboard wing station. The disagreement lights are designed on the light-off principle. Thus, the normal condition of the store for any setting of the nuclear selector is indicated by the disagreement lights remaining off. If a light comes on, it indicates that the fuze setting of the corresponding store does not agree with the AIR or GND selection of the nuclear selector, or that a malfunction exists. The press-to-test feature of the lights checks then for lighting and monitors internal store circuits.

Note

Depressing the nuclear selector buttons causes the station disagreement lights to flash momentarily. This is normal.

MULTIPLE RELEASE PANEL

The multiple-release panel on the bombardier/navigator's right console provides the means to adjust the weapons-release system for multiple racks. System operation with multiple release off provides a release pulse to all selected stations, for salvo releases sequential release pulses to each selected station for train releases, and a release pulse to each selection station stepping to the next sequential station each time a release is initiated for step releases. The following paragraph describes the multiple-release switch used.

Multiple Release QTY SEL Switch

The multiple-release rotary quantity selector switch is on the multiple-release panel and is used to select the number of release pulses to be emitted by the ordnance intervalometer. Rotating the switch to a quantity places the ordnance intervalometer in mode III and selects the number of release pulses to be emitted. When a manual or automatic release is initiated with TRN selected on the SALVO/TRN/STEP switch, one pulse will be directed to each selected station in 1, 5, 2, 4, 3 sequence with the sequence repeated until the selected quantity of pulses has been completed. When a manual or automatic release is initiated with SALVO selected on the SALVO/TRN/STEP switch, a series of release pulses is directed simultaneously to all selected stations until the selected quantity of pulses has been completed. The system will be reset automatically after each cycle of release pulses and the RESET light next to the multiple-release switch will go on. Positions are provided to select 2, 3, 4, 5, 6, 9, 12, 18, 24, or 30 release pulses.

Reset Light

The RESET light on the multiple-release panel goes on when the number of release pulses selected on the multiple-release quantity selector switch has been completed and the system has been reset. The light will go out while releasing and will come on again following the release cycle. With the MASTER ARM switch on, if the light does not come on and remain on when not releasing, the system must be reset with the rocket mode switch.

SIDEWINDER 1C I-R PANEL

The 1C I-R panel (figure 8-51), on the bombardier/navigator's instrument panel, is used to control the volume of the missile tones and the cooling system for the Sidewinder or Shrike missiles and in aircraft incorporating AFC No. 332 and AVC No. 1433 to enable firing the special Sidewinder missile. The bombardier/navigator's master caution indicator light is also on this panel. NEW

Note

The MASTER ARM switch must be in the ON or PRAC position in order to hear the missile tone.

Sidewinder (1C I-R) Cooling Switch

The 1C I-R cooling switch is a two-position toggle switch marked ON/OFF. When the switch is placed in the ON position, operating power is provided to the 1C I-R cooling system.

In aircraft incorporating AFC No. 332 and AVC No. 1433, the switch has three positions labelled I-R COOLING, OFF, and COOL/FIRE. When the switch is at the OFF position, no power is provided to the Sidewinder system and normal weapon release can occur at all stations. With the switch at I-R COOLING, cooling power is provided to the Sidewinder-loaded stations and normal weapons release can occur at all stations. When COOL/FIRE is selected the following occurs: NEW NEW NEW NEW NEW NEW

- Sidewinder tone for special side-pylon mounted missiles on stations 2 and 4 is enabled
- Rocket firing capability is inhibited at all stations
- Sidewinder fire circuit is completed for special Sidewinders at stations 2 and 4.

- Shrike and Bullpup fire at stations 2 and 4 is inhibited
- Bomb release at stations 2, 3, and 5 is inhibited
- Shrike and regular Sidewinder tone inhibited at stations 1 and 5.
- Rocket single and ripple fire inhibited at stations 1 and 5
- Special Sidewinder firing enabled at stations 2 and 4.

When the Sidewinder switch is at COOL/FIRE, Sidewinders mounted on the side of stations 2 or 4 may be fired by setting the MASTER ARM switch to ON, selecting the desired station, and depressing the pilot's manual release button.

Missile Tone Thumbwheel

The 1C I-R TONE thumbwheel controls the audio level of the missile tones. The upper and lower limits of the thumbwheel are marked HI and LO, and the tone may be adjusted to a comfortable level between these limits.

The tone from the Sidewinder or Shrike missile is heard in the pilot's headset, and it will be necessary for him to coordinate with the bombardier/navigator in achieving the optimum setting of the 1C I-R tone thumbwheel.

The tone from the Sidewinder or Shrike missile is initiated after power has been applied to the missile when a target has been sensed. The Sidewinder tone has a fixed frequency and the frequency of the Shrike tone will be the same as the prf of the target radar.

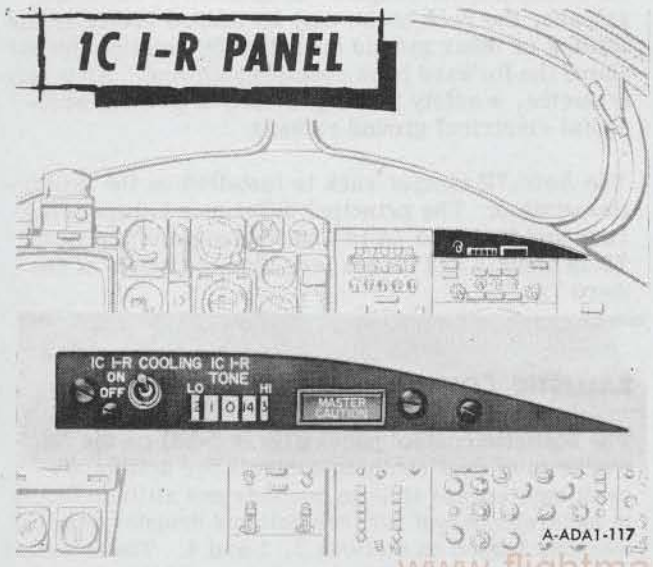

Figure 8-51

Note

Operation of the 1C I-R thumbwheel does not affect the frequency (pitch) of the tone, but will increase or decrease the tone volume.

Master Caution Light

The MASTER CAUTION light on the 1C I-R panel (figure 8-51) provides the bombardier/navigator with a means of monitoring the various caution indicators available to the pilot. Should one of the systems malfunction, and result in the pilot's indicator being activated, the MASTER CAUTION light on the bombardier/navigator's instrument panel will also be lit to advise the bombardier/navigator that a system malfunction has occurred.

STORES JETTISON

Emergency Stores Jettison Button

An emergency stores jettison (EMER STORES JETTISON) button (figure 8-52) on the upper left corner of the pilot's instrument panel provides for emergency, simultaneous jettisoning of all stores. With 70% of the aircraft weight off the wheels (left weight-on-wheels switch closed), depressing the emergency stores jettison button allows electrical power to be supplied to the five ejector racks and releases all stores simultaneously.

WARNING

Before emergency stores jettison of special stores, ensure that the SAFE button on the fuzing control panel has been depressed (safe light on and AIR and GND buttons locked). This prevents the possibility of jettisoning an armed store.

SELECTIVE STORES JETTISON Switch

A SELECTIVE STORES JETTISON switch (figure 8-52) on the pilot's left console provides for emergency jettisoning of a particular store or stores, depending upon which station has been selected. Selective jettison is used when a store has not been released through the normal circuits and a potential hazard exists. With the left main-gear door closed, MASTER ARM switch ON, and the desired station-select switch placed to SELECT or BOMBS, placing the SELECTIVE STORES JETTISON switch to JETTISON allows electrical power to be supplied to the ejector rack and release the selected store.

WARNING

Before selective jettison of stores, ensure that the SAFE button on the fuzing control panel has been depressed (SAFE light on and AIR and GND buttons locked), and the mechanical nose-tail switch placed to the SAFE position. This prevents the possibility of jettisoning of armed stores.

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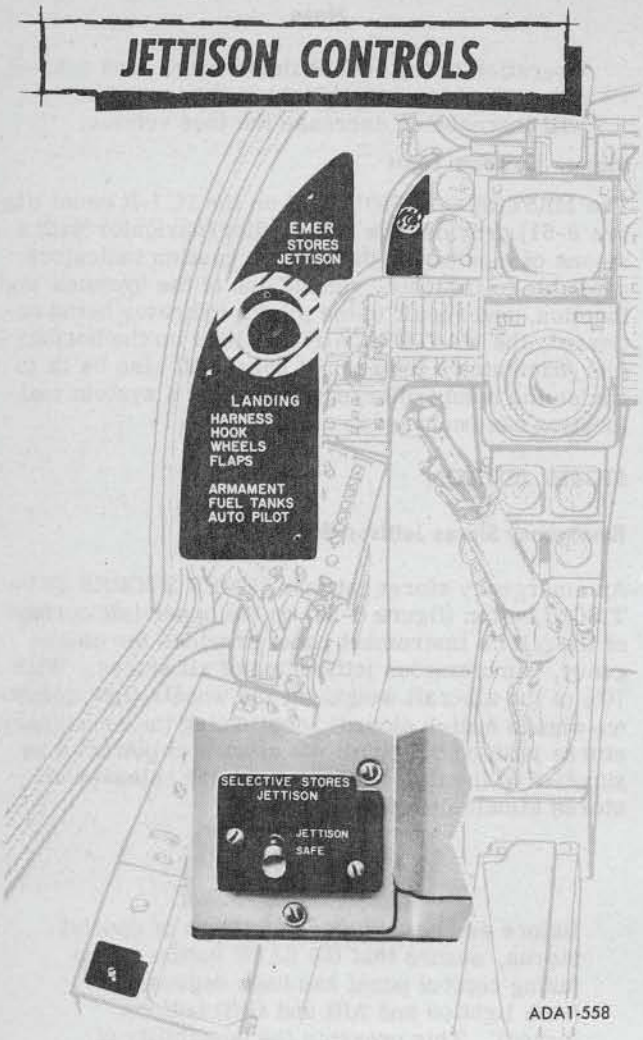

Figure 8-52

ATTACK COMMIT TRIGGER

The attack commit trigger on the pilot's control stick grip is a spring-return type switch and allows the pilot to initiate an attack. With the MASTER ARM switch ON, the landing gear up and locked, and the bombardier/navigator's attack button depressed, during general and hi-loft attack modes, depressing the attack commit trigger informs the computer that the pilot has selected a particular release and pullup point. With a straight path or rocket attack mode selected, depressing the trigger informs the computer that an automatic store release will be used. During LAB IP and LAB TGT attack modes, depressing the attack commit trigger initiates the intervalometer timer and completes the release circuitry when at the selected release angle.

Note

- The attack commit trigger must be depressed at release or automatic delivery will not occur.
- Depressing the attack commit trigger to the first detent causes the optical sight movable reticle to be aligned with the track radar antenna in azimuth and elevation.
- In aircraft incorporating the Mk-4 gun pod controls, when the gun pod switch is at READY, the function of the attack commit trigger is gun firing only.

MANUAL RELEASE BUTTON

The pilot's manual release button on the control stick grip allows for manual release of stores. During any of the attack modes, with the necessary prerelease procedures accomplished and the release mode switch placed to MAN, depressing the manual release button allows electrical power to be supplied to the ejector racks or launchers in turn, releasing the selected weapons.

A manual release may be obtained with the release mode switch in either MAN or AUTO; however, the attack commit trigger must be depressed for release if auto is selected.

In aircraft equipped with the Mk-4 gun pod controls, with the master arm switch at ON and a station selected, the pilot may obtain a manual release at any time by depressing the manual release button.

WEAPON MOUNTING

AERO 7A and AERO 7B Ejector Racks

The Aero 7A ejector rack provides suspension and release capabilities for conventional weapons and special stores. The rack is a cartridge-actuated, electrically triggered assembly and may be attached to all five stations. The attachments, accessible by opening two access doors on each pylon or on the centerline fairing, make the ejector rack readily removable. Either of two sets of tandem hooks on the rack suspend the weapon. In addition to electrical release, the rack hooks may be opened manually for loading or other ground operation by rotating the nut above the forward hook counterclockwise. As a safety device, a safety pin is provided to prevent accidental electrical ground release.

The Aero 7B ejector rack is installed on the centerline station. The principal difference between this rack and the Aero 7A is that the height of the Aero 7B is about 2 1/2 inches less than the height of the Aero 7A.

BALLISTIC CONTROL PANEL

The ballistic control panel (figure 8-53) on the left engine inlet duct contains controls for setting aircraft safe escape time in seconds and altitude fuzing in hundreds of feet for free-fall and drogue-retarded weapons loaded on stations 2, 3 and 4. These values are sent to the ballistics computer, which generates

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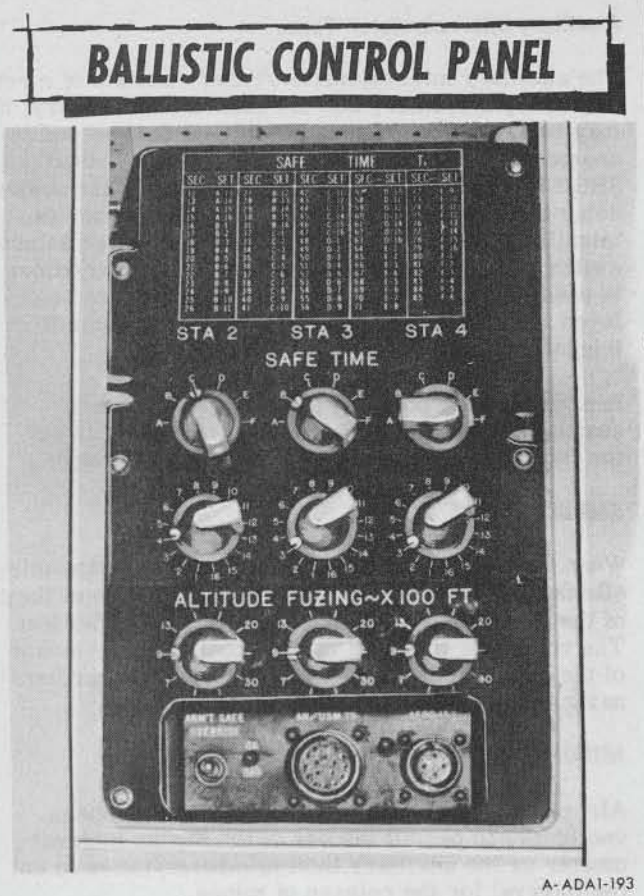

Figure 8-53

the proper steering commands for the type store selected. If the store selected is not compatible with the settings on the ballistic control panel, the station disagreement light for that station comes on and release is inhibited.

The ballistic control panel also contains the armament safety override switch and two test receptacles for maintenance purposes. The settings on the ballistic control panel are sampled for system releases of CBU or nuclear weapons.

SHRIKE CONTROL PANEL

In aircraft 19 through 309 not incorporating AFC No. 142, the Shrike control panel (figure 8-54) on the bombardier/navigator's right console contains the Shrike power switch, the Shrike intervalometer, and the target reject button.

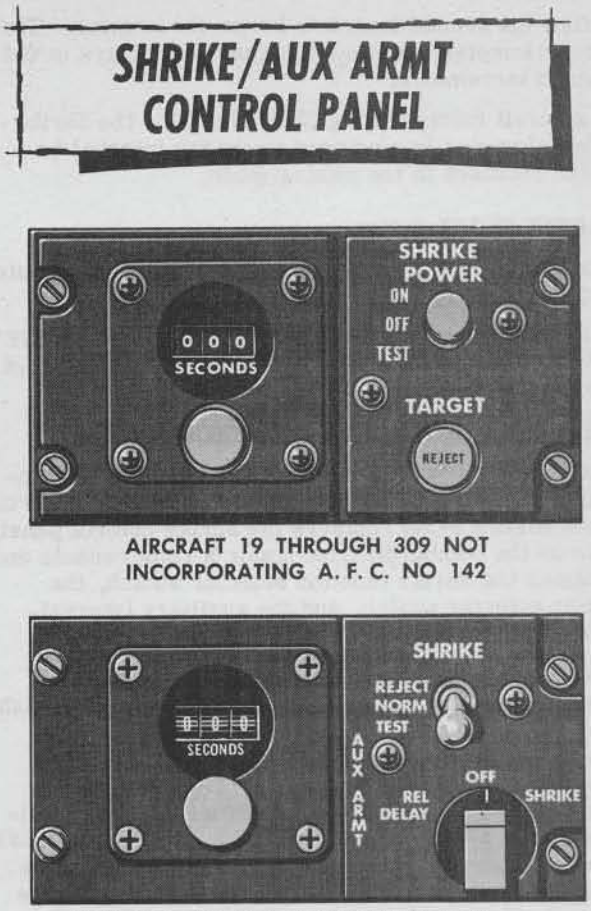

Figure 8-54

SHRIKE POWER Switch

The SHRIKE POWER switch is a three-position toggle switch marked ON, OFF and TEST. When the switch is set to ON, the system is energized, the TEST position is used only for maintenance purposes, and OFF deenergizes the system.

Note

When releasing ordnance other than Shrike, the SHRIKE POWER switch must be set to OFF.

Shrike Intervalometer

The intervalometer consists of a setting knob, a counter, and the associated circuitry. When it is desired to launch two missiles, the delay desired

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before the second launch is set on the counter. The intervalometer may be set for varying delays in 0.1-second increments.

In aircraft incorporating IAFC No. 205, the Shrike intervalometer is also used to set the interval between releases in the mining mode.

TARGET REJECT Button

Target-reject capability is presently not incorporated in the Shrike missile.

In aircraft incorporating IAFC No. 205, the TARGET REJECT button is used to select the mining mode of the Shrike intervalometer.

AUXILIARY ARMAMENT CONTROL PANEL

In aircraft 310 and subsequent and aircraft incorporating AFC No. 142, the auxiliary armament control panel (figure 8-54) replaces the Shrike control panel. It is on the bombardier/navigator's right console and contains the Shrike function selector switch, the power selector switch, and the auxiliary intervalometer /timer.

In aircraft incorporating the P8.6 computer program, automatic Shrike ranging and firing is available.

Shrike Function Selector Switch

The Shrike function selector switch is a three-position toggle switch labeled REJECT, NORM, and TEST. Except in aircraft incorporating I.A.F.C. No. 205 (mining mode), the REJECT position is inoperative because the target-reject capability is presently not incorporated in the Shrike missile. In aircraft incorporating IAFC No. 205, the REJECT position is used to select the mining mode of the auxiliary intervalometer/timer. The NORM position permits normal operation of the Shrike system, and the switch must be in this position for Shrike to be launched. The TEST position is used for maintenance purposes only.

Power Selector Switch

The power selector (PWR SEL) switch is a three-position rotary selector switch marked REL DELAY, OFF, and SHRIKE. When the switch is at OFF, the Shrike and release delay circuits are deenergized. When the switch is at SHRIKE and the SHRIKE function selector switch is at NORM, all Shrike circuits are energized, permitting Shrike tones to be heard, the auxiliary intervalometer/timer to be used in conjunction with Shrike launches, and permitting the Shrike to be launched. When the switch is at REL DELAY, automatic laydown bombing is selected and when the pilot commits, a release pulse delayed by the time set on the auxiliary intervalometer/timer is directed to the selected store stations.

Note

The power selector switch should be kept at OFF unless a Shrike or laydown delivery is desired. Improper selections will result in a reselect light.

Auxiliary Intervalometer/Timer

The auxiliary intervalometer/timer consists of a setting knob, a counter, and the associated circuitry; it may be set for different intervals, in 0.1-second increments. When the power selector switch is at SHRIKE, the intervalometer is used to set the desired delay between the first and second launch when two missiles are to be launched. When the power selector switch is at REL DELAY, the intervalometer/timer is used to set the time the release pulse is to be delayed after the pilot depresses the attack commit trigger.

In aircraft incorporating IAFC No. 205, the auxiliary intervalometer/timer is also used to set the interval between releases in the mining mode.

SHRIKE TONE

When the SHRIKE POWER switch is on, and the missile detects a source of radar energy, a tone at the prf of the detected radar is heard in the pilot's headset. The volume of this tone may be controlled by means of the 1C I-R TONE thumbwheel on the bombardier/navigator's instrument panel.)

MINING MODE

Aircraft incorporating IAFC No. 205 have been configured to permit the use of the Shrike intervalometer or the auxiliary intervalometer/timer to set the interval for the release of mines.

In aircraft with the Shrike panel, with the SHRIKE POWER switch and the MASTER ARM switch at ON, momentarily depressing the TARGET-REJECT button places the Shrike intervalometer in the mining mode. In aircraft with the AUX ARMT panel, with the power selector switch and the MASTER ARM switch at ON, the mining mode is selected by momentarily actuating the Shrike function select switch to REJECT. With the mining mode selected, and the attack commit trigger depressed, the first release is initiated when the pilot depresses his manual release button. Subsequent releases occur at the interval selected plus 1.5 second. The commit trigger and the release button need not be held after the first release.

Note

With the mining mode selected, the multiple release selector switch must always be at OFF to get the desired releases.

GROUND-CONTROLLED BOMBING SYSTEM (GCBS)

The ground-controlled bombing system (airborne system) operates in conjunction with the TPQ-10 remote bombing system (ground station) and provides ground-controlled steering and weapon release for close-support bombing attacks. The system

components in the aircraft include the ground-controlled bombing system control panel on the bombardier/navigator's right console, the address panel on the pilot's instrument panel, and the necessary receiver and antenna assemblies located throughout the aircraft. The ground station tracks the aircraft relative to the target coordinates; computes altitude, velocity and heading error; and transmits coded signals to the airborne system.

GROUND-CONTROLLED BOMBING SYSTEM CONTROL PANEL

This control panel is on the bombardier/navigator's right console (figure 8-55), aft of the chaff control panel, and controls the mode selector and channel selector capabilities of the system. It also contains the necessary controls to initiate operation of the ground-controlled bombing system equipment.

Channel Selector Switch

This control provides for selection of the four operating channels, and initiates system operation. This switch is rotated to reflect selection of the particular command-coded channel of the TPQ-10 equipment.

The channel selector control is placarded OFF, 1, 2, 3, and 4. The numbered positions represent available channel selections on the ground station equipment.

Engage Switch

This two-position toggle switch is used to engage the TPQ-10 ground system to the automatic flight control system of the aircraft. When this is actuated, the commands from the ground station are automatically initiated by the automatic flight control system without the aid of the pilot or bombardier/navigator.

Figure 8-55

Code Selector Switch

This control permits selection of any one of four coded signals generated by the TPQ-10 ground equipment. The code selector switch is placarded 1, 2, 3, and 4, and is rotated to select the desired signal.

ADDRESS PANEL

This panel (figure 8-55) in aircraft not incorporating the APR-25 is on the pilot's instrument panel, forward of the center console. In aircraft with the ARP25, the GCBS ADDRESS panel is on the center console, forward. The panel contains an indicator light, placarded ARM WEAPON. When the system is commanded by a ground signal, the ARM WEAPON indicator is lit, advising the bombardier/navigator to arm the weapon before its release.

STRIKE CAMERA SYSTEM LB-31A

Aircraft 246 through 486 incorporating AFC No. 256 have provisions for carrying the LB-31A strike camera system. The system consists of the LB-31A camera pod suspended on the No. 1 or No. 3 external store stations, installed on either the AERO 7 rack or on the A/A37 MER. The camera pod contains a KB-18B panoramic camera and a KB-19A forward-looking motion picture camera. The panoramic camera provides continuous film documentation of the strike area throughout an air-to-ground armament delivery. The forward-looking camera provides motion picture coverage of the area forward of the aircraft along the boresight line during an air-to-ground armament delivery. Both cameras operate simultaneously when energized by automatic or manual control circuits. The system receives power from the 28 V dc monitored bus through the LB-31A DC circuit breaker on the AC-DC power circuit breaker panel. The two heated camera windows are supplied power from the 115 V ac monitored bus through the LB-31A circuit breaker on the AC-DC power circuit breaker panel.

KB-18B CAMERA

The KB-18B camera components contained in the pod are the camera body with an accessory magazine LB-29A, and a camera control LB-17A. The camera has a 3-inch focal length f/2.8 lens. The shutter speeds range from approximately 1/100 sec to 1/4000 sec depending on limits established by a cycle rate switch and an aerial exposure index (AEI) switch. The accessory magazine accommodates 250 feet of film (300 exposures) and produces photographs with a format size of 2.25 by 9.40 inches. Panoramic photography is accomplished by rotating a double dove prism in front of the lens while the film is advanced across a narrow slit at the focal plane of the camera. Film advance is synchronized with prism rotation, projecting the panoramic image of the strike area on the film as the prism scans 180° fore and aft. Side coverage is 20° either side of the aircraft vertical axis. The automatic exposure control

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senses variations in the light source and initiates compensatory aperture adjustments. The camera control contains switches for ground testing the camera and preselecting camera operating functions required for the mission. The controls include the ground test switch, cycle rate switch, overrun dial, and the AEI switch.

Overrun Dial

The overrun dial setting determines the amount of time the camera will run (automatic mode only) after the attack commit trigger or manual weapon release button is released. Dial settings are calibrated in 2-second increments from 0 to 20 seconds plus an additional setting of 32 seconds.

Cycle Rate Switch

The cycle rate switch permits selection of 1, 2, or 4 frames per second during camera operation. The switch is set in accordance with the planned mission altitude/airspeed combination.

AEI Switch

The AEI switch is set as determined by the type of film in the camera. Film speeds (exposure sensitivity) of 40, 64, 80, or 200 are selectable.

KB-19A CAMERA

The KB-19A camera mounted in the forward fairing of the pod, provides 16mm motion picture coverage of the area forward of the aircraft along the boresight line. The film magazine attached to the camera contains 100 feet of film. An automatic exposure control (AEC) controls the shutter sector opening to ensure proper exposure.

Overrun Switch

The overrun switch controls the time the camera continues to operate after attack commit trigger or manual weapon button release and provides the following overrun selections: 0, 5, 10, or 15 seconds. An overrun indicator light marks the film at the release of the trigger or weapon release button and continues marking until completion of the overrun period.

Test Switch

The test switch on the rear of the camera is used by the ground crew to test operation of the camera.

STRIKE CAMERA CONTROL PANEL

The strike camera control panel on the bombardier navigator's right console (figure FO-3), controls the operating modes of the strike camera system. The panel labeled LB-31A POD contains a mode switch and press-to-test OPERATE light. In the AUTO position, the cameras operate when the proper station armament switches are energized and the pilot actuates the attack commit trigger or manual weapon release button. When the attack commit trigger or manual weapon release button is released, the cameras continue to operate for the preselected overrun time. The MANUAL position is a momentary position and the cameras operate as long as the switch is held in MANUAL. The manual mode is independent of the armament system and enables film coverage of specific terrain without armament delivery. The OPERATE light comes on whenever the cameras are operating.

RADAR BEACON AN/APN-154(V)

The radar beacon is used with the TPQ-10 ground-based control radar to extend the radar range of the ground station and to assist in determining the range and location of the aircraft. Basically, the ground-based radar transmits a coded interrogating signal; the radar beacon receives the interrogation, decodes the signal, and transmits replies to the ground-based radar.

RADAR BEACON CONTROL PANEL

The radar beacon control panel, which is on the rear center console (figure 8-56), controls the operation of the radar beacon.

POWER STBY-OFF Switch

This three-position switch provides power for radar beacon operation. The STDBY position places the equipment in a standby condition but does not permit

Figure 8-56

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the transponder to reply to interrogation. The POWER position places the beacon in full operation. The OFF position turns off all power to the equipment.

MODE Selector Switch

This six-position rotary switch selects the function to be performed by the transponder. If the radar beacon is to respond to a single-pulse interrogation place the MODE selector switch on the SINGLE position. If it is to respond to double-pulse interrogation, place the MODE selector switch on 1, 2, 3, 4, or 5 of the DOUBLE bracket. The double-pulse code response desired determines the position of the switch.

RADAR BEACON OPERATION

1. POWER-STDBY-OFF switch - STBY
   For optinum performance, allow 5 minutes for warmup.

2. POWER-STDBY-OFF switch - POWER.

3. MODE selector switch - AS DESIRED

Note

The radar beacon will warm up with the switch in either STDBY or POWER position. To prohibit response to a premature or unintentional interrogation, warmup should be accomplished in the STDBY position.

part 4 A-6E Weapon System

To solve the navigation problem, the attack/navigation system (figure FO-9 (integrates data from various on-board sensors by means of a general-purpose digital computer. The computer receives automatic inputs from the sensors and navigation aids and manual inputs from the crew, evaluates the inputs based on programmed logic and integrates the data which is valid. Position and correction signals are then sent to the sensors and navigation aids as required, and the crew is provided with displays of steering commands and other data necessary to navigate to a target and deliver ordnance accurately without visual reference to the surface. When an attack is being executed, the computer performs certain additional calculations related to the attack profile and weapons selected by the crew and provides attack steering commands to the crew and if an automatic release has been selected, weapon release signals to the armament control unit. As shown in figure FO-9, the following sensors provide data which is processed in the computer:

- Search Radar AN/APQ-148 or Search Radar AN/APQ-156
- Inertial Navigation System AN/ASN-31 or Carrier Inertial Navigation System AN/ASN-92
- Magnetic Compass MA-1 (Backup)
- Vertical Gyro Indicator MM-3 (Backup) or Attitude Reference Indicator ID-1791/A (Backup)
- Doppler Navigation System AN/APN-153
- Air Data Computer
- Normal Accelerometer
- Air Temperature Probe
- Angle of Attack Probe

(Air Data Computer, Normal Accelerometer, Air Temperature Probe, Angle of Attack Probe: Aircraft Data Sensors)

Those equipments which are primarily flight-related are described in Section I. Therefore only their inputs to the attack/navigation system will be discussed in this section.

AIRCRAFT DATA SENSORS

Data from the angle of attack probe, the temperature probe, the normal accelerometer and the air data computer, which will be discussed under the general heading of aircraft data, are provided to the digital computer for use in the attack/navigation system.

Aircraft angle of attack as measured by the angle-of-attack probe with respect to the ADL is received by the computer and is used to calculate aircraft true angle of attack with respect to the airspeed vector if inertial vertical velocity is not used.

Impact air temperature from the total temperature probe is mach-corrected in the computer and is used in calculations of airspeed and altitude to correct for nonstandard conditions.

Acceleration or load factor normal (perpendicular) to the ADL is measured by the normal accelerometer and is used in the computer in the calculation of rates of change of aircraft angular position with respect to the air mass and the earth.

The air data computer provides mach number, which is used to calculate true airspeed, and static pressure, which is used in computing altitude.

option of initiating the replacement of data from the Mach sensor.

The replacement for a bad angle of attack from the probe is from backup computation using the aircraft elevation angle and the rate of change of pressure altitude. This is an automatic computer replacement with vertical velocity (Vz) set bad. If temperature is bad, a standard day ambient air temperature is calculated, using static pressure. An option is available to the B/N whenever calculated standard day temperature is in use. He may bring the solution closer to actual conditions by entering known temperature, in degrees Farenheit, at the target, or if this is not known, the existing temperature at departure. The standard day temperature is then adjusted by the difference between the entered temperature and standard.

Note

- It is good practice to make the backup temperature entry whenever bringing the computer on the line, so that it will be available if needed during the mission.
- Any time mach number is set bad, temperature is also set bad.

A calculated value of normal load factor derived from inputs of aircraft angular rates from the inertial platform replaces bad inputs from the normal accelerometer.

The B/N evaluation of mach number and static pressure is based on the credibility of the readouts of true airspeed and static pressure displayed in the digital display unit (DDU) and the readings on the altimeter and airspeed indicator. If an error is large enough, system advisory codes (SAC's) displayed in the DDU will assist in the evaluation. SAC 010 is displayed if true airspeed - total inertial velocity exceeds 180 + .0055 x pressure altitude, that is, an excessive airspeed/groundspeed differential. If this code is the result of a large wind derivation, selecting OFF ERASE on the velocity correct switch may allow the code to be cleared. If not, it may be necessary to change navigation options or replace the mach input. The 011 SAC is the result of a vertical loop altitude difference of more than 640 feet. Three probable causes are:

- If an improper or unstable static pressure is continuously provided. This can be determined by checking window B1 on the DDU in the nonattack condition.
- If the vertical velocity is bad (window A3). By replacing inertial vertical velocity and static pressure, one at a time each can be evaluated, and the bad value can be replaced.
- Failure to initialize present position altitude, or trying to initialize it within 40 seconds of completing the converter portion of the ORT (before the air data computer has time to return to ambient conditions). Reentering present position altitude should remove the cause of this type of code.

When the computer receives an indication from the B/N that mach number from the air data computer is not accurate, replacement is made in one of two ways depending on the navigation option selected. If the inertial, Doppler/inertial or doppler options have been selected, true airspeed is determined by applying the current value of wind to total inertial velocity. True airspeed is then converted to mach number. If the dead reckoning option has been selected, the keyboard entry of true airspeed is converted to mach number.

Note

With the air data computer mach number bad and DR selected, the aircraft should be flown as closely as possible to the selected airspeed.

System altitude is reset to the current value of temperature-corrected pressure altitude when present position correct is selected with the radar cursors stabilized (UNSTAB not selected). System altitude is also reset when the INS is placed into a nonoperate mode or inertial velocity is set bad.

If the B/N determines that the input of vertical velocity from the inertial platform is not valid he may cause it to be replaced by a backup value calculated from true airspeed and angle of attack.

When entry is made indicating invalid pressure, present position altitude should be reinitialized using the keyboard entry. System altitude will then be derived by means of continuous integration of system vertical velocity. The vertical accelerometer feedback loop is modified to use INS elevation angle, true airspeed, and probe input of angle of attack instead of pressure to provide accelerometer corrections.

The option of replacement or elimination of bad mach number, static pressure, or inertial vertical velocity is initiated by manual entries. With the MAN key depressed and the COMPT MODE switch at ENTER, entering with the ALT ACTION key:

N111111 sets mach and static pressure sensors and inertial vertical velocity USED

N101111 sets mach sensor NOT USED; static pressure sensor and inertial vertical velocity USED

SEARCH RADAR AN/APQ-148, AN/APQ-156

The search radar is a multiple mode system which provides the capabilities of search, target tracking, moving target identification, beacon interrogation, and terrain clearance. A-6E 158041 thru 159579 and A-6E Mod M1 thru M120 have the AN/APQ-148 while A-6E 169895 and ON and A-6E Mod M121 and ON have the AN/APQ-156. The two radars are functionally the same. The principal differences are in the indicators provided and the arrangement and location of controls.

In aircraft with the APQ-148, two indicators are provided: the direct view radar indicator (DVRI) in the bombardier/navigator's instrument panel and the pilot's horizontal display (PHD) in the pilot's instrument panel. The controls for operating the radar are located principally on the bombardier/navigator's control panel, while display controls and adjustments are on the bombardier/navigator's control panel and the pilot's control panel. See figure 8-57 sheet 1. In aircraft with the APQ-156, only the DVRI on the B/N's instrument panel is provided. Radar operating and display controls are on the B/N's control panel and test controls are on the RADAR/DRS TEST panel in the right console. See figure 8-47 sheet 2.

In this discussion, the operation of the radar has been divided into general classifications of operating modes, display modes, and target tracking modes. These classifications are for descriptive purposes only.

RADAR OPERATING MODES

The operating modes include search, which is the basic mode, and beacon, airborne moving target identification (AMTI), and terrain clearance, which are additional capabilities that may be selected.

SEARCH OPERATION

The radar is in the search mode when it is on and operating and none of the additional capabilities have been selected. In this mode, reflected radar energy is displayed on the bombardier/navigator's and pilot's indicators in either a depressed center PPI or B-scan format. Range and azimuth cursors and fixed range marks are also displayed. The antenna scan and display are centered about either the aircraft ADL or the relative bearing of the azimuth cursor. Scan rate, pulse width, and prf are determined by the requirements of the range selected.

BEACON OPERATION

The beacon mode provides the capability of detecting and locating the return from a ground-based beacon. This mode is available only in high prf, is comparible with all of the target tracking modes, and may be used simultaneously with terrain clearance.

In the beacon mode, the radar interrogates the beacon, and the return is processed in the search receiver. Normal ground return video is processed in the beacon ground map receiver so that background video can be displayed along with the beacon signal. The beacon return, which is a coded pulse train, is displayed on the DVRI and the PHD at the range and bearing of the transponder's actual geographic position. This is the true position, corrected in the radar for beacon delay. The BEACON control on the B/N's control panel permits the B/N to vary the amount of ground return mixed with the beacon returns.

Note

When using the beacon for bombing, an offset with a nonzero distance entry must be used or the computer will not step into attack.

AMTI OPERATION

In AMTI operation, search radar video is processed to emphasize moving ground targets. The return from a moving target characteristically fluctuates in amplitude with respect to returns from fixed targets. During AMTI operation, a portion of each pulse of reflected radar energy is sent to a delay line to be compared in amplitude with the next pulse. Pulse-to-pulse amplitude fluctuations are detected in the AMTI unit and converted to moving target video for display on the DVRI and PHD. Those returns whose amplitude remains constant from pulse to pulse are treated as fixed returns, and are canceled. The AMTI control on the B/N's control panel permits the B/N to vary the amount of fixed target background to be added to the AMTI display.

RADAR CONTROLS AND INDICATORS

158041 THRU 159579 AND M1 THRU M120

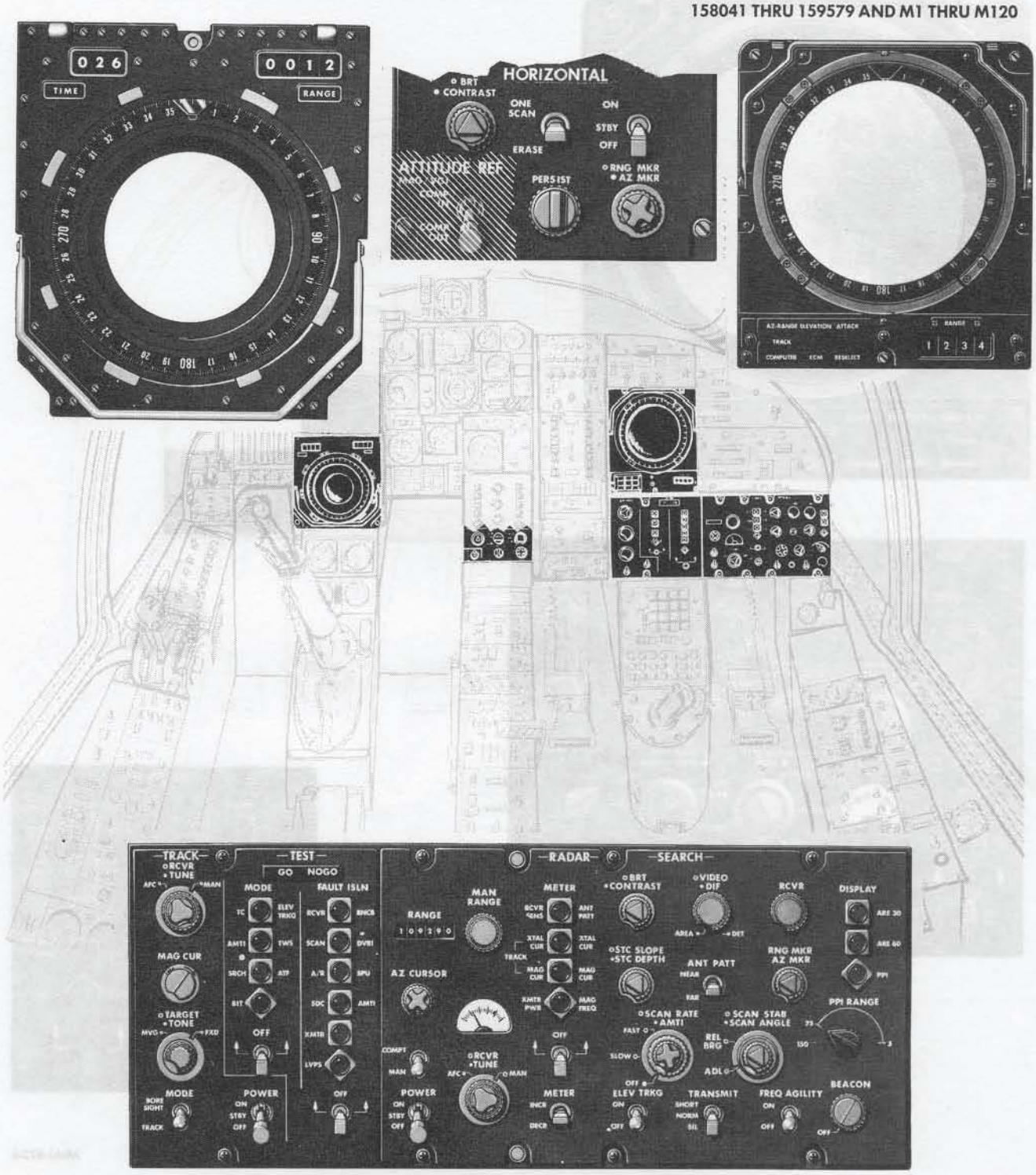

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Figure 8-57 Sheet 1

RADAR CONTROLS AND INDICATORS CONT.

159895 AND ON AND MOD 121 AND ON

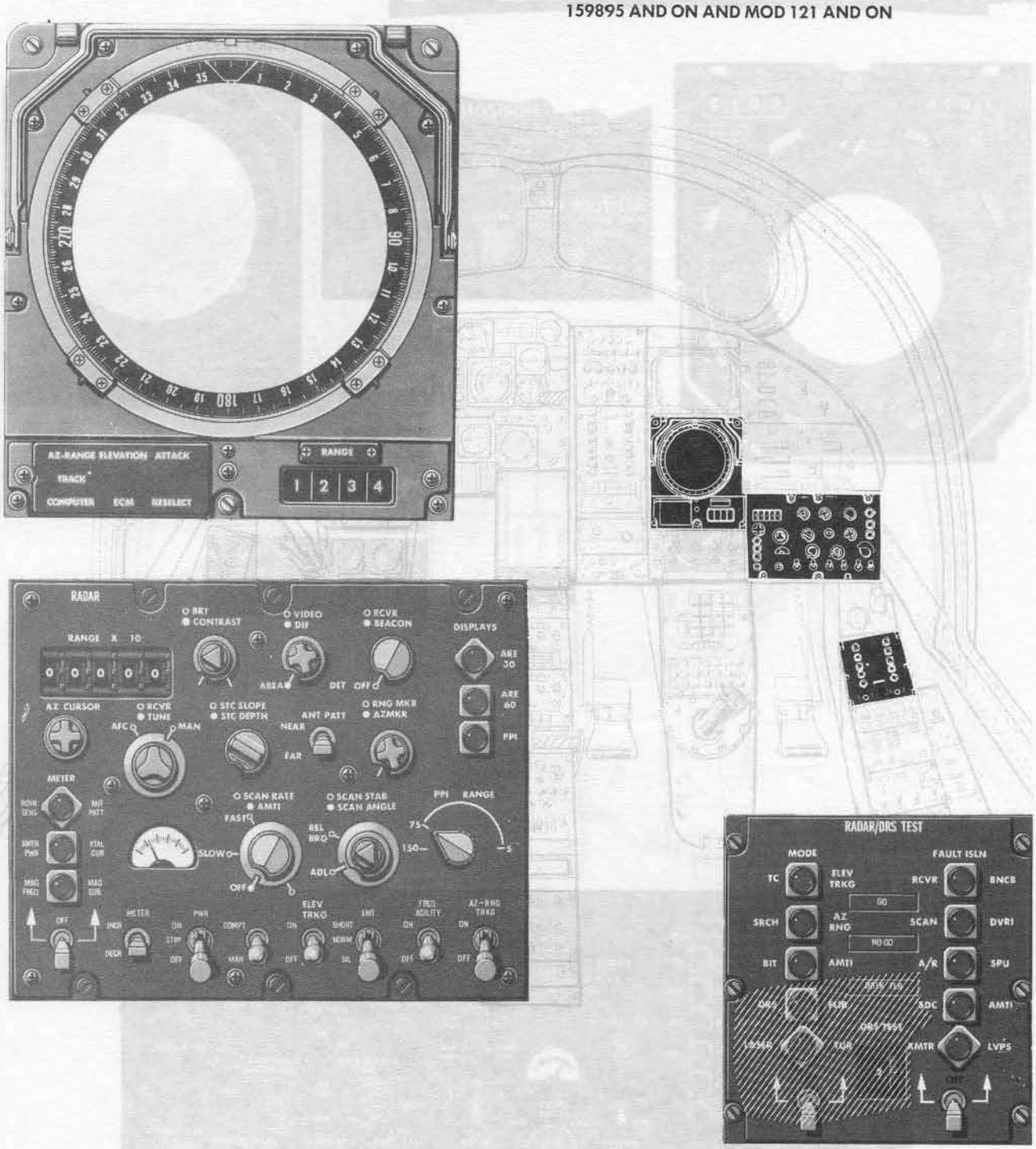

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Figure 8-57 Sheet 2

The timing pulses produced by the AMTI unit trigger radar operation during the AMTI mode to assure that transmitter and receiver operation are timed to match the pulse period required for fixed target cancellation.

The amplitude fluctuations caused by a moving target are detectable for only the range component of target movement. For this reason, a target that is moving on a line perpendicular to the aircraft heading will not be detected as a moving target. The detection range of a given moving target increases as the aircraft approach heading approximates the fore-and-aft axis of the target movement (head-on or tail-on approach). The relative approach angle (angle off) between aircraft and target becomes most critical with slow moving targets. For example, a 10 mile per hour pickup truck and 4 mile per hour road grader, traveling the same road, could both be detected at the same range on a zero degree angle-off run, but the detection range for the road grader would be half that of the truck on a 10-degree angle-off run.

The AMTI mode is compatible with all the target tracking modes, and may be used simultaneously with terrain clearance. Since AMTI operation requires normal pulse width and high PRF only short ranges may be selected with either the PPI or ARE display modes:

With 5-75 selected, range less than 27.5 miles

With ARE-30 selected, range less than 22 miles

With ARE-60 selected, range less than 18 miles

If an incompatibility exists, selecting AMTI will have no effect.

TERRAIN CLEARANCE OPERATION

In the terrain clearance mode, terrain elevation data out to a range of 10 miles is provided to the radar data converter which uses it to generate the terrain clearance display on the VDI. This mode of operation may be selected simultaneously with beacon and AMTI and is compatible with all the target tracking modes. Terrain clearance uses a normal pulse width and requires high prf. Selection of a display mode incompatible with these requirements results in a PPI display with a 27.5-mile sweep length.

Note

If BORESIGHT has been selected, the radar will not enter the terrain clearance mode.

Normal transmitting circuits and system timing are used for terrain clearance but the reflected energy is received by a special dual-channel antenna array. The phase of the returns received by the bottom row of antenna ports is compared to that of the returns received by the upper row. The difference of phase is a function of the elevation of the terrain from which the returns are received. These elevation data are provided to the pilot as a display on the VDI. For more details on the terrain clearance display, refer to System Displays in this part.

RADAR DISPLAY MODES

Radar data may be displayed on the DVRI and the PHD in either a depressed center plan position indicator (PPI) format with sweep length of 150 miles or variable 5-75 miles, or in a B-scan format. The B-scan displays are available with the computer on, and provide automatic range expansion (ARE) whereby the sweep length is automatically varied to keep the cursor intersection in the center of the display. Prf and pulse width are automatically changed in accordance with the sweep length in use.

Fixed range marks are provided in both display formats. In the PPI format, with radar range less than 27.5 miles, range marks are displayed every 10 miles, and with radar range 27.5 miles or more, they are displayed every 25 miles. In the B-scan format, two range marks are displayed: one at 1 mile beyond the range cursor, and one at 5 miles beyond the range cursor. All range marks are displayed with the middle 50% blanked.

PPI 150 DISPLAY MODE

In the PPI 150 mode, a depressed center PPI display with a fixed range of 150 miles is provided. The azimuth sector scanned is continuously variable from 20° to 110°. The radar operates at a low prf and wide pulse width. Range and azimuth cursors are displayed and may be computer- or manually controlled. The PPI 150 mode is incompatible with beacon, AMTI, and terrain clearance, but may be used with search and all the target tracking modes.

Note

If the pilot selects terrain clearance while PPI 150 is selected, the radar switches to high prf and narrow pulse width with maximum displayed range at 27.5. The minimum scan angle will be ± 30°.

PPI 5-75 DISPLAY MODE

In the PPI 5-75 display mode, a depressed center PPI display with a range which is variable from 5 to 75 miles is provided. The azimuth sector scanned is continuously variable from 20° to 110°. With the ranges between 27.5 and 75 miles selected, the radar operates with a medium prf and pulse width. Selection of a displayed range of 27.5 miles or less results in the radar operating at a high prf and narrow pulse width. At ranges of 27.5 miles and below, the PPI 5-75 mode is compatible with beacon, AMTI, and terrain clearance. It may be used at all ranges with search and with all target tracking modes.

Note

If the pilot selects terrain clearance when the displayed range selected is greater than 27.5 miles, the radar will switch to high prf and narrow pulse width and the displayed range will be reduced to 27.5 miles. The minimum scan angle will be ± 30°.

ARE-60 DISPLAY MODE

The ARE 60 (automatic range expansion -60°) display mode is presented in a B-scan format with the cursors at the center of the display. The horizontal sweep scaling is set so that a 60° scan angle completely fills the display. The vertical sweep is controlled so as to keep the range cursor in the center of the sweep. The sweep starts at 0.5 R_{SI} (one-half the slant range distance to the cursor intersection) and sweep length is set at 1.0 R_{SI}. As the range cursor is moved, the sweep start and sweep length are changed to keep the range cursor at the center of the display while the targets appear to move behind it. This relationship is maintained until the range reaches 1.5 miles, which is the minimum sweep length for the DVRI. At this point, range expansion stops and the sweep now starts at 0.75 mile before the range cursor. With continued decrease of range, the sweep start continues to approach the point at which pulse transmission begins (main bang) until R_{SI} is 0.75 nmi. At this point, sweep start is at the same time as the main bang. Further decrease of range will cause the range cursor to move toward the sweep start and no longer be centered on the display. If ARE 60 is selected when R_{SI} is greater than 18 miles, a PPI display corresponding to the selection on the PPI range control will result, until the range is reduced to less than 18 miles.

The actual azimuth angle scanned may be varied by the B/N from 10° either side of the azimuth cursor (20° scan angle) to 55° either side of the azimuth cursor (110° scan angle). If a scan angle of less than 60° is selected, only the returns in the selected area will be displayed. If a scan angle greater than 60° is selected an over-scan results where the antenna scans beyond the display limits.

Since the outer scan limit of the antenna is 55° either side of the ADL, a symmetrical picture will be displayed only so long as the combination of the selected scan angle and the relative bearing of the azimuth cursor does not exceed 55°. For example, if a scan angle of 60° (30° either side of the azimuth cursor) is selected, the picture will no longer be symmetrical when the relative bearing of the azimuth cursor is greater than 25°.

ARE 60 is a short-range display mode. If R_{SI} exceeds 18 miles, the display format will change to PPI with displayed range as selected on the PPI range switch until the range cursor is returned to within display limits.

Note

If the pilot selects terrain clearance when the range cursor is beyond 18 miles, the radar will switch to high prf and narrow pulse width and the display will be PPI with maximum displayed range of 27.5 miles. Expanded displays are still available at short ranges. The minimum scan angle will be ± 30°.

ARE-30 DISPLAY MODE

The ARE 30 (automatic range expansion - 30°) display mode is presented in a B-scan format with the azimuth cursor at the center of the display. The horizontal sweep scaling is set such that a 30° scan angle completely fills the display. The vertical sweep is controlled so as to keep the range cursor at the center of the sweep. The sweep starts at 0.75 R_{SI} (three-fourths the slant range distance to the cursor intersection) and sweep length is set at 0.5 R_{SI}. As the range cursor is moved, sweep start and sweep length are changed to keep the range cursor at the center of the display while the targets appear to move behind it. This relationship is maintained until the range is decreased to 3.0 miles which results in a sweep length of 1.5 miles, the minimum for the DVRI. At this point range expansion stops and sweep now starts at 0.75 mile before the range cursor. With continued decrease of range, the sweep start continues to approach the point at which pulse transmission begins (main bang) until R_{SI} is 0.75. At this point sweep start is at the same time as the main bang. Further decrease of range will cause the range cursor to move toward the sweep atart and no longer be centered on the display.

If R_{SI} is less than 22 miles, the radar operates at high prf and pulse width is normal, if R_{SI} is greater than 22 miles but less than 56 miles, a medium prf and medium pulse width are used. If R_{SI} is greater than 56 miles, the format will change to PPI 150.

Note

If the pilot selects terrain clearance while the range cursor is beyond 22 miles the display format will change to PPI with a maximum displayed range of 27.5 miles. Expanded displays are still available at short ranges. The minimum scan angle will be ± 30°.

RADAR CURSORS

Two cursors are displayed on the DVRI and PHD, one representing the precision range line and one

representing the azimuth line. These cursors are generated in the radar and controlled either manually or by the computer.

During computer control of the cursors, range and relative bearing to the target are provided by the computer. Precision range line position is sent from the cursor control unit to the computer, which computes a range (R_{SI}) corresponding to this position. This range is converted to time in the signal converter unit and is displayed as intensity modulation on the range sweep as the antenna scans, forming the range cursor. The computer provides relative bearing to the DVRI and the antenna/receiver. If REL BRG is selected on the SCAN STAB switch, the antenna receiver left and right limits of antenna scan are adjusted so as to center the scan about the relative bearing signal. Antenna scan is then compared to target relative bearing in the DVRI, where coincidence produces a null. The null is used in the SCU to generate an azimuth line pulse, which is mixed with search video and displayed as the azimuth cursor.

During manual control, the cursor position is based on inputs from the MAN RANGE and AZ CURSOR controls on the bombardier/navigator's control panel.

RADAR TRACKING MODES

The search radar provides four tracking modes in an ascending order of capability. These modes include cursor intersection, elevation track, azimuth range tracking and track-while-scan. In aircraft with the APQ-148, to select any of the tracking modes, the MODE switch must be at TRACK and the cursor control switch at COMPT in addition to the switch positions required to select the individual tracking modes. With the APQ-156 radar it is only necessary to select COMPT in addition to the switch positions required for the individual radar tracking mode.

Note

No radar lock-ons are permitted if the computer steering selection is UNSTAB.

CURSOR INTERSECTION TRACKING

The cursor intersection mode is a manually aided means of target tracking. The bombardier/navigator positions the cursors on the target with the slew grip and they are repositioned by the computer based on system velocities to track the target. System velocities may be improved by manual velocity correct. Cursor intersection is compatible with all operating and display modes.

ELEVATION TRACKING

When elevation tracking has been selected by setting the ELEV TRKG switch to ON, measurement of the depression angle to a ground position defined by the intersection of the range and azimuth cursors (to a maximum range of 10 miles) is provided to the computer. The computer performs tests to validate the inputs and, if they are valid, turns on the ELEVATION light on the DVRI. The radar provides the elevation angle of the target defined by the cursor intersection. Elevation track lock-ons are broken during pushovers: however, the light will come back on as soon as the aircraft stabilizes. Valid inputs are used to calculate depression angle to the aimpoint, altitude above the aimpoint, angle and closing rates, and to update target and cursor position. The cursors are initially positioned with the slew grip and the computer repositions them to track the target based on system velocities and radar inputs. Manual velocity correct may be used to improve system velocities. Slewing breaks an elevation lock; however it is reacquired as soon as slewing is stopped.

Elevation track lock is inhibited when the slant range to the cursor intersection decreases to 4000 feet.

Elevation tracking requires high prf operation. It is compatible with terrain clearance, beacon, AMTI, and the short-range display modes.

AZIMUTH-RANGE TRACKING

Azimuth-range tracking is selected with the APQ-148 by moving the slew grip dislodge switch aft. With the APQ-156 it is selected by setting the azimuth-range tracking switch to ON. It may be used to track targets out to a maximum range depending on video strength. In this mode, range is measured by using computer range cursor position to control an early-late gate measurement loop, which provides range error to the computer. Azimuth is determined in a similar manner. The radar incorporates a beam splitter and uses a left-right measurement technique, providing azimuth error to the computer. The computer performs tests to validate the inputs, and if the data are valid turns on the AZ-RANGE light on the DVRI. Valid inputs are used to calculate slant range and relative bearing to the aimpoint, angle and closing rates and to update target and cursor positions. The cursor are initially positioned with the slew grip and a lock-on is initiated by moving the dislodge switch aft. When the AZ-RANGE light comes on, the radar tracks the target in range and azimuth, further slewing is inhibited and the computer repositions the cursors to track the target based on system velocities and radar inputs. Azimuth range tracking at short ranges is compatible with terrain clearance, beacon, AMTI, and the short range display modes.

AZ RNG LITE BLINK WHEN SATURATED

TRACK-WHILE-SCAN TRACKING

Track-while-scan (TWS), the full-capability mode, providing three-axis tracking to a maximum range of 10 miles, is selected by selecting both elevation and azimuth-range tracking. Measurement of the depression angle to a position defined by the intersection of the range and azimuth cursors is provided to the computer. Range is measured

by using computer range cursor position to control an early-late gate measurement loop which provides range error to the computer. Azimuth is determined in a similar manner. The radar incorporates a beam-splitter and uses a left-right measurement technique, providing azimuth error to the computer. The computer performs tests to validate the radar inputs and if the data are valid, turns on the ELEVATION and AZ-RANGE lights on the DVRI. Valid inputs are used to calculate depression angle to the aimpoint, altitude above the aimpoint, slant range and ground range to the aimpoint, relative bearing to the aimpoint and to update target and cursor positions. At aircraft pitch, roll, or azimuth deflection angles greater than 53°, memory target tracking is used.

TWS tracking requires high prf operation. It is compatible with terrain clearance, beacon, AMTI, and the short-range display modes.

BUILT-IN-TEST (BIT)

By means of the built-in-test capability an end-to-end check (except for the antenna) of the radar can be performed on the ground or in-flight without transmitting radar energy. The radar indicators and all major functions of the radar including search, AMTI, terrain clearance, elevation tracking, and track-while-scan are checked in this manner. (See figure 8-58). In addition, the proper functioning of the test circuitry may be checked by a self-test feature which lights a GO or NO GO light.

If a fault is found during the test procedure, it may be isolated to one of 10 aircraft replaceable assemblies (ARA's) by use of a fault isolation feature, which lights a GO or NO GO light for the selected ARA.

SEARCH BIT

When BIT is selected in search or any of the other test positions a test signal is processed through the search radar circuits and displayed on the DVRI. If all circuits are functioning properly, target video will be displayed at a range of 30,780±100 feet centered in azimuth about the ADL. The fixed target will be displayed over approximately a 2° sector.

AMTI BIT

When AMTI BIT is selected, a test signal is processed through both the search radar and AMTI channels before being displayed. When the AMTI control is switched on, simulated moving targets will appear to the left and right of the area where the fixed target appeared during the search BIT. The area occupied by the search radar test target will be void of video. As the AMTI control is adjusted clockwise, hard target video will appear between the two simulated moving targets and will increase in amplitude until one continuous line is painted in azimuth at 30,780 ±100 feet throughout the selected scan angle.

TERRAIN CLEARANCE BIT

When terrain clearance BIT is selected and TC is selected on the pilot's control box, signals pertinent to TC are monitored in the antenna/receiver SCU, low-voltage power supply, and the B/N's control box. If all signals are proper, the resulting output level drives the TC failure light on the VDI and the GO-NO GO indicators on the bombardier/navigator's control panel. Since the normal terrain clearance mode of operation is vital to the safety of the aircraft, it is monitored continuously in flight and on the ground and the pilot is alerted to a failure by the TC failure light going on, when terrain clearance is selected.

When TC BIT is selected, the test target again appears on the DVRI.

During ground check of the terrain clearance mode with the TRANSMIT switch at SIL, the TC light will remain on.

Note

Since BIT disables the normal terrain clearance mode, BIT should not be selected if the terrain clearance mode is being flown.

ELEVATION TRACKING BIT

When elevation tracking BIT is selected, the same fixed target displayed during search BIT is displayed at 30,780±100 feet on the DVRI, at the same time, a boresight test signal is processed through the TC receiver. When the B/N positions the cursors over the target using the manual controls, the SCU elevation angle computer examines the resulting boresight phase signal from the TC receiver. If the calculated boresight angle is correct, the GO light on the B/N's control panel will go on. As the B/N moves the cursors off the displayed target, this light goes off and the NO GO light goes on. A NO GO light indicates that the computed boresight test target is not within specifications.

TRACK-WHILE-SCAN BIT

When TWS BIT is selected, a test signal is processed through the search radar circuits and displayed on the DVRI. The B/N manually slews the manual range line to the displayed target. When the curcors are at the target in range and azimuth, the GO light on the B/N's control panel will go on, indicating that the radar has locked on to the target in range and azimuth. As the cursors are moved off the target, to GO light goes off and the NO GO light goes on.

ATF BIT

The ATF BIT is presently inoperative.

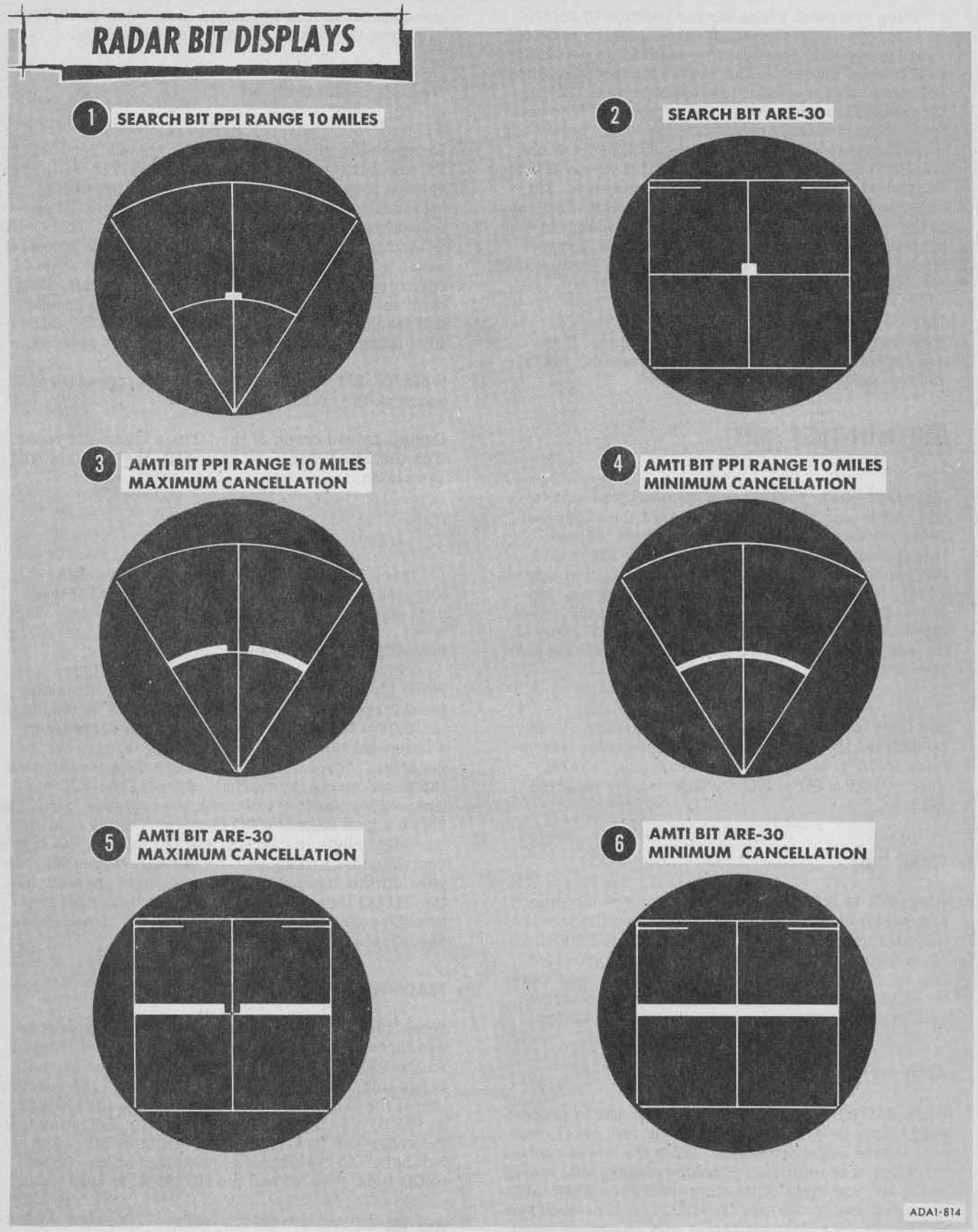

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Figure 8-58

SEARCH RADAR CONTROLS

BOMBARDIER/NAVIGATOR'S CONTROL BOX

In aircraft with the APQ-148, the bombardier/navigator's control box (figure 8-57 Sheet 1) contains the principal operating controls for the search radar, the BIT controls, the DVRI display controls, and controls for the track radar. In aircraft with the APQ-156, the bombardier/navigator's control box contains the principal operating controls for the search radar and the DVRI display controls. The BIT controls are on the RADAR/DRS TEST panel on the right console. Track radar controls have been eliminated. See figure 8-47, Sheet 2.

POWER Switch

The POWER switch is a three-position lever-lock toggle switch marked OFF, STBY and ON, which controls the application of aircraft power to the search radar. The search radar receives three-phase ac power from the primary 115 V ac bus and dc power from the 28 V dc bus through circuit breakers on the B/N's circuit breaker panel.

With OFF selected, no power is applied to the radar and the raster does not appear on the DVRI.

Positioning the switch to STBY provides low voltage only to all units and to tube filaments. The raster, fixed range marks, and cursors appear. When the receiver tune control is at AFC, sector spoking will be present.

When ON is selected, high voltage is applied to the transmitter magnetron making the radar completely operational.

Note

There is a 5-minute time delay, starting from the time the switch is set to STBY from OFF, before high voltage is available to the magnetron.

The display consists of the raster, markers and target video with ON selected. Video will not be displayed if the TRANSMIT switch is in SIL.

CAUTION

To prevent damage to the antenna, the POWER switch should be at a position other than OFF prior to taxi or flight.

TRANSMIT Switch

The TRANSMIT switch is a three-position toggle switch marked SIL, NORM, and SHORT, which permits selection of dummy load or either of two pulse widths.

When the switch is at SIL, transmission of the search radar is into a dummy load and no target video is displayed. Selection of SIL enables the pilot's horizontal display ONE SCAN/ERASE switch on the pilot's control box.

When NORM is selected, the radar transmits normally and pulse width is determined by the prf at which the radar is operating.

During high prf operation only, i.e. at short ranges, selecting SHORT reduces the pulse width by half for greater range resolution thus making it easier to distinguish between targets closely spaced in range.

Receiver Tune Control

The receiver tune control is a stacked combination rotary selector switch and tuning control which permits automatic or manual control of the frequency of the local oscillator. The control is top-coded with a clover leaf.

The outer portion of the control marked RCVR, is a rotary selector switch having two detented positions, AFC and MAN. When the switch is at AFC, the frequency of the local oscillator is automatically controlled to maintain a 30 Mhz difference from the transmitter frequency. When the switch is at MAN, the local oscillator frequency is manually controlled.

The inner portion of the control marked TUNE is a five-turn rotary control permitting manual tuning of the local oscillator during normal operation.

BRT/CONTRAST Control

The BRT/CONTRAST control is a stacked rotary control top-coded with a triangle. The outer control marked BRT adjusts the overall brightness of the DVRI raster. The inner control marked CONTRAST varies the DVRI video gain to adjust the contrast ratio of targets relative to the background on the DVRI.

RNG MKR/AZ MKR Control

The RNG MKR/AZ MKR control is a stacked rotary control top-coded with a triangle. For the APQ-156, the top-coding is a cross. The outer control marked RNG MKR varies the brightness of the fixed range markers and the range cursor on the DVRI, and the inner control marked AZ MKR varies the brightness of the azimuth marker on the DVRI.

SCAN STAB/SCAN ANGLE Control

The SCAN STAB/SCAN ANGLE control is a stacked combination rotary selector switch and control top-coded with a triangle.

The outer portion of the control marked SCAN STAB is a rotary selector switch with positions marked ADL and REL BRG. When the switch is at ADL the search radar antenna scan is stabilized about the aircraft ADL. When the switch is set to REL BRG, the search radar antenna scan is stabilized about the relative bearing of the azimuth cursor.

Note

- If terrain clearance is selected when the SCAN STAB switch is at REL BRG, antenna scan stabilization automatically switches to the aircraft ADL and the display may not be centered about the azimuth cursor.
- If relative bearing exceeds ±55°, antenna scan stabilization automatically switches to ADL.

The inner portion of the control marked SCAN ANGLE is a rotary control permitting continuous adjustment of the search antenna scan angle from an angle of ±10° to ±55° about the selected scan stabilization reference.

Note

If terrain clearance is selected, the minimum antenna scan angle is automatically set to ±30° about the ADL.

SCAN RATE/AMTI Control

The SCAN RATE/AMTI control is a stacked combination rotary selector switch and control top-coded with a cross. For the APQ-156, there is no top-code.

The outer portion, marked SCAN RATE, is a rotary selector switch with detented positions marked OFF, SLOW, and FAST. When the switch is at the push-locked OFF position, the antenna is held at the selected scan reference. If the SCAN STAB switch is at REL BRG, the antenna will be positioned to the input relative bearing. When the switch is at SLOW or FAST, the antenna scans at rates depending on the prf. At medium or high prf, scan rates of 100°/second or 50°/second may be selected. At low prf, the scan rates are 50°/second or 25°/second.

Note

When terrain clearance is selected antenna scan rate is set to 100°/second regardless of the position of the SCAN RATE switch.

The inner portion of the control, marked AMTI, is a rotary control with a detented OFF position. When the control is rotated out of the OFF detent, the AMTI mode is selected and maximum fixed target cancellation is provided. As the control is rotated clockwise, a mix of fixed targets is added to the display of moving target video.

DISPLAYS Pushbuttons

The three DISPLAYS pushbutton switches select the display mode on the DVRI and PHD. The buttons are interlocked so that only one may be selected at a time and the selected button rotates 45° when depressed. PPI, ARE 30, or ARE 60 may be selected.

Note

If the TC mode is selected, the displays revert to a high prf mode.

PPI RANGE Switch

The PPI RANGE switch is a rotary selector switch top-coded with a bar, having positions marked 150, 75, and 5, used to select the maximum displayed range on the DVRI and PHD in the PPI display modes. Selecting a range automatically selects the correct prf and corresponding transmitted pulse width. When the switch is at 150, the displayed range on the DVRI and PHD is 150 miles, the prf is low, and the transmitted pulse width is long.

The area between 75 and 5 is marked with an arc to indicate continuous adjustment of the maximum displayed range on the DVRI and PHD between 75 miles and 5 miles. Between 27.5 miles and 75 miles, the prf is medium and the transmitted pulse width is medium. Between 5 and 27.5 miles, the prf is high and the transmitted pulse width is normal or short as selected.

ANT PATT Switch

The ANT PATT switch is a three-position toggle switch spring-loaded to the center (off) position, and marked FAR and NEAR. The switch permits adjustment of the peak position of the antenna beam pattern from -2° to approximately -12°.

When the switch is held to the FAR position, the antenna dish is driven upward with respect to the feedhorn, altering the beam pattern to enhance distant targets. Holding the switch to NEAR tilts the beam down.

Note

When terrain clearance is selected the antenna pattern is automatically set to FAR, but it may then be overridden if desired.

STC SLOPE/DEPTH Control

The STC (sensitivity time control) control is a stacked rotary control top-coded with a triangle. For the APQ-156 the top-code is a bar. Used in conjunction with the RCVR gain control, the STC controls provide adjustment of target intensities to produce even overall intensity and prevent blooming of close-in strong targets on the DVRI and PHD.

The inner control is marked STC DEPTH and adjusts the initial level of receiver gain reduction applied to the affected video.

The outer control, marked STC SLOPE, adjusts the recovery or receiver gain reduction as a function of range, decreasing the amount of gain applied to closer targets relative to those farther out.

Full counterclockwise rotation of the STC controls allows target video to be displayed as received by the radar.

RCVR Gain Control

The RCVR gain control adjusts the amount of gain applied to received target video. Rotating the control clockwise increases the gain, permitting weaker targets to be displayed and increasing the intensity of all targets and the ground return. Counterclockwise rotation decreases gain and removes weaker returns and the ground return from the displays. In aircraft with the APQ-156, this control is the outer knob of a stacked control marked RCVR/BEACON.

VIDEO/DIF Gain Control

The VIDEO/DIF gain control is a stacked rotary control providing adjustment of displayed target video on the DVRI and PHD. For the APQ-156, the control is top-coded with a cross.

The outer control, marked VIDEO, adjusts the amount of gain applied to displayed target video. Clockwise rotation increases the intensity of hard target video while decreasing low-level background video; counterclockwise rotation reduces gain decreasing the intensity of hard target video while increasing low level background video.

The inner control marked DIF permits differentiation of individual targets in a complex return. When the control is at the AREA position, target information is presented as received. Rotating the control clockwise suppresses more and more of the target returns until at the DET (detail) position only the leading edges of targets are displayed.

BEACON Control

The BEACON control is a rotary control with a detented OFF position that permits selection of the beacon mode of operation. When the control is at OFF, the beacon mode is deenergized. Clockwise rotation from OFF permits beacon signals to be displayed. The intensity of the beacon target is controlled by the RCVR gain, VIDEO gain, DIF gain, and STC controls. As clockwise rotation is continued, the amount of ground mapping displayed is increased until at the full clockwise position full ground mapping video is displayed along with the beacon target. For the APQ-156, this control is the inner knob of a stacked control marked RCVR/BEACON.

ELEV TRKG Switch

The ELEV TRKG switch is a two-position toggle switch marked ON and OFF, permitting selection of the elevation mode of target tracking.

FREQ AGILITY Switch

The FREQ AGILITY switch is a two-position toggle switch marked ON and OFF. When the switch is ON, clutter and scintillation effects on target returns are reduced, providing a cleaner display. This switch has effect only during high prf operation, is overridden by selection of AMTI, SIL, or STBY and when the receiver is being manually tuned.

AZ-RANGE TRKG Switch

In aircraft with the APQ-156, the AZ-RANGE TRKG switch is a two-position lever-lock toggle switch marked OFF and ON. When the switch is at ON, azimuth-range tracking is enabled; at OFF, azimuth-range tracking is inhibited.

Cursor Control Switch

The cursor control switch is a two-position toggle switch marked COMPT and MAN. When the switch is at COMPT, the position of the range and azimuth cursors is controlled by the computer. Selecting MAN permits manual positioning of the cursors with the MAN RANGE and AZ CURSOR controls.

AZ CURSOR Control

The AZ CURSOR control is a continuously adjustable rotary control, top-coded with a cross. When the cursor control switch is at MAN, clockwise rotation of the control moves the azimuth cursor to the right. The cursor may be set to any angle from +55° to -55° with respect to the ADL. The compass rose on the DVRI will display the relative bearing of the azimuth cursor (relative bearing bug). The relative bearing bug may be rotated through 360° by use of the AZ CURSOR control even though the azimuth cursor only appears from +55° to -66° of the ADL

MAN RANGE Control and RANGE Indicator

For the APQ-148, the MAN RANGE control is a multiturn rotary control used to position the range cursor when the cursor control switch is at MAN. A six-digit RANGE readout indicator displays the setting of the control to the nearest 10 feet (the last digit is fixed at zero). Rotational stops on the control are located at 0 and 200,000 feet.

RANGE X 10 Thumbwheels

For the APQ-156, the RANGE X 10 thumbwheels and indicator windows are used to position the range cursor when the cursor control switch is at MAN, to the nearest 10 feet.

METER Select and Slew Switch (METER INCR/DECR)

The METER select consists of four dual-function pushbuttons and a three-position toggle switch, permitting selection of the function to be displayed on the meter. When the toggle switch is at OFF, no meter readings are displayed.

With the toggle switch to the right, the following functions may be monitored:

ANT PATT - The meter indicates the relative position of the peak of the transmitted beam pattern. A reading at the low end of the scale indicates that the peak is at its upper limit of 2° below the horizon (FAR pattern) while a reading at the high end indicates that the peak is at its low limit approximately 12° below the horizon (NEAR pattern).

XTAL CUR - The meter indicates the search radar mixer crystal current. When the RCVR TUNE control is in the MAN position, the inner knob of the control adjusts the XTAL CUR meter reading.

MAG CUR - The meter indicates the search radar magnetron current. This value may be adjusted using the METER slew switch. With a normal pulse, this should be set to 0.8.

MAG FREQ - The meter indicates search radar magnetron operating frequency. A reading at the

high end of the scale indicates that the radar is operating at the high end of its transmitter frequency range, a low reading indicates the low end. The frequency can be adjusted with the METER slew switch.

When the toggle switch is to the left, the following may be monitored:

RCVR SENS - The meter indicates receiver sensitivity, i.e. its ability to detect signals just above the noise level. The reading should be taken with RCVR gain at maximum. The meter reading is determined the position of the RCVR gain control.

XMTR PWR - The meter indicates transmitter power output. This meter reading is not adjustable.

TRACK XTAL CUR - This position is inoperative.

TRACK MAG CUR - The position is inoperative.

The METER slew switch is a three-position toggle switch spring-loaded to the center (off) position. Holding the switch to the INCR or DECR position permits adjustment of search radar magnetron current (power) or frequency.

MODE Switch

In aircraft with the APQ-148, the MODE switch is a two-position toggle switch marked BORESIGHT and TRACK on the TRACK portion of the B/N's control panel. Setting the switch to TRACK permits normal operation of the search radar tracking modes. Selecting BORESIGHT puts the azimuth cursor at the ADL, and puts the computer in the boresight mode. The DVRI and PHD displays revert to high PRF.

With the computer in the boresight mode, and attack selected, the azimuth cursor goes to the velocity vector, and range goes to 48,000 feet or impact point slant range, depending on aircraft pitch angle.

With the ACU panel set for a Shrike delivery, setting the MODE switch to BORESIGHT enables Shrike ranging.

In aircraft with the APQ-156, the MODE switch is not provided, the boresight mode is selected and the azimuth cursor is set to the ~~ADL~~ VEL VECTOR when the pilot depresses the attack button on the stick grip. Shrike ranging is selected by selecting a Shrike-loaded station on the ACU and setting the MASTER ARMT switch to on.

TEST Controls and Indicators

The TEST control and indicators permit selection and monitoring of the built-in test and fault isolation functions.

The MODE buttons permit selection of one of seven test modes. With the toggle switch below the buttons set to the left the following functions may be tested:

BIT - The test circuits are self-tested.

SRCH - The search radar circuits are tested.

AMTI - The search and AMTI channels are checked.

TC - The terrain clearance mode is tested.

Note

Since the BIT mode disables normal radar functions, BIT should not be selected if the clearance mode is being flown.

When the toggle switch is set to the right, the following functions may be tested.

ELEV TRKG - The operation of the elevation tracking mode is checked.

TWS - The operation of the azimuth-range tracking mode is checked.

ATF - Provisions are made for future incorporation of automatic terrain following.

If a fault is detected during one of the BIT modes, it may be isolated to one of 10 aircraft replaceable assemblies by use of the FAULT ISLN select buttons and toggle switch.

Note

All fault isolation operations must be conducted in accordance with appropriate maintenance publications and are not flight crew procedures.

The GO and NO GO indicators assist in monitoring test results.

When the two associated three-position toggle switches are at OFF, the test modes are disabled.

The RADAR/DRS TEST panel (figure 8-57 Sheet 2) includes the controls and indicators for radar BIT in aircraft with the APQ-156. When the MODE toggle is to the left, the BIT, SRCH, or TC tests may be selected. With the switch to the right, AMTI, AZ RNG (azimuth-range), or ELEV TRKG tests may be selected.

PILOT'S CONTROL BOX (APQ-148)

The lower portion of the pilot's control box (figure 8-57 Sheet 1) marked HORIZONTAL controls controls for the search radar displayed on the pilot's horizontal display.

POWER Switch

The power switch is a three-position toggle switch marked OFF, STBY, and ON, which controls power to the pilot's horizontal display (PHD). The OFF position deenergizes the PHD, the compass rose, and command heading bug; the STBY position provides power to the compass nose and command heading bug; and the ON position provides operating voltage to light the PHD storage tube.

Note

The search radar POWER switch on the B/N's control box provides low-voltage power and blower power to the PHD.

RNG MKR/AZ MKR Control

The RNG MKR/AZ MKR control is a stacked rotary control top-coded with a cross. The outer control, marked RNG MKR, varies the brightness of the range cursor and the fixed range marks on the PHD and the inner control, marked AZ MKR, varies the brightness of the azimuth marker on the PHD.

PERSIST Control

The persist control is a rotary control top-coded with a bar, which varies the persistence time of the PHD phosphor. Full clockwise rotation provides maximum persistence.

ONE SCAN/ERASE Switch

The ONE SCAN/ERASE switch is a three-position toggle switch spring-loaded to the center (off) position that controls operation of the radar when the TRANSMIT switch is at SIL. Selecting ONE SCAN causes the radar to operate for one left to right scan of the antenna. Video will be displayed on the DVRI and on the PHD long-persistence phosphor. Setting the switch to ERASE removes the display stored on the PHD screen.

BRT/CONTRAST Control

The BRT/CONTRAST control is a stacked rotary control top-coded with a triangle. The outer control, marked BRT, adjusts the overall brightness of the PHD raster. The inner control, marked CONTRAST, adjusts the contrast ratio of targets relative to the background on the PHD.

TRACK RADAR CONTROLS

In A-6E 158041 thru 159579 and A-6E Mod M1 thru M121, track radar controls are provided on the bombardier/navigator's control box (figure 8-57 Sheet 1) to permit operation should a track radar be installed.

Power Switch

The POWER switch is presently inoperative.

E2.0 NO LONGER HAS SOFTWARE FOR TRACK RADAR

Note

The position of the track radar POWER switch is considered in computer validity tests of search radar tracking modes. The switch should be left at OFF when a track radar is not installed.

MAG CUR Control

The MAG CUR control is presently inoperative.

Receiver Tune Control

The receiver tune control is presently inoperative.

TARGET/TONE Control

The TARGET/TONE control is presently inoperative.

VIDEO TAPE RECORDER AN/USH-17(V)

Provisions have been made for the installation of the AN/USH-17(V) airborne video tape recorder on the extensible equipment platform. When the recorder is installed, the control panel marked MISSION RECORDER (figure 8-59) is on the B/N's right console.

The video tape recorder (VTR) is a dual-channel solid state recorder which provides 46 minutes of recording time for single-channel and 23 minutes for dual channel operation.

In addition to the video signals being displayed on the DVRI and in TRAM configured aircraft, on the FLIR indicator, the VTR records the audio at the B/N's head-set and digital outputs from the computer. The computer provides a continuous output of the following data:

- Present position latitude and longitude
- True heading
- Ground track direction
- Groundspeed
- Altitude
- Relative bearing to cursor intersection
- Slant range to cursor intersection
- True heading to destination
- Ground range to destination
- Time-to-go to destination

At the time of weapon release, the computer freezes and provides the following data to the VTR:

- True heading
- Wind direction and velocity
- Steering error
- Aircraft angle of attack
- Ground track velocity
- Corrected true airspeed
- Vertical loop error term
- Target altitude (MSL)
- Vertical separation
- Range to target
- Computed ballistic range
- Normal acceleration
- Time of fall
- Release advance and/or 1/2 stick length
- Moving target velocity/velocity correct

The VTR receives 115 V ac for operation from the ac monitored bus and 28 V dc for heater power from dc monitored bus #1 through circuit breakers on the aft bay circuit breaker panel.

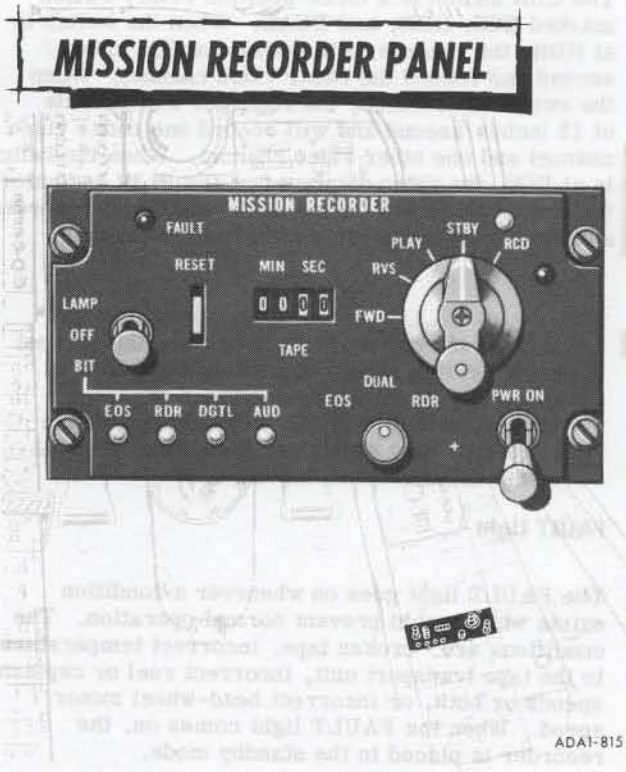

Figure 8-59

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MISSION RECORDER PANEL

The MISSION RECORDER panel on the B/N's right console (figure 8-59) contains all the controls and indicators for operating the video tape recorder.

PWR Switch

The power switch is a two-position toggle switch marked OFF and ON. When the switch is at OFF, no power is applied. Selecting ON provides 115 V ac for operation and 28 V dc for the heaters. The recorder should be at operating temperature within 3 minutes from the time power is applied. In extremely cold weather 5 minutes may be required.

Note

To reduce wear on the head-wheel bearings, the PWR switch should be OFF for launch.

TAPE Time Indicator and RESET Control

The TAPE time indicator provides a four-digit readout of elapsed recording time in minutes and seconds. The readout may be returned to zero by depressing the RESET control.

Channel Select Switch

The CHN switch is a three-position rotary switch marked EOS, RDR, and DUAL. When the switch is at RDR, the recorder will operate at 7.5 inches/second and record the radar video channel. When the switch is at DUAL, the recorder will operate at 15 inches/second and will record one radar video channel and one other video channel. When the switch is at EOS, the video displayed on the FLIR indicator (aircraft 159895 and ON and M121 and ON) is recorded and the recorder operates at 7.5 inches/second.

Note

In aircraft with no FLIR indicator, the channel select switch should be kept at RDR. Since there is presently only one video channel to record, selecting DUAL will only reduce the recording time available. Selecting EOS will result in no video on the tape.

FAULT Light

The FAULT light goes on whenever a condition exists which would prevent normal operation. The conditions are: broken tape, incorrect temperature in the tape transport unit, incorrect reel or capstan speeds or both, or incorrect head-wheel motor speed. When the FAULT light comes on, the recorder is placed in the standby mode.

Test Switch and Lights

The test switch is a three-position toggle switch marked LAMP, OFF, and BIT, spring-loaded to the OFF position. Holding the switch to LAMP tests the indicator lights on the panel. When the switch is held to BIT, the recorder goes into self-test. An internally generated signal is recorded and played back. During playback, the recording is compared with the reference. Any failure lights the EOS or RDR lights, the DGTL (digital) light, or the AUD light.

Mode Selector Switch

The mode selector switch is a five-position rotary selector switch marked RCD, STBY, PLAY, RVS and FWD which controls the mode of recorder operation. This switch must be at STBY before actuating the PWR switch to either ON or OFF.

Setting the switch to RCD places the recorder in operation and lights the RCD light. When the VTR is recording, it records the selected video, the digital data, the ICS audio, and it automatically erases any data which may have been on the tape previously.

Selecting STBY turns the STBY light on and applies power to the recording head motors, and the VTR is ready to record.

Note

When power is on and the function switch is at STBY, stepping the computer into attack automatically starts the recorder and lights the RCD light. A stop signal is automatically sent after transmission of freeze data at release. If the pilot or B/N manually steps the computer out of attack, a stop recording signal will not be sent unless steering is cycled or a new target altitude is entered.

The PLAY position is operational only for the EOS channel in aircraft with a FLIR indicator. In these aircraft, selecting PLAY permits playback of the video recorded in the EOS channel on the FLIR indicator.

Selecting RVS rewinds the tape at 100 inches/second without disturbing the recorded information.

Selecting FWD winds the tape at 100 inches/second without disturbing the recorded information.

DETECTION AND RANGING SET

In A-6E 159895 and ON and A-6E Mod M121 and ON, provisions have been made for installation of the AN/AAS-33 Detection and Ranging Set consisting of a forward-looking infrared (FLIR) receiver, a laser rangefinder/detector, and a forward air controller (FAC) laser receiver. The controls and indicators for operation of these sensors when installed are shown in figure 8-59A.

DRS CONTROLS AND INDICATORS

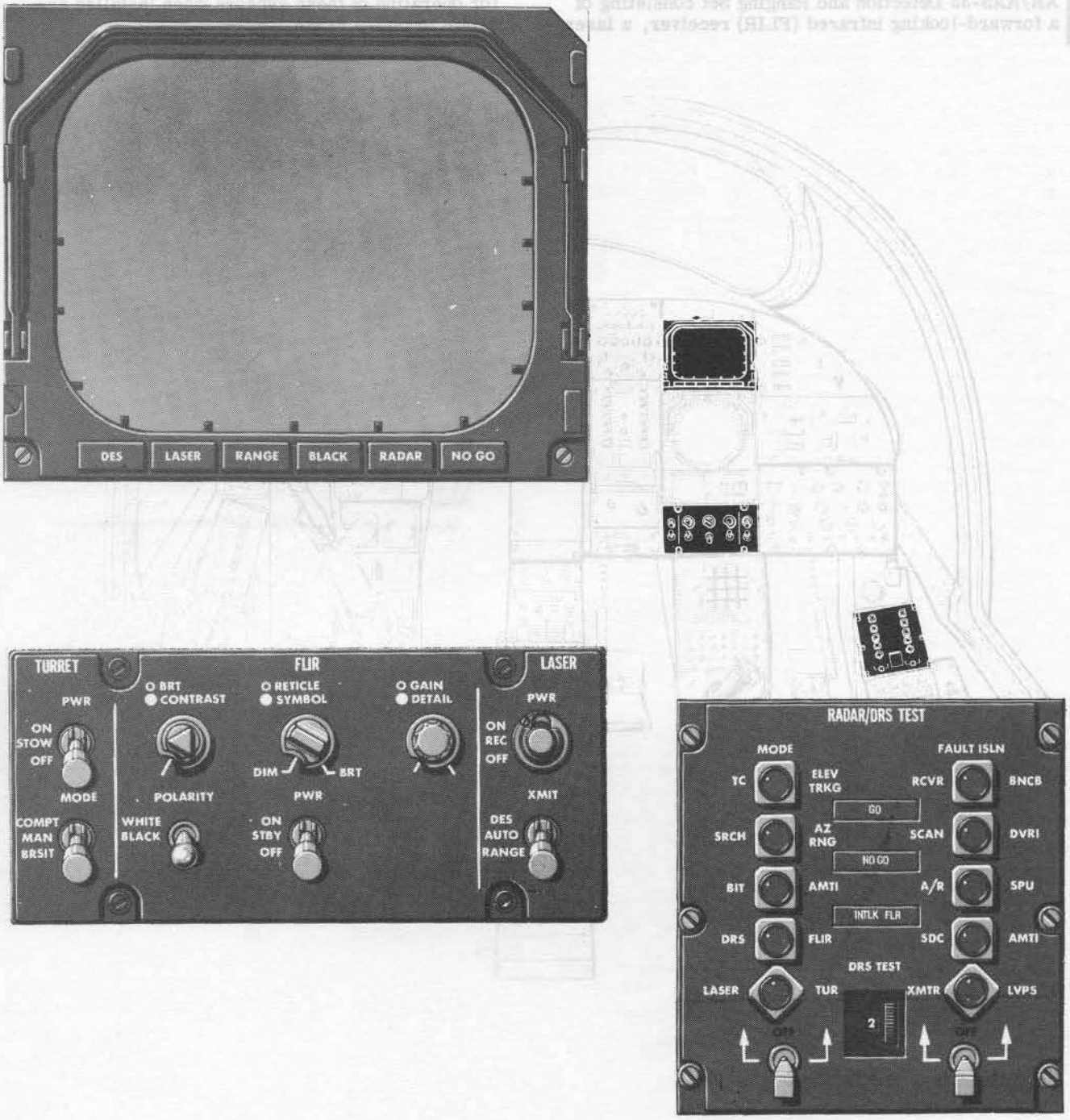

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Figure 8-59A

DOPPLER NAVIGATION RADAR

Doppler Navigation Radar AN/APN-153 is a self-contained airborne system that automatically computes aircraft groundspeed and drift angle, completely independent of ground situations and wind estimates. The only auxiliary input this system requires is pitch and roll from the aircraft attitude reference system.

Doppler-derived ground speed and drift angle are provided to the computer where they are translated into north/south and east/west components of velocity and smoothed wind. Doppler inputs are used in deriving system velocities, depending on the navigation mode selected. Doppler-derived velocities may be removed from the computer memory by setting the velocity correct switch on the computer control unit to OFF ERASE.

The Doppler navigation radar consists of three major functional units: a control panel, a receiver-transmitter and an antenna assembly. The set uses a four-beam pulsed transmission. It beams signals to the ground, receives echoes, and measures the frequency shift produced by the relative motion between the aircraft and the earth. The frequency shift drives the antenna in azimuth until the antenna is aligned with the aircraft's track. The drift angle indication is the resultant angle between the antenna axis and the aircraft axis. Once the antenna is aligned with the ground track of the aircraft, the measured frequency shift is used to derive groundspeed. When the Doppler radar is energized, it is in either a normal mode, or in a memory mode. In the normal mode, groundspeed and drift angle are measured automatically and simultaneously. In the memory mode, the MEMORY light is on and the last derived groundspeed and drift angle are retained until the radar can again acquire a usable signal, or the equipment is turned to OFF.

Note

Whenever the Doppler radar is in memory mode, the computer considers Doppler inputs invalid and they are not used.

DOPPLER OPERATING CHARACTERISTICS

The Doppler radar receives AØ 115 V ac from the PRARS bus through the APN-153 5-ampere CB in the aft bay, and 26 V ac from the primary bus through the APN-153 1/2-ampere CB on the nosewheel well (aft) circuit breaker panel. All other voltages (dc and ac) are generated in the APN-153 internal power supply.

Operating characteristics of the Doppler are:

Minimum altitude:	40 feet above terrain
Maximum altitude:	50,000 feet
Groundspeed:	80 to 800 knots
Drift angle:	25° left or right
Pitch stabilization:	17° nose up to 25° nose down
Roll stabilization:	±30°
Transmitter frequency:	13,325 MHz ±50 MHz
Pulse repetition frequency:	75 kHz nominal, modulated from 60 kHz to 50 kHZ at 30 Hertz

Note

The computer rejects Doppler signals as invalid when aircraft attitude exceeds ±17° pitch or 25° roll and ground speed or drift angle exceeds limits.

NEW

DOPPLER RADAR CONTROL PANEL

The Doppler radar control panel on the right console (figure 8-60) contains all of the operating controls, the groundspeed and drift indicators, and the controls for self-test.

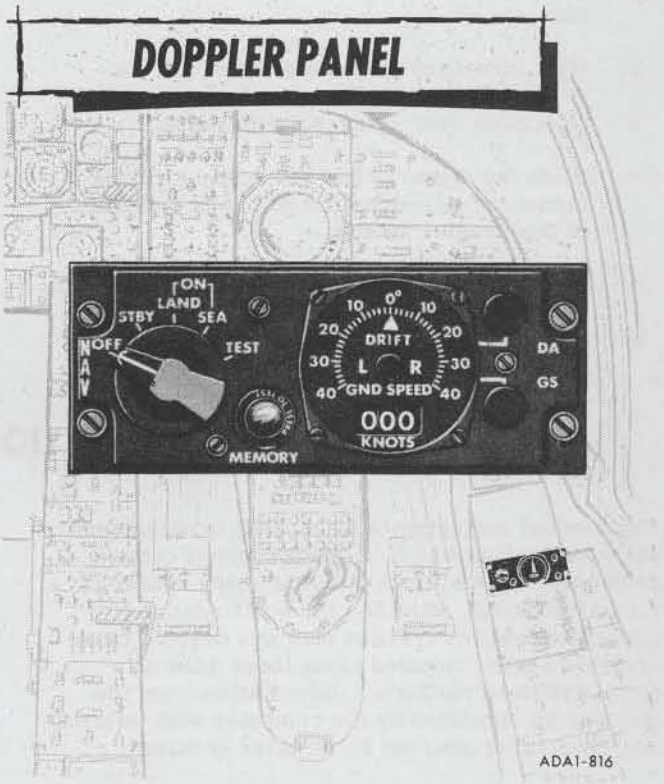

Figure 8-60

Mode Switch

The mode switch is a five-position rotary switch placarded OFF, STBY, ON LAND, ON SEA, and TEST. When the switch is in the OFF position, all power is removed from the radar navigation set. Placing the switch to STBY applies all power except magnetron high voltage. The ON LAND and ON SEA positions place the equipment in operation for the type of surface below the aircraft. SEA applies a constant (k) factor to correct for the dispersion of radar energy by water. The TEST position is used for self-test purposes and inserts a simulated Doppler signal of 121 knots and 0° drift angle.

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CAUTION

To provide stabilization to the antenna and to prevent damage to the equipment, the Doppler should be in STBY during taxi, takeoff, or landing.

Memory Indicator Light

The MEMORY indicator light is an amber press-to-test light which comes on when the mode selector is in the STBY position or when the system is operating in memory. A memory signal is also supplied to the computer.

The MEMORY light will come on under the following conditions:

1. Before a signal has been acquired on initial turn-on.
2. Operation over extremely rough terrain.
3. Operation over glassy smooth water.
4. When the signal is lost due to the aircraft maneuvering beyond the pitch and roll limits of the Doppler antenna.
5. When a cooler or power failure has occurred.
6. When the APN-153 circuit breaker on the aft bay circuit breaker panel pops or is pulled.

Ground Speed/Drift Angle Indicator

The groundspeed/drift angle indicator consists of a needle placarded DRIFT L and R marked in 2° increments to 40°, and a window placarded GND SPEED - KNOTS. Aircraft groundspeed and drift angle are read directly.

Note

Due to the antenna installation, the maximum drift reading is limited to ±25°.

Ground Speed/Drift Angle Knobs

The groundspeed (GS) and drift angle (DA) manual control knobs are used to manually set in values used in self-test of the equipment. The knobs must be depressed in order to change the values on the indicator. Values can be changed only when the set is in memory, standby, or off.

Note

Since Doppler information is rejected by the computer whenever the Doppler is in the memory mode, test, or OFF, manual insertion of groundspeed and drift is useful only when performing self-test.

INERTIAL NAVIGATION SYSTEM AN/ASN-31

The inertial navigation system (INS) is an automatic aid to navigation which is independent of outside reference. The system is the primary source of aircraft heading, attitude, and horizontal and vertical velocities. These data are derived from accelerometers mounted along three axes on a gyro-stabilized platform. Information from the INS may be combined by the computer with information from other sources for greater accuracy.

The accelerometers mounted along the three axes sense any variation in aircraft acceleration and generate acceleration signals, which are converted to velocities by the platform computer and are sent to the digital computer. The velocities are used by the computer to update latitude, longitude, and altitude. By updating these values, the computer generates earth rate correction signals to be sent to the INS to keep it level with respect to the local gravity vector and oriented to true north. Attitude and azimuth signals are generated by synchros mounted on the platform gimbals. These signals are sent to the platform adapter to provide pitch, roll, and true heading to the other aircraft systems.

INERTIAL PLATFORM ORIENTATION

The orientation of the gyro-stabilized inertial platform is maintained with respect to three mutually perpendicular axes referred to as the X, Y, and Z axes, and it is about these axes that the accelerometers measure aircraft accelerations.

ORIENTATION AXES

The Z-axis is coincident with the local vertical and the direction toward the center of the earth is considered to be positive. The X-axis is perpendicular to the Z-axis and lies in the plane of the local meridian. The positive direction of the X-axis, defines north. The Y-axis is mutually perpendicular to the X- and Z-axis, and is positive toward the east.

ALIGNMENT

In order to establish the inertial navigation system as a valid reference, the platform must be initially leveled with respect to the local vertical and oriented to true north. This process is known as alignment and is accomplished in two phases: rough alignment and fine alignment.

Alignment of the gyro-stabilized platform may be accomplished ashore, on a carrier deck or in flight. Shore-based or carrier alignments can be accomplished with the computer either on or off. In-flight alignments are normally performed with the aid of the computer. However, it is possible to rough align the INS in flight for use as an attitude reference with the computer turned off.

During the rough alignment phase, which lasts 50 seconds, the gyros are brought up to speed and the platform is leveled with respect to the elevation and roll axes of the aircraft by means of error signals transmitted to the platform gimbal motors from pitch and roll resolvers contained in the system. The platform is also oriented to within a few degrees of a true north reference provided from an outside source. The heading reference is used as a positioning signal and is sent to the azimuth gimbal motors.

Fine alignment, which begins automatically at the end of the 50-second rough alignment, consists of accurately leveling the gyro-stabilized platform and accurately orienting it to true north and requires approximately 9 to 20 minutes (9 to 14 minutes with AVC No. 1342) depending on the alignment mode selected. The accelerometers sense any displacement of the platform orientation with respect to local gravity and generate error signals which are applied to the platform gimbal motors, which level the platform. Gyrocompassing, which commences during the latter portion of fine leveling, is the method by which the platform is oriented precisely to true north.

If the X-axis is not properly aligned, a portion of the acceleration due to the earth's angular velocity proportional to the alignment error is felt about the Y-axis. This acceleration is transmitted as an error signal to the azimuth gimbal motor, which turns the azimuth gimbal until no error exists.

The bombardier/navigator can monitor the alignment by means of the indicator lights, the align progress meter on the platform control panel, the DVRI, heading indications and VDI attitude.

SHORE-BASED ALIGNMENT

The inputs to the inertial navigation system required to perform a shore-based alignment are latitude and a true heading reference. The true heading reference is derived from MA-1 compass heading ± local magnetic variation when the ATTITUDE REF switch is set to COMP IN or MAG/VGI, or the heading set in the CARR HDG window when the ATTITUDE REF switch is set to COMP OUT. Latitude is provided by means of the erection controller panel. These inputs are required for the 50-second rough alignment phase. Fine alignment normally takes 9 to 11 minutes with the COMPASS switch set to IN and 11 to 20 minutes (11 to 14 minutes with AVC No. 1342) with the switch set to OUT.

PRE-SET ALIGNMENT

Preset alignment is predicated upon three conditions; first, that the aircraft had a good alignment when the system was last turned off: second, that the aircraft has not been moved; and third, that MAG/VGI has not been selected. Given these conditions, a preset alignment can be made in approximately 3 minutes after the 5-minute warmup period by depressing the PRE-SET ALIGN button on the platform control panel. As in a normal ground alignment, rough alignment and fine alignment occur, but unlike other alignments, no gyrocompassing takes place. The true heading shaft of the platform adapter is locked in place until OPER is selected on the platform control panel. The READY light will illuminate approximately 3 minutes after selecting PRE-SET ALIGN, indicating that the level detection circuit in the platform computer has fired, and OPER may be selected. A preset alignment will result in an alignment no more accurate than the alignment that had been attained prior to the previous shutdown. Remaining in PRE-SET ALIGN will not improve the alignment accuracy inasmuch as no gyrocompassing takes place.

CARRIER ALIGNMENT

When the aircraft is on the deck of a moving carrier, the inertial navigation system requires initial inputs of latitude, a true heading reference, and carrier velocity as initial conditions for rough alignment, which takes 50 seconds. The true heading reference is derived from carrier true heading (ATTITUDE REF switch must be at COMP OUT) and aircraft spotting angle, i.e., the difference between aircraft heading and the heading of the carrier. Aircraft spotting angle is manually set in the MAG VAR window. Spotting angles to the right of carrier heading are set as east variation; angles to the left of carrier heading are set as west variation. The inputs of carrier heading and carrier speed may be set manually on the erection controller panel, or may be available automatically from the ship's inertial navigation system (SINS) through the receptacle on the external power panel on the right side of the fuselage. Latitude initially must be inserted manually but is automatically updated by the erection controller. Longitude is not required. The CARRIER ALIGNMENT receptacle also provides a two-way communications link with the SINS center. The ALIGN switch must be set to SINS ICS for communications with the SINS center. The relative velocity computer modifies carrier velocity inputs to the INS as necessary, depending upon the aircraft location with respect to the SINS. A turn rate detector in the aircraft suspends alignment and nulls the align progress meter if carrier heading changes at a rate of 30°/ minute or greater unless automatic inputs are being provided and a relative velocity computer is being used. Fine heading alignment is accomplished by gyro-compassing. A full alignment requires 20 minutes (14 minutes with AVC No. 1342) to complete.

IN-FLIGHT ALIGNMENT (FULL TERM)

In-flight alignment requires initial inputs to the INS of true heading, aircraft velocity, and the latitude of

the alignment starting point. As in shore-based alignment, the source of the heading reference for rough alignment depends on the position of the ATTITUDE REF switch and may be MA-1 heading ± local variation as set on the lower portion of the DDU or the heading set on the erection controller panel. Latitude is manually set on the erection controller panel. Aircraft velocity data can be derived from the computer and by making use of Doppler velocities or velocity-correct.

Note

If the computer is not operating, the inertial platform may be partially aligned in flight so as to provide altitude information only.

Fine alignment of attitude and velocity begins automatically after the approximately 50-second rough alignment period and requires approximately 8 minutes (6 minutes with AVC No. 1342). If the bombardier/navigator moves the ALIGN switch from OFF to GYROCOMP at this time, fine heading alignment (gyrocompassing), which requires about 20 minutes, commences.

IN-FLIGHT ALIGNMENT (SHORT TERM)

A short term alignment can be made in flight that eliminates gyrocompassing. Alignment of the inertial platform may be less than optimum due to the limitation of heading information being derived from the MA-1 compass. Aircraft velocity inputs continue to be used during fine alignment. A turn rate detector suspends alignment during turns of 30°/minute or greater. A normal short term alignment following the procedures found in Section III of this manual will provide relatively accurate results, provided a fully operational system (i.e., Doppler radar, computer, MA-1 compass, VGI, and search radar) is available.

The navigation capability after a short-term in-flight alignment will depend upon the quality of the heading information that the platform has aligned to and the velocity outputs of the system. Heading information from the MA-1 using correct magnetic variation should be within ±2°. Using this value, cross track navigation errors will be close to 3% of distance. Along track navigation for the Doppler/inertial mode will depend upon the quality of the Doppler. Typical values are 1%.

PLATFORM CONTROLS AND INDICATORS

The platform operating controls and indicators are principally located on the PLATFORM panel on the right console (figure 8-61). The ATTITUDE REF switch on the pilot's control box (figure 8-61) selects the heading reference for rough alignment. Other alignment controls are on the ERECTION CONTROLLER panel (figure 8-61).

ATTITUDE REF Switch

The attitude reference switch on the pilot's control box is a three-position toggle switch labeled COMP OUT, COMP IN, and MAG/VGL. The switch is used during platform alignments to select the source of azimuth information for the initial coarse alignment. After the platform has been aligned, the ATTITUDE REF switch serves as a selector switch for determining whether heading and attitude reference is to be provided by the INS or the MA-1 compass and the VGI.

Platform Selector Buttons

The five platform selector pushbuttons select a phase or condition of system operation. When set from OFF to STBY (standby), power is applied to the platform temperature controls to bring the platform to proper temperature. When the selector is set to ALIGN or PRESET ALIGN, power is applied to the power supply, providing operating voltages to the platform units. The normal operating condition of the inertial navigation system is with the OPER (operate) position depressed, and all platform indicator lights out.

Note

The STBY button must be depressed to set information in the erection controller panel prior to alignment.

Align Progress Indicator

The align progress indicator is used in conjunction with the READY light during platform alignments. While the READY light will go on after a level detection circuit has sensed that a level condition has existed for 55 seconds (2 minutes with AVC No. 1342), a nulled align progress indicator (±1 unit) is the only true indication that the platform is ready to be switched to OPER. Any oscillations of the needle indicate that the inertial system has not finished gyrocompassing.

Note

- When making an automatic carrier alignment a READY light is not required, provided following criteria have been met: the align progress meter indicates a null (± one unit) for at least 55 seconds prior to going to operate; at least 15 minutes have been spent in align; and actual carrier velocities are read out in the digital display unit (within 3 knots) after going to operate and no velocity drift is observed.

- When making a manual carrier alignment, turns of the carrier which are 30°/minute or more will suspend the alignment and cause the align progress meter to indicate a null. The same condition may occur during an automatic carrier alignment if the relative velocity computer is not used.

- When making a manual carrier alignment, the same criteria as for automatic carrier alignments apply with the additional requirements that the 15-minute alignment time must be exclusive of suspend align time, and there must be positive indication that a suspend align is not existing during the 55-second meter null.

INS CONTROLS AND INDICATORS

ASN-31

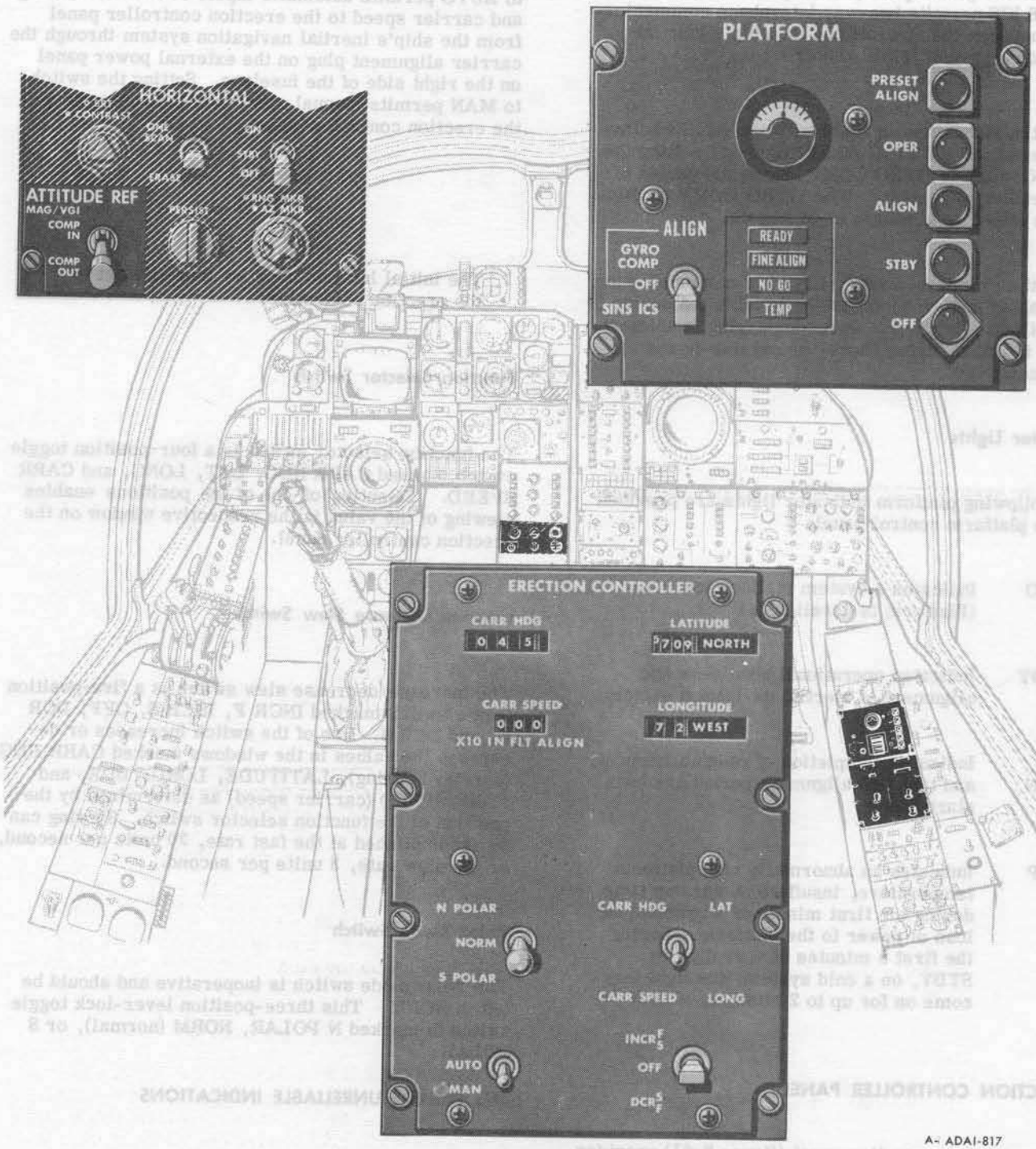

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Figure 8-61

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ALIGN Switch

The ALIGN switch is a three-position toggle switch marked SINS ICS, OFF, and GYRO COMP.

During a carrier alignment, with the carrier alignment plug inserted in the CARR ALIGN receptacle on the external power panel, setting the ALIGN switch to SINS ICS permits two-way interphone communications between the aircraft and the ship's inertial navigation system (SINS) center.

When the aircraft is in flight with the ALIGN button depressed and the FINE ALIGN light on, setting the ALIGN switch to GYRO COMP begins the period of fine heading alignment. The GYRO COMP position has no effect when weight is on wheels.

When the switch is at OFF, SINS ICS communication is disabled and gyrocompassing is inhibited during an in-flight alignment. Gyrocompassing is automatically initiated during shore- or carrier-based alignment.

Indicator Lights

The following platform indicator lights are provided on the platform control panel:

NO GO	Indicates a system malfunction. (Platform is unreliable.)
READY	Indicates operational readiness and alignment of inertial navigation system.
FINE ALIGN	Indicates completion of rough alignment, and that fine alignment period has been started.
TEMP	Indicates an abnormally high platform temperature, insufficient warmup time during the first minute of alignment, or loss of power to the platform. During the first 5 minutes of operation in STBY, on a cold system, the light may come on for up to 2 minutes.

ERECTION CONTROLLER PANEL

The erection controller panel (figure 8-61) provides erection and alignment information to the inertial navigation system for shore, carrier deck, or in-flight alignment and digital computer OFF operation. Information for the initial alignment can be set automatically in the display windows or inserted manually by the bombardier/navigator.

Mode Selector Switch

The mode selector switch is a two-position toggle switch marked AUTO and MAN. Setting the switch to AUTO permits automatic inputs of carrier heading and carrier speed to the erection controller panel from the ship's inertial navigation system through the carrier alignment plug on the external power panel on the right side of the fuselage. Setting the switch to MAN permits manual slewing of the counters on the erection controller panel.

Note

The initial latitude must be manually set in the erection controller.

Function Selector Switch

The function selector switch is a four-position toggle switch marked CARR HDG, LAT, LONG, and CARR SPEED. Selection of one of the positions enables slewing of the value in the respective window on the erection controller panel.

Increase/Decrease Slew Switch

The increase/decrease slew switch is a five-position toggle switch marked INCR F, INCR S, OFF, DCR F, and DCR S. Use of the switch increases or decreases the values in the windows marked CARR HDG (carrier heading), LATITUDE, LONGITUDE, and CARR SPEED (carrier speed) as determined by the position of the function selector switch. Slewing can be accomplished at the fast rate, 30 units per second, or the slow rate, 3 units per second.

Polar Mode Switch

The polar mode switch is inoperative and should be left in NORM. This three-position lever-lock toggle switch is marked N POLAR, NORM (normal), or S POLAR.

INS FAILURE/UNRELIABLE INDICATIONS

Figure 8-62 illustrates the indications of failure or unreliability in the INS along with possible corrective actions for each of the various conditions.

INS FAILURE/UNRELIABLE INDICATIONS

ASN-31

INDICATION	CAUSE	CORRECTIVE ACTION
1. NO GO LIGHT ON (STEADY) 2. VDI PLATFORM LIGHT ON (FLASH)	IN OPER, NO GO CONDITION	REALIGN INS, OR SELECT MAG/VGI AND INS OFF (1)
VDI PLATFORM LIGHT ON (STEADY)	NOT IN OPER, COMPASS SW. AT IN OR OUT (A-6A,B,C), OR ATTITUDE REF SW. AT COMP IN OR COMP OUT (A-6E)	SELECT OPER IF READY LIGHT IS ON OR SELECT MAG/VGI
TEMP LIGHT ON (STEADY)	OVER TEMPERATURE (MORE THAN 3 MIN. IN ALIGN) (MORE THAN 1 MIN. IN OPER)	SELECT MAG/VGI AND INS OFF FOR DURATION OF FLIGHT INCLUDING LANDING
TEMP LIGHT ON (STEADY)	LOSS OF POWER IN STBY	1. CHECK CIRCUIT BREAKERS 2. REALIGN INS OR SELECT MAG/VGI AND INS OFF (1)
TEMP LIGHT ON (STEADY) NO GO LIGHT ON (STEADY)	LOSS OF POWER IN ALIGN	1. CHECK CIRCUIT BREAKERS 2. REALIGN INS OR SELECT MAG/VGI AND INS OFF (1)
1. NO GO LIGHT ON (STEADY) 2. TEMP LIGHT ON (STEADY) 3. VDI PLATFORM LIGHT ON (FLASH)	LOSS OF POWER IN OPER	1. CHECK CIRCUIT BREAKERS 2. REALIGN INS OR SELECT MAG/VGI AND INS OFF (1)
LOSS OF VDI PICTURE	LOSS OF ADAPTER 28V OR ADAPTER FILTERED 28V	1. CHECK THE ADAPTER CIRCUIT BREAKER 2. CONTINUE USE OF INS OR USE MA-1 AND VGI FOR HEADING AND ATTITUDE REFERENCE

(1) CAUTION

TO PROVIDE PROTECTION TO THE PLATFORM, THE INS SHOULD BE IN OPERATE OR ALIGN FOR ALL TAKEOFFS AND LANDINGS.

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Figure 8-62

ALTERNATE HEADING AND ATTITUDE REFERENCES (AIRCRAFT WITH ASN-31)

The MA-1 compass and the vertical gyro indicator (VGI) provide alternate sources of heading and attitude to the computer, AFCS, search radar, Doppler radar and system displays. Control of the selection of the source of heading and attitude information is provided by the ATTITUDE REF switch (figure 8-61) on the pilot's control box. The MA-1 compass and the VGI are described in Section I of this manual.

ATTITUDE REF Switch

The ATTITUDE REF switch is a three-position toggle switch in the lower left of the pilot's control box marked MAG/VGI, COMP IN, and COMP OUT.

During inertial platform alignment, the ATTITUDE REF switch selects the source of true heading. When COMP IN or MAG/VGI is selected, MA-1 magnetic heading modified by the MAG VAR setting on the DDU is used. When the switch is at COMP OUT, the CARR HDG window on the erection controller panel provides the source of alignment heading reference.

When the OPER button is DEPRESSED, the ATTITUDE REF switch selects the source of heading and attitude information provided to the system and to the HSI.

In the COMP OUT position, platform heading and attitude information is supplied to the computer, VDI,

HSI, AFCS, Doppler, search radar and other system components. The MAG VAR must reflect the correct variation for the HSI to read magnetic headings and bearings.

In the COMP IN position, the platform provides heading and attitude to all system components except the HSI. MA-1 compass heading is displayed on the HSI.

The MAG/VGI position provides an alternate source of heading and attitude information. In the MAG/VGI position, all heading information is derived from the MA-1 compass (modified by MAG VAR) and all attitude information supplied to the computer and related systems is derived from the VGI. It is necessary to continuously update the MAG VAR on the DDU in order to maintain a true heading reference.

CARRIER AIRCRAFT INERTIAL NAVIGATION SYSTEM AN/ASN-92

The carrier aircraft inertial navigation system (CAINS) is an automatic aid to navigation and is independent of outside reference. The system is the primary source of aircraft heading, attitude, and horizontal and vertical velocities. These data are derived from an inertial measurement unit (IMU) consisting of accelerometers mounted along three axes on a gyro-stabilized platform. Information from the CAINS may be combined by the computer with information from other sources for greater accuracy. In addition, the IMU may be operated in the LEVEL mode independent of the computer to provide a pitch and roll attitude reference.

The accelerometers mounted along the three axes sense any variation in aircraft acceleration and generate acceleration signals, which are ~~converted to velocities by the platform computer and are sent~~ SENT to the digital computer. The velocities are used by the computer to update latitude, longitude, and altitude. By updating these values, the computer generates earth rate correction signals to be sent to the CAINS to keep it level with respect to the local gravity vector and oriented to the aircraft longitudinal axis. Attitude and azimuth signals are generated by synchros mounted on the platform gimbals. These signals are sent to the platform adapter to provide pitch, roll, and true heading to the other aircraft systems.

INERTIAL PLATFORM ORIENTATION

The orientation of the gyro-stabilized inertial measurement unit is maintained with respect to three mutually perpendicular axes referred to as the X, Y, and Z axes, and it is along these axes that the accelerometers measure aircraft accelerations.

ORIENTATION AXES

The Z-axis is coincident with the local vertical and the direction toward the center of the earth is considered to be positive. The X-axis, the Y-axis, and the Z-axis are mutually perpendicular. Wander azimuth refers to the procedure whereby the angular difference between IMU azimuth and true north is estimated but not driven to zero.

ALIGNMENT

In order to establish the CAINS as a valid reference, the IMU must be initially caged to the aircraft longitudinal axis and THEN leveled with respect to the local vertical.

During leveling, the IMU gyros are brought up to speed and the platform is rough-leveled with respect to the aircraft roll and pitch axes. Fine leveling is then accomplished using accelerometer outputs. When the IMU has been leveled, alignment is commenced. During alignment, the orientation of the IMU with respect to north is determined. This defines wander azimuth, which is the angular difference between the IMU platform azimuth and true north. This value is retained by the computer for future calculations. It is then possible to define true heading as the measured bearing of the aircraft longitudinal axis with respect to the IMU adjusted by (added to) wander angle.

Alignment, which requires the use of the computer, may be ground-based, carrier-based, or in-flight. For all alignments, the IMU completes the initial self-leveling, then control is transferred to the computer. Alignment status can be monitored by lights on the navigation control panel and readouts on the DDU and pilot's auxiliary indicator panel. ~~The HSI ADF needle displays the rate at which the computer estimate of wander angle is changing. The less the needle is displaced from null (zero), the better the alignment.~~ If the aircraft must be moved before completion of a ground or carrier alignment, pressing the OPER button suspends the alignment and lights the TAXI advisory light. When the aircraft is again stopped, the alignment may be recommenced by depressing the ALIGN button. While ground or carrier alignment is selected, the VDI PLATFORM light (IS FLASHING) and the VDI steering and target symbols display characteristic motion. The steering symbol arcs back and forth above the horizon, and the target symbol arcs back and forth below the horizon. In addition, the optical sight moving reticle is driven in a 25-mil circle about the fixed reticle.

GROUND ALIGNMENT

Ground alignment is selected by depressing the ALIGN button and setting the SINS DATA switch to OFF.

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Prior to ground alignment, normal inputs are present position ~~altitude~~, latitude, ~~and~~ longitude, AND ALTITUDE

CARRIER ALIGNMENT - AUTOMATIC

Automatic carrier alignment (either rf or cable) is selected by setting the SINS DATA switch to D/L and depressing the ALIGN button. This provides inputs from the SINS via the ASW-25B Digital Data Receiver. Selecting automatic carrier alignment with the data link off causes the D/L light on the NAVIGATION control panel to flash. A steady D/L light indicates data link failure.

CARRIER ALIGNMENT - MANUAL

Manual carrier alignment is selected by depressing the ALIGN button and setting the SINS DATA switch to MAN. Required inputs are carrier speed and heading, and present position latitude and longitude and altitude. Position on the deck, that is, horizontal and vertical lever arms may be set using the keyboard. Failure to enter the required information results in no alignment and the appropriate SAC.

IN-FLIGHT ALIGNMENT

In-flight alignment is selected by depressing the ALIGN button with the aircraft in flight. If gyro caging is required, that is, if pitch and roll are grossly in error, it is necessary to first select OFF. Present position must be entered via the keyboard, true heading is supplied by the MA-1 compass heading ± MAG VAR, and velocity data are provided by the velocity-correct or Doppler through the computer. At the completion of rough (gravity) leveling, the computer estimates platform tilt for a processing period of 2 1/2 minutes and then applies gyro torquing signals to bring the platform to level sufficient for navigation with reasonable accuracy, the INS light comes on, and OPER can be selected at this time. Any error in the initial heading reference will be reflected in IMU velocity errors.

CAINS CONTROL AND INDICATORS

NAVIGATION CONTROL PANEL

The NAVIGATION control panel on the bombardier/navigator's right console (figure 8-62A) contains four INS mode selector buttons, six indicator lights, fault isolation lights, an intercom switch for the ship's inertial navigation system, and a SINS DATA switch.

Mode Selector Button

The mode selector buttons are placarded OPER, ALIGN, LEVEL, and OFF. The buttons are interlocked so that only one may be depressed at a time, and when a button is depressed, it rotates 45° and locks.

OFF - When OFF is selected, all power is removed from the IMU; however, charging power is supplied to the battery in the CAINS power supply.

LEVEL - When the LEVEL button is depressed, the IMU is operated as an attitude reference only, providing pitch and roll inputs to the computer and the aircraft system.

ALIGN - Depressing the ALIGN button supplies power to all units and selects one of the alignment modes as determined by the position of the SINS DATA switch and aircraft weight on wheels.

OPER - Depressing the OPER button after alignment places the IMU in its navigation mode. Use of CAINS inputs is dependent upon B/N navigation mode selection and the status of the IMU, through computer logic.

SINS ICS Switch

The SINS ICS is a two-position toggle switch, marked ON and OFF, which permits two-way ICS communication with the ship's inertial navigation system (SINS) center during carrier alignment if the external ICS plug is inserted in the receptacle on the external power panel.

SINS DATA Switch

The SINS DATA switch is a three-position toggle switch, marked D/L, MAN, and OFF, which permits selection of the mode of alignment with the ALIGN button depressed.

D/L - Setting the switch to D/L selects automatic carrier alignment with data derived from the SINS being provided by the ASW-25B receiver. Alignment data provided consist of latitude, longitude, heading, vertical lever arm (distance from SINS center to flight deck), north velocity, east velocity, roll angle, and pitch angle. Selecting D/L with the data link receiver off causes the D/L light to flash; failure of the data link with D/L selected causes a steady light.

MAN - The MAN position selects a manual carrier alignment. Alignment data, consisting of carrier speed and heading and present position, must be entered manually. Vertical and horizontal lever arms may be entered. Voice communication with the SINS center is enabled by setting the SINS ICS switch to ON.

VERTICAL LEVER ARM MUST BE ENTERED

OFF - Setting the switch to OFF selects either a ground or in-flight alignment, depending on the status of the left weight-on-wheels switch. Present position must be entered through the keyboard.

CAINS CONTROLS AND INDICATORS

ASN-92

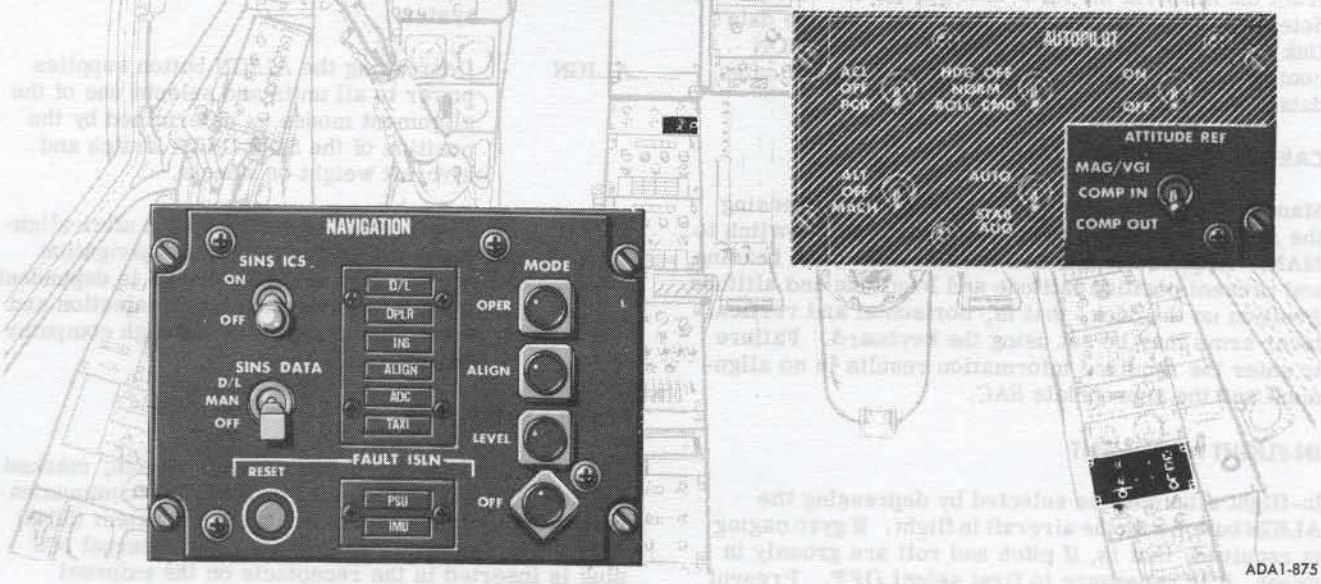

Figure 8-62A

Navigation Advisory Lights

Six advisory lights marked D/L, DPLR, INS, ALIGN, ADC, and TAXI provide indications of CAINS status and system navigation capability as follows:

D/L - This light comes on steady with the SINS DATA switch at D/L when a data link failure is detected, indicating that a manual carrier alignment should be performed. Selecting D/L with the data link off causes the light to flash.

DPLR - Invalid Doppler data with the Doppler inertial or Doppler navigation mode selected causes the light to come on steady. The light flashes if the computer has automatically reverted to the Doppler navigation mode due to invalid inertial inputs and the navigation mode selector switch is not at EMER DOP.

ALIGN - A steady light indicates that alignment is in progress and the aircraft should not be moved during ground or carrier alignment.

INS - This light comes on steady for the following conditions:

- At the completion of alignment (with the ALIGN light), OPER button may be depressed.

Note

After completion of the alignment, the INS light flashes after OPER is selected until the navigation mode is set to INERL.

- With OPER selected, when an IMU failure is detected.

Note

This light is not necessarily accompanied by an IMU fault isolation light.

The light flashes for the following conditions:

- If the DR or Doppler mode is selected prior to takeoff.
- With ALIGN selected on the ground, if IMU calibration data are not properly transferred from the IMU to the digital computer the light flashes for 1 minute. Normal alignment is not degraded. CAL DATA MUST BE RECEIVED ONCE WITH CHANGE OF IMU, COMPUTER, OR PROGRAM

ADC - This light comes on steady when DR is selected and the mach input is not invalid. The light flashes if the computer has automatically reverted to DR due to invalid Doppler or inertial inputs.

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TAXI - During ground or carrier alignment, when the OPER button is depressed before alignment is complete, the TAXI light comes on and the ALIGN light goes out.

FAULT ISLN Lights and RESET Button

Two advisory lights labeled IMU and PSU provide indications of CAINS unit failures.

PSU - This light comes on when the CAINS power supply unit built-in test (BIT) indicates a PSU malfunction or battery discharge condition.

IMU - This light comes on when the malfunction flag in the IMU is set, indicating that the IMU has a malfunction. The flag is set by the IMU internal hardware BIT.

Depressing the RESET button turns off the PSU and IMU lights and resets the PSU and IMU malfunction flags. If the fault continues to exist, the flags will be set again and the lights will come on again. The RESET button may be pressed repeatedly.

CAINS POWER SUPPLY

Aircraft 115 V ac power is provided to the CAINS through the ASN-92 and ASN-92 ADAPTER circuit breakers on the B/N circuit breaker panel, 28 V dc through the CKPT ADVISORY LT circuit breaker on the nosewheel well circuit breaker panel and through the ADAPTER DC circuit breaker on the pilot's panel.

The power supply unit (PSU) converts aircraft power to the required voltages for the IMU. The PSU also contains a battery, which provides power ~~to maintain IMU alignment~~ for up to 10 seconds in flight and up to 5 seconds on the ground in the event of power interruption.

CAINS BUILT-IN-TEST

The CAINS is provided with test circuitry in the IMU and PSU, which detects hardware malfunctions in these units, setting a malfunction flag and lighting one of the FAULT ISLN advisory lights.

ALTERNATE HEADING AND ATTITUDE REFERENCES (AIRCRAFT WITH ASN-92)

The MA-1 compass, the IMU in the LEVEL mode, and the vertical gyro indicator (VGI) provide alternate sources of heading and attitude to the computer, AFCS, TSP, search radar, Doppler radar, and system displays. Control of the selection of the source of heading and attitude reference is provided by the ATTITUDE REF switch (figure 1-5) on the AUTOPILOT panel in conjunction with the IMU MODE selector buttons. The MA-1 compass and the VGI are described in Section I of this manual.

ATTITUDE REF Switch

The ATTITUDE REF switch is a three-position toggle switch on the AUTOPILOT panel marked MAG/VGI, COMP IN, and COMP OUT.

With the switch at MAG/VGI, all heading information is derived from the MA-1 compass and all attitude information is supplied to the computer and related systems from the VGI. It is necessary to periodically update the MAG VAR on the DDU in order to maintain a true heading reference.

With the IMU LEVEL button depressed, selecting COMP IN or COMP OUT provides IMU attitude and MA-1 heading to all systems. True heading is derived by means of the DDU MAG VAR setting, which must be kept updated.

With the IMU at OPER, selecting COMP OUT provides IMU heading and attitude reference to all systems. The HSI displays backup magnetic heading derived from IMU true heading if the correct variation is set into the DDU MAG VAR dials.

Setting the switch to the normal COMP IN position causes the MA-1 heading to be displayed on the HSI and IMU heading and attitude to be provided to all other systems.

DIGITAL COMPUTER AN/ASQ-133, AN/ASQ-155

The digital computer AN/ASQ-133 or AN/ASQ-155 is a solid-state general-purpose airborne computer powered by primary three-phase 115 V ac and primary 28 V dc through the CMPTR/ACU and CMPTR circuit breakers on the B/N's circuit breaker panel. The chief operating characteristics of the computer are:

Operating altitude . . .	Sea level to 50,000 feet	
Operating temperature . . .	In-flight:	2°C to 27°C (36°F to 85°F)
	Ground:	-54°C to 49°C (-65°F to 120°F)

The computer subsystem consists of the following units:

- Computer unit
- Pedestal control unit, including the computer control unit, the interface electronics assembly, and the slew control.
- Digital display unit
- Analog-to-digital converter

In aircraft 159895 and ON and M121 and ON, to accommodate the Condor missile and provide for the DRS sensors, the computer has been modified by adding an additional memory capability and replacing the analog-to-digital converter, and redesignated AN/ASQ-156.

Based on programmed instructions, the computer performs the operations necessary for navigation and weapon delivery, provides the crew with required steering commands and, if selected by the crew, initiates automatic weapon release.

COMPUTER PROGRAM—ASQ-133

The computer program is the set of instructions permanently stored in the main storage unit under which the computer functions. The computer is periodically reprogrammed with a new set of instructions to reflect aircraft changes, new weapons, etc.; however, this is not a flight crew procedure.

The program includes a set of instructions for hardware checkout and a set of instructions for the solution of the navigation, ranging, and attack problems. The navigation/ranging/attack instructions are called the flight program and are repeated eight times per second. A repetition of these instructions is commonly referred to as an iteration. Figure FO-9 provides a general diagram of the functions performed each iteration. The instructions for hardware checkout are called the operational readiness test (ORT).

Throughout this manual, programs are identified by the letter E followed by a number that indicates the particular program's position in the order of development. Thus E1.0 would be an earlier program than E5.0. Revisions to a program are identified by a decimal point and a number. For example E 1.5 would be the fifth revision of the first program. Window C 1 on the DDU displays the program identifier number. The readout for program E1.4 is 014 and for program E2 it is 020. The current program designation is E1.5.

COMPUTER OPERATION AT TURNON

On the ground, when the computer is turned on, a 001 system advisory code (SAC) is displayed, the computer error lights come on, the ATTACK lights flash, and the computer remains inactive until the COMPT MODE switch is placed to TEST. This enters the computer into the operational readiness test (ORT) and sends a digital computer off signal to the INS. When the ORT is completed or is terminated by the B/N, the computer may be entered into the flight program by selecting ENTER. At this time the computer error lights come on, the 001 SAC is displayed, and data may be entered into the computer.

If the computer is turned on in flight, it is the B/N's option whether or not to perform the ORT. If TEST is selected, the ORT begins. If ENTER or STEER is selected, the computer is placed into the flight program, the 001 SAC is displayed, and the computer error lights come on.

Note

Present position data must be entered before depressing the SAC key to turn off the error lights or the error lights will stay on and a 002 SAC will be displayed.

COMPUTER NONATTACK OPERATION

The computer continuously derives aircraft present position along three axes using inputs from the various sensors on board the aircraft according to the navigation mode selected. The validity of aircraft data is determined and these data are either used or replaced. Corrections are provided to the inertial platform, the validity of radar tracking data is checked, cursor positioning is updated, and steering commands are provided. The computer makes digital readouts available to inform the crew of present status, and to provide a means of monitoring computer functions.

Once the aircraft armament system has been activated (MASTER ARMT switch at ON or PRAC) the computer also checks that no weapon-incompatible switch selections have been made. In the event an improper selection has been made, a reselect condition is established and the RESELECT light is turned on. With either a computer error light on or a RESELECT light on, the program inhibits entry into the attack modes.

COMPUTER OPERATION IN ATTACK

When the computer has been stepped into attack, it will perform all nonattack functions and in addition, it performs the functions related to weapon delivery. Aircraft and bomb travel distances are generated for the selected weapon and attack profile. Point of weapon release is calculated and steering to the point of weapon release is provided. Validity of the release solution is checked, release pulse spacing for train releases is computed and at the proper time, weapon release in initiated.

COMPUTER OPERATION ON THE GROUND

When the computer is operating in the flight program on the ground or the carrier deck, it performs in the same manner as in flight with the following differences of interest to the B/N:

- Mach sensor input usage is controlled by keyboard selection where:

  0 = B/N control of true airspeed

  1 = System control of true airspeed

- Temperature sensor status is always 0, and keyboarded temperature entry is displayed immediately.

- With mach sensor status set at 0, the INS at OPERATE and the inertial navigation option selected, inertial vertical velocity is displayed in window A3 of the digital display unit.

- System altitude is updated by inertial vertical velocity if its status is at 1 and the vertical velocity is not greater than 2 feet per second.

COMPUTER PROGRAM—ASQ-155

The computer program is composed of a set of instructions for ground hardware checkout, one for IMU alignment and one for flight, including navigation, ranging, and attack. One repetition (iteration) of the alignment program requires 125 milliseconds, permitting 8 iterations/second. The flight program requires ~~100~~ 180 milliseconds, permitting approximately 5 1/2 iterations per second. The current program designation is E100.

COMPUTER OPERATION AT TURNON

At turn-on, the computer automatically enters the test program, with the position of the MODE switch determining the extent of the test conducted. With the MODE switch at STEER, the initial portion of the test program requiring approximately 40 seconds, is conducted. On successful completion of this test, the COMPT ERROR light comes on, a 001 SAC is displayed, and the align program may be entered. When the computer is turned on with the MODE switch at TEST, the complete test program (ORT) is enabled. When the ORT is complete or is terminated by the B/N, the computer may be entered into the flight program by selecting ENTER. At this time, the computer error lights come on, the 001 SAC is displayed, and data may be entered into the computer.

Note

> Present position data must be entered before depressing the SAC key to turn off the error lights or the error lights will stay on and a 002 SAC will be displayed.

Doppler drift and groundspeed are automatically kept disassociated at initial turn-on from IMU velocities until the B/N evaluates them and enters a code into the computer indicating that they are valid.

COMPUTER NONATTACK OPERATION

The computer continuously derives aircraft present position along three axes, using inputs from the various sensors on board the aircraft according to the navigation mode selected. The validity of aircraft data is determined and these data are either used or replaced. Corrections are provided to the inertial measurement unit, the validity of radar tracking data is checked, cursor positioning is updated, and steering commands are provided. The computer makes digital readouts available to inform the crew of present status, and to provide a means of monitoring computer functions.

Once the aircraft armament system has been activated (MASTER ARMT switch at ON or PRAC), the computer also checks that no weapon-incompatible switch selections have been made. If an improper selection has been made, a reselect condition is established and the RESELECT light is turned on. With either a computer error light on or a RESELECT light on, the program inhibits entry into the attack modes.

COMPUTER OPERATION IN ATTACK

When the computer has been stepped into attack, it will perform all nonattack functions and in addition, it performs the functions related to weapon delivery. Aircraft and bomb travel distances are generated for the selected weapon and attack profile. Point of weapon release is calculated and steering to the point

of weapon release is provided. Validity of the release solution is checked, release pulse spacing for train release is computed, and at the proper time, weapon release is initiated.

COMPUTER OPERATION ON THE GROUND

When the computer is operating in the flight program on the ground or the carrier deck, it performs in the same manner as in flight with the following differences of interest to the B/N:

- Mach sensor input usage is controlled by keyboard selection where:

  0 = B/N control of true airspeed

  1 = System control of true airspeed

- Temperature sensor status is always 0, and keyboarded temperature entry is displayed immediately.

- With mach sensor status set at 0, the IMU at OPERATE and the inertial navigation option selected, inertial vertical velocity is displayed in window A3 of the digital display unit.

- System altitude is updated by inertial vertical velocity if its status is at 1 and the vertical velocity is not greater than 2 feet per second.

EVALUATION AND REPLACEMENT OF SENSOR DATA

The failure of a sensor or an unreliable input from one could degrade the operational capability of the weapons system. To keep possible degradation to a minimum, logic has been included in the computer program by which the reliability of the aircraft data sensors and the accuracy of their inputs are evaluated.

An advisory display of system sensor usage status is available in the computer pedestal temporary storage indicator. This display is selected by depressing the MAN key with the computer mode switch at STEER. The temporary storage indicator displays a blank followed by a series of six 1's or 0's with 1 indicating sensor usage and 0 indicating data substitution. Sensor status is displayed from the most significant digit (MSD) to the least significant digit (LSD) as follows:

ASQ-133 E1.5 Program

- MSD- BLANK
- 2MSD-Normal load factor (Set automatically)
- 3MSD- Mach number (Set manually and/or automatically)
- 4MSD- Angle of attack (Set automatically)
- 5MSD- Temperature (Set automatically)
- 6MSD- Static pressure (Set manually)
- LSD- INS vertical velocity (Set manually)

ASQ-155 E100 Program

- MSD- Use of Doppler drift and groundspeed in IMU management (initially set to NOT USED automatically, may be reset manually)
- 2MSD- Normal load factor (set manually, automatically, or both)
- 3MSD- Mach number (set manually, automatically, or both)
- 4MSD- Angle-of-attack (set manually, automatically, or both)
- 5MSD- Temperature (set manually, automatically, or both)
- 6MSD- Static pressure (set manually)
- LSD- IMU vertical velocity (set manually).

With the ASQ-133 E1.5 Program, if the computer determines that angle of attack, temperature, mach or normal acceleration are bad, these values are automatically replaced by values derived from backup calculations. The B/N must initiate the replacement of bad value of static pressure or inertial platform vertical velocity himself. He also has the option of initiating the replacement of data from the mach sensor.

With the ASQ-155 E100 Program, if the computer determines that angle-of-attack, temperature, or normal acceleration are bad, these values are automatically replaced by values derived from backup calculations. On initial turn-on, Doppler drift and groundspeed are automatically kept disassociated from IMU velocities until the B/N evaluates them and enters the code indicating that they are valid. The B/N must initiate the replacement of bad value of static pressure or inertial measurement unit vertical velocity himself. He also has the option of initiating the replacement of data from the normal accelerometer, mach, angle of attack, or temperature sensors and of eliminating the use of Doppler data.

The replacement for a bad angle of attack from the probe is from backup computation using the aircraft elevation angle and the rate of change of pressure altitude. This is an automatic computer replacement with vertical velocity (Vz) set bad. If temperature is bad, a standard day ambient air temperature is calculated, using static pressure. An option is available to the B/N whenever calculated standard day temperature is in use. He may bring the solution closer to actual conditions by entering known temperature, in degrees Farenheit, at the target, or if this is not known, the existing temperature at departure. The standard day temperature is then adjusted by the difference between the entered temperature and standard.

Note

- It is good practice to make the backup temperature entry whenever bringing the computer on the line, so that it will be available if needed during the mission.

- Any time mach number is set bad, temperature is also set bad.

A calculated value of normal load factor derived from inputs of aircraft angular rates from the inertial platform replaces bad inputs from the normal accelerometer.

The B/N evaluation of mach number and static pressure is based on the credibility of the readouts of true airspeed and static pressure displayed in the digital display unit (DDU) and the readings on the altimeter and airspeed indicator. If an error is large enough, system advisory codes (SAC's) displayed in the DDU will assist in the evaluation. SAC 010 is displayed if true airspeed - total inertial velocity exceeds 180 + .0055 x pressure altitude, that is, an excessive airspeed/groundspeed differential. If this code is the result of a large wind derivation, selecting OFF ERASE on the velocity correct switch may allow the code to be cleared. If not, it may be necessary to change navigation options or replace the mach input. The 011 SAC is the result of a vertical loop altitude difference of more than 640 feet. Three probable causes are:

- If an improper or unstable static pressure is continuously provided. This can be determined by checking window B1 on the DDU in the nonattack condition.

- If the vertical velocity is bad (window A3). By replacing inertial vertical velocity and static pressure, one at a time each can be evaluated, and the bad value can be replaced.

- Failure to initialize present position altitude, or trying to initialize it within 40 seconds of completing the converter portion of the ORT (before the air data computer has time to return to ambient conditions). Reentering present position altitude should remove the cause of this type of code.

In aircraft with the ASN-92 CAINS and the E100 program, the DPLR, INS, and ADC status lights on the NAVIGATION panel provide the B/N with additional cues in evaluating sensor data inputs.

- Invalid Doppler inputs with the Doppler navigation mode selected lights the DPLR light. The light flashes if the computer has automatically reverted to the Doppler mode due to invalid inertial inputs.

- Failure of IMU BIT or computer logic tests of the CAINS with OPER selected lights the INS light. The light flashes if the DR or Doppler navigation mode is selected prior to takeoff.

- With the DR navigation mode selected, invalid mach input lights the ADC light. The light flashes if the computer has automatically reverted to the DR navigation mode due to invalid Doppler or inertial inputs.

When the computer receives an indication from the B/N that mach number from the air data computer is not accurate, replacement is made in one of two ways depending on the navigation option selected. If the inertial, Doppler/inertial or doppler options have been selected, true airspeed is determined by applying the current value of wind to total inertial velocity. True airspeed is then converted to mach number. If the dead reckoning option has been selected, the keyboard entry of true airspeed is converted to mach number.

Note

With the air data computer mach number bad and DR selected, the aircraft should be flown as closely as possible to the selected airspeed.

System altitude is reset to the current value of temperature-corrected pressure altitude when present position correct is selected with the radar cursors stabilized (UNSTAB not selected). System altitude is also reset when the INS is placed into a nonoperate mode or inertial velocity is set bad.

If the B/N determines that the input of vertical velocity from the inertial platform is not valid he may cause it to be replaced by a backup value calculated from true airspeed and angle of attack.

When entry is made indicating invalid pressure, present position altitude should be reinitialized using the keyboard entry. System altitude will then be derived by means of continuous integration of system vertical velocity. The vertical accelerometer feedback loop is modified to use INS elevation angle, true airspeed, and probe input of angle of attack instead of pressure to provide accelerometer corrections.

With the ASQ-133 E1.5 program, the option of replacement or elimination of bad mach number, static pressure, or inertial vertical velocity is initiated by manual entries. With the MAN key depressed and the COMPT MODE switch at ENTER, entering with the ALT ACTION key:

N111111 sets mach and static pressure sensors and inertial vertical velocity USED

N101111 sets mach sensor NOT USED; static pressure sensor and inertial vertical velocity USED

N111101 sets and static pressure NOT USED, mach sensor and inertial vertical velocity USED

N101101 sets both mach and static pressure sensors NOT USED, inertial vertical velocity USED.

N111110 sets mach and static pressure sensors USED, inertial vertical velocity NOT USED.

Appropriate velocity and/or present position altitude entries should be made. The desired true airspeed is entered in knots through MAN VEL. In a similar manner, a bad value of inertial platform vertical velocity is replaced in the solution by entering N111110 MAN/ALT.

With the ASQ-155 E100 program, the option of replacement or elimination of bad Doppler drift and groundspeed, normal load factor, mach number, angle of attack, temperature static pressure, or inertial vertical velocity is initiated by manual keyboard entries. For example, with the MAN key depressed and the COMPT MODE switch at ENTER, entering with the ALT ACTION key:

- 1111111 sets Doppler USED; normal load factor, mach number, angle-of-attack, temperature and static pressure sensors and inertial vertical velocity USED.
- 0111111 sets Doppler NOT USED; normal load factor, mach number, angle of attack, temperature and static pressure sensors and inertial vertical velocity USED.

Appropriate velocity or present position altitude entries, or both, should be made. The desired indicated airspeed is entered in knots through MAN/VEL. In a similar manner, a bad value of inertial platform vertical velocity is set to zero in the solution by entering 1111110 MAN/ALT; it is replaced by a backup calculation from airspeed and angle of attack upon entry of present position altitude.

NAVIGATION OPTIONS

In using the computer to solve the navigation problem, the bombardier/navigator may select one of four computer navigation options, which determine the sensors that are used. The navigation options provide an increasing level of capability as shown in figure 8-63.

DEAD RECKONING

With the ASQ-133 E1.5 program, the dead reckoning navigation option is selected by setting the navigation mode selector switch to DR. The computer derives aircraft horizontal velocity from air data computer mach converted to true airspeed, and wind from existing system winds memorized when DR was selected, keyboard inputs or velocity correct. With the INS at OPERATE and inertial vertical velocity set good, the computer uses inertial vertical velocity. If the INS is not at OPERATE or inertial vertical velocity is set bad, vertical velocity comes from the vertical component of true airspeed. Platform leveling corrections are provided by the computer and the INS may be used as a source of heading and attitude by setting the ATTITUDE REF switch to COMP IN or COMP OUT. If the INS attitude is invalid, the MA-1 compass may be used for heading and the VGI for attitude reference by setting the ATTITUDE REF switch to MAG/VGI. All other system inputs are available to the computer. The DR option is the least accurate and should only be used when both the Doppler and the INS are providing bad velocities.

Note

The DR navigation mode is automatically selected with the INS in a nonoperate condition.

With the ASQ-155 E100 program, the dead reckoning navigation option is selected by setting the navigation mode selector switch to DR. The computer derives aircraft horizontal velocity from air data computer mach converted to true airspeed, and wind from existing system winds memorized when DR was selected, keyboard inputs, or velocity-correct. With the IMU in OPER and inertial vertical velocity set good, the computer uses inertial vertical velocity. If the IMU is not at OPER or inertial vertical velocity is set bad, vertical velocity comes from the vertical component of true airspeed. Platform-leveling corrections are provided by the computer, and the B/N may elect to use the IMU as a source of heading and attitude by selecting COMP IN or COMP OUT and OPER, or attitude only by selecting LEVEL and COMP IN or COMP OUT. In the latter case, computer heading is derived from the MA-1 compass, and the IMU alignment is lost. If the IMU attitude is not valid, the MA-1 compass may be used for heading and the VGI for attitude reference by setting the ATTITUDE REF switch to MAG/VGI. All other system inputs are available to the computer. The DR option is the least accurate and should be used only when both the Doppler and the IMU are providing bad velocities.

Note

The DR navigation option is automatically selected with the IMU and Doppler in a nonoperate condition.

DOPPLER

With the ASQ-133 E1.5 program, if the Doppler is providing valid inputs of drift and groundspeed, the Doppler navigation option may be selected by setting the navigation mode selector switch to EMER DOP. All system inputs are available to the computer except INS horizontal velocities. Platform leveling corrections are provided to the INS and it may be used as a source of heading and attitude reference if these data appear valid. System horizontal velocities are based on Doppler values of drift and groundspeed and air data computer mach converted to true airspeed. With the INS at OPERATE and inertial vertical velocity set good, the computer uses inertial vertical velocity. If the INS is not at OPERATE or inertial vertical velocity is set bad, vertical velocity comes from the vertical component of true airspeed.

With the ASQ-155 E100 pgrogram, if the Doppler is providing valid inputs of drift and groundspeed, the Doppler navigation option may be selected by setting

the navigation mode selector switch to EMER DOP. IMU roll, pitch, heading, and vertical velocity inputs are used by the computer. Platform-leveling corrections (based on Doppler only if keyboard sensor status indicates Doppler usage) are provided to the IMU and it may be used as a source of heading and attitude reference if these data appear valid. System horizontal velocities are based on Doppler values of drift and groundspeed and air data computer mach converted to true airspeed. With the IMU at OPER and inertial vertical velocity set good, the computer uses inertial vertical velocity. If the IMU is not at OPER or inertial vertical velocity is set bad, vertical velocity comes from the vertical component of true airspeed.

Note

Selecting the Doppler mode with grossly invalid groundspeed or drift angle causes the DPLR light on the NAVIGATION panel to light.

INERTIAL

When the inertial platform is operating properly and the Doppler inputs of drift and groundspeed are not valid, the inertial navigation option may be selected by setting the navigation mode selector switch to INERL and the Doppler power switch to STBY or OFF.

COMPUTER NAVIGATION OPTIONS

A-6E

ASN-31 INS

OPTION	NAV MODE SWITCH	DOPPLER MODE	ATTITUDE REF SWITCH	PLATFORM MODE	NAVIGATION INFORMATION FLOW	SUMMARY
DEAD RECKONING	DR	N/A	MAG/VGI	OPER	1. TH FROM MA-1 ± MAG VAR VIA INS PLATFORM ADAPTER 2. ATTITUDE FROM VGI VIA INS PLATFORM ADAPTER. 3. ALTITUDE, TAS FROM ADC OR DATA REPLACEMENT 4. WIND FROM VELOCITY CORRECT OR KEYBOARD INPUT.	1. MINIMUM CAPABILITY DOPPLER NOT USED; INS OUTPUTS NOT USED; ADC USED. 2. USE WHEN DOPPLER BAD AND INS VELOCITIES AND ATTITUDE BAD.
	DR	N/A	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FROM INS. 2. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 3. WIND FROM VELOCITY CORRECT OR KEYBOARD INPUT.	1. LIMITED USE OF INS; DOPPLER NOT USED; ADC USED. 2. USE WHEN DOPPLER BAD, INS VELOCITIES BAD.
DOPPLER	EMER DOP	ON LAND OR ON SEA	MAG/VGI	OPER	1. TH FROM MA-1 ± MAG VAR VIA INS PLATFORM ADAPTER 2. ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM VGI VIA INS PLATFORM ADAPTER. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM DOPPLER, VELOCITY CORRECT, AND TAS, OR FROM KEYBOARD INPUT WHEN ADC MACH NO. INPUT NOT IN USE.	1. FULL USE OF DOPPLER; INS OUTPUTS NOT USED, ADC USED. 2. USE WHEN DOPPLER GOOD INS ATTITUDE AND VELOCITY BAD.
	EMER DOP	ON LAND OR ON SEA	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM INS. 2. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT 3. WIND FROM DOPPLER, VELOCITY CORRECT, AND TAS, OR FROM KEYBOARD INPUT WHEN ADC MACH NO. INPUT NOT IN USE.	1. FULL USE OF DOPPLER; LIMITED USE OF INS; ADC USED. 2. USE WHEN DOPPLER GOOD, INS VELOCITIES BAD.
INERTIAL	INERL	STBY OR OFF	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FROM INS. 2. HORIZONTAL/VERTICAL VELOCITIES FROM INS 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM VELOCITY CORRECT, INS HORIZONTAL VELOCITIES AND TAS OR KEYBOARD INPUT WHEN ADC MACH NOT IN USE.	1. FULL USE OF INS; DOPPLER NOT USED; ADC USED. 2. SYSTEM HORIZONTAL VELOCITIES DERIVED FROM INS AND VELOCITY CORRECT. 3. SYSTEM VERTICAL VELOCITIES DERIVED FROM BARO-INERTIAL VERTICAL LOOP 4. USE WHEN DOPPLER BAD, INS GOOD.
DOPPLER – INERTIAL	INERL	ON LAND OR ON SEA	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM DOPPLER DAMPED INS. 2. HORIZONTAL/VERTICAL VELOCITIES FROM DOPPLER DAMPED INS. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM VELOCITY CORRECT, INS HORIZONTAL VELOCITIES AND TAS OR KEYBOARD INPUT WHEN ADC MACH NOT IN USE.	1. FULL USE OF INS AND DOPPLER 2. SYSTEM HORIZONTAL VELOCITIES DERIVED FROM DOPPLER DAMPED INS AND VELOCITY CORRECT. 3. SYSTEM VERTICAL VELOCITIES DERIVED FROM BARO-INERTIAL VERTICAL LOOP.

NOTE

- INS VERTICAL VELOCITY IS USED IN DR, INERTIAL OR DOPPLER-INERTIAL MODES UNLESS SET BAD BY B/N. OR PLATFORM IS NOT IN OPERATE. THEREFORE IT IS POSSIBLE TO HAVE ANY COMBINATION OF INERTIAL OR ADC DERIVED HORIZONTAL AND VERTICAL VELOCITIES.
- DR MODE IS USED IF INERTIAL SELECTED WHEN THE PLATFORM IS NOT IN OPERATE.

A-ADAT-822-1

Figure 8-63 (Sheet 1)

COMPUTER NAVIGATION OPTIONS

A-6E

ASN-92 CAINS

OPTION	NAV MODE SWITCH	DOPPLER MODE	ATTITUDE REF SWITCH	IMU MODE	NAVIGATION INFORMATION FLOW	SUMMARY
DEAD RECKONING	DR	N/A	MAG/VGI	OPER OR LEVEL	1. TH FROM MA-1 = MAG VAR VIA PLATFORM ADAPTER 2. ATTITUDE FROM VGI VIA PLATFORM ADAPTER. 3. ALTITUDE, TAS FROM ADC OR DATA REPLACEMENT 4. WIND FROM VELOCITY CORRECT OR KEYBOARD INPUT.	1. MINIMUM CAPABILITY. DOPPLER NOT USED; IMU OUTPUTS NOT USED; ADC USED. 2. USE WHEN DOPPLER BAD AND IMU VELOCITIES AND ATTITUDE BAD.
	DR	N/A	COMP IN OR COMP OUT	LEVEL	1. TH FROM MA-1 = MAG VAR VIA PLATFORM ADAPTER 2. ATTITUDE FROM IMU VIA PLATFORM ADAPTER. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM VELOCITY CORRECT OR KEYBOARD INPUT.	1. LIMITED USE OF IMU; DOPPLER NOT USED; ADC USED. 2. USE WHEN DOPPLER BAD. IMU HEADING AND VELOCITIES BAD.
	DR	N/A	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FROM IMU 2. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 3. WIND FROM VELOCITY CORRECT OR KEYBOARD INPUT.	1. LIMITED USE OF IMU DOPPLER NOT USED; ADC USED. 2. USE WHEN DOPPLER BAD, IMU VELOCITIES BAD.
	EMER DOP	ON LAND OR ON SEA	MAG/VGI	OPER OR LEVEL	1. TH FROM MA-1 = MAG VAR VIA PLATFORM ADAPTER 2. ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM VGI VIA PLATFORM ADAPTER. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM DOPPLER, VELOCITY CORRECT, AND TAS, OR FROM KEYBOARD INPUT WHEN ADC MACH NO. INPUT NOT IN USE.	1. FULL USE OF DOPPLER; IMU OUTPUTS NOT USED, ADC USED. 2. USE WHEN DOPPLER GOOD IMU ATTITUDE AND VELOCTIY BAD.
DOPPLER	EMER DOP	ON LAND OR ON SEA	COMP IN OR COMP OUT	LEVEL	1. TH FROM MA-1 = MAG VAR VIA PLATFORM ADAPTER 2. ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM IMU. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT 4 WIND FROM DOPPLER, VELOCITY CORRECT, AND TAS, OR FROM KEYBOARD INPUT WHEN ADC MACH NO. INPUT NOT IN USE.	1. FULL USE OF DOPPLER; LIMITED USE OF IMU; ADC USED. 2. USE WHEN DOPPLER GOOD IMU HEADING AND VELOCITIES BAD
	EMER DOP	ON LAND OR ON SEA	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM IMU. 2. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 3. WIND FROM DOPPLER, VELOCITY CORRECT, AND TAS, OR FROM KEYBOARD INPUT WHEN ADC MACH NO. INPUT NOT IN USE.	1. FULL USE OF DOPPLER; LIMITED USE OF IMU; ADC USED. 2. USE WHEN DOPPLER GOOD, IMU VELOCITIES BAD.
INERTIAL	INERL	STBY OR OFF	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FROM IMU 2. HORIZONTAL/VERTICAL VELOCITIES FROM IMU. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM VELOCITY CORRECT, IMU HORIZONTAL VELOCITIES AND TAS OR KEYBOARD INPUT WHEN ADC MACH NOT IN USE.	1. FULL USE OF IMU; DOPPLER NOT USED; ADC USED. 2. SYSTEM HORIZONTAL VELOCITIES DERIVED FROM IMU AND VELOCITY CORRECT 3. SYSTEM VERTICAL VELOCITIES DERIVED FROM BARO-INERTIAL VERTICAL LOOP 4. USE WHEN DOPPLER BAD, IMU GOOD.
DOPPLER-INERTIAL	INERL	ON LAND OR ON SEA	COMP IN OR COMP OUT	OPER	1. TH, ATTITUDE FOR NAVIGATION AND DOPPLER STABILIZATION FROM DOPPLER DAMPED IMU. 2. HORIZONTAL/VERTICAL VELOCITIES FROM DOPPLER DAMPED IMU. 3. ALTITUDE AND TAS FROM ADC OR DATA REPLACEMENT. 4. WIND FROM VELOCITY CORRECT, IMU HORIZONTAL VELOCITIES AND TAS OR KEYBOARD INPUT WHEN ADC MACH NOT IN USE.	1. FULL USE OF IMU AND DOPPLER 2. SYSTEM HORIZONTAL VELOCITIES DERIVED FROM DOPPPLER DAMPED IMU AND VELOCITY CORRECT. 3. SYSTEM VERTICAL VELOCITIES DERIVED FROM BARO-INERTIAL VERTICAL LOOP.

NOTE

- IMU VERTICAL VELOCITY IS USED IN DR, INERTIAL OR DOPPLER-INERTIAL MODES UNLESS SET BAD BY B/N, OR IMU IS NOT IN OPERATE. THEREFORE IT IS POSSIBLE TO HAVE ANY COMBINATION OF INERTIAL OR ADC DERIVED HORIZONTAL AND VERTICAL VELOCITIES.
- DR MODE IS USED IF INERTIAL SELECTED WHEN IMU IS NOT IN OPERATE.
- DOPPLER-INERTIAL IS ENABLED ONLY WHEN THE MSD OF THE SENSOR USAGE DISPLAY IS A 1.

ADA1 822-2

Figure 8-63 (Sheet 2)

Note

Doppler inputs are automatically eliminated by the computer when one or more of the following conditions occur:

- Doppler OFF or STBY
- Doppler in TEST
- MEMORY light on
- Roll exceeds ± 25°
- Pitch exceeds ± 17°
- The difference between raw Doppler groundspeed and system groundspeed exceeds 76 knots.
- In aircraft with the E100 program, when keyboard sensor status indicates Doppler NOT USED.

The computer derives horizontal velocities from inputs from the inertial platform and velocity correct. Vertical velocity comes from the baro-inertial vertical loop. All other system inputs are available to the computer. The computer provides inertial platform leveling signals.

DOPPLER-INERTIAL

The Doppler-inertial option, which makes full use of all the navigation equipment available, is selected by setting the navigation mode selector switch to INERL and the Doppler power switch to ON LAND or ON SEA. In aircraft with the E100 program, the keyboard sensor status must be set to Doppler USED to select Doppler-inertial. The computer determines horizontal velocities from the inertial platform damped by Doppler-derived velocities and from velocity-correct. Doppler damping of inertial velocities reduces the long term Schuler frequency oscillations inherent in inertial platforms. Vertical velocity comes from the baro-inertial vertical loop. The computer provides inertial platform leveling signals.

COMPUTER STEERING SELECTIONS

The computer provides steering to a selected target by presenting commands and displays on the DVRI, PHD optical sight, and VDI. See figures 8-64, 8-65, and 8-66. Opportunity target steering of unstabilized cursors may also be selected. Drift-corrected and roll-summed steering indications are provided.

Pilot steering remains as last selected when the COMPT MODE switch is set to ENTER regardless of the keys selected while in ENTER. The keyboard should be returned to the original configuration to avoid inadvertent disruption of pilot steering indications.

DRIFT CORRECTED STEERING

Drift-corrected steering is heading information, which permits the pilot to fly the aircraft from its present position on a direct course to a specific point. A steering error exists when the aircraft is making a ground track which would not take it from its present position on a straight line, (the commanded ground track), to the selected point. This steering error is conveyed to the pilot at all times through the VDI pathway vanishing point, and the PHD steering indicator; and in nonattack through the optical sight moving reticle. The steering information has been corrected to account for any wind conditions that may cause the aircraft to drift off course while enroute to the point. When the present ground track matches the commanded ground track, the movable reticle will be centered in azimuth, the pathway vanishing point will be in the center of the VDI, and the PHD steering indicator will be located under the fixed marker (see figure 8-64).

ROLL-SUMMED STEERING

Roll-summed steering is a computer-generated steering command which provides the pilot with an indication of the bank angle required to null out the drift corrected steering error to the selected target or release point, within 5 seconds during nonattack operation or 2 seconds in attack. This information is always displayed by the VDI steering symbol (figure 8-76); in attack it is also displayed by the optical sight moving reticle and the VDI pathway command heading lines (figure 8-76). Since all the indications of roll-summed steering commands are similar, only the operation of the VDI steering symbol will be discussed.

The maximum command bank angle is ≈30°. Full left or right deflection of the VDI steering symbol indicates that ≈30° bank is being commanded. Maximum bank angle will be commanded for a steering error of greater than 1.1° in attack and 2.8° in nonattack. As the steering error decreases, command bank angle is reduced so that the aircraft will roll out on the proper track. See figure 8-65.

COMMAND PULLUP INDICATIONS

Terrain avoidance pullup command and the terrain avoidance function are operational whenever airspeed exceeds 181 knots at dive angles below 3° and landing mode is not selected. The commands are provided on the optical sight and the VDI and are based on aircraft total velocity, dive angle, and aircraft slant range to the computer-defined surface. It is therefore suggested that when flying cross-country, the altitude of the highest terrain remaining be entered temporarily as the altitude of the selected target and then an update made as soon as the high point is passed. Here, in the absence of a radar lock-on, it is possible that premature (and not unsafe) pullup commands will be generated. However, if radar elevation tracking is not in use and target altitude is not continuously updated to terrain altitude, the computer should not be relied upon to provide a timely (safe) terrain avoidance pullup command.

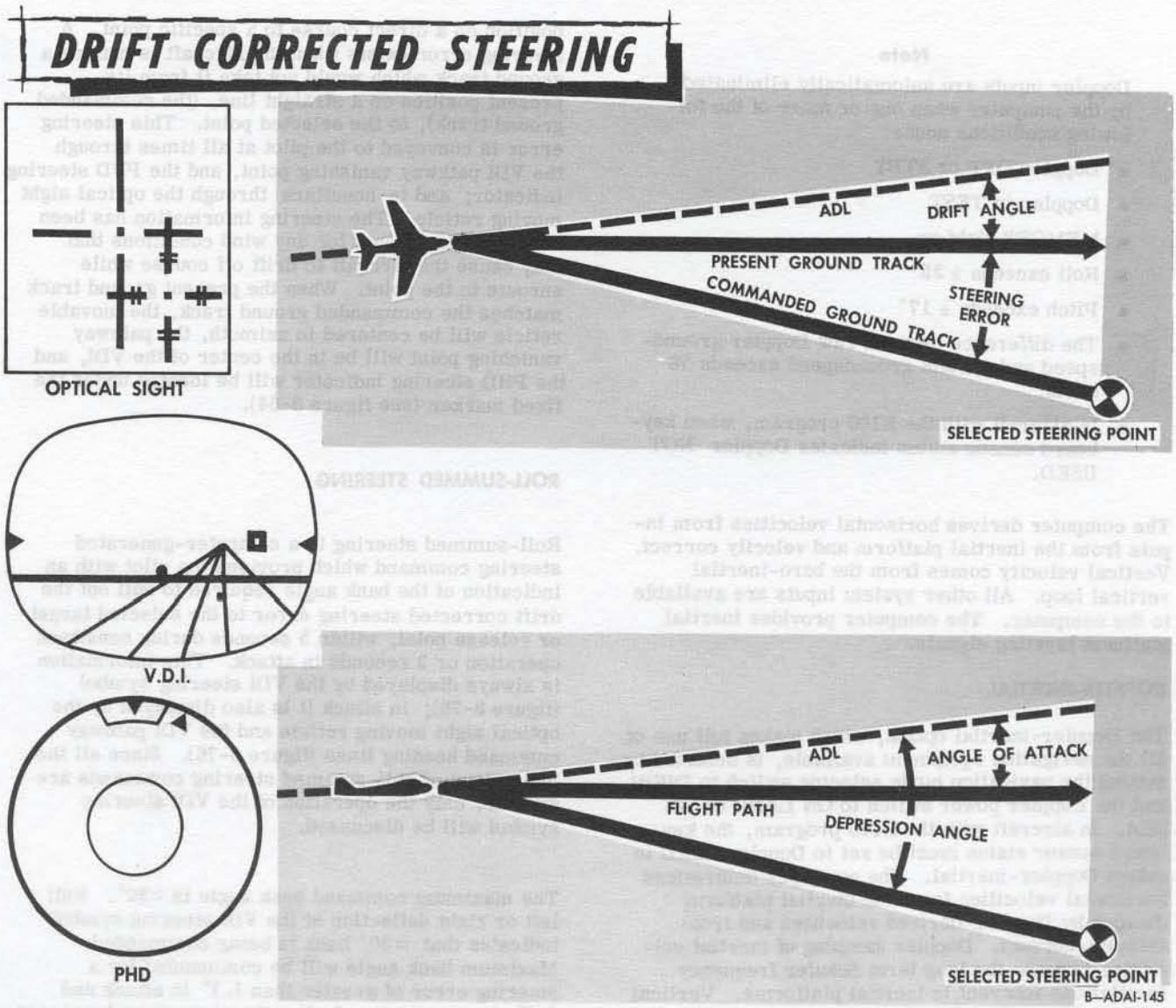

Figure 8-64

This pullup command is in addition to pullup requirements for a selected attack mode.

Command pullup is indicated when the breakaway lights flash, the pullup marker goes to the bottom of the VDI display, and pathway pitch-up (blossoming) occurs. The steering symbol and optical sight moving reticle jump vertically to indicate command g based on 4g's. With BORESIGHT selected, optical sight moving reticle jump is deleted.

When the MASTER ARMT switch is in ON or PRAC, a special pitch-up command is provided to:

- In attack, prevent the aircraft from descending below the keyboard-selected blast clearance altitude,
- In attack or nonattack, force the aircraft to climb if inadequate safe time is available for nonconventional weapons.,
- In attack, force the aircraft to climb if current geometry is incompatible with an attainable weapon release.

This special pitch-up command is indicated when the steering symbol and moving reticle command in the upward direction without the other associated pullup indications.

TARGET STEERING

When one of the four target steering keys is depressed, computer steering is provided to the stored coordinates of the selected target. When the computer is not in attack, DVRI, PHD and VDI steering indications are as shown in figure 8-67, and the PHD time-to-go readout is estimated time to the selected target in minutes. The optical sight moving reticle provides drift-corrected steering error to the selected target. If an offset aimpoint is selected, the pilot's steering indications are to the target.

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ROLL-SUMMED STEERING

A-6E

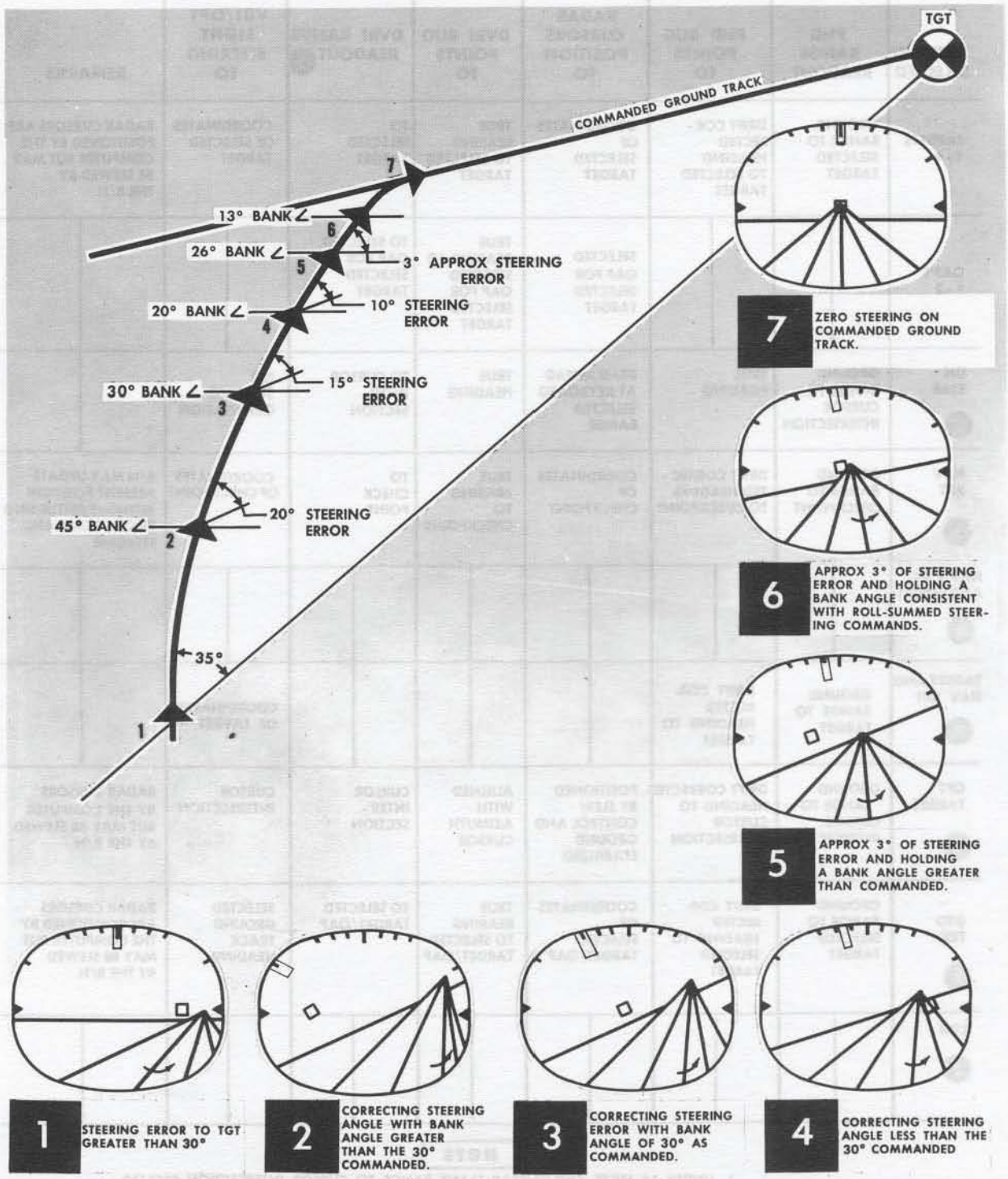

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Figure 8-65

COMPUTER NON-ATTACK STEERING SELECTIONS

A-6E
E 1.5 PROGRAM

STEERING SELECTED	PHD RANGE READOUT	PHD BUG POINTS TO	RADAR CURSORS POSITION TO	DVRI BUG POINTS TO	DVRI RANGE READOUT (1)	VDI/OPT SIGHT STEERING TO	REMARKS
TARGETS 1 - 4	GROUND RANGE TO SELECTED TARGET	DRIFT CORRECTED HEADING TO SELECTED TARGET	COORDINATES OF SELECTED TARGET	TRUE BEARING TO SELECTED TARGET	TO SELECTED TARGET	COORDINATES OF SELECTED TARGET	RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT MAY BE SLEWED BY THE B/N
OAP'S 1 - 2	↓	↓	SELECTED OAP FOR SELECTED TARGET	TRUE BEARING TO SELECTED OAP FOR SELECTED TARGET	TO SELECTED OAP FOR SELECTED TARGET	↓	↓
UN STAB (2)	GROUND RANGE TO CURSOR INTERSECTION	TRUE HEADING	DEAD AHEAD AT KEYBOARD SELECTED RANGE	TRUE HEADING	TO CURSOR INTERSECTION	NO STEERING ORIENTATION	↓
NAV XPT (2)	GROUND RANGE TO CHECKPOINT	DRIFT CORRECTED HEADING TO CHECKPOINT	COORDINATES OF CHECKPOINT	TRUE BEARING TO CHECKPOINT	TO CHECK POINT	COORDINATES OF CHECKPOINT	B/N MAY UPDATE PRESENT POSITION WITHOUT DISTURBING PILOT'S COMMAND STEERING
NAV X PT AND TARGET (4)	↓	↓	↓	↓	↓	↓	↓
TARGET AND NAV XPT (4)	GROUND RANGE TO TARGET	DRIFT CORRECTED HEADING TO TARGET	↓	↓	↓	COORDINATES OF TARGET	↓
OPT TARGET (3)	GROUND RANGE TO CURSOR INTERSECTION	DRIFT CORRECTED HEADING TO CURSOR INTERSECTION	POSITIONED BY SLEW CONTROL AND GROUND STABILIZED	ALIGNED WITH AZIMUTH CURSOR	CURSOR INTERSECTION	CURSOR INTERSECTION	RADAR CURSORS BY THE COMPUTER BUT MAY BE SLEWED BY THE B/N
GRD TRK (2)	GROUND RANGE TO SELECTED TARGET	DRIFT CORRECTED HEADING TO SELECTED TARGET	COORDINATES OF SELECTED TARGET/OAP	TRUE BEARING TO SELECTED TARGET/OAP	TO SELECTED TARGET/OAP	SELECTED GROUND TRACK HEADING	RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT MAY BE SLEWED BY THE B/N
LDG (2)	↓	↓	↓	↓	↓	↓	↓

NOTE

1. UNDER 16 MILES AND UNSTAB: SLANT RANGE TO CURSOR INTERSECTION FEET/10
   OVER 16 MILES: GROUND RANGE TO CURSOR INTERSECTION IN MILES
2. MAY BE SELECTED ALONG WITH OTHER STEERING
3. NO STEERING SELECTED
4. SEQUENCE DEPENDENT

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Figure 8-66 (Sheet 1)

COMPUTER NON-ATTACK STEERING SELECTIONS

A-6E
E-100 PROGRAM

STEERING SELECTED	PAIP RANGE READOUT (6)	RADAR CURSORS POSITION TO	DVRI BUG POINTS TO	DVRI RANGE READOUT (1) (5)	VDI/OPT SIGHT STEERING TO	REMARKS
TARGETS 1 - 4	GROUND RANGE TO SELECTED TARGET	COORDINATES OF SELECTED TARGET	TRUE BEARING TO SELECTED TARGET	TO SELECTED TARGET	COORDINATES OF SELECTED TARGET	RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT MAY BE SLEWED BY THE B/N
OAP'S 1 - 2	↓	SELECTED OAP FOR SELECTED TARGET	TRUE BEARING TO SELECTED OAP FOR SELECTED TARGET	TO SELECTED OAP FOR SELECTED TARGET	↓	↓
UPPER SPARE AND TARGETS 1-4, NAV XPT	GROUND RANGE TO SELECTED WAYPOINT	COORDINATES OF SELECTED WAYPOINT	TRUE BEARING TO SELECTED WAYPOINT	TO SELECTED WAYPOINT	COORDINATES OF SELECTED WAYPOINT	↓
LOWER SPARE AND TARGETS 1-4, NAV XPT	↓	↓	↓	↓	↓	↓
UN STAB (2)	GROUND RANGE TO CURSOR INTERSECTION.	DEAD AHEAD AT KEYBOARD SELECTED RANGE	TRUE HEADING	TO CURSOR INTER-SECTION	NO STEERING ORIENTATION	↓
NAV XPT (2)	GROUND RANGE TO CHECKPOINT	COORDINATES OF CHECKPOINT	TRUE BEARING TO CHECKPOINT	TO CHECK POINT	COORDINATES OF CHECKPOINT	B/N MAY UPDATE PRESENT POSITION WITHOUT DISTURBING PILOT'S COMMAND STEERING
NAVX PT AND TARGET (4)	↓	↓	↓	↓	↓	↓
TARGET AND NAV XPT (4)	GROUND RANGE TO TARGET	↓	↓	↓	COORDINATES OF TARGET	↓
OPT TARGET (3)	GROUND RANGE TO CURSOR INTERSECTION	POSITIONED BY SLEW CONTROL AND GROUND STABILIZED	ALIGNED WITH AZIMUTH CURSOR	CURSOR INTER-SECTION	CURSOR INTERSECTION	RADAR CURSORS BY THE COMPUTER BUT MAY BE SLEWED BY THE B/N
GRD TRK (2)	GROUND RANGE TO SELECTED TARGET	COORDINATES OF SELECTED TARGET/OAP	TRUE BEARING TO SELECTED TARGET/OAP	TO SELECTED TARGET/OAP	SELECTED GROUND TRACK HEADING	RADAR CURSORS ARE POSITIONED BY THE COMPUTER BUT MAY BE SLEWED BY THE B/N
LDG (2)	↓	↓	↓	↓	↓	↓

NOTE

1. BEYOND 100 NMI: GROUND RANGE IN NAUTICAL MILES
   16 TO 100 NMI: CURSOR SLANT RANGE IN NAUTICAL MILES
   UNDER 16 NMI: CURSOR SLANT RANGE IN FEET
2. MAY BE SELECTED ALONG WITH OTHER STEERING
3. NO STEERING SELECTED
4. SEQUENCE DEPENDENT
5. CONDOR:
   A. AUTO MODE: UNTIL LAUNCH—RANGE TO LAUNCH POINT TO NEAREST 0.1 NMI. AFTER LAUNCH—MISSILE RANGE TO TARGET TO NEAREST 0.1 NMI.
   B. MANUAL MODE: UNTIL LAUNCH—TWO LEFT DIGITS: RANGE TO TARGET TO NEAREST NMI; TWO RIGHT DIGITS: MISSILE MAX RANGE CAPABILITY. AFTER LAUNCH—MISSILE RANGE TO TARGET TO NEAREST 0.1 NMI.
6. WITH COP AND CONDOR SELECTED, SAME AS DVRI RANGE READOUT.

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Figure 8-66 (Sheet 2)

When the computer is in attack, steering indications are as before except that the optical sight moving reticle provides roll-summed steering, and all horizontal steering commands provided to the pilot are to the weapon release point rather than the target. Pilot steering commands are based on steering being nulled within 2 seconds. The PHD time-to-go readout is in seconds.

UNSTABILIZED STEERING

In the nonattack condition when unstabilized steering is selected, the radar cursors initially go to dead ahead at the range selected on the keyboard, and no steering is provided. The PHD range readout is not updated by slewing. If unstabilized steering is selected along with target steering under the nonattack condition, pilot steering is provided to the selected target.

If the computer is stepped into attack with only UNSTAB and no other steering selected, both pilot and B/N get opportunity target steering. If one of the target steering keys is depressed, the pilot's steering is to the selected target; while the B/N's indications are the same as for opportunity target.

Note

Radar lock-ons are not available with UNSTAB selected.

OPPORTUNITY TARGET STEERING

Opportunity target steering is presented when no other steering selection is made, that is when no target steering keys are depressed.

When the computer is not in attack, steering indications are shown in figure 8-66. The PHD time-to-go readout is estimated time to the cursor intersection in minutes and the optical sight moving reticle provides drift-corrected steering to the cursor intersection.

In attack, steering indications are as before except that the optical sight moving reticle provides roll-summed steering and all horizontal steering commands to the pilot are to the weapon release point rather than cursor intersection ground position. Pilot steering commands are based on steering being nulled within 2 seconds. The PHD time-to-go readout is in seconds.

WAYPOINT STEERING

In aircraft 159895 and ON and A-6E Mod M121 and ON, the ASW-25B data link permits the coordinates of waypoints to be transmitted to the aircraft, and up to 10 may be stored in the computer. If waypoint coordinates have been received, steering to any one of them may be selected. Depressing the upper spare key and TGT key 1, 2, 3, 4, or NAV XPT selects waypoint 1, 2, 3, 4, or 5 for steering. Depressing the two spare keys along with TGT 1, 2, 3, 4, or NAV XPT selects waypoint 6, 7, 8, 9, or 10.

When steering to a waypoint is selected and the computer is not in attack, steering is as shown in figure 8-5. In attack, steering is the same as target steering.

GROUND TRACK BOMBING

When the computer is not in attack, and ground track bombing is selected, steering is provided to intercept and maintain the keyboard-selected ground track heading. If target steering has also been selected, the selected track passes through the target. If opportunity target steering has been selected, the selected ground track passes through the cursor intersection ground position. See figure 8-66. The PHD time-to-go readout is estimated time in minutes to the selected target. The optical sight moving reticle provides drift-corrected steering, and the VDI, roll-summed steering, to the selected ground track heading through the target. The pilot is directed in a curving path until within 30° of the selected heading.

In attack, steering indications are as before except that vertical steering is presented on the optical sight and VDI according to the attack mode selected and the optical sight moving reticle presents roll-summed steering. All horizontal steering is vectored so that all weapons released will impact along the selected ground track across the target. The PHD time-to-go readout is in seconds.

LANDING MODE

When LDG (landing) is selected, the computer provides horizontal and vertical steering indications for an instrument landing. Vertical steering is provided on the optical sight and VDI when the aircraft is within 30° of runway heading. Runway direction is entered by the keyboard and the B/N may enter the latitude, longitude, and altitude of the point of intended landing as a target, and if the point is not radar significant, he may use an offset aimpoint. Opportunity target steering may also be selected. Glide slope angle is fixed at 3.5°.

The command altitude change indication provided to the pilot is in the form of vertical display variable pathway width. Within 1 nmi of touchdown, a full narrow pathway (figure 8-67) indicate that the aircraft is 150 feet or more above the desired glide slope. At a range greater than 1 nmi, this same indication represents 1.5° or more above desired glide slope. The full width pathway (figure 8-67) indicates that the aircraft is 150 feet or more below desired glide path slope. At ranges of greater than 1 nmi, the same indication represents 1.5° or more below the flight path.

Glide Path Bearing

The bombardier/navigator selects cursor position or radar lock-on in combination with appropriate keyboard data so as to describe the intended point of landing. Coupled with a keyboard input of glide path bearing (true heading in degrees and minutes), this information is used to establish the glide path horizontal position, or extension of the landing runway. Differences between radar-measured bearing to in-

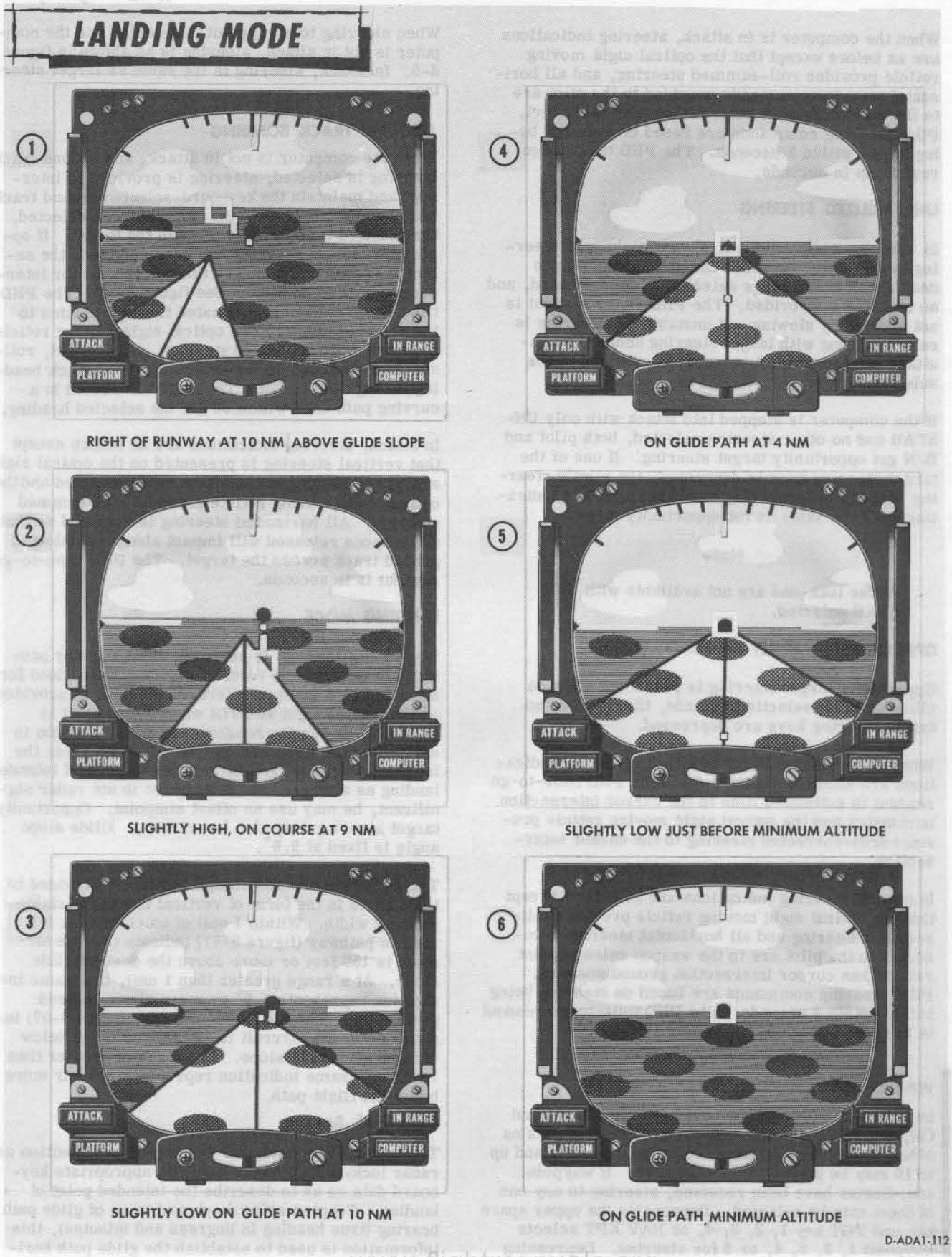

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Figure 8-67

tended point of landing and desired glide path bearing are used to position the VDI display near end (horizontal position) at ranges of 2 nmi or more. At closer ranges, the near end is positioned by the computed distance from the glide path center line.

With the aircraft centered on the selected glide path, the near end of the vertical display pathway centerline appears to pass directly below the aircraft (figure 8-67). In wings-level flight, the near-point is therefore directly below display center. At ranges less than 2 nmi, full right or left displacement of the near-point (figure 8-67) indicates that the aircraft is 301 feet or more left or right of the intended glide path. At ranges greater than 2 nmi, this same indication represents about 1.25° or more left or right of intended glide path. A well-defined and unique radar target is required for optimum glide slope information.

Note

- Glide slope command and near end position are particularly sensitive to small corrections in cursor repositioning if TWS or AZ RNG lock-on is not available. Therefore, care should be used in selecting prominent radar targets for use in landing mode.
- Use of elevation tracking while making carrier approaches using landing mode is not recommended. The low grazing angle coupled with the large radar return may cause erroneous target altitude computations resulting in incorrect vertical separation and consequently incorrect and erratic glide slope information.
- The accuracy of landing mode glide slope displacement in offset or opportunity target modes is predicated on prior knowledge of exact bearing and altitude relationships between radar targets and the intended point of landing.

Pathway Vanishing Point Horizontal Position

The keyboard input of glide path bearing is compared with computed aircraft ground track and target bearing to determine steering error, which positions the pathway vanishing point along a line through the display center and parallel with the display horizon. Twenty-seven degrees or more of difference causes full right or left displacement of the vanishing point.

USE OF LANDING MODE

Command steering and command glide angle are displayed by steering symbol position and circling orientation to the runway extension is automatically provided. Command altitude change is based on range to the point of intended landing and glide slope angle and is available when target bearing is within 30° of runway heading. Command glide angle required to zero altitude error is displayed by the steering symbol vertical position. Thus with the steering symbol centered vertically, the aircraft will intercept the glide slope. The amount of altitude error is indicated by pathway width.

Horizontal roll-summed steering command is displayed by the horizontal position of the steering symbol. Steering commands are programmed so that centering the steering symbol horizontally orients the aircraft position with respect to the runway centerline extension and allows transition to glide path intercept. Steering error is displayed by the horizontal position of the pathway vanishing point, and aircraft displacement from the extension of the runway centerline by the pathway near end horizontal position.

Maximum steering symbol commands are limited to 30° bank, 4° climb, and 6° descent. Due to these limits, the optimum range for selection of landing mode is from 4 to 10 nautical miles. Selection in this area will allow glide slope interception without overshooting and will keep orientation time to a minimum. A circling orientation is based on the smallest angle (the shortest way around) either left or right. Steering commands during orientation are programmed so that a constant radius turn centered on the point of intended landing is flown until the aircraft is within 30° of the keyboard runway heading. With the steering symbol centered, a smooth transition from orientation to glide path command is made so as to cause the aircraft ground track to match the runway heading.

The PHD bug and optical sight moving reticle provide the same steering information as the pathway vanishing point.

Minimums for landing mode are indicated by pathway disappearance. The minimum as incorporated in the computer program is 200 feet AGL. The minimum altitude with a TWS or elevation tracking lock-on is radar derived and with azimuth-range or no lock-on is the computed difference between present position altitude and target keyboard altitude.

The ground range at which the pathway disappears for minimum altitude is approximately 3/4 mile.

ATTACK MODES

The weapons system has the capability of four computer controlled full system attack modes, two LABS modes, and a delay mode.

PRIMARY ATTACK MODES

The primary system attack modes include general, straight path, high loft, and rocket and are selected by depressing the desired ATTACK selector button on the armament control unit (ACU). The computer is stepped into the attack condition by depressing the attack button on the slew grip or the pilot's attack button on the stick grip. The computer cannot be stepped into attack when the computer error or RESELECT lights are on. The ATTACK light should come on indicating that the computer has entered the attack mode. The computer then continuously calculates a weapon release point based on the ballistics of the selected weapon and the attack mode, and provides horizontal steering commands to that point until weapon release. Vertical steering is also provided based on blast clearance altitude entered, the type of weapon selected, the attack mode selected, and terrain avoidance considerations. Armament control unit and ballistic panel switch settings are tested for incompatibilities and if any are found, the RESELECT lights are turned on and the computer is stepped out of attack, turning off the ATTACK lights. The computer also checks for valid data failures. If a serious failure (i.e., system altitude or velocity breakdown),

which would prevent automatic release, is found in four successive iterations, the following occurs:

- The COMPUTER lights on the DVRI and the VDI and the COMPT ERROR light on the DDU are turned on when release is inhibited.
- The applicable system advisory code (SAC) is displayed in window A5 of the DDU.

A less serious valid data failure (i.e., unexpectedly noisy inputs) will not cause an error light, but will be evidenced by the appropriate SAC on the DDU. If there is a valid data failure of any kind, automatic release is inhibited and the VDI pathway is turned off. If a nuclear weapon or Shrike is selected, valid data failure will not inhibit a system release. Release remains inhibited and the pathway remains off until the valid data failure disappears.

The general attack is a low-loft delivery mode, which may be used for free-fall or retarded weapons and is suitable for the delivery of conventional or nuclear weapons. The general attack is the most suitable mode for use with visual boresight target acquisition or an automatic Shrike delivery.

The straight path attack is a nonaccelerated delivery mode, which may be used with free-fall or retarded conventional weapons and with nuclear weapons. This attack may be used from a level or diving condition and it is particularly well suited for use with ground track bombing and for mining.

The high-loft attack may be used with free-fall or retarded conventional weapons and with nuclear weapons.

The rocket attack mode is designed specifically for the delivery of rockets and may not be used with any other type of weapon.

A complete description of each of the primary attack modes may be found in the A-6 Tactical Manual NAVAIR 01-85ADA-1T.

WARNING

The E1.5 tactical flight program does not provide a breakaway warning when in a nonstraight path attack with a retarded weapon.

LAB IP AND LAB TARGET ATTACK MODES

The LAB IP and LAB TGT attack modes are non-computer-controlled backup loft delivery modes, which may be used with free-fall or retarded conventional weapons, Shrike missiles, or nuclear weapons.

Automatic release of ordnance is provided at release angles preset in the inertial platform adapter. For a LAB IP release, angles between 0° and 90° are available and for LAB TGT between 90° and 135° may be used. The release angles must be set before launch by ground personnel and can not be changed in flight. The angles to be used for nuclear weapons and for Shrike missiles may be found in the A-6 Tactical Manual NAVAIR 01-85ADA-1T.

The LAB IP or LAB TGT mode is selected by depressing the applicable ATTACK button on the ACU. If the computer is on, it may not be stepped into attack and no attack steering is provided; however, reselect logic protection is available. With the computer off, there is no reselect logic available. A description of the LAB IP and LAB TGT modes may be found in the A-6 Tactical Manual NAVAIR 01-85ADA-1T.

DELAY MODE

The DELAY mode, a non-computer-controlled delivery, which provides automatic release of ordnance at the end of a selected delay, is selected by depressing the DELAY attack mode button on the ACU. This mode may be used with free-fall or retarded conventional weapons or with nuclear weapons. If the computer is on, it may not be stepped into attack when DELAY is selected; however, reselect logic protection is available. With the computer off, there is no reselect logic available.

~~BORESIGHT~~ (VISUAL) TARGET ACQUISITION AND TRACKING MODE

The ~~boresight~~ (visual) target acquisition mode permits a system attack on a visual target. To use this mode, target steering or opportunity target or UNSTAB steering may be selected. In aircraft with the E1.5 program, after the cursors are initially positioned in the target area, the MODE switch on the B/N's control panel is set to BORESIGHT. In aircraft 159895 and ON and A-6E Mod M121 and ON, the visual mode is selected by the pilot depressing the attack button on the stick grip. In either case, indications are the same. Selecting the visual mode aligns the optical sight moving reticle to the aircraft velocity vector in azimuth and 20 mils below the ADL in elevation, inhibits B/N cursor slewing, activates the computer boresight ranging mode, and sets the DVRI cursors. In azimuth, the cursor reflects aircraft drift angle. In range, the cursor is positioned to 48,000 feet in climbs or level flight, and in dives, to velocity vector line of sight to the surface. The pilot maneuvers the aircraft so as to place the optical sight moving reticle on the target, and when he is satisfied that the reticle is properly placed, depresses the attack commit trigger to the first detent (COP). This designates the target to the computer.

Note

The computer must be in attack prior to COP for a designate to be recognized. The pilot may redesignate a target at any time without cycling the attack button. Computer target position will be redefined based upon the most recent designate.

The computer determines target position at designate based on velocity vector direction and system altitude. Target position is then updated continuously using system velocities. After the first designate, the designate position must be held for 1/2 second to be considered valid by the computer.

The system-derived target altitude data used at initial designate to compute line of sight range to the selected target is also used in the ballistic solution. Subsequent designations reset system target altitude as required.

Note

If there is no designation of the target before the pilot commits (i.e. depresses the attack commit trigger to the second detent) the computer regards the commit as a simultaneous designate and commit, and derives target position based upon the status of the moving reticle at commit.

The commit trigger should be released when the moving reticle is off the target and reselected when lined up. If the computer is stepped out of attack after designation, memory steering is provided to the designated target until attack is reinitiated.

With BORESIGHT (visual) selected, selection of STRAIGHT or HI LOFT on the ACU will automatically result in computer selection of a general attack, permitting a straight path maneuver after target designation without requiring 1 g unaccelerated flight at the release point.

The visual attack in the E100 program in aircraft 159895 and ON and A-6E Mod M121 and ON includes provisions for the use of FLIR and laser inputs when the equipment is installed.

SHRIKE TARGET ACQUISITION AND TRACKING MODE

In aircraft with the E1.5 program, Shrike target acquisition is enabled by selecting BORESIGHT, setting RKT/MSL on a Shrike-loaded weapon station, and then setting the MASTER ARMT switch to ON. In aircraft with the E100 program, Shrike target acquisition is enabled by selecting RKT/MSL on a Shrike-loaded weapon station and setting the MASTER ARMT switch to ON.

Note

All missile deliveries require a 60 ms or longer setting on the ACU TIME thumbwheel.

Depending upon aircraft altitude, the Shrike seeker head is capable of detecting targets at long ranges.

Once a suitable ground-based radar target has been acquired, Shrike antenna azimuth and elevation angles are presented on the VDI as horizontal and vertical deflection of the steering symbol. Shrike target position is defined in range in the computer by a single-point elevation boresight technique, which determines slant range as a function of altitude and elevation angle. Azimuth is determined by aircraft heading at the time the target was boresighted. A second boresighting of the target permits a more precise fix of target azimuth position by triangulation.

When the Shrike missile acquires a target, the pilot maneuvers the aircraft to center the steering symbol on the VDI and when it is lined up satisfactorily, he depresses the attack commit trigger to the first detent, completing the single-point boresight. Successive elevation ranges may be acquired by successive designates. A second boresight is acquired by slowly turning the aircraft away from the target to a relative bearing of 20° -30°. When the aircraft has flown long enough on the new heading, the in-range lights will flash and the target may again be boresighted when the attack commit trigger is depressed with the steering symbol centered on the VDI.

The impact point flashes to indicate that the computer is using the two-point azimuth solution.

To aid in centering the steering symbol, the target symbol is driven to the VDI centerpoint whenever the attack commit trigger is depressed to the first detent. The commit trigger should not be released until the steering and target symbols are superimposed.

Note

With BORESIGHT selected, the in-range lights do not flash at ballistic in-range in a Shrike attack. The release marker appears at ballistic in-range, however, providing a visual cue.

The Shrike-defined target position is used to position the cursors on the DVRI.

After the cursors are initially placed by Shrike ranging, they revert to normal program control, permitting radar tracking of the target when available without having to cycle steering.

Note

In aircraft with the E1.5 program, Shrike may be delivered without using the Shrike target acquisition mode by leaving the MODE switch at TRACK. When BORESIGHT is not selected, the in-range lights operate at ballistic in-range and steering remains normal.

VELOCITY CORRECT

The horizontal velocity values used by the computer to determine aircraft position and generate steering commands may be corrected from radar data either automatically or manually. If the search radar is in the track-while-scan (TWS) mode or azimuth-range tracking mode, an automatic velocity-correct may be performed. If none of these conditions exist, a manual velocity-correct may be performed. Manual velocity-correct calculations are based on a period of at least 10 seconds. If necessary, more than one velocity-correct may be accomplished. The E100 program makes provision for manual velocity correct using FLIR and laser inputs when the equipment is installed.

The corrected velocities retained when the velocity-correct switch is set to OFF SAVE are used by the system as follows:

- With the INS operating in the DR, inertial, and Doppler-inertial navigation modes, velocity-correct is used to improve present position and cursor tracking and system closing velocity determination.
- During INS in-flight alignment, in the DR navigation mode, velocity is used to calculate accelerometer correction and gyro-torquing signals as well as for system velocity calculations and for improving present position and cursor position.
- Velocity-corrects in the EMERG DOP mode are degraded by significant heading changes.

With a moving target lock-on and OFF SAVE selected, moving target velocities are calculated and displayed in the DDU, but the retained velocity-correct is used for navigation. Selecting OFF ERASE will erase both velocity-correct and moving target velocities. Cycling the AMTI control will erase the moving target velocities. With AMTI on and a valid TWS or azimuth range lock, moving target velocities are automatically used without the necessity of selecting MEMORY POINT.

AUTOMATIC VELOCITY-CORRECT

With the search radar providing valid TWS or azimuth range data or with a valid track radar discrete lock-on, setting the velocity correct switch on the B/N's pedestal to MEMORY POINT initiates an automatic velocity-correct. While the automatic velocity-correct is selected, the computer calculates a smoothed velocity-correction for each scan, based on the radar-derived rate-of-change of targets position.

MANUAL VELOCITY-CORRECT

When a manual velocity-correct is performed, the computer calculates a smoothed velocity-correction based on radar-derived rate-of-change of DVRI cursor position with respect to a radar-significant target on the DVRI. The cursor drift is introduced into the computer as follows:

1. In any ground-stabilized steering mode, place radar cursors on a persistent point target with slew grip.
2. Allow cursors to drift off target for at least 10 seconds and set the VELOCITY CORRECT switch to MEMORY POINT.

Note

Manual velocity-correct calculations are based on MEMORY POINT being selected for a period of at least 10 seconds but not longer than 128 seconds.

3. Replace cursors on original point, and note any additional cursor drift. If additional drift is observed, replace cursors and continue process until no further drift is observed.
4. When there is no further drift observed, set VELOCITY CORRECT switch to OFF SAVE.

Setting the VELOCITY CORRECT switch to MEMORY POINT enables velocity-correct calculations. Releasing one or both of the slew rate switches starts velocity-correct timing in the computer, and target rate-of-change is calculated based on the amount of slew stick input.

For manual moving target tracking (cursor intersection or elevation tracking), a manual velocity-correct is required to stabilize the cursors on a moving target. The computer adjusts system velocities to compensate for target motion. At the completion of the run, these velocities should be erased by selecting OFF ERASE on the VELOCITY CORRECT switch, and a new velocity-correct should be performed.

COMPUTER OPERATIONAL READINESS TEST (ORT)

In addition to the tactical flight program, the computer is provided with an additional program for self-test. Comprehensive built-in self-test features have been incorporated to detect, and aid in the isolation of system malfunctions. Fault isolation to a defective ARA is accomplished within approximately 10 minutes. Both hardware and software type features are employed for this purpose.

In aircraft with the E1.5 program, the ORT is initialized at turn-on by placing the COMP MODE switch in the TEST position and then turning on the computer. The computer may be placed into the test program from the flight program by depressing one of the OAP keys and setting the COMP MODE switch to TEST. The basic ORT flow for the E1.5 program is described below.

Note

- To perform the ORT, the INS must be in OPER or ALIGN.
- The AAU-19 altimeter must be in STBY.
- To pass the ORT, the search radar power switch must be at STBY or ON.
- The VDI must be in CONT ANALOG

Immediately following ORT initialization, the COMPT ERROR light on the DDU will go on for a period of approximately 4 seconds, during which time the automatic computer self-test is performed to determine computer GO-NO-GO status.

As soon as the COMPT ERROR light goes out, the ATTACK light will go on for a period of approximately 4 seconds, during which time an automatic GO-NO-GO check of the majority of the interface electronic assembly (IEA) is performed.

With both lights (COMPT ERROR and ATTACK) now out, a portion of the indicators and indicator logic is automatically tested by commanding them to read 0's and dashes(-).

By depressing the CCU CLEAR button, the computer is stepped into a further check of the CCU and DDU indicators, and associated IEA logic. In a GO system, the operator must observe 3's on all subsystem indicators.

Depressing the CLEAR button once again rotates the directional indicator (CCU, LATITUDE, and LONGITUDE) to the quantity S77777. Remaining indicators will be 7's. This test comprises a check of all CCU and DDU indicators, and IEA indicator logic.

Depressing the CLEAR button once again activates the discrete tests. This group of tests is concerned with exercising the strobed and unique discrete logic in the IEA, which interfaces with CCU, slew control, DDU, and other aircraft equipments. These tests are basically manual in nature and are employed to test both computer subsystem discretes and all other aircraft/computer discrete interfaces.

Depressing the CLEAR button again activates the analog/digital converter built-in test (BIT) modes as follows:

- The first BIT mode provides the performance of the central converter. Upon command, internally generated, fixed analog voltages are converted to digital form and the results are applied to the computer for evaluation. Different voltages are converted depending upon which two addresses are applied to the A/D converter.

- The second BIT mode is a test of the synchro input channels. Tests are accomplished when the computer commands a conversion using the channel under test. The results of this conversion are stored in the computer and the same analog input is then converted using the test channel. The computer evaluates the performance of the A/D converter by comparing the results.

- The third BIT mode serves to check the digital-to-analog conversion circuitry. The test of a particular channel is initiated by the computer transmitting an address and a predetermined digital word. The analog output resulting from the conversion is evaluated by an analog comparator in the A/D converter. A NO-GO indication is given to the computer if the resultant analog voltage is out of tolerance.

A failure during the A/D converter test stops the test and the readout in the G/S/LONG window indicates which test was failed. Depressing the CLEAR button permits the rest of the tests to be completed except for certain critical failures. See figure 8-68.

This completely automatic checkout of the A/D converter is completed in about 3 minutes. During this time, the BIT circuits of the air data computer (ADC) and the normal accelerometer are also activated.

The indications during these test modes are as follows:

- G/S/LONG reads 012000, then 011900, then 10600, if there are no failures between 011900 and 010600.

- G/S/LONG reading then decreases by 100's to 003400.

- G/S/LONG then reads 111111. A failure of the A/D converter test results in a readout other than 111111.

- ATTACK light on means air data computer out of tolerance/failure.

- COMPT ERROR light on means normal accelerometer failure.

Finally, by depressing the CLEAR button again the slew control synchro test is initiated. This test checks the maximum and intermediate positions of the slew stick in all four quadrants by displaying direction and angle quantities in the LATTITUDE and LONGITUDE windows on the DDU as a function of a slew stick position. Selecting ENTER reestablishes the computer in the flight program and displays a power-up 001 system advisory code (SAC).

In aircraft with the E100 program, either the complete ORT or only the initial 40-second automatic test may be enabled at turn-on. If the computer is turned on with the COMPT MODE switch at TEST, the entire ORT is enabled. If the COMPT MODE switch is at STEER or ENTER at turn-on, only the automatic GO-NO GO tests of the computer are enabled.

Note

If the CAINS was in the align or operate mode when the computer was last shut down, the ALIGN or OPER button on the NAVIGATION panel is still selected, an IMU ready signal to the computer is present, and the computer is turned on with the COMP MODE switch at STEER, then the automatic test will not be run and the flight or align program will be entered directly.

The E100 ORT program follows the same general flow as that for the E 1.5 program with the exception that tests of DRS equipment have been added following the initial 40-second test. These DRS tests are automatically bypassed if the equipment is not installed.

Note

- The AAU-19 altimeter must be in STBY.

- To pass the ORT, the search radar power switch must be at STBY or ON.

- The VDI must be in CONT ANALOG.

Immediately following ORT initialization, the COMPT ERROR light on the DDU will go on for a period of approximately 4 seconds, during which time the automatic computer self-test is performed to determine computer GO-NO GO status.

As soon as the COMPT ERROR light goes out, the ATTACK light will go on for a period of approximately 4 seconds, during which time an automatic GO-NO GO check of the majority of the interface electronic assembly (IEA) is performed.

With the ATTACK light still on, the COMP ERROR light comes on, and both lights stay on for approximately 4 seconds, during which time the auxiliary memory unit is tested.

With both lights (COMPT ERROR and ATTACK) now out, a portion of the indicators and indicator logic is automatically tested by commanding them to read 0's and dashes (-).

This concludes the initial test. At this time, a failed test may be repeated by pressing the SAC key, or if TEST had been selected, the ORT may be continued by pressing the CLEAR button. If STEER had been selected, at the successful completion of the automatic test, the COMPT ERROR will come on, DDU window A5 will display system advisory code (SAC) 001, and the alignment program may be entered.

With TEST selected, depressing the CLEAR button would select DRS tests if the equipment were installed and DRS BIT selected; however, these tests are automatically bypassed and the computer is stepped into a further check of the CCU and DDU indicators, and associated IEA logic. In a GO system, the operator must observe 3's on all subsystem indicators.

Depressing the CLEAR button once again rotates the directional indicator (CCU, LATITUDE, and LONGITUDE) to the quantity S77777. Remaining indicators will be 7's. This test comprises a check of all CCU and DDU indicators, and IEA indicator logic.

Depressing the CLEAR button once again activates the discrete tests. This group of tests is concerned with exercising the strobed and unique discrete logic in the IEA, which interfaces with CCU, slew control, DDU, and other aircraft equipments. These tests are basically manual in nature and are employed to test both computer subsystem discretes and all other aircraft computer discrete interfaces.

Depressing the CLEAR button again activates the analog/digital converter built-in test (BIT) modes.

A failure during the A/D converter tests stops the test and the readout in the G/S/LONG window indicates which test was failed. Depressing the CLEAR button permits the rest of the tests to be completed except for certain critical failures. See figure 8-68.

This completely automatic checkout of the A/D converter is completed in about 3 minutes. During this time, the BIT circuits of the air data computer (ADC) and the normal accelerometer are also activated.

The indications during these test modes are as follows:

- G/S LONG reads 012100, then 012000, then 01000, if there are no failures between 012000 and 010000.
- G/S LONG reading then decreases by 100's to 000400.
- G/S LONG then reads 111111. A failure of the A/D converter test results in a readout other than 111111.
- COMPT ERROR and ATTACK lights off. ATTACK light on means air data computer out-of-tolerance failure. COMPT ERROR light on means normal accelerometer failure.
- DVRI: ATTACK, RESELECT, ELEVATION, AZ-RANGE, and COMPUTER lights on.
- VDI: ATTACK, PLATFORM, COMPUTER, IN RANGE, and breakaway lights on; all other lights flash.
- VDI: Target symbol on, steering symbol, pathway and release marker off; impact point flash.

Finally, by depressing the CLEAR button again, the slew control synchro test is inititated. This test checks the maximum and intermediate positions of the slew stick in all four quadrants by displaying direction and angle quantities in the LATTITUDE and LONGITUDE windows on the DDU as a function of a slew stick position. Selecting ENTER reestablishes the computer in the flight program and displays a power-up 001 system advisory code (SAC).

SYSTEM ADVISORY CODES

During each iteration of the computer program, tests are performed to evaluate system performance, and a failure causes a system advisory code (SAC) to be displayed in window A5 of the DDU. These tests and their resulting SAC's are categorized as either serious system deficiencies or minor difficulties, which are temporary and correctable. The serious deficiencies are assigned a high display priority and the minor difficulties a low priority. If both a high priority failure and a low-priority failure are detected simultaneously, the displayed SAC will be that for the high priority failure. Figure 8-71 lists the SAC's and the failures they indicate.

HIGH PRIORITY SAC'S

The high-priority SAC's (figure 8-71) are those which have a zero in the left digit and indicate a failure of a serious nature. The computer error lights are turned on when a serious failure is present. These tests are monitored at all times in and out of attack.

In a nonattack condition, a failure must occur in four successive iterations to cause a SAC to be displayed and the computer error lights to be turned on. The SAC and error lights can be removed only by depressing the SAC ACTION key on the keyboard. The computer cannot be stepped into attack when the error lights are on.

In attack, a failure in only one iteration is necessary to cause a SAC to be displayed and the computer error light to be turned on. If the condition causing the failure disappears, and the valid data test is

A/D CONVERTER TESTS

E 1.5 PROGRAM

G/S LONG READOUT	TEST FAILED	MISSION IMPACT
012000	START TEST	CANNOT BYPASS SYSTEM NOT AVAILABLE
011900	CONVERTER CIRCUITRY	
011800	CONV. REF VOLT A	
011700	CONV. REF VOLT B	
011600	S/R ANTENNA ELEV ANGLE	ELEVATION TRACKING INVALID
011500	ROLL	DEGRADED NAVIGATION/ATTACK ACCURACIES
011400	TRUE HEADING	
011300	PITCH	
011200	DOPPLER GS	DOPPLER INVALID
011100	DOPPLER DRIFT	
011000	TEMPERATURE PROBE	TRUE AIRSPEED INVALID
010900	SLEW RANGE RATE	DEGRADED SLEW CAPABILITY
010800	SLEW AZ RATE	
010700	STATIC PRESSURE	SYSTEM ALTITUDE INVALID
010600	MACH	TAS INVALID
010500	ENABLE AIR DATA COMP TEST	AIR DATA COMP TEST INVALID
010400	INERTIAL	INS VELOCITIES INVALID
010300	INERTIAL	INS VELOCITIES INVALID; MAY RESULT IN LOSS OF PRIMARY ATTITUDE REFERENCE
010200		
010100		
010000	OPTICAL SIGHT MOVING RETICLE	MOVING RETICLE INVALID
009900		
009800	DVRI REL BRNG	DVRI REL BRNG UNRELIABLE
009700	PHD CMD HDG	PHD BUG UNRELIABLE
009600	INERTIAL	INS ALTITUDE INVALID
009500		INS VELOCITIES INVALID
009400	INFLIGHT ALIGN	DEGRADED INFLIGHT ALIGN CAPABILITY

G/S LONG READOUT	TEST FAILED	MISSION IMPACT
009300	S/R ELEVATION TRACK RATE	DEGRADED ELEVATION TRACKING
009200	COMMAND AFCS	NOT USED
009100		
009000	VDI PATHWAY	PATHWAY PRESENTATION INVALID
008900		
008800	STEERING SYMBOL	HORIZONTAL POSITION INVALID
008700	IMPACT POINT	
008600	TARGET SYMBOL	
008500	RELEASE MARKER	INDICATIONS INVALID
008400	CMD HDG LINES	
008300	PATHWAY APEX	
008200	LAND MODE ALT.	
008100	PULL-UP MARKER	
008000	PATH PULL-UP	DISTORTED PATHWAY
007900	RELEASE MARKER	DISTORTED SIZE
007800	SPARE	NONE
007700		
007600	NOT APPLICABLE	NONE
007500	INERTIAL	INS VELOCITIES INVALID
007400	STEERING SYMBOL	VERTICAL POSITION INVALID
007300	TARGET SYMBOL	
007200	IMPACT POINT	
007100	INERTIAL	INS VELOCITIES INVALID; MAY RESULT IN LOSS OF PRIMARY ATTITUDE REFERENCE
007000		
006900		
006800	INERTIAL	INS VELOCITIES INVALID
006700	INERTIAL	INS VELOCITIES INVALID; MAY RESULT IN LOSS OF PRIMARY ATTITUDE REFERENCE
006600		
006500		
006400	CONVERTER RESET	CANNOT BYPASS SYSTEM NOT AVAILABLE
006300	TIME OUT CIRC CK	
006200	RESET COMPUTER DISCRETE SIGNALS	WEAPON SYSTEM ADVISORY LIGHTS INVALID

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Figure 8-68 (Sheet 1)

A/D CONVERTER TESTS—CONT.

E 1.5 PROGRAM

NOTE • 006100 THROUGH 003400 ARE CHECKS OF COCKPIT INDICATORS AND COMPUTER DISCRETE OUTPUTS ONLY AND ARE NOT SYSTEM DEGRADING WITH THE FOLLOWING EXCEPTIONS:

G/S LONG READOUT	TEST FAILED	MISSION IMPACT
005700	BORESIGHT ON	BORESIGHT MODE INOPERATIVE
005600	ELEVATION TRACK ON	ELEVATION TRACKING INOPERATIVE
005100	AZIMUTH RANGE ON	AZIMUTH RANGE TRACKING INOPERATIVE
004200	VIDEO TAPE RECORDER ON	NO AUTOMATIC TURN-ON OF VTR

NOTE • AT THE COMPLETION OF THE A/D CONVERTER TESTS THE FOLLOWING INDICATIONS APPLY:

G/S LONG READOUT	TEST FAILED	MISSION IMPACT
111111	NONE	A/D CONVERTER TESTS COMPLETE NO FAILURES
111111	ATTACK	AIR DATA COMPUTER SELF TEST FAILURE/OUT OF TOLERANCE
111111	COMPT ERROR	NORMAL ACCELEROMETER FAILURE

NOTE

• IF A FAILURE INDICATION IS OBSERVED, THE A/D CONVERTER TEST SHOULD BE RE-RUN SEVERAL TIMES TO ESTABLISH THAT THE PROBLEM IS CONSISTENT AND VALID.

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Figure 8-68 (Sheet 2)

A/D CONVERTER TEST—E100 PROGRAM

TEST SEQUENCE	I/O FAILURE
012100	No Device Checked
012000	No Device Checked
(*) 011900	Converter Data Parity Inspection
(*) 011800	Converter Channel Timeout Generation
(*) 011700	Antenna Elev
(*) 011600	Doppler Groundspeed
(*) 011500	Doppler Drift Angle
(*) 011400	Total Temperature
(*) 011300	Static Pressure
(*) 011200	Mach
(*) 011100	Platform Heading Coarse
(*) 011000	Backup True Heading
(*) 010900	Elev. Gimbal Coarse
(*) 010800	Outer Azimuth Gimbal Coarse
(*) 010700	Elev. Gimbal Fine
(*) 010600	Inner Azimuth Gimbal
(*) 010500	Outer Azimuth Gimbal Fine
(*) 010400	Roll
(*) 010300	Pitch
(*) 010200	Slew Stick Range Rate
(*) 010100	Slew Stick Azimuth Rate

Turret Inputs

TEST SEQUENCE	I/O FAILURE
010000	Platform Hdg Fine
009900	Horizontal Drift
009800	Barometric Altitude
009700	Vert. Vel. Command Error
009600	Altitude Error
009500	Command Speed Error
009400	Bulldog Seeker Slew - AZ
009300	Bulldog Seeker Slew - Elev
009200	Moving Reticle Pos'n - Horiz.
009100	Moving Reticle Pos'n - Vert.
009000	Relative Bearing
008900	Elev. Rate Target "A"
008800	X-Axis Gyro Torque
008700	Y-Axis Gyro Torque
008600	Z-Axis Gyro Torque
008500	X-Axis Gyro Torque
008400	Y-Axis Gyro Torque
008300	Z-Axis Gyro Torque
008200	X-Axis Gyro Torque
008100	Y-Axis Gyro Torque
008000	Z-Axis Gyro Torque
007900	Computer True Hdg
007800	Command Heading - PHD

* - Code will not appear in G/S/LONG window unless a failure occurs.

Figure 8-68 (Sheet 3)

A/D CONVERTER TEST–E100 PROGRAM–CONTINUED

TEST SEQUENCE	I/O FAILURE
007700	Roll Command
007600	Path Vanish Pt. - Horiz. Pos'n
007500	Flight Path Near End - Horiz. Pos'n
007400	Weapon Sym - Horiz. Pos'n
007300	Impact Point - Horiz. Pos'n
007200	Target Horiz. Pos'n
007100	Release Marker Pos'n
007000	Cmd Hdg Lines - Horiz. Motion
006900	Path Vanish Point - Vert. Pos'n
006800	Command Altitude Change
006700	Pullup Marker Pos'n
006600	Pullup Path Rad of Curve
006500	Release Marker Size
006400	Weapon Symbol - Vert. Pos'n
006300	Target Symbol - Vert. Pos'n
006200	Impact Point - Vert. Pos'n
006100	No Device Checked
006000	No Device Checked
005900	No Device Checked
005800	Laser PRF Select - OFF

TEST SEQUENCE	I/O FAILURE
005700	Pullup Marker - OFF
005600	Flash Impact Point - OFF
005500	Computer ON-OFF
005400	DVRI Elevation - OFF
005300	DVRI Reselect - OFF
005200	System NO-GO (OFF)
005100	Return to Lvl - OFF
005000	ADI ATTACK - OFF
004900	DVRI Az-Range - OFF
004800	In Range - OFF
004700	Breakaway - OFF
004600	005800 thru 004700 - OFF
004500	00580 thru 004700 - ON
004400	Attitude Unreliable - OFF
004300	Platform Unreliable - OFF
004200	AFCS Go - OFF
004100	IMU Flip - OFF
004000	Backup Heading - OFF
003900	0° Test - OFF
003800	NCP D/L - OFF
003700	NCP ADC - OFF
003600	NCP INS - OFF
003500	DVRI - DRS ATTACK (OFF)
003400	NCP - Align - OFF
003300	NCP - Doppler - OFF

Figure 8-68 (Sheet 4)

A/D CONVERTER TEST–E100 PROGRAM–CONTINUED

TEST SEQUENCE	I/O FAILURE
003200	004400 thru 003300 - OFF
003100	004400 thru 003300 - ON
003000	Spare OFF
002900	Spare OFF
002800	PSU Flag Reset Not - OFF
002700	IMU Flag Reset Not - OFF
002600	IMU Flag Set - OFF
002500	Navigate (IMU) - OFF
002400	Spare OFF
002300	Spare OFF
002200	NCP Taxi - OFF
002100	CAINS ON - OFF
002000	D/L Mode Select - OFF
001900	003000 thru 002000 - OFF
001800	003000 thru 002000 - ON
001700	7.5° Test
001600	Normal Accel Self-Test
001500	Weapon Symbol OFF
001400	Air Data Compt Self-Test
001300	ADI Computer Error
001200	Command Heading Lines
001100	Video Tape Rcdr ON
001000	Hold "G"
000900	DRS Laser Range Valid
000800	ADI Release Marker
000700	DVRI Compt Error
000600	ADI Pathway - OFF
000500	001700 thru 000600 - OFF
000400	001700 thru 000600 - ON
111111	Converter Test Finished

Figure 8-68 (Sheet 5)

satisfied, the SAC will be erased and the lights turned off automatically.

LOW PRIORITY SAC'S

The low priority SAC's (figure 8-71) are those which have other than zero in the left digit and indicate difficulties of a minor nature. These tests are monitored only in attack after in-range. The computer error lights do not come on for failures of this nature and the SAC is erased automatically when the failure disappears.

SYSTEM FAILURES IN ATTACK

Any existing SAC will cause the VDI pathway to be turned off and will cause weapon release to be inhibited while the SAC is present. If a release is inhibited due to the presence of a SAC, the computer error lights will come on, and the appropriate SAC will remain on display after the program steps out of attack.

COMPUTER CONTROLS

Controls for operating the computer are on the digital display unit (DDU) and the computer control unit (pedestal), (figure 8-69).

DIGITAL DISPLAY UNIT CONTROLS

COMPUTER Switch

The COMPUTER switch is a two-position lever-lock toggle switch marked ON and OFF, that controls power application to the computer. When the switch is at OFF, no power is applied. Selecting ON supplies three-phase 400 Hz 115 volts ac and 28 volts dc from the primary buses.

DATA SELECT Switch

The DATA SELECT switch is a three-position toggle switch with positions marked A, B, and C. This switch controls which data are displayed in the five FLT DATA windows. Figure 8-71 represents the data displayed for each of the switch positions for the attack condition the nonattack condition and in aircraft with the E100 program, ground or carrier alignment.

Flight Data Windows

The five FLT DATA windows numbered 1 through 5 present three-digit readouts of computer data as selected with the DATA SELECT switch. See figure 8-71.

Navigation Data Switch

The navigation data switch is a three-position toggle switch marked DATA, PRES POS, and ON CALL that controls which readouts are to be displayed in the three navigation data windows. Figure 8-71 shows the readouts displayed for each of the switch positions for the nonattack condition, the attack condition and in aircraft with the E100 program, ground or carrier alignment.

Note

The ON CALL readouts for TGT 1-4 or NAV XPT are updated to agree with cursor position when it is slewed by the B/N; however, the computer retains the actual coordinates of the position for present position correct.

Navigation Data Windows

The three navigation data windows are marked WIND SPEED/LAT, G/S/LONG, and WIND DIR/ALT. These windows display readouts as selected with the navigation data switch (figure 8-71).

CORRECT POS Button

The CORRECT POS button is a pushbutton switch permitting system present position to be updated using radar information. With the COMPT MODE switch at STEER and any of the four target keys, or the NAV XPT key depressed, the latitude and longitude of system present position may be updated by placing the radar cursors on the selected target and depressing the CORRECT POS button. If UNSTAB is not selected, system altitude is also updated to temperature-corrected pressure altitude. This function is available either in the attack or nonattack condition.

Navigation Mode Selector Switch

The navigation mode selector switch is a three position toggle switch marked EMER DOP, INERL, and DR, which permits selection of the computer navigation option. See figure 8-63. When the switch is at EMER DOP, the Doppler navigation option is selected. When the switch is at INERL with no valid Doppler signal present, or in aircraft with the E 100 program with Doppler not used sensor code present, the inertial option is selected. With the switch at INERL, and a valid Doppler signal present and in aircraft with the E100 program with a Doppler used sensor code present, the Doppler inertial option is selected. When the switch is at DR, the dead reckoning option is selected.

COMPT ERROR Light

The computer error (COMPT ERROR) light is a flush-mounted amber advisory light, which comes on when one or more errors or valid data failures exist in the computer. There are two repeaters of this light both marked COMPUTER, one on the DVRI light panel and one on the lower right corner of the VDI. The pilot's repeater on the VDI may be tested by depressing the LTS WARN button.

ATTACK Light

The ATTACK light is a flush-mounted white advisory light, which goes on when the computer is stepped

into the attack condition. Repeaters of this light are on the DVRI light panel and on the lower left corner of the VDI. The pilot's repeater may be tested by depressing the LTS WARN button. If the light goes out during an attack, it indicates that a valid solution is no longer possible and the attack will have to be reinitialized. The ATTACK light has a special use during ORT, which is explained in the description of the ORT.

MAG VAR Switch and Indicator

Magnetic variation for use in the system is inserted by use of a five-position slew switch spring-loaded to the neutral (off) position. The switch is marked E INC and W INC and its two extreme positions are marked F while the two intermediate positions are marked S. Holding the switch to one of the F positions increases magnetic variation in the selected direction at a fast rate; holding the switch to one of the S positions changes the magnetic variation at a slower rate. The value and direction of the variation in use are displayed in a two-window indicator next to the MAG VAR switch.

COMPUTER CONTROLS AND INDICATORS

A-6E

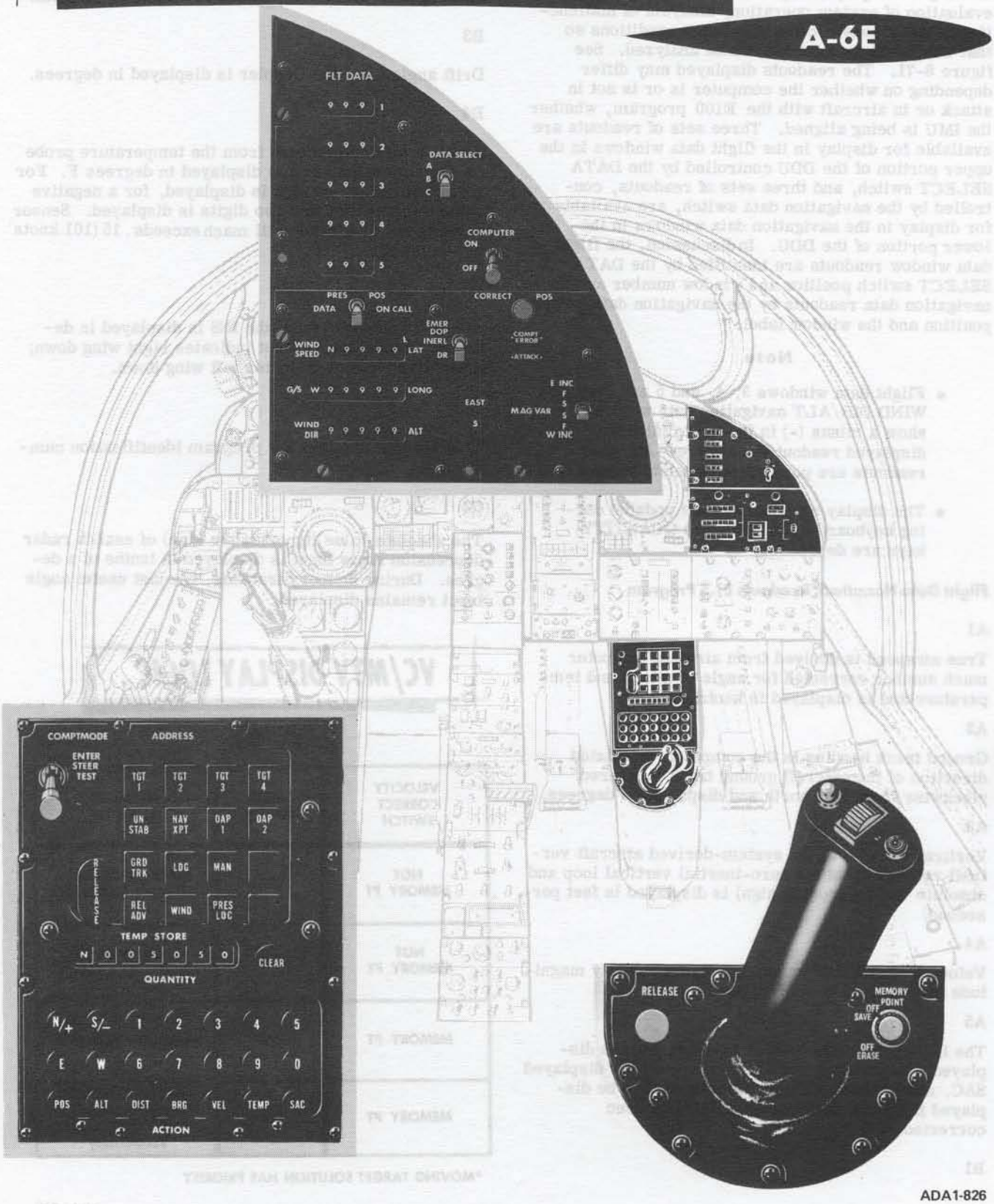

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Figure 8-69

DIGITAL DISPLAY UNIT READOUTS

The digital display unit presents readouts to permit evaluation of system operation, analysis of malfunctions, and reconstruction of release conditions so that weapon impact errors can be analyzed. See figure 8-71. The readouts displayed may differ depending on whether the computer is or is not in attack or in aircraft with the E100 program, whether the IMU is being aligned. Three sets of readouts are available for display in the flight data windows in the upper portion of the DDU controlled by the DATA SELECT switch, and three sets of readouts, controlled by the navigation data switch, are available for display in the navigation data windows in the lower portion of the DDU. In discussion, the flight data window readouts are identified by the DATA SELECT switch position and window number and the navigation data readouts by the navigation data switch position and the window label.

Note

- Flight data windows 3, 4, and 5 and the WIND DIR/ALT navigation data window show a minus (-) in the first dial when displayed readout is negative. All other readouts are positive or absolute values.
- The display readouts are not updated during keyboard entry while the QUANTITY keys are depressed.

Flight Data Nonattack Readouts E1.5 Program

A1

True airspeed is derived from air data computer mach number corrected for angle of attack and temperature and is displayed in knots.

A2

Ground track heading is the computer-calculated direction of the aircraft ground track measured clockwise from true north and displayed in degrees.

A3

Vertical velocity is the system-derived aircraft vertical velocity from the baro-inertial vertical loop and absolute value (ignoring sign) is displayed in feet per second.

A4

Velocity correction or moving target velocity magnitude is displayed in knots. See figure 8-70.

A5

The highest priority system advisory code is displayed. Depressing the SAC key erases the displayed SAC, and permits the next priority SAC to be displayed if the cause of the first SAC has been corrected.

B1

Static pressure from the air data computer is displayed in tenths of an inch of mercury.

B2

Groundspeed from the Doppler is displayed in knots.

B3

Drift angle from the Doppler is displayed in degrees.

B4

Ambient air temperature from the temperature probe or system computation is displayed in degrees F. For a positive value, no sign is displayed, for a negative value a minus sign and two digits is displayed. Sensor value is not displayed until mach exceeds .15 (101 knots at sea level).

B5

Aircraft roll angle from the INS is displayed in degrees. A positive readout indicates right wing down; a negative readout indicates left wing down.

C1

This readout displays the program identification number.

C2

The absolute value (ignoring the sign) of search radar depression angle input is displayed in tenths of a degree. During memory tracking, the last useful angle input remains displayed.

VC/MTV DISPLAY LOGIC

A-6E

VELOCITY CORRECT SWITCH	AMTI SWITCH	DISPLAYED QUANTITY
NOT MEMORY PT	OFF	VELOCITY CORRECT (IF ANY EXISTING)
NOT MEMORY PT	ON	TARGET VELOCITY IN USE BY SYSTEM
MEMORY PT	OFF	VELOCITY CORRECT
MEMORY PT	ON	SYSTEM CLOSING ERROR* (TARGET AND CORRECTION VELOCITIES)

*MOVING TARGET SOLUTION HAS PRIORITY

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Figure 8-70

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C3

System depressing angle to the target is displayed in degrees. A negative value indicates that the target is lower than the aircraft.

C4

Aircraft true angle of attack derived from the angle of attack probe or system computation is displayed in tenths of a degree. The readout is always positive when the ADL is above the airspeed vector and negative when the ADL is below the airspeed vector.

C5

Zeroes are displayed when not in attack.

Flight Data Attack Readouts E1.5 Program

A1

This readout is the same as for nonattack.

A2

This readout is the same as for nonattack.

A3

This readout is the same as for nonattack.

A4

This readout is the same as for nonattack.

A5

This readout is the same as for nonattack.

B1

System-defined total aircraft velocity relative to the earth is displayed in knots.

B2

Aircraft true heading from the INS is displayed in degrees.

B3

The system value of corrected aircraft elevation angle measured from the horizontal to the ADL is displayed in degrees. The readout is positive for ADL above the horizontal and negative for ADL below the horizontal.

B4

System calculated weapon ballistic time of fall is displayed in seconds times 0.1.

B5

Computed azimuth steering error to destination. A positive readout is an error to the left, a negative readout is an error to the right.

C1

This readout displays a code identifying the source of target tracking data. See figure 8-71.

C2

The acceleration (load factor) normal (perpendicular) to the aircraft ADL measured by the normal accelerometer or system back-up computation is displayed in tenths of a g.

C3

Weapon release angle (figure 8-71) is displayed in degrees.

C4

Search radar depression angle input measured from the horizontal to the target line of sight is displayed in degrees. A negative readout indicates that the target is lower than the aircraft.

DIGITAL DISPLAY UNIT READOUTS

E 1.5 PROGRAM

FLIGHT DATA WINDOWS

WINDOW	NON – ATTACK						ATTACK					
	DATA SELECT POSITION						DATA SELECT POSITION					
	A		B		C		A		B		C	
	UNITS	ADD	UNITS	ADD	UNITS	ADD	UNITS	ADD	UNITS	ADD	UNITS	ADD
1	KNOTS	–	IN /10	–	–	–	KNOTS	–	KNOTS	–	–	–
XXX	TRUE AIRSPEED		STATIC PRESSURE		PROGRAM IDENTIFIER		TRUE AIRSPEED		TOTAL AIRCRAFT VELOCITY		TRACKING CODE (3)	
2	DEG	–	KNOTS	–	DEG/10	–	DEG	–	DEG	–	G/10	–
XXX	GROUND TRACK HEADING		DOPPLER VELOCITY		INPUT DEPRESSION ANGLE		GROUND TRACK HEADING		INS TRUE HEADING		NORMAL LOAD FACTOR	
3	FPS	0	DEG	–	DEG	–	FPS	0	DEG	–	DEG	–
*XX	SYSTEM VERTICAL VELOCITY		DOPPLER DRIFT ANGLE		DEPRESSION ANGLE TO TARGET		SYSTEM VERTICAL VELOCITY		ELEVATION ANGLE (PITCH)		RELEASE ANGLE (4)	
4	KNOTS	–	DEG F.	–	DEG/10	–	KNOTS	–	SEC/10	–	DEG	–
*XX	VELOCITY CORRECT OR MOVING TARGET VELOCITY		AMBIENT AIR TEMPERATURE		ANGLE OF ATTACK		VELOCITY CORRECT OR MOVING TARGET VELOCITY		TIME OF FALL		SEARCH RADAR DEPRESSION ANGLE INPUT	
5	–	–	DEG	–	FEET	00	–	–	MILS	–	FEET	00
*XX	SYSTEM ADVISORY CODES (1)		INS ROLL ANGLE		RELEASE ADVANCE (2)		SYSTEM ADVISORY CODES (1)		STEERING ERROR		RELEASE ADVANCE (2)	

X DIGITS AVAILABLE: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
* DIGITS AVAILABLE: 0, 1, 2, 3, 4, 5, 6, 7, –, BLANK

NAVIGATION DATA WINDOWS

NAVIGATION DATA SWITCH – DATA

WINDOW	ATTACK	NON-ATTACK
WIND SPEED/LAT *XXXX	WIND VELOCITY (KNOTS)	WIND VELOCITY (KNOTS)
G/S /LONG *XXXXX	GROUND TRACK VELOCITY (KNOTS)	GROUND TRACK VELOCITY (KNOTS)
WIND DIR/ALT *XXXX	WIND DIRECTION (DEGREES)	WIND DIRECTION (DEGREES)

NAVIGATION DATA SWITCH – PRES POS

WINDOW	ATTACK	NON-ATTACK
WIND SPEED/LAT *XXXX	WEAPON CODE (5)	PRESENT POSITION LATITUDE (DEGREES, MINUTES)
G/S /LONG *XXXXX	VERTICAL SEPARATION (FEET)	PRESENT POSITION LONGITUDE (DEGREES, MINUTES)
WIND DIR/ALT *XXXX	SYSTEM ALTITUDE – MSL (FEET)	SYSTEM ALTITUDE – MSL (FEET)

NAVIGATION DATA SWITCH – ON CALL

WINDOW	ATTACK	NON-ATTACK
WIND SPEED/LAT *XXXX	COMPUTED BALLISTIC RANGE (FEET) ** (6)	BASED ON STEERING KEY SELECTION (7)
G/S /LONG *XXXXX	GROUND RANGE TO TARGET (FEET)	BASED ON STEERING KEY SELECTION (7)
WIND DIR/ALT *XXXX	COMPUTED TARGET ALTITUDE (FEET)	BASED ON STEERING KEY SELECTION (7)

* DIGITS AVAILABLE: WINDSPEED/LAT, G/S /LONG: N, S, E, W, 0, 1, 2, 3, 4, 5
WIND DIR/ALT 0, 1, 2, 3, 4, 5, 6, 7, 8, –
X DIGITS AVAILABLE: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

**DISPLAYED IN FEET X 10 WHEN RANGE EXCEEDS 60,000 FEET.

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Figure 8-71 (Sheet 1)

DIGITAL DISPLAY UNIT READOUTS—CONT: E 1.5 PROGRAM

NOTE

1 SYSTEM ADVISORY CODES (SAC's):

SAC	REASON
001	COMPUTER POWER UP SEQUENCE INDICATOR
002	FAILURE TO ENTER PRES POS LATITUDE AT TURN ON
009	INCOMPLETE ITERATION. PERFORM ORT.
010	TAS - GS ERROR. CHECK VELOCITY INPUTS.
011	VERTICAL LOOP ERROR. CHECK STATIC PRESSURE AND VERTICAL VELOCITY INPUTS. RE-ENTER PRES POS ALTITUDE
013	CYCLING STEERING IN MEMORY POINT
110	PILOT FAILED TO COMMIT
111	EXCESSIVE STEERING ERROR
112	EXCESSIVE BALLISTIC RANGE ERROR*
113	NORMAL ACCELEROMETER-SYSTEM VELOCITY INCONSISTENCY. CHECK THESE INPUTS.
114	FAILURE TO RELEASE DUE TO NOISY COMPUTER INPUT

*NOT DUE TO ANY SINGLE OPERATOR OR SYSTEM ERROR

2 INCLUDES ONE-HALF STICK LENGTH FOR TRAIN RELEASES AND/OR RELEASE ADVANCE

3 TRACKING CODES:

CODE	SOURCE
000	CURSOR INTERSECTION
001	MEMORY AZ-RANGE
010	MEMORY ELEVATION ANGLE
011	MEMORY TWS
101	AZ-RANGE
110	ELEVATION ANGLE
111	TWS

4 RELEASE ANGLES:

FREE FALL LOFT — RELEASE ANGLE IN DEGREES
FREE FALL STRAIGHT PATH — AIRCRAFT VELOCITY VECTOR IN DEGREES
RETARD BOMBS — ANGLE TO GO TO RELEASE
ROCKETS — LAUNCH ANGLE IN DEGREES

5 WEAPON CODES:

ACU TAPE LEGEND	WEAPON	RACK/ CAR-TRIDGE	ARM/FUZE MECH	ARM/FUZE ELEC	CODE	ACU TAPE LEGEND	WEAPON	RACK/ CAR-TRIDGE	ARM/FUZE MECH	ARM/FUZE ELEC	CODE
FFB-A	SPARE FREE FALL BOMB				1	F76	FREE FALL MK-76 PB	MER/MK2 2	3	3	07606
FFB-B	SPARE FREE FALL BOMB				1	F61	FREE FALL MK-61 NUCLEAR	AERO-7A/MK51			06101
FFB-C	FREE FALL MK-76 PB	X40			S7646	F57	FREE FALL MK-57 NUCLEAR	AERO-7A/MK51			05701
F117	FREE FALL M-117 DEMO	MER/MK2	X		1	F43	FREE FALL MK-43 NUCLEAR	AERO-7A/MK1, 2			04301
F116	FREE FALL MK-116 WETEYE	MER/MK2			11606	F28	FREE FALL MK-28 NUCLEAR	AERO-7A/MK1, 2			02801
F94	FREE FALL MK-94 CHEMICAL	MER/MK2			09406	R43	RETARDED MK-43 NUCLEAR	AERO-7A/MK1, 2			04351
F84A	FREE FALL MK-84 GP	AERO-7A/MK1, 2			08401	R57	RETARDED MK-57 NUCLEAR	AERO-7A/MK51			05751
F83A-E	FREE FALL MK-83 GP	AERO-7A/MK1, 2		X	1	R61	RETARDED MK-61 NUCLEAR	AERO-7A/MK51			06151
F83T-E	FREE FALL MK-83 GP	TER/MK2		X	1	RET-A	SPARE RETARDED BOMB				1
F83A-M	FREE FALL MK-83 GP	AERO-7A/MK1, 2		X	1	R40	RETARDED MK-40 DESTRUCTOR	MER/MK2			04052
F83T-M	FREE FALL MK-83 GP	TER/MK2	X		08303	R81	RETARDED MK-81 SNAKEYE	MER/MK2			08156
F82-E	FREE FALL MK-82 GP	MER/MK2		X	1	R82	RETARDED MK-82 SNAKEYE	MER/MK2			08256
F82-M	FREE FALL MK-82 GP	MER/MK2	X		08206	R106	RETARDED MK-106 PB	MER/MK2 2			10656
F82SN	FREE FALL MK-82 SNAKEYE	MER/MK2	X		08216	R20	RETARDED MK-20 ROCKEYE	MER/MK2			02056
F81SN	FREE FALL MK-81 SNAKEYE	MER/MK2	X		08106	CBU-24	RETARDED CBU-24 CLUSTER	MER/MK2			32053
F77	FREE FALL MK-77 FIRE	MER/MK2			07702	R-CL-A	SPARE RETARDED CLUSTER				1

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Figure 8-71 (Sheet 2)

DIGITAL DISPLAY UNIT READOUTS—CONT: NOTE E 1.5 PROGRAM

ACU TAPE LEGEND	WEAPON	RACK/ CAR-TRIDGE	ARM/FUZE		CODE	ACU TAPE LEGEND	WEAPON	RACK/ CAR-TRIDGE	ARM/FUZE		CODE
			MECH	ELEC					MECH	ELEC	
FLARES	MK6 OR 24 PARAFLARE	AERO-7A			1	CBU-1, 2	RETARDED CBU-1 OR CBU-2				1
R36	RETARDED MK-36 MINE	AERO-7A			1	RKT-A	SPARE ROCKET				1
R50	RETARDED MK-50 MINE	AERO-7A			1	RKT-B	SPARE ROCKET				1
R52	RETARDED MK-52 MINE	AERO-7A			1	RKT-C	SPARE ROCKET				1
R56	RETARDED MK-56 MINE	AERO-7A			1	RKT-D	SPARE ROCKET				1
MINE-A	SPARE MINE				1	275H151	2.75 FFAR, MK-151 HEAD	AERO-7A, TER			27515
MINE-B	SPARE MINE				1	275	2.75 FFAR, MK 5 HEAD	AERO-7A, TER			27500
MINE-C	SPARE MINE				1	ZUNI	5-INCH ZUNI FFAR	AERO-7A, TER			05555
MK4 GUN	MK-4 GUN POD	AERO-7A			1	SHRIKE	AGM-45A SHRIKE MISSILE	AERO-5A			03902
POD-A	SPARE GUNS OR NON-WEAPON				4	MSL-A	SPARE MISSILE				1
POD-B	SPARE GUNS OR NON-WEAPON				4	MSL-B	SPARE MISSILE				1
POD-C	SPARE GUNS OR NON-WEAPON				4	SWDR	AIM-9D SIDEWINDER MISSILE	LAU-7/A			1
POD-D	SPARE GUNS OR NON-WEAPON				4	BULLPUP	AGM-12C BULLPUP MISSILE	AERO-7A			1
T300	AERO-1D DROP OR D-704 BUDDY				4	WALL I	WALLEYE MISSILE	AERO-7A			1
T450	450 GAL FUEL TANK				4	CONDOR	CONDOR MISSILE	AERO-7A			1
T-SPARE	SPARE TANK				4	STD ARM	AGM-78A STD ARM MISSILE	ELA			1

1. NO BALLISTIC DATA IS PROGRAMMED. SOLID RESELECT LIGHT INHIBITS AUTOMATIC RELEASE IF SELECTED.
2. STORED TIME DELAY ASSUMES F76/R106 CARRIAGE ON MER/TER. USE OF X4D INCREASES DELAY TIME BY .040 SEC, CAUSING LONG IMPACT.
3. F76 TREATED AS NUCLEAR WITH T-375 AT AIR OR GRD; NON-NUCLEAR WITH T-375 AT OFF OR SAFE. FOR NON-NUCLEAR, RESELECT LOGIC REQUIRES USE OF EITHER MECHANICAL ARMING OR ELECTRIC FUZING.
4. NO MANUAL OR AUTOMATIC RELEASE PERMITTED. JETTISON ONLY.

6 BALLISTIC RANGE:

STRAIGHT PATH — CALCULATED DISTANCE TO TARGET
RETARDED LOFT — CALCULATED DISTANCE TO TARGET
FREE FALL GENERAL AND LOFT — COMPUTED BALLISTIC RANGE
ROCKET — WEAPON TRAVEL AT RELEASE (LIMITED TO 13,500 FEET)

7 NON-ATTACK ON CALL READOUTS:

KEY SELECTED (LOWEST ROW)	WIND SPEED/LAT WINDOW	G/S /LONG WINDOW	WIND DIR/ALT WINDOW
TGT 1-4, UNSTAB, OR OP TGT (NO KEY DEPRESSED)	LAT. CURSOR INTERSECTION (DEGREES, MINUTES)	LONG. CURSOR INTERSECTION (DEGREES, MINUTES)	COMPUTED TARGET ALTITUDE (FEET)
GRD TRK	KEYBOARD BLAST CLEARANCE ALTITUDE ABOVE TGT (FEET)	KEYBOARD GROUND TRACK HEADING (DEGREES)	↓
LDG	0 0 0 0 0	KEYBOARD RUNWAY TRUE HEADING (DEGREES)	↓
NAV XPT	KEYBOARD CHECKPOINT LAT. (DEGREES, MINUTES)	KEYBOARD CHECKPOINT LONG. (DEGREES, MINUTES)	↓
OAP1, TGT 1-4 OR OAP2, TGT 1-3	KEYBOARD TGT — OAP RANGE (FEET)	KEYBOARD TGT — OAP TRUE BEARING (DEGREES)	↓
OAP2, TGT 4	KEYBOARD TGT 4 — OAP2 N/S RANGE COMPONENT (METERS)	KEYBOARD TGT 4 — OAP2 E/W RANGE COMPONENT (METERS)	↓

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Figure 8-71 (Sheet 3)

DIGITAL DISPLAY UNIT READOUTS

E100 PROGRAM

FLIGHT DATA WINDOWS (UPPER DDU)

DATA SELECT POSITION									
	A			B			C		
WINDOW	QUANTITY	FACTOR **	UNITS	QUANTITY	FACTOR	UNITS	QUANTITY	FACTOR	UNITS
NAVIGATION									
1 [X X X]	TRUE AIRSPEED	1	KNOTS	TEMP CORR PRESSURE ALTITUDE	100	FEET	SYSTEM VERTICAL VELOCITY	1	FEET/ SEC
2 [X X X]	VERTICAL SEPARATION	10	FEET	DOPPLER VELOCITY	1	KNOTS	GROUND TRACK HEADING	1	DEGREES
3 [* X X]	SLEW DIRECTION: VELOCITY CORR	1	DEGREES	DOPPLER DRIFT ANGLE	1	DEGREES	DEPRESSION ANGLE TO TARGET	1	DEGREES
4 [* X X]	VELOCITY CORR. OR MOVING TGT VELOCITY	1	KNOTS	AMBIENT AIR TEMP	1	DEGREES (F)	INPUT DEPRESSION ANGLE	0.1	DEGREES
5 [* X X]	SAC (1)	1	—	IMU ROLL ANGLE	1	DEGREES	RELEASE ADVANCE (2)	100	FEET
ATTACK									
1 [X X X]	TRUE AIRSPEED	1	KNOTS	TOTAL AIRCRAFT VELOCITY	1	KNOTS	TRACKING CODE (3)	1	—
2 [X X X]	VERTICAL SEPARATION	10	FEET	IMU TRUE HEADING	1	DEGREES	GROUND TRACK HEADING	1	DEGREES
3 [* X X]	SLEW DIR: VELOCITY CORR	1	FEET/ SEC	ELEVATION ANGLE (PITCH)	1	DEGREES	RELEASE ANGLE (4)	1	DEGREES
4 [* X X]	VELOCITY CORR. OR MOVING TGT VELOCITY	1	KNOTS	TIME OF FALL	0.1	SEC	SEARCH RADAR DEPRESSION ANGLE INPUT	1	DEGREES
5 [* X X]	SAC (1)	1	—	STEERING ERROR	1	MILS	RELEASE ADVANCE (2)	100	FEET
ALIGNMENT									
1 [X X X]	ELAPSED ALIGN TIME	0.1	MINUTES	000	—	—	PROGRAM IDENTIFIER	1	—
2 [X X X]	TRUE HEADING	1	DEGREES	AIRCRAFT PITCH	1	DEGREES	LONGITUDINAL LEVER ARM	1	FEET
3 [* X X]	WANDER ANGLE CONVERGENCE	1	2/3 ARC SEC/ SECOND	CARRIER PITCH	1	DEGREES	ATHWART-SHIP LEVER ARM	1	FEET
4 [* X X]	000	—	—	AIRCRAFT ROLL	1	DEGREES	SINS N VELOCITY	1	FEET/ SECOND
5 [* X X]	SAC (1)	1	—	CARRIER ROLL	1	DEGREES	SINS E VELOCITY	1	FEET/ SECOND

X = DIGITS AVAILABLE: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
* = DIGITS AVAILABLE 0, 1, 2, 3, 4, 5, 6, 7, —, BLANK
** = TRUE VALUE = QUANTITY X FACTOR

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Figure 8-71 (Sheet 4)

E-100 PROGRAM

DIGITAL DISPLAY UNIT READOUTS—CONT.

NAVIGATION DATA WINDOWS (LOWER DDU)

NAVIGATION DATA SWITCH—DATA

WINDOW	ATTACK	NAVIGATION	ALIGNMENT
WIND SPEED/LAT [*XXXX]	WIND VELOCITY (KNOTS)	WIND VELOCITY (KNOTS)	CARRIER SPEED (KNOTS)
G/S/LONG [*XXXXX]	GROUND TRACK VELOCITY (KNOTS)	GROUND TRACK VELOCITY (KNOTS)	SPOTTING ANGLE—CARRIER, OR TRUE HEADING—GROUND (DEGREES X 0.001)
WIND DIR/ALT [*XXXXX]	WIND DIRECTION (DEGREES)	WIND DIRECTION (DEGREES)	CARRIER HEADING (DEGREES)

NAVIGATION DATA SWITCH—PRES POS

WINDOW	ATTACK	NAVIGATION	ALIGNMENT
WIND SPEED/LAT [*XXXX]	WEAPON CODE 5	PRESENT POSITION LATITUDE (DEGREES, MINUTES)	PRESENT POSITION LATITUDE (DEGREES, MINUTES)
G/S/LONG [*XXXXX]	VERTICAL SEPARATION (FEET)	PRESENT POSITION LONGITUDE (DEGREES, MINUTES)	PRESENT POSITION LONGITUDE (DEGREES, MINUTES)
WIND DIR/ALT [*XXXXX]	SYSTEM ALTITUDE (FEET)	SYSTEM ALTITUDE—MSL (FEET)	SYSTEM ALTITUDE—MSL (FEET)

NAVIGATION DATA SWITCH—ON CALL

WINDOW	ATTACK	NAVIGATION	ALIGNMENT
WIND SPEED/LAT [*XXXX]	COMPUTED BALLISTIC RANGE (FEET)** 6	BASED ON STEERING KEY SELECTION 7	LAT. CURSOR INTERSECTION (DEGREES, MINUTES)
G/S/LONG [*XXXXX]	COMPUTED GROUND RANGE TO TARGET (FEET)	BASED ON STEERING KEY SELECTION 7	LONG. CURSOR INTERSECTION (DEGREES, MINUTES)
WIND [*XXXXX]	COMPUTED TARGET ALTITUDE (FEET)	BASED ON STEERING KEY SELECTION 7	COMPUTED TARGET ALTITUDE (FEET)

* = DIGITS AVAILABLE: WIND SPEED/LAT, G/S/LONG — N, S, E, W, 0, 1, 2, 3, 4, 5
WIND DIR/ALT — 0, 1, 2, 3, 4, 5, 6, 7, 8, —

** = DISPLAYED IN FEET X 10 WHEN RANGE EXCEEDS 60,000 FEET

X = DIGITS AVAILABLE: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

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Figure 8-71 (Sheet 5)

E-100 PROGRAM

DIGITAL DISPLAY UNIT READOUTS—CONT.

NOTE

1 SYSTEM ADVISORY CODES (SAC'S)

CODE	CAUSE
001	INITIAL ENTRANCE TO OPERATIONAL PROGRAMS SINCE APPLICATION OR INTERRUPTION OF POWER
002	PRESENT POSITION LATITUDE AND LONGITUDE NOT ENTERED SINCE APPLICATION OF POWER OR COMPLETION OF ORT
003	PRESENT POSITION LATITUDE NOT ENTERED SINCE APPLICATION OF POWER OR COMPLETION OF ORT
004	PRESENT POSITION LONGITUDE NOT ENTERED SINCE APPLICATION OF POWER OR COMPLETION OF ORT
008	STORAGE PROTECTION ERROR OCCURRENCE
009	SELECTED PROGRAM ITERATIVE PATH NOT COMPLETED
010	AIRSPEED/GROUNDSPEED DIFFERENCE EXCEEDED ALLOWABLE TOLERANCE
011	PRESSURE DERIVED/SYSTEM DERIVED ALTITUDE DIFFERENCE EXCEEDED ALLOWABLE TOLERANCE
013	STEERING SWITCH CYCLES WHILE MEMORY POINT SELECTED
029	CAINS PSU FAULT INDICATED
030-039	INERTIAL MEASUREMENT UNIT (IMU)
030	NOT READY
031	FAIL FLAG STILL SET 2 MINUTES AFTER ALIGNMENT START
032	CLOCK FAILURE
036	CALIBRATION DATA NOT VALIDATED
037	VERTICAL AND HORIZONTAL ACCELEROMETERS BAD
038	VERTICAL ACCELEROMETER BAD
039	HORIZONTAL ACCELEROMETER BAD
040	ALL REQUIRED KEYBOARD INPUTS FOR ALIGNMENT NOT ENTERED
041	DATA LINK TRANSMISSION NOT PROPER
051	TRAM TRACKING SUSPENDED UNTIL ROLL ANGLE IS CHANGED
071-073	AIR DATA COMPUTER (ADC) BIT FAILURE
071	MACH AND STATIC PRESSURE BAD
072	STATIC PRESSURE BAD
073	MACH BAD
074	NORMAL ACCELEROMETER BAD
110-116	SYSTEM OPERATING DIFFICULTIES
110	COMMIT TRIGGER NOT DEPRESSED 3 SECONDS PRIOR TO WEAPON RELEASE
111	EXCESSIVE STEERING ERROR AT POINT OF WEAPON RELEASE
112	EXCESSIVE BALLISTIC RANGE ERROR
113	EXCESSIVE RATE OF CHANGE OF ATTACK RELEASE ANGLE
114	EXCESSIVE SYSTEM TRANSIENT OCCURRENCE NEAR WEAPON RELEASE POINT
115	WEAPON RELEASE STOPPED BECAUSE OF EXCESSIVE AIRCRAFT ROLL
116	WEAPON RELEASE STOPPED BECAUSE OF EXCESSIVE AIRCRAFT PITCH
151	SEARCH RADAR SERIAL INPUTS IMPROPER
200-499	CONDOR ARA FAILURES
2XX	FAILURE IN POD COMPUTER ASSEMBLY, SSU
3XX	FAILURE IN POD DATA LINK ELECTRONICS UNIT, AFT ANTENNA, FORWARD ANTENNA
4XX	FAILURE IN MISSILE

REPEAT TEST ON ALL FAILURES EXCEPT 208 (CONDOR COMPUTER OVER-TEMPERATURE)

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Figure 8-71 (Sheet 6)

E-100 PROGRAM

DIGITAL DISPLAY UNIT READOUTS—CONT.

NOTE

2. RELEASE ADVANCE: INCLUDES ONE-HALF STICK LENGTH FOR TRAIN RELEASES AND/OR RELEASE ADVANCE
3. TRACKING CODES
   1ST DIGIT (MODE)
   1 VISUAL DESIGNATION
   0 NORMAL TRACKING
   2ND DIGIT (SOURCE OF RANGE DATA)
   5 FLIR/LASER
   4 FLIR
   3 AZ-RANGE
   2 LASER MEMORY
   1 AZ-RANGE MEMORY
   0 CURSOR INTERSECTION
   3RD DIGIT (SOURCE OF ALTITUDE DATA)
   5 LASER
   4 FLIR
   3 ELEV TRACKING
   2 LASER MEMORY
   1 ELEV TRACKING MEMORY
   0 KEY BOARD
4. RELEASE ANGLES:
   FREE FALL LOFT—RELEASE ANGLE IN DEGREES
   FREE FALL STRAIGHT PATH—AIRCRAFT VELOCITY VECTOR IN DEGREES
   RETARD BOMBS—ANGLE TO GO TO RELEASE ROCKETS—LAUNCH ANGLE IN DEGREES
5. WEAPON CODES:

ACU TAPE LEGEND	WEAPON	RACK/ CAR-TRIDGE	ARM/FUZE MECH	ARM/FUZE ELEC	CODE	ACU TAPE LEGEND	WEAPON	RACK/ CAR-TRIDGE	ARM/FUZE MECH	ARM/FUZE ELEC	CODE
FFB-A	FREE FALL MK-82LGB	AERO-7A/MK 1, 2		X	S8201	F76	FREE FALL MK-76 PB	MER/MK2 (2)	(3)	(3)	07606
FFB-B	FREE FALL MK-83LGB	AERO-7A/MK 1, 2		X	S8301	F61	FREE FALL MK-61 NUCLEAR	AERO-7A/MK51			06101
FFB-C	FREE FALL MK-84LGB	AERO-7A/MK 1, 2		X	S8401	F57	FREE FALL MK-57 NUCLEAR	AERO-7A/MK51			05701
F117	FREE FALL M-117 DEMO	MER/MK2	X		(1)	F43	FREE FALL MK-43 NUCLEAR	AERO-7A/MK1, 2			04301
F116	FREE FALL MK-116 WETEYE	MER/MK2			11606	F28	FREE FALL MK-28 NUCLEAR	AERO-7A/MK1, 2			02801
F94	FREE FALL MK-94 CHEMICAL	MER/MK2			09406	R43	RETARDED MK-43 NUCLEAR	AERO-7A/MK1, 2			04351
F84A	FREE FALL MK-84 GP	AERO-7A/MK1, 2			08401	R57	RETARDED MK-57 NUCLEAR	AERO-7A/MK51			05751
F83A-E	FREE FALL MK-83 GP	AERO-7A/MK1, 2		X	(1)	R61	RETARDED MK-61 NUCLEAR	AERO-7A/MK51			06151
F83T-E	FREE FALL MK-83 GP	TER/MK2		X	(1)	RET-A	SPARE RETARDED BOMB				(1)
F83A-M	FREE FALL MK-83 GP	AERO-7A/MK1, 2		X	(1)	R40	RETARDED MK-40 DESTRUCTOR	MER/MK2			04052
F83T-M	FREE FALL MK-83 GP	TER/MK2	X		08303	R81	RETARDED MK-81 SNAKEYE	MER/MK2			08156
F82-E	FREE FALL MK-82 GP	MER/MK2		X	(1)	R82	RETARDED MK-82 SNAKEYE	MER/MK2			08256
F82-M	FREE FALL MK-82 GP	MER/MK2	X		08206	R106	RETARDED MK-106 PB	MER/MK2 (2)			10656
F82SN	FREE FALL MK-82 SNAKEYE	MER/MK2	X		08216	R20	RETARDED MK-20 ROCKEYE	MER/MK2			02056
F81SN	FREE FALL MK-81 SNAKEYE	MER/MK2	X		08106	CBU-24	RETARDED CBU-24 CLUSTER	MER/MK2			32053
F77	FREE FALL MK-77 FIRE	MER/MK2			07702	R-CL-A	SPARE RETARDED CLUSTER				(1)

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Figure 8-71 (Sheet 7)

DIGITAL DISPLAY UNIT READOUTS—CONT. NOTES

E-100 PROGRAM

ACU TAPE LEGEND	WEAPON	RACK/ CARTRIDGE	ARM/FUZE MECH	ARM/FUZE ELEC	CODE	ACU TAPE LEGEND	WEAPON	RACK/ CARTRIDGE	ARM/FUZE MECH	ARM/FUZE ELEC	CODE
FLARES	MK6 OR 24 PARAFLARE	AERO-7A			5	CBU-1, 2	RETARDED CBU-1 OR CBU-2				1
R36	RETARDED MK-36 MINE	AERO-7A			1	RKT-A	SPARE ROCKET				1
R50	RETARDED MK-50 MINE	AERO-7A			1	RKT-B	SPARE ROCKET				1
R52	RETARDED MK-52 MINE	AERO-7A			W5251	RKT-C	SPARE ROCKET				1
R56	RETARDED MK-56 MINE	AERO-7A			W5651	RKT-D	SPARE ROCKET				1
MINE-A	RETARDED MK-55 MINE	AERO-7A			W5551	275H151	2.75 FFAR, MK-151 HEAD	AERO-7A, TER			27515
MINE-B	SPARE MINE				1	275	2.75 FFAR, MK 5 HEAD	AERO-7A, TER			27500
MINE-C	SPARE MINE				1	ZUNI	5-INCH ZUNI FFAR	AERO-7A, TER			05555
MK4 GUN	MK-4 GUN POD	AERO-7A			1	SHRIKE	AGM-45A SHRIKE MISSILE	AERO-5A			03902
POD-A	SPARE GUNS OR NON-WEAPON				4	MSL-A	SPARE MISSILE				1
POD-B	SPARE GUNS OR NON-WEAPON				4	MSL-B	SPARE MISSILE				1
POD-C	SPARE GUNS OR NON-WEAPON				4	SWDR	AIM-9D SIDEWINDER MISSILE	LAU-7/A			1
POD-D	SPARE GUNS OR NON-WEAPON				4	BULLPUP	AGM-12C BULLPUP MISSILLE	AERO-7A			1
T300	AERO-1D DROP OR D-704 BUDDY				4	WALL I	WALLEYE MISSILLE	AERO-7A			1
T450	450 GAL FUEL TANK				4	CONDOR	CONDOR MISSILE	AERO-7A			1
T-SPARE	SPARE TANK				4	STD ARM	AGM-78A STD ARM MISSILE	ELA			1

1. NO BALLISTIC DATA IS PROGRAMED. SOLID RESELECT LIGHT INHIBITS AUTOMATIC RELEASE IF SELECTED.
2. STORED TIME DELAY ASSUMES F76/R106 CARRIAGE ON MER/TER. USE OF X4D INCREASES DELAY TIME BY .040 SEC, CAUSING LONG IMPACT.
3. F76 TREATED AS NUCLEAR WITH T-375 AT AIR OR GRD; NON-NUCLEAR WITH T-375 AT OFF OR SAFE. FOR NON-NUCLEAR, RESELECT LOGIC REQUIRES USE OF EITHER MECHANICAL ARMING OR ELECTRIC FUZING
4. NO MANUAL OR AUTOMATIC RELEASE PERMITTED. JETTISON ONLY.
5. R 106 COEFFICIENTS USED. SEE NAVAIR 01-85ADA-1T FOR PROPER RELEASE ADVANCE.

BALLISTIC RANGE:

STRAIGHT PATH—CALULATED DISTANCE TO TARGET
RETARDED LOFT—CALCULATED DISTANCE TO TARGET
FREE FALL GENERAL AND LOFT—COMPUTED BALLISTIC RANGE
ROCKET—WEAPON TRAVEL AT RELEASE (LIMITED TO 13,500 FEET)

7 **ON CALL READOUTS—NAVIGATION:**

KEY SELECTED (LOWEST ROW)	WIND SPEED/LAT WINDOW	G/S. LONG WINDOW	WIND DIR./ALT WINDOW
TGT 1, 2, UNSTAB, OR OP TGT (NO KEY DEPRESSED)	CURSOR INTERSECTION LATITUDE (DEGREES, MINUTES)	CURSOR INTERESCTION LONGITUDE (DEGREES, MINUTES)	COMPUTED TARGET ALTITUDE (FEET)
GRD TRK	KEYBOARD BLAST CLEARANCE ALTITUDE ABOVE TARGET (FEET)	KEYBOARD GROUND TRACK HEADING (DEGREES)	
LDG	00000	KEYBOARD RUNWAY TRUE HEADING (DEGREES)	
NAV XPT	KEYBOARD CHECKPOINT LATITUDE (DEGREES, MINUTES)	KEYBOARD CHECKPOINT LONGITUDE (DEGREES, MINUTES)	
OAP1, TGT 1-3 OR OAP2, TGT 1-3	KEYBOARD TARGET—OAP RANGE (FEET)	KEYBOARD TARGET—OAP TRUE BEARING (DEGREES)	
OAP1, TGT 4	KEYBOARD TGT 4 OAP1 RANGE (METERS)	KEYBOARD TGT 4 OAP1 TRUE BEARING (DEGREES)	
OAP 2, TGT 4	KEYBOARD TGT 4—OAP2 N/S RANGE COMPONENT (METERS)	KEYBOARD TGT 4—OAP2 E/W RANGE COMPONENT (METERS)	
UPPER SPARE AND TGT 1-4	DATA LINK INPUT WAYPOINT 1-4 LATITUDE (DEGREES, MINUTES)	DATA LINK INPUT WAYPOINT 1-4 LONGITUDE (DEGREES, MINUTES)	
UPPER SPARE AND NAV XPT	DATA LINK INPUT WAYPOINT 5 LATITUDE (DEGREES, MINUTES)	DATA LINK INPUT WAYPOINT 5-8 LONGITUDE (DEGREES, MINUTES	
UPPER AND LOWER SPARES AND TGT 1-4	DATA LINK INPUT WAYPOINT 6-9 LATITUDE (DEGREES, MINUTES)	DATA LINK INPUT WAYPOINT 6-9 LATITUDE (DEGREES, MINUTES)	
UPPER AND LOWER SPARES AND NAV XPT	DATA LINK INPUT WAYPOINT 10 LATITUDE (DEGREES, MINUTES)	DATA LINK INPUT WAYPOINT 10 LATITUDE (DEGREES, MINUTES)	

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Figure 8-71 (Sheet 8)

C5

When release advance (range offset) and/or train bombing is being used, the total ground distance from first impact to target is displayed to the lowest 100 feet. Values less than 100 feet read zero. A negative readout indicates impact beyond the target, a positive readout indicates impact short of the target. Zeroes are displayed when release advance is not in use.

Flight Data Navigation Readouts E100 Program

A1

True airspeed is derived from air data computer mach number corrected for angle of attack and temperature and is displayed in knots.

A2

Vertical separation is sensor-derived aircraft altitude relative to the target and is displayed in feet/10.

A3

Slew direction is true direction in degrees of slew stick input during velocity correct or moving target track.

A4

Velocity-correction or moving target velocity magnitude is displayed in knots.

A5

The highest priority system advisory code is displayed. Depressing the SAC key erases the displayed SAC, and permits the next priority SAC to be displayed if the cause of the first SAC has been corrected.

B1

Temperature-corrected pressure altitude is displayed in feet/100.

B2

Groundspeed from the Doppler is displayed in knots.

B3

Drift angle from the Doppler is displayed in degrees.

B4

Ambient air temperature from the temperature probe or system computation is displayed in degrees F. For a positive value, no sign is displayed; for a negative value, a minus sign and two digits are displayed.

B5

Aircraft roll angle is displayed in degrees. A positive readout indicates right wing down; a negative readout indicates left wing down.

C1

Vertical velocity is the system-derived aircraft vertical velocity from the baro-inertial vertical loop and absolute value (ignoring sign) is displayed in feet per second.

C2

Ground track heading is the computer-calculated direction of the aircraft ground track measured clockwise from true north and displayed in degrees.

C3

System depression angle to the target is displayed in degrees. A negative value indicates that the target is lower than the aircraft.

C4

The absolute value (ignoring the sign) of search radar depression angle input is displayed in tenths of a degree. During memory tracking, the last useful angle input remains displayed.

C5

This window displays zeros when not in attack.

Flight Data Attack Readouts E100 Program

A1

This readout is the same as for navigation

A2

This readout is the same as for navigation

A3

This readout is the same as for navigation

A4

This readout is the same as for navigation

A5

This readout is the same as for navigation

B1

System-defined total aircraft velocity relative to the earth is displayed in knots.

B2

Aircraft true heading from the IMU is displayed in degrees.

B3

The system value of corrected aircraft elevation angle measured from the horizontal to the ADL is displayed in degrees. The readout is positive for ADL above the horizontal and negative for ADL below the horizontal.

B4

System-calculated weapon ballistic time of fall is displayed in seconds times 0.1.

B5

Computed azimuth steering error to destination. A positive readout is an error to the left, a negative readout is an error to the right.

C1

This readout displays a code identifying the source of target tracking data. See figure 8-71.

C2

This readout is the same as for navigation.

C3

Weapon release angle (figure 8-71) is displayed in degrees.

C4

Search radar depression angle input measured from the horizontal to the target line of sight is displayed in degrees. A negative readout indicates that the target is lower than the aircraft.

C5

When release advance (range offset) and/or train bombing is being used, the total ground distance from first impact to target is displayed to the lowest 100 feet. Values less than 100 feet read zero. A negative readout indicates impact beyond the target, a positive readout indicates impact short of the target. Zeroes are displayed when release advance is not in use.

Flight Data Alignment Readouts E100 Program

A1

Elapsed time since start of alignment is displayed. The readout when multiplied by a factor of 0.1 provides time in minutes and tenths.

A2

True heading reference for alignment is displayed in degrees.

A3

~~This readout provides by displaying the rate at which wander angle (IMU heading) is changing in units of 2/3 arc-second per second.~~

A4

Zeros are displayed during alignment.

A5

This readout is the same as for navigation.

B1

Zeros are displayed during alignment.

B2

Aircraft pitch angle from the IMU is displayed in degrees.

B3

Carrier pitch angle from the SINS is displayed in degrees. Zeros are displayed for ground alignment.

B4

Aircraft roll angle from the IMU is displayed in degrees. A positive readout indicates right wing down; a negative readout indicates left wing down.

B5

Carrier roll angle from the SINS is displayed in degrees. Zeros are displayed for ground alignment.

C1

This readout displays the program identifier number.

C2

The longitudinal lever arm, which is the distance from the SINS to the aircraft along the ship's longitudinal axis, is displayed in feet. Zeros are displayed for ground alignment.

C3

The athwartship lever arm, which is the distance from the SINS to the aircraft along the ship's lateral axis, is displayed in feet. Zeros are displayed for ground alignment.

C4

The north-south component of carrier speed from the SINS is displayed in feet per second. Zeros are displayed for ground alignment.

C5

The east-west component of carrier speed from the SINS is displayed in feet per second. Zeros are displayed for ground alignment.

Navigation Data Readouts

Figure 8-71 presents the readouts available in the three navigation data windows in the attack, non-attack, and IMU alignment condition for the DATA, PRES POS, and ON CALL positions of the navigation data switch.

Data Freeze at Weapon Release

Six seconds after weapon release, all readouts for all positions of the DATA SELECT switch and the navigation data switch stop updating and the values at the time of release are displayed. The displayed values will change as the position of these switches is changed but they will not update until an ACTION key is depressed.

COMPUTER CONTROL UNIT CONTROLS

The computer control unit (CCU) (figure 8-69) contains the controls for manual entry of data into the computer memory unit steering selection, and replacement of invalid aircraft data. The controls consist of a mode selector switch, a keyboard and a temporary storage window. The keyboard is composed of 16 ADDRESS keys and a RELEASE key, 14 QUANTITY keys, and 7 ACTION keys.

COMPT MODE Switch

The computer mode (COMPT MODE) switch is a three-position lever-lock toggle switch marked ENTER, STEER, and TEST. With the COMPUTER switch at ON, the COMPT MODE switch is used to select the function of the keyboard or to select the ORT program. When the switch is at ENTER, the keyboard is used for the manual entry of data into the computer memory. In the ENTER mode, the procedure for manual entry of data is to select an address, enter the appropriate data into the TEMP STORE indicator in right-justified one-letter, six-digit format using the appropriate QUANTITY keys, and then depress the appropriate ACTION key.

When the switch is at STEER, the ADDRESS keys are used to select the desired computer steering.

Selecting TEST initializes the ORT program.

Note

> Program logic requires that the computer be placed in the ORT program on turn-on on the ground. In aircraft with the E1.5 program, this must be done by selecting TEST, but with the E100 program, a portion of the ORT will be run even if the computer is turned on with STEER selected.

ADDRESS Keys

The 16 ADDRESS keys are arranged in 4 rows of 4 keys. In the third and fourth rows, the fourth key is an unmarked spare reserved for future use. In aircraft with the E100 program, the unmarked keys are used in conjunction of the TGT and NAV XPT keys to select one of 10 data link waypoints for steering. Each row of keys has a mechanical interlock to prevent depressing more than one key in that row at a time. The computer sequences through the ADDRESS keys from bottom row to top row.

When the COMPT MODE switch is at ENTER, the ADDRESS keys are used to identify to the computer the address at which manual entries of data by means of the QUANTITY and ACTION keys are to be stored.

When the COMPT MODE switch is at STEER, the ADDRESS keys are used to select the mode of steering to be provided by the computer.

TGT KEYS - The keys in the top row are marked TGT 1, TGT 2, TGT 3, and TGT 4. When the COMPT MODE switch is at ENTER, depressing one of the TGT keys permits a geographical position and altitude to be entered for that address. Latitude and longitude are entered in degrees minutes and tenths using the POS ACTION key. Altitude (MSL) is entered in feet using the ALT action key. When the COMPT MODE switch is at STEER, depressing a TGT key selects the stored geographical position to which the computer will provide steering. In aircraft with the E100 program, TGT keys are also used to select data link waypoints for steering. With the COMPT MODE switch at STEER, steering to waypoint coordinates received through the ASW-25 data link receiver is selected by depressing one of the TGT keys along with the upper or both spare keys. Depressing TGT 1, 2, 3, or 4 along with the upper spare key provides computer steering to waypoint 1, 2, 3, or 4 and along with both spare keys to waypoint ~~5, 6, 7, 8, or 9~~. 5, 7, 8, OR 9
CAN ENTER WAY POINTS MANUALLY

UNSTAB KEY - With the COMPT MODE switch at ENTER, depressing the UN STAB key permits entry of the range to which the radar cursors initially move when unstabilized steering is selected. Range is entered in miles using the DIST ACTION key. When the COMPT MODE switch is at STEER, depressing the UN STAB key alone selects unstabilized steering on the VDI, PHD and DVRI. If any TGT key is selected jointly with UNSTAB, continuous steering to that target will be displayed on the VDI and PHD while the DVRI cursors remain unstabilized. UNSTAB steering will automatically revert to opportunity target stabilized steering whenever the computer is stepped into attack.

NAV XPT KEY - When COMPT MODE switch is at ENTER, depressing the NAV XPT key permits

latitude, longitude and altitude to be entered for a navigation checkpoint. Latitude and longitude are entered in degrees, minutes, and tenths using the POS ACTION key and altitude (MSL) is entered in feet using the ALT ACTION key. With STEER selected, depressing NAV XPT alone selects the stored geographical position to which the computer will provide steering. If NAV XPT is selected jointly with a target key, and the target key was selected first, memory steering to that target will be displayed on the VDI and PHD while the DVRI cursors will be positioned at the checkpoint, thus permitting the bombardier/navigator to check or update the computer present position without disturbing any other selected steering provided to the pilot. In aircraft with the E100 program, selecting NAV XPT with the upper spare key provides steering to waypoint 5 and with both spare keys to waypoint 10. See figure 8-66. When the computer is stepped into attack, VDI and PHD steering and the DVRI cursors all will reflect the NAV XPT selection.

OAP KEYS - There are two OAP keys marked OAP 1 and OAP 2. These keys must be used in conjunction with one of the TGT keys. When the COMP MODE switch is at ENTER, the location of two offset aimpoints for each of the four target locations can be entered. With any of the TGT keys and OAP 1 depressed, or with TGT 1 through 3 and OAP 2 depressed, the true bearing from the selected target to the selected aimpoint, the range from target to aimpoint and the MSL altitude differential from target to aimpoint may be entered. Bearing is entered in degrees, minutes, and tenths using the BRG ACTION key. Range is entered in feet using the DIST ACTION key and differential altitude is entered in feet using the ALT ACTION key. With TGT 4 and OAP 2 depressed, the N/S and E/W components of target to aimpoint range and the differential MSL altitude between target and aimpoint may be entered. Range components are entered in meters using the DIST ACTION key and the differential altitude is entered in feet using the ALT ACTION key. E100 & SUB, OAP ALT ENTRIES ARE MSL

When the CMPTR MODE switch is at STEER, depressing one of OAP keys selects an offset aimpoint associated with the target identified by the depressed TGT key. The cursors and DVRI range and bearing indications are to the offset aimpoint and VDI and PHD steering is provided to the selected target.

Note

Selection of an OAP key without an associated target will result in an error code, which is displayed in the temporary storage indicator.

GRD TRK KEY - With the CMPT MODE switch at ENTER, depressing the GRD TRK key permits the true bearing of a command ground track for bombing to be entered in degrees, minutes, and tenths using the BRG ACTION key. The minimum altitude for blast clearance may be entered in feet using the ALT ACTION key. With the COMPT MODE switch at STEER, depressing GRD TRK selects ground track steering.

LDG KEY - With the COMPT MODE at ENTER depressing LDG permits the true bearing in degrees, minutes, and tenths of the intended landing runway to be entered using the BRG ACTION key and the altitude of the touchdown point to be entered using the ALT ACTION key. With STEER selected, depressing the LDG key selects the landing mode.

MAN KEY - With ENTER set on the COMPT MODE switch, depressing MAN permits entry of temperature in degrees F using the TEMP ACTION key and true airspeed in knots using the VEL ACTION key. These entries are made for use as backup values. Manual entries of sensor status may be made using the ALT ACTION key where 1 indicates sensor USED and 0 indicates sensor NOT USED. When STEER is selected, depressing MAN displays the status of aircraft sensor usage in the TEMPORARY STORAGE window. The first digit in the window is blank in aircraft with the E1.5 program. Sensor usage status is indicated by 1's or 0's in the other digits, with 1 indicating in use and 0 indicating not in use, as follows:

- Doppler drift and groundspeed (E100 program only) (Initiated to 0 automatically, subsequent settings manual)
- Normal load factor (Set automatically)
- Mach number (Set manually and/or automatically)
- Angle of attack (Set automatically)
- Temperature (Set automatically)
- Static pressure (Set manually)
- Inertial platform vertical velocity vector (Set manually)

REL ADV KEY - With the COMPT MODE switch at ENTER, depressing the REL ADV key permits entry of the release distance in feet using the DIST ACTION key. A positive value is early release; a negative value is a delayed release. When the COMPT mode switch is at STEER, depressing REL ADV introduces the stored release advance value into the weapon release solution. It is displayed in window C5 of the DDU when the REL ADV key is depressed and the MASTER ARMT switch is at ON or PRAC.

WIND KEY - When the COMPT MODE switch is at ENTER, depressing the WIND key permits entry of

wind true direction in degrees, minutes, and tenths. using the BRG ACTION key and wind velocity in knots using the VEL ACTION key. Depressing the WIND key with the COMPT MODE switch at STEER provides the computer with the manual wind entry. The wind entry will only be used in the DR option or, with mach bad, in the Doppler or Doppler inertial options, therefore the required navigation option selection should be made before entering wind.

PRES LOC KEY - Depressing PRES LOC when the COMPT MODE switch is at ENTER permits a geographical position and altitude to be entered for the present position of the aircraft. Latitude and longitude are entered in degrees, minutes, and tenths using the POS ACTION key and altitude is entered in feet using the ALT ACTION key.

OPPORTUNITY-TARGET - With the COMPT MODE switch at ENTER, when no keys are depressed, the altitude to be used with opportunity target steering may be entered in feet using the ALT ACTION key. With STEER selected and none of the upper eight keys depressed, opportunity target steering is activated.

RELEASE KEY - The RELEASE key is a momentary action key, which mechanically releases any depressed ADDRESS key.

UNMARKED Keys

In aircraft with the E100 program, the unmarked fourth keys in the third and fourth rows are used in conjunction with the TGT or NAV XPT keys when the COMPTR MODE switch is at STEER to select one of waypoints 1 to 10 (if received from the ASW-25 data link) for steering. The coordinates of the selected waypoint may be displayed in the navigation data windows by setting the navigation data switch to ON CALL.

TEMP STOR Window

The TEMP STORE window is a seven-digit indicator, which displays the values being entered with the QUANTITY keys when the COMPT MODE switch is at ENTER. When the COMPT MODE switch is at STEER and the MAN button depressed, the TEMP STORE window displays sensor usage status. When the COMPT MODE switch is at TEST, many of the ORT results are displayed in the TEMP STORE window.

CLEAR Button

The CLEAR button is a momentary action pushbutton. When the COMPT MODE switch is at ENTER, depressing the CLEAR button removes any value in the TEMP STORE window without entering it into the computer. When the COMPT MODE switch is at STEER, depressing CLEAR removes the sensor status display. When TEST is selected, depressing CLEAR steps the computer to the next test in the ORT program.

QUANTITY Keys

The 14 QUANTITY keys are momentary action pushbuttons marked N/+, S/-, 1 through 5, E, W, 6 through 9, and 0. The N/+ and S/- keys are used to indicate either hemisphere for latitude entries or sign for numerical values. Latitude entries may be north or south; release advance, temperature, and altitude entries may be positive or negative. All other numbers must be entered as positive. The E and W keys are used to indicate hemisphere for longitude entries and compass direction for TGT 4 - OAP 2 distance entries.

ACTION Keys

The seven ACTION keys are momentary action pushbuttons marked POS, ALT, DIST, BRG, VEL, and SAC. They are used when the COMPT MODE switch is at ENTER to identify to the computer the type of data being entered and to complete the data entry by blanking the TEMP STORE window. The POS key is used with entries of latitude and longitude to identify the values as position data. The ALT key is used to identify entries of altitude data. DIST is used to identify values of range such as offset distance and release advance. The BRG key identifies bearing data such as ground track and landing mode heading, offset bearing, and wind direction. VEL is used to identify entries of wind velocity and backup true airspeed. TEMP is used when entering target temperature.

The seventh key marked SAC has a special purpose. It is a momentary action pushbutton used to erase computer error light and the system advisory code being displayed in the DDU window A5.

SLEW CONTROL PANEL

The slew control panel (figure 8-69) on the aft end of the bombardier/navigator's pedestal contains the slew grip, the slew grip stow release button, and the velocity correct switch.

Slew Grip

The slew grip provides operator control of computer positioning of the radar cursors. In aircraft with the E100 program, the slew grip also has the capability of providing control over the DRS turret line of sight, FLIR and Condor seeker fields of view, and manual Condor seeker positioning. The attack and slew buttons also have Condor-associated functions.

The grip is designed for left-hand operation. By pressing down on the head of the grip, it can be stowed within the computer pedestal. To release the grip for use, the RELEASE button on the left of the slew control panel is depressed allowing the spring-loaded grip to pop up to the operating position.

In aircraft with the E1.5 program, with the cursor control switch at COMPT, one or both of the slew rate switches depressed, and the radar POWER switch at ON or STBY, moving the slew grip forward or aft moves the range cursor; moving the slew grip left or right moves the azimuth cursor. In aircraft with the E100 program, pressing the lower slew button activates radar cursor slew. The upper slew button is presently inoperative and when the DRS equipment is installed will be used to activate FLIR slew. Releasing the grip returns it to the spring-loaded neutral position.

Note

- Once an azimuth-range or TWS lock-on is established, range and azimuth slewing is inhibited.
- When in attack, slewing is inhibited after release enable occurs about 2 seconds prior to release. As soon as the computer is stepped out of attack, or, with a TRAIN release selected, after the first weapon has been released, slew is functional.
- Radar slewing is inhibited when in the boresight (visual) mode.
- Slewing interrupts elevation tracking; however, elevation tracking resumes as soon as slewing is stopped.

In aircraft with the E1.5 program, when both slew rate switches are depressed and the slew grip is displaced to its limit, maximum slew speed is achieved. In aircraft with the E100 program, radar slew rate in range is a function of slant range and slew stick displacement, and, in azimuth, of slew stick displacement.

Slew Switches

In aircraft with the E1.5 program, the slew switches are two spring-loaded pushbuttons on the forward face of the slew grip, which select the maximum slew speed available when held depressed. Depressing the lower button provides a range slew rate of 1024 feet/second and an azimuth slew rate of 1°/second. Depressing the upper button provides a range slew rate of 6,100 feet/second and an azimuth rate of 5°/second. When both buttons are depressed, the range rate is 32°/second.

In aircraft with the E100 program, the slew buttons are used to select either radar or FLIR slew. The upper slew button selects FLIR slew and is presently inoperative. Depressing and holding the lower slew button enables radar slew. In azimuth, slew rate is a function of slew stick deflection. When the slew stick is deflected to its maximum, an azimuth slew rate of 32°/second is provided. In range the slew rate is a function of slant range and slew stick deflection. The maximum slew rate of 38,400 feet/second is provided in response to maximum slew stick deflection with the cursor at a long range.

Elevation Slew Switch

The elevation slew switch is presently inoperative.

In aircraft 159895 and ON and A-6E Mod M121 and ON, this switch has the function of controlling the FLIR or Condor seeker field of view. When the equipment is installed, the full aft position selects the wide field of view and full forward the narrow field of view. An indication of field of view in use will be provided on the FLIR indicator.

Azimuth-Range Switch

In aircraft with E1.5 program, the azimuth-range switch is a two-position toggle switch on the top of the slew grip, which provides control of automatic azimuth-range tracking. When the switch is in the forward position, azimuth-range tracking by the search radar is inhibited. When the switch is aft, automatic azimuth-range tracking is enabled. In aircraft with the E100 program, this switch is used to stop laser transmission and is presently inoperative.

Attack Button

The attack button is an alternate-action momentary pushbutton switch on top of the slew grip used to step the computer into or out of attack. When the computer is not in attack, depressing the attack button steps the computer into attack (provided the MASTER ARMT switch is at ON or PRAC and the RESELECT or computer error lights are out) and depressing it a second time returns the computer to the nonattack condition.

Velocity Correct Switch

The velocity-correct switch is a three-position rotary switch on the slew control panel marked OFF, ERASE, OFF SAVE, and MEMORY POINT and is used to select the various velocity-correct options.

Selecting MEMORY POINT enables velocity-correct. When a TWS or azimuth-range lock-on has been established, selecting MEMORY POINT provides automatic velocity-correct (AVC). If neither of these lock-ons exist, selecting MEMORY POINT permits a manual velocity-correct (MVC) to be accomplished by use of the slew grip.

Selecting OFF SAVE retains the velocity-correction for use by the computer. When the switch is held at the momentary OFF ERASE position, the existing velocity-correction is erased from the computer memory.

PILOT'S COMPUTER CONTROLS

The pilot's computer controls, consisting of the attack commit trigger on the stick grip (figure 8-72) and the COMMIT button on the canopy bow, give the pilot control over automatic weapon release and permit him to step the computer into attack and to designate the target in the visual boresight attack and the Shrike attack.

Attack Commit Trigger

The attack commit trigger is a three-position spring-loaded pushbutton switch on the control stick grip, which can be actuated by the forefinger. There is a detented intermediate position between the unactuated position and the fully depressed position. The computer samples the position of the attack commit trigger during each iteration and the position of the attack commit trigger affects computer operation.

Figure 8-72

In aircraft with the E1.5 program, when the tracking MODE switch is at TRACK (normal tracking selected) and the optical sight mode switch is at AUTO, depressing the attack commit trigger to the intermediate position aligns the optical sight moving reticle with the radar cursors for a computer optical positioning (COP) check. When the attack commit trigger is depressed to the COP position, the TIME window on the PHD displays true airspeed in knots. The value existing when the trigger is initially depressed is displayed instantaneously and is updated every 8 seconds while the trigger is held. An immediate update can be obtained by releasing the trigger and then depressing it again.

In aircraft with the E100 program, when the visual mode or the Shrike mode are not selected, depressing the attack commit trigger to the intermediate position aligns the optical sight moving reticle with the radar cursors for a COP check. While the attack commit trigger is in the COP position, the PIAP TIME window reads groundspeed in knots. The value existing when the trigger is initially depressed is displayed instantaneously and is updated every 8 seconds. An immediate update is available by releasing the trigger, then reselecting COP.

When the computer is in attack and the tracking MODE switch is at BORESIGHT, (visual mode selected, holding the attack commit trigger to the intermediate position designates the position defined by the optical sight moving reticle to the computer as the target.

When a Shrike delivery has been selected, holding the attack commit trigger to the intermediate position for at least 0.8 second with the VDI steering symbol centered designates the Shrike-defined target to the computer. As soon as the computer recognizes a Shrike designate, the VDI target symbol will be positioned to indicate the display center. The attack commit trigger should be held depressed until the steering and target symbols can be superimposed.

When one of the four full system attack modes is selected and the computer is in attack, holding the attack commit trigger in the fully depressed position enables the computer to solve for and provide an automatic weapon release. The attack commit trigger must be held in the commit position for an automatic release to be provided.

Note

Failure to commit in a straight path attack, results in the computer stepping out of attack 2 seconds after the computer release point. In a general or high loft attack, the computer program provides a forced commit when the last possible commit point is near to give the pilot a visual cue if he has not yet committed, however a manual commit is still required to release stores.

When the LAB IP, LAB TGT or DELAY attack is selected, holding the attack commit trigger to the fully depressed position starts the armament control unit (ACU) time countdown and enables automatic weapon release.

When a gunnery attack is selected, fully depressing the attack commit trigger fires the guns.

Attack Button

The attack button on the pilot's stick grip is an alternate-action pushbutton, which permits the pilot to step the computer into or out of attack. When the computer is not in attack, depressing the attack button steps the computer into attack (provided the MASTER ARMT switch is at ON or PRAC and the RESELECT or computer error lights are not on) and depressing it a second time returns the computer to the nonattack condition. In aircraft with the E100 program, stepping into attack with the pilot's attack button also selects the visual mode.

COMMIT Button

A button marked COMMIT mounted on a bracket on the left side of the canopy bow is provided for the pilot's convenience. This button is a spring-loaded pushbutton switch, which when held depressed has the same effect as holding the attack commit trigger to the fully depressed commit position.

SYSTEM DISPLAYS

The system displays include the B/N's direct view radar indicator, either the pilot's horizontal display or the pilot's auxiliary indicator panel, the pilot's vertical display indicator, and the pilot's optical sight. In addition there are digital display unit and computer control unit readouts which are discussed along with the digital computer.

DIRECT VIEW RADAR INDICATOR

The bombardier/navigator's direct view radar indicator (DVRI) (figure 8-57) in the center of the bombardier/navigator's instrument panel consists of a circular 7-inch cathode ray tube centered in a rotating azimuth ring. The azimuth ring provides a true heading reference and a movable pointer or bug provides true bearing data. Advisory lights and a RANGE readout are mounted on the indicator face plate.

The 7-inch cathode ray tube presents the radar displays selected by the bombardier/navigator along with fixed range marks and the range and azimuth cursors. A hood is provided to ease daylight viewing and prevent glare in the cockpit at night.

DVRI AZIMUTH RING AND BEARING POINTER

The lighted azimuth ring consists of a servo-driven rotating compass card that indicates true heading read against a fixed reference at the top of the indicator. The heading reference is provided by the INS when the ATTITUDE REF switch is at COMP IN or COMP OUT or by the MA-1 compass heading modified by magnetic variation set on the DDU when the ATTITUDE REF switch is at MAG/VGI. The movable pointer or bug rotates within the azimuth ring to indicate drift-corrected true bearing to the cursor intersection in nonattack and to the required release path vector in attack.

DVRI LIGHT PANEL

Seven advisory lights are flush-mounted on the DVRI light panel in the lower left corner of the indicator face plate located so that they may be seen by the bombardier/navigator when under the hood. These lights may be tested by depressing the B/N MASTER TEST button.

AZ-RANGE Light

The AZ-RANGE light comes on when a valid azimuth-range lock-on as determined by computer logic has been acquired. A valid TWS lock-on is indicated by lighting of both the AZ-RANGE and the ELEVATION lights. As soon as a lock-on is lost, the appropriate light will go out.

ELEVATION Light

The ELEVATION light comes on when a valid elevation track lock-on as determined by computer logic has been acquired.

ATTACK Light

The ATTACK light comes on when the computer is stepped into the attack condition; it comes on with the ATTACK light on the DDU. If the light goes out during an attack, it indicates that a valid solution is no longer possible and the attack will have to be reinitiated. The ATTACK light has a special function during ORT which is explained in the description of ORT.

TRACK Light

The TRACK light presently has no function.

COMPUTER Light

The COMPUTER light comes on when one or more errors or valid data failures exist in the computer; it comes on with the COMPT ERROR light on the DDU. The computer cannot be stepped into attack with the COMPUTER light on.

ECM Light

The ECM light comes on when one or more of the warning indicators on the ECM panel is on.

RESELECT Light

The RESELECT light comes on when, according to computer logic, an incompatible combination of weapon selection, release mode, attack mode, and arming/fuzing exists; it comes on with the RESELECT light on the armament control unit (ACU). While the light is on, there can be no automatic weapon release, and computer logic causes the computer to step out of attack.

RANGE WINDOW

The RANGE window displays a four-digit computer-derived readout as shown in figure 8-66. When the ground range to the cursor intersection is less than 16 miles, the RANGE readout is slant range to cursor intersection in feet/10. When the ground range to the cursor intersection is greater than 16 miles, the RANGE readout is ground range to the cursor intersection in miles.

PILOT'S HORIZONTAL DISPLAY

In A-6E 158041 thru 159579 and A-6E Mod M1 thru M120 the pilot's horizontal display (PHD) (figure 8-57) permits the pilot to view the radar display selected by the bombardier/navigator. The PHD is a circular daylight viewing storage tube centered in a rotating azimuth ring. Windows above the indicator display values of time and range.

The persistence of the indicator is variable with a control on the pilot's control panel. When the radar TRANSMIT switch is at SIL, the PHD will display one left to right scan when the ONE SCAN/ERASE switch is actuated to ONE SCAN. The display will remain on the scope depending on the persistence setting. Actuating the ONE SCAN/ERASE switch to ERASE removes the stored picture from the PHD.

PHD AZIMUTH RING AND COMMAND HEADING INDICATOR

The lighted azimuth ring is a servo-driven rotating compass card that indicates true heading read against a fixed reference at the top of the indicator. The heading reference is provided by the INS when the ATTITUDE REF switch is at COMP IN or COMP OUT or by the MA-1 compass heading modified by magnetic variation set on the DDU when the ATTITUDE REF switch is at MAG/VGI.

The command heading indicator (steering bug) rotates independently around the azimuth ring. The indicator provides drift corrected steering to the selected target or cursor intersection if no target is selected.

PHD TIME AND RANGE WINDOWS

Two windows above the indicator, marked TIME and RANGE are provided. The RANGE window provides a readout of computer ground range to the target in nautical miles. When the computer is in attack, the TIME window provides a readout of estimated time in seconds to the selected target for a straight path attack and to pullup for an accelerated attack. When the computer is not in attack, the TIME readout is estimated time in minutes to the selected target. The TIME readout is to the cursor intersection if no target is selected. When a computer optical positioning (COP) check is in progress, true airspeed in knots is displayed in the PHD TIME window.

PILOT'S AUXILIARY INDICATOR PANEL (PAIP)

The PAIP (figure FO-2) contains the TIME and RANGE readout windows and the HDG SEL switch.

TIME AND RANGE WINDOWS

The RANGE window provides a readout of computer ground range to the target in nautical miles. With a Condor missile selected, and the attack commit trigger in the first (COP) detent, the window provides a readout of missile capability in nautical miles.

The TIME window provides the following readouts:

- During ground or carrier alignment, elapsed alignment time in minutes/10.
- With COP selected, groundspeed in knots.
- With COP not selected, in attack, estimated time, in seconds to target for a straight path attack or pullup point for accelerated attack; not in attack, estimated time in minutes to target or cursor intersection if no target selected.
- After weapon release, absolute value of steering error in mils.

HDG SEL SWITCH

The HDG SEL switch is a three-position toggle switch marked CMD TRUE, CMD MAG, and ADF MAG, which selects the heading displayed by UHF/ADF needle on the pilot's horizontal situation indicator (HSI). When CMD TRUE is selected, system command true heading is displayed; when CMD MAG is selected, the needle points to system command magnetic heading; and when ADF MAG is selected, the needle displays UHF/ADF indications.

VERTICAL DISPLAY INDICATOR

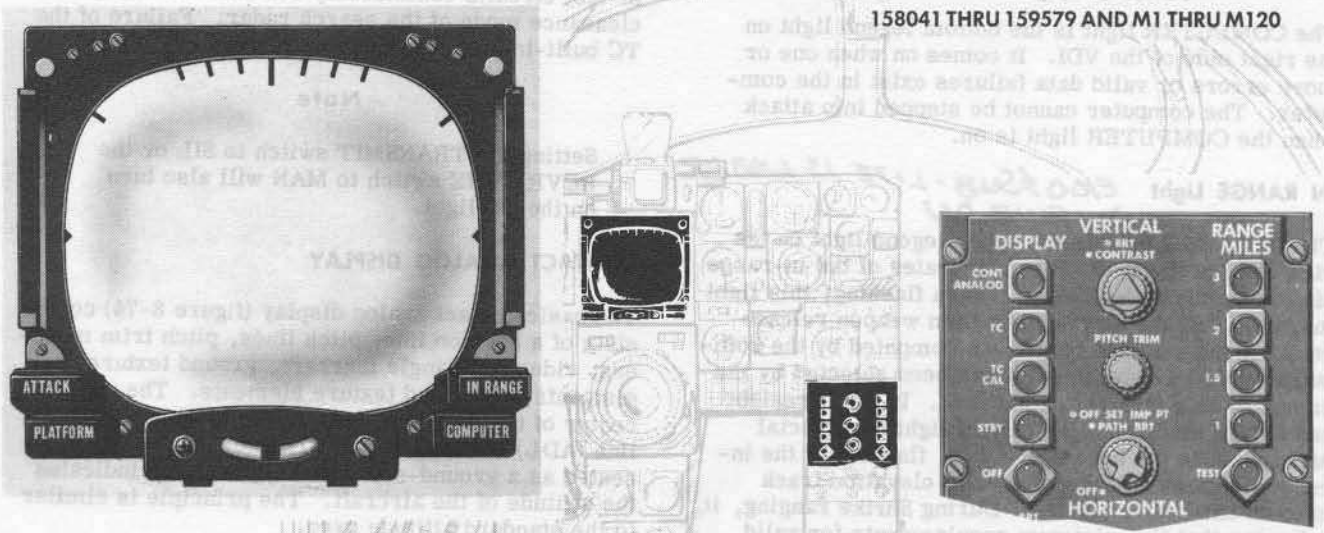
The vertical display indicator (VDI) (figure 8-73) on the pilot's instrument panel is the instrument of primary reference for flight attitude, vertical and horizontal steering commands, and terrain avoidance, giving the aircraft an all-weather capability during all phases of flight from takeoff to landing. Indications of attitude, vertical and horizontal drift, and steering commands are provided by means of symbols superimposed on a display of the world about the aircraft in analog form. This display, which includes a ground stabilized horizon line, is presented in either of two modes: contact analog and terrain clearance.

Fixed bank angle indices are marked on the glass at the top of the scope and two triangular fiducial marks at the sides of the scope mark the vertical center. Advisory lights are arranged around the viewing screen.

VERTICAL DISPLAY INDICATOR AND CONTROLS

A-6E

158041 THRU 159579 AND M1 THRU M120



159895 AND ON AND M121 AND ON

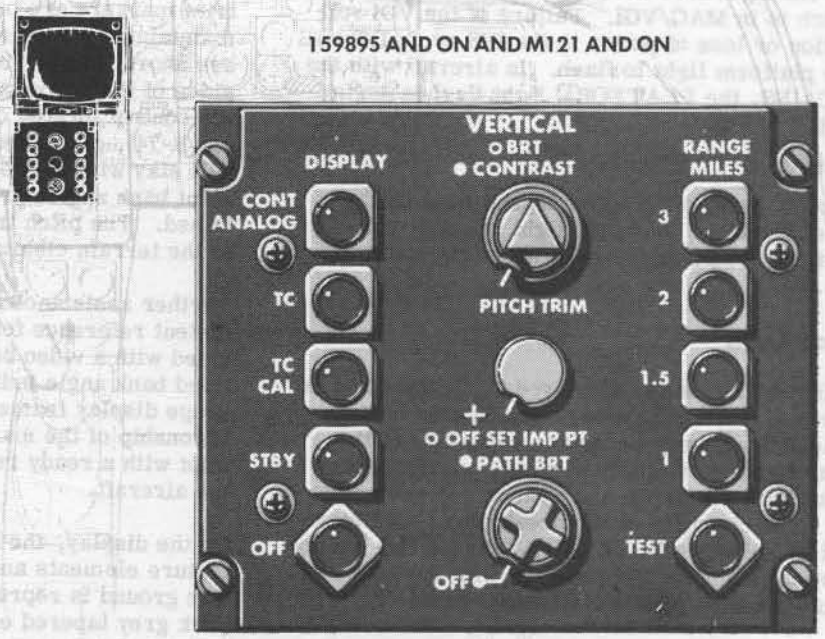


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Figure 8-73

VDI ADVISORY LIGHTS

A vertical light bar on each side of the VDI viewing screen and four rectangular legend lights provide the pilot with indications of system status and a breakaway command. The lights may be tested by depressing the LTS WARN button.

COMPUTER Light

The COMPUTER light is the bottom legend light on the right side of the VDI. It comes on when one or more errors or valid data failures exist in the computer. The computer cannot be stepped into attack when the COMPUTER light is on.

IN RANGE Light

EBO & SUB-LITE IS LASER PWR ON

The IN RANGE light is the upper legend light on the right side of the VDI. It is a repeater of the in-range display on the optical sight. When flashing, this light indicates that the aircraft is within weapon release range of the selected target, as computed by the computer or that a release point has been selected by the computer in a straight path attack. In the boresight and Shrike modes the IN RANGE light has special functions. In the boresight mode, flashing of the in-range lights indicates that a valid elevation track lock-on has been acquired. During Shrike ranging, it indicates that the minimum requirements for valid azimuth ranging have been met.

PLATFORM Light

The PLATFORM light is the lower legend light on the left side of the VDI. When the light is on it indicates that the inertial platform is not operating or has malfunctioned and is providing unreliable attitude information. The light does not go on if the ATTITUDE REF switch is in MAG/VGI. Failure of the VDI roll stabilization or loss of power to the INS or CAINS will cause the platform light to flash. In aircraft with the ASN-92 CAINS, the PLATFORM light flashes during alignment.

AND IF ID 1 TO 1 IS LAGGED.

ATTACK Light

The ATTACK light is the upper legend light on the left side of the VDI. When the light is on, it indicates that the computer is operating in the attack condition.

Breakaway Lights

The breakaway lights are displayed by flashing red on the upper half of a vertical bar on each side of the VDI. These breakaway lights are repeaters of the breakaway lights on the optical sight, providing target data terrain avoidance and weapon release pullup warning. The circuitry of the breakaway lights may be tested by selecting BREAKAWAY on the test switch on the optical sight control panel or with the LTS WARN button on the pilot's instrument panel.

Radar Altimeter Failure Light

A radar altimeter failure light shows RA in black letters on a red background in the lower half of the vertical bar on the right side of the VDI. When the output of the radar altimeter is less than 1 volt (20 feet) or greater than 26.5 volts (5000 feet) the light will be on.

Terrain Clearance Failure Light

A terrain clearance failure light shows TC in black letters on a red background on the lower half of the vertical bar on the left side of the VDI. Built-in-test circuits continuously evaluate the terrain clearance mode of the search radar. Failure of the TC built-in-test turns on the TC light.

Note

Setting the TRANSMIT switch to SIL or the RCVR TUNE switch to MAN will also turn on the TC light.

CONTACT ANALOG DISPLAY

The basic contact analog display (figure 8-74) consists of a horizon line, pitch lines, pitch trim markers, video bank angle markers, ground texture elements, and cloud texture elements. The physical center of the scope represents the armament datum line (ADL) of the aircraft. The horizon line is presented as a ground-stabilized element and indicates the attitude of the aircraft. The principle is similar to the standard attitude gyro.

To indicate pitch angles for all the flight conditions, the display is provided with a series of pitch lines which are parallel to the horizon line. These lines are relative to the horizon line and when positioned in the center of the VDI, they represent aircraft pitch angles of 30° nose up or down, 60° nose up or 90° nose up (figures 8-75, 8-78). In addition, two pitch trim markers are provided to assist the pilot in maintaining a selected pitch attitude in flight. These are short, bright markers, which emanate from the sides of the scope and can be varied in elevation by the control located on the pilot's control panel (figure 8-74), placarded PITCH TRIM. These markers will stay with the horizon line during rolls and constant bank angles provided the pitch angle is maintained. The pitch trim markers are also displayed in the terrain clearance mode.

Further assistance is provided to establish a consistent reference for bank angles. The scope is provided with a video bank angle marker and a series of fixed bank angle indices along the upper half of the scope display frame (see figure 8-74). The relationship of the marker and indices provides the pilot with a ready reference to the angle of bank of the aircraft.

On the display, the horizon line separates the ground texture elements and the cloud texture elements. The ground is represented by a grey background with dark grey tapered egg-shaped texture elements. The texture elements move from the horizon toward the bottom of the display to simulate aircraft motion. Above the horizon, the sky is lighter than the ground and has white cloud texture elements. Cloud texture elements provide additional real-world reference.

BASIC CONTACT ANALOG DISPLAYS

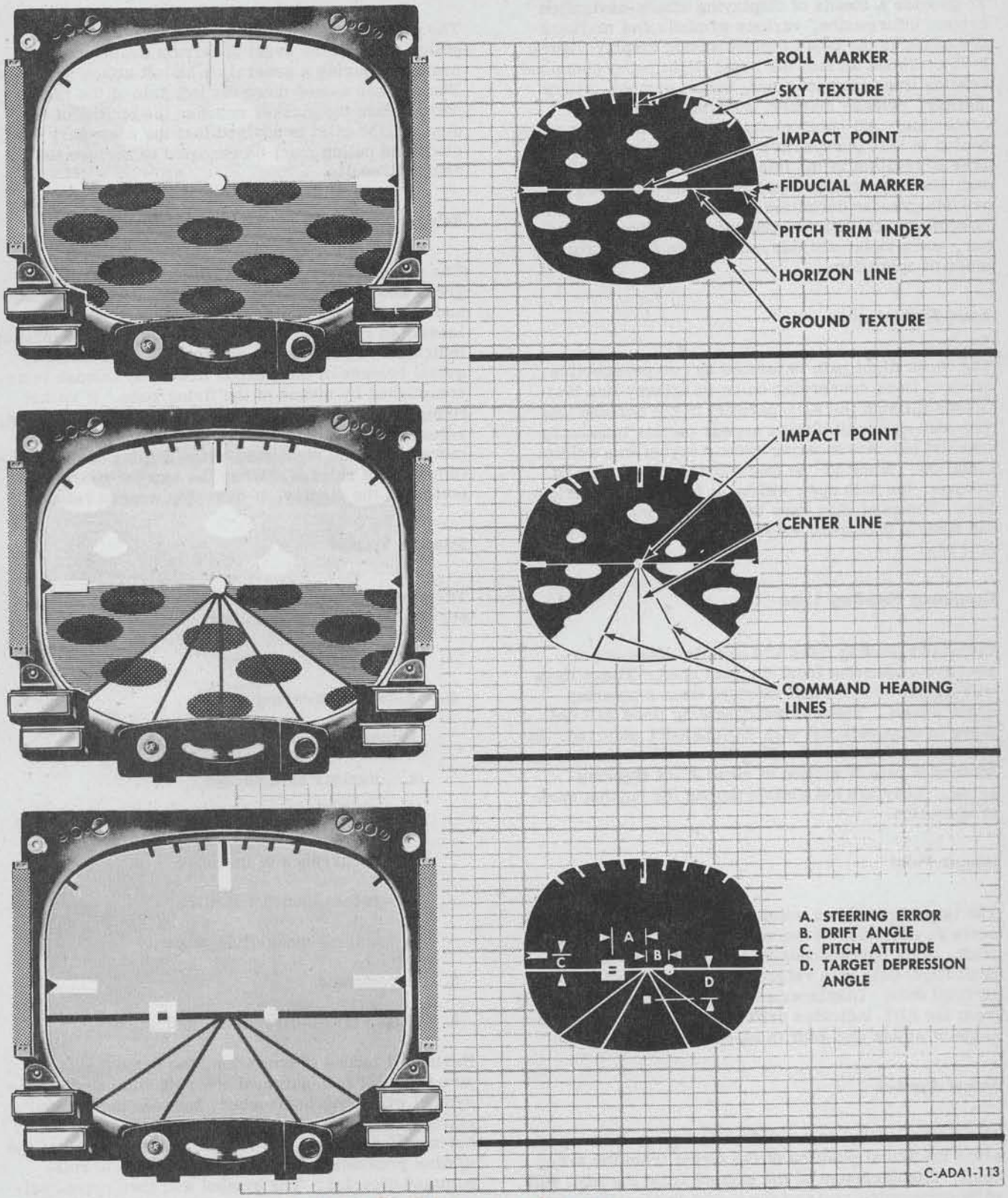

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Figure 8-74

The clouds move when the aircraft attitude is changed in pitch or heading, and remain fixed when a constant attitude is maintained.

SYMBOLS AND MARKERS

To provide a means of displaying attack-navigation system information, various symbols and markers are added to the basic contact analog display (figure 8-75). These include the basic flight path, command heading lines, impact point, target symbol, pullup marker, release marker, steering symbol, and centerline. All components of the display are represented in true perspective to afford the optimum degree of realism in the final presentation. To this end, the basic components have been shadowed to provide greater definition in the overall presentation. In addition, calibration markers, an offset impact bar, and a radar altitude curtain are display for TC mode of operation.

Basic Flight Path

The basic flight path is formed by two perspective vertical lines converging on an imaginary line that passes through the ADL parallel to the horizon line. The path apex will always appear on this imaginary line and indicate steering error, except in a pullup situation. When 27° or more of steering error is present, the path apex will be at full azimuth deflection. The pilot may vary the path brightness by using the control placarded PATH BRT on the pilot's control box.

Command Heading Lines

Command heading lines are parallel lines in perspective emanating from the path apex. These lines will appear to move left or right when a steering error exists. The command heading lines will not move in nonattack or with BORESIGHT selected. In attack, the command heading lines will attain the maximum rate of motion at about 4° of steering error. They are not visible during the landing mode of operation.

Impact Point

The impact point is a solid white circle that represents an extension of the velocity vector of the aircraft. This corresponds to a projection of the aircraft flight path with reference to all immediate aircraft data. Displacement of the impact point from the ADL indicates drift and yaw in azimuth and angle of attack and drift in elevation.

Target Symbol

The target symbol is a solid white square that represents the actual position of the target from the aircraft. Displacement of the symbol from the ADL will show depression angle of the target in elevation and true bearing in azimuth to approximately ±23°.

Note

After commit, or during Shrike designate the target symbol is positioned at the electronic center of the VDI.

Pullup Marker

The pullup marker is used to indicate a command pullup given in the event of terrain avoidance command, or during a general or hi-loft attack sequence. The marker moves down the left side of the flight path. When the marker reaches the bottom of the display, the pilot is advised that the necessary 4g command pullup must be executed to achieve the desired results.

Release Marker

The release marker is used to indicate attack progress and in-range in all attack situations. In general and hi-loft attacks, it indicates angle-to-go to release. In rocket attack however, the release marker indicates a rocket firing zone and is not related to actual release of the weapon if weapon release is accomplished by means of the firing zone. If rocket firing is accomplished by the pull-through technique, release marker operation is normal. The marker moves down the right side of the display denoting anticipation of release. When the marker reaches the bottom of the display, it indicates weapon release.

Steering Symbol

The steering symbol is a hollow white square that serves four distinct functions:

1. Roll summed steering
2. Elevation steering:

   command pitch indication for:

   a. nuclear safe escape
   b. blast clearance safety
   c. occurrence of in-range
   d. rocket launch condition
   e. landing mode glide slope
3. G-command
4. Shrike target directional indication

During all modes of operation, the symbol acts to give the pilot roll-summed steering commands. The symbol will move horizontally between the fiducial markers with the symbol base parallel to the horizon line. During hi-loft and general attacks, the symbol provides g commands in addition to roll-summed steering. The symbol will then move horizontally to indicate azimuth errors, and vertically to indicate g requirements.

VERTICAL DISPLAY SYMBOLS AND MARKERS

SYMBOL DESIGNATION	DESCRIPTION	GRAYSCALE	MAX. DIM.	MIN. DIM.	MAX. DISPLAY ANGULAR RANGE HOR.	MAX. DISPLAY ANGULAR RANGE VER.
HORIZON LINE	A GROUND STABILIZED LINE WHICH SEPARATES GROUND AND CLOUD TEXTURE	BLACK				±30°
±30° PITCHLINE	THESE LINES DENOTE EITHER +30° OR −30° ELEVATION ANGLES WHEN IN DISPLAY CENTER.	BLACK	1/8" WIDE FIXED			60°
+60° PITCH LINE	A LINE DENOTING 60° ELEVATION ANGLE WHEN IN DISPLAY CENTER	BLACK	1/4" WIDE FIXED			60°
+90° PITCH LINE	A DASHED LINE WITH SIX SEGMENTS DENOTES 90° ELEVATION ANGLE IN DISPLAY CENTER	BLACK	1/4" WIDE FIXED			60°
PITCH TRIM MARKERS	PITCH ANGLE REFERENCE TO THE HORIZON	BRIGHT	1/4" WIDE	1/8" WIDE		±30°
BANK ANGLE MARKER	SINGLE REFERENCE LINE USED TO DENOTE DEGREE OF AIRCRAFT BANK	BRIGHT	1/4" WIDE	1/8" WIDE		
GROUND TEXTURE ELEMENTS	ELLIPTICAL ELEMENTS THAT EMANATE FROM THE HORIZON AND MOVE IN ACCORDANCE WITH A QUASI RANDOM GROUND PLANE	DARK GRAY	MAJOR AXIS 1-1/2"	MAJOR AXIS 1/2"		60°
CLOUD TEXTURE ELEMENTS	ANALOG OF CUMULUS CLOUDS; STATIONARY FOR FIXED A/C ATTITUDE AND MOVE WITH ATTITUDE CHANGE	LT. GRAY	MAJOR AXIS 1-1/2"	MAJOR AXIS 1/2"		60°
BASIC FLIGHT PATH	PERSPECTIVE VERTICAL LINES CONVERGING AT THE IMAGINARY LINE WHICH PASSES THROUGH THE ADL	BLACK	30° REAL WORLD	25° REAL WORLD	±26°	60°
COMMAND HEADING LINES	THREE LINES THAT RADIATE FROM THE PATH APEX AND ROTATE WITH HEADING ERROR	DARK GRAY	1/16" WIDE FIXED			
IMPACT POINT	A SOLID WHITE CIRCLE REPRESENTING AN EXTENSION OF THE FLIGHT PATH	BRIGHT	CIRCLE 5/32" DIA.		±2 6/8°	30°
1 TARGET SYMBOL	A SOLID WHITE SQUARE THAT INDICATES THE POSITION OF THE TARGET IN THE GROUND PLANE	BRIGHT	1/4" SQUARE FIXED		±2 6/8°	±30°
2 PULL UP MARKER	A HORIZONTAL BAR THAT MOVES DOWN THE PATH LEFT SIDE IN PERSPECTIVE AND DENOTES PULL UP WHEN AT THE BOTTOM OF THE DISPLAY	BLACK	1/4" WIDE	1/16" WIDE		−30°
3 RELEASE MARKER	A HORIZONTAL BAR ENDED BY A SHORT VERTICAL BAR MOVES DOWN THE RIGHT SIDE OF THE PATH	BLACK				±30°
4 STEERING SYMBOL	A HOLLOW WHITE SQUARE THAT DENOTES ROLL SUMMED STEERING AND ELEVATION STEERING	BRIGHT	5/8" SQUARE 1/8" LINE WIDTH FIXED		±26°	±30°
CENTER LINE	A LINE WHICH IN PERSPECTIVE BISECTS THE TAKE OFF AND LANDING PATHWAY	BLACK				

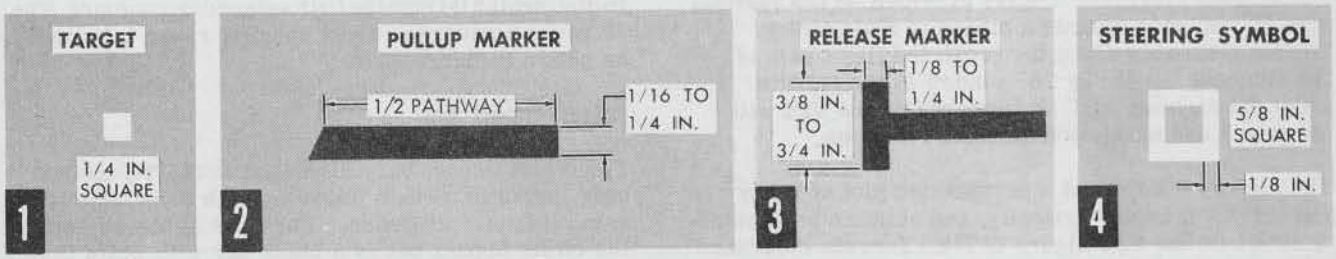

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Figure 8-75

Note

No steering commands are provided on the steering symbol when BORESIGHT is selected.

In the rocket attack mode, the symbol again provides roll-summed steering, combined with vertical steering, or angle-to-go to launch.

Note

To realize optimum system accuracy during all aircraft maneuvers, it is mandatory that the pilot fly the aircraft so that the steering symbol is centered in the VDI at all times.

In the straight path attack, roll-summed steering is combined with pitch commands. Vertical steering is provided to prevent underdiving the target.

In attack, the steering symbol commands a climb if the aircraft goes below selected blast clearance altitude.

If a nuclear weapon is selected in any attack mode, the steering symbol will command a climb if current time-of-fall is insufficient to meet the ballistics panel safe time requirement.

In the landing mode, the steering symbol will provide a pitch command to make good a 3 1/2° glide slope.

In Shrike missile attacks, the missile direction-finding signals will position the symbol.

Note

With the optical sight control switch in the AUTO position, the optical sight moving reticle displays roll-summed steering in attack and may be used as a backup for VDI and PHD steering.

Centerline

The centerline is a dark line that bisects the basic flight path. It will remain in the perspective center of the pathway, regardless of path motion. The centerline will be available only when the computer is in the landing mode of operation.

TERRAIN CLEARANCE DISPLAY

The terrain clearance display provided on the vertical display indicator affords a means of maintaining terrain clearance along the projected flight path of the aircraft. A 53° by 26° window of the terrain about the aircraft ADL is displayed on the VDI with the attack and navigation steering functions.

The display consists of a perspective plot of range and elevation angle vertically, and azimuth horizontally shown on the VDI (figure 8-75). Terrain clearance information is sensed by a dual channel horn mounted on the search radar antenna receiver. This array receives ground returns from search radar transmissions (pulse-for-pulse with the search radar).

The search radar antenna receiver derives range information from search radar timing, azimuth information from antenna position, and terrain elevation information from phase variations.

The display presentation provides 10 shaded contours starting with the lightest shade in the near range at the base of the display, and progressing to darker gray tones toward the horizon, or far ranges. These shades of gray each represent a specific range contour ahead of the aircraft. All symbols and markers are available on this display except for the ground and cloud texture elements. These are removed to avoid unnecessary scope clutter. Phase video and terrain clearance amplitude video are processed through the terrain clearance processor. The radar data converter accepts the processed video and converts the signals to a television format acceptable to the VDI.

A continuous built-in-test of the terrain clearance circuits is performed. The pilot is informed of a no-go condition in the terrain clearance mode by the lighting of the TC light.

A radar altitude curtain is displayed. This black curtain presents an analog of aircraft altitude AGL and is positioned by signals from the radar altimeter.

The curtain, like the radar altimeter, operates between the altitudes of 20 feet and 5,000 feet. The position of the curtain between the horizon and the bottom of the scope varies with aircraft altitude, attitude and the altitude scale factors, which are displayed below.

Altitude	Displacement Below Horizon Line
0 to 20 feet	0 inches
20 to 400 feet	175 feet/inch
400 to 5,000 feet	1340 feet/inch

Range Coding

Sets of four vertical code bars permanently mark the first range contour. At the option of the pilot, one of the 3rd, 4th, 5th, or 6th ranges can also be coded with vertical bars as an aid to interpretation and to provide a predetermined reference point for flying the display of terrain. The 7th contour is permanently coded with four times the normal number of bars to distinguish it from the four selectable contours. The 10 range contours present specific range information as shown in figure 8-76.

Offset Impact Bar

The offset impact bar, displayed in the TC mode only, permits terrain following with selectable terrain clearance altitudes. For ease of identification the offset impact bar is a black bar with white tips and easily distinguishable in any background (coded ranges). The offset impact bar is adjustable vertically from 1 to 4 inches below the impact point at zero angle of attack.

Calibration Markers

Whenever TC CAL mode is selected, two black horizontal calibration markers are displayed on the right side of the viewing tube, space 1.4 ± 0.25 inches apart (0° and 6°). The position and thickness of the markers are measures of the calibration of the TC display.

Radar Altitude Curtain

A black curtain indicating the radar altitude below the aircraft is superimposed on the display between 5000 feet and 20 feet AGL. The height of the curtain between the TC horizon and the bottom of the scope is dependent on the aircraft altitude, attitude, and curtain scale factor.

TC Scaling

When the VDI is in contact analog (CA), the horizon and all symbols are computed scaled to ±30°. With terrain clearance (TC) selected, the horizon and terrain are scaled in the radar data converter, while the VDI symbols are still computer-derived and scaled to ±30°. Terrain clearance video is scaled to approximately 27° (±13.5°) vertically, and 52° (±26°) horizontally.

The TC horizon is scaled to 30° in a climb (or pullup) and 15° in a dive. The change in scale occurs when the horizon is at the VDI vertical center. In most normal flight attitudes or on the ground, there should be no change in the horizon position when selecting TC from contact analog. Tracking circuits provide for correct positioning of terrain for all attitudes within the pitch (±30°) and roll (60°) limits of the antenna.

Note

When in the TC mode, if the roll or pitch limits are exceeded, the VDI display will automatically switch to contact analog when the aircraft is rolled past 52°. Due to dynamic loads on the antenna receiver, the display may switch several times before settling on contact analog. With steeper, sustained roll angles, switching may be continuous.

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TC Test

With TC selected, depressing the TEST button on the pilot's control panel causes a self-test signal to be generated in the radar data converter. This signal results in a flat earth type presentation on the VDI, permitting identification of all 10 range contours. The altitude curtain is displayed at an artificial level, thus permitting the first contour to be seen. The horizon line and the top of the 7th (permanently coded) contour coincide at the fiducial marks. If one of the selectable range contours is selected for coding, this coding is properly displayed. See figure 8-78.

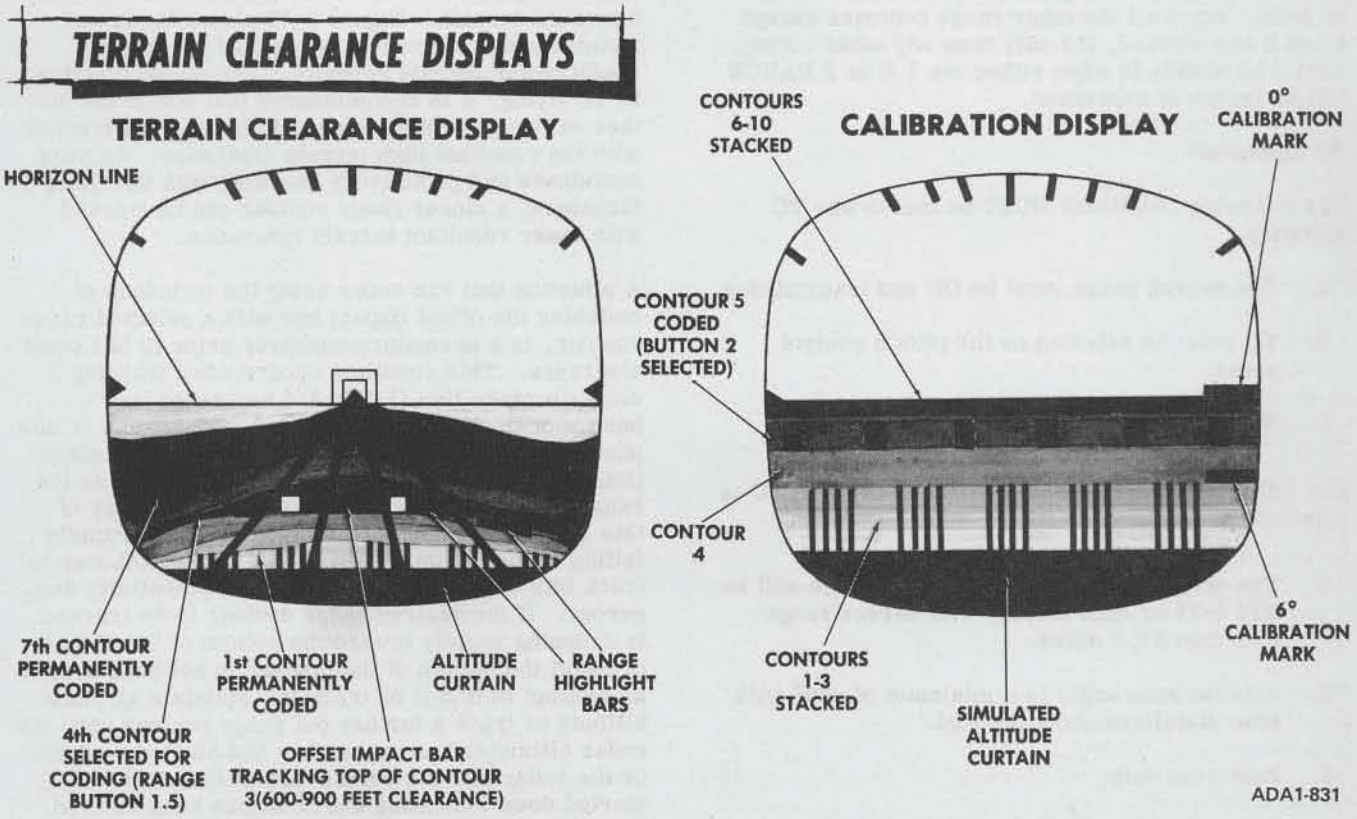

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Figure 8-76

TC Calibration

Terrain clearance calibration may be checked on the ground or in flight by depressing the TC CAL button on the pilot's control panel. When the calibration display (figure 8-76) is selected, the horizon line is positioned at the fiducial marks and the search radar and radar data converter process -6° and 0° calibration levels for display across the full azimuth window of the VDI. Range contours 1, 2, and 3 are stacked at the -6° calibrate level and range contours 6 through 10 are stacked at the 0° (horizon) level. Range contrours 4 and 5 may occur at -6° or 0° or anywhere in between.

At the right edge of the display, two black calibration markers are displayed coincident with the -6° and 0° calibrate levels. The upper marker should at least touch the horizon line at scan update. Any offset indicates an overall elevation bias error. The spacing between the two bars is a measure of the elevation scaling of the display, so they should be 1.4 ±0.25 inches apart.

The thickness of each calibration mark is a measure of how well each contour stacks at its calibration level. These marks will be at least two TV raster lines thick; however, they should not exceed 1/4 inch. If for example, the -6° marker exceeds 1/4 inch in thickness, this indicates that one or two of range contours 1 through 3 is displaced from its calibration level by more than 1°.

The altitude curtain is displayed at an artificial level permitting the first range contour with its coding to be seen. Since all the other range contours except 4 and 5 are stacked, the only time any other coding should be visible is when either the 1.5 or 2 RANGE MILES button is depressed.

TC Operation

The following conditions MUST be met to use TC properly.

1. The search radar must be ON and transmitting.
2. TC must be selected on the pilot's control panel.
3. BORESIGHT must not be selected.

The following limitations will be imposed when TC is selected.

1. The only search radar display available will be PPI 5-75 or ARE display with cursor range less than 27.5 miles.
2. Antenna scan angle to a minimum of ±30° with scan stabilized about the ADL.
3. Fast scan only.
4. Antenna pattern to FAR initially, but it may be depressed if desired.

Terrain Clearance Flight Technique

The basic technique for flying the aircraft in response to the terrain displayed on the VDI is by matching the offset impact bar (1.50 in. from horizon) with a selected coded range.

The rules that apply to this technique are:

1. The range selected for reference must be at or beyond the 1/2 to 3/4nmi range line (bottom of the first selectable coding). Do not track the first range line.
2. The range contour selected for tracking must be kept at or below the offset impact bar.
3. Do not attempt to push over rapidly and directly to a range line off the bottom of the display.
4. Do not push over rapidly in an attempt to track a range contour that is descending rapidly toward the bottom of the display.

The aircraft should be flown so as to maintain the entire offset impact bar at the selected position (top or bottom) on the desired range contour. What we are doing with this technique is maintaining a fixed angle with the terrain at the range contour being tracked. The range contour selected for tracking will be dependent on the desired resultant clearance above the terrain. Figure 8-72 shows the recommended range contour to be tracked for various conditions of terrain severity. For initial training in TC flying, it is recommended that one of the further out range contours (e.g. 1 1/2 to 2) be tracked with the resultant high terrain clearance. As pilot confidence and proficiency increase with the flying technique, a closer range contour can be tracked with lower resultant terrain clearance.

A situation that can occur using the technique of matching the offset impact bar with a selected range contour, is a premature pushover prior to hill crest clearance. This condition occurs when tracking a close-in range line (1/2 to 3/4 nmi range line - bottom of first selectable coding). The cause of this phenomenon is that the actual (and displayed) elevation angle to the hill crest decreases rapidly as the range to the hill crest decreases. The display of this event shows the tracked range contour rapidly falling to the bottom of the scope, and a pushover to track this dropping range contour is potentially dangerous. If the desired range contour to be tracked is dropping rapidly toward the bottom of the display or is off the bottom of the display do not push over in an attempt to find it or track it. Maintain airplane altitude or track a further out range contour until the radar altimeter has peaked low and started up again or the radar altitude curtain has peaked high and started down indicating the crest has been cleared. Then sequentially push over and step down in range contours until reaching the desired range line.

TERRAIN CLEARANCE OPERATING PARAMETERS

A-6E

RANGE CONTOUR	RANGE MILES BUTTON	RANGE CONTOUR REPRESENTED	TERRAIN FEATURES	TRACKING POSITION OF OFFSET IMPACT BAR	RESULTANT CLEARANCE (FEET)
1		¼ to ½ (PERM. CODED)			
2	1	½ to ¾	FLAT PLAINS	BOTTOM OF FIRST SELECTABLE CONTOUR	400 to 600
3	1	¾ to 1	ROLLING PLAINS	TOP OF FIRST SELECTABLE CONTOUR	600 to 900
4	1.5	1 to 1½	HILLS	TOP OF SECOND SELECTABLE CONTOUR	900 to 1050
5	2	1½ to 2	HILLS	TOP OF THIRD SELECTABLE CONTOUR	1050 to 1600
6	3	2 to 2½	HILLS	BOTTOM OF FOURTH SELECTABLE CONTOUR	1600 to 2000
7		2½ to 3 (PERM. CODED)	HILLS	BOTTOM OF CODED CONTOUR	GREATER THAN 2000
8 9 10		3 to 4 4 to 6 6 to 8½			

NOTE

1. The offset impact bar is measured downward from the center of the VDI.
2. Hills are defined as terrain having a differential altitude of approximately 700 feet.
3. Increasing severity of terrain features will decrease the resultant clearance when using listed tracking positions.

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Figure 8-77

A significant fact in using any combinations of coded ranges and the offset impact bar is that as long as the coded range is not masked, i.e. there is coding always displayed, there are no known possible impact situations and the technique (but not necessarily the display) is foolproof. The result of using the wrong airspeed and coded range combination for a particular terrain is crest overshoot (ballooning or excessive g but not impact). If undesirable ballooning occurs or uncomfortable g levels are encountered, the use of a further range contour or slower airspeed is indicated.

VERTICAL DISPLAY CONTROLS

The controls for the VDI are grouped on the upper section of the pilot's control panel (figure 8-73).

DISPLAY Selector Buttons

The DISPLAY selector buttons allow a choice of contact analog, (CONT ANALOG), and search radar terrain clearance (TC) displays. The standby button (STBY) keeps the vertical display in readiness for a mode selection. The TC CAL button selects the terrain clearance calibration display. With the OFF position selected, no power is supplied to the vertical display system.

RANGE MILES Buttons

The range miles buttons provide a choice of range contour coding (1, 1.5, 2, and 3), for use with the terrain clearance function.

TEST Button

With CONT ANALOG selected, all symbols and markers except the command heading line may be displayed on the VDI simultaneously (see figure 8-78) by depressing the TEST button on the pilot's control panel. With TC selected, depressing TEST selects the TC test display (figure 8-78).

BRT/CONTRAST Control

The BRT/CONTRAST control is a dual stacked control top-coded with a triangle. The outer portion marked BRT varies the brightness of the overall display and the inner portion adjust the contrast ratio of the symbols and the display background.

PITCH TRIM Control

The PITCH TRIM control permits the pilot to adjust the vertical position of the pitch trim markers with respect to the center of the VDI.

OFFSET IMP PT/PATH BRT Control

The OFFSET IMP PT/PATH BRT control is a stacked rotary control top-coded with a cross. The outer control marked OFFSET IMP PT adjusts the vertical position of the offset impact bar on the VDI in the TC mode. The inner portion of the control, marked PATH BRT, adjusts the brightness of the VDI pathway; rotating the control fully counterclockwise to the OFF position removes the pathway from the display.

VDI TEST DISPLAYS

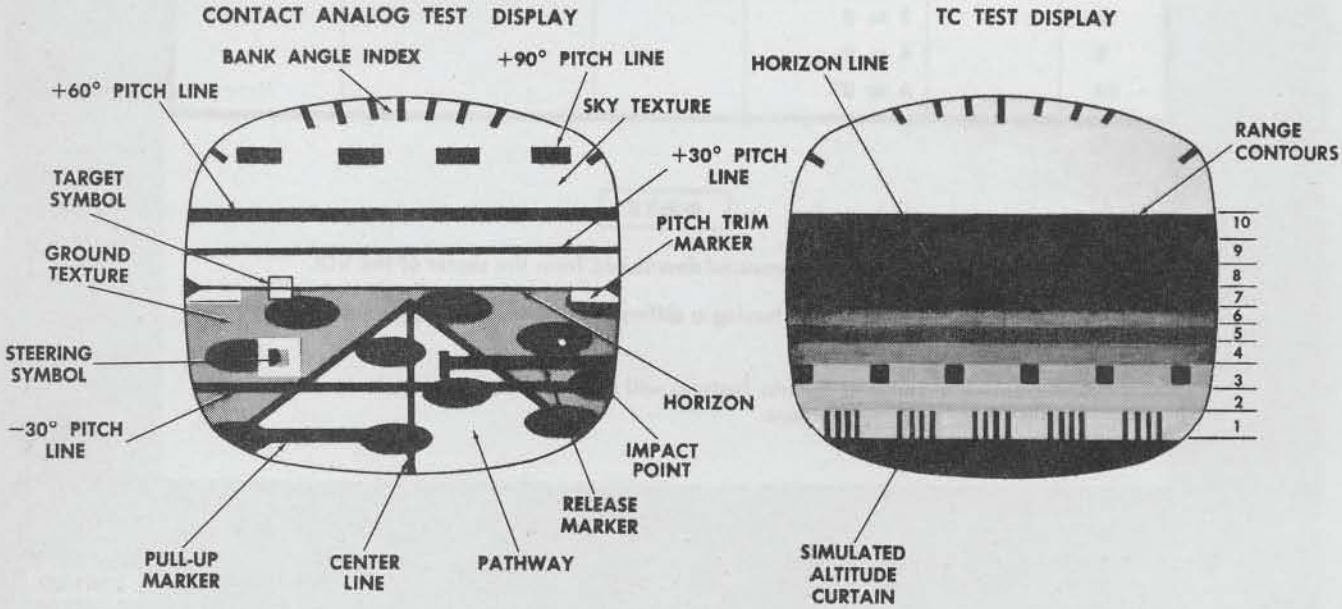

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Figure 8-78

OPTICAL SIGHT

The lead-computing optical sight (figure 8-79) is above the pilot's instrument panel and is positioned parallel with the aircraft armament datum line. The optical sight provides the pilot with accurate information regarding target lead angle, and in-range and breakaway indications, which will enable him to release a weapon at the precise time and heading that will result in destruction of the selected target. The primary function of the optical sight is accomplished by projecting four optical displays onto a reflector in the pilot's field of vision (figures 8-79 and 8-80). These displays include a fixed and a movable reticle and in-range and breakaway projections. The various functions available to the sighthead are adjusted by controls on the optical sight control panel on the pilot's left console.

RETICLE DISPLAYS

The reticle displays are illustrated in figure 8-80.

Fixed Reticle

The fixed reticle display is permanently aligned with the armament datum line (ADL) of the aircraft and reflected into the pilot's field of view. The reticle forming this display consists of a cross with a center dot and two dashed, concentric semicircular arcs spaced 50 mils apart. Additional dots, spaced at 10-mil increments, are located directly between and beneath the simicircular arcs. With masking, the fixed image reticle appears as the cross and dot without dashed semicircular arcs and dots. With the mask removed, the fixed image reverts to the cross and dot configuration complete with semicircular arcs and dots. When operating in the manual (MAN) mode, the mask may be removed so that the arcs and dots can be used for lead angle calculations. When using mil lead, set the movable reticle in the manual mode; the fixed reticle should be turned off.

Movable Reticle

When the optical sight is operated in the AUTO mode, positioning of the movable reticle is controlled by the digital computer. In this mode, the movable reticle provides the following command or status conditions:

1. Azimuth steering commands. In attack, the horizontal displacement reflects roll-summed steering; in nonattack, angular steering error is displayed.

2. Boresight target acquisition. In attack with BORESIGHT selected on the B/N control panel MODE switch and prior to commit, the horizontal and vertical displacements reflect the aircraft aiming vector, which must be lined up on the target at designate.

3. G-command. Except in the boresight mode, vertical displacement reflects g-to-go when the breakaway display is on.

4. Command pitch. Vertical displacement provides a command pitch indication under the following conditions:

   a. Nuclear safe escape criteria unsatisfied (climb)

   b. Insufficient altitude for blast clearance (climb)

   c. Aircraft underdiving target in a straight path attack

   d. Angle-to-go to release in rocket attack.

   e. Angle-to-go to 3 1/2° glide slope in landing mode.

The image reflected to the pilot's field of vision consists of a dashed cross and dot with short arcs at 25 and 50 mils. To release a weapon at the proper heading, the pilot must maintain an aircraft heading so that the movable reticle is superimposed in azimuth upon the fixed reticle. The position of the movable reticle in elevation is relative to the aircraft ADL for the function being displayed.

In-Range Display

The in-range optical display (figure 8-81) is a reflection of flashing white light. This display is generated by six small lamps within the sighthead and forms an arc reticle impression. When flashing, this light indicates that the aircraft is within weapon release range of the selected target, as computed by the computer or that a release point has been selected by the computer in straight path attack. In the boresight mode, flashing of the in-range lights indicates that a valid elevation track lock has been acquired.

Breakaway Display

The breakaway optical display (figure 8-81) provides the pilot with two distinct operational functions, involving immediate alteration of aircraft altitude. The display consists of two parallel lines of flashing red lights reflected on the port and starboard edges of the sighthead reflector and the movable reticle indicates pullup based on selected g. When this display is seen, the pilot is advised that:

1. The computer has developed a dead ahead terrain avoidance pullup based on computer present position altitude and velocity vector direction.

2. A pullup maneuver is required for a particular weapon release.

COMPUTER OPTICAL POSITIONING (COP) CHECK

The tracking accuracy of the system may be evaluated visually with the optical sight by use of the computer optical positioning (COP) check. With the radar in the desired tracking mode, the bombardier/navigator positions the cursors on a visually recognizable radar target. With the optical sight AUTO/

OFF/MAN switch at AUTO, depressing and holding the attack commit trigger to the intermediate detent aligns the optical sight moving reticle with the radar cursors. The position of the moving reticle with respect to the target may be observed and the magnitude and direction of any tracking error may be determined. The PHD TIME window displays true airspeed in knots or in aircraft 159895 and ON and A-6E Mod M121 and ON, the PAIP TIME window displays groundspeed in knots when the attack commit trigger is depressed to the COP position. This value is updated every 8 seconds as long as COP is held. An instantaneous update can be acquired by deselecting, then reselecting COP.

Note

If a COP check is performed on the ground, only azimuth indications are valid.

SIGHTHEAD OPERATING CONTROLS

The mask control and elevation thumbwheel are the only controls on the sighthead that are used in normal flight operation. All remaining operational controls are on the sight unit control panel (figure 8-79) on the pilot's left console.

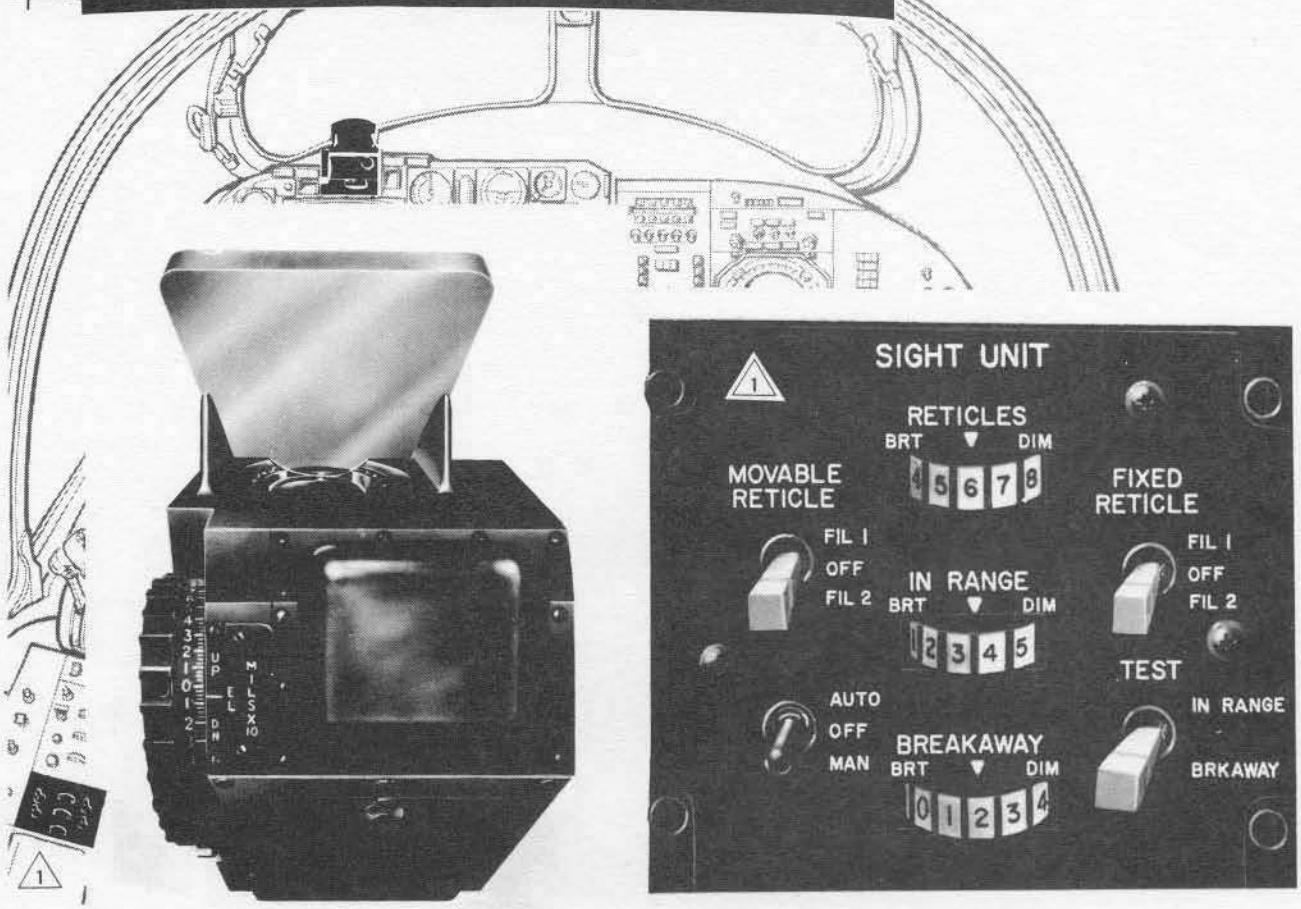
Mask Control

This control is a lever that is mechanically coupled to a hinged mask that covers the concentric arcs on the lower portion of the fixed reticle. This mask controls the image exposure content generated by the fixed reticle and subsequently presented to the pilot's view. When the mask control is placed in the OUT position, the fixed reticle concentric arcs are projected in the pilot's view to enable him to determine lead angle while in the MAN mode of operation, or when no lead angle information is available from the ballistics computer. When the mask control is in the IN position, the mask effectively covers all the fixed reticle except the cross and dot center.

Elevation Thumbwheel

The elevation thumbwheel is a calibrated control mechanically coupled to a synchro transmitter. Operation of the thumbwheel controls the position of the movable reticle in elevation when the optical sight is in the MAN mode of operation. The dial of

OPTICAL SIGHT AND CONTROL PANEL



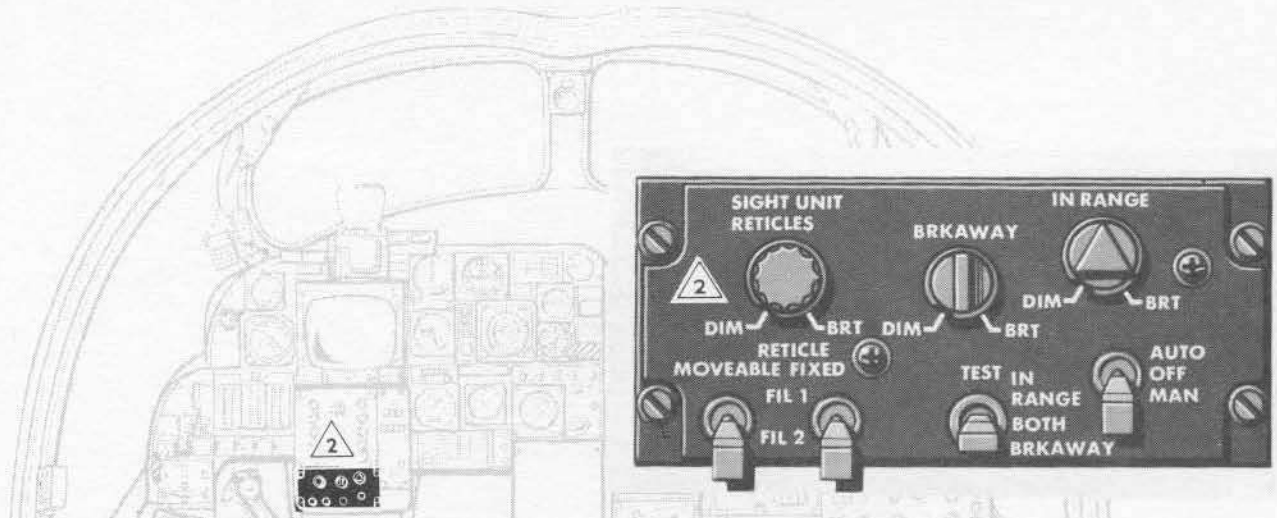


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Figure 8-79

the thumbwheel is calibrated in 350 mils of elevation down (approximately 20°) and 88 mils up (approximately 5°), and numbered in divisions of mils x 10. The dial and identification plate are edge-lighted to facilitate reading and locating the control. The intensity of dial illumination is controlled by the aircraft console lights dimmer control.

SIGHT UNIT CONTROL PANEL

Reticle Control

This thumbwheel control is marked BRT and DIM. Positioning of this control adjusts the intensity of the sighthead reticle illumination to the level desired by the pilot.

In-Range Control

This thumbwheel control is marked BRT and DIM. Positioning of the control adjusts the intensity of the sighthead in-range illumination to the level desired by the pilot.

Breakaway Control

This thumbwheel control is marked BRT and DIM. Positioning of this control adjusts the intensity of the sighthead breakaway illumination to the level desired by the pilot.

Movable Reticle Switch

This three-position switch, marked FIL 1, OFF, and FIL 2, provides filament power to the movable reticle lamp. In the OFF position, no power is supplied to the lamp and no movable reticle image is presented. In FIL 1 position, power is supplied to filament number one of the movable reticle lamp and the image is reflected to the sighthead. The FIL 2 position of the switch provides for a second filament circuit in the movable reticle lamp in the event of damage to the FIL 1 circuit. This provides a secondary means of illuminating the moving reticle.

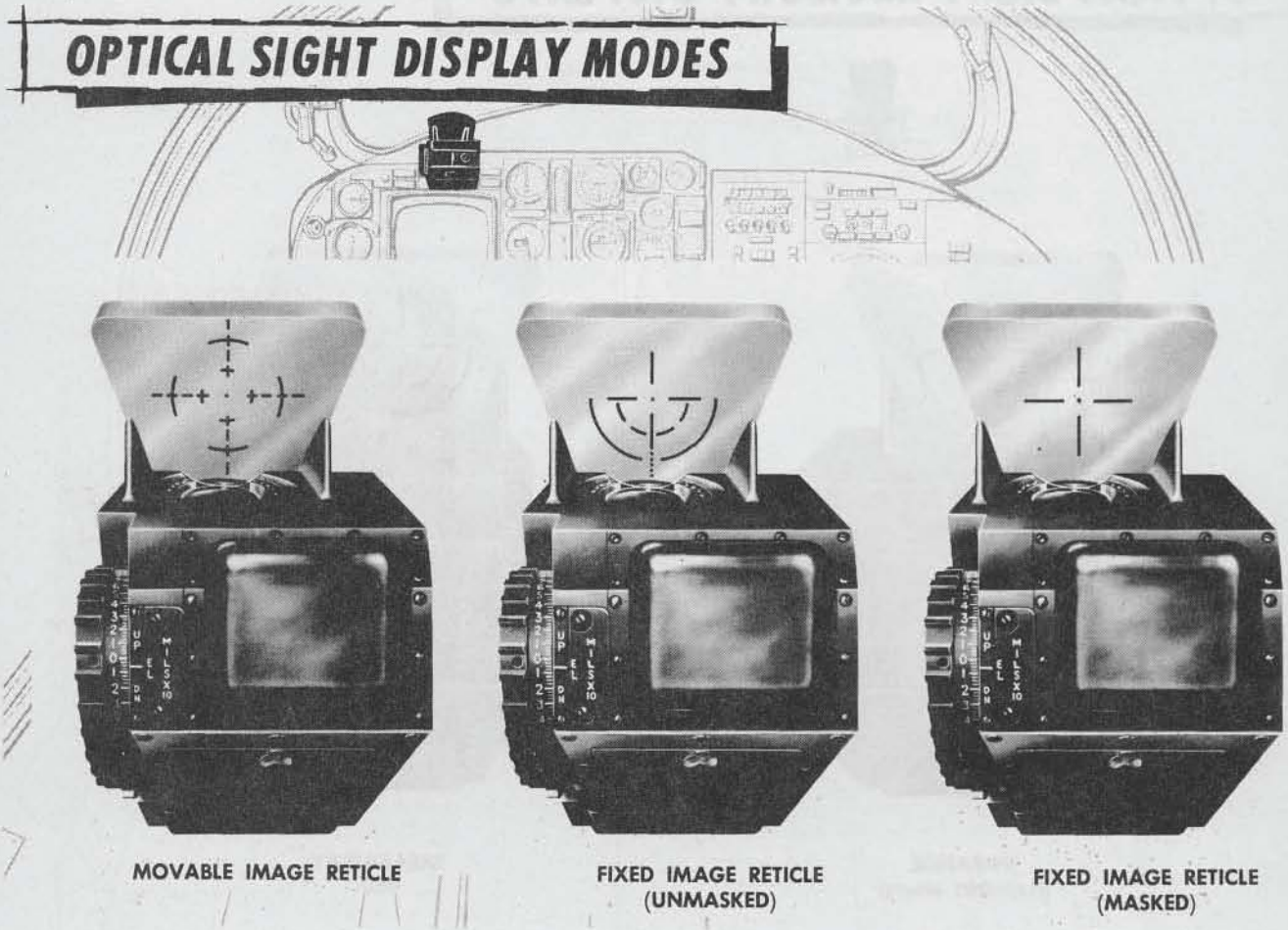

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Figure 8-80

Fixed Reticle Switch

This three-position switch, marked FIL 1, OFF, and FIL 2, provides filament power to the fixed reticle lamp. In the OFF position, no power is supplied to the lamp and no fixed reticle image is presented. In FIL 1 position, power is supplied to filament number one of the fixed reticle lamp and the image is reflected. The FIL 2 position of the switch, power is supplied to the second filament circuit in the fixed reticle lamp in the event of damage to the FIL 1 circuit. This provides a secondary means of illuminating the fixed reticle.

Automatic/Off/Manual Switch

This three-position switch, marked AUTO, OFF, and MAN, controls input power and permits selection of the desired mode of operation of the sighthead. In the OFF position, no electrical power is supplied to the sighthead. When the control is moved to the MAN position, the fixed reticle and movable reticle are illuminated, and the position of the movable image is adjustable with the elevation thumbwheel. The fixed reticle image coincides with the ADL of the aircraft. When the switch is positioned to the AUTO detent, all movable reticle inputs are initiated by the digital computer. When this switch is positioned to either AUTO or MAN the appropriate reticle image will be reflected, indicating sighthead operating condition.

Sight Unit Test Switch

This three-position switch provides a means of testing the in-range and breakaway reflections. The switch is spring-loaded to the neutral position and when momentarily held in either position, presents to the pilot the appropriate sighthead reticle indication. The sight unit test switch can also be used to test the in-range and breakaway lights on the VDI.

OPTICAL SIGHT ADVISORY DISPLAYS

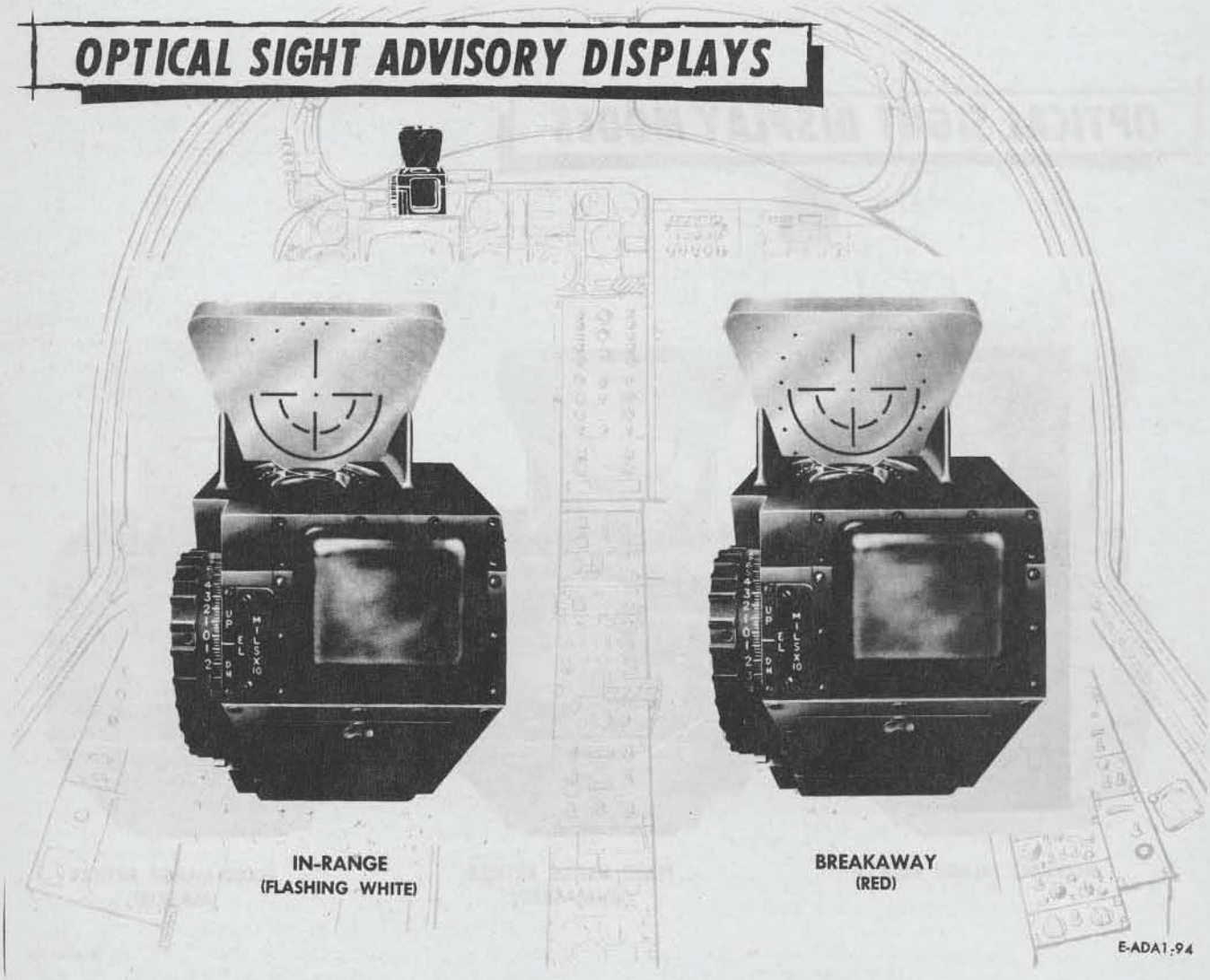

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Figure 8-81

OPERATION OF OPTICAL SIGHT

Note

Before engaging the optical sight AUTO-OFF-MAN switch, ensure that optical sight primary 28 VDC OPT-SIGHT circuit breaker and ADC/OPT SIGHT 115V/400 Hz circuit breaker on the bombardier/navigator circuit breaker panel are engaged.

1. Position AUTO/OFF/MAN switch as desired. Sight is now ready for automatic or manual operation within limits described in this section.

CAUTION

Do not leave AUTO/OFF/MAN switch OFF during taxi or flight operation.

2. Adjust reticle controls for optimum illumination.

3. Operate test control for in-range and break-away lights.

WEAPONS RELEASE SYSTEM

The aircraft weapons release system is capable of transporting and delivering a variety of conventional and nuclear weapons against air and surface targets. The system consists of the armament control unit (ACU), fuze function control set, the aircraft monitor and control system, cockpit controls and indicators, mounting facilities at five external store stations, and associated electrical wiring. The cockpit controls and indicators are located on the ACU control panel labeled ARMAMENT, the AWW-4 fuze function control panel and the NUCLEAR control panel. (See figure FO-3.)

ARMAMENT CONTROL UNIT

The ACU allows the crew to control, arm and release various weapons, fire guns, rockets, and missiles, and to jettison weapons selectively or simultaneously. Bombs, rockets, and missiles are released in either an automatic or manual mode of operation. Guns are fired only in a manual mode. The ACU provides releases as follows:

- Firing of rockets in the step, train, or salvo mode from four of the five external store stations. (1, 2, 4 and 5).

Note

The ACU has the capability to interface with seven external store stations. The two additional ACU stations labeled L OUT BD and R OUT BD, provide for future growth.

- Step, train, or salvo release of bombs from all five external store stations.
- Step or train firing of missiles from four of the five external store stations (1, 2, 4, and 5).
- Salvo firing of gun pods from four of the five external store stations (1, 2, 4, and 5).

Weapons are carried on the five external store stations: left wing outboard (1), left wing inboard (2), fuselage centerline (3), right wing inboard (4) and right wing outboard (5). The station firing priority in either the step or train mode of release is fixed at 1, 5, 2, 4, 3 and stations not selected are bypassed. When all five stations are selected in the step or train mode, after releasing the store from the fuselage centerline station (station 3), the station select logic resets back to station 1. If all stations are not selected, the station select logic resets back to the highest priority station selected after the store has been released from the lowest priority station selected. This automatic reset action continues until the quantity of release pulses as set on the ACU QUANTITY select thumbwheels has been completed.

MANUAL WEAPON RELEASES

Manual release of weapons in the step, train or salvo release mode is accomplished at any time by the pilot depressing the manual release button on either the pilot's control stick or the left canopy bow. The release button must be depressed until the preselected number of releases has been completed.

Train

The manual release signal in the train, release mode starts the intervalometer and the spacing and number of sequential releases from the selected stations is controlled by the TIME and QUANTITY select thumbwheels. The multiple release counter counts the number of release pulses generated and when the preselected quantity is reached, the intervalometer turns off, the station select logic resets to the highest priority station selected, and the COMPLETE light comes on. If the release button is released before the preselected number of releases has been completed, the intervalometer stops generating output pulses and weapon release ceases, the station select logic is not reset and the COMPLETE light is not lit. The next time the manual release button is depressed, the intervalometer starts generating output pulses and the station select logic picks up from where it left off and starts releasing weapons from the next priority station. Upon completion of the original preselected quantity or a new selected quantity, the intervalometer will turn off, the station select logic will reset, and the COMPLETE light comes on.

Step

In the step release mode, the manual release signal, generated by the manual release button, bypasses the intervalometer and drives the station select logic directly. The weapons are released from the selected stations sequentially at a manual rate. The number of releases is controlled by the number of manual release signals generated by the manual release button. The multiple release counter operates but does not inhibit release pulses in this mode.

Salvo

The salvo release mode when activated by a manual release signal operates in a similar fashion to the train release except that the weapons are released simultaneously from the selected stations and the number of release pulses generated is controlled by the QUANTITY select thumbwheel and the number of stations selected.

The spacing in time between simultaneous releases is controlled by the TIME select thumbwheel. The multiple release counter counts the number of release pulses generated and when the preselected quantity is reached the intervalometer is turned off, and the COMPLETE light is turned on.

If the release button is released before the preselected number of releases have been completed, the intervalometer stops generating release pulses, weapon release ceases, and the COMPLETE light is not turned on. The next time the release button is depressed, the intervalometer starts generating release pulses and weapons are released from the selected stations. Upon completion of the original preselected quantity or a new selected quantity, the intervalometer is turned off, and the COMPLETE light is turned on.

A multiple weapon BOMB SALVO release with only one station selected appears identical to a TRAIN release.

AUTOMATIC WEAPON RELEASES

Automatic weapon releases are activated by the following systems:

- Digital computer (GENERAL, HI LOFT, STRAIGHT, ROCKET)
- Inertial navigation system (INS) (LAB TGT, LAB IP)
- Ground-controlled bombing system (GCB)
- Armament control unit (ACU) (DELAY)

In order to release a store in the train or salvo release mode using one of the four automatic types, the attack commit trigger on the pilot's control stick or the left canopy bow must be depressed prior to receiving the automatic release signal and until the preselected number of releases has been completed.

Non-Computer Releases

Three of the automatic release types (those activated by the INS, GCBS, and ACU) use the intervalometer to drive the station select logic. The intervalometer is started by the automatic release signal in the train or salvo release mode and operates in the same manner as when started by the manual release signal.

If the attack commit trigger is released before one of these three automatic release signals is received, automatic release does not occur.

If the attack commit trigger is released after the automatic release signal is received but before the preselected number of release signals is completed, the intervalometer stops and operation is the same as if the manual release signal was stopped.

Computer Releases

In the fourth type of automatic release, the computer drives the station select logic in the train or salvo release mode. Two computer signals are required to activate this type of release. The first is the fire ready signal and the second is the automatic release signal.

If the attack commit trigger is released before the computer supplies pulses to the station select logic, weapon release does not occur.

If the commit trigger is released after the computer starts supplying pulses to the station select logic but before the preselected number of releases has been completed, the computer pulses are kept from the station select logic and weapon release ceases. In the train release mode, the station select logic does not reset and the COMPLETE light is not turned on. Upon the reapplication of computer signals, or application of output pulses from the intervalometer, or STEP release pulses, the station select logic will pick up from where it left off and start releasing weapons from the next priority station. The multiple release counter counts the number of release pulses generated and upon completion of the original preselected quantity the station select logic is reset, and the COMPLETE light is turned on.

When the salvo release mode is interrupted, the COMPLETE light is not turned on. Upon reapplication of computer signals or application of output pulses from the intervalometer, weapons are released from the selected stations. The multiple release counter will count the number of release pulses generated and upon completion of the original preselected quantity or a new selected quantity, the COMPLETE light is turned on.

ARMING AND FUZING

The fuze function control set and the aircraft monitor and control (AMAC) system operate in conjunction with the ACU and provide control over electrically fuzed and nuclear weapons respectively by means of controls on the AN/AWW-4 panel and the NUCLEAR panel.

ACU CONTROL PANEL

The armament control unit (ACU) is a seven-station device with solid-state logic and relay switching which provides control of arming and release of conventional weapons. Controls for the operation of the ACU are provided on the ARMAMENT control panel on the left side of the bombardier/navigator's instrument panel (Figure FO-3).

EXTERNAL STORE STATION CONTROLS

The external store station controls consist of seven armament tape assemblies, release indicators, and station select switches. The controls for the left and right outboard stations are provided for growth only. These outboard station controls may be used, singly or in combination, for practice. However, selection of the L OUT BD or R OUT BD station with any of the numbered stations will cause a reselect condition. See figure 8-83.

Note

It is strongly recommended that only the L OUT BD and/or R OUT BD station(s) be used for practice attacks.

Armament Tape Assemblies

Each external store station is provided with an armament tape assembly, which is a self-contained device consisting of an armament tape, readout window, thumbwheel control, gun switch, and an armament digital readout, which indicates to the computer the store selected on the armament tape.

The armament tape is a continuous loop capable of displaying 64 separate legends (figure 8-71). The tape is positioned by use of a thumbwheel control adjacent to a readout window marked for the station it represents. The store displayed in the readout window is identified to the computer by the armament digital readout as the store actually loaded on the external store station. The readout windows should be checked before takeoff to insure that they agree with the weapons loaded on the station. When the armament tape is set to MK 4 GUN, one of the pods, or one of the tanks, the gun switch operates to prevent inadvertent manual or automatic release. These stores may be jettisoned only. There is a release indicator above each readout window, which shows black when reset (the station is loaded). When a release pulse is directed to a station, its release indicator rotates changing its displayed color to black and white.

Station Select Switches

Three-position lever-lock station select toggle switches are used to select the station from which weapons are to be released and the type of weapons (bombs/guns or rockets/missiles) to be released. The three station select positions are BOMBS/GUNS (up), OFF (center) and ROCKETS/MISSILES (down).

Note

Reselect logic inhibits release if the position of the station select switch is incompatible with the armament tape setting.

A locking assembly, located on each of the switches and which can be safety-wired in the off position, prevents inadvertent operation of any of the station select switches. Before placing any of the switches to the BOMBS/GUNS position, the locking assembly must be pulled out and rotated to the collar-slot-up position. The station select switch is now free to be placed in either the BOMBS/GUNS or OFF position. Before placing any of the switches to the ROCKETS/MISSILES position, the locking assembly must be pulled out and rotated to the collar-slot-down position. The station select switch is now free to be placed in either the ROCKETS/MISSILES or OFF position.

MASTER ARMT SWITCH

The three position, lever-lock MASTER ARMT toggle switch controls the power necessary for release and selective jettison. The switch positions are ON (up), OFF (center), and PRAC (down).

With the switch OFF, no electrical power is available to the release circuitry.

With the landing gear up and locked, placing the switch ON allows electrical power to be supplied to the store release circuitry. The MASTER ARMT switch must be in the ON position before release or selective jettison of weapons can be accomplished.

The third switch position is PRAC, and is used to simulate actual operation during practice missions. When the switch is positioned to PRAC, the release pulses generated by the ACU are restriced from the pylons, and weapons are not released. Selective jettison, gun fire, gun ready, and Shrike fire ready are also inhibited. All other operations and functions will perform as during an actual release. On the ground, PRAC prevents store release but permits power to be applied to the ACU.

A locking assembly, which can be safety-wired in the OFF position, prevents inadvertent operation of the MASTER ARMT switch. Before placing the switch to ON, the locking assembly must be pulled out and rotated to the collar slot up position. The MASTER ARMT switch is now free to be placed in either the ON or OFF position. To place the switch in the PRAC position, the locking assembly must be pulled out and rotated to the collar-slot-down position. The MASTER ARMT is now free to be placed in either the PRAC or the OFF position.

RELEASE MODE SELECT BUTTONS

The RELEASE mode buttons permit selection of any one of eight release modes. The buttons are interlocked so that only one may be depressed at a time. The following paragraphs describe the release modes. Reselect logic inhibits release if the RELEASE mode selected is incompatible with the armament tape selection.

STEP

The STEP position allows for the sequential release of bombs, rockets, and missiles, based upon a manual rate of release signals generated by the manual release button.

BOMB TRAIN

In the BOMB TRAIN position, the stores are sequentially released from the selected stations. One store is released each time a release signal is directed to the station select logic. The spacing between these sequential releases is based upon the predetermined setting on the TIME thumbwheel except when using an automatic computer release mode. In the GENERAL, STRAIGHT or HI LOFT attack mode, the sequential spacing is based upon the INTERVAL thumbwheel setting if minimum safe time is satisfied.

Train releases are inhibited at pitch angles greater than 85°.

Note

Cycling the MASTER ARMT switch causes the station select logic to reset to the highest priority station selected in the 1, 5, 2, 4, 3 sequence.

BOMB SALVO

In the BOMB SALVO position, the stores are released simultaneously from all of the selected stations. One store is released from each selected station each time a release signal is directed to the station select logic. The spacing between these simultaneous releases (a train of salvos) is generated in the same manner as it is in the BOMB TRAIN position.

ROCKET TRAIN

The ROCKET TRAIN position allows for the sequential firing of rockets from the selected stations. One station is fired each time a release signal is directed to the station select logic. The spacing between the sequential firing is based upon the predetermined setting on the TIME thumbwheel except when using the ROCKET attack mode. In the ROCKET attack mode, the sequential spacing is based upon the INTERVAL thumbwheel setting.

ROCKET SALVO

The ROCKET SALVO position allows for the simultaneous firing of rockets from all of the stations selected. All selected stations are fired each time a release signal is directed to the station select logic. The spacing between these simultaneous firings (a train of salvos) is generated in the same manner as the ROCKET TRAIN position.

MISSILE

The MISSILE position allows for the sequential release of a single missile from each of the selected stations. The spacing between these sequential releases is based upon the predetermined setting on the TIME thumbwheel.

GUNS

The GUNS position allows for the simultaneous firing of the gun pods on the stations selected.

SEL JETT

The selective jettison position allows for the simultaneous jettison of the stores from all of the stations selected. This position is protected from inadvertent operation by a clear plastic guard. In order to activate this position, the guard must be held back and the pushbutton depressed.

MECH ARM SWITCH

The MECH ARM switch is a three-position, lever-lock toggle switch that controls the nose and tail arming of conventional weapons. In the NOSE/TAIL position (up), the fuzes in both the nose and tail of the weapon are set. With the switch placed to TAIL (down), only the tail fuze is set. Placing the switch to SAFE (center) prohibits all mechanical arming for safe weapons release.

Note

Reselect logic requires that either the MECH ARM switch or the electric fuzing FUNCTION switch be in a position other than SAFE.

ROCKET SWITCH

The ROCKET switch is a two-position toggle switch marked RIPPLE and SINGLE, whose only function is to permit selection of stick centering for BOMB SALVO or BOMB TRAIN releases. When the switch is at RIPPLE, release timing is adjusted to place the first bomb on the target, and when SINGLE is selected the middle bomb will be on the target.

GUNS CHARGING SWITCH

The GUNS charging switch is a three-position lever-lock toggle switch. This switch controls the charging and clearing of guns in the gun pod. In the READY position (up), the guns on the selected station are simultaneously charged and made ready for firing. Placing the switch in the CLEAR position (down) empties the gun chamber of live rounds and renders the gun inoperative. With the switch in the SAFE position (center), no electrical power is available for firing. Operation of the guns switch is such that a locking assembly prevents inadvertent operation. Before placing the switch to READY, the locking assembly must be pulled out and rotated to the collar-slot-up position. To place the switch in the CLEAR position, the locking assembly must be pulled out and rotated to the collar-slot-down position.

ATTACK MODE SELECT BUTTONS

The ATTACK mode buttons permit selection of any one of eight attack modes. The buttons are interlocked

so that only one may be depressed at a time. The following paragraphs describe the manner in which each ATTACK mode affects the weapons release. Reselect logic inhibits release if the selected ATTACK mode is incompatible with the armament tape selection.

GENERAL STRAIGHT, HI LOFT and ROCKET

These four attack modes are activated by the digital computer. When the computer is stepped into attack, it will supply a fire ready signal and release pulses to the ACU to drive the station select logic. In this mode, the ACU intervalometer is bypassed and the digital computer controls the spacing between releases from the selected stations to obtain the desired ground spacing distance. If an even number of releases has been selected and the ROCKET switch is at SINGLE, the impacts are spaced to straddle the target. The digital computer determines the correct ground spacing as follows:

1. When the MASTER ARMT switch is ON, the computer converts the ground spacing distance in feet set in the ACU INTERVAL thumbwheel to time between releases.

2. Next, the computer compares the time obtained in 1. above to the time set in the ACU TIME thumbwheel. If the time obtained in 1. above is less than the time set in the TIME thumbwheel, the computer flashes the ACU RESELECT light and releases are inhibited.

When the computer is stepped into the attack mode, the ACU RESELECT light stops flashing and automatic releases will occur at the safe station-to-station time set on the TIME thumbwheel. If the time is equal to or greater than safe time, normal release will occur at the ground spacing distance set on the INTERVAL thumbwheel. The total number of release pulses from the computer is set by the ACU QUANTITY select thumbwheel. If the digital computer is not put into the attack mode, automatic release will not occur and a manual release must be used.

DELAY

This attack mode is activated by the ACU. During this mode, the pilot's attack commit trigger activates the ACU timer, which in turn activates the ACU intervalometer when the timer countback reaches zero. The length of the countdown is determined by the setting on the INTERVAL thumbwheel. The spacing and number of releases are controlled by the TIME and QUANTITY select thumbwheels. The multiple release counter counts the number of release pulses generated and when the preselected quantity is reached, it will turn the intervalometer off and the COMPLETE light will be turned on.

LAB IP and LAB TGT

These two attack modes are activated by the INS. During these attack modes, the pilot's attack commit trigger activates the ACU timer, which is used to count down from the preselected time set on the INTERVAL thumbwheel. When the countdown is completed, the pilot begins a 4-g pullup maneuver and the INS sends a release signal to the ACU when the aircraft reaches a set pitch angle. This automatic release signal activates the ACU intervalometer and stores are released with the spacing and number as set on the TIME and QUANTITY select thumbwheels. The multiple release counter counts the number of release pulses generated and when the preselected quantity is reached, it turns the intervalometer off, the station select logic is reset, and the COMPLETE light is turned on.

GCB

This attack mode is activated by the ground controlled bombing system. During this mode, the ground-controlled bombing system supplies an automatic release signal after the pilot's attack commit trigger is depressed. This automatic release signal activates the ACU intervalometer and stores are released with the spacing and number as set on the TIME and QUANTITY select thumbwheels. The multiple release counter counts the number or release pulses generated and when the preselected quantity is reached, it turns the intervalometer off, the station select logic is reset, and the COMPLETE light is turned on.

RESELECT LIGHT

The RESELECT light is activated by the reselect relay internal to the ACU. The light may be tested by depressing the pilot's TEST button. The reselect relay is energized by a signal from the digital computer when there is an incompatibility in the ACU switch settings. The light goes out when the correct setting is made. The reselect relay, when energized, inhibits intervalometer and computer release pulses from the station select logic but not the manual STEP pulses. Since the RESELECT light is driven by computer logic, the RESELECT light is inoperative and reselect protection is not available when the computer is OFF or not in the aircraft.

COMPLETE LIGHT

The COMPLETE light is controlled by the multiple release counter circuitry. When the ACU has generated the required number of released pulses as set on the QUANTITY select thumbwheel, the COMPLETE light is turned on to indicate that the desired number of stores have been released. The COMPLETE light goes out when either the attack commit trigger or manual release button is released.

INTERVAL THUMBWHEEL

The three-digit INTERVAL thumbwheel performs two functions. In the LAB IP, LAB TGT, and DELAY attack modes, it is used to set the ACU timer so that the correct countback is obtained in real time. For this function, the thumbwheel has a range from 99.9 seconds to 00.0 seconds and it is variable in 00.1-second discrete steps. In the GENERAL, STRAIGHT, HI LOFT, and ROCKET attack modes, the thumbwheel is used to control the digital computer release pulses

to the ACU so that the correct ground spacing distance in feet is obtained. For this function, the thumbwheel has a range from 999 to 001 and it is variable in 001 discrete steps. (9990 feet to 10 feet in 10-foot discrete steps.)

Note

- Reselect logic does not permit release if INTERVAL is set to 0 and quantity is greater than 1.
- A setting on the INTERVAL thumbwheel that is less than the minimum safe time as set on the TIME thumbwheel will cause the RESELECT light to flash. Increasing the interval or stepping into attack will eliminate the flashing reselect light. If the B/N steps into attack with a flashing RESELECT light, the computer provides releases at the setting on the TIME thumbwheel.

TIME THUMBWHEEL

The three-digit TIME thumbwheel performs two functions. In the manual and three of the automatic (LAB IP/TGT, GCB, and DELAY) releases, the thumbwheel is used to set the ACU intervalometer so that the correct station-to-station release spacing is obtained in real time. For this function, the switch has a range from 9.99 seconds to 0.00 seconds and it is variable in 0.01 second discrete steps. In the GENERAL, STRAIGHT, HI LOFT, and ROCKET attack modes, the thumbwheel is used to control the digital computer release pulses to the ACU so that the weapon is not released from the aircraft below the minimum safe time. For this mode, the range is from 9.99 to 0.00 seconds in 0.01-second discrete steps.

NEW

Note

For computer release of other than rockets a minimum setting of 0.06 is required to satisfy reselected logic.

WARNING

When the digital computer is off or not installed, and a TIME of less than 0.06 is selected, stores could be released at intervals as low as 0.01 second and weapon-to-weapon collisions could occur. This condition could also result in hung stores.

QUANTITY THUMBWHEEL

The two-digit QUANTITY select thumbwheel performs two functions. In the manual and three of the automatic (LAB IP/TGT, GCB, and DELAY) releases, the thumbwheel is used to control, via the multiple release counter, the number of pulses to be generated by the ACU intervalometer. For this function, the switch has a range from 99 to 00 and it is variable in 01 discrete steps. In the GENERAL, STRAIGHT, HI LOFT, and ROCKET attack modes, the thumbwheel is used to control the number of automatic release pulses generated by the digital computer. For this function, the range is the same as above.

The quantity input for train releases is the desired number of bombs to be released. For salvo, the number of weapons released will be a multiple of the stations selected. If the quantity set is not a multiple of the stations selected, the number of bombs released will be equal to the next higher multiple. For example.

- Weapons loaded: 22 Mk-82 on stations 1, 2, 4, 5
- Stations selected: 1, 2, 4, 5
- QUANTITY setting: 18

In this case, 20 bombs would be released, because multiples of 4 are 8, 12, 16, 20.

MISSILE CONTROLS

Missile CONTROL Switch

The missile CONTROL switch is a two-position toggle switch marked ON and OFF. This switch is provided to control application of electrical power for a future missile capability.

Missile PWR/TONE Control

The missile PWR/TONE control is a dual stacked control marked PWR and TONE. The inner control, marked TONE, permits adjustment of the audio level of missile tones. Full clockwise rotation provides maximum volume; full counterclockwise rotation reduces tone volume to a minimum. The outer control, marked PWR is a three-position rotary selector switch with positions marked OFF, STBY, and ON. When the switch is at OFF, no electrical power is available to the missiles. Setting the switch to STBY provides power for the heaters on all missiles carried. When the switch is at ON, electrical power is available to the missile guidance systems on the selected stations.

Note

The MASTER ARMT switch must be at ON or PRAC to apply power to the missile heater or guidance circuits.

Missile COOLING Switch

The missile COOLING switch is a three-position toggle switch marked ON, OFF, and TEST. When the switch is at OFF, no power is available to the Sidewinder cooling circuits or the Shrike guidance circuits. When the ON position is selected, power is applied to the Sidewinder missile cooling system. When TEST is selected, electrical power is available to the Shrike guidance system for ground test.

Note

The MASTER ARMT switch must be at ON or PRAC to apply power to the Shrike guidance circuits.

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CONDOR MISSILE SYSTEM PROVISIONS

The aircraft installation for the Condor includes Condor-peculiar equipment and modification and use of associated existing aircraft equipment. The Condor-peculiar equipment consists of the Condor control panel, power switching unit, and an aircraft/pod umbilical connector. The existing aircraft equipment to be used are the FLIR indicator, computer outputs, B/N's digital display unit, slew control, armament control system, pilot's stick switches, optical sight, ICS, and pilot's range displays.

CONDOR CONTROL PANEL

POD ON/SYS RDY Switch

The POD ON/SYS RDY switch on the Control control panel (figure 8-81A) is a push-on/push-off switch, which activates the Condor system. The two placards on the face of the switch (POD ON and SYS RDY) are activated separately. Depressing the switch lights the POD ON light and applies warmup power to the missile dome and battery heaters and full operating power to the pod. The SYS RDY section of the switch lights 2 minutes after the MASTER ARMT switch is placed in either the ON or PRAC position and Condor is set in 2 and/or 4 and POD 3 to station 3 on the armament control panel tape dials.

BIT Switch

The BIT switch is a push-on momentary switch, which initiates built-in test in Condor system. When depressed, the top half of the switch lights to indicate a Condor BIT run has started. If the BIT run is successful, the bottom half of the switch lights green and the system is left in the tactical mode. If a NO-GO is encountered during BIT, the WRA light lights amber; however, the run continues to completion.

WRA Switch

The WRA switch is a push-on momentary switch, which lights amber when the first NO-GO is detected during the BIT run. Following the BIT run (BIT white light out), depressing the WRA switch causes the Condor WRA failure code number to be displayed in window A5 of the DDU. The computer light will also come on. Subsequent reactivation of the switch indicates additional WRA failure code numbers until a repeat of the initial failure, which indicates that all failures have been shown. BIT failures can be overridden by reactivating the BIT switch, which also turns off the WRA amber light.

UPDATE Switch

The update switch is not operational.

ENTER Switch

The ENTER switch is a push-on momentary switch. Depressing the switch directs the Condor computer to accept each entry made on the address and quantity

Figure 8-81A

thumbwheels. The switch lights white for 2 seconds to acknowledge each entry on the thumbwheels.

ADDRESS/QUANTITY Thumbwheel Switches

The ADDRESS/QUANTITY thumbwheel switches are used to enter Condor parameters into the Condor computer. Two thumbwheels are provided for address data and six for quantity data. Selections on these switches provide coded launch point and target coordinate data to the computer.

ALT SEL Switch

The ALT SEL switch is a thumbwheel used for prelaunch selection of the Condor missile flight altitude following launch.

DISPLAY Switch

The DISPLAY switch is a two-position toggle switch placarded TV-FLIR. In the TV position, Condor TV is shown on the FLIR display. In the FLIR position, the FLIR display can be used to display DRS video.

AUTO-MANUAL Switch

The AUTO-MANUAL switch is a two-position toggle switch placarded AUTO-MANUAL. In the AUTO position, the CONDOR computer calculates the launch point, initial turn angle (ITA), range capability, and range to target. With the pilot's attack commit trigger depressed to the second detent, the missile is launched automatically by the computer when the aircraft reaches the launch point. When MANUAL is

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selected, the missile is launched by the pilot when the aircraft reaches the launch point. When a manual launch is made, the computer will still compute initial turn angle, range capability, and range to target; however, the switch must be placed in AUTO within 5 seconds after launch in order for the ITA to be computed.

HEADING CHANGE Switch

The HEADING CHANGE switch is a three-position toggle switch placarded L and R, spring-loaded to the center off position. The missile heading is changed 1° each time the switch is activated.

ALTITUDE CHANGE Switch

The ALTITUDE CHANGE switch is a momentary, three-position, lever-lock switch placarded CLIMB-DESCENT. In the CLIMB position, the missile body maintains an 11° nose-up attitude. In the DESCENT position, the missile body maintains a 5° nose-down attitude. The missile will hold the pitch attitude selected until ALT HOLD is selected or motor burn-out occurs.

SEEKER Switch

The SEEKER switch is a two-position toggle switch placarded UNCAGE and CAGE. The switch provides commands to place the missile seeker platform in the cage or uncage position.

FUZE FUNCTION CONTROL PANEL

The fuze function control set AN/AWW-4 provides several dc voltage combinations for charging and arming electric bomb and missile fuzes. The electrical signal selected on the panel is supplied to the bomb through interconnecting cabling during the first few inches of bomb fall. The operating controls are on the fuze function control panel below the ARMAMENT panel (figure FO-3).

FUNCTION SWITCH

The FUNCTION switch is a five-position rotary selector switch marked SAFE, VT, INST DLY1 and DLY2. When the switch is set to SAFE no power is applied to the AWW-4. This switch permits selection of the following fuzing voltages.

SAFE	-	All power disconnected from the system
VT	-	+ 300 V dc
INST	-	+ 195 V dc
DLY 1	-	- 195 V dc
DLY 2	-	- 300 V dc

It is not necessary that the MASTER ARMT switch be ON to energize the high voltage circuitry in the AWW-4 power supply. However, the MASTER ARMT switch must be ON and a release signal supplied in order to supply fuze charging power to the bomb racks. No warmup time is required.

HVDC TEST BUTTON

The HVDC TEST button is a spring-return pushbutton used to test the AWW-4 power supply when the aircraft is on the deck. When weight is on the wheels and the FUNCTION switch is at a position other than SAFE, depressing the button energizes the high-voltage circuits of the AWW-4 power supply. Voltage is not supplied to the racks unless the manual release button is also depressed. In flight with the system operating properly, the HVDC TEST button serves no purpose.

HVDC LIGHT

The HVDC light is a press-to-test light which comes on whenever the high-voltage circuits of the AWW-4 power supply have been energized. It does not indicate that voltage has been supplied to the racks.

In flight, with the system operating properly, the HVDC light will come on when the FUNCTION switch is set to a position other than SAFE. The light must not come on when SAFE is selected.

The press-to-test features does not operate when the FUNCTION switch is at SAFE. The light contains a standard intensity control. Rotate the receptacle counterclockwise for full intensity.

If the HVDC light fails to come on with the FUNCTION switch at any position other than SAFE.

1. Press light to test for bulb failure.
2. Depress HVDC TEST button. If light comes on, weight-on-wheels interlock circuitry is faulty. Successful release can be made by selecting desired fuzing option and depressing HVDC TEST button during release.
3. If light does not come on when HVDC TEST button is depressed, and bulb tested good, AWW-4 power supply has not been energized. Under this condition, electric fuzes will not be properly charged. If bulb is bad, there is no assurance that power supply has been energized.

PREFLIGHT CHECK

A preflight check of the system should be performed after engine start as follows:

1. DO NOT energize MASTER ARMT or station select switches.
2. Set FUNCTION switch to anticipated delivery option (VT, INST, DLY 1 or DLY 2). HVDC lamp must remain OFF.
3. Check condition of HVDC light bulb by depressing press-to-test feature.
4. Press HVDC TEST button. HVDC light must go ON.
5. Release HVDC TEST button. HVDC light must go OFF.
6. Set FUNCTION switch to SAFE.

NUCLEAR PANEL

The NUCLEAR panel contains the controls and indicators for the operation of the T-375 aircraft weapon monitor and control system (AMAC) (figure FO-3).

NUCLEAR SELECT BUTTONS

Four pushbuttons, OFF, SAFE, GRD, and AIR control arming and safing of the nuclear weapons and allow for selection of either a ground (GRD) or AIR burst.

Depressing the SAFE button releases the OFF button and directs 28-volt dc electrical power to the special weapon fuzing circuits. The normal off condition of corresponding station disagreement lights indicates that all weapons are safe to carry or return, or are ready to be armed.

CAUTION

Never go directly from OFF to AIR or GRD. The SAFE button must first be depressed.

A locking assembly over the GRD and AIR buttons serves as a safety device and prevents inadvertent arming of the nuclear weapons. To arm the stores, the locking pins must first be compressed, and the guard over the pushbuttons lifted. The special weapons being carried may now be armed by depressing either the GRD or AIR button, depending upon the desired type of burst.

Note

Do not depress the AIR or GRD buttons under any circumstances when the aircraft is on the ground and special weapons are loaded on the aircraft.

When the AIR or GRD buttons are depressed, all special weapons being carried on the aircraft will assume an armed condition.

When the SAFE button is again depressed, following arming of the weapons, the GRD or AIR button is automatically released; the guard over these buttons must be returned to its former position and locked.

Note

The nuclear selector OFF button must be depressed before and during takeoff. Before landing, the OFF button must be depressed.

The computer program provides a capability for a practice nuclear delivery with the MK-76 practice bomb. When the armament tape for the selected station is set to F76, depressing the GND or AIR button selects a practice nuclear delivery. Depressing OFF or SAFE with the ACU MECH ARM set to NOSE/TAIL or TAIL selects a conventional weapon delivery.

SAFE LIGHT

A press-to-test SAFE indicating light monitors the T-375 system circuits. The light comes on when the SAFE button is depressed to indicate that the relay assembly in the aircraft is in the safe position. When the OFF, GND, or AIR button is depressed, the SAFE light is off.

Note

When the SAFE button is depressed, following arming of the weapons, the ARM light will remain lit momentarily. This is normal. The ARM light will go off at completion of the safing operation.

The press-to-test feature of the light checks the indicator for continuity by supplying 28-volt dc electrical power from the essential bus.

ARM LIGHT

A press-to-test ARM indicating light monitors the T-375 system circuits. The light comes on when the GND or AIR button is depressed indicating that the relay assembly in the T-375 relay module has reached the armed position. With either the OFF or SAFE buttons depressed, the ARM light is off.

The press-to-test feature of the ARM light checks it for illumination by supplying 28-volt dc electrical power from the essential bus to the light.

Station Disagreement Lights

The red press-to-test station disagreement lights monitor the store and T-375 system circuits. The numerals 2, 3, and 4 above the lights refer to the respective store locations: left inboard wing, centerline, and right inboard wing station. The disagreement lights are designed on the light-off principle. Thus, the normal condition of the weapon for any setting of the nuclear selector is indicated by the disagreement lights remaining off. If a light comes on, it indicates that the fuze setting of the corresponding weapon does not agree with the AIR or GND selection of the nuclear selector, or that a malfunction exists. The press-to-test feature of the lights checks them for illumination and monitors proper aircraft/weapon connections.

Note

Depressing the nuclear selector buttons may cause the station disagreement lights to flash momentarily. This is normal.

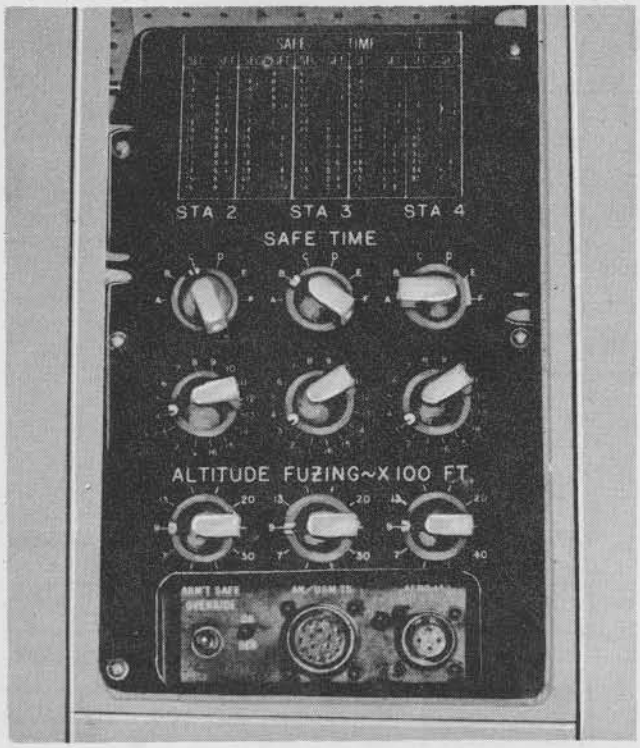
BALLISTIC CONTROL PANEL

The ballistic control panel (figure 8-82) on the left engine inlet duct contains controls for setting aircraft safe escape time in seconds and altitude fuzing in hundreds of feet for free fall nuclear and retard nuclear and cluster weapons loaded on stations 2, 3, and 4. These values are used by the computer to establish the following function for the type weapon selected:

1. Nuclear weapons - Safe escape time and burst altitude above surface, provided AIR is selected on the NUCLEAR panel.

2. Retard cluster weapons - Time from release to dispersal of bomblets if burst altitude is not equal to zero. If burst altitude is set to zero, bomblet dispersal time is assumed to be a preprogrammed constant for the weapon selected.

BALLISTIC CONTROL PANEL



ADF1-95

Figure 8-82

Note

- For nuclear weapons, the time and altitude settings on the ballistic control panel must correspond to the settings on the weapon itself.
- For cluster retard weapons, the time setting on the ballistic control panel must agree with the setting on the weapon. If the burst altitude is set to zero, however, the time set on the weapon must be the same as the programmed constant. In the latter case, the computer uses the constant and does not use the value set on the ballistic control panel.
- When a cluster weapon is loaded on one of the outboard stations (1 or 5), the time setting on the weapon must agree with the programmed constant time for that weapon since no variable time entry option is available for the outboard stations.

If more than one weapon is selected, and the settings on the ballistic control panel are not compatible with each other the RESELECT light comes on and release is inhibited. If nuclear weapons are selected and times differ, then times will be set to the maximum time available.

NEW

The ballistic control panel also contains the armament safety override switch and two test receptacles for maintenance purposes. The settings on the ballistic control panel are sampled by the computer when the MASTER ARMT is set to ON.

MANUAL RELEASE BUTTON

There are two manual release buttons, one on the stick grip (figure 8-72) and one on the left canopy bow.

Each manual release button is a spring-return pushbutton. Depressing and holding the manual release button with the MASTER ARMT switch ON activates the ACU to provide releases according to the RELEASE mode selected and the settings on the INTERVAL, QUANTITY, and TIME thumbwheels.

Note

Except with SEL JETT selected, when the armament tape for the selected station is set to MK4 GUN or one of the pods or tanks depressing either manual release button has no effect.

When the computer is on, reselect logic prevents manual train or salvo release when incompatible selections have been made.

RESELECT LOGIC

Whenever the computer is on and not in TEST, the position of the armament system switches is sampled during each iteration. If the position of any ACU switch if found to be incompatible or improper, the RESELECT light is turned on and release is inhibited. Reselect logic (figure 8-83) requires that the condition of the following be checked:

- Selected station select switches and armament tapes
- Selective jettison switch
- Mechanical arming switch
- RELEASE mode buttons
- ATTACK mode buttons
- INTERVAL, QUANTITY, and TIME thumbwheels
- AWW-4 panel
- NUCLEAR panel
- Ballistic control panel

Note

If the RESELECT light is on steady, only manual STEP releases are possible.

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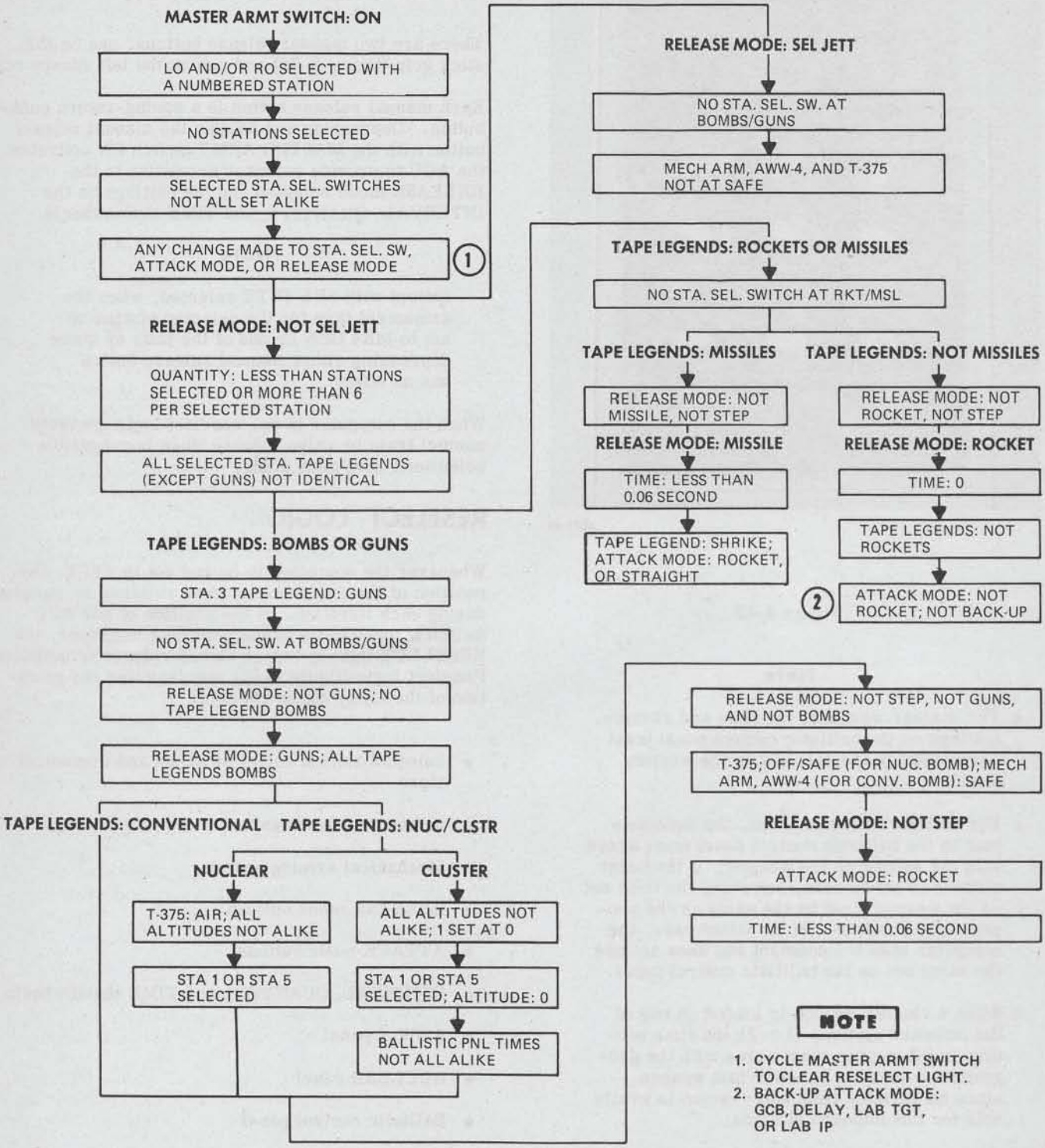
RESELECT LOGIC

COMPUTER ON

THE CONDITION DESCRIBED IN EACH BOX CAUSES A STEADY RESELECT LIGHT.

A-6E



NOTE

1. CYCLE MASTER ARMT SWITCH TO CLEAR RESELECT LIGHT.
2. BACK-UP ATTACK MODE: GCB, DELAY, LAB TGT, OR LAB IP

ADA1-834

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Figure 8-83

To clear a reselect condition, the MASTER ARMT switch must be set to OFF, the incompatible switch setting corrected and then the MASTER ARMT switch returned to ON. If the computer is in attack, a reselect condition causes it to step out of attack and the attack must be reinitiated after the reselect condition is cleared.

Note

The MASTER ARMT switch must be recycled any time the status of the RELEASE mode, ATTACK mode, or station select switches is changed. The RESELECT light will remain on until the MASTER ARMT switch is recycled.

STORES JETTISON

EMERGENCY STORES JETTISON BUTTON

An emergency stores jettison (EMER STORES JETTISON) button on the upper left corner of the pilot's instrument panel provides for emergency, simultaneous jettisoning of all stores. With 70% of the aircraft weight off the wheels, (left weight-on-wheels switch closed), depressing the emergency stores jettison button allows electrical power to be supplied to the five ejector racks and releases all stores simultaneously.

Note

Prior to emergency stores jettison of nuclear weapons, ensure that the SAFE button on the fuzing control panel has been depressed (SAFE light lit and AIR/GRD buttons locked). This prevents the possibility of jettisoning an armed weapon.

SELECTIVE STORES JETTISON BUTTON

The SEL JETT button on the ARMAMENT panel permits simultaneous jettison of stores from selected stations. With the left main gear door closed, the MASTER ARMT switch at ON, and a station select switch set to BOMBS/GUNS, depressing the SEL JETT button permits safe release of the store with the manual release button.

Note

- The clear plastic guard must be lifted to press the SEL JETT button.
- Reselect logic will light the RESELECT light if the MECH ARM switch, AWW-4 FUNCTION switch, and nuclear select button are not all at SAFE; however, this will not inhibit selective jettison of stores.

WEAPON MOUNTING

The Aero 7A ejector rack provides suspension and release capabilities for conventional weapons and nuclear weapons. The rack is a cartridge-actuated, electrically triggered assembly and may be attached to all five stations. The attachments, accessible by opening two access doors on each pylon or on the centerline fairing, make the ejector rack readily removable. Either of two sets of tandem hooks on the rack suspend the weapon. In addition to electrical release, the rack hooks may be opened manually for loading or other ground operation by rotating the nut above the forward hook counterclockwise. As a safety device, a safety pin is provided to prevent accidental electrical ground release.

The Aero 7B ejector rack is installed on the centerline station. The principal difference between this rack and the Aero 7A is that the height of the Aero 7B is about 2 1/2 inches less than the height of the Aero 7A.

GROUND CONTROL BOMBING SYSTEM (GCBS)

The ground-controlled bombing system (airborne system) operates in conjunction with the TPQ-10 remote bombing system (ground station) and provides ground-controlled steering and weapon release for close-support bombing attacks. The system components in the aircraft include the ground-controlled bombing system control panel on the bombardier/navigator's right console, the address panel on the pilot's instrument panel, and the necessary receiver and antenna assemblies located throughout the aircraft. The ground station tracks the aircraft relative to the target coordinates; computes altitude, velocity and heading error; and transmits coded signals to the airborne system.

Note

The GCB ATTACK button on the ARMAMENT panel must be depressed to permit a ground-controlled release.

GCBS CONTROL PANEL

This control panel is on the bombardier/navigator's right console (figure FO-3), aft of the chaff control panel, and controls the mode selector and channel selector capabilities of the system. It also contains the necessary controls to initiate operation of the ground-controlled bombing system equipment.

Channel Selector Switch

This control provides for selection of the four operating channels, and initiates system operation. This switch is rotated to reflect selection of the particular command-coded channel of the TPQ-10 equipment.

The channel selector control is placarded OFF, 1, 2, 3, and 4. The numbered positions represent available channel selections of the ground station equipment.

Engage Switch

This two-position toggle switch is used to engage the TPQ-10 ground system to the automatic flight control

system of the aircraft. When this switch is actuated, the commands from the ground station are automatically initiated by the automatic flight control system without the aid of the pilot or bombardier/navigator.

Code Selector Switch

This control permits selection of any one of four coded signals generated by the TPQ-10 ground equipment. The code selector switch is placarded 1, 2, 3, and 4, and is rotated to select the desired signal.

ADDRESS PANEL

The GCBS address panel (figure FO-3) is on the center console, forward. The panel contains an indicator light, placarded ARM WEAPON. When the system is commanded by a ground signal, the ARM WEAPON indicator is lit, advising the bombardier/navigator to arm or fuze the weapon prior to its release.

STRIKE CAMERA SYSTEM LB-31A

Aircraft incorporating AFC No. 256 have provisions for carrying the LB-31A strike camera system. The system consists of the LB-31A camera pod suspended on the No. 1 or No. 3 external store stations, installed on either the AERO 7 rack or on the A/A37 MER. The camera pod contains a KB-18B panoramic camera and a KB-19A forward-looking motion picture camera. The panoramic camera provides continuous film documentation of the strike area throughout an air-to-ground armament delivery. The forward-looking camera provides motion picture coverage of the area forward of the aircraft along the boresight line during an air-to-ground armament delivery. Both cameras operate simultaneously when energized by automatic or manual control circuits. The system receives power from the 28 V dc monitored bus through the LB-31A DC circuit breaker on the AC-DC power circuit breaker panel. The two heated camera windows are supplied power from the 115 V ac monitored bus through the LB-31A circuit breaker on the AC-DC power circuit breaker panel.

KB-18B CAMERA

The KB-18B camera components contained in the pod are the camera body with an accessory magazine LB-29A, and a camera control LB-17A. The camera has a 3-inch focal length f/2.8 lens. The shutter speeds range from approximately 1/100 sec to 1/4000 sec depending on limits established by a cycle rate switch and an aerial exposure index (AEI) switch. The accessory magazine accommodates 250 feet of film (300 exposures) and produces photographs with a format size of 2.25 by 9.40 inches. Panoramic photography is accomplished by rotating a double dove prism in front of the lens while the film is advanced across a narrow slit at the focal plane of the camera. Film advance is synchronized with prism rotation, projecting the panoramic image of the strike area on the film as the prism scans 180° fore and aft. Side coverage is 20° either side of the aircraft vertical axis. The automatic exposure control senses variations in the light source and initiates compensatory aperture adjustments. The camera control contains switches for ground testing the camera and preselecting camera operating functions required for the mission. The controls include the ground test switch, cycle rate switch, overrun dial, and the AEI switch.

Overrun Dial

The overrun dial setting determines the amount of time the camera will run (automatic mode only) after the attack commit trigger or manual weapon release button is released. Dial settings are calibrated in 2-second increments from 0 to 20 seconds plus an additional setting of 32 seconds.

Cycle Rate Switch

The cycle rate switch permits selection of 1, 2, or 4 frames per second during camera operation. The switch is set in accordance with the planned mission altitude/airspeed combination.

AEI Switch

The AEI switch is set as determined by the type of film in the camera. Film speeds (exposure sensitivity) of 40, 64, 80, or 200 are selectable.

KB-19A CAMERA

The KB-19A camera, mounted in the forward fairing of the pod, provides 16mm motion picture coverage of the area forward of the aircraft along the boresight line. The film magazine attached to the camera contains 100 feet of film. An automatic exposure control (AEC) controls the shutter sector opening to ensure proper exposure.

Overrun Switch

The overrun switch controls the time the camera continues to operate after attack commit trigger or manual weapon button release and provides the following overrun selections: 0, 5, 10, or 15 seconds. An overrun indicator light marks the film at the release of the trigger or weapon release button and continues marking until completion of the overrun period.

Test Switch

The test switch on the rear of the camera is used by the ground crew to test operation of the camera.

STRIKE CAMERA CONTROL PANEL

The strike camera control panel on the bombardier navigator's right console (figure FO-3), controls the operating modes of the strike camera system. The panel labeled LB-31A POD contains a mode switch and press-to-test OPERATE light. In the AUTO position, the cameras operate when the proper station armament switches are energized and the pilot actuates the attack commit trigger or manual weapon

release button. When the attack commit trigger or manual weapon release button is released, the cameras continue to operate for the preselected overrun time. The MANUAL position is a momentary position and the cameras operate as long as the switch is held in MANUAL. The manual mode is independent of the armament system and enables film coverage of specific terrain without armament delivery. The OPERATE light comes on whenever the cameras are operating.

RADAR BEACON AN/APN-154(V)

The radar beacon is used with the X-band ship- ground-based radars to extend the tracking range of the radar and to assist in determining the range and location of the aircraft. The ground-based radar transmits a coded interrogating signal; the radar beacon receives the interrogation, decodes the signal, and transmits replies to the ground-based radar. A-6E 159895 and ON and A-6E Mod M121 and ON have a Ka-band augmenter receiver to permit replies to the SPN-42 ACLS radar.

RADAR BEACON CONTROL PANEL

The radar beacon control panel, which is on the rear center console (figure FO-3), controls the operation of the radar beacon.

POWER/STDBY/OFF Switch

This three-position switch provides power for radar beacon operation. The STDBY position places the equipment in a standby condition but does not permit the transponder to reply to interrogation. The POWER position places the beacon in full operation. The OFF position turns off all power to the equipment.

Mode Selector Switch

This six-position rotary switch selects the function to be performed by the transponder. If the radar beacon is to respond to a single-pulse interrogation, place the MODE selector switch on the SINGLE position. If it is to respond to a double-pulse interrogation, place the MODE selector switch on 1, 2, 3, 4, or 5 of the DOUBLE bracket. The double-pulse code response desired determines the position of the switch. In Ka-band augmenter-equipped aircraft, this switch has a seventh position marked ACLS. Selecting this position permits response to interrogation by the SPN-42 ACLS radar. A lighted pushbutton switch marked ACLS TEST is provided to test this function. Depressing and holding the button initiates the test, and the light comes on to indicate a valid test.

RADAR BEACON OPERATION

1. POWER-STDBY-OFF switch - STBY
   For optimum performance, allow 5 minutes for warmup.
2. POWER-STDBY-OFF switch - POWER.
3. MODE selector switch - AS BRIEFED.

Note

The radar beacon will warm up with the switch in either STDBY or POWER position. To prohibit response to a premature or unintentional interrogation, warmup should be accomplished in the STDBY position.

part 5 KA-6D Mission Weapon Systems

INTERNAL AIR REFUELING SYSTEM

The aircraft uses the probe/drogue method of air-refueling. The system is capable of supplying fuel at the rate of approximately 350 gpm depending on the acceptance rate of receiver aircraft. The major components of the air-refueling system are: the hose-reel assembly, flowmeter, refueling control panel, and hose-reel ground test panel. The reel for the refueling hose is installed in the aft equipment compartment mounted to the refueling hose-reel access door. A faired canister protrudes from the lower fuselage and houses the retracted drogue. The reel and fuel transfer operation is automatically controlled except for manual selection of hose extension and retraction.

The hose-reel assembly is composed of the following: a drum containing 55 feet of 2 3/8-inch diameter hose, which is marked every 10 feet with a 1-foot long white band. MA-2 pressure-refueling coupling, 26-inch diameter drogue with integral night lighting, hose end 45±5 psi pressure regulator, combined system hydraulic motor for reel operation, hose serving gear to guide the hose onto the drum of the reel, hydraulic and electrical controls, and guillotine to sever a hose that fails to rewind.

The pressure regulator installed at the inlet to the hose-end refueling coupling regulates fuel pressure to the receiver 45±5 psi, and prevents tanker-induced surges from being transmitted to the receiver aircraft. Provisions are incorporated to protect the tanker fuel system against surges. Shutoff surges initiated by receiver disconnect or closing of fill valves are suppressed by a surge suppressor installed in the aft equipment compartment at the inlet to the hose reel. The airspeed/attitude refueling envelope limits of the hose-reel system are dependent upon the drag developed by the droque and the capability of the reel drive to provide adequate response and rewind torque. The prime demand on the reel drive is the rapid takeup of hose slack (called response) during engagement at a rate adequate to prevent hose whip. The drag of the droque, when transferred from the hose to the receiver's probe, provides the imbalance of forces that initiate this response. A finite minimum drag is necessary to provide a sufficient signal for an adequate response acceleration rate. The minimum value establishes the low airspeed limit for deploying the drogue. Maximum velocity for rewinding the hose is limited by the drag of the hose and drogue. The reel drive system, in conjunction with a 26-inch diameter drogue, provides a refueling speed range of 220 to 320 KIAS, at altitudes up to 35,000 feet.

REFUELING CONTROL PANEL

The refueling control panel (figure 8-84) on the center instrument panel contains all the necessary controls and indicators to operate the internal air-refueling system. The panel is accessible to either the pilot or observer.

POWER Switch

The POWER switch on the refueling control panel is a two-position ON and OFF switch. The ON position provides 28 V dc power from the primary bus through the PWR CONT REFUEL circuit breaker to the in-flight refueling system, to the override circuit for wing-tank pressurization to 12 psi, and opens the aft fuselage tank shutoff valve.

FUEL TRANS Switch

The FUEL TRANS switch on the refueling control panel is a three-position switch with OFF, AUTO, and OVRD positions. After engagement by a receiver aircraft and with the drogue in the refueling range (5 to 25 feet from full trail), the AUTO position energizes the refuel shutoff valve to open and both fuel transfer pumps to start. The OVRD position manually opens the refuel shutoff valve and starts both transfer pumps.

CAUTION

To prevent damage to the hose-reel hydraulic system, the OVRD position of the FUEL TRANS switch should be used only if the fuel transfer pumps fail to operate in the AUTO position. OVRD should be selected only after the receiver aircraft has engaged the drogue. The FUEL TRANS switch should be turned OFF prior to receiver disengagement. When fuel transfer pumps are operating, the drogue-to-probe locking pressure is approximately double.

DROGUE Switch

The DROGUE switch on the refueling control panel is a two-position switch, RET/EXT, that controls the hose-reel position. When the switch is placed to EXT, the hose-reel assembly hydraulic system is pressurized and the hose is extended. When the switch is placed at RET, the hose is retracted.

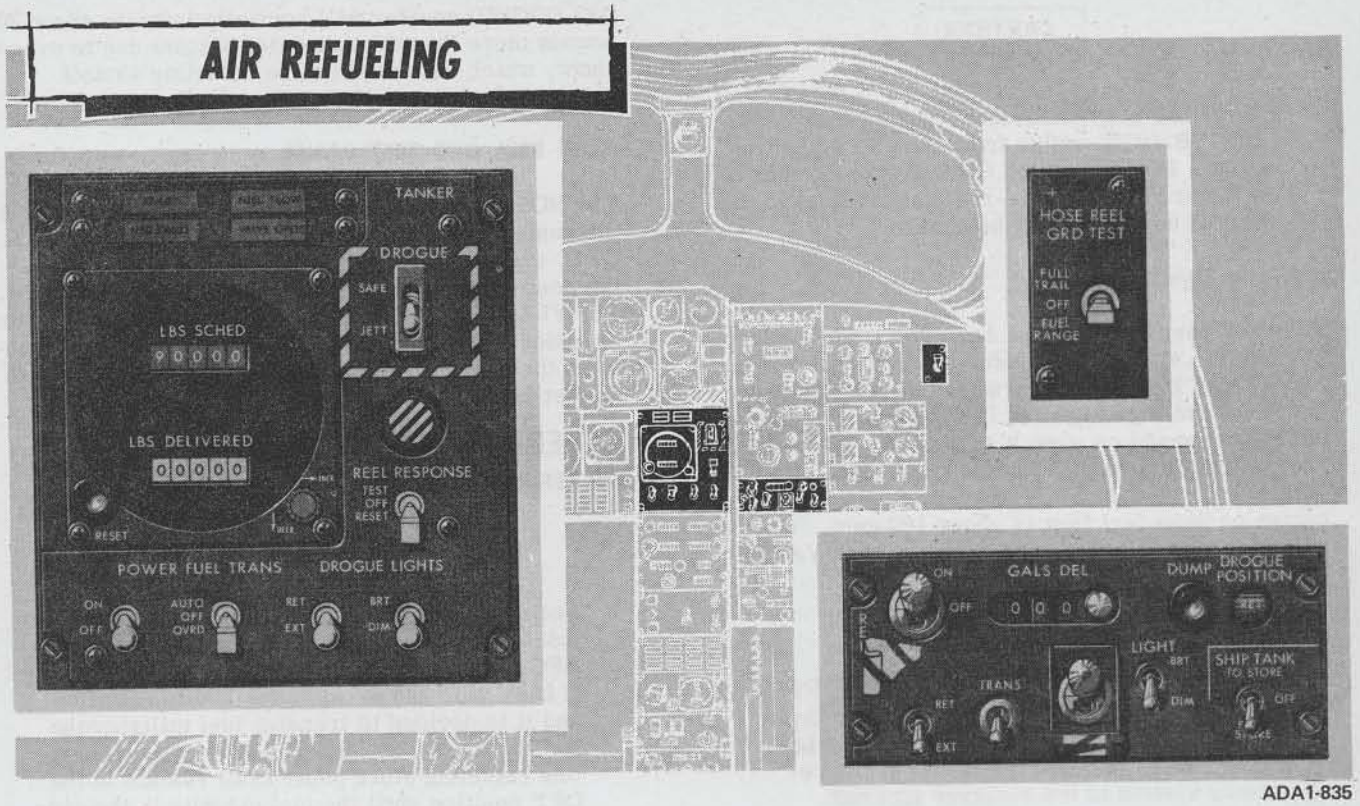

Figure 8-84

LIGHTS Switch

The LIGHTS switch on the refueling control panel has BRT and DIM positions for day or night operation. The LIGHTS switch determined the brightness of the canister-mounted advisory lights.

REEL RESPONSE TEST Switch

The REEL RESPONSE TEST switch on the refueling control panel is a three-position switch with TEST, OFF, and RESET positions, used for airborne testing of hose-reel response and for stowing the reception coupling upon completion of a refueling system ground check. When the switch is placed in TEST position, it tests the response command operation for drag load changes. When the switch is placed in the RESET position, it resets the hydraulic reference pressure for change in drag on the hose-reel drogue.

CAUTION

In aircraft not incorporating AFC No. 298, operate the REEL RESPONSE TEST switch with care. This switch is springloaded to the OFF position and may have a tendency to overshoot when released from full throw in either TEST or RESET position.

Hose Reel Position Indicator

The hose reel position indicator on the refueling control panel has STOW, barber pole, and TRAIL positions. When the indicator displays STOW, it indicates the drogue is stowed in the canister. On K 1 through K 52 not incorporating AFC No. 298, when a barber pole is displayed on the indicator, it indicates an in-transit condition of the hose and when TRAIL is displayed on the indicator, it indicates the hose is extended to full hose length or in the fueling range. On K 53 and on those aircraft incorporating AFC No. 298, when a barber pole is displayed, it indicates the hose is between the stowed condition and the full extended position and when trail is displayed, it indicates the hose is in the fully extended position.

DROGUE JETT Switch

The DROGUE JETT switch is a guarded two-position switch with SAFE and JETT positions. The JETT position is deactivated on the ground through the left weight-on wheels switch and airborne when the hose drogue is in the stowed position. Selecting JETT automatically shuts off the fuel transfer-and-dump pumps, shuts off hydraulics, and locks the hose-reel; after a 1-second time delay, severs the hose and closes the refuel shutoff valve.

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CAUTION

If hose has been jettisoned, moving the DROGUE JETT switch from the JETT position with the POWER switch ON will cause power to be restored to the hose-reel assembly, and the severed hose seal may be broken.

Advisory Lights

Four advisory lights on the refueling control panel indicate the status of the refueling system. The amber READY light comes on when the refueling hose is not in the fueling range and is out when the hose is in the fueling range or when it is stowed. When the hose-reel hydraulic pressure is below 1800 PSI, the HYD PRESS light comes on. The green FUEL FLOW light comes on when fuel flow is above 160 gpm. When the refueling shutoff valve is open, the amber VALVE OPEN light comes on.

Note

The READY, FUEL FLOW, and HYD PRESS LOW lights are matched identically by three pairs of external canister-mounted fuselage lights, which indicate the status of the refueling system to the receiver aircraft.

Fuel Flow Indicator/Totalizer

The fuel flow indicator and totalizer is an electromechanical indicator that displays the amount of pounds of fuel scheduled, LBS SCHED, to be delivered to the receiver aircraft, which is set by the tanker pilot or observer and the total pounds of fuel delivered, LBS DELIVERED, to the receiver aircraft. The LBS SCHED is a five-number counter with the last two numbers continuous zero. The LBS DELIVERED is a five-number counter with the last number a continuous zero. The INCR/DECR switch in the lower right-hand corner of the indicator/totalizer is manually operated to preset the amount of fuel to be delivered to the receiver aircraft on the LBS SCHED counter. The switch is centered in the neutral, off, position and is provided with a slow and fast slew switch position on each side of center, permitting slow or fast setting in either the increase or decrease directions. The RESET button in the lower left hand corner of the indicator/totalizer resets the LBS DELIVERED counter to all zero reading. The button must be triggered to control counter operation.

A preset amount of fuel is manually selected on the LBS SCHED counter using the INCR/DECR switch. As fuel is being delivered to the receiver aircraft, the LBS SCHED counter starts back to zero while the LBS DELIVERED counter increases to display the preset amount selected. When the preset amount of fuel is delivered, the fuel flow is automatically shut off by an internal 28-volt dc power switch of the indicator/totalizer, closing the refuel shutoff valve and stopping the fuel cell transfer-and-dump pumps. The LBS DELIVERED counter will normally indicate about 20 pounds more than the scheduled amount due to overshoot, which occurs while the refueling shutoff valve is closing.

HOSE REEL GRD TEST PANEL

The HOSE REEL GRD TEST panel on the observer's instrument panel has a three-position FULL TRAIL OFF, and FUEL RANGE test switch used to check the hose-reel circuitry on the ground prior to flight. The FULL TRAIL position simulates the drogue being extended to its full travel. The FUEL RANGE simulates the drogue being retracted to a position of 5 to 25 feet from full trail.

EXTERNAL AIR-REFUELING SYSTEM

AIR REFUELING STORE

CAUTION

Use of an external air-refueling store on the KA-6D is prohibited unless IAFC No. 296 or AFC No. 296 is incorporated in the aircraft. If IAFC No. 296 or AFC No. 296 is installed and it is decided to transfer fuel utilizing the D-704, the TO STORE switch on the centerline refueling store panel shall remain in the OFF position until the fuel quantity in the centerline refueling store is less than 500 pounds. When the fuel in the centerline refueling store reaches 500 pounds or less, move the centerline refueling store switch to the TO STORE position to replenish the store. Monitor the fuel quantity indicator closely so that the switch may be returned to the OFF position as soon as the fuel quantity indicates 1,500 pounds. If the tanker fuel transfer/dump pump starting relay is malfunctioning, the fuel transfer rate to the refueling centerline store could be fast enough to cause store failure if the indicated fuel in the store is permitted to go above 1,500 pounds.

Fuel from the tanker may be directed to the air refueling store at a rate of 190 gallons per minute. All but approximately 2,700 pounds of the KA-6D's fuel and 3,600 pounds of fuel on an A-6A, B, or E may be transferred to the receiver aircraft. Air-refueling procedures are found in Section IV of this manual. The air-refueling store carried on the centerline store station contains a 300-gallon fuel cell, a constant-speed ram-air turbine-driven hydraulic pump, a hydraulically driven fuel pump, a hydraulically driven hose reel, and 50 feet of refueling hose with attached drogue. The store is capable of transferring fuel at a rate of approximately 180 gallons per minute at a pressure of 35 to 55 PSI. The operational envelope of the store with drogue extended is limited to 300 KIAS or 0.80 IMN, whichever is lower, at altitudes up to 35,000 feet.

Air Refueling Store Lights

At the aft end of the refueling store are two lights, AMBER (left side) and GREEN (right side). These lights are for the receiver aircraft. The amber light

comes on when the hose is extended, indicating that the receiver aircraft may now engage the drogue. After engagement, the receiver must move forward (3 to 6 feet), until the amber light goes out. Lighting of the green light indicates that fuel is actually flowing from the tanker to the receiver.

Drogue Light

The white drogue light is mounted on the aft fuselage to illuminate the hose and drogue. Power from the monitored 28 V dc bus is applied to the drogue light when the refueling master switch on the centerline refueling store control panel is in the ON position.

Pylon Lights

The amber pylon lights are on the trailing edge of the pylon at stations 1 and 5. Power is provided from the monitored 28 V dc bus. When the refueling master switch on the centerline refueling store control panel is at ON, power is applied to the pylon lights. The intensity of the lights is controlled by the centerline refueling store control panel light switch. The pylon lights may also be operated from the master light control panel when the exterior lights master switch on the catapult grip is on.

AIR REFUELING STORE CONTROL PANEL

The air-refueling store control panel on the observer's instrument panel (figure 8-84) contains all the indicators and switches to operate the system.

Refueling Master Switch

The refueling master switch has three positions: ON, OFF, and DUMP. When the refueling master switch is placed ON, it unlocks and unfeathers the air-driven propeller at the forward end of the refueling store. When placed to OFF, it feathers and locks the propeller. The DUMP position is inoperative.

Gallons Delivered Counter

The gallons delivered counter registers the gallons of fuel transferred through the hose and drogue to the receiver, in increments of 2 gallons. A reset knob is provided to reset counters to zero when desired.

Drogue Position Indicator

The drogue position indicator (figure 8-84) has three indications: RET (retract), EXT (extended), and TRA (transfer). The indication will be RET only when the drogue is fully retracted or during drogue extension. The indication will be EXT only when the drogue is fully extended and ready for receiver engagement. TRA is indicated only when the hose and drogue has been engaged and approximately 4 feet of hose retracted onto the store reel and during hose retraction until the drogue is fully retracted.

Drogue Switch

The drogue switch is a two-position toggle switch with positions placarded RET and EXT. The EXT position extends the drogue and the RET position retracts the drogue. The hose is automatically snubbed for the last several feet of extension and retraction.

Transfer Switch

The transfer switch is a two-position switch with positions placarded TRANS and OFF. The TRANS position opens a control valve which permits the hydraulically driven fuel pump to operate. The TRANS position of the switch contains a holding relay and will not stay in the TRANS position unless the master switch is ON and the refueling store contains enough fuel to close a float switch. The fuel pump will not operate unless the hose is reeled in at least 2 feet. This feature stops fuel transfer prior to disengagement. The OFF position of the switch shuts off the pump.

Ship Tank Switch

The SHIP TANK switch on the lower right corner of the panel is a three-position toggle switch with positions placarded TO STORE, OFF, and FROM STORE. The TO STORE position energizes the fuel transfer-and-dump pumps, which pump fuel from the forward and aft fuselage cells to the centerline refueling store. The pump in the aft fuselage cell is powered by the primary 115 V ac bus, and the pump in the forward tank is powered by the monitored 115 V ac bus. The OFF position closes a shutoff valve, which prevents fuel flow to or from the store or drop tank. The FROM STORE position pressurizes the centerline refueling store tank to 25 PSI and forces the fuel to flow to the forward fuselage cell.

WARNING

Ensure the SHIP TANK switch is OFF prior to engine shutdown or disconnecting electrical power to prevent backflow of fuel from fuselage to air-refueling store during ground fueling operations.

Note

- Normal transfer to the tanker fuselage fuel cells from the centerline refueling store will not occur unless the SHIP TANK switch is placed in the FROM STORE position.
- The centerline refueling store will not accept fuel unless the SHIP TANK switch is placed to the TO STORE position.
- When air-refueling is completed, the FUEL READY switch must be returned to the OFF position to pressurize the wing and drop tanks for fuel transfer.

NEW

Dump Light

The DUMP light will be lit when the SHIP TANK switch is in the FROM STORE position and the air-refueling store is other than empty.

Light Switch

The light switch determines the brightness of the amber and green lights at the aft end of the refueling store and the amber lights on the aft of stations one and five pylons. The switch has two positions: BRT for daylight refueling, and DIM for night. With the switch on DIM, these lights will not normally be visible during daylight.

Hose Jettison Switch

The hose jettison switch, marked NORM and CUT, is provided to cut and crimp the store hose if a store malfunction prevents drogue retraction. It also removes all electrical power from the store controls except the SHIP TANK switch. The hose jettison switch must be kept in the NORM position at all times unless jettisoning of the hose and drogue is required during an in-flight emergency. To move the hose jettison switch to CUT, first hold back the spring-loaded channel guard, then lift the switch from its spring-loaded safety position. Ensure that this switch is in the NORM position before electrical power is applied.

WARNING

Once the CUT position has been selected, do not return it to the NORM position, as the turbine will unfeather and cause the hose to be pulled from the guillotine crimper, spilling fuel in the store and creating a fire hazard.

NEW

Refer to Section IV for additional store operation procedures and limitations.

AIR DATA COMPUTER (ADC)

Aerodynamic data relating to aircraft altitude, airspeed, and the atmosphere surrounding it are gathered from the aircraft pitot-static system and the total-temperature probe and processed in the air data computer. The ADC provides true airspeed to the ASN-41 navigation computer for computation of windspeed and direction. The ADC provides outputs of aircraft altitude, static pressure, mach number, and impact pressure to the automatic flight control system. The ADC also has an AIMS altitude reporting capability.

DOPPLER RADAR NAVIGATION SET AN/APN-153(V)

Doppler Radar Navigation Set AN/APN-153(V) is an all-weather, self-contained airborne system. It automatically and continuously computes aircraft groundspeed and drift angle, completely independent of ground situations and wind estimates. The only auxiliary input this system requires is from the aircraft attitude reference system.

Doppler-derived groundspeed and drift angle are fed to the navigation computer, where they are resolved into wind direction and velocity.

The Doppler radar navigation set consists of three major functional units: a control panel, a receiver-transmitter, an antenna assembly. The set uses a four-beam, pulsed transmission. It beams signals to the ground, receives echoes, and measures the frequency shift produced by the relative motion between the aircraft and the earth. The frequency shift drives the antenna in azimuth until the antenna is aligned with the aircraft's track. The drift angle indication is the resultant angle between the antenna axis and the aircraft axis. Once the antenna is aligned with the ground track of the aircraft, the measured frequency shift is used to derive groundspeed.

When the Doppler radar is energized, it is in either a normal mode or in a memory mode. In the normal mode, groundspeed and drift angle are measured automatically and simultaneously. In the memory mode, the MEMORY light is on and the last derived groundspeed and drift angle are retained until the radar can again acquire a usable signal, or the equipment is turned OFF.

Note

When the Doppler is in memory, the navigation computer uses the last valid wind information derived from the Doppler, and rejects erroneous Doppler inputs.

Doppler antenna stabilization power is provided by 28 V dc through the AUTOPILOT circuit breaker on the observer's circuit breaker panel.

Operating characteristics of the Doppler are:

Minimum Altitude:	40 feet above terrain
Maximum Altitude:	50,000 feet
Groundspeed:	80-800 knots
Drift Angle:	24° left or right
Pitch Stabilization:	17° nose up to 25° nose down
Roll Stabilization:	30°
Transmitter Frequency:	13,325 MHz ± 50 MHz
Pulse Repetition Frequency:	75 kHz nominal, modulated from 60 kHz

DOPPLER RADAR CONTROL PANEL

The Doppler radar control panel (figure 8-85) on the center console contains all of the APN-153 operating controls. The panel contains the groundspeed and drift indicator and the controls for operating over land or sea. A self-test function is also provided.

Figure 8-85

Mode Switch

The mode switch is a five-position rotary switch placarded OFF-STBY-ON LAND-ON SEA-TEST. When the switch is in the OFF position, all power is removed from the radar navigation set. Placing the switch to STBY applies all power except magnetron high voltage. The ON LAND and ON SEA positions place the equipment in operation for the type of surface below the aircraft. The ON SEA position applies a constant (k) factor to correct for the absorption of radar energy by water. The TEST position is used for self-test purposes and inserts a simulated Doppler signal of 121 knots and 0° drift angle.

Memory Indicator Light

The memory indicator light is an amber press-to-test light, which comes on when the mode selector is in the STBY position or when the system is operating in memory. A memory signal is also supplied to the navigation computer.

The MEMORY light will come on under the following conditions:

1. Before a signal has been acquired on initial turn on.
2. Operation over extremely rough terrain.
3. Operation over glassy smooth water.
4. When the signal is lost due to the aircraft maneuvering beyond the pitch and roll limits of the Doppler antenna.
5. When a cooler or power failure has occurred.
6. When the AC circuit breaker on the observer's CB panel pops or is pulled.

Groundspeed/Drift Angle Indicator

The groundspeed/drift angle indicator consists of a needle placarded DRIFT L and R marked in 2° increments to 40 (degrees), and a window placarded GND SPEED - KNOTS. Aircraft groundspeed and drift angles are read directly.

Note

Due to the physical antenna installation, drift readings are limited to 25° left or right (except in test).

Groundspeed/Drift Angle Knobs

The groundspeed (GS) and drift angle (DA) manual control knobs are used to manually set in values used in self-test of the equipment. The knobs must be depressed in order to change the values on the indicator. Values can be changed only when the set is in memory or off.

Note

Since Doppler information is rejected by the navigation computer whenever the Doppler is in the memory mode or OFF, manual insertion of groundspeed and drift is useful only when performing self-test.

PREFLIGHT CHECK

1. Set mode selector on control indicator to STBY.
2. Using DA (drift angle) knob, set DRIFT needle on the indicator to 20° L or R.
3. Using GS (groundspeed) knob, set groundspeed to 350 knots.

After 5-minute warmup

4. Turn mode selector to TEST position.
5. Within 35 seconds (maximum), GRD SPEED window shall read 121±5 knots and DRIFT arrow shall indicate 0±2°.
6. Return mode selector to STBY.

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NAVIGATION COMPUTER AN/ASN-41

The AN/ASN-41 navigation computer is an airborne analog dead-reckoning computer, which continuously and automatically computes and displays aircraft present position in latitude and longitude. Range and bearing to either of two destinations or target points are furnished as outputs to the HSI. If the range is less than 200 nautical miles, rhumbline computations are used. For distances between 200 miles and the maximum range of the computer, which is 2000 miles, great circle computations are used. The navigation computer also provides a display of wind direction and velocity based on Doppler drift angle and groundspeed. If Doppler is OFF or in the memory mode, windspeed and direction can be manually set into the computer. Computed present position may be corrected manually using TACAN information or an easily identified ground checkpoint.

The navigation computer receives inputs from the air data computer, the Doppler radar, and the MA-1 compass. Outputs are sent to the HSI.

The computer operates in either normal or airmass mode. Operation is in the normal mode except when there is a loss of Doppler data. When Doppler data is lost, the last computer wind is remembered and used until the Doppler signal returns or the pilot inserts corrected wind information manually.

The computer contains self-test capabilities for ground checks of computer reliability.

NAVIGATION COMPUTER CONTROL PANEL

The navigation computer control panel (figure 8-86) contains the operating controls for the ASN-41 and indicators to display present position and destination coordinates, magnetic variation, and windspeed and direction.

Present Position Counters and Knobs

The present position counters continually display present position latitude and longitude coordinates. The present position knobs are pushed in and rotated to manually update latitude and longitude. The counters also indicate whether latitude is north or south (N-S) and whether longitude is east or west (E-W).

Destination Counters and Knobs

Destination counters display latitude and longitude coordinates of the destination selected by the function selector switch (D1 or D2). The large destination knobs when rotated set the counters electrically if the function selector switch is in STBY, D1, or D2. Speed of slaving is in proportion to the amount of knob rotation. The small destination knobs when pushed in and rotated mechanically set the counters if the function selector switch is in STBY. The counters also indicate whether latitude is north or south (N-S) and whether longitude is east or west (E-W).

Wind Counters and Knobs

The wind counters display wind direction in degrees and wind velocity in knots.

When the Doppler radar is not in memory, the values displayed are based on inputs of groundspeed and drift angle from the Doppler and true airspeed from the air data computer. When the Doppler is OFF, or in memory, the wind computation is based upon the wind direction and velocity present on the wind counters. This value reflects the Doppler groundspeed and drift angle, and TAS at the time the Doppler went into memory mode or was turned OFF. With the Doppler OFF or in memory, the wind dials can be manually set.

Wind velocity and direction presented on the wind counters are used to correct present position information. When the Doppler is working, the winds will be computed from the Doppler groundspeed and drift. When the Doppler is inoperative or in memory for extended periods of time, the wind must be inserted manually based upon the best information available.

Magnetic Variation Counter and Knob

The counter, placarded VAR, displays manually inserted magnetic variation value, to tenths of a degree, and can be set for E (east) or W (west) variation.

Function Selector Switch

The function selector switch is a five-position rotary selector, placarded TEST, OFF, STBY, D1, and D2. In the OFF position, no power is supplied to the system and the counters may be set for the desired mission. In the STBY position, power is applied to the navigation computer and destination one (D1), as displayed on the counters is stored in the computer. When the function selector switch is in the D1 or D2 position, course and distance information to destination 1 or 2 is displayed on the HSI when the HSI MODE switch is in the NAV COMP position. The TEST position inserts fixed inputs into the navigation computer to provide a definite problem. The solution is displayed on the computer control panel counters and the HSI for checking computer operation and accuracy.

NORMAL OPERATION

Normal in-flight operation provides a continuous dead-reckoning update of aircraft POSITION coordinates and steering information to a selected destination. The following procedure is for normal operation of the ASN-41 navigational computer.

Perform the following before takeoff:

1. HSI mode switch - NAV COMP

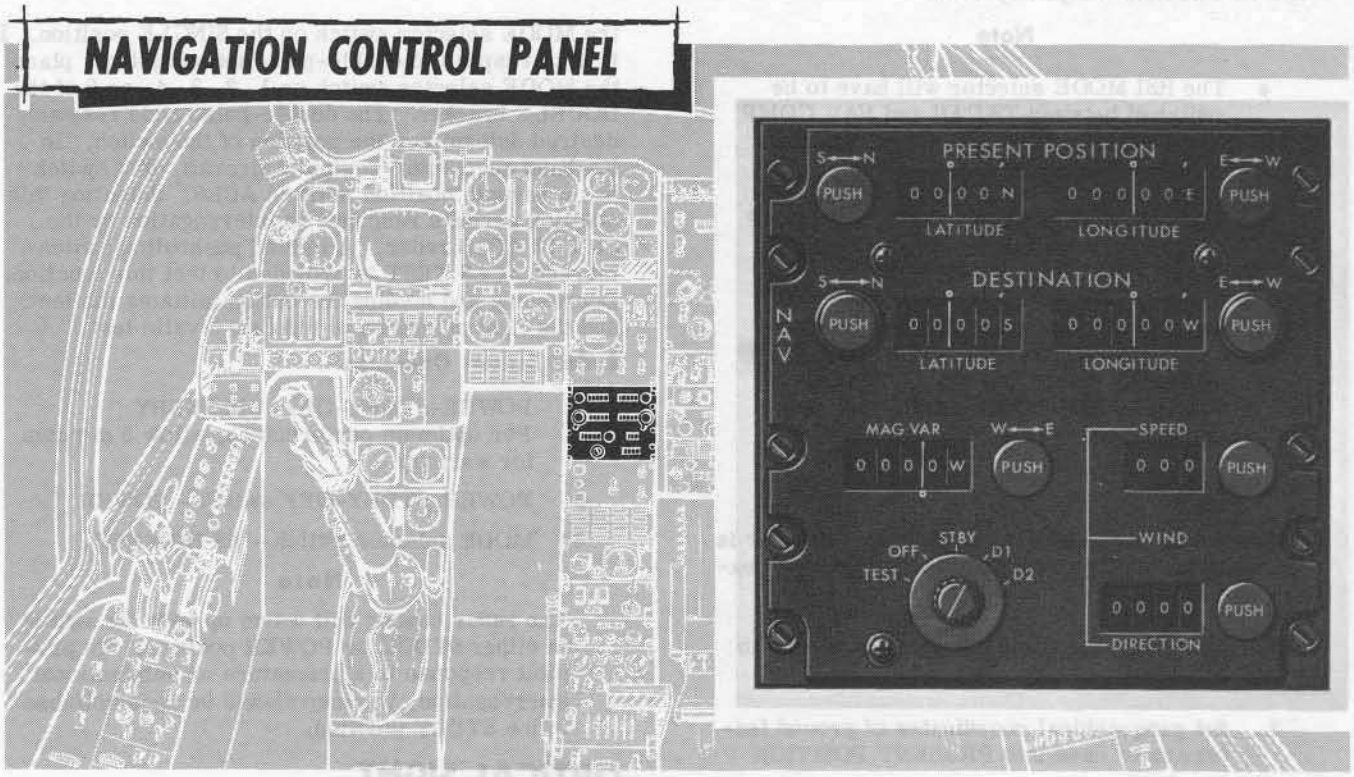

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Figure 8-86

2. Function selector switch - TEST

   Windspeed . . . . . .231±3 Knots
   Wind Direction . . . . . 91° ±1°
   Present Position
     Latitude . . . . . South Integration
   Present Position
     Longitude . . . . . East Integration
   HSI Bearing Pointer
     No. 2 . . . . . 30° Right

3. Function Selector switch - D2
   Set destination 2 latitude and longitude

4. Function selector switch - D1
   Set destination 1 latitude and longitude

5. Function selector switch - STBY

6. Magnetic variation - SET
   Set magnetic variation to local value

7. Windspeed and direction - SET
   Set surface windspeed and direction

8. Present position latitude and longitude - SET

Note

For range and bearing to be displayed on the HSI, the HSI mode selector switch must be in the NAV COMP position.

TACAN Update

A method of navigation computer update involves using TACAN radial (bearing) and DME range. TACAN update can be accomplished by the pilot using the HSI in TACAN and NAV COMP.

NAV COMP-TACAN Comparison (HSI)

1. The coordinates of the TACAN station are set into the destination counters on the ASN-41 panel with the function selector switch in D1 or D2.

2. The HSI MODE selector is set to TACAN and the range and bearing are noted.

3. The HSI MODE selector is set to NAV COMP and the PRESENT POSITION set knobs are adjusted to make the ranges and bearings coincide.

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Note

- The HSI MODE selector will have to be switched between TACAN and NAV COMP a few times and the procedure repeated to achieve accuracy.
- TACAN range is slant range; NAV COMP range is ground range. TACAN bearing is MAG; NAV COMP is TRUE.
- Slant range vs ground range differences for TACAN stations beyond 20 NMI are extremely small. At FL 30, TACAN station 20 NMI from aircraft, the range error is approximately 1/2 NMI.

Visual Update

Visual update of the ASN-41 navigation computer is accomplished using an easily identified ground feature as follows:

1. Set navigation computer function switch to STBY.
2. Set geographical coordinates of ground feature to be used into PRESENT POSITION counters.
3. Fly aircraft to position it directly over ground feature and place function switch to either D1 or D2.

RADAR BEACON AN/APN-154(V)

The radar beacon is used with X-band ship-or ground-based radar to extend the radar tracking range of the ground station and to assist in determining the range and location of the aircraft. The ground-based radar transmits a coded interrogating signal; the radar beacon receives the interrogation, decodes the signal, and transmits replies to the ground-based radar. Aircraft incorporating AFC 161 have a Ka-band augmenter receiver to permit replies to SPN-42 ACLS radar.

RADAR BEACON CONTROL PANEL

The radar beacon control panel, which is on the observer's instrument panel (figure 8-87) controls the operation of the radar beacon.

POWER STBY-OFF Switch

This three-position switch provides power for radar beacon operation. The STDBY position places the equipment in a standby condition but does not permit the transponder to reply to interrogation. The POWER position places the beacon in full operation. The OFF position turns off all power to the equipment.

Mode Selector Switch

This six-position rotary switch selects the function to be performed by the transponder. If the radar beacon is to respond to a single-pulse interrogation, place the MODE selector switch on the SINGLE position. If it is to respond to double-pulse interrogation, place the MODE selector switch on 1, 2, 3, 4, or 5 of the DOUBLE bracket. The double-pulse code response desired determines the position of the switch. In Ka-band augmenter-equipped aircraft, this switch has a seventh position marked ACLS. Selecting this position permits response to interrogation by the SPN-42 ACLS radar. A lighted pushbutton switch marked ACLS TEST is provided to test this function. Depressing and holding the button initiates the test, and the light comes on to indicate a valid test.

Radar Beacon Operation

1. POWER-STDBY-OFF switch STBY
   For optimum performance, allow 5 minutes for warmup.
2. POWER-STDBY-OFF switch - POWER.
3. MODE selector switch - AS BRIEFED.

Note

The radar beacon will warm up with the switch in either STDBY or POWER position. To prohibit response to a premature or unintentional interrogation, warmup should be accomplished in the STDBY position.

OPTICAL SIGHT

The lead-computing optical sight (figure 8-89) is located above the VDI and is positioned parallel with the aircraft armament datum line. The optical sight provides the pilot with accurate steering information regarding target lead angle which will enable him to release a weapon at the precise time and heading. The primary function of the optical sight is accomplished by projecting optical displays on a reflector in the pilot's field of vision (figure 8-89). These displays include a fixed reticle and movable reticle. The functions available to the sighthead are adjusted by controls located on the optical sight control panel on the pilot's left console, and on the sighthead itself.

RETICLES AND DISPLAYS

The reticles and displays are illustrated in figure 8-89.

Fixed Reticles

The fixed reticle display is permanently aligned with the armament datum line (ADL) of the aircraft and reflected into the pilot's field of view. The reticle forming this display consists of a cross with a center dot and two dashed, concentric semicircular arcs spaced 50 mils apart. Additional dots, spaced at 10-mil increments, are located directly between and beneath the semiciccular arcs. With masking, the fixed image reticle appears as the cross and dot without dashed semicircular arcs and dots. The mask may be removed so that the arcs and dots can be used for lead angle calculations.

Movable Reticle

The image reflected to the pilot's field of vision consists of a dashed cross and dot. To release a weapon at the proper heading, the pilot must maintain an aircraft heading such that the movable reticle is

Figure 8-87

superimposed upon the fixed reticle. Position of the movable reticle in elevation is relative to the aircraft ADL for the weapon being delivered. Elevation of the movable reticle is adjusted by using the elevation thumbwheel on the sight-head.

SIGHTHEAD OPERATING CONTROLS

The mask control and elevation thumbwheel are the only controls on the sighthead that are used in normal flight operation. All remaining operational controls are located on the optical sight panel on the pilot's left console.

Mask Control

This control is a lever mechanically coupled to a hinged mask that covers the concentric arcs on the lower portion of the fixed reticle. When the mask control is placed in the OUT position, the fixed reticle concentric arcs are projected in the pilot's view to enable him to determine lead angle. When the mask control is in the IN position, the mask effectively covers all the fixed reticle except the cross and dot center.

Elevation Thumbwheel

The elevation thumbwheel is a calibrated control. Operation of the thumbwheel controls the position of the movable reticle in elevation. The dial of the thumbwheel is calibrated in 350 mils of elevation down (approximately 20°) and 88 mils up (approximately 5°) and numbered in divisions of MILS X 10. The dial and identification plate are edge-lighted to facilitate reading and locating the control. The intensity of dial lighting is controlled by the aircraft console lights dimmer control.

SIGHT RETICLE CONTROL PANEL

The sight reticle control panel (figure 8-88) is on the pilot's left console.

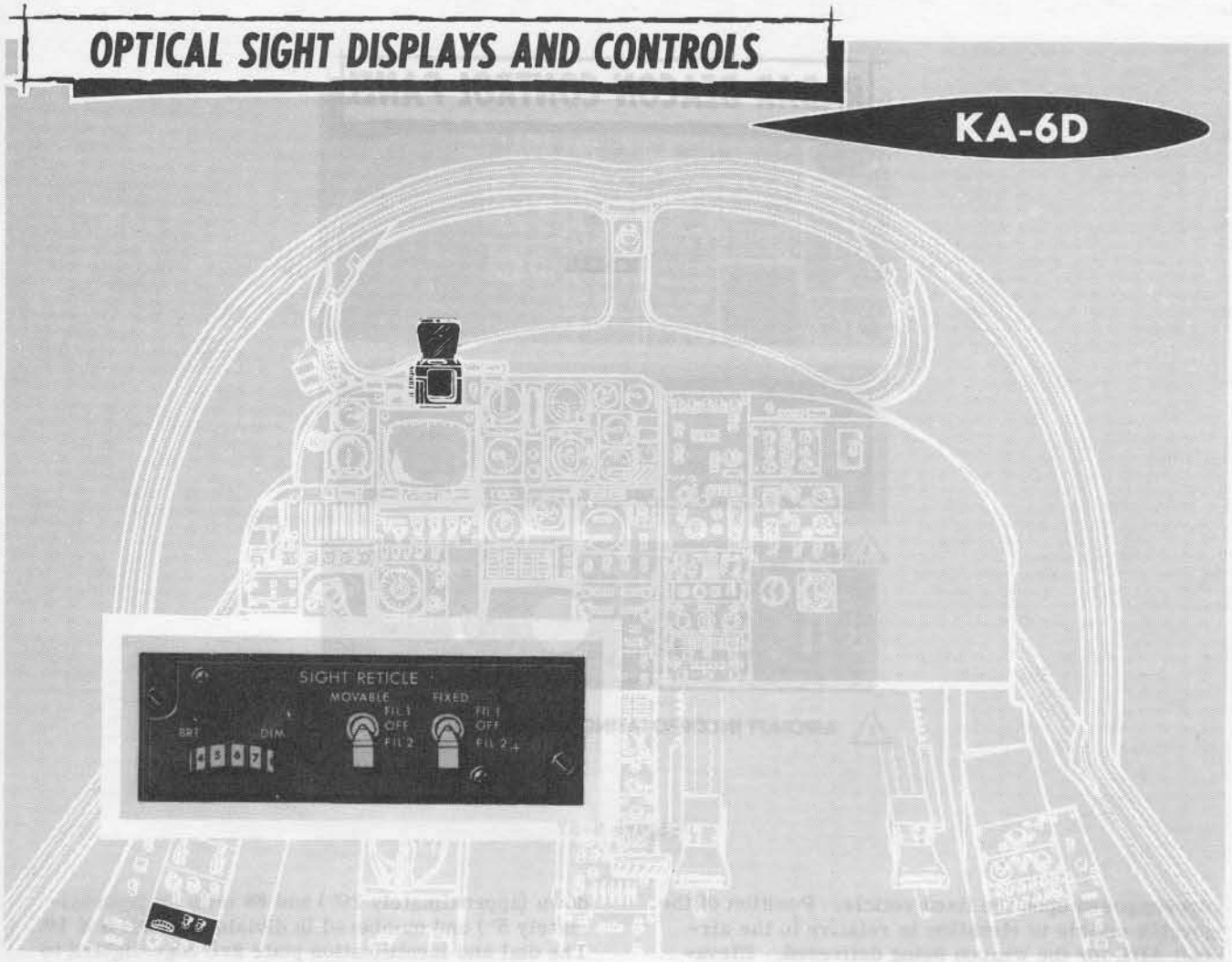
Reticle Control

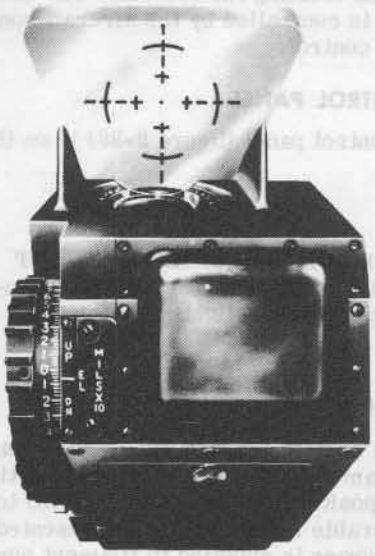
The reticle thumbwheel is marked RETICLE-BRT and DIM. Positioning of this control adjusts the intensity of the sighthead reticle lighting to the level desired by the pilot.

Movable Reticle Switch

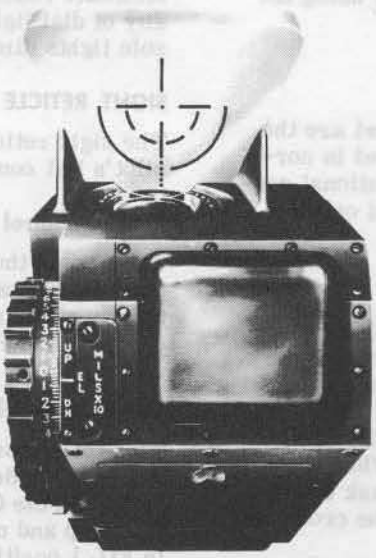
This three-position switch, marked FIL 1, OFF, and FIL 2, provides filament power to the movable reticle lamp. In the OFF position, no power is supplied to the lamp and no movable reticle image is presented. In FIL 1 position, power is supplied to filament number one of the movable reticle lamps and the image is deflected to the sighthead. The FIL 2 position of the switch provides for a second filament circuit in the movable reticle lamp in the event of damage to the FIL 1 circuit. This provides a secondary means of lighting the movable reticle.

OPTICAL SIGHT DISPLAYS AND CONTROLS





MOVABLE IMAGE RETICLE



FIXED IMAGE RETICLE (UNMASKED)

FIXED IMAGE RETICLE (MASKED)

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Figure 8-88

Fixed Reticle Switch

This three-position switch, marked FIL 1, OFF, and FIL 2, provides filament power to the fixed reticle lamp. In the OFF position, no power is supplied to the lamp and no fixed reticle image is presented. In FIL 1 position, power is supplied to filament number one of the fixed reticle lamp and the image is reflected. The FIL 2 position of the switch, power is supplied to the second filament circuit in the fixed reticle lamp in the event of damage to the FIL 1 circuit. This provides a secondary means of lighting the fixed reticle.

WEAPON RELEASE SYSTEM

The aircraft weapon release system is capable of transporting and delivering a variety of conventional weapons (bombs, rockets, and missiles) and nuclear weapons against air and surface targets. The system consists of cockpit controls and indicators, mounting facilities at five external store stations, and associated electrical wiring. The release system controls are completely electrical and allow the pilot and observer to arm and release various weapons, fire rockets and missiles, and to jettison weapons selectively or simultaneously.

The emergency store jettison button provides for simultaneous jettison of all five stores stations.

WEAPON RELEASE

The release system provides salvo, train, and step release of weapons from five external store stations in either an automatic or manual mode of operation.

Conventional weapons are carried at the five external store stations. Left wing outboard, left wing inboard, fuselage centerline, right wing inboard, and right wing outboard, (stations 1 through 5). Nuclear weapons are carried at three stations (2, 3, and 4) only. Each store station accepts the Aero 7A ejector rack to support, release, and jettison weapons. The Aero 7B may be carried on the fuselage centerline station.

WEAPON MOUNTING

AERO 7A and AERO 7B Ejector Racks

The ejector rack provides suspension and release capabilities for conventional weapons and nuclear stores. The rack is a cartridge-actuated, electrically triggered assembly and may be attached to all five stations. Either of two sets of tandem hooks on the rack suspend the weapon. In additional to electrical release, the rack hooks may be opened manually for loading or other ground operation. As a safety device, a safety pin is provided to prevent accidental electrical ground release. The rack is limited to 3,340 pounds on stations 1 through 5.

ARMAMENT CONTROL PANEL

The ARMAMENT control panel (figure 8-89) on the observer's instrument panel provides the controls for selecting the modes of weapon release and arming.

Master Armament Switch

The MASTER ARM switch (figure 8-89) is a three-position, lever-lock toggle switch used to control the power necessary for operational release and selective jettison of conventional nuclear stores. With the switch OFF, no electrical power is available to the normal release circuitry. With the landing gear up and locked, placing the switch ON allows electrical power to be supplied to the store release circuitry.

The third switch position is placarded PRAC (practice) and is used to simulate actual arming during practice missions. When the switch is positioned to PRAC, the normal mission data will be presented to the pilot and observer as if an actual release were to be made. However, the release pulse generated by the system is restricted from the racks, and the weapon cannot be dropped.

A locking assembly, which can be safety-wired in position, prevents inadvertent operation of the MASTER ARM switch. The locking assembly must be pulled out and rotated 90° clockwise or counterclockwise before the MASTER ARM switch is free to be placed to the ON or PRAC position.

Station Select Switches

Five three-position, lever-lock toggle switches are used to select a weapon release from its corresponding stores station. The three switch positions are BOMBS, OFF, and ROCKETS/GUNS. The proper position must be selected for the ordnance loaded (bombs or rockets) in order to release the weapon. If OFF is selected, no weapon will be released from that station using normal release.

Nuclear weapons are carried only on stations 2, 3, and 4, and only the corresponding station select switches are used when nuclear weapons are carried.

As a safety feature, the locking assemblies of the switches can be safety wired, to prevent inadvertent operation. Before a switch can be moved to either position, the outer ring must be pulled out and rotated 90° clockwise or counterclockwise, depending on the ordnance selected.

ATTACK Switch

The ATTACK switch is a three-position switch placarded LAB IP, MAN, and RESET. Placing the switch in LAB IP allows the store to be automatically released when the proper release point is reached. During LAB IP, when a release angle of 0° to 90° is reached, the store is automatically released provided

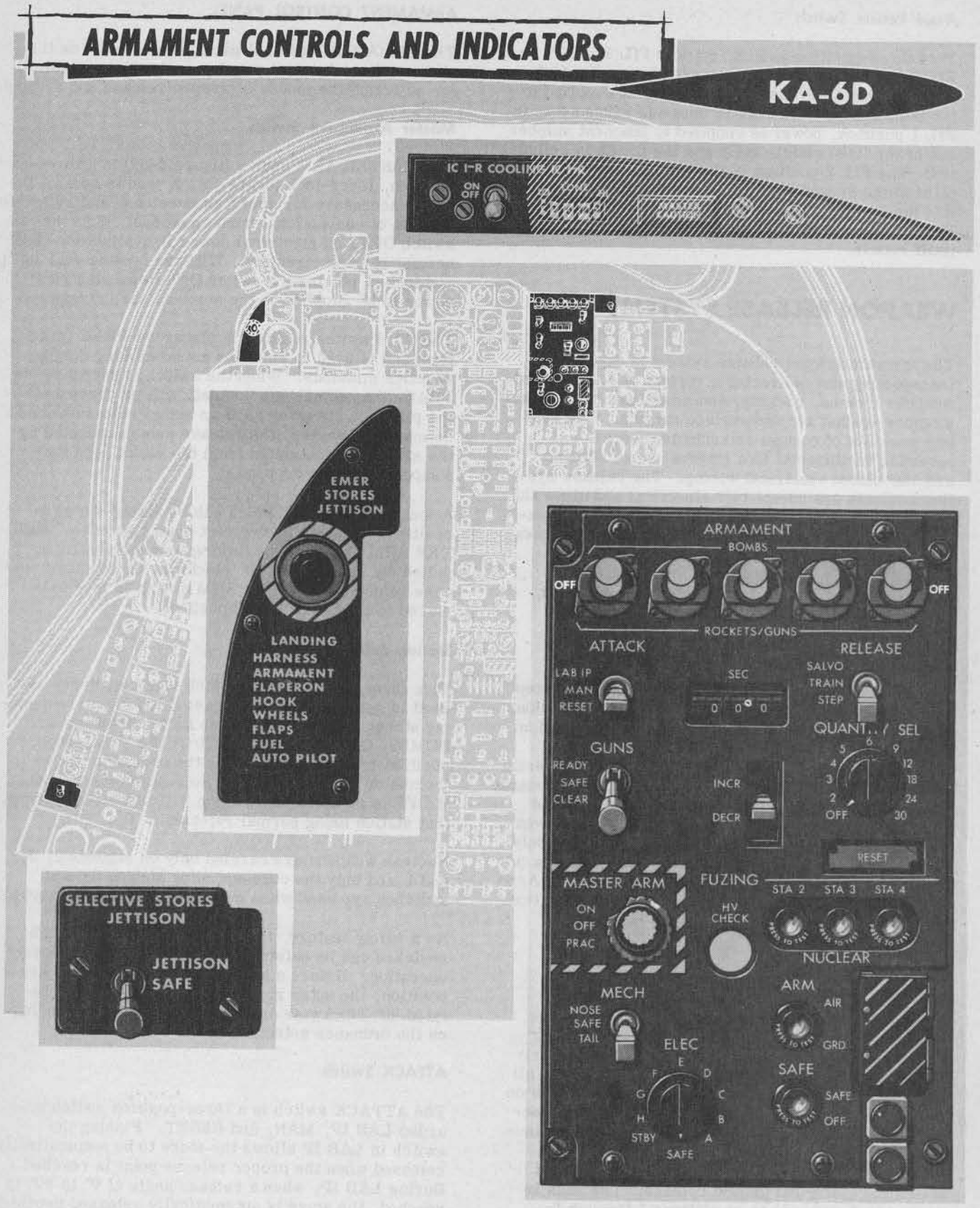

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Figure 8-89

the pilot's attack commit trigger is depressed and the station select and MASTER ARM switches have been positioned. Placing the switch to MAN permits the pilot to release the stores manually by depressing the manual release button on the control stick grip. The RESET position causes the weapon release relay to be reset for a new release cycle.

Release Switch

This three-position toggle switch marked SALVO, TRAIN, and STEP provides three modes of multiple weapon release. In the SALVO position, all weapons selected are released in salvo. In the TRAIN position, sequential firing of weapons in 1, 5, 2, 4, 3 order is based upon the presetermined rate set in the intervalometer timer window. The STEP position allows sequential release of a selected weapons at a manual rate, one from each station in 1, 5, 2, 4, 3 order.

Multiple Release QUANTITY SEL Switch

The multiple-release rotary quantity selector switch is used to select the number of release pulses to be emitted by the ordnance intervalometer. Rotating the switch to a quantity selects the number of release pulses to be emitted. When a manual or automatic release is initiated with TRAIN selected on the SALVO/TRAIN/STEP switch, one pulse will be directed to each selected station in 1, 5, 2, 4, 3 sequence with the sequence repeated until the selected quantity of pulses has been completed. When a manual or automatic release is initiated with SALVO selected on the SALVO/TRAIN/STEP switch, a series of release pulses is directed simultaneously to all selected stations until the selected quantity of pulses has been completed. The system will be reset automatically after each cycle of release pulses and the RESET light next to the multiple-release switch will go on. Positions are provided to select 2, 3, 4, 5, 6, 9, 12, 18, 24, or 30 release pulses.

RESET Light

The RESET light goes on when the number of release pulses selected on the multiple-release quantity selector switch has been completed and the system has been reset. The light will go out while releasing and will come on again following the release cycle. With the MASTER ARM switch on, if the light does not come on and remain on when not releasing, the system must be reset with the attack switch.

Ordnance Intervalometer

The ordnance intervalometer consists of the counter, the slew switch, and transistorized circuitry. The readout counter is a three-digit rotating drum type with a range from 000 to 999. The counter is set by a momentary five-position slew switch spring-loaded to the off (center) position and marked INCR (up) and DECR (down). Holding the switch in either extreme off-center position causes the counter to move at a fast rate. The two intermediate positions provide a slower slew speed. Two modes of operation are available. For train release operation, the counter can be set to the nearest hundredth of a second; for LAB IP release, to the nearest tenth of a second. To accommodate this difference in counter readout, a decimal point shift occurs when the mode is changed.

With the RELEASE switch in the TRAIN position, the counter is used to select the interval in seconds between succeeding pulses in a train of five pulses. The intervalometer has a range of from 0.06 to 2.00 seconds in 0.01-second steps. If the counter is set to a value outside this range, the intervals produced by the intervalometer will be at the nearest limit. Setting the release switch to TRAIN allows the release signal (manual or automatic) to trigger the intervalometer. Once triggered, the intervalometer produces five release pulses, which are directed to the selected store stations in 1, 5, 2, 4, 3 order. Five stations must be selected for all five release pulses to be used.

With the ATTACK switch in LAB IP, the counter is used to set LAB IP timing. The counter can be set from 0.00 seconds to 99.0 seconds in 00.1-second steps. When triggered by the pilot, the counter returns to zero at a real time rate.

When the multiple-release switch is in a position other than OFF, the intervalometer will, when triggered by a release signal, emit the number of release pulses selected on the multiple-release QUANTITY SEL switch. The system will be automatically reset at the end of each release cycle and the RESET indicator will light.

Gun Switch

The gun switch is a three-position toggle switch marked READY/SAFE/CLEAR and is presently inoperative.

Fuzing CONTROLS

The fuzing control on the armament control panel contains the fuze function control and the T-375 monitor control system controls. The fuze function control system is used to arm conventional weapons, and consists of a fuze function power supply and electrical wiring to the five inboard stations. The T-375 monitor control system monitors and controls the arming and disarming of the nuclear stores. The system consists of the required cockpit controls and indicators and associated electrical wiring to the nuclear stores, which can be loaded only at stations 2, 3, and 4.

Mechanical Fuzing Switch

The mechanical fuzing switch (MECH) is a three-position toggle switch marked NOSE, TAIL, and SAFE, and controls nose and tail arming of conventional weapons. Placing the switch to NOSE energizes both the nose and tail solenoids in the bomb racks so as to retain the arming wires that in turn are attached to the nose and tail mechanical fuzes of the weapon. With the switch placed to TAIL, only the tail solenoid is energized. Placing the switch to SAFE will cause neither solenoid to be energized.

Should a weapon be released with the switch in the SAFE position, both arming wires will fall free of the bomb rack, still attached to the weapons, thus preventing arming of either mechanical fuze.

AN/AWW-1 CONTROLS

Electrical Fuzing Switch

The electrical fuzing switch is a ten-position rotary switch placarded ELEC with positions marked SAFE, STBY, A, B, C, D, E, F, G, and H. With the switch placed at SAFE, no electrical power is available to the system. The STBY position prepares the arming switches for use. Positions A thru H are used to select one of 18 arming and impact delay combinations for charging both dc and rf type fuzes.

The combinations used will be determined by fuzing templates installed in the fuze function control set in the aft equipment bay. Positions A through D are used to provide the options for charging rf type fuzes. Positions E through H are used to provide the options for charging dc type fuzes.

Note

- For salvo release of electrically fuzed bombs, the reliability of electric fuzing diminishes with an increased number of bombs released. Inherent limitations of the AN/AWW-1 fuzing may result in duds during salvo release.
- Oscillator plug-in units and the retaining fuzing templates of Fuze Function Control Set AN/AWW-1 should be removed from the aircraft when it is intended to employ electric fuzes only in the dc modes. This will prevent inadvertent selection of any available rf modes, resulting in possibly hazardous change in arming and/or functioning time.
- In aircraft incorporating AAC No. 592, the rf fuzing capability has been permanently removed, and the fuze function control set has been redesignated AN/AWW-8.

HIGH VOLTAGE CHECK BUTTON/LIGHT

The high-voltage dc check button and light marked HV CHECK is used to check the electrical continuity of the entire weapon fuzing system prior to a mission and weapon release.

T-375 CONTROLS

Nuclear Select Buttons

Four pushbuttons, OFF, SAFE, GND, and AIR control arming and safing of the special stores and allows for selection of either a ground (GND) or AIR burst.

Depressing the SAFE button releases the OFF button and directs 28-volt dc electrical power to the special store fuzing circuits. The normal off condition of corresponding station disagreement lights indicates that all stores are safe to carry or return, or are ready to be armed.

CAUTION

Never go directly from OFF to AIR or GND. The SAFE button must be depressed for a period of 10 seconds (safe light lit).

A locking assembly over the GND and AIR buttons serves as a safety device and prevents inadvertent arming of the special stores. To arm the stores, the locking pins must first be compressed, and the guard over the pushbuttons lifted. The nuclear stores being carried may now be armed by depressing either the GND or AIR button, depending upon the desired type of burst.

WARNING

- Do not depress the AIR or GND buttons under any circumstances when the aircraft is on the ground and nuclear stores are loaded on the aircraft.
- When the AIR or GND buttons are depressed, all nuclear stores being carried on the aircraft will assume an armed condition.

When the SAFE button is again depressed, following arming of the stores, the GND or AIR button is automatically released; the guard over these buttons must be returned to its former position and locked.

Note

The nuclear selector OFF button must be depressed before and during takeoff. Before landing, the OFF button must be depressed.

Safe Light

A press-to-test safe indicating light monitors the T-375 system circuits. The light comes on when the SAFE button is depressed, to indicate that the motorized switch in the aircraft is in the safe position. When the OFF, GND, or AIR button is depressed, the safe light is off.

Note

When the SAFE button is depressed, following arming of the stores, the ARM light will remain lit momentarily. This is normal. The ARM light will go off at completion of the safe operation.

The press-to-test feature of the light checks the indicator for continuity by supplying 28-volt dc electrical power from the essential bus.

ARM Light

A press-to-test ARM indicating light monitors the T-375 system circuits. The light comes on when the GND or AIR button is depressed, indicating that the motorized switch in the T-375 relay module has reached the armed position. With either the OFF or SAFE buttons depressed, the ARM light is off.

Note

When the SAFE button is depressed, following arming of the stores, the ARM light will remain lit momentarily. This is normal. The ARM light will go off at completion of the safing operation.

The press-to-test feature of the ARM light checks it for continuity by supplying 28-volt dc electrical power from the essential bus to the light.

Station Disagreement Lights

The red press-to-test station disagreement lights monitor the store and T-375 system circuits. The numerals 2, 3, and 4 above the lights refer to the respective store locations: left inboard wing, centerline, and right inboard wing station. The disagreement light are designed on the light-off principle. Thus, the normal condition of the store for any setting of the nuclear selector is indicated by the disagreement lights remaining off. If a light comes on, it indicates that the fuze setting of the corresponding store does not agree with the AIR or GND selection of the nuclear selector, or that a malfunction exists. The press-to-test feature of the lights checks them for continuity and monitors internal store circuits.

Note

Depressing the nuclear selector button causes the station disagreement lights to flash momentarily. This is normal.

SIDEWINDER 1C I-R Cooling Switch

The 1C I-R cooling switch on the observer's instrument panel is a two-position toggle switch placarded ON/OFF. When the switch is placed in the ON position, operating power is provided to the 1C I-R cooling system.

SIDEWINDER 1C I-R TONE CONTROL KNOB

The IC I-R TONE control knob on the pilot's left console controls the audio level of the missile tones. The upper and lower limits of the thumbwheel are marked HI and LO, and the tone may be adjusted to a confortable level between these limits.

The tone from the Sidewinder missile is initiated after power has been applied to the missile when a target has been sensed. The Sidewinder tone has a fixed frequency.

Note

- Operation of the 1C I-R TONE control does not affect the frequency (pitch) of the tone, but will increase or decrease the tone volume.
- The MASTER ARM switch must be in the ON or PRAC position in order to hear the missile tone.

STORES JETTISON

Emergency Stores Jettison Button

An emergency stores jettison (EMER STORES JETTISON) button (figure 8-89) on the upper left corner of the pilot's instrument panel provides for emergency, simultaneous jettisoning of all stores. With the aircraft off the ground (weight-on-wheels switch closed), depressing the emergency stores jettison button allows 28-volt dc electrical power to be supplied to the five ejector racks and releases all stores simultaneously.

WARNING

Prior to emergency stores jettison of special stores, ensure that the SAFE button on the fuzing control panel has been depressed (SAFE light on and AIR and GND buttons locked). This prevents the possibility of jettisoning an armed store.

Selective Stores Jettison Switch

A selective stores jettison switch (figure 8-89) on the pilot's left console provides for emergency jettisoning of a particular store or stores, depending upon which station has been selected. Selective jettison is used when a store has not been released through the normal circuits and a potential hazard exists. With the wheels up and locked, MASTER ARM switch ON, and the desired station select placed to SELECT or BOMBS, placing the selective stores jettison switch to JETTISON allows electrical power to be supplied to the ejector rack and release the selected store.

WARNING

Prior to selective jettison of stores, ensure that the SAFE button on the fuzing control panel has been depressed (SAFE light on and AIR and GND buttons locked), and the mechanical nose-tail switch placed to the SAFE position. This prevents the possibility of jettisoning of armed stores.

MANUAL RELEASE BUTTON

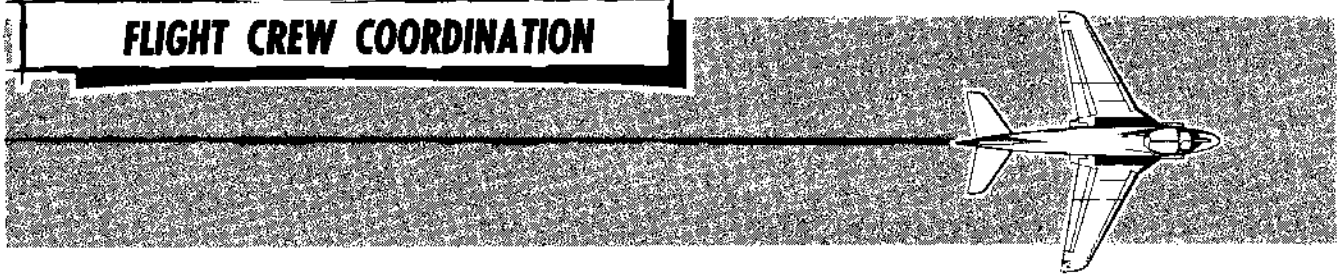
The pilot's manual release button on the control stick grip allows for manual release of stores. During any of the attack modes, with the necessary prerelease procedures accomplished and the ATTACK switch placed to MAN, depressing the manual release button allows electrical power to be supplied to the ejector racks, or launchers in turn, releasing the selected weapons.

ATTACK COMMIT TRIGGER

The attack commit trigger on the pilot's control stick grip is a spring-return type switch and allows the pilot to initiate the attack. With the master arm switch ON, and the landing gear up and locked, depressing the attack commit trigger enables automatic release. During the LAB IP mode, depressing the attack commit trigger initiates the intervalometer timer and completes the release circuitry when at the selected release angle.

section IX

FLIGHT CREW COORDINATION



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PILOT-BOMBARDIER/NAVIGATOR RESPONSIBILITIES

GENERAL

The most successful A-6 crews are those who work together continuously and know each other's reactions, weaknesses, and strengths. The mission commander bears responsibility for mission success, sharing safety of flight responsibilities whether he be the pilot or bombardier/navigator. The pilot is the aircraft commander and is responsible for the safe control of the aircraft throughout its entire mission. The bombardier/navigator should assist the pilot in every way possible, anticipating rather than awaiting, developments. The duties of the pilot-bombardier/navigator team are necessarily integrated, and each must support and contribute to the performance of the other. Each crewmember must share the responsibility of every evolution encountered. In other words, the crew concept is a system of checks and balances and, as such, it is a dual obligation equally shared. The interruption of routine functions is usually caused by an emergency; however, routine habit patterns may be broken through complacency. The assistance of the bombardier/navigator in these instances is of the utmost value, challenging the pilot with the appropriate emergency checklist and monitoring flight performance of the aircraft.

The crew responsibilities are written with the premise that the bombardier/navigator will handle UHF communications throughout the flight; however, it is recommended that prior to takeoff the pilot initiate at least one transmission to check out his communications.

The importance of each crewmember being completely aware of all his responsibilities has to be continuously stressed. Both crewmembers must realize that successful mission accomplishment and safety depends on flight crew coordination.

Note

It is stressed that the crew coordination functions, duties, and responsibilities listed in this section are not meant to be utilized as in-flight checklists.

While frequent reference is made to checklists, and certain important procedures are highlighted, the contents of this section are designed to be utilized as a basis for squadron and unit ground training syllabi. So utilized, this section will enhance the successful and safe completion of each unit's mission through intelligent and proper compliance with all NATOPS procedures and other applicable aviation directives.

To further the strengthening of aircrew integrity, it is imperative that the team concept be employed as early in the training evolution as is practicable. The best balance of talent and experience, divided into permanent pilot-bombardier/navigator teams, will develop the coordination required of a truly professional combat team.

The mission commander shall be responsible for the overall planning and execution of the aircraft mission. He shall be a highly qualified Pilot or Naval Flight Officer, NATOPS qualified and thoroughly trained in the aircraft mission. Mission Commanders shall be designated in writing by the Commanding Officer

It is always preferable to fly the KA-6D with a qualified A-6 bombardier/navigator; however, the cockpit readily lends itself to flight with an observer in the right seat. When the situation is deemed desirable, the pilot shall assume all responsibilities normally performed by the bombardier/navigator and ensure that the observer is thoroughly briefed on all aspects of the flight. If the observer's level or training and experience allow further assumption of bombardier/navigator duties, these shall be performed under the direct supervision of the pilot.

SPECIFIC RESPONSIBILITIES

FLIGHT PLANNING

Mission Commander

1. Responsibile for all phases of the assigned mission and for effectiveness of the flight.

Flight Leader

1. Assist the mission commander in preparing required charts, flight logs, and navigation computations, including fuel planning, checking weather, and NOTAMS, and in completing required flight plans.

Pilot

1. Assist the mission commander/flight leader in preparing required charts, flight logs, and navigation computations, including fuel planning, checking weather, and NOTAMS, and in completing required flight plans.

2. Be prepared to assume flight lead; thus have a thorough understanding of the conduct of the flight.

Bombardier/Navigator

1. Assist the mission commander/flight leader/pilot in preparing required charts, flight logs, and navigation computations, including fuel planning, checking weather, and NOTAMS, and in completing required flight plans.

2. Be prepared to assist the pilot in assuming flight lead; thus have a thorough understanding of the conduct of the flight.

BRIEFING

Mission Commander

1. Responsible for ensuring all crewmembers are briefed on all aspects of the operation and conduct of the flight.

2. Ensure that a briefing guide as outlined in Section III of this manual is utilized.

Flight Leader—Pilot—Bombardier/Navigator

1. Assist the mission commander in preparing required flight or briefing forms and if directed, brief all flight crewmembers on all aspects of the operation and conduct of the flight.

2. When directed, in addition to using the briefing guide as outlined in Section III, brief the following:

   a. Crew coordination in each flight evolution

   b. Command/control of aircraft

   c. Utilization of each weapons system

   d. System degradation

PREFLIGHT

Pilot

1. Check the yellow sheet for flight status, configuration, armament loading, and servicing.

2. Review at least the ten previous B sections for discrepancies noted and corrective actions taken.

3. Responsible for accepting the aircraft assigned.

4. Responsible for preflighting the aircraft assigned IAW this manual, the A-6 NATOPS Pocket Checklist, and the A-6 Tactical Manual.

5. Note any preflight discrepancies and ensure they are logged on the yellow sheet.

6. Calculate the gross weight of the aircraft for catapult launch and compare with the B/N's figures.

Bombardier/Navigator

1. Check the yellow sheet for flight status, configuration, armament loading and servicing.

2. Review at least the ten previous B sections for discrepancies noted and corrective action taken.

3. Conduct a thorough individual preflight of the entire aircraft IAW this manual, the A-6 NATOPS Pocket Checklist, and the A-6 Tactical Manual.

4. Check weapon configuration and security.

5. Note any preflight discrepancies and ensure they are logged on the yellow sheet.

6. Calculate the gross weight of aircraft for catapult launch and compare with the pilot's figures.

PRESTART

Pilot

1. Execute prestart checks IAW this manual and the A-6 NATOPS Pocket Checklist.

2. Receive a clear-to-start signal from the plane captain ensuring security of the aircraft and adjacent area.

3. Inform B/N "Prestart checks complete, ready to start."

Bombardier/Navigator

1. Execute prestart checks IAW this manual and the A-6 NATOPS Pocket Checklist.

2. Ensure starboard engine areas are clear.

3. Acknowledge pilot's "Prestart check" with "Ready to start".

4. Assist the pilot as necessary.

STARTING

Pilot

1. Start engines IAW this manual and the A-6 NATOPS Pocket Checklist.

2. Remain alert for any emergency signals from the ground crew or B/N.

Bombardier/Navigator

1. Notify the pilot of any emergency signals noted from the ground crew or any unusual occurrences observed.

2. Report any circuit breakers that do not remain seated.

3. Observe wings, reporting any movement to the pilot.

4. Alert the pilot of possibility of any foreign object that might be drawn into the compressor.

5. Report any movement of the aircraft to the pilot.

POST START

Pilot

1. Complete all before taxi checks IAW this manual and the A-6 NATOPS Pocket Checklist.

2. Prior to closing the canopy, ensure the canopy rail is area clear and inform B/N "Canopy coming closed." Receive "All Clear" from B/N.

3. Inform B/N when "Ready to Taxi".

Bombardier/Navigator

1. Complete all before taxi checks IAW this manual and the A-6 NATOPS Pocket Checklist.

2. Inform the pilot when INS is aligned and in OPERATE.

3. Inform the pilot on status of all systems.

4. Check UHF and navigation equipment and report any malfunctions to the pilot.

5. Scan instruments and circuit breakers, reporting any discrepancies.

6. Advise the pilot when "Ready for taxi."

7. Call clearance delivery and ground control when directed by the pilot.

TAXI

Pilot

1. After the aircraft has started rolling, check brakes, and report to the B/N.

2. Remain watchful for obstructions and taxi signals and inform the B/N.

3. Check wing clearance.

4. Be alert for calls from ground/tower control concerning taxi information.

Bombardier/Navigator

1. Challenge the pilot on brake check.

2. Monitor taxi speed.

3. Remain watchful for obstructions and taxi signals, relaying to the pilot.

4. Check wing clearance.

5. Be alert for calls from ground/tower control concerning taxi information.

6. Complete weapons system check. (Except KA-6D).

PRETAKEOFF

Pilot

1. Complete pretakeoff checks IAW this manual and the A-6 NATOPS Pocket Checklist.
2. Use challenge and reply system when going over the takeoff checklist.
3. Inform the B/N of acknowledged aircraft gross weight for catapult launch.
4. Complete the takeoff checklist prior to crossing the shuttle aboard ship.
5. ICS- Hot Mike.
6. Inform the B/N when ready for takeoff.

Bombardier/Navigator

1. Complete pretakeoff checks IAW this manual and the A-6 NATOPS Pocket Checklist.
2. Use challenge and reply system when going over the takeoff checklist.
3. Inform the pilot of acknowledged aircraft gross weight for carrier launch.
4. Report visual check of the wing lock indicator pins.
5. Complete the takeoff checklist prior to crossing the shuttle aboard ship.
6. ICS Hot Mike.
7. Maintain hands below the canopy sill while on the catapult.
8. Report "Ready for Takeoff."

TAKEOFF/DEPARTURE

Pilot

1. Relay engine instrument readings to the B/N.
2. Report rolling, saluting, or lights as appropriate, to the B/N.
3. Advise the B/N of any unusual occurrences.
4. Report "Bear Up" and "Flaps Up" to the B/N.
5. Inform the B/N when going from gages to visual or vice versa.
6. Inform the B/N prior to engaging the autopilot.
7. Inform the B/N when changing radio/TACAN/IFF.
8. Confirm headings and altitudes with the B/N.
9. Maintain a lookout doctrine.

Bombardier/Navigator

1. Copy and acknowledge all clearances.
2. Challenge the pilot for engine operation after throttles are advanced to takeoff power. Record engine instrument readings reported by the pilot.
3. During section takeoff, check the wingman's airplane/position.
4. Monitor airspeed and runway remaining.
5. Challenge the pilot on after-takeoff checklist.
6. Monitor instruments, maintain a diligent lookout doctrine.
7. Monitor the published or clearance departure procedures and challenge the pilot on any deviations from prescribed heading or altitude.
8. During IFR departure, inform the pilot when not monitoring gages.

RENDEZVOUS

Pilot

1. Maintain a good lookout doctrine.
2. Ensure the B/N established radio contact, as briefed.
3. Advise the B/N of any signals received from other aircraft or signals to be passed to other aircraft.

Bombardier/Navigator

1. Maintain a good lookout doctrine.
2. Monitor airspeed, angle of bank, altitude.
3. Establish radio contact, as briefed.
4. Confirm all lights BRIGHT/FLASH (if applicable).
5. Monitor closure rate, relative bearing, altitude separation.
6. Advise the pilot of any signals received from other aircraft.
7. Be prepared to give hand signals to other aircraft.

CRUISE AND MISSION

Pilot

1. Maintain a good lookout doctrine.

2. Report fuel switchology, transfer and fuel state to the B/N periodically.

3. Inform the B/N when going from gages to visual or vice versa.

4. Inform the B/N when changing radio/TACAN/IFF.

5. Advise the B/N when engaging AFCS.

6. Be constantly aware of geographical position.

7. Maintain fuel computations, flight log, and frequencies assigned.

Bombardier/Navigator

1. Maintain a good lookout doctrine.

2. Maintain a scan pattern.

3. Challenge the pilot on fuel switchology, transfer, and state periodically.

4. During IFR conditions, inform the pilot when going from gages to visual or vice versa.

5. Be constantly aware of geographical position and bingo distance for alternate/emergency airfields along the route of flight. Be prepared to give an immediate steer to home base.

6. Know winds at operating and bingo profile altitude.

7. Copy all clearances, heading/altitude changes.

8. Maintain fuel computations, flight log, and frequencies assigned.

INSTRUMENT FLIGHT

Pilot

1. Transitioning from VFR to IFR conditions, the pilot should shift completely to the gages prior to entering IFR flight and so inform the B/N.

2. Remain on instruments any time the aircraft is climbing or descending through layers or when in and out of IFR conditions at low altitudes.

3. If experiencing vertigo/disorientation, notify the B/N immediately, stay on gages, and refrain from making any UHF or IFF changes.

4. Inform the B/N any time scan is broken to change an IFF squawk, TACAN channel, radio frequency, or light configuration.

5. Inform the B/N any time a change in heading or altitude will be made.

Bombardier/Navigator

1. Assume all lookout responsibilities any time the pilot is flying instruments, monitor the flight instruments, and advise the pilot in VFR conditions.

2. If the pilot experiences vertigo/disorientation, carefully monitor gages, informing pilot of attitude, altitude, and airspeed. Be prepared to advise the pilot how to maneuver the aircraft back to a wings-level attitude.

3. Inform the pilot when going off the gages or experiencing vertigo/disorientation.

4. Inform the pilot any time prior to changing radio frequencies or TACAN channel.

5. Challenge the pilot if not at assigned altitude or heading.

6. Be particularly aware of attitude, altitude, airspeed, and geographical position at all times.

7. Advise the pilot of bank angle and changes in altitude, airspeed, or heading when flying formation.

8. Utilize radar if installed as appropriate and ensure the weapons system/tanker package is functioning properly. NEW

AIR REFUELING

Pilot

1. Maintain good lookout doctrine.

2. Complete the air-refueling checklist with B/N.

3. Report to the B/N when fuel transfer is complete.

4. After disengagement, stay behind the drogue until all members of the flight are sighted.

5. Complete the post refueling checklist with B/N.

6. Report fuel received or fuel transferred, fuel remaining, and fuel switchology to the B/N. NEW

Bombardier/Navigator

1. Acquire the tanker visually.

2. Keep the pilot informed of azimuth, range, and overtake during joinup.

3. Maintain good lookout doctrine.

4. Complete the air-refueling checklist with the pilot.

5. Insure the amber light is visible prior to commencing approach.

6. Monitor closure rate on and coach the pilot into the drogue if requested.

7. Make required voice reports as briefed.

8. Maintain sharp lookout doctrine while engaged.

9. Monitor heading, airspeed, altitude, reporting variances to pilot while engaged.

10. Advise the pilot of unusual fuel spillage or unsafe probe/drogue conditions.

11. Complete the post refueling checklist with pilot.

12. Challenge the pilot on fuel received or fuel transferred, fuel remaining, and fuel switchology. N E W

AIR COMBAT MANEUVERING

Pilot-Bombardier/Navigator

Delineating the entire realm of aircrew responsibility during ACM is beyond the scope of this manual. Careful preplanning and briefing are necessary to ensure adequate crew coordination prior to any ACM mission. As a minimum, each crewmember must have a constant awareness of the rules of engagement, flight safety, fuel state (including bingo), attitude, and minimum prebriefed base altitude and carry on a continuous supportive commentary.

DESCENT/APPROACH

Pilot

1. Select the type approach to be made with respect to existing weather.

2. Complete the descent/instrument penetration checklist with the B/N.

3. Challenge the B/N on approach plate availability and bingo profile.

4. Monitor UHF communication conducted by the B/N and copy all clearances.

5. When executing a CCA, conform to procedures contained in this manual, CVA/CVA NATOPS manual, and augmenting ship's instructions.

6. Inform the B/N when going from gages to visual or vice versa.

7. Inform the B/N when changing IFF/UHF/TACAN.

8. Confirm headings and altitudes with the B/N.

9. Cross-check the pressure altimeter and radar altimeter with the B/N below 5000 feet.

10. Advise the B/N if the fuel dump switch has been activated/deactivated.

11. Advise the B/N, if experiencing vertigo/disorientation.

Bombardier/Navigator

1. Assist the pilot in his decision to commence the approach with existing weather and the selection of the type approach to be made.

2. Prior to penetration, complete the descent/instrument penetration checklist with the pilot.

3. Update the computer prior to commencing an approach.

4. Conduct UHF communications, being prepared to request, copy, and read back clearance and provide the pilot with any required information.

5. Aid in planning holding/marshal entry and pattern timing.

6. Monitor altitude, attitude, airspeed during holding, penetration, and approach.

7. Monitor appropriate approach plate, advising the pilot of heading changes and altitudes prescribed on the approach plate.

8. When executing a CCA, monitor the procedures of this manual, CVA/CVS NATOPS Manual, and augmenting ship's instructions.

9. Utilize the radar and computer during CCA prior to landing. (Except KA-6D.) N E W

10. When not monitoring the gages, inform the pilot.

11. Challenge the pilot on deviations from published/assigned course or altitude.

12. Know the ship's/field position relative to bingo field.

13. Report to the pilot during penetration and/or descents (VFR or IFR) as the aircraft descends through each 5000 feet of altitude above 5000 feet and each 1000 feet below 5000 feet, until reaching the desired altitude.

14. Challenge the pilot on cross-checking the pressure altimeter and radar altimeter passing 5000 feet.

15. Monitor the fuel dump.

16. Advise the pilot if experiencing vertigo/disorientation.

17. If the pilot experiences vertigo/disorientation, inform him of attitude, altitude, and airspeed.

18. Be prepared to talk down the pilot through distance/altitude checkpoints when executing a CCA utilizing radar, TACAN, and computer.

19. Inform the pilot when going contact or achieving a "ball" when on GCA/CCA.

LANDING

Pilot

1. Complete the landing checklist with B/N.

2. Double-check the pressure altimeter with radar altimeter and inform the B/N.

3. Report indexer lights to the B/N. (Secondary gear check)

Bombardier/Navigator

1. Monitor traffic pattern entry, altitude, airspeed as prescribed by local course rules, or CVA/CVS NATOPS Manual while maintaining a good lookout doctrine and assisting the pilot in determining the interval.

2. Complete the landing checklist with the pilot.

3. Challenge the pilot on pressure versus radar altimeter.

4. Attempt to check gear handle down, hook handle, indexer lights, no flashing wheels light, and speed brakes out.

5. Make UHF transmissions as directed by the pilot.

6. Be alert for and report conflicting traffic to the pilot.

7. Call for "power-speed brakes" to the pilot on touchdown aboard ship.

8. On rollout, be prepared to advise of arresting gear location. (Field landing.)

9. Report to the pilot airspeed in conjunction with runway remaining.

POST FLIGHT

Pilot

1. Perform post flight checklist with B/N.

2. Report to B/N when wing fold is actuated.

Bombardier/Navigator

1. Perform post flight checklist with the pilot.

2. When informed wing fold is actuated, report to pilot wing position.

3. Advise pilot of clearances when taxiing.

4. Complete weapons system checks remaining.

5. Advise pilot when ready for shutdown.

DEBRIEFING

Mission Commander

1. Review the entire flight from takeoff to landing.

2. Specifically comment on errors and techniques and review procedures for correcting/improving them.

Flight Leader—Pilot—Bombardier/Navigator

1. Assist the mission commander when requested and if directed, debrief all crewmembers on all aspects of the flight from takeoff to landing.

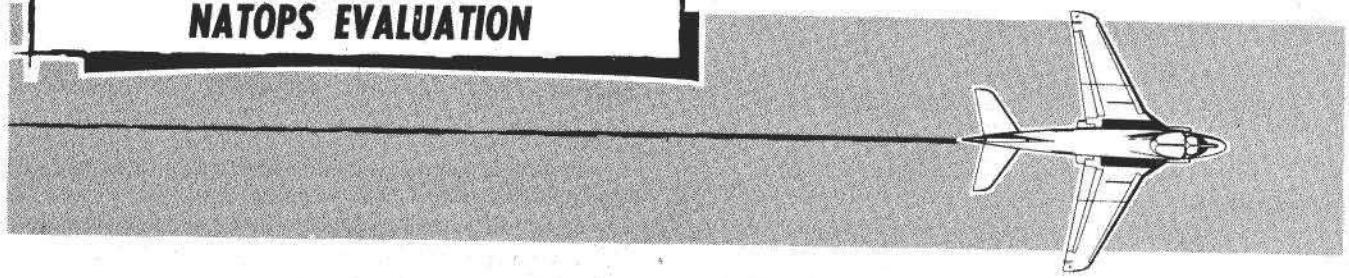
2. When directed, comment on errors and techniques and review procedures for correcting/improving them.

3. When directed, cover completely any deviations from standard operating procedures.

4. Complete yellow sheet and all required debriefing forms.

5. Utilize Anymouse reporting to pass the word on on unusual flight occurrences, if applicable.

section X
NATOPS EVALUATION



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CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating this aircraft. The NATOPS Evaluation Program is intended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatibility with the various operational commitments and missions of both Navy and Marine Corps units. The prime objective of the NATOPS Evaluation Program is to assist the unit Commanding Officer in improving unit readiness and safety. Maximum benefit from the NATOPS Evaluation Program is achieved only through the vigorous support of the program by commanding officers and squadron NATOPS instructors as well as flight crewmembers.

DEFINITIONS

The following terms, which are used throughout this section, are defined as to their specific meaning within the NATOPS program.

NATOPS EVALUATION

A periodic evaluation of individual flight crewmember standardization consisting of an open-book examination, a closed-book examination, and an oral examination. A flight evaluation is required on initial qualification and on requalification after lapse of currency. Annual NATOPS currency may be maintained by satisfactory completion of the open-book, closed-book, and oral examination in conjunction with a flight evaluation or (at the unit Commanding Officer's discretion) a WST evaluation.

NATOPS REEVALUATION

A partial NATOPS evaluation administered to a flight crewmember who has been placed in an Unqualified status by receiving an Unqualified grade for any of his ground examinations or the evaluation flight. Only those areas in which an unsatisfactory level was noted need to be observed during a reevaluation.

QUALIFIED

That degree of standardization demonstrated by a very reliable flight crewmember who has a good knowledge of standard operating procedures and a thorough understanding of aircraft capabilities and limitations.

CONDITIONALLY QUALIFIED

That degree of standardization demonstrated by a flight crewmember who meets the minimum acceptable standards. He is considered safe enough to fly as a pilot-in-command or to perform normal duties without supervision, but more practice is needed to become Qualified.

UNQUALIFIED

That degree of standardization demonstrated by flight crewmember who fails to meet minimum acceptable criteria. He should receive supervised instruction until he has achieved a grade of Qualified or Conditionally Qualified.

AREA

A routine of preflight, flight, or post flight.

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SUBAREA

A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

CRITICAL AREA

Any area or subarea that covers items of significant importance to the overall flight/mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.

EMERGENCY

An aircraft component failure, system failure, or condition that requires instantaneous recognition, analysis, and proper action.

MALFUNCTION

An aircraft component failure, system failure, or condition that requires recognition and analysis, but where time permits more deliberate action than is permitted by an emergency.

IMPLEMENTATION

The NATOPS Evaluation Program shall be carried out in every unit operating Naval aircraft. Flight crewmembers desiring to attain/retain qualification in the aircraft shall be evaluated initially in accordance with OPNAV Instruction 3510.9 series, and at least once during the 12 months following initial and subsequent evaluations. Individual and unit NATOPS Evaluations will be conducted annually; however, instruction in, and adherence to NATOPS procedures must be on a daily basis within each unit to obtain maximum benefits from the program. The NATOPS Coordinators, Evaluators, and Instructors shall administer the program as outlined in OPNAV Instruction 3510.9 series. Where a unit has more than one model variant, the differences between the types shall be reflected in training, testing and evaluation. Those who receive a grade of Unqualified on a ground or flight evaluation shall be allowed 30 days in which to complete a reevaluation. A maximum of 60 days may elapse between the day the initial ground evaluation was commenced and the date the flight evaluation is satisfactorily completed.

GROUND EVALUATION

Before commencing the flight evaluation, an evaluee must achieve a minimum grade of Qualified on the open-book and closed-book examinations, and on the OFT/WST procedures evaluation.

The oral examination is also part of the ground evaluation but may be conducted as part of the flight evaluation. To assure a degree of standardization between units, the NATOPS Instructors may use the bank of questions contained in this section in preparing portions of the written examinations. (Refer to NATOPS Evaluation Question Bank paragraph.) Due to the close coordination required between pilot and bombardier navigator in the aircraft, both crewmembers should have thorough knowledge of all aircraft systems and procedures.

OPEN-BOOK EXAMINATION

Questions in this category may be based on tables, graphs, charts, figures, and other information not conductive to or intended for memorization.

Up to 50% of the questions used may be taken from the question bank. The number of responses on the examination shall not exceed 50 or be less than 25. The purpose of the open-book examination portion of the written examination is to evaluate the familiarity with and knowledge of appropriate publications as they relate to the aircraft. The maximum time for this examination shall not exceed 8 hours.

CLOSED-BOOK EXAMINATION

Up to 50% of the closed-book examination may be taken from the question bank and shall include questions concerning normal procedures and aircraft limitations. The number of responses on the examination shall not exceed 100 or be less than 50. In addition, at least 20 questions on emergency procedures must be included. Questions designated critical will be so marked. An incorrect answer to any critical question will result in a grade of Unqualified being assigned to the examination. Maximum time for this examination shall not exceed 2 hours.

ORAL EXAMINATION

This examination is designed to evaluate the examinee's overall knowledge of the aircraft systems and components, and his ability to analyze malfunctions. Questions may be taken from this or other appropriate manuals, and drawn from the experience of the Instructor/Evaluator. Such questions should be direct and positive and should in no way be opinionated.

OFT/WST PROCEDURES EVALUATION

The OFT WST (if available) will be used to evaluate the pilot's and bombardier/navigator's efficiency in the execution of normal procedures, and their reaction to simulated emergencies and malfunctions. In areas where WST is not available, this portion may be conducted orally either in the cockpit of the aircraft, or on deck.

GRADING INSTRUCTIONS

Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of Qualified or Unqualified.

Open-Book Examination

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.5 (87.5%).

Closed-Book Examination

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.3 (87.5%).

Oral Examination and OFT/WST Procedures Evaluation

A grade of Qualified or Unqualified shall be assigned by the NATOPS Instructor/Evaluator on the basis of the following criteria:

Normal Procedures

1. QUALIFIED - Demonstrates adequate knowledge of procedures and systems with only minor deviations or omissions.

2. UNQUALIFIED - Exhibits obvious lack of knowledge of procedures and systems, which results in serious or numerous oversights affecting safety or mission completion.

Emergency Procedures and Malfunctions

1. QUALIFIED - Recognizes emergencies promptly, analyzes them properly, and takes the proper corrective action. Slow reaction in situations that cannot be realistically simulated will not justify failure of this section.

2. UNQUALIFIED - Demonstrates improper or unsafe procedures. Fails to recognize emergencies, overlooks probable or possible causes, or takes improper corrective action. Slow to act (condition no longer remediable) in obvious situations that require immediate action.

FLIGHT EVALUATION

The flight evaluation is intended to measure the degree of standardization demonstrated by the pilot or bombardier/navigator being evaluated. It is not intended to measure technique beyond a point necessary to ensure safe completion of the mission. Within reasonable limits, any individual evaluated should be able to attain a grade of Qualified, based on demonstrated knowledge without regard to special proficiency or technique.

All phases of the ground evaluation must be completed prior to commencement of the flight evaluation.

The flight evaluation may be completed on any flight that will permit the evaluee to demonstrate standard procedures in the preparation for an execution of a representative type of mission for the model aircraft concerned. With the concurrence of the Evaluator/Instructor, the unit concerned may select the mission which is best suited to aircraft configuration, training phase, target facilities, etc. Only those areas which are required by the particular mission and which can be actually observed by the Evaluator/Instructor will be graded.

Due to difficulty of grading in the A-6 type aircraft, the Bombardier/Navigator Flight Evaluation may be flown in the WST, when available.

The number of flights required to complete the flight evaluation should be kept to a minimum; normally one flight. The areas and subareas to be observed and graded on an evaluation flight are outlined in the grading criteria with critical areas marked by an asterisk (*). Subarea grades will be assigned in accordance with the grading criteria. These subareas shall be combined to arrive at the overall grade for the flight. Area grades, if desired, shall also be determined in this manner.

SAFETY CONSIDERATIONS DURING EVALUATION FLIGHTS

Due to the broad significance of safety, it is impractical to list all contingencies that may fall under the general category of grading criteria in safety. Generally, mission success is subject to compromise when there are any safety infractions, omissions, or deviations beginning with mission planning and ending with the post flight debriefing. The following provide additional guidance in these areas:

1. Violations of pertinent directives or procedures that have a direct bearing on the safe completion of the mission or negligence in following any procedure or directive that jeopardizes the safety of the crew or aircraft, will constitute an overall grade of Unqualified. The degree of jeopardy involved, in the absence of specific directive, must be determined by the Instructor/Evaluator, based on good judgment and experience.

2. The latitude given the examiner in grading safety items must be exercised with care. The examiner must observe a discrepancy that directly contributes to an unsafe condition to justify an overall grade of Unqualified for safety reasons.

3. When an in-flight safety discrepancy is imminent, and the pilot appears unaware of the condition, or has not taken the appropriate action, the examiner will correct the situation by directing that action be taken. Safety of flight cannot and must not be compromised due to the reluctance on the part of the examiner to correct any discrepancy.

4. If a grade of Unqualified is given for safety reasons, the examiner will include a written statement, describing the deficiency on the NATOPS Evaluation Report. The statement should be clearly titled "Safety Discrepancy".

GRADING CRITERIA

Only those subareas observed or required will be graded. The grades assigned for subareas shall be determined by the degree of adherence to standard procedures. Momentary deviations from standard procedures should not be considered as unqualifying provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action.

GRADE DETERMINATION

The following procedure shall be used in determining the flight evaluation grade. A grade of Unqualified in any critical area will result in an overall grade of Unqualified for the flight. Otherwise, flight evaluation (or area) grades shall be determined by assigning the following numerical equivalents to the adjective grade for each sub-area.

Unqualified. 0.0
Conditionally Qualified 2.0
Qualified. 4.0

Only the numerals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

To determine the numerical grade for each area and the overall grade for the flight, add all the points assigned to the subareas and divide this sum by the number of subareas graded. The adjective grade shall then be determined on the basis of the following scale:

0.0 to 2.19. . . . Unqualified
2.2 to 2.99. . . . Conditionally Qualified
3.0 to 4.0 . . . . Qualified

EXAMPLE: (Add subarea numerical equivalents)

$$\frac{4+2+4+2+4}{5} = \frac{16}{5} = 3.20 \text{ Qualified}$$

FINAL GRADE DETERMINATION

The final NATOPS Evaluation grade shall be the same as the grade assigned to the flight evaluation. An evaluee who receives an Unqualified on any ground examination or the flight evaluation shall be placed in an Unqualified status until he achieves a grade of Conditionally Qualified or Qualified on a reevaluation.

RECORDS AND REPORTS

A NATOPS Evaluation Report (OPNAV Form 3510-8) (Figure 10-2) shall be completed for each evaluation and forwarded to the evaluee's commanding officer. This report shall be filed in the individual flight training record and retained therein for 18 months. In addition, an entry shall be made in the PILOT/NFO flight logbook under "Qualification and Achievements" (see Figure 10-1). Both records shall include aircraft model and type for which qualified. NEW

NATOPS EVALUATION FORMS

In addition to the NATOPS Evaluation Report (figure 10-2), a NATOPS Flight Evaluation Record, OPNAV FORMS 3510 (Figure 10-3) is provided for use by the Evaluator/Instructor during the flight evaluation. All of the flight areas and subareas are listed on the worksheet with space allowed for related notes. NEW

QUALIFICATION			DATE	SIGNATURE	
NATOPS EVALUATION	(Aircraft Model)	(Crew Position)	(Date)	(Authenticating Signature)	(Unit Which Administered Evaluation)

Figure 10-1

NATOPS EVALUATION REPORT
OPNAV FORM 3510-9 (6-85) 0107-723-0000

NAME (Last, first initial)		GRADE	SERVICE NUMBER
SQUADRON/UNIT	AIRCRAFT MODEL		CREW POSITION
TOTAL PILOT/FLIGHT HOURS	TOTAL HOURS IN MODEL		DATE OF LAST EVALUATION

NATOPS EVALUATION		GRADE		
REQUIREMENT	DATE COMPLETED	q	cq	u
OPEN BOOK EXAMINATION				
CLOSED BOOK EXAMINATION				
ORAL EXAMINATION				
*EVALUATION FLIGHT		OVERALL FINAL GRADE		
FLIGHT DURATION	AIRCRAFT BUNO			

REMARKS OR EVALUATOR/INSTRUCTOR

☐ CHECK IF CONTINUED ON REVERSE SIDE

GRADE, NAME OF EVALUATOR/INSTRUCTOR	SIGNATURE	DATE
GRADE, NAME OF EVALUEE	SIGNATURE	DATE

REMARKS OF UNIT COMMANDER

RANK, NAME OF UNIT COMMANDER	SIGNATURE	DATE

*WST, OFT, COT, or cockpit check in accordance with OPNAVINST 3510.9 (effective edition).

ODG-5

Figure 10-2

A-6 FLIGHT EVALUATION RECORD

NAME:	SQDN:	DATE:
SERIAL NO:	FLIGHT CODE:	FLIGHT TIME:

AREA/SUBAREA	SUBAREA GRADE	AREA GRADE
PLANNING		
FLIGHT PLANNING/BRIEF		
PERSONAL FLYING EQUIPMENT/PUBS		
AIRCRAFT TAKE-OFF DATA		
PRE-FLIGHT		
AIRCRAFT ACCEPTANCE		
AIRCRAFT PRE-FLIGHT		
PRE-TAKE-OFF		
PRE-START/START/POST-START PROCDS.		
POINT CHECK PROCEDURES		
TAKE-OFF/LANDING		
CHECKLISTS		
PROCEDURES		
DEPARTURE		
ENROUTE/NAVIGATION		
ARRIVAL		
MISSION PROCEDURES		
SHUT DOWN/POST-FLIGHT		
COMMUNICATIONS		
SOP ADERENCE		
OVERALL FLIGHT GRADE		

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Figure 10-3

NATOPS QUESTION BANK

The following bank of questions is intended to assist the unit NATOPS Instructor/Evaluator in the preparation of ground examinations and to provide an abbreviated study guide. These questions cover material presented in this manual as well as material covered in A-6 indoctrination courses. The questions from the bank should be combined with locally originated questions as well as questions obtained from the Model Manager in the preparation of ground examinations.

1. When will the low-level fuel caution light come on?

2. What is the result of an engine fuel pump failure in flight?

   (a) Gear Stage (b) Centrifugal Stage

3. Which fuselage fuel cell supplies fuel to the engine fuel controls?

4. How can wing drop-tank fuel be transferred if a complete electrical failure is experienced?

5. After in-flight refueling of the aircraft, wing and drop-tank fuel will not transfer. What is the probable cause?

6. What indication will the pilot receive with a fuselage boost pump failure in flight?

7. What does a low-fuel-pressure light on the annunciator panel indicate?

8. What determines whether wing-tank pressure is 7 or 12 pounds?

9. What position should the wing dump switch be in for in-flight refueling, when low state?

10. What fuel cannot be dumped on RAT only power? (with AFC No. 352? without AFC No. 352?)

11. The isolation valve position is controlled by the cockpit switch and/or fluid from which hydraulic system?

12. What will be the result on the handpump system if excessive loss of combined system hydraulic fluid occurs?

13. What is the minimum airspeed for an ejection at ground level?

14. Would the position of the gear handle be of any consequence when checking the hookup for a field landing?

15. What is indicated by illumination of the RUD THRO and BACK-UP HYD caution lights?

    (a) RUD THRO (b) BACKUP HYD (c) Both?

16. What flight controls are powered by the backup hydraulic system?

17. What causes the backup hydraulic light on the annunciator panel to light?

18. Hydraulic pressures are normal but the flaps have been lowered electrically. If no other actions are taken, what happens if the landing gear are lowered?

19. While isolated, you lose all flight system pressure. What attendant losses will you experience?

20. How is the stabilizer shift mechanism actuated?

21. What is the minimum time interval to be allowed for safely cycling the landing gear?

22. Failure of one generator will result in the loss of which electrical bus?

23. Aircraft battery power is available to what items in the A-6?

24. Which bus supplies power for fuel dump control? What buses is the forward transfer dump pump on? Aft pump?

25. With a double generator failure, RAT extended, what indications will the pilot have of a complete hydraulic failure? Of a failure of only one hydraulic system?

26. What associated problems may be indicated if it is necessary to raise the landing-gear handle by actuating the override latch lever?

27. What is the normal position of the generator switches during engine start?

28. With RAT only power, what indications will the crew have of a failure of one hydraulic system? Of a complete hydraulic failure?

29. What is the indication of a CSD/S overspeed? What does a dimly flickering CSD/S caution light indicate?

30. What are the normal engine off-pressure limits? Minimum acceptable? On deck and in flight?

31. What is maximum continuous EGT?

32. When shall an anti-exposure suit be provided?

33. After a start, the starboard CSD/S light comes on and remains on. What procedure should be followed?

34. Zero-g flight is limited to how many seconds? Why?

35. What is the time limit for negative g flight?

36. What is the restriction for using the windshield rain-removal system?

37. Above what altitude is there a possibility of jamming the nose-gear door when the landing gear is activated with cockpit pressurized?

38. What is the maximum speed for retracting the ram-air turbine?

39. What is the maximum recommended gross weight for a carrier arrestment?

40. With the air-conditioning master switch off on deck, what danger exists with respect to fuel-tank pressurization and g-suit inflation?

41. What is the maximum airspeed for extending the flaps to the takeoff position? While in the takeoff position?

42. If a double engine failure occurs, what is the minimum indicated airspeed that will ensure adequate engine wind and rpm for hydraulic pressure?

43. What speed should not be exceeded until the landing gear indicates up and locked?

44. What is the speed limitation for closing the canopy airborne?

45. Are full sink rate field landings permitted with fuel in the drop tanks?

46. Why is use of the catapult grip mandatory for all catapult shots?

47. Lighting of the wheels warning light is predicated on what three conditions?

48. What is indicated by a lighted hook light?

49. With the hook bypass switch in arrest, what does a flashing indexer indicate?

50. Does the wheels warning circuitry work if the flaps are extended electrically?

51. The gang bar switch for the nosewheel well bleed-air isolation valve is labeled AUTO and OFF. What does AUTO mean?

52. What items/systems are checked by depressing the LOX-FUEL-OIL test button? What indications are looked for?

53. What is the correct stabilizer trim setting for all catapult shots?

54. What is the primary mode for the AAU-19 altimeter?

55. What is the target position for emergency flap extension due to an hydraulic system failure?

56. An A-6 at 30,000 feet with both engines windmilling and RAT extended can glide approximately how many miles?

57. The emergency gear extension system should be actuated with the gear handle in what position if both main gear will not extend?

58. In spin recovery, what altitude is required for successful recovery to level flight using a 2.5 to 3.0g round out?

59. On the Martin-Baker ejection seat, what conditions must be satisfied for the time-release mechanism to actuate? (GRU-5 and GRU-7)

60. What configuration is used for a single-engine landing in the A-6?

61. Where are the canopy seal cutouts located? What is their purpose?

62. What effect does seat tilt have on ejection?

63. What is the recommended field landing approach speed when using backup hydraulic power?

64. In the KA-6D what causes the TACAN light next to the AOA indexer to light?

65. What is the refueling speed range for the KA-6D internal refueling system?

66. How far in must the hose be pushed before fuel will begin to flow to the receiver?

67. In order, what do amber, red, and green lights on the aft external fuselage indicate?

68. What does the drogue position indicator show while the drogue is in transit?

69. What are the three ways (other than tanker empty or receiver full) in which fueling is stopped when using the external air-flight refueling system?

70. During air-flight refueling if an emergency occurs within the KA-6D, the immediate action to be taken by the tanker pilot is?

71. Why should the hose not be guillotined if there is a fuel leak in the aft fuselage or tanker package and the hose cannot be retracted?

72. What actions should be taken prior to lowering the tail hook if the hose is extended and cannot be retracted or guillotined?

73. Why is it necessary to have two-way communication when tanking in override?

74. A preflight check of the APN-153 Doppler is required. The initial step is to switch from OFF to STBY. How many minutes are required before switching from STBY to TEST?

75. From what sources does the ASN-41 derive its inputs?

76. With the ASN-41 in the TEST position, the windspeed counter should read_____ knots from a wind direction of _____, and the present position latitude and longitude counters should drive towards (South/West. North/West. South/East North/East).

77. On the ASN-41, the large outer destination knobs are used to enter coordinates (mechanically/ electrically).

78. The rate at which the coordinates of the ASN-41 are slewed is proportional to the (depth to which pushed/amount of turn) of the destination knobs.

79. ASN-41 present position coordinates are entered (mechanically/electrically).

80. When should the ASN-41 be switched from STBY to D1?

81. When is it mandatory to use oxygen in the A-6?

82. Which control actuates the warning light dimming circuits?

83. How soon before penetration should defog be turned on?

84. Actuation of the emergency harness-release performs what operations in the ejection seat? (GRU-5 and GRU-7)

85. Approximately how many minutes of oxygen are contained in the emergency oxygen bottle? (GRU-5 and GRU-7)

86. What is the function of the ACU INTERVAL thumbwheel in the primary system attack modes? (A-6E only)

87. What is the meaning of a flashing reselect light? Can the computer be stepped into attack? (A-6E only)

88. What is the purpose of the ROCKET SINGLE RIPPLE switch?

89. What is the function of the TIME thumbwheel? (A-6E only)

90. Is the position of the release indicator "fish eye" a part of reselect logic? (A-6E only)

91. What is the function of the ACU INTERVAL thumbwheel in secondary attack modes? (A-6E only)

92. The correct weapon-loaded readout tape must be selected or the computer cannot be stepped into attack. True/False

93. Will selecting mechanical fuzing satisfy reselect logic if electrical fuzed weapons are loaded?

94. What are the automatic modes of weapon release?

95. What are the functions of the attack commit switch on the pilot's stick grip?

96. Explain the procedures for setting up a boresight attack (for A-6A, C, and A6E systems)

97. What are the indications of "in-range" in a boresight attack?

98. What is the primary indication of a valid data trip?

99. If the pilot commits, but does not pull up in a general loft attack, what occurs? (A-6E only)

100. How are the angles-to-go-to-release displayed in general and high-loft attack modes?

101. How are system attacks affected by the loss of one generator?

102. In boresight mode, how is the intended target designated to the computer?

103. What information is provided to the pilot by the gunsight moving reticle in the AUTO mode?

104. Which of the track radar video presentations may be selected by the pilot? By the B/N? (A-6A, C only)

105. What switch enables the pilot to step the computer into and out of attack?

106. The steering symbol on the VDI performs what functions during a straight path attack? During a general attack? During a rocket attack?

107. What is the function of the CLEAR position of the gun control switch?

108. Why should bombing be more accurate with a track radar lock-on vice no lock-on?

109. List the data sources and conditions under which the TRACK light will come on. (A-6A, C only)

110. How does monopulse resolution improvement effect the various track radar video displays? (A-6A, C only)

111. What is roll-summed steering?

112. Can the ASQ-133 computer ORT be bypassed on ground turn-up? How? (A-6E only)

113. What will cause a stoppage in the A- to D converter test? How can the test be continued? (A-6E only)

114. What is the purpose of the GDR TRK address key? How is it used in navigation? In attack? (A-6E only)

115. What will happen to pilot's steering if the compt mode switch is moved from STEER to ENTER? (A-6E only)

116. What target altitude is used if OP TGT is selected? Can this be changed? How?

117. An automatic velocity-correction is possible in what radar mode(s)? How much time is required to accomplish an AVC?

118. How does OAP 2 TGT 4 differ from the other OAP/TGT combinations? (A-6E only)

119. With only UNSTAB steering selected, where will the pilot's and B/N's steering go to if the computer is stepped into attack?

120. What does a 011 SAC indicate? How may the erroneous sensor be determined?

121. What are the parameters of the landing mode display outside of INM? Inside INM? At what point will the pathway disappear?

122. At what point during a run should velocity-correct be discontinued?

123. What are the conditions that will cause the ballistics computer to memorize Doppler inputs?

124. What does a flickering computer overheat light on the pilot's annunciator panel indicate? What does a steady light indicate?

125. How can erroneous air data computer inputs be isolated from the ballistics computer?

126. Present position updating can be accomplished in which steering mode?

127. Under what conditions will the computer cause the breakaway lights to flash?

128. List some conditions that will cause the computer error indicator lights to come on?

129. What switches are sampled by the reselect logic of the ballistics computer that could cause the reselect lights on the armament panel and DVRI faceplate to come on?

130. What cockpit indications occur at weapons release?

131. In-range will occur at what point for each delivery mode?

132. What keyboard entries must be made in order to execute an approach using the landing mode?

133. How is the antenna of the track radar controlled in azimuth range and elevation with a discrete lock-on? With ground lock-on? With no lock-on?

134. Range and bearing readouts on the DVRI and PHD differ in what manner?

135. What methods are available to the B/N for updating the present position of the aircraft?

136. What are the procedures for selective jettison of ordnance? For emergency jettison?

137. Explain the procedures for a delay mode attack. When would a delay mode be utilized?

138. What is blast clearance? How is it entered? Where is it displayed? When? (A6E only)

139. How is OP TGT selected?

140. List procedures for nonsystem automatic release laydown bombing.

141. What conditions must be met in order to jettison external stores by using the selective stores jettison switch? The emergency stores jettison button?

142. What multiple firing options are available when firing rockets from an LAU-10/A launcher? A LAU-10A/A? A LAU-39?

143. What conditions could cause a station disagreement light on the T-375 system circuit to come on?

144. Information provided by the ordnance control panel is sampled by the ballistics computer for delivery of what type weapons?

145. What is TDTA? What are its limitations?

146. What are the various methods the computer uses to obtain vertical separation?

147. How can the crew isolate the ADC from the system?

148. What is the significance of "in-range" lights in the various attack modes?

149. What is the function of the platform adapter? What effect will its loss have on system attacks? On navigation?

150. During the rough align phase of the INS, where does the initial heading information come from in compass-in mode? In compass-out mode?

151. What is the purpose of gyrocompassing in the ASN-31?

152. What must be done if a NO GO light comes on while the inertial platform is being aligned?

153. What precautions should be observed when switching the compass switch from one position to another while airborne?

154. How can the B/N check the accuracy of the heading information derived from the inertial platform system?

155. Vertical velocity-correct may be accomplished with the navigation mode selector in what positions?

156. What is the difference between a compass-in and a compass-out alignment of the inertial platform?

157. What navigation options are available with a completely functional navigation system?

158. What is data replacement? How is it accomplished? Which data are automatically replaced if bad? Which may be replaced manually?

159. Discuss navigation and attack options with the various data sensors replaced.

160. What is the track-while-scan mode of the search radar? How is it accomplished? What is its maximum range? (A-6E only)

161. What are the parameters of SRTC in the APQ-148? What limitations does SRTC place on the B/N's operation of the radar? (A-6E only)

162. What is frequency agility? What does it do? (A-6E only)

163. How can the APQ-148 be manually tuned? (A-6E only)

164. What is the purpose of the beacon mode of the APQ-148? (A-6E only)

165. What is the purpose of the APQ-148 BIT? Can it be accomplished with the radar in silent? (A-6E only)

166. In what mode of operation should the AAU-19 altimeter be when conducting the computer operational readiness test? (A-6E only)

167. Under what conditions would the magnetron reset button be used? (A-6A, B, C)

168. What are the range parameters for use of SRTT? (A-6A, B, C only)

169. What factors limit AMTI operation?

170. What conditions must be met in order to operate SRTC to beset advantage?

171. What are the various indicators that provide terrain clearance information to the pilot?

172. What are the antenna stabilization limits for the search radar? For the track radar? (A-6A, C only)

173. What are the functional ranges for each of the search radar displays? For the track radar? (A-6A, C only)

174. What is the difference between a track radar ground lock-on and a discrete lock-on? (A-6A, C only)

175. What is the difference between the primary and secondary triggers of the search radar? (A-6A, B, C only)

176. What displays are available to the B/N on the DVRI when the pilot is using E-scan? (A-6A, C only)

177. What function does the Doppler perform when the navigation mode selector is in INERL and the Doppler switch is in XMIT? (A-6A, B, C only)

178. What are the conditions that will cause the Doppler to go into memory?

179. How does the APN-153(V) Doppler derive the drift angle? The groundspeed?

180. List the priorities for the altitude data sources used during a system bombing run.

181. What are the operating limitations of the APN-153(V) Doppler radar?

182. Altitude information may be derived by the ballistics computer from what different sources?

DISCUSSION QUESTIONS:

1. Total electrical failure in VFR conditions.

2. Field landing on the backup hydraulic system.

3. Flaperons pop up full when stick is slightly deflected.

4. Does pumping the brakes before touch down afford a good indication of usable brake system pressure? Discuss the anti-skid system.

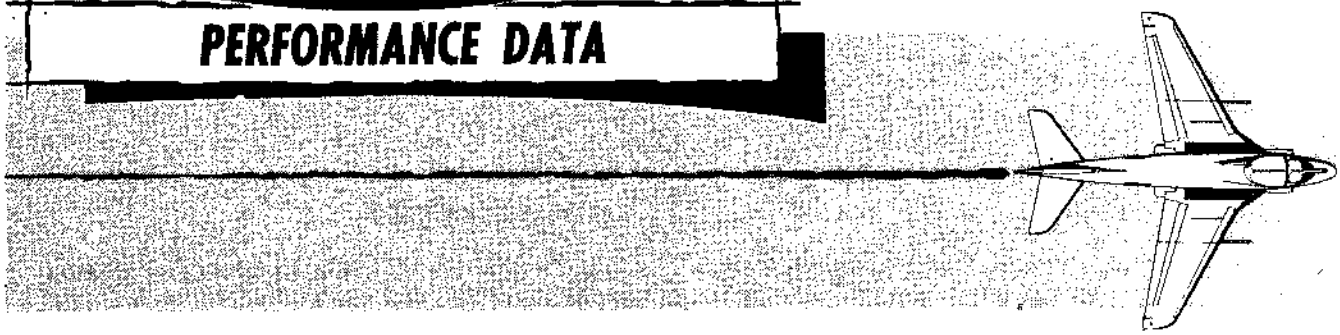
5. A controlled ejection is required as a result of a midair, but the B/N is unable to eject.

6. You are carrier based. Fuel is venting from the centerline drop tank, but the tank will not transfer.

7. What logic must be satisfied to turn on the equipment cooling ground blower? Does it affect the restriction on operation of the system? Where is the CNI blower located? Does it affect the restrictions on operation of the CNI?

8. Describe the operation of the AAU-19 altimeter? Where does it get its inputs? What kind of fail safe features does it have? What are their parameters? What are the limitations, if any in its use?

section XI
PERFORMANCE DATA



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part 1 Introduction

INTRODUCTION

Section XI is divided into eight parts to present performance data in proper sequence for preflight planning. Two concepts of data presentation are used to show drag effects on aircraft performance; i. e., specific configuration charts and drag count charts. The drag count concept is used to present military power climb, best cruise altitude, optimum endurance altitude, combat ceiling, service ceiling, cruise performance, maximum range cruise, maximum endurance speed, maximum endurance fuel, and maximum range descent. All other data are presented as a specific configuration per chart. All performance data are based on flight tests or the contractor's estimate, IACO standard day conditions except those used for takeoff and landing where temperature corrections for nonstandard atmosphere are included, and J52-P-8 engines, and JP-5 fuel.

NEW Performance data are indexed separately following the general alphabetical index.

Note

The indication of the fuel quantity indicator presents the readings of actual fuel weight remaining. This is accomplished by means of compensator readings regardless of changes in the specific density due to temperature changes. Therefore, adjustment for various fuel densities is not necessary.

The performance data in this section applies to A-6A, A-6B, A-6C, KA-6D, or A-6E. For the A-6C, allowance must be made for the centerline pod. Where practical, A-6C charts have been provided. In other cases, guidelines are presented to enable the user to estimate A-6C performance. NEW Charts peculiar to the tanker mission are provided for KA-6D.

AIRSPEED CONVERSION

The Airspeed Conversion Chart (figures 11-1 and 11-2) provides a means of converting calibrated airspeed to true mach number and true airspeed.

INDICATED AIRSPEED

Indicated airspeed (IAS) is the uncorrected airspeed read directly from the cockpit indicator when the ADC is inoperative.

CALIBRATED AIRSPEED

Calibrated airspeed (CAS) is indicated airspeed corrected for static source error.

EQUIVALENT AIRSPEED

Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility effect.

TRUE AIRSPEED

True airspeed (TAS) is equivalent airspeed corrected for atmospheric density. Refer to Airspeed Conversion, figure 11-1 and 11-2.

STANDARD DATA

NEW Figures 11-3 and 11-4 provide standard atmosphere information and conversion between standard units. NEW

AIRSPEED POSITION ERROR CORRECTION

These charts (figures 11-5 and 11-6) provide a direct-reading conversion from indicated airspeed to airspeed position error (correction to be added to obtain calibrated airspeed) and from indicated mach number to mach number position error correction.

SAMPLE PROBLEM

Aircraft Configuration: Clean

A.	Indicated Airspeed	120 kt
B.	Gross Weight	50, 000 lb
C.	Airspeed Correction (to be added to correct instrument reading)	-3 kt

Aircraft Configuration: All Configurations, All Gross Weights

A.	Indicated Mach Number	0. 82
B.	Reflector Line	
C.	Mach Number Correction (to be added to correct instrument reading)	0. 015

ALTIMETER POSITION ERROR CORRECTION

These charts (figures 11-7 and 11-8) provide ΔH corrections for various indicated airspeed and indicated mach number gross weight combinations.

NEW

Note

Altitude correction is for the standby (barometric) mode of the AAU-19 altimeter.

Aircraft Configuration: Gear and Flaps Down

A.	Indicated Airspeed	149 kt
B.	Gross Weight	55,000 lb
C.	Altitude Correction (To be added to correct instrument reading.)	-20 ft

AIRCRAFT CONFIGURATION: ALL CONFIGURATIONS, ALL GROSS WEIGHTS

A.	Indicated Mach Number	0.88M
B.	Altitude Line	Sea Level
C.	Altitude Correction (To be added to correct instrument reading.)	+500 ft

TAKEOFF AND LANDING CROSSWIND

The takeoff and landing crosswind chart (figure 11-9) presents minimum recommended takeoff and touchdown speeds for crosswind conditions. The line between recommended and not recommended is based on the maximum sideslip angle of the aircraft using maximum rudder deflection. The chart may also be used to determine the headwind and crosswind component.

USE

Determine the wind angle relative to the runway heading, and enter the plot at the lower left along the applicable relative wind angle line to the reported wind velocity arc. To find the headwind component, project a line horizontally to the left and read the headwind in knots; for crosswind component drop vertically to the baseline. To find minimum takeoff or touchdown speeds, from the intersection of the relative wind angle line and the velocity arc, project a line upward vertically to the computed takeoff or touchdown speed. If this point is not in the recommended area, continue vertically until the line between the recommended and not recommended areas is reached, and project horizontally to the right to read the minimum recommended speed.

The effect of increased speed on takeoff or landing criteria should be considered because under conditions of high gross weights, large crosswind components and short runways, it might dictate downloading, dumping, or selection of a different runway.

SAMPLE PROBLEM

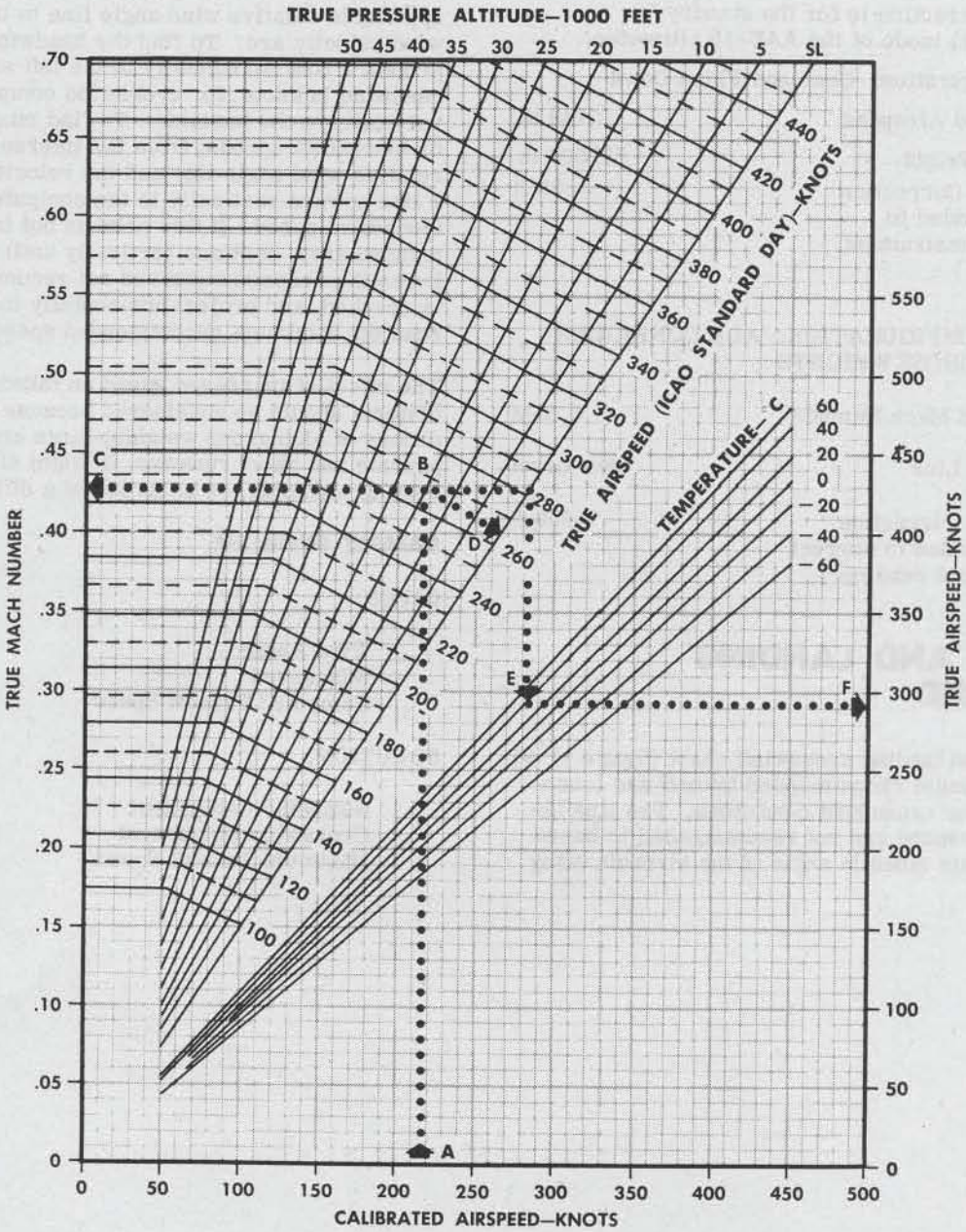
GIVEN:

Wind Angle	-70°
Windspeed	-37 kt
Computed Takeoff Speed	-125 kt

SOLUTION:

Headwind Component	-12.5 kt
Crosswind Component	-35 kt
Minimum Takeoff Speed	-127 kt

AIRSPEED CONVERSION



SAMPLE PROBLEM

A. CALIBRATED AIRSPEED	=	215 KNOTS
B. PRESSURE ALTITUDE	=	15,000 FEET
C. TRUE MACH NUMBER	=	.428
D. TRUE AIRSPEED (ICAO STANDARD DAY)	=	268 KNOTS
E. AMBIENT TEMPERATURE	=	30°C
F. TRUE AIRSPEED	=	290 KNOTS

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Figure 11-1

AIRSPEED CONVERSION

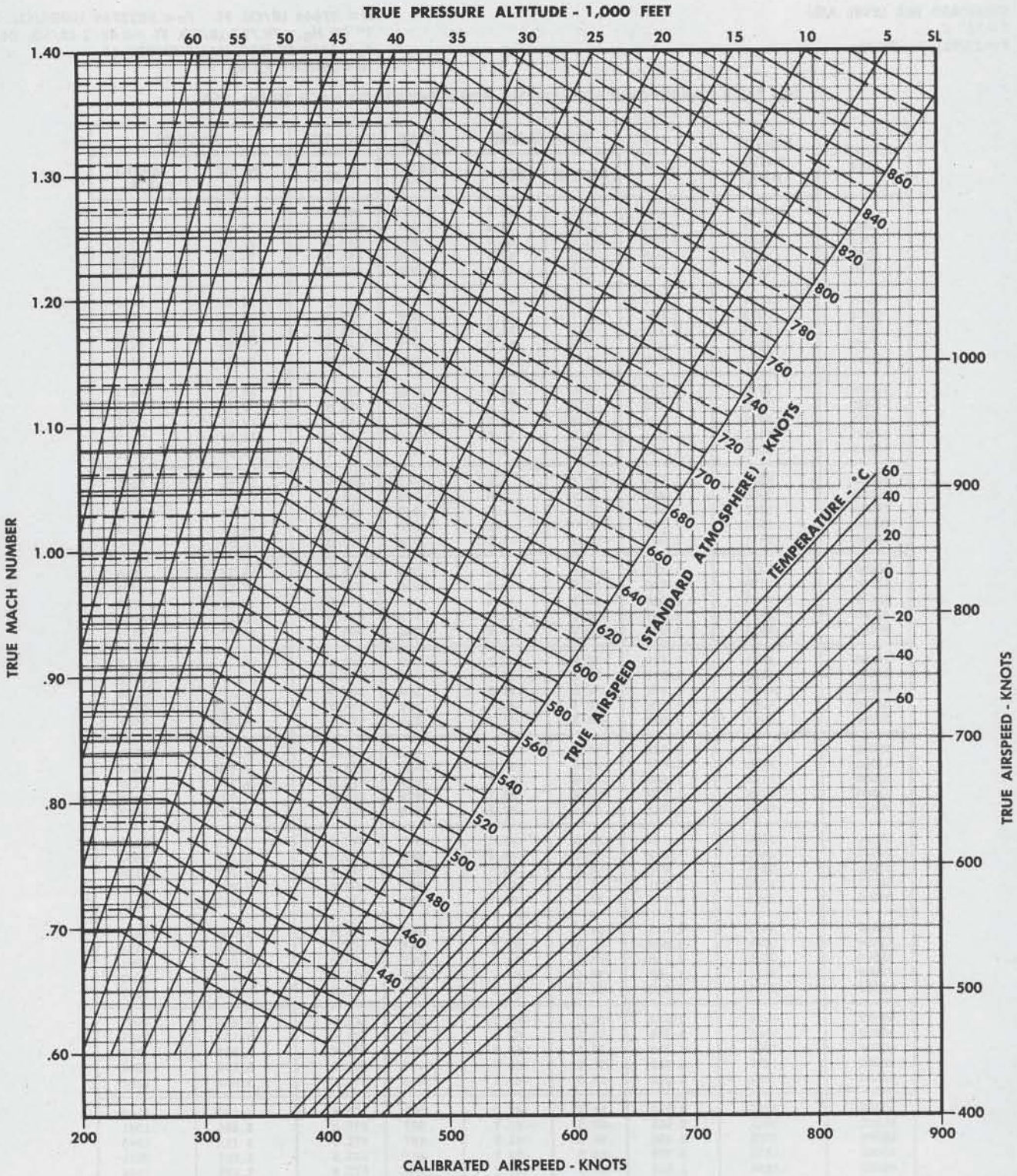

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Figure 11-2

STANDARD ALTITUDE TABLE

STANDARD SEA LEVEL AIR:
T = 15° C.
P = 29.921 IN. OF Hg.

W = .07648 LB/CU. FT. ρ_o = .0023769 SLUGS/CU. FT.
1" OF Hg. = 70.727 LB/SQ. FT. = 0.4912 LB/SQ. IN.
A_o – 1117 FT./SEC. (661.7 KNOTS) (A_o)
σ = DENSITY RATIO

THIS TABLE IS BASED ON ICAO STANDARD ATMOSPHERE FROM NACA TN NO. 3182

ALTITUDE FEET	DENSITY RATIO ρ/ρ_o	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE		SPEED OF SOUND		PRESSURE	
			DEG. C	DEG. F	RATIO A/A_o	KNOTS	IN. OF Hg	RATIO P/P_o
0	1.0000	1.000	15.0	59.0	1.000	661.7	29.92	1.0000
1000	.9711	1.015	13.0	55.4	.997	659.5	28.86	.9644
2000	.9428	1.030	11.0	51.9	.993	657.2	27.82	.9298
3000	.9151	1.045	9.0	48.3	.990	654.9	26.82	.8962
4000	.8881	1.061	7.1	44.7	.986	652.6	25.84	.8637
5000	.8617	1.077	5.1	41.2	.983	650.3	24.90	.8320
6000	.8359	1.094	3.1	37.6	.979	647.9	23.98	.8014
7000	.8107	1.111	1.1	34.0	.976	645.6	23.09	.7716
8000	.7860	1.128	-0.8	30.5	.972	643.3	22.23	.7428
9000	.7620	1.146	-2.8	26.9	.969	640.9	21.39	.7148
10000	.7385	1.164	-4.8	23.3	.965	638.6	20.58	.6877
11000	.7156	1.182	-6.8	19.8	.961	636.2	19.79	.6614
12000	.6932	1.201	-8.8	16.2	.958	633.9	19.03	.6360
13000	.6713	1.221	-10.8	12.6	.954	631.5	18.29	.6113
14000	.6500	1.240	-12.7	9.1	.951	629.1	17.58	.5875
15000	.6292	1.261	-14.7	5.5	.947	626.7	16.89	.5643
16000	.6090	1.282	-16.7	2.0	.943	624.3	16.22	.5420
17000	.5892	1.303	-18.7	-1.6	.940	621.9	15.57	.5203
18000	.5699	1.325	-20.7	-5.2	.936	619.4	14.94	.4994
19000	.5511	1.347	-22.6	-8.8	.933	617.0	14.34	.4791
20000	.5328	1.370	-24.6	-12.3	.929	614.6	13.75	.4595
21000	.5150	1.394	-26.6	-15.9	.925	612.1	13.18	.4406
22000	.4976	1.418	-28.6	-19.5	.921	609.6	12.64	.4223
23000	.4807	1.442	-30.6	-23.0	.918	607.2	12.11	.4046
24000	.4642	1.468	-32.5	-26.6	.914	604.7	11.60	.3876
25000	.4481	1.494	-34.5	-30.1	.910	602.2	11.11	.3711
26000	.4325	1.521	-36.5	-33.7	.906	599.7	10.63	.3552
27000	.4173	1.548	-38.5	-37.3	.903	597.2	10.17	.3398
28000	.4025	1.576	-40.5	-40.9	.899	594.6	9.725	.3250
29000	.3881	1.605	-42.5	-44.4	.895	592.1	9.297	.3107
30000	.3741	1.635	-44.4	-48.0	.891	589.6	8.885	.2970
31000	.3605	1.665	-46.4	-51.6	.887	587.0	8.488	.2837
32000	.3473	1.697	-48.4	-55.1	.883	584.4	8.106	.2709
33000	.3345	1.729	-50.4	-58.7	.879	581.9	7.737	.2586
34000	.3220	1.762	-52.4	-62.2	.876	579.3	7.382	.2467
35000	.3099	1.796	-54.3	-65.8	.872	576.7	7.041	.2353
36000	.2981	1.832	-56.2	-69.4	.868	574.0	6.712	.2243
37000	.2844	1.875	-56.5	-69.7	.867	573.8	6.397	.2138
38000	.2710	1.921	-56.5	-69.7	.867	573.8	6.097	.2038
39000	.2583	1.968	-56.5	-69.7	.867	573.8	5.811	.1942
40000	.2462	2.016	-56.5	-69.7	.867	573.8	5.538	.1851
41000	.2346	2.065	-56.5	-69.7	.867	573.8	5.278	.1764
42000	.2236	2.115	-56.5	-69.7	.867	573.8	5.030	.1681
43000	.2131	2.166	-56.5	-69.7	.867	573.8	4.794	.1602
44000	.2031	2.219	-56.5	-69.7	.867	573.8	4.569	.1527
45000	.1936	2.273	-56.5	-69.7	.867	573.8	4.355	.1455
46000	.1845	2.328	-56.5	-69.7	.867	573.8	4.151	.1387
47000	.1758	2.385	-56.5	-69.7	.867	573.8	3.956	.1322
48000	.1676	2.443	-56.5	-69.7	.867	573.8	3.770	.1260
49000	.1597	2.502	-56.5	-69.7	.867	573.8	3.593	.1201
50000	.1522	2.563	-56.5	-69.7	.867	573.8	3.425	.1145
51000	.1451	2.625	-56.5	-69.7	.867	573.8	3.264	.1091
52000	.1383	2.689	-56.5	-69.7	.867	573.8	3.111	.1040
53000	.1318	2.755	-56.5	-69.7	.867	573.8	2.965	.0991
54000	.1256	2.822	-56.5	-69.7	.867	573.8	2.826	.0944
55000	.1197	2.890	-56.5	-69.7	.867	573.8	2.693	.0900

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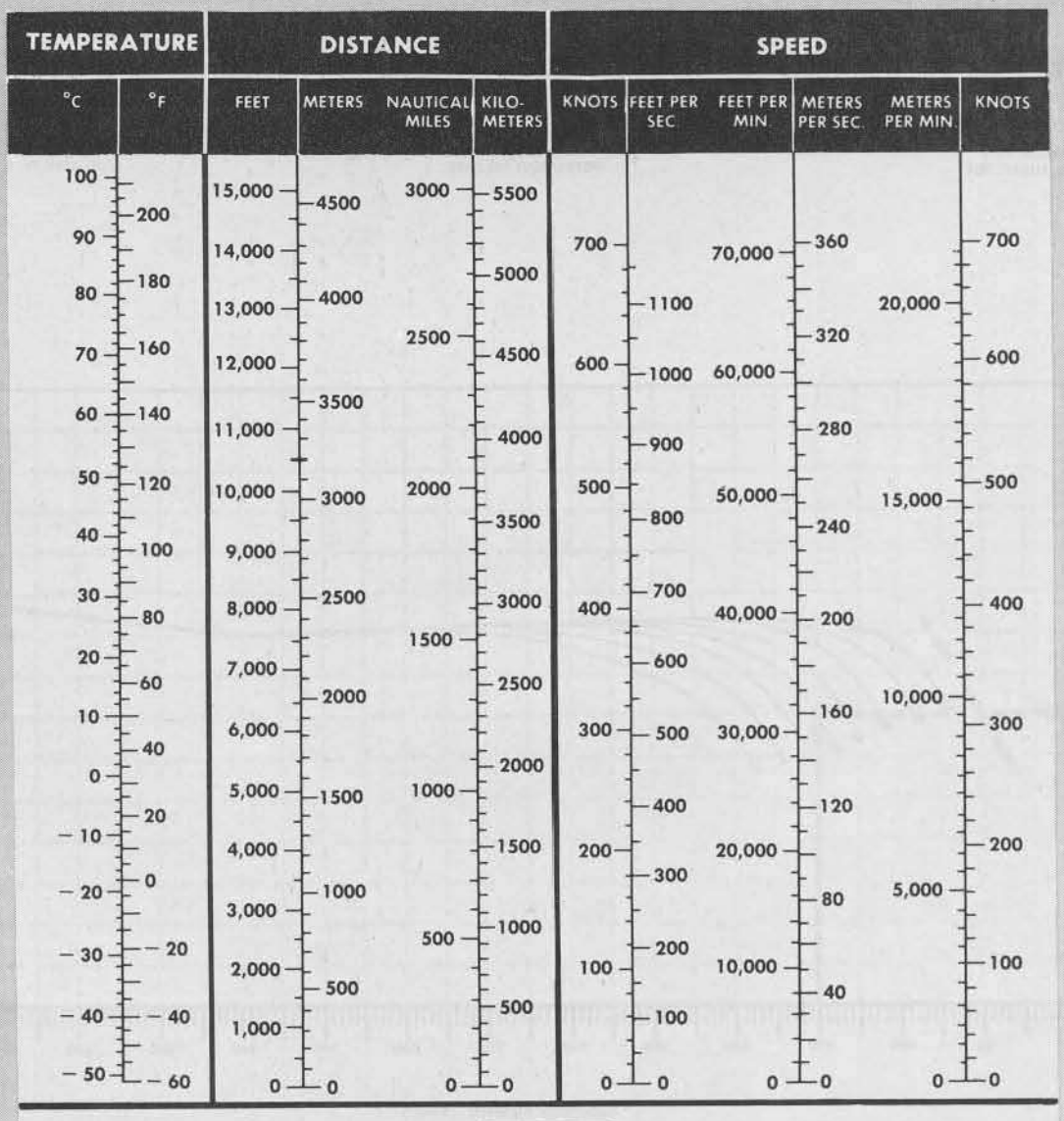
Figure 11-3

STANDARD UNITS CONVERSION CHART



NOTE

- TO OBTAIN US GALLONS MULTIPLY LITERS BY 0.264
- TO OBTAIN IMPERIAL GALLONS MULTIPLY LITERS BY 0.220
- TO OBTAIN INCHES OF MERCURY MULTIPLY MILLIBARS BY 0.0295
- TO OBTAIN POUNDS MULTIPLY KILOGRAMS BY 2.20

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Figure 11-4

AIRSPEED POSITION ERROR CORRECTION

FINBOOM AIR SPEED SYSTEM

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
ALL GROSS WEIGHTS

DATE: 10 MARCH 1970
DATA BASIS: FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT
INSTRUMENT READING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

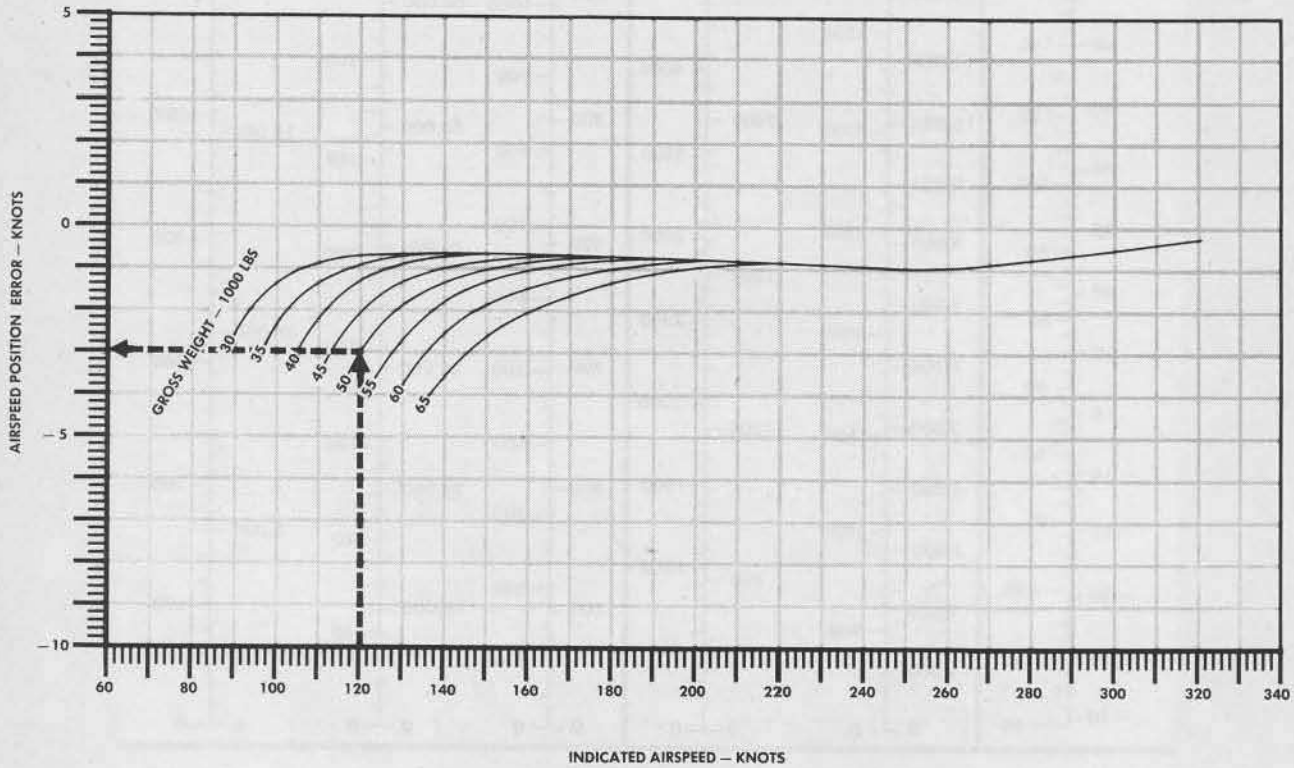

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Figure 11-5

AIRSPEED POSITION ERROR CORRECTION

FINBOOM AIR SPEED SYSTEM

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
ALL GROSS WEIGHTS

DATE: 10 MARCH 1970
DATA BASIS: FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT
INSTRUMENT READING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

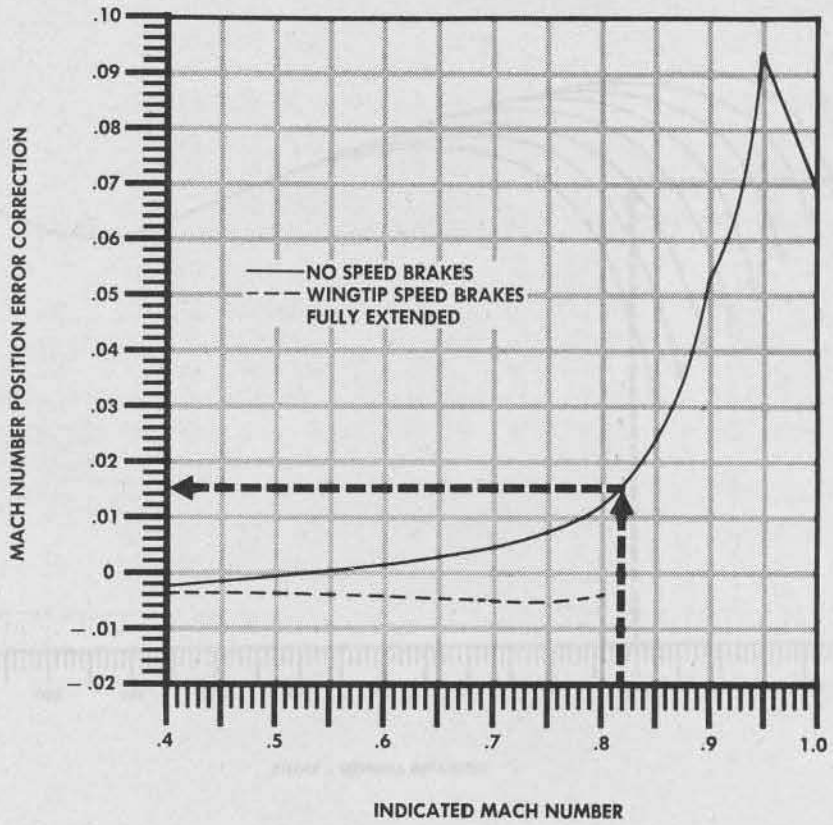

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Figure 11-6

ALTIMETER POSITION ERROR CORRECTION

FINBOOM AIR SPEED SYSTEM

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
ALL GROSS WEIGHTS

DATE: 10 MARCH 1970
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

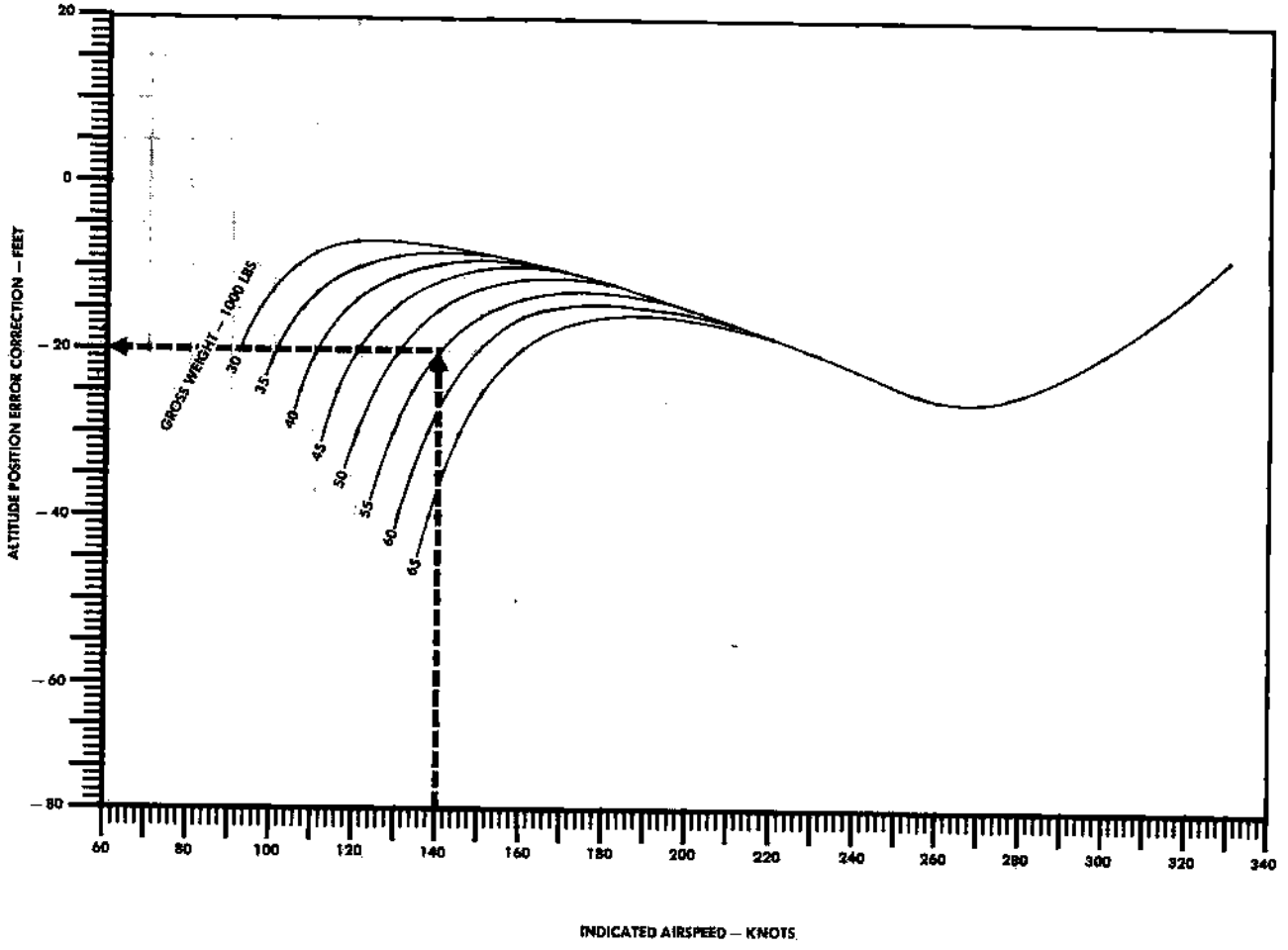

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Figure 11-7

ALTIMETER POSITION ERROR CORRECTION

FINBOOM AIR SPEED SYSTEM

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
ALL GROSS WEIGHTS

DATE: 10 MARCH 1970
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

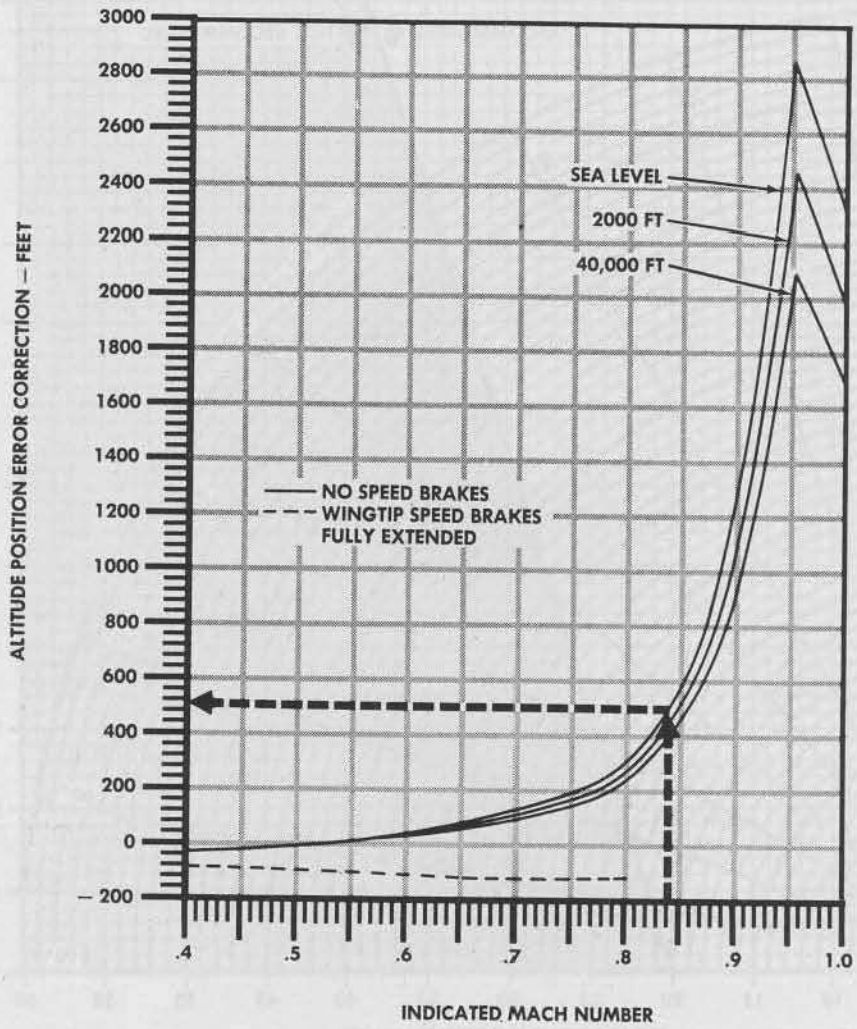

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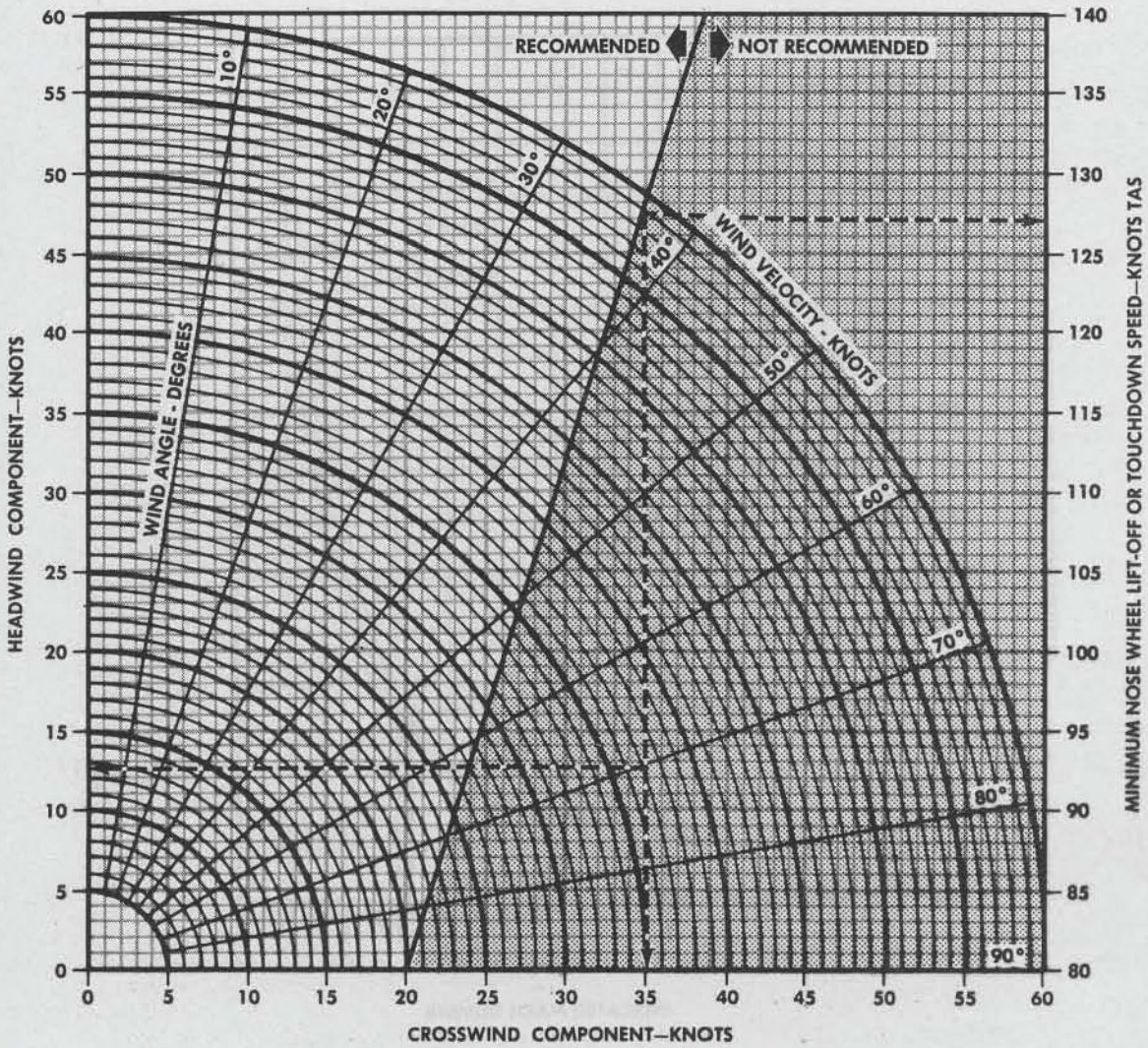
Figure 11-8

TAKE-OFF/LANDING CROSSWIND CHART

STANDARD DAY

DATE: 1 SEPTEMBER 1968
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE
CORRECT IAS FOR TEMPERATURE AND PRESSURE TO OBTAIN TAS.

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Figure 11-9

part 2 Takeoff and Climb

EFFECT OF RUNWAY SURFACE CONDITIONS

N-T-W Figure 11-10 provides the means of adjusting refusal speed and critical field length computations for runway surfaces other than dry hard.

MAXIMUM REFUSAL SPEED

The maximum refusal speed chart (figure 11-11) presents the maximum speed at which engine failure permits stopping at the end of the runway and is used during takeoff planning. Stopping distance is based upon using antiskid braking and flaperon pop-up.

USE

Enter the chart at the aircraft gross weight and proceed horizontally to the intersection of the pressure altitude. Descend to intersect the temperature scale and proceed horizontally to intersect the total runway length. From the total runway length intersection, descend to the base of the chart to read maximum refusal speed.

Sample Problem

Aircraft Configuration: All External Stores, Gear Down, and Takeoff Flaps.

A.	Takeoff Gross Weight	55,000 lb
B.	Pressure Altitude	6,000 ft
C.	Temperature	59° F
D.	Length of Actual Runway	5,000 ft
E.	Refusal Speed	96 KIAS

TAKEOFF DISTANCE

TAKEOFF DISTANCE (NORMAL)

Takeoff ground run distances and distance required to clear a 50-foot obstacle using military power is shown in the Takeoff Distance Chart, figures 11-12 and 11-14.

The distances are computed for normal takeoff technique on a hard, dry runway. Temperature, pressure altitude, gross weight, and head winds are plotted variables. The charts. may be used for any configuration considering gross weight. Liftoff airspeeds (IAS) are shown on the gross weight lines.

USE

Enter the chart at the temperature scale, proceeding vertically to intersect the pressure altitude. Proceed horizontally to the takeoff gross weight and read takeoff airspeed. Descend to the base line for wind effect and apply effective wind. Descend to the ground run scale reading ground run distance required for liftoff and further to the reflector line for reading total distance required to clear a 50-foot obstacle.

Sample Problem

Aircraft Configuration: All External Stores, Gear Down, and Takeoff Flaps.

A.	Temperature	50° F
B.	Pressure Altitude	2,000 ft
C.	Takeoff Gross Weight	45,000 lb
D.	Takeoff Airspeed	135 KIAS
E.	Wind Base Line	
F.	Effective Headwind	20 knots
G.	Takeoff Ground Run Distance	2,400 ft
H.	Reflector Line	
J.	Distance Required to Clear a 50-Foot Obstacle	3,000 ft

VELOCITY DURING TAKEOFF GROUND RUN

The velocity during takeoff ground run chart (figures 11-13 and 11-15) presents a plot of ground run distance versus indicated airspeed. Guidelines are used to indicate any momentary distance-speed relationship such as line distance at maximum refusal speed, speed at any runway marker, or takeoff ground run for other than normal takeoff speed.

USE

Enter the chart at the gross weight scale and proceed horizontally to intersect the normal takeoff airspeed curve. Descend vertically to the ground run distance required for a normal takeoff (see figure 11-12). By following the appropriate guide line, any combination of ground run distance versus airspeed may be read.

Sample Problem

Aircraft Configuration: All External Stores, Gear Down, and Takeoff Flaps.

A.	Takeoff Gross Weight	50,000 lb
B.	Intersect Normal Takeoff Airspeed Curve	
C.	Normal Takeoff Run	6,400 ft
D.	Accelerate Check Distance	5,000 ft
E.	Accelerate Check Speed	131 kt

MINIMUM TAKEOFF DISTANCE

Takeoff ground run distance and distance required to clear a 50 foot obstacle using military power is shown in the Minimum Take-Off Distance Charts (figures 11-16 and 11-17). Distances are based on the lowest, safe, lift-off speed obtainable, considering temperature, pressure altitude, and gross weight.

USE

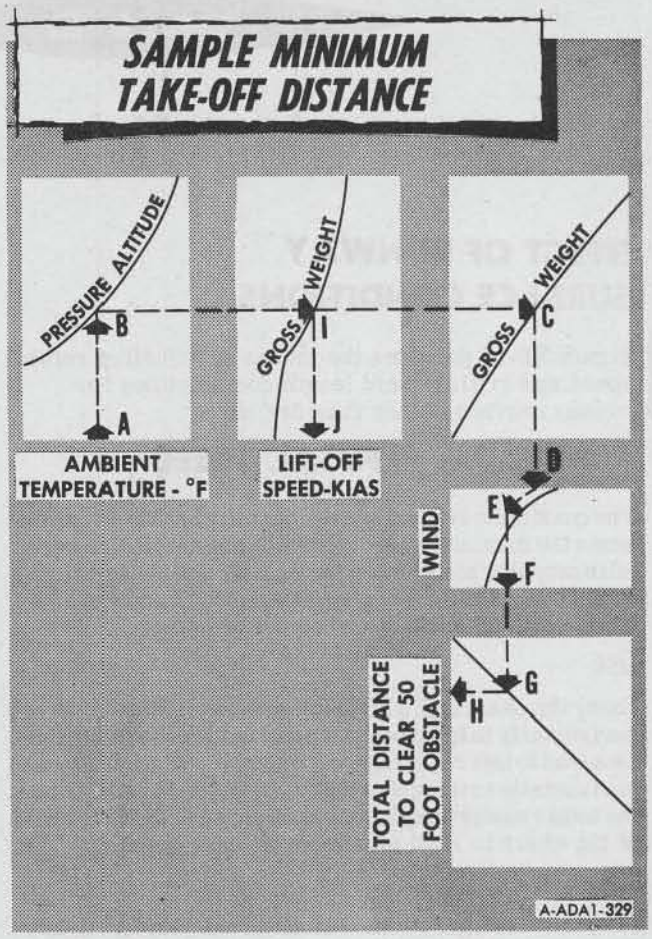
Enter the chart at the temperature scale, proceeding vertically to intersect the pressure altitude. Proceed horizontally to the takeoff gross weight. Descend to the base line for wind effect and apply effective wind. Descend to the ground run scale reading total distance required for lift-off and further to the reflector line for reading total distance required to clear a 50-foot obstacle.

Reenter the chart at the temperature scale, proceeding vertically to intersect the pressure altitude. Proceed horizontally to the takeoff gross weight and descend vertically to read lift-off speed (KIAS).

Sample Problem

AIRCRAFT CONFIGURATION: GEAR DOWN, TAKE-OFF FLAPS, MILITARY POWER

A.	Temperature	60° F
B.	Pressure Altitude	2,000 ft
C.	Takeoff Gross Weight	40,000 lb
D.	Wind Base Line	
E.	Effective Headwind	10 kt
F.	Takeoff Ground Roll Distance	1,800 ft
G.	Reflector Line	
H.	Distance Required to Clear a 50-foot Obstacle	2,350 ft
I.	Takeoff Gross Weight	40,000 lb
J.	Lift-off Speed (IAS)	112 kt



CRITICAL FIELD LENGTH

The critical field length charts (figures 11-18 and 11-19) present graphically an indication of the runway length required to accelerate the aircraft, experience an engine failure, and then either take off with the remaining engine or fully stop in the same total runway distance.

USE

Enter the chart at the temperature scale and proceed vertically to intersect the pressure altitude. Proceed horizontally to intersect the takeoff gross weight line. Descend to the base line for critical engine failure speed. Continue horizontally to intersect the takeoff gross weight line. Descend to the base line for wind effect and apply effective wind. Descend vertically downward to read critical field length and further to the reflector line for reading total distance required to clear a 50-foot obstacle.

Sample Problem

Aircraft Configuration: All External Stores, Gear Down, and Takeoff Flaps.

A.	Temperature	70° F
B.	Pressure Altitude	2,000 ft

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C.	Takeoff Gross Weight	35, 000 lb
D.	Critical Engine Failure Speed	99. 5 kt
E.	Gross Weight	35, 000 lb (120 KIAS)
F.	Wind Base Line	
G.	Effective Headwind	10 kt
H.	Critical Field Length (ground run)	3070 ft
J.	Reflector Line	
K.	Distance Required to Clear a 50-Foot Obstacle	3750 ft

MAXIMUM CLIMBOUT ANGLE

The maximum climb-out angle charts (figure 11-20 and 11-21) present the maximum climb-out-angle at an optimum climb-out airspeed after lift-off. Takeoff flight path obstacle clearance can be calculated once the climb-out angle has been established. The tangent of the climb-out angle times the distance from the point of lift-off to an obstacle equals the actual height of the takeoff flight path at the point.

USE

Enter the chart at the aircraft gross weight and proceed horizontally to intersect the appropriate pressure altitude. Descend to intersect the temperature scale, and proceed horizontally to read maximum climb-out angle.

Reenter the chart at the aircraft gross weight, and proceed horizontally to intersect the climb speed guide line. From this point, project vertically and read indicated airspeed.

Sample Problem

AIRCRAFT CONFIGURATION: ALL EXTERNAL STORES, GEAR UP, AND TAKEOFF FLAPS;

A.	Takeoff Gross Weight	50, 000 lb
B.	Pressure Altitude	2, 000 ft
C.	Temperature	90°F
D.	Climb-Out Angle	8°
E.	Takeoff Gross Weight	50, 000 lb
F.	Climb Speed Guide Line	Intersect
G.	Optimum Speed (IAS)	140 kt

MAXIMUM RATE OF CLIMB

The maximum rate of climb charts (figures 11-22 and 11-23) present the maximum takeoff flight path climb-out rate of climb at an optimum climb-out airspeed after lift-off for A-6A, B, E, or KA-6D in two external store configurations (drag counts of 0 and 48). The A-6C TRIM pod has a drag count of 90 with flaps down, representing a degradation from the performance presented. NEW

USE

Enter the chart at the aircraft gross weight and proceed horizontally to intersect the appropriate pressure altitude. Descend to intersect the temperature scale, and proceed horizontally to read maximum rate of climb.

Reenter the chart at the aircraft gross weight, and proceed horizontally to intersect the climb speed guide line. From this point, project vertically and read indicated airspeed.

Sample Problem

AIRCRAFT Configurations: All External Stores, Gear Up, and Takeoff Flaps.

A.	Takeoff Gross Weight	54, 000 lb
B.	Pressure Altitude	2, 000 ft
C.	Ambient Temperature	90°C
D.	Rate of Climb	1900 ft/min

SINGLE ENGINE CLIMB

Figures 11-26 through 11-29 provide single-engine rates of climb for various angles of attack at sea level. Figures 11-30 and 11-31 show the effect of the landing gear on single-engine climb rates at sea level. NEW

MAXIMUM CLIMB SPEED

The maximum climb speed charts (figures 11-24 and 11-25) present the optimum climb-out airspeed after lift-off that will give maximum rate of climb for A-6A, B, E, and KA-6D two external store configurations (drag counts 0 and 48). The A-6C TRIM pod has a drag count of 90 with flaps down, representing a degradation from the performance presented. NEW

USE

Enter the chart at the aircraft gross weight and proceed horizontally to intersect the appropriate ambient temperature line. Descend to intersect the appropriate pressure altitude line, and proceed horizontally to read indicated airspeed.

Sample Problem

Aircraft Configuration:

All External Stores, Gear Up, and Takeoff Flaps.

A.	Takeoff Gross Weight	54,000 lb
B.	Pressure Altitude	2000 ft
C.	Ambient Temperature	90°F
D.	Optimum Speed (IAS)	169 kt

CLIMB PERFORMANCE AFTER TAKEOFF (SINGLE ENGINE)

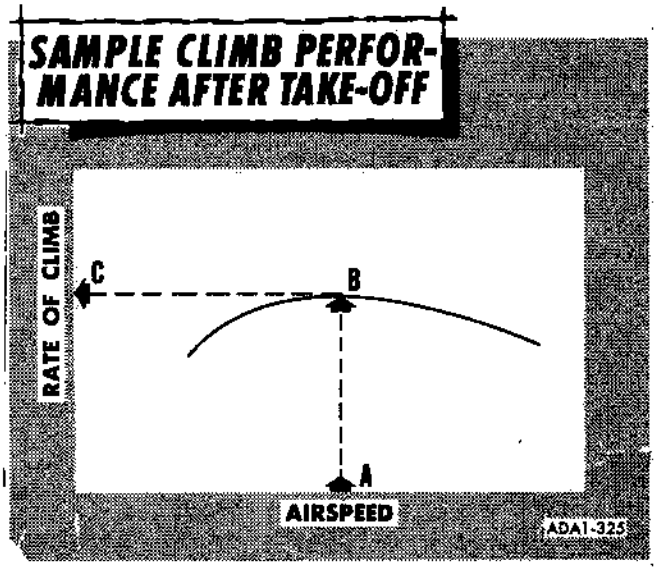
The climb performance after takeoff charts (figures 11-32 through 11-43) present the single-engine climb performance at sea level, gross weight of 42,803 pounds, and the aircraft in a clean configuration. Rate of climb is given as a function of airspeed and temperature.

USE

Enter the chart at the desired climb airspeed, and project vertically to intersect the temperature curve. From this intersection, proceed horizontally and read rate of climb as sea level.

Sample Problem

A.	Airspeed (CAS)	280 kt
B.	Temperature	59°F
C.	Rate of Climb	2600 fpm

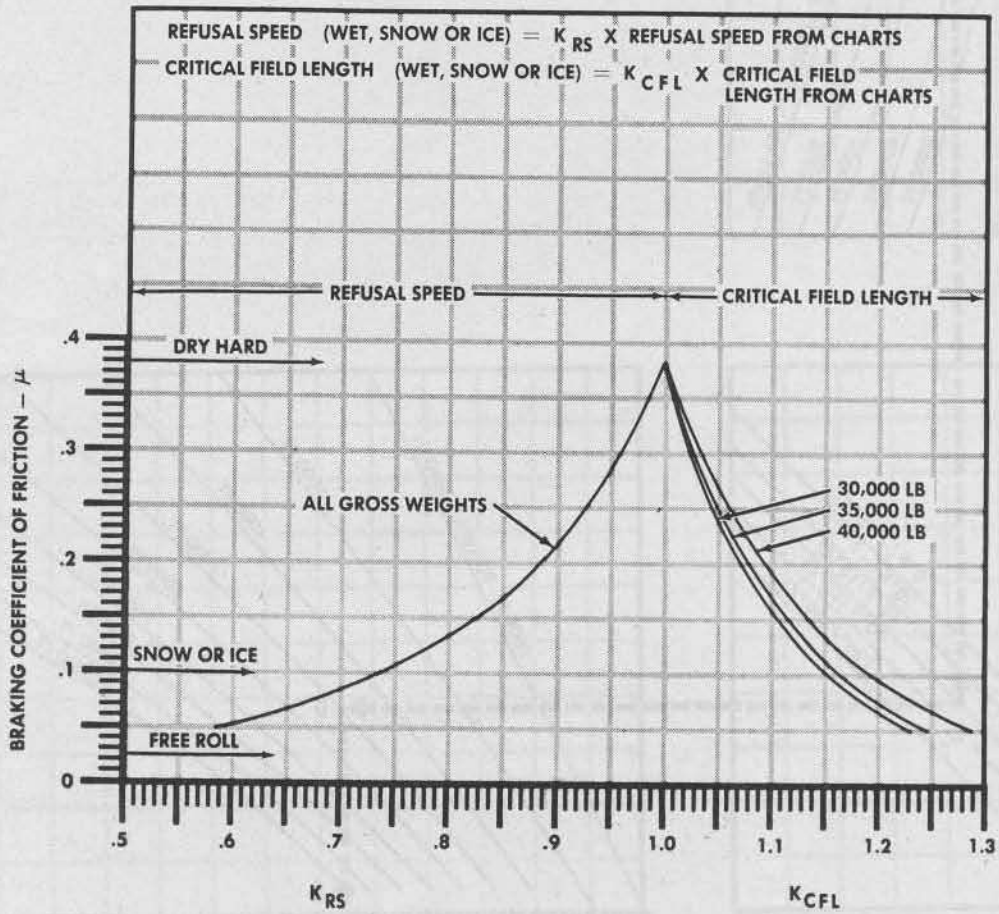


EFFECT OF RUNWAY SURFACE CONDITIONS

P-8 ENGINE

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
TAKEOFF FLAPS, GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED



C-ADA1-389

Figure 11-10

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MAXIMUM REFUSAL SPEEDS (single engine)

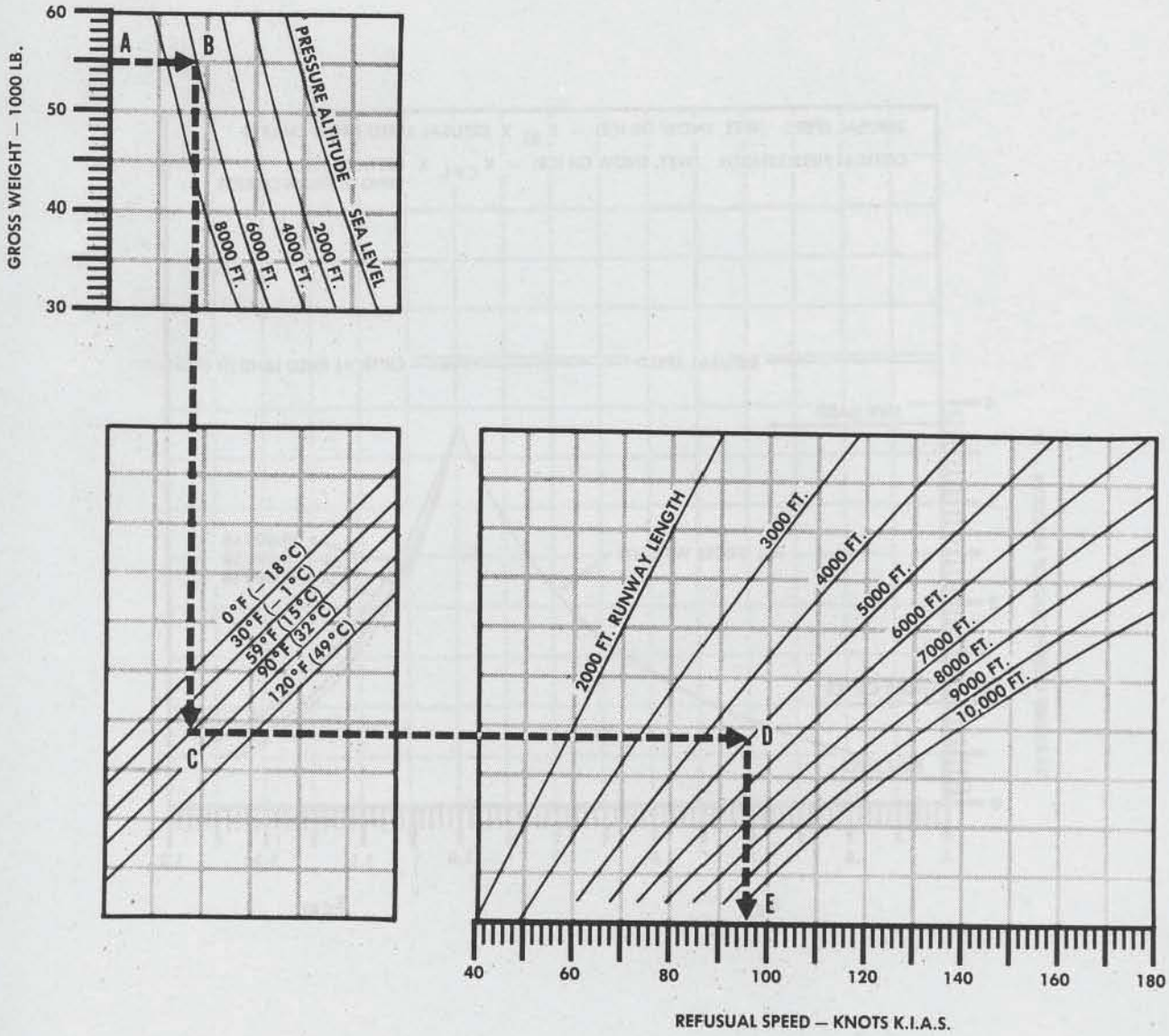
P-8 ENGINE

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
TAKE-OFF FLAPS, GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



A-ADA1-549

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Figure 11-11

TAKE-OFF DISTANCE (normal)

P-8 ENGINE

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION:
TAKEOFF FLAPS; GEAR DOWN
ALL EXTERNAL STORE CONFIGURATIONS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

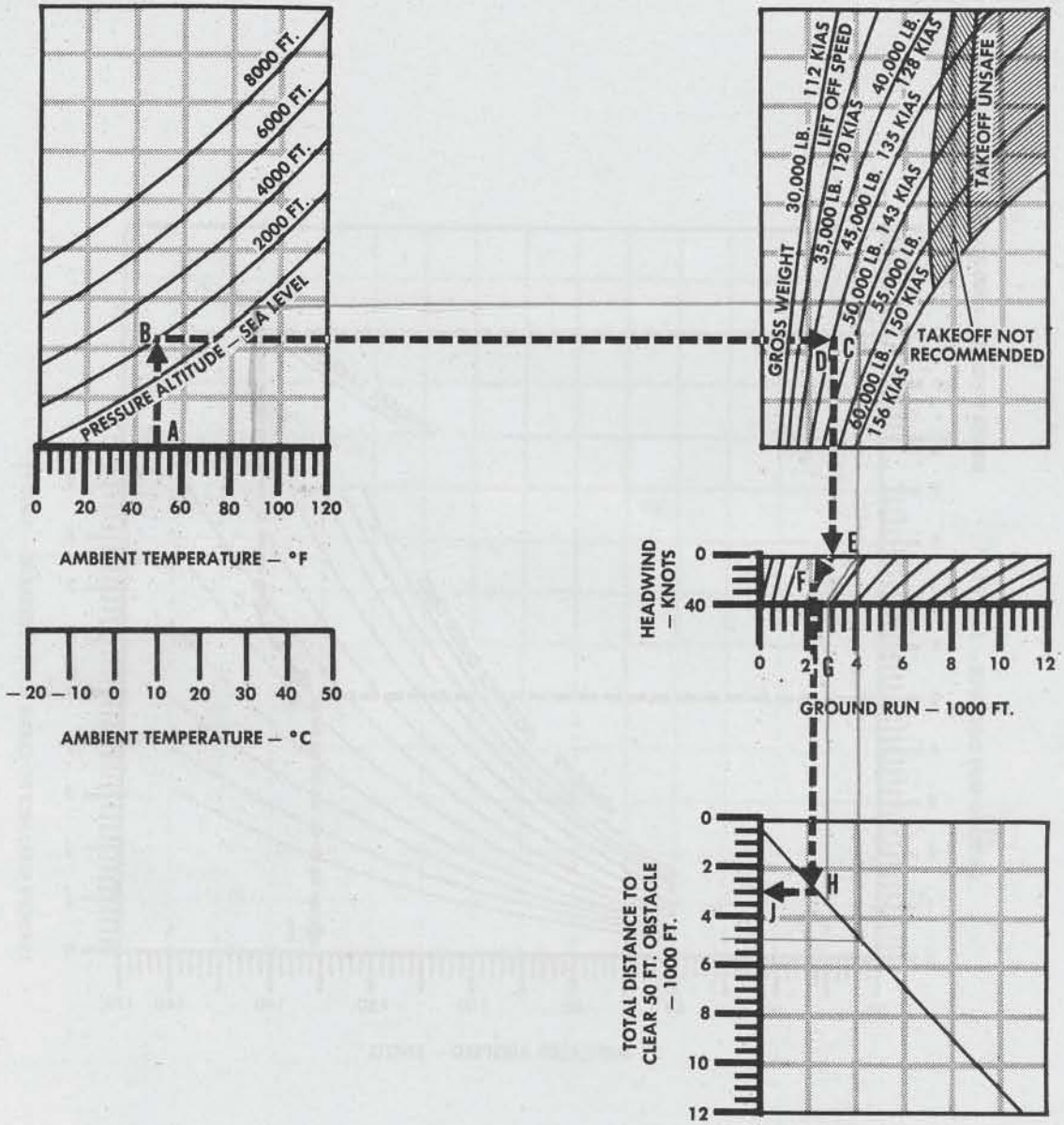

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Figure 11-12

VELOCITY DURING TAKEOFF GROUND RUN

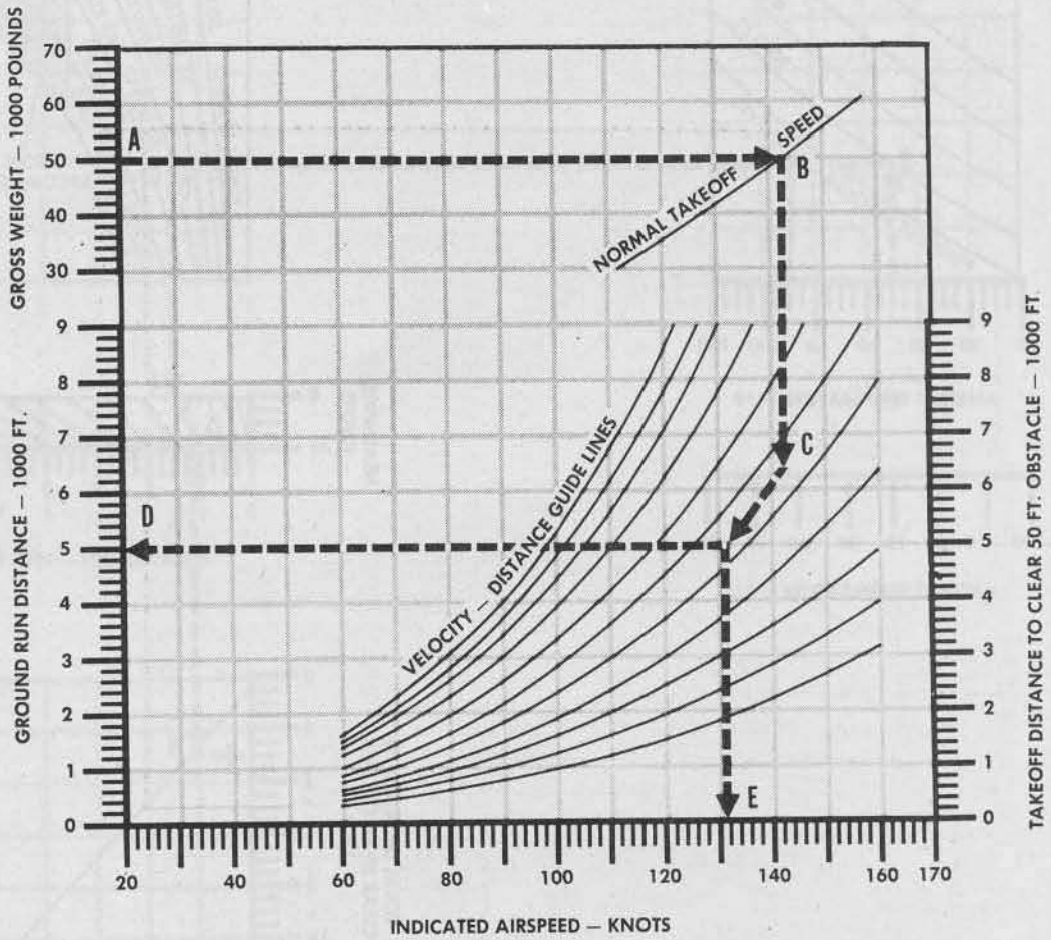
P-8 ENGINE

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
TAKEOFF FLAPS, GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



A-ADA1-649

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Figure 11-13

TAKE-OFF DISTANCE (normal)

P-8 ENGINE

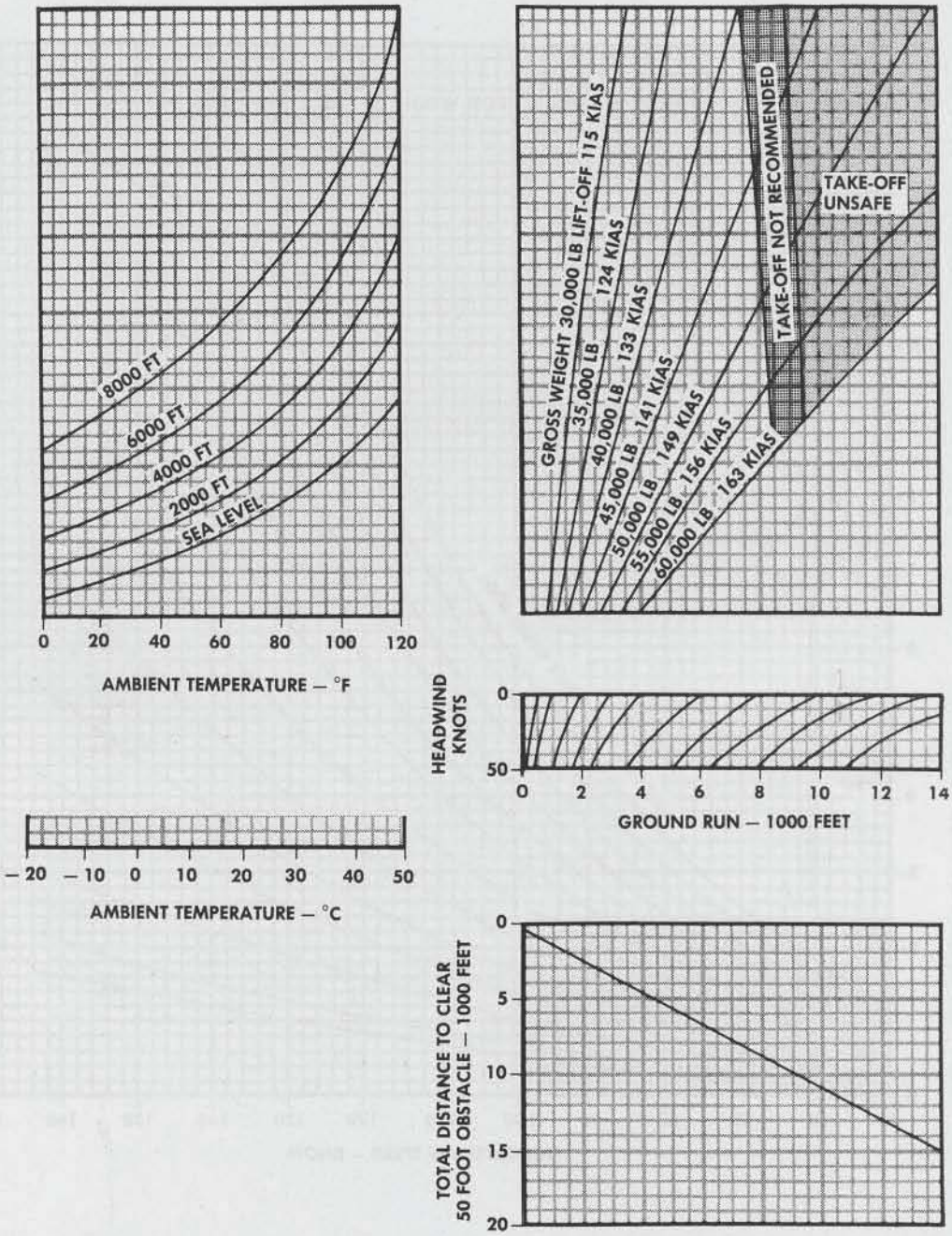
A-6C

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN
ALL EXTERNAL STORE CONFIGURATIONS

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADA1-589

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Figure 11-14

VELOCITY DURING TAKE-OFF GROUND RUN

P-8 ENGINE

A-6C

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN
ALL EXTERNAL STORE CONFIGURATIONS

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

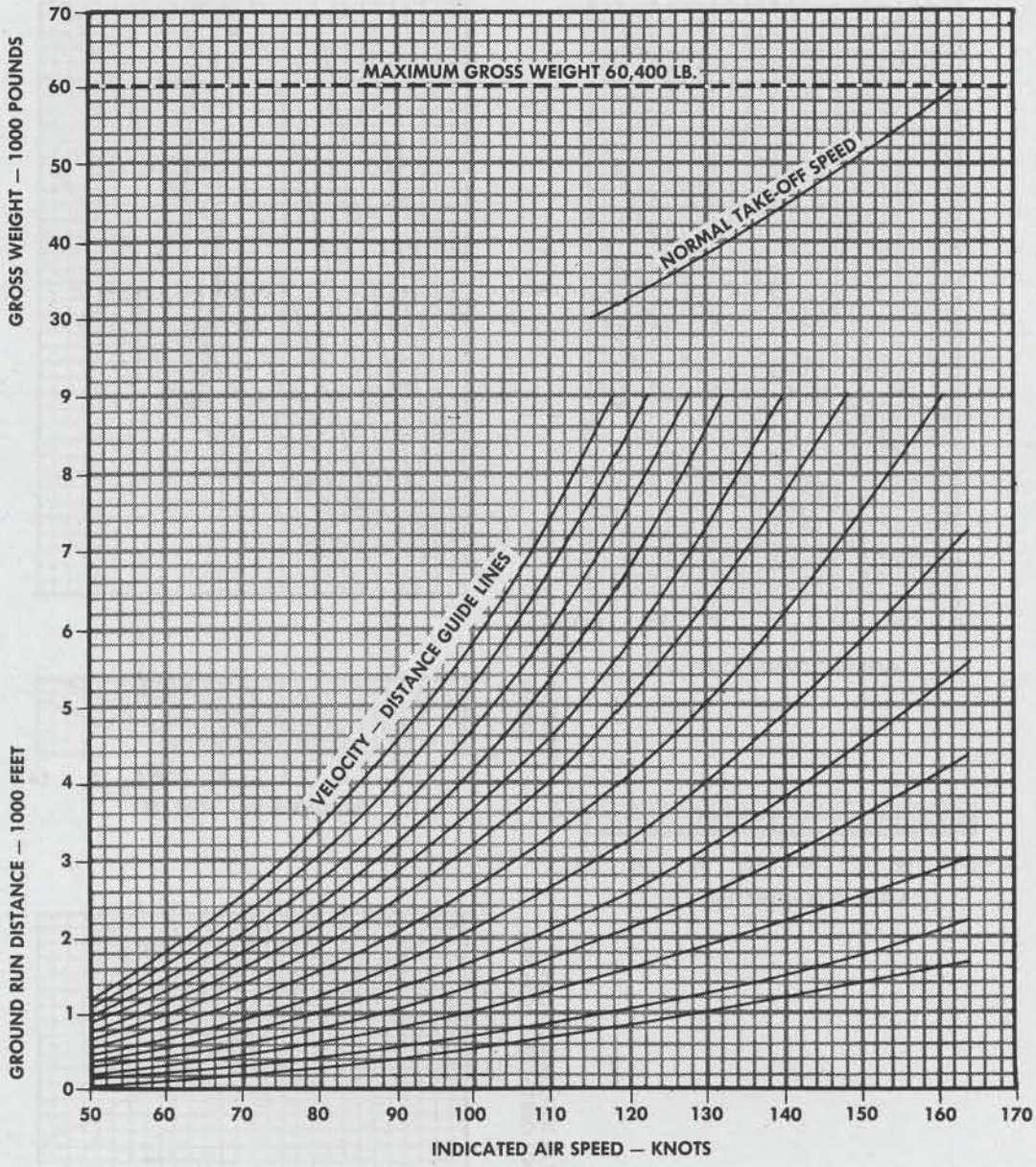

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Figure 11-15

MINIMUM TAKE-OFF DISTANCE

P-8 ENGINE

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
TAKE-OFF FLAPS, GEARS DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

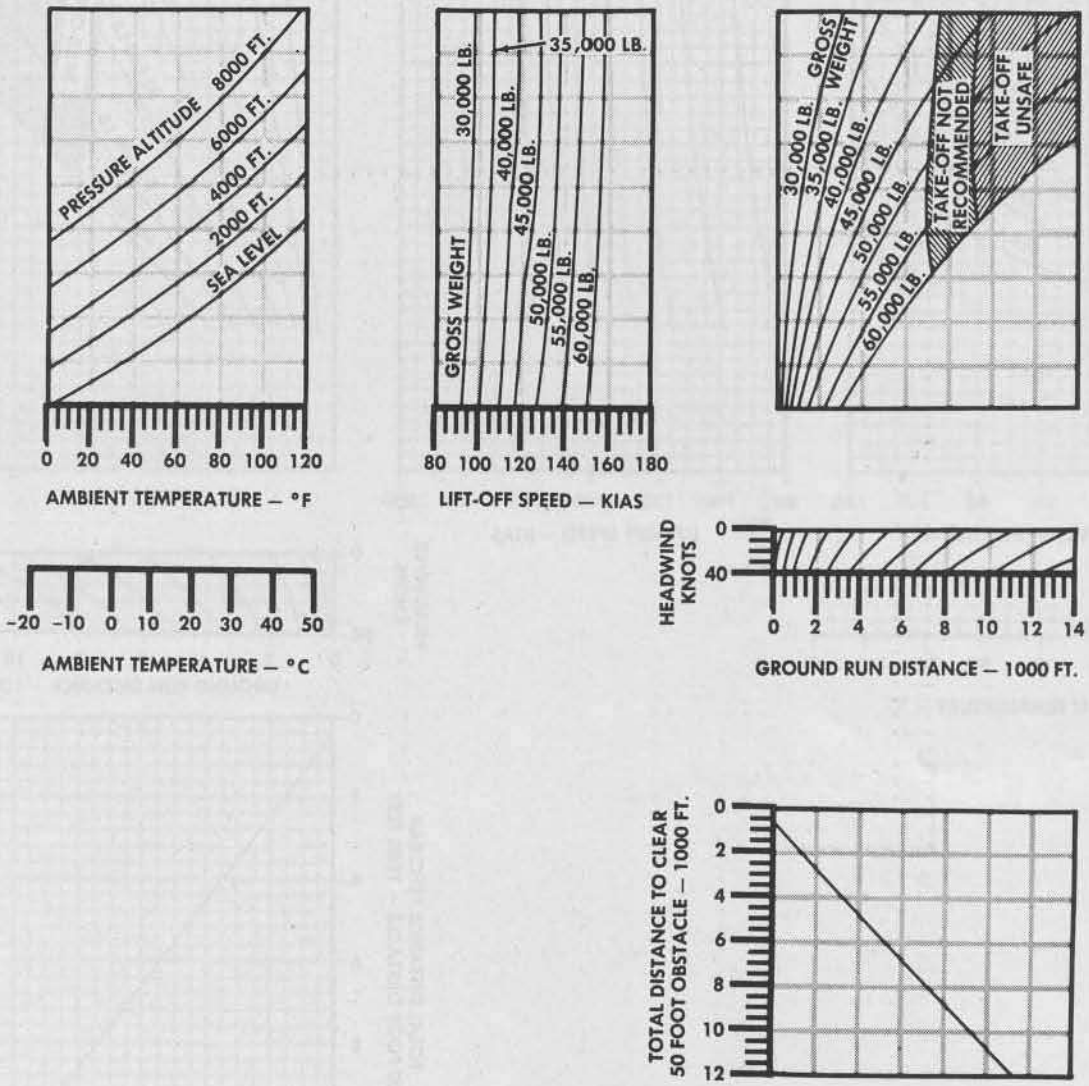

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Figure 11-16

MINIMUM TAKE-OFF DISTANCE

P-8 ENGINE

A-6C

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN
ALL EXTERNAL STORE CONFIGURATIONS

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

MILITARY POWER
HARD DRY RUNWAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

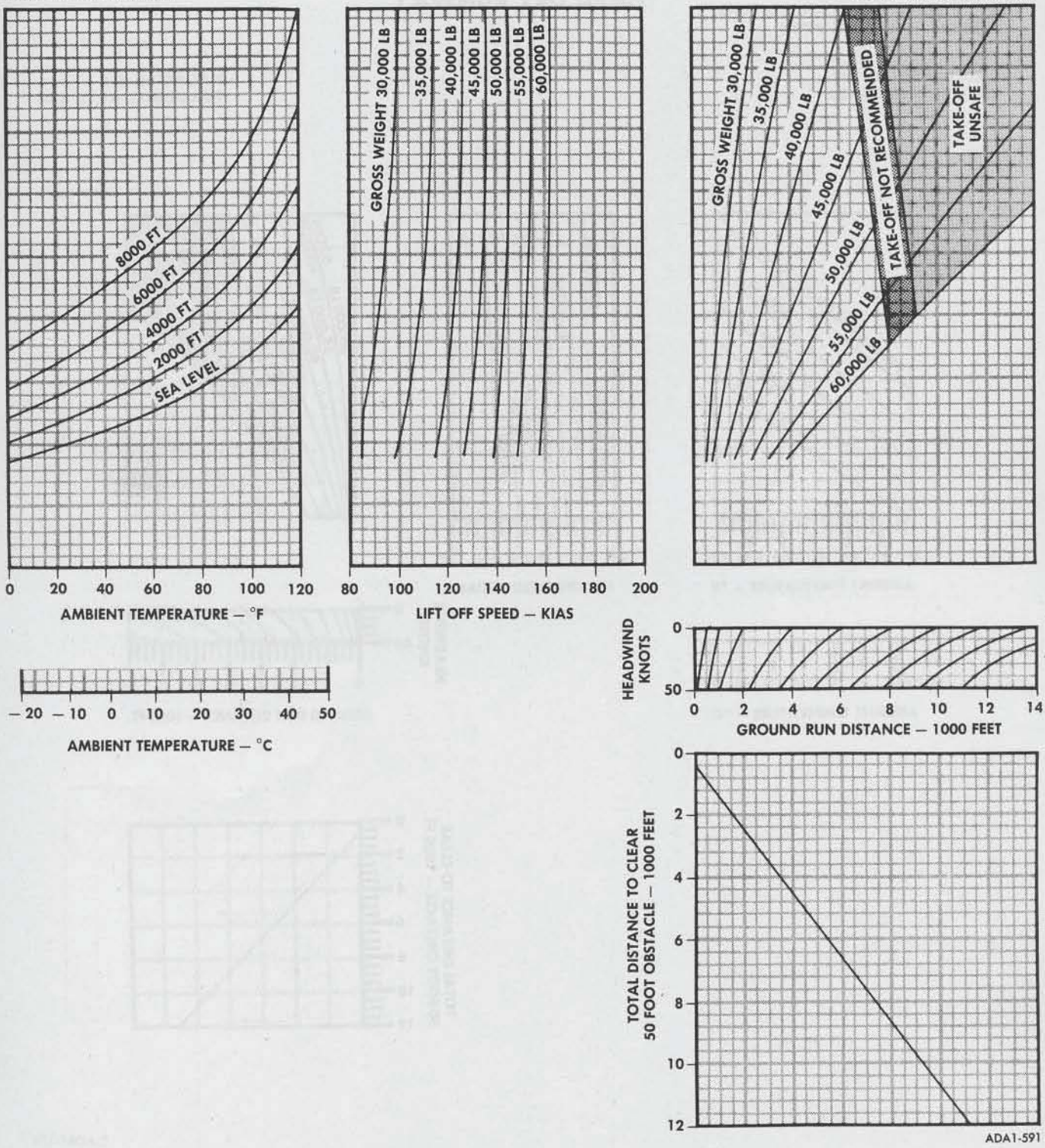

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Figure 11-17

CRITICAL FIELD LENGTH (single engine)

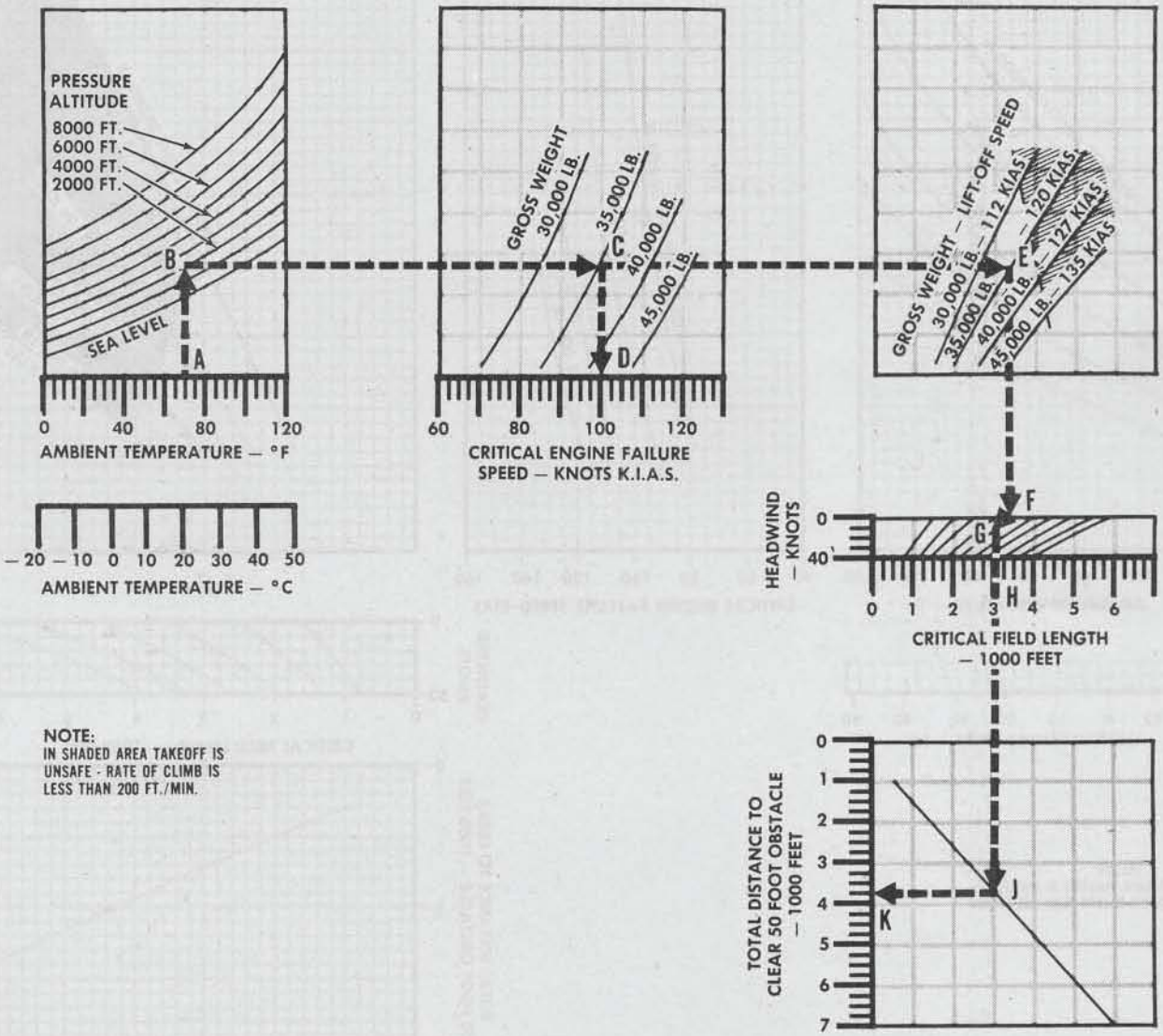
P-8 ENGINE

MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION:
ALL CONFIGURATIONS
TAKEOFF FLAPS, GEAR-DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE:
IN SHADED AREA TAKEOFF IS UNSAFE - RATE OF CLIMB IS LESS THAN 200 FT./MIN.

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Figure 11-18

CRITICAL FIELD LENGTH (single engine)

P-8 ENGINE

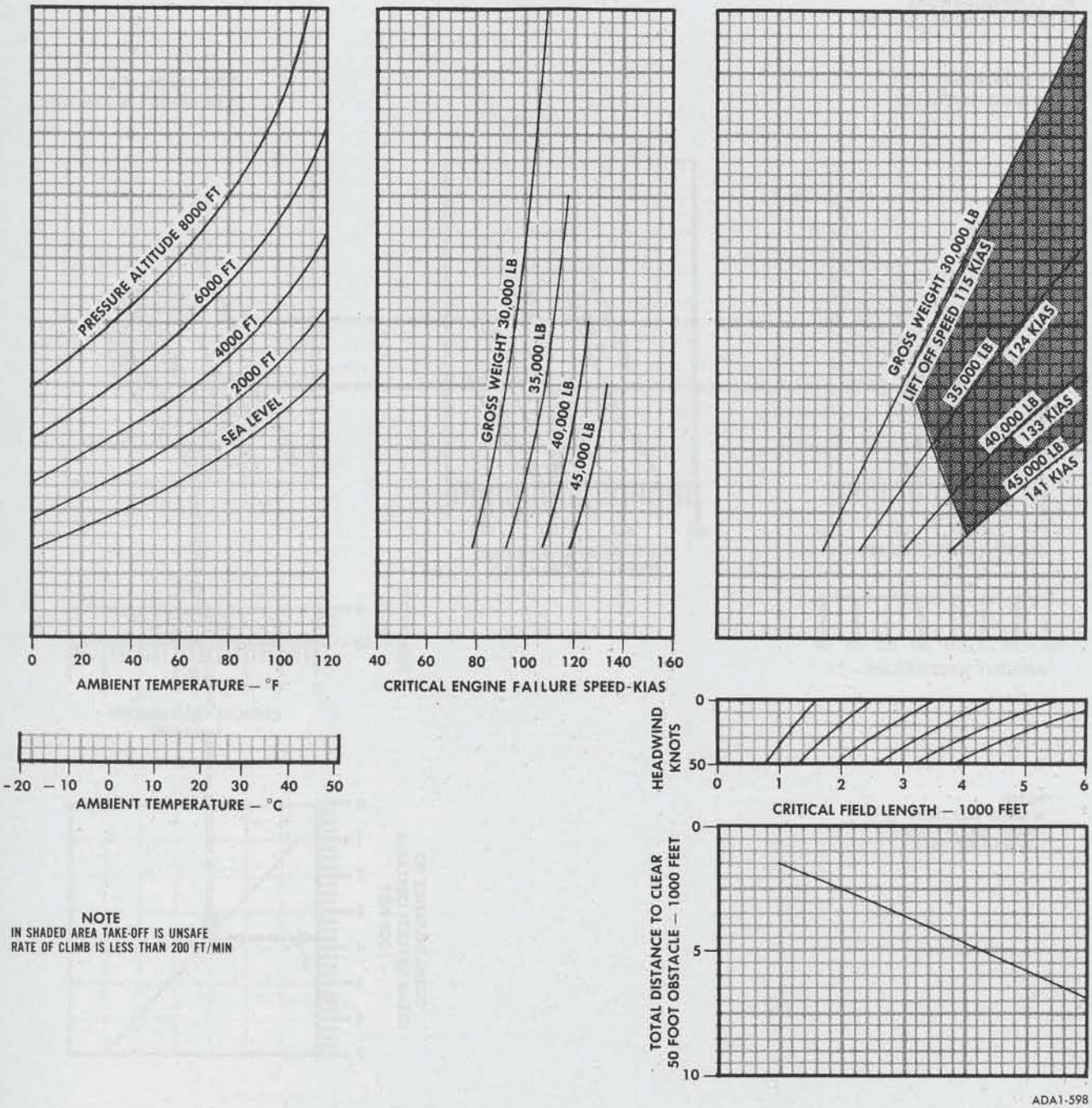
A-6C

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN
ALL EXTERNAL STORE CONFIGURATIONS

MILITARY POWER
HARD DRY RUNWAY

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE
IN SHADED AREA TAKE-OFF IS UNSAFE
RATE OF CLIMB IS LESS THAN 200 FT/MIN

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Figure 11-19

MAXIMUM CLIMB-OUT ANGLE

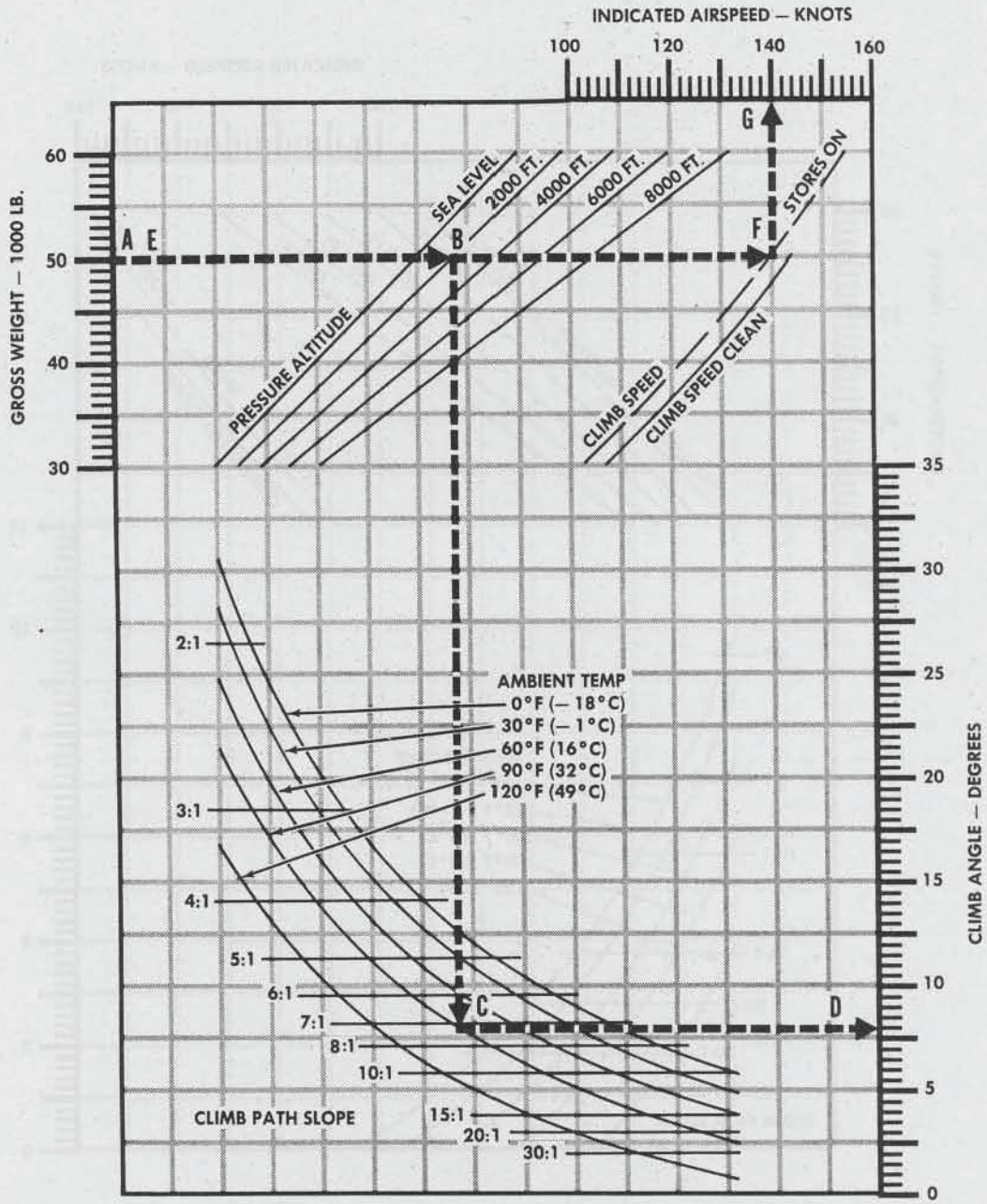
P-8 ENGINE

MILITARY POWER

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
TAKEOFF FLAPS, GEAR UP

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-357

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Figure 11-20

MAXIMUM CLIMB-OUT ANGLE (single engine)

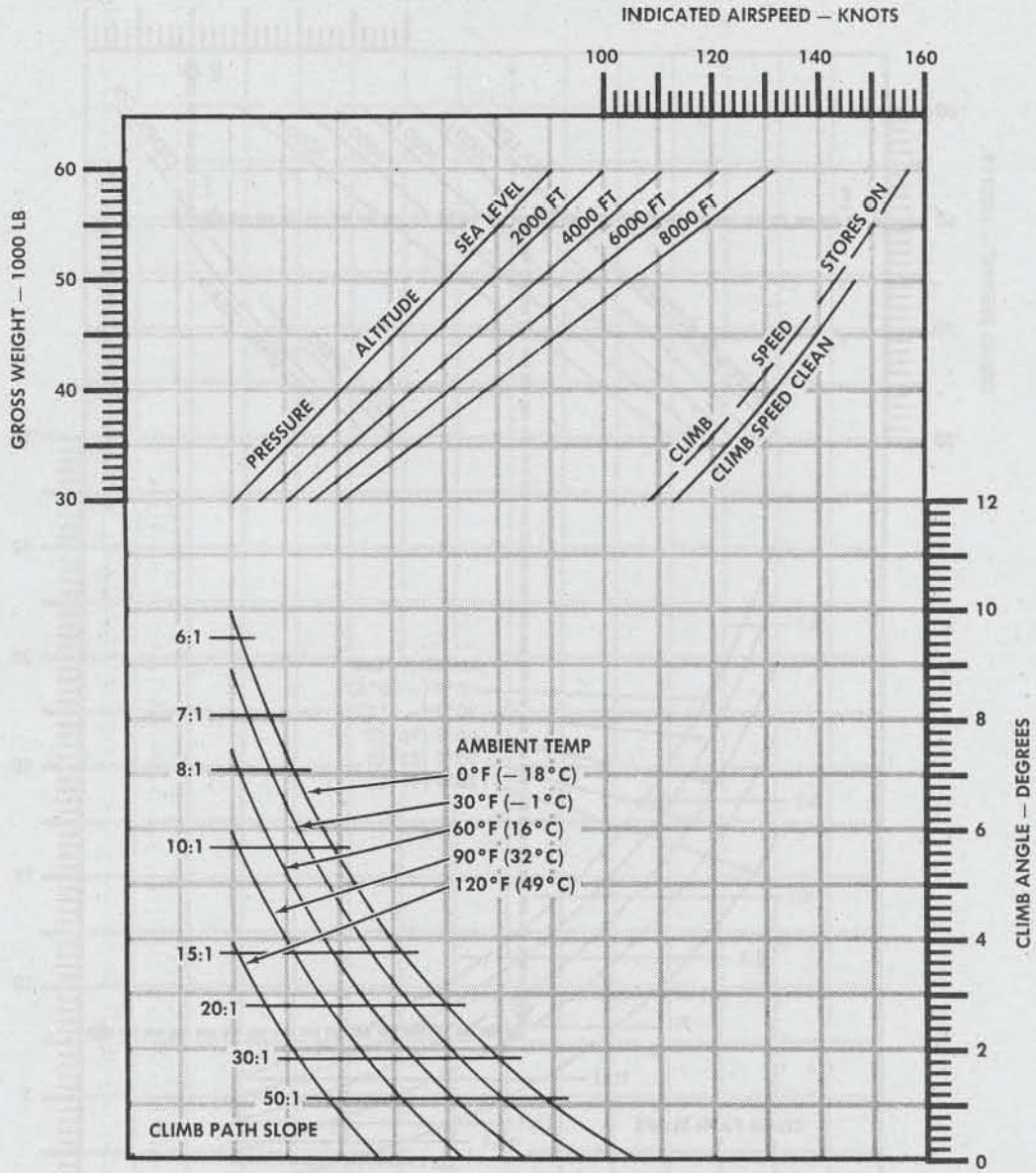
P-8 ENGINE

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
TAKEOFF FLAPS, GEAR UP

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-358

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Figure 11-21

MAXIMUM CLIMB (instantaneous)

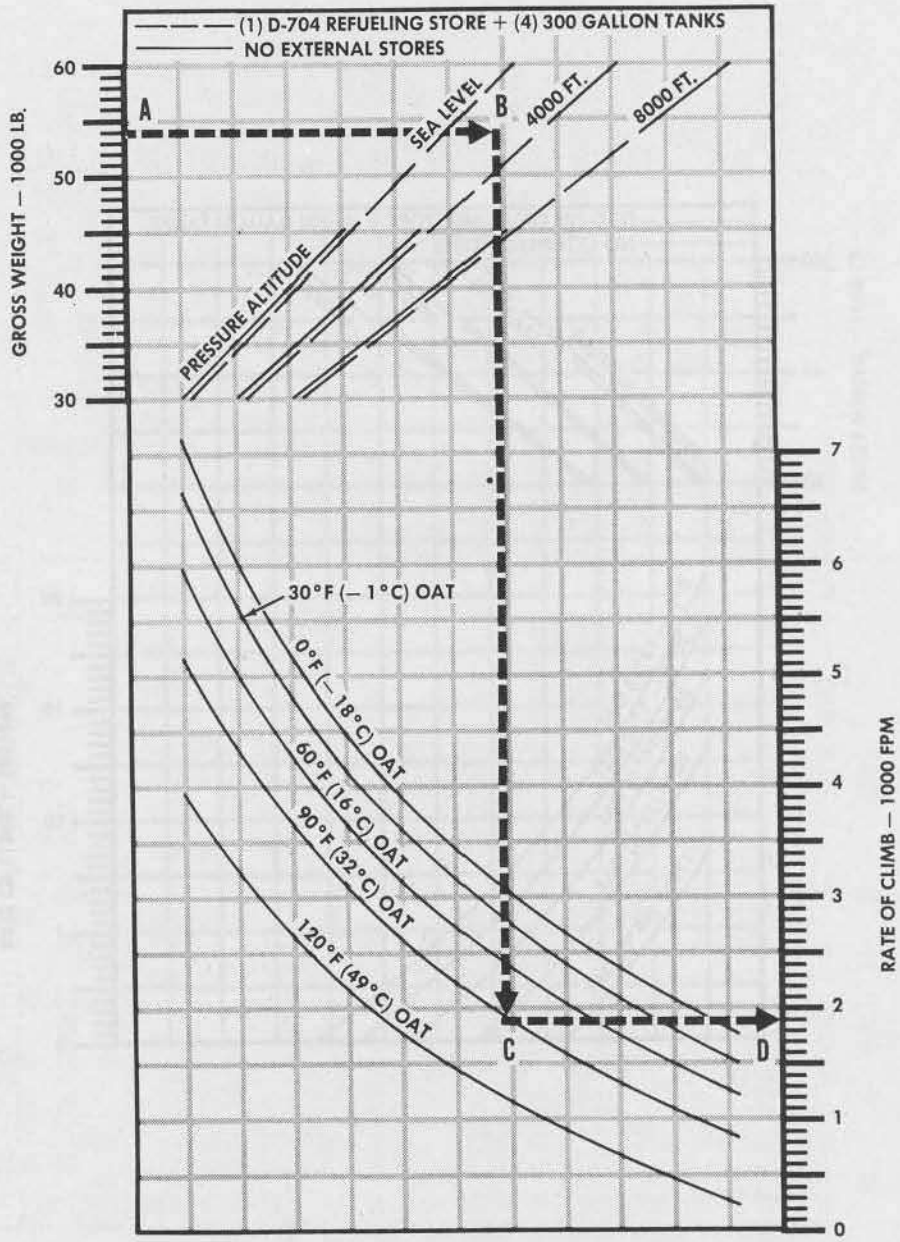
P-8 ENGINE

RATE OF CLIMB
MILITARY POWER

AIRCRAFT CONFIGURATION
TAKEOFF FLAPS, GEAR UP

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-360

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Figure 11-22

MAXIMUM CLIMB
(instantaneous, single engine)

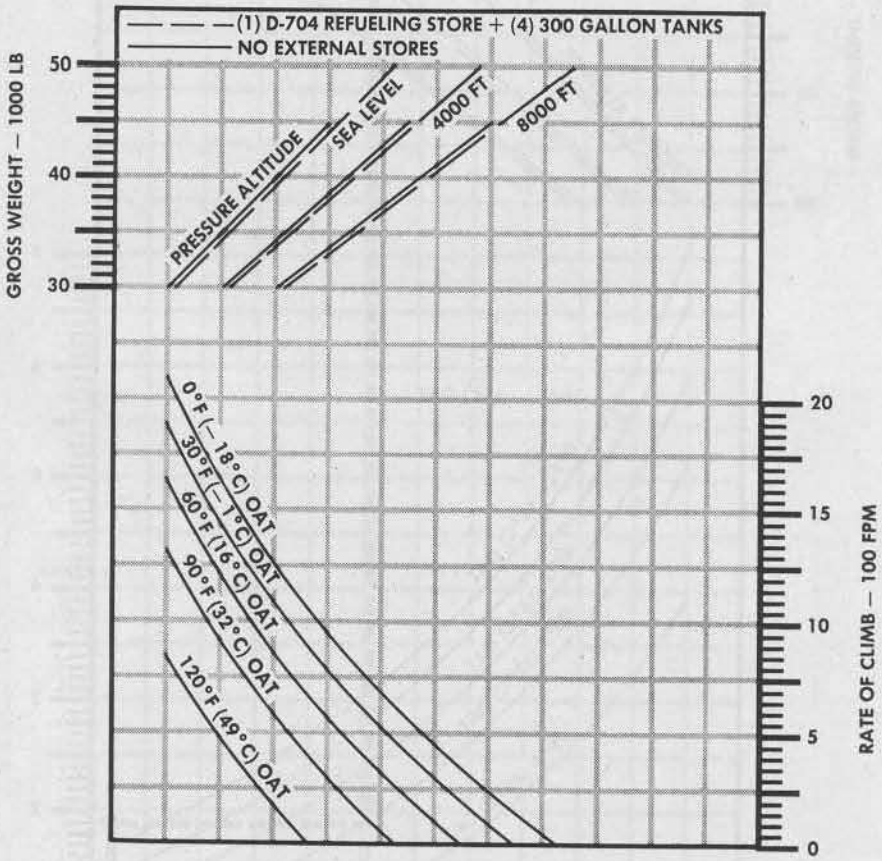
P-8 ENGINE

AIRCRAFT CONFIGURATION
TAKEOFF FLAPS, GEAR UP

RATE OF CLIMB
MILITARY POWER

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-361

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Figure 11-23

MAXIMUM CLIMB (instantaneous)

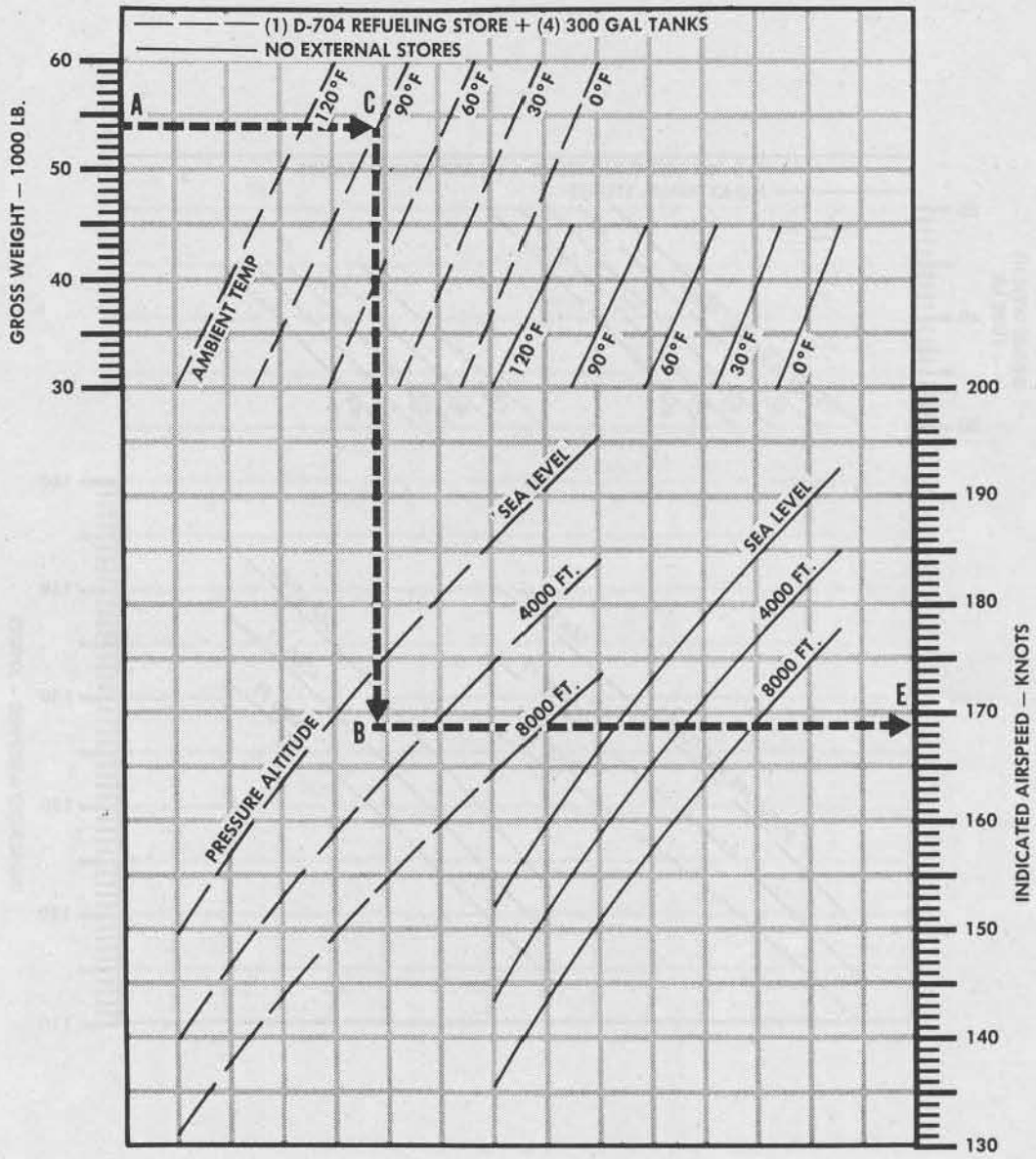
P-8 ENGINE

CLIMB SPEED
MILITARY POWER

AIRCRAFT CONFIGURATION
TAKEOFF FLAPS, GEAR UP

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-362

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Figure 11-24

MAXIMUM CLIMB (Instantaneous, single engine)

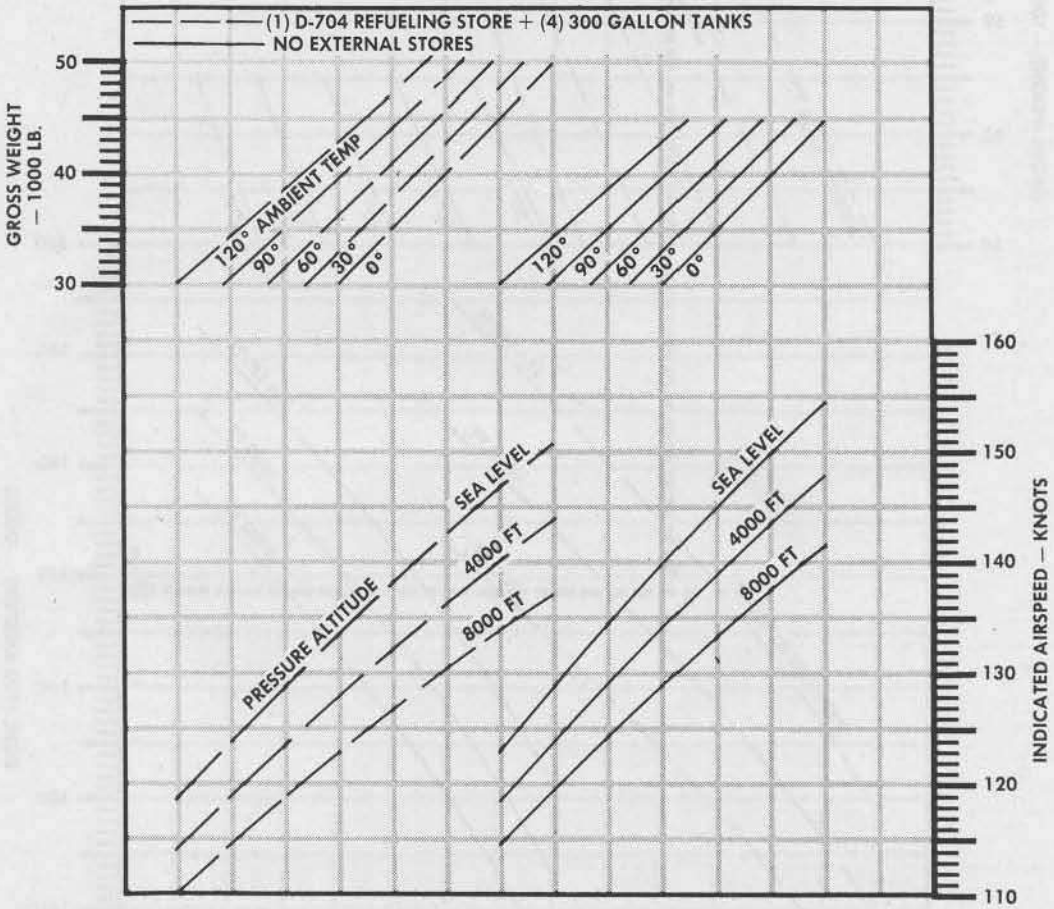
P-8 ENGINE

CLIMB SPEED
MILITARY POWER

AIRCRAFT CONFIGURATION
TAKEOFF FLAPS, GEAR UP

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-363

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Figure 11-25

RATE OF CLIMB (single engine)

P-8 ENGINE

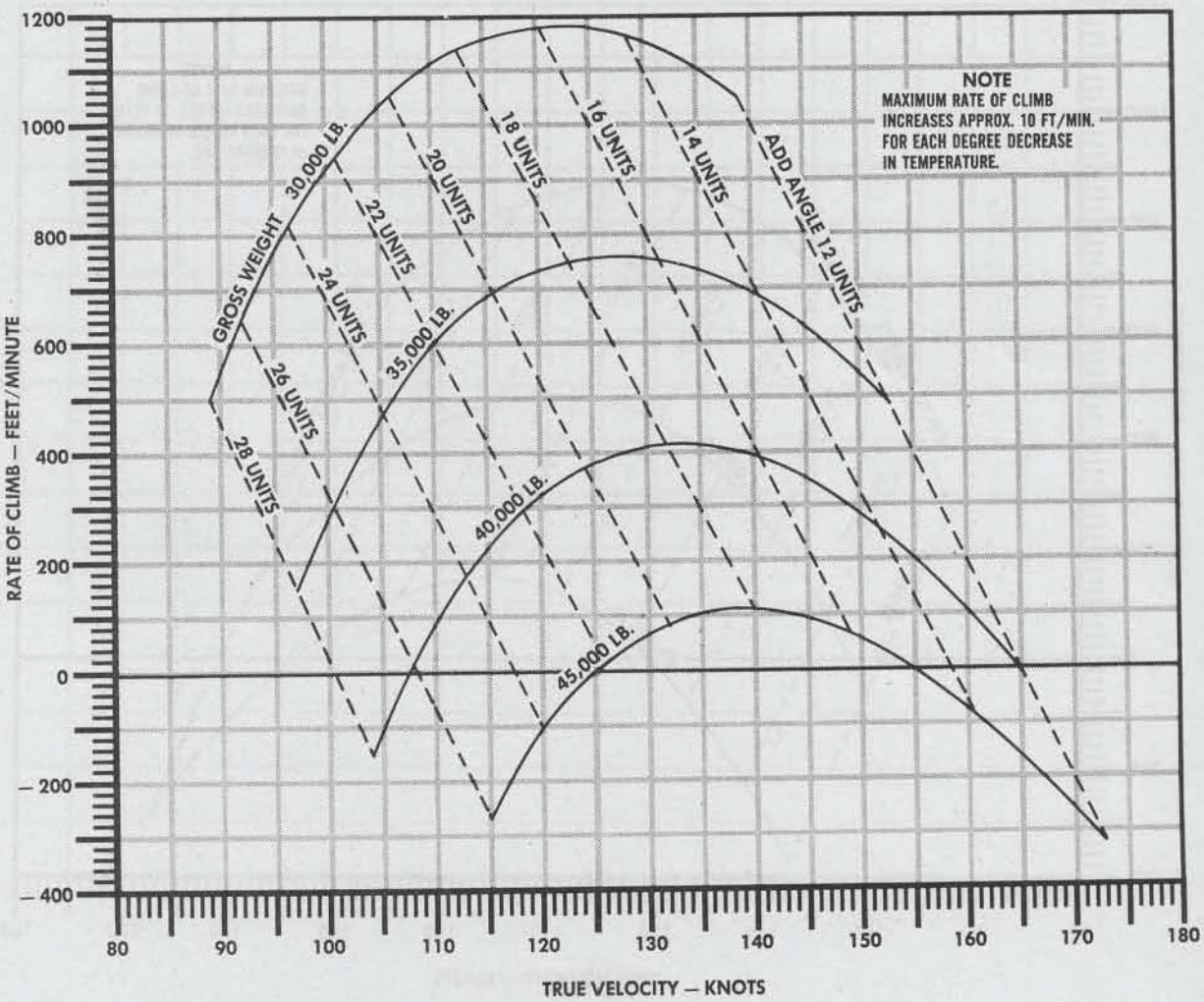
SEA LEVEL
MILITARY POWER

CONFIGURATION
NO EXTERNAL STORES
TAKEOFF FLAPS; GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-364

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Figure 11-26

RATE OF CLIMB (single engine)

P-8 ENGINE

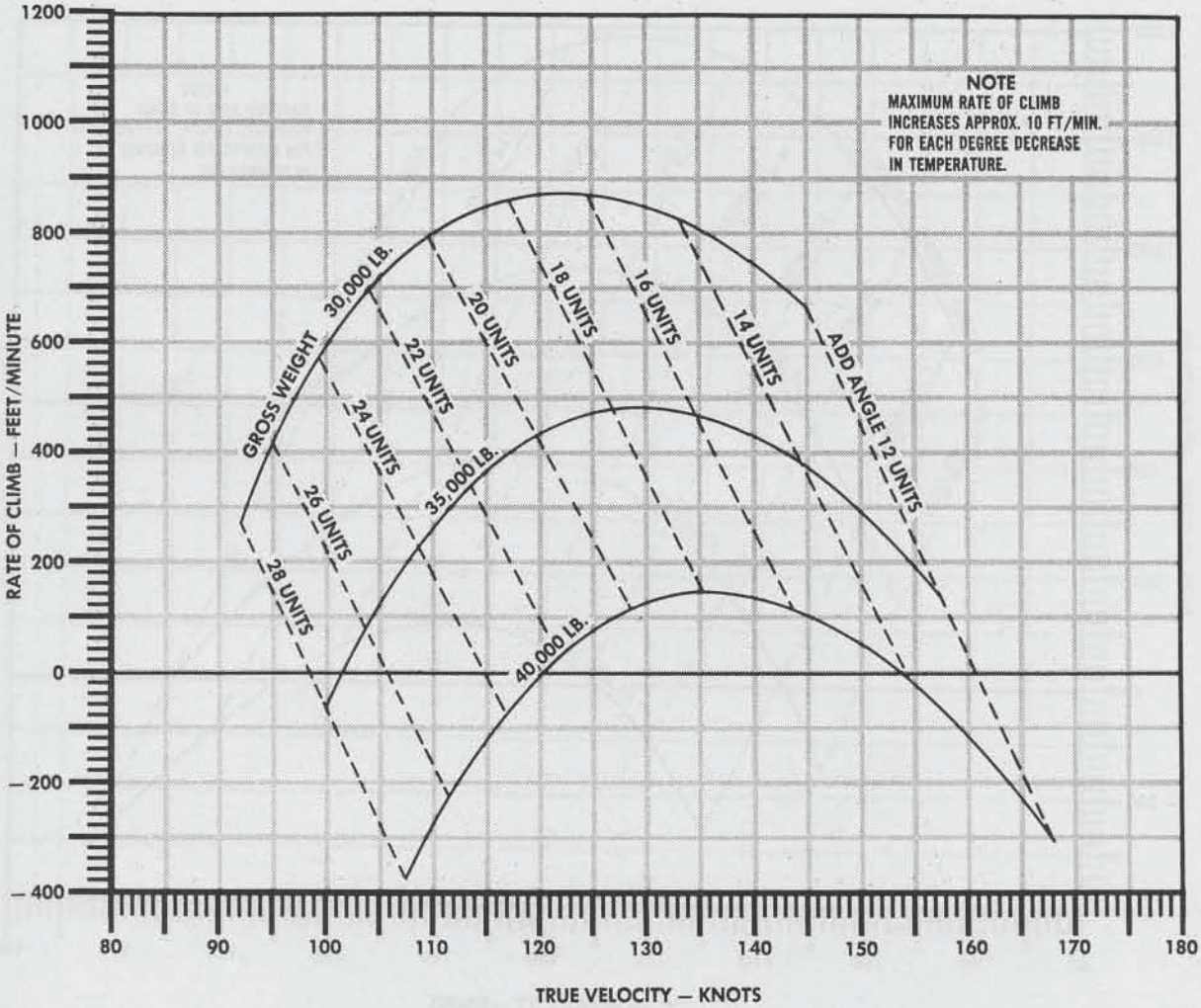
SEA LEVEL
MILITARY POWER

CONFIGURATION
NO EXTERNAL STORES
TAKEOFF FLAPS; GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
TROPICAL DAY
INOPERATIVE ENGINE WINDMILLING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-365

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Figure 11-27

RATE OF CLIMB (single engine)

P-8 ENGINE

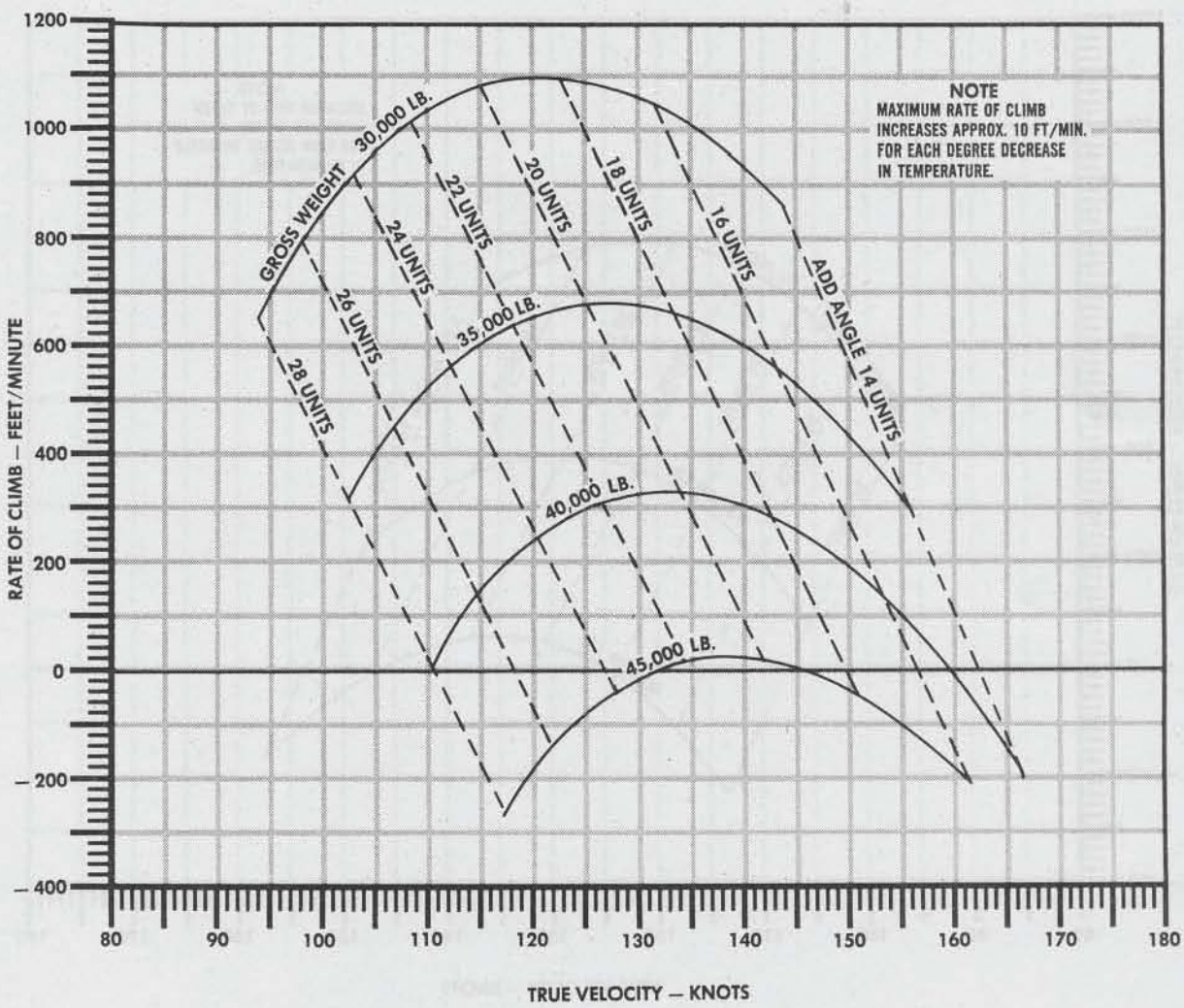
SEA LEVEL
MILITARY POWER

CONFIGURATION
(1, MK-28 STORE+(4) 300 GALLON
DROP TANKS
TAKE OFF FLAPS; GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-366

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Figure 11-28

RATE OF CLIMB (single engine)

P-8 ENGINE

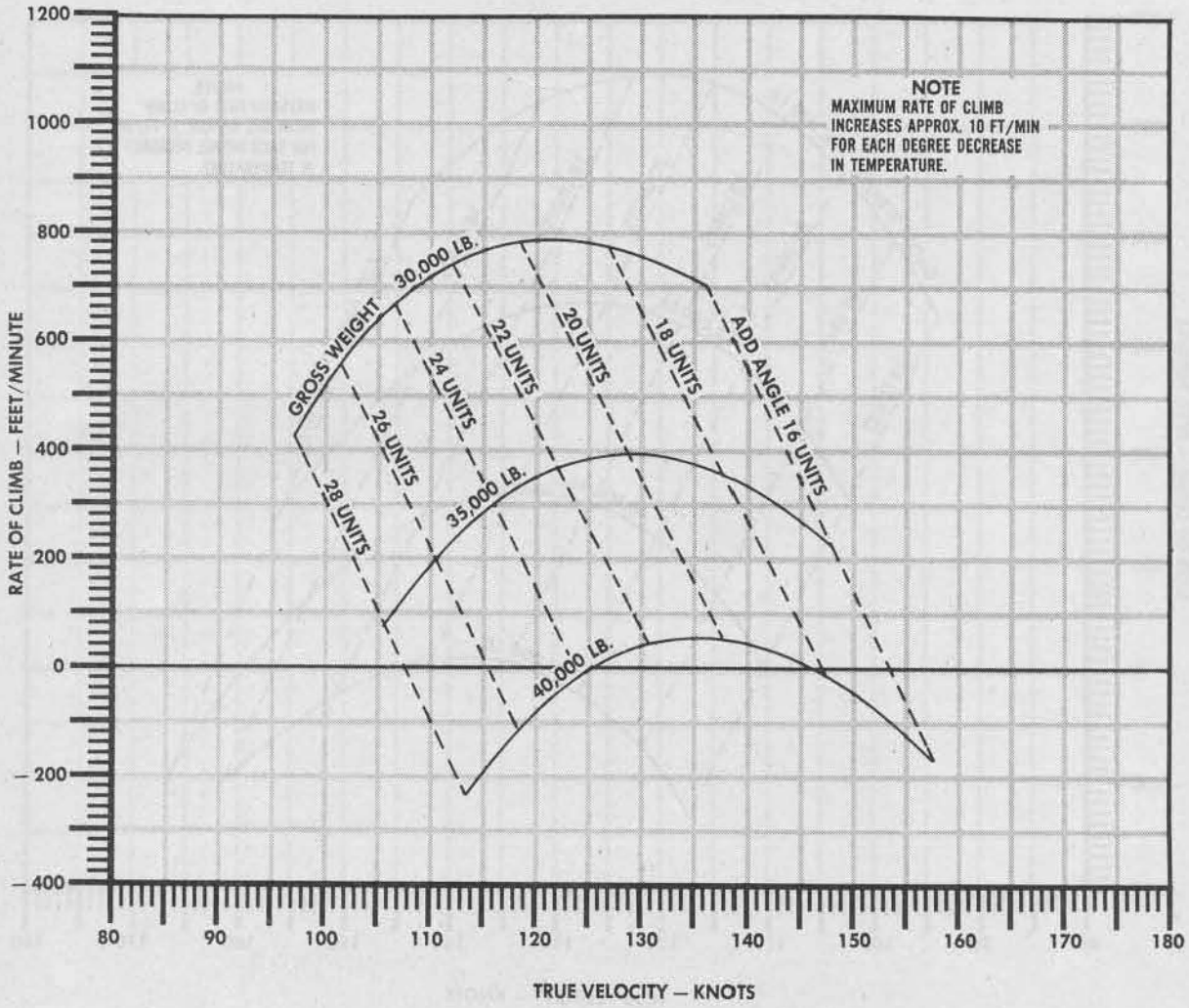
SEA LEVEL MILITARY POWER

CONFIGURATION
(1) MK-28 STORE+(4) 300 GALLON DROP TANKS
TAKE OFF FLAPS, GEAR DOWN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
TROPICAL DAY
INOPERATIVE ENGINE WINDMILLING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-367

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Figure 11-29

MAXIMUM RATE OF CLIMB (instantaneous) (single engine)

P-8 ENGINE

CONFIGURATION
(1) MK-28 STORE + (4) 300 GALLON DROP TANKS
TAKE OFF FLAPS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

SEA LEVEL MILITARY POWER

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

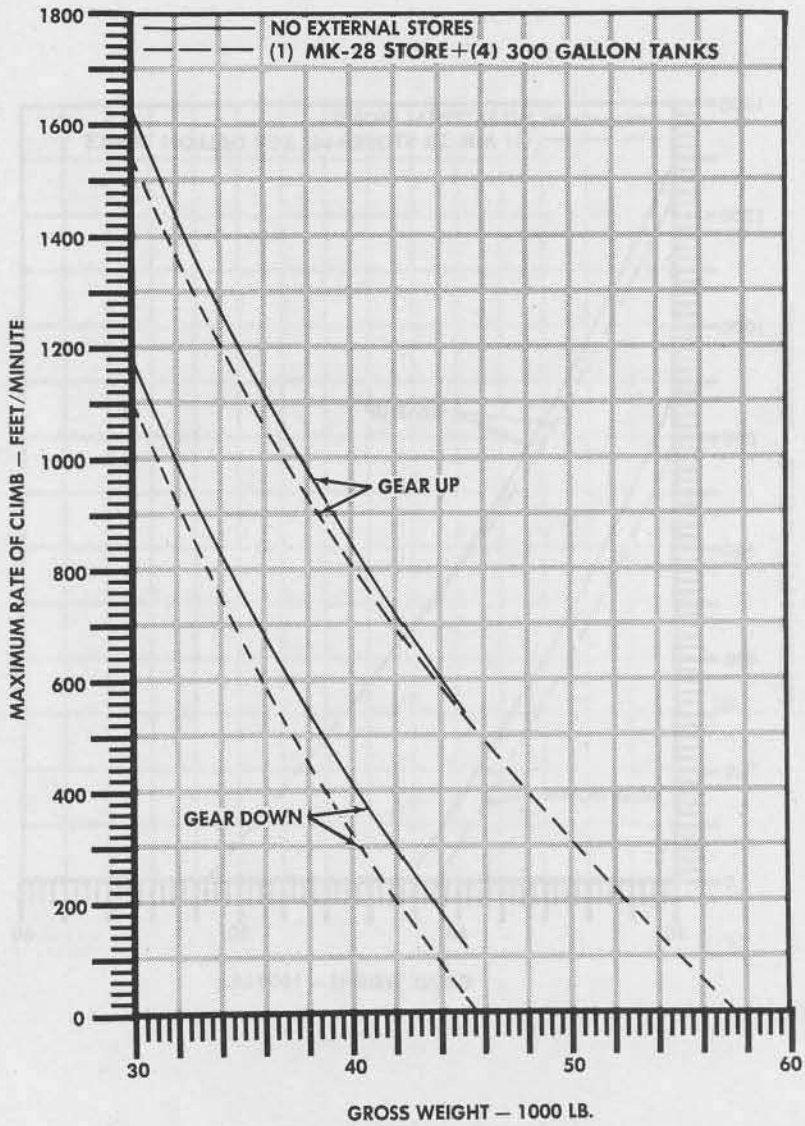

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Figure 11-30

MAXIMUM RATE OF CLIMB (instantaneous) (single engine)

P-8 ENGINE

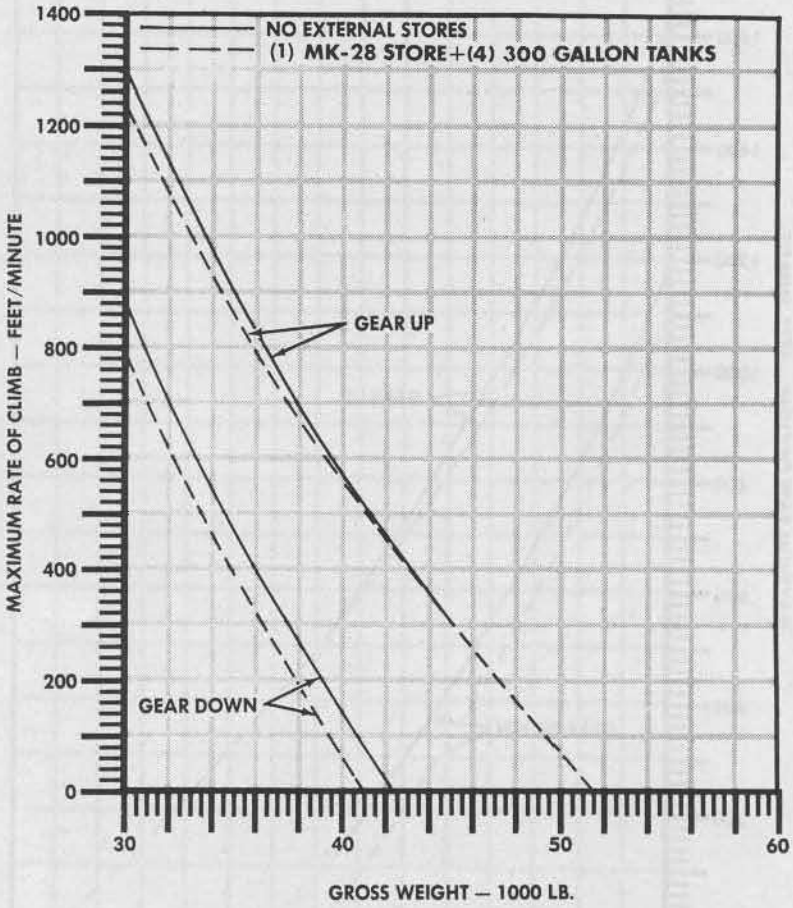
SEA LEVEL MILITARY POWER

CONFIGURATION
(1) MK-28 STORE+(4) 300 GALLON DROP TANKS
TAKE OFF FLAPS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
TROPICAL DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADF1-369

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Figure 11-31

MAXIMUM RATE OF CLIMB (instantaneous)

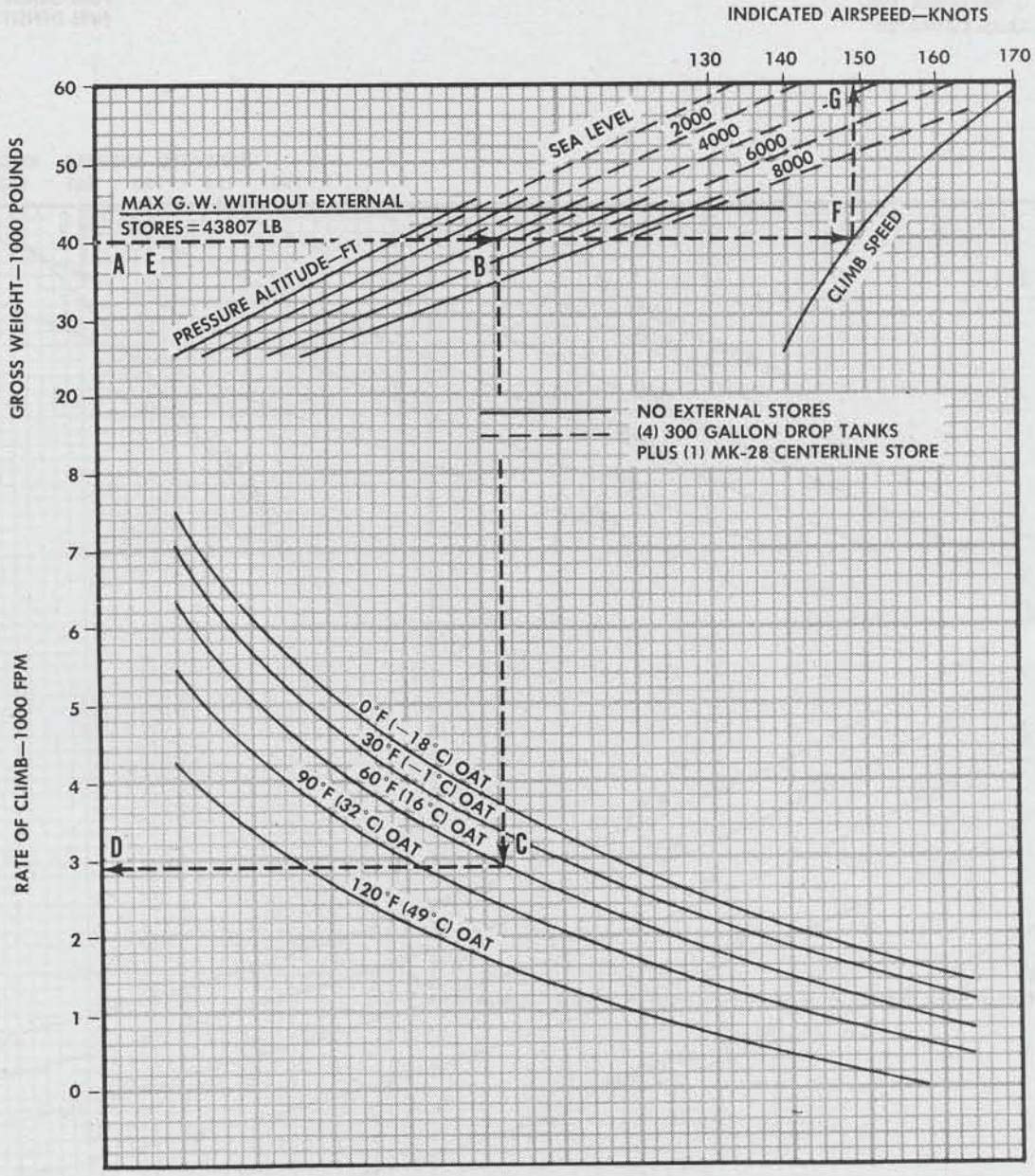
P-8 ENGINE

MILITARY POWER

AIRCRAFT CONFIGURATION
TAKEOFF FLAPS, GEAR DOWN

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADA1-644

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Figure 11-32

MAXIMUM RATE OF CLIMB (instantaneous)

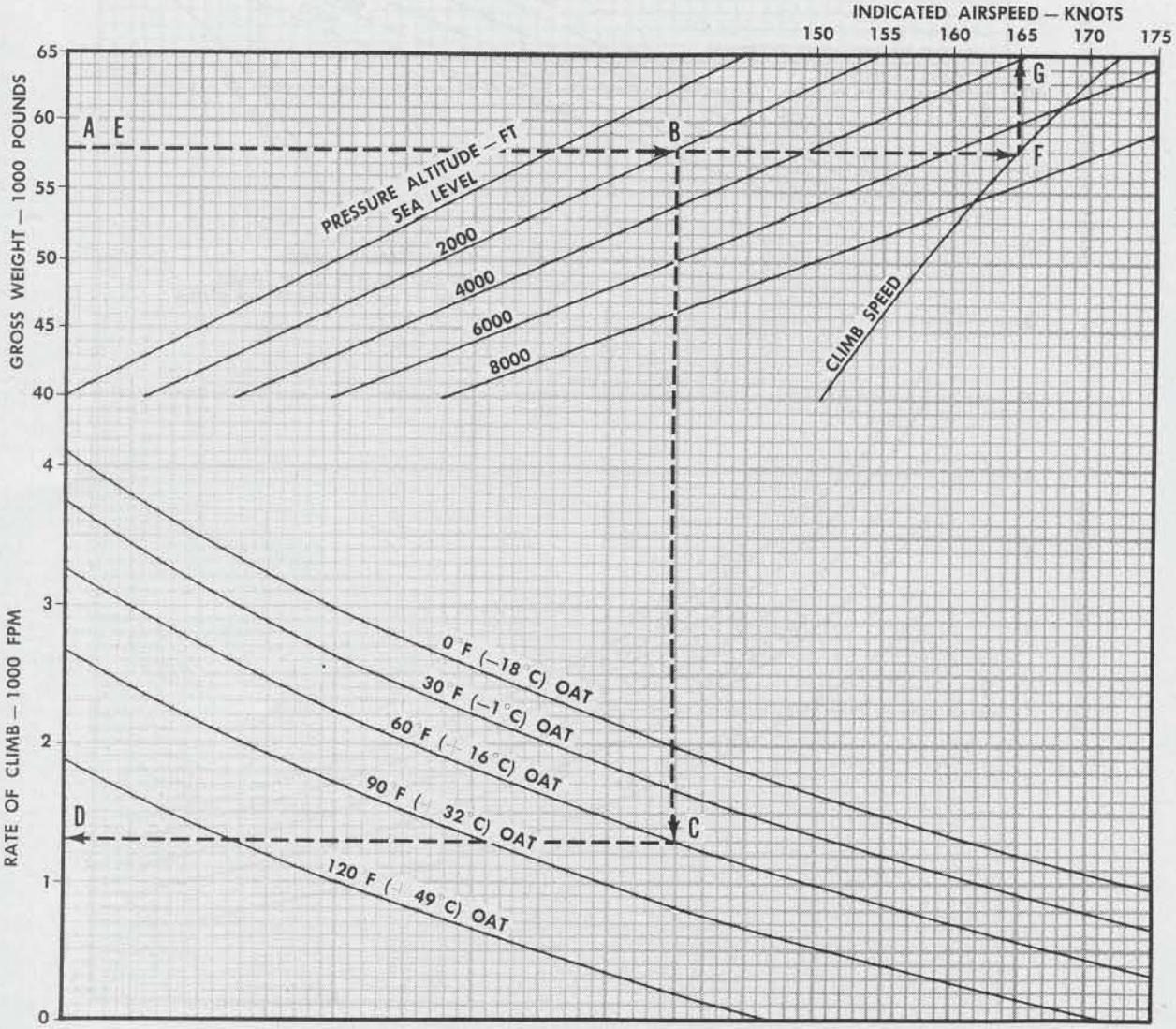
P-8 ENGINE

MILITARY POWER

AIRCRAFT CONFIGURATION
(30) MK-82 STORES INSTALLED ON
(5)A/A37B-1 MBR
TAKE-OFF FLAPS, GEAR DOWN

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADA1-645

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Figure 11-33

MAXIMUM RATE OF CLIMB (instantaneous) (single engine)

P-8 ENGINE

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN

MILITARY POWER

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

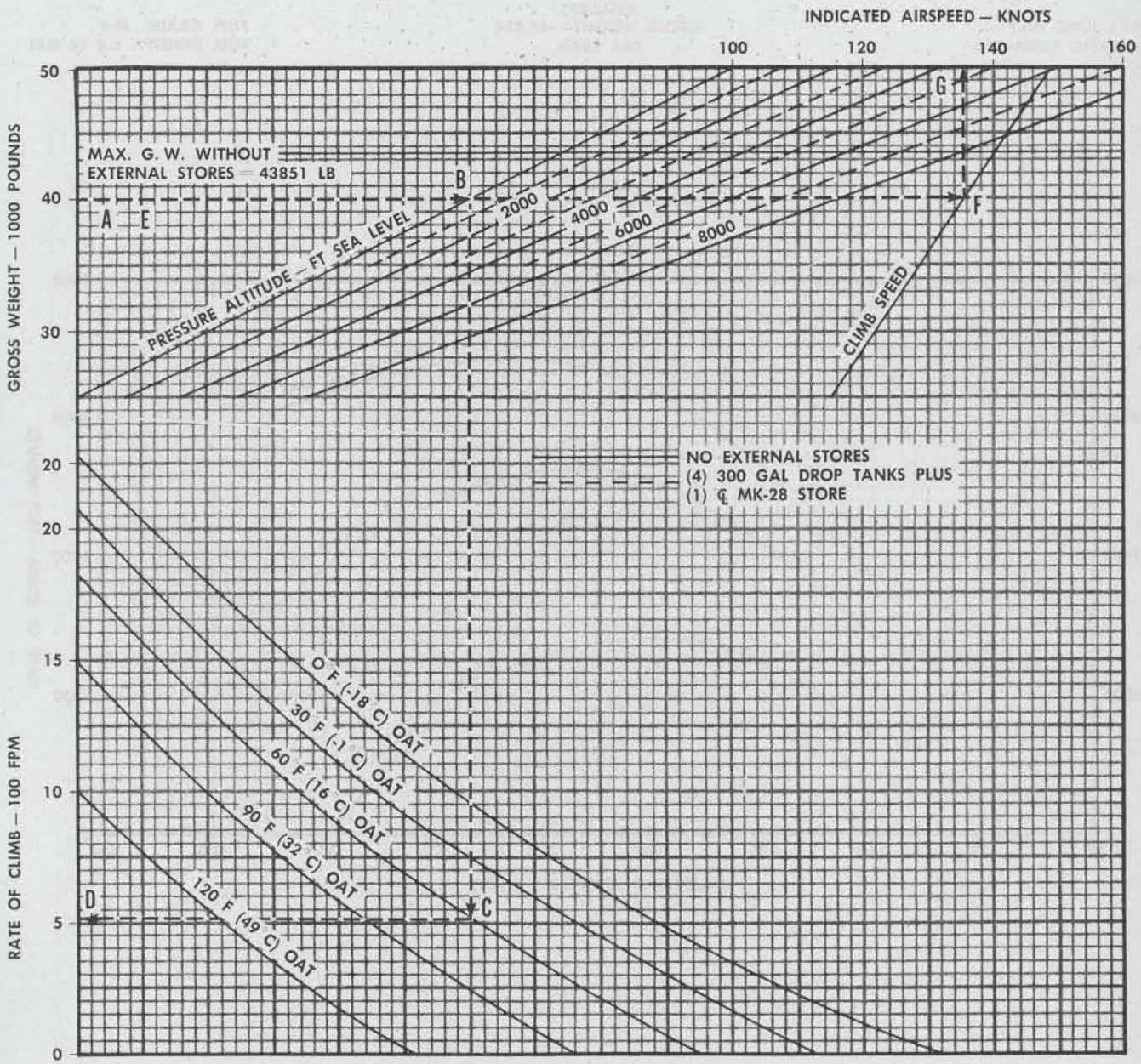

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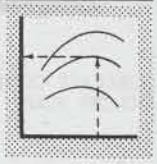
Figure 11-34

CLIMB PERFORMANCE AFTER TAKE-OFF (single engine)

P-8 ENGINE

GUIDE



MILITARY POWER

AIRCRAFT CONFIGURATION
CLEAN
FLAPS UP AND GEAR UP

DATE: 1 JUNE 1967
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT = 42,834
SEA LEVEL

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

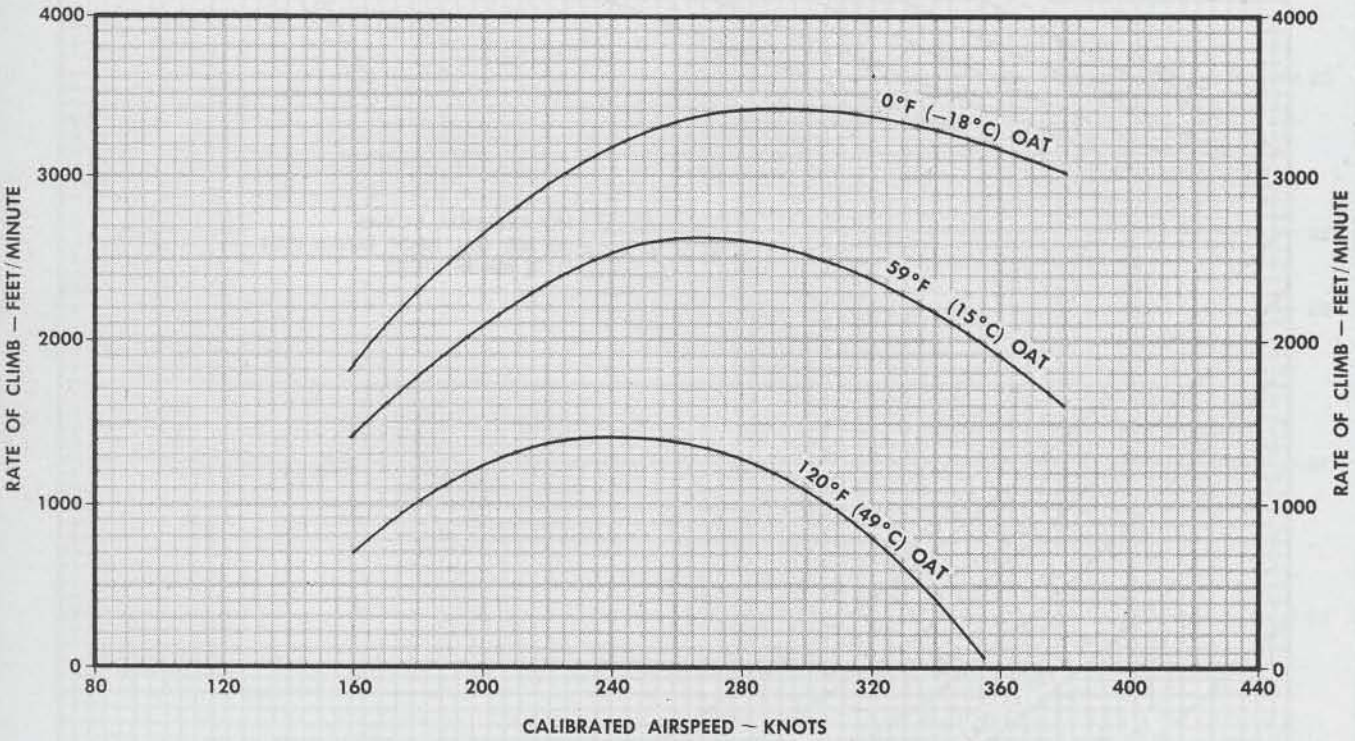


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Figure 11-35

CLIMB PERFORMANCE AFTER TAKE-OFF (single engine)

P-8 ENGINE

GUIDE

MILITARY POWER

AIRCRAFT CONFIGURATION
CLEAN
FLAPS 30° GEAR UP

DATE: 1 JUNE 1967
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT = 42,834
SEA LEVEL

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

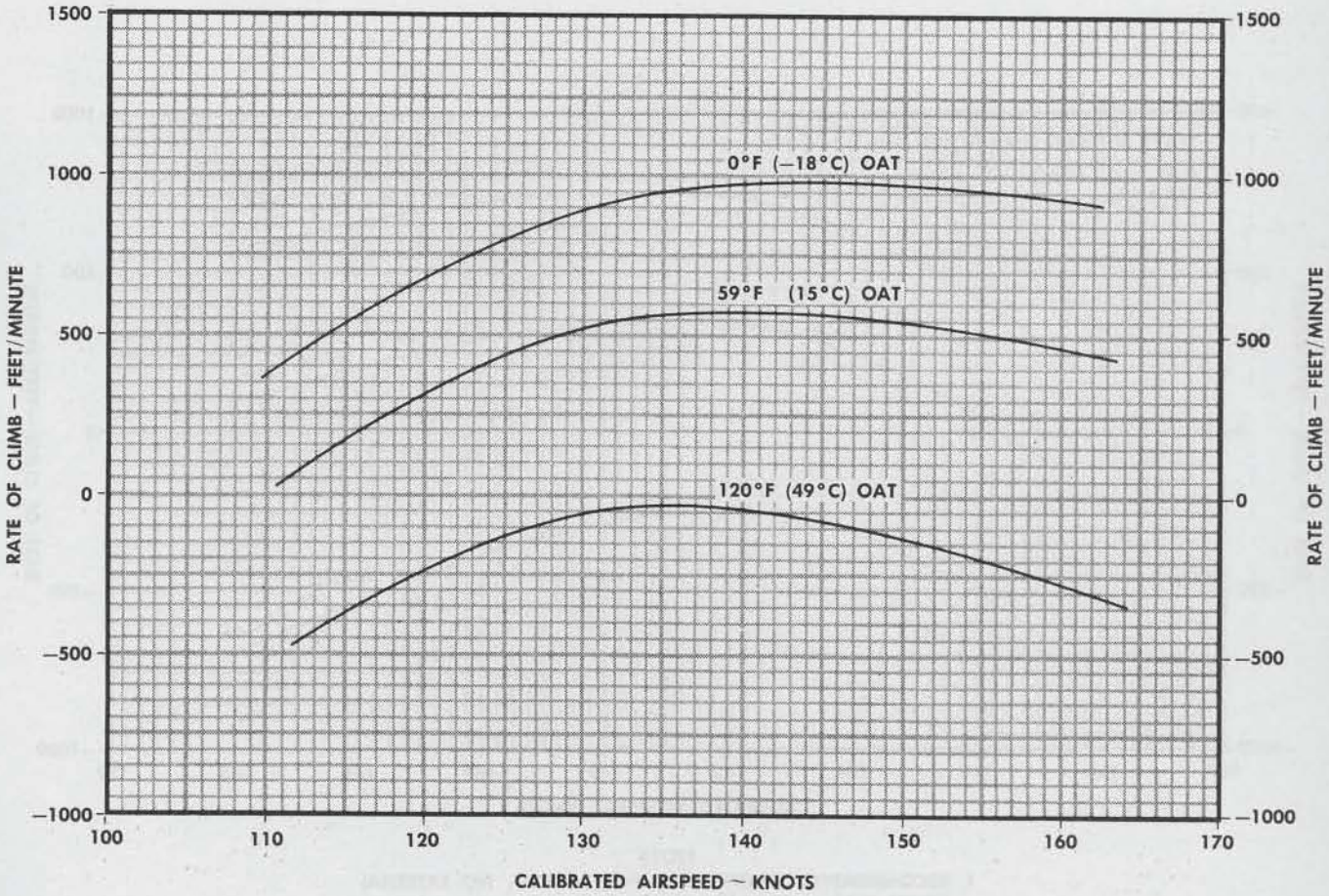

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Figure 11-36

CLIMB PERFORMANCE AFTER TAKE-OFF (single engine)

P-8 ENGINE

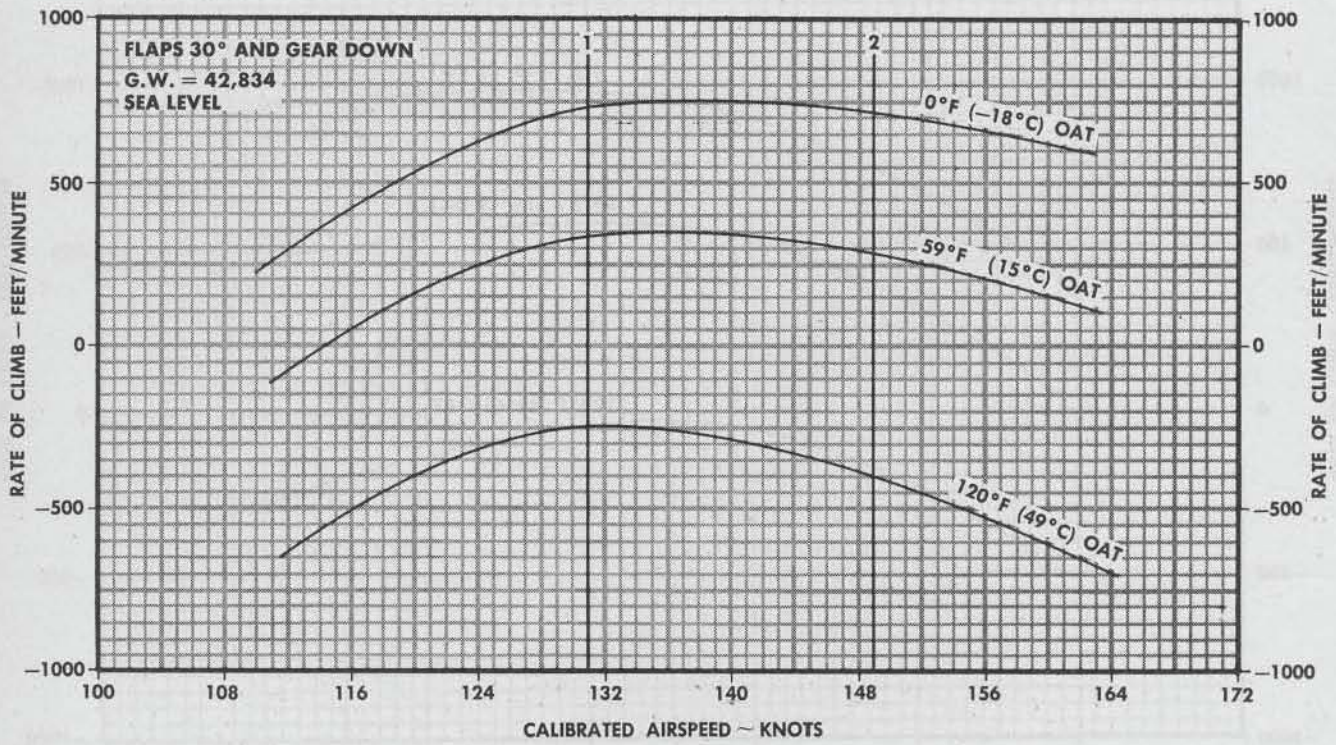
MILITARY POWER

GUIDE

AIRCRAFT CONFIGURATION
NO EXTERNAL STORES
FLAPS 30°, GEAR DOWN

DATE: 1 JUNE 1967
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE

1. RECOMMENDED LIFT-OFF SPEED FOR TAKEOFF, NO EXTERNAL STORES, G.W. = 42,834 LB.
2. RECOMMENDED LIFT-OFF SPEED FOR TAKEOFF, (4) 300 GALLON DROP TANKS PLUS CENTERLINE MK-28 STORE G.W. = 54,080 LB.

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Figure 11-37

CLIMB PERFORMANCE AFTER TAKE-OFF (single engine)

P-8 ENGINE

MILITARY POWER

AIRCRAFT CONFIGURATION: CLEAN
FLAPS UP AND GEAR UP

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT = 42,834 LB

4000 FT.

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

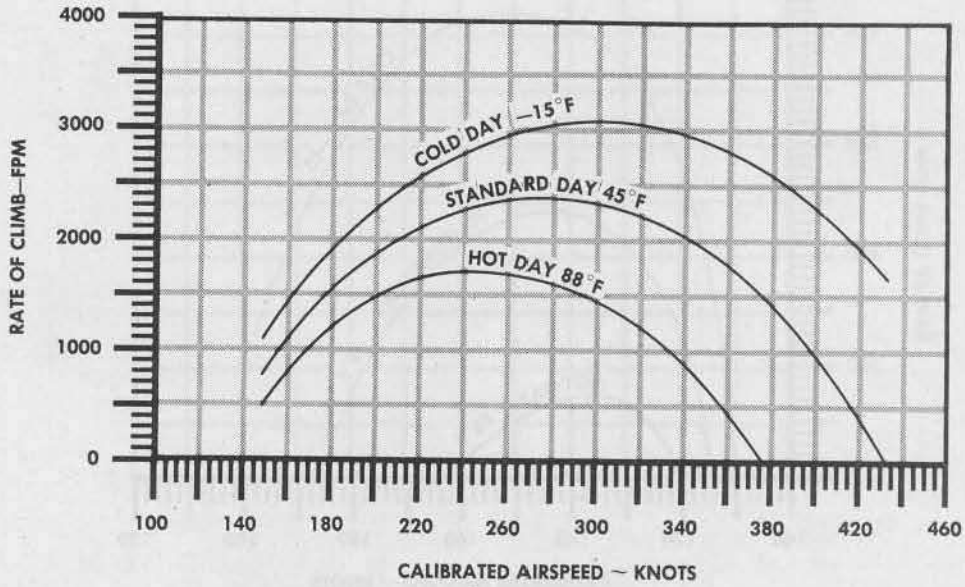

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Figure 11-38

CLIMB PERFORMANCE AFTER TAKE-OFF (single engine)

P-8 ENGINE

MILITARY POWER

AIRCRAFT CONFIGURATION: CLEAN
FLAPS 30°, GEAR UP

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT = 42,834 LB

4000 FT.

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

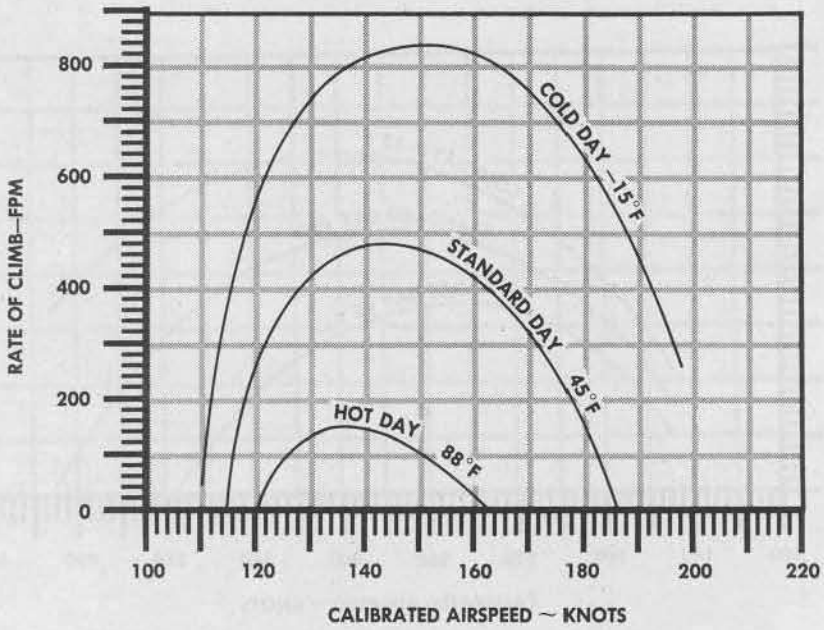

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Figure 11-39

CLIMB PERFORMANCE AFTER TAKE-OFF
(single engine)

P-8 ENGINE

MILITARY POWER

AIRCRAFT CONFIGURATION: CLEAN
FLAPS UP AND GEAR UP

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT = 42,834 LB

8000 FT.

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

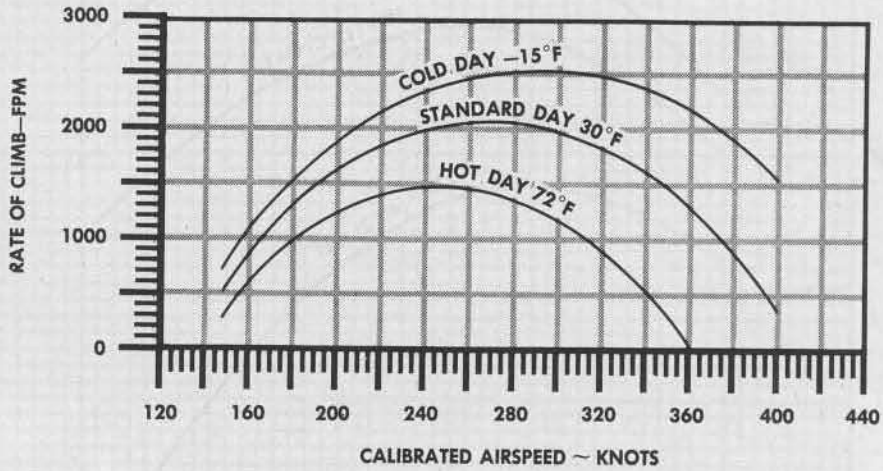

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Figure 11-40

CLIMB PERFORMANCE AFTER TAKE-OFF (single engine)

P-8 ENGINE

A-6C

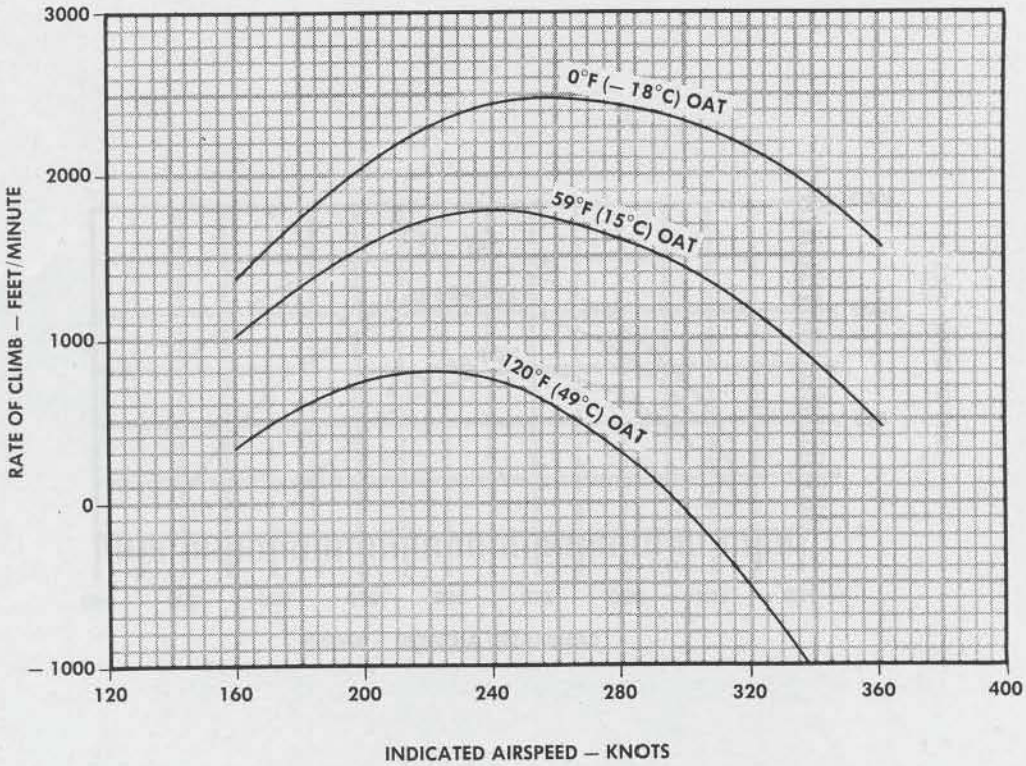
MILITARY POWER

AIRCRAFT CONFIGURATION
FLAPS UP, GEAR UP
NO EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT 45,140 LB
SEA LEVEL

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



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ADA1-592

Figure 11-41

CLIMB PERFORMANCE AFTER TAKE-OFF
(single engine)

P-8 ENGINE

A-6C

MILITARY POWER

AIRCRAFT CONFIGURATION
FLAPS 30°, GEAR UP
NO EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT = 45,140 LB
SEA LEVEL

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

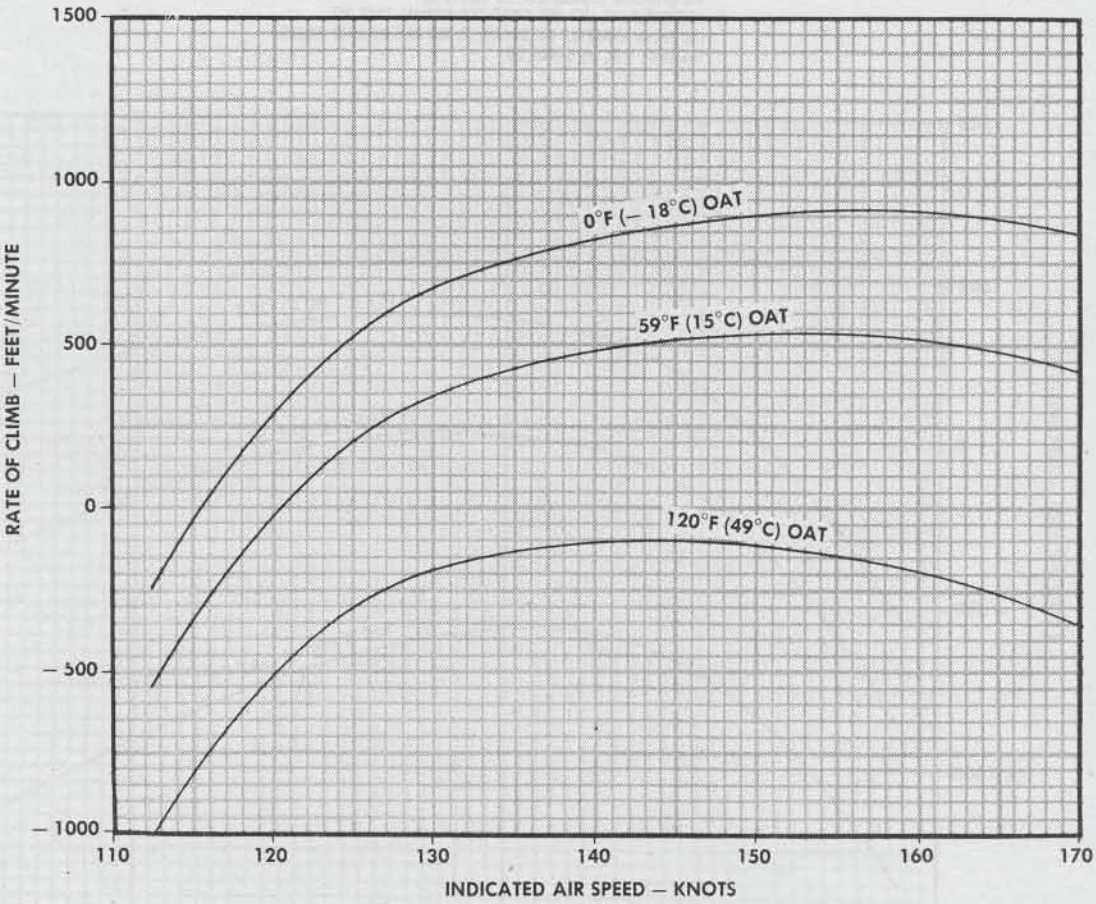

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Figure 1-42

CLIMB PERFORMANCE AFTER TAKE-OFF
(single engine)

P-8 ENGINE

A-6C

MILITARY POWER

AIRCRAFT CONFIGURATION
FLAPS 30°, GEAR DOWN
NO EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

REMARKS
GROSS WEIGHT 45,140 LB
SEA LEVEL

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

NOTE
1. RECOMMENDED LIFT-OFF SPEED FOR NORMAL TAKE-OFF, NO EXTERNAL STORES, G.W. = 45,140 LB
2. RECOMMENDED LIFT-OFF SPEED FOR NORMAL TAKE-OFF, (12) MK-82 SNAKEYES OUTBOARD, (2) 300 GALLON DROP TANKS INBOARD, G.W. = 57,980 LB

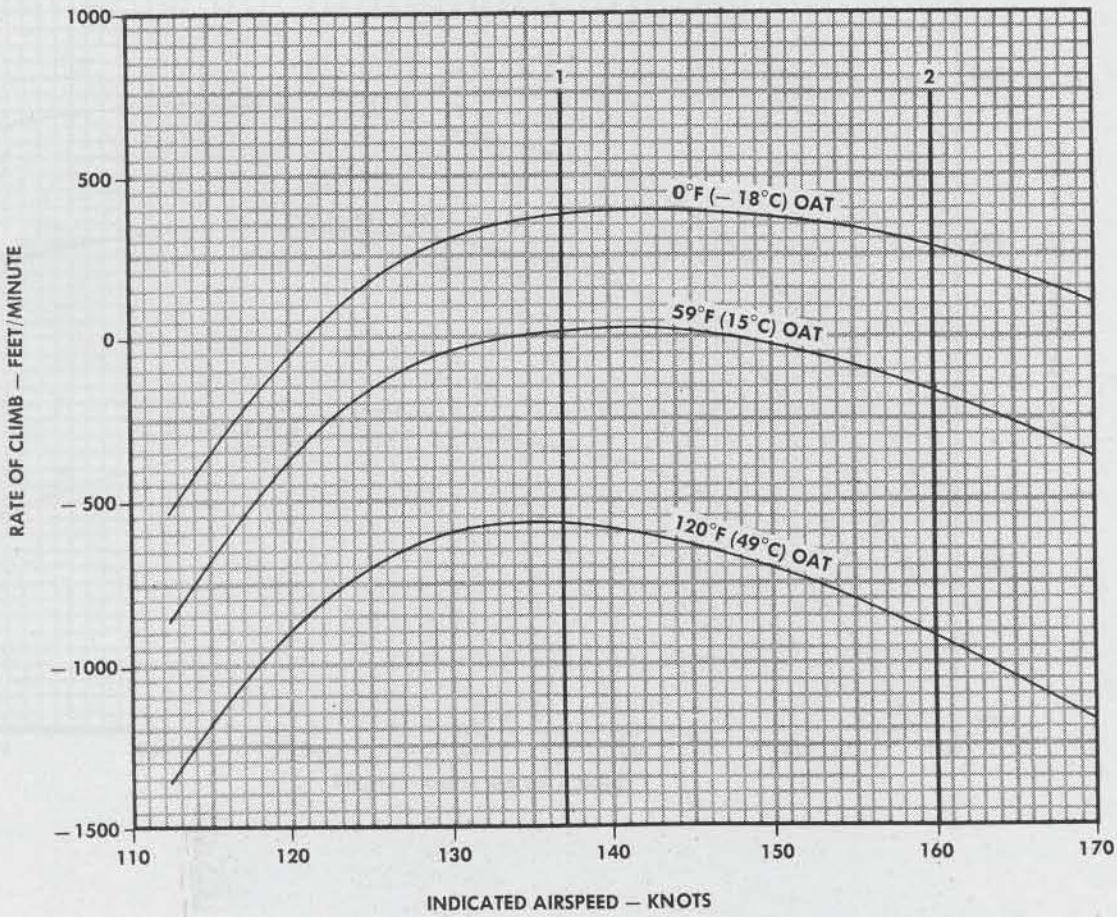

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Figure 11-43

part 3 Air Refueling

AIR REFUELING (RECEIVER)

AIR REFUELING TRANSFER TIME

This chart (figure 11-44) presents the time required to transfer a given amount of fuel, and is based on the refueling rate of the tanker aircraft.

USE

Enter the gross fuel transferred side of the chart. Proceed horizontally to intercept the particular fuel flow curve. Project vertically to the base of the chart and read time in minutes required to transfer.

Sample Problem

AIRCRAFT CONFIGURATION: ALL

A.	Fuel to be Transferred	10,000 lb
B.	Fuel Flow	1500 lb/min
C.	Time Required	6.7 min

FUEL CONSUMPTION DURING AIR REFUELING CHART

These charts (figure 11-45 through 11-47) presents the fuel flow of the receiver aircraft, based on the refueling speed (CAS-knots). Three formating altitude graphs are given for the aircraft configuration.

USE

Enter the refueling speed (CAS) side of the chart and proceed horizontally to the reflector line. Descend vertically to intersect with the initial receiving aircraft gross weight. Proceed horizontally to intersect the drag count desired. Ascend vertically to intersect the reflector line. Proceed horizontally to read fuel flow. Reenter the same refueling speed (CAS) side of the chart. From the reflector line descend vertically to intersect the final receiving gross weight. Continue horizontally to intersect the total drag count. Ascend vertically to intersect the fuel flow reflector line. Proceed horizontally and read the final fuel flow during refueling. Using the two final values, calculate the average fuel flow.

Sample Problem

Aircraft Configuration:

(4) 300-Gallon Tanks
(1) Mk 28

A.	Formating Altitude	5000 ft.
B.	Refueling Speed (CAS)	230 kt
C.	Reflector Line	
D.	Initial Receiving Aircraft Weight	40,000 lbs.
E.	Total Extra Drag	50 counts
F.	Reflector Line	
G.	Initial Fuel Flow	70 lb/min
H.	Final Receiving Aircraft Weight	50,000 lb.
I.	Total Extra Drag	50 counts
J.	Reflector Line	
K.	Final Fuel Flow During Refueling	79 lb/min
L.	Average Fuel Flow During Refueling	74.5 lb/min

ACCELERATION TO CLIMB SPEED

This chart (figure 11-48) presents acceleration fuel and distance based on the refueled gross weight at disconnect. Climb speed (TAS) conforms to the applicable formating altitude.

USE

Enter the side of the chart at the refueling disconnect speed and proceed horizontally to the reflector line. Descend and intersect the refueled gross weight. Continue horizontally and follow the base line until the desired drag count is reached. Proceed horizontally and intersect the reflector line. Ascend vertically to intersect the reflector line and then proceed horizontally to read acceleration fuel in pounds. Again proceed horizontally from the desired drag count to the reflector line. Descend to the reflector line and proceed horizontally and read acceleration distance in nautical miles.

Sample Problem

Aircraft Configuration

(4) 300-Gallon Tanks
(1) D-704

Altitude 5000 feet

A.	Refueling Disconnect Speed	235 kt
B.	Reflector Line	
C.	Refueling Gross Weight	40,000 lb.
D.	Desired Drag Count	47
E.	Reflector Line	
F.	Reflector Line	
G.	Acceleration Fuel	112 lb.
H.	Reflector Line	
I.	Acceleration Distance	230 nmi

AIR REFUELING TRANSFER TIME

P-8 ENGINE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

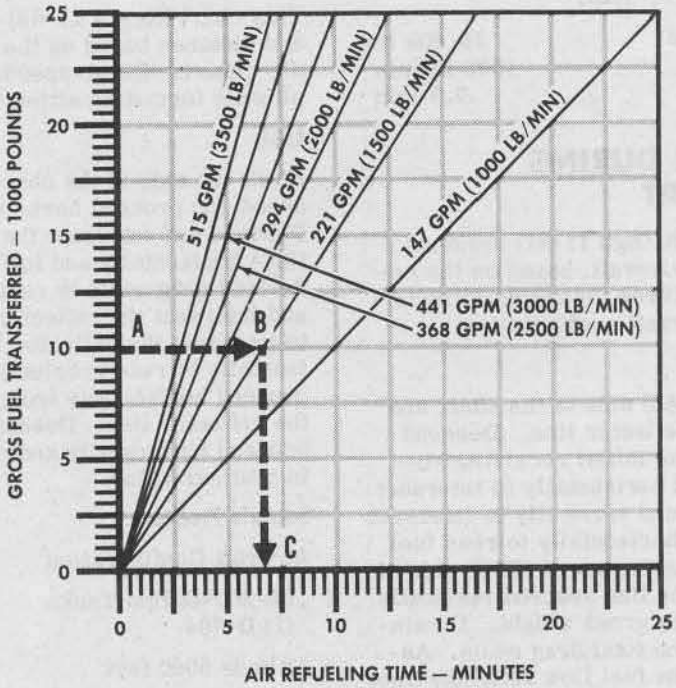

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Figure 11-44

FUEL CONSUMPTION DURING AIR REFUELING

P-8 ENGINE

5000 FT.

DATE: 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

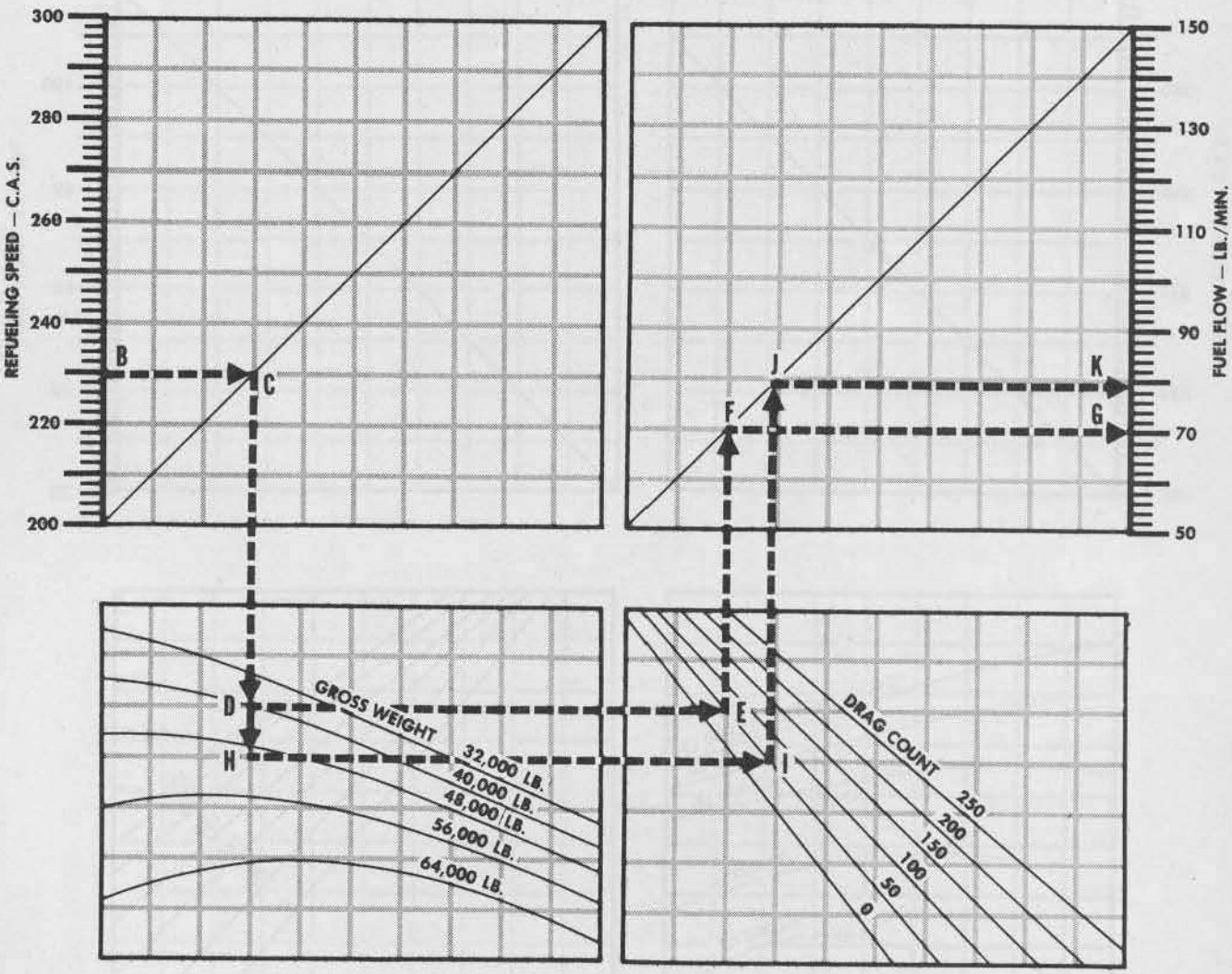

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Figure 11-45

FUEL CONSUMPTION DURING AIR REFUELING

P-8 ENGINE

30,000 FT.

DATE: 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

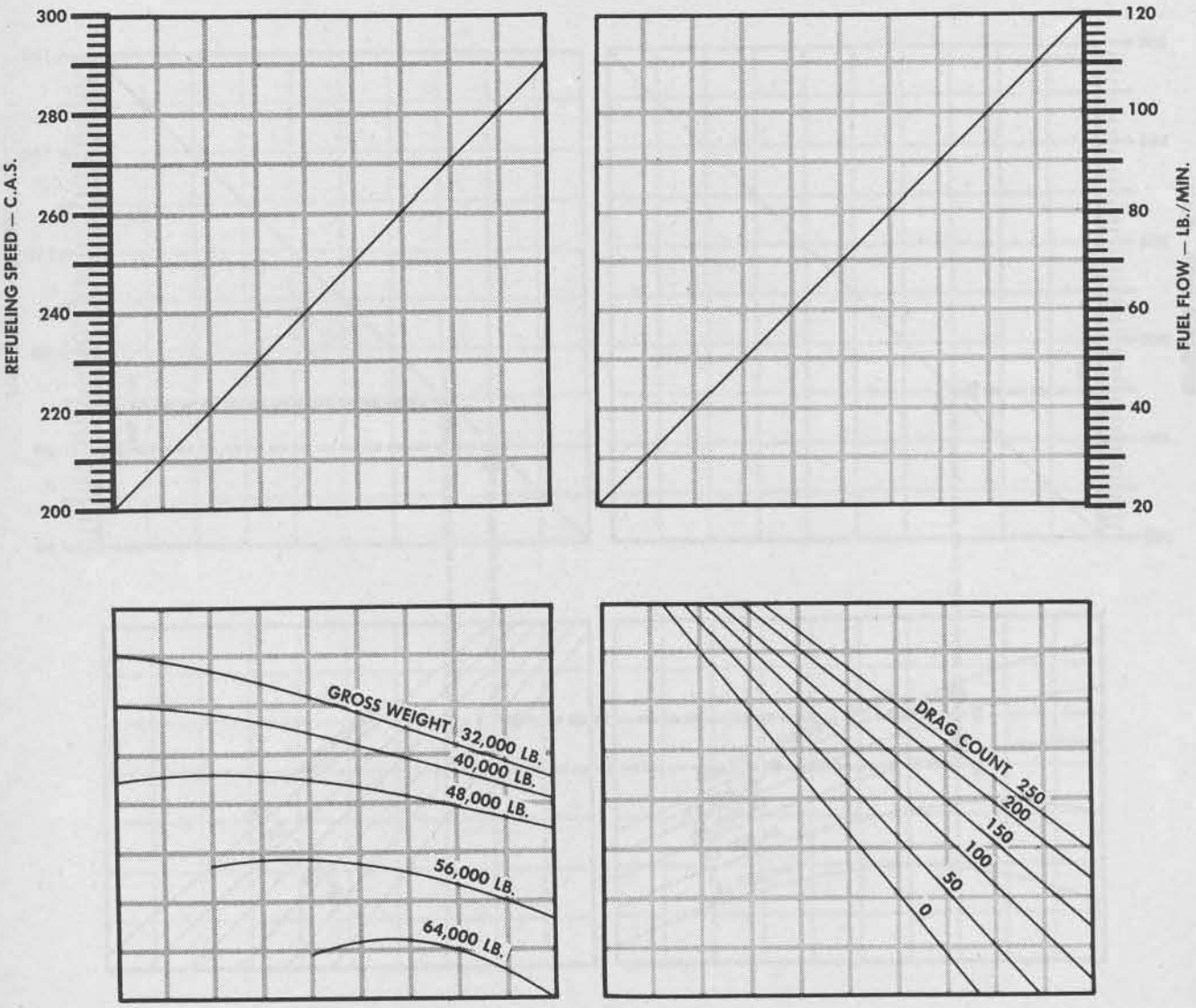

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Figure 11-46

FUEL CONSUMPTION DURING AIR REFUELING

P-8 ENGINE

35,000 FT.

DATE: 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

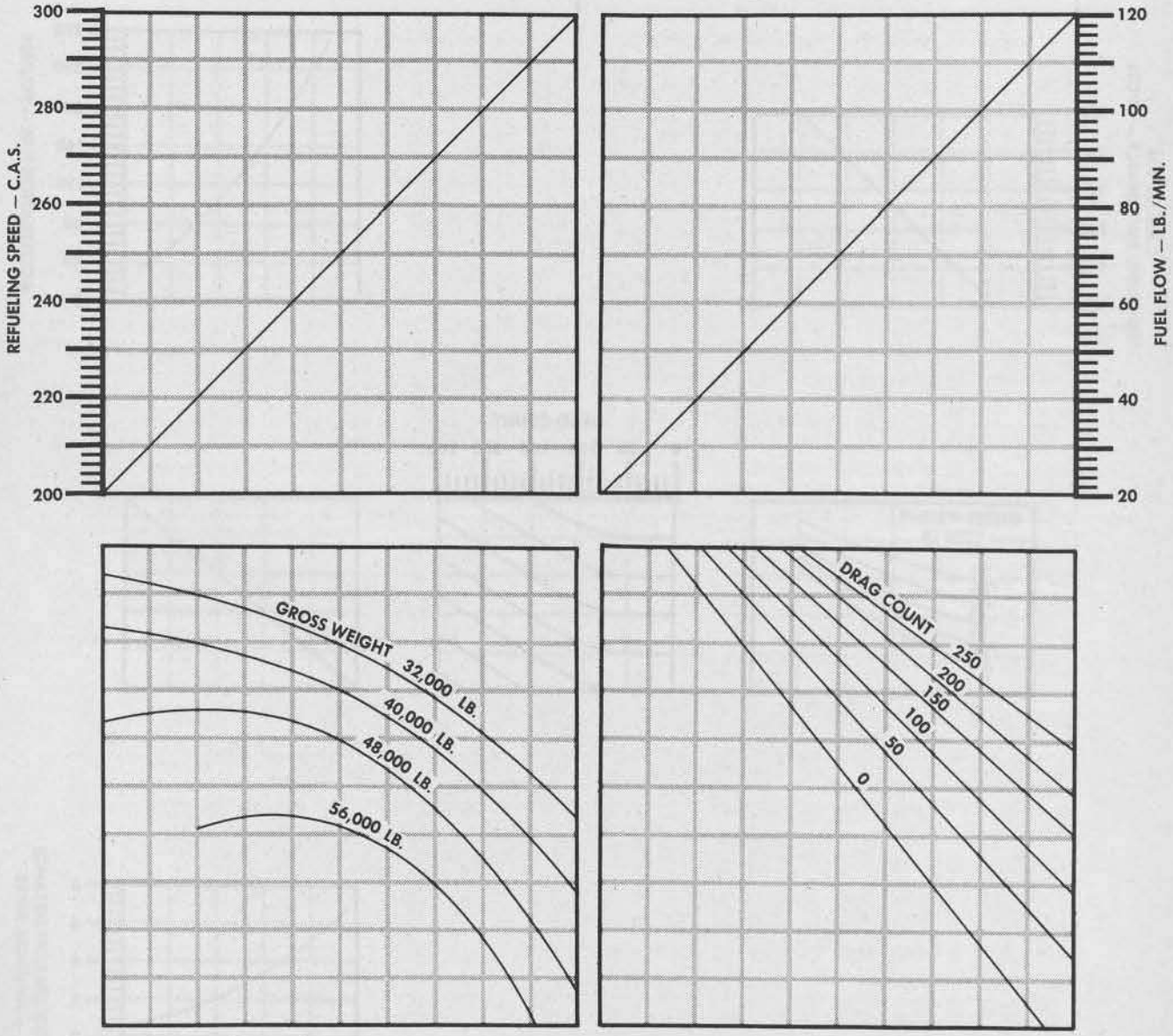

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Figure 11-47

ACCELERATION TO CLIMB SPEED

P-8 ENGINE

ALTITUDE 5000 FT.

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

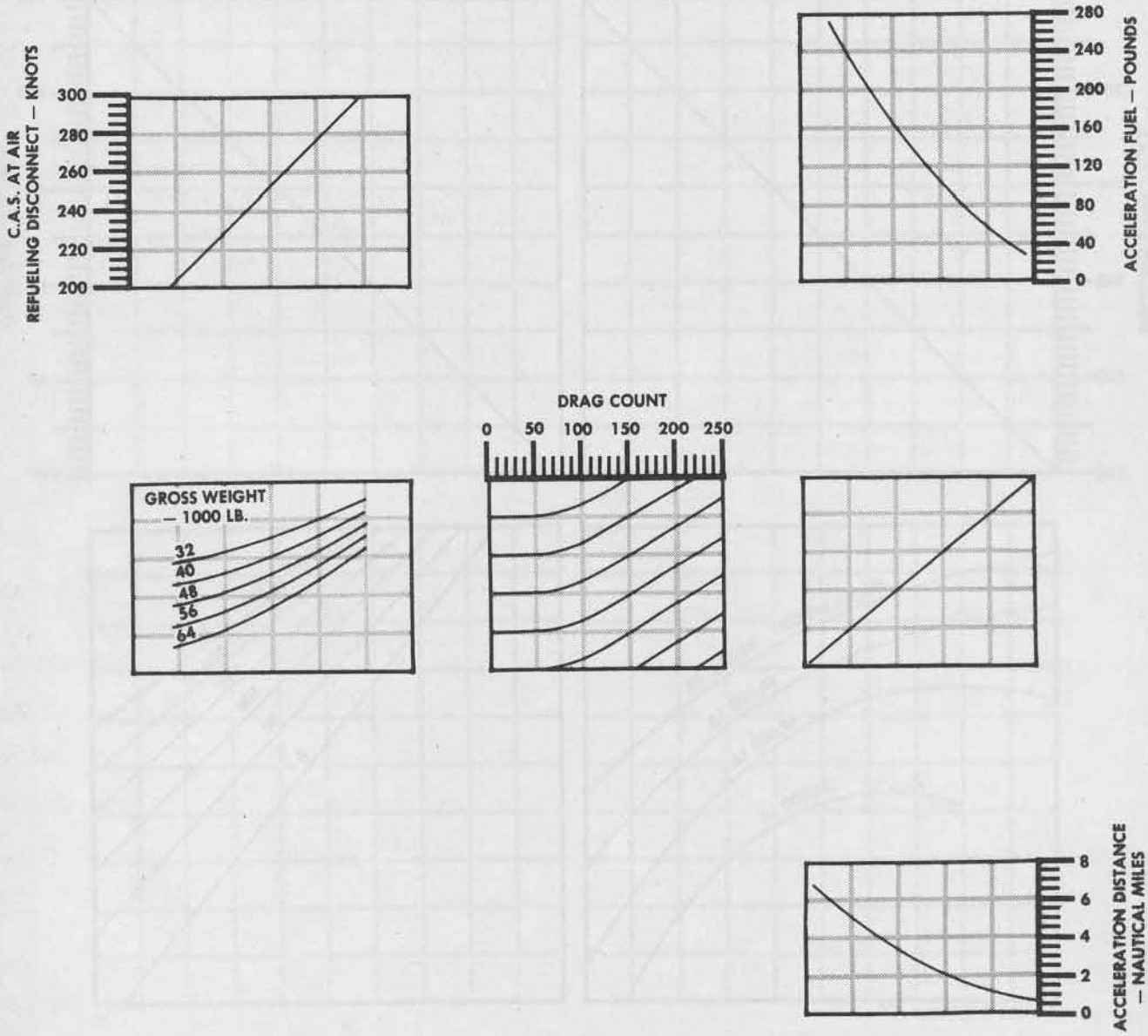

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Figure 11-48

MISSION PLANNING (KA-6D)

TANKER MISSION PLANNING

The mission planning charts (figures 11-49 through 11-52) present total tanker fuel available for transfer versus tanker mission radius, for values of constant loiter time. The total fuel available for transfer is based on refueling for aircraft with equal amounts of fuel transferred to each aircraft. These charts present three basic missions: HI-LO-HI, LO-LO-LO, and HI-HI-HI. All missions were calculated at refueling rates of 450 gal/min. and 200 gal/min., and at refueling speeds of 250-KIAS and 290-KIAS. For the HI-LO-HI mission, loiter was performed at maximum endurance altitude and refueling was performed at 5000 feet. For the LO-LO-LO mission, both loiter and refueling were performed at 5000 feet. The HI-HI-HI mission loiter was performed at maximum endurance altitude and refueling was performed at either 30,000 feet or 35,000 feet as appropriate.

USE

There are two methods by which these charts can be used. In the first instance, enter the chart with a known fuel available for transfer and proceed horizontally to intersect the known loiter time line. From the intersection of the loiter time line, descend to the base scale to read tanker mission radius. By the second method, enter the chart at a known tanker mission radius, proceed vertically upward to intersect the known loiter time line, then proceed horizontally to the left, and read fuel available for transfer.

Sample Problem

Aircraft Configuration:

(1) D-704 tank
(4) 300 gal drop tanks

Method I

A. Enter Chart at Known Total Tanker Fuel Available for Transfer

B. Loiter Time

C. Tanker Mission Radius

Method II

D. Enter Chart at Known Tanker Mission Radius

E. Loiter Time

F. Total Tanker Fuel Available for Transfer

TANKER FUEL FLOW DURING AIR REFUELING

The tanker fuel flow during refueling (figures 11-53 through 11-64) is a plot of fuel flow vs mach number and indicated airspeed for gross weight ranging from 30,000 lb to 60,000 lb.

USE

Enter the base of the chart at initial refueling mach number. Proceed vertically to intersect the initial refueling gross weight. Continue horizontally to read fuel flow. Reenter the base of the chart at the final refueling mach number. Ascend vertically to intersect the final refueling gross weight. Proceed horizontally to read final fuel flow. Average fuel flow during air refueling is then calculated.

Sample Problem

Aircraft Configuration:

(4) 300-Gallon Tanks
(1) D-704

Flaps and Gear Retracted:

A.	Mach number	.45 M
B.	Initial Gross Weight	50,000 lb
C.	Initial Fuel Flow	6,420 lb/hr
D.	Final Gross Weight	40,000 lb
E.	Final Fuel Flow	6,070 lb/hr
F.	Average Fuel Flow	6,245 lb/hr

MISSION PLANNING

P-8 ENGINE

MISSION TYPE: LO-LO-LO
REFUELING ALTITUDE: 5000 FT.

CONFIGURATION:
(4) 300 GALLON TANKS +
(1) D-704 REFUELING STORE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

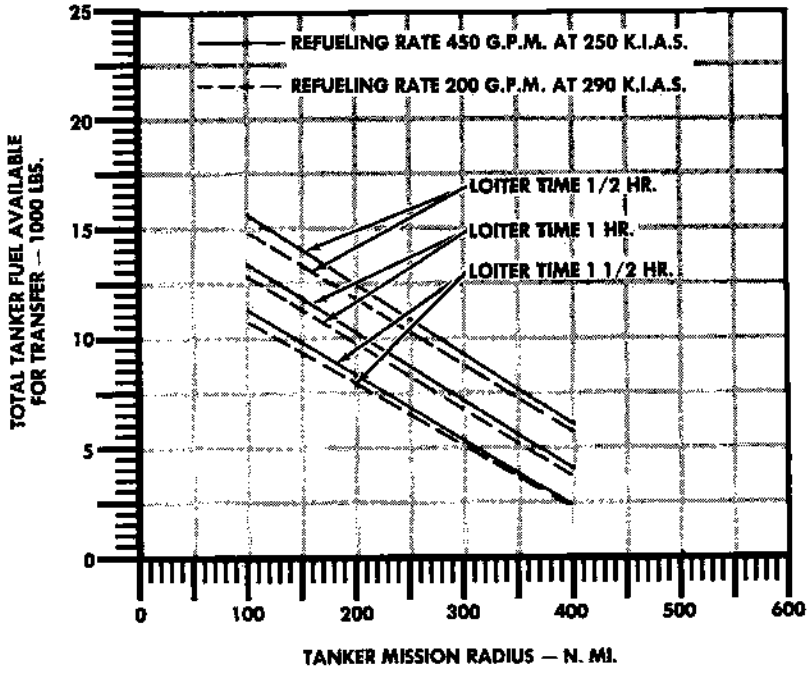

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Figure 11-49

MISSION PLANNING

P-8 ENGINE

CONFIGURATION:
(4) 300 GALLON TANKS +
(1) D-704 REFUELING STORE

MISSION TYPE: HI-LO-HI
REFUELING ALTITUDE: 5000 FT.

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

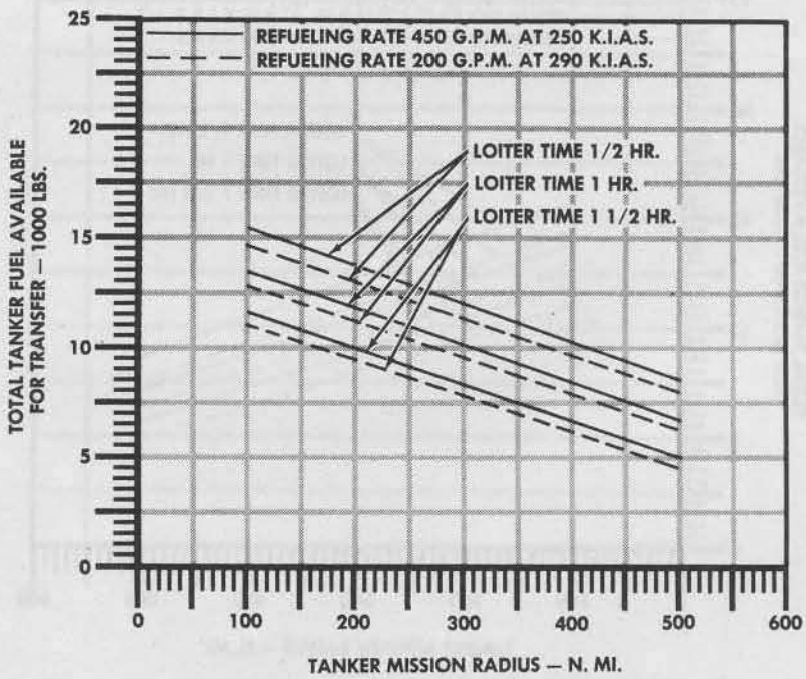

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Figure 11-50

MISSION PLANNING

P-8 ENGINE

CONFIGURATION:
(4) 300 GALLON TANKS +
(1) D-704 REFUELING STORE

MISSION TYPE: HI-HI-HI
REFUELING ALTITUDE: 30,000 FT.

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

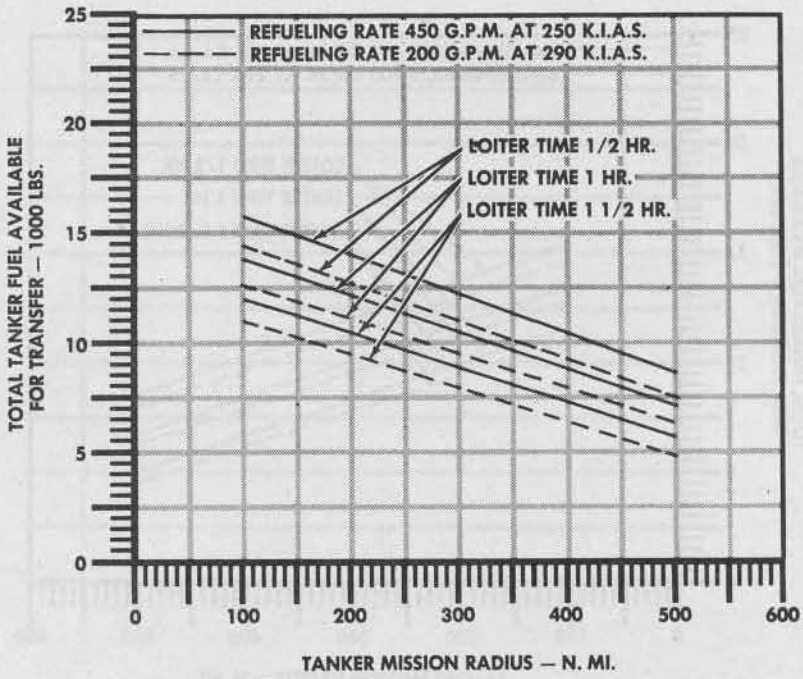

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Figure 11-51

MISSION PLANNING

P-8 ENGINE

CONFIGURATION:
(4) 300 GALLON TANKS +
(1) D-704 REFUELING STORE

MISSION TYPE: HI-HI-HI
REFUELING ALTITUDE: 35,000 FT.

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

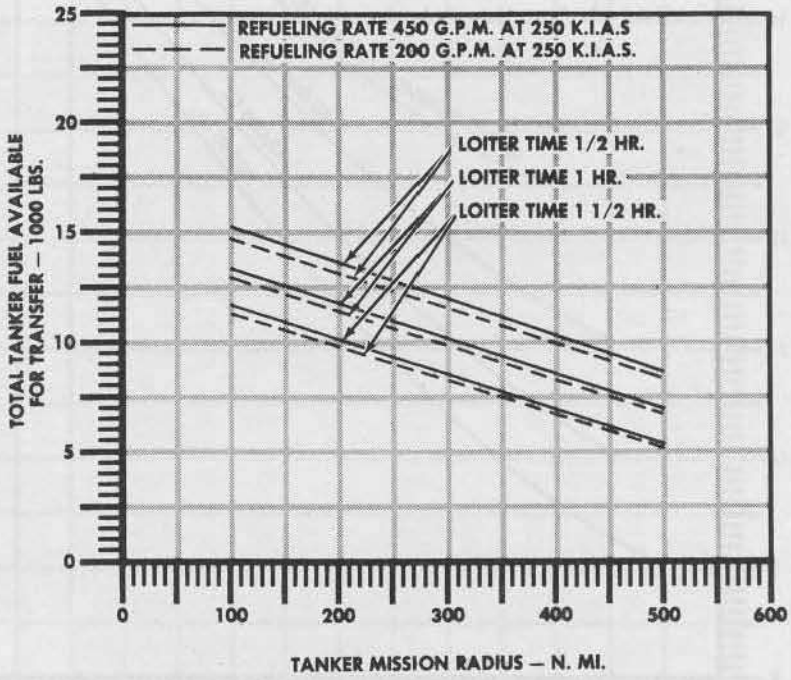

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Figure 11-52

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS — TAKEOFF, GEAR DOWN
HOSE AND DROGUE DEPLOYED

SEA LEVEL
FLAPS AND GEAR EXTENDED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

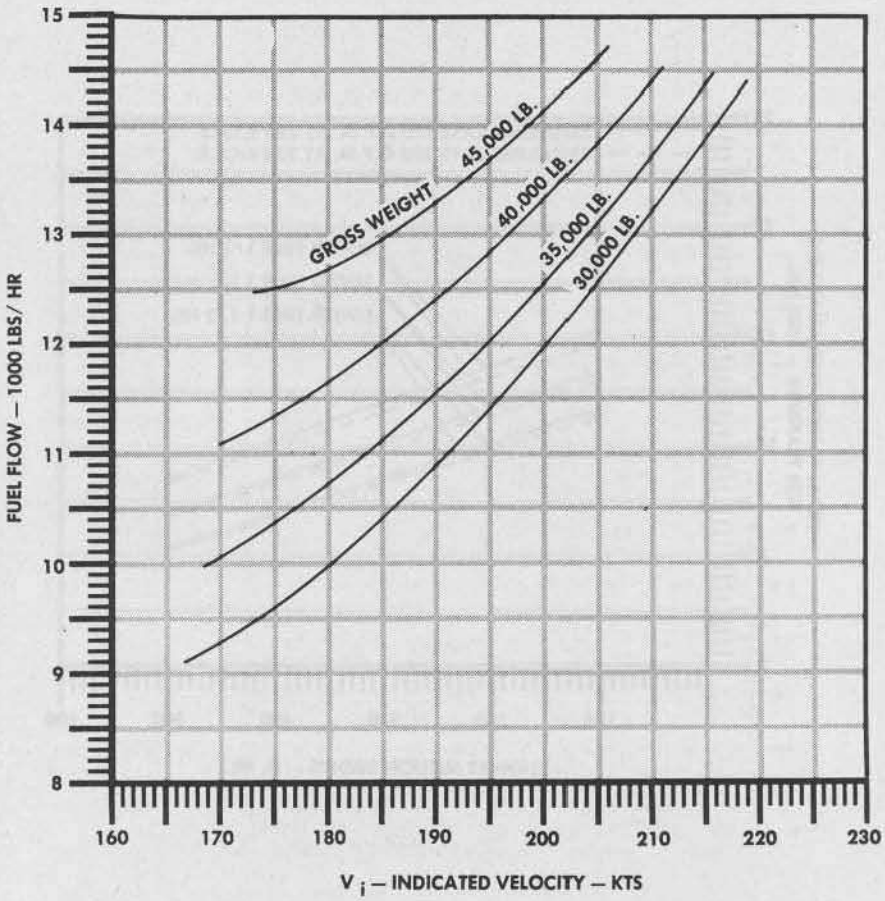

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Figure 11-53

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS — TAKEOFF, GEAR DOWN
HOSE AND DROGUE DEPLOYED

5000 FEET
FLAPS AND GEAR EXTENDED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

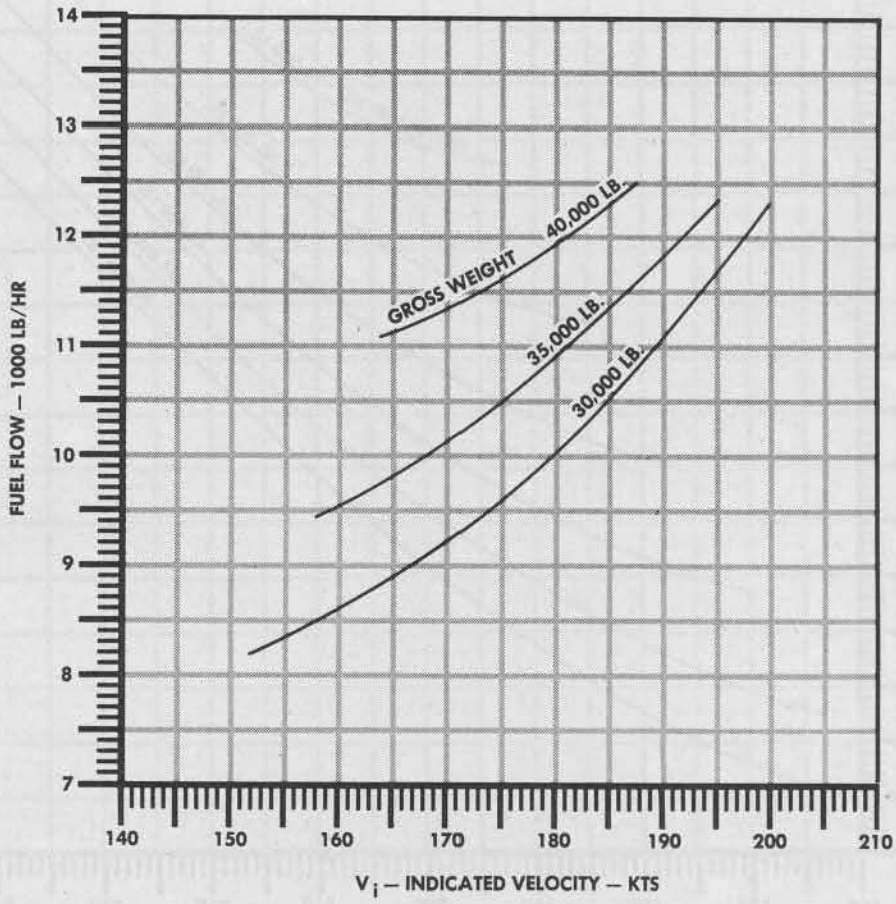

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Figure 11-54

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS — TAKEOFF, GEAR UP
HOSE AND DROGUE DEPLOYED

SEA LEVEL
FLAPS DOWN, GEAR UP

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

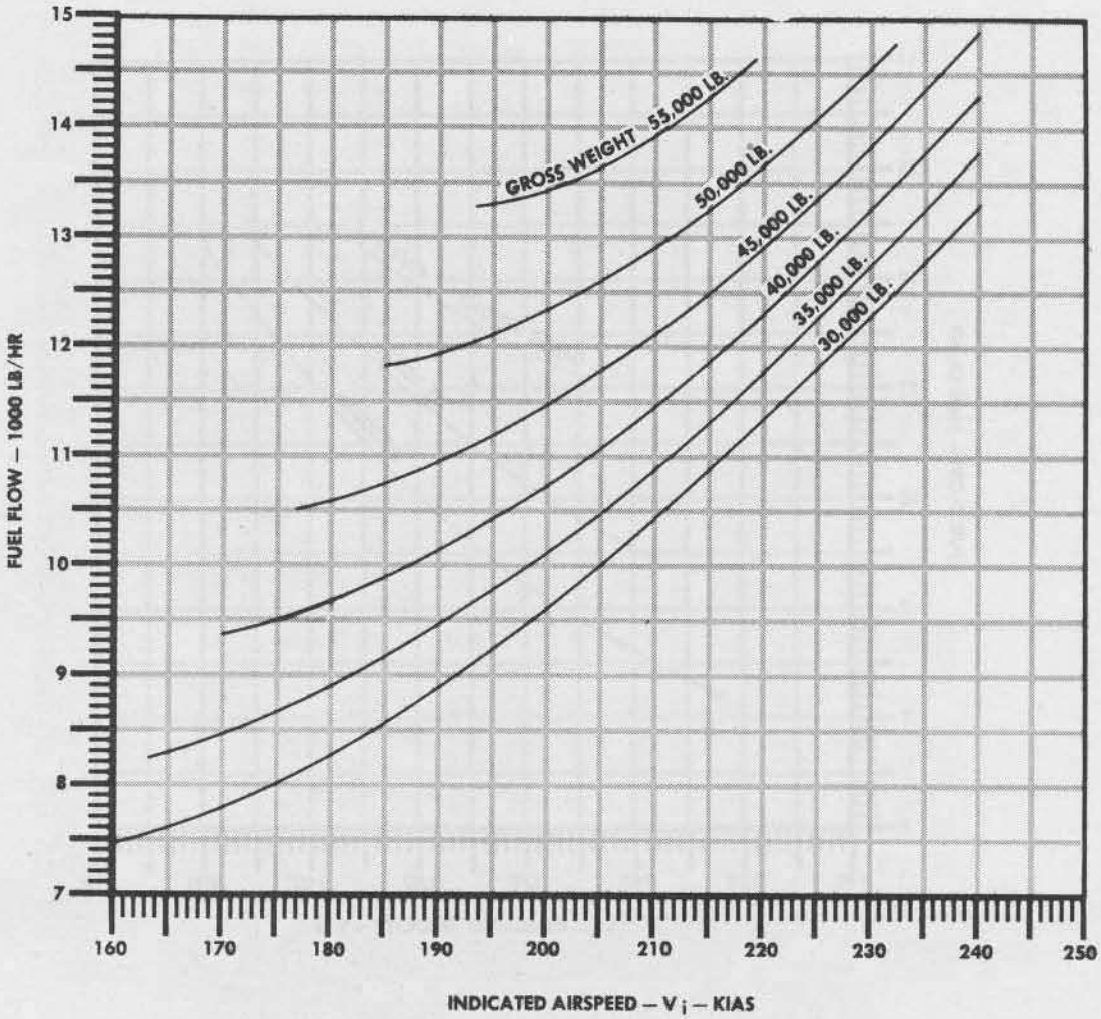

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Figure 11-55

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

5000 FEET
FLAPS DOWN, GEAR UP

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS – TAKEOFF, GEAR UP
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

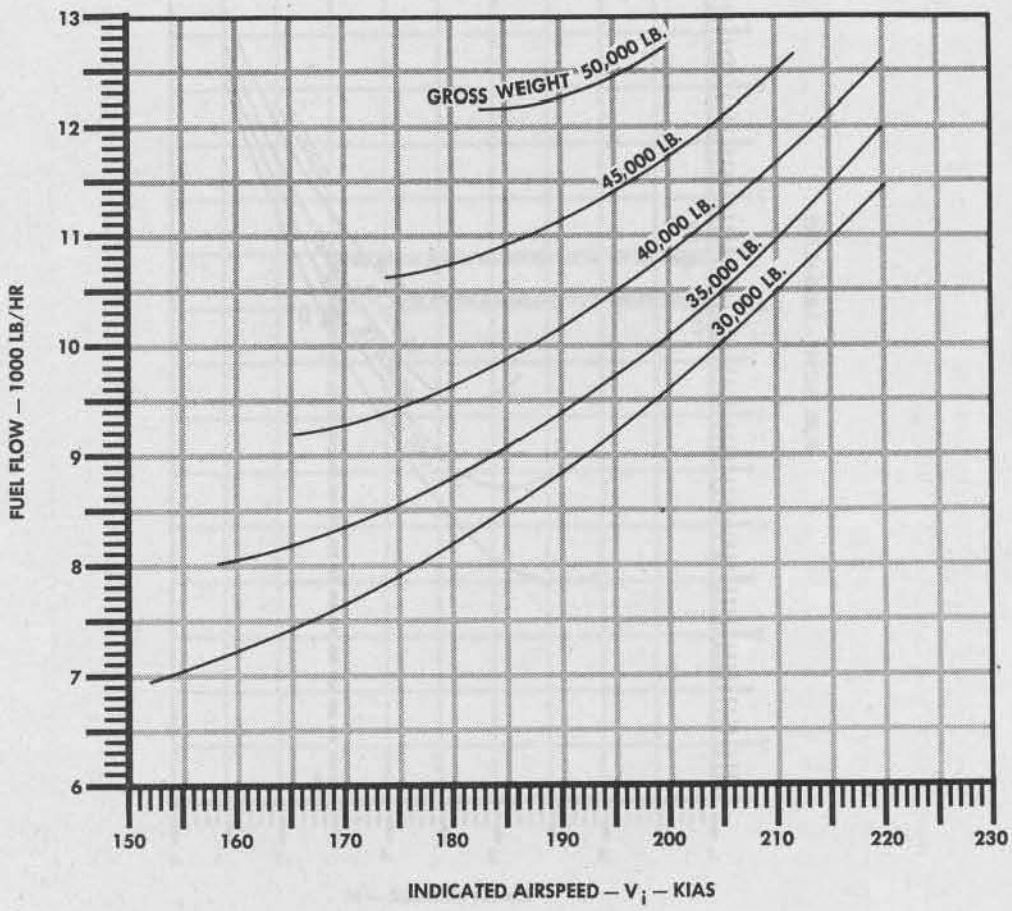

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Figure 11-56

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

SEA LEVEL

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

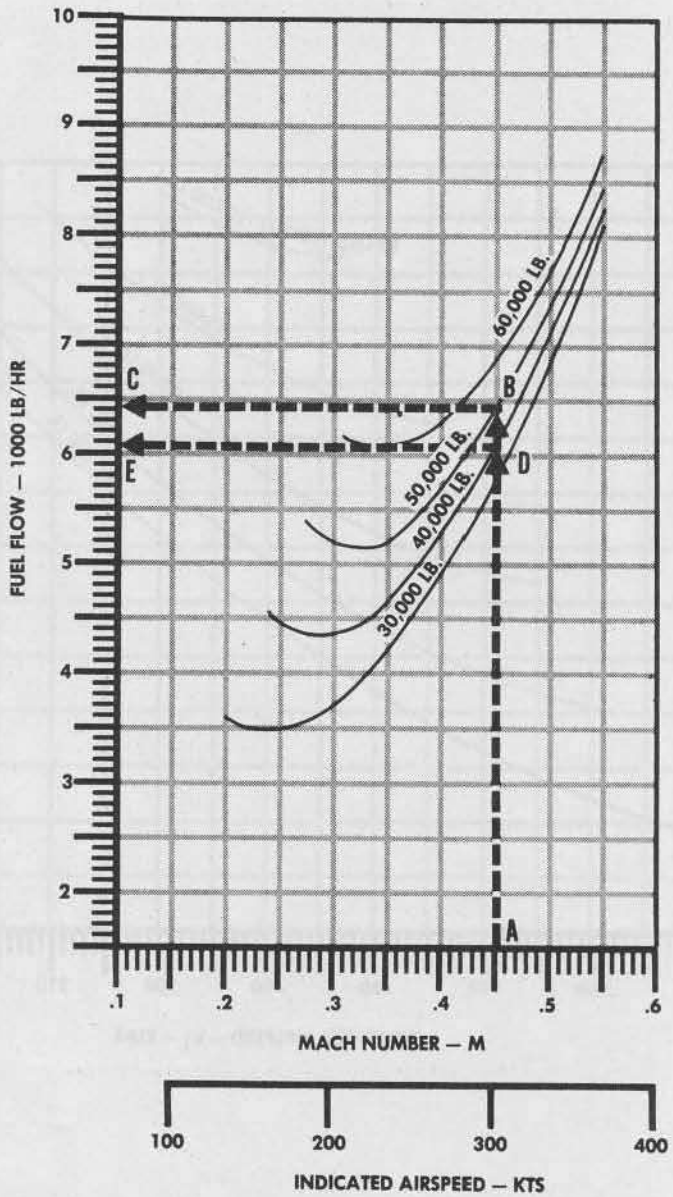

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Figure 11-57

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

5000 FEET

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

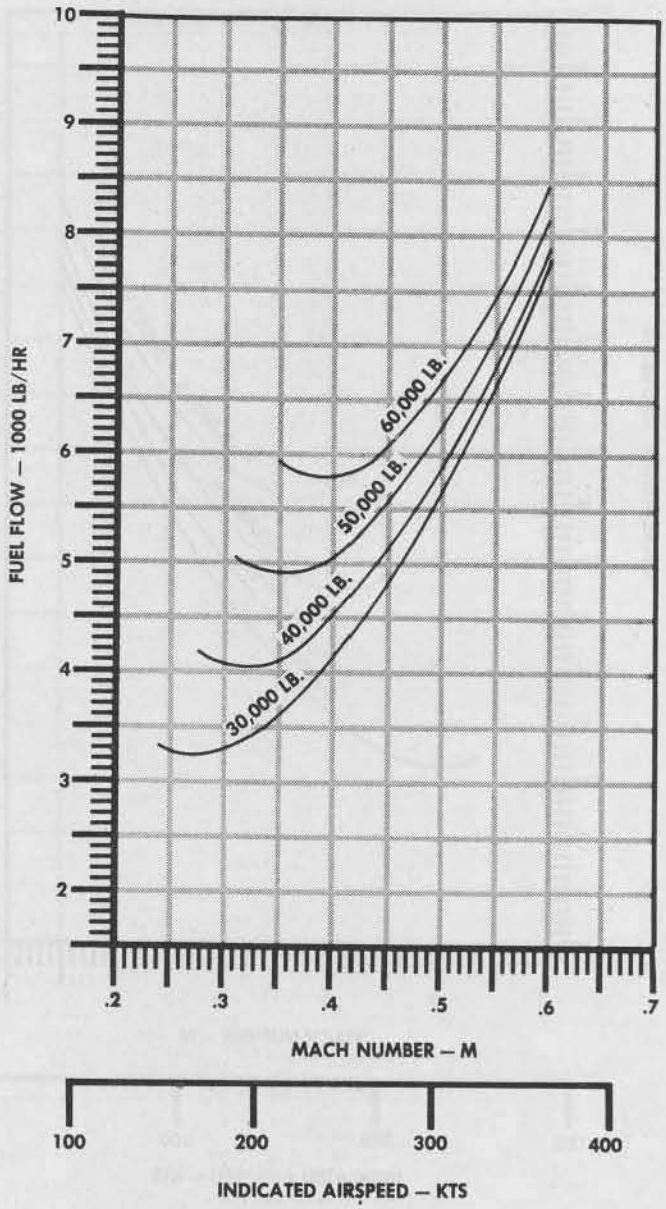

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Figure 11-58

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

10,000 FEET

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

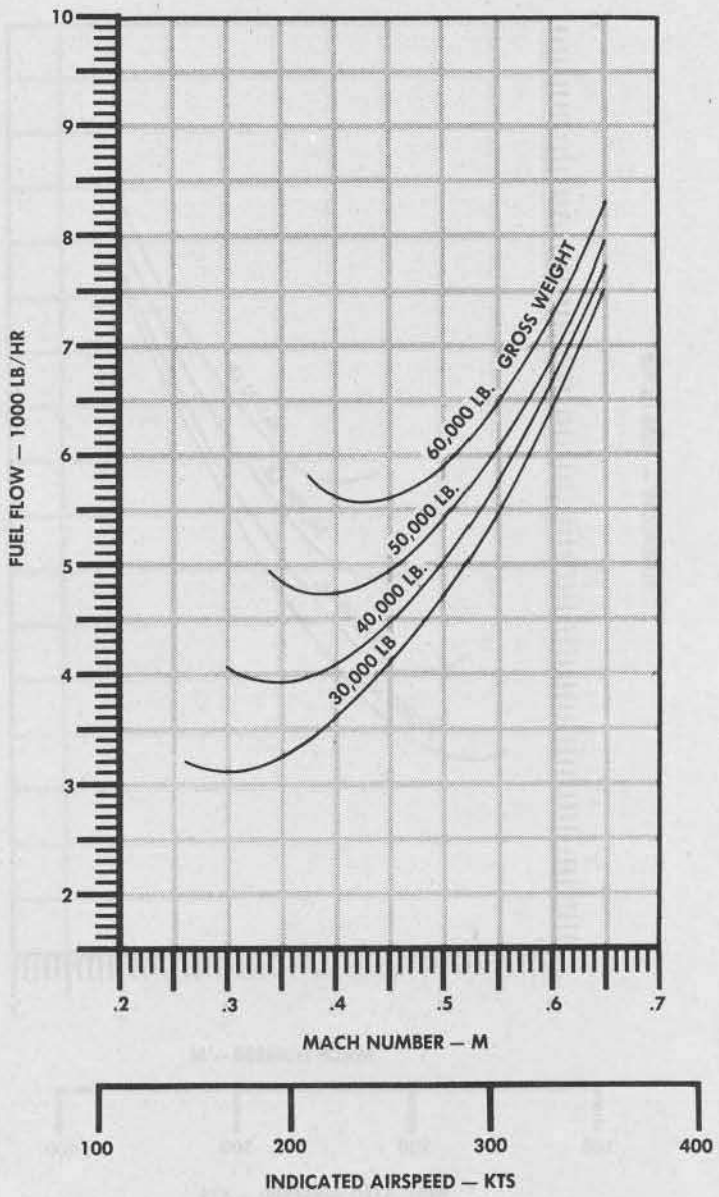

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Figure 11-59

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

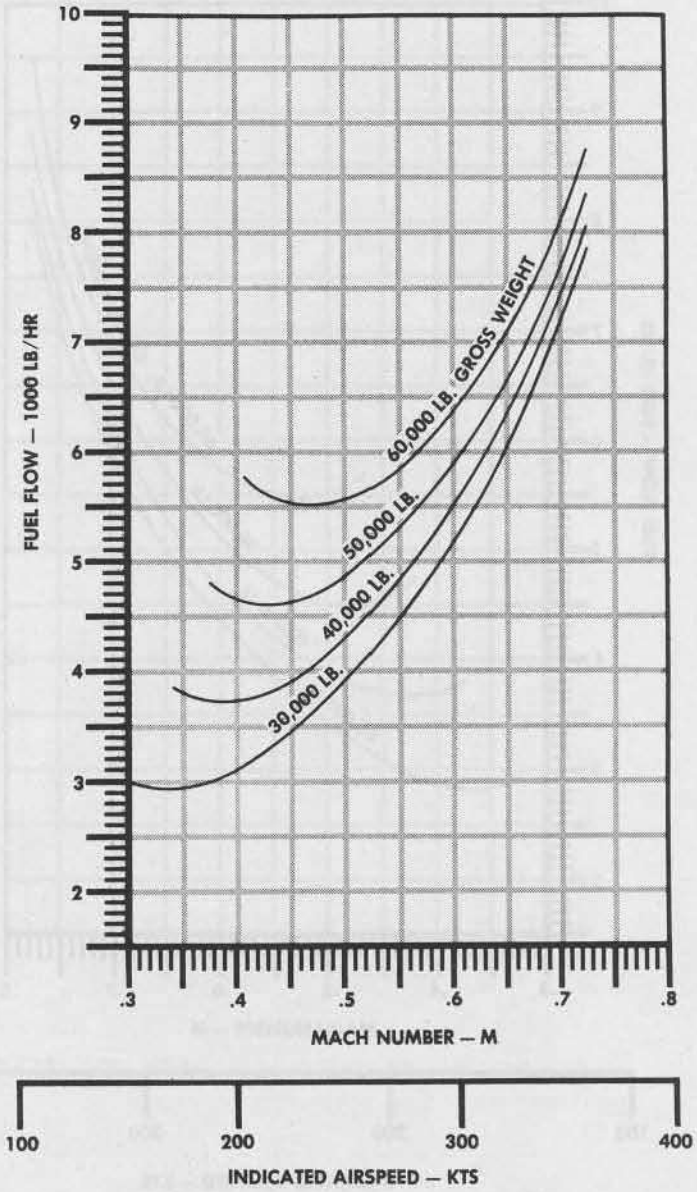
15,000 FEET

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADE1-350

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Figure 11-60

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

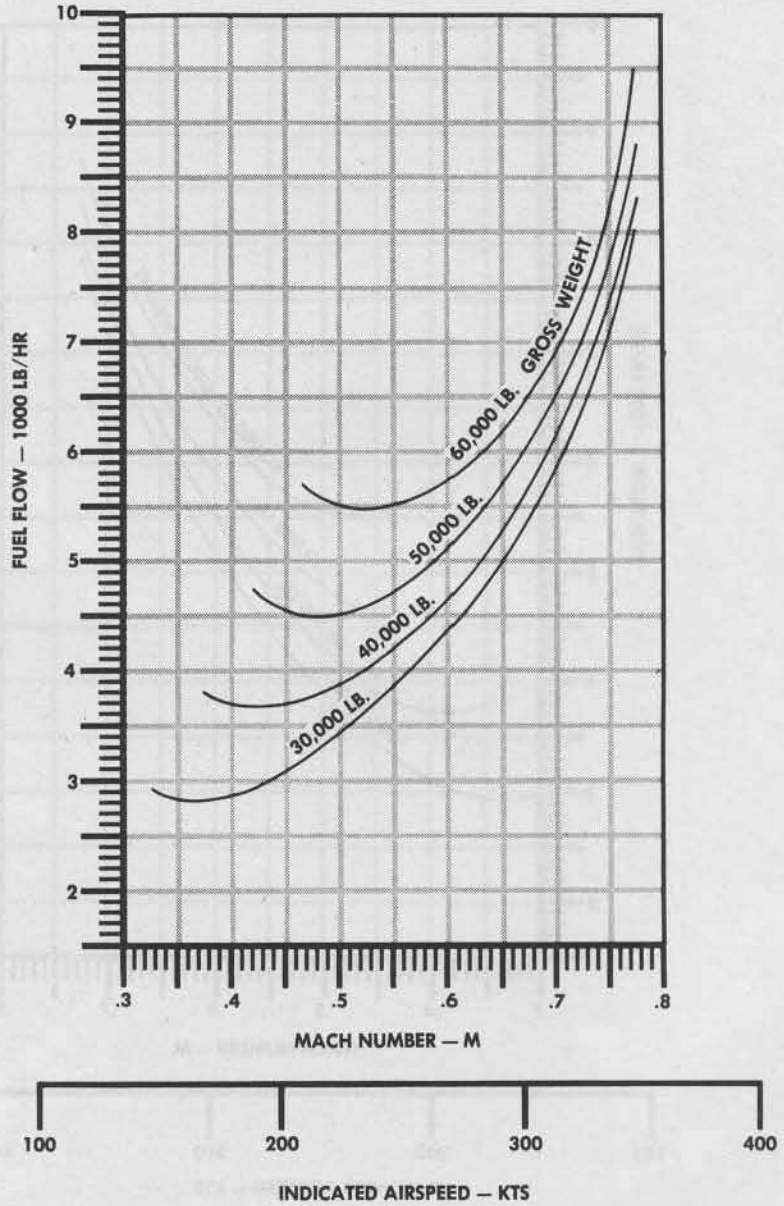
AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

20,000 FEET

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADE1-351

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Figure 11-61

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

25,000 FEET

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

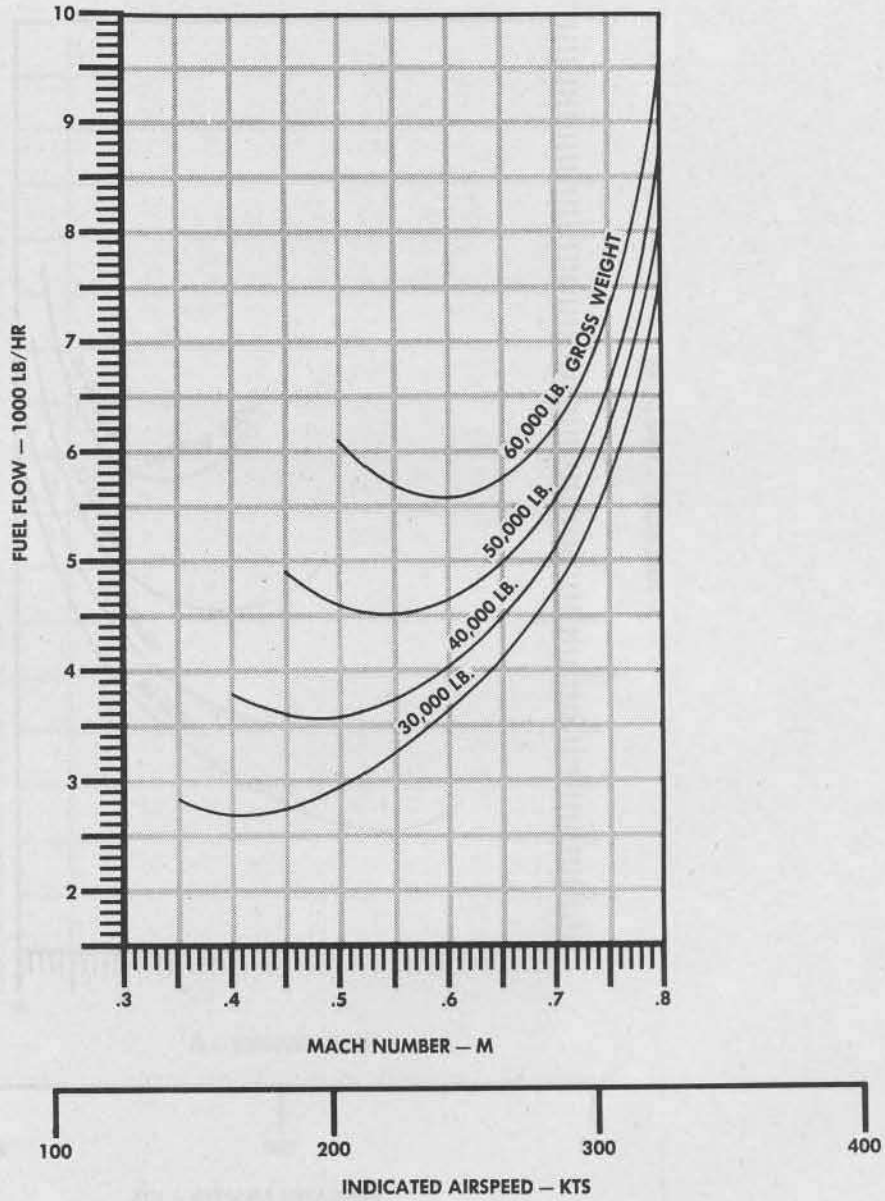

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Figure 11-62

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

30,000 FEET

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

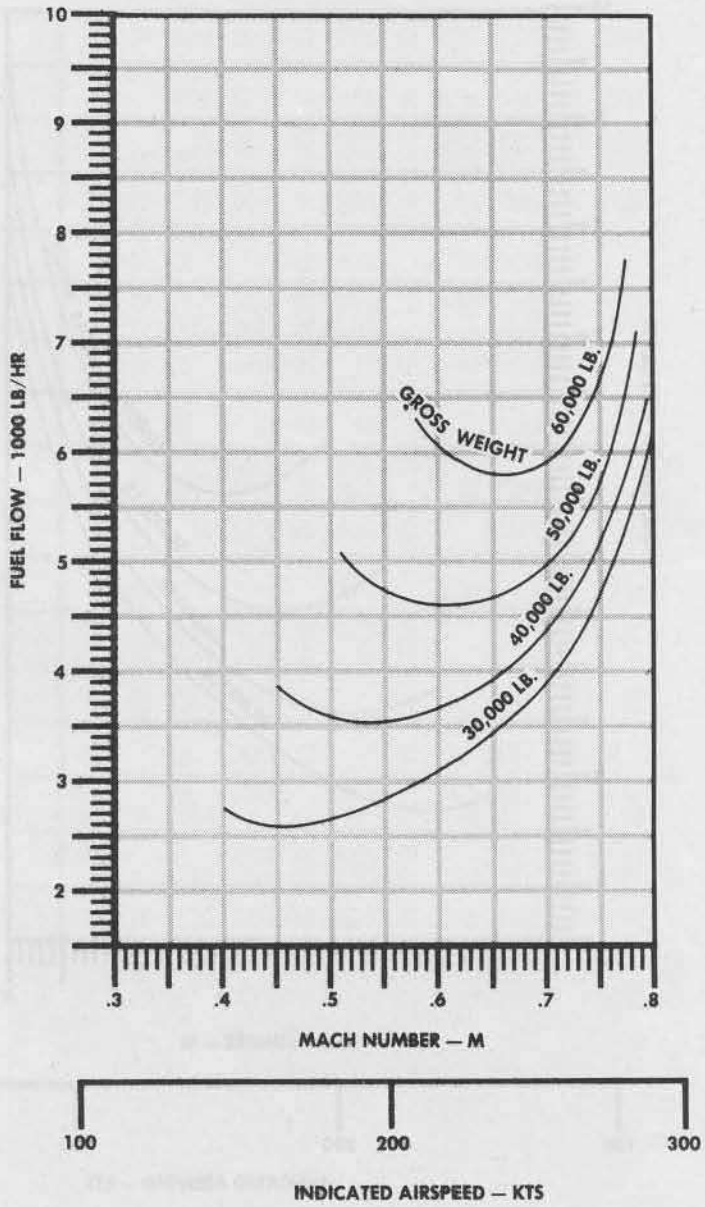

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Figure 11-63

TANKER FUEL FLOW DURING REFUELING

P-8 ENGINE

AIRCRAFT CONFIGURATION:
(1) D-704 + (4) 300 GALLON TANKS
FLAPS AND GEAR RETRACTED
HOSE AND DROGUE DEPLOYED

35,000 FEET

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

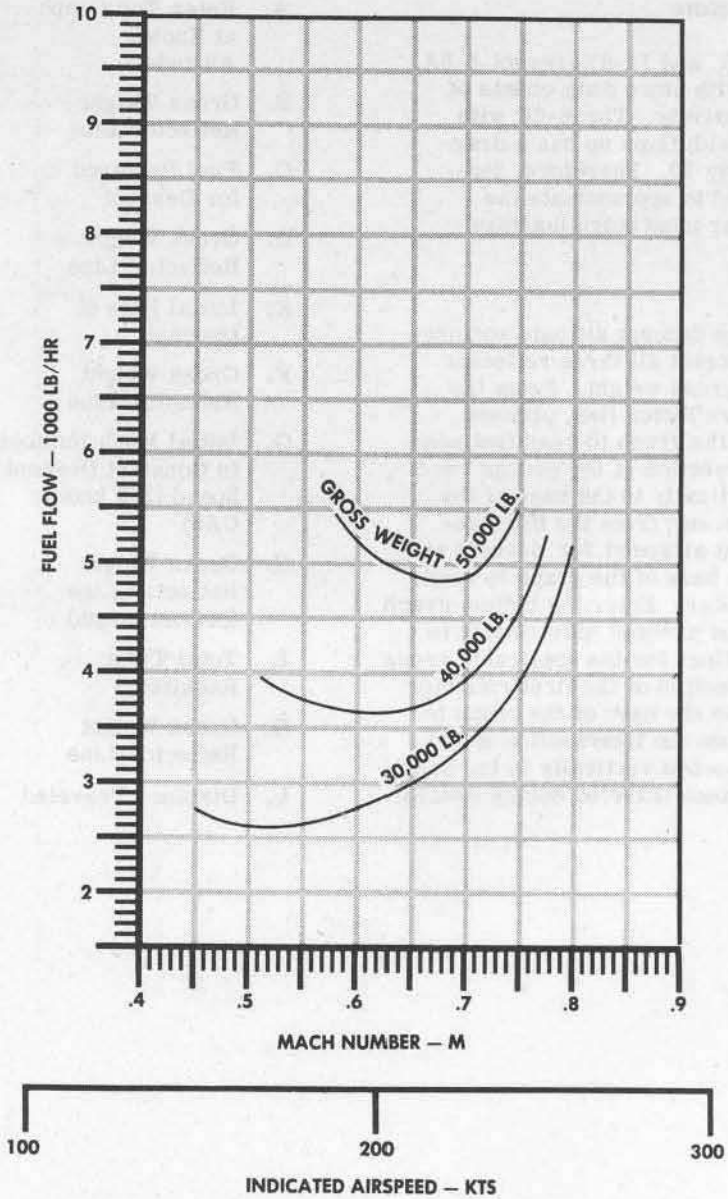

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Figure 11-64

part 4 Normal Descent

NORMAL DESCENT

The normal landing descents (figures 11-65 through 11-67) correspond to a normal letdown with recommended airspeeds, throttle settings and Mach number.

Note

Figures 11-65, 11-66, and 11-67 present A-6A, A-6B performance with store drag counts of 0, 190, and 48 respectively. The A-6C with the TRIM pod alone with flaps up has a drag count of approximately 70. Therefore, figure 11-65 can be used to approximate the A-6C performance for most store loadings.

USE

Enter the top graph at the descent altitude and proceed horizontally to intersect all three reflector lines for the applicable gross weight. From the intersection of the first reflector line, proceed vertically to the base of the graph to read fuel consumption; from the intersection of the second reflector line, proceed vertically to the base of the graph to read rate of descent; from the third reflector line, note constant airspeed for descent and proceed vertically to the base of the graph to read corresponding mach number. Enter the bottom graph at the descent altitude and proceed horizontally to intersect both reflector lines for the applicable gross weight. From the intersection of the first reflector line, proceed vertically to the base of the graph to read time to descend; from the intersection of the second reflector line, proceed vertically to the base of the graph to read distance traveled during descent.

Sample Problem

Aircraft Configuration - Clean

A.	Enter Top Graph at Known Altitude	30,000 ft
B.	Gross Weight Reflector Line	30,000 lb
C.	Fuel Required for Descent	425 lb
D.	Gross Weight Reflector Line	30,000 lb
E.	Initial Rate of Descent	7600 fpm
F.	Gross Weight Reflector Line	30,000 lb
G.	Initial Mach Number Corresponding to Constant Descent Speed (250 knots CAS)	.69 M
H.	Gross Weight Reflector Line (bottom graph)	30,000 lb
J.	Total Time Required	6.1 min
K.	Gross Weight Reflector Line	30,000 lb
L.	Distance Traveled	31.6 nmi

NORMAL DESCENT

P-8 ENGINE

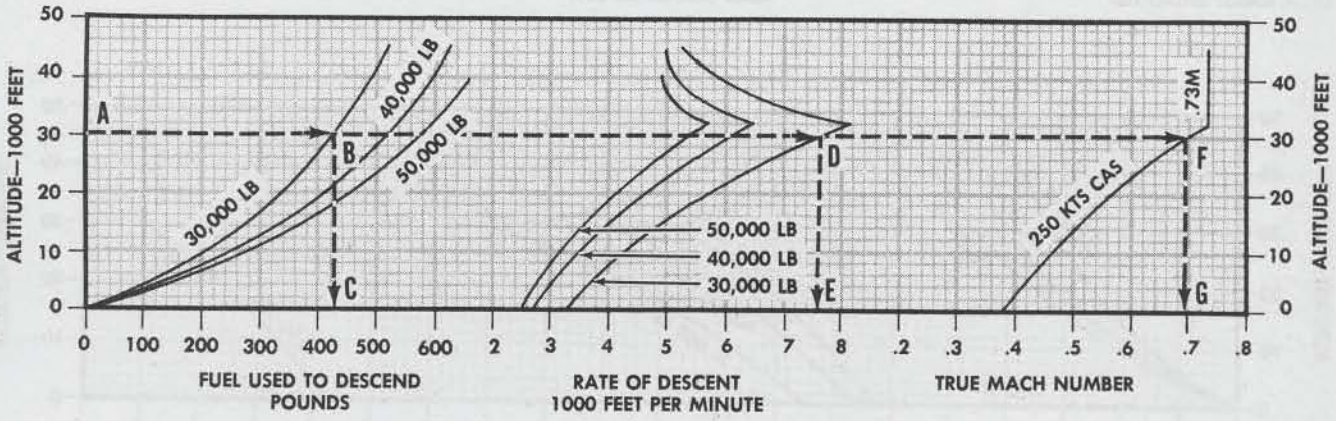
AIRCRAFT CONFIGURATION
CLEAN

250 KTS CAS
80% RPM
WING TIP BRAKES EXTENDED

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



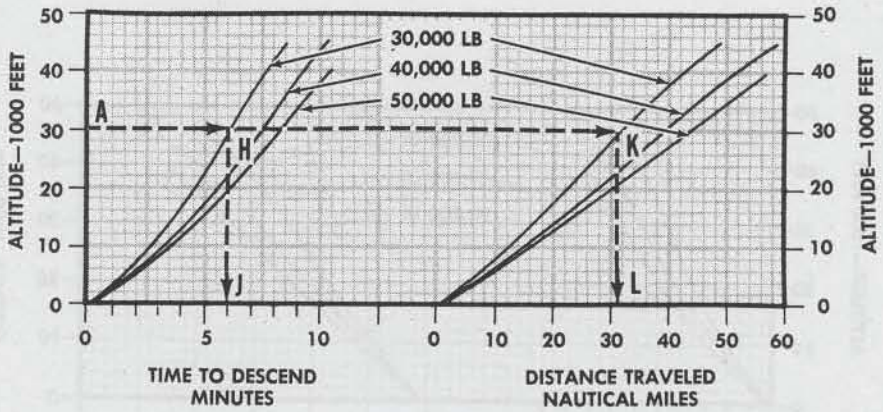


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Figure 11-65

NORMAL DESCENT

P-8 ENGINE

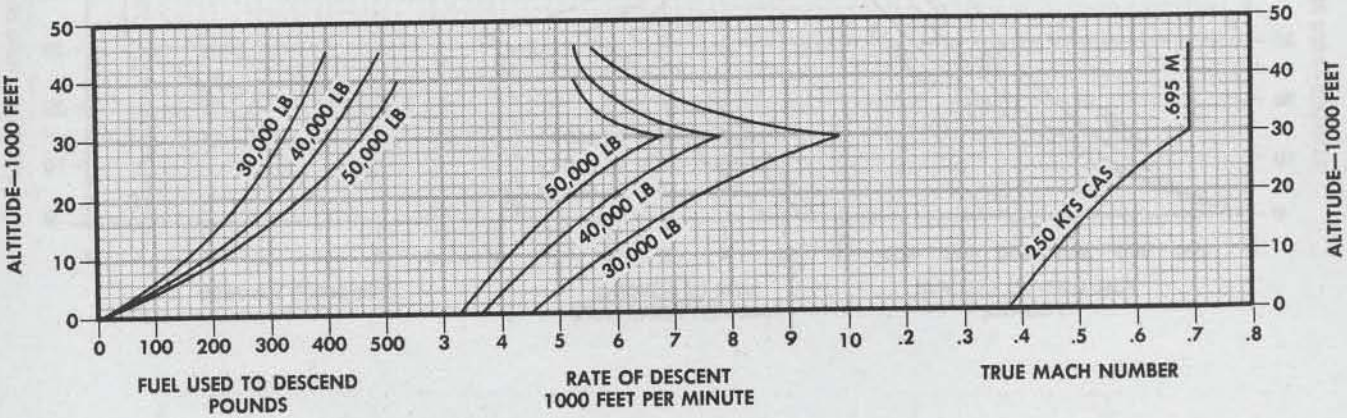
250 KTS CAS
80% RPM
WING TIP BRAKES EXTENDED

AIRCRAFT CONFIGURATION
(30) MK-82 STORES INSTALLED ON
(5) A/A378B-1 MBR

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



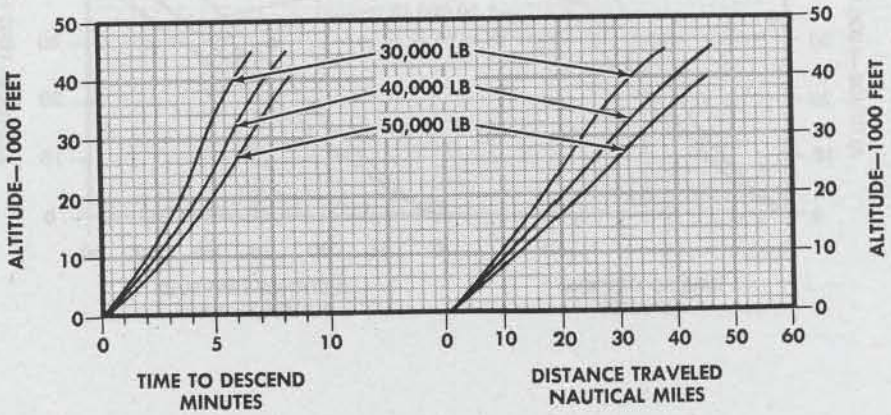


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Figure 11-66

NORMAL DESCENT

P-8 ENGINE

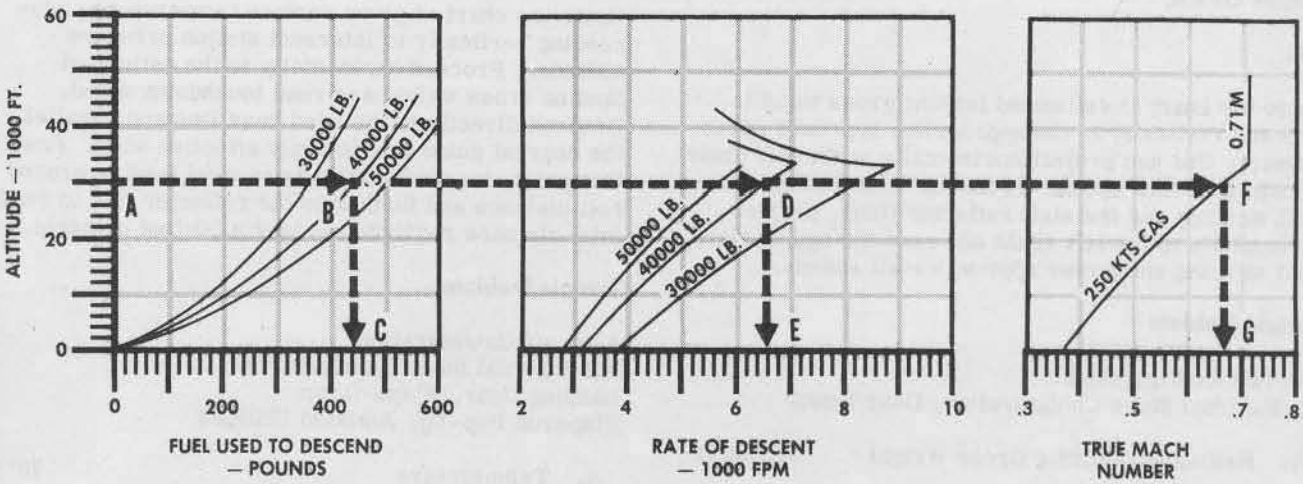
250 KTS CAS
80% RPM
WING TIP BRAKES EXTENDED

AIRCRAFT CONFIGURATION
(1) MK-28 STORE +
(4) 300 GALLON DROP TANKS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



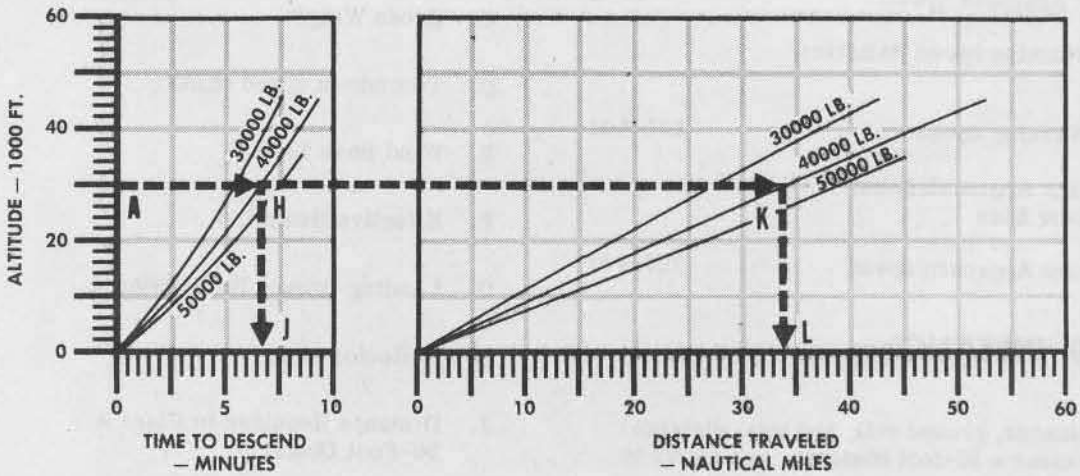


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Figure 11-67

part 5 Carrier and Field Landing

LANDING APPROACH SPEED

The Landing Approach Speed Chart (figure 11-68) shows the recommended approach speeds and minimum field landing distance approach speeds, together with stall warning and power approach stall speeds for A-6A, B, E and KA-6D. Figure 11-72 provides this information for A-6C. Figure 11-69 provides approach speeds for three angles of attack. It is pointed out that the standard configuration for landings is: Flaps TAKE-OFF (30°) and wing tip speed brakes OPEN.

USE

Enter the chart at estimated landing gross weight. Proceed vertically to the appropriate approach speed reflector line and project horizontally to the left scale to read approach speed. From the intersection of the stall warning and the stall reflector lines, project horizontally to the left scale and read the appropriate stall warning and power approach stall speeds.

Sample Problem

Aircraft Configuration:
All External Store Configuration, Gear Down

A.	Estimated Landing Gross Weight	37,000 lb
B.	Power Approach Stall Speed Reflector Line	
C.	Power Approach Speed	98 kt
D.	Stall Warning Speed Reflector Line	
E.	Stall Warning Speed	107.5 kt
F.	Optimum Approach Speed Reflector Line	
G.	Optimum Approach Speed	126.5 kt

LANDING DISTANCE

Landing distances, ground roll, and total distance required to clear a 50-foot obstacle, are shown in figure 11-70 for normal landing and figure 11-71 for minimum landing distance for A-6A, B, E and KA-6D, and in figure 11-73 and 11-74 for A-6C. The following conditions are considered: Landing on a hard, dry runway; temperature in °F and °C; pressure altitude, sea level through 8,000 feet; gross weight, 25,000 pounds through 40,000 pounds; touchdown speeds for each gross weight; headwind effect, 0 to 50 knots.

USE

Enter the chart at given surface temperature, proceeding vertically to intersect station pressure altitude. Proceed horizontally to the estimated landing gross weight and read touchdown speed. Descend directly to the wind base line and parallel the nearest guide line to apply effective wind. From this point, descend vertically to read landing ground roll distance and further to the reflector line to read total distance required to clear a 50-foot obstacle.

Sample Problem

Aircraft Configuration:
All External Store Configuration
Landing Gear, Flaps-Down
Flaperon Pop-Up, Antiskid Utilized

A.	Temperature	70° F
B.	Pressure Altitude	2,000 ft
C.	Gross Weight	40,000 lb
D.	Touchdown Speed (KIAS)	123 kt
E.	Wind Base Line	
F.	Effective Headwind	20 kt
G.	Landing Ground Roll Distance	1925 ft
H.	Reflector Line	
J.	Distance Required to Clear a 50-Foot Obstacle	3120 ft

LANDING AND APPROACH SPEEDS

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
GEAR DOWN

DATE: 15 FEBRUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

STALL SPEEDS CORRESPOND TO FIN BOOM AIRSPEED SYSTEM

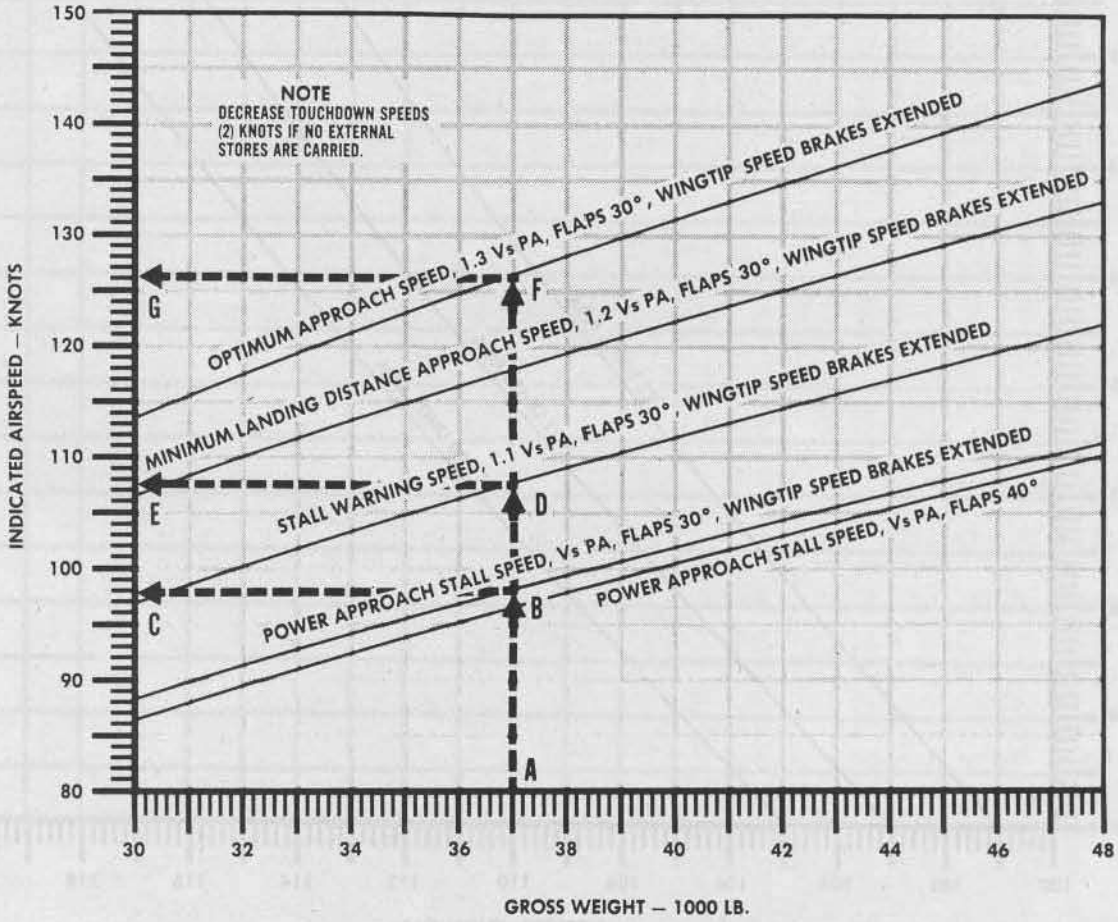

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Figure 11-68

APPROACH SPEEDS

AIRCRAFT CONFIGURATION:
NO EXTERNAL STORES
TAKE-OFF FLAPS, GEAR DOWN

DATE: 1 AUGUST 1974
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

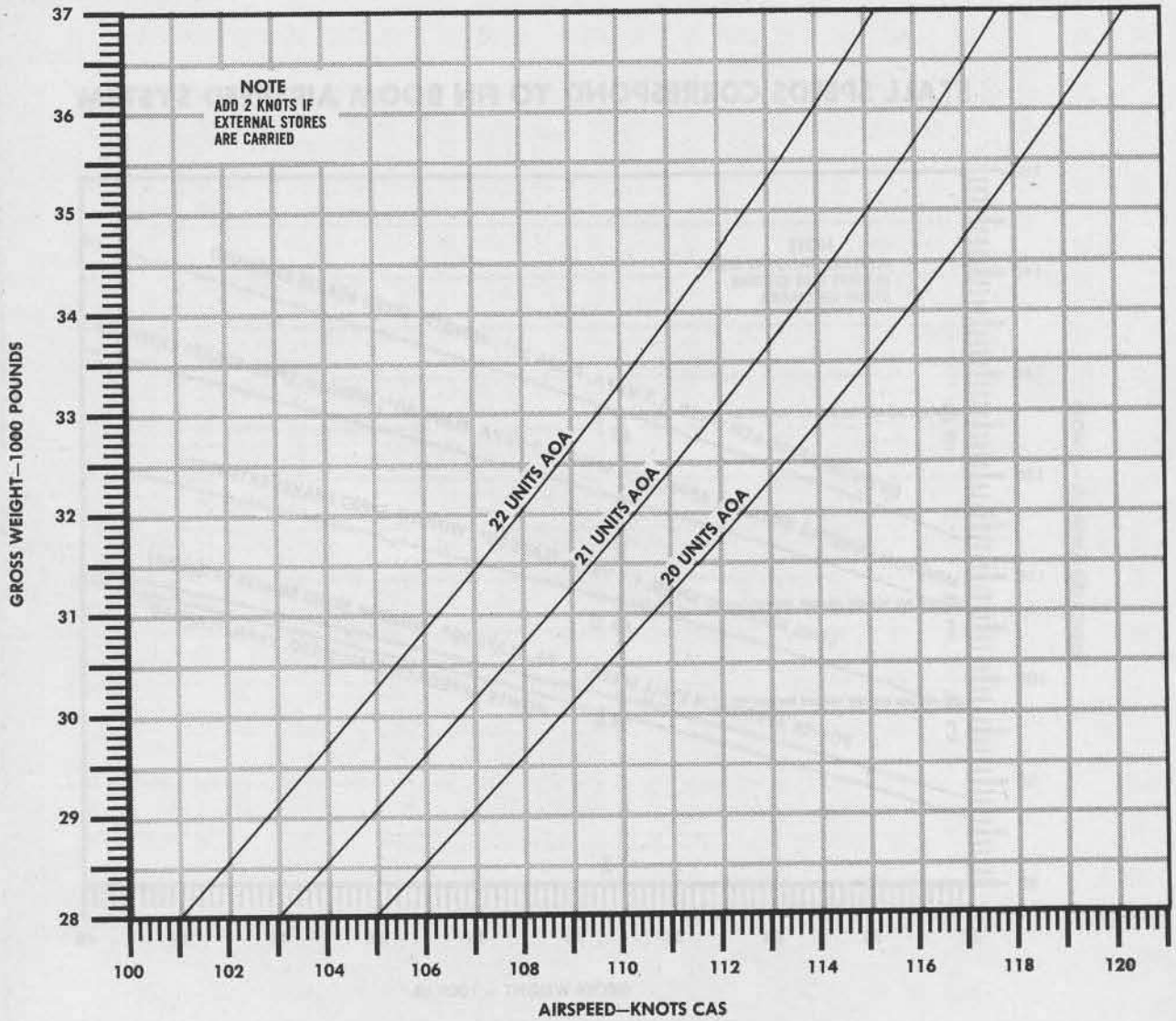

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Figure 11-69

NORMAL LANDING DISTANCE

HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
LANDING GEAR DOWN, FLAPS — TAKEOFF
WING TIP SPEED BRAKES OPEN
FLAPERON POP-UP, ANTI-SKID UTILIZED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
TOUCHDOWN AIRSPEEDS CORRESPOND TO
OPTIMUM APPROACH SPEED FOR 22 UNITS AOA

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

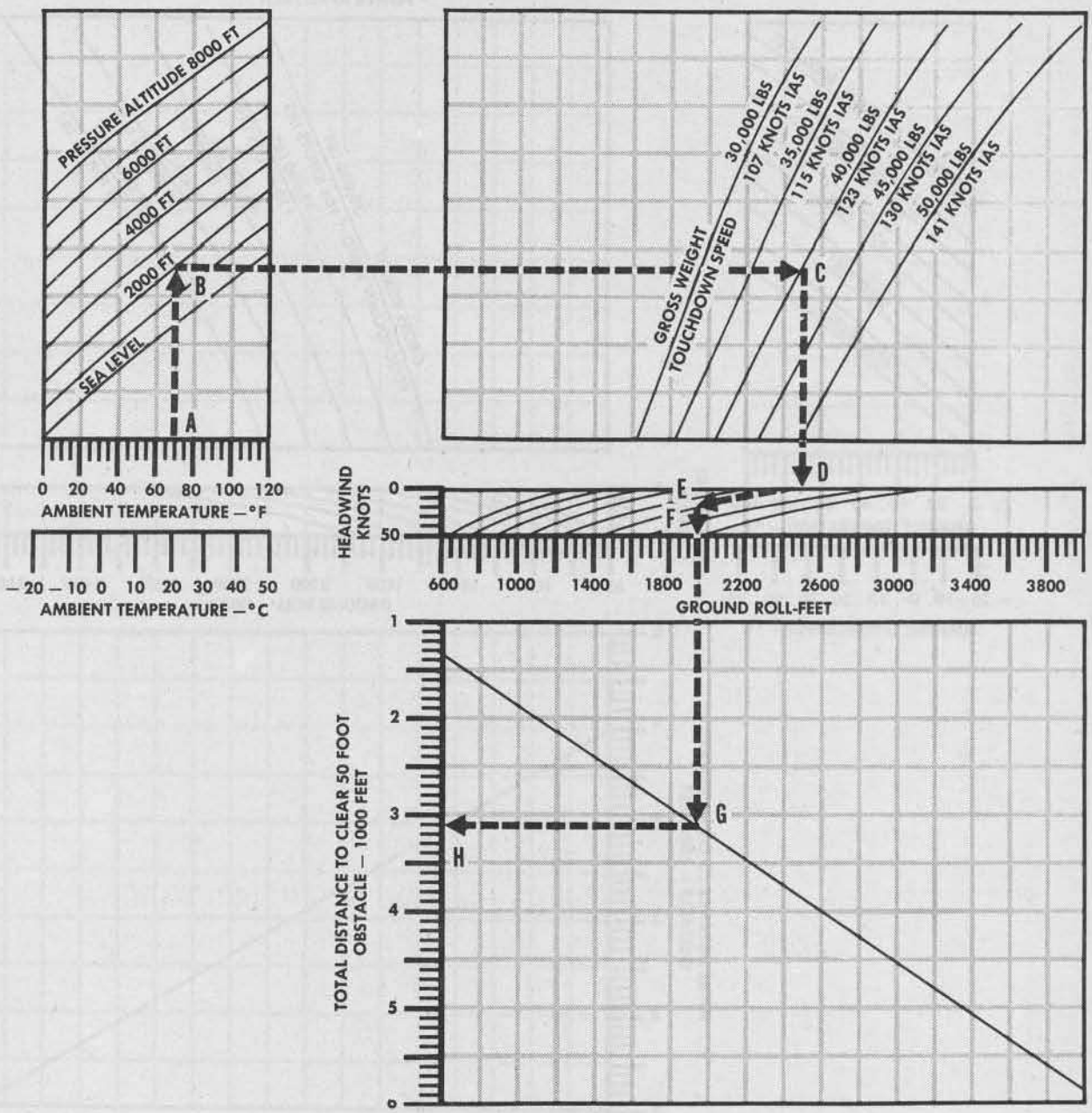

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Figure 11-70

MINIMUM LANDING DISTANCE

HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
ALL EXTERNAL STORE CONFIGURATIONS
LANDING GEAR DOWN, FLAPS — TAKEOFF
WING TIP SPEED BRAKES OPEN
FLAPERON POP-UP, ANTI-SKID UTILIZED

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
SPECIFICATION
OVER 50 FOOT OBSTACLE, AIRSPEED 1.20 X V_S POWER APPROACH

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

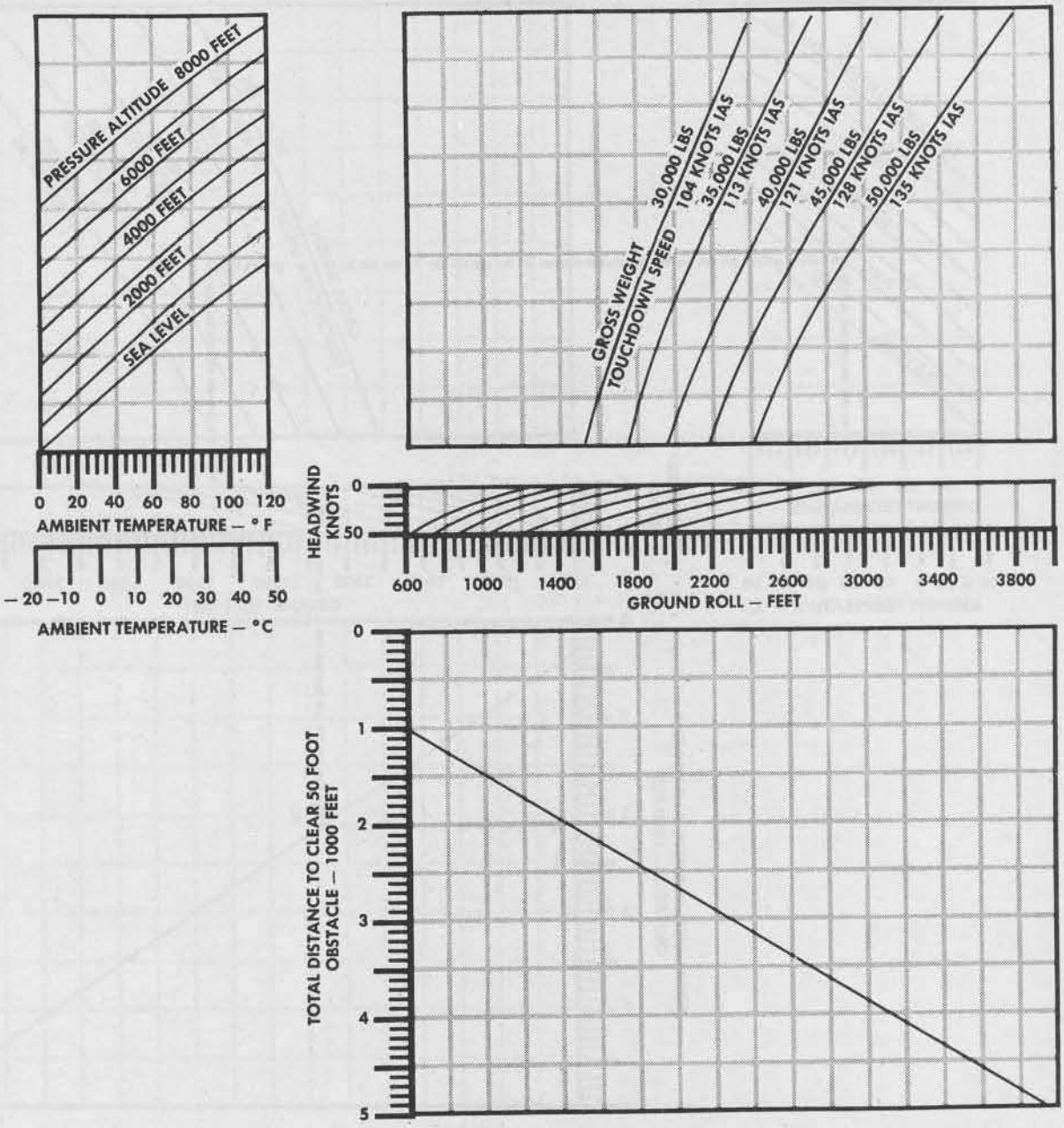

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Figure 11-71

LANDING AND APPROACH SPEEDS

P-8 ENGINE

A-6C

AIRCRAFT CONFIGURATION
30° FLAPS, GEAR DOWN
NO EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

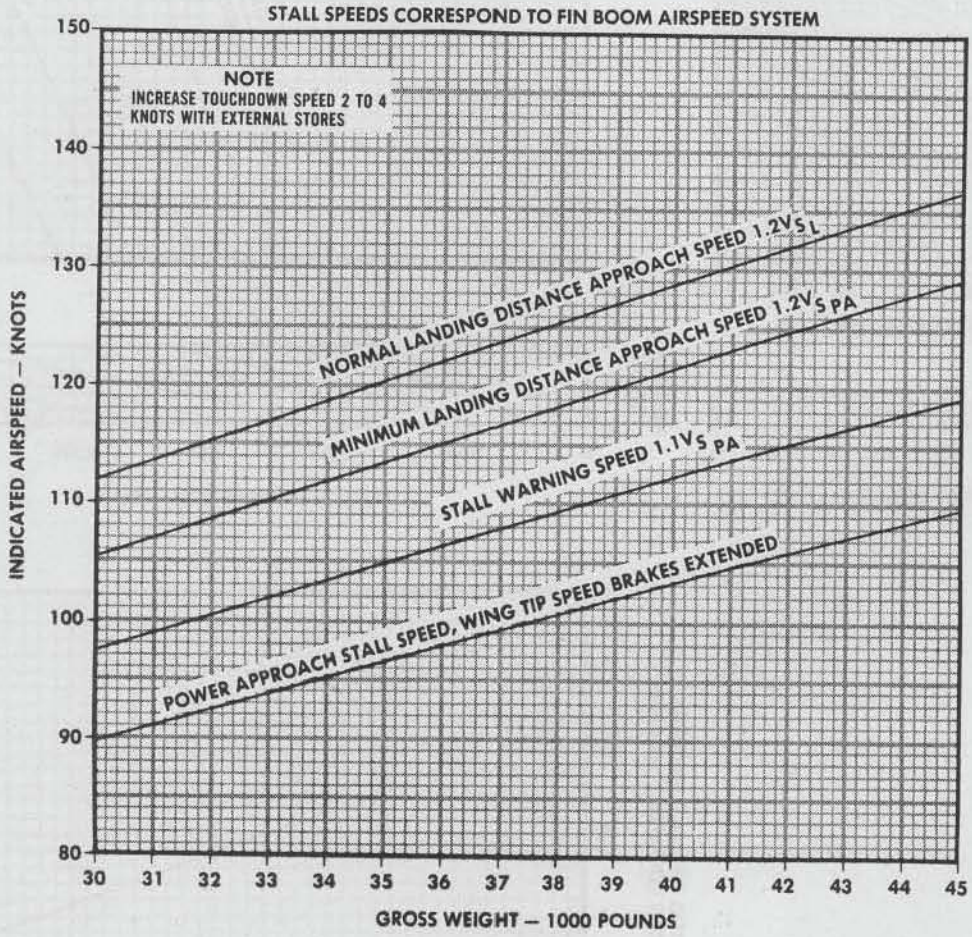

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Figure 11-72

NORMAL LANDING DISTANCE

P-8 ENGINE

A-6C

HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
LANDING GEAR, FLAPS-DOWN
FLAPPERON POP-UP, ANTI-SKID UTILIZED
NO EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

REMARKS
OVER 50 FOOT OBSTACLE, AIRSPEED = 1.2 X V_S POWER OFF

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

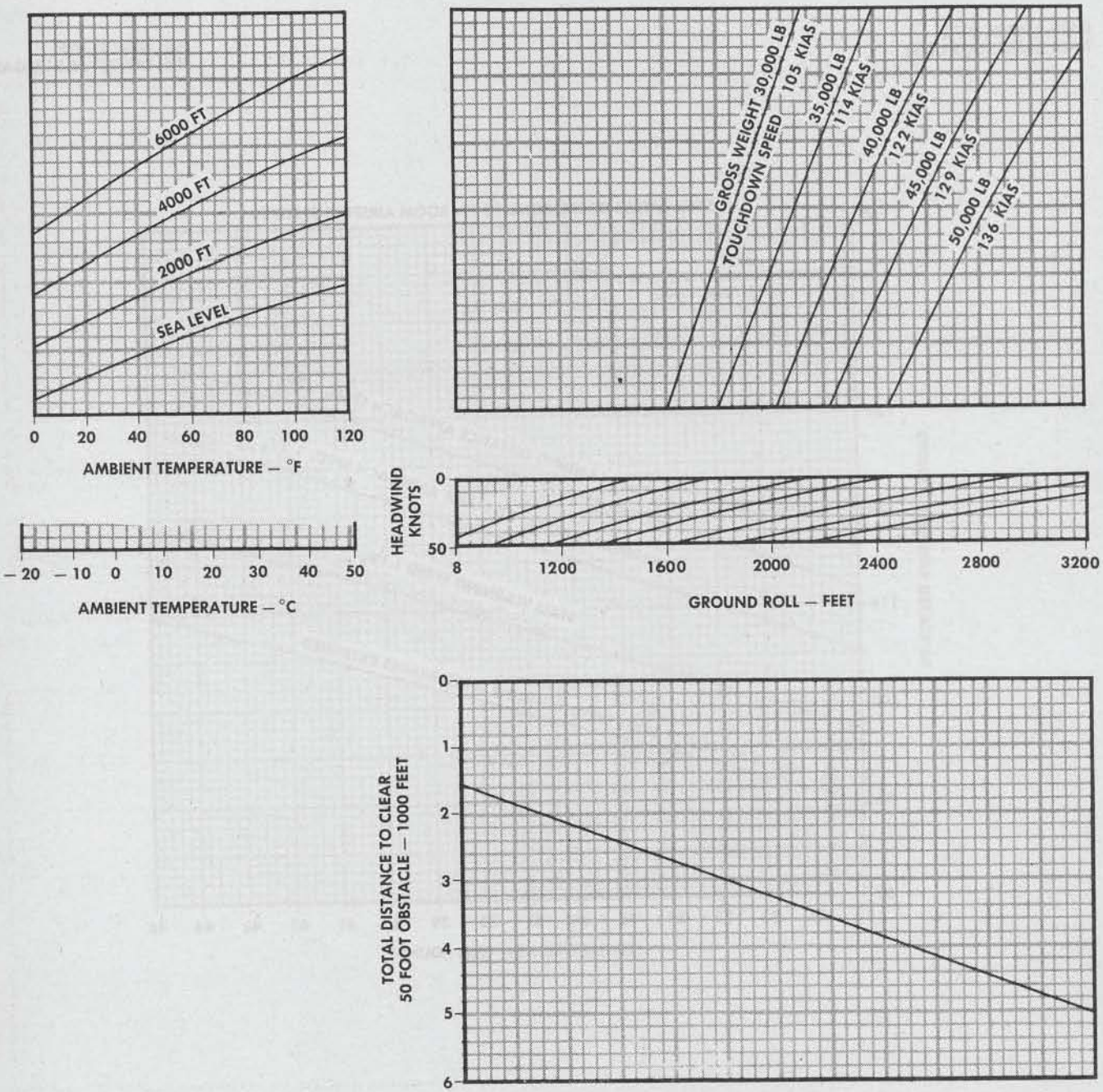

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Figure 11-73

MINIMUM LANDING DISTANCE

P-8 ENGINE

A-6C

HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
LANDING GEAR, FLAPS-DOWN
FLAPERON POP-UP, ANTI-SKID UTILIZED
NO EXTERNAL STORES

DATE: 1 APRIL 1970
DATA BASIS: ESTIMATED

REMARKS
OVER 50 FOOT OBSTACLE, AIRSPEED = 1.2 V_S
POWER APPROACH

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

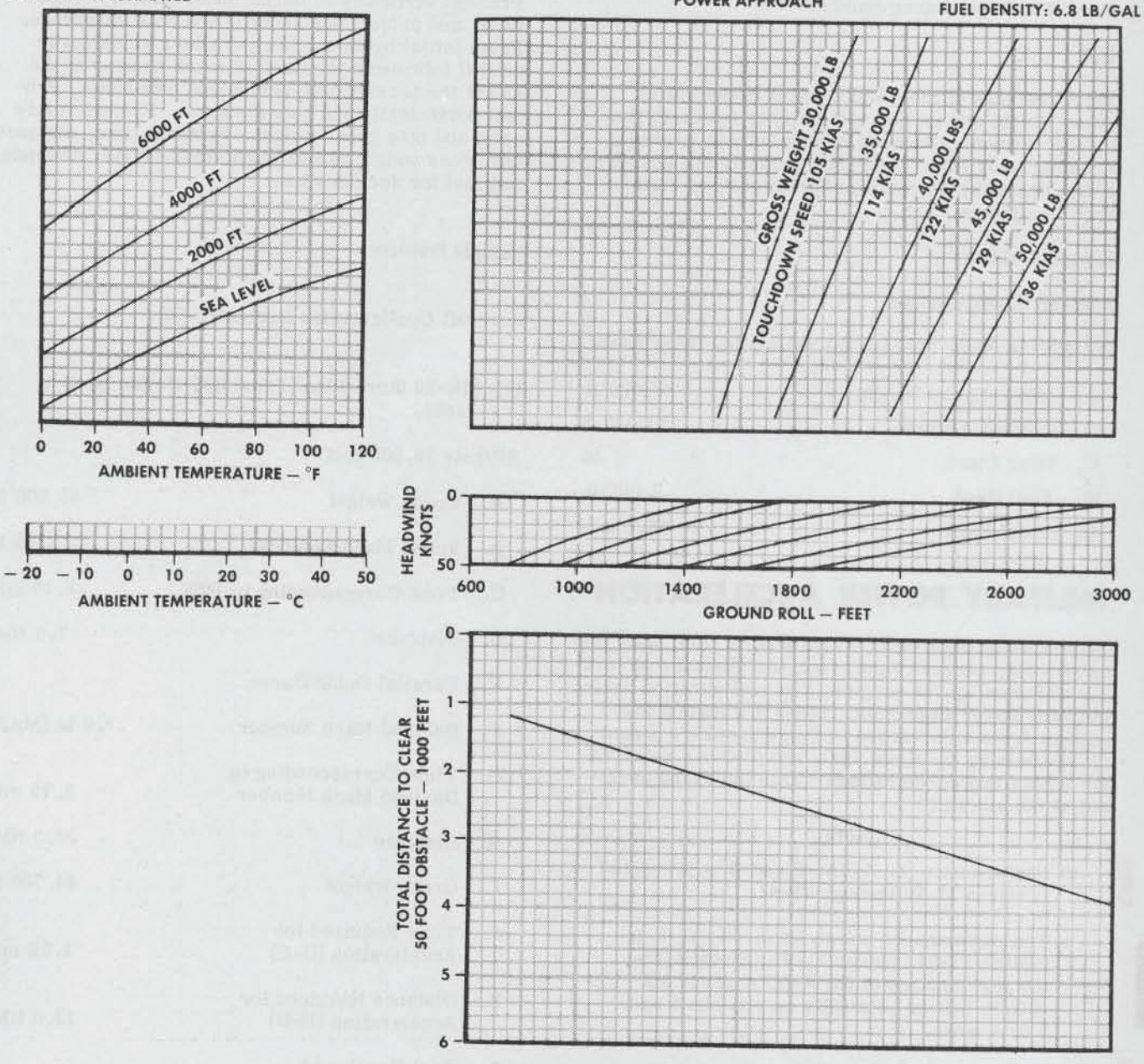

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Figure 11-74

part 6 Combat Performance

COMBAT ALLOWANCE

With a constant combat power setting, these charts (figures 11-75 and 11-76) present the relationship at an initial gross weight between time and fuel, at various altitudes and drag counts.

USE

Enter the base of the altitude chart at the initial gross weight and ascend vertically to intersect the combat altitude. Proceed horizontally to intersect the drag count line. Descend vertically to intersect a fuel line and then continue horizontally to read time in minutes.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Initial Gross Weight	45,000 lb
B.	Combat Altitude	30,000 ft
C.	Drag Count	50
D.	Fuel Used	2,000 lb
E.	Total Time	15.1 min

MILITARY POWER ACCELERATION

These charts (figures 11-77 through 11-103) show the relationship between time, fuel, and distance at various altitudes, gross weights, and configuration during Military Power Operation. Lines of constant mach number from loiter speed to V_{max} provide a means of determining the time, fuel, and distance required for level flight accelerations within the speed envelope of the aircraft.

Note

- Performance for A-6A, B and E is presented in figure 11-76 through 11-91.
- The performance shown for A-6A, B, E in figures 11-88 through 11-92 approximates the performance of the A-6C with six MK-82G.P. bombs on MER's on stations 1 and 5 or 4 tanks.
- Performance for KA-6D is presented in figures 11-93 through 11-103.

USE

To determine time, fuel, and distance required for acceleration, select the applicable chart (altitude and configuration) and enter the chart with gross weight. Proceed vertically to initial mach number. Note time, and project horizontally and note difference. From initial mach number parallel a guide curve until it intersects the desired mach number at the end of the acceleration period and note time. Project horizontally and note distance. Project vertically and note gross weight. Subtract time, distance, and gross weight values to determine time, distance, and fuel for acceleration.

Sample Problem

Aircraft Configuration (figure 11-65):

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

Altitude 15,000 feet

A.	Gross Weight	45,000 lb
B.	Initial Mach Number	.70 M
C.	Time Corresponding to IMN	1.16 min
D.	Distance	7.0 NMI
E.	Parallel Guide Curve	
F.	Desired Mach Number	.822 M (MAX)
G.	Time Corresponding to Desired Mach Number	2.75 min
H.	Distance	20.0 NMI
I.	Gross Weight	44,700 lb
J.	Time Required for Acceleration (G-C)	1.59 min
K.	Distance Required for Acceleration (H-D)	13.0 NMI
L.	Fuel Required for Acceleration (A-I)	300 lb

COMBAT ALLOWANCE

P-8 ENGINE

MILITARY POWER LIMIT EGT 650°C

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

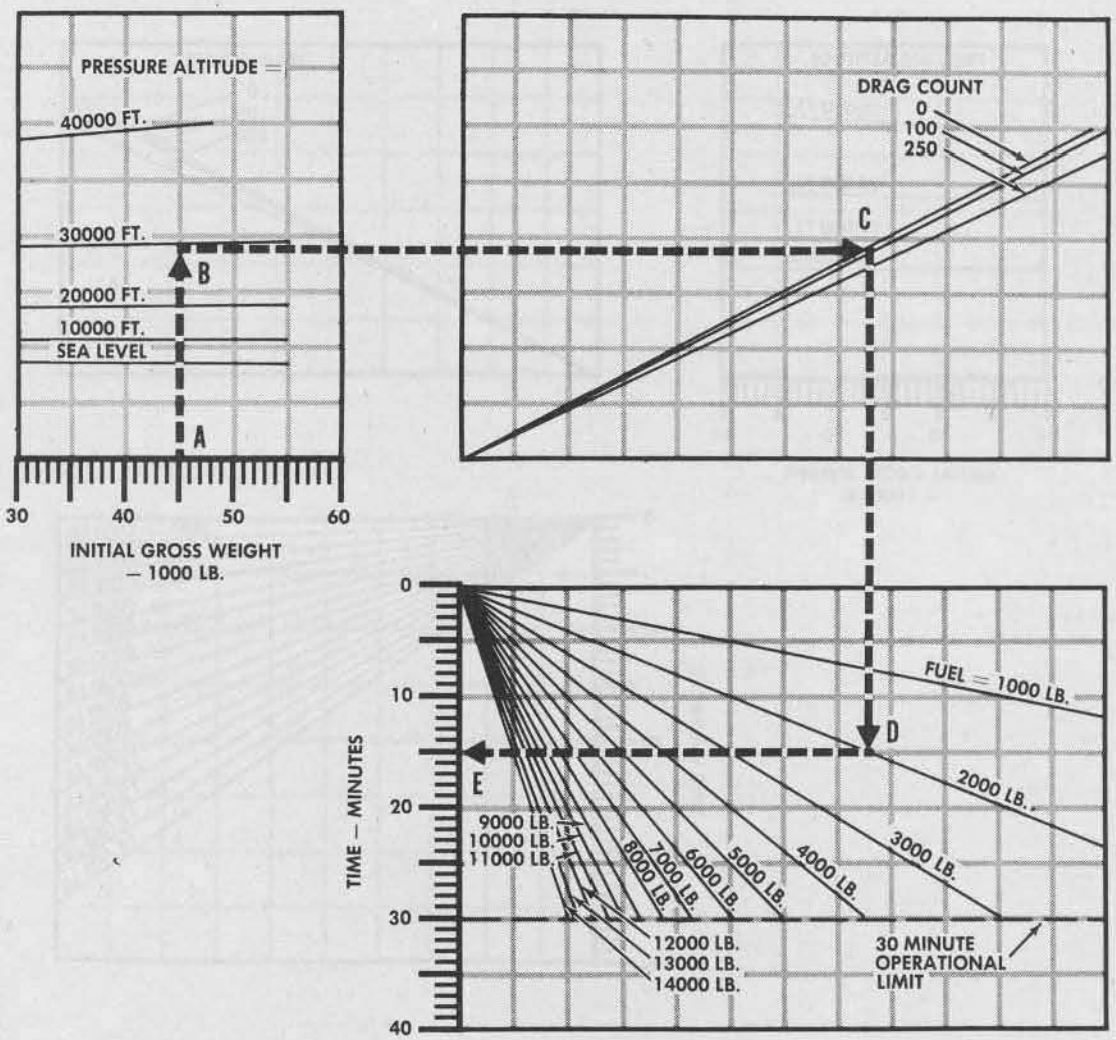

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Figure 11-75

COMBAT ALLOWANCE

P-8 ENGINE

NORMAL POWER
(MAXIMUM CONTINUOUS POWER)
LIMIT EGT 594°C

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

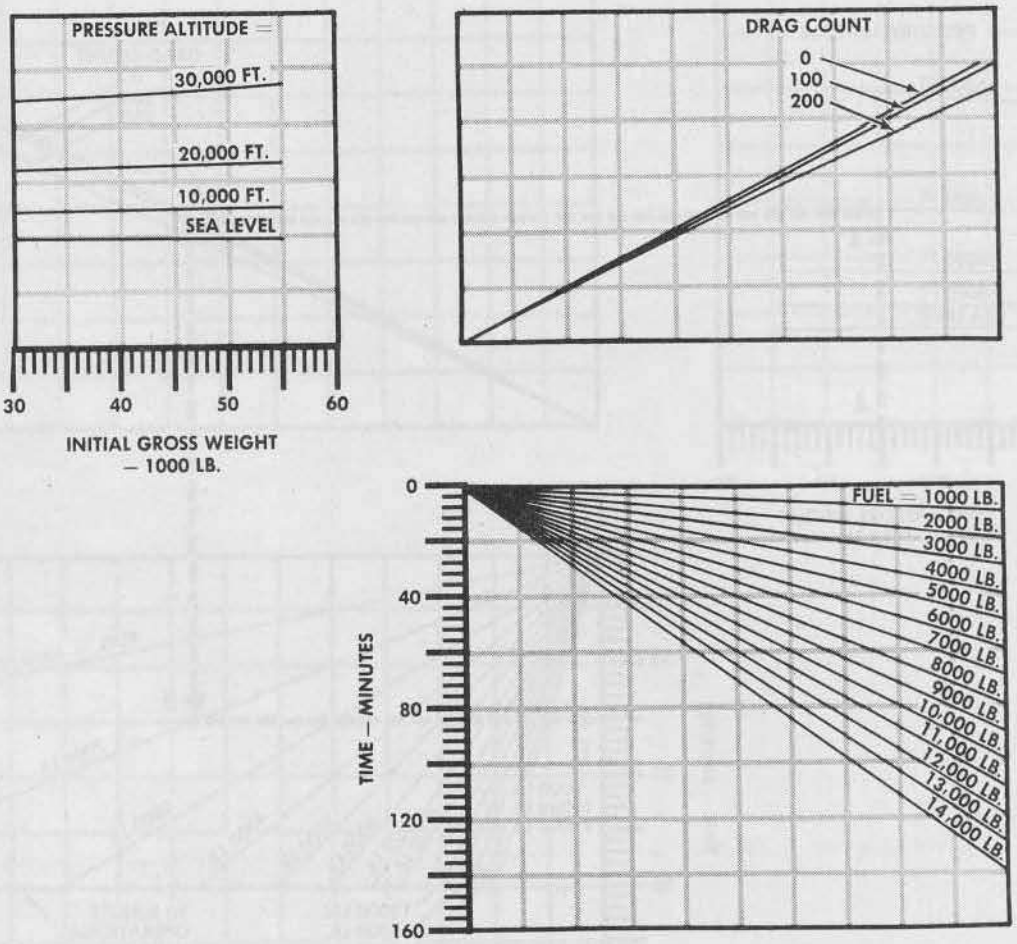

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Figure 11-76

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT SEA LEVEL

AIRCRAFT CONFIGURATION:
CLEAN

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

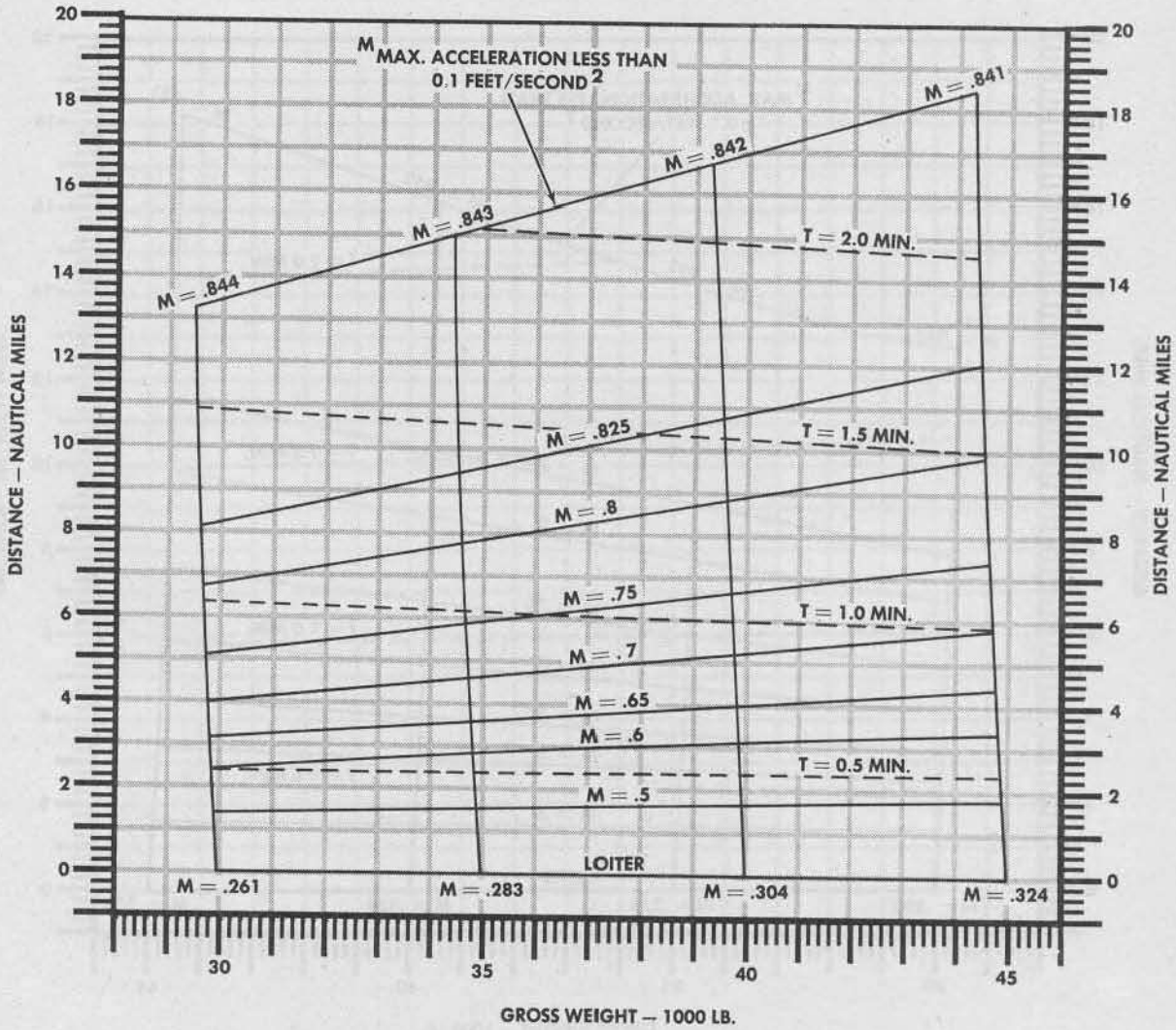

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Figure 11-77

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT 5000 FT.

AIRCRAFT CONFIGURATION:
CLEAN

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

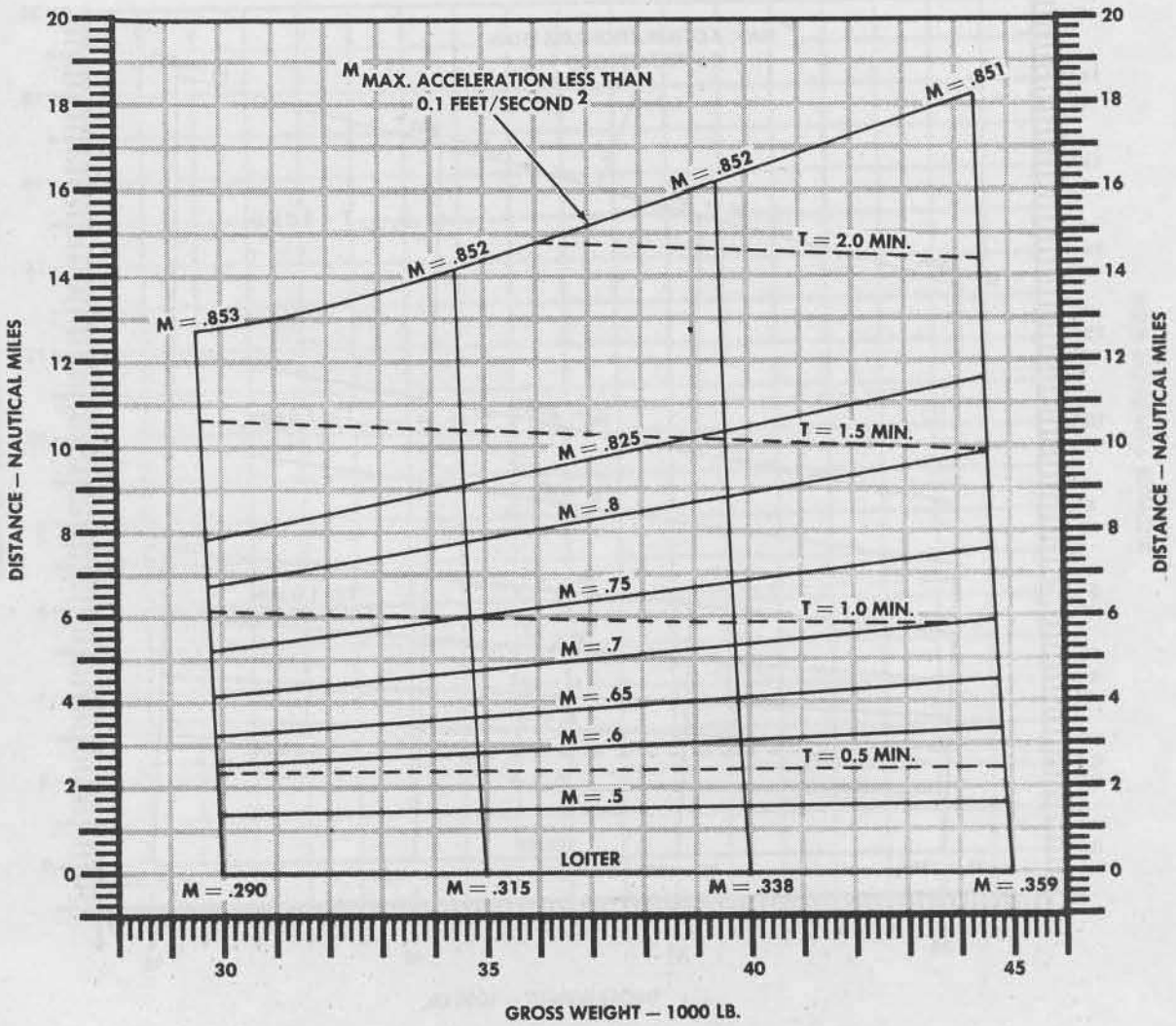

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Figure 11-78

MILITARY POWER ACCELERATION

P-8 ENGINE

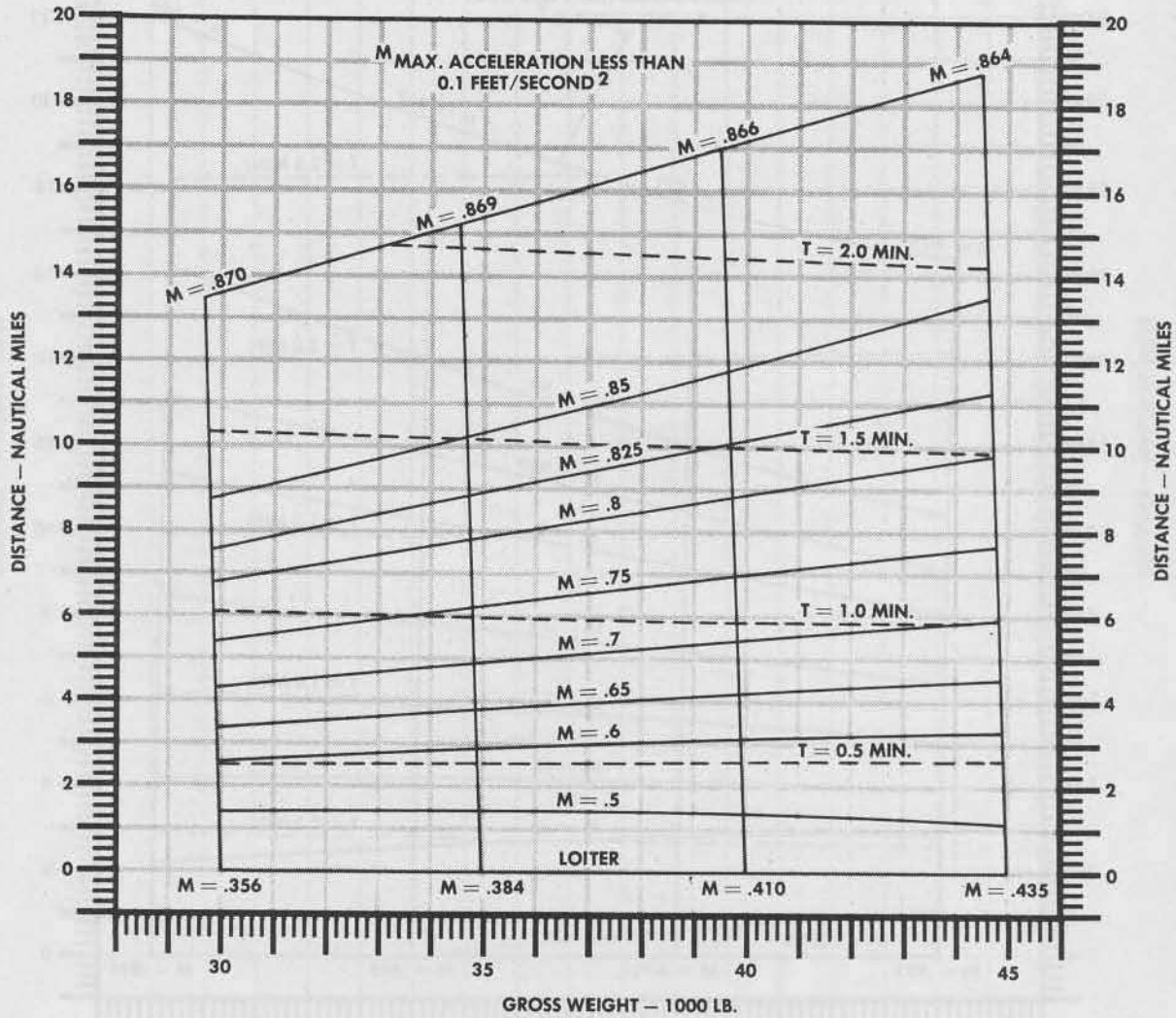
LEVEL FLIGHT 15,000 FT.

AIRCRAFT CONFIGURATION:
CLEAN

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-325

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Figure 11-79

MILITARY POWER ACCELERATION

P-8 ENGINE

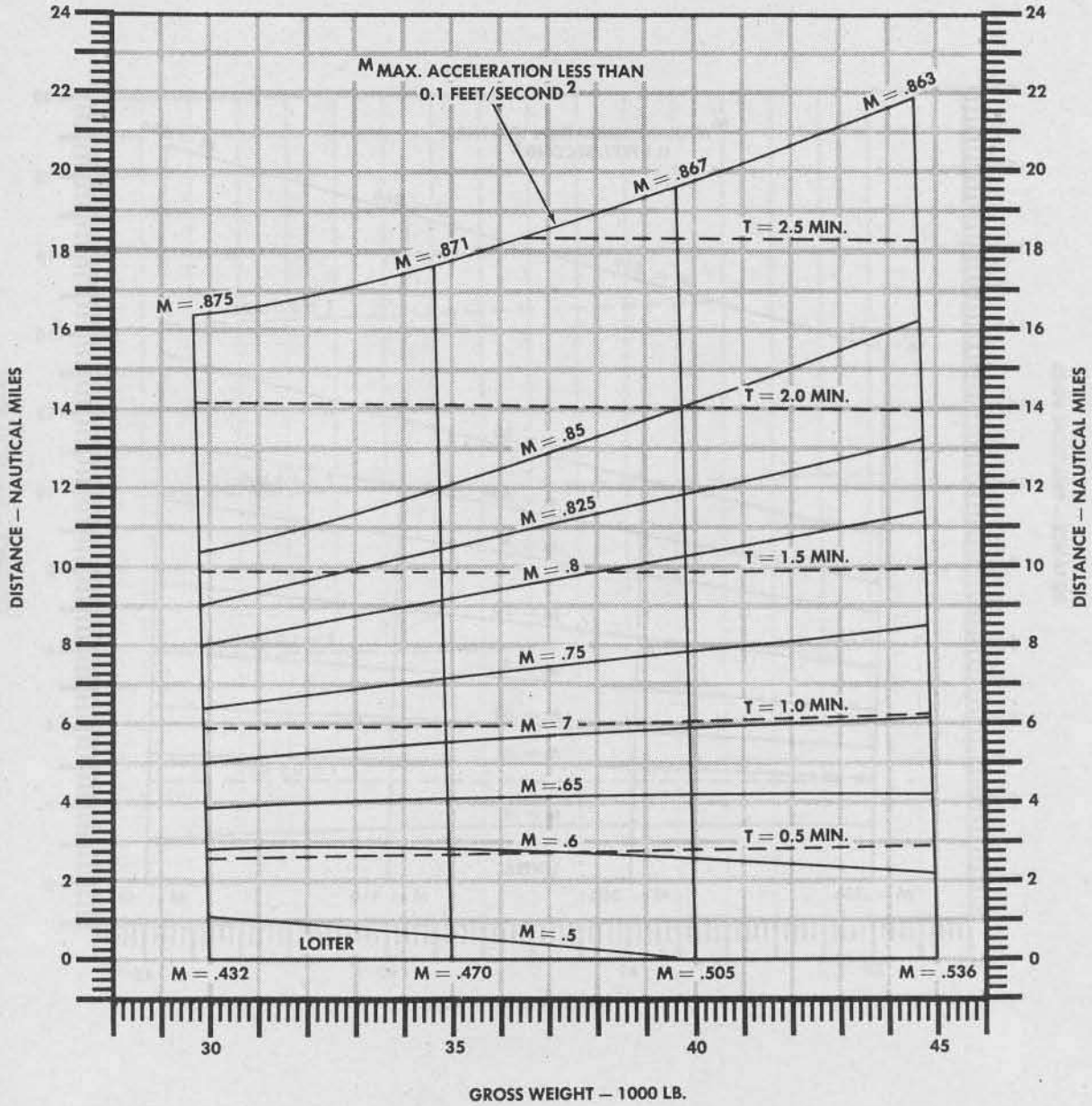
LEVEL FLIGHT 25,000 FT.

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-326

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Figure 11-80

MILITARY POWER ACCELERATION

P-8 ENGINE

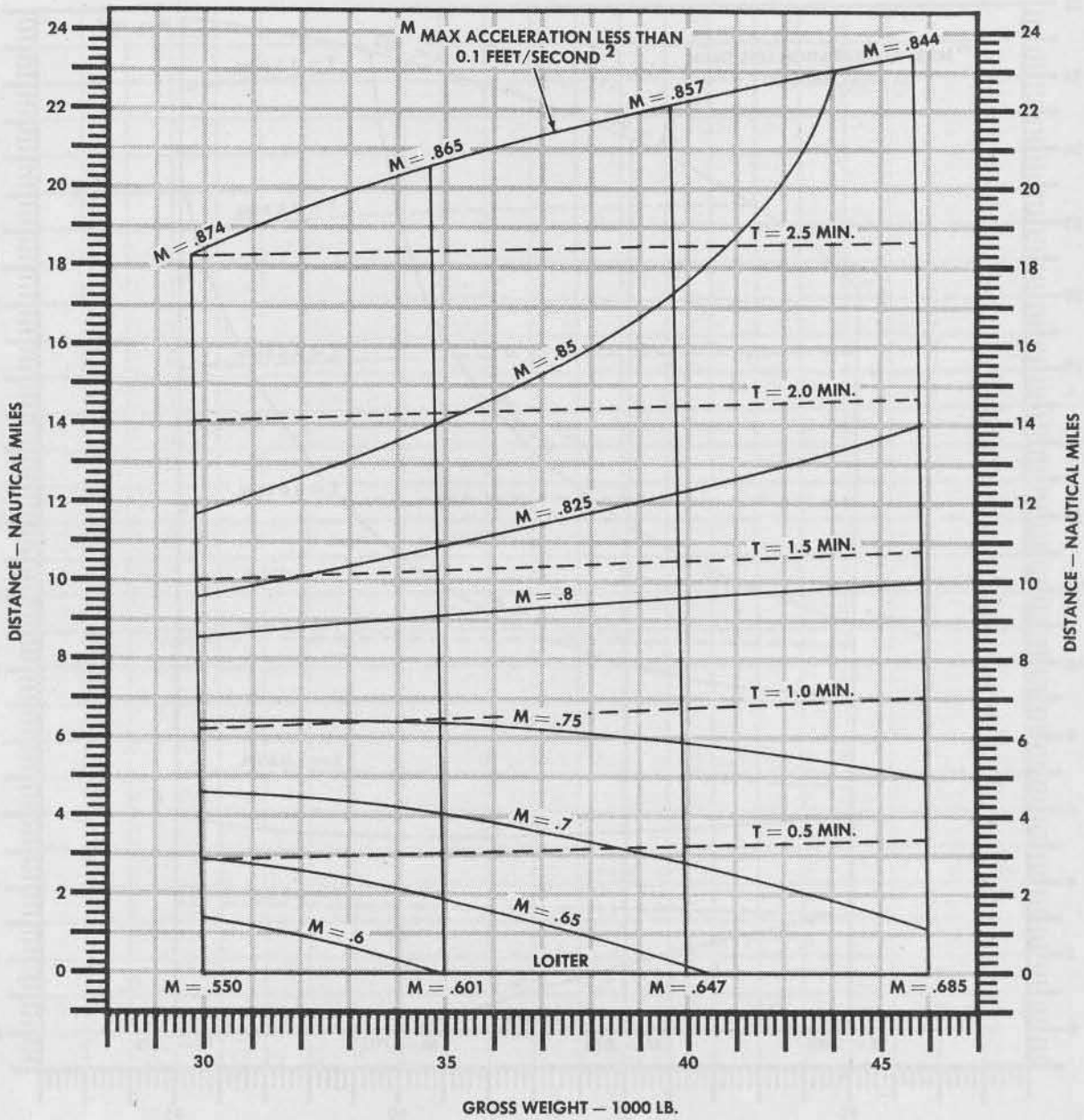
LEVEL FLIGHT 35,000 FT.

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-327

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Figure 11-81

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT 40,000 FT.

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

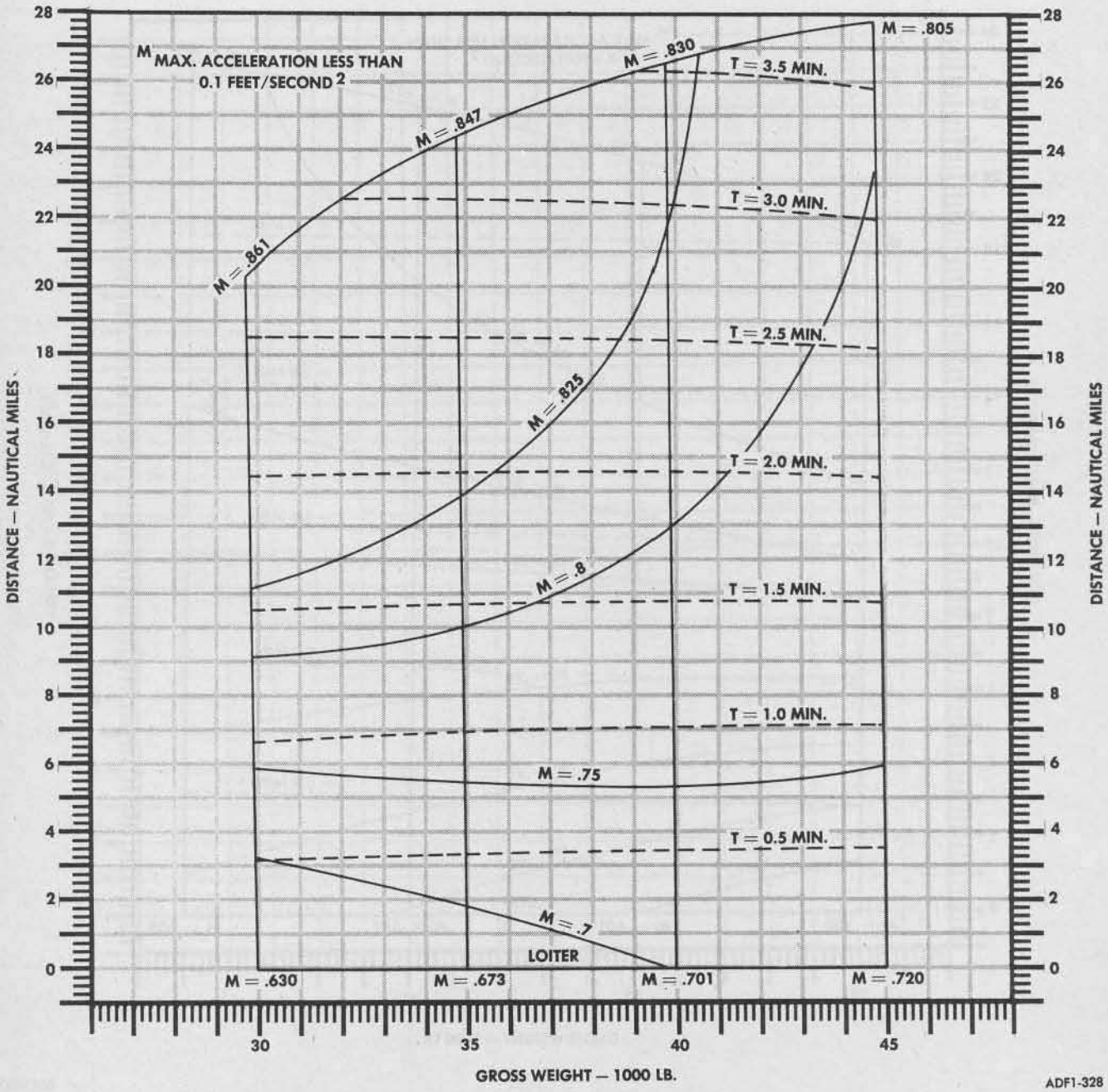

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Figure 11-82

MILITARY POWER ACCELERATION

P-8 ENGINE

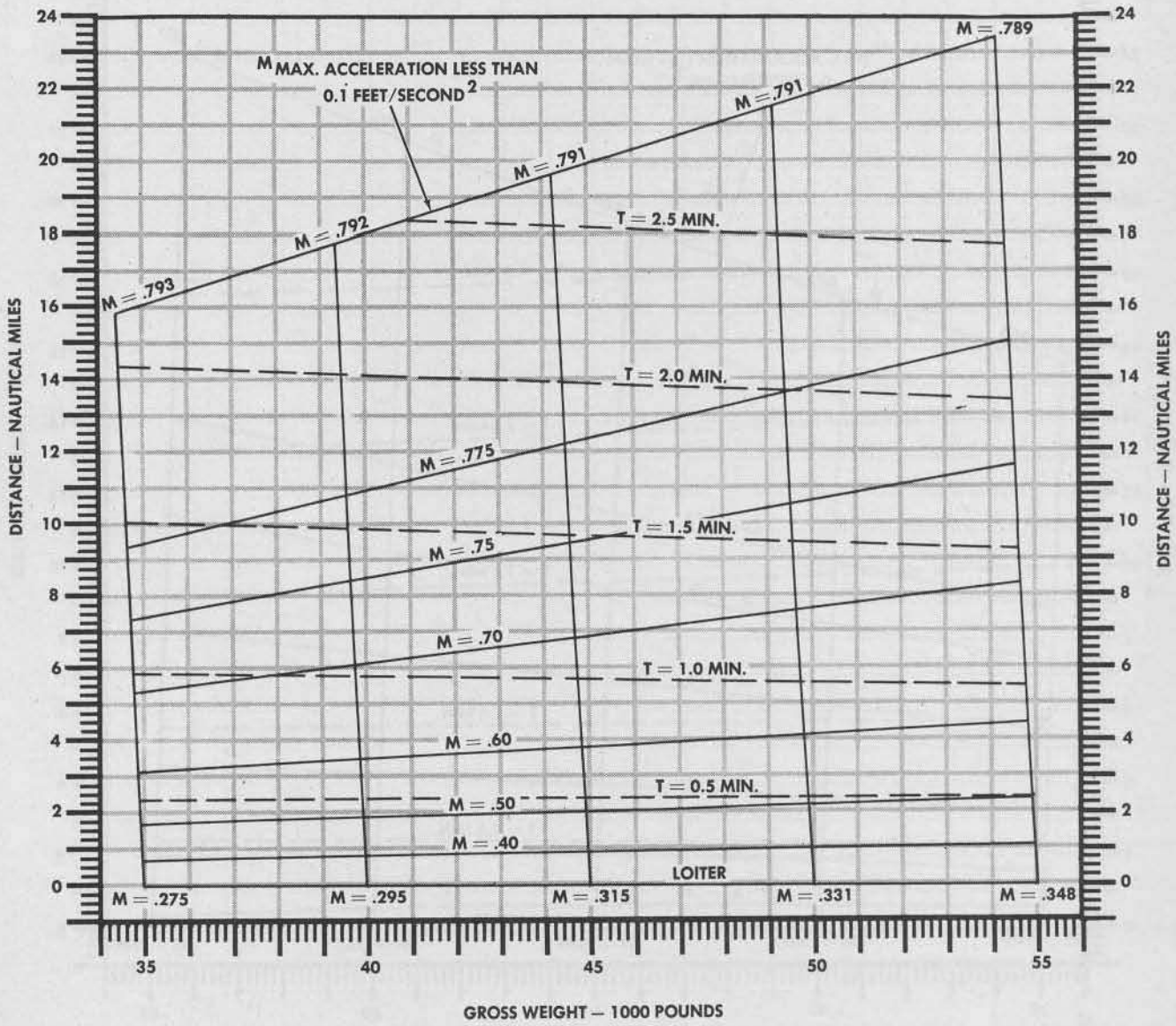
LEVEL FLIGHT SEA LEVEL

AIRCRAFT CONFIGURATION
(1) ℄ MK-28 STORE +
(4) 300 GALLON DROP TANKS

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-329

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Figure 11-83

MILITARY POWER ACCELERATION

P-8 ENGINE

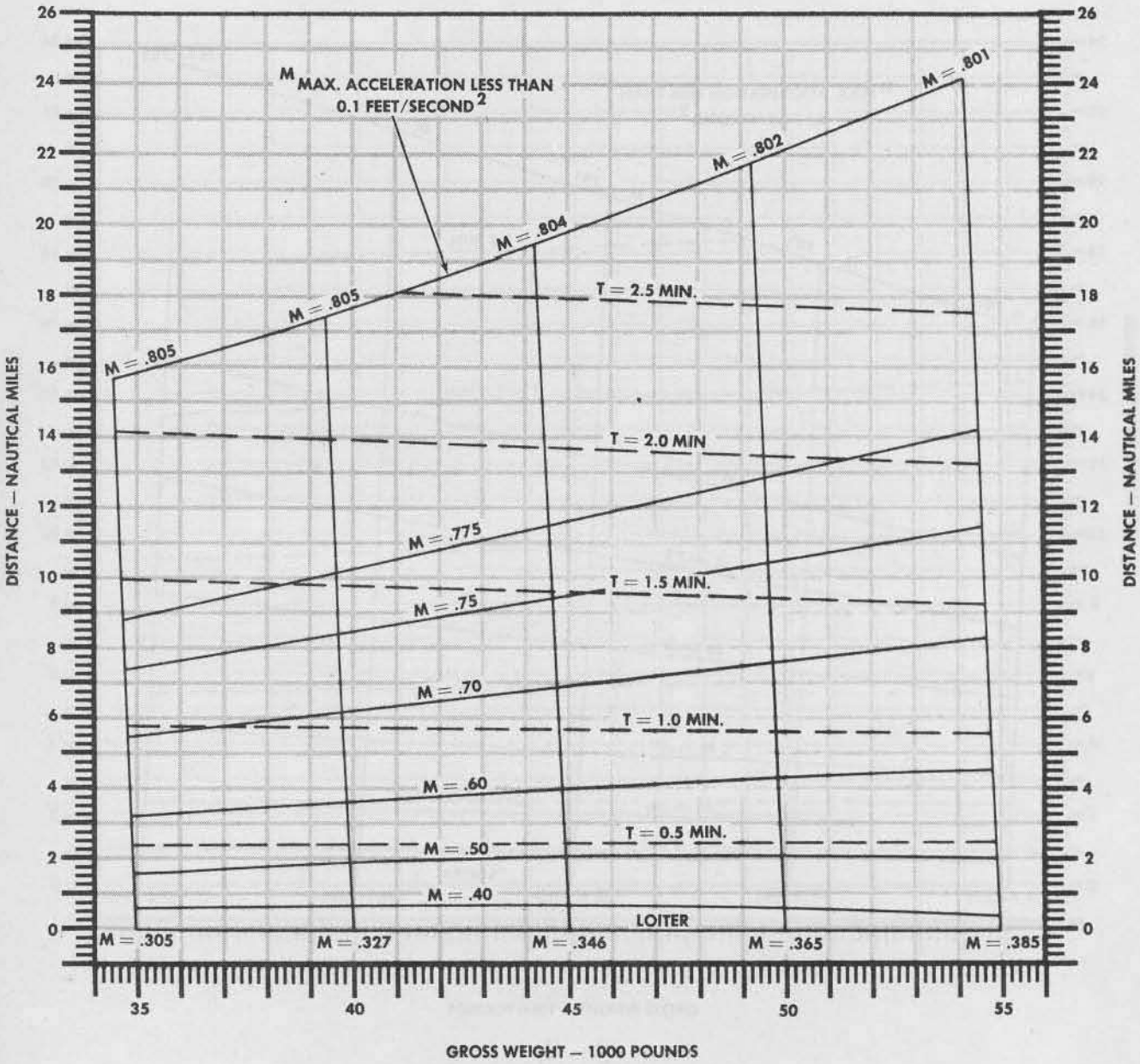
LEVEL FLIGHT 5000 FT.

AIRCRAFT CONFIGURATION
(1) ℄ MK-28 STORE +
(4) 300 GALLON DROP TANKS

DATA BASIS: ESTIMATED
DATE 15 MARCH 1971

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-330

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Figure 11-84

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT 15,000 FT.

AIRCRAFT CONFIGURATION
(1) ℄ MK-28 STORE +
(4) 300 GALLON DROP TANKS

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

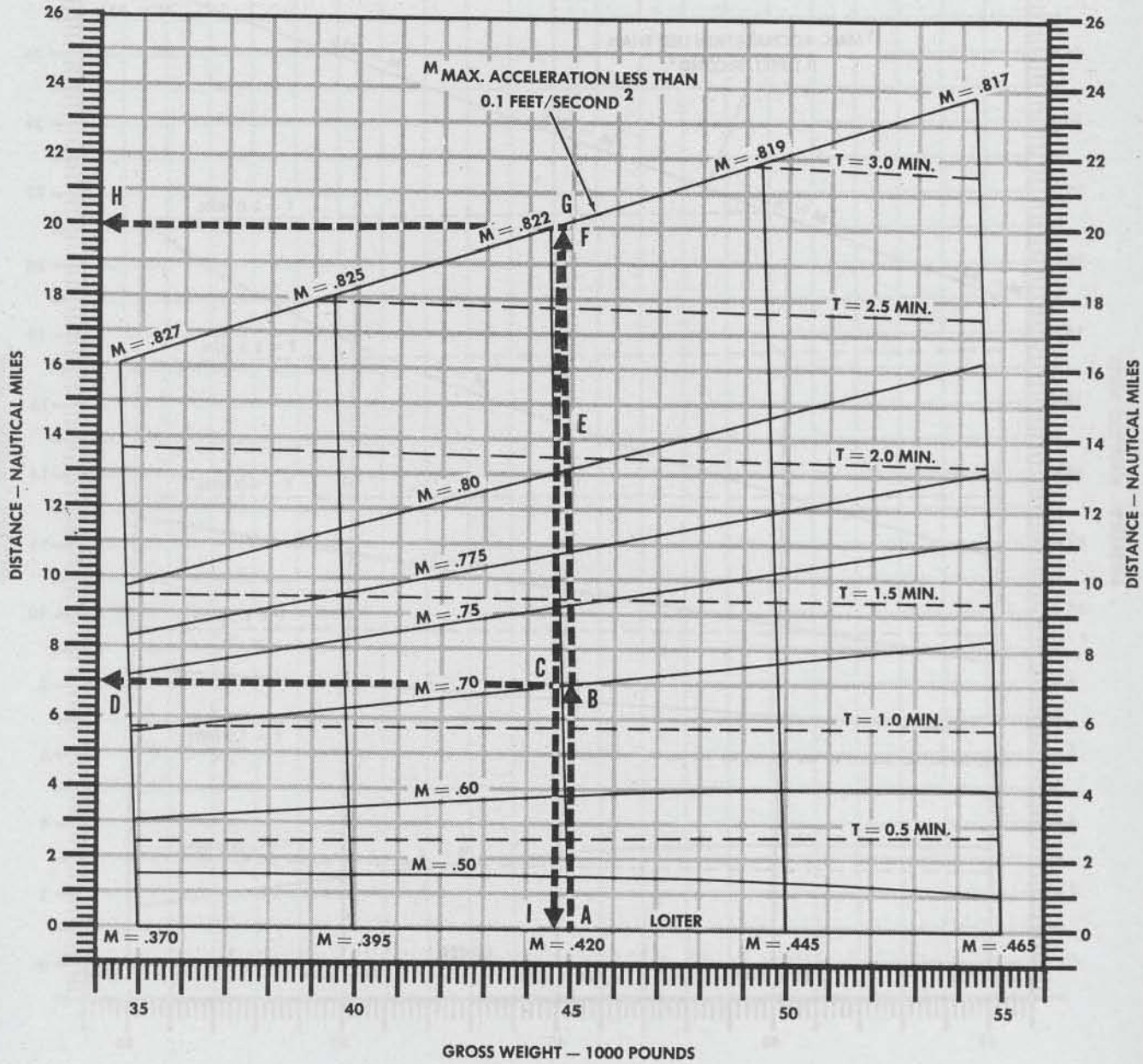

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Figure 11-85

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT 25,000 FT.

AIRCRAFT CONFIGURATION
(1) ℄ MK-28 STORE +
(4) 300 GALLON DROP TANKS

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

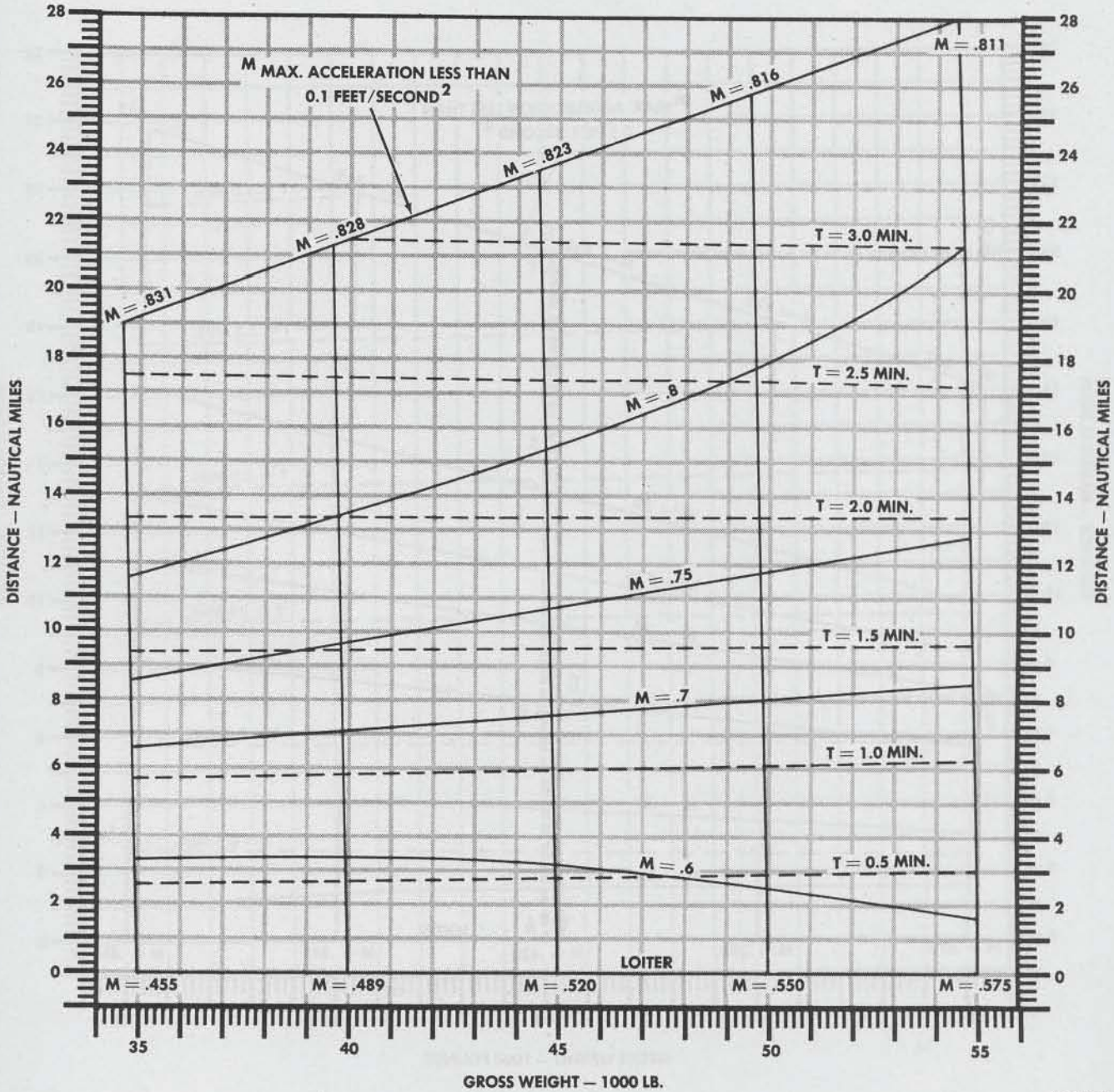

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Figure 11-86

MILITARY POWER ACCELERATION

P-8 ENGINE

AIRCRAFT CONFIGURATION
(1) ℄ MK-28 STORE +
(4) 300 GALLON DROP TANKS

LEVEL FLIGHT 35,000 FT.

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

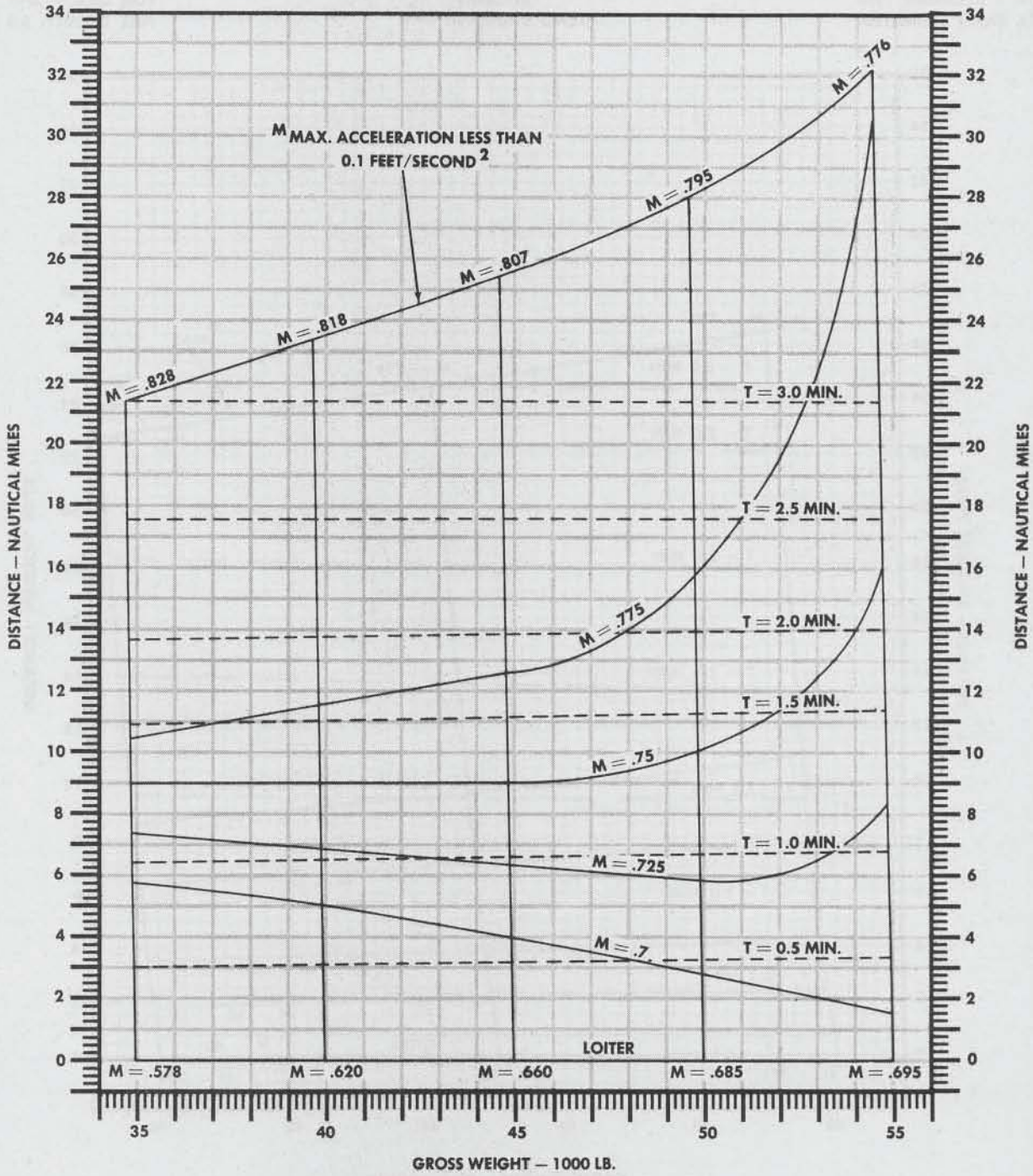

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Figure 11-87

MILITARY POWER ACCELERATION

P-8 ENGINE

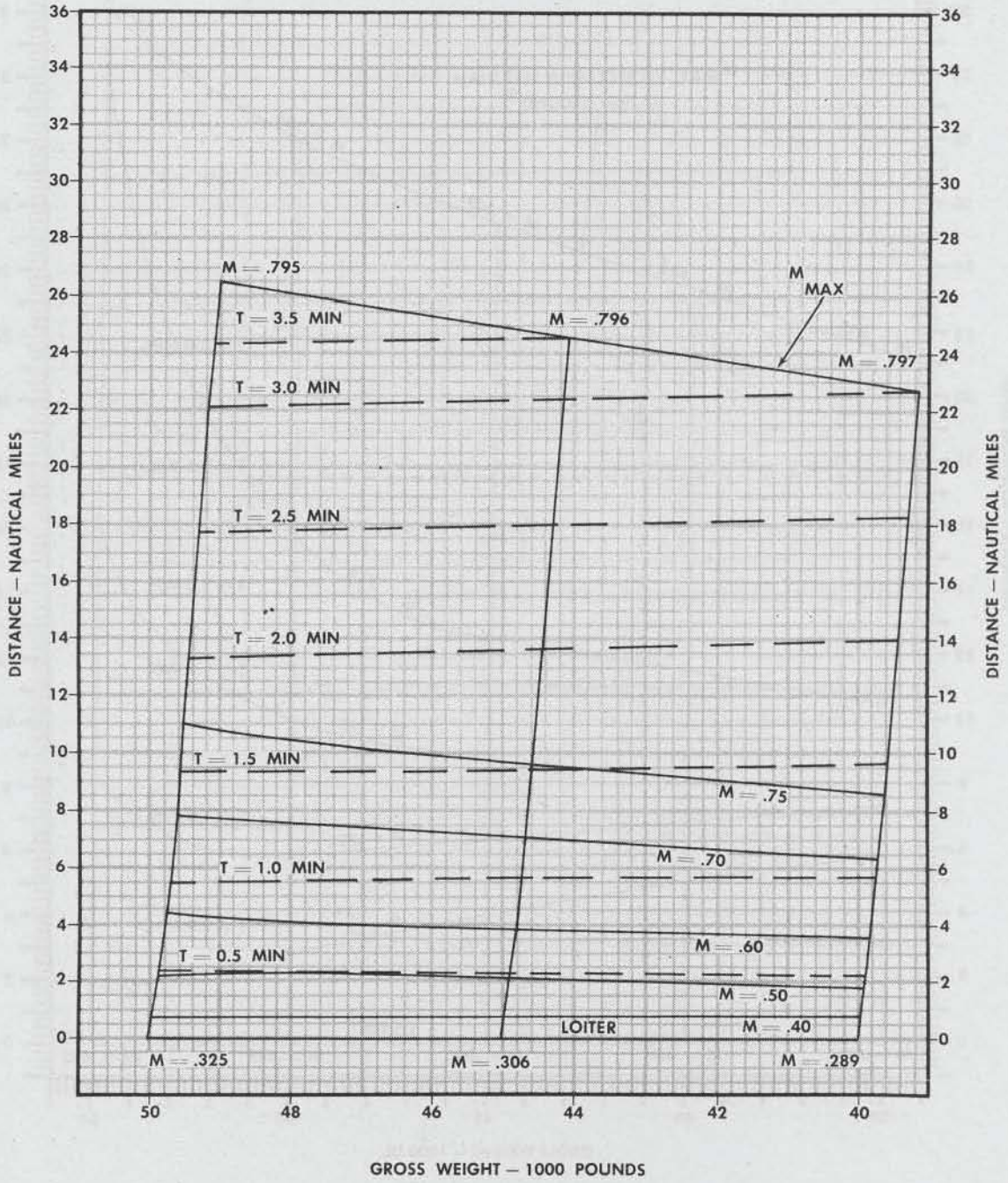
AIRCRAFT CONFIGURATION
(16) MK-82 G.P. BOMBS PLUS
2 LAU/10A ROCKET PACKS (OUTBOARD)

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

LEVEL FLIGHT
SEA LEVEL

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL



ADA1-567

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Figure 11-88

MILITARY POWER ACCELERATION

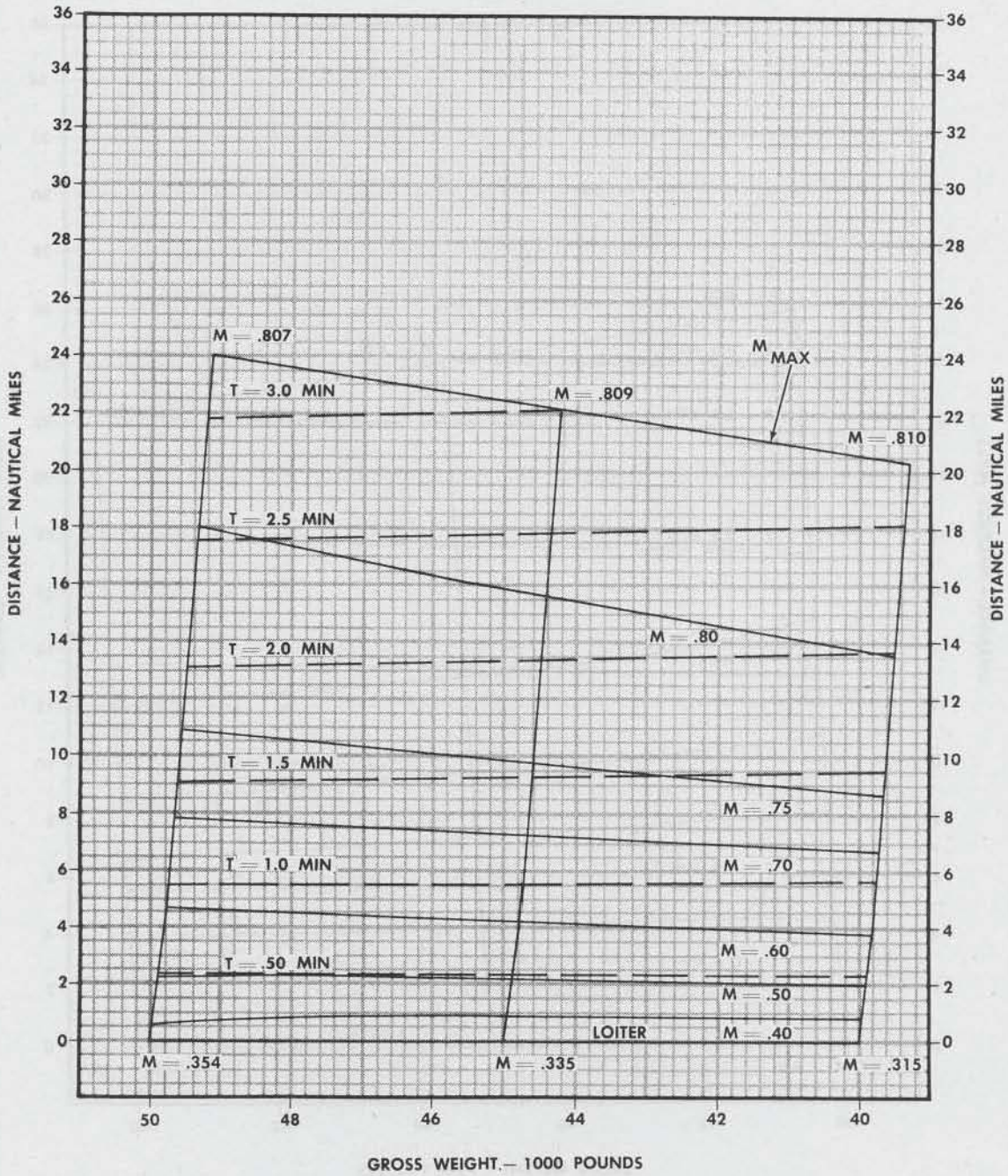
P-8 ENGINE

AIRCRAFT CONFIGURATION
(16) MK-82 G.P. BOMBS PLUS
2 LAU/10A ROCKET PACKS (OUTBOARD)

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

LEVEL FLIGHT
5000 FEET
REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL



ADA1-568

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Figure 11-89

MILITARY POWER ACCELERATION

P-8 ENGINE

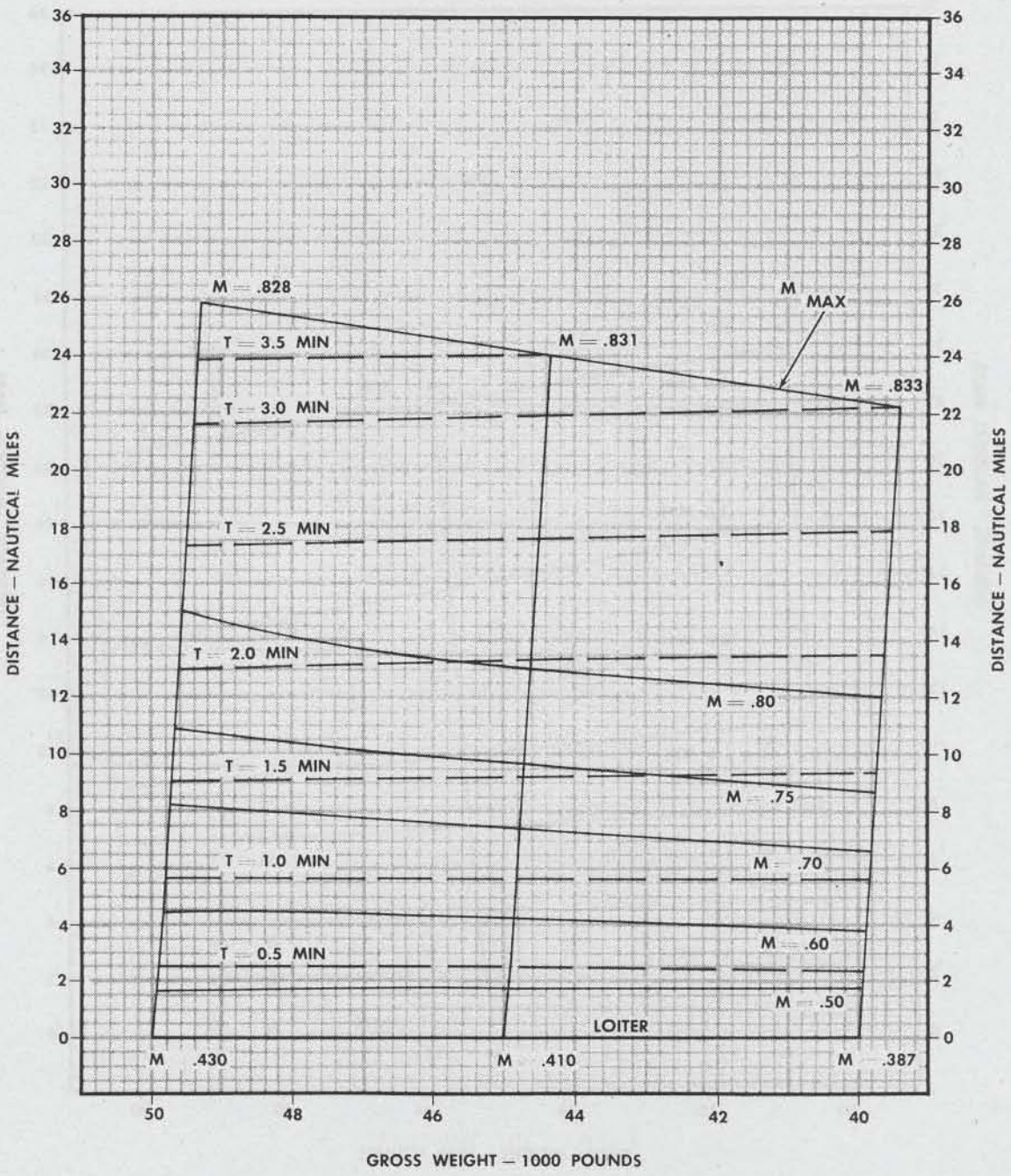
AIRCRAFT CONFIGURATION
(16) MK-82 G.P. BOMBS PLUS
2 LAU/10A ROCKET PACKS (OUTBOARD)

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

LEVEL FLIGHT
15,000 FEET

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL



ADA1-569

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Figure 11-90

MILITARY POWER ACCELERATION

P-8 ENGINE

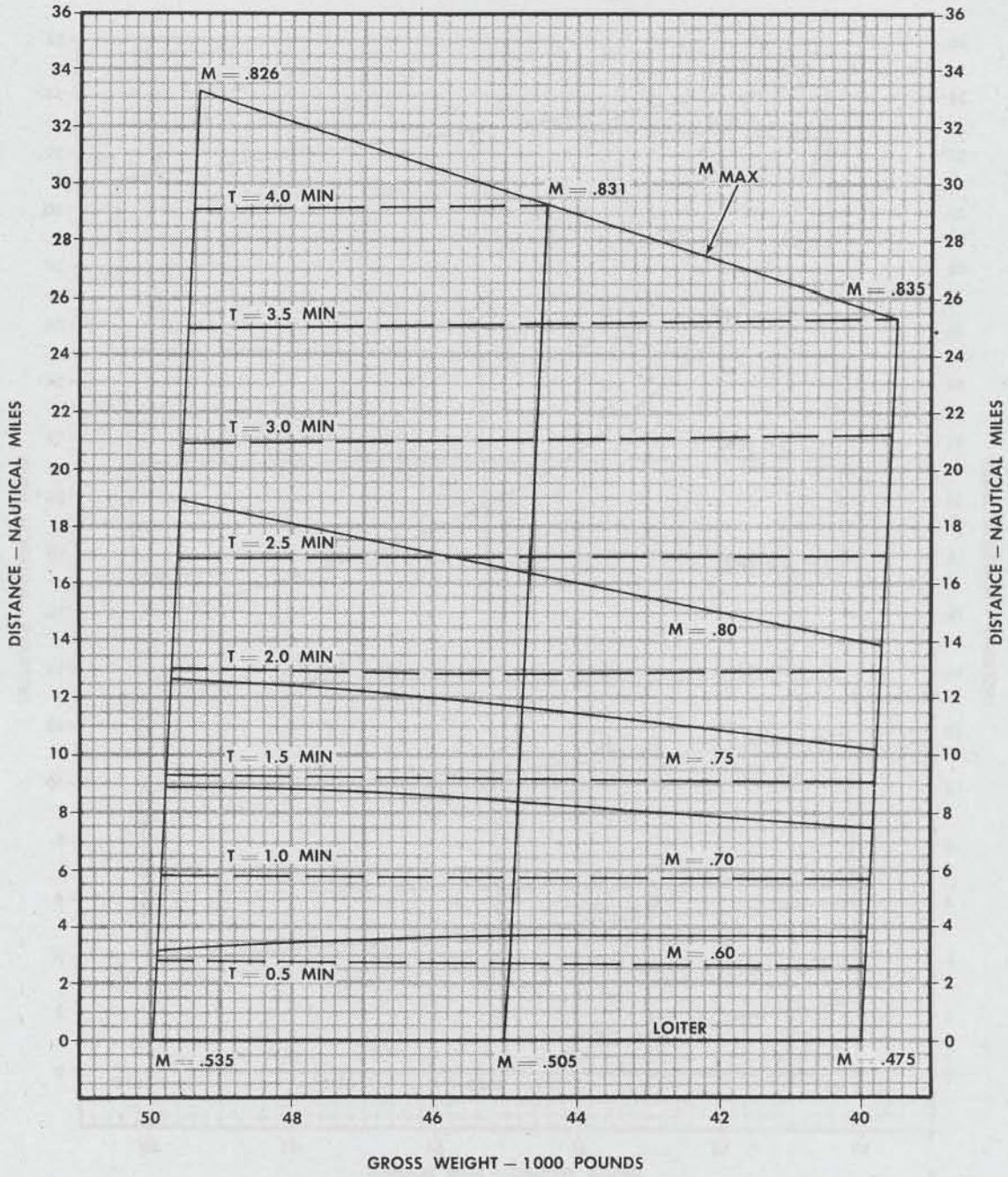
AIRCRAFT CONFIGURATION
(16) MK-82 G.P. BOMBS PLUS
2 LAU/10A ROCKET PACKS (OUTBOARD)

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

LEVEL FLIGHT
25,000 FEET

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL



ADA1-570

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Figure 11-91

MILITARY POWER ACCELERATION

P-8 ENGINE

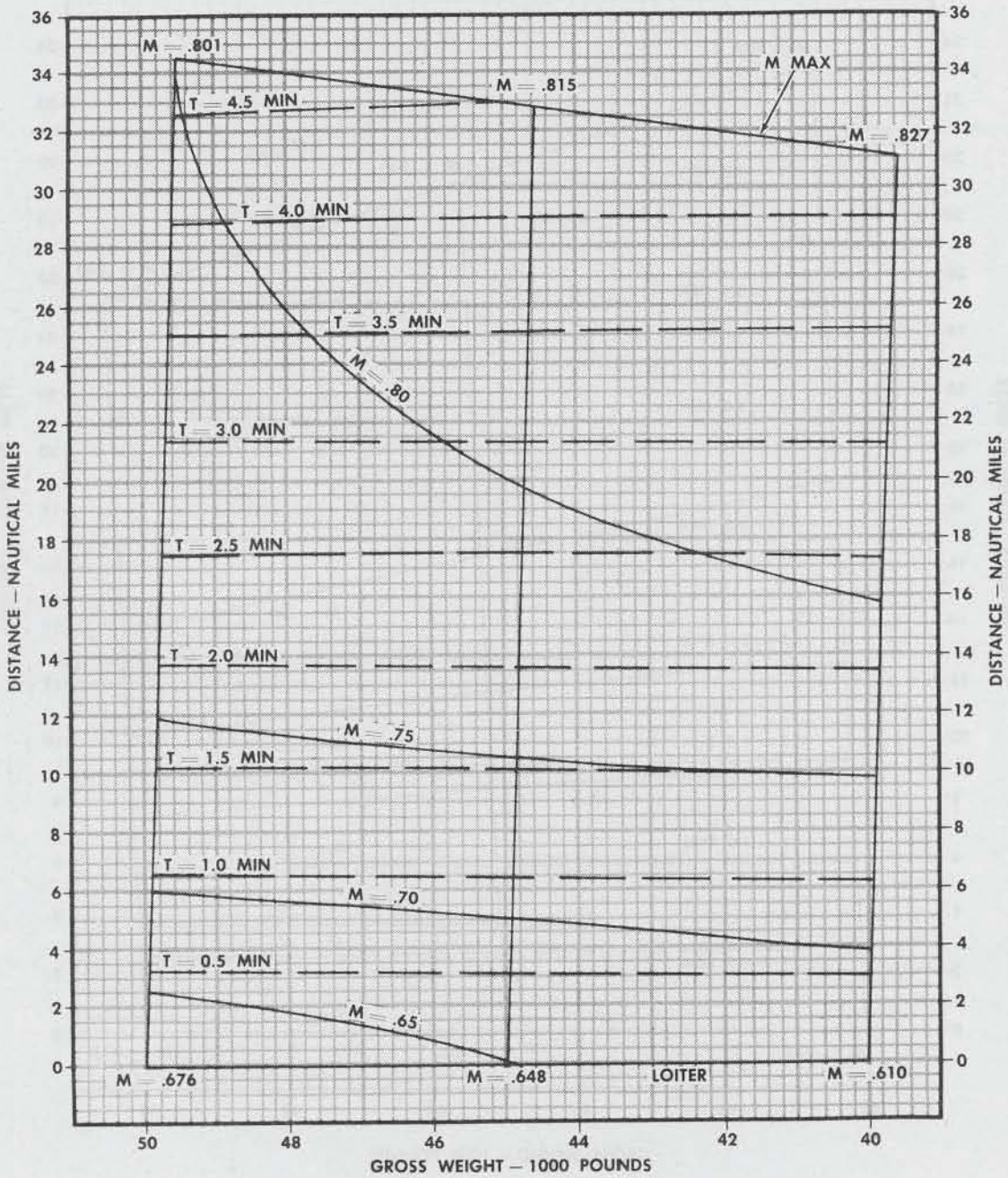
AIRCRAFT CONFIGURATION
(16) MK-82 G.P. BOMBS PLUS
2 LAU/10A ROCKET PACKS (OUTBOARD)

DATE: 1 DECEMBER 1967
DATA BASIS: ESTIMATED

LEVEL FLIGHT
35,000 FEET

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL



ADA1-571

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Figure 11-92

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
SEA LEVEL

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

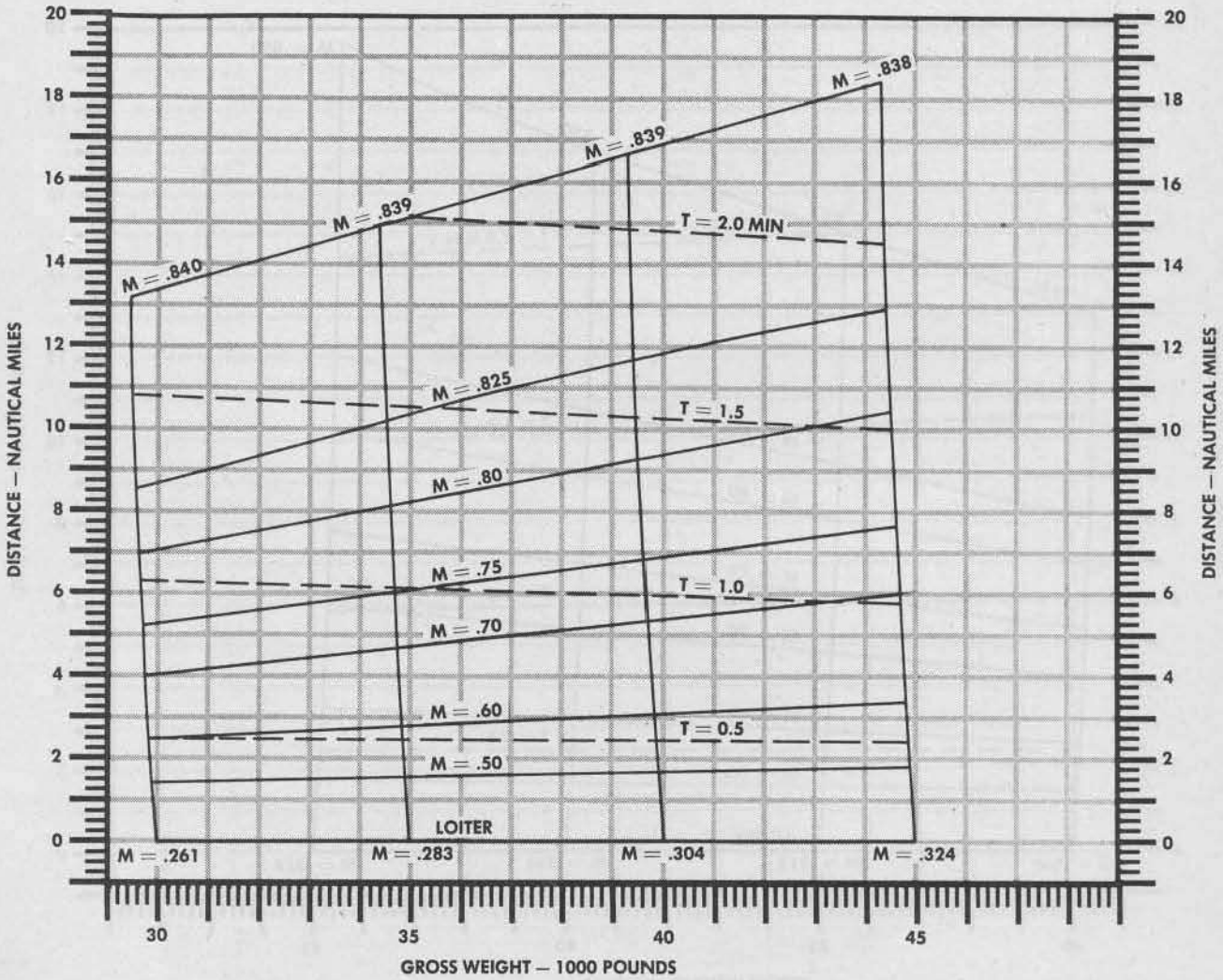

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Figure 11-93

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
5000 FEET

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

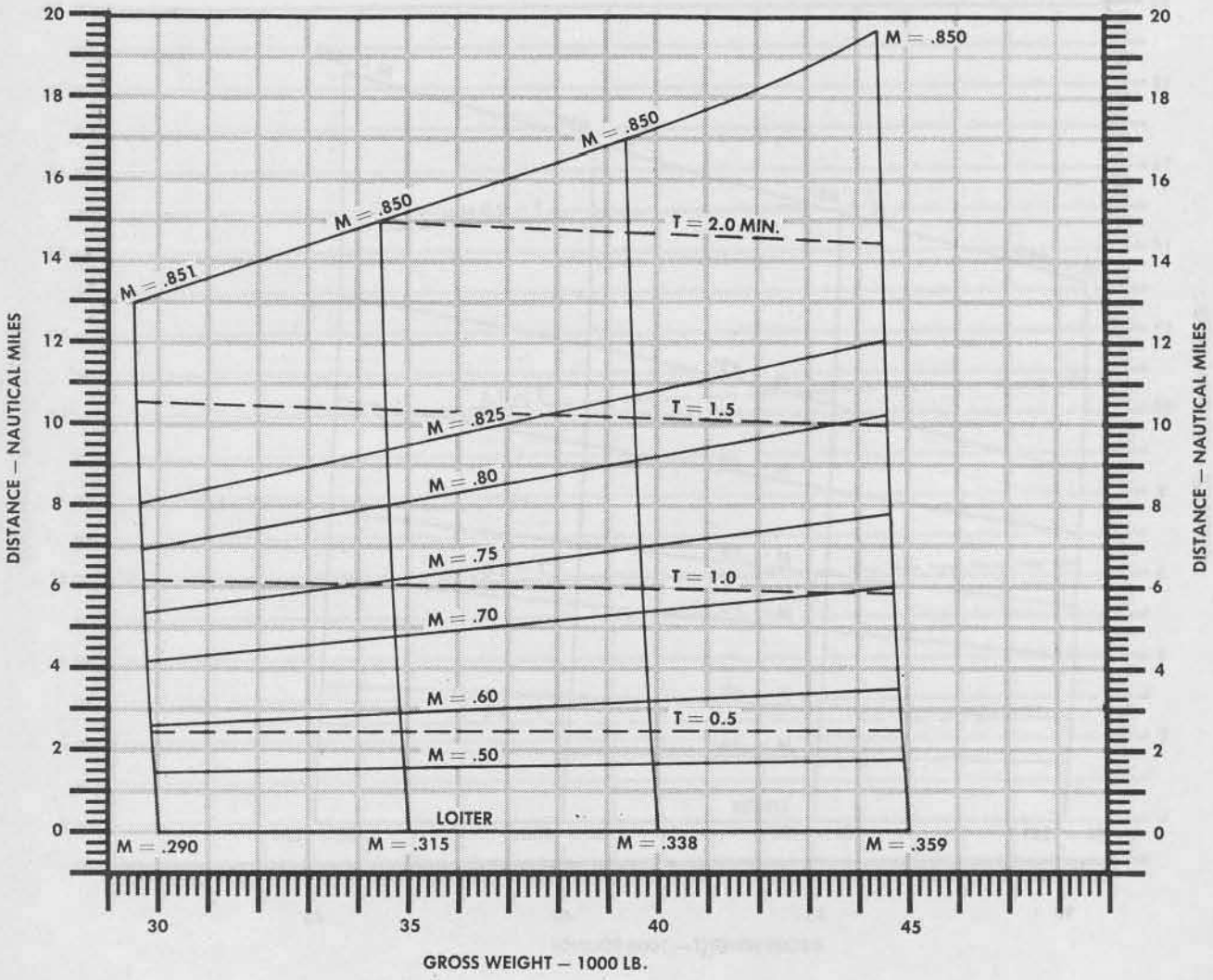

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Figure 11-94

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
15,000 FEET

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

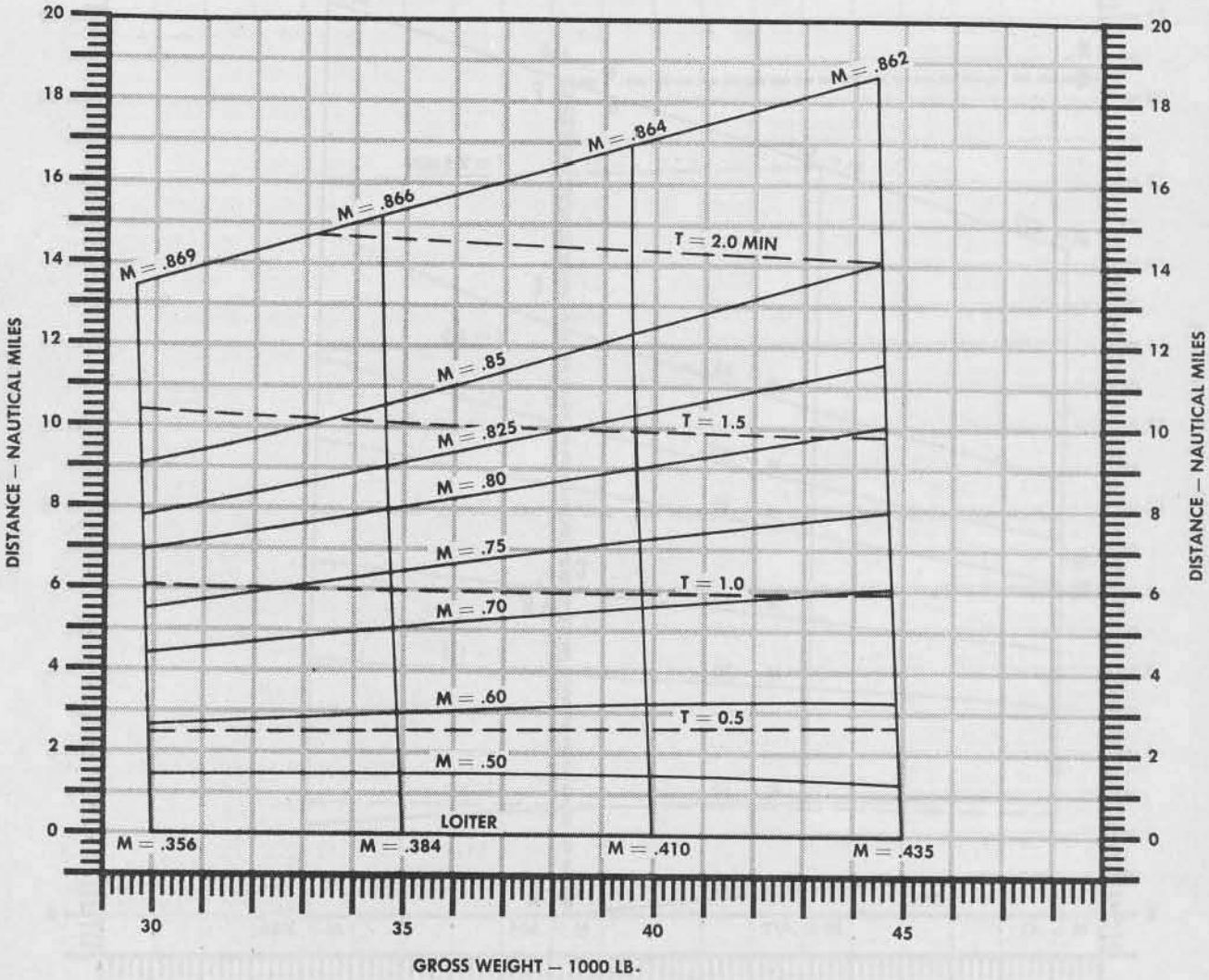

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Figure 11-95

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
25,000 FEET

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

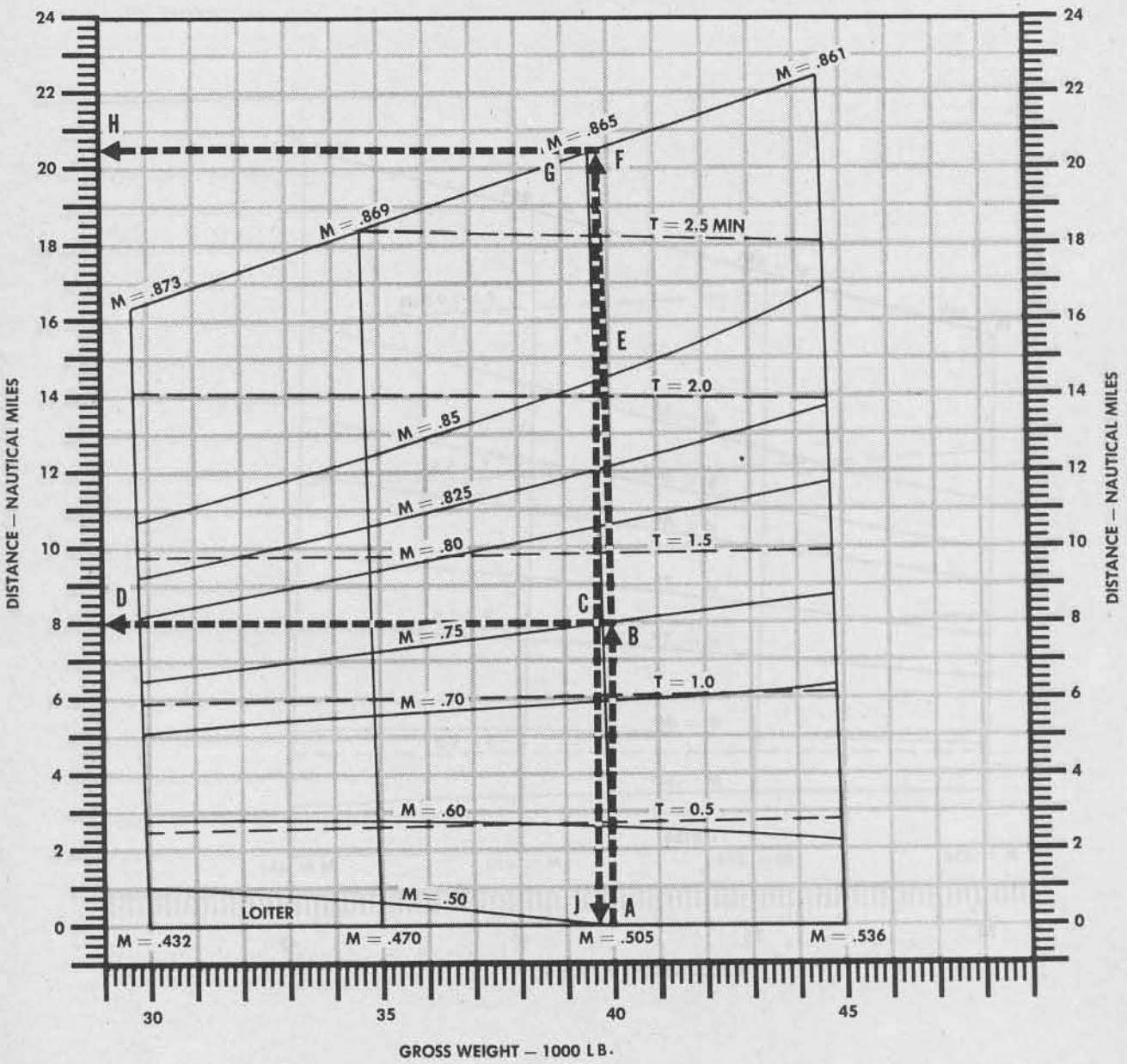

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Figure 11-96

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
35,000 FEET

AIRCRAFT CONFIGURATION
CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

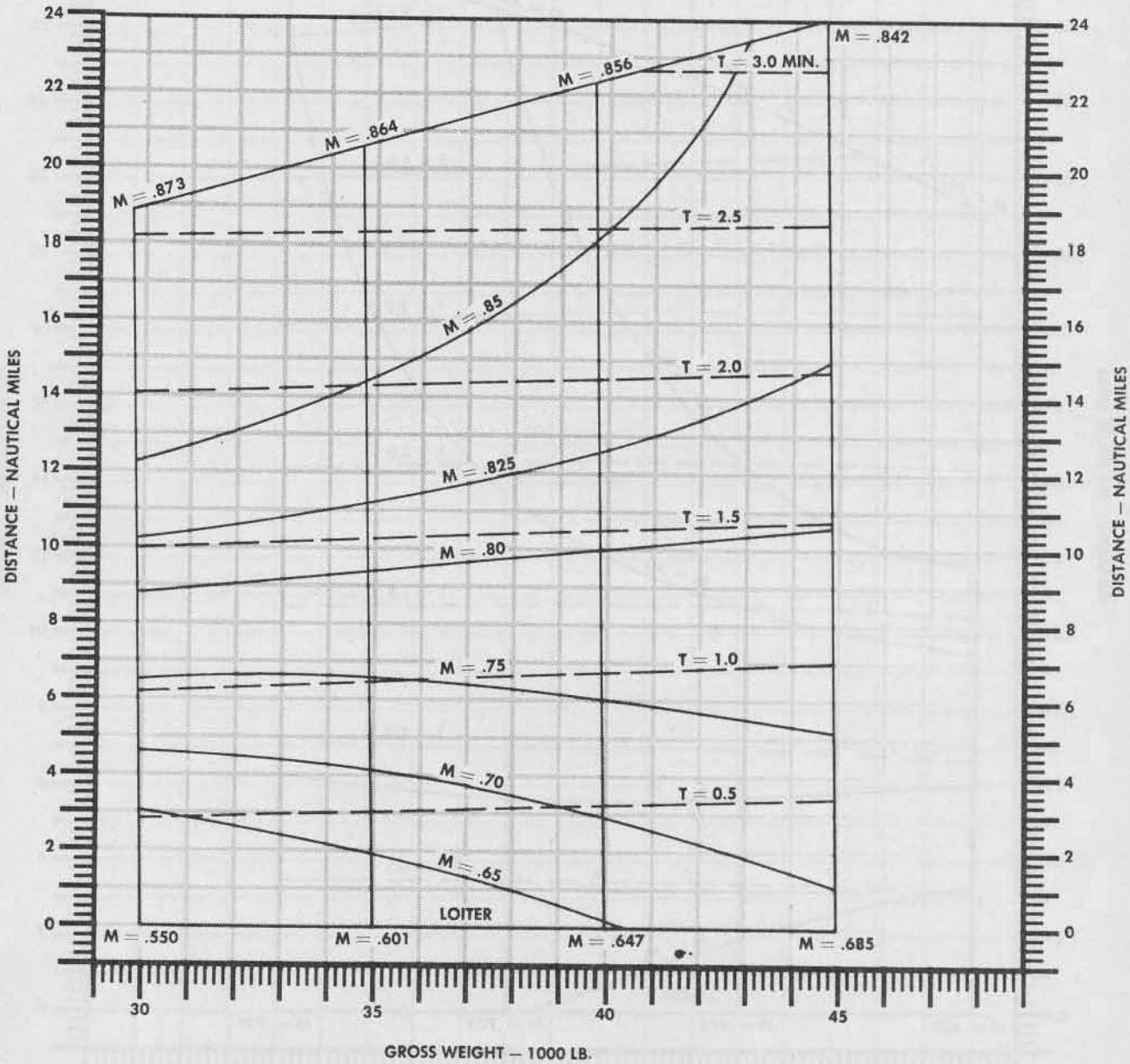

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Figure 11-97

MILITARY POWER ACCELERATION

P-8 ENGINE

AIRCRAFT CONFIGURATION
CLEAN

LEVEL FLIGHT
40,000 FEET

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

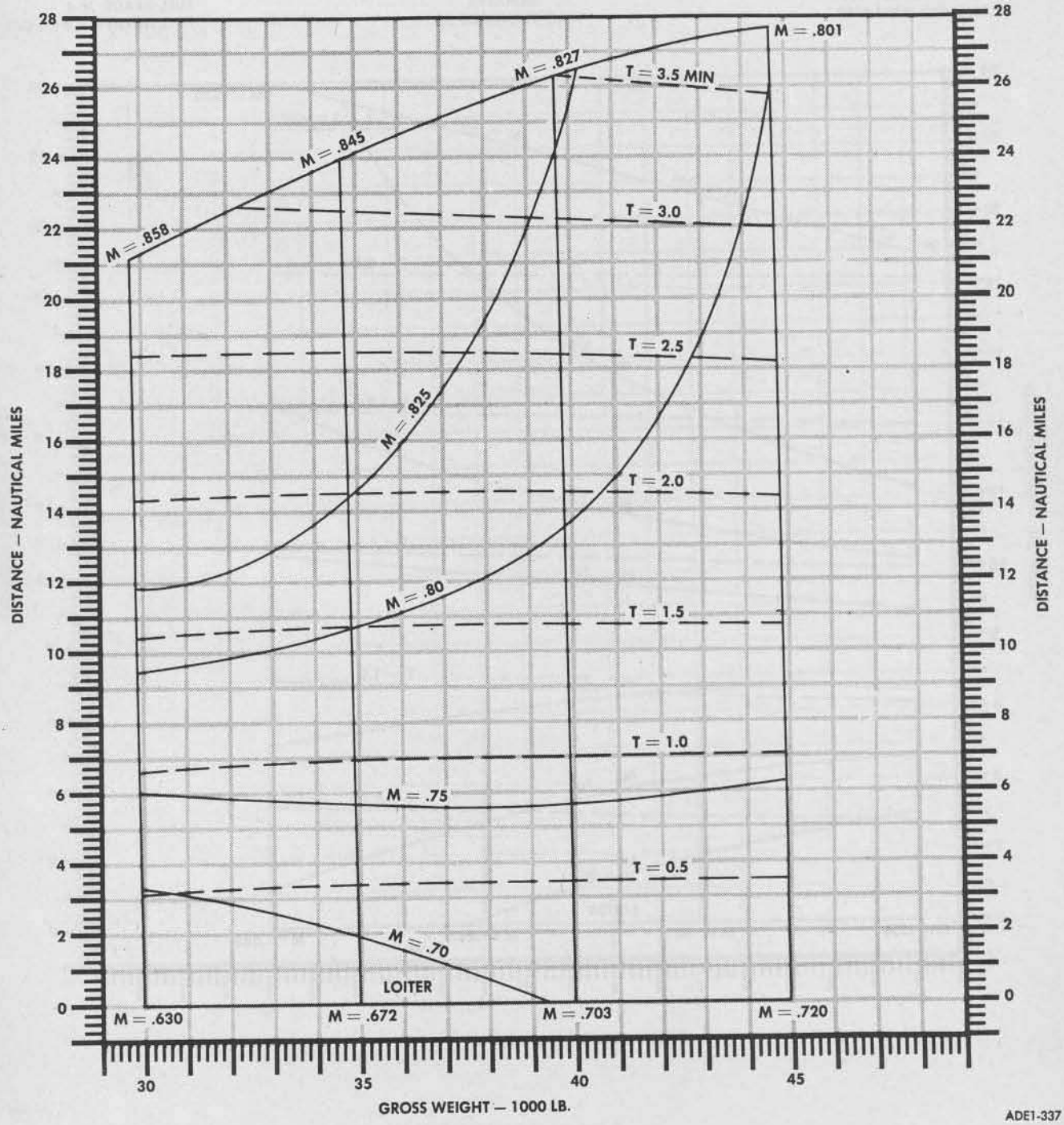

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Figure 11-98

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
SEA LEVEL

AIRCRAFT CONFIGURATION
(4) 300 GALLON TANKS PLUS
(1) D-704 REFUELING STORE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

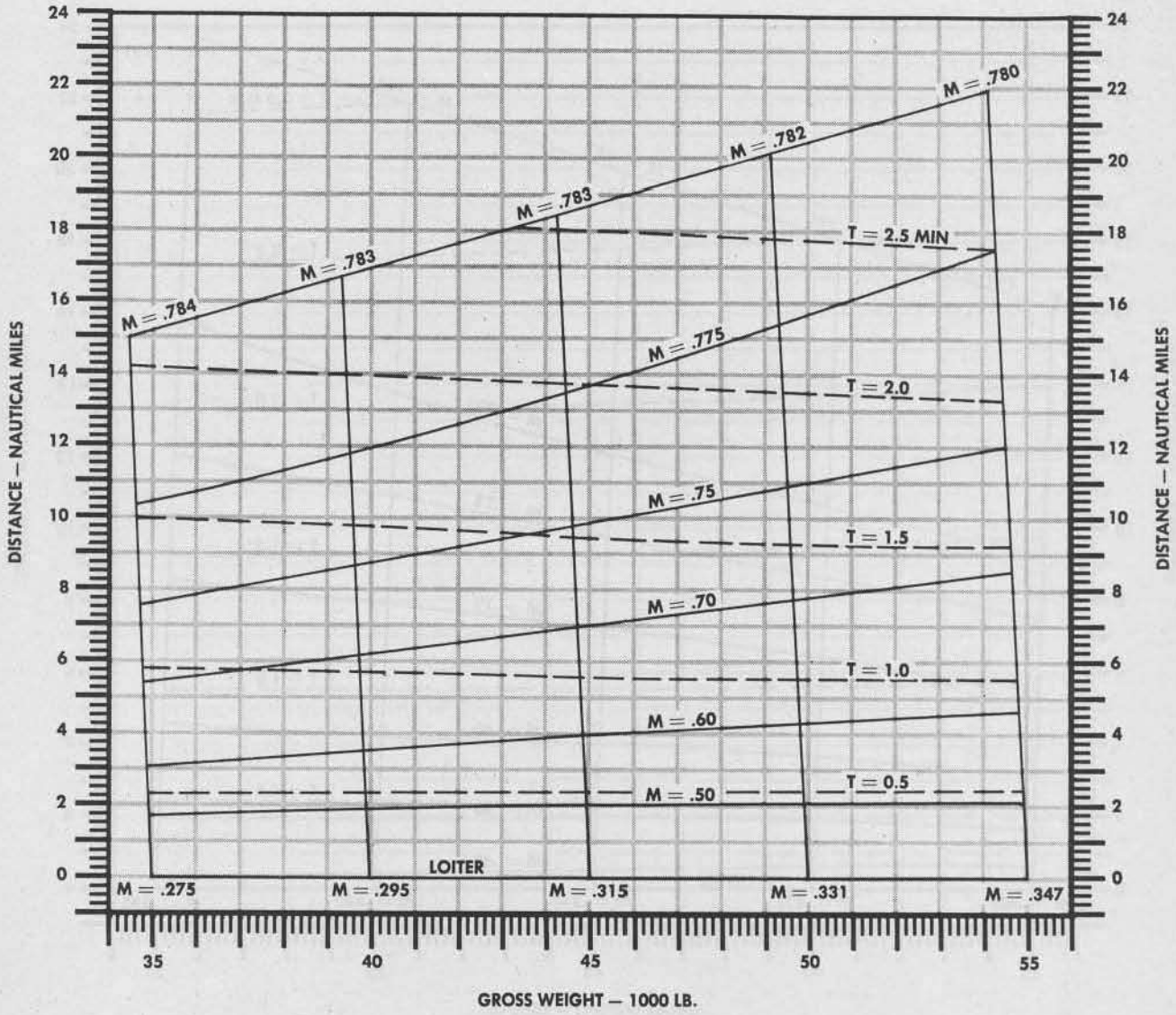

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Figure 11-99

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
5000 FEET

AIRCRAFT CONFIGURATION
(4) 300 GALLON TANKS PLUS
(1) D-704 REFUELING STORE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

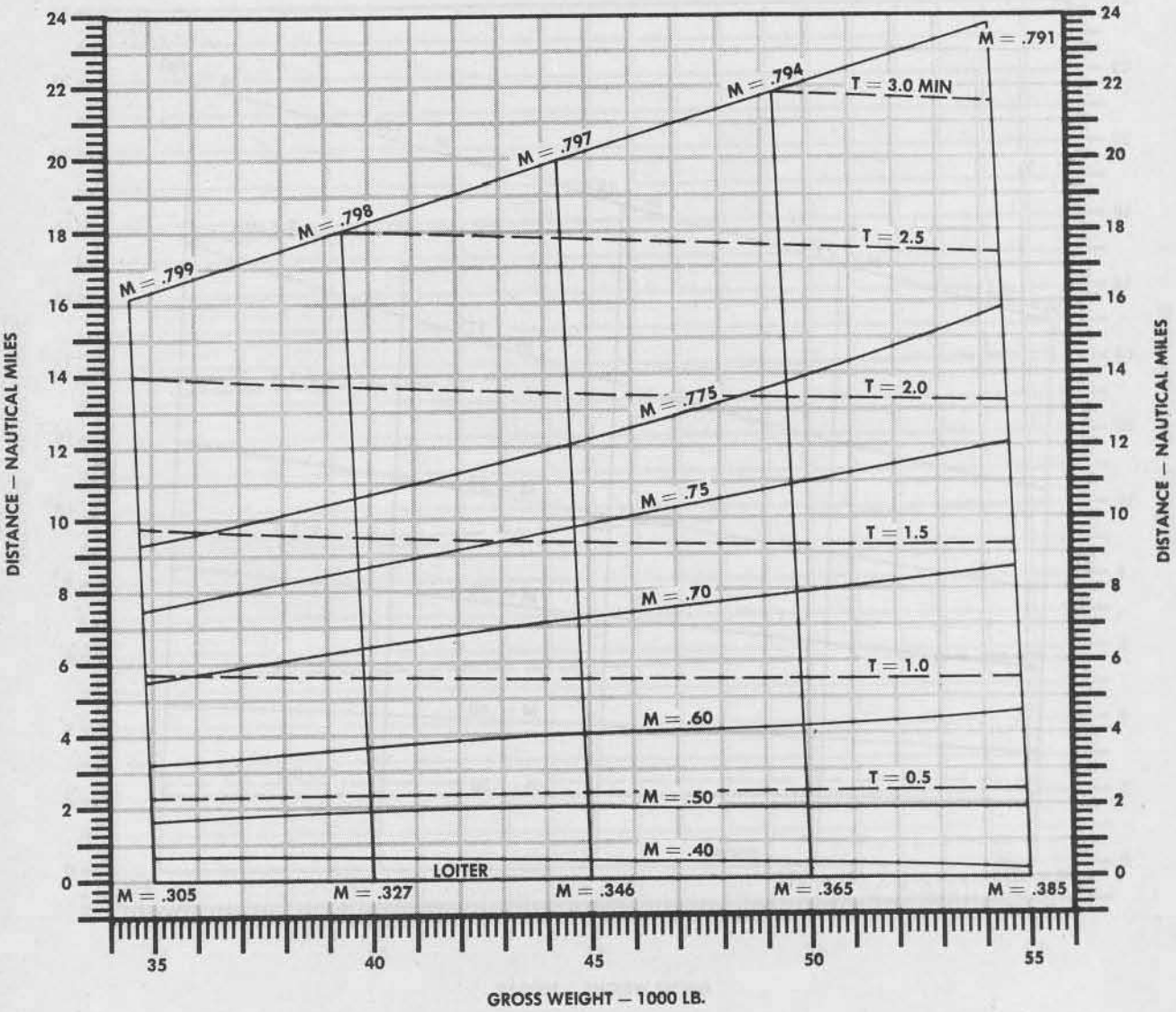

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Figure 11-100

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
15,000 FEET

AIRCRAFT CONFIGURATION
(4) 300 GALLON TANKS PLUS
(1) D-704 REFUELING STORE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

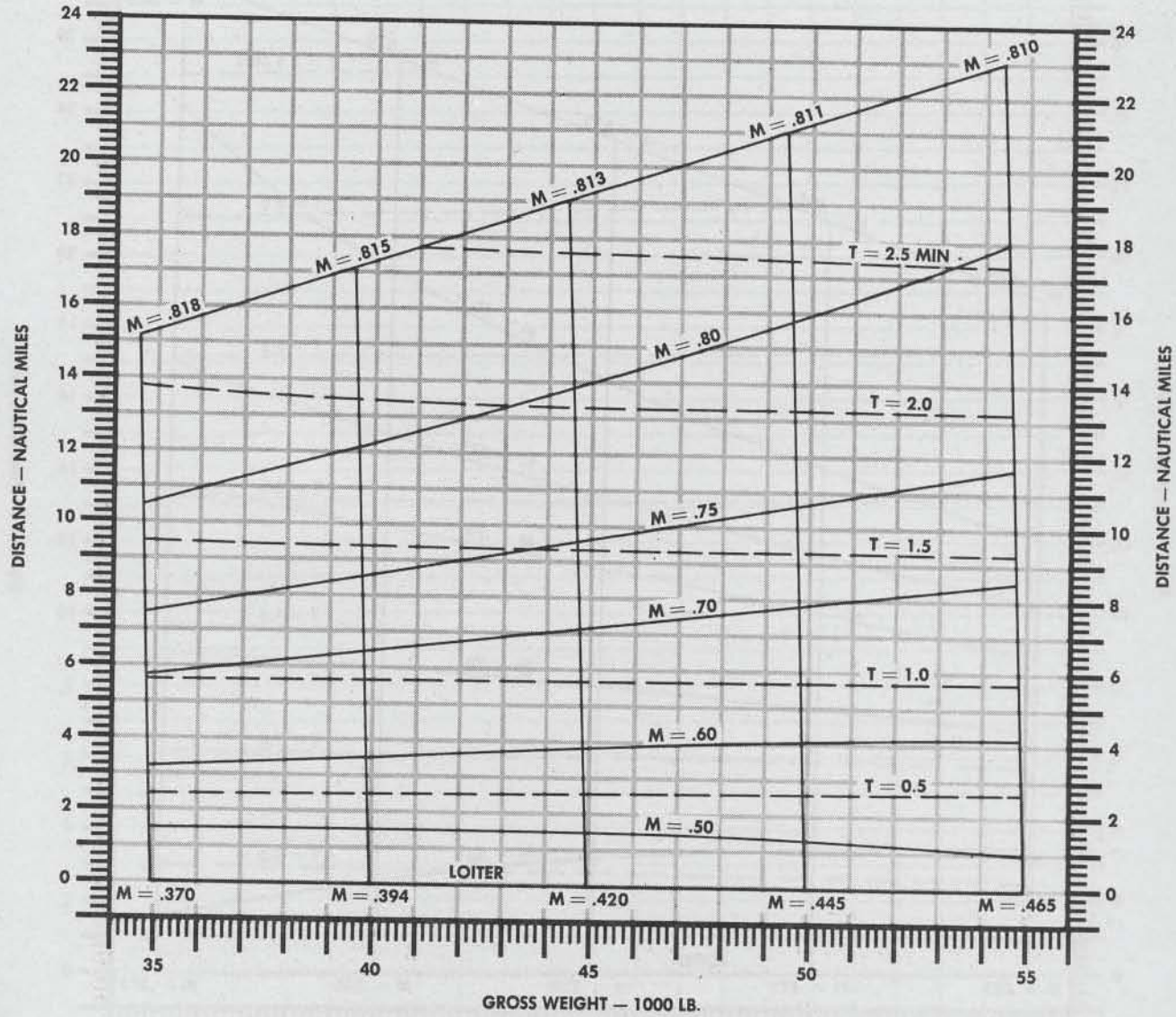

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Figure 11-101

MILITARY POWER ACCELERATION

P-8 ENGINE

LEVEL FLIGHT
25,000 FEET

AIRCRAFT CONFIGURATION
(4) 300 GALLON TANKS PLUS
(1) D-704 REFUELING STORE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

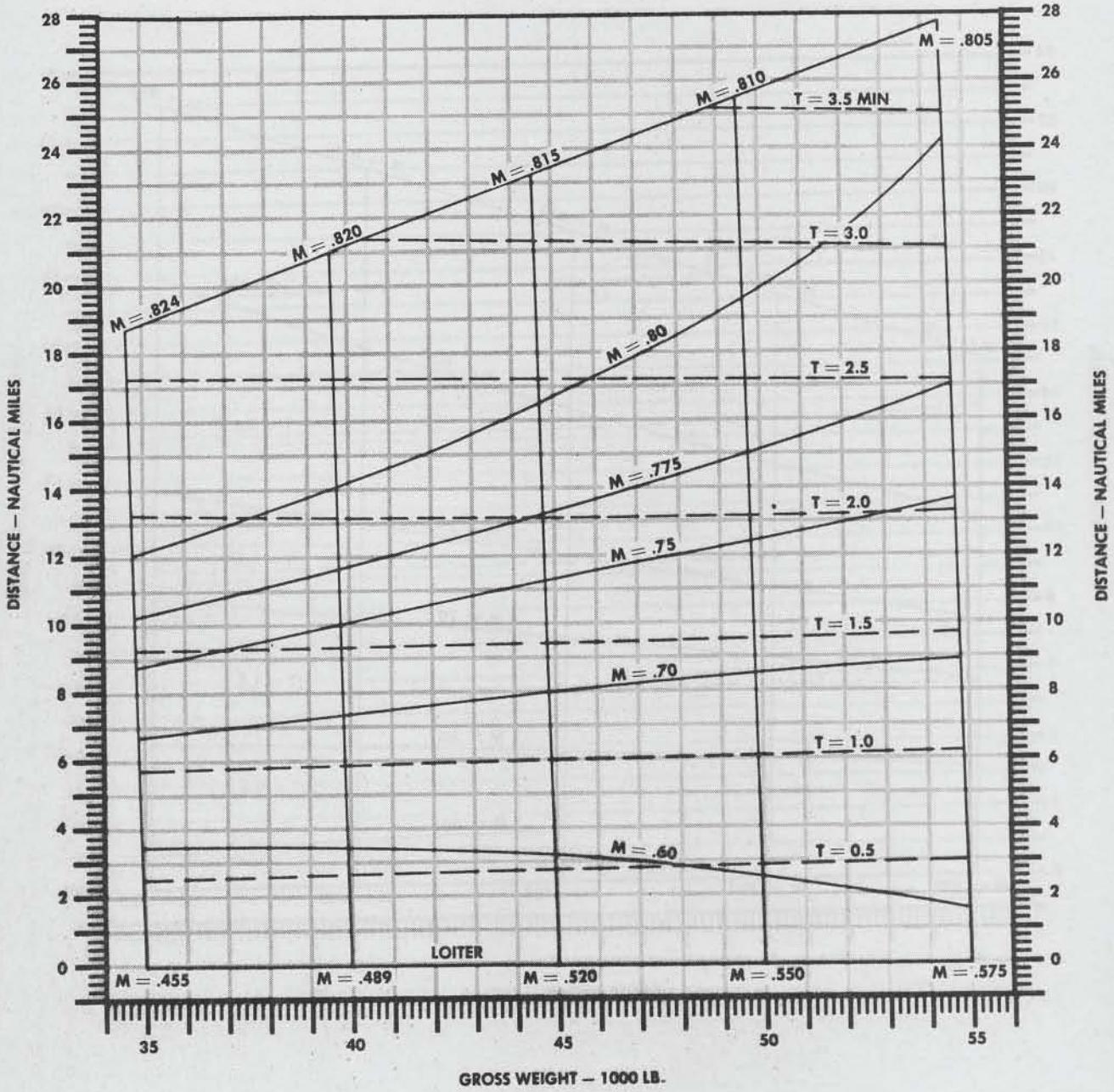

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Figure 11-102

MILITARY POWER ACCELERATION

P-8 ENGINE

AIRCRAFT CONFIGURATION
(4) 300 GALLON TANKS PLUS
(1) D-704 REFUELING STORE

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

LEVEL FLIGHT
35,000 FEET

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

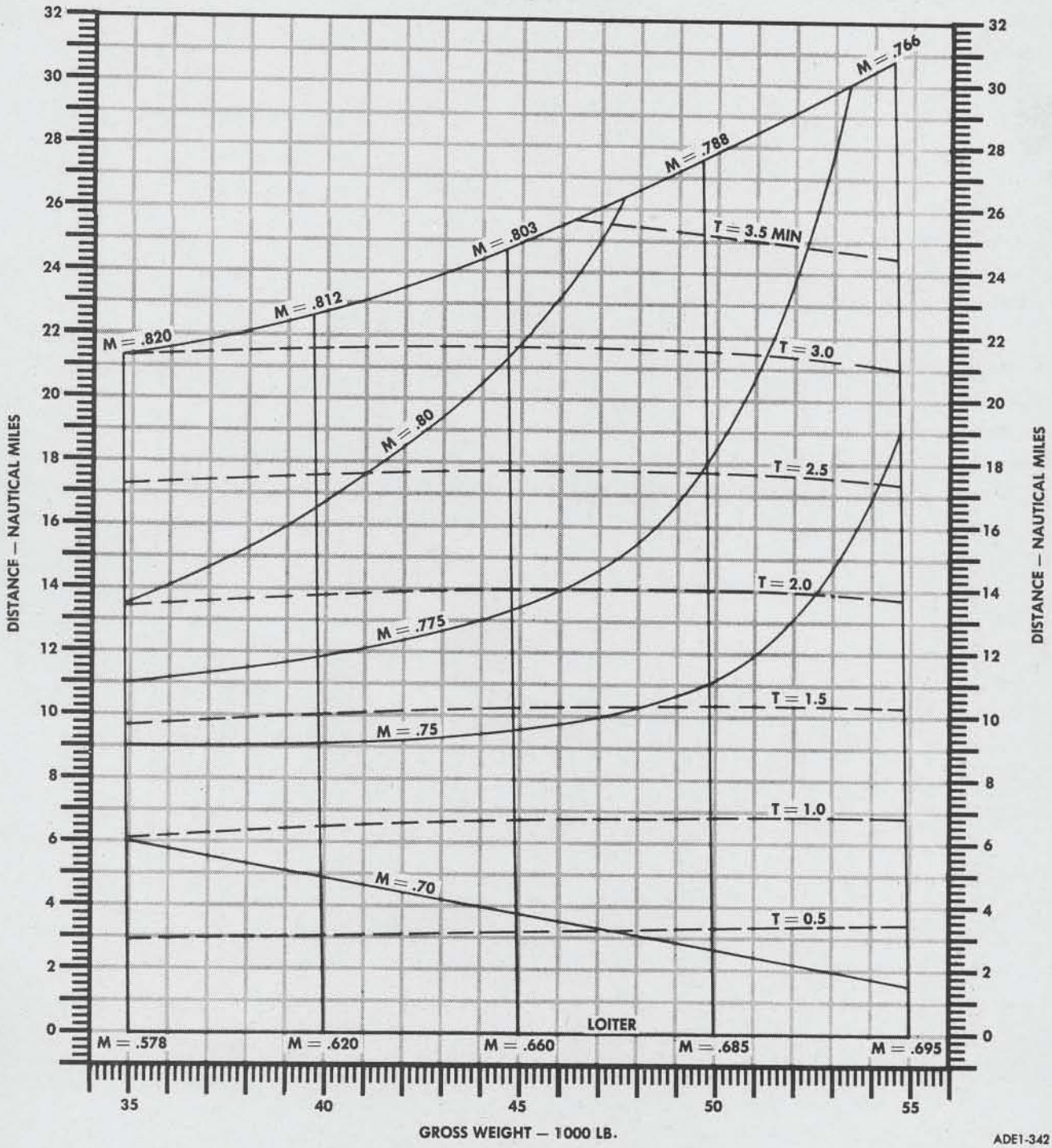

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Figure 11-103

MAXIMUM TURN PERFORMANCE

The turn performance charts (figures 11-104 through 11-112) present the maximum load factor and bank angle, maximum rate of turn, and minimum radius of turn at various constant airspeeds, altitudes, and configurations. Performance limitation is determined by either the buffet onset or military power available.

USE

For a particular weight and configuration enter the charts with mach number and proceed vertically to the desired altitude. Read load factor and bank angle, rate of turn, and radius of turn.

Sample Problem

Aircraft Configuration (figure 11-105):
Clean
Gross Weight 35,000 lb

A. Mach Number 72

B. Altitude . . . . . 15,000 ft

C. Bank Angle . . . . . 74.9°

D. Load Factor . . . . . 3.81 g

E. Rate of Turn (degrees per second) . . . 7.8°

F. Radius of Turn . . . . . .76 nmi

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

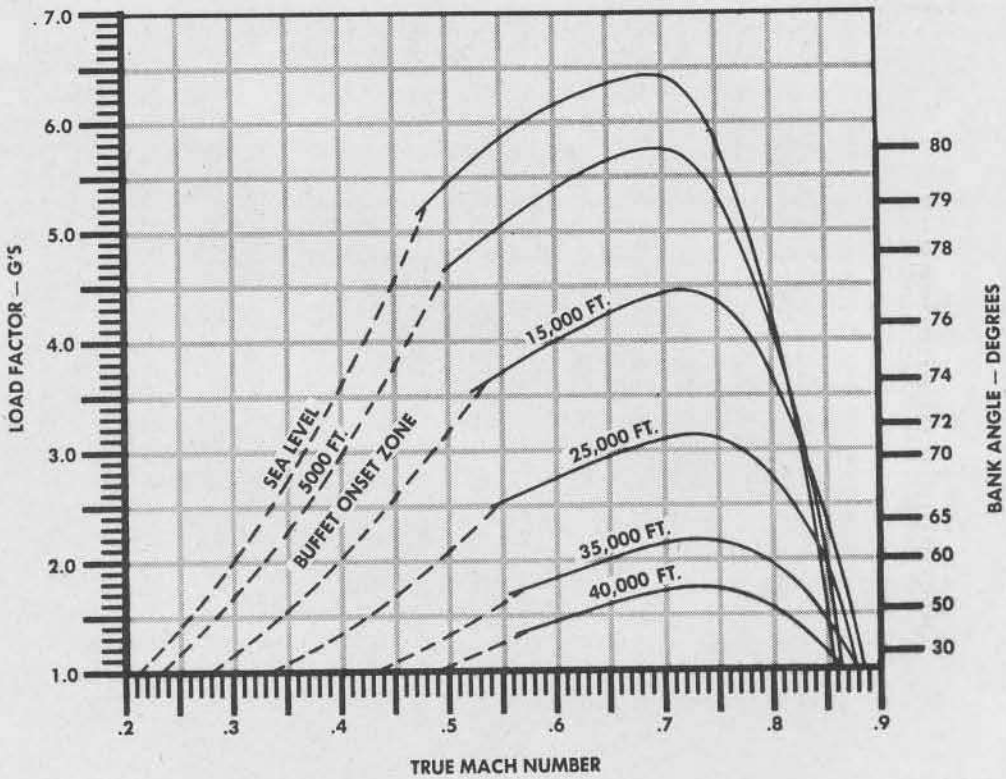
MILITARY POWER
CONSTANT SPEED AND ALTITUDE

CONFIGURATION
CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

GROSS WEIGHT — 30,000 POUNDS

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADE1-388-1

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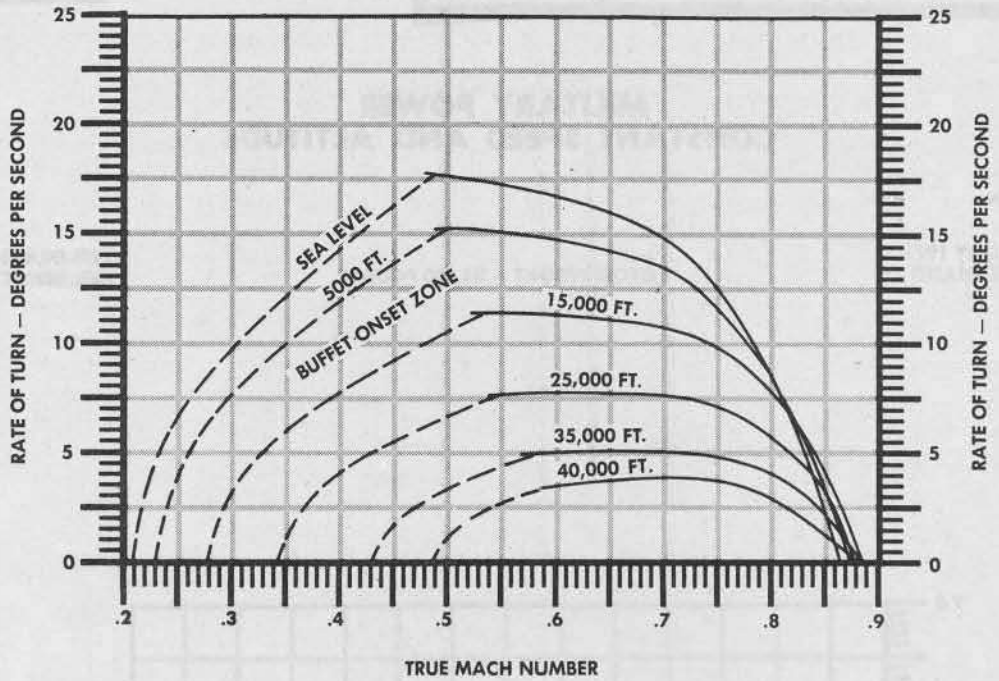
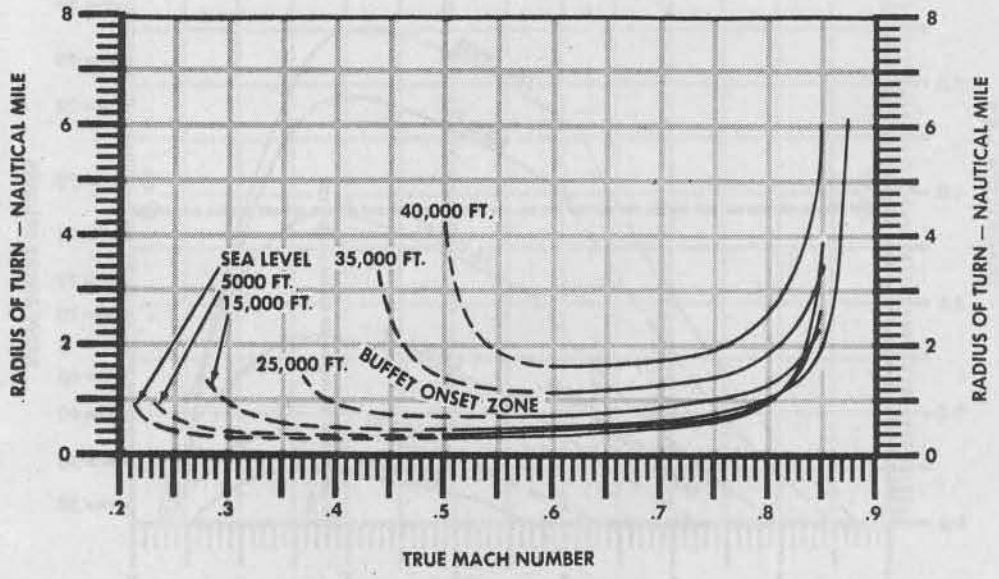
Figure 11-104 (Sheet 1)





ADE1-388-2

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Figure 11-104 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

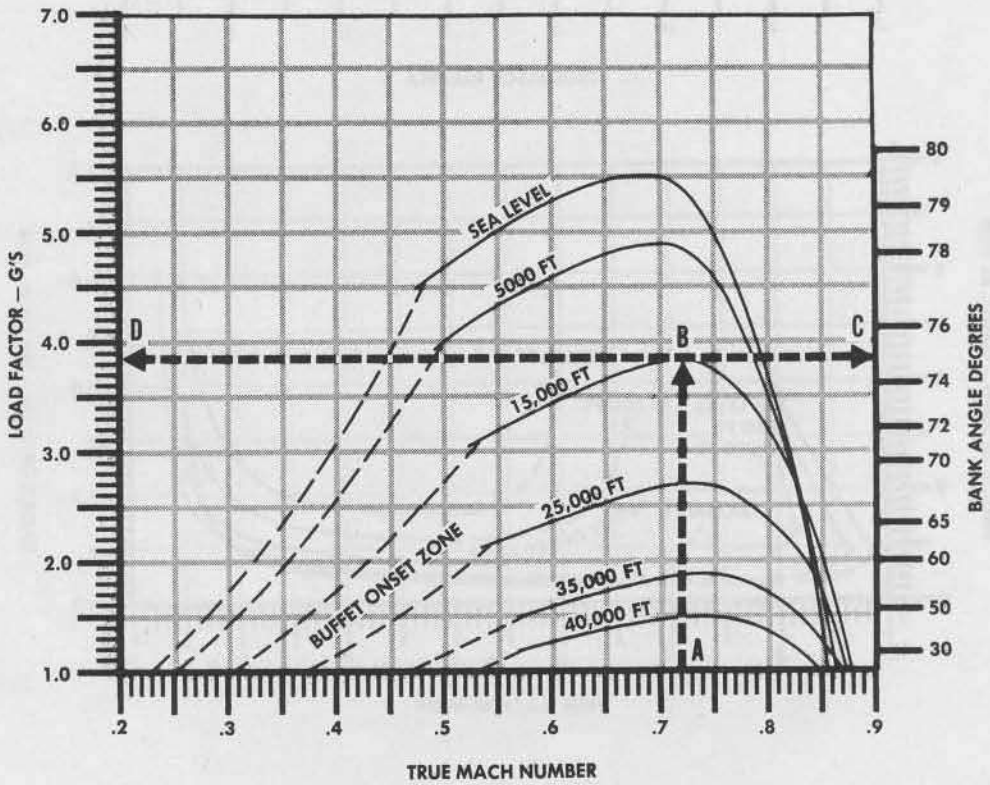
MILITARY POWER
CONSTANT SPEED AND ALTITUDE

CONFIG: CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

GROSS WEIGHT — 35,000 POUNDS

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADE1-389-1

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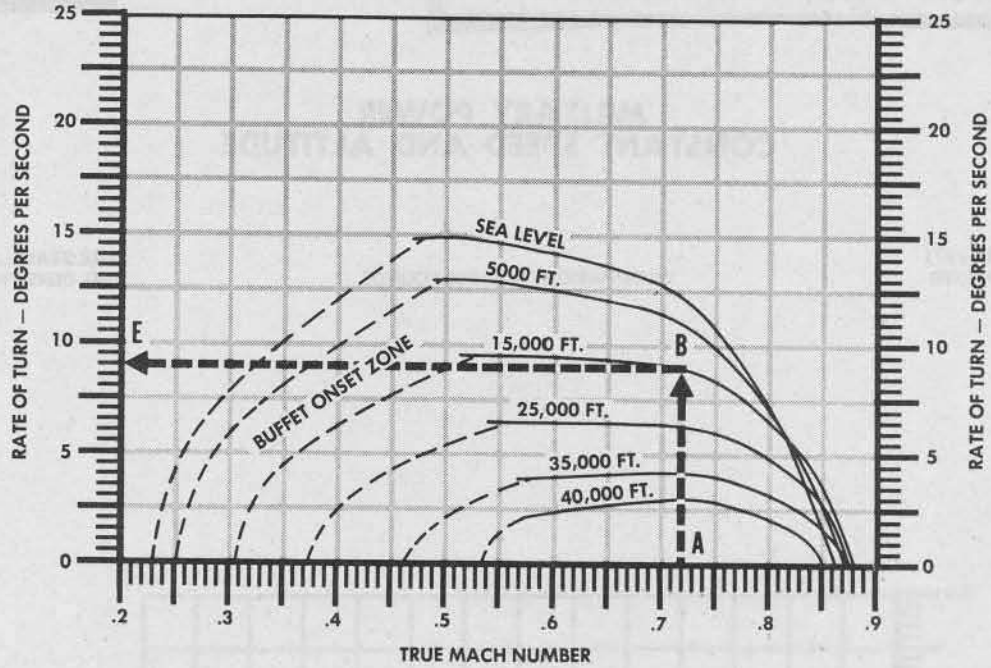
Figure 11-105 (Sheet 1)



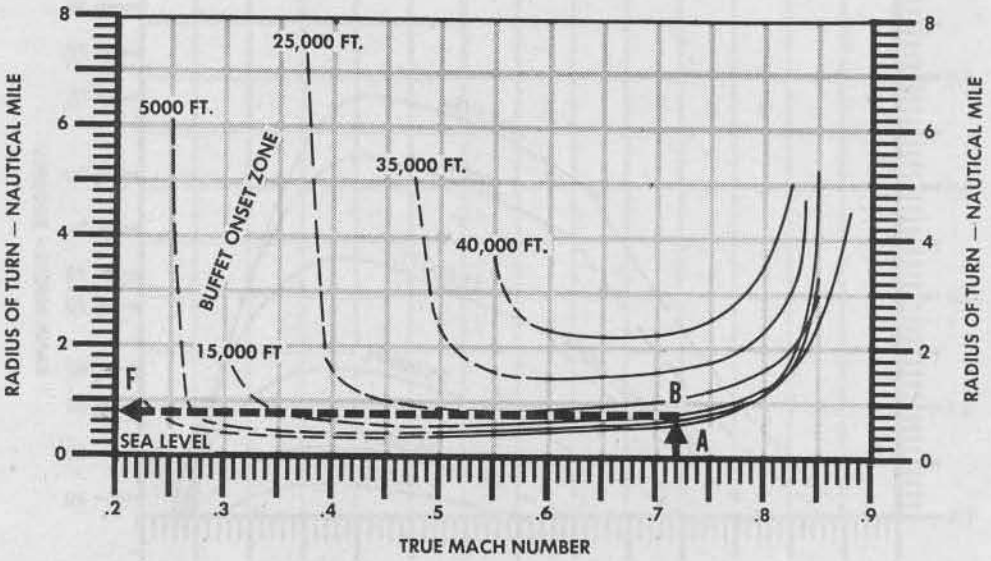


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Figure 11-105 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

CONFIG: CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

GROSS WEIGHT — 40,000 POUNDS

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

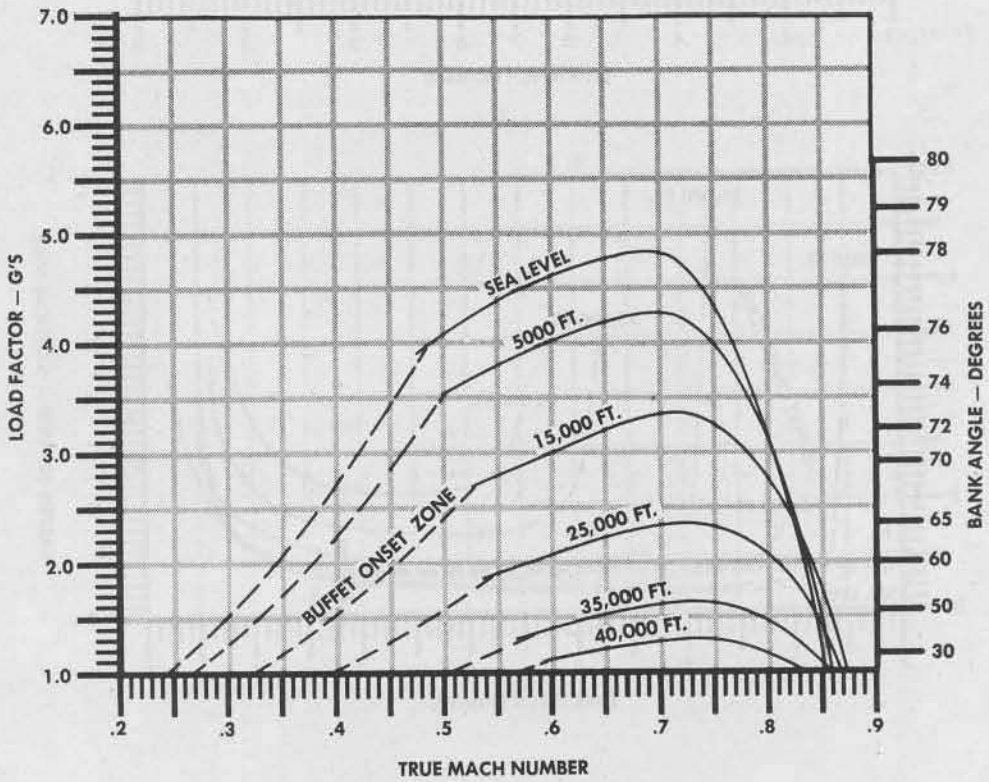

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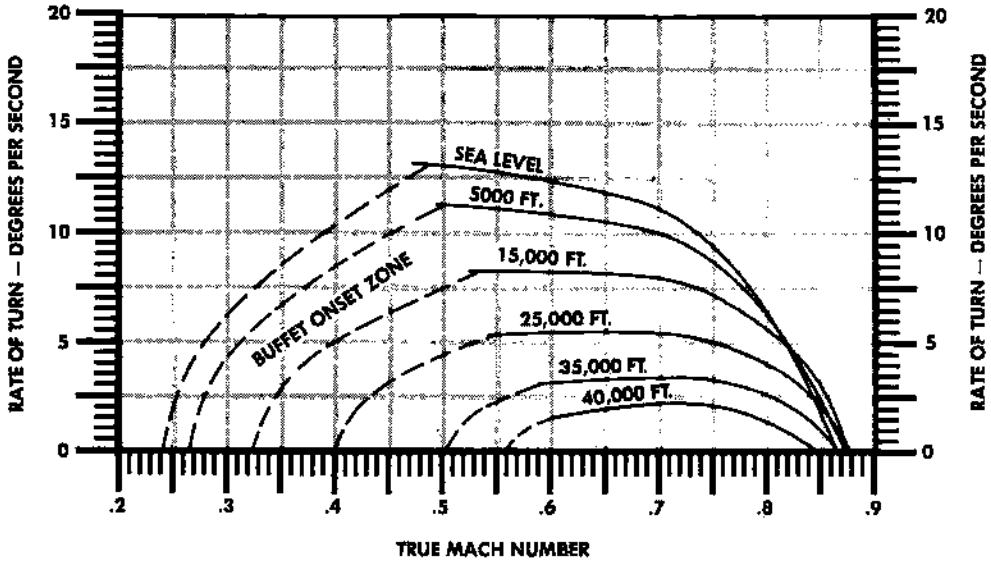
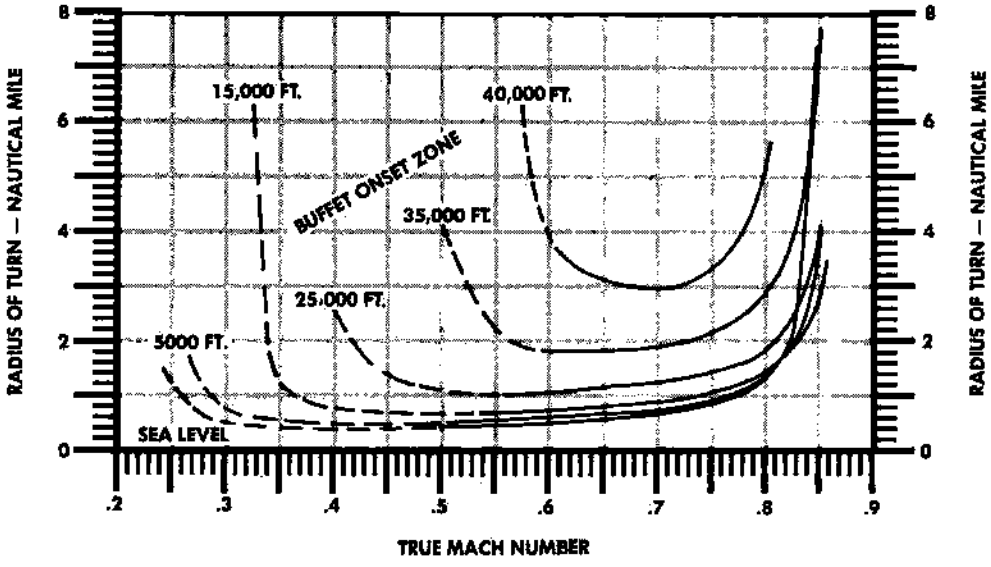
Figure 11-106 (Sheet 1)





ADE1-390-2

Figure 11-106 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

CONFIG: CLEAN

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

GROSS WEIGHT – 45,000 POUNDS

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

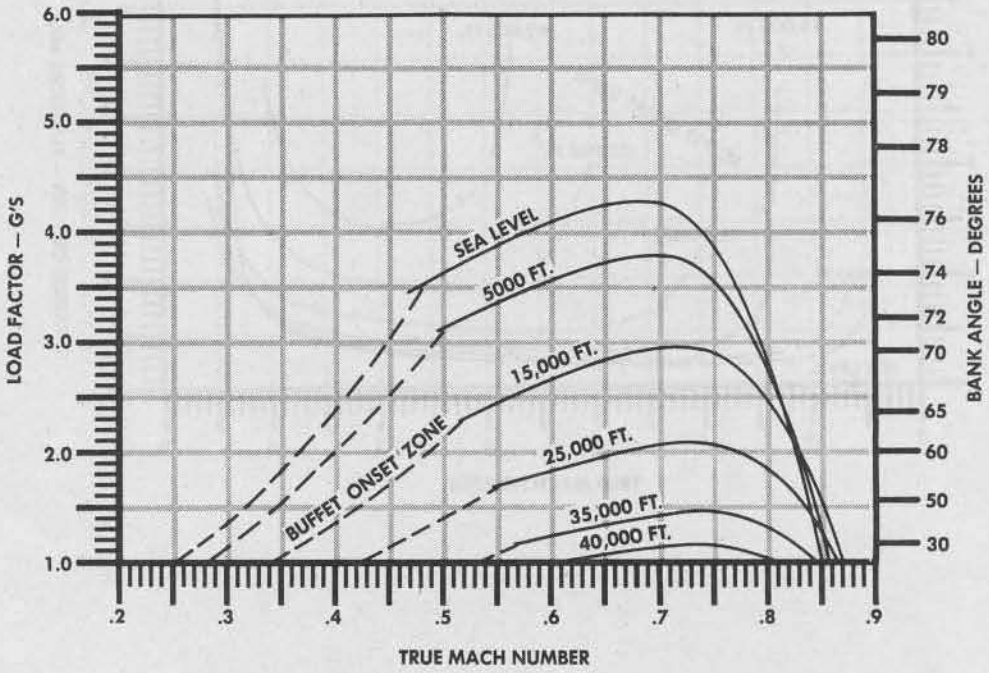


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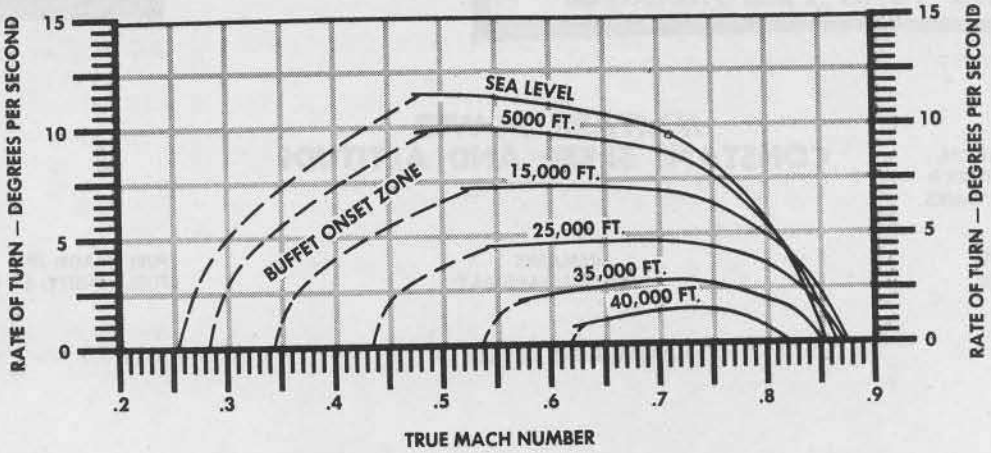
Figure 11-107 (Sheet 1)



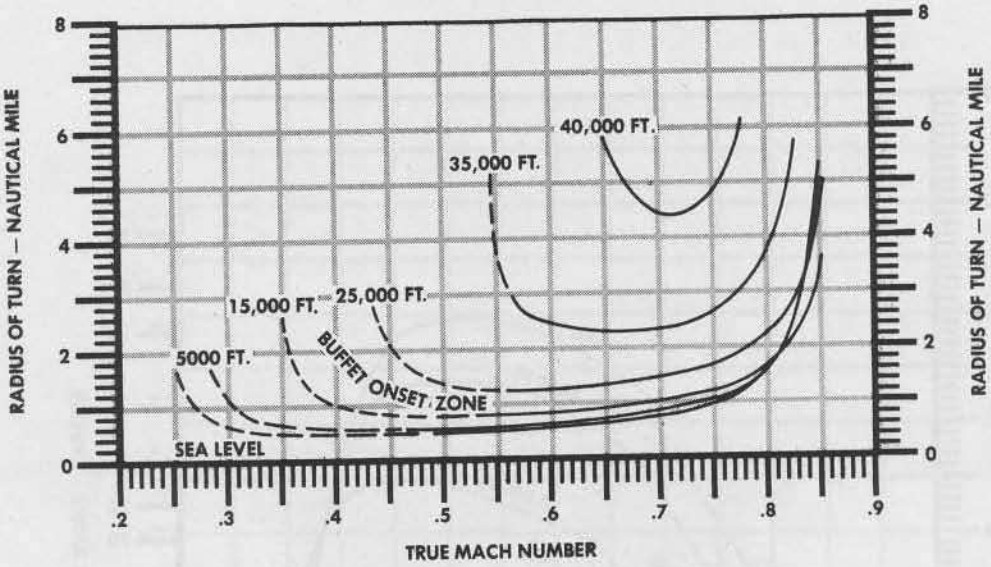


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Figure 11-107 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

AIRCRAFT CONFIGURATION:
(1) D-704 REFUELING STORE +
(4) 300 GALLON DROP TANKS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

GROSS WEIGHT — 35,000 LB.

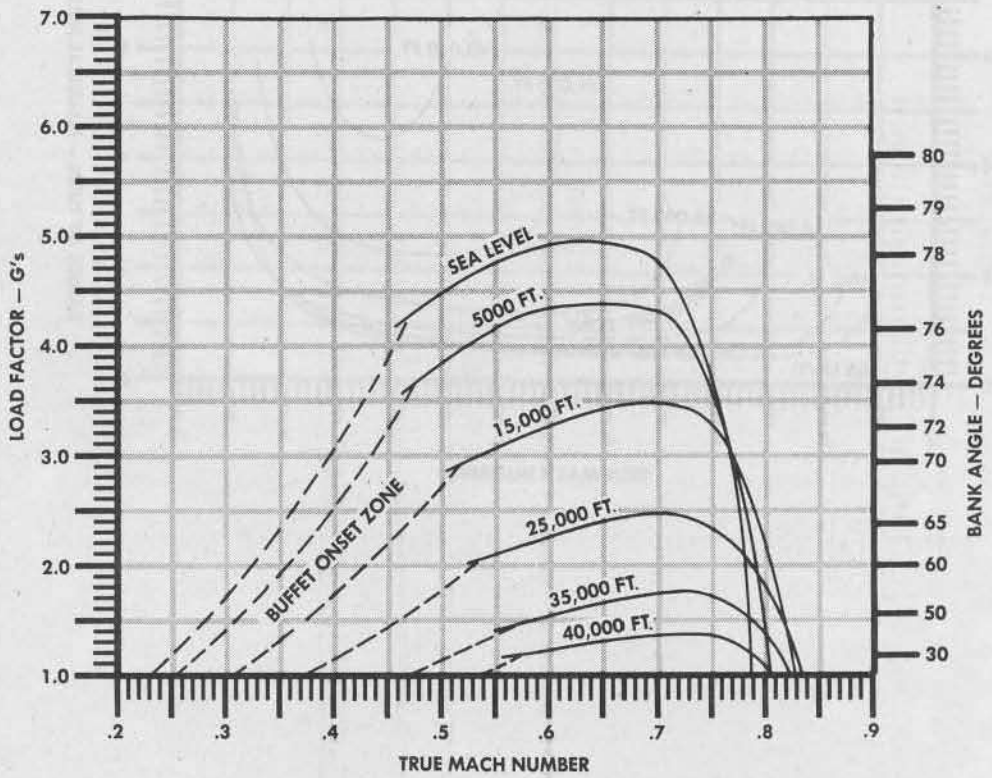

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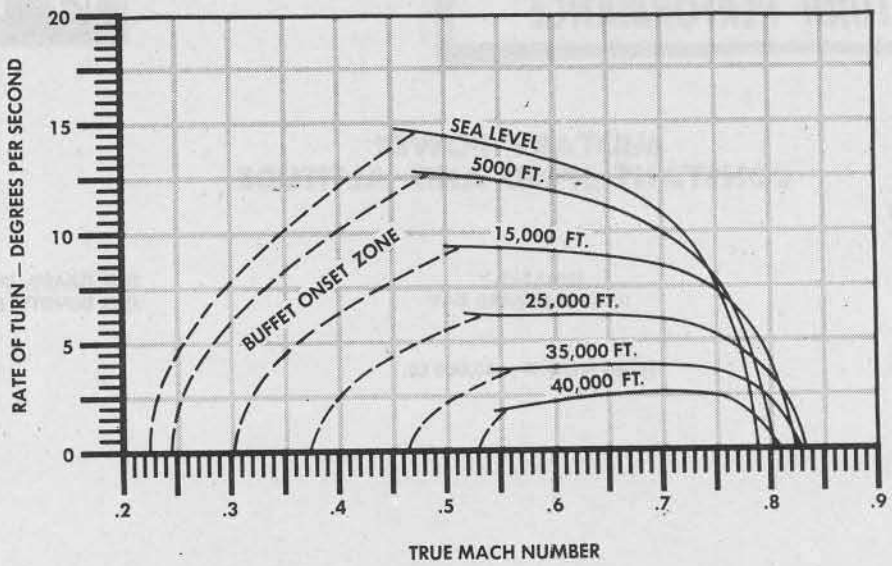
Figure 11-108 (Sheet 1)



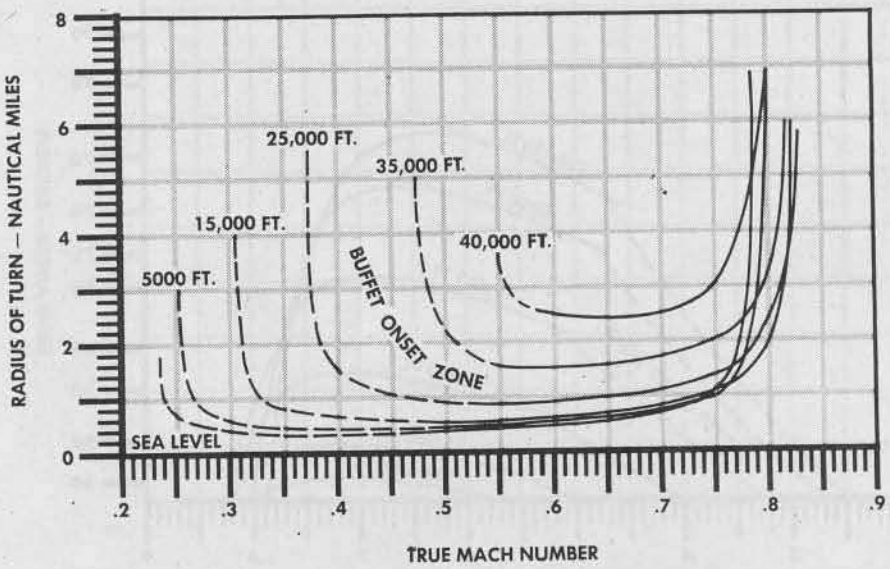


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Figure 11-108 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

AIRCRAFT CONFIGURATION:
(1) D-704 REFUELING STORE +
(4) 300 GALLON DROP TANKS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

GROSS WEIGHT — 40,000 LB.

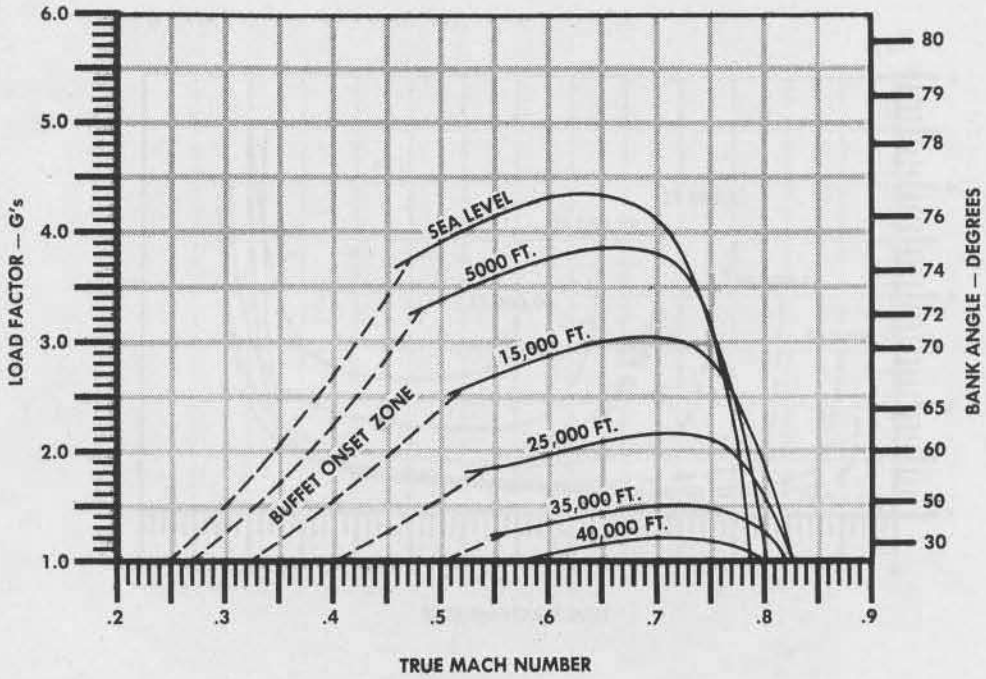

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Figure 11-109 (Sheet 1)

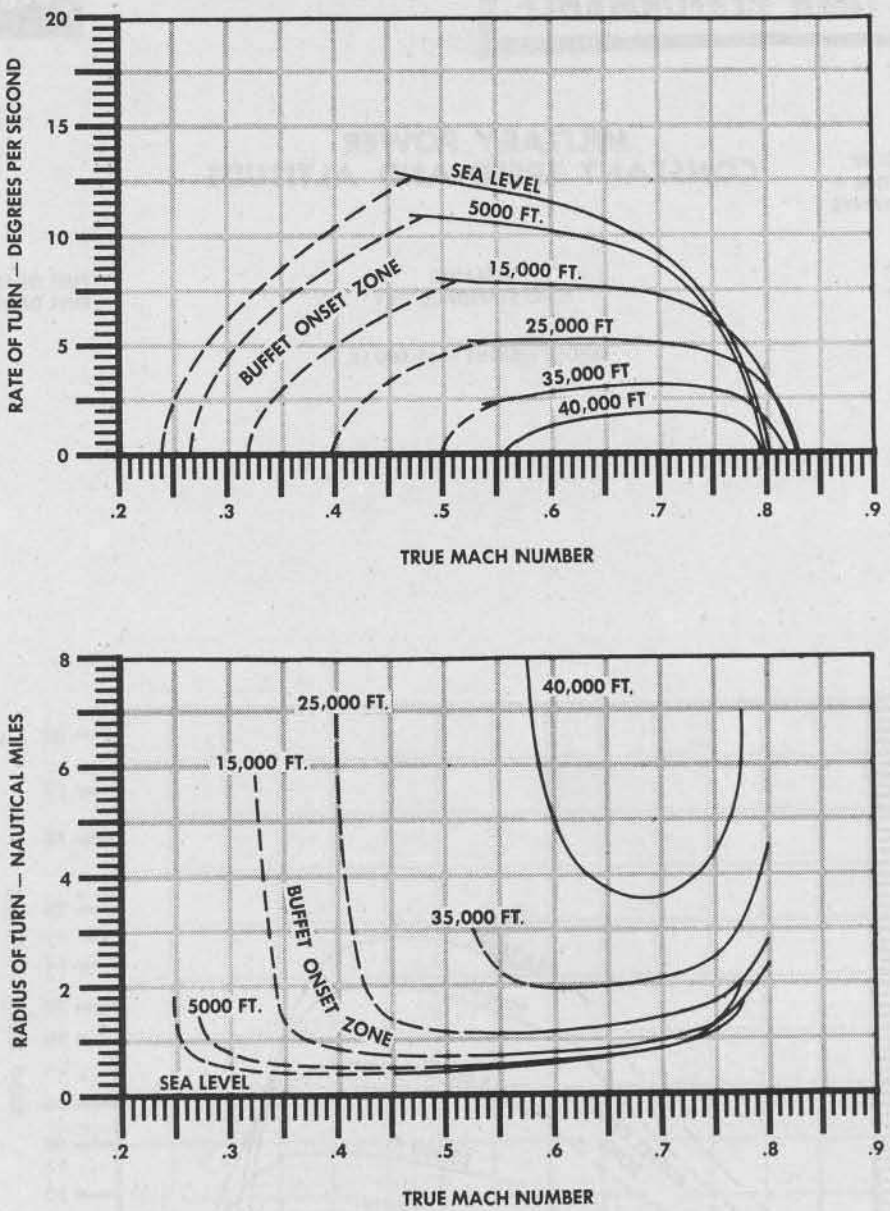

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Figure 11-109 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

AIRCRAFT CONFIGURATION
(1) D-704 REFUELING STORE +
(4) 300 GALLON DROP TANKS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

GROSS WEIGHT — 45,000 LB.

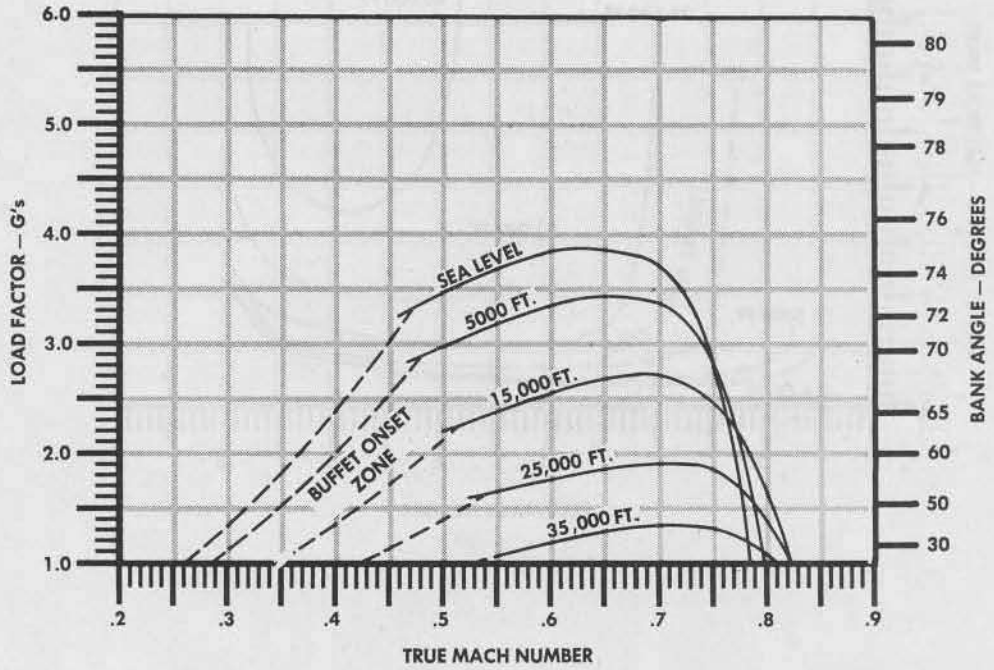

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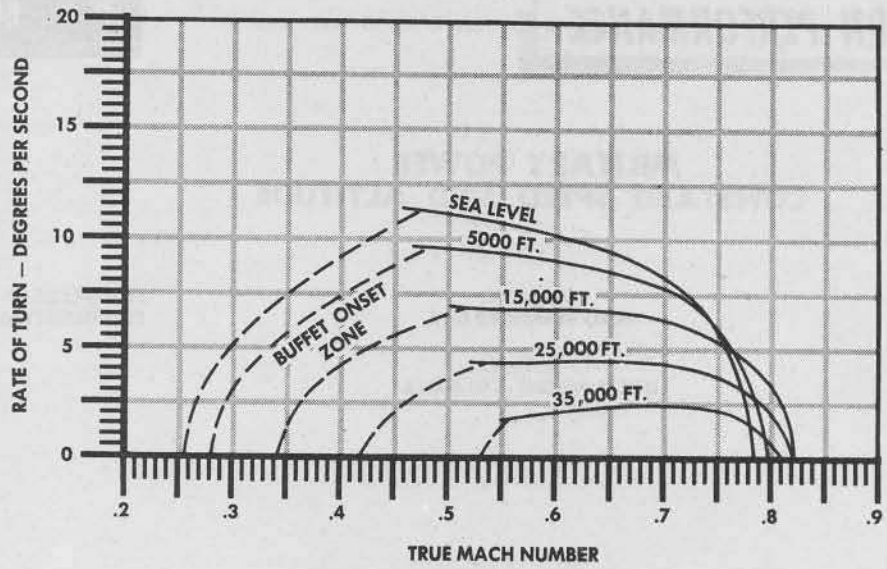
Figure 11-110 (Sheet 1)



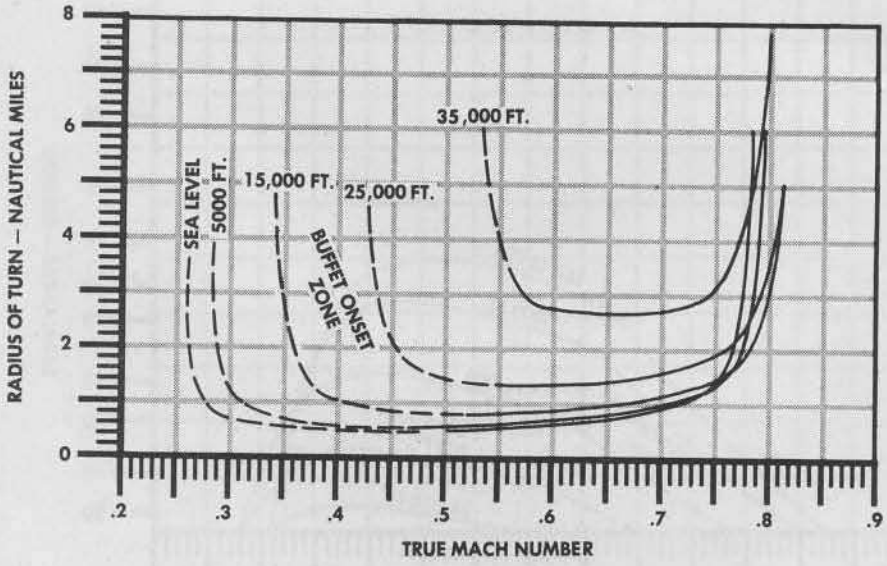


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Figure 11-110 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

AIRCRAFT CONFIGURATION
(1) D-704 REFUELING STORE +
(4) 300 GALLON DROP TANKS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

GROSS WEIGHT — 50,000 LB.

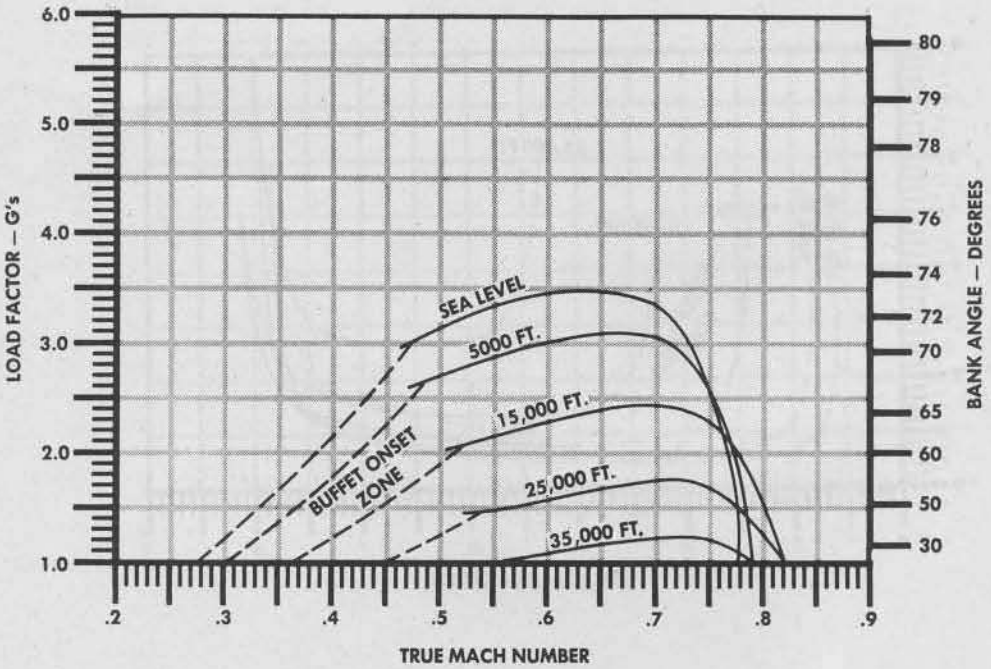

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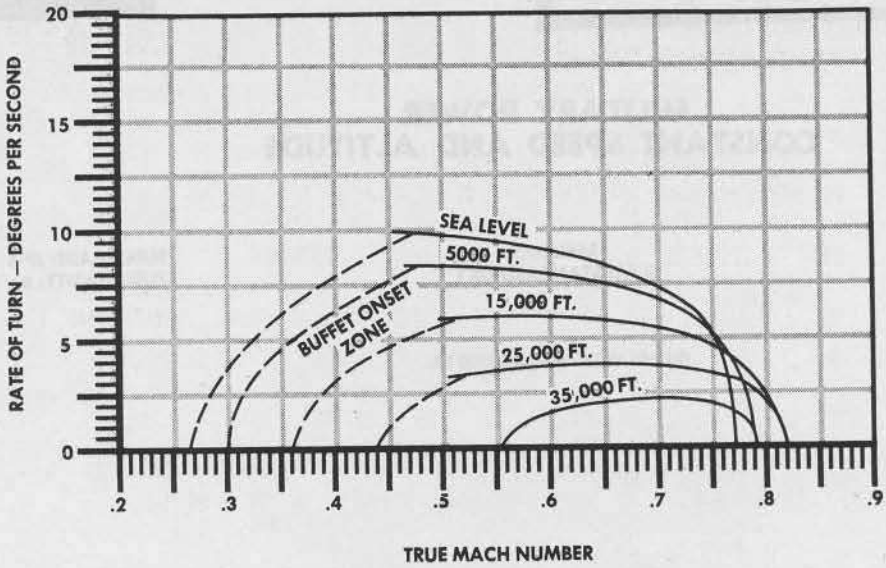
Figure 11-111 (Sheet 1)



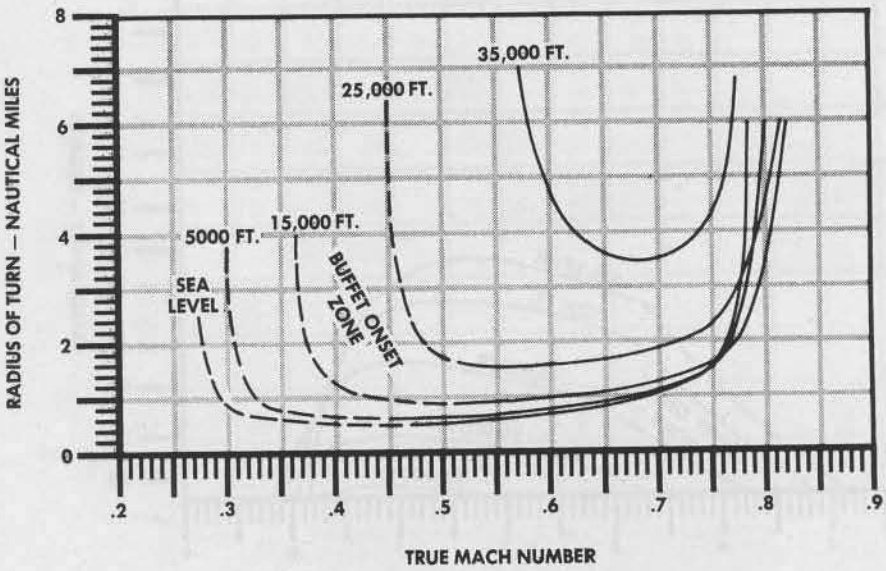


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Figure 11-111 (Sheet 2)

MAXIMUM TURN PERFORMANCE

P-8 ENGINE

MILITARY POWER
CONSTANT SPEED AND ALTITUDE

AIRCRAFT CONFIGURATION
(1) D-704 REFUELING STORE +
(4) 300 GALLON DROP TANKS

DATE 15 FEBRUARY 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

GROSS WEIGHT — 55,000 LB.

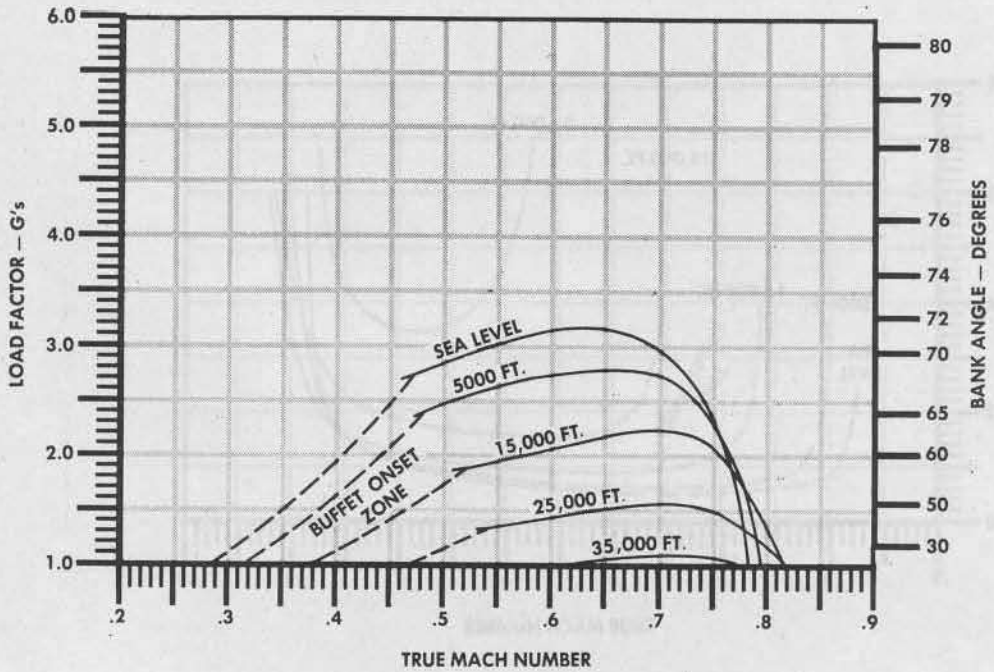

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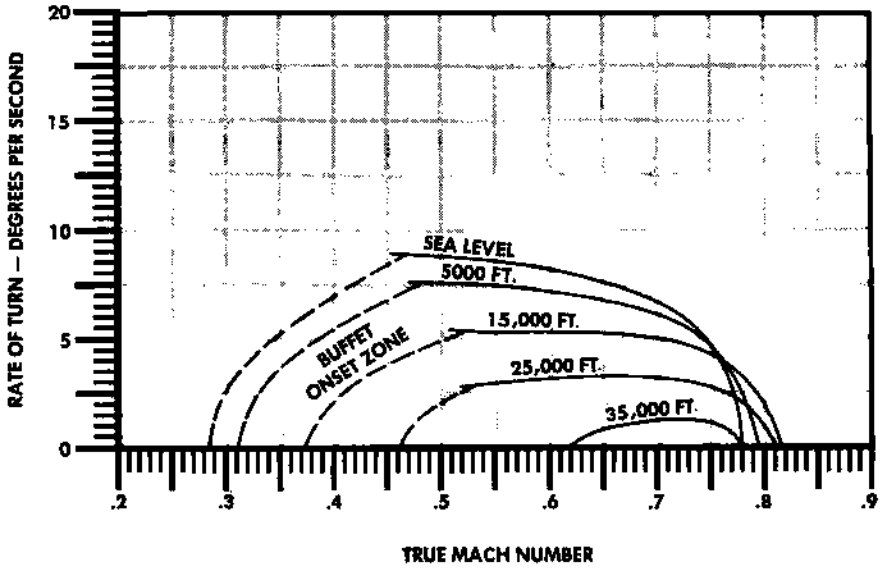
Figure 11-112 (Sheet 1)



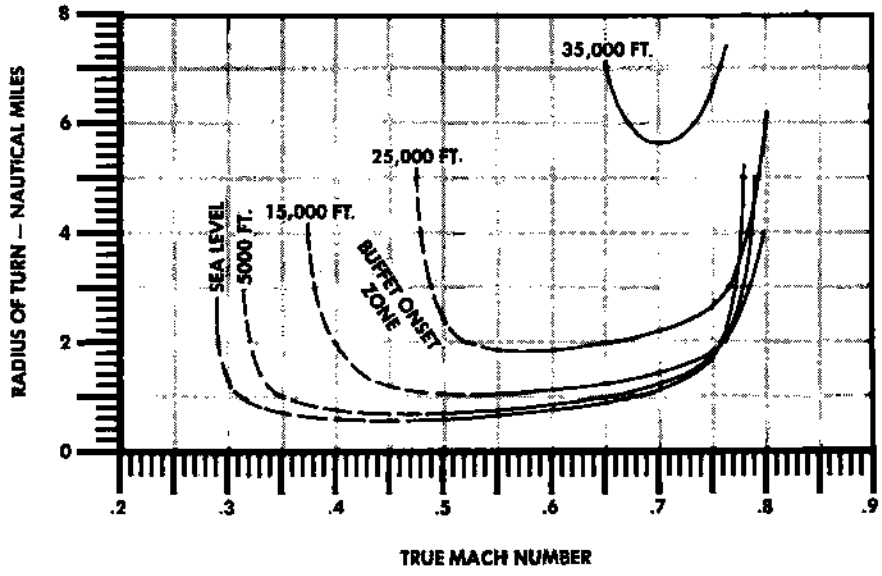


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Figure 11-112 (Sheet 2)

part 7
STORES WEIGHTS

BOMBS	WT. LB.
MK-81 LDGP	
CONICAL TAILS	260
SNAKEYE TAILS	295
MK-82 LDGP	
CONICAL TAILS	531
SNAKEYE TAILS	572
MK-82 LGB	660
MK-83 LDGP	985
MK-83LGB	985
MK-84 LDGP	1970
MK-84 LGB	2052
M117 DEMO	799
M-77 MOD 2, 4 FIRE	520
CBU-24/B, B(MOD), A/B, C/B	830
CBU-29/B, B(MOD), A/B, C/B	830
CBU-49/B, B(MOD), A/B, C/B	830
CBU-59/B, APAM	750
MK-20 (ROCKEYE II)	470
MK-36 DESTRUCTOR MOD 2 & 3	
CONICAL TAIL	531
SNAKEYE TAIL	572
MK-40 DESTRUCTOR	1057

NUCLEAR WEAPONS, SHAPES, AND MINES	WT. LB.
B-28	2040
B-43	2120
B-57	500
B-61	715
MK-104	2100
BDU-6E	2100
BDU-8/B	1970
BDU-11E	500
BDU-12/B	500
BDU-20/C	515
BDU-36	716
MK-25 MINE	2015
MK-25 DRILL MINE	2132
MK-36 MINE	1130
MK-36 DRILL MINE	1258
MK-50 MINE	580
MK-52 MINE	1200
MK-52 DRILL MINE	1325
MK-53 MINE	386
MK-55 MINE	2128
MK-55 DRILL MINE	2128
MK-56 MINE	2200
MK-56 DRILL MINE	2200

TANKS/PODS AND SENSORS	WT. LB. FULL/EMPTY
AERO 1D DROPTANK	2238/198
D-704 REFUELING STORE	2774/700
SARGENT FLETCHER MODEL 31-300 REFUELING STORE	2720/680
MK 4 GUN POD	1390/787
CNU 188/A EXTERNAL BAGGAGE CONTAINER	MAX 649/216
CTU-1A DELIVERY CONTAINER	750/230
GTC-85-72/-73 STARTER UNIT POD	575
ADSID I	23
ADSID III (FOLDING FIN)	39
GSQ-117/LS	44
GSQ-141	32
SUU-53A	100/153
LB 31A STRIKE CAMERA POD	120
ASDC CONTAINER	231

MISSILES	WT. LB.
AGM-45A (SHRIKE)	400
AIM-9D/G/H (SIDEWINDER)	196
AGM-78A (STANDARD ARM MOD-0) A-6B ONLY	1375

ROCKET LAUNCHERS	WT. LB. FULL/EMPTY
LAU-32A/A (2.75 FFAR)	167/43
LAU-32B/A (2.75 FFAR)	174/49
LAU-3A/A (2.75 FFAR)	416/79
LAU-60/A (2.75 FFAR)	473/79
LAU-61/A (2.75 FFAR)	540/133
LAU-69/A (2.75 FFAR)	507/98
LAU-56/A (2.75 FFAR)	168/43
LAU-68/A (2.75 FFAR)	218/67
LAU-10/A, 10A/A (ZUNI)	533/105

TRAINING AND PYROTECHNICS	WT. LB.
MK-86 WSF/WF PB	217/141
MK-87 WSF/WF PB	333/221
MK-88 WSF/WF PB	783/458
MK-76 MOD 4, 5 PB	25
MK-106 MOD 3, 4 PB	5
MK-124 PB	525
MK-24 PARAFLARE	27
MK-45 PARAFLARE	27
SUU-40/A OR 44/A FLARE CONTAINER (MK 24 MOD 4 PARAFLARES WITH TRAYS)	360
MK 33 MOD 1 FLARE	45.9 W/O MOTOR 102.4 W/MOTOR
MK 58 MARINE MARKER	13

EJECTOR RACKS AND LAUNCHERS	WT. LB.
AERO-7A EJECTOR RACK	53
AERO-7B EJECTOR RACK	50
A/A37B-3 PMBR	87
A/A37B-5 TER	96
A/A37B-6 MER	214
LAU-7/A MISSILE LAUNCHER	87
AERO-5 MISSILE LAUNCHER	90
ADU 299E	20
AERO 1A ADAPTER	10
GAEC ADAPTER	20
LAU-77A/A ELA	181

NOTE

THE FOLLOWING STORES WEIGHTS ARE FOR INFORMATION ONLY AND ARE NOT AUTHORITY FOR AIRCRAFT LOADING. FOR AIRCRAFT STORES LIMITATIONS REFER TO NAVAIR 01-85ADA-1T.

D-ADA1-715

Figure 11-113

part 8 Drag Count P-8A

INTRODUCTION

This part provides climb, cruise, endurance, and descent performance against drag count. Twin-engine performance is presented first, followed by single-engine data arranged in the same manner, grouped at the end of the part.

AIRCRAFT CONFIGURATION STORE DRAG COUNT

The aircraft configuration store drag count table (figure FO-8) presents various combinations of external stores that are symmetrically carried on the aircraft. A drag count has been assigned to each external store or combination of stores for the particular store station. The drag count for a given configuration is the sum of the store drag count of the centerline stations, and the stores drag count of the wing stations.

Note

- Drag count values for wing stations are based on the assumption that all wing stations are loaded. For minimum drag, if only 2 wing stations are to be loaded stations 1 and 5 should be used because of the following relationships:
  - Stations 1 and 5 only = 70% of tabulated drag count
  - Stations 2 and 4 only = 110% of tabulated drag count

  Centerline station drag count is not affected by the presence of wing stores.
- Drag count values for expended rocket pods are equivalent to the values for pods with the nose fairing off.
- Drag count values for empty ejector racks on any station are:

  TER = 5
  MER = 8
- Caution should be exercised when carrying high drag count combinations (over 50 counts/station). Most of the store loadings listed have not been quantitatively flight-tested and their influence on wing lift are unknown. Therefore these high drag count loadings may have a significant effect on catapulting, take-off, and stall speed performance.
- The A-6C TRIM pod has a drag count of 70 (including the allowance for operation of TRIM electronic equipment) in the cruise configuration. This should be added to the store drag count to determine the total drag count of the A-6C.
- A-6E 159895 and ON and A-6E Mod M121 and ON (TRAM configuration) with no stores loaded and with the turret installed have a drag count of 18. This should be added to the store drag count to determine total drag count.

USE

To determine the drag count of the aircraft, enter the table at the store loaded and pick out the tabulated drag count for the loading used on each station and add these values.

Sample Problem

Aircraft Configurations:

Centerline - Empty

Inboard - LAU-10A Rocket (Full)	= 16
Outboard - LAU-10A Rocket (Full)	= 16
Total drag count	= 32

MILITARY POWER CLIMB

CLIMB SPEED SCHEDULE

The climb speed schedule chart (figure 11-114) is a plot of the speed for military power climbs at various drag counts ranging from 0 to 250 as revised to agree with pilot technique. This climb speed schedule is not the one that corresponds to maximum rates of climb, but it does result in near optimum values of time, fuel, and distance to climb. The climb speed (calibrated airspeed) is plotted vs pressure altitude.

USE

To obtain military power climb calibrated airspeed, enter the chart at sea level for the calibrated airspeed corresponding to the appropriate drag count, interpolating if necessary. Fly this value of calibrated airspeed until reading 0.70 mach and then climb at 0.70 mach until desired altitude is reached.

TIME, FUEL AND DISTANCE TO CLIMB

The time, fuel, and distance-to-climb charts (figures 11-115 through 11-117) are based on optimum climb speeds. The charts show the time (figure 11-115), fuel (figure 11-116), and distance to climb (figure 11-117) for variation in gross weight and drag count.

USE

To obtain climb time, enter the time to climb graph (figure 11-115) at the initial gross weight of the aircraft at start of climb. From initial gross weight proceed horizontally to the selected altitude at end of climb reflector line and project a line downward to the appropriate drag count reflector line. From the drag count reflector line project horizontally to the temperature base line and parallel the nearest guide line to apply correction for the effect of temperature. Follow the guide line until intercepting the vertical projection of the temperature deviation, then move horizontally to read time to climb from sea level to selected altitude. To obtain time to climb to best cruise altitude, enter the chart at initial gross weight and proceed horizontally to the broken line corresponding to the best altitude for the known drag count. From that point proceed vertically down and proceed as given above for climb to a constant altitude. The fuel to climb (figure 11-116) and distance to climb (figure 11-117) can be found by following the time to climb procedure explained above.

Sample Problem—Time to Climb from Sea Level to Cruise Altitude

Aircraft Configuration:

(1) Aero 1C External Tank Mounted on C_L Stations Plus

(2) MK-79 MOD 1 Fire Bombs Mounted on Inboard Wing Stations Plus (2) LAU-10A Rocket Packs (Full) Mounted on Outboard Wing Stations.

A.	Initial Gross Weight	50,000 lb
B.	Altitude at End of Climb	Cruise Altitude (33,000 Ft.)
C.	Drag Count	50
D.	Time Required to Climb from Sea Level to Best Cruise Altitude (standard day)	10.8 min
E.	Temperature Deviation from Standard Day	+10°C
F.	Time Required to Climb from Sea Level to Optimum Cruise Altitude (including temperature correction)	14.7 min

MILITARY POWER CLIMB

P-8 ENGINE

CLIMB SPEED SCHEDULE
(SIMPLIFIED TO AGREE WITH PILOT TECHNIQUE)
ALL GROSS WEIGHTS

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

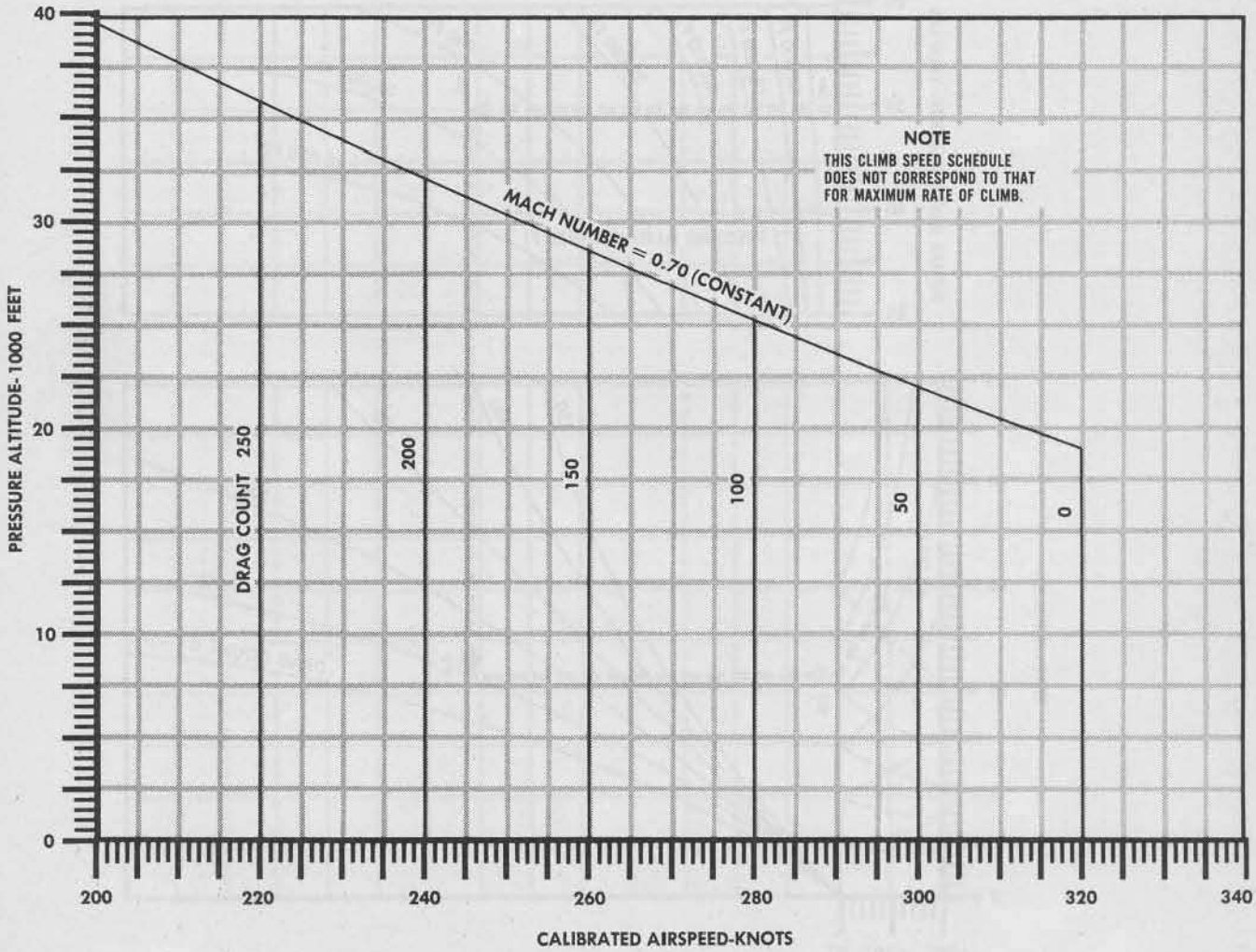

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Figure 11-114

MILITARY POWER CLIMB

P-8 ENGINE

TIME REQUIRED TO CLIMB FROM SEA LEVEL TO SELECTED ALTITUDE
(DATA CORRESPONDS TO CLIMB SPEED SCHEDULE)

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

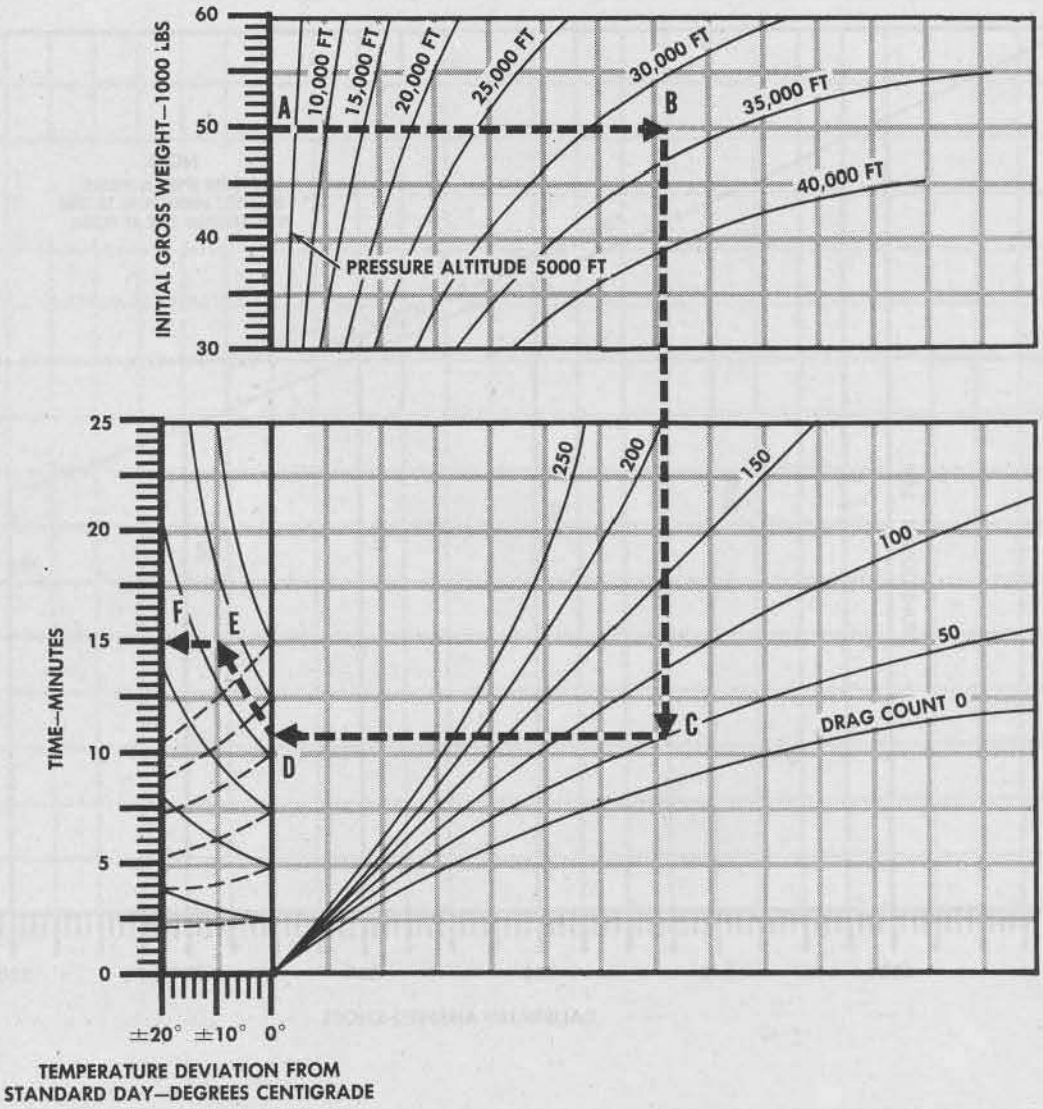

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Figure 11-115

MILITARY POWER CLIMB

P-8 ENGINE

FUEL REQUIRED TO CLIMB FROM SEA LEVEL TO SELECTED ALTITUDE
(DATA CORRESPONDS TO CLIMB SPEED SCHEDULE)

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

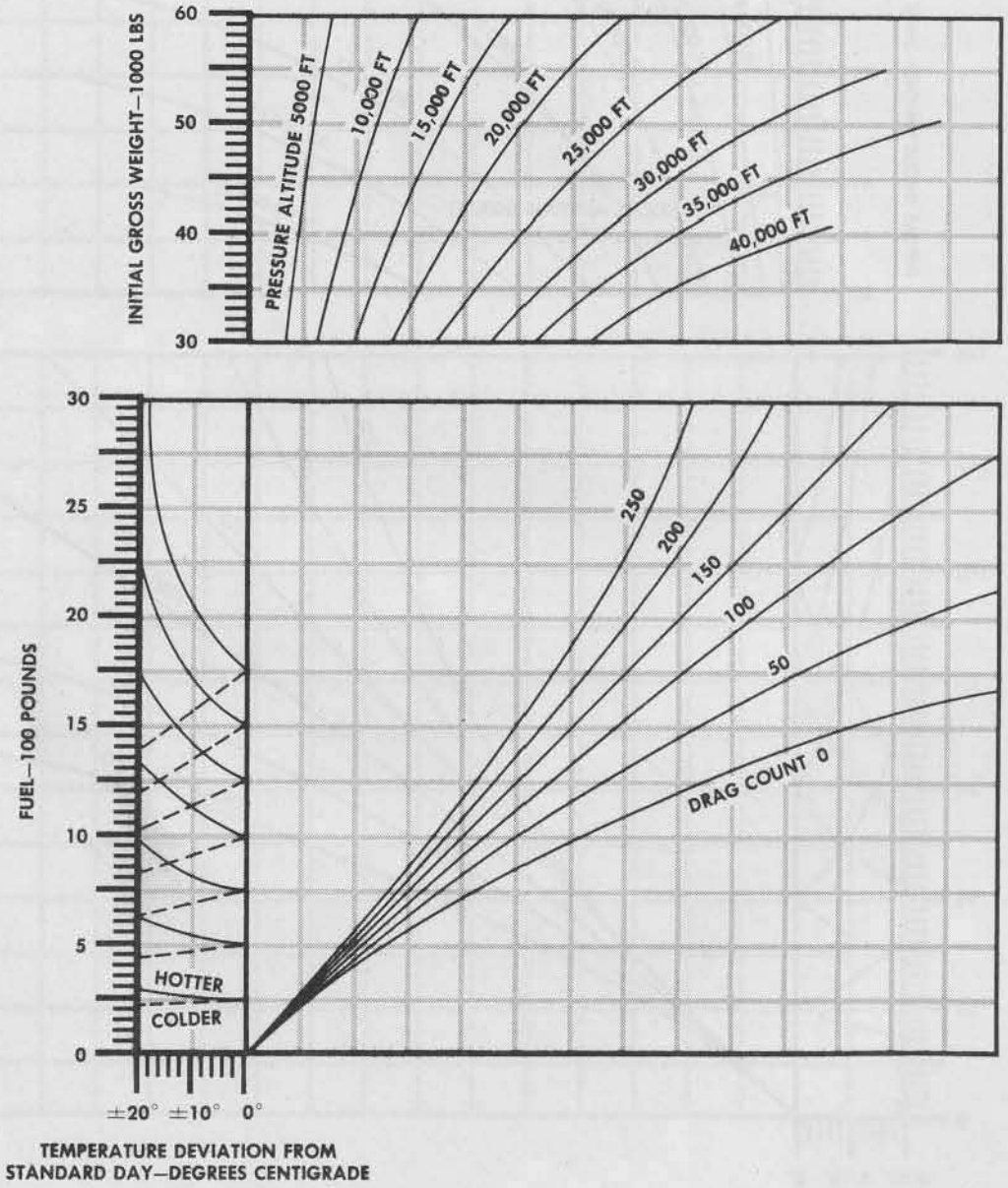

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Figure 11-116

MILITARY POWER CLIMB

P-8 ENGINE

DISTANCE REQUIRED TO CLIMB FROM SEA LEVEL TO SELECTED ALTITUDE
(DATA CORRESPONDS TO CLIMB SPEED SCHEDULE)

DATE: 1 DECEMBER 1972
DATA BASIS: ESTIMATED

FUEL GRADE: JP5
FUEL DENSITY: 6.8 LB/GAL

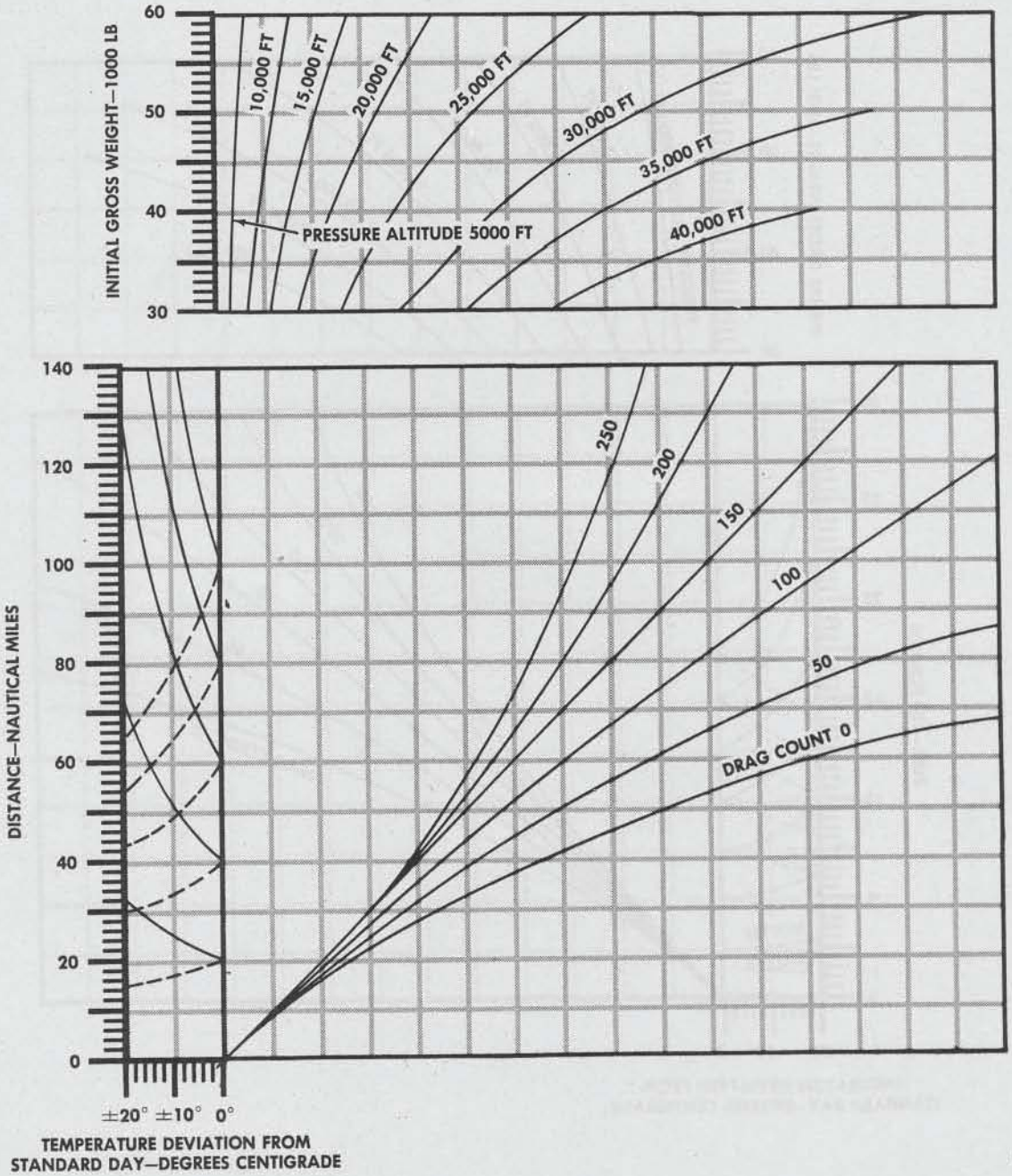

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Figure 11-117

BEST CRUISE ALTITUDE

The best cruise altitude graph is presented in the upper portion of figure 11-118. Pressure altitude for best cruise vs. weight is plotted for a drag count range of 0 to 250.

USE

Enter the chart at aircraft gross weight and proceed vertically to appropriate drag count reflector line. From this point proceed horizontally to the left scale of the graph to read optimum cruise altitude.

Sample Problem

Aircraft Configuration:

(1) MK-28 Plus (Four) 300-Gallon Tanks.

A.	Gross Weight	45,000 lb
B.	Drag Count	47
C.	Best Cruise Altitude	34,000 ft

OPTIMUM ENDURANCE ALTITUDE

The optimum endurance altitude, presented on the lower half of figure 11-118, is a plot of pressure altitude vs. gross weight for a drag count range of 0 to 250.

USE

Enter the chart at aircraft gross weight and proceed vertically to the appropriate drag count reflector line. From this point proceed horizontally to the left scale of the graph to read optimum endurance altitude.

Sample Problem

Aircraft Configuration:

(1) MK-28 PLUS (Four) 300-Gallon Tanks.

A.	Gross Weight	45,000 lb
B.	Drag Count	47
C.	Optimum Endurance Altitude	29,000 ft

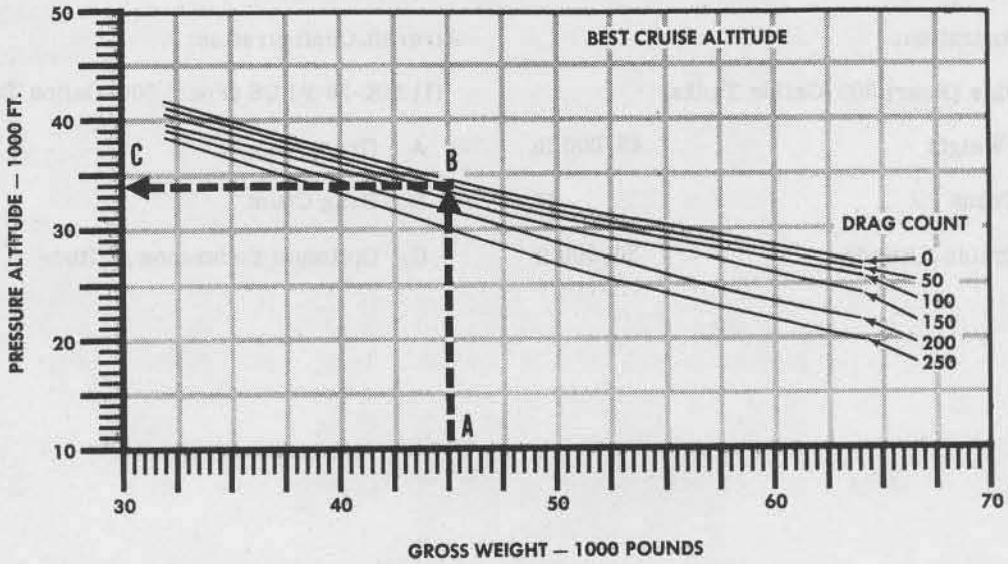
BEST CRUISE ALTITUDE AND OPTIMUM ENDURANCE ALTITUDE

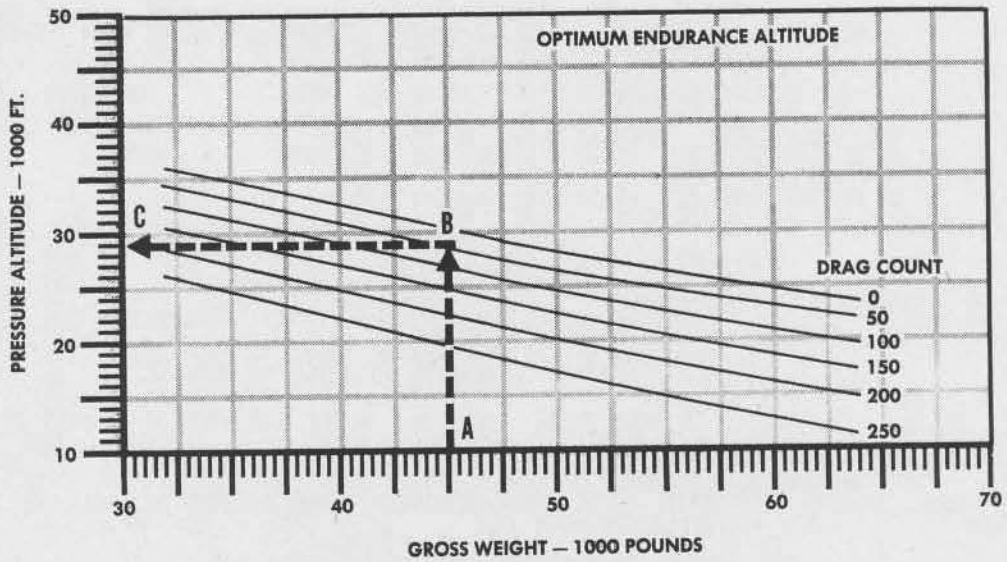
P-8 ENGINE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-319

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Figure 11-118

COMBAT CEILING

The combat ceiling graph is presented as the upper section of figure 11-119. Pressure altitude vs. gross weight is plotted for a drag count range of 0 to 250.

USE

Enter the chart at aircraft gross weight and proceed vertically to the appropriate drag count reflector line. From this point proceed horizontally to the left scale of the graph to read combat ceiling.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Gross Weight	48,000 lb
B.	Drag Count	47
C.	Combat Ceiling	39,000 ft

SERVICE CEILING

The service ceiling graph is presented as the lower section of figure 11-119. Pressure altitude vs. gross weight is plotted for a drag count range of 0 to 250.

USE

Enter the chart at aircraft gross weight and proceed vertically to the appropriate drag count reflector line. From this point proceed horizontally to the left scale of the graph to read service ceiling.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Gross Weight	48,000 lb
B.	Drag Count	47
C.	Service Ceiling	41,000 ft

COMBAT CEILING AND SERVICE CEILING

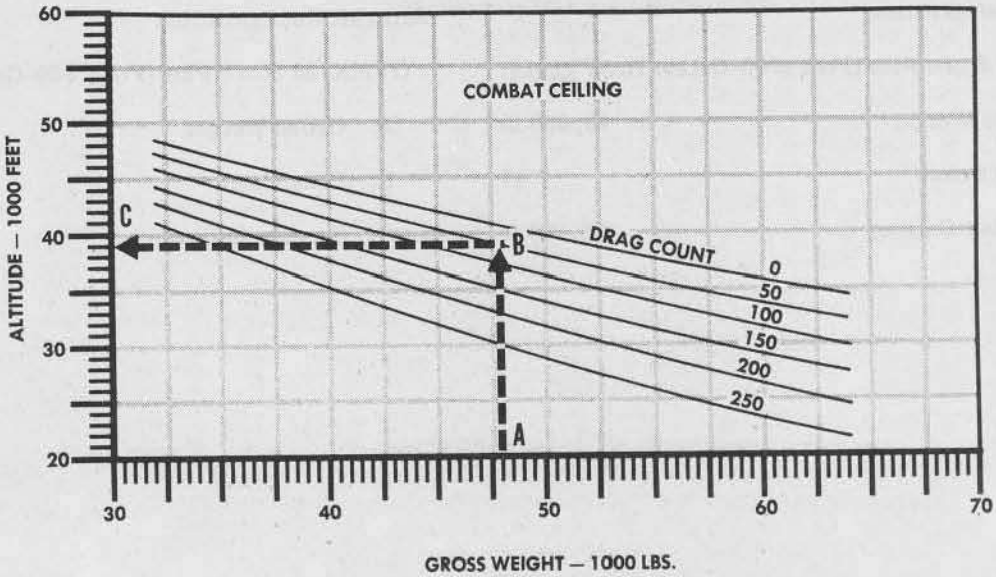
P-8 ENGINE

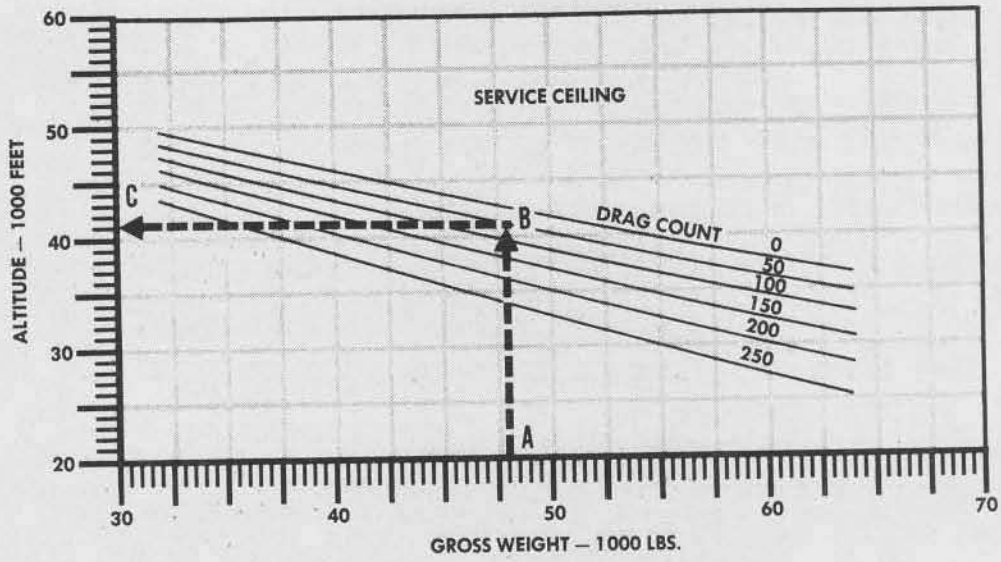
MILITARY POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-370

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Figure 11-119

CRUISE PERFORMANCE

The cruise performance is presented in four phases, figures 11-120 through 11-123. Phase I is the determination of the clean aircraft transfer number and the appropriate cruise mach number for a known aircraft gross weight, altitude, and drag count. The clean transfer number may also be determined for any desired mach number at any altitude, as well as the best cruise altitude for the aircraft. Phase II gives a final aircraft reference number by adding the clean aircraft transfer number to the drag count transfer number. Phase III yields the value of pounds of fuel per nautical mile for the cruise mach number found, or chosen, in Phase I and the reference number obtained in Phase II. Phase IV is simply a conversion from pounds of fuel per nautical mile to fuel flow for various outside air temperatures in degrees centigrade. Pounds of fuel per nautical mile and corresponding fuel flow can be determined for any possible aircraft configuration, gross weight, altitude, and air temperature.

USE

Phase I. Enter the bottom chart of figure 11-120 at the appropriate gross weight and proceed to the desired altitude. If it is desired to cruise at the optimum altitude, then proceed instead to the appropriate drag count. Proceed vertically upward to intersect the dotted line for a drag count of zero (0). If it is desired to cruise at the mach number recommended for maximum range, then parallel the nearest guide line (solid line) to intersect the appropriate drag count (broken line). From this point proceed vertically downward to read the recommended mach number for maximum range and horizontally to the right to obtain the clean aircraft transfer scale. If it is desired to fly at some other predetermined mach number, then parallel the nearest guide line from the zero drag count line to intersect a vertical line projected up from the desired mach number. Proceed horizontally to the right to obtain the clean aircraft transfer scale.

Phase II. Enter the bottom chart of figure 11-121 at the mach number determined in Phase I and proceed to the right to intersect the appropriate drag count line. Project vertically upward from this point. Enter the top chart at the transfer scale determined in Phase I and proceed to the right intersecting the line projected vertically from the bottom chart. The intersecting of these lines determines the aircraft reference number. If no external stores are carried, Phase II may be ignored. In this case, the reference number is equal to the transfer scale number determined in Phase I.

Phase III. Enter the bottom chart of figure 11-122 at the previously determined mach number and proceed to the right to the reference number found in Phase II. Proceed vertically upward to intersect the proper altitude line and then directly to the left to obtain the correct value of pounds of fuel per nautical mile.

Phase IV. Enter the bottom chart of figure 11-123 at the correct mach number and proceed to the right until the correct temperature line is reached. From this point, proceed vertically upward until the value of pounds of fuel per nautical mile found in Phase III is reached, and then horizontally to the left to read the correct value of fuel flow.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Tanks.

Phase I

A.	Gross Weight	45,000 lb
B.	Altitude	Best cruise at a drag count of 47
C.	Zero Drag Count Line	0
D.	Drag Count	48
E.	Recommended Mach Number	.695 M
F.	Clean Aircraft Transfer Scale	13.5

Phase II

E.	Recommended Mach Number	.695 M
D.	Drag Count	48
F.	Transfer Scale	13.5
G.	Reference Number	15.0

Phase III

E.	Recommended Mach Number	.695 M
G.	Reference Number	15.0
B.	Altitude at Drag Count 30 (Corresponds to best cruise altitude)	34,000 ft
H.	Pounds of Fuel Per Nautical Mile	9.20 lb/nmi

Phase IV

E.	Mach Number	.695 M
I.	Temperature (OAT) (degrees centrigrade)	-40° C
H.	Pounds of Fuel Per Nautical Mile	9.20 lb/nmi
J.	Fuel Flow	3900 lb/hr

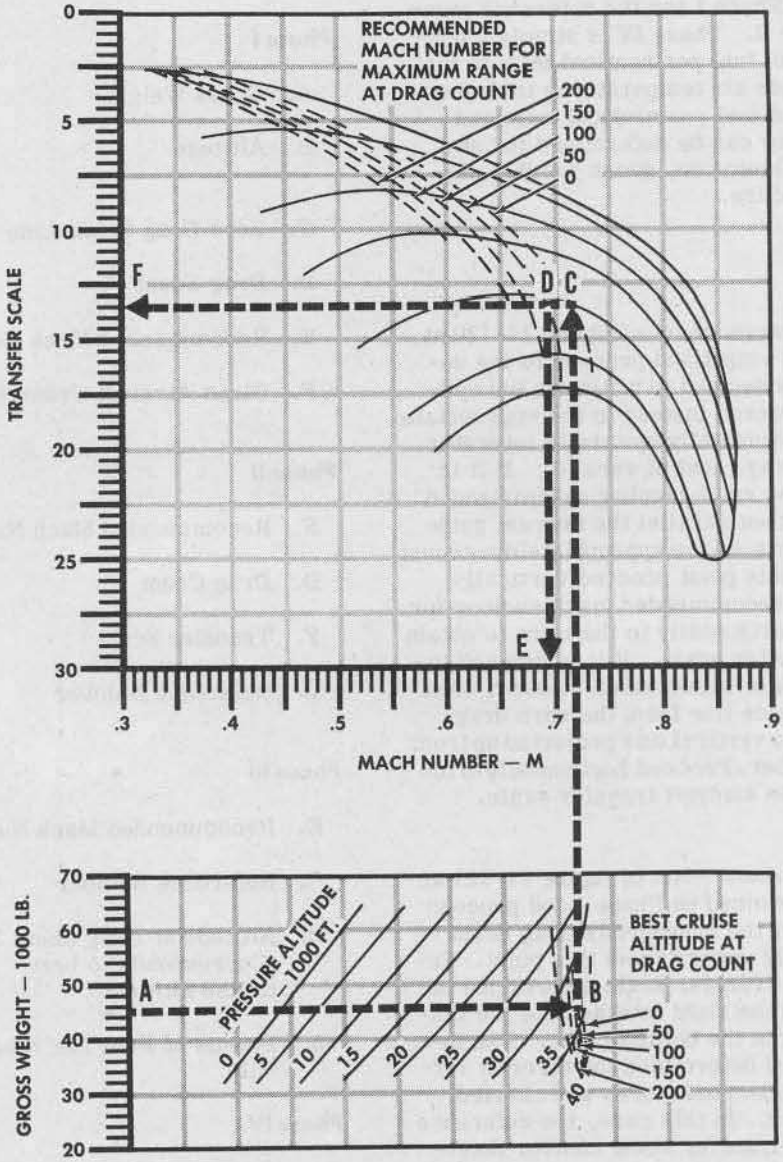
CRUISE PERFORMANCE

P-8 ENGINE

PHASE I – CLEAN AIRCRAFT TRANSFER SCALE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-311

Figure 11-120

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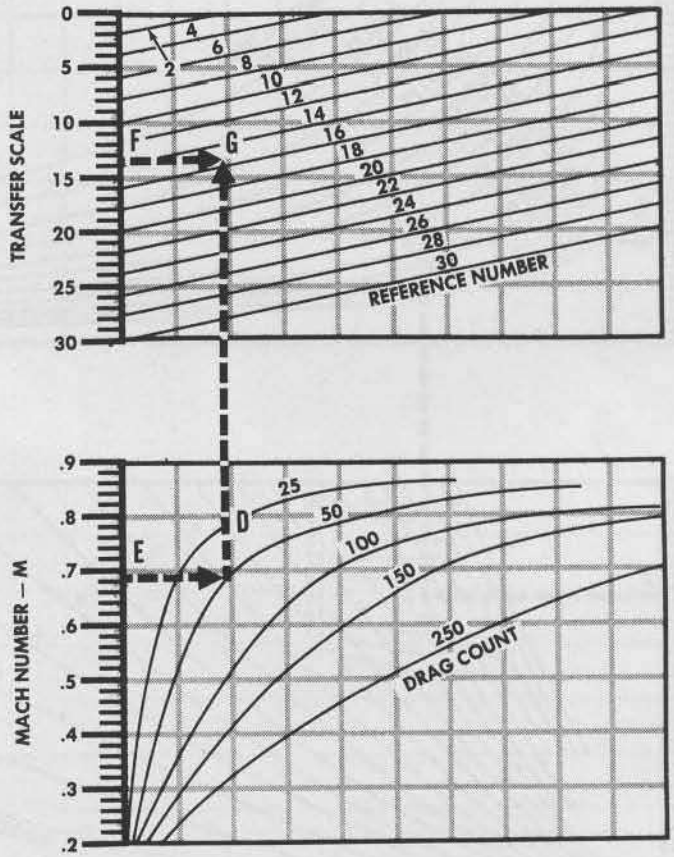
CRUISE PERFORMANCE

P-8 ENGINE

PHASE II – AIRCRAFT REFERENCE NUMBER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-312

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Figure 11-121

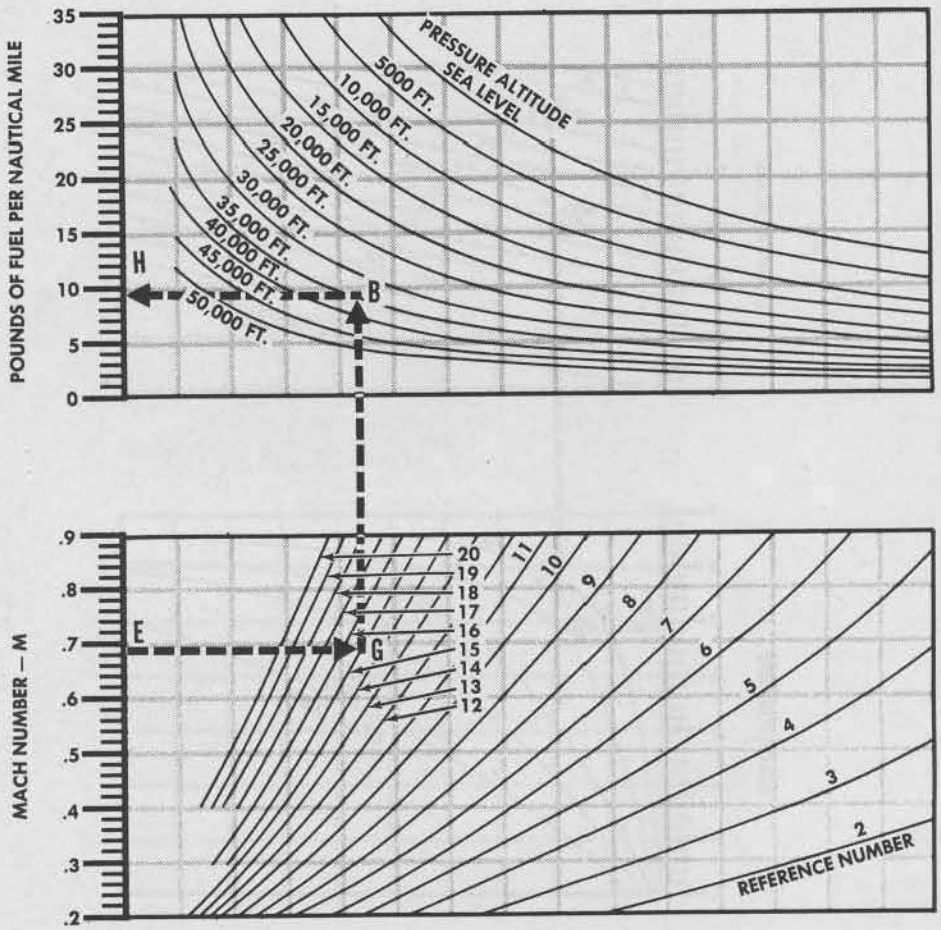
CRUISE PERFORMANCE

P-8 ENGINE

PHASE III – POUNDS OF FUEL PER NAUTICAL MILE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-313

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Figure 11-122

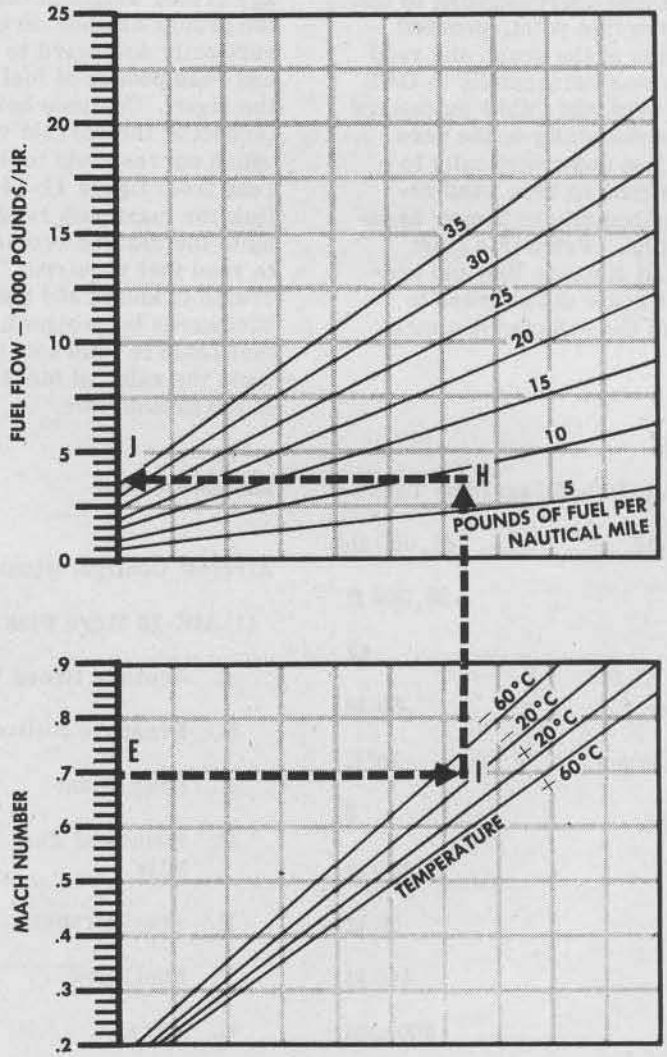
CRUISE PERFORMANCE

P-8 ENGINE

PHASE IV — FUEL FLOW

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-314

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Figure 11-123

MAXIMUM RANGE CRUISE AT CONSTANT ALTITUDE

TIME AND SPEED

The maximum range cruise time and speed graph (figure 11-124) presents the optimum cruise mach number for a constant cruise altitude with variations in gross weights. Groundspeed and time to travel a specified distance are given with temperature and wind velocity as variables.

USE

Enter the chart at the average gross weight of the aircraft. Proceed horizontally to the appropriate pressure altitude reflector line and project down vertically to the drag count line corresponding to the aircraft configuration. From this point, proceed horizontally to the right scale of the graph and read cruise mach number. Continue horizontally to OAT (outside air temperature) graph and follow guidelines to proper OAT. Proceed horizontally to the zero wind reflector line and project down vertically to read true airspeed. Trace back to zero wind reflector line and proceed horizontally to proper headwind or tailwind reflector line. From this point project vertically to selected distance line and proceed horizontally to the left scale of the graph to read time required to travel the selected distance.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Average Gross Weight	45,000 lb
B.	Pressure Altitude	25,000 ft
C.	Drag Count	48
D.	Cruise Mach Number	.63 M
E.	Outside Air Temperature	-20° C
F.	Wind Reflector Line	0
G.	True Airspeed	380 kt
H.	Tailwind	50 kt
I.	Groundspeed	440 kt
J.	Selected Distance	300 nmi
K.	Time Required	44 min

FUEL REQUIRED

The maximum range cruise at constant altitude fuel required chart (figure 11-125) graphically presents the values of fuel flow for maximum range throughout the entire range of aircraft gross weight, pressure altitude, and drag count. It also presents the amount of fuel required to fly for a known time interval under maximum range conditions, or when used in an inverse manner, presents the time in flight for a given amount of fuel.

USE

Enter the top left graph of figure 11-125 at the average cruise weight of the aircraft and intersect with the proper altitude directly to the right. Proceed vertically downward to the correct drag count value and read pounds of fuel per nautical mile directly to the right. Continue horizontally to the right to intersect at the correct value of cruise speed (TAS), which corresponds to the groundspeed at zero wind read from figure 11-124. Directly above, read fuel flow for maximum range cruise. Continue straight up to the desired cruise time and then directly left to read fuel required. If the fuel to be used for the cruise is known and the time is required, then work backwards by projecting a line to the right from the fuel scale to intersect the vertical line projected up from the value of fuel flow. The intersection point is the cruise time.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Average Gross Weight	45,000 lb
B.	Pressure Altitude	25,000 ft
C.	Drag Count	48
D.	Pounds of Fuel Per Nautical Mile	10.9 lbs/nmi
E.	True Airspeed	380 kt
F.	Fuel Flow	3950 lb/hr
G.	Time	44 min
H.	Fuel Required	3000 lb

MAXIMUM RANGE CRUISE AT CONSTANT ALTITUDE

P-8 ENGINE

TIME AND SPEED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.

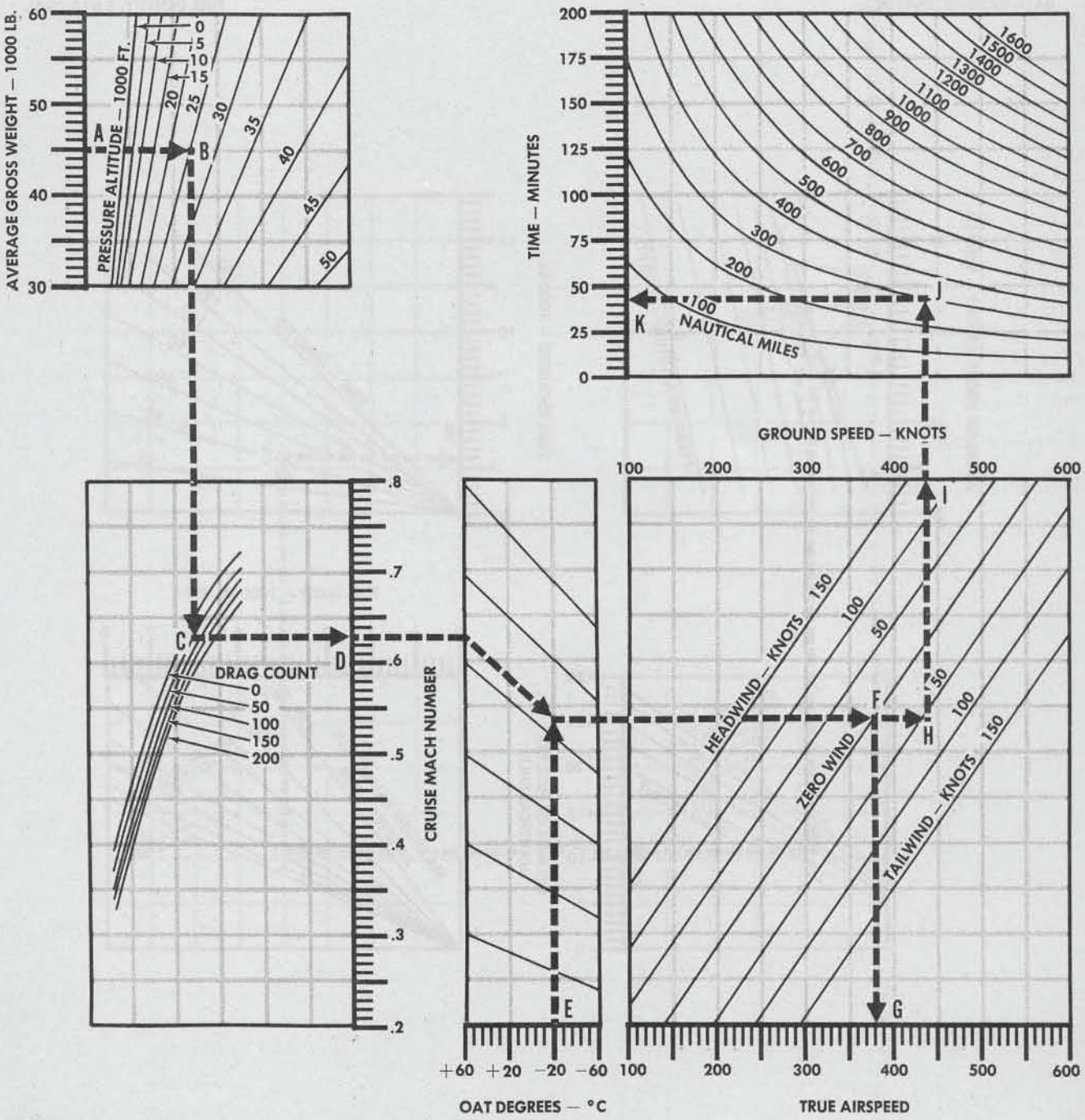

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Figure 11-124

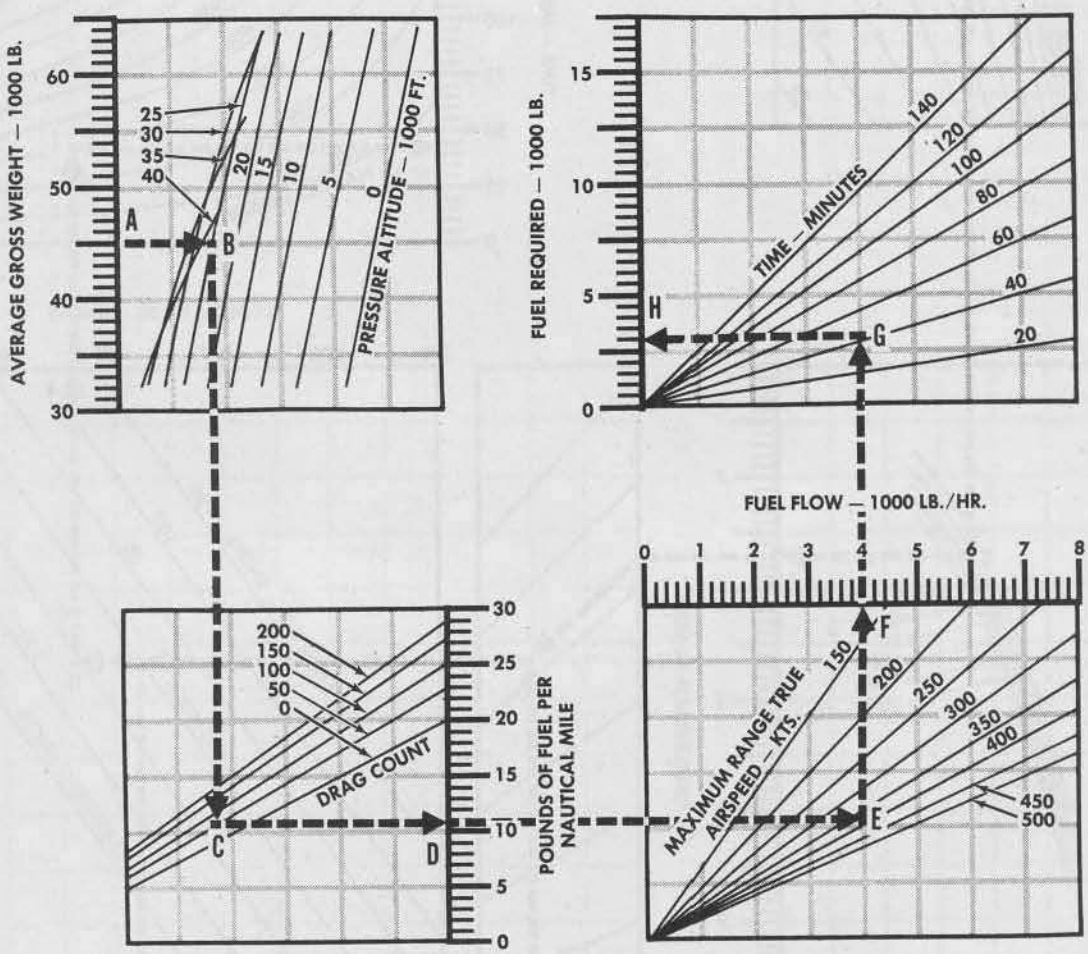
MAXIMUM RANGE CRUISE AT CONSTANT ALTITUDE

P-8 ENGINE

FUEL REQUIRED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-373

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Figure 11-125

MAXIMUM ENDURANCE

SPEED

The maximum endurance speed chart (figure 11-126) graphically presents the value of calibrated airspeed recommended for maximum endurance throughout the complete range of aircraft gross weight, pressure altitude, and drag count for values of bank angle from 0° to 50°.

USE

Enter the top right graph of figure 11-126 at the average gross weight of the aircraft. Parallel the guidelines to the correct value of bank angle. Proceed directly to the left to the selected pressure altitude. If it is desired to fly at the altitude for maximum endurance, then proceed instead to the appropriate value of maximum endurance altitude corresponding to the configuration drag count given by the broken lines. Proceed vertically downward to intersect the correct drag count value, and then directly to the right to read the maximum endurance mach number. Continue horizontally to the right to the correct pressure altitude, and then vertically downward to read the calibrated airspeed for maximum endurance.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Average Gross Weight	45,000 lb
B.	Bank Angle	25°
C.	Pressure Altitude	30,000 ft
D.	Drag Count	48
E.	Maximum Endurance Mach Number	.62 M
F.	Pressure Altitude	30,000 ft
G.	Calibrated Airspeed for Maximum Endurance	230 kt

MAXIMUM ENDURANCE

FUEL REQUIRED

The maximum endurance fuel required chart (figure 11-127) graphically presents the values of minimum fuel flow throughout the complete range of aircraft gross weight, pressure altitude, and drag count for values of bank angle from 0° to 50°, and standard day temperature deviations of up to ±20° C. It also presents the amount of fuel required to fly for a known time interval under maximum endurance conditions, or when used in an inverse manner, presents the time in flight for a given amount of fuel.

USE

Enter the top left graph of figure 11-127 at the known gross weight and parallel the guide lines to the appropriate bank angle. Proceed to the right and intersect the appropriate altitude and then vertically downward to the correct drag count value. Proceed horizontally to the right to the proper altitude and project vertically upward to read minimum fuel flow. To obtain minimum fuel flow for a standard day temperature deviation, parallel the guidelines until the temperature deviation is reached, then project vertically upward to read minimum fuel flow. Continue vertically to intersect the desired endurance time and then directly to the left to read fuel required. If it is desired to find the endurance time for a known amount of fuel to be used, then proceed as above, but choose the fuel required and proceed to the right to intersect the vertical line to read time.

Sample Problem

Aircraft Configuration:

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Average Gross Weight	45,000 lb
B.	Bank Angle	25°
C.	Pressure Altitude	30,000 ft
D.	Drag Count	48
E.	Pressure Altitude	30,000 ft
F.	Temperature Deviation From Standard Day	+10° C
G.	Fuel Flow	4050 lb/hr
H.	Endurance Time	80 min
I.	Fuel Required	5000 lb

MAXIMUM ENDURANCE

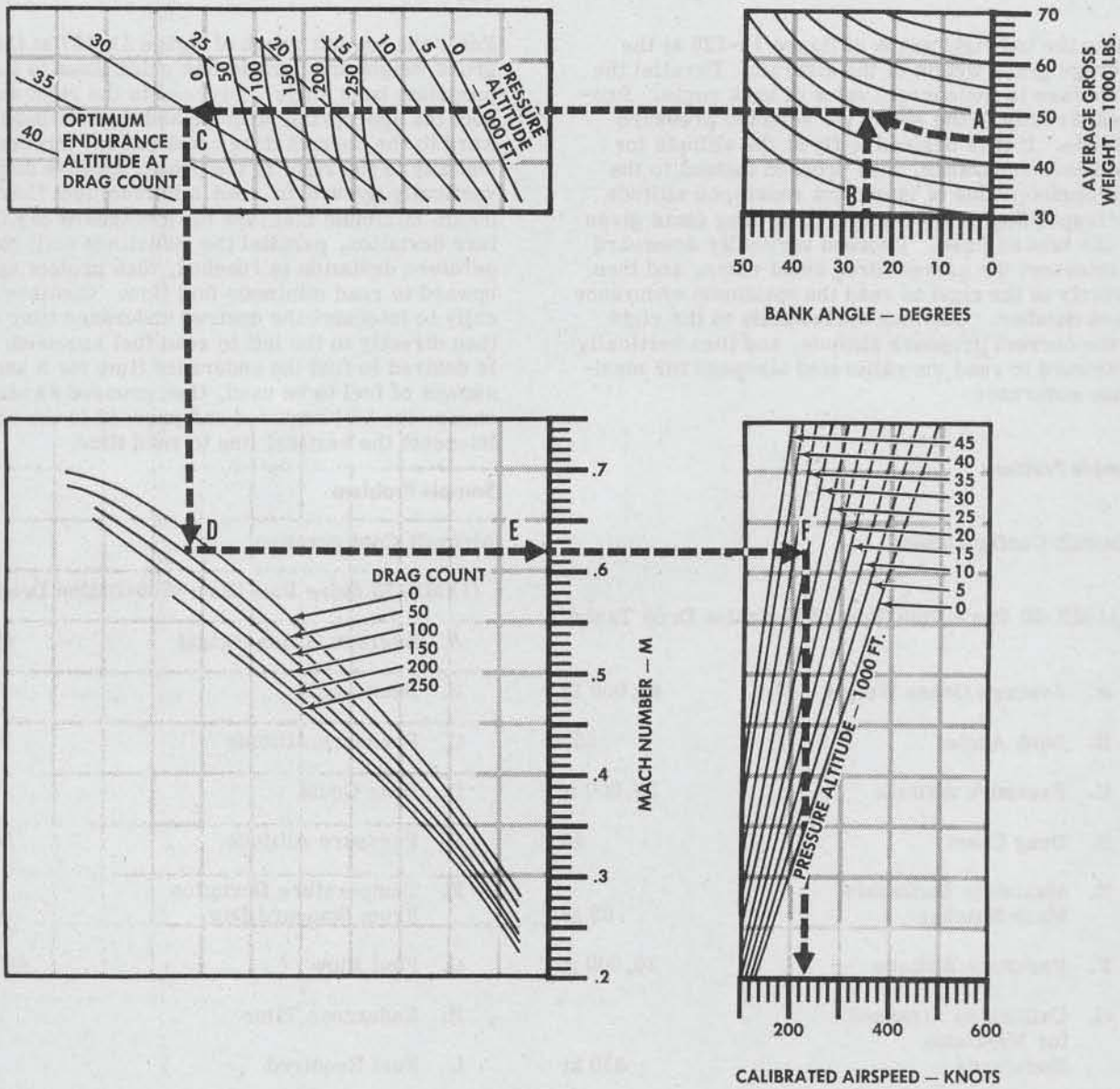
P-8 ENGINE

SPEED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-376

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Figure 11-126

MAXIMUM ENDURANCE

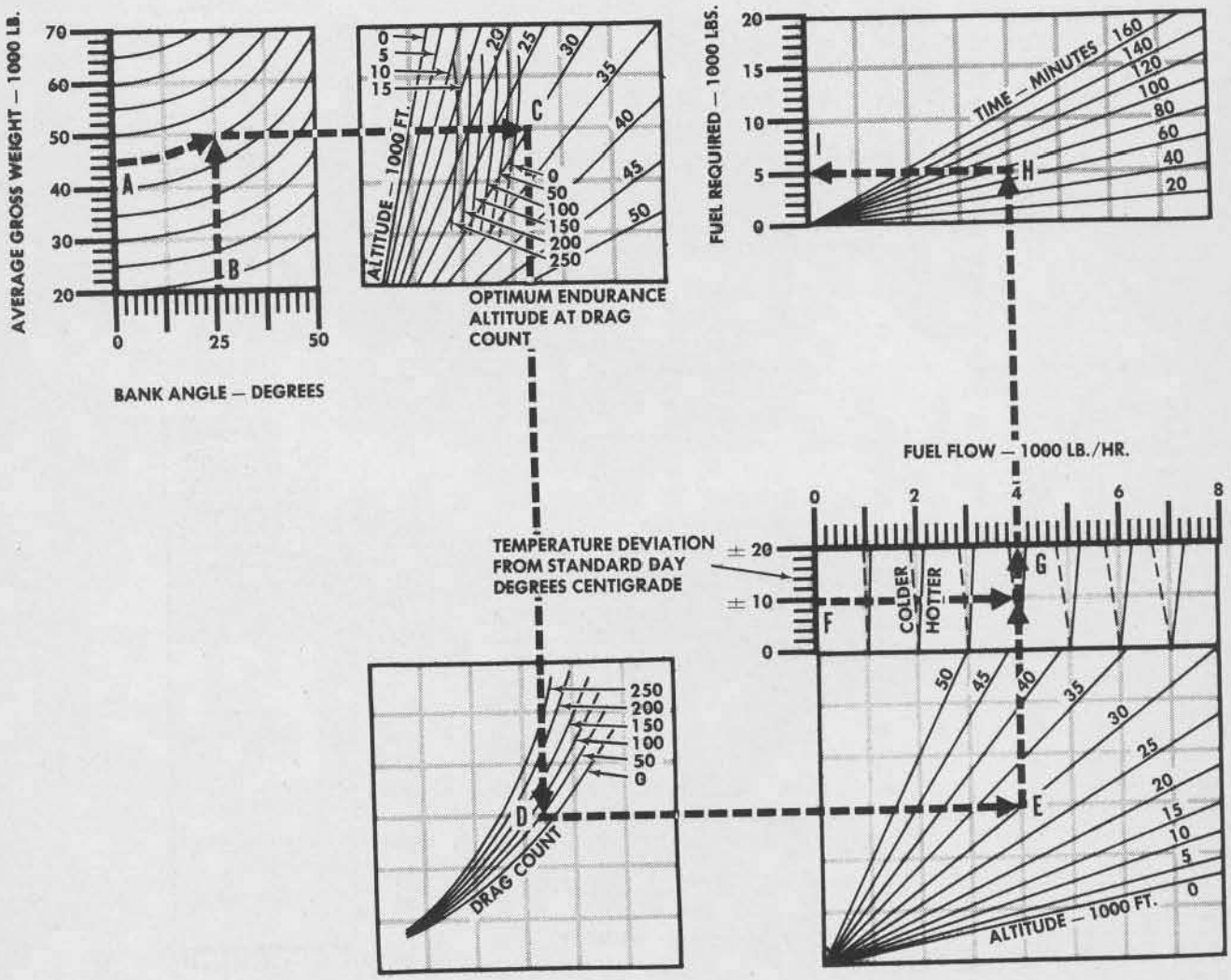
P-8 ENGINE

FUEL REQUIRED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-377

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Figure 11-127

AIRSPEED AT CRUISE ALTITUDE

Figure 11-128 provides a plot of airspeed against gross weight for 3 angles of attack at cruise altitude.

USE

Enter the left side of the chart at the gross weight, proceed horizontally to the angle of attack reflector line and project downward vertically to read airspeed KCAS.

AIRSPEED AT CRUISE ALTITUDE

DATE: 1 AUGUST 1974
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

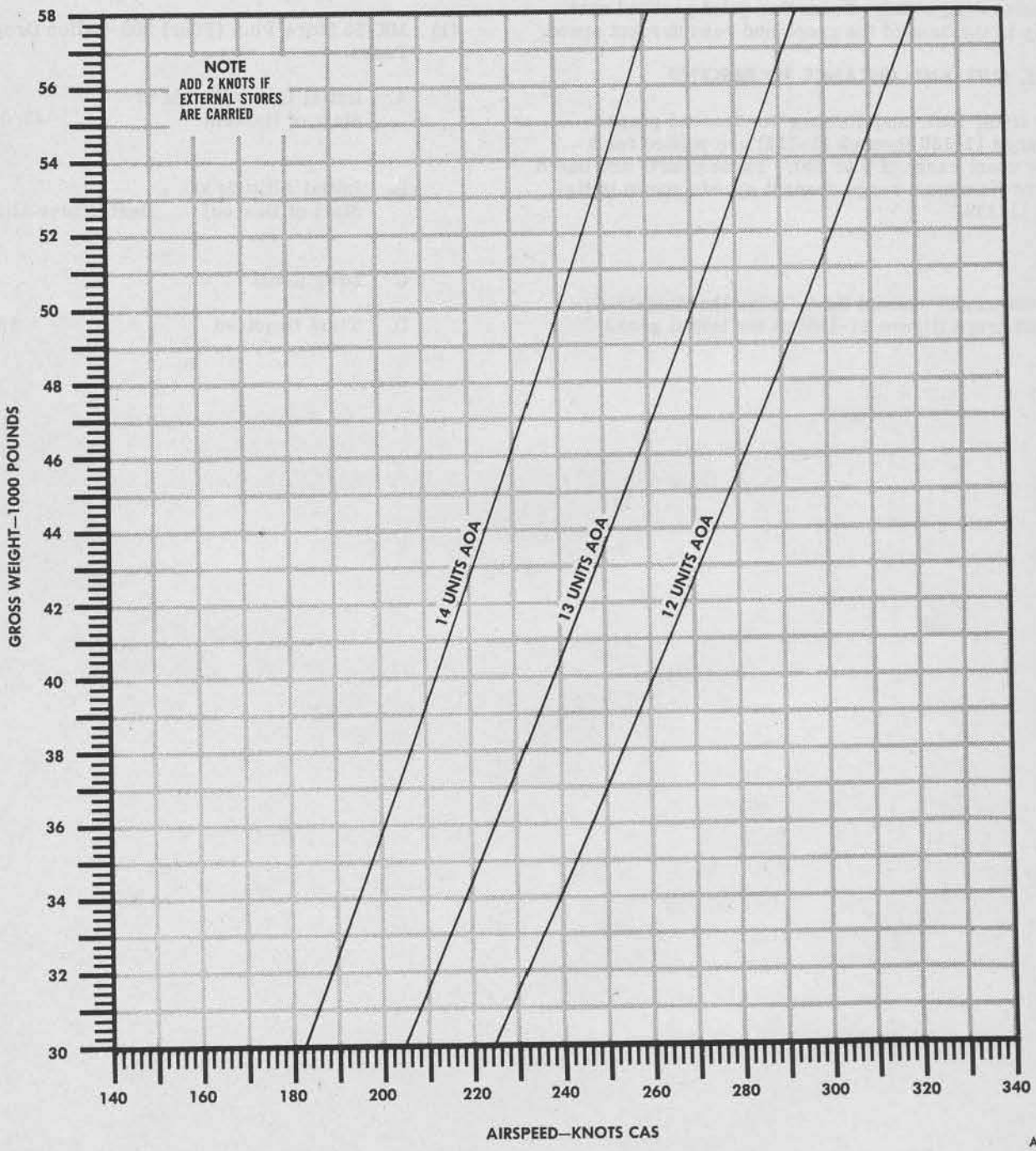

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Figure 11-128

MAXIMUM RANGE DESCENT

DESCENT SPEEDS

The maximum range descent speed is a plot of calibrated airspeed vs. gross weight for drag count ranging from 0 to 250.

USE

Enter the chart (figure 11-129) at the gross weight at start of descent and proceed horizontally to the applicable drag count. From this point proceed vertically to the base of the graph and read descent speed.

TIME, FUEL AND DISTANCE TO DESCEND

The time, fuel, and distance-to-descend graphs (figures 11-130 through 11-132) are plotted for a drag count range of 0 to 250. These charts are based on the maximum range descent speeds shown in figure 11-129.

USE

To determine descent time, enter the time-to-descend graph (figure 11-130) at the initial gross weight of the aircraft at start of descent or, if desired, the optimum cruise altitude reflector line, and project vertically to the appropriate drag count reflector line in the bottom graph. From this point, proceed horizontally to the left scale of the bottom graph and read time to descend to sea level. The above procedure can be used to determine the fuel required to descend (figure 11-131) and the distance traveled to descend (figure 11-132).

Sample Problem

Aircraft Configuration (Figure 11-130):

(1) MK-28 Store Plus (Four) 300-Gallon Drop Tanks.

A.	Initial Gross Weight at Start of Descent	45,000 lb
B.	Initial Altitude at Start of Descent	Best Cruise Altitude
C.	Drag Count	48
D.	Time Required	16 min

MAXIMUM RANGE DESCENT

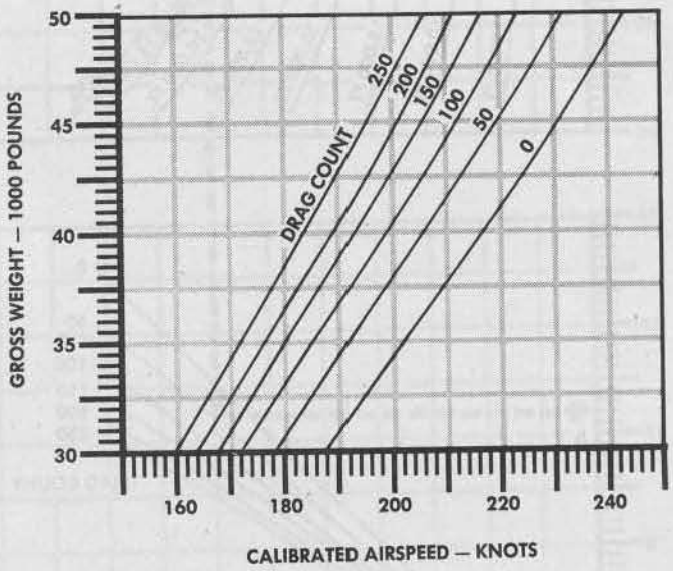
P-8 ENGINE

DESCENT SPEED
IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-385

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Figure 11-129

MAXIMUM RANGE DESCENT

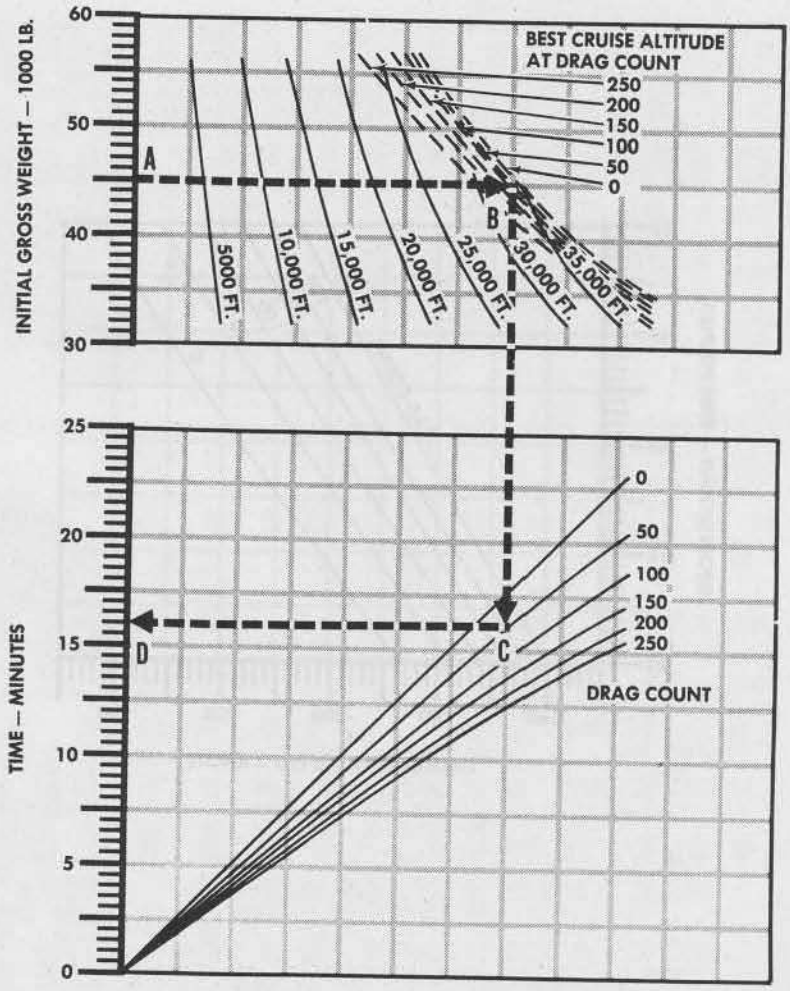
P-8 ENGINE

TIME REQUIRED TO DESCEND FROM SELECTED ALTITUDE TO SEA LEVEL IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-386

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Figure 11-130

MAXIMUM RANGE DESCENT

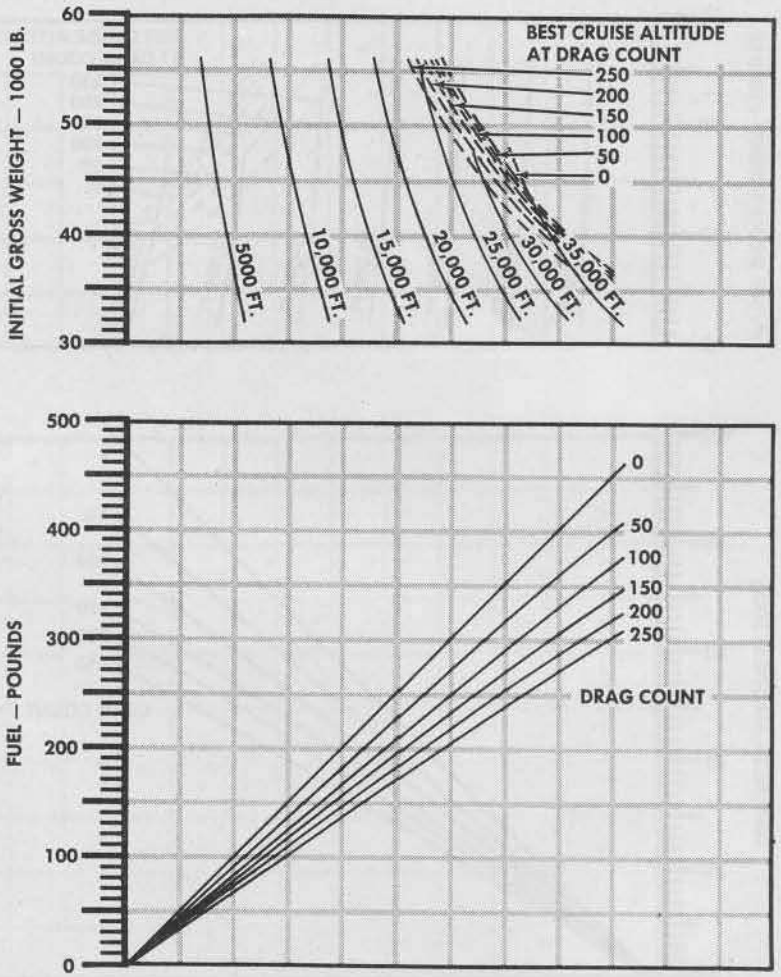
P-8 ENGINE

FUEL REQUIRED TO DESCEND FROM SELECTED ALTITUDE TO SEA LEVEL IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-387

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Figure 11-131

MAXIMUM RANGE DESCENT

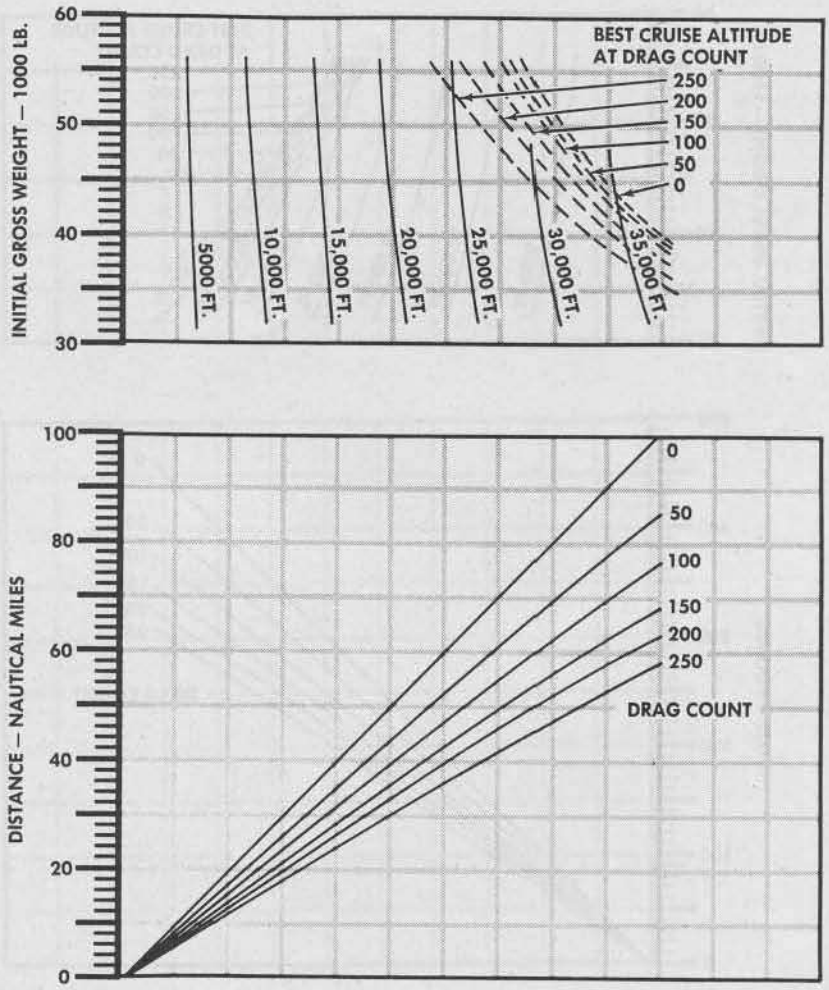
P-8 ENGINE

DISTANCE REQUIRED TO DESCEND FROM SELECTED ALTITUDE TO SEA LEVEL IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-388

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Figure 11-132

MILITARY POWER CLIMB (single engine)

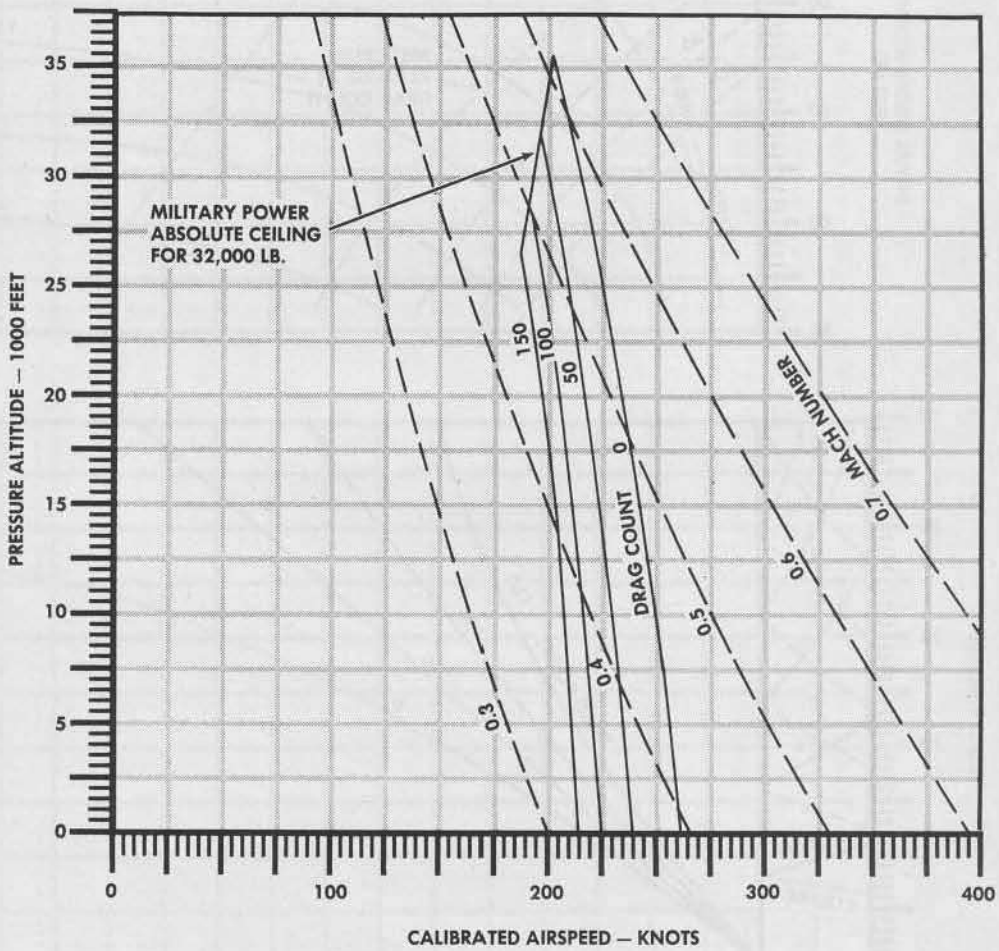
P-8 ENGINE

CLIMB SPEED SCHEDULE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-353

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Figure 11-133

MILITARY POWER CLIMB (single engine)

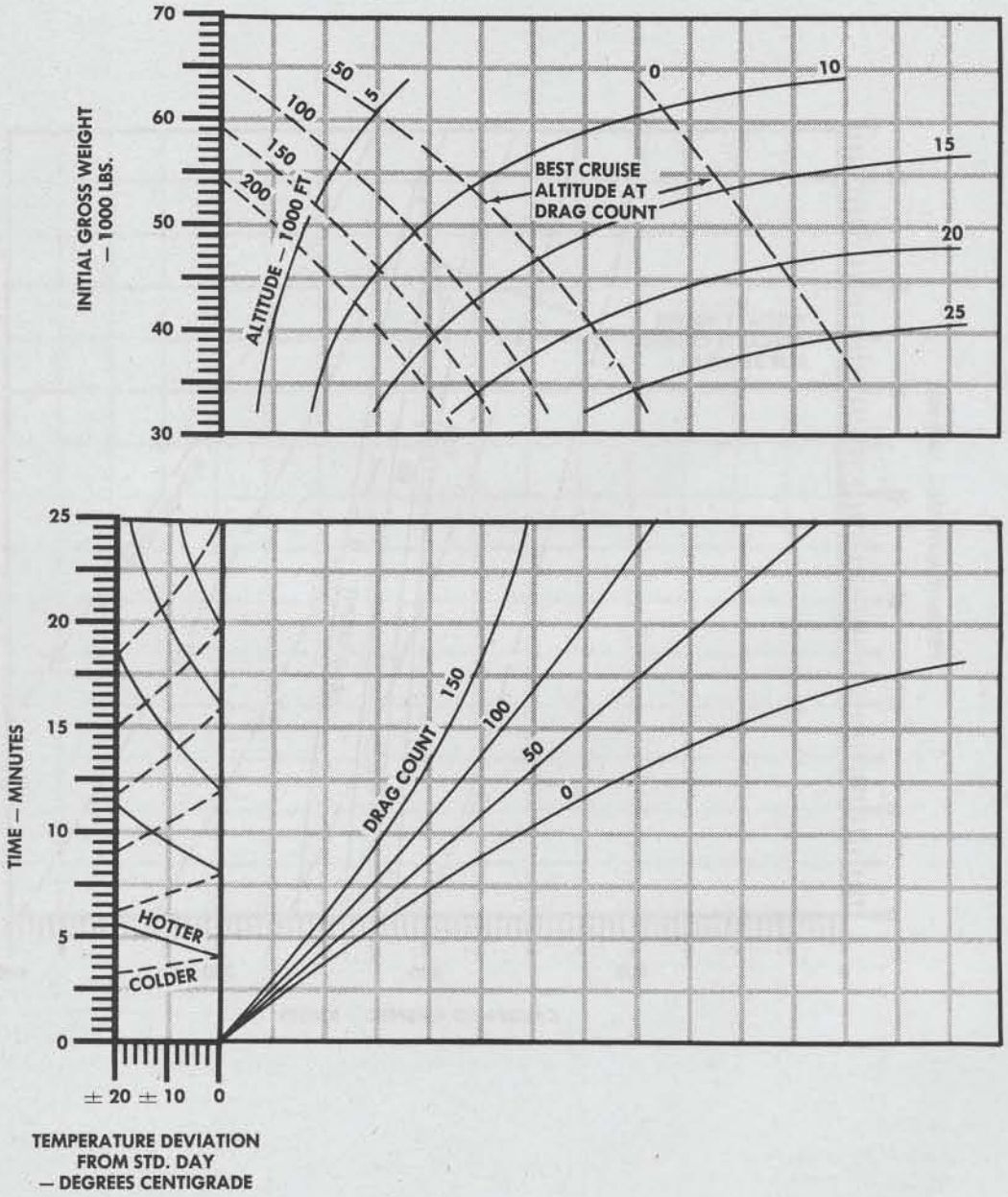
P-8 ENGINE

TIME REQUIRED TO CLIMB FROM SEA LEVEL TO SELECTED ALTITUDE (DATA CORRESPONDS TO CLIMB SPEED SCHEDULE)

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-354

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Figure 11-134

MILITARY POWER CLIMB (single engine)

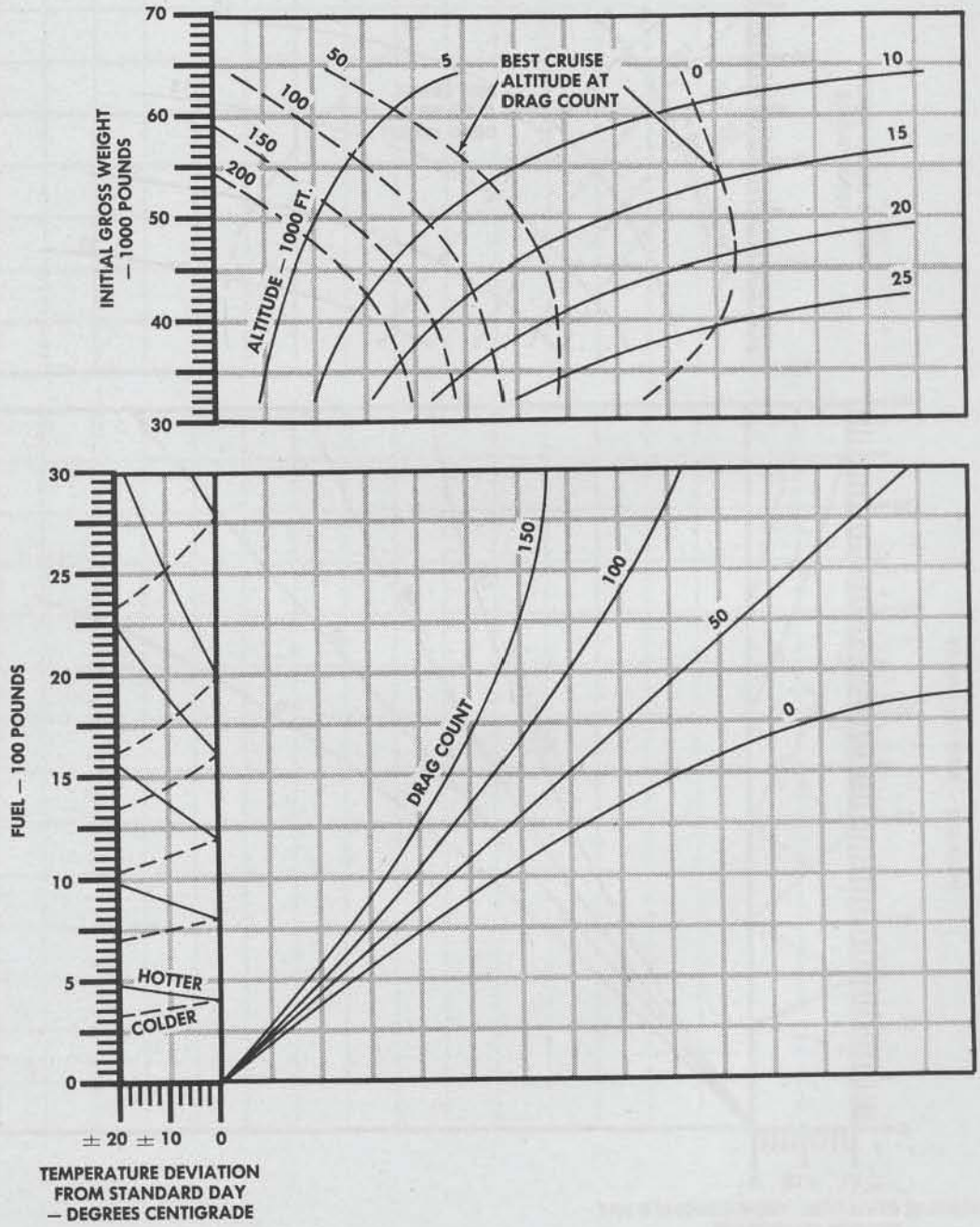
P-8 ENGINE

FUEL REQUIRED TO CLIMB FROM SEA LEVEL TO SELECTED ALTITUDE (DATA CORRESPONDS TO CLIMB SPEED SCHEDULE)

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-355

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Figure 11-135

MILITARY POWER CLIMB (single engine)

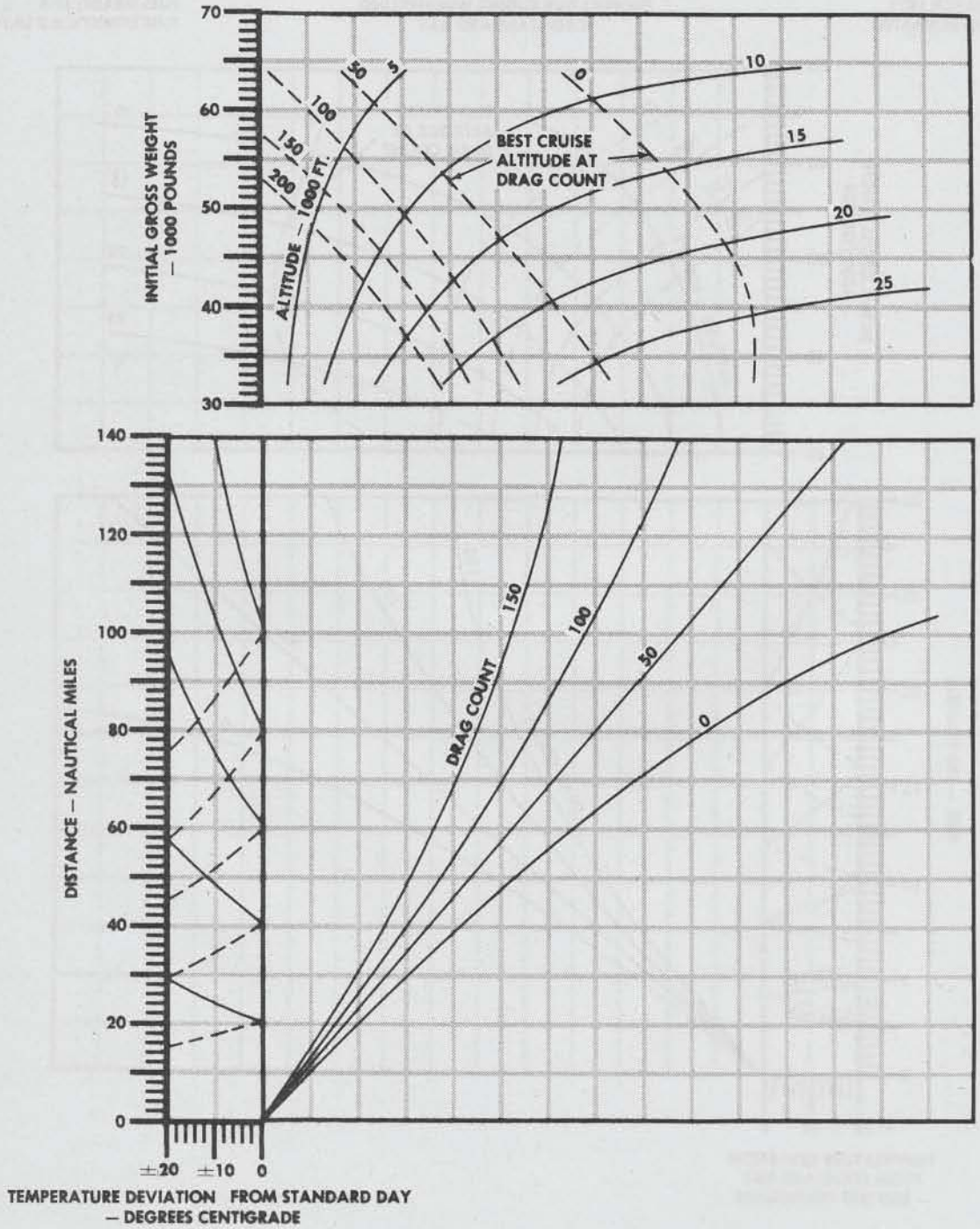
P-8 ENGINE

DISTANCE REQUIRED TO CLIMB FROM SEA LEVEL TO SELECTED ALTITUDE (DATA CORRESPONDS TO CLIMB SPEED SCHEDULE)

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-356

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Figure 11-136

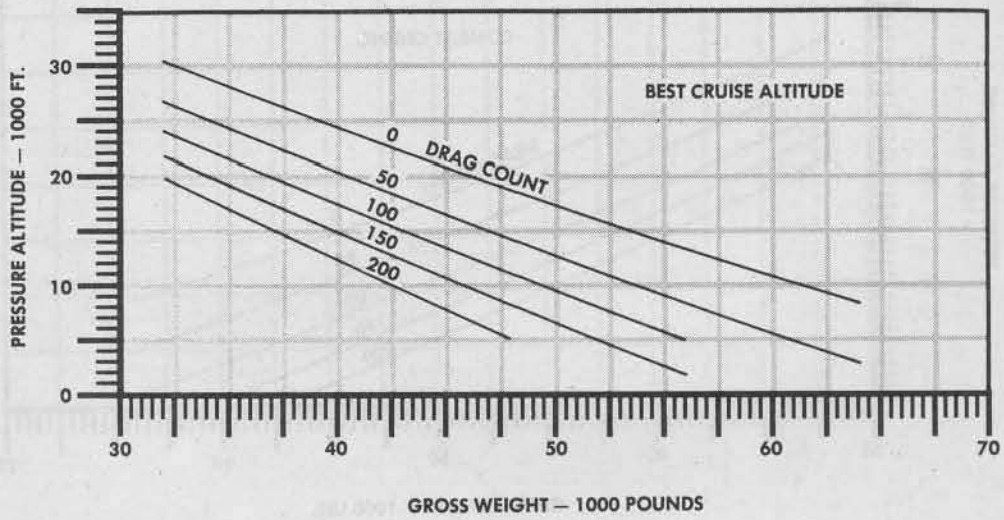
BEST CRUISE ALTITUDE AND OPTIMUM ENDURANCE ALTITUDE (single engine)

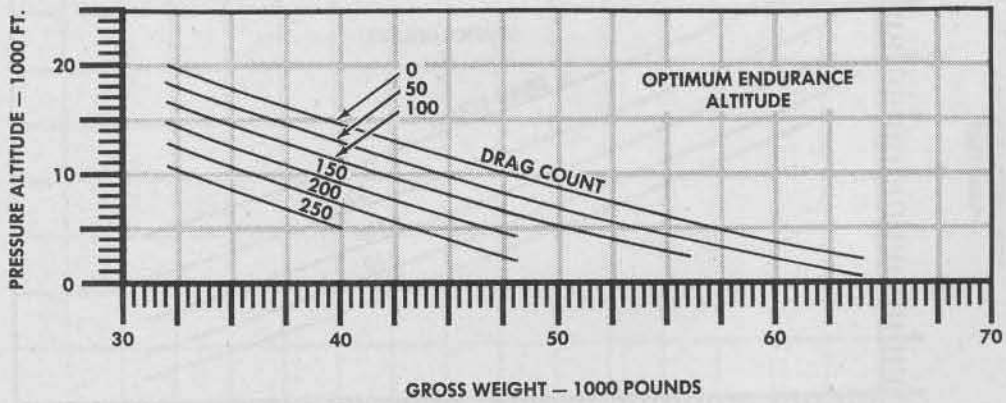
P-8 ENGINE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-320

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Figure 11-137

COMBAT CEILING AND SERVICE CEILING (single engine)

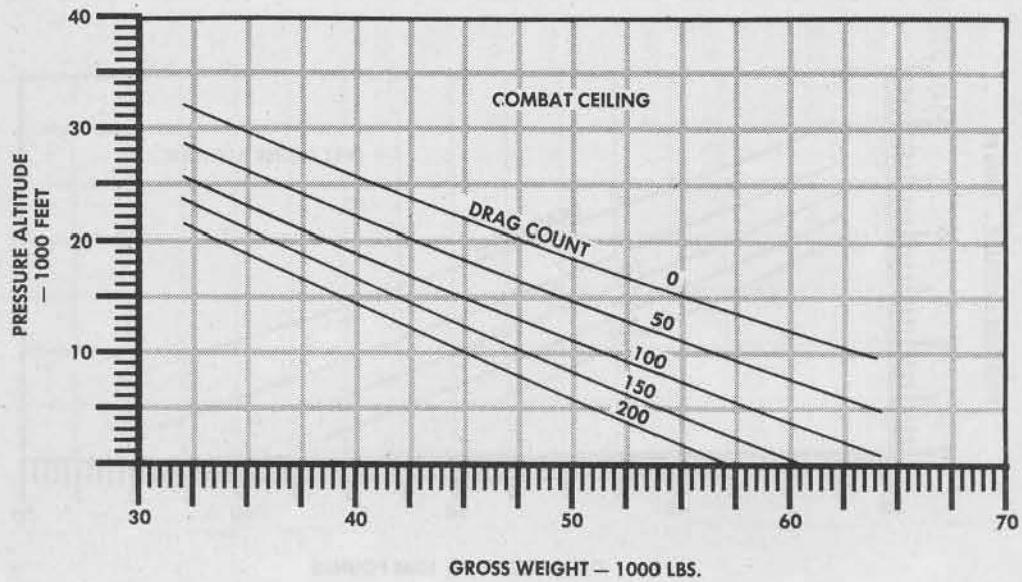
P-8 ENGINE

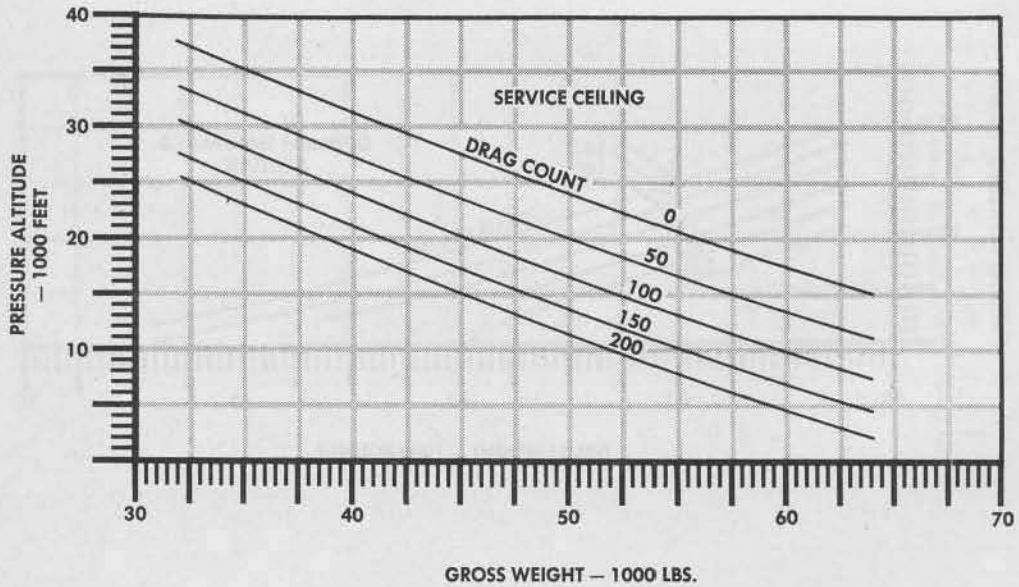
MILITARY POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-371

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Figure 11-138

CRUISE PERFORMANCE (single engine)

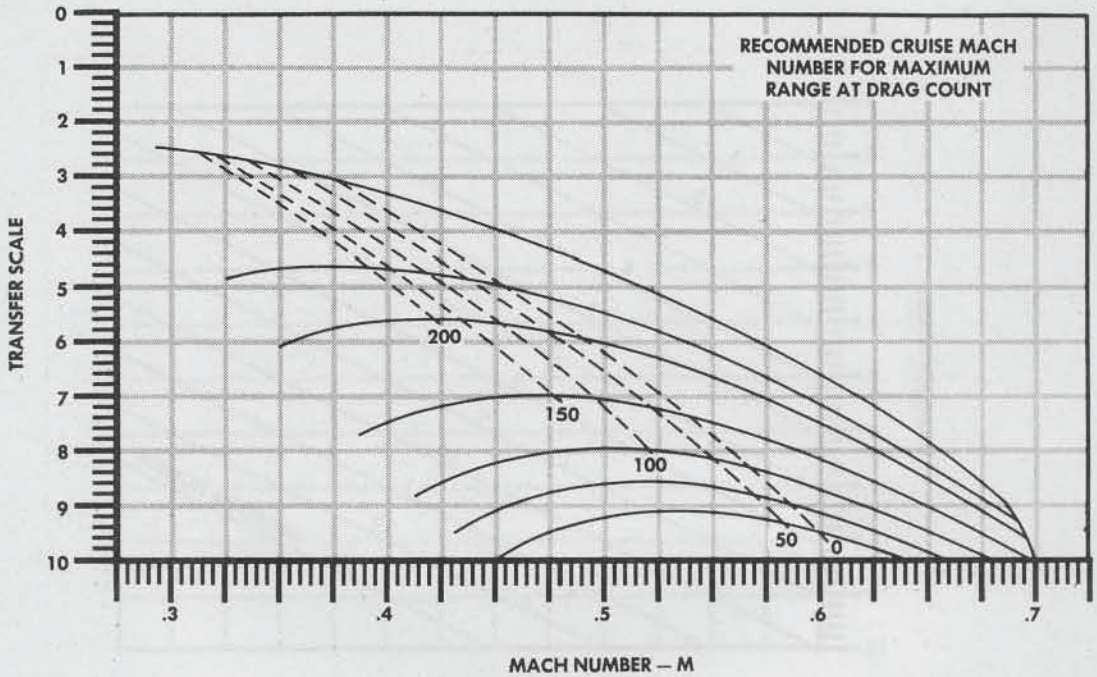
P-8 ENGINE

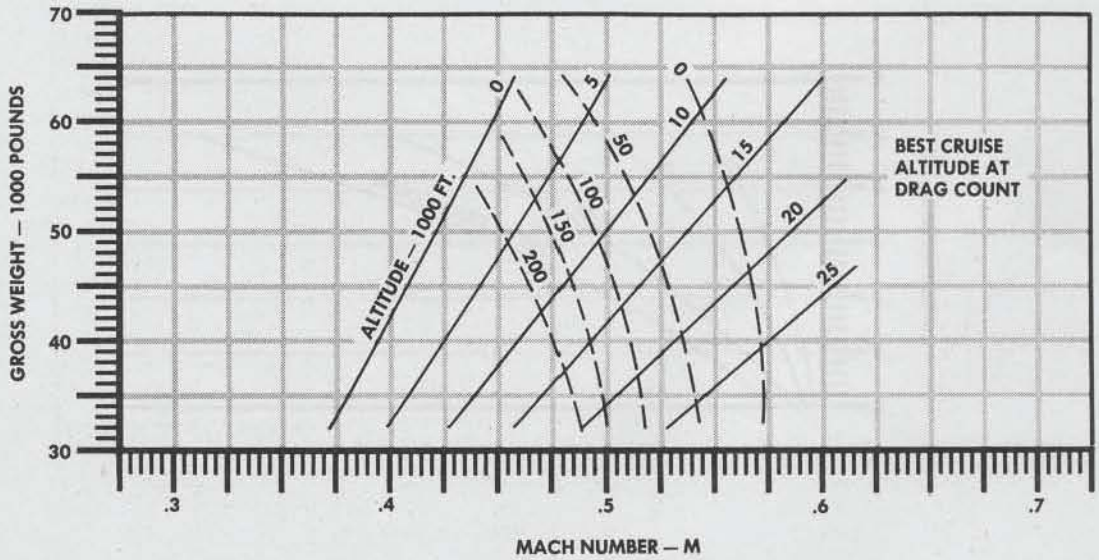
PHASE I – CLEAN AIRCRAFT TRANSFER SCALE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-315

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Figure 11-139

CRUISE PERFORMANCE (single engine)

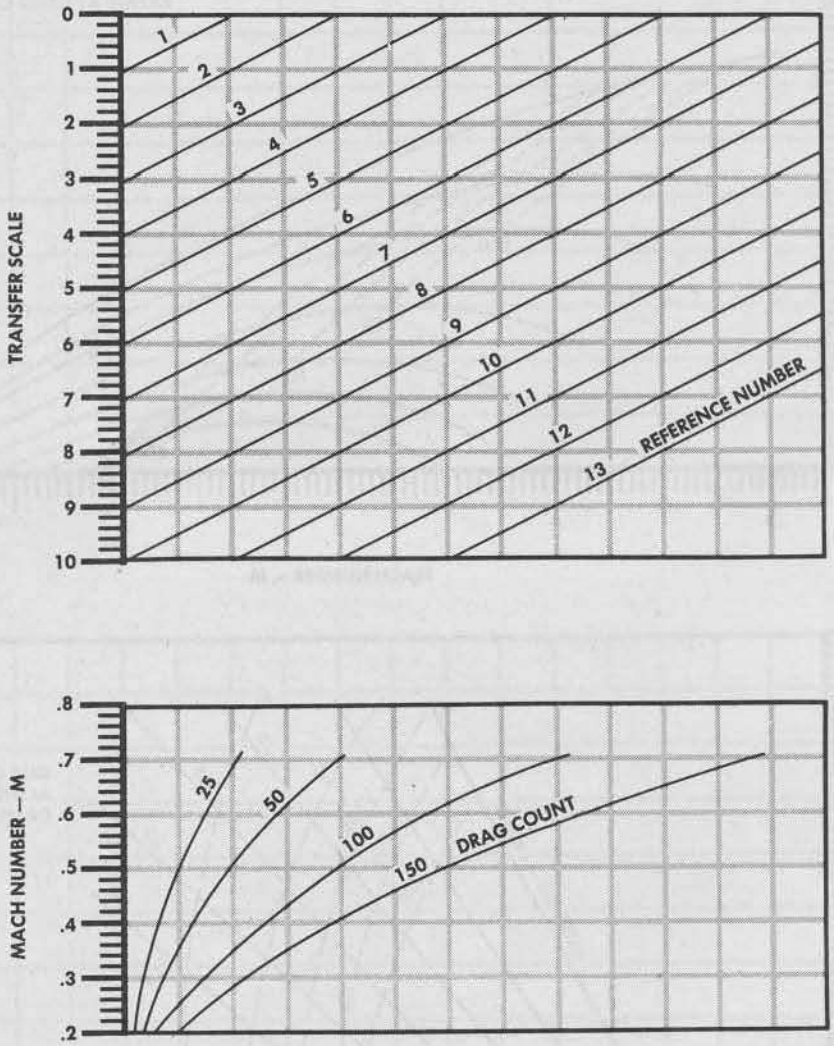
P-8 ENGINE

PHASE II – AIRCRAFT REFERENCE NUMBER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-316

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Figure 11-140

CRUISE PERFORMANCE (single engine)

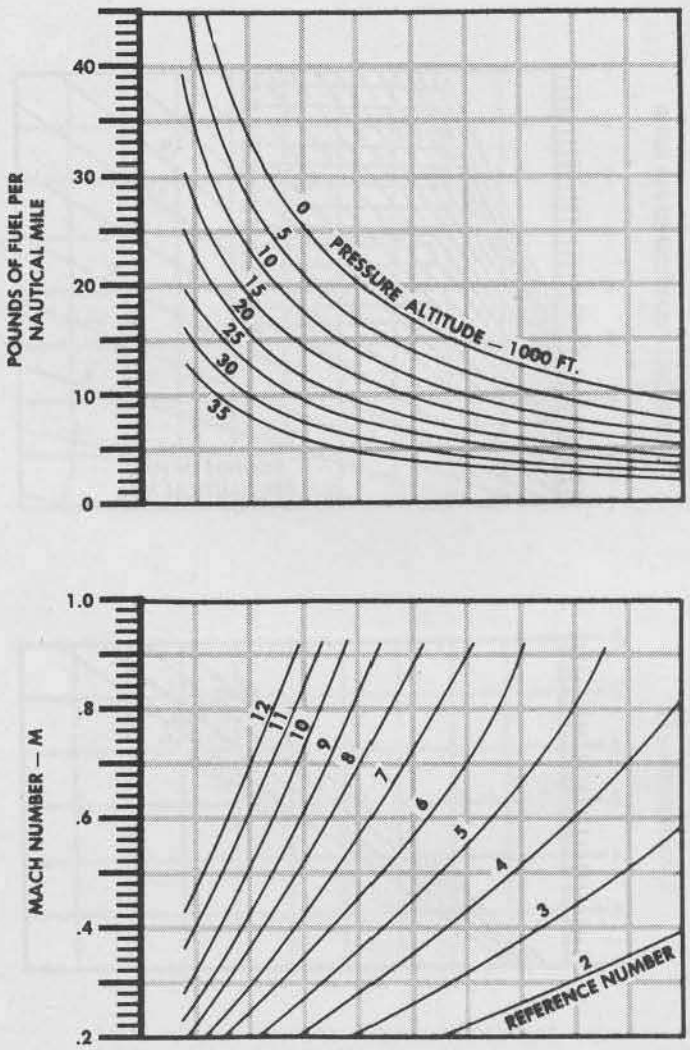
P-8 ENGINE

PHASE III – POUNDS OF FUEL PER NAUTICAL MILE

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-317

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Figure 11-141

CRUISE PERFORMANCE (single engine)

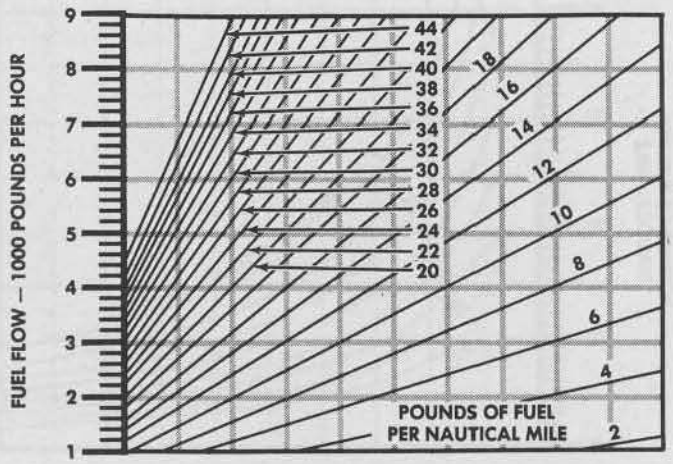
P-8 ENGINE

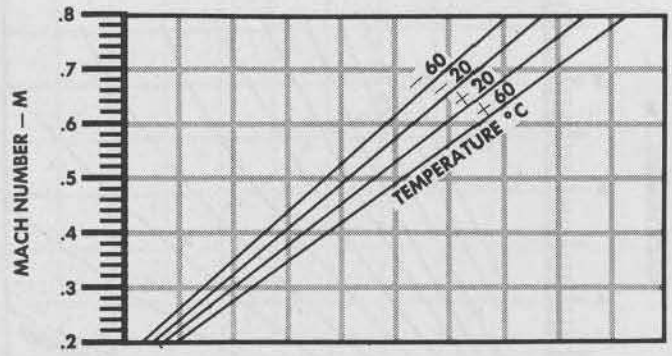
PHASE IV – FUEL FLOW

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-318

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Figure 11-142

MAXIMUM RANGE CRUISE AT CONSTANT ALTITUDE (single engine)

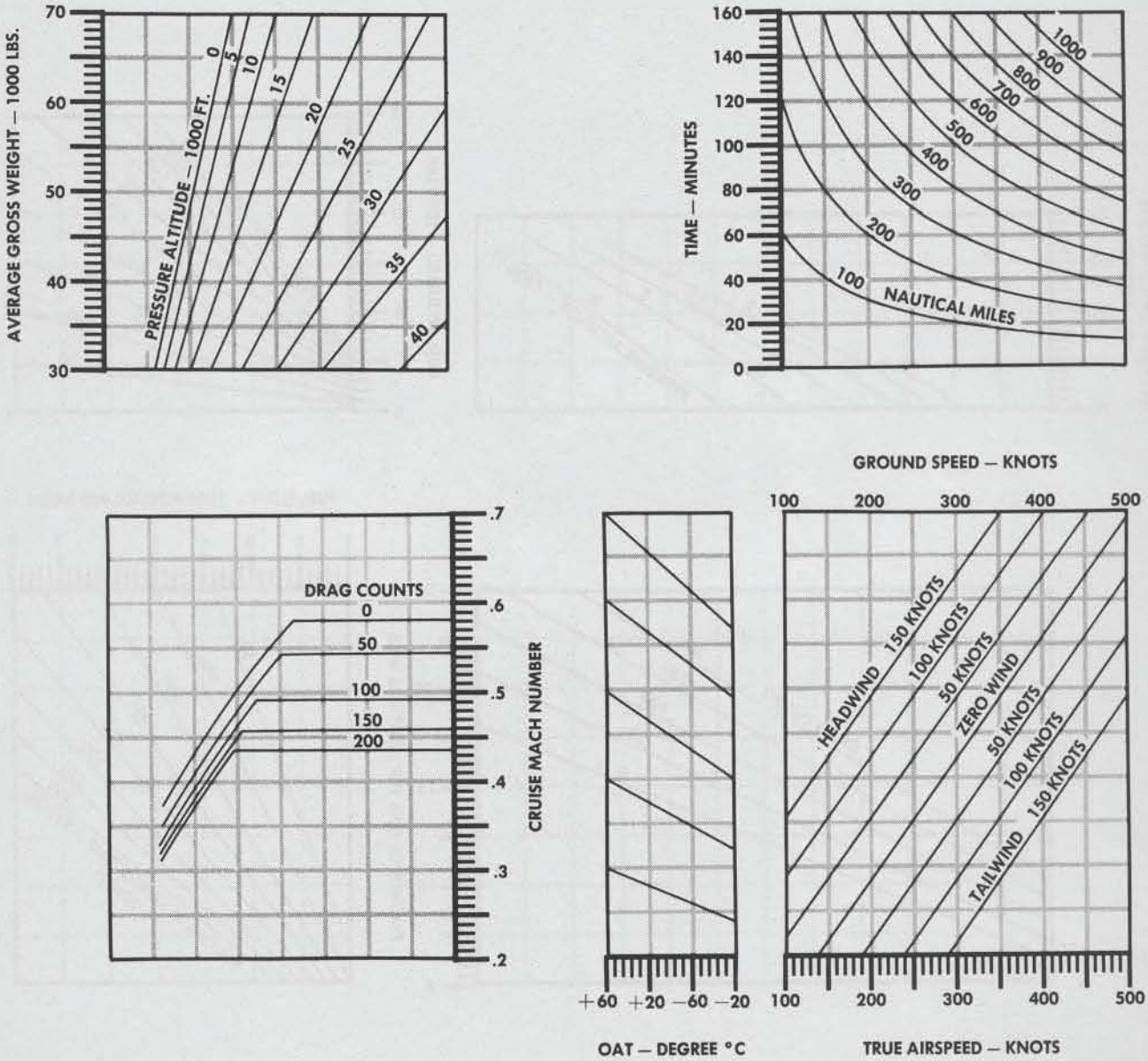
P-8 ENGINE

TIME AND SPEED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-374

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Figure 11-143

MAXIMUM RANGE CRUISE AT CONSTANT ALTITUDE (single engine)

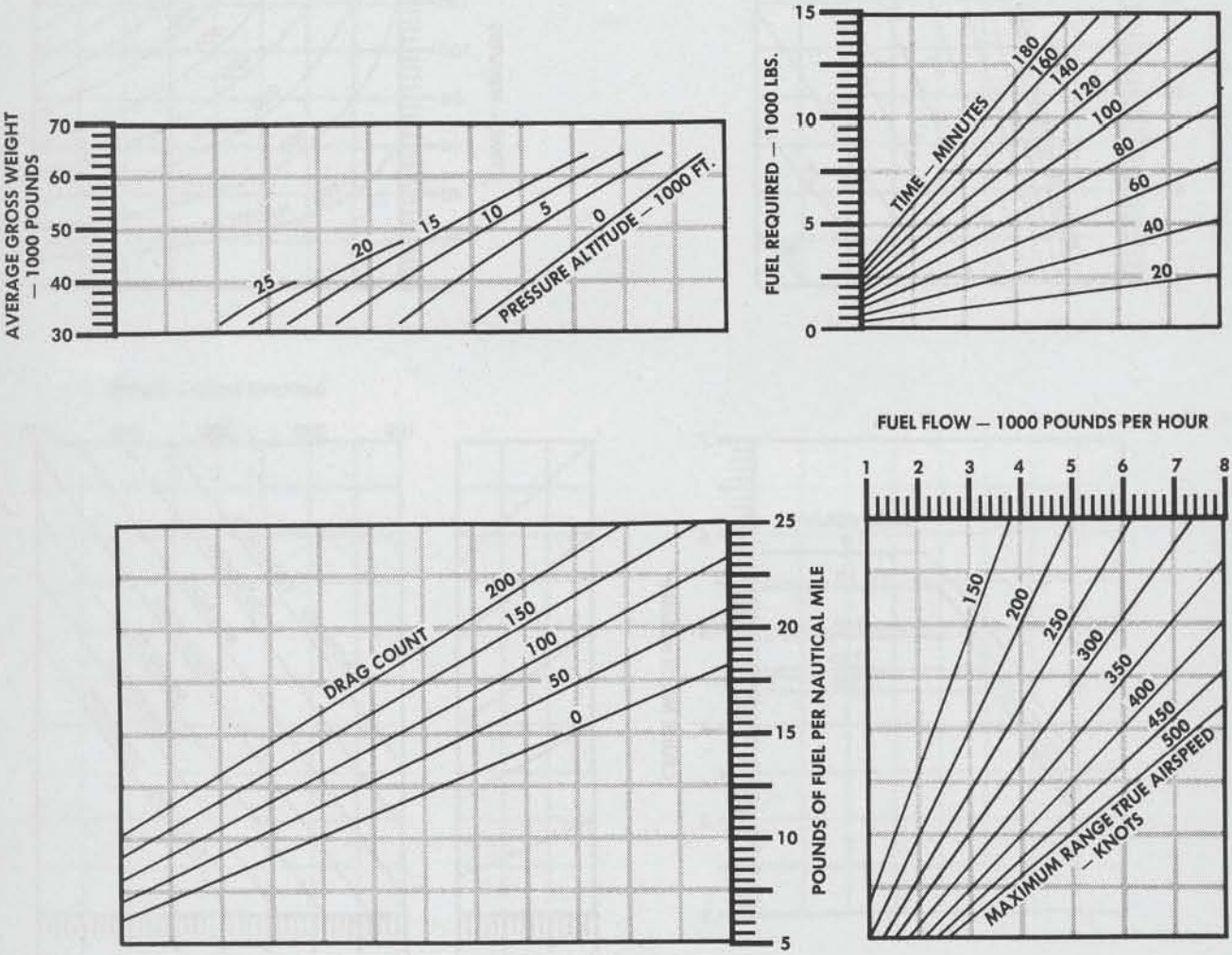
P-8 ENGINE

FUEL REQUIRED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-375

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Figure 11-144

MAXIMUM ENDURANCE (single engine)

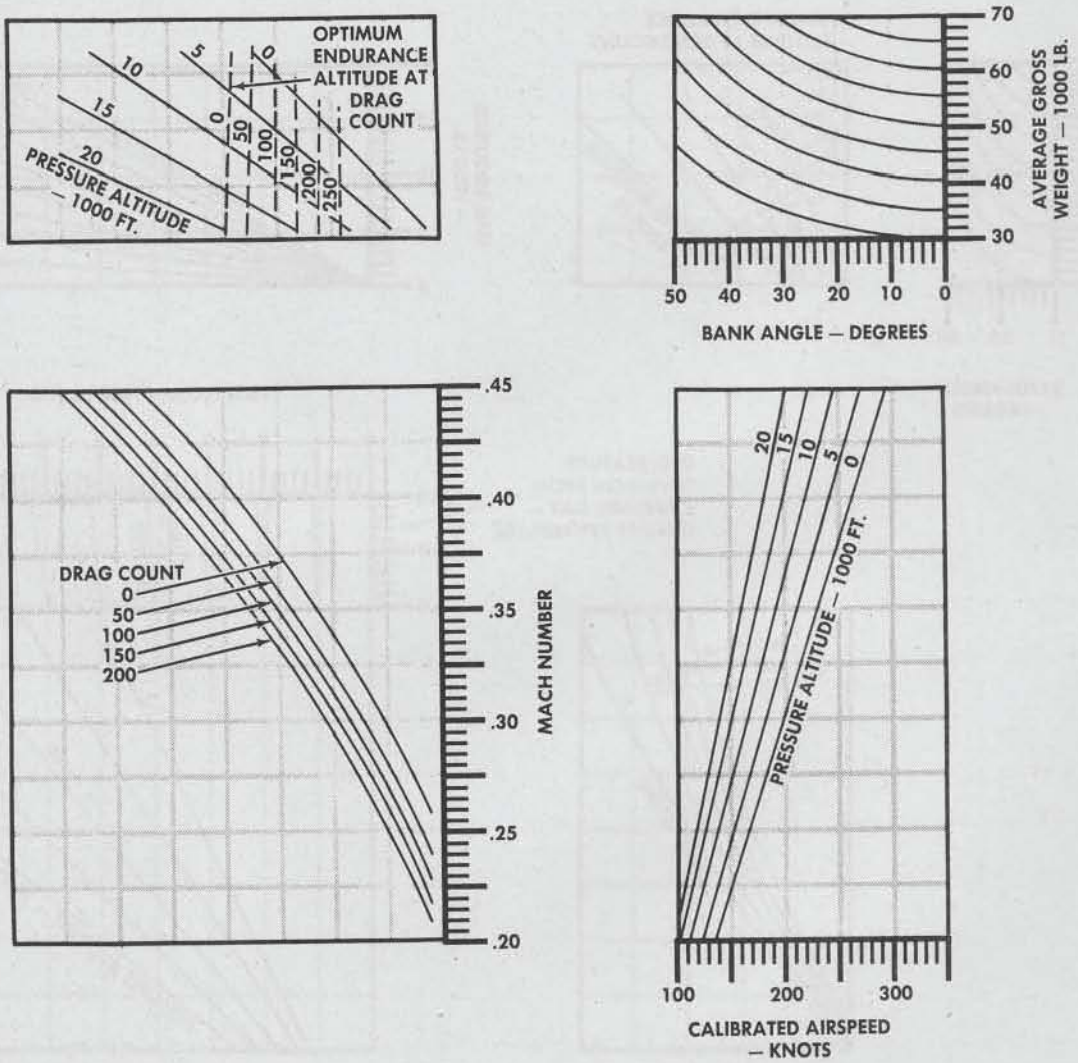
P-8 ENGINE

SPEED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-378

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Figure 11-145

MAXIMUM ENDURANCE (single engine)

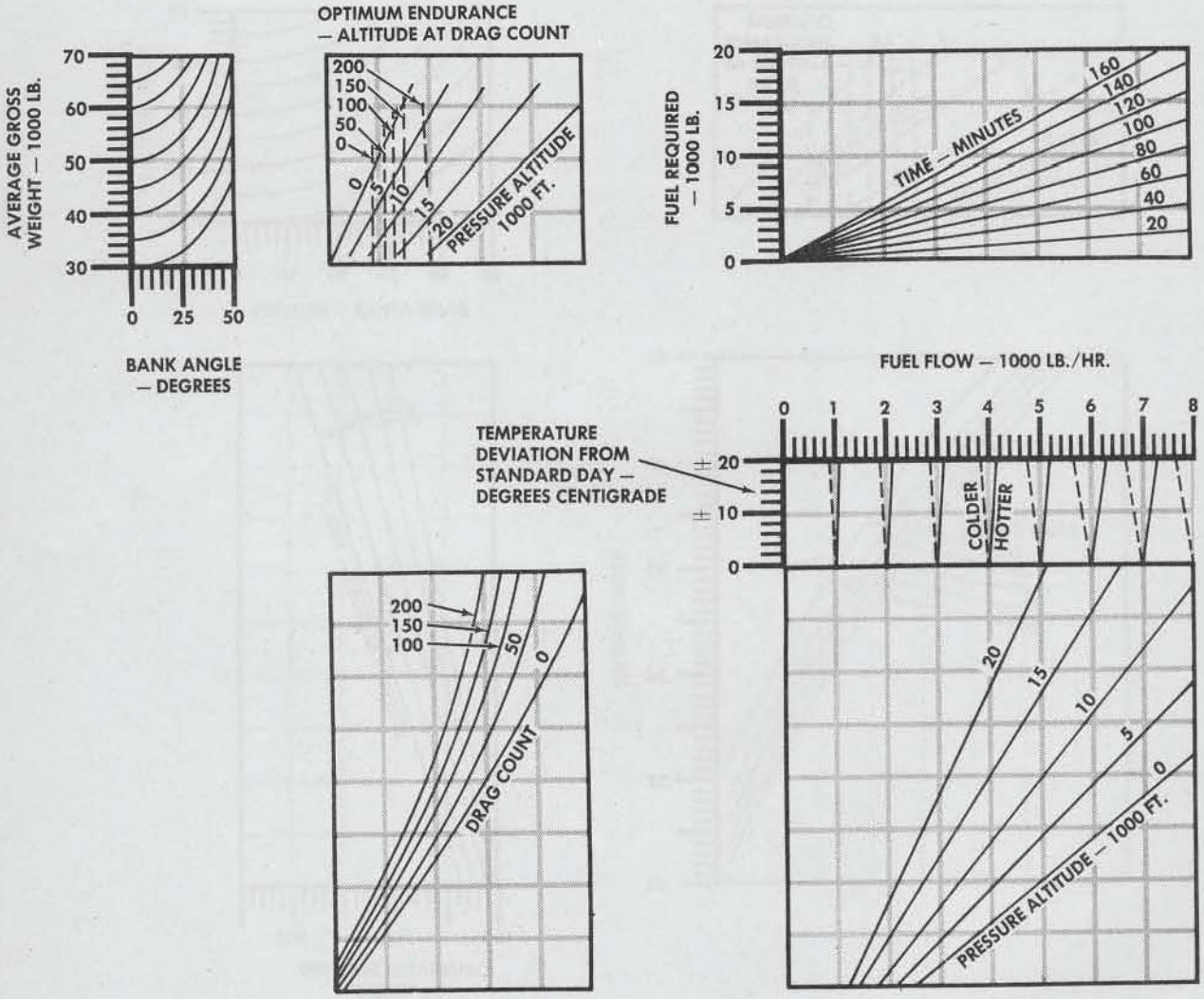
P-8 ENGINE

FUEL REQUIRED

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-379

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Figure 11-146

MAXIMUM RANGE DESCENT (single engine)

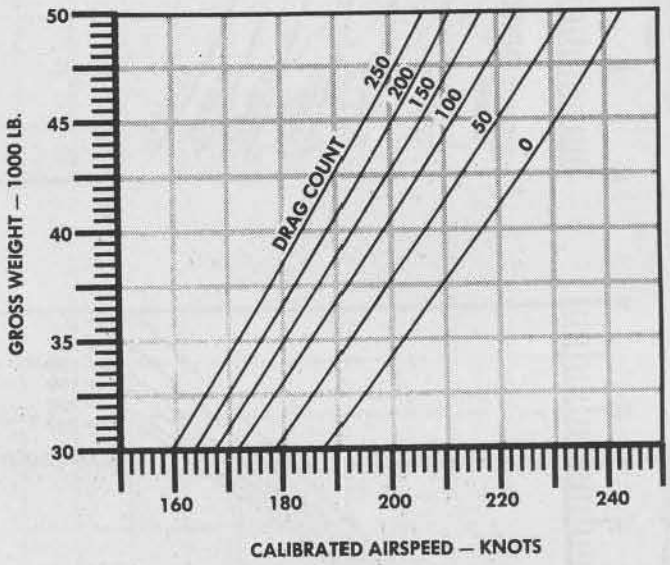
P-8 ENGINE

DESCENT SPEED
IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

ICAO STANDARD DAY
REMARKS

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-389

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Figure 11-147

MAXIMUM RANGE DESCENT (single engine)

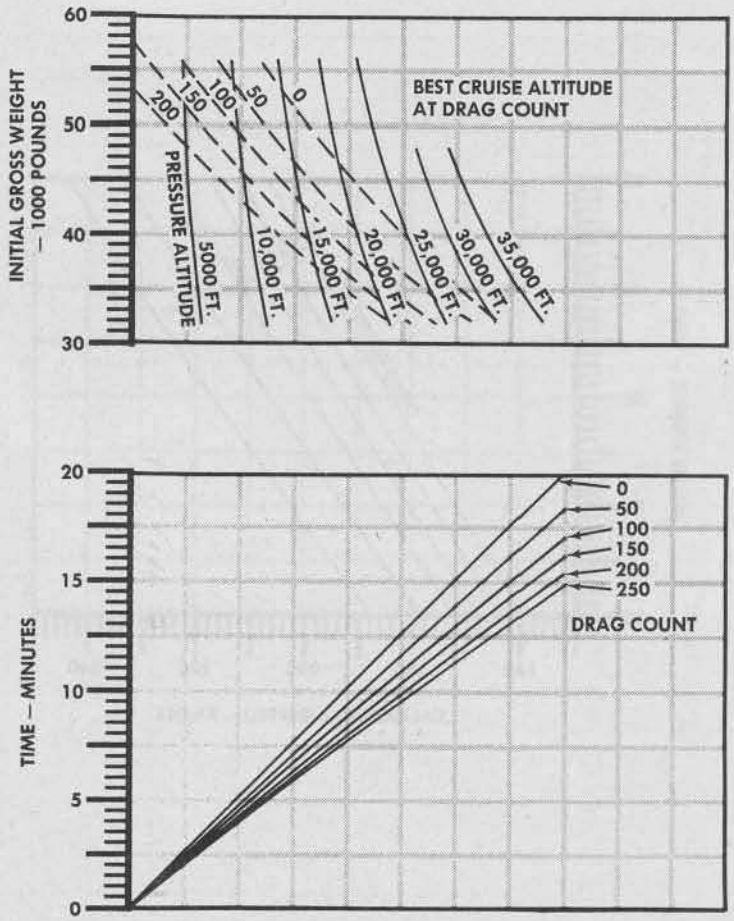
P-8 ENGINE

TIME REQUIRED TO DESCEND FROM SELECTED ALTITUDE TO SEA LEVEL IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-390

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Figure 11-148

MAXIMUM RANGE DESCENT (single engine)

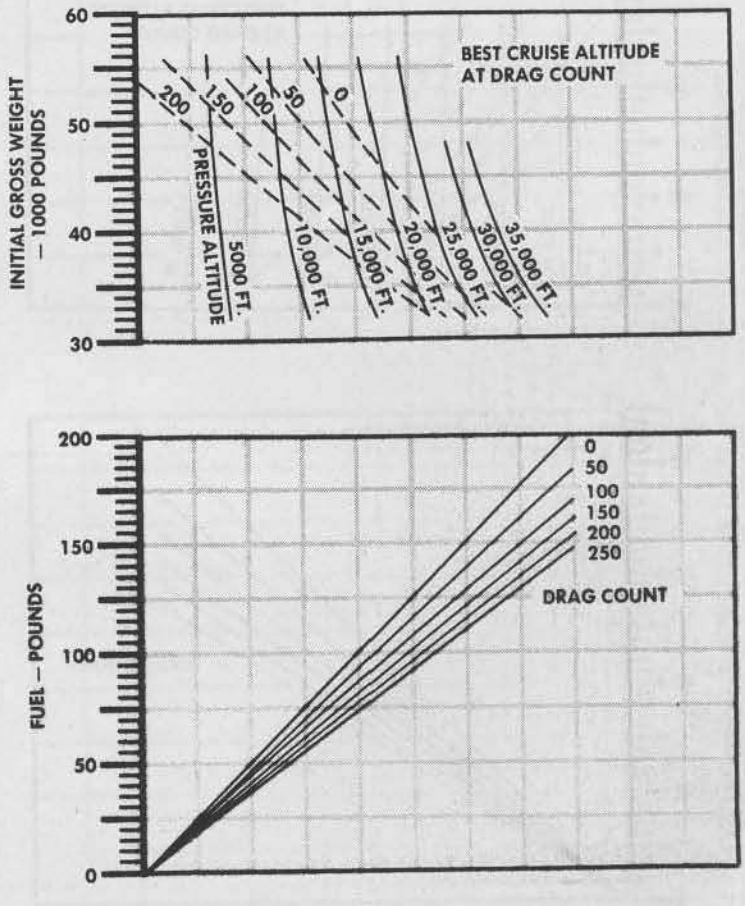
P-8 ENGINE

FUEL REQUIRED TO DESCEND FROM SELECTED ALTITUDE TO SEA LEVEL IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.



ADF1-391

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Figure 11-149

MAXIMUM RANGE DESCENT (single engine)

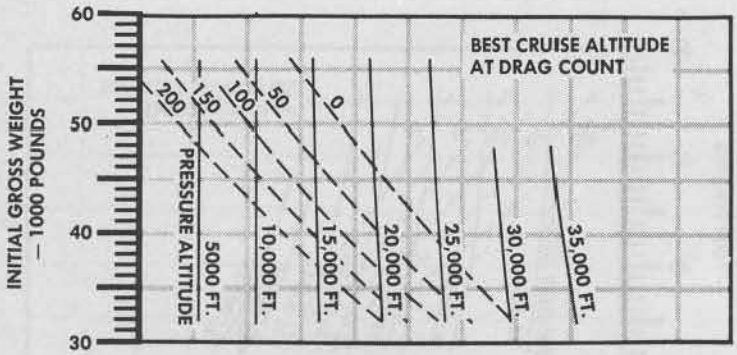
P-8 ENGINE

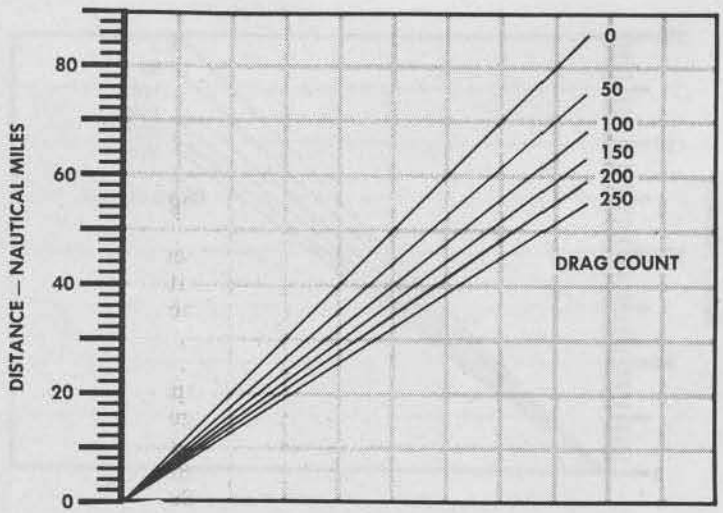
DISTANCE REQUIRED TO DESCEND FROM SELECTED ALTITUDE TO SEA LEVEL IDLE POWER

DATE 15 MARCH 1971
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-8
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB./GAL.





ADF1-392

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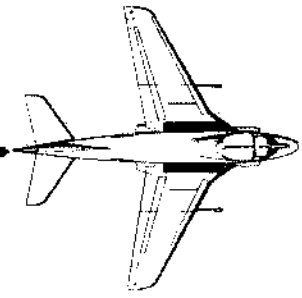
*U.S. GOVERNMENT PRINTING OFFICE: 1976-614-198/633

FOLDOUT ILLUSTRATIONS



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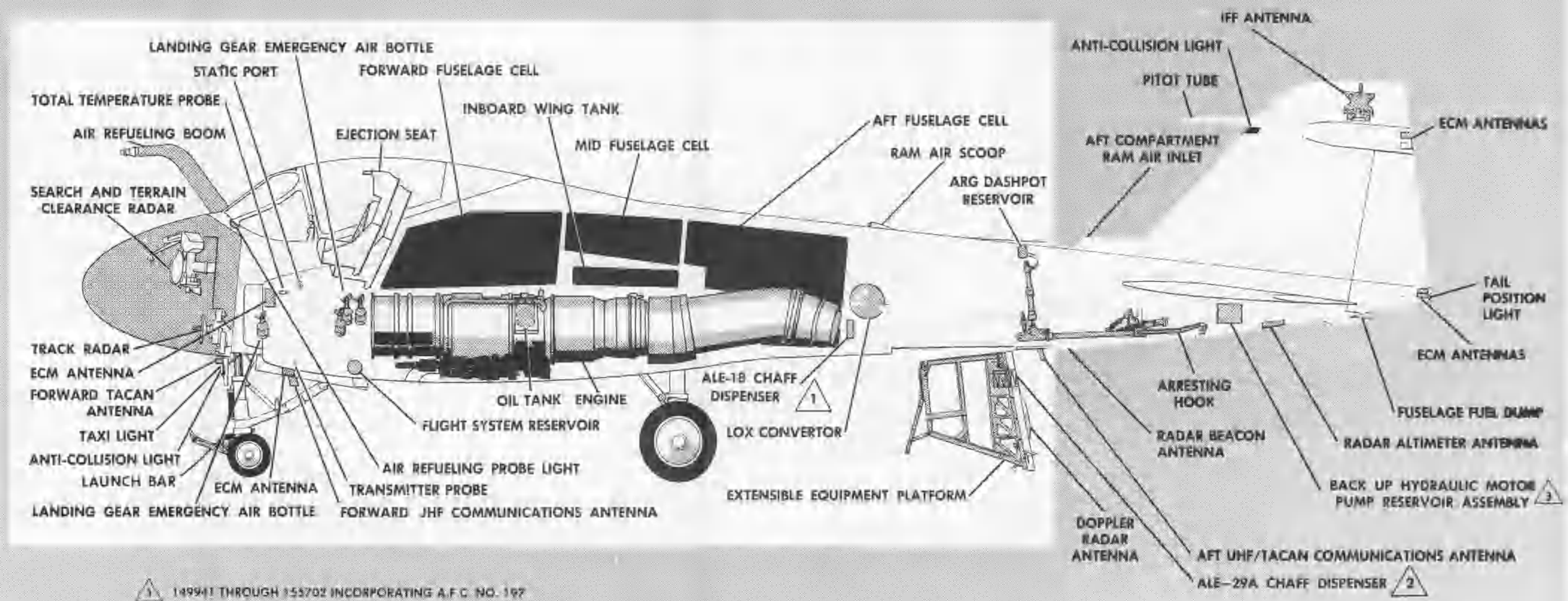
GENERAL ARRANGEMENT

A-6A/B/C TYPICAL



1 149941 THROUGH 155702 INCORPORATING A.F.C. NO. 197

2 155703 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 197

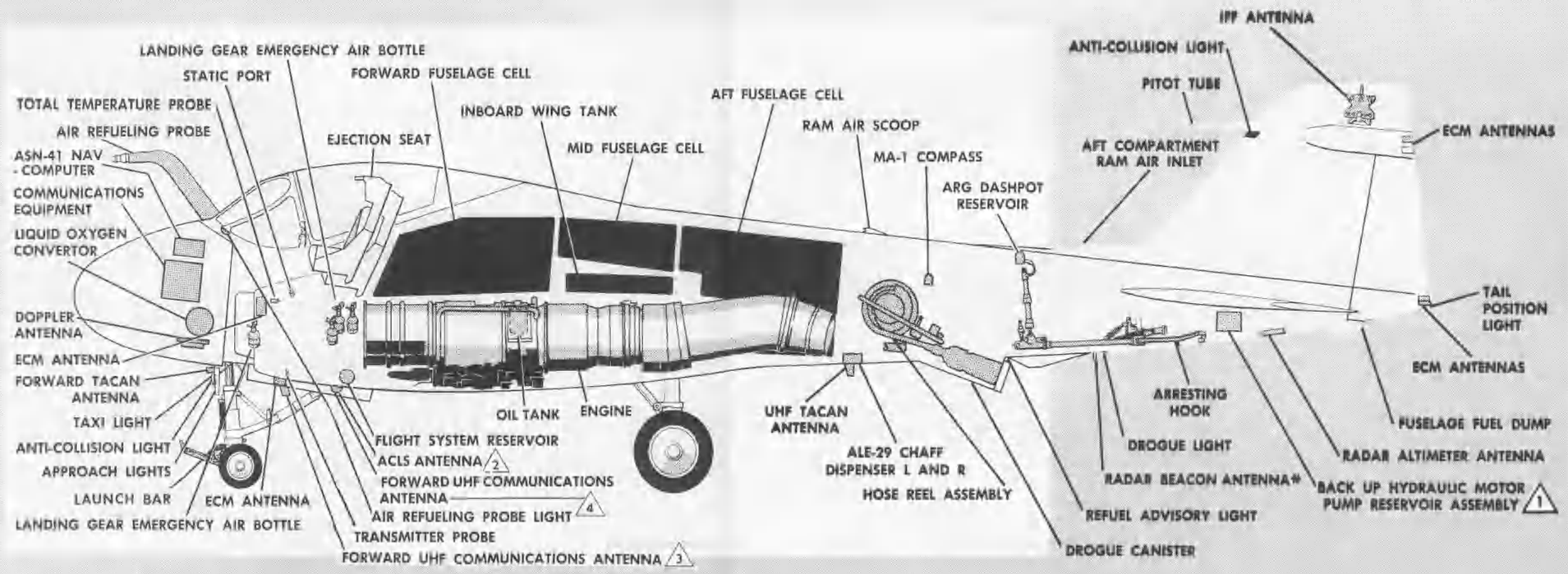
3 151570 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 183

© ADA1-716-1

Figure FO-1 (Sheet 1)

GENERAL ARRANGEMENT

KA-6D TYPICAL



1 AIRCRAFT INCORPORATING A.F.C. NO. 183

2 AIRCRAFT INCORPORATING A.F.C. NO. 230

3 AIRCRAFT NOT INCORPORATING A.F.C. NO. 161

4 AIRCRAFT INCORPORATING A.F.C. NO. 161

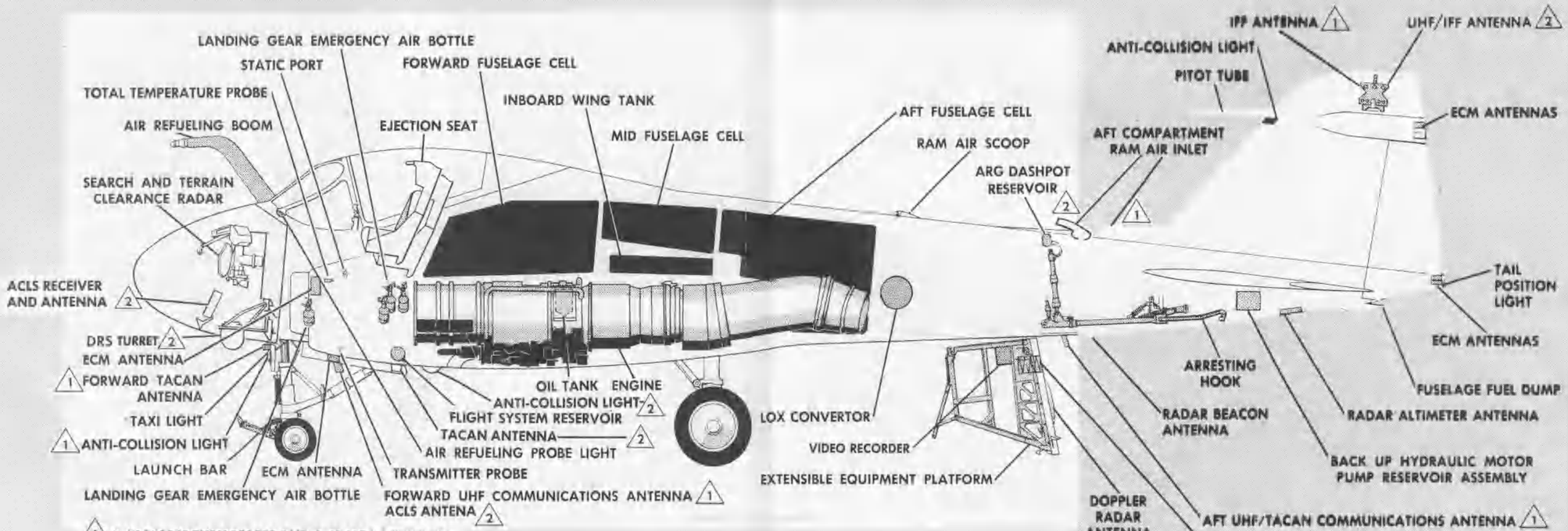
* ON RH. ENGINE DUCT IN AIRCRAFT 4

A-ADA1-716-2

Figure FO-1 (Sheet 2)

GENERAL ARRANGEMENT

A-6E TYPICAL



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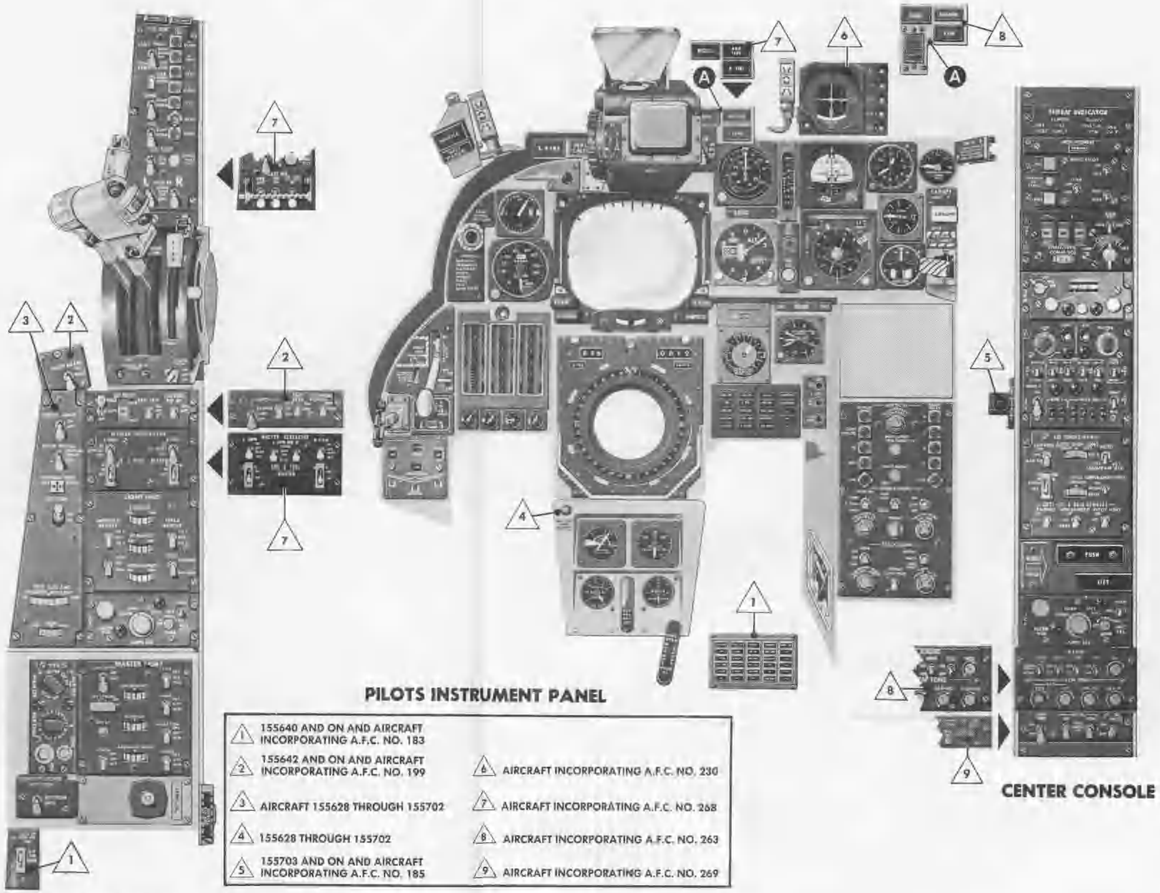

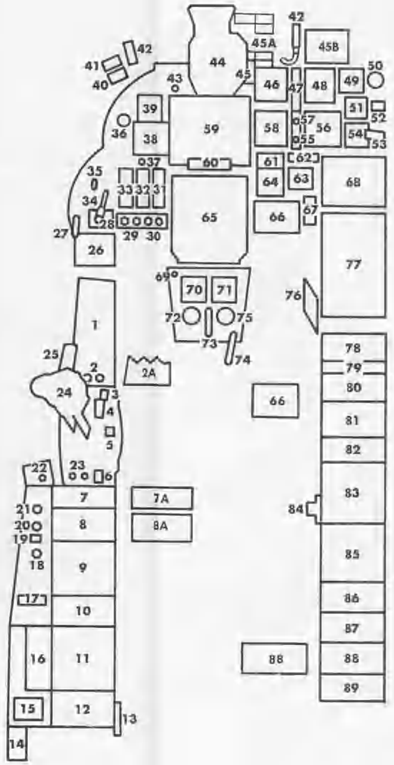

* FOR A-6B, C COCKPITS SEE NAVAIR 01-85ADA-1A

COCKPIT (PILOT)

TYPICAL | **A-6A**

PILOTS LEFT CONSOLE

1 FUEL MANAGEMENT CONTROL PANEL
2 SPEED DRIVE SWITCH
2A BLEED AIR SWITCHES
3 SPIN RECOVERY SWITCH
4 FLAP LEVER
5 THROTTLE FRICTION LEVER
6 EMERGENCY FLAP SWITCH
7 SPEED BRAKE/UHF PRESET/ANTI-SKID/FLAPERON POP-UP PANEL
7A APC/ANTI-SKID/FLAPERON POP-UP PANEL
8 MASTER GENERATOR AND FUEL MASTER CONTROL PANEL
8A MASTER GENERATOR/SPEED DRIVE/ENGINE AND FUEL MASTER CONTROL PANEL
9 SIGHT UNIT CONTROL PANEL
10 PILOT'S ICS PANEL
11 MASTER LIGHT CONTROL PANEL
12 G-VALVE TEST BUTTON
13 RAM AIR TURBINE HANDLE
14 BACK-UP HYDRAULIC SYSTEM TEST SWITCH
15 SELECTIVE STORES JETTISON SWITCH
16 AUXILIARY UHF RECEIVER PANEL
17 VENT SUIT-SEAT CUSHION CONTROL PANEL
18 OXYGEN SWITCH
19 RUDDER TRIM SWITCH
20 ARRESTING HOOK POSITION WARNING BY-PASS SWITCH
21 SMOKE ABATEMENT SWITCH
22 SPEED BRAKE TEST SWITCH
23 CRANK SWITCHES
24 THROTTLES
25 CATAPULT GRIP

PILOTS INSTRUMENT PANEL

26 INTEGRATED POSITION INDICATOR
27 BRAKE SELECTOR HANDLE
28 HYDRAULIC PRESSURE INDICATORS
29 POWER TRIM INDICATORS
30 OIL PRESSURE INDICATORS
31 FUEL FLOW INDICATOR
32 EXHAUST GAS TEMPERATURE INDICATOR
33 ENGINE RPM INDICATOR
34 LANDING GEAR HANDLE
35 LANDING GEAR OVERRIDE HANDLE
36 EMERGENCY STORES JETTISON BUTTON
37 LOW ALTITUDE WARNING LAMP
38 RADAR ALTIMETER
39 ANGLE OF ATTACK INDICATOR
40 APCS STANDBY LIGHT
41 WHEELS WARNING LIGHT
42 APPROACH INDEXER
43 MASTER CAUTION RESET BUTTON
44 OPTICAL SIGHT
45 DECM CONTROL PANEL
45A WARNING LIGHTS PANEL
45B ACLS INDICATOR
46 MACH/AIR SPEED INDICATOR
47 "G" METER
48 VERTICAL GYRO INDICATOR
49 CLOCK
50 OXYGEN QUANTITY GAGE
51 RATE OF CLIMB INDICATOR
52 CANOPY SWITCH
53 CANOPY EMERGENCY JETTISON HANDLE
54 MD-1 TURN AND SLIP INDICATOR
55 HOOK LIFT BUTTON
56 HORIZONTAL SITUATION INDICATOR
57 GYRO FAST ERECT BUTTON
58 SERVOED BAROMETRIC ALTIMETER
59 VERTICAL DISPLAY INDICATOR
60 SLIP/SKID INDICATOR
61 UHF CHANNEL/FREQUENCY
62 HOOK RELEASE HANDLE
63 B-6 ACCELEROMETER
64 FUEL QUANTITY GAGE
65 PILOT'S HORIZONTAL DISPLAY
66 ANNUNCIATOR PANEL
67 MASTER TEST PANEL
68 ECM WARNING CONTROL PANEL
69 AUX. HYD. PUMP BUTTON
70 AUXILIARY BRAKE CYCLE GAGE
71 CABIN PRESSURE ALTITUDE GAGE
72 STABILIZER TRIM GAGE
73 RUDDER PEDAL ADJUST CONTROL
74 MANUAL CANOPY HANDLE
75 RUDDER TRIM GAGE
76 FOOT HEAT CONTROL
77 PILOT'S CONTROL PANEL

CENTER CONSOLE

78 THREAT INDICATOR
79 GCBS ADDRESS PANEL
80 AUTOPILOT CONTROL PANEL
81 UHF COMMUNICATIONS PANEL
82 TACAN PANEL
83 TRANSPONDER-IFF/APX CONTROL
84 AUX. HYD. PUMP BUTTON
85 AIR CONDITIONING CONTROL PANEL
86 WING FOLD CONTROL PANEL
87 B/N's ICS CONTROL PANEL
88 PILOT'S RADIO CONTROL PANEL
89 ANT SEL/CABIN DUMP/CNI MASTER CONTROL PANEL

G-ADA1-717-2

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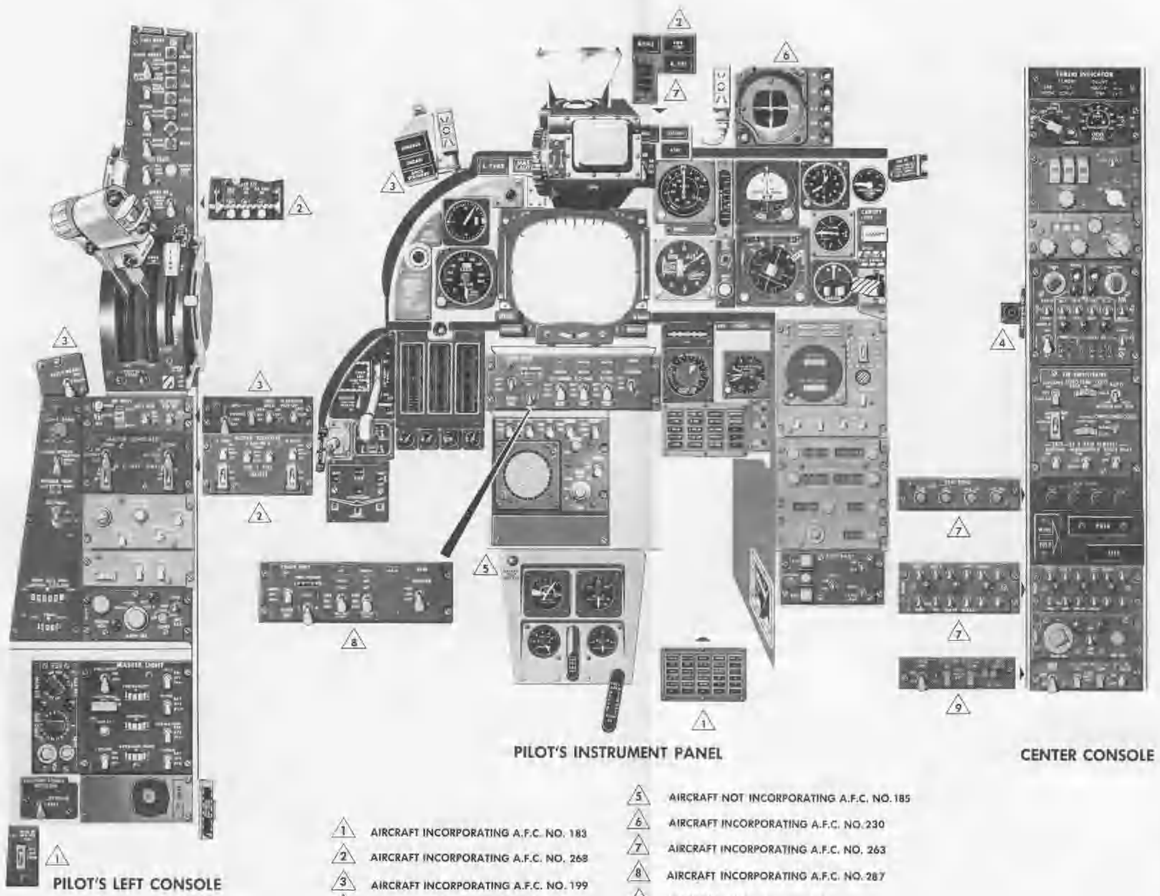

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4 AIRCRAFT INCORPORATING A.F.C. NO. 185
5 AIRCRAFT NOT INCORPORATING A.F.C. NO. 185
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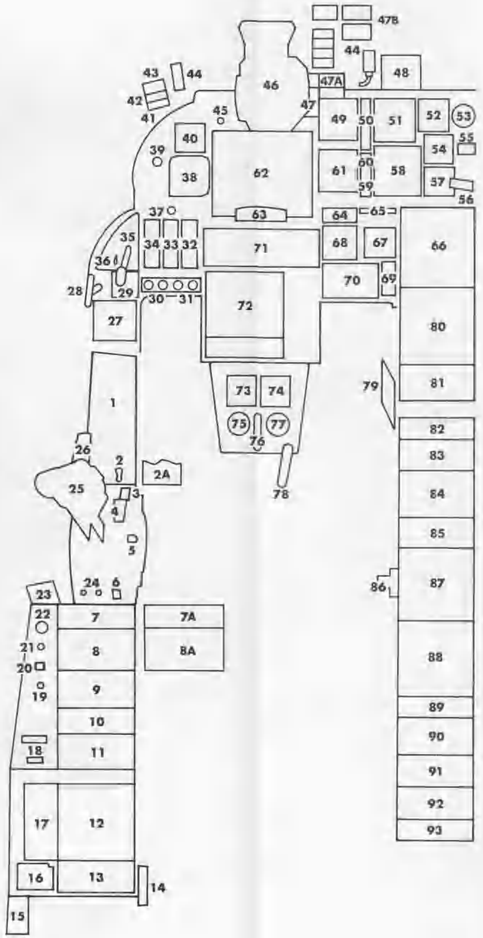

COCKPIT (PILOT)

KA-6D

NOT INCORPORATING AFC NO. 161

PILOT'S LEFT CONSOLE

1. FUEL MANAGEMENT CONTROL PANEL
2. SPEED DRIVE SWITCHES
2A. BLEED AIR SWITCHES
3. SPIN RECOVERY SWITCH
4. FLAP LEVER
5. THROTTLE FRICTION LEVER
6. EMERGENCY FLAP SWITCH
7. SPEED BRAKE/UHF PRESET/ANTI-SKID FLAPERON POP-UP PANEL
7A. APC/ANTI-SKID/FLAPERON POP-UP PANEL
8. MASTER GENERATOR/ENGINE AND FUEL MASTER CONTROL PANEL
8A. MASTER GENERATOR/SPEED DRIVE/ENGINE AND FUEL MASTER CONTROL
9. VDI CONTROL PANEL
10. SIGHT RECTICAL CONTROL PANEL
11. ICS CONTROL PANEL
12. MASTER LIGHT CONTROL PANEL
13. G VALVE TEST BUTTON
14. RAM AIR TURBINE HANDLE
15. BACK-UP HYDRAULIC SYSTEM TEST SWITCH
16. SELECTIVE STORES JETTISON SWITCH
17. AUXILIARY UHF RECEIVER PANEL
18. VENT SUIT SEAT CUSHION CONTROL PANEL
19. OXYGEN SWITCH
20. RUDDER TRIM SWITCH
21. HOOK BYPASS SWITCH
22. ICI - R TONE CONTROL
23. SPEED BRAKE TEST SWITCH
24. CRANK SWITCHES
25. THROTTLES
26. CATAPULT GRIP

PILOT'S INSTRUMENT PANEL

27. INTEGRATED POSITION INDICATOR
28. BRAKE SELECTOR HANDLE
29. HYDRAULIC PRESSURE INDICATORS
30. POWER TRIM INDICATORS
31. OIL PRESSURE INDICATORS
32. FUEL FLOW INDICATOR
33. EXHAUST GAS TEMPERATURE INDICATOR
34. ENGINE RPM INDICATOR
35. LANDING GEAR HANDLE
36. LANDING GEAR OVERRIDE LEVER
37. LOW ALTITUDE WARNING LIGHT
38. RADAR ALTIMETER
39. EMERGENCY STORES JETTISON BUTTON
40. ANGLE-OF-ATTACK INDICATOR
41. APCS STANDBY LIGHT
42. TACAN LIGHT
43. WHEELS WARNING LIGHT
44. APPROACH INDEXER
45. MASTER CAUTION RESET BUTTON
46. OPTICAL SIGHT
47. DECM CONTROL PANEL
47A. COLLISION LIGHT
47B. WARNING LIGHT PANEL
48. ACLS INDICATOR
49. MACH/AIR SPEED INDICATOR
50. G METER
51. VERTICAL GYRO INDICATOR
52. CLOCK
53. OXYGEN QUANTITY GAGE
54. RATE OF CLIMB INDICATOR
55. CANOPY SWITCH
56. CANOPY EMERGENCY JETTISON HANDLE
57. TURN AND SLIP INDICATOR
58. HORIZONTAL SITUATION INDICATOR
59. GYRO FAST ERECT BUTTON
60. HOOK LIFT BUTTON
61. COUNTER/POINTER ALTIMETER
62. VERTICAL DISPLAY INDICATOR
63. SLIP/SKID INDICATOR
64. UHF CHANNEL/FREQUENEY
65. HOOK RELEASE HANDLE
66. REFUEL CONTROL PANEL
67. ACCELEROMETER
68. FUEL QUANTITY GAGE
69. MASTER TEST PANEL
70. ANNUNCIATOR PANEL
71. ECM CONTROL PANEL
72. APR 25 CONTROL PANEL
73. AUXILIARY BRAKE CYCLE GAGE
74. CABIN PRESSURE ALTITUDE GAGE
75. STABILIZER TRIM GAGE
76. RUDDER PEDAL ADJUST CONTROL
77. RUDDER TRIM GAGE
78. MANUAL CANOPY HANDLE
79. FOOT HEAT CONTROL
80. NAVIGATION CONTROL PANEL
81. AUTOPILOT CONTROL PANEL

CENTER CONSOLE

82. THREAT INDICATOR
83. DOPPLER RADAR CONTROL PANEL
84. UHF COMMUNICATIONS PANEL
85. TACAN CONTROL PANEL
86. AUX. HYD. PUMP BUTTON
87. TRANSPONDER - IFF/APX CONTROL
88. AIR CONDITIONING CONTROL PANEL
89. ECM TONE CONTROL PANEL
90. WING FOLD CONTROL PANEL
91. RADIO RECEIVER CONTROL PANEL
92. RADIO TRANSMITTER CONTROL PANEL
93. CABIN DUMP/ANT SEL/CNI MASTER CONTROL PANEL

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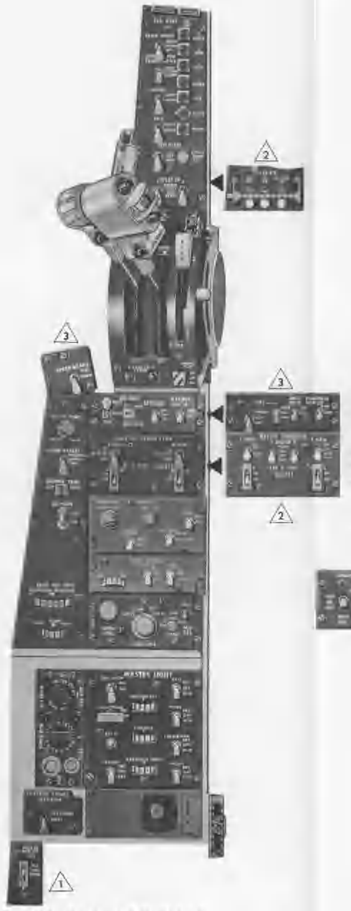
Figure FO-2 (Sheet 2)

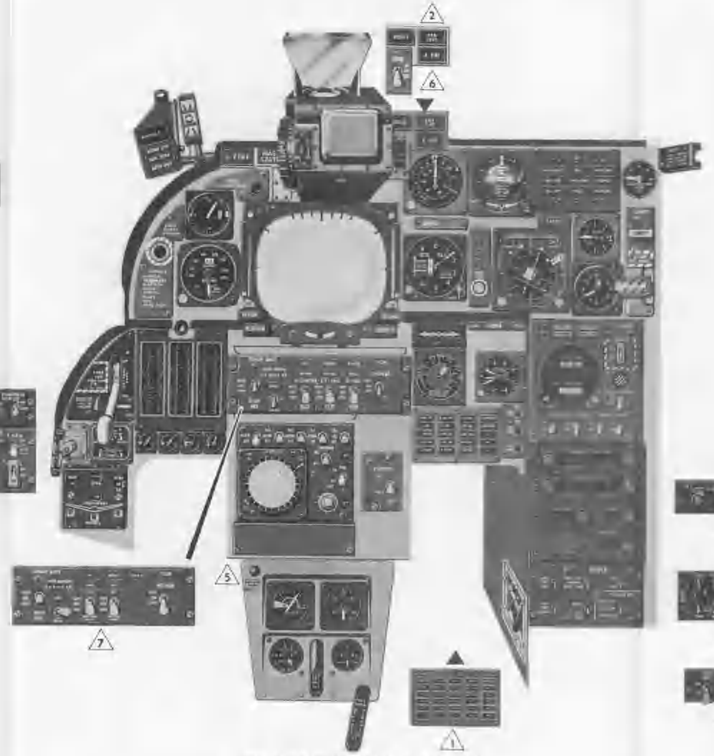
COCKPIT (PILOT)

KA-6D

INCORPORATING AFC NO. 161

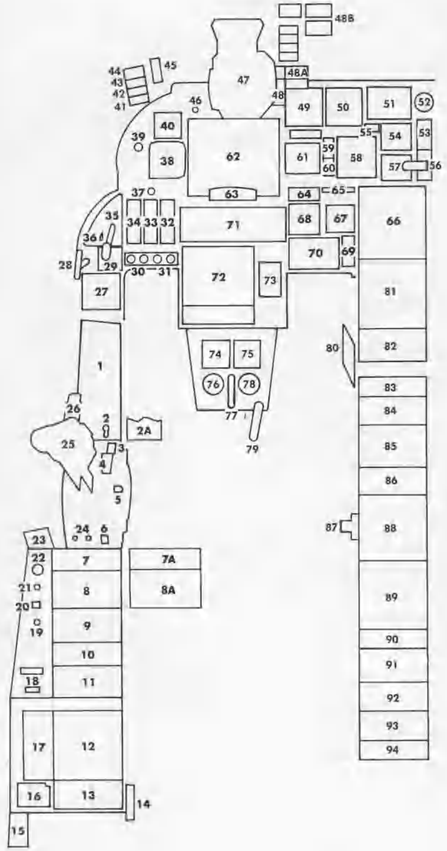


PILOT'S LEFT CONSOLE



PILOT'S INSTRUMENT PANEL

CENTER CONSOLE



1 AIRCRAFT INCORPORATING A.F.C. NO.183
2 AIRCRAFT INCORPORATING A.F.C. NO. 268
3 AIRCRAFT INCORPORATING A.F.C. NO. 199
4 AIRCRAFT INCORPORATING A.F.C. NO. 185
5 AIRCRAFT INCORPORATING A.F.C. NO. 185
6 AIRCRAFT INCORPORATING A.F.C. NO. 263
7 AIRCRAFT INCORPORATING A.F.C. NO.287
8 INCORPORATING A.F.C. NO. 269

PILOT'S LEFT CONSOLE

1. FUEL MANAGEMENT CONTROL PANEL
2. SPEED DRIVE SWITCHES
2A. BLEED AIR SWITCHES
3. SPIN RECOVERY SWITCH
4. FLAP LEVER
5. THROTTLE FRICTION LEVER
6. EMERGENCY FLAP SWITCH
7. SPEED BRAKE/UHF PRESET/ANTI-SKID FLAPERON POP-UP PANEL
7A. APC/ANTI-SKID/FLAPERON POP-UP PANEL
8. MASTER GENERATOR/ENGINE AND FUEL MASTER CONTROL PANEL
8A. MASTER GENERATOR/SPEED DRIVE/ENGINE AND FUEL MASTER CONTROL
9. VDI CONTROL PANEL
10. SIGHT RECTICAL CONTROL PANEL
11. ICS CONTROL PANEL
12. MASTER LIGHT CONTROL PANEL
13. G VALVE TEST BUTTON
14. RAM AIR TURBINE HANDLE
15. BACK-UP HYDRAULIC SYSTEM TEST SWITCH
16. SELECTIVE STORES JETTISON SWITCH
17. AUXILIARY UHF RECEIVER PANEL
18. VENT SUIT SEAT CUSHION CONTROL PANEL
19. OXYGEN SWITCH
20. RUDDER TRIM SWITCH
21. HOOK BYPASS SWITCH
22. ICI - R TONE CONTROL
23. SPEED BRAKE TEST SWITCH
24. CRANK SWITCHES
25. THROTTLES
26. CATAPULT GRIP

PILOT'S INSTRUMENT PANEL

27. INTEGRATED POSITION INDICATOR
28. BRAKE SELECTOR HANDLE
29. HYDRAULIC PRESSURE INDICATORS
30. POWER TRIM INDICATORS
31. OIL PRESSURE INDICATORS
32. FUEL FLOW INDICATOR
33. EXHAUST GAS TEMPERATURE INDICATOR
34. ENGINE RPM INDICATOR
35. LANDING GEAR HANDLE
36. LANDING GEAR OVERRIDE LEVER
37. LOW ALTITUDE WARNING LIGHT
38. RADAR ALTIMETER
39. EMERGENCY STORES JETTISON BUTTON
40. ANGLE-OF-ATTACK INDICATOR
41. APCS OUT LIGHT
42. APCS STAND BY LIGHT
43. WAVE OFF LIGHT
44. WHEELS WARNING LIGHT
45. APPROACH INDEXER
46. MASTER CAUTION RESET BUTTON
47. OPTICAL SIGHT
48. DECM CONTROL PANEL
48A. COLLISION LIGHT
48B. WARNING LIGHT PANEL
49. MACH/AIR SPEED INDICATOR
50. VERTICAL GYRO INDICATOR
51. DISCRETE MESSAGE INDICATOR
52. OXYGEN QUANTITY GAGE
53. CANOPY SWITCH
54. RATE OF CLIMB INDICATOR
55. TACAN LIGHT
56. CANOPY EMERGENCY JETTISON HANDLE
57. CLOCK
58. HORIZONTAL SITUATION INDICATOR
59. APPROACH INDEXER
60. HOOK LIFT BUTTON
61. COUNTER/POINTER ALTIMETER
62. VERTICAL DISPLAY INDICATOR
63. SLIP/SKID INDICATOR
64. UHF CHANNEL/FREQUENCY
65. HOOK RELEASE HANDLE
66. REFUEL CONTROL PANEL
67. ACCELEROMETER
68. FUEL QUANTITY GAGE
69. MASTER TEST PANEL
70. ANNUNCIATOR PANEL
71. ECM CONTROL PANEL
72. APR 25 CONTROL PANEL
73. VGI DISPLAY SWITCH
74. AUXILIARY BRAKE CYCLE GAGE
75. CABIN PRESSURE ALTITUDE GAGE
76. STABILIZER TRIM GAGE
77. RUDDER PEDAL ADJUST CONTROL
78. RUDDER TRIM GAGE
79. MANUAL CANOPY HANDLE
80. FOOT HEAT CONTROL
81. NAVIGATION CONTROL PANEL
82. AUTOPILOT CONTROL PANEL

CENTER CONSOLE

83. THREAT INDICATOR
84. DOPPLER RADAR CONTROL PANEL
85. UHF COMMUNICATIONS PANEL
86. TACAN CONTROL PANEL
87. AUX. HYD. PUMP BUTTON
88. TRANSPONDER - IFF/APX CONTROL
89. AIR CONDITIONING CONTROL PANEL
90. ECM TONE CONTROL PANEL
91. WING FOLD CONTROL PANEL
92. RADIO RECEIVER CONTROL PANEL
93. RADIO TRANSMITTER CONTROL PANEL
94. CABIN DUMP/ANT SEL/CNI MASTER CONTROL PANEL

ADA1-717-6

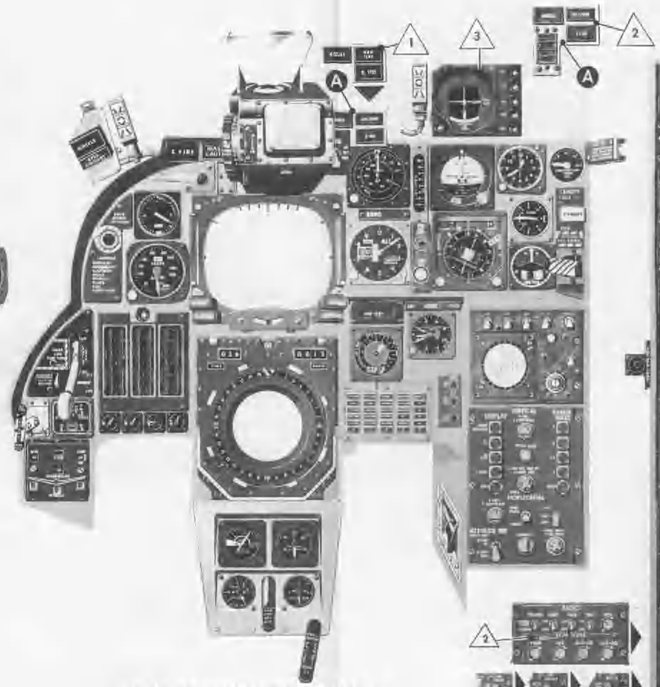
Figure FO-2 (Sheet 3)

COCKPIT (PILOT)

A-6E

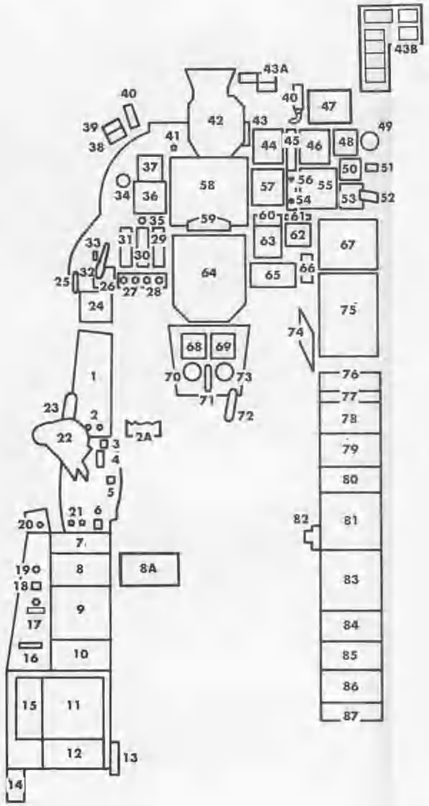
A-6E 158041 THRU 159579 AND MOD M 1 THRU M 120

PILOT'S LEFT CONSOLE



PILOT'S INSTRUMENT PANEL

CENTER CONSOLE



1. 158533 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 268
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3. AIRCRAFT INCORPORATING A.F.C. NO. 230
4. AIRCRAFT INCORPORATING APN-194
5. 158795 AND ON AND MOD M21 AND ON
6. 159041 THRU 158794 AND MOD M1 THRU M20 NOT INCORPORATING A.F.C. NO. 269
7. 158041 THRU 158794 AND MOD M1 THRU M20 INCORPORATING A.F.C. NO. 269
8. AIRCRAFT INCORPORATING AFC NO. 391

PILOT'S LEFT CONSOLE

1. FUEL MANAGEMENT CONTROL PANEL SPEED DRIVE SWITCH
2A. BLEED AIR SWITCHES
3. SPIN RECOVERY SWITCH
4. FLAP LEVER
5. THROTTLE FRICTION LEVER
6. EMERGENCY FLAP SWITCH
7. APC/ANTI-SKID/FLAPERON POP-UP PANEL
8. GENERATOR/ENGINE AND FUEL PANEL
8A. GENERATOR/SPEED DRIVE/ENGINE AND FUEL PANEL
9. SIGHT UNIT CONTROL PANEL
10. PILOT'S ICS PANEL
11. MASTER LIGHT CONTROL PANEL
12. G-VALVE TEST BUTTON
13. RAM AIR TURBINE HANDLE
14. BACK-UP HYDRAULIC SYSTEM TEST SWITCH
15. AUXILIARY UHF RECEIVER PANEL ARP 45 ARP 50
16. VENT SUIT-SEAT CUSHION CONTROL
17. OXYGEN SWITCH
18. RUDDER TRIM SWITCH
19. ARRESTING HOOK POSITION WARNING BY-PASS SWITCH
20. SPEED BRAKE TEST SWITCH
21. CRANK SWITCHES
22. THROTTLES
23. CATAPULT GRIP

PILOT'S INSTRUMENT PANEL

24. INTEGRATED POSITION INDICATOR
25. BRAKE SELECTOR HANDLE
26. HYDRAULIC PRESSURE INDICATORS
27. POWER TRIM INDICATORS
28. OIL PRESSURE INDICATORS
29. FUEL FLOW INDICATOR
30. EXHAUST GAS TEMPERATURE INDICATOR
31. ENGINE RPM INDICATOR
32. LANDING GEAR HANDLE
33. LANDING GEAR OVERRIDE HANDLE
34. EMERGENCY STORES JETTISON BUTTON
35. LOW ALTITUDE WARNING LAMP
36. RADAR ALTIMETER
37. ANGLE OF ATTACK INDICATOR
38. APCS STANDBY LIGHT
39. WHEELS WARNING LIGHT
40. APPROACH INDEXER
41. MASTER CAUTION RESET BUTTON
42. OPTICAL SIGHT
43. DECM CONTROL PANEL
43A. NWW TEMP LIGHT
43B. WARNING LIGHT PANEL/ THREAT STATUS
44. MACH/AIR SPEED INDICATOR
45. 'G' METER
46. VERTICAL GYRO INDICATOR
47. ACLS INDICATOR
48. CLOCK
49. OXYGEN QUANTITY GAGE
50. RATE OF CLIMB INDICATOR
51. CANOPY SWITCH
52. CANOPY EMERGENCY JETTISON HANDLE
53. MD-1 TURN AND SLIP INDICATOR
54. HOOK LIFT BUTTON
55. HORIZONTAL SITUATION INDICATOR
56. GYRO FAST ERECT BUTTON
57. SERVOED BAROMETRIC ALTIMETER
58. VERTICAL DISPLAY INDICATOR
59. SLIP/SKID INDICATOR
60. UHF CHANNEL/FREQUENCY
61. HOOK RELEASE HANDLE
62. B-6 ACCELEROMETER
63. FUEL QUANTITY GAGE
64. PILOT'S HORIZONTAL DISPLAY
65. ANNUNCIATOR PANEL
66. MASTER TEST PANEL
67. ECM WARNING CONTROL PANEL
68. AUXILIARY BRAKE CYCLE GAGE
69. CABIN PRESSURE ALTITUDE GAGE
70. STABILIZER TRIM GAGE
71. RUDDER PEDAL ADJUST CONTROL
72. MANUAL CANOPY HANDLE
73. RUDDER TRIM GAGE
74. FOOT HEAT CONTROL
75. PILOT'S CONTROL PANEL

CENTER CONSOLE

76. THREAT INDICATOR
77. GCBS ADDRESS PANEL
78. AUTOPILOT CONTROL PANEL
79. UHF COMMUNICATIONS PANEL
80. TACAN PANEL
81. TRANSPONDER-IFF/APX CONTROL
82. AUX. HYD. PUMP BUTTON
83. AIR CONDITIONING CONTROL PANEL
84. WING FOLD CONTROL PANEL
85. B/N's ICS CONTROL PANEL
86. PILOT'S RADIO CONTROL PANEL
87. ANT SEL/CABIN DUMP/CNI MASTER CONTROL PANEL

B-ADA1-717-4

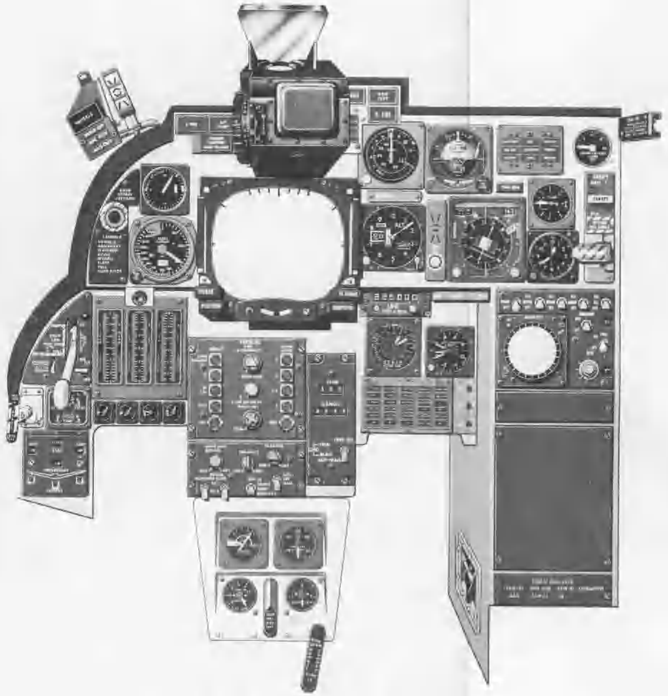
Figure FO-2 (Sheet 4)

COCKPIT (PILOT)

A-6E

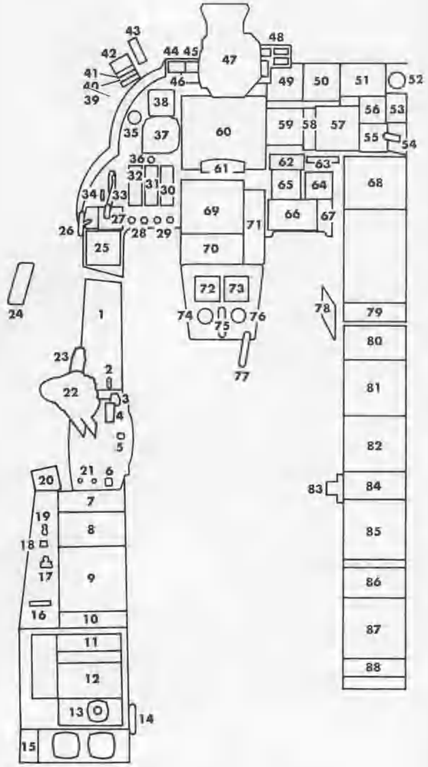
159895 AND ON MOD M121 AND ON

PILOT'S LEFT CONSOLE



PILOT'S INSTRUMENT PANEL

CENTER CONSOLE



PILOT'S LEFT CONSOLE

1. FUEL MANAGEMENT CONTROL PANEL
2. BLEED AIR SWITCHES
3. SPIN RECOVERY SWITCH
4. FLAP LEVER
5. THROTTLE FRICTION LEVER
6. EMERGENCY FLAP SWITCH
7. APC/ANTI-SKID/FLAPERON POP-UP PANEL
8. GENERATOR/SPEED DRIVE/ENGINE AND FUEL PANEL
9. MASTER LIGHT PANEL
10. ILS RECEIVER CONTROL PANEL
11. ACLS CONTROL PANEL
12. RADIO/ICS CONTROL PANEL
13. G-VALVE TEST BUTTON
14. RAM AIR TURBINE HANDLE
15. BACK-UP HYDRAULIC SYSTEM TEST SWITCH
16. VENT SUIT - SEAT CUSHION CONTROL
17. OXYGEN SWITCH
18. RUDDER TRIM SWITCH
19. ARRESTING HOOK POSITION WARNING BY-PASS SWITCH
20. SPEED BRAKE TEST SWITCH
21. CRANK SWITCHES
22. THROTTLES
23. CATAPULT GRIP
24. CANOPY BOW PANEL

PILOT'S INSTRUMENT PANEL

25. INTEGRATED POSITION INDICATOR
26. BRAKE SELECTOR HANDLE
27. HYDRAULIC PRESSURE INDICATORS
28. POWER TRIM INDICATORS
29. OIL PRESSURE INDICATORS
30. FUEL FLOW INDICATOR
31. EXHAUST GAS TEMPERATURE INDICATOR
32. ENGINE RPM INDICATOR
33. LANDING GEAR HANDLE
34. LANDING GEAR OVERRIDE HANDLE
35. EMERGENCY STORES JETTISON BUTTON
36. LOW ALTITUDE WARNING LIGHT
37. RADAR ALTIMETER
38. ANGLE-OF-ATTACK INDICATOR
39. AFCS OUT INDICATOR LIGHT
40. APC STBY INDICATOR LIGHT
41. WAVE OFF INDICATOR LIGHT
42. WHEELS WARNING LIGHT
43. APPROACH INDEXER
44. LEFT FIRE WARNING LIGHT
45. AFT TEMP WARNING LIGHT
46. MASTER CAUTION LIGHT
47. OPTICAL SIGHT
48. ECM WARNING/NWW TEMP/RIGHT FIRE WARNING LIGHTS
49. MACH AIRSPEED INDICATOR
50. VERTICAL GYRO INDICATOR
51. DISCRETE MESSAGE INDICATOR PANEL
52. OXYGEN QUANTITY GAGE
53. CANOPY SWITCH
54. CANOPY EMERGENCY JETTISON HANDLE
55. CLOCK
56. RATE OF CLIMB INDICATOR
57. HORIZONTAL SITUATION INDICATOR
58. APPROACH INDEXER/HOOK LIFT PANEL
59. SERVOED BAROMETRIC ALTIMETER
60. VERTICAL DISPLAY INDICATOR
61. SLIP/SKID INDICATOR
62. UHF CHANNEL/FREQUENCY INDICATOR
63. HOOK RELEASE HANDLE
64. B-6 ACCELEROMETER
65. FUEL QUANTITY GAGE
66. ANNUNCIATOR PANEL
67. MASTER TEST PANEL
68. ECM WARNING CONTROL PANEL
69. PILOT'S CONTROL PANEL
70. SIGHT UNIT CONTROL PANEL
71. PILOT'S AUXILIARY INDICATOR PANEL
72. AUXILIARY BRAKE CYCLE GAGE
73. CABIN PRESSURE ALTITUDE GAGE
74. STABILIZER TRIM GAGE
75. RUDDER PEDAL ADJUST CONTROL
76. RUDDER TRIM GAGE
77. MANUAL CANOPY HANDLE
78. FOOT HEAT CONTROL
79. THREAT INDICATOR

CENTER CONSOLE

80. AUTOPILOT CONTROL PANEL
81. NO. 1 UHF CONTROL PANEL
82. NO. 2 UHF CONTROL PANEL
83. AUX. HYD. PUMP BUTTON
84. TACAN CONTROL PANEL
85. IFF/SIF TRANSPONDER CONTROL
86. WING FOLD PANEL
87. AIR CONDITIONING CONTROL PANEL
88. CABIN DUMP/ MA-1/ ADC PANEL

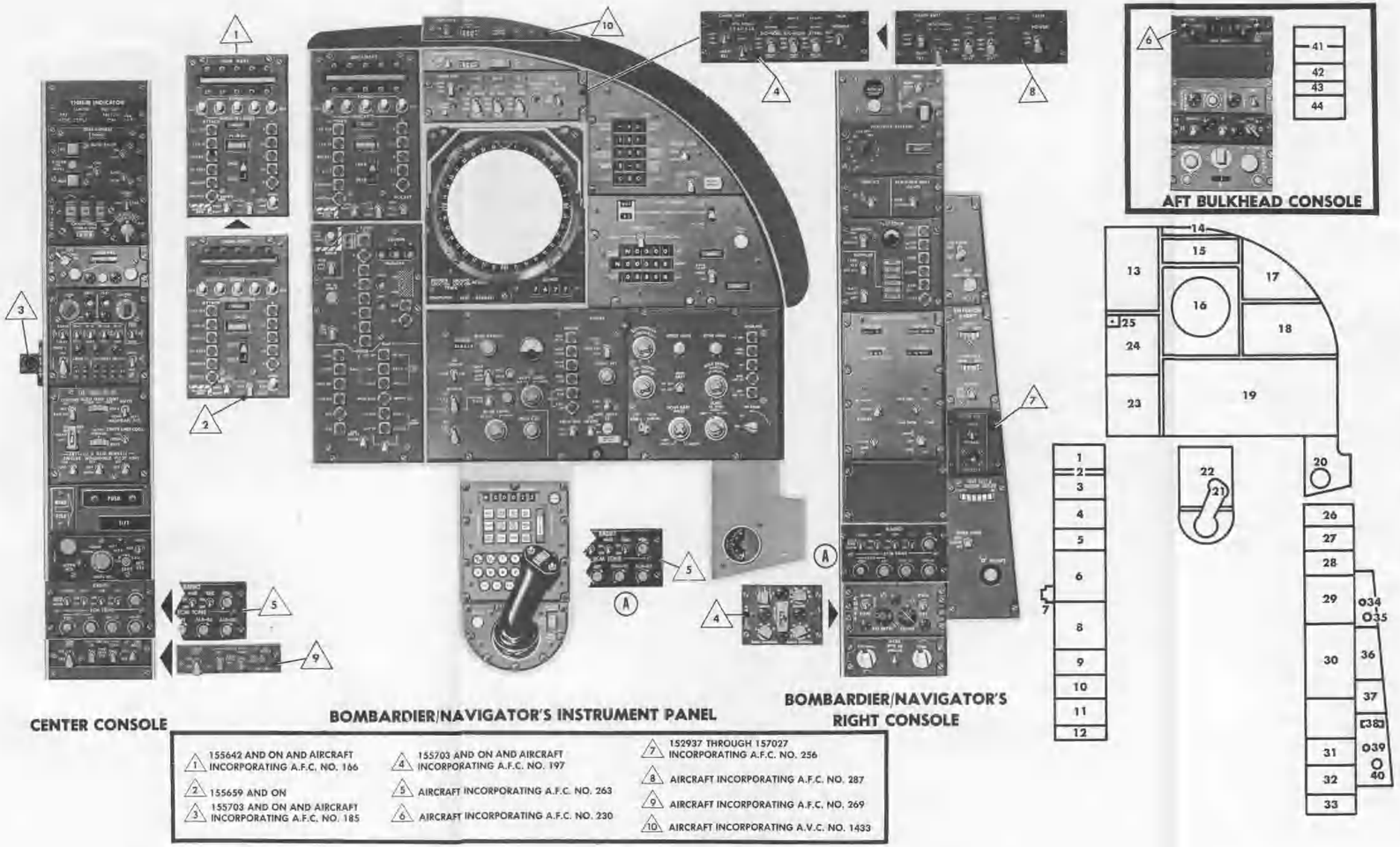
ADA1-717-5

Figure FO-2 (Sheet 5)

COCKPIT (B/N)

A-6A

FOR A-6B, C COCKPITS SEE NAVAIR 01-85ADA-1A



CENTER CONSOLE

1 THREAT INDICATOR
2 GCBS ADDRESS PANEL
3 AUTOPILOT CONTROL PANEL
4 UHF COMMUNICATIONS PANEL
5 TACAN PANEL
6 TRANSPONDER-IFF/APX CONTROL
7 AUX. HYD. PUMP BUTTON
8 AIR CONDITIONING CONTROL PANEL
9 WING FOLD CONTROL PANEL
10 B/N's ICS CONTROL PANEL
11 PILOT'S RADIO CONTROL PANEL
12 ANT SEL/CABIN DUMP/CNI MASTER CONTROL PANEL

BOMBARDIER/NAVIGATOR'S INSTRUMENT PANEL

13 ARMAMENT CONTROL PANEL
14 1C-IR COOLING CONTROL PANEL
15 ECM CONTROL PANEL
16 DIRECT VIEW INDICATOR
17 ATTACK NAVIGATION PANEL
18 NAVIGATION CONTROL PANEL
19 BOMBARDIER/NAVIGATOR'S CONTROL PANEL
20 OUTSIDE AIR TEMPERATURE GAGE
21 BOMBARDIER/NAVIGATOR'S SLEW CONTROL
22 COMPUTER KEYBOARD
23 MODE SELECTOR PANEL
24 FUZING CONTROL PANEL
25 MASTER ARM SWITCH

BOMBARDIER/NAVIGATOR'S RIGHT CONSOLE

26 AUXILIARY ARMAMENT CONTROL PANEL
27 MULTIPLE RELEASE PANEL
28 SINS ICS AND PLATFORM INFLT ALIGN PANEL
29 DOPPLER PLATFORM CONTROL PANEL
30 ERECTION CONTROLLER PANEL
31 RADIO CONTROL PANEL
32 CHAFF DISPENSER CONTROL PANEL
33 GROUND CONTROL BOMBING SYSTEM CONTROL PANEL
34 OXYGEN SWITCH
35 MASTER TEST BUTTON
36 INTERIOR LIGHTING CONTROL PANEL
37 LB-31A CAMERA POD CONTROL PANEL
38 VENT SUIT-SEAT CUSHION CONTROL
39 BOMB TONE SWITCH
40 G-VALVE TEST BUTTON

AFT BULKHEAD CONSOLE

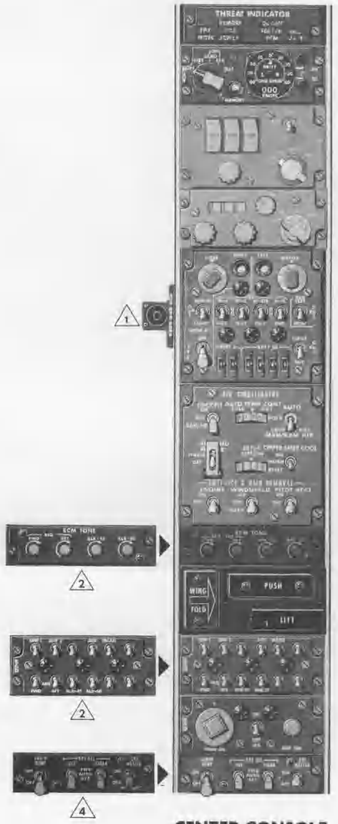
41 ACLS CONTROL PANEL
42 RADAR BEACON CONTROL PANEL
43 KY-28 CONTROL PANEL
44 MA-1 COMPASS CONTROL PANEL

D-ADA1-718-2

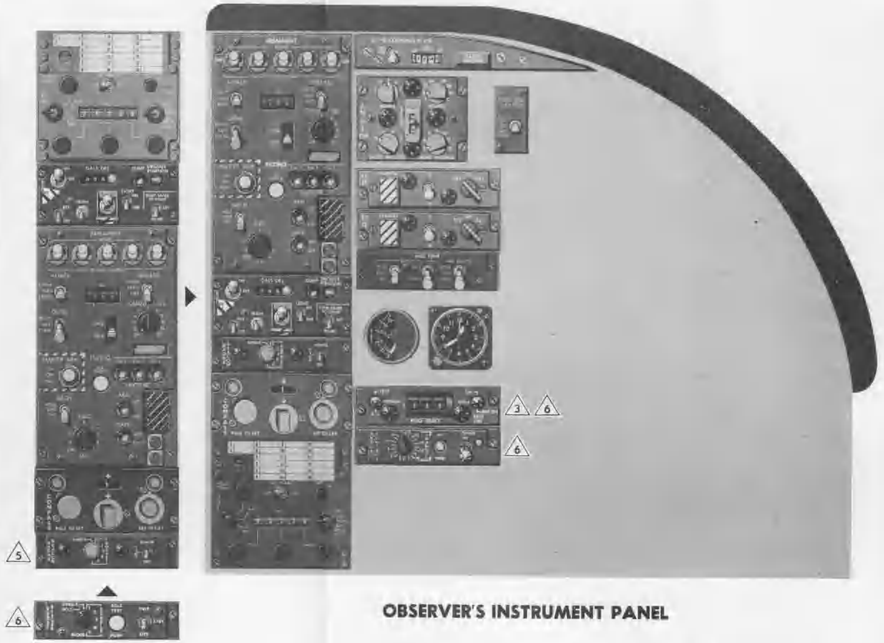
Figure FO-3 (Sheet 1)

COCKPIT (OBSERVER)

KA-6D



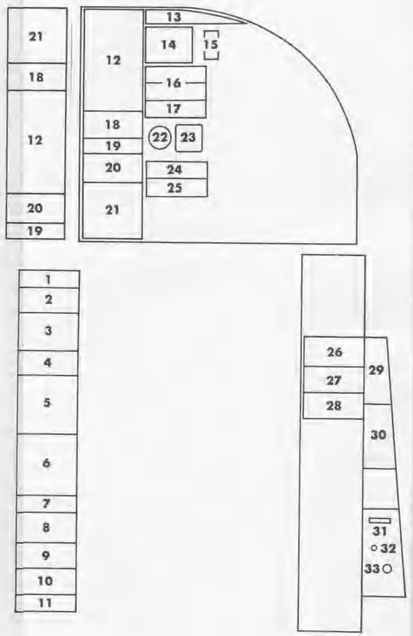
CENTER CONSOLE



OBSERVER'S INSTRUMENT PANEL

1 AIRCRAFT INCORPORATING AFC NO. 185
2 AIRCRAFT INCORPORATING AFC NO. 263
3 AIRCRAFT INCORPORATING AFC NO. 230
4 AIRCRAFT INCORPORATING AFC NO. 269
5 AIRCRAFT INCORPORATING AFC NO. 299
6 AIRCRAFT INCORPORATING AFC NO. 161

OBSERVER'S RIGHT CONSOLE



CENTER CONSOLE

1. THREAT INDICATOR
2. DOPPLER RADAR CONTROL PANEL
3. UHF COMMUNICATIONS PANEL
4. TACAN CONTROL PANEL
5. TRANSPONDER - IFF/APX CONTROL
6. AIR CONDITIONING CONTROL PANEL
7. ECM TONE CONTROL PANEL
8. WING FOLD CONTROL PANEL
9. RADIO RECEIVER CONTROL PANEL
10. RADIO TRANSMITTER CONTROL PANEL
11. CABIN DUMP/ANT SEL/CNI MASTER CONTROL PANEL

OBSERVER'S INSTRUMENT PANEL

12. ARMAMENT CONTROL PANEL
13. 1CI-R COOLING CONTROL PANEL
14. CHAFF DISPENSER CONTROL PANEL
15. HOSE REEL GROUND TEST PANEL
16. KY-28 CONTROL PANELS (2)
17. MISCELLANEOUS TONE CONTROL PANEL
18. CENTER LINE STORE CONTROL PANEL
19. RADAR BEACON CONTROL PANEL
20. MA-1 COMPASS CONTROL PANEL
21. UHF NO. 2 COMMUNICATIONS CONTROL PANEL
22. OUTSIDE AIR TEMPERATURE GAGE
23. CLOCK
24. ACLS CONTROL PANEL
25. ILS CONTROL PANEL

OBSERVER'S RIGHT CONSOLE

26. ICS CONTROL PANEL
27. RADIO TRANSMITTER SELECTOR PANEL
28. RADIO RECEIVER SELECTOR PANEL
29. OXYGEN SWITCH
30. INTERIOR LIGHTING CONTROL PANEL
31. VENT SUIT/SEAT CUSHION CONTROL
32. BOMB TONE SWITCH
33. G-VALVE TEST BUTTON

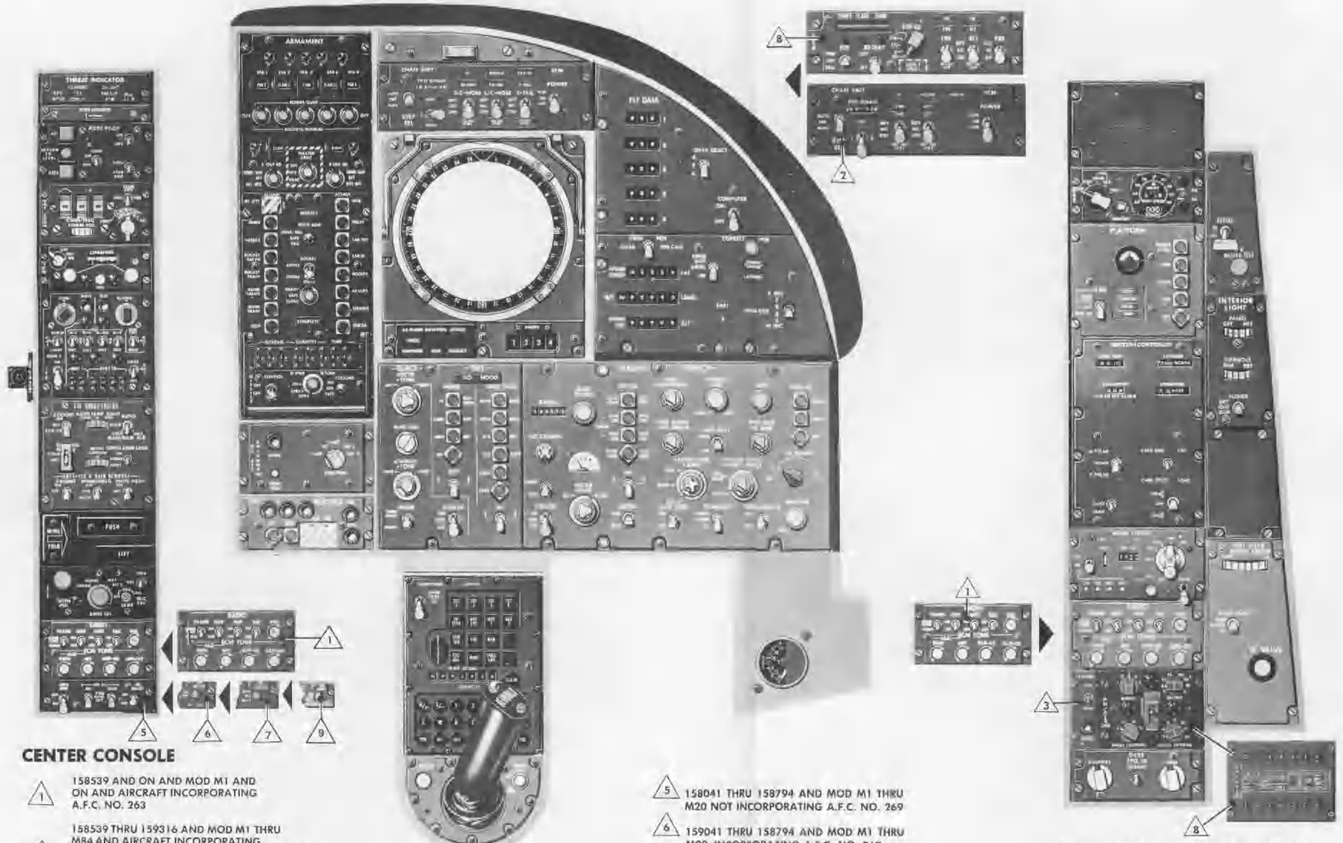
A-ADA1-718-3

Figure FO-3 (Sheet 2)

COCKPIT (B/N)

A-6E

158041 THRU 159579 AND MOD M 1 THRU M 121



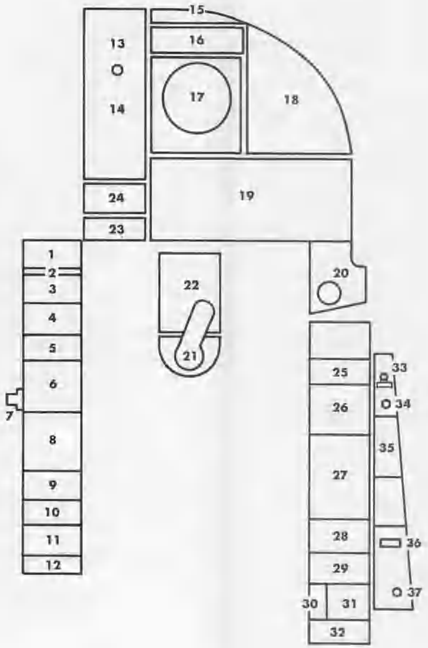
CENTER CONSOLE

1. 158539 AND ON AND MOD M1 AND ON AND AIRCRAFT INCORPORATING A.F.C. NO. 263
2. 158539 THRU 159316 AND MOD M1 THRU M84 AND AIRCRAFT INCORPORATING A.F.C. NO. 287 EXCEPT THOSE INCORPORATING A.F.C. NO. 368
3. AIRCRAFT INCORPORATING A.F.C. NO. 256
4. AIRCRAFT INCORPORATING A.F.C. NO. 230
5. 158041 THRU 158794 AND MOD M1 THRU M20 NOT INCORPORATING A.F.C. NO. 269
6. 159041 THRU 158794 AND MOD M1 THRU M20 INCORPORATING A.F.C. NO. 269
7. 158795 AND ON AND MOD M21 AND ON
8. 159317 AND ON AND M85 AND ON AND THOSE INCORPORATING A.F.C. NO. 368
9. AIRCRAFT INCORPORATING A.F.C. NO. 391

BOMBARDIER/NAVIGATOR'S INSTRUMENT PANEL

BOMBARDIER/NAVIGATOR'S RIGHT CONSOLE

AFT BULKHEAD CONSOLE



CENTER CONSOLE

1. THREAT INDICATOR
2. GCBS ADDRESS PANEL
3. AUTOPILOT CONTROL PANEL
4. UHF COMMUNICATIONS PANEL
5. TACAN PANEL
6. TRANSPONDER-IFF/APX CONTROL
7. AUX. HYD. PUMP BUTTON
8. AIR CONDITIONING CONTROL PANEL
9. WING FOLD CONTROL PANEL
10. B/N's ICS CONTROL PANEL
11. PILOT'S RADIO CONTROL PANEL
12. ANT SEL/CABIN DUMP/CNI MASTER CONTROL PANEL

BOMBARDIER/NAVIGATOR'S INSTRUMENT PANEL

13. MASTER ARMAMENT SWITCH
14. ARMAMENT CONTROL UNIT
15. MASTER CAUTION PANEL
16. ECM CONTROL PANEL
17. DIRECT VIEW RADAR INDICATOR
18. DIGITAL DISPLAY UNIT
19. BOMBARDIER NAVIGATOR'S CONTROL PANEL
20. OUTSIDE AIR TEMPERATURE GAGE
21. SLEW CONTROL
22. COMPUTER CONTROL UNIT (KEYBOARD)
23. NUCLEAR CONTROL PANEL
24. AWW-4 FUZING PANEL

BOMBARDIER/NAVIGATOR'S RIGHT CONSOLE

25. DOPPLER CONTROL PANEL
26. PLATFORM CONTROL PANEL
27. ERECTION CONTROLLER
28. VIDEO TAPE RECORDER
29. RADIO CONTROL PANEL
30. LB-31A CAMERA POD CONTROL PANEL
31. CHAFF DISPENSER CONTROL PANEL
32. GROUND CONTROL BOMBING SYSTEM CONTROL PANEL
33. OXYGEN LEVER
34. MASTER TEST BUTTON
35. INTERIOR LIGHTING CONTROL PANEL
36. VENT SUIT-SEAT CUSHION CONTROL
37. G-VALVE TEST BUTTON

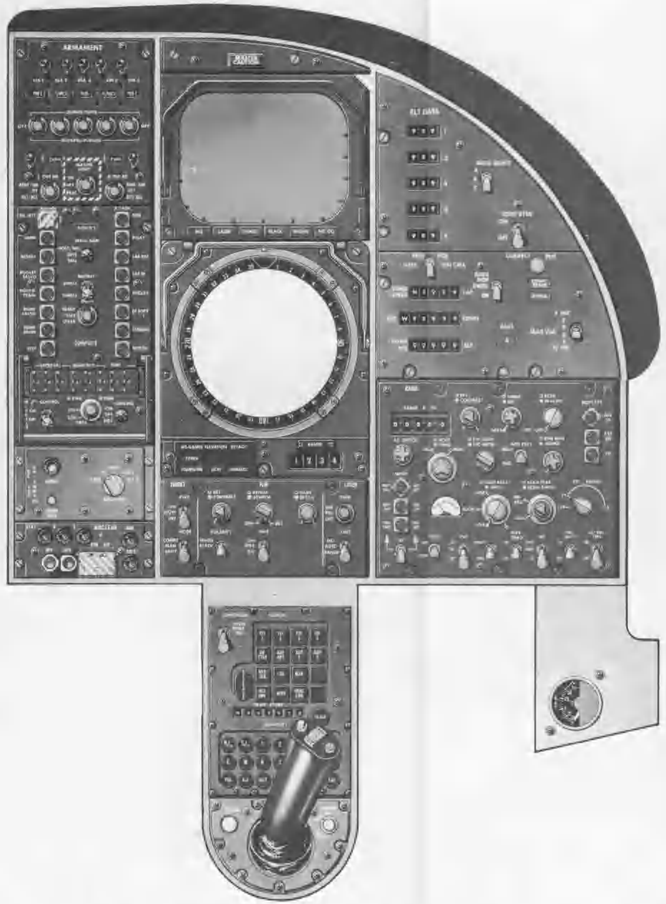
AFT BULKHEAD CONSOLE

38. ACLS CONTROL PANEL
39. RADAR BEACON CONTROL PANEL
40. KY-28 CONTROL PANEL
41. MA-1 COMPASS CONTROL PANEL

C-ADAI-718-4

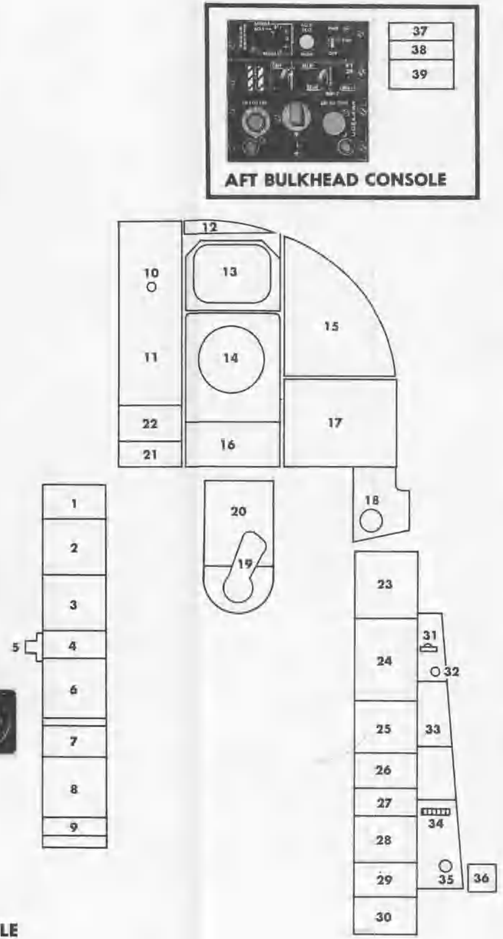
Figure FO-3 (Sheet 3)

CENTER CONSOLE



BOMBARDIER/NAVIGATOR'S INSTRUMENT PANEL

BOMBARDIER/NAVIGATOR'S RIGHT CONSOLE



COCKPIT (B/N)

A-6E

159895 AND ON MOD M121 AND ON

CENTER CONSOLE

1. AUTOPILOT CONTROL PANEL
2. NO. 1 UHF CONTROL PANEL
3. NO. 2 UHF CONTROL PANEL
4. AUX. HYD. PUMP BUTTON
5. TACAN CONTROL PANEL
6. IFF/SIF TRANSPONDER CONTROL
7. WING FOLD PANEL
8. AIR CONDITIONING CONTROL PANEL
9. CABIN DUMP/MA-1/ADC PANEL

BOMBARDIER/NAVIGATOR'S INSTRUMENT PANEL

10. MASTER ARMAMENT SWITCH
11. ARMAMENT CONTROL UNIT
12. MASTER CAUTION PANEL
13. FLIR INDICATOR
14. DIRECT VIEW RADAR INDICATOR
15. DIGITAL DISPLAY UNIT
16. DETECTION AND RANGING SET CONTROL PANEL
17. BOMBARDIER/NAVIGATOR'S CONTROL PANEL
18. OUTSIDE AIR TEMPERATURE GAGE
19. SLEW CONTROL
20. COMPUTER CONTROL UNIT (KEYBOARD)
21. NUCLEAR CONTROL PANEL
22. AWW-4 FUZING PANEL

BOMBARDIER/NAVIGATOR'S RIGHT CONSOLE

23. RADAR/DRS TEST PANEL
24. CONDOR CONTROL PANEL
25. ECM PANEL
26. VIDEO TAPE RECORDER
27. DOPPLER CONTROL PANEL
28. NAVIGATION CONTROL PANEL
29. RADIO/ICS CONTROL PANEL
30. CHAFF DISPENSER CONTROL PANEL
31. OXYGEN LEVER
32. MASTER TEST BUTTON
33. INTERIOR LIGHTING CONTROL PANEL
34. VENT SUIT-SEAT CUSHION CONTROL
35. G-VALVE TEST BUTTON
36. CLOCK

AFT BULKHEAD CONSOLE

37. RADAR BEACON CONTROL PANEL
38. KY-28 CONTROL PANEL
39. MA-1 COMPASS CONTROL PANEL

ADA1-713-5

Figure FO-3 (Sheet 4)

A-6A/B/C/A-6E AIRCRAFT FUEL SUPPLY SYSTEM

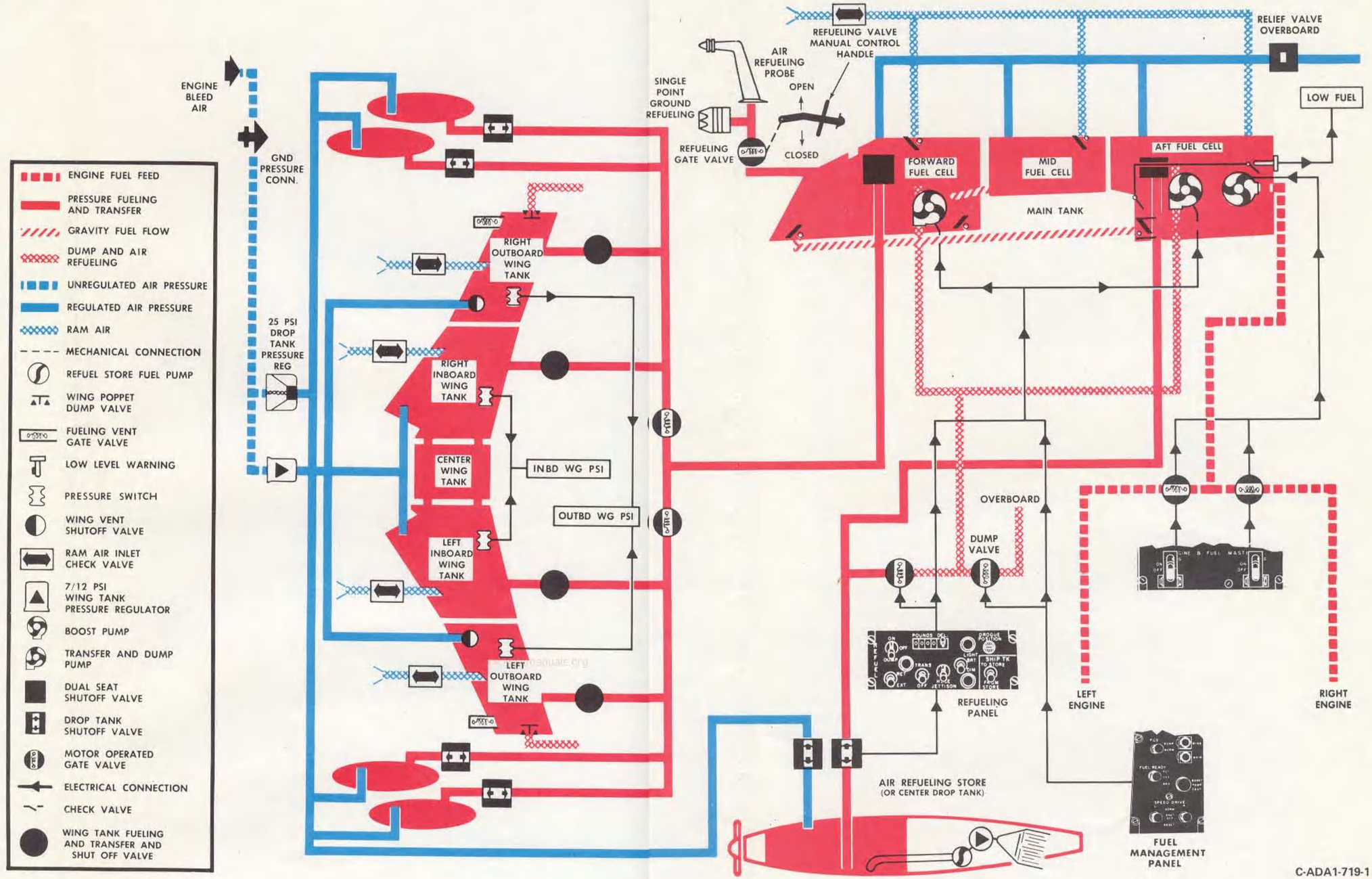


Figure FO-4 (Sheet 1)

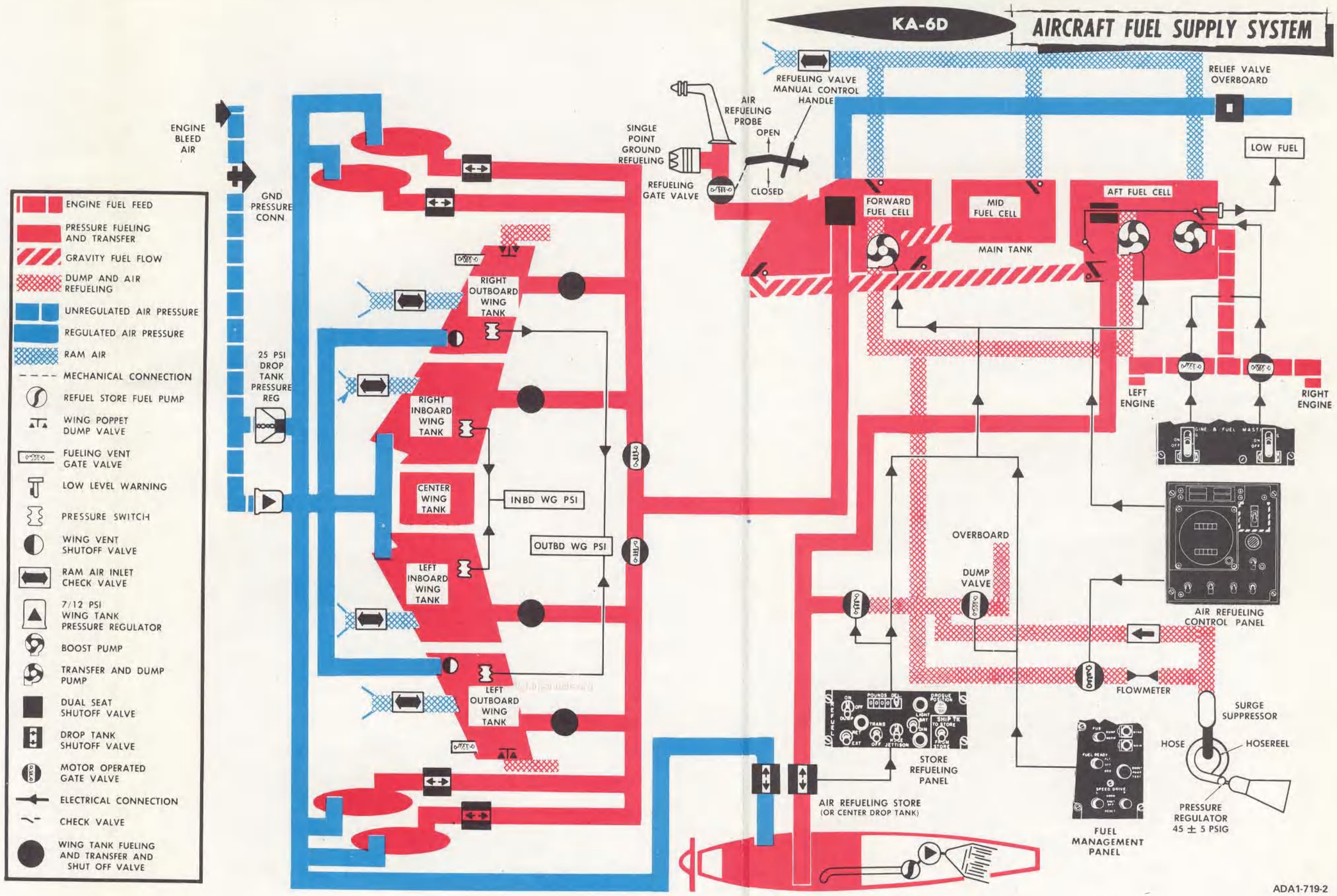
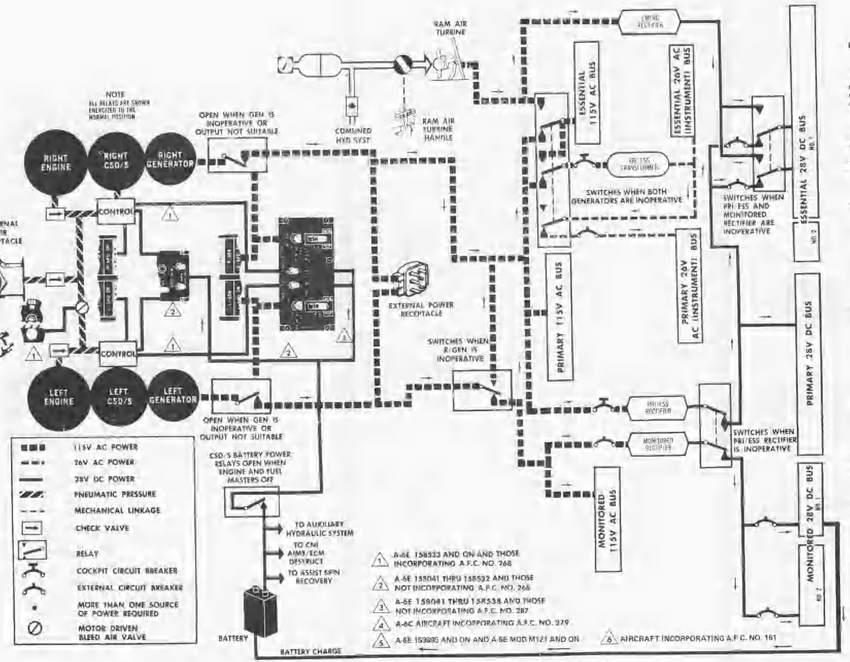


Figure FO-4 (Sheet 2)

ELECTRICAL POWER SUPPLY SYSTEM



A-6A/B/C

ESSENTIAL 28V DC BUS NO. 1

- ACLS
  - APPROACH INDEXER
- ANGLE OF ATT SYS
- ANNUNCIATOR LTS
- BALLISTIC COMPUTER
  - BULLPUP CONTROL
  - CABIN DUMP VALVE
  - ECM DESTRUCT — 2
  - EMER BRAKE RELAY
- FIRE WARNING SYS
  - FLAP/SLAT CONT
- FLAP DRIVE UNIT
- FLT INST LTS
  - GUN CLEAR
  - HOOK LIFT CONT
  - ICS PWR
- INTEGRATED POS IND
  - LANDING GEAR CONT
  - NOSE GEAR IND
  - RUDDER TRIM IND
  - SHRIKE RELAY
  - SPEED BRAKE CONT
  - SPEECH SECURITY EQUIP
  - SPEED DRIVE START
  - STABILIZER TRIM IND
  - STORE JETTISON
  - TOW LINK LOCK IND
  - TURN & SLIP IND
- WEAPON RELAY MODULE
  - WHEELS WARNING LT
  - WING FOLD CONT

NO. 2

- LABS RELAY MODULE
  - SIDEWINDER CONT
  - SPECIAL STORE PWR
  - SPECIAL STORE CONT
  - T.375 MONITOR SYS
  - WEAPON SAFE LT

PRIMARY 28V DC BUS

- AFCS CONT
- ANTI-SKID SYS
  - ANGLE OF ATT XMITTER
  - ANTI-COLLISION LT CONT
- BALLISTIC COMPUTER
- CABIN DUMP SYS
  - CANOPY DEFOG SW
  - CANOPY HANDLE CONT
  - CENTERLINE STORES VALVE
- COCKPIT LTS
- DOPPLER/PLATFORM CONT
  - FLAP/SLAT UP RELAY
  - FLIGHT FUEL READY RELAY
  - FUEL/ENGINE MASTER RELAY
  - FUEL GATE VALVE
  - GCBS PANEL
- GROUND/FLIGHT FUEL RELAY
  - GUN CHARGE
- INTEGRATED POS IND
  - ISOLATION VALVE
  - MASTER CAUTION PANEL
  - MASTER POWER RELAY

NORMAL ACCELEROMETER
- NOSE STEER SELECT VALVE
- RADAR BEACON
- SKID DETECTOR
- TOW LINK SELECT VALVE
- TOW LINK SELECT VALVE
- WEAPON RELAY MODULE
  - WINDSHIELD RAIN REMOVAL
  - WINDSHIELD WASH CONT
  - WING FOLD RELAY
  - WING LOCK/UNLOCK SELECT

MONITORED 28V DC BUS NO. 1

- AUX HYD PUMP PWR
- AUX HYD PUMP CONT
- BATTERY CHARGE
- CONSOLE LTS
- DOPPLER PWR
- DROGUE LTS
- ECM CONT
  - EXTERIOR LTS
  - LB-31A STRIKE CAMERA
  - PYLON LTS
  - RADAR RECORD PWR
  - TAIL LIGHT
  - TAXI LTS
  - TC HTR 1 & 2
  - VTR HTR — 4

NO. 2

- AIR DATA COMPUTER
- BALLISTIC COMPUTER
  - CHAFF DISPENSER
  - COUNTING ACCELEROMETER
- ECM RECEIVER PWR
  - FOLD SPREAD INTERLOCK RELAY
- G METER
- GROUND/FLIGHT FUELING RELAY
  - LAND GEAR DOWN/LOCK RELAY
- OUTSIDE AIR TEMP GAUGE
  - POWER TRIM COMPUTER
  - SMOKE ABATE CONT
  - SMOKE ABATE HEAT
- WING DUMP OVERRIDE RELAY

ESSENTIAL 115V AC BUS

- ACCELEROMETER SENSOR
  - AIR START IGNITION
  - AIR COND SELECTOR VALVE
  - AIR NAV COMPUTER PWR
- CNI PWR
  - BLEED AIR ISOL VALVE — 1
  - CONTROL STICK PWR
  - FIRE DETECTION
- FLIGHT INST LTS
  - HSI PWR
  - LAT/LONG TRIM ACTUATOR
  - LOX/FUEL/OIL IND
  - MAN TRIM CUT OFF RELAY
  - MASTER TEST PANEL
  - RUDDER TRIM ACTUATOR
  - TACAN PWR
  - VERTICAL GYRO CONT

PRIMARY 115V AC BUS

- AFCS PWR
  - AFT TRANS PUMP
  - AIR COND CONT
  - AIR COND OFF WARN
- AIR DATA COMPUTER
  - ANTI-COLLISION LT PWR
  - ANTI-ICE CONT
  - AIR REFUELING PANEL
  - BACK UP HYD PWR
- BALLISTIC COMPUTER PWR
  - BOOST PUMP PWR
  - CABIN TEMP CONT
  - CANOPY DEFOG CONT
- CNI PWR
  - CNI AUX BLOWER — 1
  - DC TRANSF & HOLD RELAY
  - DVI CONTROL
- DVI RECORDER PWR
- FLAP/SLAT DRIVE UNIT
  - FLAP/SLAT EMER PWR
  - FLAP/SLAT SELECT VALVE
- GUN FIRING
  - HSI CONTROL
- ICS PWR
- INERTIAL PLATFORM PWR
  - OPTICAL LEAD COMPUTING PWR
  - PITOT STATIC HEAT
  - RADAR ALTIMETER
  - SEARCH RADAR CONT
  - SEAT ADJUSTMENT
  - SIGNAL DATA CONVERTER
  - SUIT CONTROL
  - TRACK RADAR PWR
  - VERTICAL DISPLAY
  - VTR IRDR PWR — 4

ESSENTIAL 26V AC (INSTRUMENT) BUS

- AIR DATA COMPUTER PWR
- BALLISTIC COMPUTER PWR
  - CCT IND
  - FUEL FLOW IND
  - OIL PRESSURE IND
  - POWER TRIM COMPUTER PWR
  - POWER TRIM IND
  - RPM IND
  - UHF/ADF ANT PWR

PRIMARY 26V AC (INSTRUMENT) BUS

- CNI RECEIVER PWR
- DVI RECORDER PWR
  - HYDRAULIC PRESS IND

MONITORED 115V AC BUS

- CONSOLE LIGHTS
- DVI LIGHTS
- ECM CONTROL
- ECM PWR
  - FLIGHT INST LTS RELAY
  - FORWARD TRANSFER PUMP PWR
- G METER PWR
  - ICBS PWR
  - LB-31A STRIKE CAMERA
  - MASTER CAUTION LTS

KA-6D

ESSENTIAL 28V DC BUS

- ACLS
  - AIR REFUELING DROGUE JETT
  - APPROACH INDEXER
- ANGLE OF ATT SYS
- ANNUNCIATOR LTS
  - CABIN DUMP VALVE
  - ECM DESTRUCT — 3
  - EMER BRAKE RELAY
- FIRE WARNING SYS
  - FLAP/SLAT CONT
- FLAP DRIVE UNIT
- FLT INST LTS
  - GUN CLEAR
  - HOOK LIFT CONT
  - ICS PWR
- INTEGRATED POS IND
  - LANDING GEAR CONT
  - NOSE GEAR IND
  - RUDDER TRIM IND
  - SPEED BRAKE CONT
  - SPEECH SECURITY EQUIP
  - SPEED DRIVE START
  - STABILIZER TRIM IND
  - STORE JETTISON
  - TOW LINK LOCK IND
  - TURN & SLIP IND
- WEAPON RELAY MODULE
  - WHEELS WARNING LT
  - WING FOLD CONT

NO. 2

- LABS RELAY MODULE
  - SIDEWINDER CONT
  - SPECIAL STORE PWR
  - SPECIAL STORE CONT
  - T-375 MONITOR SYS
  - WEAPON SAFE LT

PRIMARY 28V DC BUS

- AFCS CONT
- ANTI-SKID SYS
  - ANGLE OF ATT XMITTER
  - ANTI-COLLISION LT CONT
- ARA-63 — 1
- CABIN DUMP SYS
  - CANOPY DEFOG SW
  - CANOPY HANDLE CONT
  - CENTERLINE STORES VALVE
- COCKPIT LTS
- DOPPLER/CONT
  - FLAP/SLAT UP RELAY
  - FLIGHT FUEL READY RELAY
  - FUEL/ENGINE MASTER RELAY
  - FUEL GATE VALVE
  - GROUND/FLIGHT FUEL RELAY
  - GUN CHARGE
- INTEGRATED POS IND
  - ISOLATION VALVE
  - MASTER CAUTION PANEL
  - MASTER POWER RELAY
  - NOSE STEER SELECT VALVE
  - RADAR BEACON
  - SKID DETECTOR
  - TOW LINK SELECT VALVE
- WEAPON RELAY MODULE
  - WINDSHIELD RAIN REMOVAL
  - WINDSHIELD WASH CONT
  - WING FOLD RELAY
  - WING LOCK/UNLOCK SELECT — 6

MONITORED 28V DC BUS NO. 1

- AUX HYD PUMP PWR
- AUX HYD PUMP CONT
- BATTERY CHARGE
- CONSOLE LTS
- DOPPLER PWR
- DROGUE LTS
- ECM CONT
  - EXTERIOR LTS
  - PYLON LTS
  - RADAR RECORD PWR
  - TAIL LIGHT
  - TAXI LTS

NO. 2

- ACCELEROMETER SYS
- AIR DATA COMPUTER
  - CHAFF DISPENSER
- ECM RECEIVER PWR
  - FOLD SPREAD INTERLOCK RELAY
- GROUND/FLIGHT FUELING RELAY
  - LAND GEAR DOWN/LOCK RELAY
- OUTSIDE AIR TEMP GAUGE
  - POWER TRIM COMPUTER
- WING DUMP OVERRIDE RELAY

ESSENTIAL 115V AC BUS

- AIR REFUELING PWR CONT
  - AIR START IGNITION
  - AIR COND SELECTOR VALVE
  - AIR NAV COMPUTER PWR
  - AIR ACCELEROMETER SENSOR
  - BLEED AIR ISOL VALVES — 1
- CNI PWR
  - CONTROL STICK PWR
  - FIRE DETECTION
- FLIGHT INST LTS
  - FUEL FLOW INDICATOR
  - HSI PWR
  - LAT/LONG TRIM ACTUATOR
  - LOX/FUEL/OIL IND
  - MAN TRIM CUT OFF RELAY
  - MASTER TEST PANEL
  - RUDDER TRIM ACTUATOR
  - TACAN PWR
  - VERTICAL GYRO CONT

PRIMARY 115V AC BUS

- AFCS PWR
  - AFT TRANS PUMP
  - AIR COND CONT
  - AIR COND OFF WARN
- AIR DATA COMPUTER
  - ANTI-COLLISION LT PWR
  - ANTI-ICE CONT
  - AIR REFUELING STORE PANEL
  - ARA-63
  - BACK UP HYD PWR ASN 41 EXCITATION
  - BOOST PUMP PWR
  - CABIN TEMP CONT
  - CABIN TEMP CONT
  - CNI AUX BLOWER — 1
- CNI PWR
  - DC TRANSF & HOLD RELAY
- FLAP/SLAT DRIVE UNIT
  - FLAP/SLAT EMER PWR
  - FLAP/SLAT SELECT VALVE
  - FORWARD FUEL TRANSFER PUMP
  - GUN FIRING PWR TRANS PUMP
  - HSI CONTROL
- ICS PWR
  - OPTICAL LEAD COMPUTING PWR
  - PITOT STATIC HEAT
- POWER TRIM IND
  - RADAR ALTIMETER
  - SEAT ADJUSTMENT
  - SIGNAL DATA CONVERTER
  - SUIT CONTROL
  - VERTICAL DISPLAY

ESSENTIAL 26V AC (INSTRUMENT) BUS

- AIR DATA COMPUTER PWR
  - ASN-41 SERVO EXCITATION
  - EGT IND
  - FUEL FLOW IND
  - OIL PRESSURE IND
  - POWER TRIM COMPUTER PWR
  - POWER TRIM IND
  - RPM IND
  - UHF/ADF ANT PWR

PRIMARY 26V AC (INSTRUMENT) BUS

- CNI RECEIVER PWR
- DOPPLER CONT IND
  - HYDRAULIC PRESS IND

MONITORED 115V AC BUS

- AFT TRANS PUMP
- CONSOLE LIGHTS
- ECM CONTROL
- ECM PWR
  - FLIGHT INST LTS RELAY
  - FORWARD TRANSFER PUMP
- G METER PWR
  - MASTER CAUTION LTS

A-6E

ESSENTIAL 28V DC BUS NO. 1

- AAU/19 ALTIMETER
  - AIR COND — 3
- ADF — 5
- ANGLE OF ATT SYS
- ANNUNCIATOR LTS
  - APPROACH INDEXER
  - CABIN DUMP VALVE
- CNI MA-1 COMPASS
- DIGITAL COMPUTER
  - ECM DESTRUCT — 3
  - ELECT FUZING
  - EMER BRAKE RELAY
- EMER FLAPS/SLATS
- FIRE WARNING SYS
  - FLAPS/SLAT CONT
- FLAP DRIVE UNIT
- FLT INST LTS
  - GUN CLEAR
  - GROUND SYS COOLING
  - HOOK LIFT CONT
- IFF — 5
- ICS PWR
- INTEGRATED POS IND
  - LANDING GEAR CONT
- MAV/TACAN — 5
- MASTER ARM PWR
- MISSILE PWR
  - NOSE ARM
  - NOSE GEAR IND
- OPTICAL SIGHT
  - RADAR DATA CONVERTER
  - RADAR ALT IND
  - RUDDER TRIM IND
  - SHRIKE RELAY
  - SPECIAL STORE PWR STA 3
  - SPEECH SECURITY EQUIP
  - SPEED DRIVE START
  - STBY ASSIST
  - STABILIZER TRIM IND
  - STORE JETTISON
  - TAIL ARM
  - TOW LINK LOCK IND
  - T SEC CONT
  - TURN & SLIP IND
  - UHF-1 AND UHF-2 — 5
- WEAPON RELAY MODULE
  - WHEELS WARNING LT
  - WING FOLD CONT

NO. 2

- LABS RELAY MODULE
  - SIDEWINDER CONT
  - SPECIAL STORE PWR
  - STA 2 & 4
  - SPECIAL STORE CONT
  - T.375 MONITOR SYS
  - WEAPON SAFE LT

PRIMARY 28V DC BUS

- A/D DISCRETE — 3
  - ADVISORY LIGHTS
- AFCS CONT
- AIR DATA COMPUTER
  - AIR COND
  - AIR REFUELING
- ANTI-SKID SYS
  - ANGLE OF ATT XMITTER

ANTI-COLLISION LT CONT
- APCS
- ARA-63 — 3
  - APW 73 PWR
  - ASW 25 — 5
- CABIN DUMP SYS
  - CANOPY DEFOG SW
  - CANOPY HANDLE CONT
  - CENTERLINE STORES VALVE
  - CHAFF EMIT
  - CNI
  - COCKPIT LTS
- DIGITAL COMPUTER
- DOPPLER/PLATFORM CONT
- DRS
  - ELECT FUZING
  - EQUIP COOLING — 5
  - FLAP/SLAT UP RELAY
  - FLIGHT FUEL READY RELAY
  - FUEL/ENGINE MASTER RELAY
  - FUEL GATE VALVE
  - FUEL MAIN CONT
  - FUS DUMP
  - GCBS PANEL
- GROUND/FLIGHT FUEL RELAY
  - GROUND SYSTEM COOLING
  - GUN CHARGE
  - HORIZ DISPLAY
- IFF 15
- INTEGRATED POS IND
  - ISOLATION VALVE
  - MASTER CAUTION PANEL
  - MASTER POWER RELAY
  - NOSE STEER SELECT VALVE
- OPTICAL SIGHT
  - PROBE HTR
  - RADAR BEACON
- SEARCH RADAR
  - SEQUENCER NO. 1
  - SEQUENCER NO. 2
  - SIDEWINDER PWR
  - SKID DETECTOR
  - SPEED BRAKE CONT
  - TOW LINK SELECT VALVE
  - VERTICAL DISPLAY
- WEAPON RELAY MODULE
  - WINDSHIELD RAIN REMOVAL
  - WINDSHIELD WASH CONT
  - WING FOLD RELAY
  - WING LOCK/UNLOCK SELECT

MONITORED 28V DC BUS NO. 1

- AUX HYD PUMP PWR
- AUX HYD PUMP CONT
- BATTERY CHARGE
- ECM CONT
- RADAR RECORD PWR
- TC HTR 1 & 2
- VTR IRFR (REC HTR)

NO. 2

- ACCELEROMETER SYS
- CONSOLE LTS
- DIGITAL COMPUTER TEST
  - DROGUE LTS
- ECM RECEIVER PWR
  - EXTERIOR LTS
  - EXT MASTER LTS
  - FOLD SPREAD INTERLOCK RELAY

- GROUND/FLIGHT FUELING RELAY
  - LAND GEAR DOWN/LOCK RELAY
- OUTSIDE AIR TEMP GAUGE
  - POWER TRIM COMPUTER
  - PYLON LTS
  - TAIL LIGHT
  - TAXI LTS
- WING DUMP OVERRIDE RELAY

ESSENTIAL 115V AC BUS

- ADF — 5
  - AIR START IGNITION
  - AIR COND RAM AIR VALVE
  - AIR NAV COMPUTER PWR
  - ALT ACCELEROMETER SENSOR
  - BLEED AIR ISOL VALVES — 1
- CNI MA-1 COMPASS PWR
  - CONTROL STICK PWR
  - FIRE DETECTION
- FLIGHT INST LTS — 5
  - IFF
  - MSL PWR
  - LAT/LONG TRIM ACTUATOR
  - LOX/FUEL/OIL IND
- MAV/TACAN — 5
  - MAN TRIM CUT OFF RELAY
  - MASTER TEST PANEL
  - EMER IGNITION
  - FUEL FLOW TRANS
  - RAD ICS — 5
  - RUDDER TRIM ACTUATOR
  - TACAN PWR
  - VERTICAL GYRO CONT

PRIMARY 115V AC BUS

- AFCS PWR
  - AFT TRANS PUMP
  - AIR COND CONT
  - AIR COND OFF WARN
- AIR DATA COMPUTER
  - ANTI-COLLISION LT PWR
  - ANTI-ICE CONT
  - AIR REFUELING PANEL
- ARA-63
  - APCS
- ARA-63 — 5
- ASW-32
  - BACK UP HYD PWR
  - BOOST PUMP PWR
  - CABIN TEMP CONT
  - CAINS PSU FAN — 5
  - CANOPY DEFOG CONT
  - CNI AUX BLOWER — 1
- CNI PWR
- CONDOR — 5
  - DC TRANSF & HOLD RELAY
  - DIGITAL COMPUTER PWR
- DOPPLER PWR
  - DRS
  - DVRI
- ELECT FUZING
  - ENGINE ANTI-ICE
  - EQUIP COOLING
- FLAP/SLAT DRIVE UNIT
- FLAP/SLAT EMER PWR
  - FLAP/SLAT SELECT VALVE
  - FUEL FLOW IND
- G METER POWER

- GUN FIRING
  - HSI CONTROL
- ICS PWR
  - IGNITION
  - INERTIAL PLATFORM PWR
- MISSILE PWR
- OPTICAL SIGHT PWR
  - PITOT STATIC HEAT
- POWER TRIM IND
  - RADAR ALTIMETER
  - SEARCH RADAR CONT
  - SEAT ADJUSTMENT
  - SIGNAL DATA CONVERTER
  - SPEED BRAKE NULL DET
  - SUIT CONTROL
  - VERTICAL DISPLAY
  - VTR RECORDER PWR

ESSENTIAL 26V AC (INSTRUMENT) BUS

- DIGITAL COMPUTER PWR
  - EGT IND
  - FUEL FLOWING IND
  - HSI
- MA-1/TACAN
  - OIL PRESSURE IND
  - POWER TRIM IND
  - RPM IND
  - TURNSLIP IND — 5
  - UHF/ADF ANT PWR

PRIMARY 26V AC (INSTRUMENT) BUS

- AIR DATA COMPUTER PWR
  - CNI RECEIVER PWR — 5
- CONSOLE LIGHTS
  - DOPPLER PWR
- DIGITAL COMPUTER PWR
- DRS
  - HYDRAULIC PRESS IND
  - POWER TRIM COMPUTER PWR

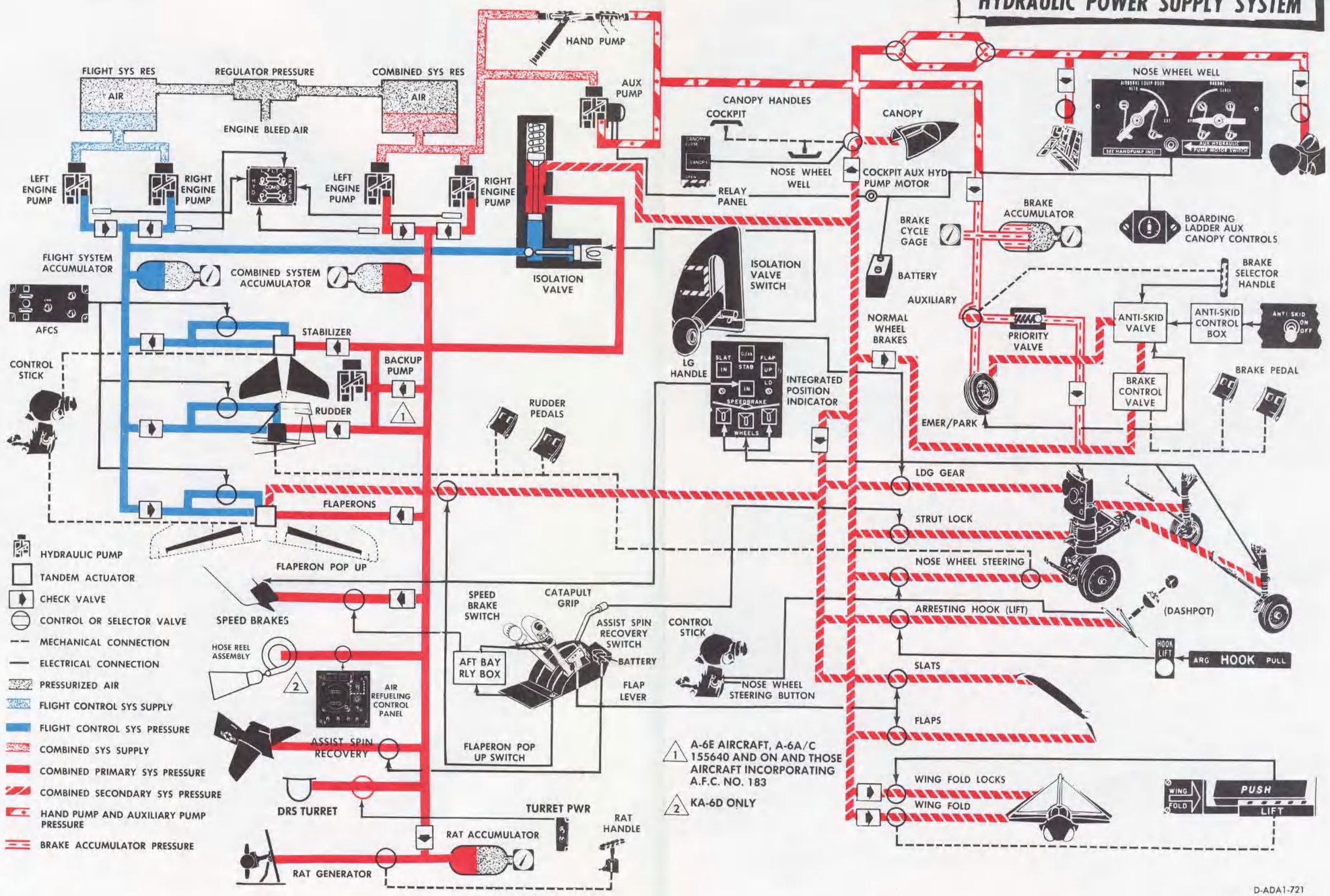
MONITORED 115V AC BUS

- CONSOLE LIGHTS
- DVRI LIGHTS
- ECM CONTROL
- ECM PWR
  - ENVIRONMENTAL CONTROL VALVES
  - FLIGHT INST LTS RELAY
  - FORWARD TRANSFER PUMP PWR
  - ICBS PWR
  - MASTER CAUTION LTS
- VTR (RDR) RECORDER PWR

G-ADA1-790

Figure FO-5

HYDRAULIC POWER SUPPLY SYSTEM



D-ADA1-721

Figure FO-6

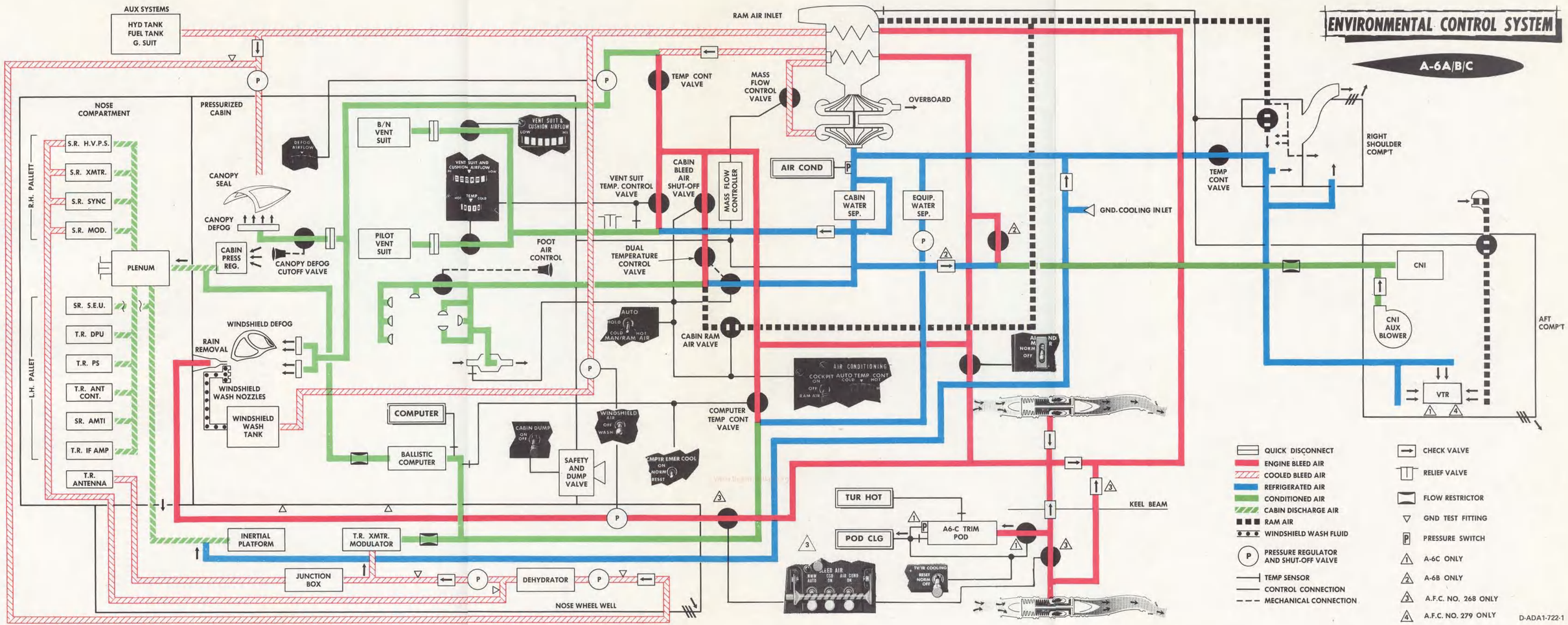


Figure FO-7 (Sheet 1)

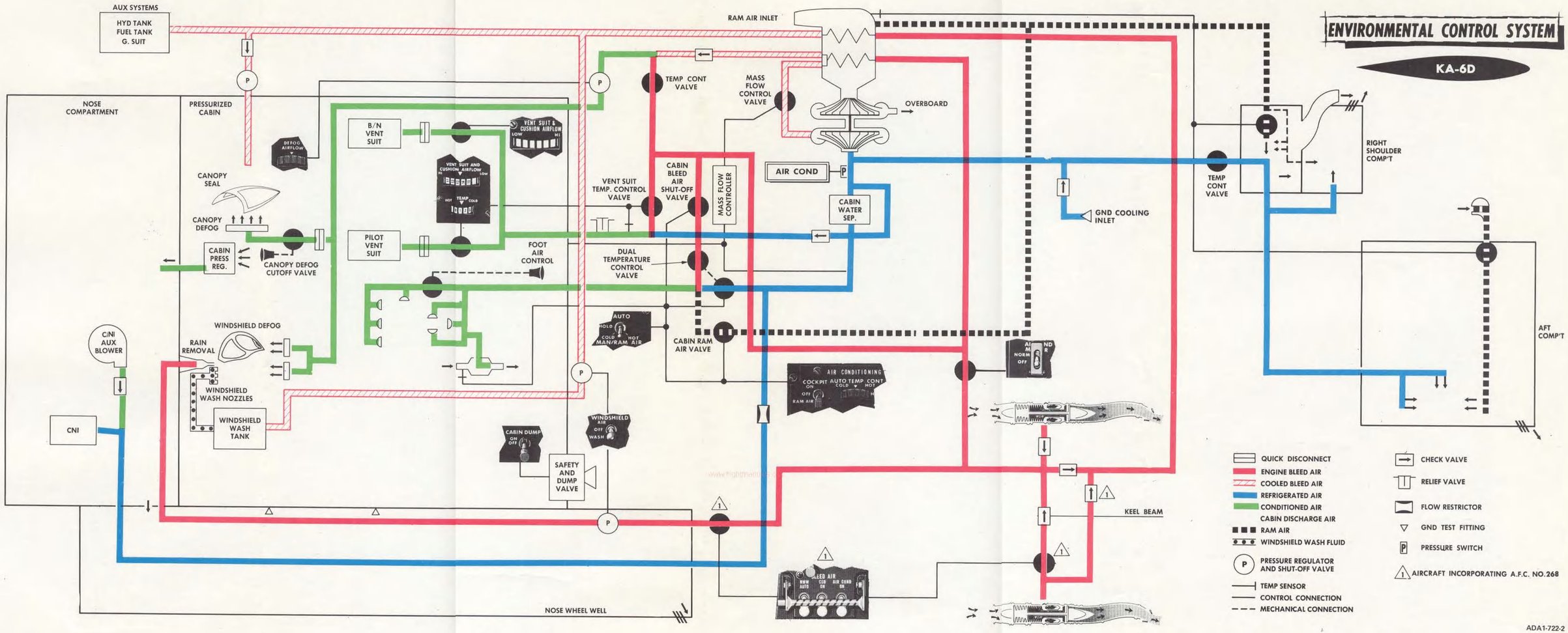


Figure FO-7 (Sheet 2)

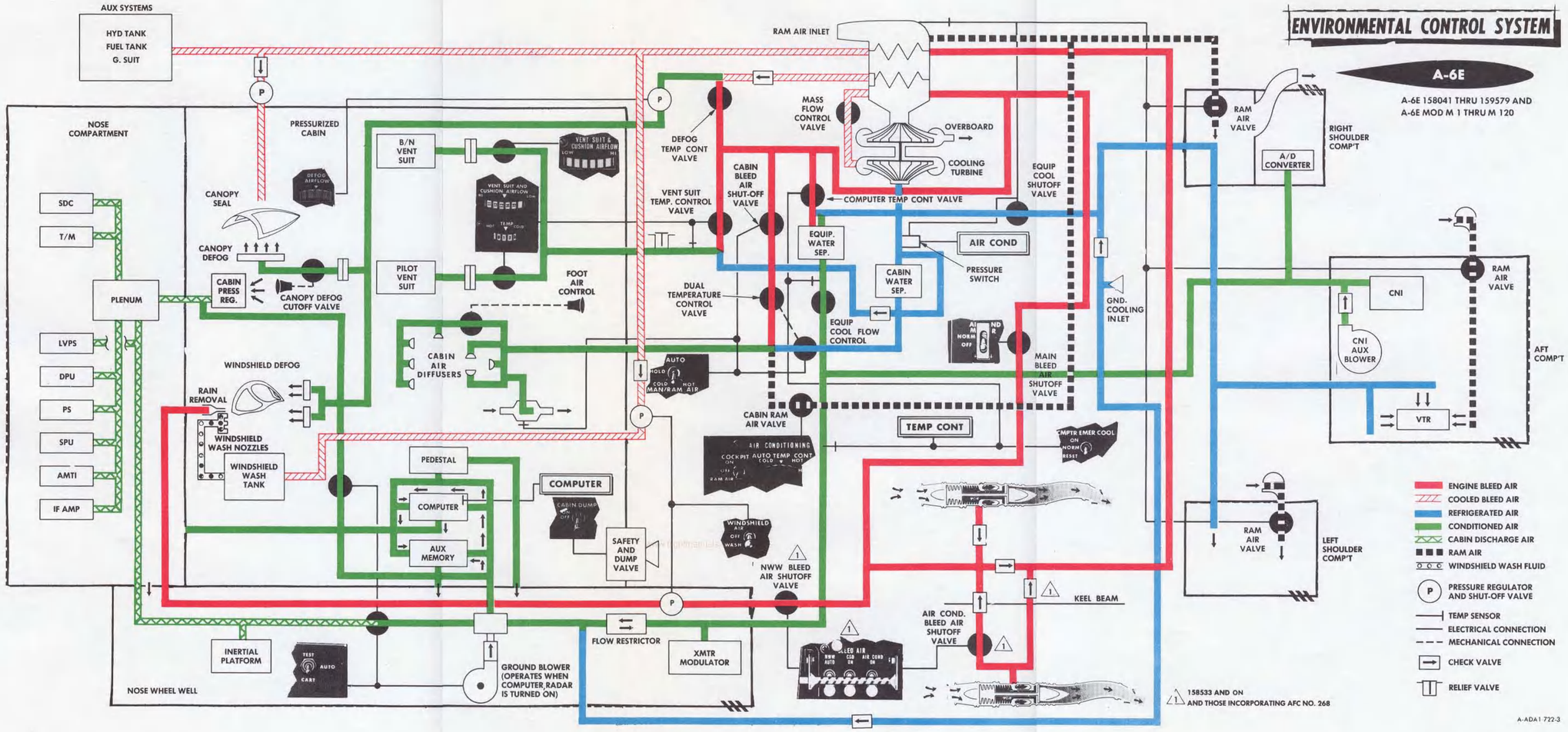


Figure FO-7 (Sheet 3)

ENVIRONMENTAL CONTROL SYSTEM

A-6E

A-6E 159895 AND ON AND A-6E MOD M-121 AND ON

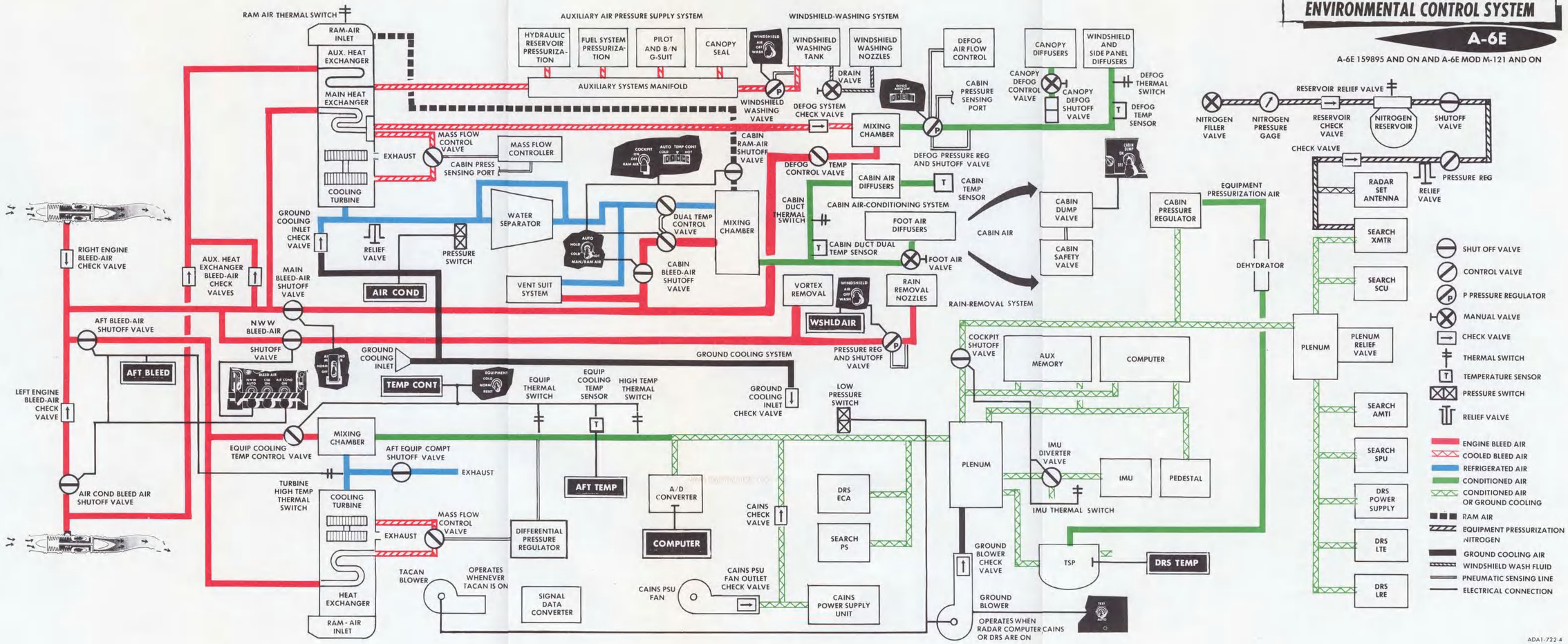


Figure FO-7 (Sheet 4)

DRAG COUNT TABLE

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-81 CONICAL TAIL	AERO 7A OR B	3	6	6
	TER	18	36	36
	TER		28	28
	MER	27		54
	MER		50	
	MER		44	44
MK-81 SNAKEYE	AERO 7A OR B	5	10	10
	TER	23	46	46
	TER		36	36
	MER	36		72
	MER		66	
	MER		56	56

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-81 SNAKEYE (CONTINUED)	MER	28		56
	MER		56	
MK-82 CONICAL TAIL	AERO 7A OR B	3	7	7
	TER	19	38	38
	TER		31	31
	MER	29		58
	MER		54	
	MER		46	46
MK-82 SNAKEYE OR MK-36 DESTRUCTOR	AERO 7A OR B	6	11	11
	TER	27	54	54
	TER		41	41
	MER	40		80

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-82 SNAKEYE OR MK-36 DESTRUCTOR (CONTINUED)	MER		74	
	MER		60	60
	MER	30		60
	MER		60	
MK-82 LASER GUIDED BOMB	AERO 7A		18	18
MK-83 LOOP CONICAL FIN	AERO 7A OR B	4	8	8
	TER	22		44
	TER		34	34
	MER ALL LOADINGS	26	52	52
MK-83 LASER GUIDED BOMB (WITH MK 82 LGB LOW SPEED FIN)	AERO 7A		28	28
	TER	23	46	46

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-40 DESTRUCTOR MK 83 WITH MAU-91 FIN	AERO 7A OR B	8	16	16
	TER	25		51
	MER ALL LOADINGS	38	76	76
MK-84 LOOP	AERO 7A OR B	6	11	11
MK-84 LASER GUIDED BOMB (HIGH SPEED)	AERO 7A		44	44
M-117 DEMOLITION BOMB	AERO 7A OR B	7	13	13
	TER	29		58
	TER		44	
	MER OR	33	66	66
CBU-24 CBU-49	AERO 7A OR B	8	16	16
	TER	34		69
	TER		51	
	MER	38		76
			76	
				59

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-77 MOD 2 & 4 FIREBOMB	AERO 7A OR B	11/19	22/38	22/38
	TER	19/28	38/55	38/55
	MER	29/42	59/84	59/84
MK-20 MOD 2 CLUSTER BOMB ROCKEYE 11	AERO 7A OR B	5	10	10
	TER	25		50
	TER		38	
	MER	38		76
	MER		70	
CBU-59/B APAM	AERO 7A OR B	8	16	16
	TER	34		
	TER		51	51
	MER		76	76
	MER	38		
AGM-45A SHRIKE	AERO 5A-1		12	12

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
SIDEWINDER AIM-9D/G/H TRAINING MISSILE (MDU-26/A)	GAEC ADAPTER, AERO 1A OR ADU 299/E OR ADU 299 A/A ADAPTER WITH LAU 7A LAUNCHER		20	20
AGM-78A A/B/C STANDARD ARM MISSILE	LAU-77A/A LAUNCHER		31	31
LAU-32A/A LAU-32B/A LAU-56/A LAU-58/A ROCKET PODS	AERO 7A		9/24	9/24
	TER			45/93
	TER		35/67	
LAU-10/A LAU-10A/A ROCKET PODS	AERO 7A		14/44	14/44
	TER			60/153
	TER		45/107	
LAU-3A/A LAU-60/A LAU-61/A LAU-69/A ROCKET PODS	AERO 7A		9/20	9/20
	TER			45/81
	TER		35/59	
MK-4 GUN POD	AERO 7A OR B		20	20

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
300 GAL. FUEL TANK	AERO 7A OR B	10	20	20
SGT. FLETCHER MODEL 31-300 REFUELING STORE D-704 REFUELING STORE	AERO 7A OR B		12	
CTU-1/A OR CTU-2/A DELIVERY CONTAINER	AERO 7A		22	22
SUU-53A DISPENSER	AERO 7A		14	14
B-28 MK-104	AERO 7A OR B	8	16	
B-43	AERO 7A OR B	10	20	
B-57	AERO 7A OR B	7	14	
BDU-20/C	AERO 7A OR B	4	8	
B-61	AERO 7A OR B	4	8	

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
BDU-36	AERO 7A OR B	5	10	
BDU-11E	AERO 7A OR B	4	8	
BDU-6E	AERO 7A OR B	10	20	
B-61 TYPE 3/E	AERO 7A OR B	5	10	
BDU-8/B	AERO 7A OR B	10	20	
BDU-12/B	AERO 7A OR B	4	8	
MK-25 MINE	AERO 7A OR B	58	116	116
MK-36 MINE	AERO 7A OR B	48	88	88
MK-52 MINE	AERO 7A OR B	45	90	90
MK-53 MINE	AERO 7A OR B	22	45	45
MK-55 MINE	AERO 7A OR B	63	126	126
MK-56 MINE	AERO 7A OR B	68	136	136
MK-86 WATER SAND FILL PRACTICE BOMB	AERO 7A OR B MER TER	(SAME DRAG COUNT AS MK-81)		
MK-87 WATER SAND FILL PRACTICE BOMB	AERO 7A OR B MER TER	(SAME DRAG COUNT AS MK-82)		

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-88 WATER SAND FILL PRACTICE BOMB	AERO 7A OR B MER TER	(SAME DRAG COUNT AS MK-83)		
MK-76 MOD 4 OR 5 PRACTICE BOMB	PMBR	29	59	59
	MER	26	52	52
	TER	14	29	29
MK-106 MOD 3 OR 4 PRACTICE BOMB	PMBR	42	84	84
	MER	38	77	77
	TER	21	42	42
MK-124 MOD 0 PRACTICE BOMB	AERO 7A OR B TER MER	(SAME DRAG COUNT AS MK-82 SNAKEYE)		

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
MK-45 MOD 0 OR MK-24 MOD 2A, 3, 4 PARACHUTE FLARE	TER	22	45	45
	MER	34	68	68
SUU-40/A OR SUU-44/A POD	AERO 7A OR B			30
	TER			77
	MER			85
SONOBUOY				
MK-58 MOD 0 MARINE LOCATION MARKER	MER	33	67	67
ADSID-1 SEISMIC SENSOR	MER	43		86
	MER		78	
	TER	27		54
	TER		46	

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
ADSID-111 SEISMIC SENSOR	MER	26	52	52
	TER	19	38	38
M129E1 AND M129E2 CHAFF CANISTER	AERO 7A OR B	5	10	10
	TER	25		50
	TER		38	38
	MER	29		
	MER		58	58
	MER	38		76
	MER		70	
CHAFFEYE WITH MK-339 FUSE	AERO 7A OR B	5	10	10
	TER	25		50
	TER		38	
	MER	38		76
	MER		70	

STORE	LOADING	Sta 3	Sta 2,4	Sta 1,5
CNU-188/A EXTERNAL BAGGAGE CONTAINER	AERO 7A	10	20	20
LB-31A STRIKE CAMERA POD	AERO 7A OR B	9		18 *9
	TER	17		34 *17
	TER	21		42 *21
AIR SHIP DELIVERY CONTAINER SYSTEM	TER		50	50

*STATION 1 ONLY.

NOTE

THE A-6E TRAM CONFIGURED AIRCRAFT (5/8/69 AND ON, AND MOD M121 AND ON) HAS A DRAG COUNT OF 18 WITH NO STORES LOADED.

DATE: 1 SEPTEMBER 1969
DATA BASIS: ESTIMATED

NOTE

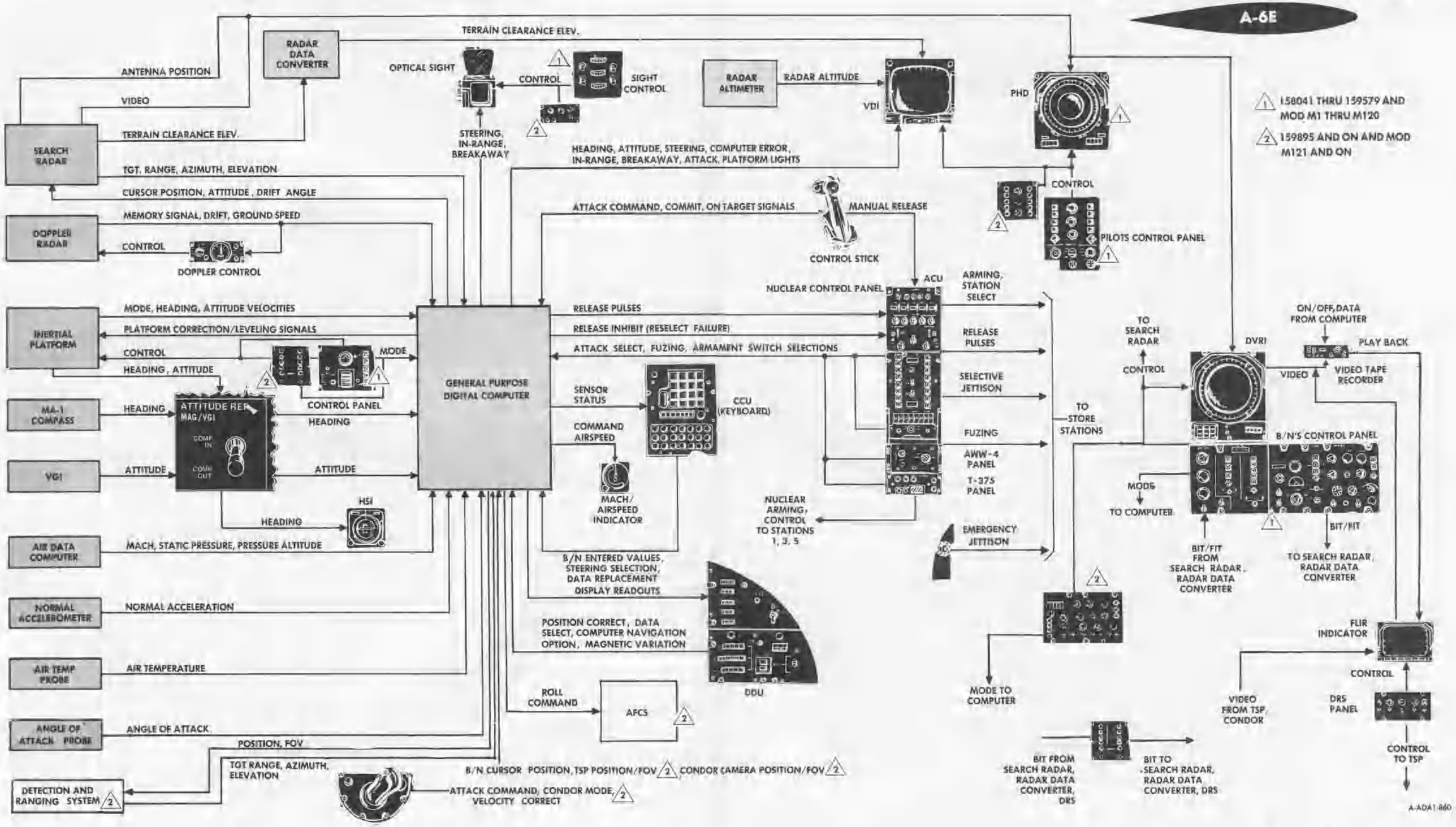
THE LOADINGS LISTED IN THIS TABLE ARE NOT TO BE TAKEN AS AUTHORITY FOR AIRCRAFT LOADING FOR AIR CRAFT STORES LIMITATIONS. REFER TO NAVAIR 01-85ADA-1T

D-ADA1-586

Figure FO-8

ATTACK/NAVIGATION SYSTEM

A-6E



1 158041 THRU 159579 AND MOD M1 THRU M120

2 159895 AND ON AND MOD M121 AND ON

Figure FO-9

COMPUTER FLOW BLOCK DIAGRAM

A-6E

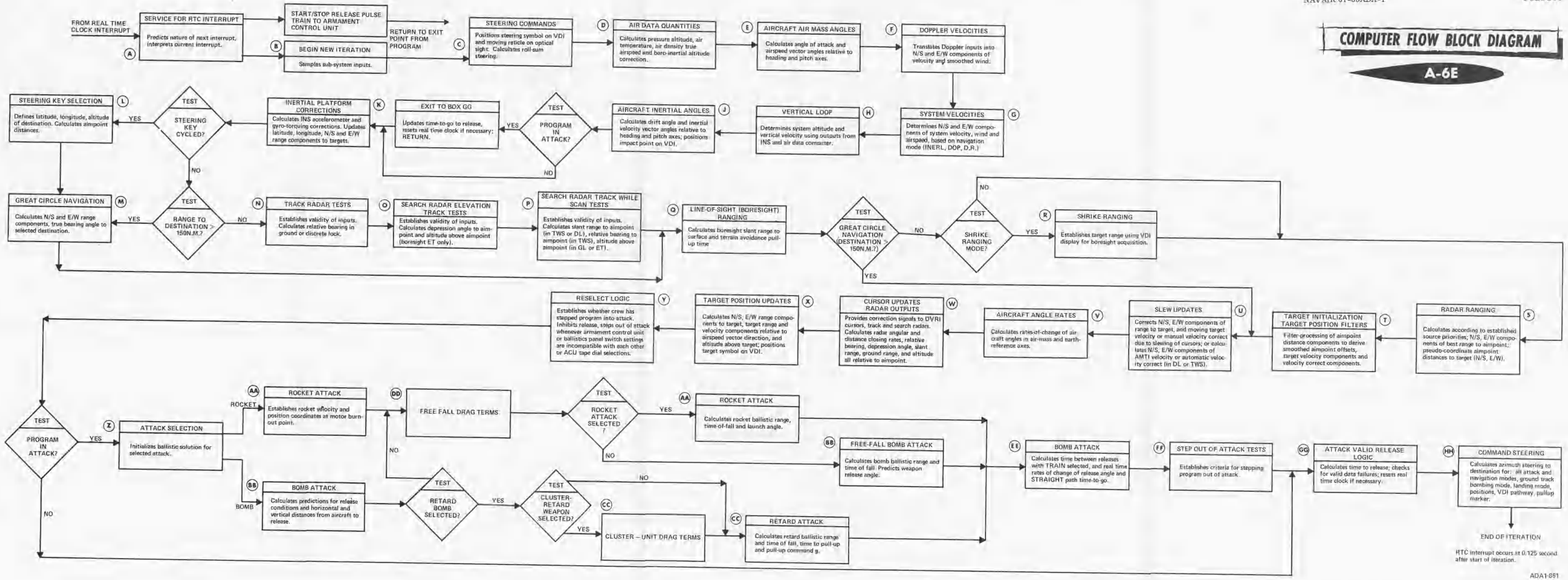
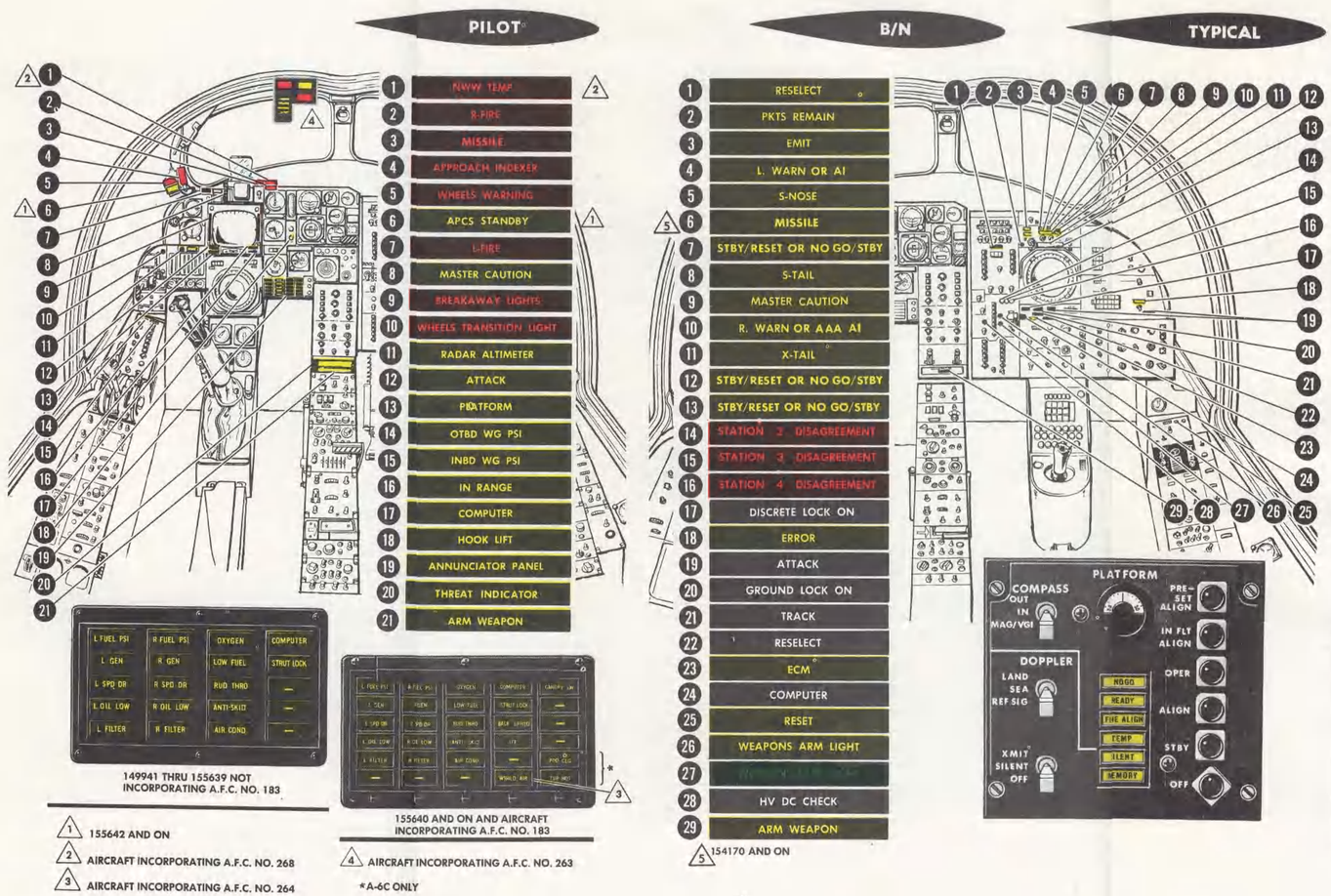


Figure FO-10

WARNING, CAUTION AND ADVISORY LIGHTS

A-6A/B/C



ANNUNCIATOR CAUTION LIGHTS

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
L OR R FUEL PSI	EITHER LIGHT—ENGINE BOOST PUMP FAILURE	DESCEND/REDUCE POWER	POSSIBLE FLAME OUT POSSIBLE THRUST LOSS
	BOTH LIGHTS—ELECTRICAL BOOST PUMP FAILURE		
L OR R GEN	LOSS OF GENERATOR, CSDS MALFUNCTION	CYCLE GENERATOR SWITCH TO OFF-RESET THEN ON	RESETTING CSDS MAY AID IN REGAINING GENERATORS
L OR R SPD DR	FLASHING: OVERSPEED	REDUCE RPM AND RESET	
	STEADY: LOW OIL PRESSURE, HIGH OIL TEMPERATURE OR CSD FAILURE	DESCEND, RESET OR SECURE AFFECTED CSD	IF GENERATOR LOSS AT NIGHT OR IFR DEPLOY RAT
L OR R OIL LOW	LESS THAN 5 QUARTS/ 20% OIL REMAINING	LAND AS SOON AS PRACTICABLE	MONITOR OIL PRESSURE CLOSELY, SHUT DOWN IF OIL PRESSURE DROPS BELOW ACCEPTABLE LIMITS
L OR R FILTER	FUEL FILTER IS OBSTRUCTED	LAND AS SOON AS PRACTICABLE	POSSIBLE FUEL CONTAMINATION
OXYGEN	LESS THAN 2 LITERS IN THE CONVERTERS, OR LESS THAN 50 PSI IN SUPPLY LINE	DESCEND, MONITOR CABIN ALTITUDE, LAND	
LOW FUEL	FUEL REMAINING IN FUSELAGE TANK: 1460 +200 −100 (4° NOSE UP ATTITUDE)	CHECK TURN/SLIP C. B. IN FUEL READY SWITCH OFF FUEL TRANSFER	IF NO FUEL TRANSFER LAND AS SOON AS POSSIBLE
RUD THROW	EXTENDED THROW AVAILABLE IN CLEAN CONFIGURATION OR SPIN ASSIST SWITCH IS ACTUATED	OBSERVE RUDDER PEDAL DEFLECTION LIMITS	
ANTI-SKID (SWITCH ON)	ANTI-SKID INOPERATIVE	ANTI-SKID SWITCH OFF	LIGHT WILL COME ON IF SWITCH IS OFF IN LANDING CONFIGURATION OR WITH SWITCH ON WHEN BRAKE SELECTOR HANDLE OUT OR ROTATED
AIR COND	AIR COND SWITCH OFF	AIR COND SWITCH NORM	IF LIGHT REMAINS ON SECURE ALL ELECTRONIC EQUIPMENT EXCEPT CNI LAND AS SOON AS PRACTICABLE
	AIR COND SWITCH NORM: OVER PRESSURIZATION IN AIR COND DUCT	LIGHT REMAINS ON—AIR COND SWITCH OFF, ELECTRONIC EQUIPMENT OFF LIGHT OUT—NO ACTION REQ	POSSIBLE DAMAGE TO AIR COND SYSTEM. LAND AS SOON AS PRACTICABLE

ANNUNCIATOR CAUTION LIGHTS (cont.)

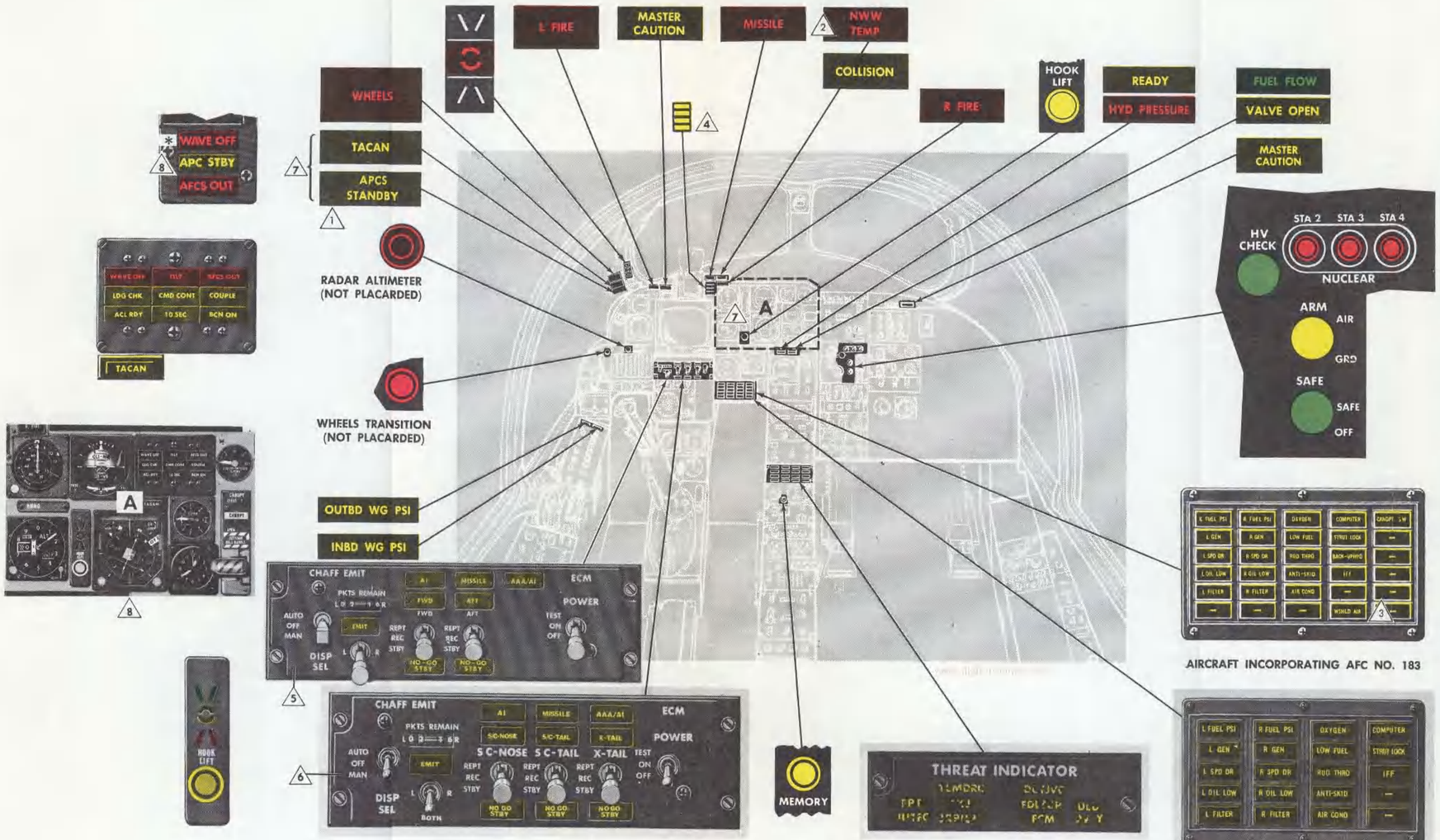
LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
COMPUTER	STEADY: NORMAL COMP. COOLING SYSTEM FAILURE	EMER COOL SWITCH ON	IF LIGHT REMAINS ON SECURE COMP AND AIR COND MASTER. SECURE ELECTRONIC EQUIPMENT.
	FLASHES: INDICATES A SHIFT FROM REGULATED TO UNREGULATED COOLING	RESET COMP EMER COOL SWITCH	
STRUT LOCK	UNLOCKED STRUT WITH TOW LINK DOWN, POWER ABOVE 82.5%	RAISE CATAPULT GRIP	INDICATES SOFT NOSE STRUT.
	HARD STRUT WITH LANDING GEAR AND FLAPS DOWN, POWER BELOW 82.5%		FIELD LANDING PREFERRED
BACK-UP HYD	BACK UP HYDRAULIC PUMP OPERATING		FLIGHT OR COMBINED HYDRAULIC SYSTEM FAILURE
IFF	IMPROPER MODE 4 OPERATION		
CANOPY SW	CANOPY SWITCH NOT AT CLOSE POSITION	SET CANOPY SWITCH TO CLOSE	SWITCH WILL REMAIN IN CLOSED POSITION
WSHLD AIR	RAIN REMOVAL SWITCH ON	WSHLD AIR OFF, IF NOT REQUIRED	IF WSHLD AIR REMAINS ON WHEN NOT DESIRED, TURN NWW SWITCH OFF
POD CLG (A-6C)	COOLANT TEMP EXCEEDS 150°F OR COOLANT PRESSURE IS BELOW 2 PSI	RECYCLE TV/IR COOLING SWITCH	IF LIGHT REMAINS ON SECURE IR SENSORS
TUR HOT A-6C	AIR TEMPERATURE IN TURRET IS ABOVE 135°F	SECURE IR SENSORS	
TUR HOT WITH COMP LIGHT A-6C	TV/IR POD AIR COND NO. 2 CIRCUIT BREAKER POPPED	RESET NO. 2 TV/IR AIR COND CIRCUIT BREAKER	IF UNABLE TO RESET SECURE IR SENSORS

ADA1-862-1

Figure FO-11 (Sheet 1)

WARNING, CAUTION AND ADVISORY LIGHTS

KA-6D



* FLASHING

1 AIRCRAFT INCORPORATING A.F.C. NO. 199
2 AIRCRAFT INCORPORATING A.F.C. NO. 268
3 AIRCRAFT INCORPORATING A.F.C. NO. 264
4 AIRCRAFT INCORPORATING A.F.C. NO. 263
5 AIRCRAFT INCORPORATING A.F.C. NO. 287
6 AIRCRAFT NOT INCORPORATING A.F.C. NO. 287
7 AIRCRAFT NOT INCORPORATING A.F.C. NO. 161
8 AIRCRAFT INCORPORATING A.F.C. NO. 161

ANNUNCIATOR CAUTION LIGHTS

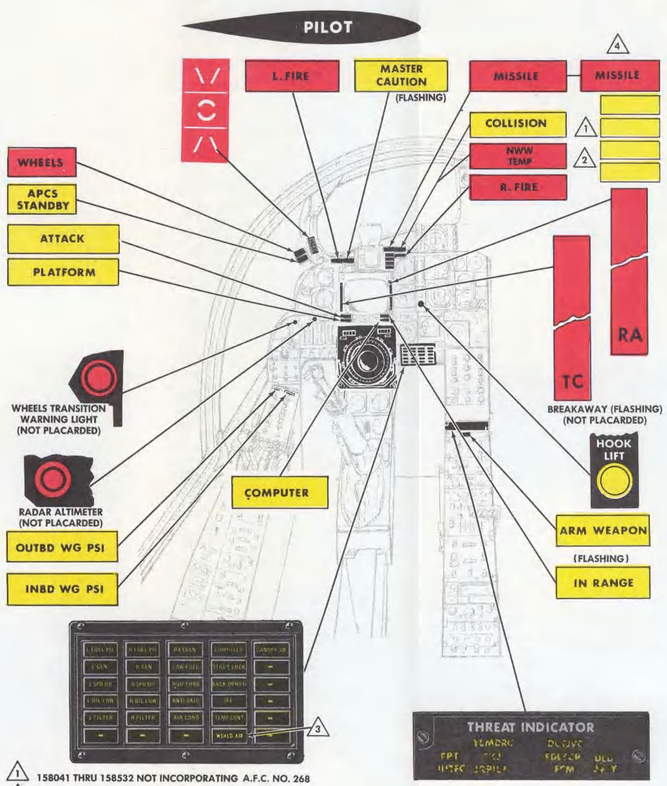
LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
L OR R FUEL PSI	EITHER LIGHT—ENGINE BOOST PUMP FAILURE	DESCEND/REDUCE POWER	POSSIBLE FLAME OUT POSSIBLE THRUST LOSS
	BOTH LIGHTS—ELECTRICAL BOOST PUMP FAILURE		
L OR R GEN	LOSS OF GENERATOR, CSDS MALFUNCTION	CYCLE GENERATOR SWITCH TO OFF-RESET THEN ON	RESETTING CSDS MAY AID IN REGAINING GENERATORS
L OR R SPD DR	FLASHING: OVERSPEED	REDUCE ARM AND RESET	
	STEADY: LOW OIL PRESSURE, HIGH OIL TEMPERATURE OR CSD FAILURE	DESCEND, RESET OR SECURE AFFECTED CSD	IF GENERATOR LOSS AT NIGHT OR IFR DEPLOY RAT
L OR R OIL LOW	LESS THAN 5 QUARTS/ 20% OIL REMAINING	LAND AS SOON AS PRACTICABLE	MONITOR OIL PRESSURE CLOSELY, SHUT DOWN IF OIL PRESSURE DROPS BELOW ACCEPTABLE LIMITS
L OR R FILTER	FUEL FILTER IS OBSTRUCTED	LAND AS SOON AS PRACTICABLE	POSSIBLE FUEL CONTAMINATION
OXYGEN	LESS THAN 2 LITERS IN THE CONVERTERS, OR LESS THAN 50 PSI IN SUPPLY LINE	DESCEND, MONITOR CABIN ALTITUDE, LAND	
LOW FUEL	FUEL REMAINING IN FUSELAGE TANK: 1460 +200 −100 (4° NOSE UP ATTITUDE)	CHECK TURN/SLIP C. B. IN FUEL READY SWITCH OFF FUEL TRANSFER	IF NO FUEL TRANSFER LAND AS SOON AS POSSIBLE
RUD THROW	EXTENDED THROW AVAILABLE IN CLEAN CONFIGURATION OR SPIN ASSIST SWITCH IS ACTUATED	OBSERVE RUDDER PEDAL DEFLECTION LIMITS	
ANTI-SKID (SWITCH ON)	ANTI-SKID INOPERATIVE	ANTI-SKID SWITCH OFF	LIGHT WILL COME ON IF SWITCH IS OFF IN LANDING CONFIGURATION OR WITH SWITCH ON WHEN BRAKE SELECTOR HANDLE OUT OR ROTATED
AIR COND	AIR COND SWITCH OFF	AIR COND SWITCH NORM	IF LIGHT REMAINS ON SECURE ALL ELECTRONIC EQUIPMENT EXCEPT CNI. LAND AS SOON AS PRACTICABLE
	AIR COND SWITCH NORM: OVER PRESSURIZATION IN AIR COND DUCT	LIGHT REMAINS ON—AIR COND SWITCH OFF, ELECTRONIC EQUIPMENT OFF LIGHT OUT—NO ACTION REQ.	POSSIBLE DAMAGE TO AIR COND SYSTEM, LAND AS SOON AS PRACTICABLE
STRUT LOCK	UNLOCKED STRUT WITH TOW LINK DOWN, POWER ABOVE 82.5%	RAISE CATAPULT GRIP	INDICATES SOFT NOSE STRUT
	HARD STRUT WITH LANDING GEAR AND FLAPS DOWN, POWER BELOW 82.5%		FIELD LANDING PREFERRED
BACKUP HYD	BACKUP HYDRAULIC PUMP OPERATING		FLIGHT OR COMBINED HYDRAULIC SYSTEM FAILURE
IFF	IMPROPER MODE 4 OPERATION		
CANOPY SW	CANOPY SWITCH AT CLOSE POSITION	SET CANOPY SWITCH TO CLOSE	SWITCH WILL REMAIN IN CLOSED POSITION
WSHLD AIR	RAIN REMOVAL SWITCH ON	WSHLD AIR OFF, IF NOT REQUIRED	IF WSHLD AIR REMAINS ON WHEN NOT DESIRED, TURN NWW SWITCH OFF

ADA1-862-2

Figure FO-11 (Sheet 2)

WARNING, CAUTION AND ADVISORY LIGHTS

158041 THRU 159579 AND MOD M-1 THRU M-120 — A-6E TYPICAL

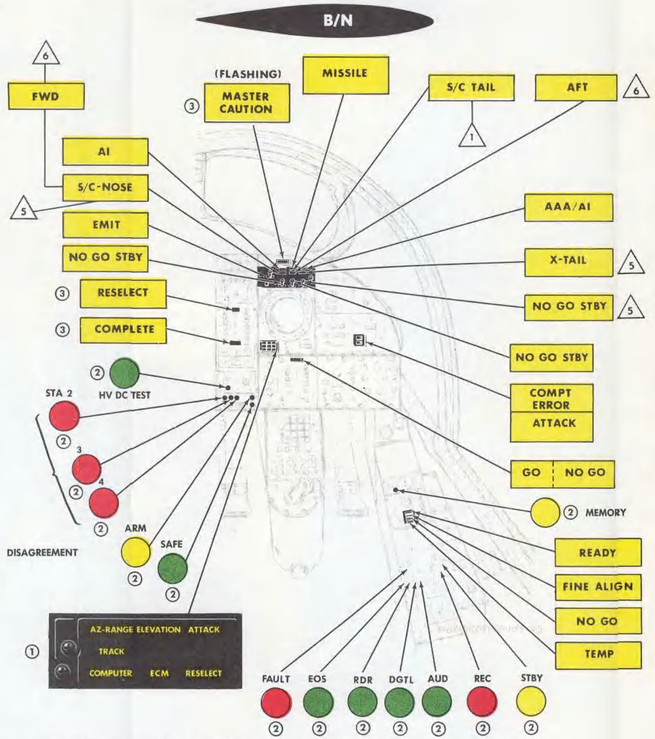


△1 158041 THRU 158532 NOT INCORPORATING A.F.C. NO. 268

△2 158533 AND ON AND THOSE INCORPORATING A.F.C. NO. 268

△3 AIRCRAFT INCORPORATING A.F.C. NO. 264

△4 AIRCRAFT INCORPORATING A.F.C. NO. 263



① MAY BE TESTED BY PRESSING EITHER PILOT'S OR B/N'S MASTER TEST BUTTON

② DOES NOT ILLUMINATE WHEN B/N'S MASTER TEST BUTTON IS DEPRESSED

③ MAY ONLY BE TESTED BY DEPRESSING PILOT'S MASTER TEST BUTTON

△5 AIRCRAFT NOT INCORPORATING A.F.C. NO. 287

△6 AIRCRAFT INCORPORATING A.F.C. NO. 287

ANNUNCIATOR CAUTION LIGHTS

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
L OR R FUEL PSI	EITHER LIGHT—ENGINE BOOST PUMP FAILURE	DESCEND/REDUCE POWER	POSSIBLE FLAME OUT POSSIBLE THRUST LOSS
	BOTH LIGHTS—ELECTRICAL BOOST PUMP FAILURE		
L OR R GEN	LOSS OF GENERATOR, CSDS MALFUNCTION	CYCLE GENERATOR SWITCH TO OFF-RESET THEN ON	RESETTING CSDS MAY AID IN REGAINING GENERATORS.
L OR R SPD DR	FLASHING: OVERSPEED	REDUCE RPM AND RESET	
	STEADY: LOW OIL PRESSURE, HIGH OIL TEMPERATURE OR CSD FAILURE	DESCEND, RESET OR SECURE AFFECTED CSD	IF GENERATOR LOSS AT NIGHT OR IFR DEPLOY RAT
L OR R OIL LOW	LESS THAN 5 QUARTS/ 20% OIL REMAINING	LAND AS SOON AS PRACTICABLE	MONITOR OIL PRESSURE CLOSELY, SHUT DOWN IF OIL PRESSURE DROPS BELOW ACCEPTABLE LIMITS
L OR R FILTER	FUEL FILTER IS OBSTRUCTED	LAND AS SOON AS PRACTICABLE	POSSIBLE FUEL CONTAMINATION
OXYGEN	LESS THAN 2 LITERS IN THE CONVERTERS, OR LESS THAN 50 PSI IN SUPPLY LINE	DESCEND, MONITOR CABIN ALTITUDE, LAND	
LOW FUEL	FUEL REMAINING IN FUSELAGE TANK: 1460 +200 −100 (4° NOSE UP ATTITUDE)	CHECK TURN/SLIP C. B. IN FUEL READY SWITCH OFF FUEL TRANSFER	IF NO FUEL TRANSFER LAND AS SOON AS POSSIBLE
RUD THROW	EXTENDED THROW AVAILABLE IN CLEAN CONFIGURATION OR SPIN ASSIST SWITCH IS ACTUATED	OBSERVE RUDDER PEDAL DEFLECTION LIMITS	
ANTI-SKID (SWITCH ON)	ANTI-SKID INOPERATIVE	ANTI-SKID SWITCH OFF	LIGHT WILL COME ON IF SWITCH IS OFF IN LANDING CONFIGURATION OR WITH SWITCH ON WHEN BRAKE SELECTOR HANDLE CUT OR ROTATED
AIR COND	AIR COND SWITCH OFF	AIR COND SWITCH NORM	IF LIGHT REMAINS ON SECURE ALL ELECTRONIC EQUIPMENT EXCEPT CNI. LAND AS SOON AS PRACTICABLE
	AIR COND SWITCH NORM: OVER PRESSURIZATION IN AIR COND DUCT	LIGHT REMAINS ON—AIR COND SWITCH OFF, ELECTRONIC EQUIPMENT OFF LIGHT OUT—NO ACTION REQ.	POSSIBLE DAMAGE TO AIR COND SYSTEM. LAND AS SOON AS PRACTICABLE

ANNUNCIATOR CAUTION LIGHTS (cont.)

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
COMPUTER	COMPUTER OVERHEATED	SECURE COMPUTER	
STRUT LOCK	UNLOCKED STRUT WITH TOW LINK DOWN, POWER ABOVE 82.5%	RAISE CATAPULT GRIP	INDICATES SOFT NOSE STRUT.
	HARD STRUT WITH LANDING GEAR AND FLAPS DOWN, POWER BELOW 82.5%		FIELD LANDING PREFERRED
BACKUP HYD	BACKUP HYDRAULIC PUMP OPERATING		FLIGHT OR COMBINED HYDRAULIC SYSTEM FAILURE
IFF	IMPROPER MODE 4 OPERATION		
TEMP CONT	STEADY: NORMAL COMP. COOLING SYSTEM FAILURE	EMER COOL SWITCH ON	IF LIGHT REMAINS ON SECURE COMP AND AIR COND MASTER. SECURE ELECTRONIC EQUIPMENT.
	FLASHES: INDICATES A SHIFT FROM REGULATED TO UNREGULATED COOLING	RESET COMP EMERG COOL SWITCH	
WSHLD AIR	RAIN REMOVAL SWITCH ON	WSHLD AIR OFF, IF NOT REQUIRED	IF WSHLD AIR REMAINS ON WHEN NOT DESIRED, TURN NWW SWITCH OFF
CANOPY SW	CANOPY SWITCH NOT AT CLOSE POSITION	SET CANOPY SWITCH CLOSE	SWITCH WILL REMAIN ON CLOSED POSITION

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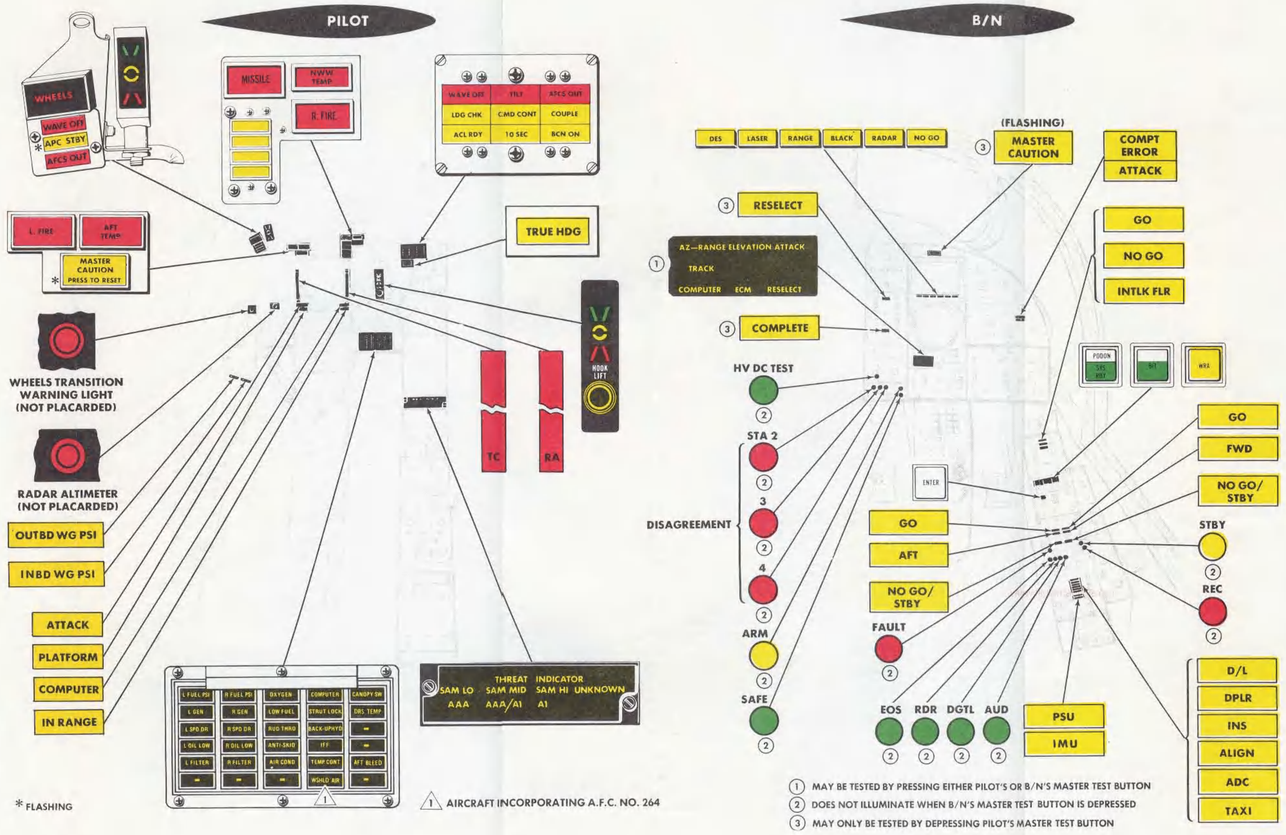
Figure FO-11 (Sheet 3)

WARNING, CAUTION AND ADVISORY LIGHTS

A-6E TYPICAL

A-6E 159895 AND ON, AND A-6E MOD M-121 AND ON



* FLASHING

1 AIRCRAFT INCORPORATING A.F.C. NO. 264

1. MAY BE TESTED BY PRESSING EITHER PILOT'S OR B/N'S MASTER TEST BUTTON
2. DOES NOT ILLUMINATE WHEN B/N'S MASTER TEST BUTTON IS DEPRESSED
3. MAY ONLY BE TESTED BY DEPRESSING PILOT'S MASTER TEST BUTTON

ANNUNCIATOR CAUTION LIGHTS

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
L OR R FUEL PSI	EITHER LIGHT—ENGINE BOOST PUMP FAILURE	DESCEND/REDUCE POWER	POSSIBLE FLAME OUT POSSIBLE THRUST LOSS
	BOTH LIGHTS—ELECTRICAL BOOST PUMP FAILURE		
L OR R GEN	LOSS OF GENERATOR, CSDS MALFUNCTION	CYCLE GENERATOR SWITCH TO OFF-RESET THEN ON	RESETTING CSDS MAY AID IN REGAINING GENERATORS
L OR R SPD DR	FLASHING: OVERSPEED	REDUCE RPM RESET	
	STEADY: LOW OIL PRESSURE, HIGH OIL TEMPERATURE OR CSD FAILURE	DESCEND, RESET OR SECURE AFFECTED CSD	IF GENERATOR LOSS AT NIGHT OR IFR DEPLOY RAT
L OR R OIL LOW	LESS THAN 5 QUARTS/ 20% OIL REMAINING	LAND AS SOON AS PRACTICABLE	MONITOR OIL PRESSURE CLOSELY, SHUT DOWN IF OIL PRESSURE DROPS BELOW ACCEPTABLE LIMITS
L OR R FILTER	FUEL FILTER IS OBSTRUCTED	LAND AS SOON AS PRACTICABLE	POSSIBLE FUEL CONTAMINATION
OXYGEN	LESS THAN 2 LITERS IN THE CONVERTERS, OR LESS THAN 50 PSI IN SUPPLY LINE	DESCEND, MONITOR CABIN ALTITUDE, LAND	
LOW FUEL	FUEL REMAINING IN FUSELAGE TANK: 1460 +200 −100 (4° NOSE UP ATTITUDE)	CHECK TURN/SLIP C. B. IN FUEL READY SWITCH OFF FUEL TRANSFER	IF NO FUEL TRANSFER LAND AS SOON AS POSSIBLE
RUD THRO	EXTENDED THROW AVAILABLE IN CLEAN CONFIGURATION OR SPIN ASSIST SWITCH IS ACTUATED	OBSERVE RUDDER PEDAL DEFLECTION LIMITS	
ANTI-SKID (SWITCH ON)	ANTI-SKID INOPERATIVE	ANTI-SKID SWITCH OFF	LIGHT WILL COME ON IF SWITCH IS OFF IN LANDING CONFIGURATION OR WITH SWITCH ON WHEN BRAKE SELECTOR HANDLE OUT OR ROTATED
AIR COND	AIR COND SWITCH OFF	AIR COND SWITCH NORM	IF LIGHT REMAINS ON SECURE ALL ELECTRONIC EQUIPMENT EXCEPT CNI. LAND AS SOON AS PRACTICABLE
	AIR COND SWITCH NORM: OVER PRESSURIZATION IN AIR COND DUCT	LIGHT REMAINS ON—AIR COND SWITCH OFF, ELECTRONIC EQUIPMENT OFF LIGHT OUT—NO ACTION REQ.	POSSIBLE DAMAGE TO AIR COND SYSTEM. LAND AS SOON AS PRACTICABLE

ANNUNCIATOR CAUTION LIGHTS (CONT.)

LIGHT	CAUSE	CORRECTIVE ACTION	REMARKS
COMPUTER	COMPUTER OVERHEATED	SECURE COMPUTER	
STRUT LOCK	UNLOCKED STRUT WITH TOW LINK DOWN, POWER ABOVE 82.5%	RAISE CATAPULT GRIP	INDICATES SOFT NOSE STRUT.
	HARD STRUT WITH LANDING GEAR AND FLAPS DOWN, POWER BELOW 82.5%		FIELD LANDING PREFERRED
BACKUP HYD	BACKUP HYDRAULIC PUMP OPERATING		FLIGHT OR COMBINED HYDRAULIC SYSTEM FAILURE
IFF	IMPROPER MODE 4 OPERATION		
TEMP CONT	STEADY: NORMAL EQUIP COOLING SYSTEM FAILURE	EQUIPMENT SWITCH COLD	IF LIGHT REMAINS ON SECURE COMP AND AIR COND MASTER. SECURE ELECTRONIC EQUIPMENT.
	FLASHES: INDICATES A SHIFT FROM REGULATED TO UNREGULATED COOLING	RESET EQUIPMENT SWITCH	
WSHLD AIR	RAIN REMOVAL SWITCH ON	WSHLD AIR OFF, IF NOT REQUIRED	IF WSHLD AIR REMAINS ON WHEN NOT DESIRED, TURN NWW SWITCH OFF
CANOPY SW	CANOPY SWITCH NOT AT CLOSE POSITION	SET CANOPY SWITCH CLOSE	SWITCH WILL REMAIN ON CLOSED POSITION
DRS TEMP	FLIR NOT AT OPERATING TEMPERATURE	ALLOW MORE COOL-DOWN TIME	
AFT BLEED	AFT BLEED AIR VALVE CLOSED	SECURE ELECTRONIC EQUIPMENT	DUE TO OVERTEMP IN AFT BLEED AIR DUCT OR AIR COND MASTER SW OFF

ADA1-862-4

Figure FO-11 (Sheet 4)