NAVAIR 01-40AVM-1

NATOPS FLIGHT MANUAL

NAVY MODEL

A-4M

AIRCRAFT

Douglas Aircraft Company, Long Beach, Calif. 90801
Contract No. N00019-70-C-0236

THIS MANUAL SUPERSEDES PRELIMINARY PUBLICATION
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FA1-2

1 November 1971

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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 531, CONSISTING OF THE FOLLOWING:

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LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach towards 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 obligated and 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.

M.F. WEISNER
Vice Admiral, USN
Deputy Chief of Naval Operations
(Air Warfare)

INTERIM CHANGE SUMMARY

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

INTERIM CHANGE NUMBER(S)	REMARKS/PURPOSE

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

INTERIM CHANGE NUMBER	REMARKS/PURPOSE
1	Constant Speed Drive Failure
2	STATIONS Select Switches; Inadvertent Positioning of
3	C-11, C-11-1 Catapult; Aircraft Gross Weight Increase
4	Maximum Elevator Effectiveness
5	Cancellation of IC No. 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

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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 judgement. 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's your responsibility to have a complete knowledge of its contents.

APPLICABLE PUBLICATIONS

The following applicable publications complement this manual:

NAVAIR 01-40AV-1T(A) (supplement)
NAVAIR 01-40AV-1T (tactical manual)
NAVAIR 01-40AV-1TB (tactical pocket guide)
NAVAIR 01-40AVM-1B (checklist)
NAVAIR 01-40AVM-1-6 (functional checklist)

HOW TO GET COPIES

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Additional copies of this manual and changes thereto may be procured by submitting Form DD 1348 to NPFC 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.

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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:

Commanding Officer
VMA-324, MAG-32
MCAS Beaufort, South Carolina 29902
Attn: NATOPS Evaluator

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

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

SAMPLE

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 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.

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, if not strictly observed, may damage equipment.

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.

NATOPS FLIGHT MANUAL GLOSSARY

A/A	Air-to-Air Ranging (TACAN)
AAR	Aircraft Accident Report
ac	Alternating current
ACC	Air Crew Change
ACP	Aircraft Communications Procedures
ADCS	Air Data Computer Set
ADF	Automatic Direction Finding
ADI	Attitude Director Indicator
ADIZ	Air Defense Identification Zone
ADL	Armament Datum Line
AFC	Automatic Frequency Control
AFCS	Automatic Flight Control System
A/G	Air-to-Ground
agc	Automatic gain control
AGL	Above Ground Level
AI	Airborne Intercept
AJB	Airborne, electro-mechanical, bombing
AMCS	Airborne Missile Control System
AOA	Angle-of-Attack
AOJ	Acquisition On Jam
AP	Autopilot
APC	Approach Power Compensator
APN	Airborne, radar, navigational aid
APQ	Airborne, radar, special purpose
AR	Air Refueling
ARC	Airborne, radio, control
ARTCC	Air Route Traffic Control Center
ASC	Aircraft Service Change
ASQ	Airborne, special type, combination of purposes
ASW	Anti-Submarine Warfare
ATC	Air Traffic Control
AWW	Airborne, armament, control
BDHI	Bearing Distance Heading Indicator
BINGO	Return fuel state
Bolter	Hook down, unintentional touch-and-go (missed wire)
BRC	Base Recovery Course
BRT	Bright
BST	Boresight
Buddy Store	Inflight Refueling Store
Buster	Full military power
CADC	Central Air Data Computer
CAP	Combat Air Patrol
CARQUAL	Carrier Qualifications
CAS	Calibrated Airspeed
CAT	Catapult
CAT	Clear Air Turbulence
CATCC	Carrier Air Traffic Control Center
CCA	Carrier Controlled Approach
CG	Center of Gravity
Charlie Time	Expected time over ramp
CIC	Combat Information Center
CIT	Compressor Inlet Temperature
CNI	Communication Navigation Identification
CO_2	Carbon dioxide
CONOLABS	Conventional Ordnance Low Altitude Bombing System
CORC	Conventional Ordnance Release Computer
COT	Cockpit Orientation Trainer
cps	Cycles per second
CRAW	Carrier Readiness Attack Wing
CSD	Constant Speed Drive
CSS	Control Stick Steering
CVA	Aircraft Carrier (Attack)
CVS	Anti-Submarine Carrier
cw	Continuous Wave
DART	Ejection Seat Stabilization System
dc	Direct current
DCU	Douglas Control Unit
Dead Beat	Causing the object, when disturbed, to return to its original position without oscillation.
Delta	Orbit pattern
DF	Direction Finding
DIRTY	Landing Configuration
DIRTY-UP	Changing to Landing Configuration
DME	Distance Measuring Equipment
Dog Radial	An assigned radial on which to set up a holding pattern
DONUT	Optimum approach index
DR	Dead Reckoning
D-ring/handle	Manual Ripcord Handle
EAC	Estimated Approach Clearance
EAS	Equivalent Airspeed
EAT	Estimated Approach Time
ECCM	Electronic Counter-Countermeasure(s)
ECM	Electronic Countermeasure(s)
EGT	Exhaust Gas Temperature
EMERG	Emergency
EPI	Engine Performance Indicator
EXT	Exterior/External
FAM	Familiarization
FL	Flight Level
FLIP	Flight Information Publication
FCLP	Field Carrier Landing Practice
Foxtrot Corpen	Fleet Course
fpm	Feet per minute
FUS	Fuselage
FWD	Forward

g's	Gravity
GAL	Gallon
Gate	Maximum Power
GCA	Ground Control Approach
GCBS	Ground Control Bombing System
GCI	Ground Control Intercept
gpm	Gallon per minute
GTC	Ground Turbine Compressor
Handfire	A delay or failure of an article of ordnance after being triggered
HDG SEL	Heading Selector Switch
HI	High
HMI	Handbook of Maintenance Instructions
Hot Start	A start that exceeds normal starting temperatures
HPA	High Precautionary Approach
HYD	Hydraulic
IAS	Indicated Airspeed
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules or In Flight Refueling
ILS	Instrument Landing System
IMN	Indicated Mach Number
IMP	Imperial
INST	Instrument
INT	Interior
IP	Identification Point
I/P	Identification of Position
IR	Infrared
JANAP	Joint Army Navy Airforce Publication
JATO	Jet Assist Takeoff
JETT	Jettison
JP	Jet Propulsion
Judy	Radar contact with target, taking over intercept
kt/kn	Knots
LABS	Low Altitude Bombing System
LAWS	Low Altitude Warning System
LDG GR	Landing Gear
LE	Leading Edge
LO	Low
LOX	Liquid Oxygen
LPA	Low Precautionary Approach
lpm	Liters per minute
LSO	Landing Signal Officer (Paddles)
LTS	Lights
MAC	Mean Aerodynamic Chord
MAN	Manual
MARSHAL	Carrier Controlled Approach Holding
MAX	Maximum
MBR	Multiple Bomb Rack
Meatball	Glide slope image of mirror landing system
MER	Multiple Ejector Rack

MIL	Military
MIM	Maintenance Instruction Manual
MIN	Minimum
MIN	Minute
Misfire	A permanent failure of an article of ordnance being triggered.
MK	Mark
MLP	Mirror Landing Practice
MOD	Modification
MSL	Mean Sea Level
NAMT	Naval Air Maintenance Training
NAMTD	Naval Air Maintenance Training Detachment
NATO	North Atlantic Treaty Organization
NATOPS	Naval Air Training and Operating Procedures Standardization
NAVAIDS	Navigation Aids
NAVPAC	Navigation Package
NMPP	Nautical Miles Per Pound
NTDS	Naval Tactical Data System
NWIP	Naval Warfare Information Publication
NWIP	Naval Warfare Intercept Procedures
NWP	Naval Warfare Publication
OAT	Outside Air Temperature
OBST	Obstruction
OFT	Operational Flight Trainer
OMNI	Omni Directional Range
PA	Power Approach
Paddles	Landing Signal Officer
PAR	Periodic Aircraft Rework
PAR	Precision Approach Radar
PC	Power Control
Pigeons	Bearing and Distance
PK	Pararaft Kit
P/C	Plane Captain
Platform	The 5000 ft altitude level in a CCA
PMBR	Practice Multiple Bomb Rack
PoGo	Return to last or assigned radio frequency
PPC	Power Plants Change
PPH	Pounds Per Hour
PPS	Pulses Per Seconds
prf	Pulse repetition frequency
PRIM	Primary
psi	Pounds per square inch
PTT	Press-to-test
q	Dynamic Pressure, psf
Qt	Quart
RADAR	Radio Detection and Ranging
RAT	Ram Air Turbine
RATCC	Radar Air Traffic Control Center
RCR	Runway Condition Reading
RDO	Runway Duty Officer
RET	Retracted
rf	Radio Frequency

RF	Reconnaissance – Fighter
RMI	Radio Magnetic Indicator
ROD	Rate of Descent
rpm	Revolution per minute
SAR	Sea Air Rescue
SAR	Surveillance Approach Radar
SEC	Second
SEC	Secondary
S/B	Speedbrake
SID	Standard Instrument Departure
SIF	Selective Identification Feature
SPD BRK	Speedbrake
SPEC	Specification
SRCH	Search
SRT	Standard Rate Turn
STA	Station
STAB AUG	Stability Augmentation
SYNC	Synchronize
TACAN	Tactical Air Navigation
TAS	True Airspeed
T/C	Terrain Clearance
TE	Trailing Edge
TER	Triple Ejector Rack
THRU	Through
TMN	True Mach Number
TRA	Transfer
TRANS	Transfer
Trap	Arrested Landing
UHF	Ultra High Frequency
US	United States
VFR	Visual Flight Rules
VHF	Very High Frequency
Vn	Velocity Acceleration Relationship
VORTAC	Very High Frequency – Omni Range and Tactical Air Navigation
Vs	Versus
W	With
W/O	Without
WST	Weapons System Trainer
Yellow Sheet	Naval Aircraft Discrepancy Record
ZDL	Zero Delay Lanyard

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Figure 1-0. Model A-4M Aircraft

SECTION I
THE AIRCRAFT

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PART 1
GENERAL DESCRIPTION

DESCRIPTION

The Navy Model A-4M Skyhawk (figure 1-0) is a single-place monoplane with a modified delta-planform wing manufactured by the Douglas Aircraft Company, Long Beach, California. It is powered by a P&WA J52-P-408 gas turbine engine, producing a sea-level static thrust rating of 11,200 pounds. Designed as a high-performance, lightweight attack aircraft, it mounts two 20-mm guns internally, carries a variety of external stores, and is capable of operating either from a carrier or from a shore base. The basic weight of the A-4M should be determined from the particular aircraft's Handbook of Weight and Balance since this weight may vary as much as 500 pounds, depending upon service change configuration. Refer to figure 11-1 for aircraft weights.

Figures 1-1 through 1-5 show the principal dimensions, major airframe components, aircraft general arrangement, cockpit general arrangement, and main differences table. Cockpit instrument panels and console are shown in figure FO-1.

TECHNICAL DIRECTIVE SUMMARY

Following is a list of service changes that apply to this manual but may not be incorporated in the aircraft. The service change is briefly described and, where applicable, information is given for visual determination of incorporation.

Service Change Number	Description	Visual Identification
AVC 1130	Video Monitor IP-936/AXQ, Modification of	Pilot's Instrument Panel: Addition of CRAB switch
AFC 487	Standby Attitude Indicator, Modification of	Pilot's Instrument Panel
AFC 489	ESCAPAC 1F-3 Ejection System	Pilot's Seat

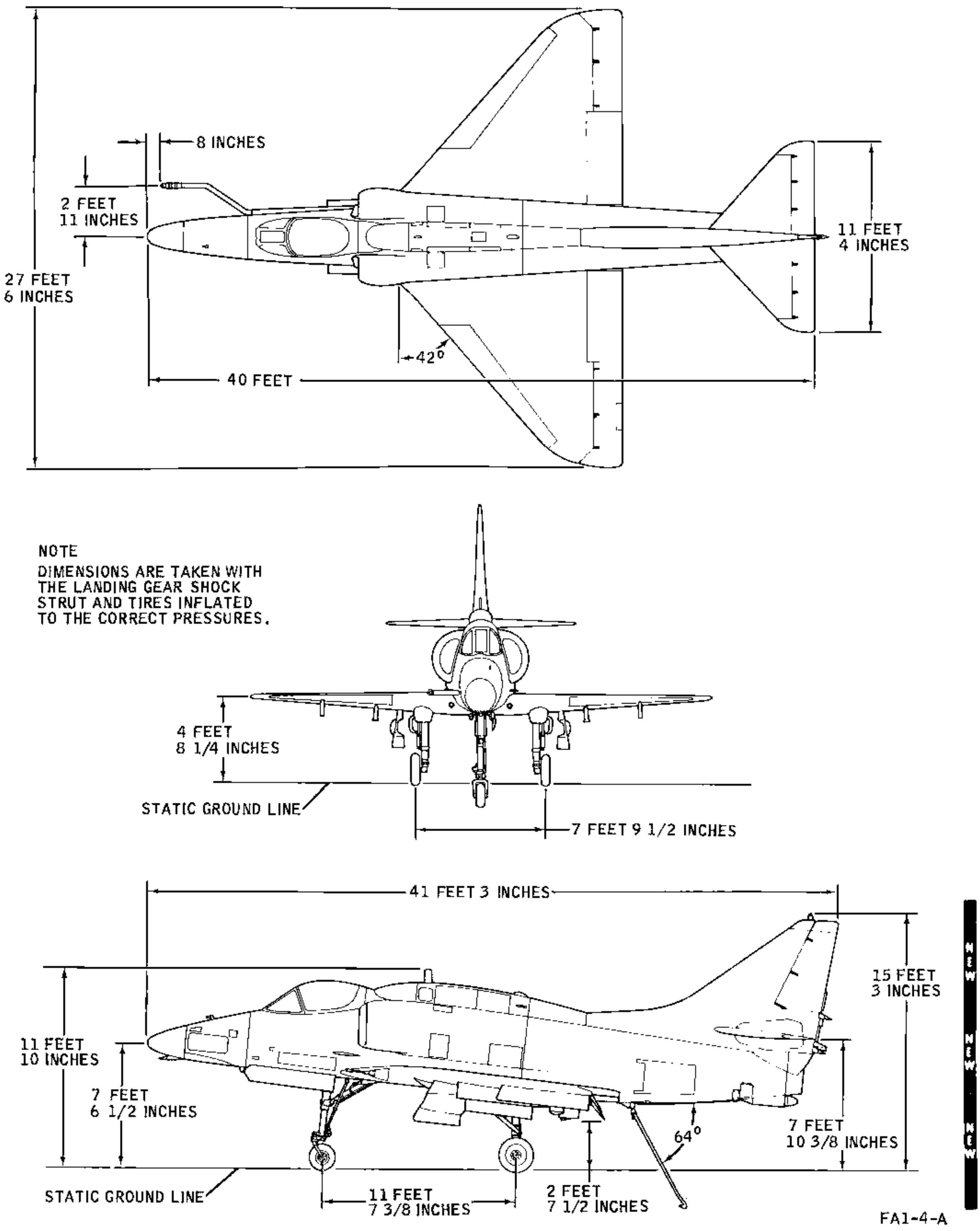

Figure 1-1. Principal Dimensions

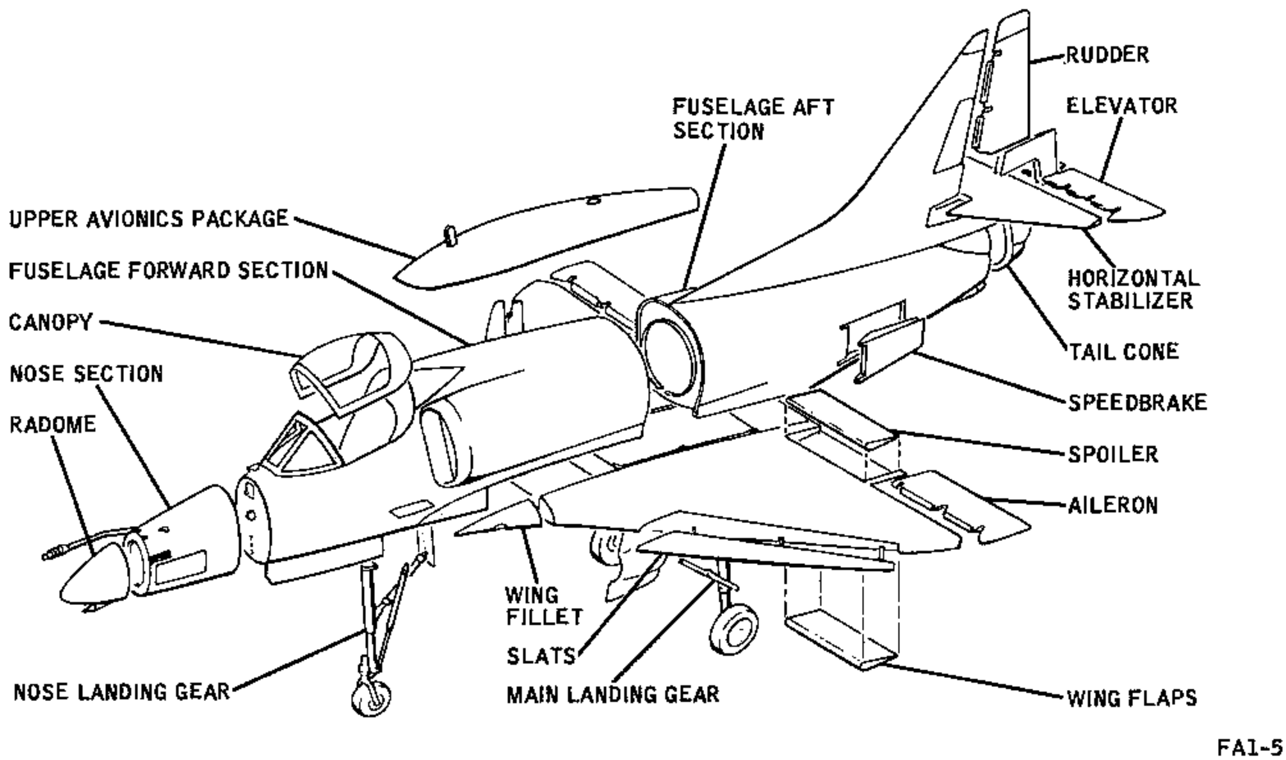

Figure 1-2. Airframe Major Components

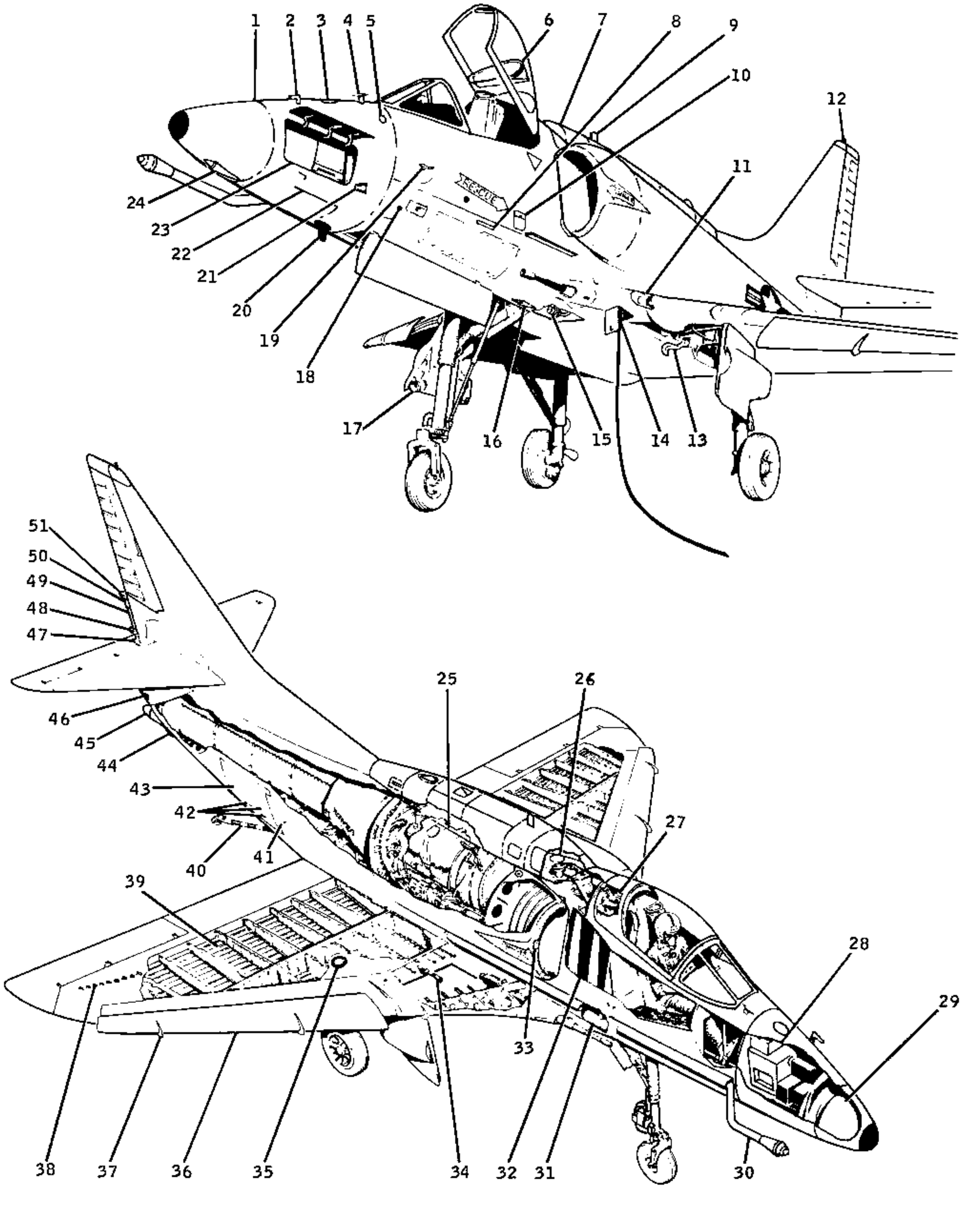

Figure 1-3. General Arrangements (Sheet 1)

KEY TO FIGURE 1-3

1. RADOME
2. PITOT TUBE
3. APX-72 IFF ANTENNA (FWD)
4. TOTAL TEMPERATURE SENSOR
5. BRAKE FLUID LEVEL WINDOW
6. THERMAL RADIATION CLOSURE
7. UPPER AVIONICS PACKAGE
8. NORMAL COCKPIT ENTRY HANDLE
9. ARC-51A (UHF) RADIO ANTENNA
10. EXTERNAL CANOPY-JETTISON HANDLE
11. APPROACH LIGHTS
12. APN-154(V) RADAR BEACON ANTENNA
13. CATAPULT HOOK
14. EXTERNAL POWER RECEPTACLE AND ACCESS DOOR
15. OIL TANK PRESSURE FILLER CAP
16. ALQ-100 PULSE TRANSMITTING ANTENNA (FWD)
17. TAXILIGHT
18. ENGINE BLEED STATIC PORT
19. ANGLE-OF-ATTACK VANE AND TRANSDUCER
20. ARN-52(V) TACAN ANTENNA (FWD), APR-27 ALERT RECEIVER ANTENNA (FWD)
21. PITOT STATIC ORIFICE
22. ARA-50 (UHF-ADF) ANTENNA COVER
23. NOSE COMPARTMENT ACCESS DOOR
24. ALQ-100 RECEIVING ANTENNA (FWD), APR-25(V) RECEIVING ANTENNA (2) (FWD)
25. OIL TANK
26. FUSELAGE FUEL TANK FILLER CAP
27. COCKPIT CANOPY AIR BUNGEE CYLINDER
28. NOSE SECTION ELECTRONIC EQUIPMENT COMPARTMENT
29. APG-53A RADAR TRANSMITTER AND RECEIVER GROUP
30. AIR REFUELING PROBE
31. EMERGENCY GENERATOR
32. FUSELAGE FUEL TANK
33. AIR REFUELING PROBE LIGHT
34. CATAPULT HOOK
35. WING TANK FILLER CAP
36. SLAT
37. BARRICADE ENGAGEMENT DETENT
38. VORTEX GENERATORS
39. INTEGRAL WING FUEL TANK
40. ARRESTING HOOK
41. JATO IGNITER TERMINAL
42. JATO MOUNTING HOOKS
43. SPEEDBRAKE
44. APX-72 IFF ANTENNA (AFT)
45. DRAG CHUTE ASSEMBLY
46. APR-25(V) RECEIVING ANTENNA (2) (AFT)
47. ALQ-100 PULSE TRANSMITTING ANTENNA (AFT)
48. ALQ-100 TRANSMITTER ABSORBER
49. TAILLIGHT
50. ARN-52(V) TACAN ANTENNA (AFT)
51. ALQ-100 RECEIVING ANTENNA (AFT)

Figure 1-3. General Arrangements (Sheet 2)

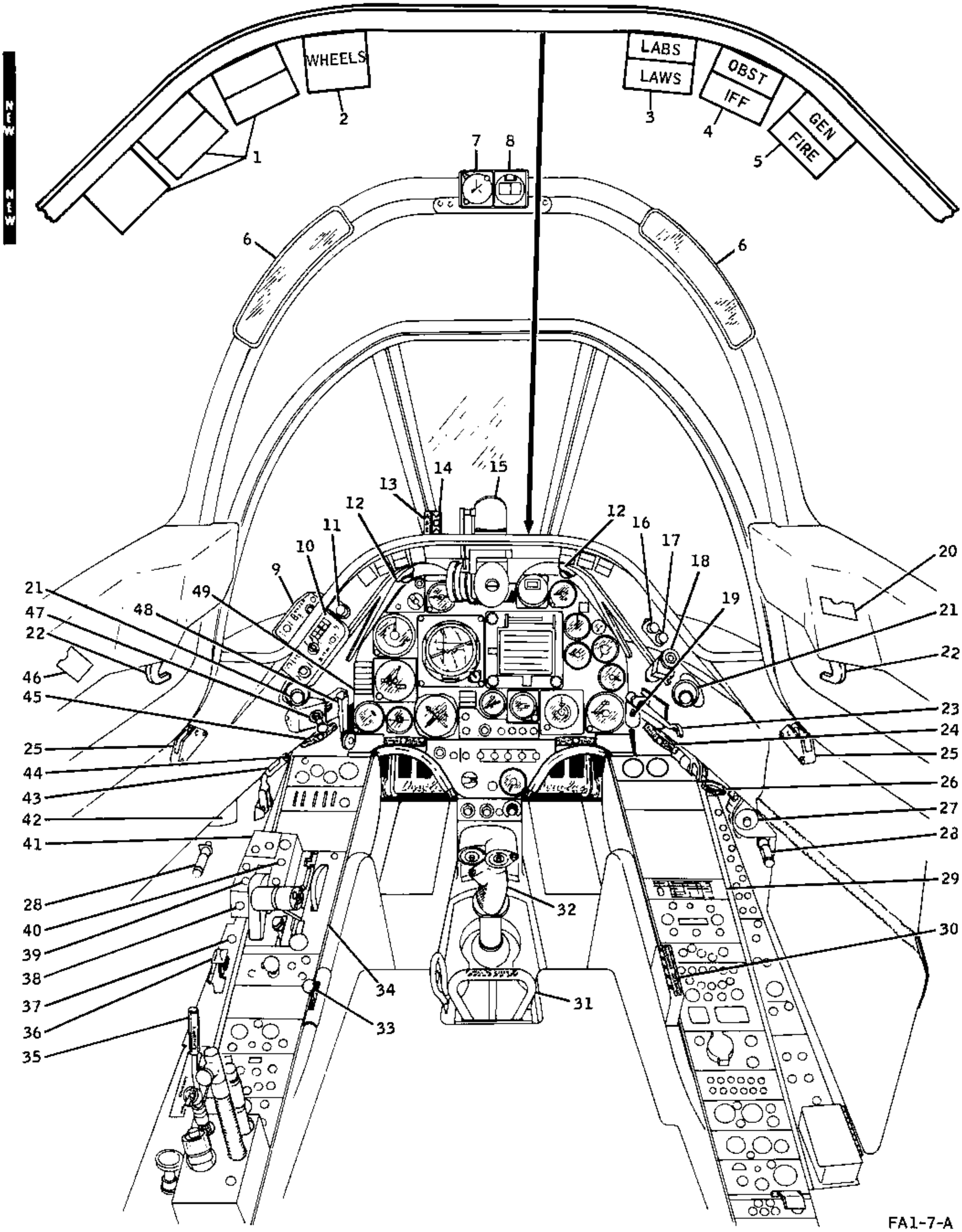

Figure 1-4. General Arrangement – Cockpit (Sheet 1)

KEY TO FIGURE 1-4

1. THREAT DISPLAY LIGHTS
2. WHEEL WARNING LIGHT
3. LOW ALTITUDE BOMBING SYSTEM (LABS) LIGHT

   LOW ALTITUDE WARNING SYSTEM (LAWS) LIGHT
4. OBSTRUCTION (OBST) WARNING LIGHT

   IFF MODE 4 FAILURE LIGHT
5. MAIN GENERATOR FAILURE LIGHT

   FIRE WARNING LIGHT
6. REAR VIEW MIRROR (2)
7. ELAPSED TIME CLOCK
8. STANDBY COMPASS
9. CHAFF CONTROL PANEL
10. ECM CONTROL MONITOR
11. GCBS LEFT-HAND TURN LIGHT
12. INSTRUMENT PANEL WHITE FLOODLIGHTS (2)
13. APPROACH POWER COMPENSATOR (APC) WARNING LIGHT
14. ANGLE-OF-ATTACK INDEX LIGHT
15. GUNSIGHT
16. GCBS ARM LIGHT
17. GCBS RIGHT-HAND TURN LIGHT
18. KNEEBOARD FLOODLIGHT
19. AUDIO BYPASS SWITCH
20. COMPASS CORRECTION CARDS
21. AIR-CONDITIONING DIFFUSERS (2)
22. CANOPY LATCH HOOK (2)
23. ARRESTING HOOK CONTROL HANDLE
24. EMERGENCY GENERATOR RELEASE HANDLE
25. CANOPY LATCH ROLLERS (2)
26. CANOPY JETTISON HANDLE
27. WHITE FLOODLIGHT CONTROL
28. RED FLOODLIGHT (2)
29. RIGHT CONSOLE (FIGURE FO-1)
30. HARNESS RELEASE HANDLE
31. ALTERNATE EJECTION HANDLE
32. CONTROL STICK
33. SHOULDER HARNESS CONTROL HANDLE
34. LEFT CONSOLE (FIGURE FO-1)
35. MANUAL CANOPY CONTROL HANDLE
36. EMERGENCY FUEL SHUTOFF CONTROL
37. NOSEWHEEL STEERING SWITCH
38. RAIN REPELLENT BUTTON
39. SPOILER ARM-OFF SWITCH
40. JATO CONTROL PANEL
41. APPROACH POWER COMPENSATOR (APC) CONTROL PANEL
42. COCKPIT WHITE FLOODLIGHT
43. CATAPULT HANDGRIP
44. JATO FIRING BUTTON
45. EMERGENCY LANDING GEAR RELEASE HANDLE
46. AIRSPEED CORRECTION CARD
47. DRAG CHUTE DEPLOY-JETTISON SWITCH
48. LANDING GEAR HANDLE
49. INSTRUMENT PANEL (FIGURE FO-1)

Figure 1-4. General Arrangement – Cockpit (Sheet 2)

	A-4A	A-4B	A-4C	A-4E	A-4F	A-4L	A-4M	TA-4F	TA-4J
ENGINE	J65-W-16A	J65-W-16A J65-W-20	J65-W-16A J65-W-20	J52-P-6A/B J52-P-8A/B	J52-P-8A/B	J65-W-20	J52-P-408	J52-P-6A/B J52-P-8A/B	J52-P-6A/B
THRUST	7,700#	7,700# 8,400#	7,700# 8,400#	8,500# 9,300#	9,300#	8,400#	11,200#	8,500# 9,300#	8,500#
FUSELAGE Fueling Probe Air Refueling Store Intake Ducts	 NO NO FLUSH	 YES YES FLUSH	 YES YES FLUSH	 YES YES SEPARATED	 YES YES SEPARATED	 YES YES FLUSH	 YES YES SEPARATED	 YES YES SEPARATED	 YES YES SEPARATED
UPPER AVIONICS COMPARTMENT	NO	NO	NO	SOME	YES	YES	YES	NO	NO
AFCS	NO	NO	YES	YES	YES	YES	YES	YES	YES
RADAR	NO	NO	AN/APG-53A	AN/APG-53A AN/APG-53B	AN/APG-53A AN/APG-53B	AN/APG-53A	AN/APG-53A (PROVISIONS ONLY)	AN/APG-53A AN/APG-53B	AN/APG-53A
VIDEO IP-936/AXQ	NO	NO	NO	SOME	SOME	YES	YES	SOME	NO
NAVIGATION COMPUTER	NONE	ASN-19A	ASN-19A	ASN-19A (EARLY A-4E) ASN-41	ASN-41	ASN-19A	ASN-41 (PROVISIONS ONLY)	ASN-41	ASN-41
LABS	AERO 18B	AERO 18B	AN/AJB-3	AN/AJB-3 AN/AJB-3A	AN/AJB-3A	AN/AJB-3A	AN/AJB-3A	AN/AJB-3A	NO
CP-741/A	NO	NO	CP-841/A	YES	YES	CP-841/A	YES	YES	NO
OXYGEN SYSTEM	5 LITER	5 LITER	10 LITER	10 LITER	10 LITER	10 LITER	10 LITER	10 LITER	10 LITER
EXTENDABLE CONTROL STICK	YES	YES	NO	NO	NO	NO	NO	NO	NO
FUEL GAGING Fuselage Wing Drop Tanks	 1 PROBE 2 PROBE YES	 1 PROBE 2 PROBE YES	 1 PROBE 6 PROBE YES	 1 PROBE 6 PROBE YES	 1 PROBE 6 PROBE YES	 1 PROBE 6 PROBE YES	 1 PROBE 6 PROBE YES	 1 PROBE 6 PROBE YES	 1 PROBE 6 PROBE YES
FUSELAGE FUEL CELL CAPACITY	1600 LB	1600 LB	1600 LB	1600 LB	1600 LB	1600 LB	1600 LB	700 LB	700 LB
ELEVATOR Boosted Powered	 YES NO	 NO YES	 NO YES	 NO YES	 NO YES	 NO YES	 NO YES	 NO YES	 NO YES
AILERON POWER	SINGLE	TANDEM	TANDEM	TANDEM	TANDEM	TANDEM	TANDEM	TANDEM	TANDEM
STABILIZER TRIM 12 Degrees Noseup 1 Degree Nosedown	 YES	 NO	 NO	 NO	 NO	 NO	 NO	 NO	 NO
11 Degrees Noseup 1 Degree Nosedown	NO	YES	YES	NO	NO	YES	NO	NO	NO
12-1/4 Degrees Noseup 1 Degree Nosedown	NO	NO	NO	YES	YES	NO	YES	YES	YES
BOMB RACKS	3	3	3	5	5	3	5	5	5
ROCKET EJECTION SEAT	ESCAPAC 1	ESCAPAC 1	ESCAPAC 1 STENCEL MOD	ESCAPAC 1 STENCEL MOD	ESCAPAC 1C-3, 1F-3	ESCAPAC 1 STENCEL MOD	ESCAPAC 1C-3, 1F-3	ESCAPAC 1C-3, 1F-3	ESCAPAC 1C-3, 1F-3
NOSEWHEEL STEERING	NO	NO	NO	NO	YES	NO	YES	YES	YES
SPOILERS	NO	NO	NO	NO	YES	YES	YES	YES	YES
DRAG CHUTE	NO	NO	NO	NO	NO	NO	YES	NO	NO
COMMUNICATIONS	AN/ARC-27A	AN/ARC-27A	AN/ARC-27A	AN/ARC-27A	AN/ARC-51A AN/ARR-69	AN/ARC-51A	AN/ARC-51A	AN/ARC-51A AN/ARR-69	AN/ARC-51A AN/ARR-69
RADAR IDENTIFICATION (IFF)	APX-6B	APX-6B	APX-6B	APX-6B	APX-64(V)	APX-64(V)	APX-72(V)	APX-64(V)	APX-64(V)
APC	NO	NO	YES	YES	YES	YES	PROVISIONS ONLY	YES	PROVISIONS ONLY
DOPPLER APN-153	NO	NO	NO	SOME	YES	NO	PROVISIONS ONLY	YES	YES
TACAN	ARN-21B	ARN-21B	ARN-21B	ARN-21B (EARLY A-4E) ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)	ARN-52(V)
ADF	ARA-25	ARA-25	ARA-25	ARA-25	ARA-50	ARA-50	ARA-50	ARA-50	ARA-50

Figure 1-5. Main Differences Between Aircraft

PART 2
SYSTEMS

ENGINE

The P&WA J52-P-408 engine is an axial-flow, dual compressor, gas turbine engine with through-flow combustion chambers arranged in an annular chamber, and a two-stage reaction turbine. The five-stage, low-pressure compressor is connected by a through-shaft to the second-stage turbine. The seven-stage, high-pressure compressor is connected independently by a hollow shaft to the first-stage turbine. The rpm of the high-pressure rotor (N_2) is controlled by the engine fuel control, whereas the rpm of the low-pressure rotor (N_1) is mechanically independent and is a function of the pressure drop across each of the two turbine stages. The engine has a two-position, low-pressure compressor inlet guide vane assembly. The first-stage turbine inlet guide vanes and rotor blades are cooled with high-pressure bleed air. There are nine combustion chambers (No. 1 at the top) which incorporate features for reduced exhaust smoke. Spark igniters are located in the No. 4 and 7 combustion chambers.

The J52-P-408 engine is rated at 11,200 pounds thrust. This is the thrust the engine will develop during sea level static operation of a standard atmospheric day, with a bellmouth inlet duct and no aircraft accessories installed.

Also included as part of the engine is the compressor inlet anti-icing system, intercompressor stall air bleed system, self contained lubrication system, fuel system, ignition system, and fuel heater.

COMPRESSOR AIRBLEED SYSTEM

The compressor airbleed system vents low-pressure compressor unit air overboard as necessary to prevent overloading the high-pressure compressor unit.

CAUTION

Covering or clogging engine bleed static port on left side of forward fuselage can cause compressor chugs and stalls and loss of thrust.

IGNITION

The engine ignition system consists of two spark igniters, an ignition timer, and dual (20-joule) ignition units. The spark igniters are located in the two combustion chambers at the 4 and 8 o'clock positions. For engine starting, the timer energizes the high-power ignition unit supplying 20 joules to both igniters for a 30- to 45-second firing cycle. The ignition switch, which energizes the ignition timer, is a momentary-contact limit switch that is actuated by movement of the throttle outboard from the OFF position.

STARTER

The engine is started on the ground by a pneumatic starter driven by compressed air from a mobile gas turbine compressor (GTC). The compressor can be carried externally on the centerline or inboard store racks. (When the GTC unit is carried on the centerline store rack, a carrier landing is permitted. With the GTC unit installed on either inboard store rack, carrier landing is not permitted and the flight limitations are set forth in part 4 of this section, must be complied with.)

ENGINE FUEL SYSTEM

The function of the engine fuel system is to supply and regulate the fuel to the combustion chambers at pressures and flows required by engine air flow at all operating altitudes and temperatures. The system has two major components: the engine fuel pump and the fuel control.

Engine Fuel Pump

The engine fuel pump consists of a centrifugal booster stage and a high-pressure single gear stage with a 40-micron filter between the two. A filter bypass, a pressure relief valve, and a vapor return to the fuselage fuel cell are also incorporated.

Fuel Control

The engine fuel control is a hydromechanical control that senses inlet air temperature, burner pressure, high-pressure compressor speed (N_2), and throttle position. When the throttle setting is changed and while accommodating to a new steady-state fuel rate, the fuel control varies the fuel flow between the limiting values established by safe tailpipe temperature and mixture combustibility. The control permits the fuel flow to reach these limits during acceleration and deceleration but does not permit transgression in either direction, thus preventing compressor stalls, excessive temperatures, or flameouts. The fuel control compensates automatically only for variations in altitude and airspeed when in MANUAL.

The engine fuel control operation may be changed from PRIMARY to MANUAL at all altitudes during flight. If airspeed at the time of switchover is above 225 KIAS, selection of MANUAL may be made at any throttle setting from IDLE to MILITARY. If airspeed is below 225 KIAS, select a minimum throttle setting of 65 percent rpm prior to switchover.

Note

During flight testing, it has been demonstrated that the manual fuel control position can be safely selected while at MILITARY up to 30,000 feet.

The switchover to the manual fuel system may be accompanied by a minor surge in engine speed and EGT.

After a switchover, the throttle should be moved slowly and smoothly to the desired power setting. Observe the engine operating limitations given in part 4 of this section. It must be remembered that when operating on the manual fuel control system, all fuel metering to the engine is accomplished by direct movement of the throttle; therefore, all power changes must be made with care, not only to prevent overspeeding and extreme temperatures, but also to avoid a flameout from the possible inability of the engine to parallel in speed the rapidly changing fuel flow during quick accelerations and decelerations.

Note

Complete loss of electrical power precludes switching the fuel control from the position selected.

ENGINE CONTROLS

Throttle

The throttle (figure FO-1), located on the left console, is mechanically linked to the engine fuel control unit and is the means of selecting engine thrust. Marked positions of the throttle are OFF, IGN (ignition), IDLE, NORMAL, and MILITARY. The OFF position closes a fuel cutoff valve in the fuel control unit, stopping all fuel flow to the engine fuel nozzles. The IGN position actuates the ignition timer when the throttle is moved outboard from the OFF position. The IDLE position has a detent to prevent inadvertent movement of the throttle to the OFF position. The NORMAL position indicates the operating range of the engine. At MILITARY the engine should develop maximum thrust and rpm, which will vary with atmospheric conditions. Switches for the radio microphone and speedbrakes are located on the inboard side of the throttle grip, with the exterior lights master switch on the outboard side. Inboard of the throttle, on the console, is the throttle friction wheel. The friction wheel is rotated forward to increase friction on the throttle. To prevent retarding the throttle during catapulting, a catapult handgrip (figure 1-4), which extends from its spring-loaded position against the cockpit rail, is grasped in conjunction with the throttle. The JATO firing button is incorporated in the catapult handgrip.

Engine Control Panel

The engine control panel, aft of the throttle, contains all other controls for the operation of the engine. On the panel are the manual fuel control warning light, the drop tanks pressurization and flight refuel switch, the air refueling fuselage-only switch, the emergency transfer and wing fuel dump switch, the engine starter switch, and the fuel control switch.

FUEL CONTROL SWITCH. A two-position fuel control switch on the engine control panel (figure FO-1) is used to select the mode of operation of the engine fuel control unit. With the switch at PRIM, the automatic metering devices in the fuel control unit regulate the flow of fuel to the engine as described above. The control compensates automatically for variations in altitude and airspeed only when the switch is in MANUAL.

MANUAL FUEL CONTROL WARNING LIGHT. The manual fuel control warning light located on the engine control panel comes on when the fuel control has shifted to the manual mode of operation. The light indicates the position of the emergency transfer valve which directs the fuel to either the primary or manual fuel control system. The emergency transfer valve is kept in the manual fuel control position by spring load until overcome by engine-driven fuel pump pressure, regardless of the position of the fuel control switch. Consequently, the light will be on during normal engine starts until fuel pressure within the control shifts the transfer valve to the PRIMARY position at approximately 5 to 10 percent rpm. The light will also come on shortly after engine shutdown indicating a shift to the MANUAL mode upon loss of fuel pressure. With normal fuel pressure, the position of the emergency transfer valve and the mode of fuel control will always correspond to the position of the fuel control switch.

ENGINE STARTER SWITCH. Actuation of the starter is controlled by the engine starter switch on the engine control panel (figure FO-1) that is labeled START-ABORT. When the switch is depressed to START, the starter air supply solenoid valve opens, allowing compressed air from the gas turbine compressor to rotate the starter. A holding relay retains the switch in the START position. When engine speed reaches approximately 50 percent rpm, a centrifugal switch opens, allowing the engine starter switch to pop up, thus stopping the air supply to the starter. Manually pulling out the engine starter switch will also stop the starter air supply.

APPROACH POWER COMPENSATOR

The approach power compensator (APC) system controls the fuel control and is designed to maintain the optimum angle of attack of 18 units resulting in an optimum approach speed on the glide slope and during normal maneuvers in the landing pattern at any landing gross weight. Major APC components are the computer, amplifier, servo actuator, accelerometer, elevator potentiometer, angle-of-attack vane transducer, and the APC control panel.

The APC is designed to command a throttle position between approximately 70 percent rpm and MRT in response to angle of attack. The angle-of-attack signal is modified by normal acceleration and elevator control stick position. Engagements at or flight at angles of attack greater than optimum will command an increasing throttle position until approximately MRT is attained or the angle of attack returns to optimum. Engagements at or flight at angle of attack less than optimum will command a decreasing throttle position until approximately 70 percent rpm is attained, or the angle of attack returns to optimum.

The APC will remain engaged only if the throttle friction is off, or weight is off the main landing gear, or the throttle position is above approximately 70 percent rpm. It is possible to manually hold the system engaged and override these disengage features.

The APC will disengage if any of the following occur: power switch is returned to standby, throttle friction is moved from off, weight is applied to the main landing gear, or an override force of 25 to 30 pounds is applied to the throttle.

APC Control Panel

The APC control panel is located outboard of the throttle on the left console (figure FO-1). The control panel contains two 3-position switches: an APC power switch and an air temperature switch.

APC Power Switch

The APC power switch, labeled OFF-STBY-ENGAGE, controls electrical power to the system. The APC is deenergized when the APC power switch is in the OFF position. The APC is energized, but not engaged, when the APC power switch is placed in the STBY position and the APC status light (located in the AOA indexer) comes on. A minimum of 15 seconds warm-up time in STBY position is required before placing the power switch in ENGAGE position to operate the system. The ENGAGE position is solenoid-held and will revert to STBY position if the holding coil current is interrupted.

Air Temperature Switch

The air temperature switch, with positions marked HOT, STD (standard), and COLD, provides a means of compensating for variation in thrust due to outside air temperature changes. The HOT position should be used for temperatures above 80°F (27°C), STD, from 40° to 80°F (5° to 27°C), and COLD, below 40°F (5°C).

APC Status Light

APC system status is indicated to the pilot by the APC status light attached to the AOA indexer above the instrument glareshield. The light comes on when the system is in standby and goes off when the APC is engaged. The light comes on when the system is disengaged and/or the switch is returned to STBY.

ENGINE INSTRUMENTS

Exhaust Gas Temperature (EGT) Indicator

The exhaust gas temperature indicator (figure FO-1), located on the instrument panel, indicates the temperature of the exhaust gases immediately downstream of the turbine assembly in degrees centigrade. The range of indications is from 0° to 1000°C.

Note

High rates of roll or positive and negative accelerations may cause the EGT indicator to give erroneous indications. However, upon return to stabilized flight, readings return to normal.

Tachometer

A tachometer (figure FO-1), located on the instrument panel, indicates the speed of the high-pressure compressor rotor (N_2) as a percentage of 12,353 rpm. Both EGT indicator and tachometer operate independently of aircraft electrical power and function whenever the engine is running.

Pressure Ratio Indicator

A pressure ratio indicator (figure FO-1), located on the instrument panel, is provided to indicate the ratio of tailpipe pressure to pressure at the pitot tube as a means of checking takeoff thrust at military power. The instrument is calibrated from 1.2 to 3.4. A knob on the lower left-hand side of the instrument operates a counter dial and simultaneously moves an index marker that travels along the perimeter of the index face. The knob is turned until the minimum acceptable takeoff pressure ratio is displayed on the counter dial. (See figure 3-3 to determine the minimum acceptable takeoff pressure ratio.) When the throttle is advanced to MILITARY power, a rotating pointer on the indicator should coincide with, or exceed, the setting of the index marker to indicate that minimum acceptable takeoff thrust is available and should be read at zero airspeed. The pressure ratio indicator reflects a direct measurement of the engine thrust output and is recommended as the primary cruise control variable when selecting engine thrust output to establish cruise schedules.

Fuel Flowmeter

A fuel flowmeter indicator (figure FO-1), located on the instrument panel, shows engine fuel consumption in pounds per hour. The portion of the dial between 300 to 5000 pounds per hour is divided into 100-pound increments. Above 5000 pounds per hour, the dial is marked into 1000-pound increments. Flow rates between 0 and 300 pounds per hour will be indicated as 300 pounds per hour. The fuel flowmeter indicator, because of engine tolerances and overhaul life, does not accurately measure engine thrust output. It should be used only as a secondary indication when establishing cruise schedules.

ENGINE OPERATION

The control of the engine consists essentially of selecting throttle positions. If the engine is in trim, the pressure ratio indicator will reflect any thrust setting (operating condition) that the pilot selects with the throttle. Exhaust gas temperature indicates how much work the engine should be, or is, doing. Therefore, EGT must never be used as a basis for setting thrust, except when it becomes necessary to reduce a throttle setting to avoid exceeding a temperature limit, or to cope with unstable operation.

The pilot must not only know and observe the engine operating limitations specified in part 4 of this section, he must also recognize relationships like those between operating temperatures and temperature limits. For example, although it is permissible for an engine to operate at the actual temperature limit corresponding to a selected thrust setting (operating condition), an engine that does so may have something wrong that causes it to run abnormally hot. Also, it is the thrust setting, not the EGT indication, that determines the allowable time limit specified in part 4. The time limit is 30 minutes because the thrust setting is Military Rated – not because the EGT indication happens to be 785°C. Report as an engine discrepancy every instance of overtemperature, noting not only the peak temperature reached, but also the length of time that the EGT exceeded limits.

Note

Under conditions of severe rainfall, maintain a minimum engine power setting of 70 percent rpm. This will assure adequate acceleration margin and prevent possible speed hangups.

Starting

Engine exhaust gas temperature will not normally rise above 340°C on ground start. However, conditions may exist that will give rise to EGT, which may approach the maximum permissible of 455°C. Under these conditions, the EGT tendency will be a better indication of proper engine operation than will the actual value attained. Thus, a ground starting EGT of 400°C and rising rapidly should concern a pilot more than a start where the EGT slowly peaks out at 450°C. The cause of the start above 340°C (extremely high ambient temperatures, starting a hot engine, high wind up the tailpipe, etc.) should always be determined as it may be indicative of some engine malfunction. Refer to section V for abnormal starts.

Acceleration

The acceleration temperature limits are specified in part 4 of this section. These limits apply to all accelerations whether from IDLE to MILITARY thrust or only a small change such as from 85 to 90 percent rpm. The limit for acceleration and maximum operating temperature should be interpreted to mean that the EGT may rise to the acceleration limit during or immediately following the acceleration, but must decrease to the MILITARY EGT limit or less within 8 minutes after the engine reaches its speed.

Steady State Operation

Exhaust gas temperatures given in part 4 of this section for Normal Rated should be thought of as the temperature that, if exceeded at approximately 3 percent less than MILITARY rpm, warns of a possible engine malfunction. The temperature shown for Military Rated and Normal Rated are positive limits that can not be exceeded without compromising the engine's service life. A normally functioning engine should operate somewhat below the EGT limits published for the several operating conditions. The IDLE EGT limit is intended only as a guide, and is not a firm operating limit.

Specified temperature limits serve two purposes: they assure that an engine will always be operated at internal temperatures that will not shorten the service life expectancy of engine components; they enable the pilot to detect an engine fuel control system or instrumentation malfunction in time to take proper corrective action.

The length of time that an engine may be operated at each of the thrust settings (operating conditions) was established to conserve the life of the engine and to make the time between overhauls predictable.

An engine's service lift budget has just so many hours of operation at high thrust. Whether these hours are used up quickly or are distributed throughout a normal calculated period depends on how conscientiously the EGT and time limits are observed by the pilot.

The time limit for operation at Military Rated is specified not so much to permit a cooling period between intervals of operation at high thrust as it is to distribute the rate of blade creep throughout the engine's normal life. Nothing is gained, therefore, by reducing a high thrust setting only momentarily before repeating it -- just to be able to report that time limits were not violated.

In the high thrust range, an increase of only 5°C may double the rate of turbine blade creep. Just so much creep can be tolerated by each blade. The rate at which blade life is depleted depends on proper pilot technique. Unfortunately, no operational technique can reverse the effect of blade creep.

Note

- During steady state engine operation in the power range 84-88 percent, a sensation similar to engine surging may be encountered due to inlet guide vane repositioning and bleed valve operation. A slight movement of the throttle will normally eliminate this effect.
- Failure of the inlet guide vanes to open at full throttle will be indicated by a low EPR.

ENGINE THRUST CUTBACK

A thrust cutback is incorporated in the J52-P-408 engine to protect the engine in high stress operating regimes. This cutback can be observed by an RPM and EGT reduction during full throttle operations at high Mach numbers. This characteristic is most noticeable at high ambient temperature conditions. At moderate ambient temperature conditions (50° F), initial cycling of the thrust cutback at high speed and low altitude can result in mild thrust surges without RPM, fuel flow, or EGT fluctuations. These surges are not cause for alarm as long as there is no substantiating evidence of a rough-running engine.

A thrust cutback is also incorporated to protect compressor RPM at low temperatures. This characteristic can be observed during high altitude climbs where maximum attainable RPM and EGT decrease with increasing altitude. Military RPM as low as 92 percent may be seen at 40,000 feet with full throttle.

OIL SYSTEM

The engine lubrication system is a self-contained, high-pressure system which supplies lubrication to the main engine bearings and to the accessory drives. Oil delivered by the engine-driven oil pump is cooled by means of an oil cooler prior to entering the bearing compartments. The oil cooler is a heat exchanger, employing the fuel flowing to the engine as a coolant. A scavenge system returns oil withdrawn from the bearing compartments and the accessory drive gearbox to the oil tank. A breather system connects the individual bearing compartments and oil tank with the breather pressure relief valve. The breather pressure relief valve vents overboard on the starboard side of the aft fuselage. See figure 1-26 for oil tank capacity and oil specification. The maximum oil consumption is 0.28 gallons (approximately 1 quart) per hour.

OIL PRESSURE INDICATOR

An engine oil pressure indicator (figure FO-1) is located on the instrument panel. Normal oil pressure is 40 to 50 psi. Minimum oil pressure for ground IDLE is 35 psi.

Note

- Maneuvers producing acceleration near zero "g" may cause a temporary loss of oil pressure. Absence of oil pressure for a maximum of 10 seconds is permissible.
- Oil pressure indications are available on emergency generator.

OIL QUANTITY INDICATOR/SWITCH

An oil quantity indicator/switch, labeled OIL LOW, is mounted on the upper right-hand side of the pilot's instrument panel (figure FO-1). The OIL LOW indicator light automatically comes on when the engine oil tank reaches a critically low engine oil level of 20 percent or less of capacity. Oil servicing is required if the OIL LOW light is not on but comes on when the indicator/light switch is pressed. This indicates that the engine oil tank contains over 20 percent but less than 80 percent of capacity.

Pressing the master TEST switch causes the OIL LOW light to come on, verifying all of the system except the 80-percent sensing circuit. The 80-percent sensing circuit may be verified by pressing the oil quantity indicator/light switch and the master TEST switch simultaneously, causing the OIL LOW light to come on.

Note

After the engine is secured, oil seeps past the high-pressure oil pump into the accessory gear case. For this reason, an oil quantity check should be made within 30 minutes after engine shutdown or when the engine has run for 8 minutes or longer at 75 percent or higher rpm, and the scavenge pump has returned the oil to the tank. False indications may be obtained if the oil quantity check is made during taxi or takeoff due to engine acceleration disrupting the oil level.

FUEL SYSTEM

The internal fuel supply is carried in two tanks containing a total of 807 US gallons. These tanks can be serviced by means of two gravity fuel tank fillers or a single-point pressure fueling receptacle.

The total usable fuel of an aircraft that is pressure-fueled and configured with two 300-gallon drop tanks and a 400-gallon centerline drop tank is 1793 gallons. Fuel is normally transferred from the drop tanks by tank pressurization and from the wing integral tank by an air-driven fuel transfer pump. Emergency wing fuel transfer may be accomplished by wing tank pressurization. All fuel is delivered to the fuselage tank, from which an electrically driven fuel boost pump delivers the fuel under pressure to the engine-driven fuel pump. A manual fuel shutoff control lever is provided in the cockpit. (See figure 1-26 for fuel grades and specifications of recommended and emergency fuels, and figure FO-2 for a schematic presentation of the fuel system.)

FUEL TANKS

Internal Tanks

Internal tanks comprise an integral wing tank and a self-sealing type fuselage tank mounted between the cockpit and the engine bay. The fuselage tank contains the control valve for regulation of transfer fuel flow, the fuel boost pump which delivers fuel to the engine, and a fuel sump with flapper valves. The flapper valves assure a flow of fuel to the fuel pump regardless of attitude and during maneuvers involving negative g-loads and inverted flight for approximately 30 seconds.

Both fuel tanks are vented. The vent system exit is located aft of the right main landing gear strut and is designed to provide a small amount of ram air pressure in the fuel vent system to reduce the amount of collapse of the self-sealing type fuselage tank when it is partially full. Both tanks incorporate provisions for gravity filling, pressure fueling and defueling, and water and sediment drainage. (For information concerning total and usable fuel capacities of each tank, see figure 1-6.)

External Tanks

Provisions are made for carrying drop tanks singly or in combination. The inboard and centerline external stores racks will accommodate either 150-gallon or 300-gallon drop tanks. The centerline rack will also accommodate a 400-gallon drop tank. All drop tanks are vented, and contain provisions for gravity fueling, pressure fueling, and pressurization to effect fuel transfer to the integral wing tank at the option of the pilot. The drop tanks may be jettisoned in the same manner as other droppable external stores.

FUEL TRANSFER

Wing Tank Transfer

The wing tank air turbine driven transfer pump utilizes engine compressor bleed air for power, and operates whenever the engine is running. Since the pump operates continuously, a fuel control float valve is placed in the fuselage tank to stop the transfer of fuel whenever the fuselage tank is full, in order to prevent transfer fuel from being pumped overboard through the fuel vent system. A fuel transfer failure caution light is provided on the left side of the instrument panel and comes on when wing tank fuel transfer pressure drops below 2 (+1/4, -1/8) psi. When engine rpm is above 70 percent, the light being on is an indication of possible fuel transfer pump failure or wing tank fuel depletion. Maneuvering flight may cause the pump to become temporarily unported, causing intermittent flashing of the fuel transfer caution light. Engine rpm settings below approximately 70 percent provide insufficient bleed air pressure to maintain the required fuel transfer pressure, thus causing the caution light to come on. In this situation, fuel may continue to transfer at a reduced rate. Increasing rpm above 70 percent will cause the light to go off, indicating normal fuel transfer has resumed.

CAUTION

Inadvertent fuel dumping may occur when DROP TANKS switch is in PRESS. If this happens, immediately place DROP TANKS switch in OFF. Next, place AIR REFUEL switch in FUS ONLY, and pressurize drop tanks.

Drop Tanks Transfer

Fuel transfer from the drop tanks to the integral wing tank and fuselage tank is effected by means of drop tank pressurization. Placing the DROP TANKS transfer switch on the engine control panel (figure FO-1) in PRESS opens a solenoid-operated air shutoff valve which directs engine compressor bleed air to the drop tanks. Once the tanks are pressurized, the flow of fuel from the drop tanks to the wing tank is controlled by the dual float pilot valve in the wing tank, which stops the transfer of fuel when the wing tank is full or allows it to continue when space is available. If the wing tank is full and the fuselage tank is not (as in the case of wing tank transfer pump failure), drop tank fuel will flow directly to the fuselage tank. Placing the DROP TANKS transfer switch in OFF energizes the drop tank air shutoff valve, thereby closing the valve and discontinuing transfer of fuel from the drop tanks. If electrical failure

FUEL QUANTITY DATA

GALLONS --POUNDS

TANKS	USABLE FUEL GALLONS	USABLE FUEL POUNDS JP-4	USABLE FUEL POUNDS JP-5	UNUSABLE FUEL LEVEL FLIGHT	EXPANSION SPACE	TOTAL VOLUME
INTEGRAL WING PRESSURE FUELING	560	3640	3808	6	9	585
INTEGRAL WING GRAVITY FUELING	570	3705	3876			
FUSELAGE PRESSURE FUELING	230	1495	1564	0	0	240
FUSELAGE GRAVITY FUELING	237	1541	1612			
LH WING (INBOARD WING RACK)						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300
CENTERLINE						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300
300 GALLON AIR REFUELING STORE	295	1918	2006	4	1	300
400 GALLON DROP	396	2574	2692	3	2	401
RH WING (INBOARD WING RACK)						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300

USABLE FUEL TOTALS

TANKS	PRESSURE FUELING	* POUNDS JP-4	* POUNDS JP-5	GRAVITY FUELING	* POUNDS JP-4	* POUNDS JP-5
FUSELAGE, WING	790	5135	5372	807	5245	5487
FUSELAGE, WING, (150) CENTER DROP	937	6090	6371	954	6201	6487
FUSELAGE, WING, (300) CENTER DROP	1085	7052	7378	1102	7163	7493
FUSELAGE, WING, (300) AIR REFUELING STORE	1085	7052	7378	1102	7163	7493
FUSELAGE, WING, (400) CENTER DROP	1186	7709	8064	1203	7819	8179
FUSELAGE, WING, TWO (150) WING RACK DROP	1084	7046	7371	1101	7156	7486
FUSELAGE, WING, (150) CENTER, TWO (150) WING RACK DROP	1231	8001	8370	1248	8112	8486
FUSELAGE, WING, (300) CENTER, TWO (150) WING RACK DROP	1379	8963	9377	1396	9074	9492
FUSELAGE, WING, (400) CENTER, TWO (150) WING RACK DROP	1480	9620	10,063	1497	9730	10,178
FUSELAGE, WING, TWO (300) WING RACK DROP	1380	8970	9384	1397	9080	9499
FUSELAGE, WING,(150) CENTER, TWO (300) WING RACK DROP	1527	9926	10,383	1544	10,036	10,499
FUSELAGE, WING,(300) CENTER, TWO (300) WING RACK DROP	1675	10,887	11,390	1692	10,998	11,505
FUSELAGE, WING, (400) CENTER, TWO (300) WING RACK DROP	1776	11,544	12,076	1793	11,654	12,191

NOTE:

* Calculated for standard day conditions using 6.5 LB/GAL for JP-4
6.8 LB/GAL for JP-5

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Figure 1-6. Fuel Quantity Data

occurs, the drop tank air shutoff valve is automatically opened, providing immediate and automatic transfer of drop tank fuel as wing tank space permits. To prevent drop tank pressurizing air from being exhausted overboard through the drop tank vent, each drop tank is equipped with a combination float and diaphragm vent shutoff valve. This valve acts to close the drop tank vent when the tank is full or pressurizing air is introduced.

Fuel transfer from the drop tanks from sea level to 5000 feet altitude is 8000 PPH: and, from 25,000 to 35,000 feet altitude is 4000 PPH (90 percent power setting).

Note

- Unless the DROP TANK fueling switch in the engine aft compartment is in OFF position, fuel transfer from the drop tanks will not be possible in the air except by extending the emergency generator.
- A noticeable thumping may be experienced during the latter stages of drop tank transfer.
- Venting of fuel through the wing cell vent mast may occur in the latter stages of drop tank transfer. Placing the drop tank switch to the OFF position will stop the venting. Drop tanks should be repressurized only when the wing cell is not completely full.

WARNING

Damaged integral wing tanks may include damage of drop tank fuel transfer lines, which are routed through wing tanks. An attempt to fuel drop tanks with broken transfer lines will result in loss of fuel and will also create a fire hazard condition.

Emergency Transfer

Emergency transfer of fuel from the wing tanks to the fuselage tank is possible. A WING FUEL switch located on the engine control panel (figure FO-1) provides for the transfer of fuel by wing tank pressurization. Moving the switch to the EMER TRANS position closes the wing tank pressure and vent valves, allowing engine compressor bleed air to pressurize the wing tank. Fuel is then transferred to the fuselage tank through the pressure fueling line. If normal transfer failure was caused by a failure of the transfer pump, emergency transfer fuel will also flow through the regular transfer line as well as the pressure fueling line to the fuselage tank.

CAUTION

- It is possible to pressurize the wing tank in excess of 8 psi and dump fuel out the dump mast when the WING FUEL switch is in EMER TRANS position, if fuel covers the fuel vent outlet. This condition can exist during negative-g flight or when aircraft is in nosedown attitude.
- Refer to part 4 of this section for limitations applicable to flight with the wing tank pressurized.
- The WING FUEL switch must be in OFF position during air refueling, hot refueling, or ground refueling with electrical power applied to the aircraft. This procedure will prevent dumping of fuel overboard through the wing fuel dump valve.

When centerline drop tank is installed, the following sequence should be used to prevent transfer of wing fuel to centerline drop tank when the wing tank is pressurized. First, transfer all drop tank fuel that will fill the wing tank and then flow directly to fuselage tank. Then, while maintaining drop tank pressurization, initiate emergency transfer. Air pressure in center drop tank will prevent flow of fuel from wing down into center drop tank, where it would not be available for immedeiate emergency transfer.

Note

- Drop tank fuel transfer may not be possible with the emergency fuel transfer switch activated.
- The emergency wing tank fuel transfer system will not operate on the emergency generator.

Fuel Consumption Effects on Aircraft Center of Gravity

Drop tank fuel consumption has the least effect on center of gravity movement. The center of gravity will move approximately 1-percent mean aerodynamic chord (MAC) forward as the drop tank fuel goes from full to empty. Aircraft normal fuel scheduling maintains the fuselage tank at a 1400 to 1500 pound level by transfer of drop tank fuel and then wing tank fuel. Wing tank fuel consumption causes the center of gravity to move forward until the wing tank is empty (figure 1-6). The center of gravity will move forward approximately 5-percent MAC as wing tank fuel goes from full to empty. The aircraft will be at the most forward center of gravity for a given configuration when only the fuselage tank is full. Fuselage tank fuel consumption causes the center of gravity to move aft. The center of gravity will move aft approximately 6 percent MAC as the fuselage tank fuel goes from normal fuselage fuel level to empty.

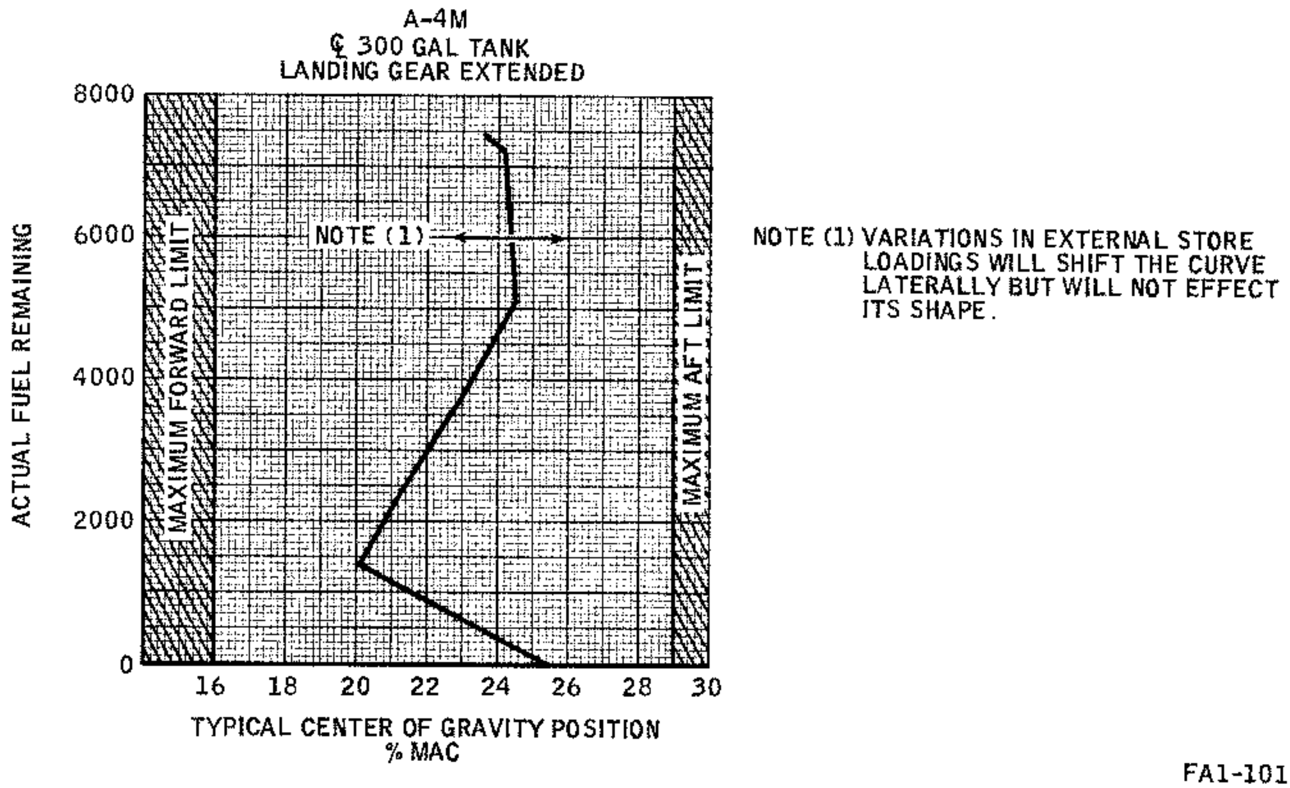


Figure 1-7. Fuel Consumption Effects on Aircraft Center of Gravity

Approximately the same center of gravity position will exist with 4000 pounds of remaining fuel with normal fuselage tank fuel as with only 600 pounds of remaining fuselage tank fuel.

Fuel Transfer Rates (Basis: Fuel lab tests using JP-5)

Normal Fuel Transfer

Air Turbine Pump Fuel Transfer from Wing to Fuselage Tank

ALT	MACH	Gallons-Pounds/Hr	
SL	V min	1260	8568
15,000	V min	1200	8160
25,000	V min	1200	8160
35,000	V min	1080	7344
SL	V max	2880+	19,584+
15,000	V max	2880	19,584
25,000	V max	2400	16,320
35,000	V max	1920	13,056

Drop Tank Stores to Internal Fuel Tanks

	Pounds/Hr
Wing drop tanks (two)	9500
Centerline drop tank	5500
Two wing/centerline drop tank combination	14,000

Note

Drop tank fuel transfer rates apply from SL to 40,000 feet for all flights except idle descent.

Wing Tank/Air Refueling Store

	Gallons-Pounds/Min	
Wing tank to air refueling store	80 to 100	544 to 680
Air refueling store to wing tank	14 to 18	95 to 122.4
Air refueling store to receiver aircraft	180	1224

Emergency Fuel Transfer

	Gallons-Pounds/Min	
Wing to fuselage tank	21	142.8

Fuel Dump Rates

	Gallons-Pounds/Min	
Wing tank	100+	680+
Air refueling store	100	680

Wing Tank Fuel Dump and Pressure Relief

CAUTION

When operating the valve pneumatically (dump function) after each valve closure, a minimum of two minutes shall be allowed for all fuel drainage from the diaphragm cavity, otherwise damage to the diaphragm may result.

A valve installed in the wing tank will prevent over-pressurization of the tank and will allow wing tank fuel to be dumped overboard if desired. Placing the WING FUEL switch, located on the engine control panel in the DUMP position will allow wing fuel to flow by gravity out the dump mast on the right main landing gear fairing at the rate of approximately 100 gallons per minute.

CAUTION

Dumping wing fuel above the freezing level may result in the dump valve freezing open. Fuel dump will then continue until the wing tank fuel is depleted or descent is made below the freezing level.

Note

- While dumping wing tank fuel, monitor the fuel quantity indicator closely to preclude inadvertent dumping of fuel below the desired level.
- The WING FUEL switch must be in OFF position during air refueling, hot refueling, or ground refueling with electrical power applied to the aircraft. This will prevent dumping of fuel overboard through wing fuel dump valve.

Scupper Drain (Gang Drain)

The mast located aft of the aft fuselage lower access door drains various aircraft and engine areas. Any fluid seen venting from this mast other than on shut-down may indicate a serious malfunction or leak and is cause for immediate landing and investigation. This mast should not be mistaken for the wing tank dump must located aft of the right main gear.

Air Refueling Fuselage Only Switch

The two-position air refueling fuselage only switch, located on the engine control panel (figure FO-1), is labeled AIR REFUEL. The positions are marked NORM and FUS ONLY. For normal air refueling operation and for ground refueling, the switch is used in the NORM position. When the switch is in the FUS ONLY position, fuel flows into the fuselage fuel tank only. If the receiver aircraft has wing damage, the FUS ONLY position prevents fuel from entering a damaged wing tank, thus averting a fuel loss/fire hazard condition. Air refueling of the drop tanks and fuselage fuel tank (bypassing the wing tanks) is possible by placing the DROP TANKS switch in the AIR REFUEL position, in addition to placing the AIR REFUEL switch in the FUS ONLY position. If wing tank damage is causing loss of fuel, any fuel remaining in the drop tanks may be transferred directly to the fuselage tank by placing the AIR REFUEL switch in FUS ONLY and pressurizing the drop tanks. Indication of fuel transfer may take as long as 10 minutes if activated with 400 pounds of fuel or less remaining in each drop tank.

CAUTION

If drop tank transfer lines, which are routed through wing tanks, are damaged, transfer of drop tank fuel or attempted air refueling of drop tanks could constitute a fire hazard.

Fuel Boost Pump

An electrically driven fuel boost pump is submerged in the fuselage tank sump. The fuselage tank sump incorporates flapper valves that act to keep the boost pump fuel inlet supplied with fuel in all aircraft attitudes, including diving flight and negative g or inverted flight not to exceed 30 seconds duration. Operation of the fuel boost pump is automatic whenever the aircraft electrical system is energized by the main generator, by external power, or by external power through the ground test switch. In the event of main generator failure, the fuel boost pump will be inoperative and will remain so even though the emergency generator is deployed. (Refer to section V, Fuel Boost Pump Failure.)

FUEL BOOST PRESSURE INDICATOR. Loss of fuel boost pressure is indicated by a FUEL BOOST warning light located on the caution panel, left-hand side of the instrument panel (figure FO-1). The warning light will come on whenever fuel boost pressure falls below 4 psi and will go out at 6 psi.

Manual Fuel Shutoff Control Lever

The fuel system incorporates a manually operated fuel shutoff control lever (figure FO-1) located outboard of the left-hand console. This lever has two positions, NORMAL and EMER OFF. The EMER OFF position of the control stops all fuel flow from the aircraft fuel system to the engine fuel control system. A spring-loaded lift-type guard is provided to prevent inadvertent movement of the lever to EMER OFF. To ensure complete fuel shutoff, the control lever must be moved fully aft into the EMER OFF detent.

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity indicating system is comprised of capacitance-type fuel quantity probes, a fuel quantity indicator, a low-level switch, fuel quantity test switch, and associated wiring. The wing tank contains six fuel quantity probes. Each external fuel tank and the fuselage tank contains one fuel quantity probe. The probes are wired into the fuel quantity indicator in such a manner as to indicate the total quantity of fuel remaining in the internal tanks when the fuselage tank contains more than 170 gallons (approximately 1100 pounds). External fuel tanks quantity is checked by depressing the external fuel switch. When the aircraft is configured with air refueling stores, the refueling stores fuel quantity can also be checked by depressing the external fuel switch.

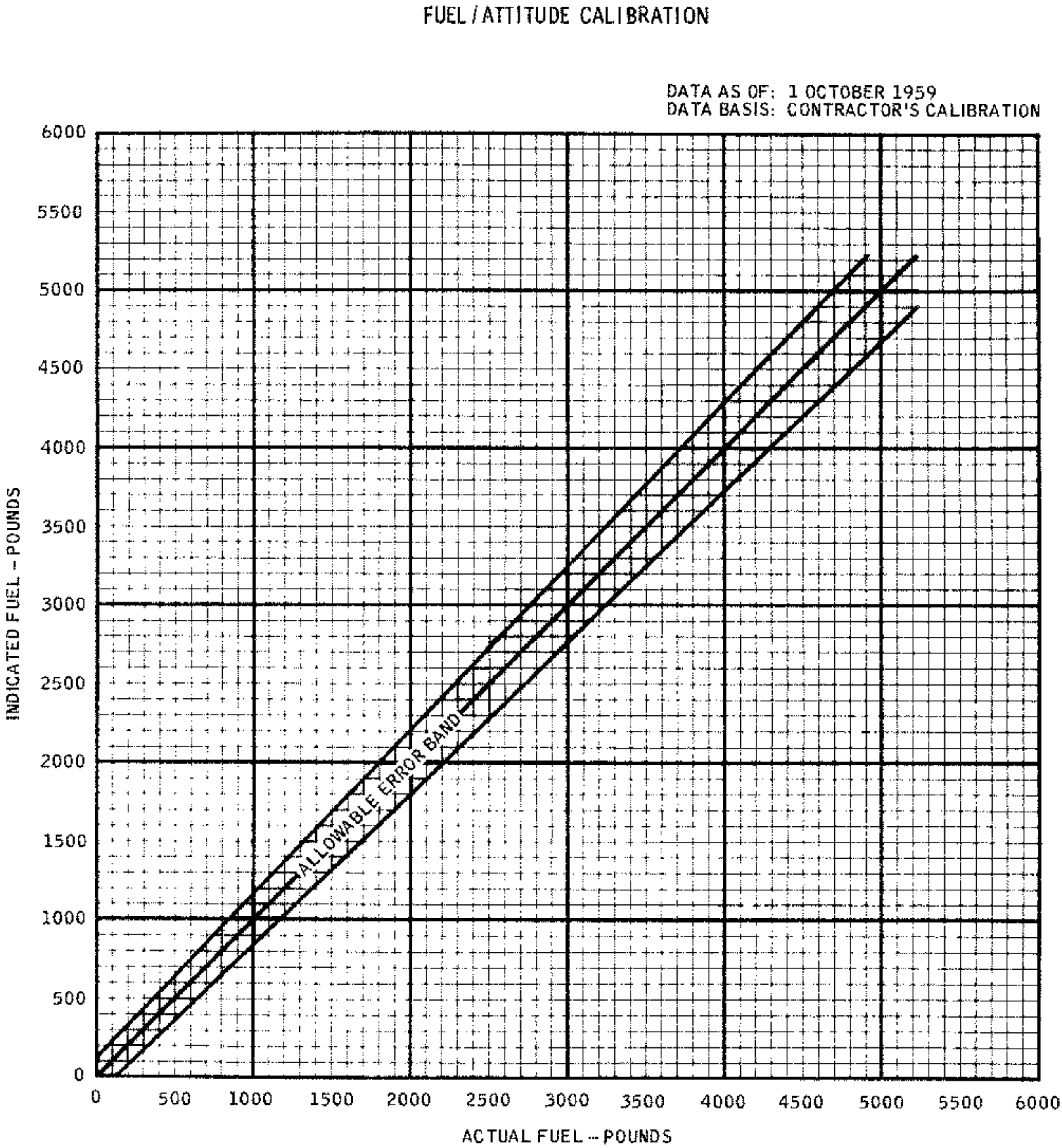
The effect of aircraft attitude on the relationship between indicated and actual total fuel quantity is shown on figure 1-8. When the fuselage tank indicated fuel quantity is at or below 1000 pounds, and the aircraft attitude is between 4 degrees noseup and 4 degrees nosedown, indicated quantity can be considered to be actual quantity. Indicated airspeed for most accurate fuel reading is 250 KIAS.

Low Fuel State Warning Indicator

The fuselage tank contains a low-level switch (thermistor bead) located approximately one-third of the distance down the length of the fuel quantity probe at about the 170-gallon level (approximately 1100 pounds). If the fuel supply in the fuselage tank falls below this level due to malfunction of the wing tank transfer system, or failure or mismanagement of the drop tank transfer system, the low-level switch will cause the reading of any remaining wing-tank transfer fuel to be dropped out, indicating to the pilot that approximately 170 gallons of usable fuselage fuel remains.

Fuel Quantity Indicator

The fuel quantity indicator (figure FO-1) located on the instrument panel, indicates the total fuel available in pounds multiplied by 1000. The range of indication is from 0 to 6400 pounds.



REMARKS:

(1) ALLOWABLE ERROR BAND PER MIL-G-7940.

(2) JP-4 FUEL.

EXAMPLE:

ASSUME INDICATED FUEL IS 4000 POUNDS.

(1) READ ACROSS TO ALLOWABLE ERROR BAND.

(2) ACTUAL FUEL IS EQUAL TO 3700 POUNDS (MINIMUM) TO 4300 POUNDS (MAXIMUM).

FA1-28

Figure 1-8. Fuel Quantity Calibration Chart

Note

- With failure of the dc converter circuit, no dc power will be available to the fuel quantity control unit. As a result, the fuel quantity indicator will indicate only fuel available in the fuselage fuel cell (fuel available in the wing tank will not be included). This fuel indication will be approximately 1400 pounds with the engine operating. As total usable fuel becomes less than 1400 pounds, the correct fuel quantity will be indicated.
- Maneuvering or accelerated flight causes erroneous fuel quantity indications.

The fuel quantity indicator may be tested by the TEST switch (figure FO-1) on the radar mode selector panel. When the test switch is depressed, the fuel quantity indicator pointer will rotate in a counterclockwise direction. When the test switch is released, the pointer will return to the original indication if all units of the fuel quantity measuring circuit are functioning properly.

External Fuel Switch

The external fuel pushbutton switch, labeled FUEL EXT, is located on the radar mode selector panel. To check external fuel quantity, including air refueling stores fuel quantity, depress the switch and hold until the fuel quantity indicator pointer stabilizes.

SINGLE-POINT FUELING AND DEFUELING SYSTEM

The pressure fueling system is designed to permit fueling at a rate of 200 gallons per minute through a single-point pressure fueling receptacle, located at the trailing edge of the wing just inside the aft engine compartment access door. The system may be defueled through the same receptacle at a rate of approximately 100 gallons a minute.

Pressure Fueling Switch Panel

The pressure fueling switch panel is located on the left side of the aft engine access compartment just inside the access door. This panel has two switches: the CHECK SWITCH, and the DROP TANK FUELING switch. The CHECK SWITCH has three positions, PRIMARY OFF, FUELING ON, and SECONDARY OFF and is used to test the operation of the dual float shutoff valves. The DROP TANK FUELING switch has two positions, ON and OFF. The ON position of the DROP TANK FUELING switch energizes the drop tanks solenoid pilot valves, permitting pressure fueling of the drop tanks.

Pressure Fueling

When the wing and fuselage tanks are being fueled, fuel pressure opens the fueling shutoff valve in each tank, allowing fuel to enter the tank and also to flow through the sensing lines to the dual float pilot valve. When the tank becomes full, the floats close the pilot valve, causing pressure to increase behind the diaphragm of the shutoff valve and close it. Each shutoff valve consists of a primary float, which is the pilot for the shutoff valve; and a secondary float, which is a standby for the shutoff valve. Placing and holding the CHECK SWITCH in either the PRIMARY OFF or SECONDARY OFF position causes solenoids to raise the respective float valve to simulate the normal shutoff valve action at the maximum fuel capacity level. This check can be made only after the pressure fueling operation has begun.

CAUTION

When external electrical power is not available during pressure fueling of the aircraft, the functional tests of pressure fueling shutoff components cannot be performed. Therefore, wing and fuselage tank gravity filler caps shall be removed during fueling to prevent possible damage to internal fuel tanks structure.

To fuel the drop tanks by means of the pressure fueling system, it is necessary to plug in external electrical power. Placing the DROP TANK FUELING switch, located on the pressure fueling switch panel, to the ON position energizes the normally closed solenoid pilot valve. The fuel pressure opens the drop tanks shutoff valves, and the fuel flows to the drop tanks. Fuel also flows through the sensing lines to the drop tanks solenoid pilot valves. When each drop tank becomes full, a float switch in each tank rises and breaks the electrical circuit to the energized solenoid pilot valve. The pilot valve closes and pressure increases behind the diaphragm of the drop tanks shutoff valve. The shutoff valve then closes, and pressure fueling to the tank is discontinued.

Note

Unless the DROP TANK FUELING switch in the aft compartment is in the OFF position after fueling the drop tanks and prior to takeoff, normal fuel transfer from the drop tanks will not be possible in the air. However, drop tank fuel transfer may be accomplished by extending the emergency generator.

When the air refueling store is installed instead of the center drop tank, it is fueled through the pressure fueling receptacle on the store.

Pressure Defueling

To defuel the integral wing tank requires no procedure other than connecting the defueling hose to the pressure fueling receptacle. To defuel the fuselage tank it is necessary to operate the manual override check valve between the wing and fuselage tanks. When the defueling operation is begun, negative pressure in the pressure fueling shutoff valves will open the valves and allow the fuel to be removed. When either the fuselage or wing tank becomes empty, the defueling low-level float valve opens, increasing the pressure behind the diaphragm of the shutoff valve, causing the valve to close. This prevents air from entering the defueling line and breaking the siphon when one tank empties ahead of the other.

To defuel the drop tanks through the pressure fueling system, it is necessary to connect a source of air pressure to the capped tee in the drop tanks pressurizing system, and first transfer the drop tanks fuel into the integral wing tank.

ELECTRICAL SYSTEM

During normal operation, all electrical power on the aircraft is supplied by the 20-kva, engine-driven main generator, which furnishes 115/200-vac, 400-cycle, 3-phase, constant frequency ac power. In addition to supplying power for ac bus loads, the generator also provides power for conversion to meet the dc power requirements. If the main generator fails, the emergency ac power system can be operated to supply ac power and converted primary dc power to components or systems that are essential for safety of flight. No dc generator or battery is provided (figure FO-3).

Actuation of the emergency ac generator disconnects power to nonessential buses, preventing excessive loads on the emergency ac power system. The monitored buses that are deenergized by operation of the emergency ac power system can be reenergized during flight if main generator operation is regained.

When the aircraft is on the ground, external power can be used to energize the system through the external power receptacle located in the lower forward plating of the left-hand wing root. Operation of the electrical system is completely automatic, with the exception of the emergency generator, which must be activated by the pilot upon failure of the main generator.

Refer to section V for emergency operation of the electrical system.

MAIN GENERATOR

The main ac generator is driven at a constant speed of 12,000 rpm over the entire operating range of the engine, from idle to maximum power, by the constant speed drive (figure FO-3). A test unit may be plugged into the receptacle on the fuse panel in the nosewheel well to ascertain that the generator is operating within the prescribed limits. Protective circuitry, contained in the generator control unit, regulates frequency and voltage to prevent damage to aircraft electronic equipment during engine shutdown or constant speed drive malfunction. The MAIN GEN switch must be ON to provide aircraft electrical power from the main generator.

Main Generator Switch

A three-position main generator switch, labeled MAIN GEN, is located outboard of the right console. The positions are marked ON, OFF RESET, and TEST. With the aircraft engine operating, the switch performs the following functions:

When the switch is placed in the ON position, the main generator supplies electrical power to the aircraft if generator electrical characteristics are within prescribed limits. If the generator electrical characteristics are not within limits, a system protective relay opens and the GEN warning light, located under the glareshield, comes on, indicating that the generator is not supplying electrical power to the aircraft. Main generator electrical power is deenergized when the switch is placed in the OFF RESET position, and the GEN warning light will, therefore, come on. The momentary TEST position is spring loaded to the OFF RESET position. To test generator electrical characteristics, the switch is held in the TEST position. When the switch is in TEST, a protective relay remains open to prevent system damage in the event of abnormal generator output. If the generator electrical characteristics are within limits, the GEN warning light will not come on. The switch will return to the OFF RESET position when released.

External-Internal Power Switch

When the external-internal power switch is in the EXTERNAL position, the aft monitored bus is disconnected from the main generator and is connected to the external power receptacle, so that power from an external source may be applied to the system. The external power receptacle door cannot be closed when the switch is in the EXTERNAL position.

EMERGENCY GENERATOR

The emergency generator, rated at 1.7 kva, is carried in a compartment in the lower right-hand side of the forward fuselage. When the generator is released into the airstream, a variable pitch propeller governs the speed of the generator at approximately 12,000 rpm to provide 400-cycle power to the primary and monitored primary buses.

Emergency Generator Bypass Switch

A two-position emergency generator bypass switch, labeled EMER GEN, is located on the right console (figure FO-1). The positions are marked BYPASS and NORMAL. With the switch in NORMAL, electrical power for the aircraft automatically switches from main generator operation to emergency generator operation when the emergency generator is extended. If main generator power is regained after the emergency generator is extended, emergency generator operation can be returned to main generator operation by placing the switch in BYPASS.

Emergency Generator Release Handle

The emergency generator release T-handle (figure 1-4) on the extreme right side of the cockpit, above the right console, provides control of the emergency electrical system in the event of main generator failure. When the handle is pulled, the emergency generator drops into the airstream, the main generator becomes disconnected from the electrical system, and the primary and monitored primary bus are connected to the emergency generator. The emergency generator bypass switch must be in the NORMAL position.

Note

> Electrical power will be provided by the emergency generator only if the emergency generator bypass switch is in NORMAL.

Once the emergency generator is extended, there is no way to retract it to the normal stowed position while in flight.

AC POWER DISTRIBUTION

Normal AC Power

Power from the main generator is sampled by a voltage regulator in the generator control unit (figure FO-3). The voltage regulator maintains a constant voltage output from the main generator by varying the current. The voltage-regulated power moves through the INTERNAL position of the external power switch.

Emergency AC Power

If the main generator has failed, extending the emergency generator into the airstream transfers electrical power to the ac monitored primary bus from the ac aft monitored bus to the emergency generator (figure FO-3). Actuation of the horizontal stabilizer manual override lever, while operating on emergency generator, diverts emergency generator power to the ac primary bus, and the ac monitored primary bus is bypassed. The same occurs when the EMER PWR switch is actuated in aircraft equipped with the DCU-75/A (AMAC) control system. Upon releasing the horizontal stabilizer manual override lever, or returning the DCU-75/A EMER PWR switch to the NORM PWR position, emergency generator power is again directed to the ac monitored primary bus.

If the main generator has not failed and the pilot should, for any reason, extend the emergency generator, the main generator will provide power to the ac aft and forward monitored buses, and the emergency generator will provide power to the remaining buses. To disconnect emergency generator power, the EMER GEN switch can be placed in BYPASS, and the main generator will provide power to all buses. However, the MAIN GEN switch must be in the ON position.

DC POWER DISTRIBUTION

The primary bus supplies 115/200-vac, 3-phase, 400-cycle ac power to a single dc converter, which converts the ac power to 28-vdc power, and powers both the 28-vdc primary bus and the monitored dc bus.

Armament Bus

The armament bus receives dc power provided that the master armament switch is ON and the landing gear handle is UP. An armament safety switch, actuated by the DOWN position of the landing gear handle, deenergizes the armament bus as a safety feature to prevent inadvertent firing of the guns or normal release of stores when the aircraft is on the ground or in flight with the wheels down.

Armament Safety Disable Switch

The armament safety disable switch is located on the outboard side of the right wheel well for ground testing of the armament circuit. When the master armament switch is ON and the armament safety disable switch is momentarily depressed, an armament safety disabling relay is closed allowing power to energize the armament bus. The relay is held closed until the master armament switch is turned off, or until electrical power is disconnected from the aircraft. When either occurs, the armament safety feature is automatically reinstated.

Emergency Bomb Release

Emergency bomb release can be accomplished by pulling the emergency stores release (EMER BOMB) T-handle (figure 8-1). See Emergency Release, section VIII.

Note

Electrical power is required (either from the main generator or the emergency generator) to jettison external stores with the emergency stores release handle. If electrical power is not available, external stores cannot be jettisoned.

FUSE PANELS

All electrical circuits, with the exception of the all attitude indicating system, are protected by fuses in lieu of circuit breakers in order to save weight and provide better wire protection. The fuses are located on three panels. Two panels are located in the nosewheel well and one panel is located in the forward engine compartment.

FIRE DETECTION SYSTEM

The fire detection system will indicate the existence of fire in the area surrounding the engine, tailpipe, and accessories section. If fire occurs in these locations, a push-to-test type FIRE warning light (figure 1-4) on the glareshield will glow. The fire detection system may be checked by depressing the master press-to-test button. When the button is depressed, the FIRE warning light will glow, indicating a properly functioning circuit. The system discriminates against short circuits and prevents illumination of the fire warning light by either the fire detection control unit or press-to-test button when a short exists.

HYDRAULIC SYSTEMS

The hydraulic systems consist of the utility hydraulic system and the flight control hydraulic system. Each system includes a self-pressurizing fluid reservoir and an engine-driven variable displacement pump. Both reservoirs are located in the upper right-hand side of the fuselage over the center of the wing, with the flight control system reservoir aft of the utility system reservoir. Capacity of the utility system reservoir is 1.25 gallons of hydraulic fluid; that of the flight control system, 0.30 gallon. Each system operates normally under a pressure of 3000 psi, and relief valves in each system open at 3650 psi to prevent damage to the lines and equipment should the pump displacement compensator fail. Tandem power cylinders are used in the aileron, elevator, and rudder power controls. One-half of each cylinder is operated by flight control system pressure, and the other half by utility system pressure. This arrangement allows the ailerons, elevator and rudder to be power-operated at reduced hinge movements by either system in the event of failure of the other.

The flight control hydraulic system powers only its half of the aileron, elevator, and rudder tandem actuating cylinders. The utility hydraulic system, in addition to powering one-half of the aileron, elevator, and rudder tandem actuating cylinders, also operates the landing gear, wing flaps, speedbrakes, arresting hook, autopilot servos, spoilers, and nosewheel steering. Hydraulic pressure warning lights are provided in the cockpit for each of the two systems. Pressure gages for both systems are installed in the right-hand wheel well. There is no auxiliary pump and no hydraulic pressure is available for ground operation unless the engine is running. Whenever the engine is running, normal pressure is supplied to both the flight control and the utility systems.

Both of the engine-driven hydraulic pumps are of the constant pressure, variable displacement type. The flow of fluid through each system will vary in rate (gallons per minute) with the operating speed of the associated pump. As rate of fluid flow determines the speed at which the various hydraulically operated units responded to actuation of their individual controls, variation in rate of flow with power changes during normal operation might ordinarily produce objectionable characteristics in operation of the hydraulic systems. Therefore, flow restrictors have been installed in the subsystems to regulate the maximum rate of flow. The flow restrictors prevent the wing flaps, speedbrakes, and arresting hook from operating too fast when fluid flow is at its peak, yet do not affect the time of operation when flow is reduced at low engine speeds. As long as the engine is turning at IDLE rpm or greater, the hydraulically operated units will operate against the usual loads. However, at engine windmilling speeds, fluid flow is greatly reduced, and the time required for hydraulically operated units to respond fully is increased. (See figure FO-4 for a schematic diagram of the hydraulic systems.)

Either the utility hydraulic system warning light or the flight control hydraulic system warning light (ladder lights) will indicate loss of pressure to one or the other of the hydraulic systems. No stiffening of the control stick, except near full surface deflection at high speeds, will be encountered except with complete failure of both the flight control and the utility hydraulic systems.

When operating on the utility hydraulic system alone, actuations of various units normally operated by utility pressure will cause a temporary decrease in the effectiveness of the flight controls.

No means are available for the pilot to correct hydraulic system failure. For action to be taken in the event of failure, refer to section V.

FLIGHT CONTROL SYSTEM

The primary flight controls systems are tandem full power hydraulic systems with artificial feel supplied by bungee springs in parallel with the controls. Motion of the stick or rudder pedals is transmitted through linkage and cable systems to the control valve. The valve ports fluid to the power cylinder, which in turn actuates the control surfaces. Each of the three systems, the aileron, elevator, and rudder, is a tandem hydraulic system.

CAUTION

> Do not attempt maneuvers requiring high control forces (such as high speed pullouts) when it is known beforehand that one or both of the systems are inoperative.

Aileron and rudder trim is obtained by repositioning the neutral force point of a load-feel bungee. Longitudinal trim is obtained by positioning the horizontal stabilizer.

In the event of total hydraulic power failure, the aileron and elevator power cylinders may be disconnected and control is maintained manually. The rudder system cannot be disconnected. With a loss of hydraulic power, the rudder control valve ports the two cylinder ports together so that the rudder can be controlled manually through the manual by-pass linkage.

Hydraulic servos in parallel with the pilot operated controls provide the aileron and elevator control forces required for automatic flight control. A load feel bungee is placed in series with the elevator servo to limit its force output for structural protection.

The rudder control system is provided with a dual input electromechanical control valve so that AFCS commands may be added to pilot commands. With AFCS or STAB AUG engaged the valve operates electrically. With AFCS and STAB AUG disengaged the valve operates mechanically.

The aileron and rudder control surfaces have rotary viscous dampers to reduce surface buzz.

AILERON CONTROL

Both ailerons are aerodynamically and statistically balanced. Lateral movement of the control stick positions the aileron control valve so that hydraulic fluid at 3000 psi is ported to the aileron power cylinder. The aileron power cylinder operates push-pull tubes to the ailerons, causing the latter to be deflected in the desired direction. Because the aileron power control is irreversible, there is no feedback to the pilot of air loads against the ailerons; therefore, artificial "feel" is provided by a spring bungee. The action of the spring bungee opposes the movement of the control stick.

AILERON TRIM SYSTEM

An electrically powered aileron trim actuator is controlled by movement of the trim switch (figure 1-9) on the stick grip to LWD (left wing down) or RWD (right wing down). The trim actuator moves the stick, power system linkages, and consequently, the ailerons to the desired trim position by changing the neutral position of the aileron load feel and centering bungee. At the same time, it positions a followup tab on the left aileron so that the aircraft will remain approximately in trim whenever the power system is disconnected. The position of the followup tab has negligible effect on lateral trim during flight utilizing either or both hydraulic power control systems.

If the hydraulic power system has been disconnected, the pilot continues to trim the ailerons in the same manner, except that now the followup tab is positioning the surfaces, and the aerodynamic forces on the ailerons will be felt by the pilot through the manual control system. The in-trim angular position of the aileron tab will vary between individual aircraft due to manufacturing tolerances, and is established by company test pilots prior to fleet delivery of each aircraft. Theoretically this setting should not change during the service life of the aircraft unless some change is made to its aerodynamic configuration. For safety of flight, it is mandatory that the in-trim position be reestablished after an aileron or wing change since this determines the range of action of the tab. Failure to do so may result in uncontrollable rolling tendencies when the power system is disconnected. (Refer to Hydraulic Power Disconnect.)

The stick trim actuator is inoperative when the emergency generator is in use. No indicator is provided to show the trim position of the ailerons and tab, but the control stick is displaced from center to a new neutral position as the trim tab and ailerons are moved from their faired positions by the trim actuator.

ELEVATOR CONTROL

Fore and aft movement of the control stick moves a pushrod attached to the elevator control valve, which ports hydraulic pressure to the elevator power control cylinder. The cylinder then, through mechanical linkage, deflects the elevator surface as desired. The elevator power control is aerodynamically irreversible and pilot's feel is induced by a spring bungee in the elevator control system. The forward and aft bob-weights also provide additional feel during vertical and longitudinal accelerations to prevent the pilot from overstressing the empennage structure. The elevators are not equipped with trim tabs. Longitudinal trim is provided by a movable horizontal stabilizer. A bungee is installed in the elevator control system to provide longitudinal load feel. The bungee is linked to the horizontal stabilizer so that the elevator deflects upward (stick moves aft) while trimming noseup and deflect downward while trimming nosedown. The elevator moves approximately 8 degrees as the stabilizer travels from full-throw up to full-throw down. When elevator hydraulic power is lost, the elevator-stabilizer linkage is ineffective. The elevators are interconnected with the operation of the speedbrakes to assist the pilot in overcoming trim changes resulting from speedbrake operation. A system of cables and springs attached to the left speedbrake actuates the control cables between the stick and the elevator control valve. When speedbrakes are opened, the system pulls the nosedown elevator cable, moving the stick forward and actuating the elevator to reduce a noseup pitch. When the speedbrakes are closed, the stick moves aft to its original trimmed position, thus reducing nosedown pitch.

HORIZONTAL STABILIZER TRIM SYSTEM

The entire surface of the horizontal stabilizer is moved by an electrically operated actuator to provide longitudinal trim. The actuator is controlled by forward and aft movement of the trim switch (figure 1-9) to NOSE DOWN or NOSE UP. The switch is spring loaded to the center or OFF position, and must be moved to the full extent of its travel in either direction to operate the horizontal stabilizer. Stabilizer travel is from 12 1/4±1/4 degrees noseup to 1 degree nosedown. The position of the horizontal stabilizer is shown on the trim position indicator.

Manual Override Lever

A horizontal stabilizer manual override lever (figure FO-1), located on the left console outboard of the throttle, will operate the horizontal stabilizer in the event the trim switch malfunctions. Forward or aft movement of the manual override lever causes a nosedown or noseup trim actuation, respectively, and overrides any opposing commands of the stick trim switch. When the emergency generator is being utilized, the manual override lever is the only means of actuating the horizontal stabilizer.

CAUTION

Do not run the horizontal stabilizer actuator against the stops during the preflight check. Use of the horizontal stabilizer manual override lever does not cut out the actuator motor when the horizontal stabilizer reaches full travel. Continued operation of the manual override lever in one direction when the stabilizer is at the limit of travel will burn out the actuator motor and will cause complete loss of stabilizer control.

RUDDER CONTROL

The aircraft is equipped with a rudder system operating at a reduced hydraulic pressure of 1150 psi. The rudder power control is operated by the flight control hydraulic system and the utility hydraulic system at the same reduced pressure. Movement of the rudder pedals mechanically positions the rudder electromechanical dual input servo valve. The valve ports hydraulic pressure to the rudder actuating cylinder as required. Since there is no feedback of air loads on the control surface of a hydraulic power system, a spring bungee is installed in the fin to center and restrain the control valve and rudder pedals, and to provide artificial feel. The rudder pedals are independently adjusted fore and aft by a lever located on the inboard side of each pedal.

Rudder Trim System

Directional trimming is accomplished by displacing the entire rudder surface as a result of repositioning the center or neutral point of the spring bungee through the action of an electrical motor controlled by the rudder trim switch (figure FO-1) on the left console. Positions of the trim switch are NOSE LEFT and NOSE RIGHT. Rudder trim position is shown on the trim position indicator. Trim is not available during emergency generator operation.

Note

Loss of rudder hydraulic power results in loss of rudder trim.

Hydraulic Power Disconnect

A manual flight control T-handle (figure FO-1) on the lower right side of the instrument panel may be used to disconnect the elevator and aileron power cylinders from the flight controls in the event of complete hydraulic systems failure. After disconnect, stick forces are high, particularly for lateral deflections. At airspeeds in excess of 300 KIAS, stick forces become extremely high.

Note

- The rudder has no hydraulic disconnect.
- As long as (normal) electrical power is available, the aircraft can be trimmed laterally. Therefore, in the event of an actual hydraulic system failure, when the T-handle is pulled, if the aircraft starts to roll, it should be trimmed immediately.

CAUTION

Hold T-handle and allow it to return to stowed position to prevent handle from striking an instrument.

Before performing a hydraulic power disconnect under controlled conditions, the emergency generator should be extended and a functional check should be made of the manual override. If the emergency trim override functions properly on emergency generator, switch to BYPASS and continue with the disconnect.

Trim Position Indicators

The positions of the rudder trim and the horizontal stabilizer are shown on the trim position indicators (figure FO-1) at the forward end of the right console. The rudder trim position indicator is graduated in 1-degree units to the L (left) and R (right) of 0. Total travel of the rudder trim position indicator represents 7 degrees of rudder travel left and right of center. All even degree marks are numbered from 0 through 6.

The scale for horizontal stabilizer position is graduated in 1-degree units from DN (down) through UP. All even numbered degree marks are identified numerically. Maximum indicators of the stabilizer trim position indicator are 3 degrees aircraft-nosedown and 13 degrees aircraft-noseup.

LANDING GEAR SYSTEM

The tricycle landing gear is retracted and extended by utility hydraulic system pressure during normal operation. The main gear retracts up and forward and the wheels rotate to fit flush into the wheel wells in the wings. The nose gear also retracts up and forward. The nose strut telescopes to allow the nosewheel to fit into the nosewheel well. When retracted, the landing gear is held up by utility hydraulic pressure and in the case of hydraulic system failure, the gear rests on the landing gear doors which are held closed by mechanical latches. For emergency extension of the landing gear, the door latches are manually released by the pilot.

LANDING GEAR HANDLE

The landing gear handle (figure 1-4), located forward of the left cockpit rail, controls the normal operation of the landing gear system. The landing gear handle has two positions, UP and DOWN, and is mechanically linked to the landing gear control valve. A mechanical guard attached to the handle locks the handle in the UP or DOWN position. Depressing the guard permits movement of the handle to the desired position.

A warning light in the wheel-shaped handle of the control comes on when the handle is moved to either of its two positions. The light remains on until the wheels are locked in either the up or down position. The position of the wheels is shown on the wheels and flaps position indicator on the left console. A flasher-type wheels warning light (figure 1-4) is installed beneath the upper left side of the glareshield adjacent to the LABS light. With the wing flap handle in any position other than the UP detent and the landing gear up or unsafe, retarding the throttle below approximately 92 percent rpm causes the WHEELS warning light to flash, informing the pilot of a possible unsafe condition.

To prevent movement of the landing gear handle to UP when the aircraft is on the ground, the landing gear handle is latched in the DOWN position. In normal operation, the retraction release switch located on the left main landing gear strut, is actuated when the aircraft becomes airborne and the landing gear struts extend, energizing the safety solenoid. The solenoid then unlatches the handle. On emergency generator power, the retraction release safety solenoid is deenergized. If it should become necessary to retract the landing gear while on the ground, the serrated end of the latch on the landing gear control panel must be moved aft to unlatch the landing gear handle.

Note

If the landing gear handle cannot be raised and angle-of-attack (AOA) indexer does not come on immediately after takeoff, a possible retraction safety-solenoid malfunction is indicated. (Refer to section V, Retraction Safety-Solenoid Inoperative.)

EMERGENCY LANDING GEAR SYSTEM

CAUTION

If the landing gear handle is raised after the emergency landing gear release T-handle is pulled, the bulkhead brackets and the landing gear handle ratchet may be damaged.

In the event of utility hydraulic system failure, the landing gear may be lowered manually by means of the emergency landing gear release T-handle (figure 1-4) on the extreme left side of the cockpit, above the left console. When the landing gear control is moved to DOWN and the emergency landing gear release handle is pulled, the landing gear doors are unlatched, allowing the landing gear to drop into the airstream. The landing gear extends and locks by a combination of gravity and ram air force.

WING FLAPS

Split flaps are installed on the trailing edges of the wings. Hydraulically actuated by a single cylinder, the wing flaps are mechanically controlled by the flap handle (figure FO-1) on the left console outboard of the throttle. The wing flaps may be extended 50 degrees by moving the flap handle to DOWN, or may be stopped at any intermediate position by placing the flap handle at STOP. When UP is selected, the flaps will retract fully. The position of the flaps is shown on the flaps position indicator. A relief valve in the wing flap system allows the flaps to blow back to prevent structural damage when airloads cause the hydraulic pressure within the actuating cylinder to exceed the pressure at which the relief valve opens (3650 psi). This automatic retraction will begin at approximately 230 KIAS.

Note

The flaps will not return automatically to the extended position if the flap handle is in the STOP position; therefore, it will be necessary to reposition the flaps after reducing airspeed below the blowback limit.

WHEELS AND FLAPS POSITION INDICATORS

The position of the landing gear and wing flaps is presented on the wheels and flaps position indicators (figure FO-1) located on the left console. When the wheels are down and locked, the image of a wheel appears in a small window provided for each wheel on the instrument. When the landing gear is up and locked, the word UP appears in each window. During the time the landing gear is in transient, or the wheels are not locked in position, diagonally striped signals are shown in the windows. The position of the wing flaps is shown in units with respect to the wing. Each unit corresponds to one-quarter of the total amount of extension possible. Labeled positions are UP, 1/2, and DOWN.

NOSEWHEEL STEERING

The nosewheel steering system is operational only when the aircraft is on the ground. Steering may be engaged by actuation of the nosewheel steering button (figure 1-9), provided hydraulic gear down pressure is available, and the NORMAL-EMER OFF steering switch located outboard of the throttle (figure FO-1), is in the NORMAL position. In case of a malfunction, place the steering switch in the EMER OFF position to deactivate the steering system. When engaged, the nosewheel position is a function of the rudder pedal displacement, with a maximum of 45 degrees either side of center. Once the nosewheel casters beyond 45 degrees of center, it must be brought within 45 degrees of center with brakes before steering can be regained. When turns greater than 45 degrees are made from a standstill, it may be advantageous to use brakes only.

When the steering switch is in the NORMAL position, the nosewheel is hydraulically centered and locked with the arresting hook handle DOWN.

Note

Although the nosewheel is hydraulically centered and locked with the arresting hook down, nosewheel steering is available by actuating the nosewheel steering button.

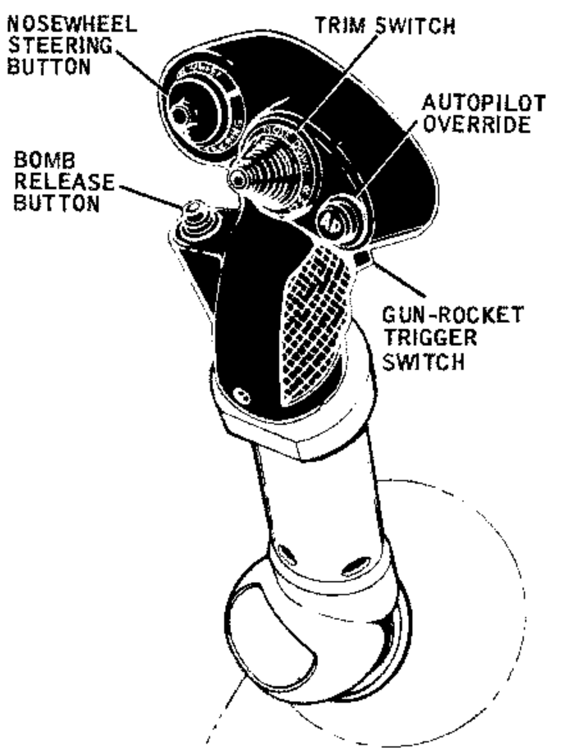


Figure 1-9. Control Stick Switches

CAUTION

Because of the high residual thrust of the engine at IDLE, excessive taxi speeds may result while taxiing with nosewheel steering. Sharp turns made under this condition may cause loss of control and possible tipping of the aircraft onto its wing.

Note

Activation of the nosewheel steering system above 60 knots is not recommended during landing roll/takeoff run unless normal rudder/brake control is not effective. Energizing the system with the rudder pedals out of neutral or centered position will result in unexpected swerving.

Full right rudder trim of 8 degrees limits the steering angle of the nosewheel to 23 degrees right, but does not limit the steering angle to the left. Full left rudder trim of 8 degrees limits the steering angle of the nosewheel to 23 degrees left, but does not limit the steering angle to the right. Any left or right rudder trim will limit the nosewheel travel in the direction of trim.

WING SPOILERS

The spoilers are hydraulically actuated and electrically controlled by the spoiler ARM-OFF switch (figure FO-1) on the left console outboard of the throttle. Utility hydraulic pressure will extend the spoilers only when: (1) the ARM-OFF switch is positioned to ARM. (2) the left main landing gear oleo is compressed, and (3) the throttle position is below 70 percent rpm. Two linear ball lock actuators prevent the spoilers from creeping open in flight.

WARNING

The spoilers operate rapidly and with great force. Be certain all personnel are clear prior to spoiler actuation.

In-flight actuation of the spoilers is not likely because of the solenoid switch on the left landing gear which permits spoiler operation only when the weight of the aircraft is on the main landing gear strut. The spoilers will immediately dump to a faired position during a touch-and-go or bolter when the throttle position is advanced above 70 percent rpm.

Note

- Spoilers will not actuate when the aircraft is operating on emergency generator.
- When spoilers are actuated with the engine in idle rpm range, the hydraulic pressure decreases and may cause the utility system ladder light to flash momentarily.

SPEEDBRAKES

Two flush-mounted speedbrakes (figure 1-3), one on each side of the fuselage, provide deceleration during flight. Hydraulically operated speedbrakes are electrically controlled by the speedbrakes switch on the inboard side of the throttle grip. Movement of the switch to either OPEN or CLOSE actuates a solenoid valve which controls the flow of hydraulic pressure to the speedbrake actuating cylinders. The speedbrakes cannot be stopped at intermediate positions between fully opened and fully closed.

The SPD BRK OPEN warning light, located on the caution panel (figure FO-1) comes on whenever the speedbrakes are in any position other than fully closed. A blowback feature allows the speedbrakes to begin closing when the hydraulic pressure exceeds the pressure at which the blowback relief valve opens (3650 psi), thus preventing damage to the speedbrake system. The speedbrakes begin to blowback at approximately 490 KIAS. The speedbrakes will not open fully above 440 KIAS.

Three flush-mounted JATO hooks are attached to each speedbrake for mounting a JATO bottle for assisted takeoffs.

CAUTION

When JATO bottles are attached to the speedbrakes, an interlock in the speedbrake electrical circuit will prevent the speedbrakes from opening when the speedbrake is in OPEN position. Ensure that the speedbrake switch is in the CLOSED position prior to takeoff to prevent inadvertent opening of the speedbrakes when the JATO bottles are jettisoned.

SPEEDBRAKE-ELEVATOR INTERCONNECT

A speedbrake-elevator interconnect spring minimizes aircraft pitchup during speedbrake actuation by automatically providing nosedown elevator when the speedbrakes are opened.

EMERGENCY SPEEDBRAKE CONTROL

The aircraft is equipped with an emergency speedbrake solenoid valve override control. A push-pull emergency speedbrake control knob, labeled EMER SPEED BRAKE (figures FO-1 and FO-4), is on the aft end of the left console. The control knob can be used to open or close the speedbrakes in the event of dc electrical failure or failure of one of the speedbrake control valve solenoids. A spring bungee holds the control knob in a neutral position. To open the speedbrakes, the knob must be pulled; to close the speedbrakes, the knob must be pushed.

In the event of electrical failure, the speedbrakes may be opened or closed by momentary operation of the emergency speedbrake control push-pull knob.

CAUTION

When JATO bottles are installed, operation of the EMER SPEED BRAKE control will force the JATO bottles off the aircraft, resulting in airframe damage.

WING SLATS

Aerodynamically controlled slats installed on the leading edges of the wings improve airflow characteristics over the wing at high angles of attack, primarily during approach and landing. The wing slats open and close independently and automatically as the aerodynamic loading dictates. Because so many variables - airspeed, gross weight, and applied load factor - affect the operation of the wing slats, no fixed airspeeds can be established at which the slats begin to open or close. In general, however, the slats begin to open below 200 KIAS and are fully open at stalling speed.

BARRICADE STRAP DETENTS

Three barricade strap detents (figure 1-3), installed on each leading edge, ensure proper barricade engagement. Two detents are spaced evenly on the wing slat. The third detent is on the leading edge of the wing, inboard of the slat.

VORTEX GENERATORS

To combat buffet and random wing drop at high altitude, vortex generators, which are small metal vanes set at various fixed angles relative to the normal airflow, are installed along the slats and on the upper surface of the wing.

ARRESTING HOOK

An externally mounted arresting hook (figure 1-3) is installed on the lower aft fuselage. Retraction and extension of the hook are accomplished by a pneumatic-hydraulic holddown cylinder in the aft engine compartment. The holddown unit is essentially a reservoir which is divided into two chambers by a relief valve and orifice arrangement. The upper chamber is filled with hydraulic fluid to the full level and then charged with compressed air to 900±50 psi with the hook retracted. The lower chamber contains the actuating piston which is attached to the arresting hook. Utility hydraulic system pressure is applied to the lower side of the piston to effect retraction of the arresting hook. The arresting hook is then held in the retracted position by a mechanical latch. Compressed nitrogen pressure and the weight of the arresting hook cause extension when the latch is released. With the arresting hook extended, the relief valve and orifice restrict the flow of fluid between the lower and upper chambers of the holddown unit to provide a snubbing action. During arrested landings, the snubbing action keeps the hook on the deck when external forces tend to bounce the hook toward the retracted position.

ARRESTING HOOK CONTROL HANDLE

An arresting hook control handle (figure 1-4) on the right cockpit rail controls the operation of the arresting hook. When the handle is moved to DOWN, the arresting hook is manually unlatched, allowing pressure from the holddown unit and the force of gravity to extend the hook.

CAUTION

The arresting hook control handle should be firmly placed into position, not flipped nor slammed.

A light in the arresting hook control handle comes on when the handle is moved to DOWN and goes off before the hook reaches the fully extended position. The UP position of the handle manually positions the arresting hook control valve to supply utility hydraulic fluid at 3000 psi into the lower part of the arresting hook holddown cylinder. The nitrogen pressure is overridden, causing the hook to be retracted against the lower surface of the fuselage. The arresting hook system employs a fail-safe feature which allows the hook to be extended in the event of cable system failure or hydraulic pressure failure.

When the utility hydraulic pressure is lost, compressed air pressure and the weight of the arresting hook will cause the hook to extend when the arresting hook handle is moved to the down position. However, the pilot cannot retract the arresting hook without hydraulic pressure.

Should the arresting hook control cable part, the uplatch will be released allowing the hook to move to the down position.

DRAG CHUTE

A drag chute is installed to provide rapid deceleration during the initial part of a landing roll or for emergency use during an aborted takeoff. The cannister, which contains the drag chute, and the release mechanism are located in the lower aft section of the aircraft. A drag chute switch box (figure 1-3), labeled CHUTE, contains a two-position, lever-lock, toggle switch. The switch positions are marked STOW JETTISON and DEPLOY 160 KN MAX. Normally, the switch is set to the STOW JETTISON position. When the switch is placed in the DEPLOY position, a spring-loaded door is released and a pilot chute is spring ejected into the slipstream resulting in deployment of the main drag chute. The drag chute may be jettisoned by returning the switch to the STOW JETTISON position.

CAUTION

- Do not deploy the drag chute at speeds above 160 KIAS.
- The drag chute risers and stowage bag will be damaged if high rpm is used with drag chute deployed. If high rpm is required to clear the runway, the drag chute should be jettisoned on the runway.

WHEEL BRAKES

Dual disk, spot-type brakes are installed on the main wheels only. The brake system includes a separate hydraulic reservoir (figure FO-4) located in the nose section of the aircraft. Two master brake cylinders, operated by toe pressure on the upper part of the rudder pedals, provide the pressure necessary for operation of the brakes.

Note

The wheel brakes are a completely independent hydraulic system. Accordingly, the pilot should realize that he will have brakes even with complete hydraulic system failure.

COCKPIT ENCLOSURE

The cockpit enclosure consists of a fixed, three-piece windshield and a hinged clamshell canopy. The two windshield side panels are of molded plastic, and the center panel is constructed of alternating layers of glass and vinyl.

CANOPY

The cockpit canopy is hinged at the aft end and moves back and up when opened. When closed, the canopy is held in place on both sides of the canopy rail by latch hooks which engage fixed rollers on the cockpit rails. An air bungee cylinder (figure 1-26), mounted aft of the ejection seat, counterbalances the canopy during normal operation and provides snubbing action. The canopy is closed by grasping the ledge on either side and by pulling down, overriding the nitrogen bungee cylinder pressure. The canopy may then be closed and locked by moving the canopy lever forward. Confirmation of the canopy being closed and latched can best be made by ensuring that the canopy handle snaps forward when the mechanism is in the overcenter position and by checking latches for proper hook engagement.

CANOPY RESTRAINT STRAP

The canopy restraint strap is used to prevent damage to the canopy hinges or actuating mechanism when warm weather operations require opening of the canopy for cockpit cooling during ground operation of aircraft. A canopy restraint strap pouch attached to the map case is provided for restraint strap stowage. When the restraint strap loop is attached to the right-hand canopy latching hook, the canopy is held just short of the open position. The restraint strap must be disengaged from the canopy latching hook and stowed in the pouch prior to closing and locking the canopy.

CANOPY CONTROLS

Canopy Lever

The canopy lever (figure FO-1), on the left console, is mechanically linked to the canopy mechanism. Moving the lever forward slides the canopy forward, causing the latch hooks to engage the latch rollers. The canopy mechanism includes an overcenter device, which causes a noticeable increase in lever load as the lever approaches the locked position. This load drops off abruptly as the lever is moved past the overcenter position to the locked position. If the lever load does not drop off as the handle is moved overcenter, canopy rigging should be checked. Moving the lever aft slides the canopy aft, disengaging the latch hooks and allowing air bungee pressure to open the canopy. Excessive pressure is necessary to open the canopy with the canopy lever before the canopy seal is deflated. To open the canopy pull the canopy lever up, waiting until the canopy seal deflates, then pull the lever to the full aft position.

External Canopy Release Handle

An external canopy release handle (figure 5-12), which can be reached from the ground, is set flush in the left side of the fuselage below the cockpit. Pulling the external canopy release handle out and forward unlatches the canopy, allowing it to open in the normal manner. To be closed and locked from the outside, the canopy must be manually held down and the external handle moved aft and in until it is flush with the fuselage.

INTERIOR CANOPY JETTISONING

Canopy Jettison Handle

The canopy may be jettisoned by pulling the canopy jettison handle (figure 1-4) located above the right console. At airspeeds of 125 knots or above, the canopy will shear when it is opened by the normal canopy opening lever. However, use of the canopy jettison handle to jettison the canopy is recommended. When the canopy jettison handle is pulled, the canopy slides slightly aft to unlatch, swings open, and shears at the hinges. To fire the initiator, the canopy jettison handle must be pulled with a force of 20 to 35 pounds. The handle will extend 3/4 inch and then fall free after the initiator has fired.

WARNING

> When canopy is jettisoned in flight by any means, rapid rearward movement of manual canopy lever occurs as wind raises and shears canopy. To avoid possible injury, ensure that hand and arm are clear of this area during canopy jettison.

Canopy Jettison Safety Pins

To prevent the cockpit enclosure air bungee from being inadvertently fired while on the ground, safety pins are provided for the canopy jettison initiators and are connected by a red streamer stenciled REMOVE BEFORE FLIGHT.

EXTERIOR CANOPY JETTISONING

An emergency canopy jettison handle (figure 5-12) is provided on each side of the fuselage, just forward of the wing root, for jettisoning the canopy during rescue. The control is a red handle, marked PULL CANOPY JETTISON, and is installed in a recess behind a spring-loaded door. The door is pointed out by a RESCUE arrow. When the door is pushed in, the handle extends and may be grasped and pulled to fire an initiator, which in turn activates a nitrogen bottle causing high-pressure nitrogen to escape into the nitrogen bungee cylinder. The canopy will jettison regardless of position.

Note

> Seat catapult is armed after jettisoning the canopy.

Underwater Canopy Jettison Relief Valve

The aircraft has an underwater canopy jettison relief valve which allows water to flow into the cockpit after a ditching. The relief valve installation is a circular insert in the outer skin on the left side of the fuselage, alongside the ejection seat just under the canopy rail. The relief valve is a door, normally sealed and held in place by a torsion rod, and is designed to open when the outside water pressure head is approximately 2 psi. The flow of water into the cockpit reduces the effective pressure head on the canopy. To open the canopy underwater, use of the CANOPY JETTISON handle is recommended, as it will provide maximum power at the bungee. The use of the manual CANOPY lever should be considered an alternative, last resort method of underwater canopy opening.

ESCAPAC 1C-3/1F-3 EJECTION SEAT SYSTEMS

The aircraft may be equipped with either an ESCAPAC 1C-3 or, if reworked per A-4 AFC 489, an ESCAPAC 1F-3 ejection seat (figure 1-10).

ESCAPAC 1C-3 EJECTION SEAT

The ESCAPAC 1C-3 ejection seat utilizes rocket thrust to provide escape capability from zero speed and zero altitude throughout the entire aircraft flight profile except for very unusual flight conditions such as inverted flight, steep angles of bank, or dives at low altitudes. The seat accommodates a back-type parachute and a RSSK-8A-1 survival kit, and is designed for use with an integrated torso harness. A nonadjustable headrest is part of the seat structure and houses the face curtain. The front surface of the seat bucket serves as a buffer for the calves of the legs, and the sides of the bucket extend above the pilot's thighs to protect the legs and minimize flailing during high speed ejection. The ejection sequence is started by pulling the face curtain over the helmet and past the face with both hands, or by pulling the alternate ejection D-handle on the seat between the pilot's legs. This jettisons the canopy and initiates the power retract mechanism on the inertia reel, pulling the pilot to the proper sitting position for ejection. As the seat travels up the guide rails, the emergency oxygen bailout bottle is actuated and the zero-delay arming lanyard arms the automatic barometric parachute actuator. The seat contacts a striker plate which trips the harness release actuator sear and fires the actuator after a 1-second delay. When the 1-second delay cartridge fires, the harness release actuator automatically releases the seat belt, shoulder harness, face curtain, alternate ejection handle, and inflates the separation bladders which separate the pilot from the seat.

The delayed action of the harness release actuator provides protection for the pilot by keeping him in the seat during the ejection period. The zero-delay arming lanyard initiates a 2-second delay cartridge in the automatic barometric parachute actuator. The 2-second delay prevents premature parachute opening that could cause damage to the parachute and severe shock to the pilot from high velocity windblast. During the delay period, the pilot and seat will decelerate to a speed where the stresses placed upon the pilot and parachute are reduced from the critical stage. As the pilot descends below 14,000 feet or if ejection occurs below 14,000 feet, the parachute is opened automatically at the end of the delay period. Other features of the rocket catapult ejection seat include a load limiting energy absorbing device to reduce the possibility of back injuries from survivable crashes or hard arrested landings. An alternate ejection control handle (to be used when conditions prevent the pilot from reaching the face curtain) is located on the seat bucket between the pilot's legs. An ejection control safety handle, located in the center of the headrest, locks the ejection mechanism in a safe condition during ground operation. A dual strap inertia reel allows for mobility while seated.

Aircraft equipped with Aircrew System Change 254 utilize a 0.75-second delay cartridge in the automatic parachute actuator. This 0.75-second delay cartridge is initiated at pilot seat separation by the actuator arming lanyard which is anchored to the harness release handle. If ejection occurs below 14,000 feet the arming lanyard intitates the 0.75-second delay cartridge, after which time the parachute will open. If ejection occurs above 14,000 feet the arming lanyard pulls the safety pin in the parachute actuator but the 0.75-second delay cartridge is not initiated until the pilot passes through the 14,000-foot altitude. The parachute will automatically open after the delay period has passed.

WARNING

With ACC 254 installed, automatic chute deployment will not occur if the pilot manually separates himself from the seat. The ripcord D-ring must be pulled.

ESCAPAC 1F-3 EJECTION SEAT

The ESCAPAC 1F-3 ejection seat operates the same as the ESCAPAC 1C-3, except as noted in the following paragraphs.

The 1F-3 ejection seat provides positive seat separation by means of a man/seat separator rocket. The thrust of the rocket simultaneously rotates and propels the seat away from the pilot minimizing the probability of collision, after man/seat separation, between the seat and the pilot or his parachute.

Note

In aircraft reworked per ACC 247, the NES-12A-2 parachute is replaced by the NB-10 parachute using a CCU-4A cartridge actuator (1.0-second delay).

The separator rocket is fired 0.75 seconds after start of the initial ejection sequence, forcibly separating the pilot from the seat. The barometric time-delay parachute actuator is armed when the pilot separates from the seat. This causes the ripcord pins to be pulled 0.75 seconds after pilot/seat separation, resulting in a fully inflated parachute canopy if ejection is below a preset altitude of 14,000±500 feet. At higher altitudes, an aneroid in the parachute release actuator delays opening of the parachute until the preset altitude of 14,000±500 feet, plus 0.75-second delay is reached by freefall of the pilot.

The 1F-3 ejection seat employs a back type, semi-rigid NES-12A-2 parachute with a 28 foot canopy and an automatic release actuator. The parachute is equipped with a tri-stage external pilot chute (EPC) that is deployed at man/seat separation. The EPC incorporates two break cords which allow incremental decrease in effective drag area with increased airspeed, and ensures effective deployment of the 28-foot canopy at all airspeeds. At line stretch the spreader gun fires, forcefully opening the mouth of the canopy allowing the canopy to inflate aerodynamically.

If the survival kit contained in the RSSK-8A-1 incorporates the pilot's emergency beacon, pilot separation from the ejection seat pulls the beacon lanyard attached between the seat and a snap on the survival kit; the lanyard activates the pilot's emergency beacon to begin transmission of signals that aid in search and rescue of the pilot after ejection.

FUNCTIONAL COMPONENTS

Harness-Release Actuator

The harness-release actuator is essentially a cylinder containing a piston, a slow burning MK 86 MOD 0 cartridge, and a firing mechanism. The firing mechanism is spring loaded and is held in a safe position by a sear in the firing pin assembly. The actuator piston rod is connected to a bellcrank attached to the seat structure. Thus, when the seat is ejected, the actuator arming pin sear is tripped by the striker plate allowing the firing mechanism to detonate the cartridge which, 0.75 second later, exerts enough force to actuate the piston. The piston extends and rotates the bellcrank causing the seat belts, shoulder harness, and face curtain (or alternate ejection handle) to pull free, and puncture the nitrogen storage bottle releasing pressure to the separation bladders, thus separating pilot and seat.

Automatic Barometric Parachute Actuator

Parachutes used with the integrated torso harness are equipped with a barometrically controlled parachute actuator. The actuator is designed to deploy the parachute automatically at a predetermined altitude, in the event of pilot incapacitation. The actuator provides a 2-second delay before opening the parachute after reaching the preset altitude. When ejection is made below, at, or slightly above, the altitude for which the actuator is set, the delay allows the pilot to decelerate prior to parachute opening, thus reducing or eliminating pilot injury or parachute damage from opening shock. The delay also prevents the parachute from fouling on the seat when ejection is made at altitudes below that for which the actuator is set, where deployment would occur immediately upon separation from the seat. The automatic parachute actuator interferes in no way with the manual parachute release ripcord grip (D-ring) which may be pulled at any time to open the parachute.

An arming pin is inserted through the actuator mechanism to prevent inadvertent release of the parachute during normal operation when the aircraft descends through the altitude for which the actuator is set. The arming pin is anchored by the automatic parachute actuator arming lanyard to the harness-release handle. The arming pin is pulled by the ZDL, and the actuator is armed as the seat moves up the guide rails. If the automatic harness-release mechanism fails to operate and the harness-release handle is used to free the pilot from the seat, the parachute should deploy automatically since the actuator was armed by ZDL.

Seat Attachments

The pilot is held in the seat by attachments to the integrated torso harness. This torso harness incorporates within its structure a seat belt, shoulder straps, and a parachute harness, thus leaving the pilot with few of the usual encumbrances. The shoulder harness straps are sewn to the parachute risers and attach to the inertia reel connection just below the headrest. The loose ends of the parachute risers have quick-disconnect fittings which engage other fittings that extend from the front shoulders of the torso harness. Short seat belts, which are sewn to the parachute harness on each side, and attached to the seat structure at the aft corners of the seat bucket, are adjustable in length. The loose ends of the seat belts have quick-action fittings which engage fittings protruding from the hip region of the torso harness.

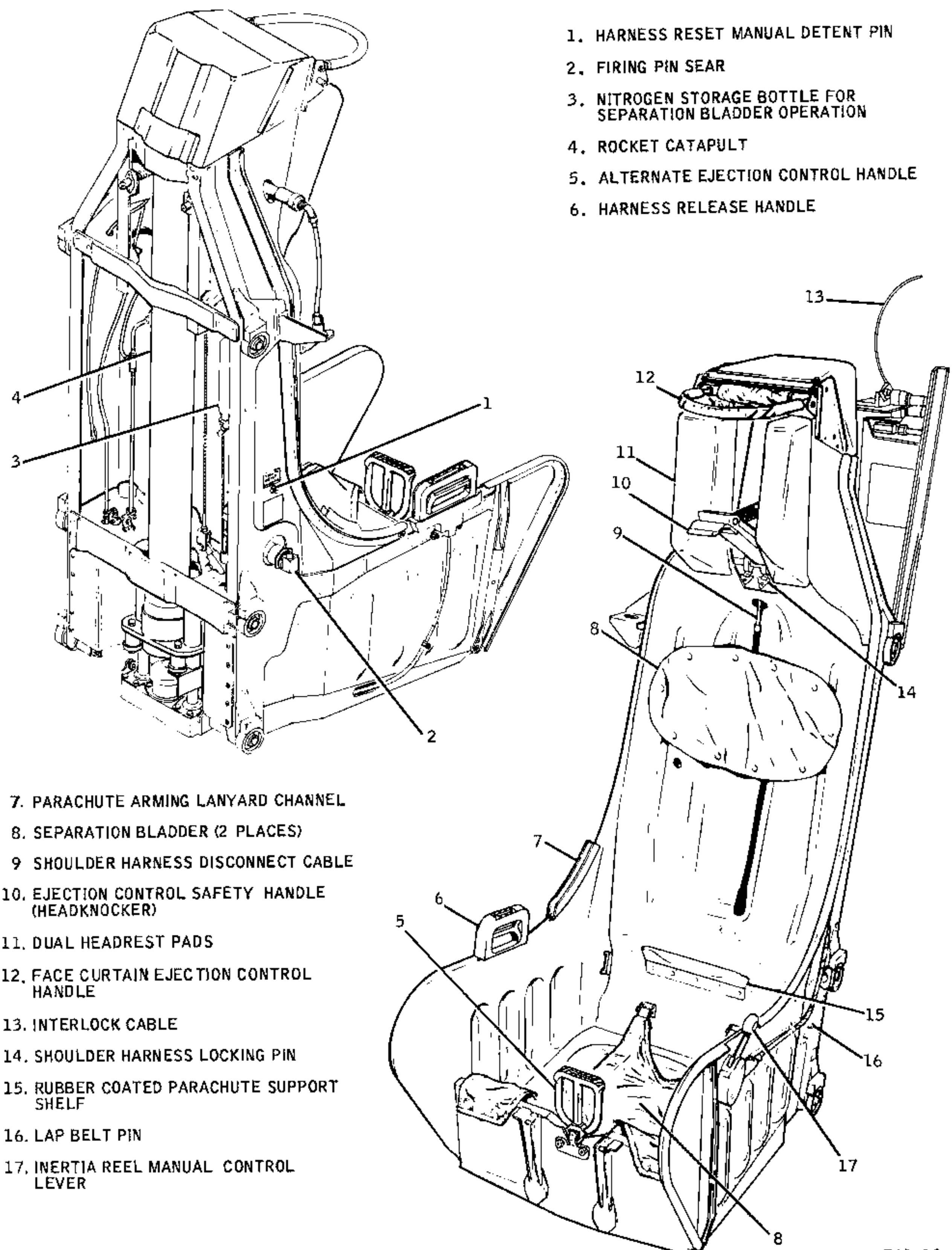
Seat Controls

SEAT SWITCH. The seat is electrically adjusted in the vertical plane by movement of the three-position seat switch located on the miscellaneous switches panel (figure FO-1) to either UP or DOWN, and is stopped at the desired position by releasing the switch to the center or off position.

SHOULDER HARNESS INERTIA REEL CONTROL. The shoulder harness inertia reel control handle (figure 1-10), on the left side of the seat bucket, locks the inertia reel drum to prevent playout of the webbing from the inertia reel. When the control is in the LOCKED position, the shoulder harness will not extend and the pilot's freedom of movement is restricted.

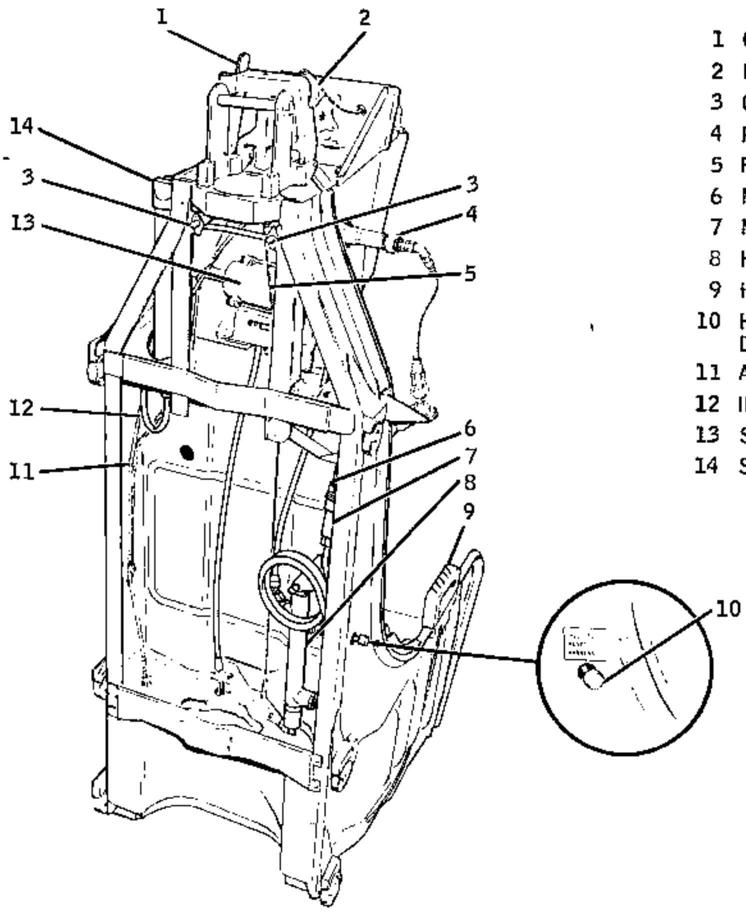
The UNLOCKED position allows the shoulder harness to extend or retract as the pilot moves about. The reel will lock automatically if the aircraft is subjected to a deceleration in excess of 2.5±0.5g along the thrust line. This safety feature helps to prevent injuries if the shoulder harness is not locked prior to an arrested landing or a crash. If the inertia reel fails to unlock while any load is being applied to the cable, relax the load and recycle the handle.

HARNESS-RELEASE HANDLE. A D-handle (figure 1-10), labeled HARNESS RELEASE, is mounted on the right side of the seat. A pin protrudes from the aft end of the handle, which extends down through the edge of the ejection seat to anchor the arming lanyard of the barometric parachute opener. A spring-loaded latch, which is grasped in conjunction with the harness release handle, retains the handle in the proper position and must be squeezed before the latter can be pulled. When the handle is pulled up, the barometric parachute opener lanyard and the shoulder harness and seat belt attachments are released from the seat, allowing the pilot to leave the cockpit with the parachute and survival kit still attached to the integrated torso harness.

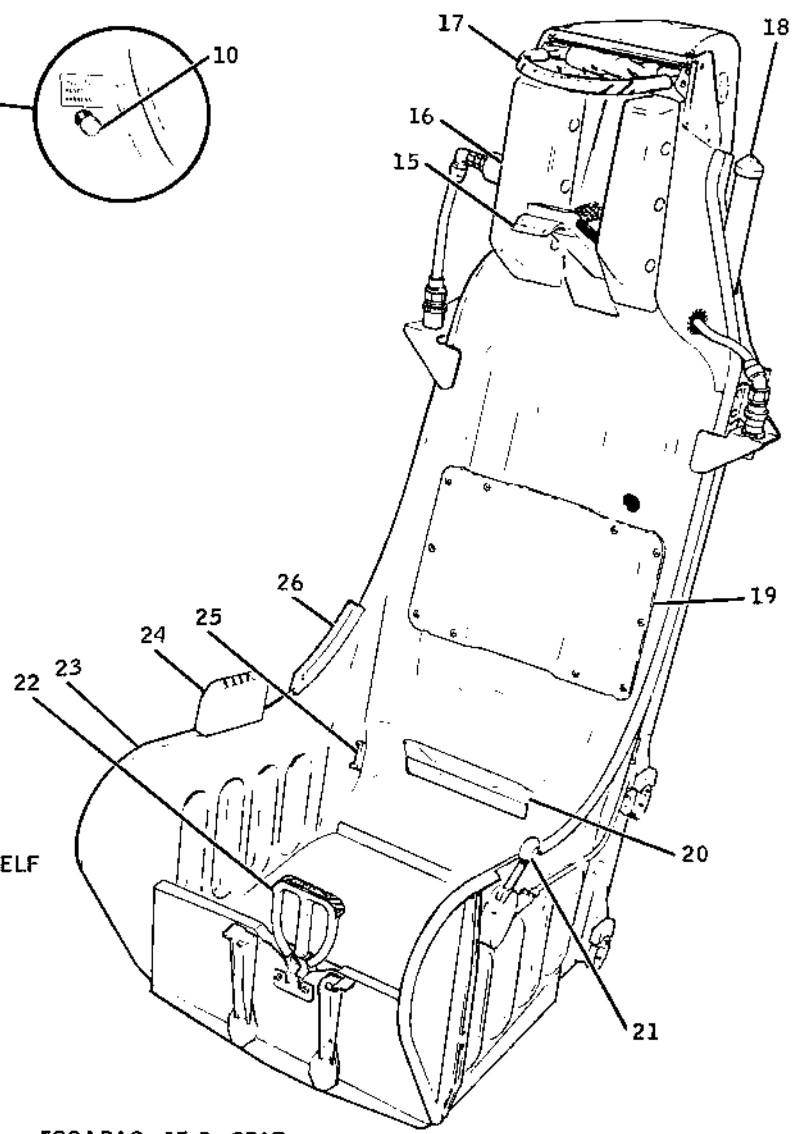


1. HARNESS RESET MANUAL DETENT PIN
2. FIRING PIN SEAR
3. NITROGEN STORAGE BOTTLE FOR SEPARATION BLADDER OPERATION
4. ROCKET CATAPULT
5. ALTERNATE EJECTION CONTROL HANDLE
6. HARNESS RELEASE HANDLE
7. PARACHUTE ARMING LANYARD CHANNEL
8. SEPARATION BLADDER (2 PLACES)
9. SHOULDER HARNESS DISCONNECT CABLE
10. EJECTION CONTROL SAFETY HANDLE (HEADKNOCKER)
11. DUAL HEADREST PADS
12. FACE CURTAIN EJECTION CONTROL HANDLE
13. INTERLOCK CABLE
14. SHOULDER HARNESS LOCKING PIN
15. RUBBER COATED PARACHUTE SUPPORT SHELF
16. LAP BELT PIN
17. INERTIA REEL MANUAL CONTROL LEVER

Figure 1-10. Ejection Seats (Sheet 1)



1 CATAPULT FIRING CONTROL
2 FACE CURTAIN RH CONTROL CABLE
3 CATAPULT INITIATOR FIRING RODS
4 POWER INERTIA REEL CARTRIDGE
5 FIRING CONTROL DISCONNECT CABLE
6 MK 12 MOD 0 INITIATOR
7 M53 INITIATOR
8 HARNESS RELEASE ACTUATOR
9 HARNESS RELEASE HANDLE
10 HARNESS RELEASE ACTUATOR MANUAL DETENT PIN
11 ALTERNATE EJECTION CONTROL CABLE
12 INERTIA REEL MANUAL CONTROL CABLE
13 SHOULDER HARNESS INERTIA REEL ASSEMBLY
14 SEPARATOR ROCKET



15 EJECTION CONTROL SAFETY HANDLE
16 DUAL HEADREST PADS
17 FACE CURTAIN EJECTION CONTROL HANDLE
18 SEPARATOR ROCKET
19 PYROTECHNIC COMPONENT SERVICING ACCESS DOOR
20 RUBBER COATED PARACHUTE SUPPORT SHELF
21 INERTIA REEL MANUAL CONTROL LEVER ASSEMBLY
22 SECONDARY EJECTION CONTROL HANDLE
23 LEG PROTECTING SIDE SUPPORTS
24 HARNESS RELEASE HANDLE
25 HARNESS RELEASE FITTING (2 PLACES)
26 PARACHUTE ARMING LANYARD CHANNEL

ESCAPAC 1F-3 SEAT

FA1-219

Figure 1-10. Ejection Seats (Sheet 2)

Note

- Pulling the harness release D-handle releases the shoulder harness and lap belt end fittings, which cannot be reengaged in flight.
- Disconnect the barometric parachute opener arming lanyard from the harness-release handle before removing the parachute from the seat. If this is not done, the arming pin will be pulled and the parachute will open.

FACE CURTAIN. The face curtain screens the face from the wind blast during ejection. The face curtain ejection control handle (figure 1-10) should be manually adjusted prior to engine start to establish a suitable handle position relative to the pilot's helmet. It serves as a control for ejecting the seat and aids in supporting and positioning the pilot during ejection. The face curtain, which is housed in the headrest structure with the handle protruding, is mechanically connected to the canopy jettison system and the seat catapult firing mechanism. When the face curtain is pulled downward, the first portion of travel jettisons the canopy and the last portion causes the seat to be ejected. The seat will not eject until the canopy is clear of the ejection path.

WARNING

Canopy jettisoning by means of partial face curtain extension should not be attempted since no positive stops are provided to prevent seat ejection after the canopy has jettisoned.

ALTERNATE EJECTION HANDLE. The alternate ejection handle (figure 1-10) is located on the forward side of the ejection seat between the pilot's legs. The handle is used to initiate the ejection sequence when use of the face curtain is not desirable or possible.

EJECTION CONTROL SAFETY HANDLE. The ejection control safety handle (headknocker), located between two rubber pads on the upper forward area of the seat assembly, functions as an ejection seat safety lock when in the down position. Locking is achieved by locking the firing control disconnect assembly and in turn, locking the face curtain ejection control handle and alternate ejection control handle. The headknocker is identified with a "PULL OUT TO SAFETY EJECTION CONTROLS" decal. Moving the headknocker to the down position engages a locking pin into a locking drum, locking all movements of the firing control disconnect. The headknocker cannot be moved to the up position (unlocking the ejection mechanism) until a safety lock is manually depressed, disengaging the lock.

Note

- Pull safety lockpin streamer before depressing the safety lock.
- The safety lock is visible only when the headknocker is in the down position. The safety lock is identified from above with a black and yellow checkerboard decal, providing visual verification that ejection controls are secured in the locked (headknocker down) position.

Ejection Seat Stabilization System (DART)

The ejection seat stabilization system counteracts the adverse effects of aerodynamics and seat system center-of-gravity variation. The system provides consistent and predictable trajectory during the rocket burning phase. The stabilization system is installed on the under side of the seat bucket and consists of two brake units, a deployable bridle arrangement, and four nylon draglines. Portions of the system lines are stowed in two fabric pouches mounted on the seat. The lines are routed through the brake units and through the eye of the bridle. At the eye, the remaining lengths of the system lines are gathered together and covered with a flame retardent sleeve. The covered section of line is stowed in a deployment pouch and the end is attached to the cockpit floor.

As the seat ejects, the slack line stowed in the deployment pouch pays out, and the bridle drops into position. At a preprogramed distance, the system lines are pulled through the brake units developing a preprogramed force in the lines and, consequently, a moment around the system center of gravity which counteracts any adverse rotation of the seat.

EJECTION SEQUENCE

Refer to section V for ejection sequence.

OXYGEN SYSTEM

Oxygen is supplied by a vacuum bottle liquid oxygen converter mounted in a vented compartment in the aft fuselage section. The converter filler valve is reached through an access door on the right side of the fuselage for servicing. The bottle contains 10 liters of liquid oxygen when serviced to capacity. Evaporation loss is constant when the system is not in use, and this loss is used to pressurize the system. By venting any excess pressure overboard through relief valves, pressure is maintained at 70±5 psi. Venting pressure may increase to 100±10 psi when the liquid oxygen system is not being used.

LIQUID OXYGEN QUANTITY INDICATOR

A liquid oxygen quantity indicator (figure FO-1) is located on the left center of the instrument panel, and is graduated with markings of 10, 8, 6, 4, 2, and 0. The quantity indicator is electrically operated and has a small OFF window to show that the indicator is inaccurate when electrical power is lost. A red low-level warning light on the indicator face comes on when the quantity falls below 1 liter. Depressing the TEST button on the instrument panel tests the operation of the liquid oxygen quantity indicator causing the needle to move counterclockwise, The low-level warning light will come on when the needle passes the 1-liter mark. When the TEST button is released, the needle should return to its previous position.

CONTROLS AND EQUIPMENT

A lift-type toggle switch installed at the rear of the left console on the anti-g and oxygen panel (figure FO-1) places the oxygen system in operation when moved from OFF to OXY ON position.

When the oxygen switch is turned on, oxygen is delivered from the supply system at a pressure of 70 psi to the oxygen receptacle located on the oxygen and anti-g panel (figure FO-1) on the left console. The pilot's supply tube is plugged into the receptacle to allow the oxygen to flow to the oxygen mask regulator, installed just below the pilot's face mask. The mask regulator reduces the 70-psi converter oxygen pressure and delivers 100-percent oxygen to the mask under a positive pressure of approximately 1-inch water pressure at all cabin altitudes below 35,000 feet. At higher cabin altitudes, the delivered pressure is automatically increased to allow the pilot adequate oxygen absorption. The type A-13A face mask used with this oxygen system should be properly fitted to the pilot's face for best results. Relatively small leaks around a mask are cumulative in effect and result in considerable oxygen loss over long periods of operation. Always check the oxygen supply tubes for tight connections before moving the OXYGEN control to ON. Escaping oxygen creates a fire hazard in the presence of oil or grease.

EMERGENCY OXYGEN SUPPLY

Emergency oxygen is contained in a U-shaped cylinder installed in the seat pan/survival kit. The cylinder pressure gage, visible through the upper surface of the forward right corner of the seat pan/survival kit, should register 1800 psi when the cylinder is full. A pressure reducer allows oxygen to flow at 60 psi through the supply tube to the oxygen regulator for delivery to the face mask. The duration of the emergency supply is approximately 4 to 20 minutes, depending upon the altitude (the higher the altitude the longer the duration). Emergency oxygen is supplied and normal oxygen is shut off to the mask when the emergency oxygen actuator assembly is activated. The manual release handle (green ring) is attached to the actuator assembly by a cable. A lanyard is also attached to the actuator assembly and to the aircraft through a quick-disconnect fitting. Pulling the green ring provides emergency oxygen at any time. When the seat is ejected or the pilot, still attached to his survival kit, leaves the cockpit, the lanyard attached to the aircraft initiates flow of emergency oxygen automatically.

Prior to flight, the following inspection should be made to ensure automatic supply of emergency oxygen during an emergency:

1. Check pressure gage for adequate supply (1800 psi).

2. Check that actuator lanyard located on cockpit floor is attached to the aircraft.

3. With the mask-to-survival kit hoses connected and the console supply shut off or disconnected, check that there is no oxygen flow.

OXYGEN DURATION

Figure 1-11 is a tabulation of hours remaining for various altitude oxygen quantity combinations for the liquid oxygen supply system. It will be noted that although 100 percent oxygen is used at all times, duration is greater at high altitudes. Because the physical property of gases is affected by pressure, the volume of oxygen increases in direct proportion to the decrease in atmospheric pressure as altitude increases. Thus, while the volume of oxygen required by the pilot is approximately the same at any altitude, the oxygen delivered in reduced cockpit pressure is lower in density and less of the supply is required to satisfy the demand.

NORMAL OPERATION

Before Flight

Before each flight, the oxygen system and mask shall be checked for proper operation

Connect the oxygen supply tube to the connector on the survival kit with the mask turned away from the face. Place the oxygen switch in ON. Listen for free flow of oxygen. Don the mask. Inhalation should be almost effortless if the regulator is delivering oxygen at a slight positive pressure. Exhalation should also be possible but will require some effort in order to close the inhalation valve.

LIQUID OXYGEN DURATION

10 Liter System

DATA AS OF: 1 February 1962
DATA BASIS: Specification MIL-I-19326(Wep)

Cabin Pressure Altitude -Feet-	Hours Remaining					
	Gage Reading (Liters)					
	10	8	6	4	2	1
40,000 UP	60.6	48.5	36.4	24.2	12.0	4.8
35,000	37.0	29.6	22.2	14.8	7.4	3.6
30,000	27.2	21.8	16.4	10.8	5.4	2.8
25,000	20.4	16.4	12.4	8.2	4.0	2.0
20,000	16.0	12.8	9.6	6.4	3.2	1.6
15,000	12.8	10.2	7.6	5.2	2.6	1.2
10,000	10.0	8.0	6.0	4.0	2.0	1.0
5,000	8.4	6.6	5.0	3.2	1.6	0.8
Sea Level	7.0	5.6	4.2	2.8	1.4	0.6

REMARKS:

(1) Based on 800 liters of gaseous oxygen per liter of liquid oxygen.
(2) Data assume the use of a properly fitted mask.

Figure 1-11. Liquid Oxygen

Note

If exhalation is difficult, there is inhalation valve leakage.

During Flight

Oxygen quantity should be checked periodically during flight. Separation of the oxygen hose couplings will be immediately apparent as oxygen flow and radio communication will cease.

FLIGHT INSTRUMENTS

The airspeed indicator, vertical velocity indicator, and altimeter are connected to the pitot-static system. The attitude gyro, standby attitude gyro, bearing-distance-heading indicator (BDHI), angle-of-attack-system, and radar altimeter are electrically operated. The accelerometer is independent of other systems in operation.

AIRSPEED INDICATOR

A combination airspeed indicator and Mach meter (figure FO-1) is located on the instrument panel. The airspeed portion of the dial is fixed in position, and is calibrated from 80 to 650 knots. The Mach meter scale is a rotating disc, marked from 0.5 to 2.9, turning beneath the airspeed dial. Only a portion of the disc can be seen through a cutout in the airspeed dial. Airspeed and corresponding Mach number are indicated simultaneously by a single needle pointer. On the Mach number disc is a movable index which is used to set a Mach reference by depressing and turning a set knob on the lower left corner of the instrument case. On the edge of the airspeed dial is an airspeed index pointer, which is adjustable through a range of 80 to 145 knots merely by turning the set knob.

VERTICAL VELOCITY INDICATOR

A vertical velocity indicator on the pilot's instrument panel (figure FO-1) is connected to the aircraft static air system and reflects the rate of change in static atmospheric pressure as the aircraft climbs or descends. This atmospheric pressure rate of change is represented in 100-foot graduations between 0 and 1000 feet, of ascent or descent, and in 500-foot graduations between 1000 to 6000 feet. The instrument can register ascents or descents too small to cause a variation in altimeter reading.

ALTIMETER

The counter-drum-pointer altimeter (figure FO-1) operates as an electrically corrected, servoed altimeter, or as a barometric pressure-sensitive altimeter. The altimeter can display altitudes up to 80,000 feet but is calibrated only to 50,000 feet.

The counter consists of three drums that display 10,000-foot, 1000-foot, and 100-foot increments of altitude. The counter drums are linked to the multi-turn pointer by a gear train. As the pointer revolves, the counter drums totalize the altitude.

The pointer is read against a scale on the perimeter of the altimeter face. The scale is marked in 100-foot graduations with numbers 0 to 9; 50-foot increments are scribed between each 100-foot graduation. As the pointer revolves through each 100-foot graduation, the 100-foot drum totalizes altitude in 100-foot increments. Each complete revolution of the pointer is a 1000-foot increment. The 1000-foot drum totalizes each 1000-foot increment. For each ten revolutions of the pointer, the 10,000-foot drum totalizes each 10,000-foot increment.

A two-position function switch on the lower right corner of the altimeter has positions marked RESET and STBY. When the switch is in the RESET position the altimeter receives the corrected altitude signals from the air data computer to function as an electrically corrected altimeter. When the switch is in the STBY position the altimeter receives the input directly from the static pressure system to function as a barometric pressure-sensitive altimeter. A flag marked STBY appears on the face of the altimeter to indicate that the altimeter is functioning as a barometric pressure-sensitive altimeter. If the corrected altitude signals are interrupted while operating with the switch in the RESET position, the altimeter will automatically revert to barometric pressure-sensitive operation and the STBY flag will appear.

A barometric pressure set knob on the lower left corner of the altimeter is used to set the desired barometric pressure setting on the barometric scale. The barometric scale is read in a window on the face of the altimeter.

RADAR ALTIMETER

The APN-141 radar altimeter (figure FO-1) employs the pulse radar technique to furnish accurate instantaneous altitude information to the pilot from 0 to 5000 feet terrain clearance. Aircraft height is determined by measuring the elapsed transit time of a radar pulse, which is converted directly to altitude in feet and displayed on the cockpit indicator. The indicator dial face is marked in 10-foot increments up to 200 feet, 50-foot increments from 200 to 600 feet, 100-foot increments from 600 to 2000 feet, and 500-foot increments from 2000 to 5000 feet. A control knob on the front of the indicator controls power to the indicator and is used for setting the low-limit indexer. It also provides for preflight and in-flight test of the equipment with a push-to-test type control knob feature. Refer to LOW ALTITUDE WARNING SYSTEM (LAWS) for information regarding low-limit indexer. An OFF flag on the indicator face appears when signal strength becomes inadequate to provide reliable altitude information, when power to the system is lost, or when the system is turned OFF.

CAUTION

Leave the APN-141 radar altimeter in the OFF position until power is applied to the aircraft and return equipment to OFF before power is removed.

Note

At altitudes above 5000 feet terrain clearance, the OFF flag will appear and the pointer will move behind the masked portion of the indicator dial. The pointer will resume normal operation when the aircraft descends below 5000 feet.

The radar altimeter operates normally during 50-degree angles of climb or dive and 30-degree angles of bank right or left. Beyond these points, the indications on the radar altimeter become unreliable but will resume normal operation when the aircraft returns to normal flight.

LOW ALTITUDE WARNING SYSTEM (LAWS)

The low altitude warning system consists of two cockpit warning lights (figure 1-4) and an aural-warning tone operated in conjunction with the APN-141 radar altimeter.

When the APN-141 indicator needle moves below the preset indexer altitude, the marker-beacon light, the low-limit warning light, and aural-warning tone are activated for 2 seconds.

The altitude warning tone is an alternating 700- to 1700-cps tone monitored through the pilot's headset at a 2-cps repetition rate. A reliability warning signal of the same frequency range (but with 8-cps repetition rate) is also provided. The reliability warning signal sounds for 2 seconds whenever the APN-141 acquires or loses lock-on.

AJB-3A ALL-ATTITUDE INDICATOR

WARNING

- Indicator is unreliable if OFF flag is visible.
- It is possible to receive erroneous indications without the OFF flag showing.

The AJB-3A all-attitude indicator is located on the instrument panel (figure FO-1). The indicator provides the pilot with a pictorial presentation of the aircraft's pitch, roll, heading, and turn-and-slip. Aircraft attitude reference signals are supplied to the indicator by electrical connection with the remotely mounted master reference platform. Pitch, roll, and heading are shown by the orientation of the all-attitude indicator sphere with the miniature reference aircraft attached to the instrument face. An electrically powered bank inclinometer and rate-of-turn pointer, under the sphere on the attitude director indicator, completes the indicator presentation. The horizon is shown as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is a light grey area above the horizon line; the lower half, symbolizing earth, is a dull black area below the horizon line. The sphere is graduated every 5 degrees in azimuth around the horizon line and every 30 degrees around the rest of the sphere. The sphere is graduated every 10 degrees of climb and dive. The sphere is free to move a full 360 degrees in pitch, roll, or heading. Roll indices are located on the top and bottom of the indicator.

Several indicating flags and pointers are incorporated in the instrument that are not used by the AJB-3A indicator. All flags and pointers are biased out of view at the completion of the warmup period and should not reappear until the system is turned off. (Refer to All-Attitude Indicator in NAVAIR 01-40AV-1T for a complete description of the horizontal and vertical director pointers.) The OFF flag disappears at the end of the warmup period and should not reappear until the system is turned off. If the OFF flag does appear, a power failure is indicated. Approximately 90 seconds may be required for gyro erection and amplifier warmup.

The turn-and-slip indicators are located below the sphere and are an integral part of the all-attitude indicator. A one-needle width deflection of the turn indicator will result in a standard rate, 2-minute, 360-degree turn. Two-needle widths deflection results in a 1-minute, 360-degree turn. The turn indicator is electrically driven and will operate on emergency generator.

A pitch trim knob, located on the lower right corner of the indicator, with an index mark at its 10 o'clock position, controls the sphere pitch setting in relation to the reference aircraft. Adjustment can be made from 10 degrees noseup to 5 degrees nosedown. The indicator is calibrated to display, at any pitch angle, the true aircraft attitude (Armament Datum Line) in relation to the surface of the earth, with pitch trim knob aligned to the index mark. It is recommended that the pitch trim knob always be aligned to the index mark before flight and be left in that position throughout the flight. This will enable the pilot to always know his true attitude in relation to the surface of the earth regardless of the maneuver performed.

Gyro Cutout Switch

A gyro cutout switch is located in the left-hand side of the forward engine compartment. In the normal position, maintenance and servicing requirements involving power application to the aircraft may be accomplished without energizing the AJB/3A system. Gyro damage will be prevented by allowing uninterrupted rundown subsequent to flight and preventing unnecessary brief turnups.

STANDBY ATTITUDE INDICATOR

A self-contained, ac-powered, standby attitude indicator is located on the instrument panel (figure FO-1). The indicator provides an independent alternate attitude display if a malfunction or failure of the AJB-3A all-attitude indicator occurs. The gyro automatically erects at a rate of 2.5 degrees per minute and the gyro may be manually caged for gyro stabilization. A caging knob is located on the lower right corner of the indicator for manual gyro caging. After engine start, the knob can be pulled and held for approximately 60 seconds for gyro stabilization. The gyro can be locked in the caged position by pulling out and rotating the knob clockwise. Pulling the caging knob causes the OFF flag to appear on the indicator. The OFF flag will also appear whenever electrical power is interrupted. After ground caging of the gyro, the indicator will display accurate attitude information within 3 minutes. When the caging knob is not pulled out (normal position), the miniature aircraft on the indicator can be adjusted through a ±5 degree pitch range by rotating the knob clockwise or counterclockwise.

With the pitch adjustment knobs centered, pitch indication of the standby attitude indicator should be 8±3 degrees of primary attitude indication (4±3 degrees if aircraft reworked per AFC 487) 6 minutes after electrical power is applied and gyro is uncaged.

The indicator is a reliable alternate attitude reference with the following characteristics: After a power failure, the indicator may provide a usable attitude reference up to 9 minutes even though the OFF flag is visible. The horizon will indicate a pitch change of 2- to 4-degrees nosedown with bank angles of 30 degrees. Exceeding the pitch limits of approximately 85-degrees noseup or nosedown can cause bank and pitch errors of up to 10 degrees. When excessive bank and pitch errors are observed during flight, the indicator may be manually caged with wings level and with a 0-degrees nosedown to 16-degrees noseup attitude (4-degrees nosedown to 12-degrees noseup if aircraft reworked per AFC 487). After caging, a 6-minute stabilization period is required for accurate attitude information.

CAUTION

Attempts to cage the gyro outside of wings level and 0-degrees nosedown to 16-degrees noseup attitude (4-degrees nosedown to 12-degrees noseup if aircraft reworked per AFC 487) will prevent proper gyro stabilization.

BEARING-DISTANCE-HEADING INDICATOR (BDHI)

The BDHI (figure FO-1) displays magnetic heading by rotation of the compass card dial. Distance and relative/magnetic bearings, in relation to a ground or shipboard station, are also displayed by the instrument.

Magnetic heading information from the compass compensator adaptor is provided to the rotating compass card which indicates magnetic heading in degrees. A fixed index at the top of the indicator denotes the reference heading of the aircraft.

A central window in the indicator face shows a three-digit display, indicating distance in nautical miles for TACAN operation. An OFF flag is displayed when distance information is not present.

Displayed on the face of the indicator are two pointers, pointer 1 (a single-bar pointer for UHF/ADF operation) and pointer 2 (a double-bar pointer for TACAN). Both pointers will indicate relative and magnetic bearing information if the compass card is in synchronization (sync).

Note

Pointer 1 will always indicate relative bearing from the aircraft. However, if the compass card is out of sync, pointer 2 will follow the compass card and indicate magnetic bearing only.

ACCELEROMETER

An accelerometer (figure FO-1), with three indicating pointers, registers and records positive- and negative-g loads. One pointer moves in the direction of the g-load being applied while the other two, one for positive-g loads and one for negative-g loads, follow the indicating pointer to its maximum travel. The recording pointers remain at the respective maximum travel positions of the g's being applied, providing a record of maximum g loads encountered. Depressing the push-to-reset knob at the lower left corner of the instrument, allows the recording pointers to return to the normal (1g) position.

Note

Accelerometers may read as much as 1/2g low, possibly lower if the pull-in rate is high.

ELAPSED-TIME CLOCK

An elapsed-time clock located at the top of the windshield has an 8-day mechanical movement and four concentrically mounted pointers: hour, minute, second, and elapsed time.

ANGLE-OF-ATTACK SYSTEM

The angle-of-attack system consists of an angle-of-attack vane transducer unit, indicator, indexer light with dimming wheel, and a three-colored external approach lights unit (figure 1-12). The angle-of-attack vane extending outboard on the left side of the fuselage senses the attitude of the aircraft in relation to the relative wind and sends the angle-of-attack readings to the indicator located at the top of the instrument panel. The indicator has a pointer, a dial graduated from 0 through 30, and an OFF window. The dial is adjustable with respect to the fixed reference index at the 3 o'clock position on the case. Relative wind angle-of-attack information is relayed by cams and wiring from the indicator to the index light located just left of the gunsight for the pilot, and to the three-colored external approach lights unit for the landing signal officer. The angle-of-attack vane is not heated when operating on emergency generator with the landing gear extended.

Angle-of-Attack Indexer Lights

The angle-of-attack indexer lights assembly, located on the top side of the glareshield in the cockpit (figure 1-4) and left of the gunsight, is in a single case containing three lamps behind a polaroid lens. The lens assembly is a tri-colored type, with the upper lens green, center lens amber, and lower one red. Angle-of-attack indications are shown on the tri-colored light assembly by a chevron (V) at the top, a doughnut (O) at the center and an inverted (Λ) chevron at the bottom. Two intermediate conditions are also indicated on the lens, when approaching or departing optimum angle of attack, by showing the (O) simultaneously with the (V) or the (Λ) display. (See figure 1-12 for concise interpretation of INDEX CONDITIONS, with the corresponding color of the external approach light visible to the landing signal officer, LSO.) The lamps in the indexer are electrically connected through a dimming mechanism within the case to the index light transformer. Dimming of the lights is controlled by manual movement of a wheel, protruding from the face on the left side of the case, to provide suitable intensity for the operator pilot. Dimming is automatically provided when the exterior lights are turned ON. A press-to-test button, labeled TEST on the face of the instrument panel, is used to check the lighting integrity of the indexer by turning on all three lamps when the test button is depressed.

Angle-of-Attack Indicator

The angle-of-attack indicator indicates units of angle of attack to the relative airstream, from 0 to 30 on the face of the dial. (These increments are not absolute but are arbitrary indicated units grouped around the optimum.) An OFF flag becomes visible when ac power is lost. The dial is adjustable by means of an allen wrench receptacle at the lower left-hand corner of the indicator to set the optimum unit setting at the 3 o'clock position. All switching is referenced to the 3 o'clock position regardless of dial setting. The recommended setting for landing approach is 18 units. If the angle-of-attack indication of 18 units does not produce the indicated airspeed for the configuration computed from figure 11-44, the flap setting should be checked. If the appropriate configuration is established, disregard the indicator and make the approach at the computed airspeed from figure 11-44.

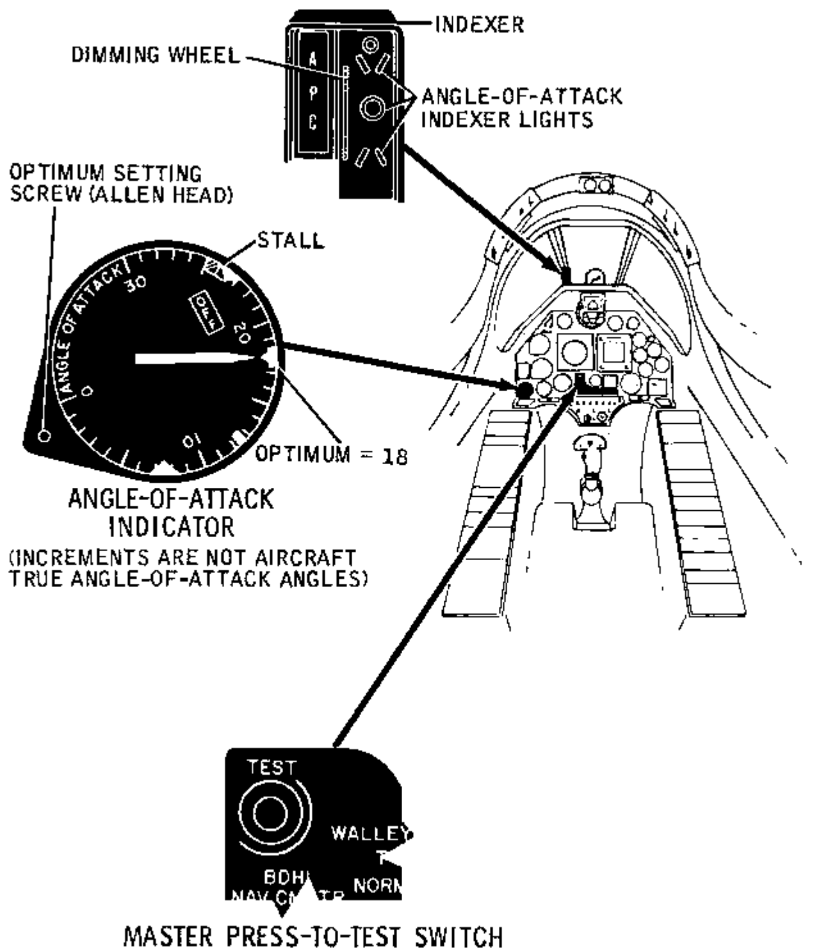
Four indices are positioned at various points around the dial. The main index represents the optimum angle of attack for approach to landing and is always placed in the 3 o'clock position. The stall index is set at 27 units near the 12 o'clock position on the dial. The triangular cruise index at the 5:30 o'clock position and the square climb index at the 4:30 o'clock position are not used because of variations in climb and cruise angles of attack in A-4 aircraft.

The angle-of-attack system may be used for cruise control if the airspeed system fails. It should be recognized that the angle-of-attack indications are inadequate to use as a prime cruise control system, since small variations result in relatively large changes in airspeed at optimum cruise. Sample angle-of-attack readings are indicated in the following:

Condition	Angle-of-Attack Cockpit Indicator Units
Maximum range climb	4.0 to 9.0
Maximum range descent or maximum endurance at all altitudes	11.2
Cruise at 5000 feet	6.3 to 7.1
Cruise at 35,000 feet	8.0 to 9.8
250-knot descent with speedbrakes extended	*7.0

*Gross weight of 14,000 pounds: Add/subtract 0.35 units for each increase/decrease of 1000-pounds gross weight.

The above data are based on an aircraft configured with two 300-gallon external tanks. For a clean aircraft these angle-of-attack indicator readings should be decreased 1.0 unit.



INDEX CONDITIONS
ANGLE-OF-ATTACK TOO HIGH (LIGHT = GREEN) (* INDICATOR = 19 - 30)
ANGLE-OF-ATTACK HIGH APPROACHING OR DEPARTING OPTIMUM (LIGHTS = GREEN - AMBER) (* INDICATOR = 18 1/2 - 19)
ANGLE-OF-ATTACK OPTIMUM ("BULLSEYE") (LIGHT = AMBER) (* INDICATOR = 17 1/2 - 18 1/2)
ANGLE-OF-ATTACK LOW APPROACHING OR DEPARTING OPTIMUM (LIGHTS = RED - AMBER) (* INDICATOR = 17 1/2 - 18)
ANGLE-OF-ATTACK TOO LOW (LIGHT = RED) (* INDICATOR = 0 - 17 1/2)
* ONLY IF OPTIMUM SETTING IS 18 WITH DIFFERENT OPTIMUM SETTING, BREAK POINTS CHANGE CORRESPONDINGLY.

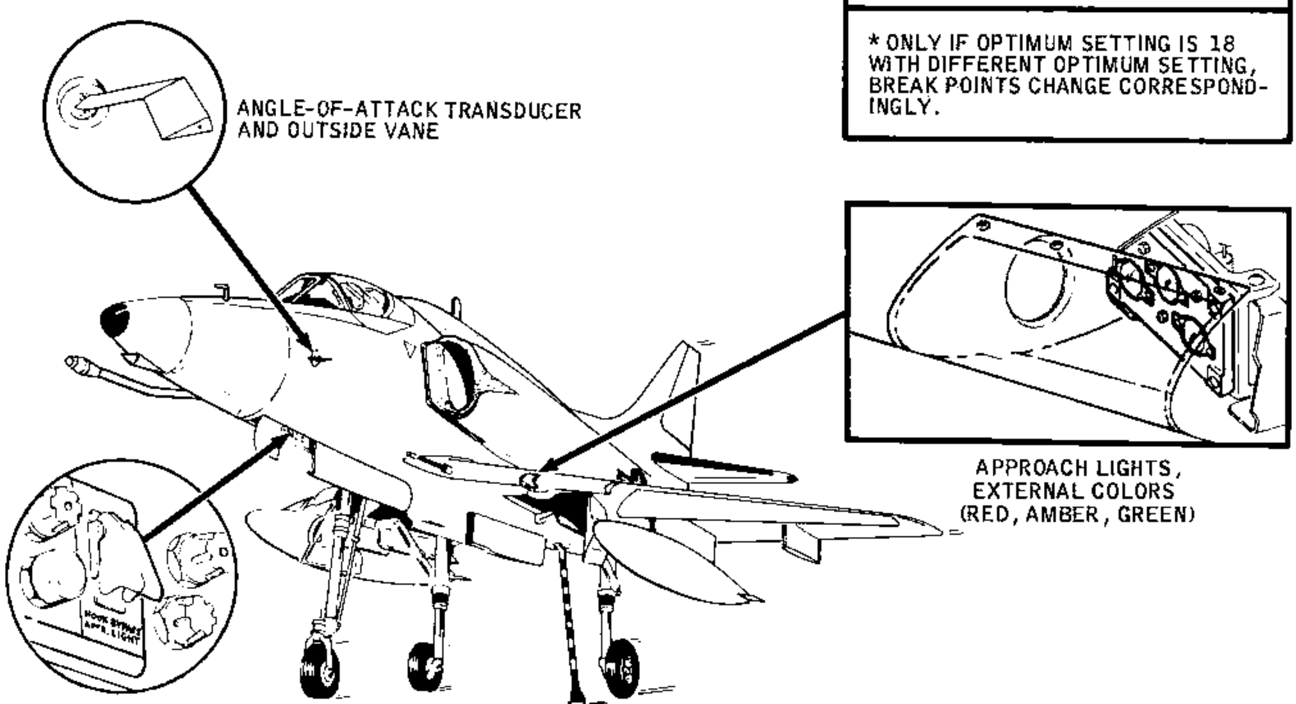


Figure 1-12. Angle-of-Attack – Approach Light System

Note

When above speeds of 200 KIAS, an angle-of-attack error of 0.5 unit can be equal to an airspeed error of 25 KIAS or more.

External Approach Light

The external approach lights unit located in the leading edge of the left wing behind a transparent section has three separate lamps covered by red, amber, and green lenses. The corresponding angle-of-attack conditions are shown to the LSO, as green for angle of attack too high; as amber for angle of attack optimum (or approaching or departing optimum); and as red for angle of attack too low.

The external approach lights are bright in the daytime and dim automatically when the master exterior lights switch is turned on for night flying.

The indicator in the cockpit will be in operation during the entire flight to present angle-of-attack information. The angle-of-attack transducer is also connected to the APG-53A radar system. The indexer lights and the external approach lights, powered by the ac primary bus, operate automatically when the landing gear is down and locked, the arresting hook is extended, and the aircraft is in flight or up on jacks. All approach lights go out, upon landing, by means of a landing gear strut compress switch (squat switch).

Note

External approach lights are operated through a dc approach light relay. With a dc electrical failure, the primary dc bus which operated the approach light relay will be inoperative and external approach lights will not be available. If a dc fuse is the problem, dc power may be regained by dropping the emergency generator.

Approach Light Arresting Hook Bypass

A momentary contact toggle switch, labeled HOOK BYPASS, is located in the nosewheel well. This guarded switch is used to bypass the arresting hook circuit of the approach light system during field mirror landing practice. To provide approach lights during field landings without using the arresting hook, a ground crewman momentarily engages the HOOK BYPASS switch to the BYPASS position. The approach lights stay on as long as the landing gear is down and the landing gear struts are not compressed enough to actuate the strust compress switch (squat switch). Normal operation of the approach light circuit is re-established by moving the arresting hook handle to the DOWN position, or interrupting electrical power to the approach light circuit.

Note

If "bounce drill" on the carrier is conducted using the approach light arresting hook bypass, extra precaution must be taken to ensure that the arresting hook is extended before an arrested landing.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

All communications and associated electronic equipment is listed in figure 1-13 and all antenna locations are shown in figure 1-14. Major units of the ARC-51A UHF radio and the ARA-50 direction finder are located in the nose section of the aircraft. Also installed in the nose section is the ARN-52(V) TACAN radio.

ARC-51A UHF RADIO COMMUNICATION SYSTEM

The ARC-51A UHF radio communication system provides voice communication between aircraft, ships, or ground-based radio stations. The range is normally limited to line-of-sight, or the horizon when airborne.

The system includes a receiver-transmitter unit, a control panel, and a blade antenna. There are 3500 frequency channels available, spaced at 50-kilohertz intervals. Frequency range is 225.00 to 399.95 megahertz. The guard receiver monitors the guard frequency (243.00 megahertz) when guard function is selected. The guard receiver can be monitored continuously while operating on another selected UHF radio frequency. UHF-ADF operation, in conjunction with the ARA-50 automatic direction finding equipment, can be selected on the UHF radio control panel. Relative bearing to a selected transmitting UHF station is displayed by the No. 1 pointer on the BDHI.

ARC-51A UHF Radio Control Panel

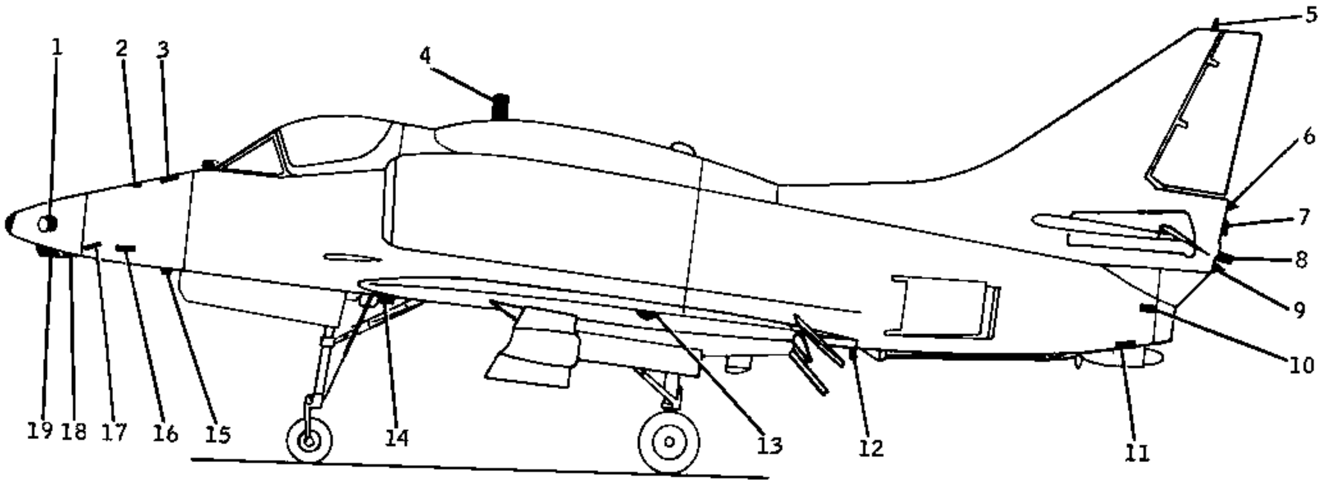
The ARC-51A UHF radio control panel (figure FO-1), located on the right console, provides remote control of the UHF radio receiver-transmitter. Controls and indicators on the control panel permit manual selection of any one of the available 3500 frequency channels or any one of 20 preset channel frequencies. Space is available on the control panel to list the preset frequencies after the numbers 1 through 20. The control panel contains a mode selector switch, a preset channel selector knob, a channel indicator, three manual frequency selector knobs, a frequency indicator, a squelch disable switch, a volume control knob, and a function selector switch.

The three-position mode selector switch has positions PRESET CHAN, MAN, and GD XMIT. When any one of the 20 preset channels is used, the mode selector switch must be in PRESET CHAN. To use frequencies selected with the manual frequency selector knobs, the mode selector switch must be in MAN. To transmit as well as receive on guard frequency 243.00 megahertz, the GD XMIT position is selected.

TYPE	DESIGNATION	FUNCTION	RANGE	LOCATION OF CONTROLS
COMMUNICATION:				
UHF RADIO	AN/ARC-51A	SHORT RANGE TWO-WAY VOICE COMMUNICATION	LINE-OF-SIGHT	RIGHT CONSOLE
SECURITY EQUIPMENT	JULIET 28	CLASSIFIED	↓	↓
AUXILIARY UHF	AN/ARR-69	SHORT RANGE RECEIVER/ADF	↓	↓
COMPASS CONTROLLER		ROTATES ALL-ATTITUDE INDICATOR AND ID-663 BDHI	360° OF ROTATION	RIGHT CONSOLE
		LATITUDE COMPENSATION	0° TO 90° NORTH AND SOUTH	↓
ELECTRONIC COUNTERMEASURES (ECM)	AN/APR-25	SEE NAVAIR 01-40AV-1T(A)	SEE NAVAIR 01-40AV-1T(A)	ECM CONTROL MONITOR-L/H GLARESHIELD
↓	AN/APR-27	↓	↓	↓
↓	AN/ALQ-100	↓	↓	↓
↓	AN/ALE-29A	CHAFF DISPENSING FOR ENEMY RADAR JAMMING	LINE-OF-SIGHT	↓
IDENTIFICATION:				
IFF RADAR	AN/APX-72 (V)	IDENTIFIES AS FRIENDLY	LINE-OF-SIGHT	RIGHT CONSOLE
NAVIGATION:				
UHF-ADF	AN/ARA-50	DIRECTIONAL HOMING	LINE-OF-SIGHT	RIGHT CONSOLE
TACAN	AN/ARN-52 (V)	PROVIDES COURSE BEARING AND DISTANCE TO SELECTED STATION AND AIR-TO-AIR INFO FROM OTHER AIRCRAFT	LINE-OF-SIGHT TO 300 MILES	↓
NAVIGATION COMPUTER	AN/ASN-41	GREAT CIRCLE AND PLANAR NAVIGATION	OVER 300 MILES	↓
DOPPLER RADAR	AN/APN-153 (V)	GROUND SPEED AND DRIFT ANGLE	LINE-OF-SIGHT	↓
RADAR BEACON	AN/APN-154 (V)	IDENTIFICATION	↓	GCBS PANEL LEFT CONSOLE
RADAR:				
AIR-TO-GROUND RECEIVE/TRANSMIT	AN/APG-53A	TERRAIN CLEARANCE	LINE-OF-SIGHT	LEFT CONSOLE AND INSTRUMENT PANEL
ALTIMETER	AN/APN-141	INDICATES HEIGHT ABOVE TERRAIN	↓	INSTRUMENT PANEL
WEAPONS DELIVERY:				
AIR-TO-GROUND MISSILE	SEE A-4/TA-4 TACTICAL MANUAL (NAVAIR 01-40AV-1T)	GUIDED MISSILE	LINE-OF-SIGHT	ARMAMENT PANEL, LEFT CONSOLE, AND CONTROL STICK

FA1-26

Figure 1-13. Electronic Equipment



1. AN/APG-53A RADAR ANTENNA
2. AN/APX-72 IFF FORWARD ANTENNA
3. MISSILE GUIDANCE ANTENNA
4. AN/ARC-51A UHF RADIO ANTENNA
5. AN/APN-154 (V) RADAR BEACON ANTENNA
6. AN/ALQ-100 ECM RECEIVE AFT ANTENNA
7. AN/ARN-52(V) TACAN AFT ANTENNA
8. AN/ALQ-100 ECM TRANSMITTER ABSORBER
9. AN/ALQ-100 ECM PULSE TRANSMITTER AFT ANTENNA
10. AN/APR-25(V) ECM RECEIVER AFT ANTENNA(2)
11. AN/APX-72 IFF AFT ANTENNA
12. AN/ARW-67 ANTENNA
13. RADAR ALTIMETER (UNDER LEFT WING OUTBOARD)
14. AN/ALQ-100 ECM PULSE TRANSMITTER FORWARD ANTENNA
15. AN/ARN-52(V) TACAN FORWARD ANTENNA
16. AN/ARA-50 UHF-ADF ANTENNA
17. AN/APN-153 (V) DOPPLER ANTENNA
18. AN/APR-25(V) ECM RECEIVER FORWARD ANTENNA (2)
19. AN/ALQ-100 ECM RECEIVER FORWARD ANTENNA

FA1-14

Figure 1-14. Antenna Locations

The preset channel selector knob is used to select any one of the 20 preset channel frequencies. The selected channel, 1 through 20, is displayed in the channel indicator window. When using preset channels, the mode selector switch must be in the PRESET CHAN position.

The three manual frequency selector knobs are used to select frequencies from 225.00 through 399.95 megahertz. Selected frequency is displayed in the frequency indicator window. When using manually selected frequencies, the mode selector switch must be in MAN position.

The two-position squelch disable toggle switch, marked SQ DISABLE, has positions OFF and ON. The switch is used to select squelch compatibility with the strength of the signal being received. Placing the switch in ON disables the receiver squelch circuit. The VOL control knob is used to adjust volume.

The four-position function selector switch has positions OFF, T/R, T/R+G, and ADF. The switch provides for modes of operation as follows:

Setting	Function
OFF	Set inoperative
T/R	Transmitter and main receiver in operation
	Guard receiver in standby; ADF in standby
T/R+G	Transmitter and main receiver in operation; guard receiver in operation
	ADF in standby
ADF	ADF in operation through main receiver
	Transmitter in standby; guard receiver in standby

ARC-51A UHF Radio Operation

1. Mode selector switch . . . . . . PRESET CHAN or MAN

Note

If a preset channel frequency is desired, the mode selector switch must be in PRESET CHAN. If a frequency selected with manual selector knobs is desired, the mode selector switch must be in MAN.

2. Select desired channel number with channel selector knob or select desired frequency with manual selector knobs.

3. Function selector switch . . . . . T/R or T/R+G

Note

- Allow a 1-minute period before keying transmitter when the UHF radio is first energized.
- If transmission on the guard frequency is desired, select GD XMIT with mode selector switch.

ARR-69 AUXILIARY UHF RECEIVER SYSTEM

The ARR-69 auxiliary UHF receiver system is used alternately with the ARC-51A UHF radio communication system, or simultaneously if one system is used for automatic direction finding and the other for communication.

An interlock between the two systems gives the auxiliary UHF receiver system some control over the UHF radio communication system.

The auxiliary UHF receiver system operates in the frequency range of 265.20 to 284.20 megahertz. Twenty preset frequency channels plus guard channel (243.00 megahertz) are available within the frequency range. An auxiliary UHF control panel is provided for remote control of the auxiliary UHF receiver system.

Auxiliary UHF Control Panel

The auxiliary UHF control panel (figure FO-1), labeled UHF, is located on the right console. The control panel is used for remote control of the auxiliary UHF receiver and also exercises some control over the UHF radio communication system. Controls contained in the control panel are a function selector switch, a preset channel selector switch, a sensitivity control knob, and a volume control knob.

The function selector switch is labeled AUX REC forward of the switch and MAIN T/R aft of the switch. AUX REC switch positions are marked OFF, ADF, CMD, and GRD. MAIN T/R switch positions are T/R, ADF, and ADF. When the function selector switch is rotated, the AUX REC and MAIN T/R positions change simultaneously. The relationship between AUX REC and MAIN T/R is as follows:

AUX REC Position	MAIN T/R Position
OFF	None
ADF	T/R
CMD	ADF
GRD	ADF

The AUX REC must be in the OFF, CMD, or GRD position to give the MAIN T/R (AN/ARC-51A UHF radio communication system) ADF capability.

The preset channel selector is labeled AUX CHAN. Positions are marked 1 through 20 for selecting preset channel frequencies. Guard frequency is selected with the function selector switch. To determine the preset channel corresponding to a given Navy/Marine UHF radio beacon, subtract 64 from the second and third digit of the frequency. Example: Frequency 267.60 would be (67-64=3) on channel 3.

The sensitivity control knob is labeled SENS. Rotating the SENS control knob clockwise increases the sensitivity. The volume control knob, labeled VOL, is used to control volume of the auxiliary UHF receiver.

AUDIO ISOLATION AMPLIFIER

The audio isolation amplifier is used to match the headset impedance with all receivers in the aircraft. A switch in the lower right corner of the instrument panel (figure 1-4) is labeled AUDIO BYPASS/NORM. The AUDIO BYPASS position removes the audio isolation amplifier from the circuit and allows only the audio signals from the UHF radio, LAWS, and SHRIKE to be heard.

Note

When the switch is in the BYPASS position, no sidetone will be heard when the pilot is transmitting on the UHF radio.

SECURITY EQUIPMENT

The security equipment (Juliet 28) is supplementary to the UHF. The security equipment control panel is located on the right console. Power for the security equipment is supplied by the 28-vdc primary bus (figure FO-3). Any further description of the security equipment or its function is above the security classification of this manual.

RADAR IDENTIFICATION EQUIPMENT

AIMS Transponder Identification System

The AIMS program is an equipment and subsystem acquisition effort that provides special capabilities to selected airborne and ground systems. The acronym AIMS is derived from the following:

ATCRBS (Air Traffic Control Radar Beacon System)

IFF (Identification Friend or Foe)

Mark XII identification system

Systems (diversified AIMS configurations)

The AIMS transponder identification system consists of transponders, interrogators, servoed altimeters, and altimeter encoder sets. Interrogators perform question functions and are slaved to a primary radar. Transponders perform the answer functions and are normally located in the aircraft.

CODING. Interrogators use three coded interrogations, Modes 1, 2, and 3/A. In addition, Mode C is used for automatic altitude reporting. In operation, an interrogation pulse group (Mode 1, 2, 3/A or C) is transmitted from the interrogator by a directional antenna. Each airborne transponder located in the direction of the antenna main beam is triggered by these signals. When triggered, a pulse-coded reply group is transmitted from each transponder. A ground interrogator-receiver decodes the reply and provides a visual display. Aircraft range is determined by the transmitted-received pulse transit time. Aircraft azimuth is determined from the main direction of the interrogator antenna beam.

Mode 1 code selection is limited to the 32 codes, from 0000 through 7300 (3 modes B4, C, and D, are not used). There are 4096 discrete codes available in Modes 2, 3/A, and C. Two special reply code configurations, EMER and IP (identification of position), are available. The emergency (EMER) code, selected by the pilot, is reported on Mode 1, 2, 3/A, as code 7700. The IP code is requested by the ground controller. Modes 2 and 3/A reply and are followed by a Special Position Identification (SPI) pulse. This pulse provides the air controllers with aircraft position upon demand.

AIMS EQUIPMENT. The AIMS system includes an AN/APX-72(V) IFF Radar Identification Subsystem.

KIT-1/T-SEC COMPUTER TRANSPONDER. The computer transponder provides MK XII IFF capability.

Output coding is applied to the AN/APX-72(V) transmitter. Codes A, B, or Zero may be selected on the C-6280 (P) APX transponder set control.

APX-72(V) IFF RADAR IDENTIFICATION SUBSYSTEM. The IFF radar identification subsystem includes a receiver-transmitter, a transponder set control panel, an IFF Mode 4 failure light, and IFF antennas.

The subsystem provides automatic radar recognition of an aircraft when challenged by other surface or airborne systems, using specifically coded pulse interrogations. The subsystem provides for reception, detection, decoding, encoding, and transmission of signals. Provisions are also incorporated to enable an emergency reply to be transmitted to the transponder, irrespective of the mode being interrogated. Provisions are also incorporated to obtain the identification position (IP) of the aircraft being interrogated.

The subsystem can provide 4096 reply codes in Mode 3/A, as well as normal reply codes for Modes 1 and 2, and full Mode C altitude reporting. Sidelobe suppression is incorporated, enabling IFF equipment to have more precise azimuth information on aircraft operating at short ranges.

APX-72 (IFF) Radar Identification System Controls

Pilot control of the system is provided by the transponder set control panel (figures 1-15 and FO-1), located on the right console. Power selection, operating modes, and reply monitoring controls for the APX-72 are provided as follows:

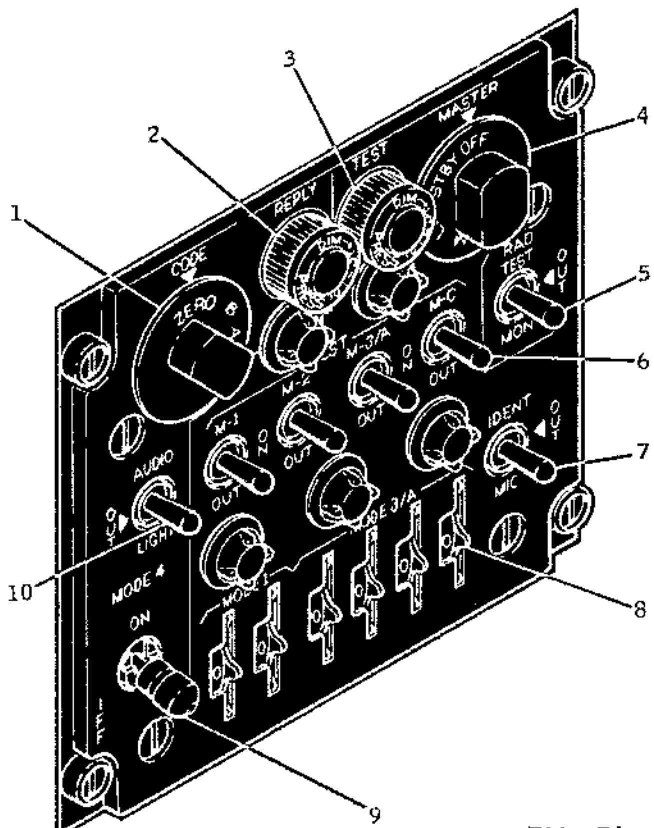


Figure 1-15. Transponder Set Control Panel

	Control	Placard	Function
1.	Code Knob	ZERO	Drops any previous coding set into external computer.
		B	Locks in mode 4 when interrogations are Code B.
		A	Locks in mode 4 when interrogations are Code A.
		HOLD	Retains codes while refueling.
2.	Light	REPLY	Indicates replies in mode 4.
3.	Light	TEST	Indicates GO condition.
4.	Master Knob	OFF	Controls power to APX-72 receiver-transmitter.
		STDY	Grounds transmitter output.
		LOW	Receiver at low sensitivity.
		NORM	Receiver at normal sensitivity.
		EMER	Enables all mode decoders, codes mode 3/A to 7700 automatically.
5.	Test Switch	RAD TEST OUT	Enables airborne transponder inflight tester by indication of lights for replies.
6.	Mode Control Switches (4)	TEST	Activates inflight tester.
		M-1, M-2 M-3/A, M-C	Enables coding of pulse trains.
		ON	Enables decoders.
		OUT	Disables decoders.
7.	MIC Switch	IDENT	Activates circuit for 30 seconds.
		OUT	Disables circuit.
		MIC	Enables external triggering of circuit.
8.	Digital Select Dials (6)	MODE-1 MODE-3/A	Digital insertion (0 to 9) dials. (Mode 2 preset on ground)
9.	Mode 4 Switch	ON	Enables mode 4 operation.
		OFF	Disables mode 4 operation.
10.	Mode 4 Audio/ Light Switch	AUDIO	Tone for mode 4 interrogations.
		OUT	Disables AUDIO and LIGHT.
		LIGHT	Light for mode 4 interrogations.

NAVIGATION EQUIPMENT

COMPASS CONTROLLER

The operation of the compass system is controlled by the compass control panel (figure FO-1) located on the right console. The switch, marked SLAVED and FREE, permits selection of either function. The set heading knob, marked PUSH TO TURN, is used to rotate the BDHI and all-attitude indicator L (left) or R (right) to any desired heading. This also may be used to synchronize the compass system with the magnetic flux valve. The rate of rotation is proportional to the amount of displacement of the set heading knob.

The PUSH TO SYNC button will do the synchronizing automatically. The compass synchronization needle is energized only when the system is operated as a slaved directional gyro. The synchronization indicator functions as a null indicator with heading information being obtained from either the BDHI or the all-attitude indicator.

If the average needle position is the centerline of the synchronization indicator when the system is operated in the SLAVED mode, the compass card is synchronized with the magnetic flux valve. Any small deviation from the null position will be slaved out in 1 to 3 minutes after the initial heading is set.

A compass card error of ±2 degrees will peg the needle. If the sync needle stays pegged after prolonged straight and level flight (more than 5 minutes), a possible malfunction of the system is indicated.

During flight, the sync needle will oscillate about the null position because of the motion of the flux valve. This oscillation is normal and indicates that correct integration is being accomplished (as long as the average position of the sync needle is the null position).

The directional gyro will integrate or smooth out these oscillations on the BDHI compass card. To synchronize the compass proceed as follows: If the sync needle is left of center, clockwise rotation of the set heading control should move the sync needle from left to right and rotate the compass card clockwise; if the sync needle is right of center, counterclockwise rotation of the set heading control should move the needle from right to left and rotate the compass card counterclockwise. For fast centering of the sync needle, push and hold the PUSH TO SYNC button until the needle is centered. To move the sync needle slowly, depress and turn the set heading knob left or right until the desired slew rate is achieved.

The latitude setting dial is used to control the apparent drift of the gyro when operating as a free gyro. This dial is marked for each 10 degrees from 0 to 90. The dial should be set to the approximate latitude of the aircraft. If the latitude changes as the flight progresses, the dial should be reset to the new latitude.

Slaved Operation

When electrical power is initially applied to the system in the SLAVED mode, allow 100 seconds for warmup, then the auto sync cycle (approximately 12 seconds) will rotate the all-attitude indicator and the BDHI compass card to the aircraft magnetic heading.

The heading indicator should show the correct magnetic heading when the synchronization needle stabilizes.

Free Gyro Operation

To operate the system as a free gyro allow 90 seconds for the system to warm up, then:

1. Place the SLAVED-FREE switch in FREE.

2. Rotate the latitude setting dial to the latitude of the aircraft.

3. Rotate the compass card of the BDHI to the desired heading by using the set heading knob.

Note

The compass synchronization needle nulls and is inoperative when the system is used as a free gyro.

TACAN BEARING-DISTANCE EQUIPMENT

The ARN-52(V) TACAN airborne equipment operates in conjunction with surface navigation beacons to provide continuous directional and distance information to the pilot. Visual indication of magnetic bearing to a selected station is provided by the No. 2 pointer of the BDHI (figure FO-1), and distance information to 300 miles is indicated in the range window. Beacon identification tone signals are received through the regular headset.

TACAN Control Panel

The control panel (figure FO-1) is identified as TACAN and is located on the right console. Operating controls include the power switch with OFF, REC, T/R, and A/A positions, two channel selector knobs, and a volume control. The REC and T/R positions give bearing information on the No. 2 pointer of the BDHI. In the T/R position, distance information in the range window of the instrument is also given. The A/A position gives air-to-air distance information between cooperative aircraft. Air-to-air (A/A) ranging requires cooperating aircraft to be within line of sight distance. This mode enables the TACAN installation to provide range indication between one aircraft and up to five others. TACAN displays normal range and azimuth information in the T/R mode and range information only in the A/A mode. (The azimuth indicator, No. 2 pointer rotates continuously.)

If A/A operation is desired between two aircraft, the channels selected must be separated by exactly 63 channels, i.e., No. 1 aircraft is set to channel 64, No. 2 aircraft is set at channel 1. Both aircraft must then select A/A mode on the TACAN function switch with the range between aircraft being displayed on the DME indicator. The maximum lock-on range is 300 miles. However, due to the relative motion of the aircraft, the initial lock-on range will usually be less.

If A/A operation is desired between one lead aircraft and five others, the channel selected by the lead aircraft may be 64, for example. The other five aircraft must be separated by exactly 63 channels, and would be on channel 1. The A/A mode must then be selected on the TACAN selector switch.

TACAN Antenna Switch

A three-position TACAN antenna switch (figure FO-1) is located on the outboard right console. The purpose of the switch is to enable the pilot to utilize the forward or aft antenna. The switch is labeled AUTO, FWD, and AFT. The AUTO position enables automatic selection of the antenna that permits station lock-on to be achieved.

Operation of TACAN Equipment

To operate the TACAN radio, proceed as follows:

1. Power switch . . . . REC
2. After 3 minutes power switch . . . . T/R
3. Channel selector switch . . . . set channel selector
4. Station identification code will be audible in headset. Volume can be controlled by knob labled VOL on the TACAN control panel.
5. BDHI NAV COMPUTER-TACAN . . . . TACAN position
6. Magnetic bearing to station will be indicated on the No. 2 pointer of the BDHI.
7. For distance information, the power switch must be turned to T/R. Read slant range distance to the beacon in nautical miles in the range window of the BDHI indicator.

AUTOMATIC DIRECTION FINDING EQUIPMENT

The ARA-50 automatic direction finding (ADF) equipment supplies automatic direction finding indication from received UHF radio signals. The equipment operates in conjunction with the UHF radio communication system, the auxiliary UHF receiver system, and the BDHI. The signal is received by the ADF equipment from either the UHF radio communication system or the auxiliary UHF receiver system. Relative bearing to the transmitting UHF station is displayed by the No. 1 pointer on the BDHI.

The ADF operation is partially controlled by the auxiliary UHF control panel (figure FO-1). The UHF radio communication system cannot be used in the ADF mode unless the function selector switch on the auxiliary UHF control panel is in the AUX REC/OFF, AUX REC/CMD, or AUX REC/GRD position. To use the auxiliary UHF receiver system in the ADF mode, place the function selector switch on the auxiliary UHF control panel in the AUX REC/ADF position.

Note

Excessive UHF-ADF bearing errors may result when stores are carried on centerline stations.

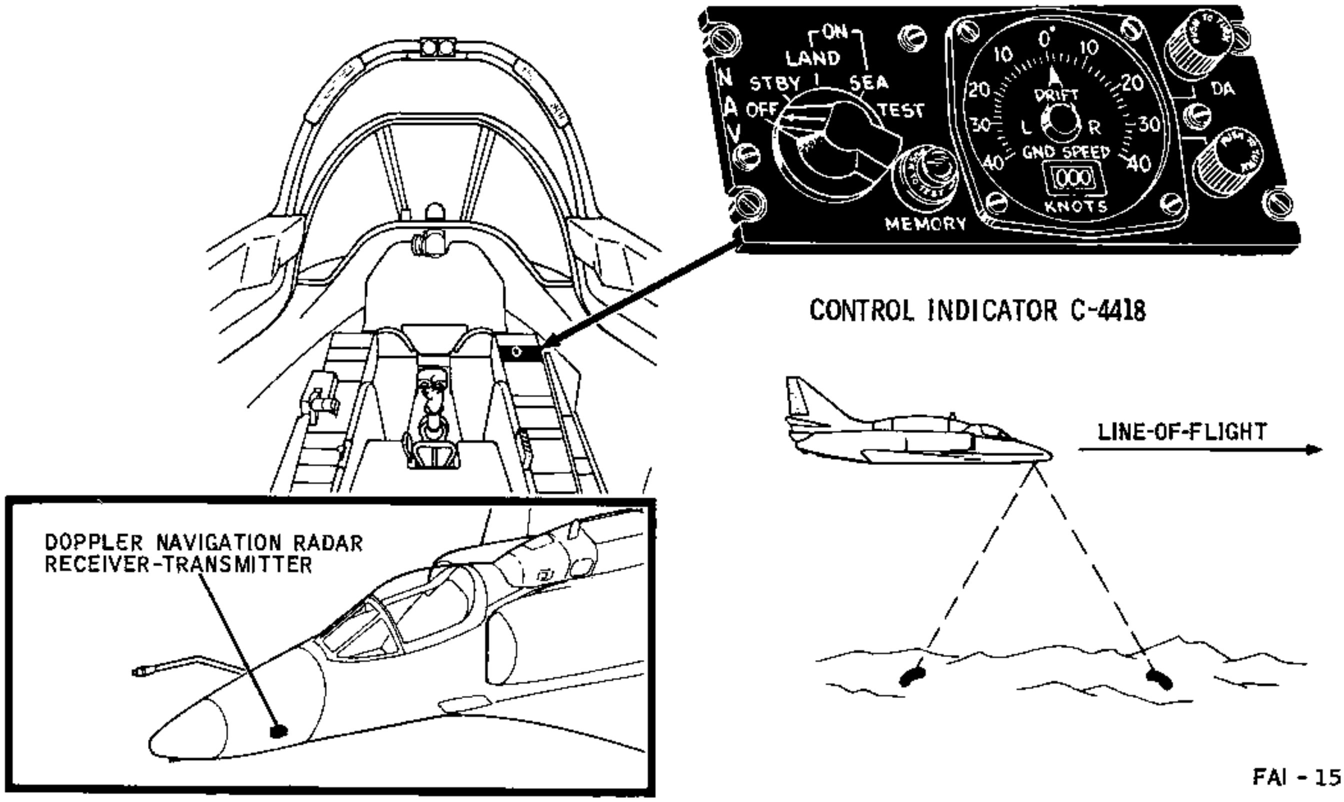


Figure 1-16. APN-153(V) Navigation Set (Doppler)

Operation of ARA-50 System

The ARA-50 ADF equipment is energized when the aircraft electrical system is energized. Tune in a UHF station on either the UHF radio communication system or the auxiliary UHF receiver system. When the station signals are received, and the station identified, set the function selector switch of the selected UHF system (UHF radio communication system or auxiliary UHF receiver system) to the ADF position. The received signal is switched from the blade antenna to the ADF antenna. The ADF antenna then rotates to the null point and the relative bearing is displayed by the No. 1 pointer on the BDHI.

Note

When the emergency generator is extended, TACAN, IFF, UHF-ADF, UHF radio communication, auxiliary UHF receiver, and the compass system are the only navigational aids available to the pilot. The TACAN is inoperative when the landing gear is down.

APN-153(V) RADAR NAVIGATION SET (DOPPLER)

The APN-153(V) (figure 1-16) is a miniaturized radar navigation set that uses the doppler principle for continuous measurement of groundspeed and drift angle. The radar set transmits rf energy to the ground and measures the shift in frequency of the returned energy to determine aircraft groundspeed, and drift angle. The doppler radar set is contained completely within the aircraft and does not depend on ground aids for navigation purposes. The radar set automatically acquires doppler information and computes groundspeed and drift angle within about 1 minute after it is turned ON. The doppler radar set operated in conjunction with the ASN-41 computer provides navigation to and from preselected targets.

System Operation

The doppler radar navigation set controls and indicators are on the C-4418/APN-153(V) control indicator panel. The control indicator panel, labeled NAV, is located on the right console (figure 1-16). To operate the doppler radar set, the selector switch knob must be turned ON to either the LAND or SEA position depending on the terrain over which the aircraft will be flying. In the SEA position, the scale factor calibration network is altered to compensate for the apparent increase in antenna looking angle when the aircraft is flying over water, thus providing proper groundspeed calibration. Circuits within the frequency tracker automatically sweep over the operating groundspeed range, seeking a usable return signal. When the reflected rf energy is of sufficient power to permit measurement of groundspeed and drift angle, then the set is switched to the normal mode of operation. Until this change takes place, the set is in the memory mode and the MEMORY light on the control indicator panel is on. While the doppler radar set is in the memory mode, the groundspeed and drift angle readings on the control indicator panel are the values computed when the doppler radar set was in the normal mode. Drift angle (DA) and groundspeed (GS) push-to-turn control knobs are provided to enable the pilot to change groundspeed and drift angle when the doppler radar set is in the memory mode. If a malfunction should occur in the doppler radar set while it is connected to the ASN-41 computer, the pilot can use the DA and GS knobs to insert approximate drift angle and groundspeed value and enable the computer to continue operating. In the LAND position, the preceding conditions can also be handled.

The set may go into the memory mode under any of the following conditions:

1. Selector switch knob is at STBY, transmitter will be off.

2. The period after the system has been turned on and before a signal has been acquired (approximately 1 minute).

3. During operation over smooth glassy seas.

4. During operation over extremely hilly terrain, where coherence may be lost despite broad antenna beams.

5. During periods when the aircraft is maneuvering beyond the antenna's limit of operation.

In the STBY position, all power except the modulator power required to drive the magnetron is applied to the APN-153(V) doppler radar set. This position is used when observing radar silence or when maintenance personnel wish to check the system. When the selector switch is on STBY, the system goes into memory mode and the amber MEMORY light comes on.

Prior to Flight

1. Turn selector switch knob to the TEST position. After 5 minutes warmup time the memory light should go off, the groundspeed dial should read 121±5 knots, and the drift angle dial should read 0±2 degrees.

2. Turn selector switch knob to STBY.

PRIOR TO TAKEOFF. Turn selector switch knob to the ON-LAND or ON-SEA position, depending upon the terrain to be flown over.

After Takeoff

1. Within approximately 30 seconds after the aircraft has reached 150 knots and an altitude of 40 feet, the memory light should go off.

2. After cruise altitude is attained, groundspeed and drift angle should be observed to read within ±50 knots and ±10 degrees respectively for the known condition of flight.

Note

It may be necessary to use the push-to-set knob and set the doppler to 150 knots after test and prior to takeoff.

3. Bank and turns are limited to 30-degree roll right or left and/or to type of terrain being flown over. If the above limitations are exceeded, the memory light will come on, indicating loss of tracking signal.

4. Climbing and descending maneuvers should be closely controlled. High-angle climbs and descents should be limited to approximately 25-degree pitch attitude, since this pitch angle is near the operating limits. The memory light may come on for periods of time, not to exceed 3 seconds.

5. At combat ceiling and at lowest mission altitude (not below 40 feet), the memory light should remain off, indicating doppler signal lockon and tracking.

ASN-41 NAVIGATION COMPUTER SYSTEM

The ASN-41 navigation computer system will supply information to the pilot about his position, windspeed and direction, distance to destination, and bearing and ground track relative to true heading. The system can store-two-target destinations without loss of primary data. The navigation system computes and provides outputs of great circle distance and bearing (relative to heading) to either of two selected targets. A great circle solution is employed for distances greater than 200 miles. A planar solution is employed for distances less than 200 miles. Present position of the aircraft in latitude and longitude coordinates is continuously computed and displayed on the ASN-41 control indicator (figure 1-17). The magnetic heading ground track bearing to the target and distance-to-go is displayed on the BDHI. Three modes of operation are available for system operation: doppler, memory, and air mass mode.

Doppler Mode

The doppler mode system receives inputs of groundspeed, drift angle, true airspeed, and magnetic heading to compute the groundspeed and airspeed vectors. The comparison of groundspeed and airspeed vectors provides a continuous solution of wind direction and windspeed.

Memory Mode

Whenever there is a temporary loss of doppler information, memory mode will automatically actuate the wind memory portion of the ASN-41 computer. The computer retains the last value of wind vector computed and combines the vector with the current airspeed vector to form a new groundspeed.

Air Mass Mode

When the doppler is completely inoperative, manually inserted wind settings are updated to combine with current airspeed to solve the groundspeed vector. When the APN-153 is inoperative, turn it off and manually set the wind settings on the ASN-41 control indicator panel or compute the drift angle and groundspeed and set them in the APN-153 with the two push-to-set knobs on the APN-153 control panel.

Navigation Computer Set Controls

The controls indicator panel, on the right console, contains the controls and display windows to indicate:

1. PRESENT POSITION – LATITUDE counter (in degrees and minutes) with a mechanical push-to-set knob.

2. PRESENT POSITION – LONGITUDE counter (in degrees and minutes) with a mechanical push-to-set knob.

3. DESTINATION – LATITUDE counter (in degrees and minutes) with a mechanical and electrical set knob.

4. DESTINATION – LONGITUDE counter (in degrees and minutes) with a mechanical and electrical set knob.

5. MAG VAR (magnetic variation) counter (in degrees and tenths of a degree) with a mechanical set knob.

6. WIND SPEED counter (0 to 300 knots) with a mechanical set knob.

7. WIND DIRECTION (in degrees) with a mechanical set knob.

8. SELECTOR SWITCH – The SELECTOR SWITCH on the control indicator (CONT IND) panel performs the following functions:

Position	Function
1. OFF	The navigation computer system is denergized. The destination and present position counters can be manually set in preparation for a mission.
2. STBY	Power is applied to the set. Destination one (D1) is displayed on the counters and is also stored in the computer memory circuit. Push-to-set or slew knobs can be used to set-up D1 in the standby position.
3. D1 (Destination)	This position supplies course and distance information for integration of present position counters on the first leg of the mission. This information can be changed at any time using the slew knobs. When in D1 position, only the slew knobs are usable. The push-to-set knobs do not function.
4. D2 (Destination)	This position provides course and distance information for destination two (D2) on the second leg of the mission. Destination two (D2) can be updated by use of the slew knobs only.
5. TEST	This position inserts a presolved problem into the navigation computer whose solution is displayed by the control indicator counter and BDHI.

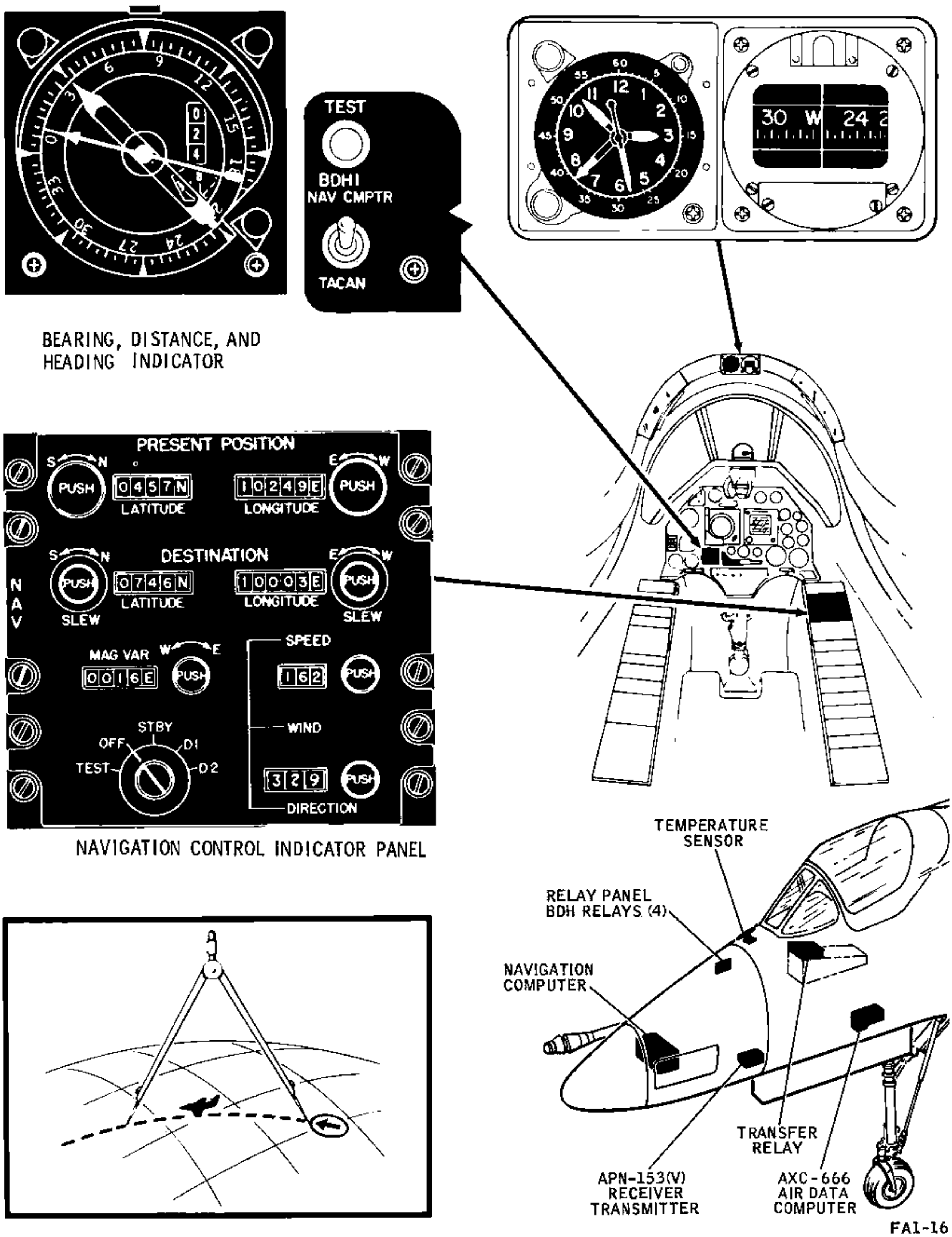


Figure 1-17. ASN-41 Navigation Computer System

Operational Procedure

PRIOR TO FLIGHT

1. Turn the ASN-41 function selector switch knob to TEST.

2. BDHI switch in NAV CMPTR position. WIND SPEED indicates 223.6±2.5 knots. WIND DIRECTION indicates 091±1.5 degree. LATITUDE PRESENT POSITION shows South integration. LONGITUDE PRESENT POSITION shows East integration. BDHI No. 2 pointer indicates 30±1 degrees right. BDHI No. 1 pointer indication depends on present position and destination data set in.

3. Turn function selector switch knob to STBY.

Note

In the STBY position, power is applied to all circuits except the present position integrator.

4. Turn function selector switch knob to D2. Using the electrical slew knobs, set in latitude and longitude destination counters to a destination. If the destination is the starting point, insert present position coordinates.

5. Turn function selector switch knob to STBY and set in D1 checkpoint or target latitude and longitude using the push-to-set or slew knobs.

6. Set in latitude and longitude of present position on present position counters using push-to-set knobs.

7. Set in magnetic variation with mechanical knobs. Variations in degrees and tenths of a degree.

8. Set in wind direction and velocity. Use climb winds.

Note

If the APN-153 doppler radar is to be used with ASN-41, step 8 need not be set in. This function will be automatically computed.

9. Leave function selector switch knob in STBY.

10. Set function switch on doppler control to STBY. Allow approximately 5-minute warmup. Turn function switch knob to TEST. If the system is operating properly, the memory light will go off, the ground speed indicator will show 121±5 knots. and the drift angle indicator will show 0±2 degrees.

Note

If above doppler test function is not acceptable, insert step 8 to complete the ASN-41 operation.

TAKEOFF

1. If planning to use an airborne starting point, leave ASN-41 function selector switch knob in STBY. and turn selector switch knob to D1 or D2 when passing over that point. If using takeoff point as the starting reference, switch the ASN-41 function selector switch knob to D1 or D2 immediately prior to takeoff roll.

Note

Minimum computer-operation airspeed for the ASN-41 is 100 KIAS. A negligible error in computer readout will result until aircraft accelerates to 100 KIAS.

2. Turn APN-153 function switch knob to either LAND or SEA position depending on the terrain over which the aircraft is flying.

3. When doppler operation locks-on (memory light out), the computer will switch to doppler mode and wind information will be automatically computed.

4. When the aircraft is over the starting point, set ASN-41 function selector switch knob to D1. The present position counters will start to integrate toward the target and the wind vector will be computed and displayed.

5. To fly great circle route (shortest route) to target, adjust aircraft heading to align with the No. 1 pointer on BDHI. Ground track (drift angle) is displayed by the No. 2 pointer. The distance counter on the BDHI indicates ground range and slant range to target or destination. To fly to a selected destination (D1 or D2), align the No. 1 pointer over the No. 2 pointer. Only in a no-drift condition will these pointers be aligned at the 12 o'clock position on the BDHI. Example: With the No. 1 pointer at the 12 o'clock position and No. 2 pointer to the right of this position, a right drift would be indicated. This would require a turn to the left to align the pointers. They would then be to the right of the 12 o'clock position when aligned.

6. New targets or checkpoints can be selected while airborne with the ASN-41 navigation computer system operating. Destination 1 selection can be changed by selecting D1 with the function switch and setting the coordinates of the new checkpoint in the destination window with the slew knobs. D2 coordinates can be changed in the same manner.

The ASN-41 can also be operated using D1 as the first target and D2 as the second target; then turning the function switch knob back to D1 position while enroute to the second target and setting a third target latitude and longitude in the destination window. Turn the function switch knob to D2 position and continue flight to the second target. When over second target, switch again to D1 position for flight to target three.

Another way of using the ASN-41 is to set the point of intended landing in D2 destination window and use D1 position for all checkpoints. Upon arrival at a checkpoint, set latitude and longitude of next checkpoint in destination windows utilizing the slew knobs with the function switch knob left in D1 position at all times until ready to proceed to point of intended landing when D2 is selected. This method provides instantaneous bingo information from any point on the route by merely shifting to the D2 position.

In order to precisely set preset position upon completion of mission over target (D1), make a long enough turn to approach the entry point of the second leg with a minimum of 2 minutes of level flight and the two pointers on BDHI aligned. Make any changes necessary to make present position coordinates the same as the longitude and latitude on target 1. At crossover of the entry to second leg, rotate function selector switch knob to D2, keeping the pointers of BDHI aligned and fly to target.

IN-FLIGHT. Monitor the navigation system and, if necessary, update the following situations:

1. If the doppler radar is off for a considerable time, the wind data can be manually updated, using the predicted wind information from the flight plan. To update the wind data in this case, it is necessary to turn the APN-153 to OFF or STBY and update the wind data on the ASN-41. Otherwise, it is necessary to compute the drift angle and groundspeed and insert them in the APN-153 with the push-to-set switches on the APN-153 control box to change wind data in the ASN-41.

APN-154(V) RADAR BEACON

The APN-154(V) radar beacon is the airborne radar portion of a ground-based radar aircraft navigational system. The airborne radar beacon extends the range capability of the interrogating ground-based radar for locating the aircraft relative to position and distance from the point of interrogation. Transmissions from the interrogating ground-based radar can be noncoded or coded depending upon the selected mode of operation. Five different coded transmissions can be used. The radar beacon decodes the interrogation and sends a reply. Controls for remote operation of the radar beacon are located on the GCBS control panel.

APN-154(V) Radar Beacon Controls

The APN-154(V) radar beacon controls, located on the GCBS control panel (figure FO-1), include a beacon toggle switch, with two positions marked OFF and BEACON, and a mode rotary switch, with two modes marked SINGLE and DOUBLE. The SINGLE mode position is used for noncoded operation, and the DOUBLE mode has positions 1, 2, 3, 4, and 5 for coded operation. Standby power to the radar beacon is controlled with the rotary CHAN (channel) selector switch. When the beacon switch is in the OFF position and the CHAN selector switch is set at any position other than 0, the radar beacon is in standby mode but is not operating. The radar beacon is operating when the beacon switch is set in the BEACON position.

APG-53A RADAR SYSTEM

The APG-53A radar system (figure 1-18) provides the pilot with search or mapping capabilities for navigational purposes, two modes of terrain clearance for obstacle avoidance in either the azimuth or elevation plane, and air-to-ground slant range for weapons delivery. Automatic fire control is not provided.

Operating controls are provided on the radar control panel located on the left console, on a small radar switch panel installed near the center of the bottom edge of the instrument panel, and around the perimeter of the azimuth-elevation-range indicator (scope) mounted in the instrument panel.

Four modes of operation are available for pilot selection: standby, search, terrain clearance, and slant range. In search mode, the B scope presentation is utilized; in terrain clearance mode, B scope presentation is used for PLAN and E scope presentation is used for PROFILE, while slant range mode is presented as a vertical sweep range bar.

Note

When using terrain clearance mode, both PROFILE and PLAN must be used for obstacle avoidance.

Radar Components

Figure 1-18 illustrates the components of the radar set. The pilot actuated controls, azimuth-elevation-range indicator (scope) and lights are shown at the top of the figure. Remotely located components are shown in the lower portion. The radar set operates on a 115-vac, 3-phase, 400-cps power supplied by the aircraft generator.

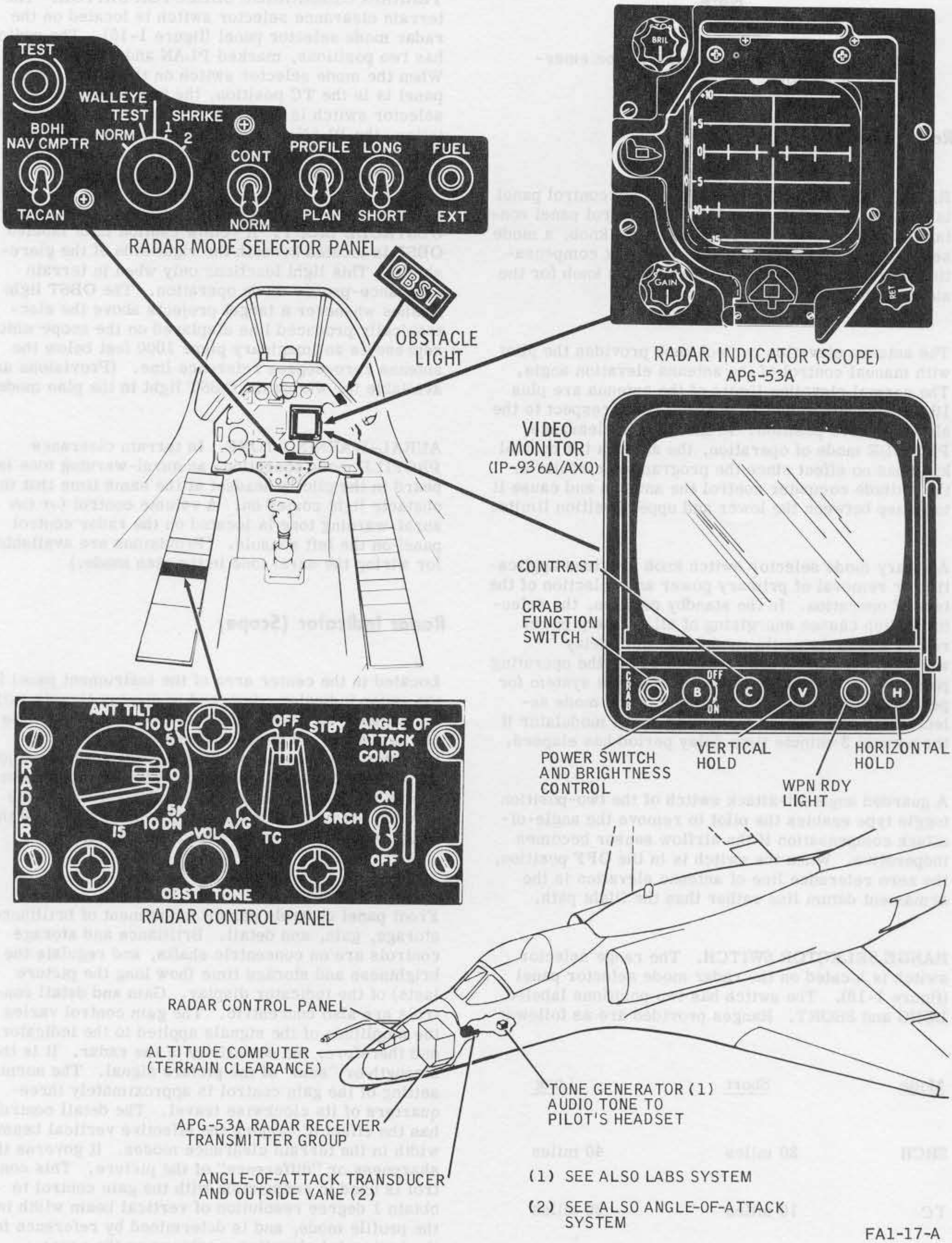


Figure 1-18. APG-53A Radar System

Note

The radar system will not operate on emergency generator.

Radar Controls

RADAR CONTROL PANEL. The radar control panel is located on the left console. The control panel contains a rotary antenna elevation control knob, a mode selector switch knob, an angle-of-attack compensation toggle switch, and a volume control knob for the aural-warning tone.

The antenna elevation control knob provides the pilot with manual control of the antenna elevation angle. The normal elevation limits of the antenna are plus 10 degrees and minus 15 degrees, with respect to the elevation zero position. In the terrain clearance PROFILE mode of operation, the antenna tilt control knob has no effect since the programing circuits in the altitude computer control the antenna and cause it to sweep between the lower and upper position limits.

A rotary mode selector switch knob provides application or removal of primary power and selection of the type of operation. In the standby position, the selector switch causes energizing of all primary power relays and initiates the modulator time delay warmup) period. When turned to one of the operating positions, the selector switch sets up the system for performing the required functions in the mode selected and also allows energizing of the modulator if the normal 3-minute time delay period has elapsed.

A guarded angle-of-attack switch of the two-position toggle type enables the pilot to remove the angle-of-attack compensation if the airflow sensor becomes inoperative. When the switch is in the OFF position, the zero reference line of antenna elevation is the armament datum line rather than the flight path.

RANGE SELECTOR SWITCH. The range selector switch is located on the radar mode selector panel (figure 1-18). The switch has two positions labeled LONG and SHORT. Ranges provided are as follows:

Mode	Short	Long
SRCH	20 miles	40 miles
TC	10 miles	20 miles
A/G	15,000 yards	15,000 yards

TERRAIN CLEARANCE SELECTOR SWITCH. The terrain clearance selector switch is located on the radar mode selector panel (figure 1-16). The switch has two positions, marked PLAN and PROFILE. When the mode selector switch on the radar control panel is in the TC position, the terrain clearance selector switch is functional. For a B-scope presentation, the PLAN position is selected, and for an E-scope presentation, the PROFILE position is selected (figure 1-20).

OBSTACLE LIGHT. A yellow caution light labeled OBST is located beneath the right side of the glare-shield. This light functions only when in terrain clearance-profile mode operation. The OBST light flashes whenever a target projects above the electronically produced line displayed on the scope which represents an imaginary plane 1000 feet below the antenna zero-degree reference line. (Provisions are available for wiring the OBST light in the plan mode.)

AURAL-WARNING TONE. In terrain clearance PROFILE mode operation, an aural-warning tone is heard in the pilot's headset at the same time that the obstacle light comes on. A volume control for the aural-warning tone is located on the radar control panel on the left console. (Provisions are available for wiring the aural tone in the plan mode.)

Radar Indicator (Scope)

Located in the center area of the instrument panel is the radar indicator, designed to display targets with a brilliance sufficient to permit viewing without the use of a hood. In addition to the iatron tube, the indicator contains the necessary sweep circuits and the high-voltage power supply. Flag-type indicators, one on the left side in a horizontal aircraft and the other at the bottom in a plan-view aircraft, show the range scale being used. (See figure 1-19.)

Front panel controls permit adjustment of brilliance, storage, gain, and detail. Brilliance and storage controls are on concentric shafts, and regulate the brightness and storage time (how long the picture lasts) of the indicator display. Gain and detail controls are also concentric. The gain control varies the amplitude of the signals applied to the indicator, and therefore, the sensitivity of the radar. It is the strength or "sum" of the picture signal. The normal setting of the gain control is approximately three-quarters of its clockwise travel. The detail control has the effect of varying the effective vertical beam width in the terrain clearance modes. It governs the sharpness or "difference" of the picture. This control is used in conjunction with the gain control to obtain 1 degree resolution of vertical beam width in the profile mode, and is determined by reference to the horizontal elevation markings on the scope reticle. The reticle knob controls the illumination

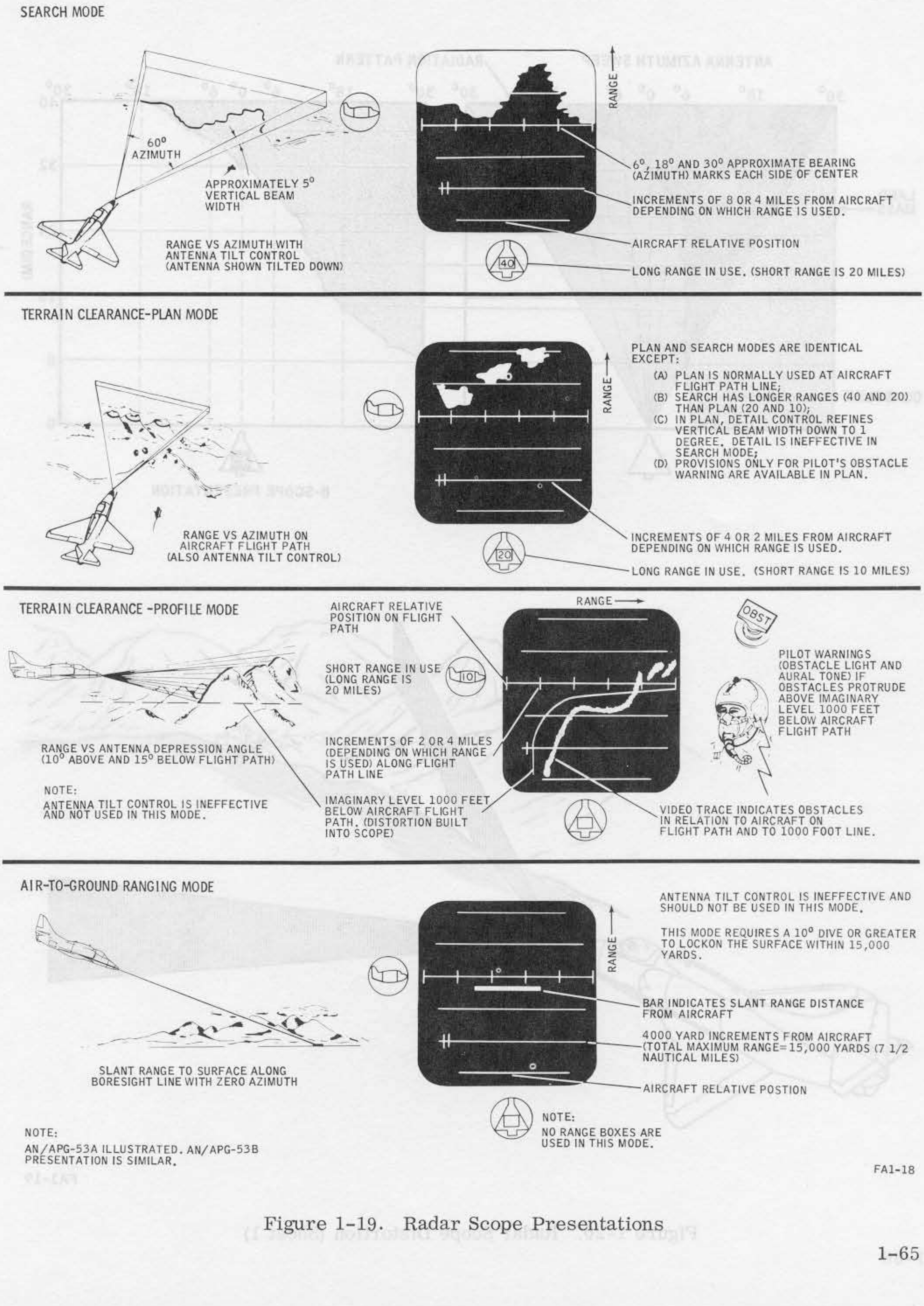
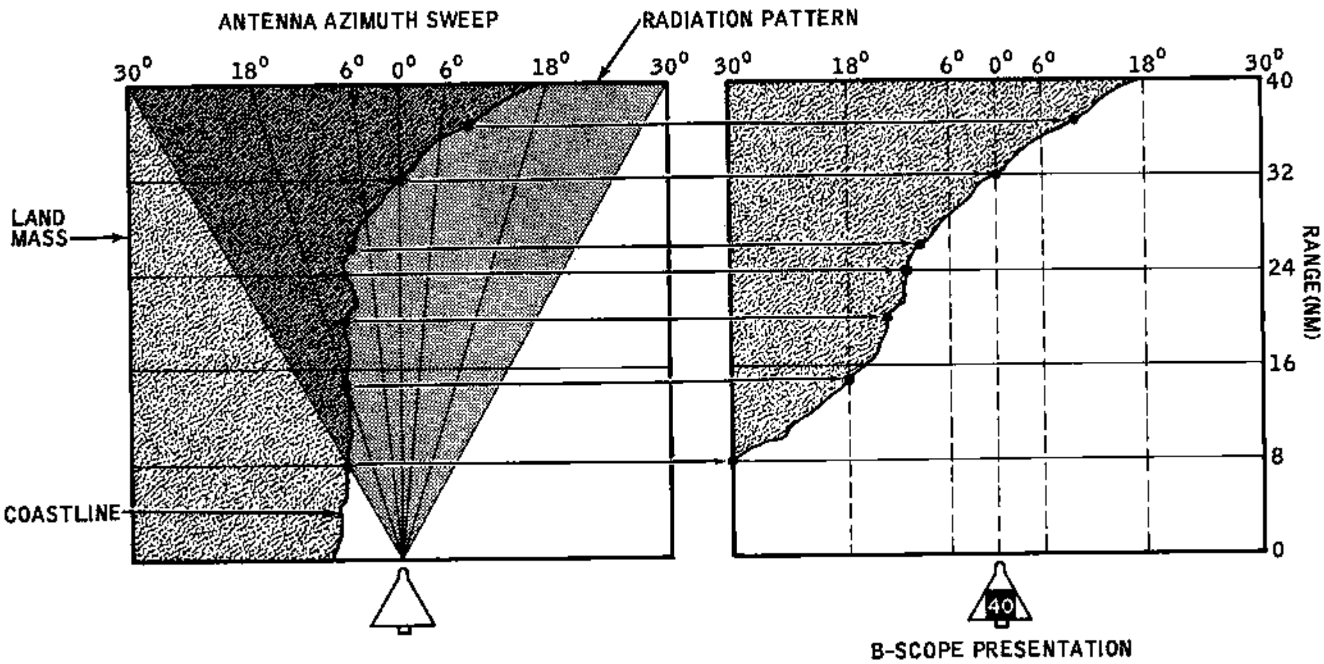


Figure 1-19. Radar Scope Presentations



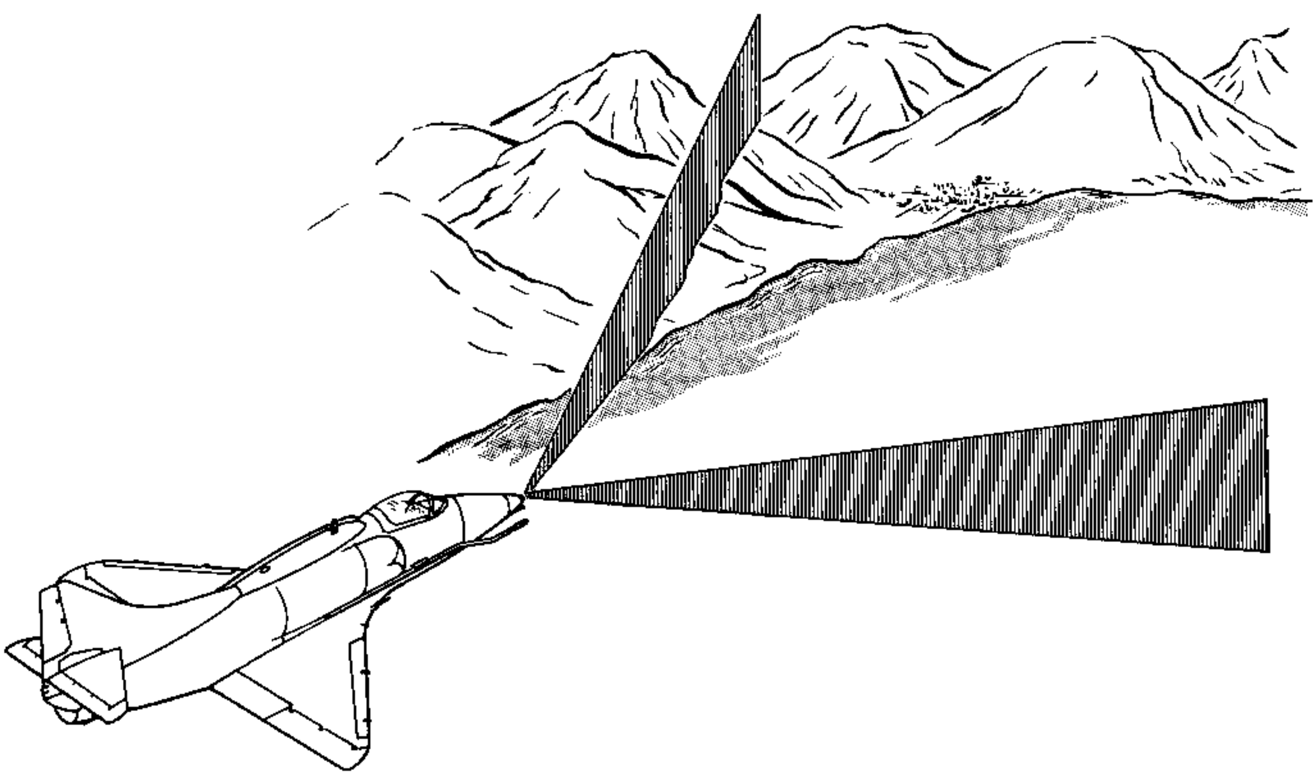


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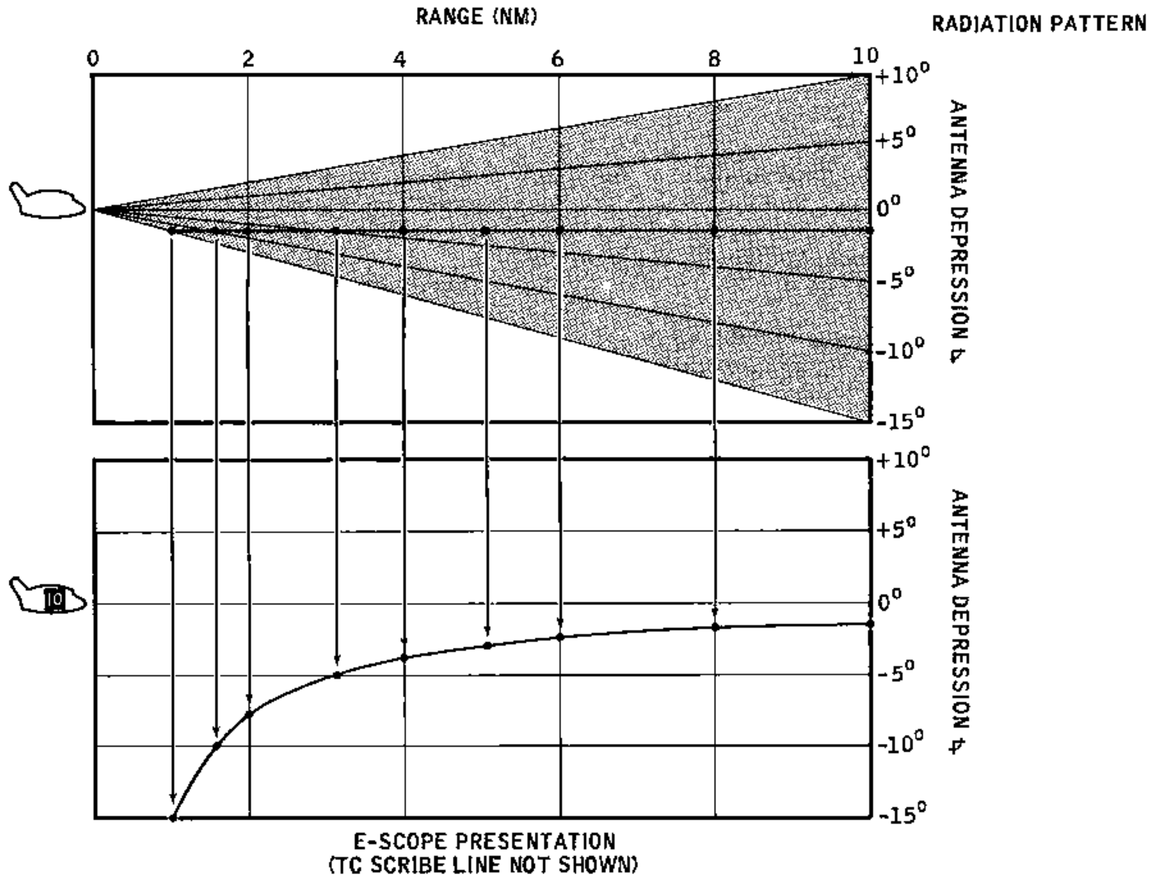
Figure 1-20. Radar Scope Distortion (Sheet 1)



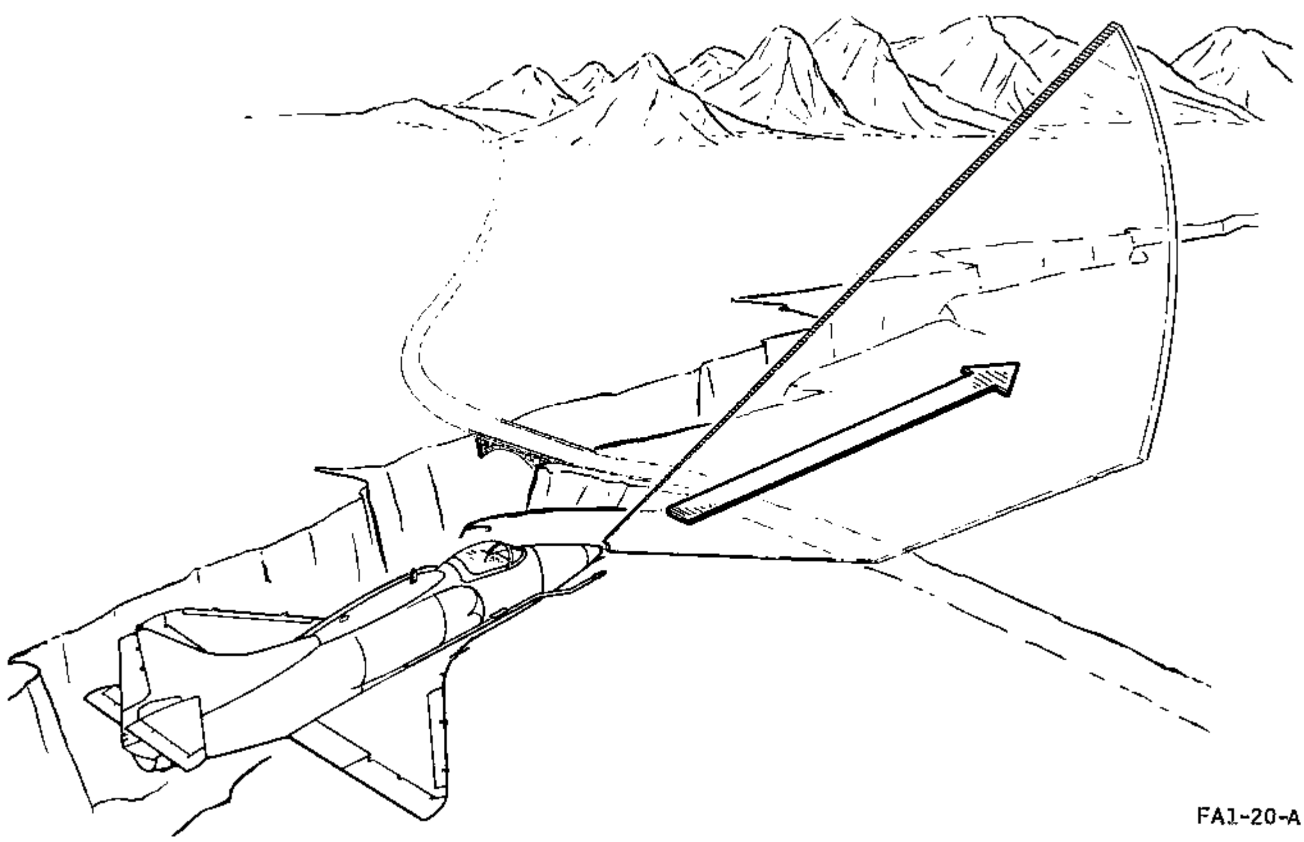


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Figure 1-20. Radar Scope Distortion (Sheet 2) of range-elevation-azimuth reference lines on the scope reticle for operation of radar in night lighting conditions.

Note

- Gain and detail controls have no effect in the air-to-ground mode.
- Detail control has no effect in the SRCH mode.
- Dimming of radar scope is completely independent of interior lights controls.

A red filter plate to cover the face of the scope is a Douglas addition to the APG-53A Radar Set. The filter is a red acrylic plate permanently secured to a spring-loaded hinge. It is used in the down position for night flying, to change the yellow-green target display to a red display to coincide with the red instrument lighting. During daytime flying, the plate is manually raised away from the face of the indicator (scope) so that a normal (yellow-green) display is seen.

Operating Modes

SEARCH MODE. The search mode presentation displays range versus azimuth. Either 0- to 20-mile range or 0- to 40-mile range in nautical miles may be selected. The range in use is shown by a flag-type marker in the plan-view aircraft at the bottom of the scope. The indicator face is divided by horizontal lines, each representing one-fifth of the total range.

With the range switch in the LONG position, the bottom (minus 15 degrees) line is zero range and the top (plus 10 degrees) line is 40 miles. This gives a calibration line every 8 miles.

With the switch at the SHORT position, each division represents 4 miles.

In SRCH, the radar antenna is programmed to sweep 60 degrees in azimuth using a 5 degree cone of radiation at the elevation angle (antenna tilt) selected by the pilot. Vertical marks on the zero elevation line of the reticle show the approximate bearing to any point on the display. The marks represent 6, 18, and 30 degrees each side of center. The antenna elevation is set by the pilot and may be varied from 10 degrees above to 15 degrees below the flight path (angle-of-attack switch ON).

Turning the antenna tilt control moves the radar antenna up or down. This function is an aid to search and ground mapping procedures. In the search mode, the antenna will remain in the position indicated by the antenna tilt control. A friction device prevents the tilt control from returning to zero until the pilot manually repositions it or the mode selector on the control panel is moved from SRCH to the TC position.

The search mode display is a B-scope presentation (range vs azimuth) of the terrain ahead of the aircraft.

Targets will appear on the scope as bright yellow-green spots. Surfaces which reflect little energy back to the radar, such as smooth water, appear on the scope as dark or unlighted areas. The result is a maplike display which is linear in the range coordinate but distorted in azimuth by a factor which is inversely proportional to range. This distortion is due to presentation of the conical radiation pattern as a rectangular display on the scope (see figure 1-20). Coast lines, islands, lakes, wide rivers, and highly reflective areas such as cities or factory complexes may be used to aid navigation when operating above an overcast or in reduced visibility, and at an altitude that ensures safe terrain clearance. The 40-mile range provides for long-range identification of coastlines. The 20-mile range permits detailed examination of closer objects. Range is attenuated as altitude is reduced so that at 1000 feet above level terrain, target return is reduced to about 18 miles except for specific targets at greater range with significant vertical development.

Brilliance and storage, can be changed at any time to get the best picture, depending upon varying cockpit lighting conditions. Normally, the gain setting should be established by "snowing" the scope, then reducing the setting to a point where only a trace of snow remains. As tilt control is changed, usually gain control will require readjustment to create the desired scope sensitivity for the range (tilt) selected. As the antenna is depressed, the gain must be reduced (counterclockwise). If only the highly reflective areas are of interest, the gain setting is reduced until only such areas are displayed.

TERRAIN CLEARANCE-PLAN MODE. With the profile-plan switch in the PLAN position, the rotary mode selector switch in the TC position, and the angle-of-attack switch ON, the indicator (scope) provides a B-scope (range-versus-azimuth) presentation of obstacles in the projected flight path of the aircraft.

The terrain clearance PLAN display is provided to enable the pilot to maneuver around obstacles rather than over them.

Azimuth scan is 60 degrees using a beam width of 5 degrees and a vertical beam width effectively reduced to 1 degree by means of the detail control on the scope.

The vertical width of the beam is determined by the setting of the detail knob on the indicator. With the knob fully counterclockwise, beam width is approximately 5 degrees; fully clockwise, beam width approximates 1/2 of 1 degree. The scope will display only those obstacles that are within the beam. If the antenna tilt control is at zero degrees and the angle-of-attack switch is in ON, the objects shown will be in a plane that contains the projected flight path and is parallel to the lateral axis of the aircraft. With the angle-of-attack switch OFF, the objects will be in the plane of the armament datum line. Only radar return from the near slope of mountains is received so the presentation is usually patchy as shown in figure 1-20.

The pilot may examine terrain above or below the flight path (or ADL) by manually adjusting the tilt control to the desired setting (from plus 10 degrees to minus 15 degrees). However, the tilt control knob is spring loaded in the TC modes and will return to zero when released.

Available for selection are ranges of 0 to 20 or 0 to 10 nautical miles (LONG or SHORT).

The range in use is indicated by a flag-type marker in the plan-view aircraft at the bottom of the scope as in SRCH mode. The horizontal lines on the indicator face each represent one-fifth of the total range. With the range switch at LONG, each calibration line represents 4 miles; in the SHORT position, 2 miles. Azimuth markings are identical to search mode; 6, 18, and 30 degrees to the left or right of the aircraft heading.

TERRAIN CLEARANCE - PROFILE MODE. With the presentation switch at PROFILE and the rotary mode selector switch at TC, the indicator (scope) provides an E-scope (range versus antenna depression angle) display of the terrain profile ahead of the aircraft. The radar beam automatically locks in azimuth and sweeps in elevation from plus 10 degrees to minus 15 degrees using a beam width of 5 degrees and a vertical beam width effectively reduced to 1 degree by means of the detail control on the scope.

The elevation zero is normally referenced to the flight line by including an angle-of-attack correction in the servo loop. This provides for an extended antenna sweep up to a maximum of plus 11 degrees to minus 19 degrees from the armament datum line (antenna sweep limits). In the event the angle-of-attack sensor vane becomes damaged, frozen, or inoperative, the angle-of-attack switch is provided to lock the zero reference line with the armament datum line. The antenna tilt control does not function in this mode.

The LONG-SHORT range switch provides either 20- or 10-mile ranges for sufficient detail under various conditions. Vertical marks on the horizontal zero-degree elevation line divide the display into 2- or 4-mile segments according to the range in use. A flag-type marker in the aircraft silhouette at the left of the scope shows which range is in use.

A solid line representing an imaginary plane 1000 feet below the antenna zero-degree elevation line is electronically displayed on the indicator as an aid to low-level navigation. This is the terrain clearance scribe line (see figure 1-20) and is synchronized with the elevation sweep. The zero-degree elevation line of the indicator reticle represents the instantaneous forward projection of the aircraft flight or armament datum line depending on the position of the angle-of-attack switch. Since the vertical calibration is in degrees of antenna depression angle rather than in feet of altitude, the resulting expansion of the conical radiation pattern into a rectangular display causes the 1000-foot marker and radar target return to curve downward at the low-range end of the indicator.

An irregular line display is the radar return. Assuming level terrain and by flying so that the radar return presentation is parallel to the 1000-foot marker, it is possible to fly at a constant altitude above level terrain.

The PROFILE function also incorporates both visual and aural warning to the pilot when obstacles protrude above a horizontal plane positioned 1000-feet below and parallel to the antenna zero-degree reference plane.

The obstacle alarm consists of both the obstacle light and the pilot's headset signal, warning the pilot that a potential hazard exists.

The alarm is controlled by the same circuits that control the 1000-foot terrain clearance scribe line and warns if any obstacle appears above it. A rough indication of the range to the target is provided by the percentage of time that the alarm is actuated. Targets near maximum range will give short blinks and as the target comes closer, the light will remain on for longer periods.

Note

By comparing the presentations in the PLAN and the PROFILE modes, the pilot can quickly decide whether to change elevation or bearing to avoid obstacles.

WARNING

- When flying 1000 feet terrain clearance at normal low-level airspeeds, crosswind component of 9 knots or more can cause a drift rate that would preclude displaying obstacles in the ground track of the aircraft in PROFILE mode. To prevent inadvertent collision with an obstacle, it is necessary to shift to PLAN mode to scan the 60-degree forward sector at intervals of 1 minute or less unless flying over known level terrain.

- Whenever possible, boresight should be checked at 1000 feet above terrain after each radar mission takeoff.

The PROFILE display also provides an aid to letdown under conditions of reduced visibility. The letdown is accomplished simply by descending at the desired schedule until the radar return intersects the 1000-foot terrain clearance scribe line at a range of 6 miles when operating on LONG range. The dive angle is then continuously readjusted to maintain the intersection of radar return and TC scribe line at 6 miles. This results in a gradual reduction in dive angle (and rate of descent) until in straight and level flight 1000 feet above the terrain.

Air-To-Ground Mode

Note

When the CP-741/A (Weapons Release Computer) is used, the air-to-ground (A/G) mode can be used for slant range input to the computer.

With the mode selector switch in the A/G position, the indicator (scope) shows the distance to the ground dead ahead. The antenna is automatically fixed in the azimuth zero position and is parallel to the armament datum line in the elevation coordinate. When the antenna boresight line and the sight line are made parallel (zero mil lead), the range indication will show the distance to the point on the ground at which the sight is aimed. The angle between the ground and the antenna boresight line should be at least 10 degrees to provide adequate radar return for ranging lock-on.

If the distance to the ground exceeds the radar lock-on range, the horizontal line will search from the top of the scope to the bottom. When ground lock-on occurs the line will stop cycling and, as the slant range decreases, the bar will move downward. The solid horizontal bar gives the pilot the approximate slant range in yards. The total maximum range in the A/G mode is 15,000 yards (approximately 7 1/2 nautical miles. The aircraft relative position is at the bottom line on the scope (minus 15 degree elevation line). After range lock-on of the horizontal bar, slant range can be read by reference to the horizontal lines etched on the reticle each of which represents a range increment of 4000 yards.

Ground Procedure

PREFLIGHT. Position controls as follows:

1. Radar control panel mode selector switch . . . . OFF

Antenna tilt control. . . . . zero degrees

Angle-of-attack switch . . . . OFF

2. Radar indicator brilliance knob. . . . . full-clockwise

Gain knob . . . . full counter-clockwise

Storage knob	full-clockwise
Detail knob	full counter-clockwise
Reticle knob	full counter-clockwise
3. Radar switch panel range switch	LONG
TC PLAN-PROFILE switch	PROFILE

BEFORE TAKEOFF. Test the scope presentations as follows:

1. Mode selector switch . . . . STBY
(Allow 3 minutes for equipment warmup.)

2. Mode selector switch . . . . SRCH

3. Antenna tilt switch . . . . minus 6 degrees

4. Turn gain control knob clockwise until targets appear.

5. Position range switch at SHORT. Presentation should double in size. Confirm that flag indicates 20 miles.

6. Position mode selector switch at TC. Confirm that flag indicates 10 miles. Antenna tilt control should zero. Turn gain knob clockwise until targets appear to be 5 degrees in vertical dimension. Turn detail knob clockwise until targets are reduced to 1 degree in vertical dimension. Tails should be disregarded in any 1-degree analysis.

7. Observe terrain clearance line on scope. Position range selector switch to LONG. Confirm that terrain clearance line moves to the left and slightly up.

8. Position mode selector switch to A/G and confirm that horizontal line on scope sweeps from top to near bottom.

9. Position the mode selector switch to OFF.

In-Flight Procedure

IN-FLIGHT TEST. A brief operational check during the first part of each tactical flight is recommended.

SEARCH MODE. Make sure that ac power is available (note that the all-attitude indicator flag is not visible after a 90-second warmup).

1. Mode selector switch . . . . STBY

Note

A 3-minute warmup procedure is required.

2. Angle-of-attack switch . . . . ON

3. Antenna tilt control. . . . . desired setting

4. LONG-SHORT range switch . . . . desired range

5. Mode selector switch . . . . SRCH

6. Brilliance, storage, and gain knobs . . . . desired picture

Note

- The PLAN-PROFILE switch is not functional in SRCH mode.
- There is no obstacle alarm in the SRCH mode.

TERRAIN CLEARANCE-PROFILE MODE. After observing the radar set operating properly in search mode, or after performing step 1 of the search mode procedure, perform the following steps:

1. Angle-of-attack switch . . . . OFF

2. Mode selector switch . . . . TC

3. PLAN-PROFILE switch . . . . PROFILE

4. LONG-SHORT range switch . . . . . SHORT

5. Brilliance and storage knobs . . . . desired picture

6. Gain and detail knobs . . . . adjust for 3-degree beam resolution

7. Angle-of-attack switch . . . . ON (Target return should shift dependent upon aircraft angle of attack.)

TERRAIN CLEARANCE-PLAN MODE. After tuning set in PROFILE and observing the radar set operating properly, shift to PLAN. Point the aircraft at an obstacle or at the ground to provide a target within the range selected and note proper display on the indicator.

Note

No change in gain, detail, brilliance, or storage is required when changing between PLAN and PROFILE operation or between LONG and SHORT range.

AIR-TO-GROUND MODE. After observing the radar set operating properly in search, or the TC modes, or after performing step 1 of the search mode procedure, perform the following steps:

1. Mode selector switch . . . . A/G

2. Brilliance and storage knobs . . . . desired picture

3. Initiate a dive of 10 degrees or greater so that the optical sight line intercepts the ground within 7 1/2 nautical miles. The horizontal bar on the scope should stop sweeping and begin to indicate the slant range between the nose of the aircraft and the intersection of the optical boresight line with the ground. Any type of terrain or choppy water is an acceptable target.

Note

- The LONG-SHORT switch, the PLAN-PROFILE switch and the gain and detail knobs are not functional in the air-to-ground mode.
- There is no obstacle warning in the air-to-ground mode.

Emergency Operation and Malfunctions

The angle-of-attack switch enables the pilot to remove the angle-of-attack compensation for line-of-flight reference for the various modes if the airflow sensor becomes inoperative. With the angle-of-attack switch in the OFF position, the zero line on the indicator is referenced to the armament datum line rather than to the flight path.

Because of its importance to the execution of the mission, the radar system has been designed so that many in-flight failures may be compensated for by normal pilot control adjustments. At any instant, the terrain clearance PROFILE mode presentation will indicate whether the equipment is transmitting, the location of the obstacle warning horizontal plane (normally positioned 1000 feet below the aircraft), and the instantaneous beam width of the system. For example, if the terrain return has widened, it can be corrected by advancing the detail knob clockwise. In the event of trouble in this channel which the detail knob will not compensate, the system may still be flown with the widened beam; but the widened video trace will cause the pilot to fly the aircraft higher than normal.

IP-936A/AXQ Video Monitor

To provide Walleye system capability, an IP-936A/AXQ video monitor (figure 1-18) may be installed in place of the APG-53A radar scope. The IP-936A/AXQ video monitor has no radar presentation capability and operates only in the television mode.

Note

Detailed description and operating procedures are incorporated in NAVAIR 01-40AV-1T.

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

The automatic flight control system (AFCS) is a completely transistorized system designed to provide pilot relief from routine control of the aircraft (figure 1-21). The AFCS will maintain heading, altitude and pitch and bank angles, and perform a coordinated turn to a preselected heading without use of the pilot control stick. These functions utilize attitude and direction information from the AJB-3A all-attitude flight reference and bombing system. Without moving a switch or disconnecting the AFCS, the pilot can maneuver the aircraft in an unlimited manner throughout the AFCS envelope by using the control stick as in normal flight. Directional stability augmentation is active during AFCS operation or can be selected separately while on normal flight control. This yaw damping action is independent of pilot movement of the rudder pedals.

The AFCS has safety features which function automatically to ensure satisfactory operation and to prevent a system malfunction from damaging the aircraft or displacing the ailerons excessively. There are operating components which sense aircraft attitude and performance, and convert electrical control and correction input signals to mechanical signals for use by the aircraft hydraulic control surfaces. The hydraulic servos require utility system hydraulic power.

The AFCS is an electro-hydraulic system requiring all three phases of the 115/200-vac, 400-cycle power and 28-vdc power. Normal hydraulic system pressure of 3000 psi is reduced to 1500+75, -50 psi for the aileron and elevator servos and to 1150+450, -50 psi for the dual input rudder valve. The AFCS will not operate on the emergency generator and will not engage unless proper electrical and hydraulic power is available. It will disengage automatically if the electrical or hydraulic power fails.

AUTOMATIC FLIGHT CONTROL PANEL

The control panel (figure FO-1) is labeled AFCS and is located on the left console.

Standby Switch

The standby switch positions are marked STANDBY and OFF. The STANDBY position is used for AFCS warmup and automatic control synchronization to prevent engage transients. Prior to engaging the stability augmentation switch or the AFCS engage switch, the standby switch should be in STANDBY for at least 30 seconds. When the standby switch is placed in the OFF position, all switches on the panel return to the OFF position automatically.

Engage Switch

The engage switch positions are marked ENGAGE and OFF. The ENGAGE position turns on the AFCS to initiate the basic modes of attitude hold and heading hold. In addition, the pilot can further select the modes of control stick steering, altitude hold, and/or preselect heading.

The ENGAGE position should not be selected until the standby switch has been in STANDBY for at least 30 seconds. The AFCS will not engage until the all-attitude indicator OFF flag disappears. The engage switch may be placed in the OFF position at any time.

When the engage switch is placed in the OFF position both the heading select switch and the altitude switch return to the OFF position. An abrupt lateral stick force of 40 pounds causes the aileron servo to bypass, which effectively disengages the AFCS lateral controls. The engage switch does not move from the ENGAGE position. Laterial control of the aircraft is then provided by the normal control system. To reengage the lateral servo, cycle the engage switch to the OFF position and then return to the ENGAGE position. This operation may be performed at any time.

Pressing the AFCS override button (AP) on the control stick causes the engage switch and all mode switches to move automatically to the OFF position. The AFCS can be reengaged by moving the engage switch to ENGAGE.

Heading Select Switch

The heading select switch positions are marked HDG SEL and OFF. When preselect heading mode operation is desired, the HDG SEL position is selected. The aircraft turns by the shortest route to the heading selected on the heading select indicator. Desired headings are set in the heading select indicator with the SET knob. The OFF position can be selected at any time. If the switch is placed in the OFF position prior to completion of a turn, the aircraft will roll smoothly to a wings level attitude and maintain the compass heading indicated at that time. If the SET knob is used to change the heading on the indicator while the switch is in the HDG SEL position, the following can occur:

1. If the aircraft is in level flight, sudden SET knob movement will result in abrupt aircraft lateral movement. If the SET knob is moved very slowly, small heading changes can be made satisfactorily.

2. If the aircraft is already in a preselect heading turn, the SET knob may be moved at any rate if the new selected heading is in the same direction as the

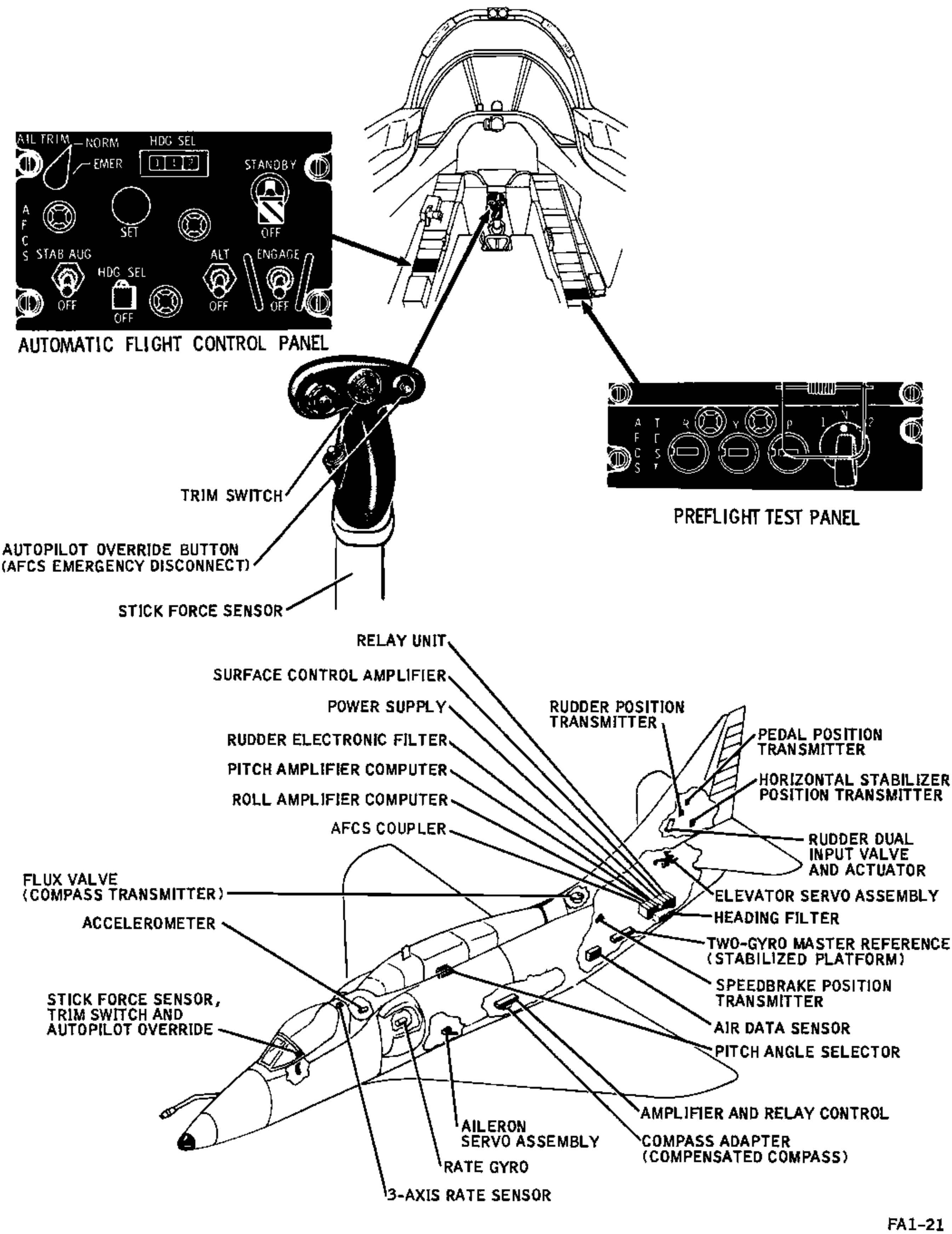


Figure 1-21. Automatic Flight Control System

turn and is less than 180 degrees away from the compass heading at the time of selection. Selection of a heading reciprocal to the present aircraft heading will cause the aircraft to reverse the turn abruptly. The HDG SEL switch will automatically move to the OFF position if the control stick steering mode is engaged.

Note

Pilot use of the SET knob within 5 seconds after placing the HDG SEL switch in the OFF position will cause an abrupt roll transient.

Upon engaging the HDG SEL switch, the approximate pitch attitude will be maintained during the turn. If a level turn is desired, the altitude hold mode should be engaged by moving the altitude switch to ALT.

Altitude Switch

The altitude switch positions are marked ALT and OFF. If altitude hold mode is desired, the ALT position is selected. When the mode is engaged in a climb or dive, the aircraft will return to the barometric altitude existing at the time of altitude switch engagement. The altitude switch cannot be engaged in climbs or descents in excess of 4000 feet per minute. The mode cannot be engaged if any force is being applied to the control stick. The switch will move automatically to the OFF position whenever control stick steering mode is engaged.

Stability Augmentation Switch

The stability augmentation switch positions are marked STAB AUG and OFF. Yaw damping action is provided when the stability augmentation switch is in STAB AUG or when the engage switch is in ENGAGE.

Aileron Trim Normal-Emergency Switch

The aileron trim switch labeled AIL TRIM has two positions, NORM and EMER. The switch is usually in the NORM position. If aileron trim is not available when the AFCS is disengaged, placing the switch in EMER restores aileron trim capability. Movement of the switch to EMER disengages and prevents reengagement of the AFCS; however, stability augmentation can be engaged. The AFCS can be reengaged after placing the switch in NORM.

AFCS PREFLIGHT TEST PANEL

The AFCS preflight test panel (figure FO-1) is located on the right console. The three indicators R, Y, and P measure dc control current to the AFCS servos for roll, yaw, and pitch respectively. The 1-N-2 switch is provided to obtain two test conditions. The switch is spring loaded in the N (normal) position and must be held in either test position 1 or test position 2. All test procedures are covered in PREFLIGHT PROCEDURE.

Note

The 1-N-2 switch must be in N position for normal AFCS operation.

CONTROL STICK

Autopilot Override Button

The control stick has an AFCS override button labeled AP. Pressing this button immediately disengages the entire AFCS.

Sensor

Within the control stick is a force sensor which transmits signals of pilot applied stick forces to the control stick steering function of the AFCS.

Control Stick Trim Switch

The control stick trim switch, which is used to trim the aircraft in roll and pitch during normal flight, is inoperative during all AFCS modes except control stick steering. During the control stick steering mode, the lateral trim signal causes a trimming adjustment within the autopilot and not within the aileron power control as in normal control system use. All pitch trim signals operate the horizontal stabilizer whether on control stick steering mode or normal flight controls.

Note

The control stick trim switch should be used with normal technique when control stick steering mode is engaged. Transients are minimized during disengagement or reengagement of control stick steering if the aircraft is correctly trimmed at that time.

AFCS MODES

The following modes of operation provide automatic flight control.

Control Stick Steering (CSS) Mode

The CSS mode provides for longitudinal and lateral control of the aircraft through the AFCS by pilot movement of the stick as in normal flight. CSS mode is engaged regardless of other modes selected or in operation by applying a force on the control stick grip of 2 pounds or more. Preselect heading and altitude hold modes are disengaged by use of CSS and they must be reengaged to be used again. The AFCS reverts from CSS mode to either attitude hold or heading hold mode when pilot force on the control stick is reduced below 2 pounds. The aircraft is controllable in all attitudes in CSS throughout the AFCS flight envelope, which is 4±1/2 positive-g, 1-1/2±1/2 negative-g, and one-half aileron deflection left or right. If these limits are exceeded, the AFCS disengages. The AFCS will not switch out of CSS at bank angles exceeding 70 degrees or pitch angles exceeding 60 degrees noseup or nosedown unless limits of acceleration or aileron deflection are exceeded.

Note

The control stick should not be released while in CSS if the pull-or-push force at the time exceeds 12 pounds because of large disengage transients. Transients are minimized if the aircraft is properly trimmed at the time of release.

Attitude Hold Mode

With an aircraft bank angle between 5 degrees and 70 degrees and a pitch angle less than 60 degrees noseup or nosedown, the aircraft lateral and longitudinal attitude at time of engagement of the AFCS or reversion from the CSS mode will be maintained.

Heading Hold Mode

If the pitch angle is within 60 degrees noseup or nosedown and the bank angle of the aircraft is less than 5 degrees upon engagement of the AFCS or reversion from CSS mode, the aircraft will be rolled to a level attitude and the heading and pitch angles at that time will be maintained.

Preselect Heading Mode

Upon engagement of the preselect heading mode after the heading has been preselected on the heading select indicator, the aircraft will roll into a smooth turn to the preselected heading and then roll out on this heading. The turn will always be in the direction of the shortest route to the preselected heading. The bank angle will be maintained at 27±5 degrees under all conditions.

Note

If the preselect heading mode is selected below airspeeds ranging from 160 KIAS at 10,000 feet to 200 KIAS at 40,000 feet, the fixed bank angle of 27±5 degrees may cause the aircraft to buffet in an approach to stall.

Stability Augmentation Mode

The stability augmentation mode provides rudder yaw damping action which is that of pilot movement of the rudder pedals. The mode can be selected at any time without other AFCS functions. It is also in operation automatically during all other AFCS functions. The pilot must trim the aircraft directionally while using the AFCS in the same manner as he would when on the normal flight control system. If the aircraft is out of trim directionally, the following will occur:

1. A lateral engage transient will occur during change to the control stick steering mode.

2. The aircraft will be in a steady heading side slip in the heading hold mode.

Altitude Hold Mode

The altitude hold mode may be engaged when the rate-of-change of altitude is less than 4000±500 feet per minute. The aircraft will maintain the altitude existing at engagement. If altitude hold mode is engaged during a climb or dive, the aircraft will automatically return to and maintain the altitude existing at engagement.

Ground Control Bombing Mode

Refer to NAVAIR 01-40AV-1T.

AUTOMATIC SAFETY FEATURES

The following automatic major safety features are incorporated in the AFCS.

Aircraft Structural Protection

The AFCS is automatically disengaged and the engage switch automatically moved to the OFF position when normal load factor approaches 4±1/2 positive g or 1 1/2±1/2 negative g, or when the aileron surface displacement exceeds 20 degrees, one-half lateral stick displacement from neutral. Normal acceleration values are reduced to 3 1/2±1/2 positive g and 1±1/2 negative g when a centerline store is carried, except when operating in CSS mode. (Refer to Control Stick Steering Mode.)

Note

> In response to hardover signals, the AFCS is disengaged with negligible upset in either noseup or nosedown attitudes. As a result of a hardover signal, the incremental load factors will vary between 0 g and 0.6 g for airspeeds up to Mach 0.85. Elevator surface rates in excess of 20 degrees per second disengage the AFCS with the same characteristics as hardover signals. For displacement rates of 5 degrees per second to 20 degrees per second at speeds in excess of 300 knots, structural limits are not exceeded. Altitude change from hardover to disconnect is less than 100 feet. This does not include the additional altitude necessary to recover to level flight.

AFCS Temporary Overpower

The AFCS can be overpowered temporarily laterally and longitudinally. Pilot application of 15 pounds longitudinal stick force will overpower the AFCS longitudinal control without affecting AFCS lateral or directional control. In the same manner a 35-pound lateral stick force will overpower the AFCS lateral control without affecting AFCS controls and will remain overpowered as long as the stick forces as noted are maintained.

Note

> The only occasion to use the overpower feature will probably be to counteract a failure within the AFCS that would cause large deflection of the elevator or aileron. Unless prevented by the failure noted above, the AFCS will engage the control stick steering mode when the stick force is applied, and will disengage this mode when the stick force is reduced below 2 pounds.

AFCS Lateral Hydraulic Disengage

The lateral AFCS control can be disengaged by applying a sudden sharp force laterally to the control stick. This lateral disengagement allows the pilot to provide lateral control through the normal system but does not affect AFCS longitudinal control. AFCS lateral control may be reengaged by cycling the engage switch to OFF and then returning it to the ENGAGE position.

Control Stick Disengage

Pressing the AP button on the control stick will disconnect the AFCS electrically. To reengage the AFCS, the engage switch is placed in ENGAGE.

AFCS PREFLIGHT PROCEDURE

The following preflight test procedure is recommended:

1. Landing gear handle . . . . DOWN
2. Engine rpm . . . . IDLE
3. All-attitude indicator power warning flag not visible.
4. Observe hydraulic power from movement of control surfaces and caution panel lights.
5. Standby switch. . . . . STANDBY
6. Aileron trim emergency switch . . . . NORM
7. Stability augmentation switch . . . . OFF
8. Heading select switch . . . . . . OFF
9. Altitude switch . . . . OFF
10. Engage switch . . . . OFF
11. 1-N-2 switch . . . . N
12. Heading select counter and set knob . . . . any preselected heading or position desired

Note

Two sets of preflight performance checks are provided here. The pilot should make the following four MANDATORY CHECKS before each flight when time is limited. If there is sufficient time available or after reworking or overhauling of the autopilot system, the COMPLETE PERFORMANCE CHECKS consisting of 18 items should be made.

AFCS Mandatory Checks

The following four checks are made with the 1-N-2 switch held in position 2 and with the engage switch in ENGAGE.

1. Check the aileron limit switch by moving the control stick right. At about half deflection, the engage switch should automatically return to the OFF position, disengaging the AFCS. After centering the control stick, place the engage switch in ENGAGE and repeat the same check to the left. The results should be the same.

2. Check the load factor monitor limit switch by displacing the control stick trim switch right. The engage switch should automatically return to the OFF position, disengaging the AFCS. After centering the control stick with the trim switch, place the engage switch in ENGAGE and repeat the same check to the left. The results should be the same.

3. Check the trim monitor switch by moving the control stick aft (noseup) and displacing the horizontal stabilizer trim toward NOSE UP. The engage switch should automatically return to the OFF position, disengaging the AFCS. After centering the control stick, place the engage switch in ENGAGE. Move the control stick forward (nosedown), and displace the horizontal stabilizer trim toward NOSE UP. The results should be the same.

4. Depress AP button. The engage switch should automatically return to OFF position disengaging the AFCS.

The pilot will know from the above tests that he has electrical power to the AFCS servos and that the safety circuits are operating.

5. Turn standby switch to OFF. Leave switch at OFF for takeoff.

Note

If all four AFCS mandatory checks are not satisfactorily completed, the AFCS STANDBY-OFF switch should be placed in the OFF position. STAB-AUG will not be available with the STANDBY switch in the OFF position.

AFCS Complete Performance Checks

It is recommended that the following checks be made in the sequence given. There are four checks in TEST POSITION 1 and 14 checks in TEST POSITION 2. The 18 checks should be made if there is adequate time or after reworking or overhauling the autopilot system.

TEST POSITION 1 CHECKS. Hold the spring-loaded 1-N-2 switch in test position 1 until the following four tests have been completed. (The AFCS is unsynchronized.)

1. All three pointers (R, Y, and P) should deflect upward and remain positioned upward. This shows dc control current to the autopilot servos and indicates proper direction for surface movement.

2. Push on the right rudder pedal. The indicator needle in the Y (yaw) window should move from the upward position to a full down position. Sluggish rudder operation will be apparent, but is normal.

3. Place the engage switch in the ENGAGE position. It should not engage, because the AFCS should never engage while in an unsynchronized condition. If the switch does not return to the OFF position, report the trouble.

4. Place the stability augmentation switch in the STAB AUG position. It should remain engaged rather than return to OFF. Return switch to OFF position when test is completed.

TEST POSITION 2 CHECKS. Hold the spring-loaded 1-N-2 in test position 2 until the following 14 checks have been completed. (The AFCS is still unsynchronized.)

1. All three pointers (R, Y, and P) should again deflect upward and remain positioned upward.

2. Place the stability augmentation switch in the STAB AUG position. It should engage, but the (Y) indicator for rudder should null (go to the center) because test position 2 closes the rudder loop. Leave the switch in the STAB AUG position for later checks.

3. Place the engage switch to the ENGAGE position. It should engage and the switch should remain engaged, because test position 2 allows engagement in the unsynchronized condition by bypassing the synchronizing monitors that normally protect the aircraft from engage transients (jumping). A small stick jump or movement normally accompanies engagement in position 2.

4. With the engage switch in the ENGAGE position (as in step 3), the P and R indicators for pitch (elevator) and roll (aileron) should null because the pitch and roll loops have been closed in test position 2.

5. Move the control stick for roll and pitch. It should feel normal.

6. Move the control stick hardover to the right. The engage switch should automatically return to the OFF position but the stability augmentation switch should remain engaged because the aileron has reached a position greater than half-travel from faired. The protection circuit has caused the AFCS system to disengage.

7. Place the engage switch back to ENGAGE. Move the control stick hardover to the left. The results should be the same as in step 6.

8. Place the engage switch back to ENGAGE. Displace the trim button to the right for right aileron. The results should be the same as in steps 6 and 7 because test position 2 feeds a test signal into the structural protection circuit.

9. Place the engage switch back to ENGAGE. Displace the trim button to the left for left aileron. The results should be the same as in step 8.

10. Place the engage switch back to the ENGAGE. Place the aileron trim emergency switch to the EMER position. The engage switch should automatically return to the OFF position, but the stability augmentation switch should remain in the STAB AUG position. The emergency trim switch is to be used only with the AFCS disengaged. The emergency trim switch interlocks the AFCS engage switch as a protective measure.

11. Return the aileron trim emergency switch to NORM. Engage the AFCS by actuating the engage switch to the ENGAGE position. Move the stick aft and, while holding an aft force on the stick, operate the stick trim button to trim the aircraft NOSE UP. The result should be that the autopilot disengages, the engage switch should automatically return to its OFF and the stability augmentation switch should remain in STAB AUG. The test simulates the automatic trim circuit working improperly (making an out-of-trim condition worse).

12. With the switches left in the positions resulting from the check of step 11, engage the AFCS and make a similar test as in step 11, but push the stick forward and trim for a NOSE UP condition. The results should be the same as in step 11.

13. Reengage the engage switch, then depress the AP button on the stickgrip. The ENGAGE switch and the stability augmentation switch should automatically return to OFF positions. All AFCS authority is removed from the aircraft control system. Turn standby switch to OFF. Leave switch off for takeoff.

14. Release 1-N-2 switch and assure that switch returns to N position.

WARNING

Takeoff trim should always be checked after completion of the AFCS preflight check. Positioning the AFCS test switch to TEST POSITION 2 may have changed the trim setting.

NORMAL IN-FLIGHT OPERATION

To Engage Stability Augmentation

1. Standby switch . . . . STANDBY
2. Warmup period . . . . 30 to 90 seconds
3. Aileron trim emergency switch . . . . NORM
4. Heading select switch . . . OFF
5. Altitude switch . . . . OFF
6. Engage switch . . . . OFF
7. 1-N-2 switch . . . . N

CAUTION

Do not use the 1-N-2 switch while in flight.

8. Stability augmentation switch . . . . STAB AUG

To Engage AFCS

Perform the above steps, then actuate the engage switch to the ENGAGE position.

Note

Engagement by use of the engage switch can be made without first using stability augmentation (STAB-AUG). However, stability augmentation actuation is recommended first so that the pilot will have the stability augmentation mode after selecting OFF on the ENGAGE switch on the AFCS control panel.

To Disengage AFCS

The pilot may disengage the AFCS by one of the following actions:

1. Pressing control stick AP button.
2. Placing the standby switch in OFF position.
3. Placing both the engage and the stability augmentation switches in OFF positions.
4. Depressing the PUSH TO SYNC button on the compass controller.
5. Moving the set HDG switch on the compass controller.
6. Placing the aileron trim NORM/EMER switch in EMER position. In the event the switchover from automatic trim to manual trim malfunctions, or upon disengagement, the EMER position gives an additional switchover and will disengage the AFCS.
7. Moving the horizontal stabilizer manual override lever on the left console will manually overcome malfunction of the automatic pitch trimmer.

Note

Up to 4 seconds of override lever actuation may be required before disengagement occurs.

8. Pulling the emergency generator release handle.

LIGHTING EQUIPMENT

INTERIOR LIGHTS

The interior lighting system includes all instrument lights, console lights, and cockpit floodlights. A light is mounted in each instrument lens (except the oil pressure gage) to provide equal illumination over the entire face of the instrument. A white floodlight is mounted on the gunsight support on each side of the gunsight beneath the glareshield. These floodlights provide auxiliary or emergency lighting of the instrument panel. A white kneeboard floodlight incorporating a red filter is mounted on the gunsight support on the right-hand side to provide lighting for the pilot's kneeboard. Six red floodlights are installed to provide auxiliary or emergency console lighting. Four white floodlights are provided for auxiliary cockpit lighting for use with the thermal radiation closure. Instrument and console lights and the red floodlights are operative on emergency generator.

Interior Lights Control Panel

An interior lights (INT LTS) control panel (figure 1-22) mounted on the right console, contains switches for the operation of all interior lights except the four high-intensity white floodlights. Three rotary switches marked PRIM INST, CONSOLES, and SEC INST afford individual control of the primary, left and right consoles, and secondary instrument lighting. Placing the PRIM INST switch clockwise from OFF will turn on the altimeters (radar and barometric), airspeed, all-attitude, and BDHI indicator lights. Placing the CONSOLES and SEC INST switches clockwise from OFF will turn on the console lights and secondary instrument lights, respectively. The brightest lighting will be reached at full clockwise rotation of any switch. The primary instruments can be adjusted to bright by pilot selection, while all other lighting is dimmed, resulting in a more compatible lighting environment for the pilot.

Note

For night operation, the ladder lights are dimmed when the PRIM INST lights rotary switch is adjusted to any setting other than OFF. If the ladder lights are dimmed during daylight operation, the lights may not be visible.

A toggle switch with three positions, BRT, DIM, and MED, controls the intensity of the red floodlights after the CONSOLES switch is turned from the OFF position. The pilot's kneeboard floodlight has separate intensity control on the case.

The four high-intensity white floodlights, two for the instrument panel and one for each console, have a common control installed above the right-hand console on the fuselage skin. Clockwise rotation from the OFF position turns the floodlights on dimly and further clockwise rotation increases the intensity.

EXTERIOR LIGHTS

The exterior lights system includes position lights, fuselage wing lights, air refueling probe light, an approach light, and a taxilight. A semiflush, white, high-intensity gas discharge and low-intensity filament

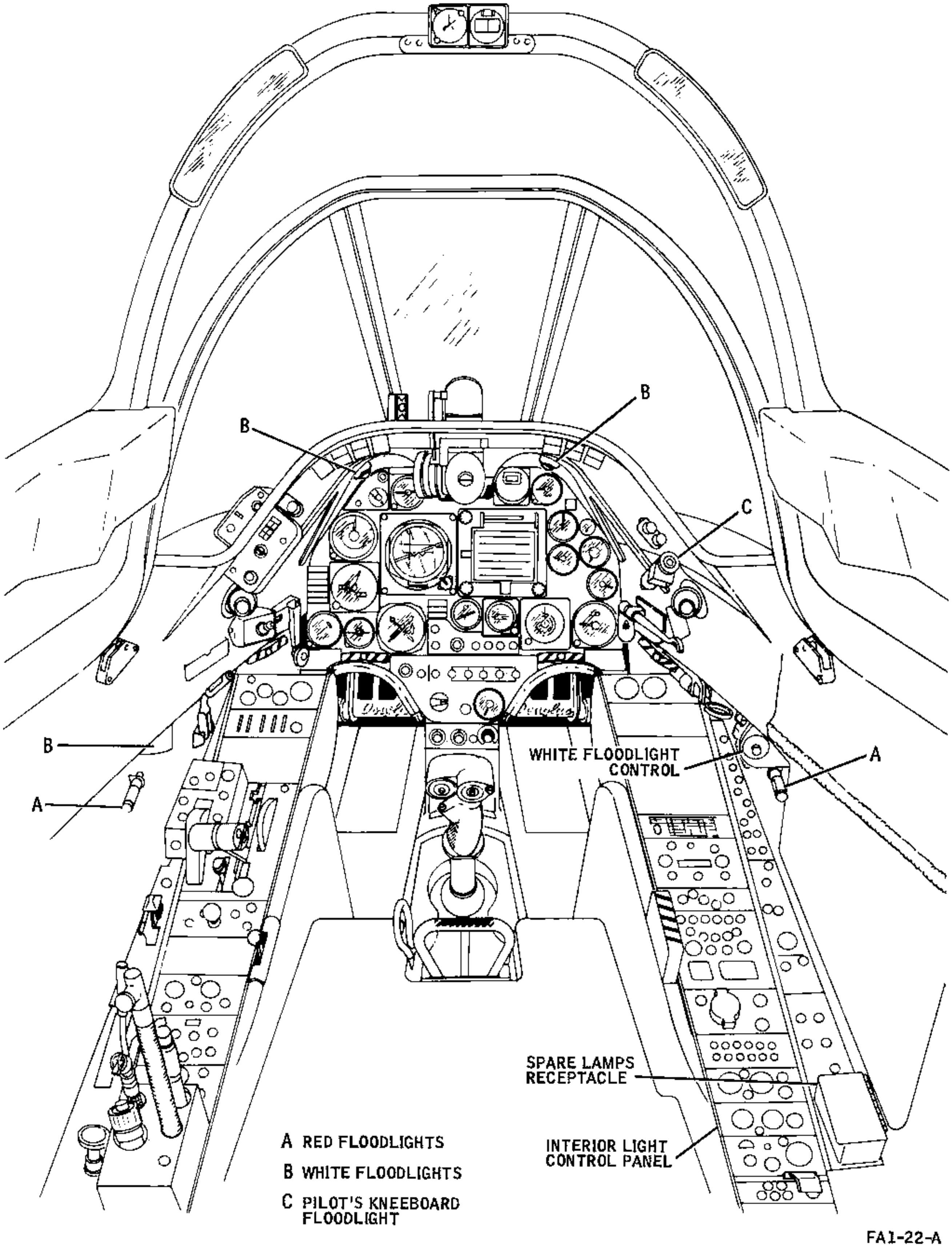


Figure 1-22. Interior Lights

fuselage wing light is located under the leading edge of each wing. The aircraft has two flashing red anticollision beacons, one mounted on the top of the fuselage and the other mounted on the left main landing gear strut fairing. The angle-of-attack approach lights are mounted in the leading edge of the left wing (figure 1-23). The taxilight is installed on the right-hand main landing gear door.

The air refueling probe light is located on the right-hand intake duct forward outboard lip (figure 1-23).

Wingtip, tail, and fuselage lights are actually double lights, as both filament and gas discharge types are provided. The BRT (bright) position directs power to the gas discharge lights; the DIM position directs power to the filament lights.

Note

The only exterior lights that will operate on emergency generator power are the approach lights.

Exterior Lights Controls

MASTER EXTERIOR LIGHTS SWITCH. A master exterior lights switch (figure 1-23), on the outboard side of the throttle grip, controls power to the exterior lights. The switch has a forward ON position, a center OFF position, and an aft momentary ON position. The master exterior lights switch is spring loaded from the aft to the center position, providing a means of signaling with the exterior lights.

CAUTION

Application of external power or starting the aircraft with external lights on BRT may cause failure of the lights. Allow 60 seconds for warmup after electrical power is applied to the aircraft with lights on DIM.

EXTERIOR LIGHTS CONTROL PANEL. An exterior lights control panel (figure 1-23), on the right console, contains switches for functional control of the exterior lights.

Approach Light Operation

The approach light circuit is controlled by a tailhook switch, a landing gear microswitch, and by a manually operated tailhook bypass switch. When the master exterior lights switch on the throttle is ON, the approach lights are automatically dimmed for night operations. Approach lights will operate on emergency generator power.

AIR CONDITIONING AND PRESSURIZATION SYSTEM

A combination air conditioning and pressurization system heats, cools, ventilates, and pressurizes the cockpit. The system comprises an air cycle system refrigeration unit, cockpit pressure regulator, pressure relief valve, and temperature control components. (See figure 1-24 for a schematic of the air conditioning and pressurization system.)

AIR CONDITIONING

Hot high-pressure air is bled from the engine compressor section, and is ducted either through or around the refrigeration unit, as governed by a cockpit temperature controller. Air passing through the refrigeration unit is directed through a heat exchanger and turbine, where it is expanded and cooled. The cooled air from the refrigeration unit is further mixed with hot air which has bypassed the unit, and is delivered to the cockpit. The degree of mixing of the conditioned air is controlled automatically by an air temperature control valve, which maintains the air at the temperature selected from the cockpit.

The air conditioning system is a delivered air temperature control system. Since the console control calls for a fixed temperature of the air as it enters the cockpit, the pilot must change the setting as cockpit heating and cooling loads change. Position of the temperature control knob is not an indicator for pilot comfort. Under certain flight conditions, full cold will provide comfort; under other conditions, full hot may be required. The pilot, therefore, must adjust the control to maintain a comfortable cockpit.

PRESSURIZATION

When the air conditioning system is in normal operation, the air provided for heating, cooling, and ventilation is also used to pressurize the cockpit. The pressurizing schedule (figure 1-25) provides for cockpit pressure to equal atmospheric pressure from sea level to 8000 feet altitude. The cockpit pressure at 8000 feet is then maintained to an altitude of 17,000 feet. From this point on, the cockpit pressure is maintained at 3.3 psi above the existing atmosphere pressure. Cockpit pressure is shown in terms of altitude by the cabin altimeter (figure 1-24), located on the right side of the armament panel.

In order to prevent excessive positive or negative pressure differentials because of possible malfunctioning of the pressure regulator, a pressure relief valve opens at a positive pressure differential of 3.6 psi and at a negative differential of minus 0.10 psi. The pressure relief valve also incorporates an emergency feature which allows it to dump cockpit pressure when the cockpit pressurization switch is placed in the RAM position.

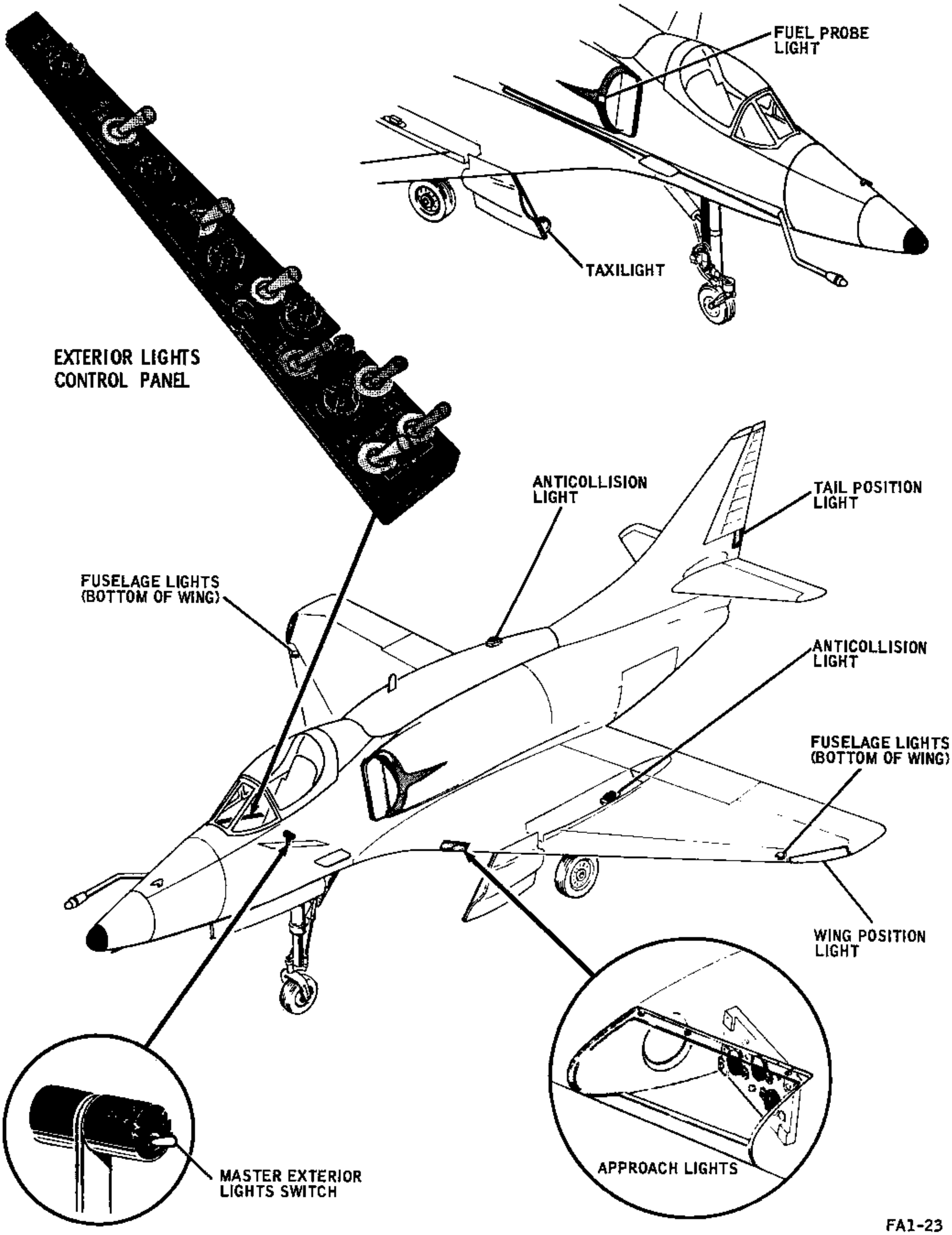


Figure 1-23. Exterior Lights

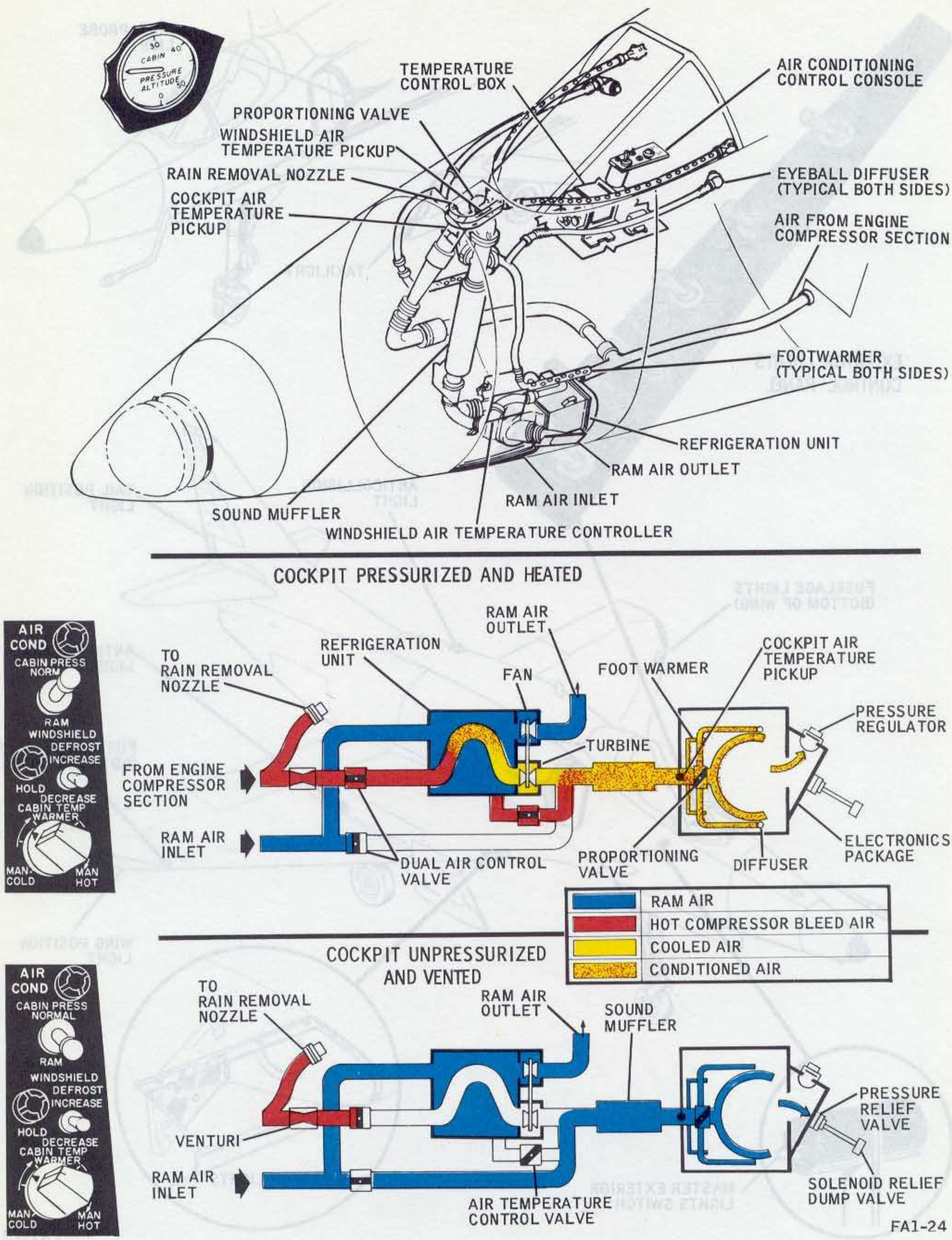


Figure 1-24. Air Conditioning and Pressurization System

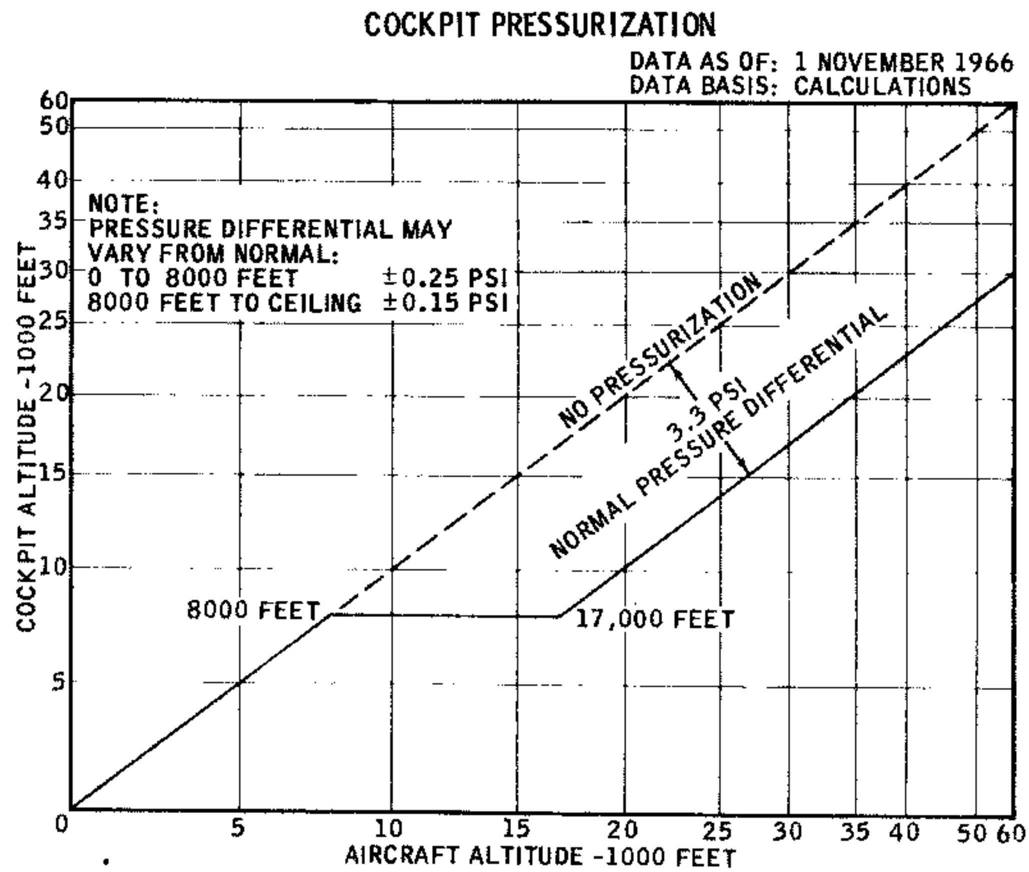


Figure 1-25. Cockpit Pressurization Chart

AIR CONDITIONING CONTROL PANEL

The air conditioning control panel (figure FO-1) is located outboard of the right-hand console. It contains a two-position lever lock toggle switch for operation of the cabin pressurization system, a rotary cabin temperature control knob, and a three-position windshield defrost switch.

Cabin Pressure Switch

The cabin pressure switch is marked RAM and NORMAL. When NORMAL is selected, and the canopy is closed, the cockpit is sealed and pressurized by engine compressor bleed air. Pressurization is automatically maintained at a predetermined schedule by the cockpit pressure regulator. The RAM position electrically opens a pressure relief valve to dump cockpit pressure and opens a motor-driven valve in the ram air duct allowing outside air to ventilate the cockpit. Selecting RAM also closes off engine bleed air to the air conditioning system.

Cabin Temperature Control

Marked positions of the rotary cabin temperature control are MAN COLD, MAN HOT, and WARMER. The control is functional whenever the cockpit pressurization switch is in the NORMAL position. In normal operation, the control is set in the arc (from 10 o'clock to 2 o'clock) designated WARMER which provides the desired cockpit temperature. In the event of a malfunction in the normal temperature control circuitry, manual temperature control is provided by rotating the temperature control past a detent to the MAN COLD or MAN HOT positions. When the control is in MAN COLD or MAN HOT, the automatic temperature control circuitry is bypassed and the mixing of hot and refrigerated air is changed in the selected direction as long as the control is held in position. The temperature control is spring loaded away from the MAN COLD and MAN HOT positions (7 o'clock and 4 o'clock, respectively) and must be held firmly in the desired position against this spring pressure. When released from the MAN COLD or MAN HOT positions, the temperature control is in a hold condition and the mixing valve motor is deenergized. The temperature control must be held in either position for at least 8 seconds to allow complete repositioning of the temperature control valve. If the air conditioning unit fails or loses electrical power, the cockpit air temperature control valves will remain in the same position and the cockpit pressure will remain as is.

Windshield Defrost Switch

The windshield defrost switch is marked INCREASE, HOLD, and DECREASE and controls a motor-driven proportioning valve which serves to proportion air between the windshield defrost manifold and the footwarmers. Air directed to the footwarmers is also shared with the "eyeball" diffusers. The "eyeball" diffusers may be turned on, off, or to any intermediate position by rotation of the diffuser nozzle and may be directed to provide airflow in the most comfortable direction by manual adjustment of the diffuser in its ball-socket base. When the defrost switch is placed in INCREASE, the proportioning valve is operated to a position which increases the proportional airflow to the windshield. If allowed to remain in this position for several seconds, all air entering the cockpit will be directed to the windshield defrost manifold. When the defrost switch is placed in its momentary DECREASE position, the proportioning valve decreases the airflow to the windshield and increases the airflow to the footwarmers (and eyeball diffusers if opened) as long as the switch is held in DECREASE, or until the proportioning valve reaches its limit. At this time, all air is bypassing the windshield defrost manifold and is directed into the footwarmers (and eyeball diffusers if opened). The HOLD position allows the proportioning valve to remain as is.

DEFROST

Defrosting of the windshield side panels is accomplished by windshield defrost air as described in preceding paragraph.

Frosting of the bullet-resistant glass center panel of the windshield is prevented by electrical means. The system is energized when the main generator is operating or when external power is supplied. A transparent layer within the glass panel provides resistance for electrical heating, and a sensing element contained in the panel causes a heating controller to regulate automatically the temperature of the surface to maintain it between two predetermined limits.

Windshield center panel defrosting also functions when the emergency generator is extended. With the emergency generator extended, a switch in the system automatically shuts off the heating element when the landing gear handle is moved to the DOWN position.

Note

To minimize fogging of the center panel when the emergency generator is extended, delay lowering the landing gear as long as possible in the landing sequence.

COCKPIT FOG AND SNOW SUPPRESSION

Small quantities of fog, light snow, or ice will frequently appear at the air conditioning outlets. A screen has been added to the manifold connection to prevent ice from being emitted from the distribution system. While this is a normal condition resulting from rapid cooling of air by the air conditioning unit, an excessively large volume of fog which obstructs vision can occur under extreme conditions of high humidity and high ambient air temperatures at low altitude. Fog may be eliminated by adjusting the cabin temperature control knob for higher cabin temperature, or by adjusting the windshield defrost switch to decrease the flow of air to the windshield defrost ducts and closing the "eyeball" diffusers, thereby dumping the fog and snow to the footwarmers. In some cases the ducting may have cooled to a point where fog will persist for a short time after the cockpit temperature has been increased. After the fog has been suppressed, a temperature setting should be selected that will provide the most comfortable temperature above the fogging point.

ANTIBLACKOUT SYSTEM

The antiblackout system utilizes high-pressure engine bleed air. Air is filtered and directed through a line to the valve located on the anti-g and oxygen panel on the left console (figure FO-1). The valve control knob can be turned to HI or LO to regulate the amount of air pressure increase in the anti-g suit. As g-forces are reduced, the valve will automatically reduce the pressure in the suit. A pushbutton on the top of the valve control knob may be manually operated to test the system. If the valve has any tendency to stick or fails to return to the closed position, it should be replaced. On long flights, this system makes it possible for the pilot to inflate the suit occasionally for body massage to lessen fatigue. The antiblackout suit connection plugs into a receptacle adjacent to the control knob.

Note

In the event of inadvertent g-suit hose disconnect, noticeable chattering in the valve may occur during accelerated flight.

ANTI-ICING SYSTEM

ENGINE

The engine anti-icing system is designed to prevent ice formation. Safe operation requires that the pilot anticipate the possibility of ice formation whenever these weather conditions exist.

Ice formation is prevented in the engine air inlet section by an integral powerplant system that utilizes hot high-pressure bleed air from the compressor section. Bleed air from both sides of the compressor discharge is piped forward through external lines and distributed through the inlet guide vanes from which it is ported into the engine inlet airstream.

ANTI-ICING CONTROL

Electrical control of the anti-icing system is accomplished by placing the anti-icing switch (figure FO-1), located outboard of the right console, in ALL position. When the switch is in ALL position, power is directed to the anti-icing valve and regulator mechanism on the external lines. The heating element of the pitot tube is also actuated.

Note

Operation below approximately 75 percent rpm may not supply sufficient heat to keep the engine air inlet ducts clear of ice.

Pitot And Angle-Of-Attack Vane

The pitot tube is electrically heated at all times when the anti-icing switch is in the ALL or PITOT position and the aircraft is airborne. The angle-of-attack vane is automatically heated whenever the aircraft is airborne and is independent of the anti-icing switch position.

RAIN REMOVAL SYSTEM

The rain removal system utilizes high-pressure engine bleed air to remove rain from the bullet-resistant glass center panel of the windshield. Hot, high-pressure bleed air is ducted to the rain removal automatic pressure regulating unit. The pressure regulating unit allows constant pressure air to be delivered to the jet pump unit. The jet pump unit mixes the hot bleed air with ambient air and delivers it to a nozzle that directs the high-velocity hot air over the windshield surface. Electrical control of the system is maintained by the rain removal control panel located on the wedge outboard of the right-hand console. The rain removal system is inoperative on emergency generator.

RAIN REMOVAL CONTROL PANEL

The rain removal control panel (figure FO-1) has two switch positions labeled RAIN REMOVAL and OFF. When the switch is placed in the RAIN REMOVAL position, hot high-pressure air is directed over the windshield surface. The OFF position of the switch cuts off the air. In the event of electrical power failure, the valve in the pressure regulating unit automatically closes, shutting off the system.

NORMAL OPERATION

On the Ground

Rain removal airblast temperatures are a function of engine power setting. At IDLE power, airblast temperature is not sufficiently hot to cause damage to the windshield and the system may be operated continuously. However, at MILITARY power, the temperature becomes extremely hot, and ground operation at high-power settings is limited to a maximum of 3 minutes.

CAUTION

Exceeding the 3-minute limit could cause bubbling of vinyl layers and cracking of the glass.

The pilot may check the rain removal system after engine starting by noting the warm airblast over the top of the windshield. The rain removal switch should always be placed in the OFF position immediately after the preflight check to prevent inadvertent operation at high-power settings and subsequent damage to the windshield. If rain removal is required on takeoff, the switch should be placed in RAIN REMOVAL just prior to the takeoff run.

In the Air

The rain removal system may be used for extended periods of time during approach and landing due to the lower power settings usually required for this phase of flight.

CAUTION

- During a waveoff when high-power settings are required, the 3-minute limitation at MILITARY power applies.
- The jet blast rain removal system was designed to operate during approach, landing, takeoff, waveoff, and taxi. Operation other than these is recommended only under emergency flight conditions in which forward visibility is necessary. System operation at high altitude may cause cracks in the outer glass ply of center windshield panel due to extreme thermal shock to the glass.

RAIN REPELLENT SYSTEM

The rain repellent system is used to improve visibility during flight through heavy rain. A pushbutton, labeled RAIN REPELLENT, is located above the left console just below the left eyeball diffuser. When the button is pressed, a metered amount of repellent is sprayed onto the windshield. The repellent fluid container and fluid gage are located in the nose compartment. Fluid level may be checked by opening the APX access door.

Note

The rain repellent system is inoperative during emergency generator operation.

AIR REFUELING (TANKER SYSTEM)

The air refueling system enables the aircraft to serve as a tanker for other aircraft. Fuel from the wing tank and the drop tanks may be transferred to the refueling store. All fuel in the tanker aircraft except that contained in the fuselage tank may be transferred to the receiver aircraft.

AIR REFUELING STORE

The refueling store carried on the centerline rack contains a 300-gallon fuel cell, a constant speed ram air turbine-driven hydraulic pump, a hydraulically driven fuel pump, a hydraulically operated hose reel, and 50 feet of refueling hose with a drogue. The store is capable of transferring fuel to the receiver aircraft at approximately 180 gallons per minute (figure 4-8). Provisions are made for dumping fuel overboard if necessary.

Air refueling stores incorporate a fuel quantity probe within the store. Air refueling stores fuel quantity will be indicated the same as that for a drop tank when the external fuel quantity switch is actuated.

The operational envelope of the store with the drogue extended is limited to 300 KIAS or 0.80 IMN, whichever is lower, at altitudes up to 35,000 feet. See section XI, part 6, for the complete operational envelope and fuel available for transfer.

Air Refueling Store Lights

At the end of the refueling store are two lights, amber (left side) and green (right side). These lights are of use only to 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 off. The green light indicates that fuel is actually flowing from the tanker to the receiver.

Air refueling stores provide for illumination of the hose and drogue to facilitate night refueling. Lights added by this change consist of two white lights mounted in the aft section of the store for illumination of the hose, and four white lights mounted in the drogue assembly. The hose lights come on when the drogue switch is placed in the EXT position and go off when the drogue switch is placed in the RET position. An air-driven generator mounted in the drogue assembly provides power to the drogue lights. The drogue lights are on continuously when the drogue is extended into the airstream.

AIR REFUELING CONTROL PANEL

The refueling control panel located forward on the left console contains all the indicators and switches used to operate the system (except the drop tank pressurization switch). Any sequence of switch positioning is possible without causing damage or malfunction to the tanker store.

Drogue Position Indicator

The drogue position indicator has three possible indications: RET (retracted), EXT (extended), or TRA (transfer). The indication will be RET only when the drogue is fully retracted or during drogue extension. The indicator indicates 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 also during hose retraction until the drogue is fully retracted.

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.

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 in OFF, it feathers and locks the propeller. When the switch is placed in DUMP, an electrically operated fuel dump valve in the bottom of the refueling store opens to dump fuel. To place the switch in DUMP, depress the spring-loaded lever guard then lift the switch from its spring-loaded safety position.

Store Dump Light

A store dump light is incorporated on the control panel. The light is on when fuel is flowing through the dump valve or from the store to the aircraft. When fuel flow ceases either because of fuel depletion or because dump/transfer has been secured, the light goes off. A press-to-test feature for the light is incorporated but is energized only when the SHIP TANK switch is in the FROM STORE position.

Drogue Switch

The drogue switch controls the hose and drogue positioning and is marked RET and EXT. When the refueling master switch is ON and the drogue switch is placed in EXT, the hose will extend to trail position. Extension of the drogue energizes a bypass relay. This relay prevents feathering of the air turbine regardless of the position of the refueling master switch until the drogue is fully retracted. When the drogue switch is positioned at RET, the hose will retract.

Note

The drogue switch also controls the white lights in the aft section of the store that provides illumination of the hose.

Fuel Transfer Switch

The fuel transfer switch controls the flow of fuel after proper hookup is made. The switch must be at TRA before fuel will transfer. Fuel flow will stop any time the switch is placed in OFF. A holding relay is provided which causes the switch to remain in TRA until store fuel is depleted or the pilot places it in OFF.

Light Switch

The light switch determines the brightness of the amber and green lights at the aft end of the refueling store. The switch has two positions: BRT for daylight fueling, and DIM for night. With the switch in DIM, store lights will not be visible during daylight.

Ship Tank Switch

The SHIP TANK switch has three positions: TO STORE, OFF, and FROM STORE. The TO STORE position permits fuel to flow from the wing tank to the refueling store. When the switch is placed at FROM STORE, fuel will flow under engine air pressurization from the air refueling store and drop tanks to the wing tank.

Hose Jettison Switch

The hose jettison switch is provided to cut and crimp the store hose in the event of a store malfunction which precludes drogue retraction. It also removes all electrical power from the store controls except for the refueling master switch. The hose jettison switch must be kept in the forward OFF 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 HOSE JETTISON, hold back the spring-loaded channel guard, then lift the switch from its spring-loaded safety position. Be sure that this switch is in its forward OFF position before electrical power is applied. Once the HOSE JETTISON position is selected, do not return it to its forward OFF 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.

Drop Tank Transfer During Air Refueling

To use the fuel in the drop tanks for air refueling, on the engine control panel place the drop tanks pressurizing switch in PRESS. This provides normal drop tank transfer to the wing, where it may then be used for transfer to the store by means of the SHIP TANK switch.

Note

When the SHIP TANK switch is in the FROM STORE position, fuel in the drop tanks will automatically be transferred to the wing regardless of the position of the drop tanks transfer switch on the engine control panel.

AIR REFUELING (RECEIVER) SYSTEM

During air refueling, fuel flows through the receiver aircraft's probe nozzle under pressure and is distributed to each tank in the same manner as it is through the pressure fueling receptacle.

JET-ASSISTED TAKEOFF SYSTEM

A two-bottle JATO system provides the aircraft with additional thrust during takeoff. A JATO bottle is mounted on each speedbrake (figure 1-3). Each bottle is capable of producing 4500 pounds of thrust for a period of 5 seconds. The bottles are fired electrically and jettisoned hydraulically by utility system hydraulic pressure controlled through a solenoid operated selector valve.

JATO CONTROL PANEL

The JATO control panel, located outboard of the left console (figure FO-1), contains the following controls for arming and jettisoning of the JATO bottles; the JATO arming switch, the JATO jettison switch, and a press-to-test type JATO arming caution light.

JATO Arming Switch

The JATO arming switch is a two-position lever-lock toggle switch labeled ARM and OFF. To place the switch in the ARM position, the spring-loaded toggle lever must be lifted. This arms the JATO firing circuit by energizing the JATO firing button on the catapult handgrip and the jettison circuit to the jettison switch.

JATO Armed Indicator Light

A JATO armed indicator light on the control panel comes on when the arming switch is energized. The press-to-test feature of this light provides a means for preflight checking of JATO arming and firing circuit continuity.

JATO Jettison Switch

The JATO jettison switch on the control panel is a guarded, momentary-control toggle switch, spring-loaded to the SAFE position. In the JATO JETTISON position the switch energizes a solenoid-controlled hydraulic selector valve which directs hydraulic pressure to the JATO mounting hook actuating cylinders. The mounting hooks are actuated to release both JATO bottles simultaneously.

CAUTION

When JATO bottles are installed, operation of the EMER SPEED BRAKE control will force the JATO bottles off the aircraft, resulting in airframe damage.

Note

An interlock in the speedbrake electrical circuit prevents normal operation of speedbrakes with JATO bottles attached. Be sure the speedbrake switch on the throttle is in the CLOSED position prior to jettisoning the JATO bottles; otherwise, upon release of the JATO bottles the speedbrakes will open.

JATO Firing Button

The JATO firing button (figure 1-4), located at the end of the catapult handgrip energizes a relay which completes the circuit to the firing mechanism. Refer to section XI, Performance Data, for additional information on takeoff airspeeds with JATO and distances at which the JATO bottles are fired.

WARNING

To prevent possible JATO system accidents, the JATO arming switch in the cockpit shall be at OFF and a no-voltage test shall be made at the aircraft igniter terminals prior to attaching the JATO igniter leads to the bottles.

BANNER TOW TARGET EQUIPMENT

Equipment consists of a banner target towline, and Mark 51 bomb rack and adapter suspended from an AERO 7A-1 bomb rack on the aircraft centerline station.

TARGETS

Standard Navy or Air Force 7 1/2x40 foot or 6x30 foot banner targets may be utilized.

TOWLINE

Recommended towline configuration is 1950 feet of 7/16-inch nylon towline attached to 50 feet of

7/32-inch armored cable leader. The armored cable leader is required at the tow plane end of the towline to prevent burn through which will occur if an all nylon towline is used.

AIRCRAFT TOWLINE ATTACHMENT

For detail on the Mark 51 bomb rack and adapter installation on the AERO 7A-1 bomb rack, refer to the pertinent aircraft armament bulletin.

MISCELLANEOUS EQUIPMENT

THERMAL RADIATION CLOSURE

A thermal radiation closure may be installed on the canopy structure for use on missions requiring pilot protection from the heat and light produced by nuclear explosions.

The closure consists of fixed fiberglass panels and a manually actuated segmented telescoping hood (buggy top) attached to the canopy. The glareshield installation includes light seals and an extension on the aft end. When the canopy is closed, the fixed panel on the canopy matches the glareshield in contour and forms a glareshield extension. The buggy top pivots down and forms a light seal with the fixed panel completely sealing the pilot within a thermal protective covering. Attached to the forward segment of the buggy top are right and left handholds for opening and closing as required. The right handhold contains a latching mechanism for locking the buggy top in the open (stowed) position. Two detent ready positions hold the buggy top partially open for forward visibility. This affords the pilot partial protection in the event of a surprise burst and shortens the time required to go from the ready position to fully closed. The buggy top should stay in detented positions if subjected to turbulence or acceleration forces of 5 g or less.

Operation

To close the buggy top, reach back with either hand and pull forward on the right handhold to release the locking mechanism.

In cases when "hands on stick" flight is required the recommended procedure for unlatching the buggy top is to reach across the chest with the left arm while holding the stick with the right hand. Pull it forward to the ready position checking by feel to assure it centers in both detents simultaneously. To fully close the buggy top, firmly grasp the handholds with both hands and slam it shut to preclude the possibility of light leaks by seating the detents firmly on both sides. Pilots should gain proficiency in operation of the thermal radiation closure on short practice missions at safe altitudes. The closure may also be used as an instrument training hood.

To open, pull back on the handholds to override the detent pressure and telescope the closure back into its stowed and locked position.

WARNING

To prevent the closure from slamming shut inadvertently, ascertain that the closure is locked in the stowed position. To check for positive lock of closure, pull forward on the hood.

The pilot should familiarize himself with the operation of the thermal radiation closure prior to flight.

The following method is suggested:

1. Adjust seat to its lowest position.
2. Close and latch the canopy.
3. Check the accessibility of the face curtain handle.
4. Adjust seat upward exercising care not to strike enclosure.

Note

When the thermal radiation closure is installed, the alternate ejection handle is recommended for ejection.

5. Unlock buggy top and pull it forward to its detent ready position. Operation should be smooth and without binding. Even fingertip pressure on each handhold should assure buggy top is firmly held in both right- and left-detent positions. A pull of approximately 10 pounds is required to override the detent pressure.
6. Close buggy top by slamming firmly down using both handholds. Check for light leaks.

Note

In direct sunlight or equivalent there shall be no outside light directly visible to the pilot.

7. Check the accessibility of the face curtain handle.

8. Return buggy top to the open (stowed) position and check for positive latch.

9. Inspect all exposed surfaces of the thermal radiation closure for cleanliness.

Emergency Operation

The thermal radiation closure will be jettisoned along with the canopy in emergencies. The extended aft portion of the glareshield is flexible and will deflect if contacted during ejection.

ANTIEXPOSURE SUIT VENTILATION

An antiexposure suit ventilation control panel is installed on the left console (figure FO-1) for use with the Mark 5 antiexposure suit. The control panel contains the SUIT BLOWER and OFF toggle switch, a ventilation blower, and a quick-disconnect flexible hose for connection to the antiexposure suit. The suit hose disconnect coupling contains a butterfly valve to control the flow of ventilating air to the antiexposure suit or to close off the opening when the suit is not used.

MAP POCKET

A map pocket is provided on the right side of the cockpit.

SPARE LAMPS RECEPTACLE

Replacement lamps are contained in the SPARE LAMPS receptacle (figure FO-1) on the right console.

REAR VIEW MIRRORS

A rear view mirror is installed on each side of the canopy bow and provides limited rearward vision during flight and taxiing.

PART 3
AIRCRAFT SERVICING

INTRODUCTION

Normally, the aircraft will be serviced by qualified maintenance personnel; however, navigation flights, diversions, weather alternates, and other operations may require the use of various bases. Therefore, the pilot must have a knowledge of aircraft servicing procedures (figure 1-26) sufficient to accomplish normal aircraft servicing. Reference to the following procedures should be adequate to ensure proper servicing by transient maintenance personnel, under the supervision of the pilot.

Note

This flight manual is not intended to be a maintenance manual. For detailed maintenance information, refer to the appropriate section of the applicable NAVAIR 01-40AVM-2 series of maintenance instructions for the system desired.

PRESSURE FUELING

NORMAL PRESSURE FUELING OF AIRCRAFT AND EXTERNAL FUEL TANKS

(See figures 1-26 and 1-27.)

WARNING

- Follow procedure only when external electrical power is available and more than 100 gallons of fuel is to be delivered. Use alternate method when external electrical power is not available. Use top-off method if adding less than 100 gallons of fuel.
- Make certain that fuel vent is not obstructed.
- Ensure that aircraft and pressure fueling equipment are properly grounded.
- All maintenance on aircraft must stop during pressure fueling; adequate fire fighting equipment must be available in immediate area.
- Do not start fueling operations within 100 feet of aircraft with radar equipment being operated.

Note

- Aircraft should be in 6-degree noseup attitude during pressure fueling to allow maximum amount of fuel to enter aircraft tanks.
- Recommended flow rate from pressure fueler is 200 gallons per minute at 18 psi.

Procedure

1. Open engine aft compartment access door.
2. Remove pressure fueling-defueling receptacle valve cap.
3. Connect pressure fueling nozzle to pressure fueling-defueling receptacle valve.

Note

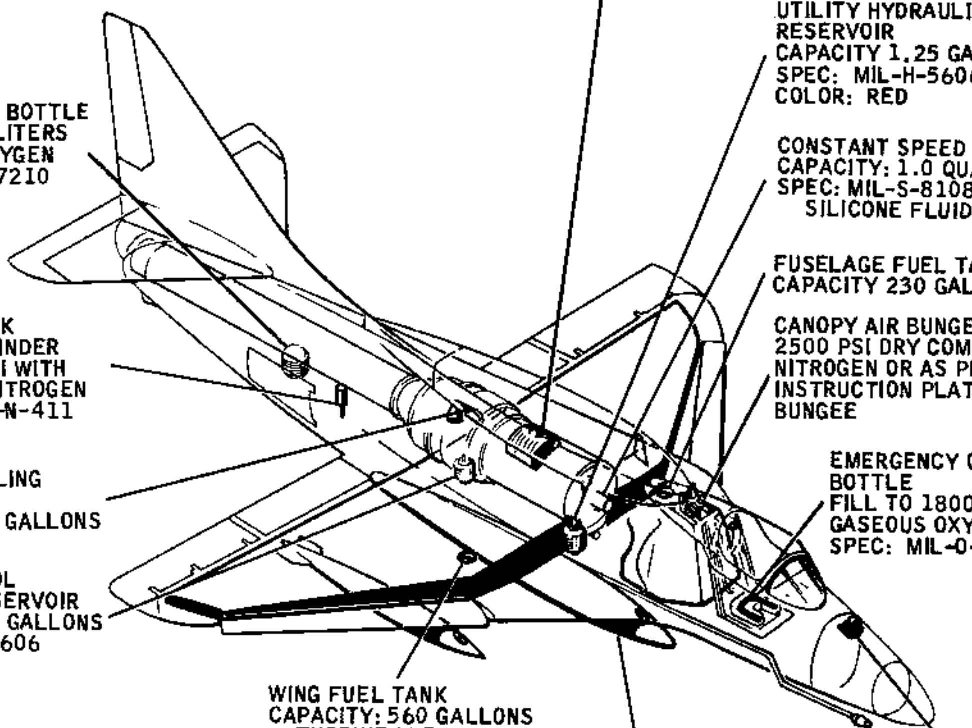
When the nozzle is connected to the valve, the aircraft is grounded automatically through the connection and no further grounding of individual fuel tanks is necessary.

4. On switch adjacent to receptacle valve, check DROP TANK FUELING switch OFF.

WARNING

Proper connection of ac external power cable plug to aircraft external power receptacle must be made. Failure to insert plug completely in receptacle can result in presence of high voltage on aircraft metal surfaces.

5. Connect external electrical power to aircraft.



NOTE:
FUEL TANK CAPACITIES BASED ON USABLE FUEL AND PRESSURE FUELING.

FUEL SPECIFICATIONS	
APPROVED FUEL	
ASHORE	AFLOAT
JP-4 JP-5	JP-5

TANKS	US GAL.	IMP GAL.	LITERS
FUSELAGE FUEL CELL	230	191.5	870.5
WING INTEGRAL FUEL TANK	560	466.2	2119.6
EXTERNAL FUEL TANK, AERO 1C	147	122.3	556.3
EXTERNAL FUEL TANK, AERO 1C	295	245.6	1116.8
EXTERNAL FUEL TANK, AERO 1D	295	245.6	1116.5
AIR REFUELING STORE	295	245.6	1116.5
EXTERNAL FUEL TANK, (400 GALLONS)	396	329.7	1498.8

FA1-8

Figure 1-26. Servicing Diagram

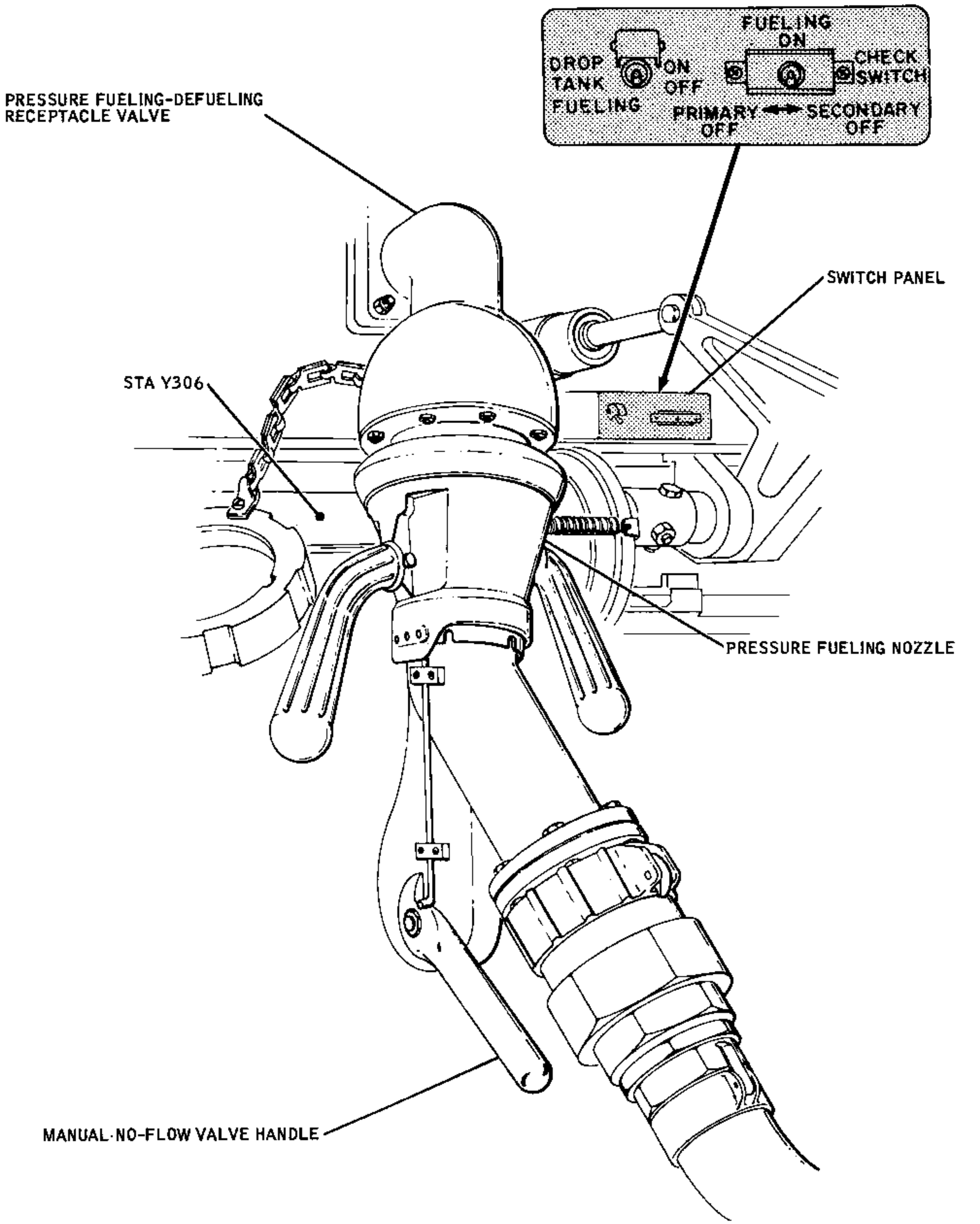


Figure 1-27. Pressure Fueling Aircraft and External Fuel Tanks

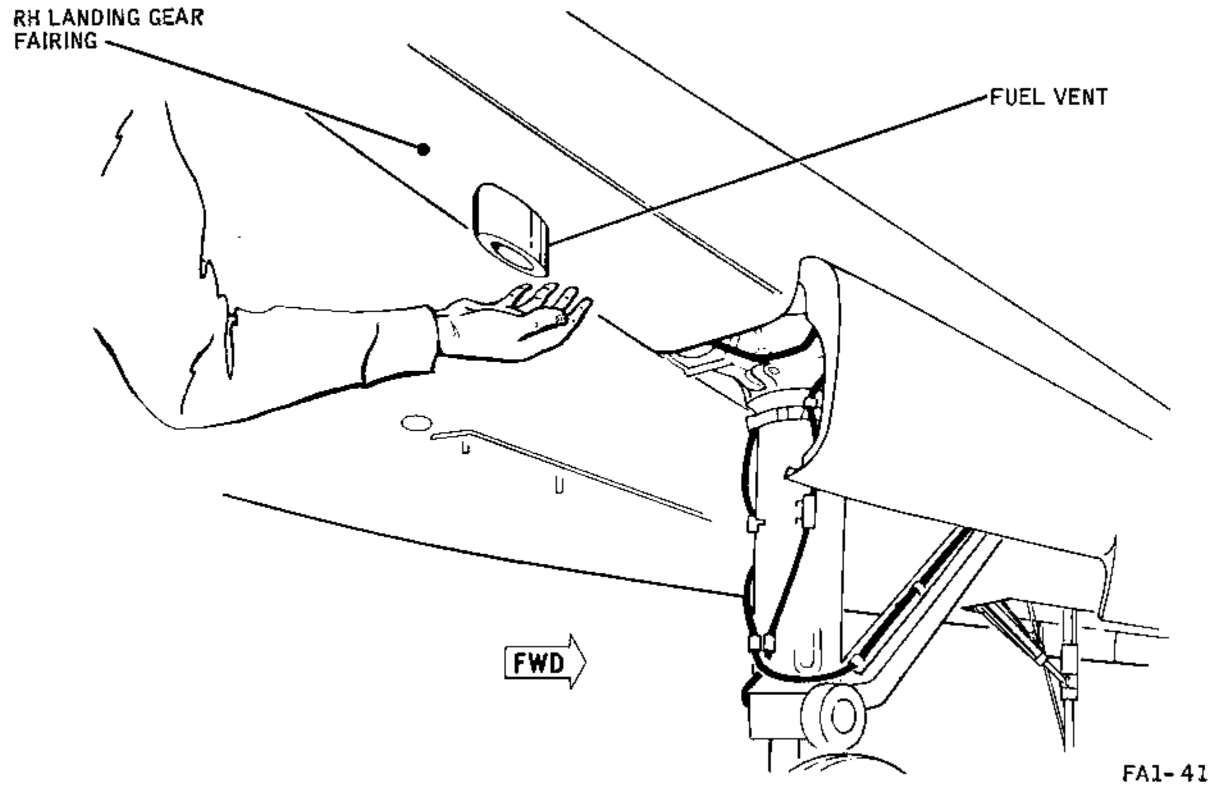


Figure 1-28. Fuel Vent System Outlet Mast

Note

Two methods of applying external ac power are possible. The first method utilizes the ground start and refueling adapter cable, which permits ac power to be applied through the engine starter access door. The second method is performed by applying ac power through the external power receptacle. (Refer to External Power Application, this section.)

6. Energize external electrical power.

7. Open manual no-flow valve on fueling nozzle and commence pressure fueling.

CAUTION

Maximum no-flow pressure must not exceed 55 psi at any time at fueling nozzle.

8. Immediately after pressure fueling has started, test the fuel vent system for proper functioning by holding the hand beneath fuel vent mast at the right-hand main gear fairing (figure 1-28).

CAUTION

Air should be exhausted from fuel vent mast during pressure fueling. If air cannot be felt exhausting from the mast, stop pressure fueling operations immediately and investigate fuel vent system.

9. During the initial stage of pressure fueling operations, perform functional test of pressure fueling shutoff components by actuating switches on switch panel as follows:

CAUTION

If fuel flow does not stop when noted in following test, stop pressure fueling operations immediately and investigate. Replace any defective component.

Note

When it is specified that fuel flow should stop during following test, an apparent leakage of 2 gpm maximum is permissible registered on pressure fueling meter. Leakage is due to flow of fuel through pilot lines of float valves. When pressure fueling is completed (all tanks full) leakage must not exceed 1 gpm.

10. Place and hold CHECK SWITCH in PRIMARY OFF position. Fuel flow should stop in 1 to 3 seconds.

11. With DROP TANK FUELING switch remaining in OFF position, place and hold CHECK SWITCH in FUELING ON position. Fuel flow should resume.

12. Place and hold CHECK SWITCH in SECONDARY OFF position. Fuel flow should stop in 1 to 3 seconds.

13. Place and hold CHECK SWITCH in SECONDARY OFF position, and place DROP TANK FUELING switch in ON position. Fuel flow should start into external fuel tanks only. Place DROP TANK FUELING switch in OFF unless drop tanks are to be filled.

14. Place and hold CHECK SWITCH in FUELING ON position. Fuel flow should start into wing integral fuel tank and fuselage fuel cell; fuel flow should continue into external fuel tanks if DROP TANK FUELING switch is ON.

Note

During pressure fueling, drop tanks may fill unevenly.

15. Continue pressure fueling.

16. During pressure fueling, inspect for evidence of fuel leakage. Correct if required.

17. When pressure fueling has been completed, place DROP TANK FUELING switch in OFF position.

18. Close manual no-flow valve on fueling nozzle.

19. Disconnect nozzle from nozzle receptacle valve.

20. Install receptacle valve cap.

21. Disconnect external electrical power from aircraft.

22. Close engine aft compartment access door.

PRESSURE FUELING — TOP-OFF METHOD

Top-off procedure is used when less than 100 gallons of fuel is required to complete filling of tanks and when external electrical power is available. The alternate method outlined in this section must be used when external electrical power is not available. Because of the short time required to pressure fuel less than 100 gallons, strict adherence to all steps is mandatory to prevent possible rupture of the wing integral tank. The procedure is as follows:

CAUTION

- Stop all maintenance on aircraft during fueling operation.
- Ensure that adequate fire fighting equipment is available in immediate area.
- Do not fuel aircraft within 100 feet of aircraft with radar equipment being operated.
- Make certain that fuel vent mast is not obstructed.

1. Open aft engine compartment access door.

2. Remove pressure fueling-defueling receptacle valve cap.

3. Remove fuselage fuel cell and wing integral tank gravity filler caps.

4. Connect pressure fueling nozzle to receptacle valve.

Note

When the pressure fueling nozzle is connected to the valve, the aircraft is grounded automatically through the connection and no further grounding of individual fuel tanks is necessary.

WARNING

Proper connection of ac external power cable plug to aircraft external power receptacle must be made. Failure to insert plug completely in receptacle can result in presence of high voltage on aircraft metal surfaces.

5. Connect external electrical power to aircraft.

6. Energize external electrical power.

7. Place and hold CHECK SWITCH, on switch panel adjacent to receptacle valve, in PRIMARY OFF position.

8. Open manual no-flow valve on fueling nozzle and observe fuel supply meter for 1 minute. Fuel flow must not be indicated; maximum allowable leakage is 2 gpm.

9. Place and hold CHECK SWITCH in FUELING ON position for 2 to 3 seconds. Fuel supply meter indicator normal fuel flow.

CAUTION

Maximum no-flow pressure at fueling nozzle must not exceed 55 psig.

10. Place and hold CHECK SWITCH in SECONDARY OFF position. Fuel flow must cease within 5 seconds. Observe fuel supply meter: maximum allowable leakage is 2 gpm.

CAUTION

If valves fail to function properly, stop fueling immediately and investigate.

11. If surveillance check indicates satisfactory valve operation, place CHECK SWITCH in FUELING ON position and resume fueling. If drop tanks are to be topped off place DROP TANK FUELING switch in ON.

12. When topping-off is completed, close no-flow valve on fueling nozzle and disconnect nozzle from receptacle.

13. Verify that DROP TANK FUELING switch is OFF.

14. Install receptacle valve cap.

15. Disconnect external electrical power from aircraft.

16. Install fuselage fuel cell and wing integral tank gravity filler caps.

17. Close engine aft compartment access door.

PRESSURE FUELING — ALTERNATE METHOD

External fuel tanks cannot be pressure fueled using the alternate procedure. The following procedure is used when external electrical power is not available. Because of the short time required to pressure fuel less than 100 gallons, strict adherence to all steps is mandatory to prevent possible rupture of the wing integral tank.

CAUTION

- Aircraft and pressure fueling equipment must be properly grounded during pressure fueling.
- All maintenance on aircraft must stop during pressure fueling.
- Adequate fire fighting equipment must be available in immediate area.
- Make certain that fuel vent mast is not obstructed.
- Do not start fueling operations within 100 feet of aircraft with radar equipment being operated.

1. Open engine aft compartment access door.

2. Remove pressure fueling-defueling receptacle valve cap.

3. Remove fuselage fuel cell gravity filler cap.

4. Remove wing integral fuel tank gravity filler cap.

CAUTION

Gravity filler caps must be removed as instructed in steps 3 and 4 to prevent possible damage to wing integral fuel tank structure.

5. Connect pressure fueling nozzle to pressure fueling-defueling receptacle valve.

Note

When the pressure fueling nozzle is connected to the valve, the aircraft is grounded through the connection and no further grounding of individual fuel tanks is necessary.

6. Open manual no-flow valve on fueling nozzle and commence pressure fueling.

CAUTION

One man should stand ready to stop pressure fueling equipment immediately should any pressure fueling shutoff component fail to stop fuel flow when tanks are full. This will be manifested by fuel flow from the filler ports.

7. During pressure fueling, inspect for evidence of fuel leakage. Also inspect fuel vent mast and external fuel tank overboard vent line for evidence of fuel leakage. Correct if leakage is evident.

8. When pressure fueling has been completed, close manual no-flow valve on fueling nozzle and disconnect nozzle from receptacle valve.

9. Verify that DROP TANK FUELING switch is OFF.

10. Install receptacle valve cap.

11. Install fuselage fuel cell gravity filler cap.

12. Install wing tank gravity filler cap.

13. Close or reinstall aft engine compartment access door.

HOT REFUELING

Refer to procedures in section III, part 5, for refueling of aircraft with the engine running.

GRAVITY FUELING

CAUTION

- Ground aircraft and fueling equipment during all fueling operations.
- Stop all maintenance on aircraft during fueling.
- Ensure that adquate fire fighting equipment is available in immediate area.
- Make certain that proper fuel is used for refueling. (Refer to servicing diagram.)
- Do not connect external electrical power to aircraft when gravity fueling.
- Do not start fueling or defueling operations within 100 feet of aircraft operating with radar equipment.

GRAVITY FUELING FUSELAGE FUEL CELL

(See figure 1-29.)

1. Open fuselage cell gravity filler access door, remove cap from gravity filler port.

CAUTION

Do not rest nozzle in filler port. Fueling nozzle must be supported to prevent damage to filler port.

2. Insert nozzle grounding jack in grounding receptacle directly aft and outboard of access door; insert refueling nozzle in gravity filler port.

3. Fill fuselage cell until fuel level is at bottom of gravity filler port neck.

4. Remove refueling nozzle from gravity filler port; disconnect grounding jack from receptacle.

5. Install gravity filler port cap and secure access door.

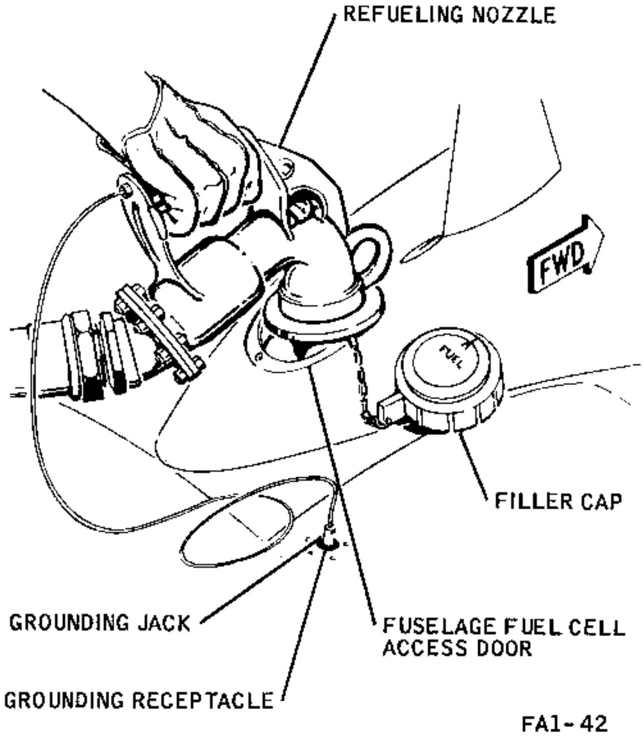


Figure 1-29. Gravity Fueling Fuselage Fuel Cell

GRAVITY FUELING WING INTEGRAL FUEL TANK

(See figure 1-30.)

1. Remove wing integral fuel tank filler cap.

2. Insert refueling nozzle grounding jack in grounding receptacle on wing nose.

CAUTION

- Do not drop fueling nozzle in wing tank filler port since nozzle will damage lower surface of tank.
- Do not pull fueling hose over wing slats.

3. Insert refueling nozzle in gravity filler port. Hold refueling nozzle in one hand and support refueling hose with other hand.

4. Fill wing fuel tank until fuel is at bottom of gravity filler port neck.

5. Remove refueling nozzle from gravity filler port; disconnect grounding jack from receptacle.

6. Install wing fuel tank gravity filler port cap and lock securely in place.

GRAVITY FUELING EXTERNAL FUEL TANK OR AIR REFUELING STORE

(See figure 1-31.)

1. Remove tank or refueling store filler port cap.

2. Insert refueling nozzle grounding jack in grounding receptacle on left-hand side of external stores rack.

CAUTION

To prevent damage to filler port or tank, support fueling nozzle in one hand and support fueling hose with other hand.

3. Insert refueling nozzle into filler port. Hold refueling nozzle in one hand and support refueling hose with other hand.

4. Fill tank or store until fuel level is approximately 1 inch below filler port to allow for thermal expansion.

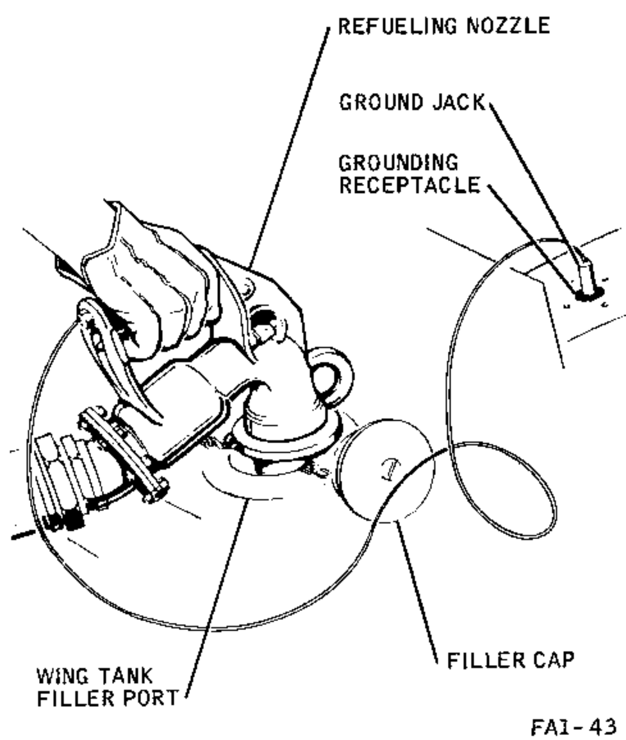


Figure 1-30. Gravity Fueling Wing Integral Tank

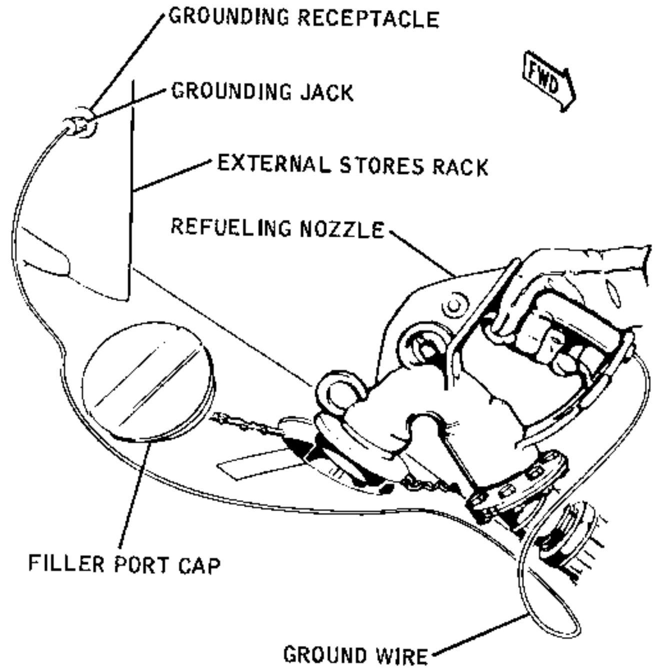


Figure 1-31. Gravity Fueling External Fuel Tank or Air Refueling Store

5. Remove refueling nozzle from filler port; disconnect refueling nozzle grounding jack from receptacle.

6. Install tank or refueling store filler port cap.

FUEL CONTROL FUEL SELECTOR

The fuel grade selector on the engine fuel control should correspond to the grade of fuel being used. After JP-4 is introduced into the fuel system of the engine, the specific gravity switch on the fuel control will be set to JP-4. The setting will not be returned to JP-5 until after the first flight during which JP-5 has been used. (See figure 1-32.)

ADJUSTMENT

1. Open engine forward compartment left-hand access door.

2. Remove retaining nut securing locking bracket to retaining stud on housing.

3. Remove locking bracket from stud.

4. Invert locking bracket and insert over hexagon shaft.

5. Using locking bracket as a wrench, rotate hexagon shaft until pointer on outside of valve is aligned with index for grade of fuel to be used.

6. Replace locking bracket over hexagon shaft so that slotted end fits over retaining stud on housing.

7. Secure bracket to retaining stud with washer and nut.

8. Close engine forward compartment left-hand access door.

ENGINE OIL SYSTEM SERVICING

Servicing provisions are accessible through the engine right-hand access door. The PON-6 pressure oiling unit is recommended for servicing the engine oil tank.

Note

Checking or filling the engine oil system should be accomplished within 30 minutes after engine shutdown. If engine is not serviced within 30 minutes, gearcase must be drained before filling.

The OIL LOW warning light on the cockpit instrument panel will come on when oil level is 20 percent or less. When oil level is between 20 and 80 percent, the OIL LOW warning light will come on only when the indicator/light switch is pressed. When oil level is above 80 percent, the OIL LOW warning light will not come on when the indicator/light switch is pressed. The two-point oil indicating system is valid only if checked while engine is running or within 30 minutes after engine shutdown.

Note

The OIL LOW warning light may remain on after engine start. Increase engine speed to 80 percent, or higher, for approximately 30 seconds and OIL LOW light should go off.

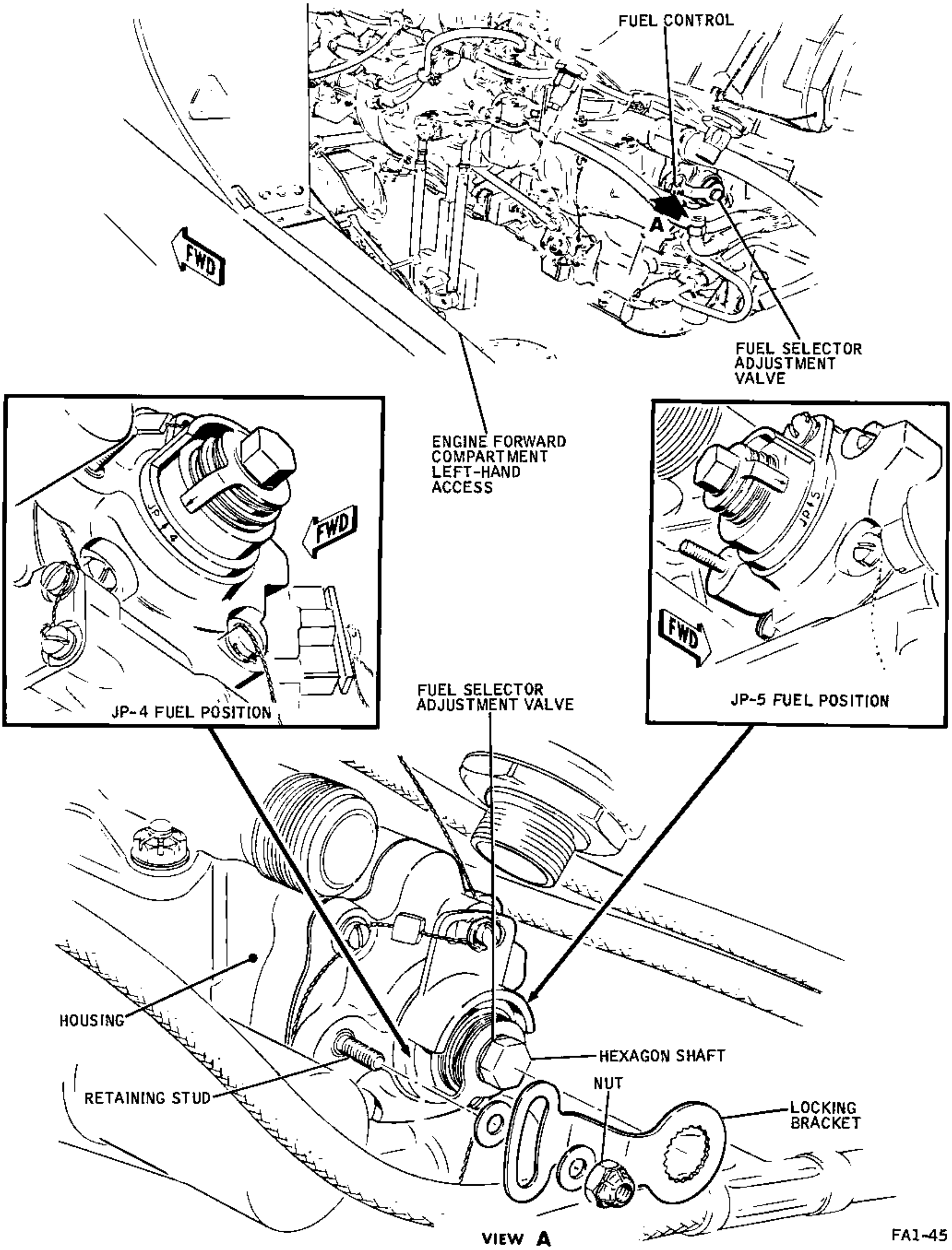


Figure 1-32. Fuel Control Fuel Selector Adjustment

ENGINE OIL SYSTEM QUANTITY CHECK

1. Connect external electrical power to aircraft (figure 1-48). OIL LOW warning light may or may not come on depending on oil level.

Note

To establish an accurate oil level indication when electrical power is applied after the engine has been shut down longer than 30 minutes, the engine must be operated to scavenge the oil from the accessory gear-case to the oil tank. This is necessary due to the design characteristics of the engine oil system which allows a relatively slow drainage of oil from the oil tank to the gear-case after engine shutdown.

2. Verify OIL LOW warning light and 20 percent sensor circuit continuity by pressing master TEST switch. OIL LOW light must come on.

3. Verify OIL LOW warning light and 80 percent sensor circuit continuity by pressing master press-to-test switch and indicator/light switch simultaneously. OIL LOW light must come on.

4. Press indicator/light switch and determine percent oil quantity from one of the following conditions:

Switch Position	Indicator/ Light	Percent Oil Quantity
Released	Remains on	Less than 20
Pressed Released	Comes on Goes off	Between 20 and 80
Pressed Released	Off Off	Over 80
Pressed Released	Goes off Comes on	(Circuit malfunction)

5. Remove external electrical power from aircraft.

ENGINE OIL SYSTEM PRESSURE FILLING

(See figure 1-33.)

1. Open engine right-hand access door.

2. Remove pressure cap from bleed adapter.

CAUTION

Never add oil unless overflow bleed is open. If overflow bleed is not open during filling, it is possible to fill the entire oil system to a degree that even a series of scavenge runs may not drain the system properly.

3. Hold free end of 3-foot bleed hose over 5-gallon container; connect other end of hose to bleed adapter.

Note

- To prevent excessive back pressure in bleed line, the 20-foot bleed hose supplied with the PON-6 pressure-oiling unit must be shortened to 3 feet or less.
- If hose other than 3/4-inch hose supplied with the unit is used, the end fitting must conform to requirements of MS24476-2.

4. Remove pressure cap from fill adapter.

5. Connect fill hose of pressure-oiling unit to fill adapter.

Note

The dispensing hose attached to the pressure-oiling unit mates with the fill adapter on the aircraft. If any other unit is used, the fill hose must be equipped with 1/2-inch quick-disconnect fitting conforming to MS24476-1.

6. Pump lubricating oil (MIL-L-23699) into engine until a steady flow comes out the bleed hose attached to the bleed adapter. (Refer to NAVAIR 19-25C-511.)

7. Disconnect fill and bleed hoses and install pressure caps on adapters.

CAUTION

To prevent deterioration of rubber or removal of paint, remove spilled oil immediately with a clean cloth moistened with naphtha (TT-N-95).

8. Close and secure engine right-hand access door.

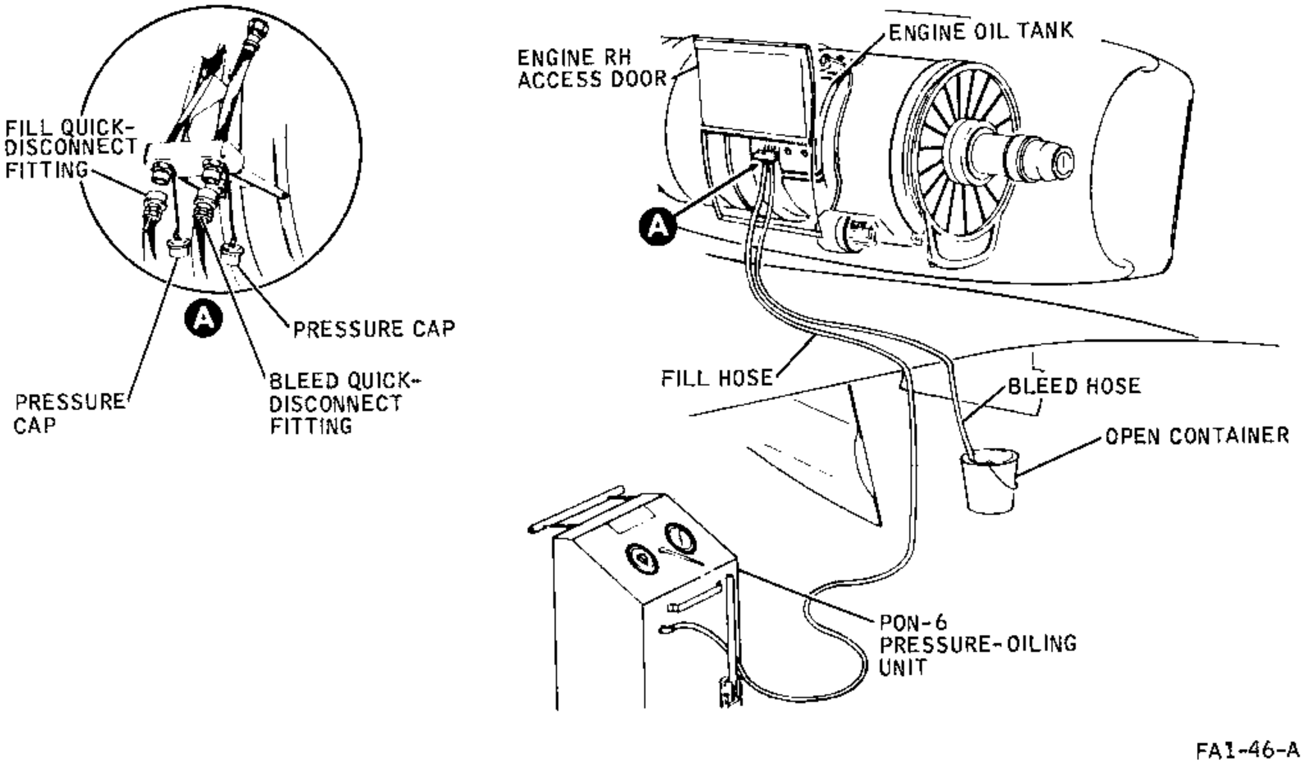


Figure 1-33. Engine Oil System – Pressure Filling

CONSTANT SPEED DRIVE (CSD) SERVICING

The constant speed drive (figure 1-34) is located on the forward end of the engine. It is mounted on an adapter bolted to the engine pad and secured by a V-band coupling. The drive unit and components should be inspected daily. Access to the constant speed drive is through the engine forward compartment lower access doors and the constant speed drive outer and inner access doors. Servicing consists of checking for proper fluid level with the test unit and adding fluid.

PREFLIGHT INSPECTION AND SERVICING

Before operating the engine, and during each daily inspection, a preflight inspection of the CSD must be made and servicing performed, if required.

Note

The Constant Speed Drive Flight Readiness Tester (figure 1-34) must be checked for proper operation before connecting it to the service panel.

1. Depress SYSTEM TEST switch. Green READY light will come on.

2. With SYSTEM TEST switch depressed, depress SELF TEST swtich. Green READY light will go off and all other lights (four red) will come on.

3. Open hydraulic fluid cooler and fuel filter unit access door.

4. Connect P1 of test cable to J1 of tester.

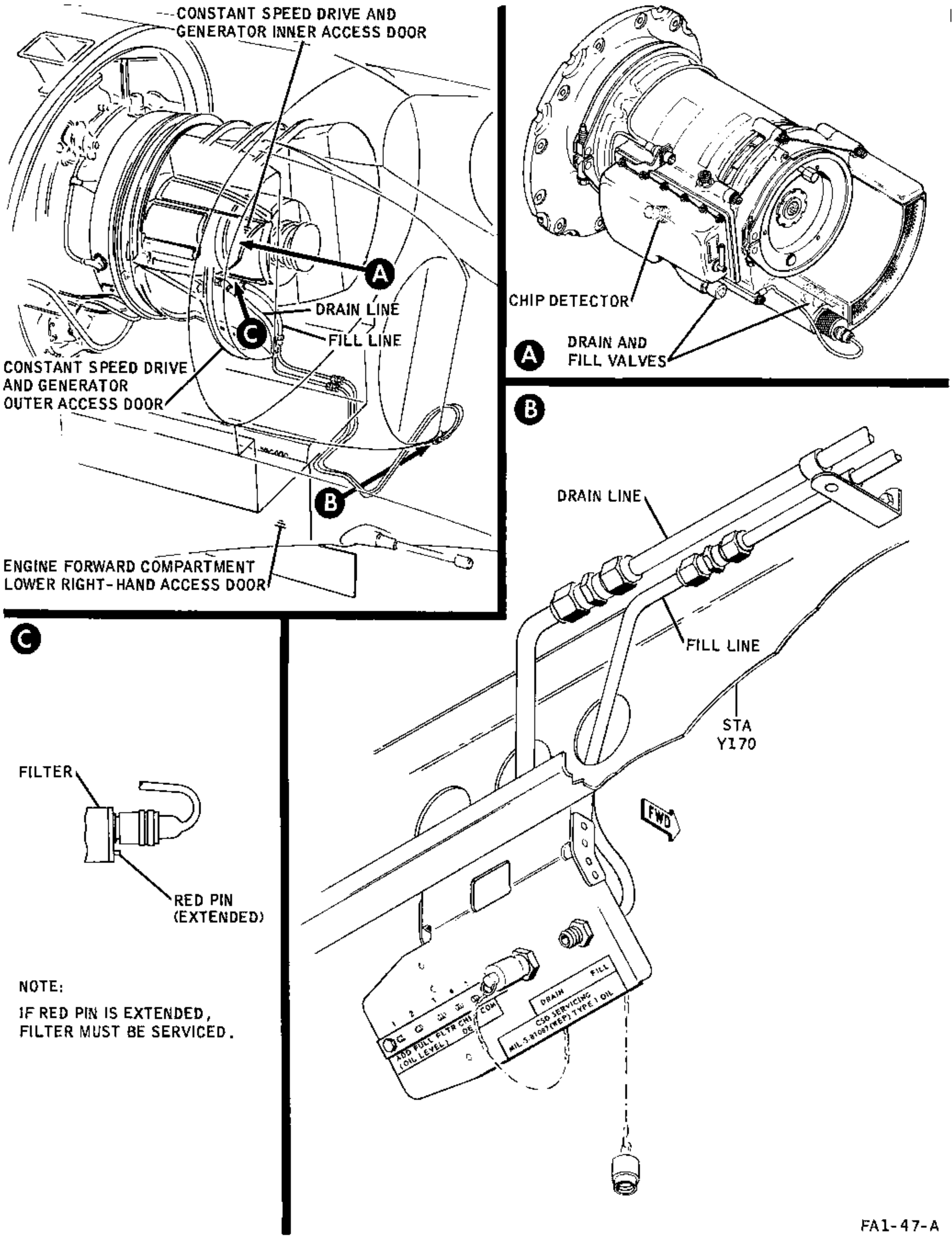


Figure 1-34. Constant Speed Drive Servicing (Sheet 1)

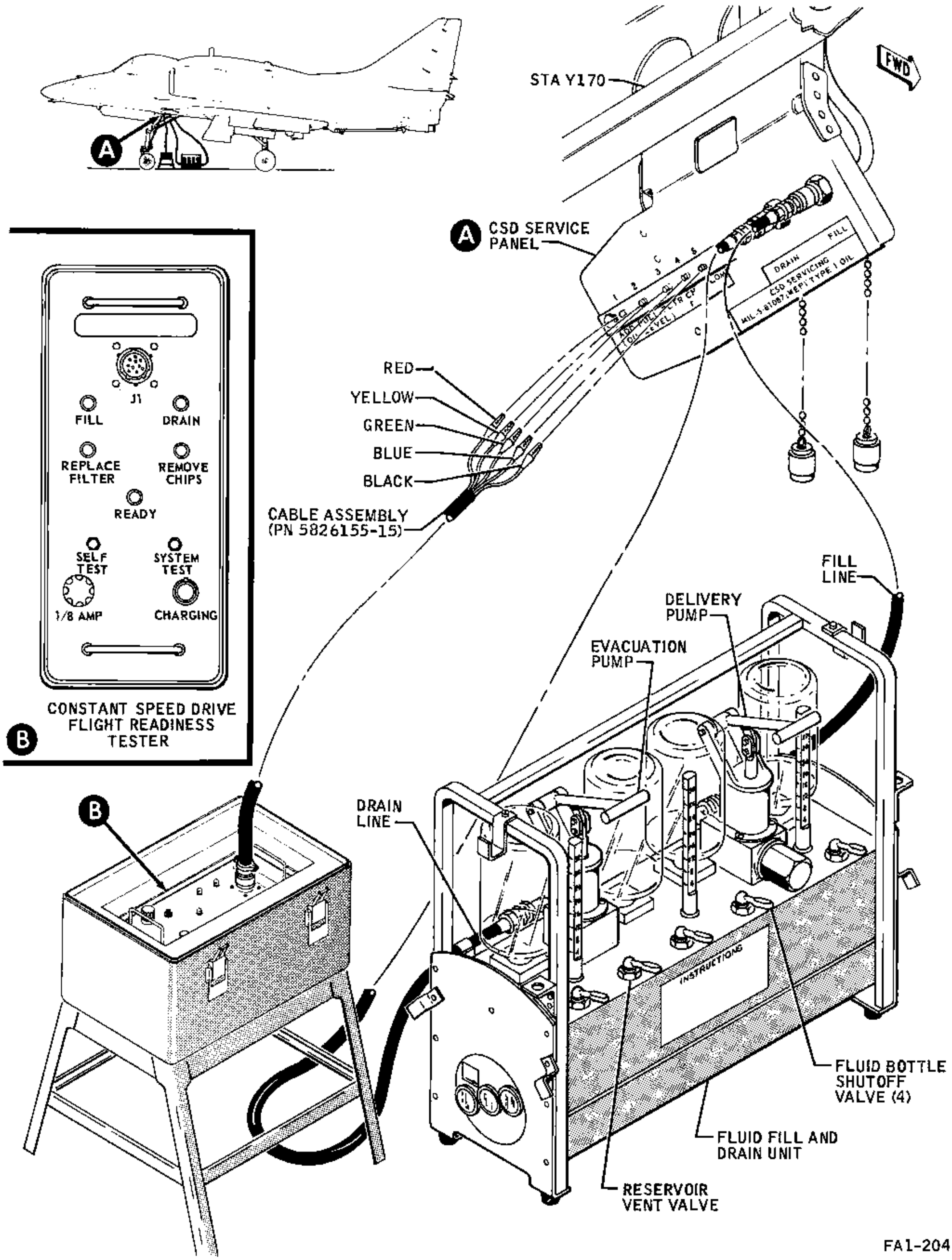


Figure 1-34. Constant Speed Drive Servicing (Sheet 2)

5. Connect red (FILL) lead from tester to terminal No. 1 (ADD) on service panel.

6. Connect yellow (DRAIN) lead from tester to terminal No. 2 (FULL) on service panel.

7. Connect green (REPLACE FILTER) lead from tester to terminal No. 3 (FLTR) on service panel.

8. Connect blue (REMOVE CHIPS) lead from tester to terminal No. 4 (CHIP DET) on service panel.

9. Connect black (COMMON) lead from tester to terminal No. 5 (COM) on service panel.

10. Depress SYSTEM TEST switch. If green READY light comes on, fluid level is at an acceptable level, chip detector and filter bypass are free of contamination.

11. If red REPLACE FILTER light comes on, bypass switch is closed and filter should be removed and cleaned. (Refer to NAVAIR 01-40AVM-2-4.)

12. If red REMOVE CHIPS light comes on, chip detector must be removed. (Refer to NAVAIR 01-40AVM-2-4.)

13. If red DRAIN light comes on, fluid level is too high.

14. Remove fill and drain caps on service panel.

15. Connect fill and drain hoses on CSD Fluid Fill and Drain Unit to FILL and DRAIN connections on service panel.

WARNING

To preclude injury to personnel, avoid skin contact with silicone fluid. If fluid gets on hands, keep hands away from eyes because fluid is extremely irritating to eyes.

CAUTION

- Use only designated silicone fluid (MIL-S-81087A, Type 1) to lubricate CSD. Improper fluid will cause internal damage to unit.
- To prevent foaming, loss of cooling, and failure of CSD, do not overfill. Ensure that aircraft is in normal noseup attitude of 3 to 6 degrees.

16. Open drain line and evacuate fluid from CSD into used fluid container in service unit until red DRAIN light goes off and green READY light comes on.

17. If red FILL light comes on, fluid level is low.

Note

Steps 18 and 19 should be accomplished prior to adding fluid to the CSD.

18. Enter engine right-hand air inlet duct, and unlatch and open constant speed drive and generator outer and inner access door.

19. Use flashlight and inspection mirror to inspect exterior of CSD for lubricant leaks. If no external leakage is found, perform step 21.

20. If leakage is noted, replace CSD. (Refer to NAVAIR 01-40AVM-2-4.)

21. Add silicone fluid (MIL-S-81087A, Type 1) to CSD until red FILL light goes off and green READY light comes on.

22. Continue filling CSD until red DRAIN light comes on. Evacuate fluid until red DRAIN light goes off and green READY light comes on.

23. Disconnect service unit hoses from FILL and DRAIN connections on service panel.

24. Disconnect tester leads from terminal strip on service panel.

25. Disconnect connector P1 from tester.

26. Close hydraulic fluid cooler and fuel filter unit access door.

HYDRAULIC SYSTEM SERVICING

The utility hydraulic system and the flight control hydraulic system are serviced separately.

UTILITY HYDRAULIC SYSTEM FILLING

(See figure 1-35.)

1. Open engine forward compartment access doors and utility hydraulic reservoir access door.

2. Remove dust caps and connect source of hydraulic fluid to FILL quick-disconnect on right-hand side of engine compartment (figure 1-36).

3. Remove utility hydraulic bleed line from retaining clips; pass free end of line through utility hydraulic reservoir access door and place end in suitable container on wing to receive any possible overflow of fluid when bleeding.

4. Fill reservoir until piston registers FULL on sight gage. (Gage is viewed through utility hydraulic reservoir access door.) (See figure 1-37.)

CAUTION

Do not allow pressure applied to FILL port to exceed 65 psi.

5. Depress manual bleed valve until sight gage is free of air bubbles. (See figure 1-38.)

6. Disconnect external supply source when reservoir has been filled and bled.

7. Install dust cap on FILL quick-disconnect.

8. Reinstall bleed line in retaining clips.

FLIGHT CONTROL HYDRAULIC SYSTEM FILLING

(See figure 1-39.)

1. Open engine control access door and flight control hydraulic reservoir access door.

2. Remove dust cap and connect source of hydraulic fluid (MIL-H-5606) supply to FILL quick-disconnect (figure 1-40).

3. Remove flight control hydraulic bleed line from retaining clip, pass free end of line through flight control hydraulic reservoir access door, and place free end in suitable container on wing to receive any possible overflow of fluid when bleeding (figure 1-41).

4. Fill reservoir until piston registers full on sight gage. (Gage is viewed through flight control hydraulic reservoir access door.) (See figure 1-42.)

CAUTION

Do not allow pressure applied to FILL port to exceed 100 psi.

5. Depress manual bleed valve until sight gage is free of air bubbles.

6. Disconnect external supply source when reservoir has been filled and bled. Install dust cap.

7. Reinstall bleed line in retaining clamps; secure engine fuel control and flight control hydraulic reservoir doors.

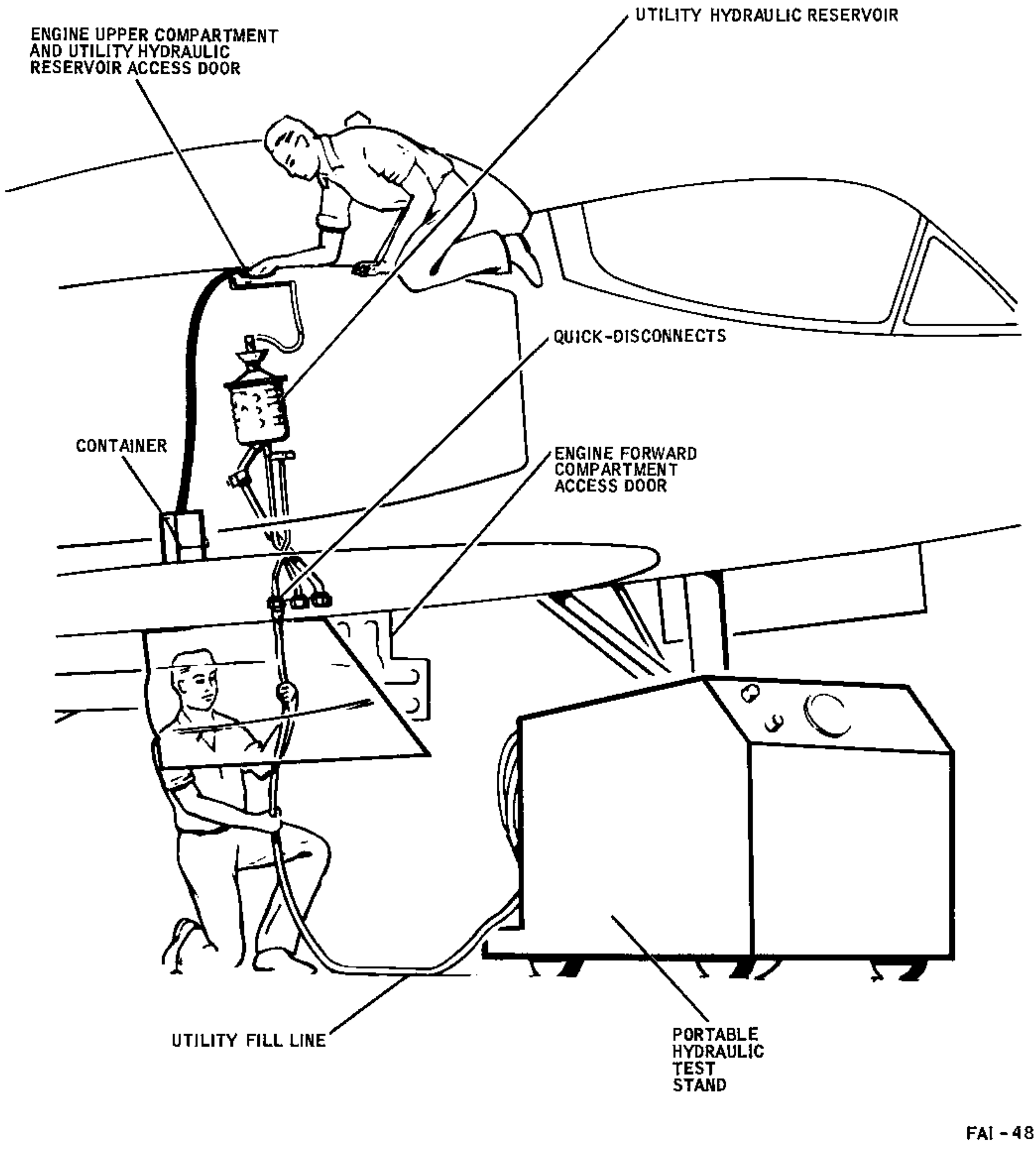
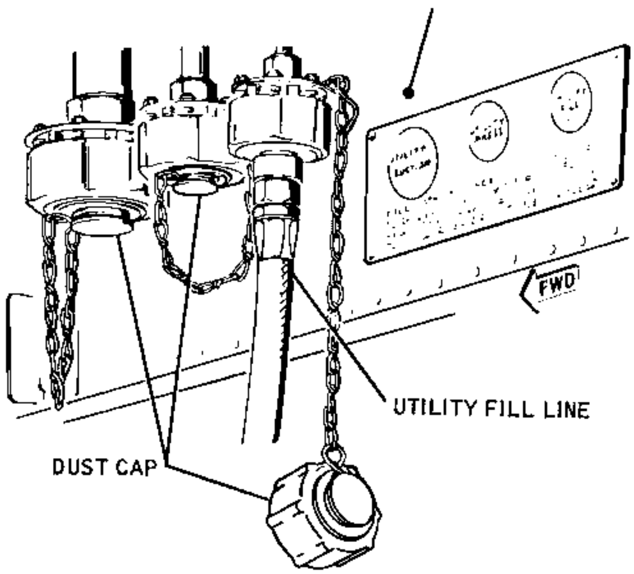


Figure 1-35. Utility Hydraulic System Filling



FA1-49

Figure 1-36. Utility Hydraulic Quick-Disconnect

BRAKE RESERVOIR SERVICING

(see figure 1-43.)

1. Open nose section.

Note

Aircraft should be in a 6-degree noseup attitude for servicing.

2. Remove filler plug from brake reservoir.
3. Insert filler nozzle of hydraulic servicing tank into reservoir filler port.
4. Fill reservoir with hydraulic fluid until gage indicates full.

Note

When sight gage indicates reservoir is full, do not add more fluid; if reservoir is filled to level of port, excess fluid will be vented overboard during flight maneuvers.

5. Install reservoir filler plug.

Note

Clean any spilled hydraulic fluid by wiping area with cloth moistened in naphtha.

6. Check brakes and bleed if necessary. (Refer to NAVAIR 01-40AVM-2-1.)

Note

If brakes are bled, service reservoir as necessary.

7. Close nose section.

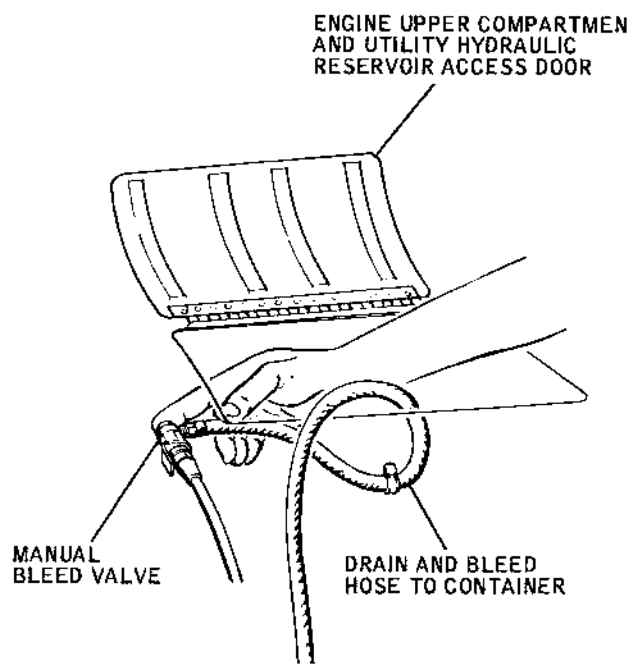
RAIN REPELLENT SYSTEM SERVICING

Servicing the rain repellent system (figure 1-44) consists of removal and replacement of the fluid container with a filled and charged container. A visual inspection of the system gage must be made during postflight inspection. If the gage indicates half full or less, the container should be replaced. Visual access to the system gage is gained through the APX-72(V) coder access door.

REMOVAL AND REPLACEMENT OF FLUID CONTAINER

WARNING

Make certain that aircraft ground handling safety equipment, referred to in NAVAIR 01-40AVM-2-1, is installed and that no electrical power is connected to the aircraft while servicing this system. Failure to comply may result in injury to personnel.



FA1-50

Figure 1-37. Utility Hydraulic Manual Bleed Valve

1. Open nose section of aircraft.

2. Loosen thumbscrew on clamp that holds container in support assembly.

3. Unscrew container from manifold.

Note

Some loss of fluid may occur during step 3 because of the residual pressure and fluid in the container. Catch residual fluid with a cloth.

4. Place new seal (MS28778-8) on full fluid container.

5. Screw container into manifold and secure with lockwire (MS20995N32).

Note

Some loss of pressure and fluid will occur during step 5. Remove fluid residue with cloth.

6. Tighten thumbscrew on clamp that holds container in support bracket.

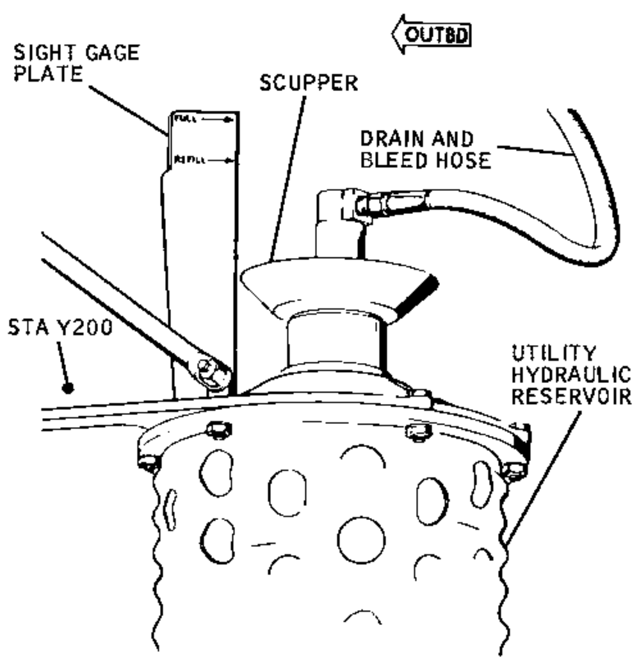


Figure 1-38. Utility Hydraulic Reservoir Sight Gage

7. Inspect area for cleanliness.

8. Close nose section. Insure that nose section is secure.

SERVICING RAIN REPELLENT FLUID CONTAINER

Servicing the rain repellent fluid container consists of refilling and recharging the container. Prior to servicing the container, secure a portable manifold assembly identical to the aircraft installation with the exception that the check valve is reversed.

1. Place container on work table with check valve up.

2. Bleed off dry nitrogen by depressing check valve.

3. Cut lockwire and unscrew check valve from neck of container. Empty remaining fluid from container into a measuring bottle.

4. Fill measuring bottle with 425±25 milliliters of rain repellent fluid (MIL-R-81261) and empty fluid into rain repellent container.

Note

Until the rain repellent fluid is available through normal supply channels, it is possible to mix locally. The following mixture produces approximately 5 gallons of rain repellent fluid.

10 percent (12.8 fl. oz.) Rain Repellent Fluid Solution 2911L-66	Foster D. Snell Co., Chemists and Engineers, New York City, New York 10007
0.5 percent (0.64 fl. oz.) Wetting Agent ARQUAD 2C-75	Armour Industrial Chemicals, Chicago, Illinois 60603
89.5 percent (114.56 fl. oz.) Freon-TF	E. I. Dupont DeNemours and Co., Inc., Wilmington, Delaware 19801

5. Replace check valve and secure to neck of container with lockwire (MS20995N32).

6. Screw container into portable manifold assembly.

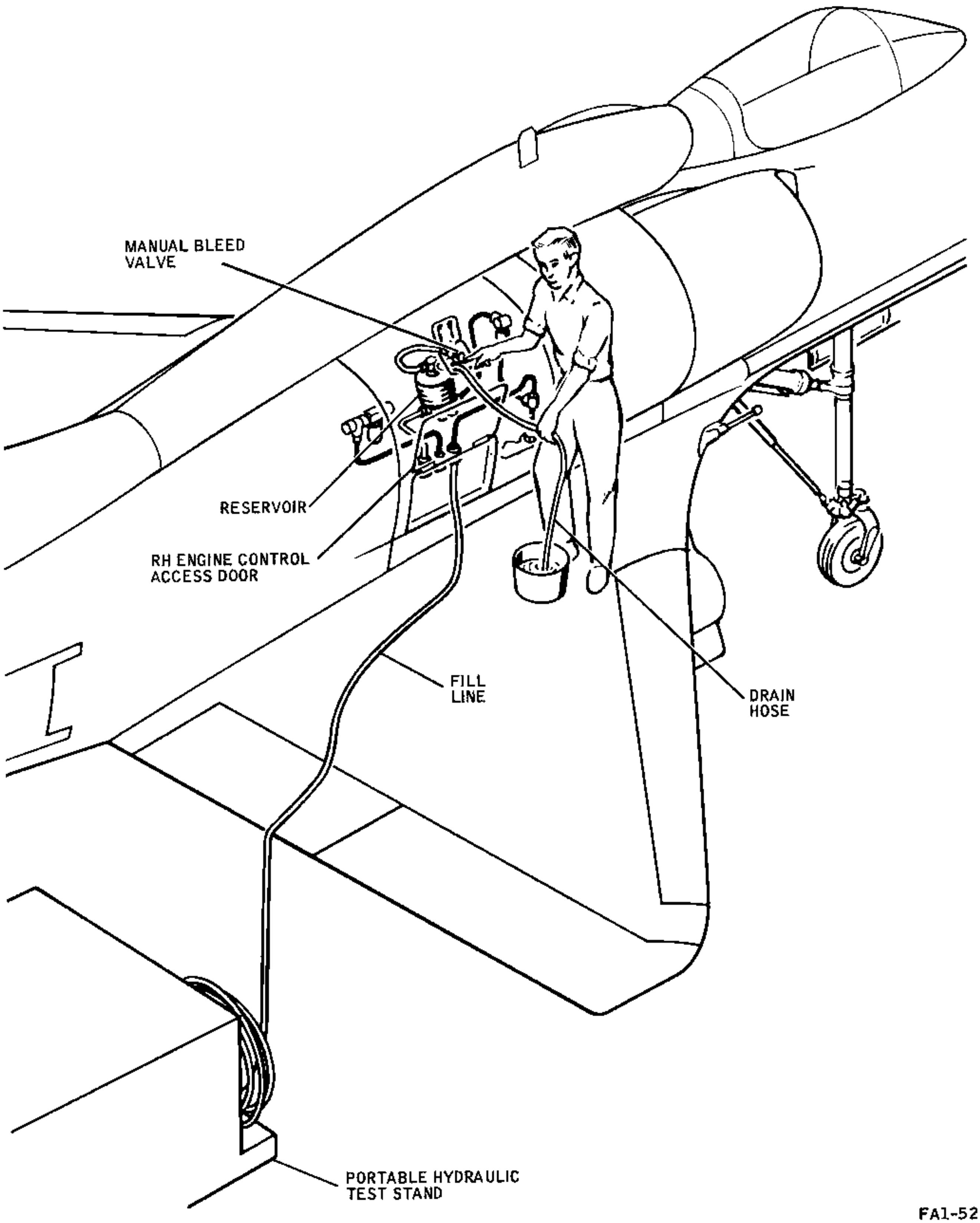


Figure 1-39. Flight Control Hydraulic System Filling

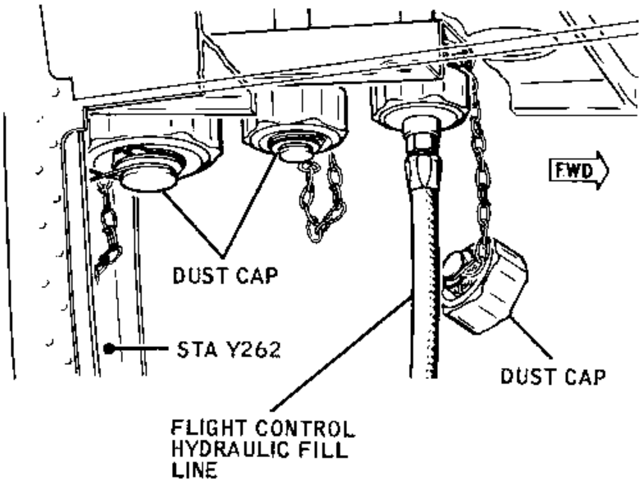


Figure 1-40. Flight Control Hydraulic Quick-Disconnect Panel

7. Attach hose from dry nitrogen supply to container and charge container to 75 to 100 psi.

8. Unscrew container from manifold.

9. Cover container check valve with suitable protective cap to protect against dust and accidental depressurization of container.

Note

Until container is used, store in dry storage area with tag that gives servicing information.

LIQUID OXYGEN SYSTEM SERVICING

Servicing of the 10-liter liquid oxygen system (figure 1-45) is accomplished by means of a portable external source. Liquid oxygen from an insulated servicing trailer is transferred under pressure to the aircraft system. Because of the nature of liquid oxygen, no external pressure source is required, as evaporation builds up sufficient pressure within the servicing trailer to complete the operation.

FILLING CONVERTER

1. Make certain oxygen switch in cockpit is in OFF position.

2. Open liquid oxygen compartment access door.

3. Remove filler valve cap from filler valve.

4. Purge filler hose on servicing trailer until oxygen flows in steady, uninterrupted stream.

5. Connect filler hose immediately to converter filler valve and commence filling.

Note

Any prolonged delay in connecting filler hose may allow liquid oxygen in hose to change to gaseous oxygen. Pressure in servicing trailer should be between 45 to 50 psi.

6. When liquid oxygen flows from overflow vent port in steady stream, close fill drain valve on servicing trailer; disconnect filler hose from filler valve which will automatically return converter to BUILDUP position.

WARNING

Warn all personnel working on aircraft and in area to stay clear of liquid oxygen overflow (figure 1-46).

Note

If the converter filler valve freezes during filling, remove filler hose and install filler valve cap. Recheck filler valve after approximately 10 minutes.

7. Relieve pressure in servicing trailer filler hose by engaging filler nozzle in purging device on trailer.

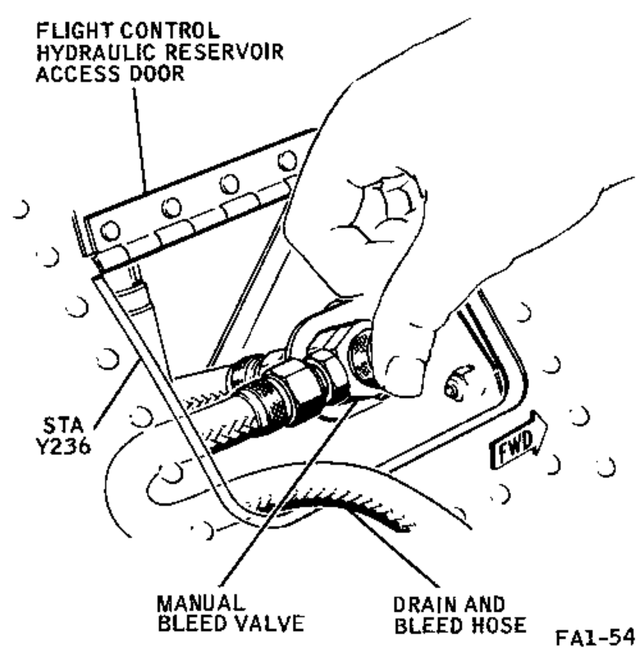


Figure 1-41. Flight Control Hydraulic Manual Bleed Valve

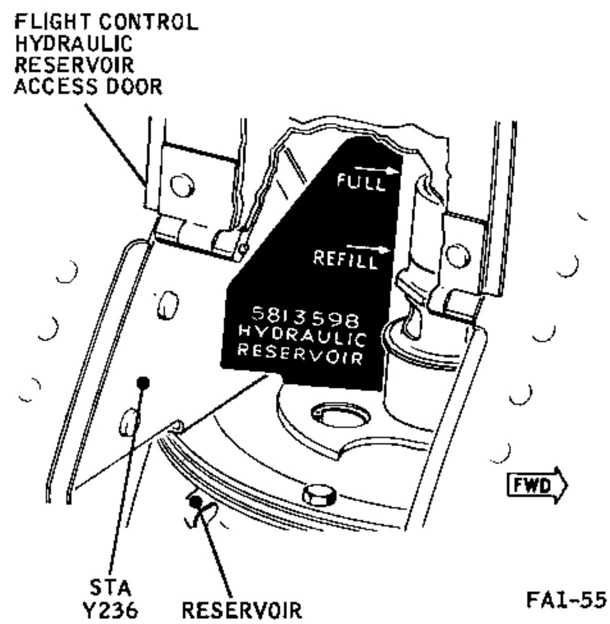


Figure 1-42. Flight Control Hydraulic Reservoir Sight Gage

8. Install dust cap on filler valve.

Note

Prior to installing filler valve dust cap, inspect cap closely for evidence of water. If water or moisture is noted, dry thoroughly with compressed air because water in cap may freeze in filler valve.

9. Install dust cap on filler hose nozzle.

10. Secure liquid oxygen compartment door.

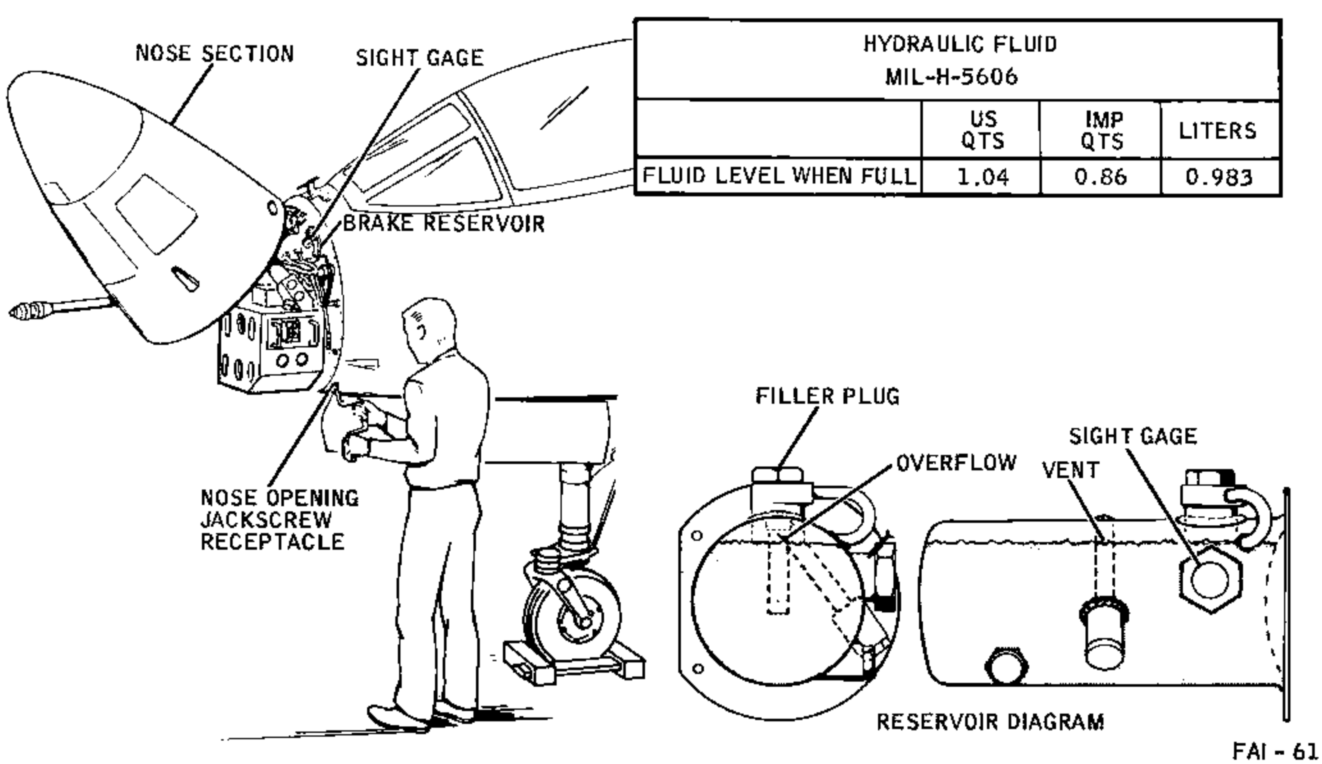
EMERGENCY OXYGEN BOTTLE SERVICING

(See figure 1-47.)

1. Unsnap seat pad at snap fasteners and fold pad back for access to filler valve cover.

2. Pry filler valve access hole cover upward from cutout on right-hand side of survival kit at position adjacent to emergency oxygen bottle pressure gage.

3. Loosen and remove filler cap on filler valve.



HYDRAULIC FLUID MIL-H-5606			
	US QTS	IMP QTS	LITERS
FLUID LEVEL WHEN FULL	1.04	0.86	0.983

Figure 1-43. Brake Reservoir Servicing

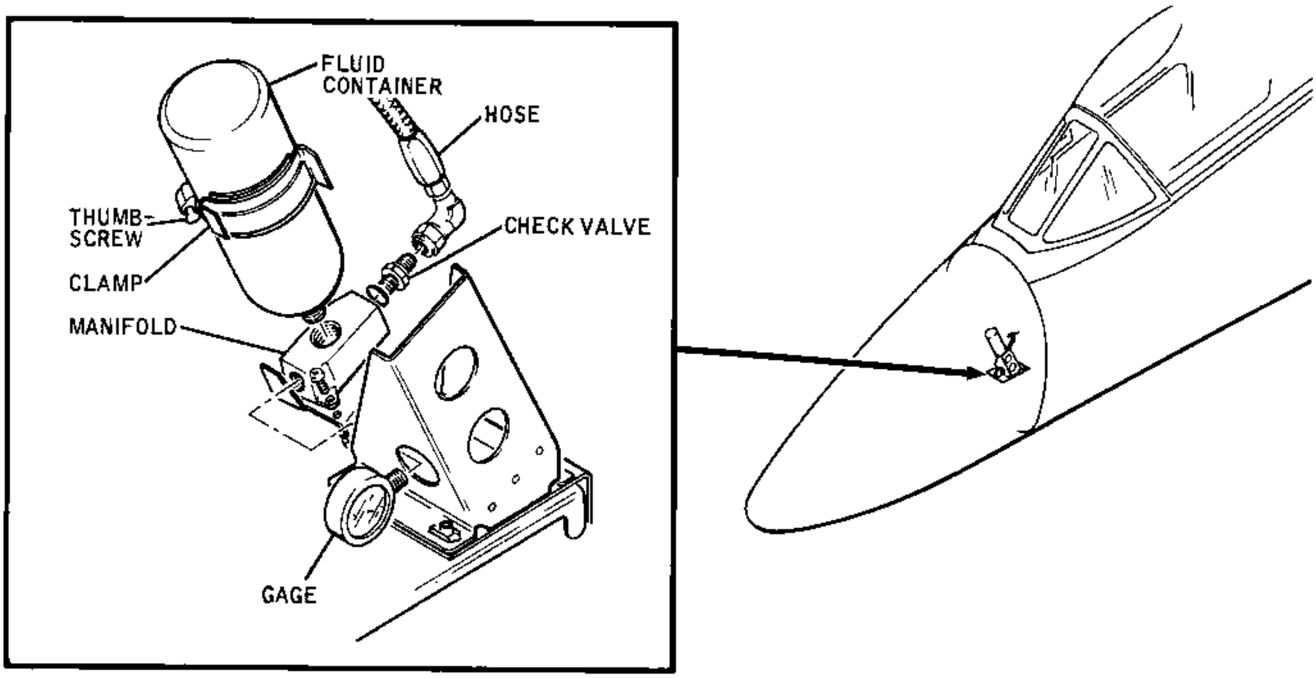


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Figure 1-44. Rain Repellent System Servicing

4. Connect source of gaseous oxygen (MIL-O-27210) to emergency bottle filler valve. Charge bottle to correct pressure compensated for ambient air temperature. See figure 1-47.

5. Disconnect oxygen supply from filler valve and check valve for leakage.

6. Install filler cap on filler valve. Press filler valve access hole cover into cutout above filler valve until cover prongs retain cover securely.

7. Fold seat pad forward into place and secure snap fasteners to mating parts on survival kit.

EXTERNAL POWER APPLICATION

Two methods of applying ac external power to the aircraft are available. The primary or standard method uses an ac mobile electrical powerplant, NC-10 or equivalent (figure 1-48). The second method enables a ground crewman to apply ac power, dc power, and starter air through the engine starter access door for pilot-controlled starts, utilizing the aircraft ground start disconnect cable. The second method supplies electrical power only to the start/abort switch and the engine ignition system.

STARTING REQUIREMENTS

A high-pressure air supply to the air turbine starter (installed in the aircraft) and external electrical power is required for starting the A-4.

SUITABLE STARTER UNITS

Suitable starter units for A-4 aircraft are:

Air Starter Units (GTC)

USN	USAF
GTC-85	MA-1
MA-1E	MA-1A
*WELLS Air Start System	MA-1TA
	MA-2
MD-3B	MD-1A
	MD-2A

*Set to low pressure ratio.

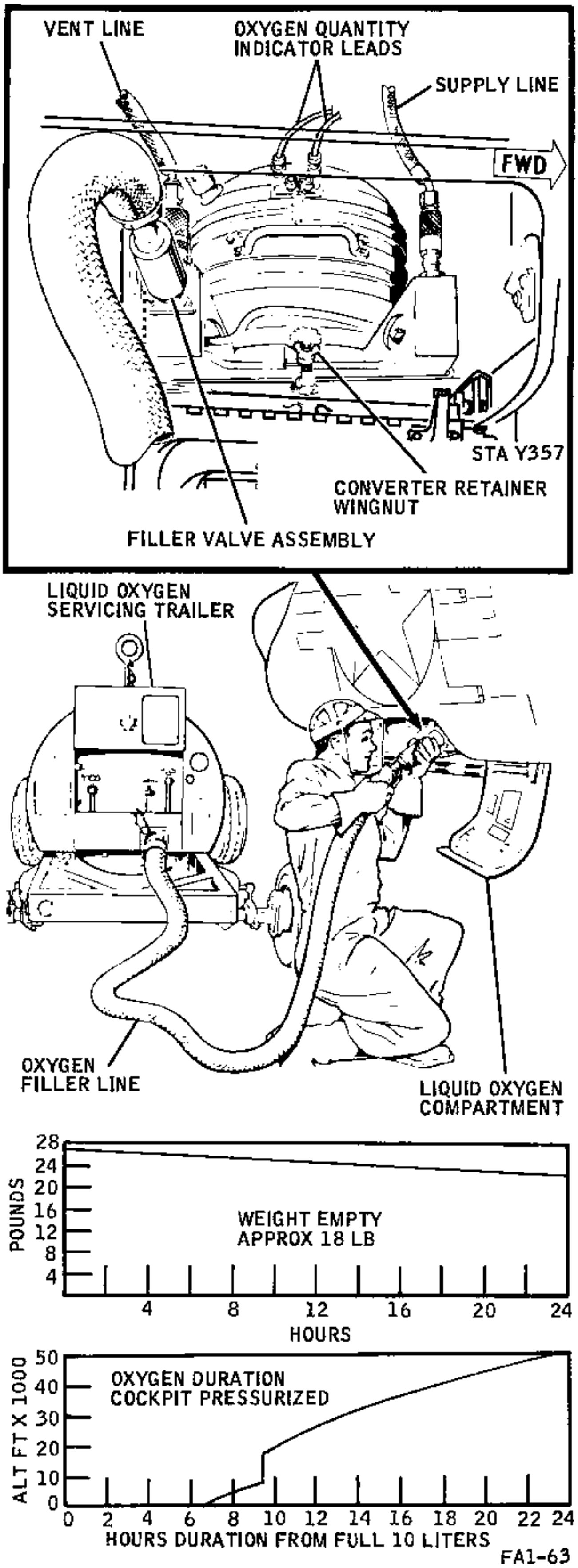


Figure 1-45. Liquid Oxygen System Servicing

Electrical Power Units

USN	USAF	RCAF
NC-5	B-10	CAN-C
NC-6	B-10A	
NC-6A	B-10B	
NC-7	MD-3	
NC-8		
NC-8A		
NC-10		
NC-12		

Combination Electrical/Air Starter Units

USN	USAF
*RCPP/RCPT/NCPP-105	MA-2MP
	MA-3MP
	M32A-60
	*MD-3A

*Set to low pressure ratio.

A source of 115-vac power is required for ignition. Twenty-eight vdc power is required if a cockpit controlled start is desired. Ac power can be provided through the external power receptacle (figure 1-48) or through the aircraft ground start disconnect (figure 1-49). Dc power (for cockpit controlled start) can only be supplied through the aircraft start disconnect.

Note

If 28-vdc power is not available, a ground start must be accomplished.

FORWARD TOWING PROVISIONS

For forward towing (see figure 1-50), either a standard towbar or an adjustable towbar may be attached to the nosewheel axle. Ensure that main and nose

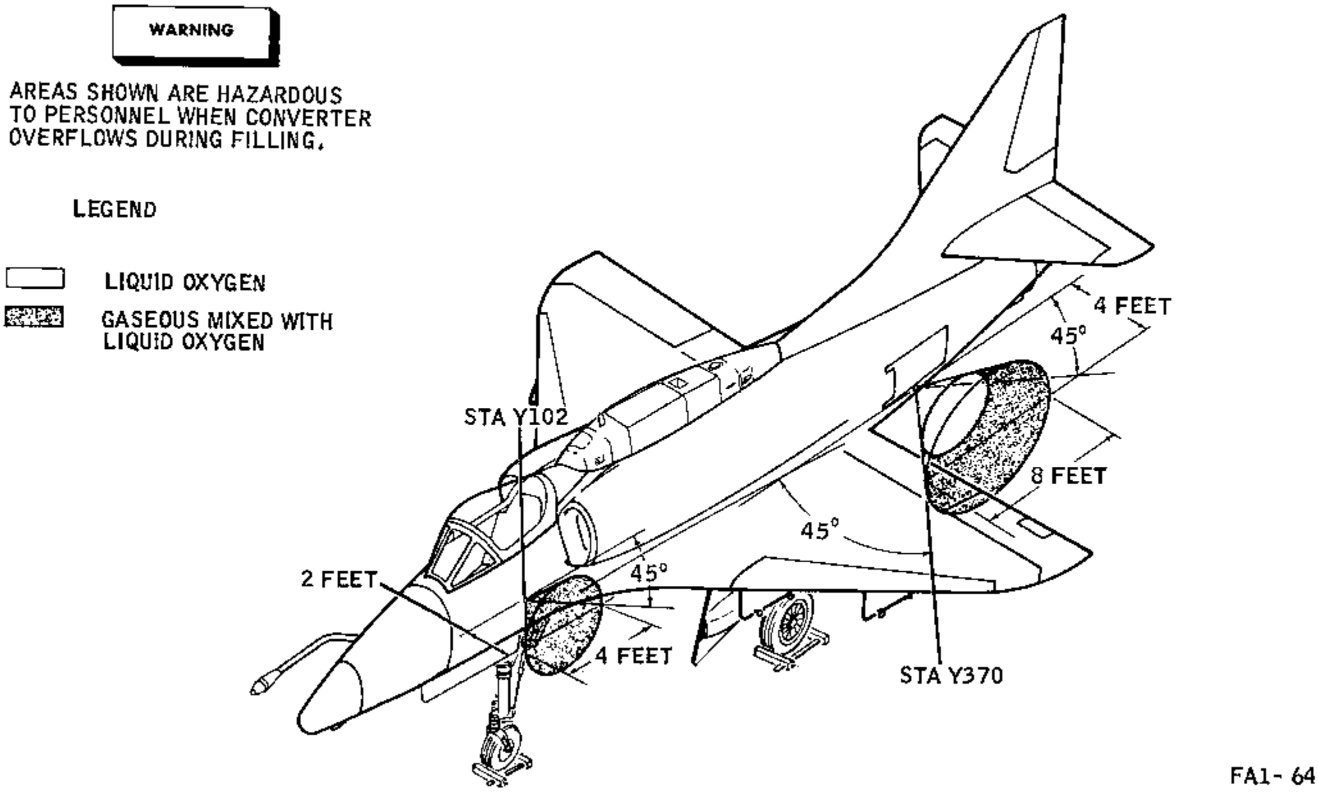


Figure 1-46. Liquid Oxygen Handling Precautions

landing gear lockpins are installed before towing aircraft. Standard hand signals shall be utilized to relay instructions to personnel towing aircraft.

CAUTION

- Towing of aircraft with the engine and tail section removed is not recommended. If the aircraft forward section must be moved, defuel the fuselage fuel cell to improve turning stability, and ensure that enough personnel are available to prevent overturn.
- To prevent possible damage to the canopy hinge structure while towing the aircraft with the canopy open, ensure that the internal canopy control handle is in the fully unlocked position and that the canopy restraint strap is attached. Do not tow the aircraft without a qualified plane captain in the cockpit.
- Do not exceed a speed of 10 miles per hour while towing along a straight path or 5 miles per hour while turning. Do not make sudden stops.

When high winds prevail, chain tiedown assemblies shall be used to secure aircraft immediately when parked.

TOWING SAFETY PRECAUTIONS

Towing the aircraft safely requires the undivided attention of all personnel concerned. Ensuing text defines limitations which should not be exceeded and procedures which should be followed for maximum safety.

TOWING WITH ASYMMETRICAL LOADS

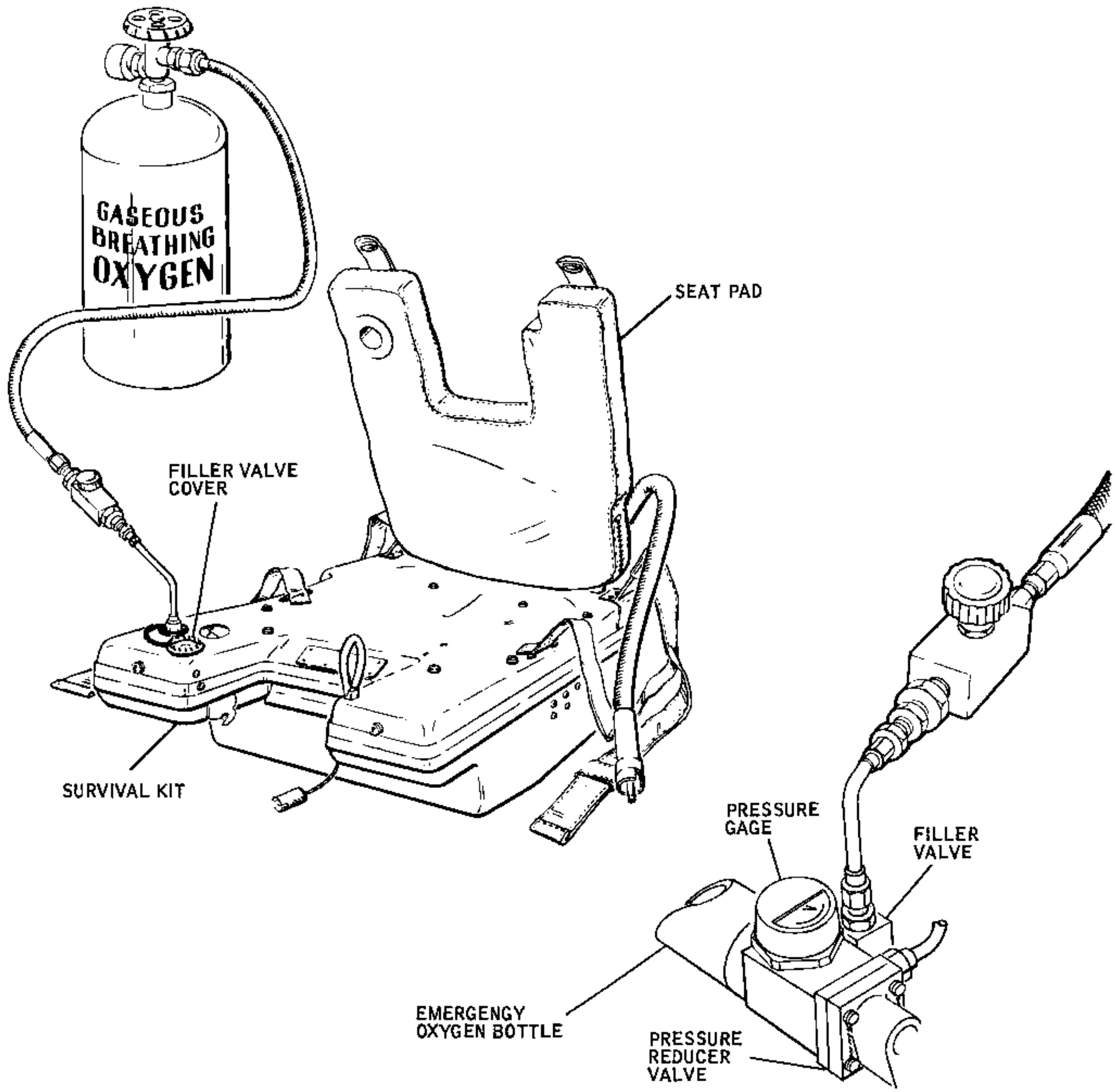
Asymmetrical loading of the aircraft imposes certain limitations on towing. Figure 1-51 shows speeds recommended for towing the aircraft with or without the fuselage aft section attached, and with asymmetrical loads at wing stations X75 and X113.

CAUTION

Turns of less than 10-foot radius shall not be made.

TIEDOWN PROVISIONS

The aircraft can be secured to the ground, flight deck, or hanger deck with chain assemblies attached to tiedown rings on the nose gear, on each main gear, and on each side of the wing lower surface. The nose gear shock strut is provided with two tiedown



WARNING

MAKE CERTAIN PRESSURE REDUCER VALVE ASSEMBLY AND LOCKWIRE ARE NOT DAMAGED OR BROKEN DURING SERVICING.

EMERGENCY OXYGEN BOTTLE CHARGING PRESSURE

AMBIENT AIR TEMPERATURE		CHARGING PRESSURE	AMBIENT AIR TEMPERATURE		CHARGING PRESSURE
F°	C°	(psi)	F°	C°	(psi)
0	-18	1600	70	21	1925
10	-12	1650	80	27	1950
20	-7	1675	90	32	2000
30	-1	1725	100	38	2050
40	5	1775	110	43	2100
50	10	1825	120	49	2150
60	16	1875	130	54	2200

FA1-65-A

Figure 1-47. Emergency Oxygen Bottle Servicing

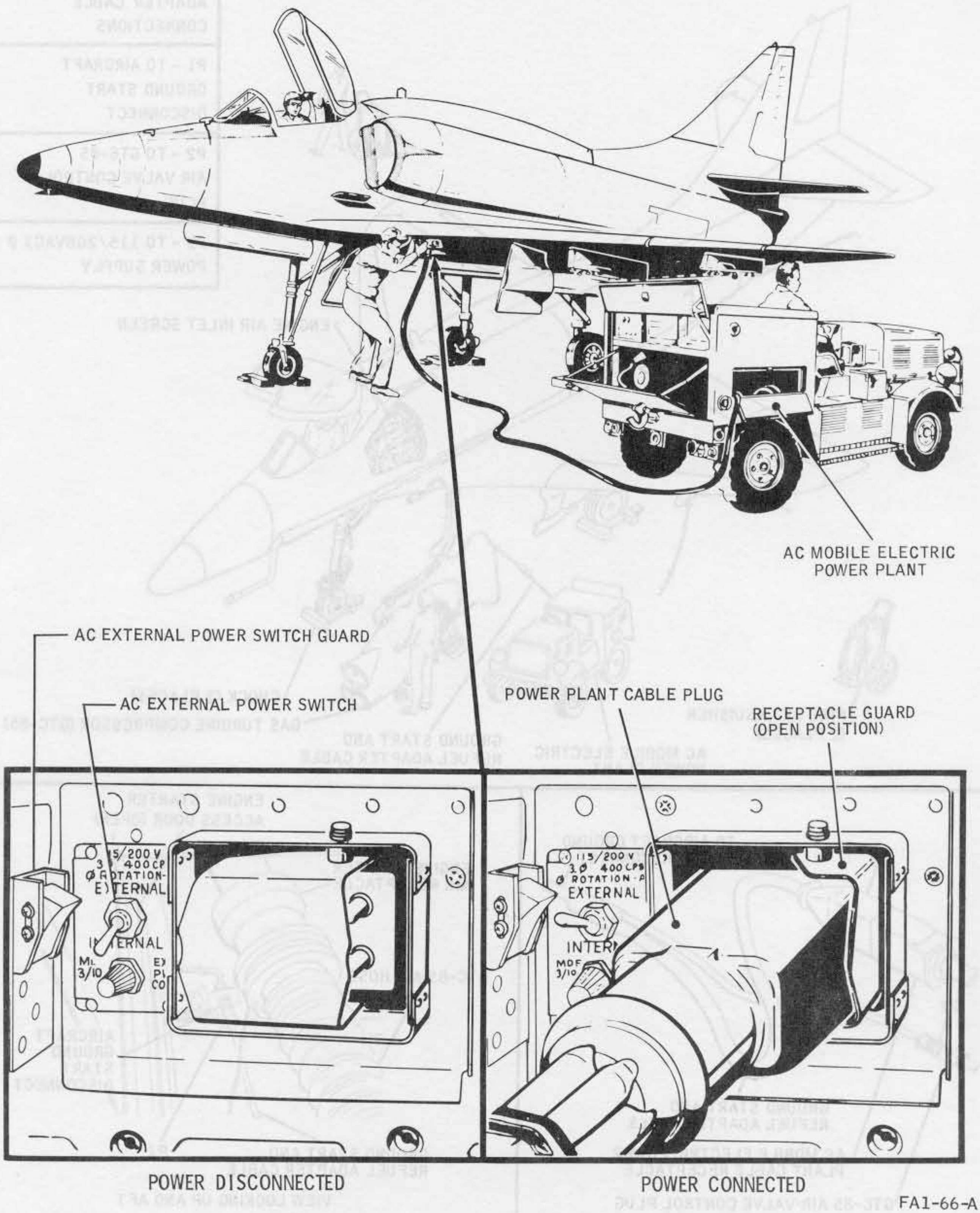
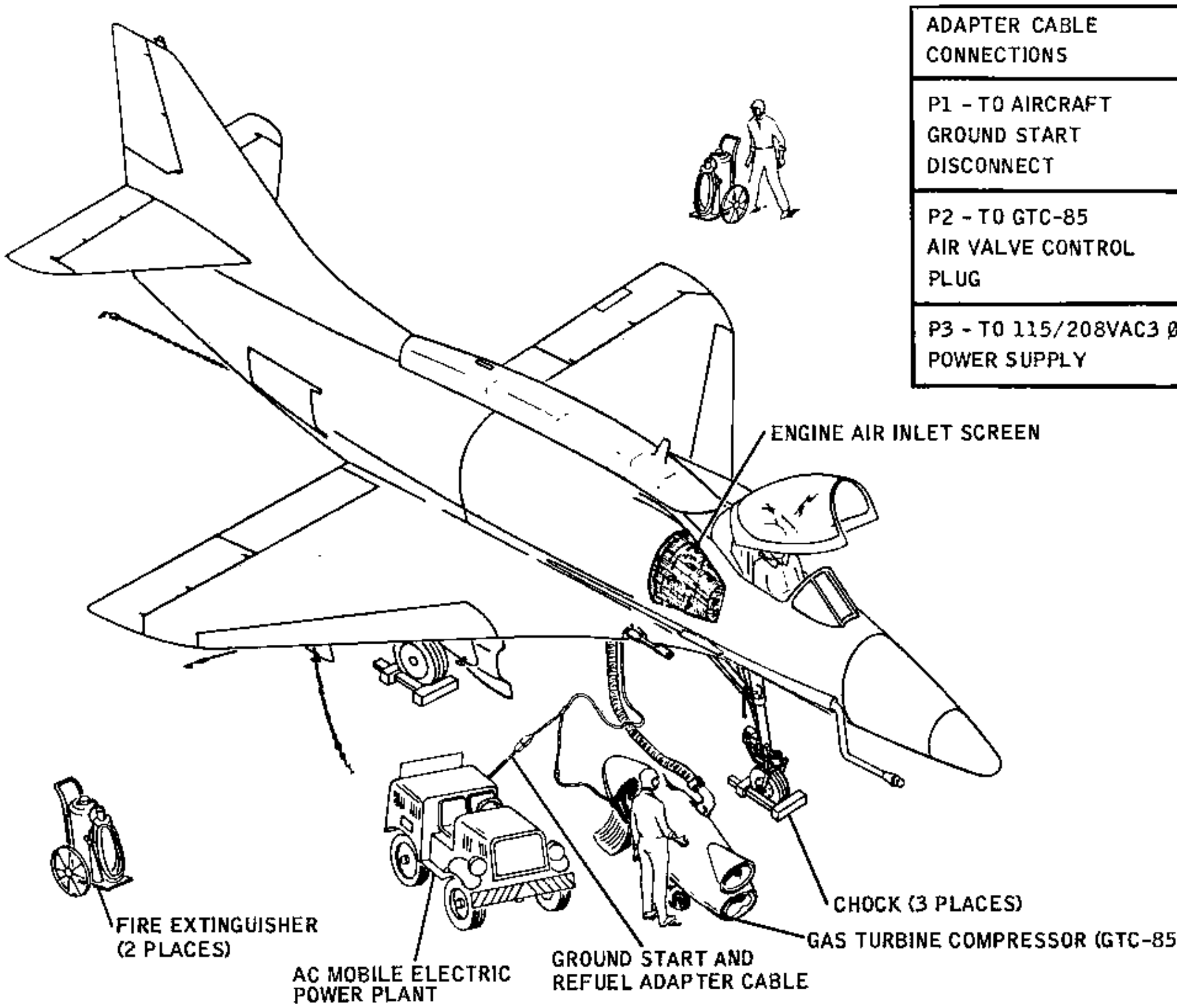
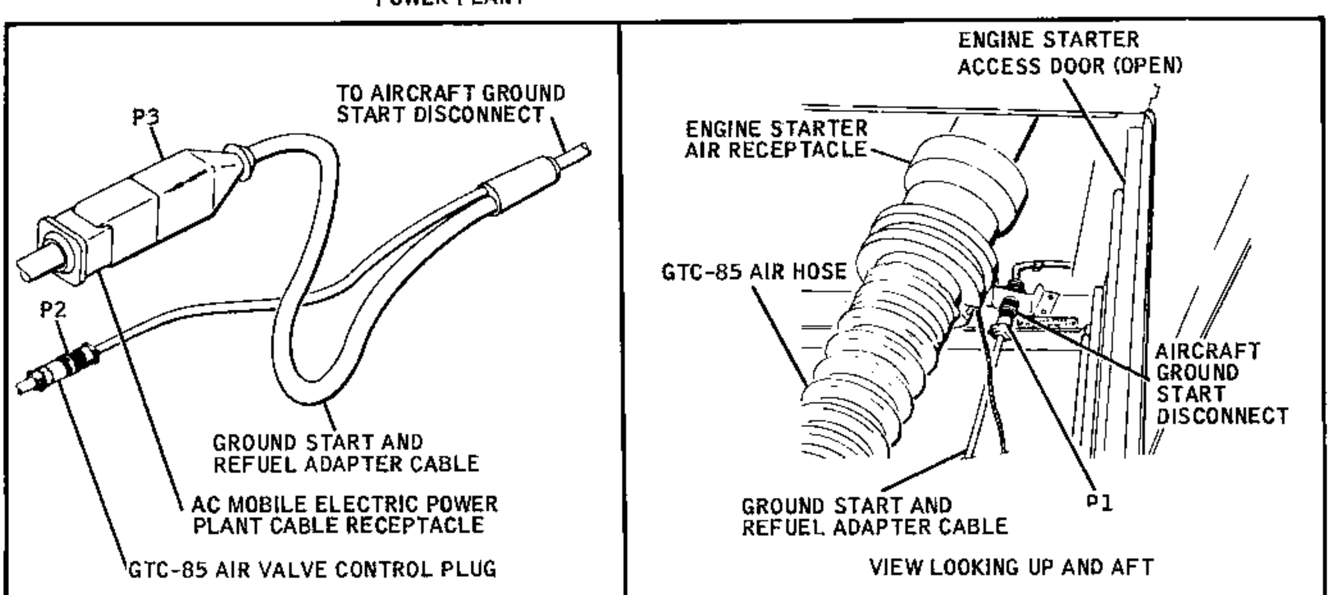


Figure 1-48. External Power Application

ADAPTER CABLE CONNECTIONS
P1 - TO AIRCRAFT GROUND START DISCONNECT
P2 - TO GTC-85 AIR VALVE CONTROL PLUG
P3 - TO 115/208VAC3 Ø POWER SUPPLY





FA1-67-A

Figure 1-49. Engine Ground Starting Preliminary Preparations

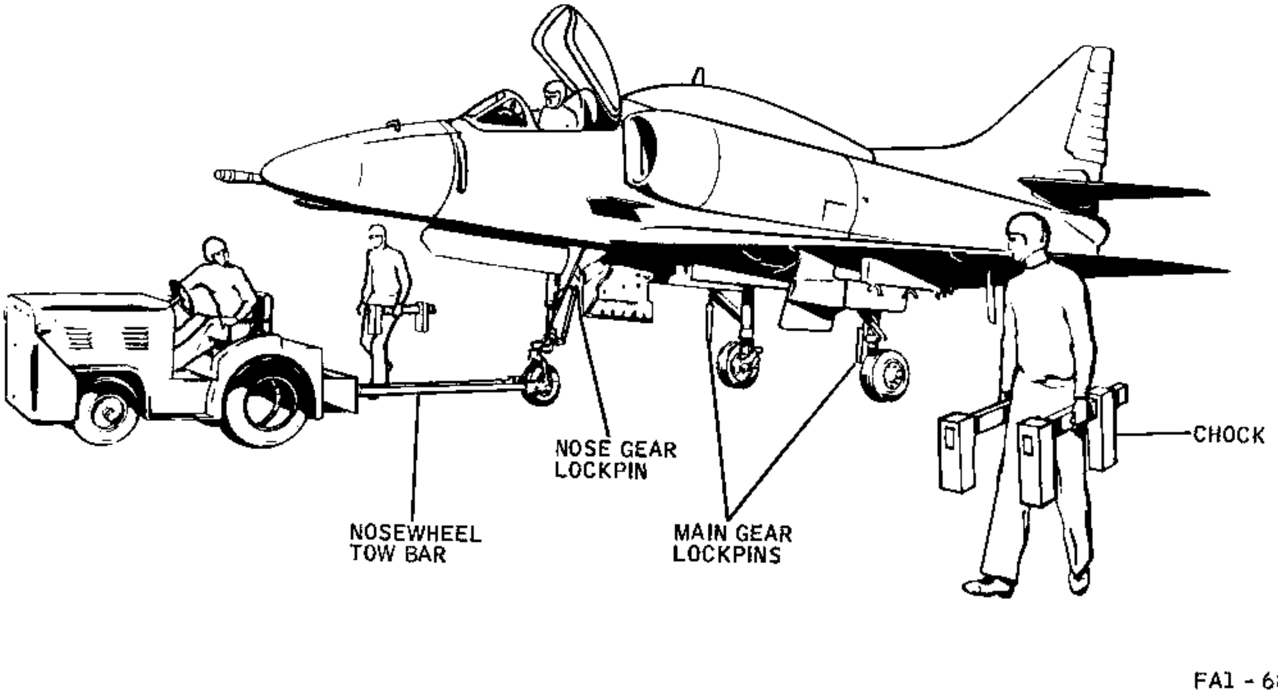


Figure 1-50. Forward Towing

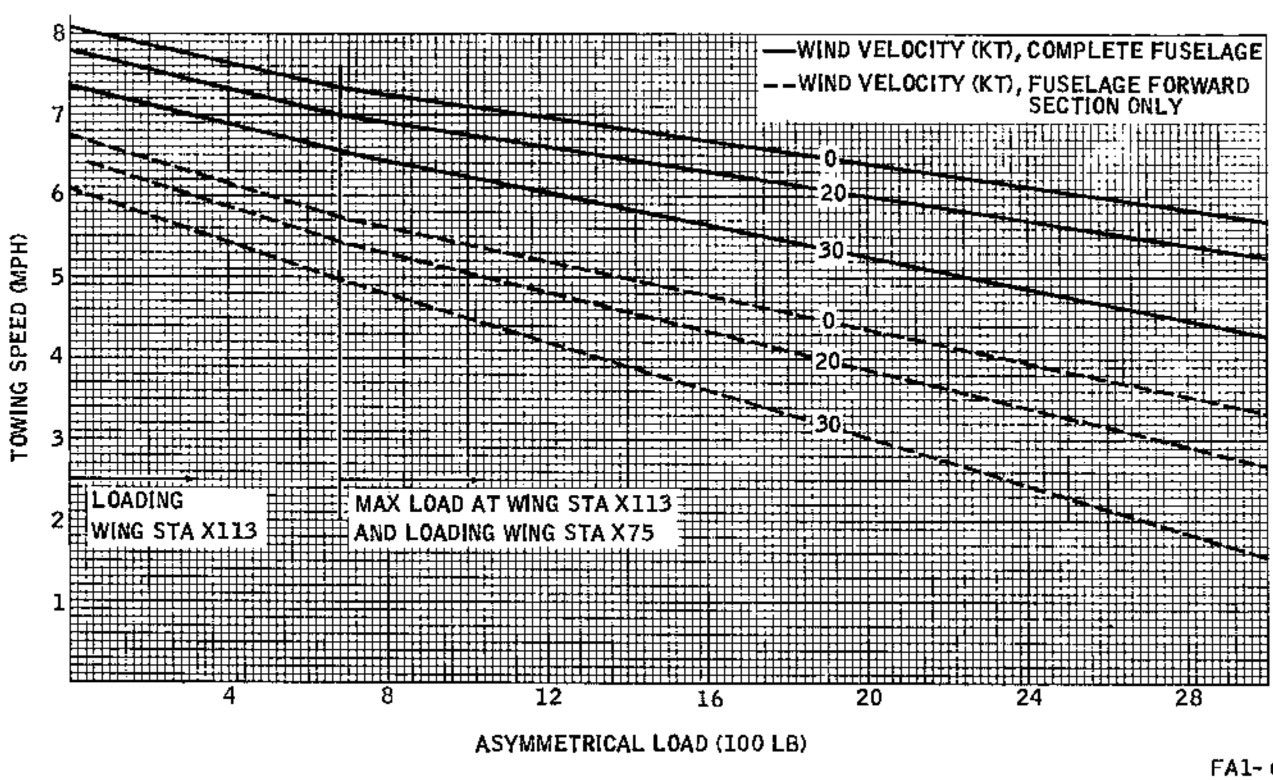


Figure 1-51. Towing Speeds for Asymmetrical Loadings

rings; one on each side. Recommended landbased tiedown procedures for normal, moderate, and heavy weather conditions are contained in subsequent paragraphs. (For shipboard tiedown procedures refer to NAVAIR 01-40AVM-2-1.)

NORMAL WEATHER LAND-BASED TIEDOWN PROCEDURES

(See figure 1-52.)

The following procedures are required for normal weather land-based aircraft tiedown.

CAUTION

Wind for normal weather tiedown must not exceed 40 knots.

1. Install landing gear lockpins.

2. Spot aircraft, on apron tiedown pad-eye pattern, with nose pointing into the wind.

3. Secure nosewheel and main gear wheels fore and aft with adjustable chocks.

CAUTION

Tiedown chains must be attached to pad-eye fittings as shown in figure 1-52 to prevent damage to aircraft.

4. Attach chain assemblies to tiedown points indicated for normal weather and tighten chains.

5. Make certain throttle lever is in OFF position and tighten THROTTLE FRICTION and LOCK CONTROL.

MODERATE WEATHER LAND-BASED TIEDOWN PROCEDURES

(See figure 1-52.)

The following procedures are required for normal weather land-based aircraft tiedown.

CAUTION

Wind for moderate weather tiedown must not exceed 60 knots.

1. Install landing gear lockpins.

2. Spot aircraft, on apron tiedown pad-eye pattern, with nose pointing into the wind.

3. Secure nosewheel and main gear wheels fore and aft with adjustable chocks.

CAUTION

Tiedown chains must be attached to pad-eye fittings as shown in figure 3-20 to prevent damage to aircraft.

4. Attach chain assemblies to tiedown points indicated for moderate weather, and tighten chains.

Note

Periodic inspection is required to ensure that chains remain tight.

5. Remove external armament stores.

6. Make certain that throttle lever is in OFF position and tighten THROTTLE FRICTION and LOCK CONTROL.

7. Close canopy and install canopy cover.

8. Install pitot and temperature probe covers.

9. Install manifold exhaust cover.

10. Install aft compartment cooling duct plugs.

11. Install wing control surface locks.

12. Install wing slat locks.

13. Install engine air inlet covers.

14. Install angle-of-attack vane guard.

15. Install nose compartment cooling duct plugs.

16. Install air conditioning ram air duct plugs.

17. Install engine exhaust cover.

18. Remove entrance ladder if installed.

HEAVY WEATHER LAND-BASED TIEDOWN PROCEDURES

(See figure 1-52.)

The following procedures are required for heavy weather land-based aircraft tiedown.

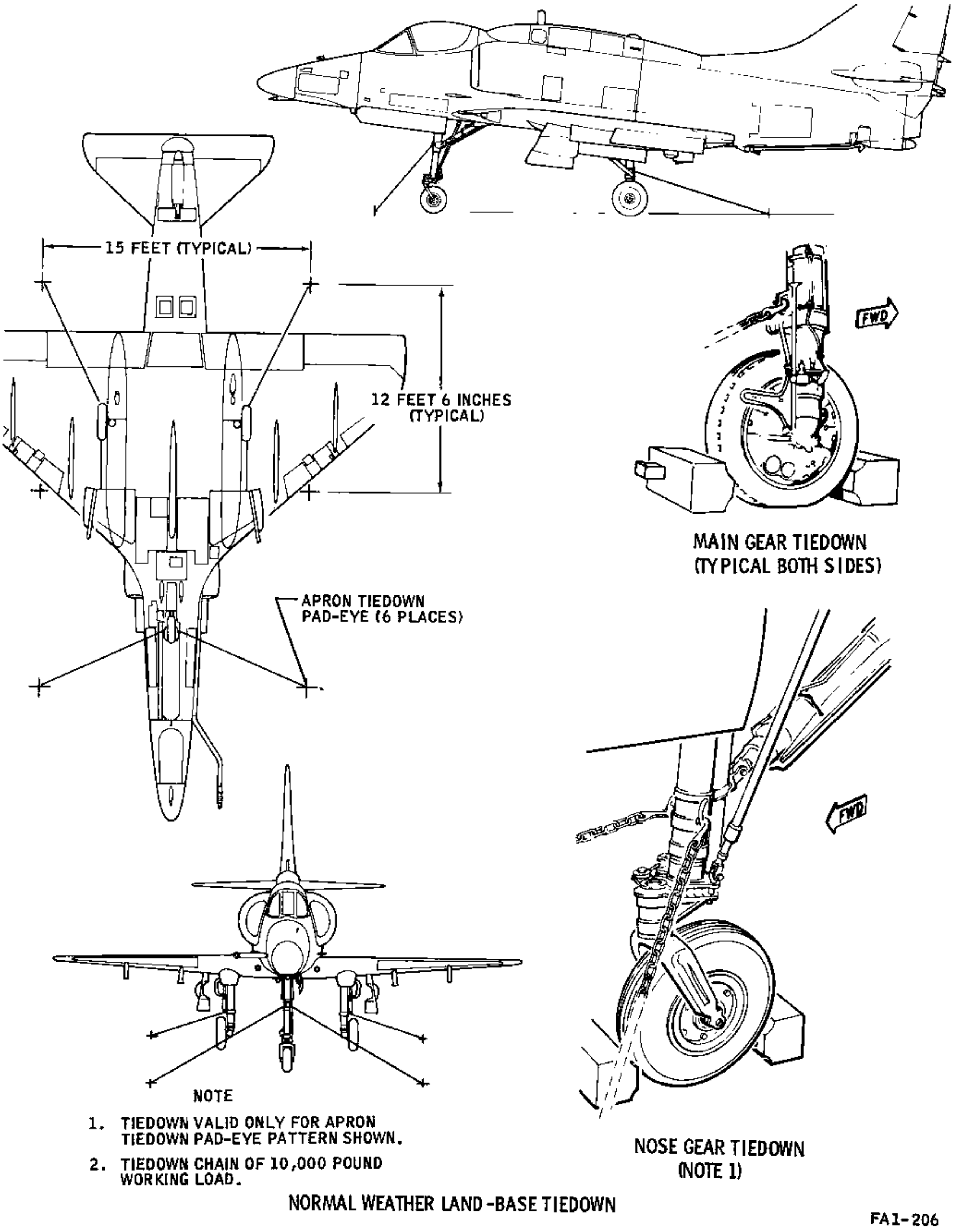


Figure 1-52. Tiedown Provisions (Sheet 1)

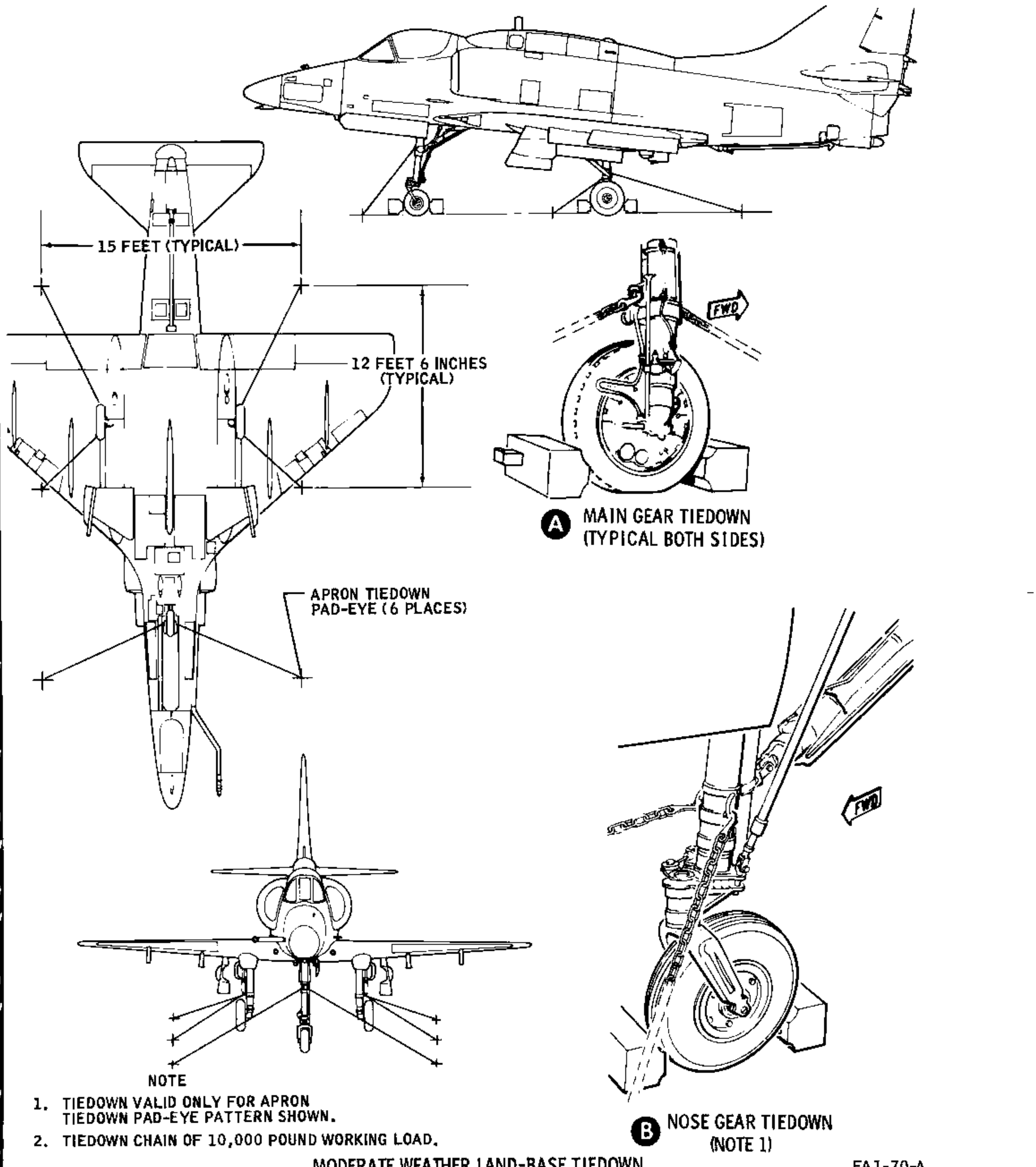


Figure 1-52. Tiedown Provisions (Sheet 2)

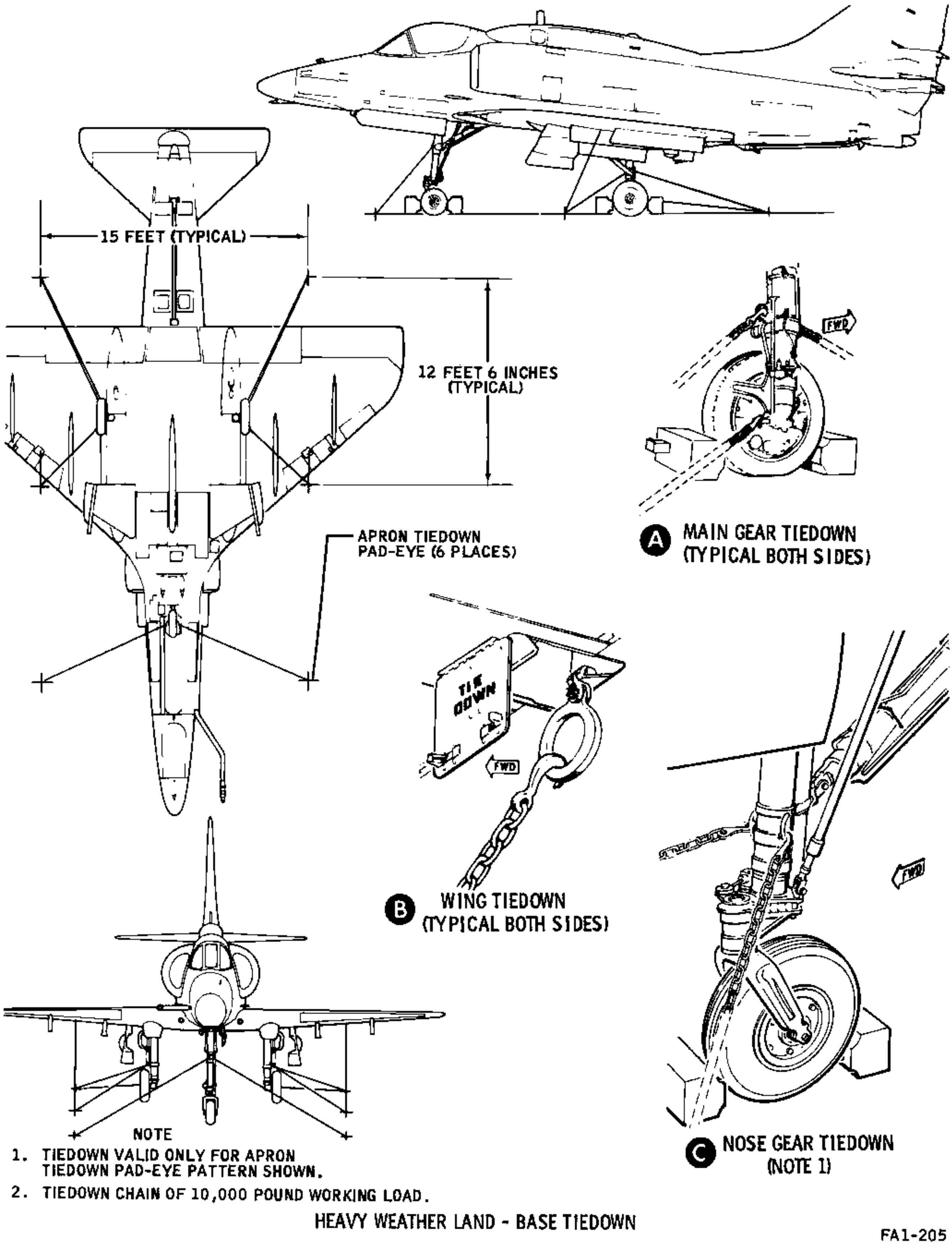


Figure 1-52. Tiedown Provisions (Sheet 3)

CAUTION

Wind for heavy weather tiedown must not exceed 100 knots.

Note

The aircraft should be moved to hangar or flown out of storm area if possible.

1. Install landing gear lockpins.

2. Spot aircraft, on apron tiedown pad-eye pattern, with nose pointing into the wind.

3. Remove all ammunition and external armament stores.

4. Add fuel, if possible, to eliminate fuel vapors and help provide stability.

5. Install nosegear shock strut safety lock.

6. Secure nosewheel and main gear wheels fore and aft with adjustable chocks. Secure chocks to wheels with short lengths of manila line.

CAUTION

Tiedown chains must be attached to pad-eye fittings as shown in figure 1-52 to prevent damage to aircraft.

7. Attach chain assemblies to tiedown points indicated for heavy weather, and tighten chains.

Note

Periodic inspection is required to ensure that that chains remain tight.

8. Close canopy and install enclosure cover.

9. Install wing control surface locks.

10. Install wing slat locks.

11. Install engine air inlet covers.

12. Fabricate and install control surface batten on rudder.

Note

A rudder batten can be fabricated from two 3/16- or 1/4-inch plywood strips approximately 2 inches wide and 8 feet long. The strips should be placed to extend across opposite sides of the vertical fin and rudder. Felt or other suitable padding should be placed on surface contacting aircraft.

13. Install pitot and temperature probe covers.

14. Install engine exhaust cover.

15. Make certain throttle lever is in OFF position, and tighten THROTTLE FRICTION and LOCK CONTROL.

16. Install manifold exhaust cover.

17. Install aft compartment cooling duct plugs.

18. Install angle-of-attack vane guard.

19. Install nose compartment cooling duct plugs.

20. Install air conditioning ram air duct plugs.

21. Remove entrance ladder.

DANGER AREAS

During ground operation certain hazardous areas exist. These areas are depicted in figure 1-53.

TURNING RADII

For turning radii of the A-4M aircraft, see figure 1-54.

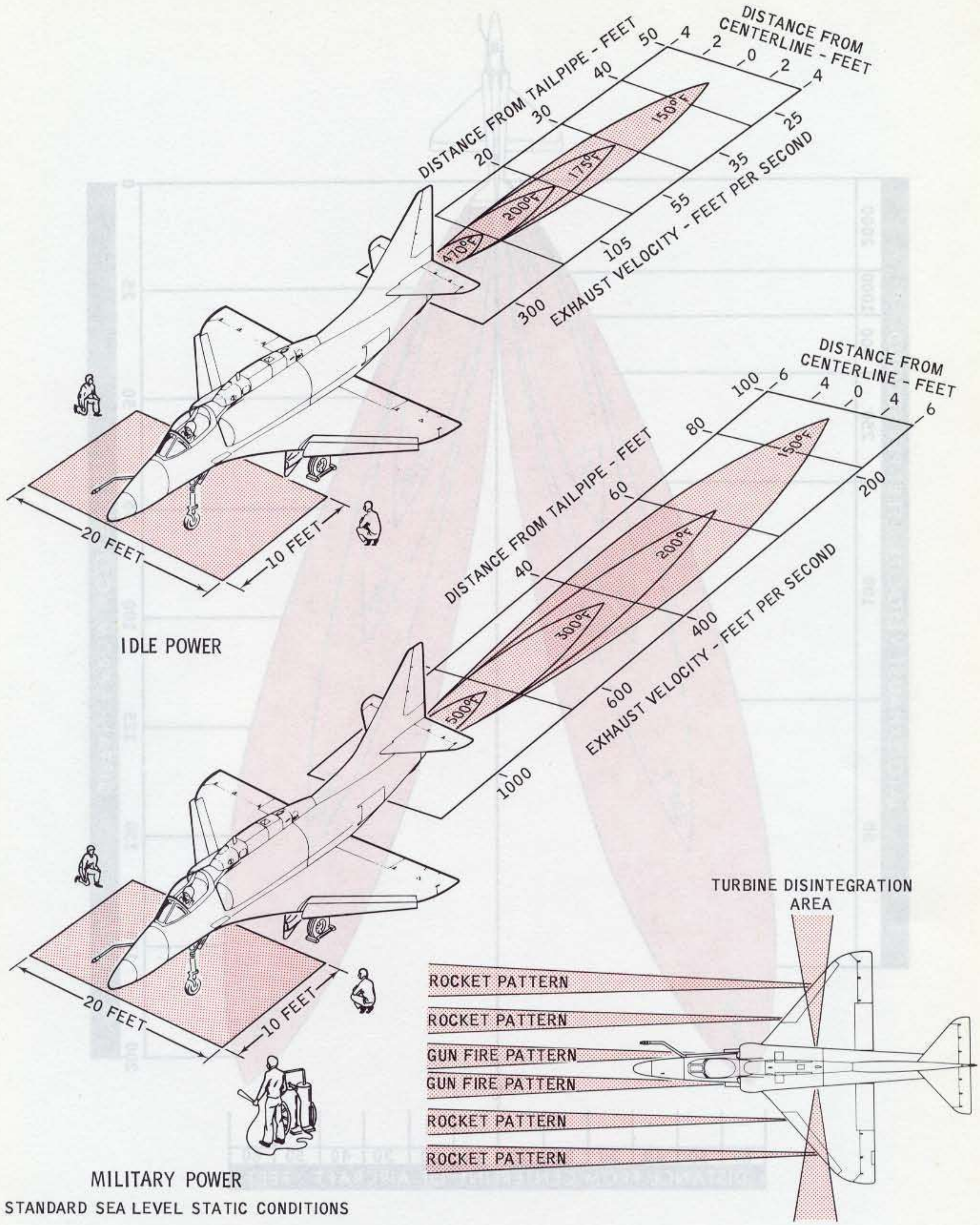


Figure 1-53. Danger Areas (Sheet 1)

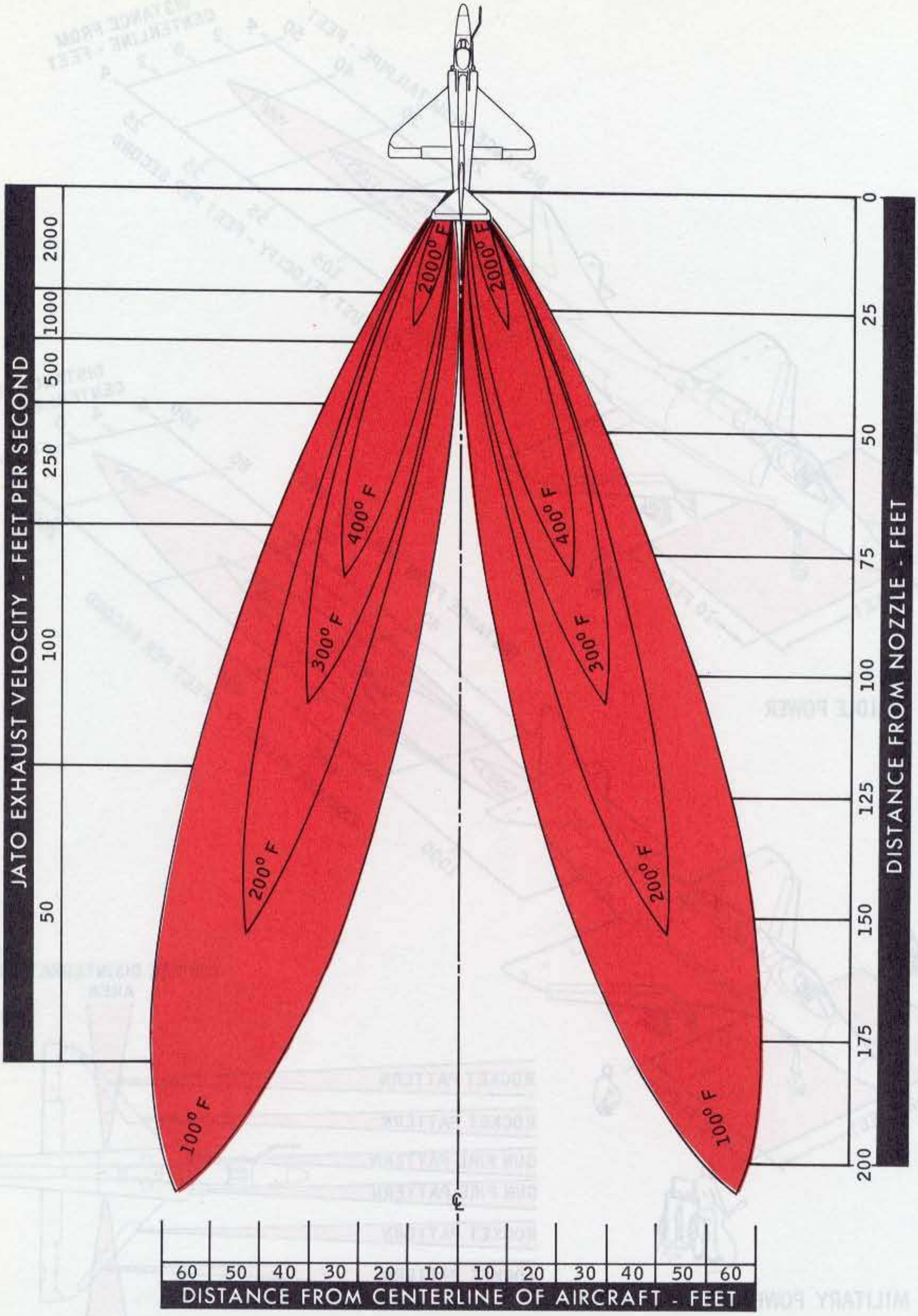
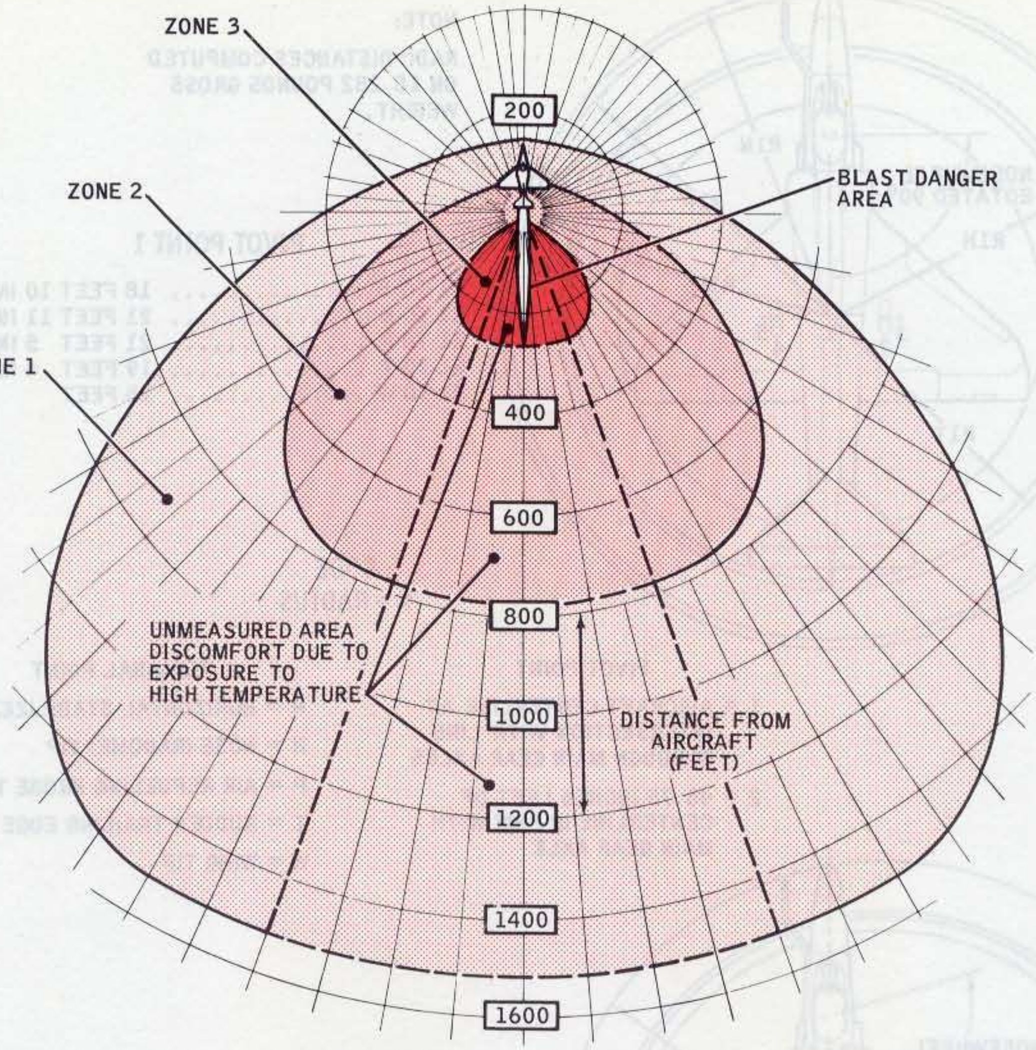


Figure 1-53. Danger Areas (Sheet 2)



ENGINE TRIM OPERATION 1. ENGINE POWER SETTING AT MILITARY WITH NO SOUND SUPPRESSORS. 2. ZONES ARE BASED ON A FIFTEEN MINUTE EXPOSURE FOR AN EIGHT HOUR PERIOD.	
DANGER AREA	DATA
ZONE 1	EARMUFFS OR EARPLUGS SHALL BE WORN WHEN WORKING WITHIN THIS AREA.
ZONE 2	EARMUFFS AND EARPLUGS SHALL BE WORN WHEN WORKING WITHIN THIS AREA
ZONE 3	CRITERIA FOR FIFTEEN MINUTE EXPOSURE EXCEEDED. PERSONNEL SHALL NOT ENTER EXCEPT FOR VERY SHORT DURATION.

WARNING

1. EAR PROTECTION SHALL BE PROPERLY FITTED TO PERSONNEL.
2. DURING ENGINE OPERATION AT IDLE POWER, EARMUFFS OR EARPLUGS SHALL BE WORN BY PERSONNEL WITHIN 100 FEET OF AIRCRAFT.

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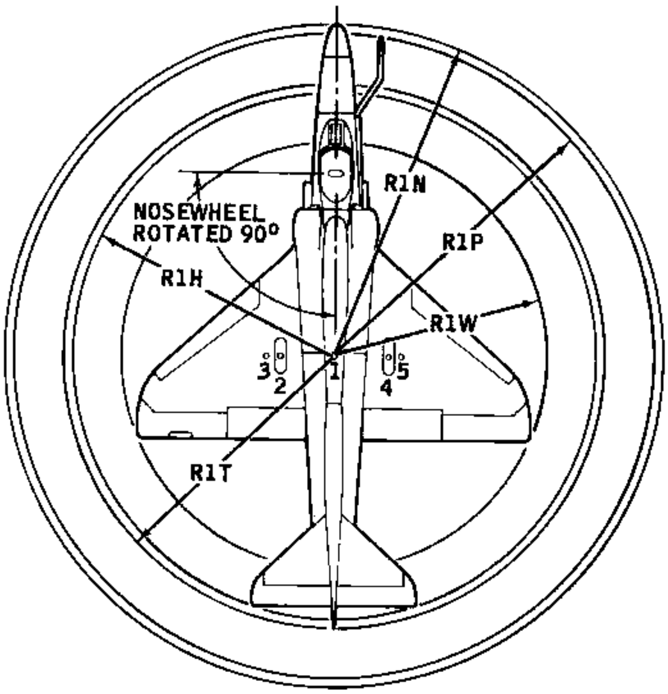
Figure 1-53. Danger Areas (Sheet 3)



NOTE:

RADII DISTANCES COMPUTED ON 18,282 POUNDS GROSS WEIGHT.

PIVOT POINT 1

R1 TO H	18 FEET 10 INCHES
R1 TO N	21 FEET 11 INCHES
R1 TO P	21 FEET 5 INCHES
R1 TO T	19 FEET 4 INCHES
R1 TO W	15 FEET

CODE
R = RADIUS

PIVOT POINT

1 = AIRCRAFT CENTERLINE AT INTERSECTION WITH LINE THROUGH MAIN GEAR AXLES

2 = 46.75 INCHES LEFT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

TERMINAL POINT

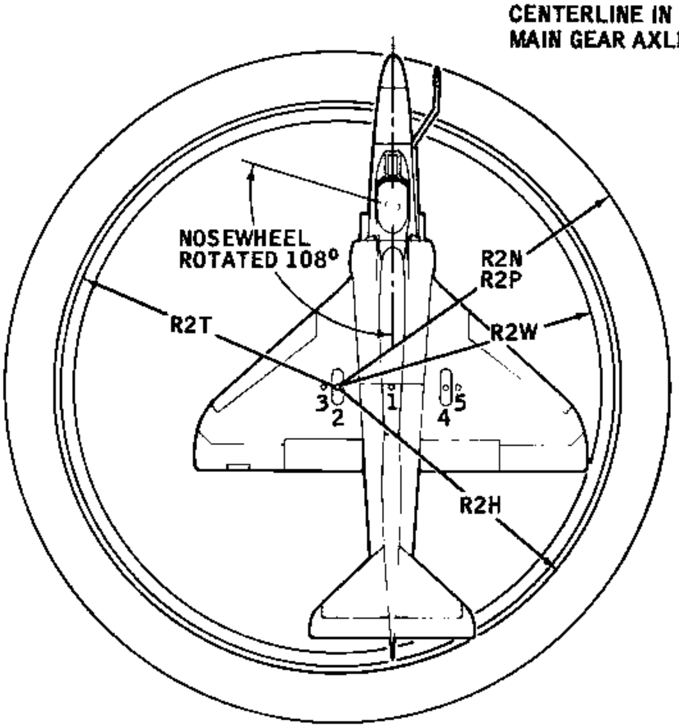
H = HORIZONTAL STABILIZER TIP

N = NOSE (RADOME) TIP

P = AIR REFUELING PROBE TIP

T = RUDDER TRAILING EDGE

W = WING TIP



PIVOT POINT 2

R2 TO H...............	20 FEET 4 INCHES
R2 TO N...............	22 FEET 3 INCHES
R2 TO P...............	22 FEET 3 INCHES
R2 TO T...............	19 FEET 9 INCHES
R2 TO W...............	18 FEET 7 INCHES

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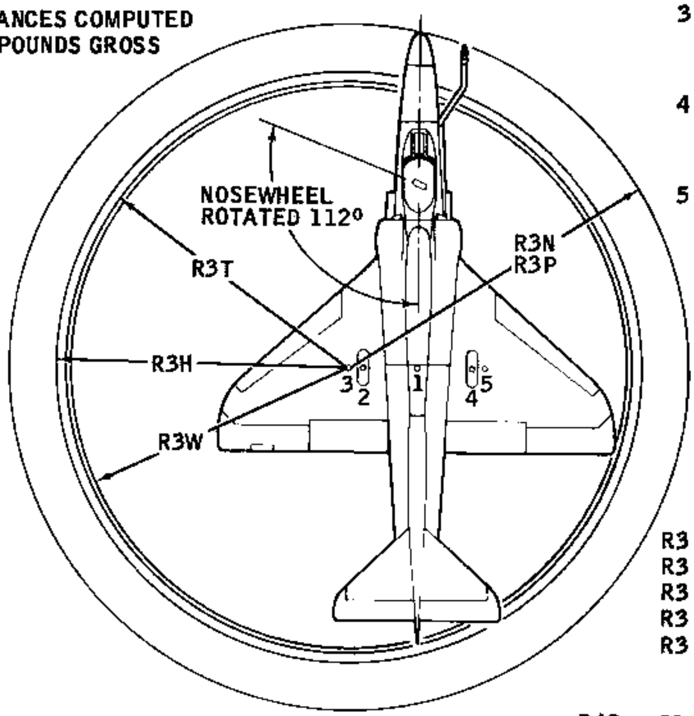
Figure 1-54. Minimum Turning Radius (Sheet 1)

NOTE:
RADII DISTANCES COMPUTED ON 18,282 POUNDS GROSS WEIGHT.



PIVOT POINT

3 = 58.75 INCHES LEFT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

4 = 46.75 INCHES RIGHT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

5 = 58.75 INCHES RIGHT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE

TERMINAL POINT

H = HORIZONTAL STABILIZER TIP

N = NOSE (RADOME) TIP

P = AIR REFUELING PROBE TIP

T = RUDDER TRAILING EDGE

W = WING TIP

PIVOT POINT 3

R3 TO H	20 FEET 10 INCHES
R3 TO N	22 FEET 6 INCHES
R3 TO P	22 FEET 7 INCHES
R3 TO T	19 FEET 11 INCHES
R3 TO W	19 FEET 7 INCHES

PIVOT POINTS 4 AND 5

R4P = 21 FEET 2 INCHES   R5P = 21 FEET 3 INCHES

FA1-40

Figure 1-54. Minimum Turning Radius (Sheet 2)

PART 4

OPERATING LIMITATIONS

INTRODUCTION

This section contains important operating limitations that shall be observed during normal operation of the aircraft. Refer to NAVAIR 01-40AV-1T for additional limitations.

ENGINE LIMITATIONS

Restrictions to be observed in the operation of the engines are based upon the use of fuel as follows:

	Approved Fuel	
	Ashore	Afloat
Recommended	JP-5	JP-5
Alternate	JP-4	

ENGINE OPERATING LIMITS

EXHAUST GAS TEMPERATURE AND ENGINE SPEED

Engine limitations are based on combinations of engine speed and exhaust gas temperature, with a maximum allowable engine speed under any condition of 102.4 percent (12,650 rpm) for the J52-P-408 engine. Mechanical speed limit of 102.4 percent is the overspeed limit and is not to be exceeded. RPM in excess of 101 percent indicates a probable fuel control malfunction and/or trim error.

Starting Temperatures

If engine exhaust gas temperature (EGT) exceeds 455°C five times, or reaches 531°C for one period of 5 seconds or more, engine must be subjected to an overtemperature inspection. Any EGT exceeding 565°C for any period of time will require a teardown inspection of all hot section parts. Refer to NAVAIR 02B-10DAA-2 and NAVAIR 02B-10DAB-6-1 for overtemperature inspection procedures.

Operating Condition	Max EGT °C	Max % RPM	Time Limit
Starting limits	455	(Start to idle)	2 minutes
Idle	340	53.3 to 62	. . . .
Acceleration	815	Military	8 minutes
Normal	705	Military-3%	. . . .
Military	785	Military	30 minutes

The IDLE temperature of 340°C is not a limit but is given as a guide to indicate the temperatures which, if exceeded, may signify an engine malfunction. Following acceleration, EGT may overshoot the stabilized value for a given throttle setting, and require some time to decrease to that value. After "peaking", EGT will decrease quite rapidly at first; then decrease progressively more slowly as it approaches the stabilized value. EGT should not stabilize at any point above the maximum steady-state value. The above limits for acceleration and temperatures should be interpreted to mean that the EGT for J52-P-408 engines may go to 815°C during acceleration but must decrease to 785°C or less within 8 minutes after acceleration. In normal operation EGT overshoot rarely occurs.

Engine Speed

RPM varies between engines at MILITARY thrust. For each engine, the specific rpm required to produce MILITARY thrust under standard day conditions is placarded on the engine data plate. Most engines will fall in the range of 97 to 100 percent. The pilot should therefore expect to see tachometer rpm indication in this range at full throttle. The rpm at MILITARY thrust also varies noticeably with changes in inlet temperature. The amount of variation from data plate rpm depends on the type of fuel control installed and the age and general condition of the engine. Variation may be approximately +1 to -5 percent for extreme conditions of hot and cold respectively. (See figure 1-55.) The 30-minute time limit at MILITARY thrust is a power level limit as well as a temperature limit, that is a particular engine which develops MILITARY thrust at an exhaust gas temperature of 720°C is still limited to 30 minutes at this power even though it is below the MILITARY operating temperature limit.

Note

Engine compressor stalls may be induced above 30, 000 feet in heavy airframe buffet at high angles of attack.

Oil Pressure Variation

The oil pressure indication at IDLE RPM should be normal (40 to 50 psi); however, a minimum of 35 psi for ground operation is acceptable. If the indication is less than 35 psi at 60 percent rpm, shut down the engine to determine the reason for the lack of, or low, oil pressure.

CAUTION

- Even though certain maneuvers normally cause a momentary loss of oil pressure, maximum operating time with an oil pressure indicating less that 40 psi in flight is 1 minute. If oil pressure is not recovered in 1 minute, the flight should be terminated as soon as practicable.
- Maneuvers producing acceleration near zero g may cause complete loss of oil pressure temporarily. Absence of oil pressure for a maximum of 10 seconds is permissible.
- If the oil pressure indicator reads high (over 50 psi), the throttle setting should be changed to reduce rpm. A landing should be made as soon as possible, and the cause investigated.

Note

During starting and initial runup, the maximum allowable oil pressure is 50 psi.

MANEUVERS

Note

Intentional spins are prohibited.

The following maneuvers are permitted:

1. Inverted flight (not to exceed 30 seconds)
2. Loop
3. Aileron roll
   a. Not to exceed 360 degrees
   b. Not to exceed one-half stick deflection with fuel in the 300-gallon drop tanks, except that above 20, 000 feet full stick deflection may be used for rolls up to 180 degrees
4. Wingover
5. Immelmann
6. Chandelle
7. Barrel roll

The maximum permissible change in angle of bank during rolling pullouts or rolling pushovers is 180 degrees.

AIRSPEED LIMITATIONS

The maximum permissible indicated airspeeds in smooth or moderately turbulent air are:

1. With no external stores and with landing gear, flaps, and hook retracted . . . . As shown in figure 1-58

2. With 300-gallon drop tanks and with landing gear, flaps, and hook retracted. . . 575 KIAS or Mach 0. 90, whichever is lower

Note

For other external stores limitations/ loadings, refer to NAVAIR 01-40AV-1T.

3. With landing gear and/or flaps extended (except in emergency to lock gear down) . . . 225 KIAS (with zero yaw) 170 KIAS (with unrestricted yaw)

CAUTION

With flaps extended, 240 KIAS should not be exceeded without an indication of flap blowback, to prevent structural damage if the blowback relief valve does not operate properly.

4. For air refueling from A-4 tanker, and for buddy store hose extensions . . . . . 300 KIAS or Mach 0. 80, whichever is lower

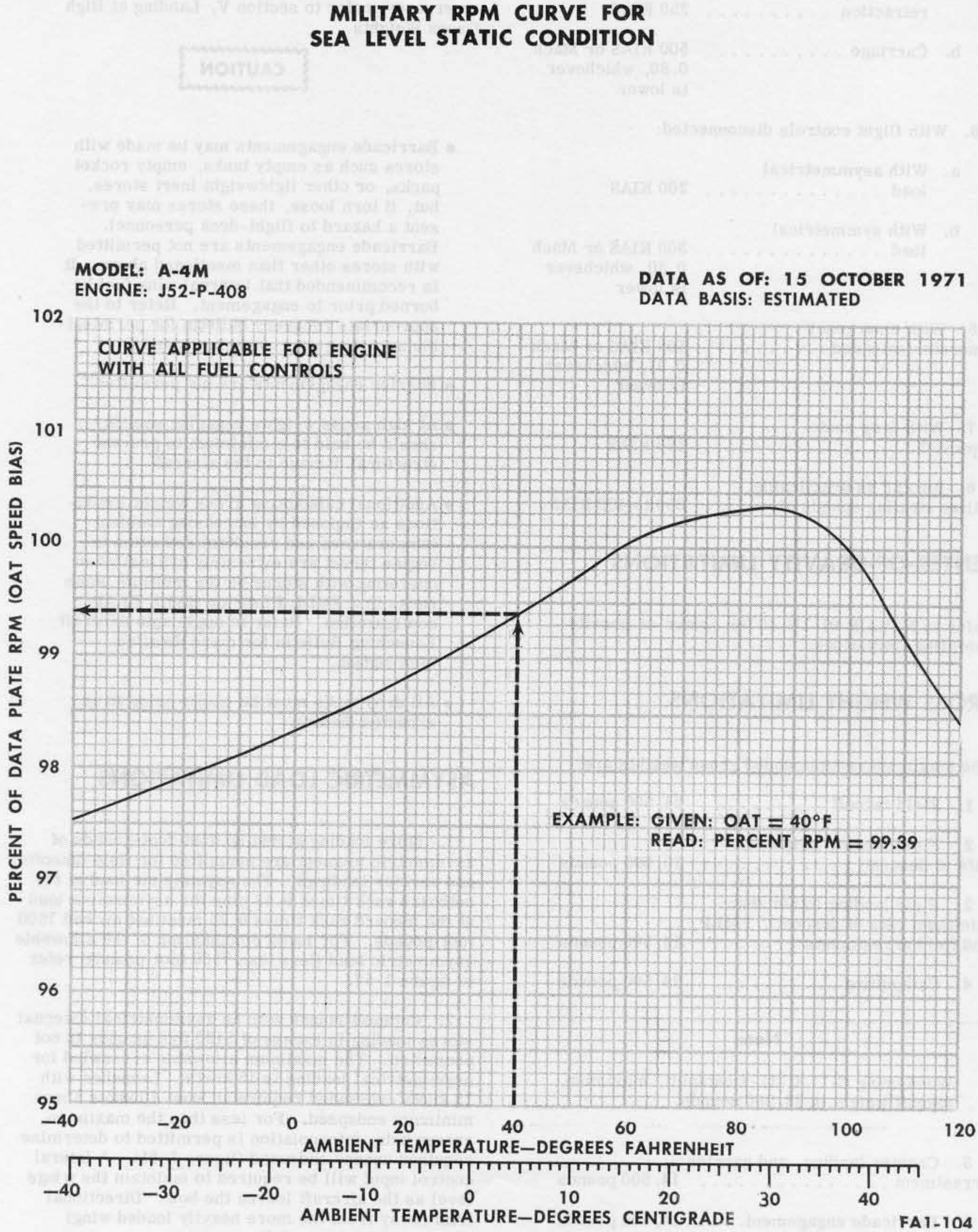


Figure 1-55. Military RPM Curve for Sea Level Static Condition

a. For buddy store hose retraction . . . . 250 KIAS

b. Carriage . . . . 500 KIAS or Mach 0.80, whichever is lower

5. With flight controls disconnected:

a. With asymmetrical load . . . . 200 KIAS

b. With symmetrical load . . . . 300 KIAS or Mach 0.80, whichever is lower

6. With emergency generator extended . . . . 500 KIAS or Mach 0.91, whichever is lower

7. With drag chute deployed . . . . 160 KIAS

8. Insofar as practicable, utilize strafing speeds of . . . . . . 350 to 450 KIAS

CENTER-OF-GRAVITY LIMITATIONS

Refer to NAVAIR 01-1B-40 for center-of-gravity operating limitations.

GROSS WEIGHT LIMITATIONS

The maximum recommended gross weights are:

1. Field takeoff . . . . 24,500 pounds

2. Field landing (minimum rate of descent) . . . . 16,000 pounds

3. Field landing (other than minimum rate of descent), FMLP, and field arrestments . . . . 14,500 pounds

4. Catapulting . . . . 24,500 pounds

Note

When using C-11/C-11-1 catapult, maximum takeoff weight is 23,500 pounds.

5. Carrier landing, and carrier arrestment . . . . 14,500 pounds

6. Barricade engagement. . . . 14,500 pounds

At gross weights in excess of 14,500 pounds, only minimum rate of descent field landings are recommended. Field landings at gross weights in excess of 16,000 pounds should be attempted only in an emergency; refer to section V, Landing at High Gross Weights.

CAUTION

- Barricade engagements may be made with stores such as empty tanks, empty rocket packs, or other lightweight inert stores, but, if torn loose, these stores may present a hazard to flight-deck personnel. Barricade engagements are not permitted with stores other than mentioned above. It is recommended that internal wing fuel be burned prior to engagement. Refer to the appropriate recovery bulletin for permissible arresting gear engaging speeds.
- Barrier engagements are not permitted.
- At high gross weights engaging speeds should be held to a minimum to prevent structural damage to the aircraft.
- Additional catapulting gross weight limitations as imposed by increasing ambient temperatures and resultant reduction in engine thrust are extremely critical when operating with stores on the multiple bomb racks in a FULL FLAP or HALF FLAP configuration. Refer to applicable Aircraft Launching Bulletin for more detailed information.
- All drop tanks must be empty prior to an arrested landing.

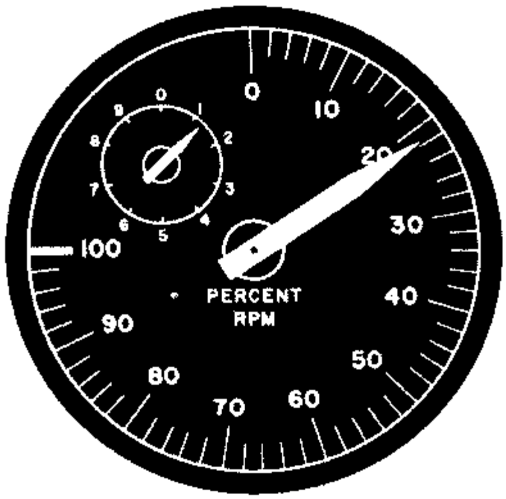
ASYMMETRIC LOAD LIMITATIONS

1. Store loading giving up 7500 foot-pounds of asymmetric moment are permitted for field takeoffs and carrier landings. The asymmetric load at the outboard rack times 9.48 plus the asymmetric load at the inboard rack times 6.25 must not exceed 7500 foot-pounds. For rapid computation of the allowable asymmetric load (less than 7500 foot-pounds) refer to figure 1-57.

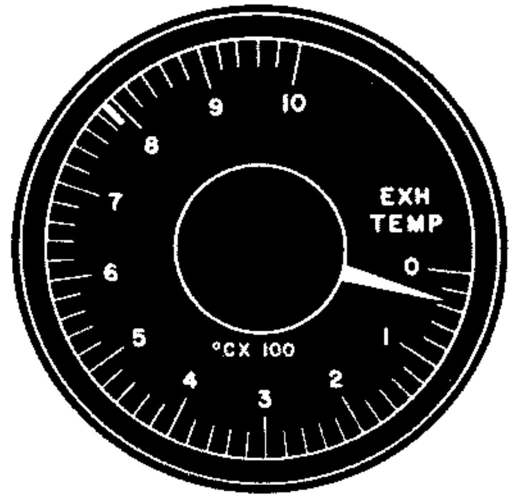
2. Catapult launch with an asymmetrical external stores loading in excess of 5120 foot-pounds is not permitted. The maximum allowable crosswind for asymmetrical loading is 15 knots. Launches with 15 knots crosswind require at least 10 knots above minimum endspeed. For less than the maximum crosswinds, interpolation is permitted to determine required excess endspeed (figure 1-61). A lateral control input will be required to maintain the wings level as the aircraft leaves the bow. Directional trim (away from the more heavily loaded wing) requirements are as follows:

0 to 10 knots crosswind - 2 units

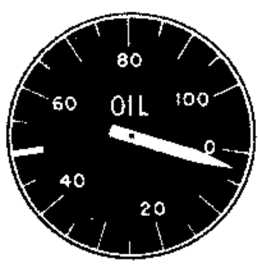
11 to 15 knots crosswind - 3 units



TACHOMETER



EXHAUST GAS TEMPERATURE



OIL PRESSURE

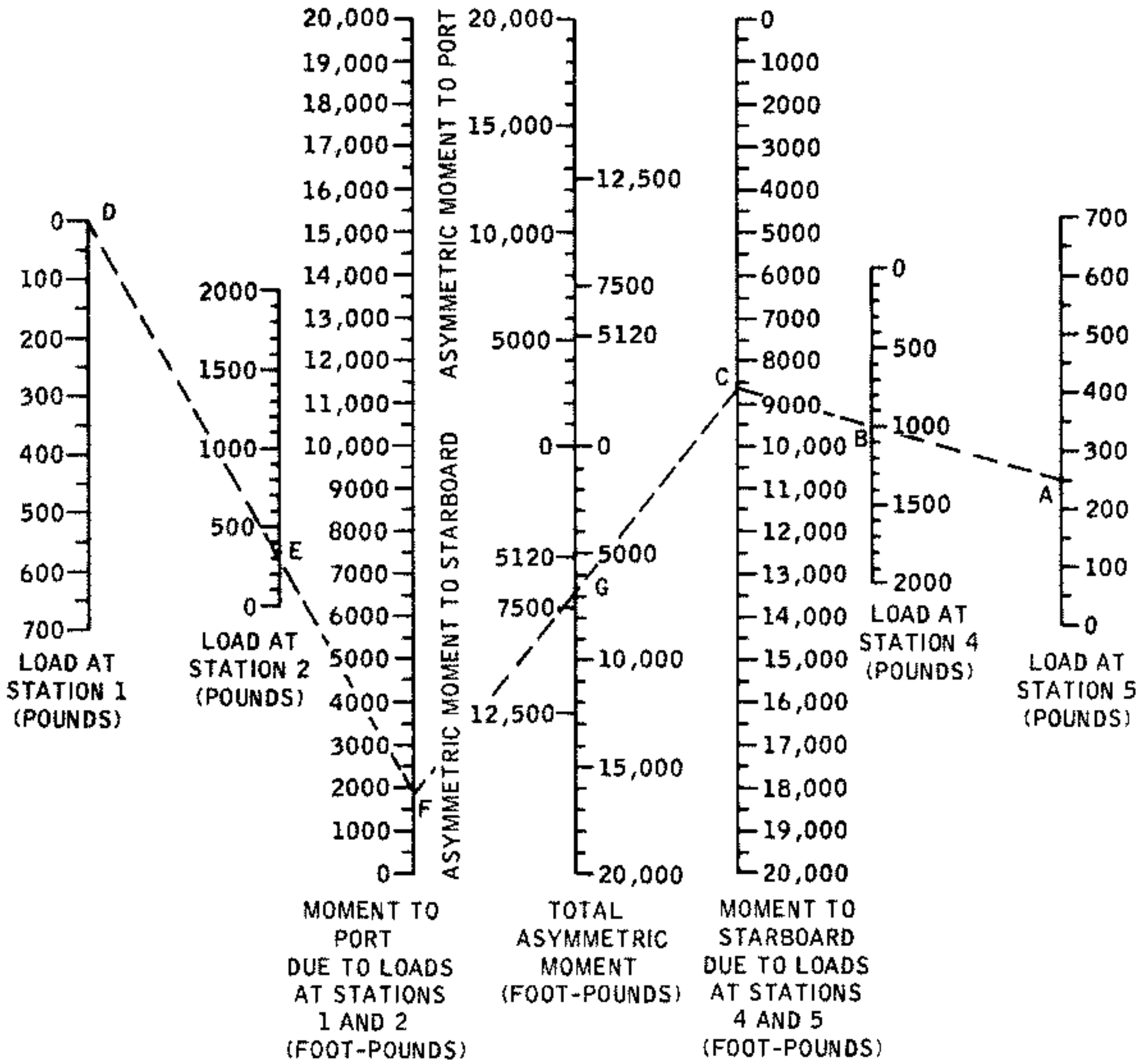
OIL QUANTITY
INDICATOR/SWITCH

ENGINE PERFORMANCE	
	J52-P-408 ENGINE
MAXIMUM STABILIZED RPM (30 MINUTES)	MILITARY
MAXIMUM STABILIZED TEMPERATURE (30 MINUTES)	785°C
MAXIMUM ALLOWABLE OIL PRESSURE	50 PSI
MINIMUM ALLOWABLE OIL PRESSURE- INFLIGHT GROUND - IDLE	 40 PSI 35 PSI

FA1-81-A

Figure 1-56. Engine Instruments

ASYMMETRIC WING STATION LOAD LIMITATION NOMOGRAM



TO USE NOMOGRAM, CONNECT KNOWN LOADS ON STATIONS 1 AND 2 (FOR MODELS A-4B/C STATIONS 5 AND 1 LOADS ARE ZERO) WITH EXTENDED STRAIGHT LINE. READ MOMENT TO PORT DUE TO LOADS AT STATIONS 1 AND 2. REPEAT PROCEDURE FOR STATIONS 4 AND 5 TO FIND STARBOARD MOMENT. CONNECT STARBOARD MOMENT AND PORT MOMENT WITH STRAIGHT LINE. READ TOTAL ASYMMETRIC MOMENT AT INTERSECTION OF CONNECTING LINE AND TOTAL ASYMMETRIC MOMENT SCALE. IF TOTAL ASYMMETRIC MOMENT IS LESS THAN THAT ALLOWED FOR A GIVEN OPERATION, LOADING IS SATISFACTORY.

LIMITATIONS:

FIELD LANDINGS......12,500 FT-LB

FIELD TAKEOFFS OR CARRIER LANDINGS.....7500 FT-LB

CARRIER CATAPULT....5120 FT-LB

EXAMPLE:

A LOAD AT STATION 5................250 LB
B LOAD AT STATION 4.............1000 LB
C MOMENT TO STARBOARD...8620 FT-LB
D LOAD AT STATION 1..................0 LB
E LOAD AT STATION 2..............300 LB
F MOMENT TO PORT...........1875 FT-LB
G TOTAL ASYMMETRIC MOMENT........................6745 FT-LB

FA1-56-A

Figure 1-57. Asymmetric Wing Station Load Limitation Nomogram

3. Landing with a crosswind component under the unloaded, or light wing, is not recommended.

4. Flared field landings are permitted with store loadings giving up to 12,500 foot-pounds of asymmetric moment. The minimum approach speed is 115 KIAS with up to 7500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 KIAS at 12,500 foot-pounds.

AUTOMATIC FLIGHT CONTROL SYSTEM LIMITATIONS

At altitudes of 7500 feet and above, operation of the AFCS is unrestricted throughout the speed range of the aircraft (figure 1-62).

The automatic flight control system may be engaged below 7500 feet except for the following conditions:

1. During takeoff and landing.

2. Between 1000 feet and 7500 feet terrain clearance, with airspeed below 300 KIAS. AFCS operation requires the hands on the control stick. Above 300 KIAS, operation is unrestricted.

3. Below 1000 feet terrain clearance, to 200 feet terrain clearance. AFCS operation is restricted to hands on the control stick and a maximum airspeed of 500 KIAS.

4. The AFCS shall not be engaged below 200 feet above the terrain.

AFCS PERFORMANCE AND POWER LIMITATIONS

The attitude hold, preselect heading, and altitude hold modes all operate within the 60-degree pitch and 70-degree roll angle limits of the AFCS. It must be realized that within these limits, each mode is further limited by the attitude, gross weight, and power performance of the basic airframe.

ACCELERATION LIMITATIONS

Accelerations at which moderate buffeting occurs shall not be exceeded. Otherwise, the maximum permissible accelerations for flight are as shown on figure 1-60. As gross weight increases above 12,500 pounds, maximum permissible accelerations decrease as shown on figure 1-60. During conditions of moderate turbulence, avoid deliberate accelerations in excess of those permitted as shown on figure 1-60 to minimize the probability of overstressing the aircraft as a result of the combined effects of gust and maneuvering loads. Transonic pitchup can occur during speed reductions in the transonic region. Buffet onset and flight strength limits at low altitude combat conditions are shown in section XI, part 9 and figure 1-59.

CAUTION

To minimize the probability of exceeding the maximum permissible load factor due to the combined effects of maneuvering load factor and transonic pitchup, the following procedure is recommended:

1. Below 15,000 feet, at speeds in excess of 0.94 IMN, avoid deliberate accelerations in excess of +4g.

2. Above 15,000 feet, avoid deliberate accelerations that exceed buffet onset.

PRESSURIZED WING TANK LIMITATIONS

The following restrictions are applicable to flight with the wing tank pressurized:

1. Aircraft velocity not to exceed 400 KIAS.

2. No catapulting.

3. No landings.

4. Coordinated turns only.

5. Aircraft load factor limits of +0.1 to +2.0.

6. No air refueling as receiver aircraft.

7. No nosedown attitudes.

8. 45-degree bank, maximum.

TIRE LIMIT SPEED

A maximum of 175 knots ground speed is imposed upon the aircraft during ground operations because of structural limits of the nosewheel tire.

DRAG CHUTE LIMITATION

A maximum speed of 160 KIAS is imposed upon the aircraft with the drag chute deployed. Flight without the drag chute canister is not permitted due to inadequate engine cooling.

AIRSPEED LIMITATIONS

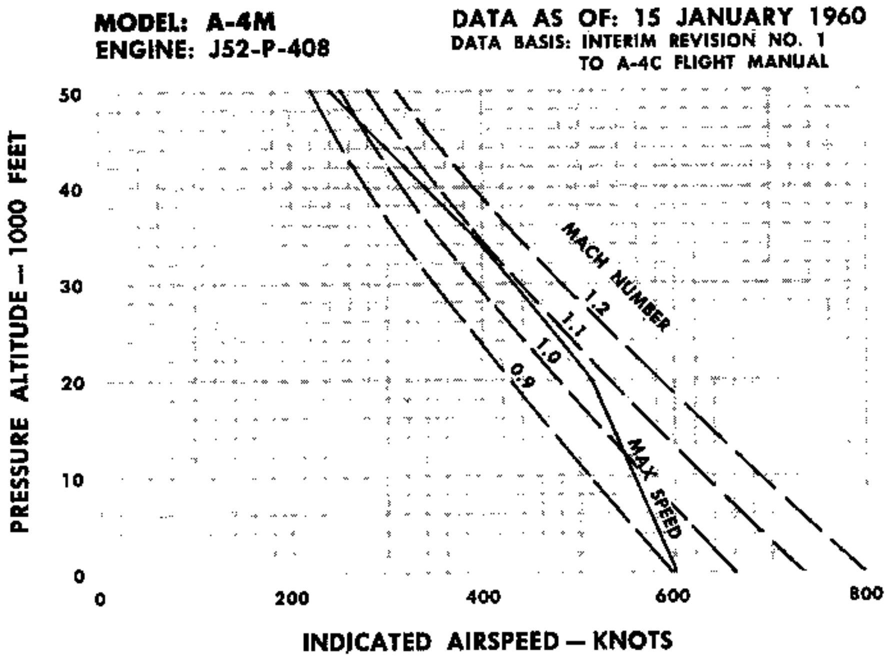


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Figure 1-58. Airspeed Limitations

OPERATING FLIGHT STRENGTH DIAGRAM

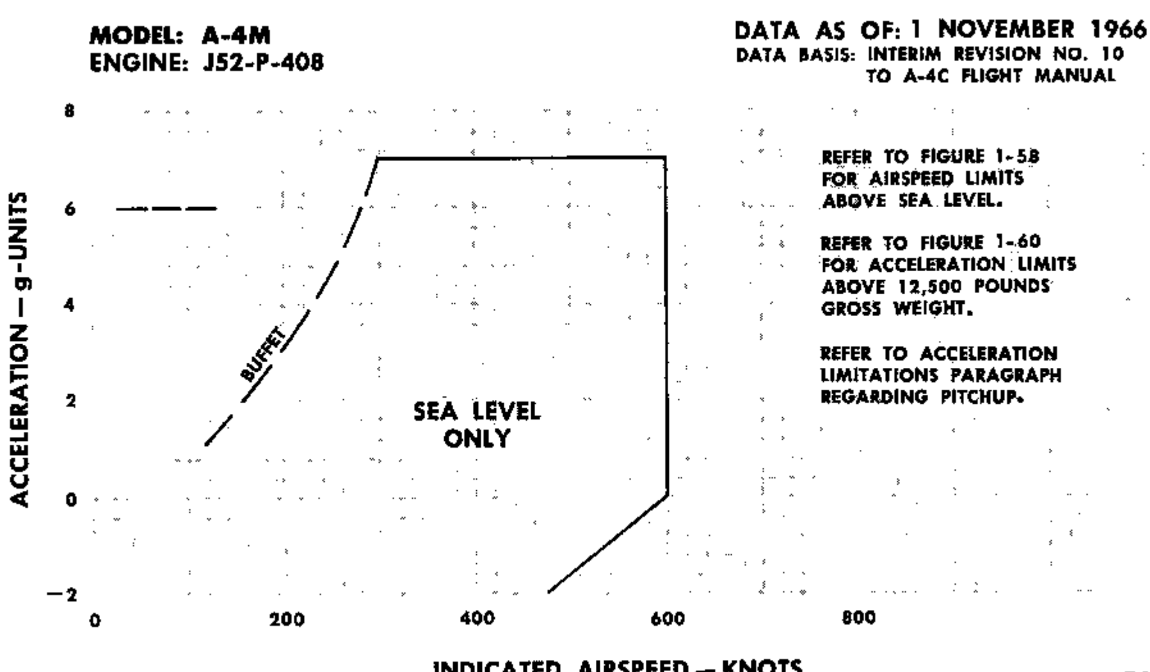

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Figure 1-59. Operating Flight Strength Diagram

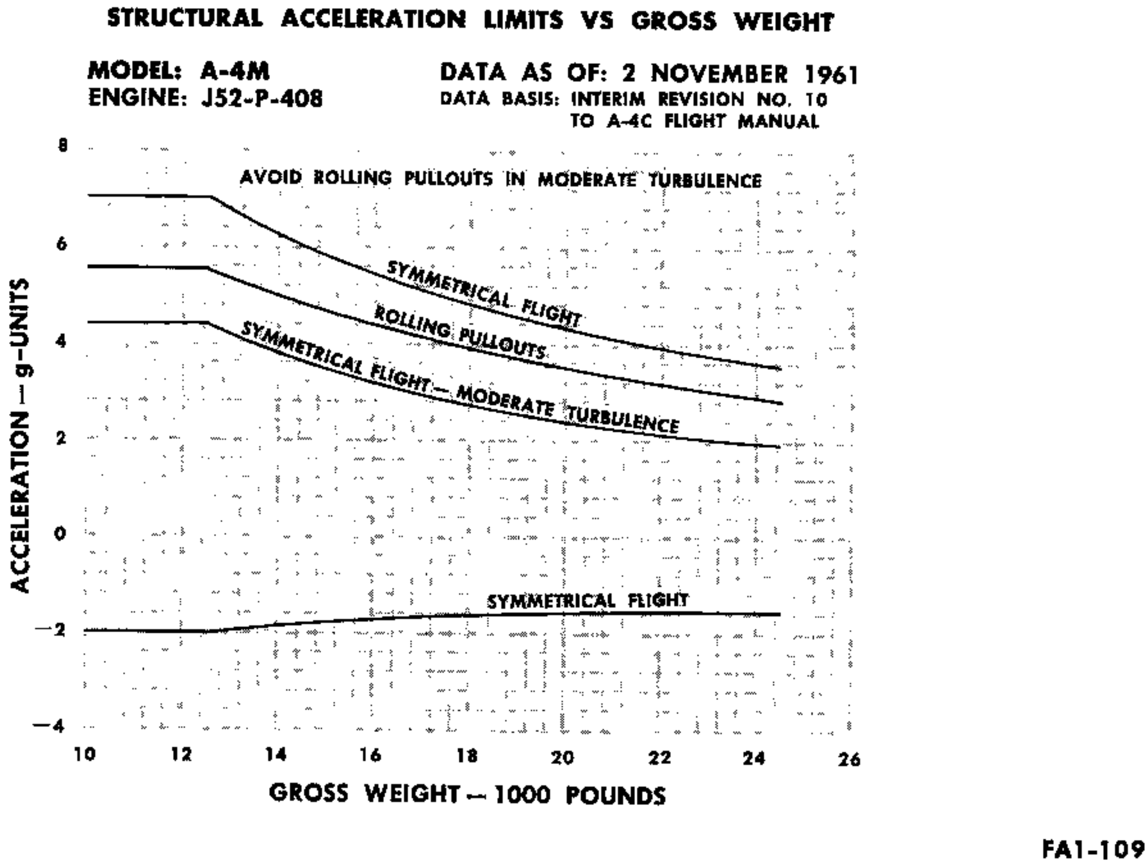

Figure 1-60. Acceleration Limits Versus Gross Weight

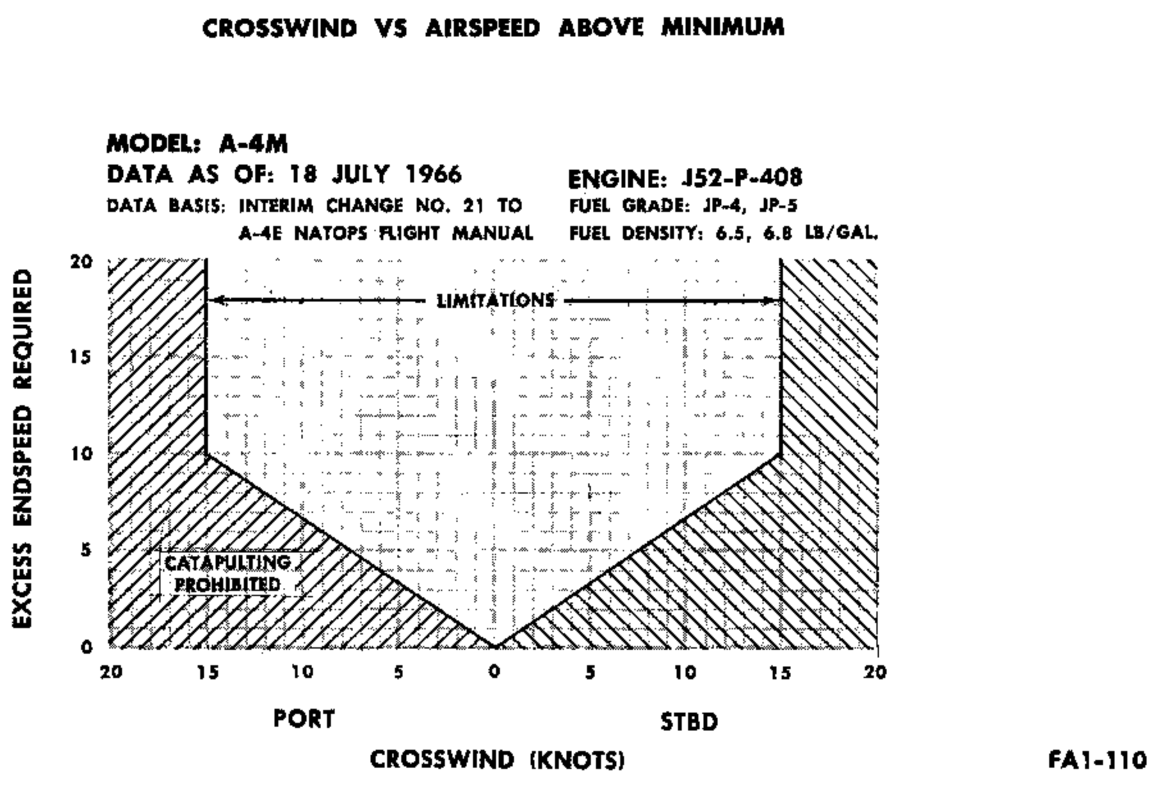

Figure 1-61. Catapult Launches with Asymmetric Loads Crosswinds vs Excess Endspeed Required

AFCS SPEED ENVELOPE

GROSS WEIGHT = 14,721 POUNDS
C G @ 20.9 MAC

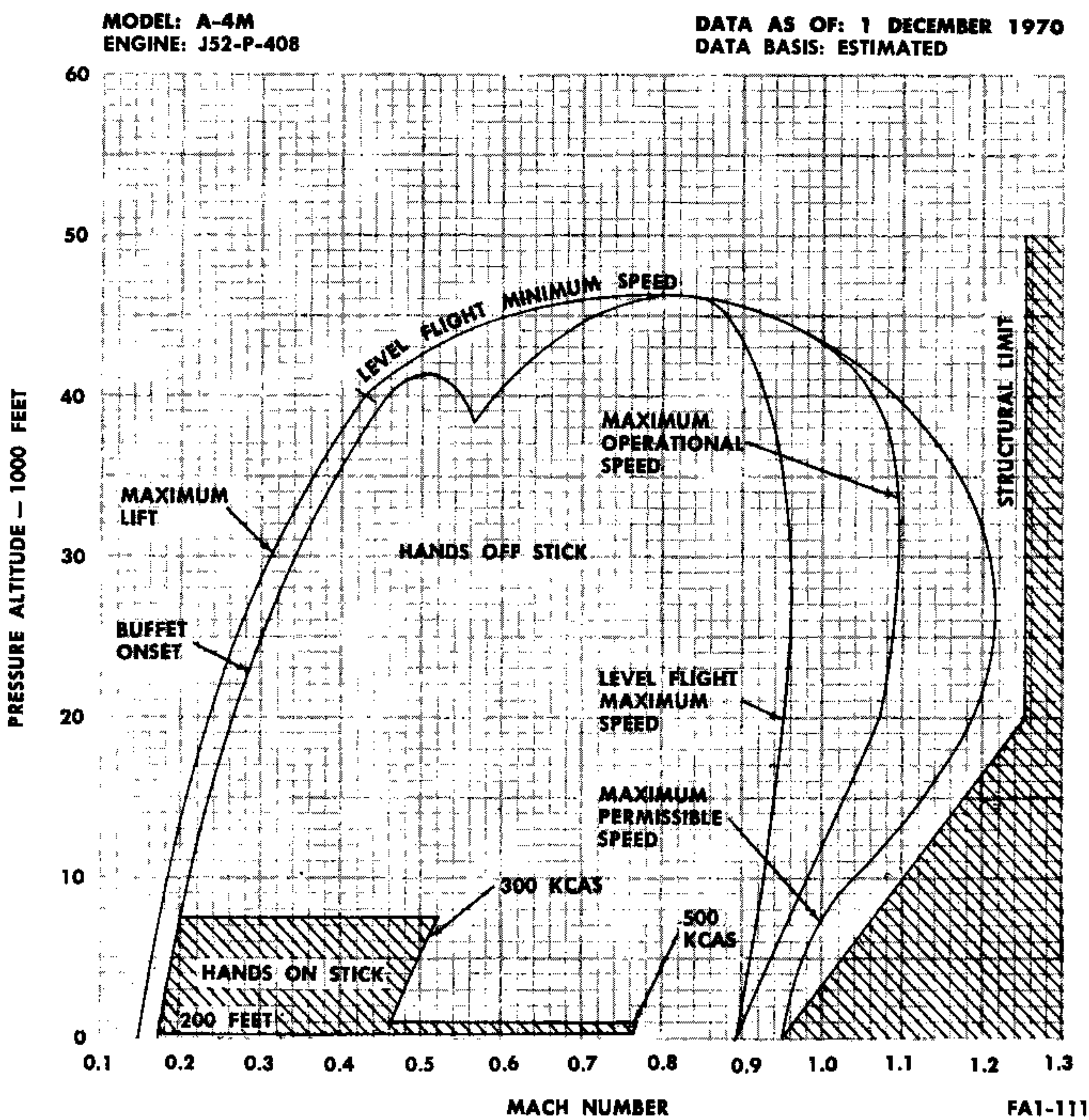

Figure 1-62. AFCS Speed Envelope

SECTION II
INDOCTRINATION

TABLE OF CONTENTS

INTRODUCTION

This section establishes minimum requirements for training, initial qualification, and currency in specified areas. Subsequent sections provide the operational information considered necessary to ensure safe and efficient operation of the A-4/TA-4 when used in conjunction with the Naval Warfare Publications series. Unit commanders are authorized to waive, in writing to the individual affected, flight hour minimums and/or OFT/WST training requirements where recent experience in similar models warrants. However, adequate preparation and guidance of the pilot for the initial flight and subsequent flights, so that he safely attains and maintains a reasonable degree of proficiency in the operation of the A-4/TA-4, is of prime importance. Too often, under pressure of operational commitments, this groundwork is abbreviated or deleted. This can result only in a deterioration of individual and unit effectiveness. For this reason, commanding officers must continuously ensure adherence to these basic criteria whenever possible. Procedures for requesting waivers from the provisions of this section are contained in OPNAVINST 3510.9 (current revision).

Training requirements, checkout procedures, evaluation procedures, and weather minimum for ferry squadrons are governed by OPNAVINST 3710.6 series.

GROUND TRAINING

Ground training should be continuous throughout the career of the A-4/TA-4 pilot. The overall syllabus will vary according to local conditions, facilities, directives from higher authority, and the unit commander's estimation of squadron readiness. However, there are certain specific requirements which must be met to ensure that the pilot is properly indoctrinated and briefed prior to flight.

GROUND TRAINING REQUIREMENTS

Ground training and other related requirements for all pilots prior to familiarization flights in the A-4/TA-4 are as follows:

Note

Currently qualified A-4/TA-4 pilots need only comply with those portions of items 3, 4, and 6 below that pertain to differences in new model.

1. Current medical clearance.

2. Aviation physiological training as set forth in OPNAVINST 3740.3 (current revision).

3. NAMO Pilot Familiarization course (if available) or equivalent lectures by RCVW, operating A-4/TA-4 squadron, or other qualified personnel.

4. Lectures from RCVW operating A-4/TA-4 squadron, or other qualified personnel on the following subjects:

a. Aircraft preflight, ground handling, hand signals, and normal flight procedures.

b. Flight characteristics (including stalls and spins) and operating limitations.

c. Use of safety and survival equipment and related procedures.

d. Cockpit troubleshooting procedures.

e. Emergency procedures.

f. Past aircraft accidents as an aid in preventing future accidents of like nature.

g. Local course rules, flying area, instrument procedures, and SAR facilities.

5. Blindfold cockpit check.

6. Minimum of 2 hours of flight and emergency procedures simulation in the OFT/WST within the 2-week period prior to the first familiarization flight. If OFT/WST is not available, a comprehensive oral and/or written examination on emergency procedures must be substituted.

7. Practice dry-run ejection accomplished in the RAPEC ejection seat in complete flight gear, utilizing both primary and alternate ejection handles.

8. Satisfactory completion of examinations on A-4/TA-4 operating limits, normal and emergency procedures, course rules, and aircraft systems.

9. Supervised aircraft preflight utilizing Daily Maintenance Requirement Cards, engine start, post-start checks using plane captain's signals, taxi, and securing engine.

10. Aviator's required reading pertinent to flight.

GROUND TRAINING SUBJECTS

The following subjects should be included in the normal A-4/TA-4 squadron's ground training syllabus.

Technical Training

1. NATOPS Flight Manual.
2. Auxiliary equipment.
3. Flight safety equipment.

Mission Training

1. Bombing and rocket theory and pipper control.
2. Glide bombing, rocket, and missile procedures.
3. Strafing procedures.
4. LABS equipment.
5. LABS/laydown delivery.
6. Patterns and procedures for local targets.
7. Close air support and GCBS procedures.
8. Pertinent publications in the NWP and NWIP series.
9. Special weapons.
10. Aviation ordnance.
11. Weapons loading.
12. High- and low-altitude navigation.
13. Radar and navigational computer operating procedures.
14. Aerial refueling.
15. Night flying.
16. MLP and carrier procedures.

Instrument Training

1. Instrument flight (general).
2. Hand held computer.
3. Airways navigation.
4. Local climbout and penetration.
5. GCA/CCA.
6. Special equipment.

Flight Safety

1. AAR reviews.
2. Aircraft emergencies: practiced whenever possible in the OFT/WST. Where such a trainer is available, its use is mandatory during familiarization, and quarterly thereafter. In addition, a refresher flight or an oral or written review of emergency procedures is required after any layoff from flying in excess of 4 weeks.
3. Use of barricade/emergency field arresting gear.

Intelligence

1. Mission planning material.
2. Orders of battle.
3. Aircraft and ship recognition.
4. Escape and evasion.
5. Authentication procedures.

Survival

1. Physiological and medical aspects.

2. First aid.

3. Survival on land/sea.

4. Pilot rescue techniques.

FLIGHT QUALIFICATIONS

Minimum requirements for qualification and currency are set forth below for each phase of flight.

Command prerogative should be exercised to increase minimums when desired. Unit commanders are authorized to waive, in writing to the individual, these minimum requirements and/or OFT/WST training where recent experience in similar models warrants.

Note

Requirements listed for flight qualifications must be First Pilot time.

Familiarization

1. Completion of the minimum ground training requirements prescribed earlier in this manual is required prior to flight.

2. Familiarization flight will be conducted in accordance with section IV, part 2.

3. Initial checkout flights will consist of a minimum of 5 hours.

Instruments

Minimum requirements prior to actual instrument flight are as follows:

1. Ten hours in A-4/TA-4 aircraft in the last 6 months.

2. At least one A-4/TA-4 flight in the last 30 days.

3. Current instrument card.

4. Demonstration of instrument proficiency in assigned model.

Weapons and Mission Training

Prerequisites for weapons and mission training are:

1. Completion of appropriate training set forth in preceding FAMILIARIZATION and INSTRUMENTS.

2. Minimum of 10 hours in A-4/TA-4 of which 5 hours must be within preceding 6 months.

3. For weapons delivery or mission training requiring a high-speed low-level run-in, a minimum of 15 hours in A-4/TA-4 aircraft within preceding 6 months of which 5 hours must be in model being flown.

4. Basic qualifications and currency requirements for various missions and weapons deliveries are set forth in OPNAV Instruction 03740.8 (current revision).

Minimum requirements prior to night weapons training are as follows:

1. Same as night-flying minimums, except 50 hours in A-4/TA-4 aircraft, and 10 hours in the last 30 days.

2. Day-proficient in type delivery in model being flown.

3. Familiar with target area and procedures.

4. Five hours night time in A-4/TA-4 of which one flight in model being flown must be within preceding 30 days.

Note

Ten hours during last 30 days may be waived for high-altitude horizontal bombing.

Night Flying

Minimum requirements prior to night flights are as follows:

1. Current instrument card.

2. Ten hours in A-4/TA-4 within the last 3 months.

FCLP and Carrier Qualification

For day and night FCLP qualification the exact number of FCLP periods required depends on the experience and ability of the individual pilot, and will be determined by the unit commander.

DAY FCLP. Minimum requirements prior to day FCLP are as follows:

1. 10 hours in A-4/TA-4 aircraft and one flight in the last 30 days.

2. Familiarity with the slow-flight characteristics of the aircraft.

3. Proficiency in instrument flying in assigned model.

4. Proper briefing in day FCLP procedures.

NIGHT FCLP. Minimum requirements prior to night FCLP are:

1. Demonstration of proficiency in day FCLP.

2. Five hours night time in the A-4/TA-4.

3. One A-4/TA-4 flight in the last 10 days; otherwise one day flight will be required prior to the night FCLP period.

4. Proficient in instrument flying in model assigned.

5. Proper briefing in night FCLP procedures.

DAY CARRIER. Minimum requirements prior to day carrier qualification are as follows:

1. Certification by Unit Commander as day field-mirror-landing qualified in model to be flown.

2. 50 hours in A-4/TA-4 aircraft.

3. Proper briefing in carrier landing, catapult, and deck procedures.

Minimum day qualifications are:

1. Two touch-and-go landings.

2. Ten arrested landings.

3. Two day CCA approaches from marshal point.

NIGHT CARRIER. Minimum requirements prior to night carrier qualifications are as follows:

1. Current day-carrier qualification in the model to be flown.

2. Ten hours night time within the last 6 months.

3. Certification by Unit Commander as night field-mirror-landing qualified in model to be flown.

4. Proper briefing in night carrier landing, catapult, and deck procedures.

5. A minimum of two satisfactory arrested landings shall be completed during the daylight hours preceding night qualification landings.

Minimum night qualifications are:

1. Six night arrested landings.

2. Two night CCA approaches from marshal point (to be conducted only after satisfactory completion of day CCA qualification).

For maintaining carrier qualifications, qualification is considered current for 6 months after the date of the last carrier landing in type. Refresher requirements to requalify are as follows:

1. Six to twelve months: four day and two night arrested landings.

2. Over 12 months: initial requirements, both day and night.

Cross-Country Flight

Minimum requirements prior to cross-country flight are as follows:

1. Current instrument card.

2. Fifteen hours in A-4/TA-4 to include 3.0 hours instrument time.

3. Flight packet, which includes security, accounting, servicing data, and accident forms.

4. Familiarity with aircraft servicing.

PERSONAL FLYING EQUIPMENT REQUIREMENTS

The following items delineated in OPNAVINST 3710.7 series are considered required flying equipment and shall be worn on every flight.

1. Protective helmet (adorned with high-visibility paint/reflective tape).

2. Flight safety boots.

3. Flight gloves.

4. Fire-resistant flight suit.

5. Identification tags (to be worn around the neck).

6. Survival knife and sheath (not to be worn exposed or attached to the life preserver).

7. Personal survival kit (appropriate to the area of operations).

8. Signal device (required for all night flights and flights over water or sparsely populated areas. An approved pistol with tracer ammunition or a pencil flare gun meets this requirement).

9. Flashlight (required for all night flights).

All survival equipment will be secured in such a manner that it is easily accessible and will not be lost during ejection or upon landing.

SECTION III
NORMAL PROCEDURES

TABLE OF CONTENTS

PART 1
BRIEFING/DEBRIEFING

BRIEFING

Briefings will be conducted using a prepared briefing guide and the appropriate mission card. The briefing shall cover those items pertinent to the specific mission assigned. Any format which is complete, concise, and orderly, and which can be readily used by the Flight Leader as a briefing guide is suitable. Each pilot will maintain a knee pad and record all data necessary to successively assume the lead and complete the assigned mission. This, however, does not relieve the Flight Leader of the responsibility for all pilots in the operation and conduct of the flight.

GENERAL

The briefing guide will include the following items, where applicable:

1. Aircraft assigned, call signs, event number, and deck spot

2. Succession to lead

3. Fuel load, stores, and aircraft gross weight

4. Engine start, taxi, and takeoff times

5. Rendezvous instructions, takeoff distance and speed, and line speed/refusal speed.

Mission

1. Primary

2. Secondary

3. Operating area/target

4. Control agency

5. Time on station or over target.

Navigation and Flight Planning

1. Duty runway/predicted Foxtrot Corpen for launch and recovery, and position in the force

2. Climbout

3. Operating area procedures and restricted areas

4. Mission plan, including fuel/oxygen management and PIM

5. Bingo/low state fuel

6. Marshal/holding (normal and emergency)

7. Penetration procedures and minimums

8. Ship/field approach and runway lighting

9. GCA/CCA procedures and minimums, missed approach

10. Recovery: course rules, pattern, breakup, landing, and waveoff

11. Divert and emergency field/ready deck.

Communications

1. Frequencies

2. Controlling agencies

3. Radio procedure and discipline

4. ADIZ procedures

5. IFF

6. Navigational aids

7. Hand/light signals.

Weapons

1. Loading

2. Arming

3. Special routes because of ordnance aboard

4. Pattern

5. Armament switches

6. Aiming point/sector setting

7. Run-in/entry airspeed

8. Minimum release/pull-out altitudes

9. G versus gross weight

10. Duds, hung ordnance procedures, dearming, jettison area

11. Safety

Weather

1. Local area, en route, and destination (existing and forecast)

2. Weather at alternate/divert fields

3. Winds, jet stream, temperature, and contrail band width.

Emergencies

1. Takeoff aborts

2. Radio failure

3. Loss of NAVAIDS

4. Loss of visual contact with flight

5. Lost-plane procedures

6. Downed pilot and SAR

7. Aircraft emergency procedures and system failures.

Air Intelligence and Special Instructions

1. Friendly/enemy force disposition

2. Current situation

3. Targets

4. Safety precautions

5. Reports and authentication

6. Escape and evasion.

Safety Precautions

DEBRIEFING

Each flight shall be followed with a thorough debriefing by the Flight Leader as soon as practical. All phases of the flight shall be covered, paying particular attention to those areas where difficulty was encountered and to the effectiveness of any tactics employed or weapons expended. To derive maximum benefit, constructive criticism and suggested improvements as to doctrine, tactics, and techniques should be given and received with the frankness, purpose, and spirit of improving the proficiency of the unit, as well as that of the individual pilot. When appropriate, it should include the individual debrief of each pilot by the LSO.

PART 2
MISSION PLANNING

MISSION PLANNING

The training objective is the orderly development of pilot techniques in preflight planning, climbout, high-altitude navigation and cruise control, air refueling, low-level navigation, and high-speed approaches to the delivery maneuver. The detailed specifics of these deliveries are set forth in NAVAIR 01-40AV-1T. Mission turn radius chart is located in section XI, part 9. A mission planning sample, section XI, part 10, is provided to assist the pilot in becoming familiar with the use of the performance section and to enable him to perform the assigned mission at the optimum conditions within the aircraft flight envelope.

PART 3
SHORE-BASED PROCEDURES

PRIOR TO FLIGHT

PREFLIGHT CHECKLIST

Exterior Inspection

Consult the Naval Aircraft Flight Record (yellow sheet) to determine the status of the aircraft; that it has been fully serviced with fuel, oil, liquid oxygen, compressed air, and hydraulic fluid. Inspect the exterior of the aircraft, proceeding as shown on figure 3-1.

Forward Fuselage (A)

1. Air refueling probe cover . REMOVED
2. Air-conditioning intake and exhaust ducts . . . . CLEAR
3. Static pressure vents (2 vents left side) . . . . CLEAR
4. Engine bleed static port (left side) . . . . CLEAR
5. Angle-of-attack vane cover . . . . REMOVED
6. Rain repellent fluid level (gage under APX-72 coder access door) . . . . HALF TO FULL
7. Nose compartment panels . CONDITION, SECURITY
8. Nose compartment cooling air inlet . . . . CLEAR
9. Static pressure vent (right side) . . . . CLEAR
10. Controls access panel . . . . SECURE
11. Nosewheel well door . . . . . CONDITION, SECURITY
12. Nosewheel steering assembly . . . . CONDITION, SECURITY
13. Nosewheel strut . . . . EXTENSION, NO LEAKAGE
14. Nosewheel tire . . . . CONDITION
15. Nose gear downlock pin . . . INSERTED
16. Emergency generator . . . . RETRACTED, SECURE
17. External canopy jettison handle . . . . STOWED: ACCESS DOOR CLOSED
18. Gun flash suppressors and guns . . . . SECURE
19. Forward engine compartment . . . . CONDITION, SECURITY
20. Gear case oil drain line cap . . . . LOCKWIRED
21. Guncharger pneumatic pressure gage . . . . CHECK
22. Aileron power package . . . CHECK ALIGNING MARKS
23. Avionics pod . . . . CONDITION, SECURITY
24. Avionics plugs
    a. Avionics pod dust plugs (3) . . . . REMOVED
    b. Avionics pod bleed port plug . . . . REMOVED

Right-Hand Wheel Well (B)

1. Main wheel well doors . . . CONDITION, SECURITY
2. Taxilight . . . . SECURITY
3. Gun pneumatic pressure gage . . . . 3200±200 psi
4. Armament safety disable switch . . . . SAFE

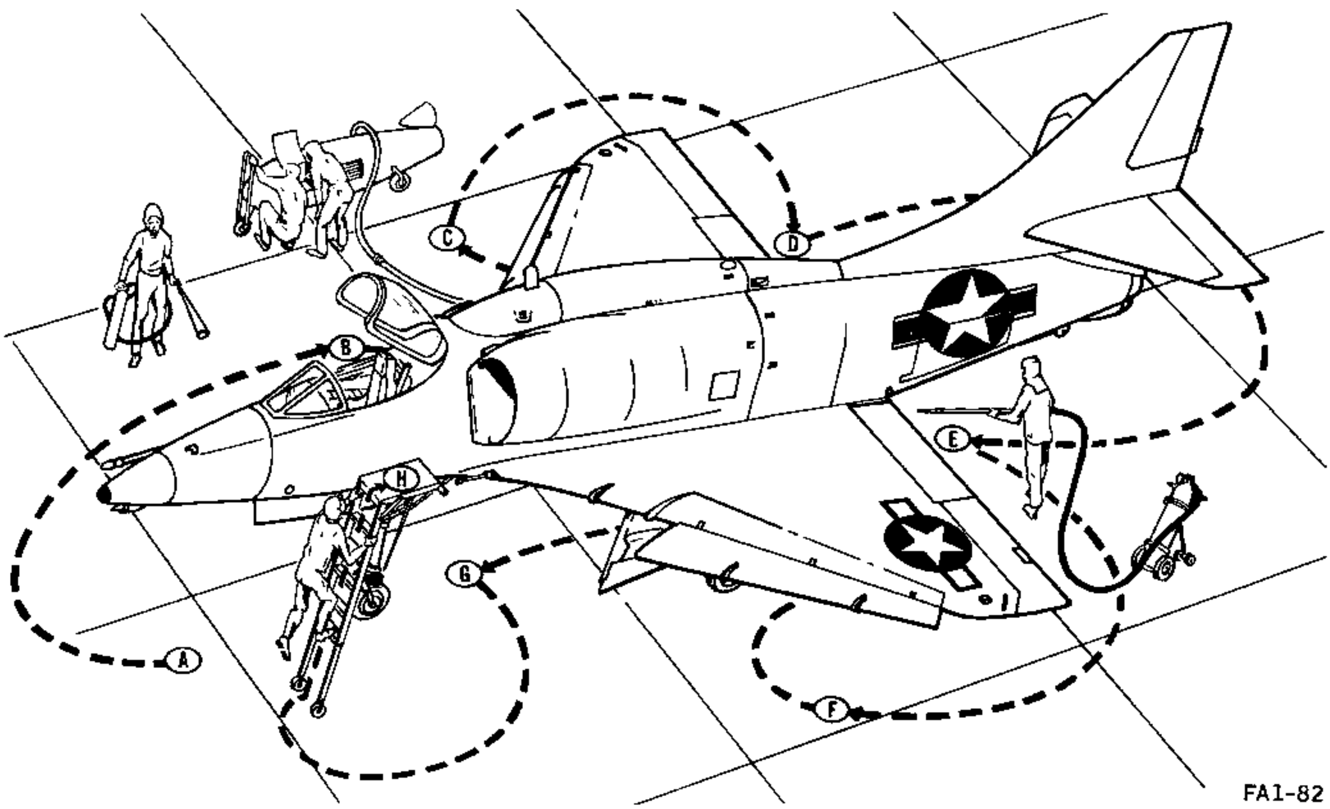

Figure 3-1. Exterior Inspection

5. Catapult hook . . . . PRELOAD, SECURITY
6. Main gear downlock pin . . . INSERTED
7. Main gear strut . . . . EXTENSION, NO LEAKAGE
8. Main wheel tire . . . . CONDITION
9. Brakes . . . . CONDITION, NO LEAKAGE
10. Fuel system vent . . . . CLEAR

Right-Hand Wing (C)

1. General condition . . . . WRINKLES, CRACKS, LOOSE RIVETS, FUEL DEPOSITS
2. Wing rack stores . . . . SECURE
3. Drop tank . . . . REMOVE FILLER-CAP, VISUALLY DETERMINE LOADING, REPLACE FILLERCAP

WARNING

Operate each slat by hand to make certain that each extends and retracts with negligible effort and without binding. Binding which causes asymmetric slat extension requires excessive lateral control deflection to maintain wings level after catapulting or during accelerated stalls and landing approaches.

4. Wing slat . . . . FREE MOVEMENT
5. Navigation and fuselage wing lights . . . . CONDITION
6. Aileron and wing flap . . . . CONDITION, BONDING
7. Spoiler . . . . CONDITION, BONDING
8. Wing tank fillercap . . . . . . SECURE
9. Fuselage tank fillercap . . . SECURE

Aft Fuselage and Tail Section (D)

1. All access doors . . . . CLOSED

2. Speedbrake . . . . CONDITION, SECURITY

3. Drag chute release safety pin . . . . REMOVED

4. Tailpipe cover . . . . . REMOVED

5. Tailpipe . . . . CRACKS, WRINKLES, BURNS, FUEL DEPOSITS

6. Taillight . . . . CONDITION

7. Rudder, elevator, and horizontal stabilizer . . . . . . CONDITION, BONDING

8. Speedbrake . . . . CONDITION, SECURITY

9. Drag chute and canister connections . . . . SECURE

10. Arresting hook . . . . . RETRACTED AND LOCKED CONDITION

11. Tension bar retainer . . CONDITION

12. Arresting hook holddown cylinder pressure gage . . . . 900±50 psi

13. Aft engine compartment . CONDITION, SECURITY

14. Drop tank fueling switch. OFF

Left-Hand Wing (E)

1. Wing flap and aileron . . CONDITION, BONDING

2. Aileron tab . . . . CONDITION

3. Spoiler . . . . CONDITION, BONDING

4. Navigation and fuselage wing lights . . . . CONDITION

5. Wing . . . . WRINKLES, CRACKS, LOOSE RIVETS; FUEL DEPOSITS

6. Wing slat . . . . FREE MOVEMENT

7. Wing rack stores . . . . SECURE

8. Drop tank . . . . REMOVE FILLER-CAP; VISUALLY DETERMINE LOADING; REPLACE FILLERCAP

9. Approach lights and cover . . . . CONDITION

Left-Hand Wheel Well (F)

1. Main gear doors . . . . . CONDITION, SECURITY

2. Catapult hook . . . . PRELOAD, SECURITY

3. Main gear downlock pin . INSERTED

4. Main wheel strut . . . . . EXTENSION, NO LEAKAGE

5. Main wheel tire . . . . . . CONDITION

6. Brakes . . . . CONDITION, NO LEAKAGE

Center Fuselage Underside (G)

1. Fuselage rack store . . . SECURE

2. Centerline fuel tank . . . REMOVE FILLER-CAP; DETERMINE LOADING; REPLACE FILLERCAP

3. Forward engine and accessories section access doors . . CLOSED

4. Link and case ejection chutes . . . . CLEAR

Cockpit Area (H)

1. External canopy jettison handle . . . . STOWED; ACCESS DOOR CLOSED

2. Controls access panel. . . SECURE

3. Angle-of-attack vane . . . CONDITION, FREE MOVEMENT

4. Engine intake covers . . . REMOVED

5. Intake ducts engine compressor blades . . . . FREE OF FOREIGN OBJECTS

6. Canopy cover. . . . . REMOVED

7. Pitot tube cover . . . . REMOVED

8. Total temperature sensor cover . . . . REMOVED

9. Canopy surface and seal . . . . . CONDITION

ESCAPAC 1C-3/1F-3 Ejection Seat Preflight

1. Ejection seat control safety handle (headknocker). . . . . DOWN

2. External canopy jettison system initiator . . . . SAFETY PIN REMOVED

3. Ejection seat catapult pin block assembly and one canopy jettison initiator pin . . . . REMOVED

4. Emergency oxygen lanyard . . . CONNECTED

5. DART system lanyard . . . . CONNECTED

6. Emergency oxygen bottle . . . . . 1800 psi

7. Canopy-seat interlock cable . . . CONNECTED

8. Face curtain and alternate handles. . . . . STOWED

9. Emergency harness release handle stowed and parachute arming cable secured . . . . CHECK

10. Shoulder harness secure . . . . . LOCKING PIN VISIBLE

11. Lap belt secure . . . . LOCKING PINS VISIBLE

12. Zero delay lanyard . . . . CONNECTED (1C-3 seat only)

Interior Inspection

Check the general appearance of the cockpit, and make sure that all gear is properly stowed and secure. Make proper harness, oxygen, radio, and antiblackout connections, and perform the following checks before starting the engine:

CAUTION

Upon entering the cockpit, make certain that the landing gear handle is DOWN and that the hose jettison switch (tanker only) is OFF (forward).

1. Exposure suit blower . . . OFF

2. Emergency speedbrake knob. . . . . NORMAL

3. Antiblackout suit blower, and oxygen-radio hoses . . . . . . CONNECT TO CONSOLE

4. Oxygen switch . . . . ON, CHECK FLOW, THEN OFF

5. AFCS standby switch . . . OFF

6. AFCS aileron trim switch . . . . NORM

7. Emergency fuel transfer switch . . . . OFF

8. Air refueling fuselage only switch . . . . NORM

9. Drop tanks switch . . . . . OFF

10. Radar selector switch . . . OFF

11. Engine starter switch . . . PULLED UP

12. Fuel control switch . . . . PRIMARY

13. Manual fuel shutoff control lever . . . . NORMAL (GUARD DOWN)

14. JATO arming switch . . . . SAFE

15. JATO jettison switch . . . SAFE

16. Throttle . . . . OFF

17. Speedbrake switch . . . . . CLOSE

18. Master exterior lights switch . . . . OFF

19. Flap handle . . . . UP

20. Spoiler switch . . . . OFF

21. Nosewheel steering switch . . . . NORM

22. Throttle friction wheel . . AS DESIRED

23. Drag chute switch . . . . . STOW-JETTISON

24. RADAR WARN/OFF switch . . . . OFF

25. Accelerometer. . . . . PUSH TO RESET

26. Airspeed indicator . . . . . 0, SET

27. Vertical velocity 0

28. Gunsight . . . . SET, LOCK

29. Radar altimeter . . . . OFF

30. Standby attitude indicator. . . . CAGED

31. Emergency stores jettison select switch . . . . AS DESIRED

32. All armament switches . . . . . OFF

33. Audio bypass switch . . . . NORM

34. Emergency handles . . . . STOWED

35. Arresting hook handle . . . . . . UP

36. Navigation computer . . . . SET UP

37. UHF function switch . . . . OFF

38. VHF function switch . . . . OFF

39. TACAN. . . . . OFF

40. IFF master switch . . . . OFF

41. APR-25(V). . . . . OFF

42. Radar selector switch. . . . . . OFF

43. Compass controller . . . . SLAVED, LATITUDE SET

44. Interior lights control panel . . . . ALL SWITCHES OFF

45. Emergency generator bypass switch . . . . NORMAL

46. Main generator switch. . . . . . ON

47. TACAN antenna switch . . . . . AS DESIRED

48. Spare lamps container. . . . . . ADEQUATE SUPPLY

49. Rain removal switch. . . . . . . OFF

50. Anti-icing switch . . . . OFF

51. Temperature knob . . . . AS DESIRED

52. Cabin pressurization switch . . . . NORMAL

53. Windshield defrost switch . . . . HOLD

54. Exterior lights control panel . . . . ALL SWITCHES OFF

55. Preflight check the thermal radiation closure.

56. Headknocker . . . . UP

WARNING

Make certain the ejection seat safety handle is stowed and locked in the full UP position before flight.

BEFORE STARTING THE ENGINE

Ascertain that the areas forward and aft of the aircraft are clear of personnel and loose objects. See figure 1-53 for danger areas. Make certain that fire fighting equipment is available and manned.

STARTING THE ENGINE

An electrical power supply of 115 vac for ignition and a source of starter air is required for ground starting the engine. The two methods of starting the engine are pilot-controlled and ground-controlled starts.

Pilot-Controlled Starts

Pilot-controlled starts should be made whenever possible, to avoid starter motor overspeed. The time delay inherent in initiating or shutting off the starter air, when using hand signals, makes the ground-controlled start less desirable.

CAUTION

Starter motor overspeed can be severe enough to cause starter motor damage or failure with a resultant hazard to personnel and equipment.

To provide automatic air supply shutoff at the correct starter cutout speed, the aircraft starter circuit receptacle must be connected to the gas turbine power unit prior to starting attempts. The ground air supply shuts off automatically at approximately 50 percent rpm unless a malfunction occurs, in which case the air supply must be shut off manually by pulling up on the engine starter switch (start-abort). The engine should be started as follows:

1. Throttle . . . . OFF

2. Engine starter switch . . . . DEPRESS TO START

3. 5 to 7 percent rpm, throttle . . . . IGN

4. 15 to 18 percent rpm, throttle . . . . IDLE

Light-off should occur within 15 seconds after the throttle is moved outboard to start the ignition cycle and is indicated by a rise in EGT after the throttle is moved to the IDLE position. If light-off does not occur within 15 seconds, retard the throttle to OFF, pull up the engine starter switch, and investigate. Normally, the engine should be stabilized at IDLE rpm within 30 seconds after depressing the engine starting button.

Ground-Controlled Starts

In most cases pilot-controlled starts are not possible, and the following procedure must be used:

1. Throttle . . . . OFF

2. One finger held vertically . . . . START GTC

After Plane Captain signals the GTC is up to speed:

3. Two fingers held vertically . . . . P/C OPEN GTC AIR VALVE

4. 5 to 7 percent rpm, throttle . . . . IGN

5. 15 to 18 percent rpm, throttle . . . . IDLE

Light-off should occur within 15 seconds after the throttle is moved outboard to start the ignition cycle and will be indicated by a rise in EGT after the throttle is moved to the IDLE position. If light-off does not occur within 15 seconds retard the throttle to OFF, signal the P/C to close the GTC air valve, and investigate. Normally, the engine should be stabilized at IDLE rpm within 30 seconds after the P/C opens the GTC air valve.

6. 45 percent rpm, three fingers held vertically . . . . P/C CLOSE GTC AIR VALVE

7. When stabilized at idle, signal external electrical power disconnect . . . . P/C SELECTS INTERNAL ELECTRICAL POWER AND DISCONNECTS EXTERNAL POWER

After Engine Light-Off

If light-off is satisfactory and engine speed is stabilized with the throttle at IDLE using either of the above methods, check the following:

1. RPM . . . . IDLE (53.3 to 62.0 percent)

Note

See figure 3-2 for IDLE rpm vs temperature relationship.

2. EGT . . . . 200° TO 340°C

Note

At IDLE rpm, the temperature pointer will normally stabilize at a position below the maximum indicated. 340°C is not a limit, but a guide to indicate the EGT which, if exceeded, may signify an engine malfunction.

3. Fuel boost . . . . LIGHT OUT

4. Oil pressure . . . . 35 TO 50 psi

Note

If the oil pressure reads low (below 35 psi) at IDLE rpm, increase rpm slightly to 60 percent. If normal pressure is not indicated at this higher rpm, shut down the engine and determine the reason for the lack of, or low, oil pressure indication.

5. Oil quantity indicator/switch . . . . LIGHT OUT

Note

- Due to oil system drainage, the oil quantity light may be on prior to starting the engine and remain on after start. If oil pressure is within limits, add power to 75 percent, quantity light should go off within approximately 8 minutes.
- When usable oil level is between 20 and 80 percent, the oil quantity indicator light will only come on when the indicator/switch is pressed. When usable oil level is 20 percent or less, the light will come on automatically.

ENGINE IDLE CHECK CURVE

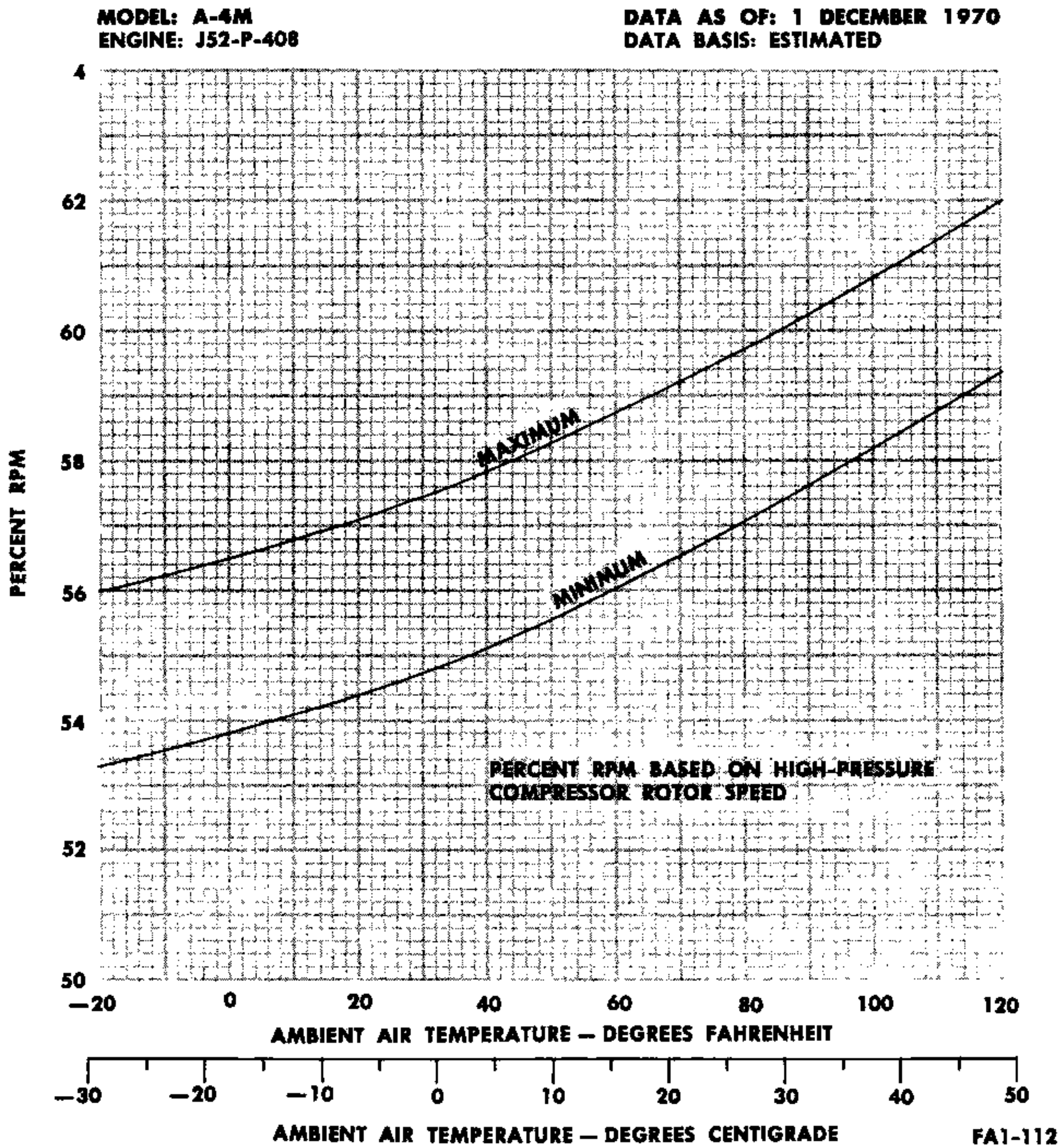

Figure 3-2. Engine Idle Check Curve

Chugs And Stalls

If chugging is encountered during an acceleration, there will be a momentary rpm hesitation without an exhaust temperature rise. Engine stall may or may not be accompanied by chugging. If a stall does occur, the rpm will hang up or decrease and the exhaust gas temperature will rise. Should either a chug or a stall occur, shut down the engine and investigate.

ENGINE GROUND OPERATION

No warmup period is necessary. Always use the minimum rpm necessary to minimize the possibility of foreign object damage.

CAUTION

Be extremely cautious if passing objects to or from ground crewmen with engine operating. This practice has proved dangerous in causing ingestion of foreign objects into the engine and subsequent damage to blading.

Equipment Warmup Time and Operating Limitations

Warmup time and operating limitations for the listed electronic equipment is as follows:

Item	Warmup
ARC-51A	3 minutes
ARR-69	3 minutes
ARA-50	3 minutes
ARN-52(V)	3 minutes
APX-72	3 minutes
ASN-41	2 minutes
APM-141	1 minute
AJB-3A	90±10 seconds
AFCS	30 seconds
APG-53A	3 minutes
APN-153(V)	5 minutes
APR-25(V)	3 minutes
ALQ-100	3 minutes

CAUTION

Ground operation is limited to thirty minutes, without air conditioning.

POSTSTART CHECKLIST

1. UHF function switch . . . . . TR + G
2. IFF master switch . . . . STBY
3. TACAN switch . . . . REC

CAUTION

Remain in REC for 3 minutes before going to the T/R position.

4. AFCS . . . . STANDBY
5. Fuel control light . . . . OFF
6. Depress master TEST switch. The angle-of-attack index light, LAWS, LABS, WHEELS, FIRE, and OBST lights, ladder caution lights, pilot advisory light, armament advisory light, radar altimeter light, OIL LOW light, IFF MODE 4 light, and oxygen low-level light should come on. The fuel quantity and liquid oxygen quantity indicators should rotate counterclockwise. The liquid oxygen warning light will come on as the liquid oxygen quantity indicator passes through 1 liter.
7. LABS light . . . . PUSH TO TEST
8. LOX quantity . . . . NOTE
9. Fuel quantity . . . . CHECK INT/EXT READINGS
10. Oil quantity indicator/switch . . . . PRESS TO TEST, LIGHT OUT
11. Attitude gyro indicator . . . . OFF FLAG DISAPPEARS (WITHIN 70±10 SECONDS)
12. Compass controller panel . . SET
13. Standby gyro . . . . ERECT, OFF FLAG NOT VISIBLE
14. Rain removal system . . . . . CHECK FOR FLOW, THEN OFF
15. AFCS . . . . OFF AFTER CHECKS COMPLETED

Additional checks and hand signals for use between pilot and plane captain for starting and poststart checks are contained in figure 7-2. These signals have been designed to work equally well, whether shore-based or carrier-based, and in daylight or darkness. During night operations, extreme care must be taken to be positive with all signals. In this regard, when using the flashlight to illuminate a hand which is giving a signal, always direct the flashlight away from the person being signalled.

WARNING

Do not operate any hydraulically operated equipment when plane captain is not in sight.

PRIOR TO TAXIING

1. Altimeter . . . . SET, NOTE ERROR
2. Clocks . . . . SET, RUNNING
3. Pressure ratio . . . . SET FOR AMBIENT TEMPERATURE (SEE FIGURE 3-3.)
4. Canopy . . . . RESTRAINT STRAP ATTACHED OR CANOPY CLOSED

TAXI

When ready to taxi, signal the plane captain to remove chocks. Advance throttle to about 70 percent before releasing the brakes. Release brakes and when the desired taxi speed is reached, retard throttle to IDLE. Use caution in confined or restricted areas. Nosewheel steering may be used with brakes as necessary for directional control.

Note

With spoiler switch in ARMED position, the spoilers will be open as long as throttle position is below 70 percent setting.

To avoid foreign object damage to engines, pilot shall maintain a minimum taxi interval of 200 feet, or taxi in close formation with wing-tip clearance and intakes clear of leader's exhaust. While taxiing, determine that nose strut is not overinflated by observing that nose strut will compress when brakes are applied firmly. Failure of the strut to compress may indicate an over-serviced nose strut. If this malfunction is suspected, have the nose strut inspected prior to flight, or an unsafe nose gear position may occur. Check standby compass swinging free and adequate fluid level; turn indicator deflecting normally. The oxygen mask should be donned while taxiing when the canopy is closed and the pressurization is on.

CAUTION

Do not taxi with the canopy open at speeds which, coupled with headwinds, cause the relative wind to exceed 60 KIAS. If taxiing with the canopy closed, be sure it is completely latched. Taxiing with the canopy partially open and the canopy control handle in the locked position imposes shear forces on the canopy hinges which exceed their safe design limits, and may cause fractures of the hinge structure.

PRETAKEOFF CHECKLIST

Before takeoff, complete the following checks:
Perform manual fuel control check:

1. Throttle . . . . 85 PERCENT RPM
2. Oil pressure . . . . 40-50 psi
3. Fuel control . . . . MANUAL
4. Fuel control light . . . . . . ON, AND ENGINE INDICATION THAT SWITCHOVER HAS OCCURRED
5. Fuel control . . . . PRIMARY
6. Fuel control light . . . . . . OFF

Referring to the TAKEOFF checklist (figure 3-4) check:

1. Trim

   Aileron . . . . STICK CENTERED. AILERONS SYMMETRICAL, TAB FAIRED ±1/5 INCH

   Rudder . . . . 0°

TAKEOFF PRESSURE RATIO

FUEL CONTROL HAMILTON P/N 744500

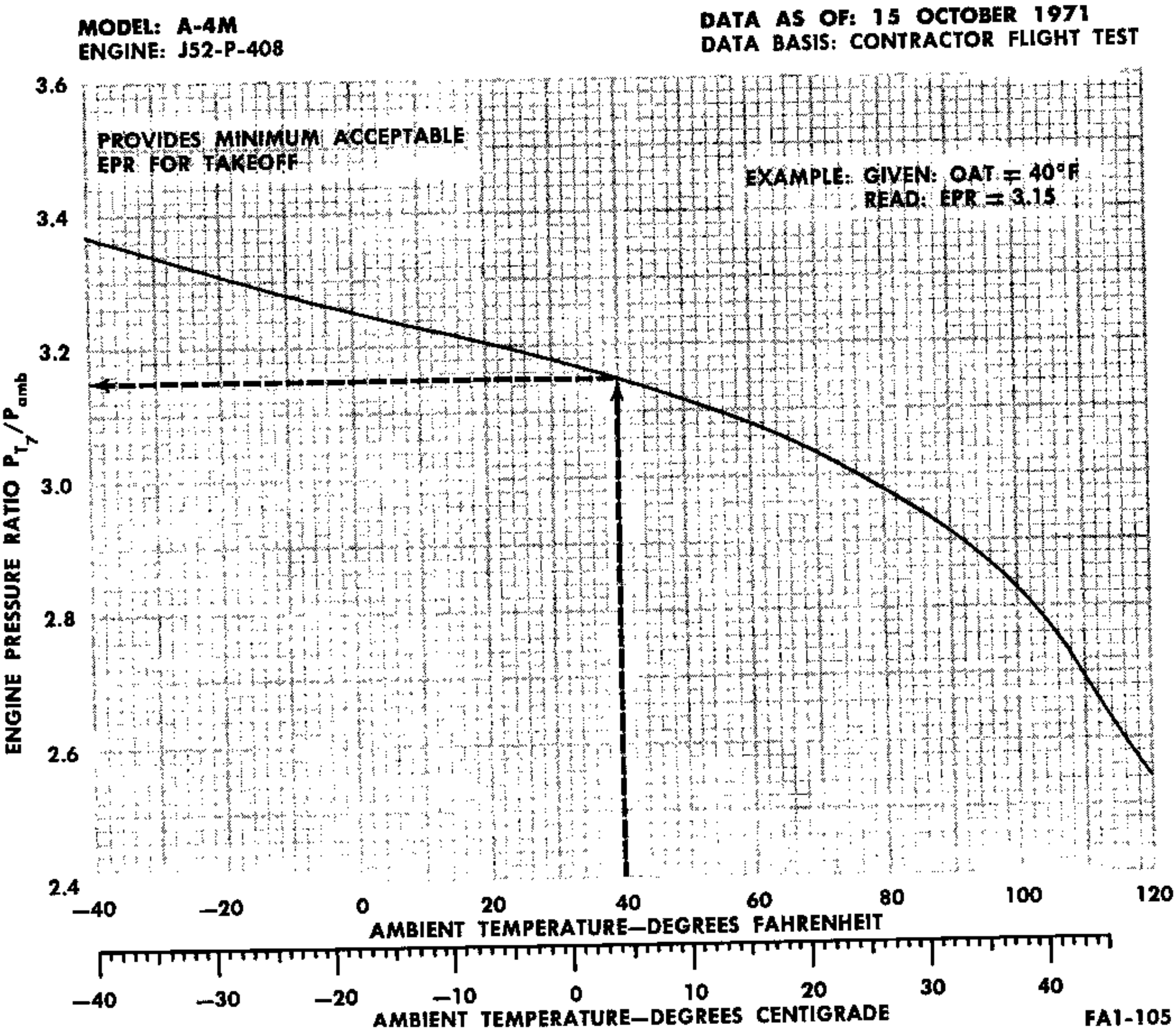

Figure 3-3. Takeoff Pressure Ratio Chart

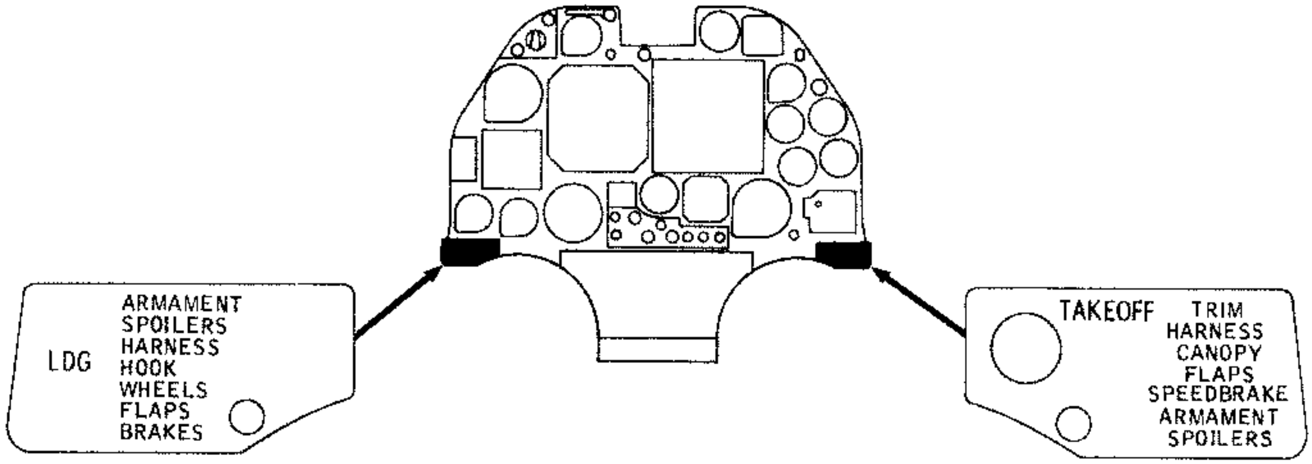

Figure 3-4. Takeoff and Landing Checklist

Horizontal Stabilizer (Field) . . . . 8° NOSEUP/ CATAPULT AND JATO AS REQUIRED

2. Harness . . . . SHOULDER HARNESS LOCKED

3. Canopy . . . . HANDLE OVER-CENTER, CANOPY HOOKS ENGAGED IN ROLLERS

4. Flaps . . . . SET AT 1/2

5. Speedbrakes . . . . CLOSED

6. Spoilers . . . . AS DESIRED (IF ARMED, CLOSED – POWER 70 PERCENT OR ABOVE)

7. Armament . . . . ALL SWITCHES OFF EMERGENCY SELECTOR SWITCH APPROPRIATE SETTING

Note

Before takeoff, it is recommended that the cabin temperature control knob be positioned in the middle of the WARMER range and all of the defrost air diverted to the foot-warmers. Direct the "eyeball" difusers away from the face.

WARNING

Make certain the ejection seat safety handle is stowed and locked in the full up position before flight.

TAKEOFF

TAKEOFF PROCEDURES

Upon completion of the pretakeoff checklist and after receipt of clearance from the tower, the aircraft will line up on the runway. Each pilot should check adjacent aircraft for correct trim settings, flap position, canopy closed, speedbrakes closed, spoilers closed, no fuel or hydraulic leaks, and ejection seat safety handle up. Half-flaps should be used for takeoff during normal shore-based operations. Each pilot shall indicate his readiness for takeoff by giving a "thumbs-up" up the line. (See figure 3-5 for typical takeoff diagram.)

Note

The amount of nose gear strut extension has no significant affect on lift-off speed, control forces, or trim position required. Refer to section XI for additional information on takeoff airspeed and ground roll distance.

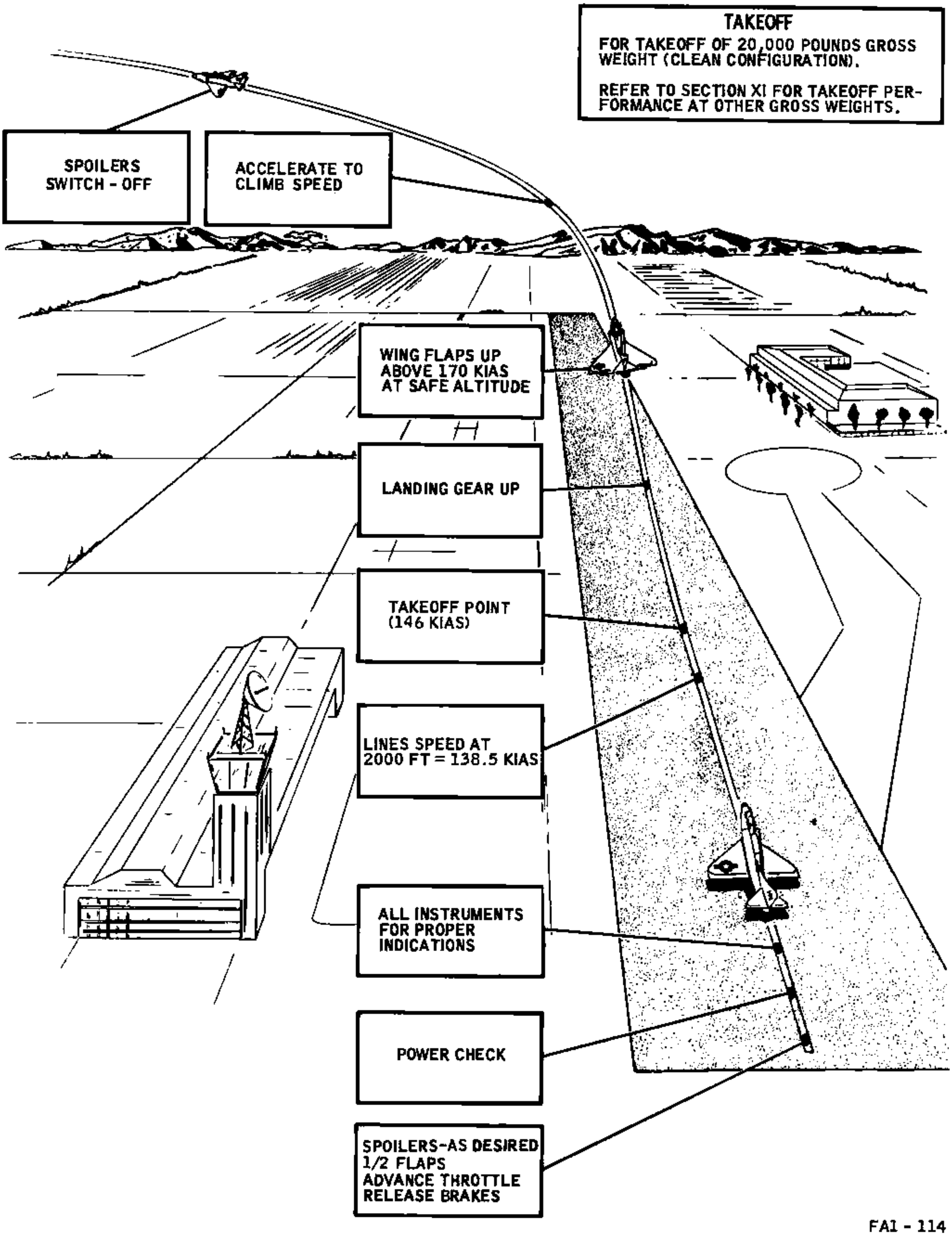

Figure 3-5. Takeoff Diagram (Typical)

As the engine accelerates through 90 percent, release brakes to prevent skidding the tires. Ensure that acceleration is within acceptable limits and that engine accelerates smoothly. When engine stabilizes initially, check for minimum takeoff engine pressure ratio (EPR), EGT, and RPM.

Note

Wind has a negligible effect on EPR readings.

Use brakes or nosewheel steering to maintain directional control until rudder becomes effective (about 70 KIAS).

Note

If nosewheel steering is used, it shall be engaged prior to brake release.

On rough runways, nosewheel bounce may be experienced. Apply forward stick as necessary to maintain nosewheel on the deck. Check the predicted line speed at selected distance marker. This check point should be selected so as to allow normal braking technique to stop the aircraft on the runway remaining. Ten knots prior to predicted takeoff speed, raise the nose to a takeoff attitude and allow aircraft to fly itself off the deck. After comfortably airborne, retract landing gear and apply brakes momentarily to stop main gear tire rotation before wheel enters wheel well. Raise the flaps at 170 KIAS or above.

CAUTION

Particular care must be exercised to ensure that the landing gear limit speed is not exceeded. Adjust throttle and pitch attitude as necessary to remain below 225 KIAS prior to a positive gear up indication.

For a single takeoff, the centerline of the runway should be used as a directional guide.

During formation takeoff (maximum of two aircraft), the leader should take position on the downwind side of the runway. Lateral separation shall be ensured to minimize danger of collision should a lead aircraft blow a tire or abort. For formation takeoffs with two sections, one section shall be airborne before the next section commences takeoff roll. Formation takeoffs are not permitted with dissimilar-type aircraft nor with a crosswind component in excess of 8 knots.

Where individual takeoffs are made with a flight of two or more aircraft, the flight leader shall take position of the downwind side of the runway. Each pilot shall, after lineup on the runway, check adjacent aircraft for correct trim settings, flap position, canopy closed, speedbrakes closed, spoilers closed, no fuel or hydraulic leaks, and ejection control ground safety handle up. Each pilot shall indicate his readiness for takeoff by giving a "thumbs-up" up the line. The second aircraft shall commence takeoff roll not less than 10 seconds behind the first aircraft. The pilot will inform the tower immediately by radio if takeoff is aborted.

Crosswind Takeoff

If strong crosswinds exist, takeoff along upwind side of runway and apply forward stick as necessary to hold nosewheel on deck until computed takeoff speed is reached. Deflect stick into wind as necessary to maintain lateral control. Use brakes or nosewheel steering to maintain directional control until rudder becomes effective (about 70 KIAS). It is recommended that the spoilers be armed prior to releasing the brakes so they will be immediately available in the event of a takeoff abort.

CAUTION

- Excessive forward stick pressure may cause a blown nose tire during takeoff roll.
- Takeoffs are not recommended with a 90-degree crosswind component in excess of 25 knots. When spoilers are not available, takeoffs are not recommended when the crosswind component exceeds 15 knots at 90 degrees.

Note

Almost constant trimming of the horizontal stabilizer will be necessary after takeoff during the period of acceleration to best climbing speed.

Be prepared for the possibility of unusual noise or vibration during the first minute after takeoff, caused by an unbalanced nosewheel tire. An unbalanced nosewheel tire creates a strong vertical vibration of decreasing frequency which can be sensed to emanate from the nose section. DON'T assume that this is the case if unusual noises occur after takeoff. DO analyze engine instruments and feel of aircraft. Be prepared to take action unless noise/vibration ceases as indicated above.

MINIMUM RUN TAKEOFF

To accomplish a minimum run takeoff, full noseup trim and half-flaps should be employed.

Note

Use of full-flaps delays nosewheel lift-off.

After brake release, as the aircraft accelerates down the runway, a generous amount of aft stick should be used to effect nosewheel lift-off. Full aft stick deflection may result in an inadvertent trim input due to interference with pilot survival equipment. During aircraft lift-off (about 10 KIAS less than normal), a noseup rotation of the aircraft will occur, which will require an immediate reduction in aft stick pressure to control. As the aircraft accelerates to climbing speed after takeoff, almost constant retrimming of the stabilizer will be necessary. The noseup rotation of the aircraft at takeoff is reduced in abruptness and severity by an increase in gross weight or by use of less aircraft noseup trim. However, if less than full-noseup trim is employed, the effect will be to increase the minimum nosewheel lift-off speed about 4 knots and increase the takeoff run approximately 300 feet for each 2 degrees of reduced noseup trim.

IN-FLIGHT

Refer to section IV.

BRAKING TECHNIQUES

Brake pedals should be pumped on final approach to ensure a firm brake pedal after touchdown. As a general technique, a steady pedal pressure should be applied and maintained during landing rollout. Brake pedals should be released and reapplied only as necessary to hold firm pedal pressure and position.

CAUTION

The capacity of the dual disc brakes makes it possible to lock the wheel brakes at any speed, causing a tire to blow.

Proper braking technique for a minimum distance landing roll requires moderate brake pedal pressure, without skidding tires, as soon as aircraft weight is firmly on the main wheels. Brake pressure must then be increased as the aircraft decelerates because aircraft weight on the tires increases as wing lift decreases, assisting braking effort.

The wing lift spoilers, when extended with full flaps, reduces wing lift by almost 84 percent and minimizes aircraft weight change on the tires as the aircraft decelerates. Therefore, brakes may be applied as soon as the spoilers are extended, with a moderately heavy pressure that will be slightly increased as the aircraft speed decreases.

Note

The maximum braking technique will not be used for normal field landings where adequate runway exists for the aircraft to decelerate below 80 KIAS before applying brakes.

LANDING

The flight shall normally approach the breakup point in echelon, parade formation, at 250 to 300 KIAS. A 3- to 5-second break will provide an adequate downwind interval. Immediately after the break, extend speedbrakes and retard throttle to 70 percent. Speedbrakes will normally remain extended throughout approach and landing. (Speedbrakes increase the stalling speed approximately 1 knot.) As the aircraft decelerates to 225 KIAS or less, lower the landing gear and extend full flaps. As the airspeed decreases to 170 KIAS, adjust power to maintain desired pattern airspeed commensurate with gross weight. Complete the landing checklist (figure 3-4) and check wheel brakes prior to reaching the 180-degree position. Cross-check airspeed with AOA indexer indication. At a gross weight of 14,000 pounds, recommended approach speed is approximately 126 KIAS at the abeam position (figure 3-6). Optimum AOA indication is 18 units.

Note

For each 1000-pound increase over 14,000 pounds, optimum approach speed (determined by the AOA indexer) increases approximately 5 KIAS.

If a discrepancy between indexer and airspeed exists, recheck landing configuration and gross weight and approach at recommended airspeed. Report error in AOA calibration.

NOTE

REFER TO LANDING DISTANCE CHARTS IN SECTION XI FOR FINAL APPROACH AND TOUCHDOWN SPEEDS.

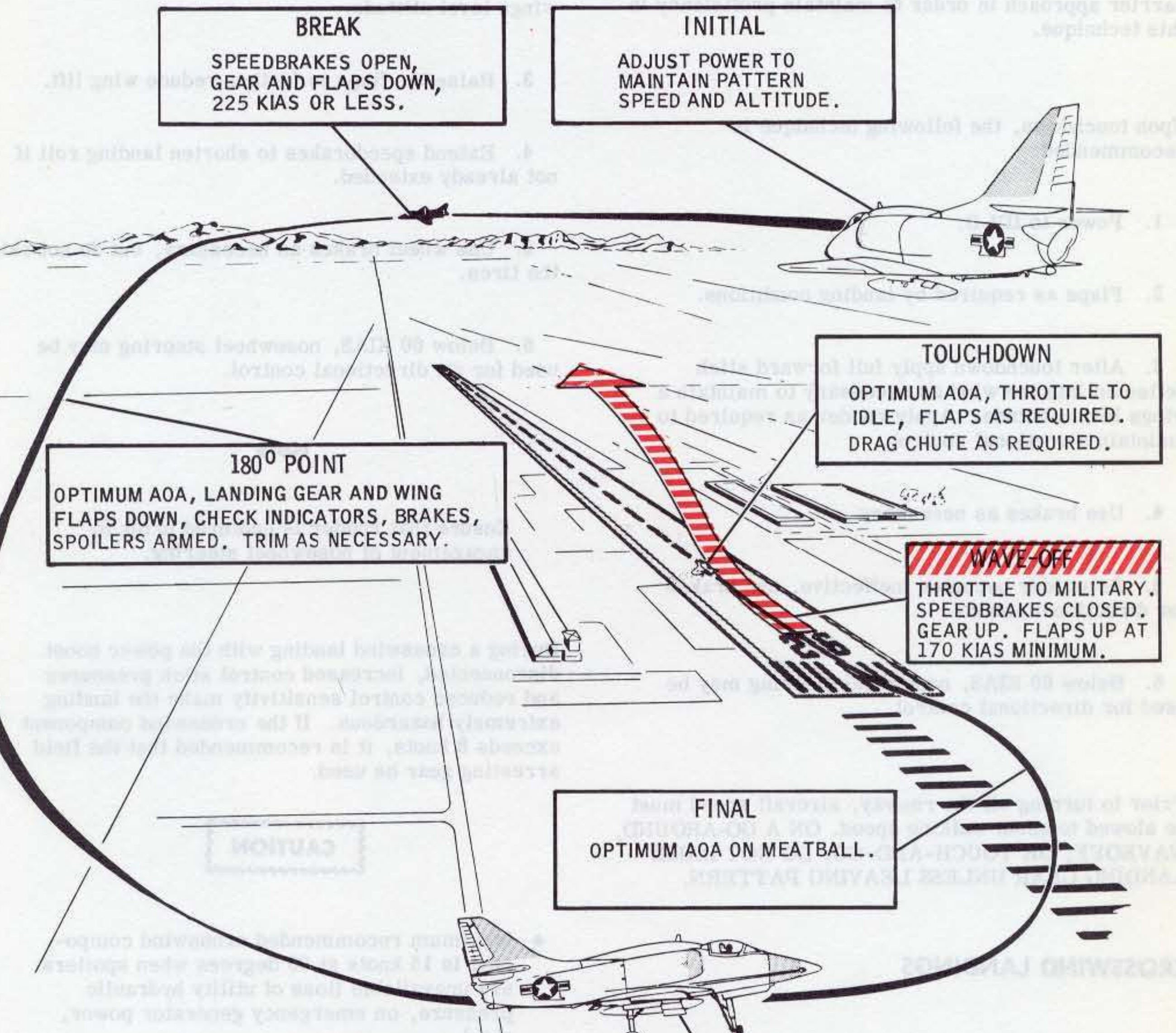

Figure 3-6. Landing and Waveoff Patterns

Begin the turn into the base leg at a point slightly downwind of the landing end of the runway in order to have adequate straightway for corrections on final. Optimum angle-of-attack approaches to touchdown will be made. Where a mirror is available, its use is recommended. Attempt to control meatball, lineup, and angle-of-attack/airspeed as precisely as for a carrier approach in order to maintain proficiency in this technique.

Upon touchdown, the following technique is recommended:

1. Power to IDLE.

2. Flaps as required by landing conditions.

3. After touchdown apply full forward stick deflected into the wind as necessary to maintain a wings level attitude. Apply rudder as required to maintain directional control.

4. Use brakes as necessary.

5. As rudder becomes ineffective, use brakes for directional control.

6. Below 60 KIAS, nosewheel steering may be used for directional control.

Prior to turning off the runway, aircraft speed must be slowed to about walking speed. ON A GO-AROUND, WAVEOFF, OR TOUCH-AND-GO, DO NOT RAISE LANDING GEAR UNLESS LEAVING PATTERN.

CROSSWIND LANDINGS

Crosswind landings are not recommended with a 90-degree crosswind component in excess of 25 knots. During the approach, maintain wing down into the wind and opposite rudder, as required, to maintain lineup. At touchdown, the aircraft alignment should be straight down the runway with no drift. After touchdown, under maximum crosswind components or less, the aircraft can easily be controlled directionally by applying aileron into the wind and using wheel brakes as required. If the upwind wing is allowed to rise, the nose of the aircraft will tend to track toward the downwind side rather than "weathercocking" into the wind as is normally expected. If strong crosswinds exist, land on the upwind side of the runway. The following procedure is recommended immediately after touchdown.

1. Reduce power to IDLE.

2. Maintain stick deflection into the wind as required and allow nose of aircraft to fall through. When nosewheel is on deck, apply full-forward stick deflected into the wind as required to maintain a wings level attitude.

3. Raise the flaps to further reduce wing lift.

4. Extend speedbrakes to shorten landing roll if not already extended.

5. Use wheel brakes as necessary, but do not skid the tires.

6. Below 60 KIAS, nosewheel steering may be used for all directional control.

Note

Ensure that rudder is centered prior to engagement of nosewheel steering.

During a crosswind landing with the power boost disconnected, increased control stick pressures and reduced control sensitivity make the landing extremely hazardous. If the crosswind component exceeds 8 knots, it is recommended that the field arresting gear be used.

CAUTION

- Maximum recommended crosswind component is 15 knots at 90 degrees when spoilers are unavailable (loss of utility hydraulic pressure, on emergency generator power, etc.).
- At high values of 90 degrees crosswind component (20 to 25 knots), wind gusts become more prevalent and close attention must be paid to lateral control, particularly when landing with asymmetric store loadings.

Note

With any asymmetrical load, the maximum permissible crosswind component under the loaded, or heavy wing, is 15 knots without spoilers and 25 knots with spoilers open.

MINIMUM DISTANCE

To accomplish a minimum distance landing, the following procedure is recommended:

1. Maintain optimum angle of attack during the approach. Land with spoilers armed.

2. At touchdown, let the nose fall through, use full forward stick, and deploy drag chute.

3. Apply moderate braking immediately. Maintain steady braking throughout the rollout, increasing brake pedal pressure as the rollout speed decreases.

4. Leave flaps fully extended unless there is excessive crosswind.

5. If circumstances dictate, the landing roll may be further reduced by shutting down the engine at approximately 80 KIAS.

CAUTION

The drag chute risers and stowage bag will be damaged if high rpm is used with drag chute deployed. If high rpm is required to clear the runway, the drag chute should be jettisoned on the runway.

Note

Spoilers will close at engine shutdown.

LANDING ON WET RUNWAY/HYDROPLANING

The following procedures should be used when landing on a wet runway.

1. Consider using short field arresting gear, if available.

2. Land on longest available runway that is acceptable to aircraft crosswind and arresting gear limitations.

3. Land no faster than optimum approach speed. Dump/burn down as much as practicable to reduce optimum approach speed and minimize stopping distances. Maintain optimum angle of attack during the approach and land with spoilers armed.

4. Land on end of runway, using MLP-type landing, DO NOT FLARE.

5. Deploy drag chute upon touchdown and use rudder as necessary to track straight down runway until below rudder effectiveness speed at which time brakes and/or nosewheel steering may be used.

Note

Nosewheel steering must be used judiciously to prevent nosewheel skidding.

6. Due to the decreased friction-coefficient, modify braking technique to prevent locking the wheels, which further decreases braking effectiveness. Tap the brakes lightly. If a skid is felt, the pilot must release the brakes and resume tapping when the track straightens out.

7. If abort is not available and there is doubt that the aircraft can be stopped on the runway, either:

(a) Wave off if adequate runway remains, or

(b) Secure the engine as the airspeed decreases below 80 KIAS with the aircraft under control.

8. Be prepared to drop the hook and take the abort gear, if necessary.

LANDING ON ICE-COVERED RUNWAY

If it is not feasible to divert to a field with better landing conditions, use the following techniques:

1. Make a short field arrestment if possible.

If unable to make a short field arrestment:

2. Land no faster than optimum approach speed. Burn/dump fuel to reduce optimum approach speed and minimize stopping distance.

3. Touch down so as to utilize all available runway.

4. Use rudder as necessary to track straight down the runway until below rudder effectiveness speed, at which time nosewheel steering may be used.

Note

Nosewheel steering must be used judiciously to prevent nosewheel skidding. In severe ice conditions, nosewheel steering may not be effective.

5. Because of the decreased friction coefficient, braking technique must be modified to prevent locking wheels, which further decreases braking effectiveness. Tap brakes lightly and evenly. If a skid is felt, the pilot must release the brakes and resume tapping when the track straightens out.

6. If abort gear is not available and there is any doubt that aircraft will not stop on the runway, secure engine as airspeed decreases below 80 KIAS with aircraft under directional control. If directional problems exist and adequate runway remains, wave off.

7. Be prepared to drop hook and use abort gear if airspeed is not down to safe taxi speed, prior to reaching abort gear.

Note

If more than one aircraft is in the flight, maintain adequate fuel reserve for the runway to be cleared and keep abort gear rigged in case the preceding aircraft has to be shut down or use abort gear.

The above procedure may be modified as necessary to allow for conditions of less severity than a completely ice-covered runway.

SECURING ENGINE

The following steps will be performed prior to shutdown:

1. Flap. . . . . UP

2. Speedbrakes . . . . IN

3. Spoilers . . . . CLOSED

4. Horizontal stabilizer trim. . . . . ZERO DEGREES

5. Drop tanks switch. . . . . . . OFF

6. Radios and all electrical equipment . . . . OFF

7. Standby attitude indicator. . . . . CAGED

8. Gear pins, ordnance pins and chocks . . . . IN PLACE

9. Ejection control safety handle . . . . DOWN

10. Check oil level by depressing OIL LOW indicator/switch (if installed). If light comes on, oil level is below 80 percent.

Note

Except for an emergency or operational necessity, when engine has been operated at or above 85 percent rpm for periods exceeding 1 minute, within 5 minutes prior to shutdown; the engine should be operated at IDLE for 30 seconds prior to shutdown to prevent overheating the rear bearings.

11. Main generator switch. . . . OFF, RESET

12. Canopy. . . . . OPEN

13. With engine stabilized at IDLE, throttle . . . . OFF

14. Time engine rundown. Be alert for unusual compressor noises.

15. Oxygen. . . . . OFF

16. Canopy jettison initiators (2) . . . . PINS INSTALLED

FIELD CARRIER LANDING PRACTICE (FCLP)

PATTERN-ENTRY PROCEDURE

Individual Entry

Call the tower for entry to the FCLP pattern. Request 800-foot break altitude. Otherwise, follow the normal field entry procedures into the break. When cleared to break and the proper interval of the aircraft downwind is assured, roll into a 45-degree banked turn.

Reduce power to 70 percent and extend speedbrakes. Speedbrakes will normally remain out throughout the approach and landing. Use of speedbrakes may not be desirable at high gross weights (in excess of 13,000 pounds) when configured with high drag stores, i.e., buddy store, MBR's, etc., due to the high thrust required during the approach. At 225 KIAS, lower gear and full flaps. Adjust angle of bank to provide correct distance abeam (1 1/4 miles). Descend to 600 feet AGL on the downwind leg. Pilots shall crosscheck airspeed against angle-of-attack indexer to ensure calibration of indexer prior to turning from the 180-degree position.

Formation Entry

The leader of the formation will enter the break as described above for single-aircraft entry. When cleared to break, the leader will give the breakup signal and execute a break by rolling into a 45-degree banked turn. The remaining aircraft in the formation will take a 10-second break interval.

PATTERN

Downwind

Maintain 600 feet AGL at a comfortable airspeed, but no faster than 150 KIAS. Complete landing checklist.

180-Degree Position

Altitude should be 600 feet AGL. Plan to lose sufficient airspeed on the downwind leg to arrive at the 180-degree position at the optimum angle-of-attack or approach speed. The approach airspeed will vary with aircraft gross weight. Distance abeam will vary with wind conditions, but 1 1/4 miles abeam is a normal position. The turn from the 180-degree position will be delayed so as to intercept the glideslope, wings level at 600 feet AGL.

90-Degree Position

Altitude should be 600 feet AGL with the aircraft at optimum angle-of-attack/airspeed.

Final

When the "meatball" appears in the center of the mirror, it will be necessary to reduce power slightly and ease the nose over, maintaining optimum angle-of-attack/airspeed. Proper glide slope and approach speed are maintained by keeping the "meatball" centered by coordinated adjustments of power for altitude corrections, and of attitude for airspeed corrections. The straightaway, with wings level, should be about 1-1/2 miles long.

Once the "meatball" is sighted, the approach should be monitored by cross-checking MEATBALL, LINEUP, ANGLE-OF-ATTACH INDEXER/AIRSPEED. Make necessary corrections immediately but smoothly.

Landing

Keep the aircraft on the glide slope and centerline. Keep the "meatball" centered until touchdown. Do not flare. Upon touchdown, add full power and retract speedbrakes immediately. Climb straight ahead until reaching at least 300 feet and 150 KIAS. Turn downwind when the aircraft ahead is approximately in the 10 o'clock position on the downwind leg. Do not exceed 150 KIAS in the pattern. About 30-degree angle of bank turning downwind should establish the correct distance abeam. Extend speedbrakes on the downwind leg prior to reaching the 180-degree position.

Waveoff

To execute a waveoff, immediately add full power, retract speedbrakes, and transition to a climbing attitude to prevent further loss of altitude. Make all waveoffs directly down the runway until at least 300 feet of altitude and 150 KIAS are attained.

NIGHT FLYING

FLIGHT PROCEDURES

See section IV.

NIGHT LIGHTING DOCTRINE FOR SHORE-BASED OPERATIONS

Line Area

CAUTION

Application of external power or starting the aircraft with external lights on BRT may cause failure of the lights. Allow 60 seconds for warmup after electrical power is applied to the aircraft with lights on DIM.

Prior to start, turn wing and tail lights to STDY/DIM and all others to OFF. This is the minimum lighting condition that should be used whenever the engine is running. Turn the master exterior lights switch ON, so that when the engine starts the exterior lights will come on. Perform customary poststart checks, including exterior lights check. Signal the plane captain when ready to taxi by flashing the exterior lights. Taxi in the line area with fuselage and anticollision lights OFF and remaining navigational lights DIM.

Taxiing

Once clear of the line area, turn lights to BRT/FLSH. The taxilight should be utilized at any time the field lighting is insufficient for safe ground operations. Discretion is required since night vision may be impaired.

WARNING

Utilization of the taxilight while airborne may destroy night vision and cause disorientation.

At Approach End of Runway

While completing the takeoff checklist in the turnup area, keep all lights BRT/FLSH unless other aircraft are in the turnup area, in which case it may be necessary to dim all lights to prevent pilots of other aircraft from losing their night vision.

It may be necessary to modify the above procedure to conform to local operating procedures.

Takeoff

For single-aircraft takeoff, all lights will normally be BRT/STDY with anticollision light on, unless otherwise specified in local operating regulations. For a section takeoff, the leader will turn his lights DIM/STDY when in position on the runway, while the wingman will have his lights on BRT/STDY. After turnup to 90 percent, the wingman will indicate his readiness to go by turning on his anticollision light. The leader will signal "Brake release and adding power," by blinking his exterior lights.

Operating Clear of Traffic Pattern

For single-aircraft flights, once clear of the pattern, lights will be BRT/STDY with anticollision lights on. When joining in formation, the following procedures will be utilized: As each pilot calls "ABOARD" (when he is in such a position that dimming the lights of the aircraft ahead will not affect his rendezvous), the pilot ahead will turn his fuselage and anticollision lights OFF and other lights DIM/STDY (fuselage light intensity as briefed or as desired by wingman). Normal lighting for aircraft in formation other than the last aircraft will be wing and tail DIM and all other lights OFF. As each aircraft breaks for rendezvous practice, the pilot will turn all lights to BRT/STDY and anticollision light on.

For night section penetrations, the leader will have his fuselage and anticollision lights OFF and remaining lights on DIM/STDY. The wingman will leave all lights BRT/STDY and anticollision light on, if a VFR letdown is to be made. However, at any time that instrument conditions will be encountered the wingman will turn all lights to BRT/STDY and anticollision lights OFF prior to entry into the clouds.

Landing Pattern

When returning to the base for normal breakup and landing, the lights will be at DIM/STDY, except the last aircraft will be at BRT/STDY with anticollision light on. The break will be signaled by each pilot blinking the exterior lights, just before break. Normally a 5- to 7-second interval will be used. All lights will be turned to BRT/STDY and anticollision on, when well clear of the formation. Lights remain on BRT/STDY and anticollision on, for as long as aircraft remain in traffic pattern or unless otherwise directed by the tower or LSO. Single aircraft entering the break will have lights on BRT/STDY and anticollision lights on.

When in the line area, after landing, turn fuselage anticollision lights to OFF and other lights to DIM/STDY.

FUNCTIONAL CHECK FLIGHT PROCEDURES

Check Pilots

The most important single factor in obtaining good check flights on the aircraft is to pick experienced, conscientious check pilots. Commanding officers shall designate, in writing, those pilots within their command who are currently eligible to perform this duty.

Check Flights and Forms

Check flights shall be performed when directed by, and in accordance with, the directions of NAVAIRSYSCOM, Type Commanders, or other appropriate authority. Functional flight check requirements and applicable minimums are described below. Functional check flight checklists are promulgated separately.

FUNCTIONAL CHECK FLIGHT REQUIREMENTS

The functional check flight shall be performed after the completion of the calendar maintenance requirements using the applicable Functional Check Flight Checklist. This section contains a detailed description of the check flight requirements, sequenced in the order in which they shall be performed. The check flight personnel shall familiarize themselves with these requirements prior to the flight. NATOPS procedures shall apply during the entire check flight. A daily inspection is required prior to the check flight.

CONDITIONS REQUIRING FUNCTIONAL CHECK FLIGHTS

Check flights are required under the following conditions (after the necessary ground check and prior to release of the aircraft for operational use):

1. At the completion of a Calendar Inspection. (Minimum: entire check, Parts 1 through 63).

2. At the completion of aircraft rework. (Minimum: entire check, Parts 1 through 63).

3. After the installation of engine. (Minimum: all engine and fuel control checks, Parts 24 through 28, 45, 49, 53, 62 and 63).

4. After the installation of any major components of the fuel system. (Minimum: all fuel control and fuel system checks, Parts 10, 24 through 28, 44, 49, 53 and 55).

5. When fixed flight surfaces have been installed. (Minimum: Disconnect/rate of roll check, Part 56).

6. When movable flight control surfaces have been replaced, removed for major repairs, or rigged. (minimum: Disconnect/rate of roll check, Part 56).

7. When primary control cables, rods, or tubes have been replaced or rigged. (Minimum: Disconnect/rate of roll check, Part 56).

8. When control system components have been adjusted or replaced; and when improper adjustment or installation of such components could adversely affect flight characteristics or result in loss of control of the aircraft. (Minimum: Disconnect/rate of roll check, Part 56).

9. After accomplishment of any modifications or repairs affecting any of the preceding.

10. The requirement for a check flight, under circumstances other than those specified, is a determination to be made by the Maintenance Officer and will be based on the scope of the work accomplished and its effect on safety or reliability of operation.

Note

Local commands shall set minimums for check requirements for items 9 and 10, using the minimums as set forth in items 1 through 8 as a guideline.

CHECK FLIGHT PROCEDURES

Note

For preflight, starting, and pretaxi procedures refer to other sections of this NATOPS Flight Manual.

PRETAKEOFF

Preflight Checks

1. Horizontal stabilizer manual override lever – overrides the stick trim button in both directions.

2. Flight control disconnect – ground check procedure.

Normal Trim Control Check

After start, when all systems normally required for flight are functioning on aircraft power, the normal trim control checks of the elevator, rudder, and ailerons should be performed to ensure proper operation. During the actuation of these trim systems the pilot should be assisted by ground personnel, and should use predetermined signals to ensure correlation between trim settings and cockpit trim indicators.

Maximum Aileron Followup Tab Deflection

In addition to the normal trim system check and when a power disconnect is to be performed, the aileron followup tab may be checked at the 3-degrees up and the 3-degrees down positions. This is the maximum deflection allowable for intentional, inflight, power disconnect, as an aid in visually determining this limit prior to attempting a disconnect when airborne. Three degrees deflection of the followup tab (from faired with the aileron) is difficult to determine from the cockpit even when on the ground. Therefore, ground personnel should be briefed as to what is required, and using a means of definite measurement, assist the pilot in obtaining these settings (3-degree deflection of the followup tab from faired with the aileron is approximately 1/5 of 1 inch).

Checking the followup tab at the 3-degrees up and 3-degrees down positions prior to taxi is not part of the required ground check procedure for a power disconnect flight. This check is suggested to aid the pilot in establishing a picture of what 3-degree followup tab deflection may look like in flight prior to attempting a disconnect.

Rigging Check

Prior to taxi and as part of the normal trim and rigging check, the following procedures should be accomplished:

a. Assisted by ground personnel, trim both ailerons symmetrically, (both above or below an equal amount relative to the wing), with the flaps in full up position.

b. Check the aileron followup tab a maximum of 3-degrees (1/5 inch) deflection (from faired with the aileron) when the ailerons are trimmed symmetrically.

c. Check the control stick for centering (vertical) when the ailerons are trimmed symmetrically with the wings.

d. Actuate all controls for maximum deflection and check for ease of movement to ensure that all systems are connected and functioning normally.

Note

If the control system does not meet the requirements of the preceding checks, the system is probably out of rig, and the aircraft should not be flown.

3. Vertical Velcocity Indicator – CHECK

Needle indicates 0±100 fpm

4. Pressure Altimeter – CHECK

Allowable scale error. . . . . ±75 feet

5. Airspeed and Mach – CHECK

Indices movable

6. Cabin Altimeter – CHECK

Scale error . . . . 0M±200 feet
5M±300 feet

7. AJB-3A All-Attitude Indicating System (AAI) – CHECK

a. Vertical Gyro (Gyro Erection)

(1) Off flag disappears within 90±10 seconds.

(2) Roll attitude ±2 degrees aircraft attitude in 3 minutes.

(3) Pitch attitude ±2 degrees aircraft attitude in 3 minutes

b. Indicator Display (Attitude)

(1) Pitch trim knob rotation (cw for dive, ccw for climb) 10-degrees minimum dive. Minimum climb 5 degrees (from 0 dot).

c. Directional Gyro (Gyro Erection)

(1) Off flag disappears with 90±10 seconds.

(2) Automatic synchronization 12±3 seconds after flag drops.

(3) Synchronization needle accuracy within 3/4 scale.

(4) Slow slave 1.5±0.5 degrees per minute.

(5) Synchronization needle accuracy after 3 minutes within 1/4 scale of zero. (May oscillate about this point.)

d. Indicator Display (Heading Accuracy)

(1) AAI within 3.5 degrees of ID-663 BDHI indication.

(2) BDHI within ±3.0 degrees of true magnetic heading.

e. Slew Knob Operation (Push to Turn)

(1) On cw, synchronization needle displaces to the right. AAI and BDHI increase heading.

(2) On ccw, synchronization needle displaces to the left. AAI and BDHI decreases heading.

8. APG-53A Radar – CHECK

Perform radar preflight check in accordance with Section I, Part 2.

9. Pressure Ratio Indicator – CHECK

Index and counter should move smoothly when setting knob is rotated.

10. Fuel Quantity Indicator – CHECK

a. Pointer rotates smoothly ccw when master TEST switch is pressed.

b. Quantity displayed corresponds to actual fuel on board.

c. External fuel quantity indication is accurate when button is depressed.

11. Liquid Oxygen Gage – CHECK

a. Off flag is not visible with electrical power to gage.

b. Quantity indication corresponds to known quantity (if system recently serviced).

c. Pointer rotates smoothly ccw when master TEST switch is pressed and warning light operates when indication is 0-1 liter.

12. Standby Attitude System .... UNCAGE GYRO AFTER 3 MINUTE WARMUP TIME

a. Gyro Erection

(1) Off flag not visible.

(2) Roll attitude ±2 degrees of aircraft attitude.

(3) Pitch attitude 8±1 degrees of aircraft attitude shown on AJB-3A if A-4 AFC 487 is not incorporated. With A-4 AFC 487 incorporated attitude must be within 4±1 degrees of AAI.

b. Indicator Display

(1) Pitch trim knob rotation (cw for dive, ccw for climb) 5-degree dive, 5-degree climb (from 0 dot).

(2) Indicator cages and knob locks.

13. Gunsight – CHECK

a. Rheostats on both sides of gunsight on-off control knob are operative.

b. Check day/night switch for proper operation.

c. Rotate mil drum to 270 mils while checking for smooth operation/slippage.

d. Perform gunsight check described in NAVAIR 01-40AV-1T and record mil error.

14. Standby Compass – CHECK

a. Heading error ±3.0 degrees of BDHI after magnetic deviation compensation.

b. Check fluid level.

15. ASN-41 Navigational Computer Set – CHECK

Check position in test mode. (Allow 2 minute warmup)

a. Wind speed......... 223.6±1.5 KNOTS

b. Wind direction ...... 90.5±1.5 DEGREES

c. Present position counters integrate south and east.

16. APN-153 Doppler Radar Navigation Set – CHECK

Test position (5 minute warmup)

a. Memory light .... EXTINGUISHED

b. Groundspeed .... 121±5.0 KNOTS

c. Drift angle........... 0±2.0 DEGREES

17. Automatic Flight Control System – CHECK

Perform complete preflight checks in accordance with Section I, Part 2.

18. Wing Spoilers

Normal Operation (ARM position) .... ACTUATION SHOULD OCCUR WITH LANDING GEAR STRUTS COMPRESSED AND ENGINE RPM REDUCED TO 70 TO 75 PERCENT

TAXI CHECKS

19. Brakes

a. Brake pedal travel 1 1/2 inch maximum prior to braking action.

b. Power check 85 percent and under, no aircraft forward movement. Spongy, chattering, fading, or dragging brake unacceptable.

20. Nosewheel Steering

a. Engage (Emergency control switch in NORMAL position and steering control switch depressed.)

(1) Transients........ DIRECTIONAL TRANSIENTS FROM TRACKING DURING TAXI, LANDING, OR TAKEOFF ROLL NOT ACCEPTABLE.

(2) Pedal Deflection.... VERIFY THAT AIRCRAFT TRACKS IN DIRECTION OF APPLIED RUDDER.

(3) Nosewheel Deflection .... VERIFY THAT AIRCRAFT TRACKS IN DIRECTION OF APPLIED RUDDER WHEN ARRESTING HOOK IS LOWERED.

b. Disengage (Control switch released)

(1) Castering .... AIRCRAFT SHOULD TRACK SMOOTHLY IN DIRECTION OF APPLIED BRAKING.

(2) Nosewheel Deflection . . . . WITH PEDAL DEFLECTED, NOSEWHEEL SHOULD RETURN TO CENTER WHEN ARRESTING HOOK IS LOWERED.

c. Emergency OFF

(1) EMER OFF Position . . . . NOSEWHEEL STEERING SHOULD DISENGAGE WHEN STEERING SWITCH IS PLACED IN EMER OFF POSITION.

21. Turn Needle

Check turn needle operation while taxiing.

22. ARN-52 TACAN

a. Check bearing accuracy ±1.0 degree from designated point on airfield.

b. Check DME operation.

PRETAKEOFF

23. Takeoff Checklist

Perform takeoff checklist in accordance with NAVAIR 01-40AVM-1B.

24. Manual Fuel Control Checks

a. Switch to manual fuel at 65 percent RPM. Manual fuel control warning light should come on. Any compressor stall is unacceptable. Slowly advance throttle to 80 to 85 percent RPM.

b. Fuel changeover MANUAL to PRIMARY—Changeover from MANUAL to PRIMARY should be done at 80 to 85 percent RPM, and manual fuel control warning light should go off. If compressor stall occurs, return to MANUAL and position throttle to 78 percent RPM. Return throttle to IDLE, and while engine is decelerating, attempt another changeover. Occurrence of compressor stall is unacceptable.

TAKEOFF

25. Takeoff Engine Acceleration Limits (Military Power)

a. Acceleration Time . . . . RECORD. . . . 13 seconds maximum

b. RPM . . . . RECORD . . . 102.4 percent maximum

c. EGT . . . . RECORD. . . 815°C maximum for 8 minutes

785°C maximum stabilized

d. Pressure ratio should be at or above indicator bug setting for ambient temperature at pretakeoff check.

e. Oil Pressure . . RECORD. . . 40 to 50 psi

Note

Record values for b and c as noted at rotation. RPM and EGT will increase throughout takeoff roll.

CLIMB

Climbing Through 16,000 Feet

26. Climb to altitude (approaching 16,000 feet) MILITARY power, check bias as follows:

a. RPM . . . . RECORD

b. EGT . . . . RECORD. . 815°C maximum for 8 minutes 785°C maximum stabilized

c. Oil Pressure . . . RECORD. . 40 to 50 psi

d. Pressurization. . RECORD. . 8000±1000 ft.

e. Airspeed and Mach . . . . RECORD. . Indication is 405±12 KIAS at 0.8 IMN.

Climbing Through 26,000 Feet

27. Climb to altitude (approaching 26,000 feet) MILITARY power, check bias as follows:

a. RPM . . . . RECORD

b. EGT. . . . . RECORD. . 815°C maximum for 8 minutes 785°C maximum stabilized

c. Oil Pressure . . . RECORD. . 40 to 50 psi

d. Pressurization. . RECORD. . 14,000+1300, -1800 feet

Level at 36,000 Feet

28. Jam Acceleration Check (180 KIAS minimum)

a. RPM . . . . RECORD. . (IDLE)

b. EGT. . . . . RECORD. . (IDLE)

c. Fuel Flow . . . . . RECORD. . (IDLE)

d. Pressurization. . RECORD. . (IDLE) 20,000 +1600, -2600 feet

e. Time IDLE to MILITARY . . . . RECORD. . 20 seconds maximum

f. RPM . . . . RECORD. . (MIL)

g. EGT (MIL) . . . . RECORD. . 815°C maximum for 8 minutes 785°C maximum stabilized

h. Fuel Flow . . . . . RECORD. . (MIL)

i. Oil Pressure . . . RECORD. . 40 to 50 psi

j. Airspeed/ Mach . . . . RECORD. . Indication of 275±7 KIAS at 0.83 IMN

Descending to 20,000 Feet

29. Flight Control Check

Noseover to obtain 0.90 to 1.05 IMN and check flight controls for proper response. Observe Flight Manual restrictions shown in Section I, part 4.

CAUTION

Do not exceed 0.90 IMN with external tanks installed.

Level at 20,000 Feet

30. Speedbrakes

Check in 1.0g flight at 400 KIAS.

a. Open . . . . 3 SECONDS MAXIMUM

b. Closed . . . . 3 SECONDS MAXIMUM

c. Pitch . . . . +1.0G MAXIMUM AND -0.5G MAXIMUM

d. Yaw . . . . 1/2 BALL

e. Roll . . . . 5 DEGREES PER SECOND MAXIMUM

31. Vertical Velocity Indicator – CHECK

Indicator error must be within 300 fpm while indicating a 2000-fpm rate of climb.

32. Pressure Altimeter–CHECK

A 100-foot jump is acceptable when needle is passing between 9 and 0 while established in a 3000-fpm rate of climb.

33. Accelerometer

Proper functioning and recording while pulling positive and negative "G's"

34. Turn Needle–CHECK

Rate-of-turn 120±15 seconds for 180-degree standard rate-of-turn at 250 KIAS (1/2-needle width).

35. AJB-3A System–CHECK

a. Vertical Gyro

(1) Precession after 180-degree, 4-minute turn, ±3.0 degrees in roll or pitch.

(2) Gyro erection (slow erection rate 0.8 to 1.8 degrees per minute) to within ±2.0 degrees in roll or pitch.

(3) Indicator jitter and/or hangup ±0.5 degrees.

b. Directional Gyro

(1) Fly cardinal headings by reference to the BDHI. Record corresponding headings from AJB-3A (tolerance ±3.5°) and wet compass (tolerance ±3.0°).

(2) Synchronization needle oscillations allowed about midposition.

(3) After 360-degree, 4-minute turn press sink button to check precession. A 2.0-degree heading error is acceptable.

36. Standby Attitude System

a. Maximum climb indication 92 degrees.

b. Maximum dive indication 78 degrees.

c. Precession after turn, agreement with AAI.

d. Pitch indications 7 to 8 degrees below AAI. With AFC 487, 3 to 4 degrees below.

37. ARC-51A UHF Radio—CHECK

a. System must transmit and receive on all channels. Check a minimum of five channels during flight.

b. Squelch should be silent with disable switch off.

c. Volume control operative.

d. Operational range 100 nautical miles minimum.

38. ARA-50 UHF ADF—CHECK

a. Heading error ±5.0 degrees off the nose sector and within 20 degrees all other sectors.

b. Hunting error ±1.0 degree.

39. ARR-69 UHF ADF—CHECK

a. System must be operative on all channels. Check as many as possible during the flight.

b. Sensitivity control is operative.

c. Volume control is operative.

d. Operational range is 100 nautical miles minimum.

40. APX-72 Identification Radar Beacon—CHECK

a. Check identification modes with available interrogating stations.

b. Check emergency feature.

41. ARN-52 TACAN—CHECK (with antenna in AUTO position).

a. Operational range 150 to 300 nautical miles.

b. Check as many channels as possible.

c. No flag showing when range indication is operating.

d. Volume control operative.

e. Auto antenna lockon 9 seconds maximum with usable signal.

f. Air-to-air mode, range lock-on with cooperating aircraft or station.

42. ASN-41 Navigational Computer Set

a. Bearing error . . . 2.0 DEGREES MAXIMUM

b. Range error

(1) 0 to 195 miles . . . 1 MILE OR 1 PERCENT DISTANCE TRAVELED

(2) 195 to 2000 miles . . . 5 MILES PLUS 1 PERCENT DISTANCE TRAVELED

Note

Tolerances for items a and b are for zero wind conditions.

43. APN-153 Doppler Radar Navigation Set

a. Level Flight

(1) Takeoff . . . . WITHIN 30 SECONDS AFTER MINIMUM ALTITUDE OF 40 FEET, MEMORY LIGHT SHOULD GO OFF INDICATING SYSTEM TRACKING.

b. Cruise Altitude

(1) ON-LAND position . . OBSERVE GROUND-SPEED AND DRIFT ANGLE TO BE CORRECT WITHIN ±50 KNOTS AND ±10 DEGREES RESPECTIVELY, FOR KNOWN CONDITIONS OF FLIGHT.

(2) ON-SEA position . . . OBSERVE SLIGHT INCREASE IN GROUNDSPEED INDICATION FROM ON-LAND POSITION.

(3) Memory Light . . . . . SHOULD NOT BE ON FOR PERIODS EXCEEDING 30 SECONDS.

c. Maneuvers

(1) Banked Turns . . . . . GROUNDSPEED AND DRIFT ANGLES SHALL TRACK IN BANK ANGLES OF APPROXIMATELY 30 DEGREES.

(2) Climbing and descending . . . . GROUNDSPEED AND DRIFT ANGLES UP TO 25-DEGREES ATTITUDE. MEMORY LIGHT SHOULD NOT BE ON FOR PERIODS EXCEEDING 30 SECONDS.

d. Doppler Radar Navigation System

(1) Wind direction and speed . . . . DISPLAYED

44. Drop Tank Transfer – CHECK

Ensure all external fuel tanks transfer properly.

45. Anti-icing System – CHECK

a. Anti-icing switch to ALL . . . . SLIGHT DROP IN EPR

b. Anti-icing switch to ALL . . . . SLIGHT INCREASE

46. Trim – CHECK

a. At 300 KIAS, trim aircraft for hands-off, straight, and level flight (2000- to 4000-pound fuel load) – CHECK

(1) Rudder trim indication . . . RECORD . . 0±1.0 DEGREE

(2) Elevator trim indication . . . RECORD . . 1±1/2 DEGREE NOSEUP WITHOUT WING DROP TANKS OR 1/2±1/2 DEGREE NOSEUP WITH WING DROP TANKS

b. Aileron Power Configuration – CHECK

(1) Breakout force . . . . 3.8 POUNDS MAXIMUM

(2) Control stick free play . . . 1/8 INCH MAXIMUM

c. Elevator Power Configuration – CHECK

(1) Breakout force . . . . 3.8 POUNDS MAXIMUM

(2) Control stick free play . . . 3/8 INCH MAXIMUM

d. Rudder System – CHECK

(1) Breakout force . . . . 7 TO 13 POUNDS

(2) Control stick free play . . . 1/4 INCH MAXIMUM

Note

Force measurements are given for guidance in making qualitative estimates only.

47. Slow Flight Check

a. Landing Gear – CHECK

(1) Gear up . . . . 14 SECONDS MAXIMUM (210 KIAS)

(2) Gear down . . . . 5 TO 11 SECONDS

b. Landing Flaps – CHECK

(1) Flaps down . . . . 10 SECONDS MAXIMUM (160 KNOTS AND UNDER)

(2) Flaps up . . . . 7 SECONDS MAXIMUM (160 KNOTS AND UNDER)

c. Flap Blowback – CHECK

Indication of flap blowback should occur at approximately 230 KIAS. Maximum permissible speed without flap blowback indication is 240 KIAS.

d. Wing Slats – CHECK

Wing slats should commence opening at approximately 200 KIAS, slats are 1/2 open at optimum AOA, and are fully open at stalling speed.

e. Angle-of-Attack System

(1) Check AOA system for proper operation.

(2) All angle-of-attack indexer lights come on when press-to-test button is depressed.

(3) Record fuel weight and airspeed at optimum AOA. See figure 11-44 for Airspeed/Angle-of-attack relationship.

48. Emergency Generator – CHECK

a. Initial condition . . . . AIRCRAFT DIRTY, 150 KIAS, UHF ON UNUSED FREQUENCY, ALL LIGHTS AND AVIONICS EQUIPMENT ON EXCEPT AFCS, RADAR, AND HORIZONTAL TRIM. DROPOUT EMERGENCY GENERATOR.

b. Reduce power to idle keeping UHF keyed . . . . . . SLOW AIRCRAFT TO 120 KIAS, SIDE TONE SHOULD NOT FADE OUT.

Note

Lights should fail and warning flags should appear almost simultaneously with UHF fade-out. Large airspeed spreads between events may indicate marginal systems.

c. At 145 KIAS, operate horizontal stabilizer manual override lever to ensure trim in both directions.

d. Check emergency speedbrake operation.

e. Check bypass switch operation.

Descent to 15,000 Feet

49. Jam Acceleration Check (180 KIAS minimum)

a. RPM . . . . RECORD . . . (IDLE)

b. EGT . . . . RECORD . . . (IDLE)

c. Fuel Flow . . . . . RECORD . . . (IDLE)

d. Pressurization . RECORD . . . (IDLE) 8000± 1000 feet

e. Time IDLE to MILITARY . . RECORD . . . 20 seconds maximum

f. RPM . . . . RECORD . . . (MIL)

g. EGT (MIL) . . . . RECORD . . . 815°C maximum for 8 minutes 785°C maximum stabilized.

h. Fuel Flow . . . . . RECORD . . . (MIL)

i. Oil Pressure . . . RECORD . . . 40 to 50 psi

50. Automatic Flight Control System (AFCS) – CHECK

Turn AFCS to STBY position 90 seconds prior to engagement.

a. Stability Augmentation – CHECK

(1) Engage . . . . NO AIRCRAFT UPSET (RUDDER THUMP ACCEPTABLE)

(2) False rudder . . . . . . NO APPARENT OSCILLATION REMAINING AFTER 2 CYCLES

(3) Disengage . . . . NO AIRCRAFT UPSET (RUDDER THUMP ACCEPTABLE)

b. AFCS Engage and Disengage Transients – CHECK

(1) Trimmed straight and level flight +0.5-degree bank upset. No pitch upset.

(2) Trimmed flight not straight and level . . . BANK ANGLE LESS THAN 70 DEGREES. +2.0-DEGREE BANK UPSET.

PITCH ANGLE LESS THAN 60 DEGREES, ±0.5G PITCH UPSET.

c. Heading Hold Mode – CHECK

(1) Will not engage (no force on control stick) . . . . BANK ANGLE OVER 7.0 DEGREES (ALL-ATTITUDE INDICATOR READING).

(2) Must engage (no force on control stick) . . . . BANK ANGLE UNDER 3.0 DEGREES (ALL-ATTITUDE INDICATOR READING).

(3) Upon engagement . . . WILL SEEK AND HOLD ENGAGE HEADING ±1.0 DEGREE

d. Attitude Hold Mode – CHECK

(1) Holds established pitch angle (within 60-degrees noseup to 60-degrees nosedown) . . . . ±1.0 DEGREE

(2) Holds established bank angle (within 5- to 70-degrees left or right) . . . . . . ±2.0 DEGREES

e. Preselect Heading Mode – CHECK

(1) Upon engagement . . . AIRCRAFT SHOULD TURN IN THE DIRECTION FOR SMALLEST HEADING CHANGE.

(2) During turn. . . . . . . BANK ANGLE 27±5.0 DEGREES ESTABLISHED BANK AND PITCH ANGLES REMAIN CONSTANT ±2.0 DEGREES.

(3) During rollout . . . . . ROLLOUT COMPLETED TO SELECTED HEADING WITHIN 20 SECONDS AND BANK ANGLE EVER DECREASING.

(4) Following rollout . . . ESTABLISHED HEADING SHOULD BE ±1.0 DEGREE OF PRESELECTED HEADING.

(5) Disengage Preselect Heading switch during turn . . . . AIRCRAFT RETURNS TO APPROXIMATELY WINGS-LEVEL FLIGHT WITHIN 20 SECONDS.

(6) Maximum rate of roll at any time while on Preselect Heading mode . . . . . 40 DEGREES PER SECOND

f. Altitude Hold Mode – CHECK

(1) Steady state climb or dive over 4500 fpm . . . . WILL NOT ENGAGE

(2) Steady state climb or dive under 3500 fpm . . . . MUST ENGAGE

(3) Damping upon engagement during climb or dive . . . . . 1 CYCLE TO 1/10 AMPLITUDE

(4) Load factor during damping . . . . ±0.5G FROM STEADY STATE LOAD FACTOR AT ENGAGEMENT

(5) Residual oscillation . LEVEL FLIGHT ±25 FEET OR ±5% OF ALTITUDE WITH MAXIMUM FREQUENCY OF 3 CPM

g. Control Stick Steering (CSS) Mode – CHECK

Note

Force measurements are given as a guide in making qualitative estimates only.

(1) CSS breakout force

Long./Lat . . . . 2±0.5 POUNDS

(2) CSS stick force

Longitudinal . . . . . . 50 TO 120 PERCENT OF NORMAL SYSTEM FORCES

Lateral . . . . 80 TO 120 PERCENT OF NORMAL FORCES

(3) Feedback . . . . QUALITATIVE EVALUATION.

Note

Feedback is defined as a lateral oscillation of the control stick 1 to 3 cps that the pilot feels and sees, while maneuvering the aircraft in the lateral direction in the CSS mode. This does not include any transients caused by CSS engagement or disengagement (CSS break-in or breakout).

h. Residual Oscillations – CHECK

(1) With hands off control stick while using heading hold, preselect heading or attitude hold modes ±0.5 DEGREE LATERAL AT APPROXIMATELY 2 TO 4 CPS. NO PITCH OSCILLATION.

(2) Due to external lights (flashing) . . . . ±0.75 DEGREE LATERAL AT APPROXIMATELY 1 CPS. NO PITCH OSCILLATION. RESULTANT STICK MOTION ACCEPTABLE.

i. Automatic Pitch Trim – CHECK

Time lag for trim operation after new attitude is established, and period between operations is 5±2 seconds (no transients).

j. Longitudinal Structural Protection – CHECK

(1) Windup turn on CSS mode without centerline store . . . . DISENGAGE 4±0.5G

With centerline store . . . . DISENGAGE 3.5±0.5G

(2) Attitude hold mode . . . . DISENGAGE -3.5±0.5G -1.0±0.5G

k. Lateral Structural Protection . . . . . . AFCS LATERAL CONTROL SHOULD DISENGAGE WITH APPROXIMATELY 1/2 STICK THROW OR 40-POUNDS STICK FORCE.

l. Speedbrake Compensation – CHECK

(1) With AFCS engaged, open speedbrakes . . ±0.5G MAXIMUM PITCH

(2) With AFCS engaged, close speedbrakes . -0.5G MAXIMUM PITCH

10,000 Feet and Below

51. Radar Altimeter – CHECK

a. Cross check with pressure altitude for approximate correlation.

b. Dropout should not occur at pitch angle less than 50 degrees or bank angle less than 30 degrees.

c. Operation

(1) Above 6000 feet . . . POINTER REMAINS BEHIND MASK. OFF FLAG IS IN VIEW

(2) Below 5000 feet . . . SMOOTH TRACKING OF TERRAIN CLEARANCE WITHOUT FLICKER OF OFF FLAG

(3) Warning light . . . . ON WHEN AIRCRAFT IS BELOW PRESET TERRAIN CLEARANCE ALTITUDE ±10 FEET OR 10 PERCENT, WHICHEVER IS GREATER

(4) Self-test . . . . DEPRESS CONTROL KNOB AND INDICATOR READS 5±5 FEET

52. Bombing System – CHECK

a. Switches

(1) Function select . . . . . LABS

(2) Stations select switches . . . . OFF

(3) Master armament switch . . . . ON

(4) Attack mode . . . . LOFT: for 52 b and 52 d (7). O/S for 52 c and 52 d (8).

b. LABS Timer

(1) Set timer for 2.0 seconds and depress bomb pickle . . . . 1.0 SECOND WARNING TONE AND LIGHT

(2) Timer rundown . . . . . PULL UP TONE AND LIGHT

c. G-Programer

(1) Depress bomb pickle . . . . LABS LIGHT ON. VERTICAL POINTER AND G-PROGRAMER CENTER

(2) Pullup . . . . G-PROGRAMER SCHEDULES 4.0 G IN 2.0 SECONDS

d. All-Attitude Indicator

(1) Pitch . . . . PITCH TRIM REMOVED

(2) Azimuth . . . . LOCKS ON AAI

(3) Roll . . . . DISPLAYS ROLL YAW

(4) Vertical pointer . . . . DISPLAYS ROLL YAW

(5) Yaw/roll ratio . . . . . 2.5 TO 3.5:1

(6) Yaw cancel . . . . 15±5-DEGREES YAW

(7) Low angle release . . . OCCURS AT RA1 LSS

(8) High angle release . . . . OCCURS AT RA2 LSS

(9) Reversion to all attitude mode . . . . OCCURS AT RELEASE AND CANCEL

(10) Verticality error upon completion . . ±1.0 DEGREE ROLL +2.0 DEGREE PITCH

(11) Heading error upon completion (reciprocal heading) . . . . +2.0 DEGREE AZIMUTH

53. Jam Acceleration – CHECK

6000 feet at 150 KIAS approximately 75 percent rpm with gear and flaps down.

a. Time . . . . . . RECORD . . 5 seconds maximum

b. EGT . . . . . . RECORD . . 815°C maximum 8 minutes

785°C maximum stabilized

54. Radar – CHECK

a. Search Mode

(1) Range Flags

(a) Long . . . . 40-MILE RANGE INDICATED

(b) Short . . . . . . 20-MILE RANGE INDICATED

(2) Range (select target with good vertical development) . . . . . 40 MILES MAX

(3) Gain, brilliance, and storage controls . . . . PROPER OPERATION

b. Terrain Clearance Mode

(1) Profile mode

Fly 1000 feet above target altitude.

(a) Range Flags

1 Long . . . . . 20-MILE RANGE INDICATED

2 Short . . . . . 10-MILE RANGE INDICATED

(b) Terrain clearance line . 1000' BELOW FLIGHT PATCH

(c) Range . . . . 16 MILES MIN IN LONG

(d) Obstacle warning . . . . . . LIGHT AND TONE OPERATE PROPERLY

(e) Boresight . . . . . Fly 360-400 KIAS, AOA compensation in OFF position. TOP OF TARGET TOUCHES TERRAIN CLEARANCE LINE WITHIN ±0.5°

(f) Altitude return . NONE ALLOWED

(g) Side lobe return . . . . NONE ALLOWED

(h) Servo lag . . . . . 0.75° AOA COMPENSATION – ON

0.5° AOA COMPENSATION – OFF

(2) Plan Mode

Fly at target altitude if possible.

(a) Boresight . . . . ±0.5°

(b) Range Flags

1 Long . . . . . . 20 MILE RANGE INDICATED

2 Short . . . . . . 10 MILE RANGE INDICATED

(c) Range . . . . 16 MILES MINIMUM IN LONG

(d) Gain and detail controls . . PROPER OPERATION

c. Air to Ground Mode – fly 20° dive.

(1) Range bar . . . . SWEEPS FROM 7-1/2 to ZERO MILES

(2) Lock-on . . . . . . 8000 YARDS MINIMUM

d. General Performance

(1) Focus (all modes) . . . . GOOD DEFINITION

(2) Radar induced noise in UHF . . . ACCEPTABLE LEVEL

55. Fuel Dump – Check

WARNING

Dumping wing fuel above the freezing level may result in the dump valve freezing open. Fuel dump will then continue until the wing tank fuel is depleted or descent is made below the freezing level.

a. Turn on fuel dump

(1) Note drop in internal fuel quantity and slight buffet from fuel leaving the dump mast.

b. Secure fuel dump.

Fuel quantity should stabilize and the slight buffeting cease.

56. Flight Control Disconnect

Note

The required flight control disconnect, due to wing control surface rework or other reasons, for carrier based aircraft shall be performed at the discretion of the squadron Commanding Officer.

WARNING

Do not attempt flight control disconnect check if operating on emergency generator except in case of an emergency.

This procedure is designed to be performed in conjunction with the normal flight check procedure. Items repeated, which are part of the normal procedure, are those which are exceedingly important in the proper performance of this check or those where additional checks are necessary which would not be performed in the normal flight check procedure.

AIRBORNE TEST PROCEDURE

Wind Conditions at Landing Field

A crosswind component of 8 knots will be considered maximum for a safe disconnect landing. The disconnect check will not be performed if a stronger component exists. When contacting the tower or ground control, the pilot should request the wind in degrees magnetic, velocity, and other pertinent information such as forecast wind shift, duty runway, or into-wind runway availability, and gusts. It should always be anticipated that disconnecting will result in reduced control of the aircraft, and if any condition exists which would further complicate the landing, the check should not be performed. In particular, the test should not be conducted if there is a possibility of encountering gusty wind conditions on landing. Boost off lateral forces of the A-4M are higher than other models of the A-4 series, and lateral control response is significantly reduced.

After contact with the tower has been established and the duty runway has been determined proceed as follows:

Note

Prior to performing a hydraulic power disconnect under controlled conditions, the emergency generator should first be extended and a functional check of the emergency trim override should be made. If the emergency trim functions properly on emergency generator, switch to BYPASS and continue with disconnect.

a. Establish altitude of 15,000 feet or above, with a minimum amount of fuel in the wing. Fifteen thousand feet is established as a minimum safe altitude for performing the check in the event of a momentary uncontrollable rate-of-roll. The wing tank should be as near empty as practicable to preclude fuel displacement to the descending wing and resultant increase in rate of roll.

WARNING

Under NO circumstances will the disconnect check be performed with an asymmetrical wing loading. It may be necessary to perform the check with external drop tanks installed, but it should be assured that they are empty prior to disconnect.

b. Trim for hands-off, straight and level flight at 300 KIAS. The aircraft should be in the clean configuration.

c. Visually check the followup tab for 3-degrees maximum deflection from faired with the aileron (port aileron). Three degrees deflection of the followup tab from faired with the aileron is approximately 1/5 of 1 inch, and may be determined during the normal preflight check as outlined previously. This 3-degree limit applies to all present models of the aircraft. If the followup tab is deflected more than 3 degrees when the aircraft is trimmed for hands-off, straight and level flight at 300 KIAS, the hydraulic system should not be disconnected, as an excessive rate of roll will probably occur.

d. Slow to 200 KIAS, being careful not to retrim the aircraft during deceleration. The rate-of-roll check must be performed at 300 KIAS with the trim necessary for hands-off, straight and level flight at that speed. The deceleration to 200 KIAS for the actual disconnect is for safety, in that an excessive rate of roll is more controllable at slower speeds, and there is less chance of overstressing the aircraft should an erratic condition occur.

Deceleration should be accomplished without the use of speedbrakes, if possible. The speedbrakes are directly connected to the elevator control and a possible trim change may occur due to extension and retraction.

e. Pull power disconnect handle. The power boost disconnect should be pulled smartly to ensure proper disconnect. Pulling the handle slowly may result in a partial disconnect which could cause a hazardous flight condition or erratic rate or roll. Ensure that there is no pressure on the control stick when the handle is pulled.

Normally, the disconnect cable will extend approximately 12 inches for a complete disconnect. Two slight jolts will be felt, evidencing the disconnect of the aileron and elevator hydraulic systems in that order. Once again it is emphasized that the boost disconnect handle should be pulled smartly, and no hesitation between each system disconnect should be attempted.

CAUTION

Hold the T-handle while allowing handle to return to the stowed position. This procedure is to prevent the handle striking an instrument.

After disconnect, no trim should be used if the aircraft is controllable. If an excessive rate of roll or pitch condition exists at the present speed and if the pilot considers that the aircraft may become uncontrollable at higher airspeed, no attempt should be made to perform the rate-of-roll check. In this condition, if the pilot feels able to control an excessive rate of roll at 200 KIAS, the check may be performed the same as for the 300 KIAS check; but the angle of bank should not be allowed to exceed 30 degrees. Although not as desirable as if performed at 300 KIAS, the rate of roll will enable ground personnel to make some corrective adjustment. In this case, after the rate of roll has been recorded, the aircraft should be "slow-flighted" in the landing configuration and retrimmed if necessary for a safe landing. Speeds in excess of 200 KIAS should not be used for the remainder of the flight.

In the event the aircraft becomes uncontrollable after disconnect at 200 KIAS, an emergency condition exists and the check should be abandoned. Trim should be used immediately in an attempt to stop the roll and regain control and the throttle should be retarded to idle to reduce airspeed.

In the event of excessive nosedown pitch, it should be remembered that use of the speedbrakes may cause an increased nosedown tendency due to the design of the system.

f. Accelerate to 300 KIAS. Under normal conditions the rate-of-roll check should be performed at 300 KIAS, since the aircraft was trimmed for hands-off, straight and level flight at this speed, and since it is the rate of roll after disconnect at this speed that is to be determined.

During the acceleration, straight and level flight should be maintained without use of the trim system since this will destroy the conditions for a proper rate-of-roll check. If the control forces become so severe during acceleration that control of the aircraft during an excessive rate of roll is doubtful, the check should be discontinued or performed as described in step 5.

g. RECORD rate of roll at 300 KIAS. When stabilized at 300 KIAS, wings level, time the rate of roll by means of the elapsed time clock and reference to the gyro horizon. Do not allow the aircraft to exceed 60 degrees of bank. An angle of bank in excess of 60 degrees may allow the aircraft to "fall through," increase bank rapidly, and in the case of an excessive rate of roll, cause the aircraft to become uncontrollable before corrective action can be taken.

Return the aircraft to the wings level attitude without use of trim if possible and repeat the check to ensure an accurate rate-of-roll recording. Four and one-half degrees per second, the maximum allowable rate-of-roll, is very slow and an error in timing is possible during the initial attempt.

h. Retrim for hands-off, straight and level flight at 300 KIAS. After determining the direction and rate of roll, the aircraft should be returned to straight and level flight and retrimmed to maintain this condition.

i. After the aircraft has been retrimmed at 300 KIAS, note and record the deflection angle of the followup tab and the aileron. This trim check should be performed as near hands-off stick as possible in straight and level flight. Decelerate and perform a simulated landing approach. In decelerating prior to performing the simulated approach, use should be made of all systems which may be needed in the actual landing (speedbrakes, landing gear, flaps) to determine any adverse effects they might have on the control of the aircraft. Safety is of primary importance throughout the entire disconnect check, and if aileron trim is necessary after disconnect or during the landing for any reason, the pilot should not hesitate to retrim.

j. Prior to landing, the stability augmentation switch on the AFCS control panel should be placed in the STAB AUG position; the spoiler switch should be placed in the ARM position.

Upon completion of the flight, notations should be made on the Discrepancy Report that the hydraulic system was disconnected; the direction and rate of roll if any: and any adverse flight conditions resulting from the disconnect. This information and any pertinent remarks which may aid other pilots or maintenance personnel in the future, should be entered in the aircraft logbook.

LANDING

57. Brake operation – CHECK

58. Ground handling characteristics – CHECK

59. Drag chute – CHECK

AFTER LANDING

60. Drag chute jettison – CHECK

61. Oxygen consumption – CHECK

62. Engine oil quantity – CHECK

63. Engine rundown time . . . . RECORD

N_1 (low-pressure compressor) . . . . 30 TO 60 SECONDS

N_2 (high-pressure compressor) . . . . 50 TO 80 SECONDS

PART 4
CARRIER-BASED PROCEDURES

GENERAL

The CVA/CVS and LSO NATOPS manual is the governing publication for carrier-landing operation.

DAY OPERATIONS

Preflight

Preflight, start, and poststart checks shall be accomplished in accordance with section III, part 3, with the following additions:

1. Record the expected gross weight of the aircraft for catapult launch in the designated area.

2. Ensure that the tension-bar retainer clip is installed securely and is in good condition.

3. Note the relationship of arresting hook to deck edge. Do not lower hook during poststart checks unless hook point will drop on the flight deck.

Poststart

1. Engines will normally be started 10 to 15 minutes prior to launch, and the customary functional checks will be performed.

2. The canopy will be either open or fully closed and locked. It should be closed when necessary to prevent damage from wind or jet blast.

3. Set emergency-jettison select switch to appropriate position prior to launch.

Taxi

WARNING

Spoilers shall be dearmed during shipboard operations because of potential hazard to flight deck personnel.

CAUTION

Taxi with flaps fully retracted.

1. Taxiing aboard ship is generally similar to that on land, with some variation of power required due to increased wind and turbulence and decreased braking effectiveness because of higher tire pressures. Particular attention should be given to keeping speed under control.

2. While taxiing with appreciable wind over the deck, pilots should avoid attempts to turn large angles to the relative wind or to the jet blast of another aircraft. However, it is imperative that the director's signals be followed closely at all times.

3. Under high wind conditions, directional control is sometimes difficult. Primary control for taxiing will be nosewheel steering augmented by brakes. If The nosewheel cocks, add throttle to 70 to 80 percent and use rapid intermittent brake to bounce the nose strut, while moving slowly forward. This should decrease the weight on the nosewheel long enough for it to swivel in the desired direction. If this procedure is not effective, hold brakes, retard throttle to IDLE, and signal for a tiller bar. Normally, under heavy crosswind conditions, a tiller bar and wing walkers should be provided.

WARNING

If a tiller bar is being used, use both brakes together and with equal pressure. Using brakes singly can injure the tiller bar man. Do not use nosewheel steering while tiller bar is on aircraft.

Catapult Launches

Proper positioning on the catapult is easily accomplished by maintaining a slight amount of excess power and using the brakes to control speed. The pilot must anticipate the initial "hold" immediately after the nosewheel drops over the shuttle, followed by a "come ahead" as the holdback unit is placed on the tension bar. After the nosewheel drops over the shuttle, the pilot must move ahead very slowly to prevent overstressing the tension bar. Upon receipt of the "release brakes" signal from the catapult director, release brakes and immediately increase power to MILITARY. Observe acceleration time and allow engine to stabilize.

Note

Wind has a negligible effect on EPR readings.

Recheck the attitude gyro, BDHI, engine instruments, trim indicators, and flap setting. Ensure a firm grip on the throttle and catapult handgrip, place your head against the headrest, salute, and wait. Normally, the catapult will fire 3 seconds after the launching officer gives the "fire" signal.

Technique

Prior to launch, select the optimum trim settings for the anticipated endspeed and aircraft loading. The control stick, if unrestrained by the pilot, will move to the full aft position at the beginning of the catapult power stroke and return to the trimmed position by the end of the power stroke. The proximity of the control stick handgrip to the pilot, and pilot physical geometry, make it difficult to fully brace the arm while holding the stick in the trimmed position during high acceleration launches. The recommended technique is to cup the hand just aft of the stick and restrain as much arm movement as possible by pressing the arm against the side and/or thigh. As soon as practicable after end of power stroke, grasp the stick in its pretrimmed position (optimum horizontal stabilizer setting) and allow aircraft to rotate to a flyaway attitude with a minimum of fore/aft stick movement. The pilot must avoid any large longitudinal control movements as the aircraft becomes airborne, yet be prepared to make minor attitude corrections as necessary and correct any aircraft wing drop that may occur. An initial attitude of approximately 12-degrees noseup is recommended. Adjust attitude as necessary for climbout; normally this will be about 12- to 14-degrees noseup on the attitude gyro. Crosscheck angle of attack, airspeed, and other appropriate instruments. Do not rely solely upon one instrument. Ensure a positive rate of climb. Retract flaps at 170 KIAS minimum.

Optimum Trim Settings

1. Rudder. . . . . ZERO DEGREES
2. Aileron . . . . FAIRED SYMMETRICALLY
3. Horizontal stabilizer:

   Basic trim at 0 to 10 KIAS excess endspeed:

   Full flaps . . . . 8.0 DEGREES

   Half flaps . . . . 7.5 DEGREES

   Basic trim at 11 to 40 KIAS excess endspeed:

   Full/half flaps . . . . 6.5 DEGREES

Trim Settings for Asymmetrical Loadings

Asymmetrical bow catapult launches with up to 5120 foot-pounds of static moment are permitted. The following trim and control inputs are recommended for the listed crosswind conditions.

Allowable crosswind (knots)	Required endspeed above minimum (KIAS)	Rudder trim units (away from loaded wing)	Aileron
0 to 5	0 to 3	2	Faired
6 to 10	4 to 6	2	Faired
11 to 17 (max)	7 to 10	3	Faired

Note

Approximately 5 pounds of lateral stick force is required with 0 to 10 KIAS crosswind and one-quarter to one-half lateral stick deflection is required with 10 to 17 KIAS crosswind to maintain wings level after leaving the bow.

Aircraft or Catapult Malfunction

If, after established at MILITARY POWER, the pilot determines that the aircraft is down, he so indicates to the launching officer by SHAKING HIS HEAD FROM SIDE TO SIDE. NEVER raise the hand into the catapult officer's view to give a "thumbs-down" signal. It is possible that the launching officer may construe the signal to be a salute and fire the catapult. When the catapult officer observes the "NO-GO" signal, he should immediately give a suspend signal. If his response is not immediate, call on land/launch frequency "Suspend, suspend".

LANDING PATTERN

Under VFR conditions, the formation shall approach the breakup position in right echelon, close aboard the carrier on the starboard side, parallel to the Base Recovery Course (BRC) at 800 feet and 250 KIAS. A minimum straight-in of 3 miles is desired for VFR entry to the break. Aircraft shall be in parade formation with hooks down. Breakup should commence when past the bow and adequate interval on downwind traffic is assured. Normally, a 17-second break interval will establish a 35-second ramp interval. Close adherence to pattern details by all pilots is required for uniform landing intervals. The pattern given in figure 3-7 is recommended. Each pilot shall have the landing checklist completed, be at optimum AOA/approach speed, and have the wheel brakes checked by the 180-degree position. Speedbrakes will normally remain out throughout the approach and landing. Use of speedbrakes may not be desirable at high gross weights (in excess of 14,000 pounds) when configured with high drag stores, i.e., buddy store, MER's, etc., due to the high thrust required during the approach.

Waveoff

To execute a waveoff, immediately add full power, retract speedbrakes, and maintain optimum attitude. Make all waveoff's straight up the angled deck.

CAUTION

Rotation of the aircraft to an exaggerated nose-high attitude on a waveoff lowers the arresting hook beyond its normal reach and can result in an in-flight engagement. The resulting arrestment can cause damage to the aircraft. Over-rotation on a waveoff can also place the aircraft on the back side of the power-required curve where sufficient power is not available to stop the descent.

ARRESTED LANDING AND EXIT FROM THE LANDING AREA

Upon touchdown, advance the throttle to MILITARY and retract the speedbrakes. After arrestment is assured, retard the throttle to IDLE and raise the hook and flaps. The aircraft should be allowed to roll back a short distance after arrestment to permit the hook to disengage from the pendant. Hold both brakes when signaled by the director, apply power (about 70 percent), and engage nosewheel steering in anticipation of the "come-ahead" signal, unless pull-back is indicated by the director. If pull-back is directed, retard the throttle to IDLE, release brakes, and allow the aircraft to be pulled back until a brake signal is received. Then, apply brakes judiciously to prevent the aircraft from tipping or rocking back. Anticipate the "come-ahead" signal by adding power to about 70 percent.

CAUTION

Cross the foul line and follow the director's signals. The usual wind over the deck will give a substantial crosswind component while taxiing on the flight deck. Wing walkers should be provided to assist in leaving the landing area when there is a severe crosswind or wind over the deck exceeding 40 knots. Water, oil and hydraulic fluid spillages on the flight deck require that caution be exercised in using power and brakes.

POSTLANDING PROCEDURES

As long as the aircraft is taxiing, the canopy should remain closed and the pilot shall keep his helmet and oxygen mask on. Prior to shutdown, he will open the canopy. If the aircraft is towed or pushed, he shall keep speed slow and under control, and, as noise level is normally high, he must remain alert for either hand or whistle signals from aircraft handling personnel. Whenever the plane director is not in sight, STOP: Do not release brakes until the aircraft has at least an initial tiedown. Plane captains shall not install the access ladder until this has been accomplished.

NIGHT OPERATIONS

FLIGHT DECK

Preflight

External preflight will be made using a red-lens flashlight. In addition to normal cockpit preflight, ensure that external light switches are properly positioned for poststart exterior lights check. The master exterior lights switch, anticollision light switch, and the taxi light switch should always be in the OFF position prior to start. Wing lights and taillights should be set to BRT/STDY position for the poststart checks. Instrument lights and console lights control should be turned on. Direct cockpit emergency floodlights on instrument panel and kneeboard light as desired.

Poststart

Adjust cockpit lights intensity to desired level. After normal systems checks are completed, perform exterior lights check. Place the master exterior lights

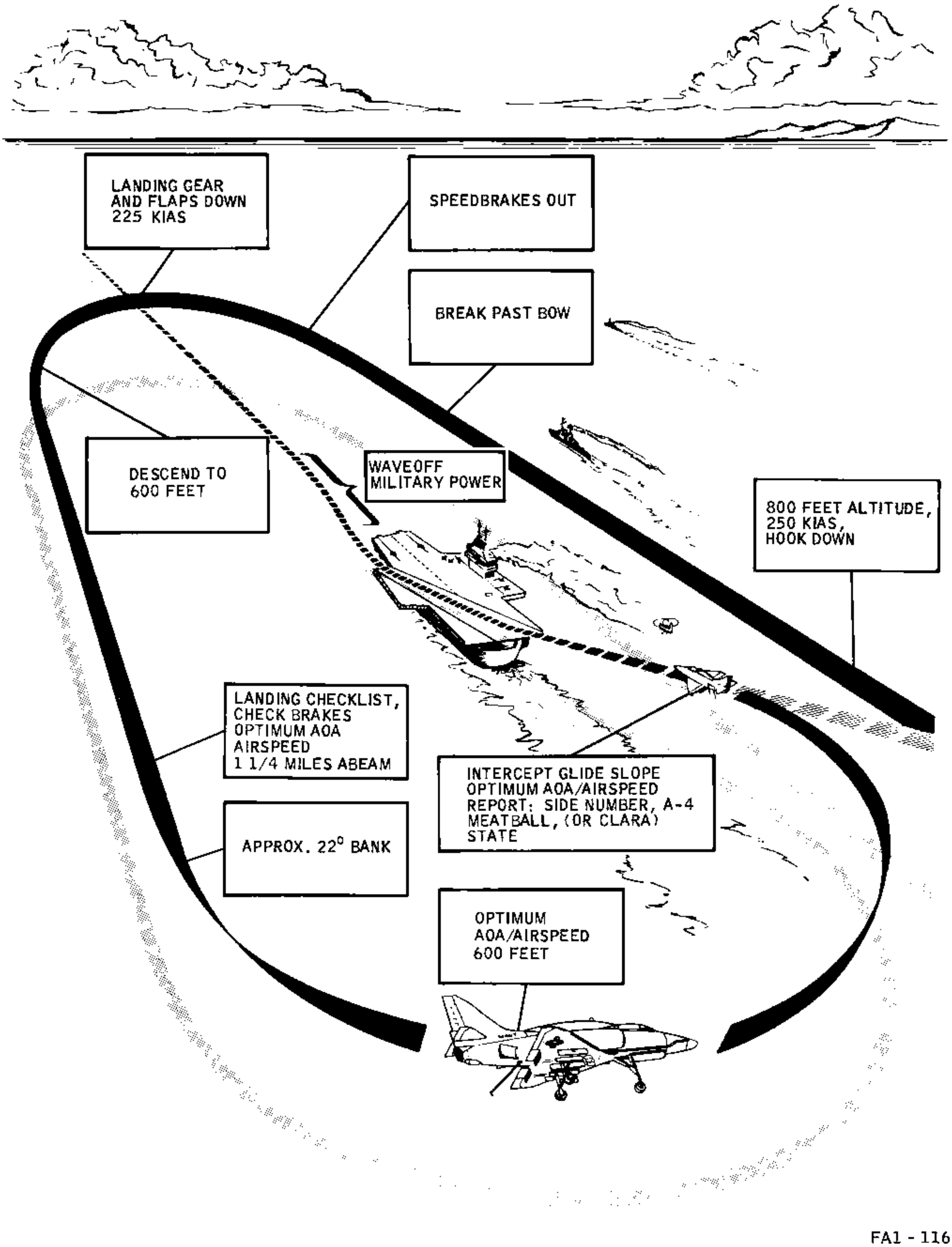

Figure 3-7. Carrier-Landing Pattern (Typical)

switch in ON momentarily. Upon completion of exterior lights check, place master exterior lights switch in the OFF position.

Taxi

Slow and careful handling of aircraft by both the plane director and the pilot is mandatory. If the pilot has any doubt as to the plane director's signals, STOP.

Catapult Launches

The difficulty of "getting on" the catapult at night is increased by the fact that it is difficult for the pilot to determine his speed. The pilot must rely upon, and follow closely, the directions of the plane director. As the aircraft approaches the catapult, the plane director should position himself forward and remain stationary to give the pilot a visual reference for controlling taxi speed as the aircraft approaches the shuttle.

Upon receiving the signal from the catapult director, release brakes. Immediately increase power to MILITARY in anticipation of the turnup signal from the launching officer.

Note

Wind has a negligible effect on EPR readings.

When satisfied that the aircraft is ready for launch, the pilot so signifies by placing the master exterior lights switch in the ON position. The pilot must be prepared to establish a wings-level, climbing attitude on instruments. An initial attitude of approximately 12-degrees noseup is recommended. Cross check angle of attack, airspeed, and other appropriate instruments. Do not rely solely upon one instrument. Ensure a positive rate of climb is obtained. Retract the landing gear at 300 feet or above. Retract flaps at 170 KIAS or above. During night launches, do not make clearing turns. At 2500 feet or higher, adjust exterior lights as briefed.

Note

Variations in EPR readings for wind-over-the-deck for catapult launches are negligible.

AIRCRAFT OR CATAPULT MALFUNCTION. The pilot's "NO-GO" signal for night catapult launch consists of not turning his exterior lights ON. The pilot should call on land/launch frequency "Suspend, suspend." Maintain MILITARY power until the launching officer gives the "throttle-back" signal.

Do not turn exterior lights ON unless completely ready to be launched.

LANDING PATTERN

Night and instrument recoveries normally will be made utilizing TACAN CCA approaches in accordance with the CVA/CVS NATOPS Manual.

Arrested Landing and Exit From the Landing Area

The LSO will normally take control when the aircraft is approximately 1 mile from the ramp. The pilot should have exterior lights set in accordance with Air Wing doctrine. Following arrestment, immediately place master exterior lights switch to OFF. Taxi out of 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 (CCA)

General

The pattern procedures, and terms used for carrier-controlled approaches shall be in accordance with the CVA/CVS NATOPS Manual.

Procedures

A CCA approach is similar to a straight-in jet penetration. Lower the hook entering the holding pattern and maintain maximum endurance airspeed. Single aircraft must leave the Marshal point at estimated approach time (EAT). If the flight consists of two or more aircraft, the Flight Leader normally should plan to be in holding at Marshal in time to make a half standard-rate 180-degree left turn, break off from the flight, and return to the Marshal point at his EAT. Subsequent aircraft in the flight break at 30-second intervals. As each pilot reaches Marshal, he commences his letdown at 250 KIAS, 4000 fpm rate of descent, speedbrakes OUT, and about 80- to 82-percent RPM. At 5000 feet (platform), the rate of descent is reduced to 2000 fpm, although penetration speed is maintained at 250 KIAS. Level off at 1200 feet, retract speedbrakes, and adjust power to maintain 250 KIAS to the 10-mile gate. At this point, transition to 150 KIAS by retarding the throttle to 70 percent. Extend speedbrakes and drop wheels and flaps as airspeed drops below 225 KIAS. Retract speedbrakes and adjust power to maintain 150 KIAS. Aircraft shall be in landing configuration prior to reaching the 6-mile gate. Unless otherwise directed, maintain 1200 feet and optimum approach speed until directed to commence descent at about 2 3/4 miles. Then extend speedbrakes, and maintain optimum AOA/airspeed.

After transition is made to landing configuration, all turns should be standard rate. Do not exceed 30 degrees bank at any time. Do not exceed 15 degrees bank below 600 feet on final approach.

Section CCA

A section CCA may be necessary in the event a failure occurs affecting navigation aids, communications equipment, or certain other aircraft systems. Normally, the aircraft experiencing the difficulty will fly the starboard wing position during the approach. The lead aircraft should fly a slightly faster approach (about 10 knots above optimum AOA/airspeed) to afford the wingman some comfort and latitude in power control. If leading a dissimilar type aircraft comply with Air Wing doctrine.

The section leader will detach the wingman when the meatball is sighted and continue straight ahead, offsetting as necessary to the left to determine if the wingman lands successfully. The leader shall commence a slow descent to not lower than 300 feet altitude and adjust exterior lights in accordance with Air Wing Doctrine to provide the wingman with a visual reference and a leader should the wingman bolter or waveoff. The wingman should not detach unless he has the meatball in sight. Necessary visual signals are contained in figure 7-9.

Waveoff/Bolter Pattern

Waveoff will be straight up the angled deck, when given close-in. Pilots must bear in mind that during a late waveoff, an in-flight engagement is possible, therefore the aircraft must be lined up with the centerline to reduce the possibility of aircraft damage. After a waveoff or a bolter, establish a positive climb and maintain the approach final bearing. DO NOT CROSS THE BOW while flying upwind. Be alert for other aircraft launching from the catapult or entering the pattern from the break. The aircraft ahead will have priority for the turn downwind. If in doubt, use the radio. A waveoff to the right will be made when overshooting the landing line to the extreme. When waving off to the right, remain well clear of the planeguard helicopter.

CARRIER EMERGENCY SIGNALS

See CVA/CVS NATOPS Manual for emergency signals from carrier to aircraft.

SHORT AIRFIELD FOR TACTICAL SUPPORT (SATS) PROCEDURES

GENERAL

A-4 SATS catapult operations are limited to a minimum gross weight of 18,000 pounds, density altitude ranges from -2000 to +2000 feet, and no more than 15 knots of direct crosswind.

DAY OPERATIONS

General

Preflight, start and poststart checks shall be accomplished in accordance with normal field procedures and the additions noted.

Preflight

1. On the nose gear door, record the expected gross weight of the aircraft for catapult launch.

2. Ensure that the tension bar retainer clip is in good condition and secured.

Start

1. Start engine sufficiently ahead of time to allow for taxi, catapult launches, and rendezvous before proceeding on the assigned mission.

Poststart

1. Place the emergency-jettison armament switch in the proper position prior to taxi.

2. Set trim and flaps as follows:

a. Rudder . . . . 0°

b. Aileron . . . . STICK CENTERED, AILERONS SYMMETRICAL, TAB FAIRED ±1/5 INCH

c. Longitudinal . . . . 6 units ANU

d. Flaps . . . . Half

Taxi

1. Taxiing on advanced airfields presents little difficulty if attention is given to keeping speed under control.

2. Taxiing in and out of revetted areas cannot normally be accomplished without the use of the nose tiller bar.

WARNING

If a tiller bar is being used, apply both brakes simultaneously and with equal pressure. Differential braking can injure the tiller bar operator.

3. Wet or oily metal runway and taxiway surfaces require especially slow taxi speeds due to a greatly reduced coefficient of friction. Sharp turns cannot be made and the wheels will slide with moderate braking action.

SATS Catapult Launches

Proper positioning on the catapult is not easily accomplished because of surface irregularities in the holdback and arrester area. If the previously launched aircraft utilized afterburner, expect the area aft of the dolly arrester ropes to be wet and slippery. Approach the launch area slowly and be alert for signals from the taxi director.

WARNING

Do not taxi into the dolly arrester ropes immediately following the launch of another aircraft until the dolly returns and is arrested. Failure of the arrester ropes may occur on dolly rebound. Wait until the dolly returns and is arrested.

1. Approximately 80 to 85 percent rpm is required to taxi up and over the arrester ropes and dolly ramp.

CAUTION

Keep speed under control. Do not use differential braking if a nose tiller bar is used.

2. As the main wheels roll over the arrester ropes, be prepared for immediate braking and power reduction.

3. When the "come-ahead" signal is given by the taxi director, move ahead cautiously to prevent overstressing the tension bar.

4. After the aircraft is properly positioned and the holdback is engaged, the taxi director will signal for the pilot to release the brakes while the catapult is tensioned.

CAUTION

Ensure that the brakes are released before tension is taken.

5. After tension is taken, the taxi director will transfer control of the aircraft to the launch officer who will signal the catapult for prelaunch turnup. When the catapult is ready, the launch officer will signal the pilot for full power. Increase the throttle to MRT, observe acceleration time, and allow the engine to stabilize.

6. Check attitude gyro, RMI, engine instruments, trim indicators, and flap setting. Grip throttle and catapult handgrip firmly.

7. When ready for launch, salute the catapult officer with the right hand, place head against the headrest, observe the green cutoff light, and wait. Launch will occur approximately 3 to 5 seconds after the catapult officer gives the launch signal.

CAUTION

After receiving the signal for full-power turnup, do not allow your hands to appear above the canopy rails unless you intend to salute as a launch signal. Unusual hand movements, such as lowering a helmet visor, will probably result in a premature launch.

Technique

1. The low acceleration forces of the SATS catapult make it unnecessary to fully brace the right arm and restrain the stick from movement. Instead, cup the hand just aft of the stick and restrain arm movement by pressing against the side and/or thigh. Upon perceiving the change in the cutoff light from green to amber, grasp the stick and move it to a position slightly aft of trim. Allow the aircraft to rotate to a liftoff attitude (approximately 12 degrees on the attitude gyro) and fly away. The pilot must avoid gross control movements as the aircraft becomes airborne but should be prepared to make any attitude changes required. When safely airborne, retract gear and flaps as appropriate.

2. The A-4 displays an uncontrollable but mild yaw oscillation during SATS catapult launches. The oscillation commences shortly after holdback release and reaches a maximum at bridle shed. The severity of the oscillation increases at the lower gross weights.

CAUTION

Do not attempt to prevent directional oscillation during the power stroke by the use of rudders.

Aircraft or Catapult Malfunction

1. If, after established at MRT, the pilot determines that the aircraft is down, he so indicates to the launching officer by shaking his head from side to side. Never raise a hand into the catapult officer's view to give a "thumbs down" signal. Simultaneously broadcast "Suspend" to the tower. When the catapult officer observes the "No-Go" signal, he will immediately give a suspend signal.

2. If bridle shed or bridle failure occurs after hold-back release, the pilot will note a sudden loss of acceleration; the dolly will continue to accelerate and move ahead of the aircraft. Wait until the dolly can be seen ahead of the aircraft, then maneuver to the side of the runway to avoid contact with the rebounding dolly. If safe abort or takeoff is not possible and ejection speed has been attained - EJECT.

Landing Pattern

Approach the breakup point either individually or in echelon, parade formation, at 250 to 300 KIAS. A 17- to 20-second break interval will provide a 35- to 40-second touchdown interval. Have the landing checklist completed, be at optimum AOA/approach speed, and have the wheel brakes checked by the 180-degree position. Speedbrakes will normally remain out throughout the approach and landing. This may not be desirable at gross weights in excess of 14,000 pounds or when configured with high drag stores. Maximum gross weight for an arrested landing is 14,500 pounds and the maximum crosswind component recommended is 15 knots.

Approach

Plan for and execute an on-glideslope, optimum AOA, on-speed approach. Pay particular attention to maintaining the proper airspeed and correct lineup.

Waveoff

To execute a waveoff, immediately add full power, retract speedbrakes, and maintain optimum attitude. Make all waveoffs straight ahead until clear of the landing area.

CAUTION

Rotation of the aircraft to an exaggerated nose high attitude on waveoff lowers the arresting hook beyond its normal reach and can result in an inflight engagement.

Arrested Landing

The aircraft should be on runway centerline at touchdown. Aircraft alignment should be straight down the runway with no drift. Upon touchdown, maintain the throttle at the approach position and retract the speedbrakes. When arrestment is ensured, retard the throttle to idle. Allow the aircraft to roll back to permit the hook to disengage from the pendant. When directed by the taxi director, apply both brakes to stop the rollback, and raise the hook and flaps. If further rollback is directed, release brakes and allow the aircraft to be pulled back until a brake signal is given. Then apply brakes judiciously to prevent the aircraft from tipping or rocking back.

CAUTION

Be very careful when taxiing on a wet SATS runway.

Bolter

Bolters are easily accomplished. Simultaneously close the speedbrakes, apply full power, and retract the arresting gear hook. Smoothly rotate the aircraft to a liftoff attitude and fly away.

WARNING

If landing on a runway with a SATS catapult installed, be careful to prevent engagement of the dolly arrester ropes with the aircraft's tailhook, or structural damage to the aircraft and catapult will result.

NIGHT OPERATIONS

General

This section covers only that portion of night operations significantly different from day operations.

Poststart and Taxi

It is prudent to perform the poststart and taxi phase with the aircraft exterior lights and rotating beacon operating if allowed by local regulations and combat conditions. Wing lights should be on BRT/STDY.

Catapult Launches

Immediately prior to taxi onto the catapult, turn off all exterior lights using the master exterior light switch and the rotating beacon switch. Rely upon and follow closely the directions of the plane director. Upon receiving the signal from the plane director, release brakes as tension is applied. When given the turnup signal by the catapult officer, apply full power, and check acceleration time and instruments. When satisfied that the aircraft is ready for launch, so signify by placing the master exterior light switch in the ON position. Be prepared to establish a wings-level climbing attitude on instruments. An initial attitude of approximately 12 degrees noseup is recommended. Retract gear when above 300 feet, and retract flaps at no lower than 170 KIAS. When climbing through 2500 feet, adjust lights and radio as briefed.

PART 5
HOT REFUELING PROCEDURES

HOT REFUELING PROCEDURES

The following procedures shall be strictly adhered to by pilots and ground personnel when refueling aircraft with the engine running.

Note

A-4 aircraft will be hot refueled through the probe only.

PRIOR TO ENTERING THE PITS

1. The pilot will secure all electrical and electronic gear not required for refueling operations.

2. The plane captain shall check for hot brakes. If the aircraft has hot brakes, the plane captain shall direct it away from the pits.

3. All ordnance shall be removed or dearmed in accordance with local regulations. This includes practice bombs with smoke charges installed.

4. Fueling personnel shall check the fuel pits for loose objects which could be ingested into engine.

5. The aircraft will be taxied into the fuel pits under the guidance of a qualified plane director.

PRIOR TO REFUELING

1. The aircraft will be chocked.

2. The plane captain shall attach grounding wire to aircraft before any other connections are made.

3. The pilot will close and lock the canopy and select ram air. The radio will be set on ground control or, if aboard ship, other appropriate frequency.

4. Drop tanks pressurization switch shall be placed in OFF position.

5. Ensure that AIR REFUEL switch is in NORM position.

CAUTION

Ensure that fuel dump switch is in OFF position prior to refueling.

6. The work stand will be positioned in front of in-flight refueling probe and wheels will be locked.

7. The nozzle operator shall attach nozzle adapter to the probe.

8. The pilot will signal to fuel pit coordinator when he is ready to commence fueling by a "thumbs-up" signal in the daytime and "thumbs-up" illuminated by flashlight at night.

AFTER COMMENCEMENT OF REFUELING

WARNING

The plane captain shall visually check drop tanks upon completion of hot refueling to ensure that tanks are either completely full or completely empty. This procedure shall be used whether the drop tank fueling switch has been placed in the ON or OFF position during refueling. In all hot refueling operations, the pilot shall check his external fuel gage to ensure proper fuel load after completion of refueling.

1. Nozzle operator will slowly open valve and check for fuel leaks until the valve is fully open.

2. Immediately upon commencement of refueling, the plane captain will conduct the primary and secondary valve checks in accordance with NAVAIR 01-40AVM-2-4.1. If this check is not satisfactory, the refueling operation shall be secured immediately.

3. If the drop tanks are to be filled, either the plane captain shall place the DROP TANK FUELING switch in the ON position, or the pilot shall place the DROP TANKS switch in the AIR REFUEL position.

Note

When refueling ashore, gravity fueling method must be used for partial drop tank loads.

4. Appropriately assigned personnel shall monitor vent mast on wing to ensure that it is not obstructed.

CAUTION

If air cannot be felt coming from the vent mast, the refueling operation shall be secured immediately.

5. The pilot will signal the pit coordinator by a cut signal in the daytime and by flashlight at night when refueling is completed. The pit coordinator will signal the nozzle operator and pit operator. The nozzle operator will close the valve on the nozzle but will not remove the probe adapter until the pit operator has evacuated all fuel from the nose.

Note

The rotating beacon will be used as an emergency fuel cutoff signal at night.

6. The ground wire shall be detached after all other refueling equipment is removed.

7. A qualified plane director will direct the aircraft out of the pits.

SECTION IV
FLIGHT CHARACTERISTICS

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PART 1
FLIGHT CHARACTERISTICS

GENERAL

The flight characteristics of the aircraft as described in this section are based, whenever possible, on actual flight test information. In some instances, the results of extensive wind tunnel tests and data from flight tests of similar aircraft are used. Although additional information will be submitted periodically in the form of changes to this manual, the latest service directives and technical orders concerning this aircraft should be consulted regularly to keep abreast of pertinent information

The aircraft has the excellent slow flying characteristics usually found in aircraft designed for carrier operations. Positive stability in the power approach configuration (landing gear and flaps down) results in a return to the trimmed condition when disturbed by turbulence or pilot induced displacement.

FLIGHT CONTROLS

Ailerons

Aileron control forces are light at all subsonic speeds when the aileron power system is operative. In the transonic region and above, the air loads on the ailerons become large enough to require the total output of the power control system to deflect the ailerons beyond a certain point.

On manual control, the available rate of roll is markedly reduced at all speeds. Adequate lateral control can be maintained if the speed is reduced below Mach 0.80 or 300 knots, whichever is lower, where a maximum rate of roll of approximately 10 degrees per second is available at sea level. This increases to 40 degrees per second at 40,000 feet. (Refer to section I, part 2, Hydraulic Power Disconnect, for further information on aileron power disconnect.)

Elevators

The powered elevator provides good control at all speeds. (See figure 4-1, for a powered elevator stick forces diagram.) A bungee is installed in the elevator control system to provide longitudinal load feel. The bungee is linked to the horizontal stabilizer so that the elevator deflects upward (stick moves aft) while trimming noseup and deflects downward while trimming nosedown. The elevator moves approximately 8 degrees as the stabilizer travels from full-throw up to full-throw down.

With the elevator power control system inoperative or disconnected, elevator stick forces will be increased, but for flight at subsonic speeds, adequate control will be available. On manual control, no more than 1.8g can be obtained with the application of 120 pounds of stick force at Mach 0.96 at any altitude. As Mach number is increased, the maneuverability is further decreased. At Mach numbers less than 0.85 and altitudes below 5000 feet, a load factor of 2.7g can be attained with 120 pounds of stick force. Above 5000 feet, and below Mach 0.85, maneuverability is increased and is limited by buffet or accelerated stall.

Rudder

The rudder power system provides good rudder control at all airspeeds. In the event of hydraulic failure, rudder pedal forces will increase with airspeeds, but very little effort is required at approach and landing speeds. There is no rudder trim available with hydraulic failure.

Trim Surfaces

The trimming surfaces are capable of reducing stick forces to zero for all stabilized level flight conditions. The horizontal stabilizer will require almost constant repositioning during rapid acceleration and deceleration during takeoff and approach to landing. If the stabilizer actuator fails while the aircraft is trimmed for high-speed flight, the aircraft can be landed with the flaps retracted, at an airspeed sufficient to assure adequate control. A complete discussion of landing with runaway/stuck nosedown trim is presented in Section V.

Retrimming the rudder will not be necessary except when asymmetrical drag configurations are encountered, as would occur if two large stores were being carried on the wing racks and one was dropped.

When the aircraft is laterally retrimmed, the aileron trim system actuator relocates the neutral position of the control stick through the aileron power control system. If the power control system fails or is disconnected, the followup tab provides sufficient trim for all flight conditions as long as electrical power is supplied.

Slats

The wing slats open automatically under various flight conditions to improve airflow characteristics over the wing. As the two slats operate independently, and aerodynamically, one may occasionally open slightly in advance of the other, and impose a rolling movement.

Wing Flaps and Landing Gear

Lowering the wing flaps or landing gear causes a nosedown trim change, while a noseup trim change results from raising either or both. The trim changes are slight and are overcome easily through use of the control surfaces or by retrimming.

Speedbrakes

Operation of the speedbrakes results in changes in trim characterized by a noseup pitch when opened and a nosedown pitch when closed. To counter this characteristic, a speedbrake-elevator interconnect is installed which physically displaces the elevator when the speedbrakes are operated. This interconnect mechanism pulls the control stick forward when the speedbrakes are opened, and returns the stick to its original position when the speedbrakes are closed, thus decreasing the noseup and nosedown pitching. Some trim change will occur when the speedbrakes are operated. The degree of this trim change will be a function of airspeed. For further information on use of the speedbrakes, refer to the paragraph on Diving, in this part.

LEVEL FLIGHT CHARACTERISTICS

SLOW FLIGHT

Control is good during slow flight at approach and landing speeds; however, a lateral-directional oscillation is present in rough air.

STICK FORCES

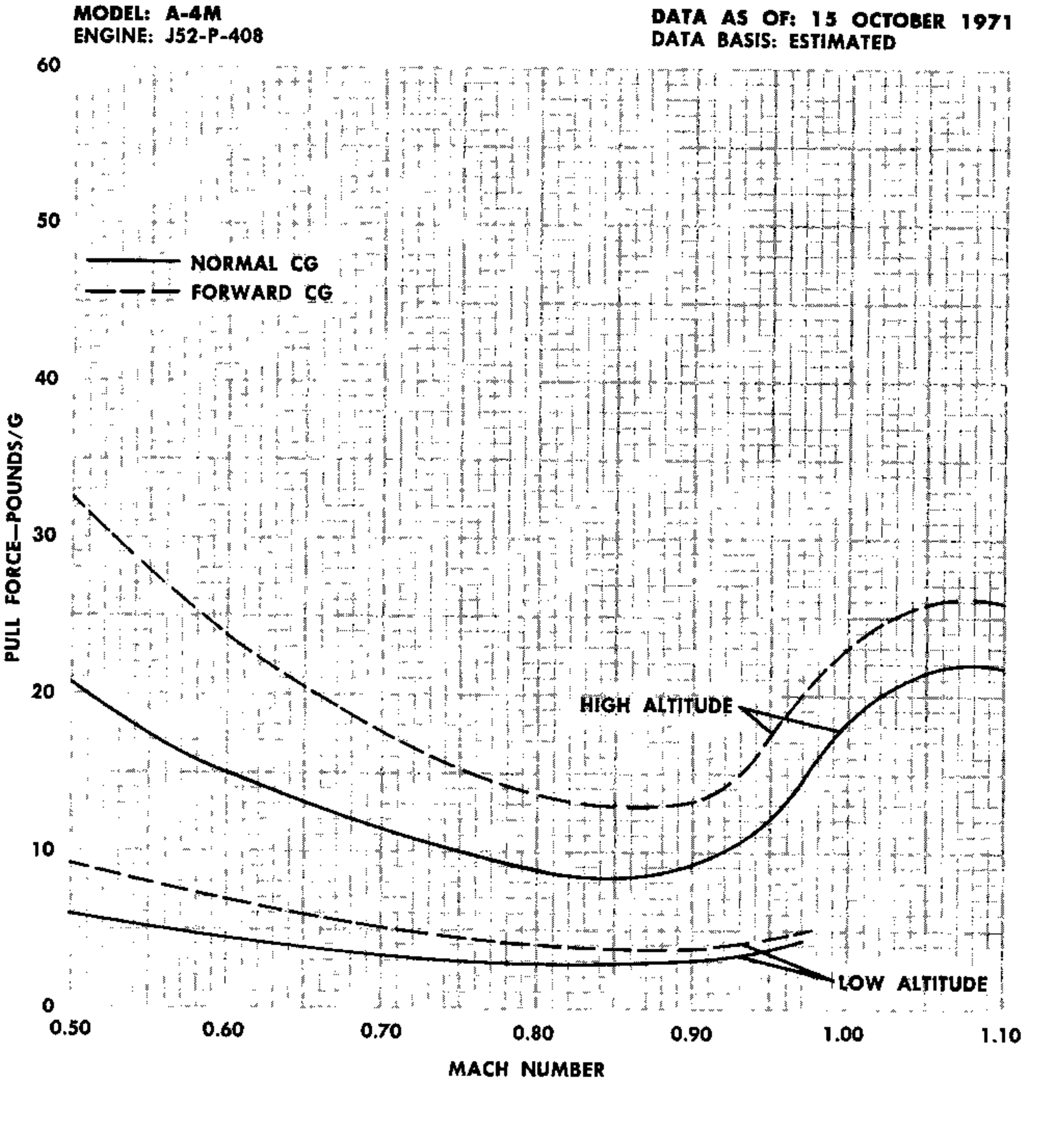

Figure 4-1. Stick Forces

CRUISING

Level flight cruising characteristics are normal, and satisfactory trim and control forces are available. At high altitudes and cruising airspeeds, a lateral-directional oscillation occurs in rough air, which may be counteracted by application of control surfaces. Longitudinal stability is weak to neutral at increasing aft cg positions.

TRANSONIC MACH CHARACTERISTICS

At airspeeds up to Mach 0.85 no unusual tendencies are apparent and stick forces are low to moderate. A mild nosedown trim change occurs at Mach 0.85 and increases slightly up to limit Mach number. This trim change can be countered by applying small increments of noseup stabilizer trim. (Refer to paragraph on Diving in this part.) If the control stick is displaced forward of neutral and released, the aircraft will diverge to a faster speed. Care must be exercised to avoid exceeding the maximum limits. The aircraft is also predictably sensitive to longitudinal control and trim inputs. Up to Mach 0.90 the maneuvering stick forces are normal and control is good, but above Mach 0.90, elevator effectiveness drops appreciably. An increase in stick deflection and therefore an increase in stick force will be required to achieve comparable load factors (figure 4-3). Lateral-directional oscillations will be more noticeable in this flight regime if stability augmentation is not engaged. Transonic flight should be conducted with STAB AUG on.

TRANSONIC PITCHUP

During recoveries from dives at supersonic speeds, a marked pitchup will occur at approximately 0.95 IMN. This increase in load factor is partially due to a marked increase in elevator effectiveness when decelerating through 0.95 IMN. After the initial abrupt increase in load factor or pitchup, the load factor will continue to build up at a slower rate as Mach number is decreased below 0.95 IMN, unless the pilot relaxes aft pressure on the stick.

In the critical aft cg condition, it is possible to develop the following load factors at supersonic speeds and maintain constant stick force as speed drops off to IMN = 0.85 without exceeding limit load factor in the ensuing pitchup:

10,000 feet	3.8g
20,000 feet	3.5g
30,000 feet	3.2g

The pitchup severity depends on the initial load factor or stick position, being more severe for full aft stick. At altitudes above 15,000 feet, and at high load factors, aircraft buffet will be encountered at above 0.98 to 0.95 IMN. This buffet should be heeded as a warning to relax aft stick pressure. If corrective action is applied by promptly relaxing the aft stick pressure, the pitchup can be appreciably lessened.

CAUTION

When using load factors in excess of those listed above for supersonic dive recoveries, relax aft stick pressure promptly, either upon encountering the initial sharp pitchup at about IMN = 0.95 or on encountering aircraft buffet. Note that at altitudes below 15,000 feet aircraft buffet does not occur prior to pitchup.

Transonic pitchup during a speed reduction in the region where a marked increase in elevator effectiveness occurs can be appreciably decreased or eliminated entirely by reducing aft stick force as Mach reaches 0.98.

FLIGHT WITH POWER CONTROL DISCONNECTED

Power control disconnect above 300 KIAS or Mach 0.85 should be avoided if at all possible. Reduce thrust and open speedbrakes to decrease Mach to this value before disconnecting. Trim aircraft laterally prior to disconnect, if possible. The aircraft is subject to strong wing dropping tendencies above Mach 0.90, with the boost disconnected. Available rate of roll with maximum pilot effort in this speed range may be insufficient to overcome wing dropping tendencies. Although the aileron tab retains some effectiveness, the slow speed of operation of this tab makes it difficult to keep up with the random wing dropping. Wing dropping tendency disappears as airspeed is reduced to Mach 0.85, and available roll rate from pilot input forces increase, making the aircraft once more controllable. (Refer to Hydraulic Power Disconnect, section I, part 2.)

FLIGHT WITH EXTERNAL STORES

Flight characteristics with external stores aboard are satisfactory. Adequate control is available to hold the wings level during landing with an asymmetrical loading up to 7500 foot-pounds static moment on either wing. Wing heaviness or random wing drop may be encountered at medium altitudes (20,000 to 25,000 feet) and high subsonic speeds (between Mach 0.94 and Mach 1.0) when carrying certain stores, or in braked dives.

With various aft store loadings on the multiple bomb racks, the cg will shift aft. In the event that the aft bombs fail to release due to a rack malfunction, the cg may exceed the permissible aft limit. As the cg moves aft, the longitudinal stick forces become very light during low fuel state operation, and particularly in the landing configuration. If stick forces are so light and control sensitivity so great that landing may be extremely hazardous, the pilot should jettison the multiple bomb racks. (Refer to AN 01-1B-40, for permissible cg limits.)

With asymmetric loadings, simple elevator control displacement induces roll as well as pitch. With control hydraulic power on, aileron control is sufficient to counteract roll induced by elevator control displacement. With hydraulic power off, at speeds above 200 KIAS, the roll induced by elevator displacement cannot be adequately controlled because of high lateral stick forces and low lateral control response. Accordingly, with hydraulic power off, longitudinal control should be minimized and airspeed should not exceed 200 KIAS with asymmetrical loadings. (Refer to Hydraulic Power Disconnect, section I, part 2.)

With asymmetric store loadings, the following recommendations are made:

1. A straight-in approach should be made when a known or suspected asymmetrical load is carried. Increased wing drop may be experienced if a break is made into the heavy wing. An asymmetric loading condition greatly decreases available aileron deflection required for lateral attitude control, as the aircraft transitions from break airspeed to landing pattern airspeed.

2. That the minimum approach speed be 115 KIAS with up to 7500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 KIAS at 12,500 foot-pounds. Normal approach angle of attack should be maintained so long as the resulting airspeed does not become less than this minimum. On manual control, with asymmetric moments up to 7500 foot-pounds, the initial approach speed should be a minimum of 140 KIAS, with a minimum final approach and touchdown speed of 125 KIAS. Landings on manual control with asymmetric moments greater than 7500 foot-pounds are not recommended. When landing with 7500 to 12,500 foot-pounds of asymmetric loading, a minimum rate of descent landing is recommended.

3. That crosswind landings be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing providing other factors such as runway length and gross weight are considered.

MANEUVERING FLIGHT

Available maneuverability is shown graphically in figure 4-3. Longitudinal and lateral maneuvering characteristics are normal throughout the level flight speed range of the aircraft, however, flight characteristics in the following maneuvers should be noted.

TRANSONIC MANEUVERING

In the pullouts or maneuvering in the transonic range, a small abrupt random wing drop accompanied by general aircraft buffet occurs. The intensity of the buffeting is generally proportional to the load factor developed.

AILERON ROLLS

During and upon termination of high rate aileron rolls (above 200 degrees per second) in the high speed, low altitude region, abrupt pitchdown will be noted. This pitchdown, though uncomfortable, is structurally safe and aircraft structure limits will not be exceeded provided that 360 degrees of roll are not exceeded.

CAUTION

When executing high rate, low altitude rolls (above 200 degrees per second), recovery controls must be applied after completing 180 degrees of roll to prevent exceeding 360 degrees of roll.

ROLLING PULLOUTS

High sideslip angles and a pitchup tendency occur in rolling pullouts in which high roll rates are developed. At high altitudes, the pitchup tendency increases the likelihood of inadvertent stalling and spinning out of the maneuver. At low altitudes, sideslip angles are reduced but the pitchup tendency is considerably stronger. The normal load factor should be monitored during rapid rolling pullouts at low altitude, and if an increase in the normal load factor is noted, the stick should be eased forward.

ROLLING PUSHOVERS

During recoveries from high rate rolling pushovers in the high and medium speed, low altitude region, a marked pitchdown will be noted. The pitching tendency is a result of inertia coupling and is not noticeable in normal rolling pushovers with a moderate roll rate. If bank angle changes are limited to 180 degrees or less, the pitchdown will not become excessive regardless of the lateral stick deflection used during the maneuver. In a stabilized dive of 45-degree dive angle, or greater, the decreased normal load factor results in the same effect as a pushover and the recovery from high rate rolls in the above regions will also cause a pitchdown.

CAUTION

The pitchdown, described above, may exceed the structural limits of the aircraft.

HIGH ANGLE-OF-ATTACK PITCHUP

During flight with center of gravity aft of 26 percent MAC, high angle-of-attack pitchup may be encountered when applying load factor. This pitchup is normally preceded by buffet onset and a buildup of buffet intensity. The pitchup manifests itself by a rapid increase in load factor with no change in stick position. At altitudes above 30,000 feet, the aircraft limit load factor will not be exceeded if pitchup is encountered. At altitudes below 15,000 feet and speeds above Mach 0.80, limit load factor precludes the aircraft from encountering pitchup. Between 0.50 and 0.80 Mach with a center of gravity of 26 percent, it is possible to attain pitchup when maneuvering near limit load factor. At altitudes of 15,000 to 30,000 feet, the pitchup can cause the limit load factor to be exceeded. Even though the elevator effectiveness is drastically reduced under these conditions, the severity of the pitchup can be controlled by partial forward stick movement. Buffet onset and ensuing buildup in intensity serve as a warning that the pitchup boundary is being approached.

Pitchup does not occur below Mach 0.40 and therefore does not present a landing or low speed problem. It can be avoided entirely by limiting pullups to buffet onset when flying with less than 750 pounds of fuel aboard or with other loadings where the cg is aft of 26 percent MAC. (Refer to cg loading charts.)

CAUTION

Full forward stick should not be used to recover from a high angle-of-attack pitchup, as excessive negative load factors will occur.

STALLS

Stall characteristics are normal in all configurations. The conventional technique of decreasing angle-of-attack with forward stick, simultaneously adding of full power, then leveling the wing should be used to recover from a stalled condition. An angle-of-attack setting of between 8 and 12 units is recommended for recovery from nose-high stalls. Warning of an impending stall occurs in the form of light buffeting of the aircraft, increasing in intensity as the stall is approached. The characteristics of a stall are a mild nosedown pitching accompanied by light directional and lateral oscillation. If the stall is reached when a high power setting is used, the nosedown pitch is very mild. Any tendency for a wing to drop can be effectively counteracted by application of opposite rudder. Stall speeds are shown in figure 4-2.

Note

Asymmetric slat extension may require full lateral control to maintain wings level when airspeed is approximately 5 knots above stall.

ACCELERATED STALLS

Accelerated stalls are preceded by adequate stall warnings in the form of general airframe buffeting.

Recovery is easily accomplished by employing normal procedures. A light buffet occurs just prior to slat opening. After the slats open, the buffeting disappears until the airspeed decreases to the accelerated stall warning speed, at which time the buffeting occurs again. Occasionally, failure of the slats to open simultaneously causes an abrupt roll toward the side with the slower opening slat. When aggravated by an aft center of gravity position and by asymmetric slat extension, an accelerated stall may result in an uncontrollable roll, which will stop when the load factor is reduced.

SPINS

The following steps summarize the spin recovery procedures and apply to all loading conditions of the A-4M aircraft:

1. Neutralize flight controls and physically hold centered (visually check position of stick).

2. Retard throttle to IDLE.

3. Determine type (erect or inverted) and direction of spin.

4. Apply and maintain recovery controls:

   Aileron – Full with turn needle deflection if erect spin.

   – Full opposite turn needle deflection if inverted spin.

   Rudder – Full opposite to turn needle deflection.

   Stick – Neutral to slightly aft.

5. Check trim setting and retrim to between 0° and 4° aircraft noseup.

6. Neutralize controls when rotation stops and recover from ensuing dive at a maximum of 18 to 20 units angle of attack.

STALL SPEEDS
SPEEDBRAKES RETRACTED
GEAR DOWN

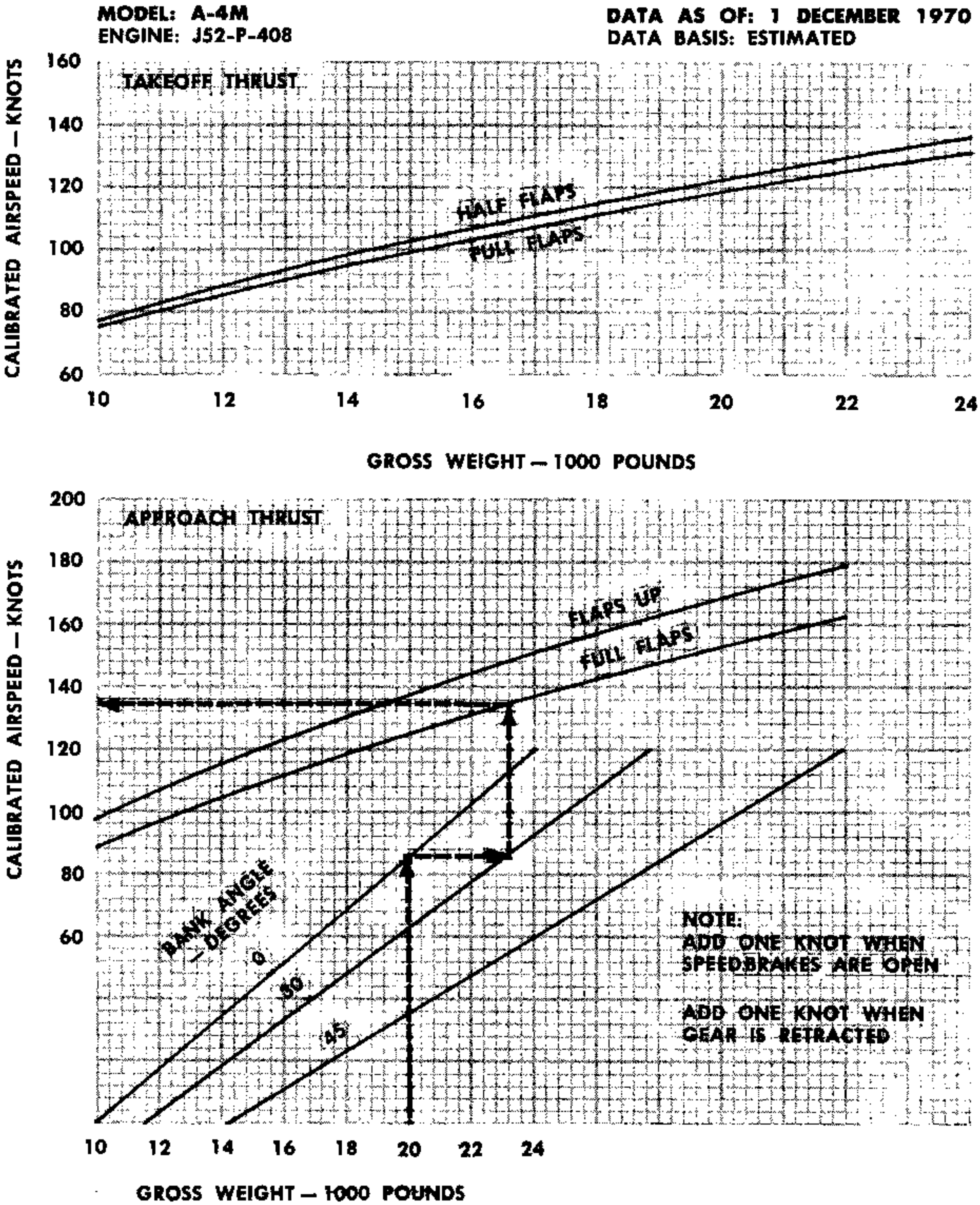

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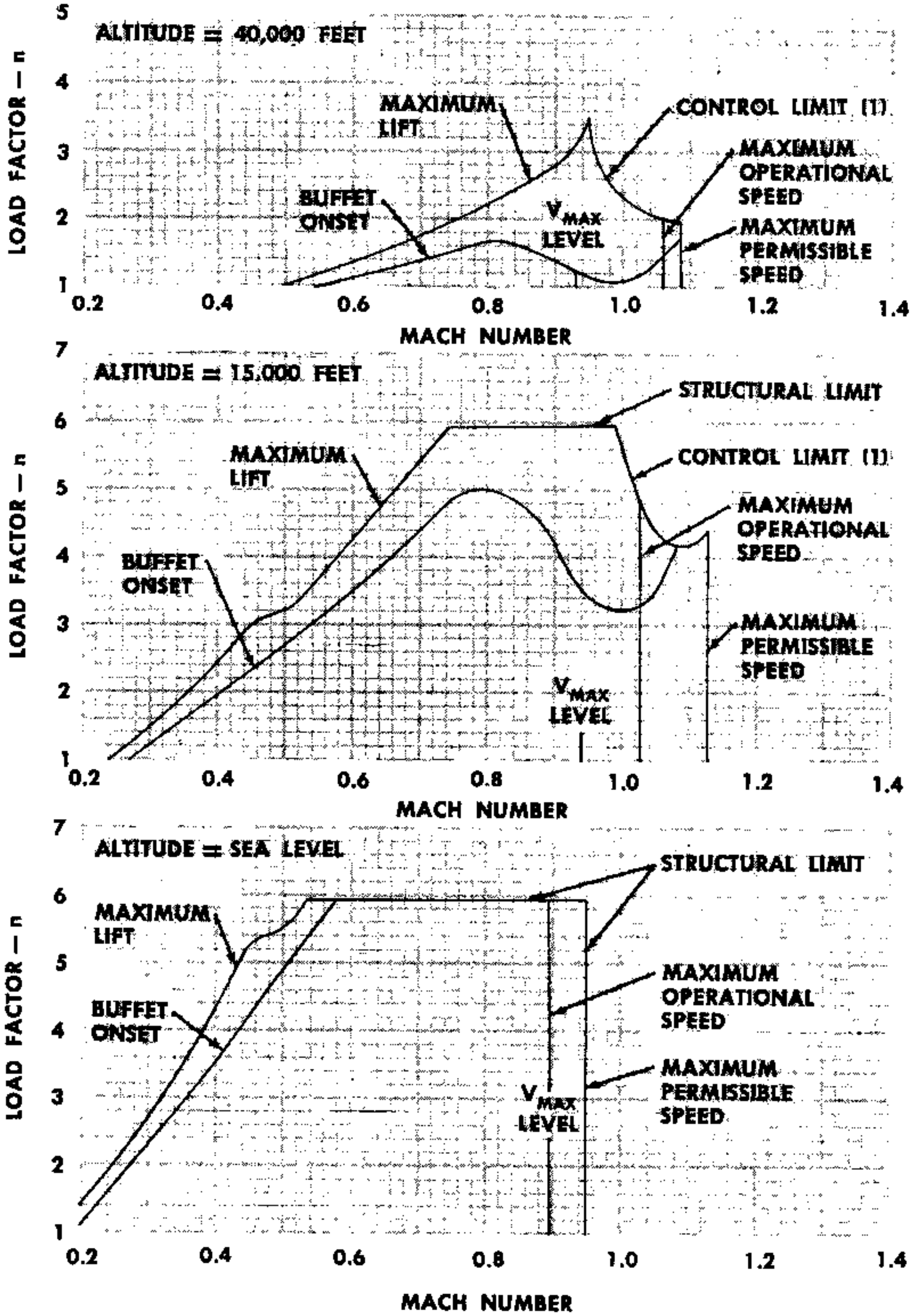
Figure 4-2. Stall Speeds

AVAILABLE MANEUVERABILITY
GROSS WEIGHT = 14,721 POUNDS
C G @ 20.9 MAC

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED



(1) STICK FULL BACK, STABILIZER FIXED, TRIMMED FOR n = 1

FA1-103

Figure 4-3. Available Maneuverability

Out-of-control flight can, in general, be divided into three phases:

1. Departure (post-stall gyration):
   When the aircraft, as the result of a stall or other phenomenon, such as asymmetric slat extension, leaves the region of normal flight and actuation of the regular flight controls does not result in the normal aircraft response.

2. Incipient spins:
   That phase of a spin, after departure, when the aircraft is pitching, rolling and yawing in a spinning-like motion, but prior to the time when a steady state spin has developed.

3. Steady state spin:
   That phase of a spin when the aerodynamic and inertia forces have reached a balance and the aircraft pitching, rolling and yawing motions are repeating in cyclic fashion. The yaw rate is sustained and angle of attack is above stall in either a positive or negative direction.

Actual spin testing has not been conducted with the A-4M aircraft. However, spin characteristics of the A-4M are expected to be similar to those of the TA-4F and previous A-4 series aircraft. The results of the Navy spin evaluation of the TA-4F are used for the following discussion. Actual spin testing of the A-4M will be conducted in the near future and the results promulgated as soon as possible.

ERECT SPIN CHARACTERISTICS

The aircraft is reluctant to enter fully developed erect spins unless prospin controls are applied and maintained. Prospin controls for erect spins are full aft longitudinal stick, rudder in the direction of the spin, and aileron neutral or opposite the applied rudder. However, in certain loading/CG conditions the aircraft has been known to spin with only full aft stick and full aileron deflection. In the erect steep oscillatory mode spin, a 360° roll occurs during the first one or two turns. Bank and pitch oscillations occur continually after the first turn. Bank angle varies ±70° and the nose pitches from 70° nosedown to near level with the horizon. There are frequent hesitations in spin rotation with reversals in yaw up to 3/4 turn. No sustained yaw rate develops and airspeed usually increases as the spin continues.

Note

> Increasing airspeed indicates the aircraft is flying out of the incipient spin condition and that neutralizing the flight controls will result in recovery.

Spin rotation rate varies from 4 to 14 seconds per turn with an altitude loss or 2000 to 7000 feet per turn. High rotation rates result in lower altitude loss per turn and, conversely, greater altitude loss per turn occurs with slow rotation rates. Rate of descent will vary from 20,000 to 35,000 feet per minute.

Erect spins entered from an accelerated stall have the same characteristics as those entered from 1.0g flight, except that more violent snaproll type maneuvers occur during the first two or three turns.

Relatively flat, erect spins have occurred, sometimes developing after several steep turns as described above. Aircraft pitch oscillations vary from 20° to 45° nose down and lateral oscillations vary between 20° left and 20° right wing down. Airspeed fluctuates between 50 and 150 knots but does not increase as the spin progresses. The angle of attack will be pegged at 30 units AOA. There is no hesitation in spin rotation and the spin rate is fast: 3 to 4 seconds per turn with an altitude loss of 1200 to 1500 feet per turn. Recovery from this spin mode will be slower than from the previously described erect steep oscillatory mode.

INVERTED SPIN CHARACTERISTICS

The aircraft is reluctant to enter an inverted spin unless prospin controls are applied and maintained. Inverted spins have been attained with:

1. Full forward stick and full rudder in the direction of the spin and,
2. Full aft stick, full rudder in the direction of the spin and full aileron opposite to the rudder.

The inverted spin is oscillatory and disorienting. Pitch attitude varies from the horizon to full 90° down and bank oscillations are erratic. The angle-of-attack indication is pegged at 0 units and airspeed fluctuates between 50 and 150 knots. The aircraft sometimes executes 360° rolls while spinning inverted and sometimes rolls to an erect position, pauses momentarily, and then continues inverted. During these rolls to the erect position the turn needle oscillates as yaw rate changes direction, and g is momentarily positive. The spin rate is fast: 3 to 4 seconds per turn with altitude loss of 800 to 1200 feet per turn. Negative load factors of over -2.5g have been experienced during inverted spins.

SPIN RECOVERY

Neutralization of all flight controls will facilitate recovery during the departure or incipient phase of the spin. In fact, application of spin recovery controls during these phases will increase the probability of spin entry. Therefore, the first step in any spin recovery is to neutralize the controls and determine if the aircraft is really spinning. Do not be hasty in applying recovery controls. The spin is likely to stop while maintaining the controls neutral. Experience has shown that recovery from the steep

TYPE OF SPIN	AILERON	RUDDER	ELEVATOR
ERECT	FULL – WITH TURN NEEDLE	FULL – OPPOSITE TO TURN NEEDLE	NEUTRAL TO SLIGHTLY AFT
INVERTED	FULL – OPPOSITE TO TURN NEEDLE		

Figure 4-4. A-4M Spin Recovery Controls

oscillatory mode always occurs within one turn if controls are held neutral.

WARNING

During inverted spins the control stick will float forward if released. Forward stick will impede or even prevent recovery. To ensure that the stick is in neutral it is necessary to visually verify the control stick position. Normal stick force cues are not valid.

The large airflow distortions possible during the spin make compressor stalls quite likely. Higher power settings result in higher energy and more severe compressor stalls.

CAUTION

Following departure from controlled flight, the throttle should be set at IDLE to reduce compressor stalls.

Large noseup stabilizer trim settings have sometimes impeded the recovery from erect spins. In addition, noseup trim settings of more than 6° may cause the aircraft to enter an accelerated stall on recovery. Longitudinal trim setting should be checked and the stabilizer retrimmed to 0° to 4° after departing controlled flight while maintaining recovery controls.

The type and direction of spin is occasionally difficult to determine because of roll attitude changes and varying accelerations. During inverted spins the difficulty of determining spin direction is increased because yaw and roll rates are in opposite directions. The type of spin is accurately indicated by the angle-of-attack indicator and g: zero units angle of attack and negative g for inverted spins; 30 units angle of attack and positive g for erect spins. The turn needle always indicates the direction of spin. Maintain controls positively neutralized until both angle of attack and turn needle are pegged, then apply and maintain recovery controls.

The recovery controls for erect spins, whether steep oscillatory or flat, are full rudder against the spin (opposite direction of the turn needle), full aileron with the spin (same direction as turn needle), and longitudinal stick position from neutral to slightly aft. When spin rotation stops, neutralize all controls. The aircraft will be in a nosedown attitude.

The recovery controls for inverted spins are full aileron and full rudder against the spin (opposite direction of the turn needle). Longitudinal stick position must be neutral or slightly aft. Forward stick impedes recovery. The ailerons are the primary recovery control and aircraft response will occur in the form of roll in the direction of the applied aileron. Spin rotation stops as the aircraft rolls to an erect nosedown attitude. Neutralize all controls when spin rotation has stopped. Occasionally the aircraft will reenter an inverted spin after apparent recovery. If this occurs, maintain controls neutral while determining type and direction of spin, then reapply recovery controls until rotation stops. The aircraft will recover in a nose low erect attitude. A-4M spin recovery controls are summarized in figure 4-4.

Note

With recovery controls properly maintained, recovery from a fully developed spin may require up to three turns if erect and up to four turns if inverted.

When rotation stops, neutralize the controls and allow airspeed to increase to 200 knots prior to starting the pullout. Altitude loss can be minimized by applying g as necessary to maintain airspeed at about 200 knots and angle of attack at 18 to 20 units. A loss of 4000 to 5000 feet will occur during pullout.

A minimum altitude of 10,000 feet above the terrain is recommended to terminate spin recovery attempts if still spinning.

WARNING

If a spin occurs below 10,000 feet AGL and neutralization of flight controls does not result in prompt recovery, EJECT. Recovery from a fully developed spin below 10,000 feet is considered doubtful since 4000 to 5000 feet may be needed to stop the spin and an additional 4000 to 5000 feet are required to pullout. Recovery from a departure may be accomplished with altitude losses varying from 0 to 7000 feet depending on entry condition and pitch attitude on recovery.

AVAILABLE MANEUVERABILITY

For available maneuverability of the A-4M, refer to figure 4-3.

DIVING

The diving characteristics of the aircraft are normal except when steep clean dives are conducted from high altitudes where airspeeds increase into the supersonic range. Under these conditions, the elevator effectiveness will be reduced and the aircraft basic stability will become high, and it will be necessary to retrim with the stabilizer to dive the aircraft supersonically.

Dive recovery nomographs are provided on figure 4-5. Figure 4-5, sheet 1 shows the altitude loss after the load factor is applied and sheet 2 shows the pilot reaction time. An additional factor, altimeter lag, must be added to the above two values to determine the total loss in altitude from initiation of the dive recovery to level flight.

WARNING

Figure 4-5 (sheets 1 and 2) does not consider buffet onset or structural limits. See maneuverability chart, figure 4-3.

The accelerometer should be referred to immediately upon initiating a pullout from a supersonic dive to ensure that enough load factor is being developed to recover.

Note

- If difficulty is experienced in recovering from dive, speedbrakes should be opened immediately and throttle retarded in an effort to reduce airspeed and limit altitude loss in recovery maneuver.
- Maximum speed for fully effective opening of speedbrakes is 440 KIAS. However, speedbrakes are partially effective up to maximum speed capabilities of the aircraft.

If the elevator power system should fail during a supersonic dive, the stick force required for recovery will be so high as to prohibit normal recovery procedures. Use of aircraft noseup stabilizer trim will then become mandatory to effect recovery.

CAUTION

Do not use the horizontal stabilizer as a dive recovery device except in an emergency. A strong pitchup will result as the airspeed drops below approximately Mach 0.94.

Trim settings for diving should be established on the basis of aircraft configuration and a knowledge of the individual aircraft, as each will require somewhat different trim settings for a given flight condition. It is usually considered preferable to trim the aircraft so that a moderate push force is required to maintain the dive just prior to the pullout.

If the speedbrakes are used before entering the dive, airspeeds will be limited to lower values where the increase instick forces will not be severe.

Note

The speedbrake will begin to "blowback" at approximately 490 KIAS.

The speedbrakes should not be closed until the recovery has been completed to prevent an increase in stick forces resulting from the combined effects of the buildup in airspeed and the characteristic nosedown trim changes that accompanies closing of the speedbrakes. The control stick forces required to produce 1g change in load factor at various Mach numbers are presented in figure 4-1.

FLIGHT CHARACTERISTICS ON AFCS

The AFCS (autopilot) is described in detail in section I, part 2. When flying "hands off", the aircraft is completely stable about all three axes, with no tendency to oscillate. Refer to section I, part 4 for Airspeed Limitations while operating on AFCS.

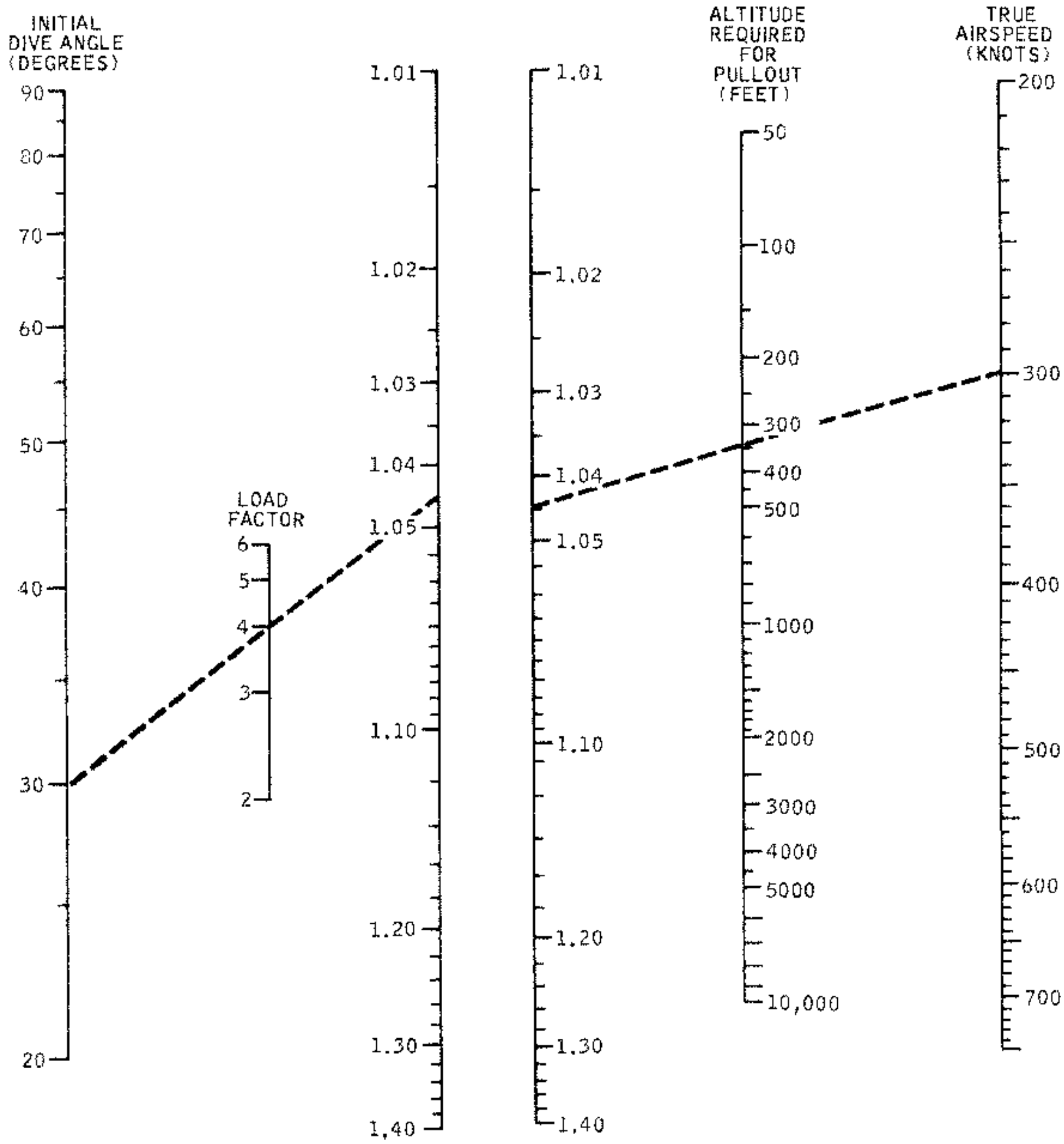
Certain flight characteristics of the AFCS are inherent in its detail design and constitute normal performance. Flight characteristics which are evident to the pilot are discussed in the following paragraphs.

WING DOWN PHENOMENA ON HEADING HOLD

There are particular circumstances which may result in temporary wing down condition while on heading hold. Asymmetric loading, directional trim, and platform gyro precession result in temporary wing down conditions.

Asymmetric loading causes the aircraft to be directionally out of trim and to fly wing down. Lateral and directional trim is available to the pilot and he should trim when necessary. On AFCS, directional trim is

DIVE RECOVERY
ALTITUDE LOSS DURING CONSTANT G PULLOUT



NOTE:

$$\Delta h = 0.08856\, V_T^2 \ln\left(\frac{n - \cos\gamma}{n - 1}\right)$$

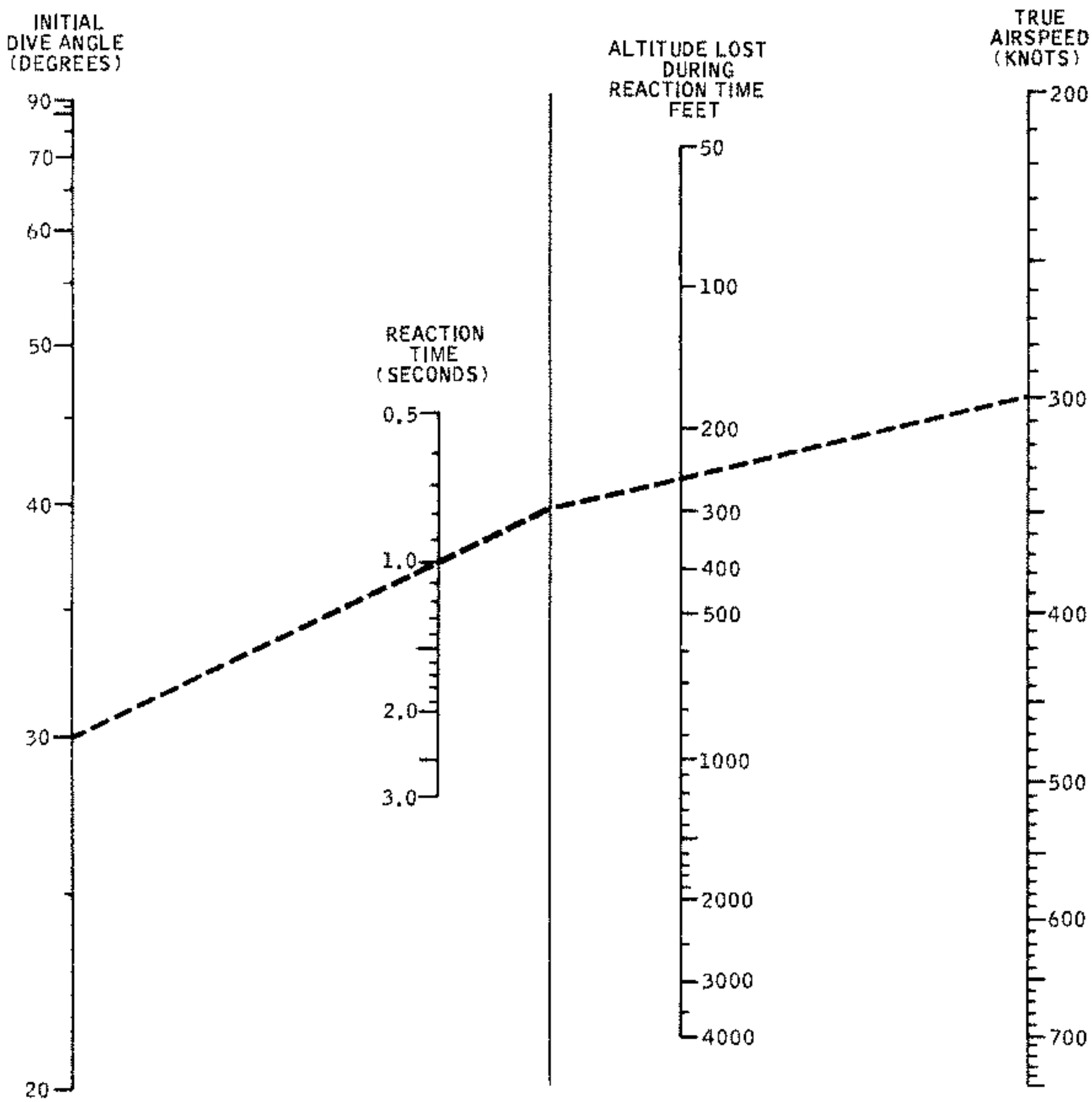
Δh = ALTITUDE LOST (FT)
V_T = TRUE AIRSPEED (KN)
n = NORMAL LOAD FACTOR
γ = FLIGHT PATH ANGLE

FA1-84

Figure 4-5. Dive Recovery Chart (Sheet 1)

DIVE RECOVERY

ALTITUDE LOSS DURING PILOT REACTION TIME



NOTE:

$\Delta h = 1.689\, V_T \times \Delta T \sin \gamma$

Δh = ALTITUDE LOST (FT)

V_T = TRUE AIRSPEED (KN)

ΔT = REACTION TIME (SEC)

γ = FLIGHT PATH ANGLE (DEG)

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Figure 4-5. Dive Recovery Chart (Sheet 2) available at all times. Lateral and pitch trim is available in the control stick steering mode. If the pilot does not trim directionally, the aircraft will maintain a constant skid at a banked attitude. Speed changes result in changes in directional trim. On AFCS flight, just as in normal flight, the pilot should trim the aircraft as necessary.

ROLLBACK ON ROLL ATTITUDE HOLD

Control stick steering switching levels and pilot technique in conjunction with the ability of the AFCS to synchronize changes in roll attitude will determine the amount of rollback obtained on roll attitude hold. On establishing a bank angle, some pilots prefer to release the stick before the rolling rate decays to zero. In this event, the roll synchronizer will lock on the roll reference at the time the force on the stick passes below 2 pounds. The aircraft overshoot and "rollback" can be as much as 5 degrees to the AFCS reference. If the pilot elects to hold the desired bank angle in control stick steering for a second or two, no rollback will occur. Both techniques may be used. Obtaining roll attitude accuracy will require use of the latter technique.

CONTROL STICK STEERING FEEL

The flight characteristics when on "control stick steering" mode are the same as for the basic aircraft except that the control stick experiences a change in feel which is the result of roll rate feedback and mode switching.

When on control stick steering, the stick is referenced to the rate gyros and as rate is developed, a very small amplitude, low frequency stick motion or feel results. Slight stick transients caused by the automatic return to the heading hold mode occur when making small bank or heading changes. These transients will be observed whenever the stick force varies above or below the 2-pound level and the aircraft is at a bank angle of less than 5 degrees. Such transients are normal and result from the design characteristics of the heading hold mode.

Pitch

On control stick steering mode, forces are provided by electrical signals from the accelerometer, pitch rate gyro, and elevator deflection. The resulting electrical "feel" is slightly lower than that of the normal power control. There is less variation in stick force per "g" over the flight regime. The breakout force on control stick steering mode has been reduced to 2 pounds, as compared with 3 pounds on normal power control.

Roll

Aileron control forces in the control stick steering mode are slightly lower than normal power control forces. Breakout forces are 2 pounds and 3 pounds, respectively.

Yaw

The rudder control forces and breakout forces are identical in both modes.

CONTROL STICK STEERING ENGAGE TRANSIENTS DURING AUTO TRIM

The AFCS is equipped with automatic pitch trim which operates within 4 to 6 seconds after establishing a new flight condition. If the pilot should elect to go back on control stick steering before the automatic trim system has stabilized, he may encounter a control stick steering engage transient. This is normal and will not occur if the pilot remains out of the CSS mode longer than 6 seconds.

HESITATION OR LOSS OF ROLLING RATE ON PRESELECT HEADING ROLL IN

During the preselect heading roll in, a slight hesitation or loss of rolling rate may occur at approximately 20 degrees of banked attitude. This is a normal phenomenon which is not detrimental to the performance of these circuits.

PRESELECT HEADING "STEPPY" ROLLOUT

During the preselect heading rollout a tendency to roll out in steps or hesitations has been observed. These steps are the result of choosing the optimum gain ratio between heading and roll attitude. The optimum heading to bank ratio is a compromise between a smooth rollout and a short rollout time.

SENSITIVE REGIONS OF PRESELECT HEADING

Abrupt roll transients will occur on preselect heading if the SET knob is adjusted to command a turn in a direction opposite to the turn being made. The same phenomenon will occur if a heading change greater than 180 degrees to the present aircraft heading is commanded while the aircraft is stabilized in the preselect heading turn. The preselect heading mode is designed to take the shortest path to the selected heading. If the aircraft is stabilized in a bank for a left turn and a right turn is commanded, the aircraft will immediately roll the opposite direction at maximum rate. Such preselect heading commands should not be initiated while stabilized in a turn.

LONGITUDINAL STICK MOTION DURING AUTOMATIC TRIM

Automatic trim or trim transfer is provided when the pilot relief modes of the AFCS are in use. When the automatic trimming occurs, the stick is observed to move longitudinally. This movement arises from two sources. These are the geared elevator effect and relief of trim. The elevator is mechanically geared to the stabilizer so that any motion of the stabilizer will result in a motion of the elevator. The elevator motion is always in a direction to increase the camber of the horizontal tail. Trim relief occurs when the elevator is no longer holding the aircraft in trim and the elevator is returned to the zero position. The stabilizer now maintains aircraft trim. In event of a maneuver such as prolonged high "g" turns in attitude hold, automatic trim of the horizontal stabilizer will result in 2 to 3 degrees noseup stabilizer. As speed decreases additional noseup stabilizer is required. At this time, if reversion to level attitude hold is desired, a force up to 15 pounds may be required on the stick, and if released, will cause pitchup. This stick force must be trimmed out on AFCS to approximately zero force prior to releasing stick.

APPROACH POWER COMPENSATOR

NORMAL PROCEDURES

Before Landing

Perform the following checks and actions:

1. Complete landing checklist.
2. Throttle friction . . . . . . OFF
3. Air temperature switch . . Set
4. APC power switch . . . . . STANDBY (observe APC light ON)
5. APC power switch . . . . . ENGAGE (observe APC light off)

WARNING

Do not engage APC with the fuel control in MANUAL. Automatic throttle movements associated with APC operation are rapid and could result in compressor stall or flameout.

6. Throttle . . . . OBSERVE MOVEMENT
7. Angle of attack/airspeed . CROSS-CHECK

After Landing

Perform the following checks and actions:

1. Throttle . . . . AS REQUIRED
2. APC light . . . . ON
3. APC power switch . . . . . CHECK FOR STANDBY POSITION

APC TECHNIQUE

The technique required for an APC approach differs from a manual approach in that all glideslope corrections are made by changing aircraft attitude. Since this technique violates the basic rule that altitude is primarily controlled by the throttle, practice is required to develop the proper control habits and coordination necessary to use APC.

Smooth attitude control is essential for the satisfactory performance of the APC. Large, abrupt attitude changes result in excessive thrust changes. Close-in corrections are very critical. A large attitude correction for a high close-in condition produces an excessive power reduction and can easily result in a hard landing. If a high close-in situation develops, the recommended procedure is to stop meatball movement and not attempt to recenter the meatball. A low close-in condition is very difficult to safely correct with APC and usually results in an over-the-top bolter. The recommended procedure for a low close-in condition is to override the APC and complete the pass manually. Throughout the approach, the pilot should keep his hand lightly on the throttle in case it becomes necessary to manually override the APC.

ANGLE-OF-ATTACK RELATIONSHIP

The angle-of-attack relationship for the operational envelope of the aircraft is portrayed in figure 4-6.

ANGLE-OF-ATTACK RELATIONSHIP

SPEEDBRAKES CLOSED

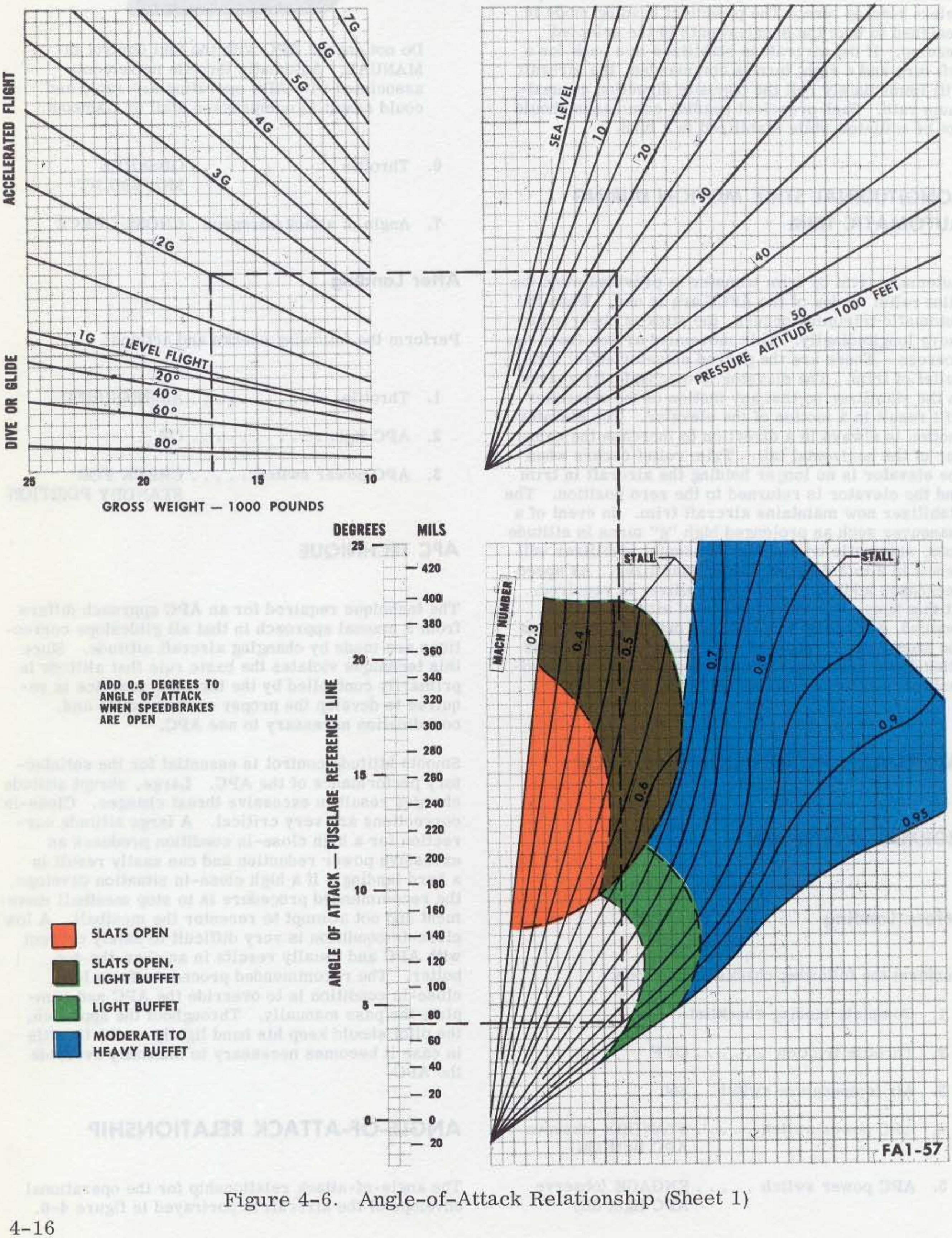


Figure 4-6. Angle-of-Attack Relationship (Sheet 1)

ANGLE-OF-ATTACK RELATIONSHIP
SPEEDBRAKES CLOSED

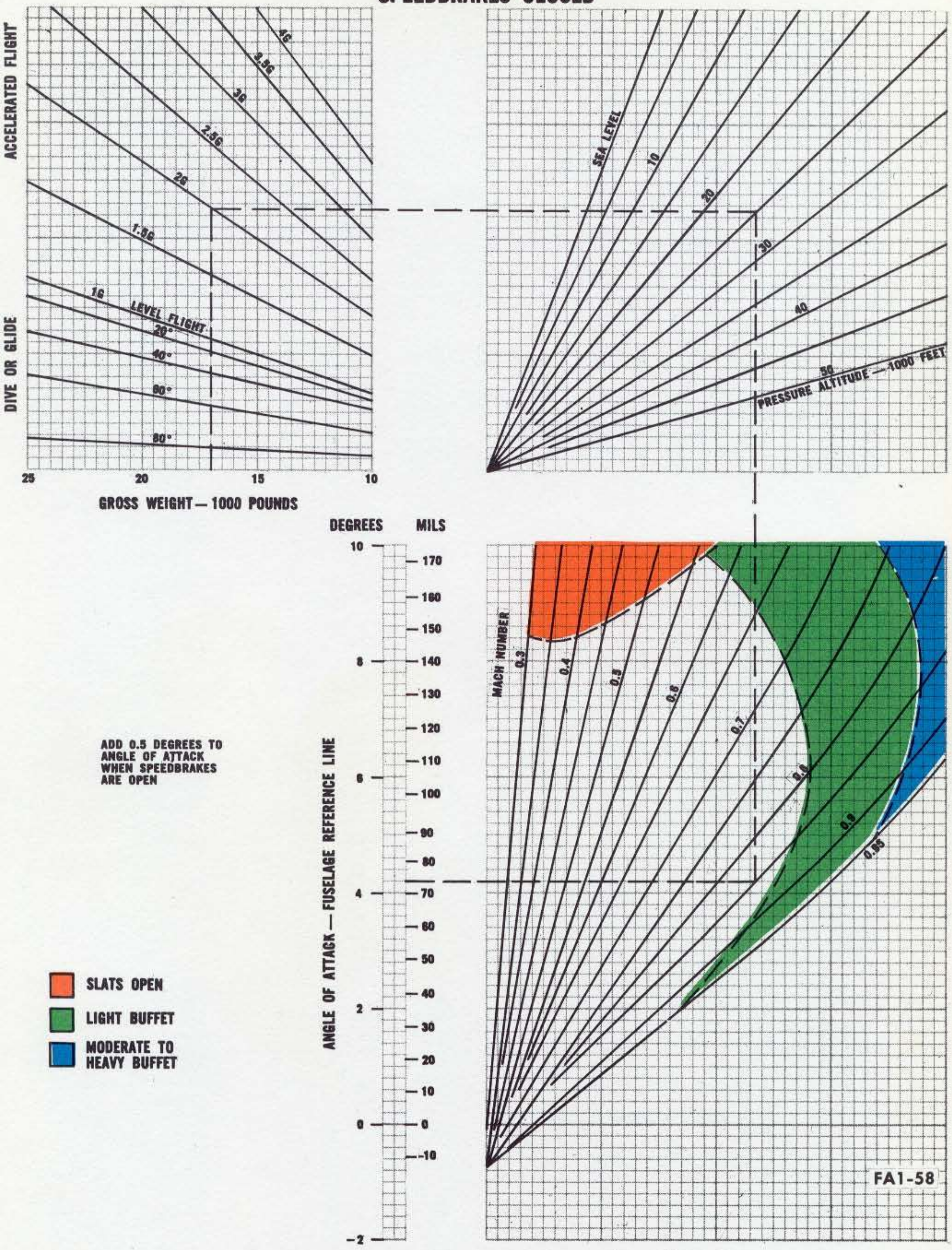


Figure 4-6. Angle-of-Attack Relationship (Sheet 2)

PART 2
FLIGHT PROCEDURES

GENERAL

The basic flight procedures contained in this section are for guidance. Where amplification is desired, refer to the appropriate Naval Warfare Publication.

TRANSITION AND FAMILIARIZATION

REQUIREMENTS

Transition and familiarization will be accomplished in accordance with the requirements outlined in section II. This training will be conducted in the replacement air wing or in the squadron, as directed by the appropriate Commander. It is desirable that pilots with no recent jet experience demonstrate their proficiency in two-seated, swept-wing jet trainers prior to flying the A-4M aircraft.

Familiarization flights should be designed to acquaint the pilot with the flight characteristics of the A-4M while it is flown at various attitudes, altitudes, and configurations.

PROCEDURES

The following procedures shall be followed for the first familiarization flight, in addition to those required for other flights.

Before Flight

The chase pilot shall accompany the familiarization (Fam) pilot during his preflight inspection and start. The Fam pilot shall be lead aircraft on takeoff.

During Flight

Perform those prebriefed maneuvers which will give a general feel of the aircraft, both in the clean and dirty configuration. Stalls and confidence maneuvers will be practiced in designated areas and at altitudes which will ensure straight and level flight above 10,000 feet AGL upon completion.

Return to Field and Landings

The Fam pilot will lead the flight back to the field. Landings on the first two Fam flights will be monitored by a chase pilot, or by a qualified A-4M pilot at the end of the runway with radio communications. If the approaches are chased, the chase pilot will fly a comfortable yet reasonably close wing position on the Fam pilot throughout all landings and will coach the Fam pilot when necessary. Chase aircraft will not descend below 100 feet, and should follow the configuration changes of the Fam pilot during the approach.

WEATHER CONSIDERATIONS

All familiarization flights will be conducted under conditions which will permit climb and descent in VFR conditions and permit visual contact with the ground at all times.

NORMAL FLIGHT

CRUISE CONTROL

For general cruise-control techniques refer to NAVAIR 01-40AV-1T. Cruise-control data for the A-4M is contained in section XI of this manual. Additional comments and suggestions follow.

Climb

Acceleration to initial climb speed should be effected prior to passing through 1000 feet.

Use the airspeeds recommended in the Performance Data charts to obtain the best rate of climb; however, speeds may be varied 10 knots above or below those stipulated without appreciably affecting climb performance. Maintain MILITARY rpm throughout the climb for best results, observing at all times the engine rpm, exhaust gas temperature, and time limitations as set forth in section XI.

Cruise

Shortly after leveling at altitude and establishing cruising speed, the pilot should note the fuel used in the climb and check actual fuel flow against the planned consumption rate. The transfer from the external tanks should be commenced. Each pilot should develop his ability to judge distances on the ground from his position and altitude. Sense of distance is quite necessary for accurate navigation at high altitude. Landmarks at considerable distances from the desired track may frequently be used.

Descent

Descents may be made very rapidly by using IDLE power and speedbrakes.

For a maximum range descent, throttle back to IDLE and maintain the gliding speeds recommended in section XI.

CAUTION

Maintain gliding speed. Do not select power settings below 65 percent RPM when below 225 knots.

Prior to descent, adjust cabin temperature and defrost air as necessary to prevent windshield frost.

FORMATION AND TACTICS

Procedures for specific maneuvers are promulgated in NAVAIR 01-40AV-1T. The following instructions apply to A-4/TA-4 aircraft as general basic maneuvers.

RENDEZVOUS

Turning Rendezvous

The turning rendezvous is made at 250 KIAS (unless otherwise briefed). When all aircraft are in a loose trail position, the leader commences a 25- to 30-degree bank turn. Each member of the flight waits until the lead aircraft passes 30 degrees off his nose (out of the bullet resistance windshield) and then rolls into a 45-degree bank turn, moving toward the inside of the leaders turn. After the leader passes back through the 12 o'clock position, the bank angle should be decreased slightly to avoid an excessive heading change. Wingmen may add enough power to gain a 10- to 15-knot speed advantage to expedite the rendezvous. As the rendezvous bearing is attained (35 to 40 degrees aft of abeam), adjust the bank angle to maintain this bearing. As the aircraft closes on the leader and his aircraft becomes more well defined, the leading edge of his wing (38 degrees) should be utilized as the correct bearing, and power should be readjusted to control the closure rate. The wingman should join on the inside of the leader and then cross-under to a normal wing position on the opposite side. This rendezvous may be accomplished either in level flight or with the leader in a stabilized climb.

TACAN-Circling Rendezvous

A TACAN-circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals. The pattern will be a port 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 and cruise speed. Upon reaching the joinup circle, each pilot commences a 250 KIAS (unless otherwise briefed) port orbit using 30 degrees of bank until visual contact is made with the Flight Leader. At this time, the pilot plans a turn to cut across the circle, making sure that he is not cutting another aircraft out, and intercepts the rendezvous bearing. He then proceeds with a normal rendezvous. If necessary, request the leader's position. The leader will then state his position in the orbit pattern using the numbers 1, 2, 3 and 4 corresponding respectively to the orbit point, 90, 180, and 270 degrees as shown in figure 4-7. If TACAN is not available, this same procedure may be accomplished by establishing the orbit point passing over a geographical point on a base heading. UHF/ADF may be useful in picking up the leader.

Running Rendezvous

A running rendezvous is effected by closing on the leader from the rear on a prebriefed radial or heading. This rendezvous is usually utilized in a climb-on-course situation and should be accomplished with the leader maintaining 250 KIAS and 90 percent rpm (unless otherwise briefed). If it is effected in level flight, the leader will maintain 250 KIAS (unless otherwise briefed) at a prebriefed or designated altitude. This being the most dangerous type rendezvous due to lack of adequate depth perception and sense of closure rate by the pilot joining, requires strict compliance with proper procedures. The joining aircraft will utilize no more than a 100 KIAS closure rate. A 6 o'clock approach will not be maintained closer than 1 1/2 miles from the leader. At a minimum of 1 1/2 miles, the joining aircraft will move out to a 5 or 7 o'clock position from the leader and establish a course parallel to the leader. This course will be maintained until the joining aircraft arrives at a

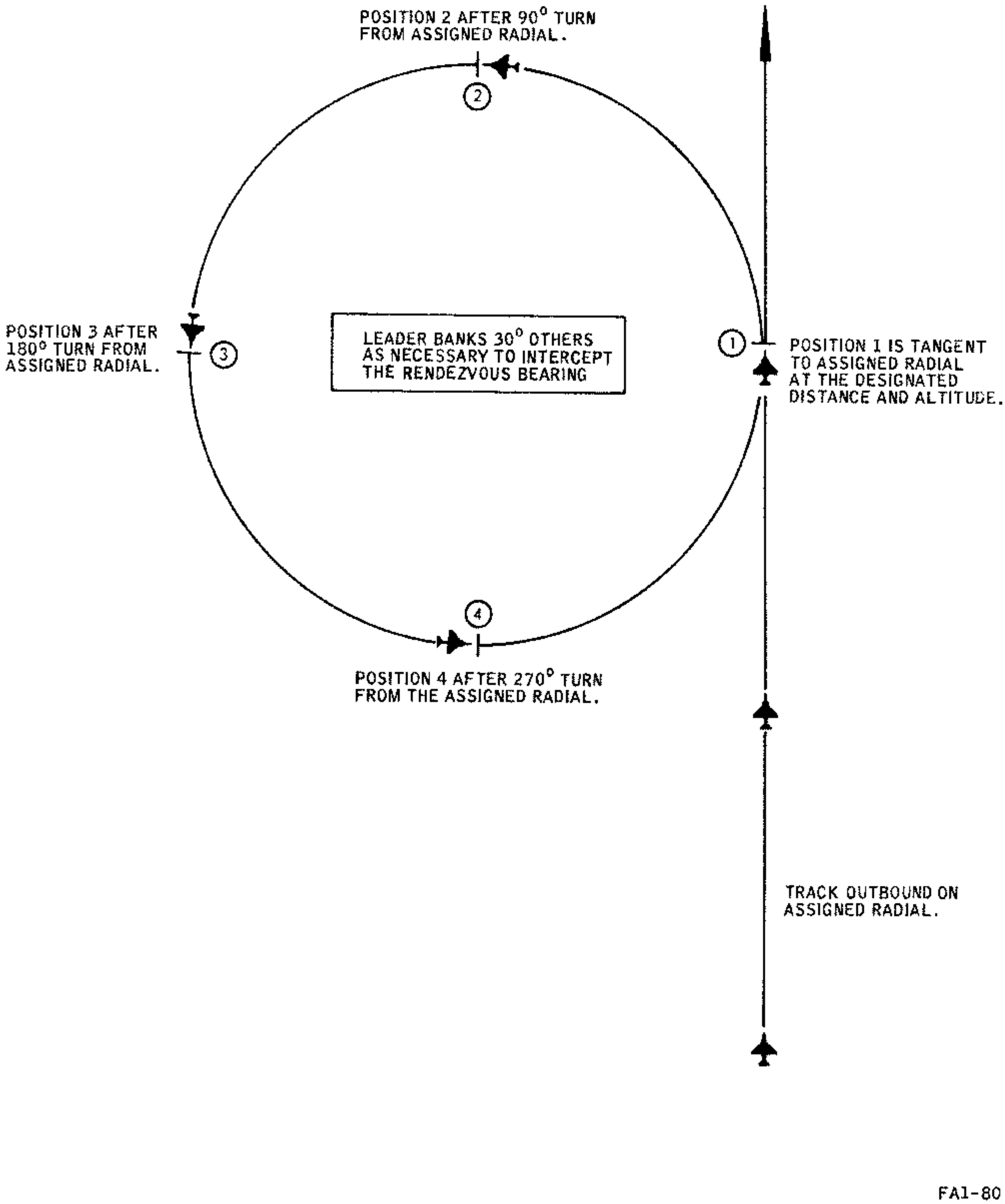


Figure 4-7. TACAN — Circling Rendezvous

position abeam and has matched the leader's airspeed. The wingman will then slide laterally to the normal wing position. The use of the air-to-air (A/A) mode of the TACAN and the UHF/ADF for rendezvous during periods of darkness or reduced visibility enhances safety immeasurably and should be utilized if possible.

UHF/ADF Running Rendezvous

The UHF/ADF rendezvous is useful for joining aircraft under all conditions, and particularly during a straight-course running rendezvous. When used in conjunction with the air-to-air mode of the TACAN, rendezvous ability and safety are greatly enhanced. The procedure to be used for the latter is as follows:

1. Trailing aircraft select ADF position on the UHF control.

2. The Flight Leader will transmit a short count every minute, and when climbing, include the passing altitude.

3. Trailing aircraft will position themselves so that as the leader transmits the short counts, the No. 1 needle points 5 degrees left or right of the nose position. The No. 2 aircraft will hold the leader to his left, No. 3 to his right, etc.

4. As the trailing aircraft approach the Flight Leader, they will turn to keep him 5 degrees (left or right respectively) off the nose position. The amount of turn required to maintain the leader in this position will increase as the separation is reduced. Continue until visual sighting is obtained.

Note

Slight altitude separation may be warranted.

TACAN Ranging (A/A)

Note

When operating the TACAN in the A/A mode, distance to the origin of the strongest signal received will be transmitted to as many as five aircraft. This signal is not necessarily the distance to the nearest aircraft.

Air-to-air (A/A) ranging requires cooperating aircraft to be within line of sight distance. This mode enables the TACAN installation to provide range indications between one aircraft and up to five others. TACAN displays normal range and azimuth information in the T/R mode and range information only in the A/A mode (the azimuth indicator, No. 2 needle, rotates continuously).

If A/A operation is desired between two aircraft, the channels selected must be separated by exactly 63 channels, i. e., No. 1 aircraft set to channel 64, No. 2 aircraft is set at channel 1. Both aircraft must then select A/A on the TACAN function switch with the range between aircraft being displayed on the DME indicator. The maximum lock-on range is 298 miles. However, due to the relative motion of the aircraft, the initial lock-on range will usually be less.

If A/A operation is desired between one lead aircraft and five others, the channel selected by the lead aircraft may be 64, for example. The other five aircraft must be separated by exactly 63 channels, and would be on channel 1. The A/A mode must then be selected on the TACAN selector switch.

UHF/ADF Circling Rendezvous

If a circling rendezvous is to be made, the Flight Leader will maintain prebriefed airspeed, 30 degrees 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 rendezvousing 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 the aircraft to be joined.

2. Place all lights in BRIGHT and FLASHING (if applicable).

3. Rendezvous about 1000 feet out, slightly aft of abeam (4 or 8 o'clock) the 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 the 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 conducive 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 stepdown should be used to ensure vertical clearance on the aircraft ahead.

4. When necessary a wingman should abort the rendezvous by leveling his wings, sighting all aircraft ahead, and flying underneath them to the outside of the formation. He should then remain on the 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 the 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

Section Takeoff

The leader will position his aircraft on the downwind side of the runway. Section takeoffs will not be performed with dissimilar type aircraft, nor with a crosswind component in excess of 8 knots. Aircraft will lineup 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 on takeoff. When the section is in position, the Flight Leader will give a one-finger turnup signal and both pilots will turnup to 85 percent rpm. All final checks will then be made before takeoff and each pilot will check the other's aircraft visually for leaks, trim settings, canopy closed, and flap setting.

Note

For section takeoffs, 6-degree noseup trim is permissible.

A raised hand will be signaled by each pilot when this is accomplished and he is ready for takeoff. The leader will then drop his hand smartly out of view at brake release, for commencement of takeoff roll. Power will be smoothly advanced to MILITARY, then reduced approximately 3 percent by the leader. The wingman will adjust his power to maintain relative position. When the section is comfortably airborne, the leader will give a head nod and raise the gear. After the gear is up, the flaps will be raised above 170 KIAS. When comfortable with gear and flaps up, the wingman may slide to a proper parade position.

Parade Formation

This formation will normally be employed when operating within the airport control zone, or in conditions of low visibility and/or darkness. The Flight Leader is very restricted and must be smooth. It is recommended that all power changes, climbs, glides, and turns be signaled by the leader. Speedbrake and gear signals are mandatory. Sliding turns by the wingmen are not permitted.

SECTION. Bearing is determined by lining up the wingtip light (bright) with the break in the fuselage. Stepdown of about 5 feet is achieved by flying level with the leader's wing. The 5 feet of wingtip lateral clearance is achieved by estimating a 20-foot clearance from the wingman's cockpit to the leader's wingtip.

FOUR PLANE DIVISION (FINGERTIP FOUR). No. 3 aircraft flies identical position on leader as No. 2. A check for both aircraft being in position is to line up the tips of opposite wingman's drop tanks. No. 4 lines up canopies of No. 1 and No. 3.

ECHELON. All aircraft are on the same side of the leader. No. 3 and No. 4 line up canopies with No. 2 and leader to maintain position. No. 2 must fly with increased stepdown (eye-level with the centerline of the drop tanks).

CROSSUNDERS. Upon receipt of the crossunder signal, the wingman will acknowledge and commence an arcing crossunder by reducing power, dropping nose and sliding aft to clear the leader's tailpipe and jet wash. As the nose passes below and aft of the leader's tail, smoothly add power and complete the crossunder by sliding up and forward to the proper wing position. A section crossunder is similar with the wingman passing directly aft of the section leader as the section leader passes directly aft of the division leader. The section leader must ensure that his wingman receives the crossunder signal.

Free Cruise Formation

The free cruise formation provides better lookout capabilities and maximum freedom of movement for the leader and other members of the element.

SECTION. The bearing is 35 to 40 degrees aft of abeam-the-leader (a bearing generating from the leading edge of the leader's wing - 38 degrees). The wingman's distance out on-bearing may vary between 50 to 100 feet, depending upon the mission. This distance will always provide for a minimum of 10 feet nose-to-tail clearance when crossing under. The wingman will maintain position primarily by sliding to the inside of the leader's turns with a minimum of throttle movement. The wingman should not cruise in the leader's 6 o'clock position during turns, but remain on the inside of the turn, on-bearing. The leader cannot see the wingman while in a 6 o'clock position, and signals cannot be passed while in this position.

DIVISION. The bearing of the section leader from the leader is the same as that of the wingman. The section leader will maintain adequate distance on-bearing to give him a minimum of 10 feet nose-to-tail clearance from No. 2 aircraft, when sliding laterally. All members of the element should maintain proper nose-to-tail distance and remain on-bearing as much as possible to enable the leader to pass signals at any time and to know where element members are at all times. (No. 4 aircraft receives signals from the section leader.)

TAIL CHASE. This formation is to be used as a confidence builder and as a practical application of relative motion. As such, it will only be flown when specifically briefed.

Position for all aircraft is 10 feet nose-to-tail clearance with sufficient stepdown to avoid the jet wash of the preceding aircraft. The tail-on view of the aircraft should be such that the tailpipe is placed on top of the canopy bow and used as a wing position indicator. Power setting used by the leader should be commensurate with the maneuver to be performed and be considerate for the number of aircraft in the formation. Others in the flight should keep in mind that since the leader decelerates first on the climb, a power reduction will probably be necessary initially, and on dives, a throttle increase due to his accelerating first.

AIR REFUELING

See figure 4-8.

BEFORE TAKEOFF

1. Ship tank switch . . . . OFF
2. Drogue position . . . . RET
3. Refueling master switch . . . OFF
4. Fuel transfer switch . . . . . OFF
5. Light switch . . . . BRT (DAY); DIM (NIGHT)
6. Gallons delivered indicator set to 000
7. Hose jettison switch . . . . . OFF (FORWARD)
8. Ship tank switch . . . . FROM STORE
9. Dump light . . . . TEST

Note

If there is fuel in the store, the light should come on. If there is no fuel in the store, press-to-test the light to ensure that bulb is good.

10. Ship tank switch . . . . OFF

DROGUE EXTENSION

1. Refueling master switch . . . . ON
2. Drogue position switch . . . . EXT

Note

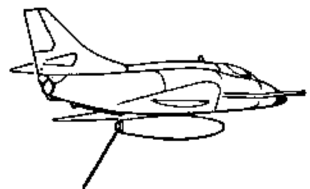
Be prepared for small trim changes as the drogue is extended.

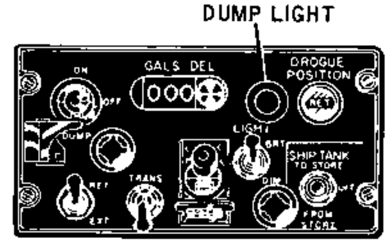
3. Drogue position indicator will read . . . . EXT, WHEN DROGUE REACHES FULL TRAIL POSITION
4. Ship tank switch . . . . TO STORE, FOR OVER 300-GALLON TRANSFER

NORMAL OPERATION

When the amber light on the tanker refueling store is on, the aircraft to be fueled maneuvers into position for probe-drogue engagement. After the probe is engaged in the drogue, the receiving aircraft must move forward (4 to 6 feet in relation to the tanker) until the store amber light goes off. As long as the two aircraft maintain this relationship, fuel transfer may be made. Actual refueling will be indicated by

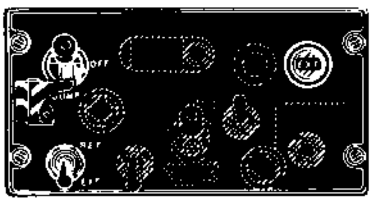
TANKER PANEL CONFIGURATION
PRIOR TO REFUELING

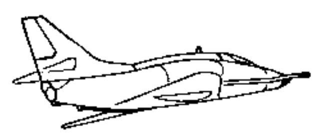




REFUELING MASTER SWITCH........... OFF
FUEL COUNTER........................ 000
DROGUE POSITION INDICATOR.......... RET
DROGUE POSITION SWITCH............. RET
TRANSFER SWITCH..................... OFF
HOSE JETTISON SWITCH...(FORWARD) OFF
LIGHT SWITCH................. (DAY) BRT
(NIGHT) DIM
SHIP TANK SWITCH .... OFF

DROGUE EXTENDED - NOT ENGAGED

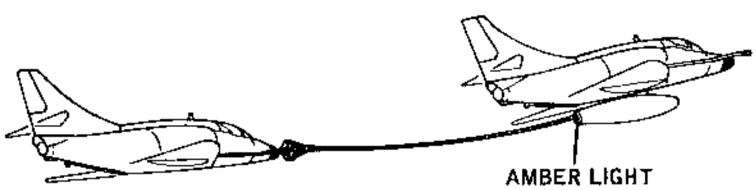


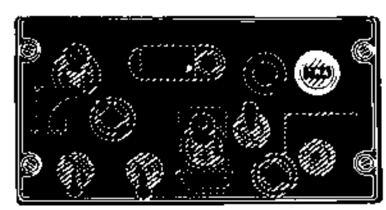


REFUELING MASTER SWITCH............. ON
DROGUE POSITION SWITCH............. EXT
DROGUE POSITION INDICATOR.......... EXT

NOTE
ON POSITION OF REFUELING MASTER SWITCH UNFEATHERS RAM AIR TURBINE FOR STORES HYDRAULIC PRESSURE.

ENGAGED - BEFORE FUEL TRANSFER

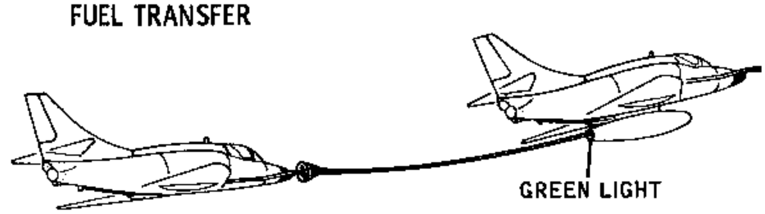




DROGUE POSITION INDICATOR........... TRA

NOTE
COUPLING OF PROBE WITH DROGUE WHILE TRANSFER SWITCH IS OFF CAUSES DROGUE POSITION INDICATOR TO SHOW (TRA) MEANING READY TO TRANSFER.

FUEL TRANSFER



TRANSFER SWITCH.................. TRANS
FUEL COUNTER........ (COUNTS GALLONS)

NOTE
GALLONS DELIVERED COUNTER CONFIRMS FUEL TRANSFER TO TANKER PILOT GREEN LIGHT CONFIRMS FUEL TRANSFER TO RECEIVER PILOT.

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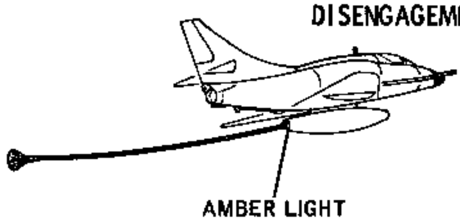
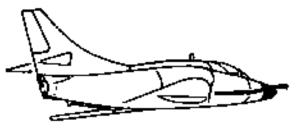
Figure 4-8. Tanker Operation – Air Refueling (Sheet 1)

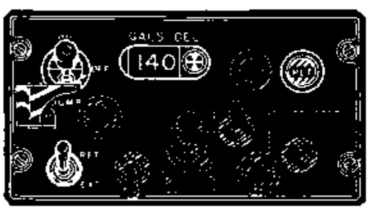
DISENGAGEMENT





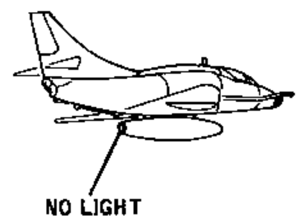
REFUELING MASTER SWITCH............ON
TRANSFER SWITCH....................OFF
DROGUE POSITION INDICATOR..........EXT

DROGUE RETRACT

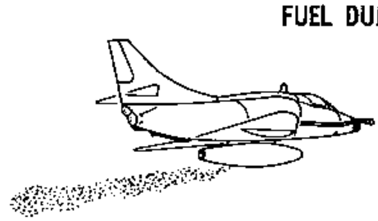


REFUELING MASTER SWITCH............ON
DROGUE POSITION SWITCH.............RET
DROGUE POSITION INDICATOR..........RET

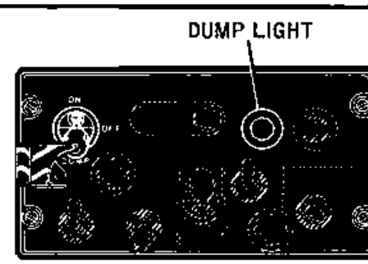
AFTER DROGUE RETRACT
REFUELING MASTER SWITCH .... OFF



FUEL DUMP



NOTE
FUEL DUMPING SHOULD ALWAYS BE DONE PRIOR TO ANY ARRESTED LANDING EITHER AFLOAT OR ASHORE.

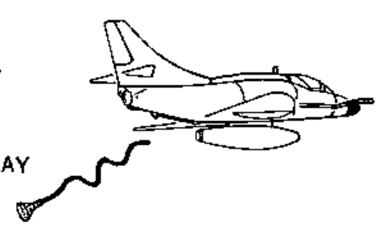


REFUELING MASTER SWITCH.........DUMP
(ALL OTHER SWITCHES SAME AS NORMAL PANEL CONFIGURATION)

HOSE AND DROGUE JETTISON - EMERGENCY

HOSE JETTISON SWITCH ...HOSE JETTISON
TRANSFER SWITCH............OFF
REFUELING MASTER SWITCH..(CONDITION)
DROGUE POSITION SWITCH....(CONDITION)
DROGUE POSITION INDICATOR...EXT

NOTE
5 TO 20 SECOND TIME DELAY IS A SAFETY FEATURE.



NOTE
JETTISONING CUTS OFF ALL STORE POWER EXCEPT POWER TO SHIP TANK SWITCH AND TO DUMP FUEL. THEREFORE, FUEL DUMP IS POSSIBLE AFTER JETTISONING.

WARNING

DO NOT MOVE HOSE JETTISON SWITCH FROM HOSE JETTISON POSITION AFTER JETTISONING.

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Figure 4-8. Tanker Operation – Air Refueling (Sheet 2) the green light on the store coming on. Fuel flow through the probe to the wing and fuselage tanks is automatic.

If the drop tanks are to be fueled, the drop tanks switch must be positioned at AIR REFUEL. Fuel flow will then be through the probe to the drop tanks, wing tank, and fuselage tank simultaneously.

CAUTION

On all receiver aircraft that have the Air Refueling Store Control Panel installed in the left console, ensure that the SHIP TANK switch is in the OFF position before engaging in air refueling. Ensure that the EMERGENCY WING TANK TRANSFER switch on engine control panel is in the OFF position before engaging in air refueling.

Stopping Fuel Transfer

To halt fuel transfer to the receiver at any time, place the fuel transfer switch in OFF.

Note

Refueling cannot be stopped by placing the refueling master switch in the OFF position. 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 window will change from TRA to EXT.

To halt fuel transfer to the store, turn SHIP TANK switch to OFF.

Drogue Retraction

1. Fuel transfer switch . . . . OFF
2. Airspeed . . . . 250 KIAS OR LESS
3. Drogue switch . . . . RET

Note

If the drogue cannot be fully retracted at 250 KIAS, reducing airspeed to 230 KIAS or less should permit full retraction.

4. When drogue position indicator reads RET, place the refueling master switch to OFF.

Note

The refueling master switch may be moved to OFF at any time after the drogue has extended. In this case the tanker store propeller will feather automatically only after the drogue has returned to the retracted position.

Transfer From Store to Store

If it is desired to transfer fuel from the refueling store to the wing tank,· place the SHIP TANK switch to FROM STORE. This will cause both drop tank air shutoff valves and the refueling store shutoff valve to open, allowing all external tanks to be air pressurized by the engine. Fuel will then flow from the droptanks and the refueling store to the wing tank. Transfer of fuel from the store to the wing tank is very slow but will transfer fuel at approximately the rate that fuel is burned unless high power settings are used. While fuel is flowing from the store to the wing, the dump light will be on.

Note

If transfer of fuel from the drop tanks cannot be stopped by placing the drop tanks pressurization switch on the engine control panel to OFF, check to see that the ship tank switch on the air refueling control panel is in the OFF position. If this switch is in the FROM STORE position, transfer from the drop tanks and refueling store is automatic and pressurization will be continuous unless the ship tank switch is placed at OFF.

Dumping Fuel

An electrically operated fuel dump valve is located on the bottom of the refueling store. To dump fuel, first depress the spring-loaded lever guard assembly, then raise the master switch from the spring-loaded safety position and position at DUMP. While fuel is actually dumping, the dump light will be on.

CAUTION

On rare occasions, fuel dumping from the store may reenter and accumulate in the aft section of the store and may create a fire hazard if the store is operated after dumping.

BEFORE LANDING

1. Ship tank switch . . . . OFF
2. Drogue switch . . . . RET
3. Drogue position indicator . . . . RET
4. Refueling master switch . . . . OFF
5. Fuel transfer switch . . . . OFF
6. Drop tanks switch . . . . OFF

Note

If practicable, open store dump valve prior to any arrested landing to ensure the store is empty. Ensure dump valve is closed prior to landing.

JETTISONING THE FUELING STORE

The air refueling store may be jettisoned electrically in the same manner as other droppable external stores. (Refer to section VIII, Armament System.)

EMERGENCY OPERATION

Refer to section V, Emergency Procedures.

TANKER SAFETY PRECAUTIONS

CAUTION

- Be sure that the ship tank switch is OFF during catapulting and arrested landings. The integral wing tank pressure increases to 6 psi above ambient when the ship tank switch is in the TO STORE position. The addition of the 6-psi static pressure to the accelerations induced by catapulting and arresting would impose severe loads on the tank surfaces.
- When the ship tank switch is in the TO STORE position, overpressurization of the wing tank is possible if fuel covers the fuel vent outlet in the tank. This condition will exist during negative-g operation, and when the aircraft is in a nosedown attitude.

The following is a summary of the restrictions applicable to flight with the wing fuel tank pressurized:

1. Aircraft velocity not to exceed 400 KIAS
2. No catapulting
3. No landings
4. Coordinated turns only
5. Aircraft load factor limits N_2 = 0.1 to +2.0
6. No air refueling as receiver aircraft

CAUTION

- Do not start the turbine or extend or retract the drogue when over populated areas or when other aircraft are close abeam or astern.
- Do not extend the drogue after it has been retracted when a hydraulic leak has been observed.
- Do not extend the drogue if there is any evidence of a possible electrical failure.
- Do not energize the turbine after dumping fuel unless failure to provide fuel will place another aircraft in jeopardy.
- Do not actuate the speedbrakes during any part of the refueling operation.
- Once the hose jettison switch is actuated to its HOSE JETTISON position for emergency jettisoning in flight, it shall not be moved back to its OFF position. Inadvertent cycling of this switch will cause internal damage to the store and may create a fire hazard.

STORE LIMITS

The following limitations apply to the store:

1. Maximum speed for unfeathering is 300 KIAS: for extension of the drogue and refueling, it is 300 KIAS or 0.80 IMN. The recommended unfeathering and extension speed for training is 250 KIAS or less.

2. Maximum speed for drogue retraction is 250 KIAS. (If the drogue will not retract fully at 250 KIAS, slow to 230 KIAS or less and recycle drogue.)

3. Conduct refueling operations in straight and level flight whenever possible and, if possible, do not select TO STORE until 50 gallons of fuel has been delivered to the receiver.

PILOT TECHNIQUE

WARNING

When receiving fuel from a KC-135 aircraft, the maximum total fuel on board the receiver shall not exceed 4500 pounds of JP-4 or 4750 pounds of JP-5. Failure to observe these limitations may result in overpressurization and rupture of the fuel tanks due to inadequate pressure regulation of KC-135 aircraft tanker systems.

Air refueling engagements can be accomplished at any altitude within a wide range of airspeed. Successful engagements have been made between sea level and 32,000 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.

Closure rates above 5 knots may induce hose whip. If hose whipping or kinking occurs during normal receiving hookup, disengagement should be made immediately and the store inspected for hose tension regulator malfunction.

Thermal turbulence from the deck may be annoying for hookups at very low altitudes due to oscillatory drogue motion.

The receiver should start the engagement approach from behind and below the tanker. The receiver's flight path prior to engagement should follow the angle of the trailing drogue hose, using the drogue only as a target reference during the final 3 or 4 feet prior to contact. The receiver pilot will notice increased pitch sensitivity at this point. A slight throttle advance may be necessary to maintain a definite closing rate during the final 3 feet. To facilitate engagement at night, an air refueling probe light is mounted in the outboard leading edge of the right airscoop and is controlled by a switch located on the wedge outboard of the right-hand console.

After engaging, the receiver aircraft must move forward so that a minimum of 4 feet of hose takeup occurs, starting the fuel transfer. The store hose is striped each two feet for the last 20 feet to be unreeled. The receiver refers to these stripes to assist in maintaining a stable distance from the tanker during refueling. It is never necessary to close to a point where the stripes are not visible.

The receiver should be flown so that the hose is centered laterally and maintained just above the lower centerline lip of the store's trailing edge, but not riding on or touching the lower lip. This optimum position is approximately 2 feet below the drogue's normal trailing position. This position is the most comfortable position for the receiver to avoid severe buffeting. Once the engagement has been accomplished, it is not difficult to fly the receiver dead astern with a 2-foot lateral tolerance, even in rough air or in turns up to 30 degrees bank angle.

Mild buffeting will be felt by the receiver, but it should not be uncomfortable. Occasional mild fuel sprays of short duration may hit the receiver, but the only adverse result is possibly a greasy film on the windshield. Disconnecting is accomplished by the tanker holding constant power while the receiver retards throttle. The hose reel will unwind the takeup until it reaches the end of the hose travel and the receiver will break free.

CAUTION

Do not engage, or remain engaged to a steadily leaking drogue. The leaking fuel will be ingested into the engine and may ignite and explode. The small amount of fuel that is leaking momentarily during plug in and disengagement is not considered dangerous.

FLIGHT PROCEDURES — REFUELING TRAINING AND REFRESHER

Refueling training should be accomplished at various altitudes in accordance with current directives.

Prior to Refueling

1. After rendezvous have been effected, the Flight Leader of the receiver aircraft will position his flight in loose echelon away from the tanker on the side opposite the tanker escort, if assigned. The Flight Leader will then pass the lead to the tanker pilot if applicable.

The Flight Leader's position will be abeam the tanker with at least 200 feet separation in case a store turbine blade flies off during unfeathering.

2. When the flight is in position, the leader of the receiver aircraft or tanker escort (if assigned) will signal the tanker to unfeather (1-finger turn-up signal).

3. The tanker will unfeather, ensuring airspeed is 300 KIAS or less.

4. The Flight Leader (or tanker escort) will indicate by a "thumbs-up" or "down" whether or not the turbine unfeathered. If the turbine does not unfeather the tanker will secure store and not make further attempts to unfeather, unless failure to provide fuel would place receiver aircraft in jeopardy.

5. If the turbine unfeathers on the first attempt, the tanker responds to the "thumbs-up" signal of the Flight Leader (or escort) by extending the drogue.

6. As the drogue extends, the flight should fall back so that leader is abeam and level with the drogue, with about 100 feet lateral separation. Drogue extension will slow tanker speed. The tanker should adjust power to maintain desired refueling speed. 230 KIAS is recommended; however, plug-ins may be made anywhere in the store operational envelope of 200 to 300 KIAS. All aircraft will remain clear of the area directly behind the drogue during extension or retraction, in the event the hose and drogue separate from the store. If drogue extension is not snubbed as it approaches the fully extended position, do not attempt plug-ins.

7. The tanker pilot, as leader of the refueling formation, has the primary responsibility for maintaining a good lookout for other aircraft, although other members of the flight are responsible for assisting to the maximum extent possible.

8. Any evidence of a hydraulic leak from the buddy store during refueling operations should immediately be reported to the tanker pilot and the store secured.

9. Do not turn pressurization to RAM while inflight refueling. Eyeball diffusers shall be turned away from pilot's face. If fuel is injected into the engine from a leaking drogue, it may appear in the cockpit as white smoke. Immediately disengage if smoke appears in the cockpit.

10. If tanker escort is assigned, the escort pilot will fly a close parade position on the tanker throughout the evolution (except during moment of unfeathering turbine) and inform tanker when the dumping has been completed. The escort will watch for store malfunctions and provide assistance in case of tanker radio failure. Tanker escort, when assigned, will give any necessary signals for actuation of turbine and drogue. The escort will not take part in the refueling sequence when another formation is refueling.

Refueling

1. The leader should detach and move into a position 20 feet behind and below the drogue, on a plane with the trailing hose, to minimize turbulence from the tanker's wake. Call "___, lining up," before sliding into position behind the tanker. Observe amber light on tanker store, indicating store may be engaged. If light is not on, be cautious during engagement, since hose tensioning and reel-in may be inoperative. The most likely cause, however, is a burned-out bulb. Trim the aircraft slightly nose down to remove any slop from the elevator control system, and move forward and up the hose reference until the tip of the probe is 5 to 10 feet directly behind the drogue. Pause here long enough to get stabilized, then add enough power to close and engage the drogue at a closure speed of about 3 knots. Either the tanker or the probe and drogue may be used as the primary visual reference; however, both must be perceived to make consistent and safe engagements. Closing speeds in excess of 5 knots may cause hosewhip, with ensuring damage to probe; hose and drogue, or both. Also, if misaligned at high closure speeds, damage to radome, nose section, pitot tube, or canopy may occur. If the drogue is missed, stay below the drogue and back straight out until the drogue is in sight. Avoid looking up to high for the drogue as the pilot may unconsciously pull back on the stick and climb into the drogue. Instead, use the tanker as a reference until safely aft of the drogue.

2. After engaging the drogue, continue to push in the hose until the amber light is out, and then call "___, contact." The last 20 feet of hose to unreel from the store has a white stripe every 2 feet. At least two stripes must be pushed into the store before the transfer will occur. Do not fly so close that no stripes are visible. Maintain a position so that if some opening between the tanker and the receiver occurs, the transfer will not be interrupted. This position should also be along the general reference of the hose before plug-in and will keep the nose centered slightly above the lip of the aft end of the store.

CAUTION

To preclude possible engine flameout and/or explosion, the following procedures should be used during receiver hookup. After the receiver pilot has made hookup, the tanker pilot will place the transfer switch momentarily to the transfer position and transfer 2 to 4 gallons of fuel to test for proper probe/drogue coupling. If no transmissions are heard from the receiver or the receiver does not disengage, reinitiate transfer. Excessive fuel on the windscreen, smoke or mist in the cockpit, and rising EGT are indications of possible impending engine explosion due to fuel ingestion in the engine intakes. If excessive fuel leakage is noted, the receiver pilot should notify the tanker operator immediately, retard throttle to idle and disengage from the tanker. If the IFR probe valve continues to leak excessive fuel after disengagement, full right rudder should be applied until the valve has fully closed. This will tend to cause the fuel to flow outboard of the engine intake ducts. Do not attempt further plug-ins unless low fuel state so dictates. Inspect the probe and drogue for malfunction after landing.

3. Breakaway is accomplished by the receiver reducing power in order to open from the tanker at about 3 knots. Back straight away and down, following the line of the trailing hose. Stay behind the drogue until all members of the flight are sighted. To facilitate this, it is necessary that all members of the flight properly maintain their position in echelon. When the receiver aircraft is clear of the area behind the hose and drogue, call "___, clear."

4. After breaking away, the leader will move to the opposite side of the tanker, where he will supervise the refueling, giving help as necessary. After the leader is clear of the drogue, the No. 2 man in the flight will move into position and make his plug-in. He will then disengage and join the leader in loose, outside echelon, as before. Each member in turn will make plug-ins and upon completion will move to the next position on the leader.

After Refueling

1. When all members of the flight have successfully completed the hookups and are clear of the drogue, the Flight Leader will signal to secure the store by moving the flight forward in echelon until the leader is again abeam the tanker, with at least 200 feet separation. When the tanker pilot observes the entire flight (and escort) in this position, he will retract the drogue and feather the air turbine. The Flight Leader (escort, if assigned) will indicate that the turbine is feathered by giving a "thumbs-up."

2. Upon completion of refueling, the Flight Leader should resume lead of his flight, breaking away from the tanker in an easy turn until well clear. The tanker maintains straight and level flight until adequate separation from the receiver aircraft is assured. To ensure safe separation, an altitude differential should be maintained.

MISSION REFUELING

Range and fuel specifics for mission refueling are covered in section XI, part 6 of this manual and in NAVAIR 01-40AV-1T and supplement.

NIGHT FLYING PROCEDURES

Night flying procedures are identical to day procedures with the exception given below. Night lighting doctrine is contained in section III.

Night Rendezvous

Rendezvous at night are similar to daytime, except that in the final portion the pilot should try to close to a position slightly astern rather than directly toward the plane ahead. Pilots must be sure not to carry excess airspeed in the rendezvous. The leader must maintain a constant airspeed and altitude. Whenever it is necessary for a pilot to go to the outside of the rendezvous, he will report this to the Flight Leader. Stay on the outside of the rendezvous until the remaining members of the flight have rendezvoused and then add power as necessary to join up. Pilots joining from astern will move out to the side to enhance their judgment of closure rates, as well as to ensure safe clearance.

Night Formation

It is important to maintain the correct bearing so that the wingman can be seen by the leader. Ensure that wingtip clearance is maintained at all times. The pilot should not fly so close that he feels uncomfortable. Avoid staring at the aircraft ahead and getting fixation on its lights. Turns will be made as in instrument conditions, by rolling around the leader's axis.

Where no light signal exists for a certain maneuver, the radio should be used. Speedbrake signals may be given on the radio by transmitting "flight, speedbrakes-now." Channel changes will be given on the radio and should be acknowledged before and after making the shift.

Night Refueling

Night refueling is performed in essentially the same manner as during the day. The tanker should have all lights on BRT and STDY, except the anticollision lights. The buddy-store lights should be on DIM. The tanker lights illuminate enough of the tanker and the drogue to allow the receiver pilot sufficient light for the approach lineup. The receiver pilot should request adjustment of the tanker lights to meet his requirements.

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 the receiver pilot sensing the tanker's jet-wash on his vertical stabilizer. The receiver-aircraft lights should be on BRT and STDY. The receiver's probe light and/or fuselage light will provide sufficient illumination to see the drogue from 10 to 20 feet aft. The tendency in night air 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.

BANNER TOW TARGET OPERATION

Refer to NAVAIR 01-40AV-1T.

HYDRAULIC POWER DISCONNECT WITH ASYMMETRIC LOADINGS

Disconnect tests should not be performed with asymmetric loadings. However, in the event that an actual hydraulic power disconnect must be made with asymmetric wing or store loadings, the following recommendations are made:

1. Speed must be reduced to less than 200 KIAS prior to disconnecting.

2. After disconnect, excessive longitudinal stick motions must be avoided.

e. Crosswind landings must be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing.

4. Recommended approach airspeed is 140 KIAS with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control speed is 115 KIAS with hydraulic power failure and up to 7500 foot-pounds asymmetric moment.

SECTION V
EMERGENCY PROCEDURES

TABLE OF CONTENTS

GENERAL

The course of action a pilot will take when faced with an emergency situation is based upon his knowledge of the aircraft and emergency procedures. For this reason, initial training must be thorough in these areas, but should not be considered complete.

Aircraft systems and procedures must be frequently reviewed on a regular basis. Periodic emergency drills in OFT/WST are ideally suited for realistic simulation of almost all emergencies that might be experienced. Above all, the pilot must be able to recognize emergency situations, analyze the possible courses of action, select the best course to follow, and then take the action necessary in accordance with the procedures of good airmanship.

1. NWP 41 (series) and supplements contains general considerations which are applicable in various emergency situations.

2. NWP 37 (series) discusses SAR organization and procedures.

3. The FLIP Enroute Supplement covers current procedures for two-way radio failure VFR-IFR, recommended procedures for any emergency phase (uncertainty, alert, distress, lost), and procedures for use with a rescue interceptor, both day and night.

4. Operation plans and orders of carrier-force Commanders and Commanders of other forces employing aircraft contain provisions for handling aircraft in distress and for rescue of personnel.

5. When an emergency is experienced while operating in the continental limits of the United States, the IFF MASTER knob will be turned to the EMER position unless otherwise directed by competent authority. When EMER position is selected, MODE 3/A is coded to 7700 automatically.

This chapter contains the specific step-by-step procedures to be used for all emergencies likely to be encountered. Use it as the primary guide for studying remedial procedures for various emergencies. The information contained in other sections of this manual must be used to provide additional knowledge of systems operation and malfunctions.

In general, the emergencies a pilot will encounter fall into one of four categories: ground emergencies, takeoff emergencies, in-flight emergencies, and landing emergencies. It is likely that most emergencies will require some deviation from the procedure set forth for a simple failure, because of varied conditions; i.e., compounded emergencies, facilities available, weather factors. Consequently, thoughtful analysis of each situation is necessary, and the selection of the course of action to be taken rests with the pilot.

GROUND EMERGENCIES

ABNORMAL STARTS

Hung Start

A hung start condition exists when engine appears to light-off normally, rpm stabilizes at some point below IDLE (usually 40 to 45 percent), and exhaust gas temperature (EGT) continues to rise toward maximum temperature limits. Upon determining that a hung start exists, immediately move throttle to OFF. Continue windmilling the engine with the air starter to cool turbine section and clear engine. Before attempting another start, determine that the compressor/turbine is turning freely. If the second start attempt results in a hung start, no additional starts shall be attempted until a thorough investigation has been made to determine the cause.

Hot Start

Any start during which the EGT exceeds 445°C is a hot start. If the starting limit seems likely to be exceeded, immediately move the throttle to OFF.

Note

Continue cranking the engine using the air starting unit.

Before attempting another start, have a crewmember check the overboard drain to make sure that fuel has drained completely from the combustion chamber.

Note

- If EGT exceeds 445°C five times, or reaches 530° to 565°C for 5 seconds or longer, engine must be subjected to an overtemperature inspection. An EGT exceeding 565°F for any period of time will require a teardown inspection of all hot section parts.
- Log duration and peak temperature for each start during which EGT exceeds 455°C.

False Start

When the engine lights-off normally and EGT remains in limits but the rpm does not increase to IDLE and remains at some lower rpm, a false start is indicated. When this occurs, or if the time from light-off to IDLE exceeds 120 seconds, retard the throttle to OFF and secure the starting air. Have the ground crew investigate the cause of the false start prior to making another starting attempt.

Wet Start

A wet start will occur when engine light-off is not obtained within 15 seconds. When this occurs, there will be no EGT indications and fuel vapor will emit from the tailpipe. When it has been determined to be a wet start as indicated to the pilot by ground personnel, the following should be accomplished.

Retard the throttle to the OFF position, being careful not to actuate the igniters. Proceed with CLEAR ENGINE PROCEDURE.

Clear Engine Procedure

To clear the engine of excess fuel after abnormal starts:

1. Throttle . . . . OFF
2. Depress the engine starter switch, or signal ground crew to continue applying air to the engine.
3. Windmill the engine until ground personnel ascertain that the engine is clear of excess fuel.
4. Secure the starting air.

CAUTION

Upon experiencing a wet start, determine that no residual fuel remains in the combustion chamber or tailpipe before attempting another start. If residual fuel is evident and a period of time has elapsed, a close inspection must be made to ensure that no fuel has seeped under the tailpipe heat blanket before restart is attempted.

ENGINE FIRE DURING START

1. Throttle . . . . OFF
2. Manual fuel shutoff valve . . . . EMER OFF
3. Apply starting air.
4. Allow starter to windmill the engine until fire has disappeared.
5. If fire is not promptly extinguished, fire guard should apply CO_2 to engine intake duct.
6. If fire persists (or if no starting unit is available), abandon aircraft.

WING OR ACCESSORY SECTION FIRE

If ground personnel determine that fire is in the wing or accessory section, they should signal to the pilot to abandon the aircraft, apply CO_2 to the fire, and assist in the pilot's egress as much as possible. Before abandoning the aircraft, the pilot should perform the following:

1. Throttle . . . . OFF
2. Manual fuel shutoff valve . . . . EMER OFF
3. Secure starting air.

BRAKE FAILURE DURING TAXI

1. Engage nosewheel steering to maintain directional control.
2. Notify control tower.
3. In event of single-brake failure, use remaining brake and nosewheel steering to maintain directional control and to stop aircraft as required. Groundloop, if necessary, to remain on taxiway or flight deck.
4. Throttle OFF.
5. Retract landing gear only as last resort to stop aircraft.

Note

- The landing gear handle safety solenoid must be actuated manually to move handle to UP position.
- The hook may be dropped at any time and nosewheel steering will be retained by actuating the nosewheel tailhook bypass switch, located on the control stick (figure 1-9).
- If the engine is shut down, nosewheel steering will be lost.

HOT BRAKES

1. When excessive braking has occurred (such as after an aborted takeoff), or hot brakes are suspected, notify the tower to alert the crash crew and to inform other personnel to stand clear. A dragging brake will also produce excessive heat at the wheel. In each case, the amount of heat will vary. A badly dragging brake (indicated by necessity of RPM in excess of IDLE to maintain taxi speed) could raise wheel temperatures to a point where a normal takeoff would heat the wheel enough to produce an explosive failure.

2. Taxi the aircraft to the hot-brake area. If no specific hot-brake area has been designated, taxi the aircraft clear of the duty runway and taxiways in use. Park so that the wheel axle points toward the clear area. Allow a minimum of 45 minutes for brakes to cool prior to moving.

3. If operational necessity requires immediate takeoff, leave the landing gear extended at least 3 minutes after takeoff to provide sufficient cooling of the wheel assembly to prevent explosive failure. Refer to NAVAIRINST 13420.1 series for additional information on this subject.

TAKEOFF EMERGENCIES

JETTISONING OF STORES

Jettisoning stores should be considered in situations where a successful takeoff becomes questionable if continued in present configuration. Such situations might include blown tires, loss of directional control where runway departure prior to arresting gear seems likely, flap creep, improper or runaway trim settings, etc. With a properly operating engine and airspeed at or above that required for liftoff in a clean configuration, stores should be jettisoned and takeoff continued.

CAUTION

Avoid contacting the landing gear handle when using the emergency bomb release handle. A landing gear handle guard malfunction may result in raising or lowering of the landing gear.

Stores may be jettisoned using either main or emergency generator power. Select the desired position on the EMER SEL switch and pull the emergency bomb release handle.

NOSE GEAR STEERING FAILURE

1. Release stick control button.
2. Place nosewheel switch to EMER OFF.

FLAPS UP TAKEOFF

Half flaps are recommended for all field takeoffs. However, in the case of flap malfunction or the inadvertent leaving of the flaps in the up position, it is possible to safely complete the takeoff, provided the flaps-up takeoff speed does not exceed the safe tire limit of 175 knots ground speed.

A flaps-up takeoff may be accomplished by increasing the half-flaps takeoff speed (figure 11-6) from 7 knots at 18,000 pounds to 9 knots at 24,500 pounds. This increase in takeoff speed results in an increase in ground run distance over that shown in figure 11-6 of from 200 to 400 feet.

Caution must be exercised when attempting a flaps-up takeoff in order that the safe tire speed limit of 175 knots ground speed is not exceeded. This restriction is, in effect, a limit on the maximum weight at which a flaps-up takeoff may be safely completed. This maximum weight is that weight at which the flaps-up takeoff speed is 175 knots ground speed.

ABORTING TAKEOFF

There are many circumstances that may require aborting a takeoff. Some of these circumstances are unacceptable engine acceleration check, less than normal takeoff EPR/EGT/RPM, illumination of fire-warning light, runaway nosedown trim, loss of oil pressure, fuel-transfer light ON, smoke in the cockpit, abnormally slow aircraft acceleration to takeoff speed, blown tire, and loss of canopy. To successfully abort a takeoff, the pilot must be aware of the location of airfield facilities that may be at his disposal. Effects of wind component must be considered. A takeoff shall be aborted by use of arresting gear when available, unless it is certain the aircraft will be stopped on the remaining runway by normal braking with drag chute and spoilers deployed. The procedure for takeoff abort are considered relative to takeoff refusal speed.

1. When aborting after brake release and before takeoff refusal speed, the following procedures should be used:

   a. Throttle to IDLE

Note

In all A-4 aircraft best deceleration will occur by placing the throttle to IDLE until below 80 KIAS and then by placing the throttle to OFF.

   b. Drag chute DEPLOY (if required)

   c. Speedbrakes OPEN

   d. Ensure spoilers ARMED

   e. Stick forward

   f. Simultaneously with above steps, broadcast "(identification) aborting takeoff," to warn following aircraft and tower.

   g. Flaps as set

   h. Braking as required

Note

Do not blow the tires. Maximum braking is required at takeoff refusal speed. For maximum braking apply forward stick followed immediately by moderately heavy application of brake pedal pressure. Maintain steady braking throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

   i. Nosewheel steering may be used to keep the aircraft lined up with the runway centerline or return it to the centerline. If the aircraft engine is secured, nosewheel steering will become immediately inoperative due to loss of electrical power.

j. Hook DOWN 1000 feet prior to arresting gear, if required.

WARNING

If off-center just prior to engaging arresting gear, do not attempt to go for center of runway. Continue straight ahead parallel to runway centerline.

2. When aborting after takeoff refusal speed, and if abort gear is available, the following procedures should be used:

a. Throttle to IDLE

Note

Best deceleration will occur by placing the throttle to IDLE until 80 KIAS and then by placing the throttle to OFF.

b. Drag chute DEPLOY

CAUTION

- After throttle has been retarded and engine is at a low rpm, drag chute damage may be lessened and aircraft deceleration enhanced by timely deployment of the drag chute.
- The drag chute should be used to decelerate the aircraft when aborting. If use of maximum braking, drag chute, spoilers, and securing engine at 80 KIAS will not stop or slow aircraft to safe taxi speed on remaining runway, drop hook 1000 feet prior to arresting gear and make a roll-in type field arrestment.

c. Hook DOWN 1000 feet prior to arresting gear

WARNING

If off-center just prior to engaging arresting gear, do not attempt to go for center of runway. Continue straight ahead parallel to runway centerline.

d. Ensure speedbrakes OPEN, spoilers ARM, stick forward, broadcast warning and apply brakes, if possible.

3. If aborting after exceeding takeoff refusal speed where abort gear is not available or if the hook skips the arresting gear, decide whether to eject or remain with the aircraft. The decision to eject if the aircraft is leaving the runway or overrun must be made with consideration to speed and the nature of the surface onto which the aircraft will go.

ABORTING A SECTION TAKEOFF

To avoid a collision in a section by an aircraft aborting a takeoff requires aircraft separation prior to extending the hook and aligning the aircraft on the runway centerline for the engagement of the arresting gear.

MAXIMUM BRAKING PROCEDURE

When the nosewheel is firmly on the runway and excessive crosswind does not exist, immediate moderately heavy braking should be applied. Steady braking (or pumping brakes once if pressure is low or lost) should be maintained throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

If excessive crosswind exists, apply full aileron deflection into the wind concurrent with full forward stick. Apply opposite rudder as required to maintain straight tracking down the runway. Braking can then be applied as described above if the wings are level. If the wings are not level, brake pedal pressure on the upwind side should be reduced to prevent tire blowout. External stores on the aircraft help stabilize the aircraft in crosswind conditions and allow heavier braking than a clean configuration aircraft.

BLOWN TIRE ON TAKEOFF

If a tire blows on takeoff, the pilot must decide whether to abort or continue the takeoff. The following generalities are pertinent:

1. If a tire blows early in the takeoff roll before a moderate amount of rudder effectiveness is available (about 70 KIAS), the takeoff should be aborted. Below 60 KIAS, maintain directional control using nosewheel steering or brakes.

2. At high gross weights where takeoff distance utilizes most of the runway, increased drag of the

blown tire may preclude successful takeoff. Abort the takeoff at any airspeed if arresting gear is available and if it is apparent that lift-off cannot be accomplished prior to reaching the end of the runway.

3. If a successful takeoff is made with a blown main or nose tire, after airborne, delay retraction of the landing gear until rotation has ceased. If possible, obtain a visual check of tire by another aircraft to determine whether retraction can be safely accomplished without the wheel hanging up in the wheel well. Usually, the tire will be hot, and a minimum of 3 minutes should be allowed with the gear extended to permit the tire to cool.

4. The braking effectiveness of a blown tire is less than that of a tire in good condition. Consequently, to deliberately blow a good tire to "balance" another that has blown is not good procedure.

RUNAWAY NOSEDOWN TRIM

If unable to rotate the nose to a takeoff attitude 5 knots below the predicted takeoff airspeed, the pilot must decide whether to abort, apply corrective noseup trim (using the manual override), or eject. Foresight can prevent this situation. Use the takeoff checkoff list on the instrument panel immediately prior to takeoff roll and glance at the trim indicators when approaching lift-off distance. An added precaution is to ensure that the stick is grasped in a manner that the trim button cannot be moved inadvertently.

ENGINE FAILURE DURING TAKEOFF

If engine failure is suspected during takeoff, ascertain that the throttle is at MILITARY. Improper adjustment of the throttle friction may allow the throttle to retard, thereby giving the impression of engine failure. In the event of a confirmed engine failure, fire, or structural failure, abort the takeoff, as above. If the aircraft cannot be stopped on the runway remaining, or if airborne, EJECT. The decision to eject if the aircraft is leaving the runway or overrun must be made with consideration to speed and the nature of the surface onto which the aircraft will go.

ENGINE FAILURE DURING CATAPULTING

In the event of a confirmed engine failure during catapulting, EJECT. If unable, ditch the aircraft straight ahead in a nose-high (but not in a stalling) attitude to prevent diving after contact with the water. Accomplish the following, if time permits:

1. Landing gear handle . . . . UP
2. Emergency bomb release . . . . PULL
3. Throttle . . . . OFF
4. Canopy jettison handle . . . . PULL
5. Remain braced until all shocks stop.
6. Emergency oxygen ring . . . . PULL
7. Harness release handle . . . . PULL

Refer to Ditching and Underwater Escape.

ENGINE FAILURE AFTER TAKEOFF

If the engine fails after the aircraft becomes airborne and insufficient runway remains to make a safe landing, convert excess airspeed to altitude. Buffet onset indicates attitude which will provide maximum altitude gain. Ensure that power loss is not due to inadvertent retarding of the throttle because of insufficient throttle friction. If time permits, extend emergency generator and jettison external stores. EJECT at or just prior to the peak altitude while the aircraft is still ascending. If unable to eject, accomplish as many of the following as possible.

1. Throttle . . . . OFF
2. Landing gear . . . . UP, IF INSUFFICIENT RUNWAY REMAINS FOR LANDING
3. Emergency generator . . EXTEND
4. Emergency bomb release handle . . . . PULL
5. Flaps . . . . AS SET
6. Manual fuel shutoff valve . . . . EMER OFF
7. Land straight ahead . . . (REFER TO FORCED LANDINGS.)

JATO BOTTLES FAILURE

If the JATO bottles fail to fire, either continue the takeoff or abort as determined from the takeoff charts in section XI. If the JATO bottles cannot be jettisoned after takeoff, continue mission if operational situation warrants, or dump down below maximum permissible landing gross weight and land.

RETRACTION SAFETY SOLENOID INOPERATIVE

To raise the gear with the retraction safety solenoid inoperative:

1. Obtain visual check of main landing gear mounts to ensure proper strut extension.

CAUTION

Retraction safety solenoid failure may result if the left main mount is not fully extended. If an attempt is made to raise the landing gear when this solenoid failure occurs, the tire and wheel assembly may hang up, resulting in a wheels-up landing. Retraction safety solenoid failure may also result from inadvertent emergency generator extension, dc converter failure, or microswitch failure.

2. Release landing gear control lock and rotate gear handle toward UP position.

3. Move retraction release switch aft and simultaneously raise gear handle to full UP position.

UNSAFE GEAR-UP INDICATION

Gear indications of UNSAFE, after gear retraction cycle is completed, are usually caused by faulty microswitches, failure to remove the landing gear safety pins, or in the case of the nose gear, possibly by nose strut overinflation. For unsafe condition, proceed as follows:

Main Gear Unsafe or Down, Gear Handle up

1. Maintain 225 KIAS or less.

2. Cycle gear in attempt to obtain UP indication.

3. If unable to obtain UP indication by cycling, have other aircraft or ground personnel visually check main gear. Continue mission if gear doors are closed and flush with aircraft. Otherwise, dump excess fuel and land.

Nose Gear Unsafe or Down, Gear Handle up

1. Maintain 225 KIAS or less.

2. Have other aircraft or ground personnel visually check nose gear to determine whether nose gear door is closed and flush with aircraft. Cycle gear, if door is reported to be closed, in attempt to obtain UP indication. Continue mission.

3. If a visual check cannot be made, lower gear as soon as practicable, dump excess fuel and land. Do not cycle gear.

4. If visual check indicates that nose gear is not fully retracted or that nosewheel door is not fully closed, do not cycle. Lower gear as soon as practicable, dump excess fuel, and land.

FLIGHT CONTROL DISCONNECT

If a flight control disconnect has occurred, greater than normal stick forces will be required to counteract the positive pitching moment at takeoff. Leave the flaps down to reduce trim changes, and use longitudinal trim as required to control the aircraft. Do not let angle of attack become too high. Comply with the procedures for a flight control disconnect.

Partial Disconnect of Elevator Power System

The hydraulic flight control power system will not disconnect in flight unless the pilot pulls the manual flight control (MAN FLT CONT) T-handle or the elevator hydraulic power system is partially latched. A partially latched condition can result only from improper resetting of the elevator power mechanism after a disconnect or from the release cable being inadvertently pulled, especially when working through the lower engine access doors. A partially latched condition of the elevator hydraulic power mechanism will not be detectable from stick response prior to flight. Air loads on the elevator can cause partial disengagement of the elevator power cylinder at or shortly after takeoff. Partial disengagement of the power cylinder causes loss of the elevator hydraulic flight control in the nose down direction only, without shifting to the manual mode.

With a partial elevator power disconnect the aircraft will be flyable, but forward elevator control is not available. Neutral or in-trim position of the stick will be aft of normal stick position. Forces to move the stick forward of neutral will be markedly higher, but forces will be normal for stick motion aft of the neutral point. Full nose down trim will be needed to minimize the strong nose-up tendency of the aircraft. A climb should be established leaving the flaps down to increase the aircraft's nose down trim while adjusting power to maintain a safe flying speed.

WARNING

Pulling the manual flight control T-handle with a forward force on the stick will prevent complete shifting of the elevator power mechanism to the manual flight control mode.

The hydraulic power system should be disconnected after reaching a safe altitude by sharply pulling the manual flight control T-handle without any force on the control stick.

The flight control hydraulic power system should not be disconnected with a hydraulic system functioning if the flight controls appear to be jammed or malfunctioning in some other manner than the partial elevator power system disconnect described above.

IN-FLIGHT EMERGENCIES

ENGINE MALFUNCTIONS

Chugs and Stalls

Possible causes are icing, PRIMARY fuel control failure, rapid engine acceleration while operating at excessive angle-of-attack at high altitudes, adding throttle too fast while operating in MANUAL fuel control, or malfunctioning compressor bleed valve control.

1. Reduce power as necessary to regain normal operation. If chugs/stalls persist, decrease angle-of-attack and increase airspeed if possible. If this is ineffective, shift to MANUAL fuel control.

2. If icing is suspected turn on engine anti-icing system, shift to MANUAL fuel control, and change altitude, if possible.

3. If stalled condition persists, secure engine and perform air start.

4. If chug/stall is pilot induced and no other adverse symptoms are apparent, continue the flight, but record the circumstances upon return.

RPM/EGT Malfunctions

Fluctuating rpm not corresponding to similar indications of fuel flow, EPR, or EGT should be assumed to be a faulty tachometer system. Use airspeed and throttle position for power reference if rpm is unreadable. If fuel flow or EGT is also fluctuating, assume a PRIMARY fuel control malfunction and shift to MANUAL fuel control.

Fuel flowmeter, EGT, or EPR fluctuations should be treated similarly; i.e., unless engine performance is determined to be erratic from more than one source, assume an instrument error. Otherwise, shift to MANUAL fuel control.

Engine Overtemping

During climbs or sustained operations at MILITARY power, minor engine overtemping (5°C or less) may occur. This overtemping should be controlled by reducing rpm slightly to maintain EGT within limits. If overtemping recurs at the reduced RPM or is in excess of 5°C, land at the nearest suitable landing facility as soon as possible unless other action is indicated.

Fuel-Boost Pump Failure

With an inoperative boost pump, gravity flow of fuel to the engine-driven fuel pump provides an adequate supply of fuel for all power conditions up to 6000 feet and for continued operation at reduced rpm at higher altitudes.

Note

There have been repeated instances of successful full power operation at 35,000 feet.

When the boost pump fails, reduce throttle to minimum required. Avoid zero g, negative g, or inverted flight. Ensure positive g during speedbrake operation.

Throttle Linkage Failure

No provisions are incorporated for automatic positioning of the fuel control in the event of throttle linkage failure. The engine may accelerate to MILITARY, remain as is, retard to IDLE, or flame out. If the throttle linkage breaks and the engine rpm permits continued flight, attempt a precautionary approach modified as necessary. If it becomes necessary during flight or after touchdown, secure engine using the manual fuel shutoff control lever. The time from actuation of the control lever until the engine shuts down will be approximately 4 seconds.

Loss of Thrust

Possible causes are inadvertent reduction of throttle, broken throttle linkage, PRIMARY fuel control failure, or icing.

1. Check throttle for position and engine response.

2. Shift to MANUAL fuel control unless other action is indicated. (See Fuel Control Malfunctions.)

3. If icing is suspected turn on engine antiicing system, shift to MANUAL fuel control, and change altitude if possible.

4. If flameout occurs, secure engine and perform air start. (Refer to Air Start.)

5. For loss of thrust occurring under low altitude/high airspeed conditions, refer to Low Altitude Loss of Thrust/Flameout.

Low-Altitude Loss of Thrust/Flameout

When loss of thrust occurs under low-altitude/high airspeed conditions, the heavy demands on the pilot in the brief time available make it difficult to determine whether flameout has occurred, or whether the engine is still running at, or near, IDLE. Because of this and the fact that time available usually precludes a complete AIR START, the following procedure is recommended.

1. Commence zoom climb.

2. Switch fuel control to MANUAL.

3. Hit igniters and return throttle to IDLE.

4. Cautiously advance throttle and ascertain restoration of thrust.

5. If engine fails to respond adequately, and peak altitude at zoom apex is less than 5000 feet, EJECT. If time and altitude permit, establish 250-KIAS glide and commence AIR START procedures.

Fuel Control Malfunctions

A malfunction of the fuel control unit may result in fluctuating rpm and exhaust temperature, a sudden drop on the fuel flow indicator, or a complete loss of power. When any of these occur, proceed as follows:

1. Throttle . . . . MATCH WITH RPM

2. Fuel control switch . . . . MANUAL

Note

If a shift from MANUAL to PRIMARY is made, perform the shift between 80 to 85 percent rpm to minimize the risk of flameouts and to prevent possible compressor stall when switching.

3. Advance throttle slowly and smoothly to desired power setting.

CAUTION

Do not reset fuel control to PRIMARY after air start unless flameout is known to have been caused by other than engine fuel system malfunction. Operate throttle cautiously so as not to exceed rpm and temperature limitations when operating in MANUAL. If shift from MANUAL to PRIMARY is made, perform the shift between 80 to 85 percent rpm to minimize the risk of a flameout.

Abnormal Oil Pressure

If abnormal or significant changes in oil pressures are noted, gradually adjust engine rpm to the minimum required for level flight to the nearest suitable landing facility and execute a precautionary approach to landing. The reduction of engine rpm below that required for level flight is not recommended until landing on the runway is ensured, or until the decision is made to eject. Increased engine friction may prevent the engine from accelerating once the throttle has been retarded. With a bearing failure, operation at very low power settings may hasten engine seizure.

Note

- Maneuvers producing acceleration near zero "g" may cause a temporary loss of oil pressure. Absence of oil pressure is permissible for a maximum of 10 seconds.
- Electrical power failure causes the oil pressure gage to be inoperative. Deploying the emergency generator should correct this condition.

Low Oil Quantity

If the oil quantity light (OIL LOW) comes on during flight, abort the flight using a precautionary approach to landing at the nearest suitable landing facility.

Engine-Driven Fuel Pump

When the engine-driven fuel pump fails, a flameout will occur and no relight is possible.

ENGINE FAILURE

Symptoms of imminent engine failure, singly or in combination:

1. Loss of thrust not due to throttle movement or icing.

2. Fluctuating rpm, EGT, and EPR not eliminated by shifting to MANUAL fuel control.

3. Abnormally high EGT in relation to engine rpm.

4. Oil pressure dropping, or less than 40 psi.

5. Abnormal vibration, or loud or explosive sounds apparently emanating from the engine.

If any of the above symptoms appear, gradually adjust power to the minimum rpm required for level flight and land as soon as possible, executing a precautionary approach, at the nearest suitable landing facility.

Procedure on Encountering Engine Failure

FLAMEOUT. When engine failure occurs, quickly retard the throttle. The engine might run at some reduced thrust setting if the throttle is retarded to a point at which the engine is "caught" before engine flameout occurs. When the loss of thrust cannot be prevented by this action, proceed as follows:

1. Throttle .... OFF

2. Emergency generator .... EXTEND

3. Check for evidence of fire. (Refer to Fire.)

4. If fire is present or existed prior to shutdown, do not attempt to restart engine. (Refer to Ejection.)

5. If no fire exists, start the engine as described in Air Start.

Low-Altitude Airstart

Refer to Low-Altitude Loss of Thrust/Flameout.

Airstart

1. Throttle .... OFF

2. Emergency generator .... EXTEND

Note

Ensure NORMAL/BYPASS switch is in NORMAL position.

3. Fuel control switch .... PRIMARY/MANUAL

Note

- Unless fuel control malfunctions exist, airstarts may be made with PRIMARY fuel control selected.
- Avoid negative g flight to prevent air being trapped in the engine-driven fuel pump inlet.

4. If practicable, descend to 30,000 feet or below, at best glide speed (figure 5-2).

Note

Successful airstarts can be obtained at any airspeed and altitude combination within the prescribed airstart envelope of figure 5-1. Mild compressor stalls are likely at both the low and high speed portions of the envelope above 30,000 feet; however, the stalls are self clearing and cease by the time 50-percent RPM is obtained.

5. Establish 250 KIAS glide.

6. Throttle .... IGN then IDLE

7. Monitor RPM and EGT.

8. If relight does not occur in 30 seconds, retard throttle to IGN position, then return to IDLE.

CAUTION

Do not reset fuel control to PRIMARY after airstart unless flameout is known to have been caused by other than engine fuel control malfunction. Use caution when operating with fuel control in MANUAL to preclude exceeding engine limitations. If shift from MANUAL to PRIMARY is made, perform shift between 80 to 85 percent RPM to minimize risk of flameout.

MAXIMUM GLIDE ENGINE WINDMILLING (EMERGENCY GENERATOR EXTENDED). The recommended speed for maximum gliding range is approximately 200 KIAS for gross weights up to 14,000 pounds, clean configuration, and altitudes up to 45,000 feet. See figure 5-2 for approximate gliding ranges from various altitudes. For each 1000-pound increase over 14,000 pounds, increase airspeed by 5 knots. The maximum gliding range angle of attack is 10.2 units without stores and 11.2 units with wing stores.

FIRE

Engine Fire

Illumination of the FIRE warning light is usually the first indication of fire or overheat condition in the engine compartment or tail section. The pilot should be alert for corroborating evidence that a fire actually exists before executing any drastic emergency procedure based on illumination of the FIRE warning light.

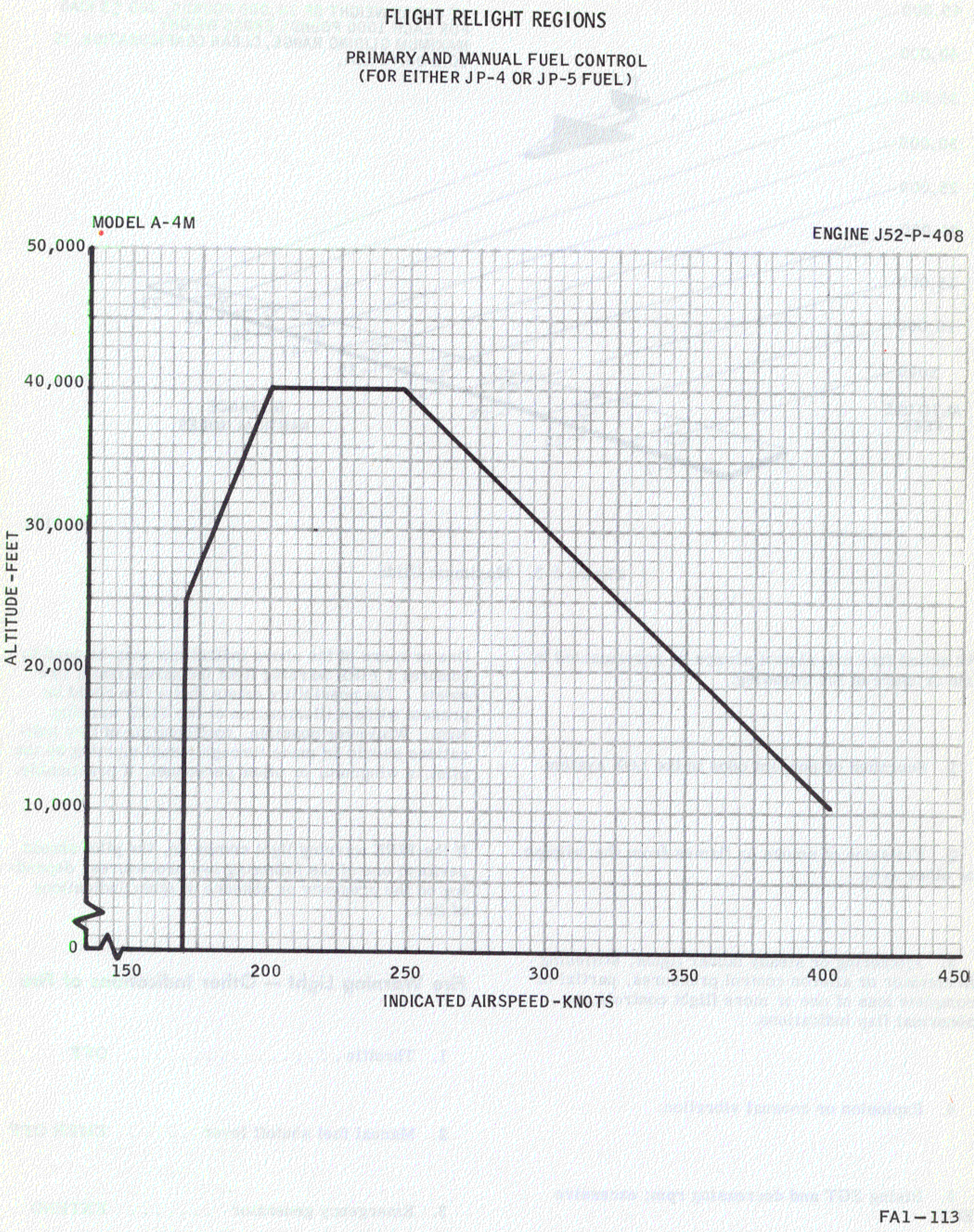


Figure 5-1. Flight Relight Regions

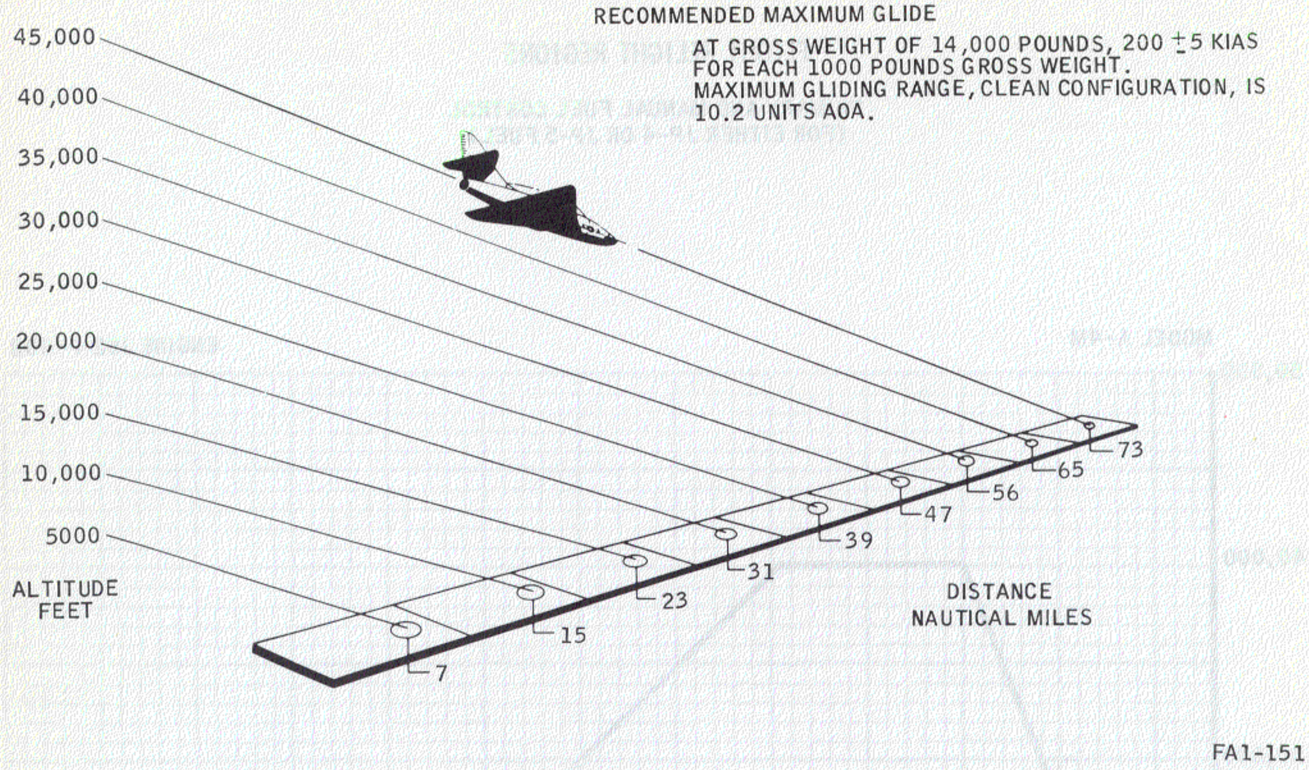


Figure 5-2. Maximum Glide

An actual fire will almost always be accompanied by one or more of the following:

1. Scorched or pungent odor in the LOX system.

2. Emission of smoke or flames from the tailpipe or other area.

3. Flickering or steady ladder lights, stiffening in elevator or aileron control pressures, partial or complete loss of one or more flight controls, or abnormal flap indications.

4. Explosion or unusual vibration.

5. Rising EGT and decreasing rpm; excessive EGT.

One or more of the above indications may be used to confirm a FIRE warning light indication that a fire exists. The possibility exists that a fire could be present without illumination of the FIRE warning light. Whenever possible, confirmation of fire indications should be made through visual sighting by the pilot, a wingman, or other personnel, if practicable.

If the FIRE warning light comes on, the pilot should perform one of the following two procedures, depending on the presence or absence of other indications of fire.

Fire Warning Light — Other Indications of Fire

1. Throttle . . . . OFF
2. Manual fuel shutoff lever . . . . . EMER OFF
3. Emergency generator . . . . EXTEND

4. If the fire is extinguished by moving the throttle to OFF and cutting off the fuel supply to the engine, as evidenced by the FIRE warning light going off and the disappearance of other indications of fire, do not attempt to restart the engine. Depending on the sequence of events and indications, immediate ejection may be indicated. However, the pilot must decide when to eject, taking into consideration aircraft altitude, attitude, airspeed, and condition; weather; chances for improving rescue/survival environment by gliding toward land or a ship; and other factors. (Refer to Ejection.)

Fire Warning Light — No Other Indications of Fire

1. Throttle . . . . minimum required for flight

2. Be alert for other indications of fire. Whenever possible, have wingman or other personnel visually check for smoke or flames. If no one is available to make this check, the pilot should bank the aircraft and observe his flight path for smoke. If fire is confirmed, proceed as outlined in Fire Warning Light — Other Indications of Fire.

3. If there is no other indication of fire, it is most likely that a false FIRE warning light indication exists.

4. Land as soon as possible at the nearest suitable landing facility. If there is any evidence that a fire actually exists, shut down engine immediately after touchdown. Move manual fuel shutoff control lever to EMER OFF. Abandon aircraft as soon as the aircraft comes to a stop.

Wing Fire

A fire in the wing could be caused by either fuel leakage or defective electrical wiring.

1. Jettison all combustible external stores.

2. Follow procedure for electrical fire, if indicated.

3. If fire continues to burn or is obviously fuel-fed, EJECT.

Electrical Fire

When a fire seems to be electrical in origin proceed as follows:

1. Turn OFF all electrical equipment.

2. If fire persists, extend emergency generator.

3. If fire is extinguished, turn ON only necessary equipment, one at a time. If offending circuit is again energized, secure it.

4. If fire cannot be extinguished in this manner, the pilot must decide whether to land as soon as possible or EJECT.

Note

Deployment of the emergency generator may deactivate the defective circuit.

Smoke or Fumes

There are several possible sources of smoke or irritating fumes in the cockpit:

1. Air conditioning system

2. Bleed-air line may not be connected to the g suit valve, or there may be an improper assembly of the valve.

3. Torn canopy seal

4. Bleed-air line may not be connected to the turn-and-slip indicator.

5. Electrical fire in the cockpit.

Note

Selecting RAM on the cabin-pressure switch will correct only the smoke or fumes from the first source listed, while all others will remain unaffected.

Elimination of Smoke or Fumes

1. Eliminate the possibility that smoke or fumes are mistaken for fog from the air conditioning system by increasing the temperature control to MAN HOT.

2. Select RAM.

3. If the smoke or fumes are not eliminated, lift the oxygen mask for a cautious smell. Do not inhale deeply because of the possible presence of oil fumes (Spec MIL-L-23699) which are highly toxic.

4. If the odor smells like burning or hot electrical insulation, proceed as in Electrical Fire.

5. If it is determined that the smoke or fumes are not electrical in origin, be alert for other evidence of fire. (Refer to Fire.)

6. If the smoke or fumes cannot be eliminated and so limit the vision that a safe landing could not be made, or if they are accompanied by excessive cockpit temperatures, jettison the canopy.

Note

Slow aircraft as much as possible prior to jettisoning canopy.

7. Land as soon as possible.

EJECTION

Ejection may be necessary as a result of fire, engine failure, structural failure, midair collision, or when the aircraft becomes uncontrollable. In each case, the pilot must decide when to eject, using the following as a guide:

1. Ejection is mandatory under the following conditions, except when unusual circumstances clearly indicate to the pilot that the cause of safety to himself and others will be better served by a flameout approach than by ejection.

Serious, uncontrolled fire.

If the aircraft is in uncontrolled flight at 10,000 feet AGL or below.

When engine flameout occurs below 1500 feet AGL and 250 KIAS.

If repeated relight attempts are not successful between 30,000 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.

Certain landing-gear configurations. (Refer to figure 5-17.)

2. If the engine flames out below 10,000 feet AGL, zoom to convert excess airspeed to altitude. Attempt an air start as time permits. If the peak altitude is above 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.

3. If the decision to eject is made at high altitude, it is recommended that the pilot eject at a minimum of 10,000 feet AGL, or higher, if conditions so indicate. (See figure 5-3.)

With the ESCAPAC 1C-3/1F-3 ejection seat ejection may be accomplished on the ground at zero airspeed and above, and at all other altitudes and airspeeds within the flight range of the aircraft (figures 5-4 and 5-5), except for abnormal flight conditions of steep angles of bank (or inverted flight and high rates of descent at very low altitudes). For all practical purposes, in predicting minimum terrain clearance altitude (figure 5-12) from the charts, dive angle and angle-of-bank chart altitudes are additive up to 60-degrees dive. In steeper dives, bank angle is negligible. The possibility of injury to shoulders and hips from flailing and wind-blast damage to personal gear, makes it imperative that the airspeed be reduced to 350 KIAS or less prior to ejection whenever possible. Inverted and severe yaw positions should be corrected, if feasible, prior to ejection, and every attempt should be made to reduce speed.

Usually, the pilot will have time enough to do several things to prepare himself for a successful ejection prior to pulling the face curtain. However, when the emergency condition requiring ejection is such that ejection must be made without hesitation, simply grasp the face-curtain handle (or alternate ejection handle) and pull forceably to the fullest extent until seat ejects.

Ejection Sequence

See figures 5-4 through 5-11 for ejection sequence and figure 5-13 for velocity decay.

Controlled Ejection

The following procedure is recommended, if time permits:

1. Throttle . . . . IDLE
2. Slow aircraft as much as possible.
3. Seat . . . . full down position
4. Emergency generator . . . . As required
5. IFF . . . . EMERGENCY
6. Transmit MAYDAY position report.

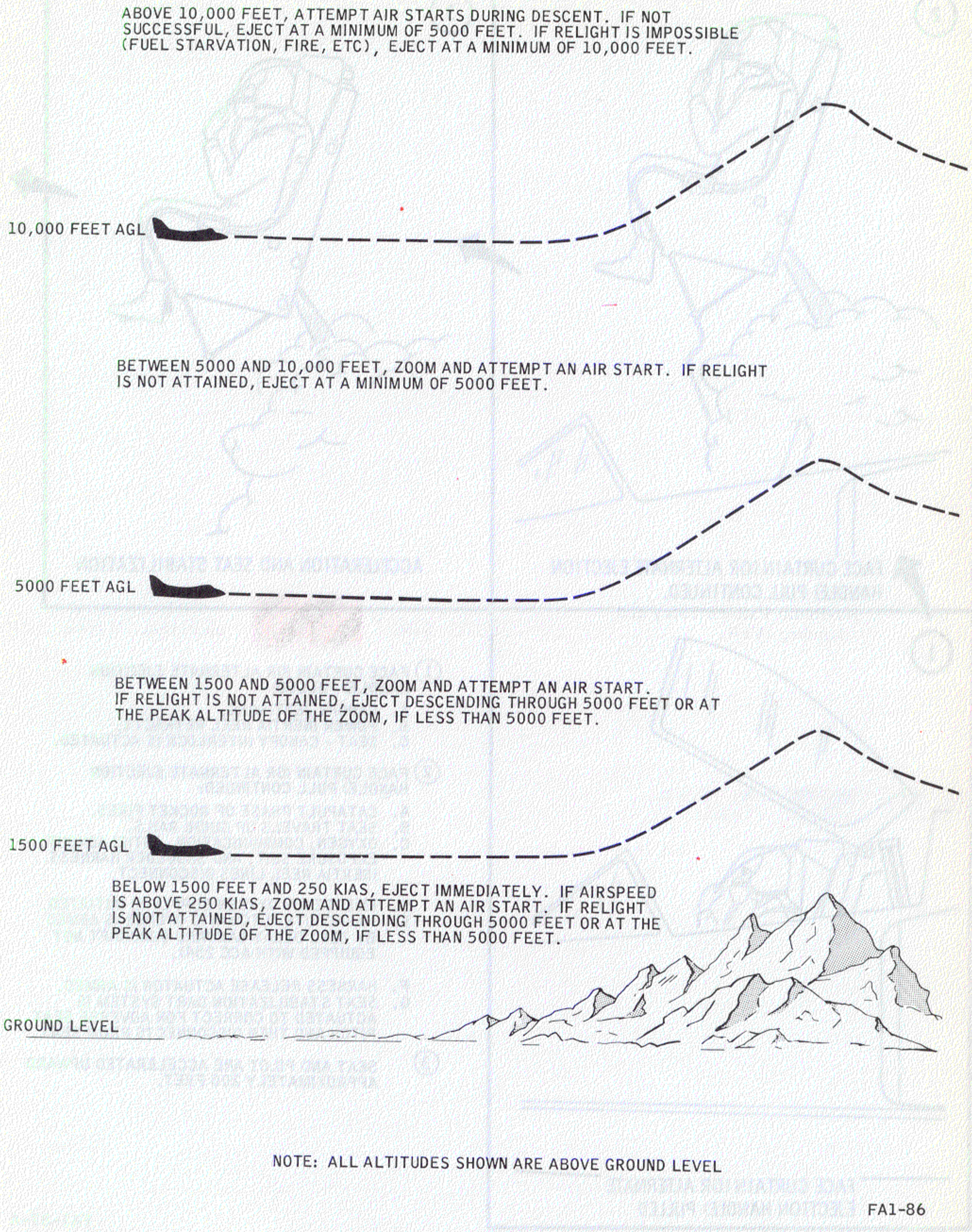


Figure 5-3. Summary of Flameout Action

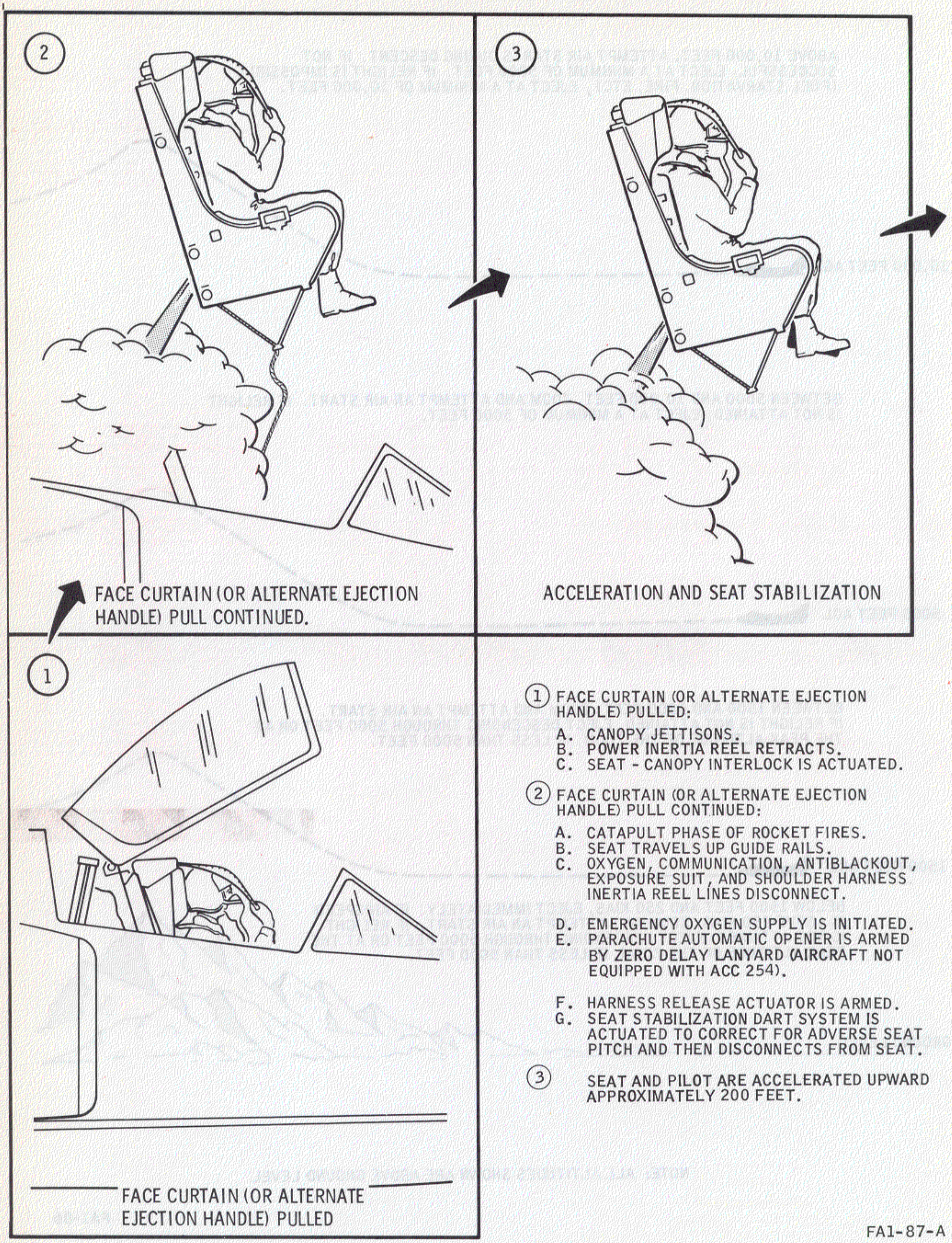
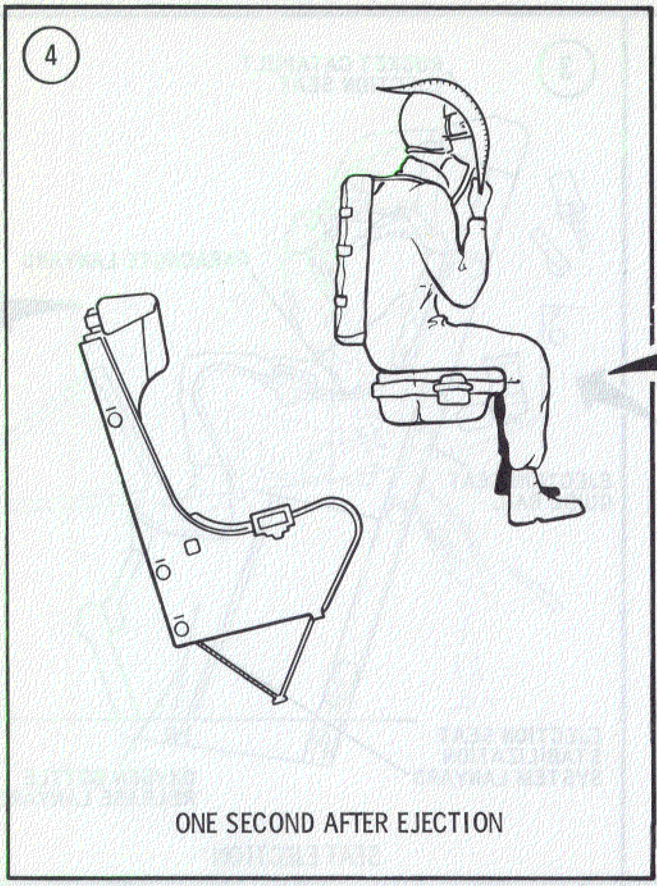
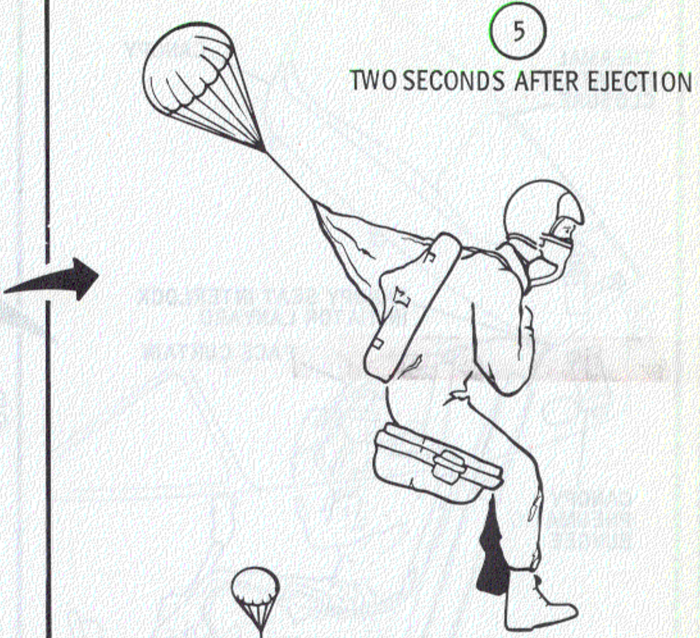


Figure 5-4. Ejection Sequence – ESCAPAC 1C-3 Ejection Seat (Sheet 1)





(4) ONE SECOND AFTER EJECTION:

A. HARNESS AND SURVIVAL GEAR FITTINGS RELEASE FROM SEAT.
B. EJECTION CONTROL HANDLE USED DISCONNECTS FROM SEAT.
C. SEPARATION BLADDERS INFLATE.
D. PARACHUTE AUTOMATIC ACTUATOR IS ARMED (WITH ACC 254 INSTALLED).

WARNING

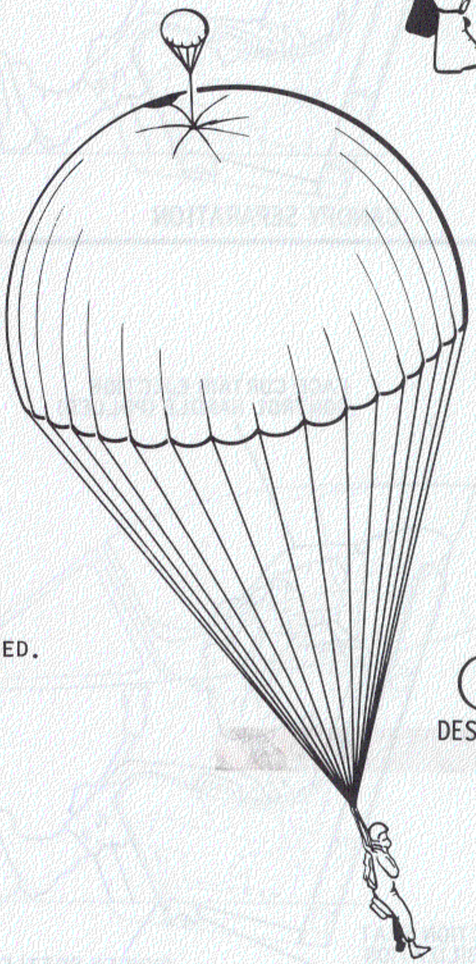
IN THE EVENT OF INADVERTENT BLADDER INFLATION AND SEAT/MAN SEPARATION, EJECTION CAPABILITY IS LOST BECAUSE BOTH FACE CURTAIN AND ALTERNATE HANDLE ARE RELEASED. FIELD AND CARRIER ARRESTMENTS ARE NOT RECOMMENDED BECAUSE THE PILOT IS NOT RESTRAINED.

(5) TWO SECONDS AFTER EJECTION:

PARACHUTE BEGINS TO DEPLOY IF BELOW 14,000 ± 500 FEET.

(6) DESCENT

A. REMOVE OXYGEN MASK AND DISCONNECT OXYGEN/RADIO HOSE BELOW 10,000 FEET BUT BEFORE CONTACT.
B. PULL SEATPACK RELEASE HANDLE TO DEPLOY LIFERAFT. LIFERAFT WILL INFLATE AND SUSPEND FROM A 20-FOOT LINE.



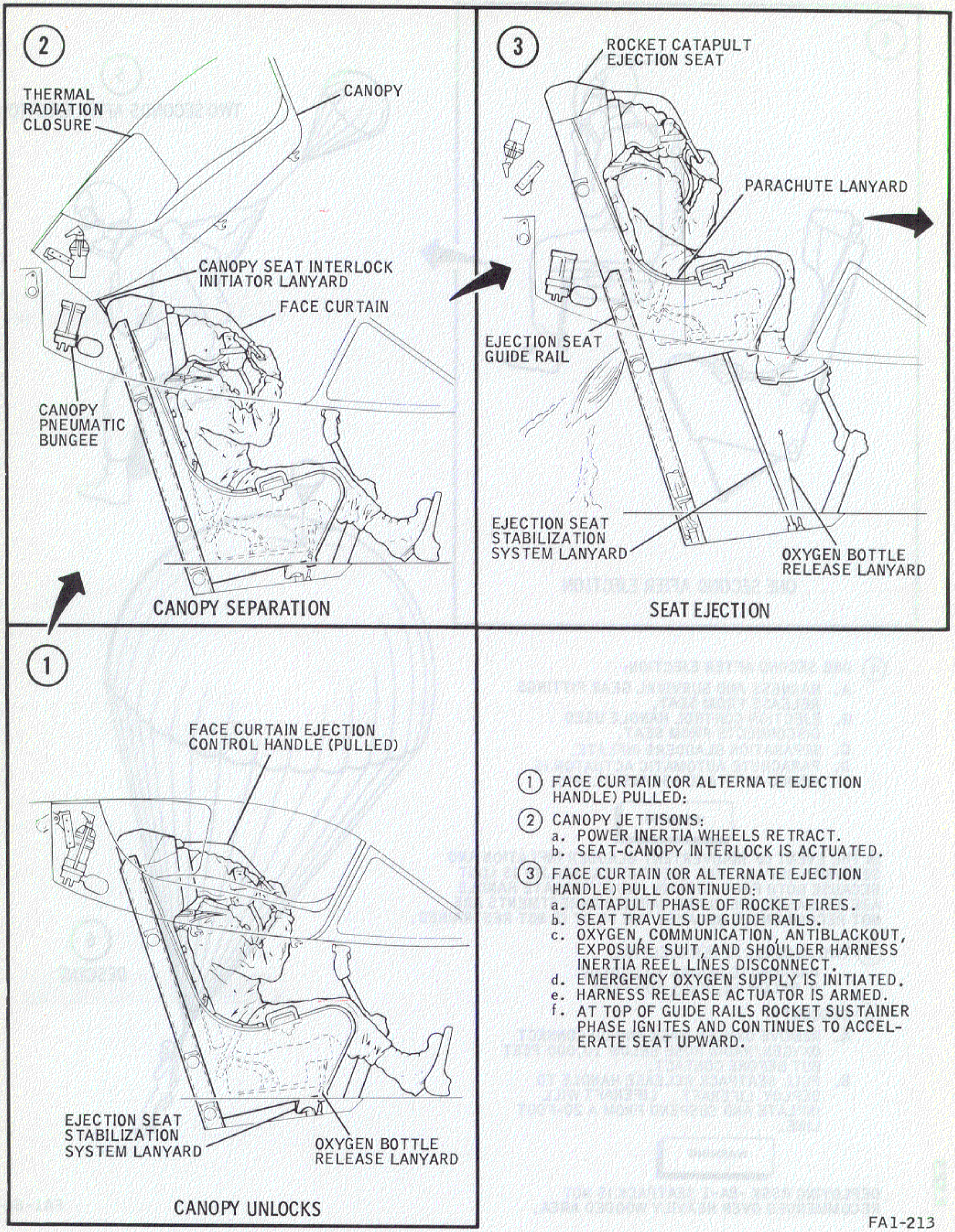
NEW

WARNING

DEPLOYING RSSK -8A-1 SEATPACK IS NOT RECOMMENDED OVER HEAVILY WOODED AREA.

FA1-88-A

Figure 5-4. Ejection Sequence – ESCAPAC 1C-3 Ejection Seat (Sheet 2)



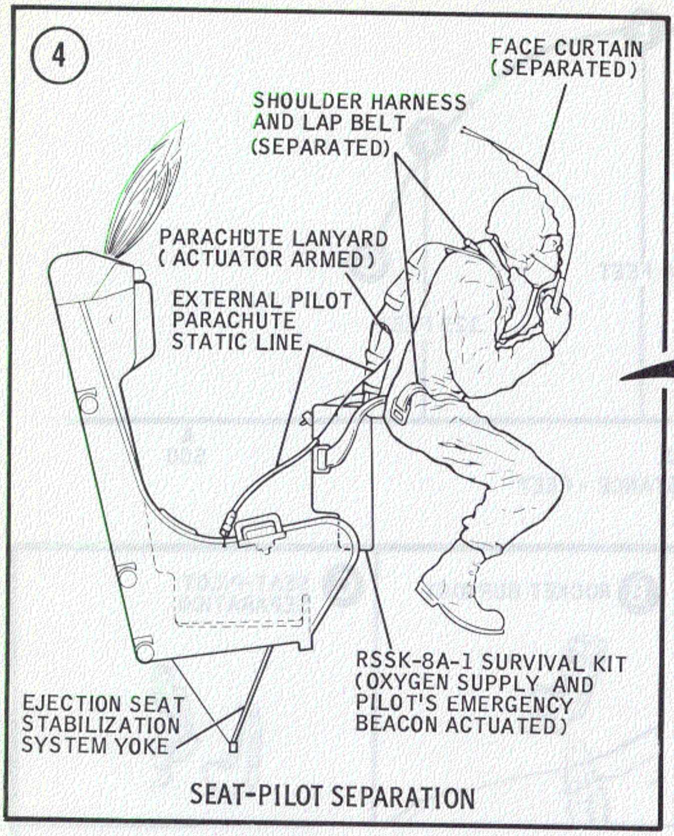
① FACE CURTAIN (OR ALTERNATE EJECTION HANDLE) PULLED:

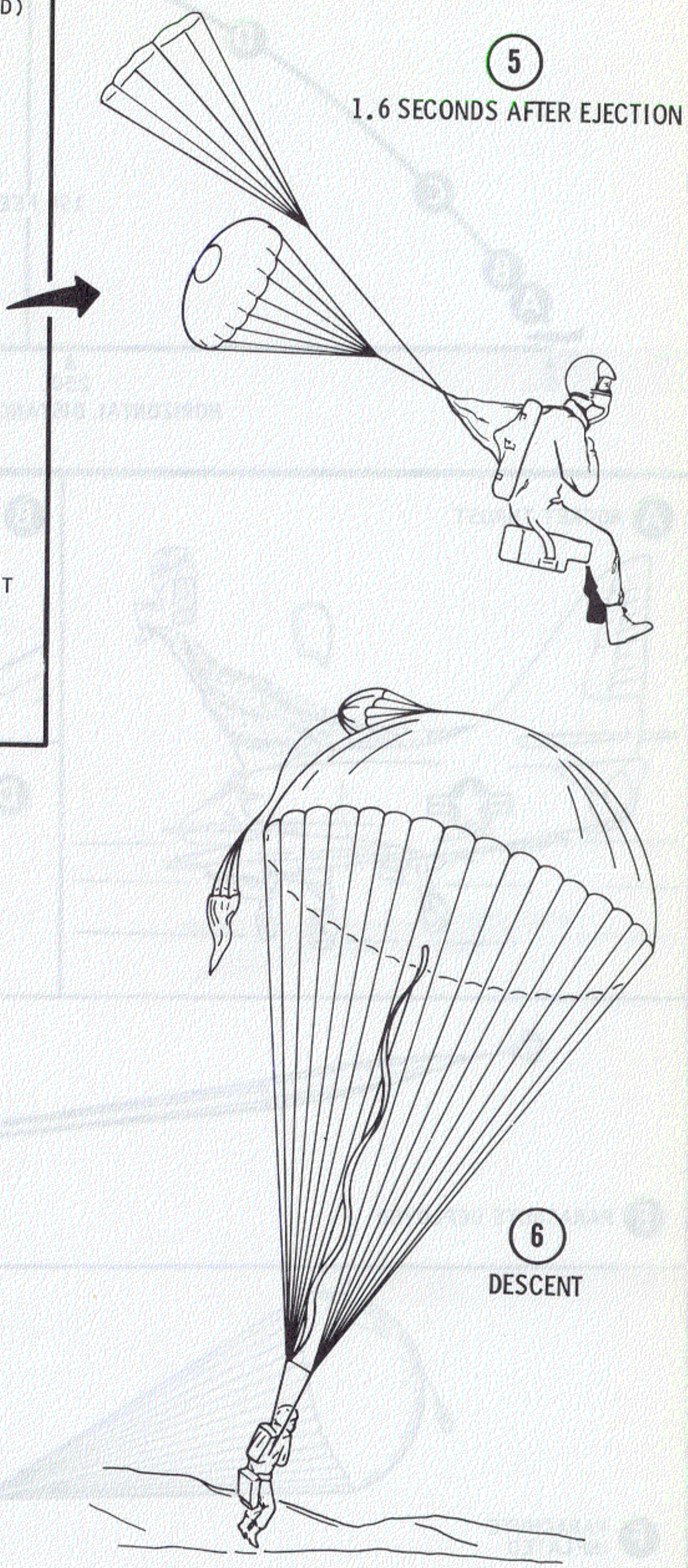
② CANOPY JETTISONS:
a. POWER INERTIA WHEELS RETRACT.
b. SEAT-CANOPY INTERLOCK IS ACTUATED.

③ FACE CURTAIN (OR ALTERNATE EJECTION HANDLE) PULL CONTINUED:
a. CATAPULT PHASE OF ROCKET FIRES.
b. SEAT TRAVELS UP GUIDE RAILS.
c. OXYGEN, COMMUNICATION, ANTIBLACKOUT, EXPOSURE SUIT, AND SHOULDER HARNESS INERTIA REEL LINES DISCONNECT.
d. EMERGENCY OXYGEN SUPPLY IS INITIATED.
e. HARNESS RELEASE ACTUATOR IS ARMED.
f. AT TOP OF GUIDE RAILS ROCKET SUSTAINER PHASE IGNITES AND CONTINUES TO ACCELERATE SEAT UPWARD.

FA1-213

Figure 5-5. Ejection Sequence— ESCAPAC 1F-3 Ejection Seat (Sheet 1)





(4) SEAT AND PILOT ARE ACCELERATED UPWARD APPROXIMATELY 200 FEET. SEAT STABILIZATION (DART) SYSTEM CORRECTS FOR ADVERSE SEAT PITCH IF PRESENT.
0.75 SECONDS AFTER EJECTION:
- a. HARNESS AND SURVIVAL GEAR RELEASE FROM SEAT.
- b. BOTH EJECTION CONTROL HANDLES DISCONNECT FROM SEAT
- c. SEPARATOR ROCKET FIRED.
- d. PARACHUTE LANYARD (ACTUATOR ARMED)

(5) *1.6 SECONDS AFTER EJECTION:
- a. PARACHUTE BEGINS TO DEPLOY (IF BELOW 14,000 FEET)
- b. BELOW 14,000 FEET FULL PARACHUTE INFLATION MAY REQUIRE 1 TO 2.5 SECONDS DEPENDING ON AIRSPEED.

(6) DESCENT:
- a. REMOVE OXYGEN MASK AND DISCONNECT OXYGEN/RADIO HOSE BELOW 10,000 FEET BUT BEFORE CONTACT.
- b. PULL SEAT PACK RELEASE HANDLE TO DEPLOY LIFERAFT. LIFERAFT WILL INFLATE AND SUSPEND FROM A 20-FOOT LINE.

WARNING

DEPLOYING RSSK-8A-1 SEAT PACK IS NOT RECOMMENDED OVER HEAVILY WOODED AREA.

* 1.85 SECONDS IF ACC-247 INCORPORATED (INTERIM NB-10 WITH 1.0-SECOND DELAY)

FA1-214

Figure 5-5. Ejection Sequence—ESCAPAC 1F-3 Ejection Seat (Sheet 2)

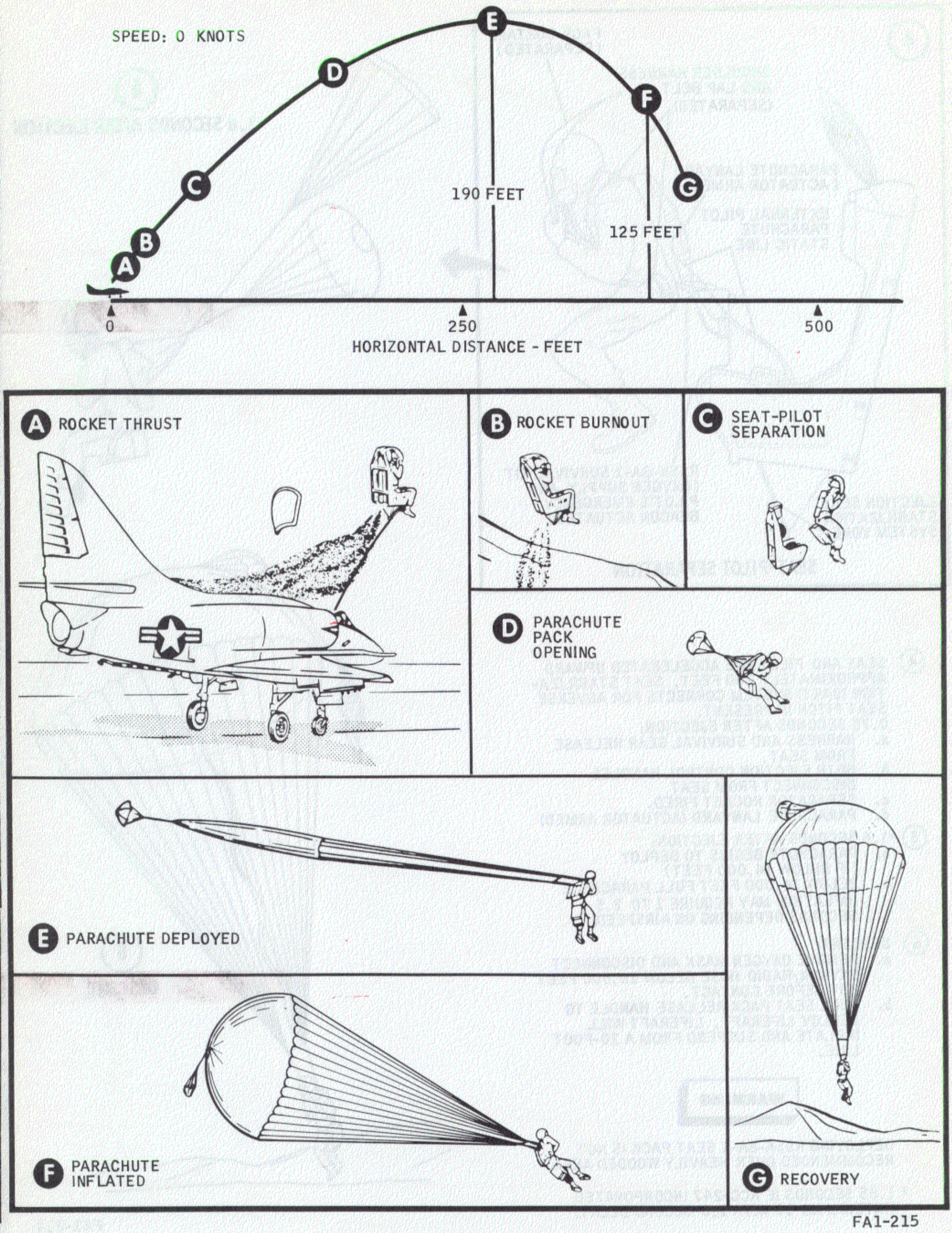


Figure 5-6. Ground Level Ejection—1C-3

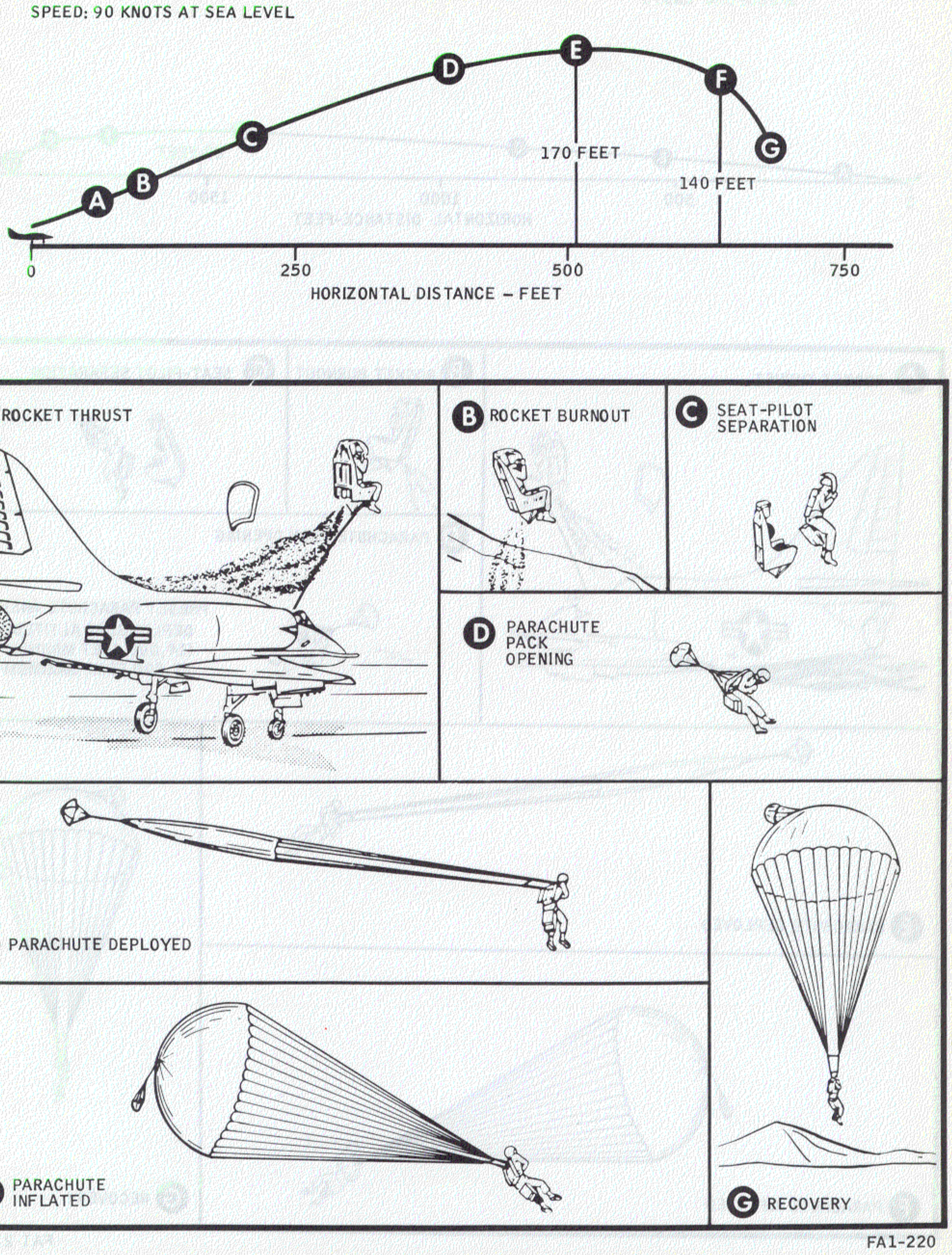


Figure 5-7. Low Speed Ejection–1C-3

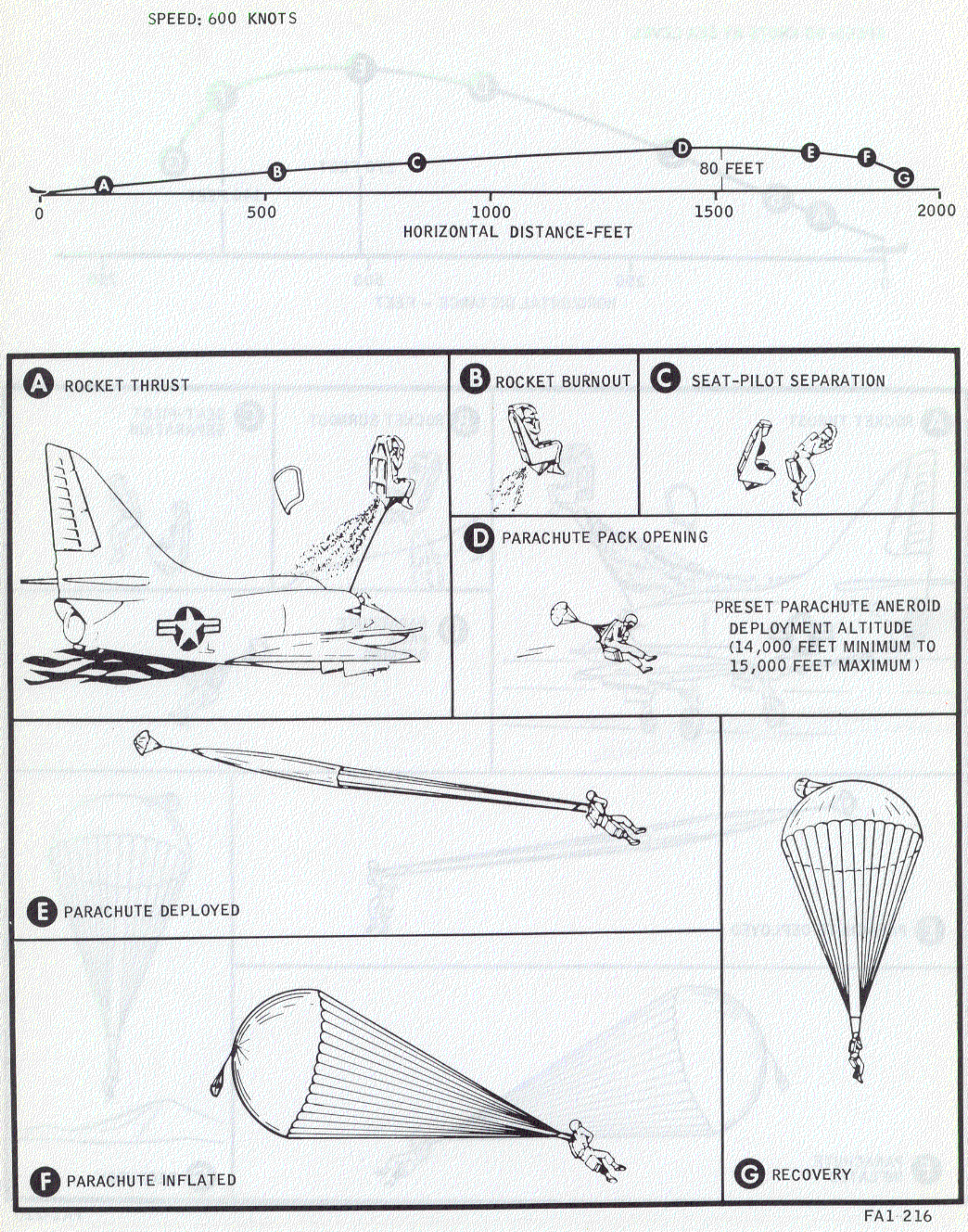


Figure 5-8. High Speed Ejection–1C-3

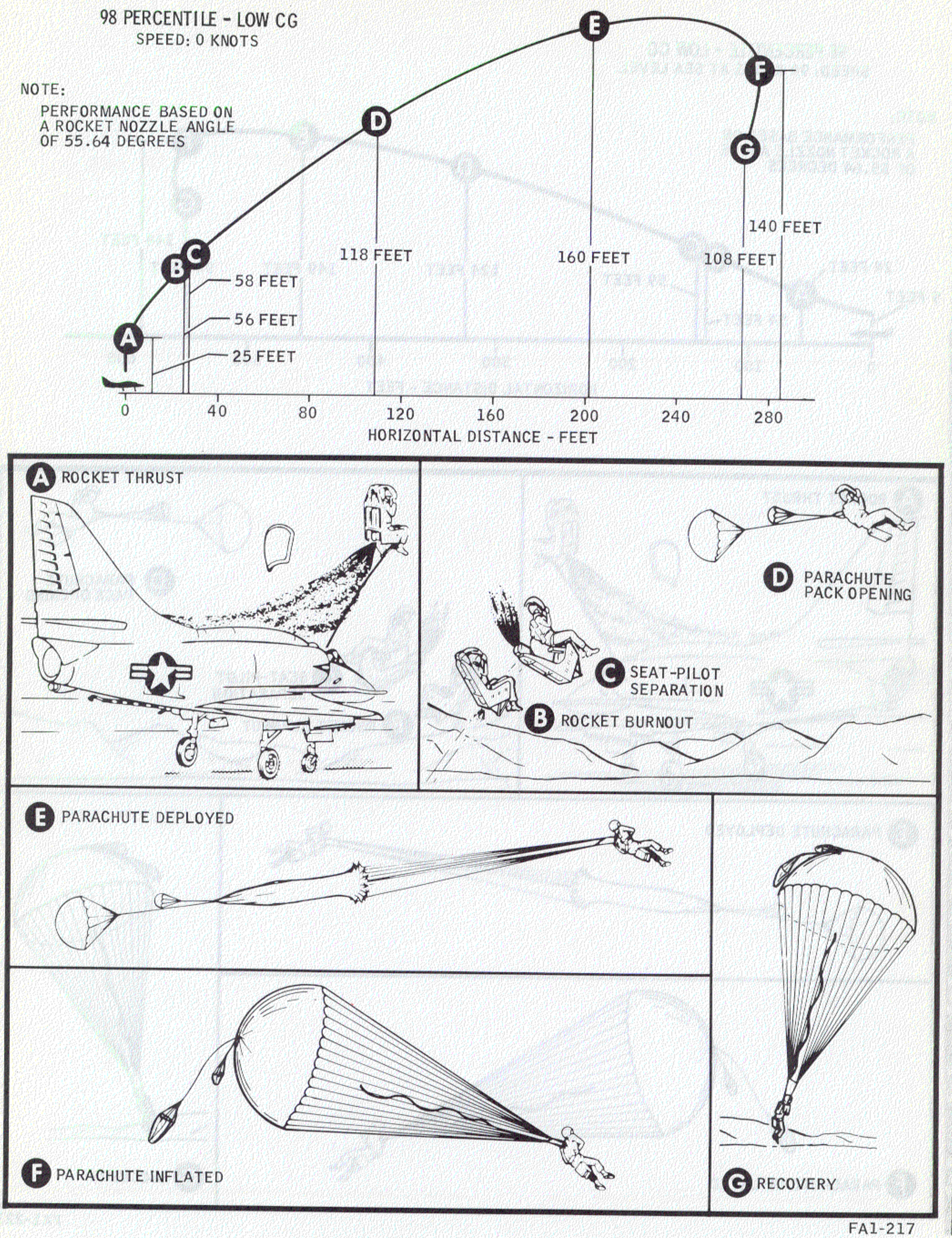


Figure 5-9. Ground Level Ejection—1F-3

NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW

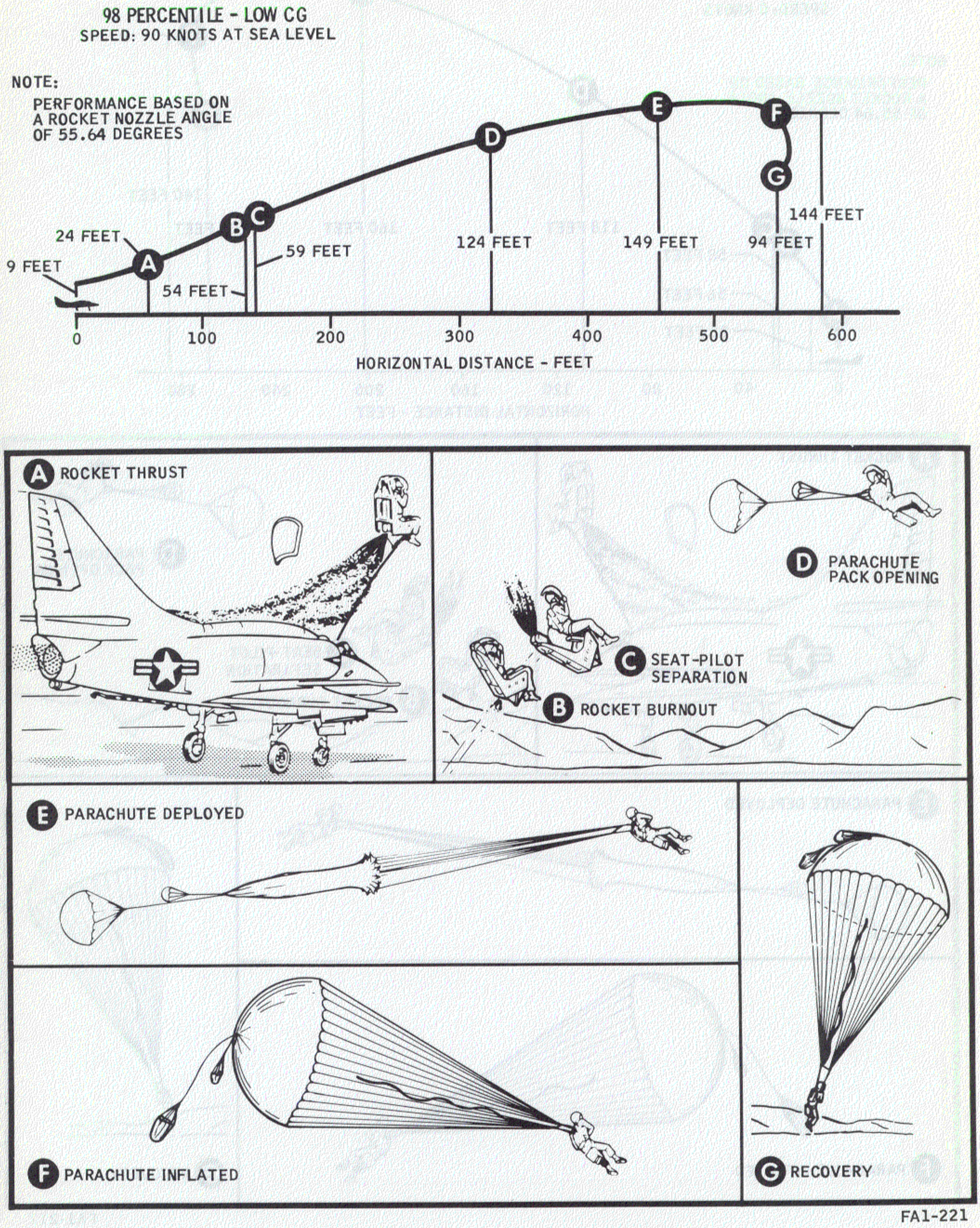


Figure 5-10. Low Speed Ejection—1F-3

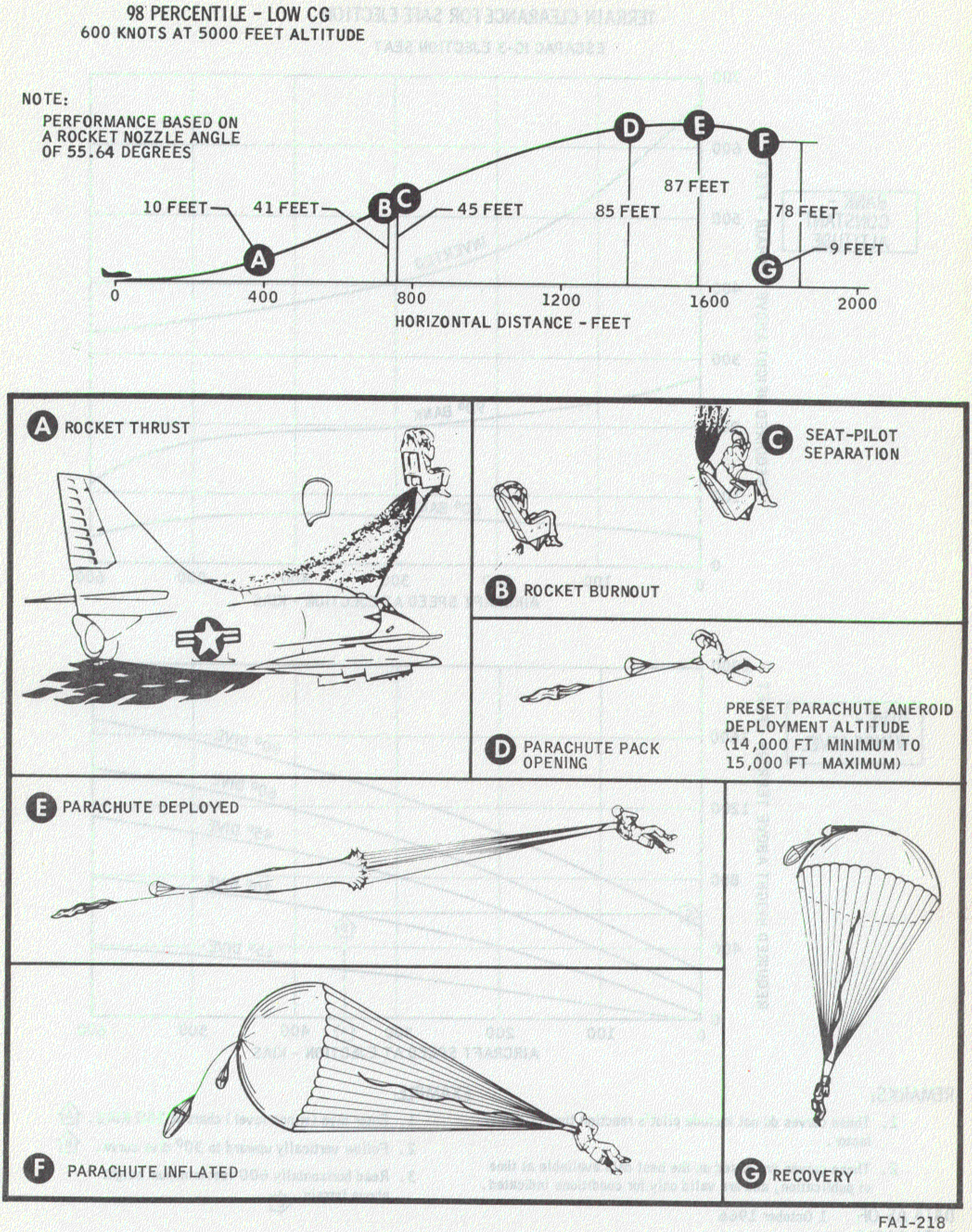
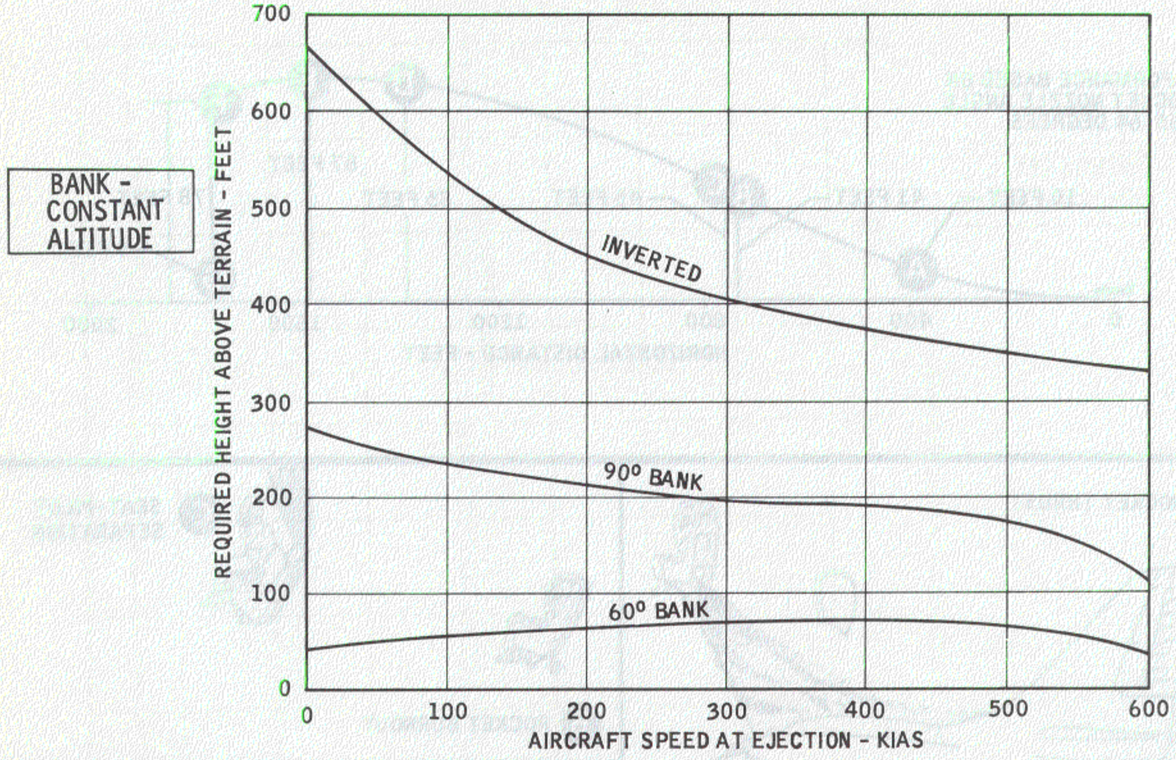
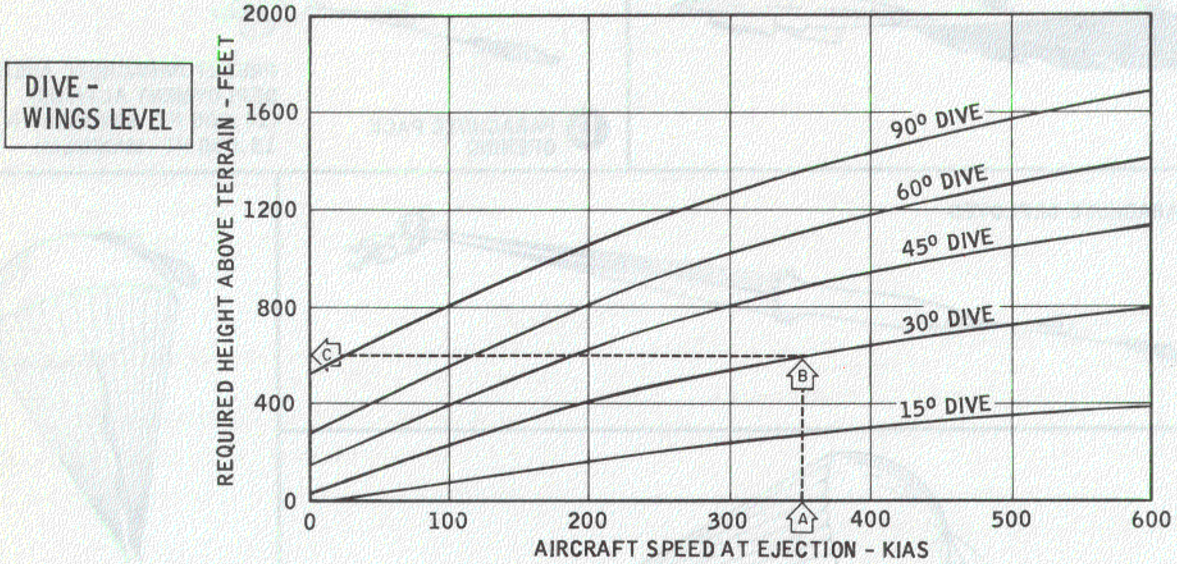


Figure 5-11. High Speed Ejection—1F-3

TERRAIN CLEARANCE FOR SAFE EJECTION

ESCAPAC IC-3 EJECTION SEAT





REMARKS:

1. These curves do not include pilot's reaction time or safety factor.
2. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

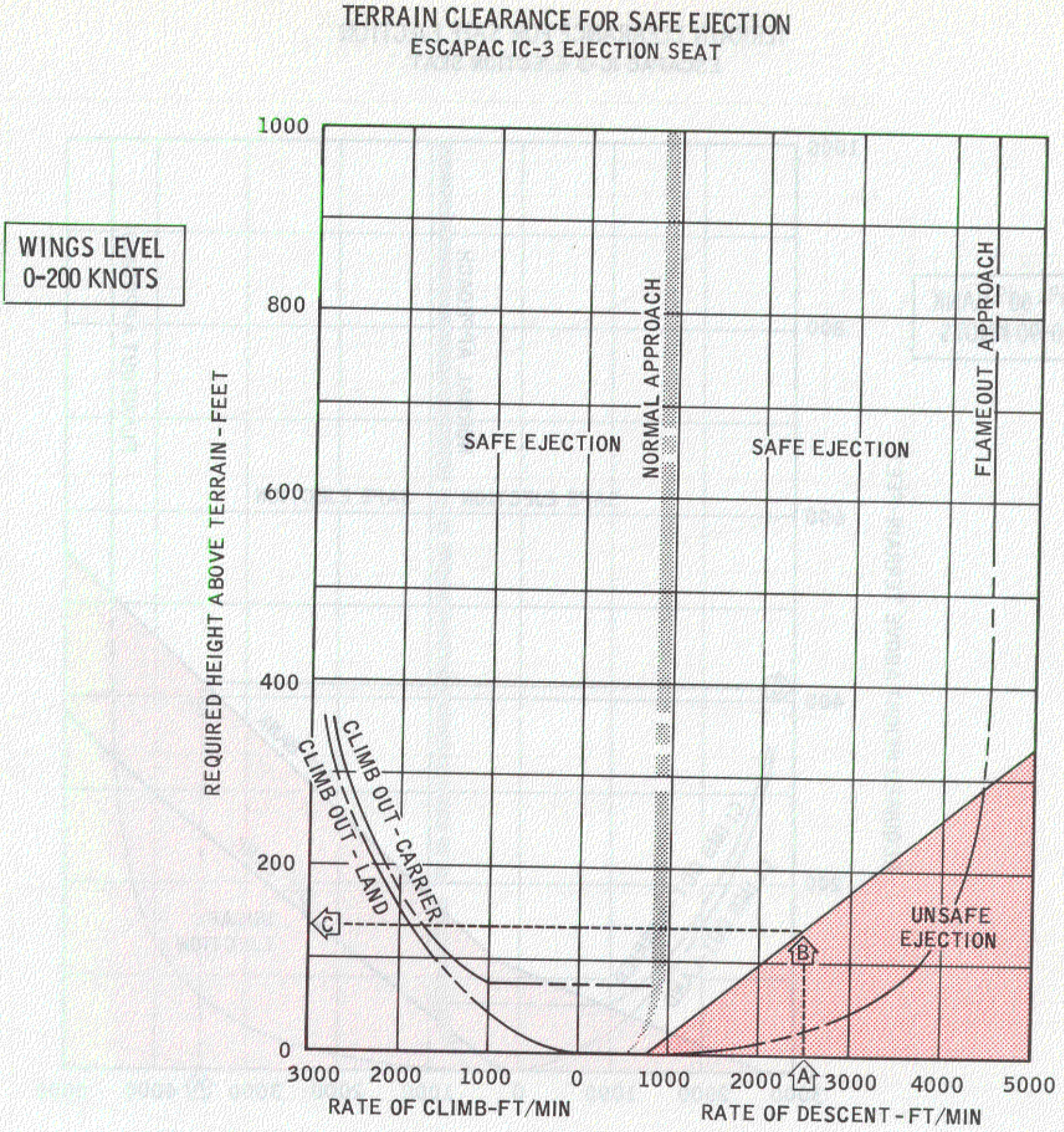
EXAMPLE:

1. Enter dive (wings level) chart at 350 KIAS. (A)
2. Follow vertically upward to 30° dive curve. (B)
3. Read horizontally 600 feet minimum height above terrain. (C)

DATA AS OF: 1 October 1966
DATA BASIS: Computer Calculations

FA1-89

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 1)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. These curves are based on best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 October 1966
DATA BASIS: Computer Calculations

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min:

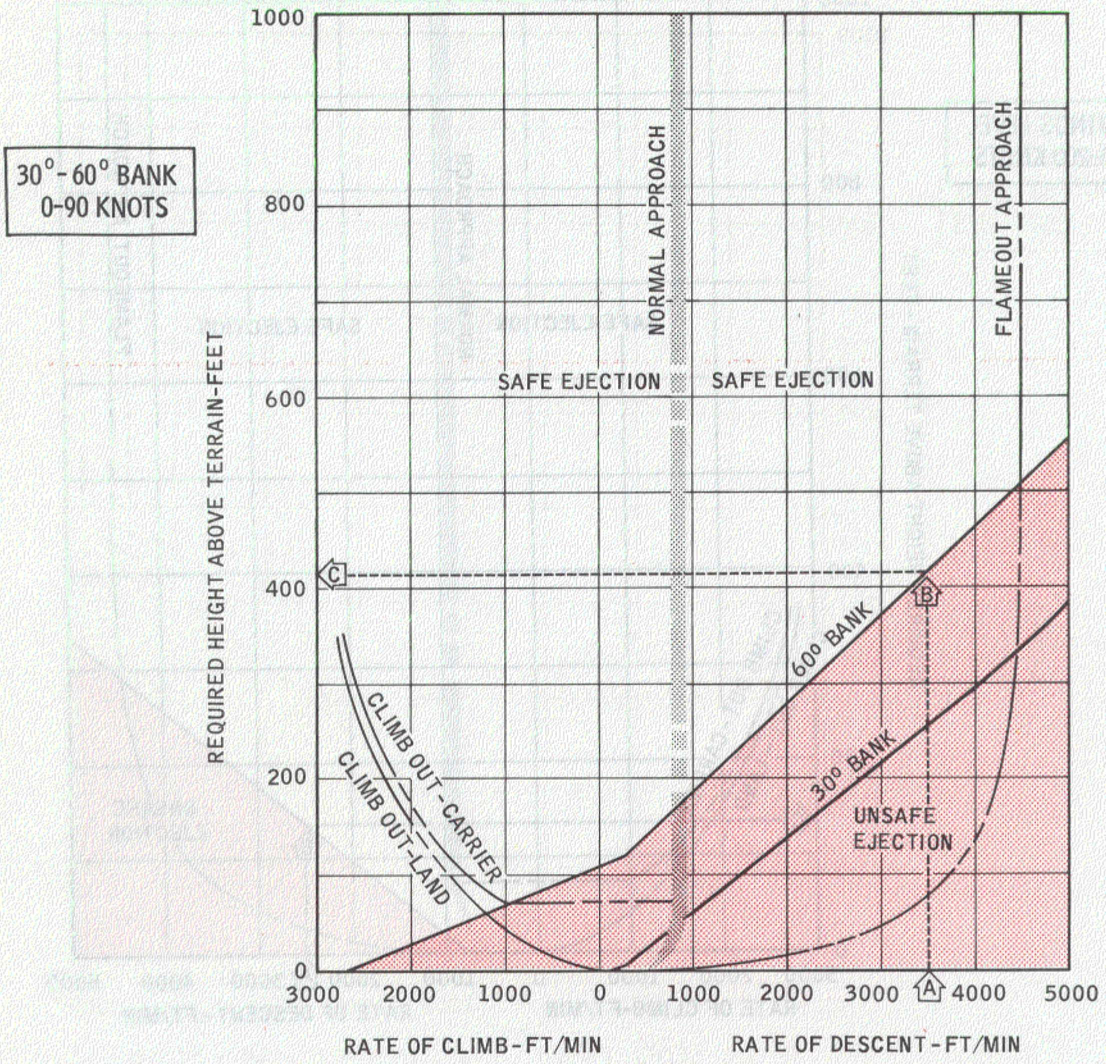
1. Enter chart at 2500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 136 feet minimum height above terrain. (C)

FA1-90

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 2)

TERRAIN CLEARANCE FOR SAFE EJECTION

ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. These curves are based on best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft/min, and a bank angle of 60 degrees:

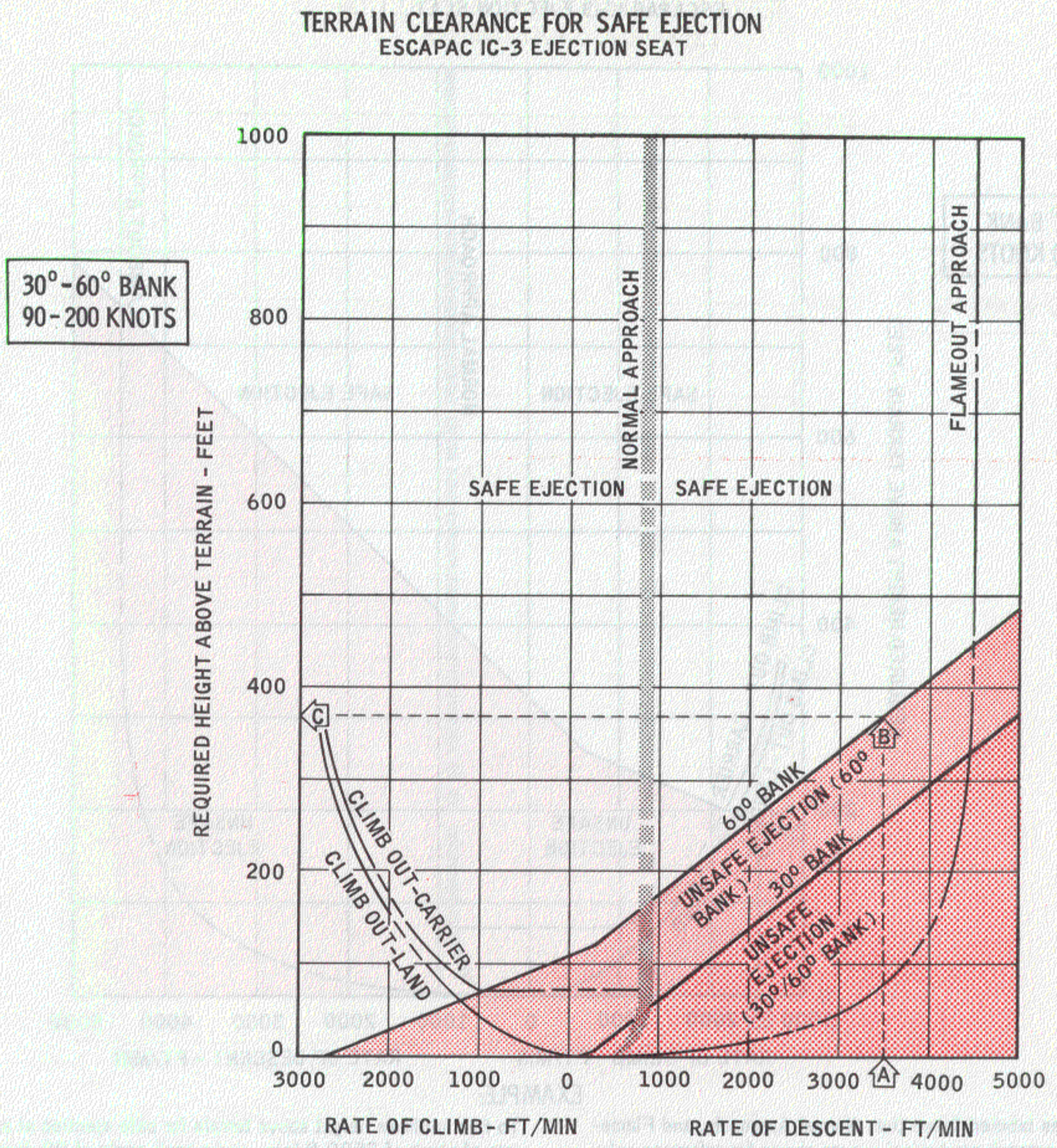
1. Enter chart at 3500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 410 feet minimum height above terrain. (C)

DATA AS OF: 1 October 1966

DATA BASIS: Computer Calculations.

FA1-91

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 3)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ±15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. These curves are based on best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 October 1966
DATA BASIS: Computer Calculations.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft/min, and a bank angle of 60 degrees:

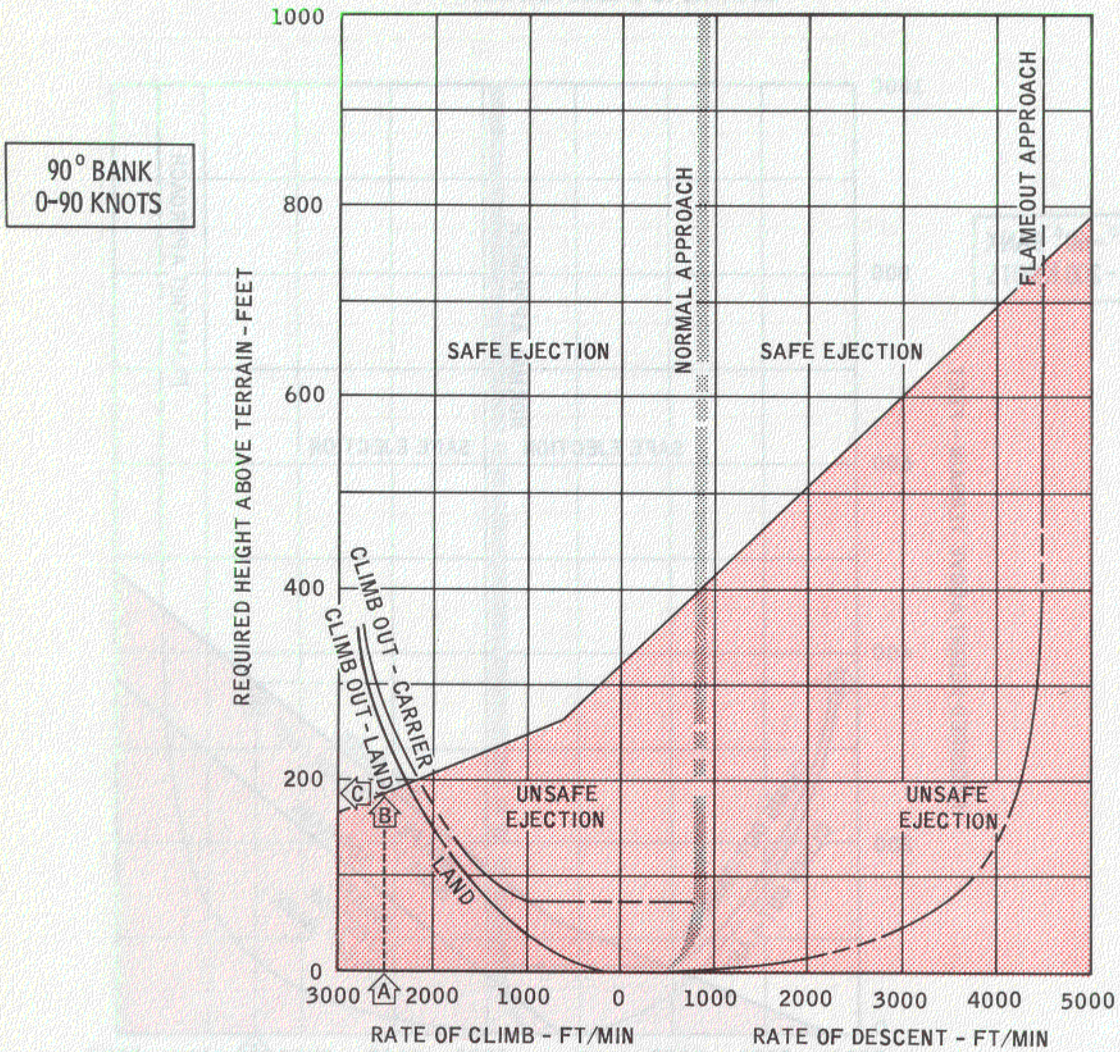
1. Enter chart at 3500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 370 feet minimum height above terrain. (C)

FA1-92

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 4)

TERRAIN CLEARANCE FOR SAFE EJECTION

ESCAPAC IC-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. To obtain height for safe ejection in inverted flight, add 300 feet to the height shown for 90° bank.
4. These curves are based on best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of climb of 2500 ft/min, and a bank angle of 90 degrees.

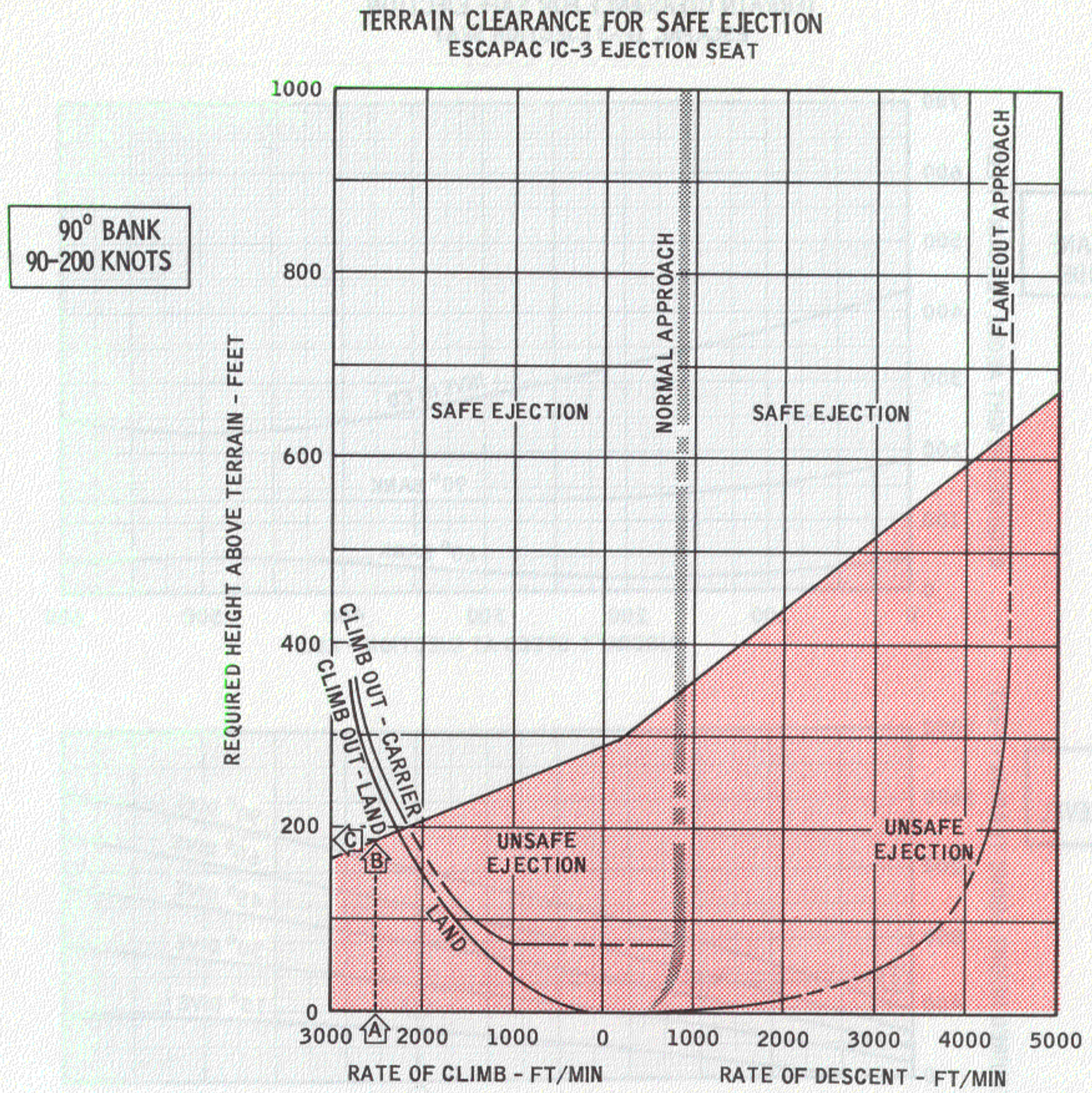
1. Enter chart at 2500 ft/min rate of climb. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 186 feet minimum height above terrain. C

DATA AS OF: 1 October 1966

DATA BASIS: Computer Calculations.

FA1-93

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 5)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve. (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch $\pm 15^o$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 50-foot recovery height safety factor.
3. To obtain height for safe ejection in inverted flight, add 300 feet to the height shown for 90^o bank.
4. These curves are based on best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

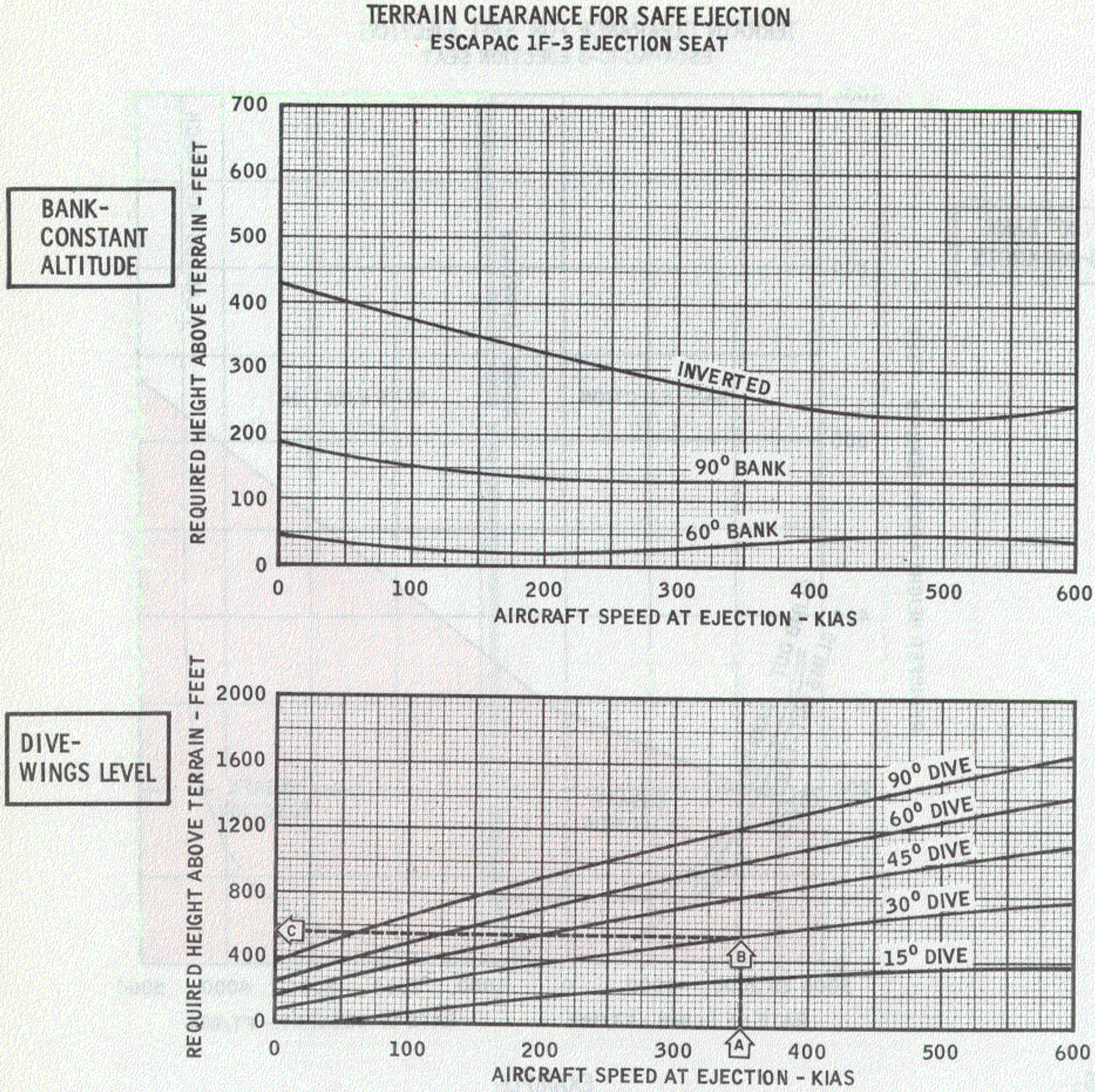
To find minimum height above terrain for safe ejection at a rate of climb of 2500 ft/min, and a bank angle of 90 degrees:

1. Enter chart at 2500 ft/min rate of climb. A
2. Follow vertically upward to ejection capability curve. B
3. Read horizontally 186 feet minimum height above terrain. C

DATA AS OF: 1 October 1966
DATA BASE Computer Calculations

FA1-94

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 6)



REMARKS:

1. These curves do not include pilot's reaction time or safety factor.
2. These curves are based on the best data available at time of publication and are valid only for conditions indicated.

EXAMPLE:

1. Enter dive (minus level) chart at 350 KIAS. (A)
2. Follow vertically upward to 30° dive curve. (B)
3. Read horizontally 530 feet minimum height above terrain. (C)

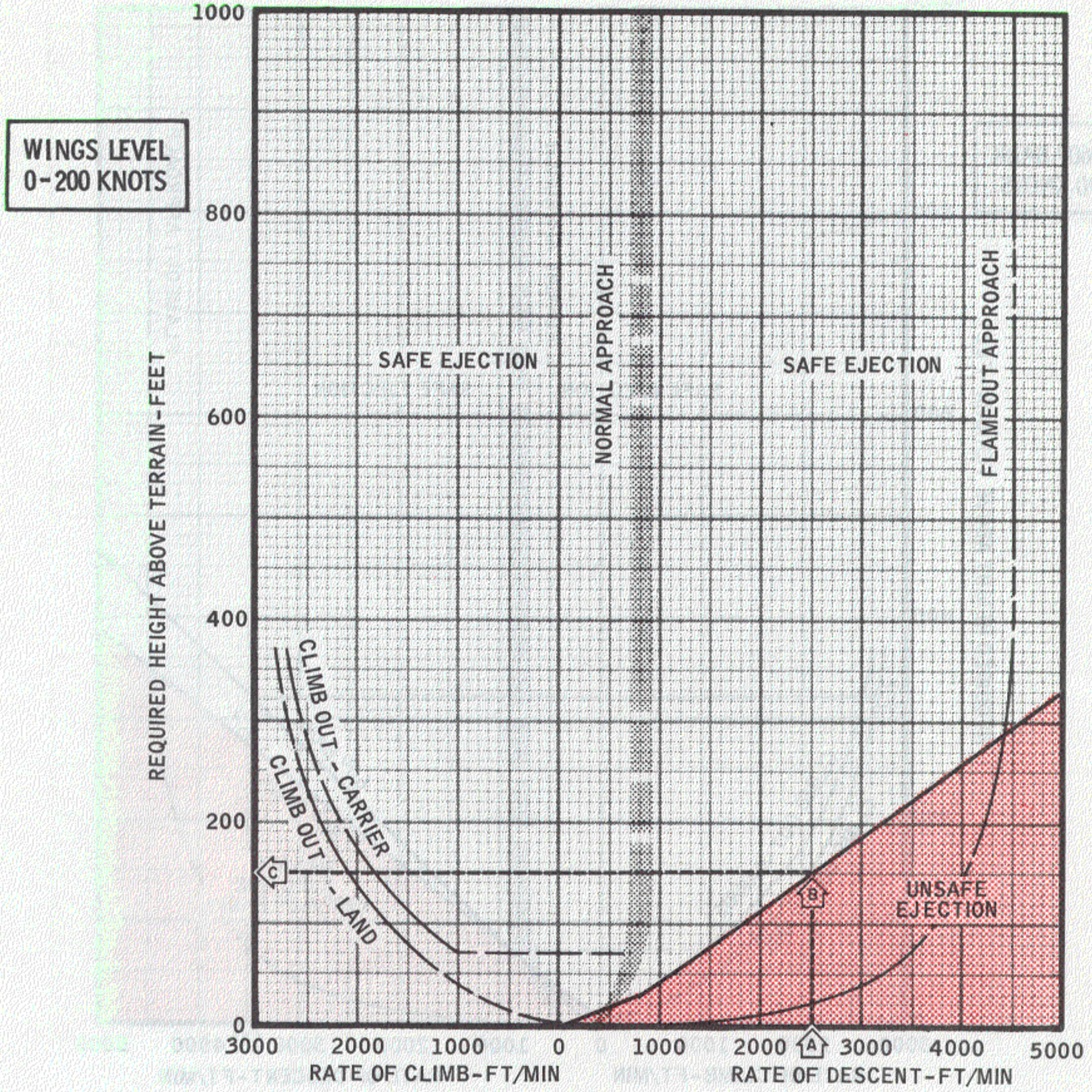
NOTE:
PERFORMANCE BASED ON A ROCKET NOZZLE ANGLE OF 55.64 DEGREES

DATA AS OF: 1 November 1971
DATA BASIS: Computer Calculations

FA1-207

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 7)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1F-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ± 15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 Percentile crewman - low cg
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 November 1971
DATA BASIS: Computer Calculations

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft./min.

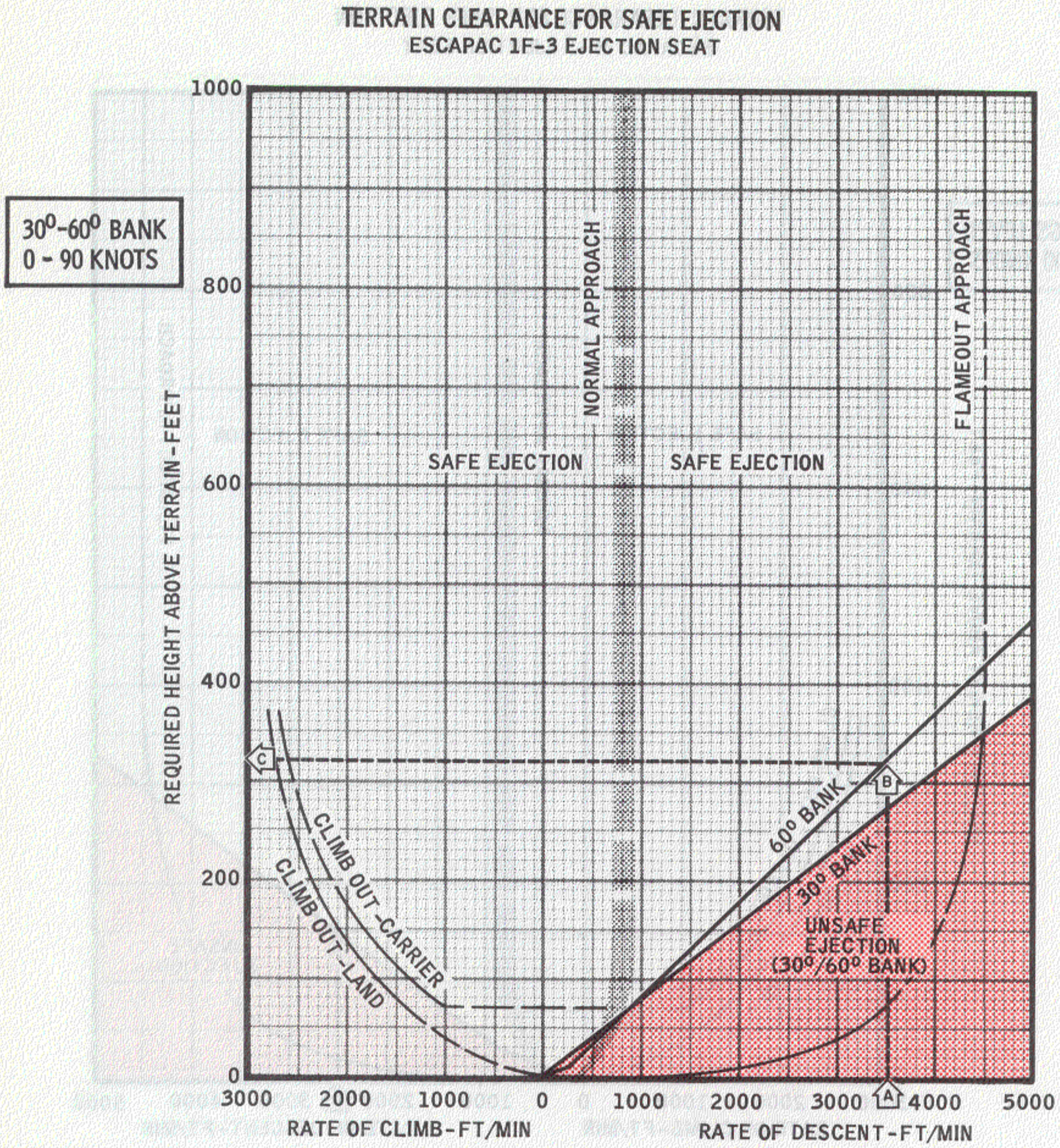
1. Enter chart at 2500 ft./min. rate of descent. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 150 feet minimum height above terrain. (C)

NOTE:

PERFORMANCE BASED ON A ROCKET NOZZLE ANGLE OF 55.64 DEGREES

FA1-208

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 8)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ± 15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewman - low cg.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 November 1971
DATA BASIS: Computer Calculations

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft/min and a bank angle of 60 degrees:

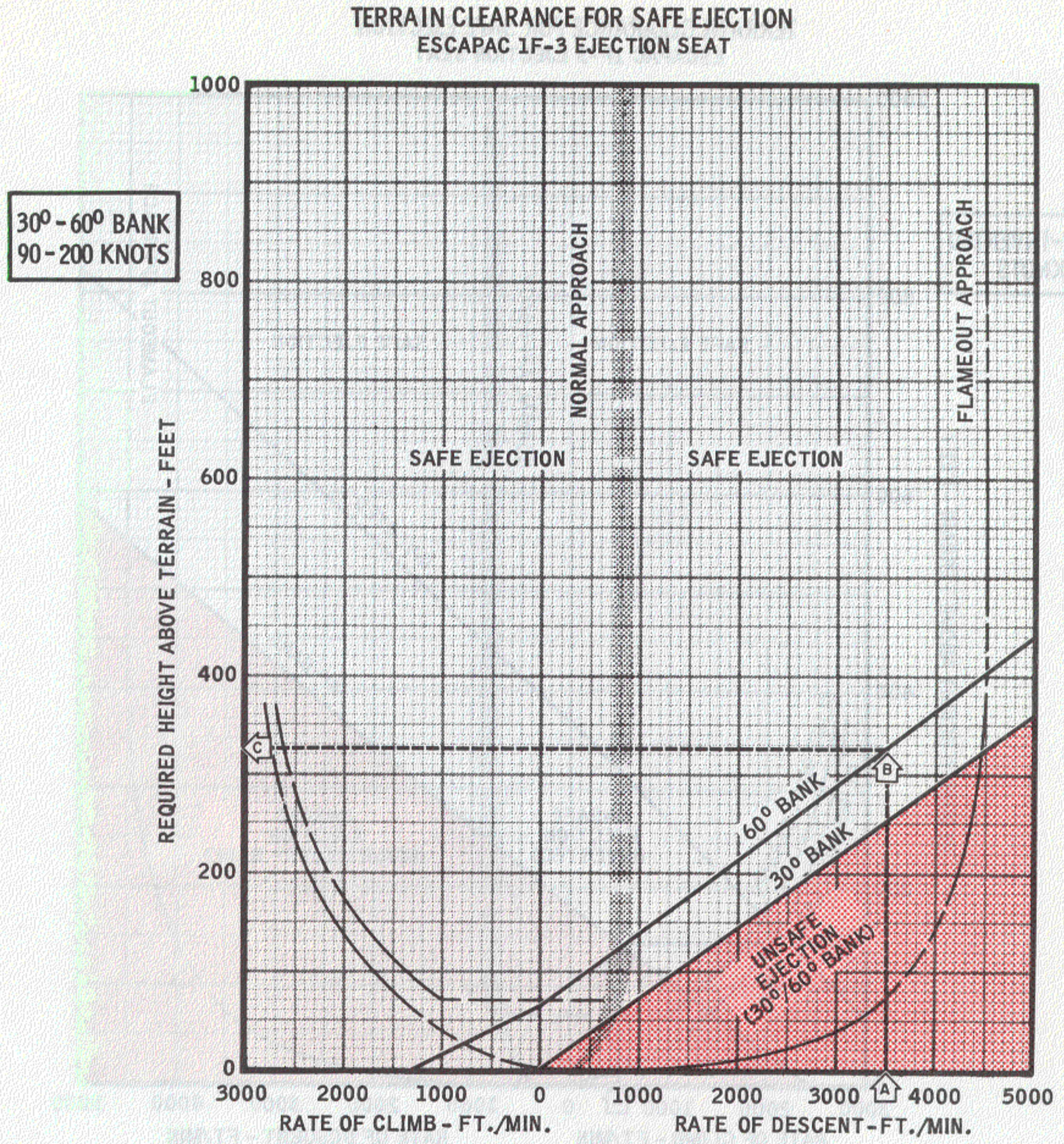
1. Enter chart at 3500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 320 feet minimum height above terrain. (C)

NOTE:

PERFORMANCE BASED ON A ROCKET NOZZLE ANGLE OF 55.64 DEGREES

FA1-209

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 9)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ± 15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewman-low CG
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 November 1971
DATA BASIS: Computer Calculations.

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft./min. and a bank angle of 60° degrees:

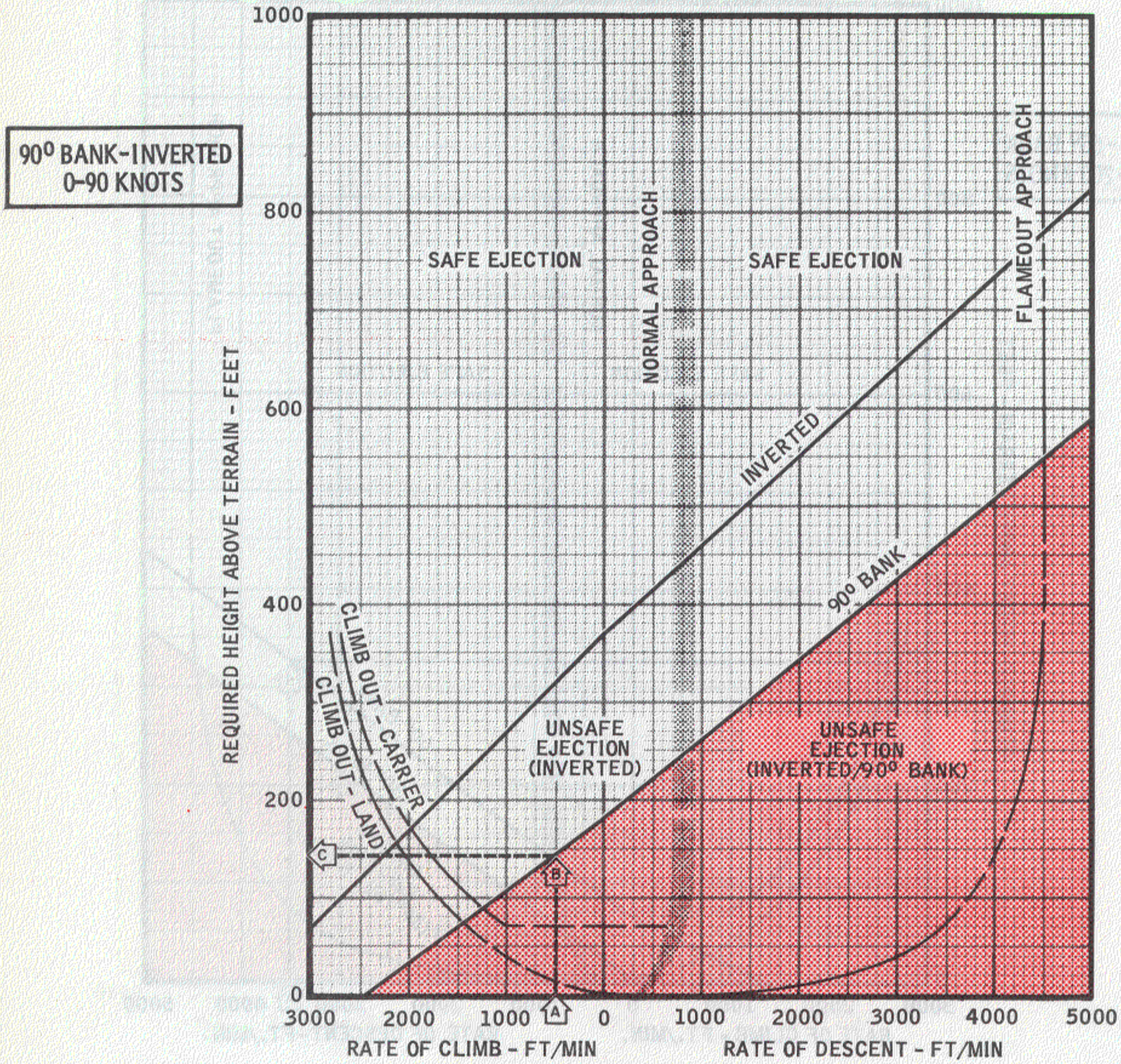
1. Enter chart at 3500 ft./min. rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 330 feet minimum height above terrain. (C)

NOTE:
PERFORMANCE BASED ON A ROCKET NOZZLE ANGLE OF 55.64 DEGREES

FA1-210

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 10)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1F-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ± 15° for condition shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewmen - low CG
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 November 1971
DATA BASIS: Computer Calculations

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of climb of 500 ft./min. and a bank angle of 90 degrees.

1. Enter chart at 500 ft./min. rate of climb. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 145 feet minimum height above terrain. (C)

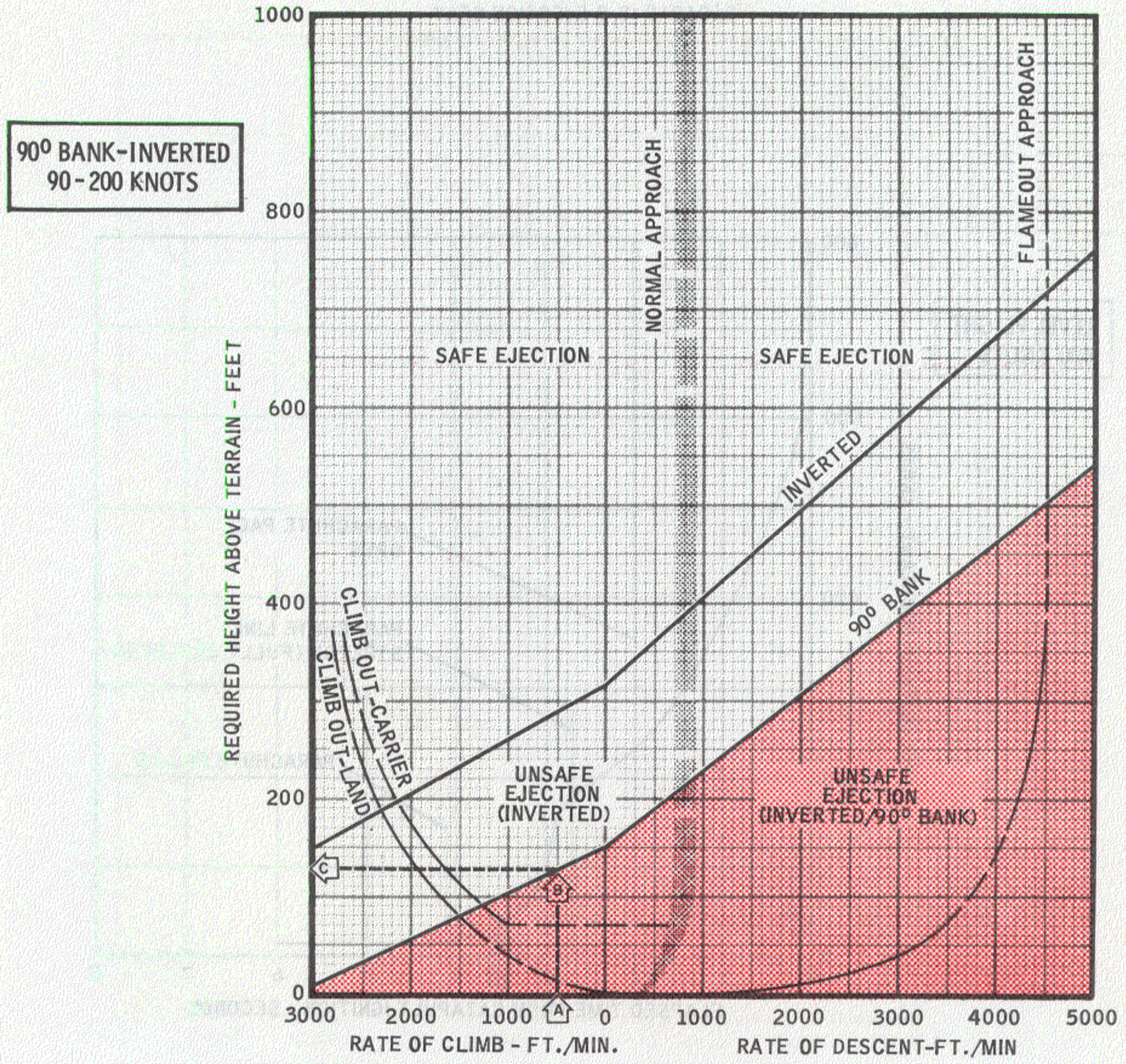
NOTE:

PERFORMANCE BASED ON A ROCKET NOZZLE ANGLE OF 55.64 DEGREES

FA1-211

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 11)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1F-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Normal aircraft pitch ± 15° for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewman-low CG
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 1 November 1971
DATA BASIS: Computer Calculations

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of climb of 500 ft./min., and a bank angle of 90 degrees:

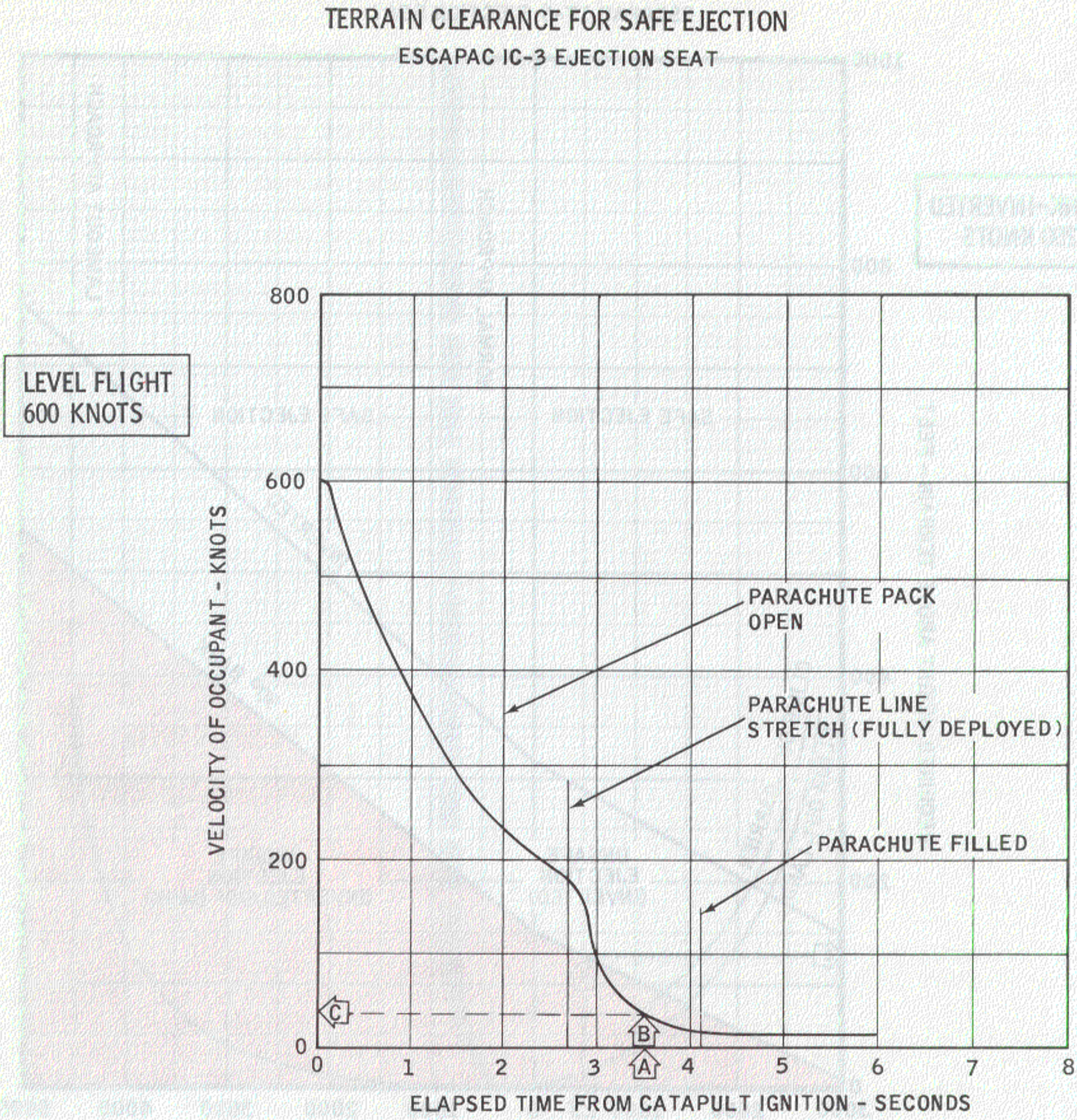
1. Enter chart at 500 ft./min. rate of climb. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 130 feet minimum height above terrain. (C)

NOTE:

PERFORMANCE BASED ON A ROCKET NOZZLE ANGLE OF 55.64 DEGREES

FA1-212

Figure 5-12. Terrain Clearance for Safe Ejection (Sheet 12)



REMARKS:

1. This curve shows velocity decay following an ejection from an aircraft in level flight at 600 KIAS.
2. Curve is based on best data available at time of publication and is valid only for conditions indicated.

DATA AS OF: 1 October 1966
DATA BASIS: Computer Calculations

EXAMPLE:

To find velocity of the occupant 3.5 seconds after ejection from an aircraft in a 600 knot level flight condition:

1. Enter chart at 3.5 seconds. (A)
2. Follow vertically upward to velocity decay curve. (B)
3. Read horizontally 31 knots velocity. (C)

FA1-95

Figure 5-13. Velocity Decay After Ejection

7. Shoulder harness . . . . locked

8. Visor . . . . down

9. Air conditioning switch . . . . RAM

10. Leave feet on rudder pedals.

11. Sit erect, with spine straight and head firmly against headrest.

12. Grasp face curtain handle with both hands and pull down forcefully to fullest extent. The canopy should jettison when the curtain is pulled over the helmet and the catapult should fire when the handle passes the nose or chin. A canopy interlock prevents firing of the catapult before the canopy is jettisoned. Consequently, if the curtain is pulled very fast, the interlock may cause a pause or stop and the force of the continued pull on the face curtain may not be sufficient to effect catapult firing. It will then be necessary for the pilot to jerk as hard as possible on the face curtain to obtain sufficient pull force. If the seat still does not fire, release the face curtain and apply a strong, steady, two-handed pull on the alternate ejection handle.

13. If pulling on face curtain (or alternate ejection handle) fails to jettison canopy, perform the following emergency procedure:

a. Retain a firm grip on face curtain (or alternate ejection handle) with one hand, but do not pull it farther out. Hold elbow inboard.

b. PULL canopy-jettison handle firmly.

c. After the canopy leaves, continue pulling face curtain (or ejection handle) with both hands.

d. As a last resort, if the canopy still remains, it may be removed by the force of the airstream by unlatching canopy manually, if airspeed is in excess of 125 KIAS.

WARNING

Beware of a rapid rearward movement of the canopy lever when this is done.

Retain the face curtain (or alternate ejection handle) with one hand during this procedure.

14. If ejection occurs above the preset altitude, the parachute will not deploy automatically until after descent below the preset altitude of 14,000 feet. If ejection occurs below the preset altitude and the automatic barometric ripcord actuator seems not to function (i.e., after the 2-second time delay), open the parachute with the manual ripcord (D-ring) when clear of the seat. The manual ripcord overrides the barometric release. If high-altitude ejection is made, free-fall to approximately 14,000 feet before opening the parachute. If the parachute must be opened manually after a high-speed ejection, wait at least 4 seconds after ejection for speed to reduce.

15. If the integrated harness is not automatically released following ejection, seat separation may be accomplished while falling by pulling the harness release handle, located on the right side of the pilot's seat. Roll forward to clear the chute from the back of seat and push clear of the seat.

16. The emergency oxygen bottle will be actuated automatically upon ejection. However, should the oxygen appear not to be flowing, pull the green ring on the left front inside corner of the seat pan.

17. At about 10,000 feet altitude, but before contact, the oxygen mask should be removed and the oxygen/radio hose should be disconnected.

18. During descent, the yellow release handle on the right side of the seat pack should be pulled to separate the lower part of the seat pack. This will cause the liferaft in the lower part to inflate and suspend from a 20-foot line.

WARNING

Deploying RSSK-8A-1 seatpack is not recommended over heavily wooded area.

19. In the event a parachute landing is made into the water or in a high wind which prevents normal spilling of the parachute canopy, disconnect both quick-disconnect fittings that attach risers to the torso-harness suit, thus jettisoning the parachute canopy. Do not disconnect the parachute-riser releases until after contact with the ground or water.

Immediate Ejection

During any combined low altitude/low airspeed conditions, as in the landing pattern or immediately after launch, the alternate handle should be considered the primary means of ejection. Continue to fly the aircraft with the right hand keeping the wings level and maintaining altitude or the lowest possible sink rate while initiating ejection sequence with the left hand.

Note

During ejection, if either the harness release or automatic barometric parachute actuator cartridges fail to function properly, automatic seat separation and/or parachute deployment may not occur. Therefore, during any low altitude ejection, the pilot should attempt to "beat the seat" by manually pulling the harness release handle and then the parachute ripcord D-ring immediately after ejection.

BAILOUT

Bailout from high-performance aircraft is extremely hazardous, even under the most favorable conditions (level flight, slow airspeed), and is considered a last-resort method of escape. However, if the seat cannot be ejected, the following bailout procedures are suggested:

1. Pull green ring on seat pan for emergency oxygen.
2. Disconnect console oxygen and antiblackout hoses.
3. Select RAM air.
4. Jettison canopy.
5. Pull harness release handle.
6. Lean forward to clear parachute past headrest.
7. Trim aircraft nosedown and roll inverted.
8. Position arms against body and let stick snap forward.
9. When clear of aircraft and below approximately 14,000 feet, pull ripcord D-ring.

STRUCTURAL FAILURE OR DAMAGE

Loss of structural integrity may result from midair collision, exceeding structural limits, bird strikes, etc. The following procedure generally applies:

1. Reduce airspeed as much as practicable. If at low altitude, zoom to convert airspeed to altitude.
2. Determine whether adequate control of aircraft is available for continued flight. If not, eject.
3. If able to control aircraft, climb to minimum recommended ejection altitude, 10,000 feet or higher, at a reduced airspeed to prevent further damage.
4. Operate engine at minimum power to maintain level flight or slow climb if it is suspected that foreign objects may have entered the engine.
5. Whenever possible, request a visual inspection by another aircraft to assist in evaluating the damage.
6. Examine the slow-flight characteristics of the aircraft in the landing configuration at 10,000 feet, or above, prior to attempting a landing. Don't stall. Lower flaps in increments to determine if a split flap condition exists.
7. Land at the nearest suitable facility, using a precautionary approach, modified as necessary, unless the damage is determined to be negligible. If a bird has been ingested into the engine, even though there is no visible damage or indications of engine malfunctions, a prompt landing should be made, since a possibility exists that the engine may seize. Assume that the bird has been ingested if it strikes either side of the fuselage forward of the engine intake ducts.

SYSTEMS FAILURES

Hydraulic Systems Failures

Either the utility or the control hydraulic system warning light on indicates a loss of pressure to one or the other of the tandem hydraulic systems. Both UTIL HYD and CONT HYD warning lights on and a stiffening of the controls indicate a complete hydraulic failure.

Note

The manual flight control handle should not be pulled unless both the flight control and utility systems have failed.

No means are available to the pilot to restore hydraulic system pressure.

When operating on utility system only, actuation of various units normally operated by utility system pressure will cause a temporary decrease in the effectiveness of the flight controls.

CAUTION

- If a hydraulic system is lost in flight, be alert for evidence of fire, as the possibility of an engine-section fire exists.
- Do not attempt maneuvers requiring high control forces (such as high-speed pullouts) when it is known that one or both systems are inoperative.

COMPLETE HYDRAULIC FAILURE. In the event of a complete hydraulic system failure, as previously defined, the following procedure should be followed for flight control disconnect.

1. Terminate any accelerated maneuver.

2. Reduce airspeed to 200 KIAS, if possible. Lateral-control forces are high on manual control except at low speeds.

3. Trim aircraft laterally.

Note

As long as (normal) electrical power is available, the aircraft can be trimmed.

4. Manual flight-control handle . . . . PULL

Note

To ensure complete hydraulic power disconnect, relax stick pressure while pulling the manual flight control (MAN FLT CONT) handle.

5. Trim if necessary.

6. Terminate flight as soon as practicable.

7. An arrested landing is recommended whenever possible to minimize fire hazard due to possible hydraulic leak.

Note

Emergency extension of the landing gear and a no-flaps approach and landing will be required. Spoilers and nosewheel steering will be inoperative. Landing gear safety pins should be installed as soon as possible after landing.

When a hydraulic power disconnect is made with asymmetrical wing or store loadings, the following recommendations are made:

1. Speed less than 200 KIAS prior to disconnect, if possible.

2. After disconnect, avoid excess longitudinal stick motion.

3. Plan approach to ensure that crosswind component is under heavier wing.

4. Recommended approach airspeed is 140 KIAS, with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control speed is 115 KIAS with hydraulic power failure and up to 1200-pound asymmetrical load.

5. When crosswind component exceeds 8 knots, an arrested landing is recommended to minimize ground handling problems during landing rollout.

Note

In case of excessive nose pitchdown, the use of speedbrakes may cause increased nose-down tendency due to the design of the speedbrake system.

The manual flight control handle should be pulled all the way out (approximately 1 foot) with a rapid and positive motion. This action will ensure a clean disconnect and will aid in preventing a tendency for the aircraft to roll as the switch to manual control is made. The manual flight control mechanism cannot be reset in flight once it has been disengaged.

If, for any reason, the manual flight control handle is pulled while hydraulic pressure is still available, a metallic thud will be heard when the stick is moved. This sound, caused when hydraulic pressure slams the piston against the end of the cylinder, is normal for the system under the above conditions and should not be a cause for alarm.

When a disconnect has been made and utility system pressure is available, it is possible to engage and utilize the AFCS to reduce stick forces.

Note

The tandem rudder actuator is not disconnected by the flight control disconnect handle, and high rudder forces can be expected.

Electrical System Failure

MAIN GENERATOR FAILURE. Partial or complete failure of the main generator to provide the aircraft with the required output may be caused by generator constant-speed drive failure, blown fuse(s), and other mechanical or electrical discrepancies. Partial failures may result in a loss of one or more phases of ac, or reduced or fluctuating frequency or voltage. The most likely signs of a partial failure will be the GEN light coming on, TACAN unlocking and spinning, loss of air conditioning, erroneous attitude presentation of the all-attitude indicator with or without an OFF warning flag indication, or abnormally slow trim speed.

TACAN breaking lock-on, variation of instrument light intensity, sluggish or unstable gyro action, and variations in UHF background noise when associated with throttle reductions are an indication of impending generator drive transmission failure. Under this condition, continued throttle manipulation can induce various fuse failures including dc converter fuse failure. It is recommended that throttle manipulation be reduced to the minimum. If symptoms persist, deploying the emergency generator will prevent loss of power as long as airspeed is kept at or above 120 KIAS.

If the main generator should fail completely, all electrical equipment will be rendered inoperative immediately. The most easily recognizable indications of complete main generator failure occur simultaneously, as follows:

1. Landing gear indicators	UNSAFE
2. Flap position indicator	OFF
3. Attitude gyro-indicator	OFF FLAG VISIBLE
4. Trim position indicators	OFF SCALE
5. UHF/TACAN	INOPERATIVE
6. Exterior/interior lights	INOPERATIVE

When a main generator failure is known or suspected, pull the emergency generator release handle. At altitudes above 25,000 feet, first reduce throttle to 90 percent or less, as fuel-boost pump will be lost and engine may flame out. When operating on the emergency generator, the emergency generator bypass switch must be set at NORMAL. If electrical power is not partially restored when the emergency generator is extended, ensure that the bypass switch is in NORMAL.

To prevent damage to the emergency generator, do not extend the emergency generator at airspeeds above 500 KIAS or 0.91 IMN. At low indicated airspeeds, the emergency generator may not be capable of supplying adequate electrical power to support the equipment powered from the primary bus. For this reason, during operation with the emergency generator extended, the following precautions should be observed:

1. During flight at night or in adverse weather conditions, an indicated airspeed in excess of 120 KIAS should be maintained until the flight can be maintained by visual reference.

Note

External approach lights are operated through a dc approach light relay. With a dc electrical failure, the primary dc bus which operated the approach light relay will be inoperative and external approach lights will not be available. If a dc fuse is the problem, dc power may be regained by dropping the emergency generator.

2. During landing approaches, an indicated airspeed of 120 KIAS should be maintained as long as power for the operation of the horizontal stabilizer actuator is desired.

3. Advise tower that radio communication will be lost during landing rollout.

Note

Emergency generator power to operate the TACAN, the angle-of-attack vane heater and the nesa glass heater will not be available when the landing gear is down. Power may be restored by first retracting the wheels and then cycling the emergency generator BYPASS switch.

DC CONVERTER FAILURE. Failure of the dc converter is indicated when dc-powered equipment malfunctions while ac-powered equipment is operating normally. The same indications will be present with an open dc power fuse. If the malfunction is an open fuse, deploying the emergency generator will restore dc power. If deploying the emergency generator does not restore dc power, a converter failure is confirmed and full ac power can be regained by selecting emergency generator BYPASS position. Refer to figure FO-7 for equipment lost following a dc converter failure.

WARNING

An airstart is not possible following a dc converter failure.

EXTERIOR LIGHTS FAILURE. If exterior lighting is lost:

1. Maintain a sharp lookout to prevent collision with other aircraft.

2. Join up on another aircraft, if possible.

3. Request radar control for assistance if unable to join another aircraft.

INTERIOR LIGHTS FAILURE. If interior lighting is lost, use the cockpit emergency-floodlights or a flashlight to illuminate the instruments or the console.

CONSTANT-SPEED DRIVE (CSD) FAILURE. Any combination of the following should be considered as an indication of an impending failure:

1. TACAN unlocking.

2. AJB-3A malfunction (with or without an OFF flag).

3. Gear and flaps indicator failure.

4. Intensity of cockpit lights with throttle movement.

Failure of the CSD can cause the ac-dc converter ac primary (monitored) fuses to open. Dc power can be restored by extending the emergency generator with the emergency ac generator BYPASS switch in the NORMAL position.

TACAN Failure

LOSS OF BEARING. When bearing information is lost, any of the following may be used (listed in order of preference:

1. Select alternate antenna position.

2. Homing feature (ARA-50 or ARR-69).

3. UHF-DF steer.

4. Mileage indication may be used to find the station as follows:

a. Identify station.

b. Turn as necessary to stop mileage and establish an arc from the station.

c. Note BDHI heading at wingtip which is thought to be in direction of station.

d. Turn left or right toward noted heading.

e. If mileage increases, turn to reciprocal heading. Otherwise, continue inbound to half the initial distance and repeat preceding steps 4a. through 4d. until DME reading is 20 miles or less. Continue inbound on predetermined heading. Observe station passage and range when distance begins to increase.

Loss of DME

1. Select alternate antenna position.

2. To determine the range, turn 30 degrees off the inbound heading to the station until a bearing change of 10 degrees from the original bearing is accomplished. Note the time required. Turn to place the station on the nose again. Time to the station is approximately three times that required to change the bearing 10 degrees.

GROUND STATION INTERFERENCE. Ground station interference is recognized by an erroneous lock-on by the No. 2 needle, by erroneous mileage, and by unusually garbled identification. Use dead reckoning until free of interference from the undesired station or select other means of navigating.

OTHER TACAN MALFUNCTIONS. Tube failure or improper adjustment may cause a 40-degree error in lock-on in either direction from the correct bearing. ID 307 malfunctioning may cause errors in lock-on in multiples of 40 degrees in either direction from the correct bearing. Detection of these discrepancies may be accomplished by observing the rapid drift of the No. 2 needle 40 degrees from its previously stabilized position or by observing that the rate of closure on the DME is less than normal with the No. 2 needle on the nose of the aircraft.

1. Change channels so as to unlock the No. 2 needle, and then return to the proper channel in an attempt to get a proper lock-on.

2. Take a heading 40 degrees more or less than indicated by the No. 2 needle and fly to the station, observing DME closure rate.

3. Use ARA-50, ARR-69, or UHF-DF facilities, if available.

Compass System Failure

If the compass system will not remain in SYNC during the slaved operation, switch to FREE DG and set correct north or south latitude in on the compass controller. Set heading to match the standby magnetic compass. If the compass card fails or is unreadable due to spinning, use the standby compass. Note the magnetic deviation on the deviation card when using the standby compass as deviation errors of up to 10 degrees are possible.

FLIGHT CONTROLS SYSTEMS FAILURE

Restricted Forward Stick Travel

An aircraft noseup out-of-trim condition due to up elevator and restricted forward stick travel may be caused by an uninitiated disconnect of elevator hydraulic power. The attitude problem may be alleviated by low airspeed, nosedown trim, extended flaps and landing gear, and all available forward stick. To restore full stick travel, follow the procedure for complete hydraulic failure. If the condition persists, relax pressure on the stick while pulling the manual flight control (MAN FLT CONT) T-handle.

Horizontal Stabilizer Actuator Failure

If the stabilizer actuator should fail while the aircraft is trimmed for high speed flight, a landing can be accomplished by flying the aircraft onto the runway with the flaps retracted, at an airspeed which ensures adequate control. Landing with the flaps retracted is recommended due to the nosedown trim change which occurs when the flaps are extended. Since the inoperative stabilizer cannot be moved to correct for the trim change, the elevator would have to be employed, in effect reducing the amount of elevator travel remaining to accomplish the landing. Maximum elevator effectiveness is achieved by burning down to 600 pounds of fuel remaining to provide an aft CG condition.

Horizontal Stabilizer Runaway Trim

1. In the event of runaway longitudinal trim, use MANUAL OVERRIDE control in the opposite direction to stop the runaway condition and to obtain the correct trim. When the acceptable trim has been regained and it is necessary to continually use the MANUAL OVERRIDE to prevent a recurrence of the runaway trim, proceed as follows:

a. Deploy emergency generator. This action provides the only means of deenergizing the stick switch/relay control circuit, the logical cause of the runaway trim.

2. Remain on hydraulic power control system.

3. If unable to retrim, adjust airspeed as required to minimize stick forces.

Normal Aileron Trim Failure

If aileron trim fails to respond while attempting normal corrective trim, do not attempt to check the trim circuit by operating the trim switch in the opposite direction. This will make the out-of-trim condition worse.

Aileron Trim Runaway

1. Stop runaway aileron trim by extending emergency generator.

2. Remain on hydraulic power control system.

3. Burn down excess fuel, and land.

With the trim jammed at maximum deflection in either direction, the forces required to return the stick to neutral will be moderate.

WARNING

- Do NOT disconnect flight control system.
- At high speeds on manual control, lateral forces will be uncontrollable if aileron trim has runaway.

Rudder Trim Runaway

1. Stop runaway rudder trim by extending emergency generator.

2. Remain on hydraulic power control system.

3. Burn down excess fuel, and land.

The force required to return the rudder to neutral will be moderate.

AFCS Malfunction

If the flight controls operate in an erratic manner, such as uncontrolled lateral or pitch oscillations, or if a "hardover" condition occurs, whether operating with AFCS in STANDBY or OFF, proceed as follows:

1. Depress autopilot override button on control stick.

2. If normal control is not restored and AFCS standby switch is in STANDBY, turn switch OFF.

3. If this does not restore normal conditions, deploy emergency generator.

4. If normal aileron trim is not restored upon disengagement of AFCS, move AFCS aileron trim NORM/EMER switch to EMER position. This should restore normal operation.

Note

Do not actuate flight control power disconnect to rectify an AFCS malfunction.

Frozen Controls (Icing)

Icing may cause freezing of the lateral or longitudinal flight controls. If this occurs, DO NOT pull the disconnect and attempt to fly using manual control, but proceed as follows:

1. Strike stick smartly. It may require as much as 50 pounds or more of force to free controls.

2. If unable to free controls, fly with trim tabs and rudder to an altitude below freezing level and repeat step 1.

The possibility of experiencing this condition can be minimized by setting the horizontal-stabilizer trim to 0 degrees prior to engine shutdown to prevent rain and spray entering the elevator, and by moving the controls through full-travel immediately prior to takeoff.

Spoiler Malfunction

If spoilers extend in flight, proceed as follows:

1. Ensure that power is above 70 percent.

2. SPOILER switch in OFF.

3. Deploy emergency generator.

4. If none of the above steps succeeds in closing the spoilers, slow flight aircraft to 5000 feet AGL or above to check landing characteristics.

If one spoiler fails to open during landing roll, proceed as follows:

1. Control swerving with corrective rudder, brakes, nosewheel steering, and aileron, as required.

2. When control is regained, place SPOILER switch in OFF.

3. Raise flaps as soon as possible.

Speedbrake Failure

In the event of a speedbrake control valve solenoid or dc electrical failure, operate the speedbrakes as follows:

1. Speedbrake switch ..... OPEN OR CLOSE, AS REQUIRED

2. EMER SPEED BRAKE control knob .... PULL TO OPEN OR PUSH TO CLOSE, AS REQUIRED

The emergency speedbrake control may be used to override the electrical signal, but the handle must be held in the desired position. In case of hydraulic and electrical failures when the speedbrakes are open, the speedbrakes may be closed to the trail position by momentary actuation of the manual control.

FUEL SYSTEM FAILURE

Fuel Quantity Indicator Failure

If the indicator needle will not move or if it continuously rotates, manage the fuel using the flowmeter and the best estimate of fuel remaining. If in company with other aircraft and the initial fuel load and mission performed have been identical, the fuel remaining will usually be within a few hundred pounds of that of the accompanying aircraft. Land as soon as practicable, in either case.

Fuel Transfer Failure

The fuel transfer caution light will come on to indicate fuel transfer pump failure.

When the fuel transfer caution light remains on, assume that the usable fuel remaining is either 1600 pounds or the indicated fuel quantity (whichever is less) and land as soon as possible.

Note

- The fuel transfer caution light will come on in flight or on the ground when engine rpm is approximately 70 percent or below, or when wing fuel is actually depleted.
- Maneuvering flight may cause the light to come on intermittently.

When the fuel remaining in the fuselage tank falls below approximately 1100 pounds (the level at which the wing tank capacitance units are moved from the indicating circuit), there will be an abrupt drop in fuel quantity indication to a reading corresponding to the fuel remaining in the fuselage tank. When the wing tank transfer pump fails, only the fuel remaining in the fuselage fuel tank will be available. However, if the external fuel tanks contain fuel and are pressurized, fuel will flow to the wing tank until it is full and then will flow directly to the fuselage cell until drop tank fuel is exhausted. Drop tank fuel may be transferred directly to the fuselage fuel cell without first filling the wing tank by placing the AIR REFUEL switch in the FUS ONLY position.

When drop tank fuel has been exhausted, place the WING FUEL switch in EMER TRANS. This will pressurize the wing tank, forcing fuel to the fuselage cell through the path of least resistance (air refueling plumbing and/or normal fuel lines between the transfer pump and fuselage cell).

With a centerline drop tank installed, place the drop tank transfer switch in the PRESS position to prevent wing fuel from flowing into the centerline tank when the emergency transfer system is activated.

With an air-refueling store installed, place the ship-tank switch on refueling control panel in the FROM STORE position to prevent wing fuel from flowing into the store when the emergency transfer system is activated.

With the emergency transfer switch in EMER TRANS position, a static pressure of 6 psi is imposed in the wing tank. Inadvertent dumping of wing tank fuel may occur through a pressure relief and dump valve if the wing tank is overfilled or if the wing tank vent becomes blocked with fuel. Inadvertent dumping of fuel will be apparent from a rapid drop in fuel quantity indication (about 700 pounds per minute). It may be necessary to turn off the emergency fuel transfer switch temporarily to permit a decay of wing pressurization and the dump valve to reseat.

Fuselage Tank Float Valve Failure

If the fuselage tank float valve sticks in the closed position, the fuel transfer caution light will not come on, and the only indication of a failure will be the abrupt drop in fuel quantity to approximately 1100 pounds (the reading corresponding to the fuel remaining in the fuselage tank). If there is fuel in the external tanks and they are pressurized, this will not normally occur until external fuel is depleted as it will continue to transfer to the fuselage tank through the air refueling plumbing. When the fuel quantity drops unexpectedly to 1100 pounds, whether or not the fuel transfer caution light is on, proceed as follows:

1. Ensure that drop tank transfer switch is in PRESS.

2. The float valve may be unseated by rapid oscillation of the control stick, within the structural limits of the aircraft. If this action unseats the valve, landing at the nearest suitable facility is recommended as there is a possibility that the valve will stick again.

3. If preceding steps 1 and 2 are not practicable or are unsuccessful, place the emergency transfer switch in EMER TRANS and proceed as described for Fuel Transfer Pump Failure. If there is still fuel in the external tanks and drop tanks transfer is normal, do not select EMER TRANS until it is depleted.

4. Land as soon as possible.

Drop Tank Transfer Failure

Normal fuel transfer from the drop tanks will not be possible in flight unless the drop tank fueling switch, in the aft engine compartment, is placed in the OFF position after drop tank fueling and before takeoff. If the drop tank fueling switch has been left in the ON position, drop tank transfer may be accomplished by extending the emergency generator. If the main generator has failed, the air pressure control valve will fail-safe to the open position. Prior to extension of the emergency generator, or if a complete aircraft electrical power failure occurs, the air pressure in the drop tanks, resulting from the open air pressure control valve, immediately commences drop tank fuel transfer. Such transfer is necessarily dependent upon wing tank or fuselage fuel cell space being available to accommodate the drop tank fuel. When the pilot extends the emergency generator, the AIR REFUEL switch on the engine control panel is powered. The pilot then has the option of bypassing the wing tank and directing drop tank fuel to the fuselage cell by placing the AIR REFUEL switch in the FUS ONLY position.

WING BYPASS TRANSFER

The air refueling FUS (fuselage) ONLY switch can be used to prevent fuel from entering a damaged wing tank, thus averting a fuel loss/fire hazard condition.

To transfer fuel directly from the drop tanks to the fuselage cell, place the AIR REFUEL switch in the FUS ONLY position and pressurize the drop tanks.

Note

Indication of fuel transfer may take as long as 10 minutes, if activated with 400 pounds of fuel or less remaining in each drop tank.

To air refuel the fuselage cell and drop tanks only, place the AIR REFUEL switch in FUS ONLY and the DROP TANKS switch in the AIR REFUEL position.

NEW NEW NEW NEW NEW NEW

OXYGEN SYSTEM/MASK FAILURE

If no oxygen is available because of system depletion or failure, or if mask malfunctioning or contaminated oxygen is suspected, proceed as follows:

1. Place oxygen switch in OFF and pull green ring. Descend rapidly to cabin altitude of 10,000 feet or below.

2. Remove mask if unable to breathe or when bail-out oxygen is depleted.

3. If fuel remaining permits, descend to 10,000 feet pressure altitude or lower and select RAM air.

4. Land as soon as practicable.

AJB-3A FAILURES

Failures may occur where roll, pitch, or heading indications are lost singly or in combination. The OFF warning flag will always promptly indicate the loss of 28 vdc. One or two phases of ac may be lost, yet the indicator will continue to function for an indefinite period with an OFF flag indication, even though the information presented may be erroneous. Backup instrumentation is provided by a standby gyro, turn and bank, magnetic compass, etc., to permit continued flight. Intentional flight in instrument conditions with any type of AJB-3A failure should be avoided whenever possible.

Note

With loss of any phase of ac power the OFF warning flag of the AJB-3A will be visible.

PITOT-STATIC SYSTEM FAILURE

When airspeed indications are lost or are suspected to be erroneous, the altimeter and vertical speed indications will probably be similarly affected. Turning the pitot heat ON should promptly restore normal operation, if the malfunction was due to pitot-tube icing. If it is apparent that icing is not the cause, place the cockpit pressurization switch in RAM and break the glass from the vertical speed indicator. This may restore operation by providing a source of static pressure, but instrument readings will not be accurate. There will be a pronounced lag, and the vertical speed indications will be reversed. Use the cabin altimeter as a rough cross-check on altitude.

AIR CONDITIONING TEMPERATURE CONTROL FAILURE

Occasionally, malfunctions will occur which cause the air conditiong system to provide either full-hot or full-cold air to the cockpit. Manual positions are provided for the temperature control knob with which the pilot can select a desired temperature level. If the manual temperature is inoperative and the pilot becomes uncomfortably hot or cold, the NORMAL/RAM switch should be placed in RAM. If it is not practical to operate in RAM, adjust the eyeball diffusers and defrost control to minimize airflow. Use minimum rpm required for flight. Changing altitude should extend the period the adverse temperature can be endured. The pilot should land before debilitating effects reduce the pilot's capability to do so safely. As a last resort, if the cockpit temperature is unbearable and pilot is unable to switch to RAM operation, the canopy should be jettisoned, if doing so would improve the situation.

LOSS OF CANOPY

When the canopy is lost/jettisoned after takeoff or in flight, slow aircraft to 200 KIAS or below. Since surface control damage may result from canopy loss, slow-flight of the aircraft should be accomplished prior to landing. If loss occurs immediately after takeoff, the pilot should maintain speed commensurate for aircraft weight and enter downwind for landing. If loss occurs at high altitudes, an immediate descent to warmer temperatures should be made before the pilot is incapacitated. If able to descend to an altitude where a comfortable temperature exists, the pilot should decide whether to return to home base or land at the nearest facility. Should existing conditions preclude descent to acceptable temperatures, the pilot should eject prior to becoming incapacitated.

Note

After canopy loss/jettison, the pilot should be alert for excessive flapping of the face curtain. If such condition develops, lower the ejection seat safety handle until transition to final landing.

AIR REFUELING STORE FAILURE

Hose Jettison

Hose jettison may be desirable when store hydraulic pressure is lost or when an electrical malfunction occurs which prevents retraction of the drogue. When hose jettison is elected, proceed as follows:

1. Reduce airspeed to 250 KIAS or less.

2. Hold back the spring-loaded channel guard and lift the hose jettison switch and move to the JETTISON (aft) position.

Note

A 5- to 20-second time delay will occur prior to the hose jettisoning.

3. Do not change the position of the hose jettison switch after jettisoning the hose and drogue.

If hose jettison is accomplished at a speed greater than 250 KIAS, excessive tension on the hose due to hose stretching may pull the hose from the crimper after the guillotine is fired. Hose jettison is available on emergency generator. Fuel dumping from the store is not possible on emergency generator. Fuel transfers automatically to the wing fuel tank when normal electrical power is lost or when operating on emergency generator.

Electrical Failure

Should the main generator or store electrical system fail with the drogue extended, the ram air turbine will automatically feather, transfer of fuel to the receiver aircraft will terminate, and automatic transfer of all external fuel will commence. Store hydraulic power will terminate as the ram air turbine feathers. On emergency generator, the drogue cannot be retracted and any remaining fuel in the store cannot be dumped. Hose jettison is the only store system available on emergency generator.

If failure occurs which prevents retraction of the drogue, proceed as follows:

1. Ashore: Jettison the hose and drogue as necessary, only if indicated by other considerations, such as field arrestment required, decreased drag necessary for safe return, etc.

2. Carrier-based: Jettison hose and drogue, if possible, before landing. Make a normal approach. Advise ship of condition so that flight deck personnel can be warned.

CAUTION

Any evidence of a hydraulic leak observed during refueling operation should immediately be reported to the tanker pilot and the store should be secured.

Drogue And Coupling Lost and/or Hose Severed (Other Than Hosecutter Severance)

Should the basket or hose be lost, the remaining hose will automatically retract due to the loss of the drag created by the basket. This is accomplished by the 200-pound force continually applied by the hose reel assembly. The following procedure is recommended:

1. Place drogue position switch in RET.

2. Deploy emergency generator.

3. Place refueling master switch in OFF.

4. Select emergency generator bypass to remain on main generator.

Note

The store may be dumped, but the refueling master switch shall not be placed in ON.

The preceding procedure is recommended to reduce the fire hazard created by actuation of the hose jettison. A secondary procedure is as follows:

1. Place drogue position switch in RET.

2. Place hose jettison switch in JETTISON and leave in this position until after engine shutdown.

Loss of Store Feathering Control

If unable to feather the store air turbine after drogue retraction, check drogue position indicator. If drogue indicates RET, observe limiting airspeed of 300 KIAS or 0.80 IMN for remainder of flight. If the drogue position indicates TRA but drogue is reported to be retracted, slow to 230 KIAS and recycle drogue in an attempt to obtain a RET indication. If not successful, slow to 200 KIAS or 0.80 IMN for the remainder of the flight. After a shore-based landing, drogue will probably trail out and sustain damage. For shipboard, make a normal approach. Advise ship of possible necessity to tie up or carry drogue as aircraft is taxied from landing area.

BANNER TOW TARGET FAILURE

1. In the event of MK 51 bomb rack malfunction and/or inability to release a towline and banner, a landing with towline and banner attached can be made on runways of 10,000 feet or greater length. Make a steep diving approach to a landing approximately 5000 feet down the runway. The chase aircraft can verify banner terrain clearance during the landing approach. Drag caused by the banner and towline on the runway after landing will normally obviate the need for an arrested landing.

2. In an emergency situation requiring immediate release of the towline and banner, the MK 51 rack assembly can be electrically released from the AERO 7A-1 bomb rack by using the emergency bomb release circuit. This procedure can be employed if the normal release circuit malfunctions and landing with the towline and banner is not considered safe.

LOST/DOWNED PLANE PROCEDURES

Lost Plane Procedures

If unable to orient yourself, either using available NAVAIDS or visually, proceed as follows:

WITH RADIO

1. Admit being lost.

2. If at low altitude, climb to increase endurance and communications/radar detection range.

3. Conserve fuel by flying at maximum endurance airspeed until oriented.

4. Squawk EMERGENCY IFF codes.

5. Switch to GUARD channel: 243.0 mc.

6. Broadcast the word "PAN" or "MAYDAY" three times, as appropriate.

7. Transmit type of aircraft, estimated position, course, speed, altitude, and fuel supply in minutes.

8. State difficulty.

9. State assistance desired or intentions.

10. Transmit for D/F steer as requested.

11. Once in contact with a radio facility, make a broadcast that you are in contact with ____________ and ask all others to remain SILENT unless called. Do not shift frequency or ground stations unless necessary.

12. Comply with instructions given.

13. When oriented and decision is made as to destination, use maximum range airspeed to get there.

WITH RECEIVER ONLY

1. Use with Radio steps, if applicable.

2. Fly two triangles to the right (1-minute legs). Repeat pattern every 10 minutes. Meanwhile, maintain estimated best course.

3. Monitor GUARD channel and comply with instructions given by responding station.

WITHOUT RADIO

1. Use with Receiver Only steps, if applicable.

2. Fly two triangles to the left (1-minute legs). Repeat pattern every 10 minutes. Meanwhile, maintain estimated best course.

3. Maintain lookout for interceptor. Refer to FLIP planning document or en route supplement emergency procedures for current day-and-night interceptor procedures and signals.

REMEMBER THE FIVE "C"s

1. Confess

2. Communicate

3. Climb

4. Conserve

5. Comply with the instructions.

Downed Plane Procedures

SINGLE AIRCRAFT. If the situation permits, prior to ejection, crash landing, or ditching, make every effort to switch IFF code to EMERGENCY settings and send a MAYDAY message on the GUARD channel. Turn IFF OFF just prior to ejection. Conditions existing after abandoning the aircraft will dictate whether to remain near the scene of the crash or attempt to find assistance.

SECTION. If one member of a section goes down, the other member should:

1. Establish contact with ground station, preferably GCI site or radar control agency. Switch IFF to EMERGENCY and UHF to GUARD.

2. Make every effort to follow pilot during descent, keeping him in sight at all times. Note as accurately as possible his position on the ground or in the water, using bearings and distances from known prominent landmarks or navigational aids to direct rescue planes or boats to the scene.

3. Maintain sufficient altitude to ensure radio contact with rescue facility.

4. Request assistance of other aircraft if necessary to maintain communications with and continuous surveillance of survivor.

5. Leave area with sufficient fuel remaining to POSITIVELY ensure return to base or an alternate field.

DIVISION. Everything previously mentioned for downed plane procedures holds true if there are more than two members in the flight. Some additional procedures can be followed which generally will ensure a greater likelihood of a successful rescue.

1. The other member of the section in which the downed pilot was flying will follow pilot during his descent and circle survivor at low altitude and a maximum endurance airspeed, keeping him in sight at all times.

2. Other members of the flight will remain at altitude, alert the appropriate SAR facilities, relay communications, and conserve fuel.

Other Considerations

1. The flight leader will shift all communications to the local SAR frequency when directed by the SAR coordinator.

2. All aircraft not specifically requested to assist will remain clear of the area.

3. Arrange for a relief on station in a timely manner, fuel permitting.

4. The aircraft on low station must not become distracted from the primary requirement of flying his aircraft. Maintain flying speed. Don't fly into ground or water.

5. Turn off emergency IFF code when departing from scene.

LANDING EMERGENCIES

NO-RADIO PATTERN ENTRY AND LANDING (VFR)

Day

Determine the duty runway by observing traffic or the tetrahedron. Enter the break, maintaining a vigilant lookout for other aircraft. Rock the wings slowly (about 20-degree bank) until over midfield. Make a standard break to the downwind. Double-check gear down at the abeam position. During the approach, periodically check the tower for a light signal. If a red light or no light is received, wave off (fuel permitting) and enter downwind. Do not raise the landing gear unless departing the pattern. Be alert for aircraft breaking above. Airfields with dual runways should attempt to designate either the left or right runway for no-radio landings.

Section of Aircraft

The no-radio approach may be straight-in or by entry into the break. Aircraft with radio failure will fly on the starboard wing (port wing if the field has a right-hand pattern). If entering the break, the no-radio aircraft will break with the leader. The standard signal for speedbrakes will be given by the leader to slow to 220 KIAS. When airspeed is below 220 KIAS, the standard signal for gear down will be passed and both aircraft will lower gear and flaps. Aircraft will continue into the groove in section. When the leader has the ship/runway in sight and the no-radio aircraft has been cleared to land, the leader will point to the ship/runway and detach wingman by blowing a kiss and pointing to wingman. The leader will then level-off, obtain lateral separation, and parallel the final bearing/runway heading until the wingman is safely on deck. In the event of a waveoff or bolter, the wingman will rejoin the leader, and the procedure will be repeated.

Night

In the event of radio failure with the external lights operative, follow the day procedure, adding a series of rapid, manual flashes, with the external lights on BRT/STDY, to the wingrock.

When complete electrical power is lost at night, the only course of action open to the pilot, short of ejection, is to maintain an extremely vigilant lookout, and observe traffic or the tetrahedron to locate the duty runway. If landing traffic cannot be observed on the runway, to ascertain that the runway is clear, attempt to alert the tower, prior to landing, by making a low pass parallel to the lighted runway, close aboard the tower, jazzing the throttle. Land, if possible, when the pattern is clear of traffic.

NIGHT (OR IFR)

The leader (or aircraft with good radio) obtains marshal (shipboard) or approach clearance (shore-based) and leads the no-radio aircraft to meatball. See figure 7-10 for light signals. Aboard ship, hook will be lowered prior to departing marshal. Bolter and waveoff procedures are the same as for day.

PRECAUTIONARY APPROACHES

A precautionary/flameout approach should be made when engine failure is considered imminent. In this situation, the most important factor is to land the aircraft safely as soon as possible at the nearest suitable field. The precautionary/flameout approach is designed to afford the pilot a means of landing safely and expeditiously while providing him a safe ejection altitude should he elect to discontinue the approach.

High Precautionary/Flameout Approach

The high precautionary/flameout approach is shown in figure 5-14. The pattern consists of a 270-degree approach, with checkpoints at the initial, 180-degree, and 90-degree positions. The optimum airspeed of NEW

AIRSPEED AND ALTITUDE

	OPTIMUM	USABLE BAND
APPROACH SPEED-KNOTS	180	170 TO 200
INITIAL POINT ALTITUDE	7000 FT	6000 FT (GEAR UP)
180° POINT ALTITUDE	4500 FT	4000 FT TO 5000 FT (GEAR DOWN)
90° POINT ALTITUDE	3000 FT	2800 FT TO 3200 FT (GEAR DOWN)
FINAL APPROACH ALTITUDE	1000 FT	500 FT MINIMUM
FLARE	200 FT	200 FT TO 300 FT

OPTIMUM CONFIGURATION: GEAR DOWN-FLAPS UP.
ALL ALTITUDES SHOWN ARE TERRAIN CLEARANCE.

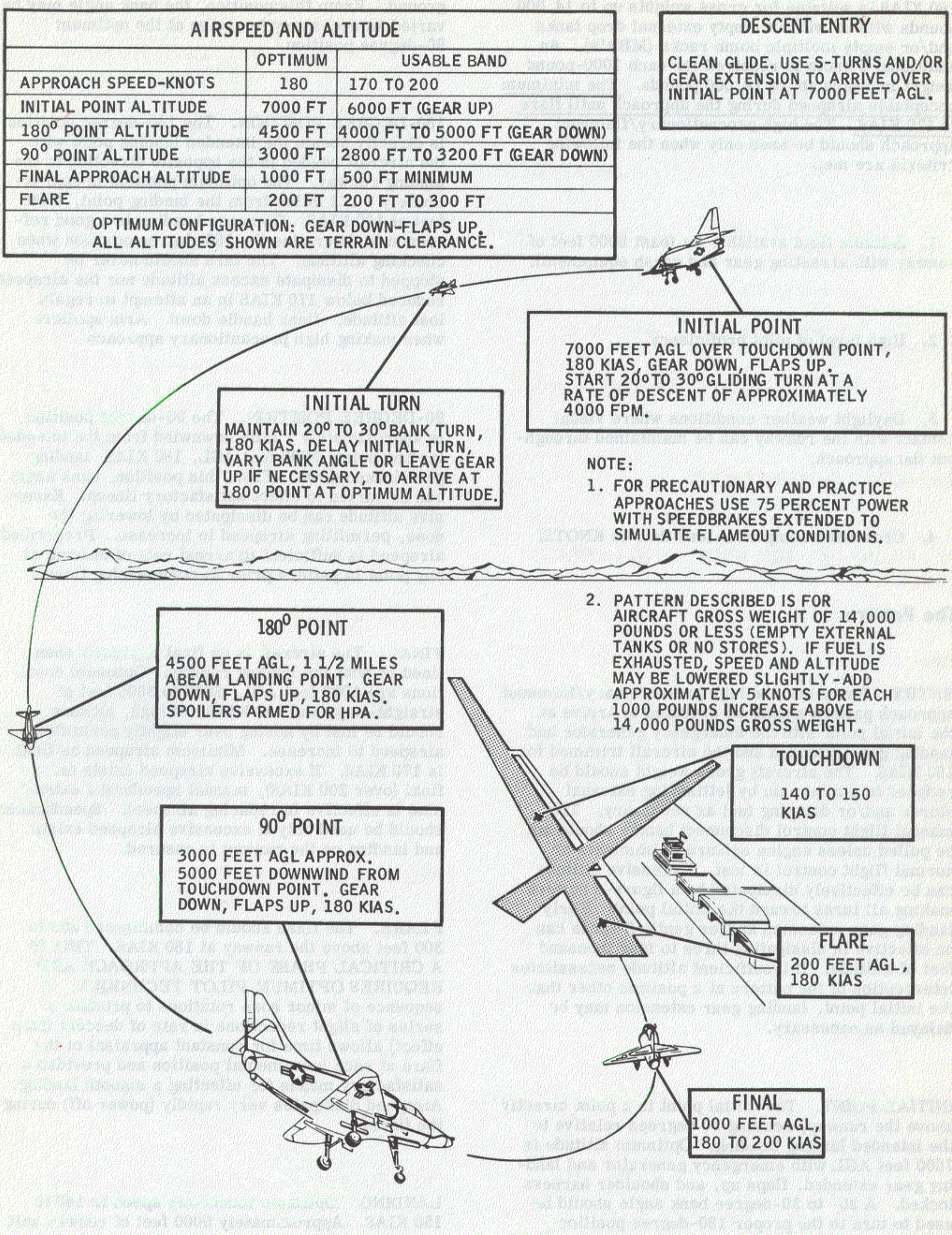


Figure 5-14. High Precautionary/Flameout Approach

180 KIAS is suitable for gross weights up to 14,000 pounds with or without empty external drop tanks and/or empty multiple bomb racks (MBR's). An additional 5 knots is required for each 1000-pound weight increase above 14,000 pounds. The minimum acceptable airspeed during the approach until flare is 170 KIAS. The high precautionary/flameout approach should be used only when the following criteria are met.

1. Suitable field available (at least 8000 feet of runway with arresting gear and crash equipment).

2. High level of pilot proficiency.

3. Daylight weather conditions where visual contact with the runway can be maintained throughout the approach.

4. Crosswind component less than 15 KNOTS.

The Pattern

ENTRY. Entry into the high precautionary/flameout approach pattern should be executed to arrive at the initial point with the emergency generator and landing gear extended and the aircraft trimmed for 180 KIAS. The aircraft gross weight should be reduced to a minimum by jettisoning external stores and/or dumping fuel as necessary. The manual flight control disconnect handle should not be pulled unless engine seizure is imminent or normal flight control is lost. Excessive altitude can be effectively dissipated by a figure-8 pattern making all turns toward the initial point. Early landing gear extension and/or gentle S-turns can be effective in dissipating three to four thousand feet of altitude. If insufficient altitude necessitates interception of the pattern at a position other than the initial point, landing gear extension may be delayed as necessary.

INITIAL POINT. The initial point is a point directly above the runway, heading 90 degrees relative to the intended landing heading. Optimum altitude is 7000 feet AGL with emergency generator and landing gear extended, flaps up, and shoulder harness locked. A 20- to 30-degree bank angle should be used to turn to the proper 180-degree position. The 180-degree position closely approximates the normal, no-flap 180-degree position over the ground. From this position, the bank angle may be varied as necessary to arrive at the optimum 90-degree position.

180-DEGREE POSITION. The 180-degree position is directly abeam the intended landing point with the aircraft headed in the opposite direction to the landing runway. The optimum position is approximately 1 1/2 miles from the landing point, 4500 feet at 180 KIAS. Compass heading is a good reference to determine the 180-degree position when checking altitude. The turn should never be stopped to dissipate excess altitude nor the airspeed reduced below 170 KIAS in an attempt to regain lost altitude. Gear handle down. Arm spoilers when making high precautionary approach.

90-DEGREE POSITION. The 90-degree position is approximately 1 mile downwind from the intended landing point, 3000 feet AGL, 180 KIAS, landing gear locked down. From this position, bank angle can be varied to effect satisfactory lineup. Excessive altitude can be dissipated by lowering the nose, permitting airspeed to increase. Prescribed airspeed is sufficient to arrest rate of descent at any point in pattern prior to commencing flare.

FINAL. The aircraft is on final approach when lined up with the landing runway. Optimum conditions are 1000 feet AGL, 2000 to 3000 feet of straight-way, and 180 KIAS. If high, altitude should be lost by nosing over slightly permitting airspeed to increase. Minimum airspeed on final is 170 KIAS. If excessive airspeed exists on final (over 200 KIAS), manual speedbrake extension is effective in reducing airspeed. Speedbrakes should be used only if excessive airspeed exists and landing on the runway is ensured.

FLARE. The flare should be commenced 200 to 300 feet above the runway at 180 KIAS. THIS IS A CRITICAL PHASE OF THE APPROACH AND REQUIRES OPTIMUM PILOT TECHNIQUE. A sequence of minor nose rotations to produce a series of slight reductions in rate of descent (step effect) allows time for constant appraisal of the flare at each incremental position and provides a satisfactory means for effecting a smooth landing. Airspeed dissipates very rapidly (power off) during the flare.

LANDING. Optimum touchdown speed is 140 to 150 KIAS. Approximately 5000 feet of runway will be required for stopping at these airspeeds. Airspeeds below 140 KIAS should be avoided to prevent a hard landing. A safe landing can be accomplished at touchdown airspeeds as high as 180 KIAS if sufficient runway remains. Deploy drag chute when below 160 KIAS. For most effective braking, moderate brake pedal forces should be applied as rapidly as possible after touchdown. Pedal forces should be increased gradually as the aircraft decelerates to a stop or safe taxi speed. If insufficient runway remains, the arresting hook should be extended for emergency arresting gear engagement.

ADDITIONAL CONSIDERATIONS. Effort must be made to fly the optimum patterns, and many variables must be considered. Only through repeated practice can the individual pilot acquire the proficiency to properly assess his approach. Some considerations which should be taken into account are:

DETERMINATION OF LANDING POINT. The selected landing point should be 2000 feet down the runway. Once the landing point has been selected, all checkpoints in the pattern are referred to it. Touchdown should be effected as soon as possible once a safe landing on the runway is ensured.

ALTITUDE ADJUSTMENT CONSIDERATIONS. Altitudes as low as 500 feet below optimum can easily be compensated for by varying bank angle slightly during the approach. Altitudes 500 feet or more below optimum require changes in the basic pattern; i.e., closer 180-degree position, 90-degree position, delay lowering landing gear. However, gear handle must be placed in DOWN position by the 180-degree position to ensure the gear down on final. The required changes can only be determined by continuous analysis of ground track position, airspeed, and altitude. Airspeed should never be decreased below 170 KIAS in an effort to decrease the rate of descent. Lack of sufficient airspeed to stop the steep rate of descent may not only result in an unsafe landing but may also preclude safe ejection. Excess altitude should be dissipated by lowering the nose, allowing airspeed to increase, rather than by adjusting pattern.

EFFECTS OF AIRCRAFT CONFIGURATION CHANGES. The increased drag of three empty MBR's causes less than 500-fpm increase in the rate of descent. The optimum flameout pattern provides sufficient altitude to compensate for this slight increase. The flare characteristics with MBR's are more critical due to the increased drag and require exacting pilot technique.

EFFECTS OF WIND. Wind velocity and direction is of vital importance during the flameout approach. A 15-knot wind will displace the touchdown point approximately 3000 feet downwind if corrections are not made. Correction for wind should be effected by varying bank angle to maintain optimum position if required in the approach. Actual flameout landings should not be attempted when the crosswind component exceeds the specified NATOPS limitations for landings with normal or manual flight controls.

Flight Characteristics With Engine Failure

Note

If, during the high precautionary approach, the engine should fail (flameout, seizure, etc.) and the pilot elects to continue the approach to touchdown, it should be understood that the pilot must be well qualified in the A-4M and have assessed the situation to the fullest extent.

ADEQUACY OF FLIGHT CONTROLS. At the recommended airspeeds, the windmilling engine provides adequate hydraulic pressure for excellent controllability with the normal flight control system during flameout approach and landing. During landing rollout, lateral control is retained down to approximately 40 KIAS. With full elevator deflection (not normally required) or manual speedbrake extension at touchdown, normal flight controls become very stiff at approximately 80 KIAS. The manual flight control system, which must be selected in the event of engine seizure, provides adequate controllability, but the rapid control response required for high crosswind landing is lost.

LANDING GEAR AND SPEEDBRAKE ACTUATION. If flameout occurs during a precautionary approach, manual speedbrake retraction requires less than 2 seconds and causes no adverse trim changes.

Note

A pilot will not attempt a flameout approach until he has demonstrated his ability to make consistent successful practice high precautionary/flameout approaches. If a complete power loss occurs, the decision to make a flameout landing after recent demonstration of satisfactory practice approaches will be left to pilot discretion.

CANOPY AND WINDSHIELD FROSTING. Depending on atmospheric conditions and the altitude at which flameout occurs, some frosting of canopy and windshield can be expected. The majority of frosting will occur on the canopy, with some accumulation on the windshield side panels. The center windshield panel is electrically heated by the emergency generator when the landing gear is retracted and will remain clear during the flameout glide.

Practice High Precautionary/Flameout Approaches

GENERAL. Every practice high precautionary approach (figure 5-14) and landing should be executed as realistically as possible. The following power settings with speedbrakes extended, closely approximate a flameout condition:

Altitude	RPM (Percent)	Rate of Descent
20,000 to 10,000	75	4500 fpm
Below 10,000	70	4100 fpm

Simulated flameout conditions should be established at varying directions and distances from the field and maintained to touchdown, or waveoff if landing is inadvisable. Skill in maneuvering the aircraft to the initial point as well as flying the approach and landing is important. If successful interception of the initial point is not possible, the practice approach should be continued to intercept the pattern at the first possible checkpoint to execute a safe landing.

Due to the high rate of descent, familiarity with the flameout condition flare characteristics and proficiency in flying the pattern must be established prior to carrying any approach below 500 feet AGL.

When making approaches to touch-and-go landings, the throttle should be reduced to IDLE during the flare to more closely simulate the flameout flare characteristics.

Minimum Pilot Qualifications

1. A minimum of six satisfactory practice high precautionary/flameout approaches to a minimum altitude of 500 feet AGL shall be accomplished prior to executing an approach to touchdown. Two of these should be demonstrated just prior to touchdown.

2. A minimum of three consecutive satisfactory approaches to touch-and-go landings shall constitute qualification.

3. Following initial qualification, a minimum of two satisfactory approaches to touch-and-go landings, or waveoff, should be executed each month to maintain an acceptable level of proficiency.

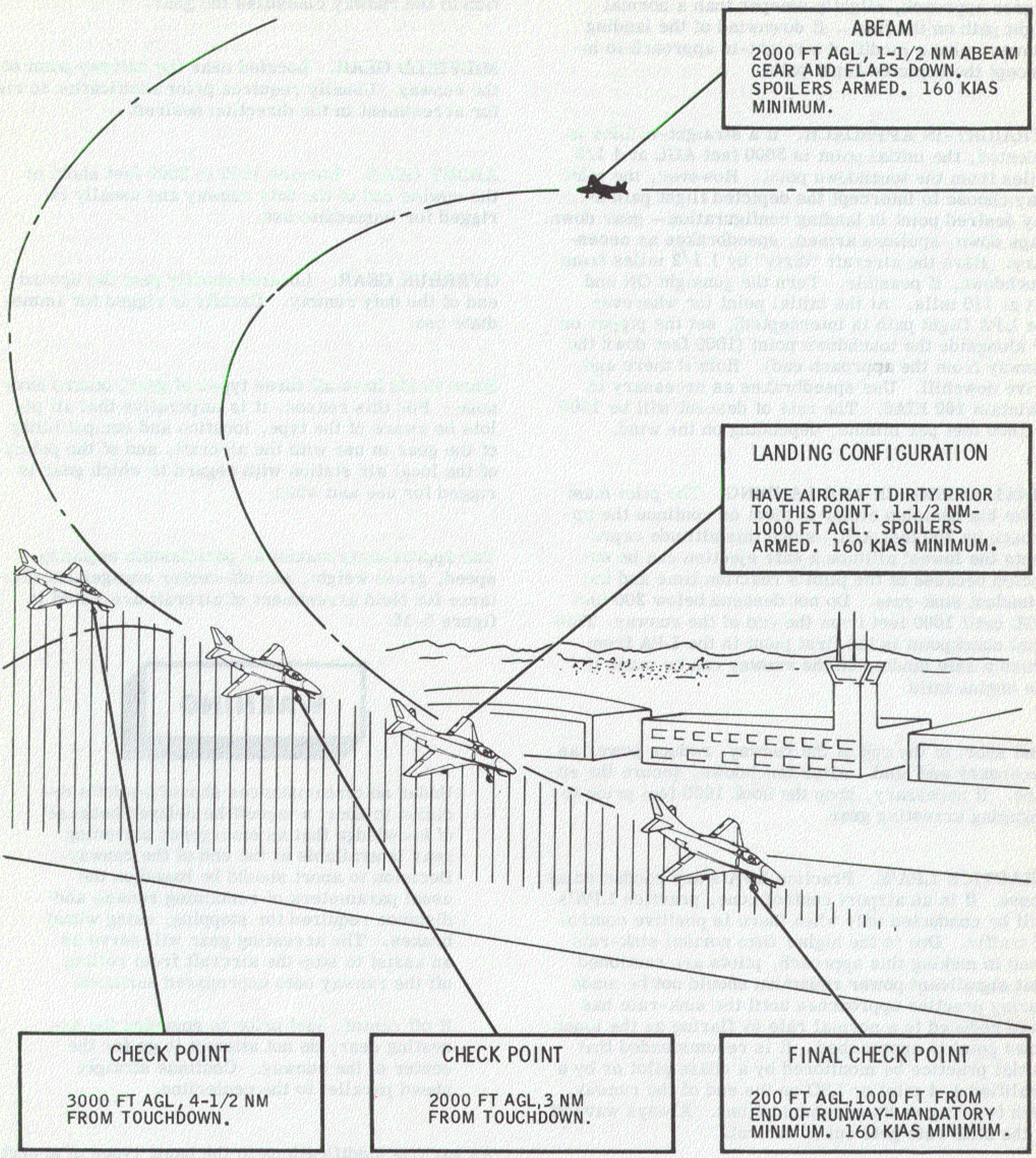
4. All approaches prior to qualification shall be monitored by a qualified chase pilot.

5. A record of satisfactory approaches should be maintained for each pilot.

Low Precautionary Approach (LPA)

The low precautionary approach (LPA) (figure 5-15) may be used whenever circumstances make it desirable, such as low ceiling or visibility, loss of oil pressure, or other engine difficulties which make it undesirable or impossible to reduce rpm. The variations in pattern entry and altitude allow a wide margin of flexibility. A suitable field for an LPA is one with a minimum of 8000 feet of hard-surfaced runway. Select a field with crash equipment and arresting gear, if practicable.

ENTRY. Approaches to the field for an LPA are divided into upwind or downwind categories. If upwind of the landing runway, plan to pass through a normal



NOTE:
THE STRAIGHT-IN FLIGHT PATH MAY BE INTERCEPTED AT THE MOST CONVENIENT POINT PRIOR TO THE FINAL CHECK POINT. THE CHECK POINTS ARE GUIDELINES ONLY.

FA1-98

Figure 5-15. Low Precautionary Approach

left or right base at 2000 feet AGL, executing a 180-degree approach, slightly steeper than a normal flight path on the final. If downwind of the landing runway, plan a modified straight-in approach to intercept the depicted flight path.

STRAIGHT-IN APPROACH. If a straight-in LPA is selected, the initial point is 3000 feet AGL at 4 1/2 miles from the touchdown point. However, the pilot may choose to intercept the depicted flight path at any desired point in landing configuration – gear down, flaps down, spoilers armed, speedbrakes as necessary. Have the aircraft "dirty" by 1 1/2 miles from touchdown, if possible. Turn the gunsight ON and set at 110 mils. At the initial point (or wherever the LPA flight path is intercepted), set the pipper on or alongside the touchdown point (1000 feet down the runway from the approach end). Hold it there and drive downhill. Use speedbrakes as necessary to maintain 160 KIAS. The rate of descent will be 1500 to 1800 feet per minute, depending on the wind.

FINAL APPROACH AND LANDING. The pilot must make his decision either to eject or continue the approach by 200 feet AGL, since this altitude represents the lowest altitude a safe ejection can be expected because of the pilot's reaction time and the attendant sink-rate. Do not descend below 200 feet AGL until 1000 feet from the end of the runway. This final checkpoint is the first point in the LPA from which a safe landing on the runway can be made if the engine fails.

Just short of the end of the runway, reduce power as necessary and land. After touchdown, secure the engine. If necessary, drop the hook 1000 feet prior to engaging arresting gear.

PRACTICE LPA'S. Practice LPA's are conducted as above. If in an airport control zone, practice LPA's will be conducted only when there is positive control of traffic. Due to the higher than normal sink-rate used in making this approach, pilots are cautioned that significant power reduction should not be made during practice approaches until the sink-rate has been reduced to a normal rate by flaring as the touchdown point is approached. It is recommended that initial practice be monitored by a chase pilot or by a qualified A-4 pilot or LSO on the end of the runway, with two-way radio communications. Always waveoff if the sink-rate gets out of control.

LANDING — USE OF EMERGENCY FIELD ARRESTING GEAR

There are several types of field arresting gear including the anchor chain cable, water squeeze, and Morest-type equipment. All types require engagement of the arresting hook in a cable pendant rigged across the runway. Location of the pendant in relation to the runway classifies the gear.

MIDFIELD GEAR. Located near the halfway point of the runway. Usually requires prior notification to rig for arrestment in the direction desired.

ABORT GEAR. Located 1500 to 2500 feet short of the upwind end of the duty runway and usually is rigged for immediate use.

OVERRUN GEAR. Located shortly past the upwind end of the duty runway. Usually is rigged for immediate use.

Some fields have all three types of gear; others have 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 of 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 5-16.

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 serve as an assist to stop the aircraft from rolling off the runway onto unprepared surfaces.

If off center, just prior to 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.

Depending upon the existing emergency condition, runway conditions, weather, time, fuel remaining, and other considerations it may be impractical or

Arresting Gear	Short Field Landing (g)		Long Field Landing		Aborted Takeoff		Maximum Offcenter Engagement (Feet)
	Aircraft Gross Weight (f)	Maximum Engaging Speed (Knots) (c)	Aircraft Gross Weight	Maximum Engaging Speed (Knots) (c)	Aircraft Gross Weight	Maximum Engaging Speed (Knots) (c)	
M-2	14,500	130 (d)	16,000	130 (d)	24,500	118(d)	20
E-14-1	14,500	147 (b)	16,000	147 (b)	24,500	152 (a)	35
E-27	14,500	157 (b)	16,000	157 (b)	24,500	160 (d)	20
E-15 (200 ft Span)	14,500	150 (b)	16,000	150 (a), (b)	24,500	145 (a)	20
E-15 (300 ft Span)	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	40
M-21	14,500	151 (a)	16,000	151 (a)	24,500	144 (a)	10
E-28	14,500	160 (d)	16,000	160 (d)	24,500	150 (a)	40
E-5 (Std Chain)	14,500	143 (b)	16,000	150 (d)	24,500	150 (d)	(e)
E-5-1 (Std Chain)	14,500	143 (b)	16,000	163 (a)	24,500	163 (a)	(e)
E-5 (Hvy Chain)	14,500	141 (b)	16,000	150 (d)	24,500	150 (d)	(e)
E-5-1 (Hvy Chain)	14,500	141 (b)	16,000	164 (a)	24,500	163 (a)	(e)
BAK-6	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	15
BAK-9	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	30
BAK-12	14,500	160 (d)	16,000	160 (d)	24,500	160 (d)	50

(a) Maximum engaging speed limited by aircraft arresting hook strength.

(b) Maximum engaging speed limited by aircraft limit horizontal drag load factor (mass item limit G).

(c) Maximum engaging speed limited by aircraft landing gear strength.

(d) Maximum engaging speed limited by arresting gear.

(e) Offcenter engagement may not exceed 25 percent of the runway span.

(f) Recommended approach airspeed for 14,500 pounds is 130 KCAS.

(g) 3.0 degree glideslope setting.

Figure 5-16. A-4M Field Arrestment Data

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 prevailing conditions. 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, the pilot should request it at this time.

In general, the arresting gear is engaged on the centerline at as slow a speed as possible. Burn down to 1500 pounds of fuel 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. After engaging the gear, good common sense and existing conditions determine whether to keep the engine 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 that a minimum rollout is desired, a short field arrestment should be made and the assistance of an LSO should be requested. Inform the LSO of the desired touchdown point. If midfield or Morest-type gear is available, it should be used. If neither is available, use abort gear. Make a flat approach, with sink rate as low as possible. Touch down on centerline, approximately 300 feet short of the arresting gear, with the hook extended. The hook should be lowered while airborne and a positive hookdown check should be made, if possible. Use an approach speed commensurate with the emergency experienced. Landing approach power will be maintained until arrestment is assured, or until a waveoff is taken. Be prepared for a waveoff 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 hook to extend fully prior to engagement. Do not lower the hook too early and weaken the hook point. Line up the aircraft on the runway centerline. Inform the control tower of your intentions to engage the arresting gear, so that aircraft landing behind you may be waved off. If no directional control problem exists (crosswind, brakes out, etc.), secure the engine.

Aborted Takeoff

If 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 5-16. The data provided in the Long Field Landing column may be used for lightweight aborted takeoff, where applicable.

Note

The taxilight may be used in locating arresting/abort gear at night.

Field Barrier

At many Air Force bases and some USN/USMC fields, there is some form of jet barrier, usually a Davis type. Compatibility of the A-4 with this type of gear has not been determined, and its use is not permitted.

CARRIER BARRICADE ENGAGEMENT

Carrier

The barricade will be used when a normal arrestment is not feasible. Refer to section I, part 4, for the maximum aircraft gross weight for barricade engagement and the applicable Recovery Bulletin for maximum allowable engaging speed and emergency-mirror/lens settings. Such stores as empty tanks, empty rocket packs, or other lightweight inert stores will not interfere with barricade engagement; but, if torn loose, they may present a hazard to flight deck personnel. Fly a normal approach: on speed, on meatball, on centerline. Do not dive for the deck or engage the barricade while in flight. Anticipate the loss of the meatball for a short period late in the approach, as the barricade stanchions may obscure the mirror.

Approach light indications will not be available to the LSO with the landing gear retracted nor will indexer indications be available for the pilot.

LANDING WITH LANDING GEAR MALFUNCTIONS

Figure 5-17 furnishes course of action guidance for emergency landings with landing gear malfunctions. These are recommendations only and are based on experience and statistical data available to date. It is recognized that sea, deck, weather, operational and pilot considerations may indicate different actions. The general considerations which follow are pertinent.

Field Arrestments

Always request the assistance of an LSO. When the arrestment is to be made at night, have the arresting gear position illuminated. If the landing must be made with fuel in the wing or external tanks, it is recommended that the intended landing area be foamed. Do not land wheels-down in "abort" type gear unless enough runway remains for runout. Normally, 1500 feet should be adequate.

LANDING — OTHER FAILURES

No Utility Hydraulic Pressure

Intermittent illumination of the utility system ladder light will usually warn the pilot of the impending loss of utility system pressure prior to the complete loss of pressure. When this is observed and it is practical to do so, slow the aircraft and lower the landing gear and flaps, placing the flap-selector in the STOP (center) position after extension. Return to base and land. Be prepared to disconnect the flight control power mechanisms in the event the flight control hydraulic system should also fail. (Refer to Hydraulic Systems Failure.)

It is not practical to dirty-up because of fuel considerations; slow to 300 KIAS or below. Return to base or an alternate field. Lower the wheels, using the emergency landing gear extension procedure set forth in this section. Wing flaps and speedbrakes will not be available unless extended and locked prior to utility system failure. Spoilers will be inoperative. Nosewheel steering control switch should be placed in the EMER OFF position. Landing gear safety pins should be installed as soon as possible after landing.

The wheel brakes hydraulic system is completely independent of the aircraft hydraulic system. Because the system is separate, the pilot will have wheel brakes available even though he makes a field landing with aircraft hydraulic system failure. In addition, should the aircraft have such a failure, the pilot can extend the arresting hook. Compressed air pressure and arresting hook weight cause the hook to extend when the HOOK handle is moved to the DOWN position. However, the arresting hook cannot be retracted without aircraft hydraulic system pressure.

When making a field landing with aircraft hydraulic system failure, the arresting hook should not be extended in flight. Wheel brakes should be sufficient to stop the aircraft. If the arresting hook is required as a last resort measure, it should not be extended until 1000 feet prior to engagement. Dragging the hook on the runway unnecessarily could perhaps cause it to be damaged to the extent of complete failure.

Emergency Landing Gear Extension

Utility hydraulic system failure will necessitate lowering the landing gear with the emergency release system as follows:

1. Airspeed . . . . 130-225 KIAS
2. Landing gear handle . . . . DOWN
3. Emergency landing gear release . . . . PULL
4. If the landing gear does not extend fully or lock down, increase the airspeed and apply positive "g" loading in an attempt to get gear-down indication.

After lowering the landing gear by the emergency release system, the gear handle should be left in the DOWN position until the ratchet in the emergency system has been reset and cavitation in the geardown hydraulic pressure line has been eliminated by the application of hydraulic power. This procedure should be followed to prevent a failure of the ratchet and damage caused by premature closing of the gear doors. However, if utility system pressure is available and circumstances warrant, the landing gear can be raised by means of the landing-gear handle.

Unsafe Gear Indications

The most likely causes of failure of the landing gear to indicate DOWN after completion of the gear extension cycle are faulty microswitches, sticking gear-position indicator, utility system hydraulic failure, or failure of the main landing gear actuating cylinder.

If all gear remain UNSAFE or UP with the gear handle down, the utility hydraulic system has most likely failed. Use the preceding emergency landing gear extension procedure.

FINAL CONFIGURATION	CARRIER		FIELD Arresting gear available			FIELD No arresting gear	
	Land or Eject?	Notes	Land or Eject?	A/G Used?	Notes	Land or Eject?	Notes
All gear up	LAND	1	LAND	Yes	3, 4	LAND	3
Nose gear up	LAND	1, 2	LAND	Yes	5, 6	LAND	5, 8
Stub-nose gear	LAND	1	LAND	Yes	5, 6	EJECT	
One main gear up	LAND	1	EJECT	No	7	EJECT	
Stub-main gear	LAND	1	EJECT	No		EJECT	
One main gear up; Nose gear up	EJECT		EJECT	No		EJECT	
Both main gear up	EJECT		LAND	Yes	5, 9	LAND	5, 9

General:

Whenever any landing gear is damaged or not down and locked, but all gear can still be retracted, retract gear and divert ashore if feasible. Retain and land on empty tank(s), empty rocket packs, or other lightweight inert stores, with exception of air refueling store. Jettison drop tanks, if they cannot be emptied. Prior to landing with any of the above malfunctions, burn down to 1500 pounds or less fuel remaining, to ensure that wing fuel is expended and fire hazard minimized.

Notes:

1. Crossdeck pendant configuration shall be in accordance with current recovery bulletin.
2. If time considerations preclude the removal of cross-deck pendants, land with the hook up to prevent severe nosedown rotation, should arrestment occur prior to barricade-engagement.
3. Preferred method: Land into the arresting gear on a foamed runway under LSO control. If arresting gear is not available, landing on a foamed runway is recommended. In both cases, fly a flat approach at normal approach speed. Touch down lightly at a minimum sink rate.
4. Alternate: Use arresting gear without foamed runway. Wave off if wire is missed.
5. Burn down to 600 pounds prior to landing.
6. Make a short field arrestment from a flat approach at normal approach speed. Trim full NOSE-UP approaching touchdown. At touchdown, do not retard throttle. Hold nose up until arrestment. Wave off if the wires are missed.
7. An alternative to ejection for this condition is to land in an approach similar to that in Note 6, except slightly fast and with the touchdown point immediately prior to the arresting gear. Grease this one on holding the wings level with the stick as long as possible. An LSO is probably a necessity for this situation unless the gear location is prominently marked.
8. Make a flat approach at normal approach speed. Trim full NOSE-UP approaching touchdown. At touchdown, secure the engine. Lower the nose slowly before elevator effectiveness is lost.
9. Ejection mandatory without two drop tanks installed.

Figure 5-17. Guide to Emergency Landings With Landing Gear Malfunctions

1. Main gear only unsafe, gear handle down

a. Maintain 225 KIAS or less.

b. If practicable, obtain visual check from another aircraft or from qualified ground personnel to determine if cause is faulty indication or that gear is actually not down and locked.

c. Even though gear is visually determined to be down and locked, make a short field arrestment, if arresting gear is available. The engine should be kept running at IDLE after the arrestment to provide hydraulic power until the ground crew inserts the gear pins. If arresting gear is not available, make a normal landing. To ensure that the gear is down and locked (unless the gear indicates DOWN after touchdown), have the ground crew install the gear pins before turning off the runway. The gear pins cannot be installed if the gear is other than safe. When slow, angle off the runway onto any paved area, if it is possible to do so without making a definite turn and there is an obvious necessity to clear the runway for other aircraft to land.

d. If a main gear is determined to be unsafe or no visual check is possible, cycle the gear in an attempt to obtain a DOWN indication. As soon as both mains indicate down, cease cycling. The nose gear extension may require as much as 2 minutes because of back pressure in the return line, if the cause is a broken nut in the main landing gear actuating cylinder. If a visual check reveals that one or more landing gear doors or strut doors remain closed, proceed as indicated in Emergency Landing Gear Extension. If all landing gear and strut doors are open, do not use the emergency landing gear release since doing so simply unlatches the doors. If gear remains unsafe and utility hydraulic pressure is available, attempt to raise all three landing gear and proceed in accordance with figure 5-17 for the particular situation that exists.

2. Nose gear only unsafe, gear handle down

a. Maintain 225 KIAS or less.

b. If practicable, obtain visual check.

c. Attempt to obtain a DOWN indication by cycling gear. If a visual check reveals that the nose-gear door is not open proceed as indicated in Emergency Landing Gear Extension. If the nose gear door is open, do not use the emergency landing gear release since doing so simply unlatches the landing gear door. If the gear remains unsafe and utility hydraulic pressure is available, attempt to raise all three landing gear and proceed in accordance with figure 5-17 for the applicable situation.

d. If unable to get a DOWN indication by cycling, obtain visual check by other aircraft or by qualified ground personnel.

e. Even though the gear is visually determined to be down and locked, make a short field arrestment, if arresting gear is available. The engine should be kept running at IDLE after the arrestment to provide hydraulic power until the ground crew inserts the gear pins. If arresting gear is not available, make a normal landing. To ensure that the gear is down and locked (unless the gear indicates DOWN after touchdown), have the ground crew install the gear pins before turning off the runway. The gear pins cannot be installed if the gear is other than safe. When slow, angle off the runway onto any paved area, if it is possible to do so without making a definite turn and there is an obvious necessity to clear the runway for other aircraft to land.

f. If unable to obtain a DOWN indication or a visual check and cycling proves ineffective, proceed as indicated in figure 5-17 for the particular situation which exists.

3. For in-flight checking of the main gear in the down-and-locked position, a high-visibility fluorescent red-orange paint stripe is applied to the inboard side of the main gear drag link in two places. When these stripes are lined up, the gear is down and locked. A more positive check that the main gear is down and locked is observing that the overcenter lever at the midpoint of the drag links is positioned forward and parallel to the lower surface of the wing. The nose gear should be checked down and locked by visually sighting through the ground safety-pin hole. If for any reason a visual check is not possible and one or more landing gear indicate UP or UNSAFE with the landing gear handle down, and all other attempts to lower the gear have failed, an attempt should be made to lower the gear with the emergency landing gear release system. If the gear remains unsafe and utility hydraulic pressure is available, attempt to raise all three landing gear and proceed in accordance with figure 5-17 for the applicable situation.

4. If the landing gear does not indicate down and locked with the gear doors extended, slowly increase airspeed up to a maximum of 350 knots to obtain a down and locked indication. Particular attention must be made to keep aircraft in balanced flight.

Landing — No Flaps

If unable to extend flaps for landing, fly optimum attack angle. Optimum is 10 to 15 KIAS above full-flap approach speed. Fly slightly wider pattern at about 1 1/2 miles abeam. For shipboard recovery burn-down or dump-down fuel to 13,000 pounds maximum gross weight to avoid exceeding maximum engage speed.

Landing — No Speedbrakes

Utilize the standard pattern entry, approach, and landing when making a no-speedbrakes approach. The airspeed will be more sensitive to changes in the nose position. In the event of a waveoff, acceleration time to 100 percent will be slightly longer, but the overall difference from a speedbrake pass is negligible.

Landing — Stuck Slat

Fly optimum angle of attack. If angle of attack is not available, add 10 knots to the normal approach speed. Trim out any adverse lateral-control pressures. Be alert to apply prompt correction, should the slat extend during the approach. Aboard ship, observe the maximum engaging speed.

Landing — Spoiler Malfunction on Landing Roll

The spoilers are not interconnected; therefore, there is a remote possibility that only one spoiler will be actuated if a spoiler malfunction occurs. The pilot will notice an immediate swerving tendency which can be controlled by application of corrective rudder, brakes, and aileron, as required. When control of the aircraft is regained, place the spoiler switch in OFF. The flaps should be raised as soon as possible.

Note

The spoilers are inoperative during use of emergency power or following loss of utility hydraulic pressure.

Landing With Asymmetric Load

With asymmetric loads, landing should be made upwind or downwind, whichever is required to put the crosswind component under the heavy wing, providing other factors are considered; runway length, gross weight, and appreciably shortened rollout by securing the engine. Make a long straight-in approach. Execute a steady heading sideslip (wing down, opposite rudder) during approach by applying rudder in the direction of the heavy wing to move internal wing tank fuel to the opposite wing, which will help balance the asymmetric load. The minimum approach speed is 115 knots with up to 7500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 knots at 12,500 foot-pounds. Normal approach angle of attack should be maintained as long as the resulting airspeed does not become less than the minimum. On manual control with asymmetric moments up to 7500 foot-pounds, the initial approach speed should be a minimum of 140 knots, with a minimum final approach and touchdown speed of 125 knots. Landings on manual control with asymmetric moments greater than 7500 foot-pounds are not recommended. With asymmetric loading, the maximum 90-degree crosswind component under the loaded, or heavy wing, is 15 knots without spoilers and 25 knots with spoilers up.

Landing with any amount of crosswind under the unloaded, or light wing, is not recommended due to a considerable reduction in control capability and possible unsafe characteristics during rollout.

Landing — Manual Flight Control (Hydraulic Power Disconnected)

With the flight controls disconnected and all other systems operative, a modified approach with a long straightaway should be utilized. If the utlity hydraulic system is inoperative, modify the approach as specified for landing with no flaps. Maximum recommended crosswind component for landing is 8 knots. Above 8 knots, an arrested landing is recommended.

Landing — Manual Flight Control — Asymmetric Loading (Hydraulic Power Disconnected)

Hydraulic power disconnects should not be performed with asymmetric loadings. If an actual hydraulic power disconnect must be made with asymmetric wing or store loadings, the following is recommended:

1. Speed must be reduced to less than 200 KIAS prior to disconnecting.
2. After disconnect, excessive longitudinal stick motions must be avoided.
3. Crosswind landings must be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing.
4. Recommended approach airspeed is 140 KIAS with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control speed is 115 KIAS with hydraulic power failure, and up to 7500 foot-pounds asymmetric moment.

Landing — No Airspeed Indication

Landing with the airspeed indicator inoperative can be accomplished safely. The angle-of-attack indicator/indexer should provide the pilot with a safe landing approach attitude reference. The wing slats, when halfway out with gear and flaps down, will also serve to indicate a safe landing approach speed.

Landing With Runaway/Stuck Nosedown Trim

If longitudinal trim sticks in the normal cruise position (near zero) or jams in the full nose down position and cannot be moved with horizontal stabilizer MANUAL OVERRIDE, the following factors concerning landing with reduced elevator effectiveness must be considered.

- Center of gravity position
- Runway available
- Weather conditions at the landing field
- External loading

As shown in figure 1-7, CG is generally aft as external fuel is burned; moves forward as internal wing fuel is depleted; and moves aft thereafter. CG positions vary with external ordnance and certain combinations of hung ordnance, in conjunction with full fuselage fuel only, can place the maximum forward CG position encountered in flight at or near the forward limit. It is in this area that the elevator is least effective for a given airspeed and landing approaches are not recommended. However, with 600 pounds of fuel remaining the CG should be sufficiently aft to accomplish a safe, no-flap landing in all loadings. The alternative of employing a higher approach speed to increase elevator effectiveness has a limited application due to the higher flaps-up donut airspeed and the associated increase in landing distance. The decision to burn down to 600 pounds of fuel remaining must be made with landing field weather taken into consideration.

Controllability must be determined at a safe altitude prior to attempting a landing. Stabilized level flight is not in itself sufficient to judge pitch response, as further aft stick will be required to counter wind gusts and to accomplish a wave off, if required. The aircraft should be stabilized with flaps up and speedbrakes out at a moderate rate of descent and flown through a simulated wave off. If controllability is questionable, jettison external ordnance (retain fuel tanks) and burn down to 1000 pounds fuel remaining in order to place the CG in a more favorable position. With partial wing fuel the danger exists that satisfactory controllability will be determined at altitude but will then become marginal on landing approach due to fuel burned in the interim. This danger would be negligible if an expeditious landing is made. In the event that the decision is made to burn down to less than full fuselage fuel, use fuel dump to ensure that the wing tanks are empty as fuel gage can be as much as 200 pounds in error at slow airspeeds.

When stuck/runaway nose down trim is experienced:

1. Determine minimum acceptable fuel on final approach consistent with expected weather conditions.

2. At a safe altitude, lower the landing gear and extend the speed-brakes. Do not lower the flaps.

3. Cautiously reduce airspeed to a reasonable approach speed commensurate with runway available for stopping. The airspeed selected must provide adequate pitch attitude response to counter nosedown gusts and to accomplish a satisfactory waveoff.

4. If controllability is satisfactory, land as soon as possible, using a straight-in approach.

5. If controllability is marginal or unsatisfactory, jettison external ordnance (retain fuel tanks), burndown and dump to zero wing fuel, and again check controllability at 1000 pounds of fuel remaining.

WARNING

Extending the flaps will significantly reduce the amount of back stick available.

Note

- Retracting the speedbrakes will cause a nose down pitching moment, thus reducing the amount of back stick available for approach and wave off.
- A carrier landing with nosedown trim is not recommended. If possible, a divert to a shore station should be accomplished. If a divert is not feasible, a barricade engagement is recommended, since bolter capability is extremely marginal.

Landing With Runaway Noseup Trim

Make a normal approach and landing with full flaps. A moderate amount of forward stick pressure will be required at normal approach speed.

Landing — Known Brake Failure

Landing with one or both brakes inoperative should be accomplished as follows. If arresting gear is available, make a short field arrestment, preferable into the midfield gear. Be prepared to wave off if the arresting gear is missed. If arresting gear is not available, land wheels-up on empty tanks, racks, or lightweight inert stores.

When landing aboard ship with a known brake failure, do not reduce power below 80 percent; leave hook down and engaged with cross-deck pendant until towbar and tractor have been connected to aircraft.

Landing — Brake Failure After Touchdown

When a brake failure occurs after touchdown, wave off if possible and proceed as described in Landing – Known Brake Failure. If unable to wave off and arresting gear is available, maintain directional control with rudder and make an arrested landing.

Prudent use of nosewheel steering may be desirable at slower airspeeds. The aircraft should be straight on centerline at least 1000 feet prior to the arresting gear when the hook is lowered. The nosewheel will center as the hook is lowered, and steering ability will be reduced. Nosewheel steering may be maintained while the hook is lowered by pressing the nosewheel steering button (figure 1-9).

When arresting gear is not available and waveoff is not feasible, a decision to jettison flammable stores, retract landing gear, and shut down the engine must be made if the aircraft is not going to remain on the runway. Ejection is a feasible alternative.

Landing — Nosewheel Steering Failure

If there is indication of loss of control in nosewheel steering, immediately release stick control button. Regain control of aircraft with rudder and brakes as necessary, and switch nosewheel steering to EMER OFF (figure FO-1).

Landing With Blown Main Tire

Little difficulty should be experienced in landing with a blown main tire. If it is known prior to landing that the tire is blown, a short field arrestment is recommended. If there is no arresting gear available, secure the engine after touchdown to minimize landing roll. In crosswind conditions, always use the arresting gear, if available. Land on the left, right, or center of the runway, depending on crosswind and which tire is blown. For instance, with the left tire blown, a crosswind from the right, and no arresting gear available, land on the right side of the runway to provide the maximum distance for arcing to the left. In this case, both wind effect and the increased drag of the blown tire are additive, tending to drift the aircraft across the runway to the left. If the tire blows during normal landing rollout, use full rudder, if necessary, and brakes as required to maintain directional control. Usually, a blown tire will not even be noticeable until 80 knots or less. If the stopping distance appears marginal, secure the engine. If the use of abort or overrun gear becomes apparent, drop the hook 1000 feet prior to engagement. More braking effectiveness can be obtained from a good tire than blown one; consequently, it is poor technique to intentionally blow the good tire. In A-4M aircraft, nosewheel steering may be used below 60 knots to maintain directional control.

Landing With Blown Nosewheel Tire

When landing with a blown nose tire, a short field arrestment is recommended. Obtain a positive hookdown check with the tower or the LSO. Make practice passes, burning down to 600 pounds for the final pass to provide an aft CG. Make a flat approach at normal approach speed. Trim full NOSE UP just prior to touchdown. Touch down with minimum sink-rate and hold the nose off until passing over the wires. Do not retard the throttle below approach power setting until the arrestment is felt. Wave off if the wires are missed. If there is no arresting gear available, fly the same type of approach, on touchdown lower the nosewheel slowly to the runway before elevator effectiveness is lost, and secure engine at approximately 80 knots. Little difficulty should be experienced with this landing, with or without arresting gear available.

LANDING AT HIGH GROSS WEIGHTS

Occasionally, the problem will arise of landing at a gross weight in excess of the recommended maximum, due to emergencies, fuel transfer problems, etc. Ashore, the problem is simply one of stopping, since the sink speed at touchdown can be minimized; and the stopping distance may be reduced by increased braking, securing the engine, and/or using the arresting gear. A flat approach using optimum AOA will be maintained to avoid high rates of descent and excessive airspeed. Final approach speed is critical and once the runway is definitely made, power and attitude should be adjusted to touch down with a minimum rate of descent. Landings are recommended only in day VFR conditions onto runways of 10,000 feet or more, utilizing a straight-in approach.

Aboard ship, if it is necessary to make a heavy landing, the most important consideration is to keep the sink speed to a minimum. If time permits, the mirror should be changed to a 3.5-degree glide slope in accordance with the recovery bulletins. Diving for the deck would be very bad procedure. The angle-of-attack indexer will show the best approach speed for the weight and should not be exceeded. If the downwind leg angle-of-attack check results in a high airspeed, it is best to fly the high airspeed rather than conclude that the angle-of-attack system is in error. There may be fuel in the tanks or in the buddy store, or there may be hung ordnance of which the pilot is not aware. If a gross discrepancy exists, inform the LSO, who can tell by the aircraft attitude and the SPN-12 reading which instrument is correct. Another important point is to land wings-level and on the centerline. A late lineup correction may result in a collapsed landing gear. Landings in excess of the maximum gross weight recommended in section I, part 4, or the applicable Recovery Bulletin, should be made only in an emergency, as the structural limits of the landing gear or arresting hook may be exceeded.

FORCED LANDINGS

Landing on Unprepared Surfaces

Landing on unprepared terrain is extremely hazardous. If sufficient altitude is available, ejection is preferable to attempting an emergency landing on any surface other than a runway. When power is available, more deliberation can usually be given to evaluating the many variables affecting a safe emergency landing, such as direction and speed of the wind, and the type of surface or terrain on which the landing is to be made. On areas other than prepared runways and surfaces of known adequate hardness, the landing should always be made with the wheels retracted. If the nature of the emergency is such that all wheels will not fully extend, the landing gear should be left in the retracted position. Prior to any wheels-up landing on prepared surfaces, all external stores should be jettisoned, except empty drop tanks and lightweight inert stores which help absorb the force of the landing. The oxygen mask should be left on during crash landings, and a decision to jettison or retain the canopy should be made prior to impact. Remain braced until the shocks stop. Use normal approach speeds throughout the landing pattern and attempt to touch down at, or slightly above, the normal landing speed.

Emergency Exit

Three methods for emergency exit are given, the choice of which depends on the emergency condition. Method 1 is recommended only under extreme emergency conditions where circumstances clearly indicate immediate exit. Methods 2 and 3 are recommended only if time permits.

METHOD 1. Eject. Refer to Ejection procedures.

METHOD 2. This method may be used when the pilot elects to exit without his parachute and survival gear.

a. Jettison canopy by pulling CANOPY JETTISON handle.

Note

The canopy can be jettisoned with the cockpit normal canopy control handle in any position.

b. Unfasten the four parachute harness fittings.

c. Disconnect oxygen hose.

d. If time permits, safety ejection controls by pulling safety handle on pilot's headrest to DOWN and LOCKED position. This will prevent inadvertent ejection of seat.

e. Exit from aircraft.

METHOD 3. This method may be used when the pilot elects to exit with his parachute and survival gear attached. However, it is not recommended when the height of the jump to the ground may result in injury which would prevent the pilot from moving a safe distance from the aircraft. Also, retaining the parachute and survival kit unduly restricts body movement, consequently compromising quick exit from the cockpit.

a. Jettison canopy by pulling CANOPY JETTISON handle.

b. Pull harness release handle to release pilot from seat with parachute and survival gear attached.

c. If time permits, safety ejection controls by pulling safety handle on pilot's headrest to DOWN and LOCKED position. This will prevent inadvertent ejection of the seat.

d. Exit from aircraft.

Emergency Entrance

When it is necessary to gain entrance to the cockpit in an emergency, it may also be necessary to effect the quick and safe removal of the pilot from his seat and parachute. This entry-and-rescue operation requires that certain procedures be followed and that certain precautions be taken. (See figure 5-18.)

An external control for jettisoning the canopy is provided on each side of the fuselage. Push in on the rescue-access door and PULL the red canopy-jettison handle that extends. This action will jettison the canopy if it is closed and locked.

WARNING

- When the canopy is jettisoned, the seat-catapult interlock is extracted and care should be taken to avoid firing the seat-catapult charge.
- Pull ejection safety-handle down prior to removal of pilot from seat.

To release the pilot from the seat without the parachute and survival equipment attached, unfasten the harness fasteners (four places) and disconnect the pilot's oxygen hose from the seat-pan oxygen hose.

Pulling the harness-release handle releases the pilot from the seat with the parachute and survival equipment attached.

DITCHING

Ditching at Sea

A forced landing at sea should be made only as a last resort. Ejection is recommended whenever possible. Whenever possible, ditch while power is still available.

If power is not available, the pilot must necessarily choose between a high sink-rate or increased speed, both extremely dangerous approaches to the water. Moreover, the pilot has the difficult problem of determining exactly how high to flare above the water without stalling, often without any visual references to assist in height determination.

As many as possible of the following should be accomplished if ditching is imminent:

1. Shoulder harness . . . . LOCKED
2. Landing gear . . . . UP
3. External stores . . . . JETTISON
4. Wing flaps . . . . DOWN
5. Seat . . . . MIDPOSITION
6. IFF . . . . EMERGENCY
7. Transmit MAYDAY position report.

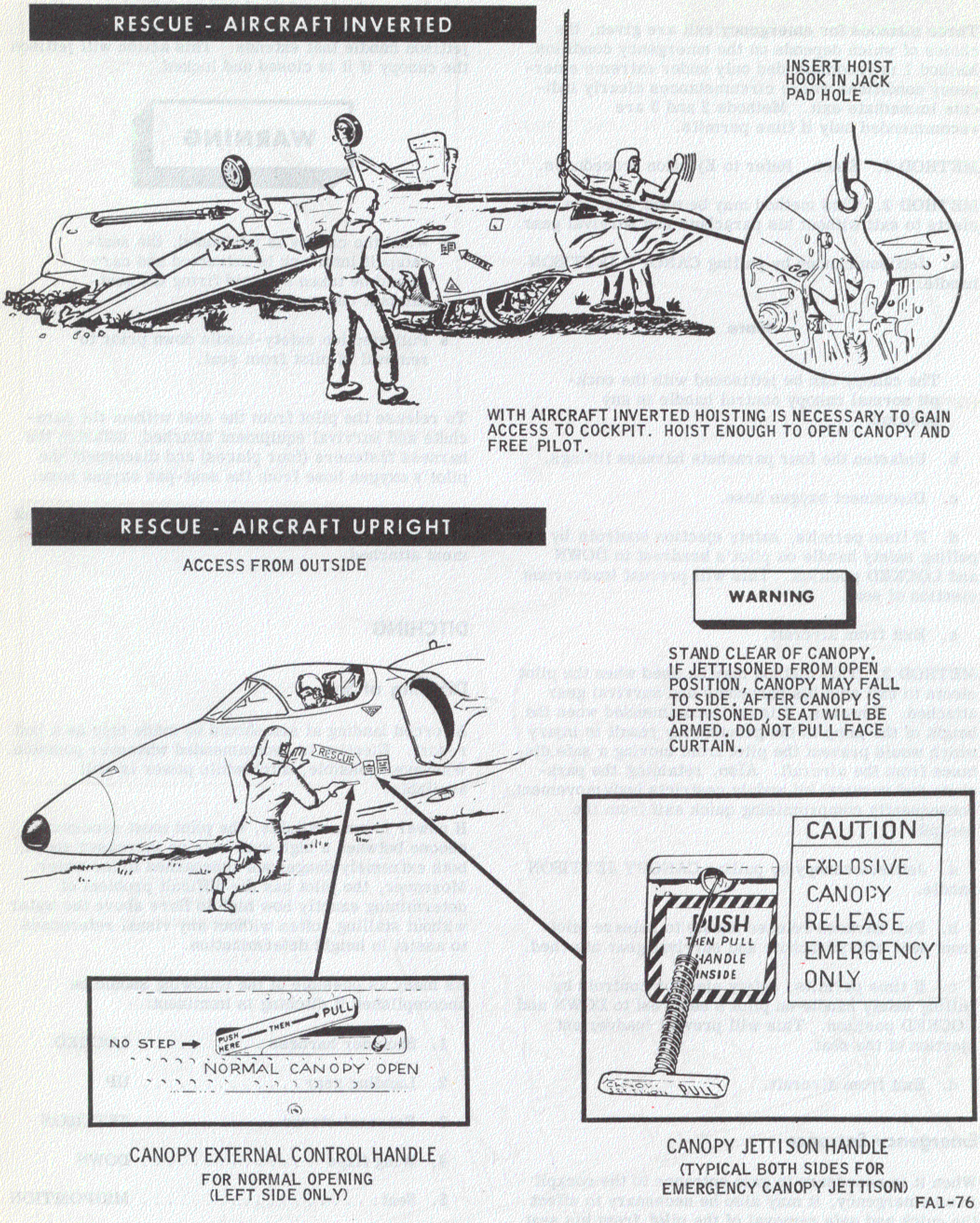


Figure 5-18. Emergency Entrance (Sheet 1)

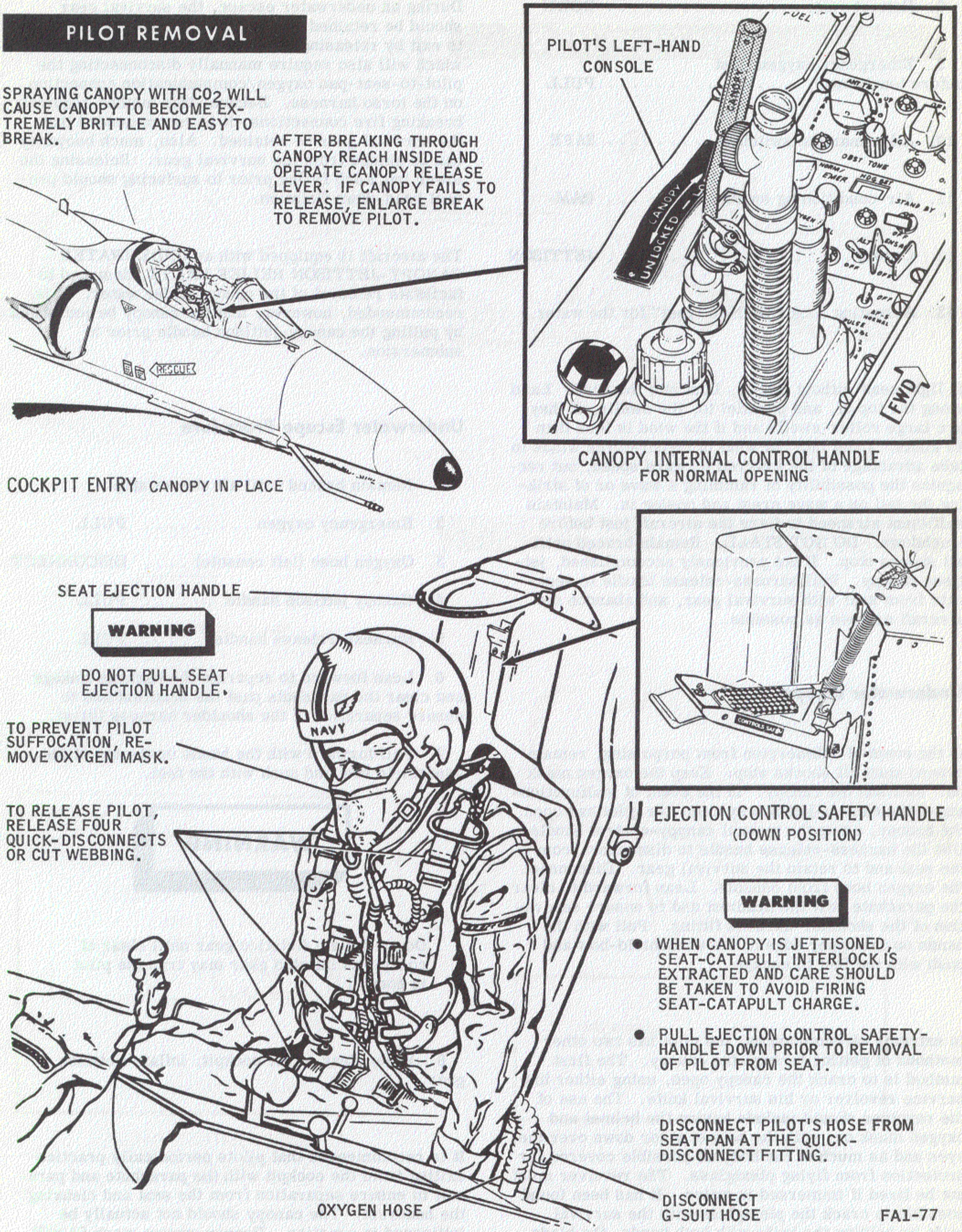


Figure 5-18. Emergency Entrance (Sheet 2)

8. Helmet visor . . . . DOWN

9. Emergency oxygen (just before touchdown). . . . . PULL

10. All armament switches . . . . SAFE

11. Air-conditioning switch . . . . RAM

12. Canopy . . . . JETTISON

13. Arresting hook DOWN to "feel" for the water.

In light seas without swells, land into the wind. Land along the top of, and parallel to, the swells, if they are large roller-swells and if the wind is less than 25 knots. Land into the wind in higher-force winds to take advantage of the lowered forward speed, but recognize the possibility of ramming a wave or of striking the tail on a wave crest and nosing in. Maintain sufficient airspeed to flare the aircraft just before touchdown. DO NOT STALL. Remain braced until all shocks stop. If not previously accomplished, jettison canopy. Pull harness-release handle to separate from seat with survival gear, and abandon the aircraft as soon as possible.

Underwater Escape

In the event of submersion from porpoising, remain braced until all shocks stop. Keep the oxygen mask on. Jettison the canopy. In the event of malfunctioning of the canopy-jettison system, the pilot can open the canopy, using the manual canopy-control handle. Use the harness-release handle to disconnect from the seat and to retain the survival gear. Disconnect the oxygen hose from console. Lean forward to clear the parachute past the headrest and to ensure separation of the shoulder-harness fitting. Pull with the hands on the upper edge of the windshield-bow and push with the feet to escape.

In extreme circumstances, the pilot has two other methods of getting through the canopy. The first method is to crack the canopy open, using either his service revolver or his survival knife. The use of the revolver should include having the helmet and oxygen mask on, with the helmet visor down over the eyes and as much of the body as possible covered for protection from flying plexiglass. The revolver must not be fired if immersed in water. It has been found possible to crack the plexiglass with the survival knife by holding the knife with both hands, the blade pointing up, and striking the canopy above the head with the point of the knife. During an underwater escape, the survival gear should be retained. The second method is to attempt to exit by releasing the Koch quick-disconnect fittings which will also require manually disconnecting the pilot-to-seat-pan oxygen/communication connection on the torso harness. Because this method requires breaking five connections, it is recommended that the survival gear be retained. Also, much buoyancy can be gained from the survival gear. Releasing the lower left Koch fitting prior to surfacing should prevent head-down flotation.

The aircraft is equipped with an UNDERWATER CANOPY-JETTISON RELIEF VALVE, designed to facilitate removal of the canopy under water. It is recommended, however, that the canopy be jettisoned by pulling the canopy-jettison handle prior to submersion.

Underwater Escape Procedure

1. Remain braced until all shocks stop.

2. Emergency oxygen . . . . PULL

3. Oxygen hose (left console) . . . . DISCONNECT

4. Canopy jettison handle . . . . . . PULL

5. Harness-release handle . . . . . PULL

6. Lean forward to separate the harness linkage and clear the parachute past the headrest and to ensure separation of the shoulder harness fitting.

7. Pull forward with the hands on the top of the windshield bow and push with the feet.

WARNING

Do not inflate flotation gear until clear of cockpit as inflated gear may trap the pilot in cockpit.

8. When clear of the cockpit, inflate flotation gear.

It is recommended that pilots periodically practice exiting from the cockpit with the parachute and pararaft to ensure separation from the seat and clearing the headrest. The canopy should not actually be jettisoned in practice. Proper oxygen mask fit will prevent water from seeping in during the critical underwater escape.

SECTION VI
ALL-WEATHER OPERATIONS

TABLE OF CONTENTS

GENERAL

Discussions of special techniques and procedures for operation in adverse weather necessarily includes some instructions found in other sections of this handbook. Operating instructions covered in this section will be repeated only to establish the correct sequence of operations or to emphasize the importance of certain procedures. Any discussion concerning systems operation will be found in Section I. The NATOPS Instrument Flight Manual should be used in conjunction with this section.

INSTRUMENT FLIGHT PROCEDURES

This section presents certain characteristics and limitations of the aircraft during instrument flight conditions as a supplement to previous training and experience. Successful fulfillment of a mission under instrument flight conditions requires careful preflight planning, current instrument proficiency on the part of the pilot, and adequate instrumentation for climbout, cruise, and approach. The UHF receiver-transmitter provides static-free communication and works in conjunction with the UHF homing adapter receiver (automatic direction finding equipment). The TACAN operates in conjunction with surface navigation beacons to provide continuous directional and distance information to the pilot.

INSTRUMENT TAKEOFF

Prior to Takeoff

To reduce fuel consumption, complete as much as possible of the pretakeoff check before starting the engine.

1. Connect external source of electrical power.

2. Check all communications and navigation equipment for correct operation.

3. Switch IFF to NORMAL.

4. Set navigation equipment on local channel so that an immediate heading indication is available if an emergency develops after takeoff.

5. Check cockpit lighting and set as low as possible in order to retain night vision. Adjust the forward floodlights for use in reading instrument flight guides, maps, etc.

6. Check oxygen supply and oxygen mask fit.

7. Set altimeter at field's barometric pressure (See NATOPS Instrument Flight Manual).

8. Adjust all-attitude indicators.

9. Set clock.

10. Make mandatory autopilot preflight checks.

11. Check proper operation of all directional instruments while taxiing.

12. Check canopy closed.

13. Complete normal checklist.

14. Review the procedure used to jettison stores during a takeoff emergency.

15. Set PRESENT POSITION, D1, and D2 on NAV computer (ASN-41).

Takeoff

When in takeoff position and lined up with the runway:

1. Check compass SLAVED and in sync.

2. Check all-attitude indicator for correct operation.

3. Turn on engine anti-icing/pitot heat switch as required. Do not prolong pitot heat use on the ground.

4. Advance throttle, maintaining directional control with brake until rudder control is effective (approximately 70 knots).

5. When takeoff speed is reached, lift nose gently from the ground to prevent an excessively high angle of attack.

6. When aircraft is well clear of the ground, raise the gear.

7. Raise flaps 170 KIAS minimum, wings level.

BASIC INSTRUMENTS

The procedures to be used in performing basic instrument maneuvers in the A-4M are discussed in the following paragraphs.

Climb Schedule

Climb schedule for basic instrument flights will be 310 KIAS to 0.72 IMN to 240 knots minimum at higher altitudes.

Speed Changes

1. To reduce airspeed, reduce power to approximate power setting necessary for airspeed desired and extend speedbrakes. Retract speedbrakes 5 knots above desired airspeed. During transition, retrim aircraft as necessary.

2. When increasing airspeed, advance power to MILITARY. When desired airspeed is attained, reduce power to approximate power setting necessary to maintain desired airspeed and altitude.

Turns and Reversals

1. Turns and reversals will be performed at 300 knots. At bank angles steeper than 30 degrees, it will be necessary to advance throttle to maintain airspeed.

2. Banks used will be 30, 45, and 60 degrees.

3. Turns will be made in both directions with each of the above angles of bank. Turns will be maintained for twice the number of degrees as the angle of bank. (For a 30-degree bank, turn right or left for 60 degrees of turn; for a 45-degrees bank, turn right or left for 90 degrees of turn, etc.)

Vertical S-1 Pattern

1. The pattern describes a "W" in that it is a series of descents and climbs of 1000 feet of altitude, while maintaining constant airspeed and heading.

2. The pattern will be performed at 250 knots in a clean configuration with speedbrakes IN.

3. Rate of descent will be 1000 fpm and should be timed with the clock. It will be necessary to lead all transitions by 5 seconds.

Vertical S-2 Pattern

1. A vertical S-2 pattern is similar to the vertical S-1 pattern, except that a constant one-half standard-rate turn is maintained throughout the pattern.

2. After 1 minute, the pilot should have lost 1000 feet and turned 90 degrees. At the end of the second minute, he should have climbed 1000 feet and turned 180 degrees. After the third minute, he should have descended 1000 feet and turned through 270 degrees. After the fourth minute, he should have climbed 1000 feet, bringing him back to the original heading and altitude.

Vertical S-3 Pattern

The vertical S-3 pattern is similar to the S-2 pattern, except that the turn is reversed after 180 degrees of turn.

Yankee Pattern

Figure 6-1 is a diagram of the Yankee Pattern.

Hooded Instrument Flight

Hooded instrument flight will not commence until radio communications have been established with the safety pilot and an altitude of 2000 feet AGL has been obtained.

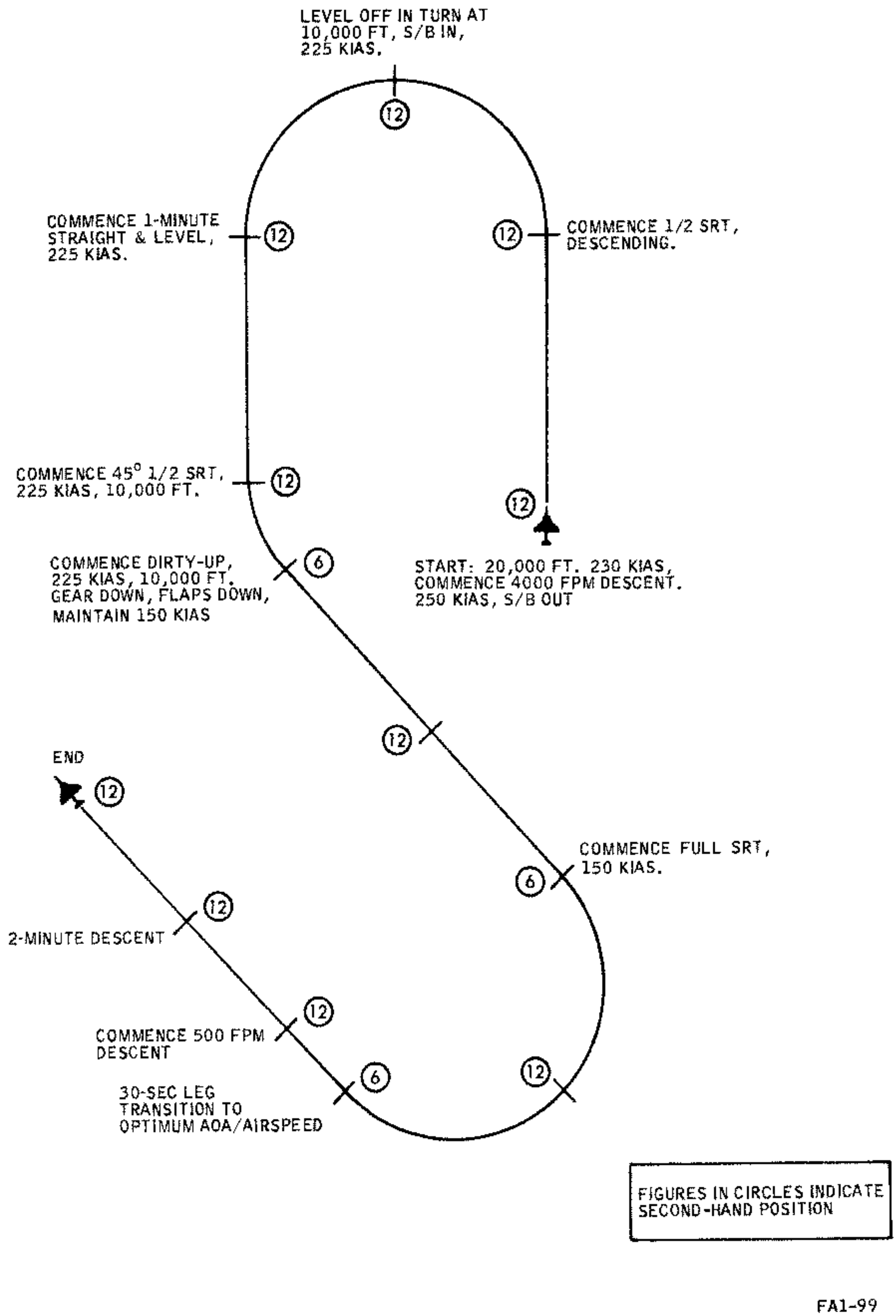


Figure 6-1. Yankee Pattern

Jet Penetrations

A penetration is a maneuver which combines a high rate of descent with a constant airspeed and maintains the aircraft within a specific airspace. It is designed to minimize fuel consumption and the effects of turbulence, icing, and wind; and serves to place the aircraft in position for a low approach. Prior to commencing a penetration, the following checklist should be completed.

1. Air conditioning . . . . HOT
2. Windshield defrost . . . . INCREASE
3. Altimeter . . . . SET
4. Shoulder harness . . . . LOCKED
5. Engine anti-icing pilot heat . . . . AS REQUIRED

CLEAN PENETRATION. The clean penetration is conducted at 250 KIAS, speedbrakes OUT, and at a rate of descent of 4000 to 6000 fpm. Clean penetration will require an initial power setting of about 80 percent. At penetration fix and 230 KIAS, the nose is lowered to approximately 7 degrees nosedown to start penetration. As airspeed reaches 245 KIAS, speedbrakes are extended. Maintain 250 KIAS and adjust power as necessary to maintain 4000 to 6000 fpm rate of descent. It is vital that the pilot be conscious of the aircraft's approach to each even 10,000-foot level to preclude misreading of the altimeter by 10,000 feet.

In the event of low-fuel state, a penetration can be accomplished, utilizing IDLE rpm and speedbrakes IN. Maintain 250 KIAS and adjust power as necessary to provide 4000 to 6000 fpm rate of descent. Windshield may frost up during this type of descent due to reduced defrost air circulation.

Start transition to level flight about 1500 feet above the desired altitude. There is a tendency to lose altitude after bottoming out of the penetration and "dirty-up" which can be avoided by leading with adequate power. At level-off during single-aircraft approaches, slow to and maintain gear-down speed. Gear and flaps should be lowered in order to reach the "gate" in a landing configuration at desired approach speed.

DIRTY PENETRATION. The "dirty" penetration is recommended when one member of the flight has radio and/or NAVAIDS failure and it is necessary to penetrate in section to a minimum ceiling. "Dirty-up" is accomplished "VFR on top." When performed at night, the lead aircraft will keep his lights on BRT/STDY and his fuselage/anticollision light OUT. The controlling agency must be advised of the airspeed deviation prior to initiating this type of penetration.

The "dirty" penetration is performed at 170 KIAS, wheels and flaps DOWN, speedbrakes OUT, and at a rate of descent of 3000 to 5000 fpm. Just prior to reaching initial penetration fix, slow to 225 KIAS and drop wheels and flaps. Upon reaching the fix, reduce throttle to 80 percent, drop the nose about 7 degrees below the horizon, and extend the speedbrakes. Maintain 170 KIAS. Start transition to level flight about 1500 feet above the desired altitude.

Ground-Controlled Approach (GCA)

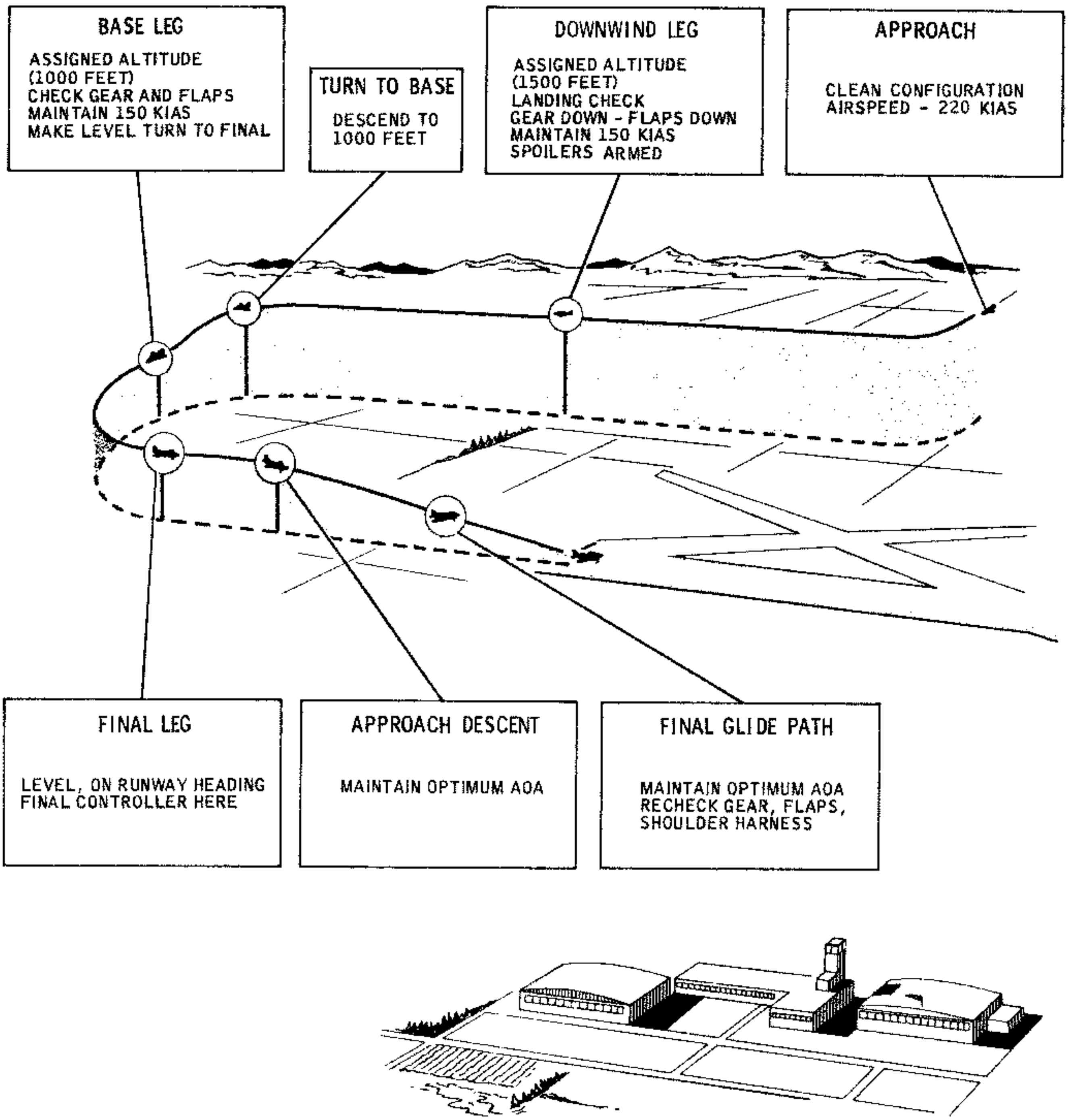
Achieving the precision necessary to make successful GCA's to minimums will require practice, alert flying, and smooth, coordinated control of power, attitude, and altitude. Turns in the pattern will be standard rate, with the following exceptions:

1. Do not exceed 30-degrees bank.
2. Do not exceed 15-degree bank on final approach. Use positive rudder control in all turns.

When precipitation is heavy, the relatively small reflecting surfaces of the A-4 design may make it difficult for the GCA controller to pick up the aircraft with radar for an initial entry. The pilot can assist the pickup by extending speedbrakes and landing gear higher in the pattern, until identified. Then he should go back to the normal GCA procedure. A typical GCA for the aircraft is shown in figure 6-2.

GLIDEPATH. Prior to descent down the glidepath, complete landing checklist. Assuming that the airspeed has been properly adjusted to final approach speed prior to reaching the glidepath, the following entry procedure will be used: When the controller says "You are approaching glidepath, commence standard rate of descent, "DO NOT commence descent. When the controller says "You are up and on the glidepath," reduce throttle, drop nose slightly, and establish an initial rate of descent in accordance with the following table. The rates of descent are approximations for a 3-degree glide slope:

Groundspeed	Rate of Descent
150	795
140	745
130	690
120	635
110	585



NOTES:
ALL TURNS STANDARD RATE.
ALL ALTITUDES ARE TERRAIN CLEARANCE.
AVERAGE FUEL CONSUMPTION: 400 POUNDS (INCLUDING PENETRATION).
AVERAGE TIME: 8 MINUTES (INCLUDING PENETRATION).

FA1-100

Figure 6-2. Typical Ground-Controlled Approach

In general, a 700-fpm rate of descent is most common with a 100-fpm change for 20 knots change in groundspeed. Change rate of descent by 100 fpm for each 1/2 degree variation from a 3-degree glide slope.

WAVEOFF. When instructed, or when at GCA minimums and the field is not in sight, waveoff by adding full throttle, retracting speedbrakes (if applicable) when rotating the nose to a climbing attitude. When a positive climb is indicated by the vertical speed indicator and altimeter, raise the gear and commence a turn if required. Do not raise the flaps until the wings are level and the airspeed is 170 KIAS minimum. When the controller advises "Wave off, tower instruction," this is a mandatory waveoff.

SIMULATED INSTRUMENTS

PRACTICE. All simulated instrument flight shall be accompanied by a safety pilot who will maintain a chase position, which is 100 yards on the starboard quarter level with lead aircraft. The safety pilot will not descend below 100 feet and at all times will maintain the same configuration as the lead aircraft. The lead aircraft will not go hooded until cleared by the chase pilot and not before reaching 2000 feet AGL. On GCA, the chase will fly the position assigned by the controller and will not descent below 300 feet AGL. The lead aircraft will go contact at 500 feet AGL. For level turns in the pattern, it willbe necessary to add 2 percent rpm; 1 percent rpm change will vary the rate of descent 100 fpm. Radio checks will be exchanged between aircraft at least once every 5 minutes. In addition, simulated flight may be logged when a single aircraft is under radar control (see OPNAVINST 3710.7 series).

SECTION PENETRATIONS/GCA

Section penetrations and/or GCA's will be necessary when conditions occur which preclude making an individual instrument approach (loss of NAVAID's radio failure, flight instruments failure, etc.). In section penetrations/GCA's, the wingman flies a comfortable parade formation, close enough to ensure visual contact on the side opposite the missed-approach turn, unless a significant crosswind component exists. In this case, the wingman should be positioned on the upwind side. It will be necessary for the leader to monitor the surface wind and position the wingman accordingly.

The wingman will follow the configuration changes of the leader. Appropriate signals for use in the penetration or GCA pattern are contained in figure 7-10. After turning onto final, the leader should reduce speed to 140 knots for aircraft gross weight of 14,000 pounds or less with an increase of 5 knots for every additional 1000 pounds in gross weight.

The wingman should not descend below the leader once the descent on final is started until the leader signals the runway is visible and the wingman has the runway in sight. The leader will execute a low-visibility approach, another GCA, or a section landing as conditions (fuel, weather, etc.) require.

Section Landings

If a section landing is to be made, the leader will not pass the lead and each aircraft will land and roll out in the middle of his half of the runway.

WARNING

To preclude danger of decelerating approach or flying into leader's jet wash, NO ATTEMPT WILL BE MADE TO ESTABLISH LANDING INTERVAL ON FINAL.

CAUTION

If section landings must be made on slick runways or where significant crosswinds exist, extreme caution must be exercised during lineup, touchdown, or rollout.

Note

Prior to landing, coordinate use of spoilers between aircraft.

Section penetrations/GCA's may be practiced to a landing; however, prudence dictates that individual landings will normally be made.

Loss Of Visual Contact

1. When visual contact with the flight is lost during VFR conditions, proceed to a predetermined point for rendezvous.

2. When visual contact is lost during instrument conditions, the following procedures shallbe followed.

a. Notify flight leader by radio.

b. Go on instruments, take 10-degree turn away from leader, hold for 1 minute, then resume original heading. If flying in division "fingertip" formation, number 4 man take 20-degree turn from base course away from section leader, hold for 2 minutes, then resume original heading.

c. If flight conditions permit, wingman should reduce power slightly (1 to 2 percent) to permit additional separation.

d. The flight leader will determine whether the flight should attempt to rendezvous in VFR conditions, or if separation is to be established and maintained through normal ARTC procedures.

LOW-VISIBILITY APPROACHES

A low-visibility approach is used in conditions of low ceiling and/or visibility, when:

1. The approach heading of the aircraft varies from the runway heading to such a degree that it precludes an immediate landing from that direction.

2. The runway is crossed at an airspeed and/or altitude which precludes an immediate landing.

A low visibility approach should be made only when able to maintain visual contact with the runway.

Procedure

1. When approaching a runway with a landing direction that is approximately 180 degrees from the heading of the aircraft, fly two-thirds of the runway length, then execute a 90-degree SRT turn to the right, followed by a 270-degree SRT reversal to the left to the runway heading. Maintain an airspeed about 10 knots above optimum approach speed/AOA and at or above minimum circling altitude until the runway is again in sight.

2. When approaching the runway in the proper direction, but too high and fast for a landing, maintain an airspeed about 10 knots above optimum AOA/approach speed and execute a 360-degree left or right SRT. Adjust position by adding a straightaway downwind if necessary. Remain at or above circling minimums until the runway is again in sight.

3. When the aircraft is approximately 90 degrees from the landing runway, cross at not more than one-third of the runway length from the approach end, at 90 degrees from the runway heading. Hold this heading for 20 seconds and then execute a right or left SRT, as appropriate, for the runway heading.

WEATHER CONSIDERATIONS

To conduct flights in accordance with the latest weather information available, pilots on IFR flight plans in the continental United States should make maximum use of "pilot-to-forecaster" services. In addition, radar following can be requested of ARTC on assigned frequency to assist in circumnavigation of storm centers.

Flights which are conducted at high altitudes following climbout through rain or aircraft cold-soaked during a previous flight, will occasionally experience control system icing (aileron or elevator). This is seldom of a serious nature and the controls may be kept free by frequent movement of the control stick fore and aft, or right and left, through neutral. If this is not effective, use trim as necessary and descend below freezing level, if possible.

ICE, SNOW, AND RAIN

Precipitation can create flight hazards when the temperature borders on freezing. A thorough preflight inspection just prior to takeoff is essential. Frost can form on the wing surface in a very short time, making takeoff hazardous. Wet snow, if allowed to accumulate while the aircraft is on the ground, may freeze while the aircraft is gaining altitude and seriously reduce airspeed and range for an indefinite period. Takeoffs should never be attempted when frost, ice, or patches of wet snow adhere to the surfaces.

Note

The white and grey color of the aircraft surface may make it difficult to detect glaze ice formation on the wings. Because of the rapidity with which icing conditions may occur, the importance of making last minute checks of the exterior of the aircraft cannot be overstressed.

Taxiing on ice may present problems, particularly in a wind. Icing occurs in flight when freezing conditions exist and one or more of the following weather types are encountered: rain, fog, sleet, wet snow, supersaturated vapor, and high humidity.

Note

The aircraft is not equipped to prevent ice formation on the wings or fuselage and should not be flown in areas where heavy icing is likely to be encountered.

Two kinds of icing may be encountered in flight: aircraft icing and engine icing. A loss of airspeed is an indication of both types of icing. Engine icing is recognized by a decrease of engine rpm and an increase in tailpipe temperature. Icing may form in the air intake ducts forward of the engine, and is indicated by an increase in tailpipe temperature and a loss of airspeed, with rpm remaining constant. Icing of the inlet pressure sensing probe of the fuel control may be corrected by switching to MANUAL. Shift at an airspeed of 225 KIAS or above after making sure that throttle position approximately matches existing rpm.

CAUTION

Operation of the rain removal system to remove snow or ice on the windshield may crack the glass due to extreme thermal shocks and therefore should only be used in an emergency condition.

Snow or fog may occur in the cockpit on certain days when humid air reaches a low (air conditioning) temperature. This usually occurs during takeoffs and landings; within a few seconds visible moisture in front of the pilot may be so thick as to obscure the entire instrument panel. In the event of this phenomenon, the air conditioning control knob should be adjusted to full hot (to be readjusted later to a more comfortable temperature) and the windshield air should be switched from the windshield to the footwarmers by holding the windshield defrost switch in the DECREASE position. Should this fail to correct the situation, the cockpit pressure switch should be moved to RAM. If high humidity exists on takeoff so that cockpit fogging or snow is anticipated, it is recommended that takeoffs be accomplished with the cockpit pressure switch at RAM, moving the switch to NORMAL after the aircraft is comfortably airborne.

In extremely cold weather, some moving parts may freeze. The two most likely to freeze are the slats and the landing gear microswitches. Because of the great force used to actuate the landing gear and gear doors, the gear doors themselves are not likely to freeze open or closed. Prior to takeoff, the pilot should check both slats for freedom of movement. In flight, there is the possibility that one or both slats may freeze closed in freezing rain. After flying in freezing rain, the pilot should check both slats during the approach and, if the slats are frozen in, should approach at an airspeed higher than the recommended approach speed. To get the proper rate of descent and flareout, the pilot must consider buffet onset as a minimum speed factor if the condition of wing slats is not known. Should a landing gear microswitch become frozen, an incorrect gear position indication will be made.

Should canopy frosting occur from ice crystals on the inside, some side vision may be temporarily obtained by scraping off the ice.

On fields which have arresting gear, the arresting hook may be used for landing on wet or icy runways.

There is no water separator in the air conditioning system.

Rain Removal

The aircraft is equipped with rain removal and rain repellent systems to permit improved visibility upon encountering rain. (Refer to Rain Removal System and Rain Repellent System, Section I, for additional information.)

Antifogging Compound

An antifogging compound (MIL-A-21070) for coating the interior surface of the windshield and canopy, prevents fogging of these transparent surfaces:

The antifogging compound is applied as follows:

1. Wash interior surface if it is excessively soiled.

2. Apply the antifogging compound, using the application unit.

3. Wipe the surface with a clean, lint-free cloth until it is clear.

CAUTION

- The antifogging compound has a detrimental softening effect on cellulose nitrate instrument lacquer when in contact longer than 1 hour. Care should be taken to prevent contact of the compound with the instrument panel finish.
- The antifogging compound has a severe swelling effect on rubber. Be careful to minimize contact of the compound with the rubber and sealant surrounding the windshield and canopy.

One application of the antifogging compound is effective for a minimum of 10 fogging and drying cycles. When there is doubt as to the condition of the film, a new film should be applied.

FLIGHT IN TURBULENCE AND THUNDERSTORMS

Flights should not be conducted through known areas of clear icing or severe turbulence.

Turbulence

The key to flying in turbulent air is to "fly attitude." Reduce airspeed to approximately 250 KIAS, fly the all-attitude indicator, and pay less attention to altitude changes.

Thunderstorms

Whenever possible, thunderstorms should be bypassed. If a thunderstorm penetration is unavoidable, the following procedures have been thoroughly tested and proved to be effective.

If a storm area covers a wide front, it is usually advisable to fly above the weather to avoid heavy icing and hail-damage to the plastic nose. However, never attempt to top a storm by sacrificing optimum penetration airspeed. Should operations require some thunderstorm flying, an airspeed of about 250 KIAS will aid in reducing excessive gust loads in the structure. Vertical air currents in well developed thunderstorms will sometimes alter the aircraft altitude several thousand feet, and airspeed will fluctuate considerably. Rather than attempt to fly at a constant altitude, the pilot should maintain the initial flight attitude commensurate with a safe airspeed, keep a constant throttle setting, and use light stick forces to fly the attitude indicator. Abrupt pitch corrections should be avoided. Chasing the airspeed indicator should be avoided because the readings are unreliable during pressure changes within the storm cell and have been known to go to zero during thunderstorm penetration. Flying by pitch attitude reference should keep the airspeed and altitude relatively constant regardless of instrument indications.

Before Takeoff

A flight plan avoiding known thunderstorms must be made. A check should be made of all flight instruments, navigation equipment, interior lighting, and the anti-icing system. Pitot heat should not be left "ON," as prolonged ground operation without cooling airflow can damage the heating element.

Approaching the Storm

Preparation before entering the storm may be generalized into four basic steps. The first letter of each step spells HALT: Heat, airspeed/attitude, light, and tight.

Heat

Anti-icing switch in ALL.

Airspeed/Attitude

Reduce airspeed to about 250 KIAS and set throttle friction.

Go on instruments and stabilize airspeed and attitude prior to penetrating the storm.

Adjust all-attitude reference.

Fly on a heading calculated to provide the quickest passage through the storm at an altitude affording the lest turbulence and icing while clearing all ground obstacles by a wide margin. Use autopilot, if desired, but do not engage ALT hold.

Light

Turn all cockpit lights BRIGHT, including white floodlights. (Annunciator panel caution lights will be dimmed.)

Tight

Lower the seat to prevent striking the head against the canopy and to reduce the blinding effect of lightning.

Tighten torso harness straps.

Lock shoulder harness.

In the Storm

Once inside the storm, the problem becomes one of holding attitude and heading. Don't chase the altimeter or the airspeed. The primary instrument is the attitude indicator. All control movements should be small and the tendency to "fight" every motion of the aircraft should be avoided. Maintain wings' level and use as little horizontal stabilizer control as possible to minimize the possibility of overstressing the aircraft. The pilot should remember at all times that the aircraft is capable of safely penetrating the storm; however, some damage can be expected from the hail usually encountered. Maintain the initial heading through the storm, correcting any deviation from flight plan after emerging from the weather. Devote all attention to flying the aircraft. Expect turbulence, precipitation, and lighting. Do not allow these conditions to cause undue concern.

OPERATION CONDITIONS

COLD WEATHER OPERATIONS

Low temperatures will be encountered in all regions at high flight altitudes. However, most cold weather difficulties exist on the deck or airfield. Safety of flight depends on thorough preparation and careful observation of weather by the pilot. Equally important are preflight inspections which lessen the hazards of cold weather when the aircraft is exposed to ice, snow, and frost while on the ground.

Note

The collection of ice, snow, and frost on the aircraft surfaces constitutes one of the major flight hazards in low temperature operation and can result in loss of lift and in treacherous stalling characteristics.

Before Entering the Aircraft

A thorough check of the following items should be made by the pilot before entering the cockpit.

1. Visually check engine intakes for evidence of ice.

2. Check fuel drains (defueling valves), fuel lines, and shutoff valves for frozen condensation.

3. Remove all ice from fuel tank vents, static air sources, and pitot tube.

4. Remove dirt and ice from shock struts. Inspect limit switches, door hinges, actuating cylinders, and wheels.

5. Check control surfaces and hinges.

6. Check wing slats for smooth roller and track movement and that they can be closed manually.

7. Check the entire aircraft for freedom from ice, snow, and frost. Carefully remove ice by approved methods and remove snow or frost by light brushing.

CAUTION

- Do not permit ground crew to scrape or chip ice from aircraft surfaces, as damage to the skin will result.
- Check that water from ice removal does not refreeze, particularly on the control hinges.

8. Make sure that wheels are chocked securely to prevent slippage.

On Entering the Aircraft

The canopy seal must be inspected to make sure that no ice has accumulated to prevent proper seating.

Before Starting Engine

1. Check that compressor rotates freely by momentary starter application. Engine heat on shutdown melts ice accumulated during the previous flight, and the moisture may refreeze on the lower sections of the low-pressure compressor blades. Heat may be applied to melt ice, and engine should be started as quickly as possible after the compressor is free.

2. Before starting, and with external power engaged, the pitot heater should be checked, but should not be left ON, as prolonged ground operation without cooling airflow can damage the heating element.

3. Connect antiexposure suit and check blower operation.

Starting and Warmup Ground Check

1. Use normal procedure for starting engine. If temperature is less than -35°C, run at IDLE for 2 minutes before takeoff.

2. Make sure all instruments have been sufficiently warmed up to ensure normal operation. Check for sluggish instrument indicator movement during taxiing.

3. Check all flight controls, both visually and by feel, for unrestricted movement.

4. Run through a complete cycle with rudder trim, stabilizer trim, aileron trim (observing the tab), stick, speedbrakes, and flaps, several times, to ensure correct operation.

5. Cabin temperature knob as desired.

6. Be cautious while running engine up on a slippery surface, as the chocks may slide. A normal full power check can be made during the initial part of the takeoff roll.

Taxiing

1. Maintain directional control using nosewheel steering and/or brakes as required.

2. If it is necessary to taxi on ice or snow, allow greater distance for braking action. Skidding may occur with temporary loss of control when sharp turns are made or when a crosswind exists. Taxiing in deep snow is difficult and may also cause freezing of brakes and gear after takeoff.

3. Avoid taxiing through melted snow or slush caused by the jet blast of other aircraft, to prevent accumulation of ice on the aircraft surfaces.

4. Be careful when taxiing in the vicinity of other aircraft. Increase the space between aircraft to ensure safe stopping distance. Jet blast can impair visibility by blowing clouds of dry snow over a large area.

5. Minimize taxi time to conserve fuel and reduce amount of ice-fog generated by jet engines.

Before Takeoff

1. Turn air conditioning temperature to hot temporarily, to ensure minimum fogging and frosting.

WARNING

Do not take off with frosted windshield, or with frost, snow, or ice on wings or control surfaces.

2. Pitot heat ON just prior to takeoff.

3. If surface of runway is too slippery for engine runup, the power check must be made during early part of takeoff.

Takeoff

1. When starting the takeoff run, advance the throttle rapidly and check engine instruments.

2. After takeoff from snow or slush-covered runways, operate the landing gear and wing flaps through several cycles to prevent possible freezing in the up position. (Expect considerably slower operation of the landing gear in cold weather.)

CAUTION

- Do not exceed the wheels and flaps down airspeed limits during the cycling operation.
- Do not apply brakes to stop rotation of retracted wheels.

3. Check instruments. At extremely low outside air temperatures, instruments should be sufficiently warmed up to ensure reliable operation.

During Flight

1. The flight characteristics of the aircraft are not affected by cold weather, although colder than normal temperature increases air density and produces greater ram pressure. Engine rpm, therefore, may be reduced to establish the desired airspeed-altitude combination for maximum range.

2. Use cockpit air conditioning system as desired.

Descent

1. Should canopy frosting or fog or snow in the cockpit occur, increase the temperature. The heated windshield (nesa glass) should give forward vision and, in an emergency, some side vision can be obtained by scraping off the ice with a glove. (Use a kneeboard or sharp object only in an extreme emergency.)

2. If flight has been through freezing rain, check that slats open in the landing approach. (Refer to Ice, Snow, and Rain.)

3. A carrier-type approach is recommended for landing on wet and icy runways to lessen the possibility of skidding. This approach gives the maximum runway available, requires a minimum of braking, and allows landing at the lowest airspeed.

Landing

When landing on snow, or wet or ice-covered runways, be careful to avoid drift which will cause skidding and consequent loss of control. Maintain a straight course down the runway, applying brakes evenly and lightly. Nosewheel steering may be used below 60 knots to maintain directional control. The best approach to a landing on wet and icy runways is a carrier-type approach, with touchdown as close to the end of the runway as possible. After touchdown, retract flaps and leave speedbrakes extended for drag and increased braking effectiveness. The proper braking technique is light tapping of the pedals. If the aircraft starts to skid, the brakes should be released and tapping should be resumed after the aircraft again tracks normally.

Note

Hard braking on icy or wet runways may result in dangerous skidding or fishtailing.

Be certain to turn the pitot heater and engine anti-icing switch OFF after landing.

Shutdown and Postflight

1. Use normal shutdown procedures.

2. See that wheels are chocked securely.

3. Have aircraft serviced and fuel lines (defueling valves) drained. Every effort should be made during servicing to prevent moisture from entering the fuel system.

4. Have covers and plugs installed in mooring outside. Make certain aircraft is tied down securely.

5. If it is not snowing or raining, leave canopy open to allow circulation until the cockpit has cooled off, to prevent canopy cracking from differential contraction.

HOT WEATHER AND DESERT OPERATION

When wearing tight clothing, take as little time as possible in getting the engine started if ground connected air conditioning is not provided for the cockpit. Metal exposed to the sun can inflict severe burns.

Before Starting Engine

1. Make visual inspection of the aircraft exterior, checking for system leakages, sand or dust accumulation, tire overinflation or blistering, corrosions, and loose inspection plates.

2. Check that all lockpins, protective covers, and plugs (including pitot head cover) are removed.

3. Make any other necessary ground checks prior to starting engine, such as oxygen and fuel servicing.

4. Make sure air conditioning system is turned on.

After Starting Engine

1. Make engine ground runup as short as possible.

2. Acceleration to IDLE rpm will take longer than on a normal or cold day.

Taxiing and Takeoff

1. Avoid excessive use of brakes.

CAUTION

When aggravated by hot weather, excessive use of brakes is likely to increase tire pressure and decrease both tire and wheel strength sufficiently to cause explosive failure. Such a failure, if it occurs after a wheel is retracted, can rupture a door fairing, or integral fuel tank.

2. Watch exhaust temperatures closely.

3. Because of the lower density of air in hot weather, be prepared for slower acceleration, longer takeoff distance, and reduced thrust at all throttle settings. The increased requirement for takeoff distances commonly associated with hot weather operation of any aircraft is even greater for jet. An increase in temperature of 1°C will result in a 1 percent increase in takeoff distance. TAS will be greater for the normal IAS, and strict adherence to recommended IAS is essential to safe flight.

CAUTION

Do not attempt to take off in a sandstorm or duststorm. Park the aircraft crosswind and shut down the engine to prevent sand or dirt from damaging the engine.

Before Leaving Aircraft

1. If sand or dust is not blowing, leave canopy open to permit air circulation within the cockpit.

2. Check that protective covers are installed on pitot heat, canopy, and intake and exhaust ducts.

SECTION VII
COMMUNICATIONS PROCEDURES

TABLE OF CONTENTS

COMMUNICATIONS

GENERAL

Because of the nature of jet operations, voice radio is normally used for communications between aircraft. Occasionally, however, conditions of radio silence are prescribed for certain operations. Proficiency in the use of visual signals must therefore be maintained by all pilots.

Information and additional references concerning the following categories of radio/electronic communications are contained in Chapter VI of NWP 41 (series):

1. Communications procedures and terminology
2. Operational use of voice radio
3. Standard fleet weather reporting procedures
4. Contact reports
5. Aircraft identification procedures
6. IFF procedures.
7. Security voice procedures (Juliet 28).

RADIO COMMUNCATION

Radio Discipline

Good operating procedures must be practiced by each pilot if radio communication is to be effective. Compliance with the basic, common sense guidelines of correct radio operation which follows will eliminate the most frequent breaches of good radio discipline:

1. Use proper R/T voice procedure and terminology.
2. Do not cut in on other transmissions.
3. Make only necessary transmission and then be as brief as possible.
4. Use complete call signs to avoid confusion.
5. Mentally phrase a message prior to keying the mike.
6. Delay the transmission approximately 1 second after keying the mike to avoid loss of the first syllable.
7. Transmit on the guard channel only in an emergency.
8. Leave the UHF selector switch on T/R & G position.
9. Take pride in a "silent" flight, if it can be accomplished safely and effectively.
10. Do not switch the radio or IFF frequency codes below 2500 feet at night or instrument conditions except for urgent military necessity. If this necessity arises, the aircraft should be in stabilized, level flight before changing frequencies or codes.

VISUAL COMMUNICATIONS

Aircraft visual communications include those made with the hands or other parts of the body, aircraft maneuver, code transmission, or lights. Ground-to-air signals also include panel signals or other displays.

Information and additional references concerning the following categories of visual communications are contained in Chapter VI of NWP 41 (series):

1. Air-station control-tower light signals.

2. Signals between ground and aircraft for use by downed pilots. These include body signals, international ground-air emergency codes and aircraft replies, paulin signals, pyrotechnics, ground search-party signals, RESCAP rescue, and miscellaneous signals.

Visual signals should be used between aircraft whenever practicable, provided no loss in operational efficiency results. Those signals with which the pilot is primarily concerned are contained in this manual, as follows:

1. Starting and poststart signals (figure 7-2).

2. No-radio-penetration/instrument approach signals (figure 7-10).

3. Flight signals between aircraft:

General signals . . . . Figure 7-1

Takeoff, changing lead, leaving formation, breakup, and landing signals . . . . Figure 7-3

Formation signals . . . . Figure 7-4

Electronic communications and navigation signals . . . . Figure 7-5

Armament signals . . . . Figure 7-6

Aircraft and engine operation signals . . . . Figure 7-7

Air refueling signals . . . . Figure 7-8

Emergency signals between aircraft . . . . Figure 7-9

4. Arming and safing signals . . . . Figure 7-11

5. Postflight ground crew to pilot signals . . . . Figure 7-12

6. Signals between aircraft and surface ships . . . . Section VII

7. Surface ship one-letter code . . . . Section VII

NIGHT TACTICAL SIGNALS

Night tactical signals are usually given on voice radio, but they may be transmitted by the use of external lights or by a maneuver using the appropriate signal as shown. Maneuvers at night should be kept to a minimum consistent with the effective performance of the assigned task.

SIGNALS BETWEEN AIRCRAFT AND SURFACE SHIPS

If an aircraft which is not in radio communication with a ship wishes to attract attention to survivors or to an aircraft in distress, a standard procedure is used. The aircraft first circles the ship closely at low altitude. This circle is made at least once. The pilot then flies across the bow of the ship at low altitude with the hook up, changing power setting and rocking the wings. After this, he heads in the direction of the distress incident. Flight across the bow and in the direction of the incident is repeated until the ship acknowledges by following the aircraft.

The ship should either follow the aircraft or indicate by the visual signal "NOVEMBER" that this is impossible. The action taken must be reported to the OTC. Surface ships may use signals from the one-letter code given below when assisting a distressed aircraft.

SURFACE SHIP ONE-LETTER CODE

A one-letter aircraft code is available to surface ships for controlling the aircraft. The code is peculiar to aircraft operations and is limited to that use. The signals are made only by flashing-light or deck panels. Letters and their meanings are as follows:

Code	Meaning
B	Make passes.
C	Land aboard.
D	Delay; reform; remain within signal distance until further notice. (When the delay in recovery will be for more than 5 minutes, the number of minutes, in tens, may be flashed after the letter "D." Example: a 20-minute delay would be indicated by flashing the signal "D2.")
F	Flaps are not down.
G	Jettison droppable fuel tank(s).
H	Hook is not down.

Code	Meaning
K	Your (my) aircraft is damaged. (Unless otherwise directed, aircraft should land aboard carrier last.)
M	Proceed to base or carrier in accordance with doctrine or orders. (Unless otherwise briefed, this signal will mean to proceed to the designated bingo field, or if not designated, to the nearest suitable field.)
Q	Jettison bombs.
R	Radio failure. (By aircraft, utilizing the external lights or white fuselage lights.)
S	Flight Commander fly alongside and read signals.
U	Turn off (on) running lights.
W	Lower landing gear.
X	Previous landing order canceled.
Z	Do not land aboard; ditch aircraft in water or eject.

Signal		Meaning	Response
Day	Night		
1. Thumbs-up, or nod of head.	Flashlight moved vertically up-and-down repeatedly.	Affirmative. ("Yes," or "I understand.")	
2. Thumbs-down, or turn of head from side to side.	Flashlight moved horizontally back-and-forth repeatedly.	Negative. ("No," or "I do not understand.")	
3. Hand cupped behind ear as if listening.		Question. Used in conjunction with another signal, this gesture indicates that the signal is interrogatory.	As appropriate.
4. Hand held up, with palm outward.		Wait.	
5. Hand waved back and forth in an erasing motion in front of face, with palm turned forward.	Letter N in code, given with external lights.	Ignore my last signal.	
6. Hand held up, with thumb and forefinger forming an 0 and remaining fingers extended.		Perfect, well done.	
7. Employ fingers held vertically to indicate desired numerals 1 through 5. With fingers horizontal indicate number which added to 5 gives desired number from 6 to 9. A clenched fist indicates 0. (Hold hand near canopy when signalling.)		Numerals as indicated.	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.
8. Make hand into cup shape, then make repeated pouring motions.		I am going to dump fuel.	
9. Slashing motion of index finger across throat.		I have stopped dumping fuel.	
10. Horizontal '[illegible]' sign.	Same with wands.	You are on fire.	As required.

Figure 7-1. General Signals

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
1. Pilot holds one finger vertically.	Same NOTE 1	Start GTC	P/C executes.	Same NOTE 1
2. Plane captain holds two fingers vertically, then points to: Pilot (for pilot-controlled start) or Self (for ground-controlled start). NOTE 2	Same	GTC is up to speed and READY light is lit. GTC hose connected. Electrical power for ignition available. 1. This will be a pilot-controlled start. 2. This will be a ground-controlled start.	None	Same
3. Pilot holds two fingers vertically.	Same	1. If pilot-controlled start, START-ABORT switch is depressed. 2. If ground-controlled start, P/C open GTC air valve.	P/C returns rotating two-finger signal when GTC hose inflates.	P/C rotates flashlight vertically when GTC hose inflates.
4. Pilot holds three fingers vertically.	Same	1. Pilot-controlled start: START-ABORT switch has popped up. P/C remove starting air hose and electrical service cable. 2. Ground-controlled start: Engine RPM is at 50 percent. P/C close GTC air valve and remove starting air hose and electrical cable.	1. P/C checks for GTC hose collapse, removes starting air hose and electrical cable, and secures access panel. 2. P/C closes GTC air valve, checks for hose collapse, removes starting air hose and electrical cable, and secures access panels.	Same
5. If necessary, P/C attract pilot's attention by waving arms over head. Give "cut" signal by slashing motion of index finger across throat.	If necessary, P/C attract pilot's attention with flashlight. Give "cut" signal by repeated slashing of flashlight across throat.	Secure start/cut engine.	Pilot move throttle to OFF.	Same
6. P/C gives "OK" signal by forming circle with thumb and forefinger, with remaining fingers extended.	Same	Hydraulic pressure is 3000 psi on wheel well gages.	Pilot acknowledges with "thumbs-up."	Pilot moves horizontally-held flashlight up and down several times.

Figure 7-2. Starting and Poststart Signals (Sheet 1)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
7. P/C holds vertical fist in front, makes large horizontal circle with fist. NOTE 2	Same, except with vertically held flashlight pointed upward. NOTE 2	Pilot move all controls through full travel, checking for proper throw and feel, no hydraulic ladder lights ON when flight controls are moved rapidly. Then position flight controls as follows: full left rudder, stick full aft and port.	Pilot execute. P/C check control surfaces for correct deflection.	Same
8. P/C holds hands in front of body with palms together horizontally and makes: Open, or Closing motion with palms in alligator-mouth fashion. NOTES 2, 3, & 7	Same NOTES 2, 3, & 7	1. Lower flaps. 2. Raise flaps	Pilot execute. P/C check both flaps for: 1. Full deflection and security (certain ordnance configurations may restrict flaps to less than full deflection). 2. Full retraction and security. If satisfactory, give pilot "thumbs-up" after check is complete.	Same
9. P/C gives previous signal, followed immediately by "plus" sign formed by index fingers. NOTES 2 & 3	Same NOTES 2 & 3	Pilot raise or lower flaps to 1/2 deflection as signalled	Pilot execute. P/C check both flaps for 1/2 deflection and security. If satisfactory, give pilot "thumbs-up" after check is complete.	Same
10. P/C holds hand in front, palm vertical, and makes: Open, or Closing motion with palms in alligator-mouth fashion. NOTES 2 & 3	Same NOTES 2 & 3	1. Extend speedbrakes. 2. Retract speedbrakes.	Pilot execute. P/C check both speedbrakes for: 1. Full extension, leaks, security. 2. Full retraction. If satisfactory, give pilot "thumbs-up" after check is completed.	Same
11. P/C holds hand in front and Suddenly lowers other fist, with thumb extended downward to meet horizontal palm of extended hand.	Same, except points flashlight vice thumb toward extended palm of hand in direction desired.	1. Lower arresting hook.	Pilot execute. P/C check: 1. Hook down and for effective snubber action.	Same

Figure 7-2. Starting and Poststart Signals (Sheet 2)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
11. (Continued) Suddenly raises other fist, with thumb extended upward to meet horizontal palm of extended hand. NOTES 2 & 3	NOTES 2 & 3	2. Raise arresting hook.	2. Hook retracted and centered. If satisfactory, give pilot "thumbs-up" after check is completed.	
12. P/C holds one finger aloft. NOTE 4	Same. Illuminated by flashlight. NOTE 4	Cycle and set rudder trim to 0 degrees, using trim indicator.	Pilot execute. P/C points index finger toward vertical palm of other hand in direction rudder must be moved if not faired by pilot. When faired, P/C give next sequential signal. Pilot check indicator for possible error and note.	Pilot: Same. P/C: same, except use flashlight vice finger to indicate direction rudder must be moved.
13. P/C holds two fingers aloft. NOTE 4	Same. Illuminated by flashlight. NOTE 4	Cycle, override in both directions, and set elevator trim to 8 degrees noseup, using trim indicator. (If setting other than 8 degrees noseup trim is desired, the pilot shall inform P/C of desired setting prior to start.)	Pilot execute. P/C indicates trim setting by numerical hand signal. Pilot checks indicator for possible error, notes same, and corrects trim setting if error exists.	Pilot: Same. P/C: same, except use flashlight vice finger to indicate direction elevator must be moved.
14. P/C holds three fingers aloft. NOTE 4	Same. Illuminated by flashlight. NOTES 4 & 5	Cycle aileron trim and follow P/C signals. Check stick centered and aileron followup tab ±1/5 inch from aileron.	Pilot execute. P/C signal cycling of aileron trim and set ailerons symmetrically (both equally up, down, or even) and tap at ±1/5 inch.	Same
15. P/C holds four fingers aloft.	Same. Illuminated by flashlight.	Pressurize external drop tanks and/or buddy store. P/C check pressurization.	Pilot execute.	Same
16. P/C holds five fingers aloft.	Same. Illuminated by flashlight.	Depressurize external drop tanks and/or buddy store.	Pilot execute.	Same
17. Pilot points one finger at eye.	Same NOTE 6	P/C check all exterior lights BRIGHT, then DIM. (Modify locally, as necessary, according to situation.)	P/C execute. Give pilot "thumbs-up" after checking lights BRT, then check on DIM.	Same

Figure 7-2. Starting and Poststart Signals (Sheet 3)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
18. P/C holds nose, then gives "thumbs-up or down."	Same	Aircraft has no visible fuel, oil, or hydraulic leaks. Fuel has ceased draining from gang drain. (During start, indicates wet start.)	Pilot acknowledge with "thumbs-up."	Same
19. Pilot holds closed fist with thumb extended horizontal.	Same except flashlight vice thumb held horizontal.	P/C cycle approach light hook bypass switch in nosewheel well.	P/C executes.	Same
20. P/C forms circle with thumb and forefinger, then extracts forefinger of opposite hand from circle, using "pull-away" motion.	Same, except makes "pull-away" motion with flashlight.	Can I remove landing gear and external store-racks safety pins?	Pilot give "thumbs-up" (YES) or "thumbs-down" (NO). If yes, P/C removes pins and holds for pilot to count before stowing in pin bag in left-hand wheel well or aft hell-hole.	Same, except pilot moves horizontally-held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.
21. P/C pats back of neck with hand.	Same. Use flashlight vice hand.	Check ejection control safety handle in desired position.	Pilot check handle.	Same
22. P/C gives one finger turnup when cleared by flight deck director.	Same. Illuminated by wand.	You are cleared for turnup for fuel control check.	Pilot executes fuel control check.	Same
23. P/C extends arms bent 90 degrees so hands are level in front of chest. Place right palm on top of left hand and with positive movement raise right hand and lower left hand.	Same, except make signal with wands.	Can I move EXT/INT switch to EXT position?	Pilot gives "thumbs-up" (YES) or "thumbs-down" (NO).	Same, except pilot moves horizontally-held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.
24. Plane director puts forefinger on end of nose then gives a "thumbs-up."	Same. Use wands vice fingers.	Tillerbar connected. Director will assume directional control.	Head nod. Pilot controls only speed of aircraft with brakes.	Same
Plane director puts forefinger on end of nose then makes a downward sweeping motion with forearm toward direction of aircraft movement.	Same. Use wands vice fingers.	Tillerbar disconnected. Pilot will assume directional control.	Head nod. Pilot assumes directional control.	Same

Figure 7-2. Starting and Poststart Signals (Sheet 4)

Signal		Meaning	Response	
Day	Night	Day and Night	Day	Night
25. P/C extends arms directly in front of himself placing right palm on top of left palm, and with positive movement, raises right hand directly overhead.	Same, except make Signal with wands.	Activate spoilers open.	Turn spoiler switch to ARM. Advance and quickly retard throttle. Spoilers should close and reopen.	Same
26. P/C lowers arm to original extended position.	Same, except make signal with wands.	Activate spoilers closed.	Pilot turns spoiler switch OFF. When spoilers close, P/C gives "thumbs-up" to pilot.	Same
27. Pilot holds left palm vertical and right palm flat and 90 degrees to left palm making a connecting motion.	Same NOTE 1	Connect electrical power; then, place INT/EXT power switch in EXT position.	Pilot gives "thumbs-up" when power is received.	Same
28. Pilot holds left palm vertical and right palm flat and 90 degrees to left palm making a disconnect motion.	Same NOTE 1	Place INT/EXT power switch in INT position; then, remove external power.	Pilot gives "thumbs-up" when aircraft is running on internal power.	Same

NOTES:

1. Where night signal is listed as "Same," unless otherwise indicated, signal is identical to day signal, except red flashlight is used to illuminate hand (if appropriate).

2. Prior to giving this signal, the affected area must be checked visually by the P/C to ensure that there exists no hazard to personnel.

3. Normally these hand signals will be given in close sequence without hesitation; i.e., speedbrakes, flaps, etc. The pilot shall hold up both hands to prevent actuation of hydraulically operated systems while the P/C checks the speedbrakes, flaps, spoilers, and hook.

4. P/C shall be stationed at port wingtip, within sight of pilot, for the trim signals.

5. After giving 3-finger signal, P/C illuminates followup tab from inboard end.

6. For use prior to night flight or at pilot's discretion.

7. During periods of operations in which ordnance configurations limit flaps to less than full extension, this check may be conducted using half flaps vice full flaps.

Figure 7-2. Starting and Poststart Signals (Sheet 5)

Signal		Meaning	Response
Day	Night		
1. Section takeoff-leader raises either forearm to vertical position. 2. Wingman raises forearm. 3. Leader lowers arm.	Refer to Night Flying, Section III, for night section takeoff light signals.	1. I have completed my takeoff checklist and am ready for takeoff. 2. I have completed my takeoff checklist and am ready for takeoff. 3. Takeoff path is clear, I am commencing takeoff.	1. Stands by for reply from wingman, holding arm up until answered. 2. Wingman lowers arm and stands by for immediate takeoff. 3. Execute section takeoff.
Leader pats self on the head, points to wingman.	1. Lead aircraft switches lights to BRT/STDY. 2. If external lights are inoperative, leader shines flashlight on hardhat then shines light on wingman.	Leader shifting lead to wingman.	1. Wingman pats head and assumes lead. 2. Wingman places lights on DIM/STDY and assumes lead. 3. Wingman shines flashlight at leader, then on his hardhat and assumes lead.
Leader pats self on head and holds up two or more fingers.		Leader shifting lead to division designated by numerals.	Wingmen relay signal; division leader designated assumes lead.
Pilot blows kiss to leader.		I am leaving formation.	Leader nods ("I understand") or waves goodby.
Leader blows kiss and points to aircraft.		Aircraft pointed out leave formation	Wingman indicated blows kiss and executes.
Leader points to wingman, then points to eye, then to vessel or object.		Directs plane to investigate object or vessel.	Wingman indicated blows kiss and executes.
Division leader holds up and rotates two fingers in horizontal circle, preparatory to breaking off.		Section break off.	Wingman relays signal to section leader. Section leader nods ("I understand") or waves goodby and executes.
Leader holds hand over head and makes a circular motion with forefinger extended.	Series of "I's" in code, given by external lights.	Breakup (and rendezvous).	Wingman take lead, pass signal after leader breaks, and follow.
Landing motion with open hand: 1. Followed by patting head. 2. Followed by pointing to another aircraft.		Refers to landing of aircraft, generally used in conjunction with another signal. 1. I am landing. 2. Directs indicated aircraft to land.	1. Nods. ("I understand") or waves goodby. 2. Aircraft indicated repeats signal, blows a kiss and executes.

Figure 7-3. Takeoff, Changing Lead, Leaving Formation, Breakup, and Landing

Signal		Meaning	Response
Day	Night		
Open hand held vertically and moved forward or backward, palm in direction of movement.		Adjust wing position forward or aft.	Wingman moves in direction indicated.
Open hand held horizontally and moved slowly up or down, palm in direction of movement.		Adjust wing position up or down.	Wingman moves up or down as indicated.
Open hand used as if beckoning inboard or pushing outboard.		Adjust wing position laterally toward or away from leader.	Wingman moves in direction indicated.
Hand opened flat and palm down, simulating dive or climb.		I am going to dive or climb.	Prepare to execute.
Hand moved horizontally above glareshield, palm down.		Leveling off.	Prepare to execute.
Head moved backward		Slow down.	Execute.
Head moved forward.		Speed up.	Execute.
Head nodded right or left.		I am turning right or left.	Prepare to execute.
Thumb waved backward over shoulder.	Series of 00's in code, given by external lights	Take cruising formation or open up.	Execute.
1. Holds up right (or left) forearm vertically, with clenched fist or single wing'dip. 2. Same as above, except with pumping motion or double wing-dip.	1. Single letter R (or K) in code, given by external lights. 2. Series of RR's (or KK's) in code, given by external lights.	1. Wingman cross under to right (or left) echelon or in direction of wing-dip. 2. Section cross under to right (or left) echelon or in direction of wing-dips.	1. Execute. 2. Execute.
Triple wing-dip.		Division cross under.	Execute.
	Series of VV's in code, given by external lights.	Form a Vee or balanced formation.	Execute.
Series of zooms.	Series of XX's in code, given by external lights.	Close up or join up; join up to me.	Execute.
Rocking of wings by leader.		Prepare to attack.	Execute preparation to attack.

Figure 7-4. Formation Signals (Sheet 1)

Signal		Meaning	Response
Day	Night		
Rocking of wings by any other member of flight.		We are being, or are about to be, attacked.	Standby for and execute defensive maneuvers.
Lead plane swishes tail.		All aircraft in this formation form stepdown column in tactical order behind column leader.	Execute. Leader speeds up slightly to facilitate formation of column.
Shaking of ailerons.	Long dash, given with external lights.	Execute signal; used as required in conjunction with another signal.	Execute last signal given.

Figure 7-4. Formation Signals (Sheet 2)

Signal		Meaning	Response
Day	Night		
Tap earphones, followed by patting of head, and point to other plane.		Take over communications.	Repeat signals, pointing to self, and assume communications lead.
Tap earphones, followed by patting of head.		I have taken over communications.	Nod ("I understand").
Tap earphones and indicate by finger-numbers, number of channels to which shifting.		Shift to radio frequency indicated by finger-numbers.	Repeat signal and execute.
Tap earphones, extend forearm vertically, and rotate fingers, formed as if holding a grapefruit followed by four numbers.		Manually set up ARC-51A on frequency indicated.	Repeat signal and execute.
Tap earphones, followed by question signal		What channel (or frequency) are you on?	Indicate channel (or frequency) by finger-numbers.
Tap earphones and point to plane being called, followed by finger-numbers indicating frequency.		You are being called by radio on channel indicated by finger-numbers.	Repeat numbers. Check receiving frequency and switch to channel indicated by originator. Dial in manually, if necessary.
Vertical hand, with fingers pointed ahead and moved in a horizontal sweeping motion, with four fingers extended and separated.		What is bearing and distance to the TACAN station?	Wait signal, or give magnetic bearing and distance with finger-numbers. The first three numerals indicate magnetic bearing and the last two or three, distance.

Figure 7-5. Electronic Communications and Navigation (Sheet 1)

Signal		Meaning	Response
Day	Night		
Vertical hand, with four fingers extended and separated, pointed ahead in a fore-and-aft chopping motion, followed by a question signal.		What is bearing to TACAN station?	Repeat signal and give bearing in three digits.
Arm and vertical hand, with four fingers extended and separated, moved ahead in a fore-and-aft circular motion, followed by question signal.		What is distance to TACAN station?	Repeat signal and give distance in two or three digits.
TACAN bearing or distance signal, followed by thumbs up or down.		TACAN bearing or distance, up or down.	Thumbs up or nod ("I understand").
TACAN bearing signal, followed by finger-numbers.		Switch to TACAN station indicated.	Repeat and execute.
Hand held up. First and fourth fingers extended, moved in fore-and-aft chopping motion, followed by: 1. Four numbers. 2. Question signal. 3. Up or down signal.		 1. Set up UHF/ADF on frequency indicated. 2. What is UHF/ADF bearing? 3. My UHF/ADF is up or down.	 1. Repeat signal and execute. 2. Repeat chopping motion, followed by wait, or three numerals indicating magnetic bearing. 3. Thumbs up or nod ("I understand").
Two fingers pointed toward eyes (meaning IFF signals), followed by: 1. "CUT." 2. Three-digit numbers.		 1. Turn IFF to "STANDBY." 2. Set mode and code indicated; first numeral-mode, second and third numerals - code.	Repeat, then execute.
1. Open hand held up, fingers together, moved in fore-and-aft chopping motion (by leader). 2. Followed by question signal. 3. Followed by three finger-numbers.		1. Course to be steered is present compass heading. 2. What is your compass heading? 3. My compass heading is as indicated by finger-numbers.	1. Nod of head ("I understand"). 2. Repeat signal and give compass heading in finger-numbers. 3. Nod or clarify as appropriate.
Tap oxygen mask (or earphones) and give thumbs down.	Turn wing and taillights BRT/FLASH.	I have UHF transmitter (or receiver) failure.	Execute no radio procedure as briefed. Attempt contact on guard if necessary.

Figure 7-5. Electronic Communications and Navigation (Sheet 2)

Signal		Meaning	Response
Day	Night		
1. Pistol-cocking motion with either hand. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Ready or safety guns, as applicable. 2. How much ammo do you have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Thumbs-up - "over half"; thumbs-down - "less than half." 3. Nod head ("I understand").
1. Shaking fist. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety bombs, as applicable. 2. How many bombs do I have? 3. I am unable to drop.	1. Repeat signal and execute. 2. Indicate with appropriate finger-numbers. 3. Nod head ("I understand").
1. Shaking hand, with fingers extended downward. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety rockets, as applicable. 2. How many rockets do I have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Indicate with appropriate finger-numbers. 3. Nod head ("I understand").
Pistol cocking motion with either hand, followed by fore and aft pulling motion with a clenched fist.	1. Rotating beacon ON and OFF by lead aircraft. 2. Rotating beacon turned ON for second time (allow time for setting up switches).	Jettison external stores. 1. Set up your switches for jettison. 2. You are cleared to drop.	Repeat signal and execute. 1. Set up jettison/ordnance switches. 2. Execute.
Fingers to be extended horizontally: 1. One finger. 2. Two fingers. 3. Three fingers. 4. Four fingers. 5. Five fingers.	Same signals with fingers held in front of flashlight.	1. JATO arming switch ARMED. 2. Depress JATO firing button. 3. Release JATO firing button. 4. JATO arming switch OFF. 5. JATO connected and ready.	1. Repeat signal and execute. 2. Repeat signal and execute. 3. Repeat signal and execute. 4. Repeat signal and execute. 5. JATO arming switch ARMED. Check JATO armed indicator light ON. If no light, give four-finger signal to ordnance crew to recheck. If no light after recheck, return to line.

Figure 7-6. Armament

Signal			
Day	Night	Meaning	Response
Raise fist with thumb extended in drinking position.		How much fuel have you?	Repeat signal, then indicate fuel in hundreds of pounds by finger-numbers.
Rotary movement of clenched fist in cockpit as if cranking wheels, followed by head nod.	Letter W in code, given by external lights, or rotary motion of flashlight.	Lower or raise landing gear and flaps, as appropriate.	Repeat signal. Execute when leader changes configuration.
Leader lowers hook.	Letter H in code, given by external lights.	Lower arresting hook.	Wingman lower arresting hook. Leader indicate wingman's hook is down with thumbs-up signal.
Open and close four fingers and thumb.		Extend or retract speed-brakes, as appropriate.	Repeat signal. Execute upon head nod from leader or when leader's speed-brakes extend/retract.

Figure 7-7. Aircraft and Engine Operation

Signal			
Day	Night	Meaning	Response
One finger turnup signal.		By receiver: start turbine.	Tanker execute. Receiver gives thumbs-up when turbine starts.
Form cone-shape with hand, all fingers extended aft (make signal close to canopy).			Tanker execute. Receiver give thumbs-up if:
1. Cone moved aft.		1. By receiver: extend drogue.	1. Drogue extends properly.
2. Cone moved forward.		2. By receiver: retract drogue.	2. Drogue retracts fully and air turbine feathers.
Make hand into cup-shape, then make repeated pouring motions.		By tanker: I am going to dump fuel.	By receiver: Nod. Give thumbs-up when fuel dumping commences.
Slashing motion of index finger across throat.		By tanker: I have stopped dumping fuel.	By receiver: Give thumbs-up if fuel dumping has ceased.

Figure 7-8. Air Refueling

Signal		Meaning	Response
Day	Night		
Arm bent across forehead as if weeping:	Series of dots with external lights followed by:	I am in trouble.	Escort disabled plane, assuming lead, if indicated, and return to base or nearest suitable field.
1. Followed by HEFOE signal and code.	1. HEFOE signal and code.	1. I am having trouble with indicated system.	
2. Followed by landing signal.	2. HEFOE signal and code, followed by wheels signal.	2. I must land immediately.	
MALFUNCTIONING OF EQUIPMENT (HEFOE CODE)			
Arm bent across forehead as if weeping and then indicating by finger-numbers 1 to 5 the affected system.	Flashlight held close to top of canopy, pointed toward wingman, followed by 1 to 5 dashes to indicate system affected.	Number of fingers or dashes means: 1. Hydraulic system. 2. Electric system (including TACAN and flight instruments). 3. Fuel system. 4. Oxygen system. 5. Engine	Day: Nod, or thumbs-up ("I understand"). Night: Vertical movement of flashlight. Pass lead to disabled plane or assume lead, if indicated.

Figure 7-9. Emergency Signals Between Aircraft

Signal		Meaning	Response
Day	Night		
Open and close four fingers and thumb in pinching motion.	3 dashes w/external lights.	Extend speedbrakes, commencing approach.	Execute when leader extends speedbrakes.
Rotary movement of clenched fist in cockpit as if cranking wheels.	2 dashes w/external lights.	Extend wheels and full flaps.	Execute when leader extends wheels, flaps.
Pointing index finger toward runway/ship in stabbing motion, repeatedly, followed by lead change signal.	Series of dashes w/external lights.	Landing runway/meatball and ship in sight.	Ashore: Take position for landing Carrier: Break off and land.

Note: Configuration change should be executed promptly after completion of the signal.

Figure 7-10. Flight Signals Between Aircraft Penetration/Instrument Approach (no radio)

Signal			
Day	Night	Meaning	Response
ARMING			
1. Arming supervisor: Hands over head with fingers touching.	Red wands over the head with tips touching.	Pilot: Check all armament switches OFF or SAFE.	Pilot: Execute. Raise both hands into view of arming supervisor after checking switch positions. (Hands remain in view during check and hook-up).
2. Arming supervisor: Points at crewmember (used if applicable).	Same as day only with red wand.	Crew: Perform stray voltage checks.	Arming crew: Execute. Give arming supervisor thumbs-up if no stray voltage exists. Thumbs down if exists. Night: Vertical sweep with flashlight indicates no stray voltage. Horizontal sweep indicates stray voltage.
3. Arming supervisor: Raises fist, thumb extended upward, to meet horizontal palm of other hand.	Form a Tee with red wands.	Arming Crew: Arm weapons (as applicable).	Arming crew: Execute. Give arming supervisor thumbs-up when arming completed and clear immediate area. Thumbs down if a malfunction exists. Night: Same as step 2 above.
4. Arming supervisor gives pilot:			Pilot:
a. Thumbs-up.	a. Vertical sweep with red wand.	a. Aircraft is armed and all personnel and equipment clear of area.	a. Acknowledge with similar signal.
b. Thumbs-down.	b. Horizontal sweep with red wand.	b. Aircraft is down for weapons.	b. Acknowledge with similar signal.
SAFING			
1. Safing supervisor: Hands over the head with fingers touching.	Red wands over the head with tips touching.	Pilot: Check all armament switches OFF or SAFE.	Pilot: Execute. Raise both hands into view of safing supervisor after checking switch positions. (Hands remain in view during safing.)
2. Safing supervisor points at crew member.	Same as day only with red wand.	Crew: Safe weapons (as applicable).	Crew: Execute.
3. Safing supervisor give pilot: Thumbs-up.	Red vertical wand.	Pilot: Aircraft is safed and crew and equipment are clear.	Pilot: Acknowledge with similar signal.

Figure 7-11. Arming and Safing Signals

Signal		Meaning	Response
Day	Night		
P/C rapidly fans hand in front of face and points to wheel with other hand.	Same, except with wand.	Your aircraft has hot brakes.	Comply with local hot brakes procedures.
P/C extends arms bent 90 degrees so hands are level in front of chest. Place right palm on top of left hand and with positive movement raise right hand and lower left hand.	Same, except make signal with wands.	Can I move EXT/INT switch to EXT position?	DAY: Pilot give "thumbs-up" (YES) or "thumbs-down" (NO). NIGHT: Same, except pilot moves horizontally held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.

Figure 7-12. Postflight Ground Crew to Pilot Signals

SECTION VIII
WEAPONS SYSTEMS

TABLE OF CONTENTS

ARMAMENT EQUIPMENT

GENERAL

This section describes the minimum armament equipment required to release external stores carried in a nontactical environment and a basic description of the gunsight. A complete description of the aircraft weapons system is contained in NAVAIR 01-40AV-1T. This flight manual is incomplete without the tactical manual.

The aircraft is capable of carrying a wide variety of ordnance. All stores are carried externally on five racks. A four-hook ejector bomb rack is installed on the centerline (fuselage) station, and a two-hook bomb ejector rack is installed on each of the four wing stations. The centerline rack (AERO 7A-1) can be used to carry stores requiring either 30- or 14-inch suspension. Wing racks (AERO 20A-1) are provided with 14-inch suspension only.

ARMAMENT CONTROLS

The cockpit includes an armament panel, control stick armament switches, emergency stores release handle, gunsight, and a gunsight reticle light control panel. Armament controls used with specific weapons systems (BULLPUP, gun pod, etc.) are shown in figure 8-2. Operation of weapons systems controls are explained in NAVAIR 01-40AV-1T.

ARMAMENT PANEL

The armament panel (figure 8-1) is located below the instrument panel. Armament panel controls consist of the MASTER armament switch, STATIONS select switches, function selector switch, bomb ARM switch, GUNS switch, and EMER SEL switch.

Master Armament Switch

All armament circuits are controlled by the MASTER armament switch (figure 8-1) with the exception of gun charging and emergency jettisoning of external stores. The MASTER armament switch must be in the ON position to energize armament circuits.

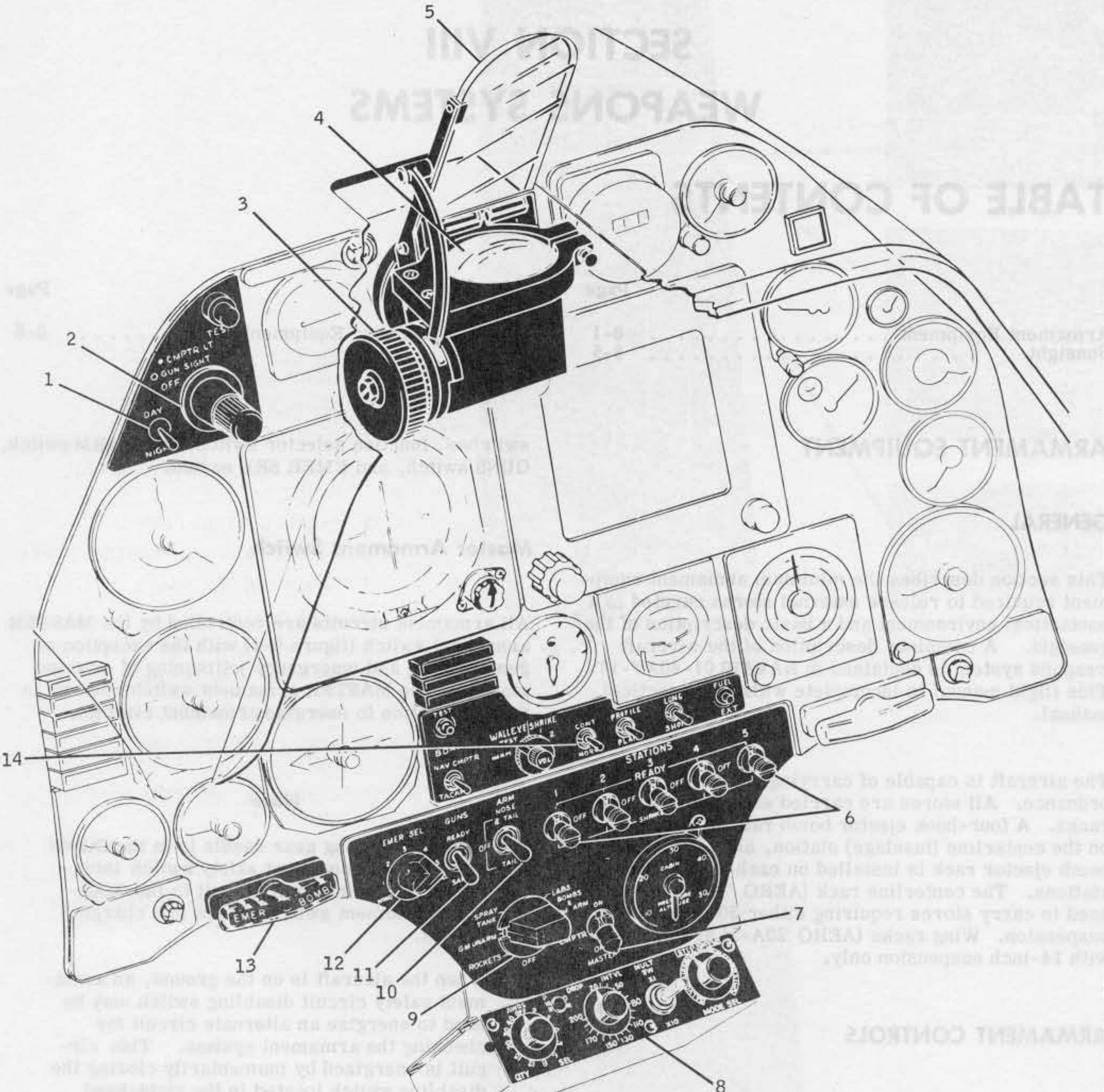
Note

- When the landing gear handle is in the DOWN position, an armament safety switch intertupts the power supply circuit to the MASTER armament switch and the gun charging circuit.
- When the aircraft is on the ground, an armament safety circuit disabling switch may be used to energize an alternate circuit for checking the armament system. This circuit is energized by momentarily closing the disabling switch located in the right-hand wheel well. Raising the landing gear or moving the MASTER armament switch to OFF will restore the armament safety circuit to normal operation.

Stations Select Switches

Five STATIONS select switches (figure 8-1) provide for selection of any station or combination of stations for firing or release (except for emergency release) of external stores. A number, on the STATIONS READY position, above each switch identifies the switch with the external stores station it controls. In

Figure 8-1. Armament Controls



1. GUNSIGHT DAY NIGHT SWITCH
2. GUNSIGHT LIGHT CONTROL
3. GUNSIGHT ELEVATION CONTROL
4. GUNSIGHT
5. GUNSIGHT REFLECTOR PLATE
6. STATIONS SELECT SWITCHES
7. MASTER ARMAMENT SWITCH
8. AIRCRAFT WEAPONS RELEASE SYSTEM CONTROL PANEL
9. FUNCTION SELECTOR SWITCH
10. BOMB ARMING SWITCH
11. GUNS SWITCH
12. EMERGENCY SELECTOR SWITCH
13. EMERGENCY STORES RELEASE HANDLE
14. SIDS CONT-NORM MODE SWITCH

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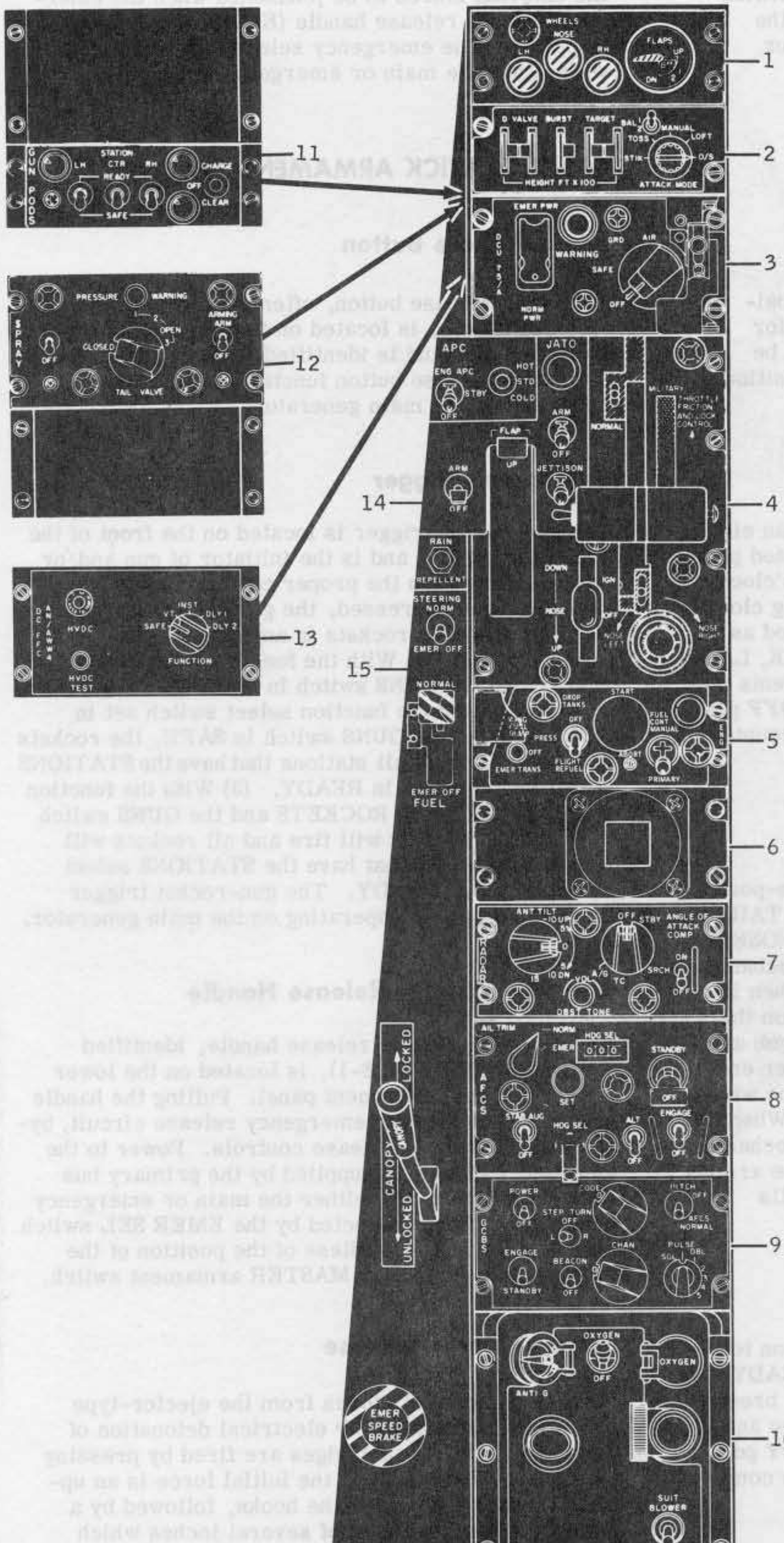
Figure 8-1. Armament Controls



1. WHEELS AND FLAPS POSITION INDICATOR
2. WEAPON CONTROL PANEL
3. DCU/75A CONTROL PANEL
4. THROTTLE QUADRANT CONTROL PANEL
5. ENGINE CONTROL PANEL
6. BULLPUP ADAPTIVE CONTROL PANEL
7. RADAR CONTROL PANEL
8. AFCS CONTROL PANEL
9. GCBS CONTROL PANEL
10. AIRCREW SERVICES PANEL
11. GUN PODS CONTROL PANEL
12. AERO 14B SPRAY TANK CONTROL PANEL
13. FUZE FUNCTION CONTROL PANEL AN/AWW 4
14. JATO, SPOILER, APC, AND RAIN REPELLENT CONSOLE
15. EMERGENCY FUEL AND NOSEWHEEL STEERING PANEL

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Figure 8-2. Alternate Weapons Control Panels addition, each switch is labeled OFF and SHRIKE PAIR. For further particulars concerning the SHRIKE PAIR positions and weapons firing or release, refer to NAVAIR 01-40AV-IT.

WARNING

The SHRIKE PAIR position is a "hot" position, equivalent to the READY position for ordnance other than SHRIKE, and could be inadvertently selected when the OFF position is intended.

Function Selector Switch

The function selector switch (figure 8-1) is an eight-position rotary switch. Seven of eight detented positions are identified, while one position (12 o'clock position) is unidentified and unused. Starting clockwise from the bottom, positions are identified as OFF, ROCKETS, GM UNARM, SPRAY TANK, LABS, BOMBS GM ARM, and CMPTR. A stop prevents the switch from being rotated clockwise to the OFF position; therefore, the switch must be rotated counterclockwise to return to the OFF position.

Bomb ARM Switch

The bomb ARM switch (figure 8-1) is a three-position toggle switch with positions labeled NOSE & TAIL, OFF, and TAIL. Placing the switch in the NOSE & TAIL position energizes the nose and tail mechanical bomb arming units on each ejector rack. When in the TAIL position, only the tail arming unit on the ejector rack is energized. A mechanical bomb arming unit, when energized, locks onto the upper end of the arming wire, causing the arming pin to be withdrawn as the bomb falls from the aircraft. When the arming switch is in the OFF position, the mechanical arming units are not energized permitting the arming wires to fall with the bomb, and the bomb falls unarmed.

GUNS Switch

The GUNS switch (figure 8-1) is a two-position toggle switch with positions identified SAFE and READY. When the switch is in the SAFE position, the breechblock of each gun is an out-of-battery position and the guns are inoperative. When in the READY position, the gun charging and firing circuits are completed, making the guns ready for firing.

Emergency Selector Switch

The emergency selector switch, identified EMER SEL (figure 8-1), is a rotary switch labeled WING, 1, 2, 3, 4, 5, and ALL. The switch provides selection of the external stores to be jettisoned when the emergency stores release handle (EMER BOMB T-handle) is pulled. The emergency selector switch functions with either the main or emergency generator in operation.

CONTROL STICK ARMAMENT SWITCHES

Bomb Release Button

The bomb release button, often referred to as the "pickle" switch, is located on the left side of the control stick grip and is identified with the letter "B." The bomb release button functions only when operating on the main generator.

Gun-Rocket Trigger

The gun-rocket trigger is located on the front of the control stick grip and is the initiator of gun and/or rocket firing when the proper conditions are established. When depressed, the gun-rocket trigger fires guns and/or rockets in any one of three arrangements: (1) With the function select switch set in OFF and the GUNS switch in READY, the guns are fired. (2) With the function select switch set in ROCKETS and the GUNS switch in SAFE, the rockets will be fired from all stations that have the STATIONS select switches set in READY. (3) With the function select switch set in ROCKETS and the GUNS switch in READY, the guns will fire and all rockets will fire from stations that have the STATIONS select switches set in READY. The gun-rocket trigger functions only when operating on the main generator.

Emergency Stores Release Handle

An emergency stores release handle, identified EMER BOMB (figure 8-1), is located on the lower left side of the instrument panel. Pulling the handle closes a switch in the emergency release circuit, bypassing the normal release controls. Power to the emergency circuit is supplied by the primary bus which is energized by either the main or emergency generator. Stores selected by the EMER SEL switch may be released regardless of the position of the landing gear control or MASTER armament switch.

External Stores Release

Release of external stores from the ejector-type racks is accomplished by electrical detonation of cartridges. When cartridges are fired by pressing the bomb release button, the initial force is an upward thrust which opens the hooks, followed by a downward ejector thrust of several inches which forces the store clear of the aircraft. An ejector foot is located aft of center on the bomb rack to counteract the twisting moment of the bomb caused by drag forces in high-speed flight. Each ejector rack contains two cartridges: both are fired by either the normal or emergency release circuit.

Note

Normal release of external stores is possible only while operating on main generator. Emergency release may be accomplished while operating on the main or emergency generator.

NORMAL RELEASE

1. Function selector switch . . . . . BOMBS GM ARM

2. STATION select switches (as desired) . . . . READY

3. MASTER armament switch . . . ON

4. Bomb release button. . . . . DEPRESS

Note

For releasing stores in an inert condition, the bomb ARM switch (controlling mechanical arming circuits) must be in the OFF position and/or the function selector switch on the AN/AWW-4 fuze function control panel (controlling electrical arming circuits) must be in the SAFE position.

EMERGENCY RELEASE

1. EMER SEL switch . . . . AS REQUIRED

CAUTION

When the emergency stores release handle is used to jettison wing stores only (EMER SEL switch set in WING) ensure that STATION select switch for the centerline station is in the OFF position to prevent electrical feedback through the normal bomb release circuit and inadvertent release of the center store.

2. Emergency stores release (EMER BOMB) handle . . . . PULL

Note

Electrical power is required (either from the main generator or the emergency generator) to jettison external stores with the emergency stores (EMER BOMB) release T-handle. If electrical power is not available, external stores cannot be jettisoned.

GUNSIGHT

A lighted gunsight is located directly above the center of the instrument panel. Gunsight controls include an elevation control knob on the lower left-hand side of the gunsight and a gunsight lighting control panel located in the upper left-hand corner of the instrument panel (figure 8-1).

GUNSIGHT CONTROLS

The gunsight elevation control knob is used to adjust the angle of the glass reflector for increasing or decreasing lead angle.

The gunsight lighting control panel incorporates three controls: a rotary reticle light (rheostat) control knob labeled GUNSIGHT, a two-position DAY NIGHT toggle switch, and a press-to-test light labeled TEST.

Rotating the GUNSIGHT reticle light control knob allows the pilot to select either of two filaments for gunsight reticle lighting. Light intensity can also be adjusted by positioning the control knob between the OFF position for either filament. Light is beamed through a condenser lens and a ladder-type fixed reticle upward through a collimating lens to a reflector plate, where it is superimposed upon the target. When using the gunsight with guns or rockets, the proper ballistic drop of the projectile is set into the gunsight as down lead. The center of the reticle image is kept on the center of the target, provided it is a fixed target. If the target is moving, the required lead angle must be established by using the graduations on the reticle.

The two-position DAY NIGHT toggle switch is used to further adjust the intensity of the gunsight reticle light to compensate for ambient light conditions. When the switch is in the DAY position, a gunsight light register circuit is bypassed allowing maximum power to the gunsight reticle light control rheostat. With the switch in the NIGHT position, power is directed through the gunsight light resistor circuit, resulting in lower light intensity with variance controlled by the reticle light control rheostat.

The TEST light is a press-to-test device for testing the condition of the bulbs throughout the gunsight lighting circuitry.

The inner knurled knob, within the GUNSIGHT reticle light control knob, is labeled CMPTR LT and controls the intensity of the CP-741/A computer LOCK ON and IN RANGE display lights. The computer display lights are mounted on the upper gunsight assembly for pilot convenience. Although the CMPTR LT control knob does not have a direct function in gunsight light control, it enables the pilot to adjust the intensity of the display lights to the most comfortable level for gunsight vision.

SPECIAL ELECTRONIC EQUIPMENT

A-4M aircraft are equipped with the following special electronic equipment:

AN/ALQ-100 Countermeasures System

AN/APR-27 Alert Receiver System

Countermeasures Destruct System

AN/ALE-29A Countermeasures Chaff Dispensing System

AN/APR-25 Homing and Warning System.

Some of the special electronic systems use common components, and some systems use components of electronic systems not discussed in this section. Each special electronics system is discussed separately insofar as classification allows, and the common components or components of other systems are covered under each of the five systems as they apply to that particular system.

UPPER AVIONICS POD

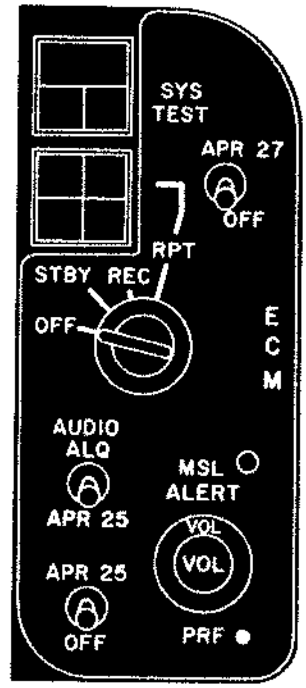
An upper avionics pod is installed on top of the fuselage along the centerline of the aircraft. The pod contains electrical wiring and coaxial cables necessary for the installation of some of the special electronic system components.

AN/ALQ-100 COUNTERMEASURES SYSTEM

All operating controls for the AN/ALQ-100 countermeasures system are on the ECM control monitor (figure 8-3). The ECM control monitor is located in the cockpit on the lower left-hand side of the instrument panel glareshield. The ECM control monitor is a combination control panel and contains control switches and indicator light groups for the AN/ALQ-100 countermeasures system, the AN/APR-27 alert receiver system, and the AN/APR-25 homing and warning system.

Operation

The AN/ALQ-100 countermeasures system control switch is the rotary switch centered on the ECM control monitor panel. The switch has four detented positions labeled OFF, STBY, REC, and RPT. The switch position markings except OFF, are duplicated on three of the indicator lights in the four-light assembly above the AN/ALQ-100 control switch. The control switch is rotated from OFF to STBY (standby mode) as the first step in operating the system. The amber STBY light will come on immediately and will go off after the warmup time-delay period of approximately 2 minutes. When the STBY light goes off the AN/ALQ-100 countermeasures system is ready to function. Rotating the switch from STBY to REC (receive mode) places the system in operation, and the red REC light will come on if certain radar signals are being received. The red REC light will go off when the signals are no longer being received. When the red REC light is on, rotating the switch to the RPT (repeat mode) position will cause the green RPT light to come on at the same time that the red REC light is on and enable the AN/ALQ-100 countermeasures system to transmit signals designated to counter signals received from opposing radar.



FA1-34

Figure 8-3. ECM Control Monitor

Note

> The ECM control monitor includes a two-position toggle switch labeled ALQ and APR 25. Use of this switch enables the pilot to select the audio tone of either the AN/ALQ-100 countermeasures system or the AN/APR-25(V) homing and warning system. The volume of both audio tones are controlled by the PRF volume control knob.

An excessive current drain, a blown fuse, or a power circuit failure is indicated if the amber STBY light comes on while the control switch is in the REC or RPT position. An exception to this indication is when the control switch is rotated from OFF to either the REC or RPT position. The STBY light will come on, indicating that the required warmup period has been violated.

Two receiving antennas are used for reception of signals, and two transmitting antennas are used for transmission of counter signals. A power divider is used to separate transmitted signals to the forward and aft transmitting antennas. Another power divider is used to combine received signals from the forward and aft receiving antennas.

Much of the information concerning the AN/ALQ-100 countermeasures system is above the security classification of this manual. For more detailed information on the operation of the system and further description of system components, refer to NAVAIR 01-40AV-1T(A).

AN/APR-27 ALERT RECEIVER SYSTEM

The AN/APR-27 alert receiver is installed in the upper avionics pod. The system is energized when the toggle switch labeled APR 27, OFF on the ECM control monitor (figure 8-3) is placed in the APR 27 position. All further operations are automatic. Power for the system is obtained from the 28-vdc bus through a 5-ampere fuse labeled DECM. Power is routed to the ECM control monitor and through the control switch contacts to the alert receiver.

Operation

The alert receiver system uses the forward TACAN antenna. A diplexer is installed to provide automatic switching between the TACAN and alert receiver systems. The diplexer allows simultaneous reception of TACAN and radar signals.

Under certain conditions, the alert receiver system will cause the red alert light, on the lower indicator light assembly on the ECM control monitor, to come on and will give a 500-cps tone in the pilot's headset. A volume control knob, labeled MSL ALERT, also on the ECM control monitor, allows manual adjustment of the audio level in the headset.

Most information concerning the operation and further description of AN/APR-27 components is above the security classification of this manual. For detailed information on the alert receiver system, refer to NAVAIR 01-40AV-1T(A).

COUNTERMEASURES DESTRUCT SYSTEM

The countermeasures destruct system is an automatically controlled electronic system capable of causing electronic/pyrotechnic destruction of the AN/ALQ-100 countermeasures receiver-transmitter and the AN/APR-27 alert receiver. The system consists of a destruct ignitor initiator (DII), an altitude pressure switch, and a destruct safe switch.

Operation

The countermeasures destruct system is designed for two methods of automatic operation. The automatic operation of the system is accomplished either by the pilot ejecting from the aircraft or by the shock absorbed from aircraft impact.

The DII is armed when the destruct safe switch is in the arm position and aircraft power is applied causing the energy storage capacitor located within the DII to charge. When the storage capacitor is charged, loss of aircraft power in the arm mode will not prevent the DII from initiating destruct in either the seat eject or impact mode. The DII capacitor stored energy is capable of initiating destruct after loss of aircraft power for a minimum period of 30 minutes.

Note

The destruct microswitch is located below the landing gear handle. When the landing gear handle is in the DOWN position, the switch is in the safe position. When the landing gear handle is in the UP position, the switch is in the arm position.

When the pilot ejects from the aircraft, the ejection seat switch closes and sends a signal to the normally open altitude pressure switch. When the aircraft drops below 20,000 feet altitude, or the equivalent barometric pressure altitude, the altitude pressure switch closes, causing the DII capacitor stored energy to send an electrical signal to the pyrotechnics encased in the AN/ALQ-100 receiver-transmitter and the AN/APR-27 alert receiver. The pyrotechnics burn out at an extremely high temperature, causing total destruction of the electronic circuitry.

When ejection occurs at 20,000 feet or below, the destruct action follows immediately.

The impact method accomplishes the same destructive results as does the ejection method. Upon crash, the impact switch within the DII will immediately transfer the capacitor stored energy to the destruct packages.

AN/ALE-29A COUNTERMEASURES CHAFF DISPENSING SYSTEM

The following components compose the AN/ALE-29A chaff system.

Chaff control indicator

Programer control, AN/ALE-29A

Sequencing switch, AN/ALE-29A (2)

Dispenser housing, AN/ALE-29A (2)

Dispenser unit, AN/ALE-29A (2)

Chaff control relay

Chaff disarm switch.

The AN/ALE-29A countermeasures chaff dispensing system incorporates the following components of the JATO system.

JATO control panel

JATO firing switch

JATO distribution box.

The AN/ALE-29A countermeasures chaff dispensing system provides protection to the aircraft by ejecting metallic chaff into the atmosphere while the aircraft is airborne. The falling chaff serves to confuse and lessen the effectiveness of the enemy radar. The capabilities of the system are shown in figure 8-4. See figure 8-5 for component locations.

Operation

The AN/ALE-29A countermeasures chaff dispensing system is designed to dispense the type of chaff that can be packaged in a plastic tube approximately 1.5 inches in diameter and 5.8 inches long. The tube is closed at one end with a cap and the other end has an open space, above the chaff, which varies according to the type of chaff being used. The open end of the tube is flanged to hold the tube in the dispenser unit. The chaff is expelled by electrically firing a cartridge into the open end of the tube. The expanding gases from the fired cartridge blow the chaff out of the tube, and into the airstream, with an exit velocity of 75 to 140 feet per second. To aid in maximum utilization of the expanding gases, a plastic cartridge retainer is placed in the open end of the tube. The retainer concentrates the gases in the open end of the tube and prevents the cartridge from being accidentally dislodged from the electrical receptacle. The tube containing the chaff is referred to as the chaff package unit. The combined ALE-29A dispenser housing and ALE-29A dispenser unit are referred to as the dispenser assembly.

Two dispenser assemblies are used with a total capacity of 60 chaff package units or tubes of chaff. The ALE-29A chaff dispensers are installed on the lower surface of the aft fuselage, one on the right-hand side and one on the left-hand side at station Y342. Each dispenser assembly consists of a housing assembly and a dispenser unit. The dispenser unit is easily removed, leaving the housing assembly installed in the aircraft. The dispenser unit contains two telescopic spring-loaded handles that are normally retracted within the dispenser unit. When released, the handles are used for removing and installing the dispenser unit. The dispenser unit consists of a printed circuit board and a plastic tube assembly. The printed circuit board provides the circuitry and electrical receptacles for the chaff-expelling cartridges.

When the printed circuit board is removed from the plastic tube assembly, the cartridge electrical receptacles on the printed circuit board are available for installing the cartridge. Removing the printed circuit board also exposes the end of the plastic tube assembly into which the chaff package units are loaded. The loading end of the plastic tube assembly has an indented flange around each of the 30 holes or tubes in the plastic tube assembly. When the chaff package unit is inserted in the loading end of the plastic tube assembly and the cartridge retainer is placed in the open end of the chaff package unit, the top of the combined cartridge retainer and chaff package unit is flush with the surface of the loading end of the plastic tube assembly.

The plastic tube assembly is loaded with chaff package units and cartridge retainers. The printed circuit board electrical receptacles are loaded with cartridges. The loaded printed circuit board is placed on the plastic tube assembly with the individual cartridges fitting into the individual chaff package unit. The printed circuit board is secured to the plastic tube assembly, and the dispenser unit is installed in the housing assembly on the aircraft. When a cartridge is fired, the expanded gases are limited to the chaff package unit tube, driving the chaff out of the aircraft, and leaving the empty chaff tube, cartridge retainer, and spent cartridge in the dispenser assembly.

The chaff dispensing system has two controls: the ALE-29A programer control and the chaff control

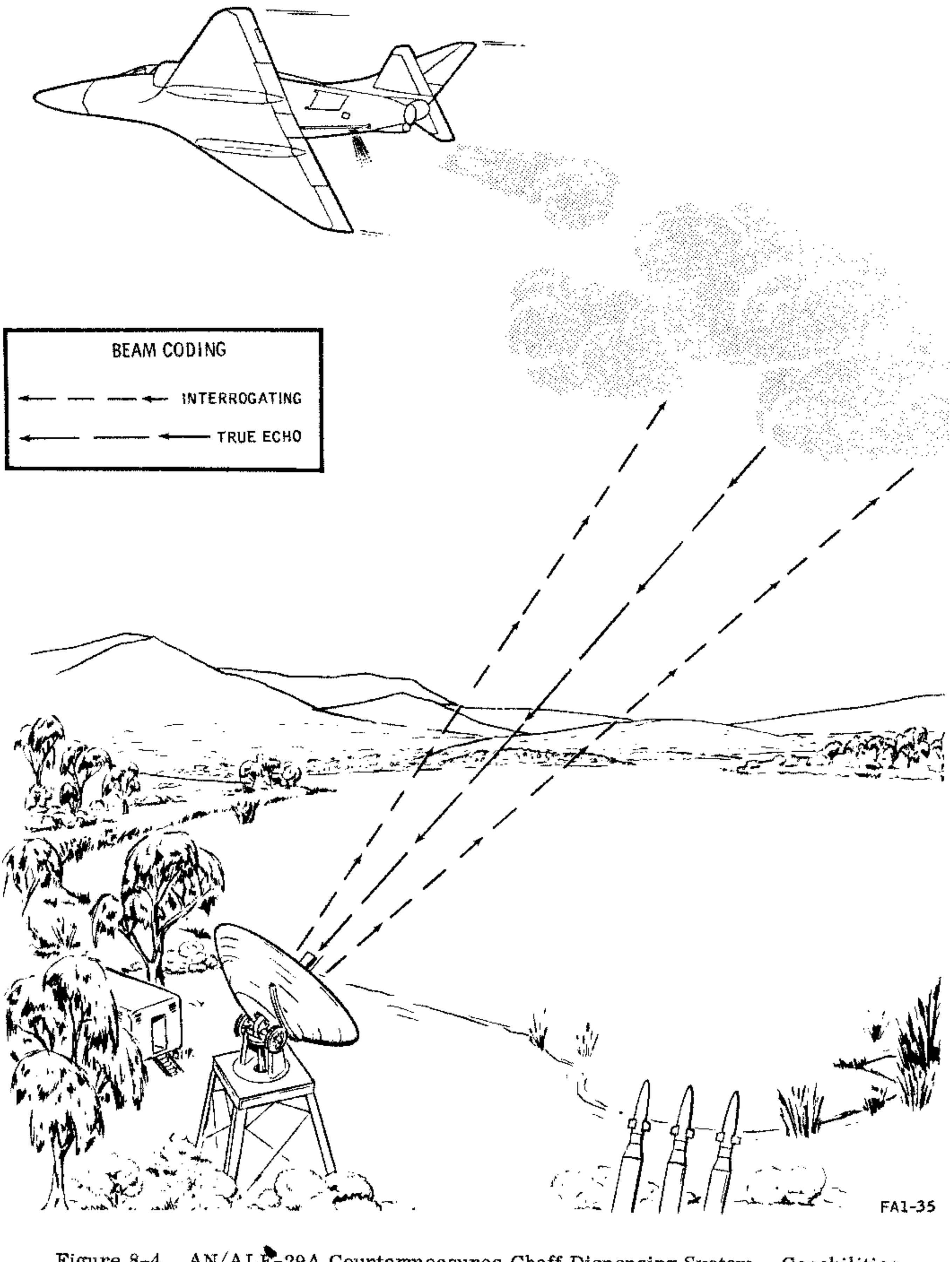


Figure 8-4. AN/ALE-29A Countermeasures Chaff Dispensing System – Capabilities

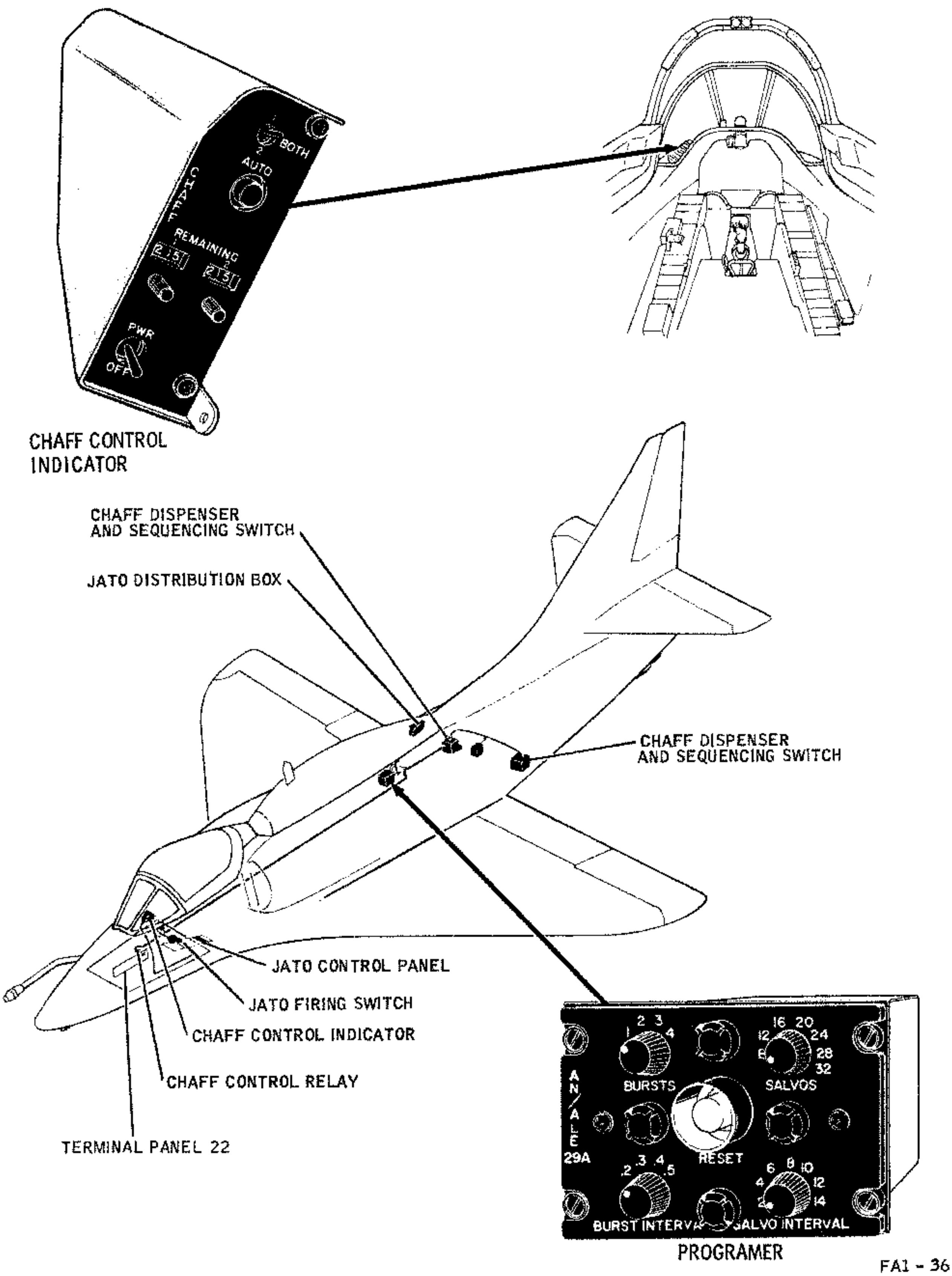


Figure 8-5. AN/ALE-29A Chaff Dispensing System

indicator (figure 8-5). The programer control switch settings are normally adjusted before flight. The programer control is installed on a mounting bracket located on the right-hand side of the engine compartment. The chaff control indicator is located above the cockpit glareshield on the left-hand side and is normally the only control used during flight. The controls, indicators, and functions of the chaff dispensing system are listed in figure 8-6.

The ALE-29A programer control is programed before flight by positioning four switches on the face panel of the programer control. The number of salvos of chaff desired can be set in multiples of 4, from 4 to 32. The time interval between the salvos can be adjusted from 2 to 14 seconds in 2-second steps. The number of bursts in one salvo can be set from one to four ejections of individual packages of chaff. The time interval between ejections can be set from 0.2- to 0.5-second intervals in 0.1-second steps.

The RESET pushbutton switch in the center of the programer control face panel should never be depressed after a portion of the chaff packages have been fired. Depressing the RESET switch causes the ALE-29A sequencing switch to reset to the starting position for firing cartridges. Since some cartridges have been fired, the electrical impulses for cartridge firing on subsequent operations would go to expended cartridges and no chaff would be ejected. The sequencing switch would have to step through all the expended cartridge positions before any further chaff could be ejected. The RESET switch is normally used only after the dispenser unit is removed, loaded, and replaced in the aircraft. The RESET pushbutton is depressed and held for approximately 5 seconds to allow sufficient time for the resetting operation. The RESET pushbutton is protected against accidental operation by recessing the pushbutton into a guard.

The chaff control indicator is used to apply power to the system and to choose between dispensing from either, or both dispenser units. Two subtractive counters are provided for the two dispenser units and are set, before flight, to the number of chaff package units in each dispenser. As a chaff package unit is fired, an electrical impulse is sent to the proper counter, causing the counter to subtract one digit. The two counters will indicate the number of chaff package units remaining to be fired.

The pilot has a choice of either automatic or manual operation of the chaff dispensing system. The automatic mode is enabled by the AUTO switch on the chaff control indicator. The manual mode is enabled by the JATO switch on the JATO control panel. When the aircraft is airborne, placing the chaff control indicator PWR OFF selector switch in PWR position applies 28 vdc to the chaff control relay, which energizes the relay. The relay transfers the wiring from the JATO system firing switch to the AN/ALE-29A countermeasures chaff dispensing system. The relay contacts also place 28 vdc on one contact of the JATO firing switch and on one contact of the AUTO switch on the chaff control indicator. The 28 vdc is obtained from the 28-vdc bus on TERMINAL PANEL 22 through a 5-ampere fuse identified JATO/CHAFF. When the JATO switch is depressed, the system dispenses a single salvo, as selected by the programer control BURSTS and BURST INTERVAL switch settings, providing automatic dispensing is not in progress. If automatic dispensing is in progress, depressing the JATO switch will dispense one chaff package only each time the JATO switch is depressed. The single salvo is dispensed from the dispenser or dispensers selected by the chaff control indicator, BOTH-1-2 switch. No further action will take place until the JATO switch is again depressed, when another salvo is dispensed.

If automatic dispensing is desired, the AUTO switch is depressed on the chaff control indicator, starting the automatic operation. The chaff will be dispensed according to the programer control switch settings and the chaff control indicator, BOTH-1-2 switch position. The automatic operation can be stopped only by placing the chaff control indicator PWR OFF switch in OFF position and then back in PWR position. If the automatic operation is started on only one dispenser and allowed to continue, the dispensing will automatically be switched to the other dispenser unit when the first dispenser is empty. The same automatic action also takes place when the JATO operation is used. Dispensing continues from the second dispenser according to the programer control switch settings.

The JATO pushbutton switch can be used during automatic operation to dispense one additional burst from a single chaff package unit from either or both dispensers by placing the chaff control indicator BOTH-1-2 switch in the desired position. The manual operation, in this case, differs from the regular manual operation, in that only one chaff package unit will be fired instead of a salvo of several bursts. Use of the JATO switch does not disrupt the automatic dispensing operation. If the JATO pushbutton is depressed during automatic operation, the pulse caused by depressing the JATO switch could coincide with the normal automatic operation pulse. If the two pulses coincide, only the automatic pulse is effective and only automatic chaff ejection will occur.

A sequencing switch is mounted on the inboard side of each dispenser assembly (figure 8-7). The switch provides the electrical firing impulse to the proper cartridge. The sequencing switch is controlled by the programer control. At the same time that the sequencing switch fires the cartridge, the switch sends an electrical impulse to the proper subtractive counter on the chaff control indicator in the cockpit. Actuation of the RESET pushbutton switch on the programer control electrically positions the sequencing switch to the No. 1, or starting, position.

Component	Control or Indicator	Function
Chaff control indicator	PWR-OFF toggle switch	In OFF position, removes electrical power from system.
		In PWR position, applies 28 vdc to programer control and AUTO switch contacts.
	AUTO pushbutton switch	Depressing switch starts automatic programed chaff dispending.
	BOTH 1-2	Selects forward, aft, or both dispensers. In the 1 position, the forward dispenser ejects chaff when the JATO or AUTO switch is depressed. When the forward dispenser is empty, dispensing transfers automatically to the aft dispenser. In the 2 position the aft dispenser operates in the same manner as the forward dispenser.
		In BOTH position, dispensing is from forward and aft dispensers simultaneously.
	Quantity counters	1 counter subtracts one digit each time one chaff package unit is fired from forward dispenser assembly to indicate number of chaff package units remaining in dispenser assembly to be fired.
		2 counter subtracts one digit each time one chaff package unit is fired from aft dispenser assembly to indicate number of chaff package units remaining in dispenser assembly to be fired.
	Counter setting knobs	Knob is used to set digital indication in respective counter. Digital setting is done only at time chaff loading in aircraft is accomplished, and indicates total number of chaff package units in respective dispenser assembly.
AN/ALE-29A programer control	RESET pushbutton switch	Depressing switch resets sequencing switch to No. 1 firing position. RESET switch is used only when chaff is loaded in aircraft.
	BURSTS switch	Sets number of chaff package units, from one to four, to be ejected in one salvo.
	BURST INTERVAL switch	Sets time interval in 0.1-second increments, from 0.2 to 0.5 second, between chaff package unit ejections in one salvo.
	SALVOS switch	Sets number of salvos to be dispensed, in increments of four, from 4 to 32.
	SALVO INTERVAL switch	Sets interval from time of ejection of last chaff package unit in one salvo to time of ejection of first package unit in following salvo. Time interval is set, in increments of 2 seconds, from 2 to 14 seconds.

Figure 8-6. AN/ALE-29A Controls, Indicators, and Functions

AN/ALE-29A Circuitry

The AN/ALE-29A countermeasures chaff dispensing system receives 28 vdc from the 28-vdc bus on TERMINAL PANEL 22 through a 5-ampere fuse identified JATO/CHAFF. When the aircraft is airborne, the retraction release relay is automatically energized, and the 28 vdc is used to fire the cartridge selected by the programer control and the sequencing switch.

AN/ALE-29A COMPONENTS

The components of the AN/ALE-29A countermeasures chaff dispensing system are discussed in the following paragraphs.

Chaff Control Indicator

The chaff control panel (figure 8-5), labeled CHAFF, is located above the cockpit glareshield on the left-hand side. The chaff control indicator is used to control chaff package firing and to indicate the number of chaff packages remaining in the two dispensers. The chaff control indicator is composed of three switches and two counters. The AN/ALE-29A countermeasures chaff dispensing system PWR OFF selector switch is located on the lower part of the chaff control indicator face panel. When the switch is in the PWR position, electrical power is applied to the AN/ALE-29A countermeasures chaff dispensing system, and electrical power is removed from the JATO light. Power is removed from the JATO light so the light cannot come on if the switch is inadvertently left

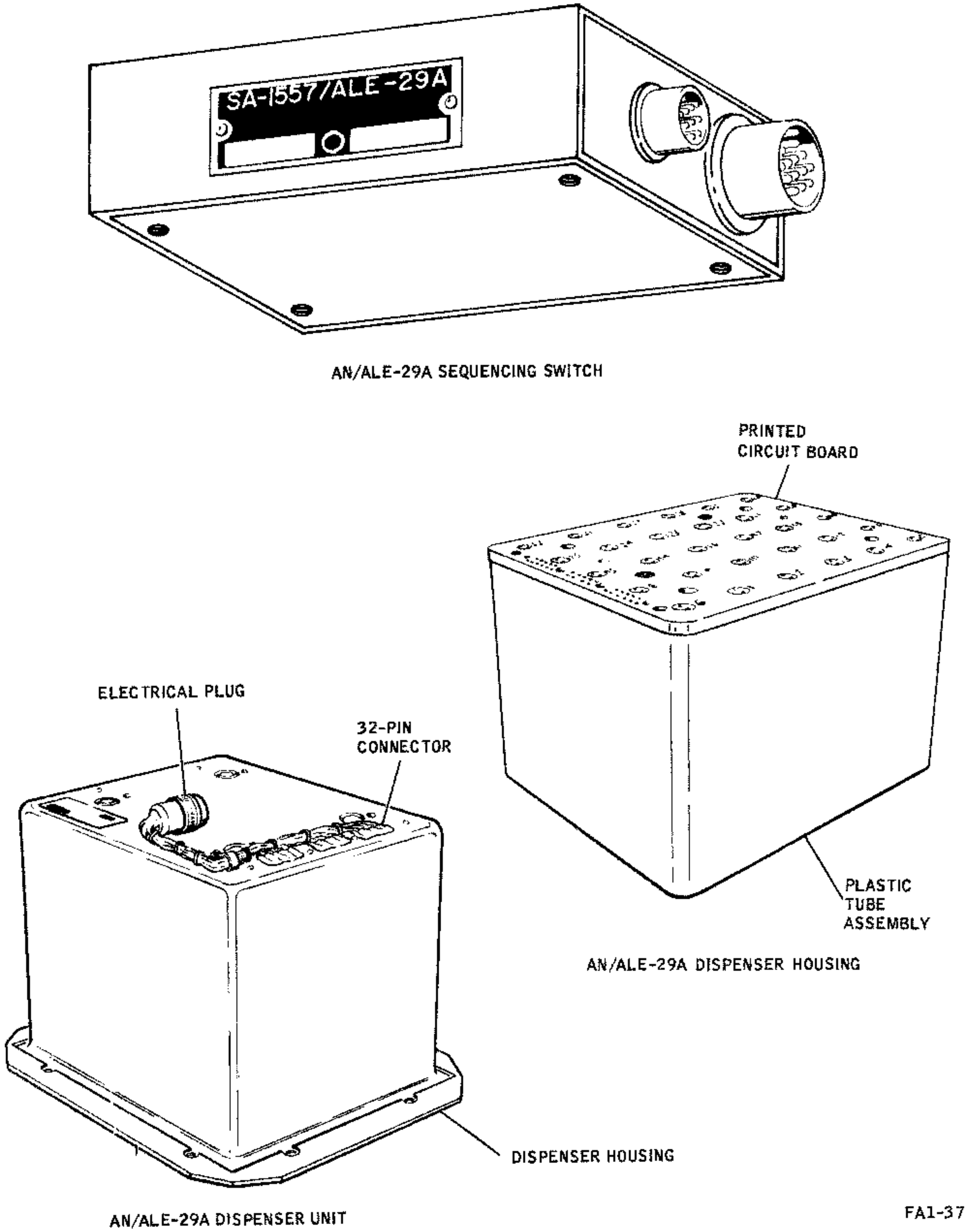


Figure 8-7. AN/ALE-29A Sequencing Switch and Dispenser Unit

in the PWR position on takeoff. The switch must be in OFF position for the JATO system to work properly.

The AUTO switch is mounted on the upper part of the chaff control indicator face panel and is used to place the AN/ALE-29A countermeasures chaff dispensing system in automatic operation. When the switch is depressed, the two chaff dispensers will start dispensing chaff packages according to the settings on the ALE-29A programer control (figure 8-5). The dispensing will continue automatically until all chaff packages are dispensed. If it becomes necessary to stop the automatic action, the PWR OFF selector switch must be placed in OFF position, removing power from a relay in the programer control. The system can again be used in either manual or automatic mode by placing the PWR OFF selector switch in PWR position and using the JATO firing switch for manual dispensing, or the AUTO switch for automatic operation.

The counters in the center of the chaff control panel are used to indicate the number of chaff packages remaining in the two dispensers. The counters are the solenoid type, moving the counter backward numerically each time an electrical impulse is received. The electrical pulses come from the ALE-29A programer control each time a chaff package is fired. A counter setting adjustment is provided on the face panel to set the counter to the exact number of chaff packages in the two chaff dispensers.

AN/ALE-29A Programer Control

ALE-29A programer control (figure 8-5) is used for automatic programing of chaff dispensing. The programer control contains four single-deck rotary switches, one pushbutton switch, and the following printed circuit board modules:

Power (A1)

Mono (A2)

Logic (A3)

Salvo (A4)

Generator (A5)

Delay (A6)

The printed circuit board modules interconnect through a patch board containing four single-deck rotary switches which are labeled as follows:

Switch Name	Switch Positions
BURSTS	1, 2, 3, 4
BURST INTERVAL	.2, .3, .4, .5
SALVOS	4, 8, 12, 16, 20, 24, 28, 32
SALVO INTERVAL	2, 4, 6, 8, 10, 12, 14

The BURSTS switch is set from one to four single-chaff package unit ejections in one salvo. The time interval between single ejections is set by the BURST INTERVAL switch from 0.2 to 0.5 second. The number of salvos is set from 4 to 32 in increments of four by the SALVOS switch. The time interval between the last burst of one salvo and the next burst of the following salvo is set from 2 to 14 seconds in increments of 2 seconds by the SALVO INTERVAL switch.

The RESET pushbutton switch is recessed in a guard to prevent inadvertent operation. The RESET switch is used when the dispenser assemblies are loaded to set the sequencing switch in the No. 1 firing position. The RESET switch is not normally used during flight. If part of the chaff package units have been dispensed, setting the sequencing switch in the No. 1 firing position will mean that the switch will have to step through all the previously fired positions, sending the firing pulse to empty chaff package positions, before any further chaff package units can be dispensed. Four replaceable lights are used for panel lighting of the programer control.

AN/ALE-29A SEQUENCING SWITCH

One AN/ALE-29A sequencing switch (figure 8-7) is installed on the inboard side of each dispenser assembly. The switch is designed to step in selected intervals by pulses from the programer control. The switch will normally step from the No. 1 firing position to the No. 30 firing position. The firing pulses will then automatically transfer to the other sequencing switch if there are unfired chaff package units in the other dispenser assembly. The sequencing switch contains a relay that is energized by the programer control. The relay contacts furnish the firing voltage to the individual cartridges through the sequencing switch.

AN/ALE-29A DISPENSER HOUSING

Two dispenser housings (figure 8-7) are used together with two ALE-29A dispenser units to form the two dispenser assemblies. The dispenser housing does not have to be removed from the aircraft for chaff loading. One dispenser assembly is installed on the aft right-hand side of the fuselage, and the other dispenser assembly is installed on the aft left-hand side. A 32-pin connector is used to connect the dispenser unit to the housing and provide an electrical connection between the housing and the dispenser unit. The 32-pin connector is also connected to an electrical cable and plug on the top of the dispenser housing. The cable and plug are used to connect the ALE-29A sequencing switch to the dispenser housing.

ALE-29A Dispenser Unit

The ALE-29A dispenser unit (figure 8-7) is installed in each ALE-29A dispenser housing. Each dispenser unit has a capacity of 30 individual chaff package units. The dispenser unit is designed to be easily removable for chaff loading without disturbing the aircraft installation of the dispenser housing. The dispenser unit consists of a removable printed circuit board and a plastic tube assembly. The printed circuit board contains the electrical receptacles for the 30 individual cartridges and the wiring to connect the receptacles to the 32-pin connector that mates with the dispenser housing connector. The plastic tube assembly is used to hold the individual chaff package units and the plastic cartridge retainers.

Chaff Control Relay

The chaff control relay is located on TERMINAL PANEL 23. The relay is used to transfer the JATO firing switch wiring from the JATO system to the ALE-29A chaff dispenser system. The JATO firing switch can then be used for manual firing of chaff packages. The chaff control relay also applies 28-vdc power to the chaff dispenser system. One side of the chaff control relay solenoid coil is connected to ground. The voltage to energize the relay comes from the PWR OFF switch on the chaff control indicator.

Chaff Disarm Switch

The chaff disarm switch is located forward of the chaff dispensers at station 335. When the chaff disarm pin is inserted into the switch, 28-vdc chaff firing power is removed from the chaff dispensers. The disarm switch is a single-throw microswitch that breaks the circuit between the programer control and the sequencing switches.

APR-25(V) HOMING AND WARNING SYSTEM

The APR-25(V) homing and warning system provides the pilot with visual and aural threat warning indications. System components are shown in figure 8-8.

The operating controls for the APR-25(V) homing and warning system include an APR 25 OFF power switch, an ALQ APR 25 toggle switch, and a PRF VOL (volume) control on the ECM control monitor, threat warning lights on the glareshield, an azimuth indicator (scope) on the lower right-hand instrument panel, and an ECM control panel on the pilot's right-hand console.

Operation

Most APR-25(V) homing and warning system operations are automatic after the combined control switches are placed in operating position. Refer to NAVAIR 01-40AV-1T(A) for classified specifics concerning APR-25(V) controls, indicators, and system functions. The following operating procedures are not classified and will place the APR-25(V) homing and warning system in operation:

1. Place the five NORMAL, DEFEAT switches on ECM control panel in NORMAL position.

2. Place APR 25, OFF switch on ECM control monitor in APR 25 position.

3. Depress and hold the outboard TWS SYSTEM TEST pushbutton switch for 3 seconds.

Note

The strobes will appear on azimuth indicator after SYSTEM TEST switch is released and will be visible for 4 to 10 seconds. If adjustments in steps 4 and 5 are not made before strobes disappear, repeat step 3 until adjustments are completed.

4. Adjust INT control on upper left-hand corner of azimuth indicator for most comfortable viewing level of strobe.

Note

If strobes are too heavy and bright, blinking of strobe may be difficult to see. Blinking is seen as steady flicker of strobe.

5. Adjust PRF, VOL (inner) control knob on ECM control monitor for desired audio level of self-test aural warning signal.

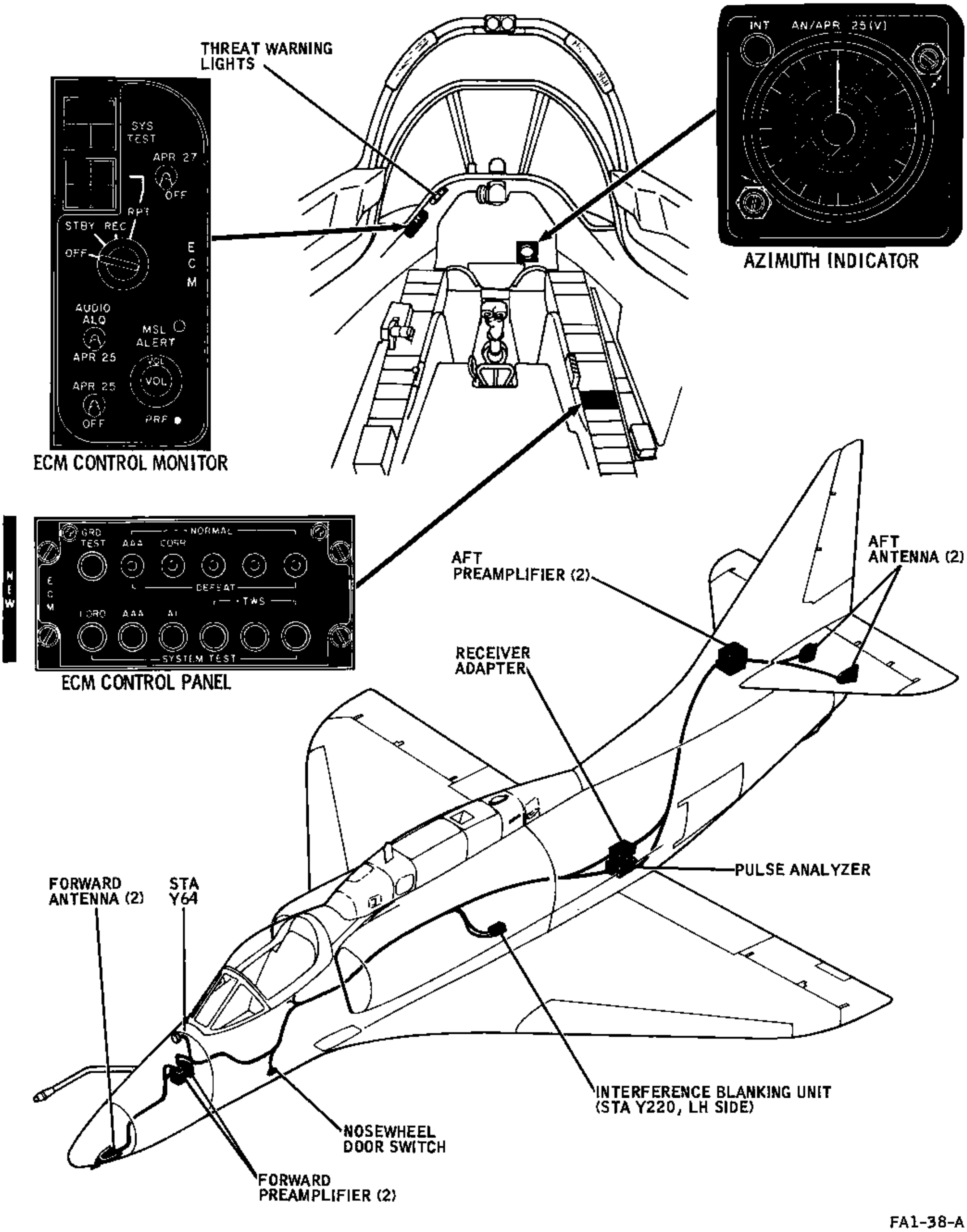


Figure 8-8. APR-25(V) Homing and Warning System

Note

The ECM control panel includes a two-position toggle switch labeled ALQ and APR. Use of this switch enables the pilot to select the audio tone of either the AN/ALQ-100 countermeasures system or the AN/APR-25(V) homing and warning system. The volume of both audio tones is controlled by the PRF volume control knob.

6. Perform self-test function on other threats that are considered undesirable at the time.

Note

Self-test procedures may be used at any time by depressing the appropriate SYSTEM TEST pushbutton on the ECM control panel. The length of time the pushbutton is held governs, to some extent, the length of the self-test cycle.

7. Observe threat warning light from time to time for possible warning light operation.

8. When threat warning light comes on, observe azimuth indicator strobe for further identification of threat. (Refer to NAVAIR 01-40AV-1T(A) for types of threats and corresponding indications.)

Note

If too many threats are displayed simultaneously, the lesser threats may be removed from display by using the DEFEAT switches. The correlation signal action may also be defeated by placing the CORR switch in DEFEAT position.

SECTION IX
FLIGHT CREW COORDINATION

(Not Applicable)

SECTION X
NATOPS EVALUATION

TABLE OF CONTENTS

NATOPS EVALUATION

CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating A-4/TA-4 aircraft. The NATOPS Evaluation is intended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatibility with 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 through constructive comment. Maximum benefit from the NATOPS program is achieved only through vigorous support of the program by commanding officers as well as flight crewmembers.

IMPLEMENTATION

The NATOPS Evaluation program shall be carried out in every unit operating naval aircraft. The various categories of flight crewmembers desiring to attain/retain qualification in A-4/TA-4 aircraft shall be evaluated in accordance with OPNAV Instruction 3510.9 series. Individual and unit NATOPS evaluations will be conducted periodically; however, instruction in and observation of 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 OPNAVINST 3510.9 series. Evaluees who receive a grade of "Unqualified" on a ground or flight evaluation shall be allowed 30 days in which to complete a re-evaluation. A maximum of 60 days may elapse between the date the initial ground evaluation was commenced and the date the flight evaluation is satisfactorily completed.

Note

- Pilots possessing a current A-4/TA-4 NATOPS report form (OPNAV Form 3510-8) are considered qualified in all A-4/TA-4 models provided the applicable GROUND TRAINING REQUIREMENTS outlined in section II are met.
- Pilots attending a formal course of RCVW training shall be considered, as a minimum, conditionally NATOPS qualified for 1 year, provided all required phases of instruction are completed. If practical, RCVW graduates will be fully NATOPS qualified. ground and flight evaluations, upon completion of the required instruction. An appropriate entry of NATOPS qualification shall be made in the pilot's log book.

DEFINITIONS

The following terms, 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, an oral examination, and a flight 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 flight evaluation. Only those areas in which an unsatisfactory level was quoted need be observed during a reevaluation.

Qualified

Well standardized. Evaluee demonstrated highly professional knowledge of and compliance with NATOPS standards and procedures; momentary deviations from or minor omissions in noncritical areas are permitted if prompt and timely remedial action is initiated by the evaluee.

Conditionally Qualified

Satisfactorily standardized. One or more significant deviations from NATOPS standards and procedures, but no errors in critical areas and no errors jeopardizing mission accomplishment or flight safety.

Unqualified

Not acceptably standardized. Evaluee fails to meet minimum standards regarding knowledge of and/or ability to apply NATOPS procedures; one or more significant deviations from NATOPS standards and procedures which could jeopardize mission accomplishment or flight safety.

Area

A routine of preflight, flight, or postflight.

Subarea

A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

Critical Area/Subarea

Any area or subarea which covers items of significant importance to the overall mission requirements. the marginal performance of which would jeopardize safe conduct of the flight.

Emergency

An aircraft component. system failure, or condition which requires instantaneous recognition, analysis, and proper action.

Malfunction

An aircraft component or system failure or condition which requires recognition and analysis. but which permits more deliberate action than that required for an emergency.

GROUND EVALUATION

Prior to commencing the flight evaluation, an evaluee must achieve a minimum grade of "Qualified" on the open book and closed book examinations. The oral examination is also part of the ground evaluation but may be conducted as part of the flight evaluation. To ensure a degree of standardization between units, the NATOPS Instructors shall use the bank of questions contained in this section in preparing portions of the written examinations.

Open Book Examination

The open book examination shall be composed of not less than 50 questions selected from the question bank. This examination should require extensive use of section XI Performance Data and provide a comprehensive review of the flight manual in general. No time limit.

Closed Book Examination

The closed book examination shall consist of not less than 50 questions selected from the question bank. No time limit.

Oral Examination

The questions may be taken from this manual 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 utilized to evaluate the pilot's knowledge and performance of normal procedures and his reaction to simulated emergencies and malfunctions. In areas not served by OFT/WST facilities, the procedures check should be conducted in a cockpit orientation trainer. If neither of these devices is available, the procedures check should be conducted by oral examination and discussion with the examinee in the cockpit of the applicable A-4 model aircraft. The following list of procedures and conditions are those which will be simulated during the OFT/WST procedures evaluation whenever possible. Critical emergency procedures which require an immediate response are designated by an asterisk(*).

INTERIOR INSPECTION (Pocket Checklist)

ENGINE STARTING PROCEDURES

1. Wet start
2. Clear engine
3. Fire during start*
4. Normal start
5. Oil pressure failure.

GROUND TESTS (Pocket Checklist)

BEFORE TAKEOFF (Pocket Checklist)

TAKEOFF

1. Aborting takeoff (fire, thrust loss, runaway trim). *

AFTER TAKEOFF

1. Retraction release solenoid inoperative
2. Unsafe nose gear indication after gear retraction
3. Flameout below 250 KIAS after gear retraction. *

DURING FLIGHT

1. Fuel transfer pump failure
2. Fuel tank float valve sticks closed
3. Fuel boost pump failure
4. Oil pressure failure (low, fluctuation, out)
5. Runaway aileron trim
6. Main generator failure
7. Flight control hydraulic failure only
8. Complete loss of both hydraulic systems
9. Speedbrake failure
10. Loss of oxygen supply
11. Engine failure above 20,000 feet
12. Fire warning light ON and remains ON (other indications of fire)

13. Maximum glide

14. Ejection*

15. Bailout

16. Ac-dc power converter

17. Electrical fire in flight

18. EGT and/or rpm failure

19. Gyro horizon failure

20. Runaway elevator trim

21. Fuel quantity gage failure (rotates)

22. Engine icing

23. The 300-gallon drop tank on wing station will not transfer.

24. Loss of airspeed indicator

25. Surging engine (rpm and EGT) or loss of thrust

26. Fuel flow fluctuation/failure

27. Fire warning light ON (no other indications)

28. Throttle linkage failure

29. Smoke/fumes in cockpit

30. Air conditioning goes full-hot

31. Smoke/fumes in cockpit in RAM position

32. Runaway rudder trim

33. Ditching (land/sea).

PRETRAFFIC PATTERN CHECKLIST

1. Utility hydraulic system failure.

TRAFFIC PATTERN CHECKLIST

1. Loss of wheel brake(s)

2. Unsafe main or nose gear indication

3. One main gear up.

LANDING AND ROLLOUT

1. No airspeed indicator

2. Runaway nosedown trim.

STOPPING THE ENGINE

BEFORE LEAVING THE AIRCRAFT

Grading Instructions

Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of "Qualified" or "Unqualified."

On the Open Book examination, the evaluee must obtain a minimum score of 3.5 to obtain a grade of "Qualified."

On the Closed Book examination, the evaluee must obtain a minimum score of 3.3 to obtain a grade of "Qualified."

On the Oral examination and OFT Procedure Check (if conducted), a grade of "Qualified" or "Unqualified" shall be assigned by the instructor/evaluator.

FLIGHT EVALUATION

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 a flight evaluation are outlined in the grading criteria with critical areas designated. 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.

Note

Critical areas or subareas are indicated by an asterisk (*) or are outlined in mission evaluation.

The flight evaluation will be flown in daylight conditions to facilitate observations and grading by the instructor/evaluator; however, instrument conditions may be encountered if desired.

OFT/WST procedures evaluation may be substituted for the flight evaluation at the Commanding Officer's discretion.

Safety Considerations During Evaluation Flights

Due to the broad significance of safety, it is impractical to list all contingencies without at the same time developing a lengthy and voluminous grading criteria. Generally, mission success is subject to compromises due to safety infractions, violations, omissions, or deviations, beginning with Mission Planning and ending with the Postflight Debriefing. The following paragraphs provide additional guidance in these areas.

(1) Violations of Pertinent Directives or Procedures which have a direct bearing on the safe completion of the mission or negligence in following any procedure or directive to the extent of jeopardizing the safety of the pilot or aircraft will constitute an overall grade of "Unqualified." The degree of jeopardy involved, in the absence of specific criteria, must be an evaluator/instructor determination based on experience and good judgement.

(2) The Latitude Given Evaluators/Instructors in Grading Safety Items must be exercised with care. They should avoid assumptions in concluding that a safety discrepancy exists. To reason that a safety discrepancy could possibly occur as a result of a remote set of circumstances is unfair to the pilot being evaluated.

(3) When an In-flight Safety Discrepancy is Evident or is dangerously imminent, and the pilot appears to be unaware of the condition or has not taken appropriate action, the evaluator/instructor will correct the situation by directing or taking the necessary corrective action immediately. Safety of flight will not be compromised due to any reluctance on the part of the evaluator/instructor to correct the discrepancy.

(4) If a Grade of "Unqualified" is Given, a brief descriptive statement concerning the safety discrepancy will be entered on the Evaluation Report Form. The statement should be recorded "Safety Discrepancy."

Use of Judgment of NATOPS Evaluation Flights

The grading criteria establish standards for grading pilot performance, but this does not relieve the evaluator/instructor from using good judgement based upon experience. In those items where a pilot fails to meet the minimums set forth in the grading criteria but the evaluator/instructor, through past experience and judgement, knows the error to be caused by contributing factors such as weather, turbulence, etc., he may assign the pilot a grade of "Qualified." However, the reason for such action must be recorded on the worksheet and Report Form. If the pilot being evaluated consistently made poor or wrong decisions, a statement to this effect will be reflected on the worksheet and the Remarks portion of the Report Form, regardless of whether or not the pilot successfully completed the Evaluation. The only way the final grade and degree of performance of the pilot can be determined is by use of the grading criteria. Unless an obviously unsafe act has been observed (which would automatically and immediately terminate the flight), the evaluator/instructor should not attempt to determine during the flight if the evaluee passes or fails.

Minor Discrepancies and/or Omissions

Minor discrepancies and/or omissions are defined as those which will not adversely affect the successful completion of the mission or jeopardize the safety of the pilot and/or aircraft.

Momentary Deviations

Deviations from the tolerances set forth in the grading criteria which are momentary in nature will not be considered in grading, provided the evaluee is alert in applying corrective action, the deviation does not jeopardize the safety of the pilot or aircraft, and the deviation does not exceed the limitations prescribed for a conditionally qualified grade. Cumulative momentary deviations will result in downgrading.

Flight Evaluation Areas

MISSION PLANNING

1. Flight plan
2. Weather.

BRIEFING

PREFLIGHT

1. Records check
2. Preflight Check. *

START/POSTSTART

1. Start
2. Poststart procedures.

TAXI/RUNUP

1. Taxi
2. Engine runup
3. Clearances.

TAKEOFF*

1. Procedures.

CLIMB/CRUISE

1. Climb schedule
2. Transition
3. En route procedures.

APPROACH AND LANDINGS*

1. Pattern entry
2. Approach.

EMERGENCY PROCEDURES

1. Simulated emergencies may be given.

SHUTDOWN/POSTFLIGHT

1. Shutdown*
2. Postflight inspection
3. Yellow sheet
4. Debriefing.

Mission Evaluation Areas

RENDEZVOUS

1. Procedures.

WEAPONS

1. Target procedures
2. Rendezvous procedures.

NAVIGATION

1. Low level
2. Medium level.

FLIGHT EVALUATION GRADING CRITERIA

Only those subareas provided or required will be graded. The grades assigned for a subarea shall be determined by comparing the degree of adherence to standard operating procedures with adjectival rating listed below. Momentary deviations from standard operating procedures should not be considered as unqualifying provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action. The NATOPS evaluation flight is intended to evaluate unit/individual compliance with approved standardized operating procedures. The successful completion of all ground checks and examinations is required before commencement of the flight evaluation. Insofar as possible, checks will be scheduled so as not to interfere with squadron operations. The flight evaluation check should conform to any syllabus flight. Only those areas observed, or required by the mission assigned, will be evaluated. The flight evaluation grade will be attained by comparing the degree of pilot(s) adherence to standard operating procedures with the adjective ratings as outlined for individual areas and subareas of this section. Determination of the final flight evaluation grade will be made as outlined in FINAL GRADE DETERMINATION.

FLIGHT EVALUATION GRADE DETERMINATION

The following procedure shall be used in determining the flight evaluation grade.

A grade of "Unqualified" in any critical area/subarea 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 subarea. Only numericals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

Unqualified 0.0

Conditionally Qualified. 2.0

Qualified 4.0

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: $\frac{4+2+4+2+4}{5} = \frac{16}{5}$ = 3.20 or 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

The NATOPS Evaluation Report, OPNAV Forms 3510-8, shall be completed for each evaluation conducted and shall be forwarded to the evaluee's Commanding Officer only. This report shall be filed in the individual flight training record and retained therein for 18 months.

An entry shall be made in the Pilot/NFO Flight Log Book under "Qualifications and Achievements" as follows:

NATOPS EVAL.	(AIRCRAFT MODEL)	(CREW POSIT.)	(DATE)	(AUTHENTICATING SIGNATURE)	(UNIT WHICH ADMINISTERED EVAL.)

In the case of enlisted flight crewmembers, an entry shall be made in the administrative Remarks section of his Personnel Record upon satisfactory completion of the NATOPS Evaluation as follows:

(DATE) Completed a NATOPS Evaluation in (aircraft designation) as (flight crew position) with an overall grade of (Qualified or Conditionally Qualified).

A-4M 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. The questions from the bank may be combined with locally originated questions in the preparation of ground examinations.

A-4M NATOPS QUESTION BANK

1. How is the 80 percent sensing circuit of the oil quantity indicator/switch checked?
2. With a throttle linkage failure how can the engine be secured?
3. Describe the functioning of the fuel quantity indicator after a failure of the dc converter.
4. When external electrical power is not available during pressure fueling, what precautions must be taken to prevent possible damage to the internal fuel tanks structure?
5. Can a short circuit in the fire-detection system be detected by the pilot? If so, how?
6. Where are the hydraulic system pressure gages located?
7. List the components operated by the utility hydraulic system.
8. What is the purpose of the rotary viscous dampers on the ailerons and rudder?
9. What caution must be observed when operating the horizontal stabilizer manual override lever?
10. In the event of a utility hydraulic system failure, what prevents the landing gear from extending when hydraulic pressure is lost?
11. What is the purpose of the aileron followup trim tab?
12. What is the purpose of the retraction release safety-solenoid?
13. What prevents spoiler operation during flight?
14. What caution should be observed after the emergency landing gear handle has been pulled?
15. What is the purpose of the vortex generators?
16. Can the arresting hook be lowered after a complete hydraulic failure?
17. What warning must be observed to avoid injury when the canopy is jettisoned in flight?
18. What is the best method of ensuring that the canopy is closed and latched?
19. Can the canopy be jettisoned in the open position by pulling the canopy jettison handle?
20. What is the purpose of the DART system?
21. If the pilot separates from the seat manually (by use of the harness release handle) will the parachute deploy automatically?
22. Where is the gyro cutout switch located?
23. What is the maximum length of time that the fast erect switch may be pressed without damaging the circuitry?
24. How is the angle-of-attack indexer lighting integrity checked?
25. What switch activates the angle-of-attack vane heater?

A-4M NATOPS QUESTION BANK (Continued)

26. Where is the UHF communication antenna located?

27. How many reply codes is the AN/APX-72 system capable of providing in Mode 3/A?

28. How many minutes warmup should be allowed before switching TACAN from REC to T/R?

29. What NAVAIDS are available on the emergency generator?

30. What prevents frosting of the bullet-resistant glass center panel of the windshield?

31. What precaution must be taken to prevent the windshield center panel from fogging when the emergency generator is extended?

32. What action should be taken if rpm exceeds 101 percent during flight?

33. If oil pressure exceeds 50 psi in flight, what action should be taken?

34. With fuel in the 300-gallon external fuel tanks, what limitations must be observed when performing aileron rolls?

35. During taxi, what indications would the pilot have if nose strut were overinflated?

36. What signal should pilot use to cut off starting air to engine?

37. What effect will shutting down the engine at touchdown have on reducing landing roll? Why?

38. Describe "gouge" for proper parade formation bearing.

39. Describe "gouge" for proper freecruise formation bearing.

40. If a successful takeoff is made with a blown tire, what precautions should be taken?

41. In the event of a confirmed engine failure during catapult launch, what action should be taken?

42. After takeoff the nosegear indicates unsafe with the landing gear handle up and both main gear indicating UP. What should you do?

43. What action is recommended when a loss of thrust occurs and icing is suspected?

44. You're cruising at FL 310 and suddenly experience fluctuating EGT, fuel flow, and EPR. What would you do?

45. Off your third bombing run, the oil quantity light comes on steady. What action would you take?

46. What indication would you have of failure of the engine-driven fuel pump?

47. During flight you get dense smoke in the cockpit. You select RAM air and find no evidence of fire but the smoke becomes so dense that you can't see. What would you do?

48. You are climbing through 1200 feet off the catapult and accelerating through 230 KIAS when a flameout occurs. What action would you take?

FILL IN THE BLANKS

1. The aircraft is powered by a ______________________ gas turbine engine producing a sea-level static thrust rating of __________ pounds.

2. Basic weight (to nearest 50 pounds) is ______________(total operating weight from figure 11-1).

A-4M NATOPS QUESTION BANK (Continued)

3. Wingspan is________________feet.

4. The total temperature sensor is located ____.

5. The engine utilizes a split _______________stage axial compressor.

6. There are _________combustion chambers. Numbers ______and______have spark igniters.

7. For engine starting, the timer energizes the high-power ignition unit supplying_________joules to both igniters for a_________to__________second firing cycle.

8. The manual fuel control system compensates only for____ ____.

9. When shifting the engine fuel control from PRIMARY to MANUAL below 225 KIAS, select a minimum throttle setting of_________percent rpm.

10. During a normal start the manual fuel control warning light will go out at about_____to_____ percent rpm.

11. The tachometer indicates the speed of the_________-pressure compressor rotor (N_____) as a percentage of________rpm.

12. The pressure ratio indicator provides the ratio of_____pressure to pressure at the_________________ ____

13. The pressure ratio indicator should be read at_________airspeed.

14. In the high thrust range an increase of only_________°C may double the rate of turbine blade creep.

15. The oil cooler employs______________________________________ as a coolant.

16. Maximum oil consumption is approximately____________quarts per hour.

17. Absence of oil pressure is permissible for a maximum of_____________seconds.

18. A fuel sump with flapper valves will provide fuel during inverted or negative-g flight for approximately _________seconds.

19. The wing tank transfer pump utilizes____for power.

20. The fuel transfer caution light will be on when engine rpm is below________percent rpm.

21. Approximate fuel transfer rates from the drop tanks (90 percent power setting) are:_______________pph from SL to 5000 feet MSL and___________pph from 25,000 to 35,000 feet MSL.

22. The emergency transfer system allows____ to pressurize the____.

23. List the usable fuel in pounds for the following: (standard day, JP-5, pressure fueling)

Fuselage____________

Wing _______________

Two 300-gallon droptanks______________

Total _________________

24. Indicated airspeed for most accurate fuel reading is____________ KIAS.

25. When fuselage tank quantity drops to about________pounds, wing fuel cell quantity will not be indicated on the fuel quantity indicator.

A-4M NATOPS QUESTION BANK (Continued)

26. Electrical power is normally supplied by a______KVA engine-driven generator which furnishes________/________volt______phase_________cycle constant-frequency ac power.

27. The emergency generator is rated at_________KVA.

28. The main generator is driven at a constant speed of_________rpm.

29. The emergency generator is driven by a variable-pitch propeller at approximately_____ rpm and provides power to the______________________ and___________________buses.

30. The emergency generator bypass switch should be in the__________________position for normal flight operations.

31. While operating on emergency generator, actuation of____ or____will divert power from the monitored primary bus.

32. Fuses are located on three panels. Two of them located____ and the other located____.

33. The hydraulic systems operate at a pressure of about______psi and relief valves open at__________psi.

34. When the speedbrakes are opened, the control stick moves_______________________________________.

35. The rudder system operates at a reduced hydraulic pressure of_________psi.

36. Total travel of the rudder trim position indicator represents__________degrees of travel left and right of center.

37. List all possible cockpit indications of an unsafe landing gear condition.

a. ____

b. ____

c. ____

38. List the conditions necessary to activate the nosewheel steering system.

a. ____

b. ____

c. ____

d. ____

e. ____

39. During ground operations with the nosewheel steering switch in NORMAL and the arresting hook handle DOWN, and the stick button not depressed, the nosewheel will be____________________________________ ____.

40. With full right rudder trim. the nosewheel will steer________degrees right and________degrees left.

41. The wing flaps are____________controlled,____________actuated and extend_________degrees when full DOWN.

42. The speedbrakes begin to blow back at______KIAS and will not open fully above________KIAS.

43. The wing slats begin to open at some airspeeds below________KIAS and are fully opened at____________.

44. Normal arresting hook snubber pressure is_________psi.

A-4M NATOPS QUESTION BANK (Continued)

45. Pulling the canopy jettison handle fires an initiator which in turn activates a ____________ ____________ causing high pressure ______________ to escape into the ________ ____________ ____________ which jettisons the canopy.

46. The automatic barometric parachute openers are set to operate at ________ feet altitude.

47. When the harness release handle is pulled up, the ______________________________ ______________________________ lanyard and the ______________________________ and ______________________________ attachments are released from the seat allowing the pilot to leave the cockpit with the ______________________________ and ______________________________ still attached to his torso harness.

48. Sea level liquid oxygen duration is about doubled at ______ feet altitude, increased four times at ________ feet altitude and increased ______ times at 40,000 feet altitude.

49. The emergency oxygen cylinder pressure gage should register __________ psi when full.

50. The emergency oxygen supply will last from _______ to ________ minutes depending on altitude.

51. Pitot-static system instruments are:

a. ______________________________

b. ______________________________

c. ______________________________

52. Electrically operated flight instruments are:

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

53. A maximum of ________ seconds may be required for gyro erection and amplifier warmup.

54. On the BDHI, needle No. 1 will always indicate ____________ bearing, however, if the compass card is out of "sync" needle No. 2 will indicate ______________ bearing only.

55. Maximum endurance is obtained at _______ units angle-of-attack (with two 300-gallon tanks).

56. Optimum angle-of-attack setting should be ________ units.

57. The approach light arresting hook bypass switch is located ______________ ______________ ______________________________.

58. The squelch-disable switch should normally be placed in the ______________________________ position.

59. A compass card error of ± __________ degrees will peg the sync needle of the compass controller.

60. For A/A TACAN operation, the cooperating aircraft must be separated by exactly ____________ channels.

61. A/A TACAN may be utilized by one lead aircraft and up to ________ others.

A-4M NATOPS QUESTION BANK (Continued)

62. To check the ASN-41, rotate function selector to TEST and place BDHI switch to NAV CMPTR. Proper indications are:

WIND SPEED______________

WIND DIRECTION______________

LAT PRESENT POSIT__________________integration

LONG PRESENT POSIT__________________integration

BDHI No. 2 pointer_____________________

BDHI No. 1 pointer_____________________

63. To check APN-153, allow_________minute(s) warmup to STBY, then switch to TEST. Proper indications are:

Memory light______

Groundspeed_______

Drift angle________

64. Ranges provided by the APG 53A are as follows:

Mode	Short	Long
SRCH	_____miles	_____miles
T/C	_____miles	_____miles
A/G	_____yards	_____yards

65. In the T/C PROFILE mode of the radar, proper use of the detail control reduces the vertical beam width to_____________degrees.

66. When flying 1000-foot terrain clearance at normal low level airspeeds, a crosswind component greater than_______knots will displace the PROFILE mode scan off the ground track of the aircraft.

67. The AFCS will maintain a bank angle of________degrees in a preselected heading turn.

68. Warm-up period of the AFCS is________to________seconds.

69. The AFCS altitude-hold switch cannot be engaged in climbs or descents in excess of______________fpm.

70. The AFCS will disengage from control stick steering mode when the ailerons are deflected over_________ ________________________.

71. If the ladder lights are not visible in daylight, check the________________________switch(es) full OFF.

72. Normal cockpit pressurization schedule holds______feet cockpit altitude to an aircraft altitude of_______feet.

73. With normal cockpit pressurization, cockpit altitude will be about_______feet at an aircraft altitude of 20,000 feet, and______feet at an aircraft altitude of 35,000 feet.

74. In order to prevent excessive pressure differential in the cockpit, a relief valve opens at a positive pressure differential of_________psi and at a negative differential of_______psi.

75. For maximum use of the engine anti-icing system, the engine should not be operated below_____percent rpm.

A-4M NATOPS QUESTION BANK (Continued)

76. Rain removal system operation at MILITARY power is limited to__________minutes on the ground, and __________minutes in flight.

77. The centerline refueling store contains a__________gallon fuel cell.

78. The operational envelope of the store with the drogue extended is limited to__________KIAS or__________ Mach, whichever is lower, at altitudes up to 35,000 feet.

79. The amber light on the aft end of the air refueling store comes on when__________________________. and the green light comes on when__________________________.

80. Actuating the air refueling store HOSE JETTISON switch removes all electrical power from the store controls except the__________________________.

81. Do not start ground fueling operations within________feet of aircraft with radar equipment operating.

82. When pressure fueling by the alternate method,__________________________ must be removed to prevent possible damage to wing integral fuel tank structure.

83. The fuel control selector is accessible through the engine__________________________ access door.

84. Checking or filling the engine oil system should be accomplished within________minutes after engine shutdown. If not serviced within this period, the engine must be turned up at 75 percent rpm or more for __________________________to establish actual oil tank level.

85. Engine oil spec is__________________________.

86. The CSD utilizes__________________________fluid.

87. To start the aircraft,____________________electrical power is required for ignition.

88. During start EGT exceeds________°C__________times, or reaches________°C to________°C for one period of________seconds or more, engine must be subjected to an overtemperature inspection. An EGT exceeding________°C for any period of time will require a teardown inspection of all hot section parts.

Operating Condition	Max Egt °C	Max rpm Percent	Time Limit
Idle			
Acceleration			
Normal			
Military			

89. If oil pressure indication is less than________psi at______percent rpm, shut down engine and investigate cause.

90. Maximum operating time with oil pressure less than 40 psi in flight is__________________________.

91. Absence of oil pressure for a maximum of__________seconds is permissible.

92. Normal oil pressure limits for flight are______psi to________psi.

93. The maximum permissible change in angle of bank during rolling pullouts or pushovers is____________.

A-4M NATOPS QUESTION BANK (Continued)

94. Thrust cutback will be experienced in the A-4M under conditions of _______ and _______.

95. Airspeed limitations with gear and flaps extended are________KIAS with zero yaw and________KIAS with unrestricted yaw.

96. The airspeed limitation on buddy store hose retraction is__________KIAS.

97. Airspeed limitations with flight controls disconnected are:

Asymmetrical Loading:_____________KIAS

Symmetrical Loading:____________KIAS or____________IMN whichever is lower.

98. The airspeed limitation with the emergency generator extended is__________KIAS or_________IMN whichever is lower.

99. The maximum recommended gross weight for field takeoff is_________________pounds.

100. The maximum gross weight for field landing is__________with minimum rate of descent or_____________ ________________pounds normally.

101. Maximum recommended catapult weight is____________________pounds.

102. Carrier arrestment weight limitation is___________________pounds.

103. The maximum recommended gross weight for barricade engagement is ________________pounds.

104. Maximum asymmetrical load limitations are_______foot-pounds for field takeoffs and carrier landing and____________foot-pounds for carrier catapult launches.

105. Operation of the AFCS is unrestricted above_____________feet altitude.

106. Minimum altitude for operation of the AFCS is__________feet.

107. HANDS OFF operation of the AFCS will be permitted between 1000 feet and 7500 feet, if________________ ____.

108. At 18,000 pounds gross weight in symmetrical flight, structural acceleration limits are +____________g and -_____________g.

109. Minimum requirements for night flying are:

1. ____

2. ____

110. Before actual instrument flight in the A-4M, a pilot must have at least_____hours in the A-4/TA-4 in the last_____months, one flight within_____days, a current instrument card, and demonstrated instrument proficiency in model.

111. On preflight, the arresting hook holddown cylinder pressure gage should read_____________________psi.

112. On a cart controlled start, the pilot should signal to cut off the air supply at_______to_______percent rpm.

113. Engine should light off within__________seconds after throttle is moved outboard to start ignition.

A-4M NATOPS QUESTION BANK (Continued)

114. Warmup time for electronic equipment is as follows:

ITEM	WARM-UP TIME
UHF Radio	________
ARR-69	________
UHF/ADF	________
TACAN	________
APX-72 (IFF)	________
ASN-41	________
APN-141	________
AJB-3/A	________
AFCS	________
APG-53	________
APN-153	________

115. TACAN switch should be placed in REC position for________minutes before going to T/R position.

116. Minimum taxi interval is__________feet, or taxi in close formation.

117. For aileron trim check, P/C should check followup tab ±________inch from faired with aileron trailing edge.

118. After takeoff raise the flaps at_________KIAS or above.

119. Section takeoffs are not permitted with a crosswind component in excess of_________knots.

120. Takeoffs are not recommended when the crosswind component exceeds____________knots.

121. To accomplish a minimum run takeoff, ______________________noseup trim and_______________flaps should be employed.

122. At a gross weight of 12,000 pounds recommended approach speed (optimum AOA) is__________ knots and increases___________knots for each 1000 pounds increase.

123. Maximum recommended crosswind components for landing are:

With spoilers__________knots.

Without spoilers___________knots.

124. With a power boost disconnect, maximum crosswind component is________knots.

125. After touchdown on a crosswind landing the control stick should be placed ____.

126. Desired distance abeam in the FCLP pattern is _________nautical miles.

127. After an FCLP touch and go landing, climb straight ahead until reaching at least_______feet altitude and _________KIAS.

128. During night VFR conditions the wingman should have______________________________ lights on__________________________, and the anticollision light_____________________________.

A-4M NATOPS QUESTION BANK (Continued)

129. At the end of the catapult power stroke the aircraft should be rotated to approximately ______ degrees on the attitude gyro.

130. During hot refueling at night, the emergency fuel cutoff signal is ______________________.

131. Aboard ship, the plane captain must ____________________ upon completion of hot refueling. Drop tanks must be either ________________ or ____________________.

132. A ______________ is installed in the elevator control system to provide longitudinal load feel.

133. Above 0.9 IMN the elevator effectiveness ______________________________.

134. During recoveries from dives at supersonic speeds, a marked pitchup will occur at approximately ________ IMN.

135. The aircraft is subject to strong ____________________ tendencies above 0.9 IMN with flight control boost disconnected.

136. With flight control boost disconnected and asymmetric store loadings, the minimum initial approach airspeed is ______ KIAS and minimum final approach and touchdown is ______ KIAS.

127. Compute stalling speeds with speedbrakes retracted, gear down, takeoff thrust, and half flaps for the following gross weights:

12,000 pounds: ________ KIAS, 16,000 pounds: ________ KIAS, 20,000 pounds: ________ KIAS

138. Compute stalling speeds with speedbrakes open, gear and full flaps down, and approach thrust, for the following conditions:

	BANK ANGLE		
GROSS WT	0	30	45
12,000			
14,000			
16,000			

139. During flight with aft CG locations (aft of 26 percent MAC), ______________________ may be encountered when applying load factor.

140. Do not select power settings below ______ percent rpm at speeds below ______ KIAS.

141. Eject if an inadvertent confirmed spin occurs below ________ AGL.

142. Spin recovery techniques are as follows:

TYPE SPIN	RUDDER	AILERON	STICK
ERECT	----------IF NO RESPONSE----------		
INVERTED			

A-4M NATOPS QUESTION BANK (Continued)

143. Recovery from a fully developed spin requires________to________feet altitude with proper application of controls.

144. In uncontrolled flight, immediately after a full stall, the best control technique to prevent a spin is____.

145. Unless otherwise briefed, rendezvous are made at__________KIAS.

146. The lead aircraft in a turning rendezvous should maintain________degrees of bank.

147. Proper rendezvous is_________degrees, relative.

148. After engaging drogue, receiver aircraft must move forward_______to_______feet and extinguish amber light on the refueling store before fuel transfer can commence.

149. Maximum speed for unfeathering the air refueling store turbine is__________KIAS.

150. Maximum speed for extension of the drogue and air refueling is_________KIAS or__________IMN.

151. Closure rates above________knots may induce hose whip.

152. Optimum airspeed for air refueling is______________KIAS.

153. If fuel leaks from the probe after disengagement, the pilot should____.

154. Aircraft should maintain at least_______feet lateral separation from the tanker during unfeathering or feathering of the air turbine.

155. During night formation flight, channel changes shall be made by______________________________ whenever possible.

156. A false start occurs when the time from lightoff to IDLE exceeds__________seconds.

157. On a wet start the throttle should be retarded to OFF, being careful____.

158. List the initial procedures for an engine fire during start.

1. ______________________________

2. ______________________________

3. ______________________________

159. The signal for brake failure on the flight deck is:

Day______________________________

Night______________________________

160. On a takeoff abort the hook should be dropped__________feet prior to abort gear, if required.

161. With a fuel-boost pump failure, full power is available to________feet and possibly as high as_____feet. Observe the following restrictions: ____.

162. To shift fuel control from PRIMARY to MANUAL, throttle should be______________________________.

163. If engine oil pressure drops below 40 psi, gradually adjust engine speed to________________________.

A-4M NATOPS QUESTION BANK (Continued)

164. Describe the AIRSTART procedures.

165. List three indications which may confirm a fire warning light indication.

166. Describe proper procedures to be taken with a fire warning light and other indications of fire.

167. Ejection is mandatory if the aircraft is in uncontrolled flight at ________ feet AGL or below.

168. While on the run-in line for an O/S loft delivery, the engine flames out. What would you do? ________

If relight is not obtained, when would you eject? ________

169. What does the zero delay lanyard do in the ejection sequence? ________

170. Canopy can be unlatched manually and removed by the airstream if airspeed is above ________ KIAS.

171. Deploying the RSSK-8A seat pack is not recommended over ________.

172. During any low altitude ejection, the pilot should ________ immediately after ejection.

173. Determine terrain clearance for safe ejection for the following conditions:

Wings level, 90 to 200 knots, 800 fpm descent; ________ feet altitude.

Wings level, 90 to 200 knots, 4000 fpm descent; ________ feet altitude.

60-degree bank, 90 to 200 knots, 1000 fpm climb ________ feet altitude.

30-degree bank, 90 to 200 knots, 1500 fpm descent ________ feet altitude.

90-degree bank, 90 to 200 knots, level flight ________ feet altitude.

174. The recommended speed for maximum glide range with engine windmilling is approximately ________ KIAS for gross weights up to 14,000 pounds in the clean configuration. Increase airspeed ________ knots for each 1000 pounds increase over 14,000 pounds.

175. On a round-robin day instrument flight you suffer a bird-strike on missed approach from a GCA at an AFB. Your wingman determines that the bird hit the port side of the radome and did no visible structural damage. All engine instruments are normal and you have been cleared on your route to your home field 200 NM away. What would you do? ________

176. If a hydraulic system is lost during flight, be alert for evidence of ________.

A-4M NATOPS QUESTION BANK (Continued)

177. Describe the flight control disconnect procedure.

____

178. What may happen if you deploy the emergency generator above 25,000 feet and 96 percent power? Why?

____

179. With a main generator failure and while operating on the emergency generator, which of the following systems will continue to operate?

UHF RADIO
TACAN
FUEL QUANTITY
FIRE WARNING
SPEED BRAKES
NORMAL TRIM
AJB-3/A
WING LIGHTS
TRIM INDICATORS
IFF
ASN 41
APPROACH LIGHTS
NORMAL WEAPONS RELEASE
AILERON TRIM
OIL PRESSURE DIRECT READING
UHF HOMER
EMERGENCY BOMB RELEASE
HORIZONTAL STABILIZER OVERRIDE
WHEEL AND FLAP INDICATORS
ANGLE-OF-ATTACK INDICATOR

180. If the AFCS malfunctions and cannot be desengaged with the AP button on the control stick or by turning the AFCS switch OFF, you should: ____.

181. If normal aileron trim is not restored upon disengagement of the AFCS, what can you do to restore normal operation? ____

182. In event spoilers deploy in flight, proceed as follows: ____

183. During flight, with 1200 pounds external fuel remaining, drop tanks pressurized and transferring normally, and full internal fuel, the fuel transfer light comes ON steady and stays ON.

What malfunction is indicated? ______________________

At this point, how much fuel would you assume you have available? ______________ pounds.

Would you actuate the emergency transfer system at this time? ______________________

Explain your decision. ____

184. List the restrictions applicable to flight with the EMER TRANS system activated.

Airspeed ______________ Attitude ______________ Other ______________

Bank angle ______________ Landings ______________ ______________

Load Factor ______________ Air refueling ______________ ______________

185. If unable to obtain drop tank fuel by normal means, what action may be taken to obtain the fuel?

____.

A-4M NATOPS QUESTION BANK (Continued)

186. If you have a pitot-static system failure which is not rectified by selecting pitot heat, and you require pitot-static instruments to complete the flight, what can you do to restore operation?__________________

____

Will this restore normal operation?____

187. If the air refueling store drogue and coupling are lost, what must be done to feather the ram air turbine blades?____

188. What are the night light approach signals to a no-radio wingman?__________________

____

189. For an LPA, set the gunsight at_______mils, place pipper______feet from the approach end of the runway to establish desired glide slope at_______KIAS. Rate of descent will be________to_______fpm depending on wind.

190. LPA checkpoints are established on the basis of_______feet altitude for each_______NMI from touchdown.

191. Which type of field arresting gear has the lowest maximum engaging speed limit (for all types of arrestments)____

192. Which type of field arresting gear has the lowest maximum off-center engagement limit?______________

____

193. If you must land gear up on a foamed runway, what is the maximum desired fuel load? Why?__________

____

194. Describe the emergency landing gear extension procedure:

____

____

____

____

195. In the event the landing gear does not indicate down and locked with the gear doors open, slowly increase airspeed up to a maximum of_________KIAS to obtain a down and locked indication.

196. How is approach speed determined on a no-flap approach?__________________________

197. Maximum recommended gross weight for a no-flap landing aboard ship is________pounds.

198. What angle-of-attack should be flown on landing approach with a stuck slat?________________

____

199. With no airspeed or angle-of-attack, what can be used to indicate a safe approach speed?____________

____

200. Describe procedure for landing with full NOSEDOWN trim:

____

____

____

201. If you know prior to landing that you have a blown main tire, what type of field landing would you plan to make?____

202. Procedures for a clean penetration are as follows: At penetration fix with 230 KIAS, lower nose to about _______degrees nosedown. As airspeed reaches_________KIAS, extend speedbrakes. Maintain_________ KIAS and adjust power as necessary to maintain_______to______fpm rate of descent. Initial power setting should be about_______percent rpm.

203. The dirty penetration is performed at______KIAS, wheels and flaps DOWN, speedbrakes______________ and a rate of descent of______to______fpm. Power setting should be about_______percent rpm.

A-4M NATOPS QUESTION BANK (Continued)

204. What is the approximate rate of descent for a GCA on a 3-degree glide slope with 5 knots of headwind? ____________

205. On a section landing approach, when does the wingman obtain landing interval? ____________

206. A section of aircraft is flying in instrument conditions when the wingman loses sight of the leader. He should:

a. ____________

b. Go on instruments, take ______ degree turn away from leader, hold for ______ minute then resume original heading.

207. The four basic steps of preparation for thunderstorm penetration are:

H ____________

A ____________

L ____________

T ____________

208. When utilizing the UHF transceiver, delay the transmission about 1 second after keying the mike to avoid ____________

209. Minimum altitude for switching radio or IFF under night or IFR conditions is ______ feet.

210. Describe the visual hand signal used to indicate a question. ____________

211. What is the day signal that you are going to dump fuel? ____________

212. Describe the day signal to put your flight into cruising formation. ____________

213. A series of zooms is a signal to: ____________

214. Describe the signal used to ask bearing and distance to a TACAN station. ____________

215. Describe visual signal to wingman to have him turn his IFF to STANDBY. ____________

216. Describe signal that your UHF transmitter has failed.

DAY ____________

NIGHT ____________

217. Describe signal to ready guns. ____________

218. The day HEFOE signal is arm bent across forehead as if weeping, followed by a numeral hand signal 1 to 5. What does each number stand for?

1. ____________

2. ____________

3. ____________

A-4M NATOPS QUESTION BANK (Continued)

218. (Continued)

4. ______________________________

5. ______________________________

219. As a no-radio wingman, you have been brought back to the field or ship and are configured for landing; your leader gives you a "thumbs-up" and points his finger toward the runway or ship with repeated stabbing motions. What does this signal mean? ______________________________

What action would you take? ______________________________

____

220. What is pilot's response to the pistol cocking signal from the arming supervisor? ______________________________

____

221. What signal should the ground crew use to indicate hot brakes? ______________________________

____

222. Why is it important that guns be SAFED in an authorized area? ______________________________

223. Maximum recommended crosswind component for landing is ______________________________.

224. The ESCAPAC 1C-3 seat provides ground level escape capability at _____ KIAS with _______ rate of descent.

225. Minimum acceptable grades for the NATOPS written examinations are:

Open book ______________________________ Closed book ______________________________

226. Maximum speed for deploying the drag chute is ________.

PERFORMANCE DATA

1. Weight and Drag Computations

Given: Operating weight from Figure 11-1 as basic weight. In addition to items listed, the aircraft carries:

Full internal fuel JP-5 (pressure fueling).
200 rounds ammo.

Station 3: Full 300-gallon fuel tank.
Stations 1 and 5: AGM-12B missiles on Aero 5A-1 launches.
Stations 2 and 4: 2 MK 82 LDGP (conical tails) on TER-7.

Find: Gross weight ______________.
Total drag index ____________.

2. Takeoff Speed – Operational

Given: Runway temperature: 90°F.
Runway pressure altitude: 500 feet.
Takeoff weight: 22,000 pounds.

Find: Takeoff speed – Operational ___________ KCAS.

3. Takeoff distance – Operational, Line Speed Check, Takeoff Refusal Speed and Stopping Distance

Given: Data from Takeoff speed problem above.
Headwind: 6 knots.
Runway gradient: +1 percent.

A-4M NATOPS QUESTION BANK (Continued)

3. (Continued)

Find: Takeoff distance – Operational_________feet.
Total distance to clear a 50-foot obstacle________feet.
Line speed check at the 2000-foot runway marker__________KCAS.
Takeoff refusal speed for an 8500-foot runway___________KIAS.
Stopping distance at takeoff refusal speed___________feet.

4. Climb, Combat Ceiling and Optimum Cruise Altitude

Given: Initial gross weight: 21,000 pounds.
Cruise altitude: 27,000 feet.
Drag index: 100.
Temperature deviation: +5°C.

Find: Climb fuel_________pounds.
Climb distance__________nautical miles.
Climb time___________minutes.

Given: Gross weight: 20,000 pounds.
Drag index: 100.

Find: Combat ceiling__________feet.
Optimum cruise altitude_________feet.

5. Fouled Deck Range

Given: Fuel on board: 1900 pounds.
Altitude: 20,000 feet.

Find: Chart is based on________drag index.
Reserve fuel allowance for landing_________pounds.
Range at 20,000 feet________nautical miles.
Optimum altitude___________feet.
Range at optimum altitude_________nautical miles.
KCAS at optimum altitude___________KCAS.
Climb schedule speed____________________________.
Descent speed____________KCAS.
Start letdown from altitude with________pounds fuel remaining.

6. Long Range Cruise

Given: Average gross weight: 16,000 pounds.
Cruise altitude: optimum.
Drag index: 75.

Find: Optimum cruise altitude_________feet.
EPR______________________.
Mach number___________.
Specific range_____________nautical miles/1000 pounds fuel

7. Maximum Range Cruise

Given: Average gross weight: 16,000 pounds.
Pressure altitude: 35,000 feet.
Drag index: 75.
Outside air temperature: -50°C.
Wind: 50-knot headwind.
Ground distance: 400 nautical miles.

A-4M NATOPS QUESTION BANK (Continued)

7. (Continued)

Find: True Mach number__________.
Maximum range TAS__________KTAS.
Time__________minutes.
Specific range__________nautical miles/1000 pounds fuel.
Fuel flow__________pph.
Fuel required__________pounds.

8. Nautical Miles Per Pound of Fuel

Given: Average gross weight: 18,000 pounds.
Cruise altitude: 15,000 feet.
Drag index: 150.
True Mach number: 0.59.
Outside air temperature: -20°C.

Find: Clean aircraft thrust required/δ amb__________pounds.
Total thrust required/δ amb__________pounds.
Nautical miles per pound of fuel__________.
True airspeed__________KTAS.
Fuel flow__________pph.
EPR__________.

9. Bingo Endurance

Given: Fuel on board: 1700 pounds.
Altitude: sea level.

Find: Chart is based on__________drag index.
Reserve fuel allowance for landing__________pounds.
Endurance at sea level__________minutes.
Optimum altitude__________feet.
Endurance at optimum altitude__________minutes.
KCAS at optimum altitude__________KCAS.
Climb schedule airspeeds____________________
____
Descent speed__________KCAS.
Start letdown from altitude with__________pounds fuel remaining.

10. Maximum Endurance

Given: Average gross weight: 13,000 pounds.
Bank angle: 15 degrees.
Loiter altitude: optimum.
Drag index: 100.
Temperature deviation from standard day: +60°C.
Loiter time: 40 minutes.

Find: Optimum altitude__________feet.
Optimum true Mach number__________.
Loiter airspeed__________KCAS.
Fuel flow__________pph.
Fuel required__________pounds.

11. Tanker Fuel Available for Transfer

Given: Fuel: JP-5
Refueling radius: 20 nautical miles

Find: Fuel available for transfer__________pounds.

A-4M NATOPS QUESTION BANK (Continued)

11. (Continued)

Tanker Fuel Transfer Time

Given: Fuel: JP-5
Fuel transferred to receiver: 5500 pounds.

Find: Elapsed time__________minutes.
Point where fueling temporarily discontinued___________minutes.
Point where fueling resumed_________minutes.

12. Fuel Consumption of Tanker During Air Refueling

Given: Refueling speed: 230 KCAS.
Gross weight: 22,000 pounds.

Find: Fuel flow at 30,000 feet______pph.
Fuel flow at 20,000 feet______pph.

13. Descent

Given: Initial gross weight: 13,000 pounds.
Cruise altitude: 40.000 feet.
Drag index. 100.

Find: Fuel required__________pounds.
Distance___________nautical miles.
Descent speed___________KCAS.
Time____________minutes.

14. Approach Speed

Given: Gear: down.
Speedbrakes: open.
Thrust required to maintain 4-degree slide slope.
Optimum approach AOA.

Find: Indicated airspeeds as follows:

SPEED	FLAPS	GROSS WEIGHT – POUNDS			
		12,000	13,000	14,000	16,000
Stall speed	Flaps up				
	Full flaps				
Approach speed	Flaps up				
	Full flaps				

15. Landing Distance

Given: Air temperature: 40°F.
Pressure altitude: 4000 feet.
Gross weight: 14,000 pounds.
Flap deflection: Full.
Headwind: 10 knots.
Runway gradient: 0.

A-4M NATOPS QUESTION BANK (Continued)

15. (Continued)

Find: Ground roll distance – dry runway____________feet.
Total distance to clear a 50-foot obstacle with 4-degree glide slope for dry runway________feet.
Ground roll distance – wet runway____________feet.
Ground roll distance – snow and ice____________feet.
Ground roll distance – drag chute deployed____________feet.

16. Turning Radius

Given: True airspeed: 350 KTAS.
Bank angle: 45 degrees.
Heading change: 90 degrees.

Find: Turning radius____________feet.
Distance traveled in turn____________nautical miles.

17. Maneuverability

Given: Gross weight: 20,000 pounds.
Mach number: 0.65.
Altitude: sea level.
Drag index: 100.

Find: Normal load factor x gross weight____________pounds.
Normal load factor__________g.

18. Maximum Mach number

Given: Drag index: 72.
Gross weight: 18,000 pounds.

Find: Maximum true Mach number – sea level____________.
Maximum true Mach number – 10,000 feet____________.

19. Military Fuel Flow

Given: Pressure altitude: 16,000 feet.
Mach number: 0.8.

Find: Fuel flow____________pounds/minute.
Fuel flow____________pounds/hour.

TRUE OR FALSE

1. The manual fuel control light should never be on while the fuel control switch is in the PRIMARY position.
2. High rates of roll can cause momentary erroneous EGT indications.
3. Fuel flow rates less than 300 pounds per hour may be interpolated on the indicator dial.
4. The IDLE EGT limit of 340°C is not a firm operating limit.
5. Oil pressure indications are not available on emergency generator.
6. Oil quantity indicator/switch indications should be valid during taxi.
7. When utilizing emergency transfer, fuel is transferred to the fuselage tank through the pressure fueling line only.
8. The emergency wing tank fuel transfer system will not operate on emergency generator.

A-4M NATOPS QUESTION BANK (Continued)

9. Transfer of external fuel may not be possible with the wing fuel switch in the EMER TRANS position.
10. Operating the wing fuel switch to the DUMP position while the drop tanks are pressurized may over-pressurize the wing fuel cell.
11. Drop tank fuel transfer is not available on emergency generator.
12. The fuel boost warning light normally comes on when the wing fuel cell is depleted.
13. The armament safety disable switch is a momentary switch and enables power to energize the armament bus only while it is held closed.
14. Hydraulic systems will operate with engine windmilling.
15. With a flight control hydraulic system failure, dropping the landing gear will cause a temporary decrease in the effectiveness of the flight controls.
16. Ailerons may be trimmed with the followup tab when on emergency generator.
17. Loss of rudder hydraulic power will result in loss of rudder trim.
18. Pulling the manual flight control T-handle disconnects the elevator, aileron, and rudder power cylinders from the flight controls.
19. Normal trim is available after a hydraulic power disconnect.
20. Speedbrakes are not available on emergency generator.
21. Wheelbrakes utilize utility system pressure.
22. It is possible to receive erroneous indications on the gyro indicator without OFF flag showing.
23. Turn needle on AJB-3A is still reliable when OFF flag appears on gyro indicator.
24. The turn needle will operate on emergency generator power.
25. A/A mode of the TACAN provides range and bearing information on a cooperating aircraft.
26. Excessive UHF-ADF bearing errors may result when stores are carried on centerline station.
27. The detail control has no effect when the radar is in SEARCH mode.
28. The AFCS will not operate on emergency generator.
29. With both hydraulic systems normal the AFCS will operate after the manual flight control disconnect handle is pulled.
30. The AFCS will continue to operate if only the utility hydraulic system fails.
31. The AFCS can be utilized in all modes with the aileron trim switch in the EMER position.
32. The AFCS should be placed in STBY for takeoff.
33. The control stick trim switch is inoperative whenever the AFCS is engaged.
34. Depressing the PUSH TO SYNC button on the compass controller will disengage the AFCS.
35. The rain removal system is available on emergency generator.
36. The rain repellent system is inoperative during emergency generator operation.
37. A utility hydraulic system failure has no effect on JATO system operation.

A-4M NATOPS QUESTION BANK (Continued)

38. The thermal radiation enclosure must be open prior to attempting an ejection.

39. Drop tanks cannot be pressure fueled if electrical power is not available.

40. External electrical power should be connected to the aircraft for gravity fueling.

41. Failure of the J52-P-408 engine fuel control to maintain EGT within limits at all altitudes is a "downing" discrepancy.

42. Low air pressure in the canopy air bungee cylinder will jeopardize canopy jettison capability.

43. Aircraft may be taxied with the canopy partially open if the canopy control handle is placed in the closed position and relative wind does not exceed 60 knots.

44. If directional control difficulties are encountered during takeoff, nosewheel steering may be safely engaged at speeds up to 70 knots.

45. Spoilers should be used when taxiing in a crosswind on the flight deck aboard ship.

46. When a tillerbar is used, nosewheel steering should be used judiciously.

47. If the aircraft goes down on the catapult, give the catapult officer a thumbs-down signal.

48. EPR readings are not valid on catapult launches because of the wind-over-the-deck.

49. The aircraft may be hot-refueled through the probe or the pressure fueling receptacle.

50. The pilot will close and lock the canopy and select ram air during hot-refueling.

51. Raising the wing flaps or landing gear causes a nosedown trim change.

52. The AFCS is equipped with automatic pitch trim.

53. Receiver must ensure that the EMERGENCY WING TANK TRANSFER switch is OFF before engaging in air refueling.

54. After the HOSE JETTISON switch is actuated, it should be returned to the OFF position.

55. The air refueling store turbine should not be energized after fuel is dumped from the store.

56. Placing the SHIP TANK switch in the TO STORE position imposes the same restrictions on the aircraft as placing the EMERGENCY WING TANK TRANSFER switch to EMER TRANS.

57. Restrictions listed with SHIP TANK switch in the TO STORE position do not apply unless a refueling store is actually carried.

58. Brakes should be pumped for maximum effectiveness on a minimum distance landing.

59. If the retraction safety-solenoid is inoperative after takeoff, actuate the retraction-release switch manually, raise the gear, and continue the mission.

60. With a throttle linkage failure the engine will stabilize at 85 to 87 percent rpm.

61. Negative-g flight is recommended prior to lightoff on an airstart, to clear the engine of residual fuel.

62. With a wing fire in flight, you should jettison your drop tanks even through transfer has been completed.

63. In the event of electrical fire on normal generator, placing the emergency generator bypass switch to BYPASS will eliminate normal generator electrical power to the aircraft.

64. When a water landing is imminent, disconnect the parachute-riser releases just prior to water contact.

65. After flight control disconnect on a test hop, you can utilize the AFCS.

A-4M NATOPS QUESTION BANK (Continued)

66. With a complete hydraulic failure and the flight control system disconnected, high rudder forces should be expected because the tandem rudder actuator does not disconnect.

67. If aileron trim fails, you should attempt to check the trim circuit by operating the trim switch in the opposite direction.

68. If aileron trim runs to maximum deflection before it can be stopped, disconnect the flight control system.

69. Air refueling store hose jettison is available on emergency generator.

70. Fuel cannot be transferred from the air refueling store to the wing when on emergency generator.

71. For a carrier barricade engagement with a landing gear malfunction, the cross deck pendants should be left on deck.

72. In an underwater escape situation, if the canopy cannot be jettisoned, the service revolver should be used to crack out the plexiglass.

73. In an underwater escape situation, inflating the MK-3C while in the cockpit will aid in escape by floating the pilot out of the cockpit.

74. Use of the rain removal system is recommended to remove ice from the windshield.

75. The air conditioning system contains a water separator.

76. If gun charging switch is inadvertently switched to SAFE after your first practice live strafing run, you can switch back to READY and continue making firing runs if guns fired normally on the first pass.

77. External stores cannot be jettisoned by the emergency release system if the landing gear are down.

78. A pilot who achieves a grade of conditionally qualified on a NATOPS evaluation may not fly without a qualified chase pilot.

79. The NATOPS Ground Evaluation must be satisfactorily completed prior to the Flight Evaluation.

80. When the AIR REFUEL switch is in FUS ONLY, no fuel is transferred to or from the wing tanks.

81. The APX-72 (IFF) will operate on emergency generator power.

82. The ejection seat face curtain handle adjusts automatically during seat position adjustment.

83. In the J52-P-408 engine, ground starting ignition is supplied by the 20-joule system.

84. If the generator is functioning properly, the generator light should be on when the generator switch is held in the TEST position.

85. Normal electrical power is available when the generator switch is in the OFF, RESET position.

MULTIPLE CHOICE

1. Horizontal stabilizer trim limits are:

   a. 12 degrees noseup, 1 degree nosedown
   b. 11 degrees noseup, 1 1/2 degrees nosedown
   c. 12 1/4 degrees noseup, 1 1/4 degrees nosedown
   d. 12 1/4 degrees noseup, 1 degree nosedown.

2. When the master light switch is ON, the approach lights will be:

   a. Unaffected
   b. Dimmed
   c. Bright
   d. Flashing.

A-4M NATOPS QUESTION BANK (Continued)

3. On emergency generator:

   a. Only exterior lights are available.
   b. Exterior and interior lights are available.
   c. Probe light is available.
   d. Approach lights are available.

4. With a full air refueling store and two full drop tanks, placing the air refueling store SHIP TANK switch in the FROM STORE position and the drop tank transfer switch in OFF, external fuel will:

   a. Not transfer.
   b. Transfer from air refueling store only.
   c. Transfer from air refueling store and drop tanks.
   d. Transfer from drop tanks only.

5. The rpm at MILITARY thrust:

   a. Does not vary with changes in inlet temperature.
   b. Decreases as inlet temperature decreases.
   c. Increases as inlet temperature decreases.
   d. None of the above.

6. When P/C holds his fist vertically in front of himself and makes a large horizontal circle with his fist, proper pilot response is:

   a. Move all controls through full travel checking for proper throw and feel.
   b. Ascertain no hydraulic ladder lights come on when flight controls are moved rapidly.
   c. Position flight controls to full left rudder, stick full aft and port.
   d. All of the above.

7. If refueling master switch is placed in OFF position with a receiver aircraft plugged in and receiving fuel, the following will result.

   a. Fuel transfer will stop.
   b. Fuel transfer will stop and hose will retract.
   c. Air turbine will feather.
   d. None of the above.

8. Which of the following will stop fuel transfer to a receiver aircraft?

   a. Turning SHIP TANK switch OFF.
   b. Placing refueling master switch OFF.
   c. Turning fuel transfer switch OFF.
   d. All of the above.

SECTION XI
PERFORMANCE DATA

TABLE OF CONTENTS

INTRODUCTION

The operating data charts contained in this section provide the pilot with information enabling him to realize the maximum performance capabilities of the aircraft. Use of the chart material for preflight planning and application of the prescribed operating procedures will result in optimum effectiveness of the aircraft.

Section XI is divided into 10 parts to present performance data in proper sequence for preflight planning. Sample problems and charts are provided to present the sequence of steps required to find the proper values and solution of a given problem. Performance data are presented in graphical type charts for ICAO standard day conditions. In some instances, temperature corrections for non-standard atmosphere have been included.

PART 1
GENERAL

PERFORMANCE DATA BASIS

Performance data are based on aircraft characteristics obtained from A-4E/F Navy and TA-4F Contractor flight tests, calculations, and engine data from Pratt and Whitney specifications. All charts are presented for ICAO standard atmosphere conditions, although ambient temperature correction scales are provided in a number of charts where temperature effects are significant. All performance is based on a center of gravity position of 25 percent MAC. All charts are applicable to JP-4 or JP-5 fuel, having a nominal density of 6.5 and 6.8 pounds per gallon respectively.

ABBREVIATIONS, SYMBOLS, AND DEFINITIONS

Abbreviation	Definition
a/a_0	Ratio of speed of sound at altitude to speed of sound at sea level, ICAO standard day
ac	Alternating current
ADF	Automatic direction finding
Alt	Altitude
°C	Degrees Centigrade
CAS or V_c	Calibrated airspeed = IAS corrected for position error
CG	Center of gravity
dc	Direct current
Deg	Degree
Amb	Free stream static condition
EAS or V_e	Equivalent airspeed = CAS corrected for compressibility effect
EGT	Exhaust gas temperature
EPR	Engine pressure ratio
°F	Degrees Fahrenheit
Flt	Flight
FPM or fpm	Feet per minute
Freq	Frequency
Ft or ft	Feet
g	Gravity force
H or h	Altitude
Hg	Mercury
hr	Hour
IAS or V_i	Indicated airspeed = instrument reading corrected for instrument error
ICAO	International Civil Aviation Organization
In	Inches
KCAS	Knots calibrated airspeed
KEAS	Knots equivalent airspeed
KIAS	Knots indicated airspeed
KTAS	Knots true airspeed
Kts/Kn	Knots
lb	Pounds
M	Mach number
MAX	Maximum
min	Minutes
mm	Millimeters
n	Normal load factor
NM or NMi	Nautical Miles
OAT	Outside air temperature

Abbreviation	Definition
P	Static atmospheric pressure at any altitude
P_o	Static atmospheric pressure at sea level ICAO standard day = 29.92 inches of mercury
psi	Pounds per square inch
RCR	Runway condition reading
RNI	Reynolds number index
RPM	Revolutions per minute (Engine speed)
SL	Sea level
Std	Standard
T	Static absolute temperature at any altitude
T_o	Static absolute temperature at sea level ICAO standard day = 288.2 degrees Kelvin
TAS	True airspeed
Vol	Volume
Wt	Weight
Δ	Delta – change in (e.g. gross weight)
δ or P/P_o	Delta – ratio of static air pressure to ICAO standard sea level static air pressure
μ	Coefficient of rolling friction
ρ	Rho – density of atmosphere in slugs per foot at any altitude
ρ_o	Rho – density of atmosphere at sea level ICAO standard day = 0.002378 slugs per foot
σ or ρ/ρ_o	Sigma – ratio of density at any altitude to density at sea level, ICAO standard day
θ or T/T_o	Theta – ratio of absolute temperature of any altitude to absolute temperature at sea level; ICAO standard day

DRAG COUNT INDEX SYSTEM

The large variety of external store loadings permitted on the A-4M aircraft requires a method of data presentation that can reflect a variable external configuration. This method is called the Drag Count Index System.

In the Drag Count Index System, each item of the external store configuration, such as a bomb, tank, or pylon, is assigned a drag number value that depends upon the size and shape of the item and its location on the aircraft. The sum of these individual drag numbers, for a particular loading, reflects the drag index for that configuration. This index, when applied to the performance charts, defines the performance of that configuration.

Some of the individual drag numbers used for determining drag indexes are shown in figure 11-1, and a complete listing is made in NAVAIR 01-40AV-1T. Note that the drag numbers for a given store depend on the store station on which they are carried. The weights of typical external stores, pylons, tanks, and adapters are included in figure 11-1. The drag of the clean aircraft includes the drag of the centerline pylon, upper avionics pod, inflight fueling probe, and drag chute, but no guns or wing pylons.

SAMPLE PROBLEM

Drag Indexes

(For figure 11-1)

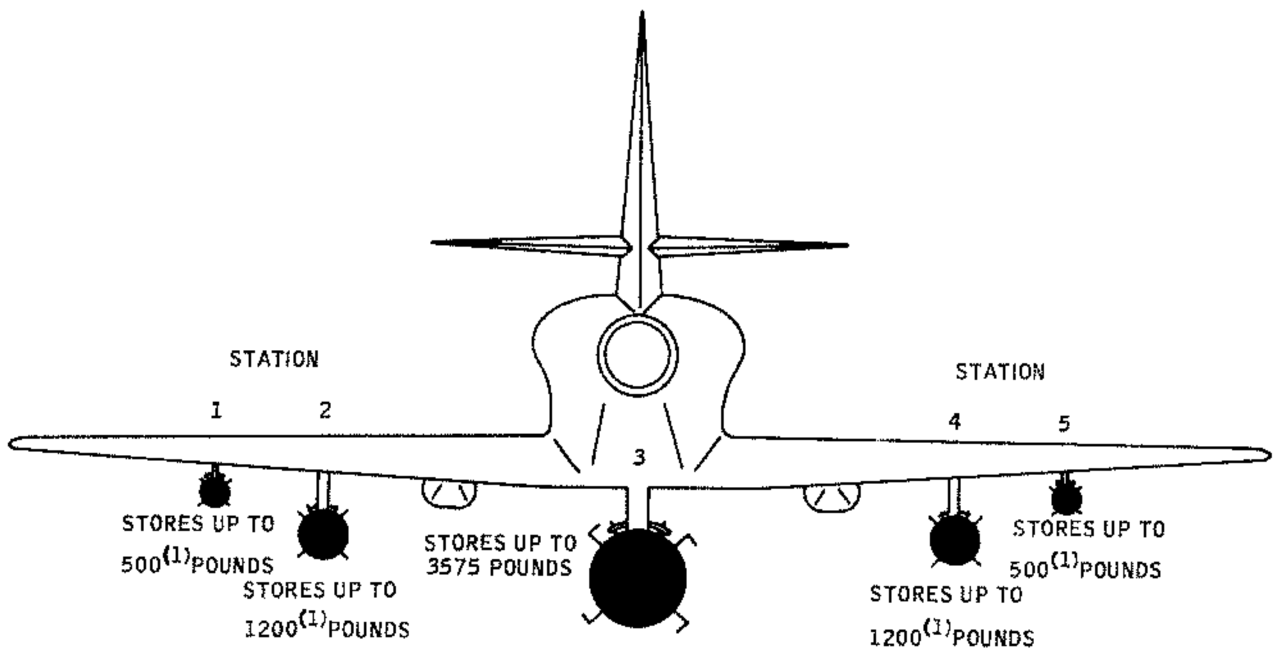
Assume the external configuration consists of a 300-gallon Aero 1-D fuel tank on the centerline pylon, a 6x300-pound MK 81 Snakeye bomb cluster on each inboard wing pylon, and a 530-pound MK 82 bomb on each outboard wing pylon.

STORE DRAG INDEXES AND GROSS WEIGHTS

DRAG INDEX FOR CLEAN CONFIGURATION (2) = 0

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED



AIRCRAFT WEIGHT (POUNDS)

ESTIMATED WEIGHT EMPTY (3)	11,326
TWO 20 MM GUNS (NO AMMO)	344
TWO AERO 20 A-1 RACK-PYLONS ON STATION 75 (2 AND 4)	140
TWO AERO 20 A-1 RACK-PYLONS ON STATION 113.75 (1 AND 5)	128
TWO 300-GALLON AERO-1D EXTERNAL FUEL TANKS (EMPTY)	398
ARMOR PLATE	101
TOTAL OPERATING WEIGHT EMPTY	12,437

NOTE:

(1) REFER TO NAVAIR 01-40AV-1T FOR CARRIAGE AND RELEASE LIMITATIONS, AND EXCEPTIONS FOR CARRIAGE OF CERTAIN STORES WEIGHING MORE THAN STATION LIMITATIONS SHOWN.

(2) CLEAN AIRCRAFT CONFIGURATION DOES NOT INCLUDE GUNS AND WING PYLONS.

(3) OPERATING WEIGHT INCLUDES A CENTERLINE AERO 7A-1 RACK (WITH FAIRING), PILOT, ENGINE OIL, TRAPPED FUEL AND OIL, LIQUID OXYGEN (10 LITERS), DRAG CHUTE, ECM EQUIPMENT, AND MISCELLANEOUS EQUIPMENT (PARAKITS, ETC).

FA1-117

Figure 11-1. Drag Indexes (Sheet 1)

Guns and Suspension Equipment	Approx Weight lb/ea	Drag Index at Store Station				
		1	2	3	4	5
Two MK 12 Guns and 400 Rounds Ammo	628			7		
400 Rounds 20-mm Ammo	284	-	-	-	-	-
One AERO 20A-1 Rack-Pylon	70		6		6	
One AERO 20A-1 Rack-Pylon	64	7				7
AERO 5A-1 Launcher	99	6	6	6	6	6
A/A 37B-1 MBR	159	14	14	14	14	14
A/A 37B-3 PMBR	87	18	18	18	18	18
TER-7	105		12	12	12	
MER-7	223		23	23	23	

Tanks and Pods (1)	SUSPENSION	No. of Stores	Approx Weight lb/ea	Drag Index at Store Station				
				1	2	3	4	5
150-GAL Fuel Tank; FULL/EMPTY (2)	AERO 20A-1, 7A-1	1	1156/136		10	10	10	
300-GAL Fuel Tank (Bobtail); FULL/EMPTY (2)	AERO 7A-1	1	2223/183			15		
300-GAL Fuel Tank (4 Fins); FULL/EMPTY (2)	AERO 20A-1	1	2239/199		14		14	
400-GAL Fuel Tank; FULL/EMPTY (2)	AERO 7A-1	1	2960/240			20		
300-GAL Refueling Store; FULL/EMPTY (2)	AERO 7A-1	1	2765/725			30/118 (3)		
GTC-85 Pod-Mounted; FULL/EMPTY	AERO 20A-1, 7A-1	1	585/487		19	21	19	

NOTES:
1. Refer to the NAVAIR 01-40AV-1T for all other applicable external store drag index and weight data, carriage and release limitations, and exceptions for carriage of the stores weighing more than station limitations noted on sheet 1.
2. Fuel tank weight for JP-5 fuel.
3. Hose and drogue: retracted/extended.

Figure 11-1. Drag Indexes (Sheet 2)

External Store Item	Drag Index	Weight-Pounds
Clean aircraft	0	-
2 MK 12 20-mm guns with 400 rounds of ammunition	7	628
1 300-gallon Aero-1D fuel tank on centerline	15	183
2 inboard wing pylons	12	140
2 outboard wing pylons	14	128
2 multiple ejector racks	46	446
2 5x300-pound MK 81 Snakeye bombs	70*	3000
2 530-pound MK 82 bombs	6*	1060
Totals	170	5585

As the mission is flown, tanks may be dropped and stores will be expended, changing the external store configuration and thus the drag index.

*Refer to NAVAIR 01-40AV-1T.

AIRSPEED CORRECTIONS

Several corrections to the airspeed indicator reading must be added to arrive at the true airspeed of the aircraft. Two corrections peculiar to the indicator itself are instrument error and lag. These errors, which are usually small, are added algebraically to the indicator reading to obtain the indicator airspeed.

Calibrated airspeed is equal to the airspeed indicator reading corrected for position and instrument error. Position error, shown in figure (to be furnished at a later date), is an error introduced due to the location of the static source at a point of nonambient static pressure.

Equivalent airspeed is equal to the airspeed indicator reading corrected for position error, instrument error, and for the compressibility at a particular altitude.

True airspeed is related to equivalent airspeed by the following: $KTAS = KEAS \times 1/\sqrt{\sigma}$

The quantity $1/\sqrt{\sigma}$ may be found in figures 11-3 and 11-5.

To convert calibrated airspeed to true airspeed and true Mach number, figure 11-2 is provided. Figure 11-2 has compressibility effects built into the graph permitting a direct step from calibrated to true airspeed.

A position error is associated with the Mach number indicated values and the true Mach number values. This relationship is shown in figure (to be furnished at a later date).

SAMPLE PROBLEM

Altitude Correction for Position Error

(For figure 11-6)

(Data to be furnished at a later date.)

Mach Number Correction for Position Error

(For figure 11-7)

(Data to be furnished at a later date.)

Airspeed Conversion

(For figure 11-2)

(A) Calibrated airspeed . . . . 360 kn

(B) True pressure altitude . . . . 25,000 ft

(C) True Mach number 0.849

(D) OAT . . . . 20°C

(E) True airspeed . . . . 565 kn

ALTIMETER CORRECTIONS

The altimeter is connected to the static source. Position error corrections, similar to those for airspeed indications, must be applied to the altimeter indications to obtain true pressure altitude. The corrections are given in figure (to be furnished at a later date). Instrument error and altimeter lag are also prevalent in the altimeter system. The lag error (approximately 200 feet) could be significant in a low-altitude dive pullout.

SAMPLE PROBLEM

Airspeed Correction for Position Error

(For figure 11-6)

(Data to be furnished at a later date.)

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AIRSPEED CONVERSION

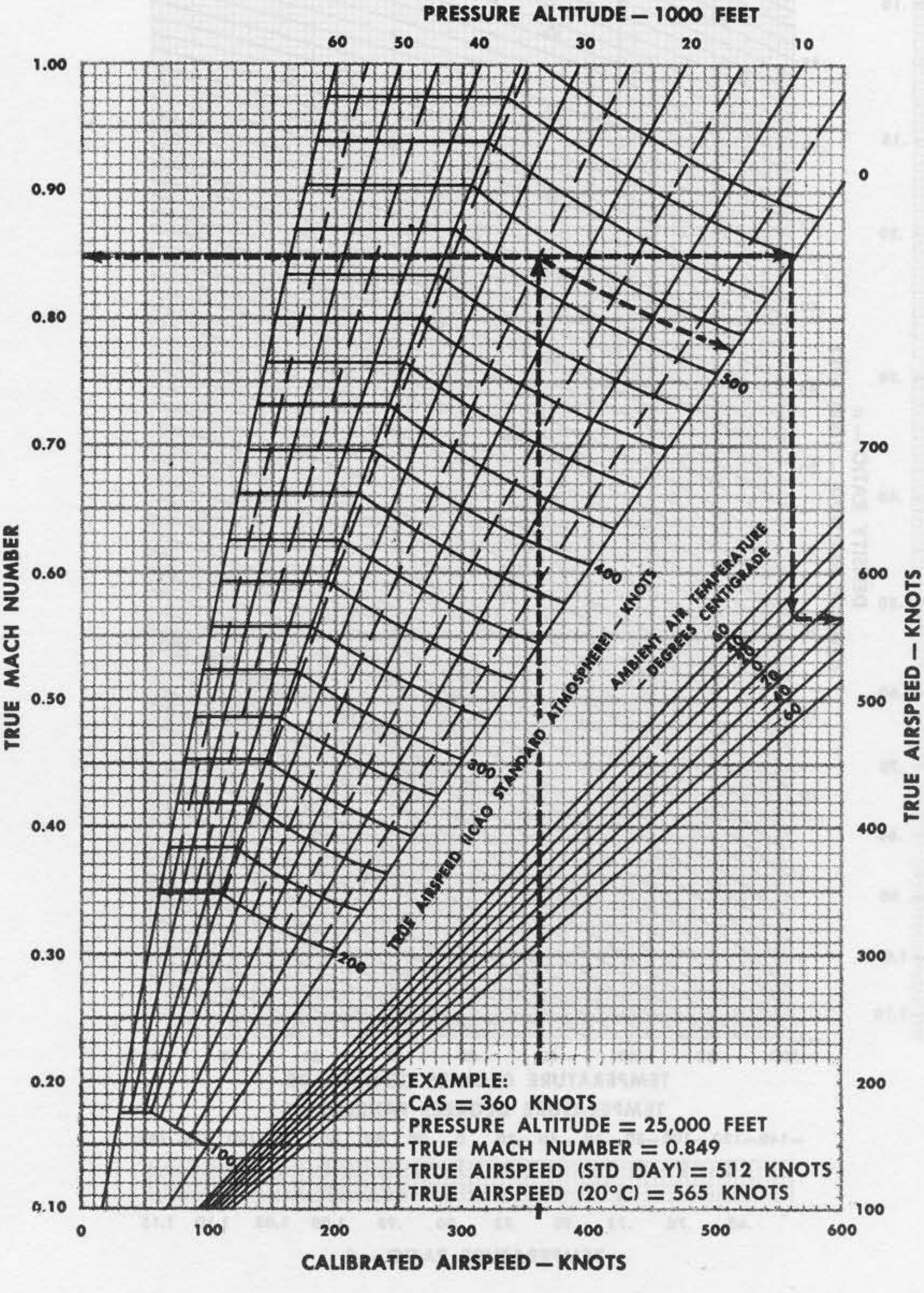

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Figure 11-2. Airspeed Conversion

DENSITY ALTITUDE CHART

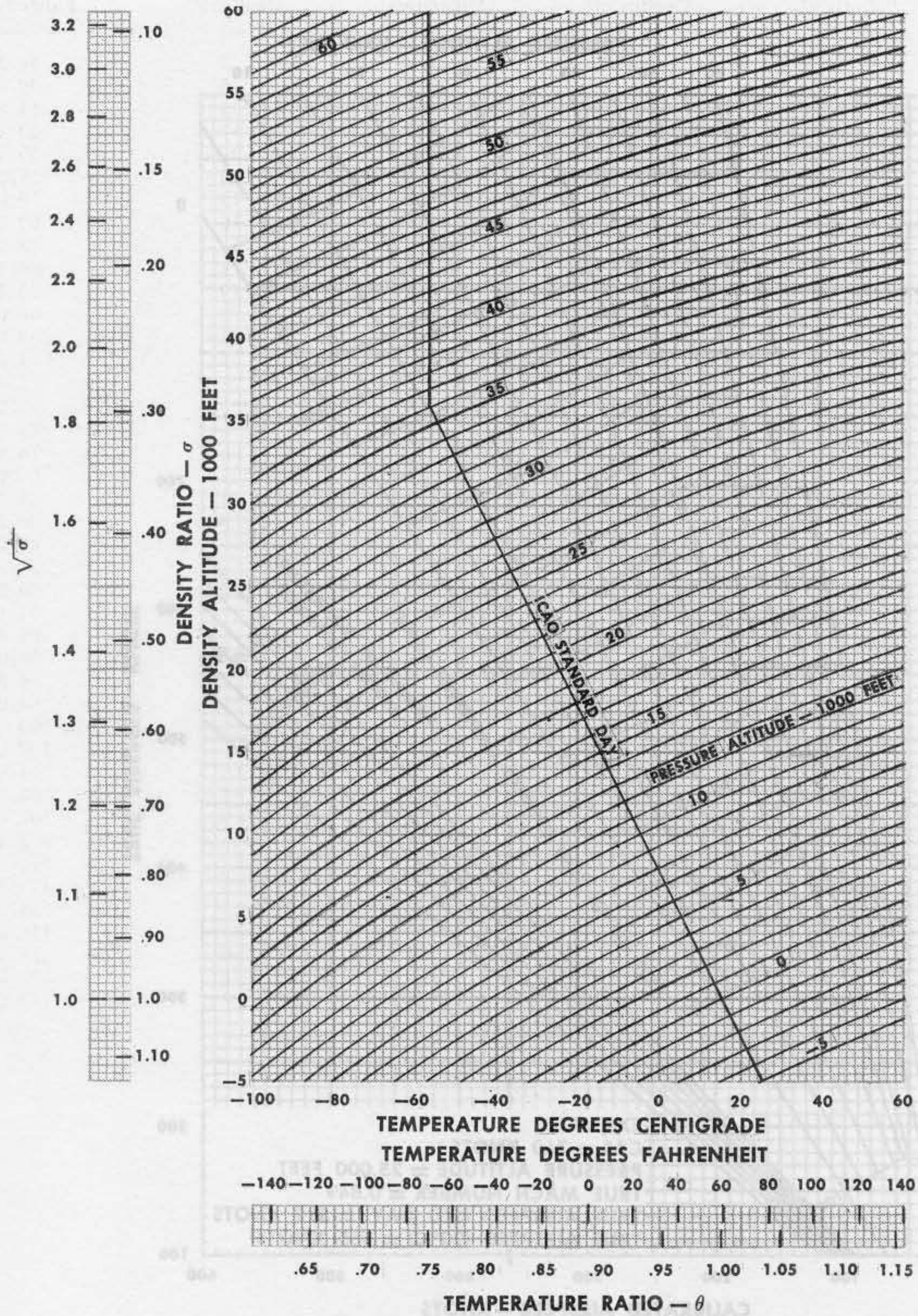


Figure 11-3. Density Altitude Chart

Degrees Centigrade	Degrees Fahrenheit	Degrees Centigrade	Degrees Fahrenheit	Degrees Centigrade	Degrees Fahrenheit
-75	-103.0	-33	-27.4	9	48.2
-74	-101.2	-33	-25.6	10	50.0
-73	- 99.4	-31	-23.8	11	51.8
-72	- 97.6	-30	-22.0	12	53.6
-71	- 95.8	-29	-20.2	13	55.4
-70	- 94.0	-28	-18.4	14	57.2
-69	- 92.2	-27	-16.6	15	59.0
-68	- 90.4	-26	-14.8	16	60.8
-67	- 88.6	-25	-13.0	17	62.6
-66	- 86.8	-24	-11.2	18	64.4
-65	- 85.0	-23	- 9.4	19	66.2
-64	- 83.2	-22	- 7.6	20	68.0
-63	- 81.4	-21	- 5.8	21	69.8
-62	- 79.6	-20	- 4.0	22	71.6
-61	- 77.8	-19	- 2.2	23	73.4
-60	- 76.0	-18	0.4	24	75.2
-59	- 74.2	-17	1.4	25	77.0
-58	- 72.4	-16	3.2	26	78.8
-57	- 70.6	-15	5.0	27	80.6
-56	- 68.8	-14	6.8	28	82.4
-55	- 67.0	-13	8.6	29	84.2
-54	- 65.2	-12	10.4	30	86.0
-53	- 63.4	-11	12.2	31	87.8
-52	- 61.6	-10	14.0	32	89.6
-51	- 59.8	- 9	15.8	33	91.4
-50	- 58.0	- 8	17.6	34	93.2
-49	- 56.2	- 7	19.4	35	95.0
-48	- 54.4	- 6	21.2	36	96.8
-47	- 52.6	- 5	23.0	37	98.6
-46	- 50.8	- 4	24.8	38	100.4
-45	- 49.0	- 3	26.6	39	102.2
-44	- 47.2	- 2	28.4	40	104.0
-43	- 45.4	- 1	30.2	41	105.8
-42	- 43.6	0	32.0	42	107.6
-41	- 41.8	1	33.8	43	109.4
-40	- 40.0	2	35.6	44	111.2
-39	- 38.2	3	37.4	45	113.0
-38	- 36.4	4	39.2	46	114.8
-37	- 34.6	5	41.0	47	116.6
-36	- 32.8	6	42.8	48	118.4
-35	- 31.0	7	44.6	49	120.2
-34	- 29.2	8	46.4	50	122.0

Figure 11-4. Centigrade/Fahrenheit Conversion

Altitude Feet	Density Ratio $\sigma = \rho/\rho o$	$\frac{1}{\sqrt{\sigma}}$	Temperature °C	Temperature °F	Temperature Ratio $\theta = T/T_o$	Speed of Sound Ratio a/ao	Pressure In. of Hg	Pressure Ratio $\delta = P/P_o$
Sea Level	1.0000	1.0000	15.000	59.000	1.0000	1.000	29.921	1.0000
1000	0.9711	1.0148	13.019	55.434	0.9931	0.997	28.856	0.9644
2000	0.9428	1.0299	11.038	51.868	0.9862	0.993	27.821	0.9298
3000	0.9151	1.0454	9.056	48.302	0.9794	0.990	26.817	0.8962
4000	0.8881	1.0611	7.075	44.735	0.9725	0.966	25.842	0.8637
5000	0.8617	1.0773	5.094	41.169	0.9656	0.983	24.896	0.8320
6000	0.8359	1.0938	3.113	37.603	0.9587	0.979	23.978	0.8014
7000	0.8106	1.1107	1.132	34.037	0.9519	0.976	23.088	0.7716
8000	0.7860	1.1279	-0.850	30.471	0.9450	0.972	22.225	0.7428
9000	0.7620	1.1456	-2.831	26.905	0.9381	0.969	21.388	0.7148
10,000	0.7385	1.1637	-4.812	23.338	0.9312	0.965	20.577	0.6877
11,000	0.7156	1.1822	-6.793	19.772	0.9244	0.961	19.791	0.6614
12,000	0.6932	1.2011	-8.774	16.206	0.9175	0.958	19.029	0.6360
13,000	0.6713	1.2205	-10.756	12.640	0.9106	0.954	18.292	0.6113
14,000	0.6500	1.2403	-12.737	9.074	0.9037	0.951	17.577	0.5875
15,000	0.6292	1.2606	-14.718	5.508	0.8969	0.947	16.886	0.5643
16,000	0.6090	1.2815	-16.699	1.941	0.8900	0.943	16.216	0.5420
17,000	0.5892	1.3028	-18.680	-1.625	0.8831	0.940	15.569	0.5203
18,000	0.5699	1.3246	-20.662	-5.191	0.8762	0.936	14.942	0.4994
19,000	0.5511	1.3470	-22.643	-8.757	0.8694	0.932	14.336	0.4791
20,000	0.5328	1.3700	-24.624	-12.323	0.8625	0.929	13.750	0.4595
21,000	0.5150	1.3935	-26.605	-15.889	0.8556	0.925	13.184	0.4406
22,000	0.4976	1.4176	-28.586	-19.456	0.8487	0.921	12.636	0.4223
23,000	0.4807	1.4424	-30.586	-23.022	0.8419	0.918	12.107	0.4046
24,000	0.4642	1.4678	-32.549	-26.588	0.8350	0.914	11.597	0.3876
25,000	0.4481	1.4938	-34.530	-30.154	0.8281	0.910	11.104	0.3711
26,000	0.4325	1.5206	-36.511	-33.720	0.8212	0.906	10.627	0.3552
27,000	0.4173	1.5480	-38.493	-37.286	0.8144	0.902	10.168	0.3398
28,000	0.4025	1.5762	-40.474	-40.852	0.8075	0.899	9.725	0.3250
29,000	0.3881	1.6052	-42.455	-44.419	0.8006	0.895	9.297	0.3107
30,000	0.3741	1.6349	-44.436	-47.985	0.7937	0.891	8.885	0.2970
31,000	0.3605	1.6654	-46.417	-51.551	0.7869	0.887	8.488	0.2837
32,000	0.3473	1.6968	-48.399	-55.117	0.7800	0.883	8.106	0.2709
33,000	0.3345	1.7291	-50.379	-58.683	0.7731	0.879	7.737	0.2586
34,000	0.3220	1.7623	-52.361	-62.249	0.7662	0.875	7.382	0.2467

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft
= 0.4912 lb per sq in.

(2) ICAO Standard Sea Level Air
t_o = 15°C
P_o = 29.921 in. of Hg
ao = 661.8 knots
ρ_o = 0.0023769 slug per cu ft

DATA BASIS: NACA Technical Note No. 3182

Figure 11-5. ICAO Standard Altitude Chart (Sheet 1)

Altitude Feet	Density Ratio $\sigma = \rho/\rho_o$	$\frac{1}{\sqrt{\sigma}}$	Temperature °C	Temperature °F	Temperature Ratio $\theta = T/T_o$	Speed of Sound Ratio a/a_o	Pressure In. of Hg	Pressure Ratio $\delta = P/P_o$
35,000	0.3099	1.7964	-54.342	-65.816	0.7594	0.871	7.041	0.2353
36,000	0.2981	1.8315	-56.323	-69.382	0.7525	0.867	6.712	0.2243
36,089	0.2971	1.8347	-56.500	-69.700	0.7519	0.867	6.683	0.2234
37,000	0.2844	1.8753					6.397	0.2138
38,000	0.2710	1.9209					6.097	0.2038
39,000	0.2585	1.9677					5.811	0.1942
40,000	0.2462	2.0155					5.538	0.1851
41,000	0.2346	2.0645					5.278	0.1764
42,000	0.2236	2.1148					5.030	0.1681
43,000	0.2131	2.1662					4.794	0.1602
44,000	0.2031	2.2189					4.569	0.1527
45,000	0.1936	2.2728					4.355	0.1455
46,000	0.1845	2.3281					4.151	0.1387
47,000	0.1758	2.3848					3.956	0.1322
48,000	0.1676	2.4428					3.770	0.1260
49,000	0.1597	2.5022					3.593	0.1201
50,000	0.1522	2.5630					3.425	0.1145
51,000	0.1451	2.6254					3.264	0.1091
52,000	0.1383	2.6892					3.111	0.1040
53,000	0.1318	2.7546					2.965	0.0991
54,000	0.1256	2.8216					2.826	0.0944
55,000	0.1197	2.8903					2.693	0.0900
56,000	0.1141	2.9606					2.567	0.0858
57,000	0.1087	3.0326					2.446	0.0818
58,000	0.1036	3.1063					2.331	0.0779
59,000	0.09877	3.1819					2.222	0.0743
60,000	0.09414	3.2593					2.118	0.0709
61,000	0.08972	3.3386					2.018	0.0675
62,000	0.08551	3.4198					1.924	0.0643
63,000	0.08150	3.5029					1.833	0.0613
64,000	0.07767	3.5881					1.747	0.0584
65,000	0.07403	3.6754	-56.500	-69.700	0.7519	0.867	1.665	0.0557

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft
= 0.4912 lb per sq in.

(2) ICAO Standard Sea Level Air
t_o = 15°C
P_o = 29.921 in. of Hg
a_o = 661.8 knots
ρ_o = 0.0023769 slug per cu ft

DATA BASIS: NACA Technical Note No. 3182

Figure 11-5. ICAO Standard Altitude Chart (Sheet 2)

(CHART)

Data pertaining to Airspeed and Altitude Correction for Position Error not available at this time. Will be furnished at a later date.

Figure 11-6. Airspeed and Altitude Correction for Position Error

(CHART)

Data pertaining to Mach Number Correction for Position Error not available at this time. Will be furnished at a later date.

Figure 11-7. Mach Number Correction for Position Error

PART 2
TAKEOFF

TAKEOFF CHARTS

The takeoff charts present takeoff distance, maximum takeoff weight, JATO firing delay, and JATO takeoff distance. The charts encompass such variables as takeoff weight, equivalent airspeed, ambient runway temperature, runway pressure altitude, headwind, and runway gradient. Half flaps and MILITARY thrust are recommended for all takeoffs.

Variables, which are not considered in the charts, that will influence the acceleration of the aircraft during ground run are pilot braking to maintain directional control; runway surface conditions which constitute a lower or higher value for the rolling coefficient of friction (μ); external store loadings on the wing stations which protrude forward or near the leading edge of the wing and influence the flow field of air over the wing, reducing lift and increasing required takeoff speeds; and rough or bumpy runways which influence the taxi attitude of the aircraft, introducing aerodynamic braking during the ground run. Of these variables, pilot braking, which is a function of pilot technique, probably has the greatest influence on acceleration-retardation and will increase the ground run significantly.

OPERATIONAL TAKEOFF DISTANCE

Operational takeoff distance, total distance to clear a 50-foot obstacle, without JATO assist, and recommended takeoff speeds are shown in figure 11-8. Takeoff distances are based on half flaps, MILITARY thrust, and 8 degrees aircraft noseup trim.

The takeoff airspeeds and distances are based on NATC flight test data of the Model A-4E aircraft. Note the region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area in which the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limit speed of 175 knots ground speed may be exceeded. Since temperature and altitude are not independent, the boundary lines in this box are shown for extreme altitude-temperature combinations. A more detailed explanation of the marginal region is given under maximum takeoff weight. The method of obtaining the ground run distance, total distance to clear a 50-foot obstacle, takeoff airspeed, and the line speed check are described in the following example.

Note

If operational conditions require takeoffs for which computed takeoff distance places the aircraft in the region labeled TAKEOFF IS MARGINAL on the chart, lift-off speed should be increased approximately 5 to 10 knots, not to exceed tire limiting speed. This will result in increased rates of climb. Runway length and location of abort gear must be considered in planning this type of takeoff.

SAMPLE PROBLEM

Takeoff Distance — Operational

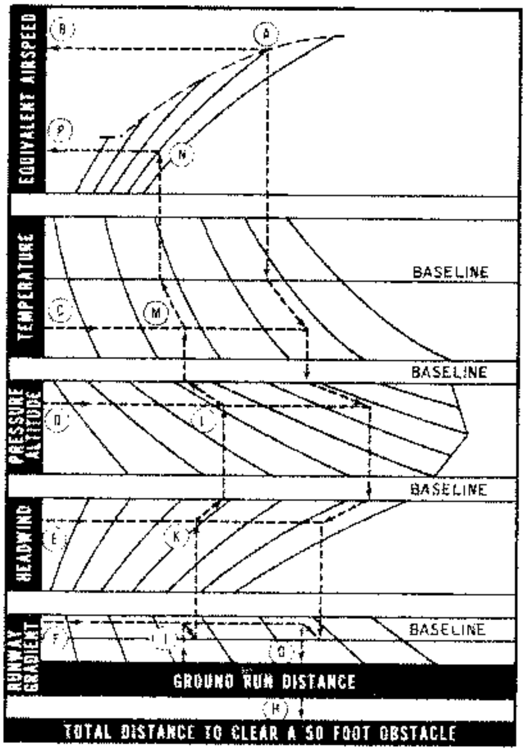
(For figure 11-8)

(A)	Takeoff weight	20,000 lb
(B)	Takeoff airspeed	146 KIAS
(C)	Ambient runway air temperature	30°C
(D)	Runway pressure altitude	2000 ft
(E)	Headwind	10 kn
(F)	Runway gradient	-2 percent
(G)	Ground run distance	2450 ft
(H)	Total distance to clear 50-foot obstacle	3600 ft

LINE SPEED CHECK

A line speed check is a simple procedure for determining that aircraft acceleration during takeoff run is normal. If aircraft acceleration is not normal, the line speed check is sufficiently early to allow normal braking to stop the aircraft on the runway. The pilot selects a suitable and recognizable known distance down the runway from the point that takeoff run commences (such as runway distance marker, runway intersection, etc.). The normal takeoff distance chart is used by entering the chart at the selected distance and working in reverse through the chart.

SAMPLE TAKEOFF DISTANCE



FA1-139

applying the corrections for variation from standard conditions. The first line speed check should be made at the 2000-foot runway marker.

SAMPLE PROBLEM

Line Speed Check

(For figure 11-8)

(J)	Runway gradient	-2 percent
(K)	Headwind	10 kn
(L)	Runway pressure altitude.	2000 ft
(M)	Ambient runway air temperature	30°C
(N)	Takeoff weight	20,000 lb
(P)	Indicated airspeed	133 KIAS

MAXIMUM TAKEOFF WEIGHT — WITH AND WITHOUT JATO

The maximum takeoff weight (figure 11-9) is given as a function of pressure altitude and ambient air temperature. The data basis for this chart assumes that the landing gear is fully extended, takeoff is at airspeeds shown in figure 11-8, the aircraft is climbing out with MILITARY thrust with the assist of ground effect, multiple carriage stores are carried on wing stations, and wing flaps are set at the half-flaps position. The maximum takeoff weight criteria is based on the most critical of the following:

1. Excess thrust shall not be less than minimum established by NATC flight test.

2. The safe tire speed limit of 175 knots ground speed shall not be exceeded.

NATC flight test of the Model A-4E aircraft shows that the above criteria, when met, will provide acceptable climbout characteristics. Since JATO burnout occurs at lift-off, this chart is valid for both with and without JATO assist.

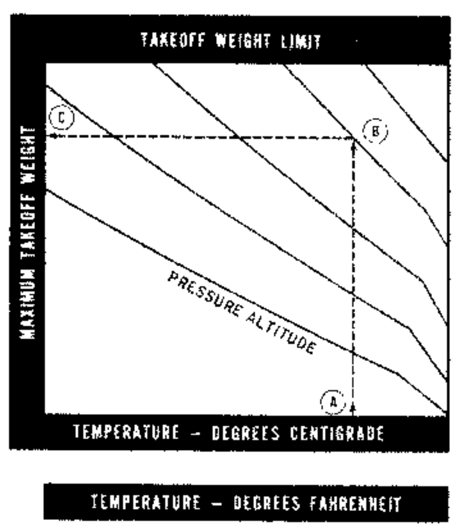
SAMPLE PROBLEM

Maximum Takeoff Weight — Operational

(For figure 11-9)

(A)	Ambient runway air temperature	30°C
(B)	Runway pressure altitude.	4000 ft
(C)	Maximum takeoff weight	23,220 lb

SAMPLE MAXIMUM TAKEOFF WEIGHT



FA1-140

JATO FIRING DELAY, MINIMUM TAKEOFF DISTANCE — TWO MK 7 MOD 2, 5KS-4500 JATO BOTTLES

The minimum ground run distance and the total distance to clear a 50-foot obstacle may be realized by firing the JATO bottles so that burnout occurs at lift-off. Burnout at lift-off is recommended for the following reasons:

1. Burnout at lift-off produces the shortest takeoff distance.

2. A misfire can be detected early and the takeoff can be aborted well before the refusal point.

The following trim settings are required for JATO operation to avoid excessive nose-high attitudes at low gross weights due to noseup pitching moments generated by possible JATO burning after lift-off.

Gross Weight (Pounds)	Recommended Trim (Degrees Noseup)
13,500	2
17,500	5
22,500	7
24,500	8

With the above recommended trim settings, the flight trim stick force without JATO burning varies linearly with gross weight from approximately 12 pounds pull at 16,000 pounds gross weight to 3 pounds pull at 24,500 pounds gross weight. This stick force is not objectionable since a reduction in angle-of-attack is required to maintain airspeed or to continue acceleration.

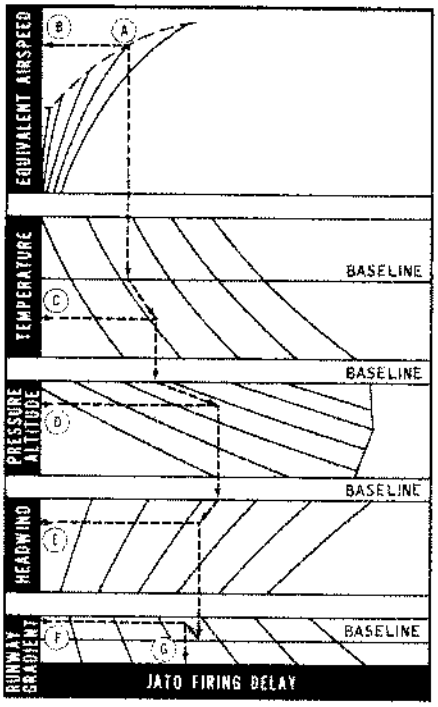
It is recommended that the firing point be established by distance markers alongside the runway. This recommendation is made for the following reasons:

1. Using a time interval from brake release is considered to be too inaccurate.

2. Using airspeed as a reference for JATO firing would not be possible since, generally, JATO firing occurs at a speed below the speed at which the airspeed indicator begins to register.

Figure 11-10 shows the ground run distance from brake release to ignition of JATO. Takeoff speed, ground run distance, and total horizontal distance to clear a 50-foot obstacle are presented in figure 11-11. Takeoff distances are based on half-flaps, military thrust, and trim settings.

SAMPLE JATO FIRING DELAY



FA1-141

The takeoff airspeeds and distances are based on JATO flight test data of the Model A-4E aircraft. Note the region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area in which the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limiting speed at 175 knots ground speed may be exceeded. Since temperature and altitude are not independent, the boundary lines in this box are shown for extreme altitude-temperature combinations. A more detailed explanation of the marginal region is given under Maximum Takeoff Weight. The method of obtaining the JATO firing distance, JATO takeoff airspeed, JATO ground run distance, and total distance to clear a 50-foot obstacle is described in the following examples.

SAMPLE PROBLEM

JATO Firing Delay

(For figure 11-10)

(A) Takeoff weight . . . . 20,000 lb

(B) Takeoff airspeed . . . . 146 KIAS

(C) Ambient runway air temperature . . . . 30°C

(D) Runway pressure altitude . . . . 2000 ft

(E) Headwind . . . . 10 kn

(F) Runway gradient . . . . -2 percent

(G) JATO firing distance . . . . 450 ft

JATO Takeoff Distance

(For figure 11-11)

(H) Takeoff weight . . . . 20,000 lb

(J) Takeoff airspeed . . . . 146 KIAS

(K) Ambient runway air temperature . . . . 30°C

(L) Runway pressure altitude . . . . 2000 ft

(M) Headwind . . . . 10 kn

(N) Runway gradient . . . . -2 percent

(P) Ground run distance . . . . 1350 ft

(Q) Total distance to clear 50-foot obstacle . . . . 2500 ft

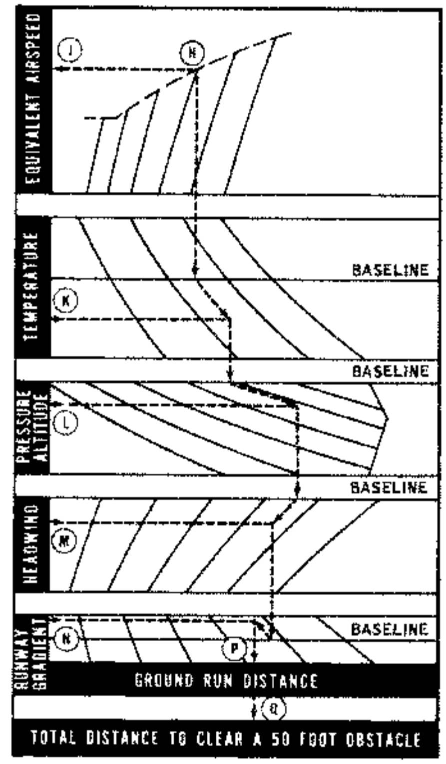
Note

Jettisoning of JATO bottles should be performed in 1.0 g level flight, in cruise configuration, at or below 400 KIAS (maximum).

REFUSAL SPEED

The maximum refusal speed is that speed at which engine failure permits stopping the aircraft on a runway of specified length. Figures 11-12 and 11-14 present this data for engine failure during a military thrust takeoff without JATO burning. Data includes distance covered during a pilot reaction time of 2 seconds and for an 8-second engine deceleration time from military to idle rpm. Figure 11-12 is without drag chute deployed and figure 11-14 is with drag chute deployed.

SAMPLE JATO TAKEOFF DISTANCE



FAI-142

SAMPLE PROBLEM

Takeoff Refusal Speeds

(For figure 11-12)

Configuration: All configurations

(A) Runway temperature . . . . 30°C

(B) Runway pressure altitude . . . . 2000 ft

(C) Transfer scale 1.12

(D) Field length . . . . 8000 ft

(E) Takeoff weight . . . . 20,000 lb

(F) Headwind . . . . 10 kn

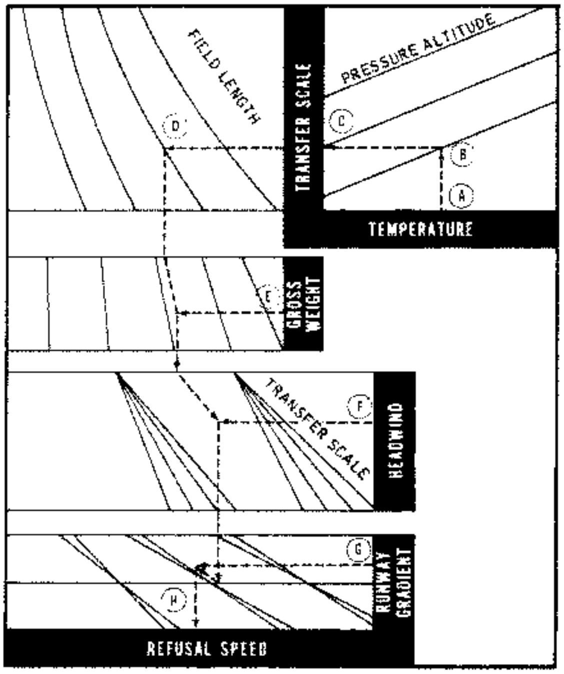
(G) Runway gradient . . . . -2 percent

(H) Takeoff refusal speed . . . . 91 KIAS

STOPPING DISTANCE

The stopping distance charts (figures 11-13 and 11-15) are included primarily for use if the takeoff should be

SAMPLE TAKEOFF REFUSAL SPEED



FA1-143

aborted. It is not intended for use in determining landing distance. The data does not include pilot reaction and deceleration time. Distances are based on the application of maximum braking effort without skidding the tires, below brake energy limit speed, and throttle positioned at idle thrust. To minimize diversion of pilot's attention during this critical stage of the takeoff abort, it is recommended that flaps be left in the position selected for takeoff. Figure 11-13 is without drag chute deployed, and figure 11-15 is with drag chute deployed.

Note

Shutting down the engine at 80 KIAS will shorten the rollout considerably.

SAMPLE PROBLEM

Stopping Distance

(For figure 11-13)

Configuration: All Configurations

(A) Runway temperature . . . . 30°C

(B) Runway pressure altitude . . . . 2000 ft

(C) Indicated airspeed at abort . . . 91 KIAS

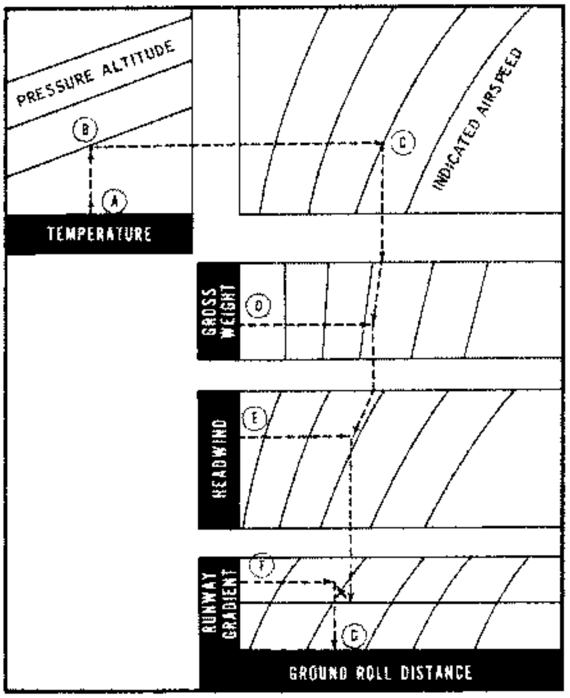
(D) Aircraft gross weight . . . . 20,000 lb

(E) Headwind . . . . 10 kn

(F) Runway gradient . . . . -2 percent

(G) Stopping distance . . . . 4500 ft

SAMPLE STOPPING DISTANCE



FA1-144

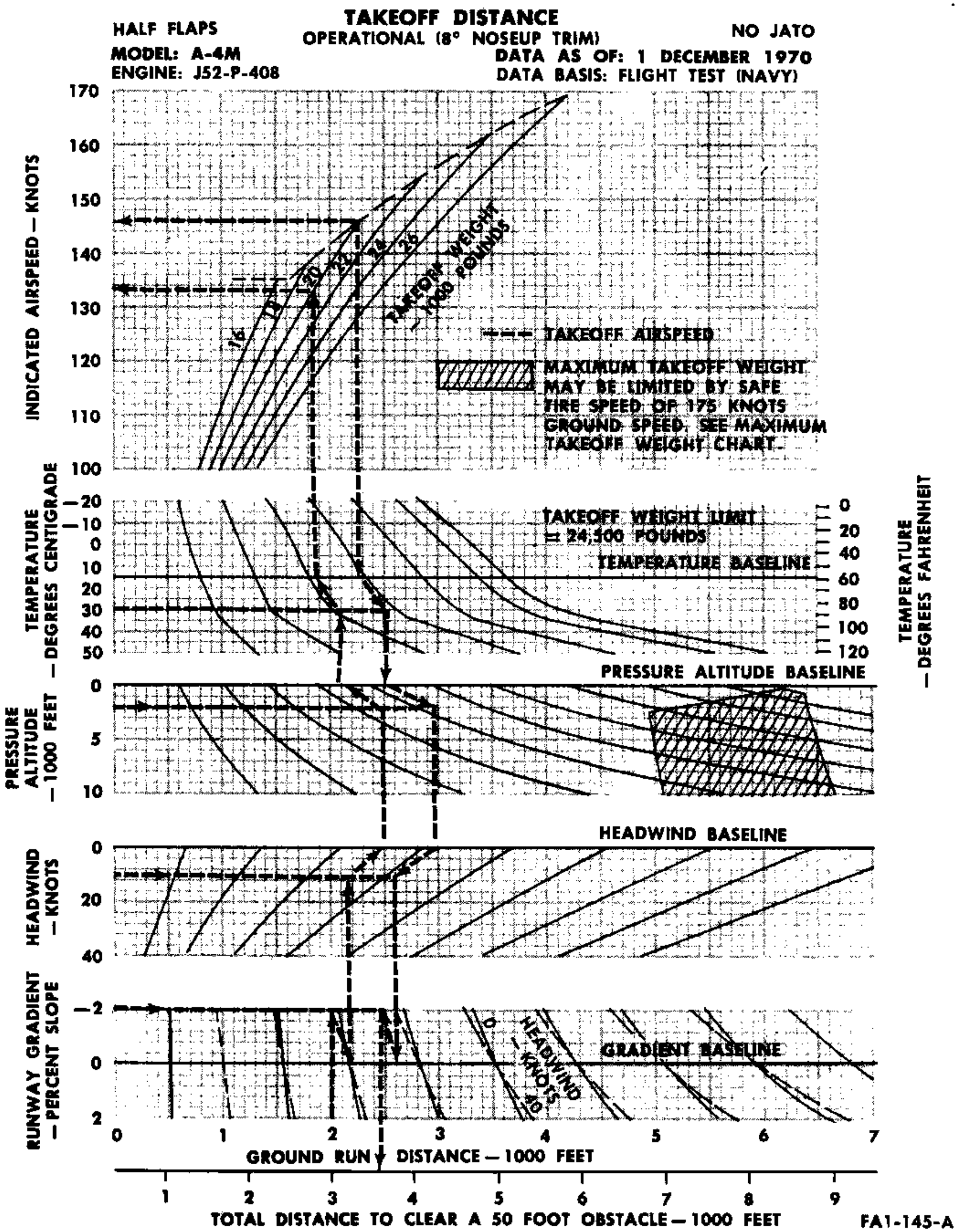


Figure 11-8. Takeoff Distance

MAXIMUM TAKEOFF WEIGHT

HALF FLAPS — **WITH AND WITHOUT JATO**

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: FLIGHT TEST (NAVY)

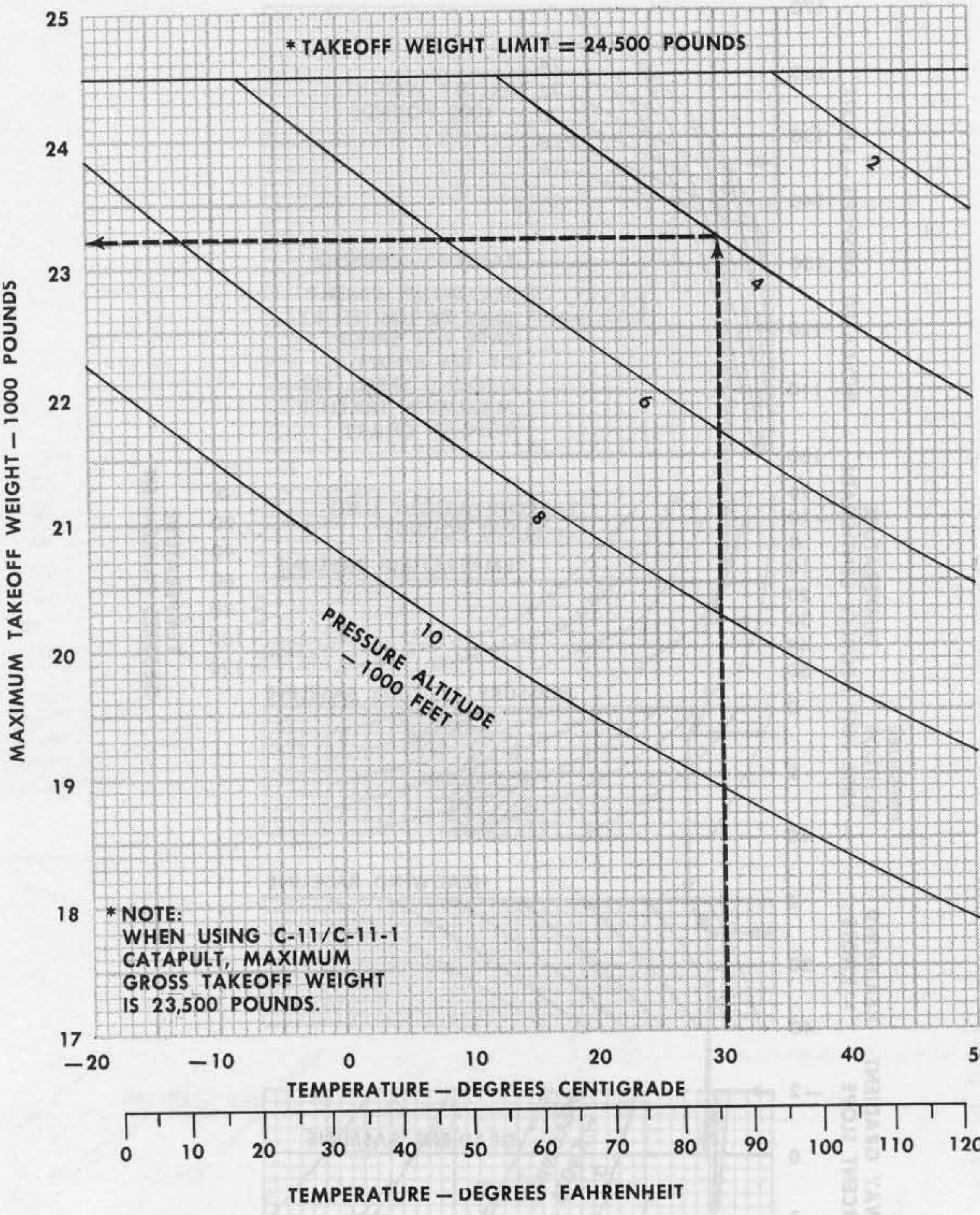


Figure 11-9. Maximum Takeoff Weight

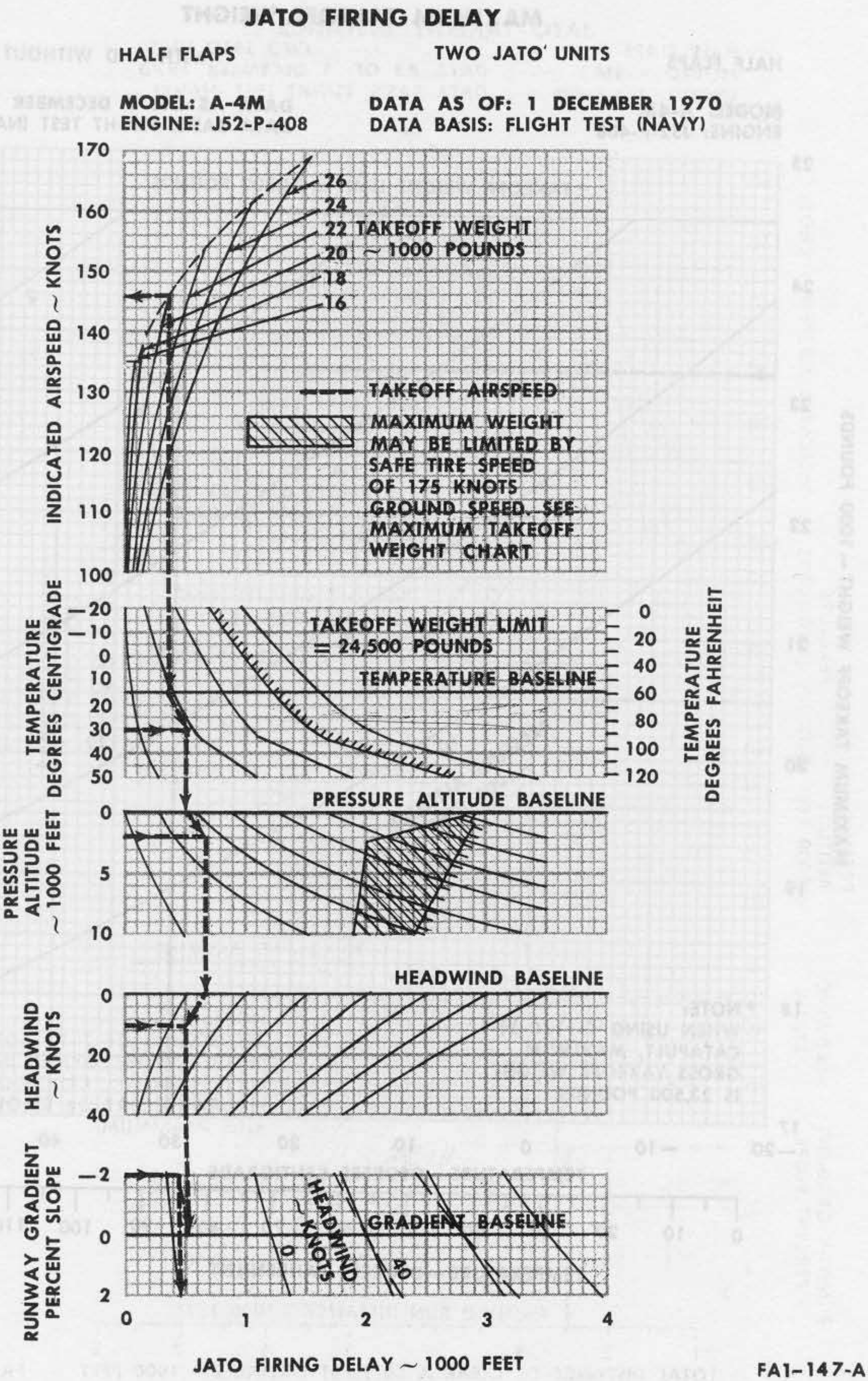


Figure 11-10. JATO Firing Delay

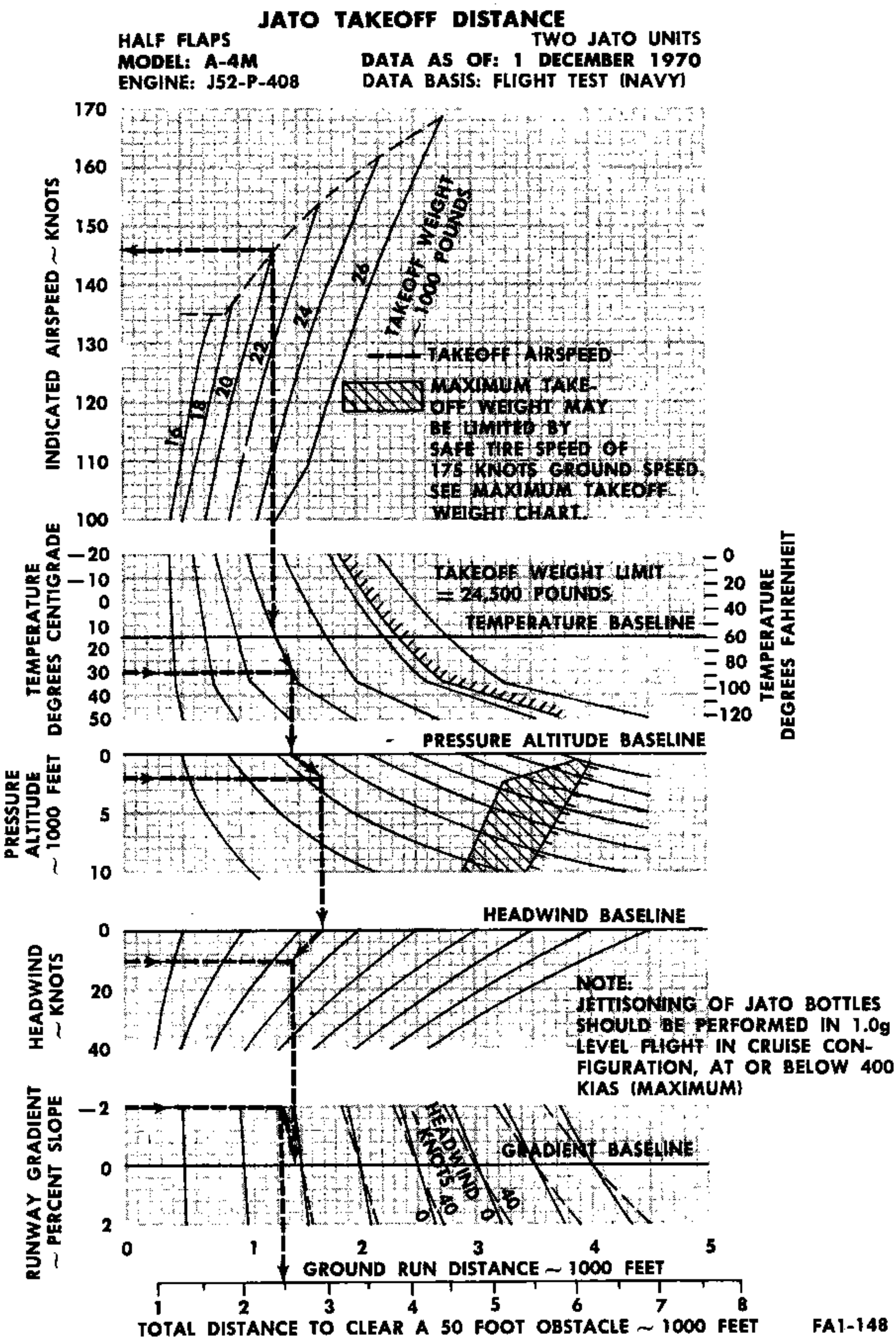


Figure 11-11. JATO Takeoff Distance

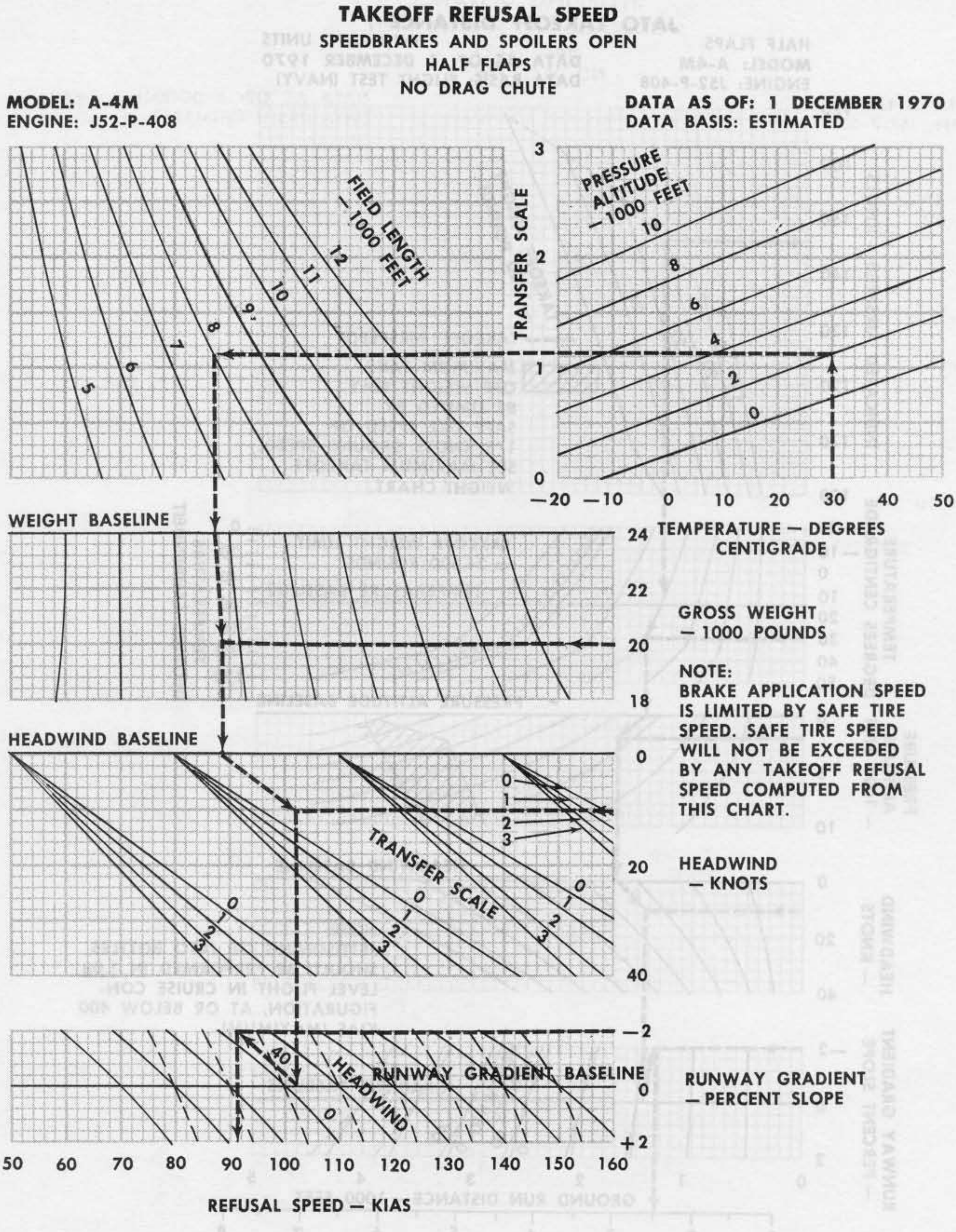


Figure 11-12. Takeoff Refusal Speed — No Drag Chute

STOPPING DISTANCE
SPEEDBRAKES AND SPOILERS OPEN
HALF FLAPS
NO DRAG CHUTE

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED

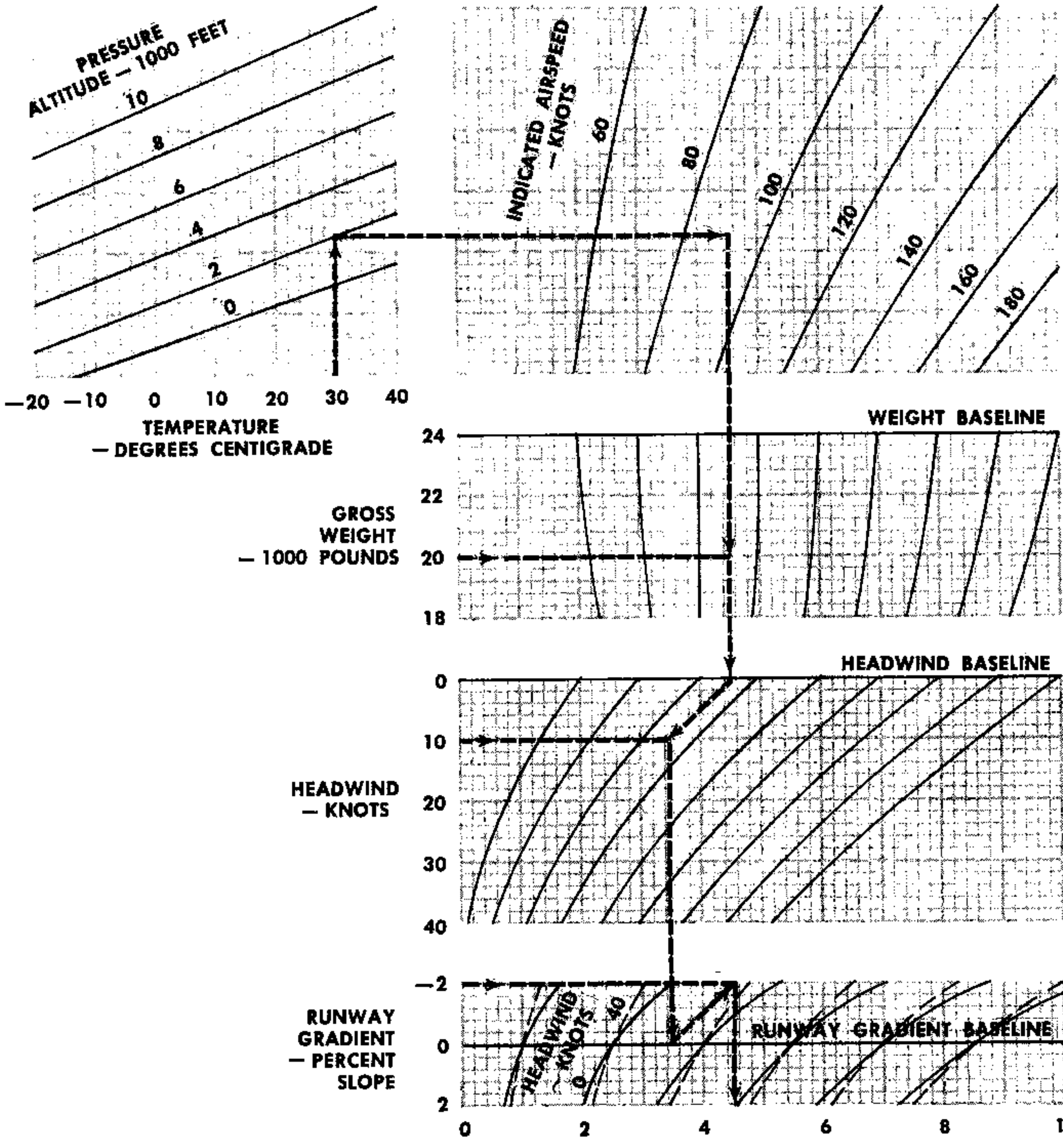


Figure 11-13. Stopping Distance – No Drag Chute

TAKEOFF REFUSAL SPEED

SPEEDBRAKES AND SPOILERS OPEN
HALF FLAPS
DRAG CHUTE DEPLOYED

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

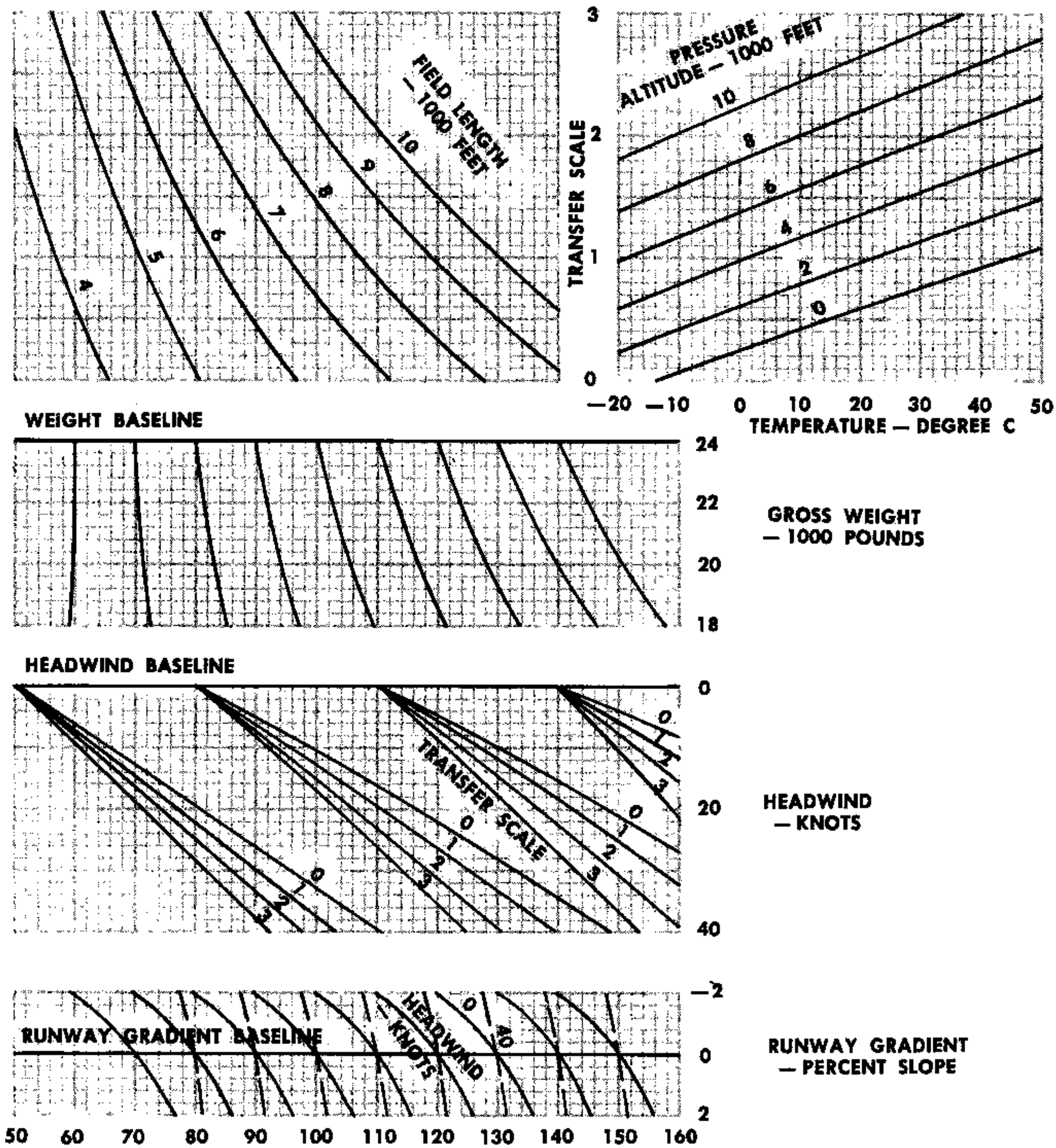


Figure 11-14. Takeoff Refusal Speed — With Drag Chute

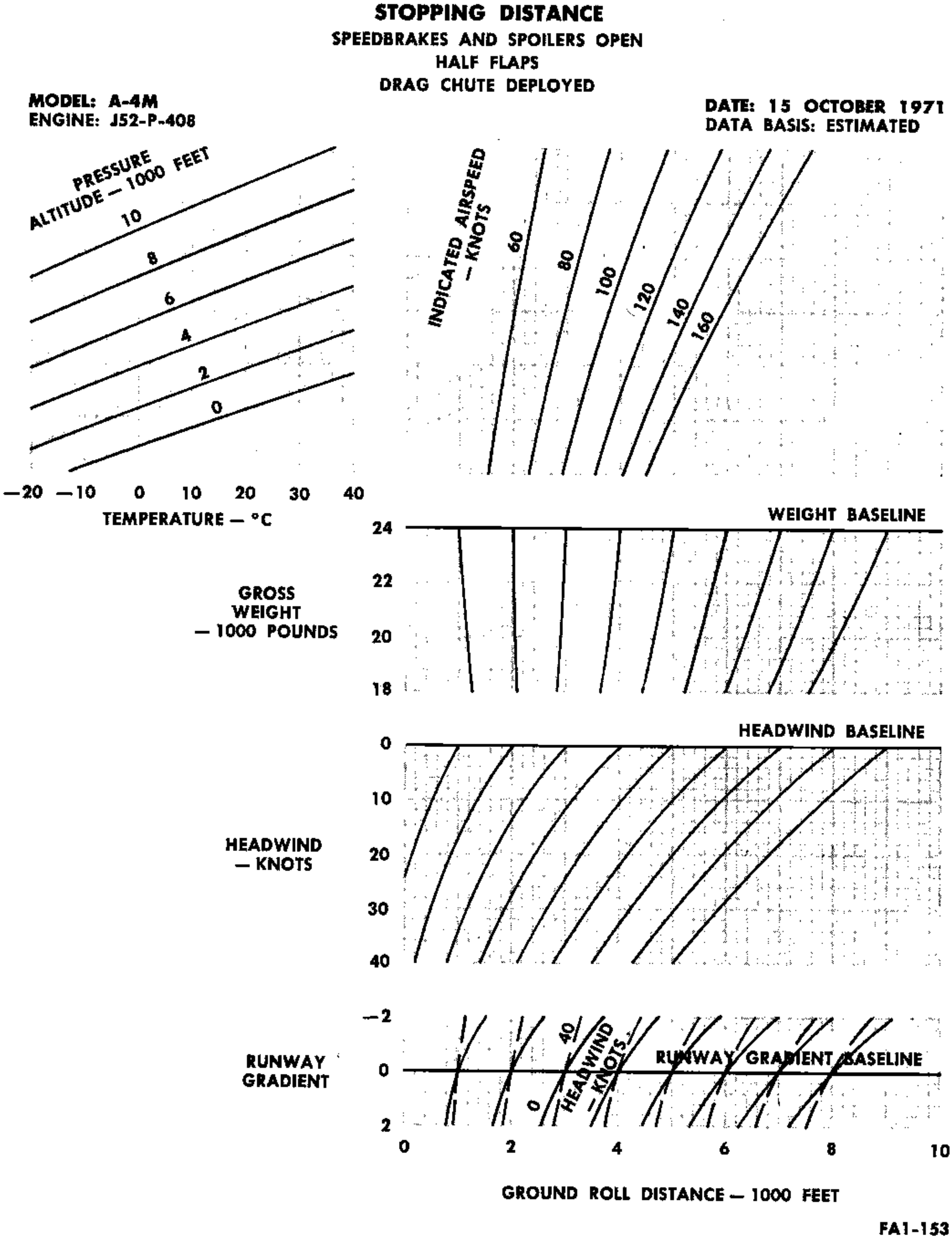


Figure 11-15. Stopping Distance – With Drag Chute

PART 3
CLIMB

CLIMB

Climb charts (figures 11-16 through 11-20) present the climb performance for all drag index configurations with the engine operating at military thrust. Climb speeds are presented in figure 11-16 as a function of drag index but independent of gross weight. The climb speed schedule is based on a minimum time to climb and does not represent a maximum range climb.

Fuel, distance, and time to climb are presented in figures 11-17 through 11-19 as a function of gross weight, pressure altitude, drag index, and temperature deviation from ICAO standard day. The data are based on the climb speed schedule shown in figure 11-16.

SAMPLE PROBLEM

Climb Speed Schedule

(For figure 11-16)

(A) Cruise altitude . . . . 30,000 ft

(B) Drag index 50

(C) Climb speed at cruise altitude . . . . . 292 KCAS

(D) Initial climb altitude . . . . 5000 ft

(E) Climb speed at initial altitude. . . . . 345 KCAS

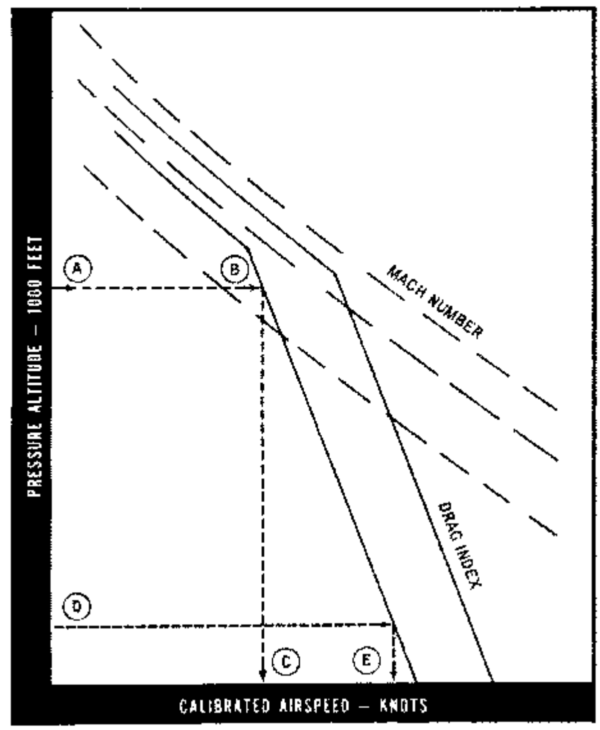
SAMPLE PROBLEM

Climb Fuel

The method of presenting data for fuel, distance, and time is identical; therefore, only one sample is shown.

(For figure 11-17)

SAMPLE CLIMB SPEED SCHEDULE



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(A) Initial gross weight . . . . 18,000 lb

(B) Cruise altitude . . . . 30,000 ft

(C) Drag index 50

(D) Temperature baseline

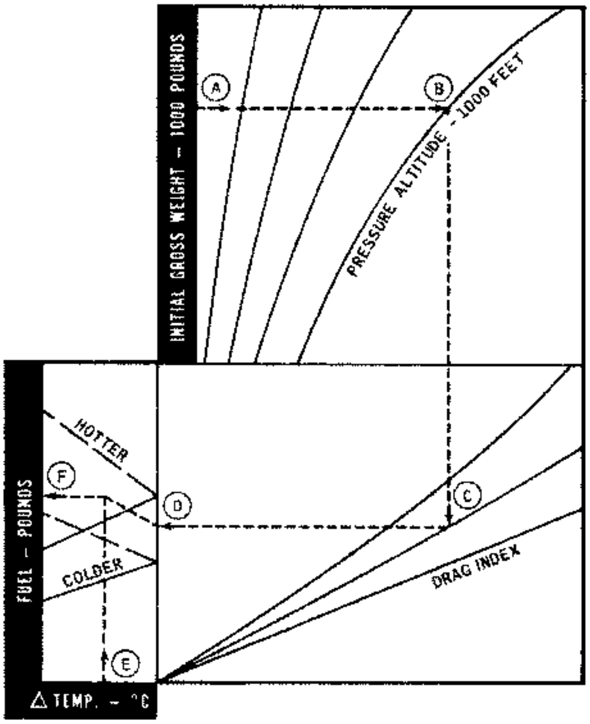
(E) Temperature deviation from ICAO standard day . . . . +10°C

(F) Fuel to climb from sea level . . . . 525 lb

COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE

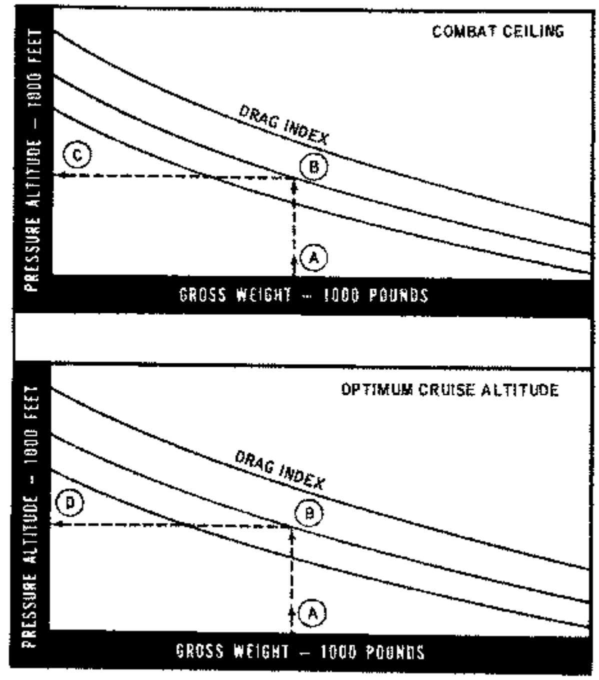
Combat ceiling, the altitude for 500-fpm rate of climb with military thrust, and optimum cruise

SAMPLE CLIMB FUEL



FA1-119

SAMPLE COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE



FA1-120

altitude, the altitude that will produce the maximum cruise distance per pound of fuel, are presented in figure 11-20. The data are presented as a function of gross weight and drag index.

SAMPLE PROBLEM

Combat Ceiling and Optimum Cruise Altitude

(For figure 11-20)

(A) Aircraft gross weight . . . . 18,000 lb

(B) Drag index 50

(C) Combat ceiling . . . . 40,400 ft

(D) Optimum cruise altitude . . . . 34,000 ft

CLIMB SPEED SCHEDULE
MILITARY THRUST

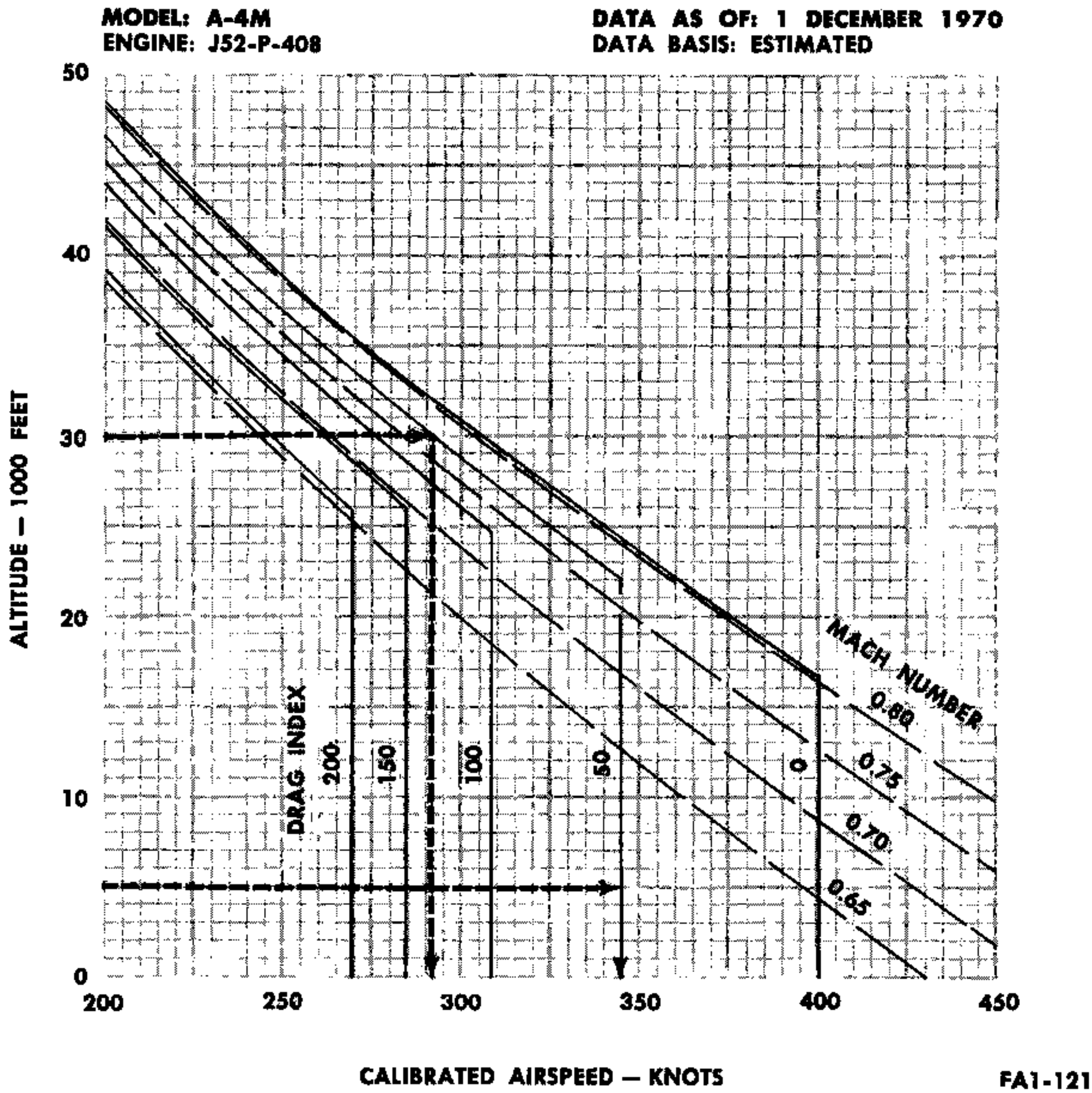
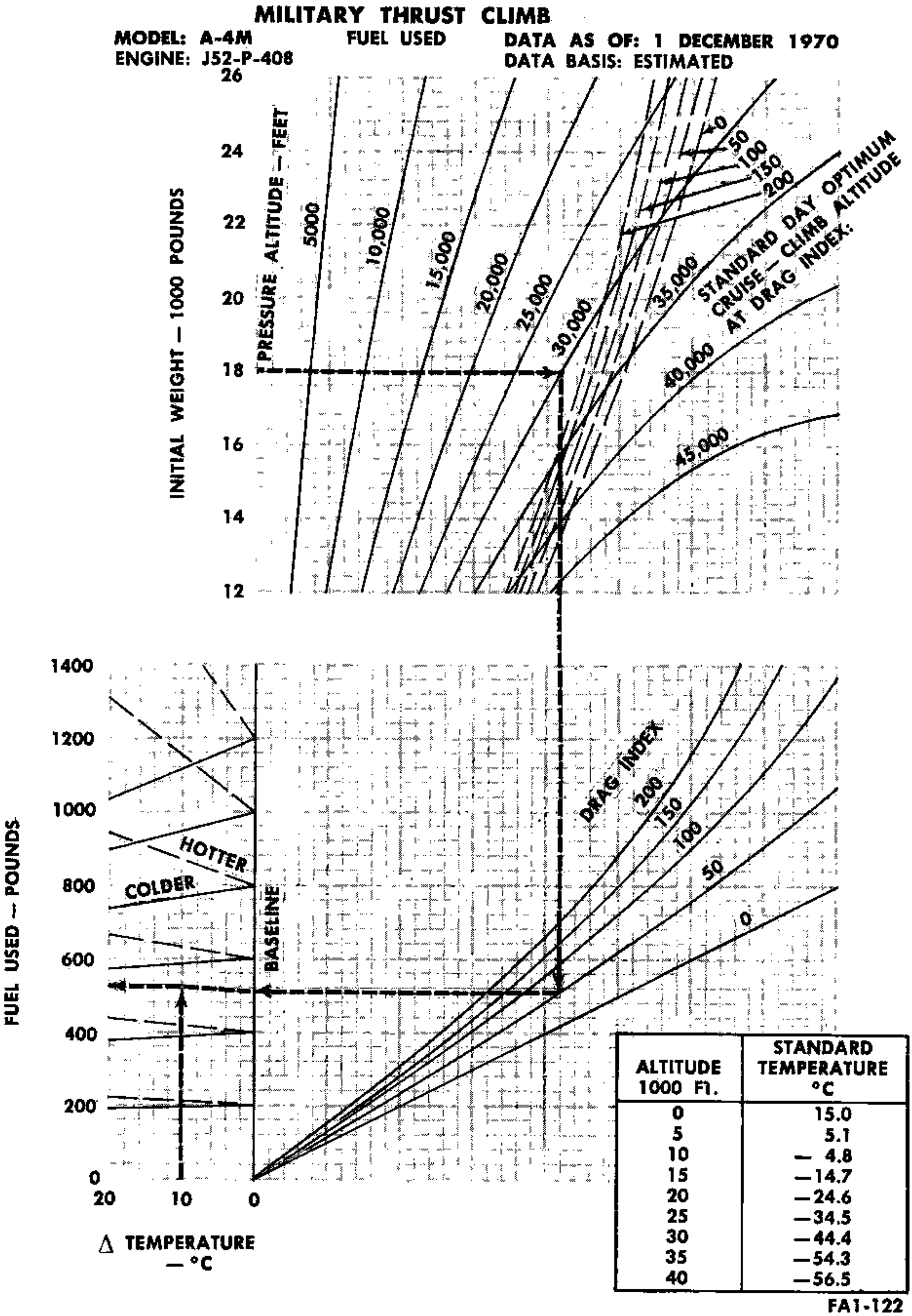


Figure 11-16. Climb Speed Schedule



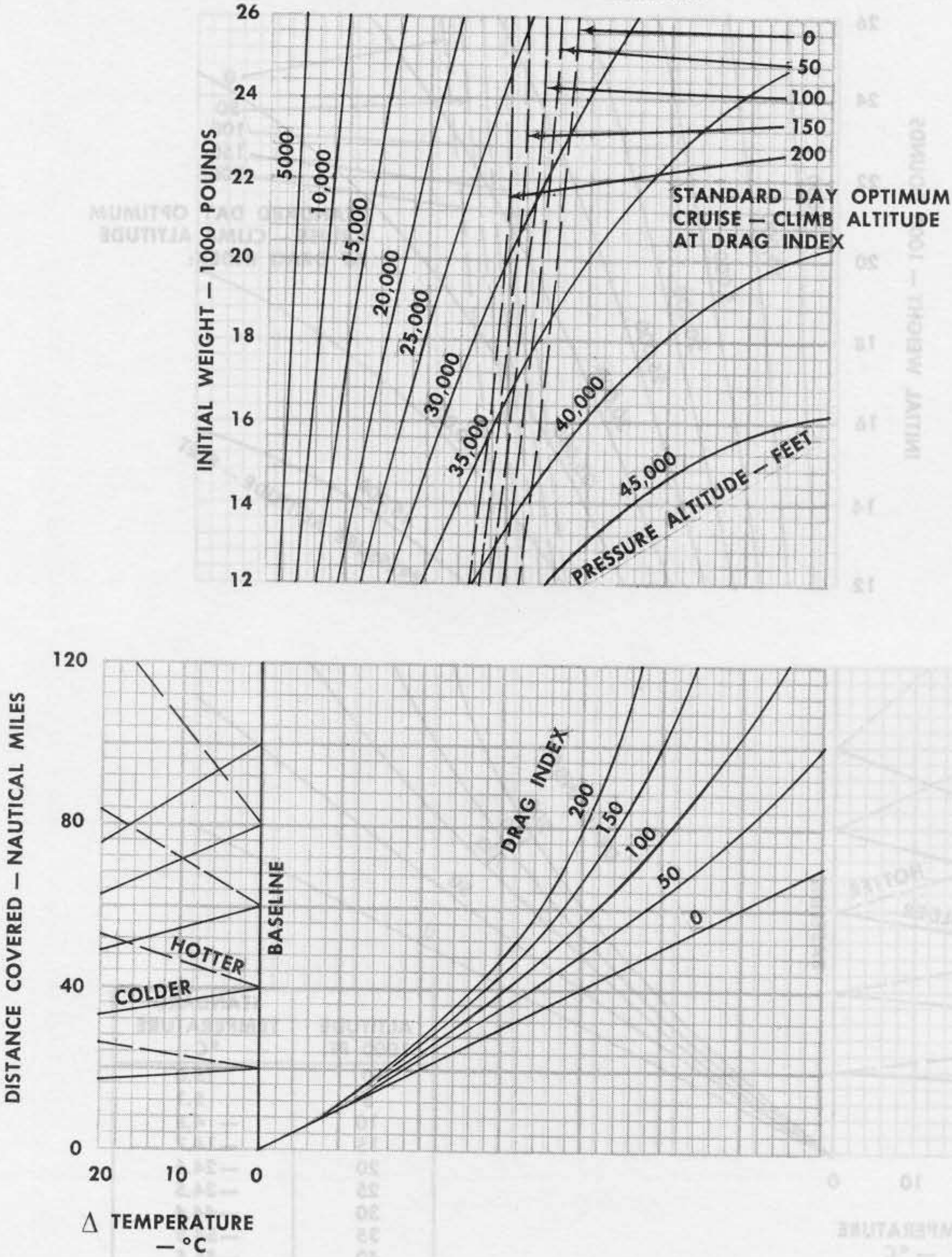
ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	— 4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5

Figure 11-17. Climb Fuel

MILITARY THRUST CLIMB
DISTANCE COVERED

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED



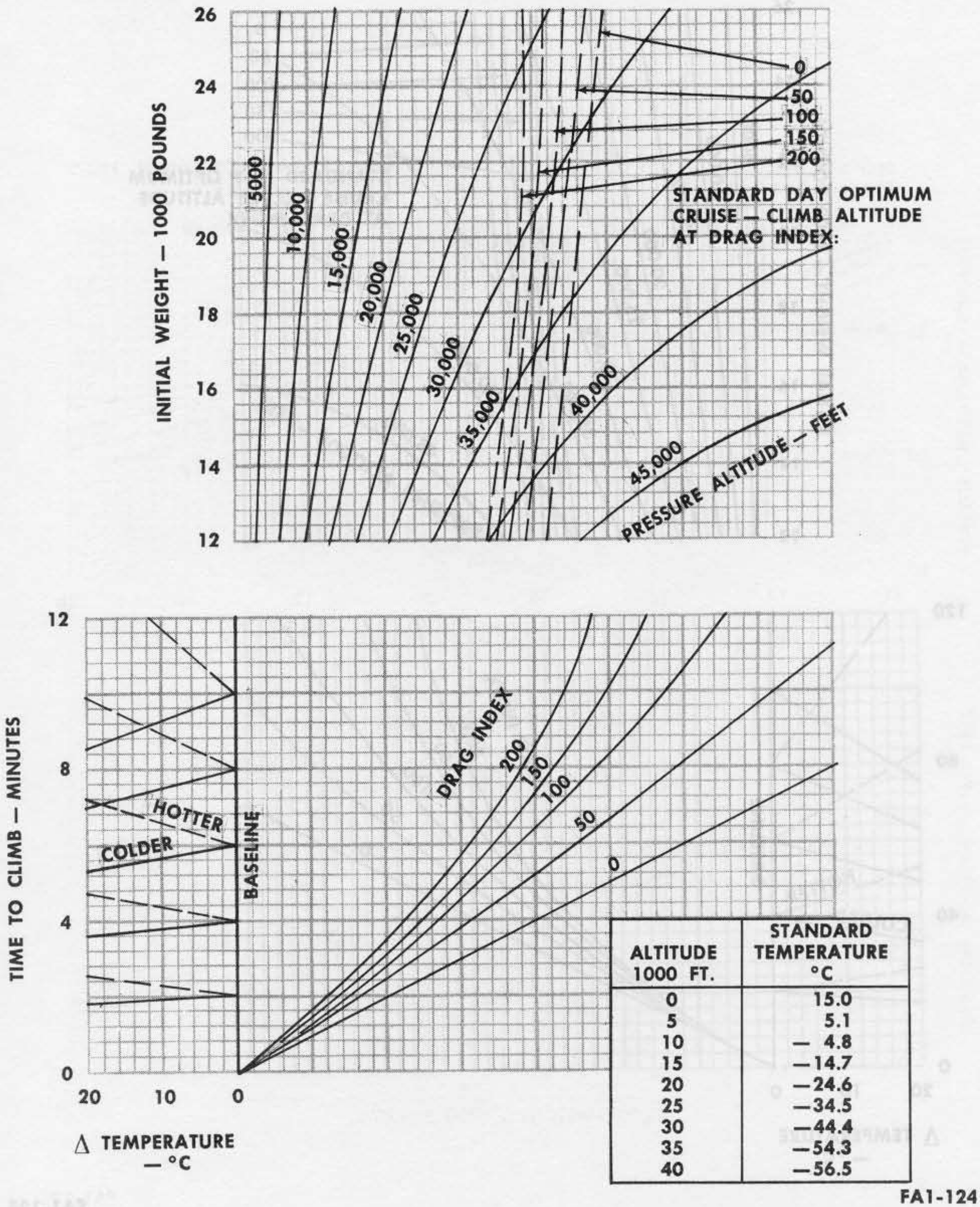
FA1-123

Figure 11-18. Climb Distance

MILITARY THRUST CLIMB
TIME TO CLIMB

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED



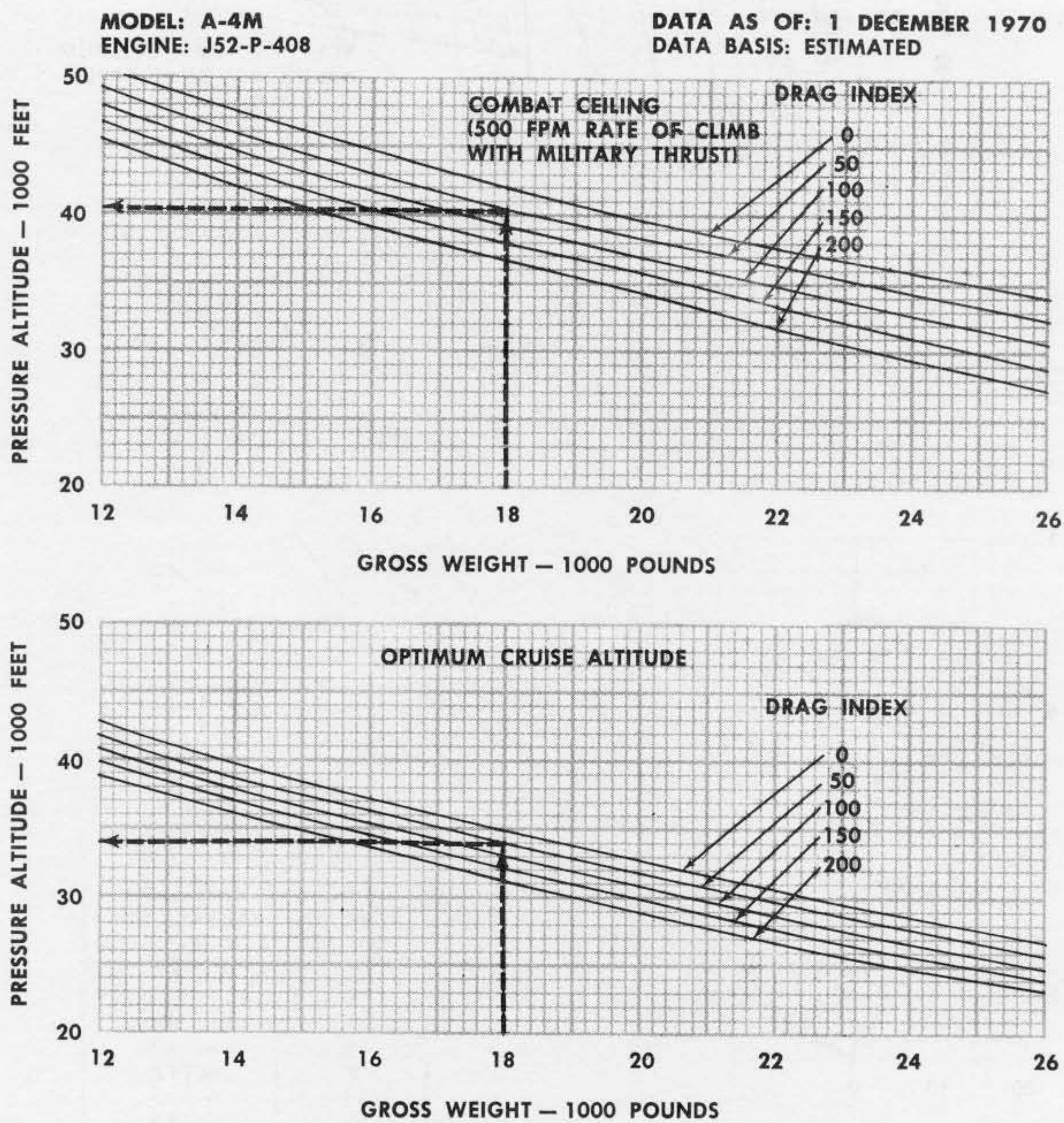
ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	− 4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

FA1-124

Figure 11-19. Climb Time

COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE

ICAO STANDARD ATMOSPHERE



FA1-125

Figure 11-20. Combat Ceiling and Optimum Cruise Altitude

PART 4
RANGE

RANGE FACTOR CHART

The Range Factor chart (figure 11-21) provides a means of correcting specific (or total) range for existing wind effects. The presented range factors consider wind speeds up to 120 knots from any relative wind direction for aircraft speeds of 350 to 500 KTAS.

USE

Determine the relative wind direction by measuring (in a clockwise direction from the fuselage reference plane) the angular difference between the aircraft heading and the true wind direction. At a given wind direction, wind speed, and aircraft true airspeed, read the range factor. Multiply the specific range by this range factor to obtain specific range as affected by wind.

FOULED DECK RANGE

Occasions arise during carrier operations when the deck becomes fouled and aircraft cannot be taken aboard until the deck is cleared. In these instances, it is desirable for the pilots and the air officer to be aware of the range capabilities of the unrecovered aircraft in order that an immediate decision can be made concerning the proper course of action. Should the estimated "clear deck" time be beyond the endurance time of the aircraft, then the aircraft must either depart immediately for the beach or land aboard the ready deck of another carrier, if available. However, if it is either desirable or mandatory that the aircraft orbit until the deck is clear, it is necessary that the pilot fully understand the proper procedure to obtain the maximum endurance with the available fuel. The Fouled Deck Endurance chart is shown in figure 11-32.

The Fouled Deck Range chart (figure 11-22) tabulates the range distances obtainable for various quantities of fuel on board at both the initial altitude and the optimum, best range altitude. The aircraft configuration consists of four empty wing pylons plus guns, with a total drag index of 33. Climb speeds and airspeeds for maximum range are included in the chart as well as letdown instructions.

The time at which letdown should be initiated is given in terms of fuel on board, and represents the fuel required to conduct a maximum range descent from altitude to sea level. A 250-pound fuel allowance is included for approach and landing.

Bingo Range and Bingo Range - Gear Down charts are presented in figures 11-23 and 11-24 respectively. These charts are provided for an aircraft configuration consisting of four wing pylons, guns, and two 300-gallon external fuel tanks, with a total drag index of 61 with gear up and 391 with gear down. The procedures for the use of these charts are identical to those for the Fouled Deck Range chart; however, an 800-pound fuel allowance is included in Bingo Range and Bingo Range - Gear Down charts for approach and landing.

LONG RANGE CRUISE

The Long Range Cruise charts are shown in figures 11-25 and 11-26. Long range cruise is defined as the highest Mach number which will result in 99 percent of the maximum miles per pound of fuel. Essentially, long range cruise permits an increase of 20 to 35 knots in airspeed for an increase of 1 percent in fuel consumption. To use the Long Range Cruise charts, average gross weight, drag index, ambient temperature, and desired cruise altitude must be known for a given cruise leg. With these known conditions, long range cruise Mach number, engine power setting in terms of EPR, and specific range (nautical miles per pound of fuel) can be determined. The optimum long range cruise altitudes are also shown on figures 11-25 and 11-26, and are the altitudes that will produce the maximum miles per pound of fuel at the long range cruise condition.

SAMPLE PROBLEM

Long Range Cruise—Mach Number and EPR

(For figure 11-25)

(A) Average gross weight. . . . . . . 18,000 lb

(B) Cruise altitude. . . . . 25,000 ft

Relative Wind – Degrees	KTAS	Wind Speed – Knots				
		40	60	80	100	120
0° Headwind	350	0.886	0.829	0.772	0.714	0.657
	400	0.900	0.850	0.800	0.750	0.700
	450	0.911	0.867	0.822	0.778	0.733
	500	0.920	0.880	0.844	0.800	0.760
	550	0.927	0.891	0.855	0.818	0.782
30°	350	0.899	0.848	0.796	0.742	0.688
	400	0.912	0.867	0.822	0.776	0.729
	450	0.922	0.882	0.842	0.801	0.760
	500	0.930	0.894	0.858	0.822	0.785
	550	0.936	0.904	0.871	0.839	0.805
60°	350	0.938	0.903	0.866	0.824	0.784
	400	0.946	0.917	0.885	0.852	0.816
	450	0.953	0.927	0.889	0.870	0.840
	500	0.958	0.935	0.910	0.885	0.858
	550	0.962	0.941	0.919	0.897	0.873
90°	350	0.994	0.985	0.974	0.959	0.941
	400	0.995	0.989	0.980	0.969	0.955
	450	0.996	0.991	0.984	0.975	0.964
	500	0.997	0.992	0.987	0.980	0.971
	550	0.997	0.994	0.989	0.984	0.976
120°	350	1.062	1.097	1.134	1.176	1.216
	400	1.054	1.083	1.115	1.148	1.184
	450	1.047	1.073	1.101	1.130	1.160
	500	1.042	1.065	1.090	1.115	1.142
	550	1.038	1.059	1.081	1.103	1.127
150°	350	1.101	1.152	1.205	1.258	1.312
	400	1.088	1.133	1.178	1.224	1.271
	450	1.078	1.118	1.158	1.199	1.240
	500	1.070	1.106	1.142	1.178	1.215
	550	1.064	1.096	1.129	1.162	1.195
180° Tailwind	350	1.114	1.172	1.228	1.286	1.343
	400	1.100	1.150	1.200	1.250	1.300
	450	1.089	1.133	1.178	1.222	1.267
	500	1.080	1.120	1.160	1.200	1.240
	550	1.073	1.109	1.146	1.182	1.218

Figure 11-21. Range Factor Chart

FOULED DECK RANGE

Drag Index = 33
Aircraft Weight (Less Fuel) = 12,039 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel for Landing = 250 Pounds

Model: A-4M
Engine: J52-P-408

Date as of: 1 December 1970
Data Bases: Estimated

Fuel On Board – Pounds	If You Are at Sea Level			If You Are at 10,000 Feet			If You Are at 20,000 Feet		
	Range at Sea Level	Range at Optimum Altitude	Optimum Altitude	Range at 10,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 20,000 Feet	Range at Optimum Altitude	Optimum Altitude
	NMI	NMI	Feet	NMI	NMI	Feet	NMI	NMI	Feet
2300	206	493	40,000	290	518	40,000	396	543	40,000
1900	167	393	40,000	236	419	40,000	324	444	40,000
1700	147	342	40,000	209	368	40,000	288	392	40,000
1500	127	291	40,000	182	316	40,000	251	341	40,000
1300	107	238	40,000	155	264	40,000	215	288	40,000
1100	86	185	40,000	128	211	40,000	178	235	40,000
900	66	132	40,000	100	157	40,000	141	181	40,000
700	46	80	30,000	73	103	40,000	104	127	40,000
500	26	37	15,000	45	53	25,000	67	73	30,000
	If You Are at 30,000 Feet			**If You Are at 35,000 Feet**			**If You Are at 40,000 Feet**		
	Range at 30,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 35,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 40,000 Feet	Range at Optimum Altitude	Optimum Altitude
	NMI	NMI	Feet	NMI	NMI	Feet	NMI	NMI	Feet
2300	499	562	40,000	548	571	40,000	579	579	40,000
1900	410	462	40,000	452	471	40,000	479	479	40,000
1700	365	411	40,000	403	420	40,000	428	428	40,000
1500	320	360	40,000	353	368	40,000	377	377	40,000
1300	274	307	40,000	303	315	40,000	324	324	40,000
1100	228	254	40,000	253	262	40,000	271	271	40,000
900	182	201	40,000	202	209	40,000	217	217	40,000
700	135	146	40,000	150	154	40,000	163	163	40,000
500	88	91	40,000	98	99	40,000	108	108	40,000

Pressure Altitude	Climb Speed Military Thrust		Cruise Speed	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown from Altitude with Fuel Remaining
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds
Sea Level	365		270	185	250
5,000	365		265	185	274
10,000	365		260	185	292
15,000	365		255	185	307
20,000	365		250	185	322
25,000		0.783	245	185	336
30,000		0.783	235	185	349
35,000		0.783	220	185	362
40,000		0.783	210	185	375
45,000		0.783	200	185	387

Figure 11-22. Fouled Deck Range

BINGO RANGE

Drag Index = 61
Aircraft Weight (Less Fuel) = 12,437 Pounds
All Pylons, Guns (No Ammo), and Two 300-Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: A-4M
Engine: J52-P-408

Data as of: 1 December 1970
Data Basis: Estimated

Fuel On Board – Pounds	If You Are at Sea Level			If You Are at 10,000 Feet			If You Are at 20,000 Feet		
	Range at Sea Level	Range at Optimum Altitude	Optimum Altitude	Range at 10,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 20,000 Feet	Range at Optimum Altitude	Optimum Altitude
	NMI	NMI	Feet	NMI	NMI	Feet	NMI	NMI	Feet
2700	179	400	40,000	252	424	40,000	341	448	40,000
2500	161	356	40,000	227	380	40,000	308	404	40,000
2300	142	311	40,000	202	336	40,000	275	359	40,000
2100	123	265	40,000	177	290	40,000	241	314	40,000
1900	105	220	40,000	151	244	40,000	208	268	40,000
1700	86	173	40,000	126	197	40,000	174	221	40,000
1500	67	125	40,000	100	150	40,000	140	174	40,000
1300	48	79	30,000	75	102	40,000	106	126	40,000
1100	29	41	15,000	49	58	25,000	72	79	35,000

Fuel On Board – Pounds	If You Are at 30,000 Feet			If You Are at 35,000 Feet			If You Are at 40,000 Feet		
	Range at 30,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 35,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 40,000 Feet	Range at Optimum Altitude	Optimum Altitude
	NMI	NMI	Feet	NMI	NMI	Feet	NMI	NMI	Feet
2700	428	467	40,000	466	474	40,000	483	483	40,000
2500	387	423	40,000	422	431	40,000	439	439	40,000
2300	346	378	40,000	378	386	40,000	395	395	40,000
2100	305	333	40,000	333	341	40,000	350	350	40,000
1900	263	287	40,000	289	295	40,000	304	304	40,000
1700	221	240	40,000	243	249	40,000	257	257	40,000
1500	179	193	40,000	197	202	40,000	210	210	40,000
1300	137	145	40,000	151	154	40,000	162	162	40,000
1100	94	97	40,000	104	105	40,000	114	114	40,000

Pressure Altitude	Climb Speed Military Thrust		Cruise Speed	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown from Altitude with Fuel Remaining
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds
Sea Level	340		275	187	800
5,000	340		270	187	823
10,000	340		265	187	839
15,000	340		260	187	853
20,000	340		255	187	867
25,000		0.764	250	187	880
30,000		0.764	240	187	892
35,000		0.764	225	187	904
40,000		0.764	210	187	915
45,000		0.764	200	187	927

Figure 11-23. Bingo Range

BINGO RANGE

Gear Down

Drag Index = 391
Aircraft Weight (Less Fuel) 12,437 Pounds
All Pylons, Guns (No Ammo), and Two 300-Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: A-4M
Engine: J52-P-408

Data as of: 1 December 1970
Data Basis: Estimated

Fuel On Board – Pounds	If You Are at Sea Level			If You Are at 10,000 Feet		
	Range at Sea Level	Range at Optimum Altitude	Optimum Altitude	Range at 10,000 Feet	Range at Optimum Altitude	Optimum Altitude
	NMI	NMI	Feet	NMI	NMI	Feet
2700	120	206	30,000	164	223	30,000
2500	108	183	30,000	148	200	30,000
2300	95	160	30,000	131	176	30,000
2100	83	136	30,000	115	153	30,000
1900	70	113	30,000	99	129	30,000
1700	57	89	30,000	82	105	30,000
1500	45	65	25,000	66	81	30,000
1300	32	43	20,000	49	57	25,000
1100	19	23	10,000	33	35	20,000

Fuel On Board – Pounds	If You Are at 20,000 Feet			If You Are at 30,000 Feet		
	Range at 20,000 Feet	Range at Optimum Altitude	Optimum Altitude	Range at 30,000 Feet	Range at Optimum Altitude	Optimum Altitude
	NMI	NMI	Feet	NMI	NMI	Feet
2700	215	238	30,000	252	252	30,000
2500	195	215	30,000	229	229	30,000
2300	174	192	30,000	206	206	30,000
2100	153	169	30,000	182	182	30,000
1900	132	145	30,000	158	158	30,000
1700	111	121	30,000	134	134	30,000
1500	90	97	30,000	110	110	30,000
1300	69	72	30,000	85	85	30,000
1100	47	48	25,000	60	60	30,000

Pressure Altitude	Climb Speed Military Thrust	Cruise Speed	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	KCAS	KCAS	Pounds
Sea Level	240	215	160	800
5,000	240	210	160	815
10,000	240	205	160	830
15,000	240	205	160	840
20,000	230	200	160	850
25,000	205	195	160	860
30,000	185	185	160	870

Figure 11-24. Bingo Range – Gear Down

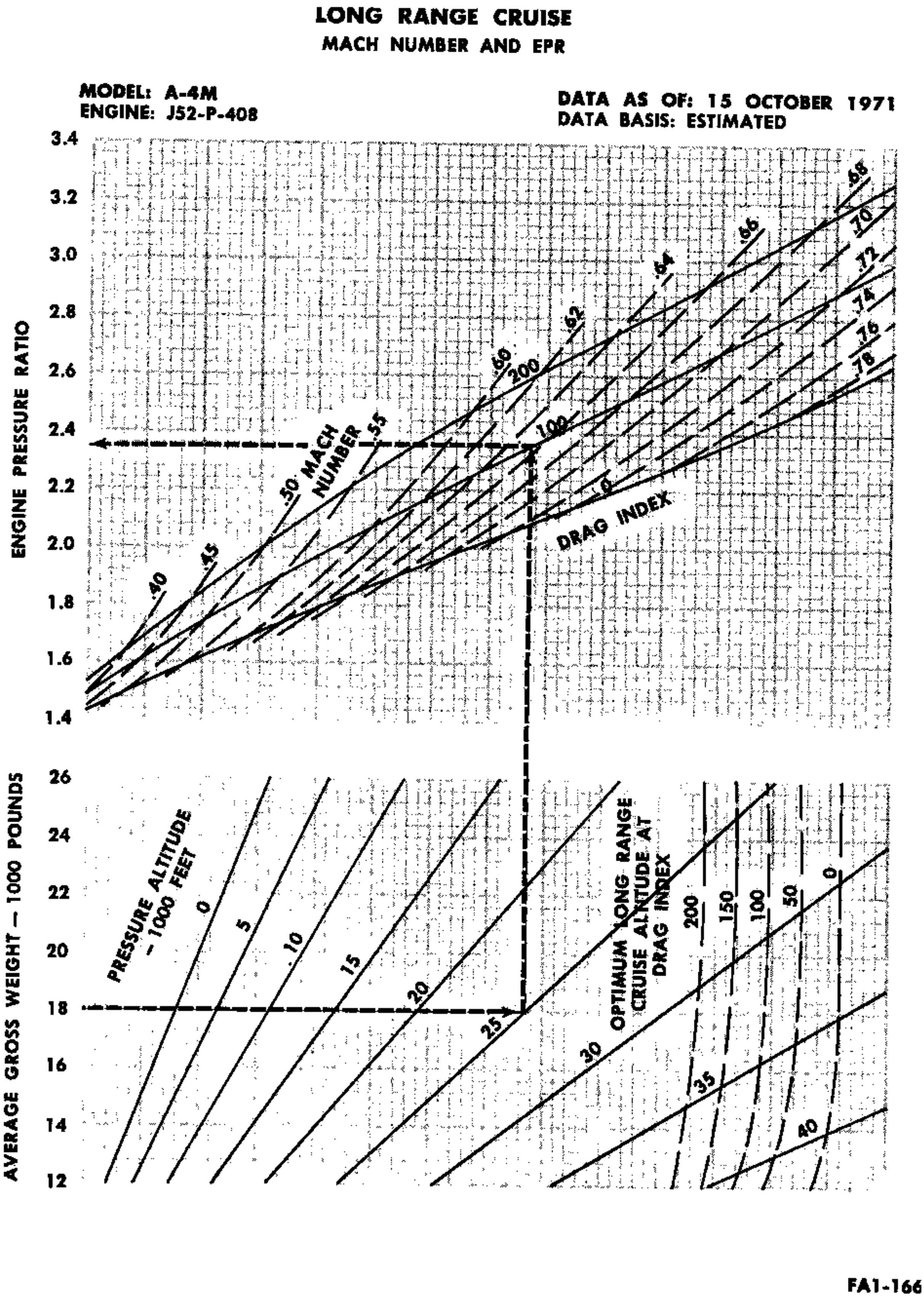


Figure 11-25. Long Range Cruise—Mach Number and EPR

LONG RANGE CRUISE

NAUTICAL MILES PER POUND OF FUEL

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

PRESSURE ALTITUDE — 1000 FT	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	—4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5

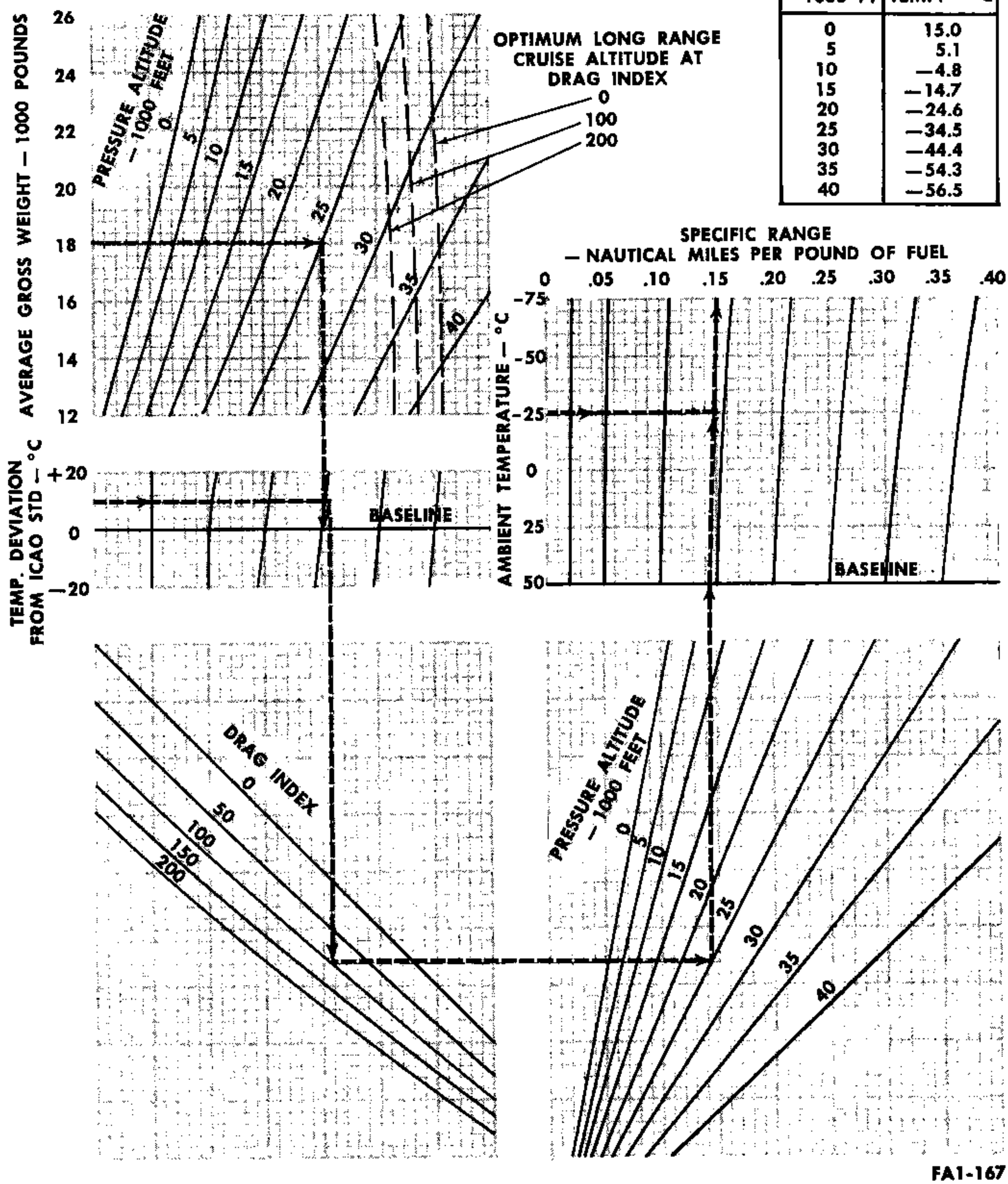


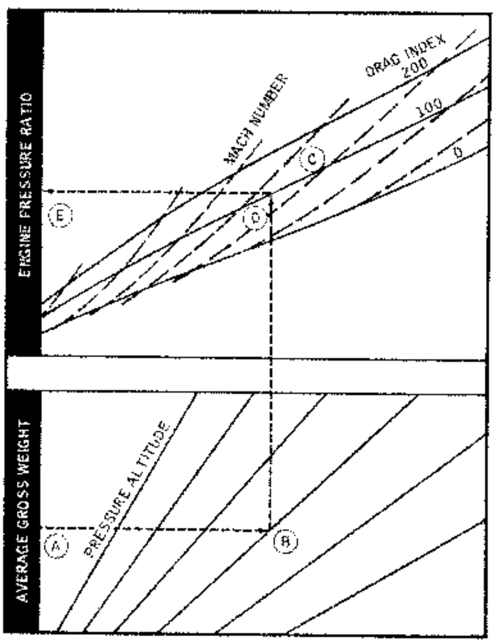
Figure 11-26. Long Range Cruise—Nautical Miles per Pound of Fuel

(C) Drag index 100

(D) Mach number 0.655

(E) EPR 2.35

SAMPLE LONG RANGE CRUISE – MACH NUMBER AND EPR



FA1-154

Long Range Cruise—Nautical Miles per Pound of Fuel

(For figure 11-26)

(F) Average gross weight . . . . 18,000 lb

(G) Pressure altitude . . . . 25,000 ft

(H) Temperature deviation from ICAO standard (Ambient temperature = -24.5°C) . . . . +10°C

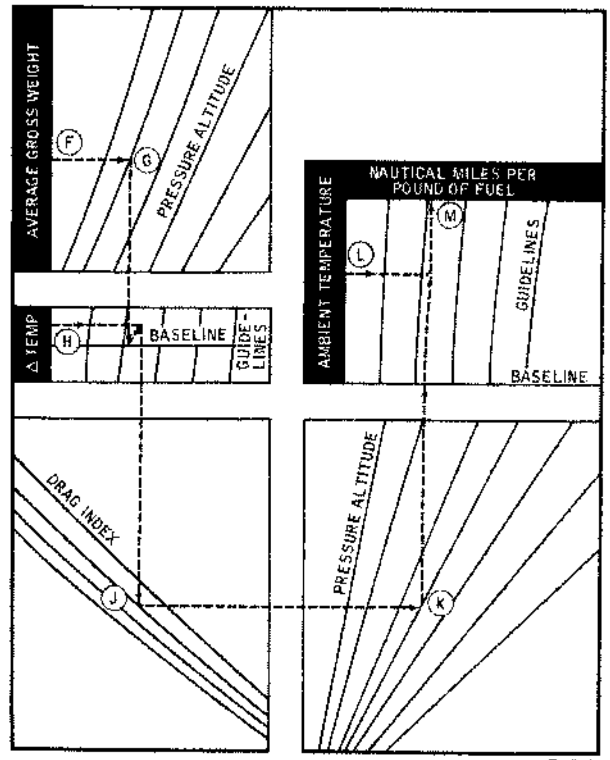
(J) Drag index 100

(K) Pressure altitude . . . . 25,000 ft

(L) Ambient temperature . . . . -24.5°C

(M) Nautical miles per pound of fuel . . . 0.150

SAMPLE LONG RANGE CRUISE– NAUTICAL MILES PER POUND OF FUEL



FA1-155

MAXIMUM RANGE CRUISE

Maximum Range Cruise charts, shown in figures 11-27, 11-28, and 11-29, present the necessary mission planning data to set up maximum range cruise schedules for a constant cruise altitude. To use the maximum range charts, the average gross weight, cruise altitude, drag index, ambient air temperature, relative wind, and ground distance to be covered must be known. It is then possible to determine true Mach number, true airspeed, time enroute, nautical miles per pound of fuel, fuel flow, and total fuel required. Optimum cruise altitude (altitude for best range) lines are superimposed on the pressure altitude plot.

SAMPLE PROBLEM

Maximum Range Cruise—Time and Speed

(For figure 11-27)

(A) Average gross weight for cruise leg . . . . 18,000 lb

MAXIMUM RANGE CRUISE
TIME AND SPEED

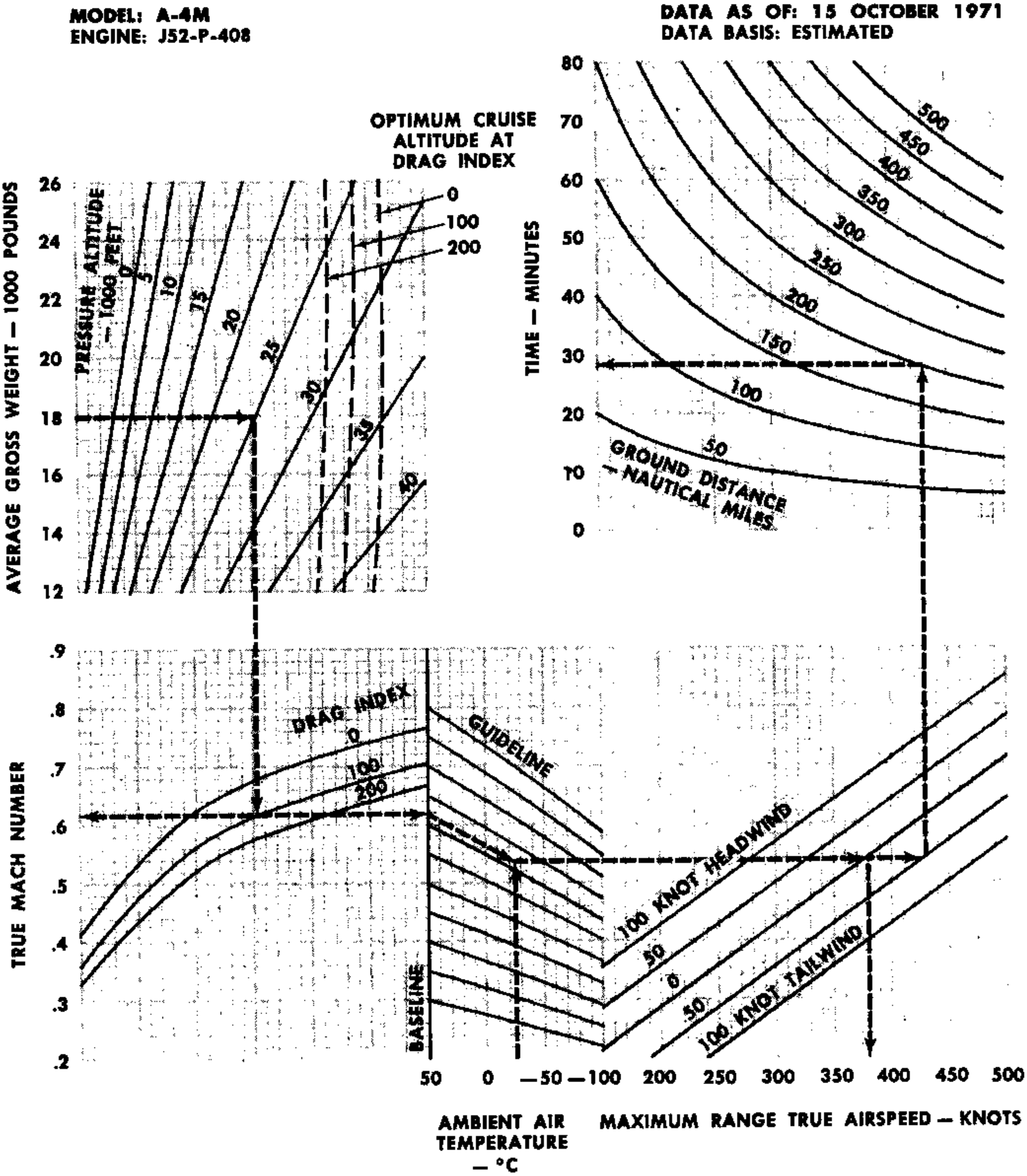


Figure 11-27. Maximum Range Cruise—Time and Speed

MAXIMUM RANGE CRUISE

NAUTICAL MILES PER POUND OF FUEL

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

PRESSURE ALTITUDE — 1000 FT.	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	−4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

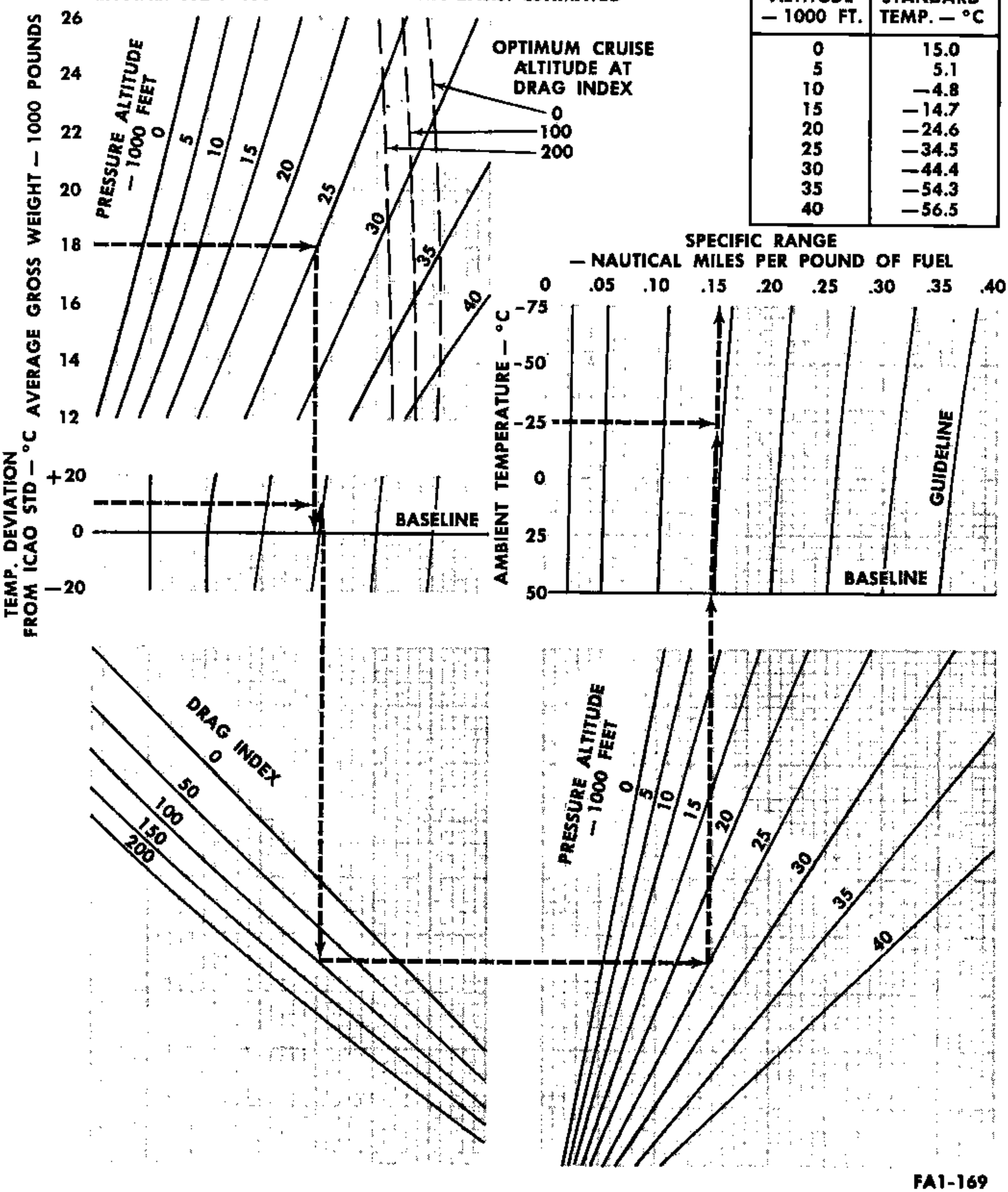


Figure 11-28. Maximum Range Cruise—Nautical Miles per Pound of Fuel

MAXIMUM RANGE CRUISE
FUEL

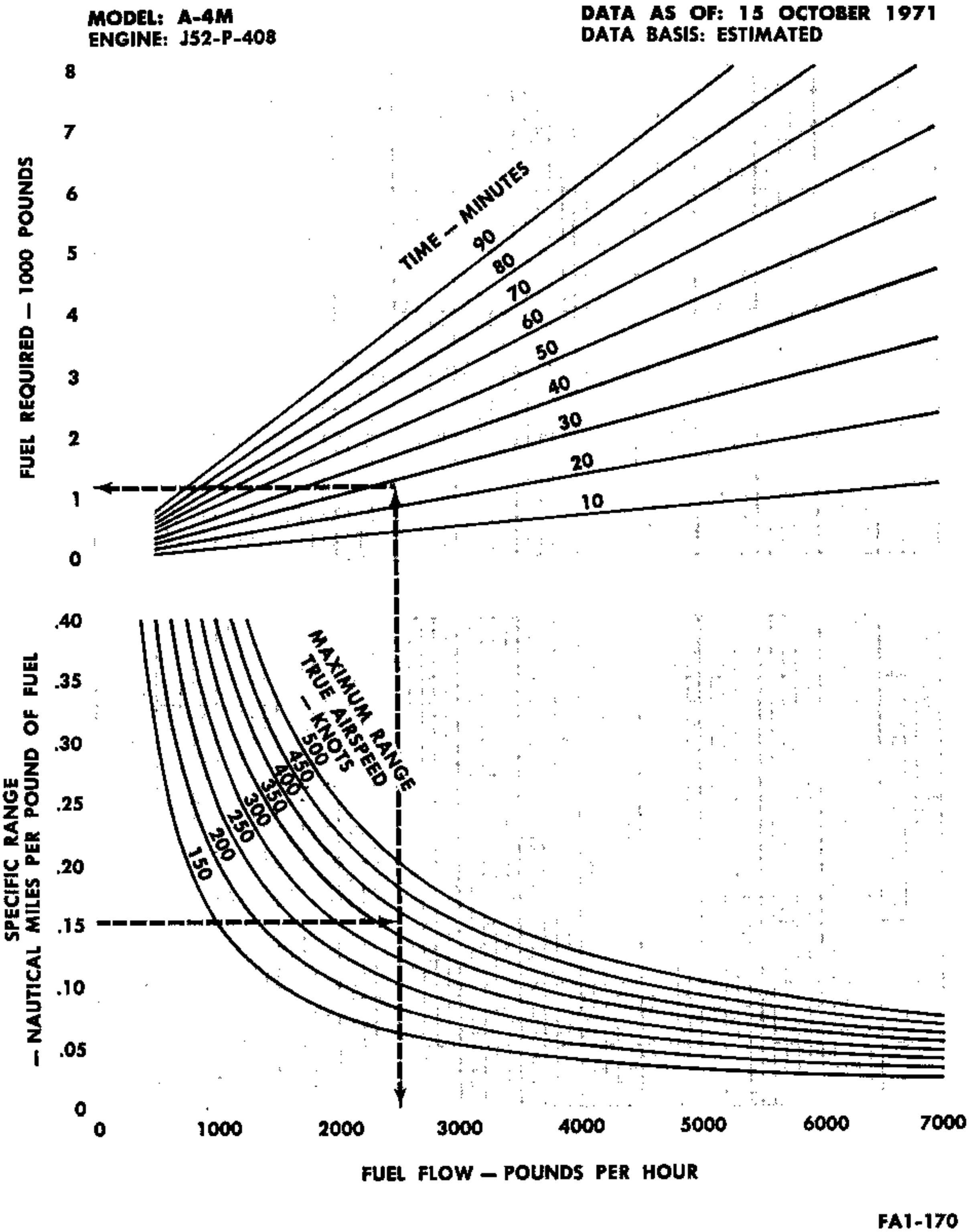


Figure 11-29. Maximum Range Cruise—Fuel

(B) Cruise altitude . . . . 25,000 ft

(C) Drag index. 100

(D) True Mach number 0.615

(E) Ambient air temperature at cruise altitude (ICAO standard temperature +10°C). . . . . -24.5°C

(F) True airspeed . . . . 380 kn

(G) Tailwind. . . . . 50 kn

(H) Ground distance . . . . 200 NMI

(J) Time . . . . 28.0 min

Maximum Range Cruise—Nautical Miles per Pound of Fuel

(For figure 11-28)

(K) Average gross weight . . . . . . 18,000 lb

(L) Cruise altitude . . . . 25,000 ft

(M) Temperature deviation from ICAO standard (Ambient temperature = -24.5°C) . . . . . +10°C

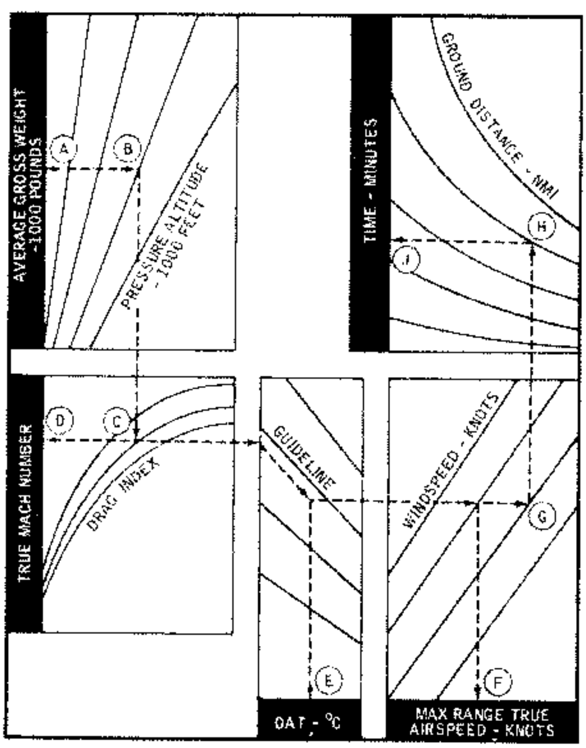
(N) Drag index. 100

(P) Cruise altitude . . . . 25,000 ft

(Q) Ambient temperature . . . . . . -24.5°C

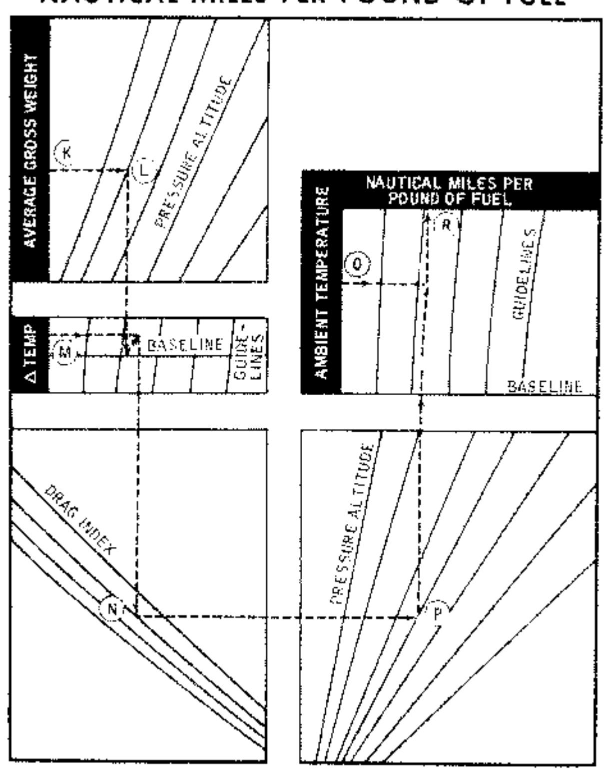
(R) Nautical miles per pound of fuel . . 0.152 NMI/lb

SAMPLE MAXIMUM RANGE CRUISE—TIME AND SPEED



FA1-156

SAMPLE MAXIMUM RANGE CRUISE— NAUTICAL MILES PER POUND OF FUEL



FA1-157

Maximum Range Cruise—Fuel

(For figure 11-29)

(S) Nautical miles per pound of fuel . . . . 0.152 NMI/lb

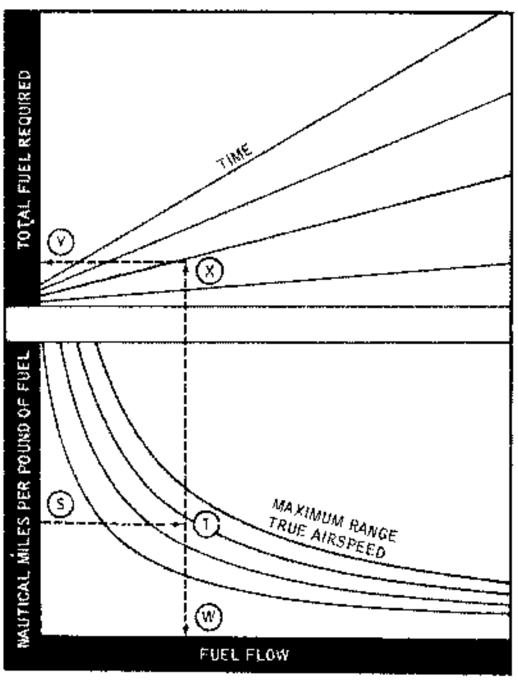
(T) Maximum range true airspeed . . 380 KTAS

(W) Fuel flow . . . . 2500 lb/hr

(X) Time . . . . 28.0 min

(Y) Total fuel required . . . . 1170 lb

SAMPLE MAXIMUM RANGE CRUISE — FUEL



FA1-158

NAUTICAL MILES PER POUND OF FUEL

Nautical Miles per Pound of Fuel charts (figure 11-30, sheets 1 through 6) present cruise data throughout the gross weight, airspeed, and drag index range of the aircraft. These data are presented for use when cruise data are required for speed conditions other than maximum range or long range cruise. To use the Nautical Miles per Pound of Fuel charts, the average gross weight, pressure altitude, cruise Mach number, drag index, and ambient air temperature must be known. It is then possible to determine true airspeed, nautical miles per pound of fuel, fuel flow, and engine pressure ratio. It is recommended that engine pressure ratio be used as the primary measurement of engine thrust output rather than fuel flow when setting up cruise schedules.

SAMPLE PROBLEM

Nautical Miles per Pound of Fuel

(For figure 11-30, sheet 1)

(A) Average gross weight. . . . . . . 14,000 lb

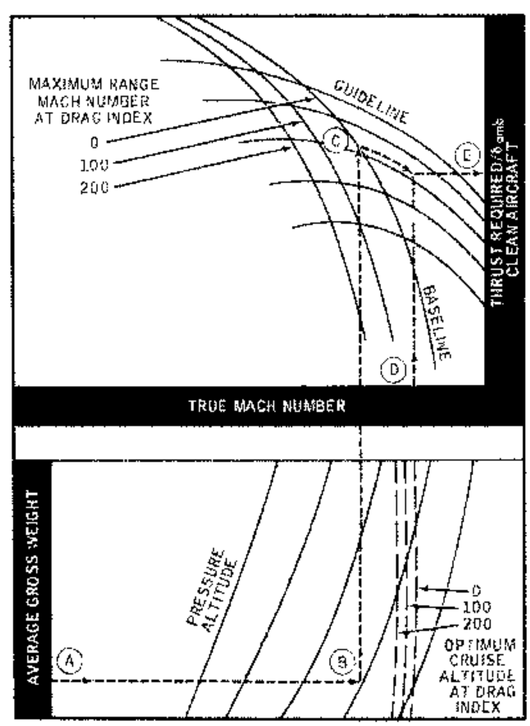
(B) Cruise pressure altitude . . . . . 30,000 ft

(C) Drag index = 0 (baseline)

(D) Cruise Mach number 0.75

(E) Thrust required/δ amb – clean aircraft 6225

SAMPLE NAUTICAL MILES PER POUND OF FUEL



FA1-159

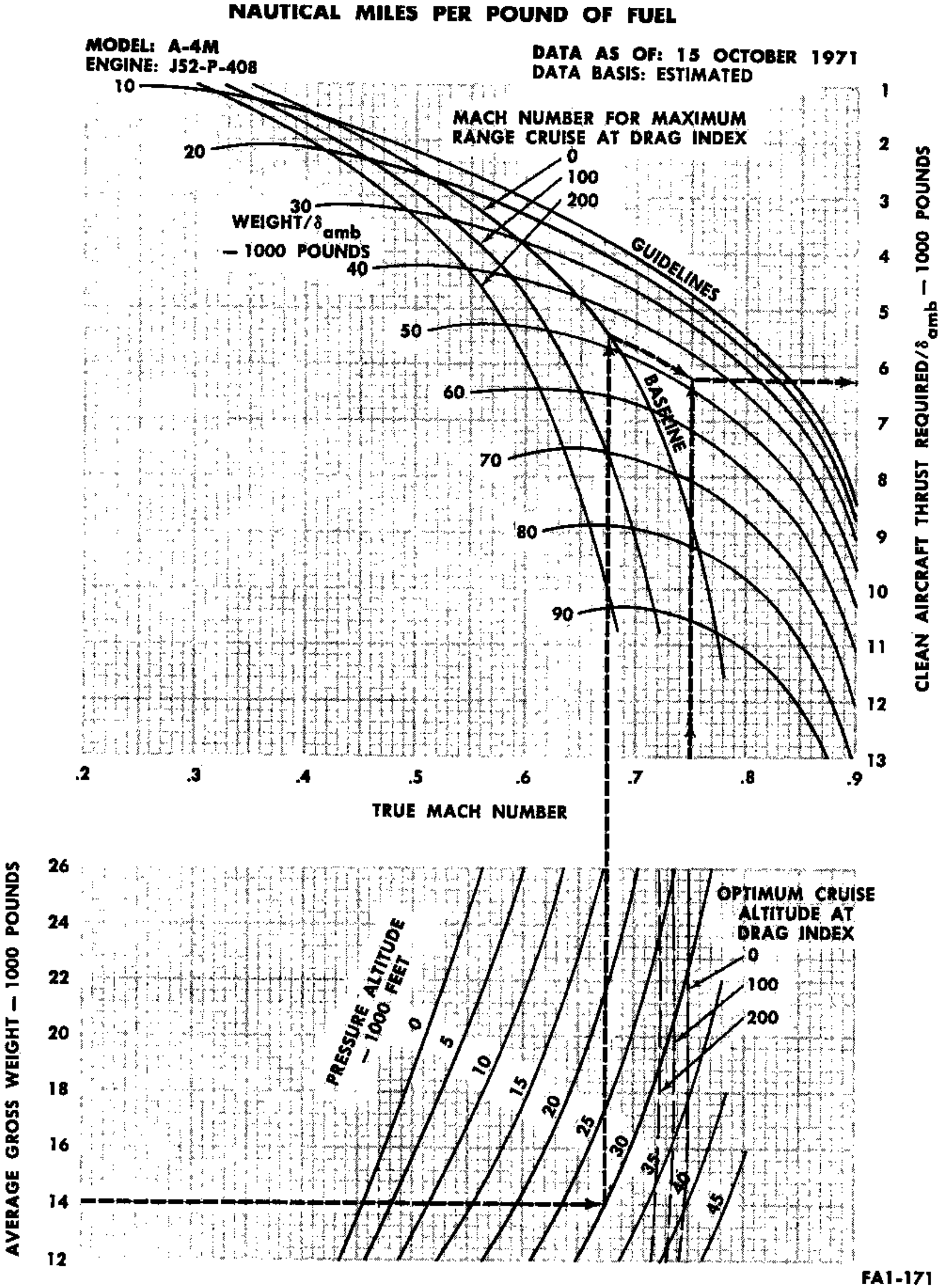


Figure 11-30. Nautical Miles per Pound of Fuel (Sheet 1)

NAUTICAL MILES PER POUND OF FUEL

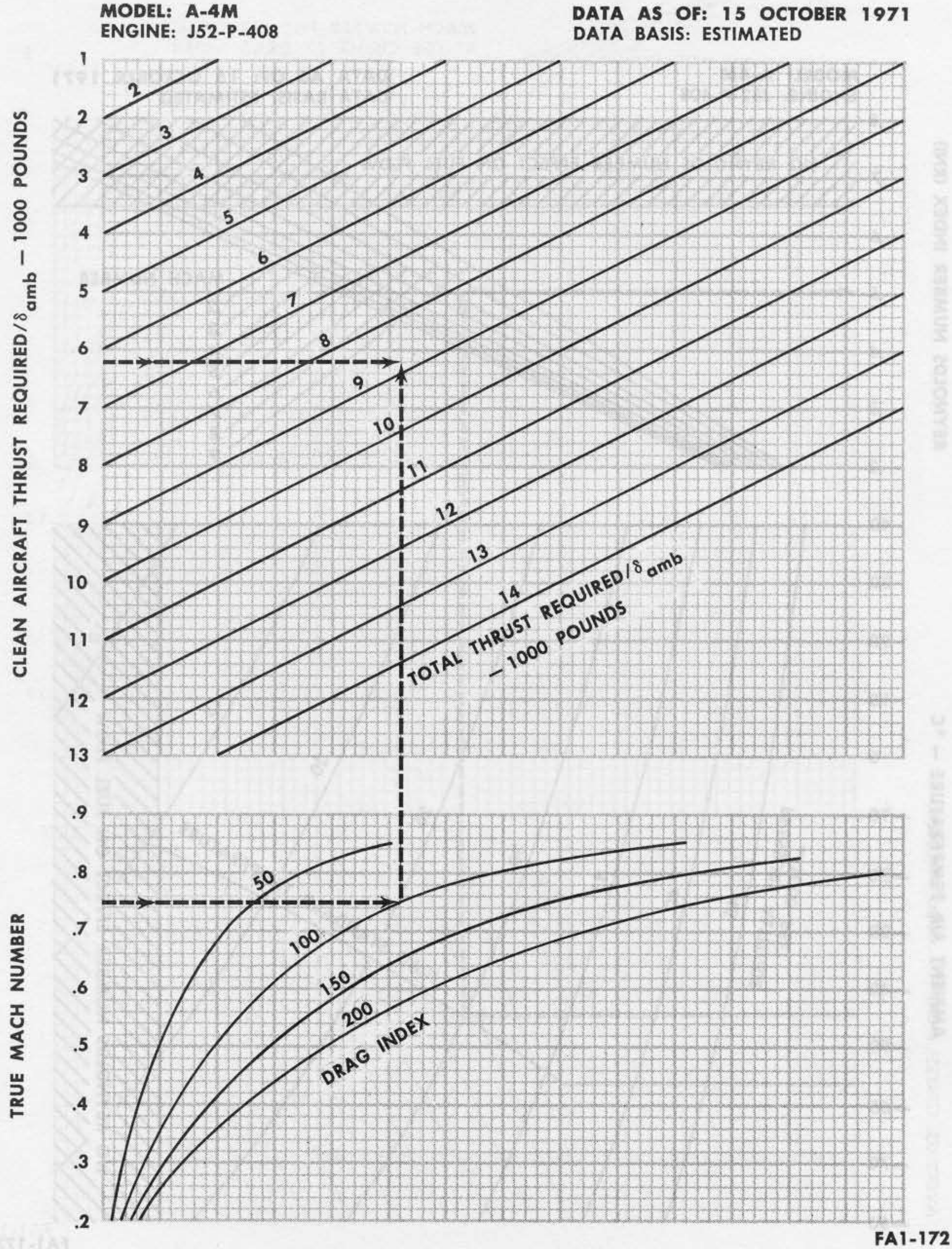


Figure 11-30. Nautical Miles per Pound of Fuel (Sheet 2)

NAUTICAL MILES PER POUND OF FUEL

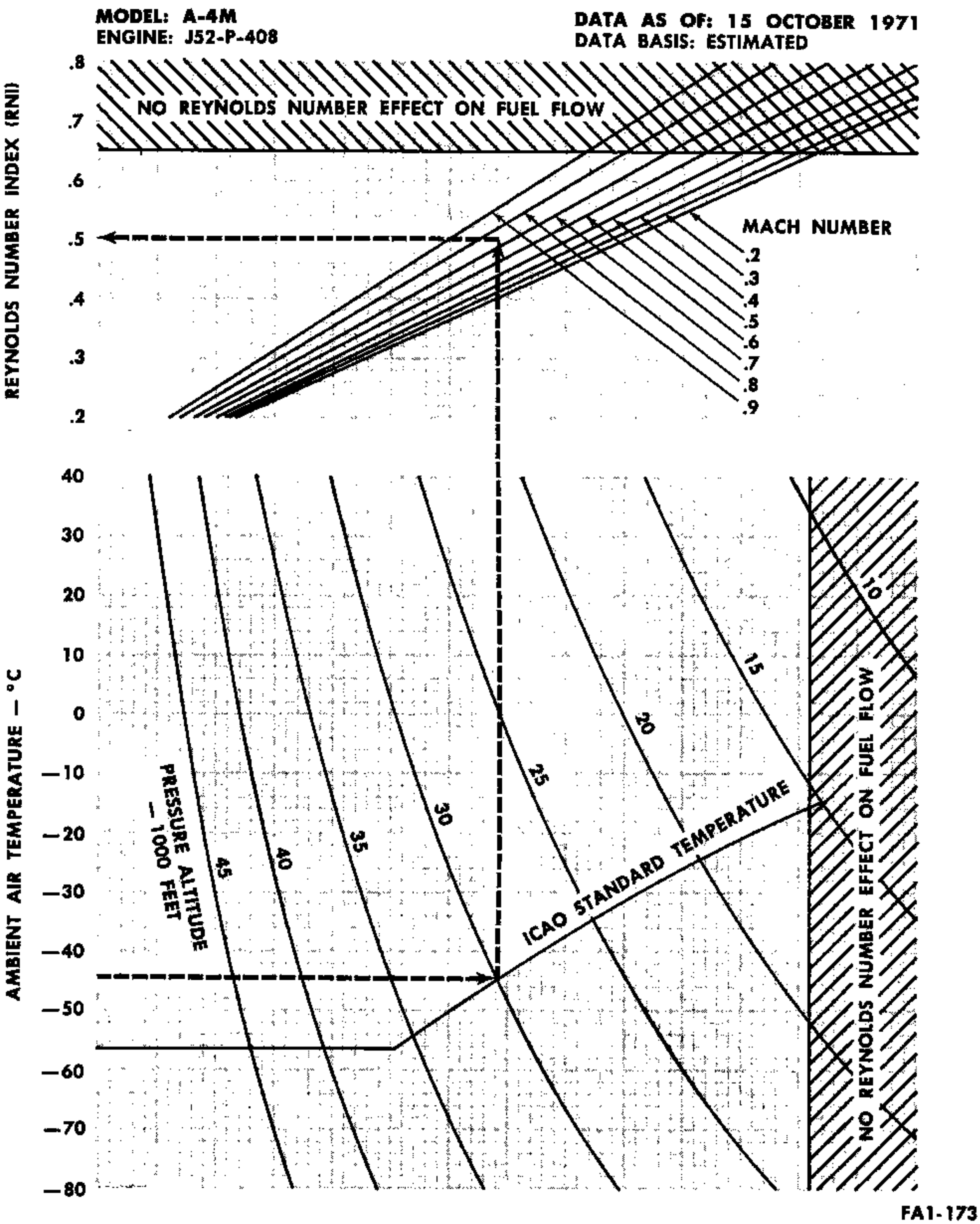


Figure 11-30. Nautical Miles per Pound of Fuel (Sheet 3)

NAUTICAL MILES PER POUND OF FUEL

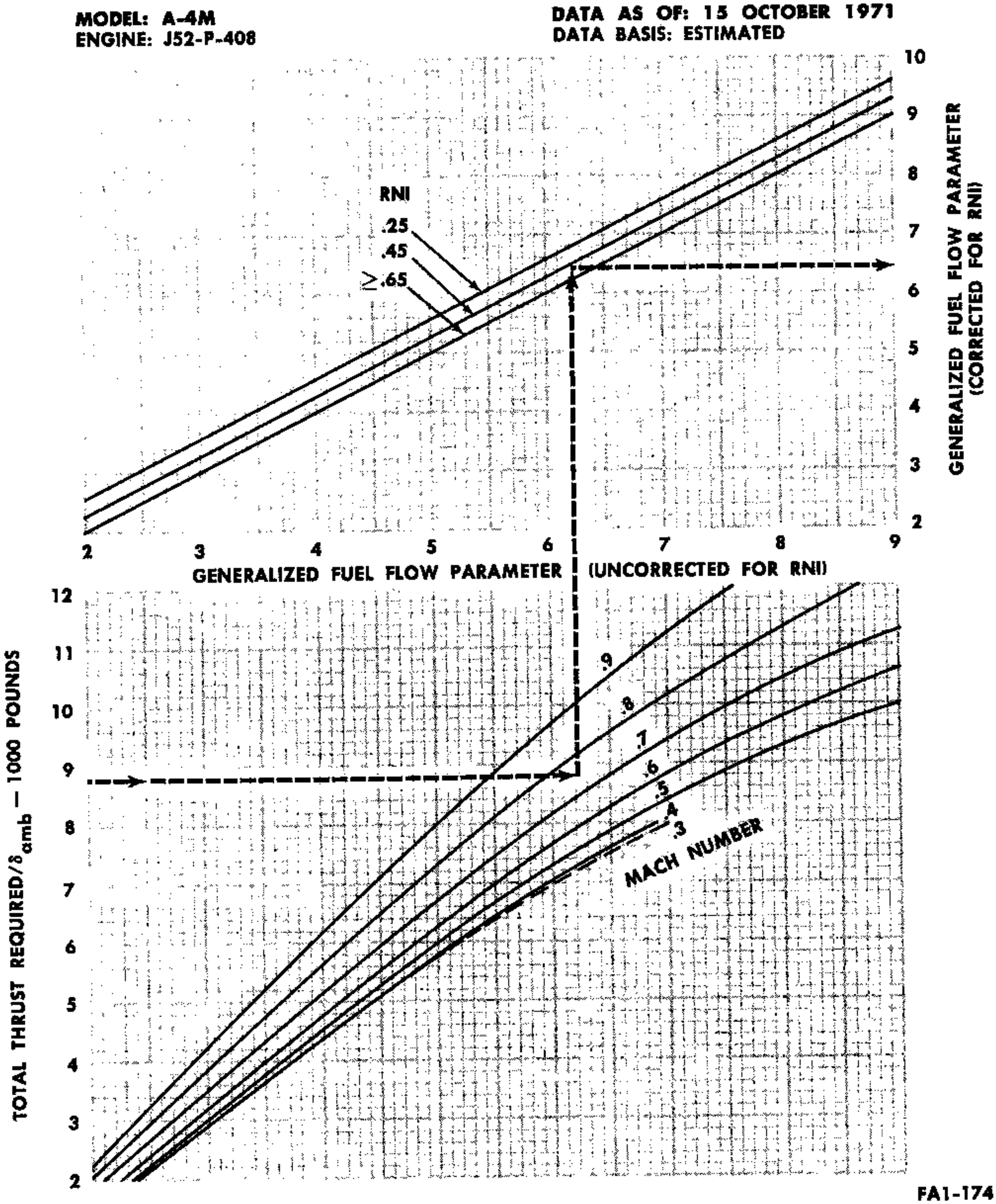


Figure 11-30. Nautical Miles per Pound of Fuel (Sheet 4)

NAUTICAL MILES PER POUND OF FUEL

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

PRESSURE ALTITUDE — 1000 FT.	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	—4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5
45	—56.5

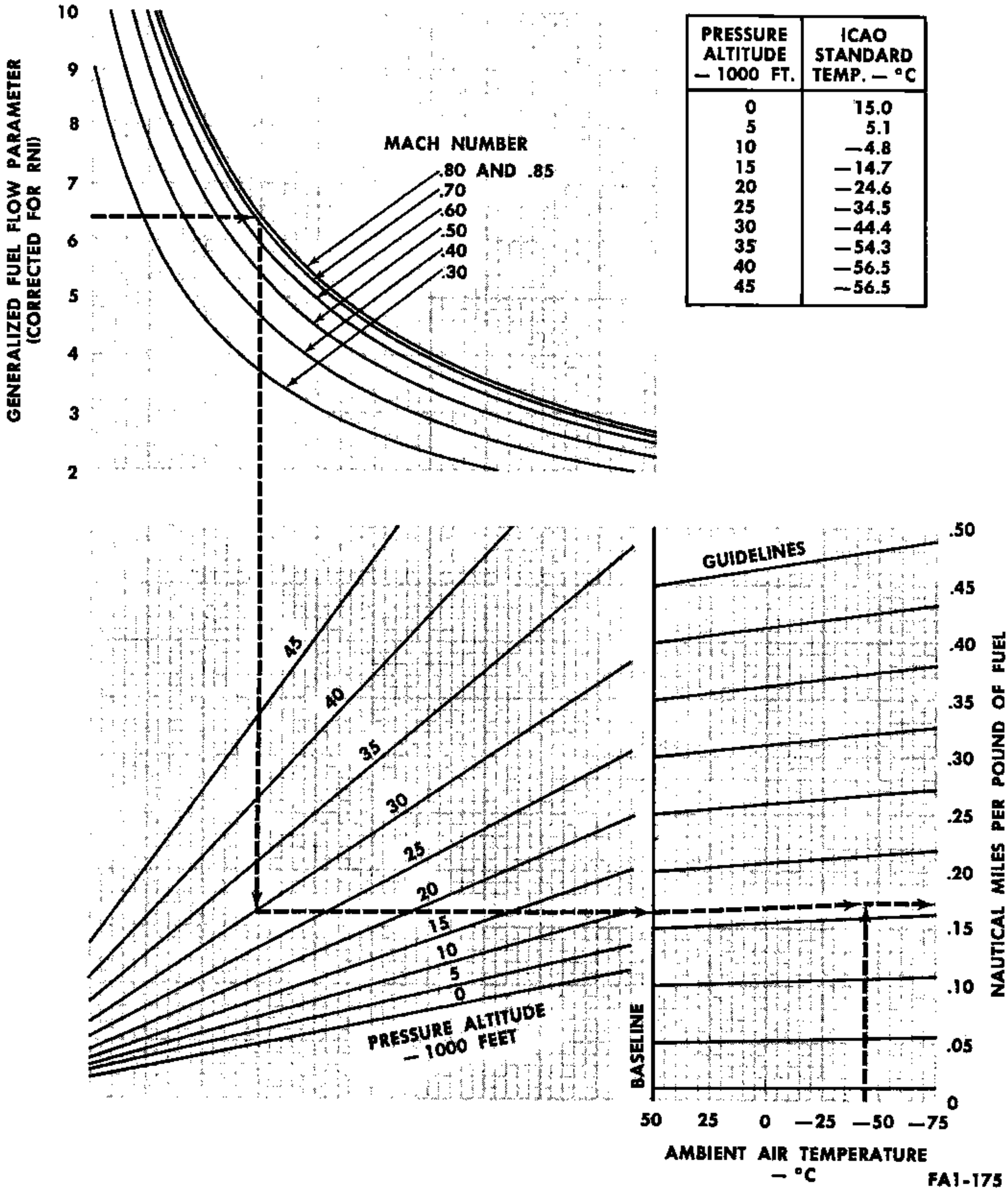


Figure 11-30. Nautical Miles per Pound of Fuel (Sheet 5)

NAUTICAL MILES PER POUND OF FUEL

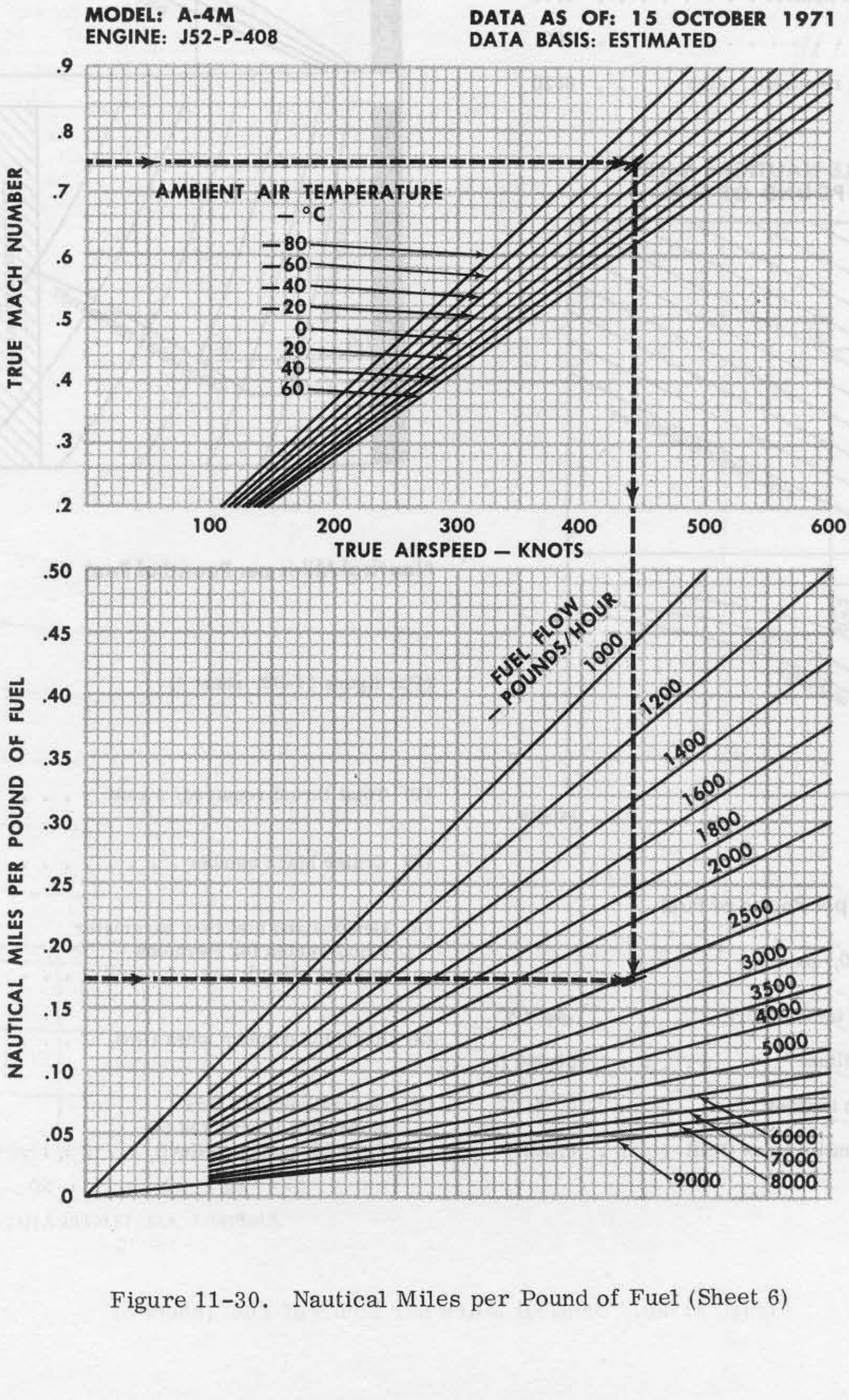


Figure 11-30. Nautical Miles per Pound of Fuel (Sheet 6)

Nautical Miles per Pound of Fuel

(For figure 11-30, sheet 2)

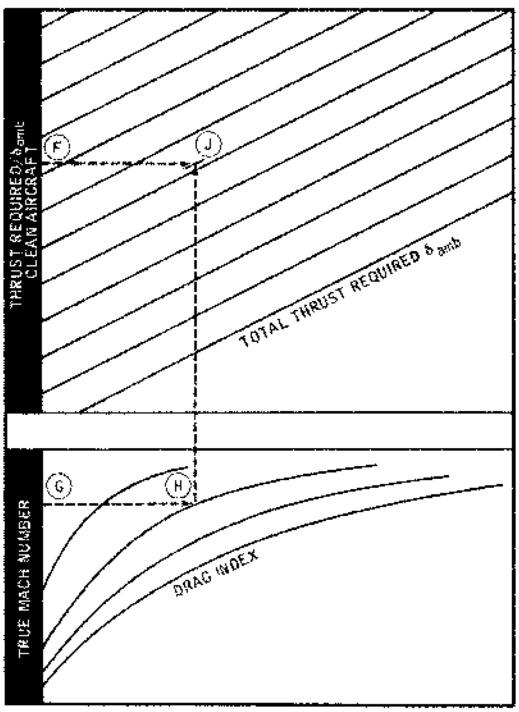
(F) Thrust required/ δ amb – clean aircraft 6225

(G) Cruise Mach number 0.75

(H) Drag index 100

(J) Total thrust required/ δ amb 8820

SAMPLE NAUTICAL MILES PER POUND OF FUEL



FA1-160

Nautical Miles per Pound of Fuel

(For figure 11-30, sheet 3)

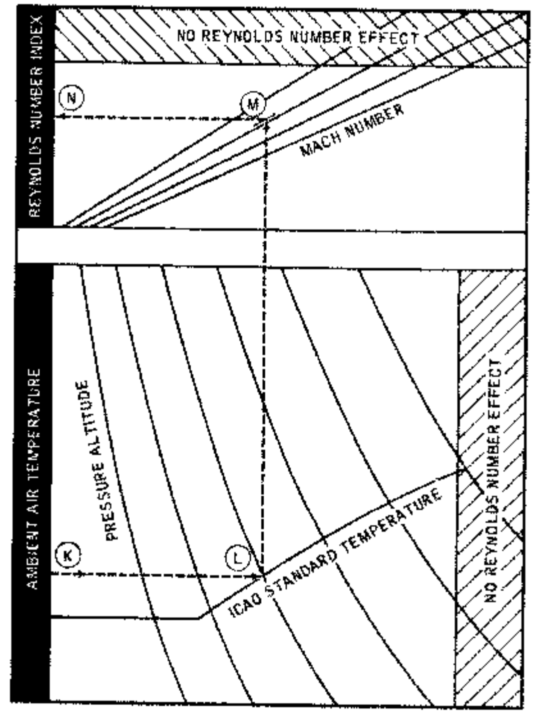
(K) Ambient air temperature . . . . . . -44.4°C

(L) Pressure altitude . . . . 30,000 ft

(M) Cruise Mach number 0.75

(N) Reynolds number index (RNI) 0.503

SAMPLE NAUTICAL MILES PER POUND OF FUEL



FA1-161

Nautical Miles per Pound of Fuel

(For figure 11-30, sheet 4)

(P) Total thrust required/ δ amb . . . . 8820 lb

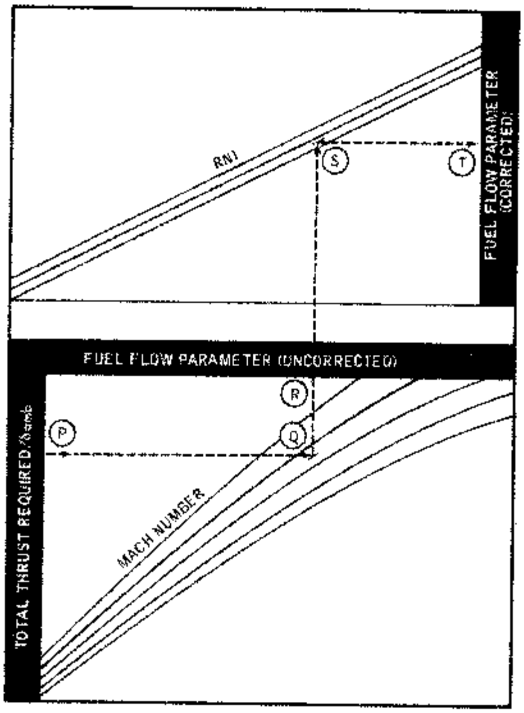
(Q) Cruise Mach number 0.75

(R) Generalized fuel flow parameter (uncorrected for Reynolds number effect) 6.23

(S) Reynolds number index (RNI) 0.503

(T) Generalized fuel flow parameter (corrected for Reynolds number effect) 6.41

SAMPLE NAUTICAL MILES PER POUND OF FUEL



FA1-162

Nautical Miles per Pound of Fuel

(For figure 11-30, sheet 5)

(U) Generalized fuel flow parameter (corrected for Reynolds number effect) 6.41

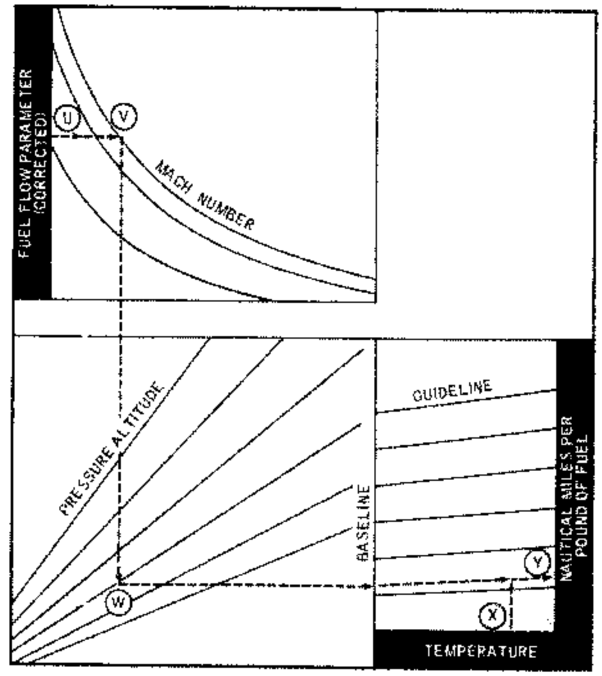
(V) Cruise Mach number 0.75

(W) Pressure altitude . . . . 30,000 ft

(X) Ambient air temperature . . . . -44.4°C

(Y) Nautical miles per pound of fuel 0.174

SAMPLE NAUTICAL MILES PER POUND OF FUEL



FA1-163

Nautical Miles per Pound of Fuel

(For figure 11-30, sheet 6)

(A) True Mach number 0.75

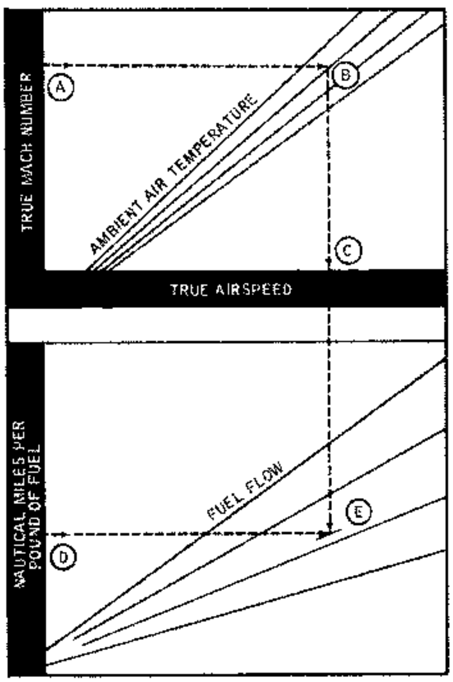
(B) Ambient air temperature . . . . . . -44.4°C

(C) True airspeed . . . . 442 kn

(D) Nautical miles per pound of fuel 0.174

(E) Fuel flow . . . . 2550 lb/hr

SAMPLE NAUTICAL MILES PER POUND OF FUEL



FA1-164

SAMPLE PROBLEM

Engine Pressure Ratio for Cruise

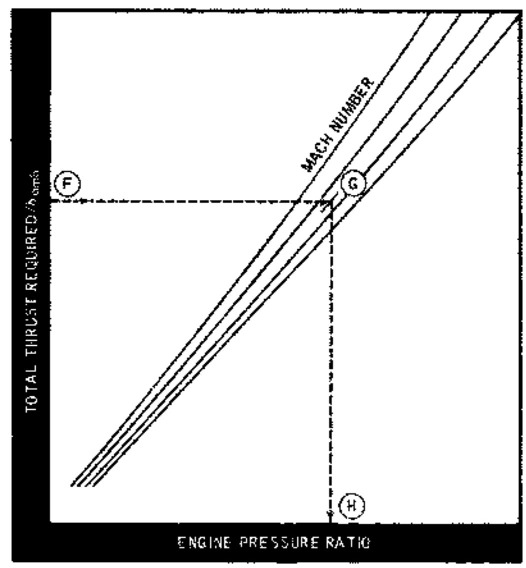
(For figure 11-31)

(F) Total thrust required/ δ amb . . . . 8820 lb

(G) True Mach number 0.75

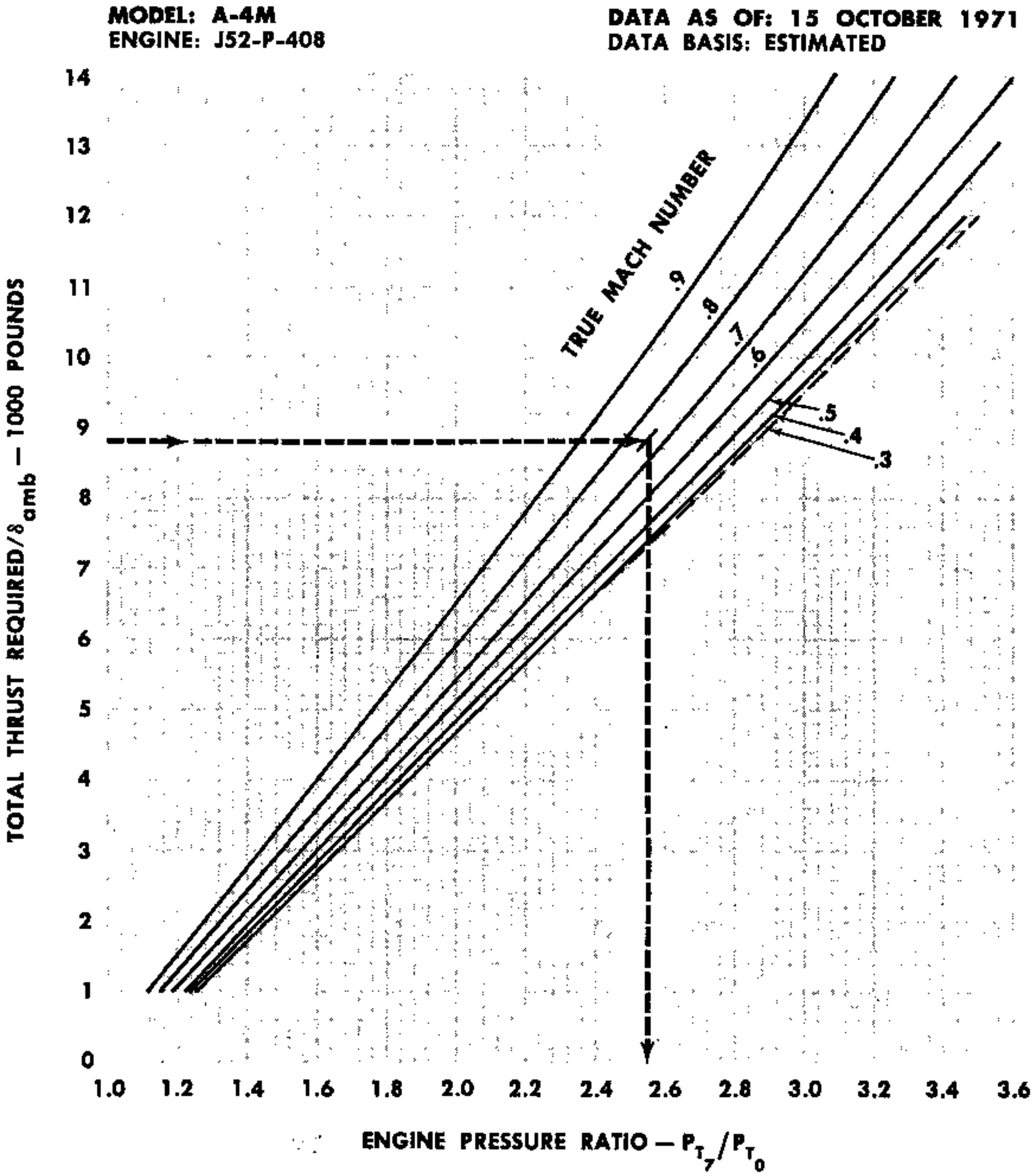
(H) Engine pressure ratio 2.55

SAMPLE ENGINE PRESSURE RATIO FOR CRUISE



FA1-165

ENGINE PRESSURE RATIO FOR CRUISE



FA1-177

Figure 11-31. Engine Pressure Ratio for Cruise

PART 5
ENDURANCE

FOULED DECK ENDURANCE

Occasions arise during carrier operations when the deck becomes fouled and aircraft cannot be taken aboard until the deck is cleared. In these instances, it is desirable for the pilots and the air officer to be aware of the endurance capabilities of the unrecovered aircraft so that an immediate decision can be made concerning the proper course of action. Should the estimated "clear deck" time be beyond the endurance time of the aircraft, then it must either depart immediately for the beach, or land aboard the ready deck of another carrier, if available. However, if it is either desirable or mandatory that the aircraft orbit until the deck is clear, it is necessary that the pilot fully understand the proper procedure to obtain the maximum endurance with the available fuel. The Fouled Deck Endurance chart (figure 11-32) tabulates the endurance times for various quantities of fuel on board at both the initial altitude and the optimum, best endurance altitude. The aircraft configuration consists of four empty wing pylons plus guns with a total drag index of 33. The endurance values are given in minutes; for the optimum altitudes include the time required for a military thrust climb to that altitude and a maximum range descent to sea level with 250 pounds of fuel remaining for approach and landing. The endurance times for the initial altitude include only the descent time since no climb is required. Climb speeds and airspeeds for maximum endurance are included in the chart together with letdown instructions.

The time at which letdown should be initiated is given in terms of fuel on board and represents the fuel required to conduct a maximum range descent from altitude to sea level. A 250-pound fuel allowance is included for approach and landing.

Bingo Endurance and Bingo Endurance-Gear Down charts are presented in figures 11-33 and 11-34 respectively. These charts are provided for an aircraft configuration consisting of four wing pylons, guns, and two 300-gallon external fuel tanks with a total drag index of 61 with gear up and 391 with gear down. The procedures for the use of the charts are identical to those for the Fouled Deck Endurance chart; however, an 800-pound fuel allowance is included for approach and landing.

MAXIMUM ENDURANCE

The Maximum Endurance charts provide a means of determining the Mach number and calibrated airspeed for maximum endurance with the associated fuel flow and fuel required for a specified loiter time. These data are provided for a constant altitude loiter condition. Optimum loiter altitude lines, altitude for best endurance are superimposed on the pressure altitude plots. To use these charts, the average gross weight, bank angle, pressure altitude, drag index, ambient air temperature, and loiter time must be known. The charts then provide Mach number, calibrated airspeed, fuel flow, and fuel required for maximum endurance.

SAMPLE PROBLEM

Maximum Endurance Speed

(For figure 11-35)

(A) Average gross weight . . . . . 15,000 lb

(B) Bank angle . . . . 15 degrees

(C) Loiter pressure altitude . . . . 25,000 ft

(D) Drag index 100

(E) Mach number for maximum endurance 0.475

FOULED DECK ENDURANCE

Drag Index = 33
Aircraft Weight (Less Fuel) = 12,039 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel for Landing = 250 Pounds

Model: A-4M
Engine: J52-P-408

Data as of: 1 December 1970
Data Basis: Estimated

Fuel On Board - Pounds	If You Are at Sea Level			If You Are at 10,000 Feet			If You Are at 20,000 Feet		
	Endurance at Sea Level	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 10,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 20,000 Feet	Endurance at Optimum Altitude	Optimum Altitude
	Minutes	Minutes	Feet	Minutes	Minutes	Feet	Minutes	Minutes	Feet
2300	57	85	35,000	71	89	35,000	85	93	35,000
1900	47	69	35,000	59	73	35,000	70	77	35,000
1700	41	60	35,000	52	64	35,000	63	69	35,000
1500	36	52	35,000	46	56	35,000	55	60	35,000
1300	30	44	35,000	39	48	35,000	48	52	35,000
1100	24	35	35,000	33	39	35,000	40	43	35,000
900	19	26	35,000	26	30	35,000	32	35	35,000
700	13	18	30,000	19	22	35,000	25	26	35,000
500	7	10	15,000	12	13	25,000	17	17	30,000

Fuel On Board - Pounds	If You Are at 30,000 Feet			If You Are at 35,000 Feet			If You Are at 40,000 Feet		
	Endurance at 30,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 35,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 40,000 Feet	Endurance at Optimum Altitude	Optimum Altitude
	Minutes	Minutes	Feet	Minutes	Minutes	Feet	Minutes	Minutes	Feet
2300	93	96	35,000	97	97	35,000	97	99	35,000
1900	78	80	35,000	81	81	35,000	82	83	35,000
1700	70	72	35,000	73	73	35,000	74	75	35,000
1500	62	64	35,000	65	65	35,000	66	66	35,000
1300	54	55	35,000	57	57	35,000	58	58	35,000
1100	45	47	35,000	48	48	35,000	49	49	35,000
900	37	38	35,000	39	39	35,000	41	41	35,000
700	29	29	35,000	31	31	35,000	32	32	35,000
500	20	20	35,000	22	22	35,000	23	23	35,000

Pressure Altitude	Climb Speed Military Thrust		Endurance Speed	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds
Sea Level	365		185	185	250
5,000	365		185	185	274
10,000	365		185	185	292
15,000	365		185	185	307
20,000	365		185	185	322
25,000		0.783	185	185	336
30,000		0.783	185	185	349
35,000		0.783	185	185	362
40,000		0.783	185	185	375
45,000		0.783	185	185	387

Figure 11-32. Fouled Deck Endurance

BINGO ENDURANCE

Drag Index = 61
Aircraft Weight (Less Fuel) = 12,437 Pounds
All Pylons, Guns (No Ammo), and Two 300-Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: A-4M
Engine: J52-P-408

Data as of: 1 December 1970
Data Basis: Estimated

Fuel on Board — Pounds	If You Are at Sea Level			If You Are at 10,000 Feet			If You Are at 20,000 Feet		
	Endurance at Sea Level	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 10,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 20,000 Feet	Endurance at Optimum Altitude	Optimum Altitude
	Minutes	Minutes	Feet	Minutes	Minutes	Feet	Minutes	Minutes	Feet
2700	50	70	35,000	62	74	35,000	73	78	35,000
2500	45	63	35,000	56	67	35,000	66	71	35,000
2300	40	56	35,000	50	60	35,000	59	64	35,000
2100	35	48	35,000	44	52	35,000	53	56	35,000
1900	29	42	35,000	38	45	35,000	46	49	35,000
1700	24	33	35,000	32	37	35,000	39	41	35,000
1500	19	25	35,000	26	29	35,000	32	33	35,000
1300	14	17	30,000	19	21	35,000	25	25	35,000
1100	8	10	15,000	13	14	20,000	17	17	30,000

Fuel on Board — Pounds	If You Are at 30,000 Feet			If You Are at 35,000 Feet			If You Are at 40,000 Feet		
	Endurance at 30,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 35,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 40,000 Feet	Endurance at Optimum Altitude	Optimum Altitude
	Minutes	Minutes	Feet	Minutes	Minutes	Feet	Minutes	Minutes	Feet
2700	80	82	35,000	83	83	35,000	81	85	35,000
2500	73	75	35,000	76	76	35,000	74	77	35,000
2300	66	67	35,000	69	69	35,000	67	70	35,000
2100	59	60	35,000	61	61	35,000	60	63	35,000
1900	51	52	35,000	54	54	35,000	53	55	35,000
1700	44	44	35,000	46	46	35,000	46	47	35,000
1500	36	37	35,000	38	38	35,000	38	39	35,000
1300	29	29	35,000	30	30	35,000	31	32	35,000
1100	21	21	30,000	22	22	35,000	23	24	35,000

Pressure Altitude	Climb Speed Military Thrust		Endurance Speed	Descent Speed Engine Idle—Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds
Sea Level	340		190	187	800
5,000	340		190	187	823
10,000	340		190	187	839
15,000	340		190	187	853
20,000	340		190	187	867
25,000		0.764	190	187	880
30,000		0.764	190	187	892
35,000		0.764	190	187	904
40,000		0.764	190	187	915
45,000		0.764	190	187	927

Figure 11-33. Bingo Endurance

BINGO ENDURANCE

Gear Down

Drag Index = 391
Aircraft Weight (Less Fuel) = 12,437 Pounds
All Pylons, Guns (No Ammo), and Two 300-Gallon External Tanks
Reserve Fuel for Landing – 800 Pounds

Model: A-4M
Engine: J52-P-408

Data as of: 1 December 1970
Data Basis: Estimated

Fuel on Board — Pounds	If You Are at Sea Level			If You Are at 10,000 Feet		
	Endurance at Sea Level	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 10,000 Feet	Endurance at Optimum Altitude	Optimum Altitude
	Minutes	Minutes	Feet	Minutes	Minutes	Feet
2700	40	48	20,000	48	52	20,000
2500	36	43	20,000	44	47	20,000
2300	32	38	20,000	39	42	20,000
2100	28	33	20,000	35	37	20,000
1900	24	28	20,000	30	31	20,000
1700	19	23	20,000	25	26	20,000
1500	15	17	15,000	20	21	20,000
1300	11	12	15,000	15	16	15,000
1100	7	7	10,000	10	10	10,000

Fuel on Board — Pounds	If You Are at 20,000 Feet			If You Are at 30,000 Feet		
	Endurance at 20,000 Feet	Endurance at Optimum Altitude	Optimum Altitude	Endurance at 30,000 Feet	Endurance at Optimum Altitude	Optimum Altitude
	Minutes	Minutes	Feet	Minutes	Minutes	Feet
2700	55	56	25,000	57	58	25,000
2500	50	50	25,000	52	53	25,000
2300	45	45	25,000	47	48	25,000
2100	40	40	25,000	42	43	25,000
1900	35	35	25,000	37	38	25,000
1700	30	30	20,000	32	32	25,000
1500	24	24	20,000	27	27	25,000
1300	19	19	20,000	21	21	25,000
1100	13	13	20,000	16	16	25,000

Pressure Altitude	Climb Speed Military Thrust	Endurance Speed	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	KCAS	KCAS	Pounds
Sea Level	240	165	160	800
5,000	240	165	160	815
10,000	240	165	160	830
15,000	240	165	160	840
20,000	230	165	160	850
25,000	205	165	160	860
30,000	185	165	160	870

Figure 11-34. Bingo Endurance – Gear Down

MAXIMUM ENDURANCE SPEED

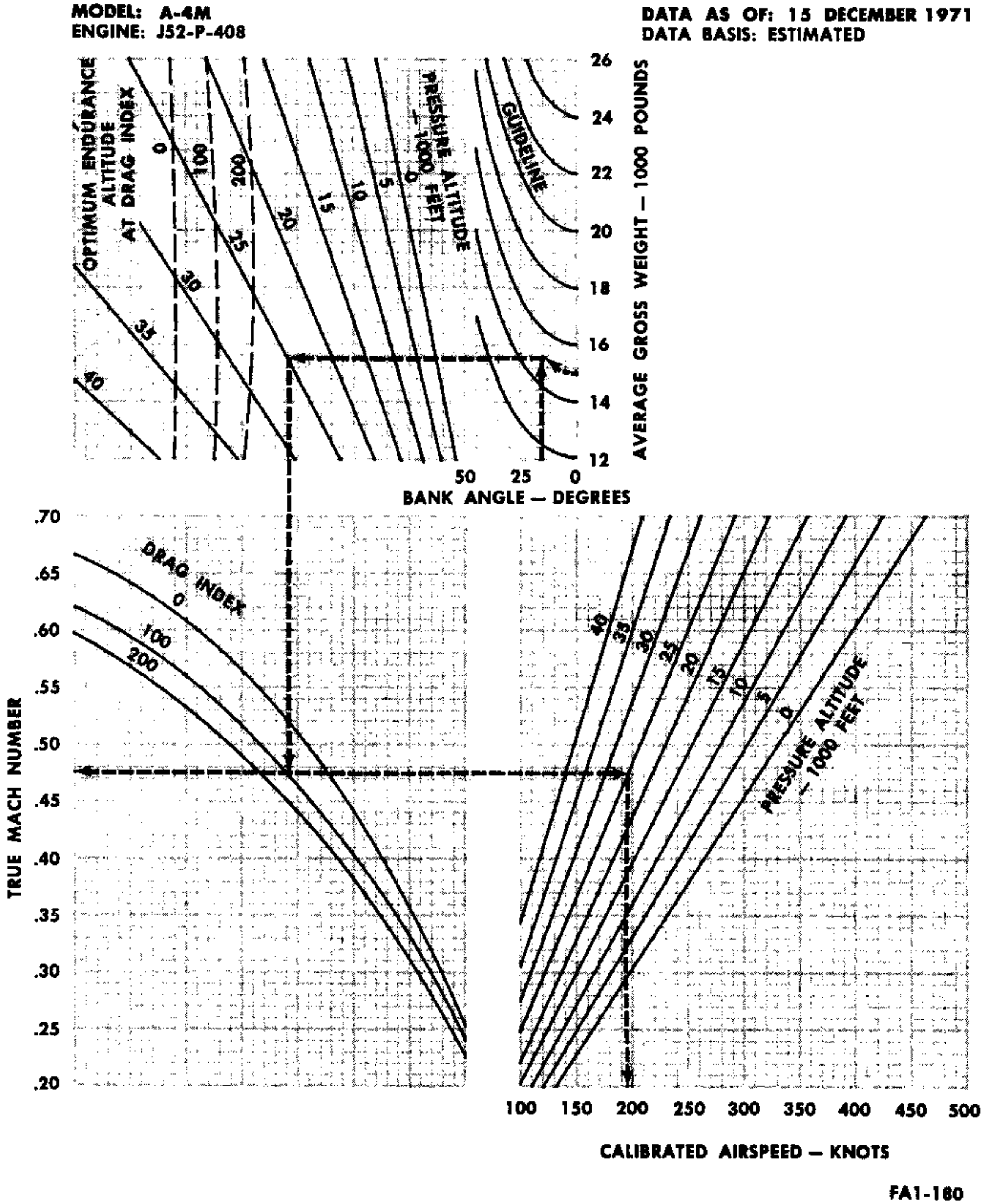
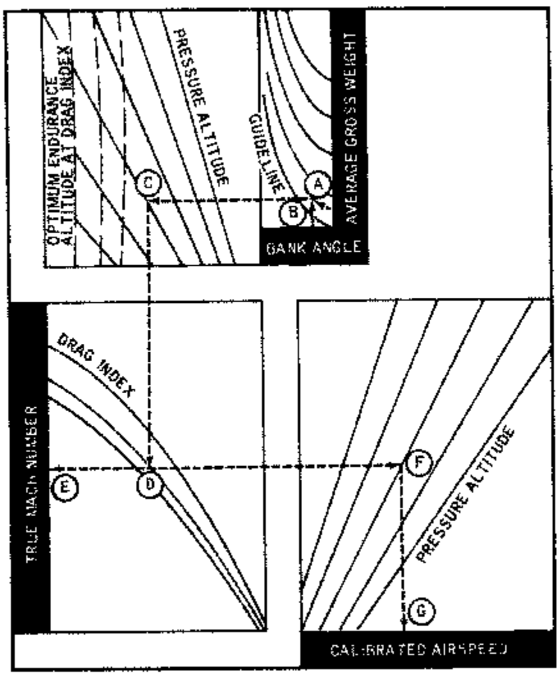


Figure 11-35. Maximum Endurance Speed

(F) Loiter pressure altitude . . . . . 25,000 ft

(G) Loiter airspeed . . . . 195 KCAS

SAMPLE MAXIMUM ENDURANCE SPEED



FA1-178

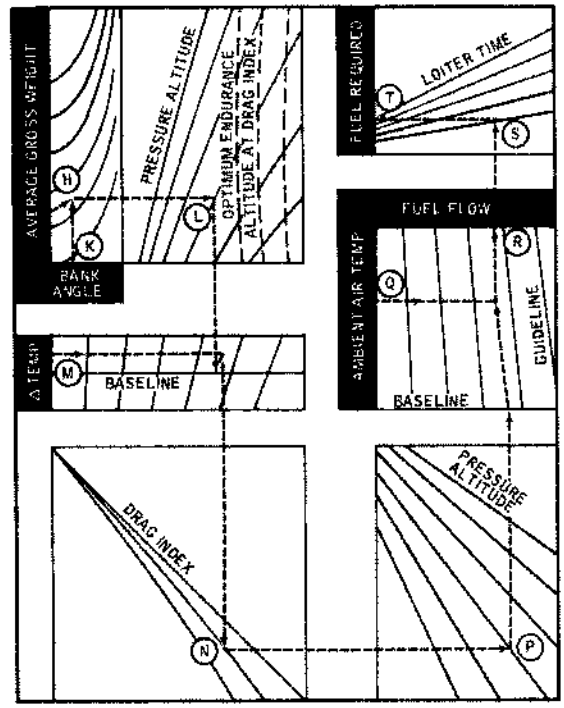
SAMPLE PROBLEM

Maximum Endurance Fuel

(For figure 11-36)

(H) Average gross weight . . . . . 15,000 lb

SAMPLE MAXIMUM ENDURANCE FUEL



FA1-179

(K) Bank angle . . . . 15 degrees

(L) Loiter pressure altitude . . . . 25,000 ft

(M) Temperature deviation from ICAO standard (Ambient temperature = -24.5°C) . . . . +10°C

(N) Drag index 100

(P) Loiter pressure altitude . . . . 25,000 ft

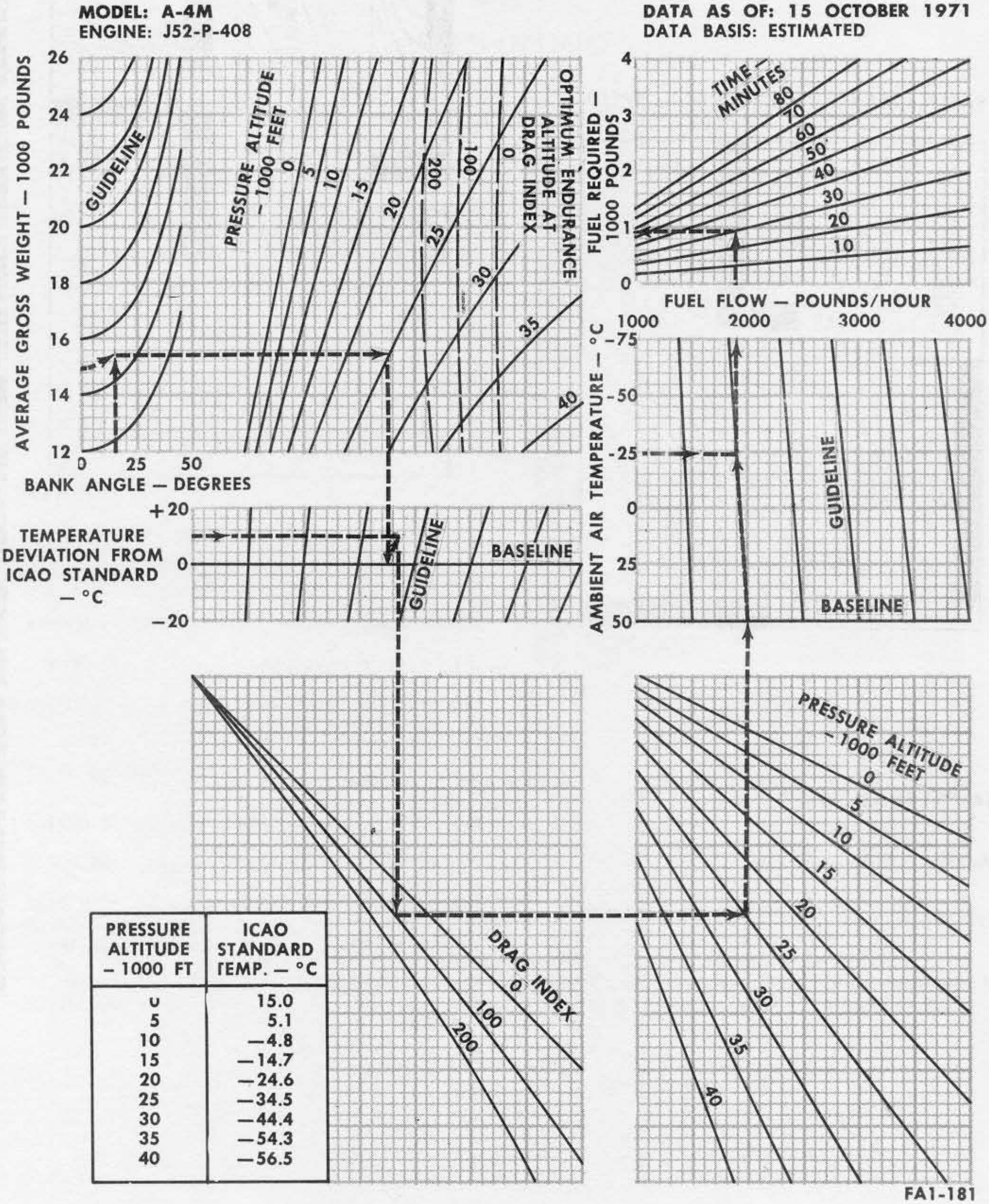
(Q) Ambient air temperature . . . . -24.5°C

(R) Fuel flow . . . . 1900 lb/hr

(S) Loiter time . . . . 30 min

(T) Fuel required . . . . 950 lb

MAXIMUM ENDURANCE FUEL



PRESSURE ALTITUDE — 1000 FT	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	−4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

Figure 11-36. Maximum Endurance Fuel

PART 6
AIR REFUELING

AIR REFUELING CHARTS

The air refueling charts present the performance of a tanker configured with an air-refueling buddy store on the centerline pylon, four wing pylons, two 300-gallon external fuel tanks, and two 20mm guns. All performance data shown are based on an ICAO standard atmosphere.

TANKER SPEED ENVELOPE

The operating speed envelope of the tanker aircraft is shown in figure 11-37. Data are presented for both drogue extended and drogue retracted configurations as a function of gross weight.

SAMPLE PROBLEM

Tanker Speed Envelope

(For figure 11-37)

(A) Pressure altitude . . . . 20,000 ft

(B) Gross weight hose and drogue extended . . . . 24,000 lb

(C) Minimum refueling Mach number 0.505

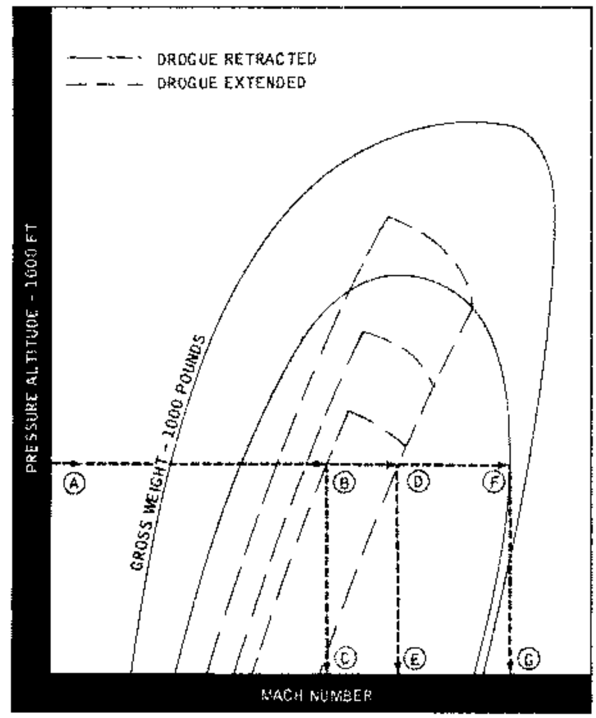
(D) Maximum refueling calibrated airspeed . . . . 300 kn

(E) Maximum refueling Mach number 0.65

(F) Gross weight hose and drogue retracted . . . . 24,000 lb

(G) Maximum Mach number 0.86

SAMPLE TANKER SPEED ENVELOPE



FA1-182

TANKER SPEED ENVELOPE

TANKER CONFIGURATION
1-300 GALLON REFUELING STORE PLUS 2-300 GALLON TANKS
5 PYLONS AND GUNS

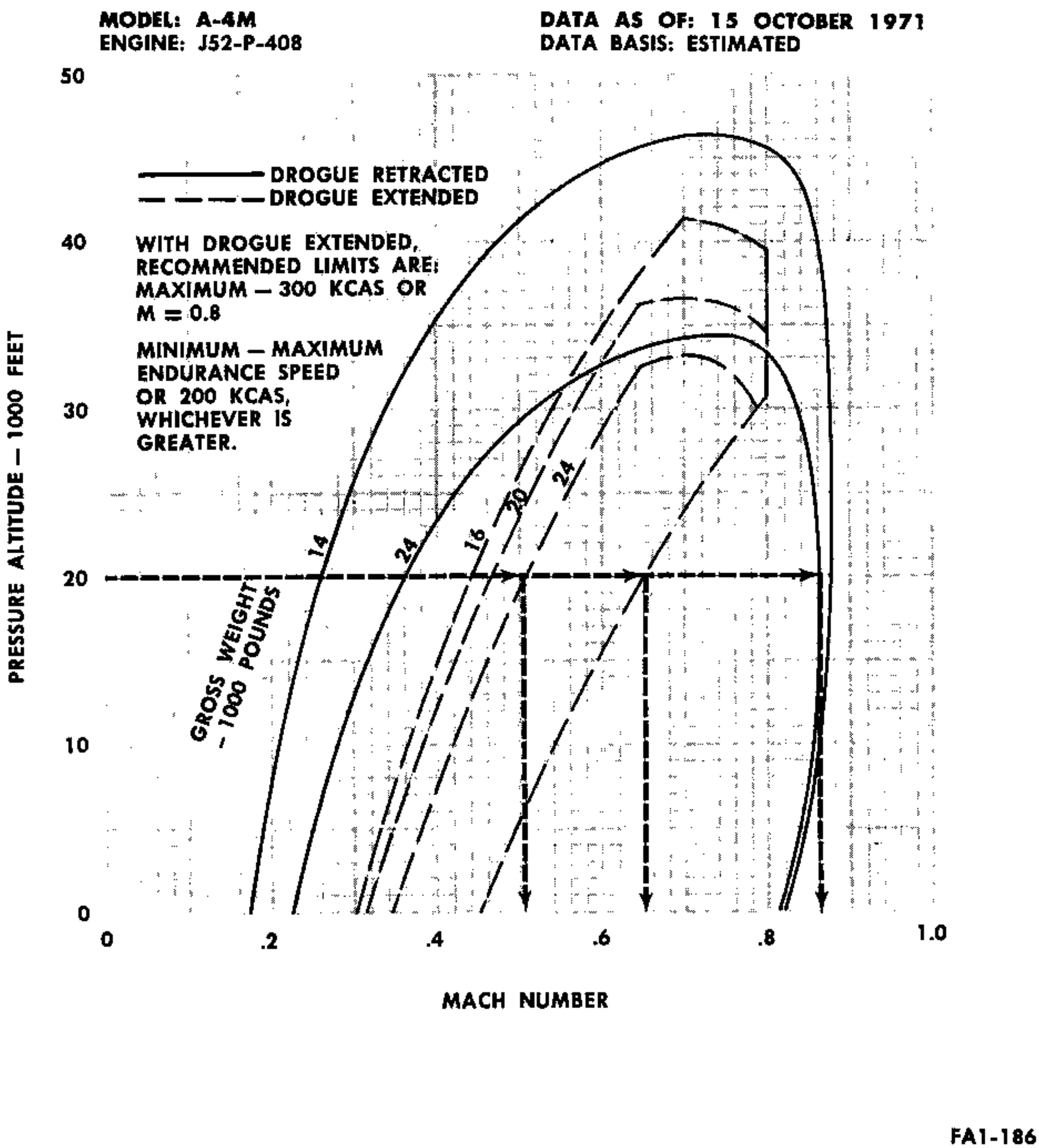
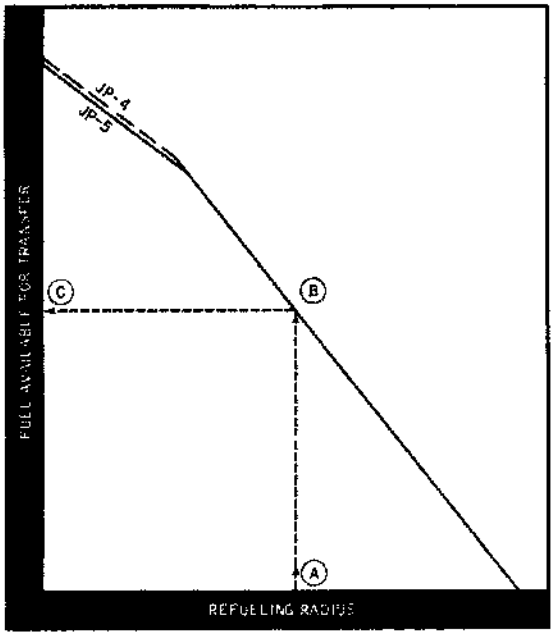


Figure 11-37. Tanker Speed Envelope

SAMPLE TANKER FUEL AVAILABLE FOR TRANSFER



FA1-183

TANKER FUEL AVAILABLE FOR TRANSFER

The tanker fuel available for transfer is shown as a function of radius in figure 11-38 for operation with JP-4 or JP-5 fuel. These data are presented, assuming standard buddy-tanker reserves consisting of fuel for 20 minutes of maximum endurance at sea level plus 5 percent of all fuel not transferred. In addition, a fuel allowance for rendezvous and hook-up has been added. This allowance consists of fuel for 5 minutes at speed for maximum endurance, with hose and drogue extended, at 30,000 feet pressure altitude.

At refueling radii of less than 250 nautical miles with JP-5 fuel and less than 235 nautical miles with JP-4 fuel, the tanker is unable to consume all of the 320 gallons of non-transferable fuel. Therefore, if refueling is accomplished at radii less than those noted and all the available fuel is transferred, the tanker will return to base with an excess of reserve fuel.

SAMPLE PROBLEM

Tanker Fuel Available for Transfer

(For figure 11-38)

(A) Refueling radius . . . . 400 NMI

(B) JP-5 fuel line . . . .

(C) Fuel available for transfer . . . . 3840 lb

TANKER FUEL TRANSFER TIME

The relationship of fuel transferred to receiver versus elapsed time is presented in figure 11-39. The flow rate to the receiver aircraft is 180 gallons per minute. After 2.85 minutes, refueling is temporarily discontinued to allow the refueling store to fill from the external fuel tanks.

The maximum amount of fuel that can be transferred to the receiver during a continuous refueling operation is limited to 513 gallons. The limiting factor is the external transfer rate of tanker fuel from the external fuel tanks and wing tanks to the refueling store. If more than 513 gallons is to be transferred to the receiver, refueling must be discontinued to allow the refueling store to be replenished from the tanker internal fuel. The time delay is dependent upon the amount of additional fuel to be transferred.

SAMPLE PROBLEM

Tanker Fuel Transfer Time

(For figure 11-39)

(A) Fuel transferred to receiver (JP-5) . . . . 4500 lb

(B) JP-5 fuel flow line

(C) Elapsed time . . . . 4.87 min

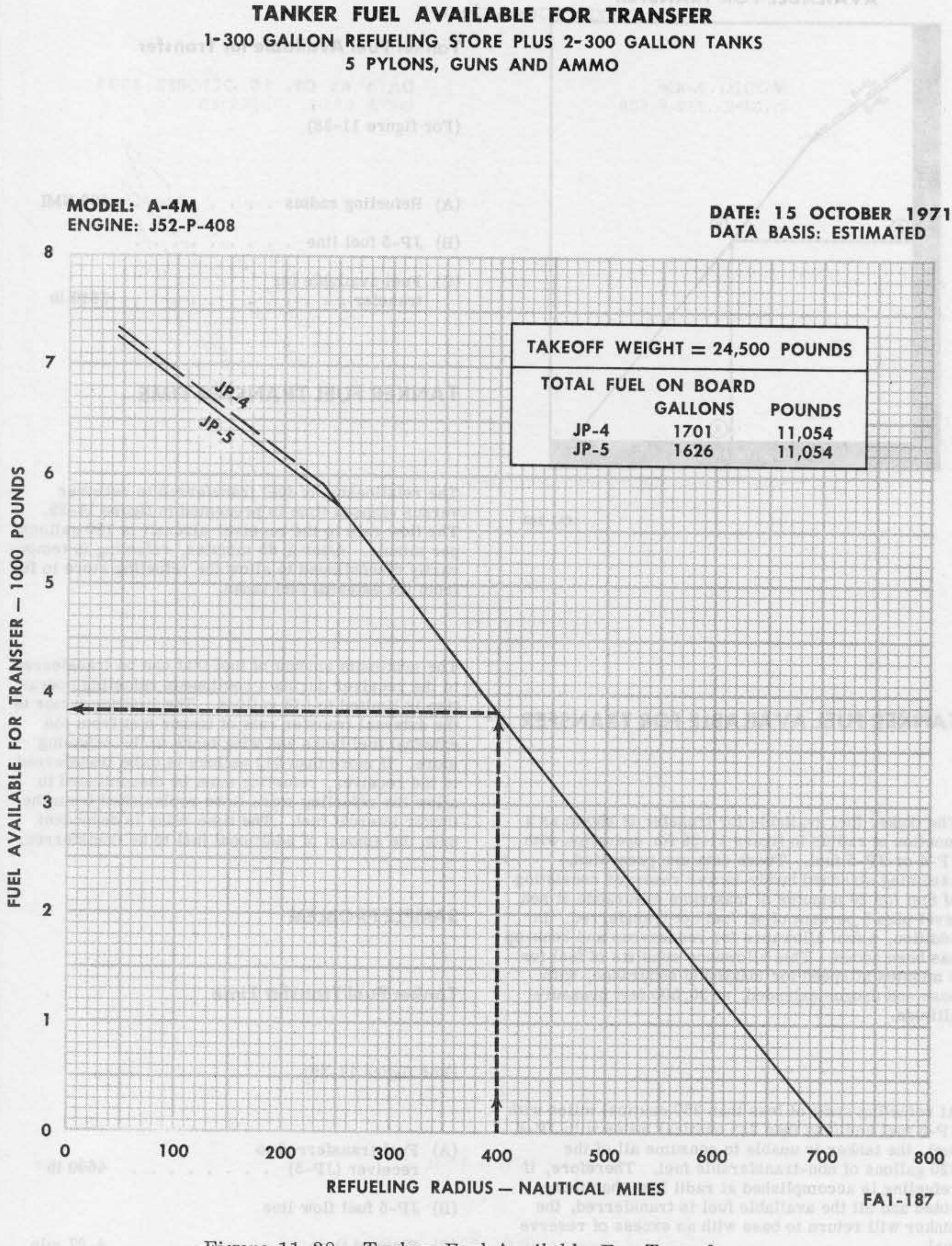


Figure 11-38. Tanker Fuel Available For Transfer

TANKER FUEL TRANSFER TIME

TANKER CONFIGURATION

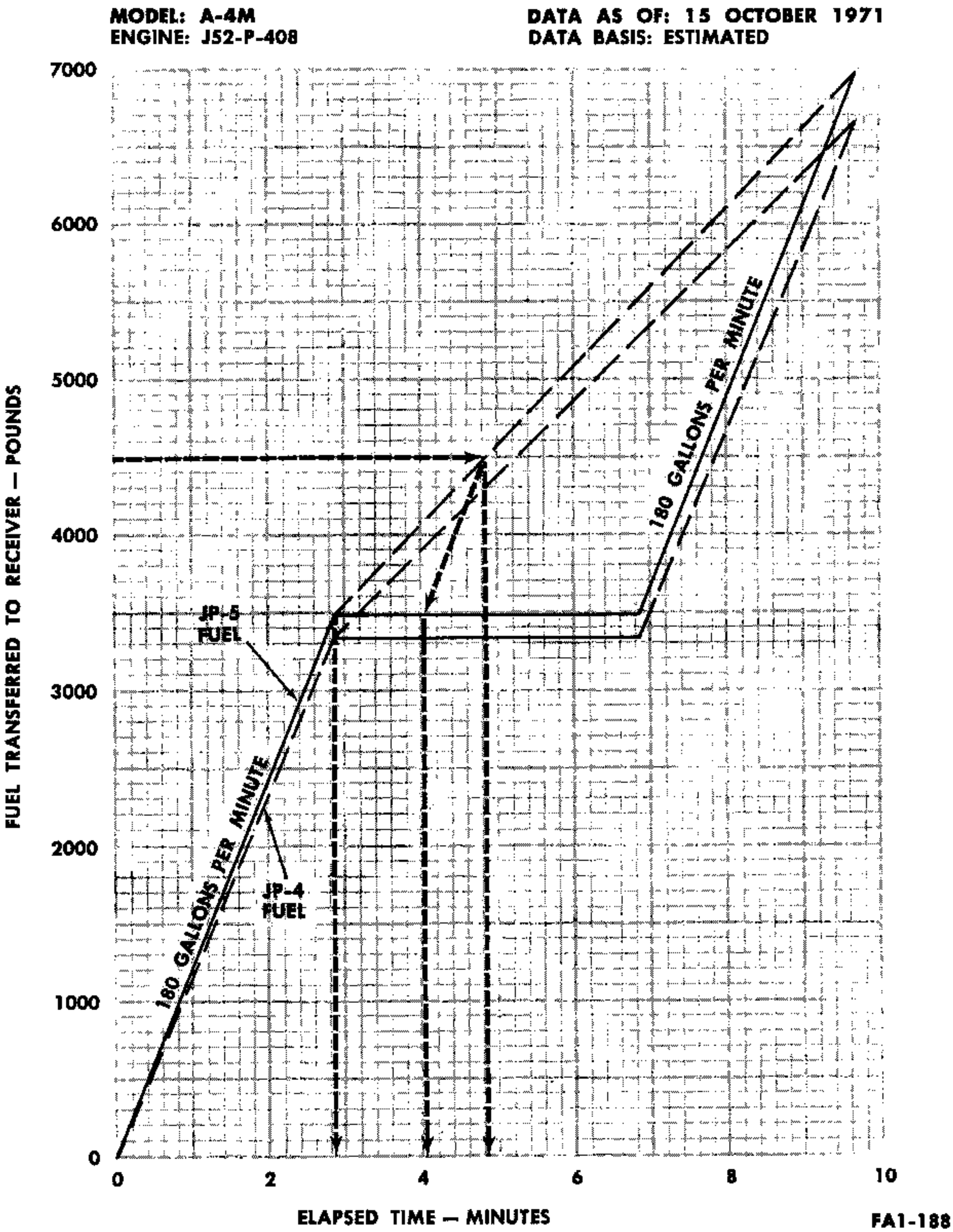
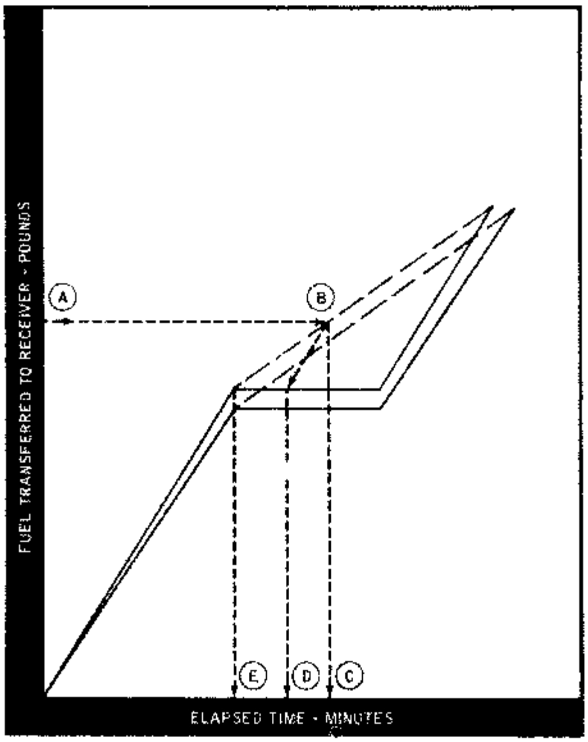


Figure 11-39. Tanker Fuel Transfer Time

(D) Point where refueling is resumed . . . . 4.04 min

(E) Point where refueling is temporarily discontinued . . . . 2.85 min

SAMPLE TANKER FUEL TRANSFER TIME



FA1-184

FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

The tanker fuel consumption with the hose and drogue extended is presented in figure 11-40 for two pressure altitudes for speeds throughout the flight envelope.

SAMPLE PROBLEM

Fuel Consumption of Tanker During Air Refueling

(For figure 11-40)

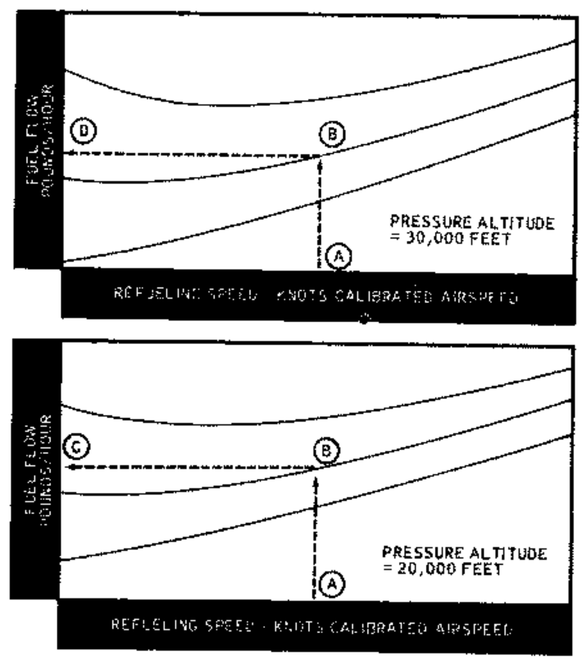
(A) Refueling speed . . . . 250 KCAS

(B) Gross weight . . . . 20,000 lb

(C) Fuel flow – 20,000 ft . . . . 2860 lb/hr

(D) Fuel flow – 30,000 ft . . . . 3020 lb/hr

SAMPLE TANKER FUEL CONSUMPTION DURING AIR REFUELING



FA1-185

FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

1-300 GALLON REFUELING STORE PLUS 2-300 GALLON TANKS
5 PYLONS, GUNS AND AMMO

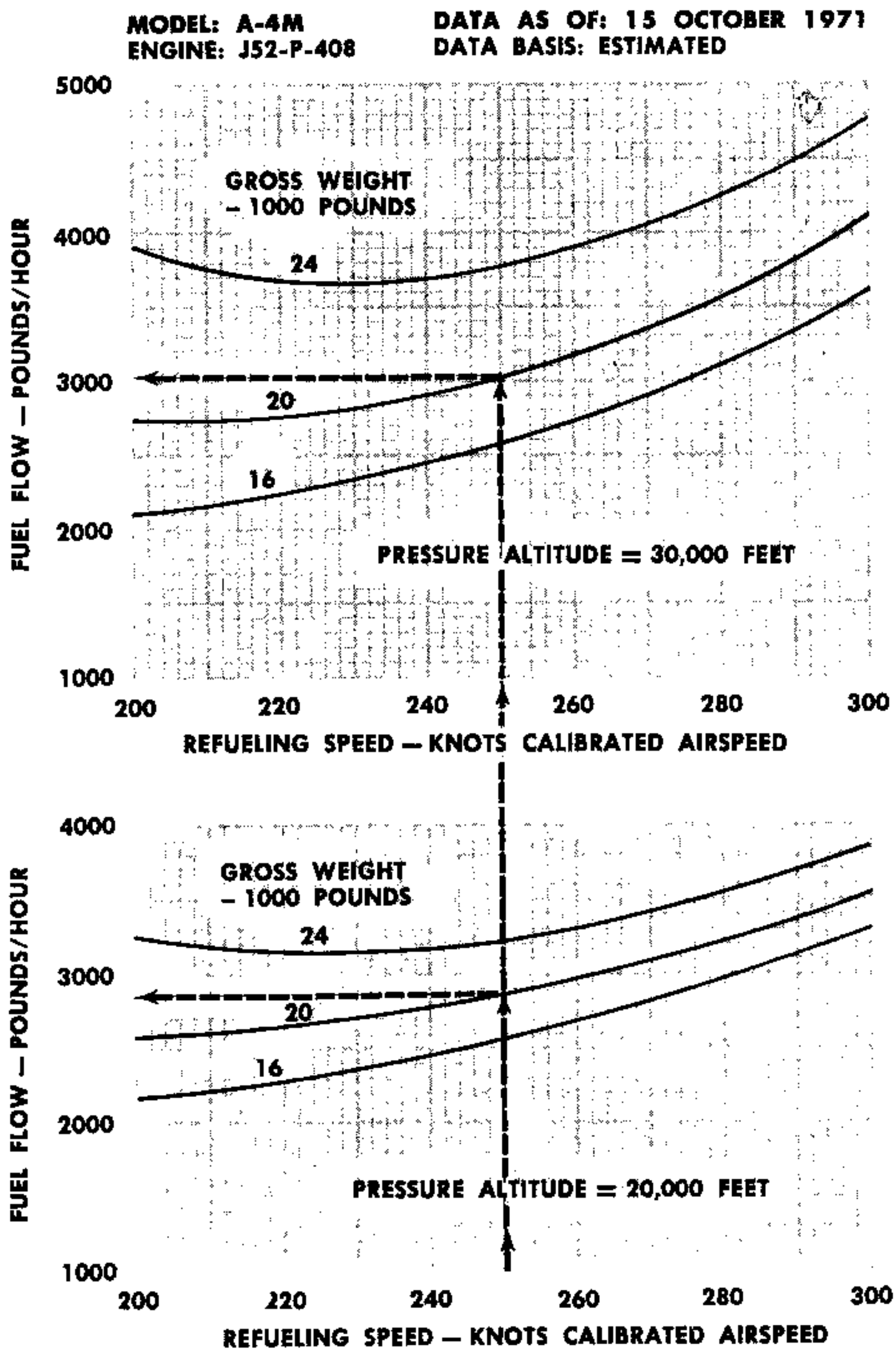


Figure 11-40. Fuel Consumption of Tanker During Air Refueling

PART 7
DESCENT

MAXIMUM RANGE DESCENT

Graphical data are presented in figures 11-41 through 11-43 for maximum range descent using idle thrust and with speedbrakes closed. Recommended maximum range descent speed, fuel consumed, distance covered, and elapsed time from any desired altitude to sea level are presented as a function of gross weight and drag index. All data is based on an ICAO standard atmosphere.

The method of presenting data for fuel, distance, and time is identical. Therefore, only one sample problem is shown.

SAMPLE PROBLEM

Descent Fuel

(For figure 11-41)

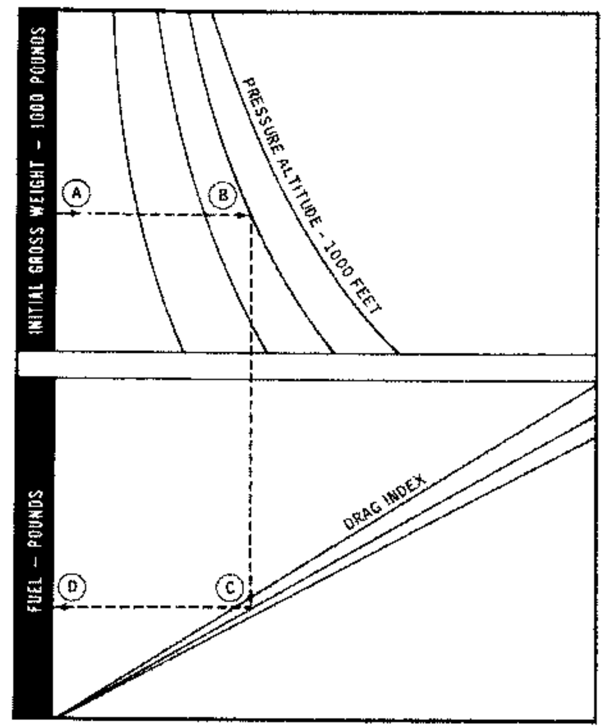
(A) Initial gross weight . . . . 14,000 lb

(B) Cruise altitude . . . . 35,000 ft

(C) Drag index 0

(D) Fuel required from cruise altitude to sea level . . . . 112 lb

SAMPLE DESCENT FUEL



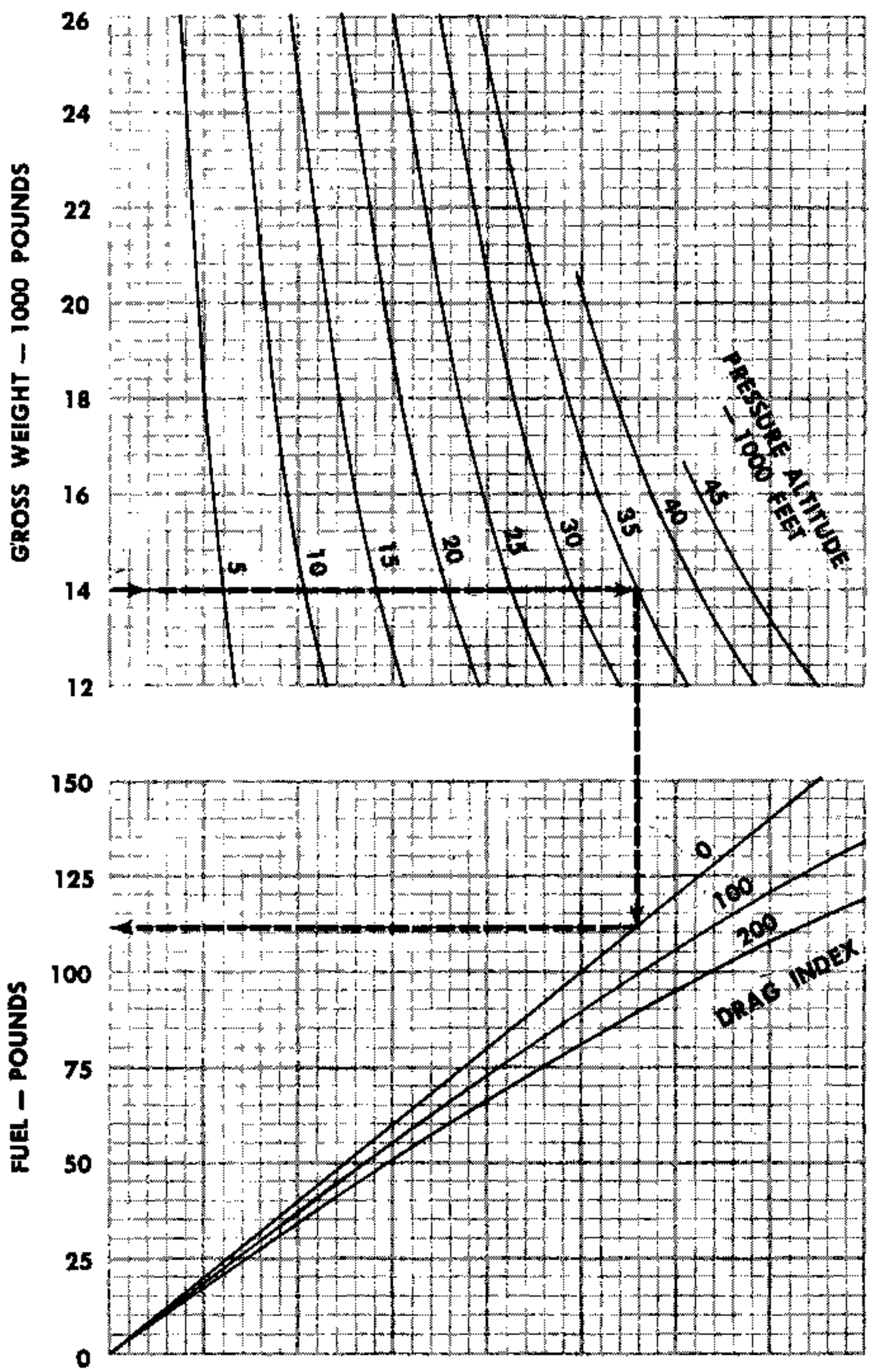
Note

From figure 11-42, descent speed is 200 KCAS.

DESCENT FUEL
IDLE THRUST
GEAR UP
FLAPS UP
SPEEDBRAKES RETRACTED

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED



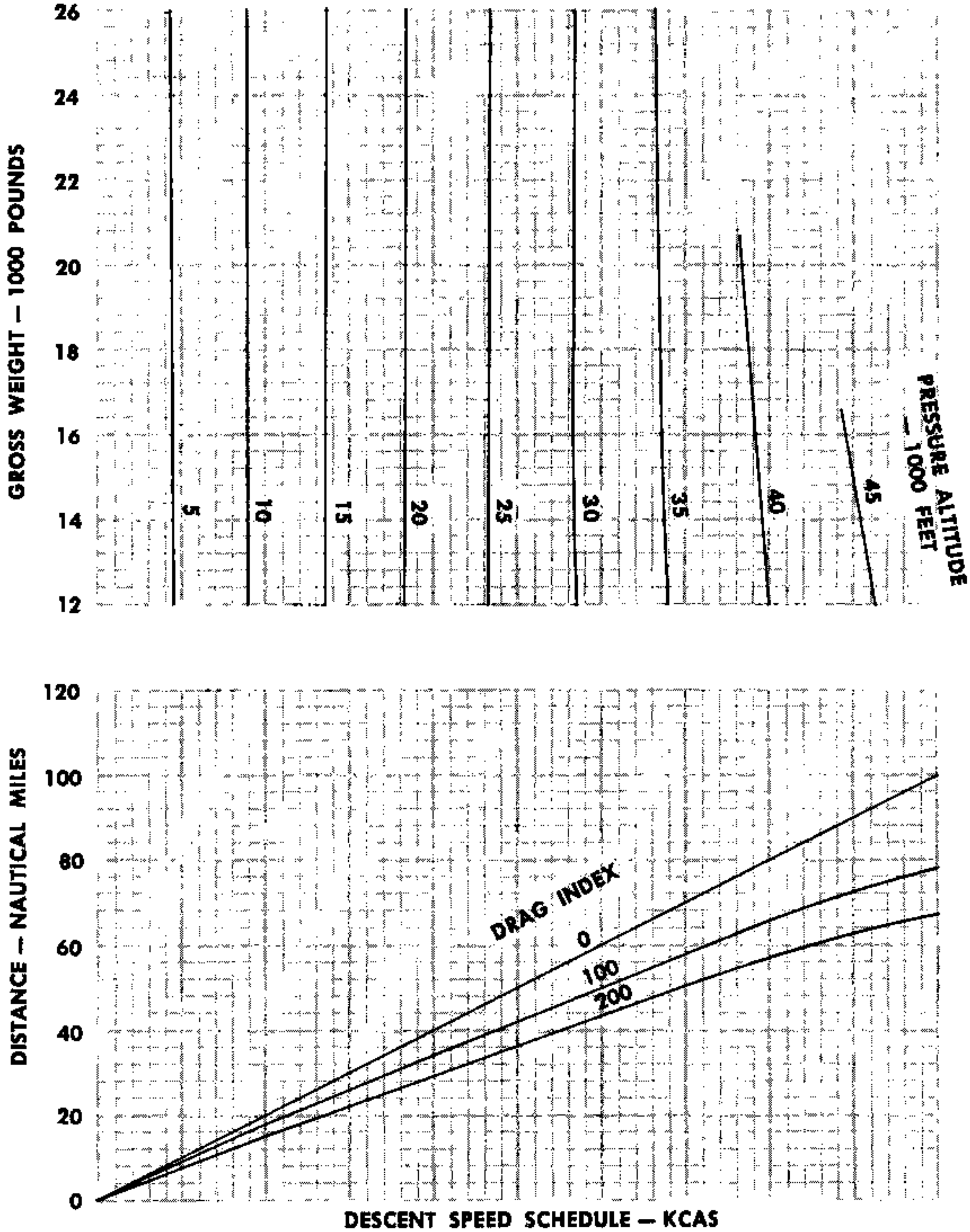
FA1-127

Figure 11-41. Descent Fuel

DESCENT DISTANCE

IDLE THRUST | FLAPS UP | SPEEDBRAKES RETRACTED | GEAR UP

MODEL: A-4M
ENGINE: J52-P-408
DATA AS OF: 1 DECEMBER 1970
DATA BASIS: ESTIMATED



	GROSS WEIGHT — 1000 POUNDS							
DRAG INDEX	12	14	16	18	20	22	24	26
0	185	200	215	225	240	250	260	270
100	175	185	200	210	220	230	240	250
200	165	180	190	200	210	220	230	240

FA1-128-A

Figure 11-42. Descent Distance

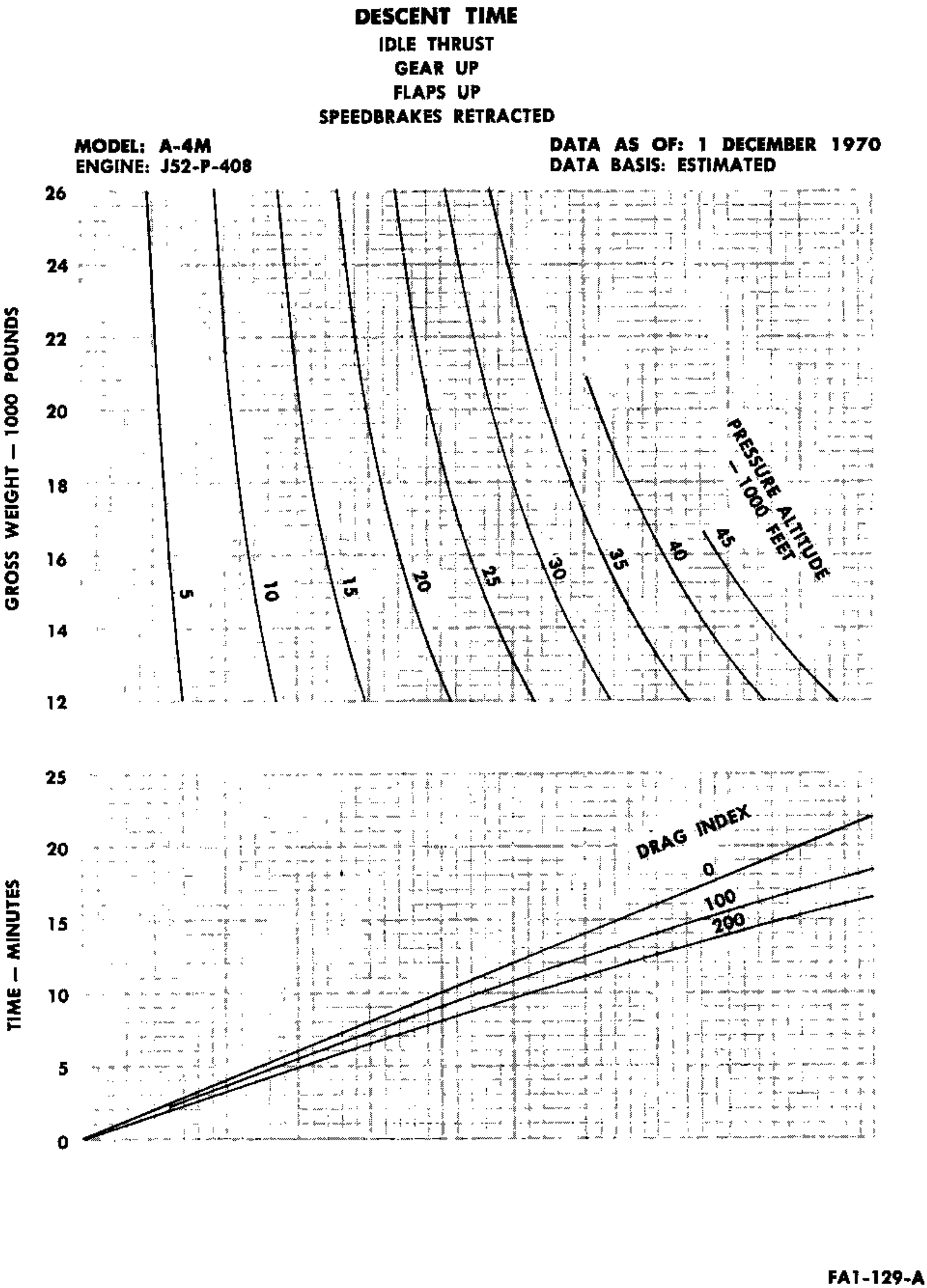


Figure 11-43. Descent Time

PART 8

LANDING

LANDING

Approach speeds, stall speeds, and corresponding angle-of-attack units are presented for the landing configurations in figure 11-44. These data are presented for an aircraft with gear down and speedbrakes open, using thrust required to maintain a 4-degree glide slope. If an angle-of-attack indication of 18 units does not produce the indicated airspeed as determined from figure 11-44 at the flap setting used for approach, recheck the configuration. If the appropriate configuration is established, disregard the angle-of-attack indicator and make the approach at the indicated airspeed from figure 11-44.

SAMPLE PROBLEM

Approach Speed

(For figure 11-44)

(A) Gross weight . . . . 14,000 lb

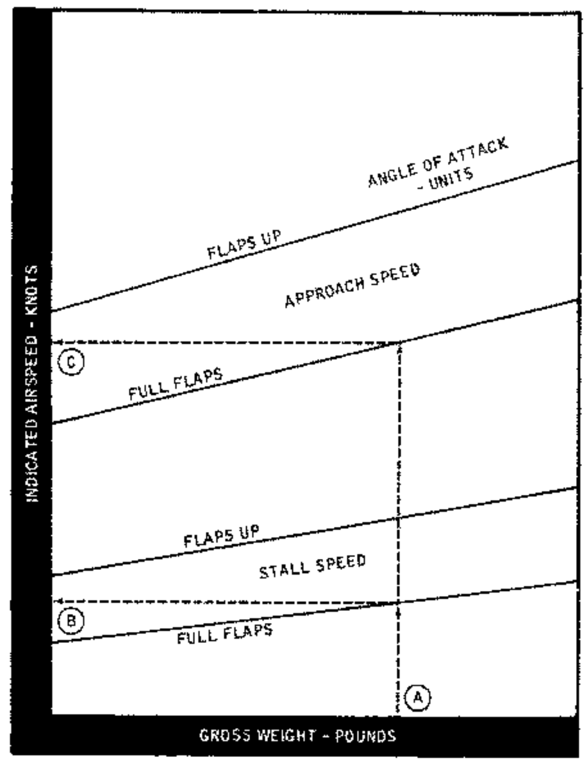
(B) Stall speed (Full flaps) . . . . 105.4 KIAS
Angle of attack . . . . 25.8 units

(C) Approach speed (Full flaps) . . . . . . 126 KIAS
Angle of attack . . . . 18 units

Landing ground-roll distances are presented in figures 11-45 and 11-46. Figure 11-45 presents ground-roll distances without drag chute and figure 11-46 presents ground-roll distances using the drag chute. Data are provided for three runway conditions: dry, wet, and snow and ice. All distances are based on an aircraft with speedbrakes and spoilers fully extended, flaps as set for approach, approach speeds as determined from figure 11-44, maximum braking effort without skidding the tires, and the throttle set at idle throughout the ground-roll.

To use the landing distance charts, the temperature, pressure altitude, gross weight, flap deflection, headwind, and runway gradient must be known. The distance to clear a 50-foot obstacle is measured horizontally from the 50-foot obstacle to the end of the ground roll and is determined by adding 715 feet to the ground-roll distance, assuming a standard 4-degree glide slope.

SAMPLE APPROACH SPEED



FA1-190

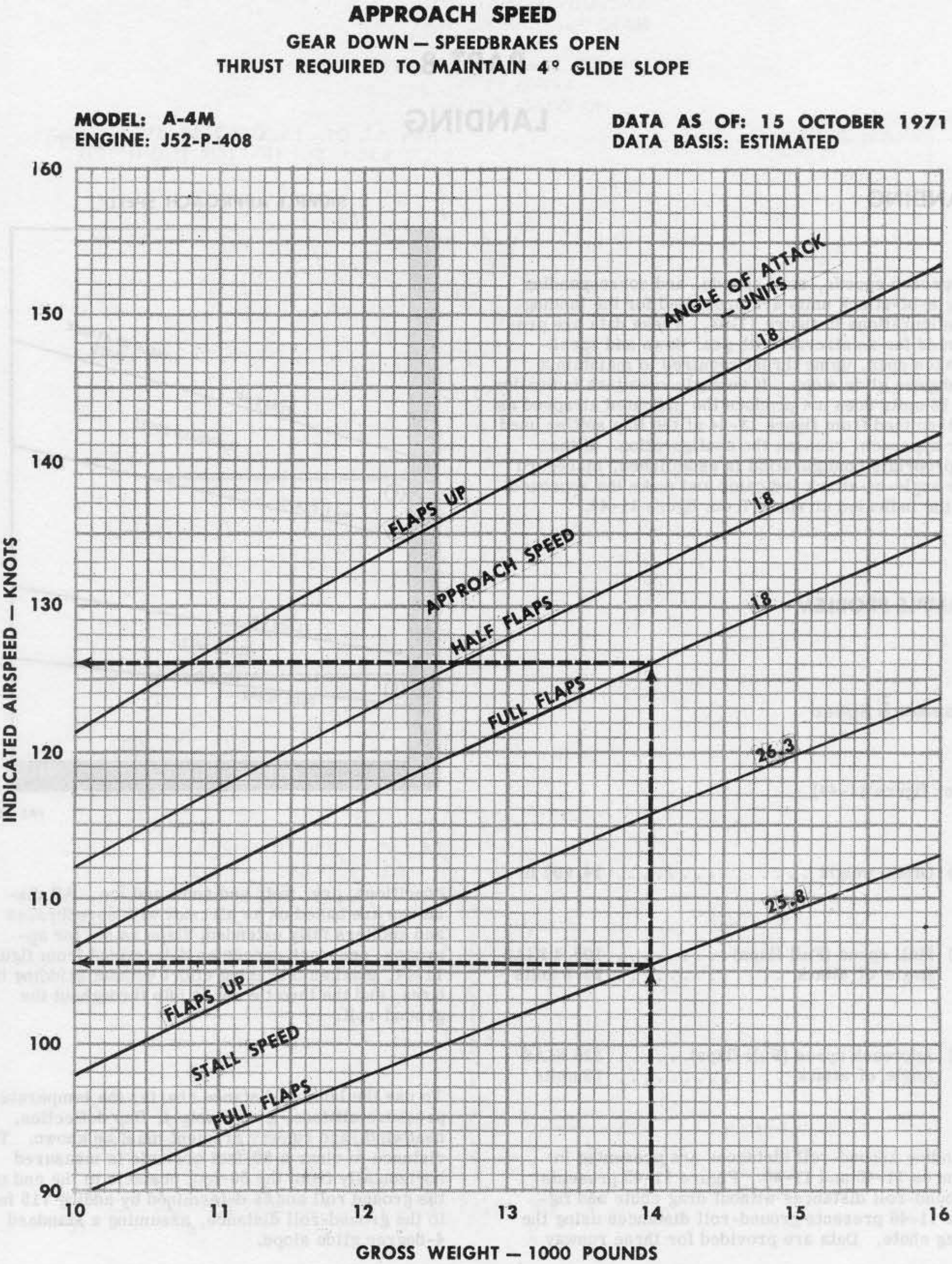


Figure 11-44. Approach Speed

LANDING DISTANCE
HARD SURFACE RUNWAY
DRY
SPEEDBRAKES AND SPOILERS OPEN
RCR = 23
NO DRAG CHUTE

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: CONTRACTOR FLIGHT TEST

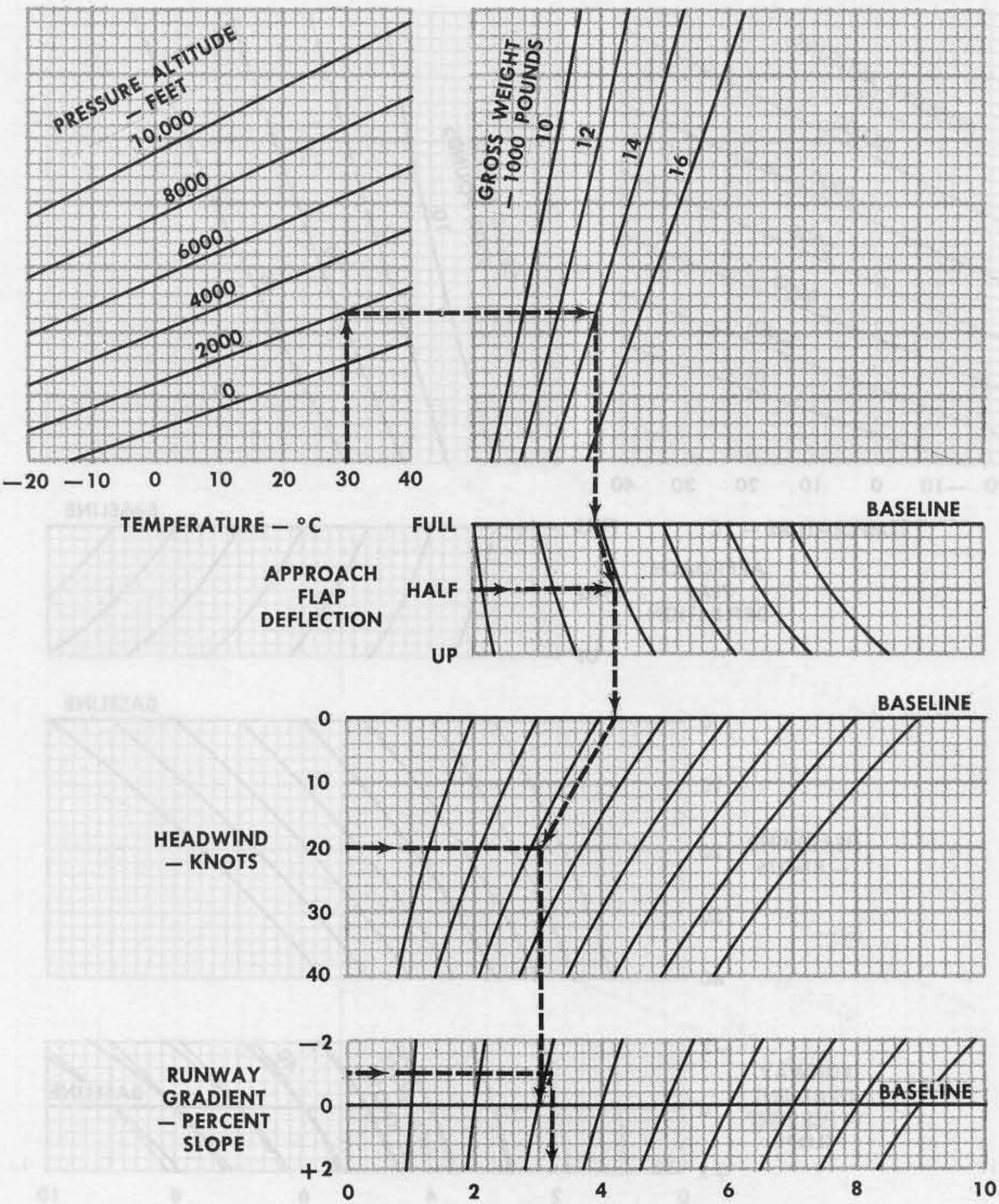


Figure 11-45. Landing Distance – No Drag Chute (Sheet 1)

LANDING DISTANCE

HARD SURFACE RUNWAY
WET
SPEEDBRAKES AND SPOILERS OPEN
RCR = 15
NO DRAG CHUTE

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

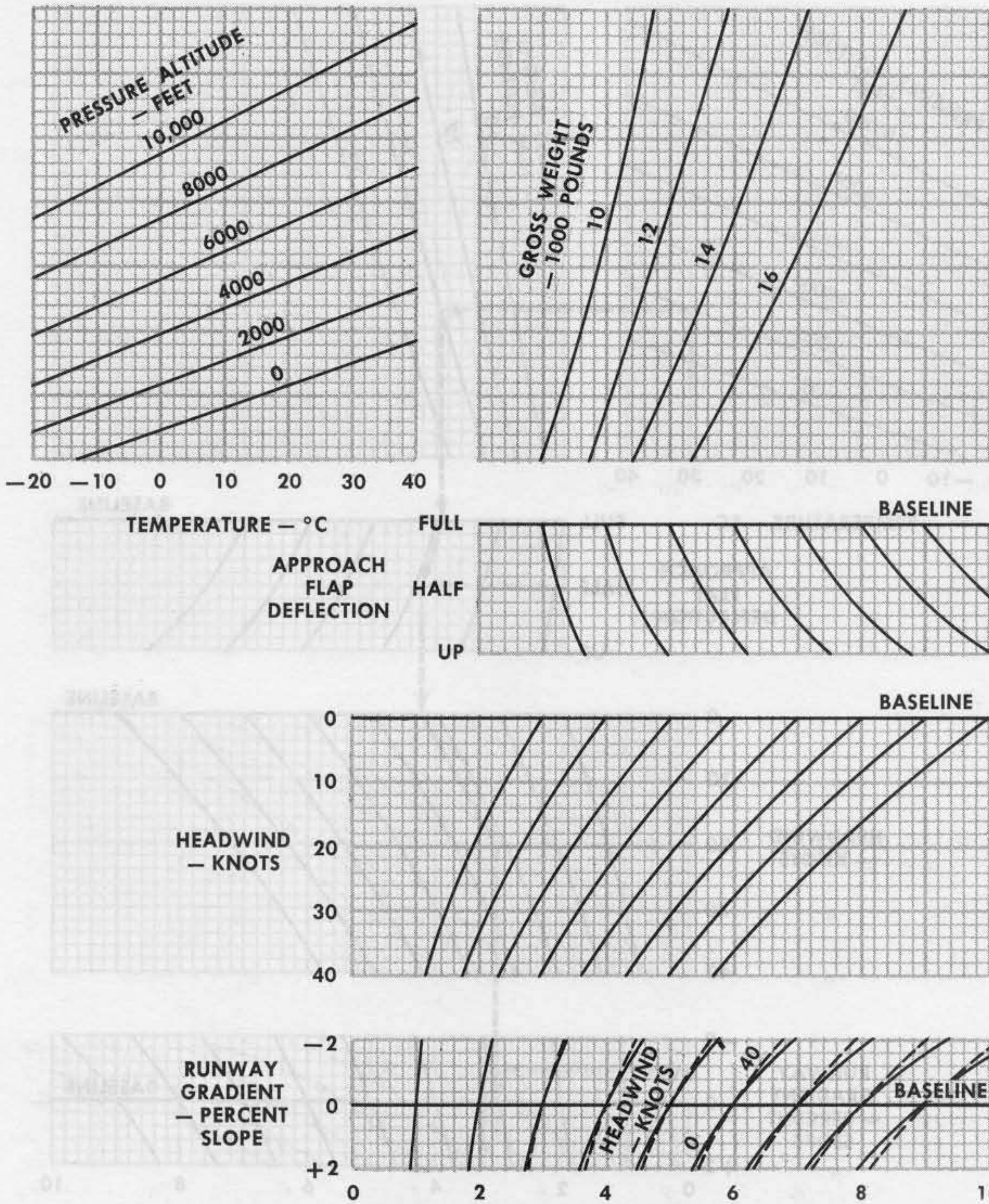


Figure 11-45. Landing Distance — No Drag Chute (Sheet 2)

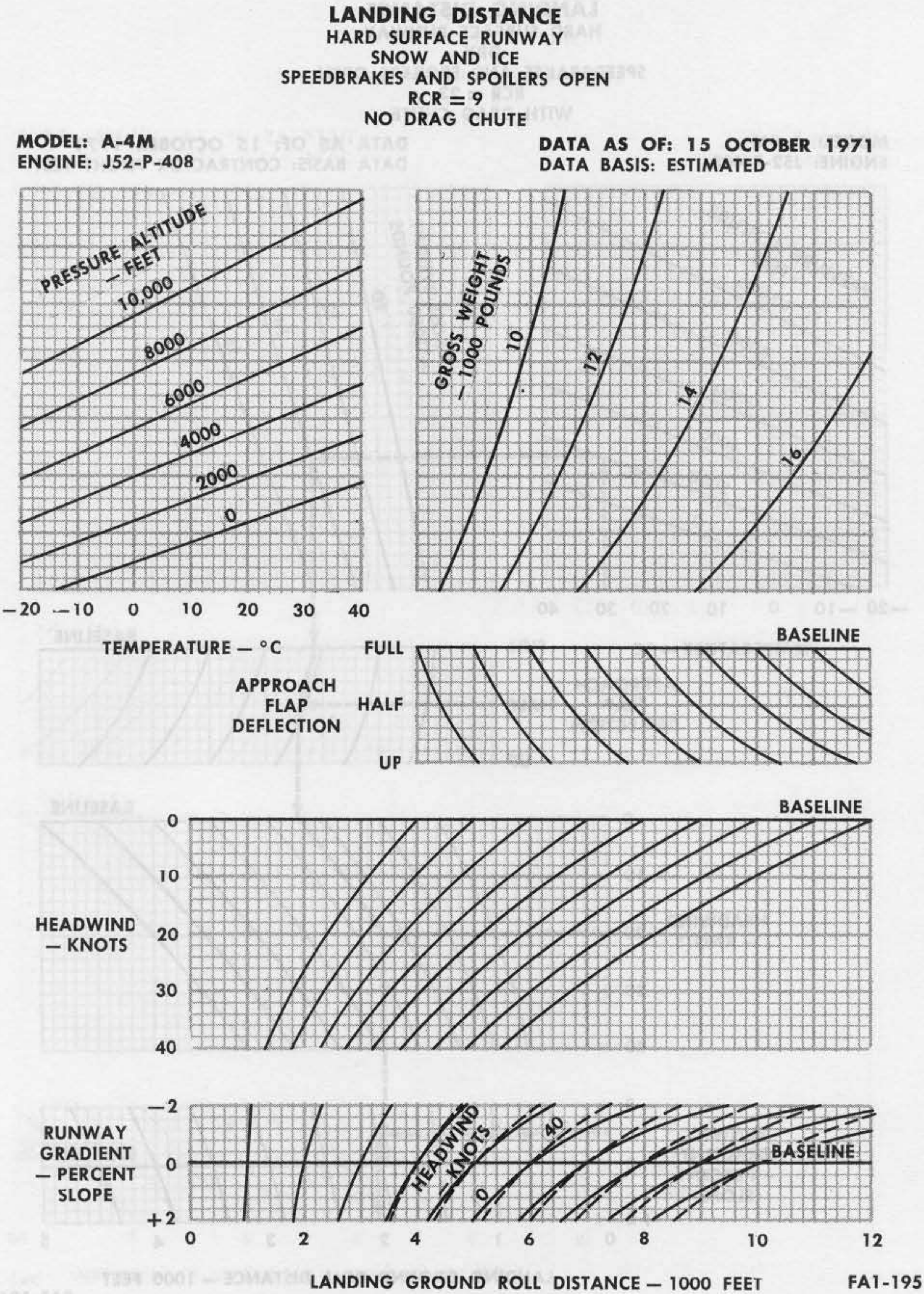


Figure 11-45. Landing Distance — No Drag Chute (Sheet 3)

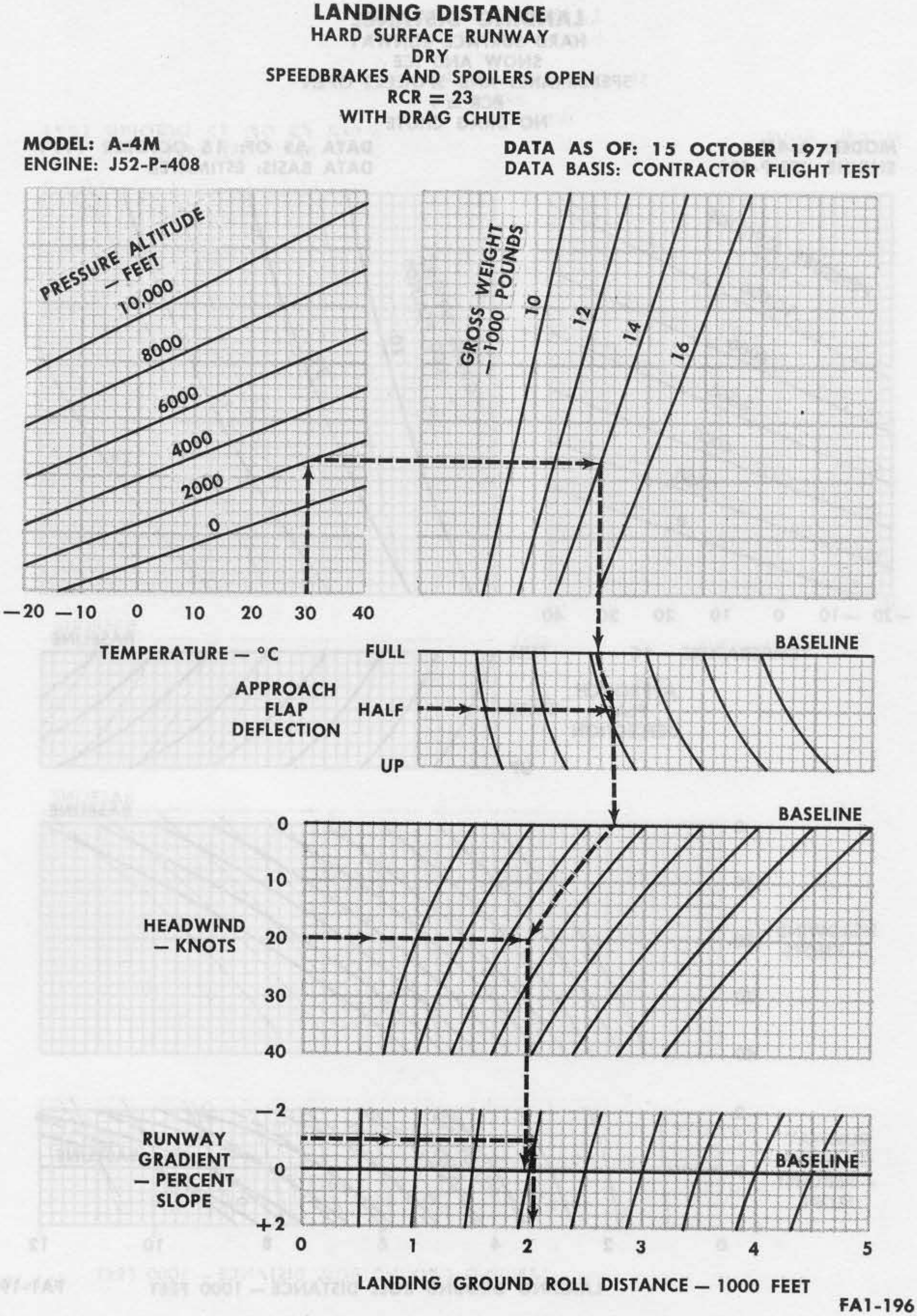


Figure 11-46. Landing Distance – With Drag Chute (Sheet 1)

LANDING DISTANCE
HARD SURFACE RUNWAY
WET
SPEEDBRAKES AND SPOILERS OPEN
RCR = 15
WITH DRAG CHUTE

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

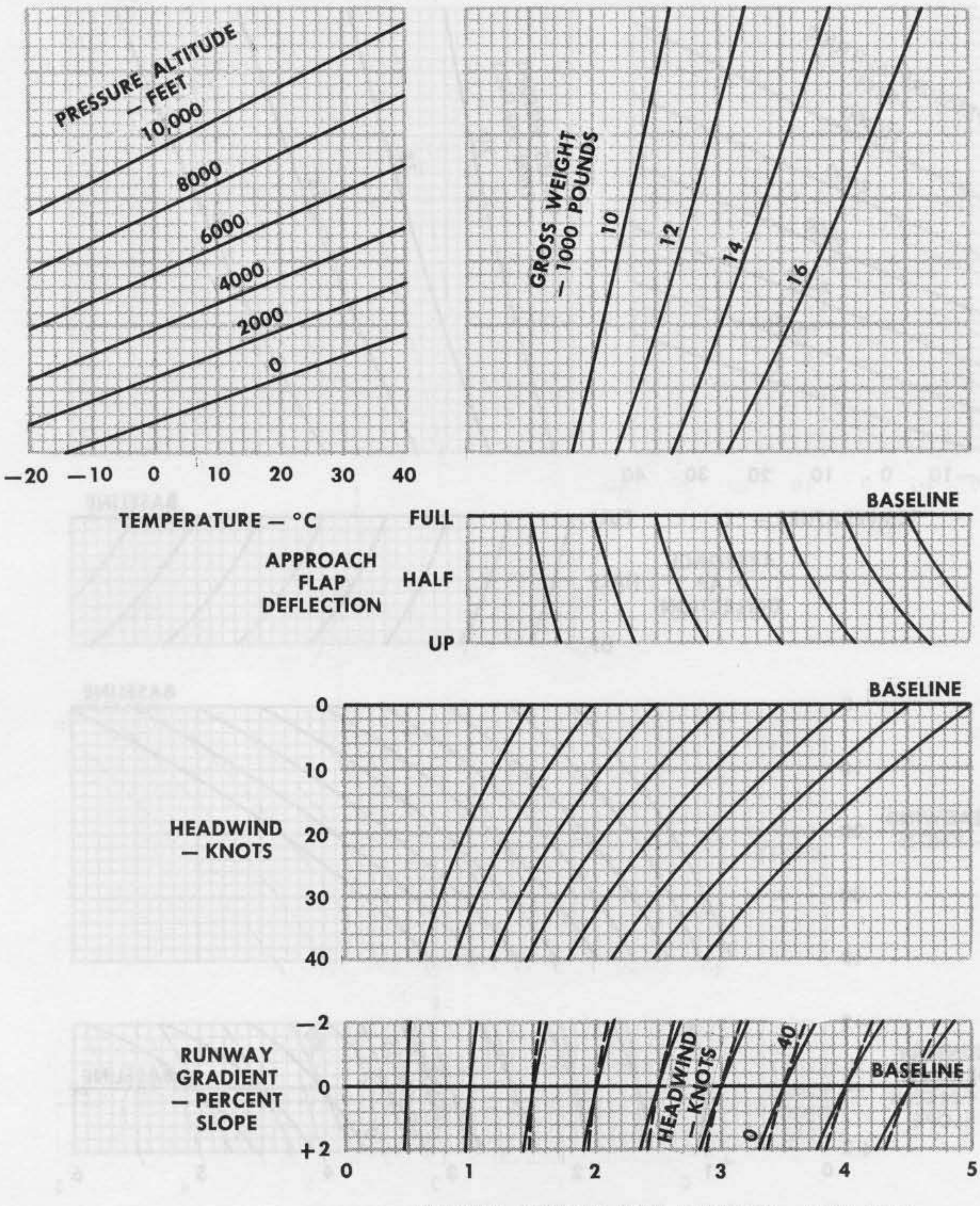


Figure 11-46. Landing Distance — With Drag Chute (Sheet 2)

LANDING DISTANCE

HARD SURFACE RUNWAY
SNOW AND ICE
SPEEDBRAKES AND SPOILERS OPEN
RCR = 9
WITH DRAG CHUTE

MODEL: A-4M
ENGINE: J52-P-408

DATA AS OF: 15 OCTOBER 1971
DATA BASIS: ESTIMATED

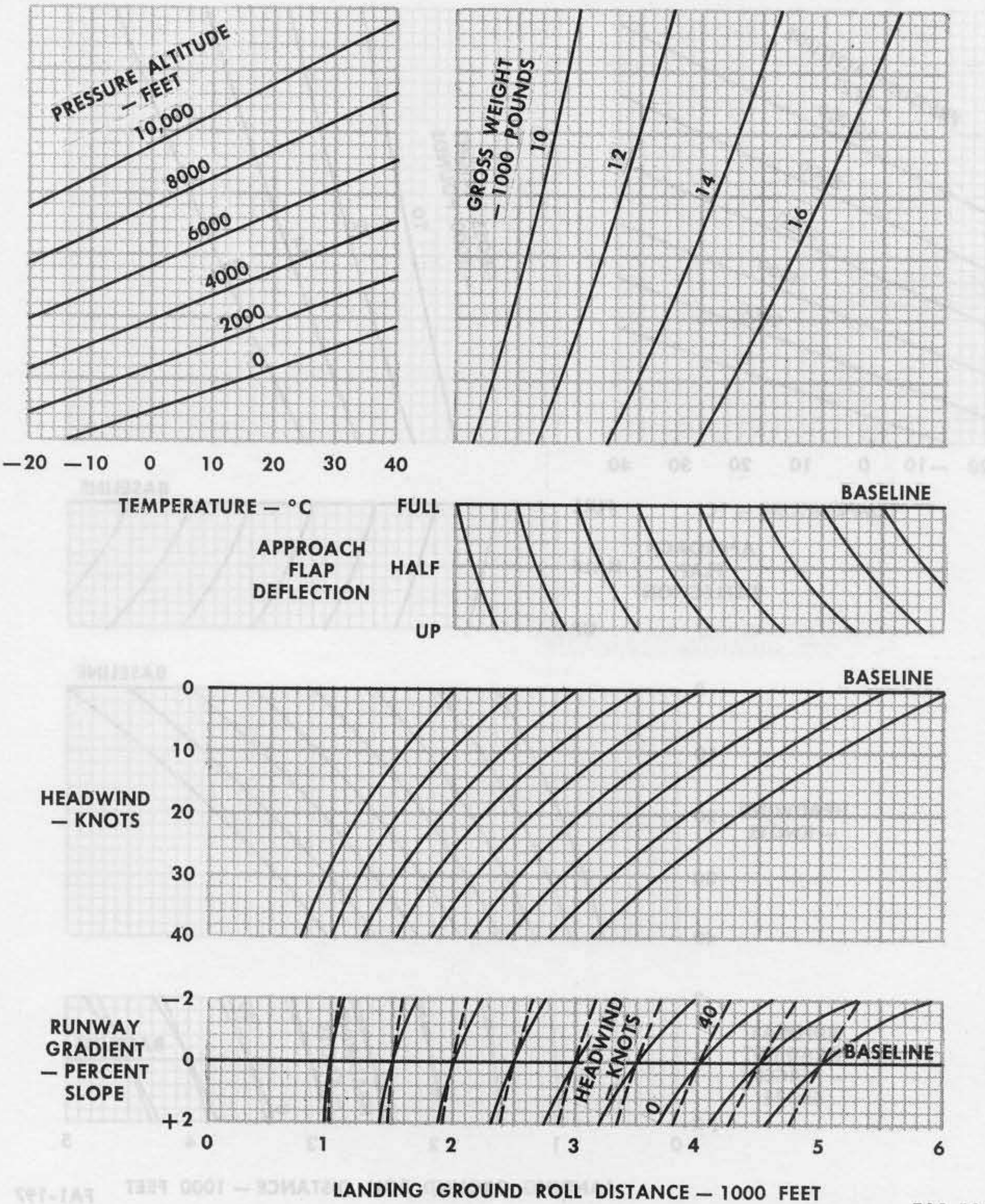


Figure 11-46. Landing Distance — With Drag Chute (Sheet 3)

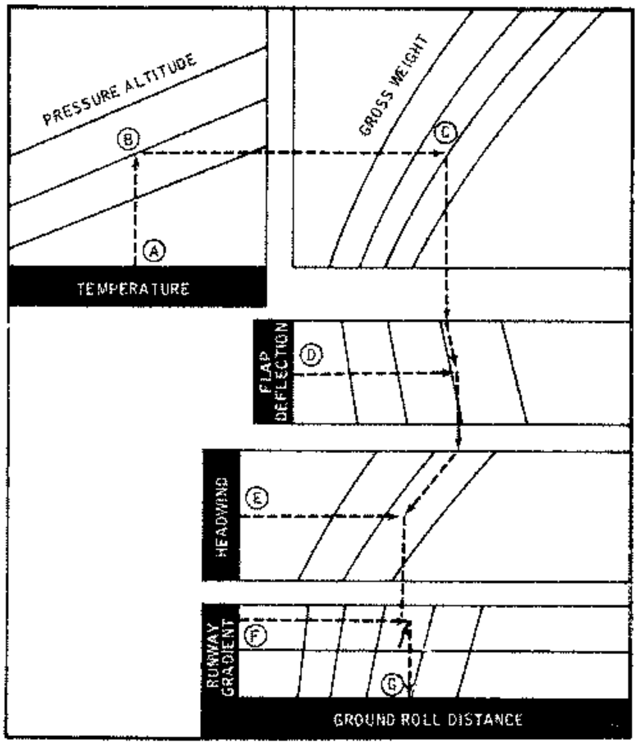
SAMPLE PROBLEM

Landing Distance

(For figure 11-45, sheet 1 and figure 11-46, sheet 1)

Runway Condition: Wet

SAMPLE LANDING DISTANCE



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(A) Outside air temperature ..... 30°C

(B) Runway pressure altitude ..... 2000 ft

(C) Landing gross weight .... 14,000 lb

(D) Approach flap deflection ...... Half

(E) Headwind .... 20 kn

(F) Runway gradient .... -1 percent

(G) Ground roll distance:

No drag chute .... 3200 ft

With drag chute .... 2020 ft

PART 9
COMBAT PERFORMANCE

COMBAT PERFORMANCE

This part contains the performance charts associated with the combat phase of the mission. Turning radius, maneuverability, maximum Mach number, and military fuel flow are included.

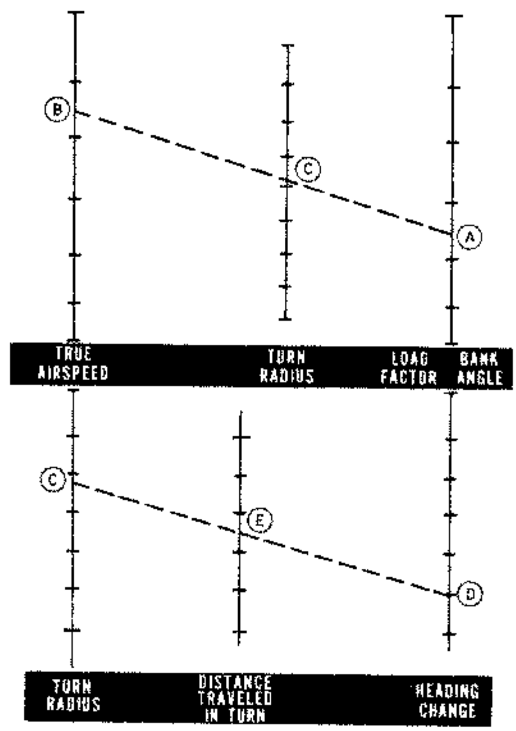
TURNING RADIUS

The turning radius nomograph, figure 11-47, presents data for steady state level turns as a function of true airspeed, normal load factor, bank angle, distance traveled, and heading change. When used in conjunction with the load factor limitations of the maneuverability charts, figure 11-48, the aerodynamic, engine, and structural characteristics of the aircraft are taken into account.

Note

> At normal low level airspeeds a rough planning aid for turning radius is the use of a dime on an ONC (1:1,000,000) or a quarter on a PC (1:500,000).

SAMPLE TURNING RADIUS



FA1-130

SAMPLE PROBLEM

Turning Radius

(For figure 11-47)

From Maneuverability Sample Problem 1 (Figure 11-48)

Mach Number 0.75

Normal Load Factor 3.84g

(A) Normal Load Factor 3.84g
(Bank Angle . . . . . 74.6 Degrees)

(B) True Airspeed . . . . 496 KTAS

(C) Turning Radius . . . . 6000 ft

(D) Heading change . . . . 90 degrees

(E) Distance Traveled in Turn . . . . . . 9200 ft

MANEUVERABILITY

Low-altitude maneuverability characteristics of the A-4M aircraft are shown in figure 11-48. These data provide a means of determining either the maximum load factor attainable at a specified Mach number (sample problem 1) or the maximum (and minimum) Mach number for a predetermined load factor requirement (sample problem 2). These data are presented as a function of altitude, normal load factor

TURNING RADIUS

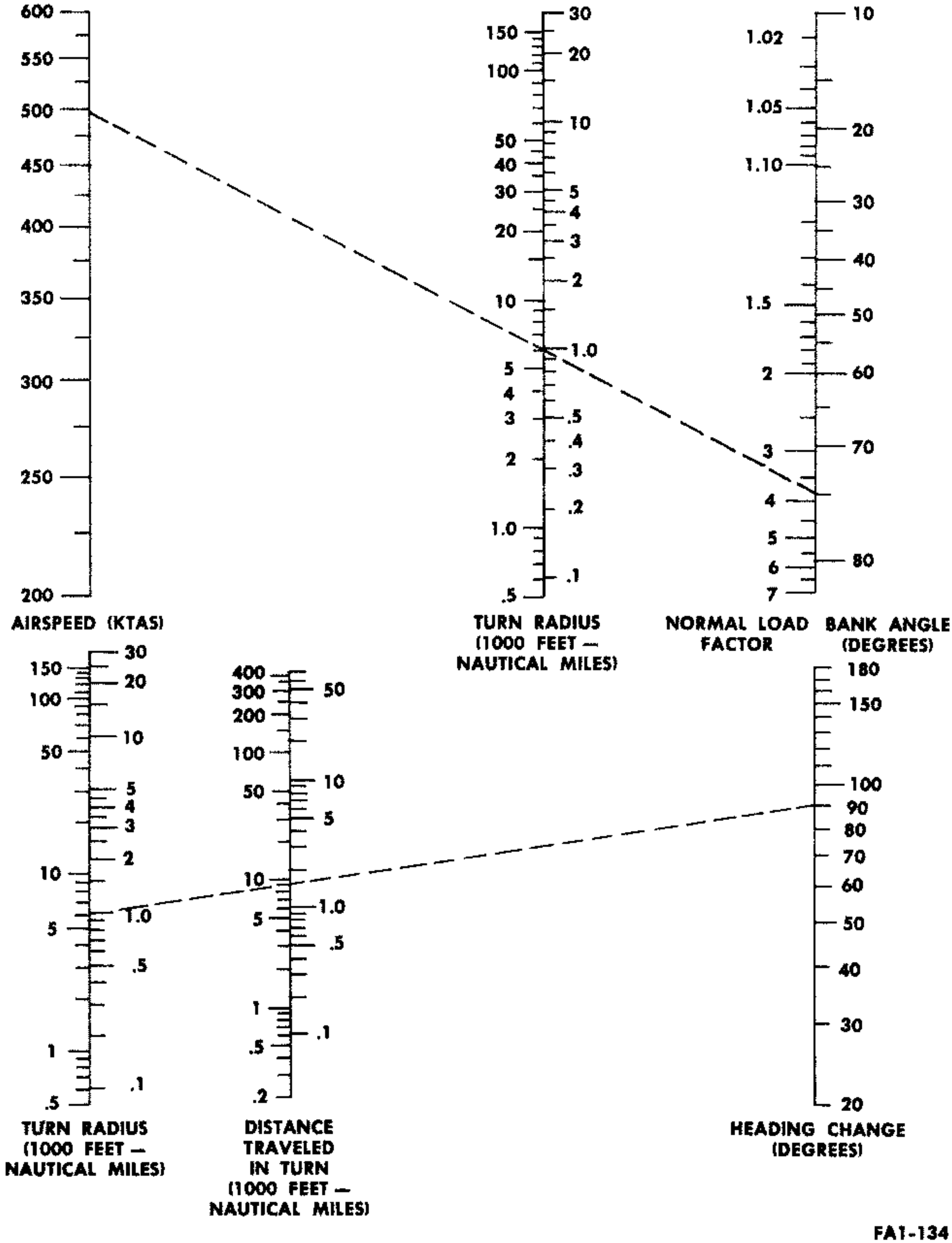


Figure 11-47. Turning Radius

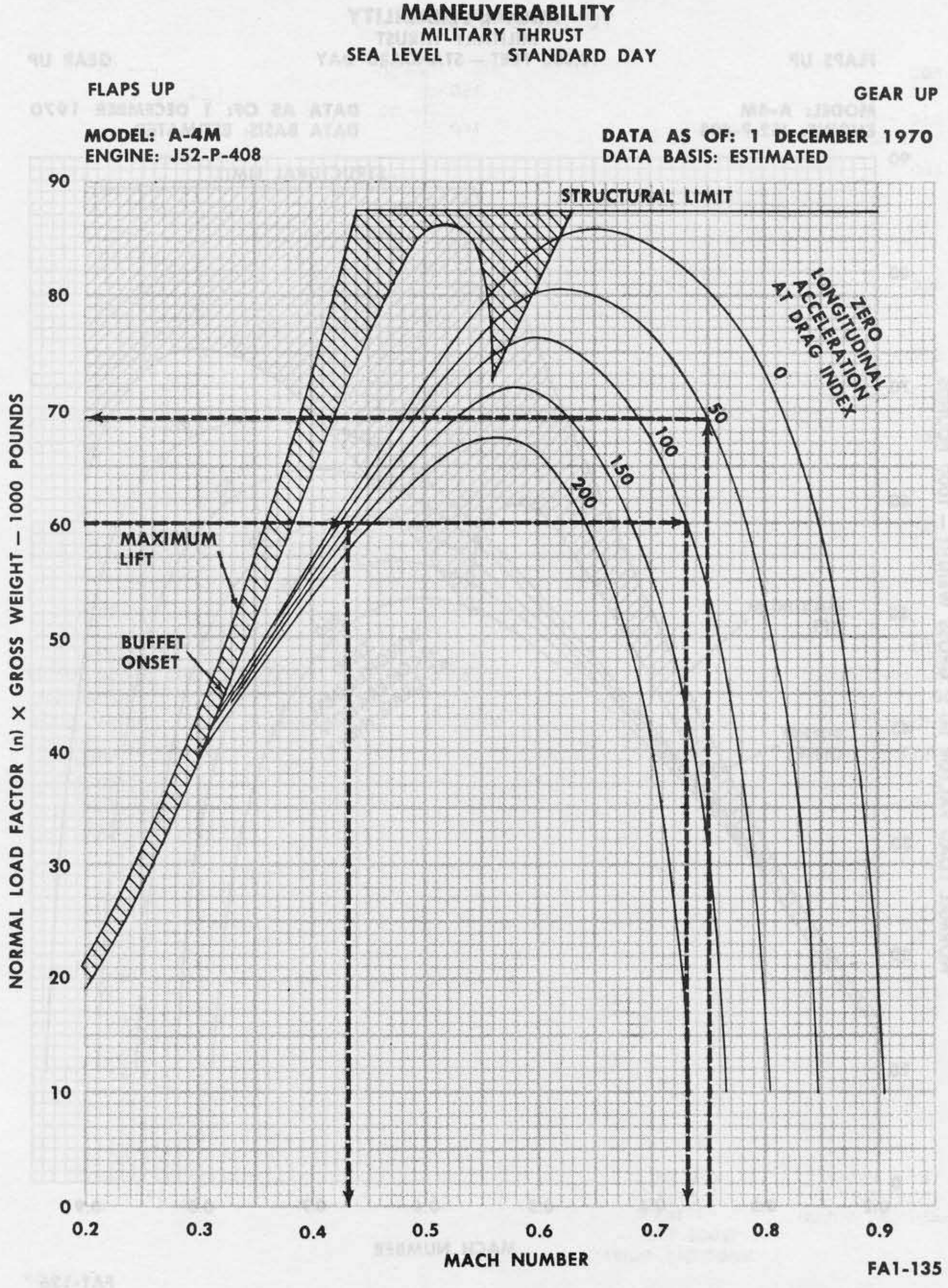


Figure 11-48. Maneuverability (Sheet 1)

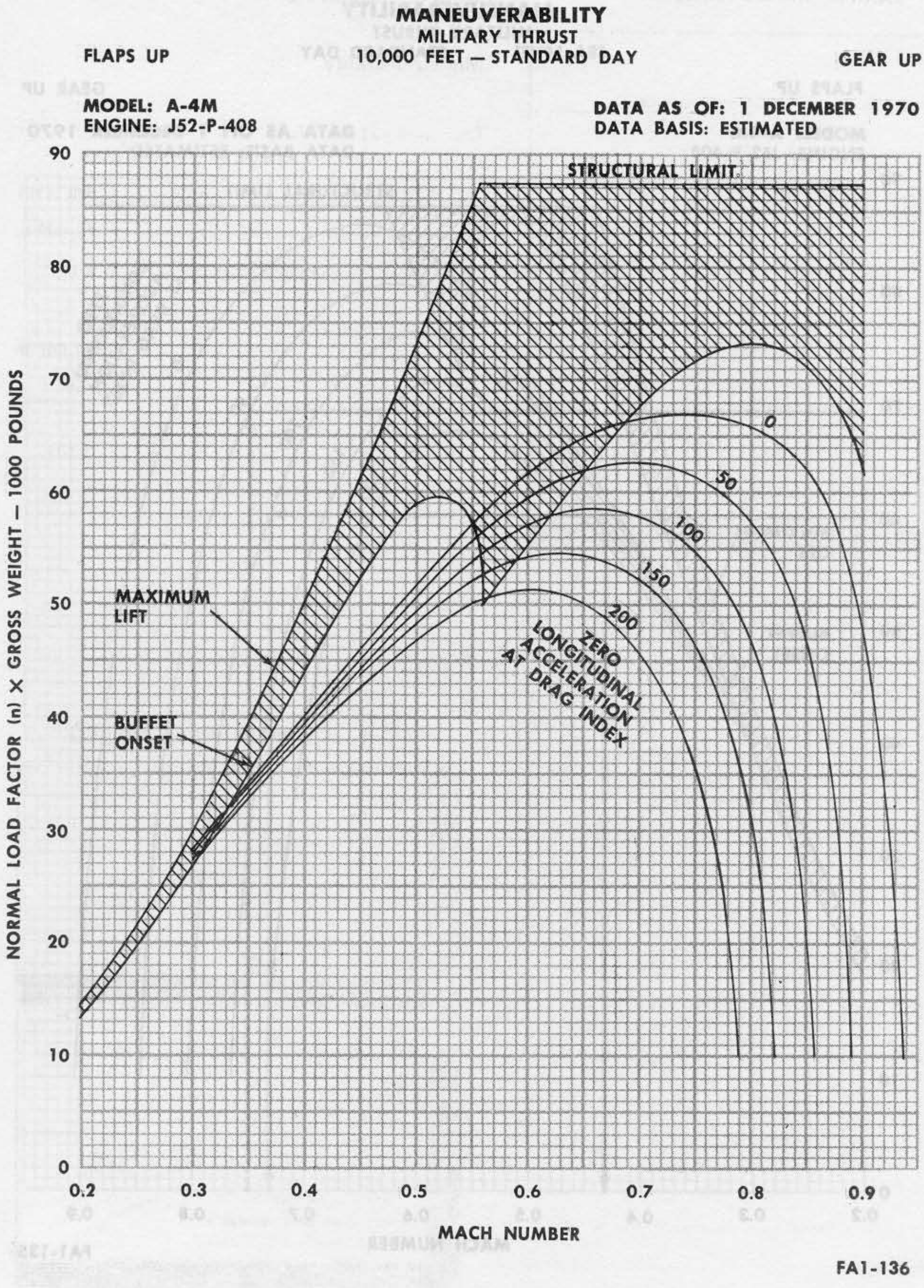
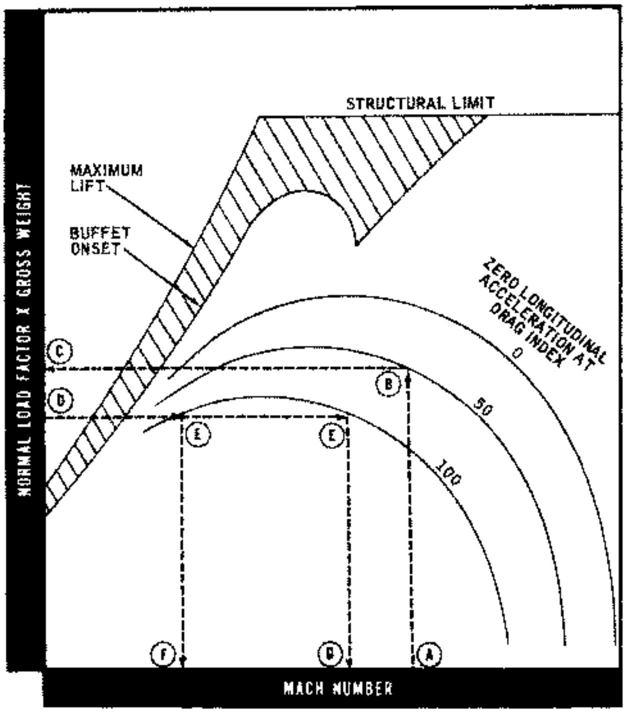


Figure 11-48. Maneuverability (Sheet 2)

SAMPLE MANEUVERABILITY



FA1-131

times gross weight, Mach number, and drag index for zero longitudinal acceleration. Superimposed on the graphs are lines showing maximum lift, buffet on-set, and structural limits. All data presented are based on the engine developing military thrust.

SAMPLE PROBLEM 1

Maneuverability

(For figure 11-48, sheet 1)

	Altitude	Sea level
	Gross weight	18,000 lb
(A)	Mach number	0.75
(B)	Drag index	50
(C)	Normal load factor x gross weight . .	69,000 lb
	Gross weight.	18,000 lb
	Normal load factor at zero longitudinal acceleration	3.84g

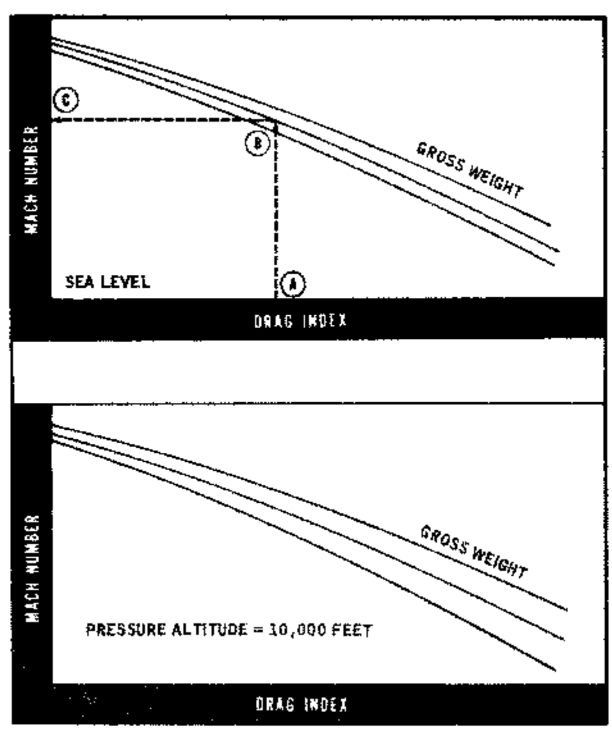
SAMPLE PROBLEM 2

Maneuverability

(For figure 11-48, sheet 1)

	Altitude	Sea level
	Gross weight	20,000 lb
	Normal load factor required	3.0g
(D)	Normal load factor x gross weight	60,000 lb
(E)	Drag index	100
(F)	Minimum Mach number at 3.0g	0.434
(G)	Maximum Mach number at 3.0g	0.731

SAMPLE MAXIMUM MACH NUMBER



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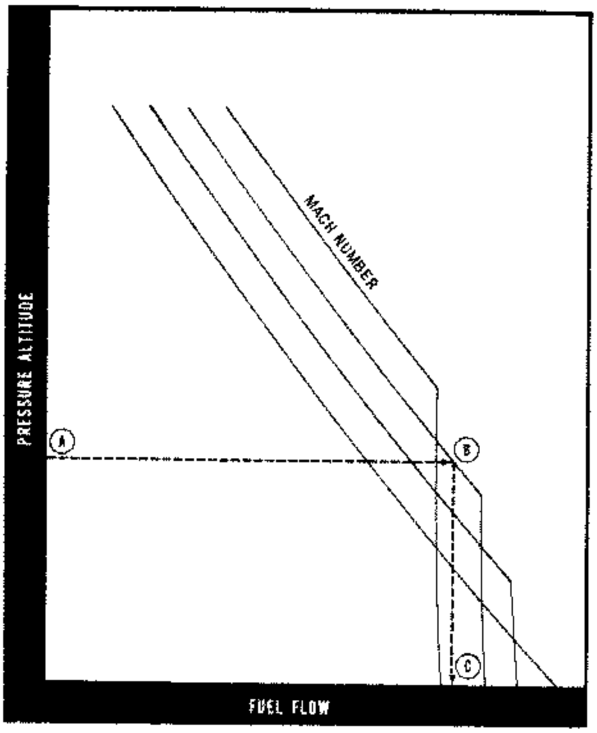
SAMPLE MILITARY FUEL FLOW



FA1-133

MAXIMUM MACH NUMBER

Level flight maximum Mach number, at military thrust, is shown in figure 11-49, as a function of drag index and gross weight at altitudes of sea level and 10,000 feet. Military thrust fuel flow is presented in figure 11-50 as a function of pressure altitude and Mach number.

SAMPLE PROBLEM

Maximum Mach Number

(For figure 11-49)

(A) Drag index 60

(B) Gross weight at sea level . . . . 18,000 lb

(C) Maximum Mach number 0.833

SAMPLE PROBLEM

Military Fuel Flow

(For figure 11-50)

(A) Pressure altitude . . . . 10,000 ft

(B) Mach number 0.90

(C) Fuel flow . . . . 156 lb/min

MAXIMUM MACH NUMBER
MILITARY THRUST
ICAO STANDARD ATMOSPHERE

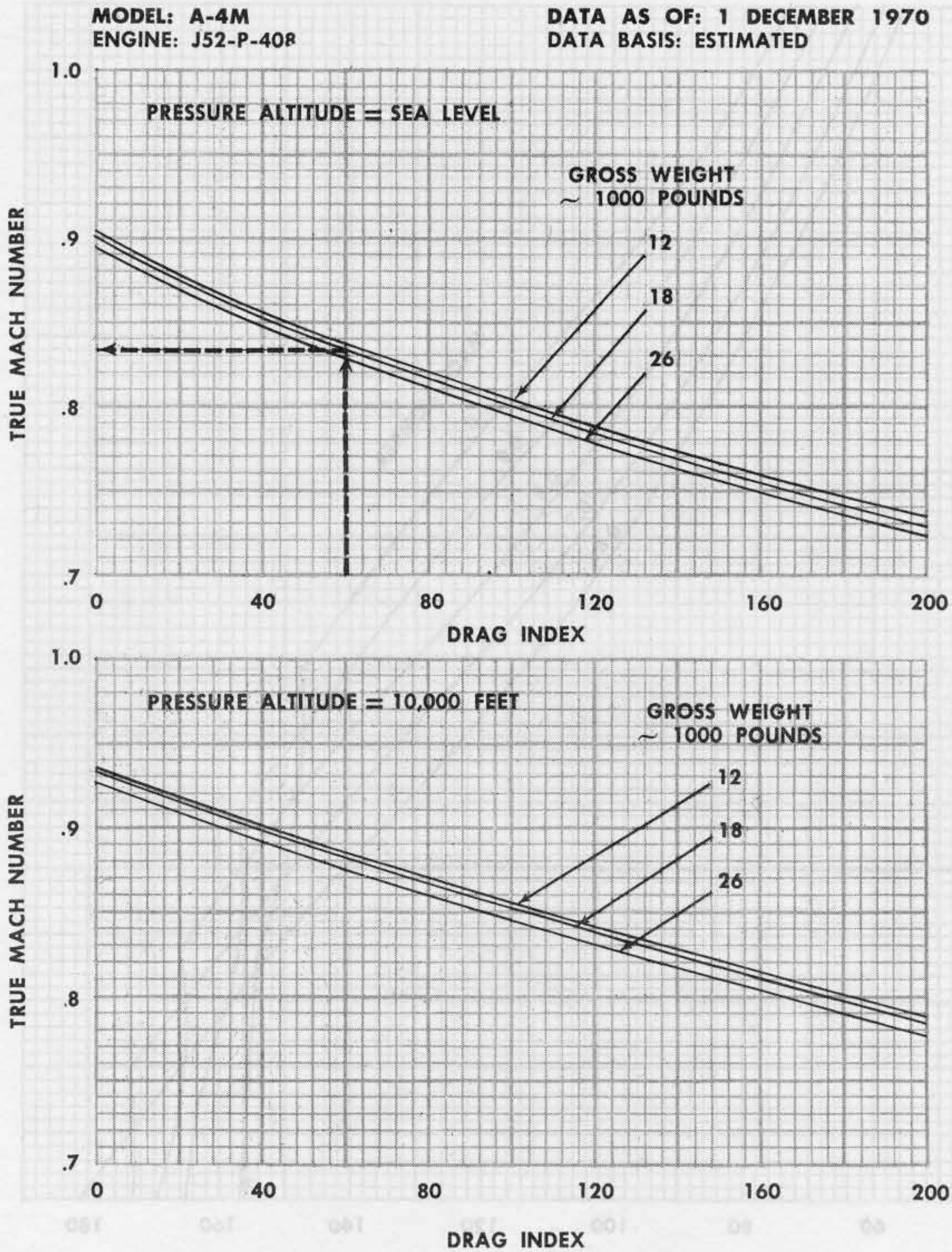


Figure 11-49. Maximum Mach Number

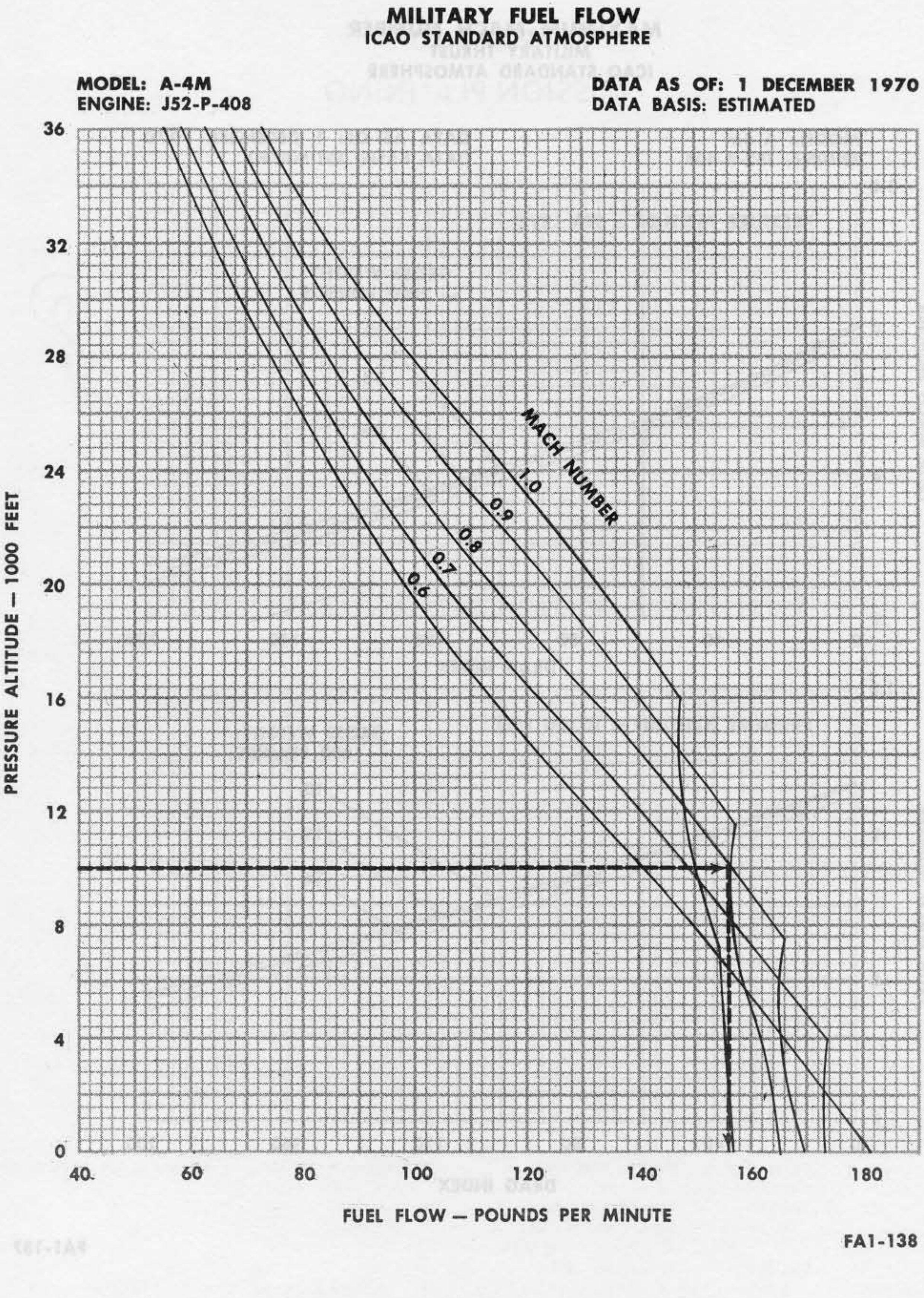


Figure 11-50. Military Fuel Flow

PART 10
MISSION PLANNING

MISSION PLANNING

Optimum use of the aircraft to obtain maximum performance at a minimum rate of fuel consumption requires careful preflight planning for the mission. One of the most important phases of mission planning is the determination of the maximum radius of action from the field which will allow return with an adequate fuel reserve.

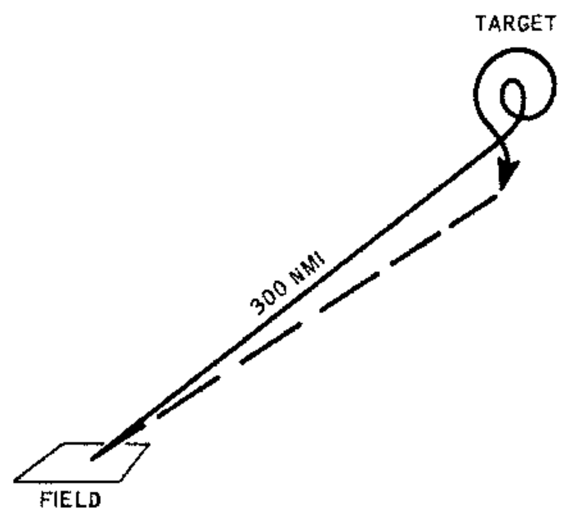
To find the maximum radius, a combat plan must be formulated in advance, and a loiter altitude and distance must be established before the combat phase of the mission is begun. Fuel consumption is high during combat maneuvers and any delay in beginning the combat action will shorten the combat time, or seriously reduce the amount of planned fuel reserve.

The following sample problem is an exercise in the use of the performance charts contained in Parts 1 through 9. The example is not intended to reflect an actual mission. The sample problem illustrates, through a graphical solution, how the performance charts can be integrated to form a complete mission flight plan. The steps used to develop such a plot are shown with the problem.

SAMPLE PROBLEM

Takeoff and proceed on course at 25,000 feet altitude at maximum range Mach number, descend to 5000 feet altitude; hold on station awaiting instructions from ground observers then attack the target with two clusters of 5xMK 81 LDGP bombs along with two single MK 81 LDGP bombs. Return to the field at maximum range cruise altitude with 800 pounds of reserve fuel. Following is a plan view.

SAMPLE PLAN VIEW

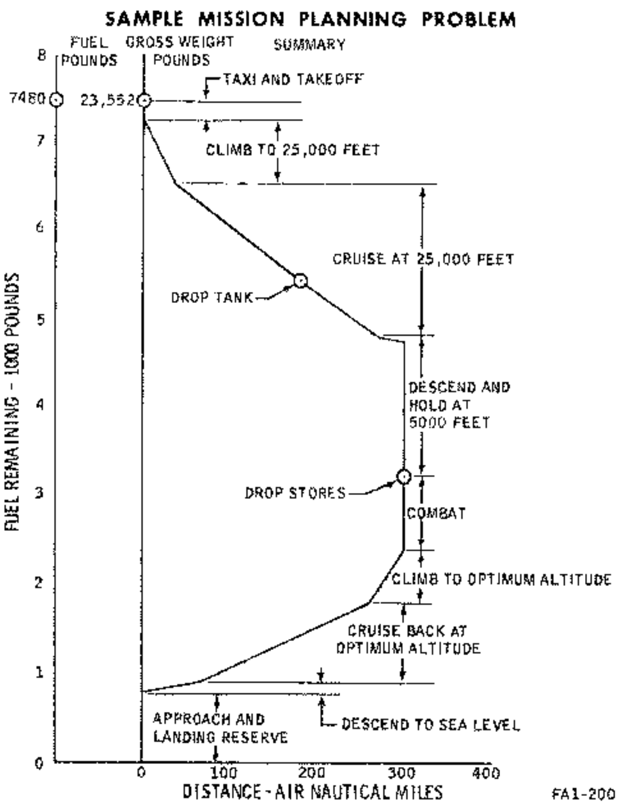


FA1-199

Assumptions and Comments

1. Assume zero wind and ICAO standard day conditions.
2. Assume the gun ammunition is not fired during the mission.
3. Assume a combat allowance of 5 minutes at military thrust to drop the bombs at the target.

The Sample Mission Planning Problem Summary solution of the problem is introduced at this point so the pilot can see the complete graphic picture before the actual solution is broken into parts.



The problem is solved by plotting fuel remaining versus air distance. Gross weight is also superimposed on the vertical scale.

The first step is to derive gross weight and drag index values as shown. The mission problem is then solved in incremental steps, working from takeoff through descent and working backward from landing to combat.

Start solving the mission requirements by working backward from the landing reserves. The solution follows.

Gross Weight and Drag Index

(From figure 11-1 and NAVAIR 01-40AV-1T)

Items	Drag Index	Weight (pounds)
Zero fuel, zero payload	0	11,427
Two 20mm guns and ammo	7	628
Two station 75 wing pylons	12	140
Two station 113.75 wing pylons	14	128
Two MER-7 on station 75	46	446
One 300-gallon bobtail fuel tank on centerline station	15	183
Two 5xMK 81 LDGP bombs	28	2600
Two 1xMK 81 LDGP bombs on station 113.75	4	520
Internal fuel (800 gallons JP-5)		5440
External fuel (300 gallons JP-5)		2040
Takeoff Totals	126	23,552
Drop 300-gallon tank	-15	-183
Total	111	
Drop bombs	-32	-3120
Total	79	
Fuel used (internal)		-5440
Fuel used (external)		-2040
Total (zero fuel weight)	79	12,769

Approach and Landing Reserve Allowances

The landing reserve is assumed to be 800 pounds which will permit sea level landing pattern operation for 15 to 20 minutes. This point is plotted as shown on the Sample Cruise Back, Descent, and Landing Reserve plot at 800 pounds of fuel remaining and zero nautical miles distance.

Descent from Optimum Cruise Altitude to Sea Level

Time, fuel, and distance for descent can be determined from the descent charts (figures 11-41 through 11-43). The drag index for this configuration is 79. Assume that the weight at the beginning of the letdown is equal to the gross weight with reserve fuel (12,769 lb + 800 lb = 13,569 lb). The optimum cruise altitude for this weight and drag index is read from figure 11-20.

Initial Weight (pounds)	Optimum Cruise Altitude (feet)	Time (minutes)	Distance (nautical miles)	Fuel (pounds)
13,569	38,700	15	64	110

These values are plotted as shown on the Sample Cruise Back, Descent, and Landing Reserve plot at fuel remaining of 910 pounds (800 lb + 110 lb = 910 lb) and 64 nautical miles distance.

Return at Optimum Cruise Altitude

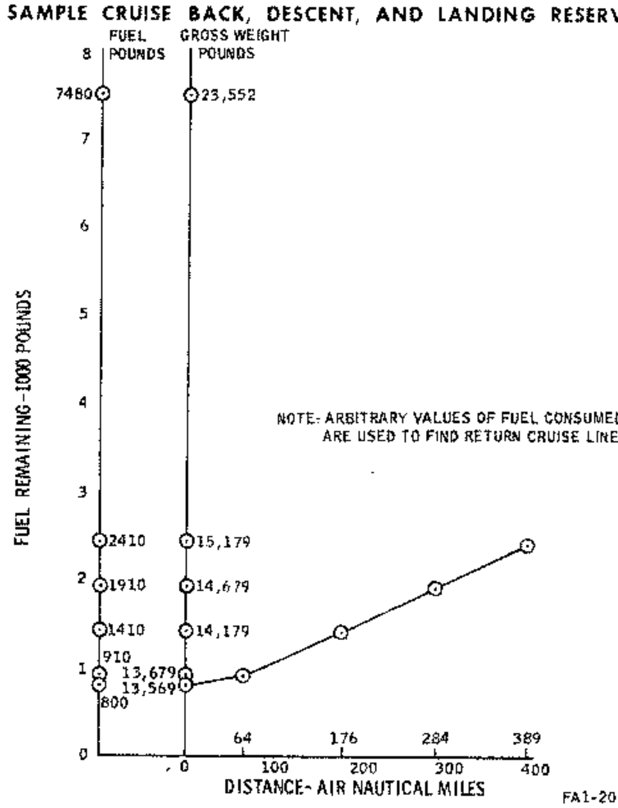
The optimum cruise altitude fuel requirements can be determined from figures 11-27 and 11-28. The drag index is 79 and the weight at end of cruise is 13,679 pounds (12,769 lb + 800 lb + 110 lb = 13,679 lb). Assume arbitrary cruise fuel increments and construct the return fuel-distance line as shown on the Sample Cruise Back, Descent, and Landing Reserve plot.

Fuel Increment (pounds)	Average Weight (pounds)	Optimum Cruise Altitude (feet)	Optimum Cruise Mach Number
500	13,929	38,200	0.685
500	14,429	37,100	0.685
500	14,929	36,900	0.685

Nautical Miles per Pound of Fuel	Distance Increment (nautical miles)
0.224	112
0.216	108
0.209	105

These points are plotted as shown on the Sample Cruise Back, Descent, and Landing Reserve plot at fuel remaining of 1410, 1910, and 2410 pounds respectively (fuel remaining = reserve fuel + descent fuel + cruise fuel increment). The corresponding distance points are 176, 284, and 389 air nautical miles (distance = descent distance + distance increment).

SAMPLE CRUISE BACK, DESCENT, AND LANDING RESERVE



FA1-201

Climb to Optimum Cruise Altitude

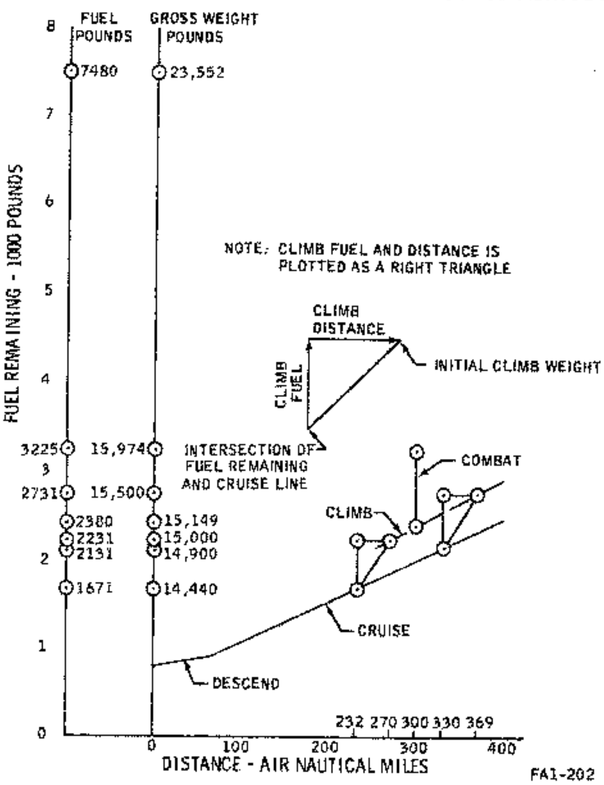
The time, fuel, and distance to climb from sea level to optimum cruise altitude can be determined from figures 11-16 through 11-20. Assume two arbitrary initial climb weights of 15,000 and 15,500 pounds and read the values at 79 drag index. Construct right triangle fuel-distance lines as shown on the Sample Combat and Climb to Optimum Cruise Altitude plot beginning at the appropriate fuel remaining values on the return at optimum cruise altitude line (fuel remaining = assumed initial climb weight -zero fuel weight -fuel to climb).

Initial Weight (pounds)	Fuel (pounds)	Distance (nautical miles)	Time (minutes)	Fuel Remaining (pounds)
15,000	560	38	5.9	1671
15,500	600	39	6.0	2131

Combat

A five-minute sea level, maximum speed, combat allowance is assumed to expend the bombs over the target. To permit a conservative fuel allowance, it is assumed that the bombs have been dropped prior to combat and the drag index is 79. Since the variation in maximum speed with gross weight at sea level is small assume that the combat weight is that weight which is determined by the intersection of the climb line and the required mission radius (combat weight = zero fuel weight + fuel remaining at 300 nautical miles (15,149 lb = 12,769 lb + 2380 lb). From figure 11-49 at a weight of 15,149 pounds and drag index of 79, maximum Mach number = 0.819. From figure 11-50 at sea level and Mach number of 0.819, fuel flow = 169 pounds per minute. Therefore fuel for 5 minutes is 845 pounds. The combat allowance of 845 pounds is added to the fuel remaining at 300 nautical miles. Assume that no distance is covered during combat.

SAMPLE COMBAT AND CLIMB TO OPTIMUM CRUISE ALTITUDE



FA1-202

Taxi, Takeoff, and Acceleration

The first portion of the plot is constructed by working backwards from the landing reserve. The remainder of the plot can be developed by starting at the taxi-takeoff condition. Takeoff weight is 23,552 pounds with a drag index of 126. Assume a five-minute taxi fuel flow at 12 pounds per minute, takeoff acceleration allowances of 150 pounds of fuel used, and no distance covered. Plot this point as shown on the Sample Takeoff, Climb, Cruise, Descent, and Hold on Station plot at 7270 pounds of fuel remaining (7480 lb - 60 lb - 150 lb = 7270 lb) and zero distance covered.

Climb to 25,000 Feet Cruise Altitude

The time, fuel, and distance to climb values are read from figures 11-16 through 11-20 at a drag index of 126 and an initial weight of 23,342 pounds (23,552 lb - 60 lb - 150 lb = 23,342 lb).

Initial Weight (pounds)	Fuel (pounds)	Distance (NMI)	Time (minutes)
23,342	740	37	6.0

These values are plotted, as shown on the sample plot, at a fuel remaining of 6530 pounds (7480 lb -60 lb - 150 lb = 6530 lb) and a distance of 37 nautical miles.

Cruise Out at 25,000 Feet Altitude

The initial cruise-out weight is 22,602 pounds (23,342 lb - 740 lb = 22,602 lb), and the drag index is 126. The fuel remaining in the 300-gallon drop tank is 1090 pounds (2040 lb - 60 lb - 150 lb - 740 lb = 1090 lb) and will be used during the initial portion of the cruise-out leg. Read nautical miles per pound of fuel from figures 11-27 and 11-28.

Fuel Increment (pounds)	Average Weight (pounds)	Maximum Range Mach Number	NMI/ Pound of Fuel	Distance Increment (NMI)
1090	22,057	0.635	0.131	143

Plot these values as shown on the sample plot at a fuel remaining of 5440 pounds (7480 lb - 2040 lb = 5440 lb) and a distance of 180 nautical miles (37 NM + 143 NM = 180 NM).

At this point the external fuel tank is dropped and the aircraft weight is 21,329 pounds (22,602 lb - 1090 lb - 183 lb = 21,329 lb) with a drag index of 111 (126 - 15 = 111). Assume arbitrary fuel increments and continue to construct the cruise out line.

Fuel Increment (pounds)	Average Weight (pounds)	Maximum Range Mach Number	NMI/ Pound of Fuel	Distance Increment (NMI)
500	21,079	0.635	0.137	69
500	20,579	0.630	0.141	71

These values are plotted as shown on the sample plot at fuel remaining values of 4944 pounds (5440 lb - 500 lb = 4940 lb) and 4440 pounds (4940 lb - 500 lb = 4440 lb) with corresponding distances of 249 nautical miles (180 NM + 69 NM = 249 NM) and 320 nautical miles (249 NM + 71 NM = 320 NM).

Descent to 5000 Feet Altitude from 25,000 Feet Altitude

Assume the initial descent weight is that weight which is determined by the intersection of the cruise-out line and the required mission radius (300 NM). From the graph fuel remaining at 300 nautical miles is 4590 pounds; therefore the assumed initial descent weight is 20,479 pounds (23,552 lb - 7480 lb - 183 lb + 4590 lb = 20,479). Read time, fuel, and distance to descent from figures 11-41 through 11-43.

Initial Weight (pounds)	Time (minutes)	Distance (NMI)	Fuel (pounds)
20,479	6.7	30	46

These values are plotted as shown on the sample plot in the following manner. The distance of 30 nautical miles is covered in the descent. To arrive at the required mission radius at 5000 feet, a point is plotted on the cruise-out line at 270 nautical miles (300 NM - 30 NM = 270 NM). At this point read fuel remaining of 4800 pounds; therefore fuel remaining at 300 nautical miles is 4754 pounds (4800 lb - 46 lb = 4754 lb). The aircraft has arrived at the required mission radius (300 NM) with a fuel remaining of 4754 pounds.

Hold on Station at 5000 Feet Altitude Over Target

The final step in planning the mission is to determine the loiter time available over the target with the remaining fuel. At this point it is advised that all the various parts of the problem be integrated into a single summary plot as shown at the beginning of the problem. Fuel available for loiter is then found to be the fuel remaining at end of descent to 5000 feet, less the fuel remaining at start of combat. Fuel available is 1529 pounds (4754 lb - 3225 lb = 1529 lb).

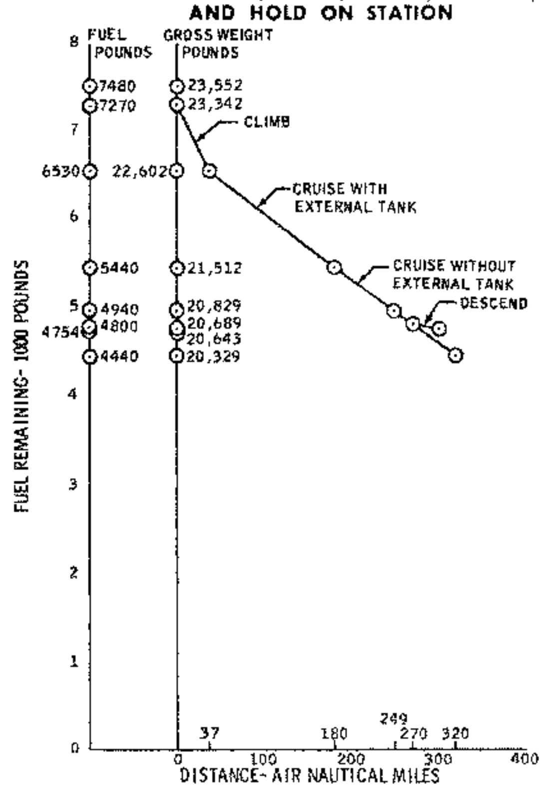
It is assumed that the holding condition is flown in a race track pattern and the average bank angle is 15 degrees. It is also assumed that the stores are retained throughout the loiter.

Average gross weight is 20,062 pounds $(23,552\ \text{lb} - 7480\ \text{lb} + 3225\ \text{lb} + \frac{1529}{2}\ \text{lb} = 20,062\ \text{lb})$ with a drag index of 111. From figures 11-35 and 11-36 read loiter conditions.

Average Weight (pounds)	Maximum Endurance Mach Number	Fuel Flow (pounds/hour)	Hold Time at 5000 Feet Altitude (minutes)
20,062	0.370	2910	31.5

The mission requirements can be met, providing that the hold time over the target is restricted to approximately 30 minutes.

SAMPLE TAKEOFF, CLIMB, CRUISE, DESCENT, AND HOLD ON STATION



FA1-203

TAKEOFF AND LANDING DATA CARD

Certain items of takeoff performance can be entered on the Takeoff and Landing Data Card for convenient reference. Entries illustrated on figure 11-52 are from the sample mission problem and may be read from Section XI, Part 2. Normal landing performance data are available in Part 8.

SEGMENT	INITIAL WEIGHT ~ LB	FUEL ~LB	TIME ~MIN	DISTANCE ~ NMI	
TAKEOFF	23,552	210	5.0	0	
CLIMB TO 25,000 FT	23,342	740	6.0	37	CLIMB SPEED (ALT – 1000 FT / KCAS): 0 / 295; 10 / 295; 20 / 295; 25 / 295
CRUISE AT 25,000 FT (WITH TANK)	22,602	1090	22.4	143	CRUISE SPEED – KCAS: 265; FUEL FLOW LB/HR: 2910
CRUISE AT 25,000 FT (TANK DROPPED)	21,329	640	14.2	90	CRUISE SPEED – KCAS: 265; FUEL FLOW LB/HR: 2710
DESCENT TO 5000 FT	20,689	46	6.7	30	DESCENT SPEED – KCAS: 220
HOLD AT 5000 FT	20,643	1529	31.5	0	LOITER SPEED – KCAS: 225; FUEL FLOW LB/HR: 2910
COMBAT	15,974	845	5.0	0	MACH NUMBER: 0.819; FUEL FLOW LB/HR: 10,140
CLIMB TO OPTIMUM ALTITUDE (OPTIMUM ALTITUDE = 37,500 FT)	15,149	570	6.0	38	CLIMB SPEED (ALT – 1000 FT / KCAS OR MACH): 0 / 325; 10 / 325; 20 / 325; 30 / 0.75; 40 / 0.75
CRUISE BACK AT OPTIMUM ALTITUDE (FINAL ALTITUDE = 38,500 FT)	14,579	900	30.2	198	CRUISE SPEED (MACH / KCAS): 0.685 / 215; FUEL FLOW LB/HR: 1787
DESCENT TO SEA LEVEL	13,679	110	15.0	64	DESCENT SPEED – KCAS: 190
APPROACH AND LANDING RESERVE	13,569	800	---	---	
TOTAL		7480	142.0	600	

Figure 11-51. Summary of Sample Mission

TAKEOFF AND LANDING DATA CARD

CONDITIONS

Gross Weight	23,552 LB
Runway Length	9000 FT
Runway Temperature	+15°C
Pressure Altitude	SEA LEVEL
Runway Wind Component	0 KN
Runway Gradient	0 PERCENT

TAKEOFF

Acceleration Check	128 KIAS AT 2000 FT
Takeoff Speed	160 KIAS
Ground Run	3300 FT
Total Distance to Clear 50-Foot Obstacle	4690 FT
Refusal Speed	
No Drag Chute	104 KIAS
With Drag Chute	130 KIAS
Stopping Distance	
No Drag Chute	4950 FT
With Drag Chute	4100 FT

CONDITIONS

Gross Weight	13,569 LB
Runway Temperature	+15°C
Pressure Altitude	SEA LEVEL
Flap Deflection	FULL
Runway Wind Component	0 KN
Runway Gradient	0 PERCENT
RCR	23

LANDING

Approach Angle of Attack	18 UNITS
Final Approach Speed	124 KIAS
Landing Ground Roll	
No Drag Chute	3400 FT
With Drag Chute	2270 FT

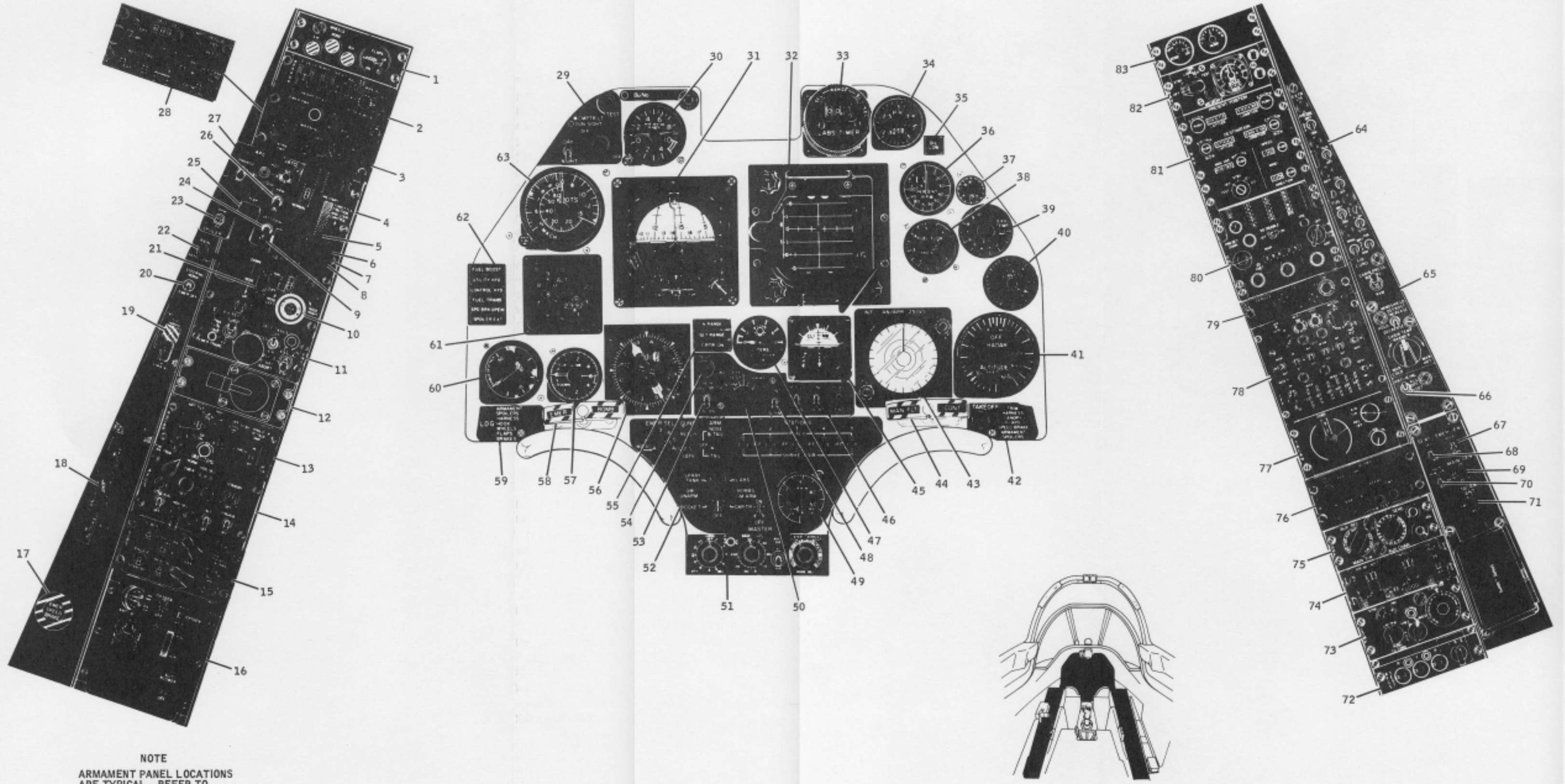
Figure 11-52. Takeoff and Landing Data Card

ALPHABETICAL INDEX

D

FOLDOUT ILLUSTRATIONS

TABLE OF CONTENTS



NOTE
ARMAMENT PANEL LOCATIONS ARE TYPICAL. REFER TO SECTION VIII FOR ALTERNATE PANEL INSTALLATIONS.

1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. WEAPONS CONTROL PANEL (CP-741/A)
3. DCU-75A (T-SYSTEM) CONTROL PANEL
4. THROTTLE QUADRANT
5. THROTTLE FRICTION AND LOCK CONTROL
6. THROTTLE CONTROL LEVER
7. COMMUNICATION RADIO MIKE BUTTON
8. SPEEDBRAKE SWITCH
9. EXTERIOR LIGHTS MASTER SWITCH
10. RUDDER TRIM CONTROL
11. ENGINE CONTROL PANEL
12. BULLPUP ADAPTIVE CONTROL PANEL
13. RADAR CONTROL PANEL
14. AUTOPILOT CONTROL PANEL
15. GROUND CONTROLLED BOMBING SYSTEM CONTROL PANEL
16. OXYGEN, ANTI-G, AND ANTIEXPOSURE SUIT CONTROL PANEL
17. EMERGENCY SPEEDBRAKE CONTROL KNOB
18. CANOPY CONTROL HANDLE
19. EMERGENCY FUEL MANUAL SHUTOFF CONTROL LEVER
20. NOSEWHEEL STEERING SWITCH
21. HORIZONTAL STABILIZER TRIM MANUAL OVERRIDE CONTROL LEVER
22. RAIN REPELLENT SWITCH
23. SPOILER ARM SWITCH
24. JATO JETTISON SWITCH
25. FLAP HANDLE
26. JATO ARM SWITCH
27. APPROACH POWER COMPENSATOR CONTROL PANEL
28. INFLIGHT REFUELING CONTROL PANEL (Alternate Panel)
29. GUNSIGHT CONTROL PANEL
30. ACCELEROMETER
31. ALL-ATTITUDE INDICATOR
32. RADAR INDICATOR (SCOPE) (APG-53A)
33. LABS TIMER
34. ENGINE PRESSURE RATIO INDICATOR
35. OIL LOW WARNING LIGHT/SWITCH
36. TACHOMETER
37. OIL PRESSURE INDICATOR
38. FUEL FLOW INDICATOR
39. EXHAUST GAS TEMPERATURE INDICATOR
40. FUEL QUANTITY INDICATOR
41. RADAR ALTIMETER
42. TAKEOFF CHECKLIST
43. AZIMUTH INDICATOR (APR-25)
44. EMERGENCY MANUAL FLIGHT CONTROL RELEASE HANDLE
45. STANDBY ATTITUDE INDICATOR
46. RADAR MODE SELECTOR PANEL
47. LIQUID OXYGEN QUANTITY INDICATOR
48. SHRIKE MODE SELECT SWITCH
49. CABIN PRESSURE ALTITUDE INDICATOR
50. WALLEYE TEST NORM, SHRIKE 1 AND 2, AND SHRIKE VOLUME CONTROL SWITCH
51. AIRCRAFT WEAPON RELEASE SYSTEM PANEL (UNIVERSAL)
52. ARMAMENT CONTROL PANEL
53. BDHI NAV COMPUTER, TACAN SWITCH
54. TEST SWITCH
55. PILOT'S WEAPON ADVISORY LIGHTS
56. BEARING, DISTANCE, HEADING INDICATOR (BDHI)
57. VERTICAL VELOCITY INDICATOR
58. EMERGENCY STORES RELEASE HANDLE
59. LANDING CHECKLIST
60. ANGLE-OF-ATTACK INDICATOR
61. ALTIMETER
62. CAUTION PANEL (LADDER LIGHTS)
63. AIRSPEED INDICATOR
64. EXTERIOR LIGHTS PANEL
65. AIR CONDITIONING CONTROL PANEL
66. ANTI-ICING CONTROL SWITCH
67. EMERGENCY GENERATOR BYPASS SWITCH
68. SEAT ADJUSTMENT SWITCH
69. MAIN GENERATOR SWITCH
70. RAIN REMOVAL SWITCH
71. TACAN ANTENNA CONTROL SWITCH
72. AFCS TEST PANEL
73. COMPASS CONTROL PANEL
74. INTERIOR LIGHTS PANEL
75. AUXILIARY UHF CONTROL PANEL (ARR-40)
76. ECM CONTROL PANEL (APR-25)
77. TACAN CONTROL PANEL
78. IFF CONTROL PANEL (APX-72)
79. JULIET 28 CONTROL PANEL
80. UHF RADIO CONTROL PANEL (ARC-51)
81. NAVIGATION COMPUTER CONTROL PANEL
82. DOPPLER RADAR CONTROL PANEL
83. TRIM POSITION INDICATOR

FA1-29A

Figure FO-1. Typical Instrument Panel and Consoles

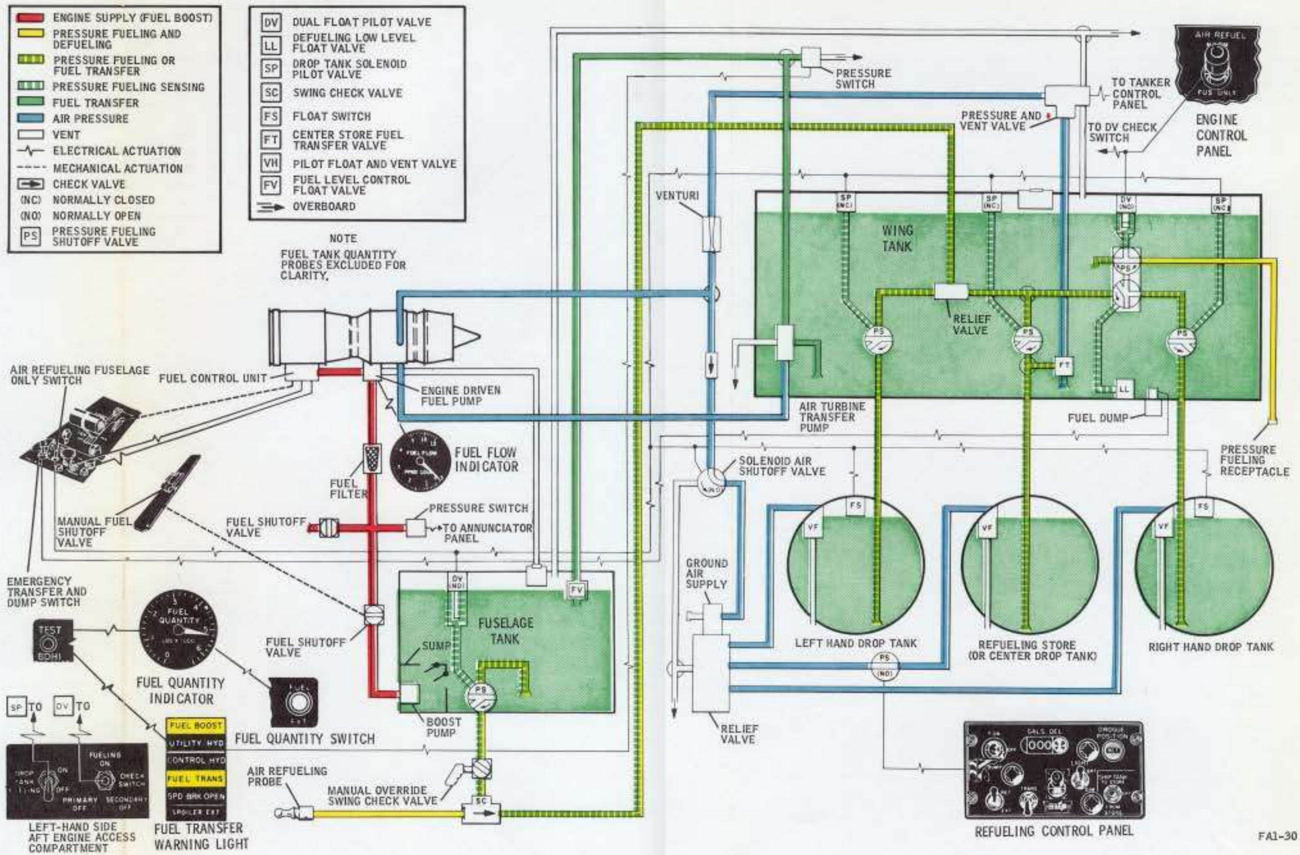
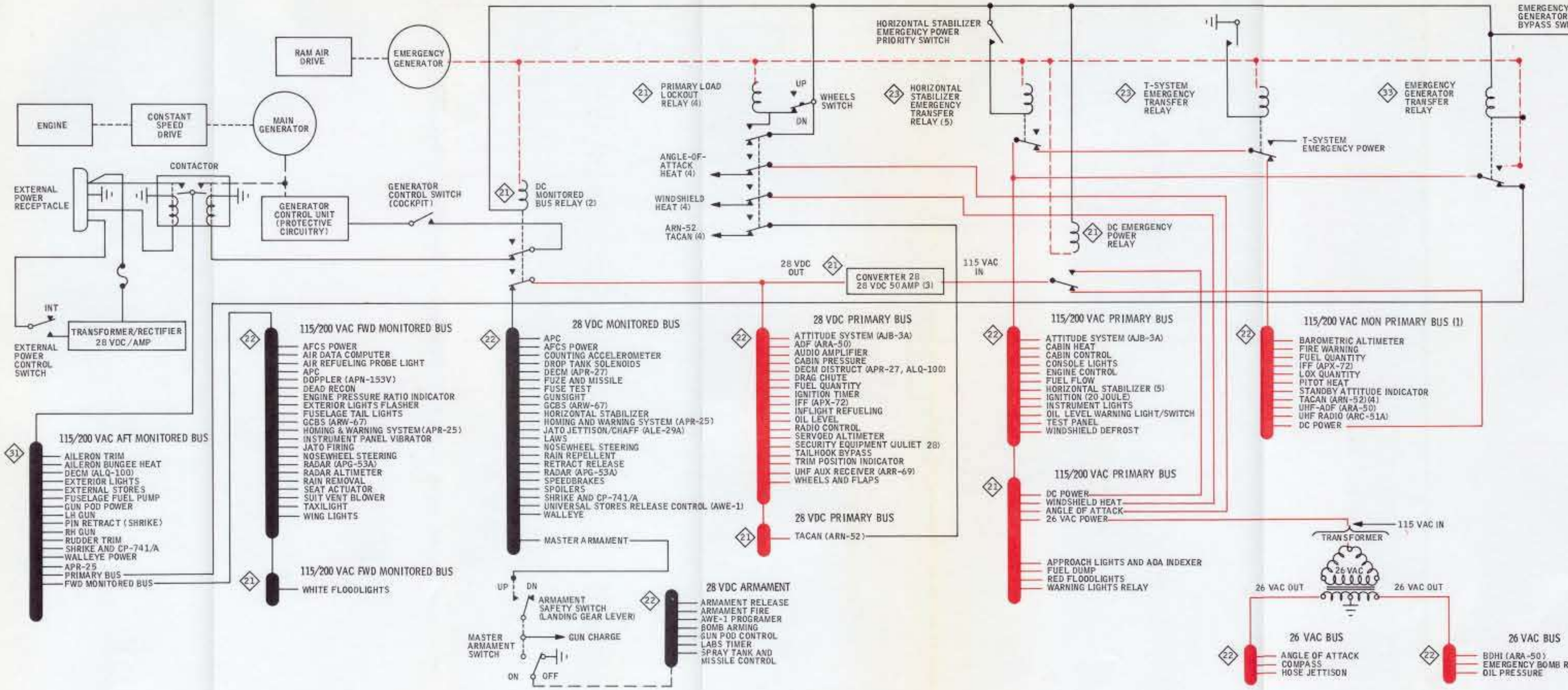


Figure FO-2. Fuel System



LEGEND

- MAIN GENERATOR ONLY
- EXTERNAL POWER AND MISCELLANEOUS
- EMERGENCY GENERATOR OR MAIN GENERATOR
- EMERGENCY GENERATOR ONLY
- TERMINAL PANEL IDENTIFIER

NOTES:

(1) MONITORED PRIMARY AC BUS IS ENERGIZED BY EMERGENCY POWER EXCEPT FOR OCCASIONAL ACTUATION OF HORIZONTAL STABILIZER OVERRIDE OR T-SYSTEM (DCU-75/A) EMERGENCY POWER SWITCH.

(2) MONITORED DC BUS RELAY DISCONNECTS MONITORED DC BUS DURING EMERGENCY GENERATOR OPERATION.

(3) DC CONVERTER RECEIVES POWER FROM PRIMARY BUS DURING EMERGENCY GENERATOR OPERATION ONLY; NORMALLY FROM MON PRIMARY BUS.

(4) INOPERATIVE ON EMERGENCY GENERATOR WHEN LANDING GEAR IS DOWN. REPOSITIONING LANDING GEAR TO UP POSITION (FROM DOWN) WILL NOT RETURN TACAN, AOA HEAT, AND WINDSHIELD HEAT UNLESS NORMAL BYPASS SWITCH IS RECYCLED.

(5) WHEN THE EMERGENCY GENERATOR IS BEING UTILIZED, THE HORIZONTAL STABILIZER MANUAL OVERRIDE LEVER IS THE ONLY MEANS OF ACTIVATING THE HORIZONTAL STABILIZER.

THE FOLLOWING IS A PARTIAL LIST OF EQUIPMENT THAT WILL BE LOST WHILE OPERATING ON EMERGENCY GENERATOR:

1. ALL NORMAL TRIM
2. ALL NORMAL WEAPON DELIVERY CAPABILITY
3. ALL EXTERNAL LIGHTS EXCEPT APPROACH LIGHTS (WITH HOOK DOWN)
4. AFCS
5. RADAR ALTIMETER
6. RAIN REMOVAL
7. SEAT ACTUATOR
8. INSTRUMENT PANEL VIBRATOR
9. WHITE FLOODLIGHTS
10. NORMAL DROP TANK TRANSFER (DROP TANKS GO TO AUTOMATIC TRANSFER)
11. NORMAL SPEEDBRAKE CONTROL
12. FUEL BOOST PUMP
13. NOSEWHEEL STEERING (ON LANDING)
14. SPOILERS (ON LANDING)

FA1-75-A

Figure FO-3. Electrical System

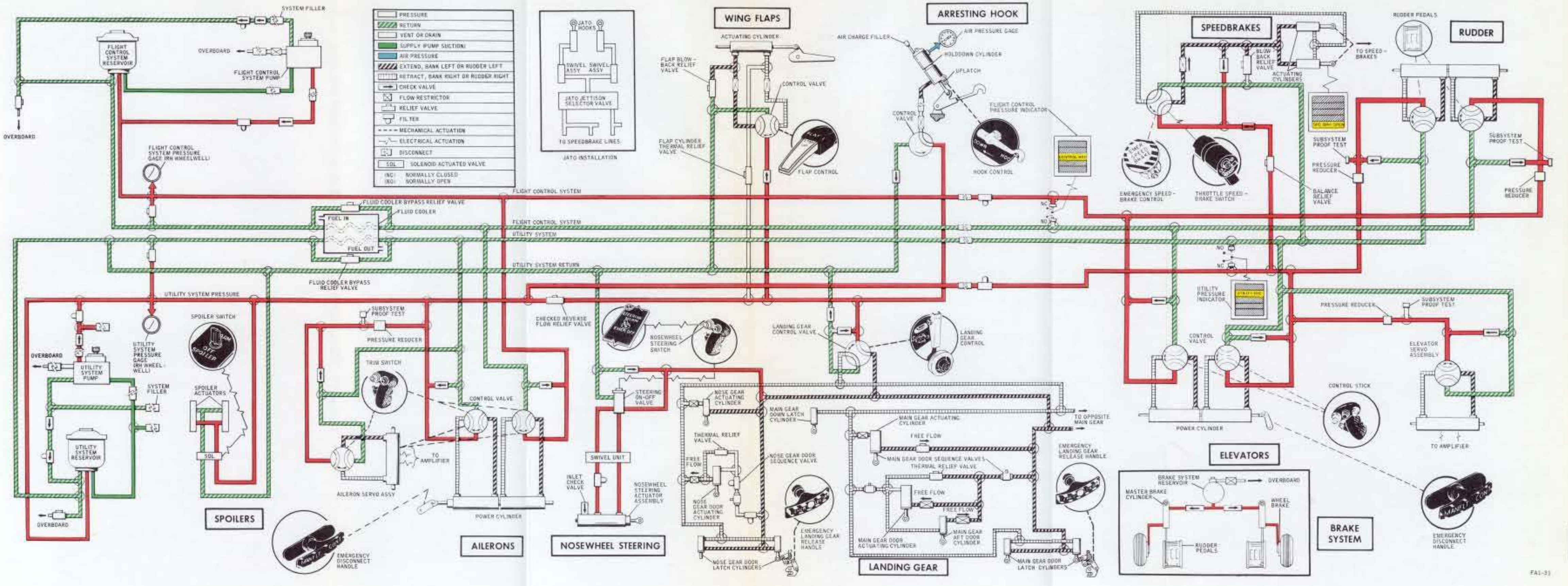


Figure FO-4. Hydraulic System