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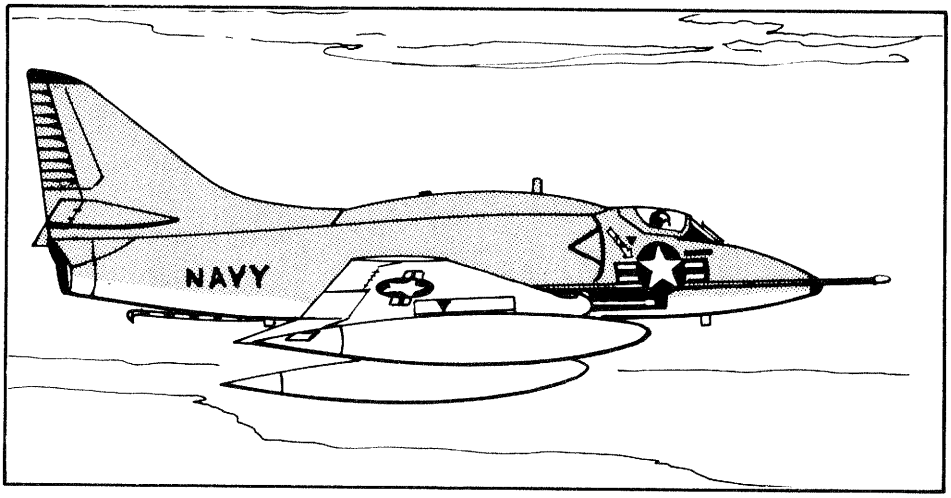
NATOPS FLIGHT MANUAL

NAVY MODEL

A-4C/L

AIRCRAFT

THIS PUBLICATION SUPERSEDES ONLY THAT INFORMATION PERTAINING TO THE A-4C AND A-4L AIRCRAFT CONTAINED IN NAVAIR 01-40AVB-1 DATED 15 JULY 1969, CHANGED 1 MARCH 1972



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

1 JANUARY 1973
Change 3 — 1 April 1977

THE AIRCRAFT
INDOCTRINATION
NORMAL PROCEDURE
FLT CHARAC & FLT PROCED
EMERGENCY PROCEDURES
ALL-WEA OPERATION
COMM PROCEDURE
ARMAMENT SYSTEMS
FLT CREW COORD
NATOPS EVAL
PERFORM DATA
INDEX & FOLDOUTS

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LIST OF EFFECTIVE PAGES

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INTERIM CHANGE SUMMARY

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

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1 thru 12	

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

INTERIM CHANGE NUMBER	REMARKS/PURPOSE
13	Aileron Trim System

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

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

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

1 January 1973

LETTER OF PROMULGATION

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

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

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

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

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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 01-40AVE-1B (pocket checklist)
NAVAIR 01-40AVE-1F (functional checkflight checklist)
NAVAIR 01-40AV-1T (tactical manual)
NAVAIR 01-40AV-1T(A) (supplement)
NAVAIR 01-40AV-1TB (tactical pocket guide)

HOW TO GET COPIES

Each flight crewmember is entitled to personal copies of the NATOPS Flight Manual and appropriate applicable publications.

Automatic Distribution

To receive future changes and revisions to this manual or any other NAVAIR aeronautical publication automatically, a unit must be established on an automatic distribution list maintained by the Naval Air Technical Services Facility (NATSF). To become established on the list or to change existing NAVAIR publication requirements, a unit must submit the appropriate tables from NAVAIR 00-25DRT-1 (Naval Aeronautic Publications Automatic Distribution Requirements Tables) to NATSF, 700 Robbins Ave., Philadelphia, Pa. 19111, listing this manual and all other NAVAIR publications required. For additional instructions refer to NAVAIRINST 5605.4 series and Introduction to Navy Stocklist of Publications and Forms NAVSUP Publications 2002 (S/N 0535-LP-004-0001).

Additional Copies

Additional copies of this manual and changes thereto may be procured by submitting DD Form 1348 to NAVPUBFORMCEN Philadelphia in accordance with Introduction to Navy Stocklist of Publications and Forms NAVSUP Publication 2002.

UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, NATOPS review conferences are held in accordance with OPNAVINST 3510.9 series.

CHANGE RECOMMENDATIONS

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

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

VA - 204
NAS Memphis
Millington, Tennessee 38054
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.

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)

Justification

SAMPLE

☐ CHECK IF CONTINUED ON BACK

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

YOUR RESPONSIBILITY

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

NATOPS FLIGHT MANUAL INTERIM CHANGES

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

CHANGE SYMBOLS

NEW NEW NEW 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 infomation, 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 may result in damage to equipment if not carefully observed or followed.

Note

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

WORDING

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

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

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

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

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

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
ARTC	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
FMLP	Field Mirror 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
Hangfire	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
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	Speed Brake
SID	Standard Instrument Departure
SIF	Selective Identification Feature
SPD BRK	Speed Brake
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
ZDL	Zero Delay Lanyard

AIRCRAFT CHANGE SUMMARY

The A-4 aircraft have been modified by many field changes which affect operation of the aircraft and equipment. Throughout this manual, field changes are referred to by Aircraft Service Change (ASC) or Airframe Change (AFC) number, one or the other of which is assigned to the required modification. Following is a list of ASC'S/AFC'S that apply to this manual. The change is briefly described and, where applicable, information is given for visual determination of incorporation. Since all ASC'S/AFC'S referred to on this page may not be incorporated into a particular aircraft, the pilot must check with the maintenance department to determine which changes have been installed in the aircraft.

ASC or AFC No.	Description	Visual Identification
182	VGI Fast Erect Switch	Instrument Panel
186	Ground Control Bombing System	Glareshield
187	Counting Accelerometer	Nosewheel Well
188	Remote ARC-27 Channel Indicator	Glareshield
189	Manual Fuel Shutoff Lock	Left Console
209	Emergency Transfer of Fuel	Left Console
217	Elapsed-Time Clock	Windshield Frame
218	Windshield Wiper	Left Cockpit Rail
228	Emergency Generator Bypass Switch	Right Console
256	Bullpup Adaptive Control	Left Console
258	Gyro Cutout Switch	Left Forward Engine Compartment
266	Removal of Eight-Day Clock	Instrument Panel
N C W 266 ACC	Seat Separation Bladder Mod	Upper Seat Separation Bladder
272	Replace Wheels and Brakes	Landing Gear
278	Approach Power Compensator	Left Console, Glareshield
299	Wheels Warning Light	Glareshield
303-II	Universal Stores Release	Instrument Panel
317	Fuel Transfer Bypass Switch	Right Console
318-II	WALLEYE Weapon System	Instrument Panel
328	Conventional Ordnance Release Computer System (CORC)	Gunsight
N C W 332 AYC	External Baggage Container (EBC)	Centerline Station (If Installed)
333	Low Altitude Warning System (LAWS)	Glareshield
339	Canopy Restraint Strap	Right Console
343	Security Equipment (Juliet 28)	Right Console
344	Emergency Bomb Release Switch	Instrument Panel
353-III	Gunsight Light Dimming	Instrument Panel
359	Ejection Seat Stabilization (DART)	Ejection Seat
365	Interim Shrike Missile System	Left Console
378	Standby Vertical Gyro	Instrument Panel

ASC or AFC No.	Description	Visual Identification
379	Audio Isolation Amplifier	Instrument Panel
387	Relocation Radar Control	Left Console
394-II	Homing and Warning System	Glareshield
417	Install J65-W-20 Engine	Placarded Instrument Panel
418-II	Chaff Dispenser	Glareshield
428	Instrument Panel Lighting	Right Console
438-I	Stations Select Switches Mod	Armament Panel
446	Spoilers, Improved Avionics, and ECM	Left Console
447	Wheels Warning Light Dimming	WHEELS Warning Light Dims When Instrument Panel Lights Are Turned On
451	Gunsight Modification	Instrument Panel
451-I	Interchange AOA Indexer and Accelerometer	Instrument Panel
456	AOA Indexer Light Modification	Glareshield
473-II	Radar Beacon	Left Console
490	Removal of Fuel Quantity Indicating System Transformer-Rectifier	Fuel Quantity Removed from Monitored Primary Ac Bus and Connected To Engine Control Fuse on the Primary Dc Bus
AVC-991	EPI Minimum Marking	Instrument Panel
516	Protection of Elevator Power Disconnect Mechanism	
527	Centerline Stations Select Switch Mod	Armament Panel



Figure 1-1. Model A-4C/L Aircraft

SECTION I

THE AIRCRAFT

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Dive Angle Limitations 1-126
Gross Weight Limitations 1-126
Miscellaneous Limitations 1-128
Carrier Operations Limitations 1-128
External Stores Limitations 1-128

NOTICE

Certain illustrations referred to within this section may be located in Appendix A. These illustrations are referred to within the text as figure A-1, A-2, etc.

PART 1

GENERAL DESCRIPTION

DESCRIPTION

The Navy Model A-4C/L Skyhawk (figure 1-1) is a jet-propelled, single-place monoplane with a modified delta-planform wing, and is manufactured by the McDonnell Douglas Corporation. It is powered by a Wright J65-W-20 turbojet engine, producing a sea-level static thrust rating at MILITARY of 8400 pounds. Designed as a high-performance , light-weight, 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.

NEW NEW NEW

Note

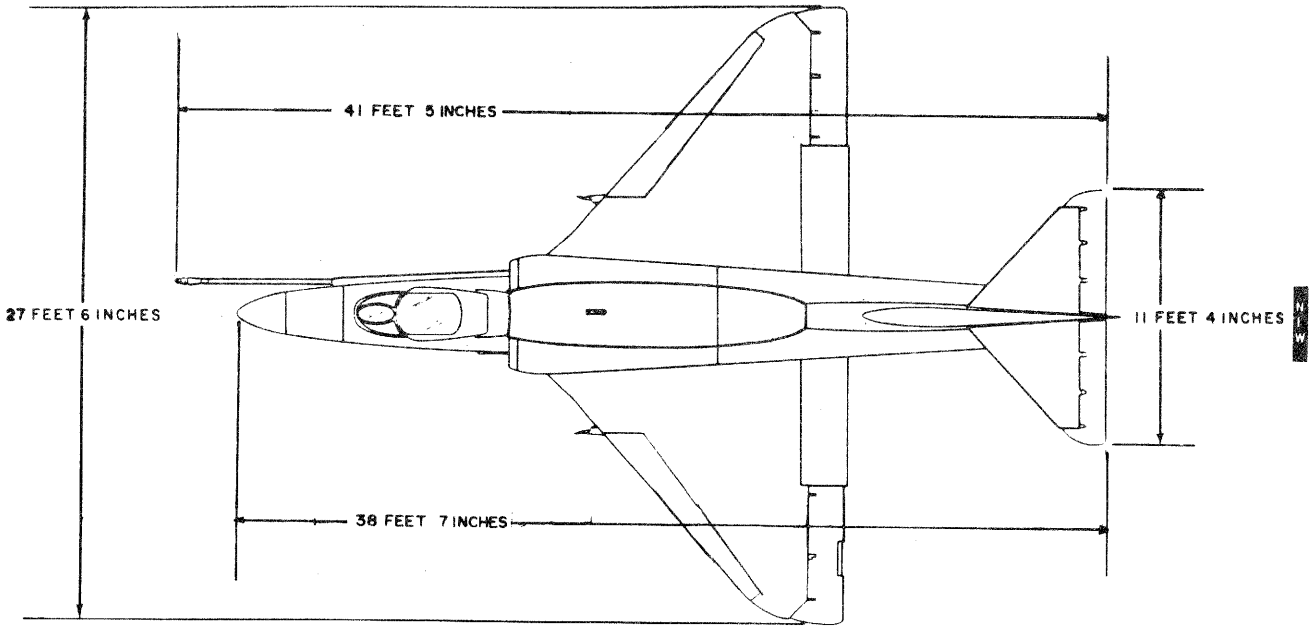
The A-4C/L may have either the J65-W-20 or W-420 engine installed. The primary difference is in the gearbox section. The operation and limitations of the engine are not affected. All references throughout this manual to the W-20 engine also apply to the W-420 engine.

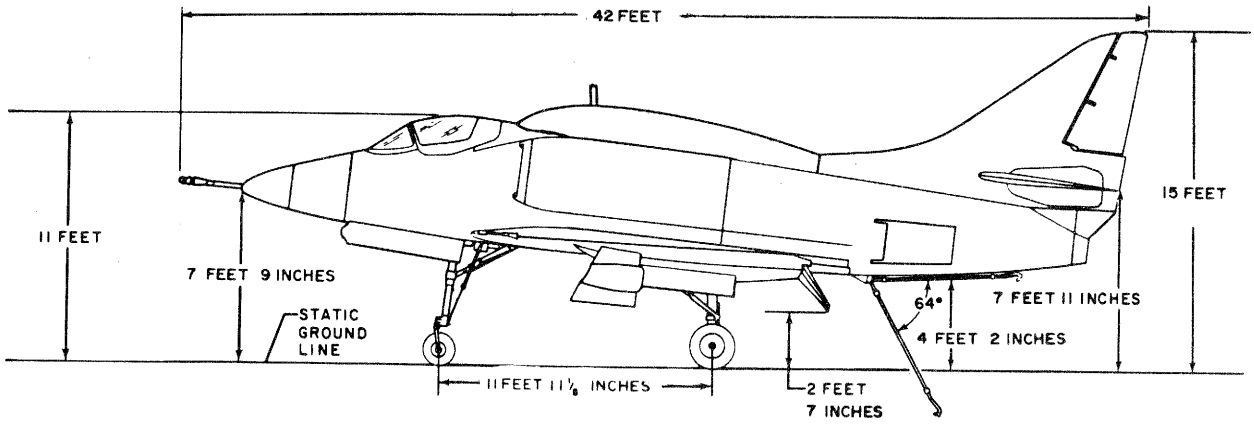
The basic weight of the A-4C/L should be determined from the particular aircraft Handbook of Weight and Balance Data, since this weight may vary as much as 500 pounds depending upon Service Change configuration. Refer to figure 11-1 for typical aircraft weights.

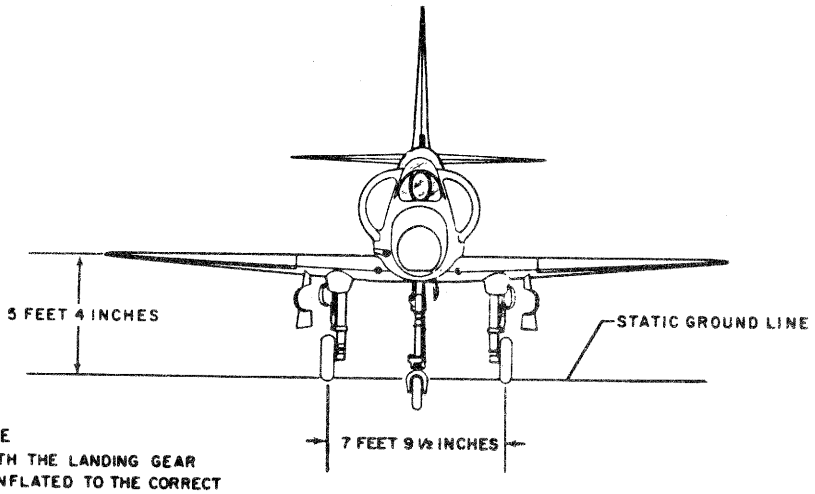
Typical instrument panels and right- and left-consoles are shown in figure A-1.

Principal dimensions, airframe major components, general arrangement, and main differences between A-4 models are shown in figures 1-2 through 1-7.

A-4C aircraft reworked per AFC 446 are redesignated A-4L. A-4L aircraft have wing lift spoilers, an upper avionics compartment, ECM provisions, and improved avionics. Performance data is located in section XI, parts 2A through 9A.





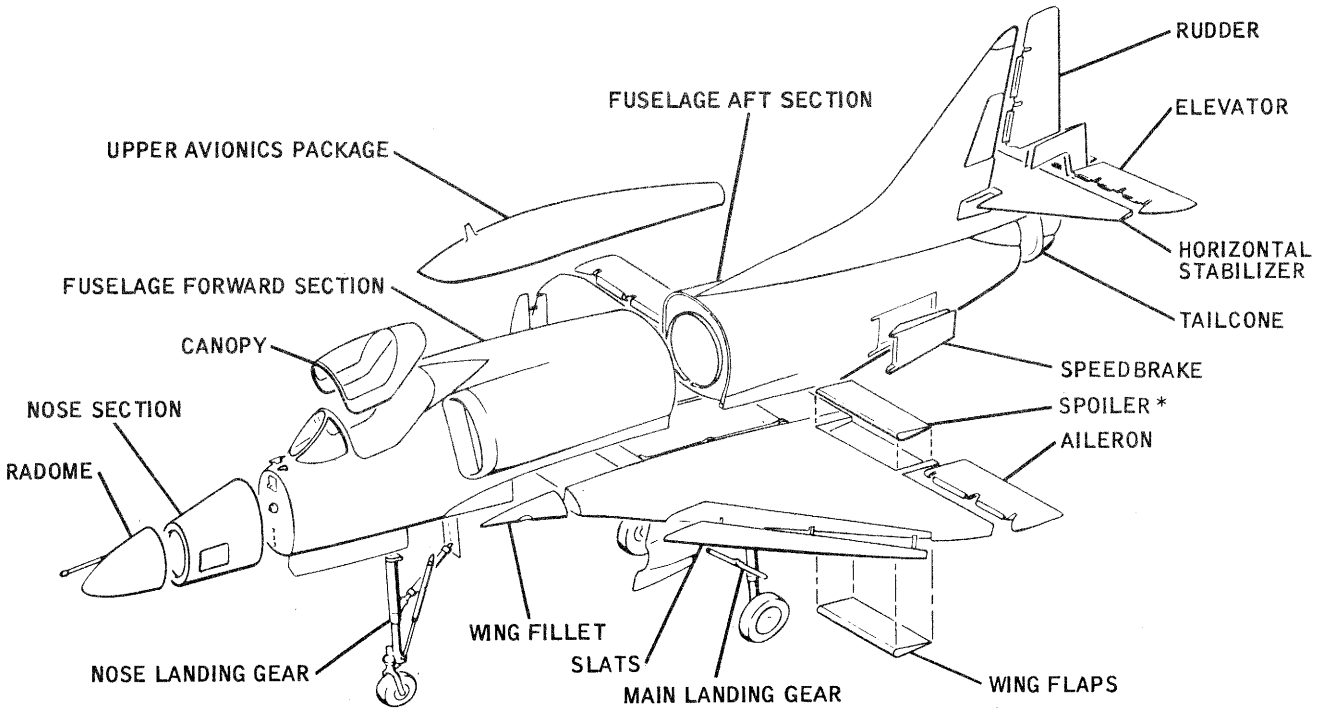


NOTE

DIMENSIONS ARE TAKEN WITH THE LANDING GEAR SHOCK STRUT AND TIRES INFLATED TO THE CORRECT PRESSURES.

AV8-1-1 P-27831-1A

Figure 1-2. Principal Aircraft Dimensions



*A-4L ONLY.

Figure 1-3. Airframe Major Components

Key to Figure 1-4

1. Air refueling probe
2. Radome
3. Total temperature sensor
4. Brake fluid level window
5. Pitot tube
6. Thermal radiation closure
7. Oxygen overboard vent
8. UHF radio antenna
9. Normal cockpit entry handle
10. External canopy-jettison handle
11. 20-millimeter guns
12. Angle-of-attack approach light
13. Anticollision lights
14. Catapult hooks
15. External power receptacle and access doors
16. Four hook ejector rack assembly
17. Taxi light
18. Missile guidance antenna (when carried)
19. Angle-of-attack vane and transducer
20. TACAN antenna
21. Static orifice
22. UHF-ADF antenna cover
23. Nose compartment access door
24. Oil tank fillercap
25. Oil tank
26. Fuel nozzle grounding receptacle
27. Fuselage fuel tank fillercap
28. Wing position lights
29. Cockpit canopy air bungee cylinder
30. IFF-SIF radar identification antenna
31. AN/ASQ-17 integrated electronic central
32. Radar transmitter and receiver group
33. Emergency generator
34. Fuselage fuel tank
35. Air refueling probe light
36. Wing tank fillercap
37. Slat
38. Barricade engagement detent
39. Vortex generators
40. Integral wing fuel tank
41. Arresting hook
42. JATO igniter terminal
43. JATO mounting hooks
44. Speedbrake

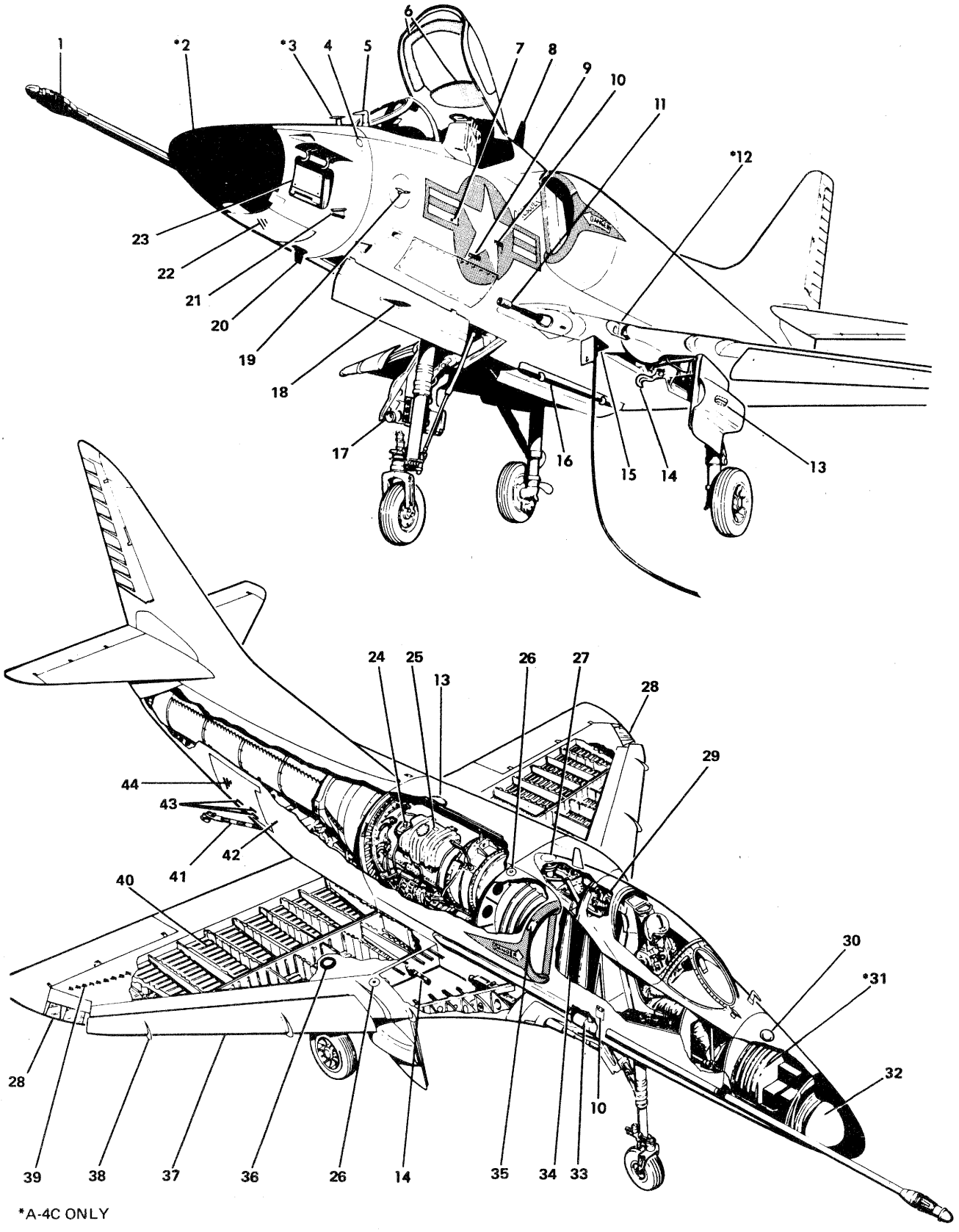
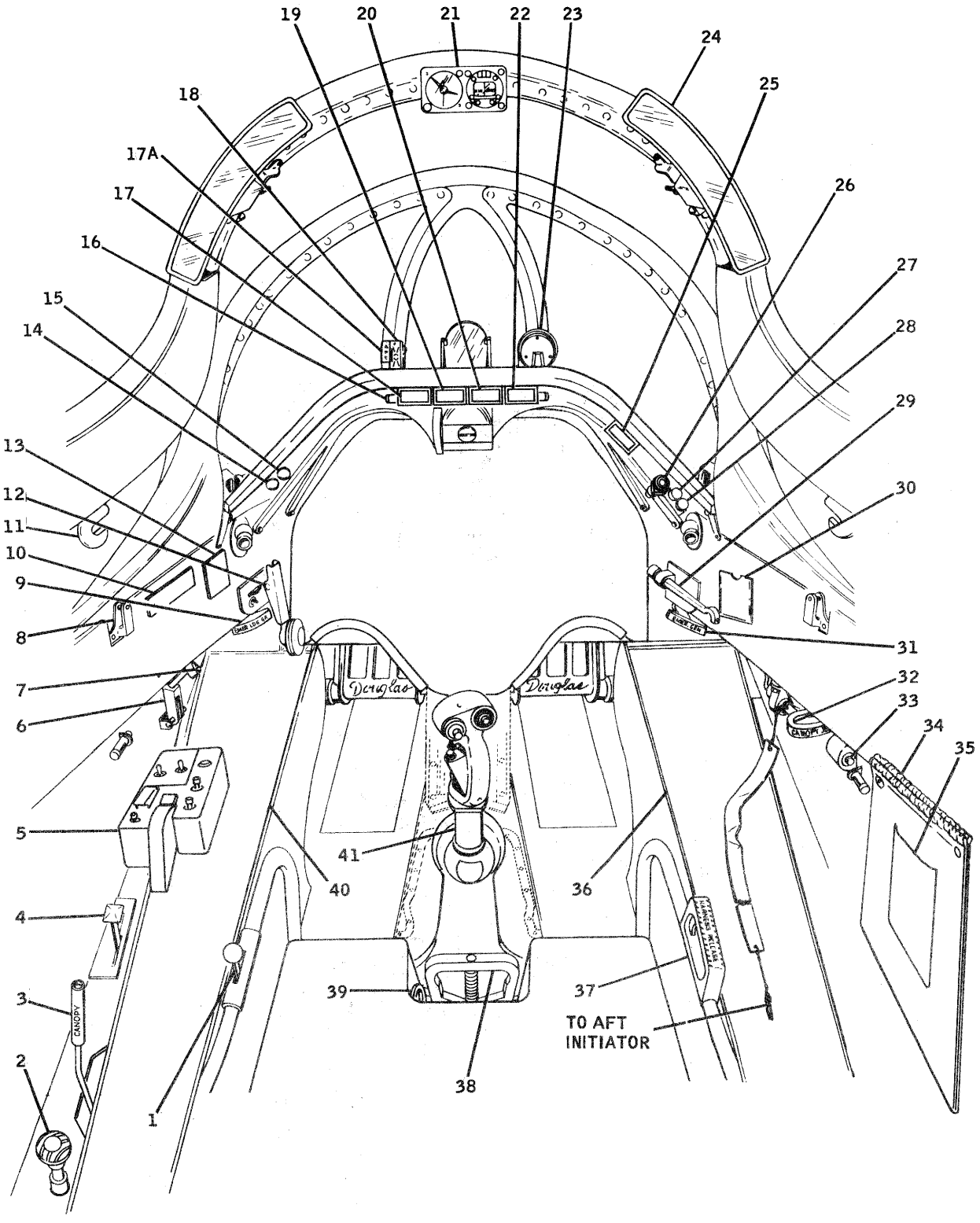


Figure 1-4. General Arrangement



Effectivity: A-4C aircraft not reworked per AFC 328 and 394.

Figure 1-5. Typical Cockpit General Arrangement (Sheet 1)

1. SHOULDER HARNESS CONTROL HANDLE
2. EMERGENCY SPEEDBRAKE CONTROL
3. MANUAL CANOPY CONTROL HANDLE
4. MANUAL FUEL SHUTOFF LEVER
5. SPOILER ARM SWITCH
6. CATAPULT HANDGRIP
7. JATO FIRING BUTTON
8. CANOPY LATCH ROLLERS
9. EMERGENCY LANDING GEAR RELEASE HANDLE
10. COMPASS DEVIATION CARD
11. CANOPY LATCH HOOKS
12. LANDING GEAR HANDLE
13. COMPASS CORRECTION CARD
14. GCBS LEFT TURN LIGHT
15. MARKER BEACON INDICATOR LIGHT
16. COCKPIT FLOODLIGHTS
17. WHEELS WARNING LIGHT
17A. APC STATUS LIGHT
18. ANGLE-OF-ATTACK INDEX LIGHT
19. LABS INDICATOR LIGHT
20. LOW ALTITUDE WARNING SYSTEM (LAWS) LIGHT
21. STANDBY COMPASS AND ELAPSED TIME CLOCK
22. OBST WARNING LIGHT
23. REMOTE CHANNEL INDICATOR
24. REAR VIEW MIRRORS
25. FIRE WARNING LIGHT
26. GCBS RIGHT TURN LIGHT
27. ARM/ORD LIGHT
28. UTILITY FLOODLIGHT
29. ARRESTING HOOK HANDLE
30. STANDBY COMPASS DEVIATION CARD
31. EMERGENCY GENERATOR RELEASE HANDLE
32. CANOPY JETTISON HANDLE
33. WHITE FLOODLIGHTS CONTROL
34. MAP CASE
35. CANOPY RESTRAINT STRAP POUCH
36. RIGHT CONSOLE
37. HARNESS RELEASE HANDLE
38. ALTERNATE EJECTION HANDLE
39. EMERGENCY OXYGEN BOTTLE ACTUATOR
40. LEFT CONSOLE
41. CONTROL STICK

Effectivity: A-4C aircraft not reworked per AFC 328 and 394.

Figure 1-5. Typical Cockpit General Arrangement (Sheet 2)

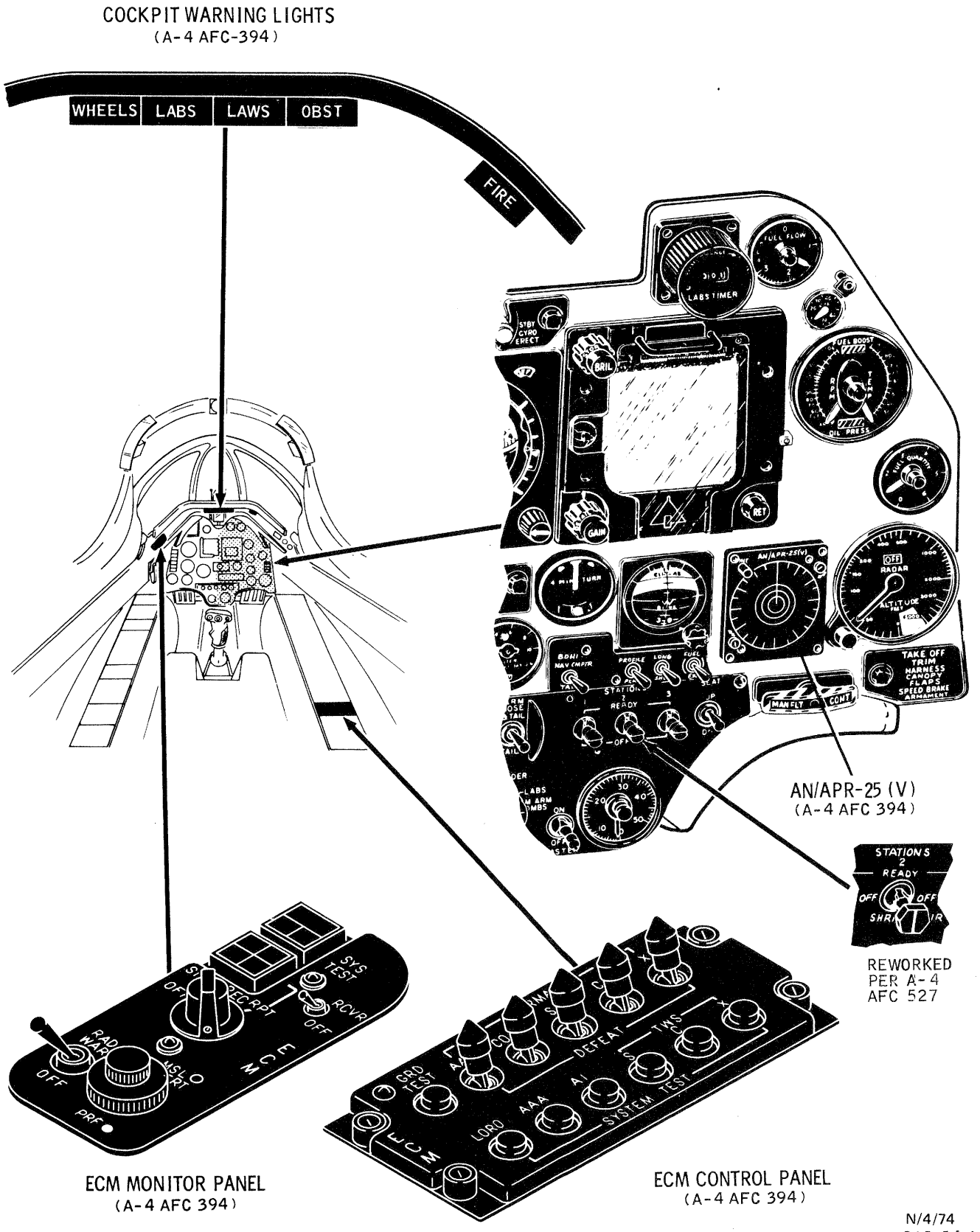
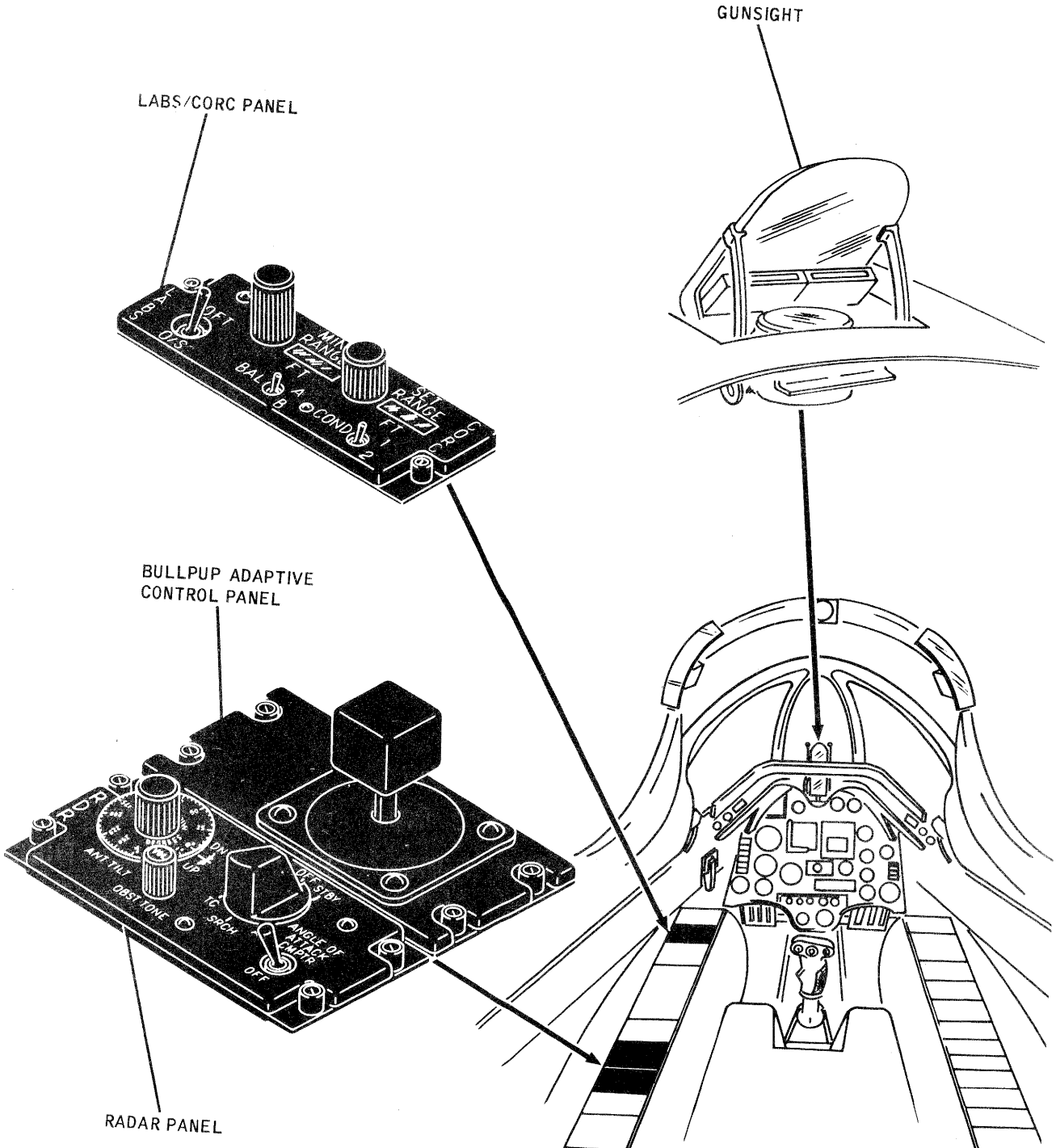


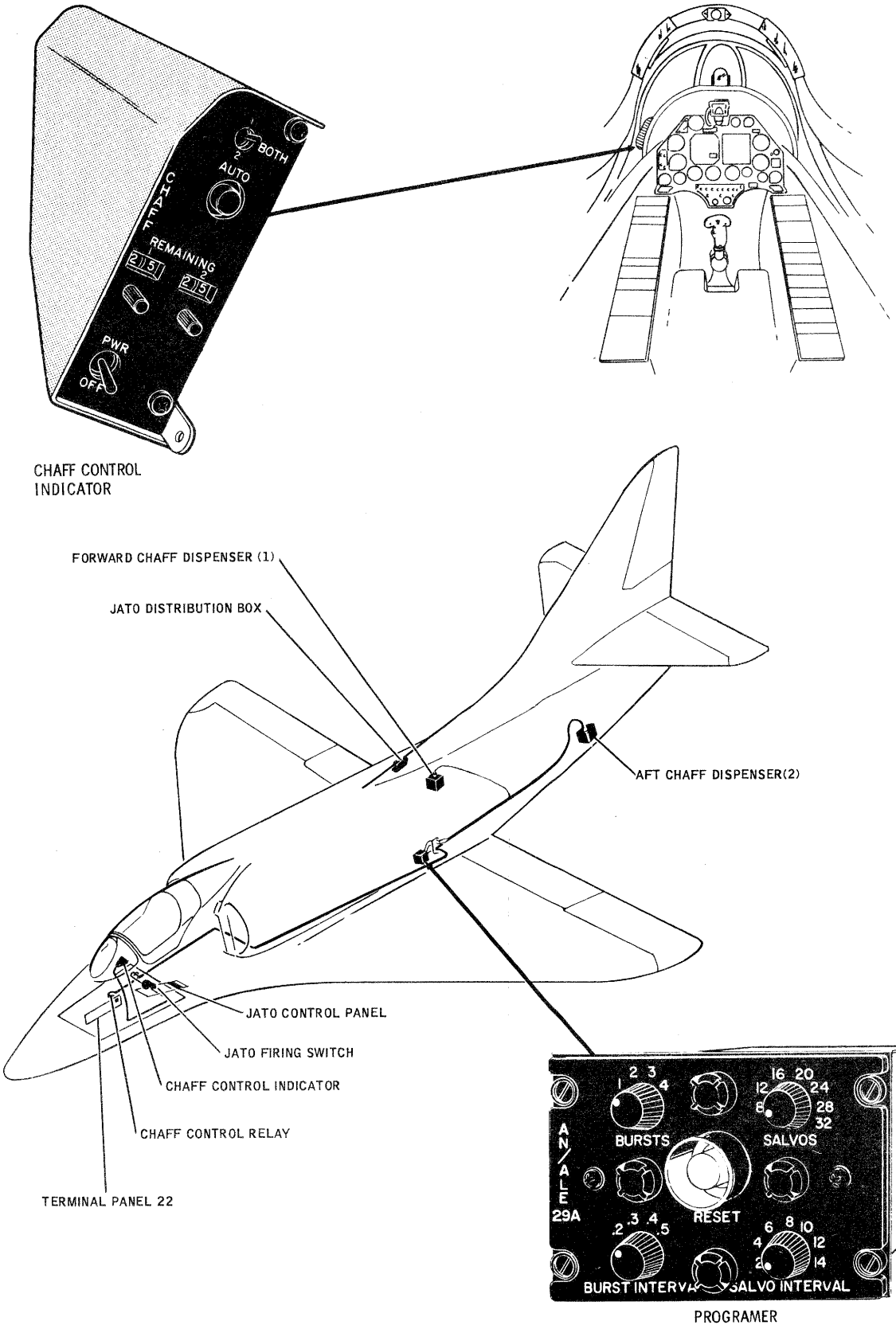
Figure 1-5. Typical Cockpit General Arrangement (Sheet 3)



SS1-19

Effectivity: A-4C aircraft reworked per AFC 328

Figure 1-5. Typical Cockpit General Arrangement (Sheet 4)



Effectivity: A-4C aircraft reworked per A-4 AFC 418-II.

Figure 1-6. AN/ALE-29A Chaff Dispenser

	A-4C/L	A-4E	A-4F	TA-4F/J
ENGINE	J65-W-20	J52-P-6A J52-P-8A	J52-P-6A J52-P-8A	J52-P-6A J52-P-8A (TA-4F)
FUSELAGE				
Fueling Probe	YES	YES	YES	YES
Air Refueling Store	YES	YES	YES	YES (TA-4F)
Intake Ducts	FLUSH	SEPARATED	SEPARATED	SEPARATED
UPPER AVIONICS COMPARTMENT	NO YES (A-4L)	NO	YES	NO
AFCS	YES	YES	YES	YES
APPROACH POWER COMPENSATOR	YES	YES	YES	YES
CORC	YES	NO	NO	NO
RADAR	AN/APG-53A	AN/APG-53A AN/APG-53B	AN/APG-53A AN/APG-53B	AN/APG-53A(TA-4F) AN/APG-53B(TA-4F)
RADAR BEACON	AN/APN-154(V)	AN/APN-154(V)	AN/APN-154(V)	NO
AN/ALE-29A CHAFF DISPENSER	YES	YES	YES	NO
VIDEO IP-936/AXQ	NO	SOME	SOME	SOME(TA-4F)
NAVIGATION COMPUTER	AN/ASN-19	AN/ASN-10 AN/ASN-41	AN/ASN-41	ASN-41(TA-4F)
LABS	AN/AJB-3	AN/AJB-3 AN/AJB-3A	AN/AJB-3A	AN/AJB-3A
BOMBING COMPUTER	CP-841/A	CP-741/A	CP-741/A	CP-741/A
OXYGEN SYSTEM	10 LITER	10 LITER	10 LITER	10 LITER
EXTENDABLE CONTROL STICK	NO	NO	NO	NO
FUEL GAGING				
Fuselage	1 PROBE	1 PROBE	1 PROBE	1 PROBE
Wing	6 PROBE	6 PROBE	6 PROBE	6 PROBE
Drop Tanks	YES	YES	YES	YES
FUSELAGE FUEL CELL CAPACITY (POUNDS)	1600	1600	1600	700
ELEVATOR				
Boosted	NO	NO	NO	NO
Powered	YES	YES	YES	YES
AILERON POWER	TANDEM	TANDEM	TANDEM	TANDEM
STABILIZER TRIM				
12 Degrees Nose Up 1 Degree Nose Down	NO	NO	NO	NO
11 Degrees Nose Up 1 Degree Nose Down	YES	NO	NO	NO
12 1/4 Degrees Nose Up 1 Degree Nose Down	NO	YES	YES	YES
BOMB RACKS	3	5	5	5
ROCKET EJECTION SEAT	ESCAPAC 1 STENCEL MOD	ESCAPAC 1 STENCEL MOD	ESCAPAC 1C-3	ESCAPAC 1C-3
NOSEWHEEL STEERING	NO	NO	YES	YES
SPOILERS	NO YES (A-4L)	YES	YES	YES

Figure 1-7. Main Differences Between Aircraft

PART 2
SYSTEMS

ENGINE

The Wright J65-W-20 is a turbojet engine. The engine has a multistage, axial-flow compressor driven by a two-stage turbine. Engine accessories are driven through an accessory gearbox by the compressor. Components driven by the gearbox are the engine-driven fuel pump, hydraulic pumps, fuel control governor, tachometer generator, and ignition generator. Engine cooling is accomplished by the routing of compressor air through various parts of the engine. The main bearings of the engines are cooled by air bled from the fifth compressor stage and are lubricated by oil from the oil system. The Wright J65-W-20 engine is rated at standard, sea-level , static conditions as follows:

J65-W-20/W-420 Standard Rated			J65-W-20/W-420 Down Trimmed		
Rating	Thrust	Rpm	Rating	Thrust	Rpm
Military	8400	104.6%	Military	8200	102%
Normal	7400	100%	Normal	7100	98%

Ignition

Components of the ignition system are: a throttle lever switch actuated by movement of the throttle from OFF to IDLE, an ignition generator, a dual ignition unit, a rectifier and filter assembly, and two igniter plugs. As the engine turns during starting, the ignition generator charges the dual ignition unit. When the throttle is advanced to IDLE, the throttle ignition switch is opened, causing the dual ignition unit to discharge through the igniter plugs, thus igniting the primer fuel, which began to flow when the throttle was opened. At 17.5 percent rpm, the centrifugal switch in the ignition generator closes, stopping ignition and closing the fuel priming valve.

Starter

The engine is started on the ground by use of an external pneumatic starter driven by compressed air from a mobile gas turbine compressor. The starter shaft is inserted into a receptacle located inboard of the right main wheelwell, where it engages the hydraulic ball pump generator drive, completing both mechanical and electrical connections and allowing actuation of the starter from the cockpit. Crew members should be cautioned to remove the starter probe assembly immediately following completion of a successful start to prevent damage to the starting probe equipment. Provision is made for carrying the starter probe internally in the aft fuselage under the engine for use when landing away from base, except for aircraft equipped for ground-controlled bombing. The gas turbine compressor can be carried externally on any store rack.

Engine Fuel System

The engine fuel control system consists of a fuel pump, fuel control unit, six flow dividers, a fuel primer solenoid, and two fuel primers.

ENGINE FUEL PUMP

The engine-driven fuel pump consists of a centrifugal booster element, operating in series with two, parallel, gear-type main elements. Should either gear element fail, the operative element is capable of supplying the engine with enough fuel for full power requirements under static sea-level conditions. There is no engine fuel pump failure warning light.

FUEL CONTROL

The engine fuel control contains two control systems: a primary system for normal operation, and a manual system for use if the primary system should fail. When the engine is operating on the primary fuel control system, the engine fuel control provides fuel governing for all engine speeds, including idle. Operating schedules provide optimum rates of acceleration and deceleration for all throttle movements under any ambient condition. The acceleration schedule ensures a safe surge margin during rapid advancing of the throttle, and the deceleration schedule prevents flameout during rapid retarding of the throttle.

Basically, the fuel control consists of two main valves in series: a governor valve, and a contoured regulator valve. The governor valve is adjusted by throttle position, which springloads the valve against a balancing force from a flyball governor. The flyball governor senses engine rpm and acts to open or close the governor valve as necessary to maintain

the throttle-selected rpm. The correct fuel pressure drop across the governor valve is maintained by the regulator valve, which is positioned by, and compensated for, ambient conditions and engine speed. The fuel control metering schedules are not compensated for fuel viscosity. The high viscosity of cold JP-5 fuel, relative to lower JP-4 viscosities at the same temperature, may cause a lean acceleration flow schedule which does not provide a sufficient amount of fuel flow to meet engine requirements when accelerating. This inability of the engine to accelerate above a certain rpm, usually 78 to 82 percent, results in a "hangup" condition.

When the engine is operating on the manual fuel control system, all fuel metering is accomplished manually by the throttle through direct linkage with an emergency throttling valve in the fuel control, but with no compensation for ambient conditions or engine speed. An emergency solenoid valve, actuated electrically by the fuel control switch in the cockpit, isolates the automatic metering features of the fuel control unit by rerouting the flow of fuel to the engine. Refer to Section V, Fuel Control Malfunction, for restrictions and precautions to be observed when changing fuel control operation between PRIMARY and MANUAL.

FAIL-SAFE FUEL CONTROL POSITIONER

If throttle linkage fails, a throttle positioner automatically positions the fuel control at approximately the 87 percent rpm position, which normally allows safe flight and controllable landing, including waveoff. The engine can be shut down by moving the fuel valve to EMER OFF. (Refer to MANUAL FUEL SHUTOFF in this section.)

FUEL PRIMERS

When the throttle is moved from OFF to IDLE during starting, priming fuel is supplied automatically from the fuel control unit through the primer solenoid valve to the fuel priming tubes. The primer tube nozzles are installed in conjunction with the igniter plugs to supply fuel for ignition. When a centrifugal switch within the ignition generator closes at 17.5 percent rpm, the fuel and primer solenoid valve is closed, thus stopping the flow of priming fuel and breaking the circuit to the igniters.

FLOW DIVIDERS

The flow dividers are fuel manifolds which are connected by lines to the fuel burner. Each of the six flow dividers contains an inlet port with filter, a pressure regulating piston, and an outlet port with pressure tap.

Engine Controls

THROTTLE

The throttle (figure A-1), located on the left console is mechanically linked to the engine fuel control unit and controls engine thrust. Marked positions of the throttle are OFF, IDLE, NORMAL, and MILITARY. The OFF position closes a fuel shutoff valve in the fuel control unit, stopping all fuel to the engine. 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 (figure A-1) which is rotated forward to increase friction on the throttle. To prevent retarding the throttle during catapulting, a handgrip (figure A-1) which extends from its spring-loaded position against the cockpit rail, is grasped in conjunction with the throttle.

ENGINE CONTROL PANEL

The engine control panel, just 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 emergency transfer and wing fuel dump switch on aircraft with ASC 209 incorporated, the engine starter switch, and the fuel control switch.

FUEL CONTROL SWITCH. A two position fuel control switch on the engine control panel (figure A-1) is used to select the mode of operation of the engine fuel control unit. With the switch at PRIMARY, the automatic metering devices in the fuel control regulate the flow of fuel to the engine. With the switch at MANUAL, fuel flow is routed around the automatic metering mechanisms and all fuel metering is accomplished directly by manipulation of the throttle.

MANUAL FUEL CONTROL WARNING LIGHT. The manual fuel control warning light on the engine control panel illuminates when the fuel control switch is moved to MANUAL position.

Note

- Illumination of the manual fuel control warning light does not indicate an actual shift to manual but only that the switch is in the MANUAL position.
- When operating in MANUAL fuel control, a failure or interruption of electrical power will cause the fuel control to shift to primary.

ENGINE STARTER SWITCH. Actuation of the starter is controlled by the engine starter switch on the engine control panel (figure A-1) and 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 shaft. When the engine speed reaches a predetermined rpm, a starter overspeed switch opens, allowing the engine starter switch to pop out, thus stopping the air supply to the starter. Manually pulling out the engine starter switch will also stop the starter air supply.

AIRSTART SWITCH. A guarded airstart switch (figure A-1), outboard of the throttle, allows the normal ignition system to function above the normal engine rpm cutoff point of 17.5 percent. When the throttle is advanced into the normal operating area of the quadrant, the ignition will be continuous unless the airstart switch is returned to the OFF position after a successful relight has occurred. Aircraft reworked per Engine Bulletin 328 and A-4 ASC 155 have ignition available for inflight starting from the OFF throttle position throughout its entire range as long as the airstart switch is ON. This feature ensures that ignition is available when fuel flow commences, and decreases the possibility of a tail section fire from residual fuel. Therefore, for inflight starting of the engine, when the switch is moved to ON, ignition is supplied through the igniter plugs. The OFF position discontinues the ignition cycle and must be selected manually. (Refer to section V, AIRSTART procedure.)

Approach Power Compensator

The approach power compensator (APC) system is installed in aircraft reworked per A-4 AFC 278. The APC controls the fuel control and is designed to maintain the optimum angle-of-attack of 17.5 units resulting in an optimum approach speed on the glideslope 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 throttle position between an approximate 70 percent rpm and an approximate military rated thrust (MRT) in response to angle of attack. The angle-of-attack signal is modified by normal acceleration and elevator control stick position. If the APC is engaged or operating when aircraft angles of attack are greater than or less than optimum, the APC will compensate by increasing or decreasing throttle position accordingly. At angles of attack greater than optimum, the APC will command an increasing throttle position until MRT (approximate) is attained or the angle of attack returns to optimum. Conversely, at angles of attack less than optimum, the APC will command a decreasing throttle position until 70 percent (approximate) rpm is attained or the angle of attack returns to optimum.

When the APC is in operation (power switch in ENGAGE position), the system will disengage if any of the following occurs:

1. Throttle friction is applied.
2. Throttle position is below 70 percent (approximate) rpm.
3. Weight is applied to the main landing gear.

Note

It is possible to manually hold the APC engaged and override the disengage features in steps 1, 2, and 3. However, this procedure is not recommended because the above engage interlock safety circuits are bypassed. NEW

4. An override force of 25 to 30 pounds is applied to the throttles.
5. Power switch is manually returned to STBY position.

APC CONTROL PANEL

The APC control panel (figure A-1) is located outboard of the throttle on the left console. 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, and ENGAGE, controls electrical power to the APC system. When the switch is in the OFF position, the APC is deenergized. Placing the switch in STBY position energizes the APC but does not engage the system. After the power switch has been positioned in STBY for a minimum of 15 seconds and the APC status light (located on the AOA indexer) comes on, the APC will function when the power switch is placed in the ENGAGE position.

AIR TEMPERATURE SWITCH

The air temperature switch, labeled HOT, STD (standard), and COLD, provides a means of compensating for variations 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

Status of the system is indicated to the pilot by the APC status light located in the AOA indexer above the instrument glareshield. The light comes on when the APC is in STBY and goes off when the APC is in ENGAGE. The light will come on again if the APC disengages or is returned to STBY.

Engine Instruments

ENGINE PERFORMANCE INDICATOR (EPI)

The EPI (figure A-1), on the instrument panel, is part of an integrated performance indicating system which presents engine speed, exhaust temperature, fuel boost pressure, and engine oil pressure readings on one instrument. Engine speed is presented in terms of engine operating conditions as well as a percentage of maximum rpm. The conditions are START, IDLE, 103.8 to 104.6 percent, and 106 percent for aircraft powered with J65-W-20 engines.

NEW

Note

EGT may read 10°C low when the APG-53A is operating due to electromagnetic interference.

NEW

Fuel boost pressure and engine oil pressure are shown in small windows at the top and bottom, respectively, of the indicator. Fuel boost pressure is indicated by the words OUT and NORM; oil pressure is shown by the words OUT, NORM, and HIGH. An oil pressure indicator, installed adjacent to the EPI, is calibrated between 0 and 70 psi.

Instrument indications and associated engine limitations are listed as follows:

INDICATION	MAX TEMP °C
PERCENT RPM	J65-W-20
Start – 10 to 12 (830 to 995 rpm)	720
IDLE – 42 to 48 (3525 to 3985 rpm)	650
100 (8300 rpm)	640
103.8 (8600 rpm)	695
104.6 (8665 rpm)	695
106 (8800 rpm)	720
Normal	640
Military	695
Acceleration	720
Max Indication	750

INDICATION	INTERPRETATION
FUEL BOOST	
OUT	Below 4 psig
NORM	6 psig and above
OIL PRESSURE	
OUT	Below operating range
NORM	Allowable operating range
HIGH	Above operating range

The settings of the pressure sensing switches for oil pressure indications presented on the EPI are as follows:

EPI	J65-W-20
OUT	Below 24 psi
NORM	24 to 50 psi
HIGH	Above 50 psi

OIL PRESSURE GAGE

The oil pressure gage (nickel gage) on the upper right side of the instrument panel reads oil pressure just downstream of the engine driven oil pump.

FUEL FLOWMETER

The fuel flowmeter indicates the fuel flow to the engine in pounds per hour. The instrument is numbered from 0 to 12, with intermediate markings between the numerals. To determine the fuel flow in pounds per hour, multiply the instrument reading by 1000.

Engine Operation

Engine operation consists of selecting throttle positions and monitoring EPI and fuel quantity/pressure readings. If the engine is in trim, the fuel control system will schedule correctly any thrust setting (operating condition) that the pilot selects with the throttle. The throttle provides a means of selecting rpm conditions for which the fuel control unit meters fuel to the engine and is indicated on the EPI as a percentage of 8300 rpm. Exhaust gas temperature tells him how much "effort" the engine is making, rather than 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 Section I, Part 4, he must also recognize relationships such as 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 Section I, Part 4. That is, the time limit is 30 minutes because the thrust setting is at MILITARY -- not because the EGT indication happens to be 695°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.

STARTING

During an engine start, the maximum EGT specified in Section I, Part 4 is permitted only momentarily. The momentary starting time limit will probably never be exceeded unless some abnormal condition like a hung start results. In such a start, rpm hangs at some value below IDLE, and the engine "cooks" at some high internal temperature at or above the starting temperature limit.

The engine starting attempt must be discontinued immediately, and the reason for the hot or hung start should be determined.

The EGT tendency may be more significant than the EGT itself. Thus, a ground starting EGT of 600°C and rising rapidly should concern the pilot more than one of 700°C and falling. The 600°C value is sufficiently below the allowable starting EGT to permit him to abort the start before the starting temperature limit is reached.

ACCELERATION

The acceleration temperature limit and corresponding time limit apply to engine rpm, not airplane acceleration. Although the EGT limit specified in Section I, Part 4, applies to both cold and hot engines, its relatively high value was set to take care of cold engines. A cold engine is defined as one that has just been started or has been permitted to cool at IDLE for at least 5 minutes before an acceleration. The time limit applies to the period between the time that the throttle is advanced and the time that the rpm reaches MILITARY. Another criterion of a properly functioning engine is that the EGT should stabilize at or near the normal operating temperature for the higher thrust setting within 5 minutes after the throttle is advanced for an acceleration.

The performance of an engine is not acceptable if it exceeds either the EGT or time limit. The acceleration temperature limit applies only when an acceleration is made over the full thrust range of the engine, as from IDLE to MILITARY. For an acceleration from IDLE to normal rated, the EGT limit for normal rated, instead of for acceleration, applies. Throttle movement during acceleration should be smooth, continuous, and slow enough to prevent overtemperature.

STEADY STATE OPERATION

Exhaust gas temperatures indicated for normal rated operating conditions (refer to Section I, Part 4) should not be considered limits, but the temperatures which, if attained or exceeded during routine operations, should warn the pilot of a possible engine malfunction. An engine that exceeds the maximum EGT for cruise conditions when it is operated below

normal rated can be expected also to exceed the temperature limits when it is operated at higher thrust settings. The same assumption can be made about EGT at IDLE, which is intended only as a guide, and is not a firm operating limit. Nevertheless, the temperatures shown for military rated and normal rated are positive limits that can not be exceeded without compromising the engine service life. A normally functioning engine should operate somewhat below the EGT limits published for the several operating conditions.

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. Without these time limits to guide him, the careless or insensitive pilot might literally wear out an engine in a few hours of operation, and would certainly disrupt the logistic structure of any large scale operation predicated on fixed overhaul periods.

An engine that is always operated conservatively will last many times longer than one which is habitually operated at maximum limits. 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. How fast the blade life is depleted depends on proper pilot technique. Unfortunately, no operational technique can reverse the effect of blade creep.

The time limit for operation at MILITARY 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 normal life of the engine. 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.

An engine's service life "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.

OIL SYSTEM

The oil system is automatic in operation whenever the engine is running. The oil tank (see figure 1-4) is located on the upper right side of the engine compressor housing. Tank capacity is four gallons of usable oil when filled to the top of the filler neck in the normal 6-degree noseup ground attitude. A flapper valve arrangement provides oil during inverted flight. An engine-driven gear-type pump and two metering pumps supply oil to all main bearings and accessory drives. A scavenging pump in the accessory gear box returns the oil from the accessory section and the front main bearing, through a strainer, to the oil tank. This oil is then available for recirculation. After use, oil from the center main bearing and rear main bearing is vented overboard.

Note

- Maneuvers producing acceleration near zero g may cause a temporary loss of oil pressure. Absence of oil pressure for a maximum of 1 minute is permissible.
- Electrical power failure causes the oil pressure window of the EPI gage to read OUT. This will occur, however, in conjunction with other symptoms of electrical systems failure.

FUEL SYSTEM

The internal fuel supply is carried in two tanks containing a total of 807 U. S. 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 1776 gallons. Fuel is normally transferred from the drop tanks by tank pressurization and from the wing tanks by an air-driven fuel transfer pump. In aircraft reworked per A-4 ASC 209, 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 section I, part 3, for fuel grades and specifications of recommended and emergency fuels, and figure A-2, for a schematic presentation of the fuel system.

Fuel Tanks

INTERNAL TANKS

Internal tanks consist of 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 transfer shutoff valve for regulation of transfer fuel flow, the fuel boost pump which delivers fuel to the engine, and a fuel pump with flapper valves. The flapper valves assure a flow of fuel to the fuel pump during all attitudes and maneuvers involving negative g-loads and inverted flight for approximately 10 seconds. NEW

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 1-8.)

EXTERNAL TANKS

Provisions are made for carrying drop tanks singly or in combination. The wing 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. Wing tanks must have fins.

Fuel Transfer

WING TANK TRANSFER

The wing tank air turbine transfer pump utilizes engine compressor bleed air for power, and operates whenever the engine is running. Since the pump operates continuously, a float valve is placed in the fuselage tank to stop the flow of transfer fuel whenever the fuselage tank is full, to prevent transferred fuel being pumped overboard through the fuel vent system. A fuel transfer failure caution light, on the left side of the instrument panel, comes on when wing tank fuel transfer pressure drops below 2 (+1/4, -1/8) psi. A steady light indicates fuel transfer pump failure or wing tank fuel depletion. Maneuvering flight may induce intermittent flashing caused by the pump becoming temporarily unported. 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 approximately 70 percent will cause the light to go out, indicating normal fuel transfer has resumed.

CAUTION

Effectivity: All A-4C/L aircraft reworked per A-4 AFC 209 and 317 but not reworked per A-4 AFC 469. Inadvertent fuel dumping may occur when the drop tanks switch is in the PRESS position. If this happens, immediately place the drop tanks switch to OFF. Next place the fuel transfer bypass switch to FUEL TRANS BYPASS and pressurize the drop tanks. If the aircraft has not been reworked per A-4 AFC 317, place drop tanks transfer switch to OFF and divert to the nearest suitable landing field.

DROP TANK TRANSFER

Fuel transfer from the drop tanks to the integral wing tank and fuselage tank is accomplished by drop tank pressurization. Placing the drop tanks switch on the engine control panel (figure A-2) at 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 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. The flow rate varies from 8000 pph at sea level to 4000 pph at 35,000 feet MSL using 90 to 92 percent rpm. Placing the drop tanks switch at OFF energizes the drop tank air shutoff valve, thereby closing the valve and discontinuing transfer of fuel from the drop tanks. If electrical failure 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.

CAUTION

Drop tank fuel transfer shall not be operated during any maneuvers that could result in an inverted spin.

NEW NEW

Note

- Unless the drop tanks 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 tank vent mast may occur in the latter stages of drop tank transfer. Placing the drop tank switch to OFF will stop the venting, and drop tanks should be repressurized only when the wing cell is not completely full.

EMERGENCY TRANSFER

After incorporation of ASC 209, 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 A-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

- When the wing fuel switch is in EMER TRANS position, over-pressurization of wing is possible if fuel covers fuel vent outlet in tank due to 6-psi static pressure imposed on wing during emergency transfer. This condition can exist during negative g flight or when aircraft is in nosedown attitude.

- Refer to section I, part 4, for limitations applicable to flight with the wing tank pressurized.

With a centerline drop tank installed, the following sequence should be used to prevent duel flow to the drop tank. First transfer all drop tank fuel, 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 be unavailable for immediate emergency transfer.

Note

- External 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.

- Emergency fuel transfer is not possible with a blown drop tank pressurization solenoid fuse. The failure of this fuse can be detected on the post start five-finger check when the drop tanks do not depressurize.

NEW NEW

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 MAC (mean aerodynamic chord) 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. The center of gravity will move forward approximately 6 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 7 percent MAC as the fuselage tank fuel goes from normal fuselage fuel level to empty.

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

FUEL TRANSFER RATES

Fuel transfer rates are shown in figure 1-9.

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
PRESSURE FUELING INTEGRAL WING	560	3640	3808	6	9	585
GRAVITY FUELING	570	3705	3876			
PRESSURE FUELING FUSELAGE	230	1495	1564	0	0	240
GRAVITY FUELING	237	1541	1612			
LH WING						
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						
150 GALLON DROP	147	956	1000	2	1	150
300 GALLON DROP	295	1918	2006	4	1	300

TANKS	USABLE FUEL TOTALS 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	1090	7085	7412	1107	7195	7527
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 1-8. Fuel Quantity Data

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 prior to reactivating the dump switch; otherwise, damage to the diaphragm may result.

On aircraft reworked per A-4 AFC 209, a valve installed in the wing tank will prevent overpressurization of the tank and allow wing tank fuel to be dumped overboard if desired. Moving the wing tank fuel dump switch, located on the engine control panel (figure A-1), to the DUMP position will allow wing fuel to flow by gravity out of the fuel dump mast on the right main gear fairing at the rate of approximately 100 gallons per minute.

FUEL TRANSFER RATES (APPROXIMATE)

1. WING TO FUSELAGE –18,400 lbs per hour (90% RPM)
2. DROP TANKS (WING) – 9500 lbs per hour (Max range cruise power and above; 30% less at loiter power)
3. DROP TANK (C/L) – 5500 lbs per hour (Max range cruise power and above; 30% less at loiter power)
4. DUMP – 680 lbs per minute
5. AIR REFUELING STORE:

   From store – 100 lbs per minute

   To store – 540 lbs per minute

   Dump – 200 lbs per minute

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Figure 1-9. Fuel Transfer Rates

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

- When dumping fuel from wing tank, monitor the fuel quantity indicator closely to prevent 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 fuselage lower access door drains various aircraft and engine areas. Any fluids seen venting from this mast other than on shutdown 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 mast located aft of the starboard main gear.

Fuel Transfer Bypass Switch

In aircraft incorporating AFC 317, a fuel transfer bypass switch is located on the right console. When the switch is placed in the FUEL TRANS BYPASS position during air refueling, fuel flows into the fuselage fuel tank only. The switch is normally used when the receiver aircraft has wing damage to prevent 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 tank) is possible by placing the DROP TANKS switch to the FLIGHT REFUEL position, in addition to placing the fuel transfer bypass switch to the FUEL TRANS BYPASS position.

If a wing tank is damaged, causing loss of fuel, any fuel remaining in the drop tanks may be transferred directly to the fuselage tank by activating the FUEL TRANS BYPASS switch and pressurizing the drop tanks. Indication of fuel transfer may take as long as 10 minutes if activated with 400 pounds 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.

Note

The fuel transfer bypass switch is operable on emergency generator power.

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 fuel inlet supplied with fuel in all aircraft attitudes, including diving flight and negative g or inverted flight not to exceed 10 seconds duration.

WARNING

Sustained normal accelerations between plus 0.5 and minus 0.5 g may result in a loss of boost pump fuel transfer followed by engine flameout. Transient flight maneuvers only, are permitted in this normal acceleration range.

Operation of the fuel boost pump is automatic whenever the aircraft electrical system is energized by the main generator, 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 inoperative even though the emergency generator is deployed. (Refer to Section V, Fuel Boost Pump Failure.)

FUEL BOOST PRESSURE INDICATOR

Fuel boost pressure is shown in the fuel boost window of the engine performance indicator (figure A-1). The indicator is powered by the primary 28-vdc bus and has two positions, NORM and out. The NORM position indicates that fuel boost pressure is above 6 psi, and the OUT position indicates that pressure is below 4 psi.

Manual Fuel Shutoff Control Lever

The fuel system incorporates a manually operated fuel shutoff control lever (figure A-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 springloaded, lift-type, safety lock prevents inadvertent movement of the control lever to EMER OFF position.

Note

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 consists of capacitance-type fuel quantity probes, a fuel quantity indicator, 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 to indicate the total quantity of fuel remaining in the internal tanks when the fuselage tank contains more than 170 gallons (approximately 1100 pounds). The external tanks and air refueling store fuel quantity is indicated on the fuel gage by moving the INT/EXT fuel switch to EXT.

The effect of aircraft attitude on the relationship between indicated and actual total fuel quantity is shown in figure 1-10. 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, located on the instrument panel (figure A-1), indicates the total fuel, fuselage and wing, available in pounds multiplied by 1000. The range of indication is from 0 to 6400 pounds.

Note

NEW NEW NEW

- With the 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 1600 pounds with the engine operating. As total usable fuel becomes less than 1600 pounds, the correct fuel quantity will be indicated.

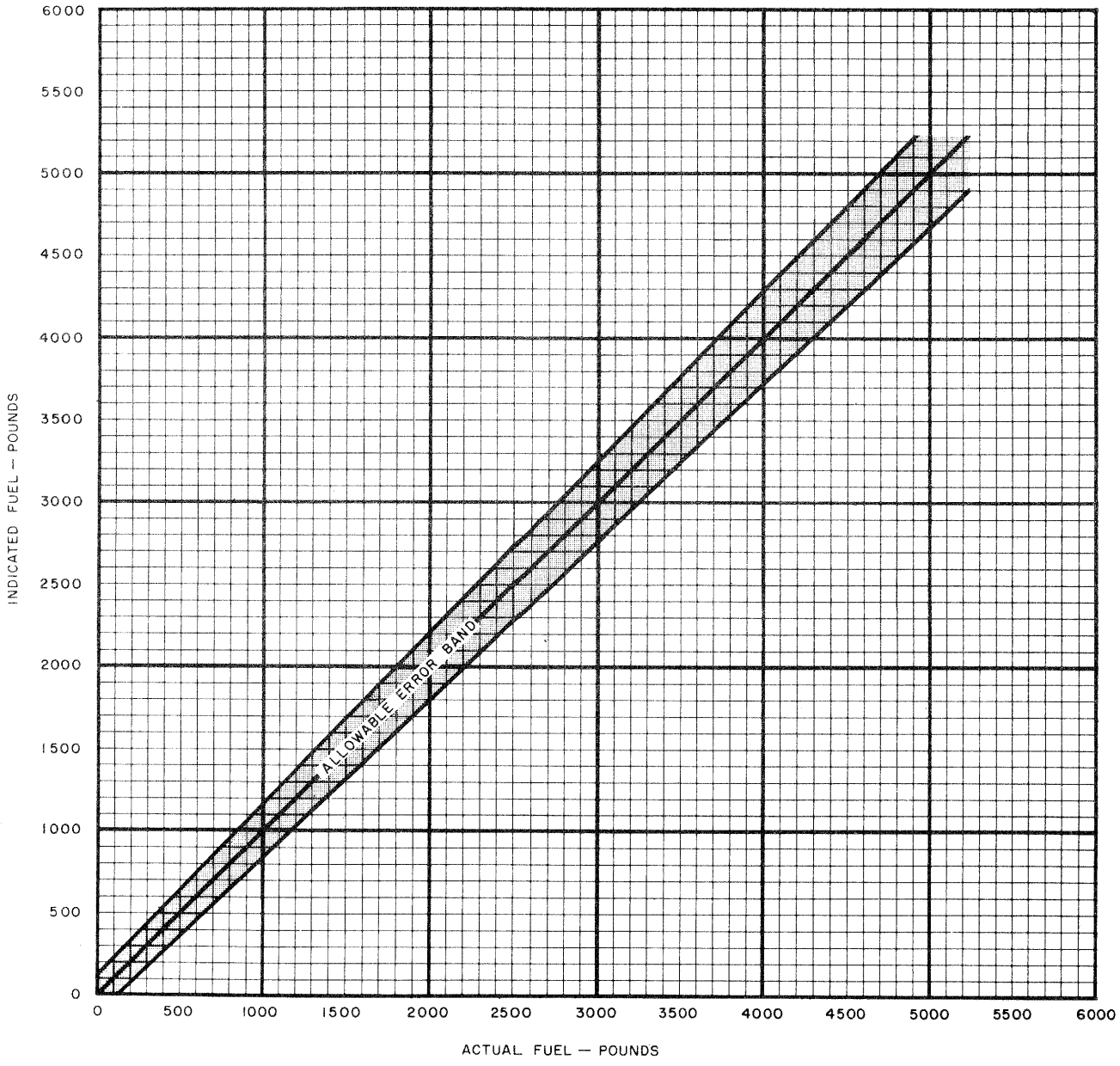
- Maneuvering or accelerated flight will cause erroneous fuel quantity indications.

INTERNAL-EXTERNAL FUEL SWITCH

A toggle-type switch labeled INT-EXT is located on the instrument panel (figure A-1) for checking external fuel load. The switch is spring-loaded to the INT position. External fuel quantity will be indicated when the switch is held to the EXT position until the indicator needle stabilizes.

FUEL QUANTITY CALIBRATION

DATA AS OF: 1 OCTOBER 1959
DATA BASIS: CONTRACTOR'S CALIBRATION



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REMARKS:

(1) Allowable error band per MIL-G-7940.

(2) JP-5 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).

DATA AS OF: 1 October 1959
DATA BASIS: Contractor's Calibration

Figure 1-10. Fuel Quantity Calibration Chart-A-4C/L

Single Point Fueling and Defueling System

The pressure fueling system permits 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. The 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 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. Moving the check switch to 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 must be removed during fueling to prevent possible damage to internal fuel tanks structure.

To fuel the drop tanks by the pressure fueling system, it is necessary to plug in external electrical power. Placing the drop tank fueling switch on the pressure fueling switch panel at ON energizes the normally closed solenoid pilot valve, permitting fuel pressure to open the drop tanks shutoff valves and, subsequently, flow to the drop tanks. Under these conditions fuel also flows through the sensing lines to the drop tanks solenoid pilot valves. As each drop tank becomes full, a float switch in the tank rises and breaks the electrical circuit to the energized solenoid pilot valve. This causes the pilot valve to close and pressure to build up behind the diaphragm of the shutoff valve, which then also closes, discontinuing the pressure fueling to that tank.

Note

Unless the drop tank fueling switch in the aft compartment is in the OFF position after fueling the drop tanks and before takeoff, 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 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 before the other.

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

ELECTRICAL SYSTEM

Electrical power is normally supplied by a 10KVA engine-driven generator, which furnishes 115/200-volt, 3-phase 400-cycle, constant frequency ac power, and, through a transformer-rectifier, 28-vdc power. No dc generator or battery is provided. An additional transformer modifies generator power to 26-vac power for the operation of certain equipment. NEW

Eight buses distribute power to the various electrical units. An airstream-operated emergency generator provides electrical power to essential equipment in the event of main generator or engine failure. External power can be used to energize the system through an external power receptacle located in the lower forward plating of the left 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, and see figures A-3 and A-4 for schematic presentation of normal and emergency electrical power distribution.)

Main Generator

The main generator is driven at a constant 8000 rpm by the engine through a hydraulic ball-pump assembly and delivers rated capacity at engine speeds from idle to maximum. The drive assembly utilizes a separate oil reservoir located in the engine forward compartment.

GENERATOR FIELD FLASH SWITCH

The generator field flash switch is installed adjacent to the hydraulic system pressure gage in the right wheel well. The momentary contact switch restores or reverses the polarity of the main generator exciter field circuit by the process of "flashing the field." Power for the flashing circuit is supplied by the dc power source in the external starter compressor store. A test unit may be plugged into the receptacle on the fuse panel in the nosewheel well during start to ascertain that the generator is operating within prescribed limits.

External Power Switch

When the external 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.

Retraction Release Switch

The retraction release switch system has two positions, airborne and ground. The airborne position is obtained by extending the left main gear strut as aircraft becomes airborne. The ground position is obtained as the left main gear strut compresses on aircraft landing. If the aircraft is airborne and retraction release switch system malfunctions to the ground position, operation of the following systems will be affected:

1. Landing gear lever safety solenoid inoperative requiring manual movement of the serrated lever to place landing gear handle in the UP position.

2. AFCS and STAB-AUG inoperative (will not engage).

3. Spoilers will open if armed and the throttle is reduced below the 70 percent position. (A-4L only.)

4. AFCS inoperative (will not engage).

5. Approach AOA lights and transducer heat inoperative.

6. Radar altimeter inoperative.

If aircraft is on ground and retraction release switch malfunctions to airborne position, operation of the following systems will be affected:

1. STAB-AUG will not disengage on landing.

2. AFCS will not disengage on landing.

3. AOA transducer heat will not be removed on landing and AOA lights will stay on.

4. Spoilers will not operate. (A-4L only.)

Emergency Generator

The emergency generator, rated at 1.7 kilovolt-amperes, is carried in a compartment in the lower right 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 bus.

Note

If the emergency generator has been deployed with an operating main generator, main generator power will be regained during landing rollout as the emergency generator drops off the line.

NEW NEW

EMERGENCY GENERATOR BYPASS SWITCH

In aircraft, reworked per A-4 ASC 228, an emergency generator bypass switch labeled NORMAL-BYPASS is located on the right console (see figure A-1). If the emergency generator is extended, placing this switch in BYPASS allows the pilot to return to main generator operation, providing main generator power has been regained.

EMERGENCY GENERATOR RELEASE HANDLE

The emergency generator release T-handle (see figure 1-5) 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 buses 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, which maintains a constant voltage output from the main generator by varying the current in the generator exciter field. The voltage-regulated power moves through the INTERNAL position of the external power switch to the aft monitored bus. The aft monitored bus distributes power to the electrical units connected to it, to the forward monitored bus, to the primary bus, and to the monitored primary bus. The primary bus supplies power to a transformer which reduces the voltage to 26 volts to power the 26-volt ac bus. Each of the buses in the electrical system distributes power through protective fuses to connected electrical units.

EMERGENCY AC POWER

Extending the emergency generator into the airstream breaks the main generator exciter field circuit, rendering the main generator inoperative, and transfers the primary bus and monitored primary bus from the aft monitored bus to the emergency generator (figures A-3/A-4). If either the horizontal stabilizer manual override lever or the AMAC SYS EMER PWR switch is actuated while operating on emergency generator, the monitored primary bus will be lost as all emergency generator power is diverted to the primary bus. Upon releasing the manual override, or returning the AMAC SYS switch to the NORM position, power is again directed to the monitored primary bus.

NEW

CAUTION

Emergency generator rated power output is assured at a minimum of 145 KIAS gear down and 165 KIAS gear up. Prolonged trim motor actuation below these speeds may cause complete failure of the emergency generator by demagnetizing the permanent magnet rotor.

Note

High "g" maneuvers, touch and go landings and other evolutions with the emergency generator extended may overstress the emergency generator supports and are not recommended.

DC Power Distribution

The forward monitored bus supplies 115/200-volt, 3-phase, 400-cycle, ac power to a transformer-rectifier, which converts the ac power to 28-volt dc power to energize the dc bus. The dc bus further distributes power to connected electrical units and to the armament bus.

DC BUS

The dc bus is energized when the main generator is operating, or when external power is connected to the airplane. The emergency generator does not energize the dc bus.

28-VOLT DC PRIMARY BUS

The 28-volt dc primary bus is normally energized by the main generator and under emergency conditions, is energized by the extended, air-driven, emergency generator.

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, de-energizes the armament bus as a safety feature to prevent inadvertent firing of the guns or release of stores when the aircraft is on the ground or in the landing pattern with the wheels down.

ARMAMENT SAFETY DISABLING SWITCH

The armament safety disabling 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 disabling 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 electrical power is disconnected from the aircraft. When this occurs, the armament safety feature is automatically reinstated.

Fuse Panels

All electrical circuits with the exception of the all attitude indicating system are protected by fuses in place of circuit breakers to save weight and to provide better wire protection. The fuses are located on three panels, two in the nosewheel well, and the other 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 FIRE warning light on the glare-shield glows. The fire detection system may be checked by depressing the MASTER press-to-test button. When the button is depressed, the FIRE warning light glows, indicating a properly functioning circuit.

Note

When operating on emergency generator, depressing the test switch will not illuminate the fire warning light although the fire warning light will still function normally.

HYDRAULIC SYSTEMS

The hydraulic system (figure A-5) consists of the utility hydraulic system and the flight control hydraulic system, which utilizes two self-pressurizing fluid reservoirs and two identical engine - driven variable displacement pumps. Both reservoirs are located in the upper right 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, and the flight control system reservoir capacity is 0.30 gallons. 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.

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. Rate of fluid flow determines the speed at which the various hydraulically operated units respond to actuation of their individual controls. Any variation in rate of flow due to power changes during normal operation might ordinarily produce objectionable characteristics in operation of the hydraulic systems. To overcome this, flow restrictors have been installed in the subsystems to regulate the maximum rate of flow. These restrictors prevent the wing flaps, speedbrakes, and arresting hook from operating too fast when fluid flow is at its peak, yet do not effect the time of operation when flow is reduced at low engine speeds. As long as the engines are 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.

Either the utility hydraulic system warning light or the control 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 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 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 hydraulic failure of one or both systems, refer to Section V.

Hydraulic pressure in both the flight control and utility system may be checked by the ground crew on gages located in the right wheel well. Since there is no auxiliary pump, hydraulic pressure is not available for ground operation unless the engine is running.

Tandem power cylinders are used in the aileron, elevator, and rudder power controls; one half of each cylinder being operated by flight control system pressure. This arrangement allows the ailerons, elevator, and rudder to be power-operated at reduced hinge moments by either system in the event of failure of the other. The flight control system powers only its half of the aileron, elevator, and rudder tandem actuating cylinders. The utility hydraulic system also operates the landing gear, wing flaps, speedbrakes, arresting hook, autopilot servos, and spoilers(A-4L).

FLIGHT CONTROL SYSTEMS

Flight control surfaces are conventional. To reduce control stick forces and increase maneuverability, separate hydraulic power controls are provided for operation of the ailerons, rudder, and elevator. Motion of the stick or rudder pedals is transmitted through linkage and cable systems to the power cylinder, which in turn actuates the control surfaces. 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. The aileron and rudder control surfaces have rotary viscous dampers to reduce surface buzz.

When total hydraulic power failure occurs, the aileron and elevator power cylinders may be disconnected and control can be maintained manually. With a loss of hydraulic power, the rudder valve ports the two cylinder ports together so that the rudder can be controlled manually through the manual bypass 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 electro-mechanical control valve so that the 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.

CAUTION

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

Aileron Control

Both ailerons are aerodynamically and statically 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 induced 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 8-3) 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-reel and centering bungee. At the same time, it positions a followup tab on the left aileron so that the airplane will remain approximately in trim whenever the power system is disconnected.

Note

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 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 airplanes due to manufacturing tolerances, and is established by company test pilots prior to fleet delivery of each airplane. Theoretically, this setting should not change during the service life of the airplane unless some change is made to its aerodynamic configuration. **For safety of flight, it is mandatory that the trim tab rigging the "in trim" position, and the trim tab movement opposite of aileron be verified after replacement or adjustment of the aileron, wing, or lateral trim system components. Failure to do so may result in uncontrollable rolling tendencies when the power system is disconnected.** (See Hydraulic Power Disconnect.) NEW NEW

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, through mechanical

linkage, deflects the elevator surface as desired. The elevator power control is irreversible, and pilot's "feel" is induced by a spring bungee and forward and aft bobweights in the elevator control system. The forward and aft bobweights also provide additional feel during vertical and longitudinal accelerations to prevent the pilot from overstressing the aircraft. The elevators are not equipped with trim tabs, as 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 deflects 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, this 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, thereby 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 backward movement of the TRIM switch (figure 8-3) to NOSE DOWN or NOSE UP. Stabilizer travel, regardless of landing gear position, is from 11 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 A-1) on the left console outboard of the throttle will operate the horizontal stabilizer if the TRIM switch becomes inoperative. The positions of the manual override lever correspond to those of the TRIM switch, and as the control is spring-loaded to the center or OFF position, it must be moved to the full extent of travel in either direction to operate the horizontal stabilizer. When the emergency generator is operating, the manual override lever is the only means of actuating the horizontal stabilizer.

CAUTION

Do not run the 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 cause complete loss of stabilizer control.

HORIZONTAL TRIM DISCONNECT SWITCH

Some A-4 aircraft will have COMNAVAIRPAC Aircraft Bulletin 11-63 incorporated. This provides for a trim disconnect switch located on the left side of the cockpit above and slightly forward of the open position of the canopy handle, which will interrupt all electrical power to the horizontal stablizer trim motor. This system may be utilized during critical phases of flight such as field take-offs and catapult launches to preclude horizontal stablizer runaway trim. (Refer to Section V.)

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 system and the utility 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".

RUDDER PEDAL ADJUSTMENT

The rudder pedals are adjustable fore and aft by a lever on the inboard side of each pedal.

Rudder Trim System

Directional trimming is achieved 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 A-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

- Fluctuating flight system hydraulic pressure results in erratic rudder movement.
- Loss of rudder hydraulic power results in loss of rudder trim.

Hydraulic Power Disconnect

NEW NEW

Note

If normal electrical power and utility hydraulic pressure is available after disconnect, the AFCS may be used to reduce stick forces.

A flight control disconnect handle is located on the lower right side of the instrument panel which 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.

CAUTION

Hold the T-handle while allowing it to return to the stowed position to prevent the handle from striking an instrument.

Refer to sections IV and V for further information.

Before performing a hydraulic power disconnect under controlled conditions, the emergency generator should first be extended and a functional check of the emergency trim override made. 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 A-1) located 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 of horizontal stabilizer position is graduated in 1-degree units from DN (down) through 0, and in 1-degree units from 0 through UP. All even numbered degree marks are identified numerically. Maximum indications of the stabilizer trim position indicator are 3 degrees aircraft nosedown and 11 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 1-5) 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. A flasher-type WHEELS warning light (figure 1-5) to warn the pilot of a possible unsafe condition, is installed beneath the glareshield. The WHEELS warning light flashes when the throttle is retarded below approximately 92 percent if landing gear is up or unsafe and the wing flap handle is not in the UP detent.

Note

On aircraft reworked per A-4 AFC 447, the WHEELS light will come on bright when the PRIM INST lights switch is adjusted within the first 20 degrees (approximate) of rotation, including OFF position. When the switch is adjusted within the sector beyond the first 20 degrees, the WHEELS light will come on dim for night operation and may not be visible in daylight.

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 the safety solenoid should malfunction, or if it should become necessary to retract the landing gear during emergency generator operation or 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 landing gear handle cannot be raised and angle-of-attack indexer does not come on immediately after takeoff, a possible retraction release switch malfunction is indicated. Refer to section V, Retraction Safety-Solenoid inoperative.

Emergency Landing Gear System

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 1-5) 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. Once lowered by the emergency system, the landing gear cannot be retracted again unless utility hydraulic pressure is available.

CAUTION

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

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 control (figure A-1) on the left console, outboard of the throttle. The wing flaps may be extended 50 degrees maximum by moving the FLAP control to DOWN, or may be stopped at any intermediate position by placing the FLAP control at STOP. When UP is selected, the flaps retract fully. The position of the flaps is shown on the wheels and flaps position indicator on tne left console. A relief valve in the wing flap system allows the flaps to blowback to prevent structural damage when the air load against the flaps increases the hydraulic pressure to 3650-psi. At 3650-psi pressure the relief valve will open. This automatic blow back will begin at approximately 230 KIAS.

Note

The flaps will not return automatically to the extended position if the FLAP control is in the STOP position. Therefore, it will be necessary to reposition the flaps after reducing airspeed below the blow back 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 A-1) 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 indicator panel. When the landing gear is up and locked, the word UP appears in each window. During the period when the landing gear is transient, or whenever 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

SPEEDBRAKES

Two flush-mounted speedbrakes (see figure 1-4), one on each side of the aft fuselage, provide deceleration during flight. Hydraulically operated, the speedbrakes are electrically controlled by the SPEEDBRAKE switch (figure A-1) 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. As the SPEEDBRAKE switch has only two position, the speedbrakes cannot be stopped at intermediate positions between fully open and fully closed.

A SPD BRK OPN warning light located on the caution panel (figure A-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 airload against them causes the hydraulic pressure in the actuating cylinders to exceed the pressure at which the blowback relief valve opens (3500 psi), thus preventing damage to the speedbrake system. The speedbrakes begin to blow back at an indicated airspeed of approximately 490 knots. The speedbrakes will not open fully above 440 KIAS.

On aircraft configured for JATO, three flush-mounted hooks are attached to each speedbrake for mounting a JATO bottle when required for assisted takeoffs.

Note

When JATO bottles are attached to the speedbrakes, an interlock in the speedbrake electrical circuit prevents the speedbrakes from opening when the speedbrakes switch is in the OPEN position. Ascertain that the speedbrake switch is in the CLOSED position before 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 manual override control. The EMER SPEEDBRAKE control (figure A-1) at the aft end of the left console may be used to open or close the speedbrakes in the event of complete dc electrical failure, or failure of one of the speedbrake control valve solenoids. The EMER SPEEDBRAKE control is held in a neutral position by the action of a spring bungee and must be pulled up or pushed down momentarily to open or close the speedbrakes, respectively. In the event of electrical failure, the speedbrakes may be opened or closed by momentary operation of the EMER SPEEDBRAKE control push-pull knob.

Note

When JATO bottles are installed, operation of the EMER SPEEDBRAKE control will jettison the JATO bottles.

WING SLATS

Aerodynamically controlled slats, installed on the leading edges of the wings, improve airflow characteristics over the wing surfaces at high angles-of-attack, primarily during approach and landing. The wing slats open and close independently and automatically as the aerodynamic loading on them 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 as the points at which the slats begin to open or close. In general, however, they begin to open at some airspeed below 200 knots, and are fully opened at stalling speed.

Barricade Strap Detents

Three barricade strap detents are installed on each leading edge to ensure proper barricade engagement. Two of the detents are spaced evenly on the wing slat; the third is on the leading edge of the wing, inboard of the slat (figure 1-4).

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 span of the slats and on the upper surface of the wing.

ARRESTING HOOK

An externally mounted arresting hook (figure 1-4) 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, which is then held in the retracted position by a mechanical latch. Compressed air 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 provide snubbing action to keep the hook on the deck during arrested landings by restricting the flow of fluid between the lower and upper chambers of the holddown unit when external forces tend to bounce the hook toward the retracted position.

Arresting Hook Handle

An arresting hook handle (figure 1-5) 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 handle should be firmly placed in position, not flipped nor slammed.

A light in the hook 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 so that utility hydraulic fluid at 3000 psi flows into the lower part of the arresting hook holddown cylinder, overriding the air pressure and causing the hook to be retracted and latched 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 utility hydraulic pressure is lost, compressed air pressure and the weight of the arresting hook cause the hook to extend when the 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 up-latch will be released allowing the hook to move to the down position.

WING SPOILERS

A-4L aircraft have wing spoilers. The spoilers are hydraulically actuated and electrically controlled by the spoiler ARM-OFF switch (figures 1-6 and A-1) located 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 is below the 70 percent position.** Two linear ball lock actuators prevent the spoilers from creeping open in flight.

WARNING

- Spoilers operate rapidly and with great force. Be certain that all personnel are clear of area prior to spoiler actuation.
- **After takeoff ensure spoiler arm switch is OFF. An underserviced port strut compressed in the wheel well or a malfunctioning retraction safety solenoid can cause an in-flight actuation of the spoilers when other actuation conditions are met.**

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 close to a faired position **during a touch-and-go when the throttle is advanced above the 70 percent position. The spoilers are inoperative during use of emergency generator power.** NEW

Note

When spoilers are actuated during engine idle rpm ranges, the hydraulic pressure decreases, which may cause the utility system ladder light to flash momentarily.

WHEELBRAKES

Single-disc (A-4C without AFC 272) or dual-disc (A-4C/L with AFC 272), spot-type brakes are installed on the main wheels only. The brake system includes a separate hydraulic reservoir (figure 1-26) 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 wheelbrakes system is a completely independent hydraulic system. Accordingly, the pilot should realize that he will have brakes even though he makes a landing with complete utility and flight hydraulic system failure. NEW

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 1-4), 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 pulling down, overriding the air 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 over-center position and by checking the canopy latches for proper hook engagement.

CANOPY RESTRAINT STRAP

A canopy restraint strap is located in a pouch attached to the map case assembly on the right-hand side of the cockpit (figure 1-5). The restraint strap, when attached by the strap loop to the right-hand canopy latching hook, holds the canopy just short of the open position to allow for cockpit cooling during warm weather ground operation without causing damage to the canopy hinges or actuating mechanism. The strap must be disengaged from the canopy latching hook prior to closing and locking the canopy.

WARNING NEW NEW NEW

Normal ejection may be precluded by canopy restraint strap. No tests have been made of canopy jettisoning with restraint strap attached.

CANOPY CONTROLS

CANOPY LEVER. The canopy lever (figure A-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. Moving the lever aft slides the canopy aft, disengaging the latch hooks and allowing air bungee pressure to open the canopy. The

canopy mechanism includes an overcenter device which causes a noticeable increase in lever load as the lever approaches the locked position. The load drops off abruptly as the lever is moved past the overcenter position to the locked position. If lever load does not drop off as the handle is moved overcenter, canopy rigging should be checked.

CAUTION

Care should be taken while strapping into seat to ensure that G-suit and oxygen hoses do not wrap around the canopy control lever.

EXTERNAL CANOPY RELEASE HANDLE. An external canopy release handle (figure 1-4), 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

The canopy may be jettisoned by pulling the canopy jettison handle (figure 1-5) on the right side above the console. At an airspeed of 125 knots or above, the canopy shears 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 three-fourths of an inch and then fall free after the initiator has fired.

WARNING

When the canopy is jettisoned in flight by any means, a rapid rearward movement of the manual canopy lever occurs as the wind raises and shears the 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 5-11) 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 identified by a RESCUE arrow. When the door is pushed in, the handle extends and may be grasped and pulled to fire the air bungee cylinder. The canopy will jettison regardless of position.

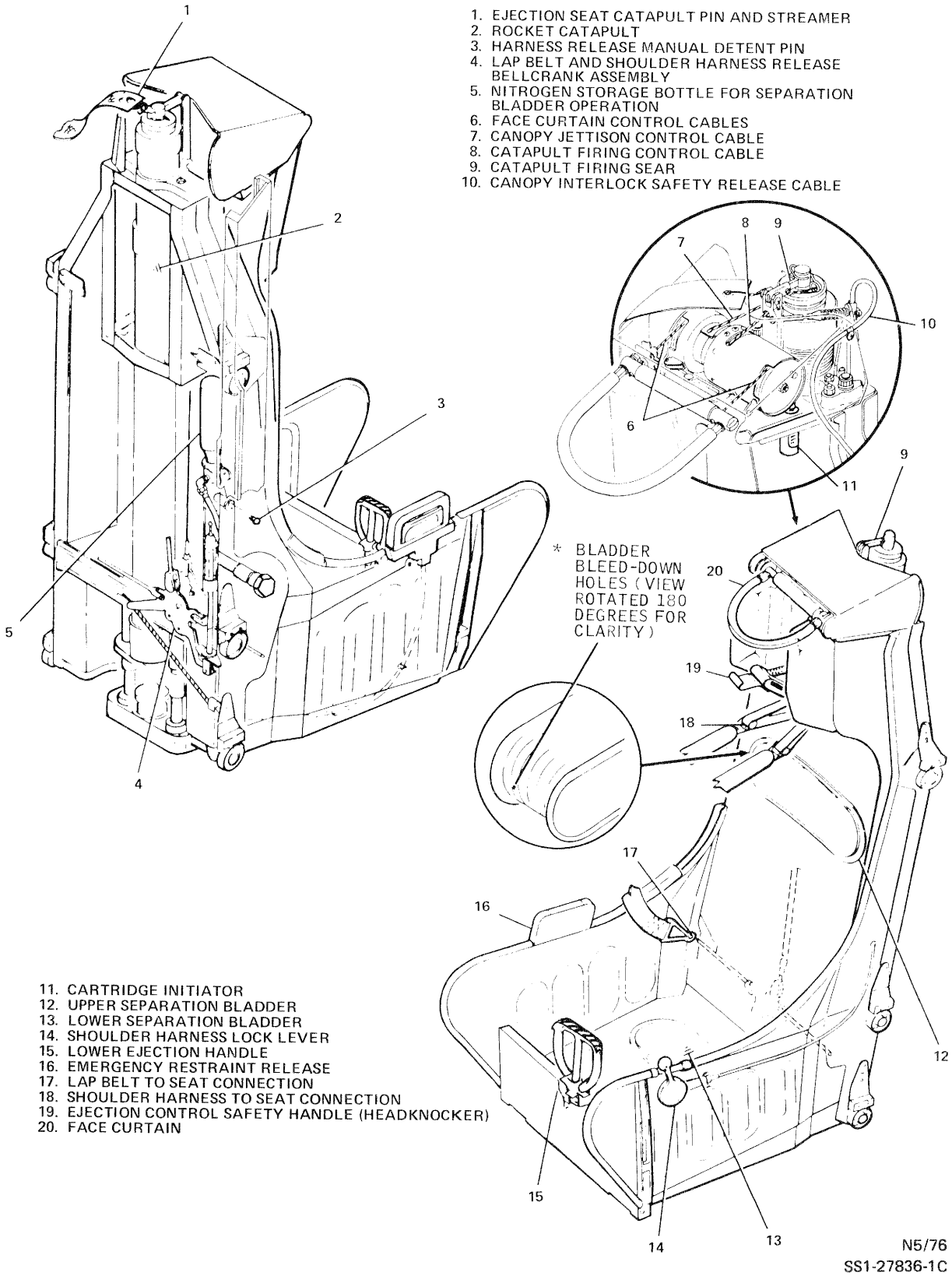
Note

- Seat catapult is armed during removal of canopy by this means.
- To jettison, canopy must be closed on aircraft not reworked per ASC 204 (nitrogen bottle).

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, which opens 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.



*Aircraft reworked per A-4 ACC 266.

Figure 1-11. Rocket Ejection Seat

ZERO—ZERO ESCAPE SEAT SYSTEM

Escapac 1A-1 With Stencil Modification

All aircraft are equipped with a rocket catapult seat which utilizes rocket thrust to propel the seat from the aircraft. The system provides ground level at zero airspeed (zero-zero) escape capability (figure 5-3), as well as ground level escape at 90 knots with 45 degrees of roll, inverted flight escape at 320 feet above ground at 90 knots, and at wings-level ground impact at flight speed range with sink rates to 2000 feet per minute.

The parachute assembly includes survival equipment, PK-2 seat pan with oxygen bottle, and a ballistically spread, 28-foot diameter back parachute which is designed to inflate in less than 1.5 seconds after pack opening. An ejection handle is positioned over the pilot's helmet. Seat bucket sides are extended to minimize leg flailing during high-speed ejection. The ejection seat stabilization system (DART), for proper trajectory control, is an integral part of the zero-zero escape seat system.

Ejection Sequence

Ejection sequence of action is canopy unlock, canopy separation, seat ejection, seat-pilot separation, and parachute inflation (figure 5-3). The ejection sequence is started by pulling the face curtain, with hands in front of the pilot's face, and reaching over the helmet. The sequence may also be started by pulling the lower ejection handle (located between the pilot's knees). Partial travel of the face curtain or lower ejection handle jettisons the canopy and removes the canopy interlock, allowing further face curtain travel; which in turn, fires the rocket catapult which ejects the seat.

NEW

If the canopy fails to jettison when either ejection seat handle is pulled, pull the CANOPY JETTISON handle, located on the right-hand cockpit rail aft of the instrument panel. Continue pulling either ejection seat handle (face curtain or lower ejection) to effect seat ejection. As the seat travels up the guide rails, the bailout oxygen bottle is actuated, acceleration forces draw pilot's legs against front panel of seat.

NEW NEW NEW

As the seat nears top of guide rails, subsequent to hose (anti-g and oxygen) breakaway and with pilot on emergency oxygen, the rocket sustainer ignites. The DART is actuated and angular error in pitch and roll are sensed and corrected during the rocket burn. At rocket burnout (seat approximately 40 feet from cockpit) the snubbing lines reach full stretch, which rotates the bellcrank releasing the pilot from the seat and also punctures the nitrogen bottle which inflates the back bladder, then the seat bladder.

Note

Zero-zero ejection seats (ESCAPAC 1A-1) reworked per ACC 266 incorporate two bleed-down holes in the upper separation bladder to allow for automatic deflation. The purpose of the modification is to prevent restriction of pilot mobility in the event of inadvertent bladder inflation in the cockpit. The bleed-down holes do not affect seat-man separation during a normal ejection sequence.

NEW

When the NB-11 parachute is used, the following applies: As the seat moves away from the pilot, an arming cable is pulled and the external pilot chute is deployed from its pouch. At speeds below 120 KIAS, the external pilot chute will ensure immediate deployment of the main recovery chute, because of its inflated condition at pack opening. At speeds above 120 KIAS (figure 5-3), the external pilot chute will separate because of an integral weak link in the bridle assembly and the internal pilot chute will initiate deployment of the main recovery parachute.

NEW NEW NEW NEW NEW

When the NES - 16 parachute is used the following applies· At time of seat-pilot separation the external pilot chute (EPC) is deployed by a lanyard attached to the seat. The external pilot chute is a tristage design, assuming various drag areas as a function of the dynamic pressure at the time of chute filling. This is accomplished by breakaway attachments on the chute bridle. This feature provides a main parachute deployment force sufficient for fast deployment during a zero-zero ejection and yet precludes undesirably high loads during high speed ejection conditions.

The snubbing lines with the back up feature of the bladders ensure seat-pilot separation. Three-quarters of a second after seat-pilot separation, a MK 4 MOD 1, 3/4 second delay cartridge will function and open the parachute pack if altitude is less than 14,000 feet MSL.

WARNING

If the parachute pack does not open, pilot shall physically actuate (pull) parachute ripcord, located on left riser.

Note

After pack opening, the external pilot chute will rapidly deploy main recovery parachute.

Prior to parachute suspension line stretch, the ballistic skirt-spreader is actuated and the main recovery chute mouth will open. After approximately 3/4 second, the amin recovery parachute reaches full-open inflation.

Note

- If a ballistic failure occurs in the fail-safe spreading gun, the gun will release slugs for an aerodynamic inflation.
- In cases of ejection over water, the pararaft kit, attached to underside of seat pan assembly and containing survival supplies, can be manually inflated upon surface impact.

Functional Components

HARNESS RELEASE ACTUATOR

NEW NEW NEW The harness release actuator is essentially a cylinder containing a piston. The actuator piston rod is connected to a bellcrank attached to the seat structure. Thus when the seat is ejected, at 40 feet of travel the snubber lines rotate the bellcrank which actuates the piston, causing the seat belts, shoulder harness, and face curtain (or lower ejection handle) to pull free, separating the pilot from the seat. The bellcrank rotation also punctures the nitrogen storage bottle releasing pressure to inflate the separation bladders, further ensuring seat-pilot separation.

AUTOMATIC BAROMETRIC PARACHUTE ACTUATOR

Parachutes used with the integrated torso harness are equipped with a barometrically controlled parachute actuator. The actuator will deploy the parachute automatically at a predetermined altitude (14,000 ±500 NEW feet) in the event of pilot incapacitation. The actuator provides a 0.75-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 before 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 eject on 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 does not interfere with the manual parachute ripcord which may be pulled at any time to open the parachute.

NEW An arming pin is inserted through the actuator mechanism to hold firing pin in armed position. The arming pin is anchored by the automatic parachute actuator arming lanyard to the harness release handle. The arming pin is automatically pulled and the actuator armed when the pilot separates from the seat after ejection.

WARNING

If the automatic harness release fails to operate and the emergency restraint release is used to free the pilot from the seat, the arming pin will not be extracted and the parachute must be opened manually.

SEAT ATTACHMENTS

The pilot is held in the seat by attachments to the integrated torso harness. The torso harness incorporates 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 after 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 3-position seat switch on the armament panel (figure A-1) to either UP or DOWN and is stopped at the desired position by releasing the switch to the center OFF position.

WARNING

The ejection seat has mechanical stops incorporated to preclude raising the seat beyond ejection system initiation position. No electrical cutoffs exist. If the seat cannot be lowered after hitting the upper bumper stops, it should be assumed that the rivets are sheared and ejection is impossible. The aircraft shall not be flown until corrective maintenance action has been taken.

SHOULDER HARNESS INERTIA REEL CONTROL. The shoulder harness inertia reel control handle (figure 1-11), 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 ±0.5 g's along the thrust line. This safety feature helps to prevent injuries if the shoulder harness is not locked before 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.

NEW EMERGENCY RESTRAINT RELEASE. A handle (see figure 1-11), labeled EMERGENCY RESTRAINT 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 emergency restraint release, 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 pararaft kit still attached to the integrated torso harness.

WARNING

NEW The emergency restraint release should not be pulled while the aircraft is airborne NEW or until it comes to a complete stop after landing. Pulling the emergency restraint release releases the shoulder harness and lap belt end fittings, which cannot be re-engaged in flight.

Note

NEW Disconnect the barometric parachute opener arming lanyard from the emergency restraint release before removing the parachute from the seat to prevent opening the parachute.

FACE CURTAIN. The face curtain (see figure 1-11) is automatically adjustable to maintain a suitable handle position relative to the pilot's helmet. It serves not only as a control for ejecting the seat, but also as a support for 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 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 except during the ejection sequence since no positive stops are provided to prevent seat ejection after the canopy has jettisoned.

LOWER EJECTION HANDLE. The LOWER ejection handle (figure 1-11) 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 securing the pulley mechanism, in turn locking the face curtain and lower ejection handle. The headknocker is placarded PULL OUT TO SAFETY EJECTION CONTROLS. Moving the headknocker to the down position engages a locking pin into a locking drum, locking all movement of the ejection control pulley mechanism. The headknocker cannot be moved to the up position (unlocking the ejection mechanism) until a safety lock is manually depressed, disengaging the lock.

Ejection Sequence

Seat-man separation is initiated in the ejection sequence at the time of bladder inflation. When this occurs, the bellcrank mechanism rotates, retracting the three yellow harness release pins and releasing both the face curtain and lower ejection handles from the seat. The pilot and parachute are now disconnected from the seat.

WARNING

In the event of inadvertent bladder inflation, ejection capability is lost because ejection sequencing cannot be initiated by either ejection handle. In the event a carrier landing is mandatory a barricade arrestment should be utilized.

Note

NEW Zero-zero ejection seats (ESCAPAC 1A-1) reworked per ACC 266 incorporate two bleed-down holes in the upper separation bladder to allow for automatic deflation. The purpose of the modification is to prevent restriction of pilot mobility in the event of inadvertent bladder inflation in the cockpit. The bleed-down holes do not affect seat-man separation during a normal 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 110 ±10 psi when the liquid oxygen system is not being used.

If the Liquid Oxygen System is allowed to become completely empty, it shall be purged prior to being refilled, to preclude possible contamination.

Liquid Oxygen Quantity Indicator

A liquid oxygen quantity indicator (figure A-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 indicator is electrically operated and has a small OFF window to show that it is not displaying an accurate reading of the quantity when electrical power is lost. A red low-level warning light on the indicator face illuminates when the quantity falls below 1 liter. Depressing the TEST button (figure A-1) tests the operation of the liquid oxygen quantity indicator, causing the needle to move counterclockwise. The low level warning light will go 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 A-1) places the oxygen system in operation when moved from OFF to OXY.

When the oxygen system is turned on, oxygen is delivered from the supply system at a pressure of 70 psi to the oxygen receptacle on the left console. The pilot's supply tube is plugged into the receptacle to allow the oxygen to flow to the chest-mount oxygen regulator, installed just below the pilot's face mask. The chest-mount oxygen regulator reduces the 70 psi converter oxygen pressure and delivers 100 percent oxygen to the mask under a positive pressure of about 1 inch water pressure at all cabin altitudes below approximately 35,000 feet. At higher cabin altitudes, the delivered pressure is automatically increased to allow the pilot adequate oxygen absorption.

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 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). If the pilot desires to use the emergency oxygen supply, he must pull the emergency oxygen actuator and turn off the normal oxygen supply from the console. This is necessary because the integral relief valve in the emergency oxygen supply will not send oxygen to the pilot's mask until the output pressure of the LOX system falls below 50 ± 10 psi (or is placed in the OFF position). The emergency oxygen actuator 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 emergency oxygen actuator 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 the flow of emergency oxygen automatically. NEW NEW NEW NEW NEW

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 left console, 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 1-12 is a tabulation of hours remaining for various altitude-tank supply 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. This is explained by the physical property of gases as 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's lungs is approximately the same at any altitude, the 100 percent oxygen delivered in reduced cockpit pressure is lower in density and less of the supply is required to satisfy the demand.

LIQUID OXYGEN DURATION

MAN HOURS REMAINING

CABIN PRESSURE ALTITUDE —FEET—	GAGE READING (LITERS)						
	10	8	6	5	4	2	1
40,000 UP ▶	60.6	48.5	36.4	30.3	24.2	12.0	4.8
35,000 ▶	37.0	29.6	22.2	18.5	14.8	7.4	3.6
30,000 ▶	27.2	21.8	16.4	13.6	10.8	5.4	2.8
25,000 ▶	20.4	16.4	12.4	10.2	8.2	4.0	2.0
20,000 ▶	16.0	12.8	9.6	8.0	6.4	3.2	1.6
15,000 ▶	12.8	10.2	7.6	6.4	5.2	2.6	1.2
10,000 ▶	10.0	8.0	6.0	5.0	4.0	2.0	1.0
5,000 ▶	8.4	6.6	5.0	4.2	3.2	1.6	0.8
SEA LEVEL ▶	7.0	5.6	4.2	3.5	2.8	1.4	0.6

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

DATA AS OF: 15 October 1957

DATA BASIS: Specification MIL-I-19326(Aer) taken from NAVAER 03-50-517

Figure 1-12. Liquid Oxygen Duration

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 seat cushion with the mask turned away from the face. Turn the oxygen switch 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.

Note

If exhalation is difficult, there is inhalation valve leakage.

DURING FLIGHT

Oxygen quantity should be checked periodically during flight.

Note

Separation of the oxygen hose couplings will be immediately apparent as oxygen flow and radio communication will cease.

FLIGHT INSTRUMENTS

The airspeed indicator, vertical speed indicator, and altimeter are connected to the pitot-static system. The turn and slip indicator is operated by engine compressor bleed air pressure. The attitude gyro, standby attitude gyro, bearing-distance-heading indicator (BDHI), angle-of-attack system, and radar altimeter are electrically operated. The eight-day clock and accelerometer are independent of other systems in operation.

Airspeed Indicator

A combination airspeed indicator and Mach meter (figure A-1) is mounted 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 0.50 to 2.0, and turns 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. A moveable index on the Mach number disc, is used to set a Mach reference by depressing and turning a set knob on the lower left corner of the instrument case. An airspeed index pointer, on the edge of the airspeed dial, is adjustable through a range of 80 to 145 knots by merely turning the set knob.

Vertical Speed Indicator

A vertical speed indicator on the instrument panel (figure A-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.

AAU-19/A Servo Altimeter

NEW

The AAU-19 counter-drum pointer servo altimeter consists of a pressure altimeter combined with an AC powered servomechanism. Altitude is displayed in digital form by a 10,000 foot counter, a 1,000 foot counter, and a 100 foot drum. A single pointer also indicates hundreds of feet on a circular scale, with center graduations of 50 feet. Below 10,000 feet, a diagonal warning symbol appears on the 10,000 foot counter. A barometric pressure setting (baroset) knob is provided to insert barometric pressure in inches of Hg. The baroset knob has no effect on the digital output (mode C) of the altitude computer, which is always referenced to 29.92 in Hg. The altimeter has a reset (servo) mode and a standby (pressure) mode of operation, controlled by a spring loaded self centering mode switch, placarded RESET and STBY. In the reset (servo) mode, the altimeter displays altitude corrected for position error, from the synchro output of the altitude computer. In the standby mode of operation, the altimeter displays altitude directly from the static system (uncorrected for position error) and operates as a standard pressure altimeter. A dc powered internal vibrator is automatically energized while in the standby mode to minimize friction in the display mechanism.

NEW

NEW

AAU-19/A Operating Characteristics

NEW

The counter drum-pointer display is designed so that the 100 foot drum and the pointer rotate continuously during altitude changes, while the 10,000 foot and 1,000 foot counters remain in a fixed position. When each 1,000 foot increment is completed, the counter(s) abruptly index to the next digit. However, when operating in the standby mode, there may be a noticeable pause of the pointer caused by the additional friction and inertia loads involved in indexing the counter(s). The momentary pause is followed by a noticable acceleration as the counter(s) change.

The pause-and-accelerate behavior occurs in the 9 to 1 sector of the scale and is more pronounced when the 10,000 foot counter changes. It is also more pronounced at high altitudes and high rates of ascent and descent. During normal rates of descent at low altitudes the effect is minimal.

Note

If the altimeter's internal vibrator is inoperative, the pause-and-accelerate effect may be exaggerated in the standby mode. If operating in the standby mode, be watchful for this behavior when the minimum approach altitude lies within the 8 to 2 sector of the scale, i.e.: 800 to 1200 feet, 1800 to 2200 feet, etc.

AAU-19/A Normal Operating Procedures

During stopstart checks, conduct field elevation checks as follows:

1. Place altimeter in standby mode. Set local field altimeter with baroset knob; indicated altitude should be published field elevation ± 75 feet.

Note

If momentary locking of the barocounters is experienced during normal use of the baroset knob, do not force the setting. Application of force may cause internal gear disengagement and result in excessive altitude errors in both reset and standby modes. If locking occurs, rotate the knob a full turn in the opposite direction and approach the setting again with caution.

2. Place Reset/Standby switch to Reset position for one to three seconds until Reset flag appears. Indicated altitude should be published field elevation ± 75 feet. In addition, the altitudes indicated in the reset and standby modes should be within ±75 feet of each other.

3. If above criteria is met, leave AAU-19/A in the reset mode for all phases of flight.

WARNING

The maximum allowable difference between the reset and standby modes is 75 feet at all altitudes. If the difference exceeds 75 feet, the standby mode of operation should be used.

Note

The AAU-19/A altimeter will automatically switch from reset to standby operation in case of an electrical power interruption for longer than 3 seconds.

During standby operation, it is possible for the transponder to continue to transmit altitude information (corrected for position error) on mode C, while the altimeter is displaying altitude uncorrected for position error.

Radar Altimeter

The AN/APN-141 radar altimeter (figure A-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 inflight test of the equipment with a push-to-test type control knob feature. This push-to-test operation should result in the needle moving from the masked portion of the indicator dial to 5 ± 5 feet, with associated LAWS indications present if the indexer has been set and the needle rotates through the selected altitude. A low-limit warning light, located on the instrument panel adjacent to the radar altimeter, illuminates when the actual altitude goes below the preselected altitude. An OFF flag on the indicator face will appear when signal strength becomes inadequate to provide reliable altitude information, when power to the system is lost, and when the system is turned OFF.

CAUTION

Leave the AN/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.

A-4C aircraft incorporating AFC 294 have a low level warning tone (steady tone) which operates in conjunction with the radar altimeter low limit warning light. The tone generator is the same as that used for the APG-53A radar terrain clearance aural warning. Volume is controlled by the rheostat located on the radar control panel. (This is an interim change and is removed when AFC 333 (LAWS) is incorporated.)

Low Altitude Warning System (Laws)

The low altitude warning system (A-4 AFC 333) consists of two cockpit warning lights (figure 1-5) and aural warning tone operated in conjunction with 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 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. (This feature is removed from aircraft with AFC 423 incorporated.) The reliability warning signal sounds for 2 seconds whenever the APN-141 acquires or loses lock-on.

AN/AJB-3 All-Attitude Indicator

The aircraft is equipped with an all-attitude indicator located on the instrument panel (figure A-2) which provides the pilot with a pictorial presentation of the aircraft pitch and roll attitude, plus heading information. Aircraft attitude reference signals are supplied to the indicator by electrical connectiin with the remotely mounted master reference platform. Pitch,m roll, and heading are presented by the orientation of the all-attitude indicator sphere which provides the background for a miniature reference aircraft attached on the instrument face. The horizon is presented on the sphere as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is indicated by a light grey area above the horizon line; the lower half, symbolizing earth, is indicated by a dull black area below the horizon line. The sphere is graduated every 5 degrees in azimuth around the horizon line, every 30 degrees around the rest of the sphere, and every 10 degrees of climb and dive. The sphere is free to move a full 360 degrees in pitch, roll, or heading without obstruction. Bank angles can be ready by reference to roll indices located around the periphery of the instrument lens.

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 nose up to 5 degrees nose down. 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.

A maximum of 90 seconds may be required for gyro erection and amplifier warmup. Complete loss of electrical power to the gyro and/or indicator will cause the OFF flap to appear.

WARNING

- The indicator is not reliable for flight indications if the OFF flag is visible.
- It is possible to receive erroneous indications on the gyro indicator without the OFF flag showing.

A combination g-programmer and g-indicator is mounted on the left side of the face of the all-attitude indicator for use with the indicator in performing loft bombing maneuvers.

GYRO GROUND TEST SWITCH

On aircraft incorporating A-4 AFC 258, a gyro ground test switch has been installed in the left 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-3. Gyro damage will be prevented by allowing uninterrupted rundown subsequent to flight and preventing unnecessary brief turnups.

Standby Attitude Indicator

A remote indicating standby attitude indicator (figure A-1) provides an alternate system for the all-weather instrumentation of the aircraft in the event of malfunction or failure of the all-attitude indicator. A fast erect switch, which has an erection rate of 30 degrees per minute, is provided to decrease the time required to erect the indicator.

CAUTION

Do not operate the fast erect switch longer than 2 minutes continuously. Extended operation may damage the circuitry.

Bearing, Distance Heading Indicator (BDHI)

The BDHI (figure A-1) displays magnetic heading by rotation of the compass card dial. Magnetic heading information from the compass compensator adaptor is provided to the rotating compass card which indicates magnetic heading in degrees. 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 on the indicator are two pointers, the No. 1 pointer (a single bar pointer for ARA-25 operation) and the No. 2 pointer (a double bar pointer for TACAN). Both pointers indicate relative and magnetic bearing information if the compass card is in synchronization (sync).

Note

The No. 1 pointer will always indicate relative bearing from the aircraft. However, if the compass card is out of sync, the No. 2 pointer will "follow" the compass card and indicate magnetic bearing only.

The information displayed by the two needles is dependent on the position of the BDHI function switch. Tacan bearing information is displayed on the No. 2 needle when the switch is in the TACAN position. There is no input to the No. 1 needle unless UHF ADF is used. When the NAV CMPTR position is selected, the No. 1 needle will present great circle route (shortest route) information and the No. 2 needle will present ground track information. If the ADF function of the ARA-25 is utilized, the No. 1 needle of the BDHI will present UHF ADF information regardless of the position of the BDHI function switch.

Turn and Slip Indicator

A turn and slip indicator located on the instrument panel consists of a turn needle used to measure rate of turn and a balance ball used to indicate balance (in trim) directional flight. The turn needle deflects in the direction of turn. A turn which deflects the turn needle one needlewidth from center will result in a one-half standard rate turn (1 1/2 degrees per second). The balance ball, when centered, indicates balanced flight.

Accelerometer

An accelerometer (figure A-1) with three indicating hands, registers and records positive and negative g-loads. One hand 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 (1 g) position.

Note

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

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 1-13). 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 to 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 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 1-5) and left of the gunsight, is in a single case containing three bulbs behind a polaroid lens. On aircraft not reworked per A-4 AFC 456, the lens assembly shows all conditions in a red glow, compatible with night flying accommodation. On aircraft reworked per A-4 AFC 456, the lens assembly is of tri-colored type, with the upper lens green, center lens yellow, 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 1-13 for concise interpretation of INDEX CONDITIONS, with the corresponding color of the external approach light visible to the landing signal officer, LSO.) The light bulbs 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 light bulbs 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 17-1/2 units. If the angle-of-attack indication of 17-1/2 units does not produce the indicated airspeed for the configuration computed from figure 11-40, the pilot should check the flap position indicator to ensure that the aircraft is in the proper configuration. The pilot should determine which instrument is providing correct information by observing the position of the wing slats. Slats should be approximately one-half extended at approach speed, gear and flaps down.

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 for this are indicated on the following table:

Condition	Angle-of-Attack Cockpit Indicator Units
Maximum range climb	5.5 to 7.0
Maximum range descent or maximum endurance at all altitude	9.5
NEW Cruise at 5,000 feet	6.5 to 7.0
Cruise at 35,000 feet	7.5 to 8.5
250-knot descent with speed brakes extended	7.0

The above data are based on an aircraft configured with two 300-gallon external tanks.

Note

When above speeds of 200 KIAS, an angle-of-attack error of 0.5 unit is equal to an airspeed error of 25 KIAS.

External Approach Light

The external approach light unit is located in the leading edge of the left wing and 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, amber for angle-of-attack optimum (or approaching or departing optimum), and red for angle-of-attack too low. The external lights are bright in the daytime and dim automatically at night when the master exterior lights switch is activated for night flying.

The indicator in the cockpit is in operation during the entire flight to present angle-of-attack information. The transducer is also connected to the AN/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).

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 "flicks" 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 struts compress switch (squat switch). Normal operation of the approach light circuit is reestablished by moving the arresting hook lever 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 insure that the arresting hook is extended before an arrested landing.

COMMUNICATIONS, AN/ASQ-17B(A-4C)

All communications and associated electronic equipment is listed in the Table of Electronic Equipment, (figure 1-14). Major units of the AN/ARC-27A UHF radio, the AN/ARA-25 direction finder, and the AN/APX-6B IFF equipment are mounted in an integrated electronics package, which is designated AN/ASQ-17B and is located in the nose section along with the AN/APA-89 coder group. The AN/ARN-21D receiver-transmitter is also installed in the nose section. All necessary antenna locations are illustrated in Antenna Locations, (figure 1-15).

The function selector switch of the AN/ARC-27 UHF radio is used as a master radio switch, and must be turned on to apply power to the AN/ARC-27A, AN/ARA-25, or AN/APX-6B. Each piece of equipment must be turned on at the associated control panel.

Note

During extended ground operation (in excess of 30 minutes), cooling air for the AN/ASQ-17B electronics package must be provided by the air conditioning system. Consequently, the canopy must be closed and locked, and pressurization switch must be in NORMAL.

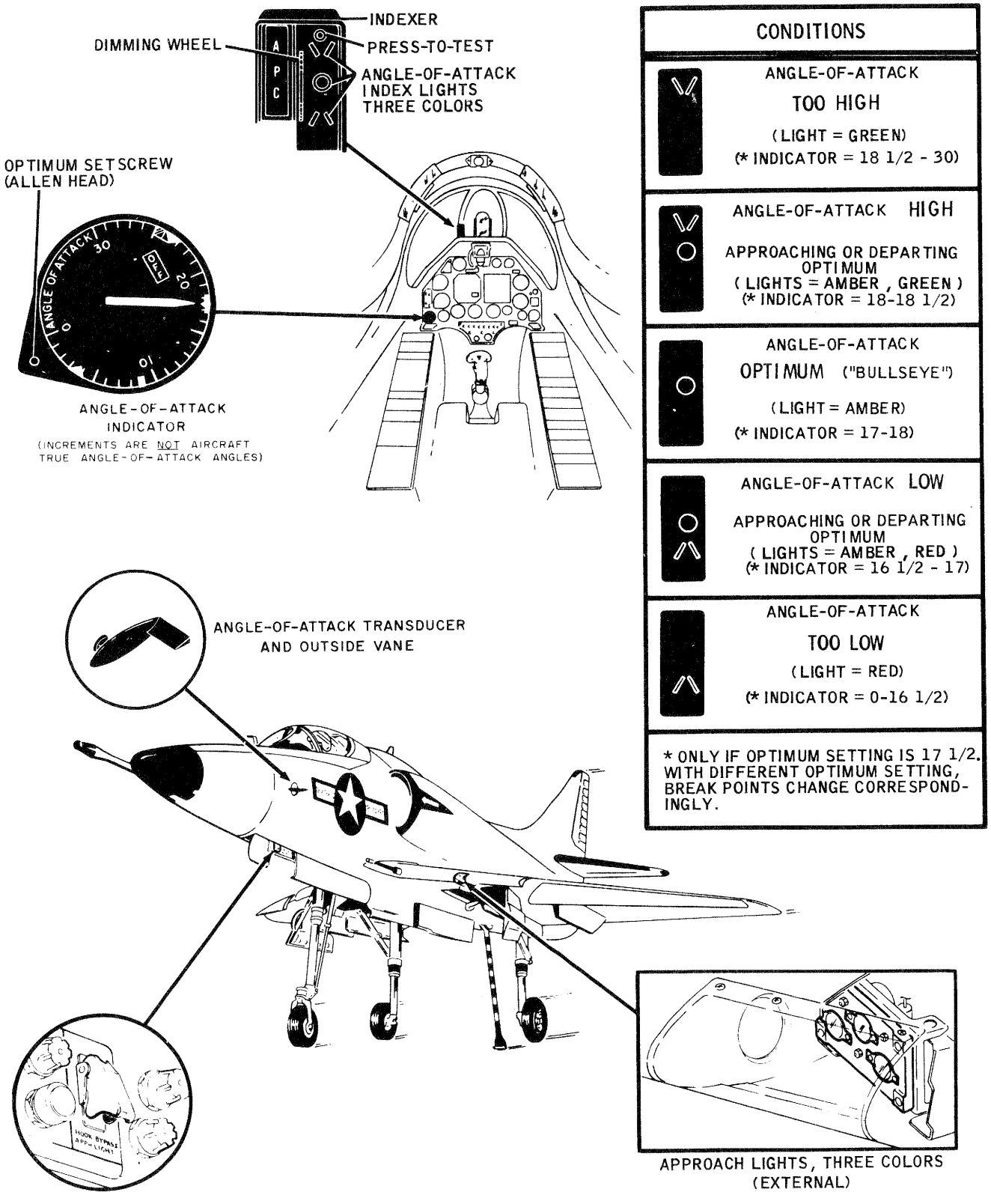


Figure 1-13. Angle-of-Attack Approach Lights System (A-4C/L)

TYPE	DESIGNATION	FUNCTION	ACFT MOD	RANGE	LOCATION OF CONTROLS
COMMUNICATION:					
UHF RADIO	ARC-27A ARC-51A	SHORT RANGE-TWO WAY VOICE COMMUNICATION	C L	LINE-OF-SIGHT	RIGHT CONSOLE
SECURITY EQUIPMENT	JULIET 28	CLASSIFIED	C/L		
AUXILIARY UHF	ARR-69	SHORT RANGE RECEIVER/ADF	L		
COMPASS CONTROLLER		ROTATES ALL-ATTITUDE INDICATOR AND ID-663 BDHI COURSE INDICATOR LATITUDE COMPENSATION	C/L	360° OF ROTATION 0° to 90° NORTH AND SOUTH	RIGHT CONSOLE
ELECTRONIC COUNTERMEASURES (ECM)	ALQ-51 ALQ-100 APR-25 APR-27	ENEMY RADAR JAMMING ALERT RECEIVER ALERT RECEIVER	C/L C/L 	SEE NAVAIR 01-40AV-1T(A)	ECM CONTROL MONITOR – L/H GLARESHIELD
IDENTIFICATION:					
IFF RADAR	APX-72 APX-6B	IDENTIFIES AS FRIENDLY	L C	LINE-OF-SIGHT	RIGHT CONSOLE
SIF RADAR	APA-89	IDENTIFICATION CODER	C/L		
NAVIGATION:	ARR-69		L		
UHF-ADF	ARA-25 ARA-50	DIRECTIONAL HOMING	C L	LINE-OF-SIGHT	RIGHT CONSOLE
TACAN	ARN-21D	PROVIDES COURSE BEARING AND DISTANCE TO SELECTED STATION	C	LINE-OF-SIGHT TO 200 MILES	
	ARN-52(V)	PROVIDES COURSE BEARING AND DISTANCE TO SELECTED STATION AND AIR-TO-AIR RANGING INFO FROM OTHER AIRCRAFT	L	LINE-OF-SIGHT TO 300 MILES	
NAVIGATION COMPUTER	ASN-19A	AUTOMATIC DEAD RECKONING	C/L	0° TO 72° NORTH AND SOUTH	
RADAR:					
AIR-TO-GROUND RECEIVE/TRANSMIT	APG-53A/B	TERRAIN CLEARANCE	C/L	LINE-OF-SIGHT	LEFT CONSOLE AND INSTRUMENT PANEL
ALTIMETER	APN-141(V)	INDICATES HEIGHT ABOVE TERRAIN	C/L		INSTRUMENT PANEL
WEAPONS DELIVERY:					
AIR-TO-GROUND MISSILE	SEE A-4/TA-4 TACTICAL MANUAL (NAVAIR 01-40AV-1T)	GUIDED MISSILE	C/L	LINE-OF-SIGHT	LEFT CONSOLE AND CONTROL STICK

Figure 1-14. Electronic Equipment

ANTENNA LOCATIONS

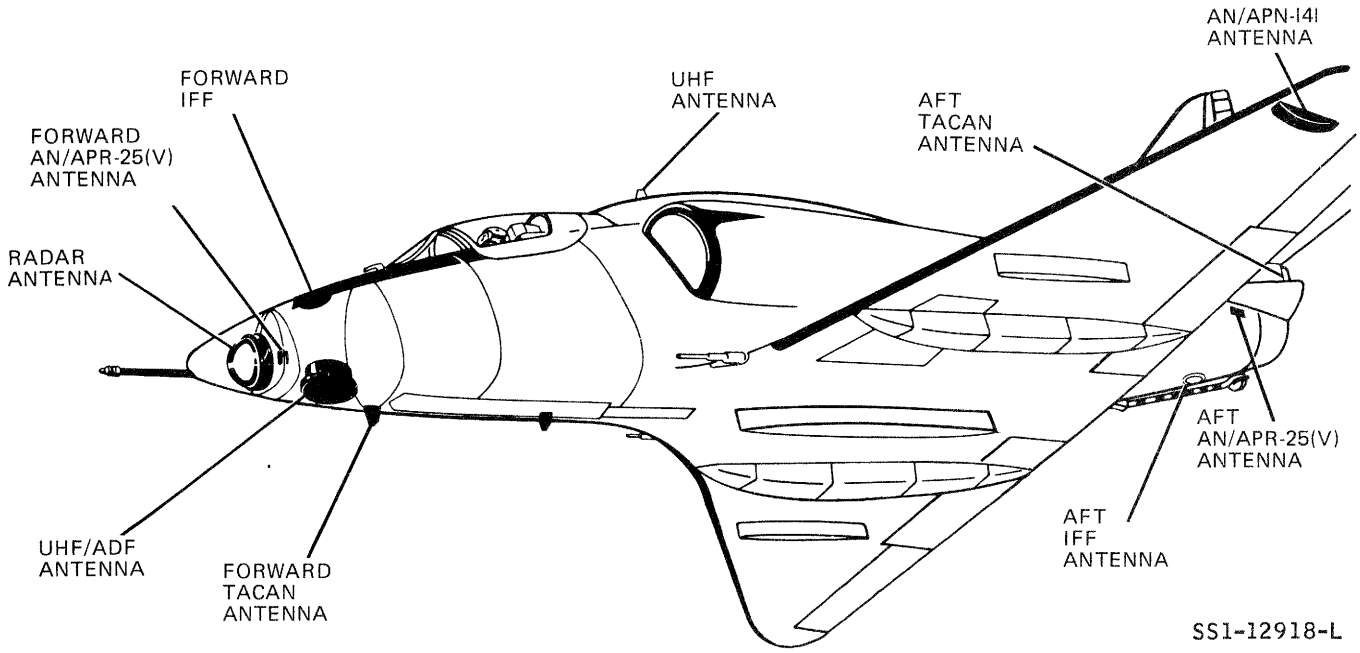


Figure 1-15. Antenna Locations

Audio Isolation Amplifier

In aircraft incorporating AFC 379, an audio isolation amplifier is used to match the headset impedance with all receivers in the aircraft. A switch, located in the lower right corner of the instrument panel, is labeled AUDIO BYPASS/NORM. The AUDIO BYPASS/NORM switch in the BYPASS position, removes the audio isolation amplifier from the circuit and allows only the audio signals from the ARC-27A, LAWS (low altitude warning system), and the SHRIKE to be heard.

UHF Radio (A-4C)

The AN/ARC-27A UHF radio equipment provides two-way voice communications with other aircraft and with surface stations. The equipment can transmit or receive through the same antenna on any one of the 1750 channels within a frequency range of 225.0 through 399.9 megacycles.

UHF RADIO CONTROL PANEL

The ARC-27A control panel (figure A-1) is located on the right console. The panel contains a volume control, a vernier sensitivity control, function selector switch, channel selector switch, a manual tuning control and a push-to-set channel button. The volume control regulates the volume of incoming signals, and the sensitivity control provides a vernier adjustment of the sensitivity. The channel selector switch has twenty channel positions, numbered 1 through 20, a G (guard) position, and an M (manual) position.

MANUAL TUNING CONTROL. The manual tuning control consists of three concentric dials. The outer dial is used to select the first two digits of the desired frequency, the center dial selects the third digit, and the inner dial selects the digit to the right of the decimal point. The channel selector switch must be placed at M before the selected frequency can be used.

FUNCTION SELECTOR SWITCH. The function selector switch is used to place the set in operation, and has four positions marked as follows:

Position	Function
OFF	Deenergized
T/R	Transmitter operable and receiver in operation
T/R + G	Same as T/R plus reception on the guard
ADF	AN/ARA-25 direction finding equipment in operation through receiver. Transmitter and receiver operable, but garbled, due to the use of the AN/ARA-25 antenna.

SENSITIVITY CONTROL. To ensure peak reception of UHF signals, the sensitivity control on the UHF control box should be set immediately below the point at which background noise occurs. This normally occurs with the SENS-knob index near the 1 o'clock position. If unable to create noise by a clockwise movement of this knob or if unable to eliminate it by a counterclockwise movement, the ASQ-17B sensitivity is not adjusted properly. The guard receiver has a separate sensitivity control which eliminates background noise on the guard receiver. The pilot has no control of this setting.

PUSH-TO-SET CHANNEL BUTTON. The push-to-set channel button permits the pilot or ground crewman to change frequencies for the twenty channel positions. To accomplish this:

1. Increase receiver sensitivity until there is noticeable background noise.

2. Set channel selector to the desired channel.

3. Dial in new frequency on manual tuning control.

4. Rotate PUSH TO SET CHANNEL button and depress it momentarily.

5. Lift PUSH TO SET CHANNEL button to its original position and release. Upon completion of channeling, background noise should again be heard.

UHF REMOTE CHANNEL INDICATOR

UHF remote channel indicator is located on the top right side of the glareshield for a quick visual check of the channel selected on the UHF control panel.

Note

The remote channel indicator is powered through the APX-6B rotary selector switch, and the switch must be at some position other than OFF to energize the indicator.

OPERATION OF THE UHF RADIO

To operate the UHF radio proceed as follows:

1. Function selector switch . . . . . T/R + G
2. Channel selector switch. . DESIRED CHANNEL
3. Throttle microphone switch . . . . . DEPRESS

CAUTION

- Allow 60-second warmup period before depressing microphone switch to prevent damage to the transmitter tube filaments.
- If cabin pressurization is lost, avoid use of the UHF transmitter above 27,500 feet. Keying the transmitter above 27,500 feet causes arcing within the ASQ-17B and premature failure.

Automatic Direction Finding Equipment (A4C)

The AN/ARA-25 automatic direction finding equipment operates in conjunction with the AN/ARC-27A UHF radio to provide a continuous directional indication of the source of signals received in the 225- to 400- megacycle band. Source indication in relative bearing for homing or navigational purposes is provided by the No. 1 pointer of the ID-663 BDHI.

Note

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

OPERATION OF THE AN/ARA-25

The AN/ARA-25 ADF equipment is energized when the aircraft electrical system is energized, and is placed in operation by moving the function selector switch on the UHF radio control panel to the ADF position.

Note

- When the emergency generator is extended, ARC-27A, ARA-25, APX-72, and the compass system are the only navigational aids available to the pilot.
- When the UHF radio is left in the ADF position, transmission and reception will be garbled.

Radar Identification Equipment

The aircraft radar identification equipment consists of the AN/APX-72 transponder (IFF) and the AN/APA-89 selective identification equipment (SIF).

AN/ARC-51A (UHF) Radio Communication System (A-4L)

The AN/ARC-51A (UHF) radio communication system provides inflight voice communication between aircraft and between aircraft and ground stations. Transmission-reception is normally limited to line-of-sight. The AN/ARC-51A (UHF) receiver-transmitter provides static-free communication and works in conjunction with the AN/ARA-50 ADF equipment. The AN/ARC-51A system consists of the following units:

1. RT-753/ARC-51A receiver-transmitter.
2. C-6555/ARC-51A control set.

3. ID-1003/ARC standing-wave ratio indicator.

4. HD-513/ARC equipment chassis cooler.

5. AT-141A/ARC UHF antenna.

6. Antenna coaxial relay.

Equipment, from other systems as listed, is also used with operation of the AN/ARC-51A:

1. AM-3624/ARA-50 control-amplifier coaxial switch assembly.

2. ADF/IP relay.

3. AS-909/ARA-48 antenna.

The AN/ARC-51A is energized by placing the C-6555/ARC-51A control set function selector switch (figure 1-16) from OFF to T/R or T/R+G. Place the mode selector switch in PRESET CHAN position if one channel (of 20) is to be used. Place mode selector switch in MAN and manually set any desired frequency (not already preset) by rotating the trio of manual select knobs. If the function selector switch has been set to T/R+G, instead of T/R, the separate guard receiver will be monitored as well as the selected channel or frequency. Two antennas are used with the AN/ARC-51A system; a communications blade-type antenna and an ADF antenna.

C-6555/ARC-51A CONTROL SET

The C-6555/ARC-51A control set provides remote control of the RT-743/ARC-51A receiver-transmitter. The control set panel contains a frequency indicator, a channel indicator, a potentiometer, a memory drum; plus switches for function selection, mode selection, and squelch disable.

MODE SELECTOR SWITCH. The mode selector switch has three positions; PRESET CHAN, MAN, and GD XMIT. The PRESET CHAN position permits selection of any of the 20 preset channels. The selected channel number is displayed in the window above the PRESET CHAN knob. A hinged cover provides access to a memory drum and numbers 1 through 20 (for channel marking) can be listed on the cover. The preset channels can be set on any frequency between 225 and 399.95 megacycles. The MAN position permits selection of channel frequencies, by rotating the three manual selection knobs located on the panel. The frequency selected will appear on the frequency indicator. In GD XMIT position, the guard frequency is automatically selected on the main receiver for both emergency transmission and reception.

Note

NEW NEW NEW

Whenever the ARC-51 transmitter is energized, both primary and auxiliary receivers are inoperative and reception is not possible. For this reason, if ARC-51 mic button sticks, the only means of radio reception is to place ARC-51 to OFF and utilize CMD or GRD position of ARR-69 for radio reception.

FUNCTION SELECTOR SWITCH. The function selector switch has four control positions:

1. OFF – AN/ARC-51A deenergized.

2. T/R – AN/ARC-51A energized.

3. T/R+G – AN/ARC-51A energized and monitoring separate guard receiver.

4. ADF – Direction finder.

SQ DISABLE SWITCH. The SQ DISABLE switch has an OFF and ON position. In OFF position, the main receiver operates in a normal manner. In the ON position, the squelch circuit is disabled.

AUDIO ISOLATION AMPLIFIER. The audio isolation amplifier is used to match headset impedance with all receivers in the aircraft. A switch, placarded AUDIO BYPASS/NORM, is located on the instrument panel (figure A-1). The AUDIO BYPASS position removes the audio isolation amplifier from the circuit and allows only the signals from the ARC-51A, LAWS, and Shrike, to be received.

AN/ARR-69 (UHF) Auxiliary Receiver

The AN/ARR-69 (UHF) auxiliary receiver system is used alternately with the AN/ARC-51A (UHF) radio communication system, or simultaneously when one system is being used for direction finding while the other is being used for communication. The AN/ARR-69 (UHF) receiver provides the capability for complete communications during UHF-ADF approaches.

An interlock gives the AN/ARR-69 (UHF) some control over the AN/ARC-51A set. The AN/ARR-69 (UHF) system operates in the frequency range of 265.0 to 284.9 megacycles. Twenty preset frequency channels, plus the guard channel, are available within the frequency range. The C-1457/ARR-40 receiver control for the AN/ARR-69 (UHF) auxiliary radio receiver is located on the right-hand console.

C1457/ARR-40 RECEIVER CONTROL PANEL. C-1457/ARR-40 receiver control panel (figure 1-16) is used as a remote controller of the R-1286/ARR-69 auxiliary radio receiver. The C-1457/ARR-40 receiver control panel also exercises some control over the AN/ARC-51A system. The function selector knob on the C-1457/ARR-40 receiver control panel is labeled AUX REC above the selector knob and MAIN T/R below the selector knob. The AUX REC positions are; OFF, ADF, CMD, and GRD. The MAIN T/R positions are; T/R, ADF, and ADF. When the function selector knob is rotated, the AUX REC and MAIN/T/R positions change simultaneously to select operating functions of both the AN/ARR-69 (UHF) and the AN/ARC-51A (UHF) systems. The comparison between the AUX REC and MAIN T/R is as listed:

AUX REC position	MAIN T/R position
OFF	none
ADF	T/R
CMD	ADF
GRD	ADF

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

The C-1457/ARR-40 receiver control center dial, labeled AUX CHAN, is marked to represent 20 preset channel frequencies. Guard frequency channel selection is provided by the function selector switch. To determine the preset channel which corresponds to a given Navy/Marine beacon, subtract 64 from the middle two digits of the frequency; for example: frequency 267.7 would be on channel 3 (67 – 64). Two potentiometer-type controls are located on the right side of the C-1457/ARR-40 receiver control panel. The control, labeled SENS, will control the sensitivity of the R-1286/ARR-69 auxiliary radio receiver. Rotating the SENS control in a clockwise direction will increase the sensitivity of the receiver. The control labeled VOL controls the volume of the R-1286/ARR-69 receiver.

AN/ARA-50 Automatic Direction Finding Equipment

The AN/ARA-50 (ADF) radio navigation system supplies automatic direction finding indications of relative bearing to transmitting station from received UHF radio signals. The AN/ARA-50 system operates in conjunction with the AN/ARC-51A (UHF) radio communication system; the AN/ARR-69 (UHF) auxiliary receiver system; and the ID-663B/U bearing, distance, and heading indicator (BDHI). The signal is received by the AN/ARA-50 from either the AN/ARC-51A or the AN/ARR-69 system, and the relative bearing to the transmitting UHF station is displayed by the No. 1 needle of the BDHI.

Note

Excessive UHF-ADF bearing error may result when stores are carried on the centerline station or when in landing configuration outbound.

The ADF operation is partially controlled by the C-1457/ARR-40 receiver control panel of the AN/ARR-69 (UHF) auxiliary receiver system. The AN/ARC-51A radio communication system cannot be used in the ADF mode unless the C-1457/ARR-40 control is in the AUX REC/OFF, AUX REC/CMD, or AUX REC/GRD position. To use the AN/ARR-69 auxiliary communication system in the ADF mode, place the C-1457/ARR-40 control in the AUX REC/ADF position.

AN/ARA-50 OPERATION. The AN/ARA-50 (ADF) equipment is energized when the aircraft electrical system is energized. Tune in a UHF station on either the AN/ARC-51A (UHF) radio or the AN/ARR-69 (UHF) auxiliary receiver system, using the normal communication system (blade) antenna (AT-256/ARC). When station signals are received in the headset and the station has been identified, the selected (AN/ARC-51A or AN/ARR-69) system control switch is moved to the ADF position. The received signal is then switched from the blade antenna to the ADF antenna (AS-909/ARA-48). The ADF antenna then rotates to the null point and the relative bearing is displayed by the No. 1 needle of the BDHI.

Note

- When the emergency generator is extended, the ARN-52(V), AN/APX-64, AN/ARA-50, AN/ARC-51A, and the compass system are the only navigational aids available.
- The AN/ARA-52(V) is inoperative when landing gear is down.

AIMS Transponder System

The acronym AIMS is derived from the following:

ATCRBS (air traffic control radar beacon system)

IFF (identification, friend or foe)

MARK XII Identification System

The AIMS transponder system is capable of automatically reporting coded identification and altitude signals in response to interrogations from surface (or airborne) stations so that the stations can establish aircraft identification, control air traffic, and maintain vertical separation. The system has five operating modes: 1, 2, 3/A, C, and 4. Modes 1 and 2 are IFF modes; mode 3 (civil mode A) and mode C (automatic altitude reporting) are primarily air traffic control modes; and mode 4 is the secure (encrypted) IFF mode. (Mode 4 is not operational unless the system includes a KIT-1A/TSEC transponder computer.)

AIMS TRANSPONDER SYSTEM COMPONENTS

The basic AIMS transponder system components are:

C-6280A(P)/APX control

APX-72 transponder

TS-1843/APX transponder test set

Antenna switching unit

CPU-66 altitude computer

AAU-19 altimeter encoder

KIT-1A/TSEC transponder computer

IFF caution light

Landing gear interlock

TS-1843 TRANSPONDER TEST SET

The TS-1843 transponder test set provides the self-test and monitor functions for modes 1, 2, 3/A, and C. The TS-1843 accomplishes the self-test functions, when actuated, by interrogating the transponder and monitoring the replies. The monitor function is accomplished, when selected, by monitoring the replies to external interrogations. The controls for the TS-1843 are included on the C-6280 control.

C-6280 TRANSPONDER CONTROL

Most of the controls for the AIMS transponder system are included on the C-6280. The REPLY light and the controls on the left side of the C-6280 are concerned with mode 4. The TEST light and the remaining controls are associated with modes 1, 2, 3/A, and C, except that the MASTER switch controls all modes of operation.

MASTER SWITCH. The MASTER switch applies power to all the AIMS transponder system components except the altimetry components. It is a five-position rotary switch placarded OFF, STBY, LOW, NORM, and EMER. The switch must be lifted over a detent to switch to EMERG or to OFF. STBY should be selected for 2 minutes prior to switching to LOW or NORM to allow the transponder to warm up. In the NORM position, the transponder system is operational at normal receiver sensitivity. In the LOW position the system is operational but the transponder receiver sensitivity is reduced. In the EMERG position the transponder transmits emergency replies to mode 1, 2, or 3/A interrogations. The mode 3/A emergency reply includes code 7700. When EMERG is selected, modes 4 and C are enabled regardless of the position of the selector switches.

Note

The transponder automatically switches to emergency operation and the mode 4 codes zeroize when seat ejection occurs, if the MASTER switch is in any position except OFF.

IDENT-OUT-MIC SWITCH. The IDENT-OUT-MIC switch is a three-position toggle switch. The spring-loaded IDENT position adds an identification of position pulse to mode 1, 2, and 3/A replies for a period of 15 to 30 seconds. In the MIC position, the identification of position function is activated for 15 to 30 seconds each time the UHF microphone switch is pressed.

MODE 1, 2, AND 3/A CODE SELECTORS. The two mode 1 thumbwheel selector switches allow selection of 32 mode 1 codes, and the four mode 3/A thumbwheel selectors allow selection of 4096 mode 3/A codes. The mode 2 code selector switches are located on the transponder and cannot be changed by the pilot during flight.

MODE SWITCHES. The four mode switches (M-1, M-2, M-3/A, and M-C) each have OUT, ON, and spring-loaded TEST positions. The center ON position of each switch enables that mode. To test the transponder, press the mode switch of each mode to the TEST position. Illumination of the TEST light indicates proper operation of that mode. The MASTER switch must be set to NORM for the test function to operate. The mode switches of the modes not being tested should be OUT when testing on the ground to prevent unnecessary interference with nearby ground stations.

Note

The TEST light may flash once as each mode switch is released from the TEST position, and as the RAD TEST-OUT-MON switch is moved. This is a characteristic of the TS-1843B, transponder test set, and is meaningless.

RAD TEST-OUT-MON SWITCH. The MON position of the RAD TEST-OUT-MON switch is used to monitor the operation of modes 1, 2, 3/A, and C. When MON is selected, the TEST light will illuminate for 3 seconds each time an acceptable response is made to an interrogation on a selected mode.

The spring-loaded RADiated TEST position is used for testing. It enables a mode 3/A code reply to a TEST mode interrogation from a ramp test set. It also enables a mode 4 reply to a VERIFY 1 interrogation from a surface station or a ramp test set. A VERIFY 1 interrogation is a modified mode 4 interrogation used for testing.

MODE 4 OPERATION. Mode 4 operation is selected by placing the mode 4 toggle switch to ON, provided that the MASTER switch is NORM or LOW. Placing the Mode 4 switch to OUT disables mode 4.

The Mode 4 CODE switch is placarded ZERO, B, A, and HOLD. The switch must be lifted over a detent to switch to ZERO. It is spring loaded to return from HOLD to the A position. Position A selects the mode 4 code for the present code period, and position B selects the mode 4 code for the succeeding code period. Both codes are mechanically inserted into the KIT-1A/TSEC transponder computer by a single insertion of the KIK-18/TSEC code changing key. The codes are mechanically held in the KIT-1A/TSEC, regardless of the position of the MASTER switch or the status of aircraft power, until the first time the landing gear is raised. Thereafter, the mode 4 codes will automatically zeroize anytime the MASTER switch or the aircraft power is turned off. The code settings can be mechanically retained after the aircraft has landed by turning the CODE switch to HOLD and releasing it at least 15 seconds before the MASTER switch or aircraft power is turned off. The codes again will be held, regardless of the status of aircraft power or the MASTER switch, until the next time the landing gear is raised.

The mode 4 codes can be zeroized any time the aircraft power is on and the master switch is not OFF by turning the CODE switch to ZERO.

An audio signal, the C-6280 REPLY light, and the IFF caution light are used to monitor mode 4 operation. The AUDIO-OUT-LIGHT switch controls the audio signal and the REPLY light, but not the IFF caution light. In the LIGHT position, the REPLY light illuminates as mode 4 replies are transmitted. In the AUDIO position, an audio tone in the pilot's headset indicates that valid mode 4 interrogations are being received and the REPLY light illuminates if mode 4 replies are transmitted. In the OUT position, the audio indications and the REPLY light are inoperative, and the REPLY light will not press-to-test.

IFF CAUTION LIGHT. The IFF caution light, located on the glare shield, lights to indicate that mode 4 is not operative. The light is operative whenever aircraft power is on and the MASTER switch is not OFF. However, the light will not operate if the KIT-1A/TSEC computer is not physically installed in the aircraft. When the IFF caution light illuminates, it also illuminates the master caution light in some aircraft. Illumination of the IFF caution light indicates that: the mode 4 codes have zeroized, the self-test function of the KIT-1A/TSEC computer has detected a faulty computer, or the transponder is not replying to proper mode 4 interrogations.

If the IFF caution light illuminates, switch the MASTER switch to NORM (if in STBY) and ensure that the mode 4 toggle switch is ON. If illumination continues, employ operationally directed flight procedures for an inoperative mode 4 condition.

ANTENNA SWITCHING UNIT

An antenna switching unit electronically switches the transponder between the top and bottom IFF antennas at a rate of 38 cps.

CPU-66 ALTITUDE COMPUTER

The CPU-66 altitude computer is a small air data computer consisting of an altitude sensor, airspeed sensor, electromechanical computing section, servo monitors, synchro outputs, and a digital encoder.

The CPU-66 computer outputs are altitude information corrected for static position error. The synchro output is supplied to the AAU-19 altimeter providing the pilot with a corrected altitude indication. The digital output from the computer is applied to the transponder for transmission on mode C. The digital output is coded in increments of 100 feet and is referenced to 29.92 inches of Hg. The CPU-66 operates automatically whenever aircraft power is on, unless the circuit breakers are pulled. In case of an electrical failure in the computer, the AAU-19 altimeters automatically switch to standby operation and the computer digital output circuit is disabled. In addition, the transponder test set mode C enabling circuit is opened preventing a GO test for Mode C.

NAVIGATION EQUIPMENT

Compass System

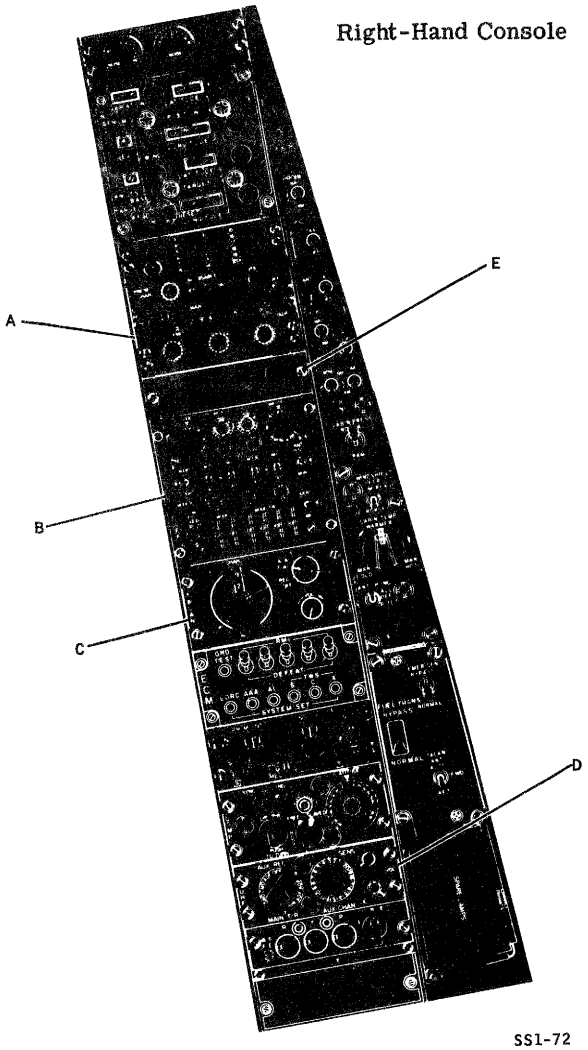
COMPASS CONTROLLER

Controls for the operation of the compass system are located on the compass controller panel (figure A-1) on the right console. The switch marked SLAVED and FREE permits selection of either function. A push-to-turn set heading knob rotates the ID-663 BDHI and the all-attitude indicator to any desired heading. This also may be used to synchronize the compass system with the magnetic flux vlave. 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. Heading information is obtained from the BDHI or the all-attitude indicator.

Control	Placard	Function
Code knob	ZERO	Drops any previous coding set into external computer.
	B	Locks in Mode 4 when interrogations are in Code B.
	A	Locks in Mode 4 when interrogations are in Code A.
	HOLD	Allows retention of codes while refueling.
Reply press-to-test	REPLY	Indicates replies in Mode 4.
Test press-to-test	TEST	Indicates GO condition of airborne tester.
Master knob	EMER	Enables all mode decoders; codes Mode 3/A to 7700, automatically.
	STBY	Applies ground in reference to signal, blocking transmitter output.
	OFF	Controls power to the AN/APX-72(V) receiver-transmitter.
	LOW	Volume
	NORM	Volume
Transponder tester switch	RAD TEST OUT MON	Enables airborne transponder inflight tester.
Mode control switches (4)	M1, M2, M-3/A M-C ON OUT	Forward - enables testing (when equipped with airborne test set). Center - enables decoders. Aft - disables decoders.
Microphone switch	IDENT OUT MIC	Enables IP for 30 seconds. Microphone switch enables external means of triggering IP circuit.
Digital select switches (6)	0 to 9	Digital insertion dials. Mode 1 = 2 dials. Mode 3/A = 4 dials. Mode 2 = preset on ground.
Mode 4 switch	ON OFF	Enables Mode 4 operation.
Mode 4 audio/light switch	AUDIO OUT LIGHT	Provides audio tone or light indication when interrogations are in Mode 4.

Figure 1-16. C-6280 (P) Transponder Set Control Functions (Sheet 1)

Right-Hand Console



SS1-72

A. C-6555/ARC-51A

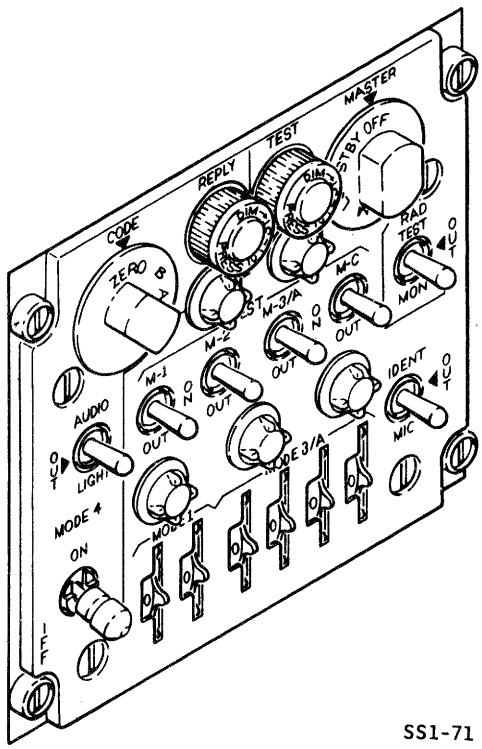
B. C-6280/APX-72

C. C-2010/ARN-52(V)

D. C-1457/ARR-40

E. JULIET 28
(SEE NAVAIR 01-40 AV-1T(A), SUPPLEMENTAL A-4/TA-4 TACTICAL MANUAL)

C-6280 (P) Transponder Set Control



SS1-71

Figure 1-16. C-6280 (P) Transponder Set Control Functions (Sheet 2)

If the average needle position is the center line 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 a period of time from 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 of inputs from the flux valve 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:

1. 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.

2. 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.

3. For fast centering of the sync needle, push the PUSH TO SYNC button and hold it until the needle is centered.

4. To move the sync needle slowly, depress and turn the set heading knob left or right until the desired slow 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 two degrees from 0 to 90. The dial should be set to the approximate latitude of the airplane. 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. The auto sync cycle (approximately 12 seconds) will then rotate the all-attitude indicator and the BDHI compass card to the airplane's 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 to FREE.

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

3. Rotate the compass card of the BDHI to the desired heading with 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-21D or ARN-52V 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 ID-663 BDHI and distance information is indicated in the range window. Beacon identification tone signals are received through the regular headset.

TACAN CONTROL PANEL

The control panel (figure A-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 ID-663 BDHI. In the T/R position, distance information in the range window of the instrument is also given. When air-to-air ranging equipment is installed in conjunction with the AN/ARN-21D or ARN-52V, the A/A position give air-to-air distance information from another cooperating aircraft.

TACAN ANTENNA SWITCH

The A-4C aircraft has a two-position TACAN antenna switch (figure A-1) on the right console adjacent to the emergency generator bypass switch, which selects the forward or aft antenna. The switch is labeled FWD and AFT.

The A-4L aircraft has a three-position TACAN antenna switch identified as TACAN ANT with positions marked AFT, FWD, and AUTO, and is located on the right-hand wedge console (figure 1-16).

OPERATION OF TACAN EQUIPMENT

To operate the TACAN radio, proceed as follows:

1. Power switch . . . . . REC
2. Allow 3 minutes for warmup.
3. Power switch . . . . . T/R
4. Channel selector switch . . . . . Set channel number
5. Antenna switch . . . . . As desired
6. Identify beacon by tone signals in headset and read magnetic bearing to station at 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.

AIR-TO-AIR RANGING. Air-to-air ranging requires cooperating aircraft within line of sight

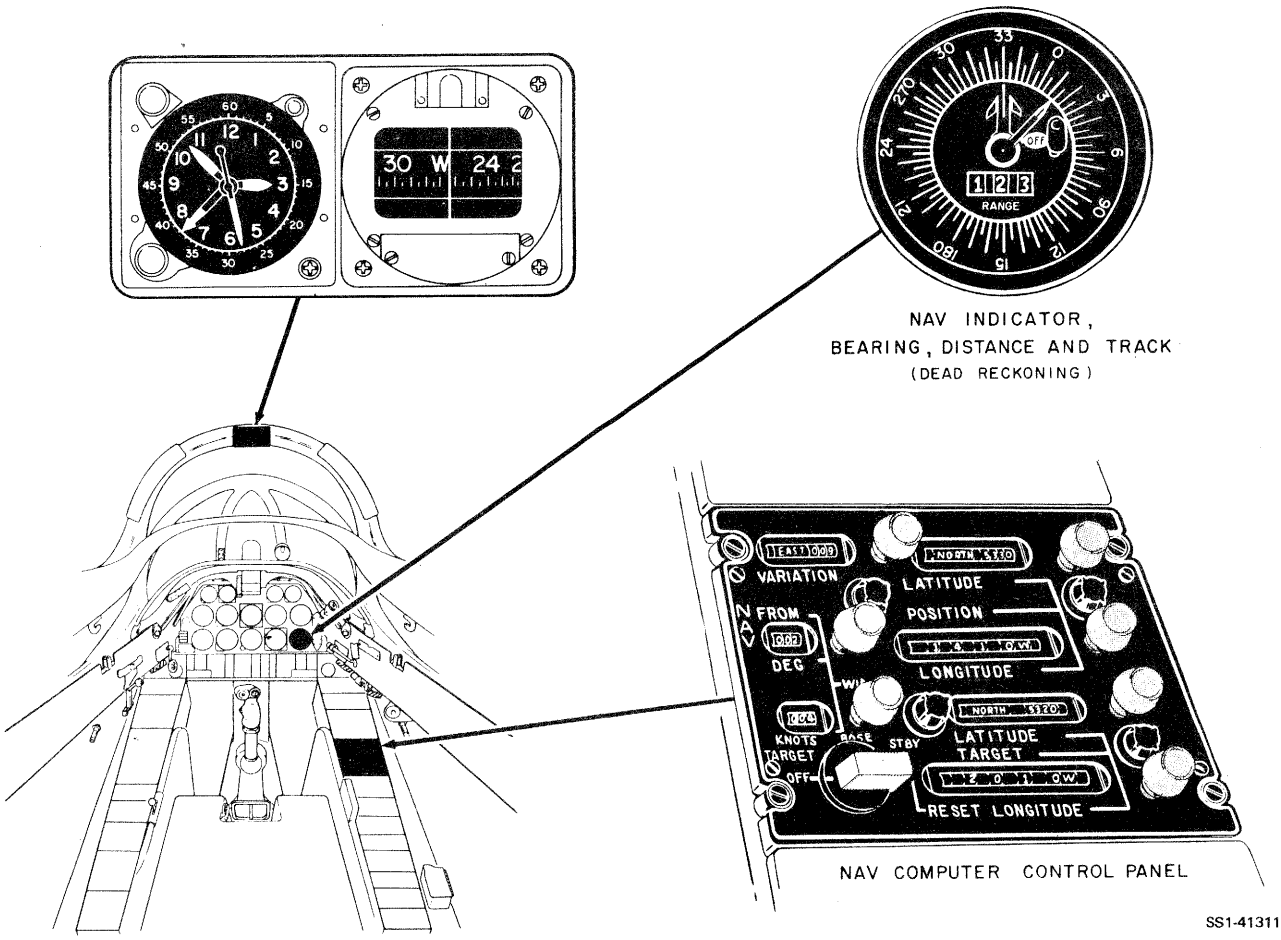


Figure 1-17. Navigational Computer Set (Automatic Dead Reckoning System)

distance. Both aircraft must be in the A/A mode. Two channels separated by 63 megacycles are required for a complete air-to-air link. Channels 15 and 78, for example, constitute one channel pair. An aircraft using channel 15 in the A/A mode transmits on 1039 MC and receives on 1102 MC. The transmissions are received by another aircraft using channel 78 in the A/A mode. The aircraft using channel 78 will transmit on 1102 and its signals will be received by the aircraft using channel 15. With the TACAN equipment in operation, air-to-air ranging may be accomplished as follows:

Power switch . . . . . A/A

Read distance to cooperating aircraft in range window of BDHI.

AN/ASN-19A Navigational Computer Set

The AN/ASN-19A automatic dead reckoning set (see figure 1-17) continuously computes and indicates throughout a flight the great circle bearing and range to a target or home base, present latitude and longitude, and the ground track angle. This system consists of a CP-434/ASN-19A computer control (data setting box) on the right console (see figure 1-17), an electronic control amplifier in the nose section, and an ID-732/ASN-19A bearing, distance, and track indicator on the pilot's instrument panel (figure A-1). The set is operative only when the main generator is running or when external power is applied to the aircraft. The TAS computer, through rotation of a synchro control transformer rotor (which is varied by outside air temperature and pitot/static pressure values), computes TAS information and transmits it to the computer control which accepts manual inputs of base position, target position, wind, and variation, as well as the automatic input from the TAS transducer and the compass system. These inputs are resolved and integrated to provide great circle bearing, range, and ground track information. Present latitude and longitude may be read in windows on the computer. True great circle bearing and distance to the target or base are presented on the indicator by means of a pointer and counter, respectively, and ground track is presented by a moving card.

NAVIGATIONAL COMPUTER SET CONTROLS

FUNCTION SWITCH. The function selector switch is used to place the set in operation and has five positions marked as follows:

Position	Function
OFF	The set is completely de-energized.
TARGET	Computations are continuously performed so that great circle distance and bearing to the target appear on the indicator.
BASE	Great circle distance and bearing to the base appear on the indicator in place of target data.
STBY	Set is energized and begins warmup.
RESET	Former base position is erased and a new base position may be established.

LATITUDE AND LONGITUDE INPUT. Four knobs are provided to set position latitude, position longitude, target latitude, and target longitude. Each of the settings is read on an adjacent counter on the computer control box. The operational range of the computer set is 72 degrees north to 72 degrees south; however, system accuracy decreases moderately at latitudes greater than 50 degrees and rapidly at those greater than 70 degrees.

WIND INPUT. Two knobs are used to set wind direction and velocity on two counters in the computer control box. The computer accepts windspeed from 0 to 200 knots.

Note

True wind direction must be set into the computer.

VARIATION INPUT. Magnetic variation up to 180 degrees east or west may be introduced into the computer by means of a single knob adjacent to the variation counter.

OPERATIONAL PROCEDURE

PREFLIGHT. Steps 1 through 7, which do not require electrical power, can be accomplished before the engine is started.

1. Switch function selector to RESET. (Knot must be pulled up approximately one-sixteenth inch.)

2. Set in magnetic variation corresponding to present position. For short flights, use average variation.

3. Set WIND-FROM and WIND-KNOTS counters. (Use true, not magnetic, wind direction.)

4. Set target LATITUDE and LONGITUDE counters. (Knobs must be pushed in.)

CAUTION

Do not rotate latitude knobs through their north/south stops when setting in latitude on counters.

5. Set in point of return (BASE) latitude and longitude on position counters. If point of return and starting point are the same, omit step 6.

6. If point of return and starting point are different, switch selector to STBY and set in latitude and longitude of starting point on position counters.

7. Switch selector to OFF. (Knob must be pulled up.)

8. After engine is started, switch selector to STBY.

9. Select SLAVED compass system operation and SYNC compass (if necessary).

Note

Leave selector in STBY until 100 knots TAS is attained. The computer assumes an input of 100 knots minimum, even at lower airspeeds.

AFTER TAKEOFF. Following steps must be accomplished:

1. Switch selector to TARGET (or BASE).

2. To fly great circle (shortest) route to target, head aircraft to align bearing needle of indicator with fixed ground track index mark (fiducial mark).

INFLIGHT. Proceed as shown in steps 1 through 3.

1. On long flights, correct variation periodically to minimize heading errors.

2. Correct WIND whenever reliable information is available. Incorrect wind settings are the major source of computer error.

Note

A new base position which lies in the flight path can be established without affecting present position computation by switching the selector to RESET momentarily, then returning it to TARGET or BASE when present position coordinates coincide with the new base coordinates. Pushing in the counter knobs automatically stops the present position computation. When the knobs are released, computation resumes. Course deviations to avoid enemy action, adverse weather conditions, and the like, may be made at any time without affecting the accuracy of computations; however, frequent or large changes of altitude cause the system to indicate arrival at the target slightly ahead of the aircraft.

3. After completing the mission, switch selector to BASE. Read base range and bearing on indicator.

Note

- At any time during flight, the target, position, wind, and variation settings may be changed, regardless of the position of the selector switch. Location is continuously shown by the latitude and longitude position windows.

- The base reference is erased whenever the function switch is moved to RESET. The location seen in the position windows at the instant the function switch is moved from RESET is the new base reference. If the aircraft is to be abondoned, and its equipment is likely to fall into the hands of an unfriendly nation, the function switch should be placed in the RESET position in order to erase base reference. The system will not operate on the emergency generator.

FLIGHT GREATER THAN 1000 MILES

1. Set into the target counters an intermediate fix which lies on the desired flight path and which is less than 1000 miles from the starting position. The intermediate fix may be an arbitrary point along the flight path. If possible, however, employ a recognizable location in order to correct the present position readings if necessary.

2. When the intermediate fix is approached, set into the target counters another intermediate fix which is less than 1000 miles away.

3. When within 1000 miles of the target, set the target coordinates in on the target counters.

4. When returning from the target, use the same procedure as above except turn the selector switch to BASE when within 1000 miles of the base position.

Note

The use of intermediate fixes does not affect the accuracy of the dead reckoning set, but is merely a convenient method for performing long range flights.

FLIGHT USING DOGLEGS

The most convenient method of flying doglegs is as follows:

1. Set the target coordinates on the target counters.

2. Before the flight, determine the ground track angle and time required for each leg.

3. Fly each leg using the ground track angle presented by the dead reckoning set indicator and the predetermined time of flight. Since the dead reckoning set continuously computes present position, intermediate legs need not be shown accurately.

4. After entering the last leg, align the bearing pointer with the fiducial mark to obtain the correct path to the target.

If it is necessary for the legs to be flown accurately, set in the end point of each leg, in turn, into the target counters. This procedure will not result in any increase in accuracy over that obtainable from the first method unless the end points are recognizable locations and are used as check points.

AN/APN-154(V) Radar Beacon

The AN/APN-154(V) radar beacon set is installed in aircraft reworked per A-4 AFC 473-II and is the airborne radar portion of a ground-based radar aircraft navigational system. The AN/APN-154(V) extends the range 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 AN/APN-154(V) decodes the interrogation and sends a reply. Mode of operation is selected on the C-4419/APN-154(V) control panel.

C-4419/APN-154(V) CONTROL PANEL

The C-4419/APN-154(V) control panel, located on the left console (figure A-1), contains a three-position power switch and a six-position mode switch. The power switch positions are marked OFF, STDBY, and POWER. No power is available to the AN/APN-154(V) in the OFF position. Power is available to the AN/APN-154(V) when the STDBY position is selected but the equipment is not operative. The AN/APN-154(V) is operative when the POWER position is selected. The mode switch is marked SINGLE and DOUBLE. The DOUBLE sector is marked with numbers 1, 2, 3, 4, and 5. SINGLE mode position is used for noncoded operation. Any one of the five positions of DOUBLE mode are used for coded operation.

OPERATION OF THE AN/APN-154(V)

To operate the AN/APN-154(V), proceed as follows:

1. Power switch . . . . . STDBY
2. Mode switch . . . . . AS REQUIRED

Note

Allow 5-minute warmup period in STDBY position for equipment stabilization.

3. Power switch. . . . . AS REQUIRED
4. To turn AN/APN-154(V) off, position power switch to OFF.

AN/APG-53A Radar System

The AN/APG-53A radar system (figure 1-18) is designed primarily to provide improved navigation and terrain clearance capabilities and to provide air-to-ground ranging, obstacle warning, and limited ground mapping. The system does not provide automatic fire control.

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 radarscope presentations or modes of operation are available for pilot selection: search, two obstacle modes (terrain clearance plan and terrain clearance profile), and air-to-ground ranging. Only the profile mode gives a visual and aural obstacle warning.

RADAR COMPONENTS

The components of the radar set are illustrated in figure 1-18. 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 3-phase, 115-volt, 400-cycle, ac power supplied by the aircraft generator.

Note

The radar system will not operate on emergency generator.

RADAR CONTROLS

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

The antenna elevation control 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 has no effect since the programming 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 provides application or removal of primary power and selection of the type of operation. In the standby position, the selector switch causes energization of all primary power relays and initiates the modulator time delay (warmup) period. When placed in 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.

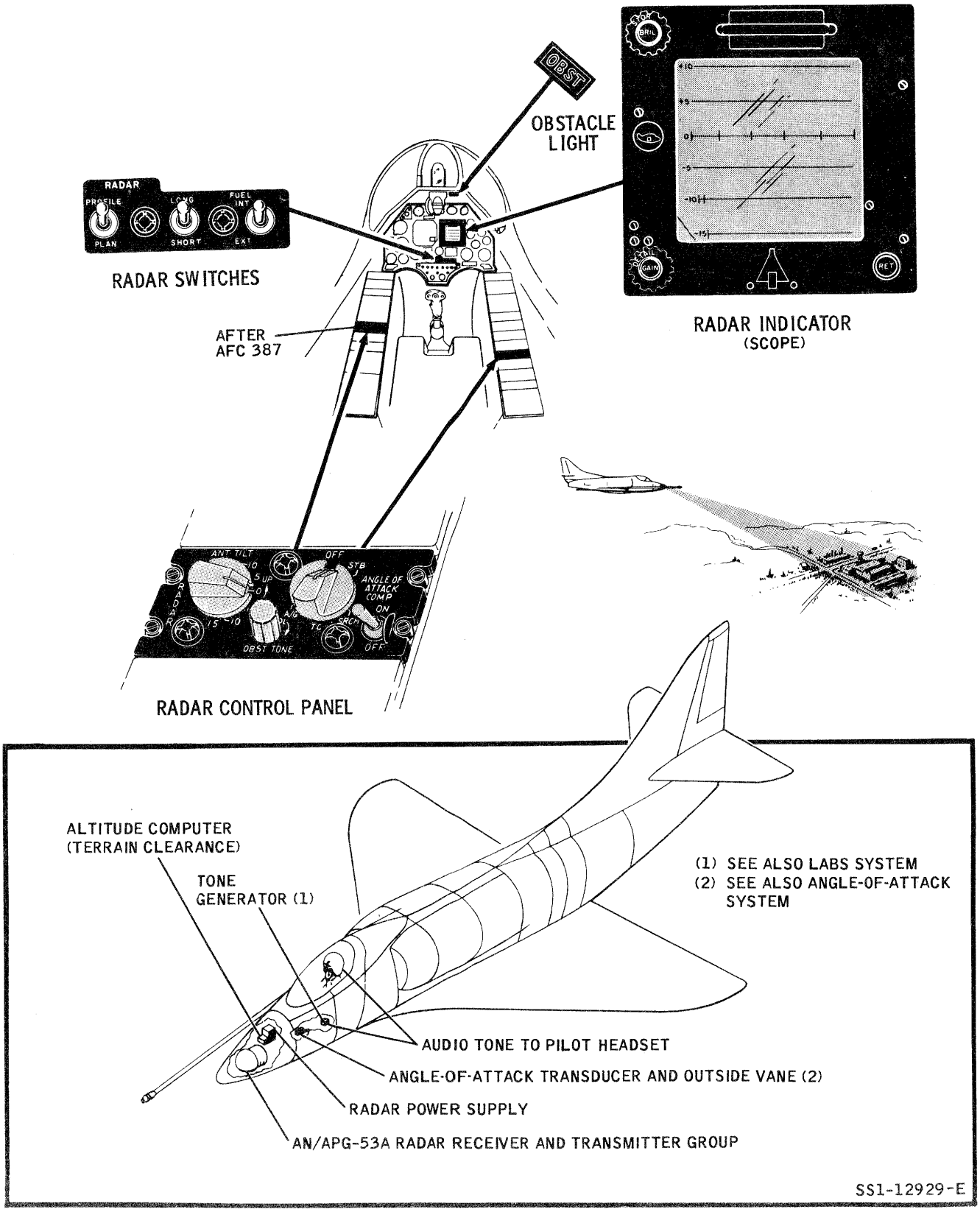


Figure 1-18. AN/APG-53A Radar System

RANGE SELECTOR SWITCH. The range selector switch (figure 1-18) is located in the center of the instruction panel. The switch has two positions, labeled LONG and SHORT.. Ranges provided are:

MODE	SHORT	LONG
SRCH	20 miles	40 miles
T/C	10 miles	20 miles
A/G	15,000 yards	15,000 yards

TERRAIN CLEARANCE MODE SELECTOR SWITCH. The switch is located in the center of the instrument panel adjacent to the range selector switch, and has two positions marked PLAN and PROFILE. The switch is functional when the mode selector switch (on the left console) is at T/C, and is used to select an E-scope presentation (profile mode) or a B-scope presentation (plan mode). (See figure 1-19.)

OBSTACLE LIGHT

A yellow caution light labeled OBST is located beneath the right side of the glareshield. 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 0 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 airplane and the other at the bottom in a plan-view airplane, 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, on concentric shafts, 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, and 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 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 search mode.
- Dimming of radarscope is completely independent of interior lights controls.

A red filter plate to cover the face of the scope is a Douglas addition to the AN/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.

Note

Always use the tab on the bottom to raise or lower the filter plate; never use the side tab.

OPERATING MODES

SEARCH MODE. The search mode presentation displays range versus azimuth. Either 0 to 20 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 airplane 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 (-15°) line is zero range and the top (10°) 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

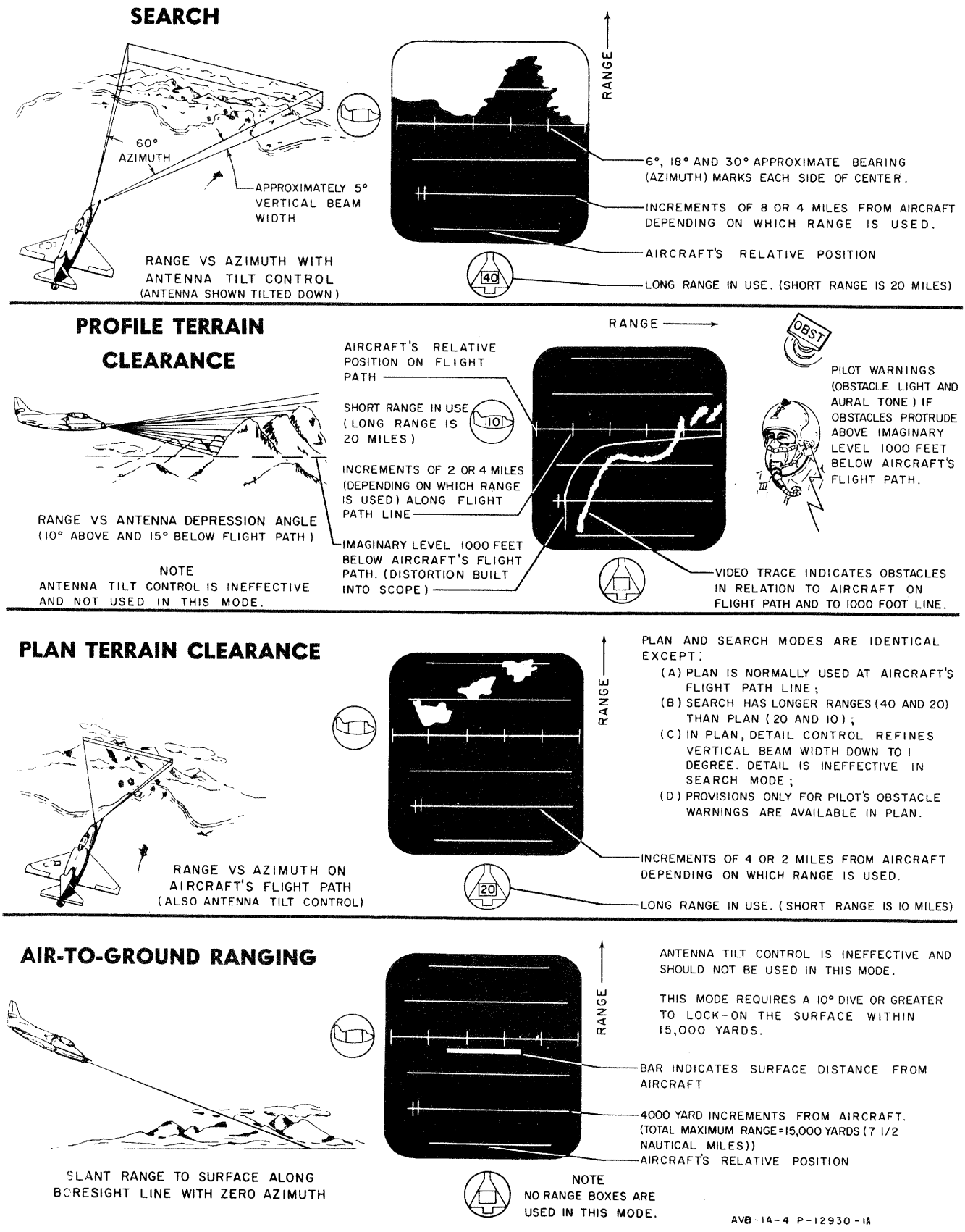


Figure 1-19. Radar Scope Presentations

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 T/C position.

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

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 map-like 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.) Coastlines, 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 which 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 T/C 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.

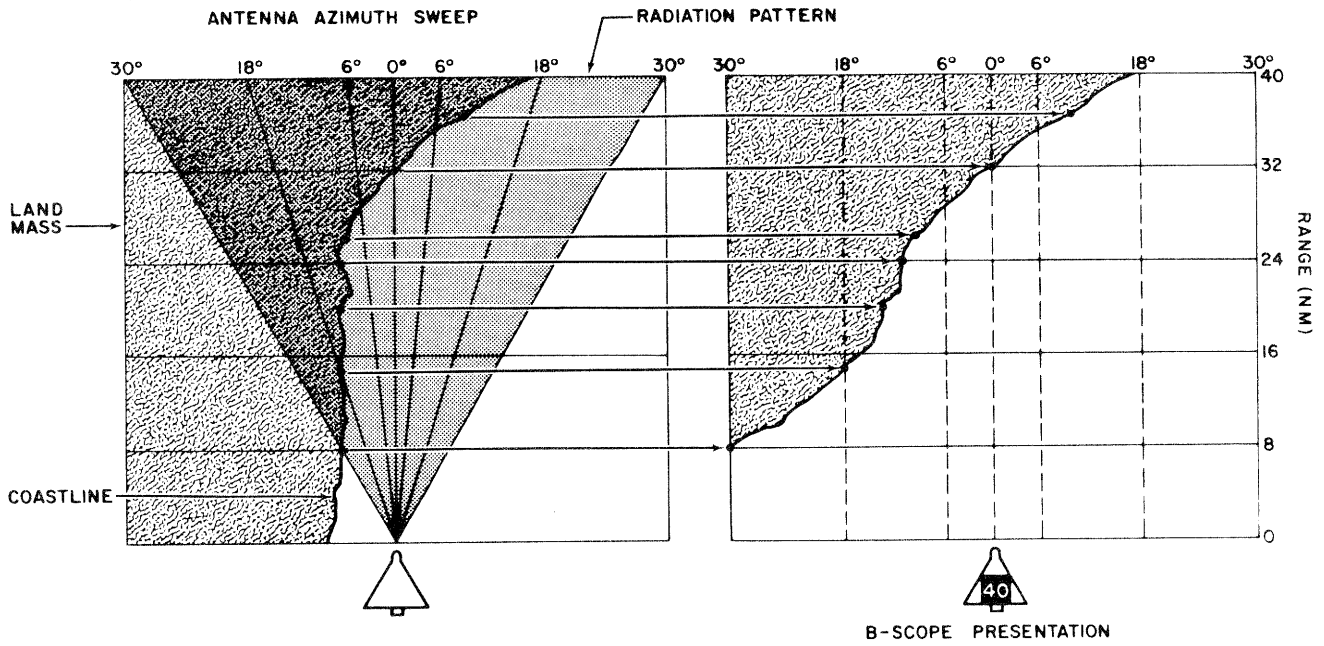
The vertical width of the beam is determined by the setting of the detail knob on the indicator. With the knob fully counterclockwise, beam width is approximately 5 degrees; fully clockwise, beam width is approximately 1/2 of 1 degree. The scope will display only those obstacles, which are within the beam. If the antenna tilt control is at 0 and the angle-of-attack switch is ON, the objects shown will be in a plane which contains the projected flight path and is parallel to the lateral axis of the airplane. 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 1-19.

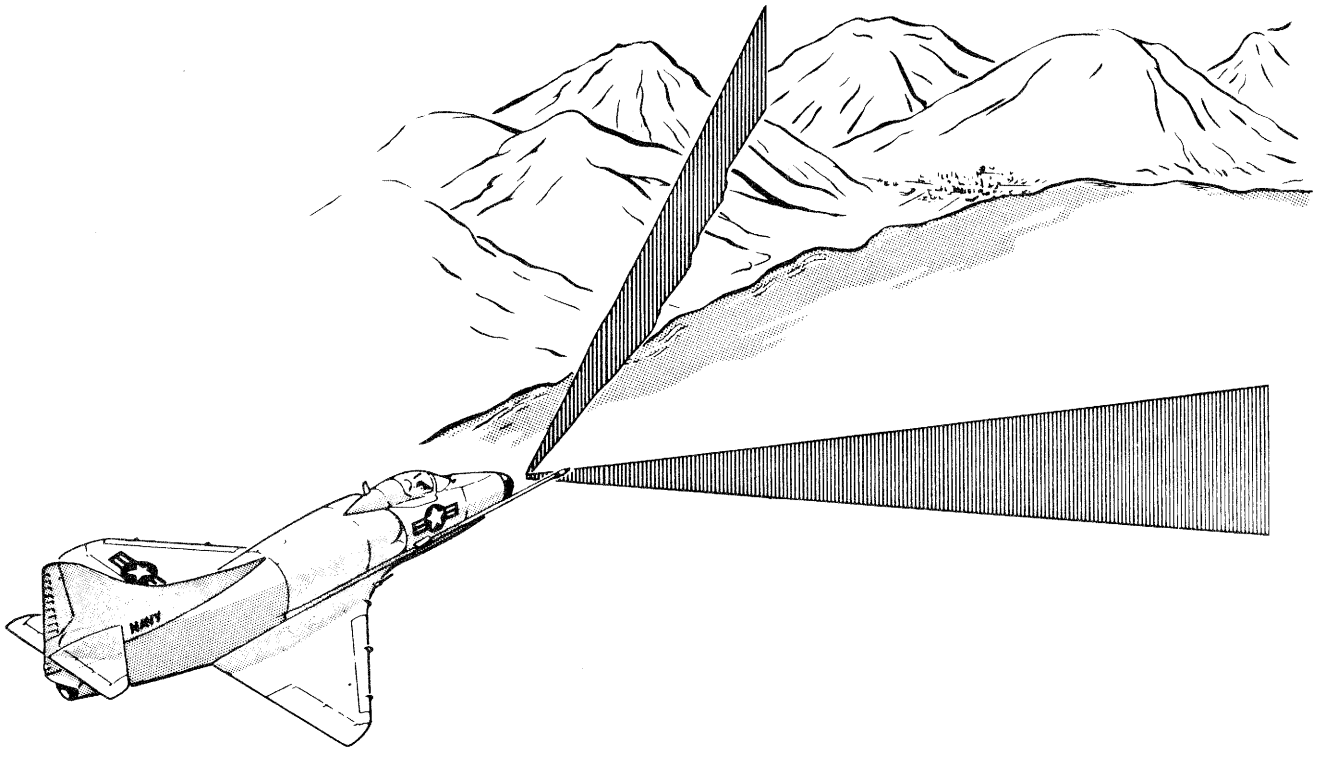
The pilot may examine terrain above or below the flight path (or ADL) by manually adjusting the tilt control to the desired setting (from plus 10 to minus 15 degrees). However, the tilt control knob is spring-loaded in the T/C modes and will return to 0 when released.

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 airplane at the bottom of the scope as in SRCH mode. Each of the horizontal lines on the indicator face represents 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 T/C, the indicator (scope) provides an E-scope (range-versus-antenna depression angle) display of the terrain profile ahead of the airplane. 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.





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Figure 1-20. Radarscope Distortion (Sheet 1)

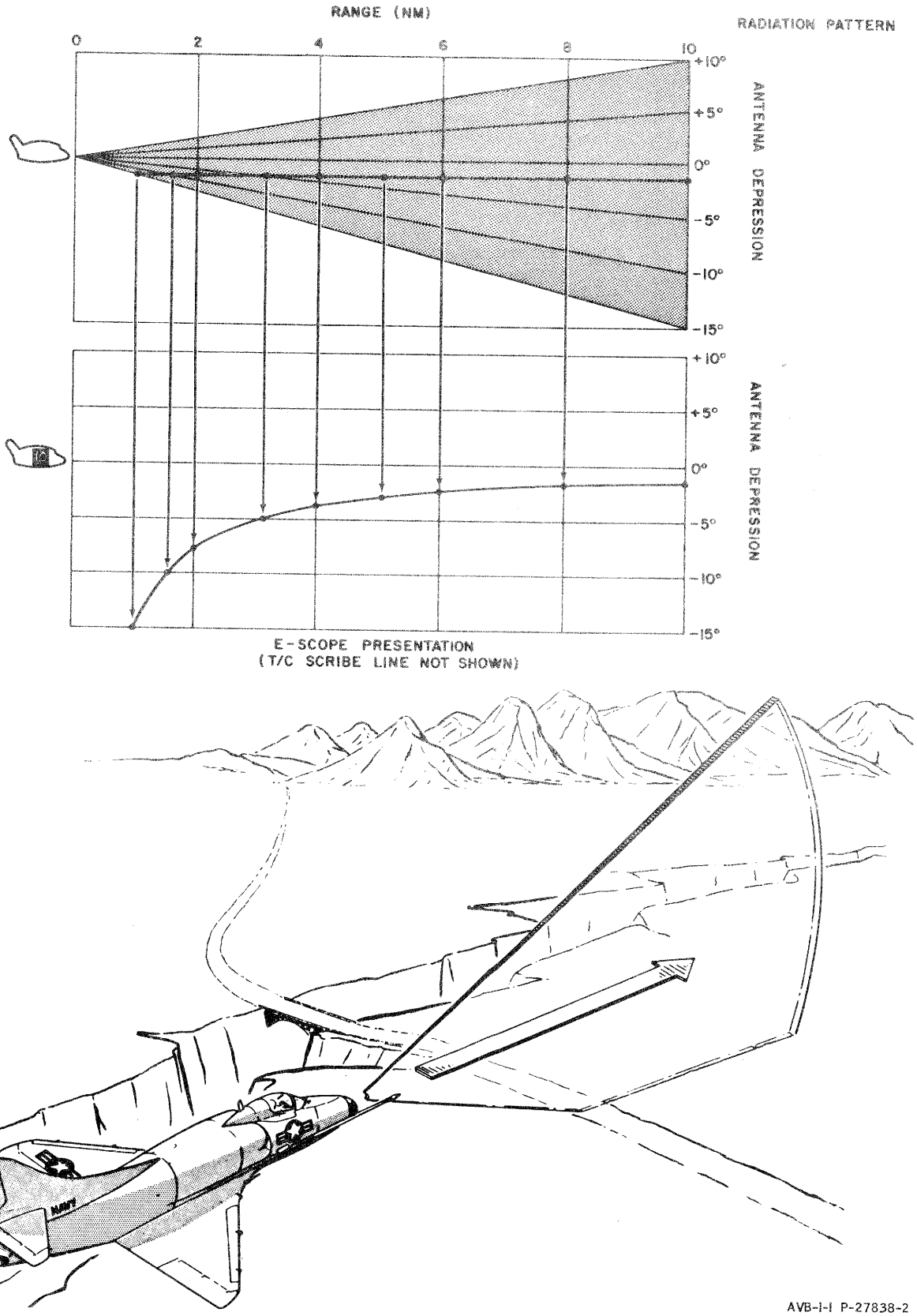


Figure 1-20. Radarscope Distortion (Sheet 2)

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 0-degree elevation line divide the display into 2-or 4-mile segments, according to the range in use. A flag-type marker in the airplane silhouette at the left of the scope shows which range is in use.

A solid line representing an imaginary plan 1000 feet below the antenna 0 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 1-19) and is synchronized with elevation sweep. The zero elevation line of the indicator reticle represents the instantaneous forward projection of the airplane 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 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. (See figure 1-19.)

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 visual and aural warning to the pilot when obstacles protrude above a horizontal plane positioned 1000-feet below and parallel to the antenna 0 degree reference plane.

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

Note

The obstacle warning will operate for targets out to 21 miles for both the long and short ranges of operation.

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.

WARNING

- When flying 1000-feet terrain clearance at normal low level airspeeds, crosswind component of 9 knots or more can cause a drift rate which would preclude displaying obstacles in the ground track of the airplane 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.

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.

The profile display also provides an aid to let down 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 T/C 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

At the present time, this mode is in no way functionally related to the armament system in this airplane.

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 elevating coordinate. When the antenna boresight line and the sight line are made parallel (0 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 lockon.

If the distance to the ground exceeds the radar lockon range, the horizontal line will search from the top of the scope to the bottom. When ground lockon 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 air-to-ground mode is 15,000 yards (approximately 7 1/2 nautical miles). The airplane relative position is at the bottom line on the scope (-15 degree elevation line). After range lockon 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.

PREFLIGHT PROCEDURE

Position controls as follows:

1. Radar Control Panel

   Mode selector switch . . . . . OFF

   Antenna tilt control . . . . . 0°

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

2. Radar Indicator

   Brilliance knob . . . . . FULL CLOCKWISE

   Gain knob . . . FULL COUNTERCLOCKWISE

   Storage knob . . . . . FULL CLOCKWISE

   Detail knob . . FULL COUNTERCLOCKWISE

   Reticle knob . FULL COUNTERCLOCKWISE

3. Radar Switch Panel

   Range switch . . . . . LONG

   T/C 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°

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 T/C. 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. These may be observed on late model radar set as shown on figure 1-19.

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.

INFLIGHT TEST

A brief operational check during the first part of each tactical flight is recommended.

INFLIGHT PROCEDURE

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 profile-plan switch is not functional in search mode.
- There is no obstacle alarm in the search 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 . . . . . T/C
3. Profile-plan 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.

AIR-TO-GROUND MODE. After observing the radar set operating properly in search, or the T/C modes, or after performing step 1 of 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 airplane 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 profile-plan 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

MODIFIED AN/APG-53A RADAR

The AN/APG-53A radar has been changed to permit interchangeability of the IP-446/APG-53A azimuth-elevation-range indicator (used for Shrike system) with the IP-936/AXQ video monitor. The
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 inflight 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 airplane), 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 airplane higher than normal.

IP-936/AXQ video monitor is used in the Walleye system to afford an automatic tracking television guidance capability. For Shrike roles, the video monitor must be removed and the IP-446/APG-53A indicator scope installed.

AUTOMATIC FLIGHT CONTROL SYSTEM

The automatic flight control system (AFCS) is a completely transistorized system designed to provide pilot relief from routine control of the airplane. (See figure 1-21.) The AFCS will maintain heading, altitude, and pitch and bank angles, and will perform a coordinated turn to a preselected heading without use of the pilot control stick. These functions utilize attitude and direction information from the AN/AJB-3 all-attitude flight reference and bombing system. Without moving a switch or disconnecting the AFCS, the pilot can maneuver the airplane 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 airplane or displacing the ailerons excessively. There are operating components which sense airplane attitude and performance, and convert electrical control and correction input signals to mechanical signals for use by the airplane hydraulic control system that moves the aerodynamic control surfaces.

The AFCS is an electro-hydraulic system requiring all three phases of the 115/200-volt, 400 cycle, ac power and 28-volt dc power. Normal hydraulic system pressure of 3000 psi is reduced to 1500 plus 75 or minus 50 psi for the aileron and elevator servos, and to 1150 plus 450 or minus 50 psi for the dual input rudder valve.

Note

- The AFCS will not operate on the emergency generator; the hydraulic servos require utility system hydraulic power.
- The AFCS will not engage unless proper electrical and hydraulic power is available, and it will disengage automatically if the electrical or hydraulic power fails.

Automatic Flight Control Panel

The control panel (figure 1-21) is labeled AFCS and is located on the left console.

STANDBY SWITCH

Movement of the standby switch to STANDBY provides electrical power to the AFCS for warmup and automatic control synchronization to prevent engage transients. This switch should be in STANDBY at least 90 seconds before engaging the stability augmentation switch or the AFCS main engage switch. When this switch is moved to the OFF position, all toggle switches on the panel return to the OFF position.

ENGAGE SWITCH

Movement of the engage switch to the ENGAGE position turns on the AFCS in one of two modes, attitude hold or heading hold, depending on flight attitude.

In addition, the pilot can further select any one of three modes: Control stick steering, altitude hold, and preselect heading. NEW

The switch may be moved to the OFF position at any time. The switch should not be moved to ENGAGE position until the standby switch has been in STANDBY position for 90 seconds.

The AFCS will not engage until the all-attitude indicator OFF flag disappears.

When this switch is moved to 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. Lateral control of the airplane 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 mode switches to move automatically to the OFF position. The AFCS can be reengaged by moving the engage switch to ENGAGE.

HEADING SELECT SWITCH

Movement of the heading select switch to the HDG SEL position starts the airplane turning by the shortest route toward the heading selected on the heading select indicator by use of the SET knob. The heading select switch may be moved to the OFF position at any time. If moved to the OFF position prior to the completion of a turn, the airplane will roll smoothly to a 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 airplane is in level flight, sudden SET knob movement will result in abrupt airplane lateral movement. If the SET knob is moved very slowly, small heading changes can be made satisfactorily.

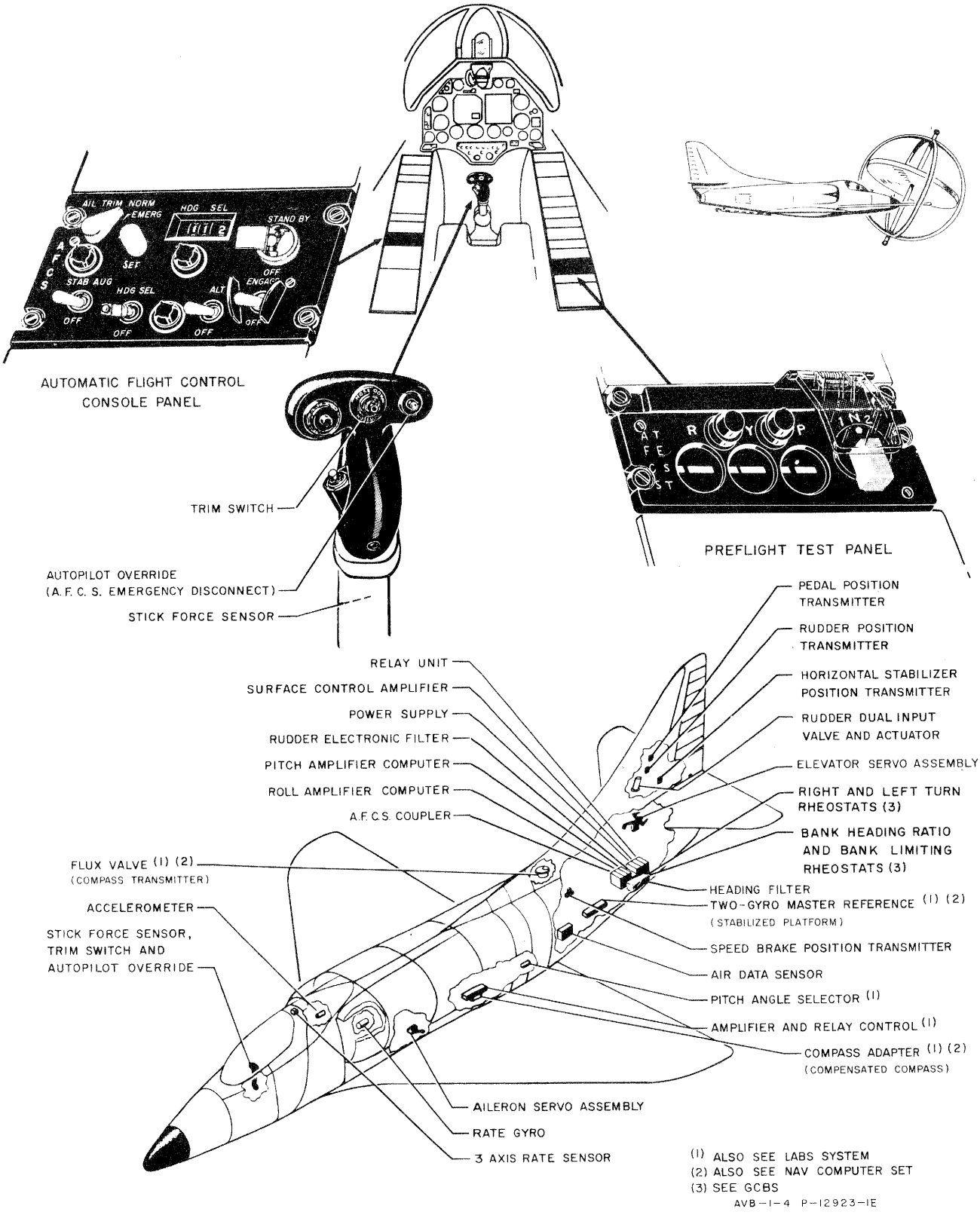


Figure 1-21. Automatic Flight Control System

2. If the airplane 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 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 airplane heading will cause the airplane to reverse the turn abruptly.

The heading select 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 moving the heading select switch to 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 HOLD SWITCH

Movement of the altitude switch to the ALT position causes the airplane to maintain the barometric altitude at actuation. If the mode is engaged in a climb or dive, the airplane will return to the barometric altitude existing at the time of altitude hold engagement. Altitude hold 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

Yaw damping action is provided when the engage switch is in the ENGAGE position or the stability augmentation switch is in the STAB AUG position.

AILERON TRIM NORM-EMERGENCY SWITCH

The aileron trim switch has two positions, NORM and EMERG. This switch is usually in the NORM position, but may be moved to the EMERG position to provide aileron trim after the AFCS is disengaged, should aileron trim not be available in NORM. Movement of this switch to the EMERG position also disengages and prevents reengagement of the AFCS, except stability augmentation, while the switch remains in the EMERG position. The AFCS can be reengaged after returning the switch to the NORM position.

Preflight Test Panel

This panel is the AFCS test panel on the aft 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.

STICK TRIM SWITCH

The control stick trim button, which is used to trim the airplane 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 button 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 airplane is correctly trimmed at that time.

AFCS Modes

The following modes of operation provide automatic flight control.

CONTROL STICK STEERING (CSS) MODE

This mode provides for longitudinal and lateral control of the airplane through the AFCS by pilot movement of the stick as in normal flight. This 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 control stick steering and they must be reengaged to be used again. The AFCS reverts from control stick steering mode to either attitude hold or heading hold mode when pilot force on the control stick is reduced below 2 pounds. The airplane is controllable in all attitudes in control stick steering 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 control stick steering at bank angles exceeding 70 degrees or pitch angles exceeding 60 degrees noseup or nosedown unless limits of acceleration or aileron deflection are exceeded.

CAUTION

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

ATTITUDE HOLD MODE

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

HEADING HOLD MODE

If the pitch is within 60 degrees noseup or nosedown and the bank angle of the airplane is less than 5 degrees upon engagement of the AFCS or reversion from control stick steering mode, the airplane 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 this mode after the heading has been preselected on the indicator, the airplane 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

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

STABILITY AUGMENTATION MODE

The stability augmentation mode provides rudder yaw damping action which is independent 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.

Note

The pilot must trim the airplane directionally while using the AFCS in the same manner as he would when on the normal flight control system.

If the airplane 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 airplane will be in a steady heading side slip in the heading hold mode.

ALTITUDE HOLD MODE

This mode may be engaged when the rate of change of altitude is less than 4000 ± 500 feet per minute. The airplane will maintain altitude at engagement. The airplane automatically will pull out of its climb or dive and return to and maintain the engage altitude.

GROUND CONTROL BOMBING MODE

Refer to the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T for Ground Controlled Bombing Mode.

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

The system, in response to hardover signals, disengages the AFCS with negligible upset in either noseup or nosedown attitudes. The incremental load factors, as a result of hardover signal, will vary between 0 g and 0.6 g for airspeeds up to Mach 0.85. Elevator surface rates in excess of 20 degrees/second disengage the AFCS with the same characteristics as hardover signals. For displacement rates of 5 degrees/second to 20 degrees/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. The AFCS can be reengaged in the normal manner.

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 seventeen items should be made.

MANDATORY CHECKS

These four checks are made in test position 2 and with the engage switch at ENGAGE.

1. Move the stick right. At about half deflection, the autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the stick. Repeat the same check to the left. The results should be the same. This is the aileron limit switch check.

2. Move the trim button right. The autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the trim button. Repeat the same check to the left. The results should be the same. This is the load factor monitor limit switch check.

3. Move the stick aft (noseup) and move the horizontal stabilizer trim toward NOSEUP. The autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the stick. Move the stick forward (nosedown) and move the horizontal stabilizer trim toward NOSEUP. The results should be the same. This is the trim monitor switch check.

4. Depress AP button. The autopilot should disengage and the engage switch will be seen to flip to its OFF position.

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

6. Recheck takeoff trim setting after completion of all checks.

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

Note

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

COMPLETE PERFORMANCE CHECKS

It is recommended that these checks be made in the sequence given. There are 4 checks in TEST POSITION 1, and 13 checks in TEST POSITION 2. These 17 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 the 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. Actuate the engage switch to the ENGAGE position; it should not engage because the AFCS should never engage while in an unsynchronized condition. If the switch does not flip back to the OFF position, report the trouble.

4. Actuate the stability augmentation switch to the STAB AUG position. It should remain engaged rather than flipping back to OFF. Return switch to OFF position when test is completed.

TEST POSITION 2 CHECKS. Hold the spring-loaded 1-N-2 switch in the 2 position until the following thirteen tests 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. Actuate the stability augmentation switch to the STAB-AUG position. It should engage, but the (Y) indicator for rudder should "null" (go to the center) because test position No. 2 closes the rudder loop. Leave the switch in the STAB AUG position for later checks.

3. Actuate the engage switch to the ENGAGE position. It should engage and the switch should remain there because test position No. 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 No. 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" (go to the center) because the pitch and roll loops have been closed in test position No. 2.

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

6. Move the control stick hard over to the right. The engage switch should flip to the OFF position, but the stability augmentation switch should remain engaged because the aileron has reached a position greater than half-travelfrom faired and the protection circuit has caused the AFCS system to disengage.

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

8. Move the engage switch back to ENGAGE position. Move the trim button to the right for right aileron. The results should be the same as in steps 6 and 7 because test position No. 2 feeds a test signal into the structural protection circuit.

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

10. Move the engage switch back to the ENGAGE position. Actuate the aileron trim emergency switch to the EMER position. The engage switch should flip 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 and this switch interlocks the AFCS engage switch as a protective measure.

11. Return the aileron trim emergency switch to the NORM position, but do not move the engage switch to its ENGAGE position at this time. Engage the AFCS by actuating the engage switch to the ENGAGE position. Then move the stick aft and, while holding an aft force on the stick, operate the stick trim button to trim the aircraft NOSEUP. The result should be that the autopilot disengages, the engage switch should flip to its OFF position, and the stability augmentation switch should remain in its STAB AUG position. 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, refair the horizontal stabilizer, engage the AFCS, and make a similar test as in step 11, but push the stick forward and trim for a NOSEUP 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 flip to their OFF positions. This emergency switch removes all AFCS authority from the aircraft control system.

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

WARNING

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

Normal Inflight Operation

ENGAGING 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

ENGAGING 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.

DISENGAGING AFCS

The pilot may disengage the AFCS in the following ways:

1. Pressing control stick AP button.
2. Moving the standby switch to its OFF position.
3. Moving both the engage and the stability augmentation switches to their OFF position.
4. Depressing the PUSH TO SYNC button on the compass controller.
5. Moving the SET HDG switch on the compass controller.
6. Moving the aileron trim NORM/EMERGENCY switch to 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 (figure 1-22) includes all instrument and 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. Two floodlights are mounted on each side of the gunsight beneath the glareshield to 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 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 are operative on emergency generator.

INTERIOR LIGHTS CONTROL PANEL

An interior lights (INT LTS) control panel (figure A-1), mounted on the right console, contains switches for the operation of all interior lights except the four high-intensity white floodlights. Two rotary switches, marked INST and CONSOLES, are rotated clockwise from OFF to turn on the instrument lights and console lights, respectively. Further rotation in a clockwise direction toward the BRIGHT position increases the intensity of the light.

Note

When the instrument light switch is in any position other than OFF, the ladder lights are dimmed and may not be visible during daylight.

Effectivity: All A-4C/L aircraft reworked per A-4 AFC 428 have three rotary switches marked PRIM INST, CONSOLES, and SEC INST. The three rotary switches afford individual control of the primary, left- and right-hand consoles, and secondary instrument lighting. Turning the PRIM INST switch clockwise from OFF will turn on the altimeters (radar and barometric), airspeed, all-attitude, and BDHI indicator lights. Turning 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 during night and/or combat missions.

Note

On aircraft reworked per A-4 AFC 447, the WHEELS light will come on bright when the PRIM INST lights switch is adjusted within the first 20 degrees (approximate) of rotation, including OFF position. When the switch is adjusted within the sector beyond the first 20 degrees, the WHEELS light will come on dim for night operation and may not be visible in daylight.

A toggle switch with three positions, BRT (bright), DIM, and MED (medium), controls the intensity of the red floodlights after the CONSOLES switch is rotated 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 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 (figure 1-23) 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 fuselage wing light is located under the leading edge of each wing. There are two flashing red anticollision beacons; one is mounted on the top of the fuselage, and the other on the left main landing gear strut fairing. The approach lights are mounted on the leading edge of the left wing.

The taxilight is installed on the right main landing gear door. The air refueling probe light is located on the right intake duct forward outboard lip.

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 LIGHT 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

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

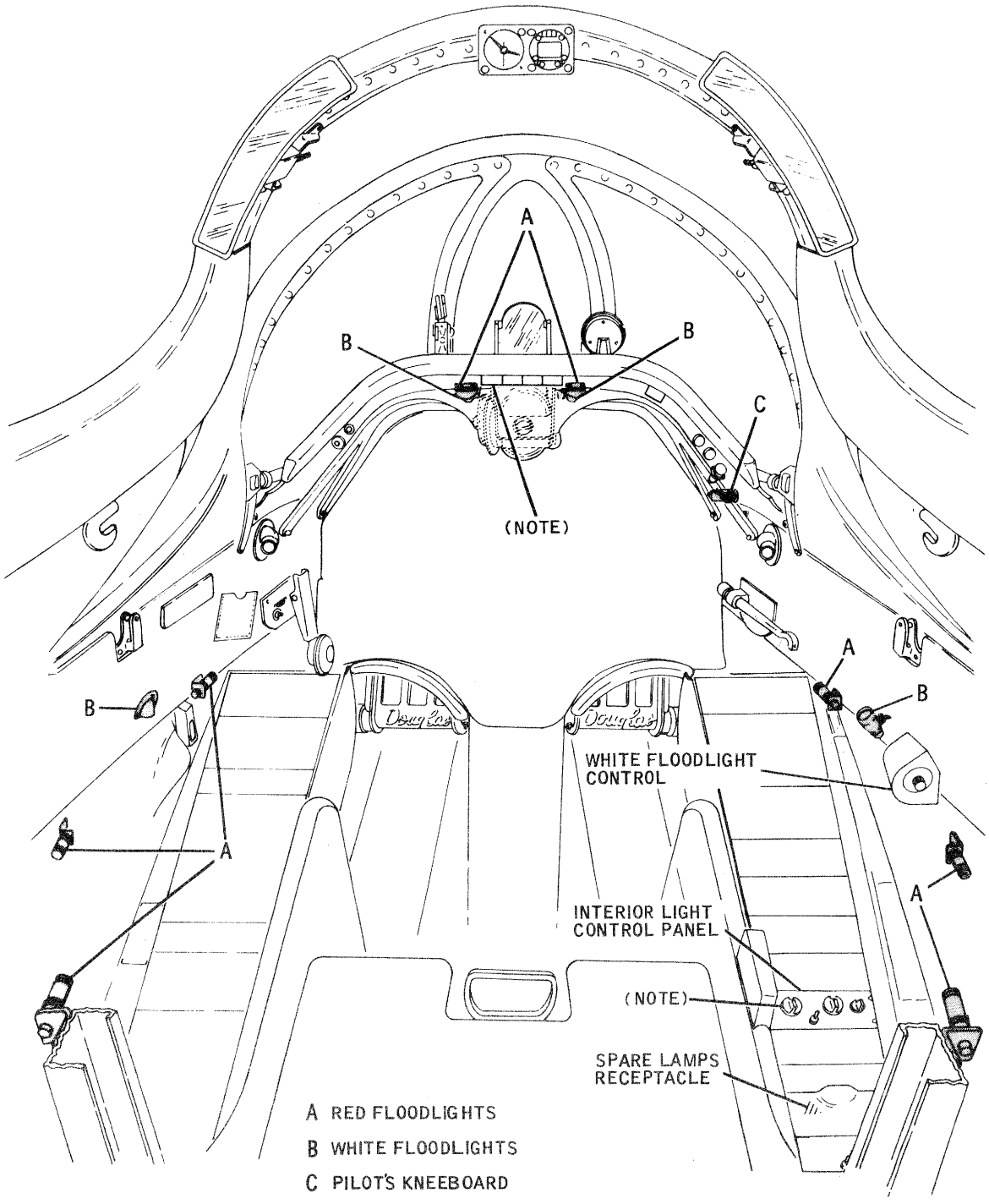
EXTERIOR LIGHTS CONTROL PANEL. An exterior lights control panel (figure 1-23) on the right console contains switches for functional control of the exterior lights.

APPROACH LIGHT OPERATION

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 (figure 1-24) 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.



NOTE:

ON AIRCRAFT REWORKED PER A-4, 428 AND AFC 447, THE WHEELS LIGHT WILL COME ON BRIGHT WHEN THE PRIM INST LIGHT SWITCH IS ADJUSTED WITHIN THE FIRST 20 DEGREES (APPROXIMATE) OF ROTATION INCLUDING OFF POSITION. WHEN THE SWITCH IS ADJUSTED WITHIN THE SECTOR BEYOND THE FIRST 20 DEGREES, THE WHEELS LIGHT WILL COME ON DIM FOR NIGHT OPERATION AND MAY NOT BE VISIBLE IN DAYLIGHT.

SS1-27839-C

Figure 1-22. Interior Lights (Typical)

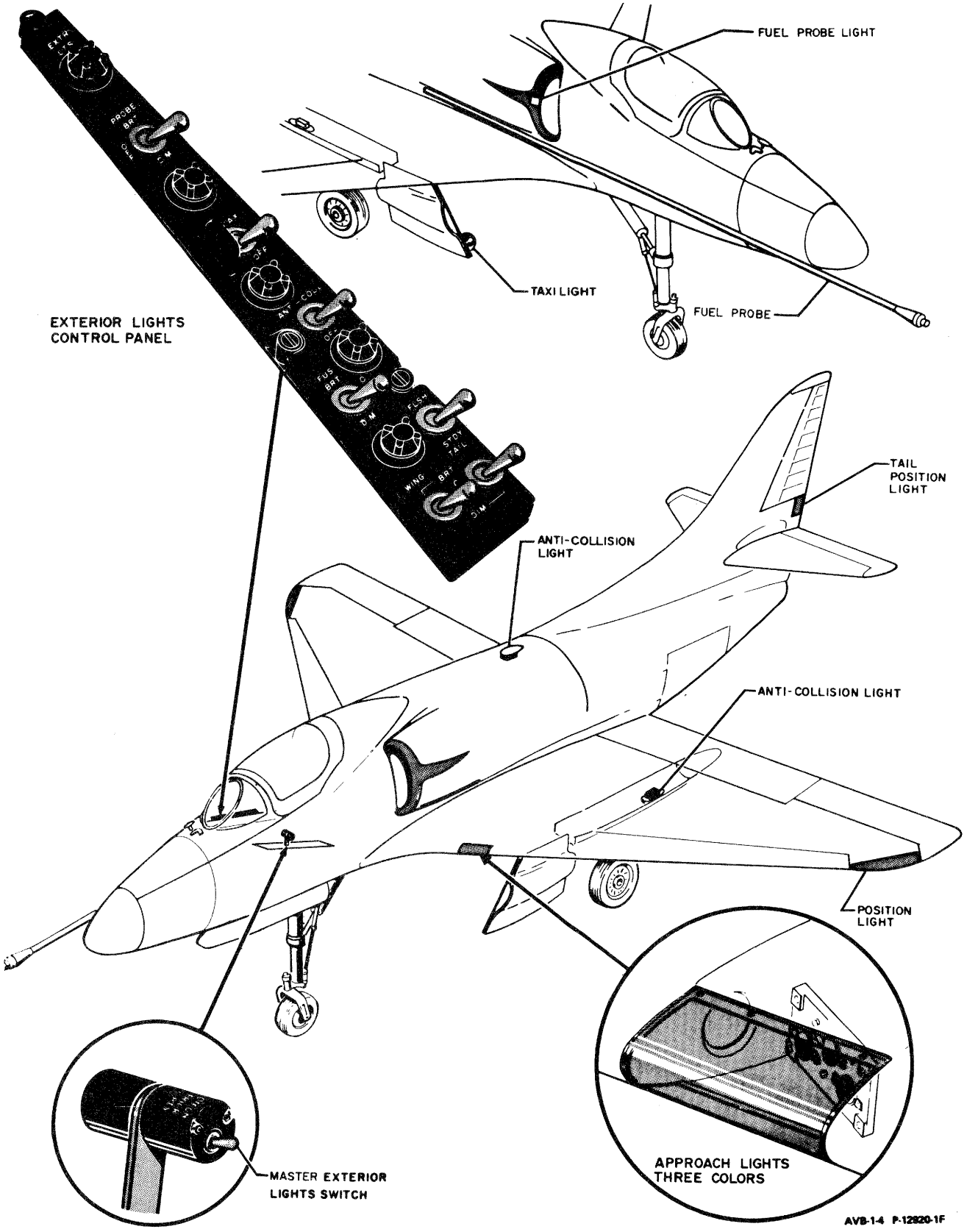


Figure 1-23. Exterior Lights (Typical)

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 temperature.

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 atmospheric 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.

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.

NEW NEW NEW

A cockpit pressurization test switch located in the nose cone allows pressurizing the cockpit and canopy seal with the canopy closed and locked while the engine is operating on the ground. The cabin altimeter will indicate an altitude lower than field elevation.

CAUTION

Any time the canopy does not open with normal force applied, switch to RAM AIR prior to reattempting. An attempt to forcibly open the canopy will likely result in explosive separation of the canopy from the aircraft.

NEW NEW NEW

AIR CONDITIONING CONTROL PANEL

The air conditioning control panel (figure 1-24) is located on the right 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 3-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 line 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. These positions bypass the automatic control circuitry and change the mixing of hot and refrigerated air in the selected direction as long as the control is held in position. The temperature control must be held in either position for at least 8 seconds to allow complete repositioning of the temperature control valve.

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. 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.

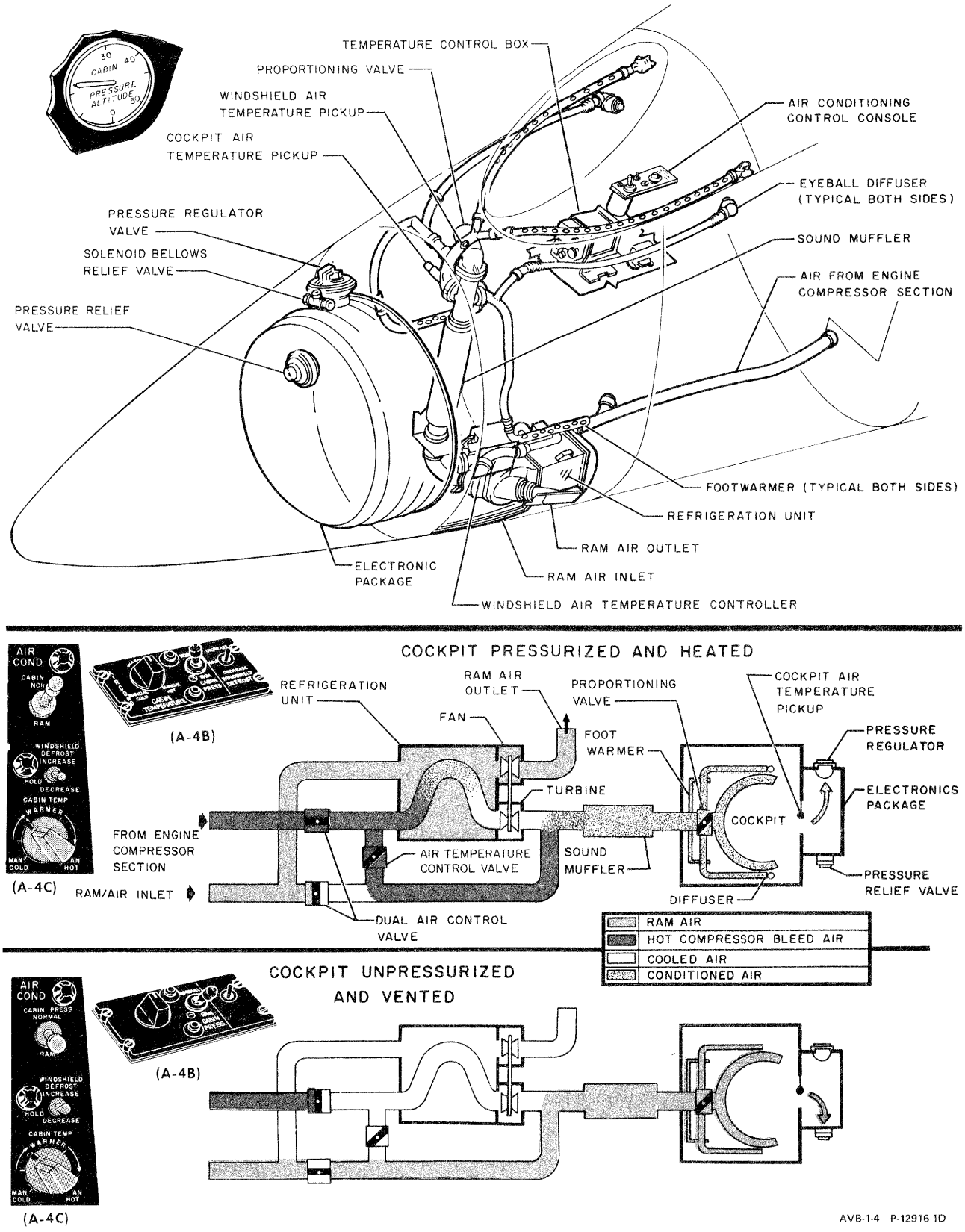
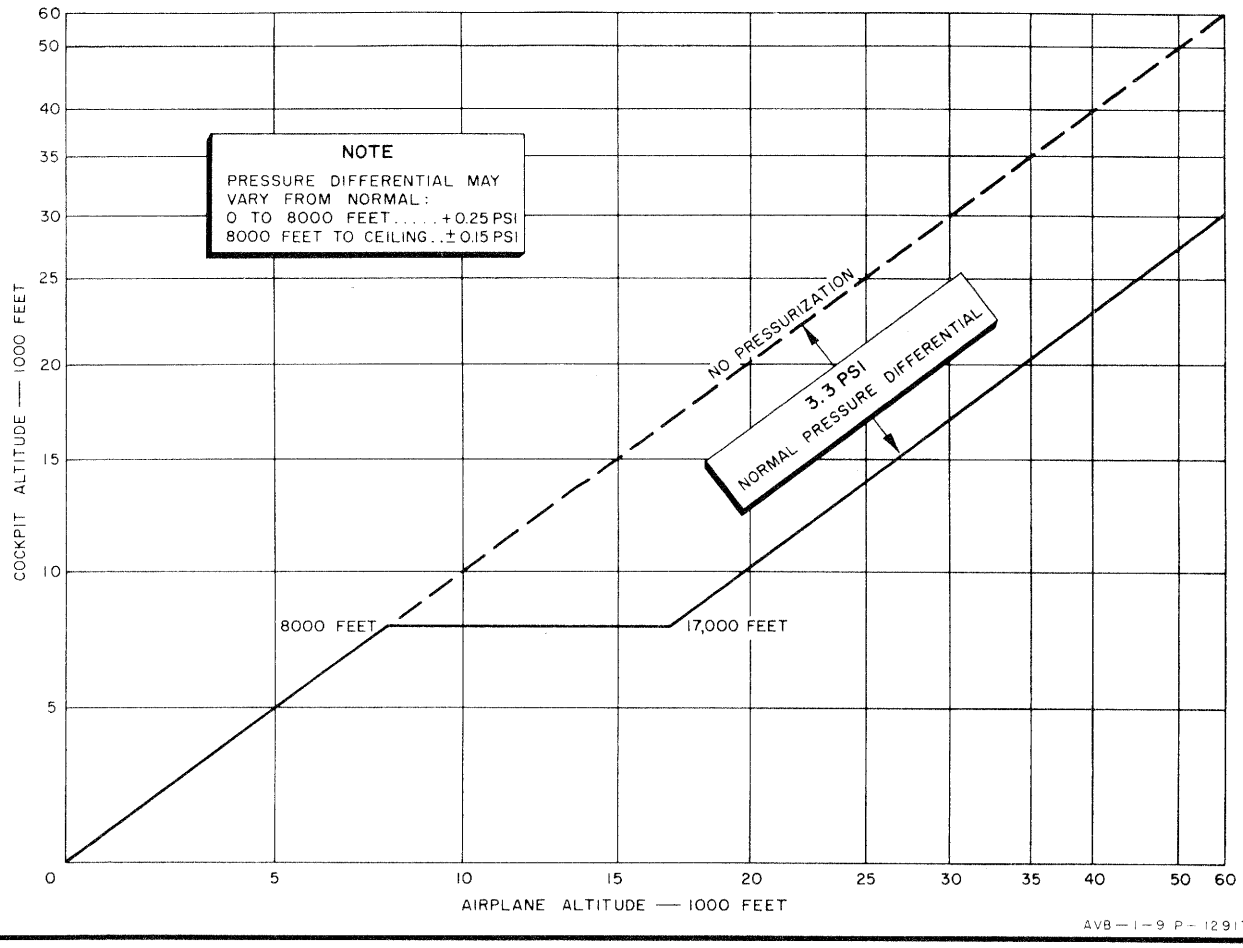


Figure 1-24. Air Conditioning and Pressurization System

COCKPIT PRESSURIZATION



DATA AS OF: 1 February 1955
DATA BASIS: Calculations

Figure 1-25. Cockpit Pressurization Chart

WINDSHIELD DEFROST SWITCH. The windshield defrost switch is marked INCREASE, HOLD, and DECREASE, and controls a motor-driven proportioning valve which proportions air between the windshield defrost manifold and the footwarmers. Air directed to the footwarmers is also shared with the "eyeball" diffusers. These diffusers may be turned on, off, or to any intermediate position by rotation of the diffuser nozzle, and may be directed to provided air flow 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 air flow 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 moved to its momentary DECREASE position, the proportioning valve increases the air flow 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.

NEW

Defrost

Defrosting of the windsheld side panels is accomplished by windshield defrost air as above.

Frosting of the bullet resistant glass center panel of the windshield is prevented by electrical means.

This 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. 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 temperature at low altitude. This fog may be eliminated by adjusting the cockpit temperature control knob for higher cockpit 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.

ANTI-ICING SYSTEM

Electrical heating element anti-icing is provided for the pitot system and the angle-of-attack vane. Heating of the pitot head is controlled by the PITOT HEAT switch located outboard of the right console. The switch has two positions, ON and OFF. The ON position should normally be used only in flight, as prolonged ground operation without cooling air flow can damage the heating element. The angle-of-attack vane is automatically heated whenever the aircraft is airborne and is independent of the PITOT HEAT switch position.

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 A-1). The valve control knob can be turned to HI or LO to regulate air pressure in the anti-g suit. As g forces are reduced, the valve will automatically reduce 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 as a massage to lessen fatigue. The antiblackout suit connection plugs into a receptacle adjacent to the control knob.

Note

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

WINDSHIELD WIPER

Aircraft incorporating ASC 218 have a windshield wiper installed. The wiper is electrically operated and is controlled by a sliding bar-type control knob mounted on the left cockpit rail. The control has positions marked PARK, OFF, LO, and HI and is spring-loaded to return to OFF from PARK position.

Operating Instructions

CAUTION

To prevent damage to windshield or blade, do not operate on dry windshield.

Moving the control knob from OFF toward LO or HI will start the wiper and regulate the speed. Moving the switch to OFF will stop the wiper.

Note

When stopping the wiper, move and hold the control knob in the PARK position until the blade moves to the maximum right side (park position) of the windshield.

CAUTION

To prevent damage to the electric motor, ensure that the control knob returns to OFF when released from the PARK position.

OPERATING LIMITATIONS

The windshield wiper is designed for taxi, takeoff, and landing operations only.

CAUTION

To prevent damage to blade assembly, do not exceed 200 KIAS with blade out of PARK position.

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. Provisions are made for dumping fuel overboard if necessary.

Air refueling store Change No. 86 incorporates a fuel quantity probe within the store. Air refueling stores with this change will provide fuel quantity when the external fuel quantity switch is actuated, the same as a drop tank.

The operational envelope of the store with the drogue extended is limited to 300 KIAS or 0.80 Mach, 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 aft 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 on indicates that fuel is actually flowing from the tanker to the receiver.

Accessory Change No. 33 adds white lights in the aft section of the air refueling store and on the periphery of the drogue. The drogue lights are positioned to indirectly illuminate the inside of the drogue and receive current from an air-driven generator located in the housing of the drogue. The lights come on when the drogue is extended into the airstream and go off when the drogue is retracted and the air-driven generator is removed from the air stream. The two white lights located in the aft section of the refueling store receive current from the electrical system of the aircraft. These lights come on when the drogue position switch is placed in the EXT position, and go off when the switch is placed in the RET position.

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). The system is designed so that any sequence of switch positioning is possible without causing damage or malfunction to the tanker store.

DROGUE POSITION INDICATOR

The drogue position indicator has 3 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 have 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 to OFF, it feathers and locks the propeller. When the switch is placed at DUMP an electrically operated fuel dump valve in the bottom of the refueling store opens to dump fuel. To place it in DUMP, first depress the spring-loaded lever guard then lift the switch from the spring-loaded safety position.

STORE DUMP LIGHT

The store dump light is incorporated on control panels modified by Accessory Change No. 1. The light will be on when fuel is flowing through the dump valve on the bottom of the store 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 will go off. A press-to-test feature for the bulb 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 positioned at 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.

FUEL TRANSFER SWITCH

The fuel transfer switch controls the flow of fuel after proper hookup is made. The switch must be at TRANS before fuel will transfer. Fuel flow will stop any time the switch is positioned at OFF. A holding relay is provided which causes the switch to remain in the TRANS position until store fuel is depleted or the pilot moves it to 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 SHIP-TANK switch and the refueling master switch. This allows for fuel dumping. 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 inflight emergency. To move the hose jettison switch to HOSE JETTISON, first hold back the spring-loaded channel guard, then lift the switch from the spring-loaded safety position. Be sure that this switch is in the forward OFF position before electrical power is applied.

WARNING

Once the HOSE JETTISON position is selected, do not return the switch to the 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, place the drop-tank pressurizing switch at 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 tank 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. A light is provided to illuminate the probe during night refueling.

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. 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 A-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 ARMED and OFF. To place the switch in the ARMED 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-contact toggle switch, spring-loaded to the SAFE position. In the JATO JETT 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 emergency speedbrake control will force the JATO bottles off of the aircraft resulting in airframe damage.

Note

An interlock in the speedbrake electrical circuit prevents the speed brakes from operating with the JATO bottles attached. Be sure the speedbrake switch on the throttle is in the CLOSED position before jettisoning the JATO bottles; otherwise, upon release of the JATO bottles, the speedbrakes will open.

JATO FIRING BUTTON

The JATO firing button (figure 1-5) 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 must be at OFF, and a no-voltage test should be made at the aircraft igniter terminals before attaching the JATO igniter leads to the bottles.

MISCELLANEOUS EQUIPMENT

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 7-1/2 foot by 40 foot or 6 foot by 30 foot banner targets may be utilized.

TOWLINE

Drag Takeoffs: Recommended towline configuration for drag takeoffs is up to 2000 feet of 11/64 inch steel cable.

Snap Takeoffs: Recommend use of 7/16 inch nylon rope for towline lengths up to 2000 feet for banner snap takeoff. The 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 connected between tow aircraft and nylon towline to prevent burnthrough which will occur if an all nylon towline is used.

Note

The 11/64 inch steel cable is not recommended for snap takeoff because of its inability to absorb high shock loads imposed during banner liftoff.

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.

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 its detented positions if subjected to turbulence or acceleration forces of 5g 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 ensure that 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.

Note

Pilots should gain proficiency in operation of the thermal radiation closure on short practice missions at safe altitudes. It is also pointed out that the closure may 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.

CAUTION

Ascertain that the closure locks in the stowed position to prevent its slamming shut inadvertently. This may be checked by pulling forward on the hood.

The pilot should familiarize himself with the operation of the thermal radiation closure before 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, being careful 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 the detent ready position. Operation should be smooth and without binding. Even fingertip pressure on each handhold should ensure that 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 should 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.

Note

The thermal radiation closure will be jettisoned 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 A-1) for use with the Mark 5 antiexposure suit.

The control panel contains the EXPOSURE SUIT VENT 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.

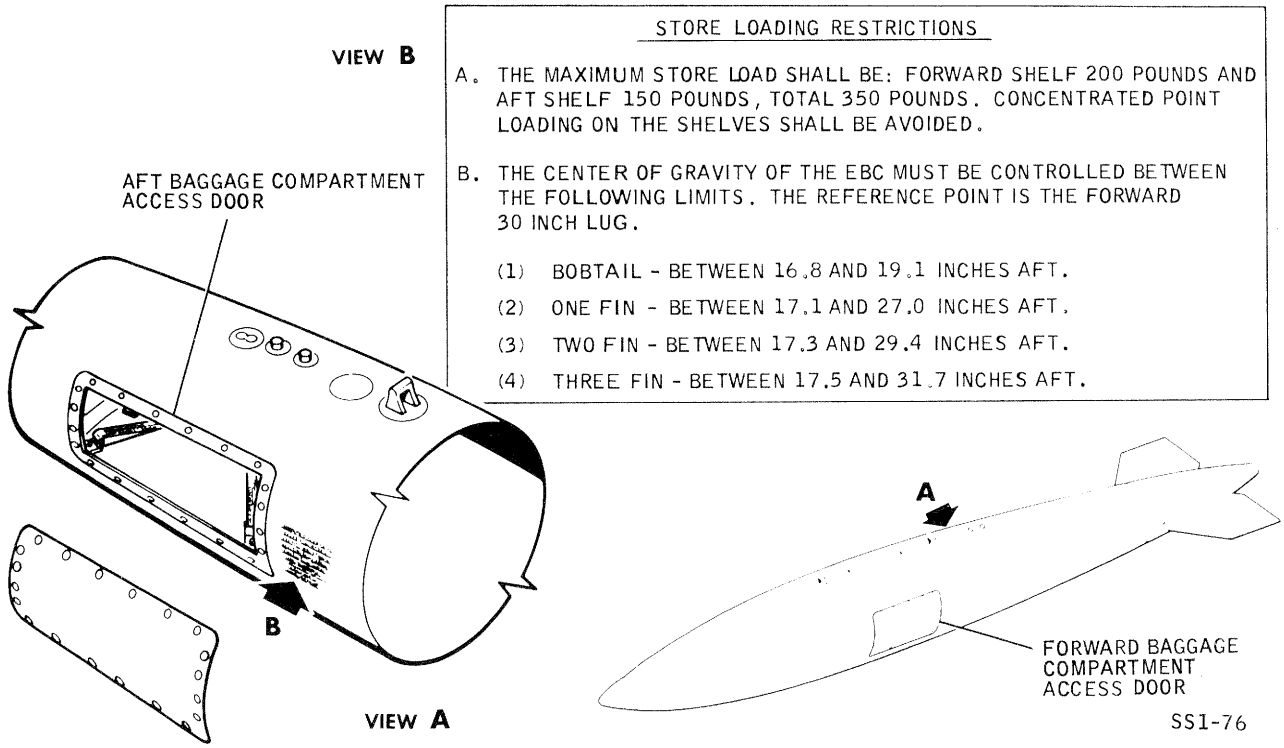


Figure 1-25A. External Baggage Container (EBC)

Map Pocket

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

Restraint Strap Stowage Pouch

A restraint strap stowage pouch is provided on the right side of the cockpit.

Spare Lamps Receptacle

Replacement lamps are contained in the SPARE LAMPS RECEPTACLE (figure A-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.

External Baggage Container (EBC)

External baggage containers (EBC) (figure 1-25A) are obsolete 300-gallon external fuel tanks reworked per A-4 AYC 332. The EBC provides a forward and an aft baggage compartment. Each compartment contains an access door, shelf, and provisions for baggage tiedown.

CAUTION

The maximum load limit of the forward shelf is 200 pounds and the aft shelf 150 pounds. Concentrated point loading of either shelf shall be avoided. Total EBC load shall not exceed 350 pounds.

The access door for the forward baggage compartment is located on the port side of the EBC and the aft compartment on the starboard side. Adjustments for tightening or loosening baggage tiedown straps can be made only at the buckle end of each strap. Ensure that baggage is properly secured prior to closing and fastening EBC doors.

External baggage containers are authorized for carriage on centerline station only.

PART 3

AIRCRAFT SERVICING

INTRODUCTION

This part describes the minimum servicing information (see figure 1-26) the pilot should know. The Maintenance Information Manual contains a complete description of all servicing procedures.

PRESSURE FUELING

General

Warnings, cautions, and notes that are applicable to the normal pressure fueling method are also applicable to all other methods of pressure refueling. They have been omitted from the other methods to avoid repetition.

Normal Pressure Fueling of Aircraft and External Fuel Tanks

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

CAUTION

- 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 firefighting equipment must be available in the 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. Place CHECK SWITCH in FUELING ON position, then place DROP TANK fueling switch in ON position.
5. Connect external electrical power to aircraft.

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.

APPROVED FUELS		
ASHORE	AFLOAT	NATO SYMBOL
JP-4 JP-5	JP-5	F-40 F-44

TANKS	US GAL	IMP GAL	LITERS
FUSELAGE FUEL CELL	240	199.8	908.4
WING INTERNAL FUEL TANK	560	466.2	2119.6
EXTERNAL FUEL TANK, AERO 1C	150	124.8	567.8
EXTERNAL FUEL TANK, AERO 1C	300	249.7	1135.5
AIR REFUELING STORE	300	249.7	1135.5
EXTERNAL FUEL TANK, ATP-D1B	400	329.7	1498.8

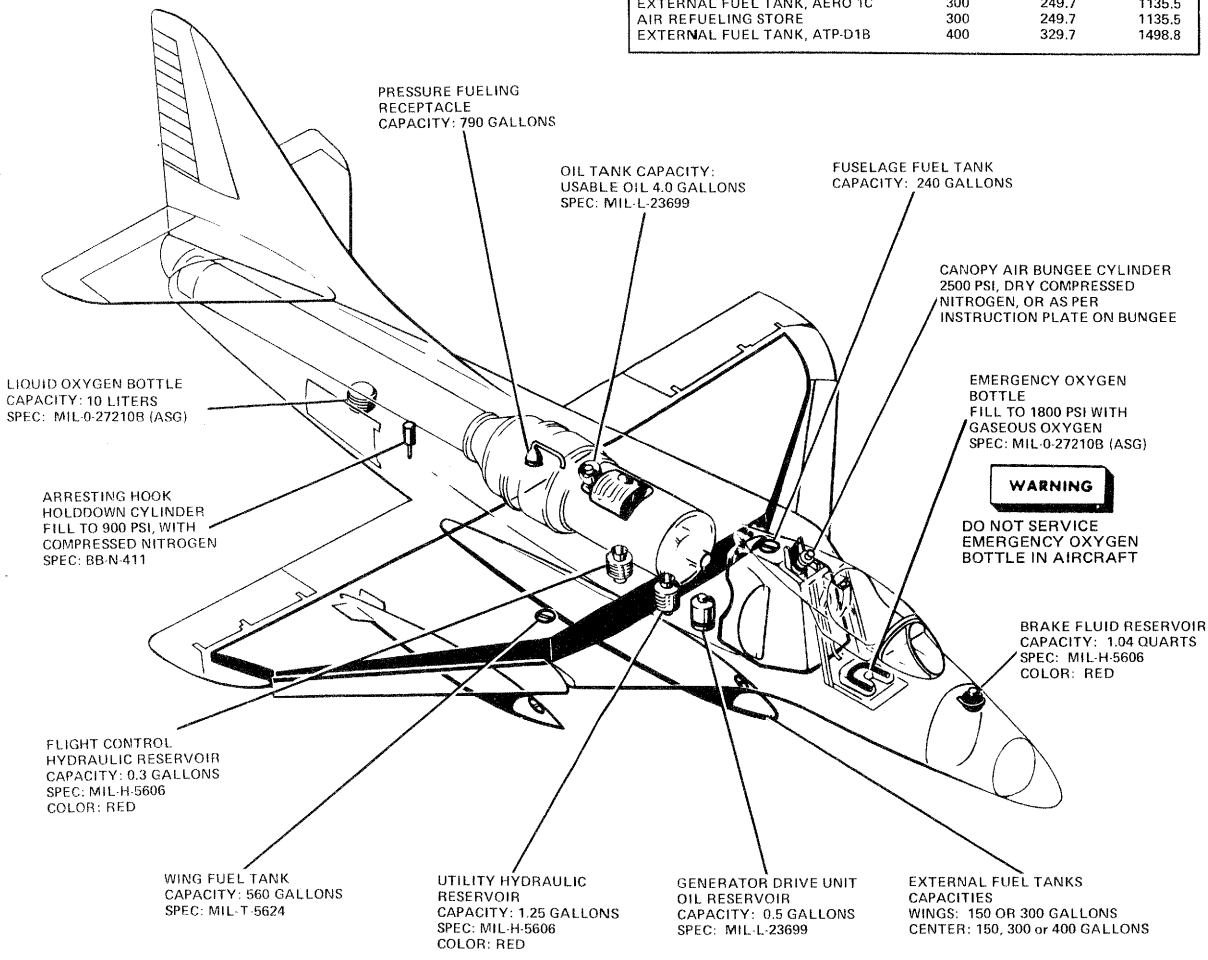


Figure 1-26. Servicing Diagram

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 Electrical Power Application, this section.)

6. Energize external electrical power.

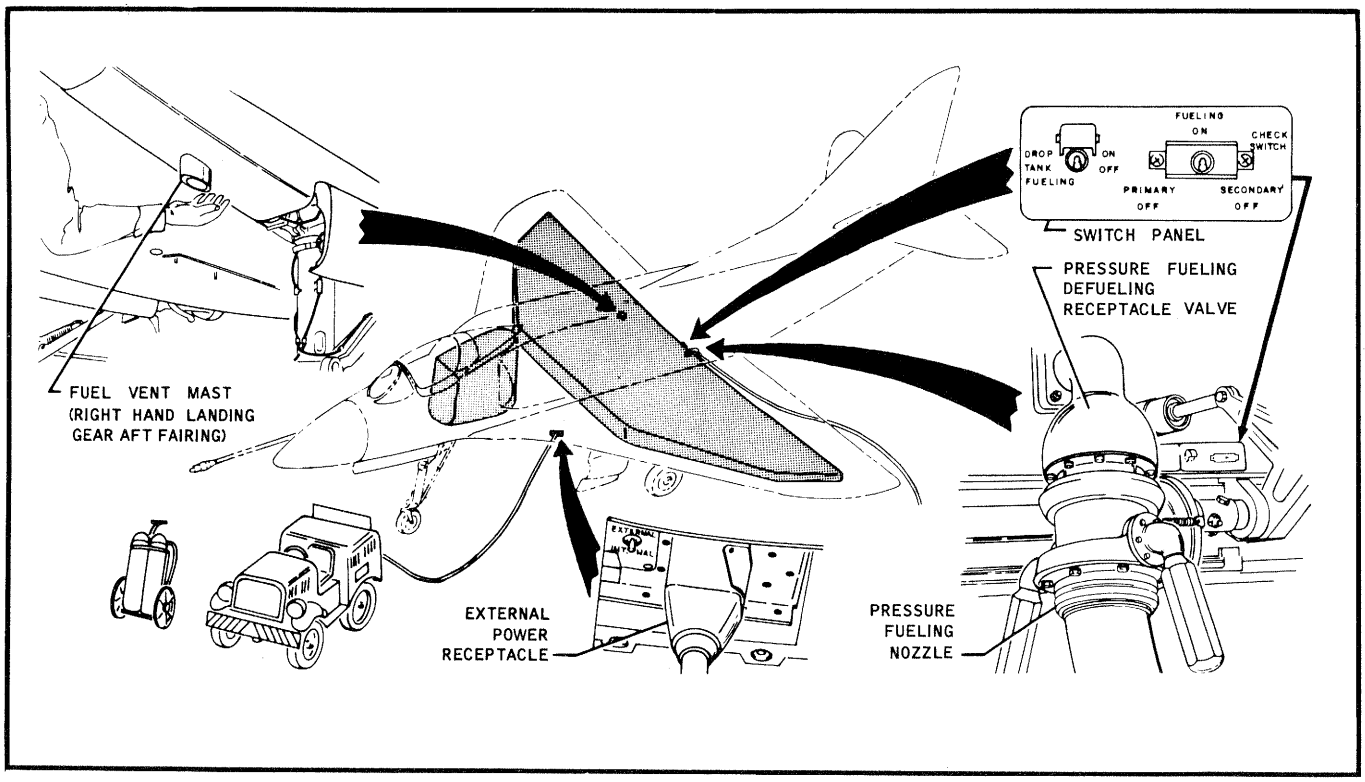
WARNING

If external fuel tanks are to be refueled, remove caps.

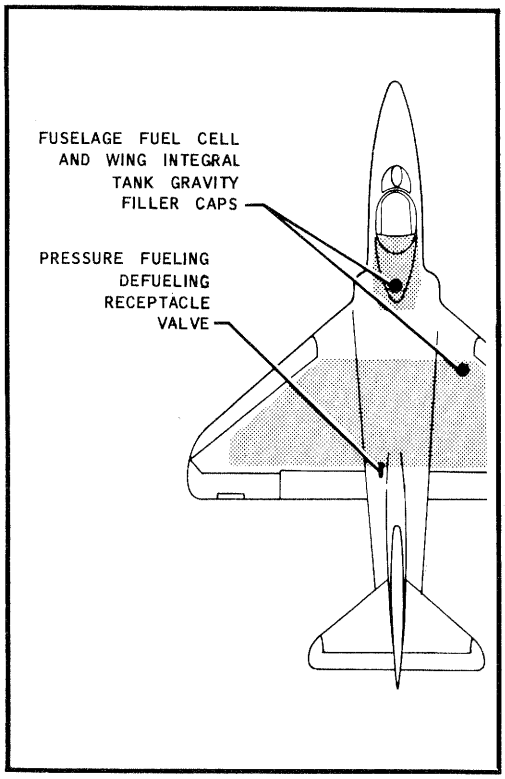
7. Open manual no-flow vlave on fueling nozzle and commence pressure fueling.

CAUTION

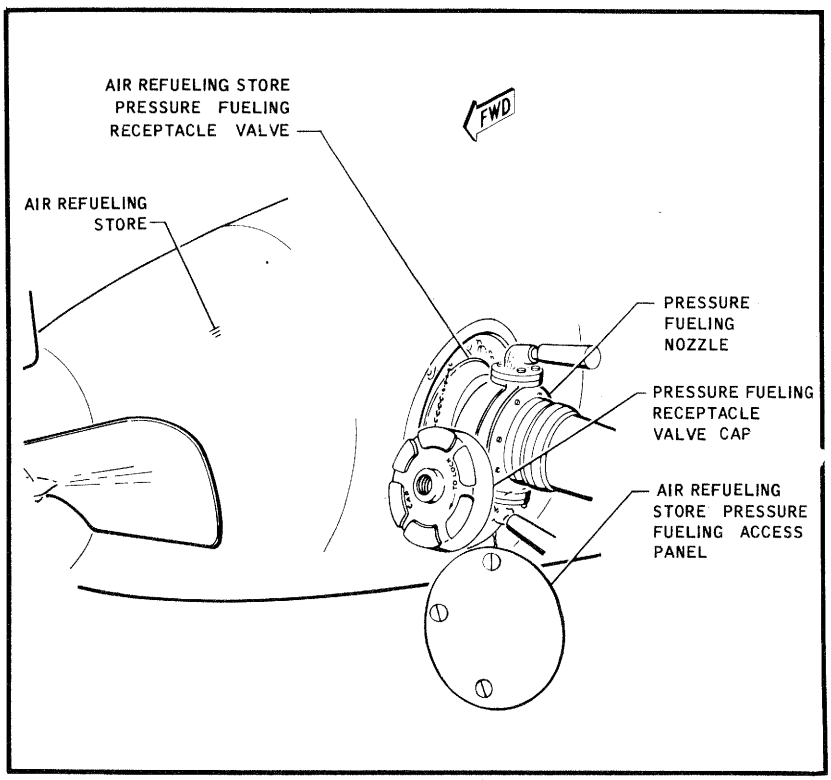
Maximum no-flow pressure must not exceed 55 psig at any time at fueling nozzle.



A. PRESSURE FUELING -- PREFERRED METHOD



B. PRESSURE FUELING -- TOP OFF METHOD
CAP REMOVAL REQUIREMENT



C. PRESSURE FUELING -- AIR REFUELING STORE

AVB-1-1 P-27840-1 A

Figure 1-27. Pressure Fueling

8. Immediately after pressure fueling has started, test fuel vent system for proper functioning by holding hand beneath fuel vent mast at right main gear fairing. (See figure 1-27.)

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 the fuel vent system.

9. During 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 the 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 maximim registered on pressure fueling meter is permissible. 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 1gpm.

10. Place DROP TANK fueling switch in OFF position, then place 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, return CHECK SWITCH to FUELING ON position. Fuel flow should start into wing integral fuel tank and fuselage fuel cell only.

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

13. 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 OFF unless drop tanks are to be filled.

14. Return CHECK SWITCH to 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 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

(See figure 1-27.)

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:

WARNING

- 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.

CAUTION

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.

5. Connect external electrical power to aircraft.

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.

6. Energize external electrical power.

NEW NEW

WARNING

If external fuel tanks are to be refueled, remove caps.

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 CHECK SWITCH in FUELING ON position for 2 to 3 seconds. Fuel supply meter must indicate 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. Remove and replace defective components.

11. If surveillance checks indicate 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 ON.

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

13. Verify that DROP TANK FUELING switch is OFF.

14. Install receptacle valve cap.

15. Disconnect external electrical power from airplane.

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

17. Close or reinstall 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.

WARNING

- Aircraft and pressure fueling equipment must be properly grounded during pressure fueling.
- All maintenance on aircraft must stop during pressure fueling.
- Adequate firefighting equipment must be available in immediate area.

CAUTION

Make certain that fuel vent mast is not obstructed.

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 remain 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 aft compartment access door.

Hot Refueling

Refer to procedures in Section III, Part 5, for refueling with the engine running.

GRAVITY FUELING

WARNING

- Ground aircraft and fueling equipment during all fueling operations.
- Stop all maintenance on aircraft during fueling.
- Ensure that adequate firefighting equipment is available in immediate area.
- Make certain that proper fuel is used for refueling. (See figure 1-26.)
- 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 1-28.)

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

Gravity Fueling Wing Integral Fuel Tank

(See figure 1-28.)

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 because nozzle will damage lower surface of tank. Do not pull fueling hose over wing slats.

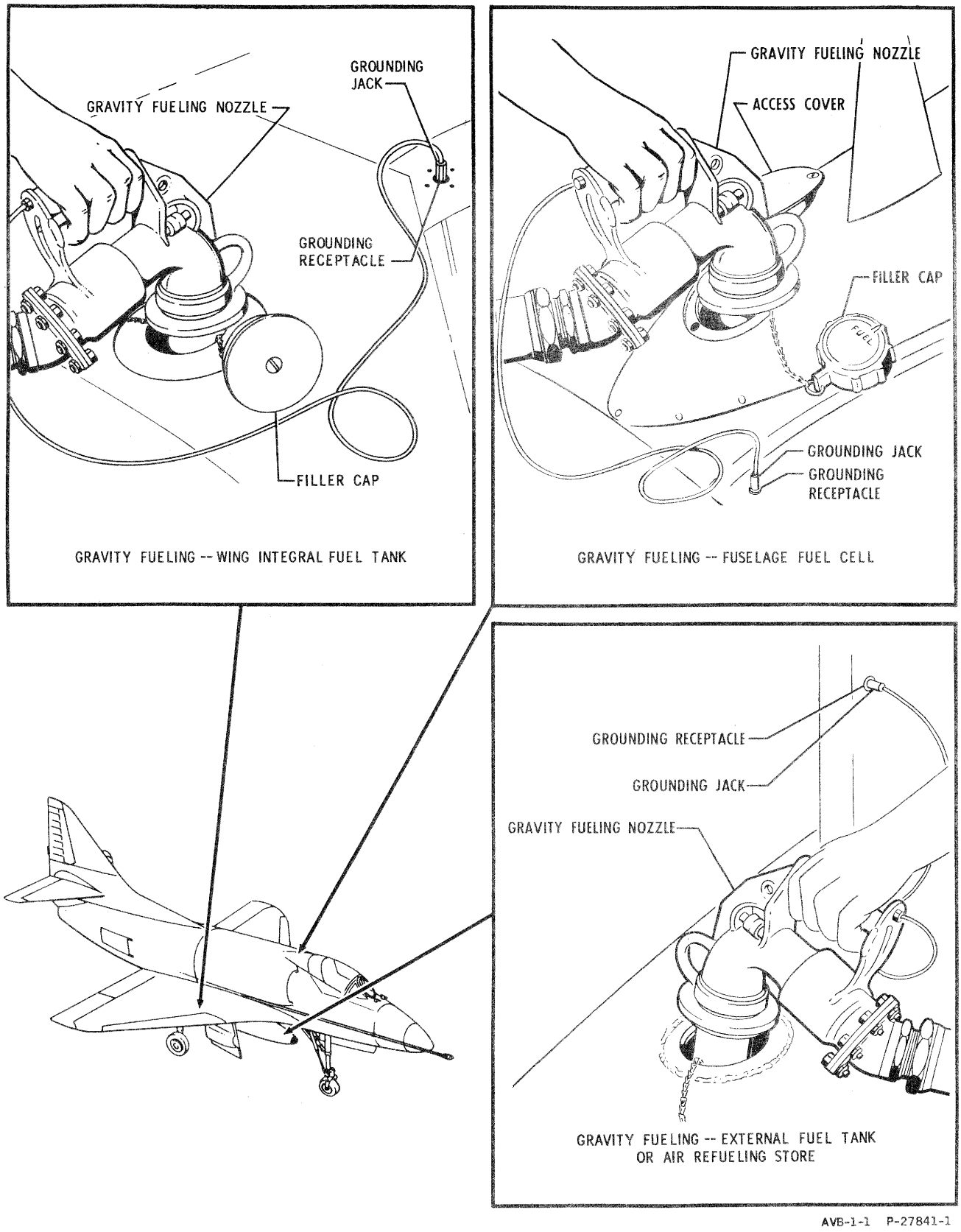


Figure 1-28. Gravity Fueling

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 1-28.)

1. Remove tank or store filler cap.

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

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.

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

6. Install tank or store filler cap.

ENGINE OIL SYSTEM SERVICING

Pressure oiling provisions are accessible through the engine forward compartment lower access doors. (For engine oil tank capacities refer to figure 1-29.) Gravity filling provisions are accessible through the oil filler access door. The PON-5A pressure oiling unit is recommended for servicing the engine oil tank. This unit is equipped with a penlight continuity checker which, when plugged into the FULL CHECK jack on the oil servicing panel, will come on to indicate that the oil level is adequate for engine operation.

Checking Oil Level

PENLIGHT METHOD

1. Open engine forward compartment lower access doors.

2. Insert penlight continuity checker into FULL CHECK jack on oil servicing panel. If continuity checker does not come on, oil level is below level for safe engine operation and oil should be added.

3. If penlight comes on, remove penlight; oil level is adequate for engine operation.

4. Close and secure forward compartment lower access doors.

VISUAL METHOD

1. Remove oil filler access door.

2. Remove filler cap assembly.

AIRCRAFT ENGINE LUBRICATING OIL MIL-L-23699				
GRAVITY FILLING	US GAL	US QTS	IMP GAL	LITERS
Oil Level Full	4.0	16.0	3.33	15.14
Expansion Space	0.0	0.0	0.0	0.0
Total Capacity	4.0	16.0	3.33	15.14
PRESSURE FILLING	US GAL	US QTS	IMP GAL	LITERS
Oil Level Full	4.0	16.0	3.33	15.14
Expansion Space	0.0	0.0	0.0	0.0
Total Capacity	4.0	16.0	3.33	15.14
CAUTION: Do not use corrosion preventive oil for flight. Maximum use for ground operation of engine is 5 hours.				

Figure 1-29. Engine Oil Tank Capacity

3. Check oil level visually in filler neck. Oil level should be at top of filler neck when oil tank is fully serviced.

Note

For valid results, oil level must be checked with engine running or within 30 minutes after shutdown.

4. Replace and secure oil cap.

5. Replace and secure oil filler access door.

Pressure Filling

(See figure 1-30.)

CAUTION

Do not remove oil tank filler cap (top of oil tank) during or immediately after pressure oiling. If cap is removed, oil will overflow from filler neck.

1. Open engine compartment right forward access door.

2. Remove oil filler and oil bleed pressure caps from ports on servicing panel. (See views A and B.)

3. Connect pressure filling unit filler hose equipped with quick-disconnect nozzle coupling (MS24475-1 or Roylyn 6960 1/2-inch) to filler adapter.

Note

MS and Roylyn parts are interchangeable. (See views A and B.)

4. Connect drain bottle assembly quick-disconnect nozzle coupling to bleed adapter.

Note

Drain bottle assembly is equipped with (Roylyn 7776 3/4-inch) quick-disconnect nozzle coupling. A drain hose, not to exceed 3 feet in length, equipped with (MS24475-2 or Roylyn 7776 3/4-inch) nozzle coupling, may be utilized in place of drain bottle. Direct drain hose overflow into open container.

5. Check 3-volt, battery-powered penlight.

6. Insert continuity checker phone plug into phone jack (JJ-034) receptacle located between aircraft filler and bleed adapters.

7. Commence pumping oil (MIL-L-23699) into oil tank until continuity checker light comes on. Do not continue oil pumping after light comes on.

Note

If continuity checker light fails to come on and oil begins to flow into drain bottle, cease pressure filling immediately. Check oil tank float switch, wiring, and associated equipment for cause of trouble.

8. Disconnect drain bottle or drain hose and oil filler hose from quick-disconnect servicing panel; install pressure caps.

9. Secure engine compartment forward access door.

Gravity Filling

If possible, the aircraft should be in a 6-degree noseup attitude to assure proper oil level/quantity relationship. To gravity fill the oil system, proceed as follows:

1. Remove oil filler access door.

2. Remove filler cap assembly.

CAUTION

All oil entering the engine oil system must first be passed through a 10-micron filter.

3. Fill oil tank until oil is level with top of filler neck.

4. Replace and secure oil cap assembly.

5. Replace and secure access door.

GENERATOR DRIVE SERVICING

(See figure 1-31.)

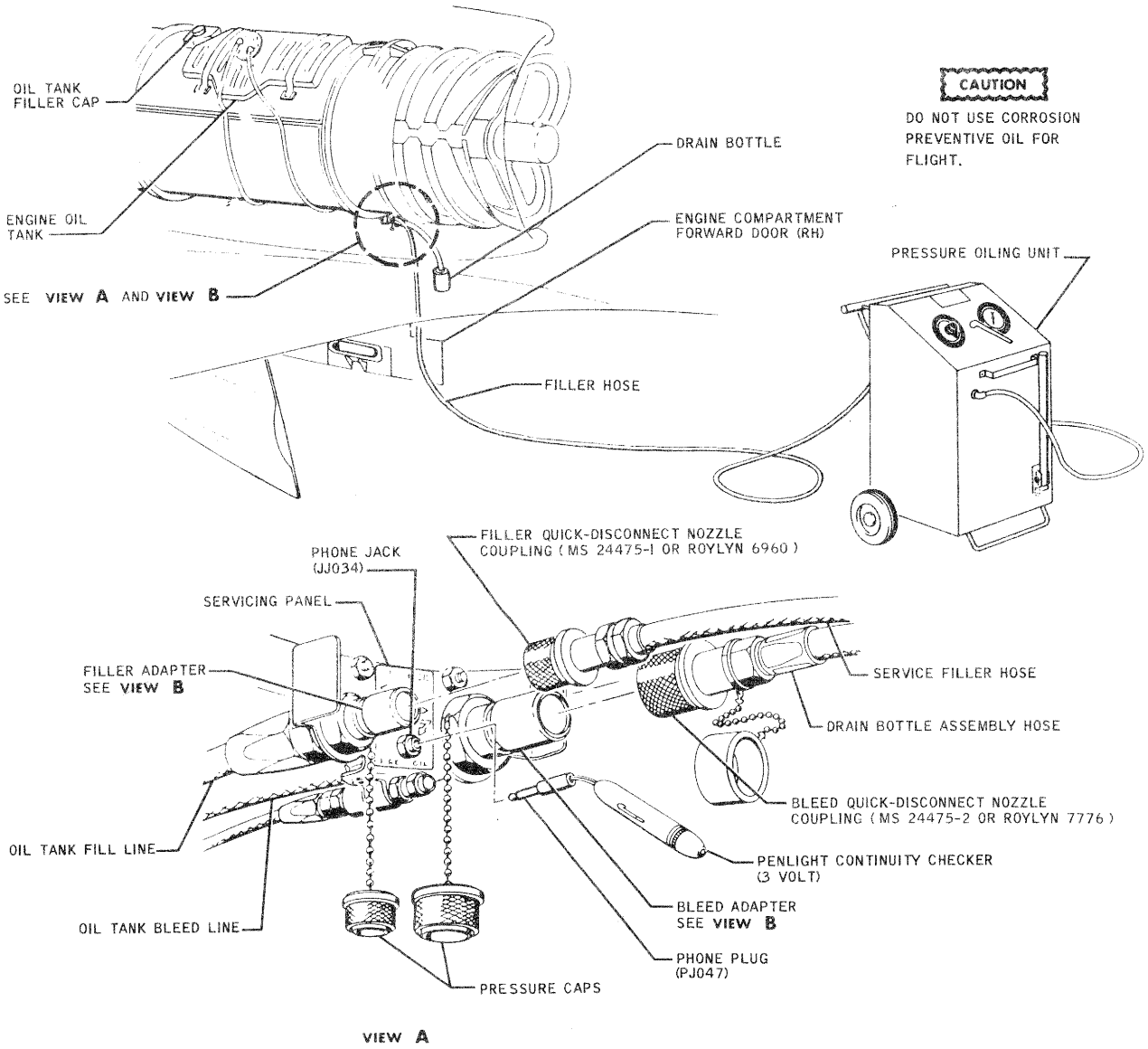
Normal Filling Method Through Ground Service Disconnects

(See figure 1-31.)

CAUTION

If generator drive unit has been removed or if new unit has been installed, make certain gasket is NOT installed between generator drive unit and engine pad.

1. Open engine compartment forward access doors.



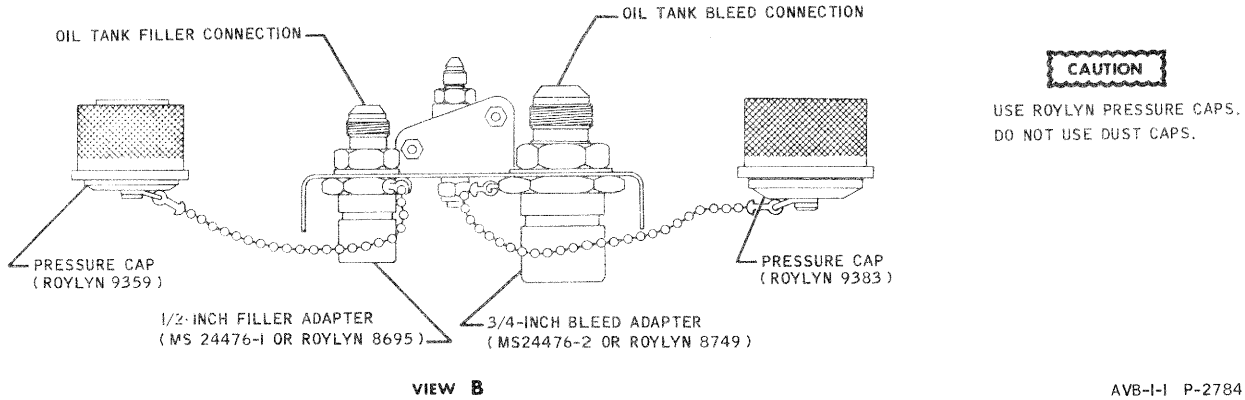


Figure 1-30. Engine Oil System Pressure Filling

2. Bleed all air from low pressure hand pump service hose and connect hose with G8005D8 coupling adapter to FILL line quick-disconnect.

3. Connect drain hose nozzle coupling (MS-24475-2 or Wiggins G8000D4) to return bleed quick-disconnect adapter (MS24476-2 or Wiggins nipple adapter G8005E4).

Note

Use upper oil outlet hose quick-disconnect to service drive unit if servicing filler and drain hose fittings do not mate with aircraft ground service disconnect fittings. (See views B and C, figure 1-31.)

4. Slowly pump oil into reservoir until steady flow of clean oil is obtained through drain hose.

5. Disconnect drain hose from BLEED line quick-disconnect and install dust cap.

6. Continue to pump oil into reservoir until oil level begins to appear in upper view window of reservoir.

Note

Reservoir pressure gage should read 15 (+5, -0) psi.

7. Disconnect hand pump hose from FILL line quick-disconnect and install dust cap.

8. Start engine and operate at IDLE for 5 minutes.

9. Check oil level after engine operation and add oil repeating steps 3 through 7 until reservoir is filled to proper level.

10. Secure engine compartment forward access doors.

NEW Alternate Filling Method Through Upper Quick-Disconnect Coupling

CAUTION

If generator drive unit has been removed or if new unit has been installed, make certain gasket is NOT installed between generator drive unit and engine pad.

1. Remove generator drive unit reservoir access plate and open fuselage forward lower access doors.

2. Disconnect oil outlet hose at quick-disconnect on upper section of engine air inlet adapter. (See views C, D, and E.)

3. Connect drain hose to upper fitting of outlet hose; place open end of drain hose in suitable container. (See views D and E.)

Note

Drain hose must have fitting to open poppet at quick-disconnect.

4. Bleed all air from low pressure hand pump service hose; connect pump hose to other end of upper outlet fitting and then pump oil through cooler, reservoir and drive unit until a steady flow of clean oil is obtained through drain hose.

5. Remove drain hose from outlet hose allowing poppet of quick-disconnect fitting to close.

6. Continue filling reservoir until oil level appears in upper window and air pressure reaches 15 psi +5 -0.

7. Disconnect pump; reconnect outlet hose to quick-disconnect coupling.

8. Start engine and operate at IDLE for 5 minutes.

9. Check oil level after engine operation; add oil repeating steps 2 through 8 until reservoir is filled to proper oil level and air pressure of 15 psi +5 -0 is obtained.

10. Secure generator drive unit reservoir access plate and fuselage forward lower access doors.

Cold Weather Servicing

Note

For temperatures below -12 °C (10 °F), reservoir oil supply must be full at all times to maintain the required 15 (+5, -0) psi pressure during engine operation.

CAUTION

Color code on generator drive unit oil reservoir air pressure gage does not indicate existing air pressure. For detailed information pertaining to gage, refer to Handbook Maintenance Instructions (NAVAIR 01-40AVA-2-1).

NEW

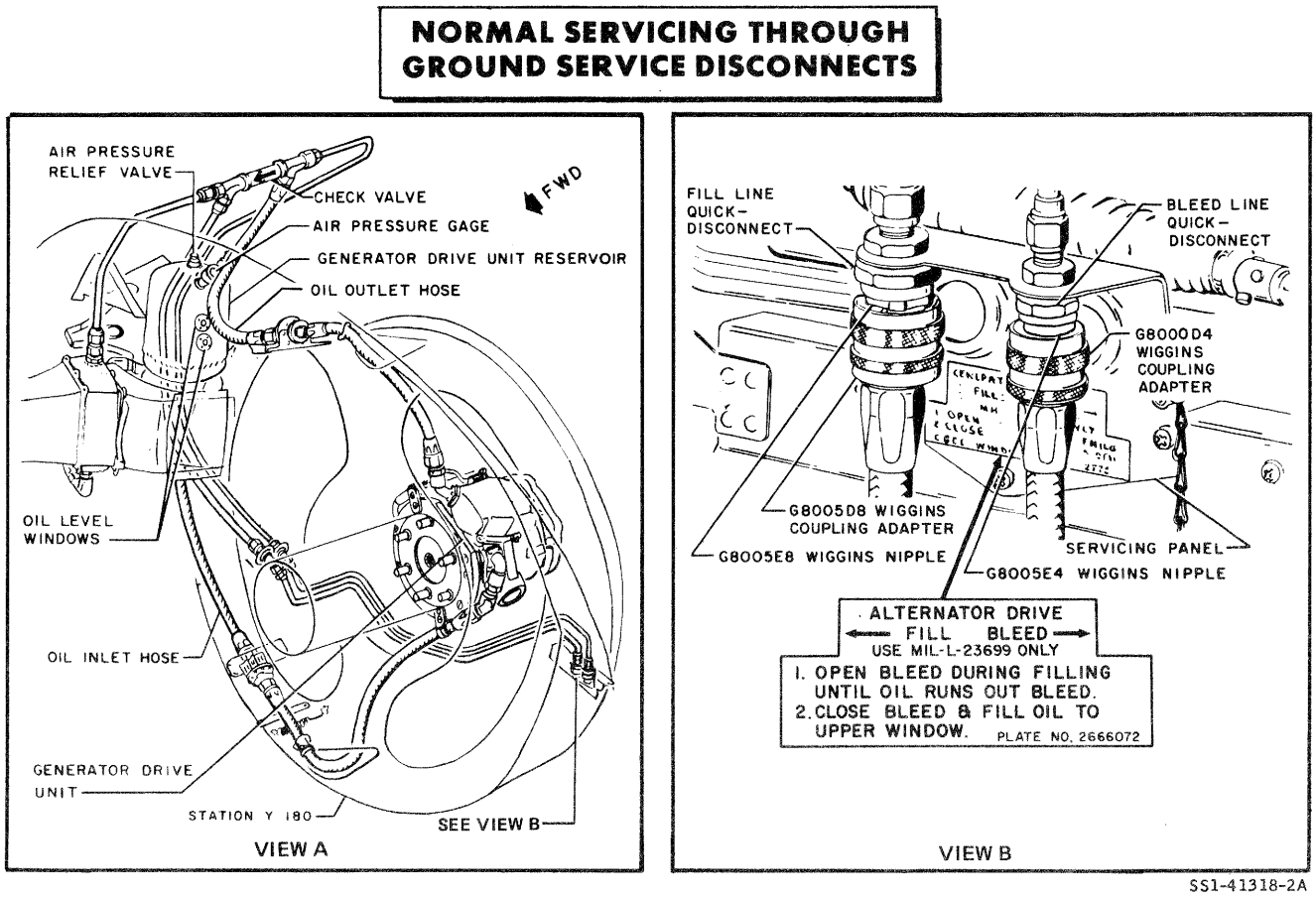


Figure 1-31. Generator Drive Servicing (Sheet 1)

1. Increase pressure to 15+5, -0 psi by adding air through hex valve on top cover of reservoir when temperatures are below -29°C (-20°F).

WARNING

Do not add air to reservoir under any other circumstances. Recheck air pressure for every 5.5°C (41°F) variation in temperature.

2. Heat oil before pumping it into reservoir when temperatures are below -40°C (-40°F).

Generator Gearbox Servicing

(See figure 1-32.)

EQUIPMENT AND MATERIALS REQUIRED

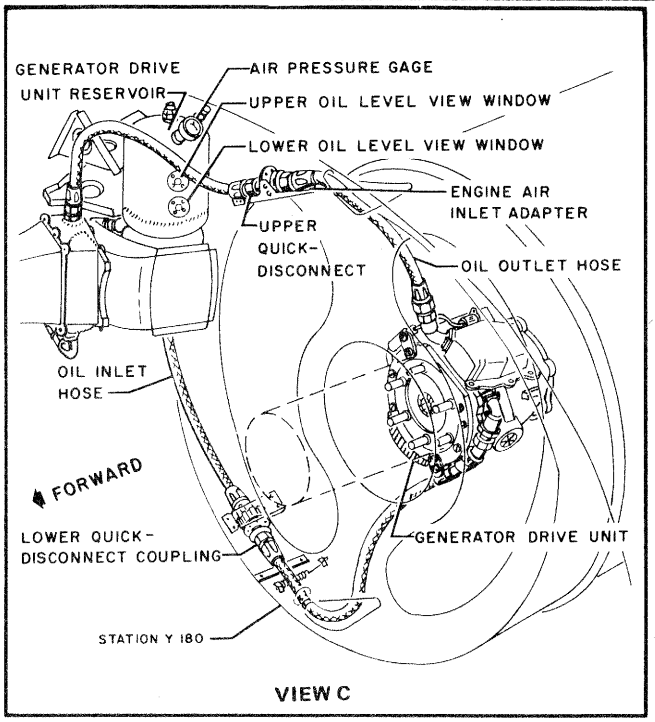
1. Hand oiler.
2. Plastic tubing (1/4 inch inside diameter and at least 40 inches long).
3. Engine oil MIL-L-23699.
4. Drycleaning solvent P-D-680.

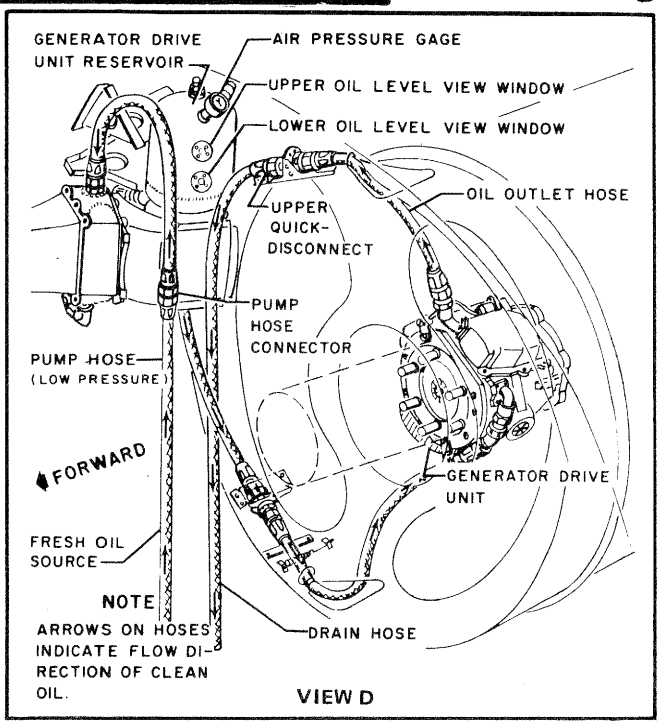
SERVICING PROCEDURES

1. Thoroughly clean hand oiler by washing in drycleaning solvent (P-D-680). Operate oiler to permit solvent to clean nozzle.
2. Fill hand oiler with engine oil (MIL-L-23699).

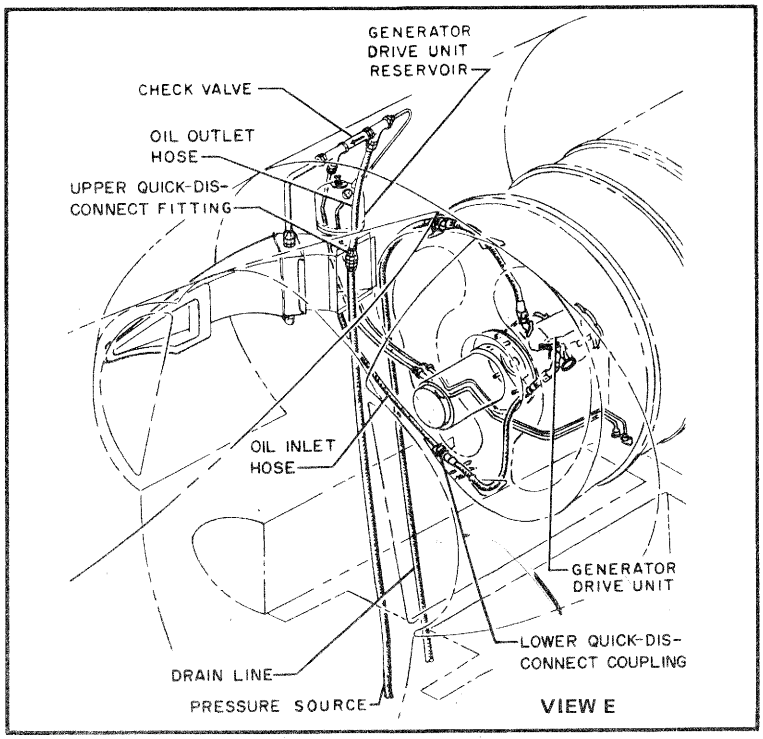
ALTERNATE SERVICING THROUGH UPPER QUICK DISCONNECT COUPLING

NEW





LUBRICATING OIL MIL-L-23699				
	US GAL	US QTS	IMP GAL	LITERS
OIL LEVEL FULL	0.5	2.0	0.45	1.8



SS1-41318-A

Figure 1-31. Generator Drive Servicing (Sheet 2)

CAUTION

- Ensure that airplane is in 6 degrees nose-up attitude.
- Ensure that engine oil is taken from oiler equipped with 10-micron filter (or equivalent).

3. Operate hand oiler to ensure solvent is rinsed from nozzle.

4. Open engine compartment forward access doors.

5. Reach up into engine compartment between structure at aft end of fuselage air inlet ducts and bulkhead at station Y180 and remove plug from gear box sight gage filler port with open end wrench.

6. Insert hand oiler nozzle in one end of plastic tubing. (See view A-A.)

7. Operate hand oiler until plastic tubing is full of oil. Squeeze or plug free end of tubing with finger to prevent oil loss.

8. Insert free end of tubing through engine compartment access doors into gear box sight gage filler port. (See view B-B.)

9. Operate hand oiler as necessary to raise oil level to FULL mark or gear box sight gage. (See view C-C.)

Note

It may be necessary to use a flashlight and inspection mirror to check sight gage during servicing procedure. Operate hand oiler slowly and intermittently to prevent oil from overflowing from filler port.

10. When oil level is at FULL mark on sight gage, remove plastic tubing from filler port.

11. Install plug in sight gage filler port and tighten securely.

12. Ensure that all tools are removed from engine compartment.

13. Close engine compartment forward access doors.

HYDRAULIC SYSTEM SERVICING

The utility hydraulic system and the flight control hydraulic system are serviced separately.

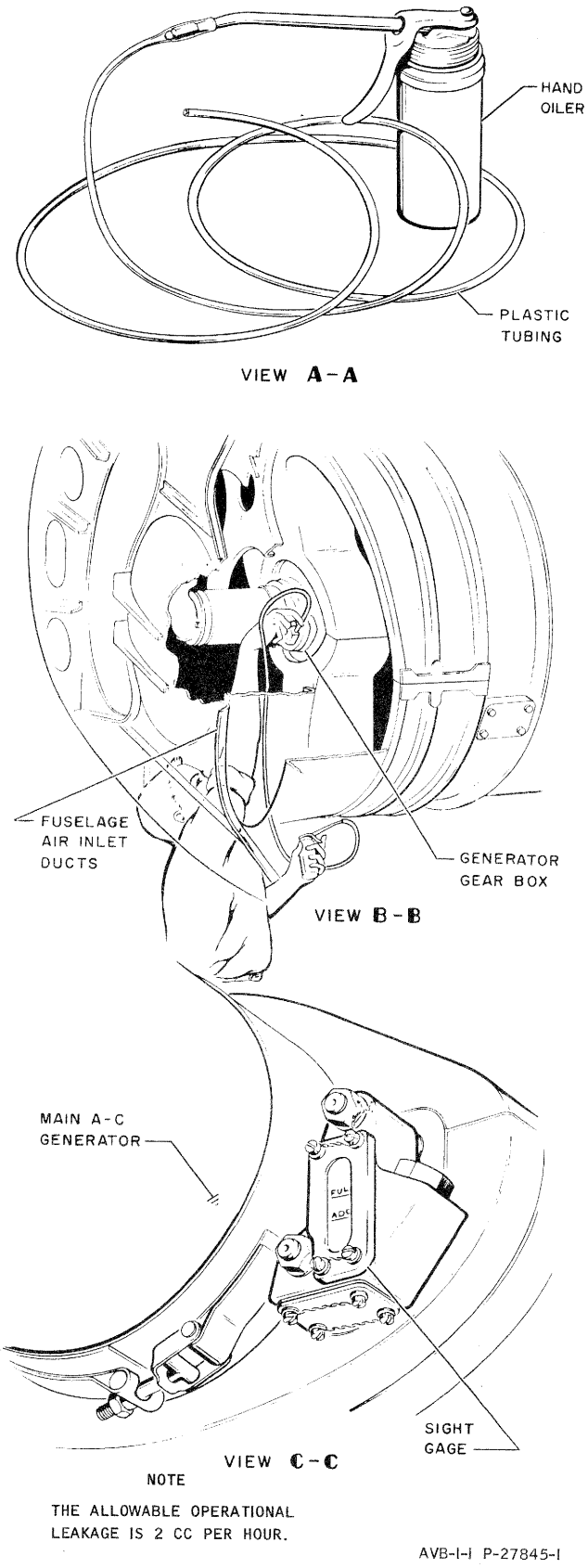


Figure 1-32. Generator Gear Box Servicing

Utility Hydraulic System Filling

(See figure 1-33.)

1. Open engine compartment forward access doors and engine forward support access plate.

2. Remove dust caps and connect source of hydraulic fluid supply to FILL quick-disconnect on the right side of the engine compartment.

3. Remove utility hydraulic bleed line from retaining clips; pass free end of line through engine forward support 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 the engine forward support access plate.)

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.

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 its retaining clips.

Flight Control Hydraulic System Filling

(See figure 1-34.)

1. Open engine control access door and engine oil tank filler access door.

2. Disconnect hydraulic pump line from quick-disconnect identified as FILL.

3. Connect source of hydraulic fluid supply to FILL quick-disconnect.

4. Remove flight control hydraulic bleed line from retaining clips; pass free end of line through engine oil tank filler access door and place free end in suitable container on wing to receive any possible overflow fluid when bleeding.

5. Fill reservoir until piston registers full on sight gage. (Gage is viewed through engine oil filler access door.)

CAUTION

Do not allow pressure applied to FILL port to exceed 100 psi.

6. Depress manual bleed valve until sight gage is free of air bubbles.

7. Disconnect external supply source when reservoir has been filled and bled.

8. Reconnect hydraulic pump line to FILL quick-disconnect.

9. Reinstall bleed line in its retaining clamps; secure engine fuel control and engine oil tank filler access doors.

BRAKE RESERVOIR SERVICING

1. Open nose section sufficiently to gain access to brake reservoir. (See figure 1-35.)

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 (MIL-H-5606A) until sight gage indicates it is full.

Note

When sight gage indicates reservoir is full, do not add any 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 naptha.

6. Check brakes and bleed if necessary. (Refer to HMI, Volume III.)

Note

If brakes are bled, reservice reservoir as necessary.

7. Close nose section.

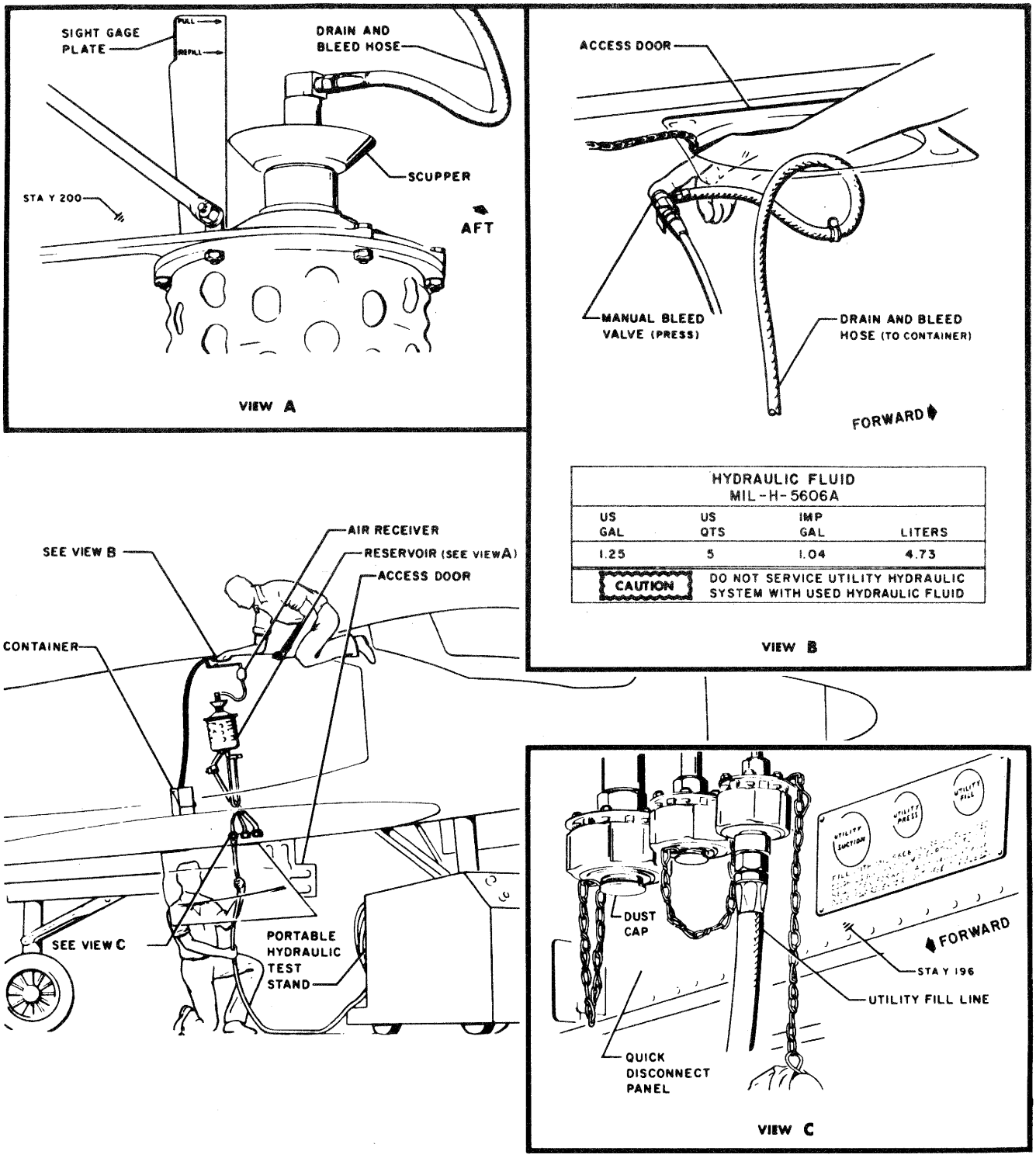


Figure 1-33. Utility Hydraulic System Filling

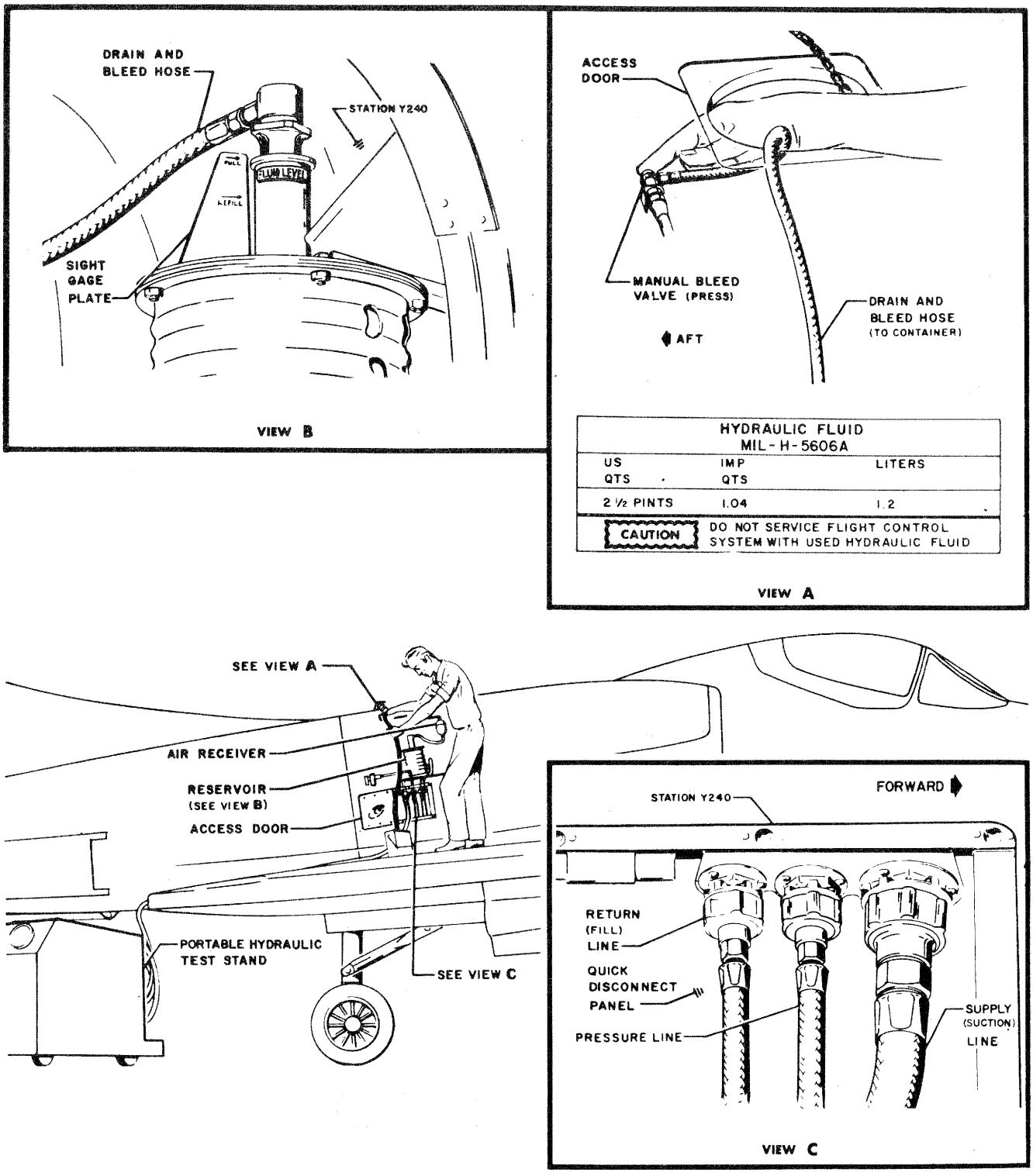
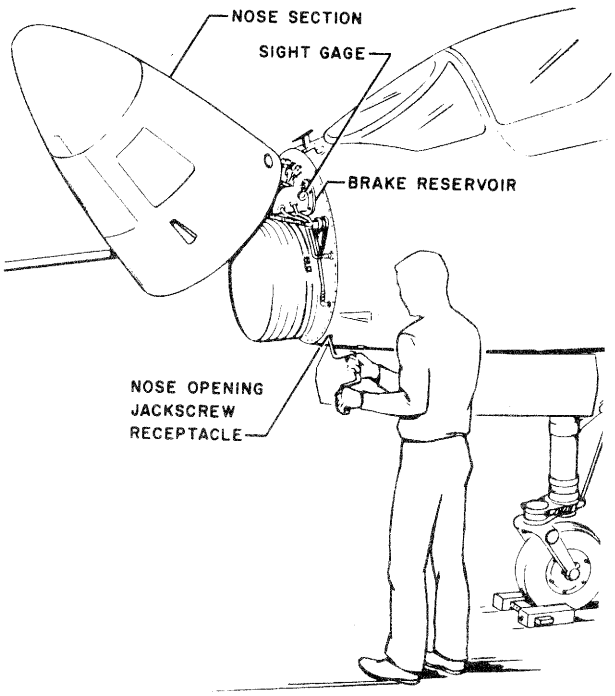
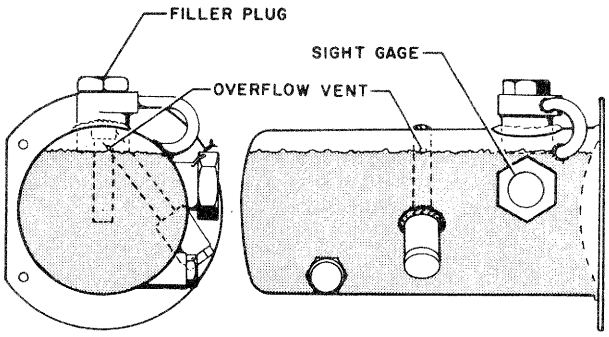


Figure 1-34. Flight Control Hydraulic System Filling



HYDRAULIC FLUID MIL-H-5606A			
	US QTS	IMP QTS	LITERS
OIL LEVEL WHEN FULL	1.04	0.86	0.983



RESERVOIR DIAGRAM

AVB-1-1 P-27848-1A

Figure 1-35. Brake Reservoir Filling

LIQUID OXYGEN SYSTEM SERVICING

Servicing of the liquid oxygen system (figures 1-36 and 1-37) 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 pressure within the trailer to complete the operation.

Filling Converter

1. Make certain oxygen switch in cockpit is in OFF position.

2. Open aft compartment access door.

3. Remove dust 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. Converter should fill in 3 to 5 minutes.
- If converter filler valve freezes during filling, remove filler hose. Install filler valve cap to stop back flow of liquid oxygen. Heat transference from filter valve cap will free filler valve.

6. When liquid oxygen flows from overflow vent port in steady stream,close fill drain valve on servicing trailer; then 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.

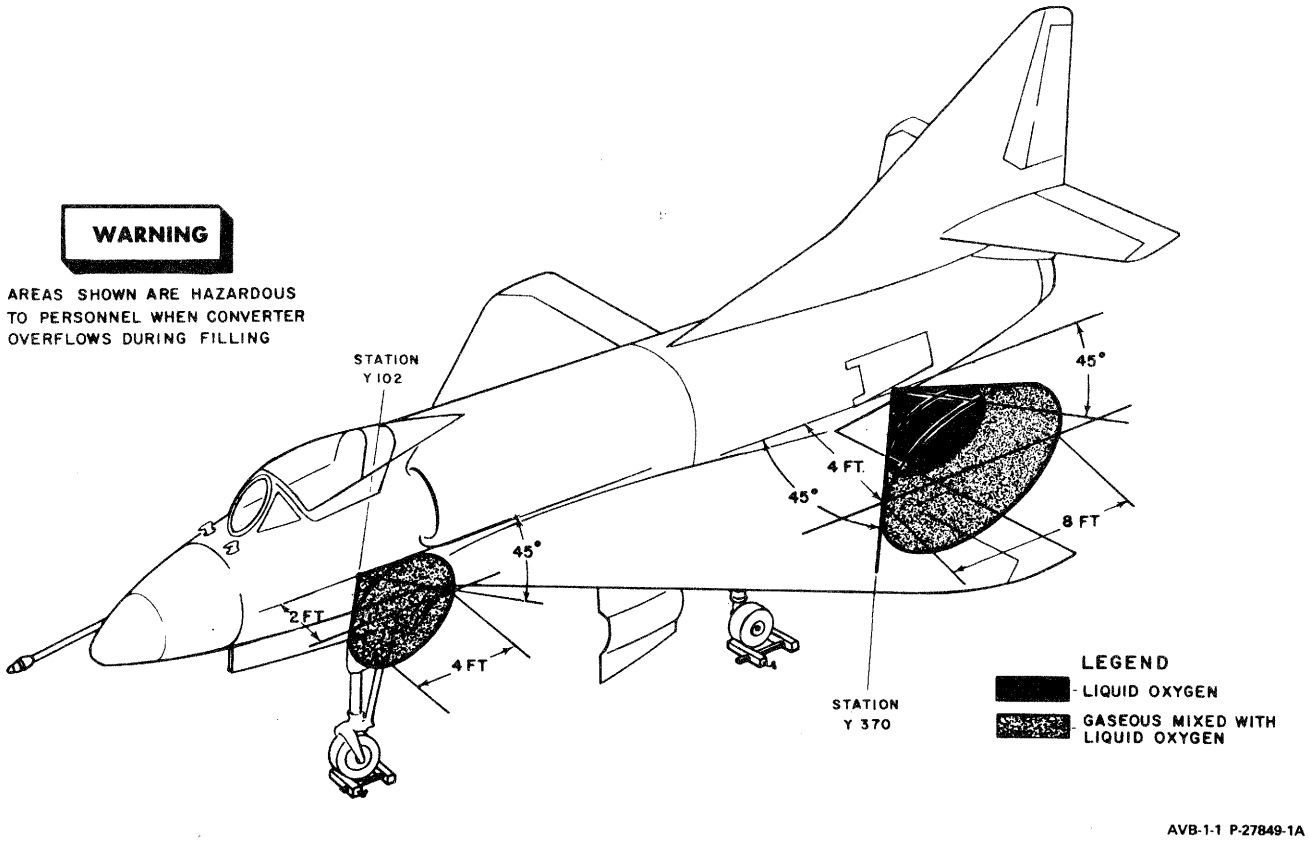


Figure 1-36. Liquid Oxygen Handling Precautions

7. Disconnect servicing trailer filler hose from converter filler valve and relieve pressure in filler hose by engaging filler nozzle in purging device on servicing trailer.

8. Install dust cap on filler valve.

Note

Before 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 aft compartment door.

EMERGENCY OXYGEN BOTTLE SERVICING

NEW Servicing emergency oxygen bottle within the aircraft is not authorized.

EXTERNAL POWER APPLICATION

Two methods of applying ac external electrical power to the aircraft are available. The primary or standard method utilizes an ac mobile electric power plant (NC-5 or equivalent). (See figure 1-38.) 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. This method will supply electrical power only to the start/abort and engine ignition systems.

STARTING REQUIREMENTS

A high pressure air supply is required for starting the engine.

Suitable Starter Units

Suitable starter units for A-4 aircraft are:

GTC-85	MD-1A
MA-1	MD-2A
MA-1A	M32A-60
MA-1E	NCPP-105
MA-1TA	RCPP/RCPT-105
MA-2MP	WELLS AIR START
MA-3MP	SYSTEM

The GTC-24 unit can be used; however, at minimum temperatures (-65°F), this unit develops torque high enough to damage the starter.

Twenty eight vdc power is required if a cockpit controlled start is desired. Ac power can be provided through the external power receptacle (figure 1-38) Dc power (for cockpit controlled start) can only be supplied through the aircraft starter electrical disconnect.

Note

If 28-vdc power is not available, a ground start must be accomplished.

STARTER PROBE INSTALLATION

(See figure 1-39.)

CAUTION

Personnel performing ground starting procedures must be thoroughly familiar with operating characteristics peculiar to ground turbine compressor (GTC) unit and starter probe. (Observe precautions noted on figures 1-40.)

1. Place compressor unit (GTC) in position forward of right wing.

WARNING

Make certain compressor unit exhaust is directed away from aircraft. Never operate unit beneath fuel vent line outlet on right wing lower surface.

2. Open starter probe support yoke access door. (See view A figure 1-39.)

Note

Starter probe support yoke must be removed from stowed position and installed in line with starter probe receptacle.

3. Remove pip pins from starter probe support yoke. (See views B and C.)

4. Align starter probe support yoke with starter probe receptacle and insert pip pins. (See view D.)

Note

Remove pip pin stowed in aft side of yoke; use pin to secure yoke during engine starting. (See view D.)

5. Remove receptacle cap from starter fitting disconnect. (See views D and E.)

(Figure 1-37 deleted)

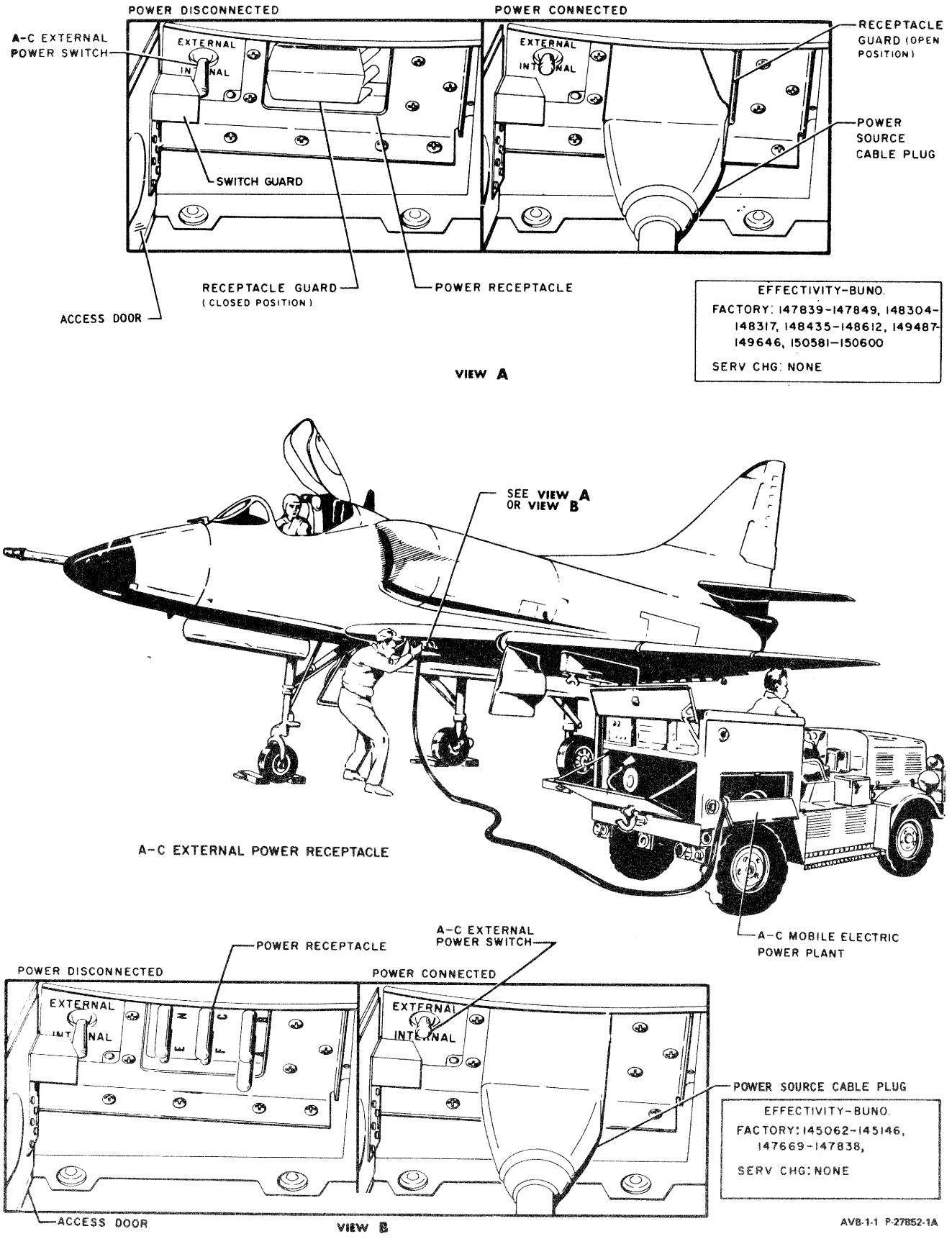


Figure 1-38. External Electrical Power Application

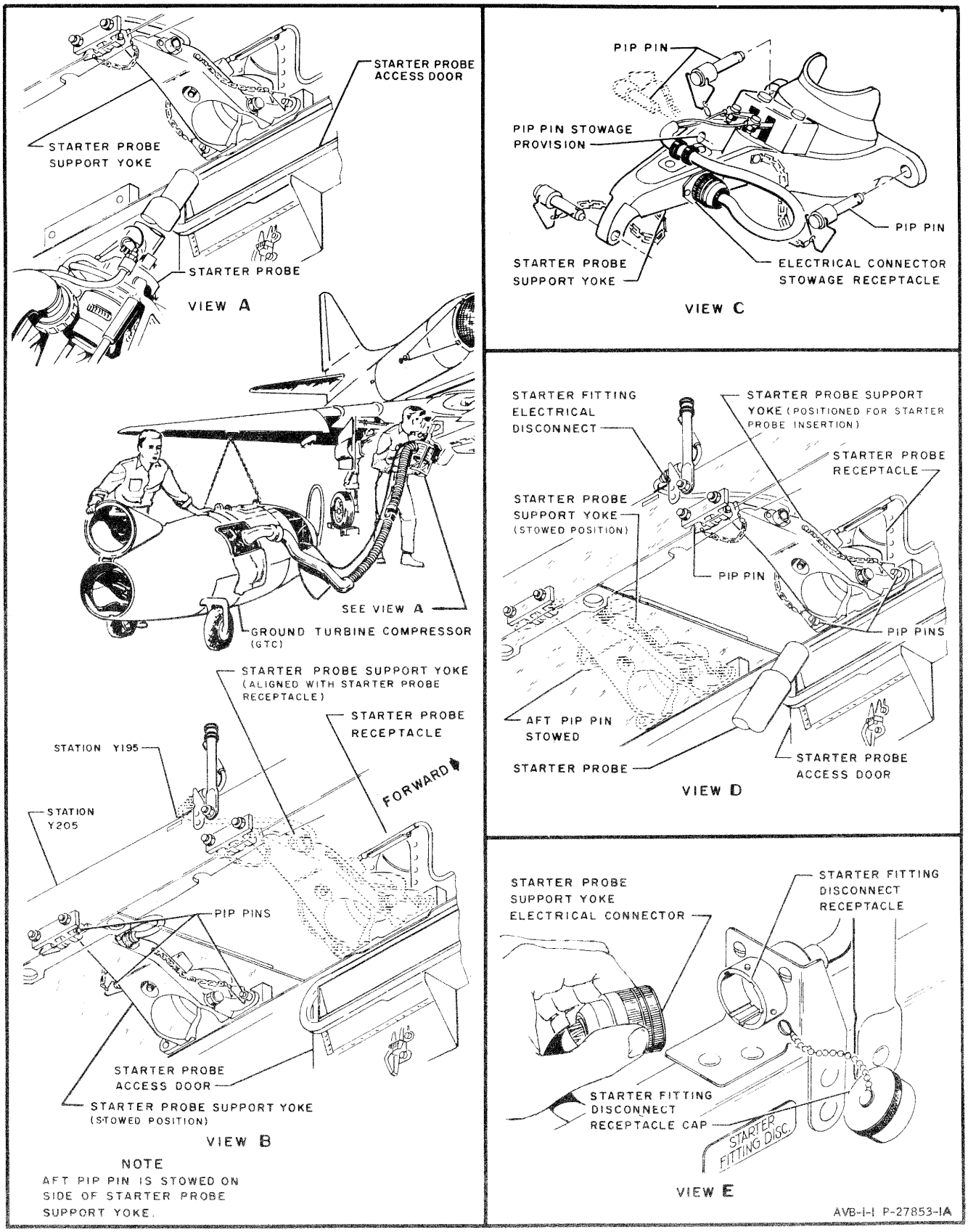


Figure 1-39. Starter Probe Installation

6. Remove electrical connector from stowage receptacle on starter probe support yoke. (See view C.)

7. Connect electrial connector to starter fitting disconnect receptacle. (See view E.)

8. Insert starter probe through support yoke; engage slots on probe housing in lugs on support yoke. Rotate probe clockwise until fully seated.

9. Pull starter probe coupling lever down to lock probe in position.

Note

Coupling lever also completes starting circuit between engine START switch and electrical receptacle on probe turbine housing.

10. Place ground turbine compressor unit master switch in OFF position.

11. Connect compressor unit ground start control cable to electrical receptacle on starter probe turbine housing.

12. Connect compressor unit air pressure hose to quick-disconnect coupling on starter probe turbine air inlet.

13. Start compressor unit and allow it to stabilize before diverting air pressure for engine starting.

Note

When engine has started, discontinue air pressure supply to starter probe and remove probe from aircraft.

14. Disconnect electrical connector from starter fitting disconnect receptacle. (See view E.) Connect electrical connector to stowage receptacle on starter probe support yoke. (See view C.)

15. Replace receptacle cap on starter fitting disconnect.

16. Remove pip pins from starter probe support yoke; install starter probe support yoke in stowage position. (See view B.)

17. Secure starter probe support yoke access door.

DANGER AREAS

During ground operation certain hazardous areas exist. These areas are shown in figure 1-40.

TURNING RADII

For turning radii of the A-4C/L aircraft see figure 1-41.

FORWARD TOWING PROVISIONS

For forward towing (refer to figure 1-42), either a standard tow bar or an adjustable tow bar may be attached to the nosewheel axle. Ensure that main and nose 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.
- If the aircraft is to be towed with the canopy open, make certain the canopy internal control handle is in the unlocked position. Bouncing of the canopy with the control handle locked can cause fracture of the canopy hinge structure. Do not tow the aircraft without a qualified plane captain in 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 required 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 1-43 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.

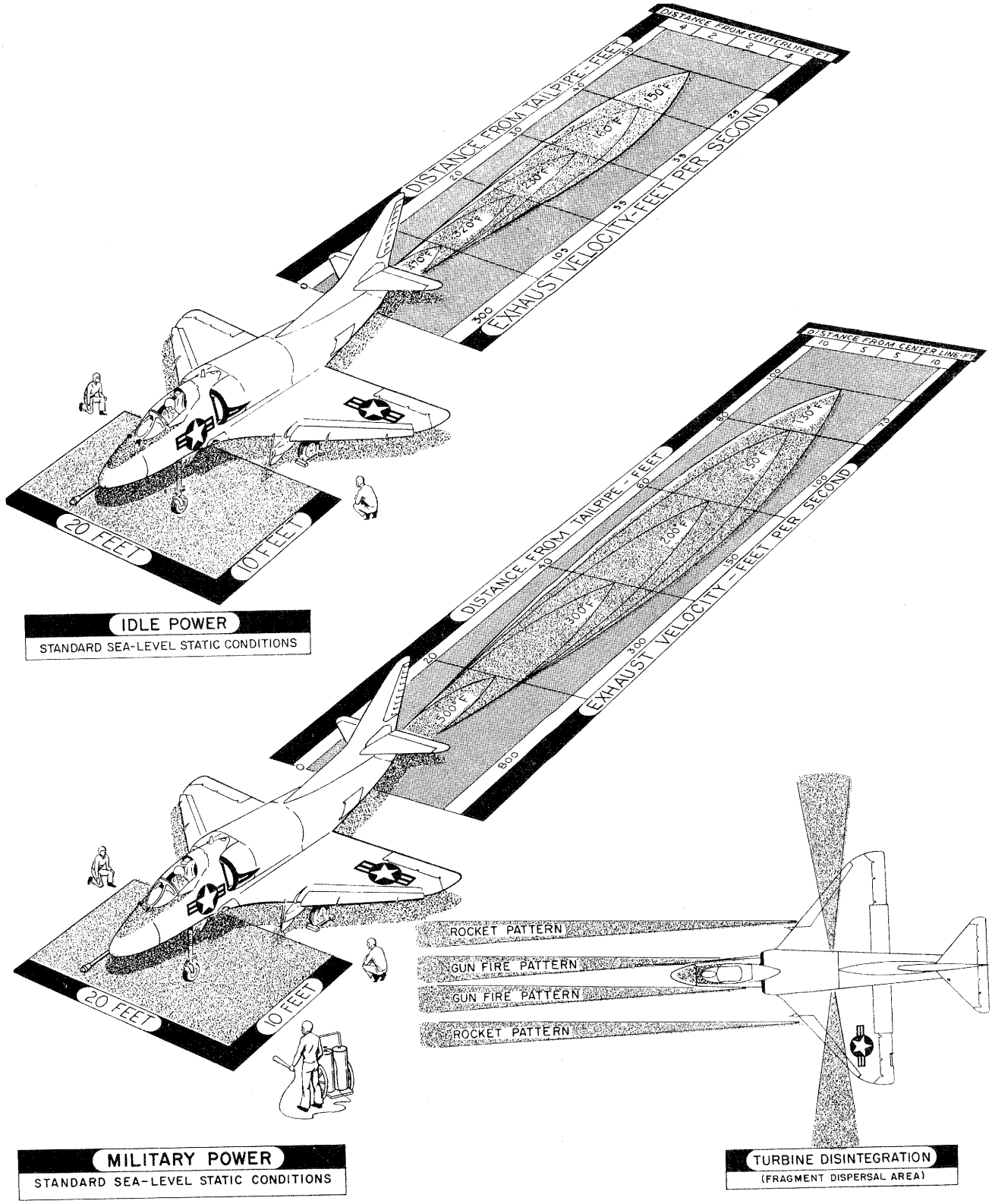


Figure 1-40. Danger Areas (Sheet 1)

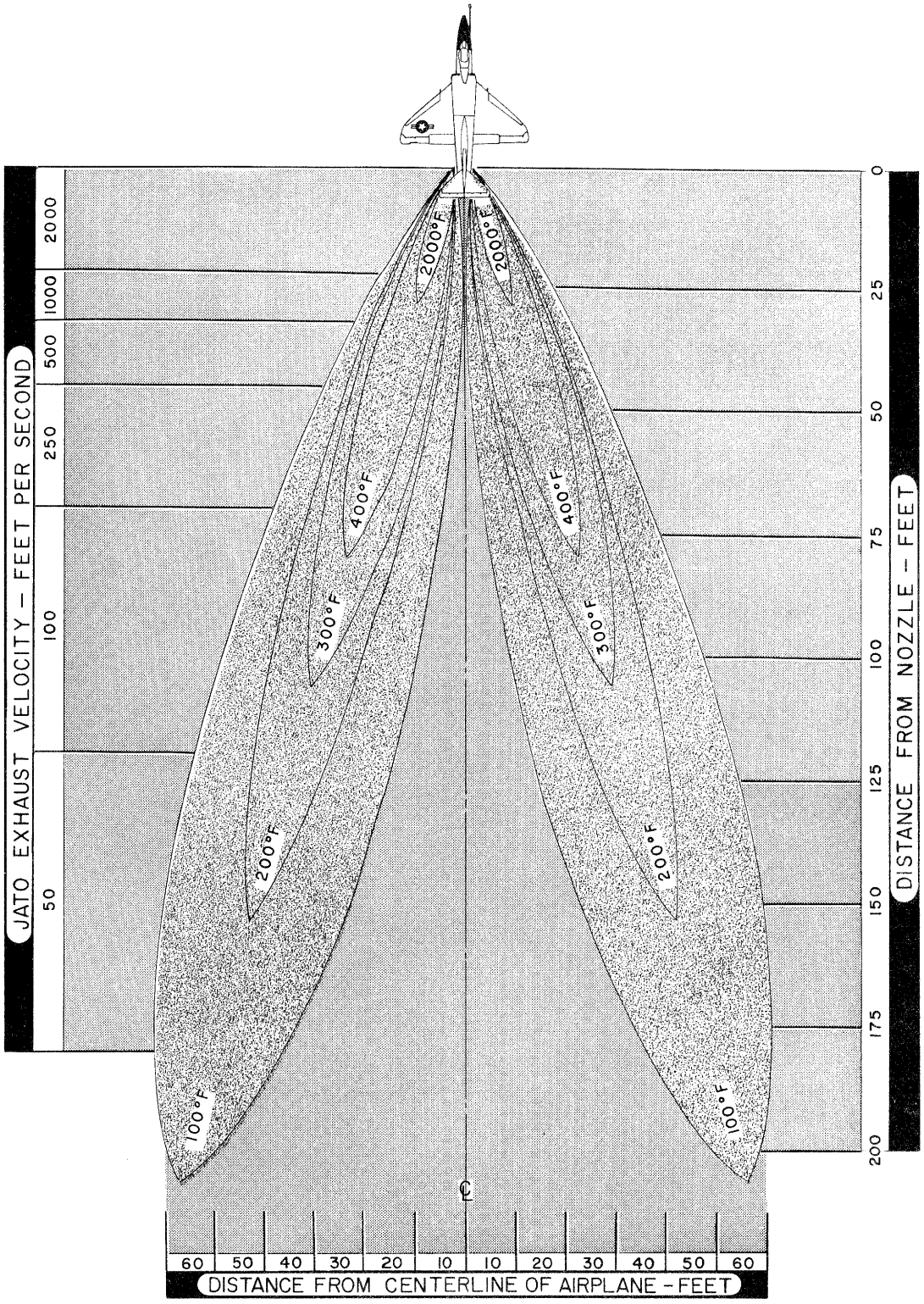


Figure 1-40. Danger Areas (Sheet 2)

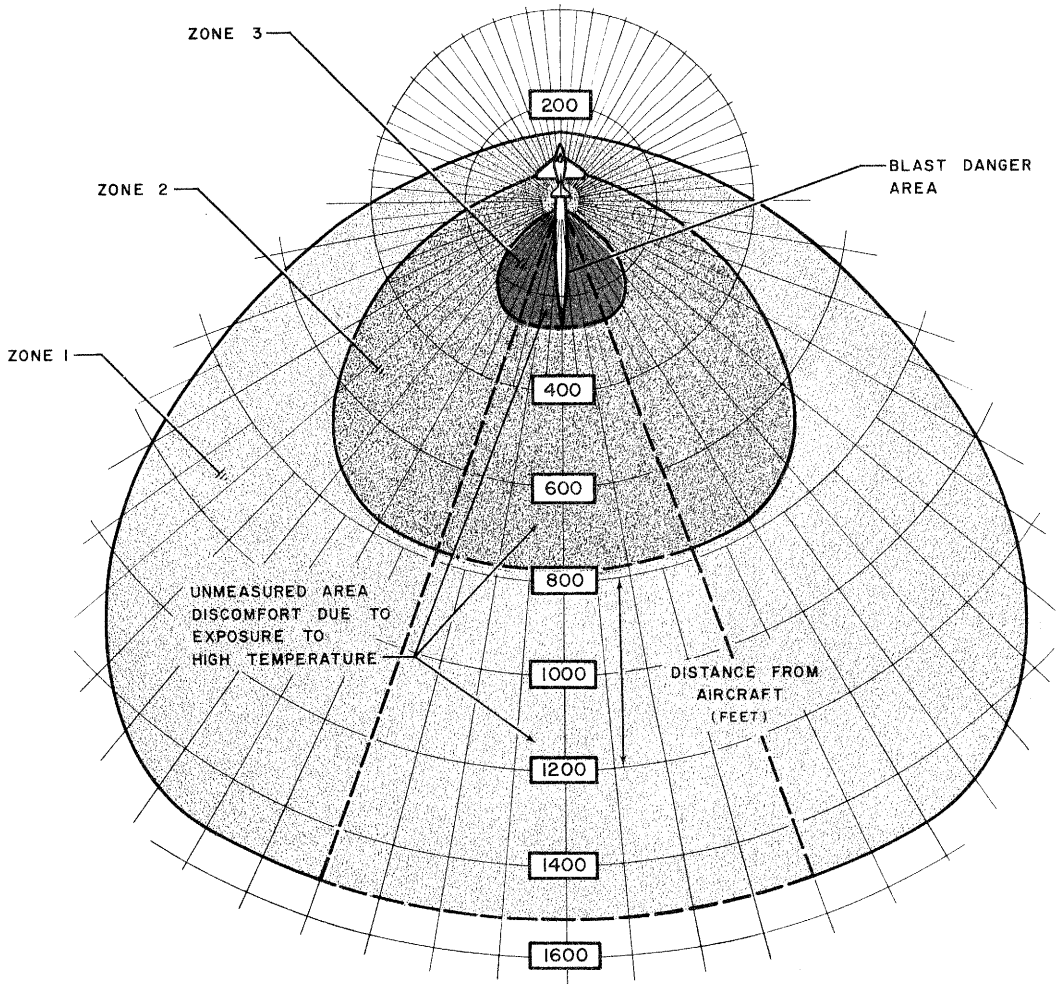
ENGINE TRIM OPERATION

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 MUST BE WORN WHEN WORKING WITHIN THIS AREA.
ZONE 2	EARMUFFS AND EARPLUGS MUST BE WORN WHEN WORKING WITHIN THIS AREA.
ZONE 3	CRITERIA FOR FIFTEEN MINUTE EXPOSURE EXCEEDED. PERSONNEL SHOULD NOT ENTER EXCEPT FOR VERY SHORT DURATION.

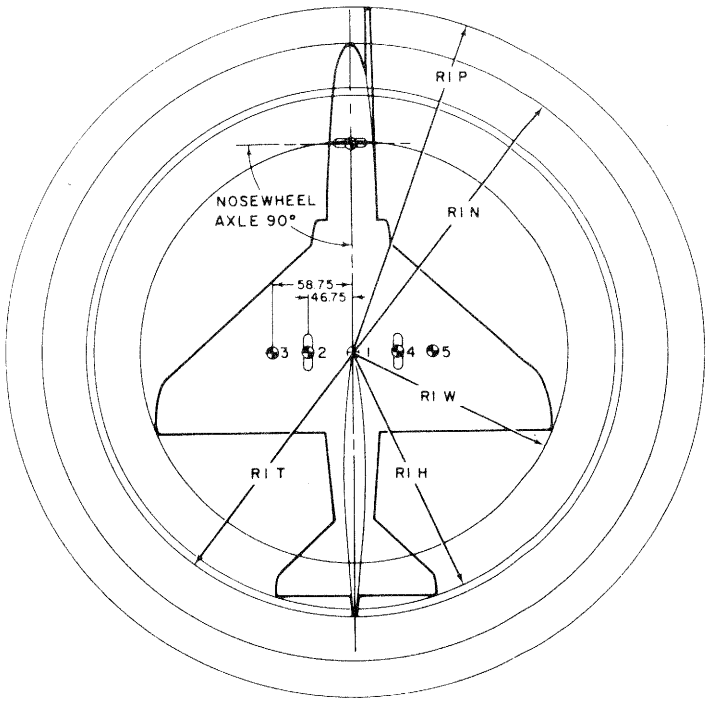
WARNING

1. EAR PROTECTION MUST BE PROPERLY FITTED TO PERSONNEL.
2. DURING ENGINE OPERATION AT IDLE POWER, EARMUFFS OR EARPLUGS ARE REQUIRED FOR PERSONNEL WITHIN 100 FEET OF AIRCRAFT.



SSI-41322-2

Figure 1-40. Danger Areas (Sheet 3)



PIVOT POINT 1

RADIUS FROM 1 TO PROBE.....24 FEET

RADIUS FROM 1 TO NOSE.....21 FEET

RADIUS FROM 1 TO WING.....15 FEET

RADIUS FROM 1 TO HORIZONTAL STABILIZER.....19 FEET

RADIUS FROM 1 TO TRAILING EDGE OF RUDDER.....20 FEET

CODE

R = RADIUS

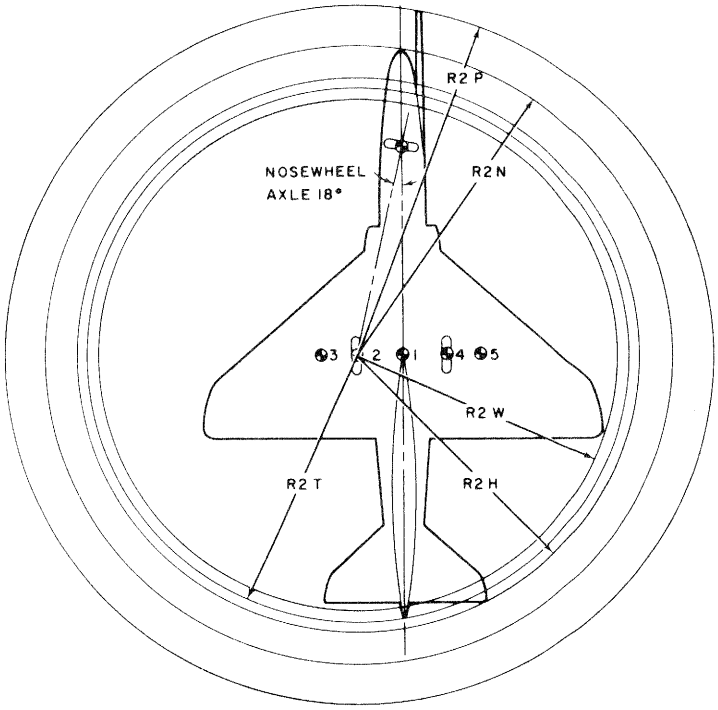
H = HORIZONTAL STABILIZER TIP

N = NOSE (RADOME) TIP

P = IN-FLIGHT FUELING PROBE TIP

T = RUDDER TRAILING EDGE

W = WING TIP



PIVOT POINT 2

RADIUS FROM 2 TO PROBE.....25 FEET

RADIUS FROM 2 TO NOSE.....22 FEET

RADIUS FROM 2 TO WING.....19 FEET

RADIUS FROM 2 TO HORIZONTAL STABILIZER.....21 FEET

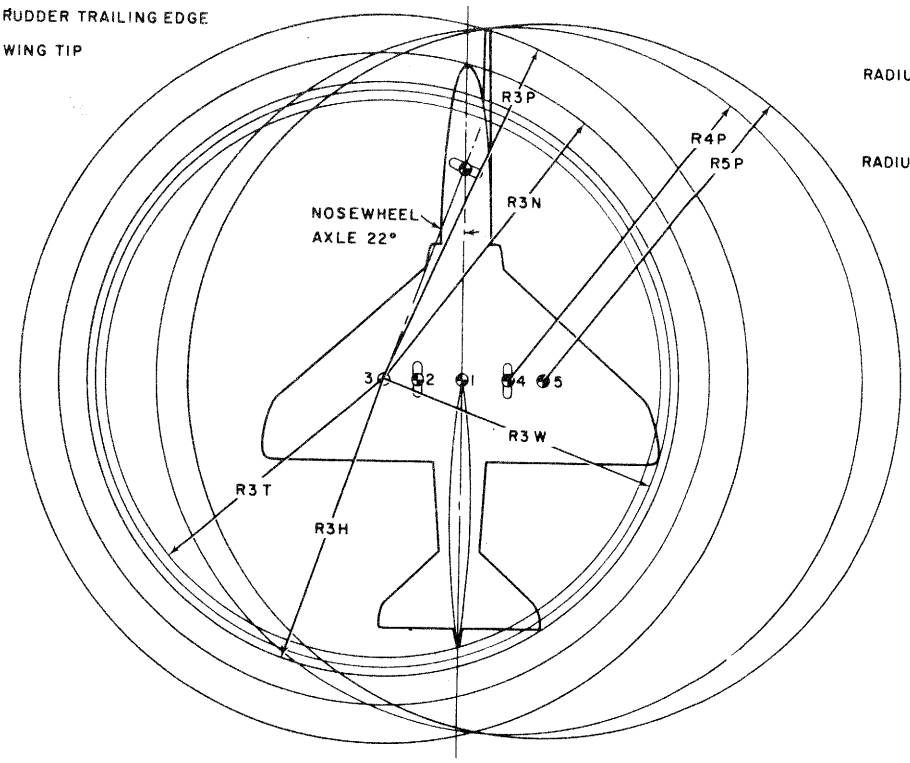
RADIUS FROM 2 TO TRAILING EDGE OF RUDDER.....20 FEET

AVB-1-1 P-27855-1

Figure 1-41. Turning Radii (Sheet 1)

CODE

R = RADIUS
H = HORIZONTAL STABILIZER TIP
N = NOSE (RADOME) TIP
P = IN-FLIGHT FUELING PROBE TIP
T = RUDDER TRAILING EDGE
W = WING TIP



PIVOT POINT 3

RADIUS FROM 3 TO PROBE.....25 FEET
RADIUS FROM 3 TO NOSE.....22 FEET
RADIUS FROM 3 TO WING.....20 FEET
RADIUS FROM 3 TO HORIZONTAL STABILIZER.....21 FEET
RADIUS FROM 3 TO TRAILING EDGE OF RUDDER.....20 FEET

PIVOT POINT 4

RADIUS FROM 4 TO PROBE.....24 FEET

PIVOT POINT 5

RADIUS FROM 5 TO PROBE.....24 FEET

AVB-I-I P-27855-2

Figure 1-41. Turning Radii (Sheet 2)

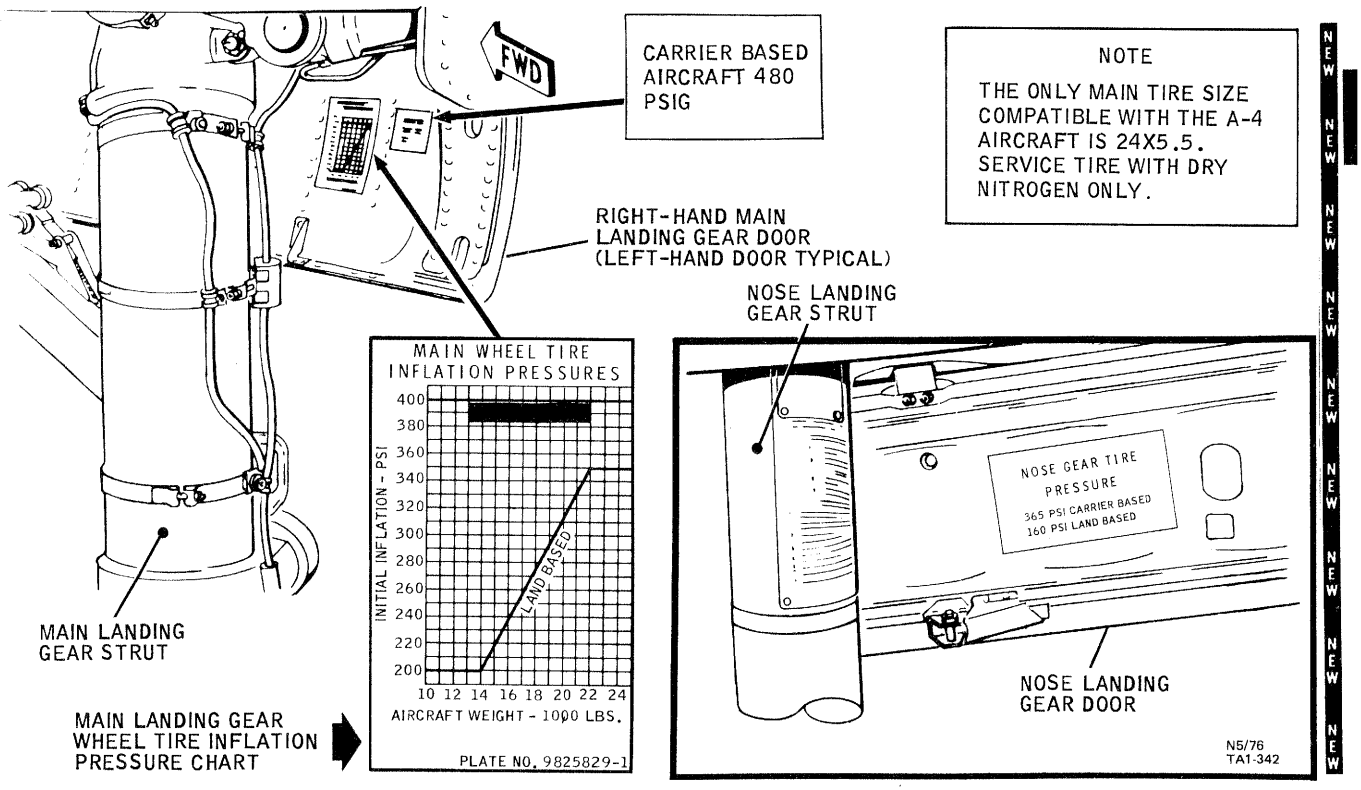


Figure 1-41A. Main Gear and Nose Gear Tire Pressures.

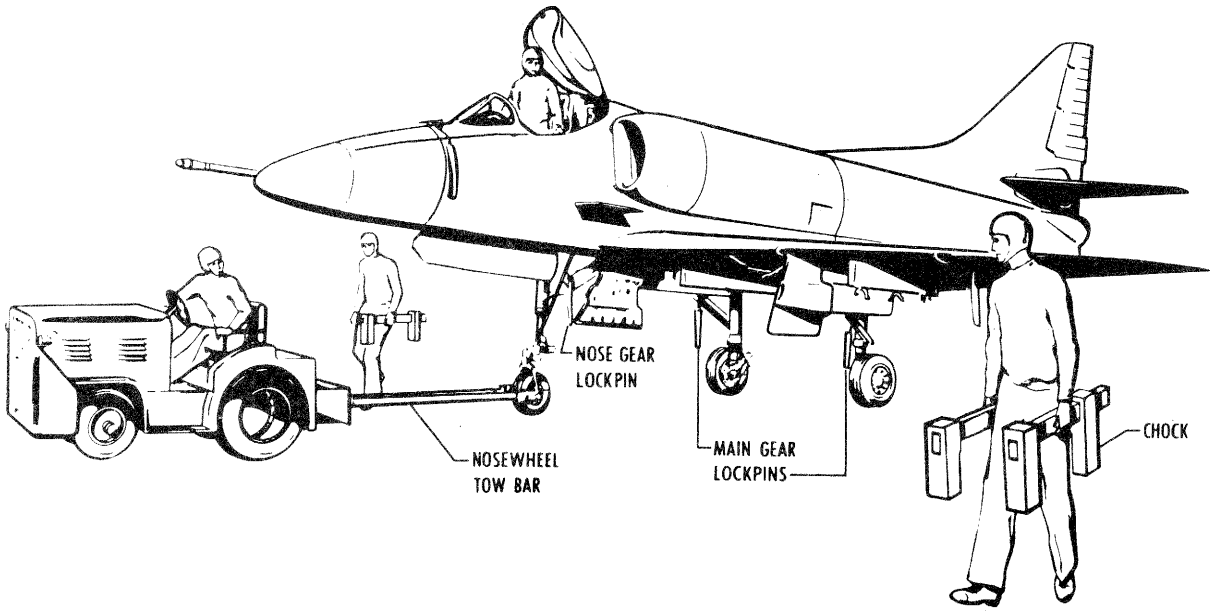


Figure 1-42. Forward Towing

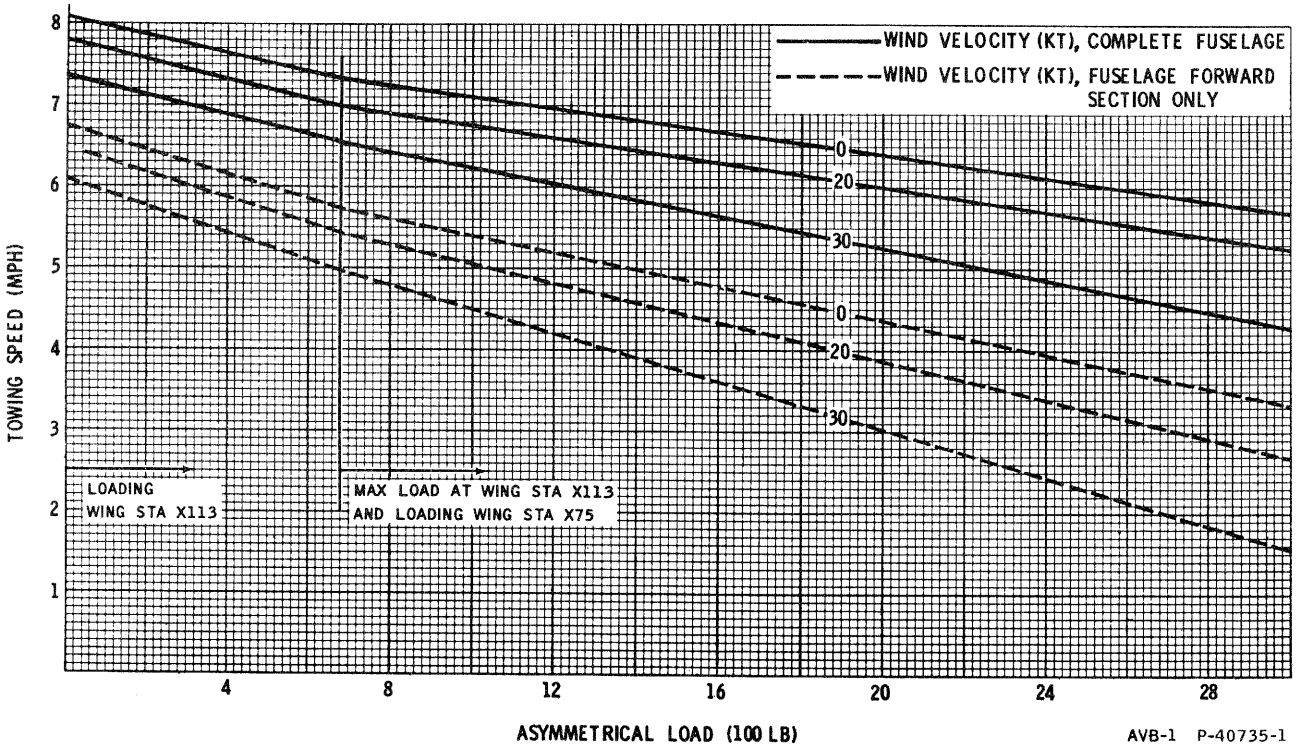


Figure 1-43. Towing Speeds for Asymmetrical Loadings

TIEDOWN PROVISIONS

The aircraft can be secured to the ground, flight deck, or hangar 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 rings, one on each side. Recommended procedures for normal weather conditions, engine runup, and shipboard fueling are contained in subsequent paragraphs.

Ground Tiedown in Normal Weather

(See figure 1-44.)

1. Install landing gear lockpins.

2. Align nosewheel fore and aft; secure nose and main gear wheels fore and aft with chocks.

Note

Use adjustable chocks if available.

CAUTION

Minimum and maximum angles of tiedown chain in relation to aircraft and ground or deck must be strictly adhered to.

3. Attach chain assemblies to tiedown points indicated for normal weather tiedown and tighten chains.

4. Make certain throttle lever is in OFF position and tighten THROTTLE FRICTION AND LOCK CONTROL.

5. Close canopy.

6. Install cockpit enclosure cover.

7. Install pitot and temperature probe covers.

8. Install manifold exhaust cover.

9. Install aft compartment cooling duct plugs.

10. Install aileron gust lock.

11. Install wing slat locks.

12. Install engine air inlet covers.

13. Install angle-of-attack probe/vane cover.

14. Install nose compartment cooling duct plugs.

15. Install air conditioning ram air duct plugs.

16. Install engine exhaust cover.

17. Remove entrance ladder, if installed.

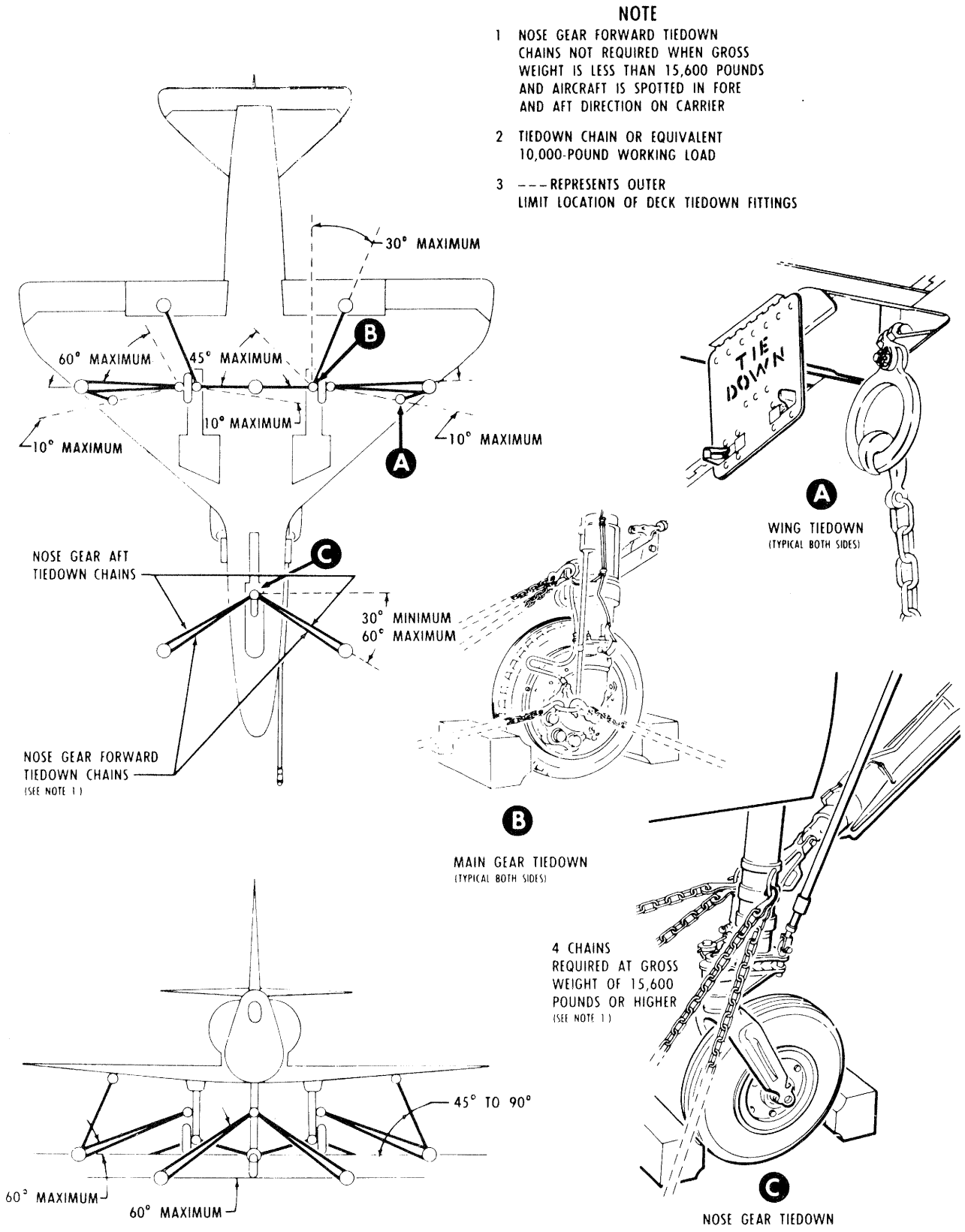


Figure 1-44. Normal Weather Tiedown

PART 4
OPERATING LIMITATIONS

INTRODUCTION

This section contains operating limitations that shall be observed during normal operation of the aircraft. Additional limitations are covered in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

ENGINE LIMITATIONS

(See figure 1-45.)

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-4 or JP-5	JP-5

Note

- During acceleration or a transient temperature rise due to an operating condition, exhaust gas temperature should not exceed 720°C nor remain at peak value for more than 10 seconds. Following acceleration, EGT will overshoot the stabilized value for a given throttle setting and will require several minutes to decrease. The temperature will decrease quite rapidly at first, then progressively more slowly as it approaches the stabilized value. EGT should not stabilize at any point above the maximum steady state value.
- The military operating time of 30 minutes is not intended as a limit, but as a guide to prolong engine life. Engine life deteriorates more rapidly by cycling the engine from military power to a lower power setting for short periods than by operating the engine at military power for 30 minutes or more.

If the starting or acceleration limits are exceeded, the following restrictions are applicable:

1. If the temperature of any start exceeds 720°C on the J65-W-20 engine, have a special "hot section" inspection performed as described in the applicable J65 Power Plant Bulletin No. 4-3 current revision or NAVAIR 02B-35AAC-2, section V.

2. Data applicable to operation on jet fuel, grades JP-4 and JP-5.

Note

Maintaining EGT within operating limits at altitudes of approximately 20,000 feet and above for the J65-W-20 may require retarding the throttle. This requirement is acceptable if the rpm varies linearly with altitude up to maximum operating altitude, and if rpm need not be reduced below 100.3 percent.

CAUTION

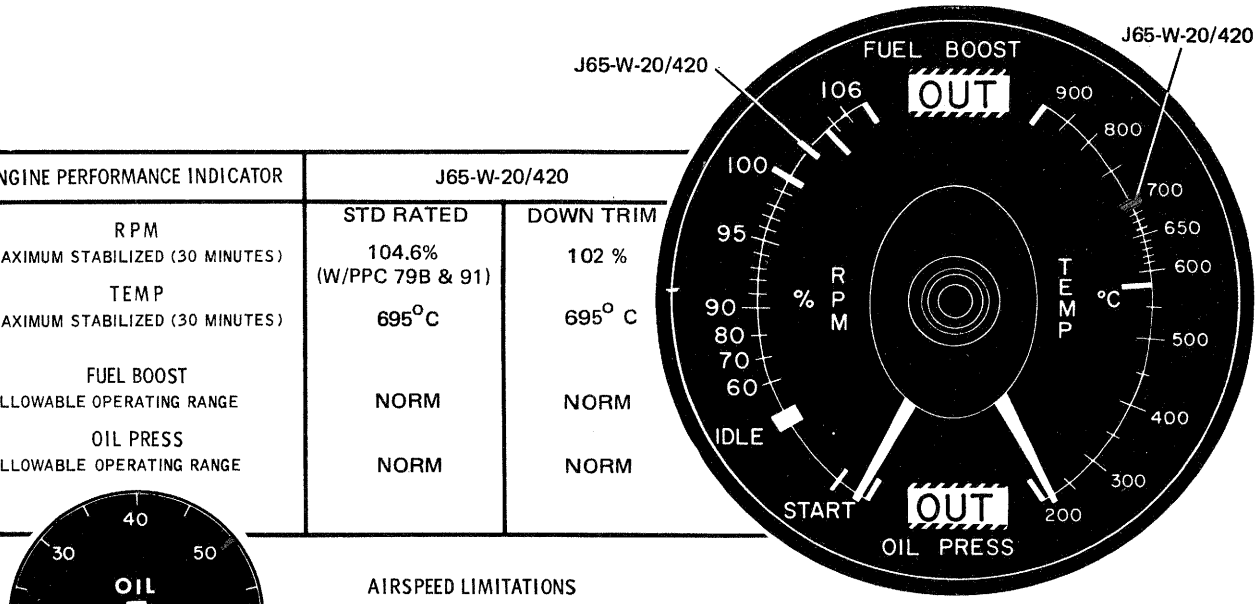
- An overtemperature condition will occur during sustained military power operation at any altitude if EGT is not properly monitored.
- To limit operating time in the region of highest compressor blade vibratory stresses, avoid steady state operation in the 60 to 82 percent rpm range except when required by operational necessity.

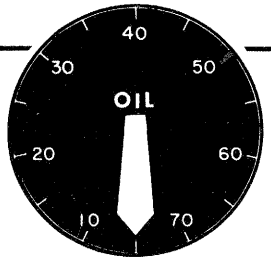
NEW NEW NEW NEW

ENGINE OPERATING LIMITS

Operating Condition	Max EGT °C	% RPM		Time Limit
	J65-W-20/420	Std. Rated	Down-Trimmed	
Starting	720	—	—	—
Acceleration	720	106	106	10 sec
Military	695	104.6	102	30 min
Normal	640	100	98	Continuous
Overspeed in dive	710	106	106	10 sec
Idle	650	42-48	42-48	—
Note: Takeoff minimums 580° C EGT/101% RPM				

ENGINE PERFORMANCE INDICATOR	J65-W-20/420	
	STD RATED	DOWN TRIM
RPM MAXIMUM STABILIZED (30 MINUTES)	104.6% (W/PPC 79B & 91)	102 %
TEMP MAXIMUM STABILIZED (30 MINUTES)	695°C	695° C
FUEL BOOST ALLOWABLE OPERATING RANGE	NORM	NORM
OIL PRESS ALLOWABLE OPERATING RANGE	NORM	NORM





OIL PRESSURE INDICATOR

AIRSPEED LIMITATIONS

THE MAXIMUM PERMISSIBLE INDICATED AIRSPEEDS IN SMOOTH OR MODERATELY TURBULENT AIR ARE:

1. WITH SYMMETRICAL LOADING, AND WITH LANDING GEAR, FLAPS, AND HOOK RETRACTED..... AS SHOWN IN FIGURE 1-46.
2. WITH ASYMMETRICAL LOADING.....510 KNOTS OR 0.90 MACH, WHICHEVER IS LOWER.
3. WITH LANDING GEAR AND/OR FLAPS EXTENDED
   225 KNOTS (WITH ZERO YAW)
   170 KNOTS (WITH UNRESTRICTED YAW)

N5/76
SS1-12934-G

Figure 1-45. Instrument Markings

Engine Instrument Fluctuations

The following limits apply when engine instrument fluctuations are encountered:

1. Maximum rpm fluctuation of 1.5 percent.

2. Maximum fuel flow fluctuation of 500 pounds per hour.

3. Exhaust gas temperature (EGT) may vary provided rpm and fuel flow fluctuation limits are not exceeded.

4. Perceptible movement of the aircraft caused by thrust variation is not acceptable.

Note

Buffeting in flight can cause thrust variation with resultant engine instrument fluctuations. This type of fluctuation should not be considered unacceptable.

Oil Pressure Variation

Minimum allowable oil pressure at IDLE rpm is 16 psi, however if EPI indicates OUT with oil pressure gage reading between 16 psi and 24 psi, advance throttle slightly to obtain NORM oil pressure indication on EPI (over 24 psi on oil pressure gage). If NORM indication cannot be obtained with increased rpm, shut down engine and investigate.

Note

During starting and initial runup, the maximum allowable oil pressure is 60 psig.

CAUTION

Even though certain maneuvers normally cause a momentary loss of oil pressure, maximum operating time with oil pressure indicating OUT (or below 24 psi) is 1 minute under all conditions. If recovery of oil pressure is not accomplished in 1 minute, the flight should be terminated as soon as practicable. If the oil pressure gage reads over 50 psi or EPI reads HIGH, the throttle setting should be reduced to lessen rpm and safeguard engine seals. Land as soon as possible and investigate.

Oil Pressure Operating Limits

Cold Start or Initial Runup	Max	60 psig
Ground Idle only	Min	16 psig
50% rpm and above at all altitudes	Min	24 psig
All normal operation	Max	50 psig

CENTER OF GRAVITY LIMITATIONS

Refer to Chart E of Weight and Balance Handbook, AN 01-1B-40 for operating limitations.

AIRSPEED LIMITATIONS

(See figure 1-46.)

The maximum permissible indicated airspeeds in smooth or moderately turbulent air are as follows:

1. With no external stores and with landing gear, flaps, and hook retracted . . . . . as shown in figure 1-46

2. With 300 gallon external fuel tanks and with landing gear, flaps, and hook retracted. . . . . 575 KIAS or 0.90 Mach, whichever is lower

NEW 2A. With external baggage container (CNU-188) and landing gear, flaps, and hook retracted . . . . . 525 KIAS or 0.80 Mach, whichever is lower NEW

Note

For other external store limitations/loadings refer to A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

3. With landing gear and/or flaps extended (except in an 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 0.80 Mach, whichever is lower. See tanker speed envelope... as shown in figure 11-33. NEW

   a. For buddy store hose retraction . . 250 KIAS

   b. Carriage. . . . . 500 KIAS or 0.80 Mach, whichever is lower

5. With control power system inoperative

   a. With asymmetrical loading. . . . . 200 KIAS

   b. With symmetrical loading . . . . . 300 KIAS or 0.80 Mach, whichever is lower

6. With emergency generator extended. . . . . 500 KIAS or 0.91 Mach, whichever is lower

7. For windshield wiper operation . . . . 200 KIAS

MANEUVER LIMITATIONS

The following maneuvers are prohibited:

1. Negative-g flight in excess of 10 seconds. NEW
2. Intentional spins.
3. Simulated flameout approaches. NEW
4. Aileron rolls:
   a. That exceed 360° of roll.
   b. That exceed one-half stick deflections with fuel in external fuel tanks. Above 20,000 feet, fullstick deflection may be used for rolls up to 180°.
5. The maximum permissible change in angle-of-bank during rolling pullouts or rolling pullovers is 180°.

WARNING

Sustained normal accelerations between ±0.5 g may result in a loss of boost pump fuel transfer followed by engine flameout. Transient flight maneuvers only, are permitted in this normal acceleration range. NEW NEW NEW

CAUTION

Drop tank fuel transfer shall not be operated during any maneuvers that could result in an inverted spin. NEW

ACCELERATION LIMITATIONS

Accelerations at which moderate buffeting occurs shall not be exceeded. Otherwise, the maximum permissible accelerations for flight are as shown in figure 1-47. As gross weight increases above 12,500 pounds, maximum permissible accelerations decrease as shown in figure 1-49. During conditions of moderate turbulence, avoid deliberate accelera-

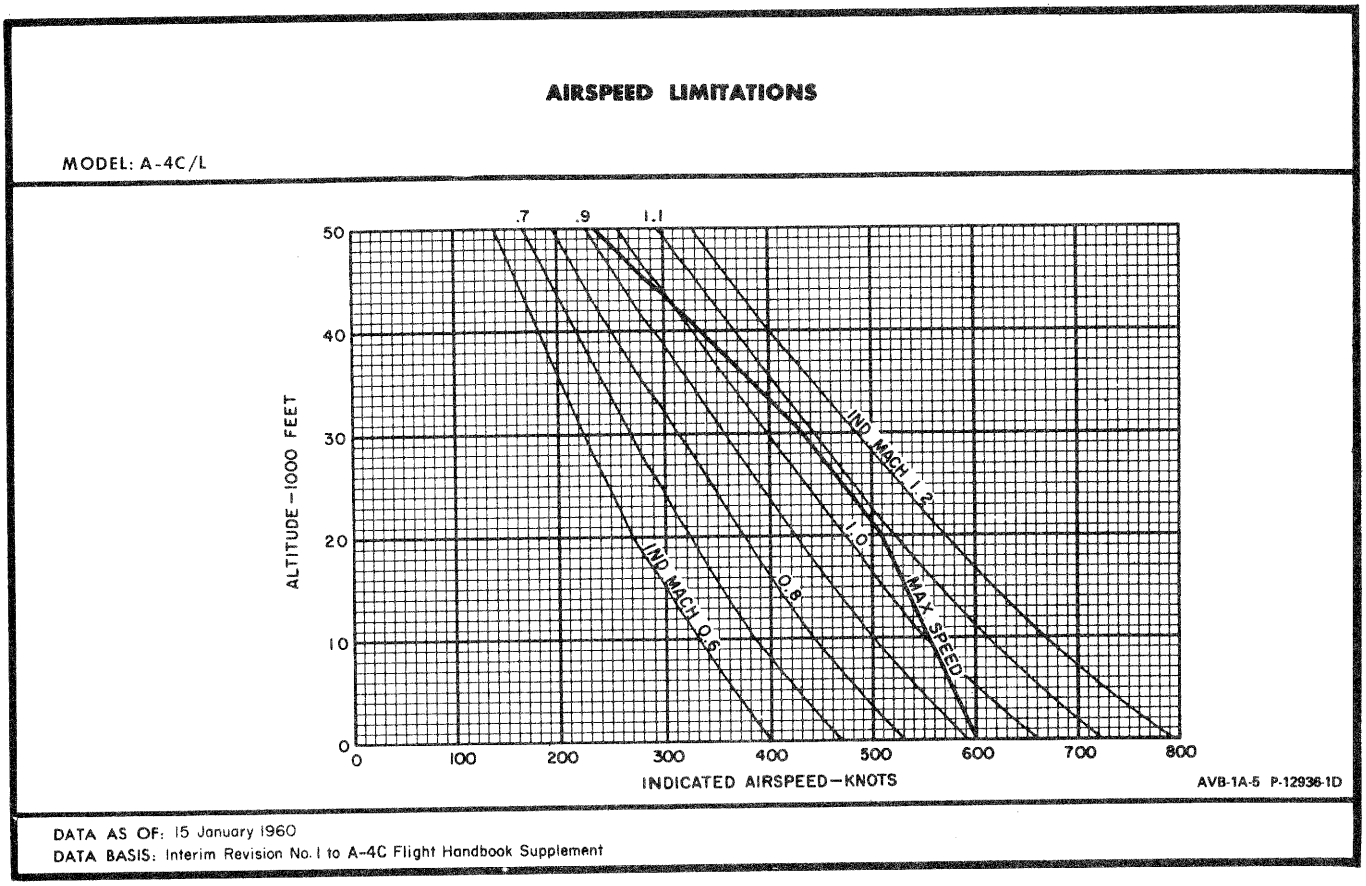


Figure 1-46. Airspeed Limitations

tions in excess of those permitted by figure 1-49 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.

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.

Below 15,000 feet, at speeds in excees of 0.94 IMN, avoid deliberate accelerations in excess of plus 4.0g. Above 15,000 feet, avoid deliberate accelerations which exceed buffet onset.

FLIGHT LIMITATIONS WITH PRESSURIZED WING TANK

The following is a summary of the restrictions 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 N_2 = +0.1 to +2.0.
6. No air refueling.
7. No nosedown attitudes.
8. 45-degree bank maximum.

AFCS LIMITATIONS

At altitudes of 7500 feet and above, operation of the AFCS is unrestricted throughout the speed range of the aircraft (figure 1-48).

The AFCS 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 knots, AFCS operation requires the hands on the control stick. Above 300 knots, 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 knots.

4. The AFCS shall not be engaged below 200 feet above the terrain.

AFCS Performance and Power Limitations

The attitude hold, preselected heading, the 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.

TANKER SPEED ENVELOPE

For the operating speed envelope of the tanker aircraft see Section XI, Part 6.

DIVE ANGLE LIMITATIONS

Dive angles may be extrapolated from Dive Recovery Charts of Section IV.

GROSS WEIGHT LIMITATIONS

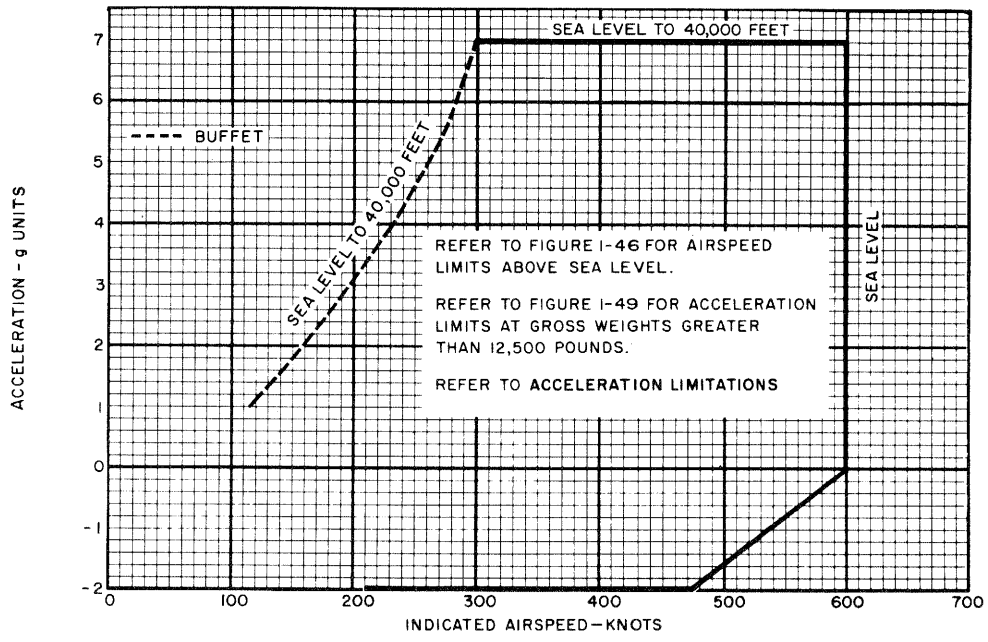
The maximum recommended gross weights are as follows:

1. Field takeoff . . . . . 22,500 pounds
2. Field landing (minimum rate of descent . . . . . 16,000 pounds
3. Field landing (other than minimum rate of descent),

   FCLP, and field arrestments . . . 14,500 pounds NEW
4. Catapulting . . . . . 22,500 pounds

OPERATING FLIGHT STRENGTH DIAGRAM

MODEL: A-4C/L



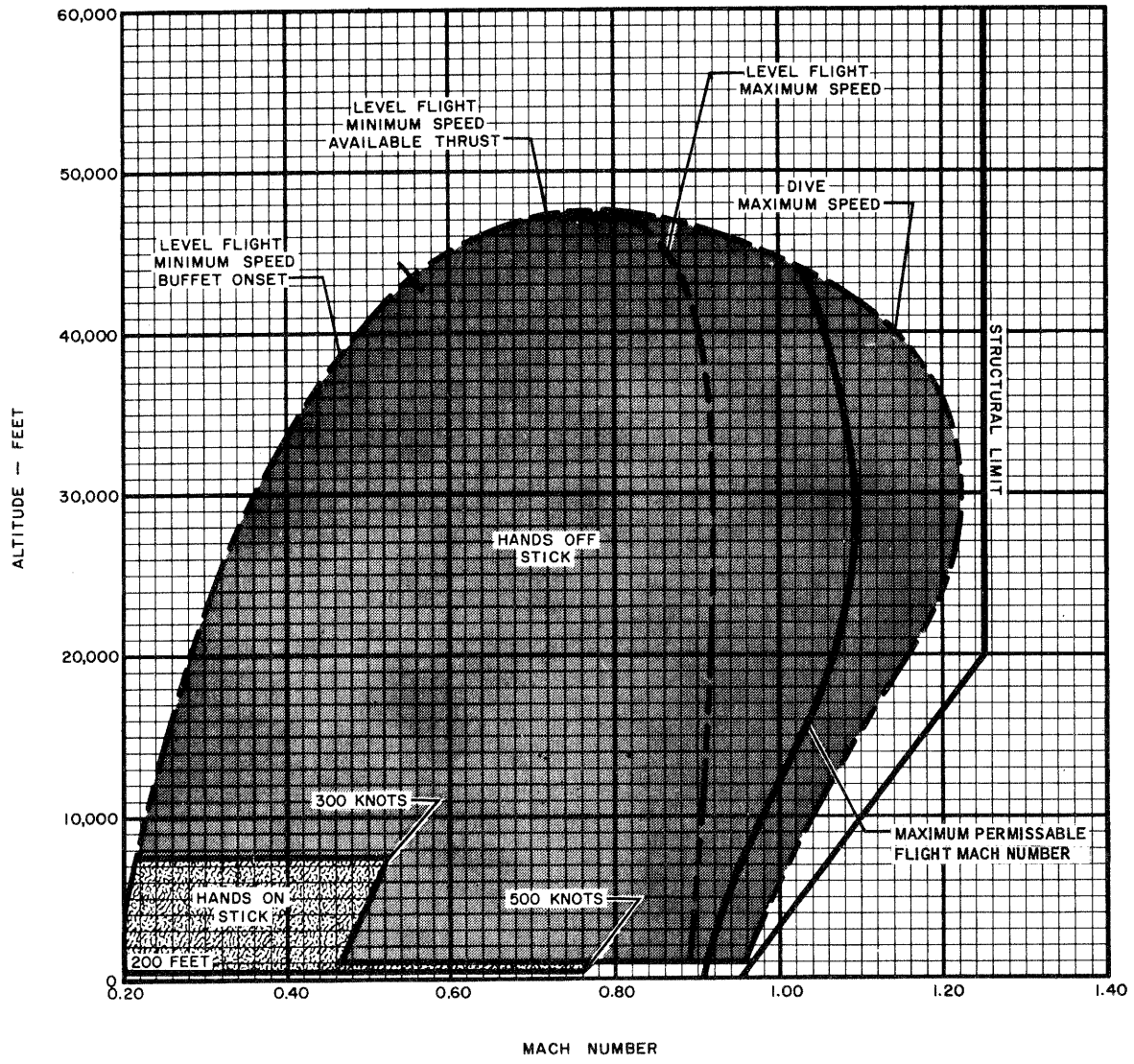
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DATA BASIS: Interim Revision No. 10 to A-4C Flight Manual Supplement

Figure 1-47. Operating Flight Strength Diagram

AFCS LIMITATIONS

MOD IV-A

MODEL: A-4C/L



AVB-1-1 P-20473-2A

REMARKS:

After incorporation of ASC 198

DATA AS OF: 1 December 1960

DATA BASIS: Contractor Flight Tests

Figure 1-48. AFCS Limitations

5. Carrier landing, and carrier arrestment . . . . . 14,500 pounds

6. Barricade engagement . . . . . 14,500 pounds

At gross weight in excess of 14,500 pounds as qualified above, only minimum rate of descent field landings are recommended. Field landings at gross weight in excess of 16,000 pounds should be attempted only in an emergency. (Refer to Section V, Landing at High Gross Weights.)

At high gross weights, engaging speeds should be held to a minimum to prevent structural damage to the aircraft. Refer to Section V, Field Arrestment, for data on engaging speeds. Additional catapulting gross weight limitations, as imposed by increased ambient temperatures and the 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 the applicable Aircraft Launching Bulletin for more detailed information.

7. Barrier Engagements

CAUTION

Barrier engagements are not recommended.

Compatability of the A-4 aircraft with this type of gear has not been flight tested, but engineering analysis has resulted in the following recommended procedures:

a. Planned use, such as a long field arrestment, is recommended only when no other type of arresting gear is available. Do not engage with fuel in the drop tanks.

b. Emergency use, such as a takeoff abort, would probably be unavoidable because the system is normally rigged. However, the hook should be lowered to increase the possibility of arrestment.

MISCELLANEOUS LIMITATIONS

Shipboard catapult shots with partial fuel loading in external drop tanks is prohibited.

The external baggage container (EBC) may be carried, loaded or empty, within the limits of flight for full 300-gallon tanks except as modified by the following restrictions:

1. Airspeed limitation is 525 KIAS or Mach 0.80, whichever is lower.

2. Normal acceleration limitations are minus 1.0 to positive 3.0g's.

3. Flight controls, propulsion controls, or other systems shall not be moved or operated so as to result in rapid or abrupt aircraft responses.

4. Side slipping or skidding shall be avoided.

5. Angle of bank shall not exceed 60 degrees.

6. Jettison in emergency only, in 1.0g level flight at a maximum of 475 KIAS/0.80 IMN.

CARRIER OPERATIONS LIMITATIONS

a. Catapult launch with an asymmetrical external stores loading in excess of 800 pounds (5120 foot-pounds) is not permitted. The maximum allowable crosswind for asymmetric loading is 15 knots. Launches with 15-knot crosswind require at least 10 knots above minimum endspeed. For less than maximum crosswinds, interpolation is permitted to determine required excess endspeed (figure 1-50). 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-knot crosswind - 2 units
11 to 15-knot crosswind - 3 units

b. Arrested landings with asymmetric wing station external store weights, including external fuel tank loadings, in excess of 1200 pounds are not permitted. Landings with a crosswind component under the unloaded, or light, wing, are not recommended.

c. For barricade engagement, refer to appropriate recovery bulletin for permissible arresting gear and barricade engagement speeds. Refer to Section V, Landing With Landing Gear Malfunctions, for recommended pilot action and technique for use of barricade.

EXTERNAL STORES LIMITATIONS

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. Refer to figure 1-51 for asymmetric wing load limitations.

For external stores limitations other than those listed in this Section, refer to NAVAIR 01-40AV-1T.

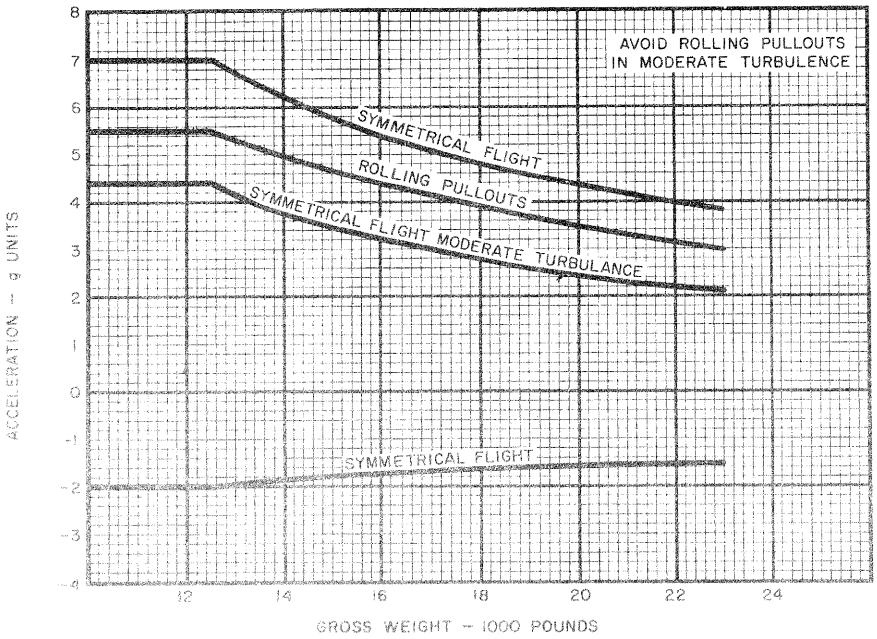
Note

- Field takeoffs are not permitted with asymmetrical loads exceeding 1200 pounds.
- Landings with a crosswind component under the unloaded or light wing are not recommended.
- Carrier arrested landings are prohibited with fuel in external tanks. Field arrested landings with fuel in external tanks are not recommended due to the possibility of structural failure of tank/rack during arrestment.

ACCELERATION LIMITS VS GROSS WEIGHT

NEW

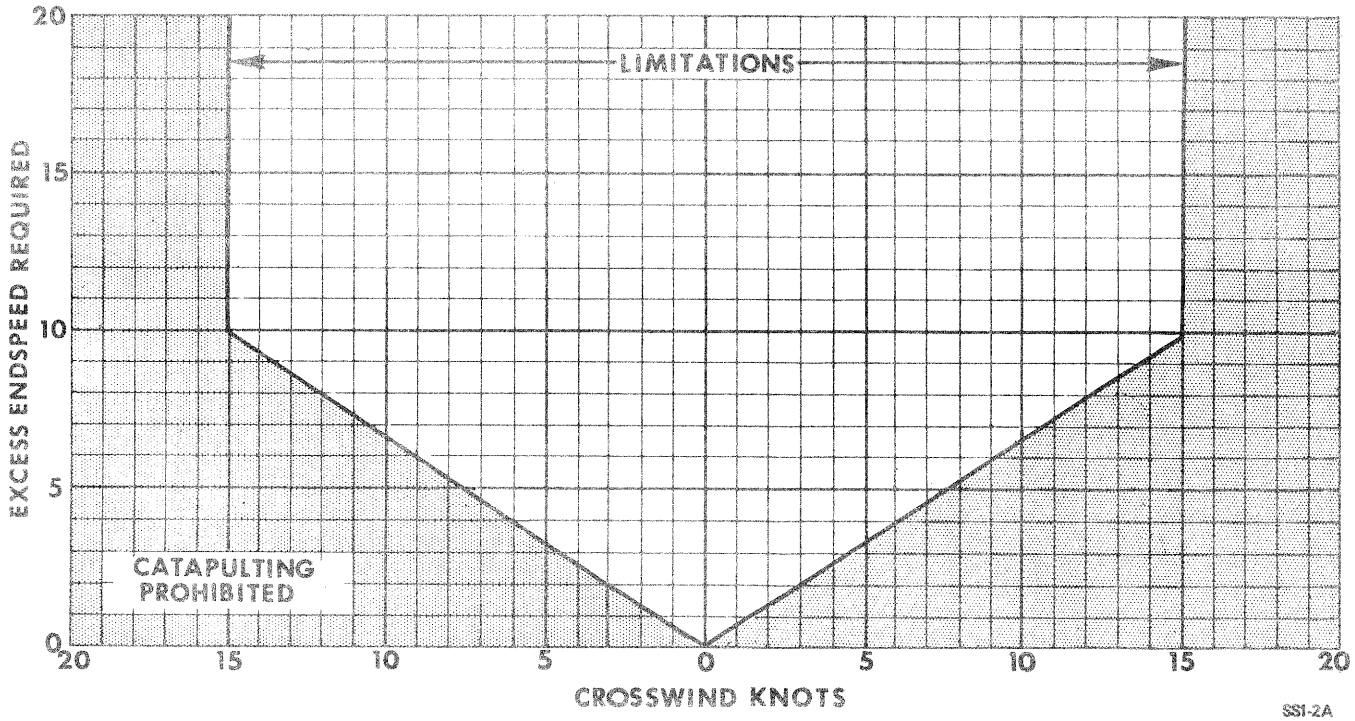
MODEL: A-4C/L



P-12938-1E

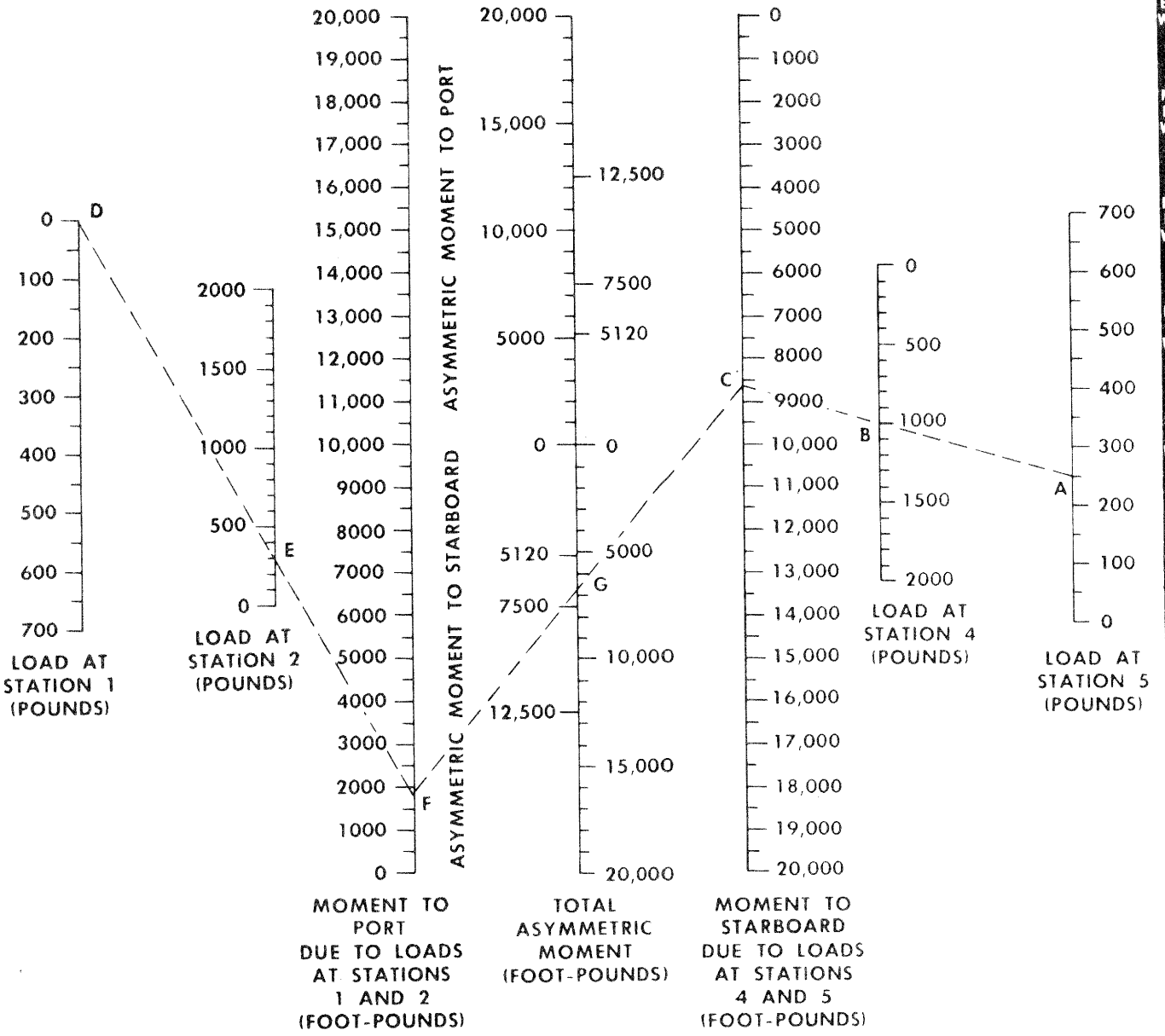
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DATA BASIS: Interim Revision No. 10 to A-4C Flight Handbook Supplement

Figure 1-49. Acceleration Versus Gross Weight



SS1-2A

Figure 1-50. Catapult Crosswind Versus Airspeed Above Minimum End Speed



TO USE THE NOMOGRAM CONNECT THE KNOWN LOADS ON STATIONS 1 AND 2 (FOR MODELS A-4C/L STATION 5 AND 1 LOADS ARE ZERO) WITH AN EXTENDED STRAIGHT LINE. READ THE MOMENT TO PORT DUE TO LOADS AT STATIONS 1 AND 2. REPEAT THIS PROCEDURE FOR STATIONS 4 AND 5 TO FIND STARBOARD MOMENT. CONNECT THE STARBOARD MOMENT AND PORT MOMENT WITH A STRAIGHT LINE. READ TOTAL ASYMMETRIC MOMENT AT THE INTERSECTION OF THE CONNECTING LINE AND THE TOTAL ASYMMETRIC MOMENT SCALE. IF THE TOTAL ASYMMETRIC MOMENT IS LESS THAN THAT ALLOWED FOR A GIVEN OPERATION THE 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 ASYMMETRICAL MOMENT	6745 FT-LB

SS1-41358-B

Figure 1-51. Asymmetric Wing Station Load Limitation Nomogram

SECTION II

INDOCTRINATION

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Introduction 2-1
Ground Training. 2-1
Flight Qualifications 2-3
Personal Flying Equipment Requirements . . . 2-4

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 aircraft when used in conjunction with the Naval Warfare Publications series. Unit commanders are authorized to waive flight hour minimums and/or OFT/WST training requirements where recent experience in similar models warrants; however, adequate preparation and guidance of the pilot, 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 ground work 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 OPNAV Instruction 3510.9 (current revision).

Training requirements, checkout procedures, evaluation procedures, and weather minima for ferry squadrons are governed by OPNAV Instruction 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 requirements for all pilots before familiarization (fam.) flight 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 listed below which pertain to differences in the new model.

1. Current medical clearance.

2. Aviation physiological training as set forth in OPNAV Instructions 3710.7 series.

3. NAMO Pilot Familiarization course (if available) or equivalent lectures by CRAW, operating A-4/TA-4 squadron, or other qualified personnel.

4. Lectures from CRAW, 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 before the first fam. 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, poststart checks using plane captain's signals, taxi, and securing engine.

10. Aviators' 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, 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. AN/APG-53A radar operating procedures (A-4C)
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 climb-out 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 period 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

NEW

Minimum requirements for qualifications are set forth for each phase of flight. Minimum requirements for currency are set forth in OPNAVINST 3710.7 series. Command prerogative may 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. Comply with the general conditions specified in Section IV.
3. Initial checkout flights will consist of a minimum of 5 hours.

Instruments

Minimum requirements before actual instrument flight are:

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 ground training.
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 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 OPNAVINST 03740.8 (current revision).

Minimum requirements before night weapons training are:

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 proficiency in type delivery in model being flown.
3. Familiarity 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 before night flights are:

1. Current instrument card.
2. Ten hours in A-4/TA-4 aircraft within the last 3 months.
3. For carrier based operations, one day carrier landing will be required prior to the night carrier landing if 10 days or more have elapsed since the last night arrestment.

FCLP and Carrier Qualification

If any of the following requirements are contradictory to the LSO NATOPS Manual, the LSO NATOPS Manual will take priority.

Minimum requirements before day FCLP are:

1. Ten hours in A-4/TA-4 aircraft and one flight within 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.

Minimum requirements before night FCLP are:

1. Demonstration of proficiency in day FCLP.
2. Five hours night time in the A-4/TA-4 aircraft.
3. One A-4/TA-4 flight within the last 10 days; otherwise one day flight will be required before the night FCLP period.
4. Proficiency in instrument flying in assigned model.
5. Proper briefing in night FCLP procedures.

Minimum requirements before day carrier qualifications are:

1. Certification by Unit Commander as day field-mirror-landing qualified in model to be flown.
2. Fifty hours in A-4/TA-4 aircraft.
3. Proper briefing in carrier landing, catapult, and deck procedures.

Minimum requirements before night carrier qualifications are:

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 the 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.

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. Minimum carrier landings for initial qualification are:

Minimum day qualifications are:

1. Two touch-and-go landings.
2. Ten arrested landings.
3. Two day CCA approaches from Marshal point.

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 the day CCA qualification).

For maintaining qualifications, qualification is considered current for 6 months after the date of the last carrier landing in type. Refresher requirements to requalify are:

1. Six to twelve months: 4 day and 2 night arrested landings.
2. Over 12 months: initial requirements, both day and night.

Cross-Country Flight

Minimum requirements before cross-country flight are:

1. Current instrument card.
2. Fifteen hours in A-4/TA-4 aircraft including 3 hours instrument time.
3. Flight packet, which includes security, accounting, servicing data, and accident forms.
4. Familiarity with aircraft servicing, starter probe installation and stowage.

PERSONAL FLYING EQUIPMENT REQUIREMENTS

The applicable flying equipment delineated in OPNAVINST 3710.7 series shall be carried/worn on every flight. In addition the following items not delineated in OPNAVINST 3710 series are also considered required flying equipment:

1. Integrated torso harness.
2. Approved light.
3. Shroud cutter.
4. Other survival equipment appropriate to the climate or required by any unusual conditions that may be peculiar to the area.
5. Survival transceiver, if available.

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

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PART 1

BRIEFING/DEBRIEFING

BRIEFING

Briefing shall 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 kneepad 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.

The briefing guide should include the following items, when applicable:

GENERAL

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, line 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 PIM.

2. Climbout and rendezvous.

3. Operating area procedures and restricted areas.

4. Mission plan, including fuel/oxygen management.

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, waveoff.

11. Divert and emergency fields/ready deck.

COMMUNICATIONS

1. Frequencies.

2. Controlling agencies.

3. Radio procedure and discipline.

4. ADIZ procedures.

5. IFF/SIF.

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 settings.

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, enroute, and destination (existing and forecast).

2. Weather at alternate/divert fields.

3. Winds, jet stream, temperature, and contrail band width.

EMERGENCIES

1. Takeoff aborts.

   a. Takeoff refusal speed.

   b. Stopping distance from refusal speed.

   c. Arresting gear availability/location.

NEW NEW

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 detail specifics of these deliveries are set forth in the A-4/TA-4 Tactical Manual (NAVAIR-01-40AV-1T). A mission turning 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

SCHEDULING

The Commanding Officer or his designated representative is responsible for the promulgation of the flight schedule, when based ashore. The flight schedule is an order of the Commanding Officer. It shall be followed rigidly. Variations require the approval of the Commanding Officer or his designated representative.

Shore-based scheduling will be directed toward preparation for deployment, with the exception of administrative commands (including the CRAW's). These preparations will include intensive weapons training, culminating in competitive exercises and the maintenance of pilot proficiency in carrier landings and/or short field operations, if required.

PRIOR TO FLIGHT

Preflight Inspection

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 in figure 3-1.

Forward Fuselage

1. Air refueling probe cover . . . . . REMOVED
2. Air conditioning intake and exhaust ducts . . . . . CLEAR
3. Static pressure vent (left side) . . . . . CLEAR
4. Angle-of-attack cover . . . . . REMOVED
5. Nose compartment panels . . . . . CONDITION, SECURITY
6. Nose compartment cooling air inlet . . . . . CLEAR
7. Static pressure vent (right side) . . . . . CLEAR
8. Controls access panel (right side) . . . . . SECURE
9. Nosewheel well door . . . . . CONDITION, SECURITY
10. Nosegear strut . . . . . EXTENSION, NO LEAKAGE
11. Nosewheel tire . . . . . CONDITION

NEW 11a. Airconditioning ground test plug (nosewheel well) . . . . . SECURITY

12. Nosegear downlock pin . . . . . INSERTED

NEW 12a. Nosewheel spindle nut . . . . . SECURITY

13. Emergency generator . . . . . RETRACTED, SECURE
14. External canopy jettison handle . . . . . STOWED: ACCESS DOOR CLOSED
15. Gun flash suppressors and guns . . . . . SECURE
16. Forward engine compartment . . . . . CONDITION AND SECURITY
17. Guncharger pneumatic pressure gage . . . . . CHECK
18. Aileron power package . . . . . OVER-CENTER

Right Wheelwell

1. Main wheelwell doors . . . . . CONDITION, SECURITY
2. Taxi light . . . . . SECURITY
3. Gun pneumatic pressure gage . . . . . CHECK
4. Armament safety disable switch . . . . . SAFE
5. Catapult hook . . . . . PRELOAD, SECURITY

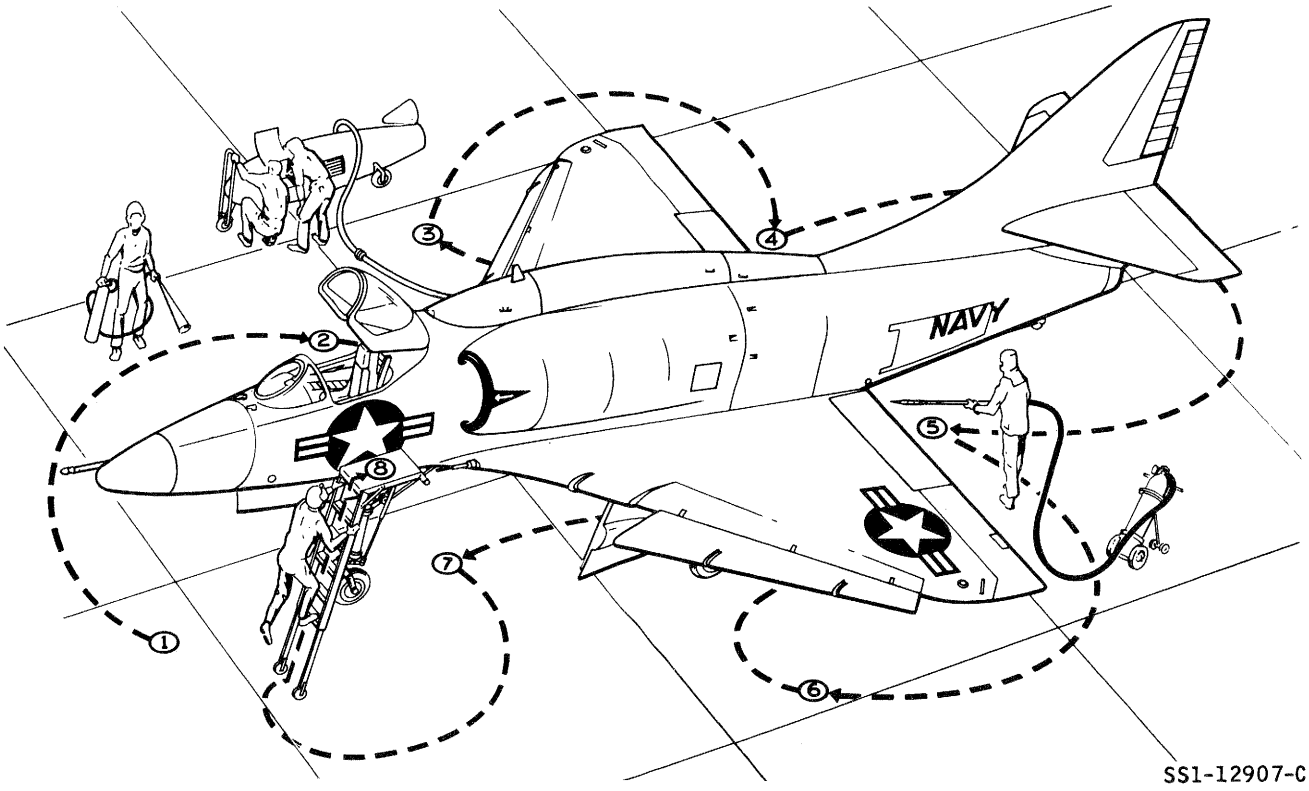


Figure 3-1. Exterior Inspection

6. Main gear downlock pin . . . . . INSERTED
7. Main wheel strut . . . . . EXTENSION, NO LEAKAGE
8. Main wheel and tire . . . . . CONDITION
9. Brakes . . . . . CONDITION, NO LEAKAGE
10. Fuel system vent . . . . . CLEAR

Right Wing

1. General condition. . . . . WRINKLES, CRACKS, LOOSE RIVETS; FUEL DEPOSITS
2. Wing rack stores . . . . . SECURE
3. Drop tank . . . . . REMOVE FILLER CAP, VISUALLY DETERMINE LOADING, REPLACE FILLER CAP
4. Wing Slat . . . . . FREE MOVEMENT

Note

Operate each slat by hand to ensure 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.

5. Position and fuselage wing lights . . . . . CONDITION

6. Aileron and wing flap . . . . . CONDITION, BONDING

7. Spoiler (A-4L) . . . . . CONDITION, BONDING

8. Wing tank fillercap . . . . . SECURE

9. Fuselage tank fillercap . . . . . SECURE

Aft Fuselage and Tail Section

1. All access doors . . . . . CLOSED

2. Speedbrake . . . . . CONDITION, SECURITY

3. Tailpipe cover . . . . . REMOVED

4. Tailpipe . . . . . CRACKS, WRINKLES, BURNS, FUEL DEPOSITS

5. Tail light . . . . . CONDITION

6. Rudder, elevator, and horizontal stabilizer . . . . . CONDITION, BONDING

7. Speedbrake . . . . . CONDITION, SECURITY

8. Arresting hook . . . . . RETRACTED AND LOCKED; CONDITION

9. Tension bar retainer . . . . . CONDITION

10. Arresting hook hold-down cylinder pressure gage . . . . . 900±50 PSI

11. Aft engine compartment . . . . . CONDITION, SECURITY

12. Drop tank fueling switch . . . . . OFF

Left Wing

1. General Condition . . . . . WRINKLES, CRACKS, LOOSE RIVETS, FUEL DEPOSITS

2. Wing flap and aileron . . . . . CONDITION, BONDING

3. Spoiler (A-4L) . . . . . CONDITION, BONDING

4. Aileron tab . . . . . CONDITION

5. Navigation and fuselage (wing) lights . . . . . CONDITION

6. Slats . . . . . FREE MOVEMENT

7. Wing-rack stores . . . . . SECURE

8. Drop tank . . . . . QUANTITY, SECURITY

9. Approach lights and cover . . . . . CONDITION

Left Wheelwell

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 and tire . . . . . CONDITION

6. Brakes . . . . . CONDITION, NO LEAKAGE

Center Fuselage Underside

1. Fuselage rack store . . . . . SECURE

2. Forward engine and accessories section access doors . . . . . CLOSED

3. Link and case ejection chutes . . . . . CLEAR

4. Centerline fuel tank . . . . . REMOVE FILLER CAP, DETERMINE LOADING, REPLACE FILLER CAP

5. Centerline external baggage container (If installed) . . . SECURE; CHECK BAGGAGE TIEDOWN; DOORS SECURED NEW NEW

Cockpit Area, External

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 plugs. . . . . REMOVED

5. Intake ducts. . . . . 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 1A-1 Ejection Seat With DART System Preflight (AFC 359 Incorporated)

1. Ejection control safety handle (headknocker). . . . . DOWN

2. Canopy air bungee cylinder pressure gage . . . . . PER INSTRUCTION ON BUNGEE

3. Cable to jettison control pulley in canted bulkhead (AFC 432 not incorporated) . . . . . ENGAGED

4. Canopy-seat interlock cable. . . . . ENGAGED

5. Canopy bungee trigger aligned. . . . . IF APPLICABLE

6. Ejection seat catapult safety pin and two canopy jettison pins . . . . . REMOVED

7. Emergency oxygen lanyard . . . . CONNECTED

8. DART system lanyard. . . . . CONNECTED

9. Emergency oxygen . . . . . 1800 PSI

10. Harness release actuator pin . . . . . NOT VISIBLE

11. Face curtain and lower ejection handle . . . . . STOWED

12. Emergency restraint release handle stowed and parachute arming cable secured . . . . . CHECK (push down on emergency restraint handle)

13. Shoulder harness secured . . . . . LOCKING PIN VISIBLE

14. Lap belt secured . . . . . HARD PULL

15. NB-11 or NES-16 parachute . . . . . INSTALLED

Note

Ensure that parachute EPC static line is stowed beneath parachute arming lanyard housing in retainer on right side of seat and not routed beneath parachute pack opening bands.

16. Spreader gun safety pin . . . . . STOWED

WARNING

If the ballistic spreader gun safety pin has not been removed, the parachute canopy will not deploy.

INTERIOR INSPECTION

CAUTION

Upon entering the cockpit, ensure the landing gear handle is DOWN and master arm switch is OFF.

Check the general appearance of the cockpit, and make certain 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:

1. Antiblackout, suit blower, and oxygen hoses. . . . . CONNECTED

2. Oxygen switch. . . . . ON/CHECK FLOW/, THEN OFF

3. Exposure suit vent switch . . . . . OFF

4. Emergency speedbrake knob . . . . . NORMAL

5. Emergency fuel transfer switch . . . . . OFF

6. AN/APN-154(V). . . . . OFF

7. AFCS standby switch. . . . . OFF

8. AFCS aileron trim switch . . . . . NORM

9. Radar selector switch. . . . . OFF

10. Drop tanks switch . . . . . OFF

11. Engine starter switch . . . . . PULLED UP

12. Fuel control switch. . . . . PRIMARY

13. Manual fuel shutoff control lever . . . . . CYCLE/NORMAL (GUARD DOWN)

14. JATO arming switch. . . . . SAFE

15. JATO jettison switch . . . . . SAFE

16. Throttle . . . . . OFF

17. Speedbrake switch . . . . . CLOSED

18. Master exterior lights switch. . . . . OFF

19. Throttle friction wheel . . . . . SET

20. Flap handle . . . . . UP
21. Spoiler switch . . . . . OFF
22. Airstart switch . . . . . OFF
23. APC switch . . . . . OFF
24. Windshield wiper switch . . . . . OFF
25. Radar altimeter aural warning . . . . . OFF
26. Accelerometer . . . . . PUSH/TO RESET
27. Airspeed indicator . . . . . O, SET
28. Altimeter . . . . . SET & CHECK
29. Vertical speed indicator . . . . . O
30. Gunsight . . . . . SET, LOCK
31. Radar altimeter . . . . . OFF
32. Emergency stores jettison select switch . . . . . AS DESIRED
33. All armament switches . . . . . OFF
34. Emergency handles . . . . . STOWED
35. Arresting hook handle . . . . . UP
36. AN/ASN-19A . . . . . SET UP
37. UHF function switch . . . . . OFF
38. TACAN . . . . . OFF
39. IFF master switch . . . . . OFF
40. SIF controls . . . . . SELECT CODE
41. AN/APR-25(V) . . . . . OFF
42. Compass controller . . . . . SLAVED, LATITUDE SET
43. Interior lights control panel . . . . . ALL SWITCHES
44. Emergency generator bypass switch . . . . . NORMAL
45. TACAN antenna switch . . . . . AS DESIRED
46. Spare lamps container . . . . . ADEQUATE SUPPLY
47. Cabin temperature knob . . . . . AS DESIRED
48. Cabin pressurization switch . . . . . NORMAL
49. Windshield defrost switch . . . . . HOLD
50. Exterior lights control panel . . . . . ALL SWITCHES OFF
51. ECM control panel switches . . . . . OFF
52. Headknocker . . . . . AS DESIRED NEW
53. Preflight check the thermal radiation closure.

WARNING

Ensure that ejection control safety handle (headknocker) is stowed and locked in the full up position before flight.

Before Starting the Engine

(Refer to figure 7-1, Starting and Poststart Signals.)

Ensure that the areas forward and aft of the aircraft are clear of personnel and loose objects. (See figure 1-40 for danger areas.) Ensure that fire fighting equipment is available and manned. If possible, start the engine with the aircraft headed into the wind under high wind/temperature conditions, as a tailwind will increase exhaust gas temperature and will aggravate any engine fire occurring during starting.

STARTING REQUIREMENTS

A source of high pressure air is required for starting the engine.

Starting the Engine

The engine should be started on the ground in the following prescribed manner:

1. Throttle . . . . . OFF
2. GTC air . . . . . APPLIED
3. Throttle . . . . . IDLE 4 seconds after GTC air is supplied
4. GTC air . . . . . REMOVED, when RPM 25-30 percent (midway between start and IDLE)

5. RPM . . . . . IDLE

Note

When required to eliminate the idle "honking", rpm may be permitted to increase until the EPI pointer moves slightly above the IDLE block, provided the temperature limits are not exceeded.

6. EGT . . . . . 650° C MAX

Note

At IDLE rpm, the temperature will normally stabilize below the maximums.

7. Fuel boost . . . . . NORM

8. Oil pressure . . . . . NORM (24 to 50 PSI)

Note

If the oil pressure window reads OUT at IDLE rpm, check the oil pressure gage; if between 16 and 24 psi, increase rpm to slightly above IDLE. If NORM is not indicated at this higher rpm, shut down the engine and determine the reason for low oil pressure indication. Refer to section 1, part 4 for oil pressure limitations.

CAUTION

Immediately following a successful start, signal ground crew to remove the starter. Running the engine with the starter inserted transmits feedback torque and may damage the starter engaging mechanisms.

Abnormal Starts

HOT STARTS

Any start during which the exhaust (EGT) exceeds 720°C is a hot start. If the starting limit seems likely to be exceeded, immediately move the throttle to OFF.

CAUTION

If the temperature during any start exceeds 720°C, an inspection is required. Pilots should record maximum temperature and duration.

Investigate if the engine consistently exceeds the starting limit when ambients are not high and other engines are starting normally.

FALSE/HUNG START

Normally engine starting speed should be attained within 30 seconds after GTC air is supplied to the starter, and light off should occur within 15 seconds after movement of the throttle to IDLE. (See figure 3-2). When the engine lights off normally and the EGT remains within limits, but the rpm does not increase to IDLE, a false start is indicated. If the rpm does not reach IDLE within 120 seconds after moving the throttle to IDLE, retard the throttle to OFF and signal to cut off GTC air to the starter. Have ground crew investigate the cause of the false start prior to making another start attempt.

WET STARTS

A wet start will occur when engine light off is not obtained within 15 seconds after moving the throttle to IDLE. When this occurs, there will be no EGT indication and fuel vapor will emit from the tailpipe. When a wet start is determined by ground personnel, retard the throttle to the OFF position and proceed with clear engine procedure.

CHUGS AND STALLS

If "chugging" is encountered during an acceleration, there will be a momentary rpm hesitation without an exhaust gas temperature rise. Engine stall may or may not be accompanied by chugging. If a stall is encountered, the rpm will hangup then start dropping, with the exhaust gas temperature increasing rapidly. Should either a chug or a stall occur, shut down the engine and investigate.

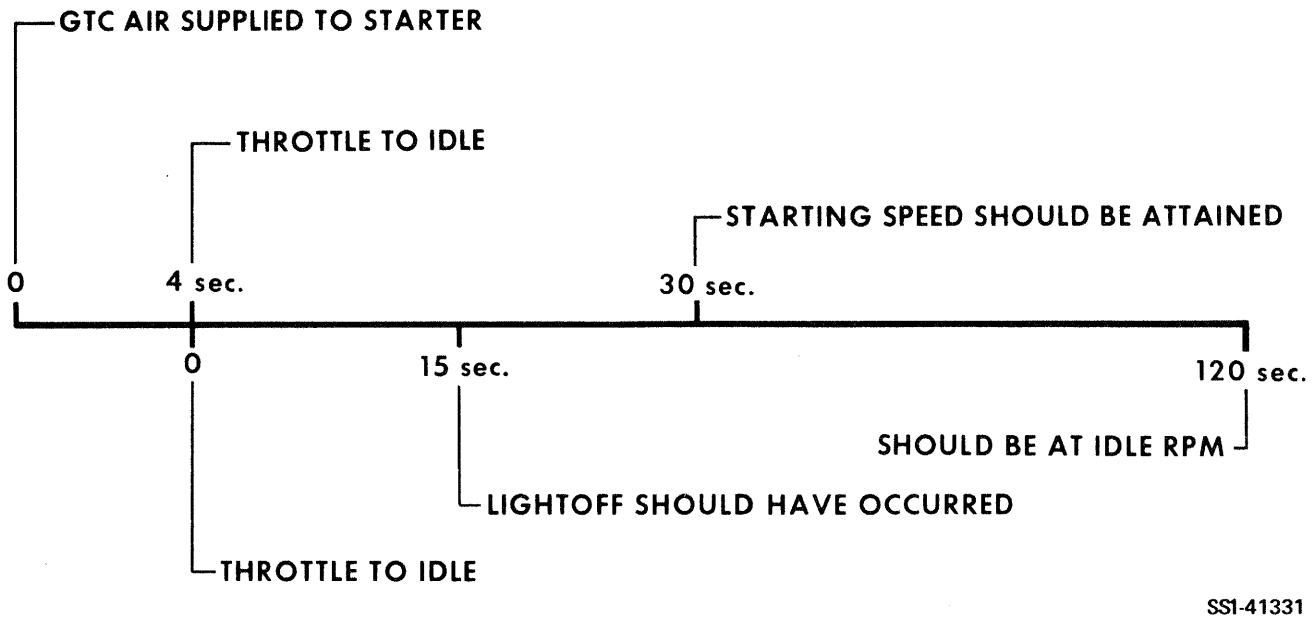


Figure 3-2. Engine Starting Sequence Chart

CLEAR ENGINE PROCEDURE

Inspect aft fuselage for fuel, if no fuel exists proceed as follows:

1. Throttle . . . . . OFF
2. GTC air . . . . . APPLIED
3. Engine . . . . . WINDMILL 15 TO 20 SECONDS
4. GTC air . . . . . OFF

Engine Ground Operation

No warmup period is necessary.

CAUTION

- To limit operating time in the region of high compressor blade vibratory stresses (first three stages), avoid steady-state inflight and ground operation in the 60- and 82-percent rpm range except as specifically required by the mission.
- Be extremely cautious when it becomes necessary to pass objects to or from ground crewman with the engine running. This practice has proved dangerous because of foreign object ingestion into engine with resultant damage to blading.

EQUIPMENT GROUND LIMITATIONS

Warmup stabilization time and ground limitations for the listed electronic equipment are as follows:

Item	Remark	Warmup/ Stabilization	
AN/ARC-27A	See Note 1	1 minute	
AN/ARC-51A		3 minutes	
AN/ARA-25	See Note 1	1 minute	NEW
AN/ARN-21/52		3 minutes	
AN/APX-6B	See Note 1	1 minute	
AN/APX-72		3 minutes	
AN/APA-89		1 minute	
AN/ASQ-17B	See Note 1	1 minute	
AN/ASN-19A		2 minutes	
AN/AJB-3		90 ±10 seconds	NEW
AN/AFCS		90 seconds	
AN/APG-53A		3 minutes	
AN/APN-154(V)		5 minutes	
AN/APR-25(V)		3 minutes	
AN/ARR-69		3 minutes	

Note 1: 30-minute ground limitation without air conditioning.

POSTSTART CHECKLIST

When electrical power becomes available after starting the engine, check the following items:

1. Seat . . . . . CHECK
2. UHF function switch . . . . . T/R+G
3. IFF master switch . . . . . STBY
4. TACAN switch . . . . . REC

CAUTION

Remain in REC position for 3 minutes before going to T/R position.

5. AFCS . . . . . STANDBY
6. Fuel control . . . . . CHECK

NEW 6A. Air start switch . . . . . CHECK OPERATION

7. APC switch . . . . . STBY/CHECK APC LIGHT/OFF
8. Depress master TEST switch to check APC, angle-of-attack indexer, LAWS, WHEELS, FIRE, OBST (radar), and ladder lights. The fuel quantity and liquid oxygen quantity indicators will rotate counter-clockwise. The liquid oxygen warning light will come on as the indicator passes through 1 liter.

Note

- Aircraft not reworked per A-4 AFC 345, LAWS, LABS, WHEELS, FUEL, OBST, and radar altimeter lights will not come on from the master TEST switch, but must be individually pressed to test.
- Aircraft reworked per AFC 356, IFF Mode 4 lights will also come on with the master TEST switch.

9. Fuel quantity . . . . . Check INT/EXT readings
10. LOX quantity . . . . . NOTE
11. Attitude gyro indicator. . OFF FLAG DISAPPEARS (WITHIN 90± 10 SECONDS)
12. Standby gyro . . . . . ERECT OFF FLAG NOT VISIBLE
13. Compass controller panel . . . . . SET
14. AFCS . . . . . RUN CHECKS, THEN ENSURE OFF AFTER CHECKS COMPLETED

WARNING

Do not operate any hydraulically operated equipment unless acknowledgement is received from plane captain.

Note

See figure 7-1 for meanings of poststart signals.

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 that is giving a signal, always direct the flashlight away from the person being signaled.

15. All flight controls . . FREE, FULL TRAVEL, PROPER MOVEMENT
16. Flaps . . . . . FULL OPEN
    Speedbrakes . . . . . OPEN
    Hook . . . . . DOWN
    Spoilers . . . . . UP
    Spoilers . . . . . CYCLE WITH THROTTLE ON P/C SIGNAL NEW

Note

Pilot should hold both hands up while P/C is making checks.

17. Flaps . . . . . SET AT 1/2
    Speed brakes . . . . . CLOSED
    Hook . . . . . UP
    Spoilers . . . . . DOWN
18. Rudder trim . . . . . CHECK AND SET AT ZERO
19. Horizontal stabilizer manual override lever. . CHECK OPERATION AND INDICATION
20. Horizontal stabilizer . . . . . SET
21. Aileron . . . . . STICK CENTERED TAB FAIRED ±1/5 INCH. CHECK BOTH LEFT AND RIGHT TRIM
22. Drop tank pressure . . . . . ON
23. Drop tank pressure . . OFF AFTER THUMBS UP FROM P/C
24. Emergency transfer. . . . . CHECK

NEW NEW NEW NEW

Note

- This emergency transfer check may be done at idle power. The idle power check may allow use of the FUEL TRANS caution light (going off and on) as a secondary indication of wing cell pressurization and depressurization.
- Fuel stores on center station should be pressurized before checking the emergency transfer system to prevent inadvertent dumping from the store vent outlet.

25. Pins. . . . . HAVE P/C PULL, STOW & CHECK ALL ACCESS DOORS CLOSED

NEW

26. Altimeter . . . . . PERFORM FIELD ELEVATION CHECK, NOTE ERROR, LEAVE IN RESET MODE

27. Headknocker . . . . . ENSURE UP

28. Canopy . . . . . RESTRAINT STRAP ATTACHED OR CANOPY CLOSED

Note

Prior to takeoff it is recommended that a final check be made to ensure security of panels, removal of pins, no leaks, and for partial/full manual flight control disconnect.

TAXI

When ready to taxi, signal the plane captain to remove chocks and turn anti-collision light on. Advance throttle to about 60-percent before releasing the brakes. Release brakes and, when the desired taxi speed is reached, retard throttle to IDLE. Be cautious in confined or restricted areas.

Note

- With the spoiler switch in the ARMED position, the spoilers will be open as long as the throttle is below the 70-percent setting.
- Ensure that the canopy restraint strap is attached to the right-hand canopy latching hook prior to taxiing with the canopy in the open position.

Sharp turns can, in some instances, lock the nosewheel at full throw, requiring outside help or excessive power application for recovery. To prevent foreign object damage to engines, pilots shall maintain a minimum taxi interval of 200 feet, or taxi in close formation with wingtip clearance and aircraft intakes clear of leader's exhaust. While taxiing, determine that the nose strut is not overinflated by observing that nose strut will compress when brakes are applied firmly. Check standby compass swinging freely and adequate fluid level; turn indicator deflecting normally. The oxygen mask should be worn whenever the canopy is closed and the pressurization is on, due to toxic fumes that may enter the cockpit via the air conditioning system.

CAUTION

- Do not taxi with the canopy open at speeds which, coupled with headwinds, would cause the relative wind to exceed 60 knots. 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.
- Prolonged IDLE operation before takeoff should be avoided to prevent exceeding the permissible aft CG limit as fuselage fuel is used. Wing tank fuel will not transfer to the fuselage tank at IDLE rpm; therefore, when the fuel quantity gage drops to approximately 1100 pounds remaining, the engine should be operated above IDLE to replenish the fuselage fuel.

Pretakeoff Engine Checks

MANUAL FUEL CONTROL CHECK

A check of the manual fuel control system should be made before each flight, as follows:

1. Set throttle to IDLE.

2. Shift the fuel control to MANUAL. Check that the warning light comes on. Expect a momentary engine and fuel flowmeter surge.

3. Switch fuel control back to PRIMARY. Manual fuel warning light should go off. A momentary fuel flow drop and surge of rpm and EGT may accompany the switch back to PRIMARY. (Refer to FUEL CONTROL in Section I, Part 2.)

Note

Recommended engine checks at MILITARY power will generally need to be made durint the takeoff roll. Static engine tests without tiedown will have to be made at the maximum power setting which can be maintained without the aircraft sliding with the brakes locked (approximately 90 percent).

AIR START SWITCH CHECK

1. Fuel control switch . . . . . PRIMARY
2. Throttle. . . . . IDLE
3. Air start switch . . . ON (momentarily)

CAUTION

Air start switch should be in the ON position only momentarily. Prolonged idle with the air start switch on may cause damage to the combustion chamber liner.

4. Fuel flow gage . . . . . Check for momentary decrease (100 to 150 PPH) in fuel flow. (150 PPH maximum drop)
5. Air start switch . . . . . OFF

CAUTION

Lack of fuel flow decrease may indicate either continuous primer fuel (and possible hot section damage) or inability to effect an air start.

PRETAKEOFF CHECKLIST

1. Trim . . . . . AILERON – STICK CENTERED, AILERONS SYMMETRICAL, TAB FAIRED ±1/5 INCH

   RUDDER 0°

   HORIZONTAL STABILIZER – FIELD 8° ANU, CATAPULT AND JATO AS REQUIRED
2. Harness. . . . . SHOULDER HARNESS LOCKED
3. Canopy. . . . . HANDLE OVERCENTER, CANOPY HOOKS ENGAGED IN ROLLERS
4. Flaps . . . . . Set at 1/2
5. Speedbrakes . . . . . Closed
6. Armament . . . . . All switches off, emergency selector switch appropriate setting.
7. Spoilers (A-4L) . . . . . ARMED (SHORE-BASED OPERATIONS)

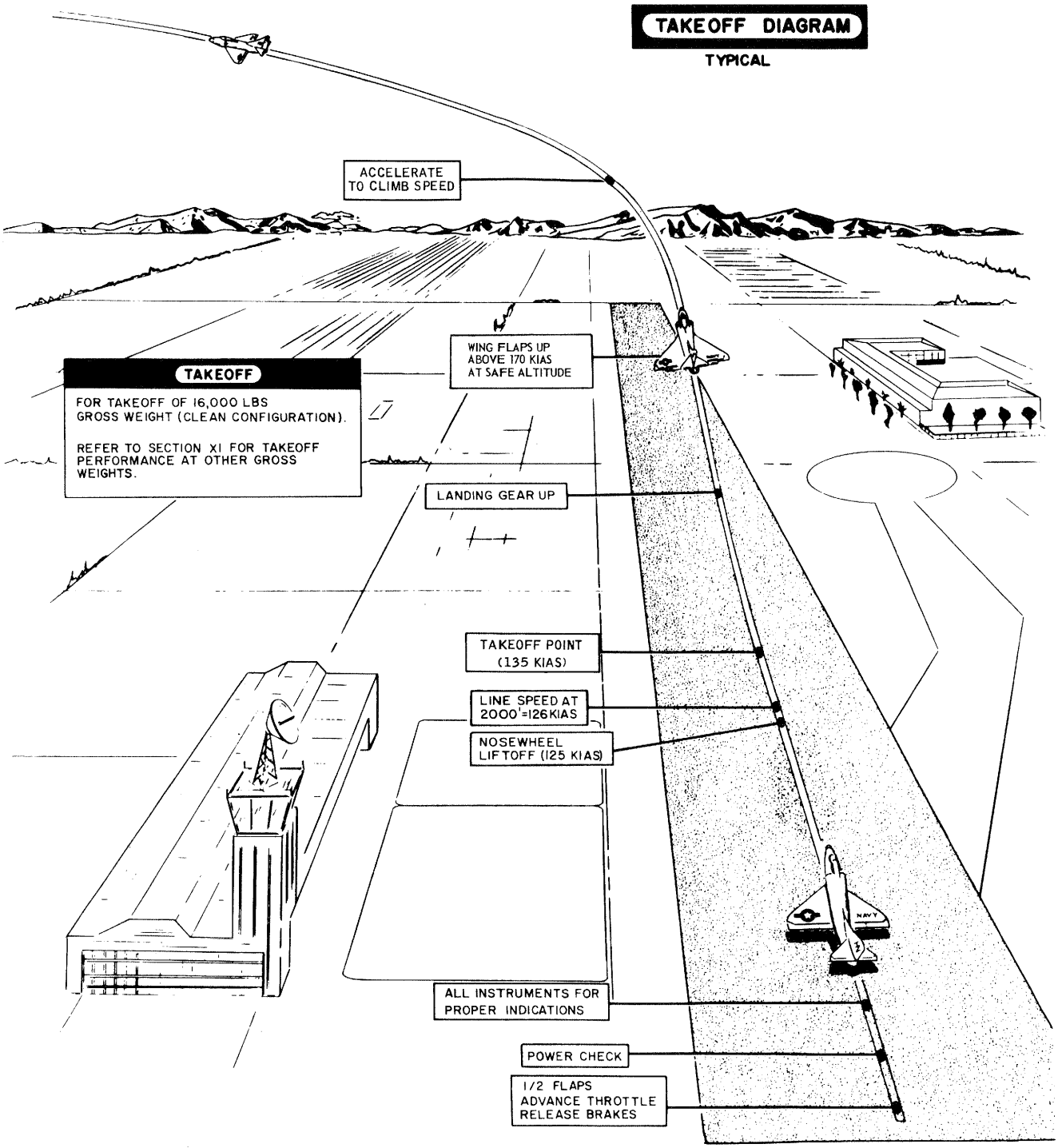


Figure 3-3. Takeoff Diagram

WARNING

Ensure that the seat catapult safety handle is in the up position for takeoff. On aircraft with the thermal radiation closure installed, the lower ejection handle located on the seat pan between the pilot's legs is recommended for ejection.

NEW

Note

Before takeoff, it is recommended that the cabin temperature control knob be positioned at approximately the 12 o'clock position, and all of the defrost air be diverted to the foot-warmers. Direct the eyeball diffusers away from the face.

Takeoff

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, no fuel or hydraulic leaks, the presence of oil mist from the oil vapor ducts, and ejection control ground safety handle up. Half-flaps should be used for takeoff during normal shore-based operations. (See figure 3-3 for typical takeoff diagram.) Each pilot shall indicate his readiness for takeoff by giving a "thumbs-up" up the line.

For a single takeoff, the centerline of the runway should be used as a directional guide. For section takeoffs the leader should use the downwind side of the runway, with the other aircraft forming an echelon in tactical order. Lateral separation shall be ensured to prevent collision should the leader abort or the wingman overrun. One section shall be airborne before the next section commences takeoff roll. Where individual takeoffs are made with two or more aircraft, the second aircraft shall commence takeoff roll not less than 10 seconds behind the first aircraft. When the crosswind component exceeds 8 knots, individual takeoffs will be made. The pilot will inform the tower immediately by radio if takeoff is aborted. Formation takeoffs are not permitted with dissimilar aircraft types. If strong crosswinds exist, take off on the upwind side of the runway and apply forward stick as necessary to maintain nosewheel on the runway until computed lift-off speed is reached. Deflect stick into the wind as necessary to maintain lateral control. Use brakes to maintain directional control until rudder becomes effective (about 70 KIAS).

CAUTION

The recommended maximum crosswind components for takeoff is 15 knots. Excessive forward stick pressure may cause a blown nose tire during takeoff roll.

As the engine accelerates through 90 percent during the acceleration check, release brakes to prevent skidding the tires. Check acceleration time, ensuring that it is within acceptable limits, and that engine smoothly accelerates through the 80 percent hangup point.

Note

- Timing of acceleration may be omitted during section takeoffs if engine has accelerated smoothly through the 80 percent hangup range on turn up before brake release. For individual takeoffs, check time of acceleration: IDLE TO MILITARY rpm 15 seconds or less; 75 percent to MILITARY rpm 4 seconds or less.
- During manipulation of the throttle from IDLE to MILITARY, a momentary "flat spot" in the rising exhaust gas temperature curve may occur before military rpm is achieved. This is a result of engine rpm passing through the best engine-cooling speed range, and need not concern the pilot, provided the temperature does not go below 350°C.

When engine stabilizes initially, 101 percent rpm and 580°C EGT are the minimums acceptable for normal takeoffs. Use brakes to maintain directional control until rudder becomes effective (about 70 knots). On rough runways, nosewheel bounce may be experienced. Apply forward stick as necessary to keep the nosewheel on the runway. Check the predicted line speed at selected distance marker. This checkpoint should be selected to allow normal braking technique to stop the aircraft on the runway remaining. Ten knots before predicted takeoff speed, raise the nose to a takeoff attitude and allow aircraft to lift off. After comfortably airborne, retract landing gear and apply brakes momentarily to stop main gear tire rotation. Raise the flaps at 170 KIAS or above.

NEW

Note

Almost constant trimming of the horizontal stabilizer will be necessary after takeoff while accelerating to best climbing speed.

Be prepared for 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.

MINIMUM RUN TAKEOFF

NEW NEW NEW NEW NEW NEW NEW NEW

Minimum distance takeoff technique of nosewheel lift-off and full noseup trim results in only a very minor improvement in takeoff distance (approximately 200 feet at all gross weights tested) and no improvement in 50 foot obstacle clearance distance. If takeoff distance is predicted to be marginal, strong consideration should be given to reducing gross weight as a means of assuring adequate takeoff and 50 foot obstacle distances.

To accomplish a minimum run takeoff, full noseup trim and half flaps should be employed. 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 or less than full aft stick is employed, minimum nosewheel lift-off speed will be increased.

IN-FLIGHT PROCEDURES

See section IV.

BRAKING TECHNIQUES

Aircraft without AFC 272 incorporated utilize a single disc unboosted hydraulic system that is separate from the other aircraft hydraulic systems.

NEW NEW NEW NEW

Proper minimum distance landing technique is identical for both dual disc and single disc brakes. This procedure requires that steady pressure be applied to the brake pedals, without skidding tires, as soon as weight is on the main wheels. Brake pressure must then be increased as the aircraft decelerates. Deceleration reduces wing lift which increases the weight on the tires and assists braking.

A-4C aircraft reworked per AFC 272 utilizes a dual-disc, unboosted, braking system that is completely separate from the other aircraft hydraulic systems. The improved capacity of the dual-disc brakes makes it possible to lock the wheels at any speed.

Wing lift spoilers (A-4L), when used with full flaps, reduce wing lift by 84 percent; therefore, brakes may be applied with moderately heavy pressure as soon as the spoilers extend.

The brake pedals should be pumped on final approach prior to touchdown to attain a firm brake pedal. A steady pedal pressure should be maintained during landing rollout. The brake pedals should be released and reapplied only when necessary to keep a firm pedal pressure and position.

The maximum braking technique would not be used for normal field landings where adequate runway exists for allowing the aircraft to decelerate to a speed below approximately 80 KIAS before applying the brakes. A steady pedal pressure should be also used for normal braking that initially would be light and gradually increased as the aircraft slows. The final brake pedal pressure for a normal stopping distance will be about equal to the moderate pressure for a minimum distance.

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, readust power to maintain desired pattern airspeed. Complete the landing checklist and check wheelbrakes before reaching the 180-degree position. Cross check airspeed with AOA indexer indication. At a gross weight of 12,000 pounds, recommended approach speed abeam is about 120 KIAS. (See figures 3-4 and 11-40).

NEW NEW

If the AOA indication of 17 1/2 units does not produce the proper IAS as computed from figure 11-40, the pilot should check flap position indicator to ensure that the aircraft is in the proper configuration. The pilot should determine which instrument is providing correct information by observing the position of the wing slats. Slats should be approximately one-half extended at approach speed, gear and flaps down.

Note

For each 1000-pound increase over 12,000 pounds, optimum approach speed increases approximately 5 KIAS.

NOTE:

REFER TO LANDING DISTANCE CHARTS IN SECTION XI FOR FINAL APPROACH AND TOUCHDOWN SPEEDS.

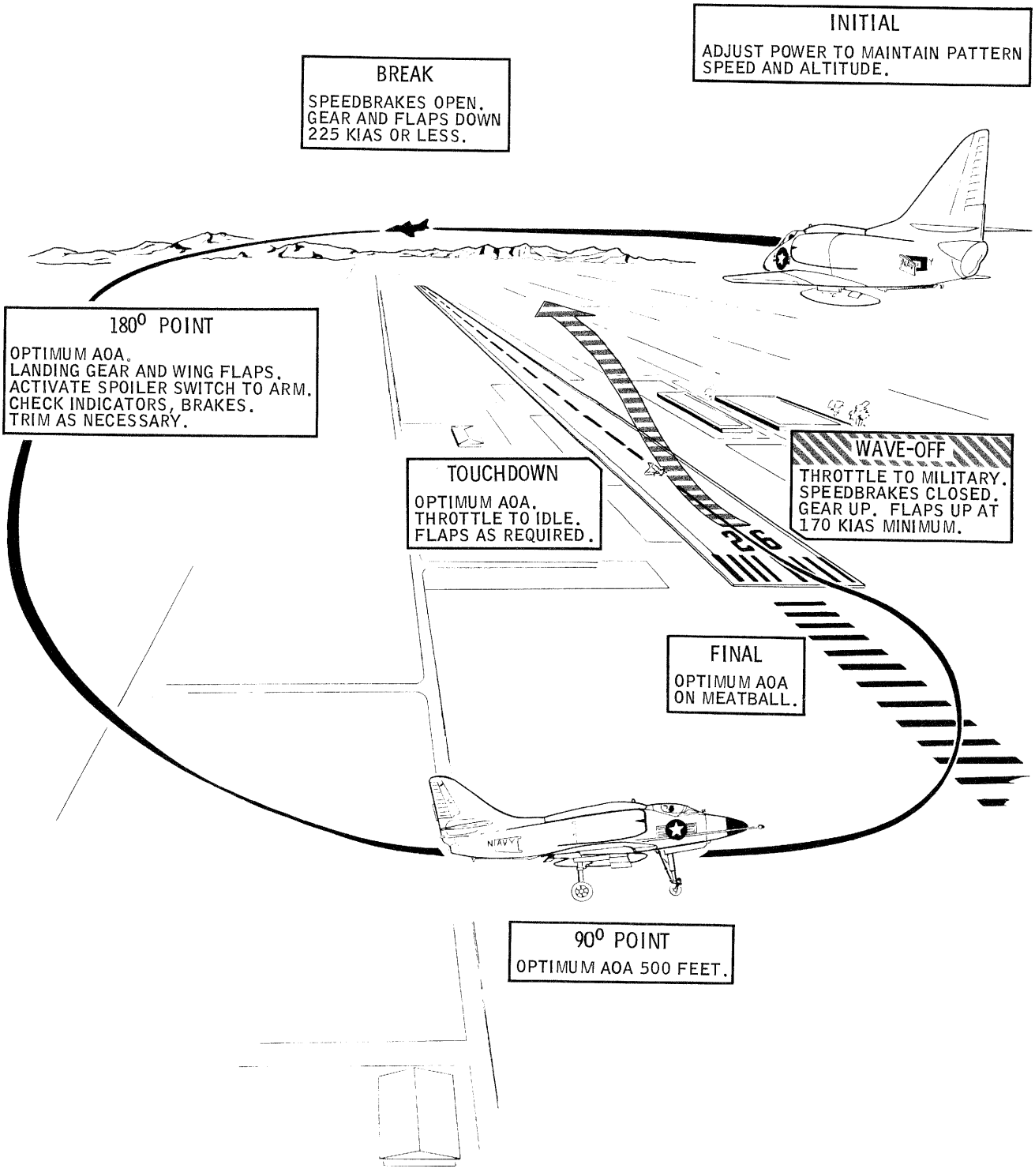


Figure 3-4. Landing and Waveoff Pattern

NEW NEW If a discrepancy between the AOA indexer and airspeed indicator exists, recheck flap position and observe position of wing slats (should be approximately one-half extended at approach speed). When in doubt land at the safer speed, i.e. the lower angle of attack or higher airspeed. Report error in angle-of-attack calibration or airspeed indicator, as appropriate.

Begin the turn into the base leg at a point slightly downwind of the landing end of the runway in order to have adequate straight-away for correction on final. Optimum angle-of-attack approaches to touchdown will be made. When 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.

CAUTION

Rapid settling occurs if a "cut" is taken while airborne.

2. Flaps as required by landing conditions.

3. Allow nosewheel to fall through and hold full-forward stick, deflected into the wind as necessary.

4. Use wheelbrakes as necessary.

Before 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

Crosswind landings are not recommended with a 90-degree crosswind component in excess of 15 knots (25 knot 90-degree crosswind component with A-4L). 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 crosswind components of 15 knots or less, the aircraft can be easily controlled directionally by applying aileron into the wind and using wheelbrakes 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 "weather-cocking" into the wind as is normally expected. If strong crosswind exists, 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 to 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 wheelbrakes as necessary, but do not skid the tires.

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 Landing

To accomplish a minimum rollout distance landing, the following procedure is recommended:

1. Maintain optimum angle-of-attack during approach.

2. Upon touchdown, let the nose fall through and use full forward stick.

3. Leave the flaps fully extended unless there is excessive crosswind.

4. Apply moderately heavy braking immediately after the nosewheel is on the runway.

5. Maintain steady braking throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

6. If circumstances dictate, the landing roll may be further reduced by shutting down the engine upon touchdown.

Note

In the A-4L aircraft, best deceleration will occur by placing the throttle to idle with spoilers ARMED until below 80 KIAS and then placing the throttle to OFF.

Landing on a Wet Runway

1. Land no faster than optimum approach speed. Burn and/or dump down as much as practicable to reduce the optimum approach speed and minimize the stopping distance.

2. Touch down so as to utilize all available runway.

3. Use an MLP type landing, do not flare. This will help alleviate hydroplaning effects.

4. Use rudder as necessary to track straight down the runway until below rudder effectiveness speed.

5. Due to the decreased friction coefficient, braking technique must be modified to prevent locking the wheels, which further decreases braking effectiveness. Tap the 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 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.

7. Be prepared to drop the hook and take the abort gear if necessary.

Landing on an 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 short field arrestment, proceed to following steps.

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.

5. Due to the decreased friction coefficient, braking technique must be modified to prevent locking the wheels, which further decreases braking effectiveness. Tap the 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 as to being able to stop on the runway, secure the engine if the aircraft is under control directionally. If directional control problems exist and adequate runway remains, wave off.

7. Be prepared to drop the hook and use the abort gear if airspeed is not down to a safe taxi speed prior to reaching the abort gear.

Note

If more than one aircraft is in the flight, maintain adequate fuel reserve for the runway to be cleared and abort gear rerigged in case the preceding aircraft had to shut down or use the abort gear.

The above procedures may be modified as necessary to allow for conditions of less severity than a completely ice covered runway.

Securing Engine

Prior to shutdown:

1. Flaps . . . . . UP
2. Spoiler switch (A-4L) . . . . . OFF
3. APC switch . . . . . OFF
4. Speedbrakes . . . . . IN
5. Horizontal stabilizer trim . . . . . ZERO
6. Drop tank switch . . . . . OFF
7. Radios and all electrical equipment . . . . . OFF
8. Cockpit temperature control . . . FULL HOT
9. Gear pins, ordnance pins, and chocks . . . . . IN PLACE
10. Ejection control safety handle . . . . DOWN

11. INT/EXT power switch . . . . . EXT (Plane Captain)

12. With engine stabilized at IDLE throttle . . . . . OFF

13. Time engine rundown. Be alert for unusual compressor noises.

14. Oxygen . . . . . OFF

After shutdown:

1. Ejection seat - safety pins installed.

NEW FIELD CARRIER LANDING PRACTICE (FCLP)

Pattern-Entry Procedure

INDIVIDUAL ENTRY

NEW Call the tower for entry to the FCLP pattern. Request 800-foot break altitude. Otherwise, follow the normal field entry procedures into the break. Enter the break at 250 KIAS. When cleared to break and the proper interval on the aircraft downwind is assured, roll into a 45-degree banked turn. Reduce power to 70 percent and extend speedbrakes. Speedbrakes will normally remain extended 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). Descent to 600 feet AGL on the downwind leg. Pilots shall cross-check airspeed against angle-of-attack indexer to ensure calibration of indexer before turning off the 180-degree position.

FORMATION ENTRY

The leader of the formation will enter the break as described above for single-plane 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 above the terrain at a comfortable airspeed, but no faster than 150 KIAS. Complete landing checklist.

180 DEGREE POSITION

Altitude should be 600 feet above the terrain. 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 shall be delayed so as to intercept the glide slope, wings level, at 600 feet.

90 DEGREE POSITION

Altitude should be 450 feet above the terrain, 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 attitude for airspeed corrections. The straightaway, with wings level, should be 30 to 35 seconds.

Once the meatball is sighted, the approach should be monitored by crosschecking MEATBALL, LINE-UP, ANGLE-OF-ATTACK INDEXER/AIRSPEED. Make necessary corrections immediately but smoothly.

Landing

Keep the aircraft on the glide slope and centerline. Keep the meatball centered right down to the deck. Do not flare. When touchdown is made, add full power and retract speedbrakes immediately. Climb straight ahead until reaching at least 300 feet and 150 KIAS. Turn downwind for next pass when 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

Any time a waveoff is received, either with waveoff lights or by radio, 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 for flight procedures.

Night Lighting Doctrine for Shore-Based Operations

LINE AREA

CAUTION

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

Before start, turn wing and tail lights to STDY/DIM and all others to OFF. This is the minimum lighting that should be used when 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 lights/anticollision lights OFF and remaining navigational lights DIM.

TAXIING

NEW NEW NEW Once clear of the line area, turn lights to BRT/STDY and anti-collision light ON, except when use of such lights adversely affects ground operations. Keep lights in this configuration during taxi to ensure that there is no confusion between aircraft and other lights. The taxilight should be utilized whenever the field lighting is insufficient for safe ground operations. Discretion is required, however, since night vision may be impaired.

TAKEOFF

For single-aircraft takeoff, all lights will normally be BRT/STDY with anticollision light ON, except where local operating procedures specify otherwise. 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 light ON.

When joining in formation, the following procedure will be utilized; As the man behind 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/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/anticollision lights OFF and remaining lights on DIM/STDY, or as desired by wingman.

The wingman will leave all lights BRT/STDY and anticollision light ON if 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 before entry into the clouds.

LANDING PATTERN

When returning to the base for normal breakup and landing, the lights will be DIM/STDY, except that the last aircraft will be BRT/STDY and anticollision light ON. The break will be signaled by each pilot, just before break, by blinking the exterior lights. Normally a 5- to 7-second interval will be used. All lights will be turned to BRT/STDY and anticollision light ON when well clear of the formation. Keep lights on BRT/STDY and anticollision light ON as long as you remain in the traffic pattern, unless otherwise directed by the tower or LSO. Single aircraft entering the break will have lights on BRT/STDY will anticollision light ON.

When in the line area, turn the fuselage/anticollision lights to OFF and other lights to DIM/STDY.

PART 4

CARRIER-BASED PROCEDURES

GENERAL

CVA/CVS and LSO NATOPS Manuals are the governing publications for carrier operations. Pilots are responsible for being familiar with manual contents prior to commencing carrier operations.

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 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 before launch, and the customary functional checks will be performed.

2. The canopy shall 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 before launch.

CAUTION

If operation in the jet blast of other aircraft cannot be avoided, idle EGT limit may be exceeded. Reduce EGT by increasing rpm.

Taxi

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, direction control is sometimes difficult. If the nosewheel cocks, increase 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 will be provided.

WARNING

If a tiller bar is being used, use both brakes together and with equal pressure to maintain speed at the equivalent of a slow walk. Using brakes singly can injure the tiller bar man.

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. Because of the lag in temperature indicating response in aircraft with the J65-W-20 engine installed, a minimum indication of 580°C is adequate for launch purposes only. Launch requirement is 101 percent rpm. Recheck the attitude gyro, RMI, engine instruments, trim indicators, and flap setting. Ensure drop tank switch in pressure position if external fuel carried, and ensure emergency wing transfer switch off. If air refueling store is carried, the ship tank switch must also be off. Ensure a firm grip on the throttle and catapult hand grip, place your head against the headrest, salute, and wait. Normally, the catapult will fire 3 seconds after the launching officer gives the fire signal. NEW

TECHNIQUE

Prior to launch, select the optimum trim settings for the anticipated end speed 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. 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 the end of the power stroke, grasp the stick in its trimmed position, which with the optimum horizontal stabilizer trim setting, will result in rotation to a flyaway attitude. 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 is obtained. Retract flaps at 170 KIAS minimum.

OPTIMUM TRIM SETTINGS

1. Aileron – Stick centered, ailerons symmetrical, tab faired ±1/5 inch

2. Rudder – 0 degrees

3. Horizontal Stabilizer

Flaps Setting	Excess End Speed (Knots)	Horizontal Stabilizer Trim (Degrees ANU)
Full	0 - 10	7 1/2
Full	11 - 40	6
Half	0 - 10	7
Half	11 - 40	6

4. Trim Settings For Asymmetric Loadings -- Asymmetric bow catapult launches with up to 5120 foot-pounds of static moment are permitted. The following trim and control inputs are required at the different wind conditions. (Interpolation between points is permitted.)

Allowable Crosswind (Knots)	Required End Airspeed Above Minimum (Knots)	Rudder Trim-Units (Away From Loaded Wing)	Aileron *
0 - 5	0 - 3	2	faired
6 - 10	4 - 6	2	faired
11 - 17(max)	7 - 10	3	faired

*From 0 to 10 knots of crosswind approximately 5 pounds of lateral control force is required, and from 10 to 17 knots of crosswind 1/4 to 1/2 lateral stick deflection is required 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 launching 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 launching 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 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 35-second ramp interval. Close adherence to pattern details by all pilots is a requisite for uniform landing intervals. The pattern given in figure 3-5 is recommended. Each pilot shall have the landing checklist completed and be at optimum AOA/approach speed and have wheelbrakes 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.

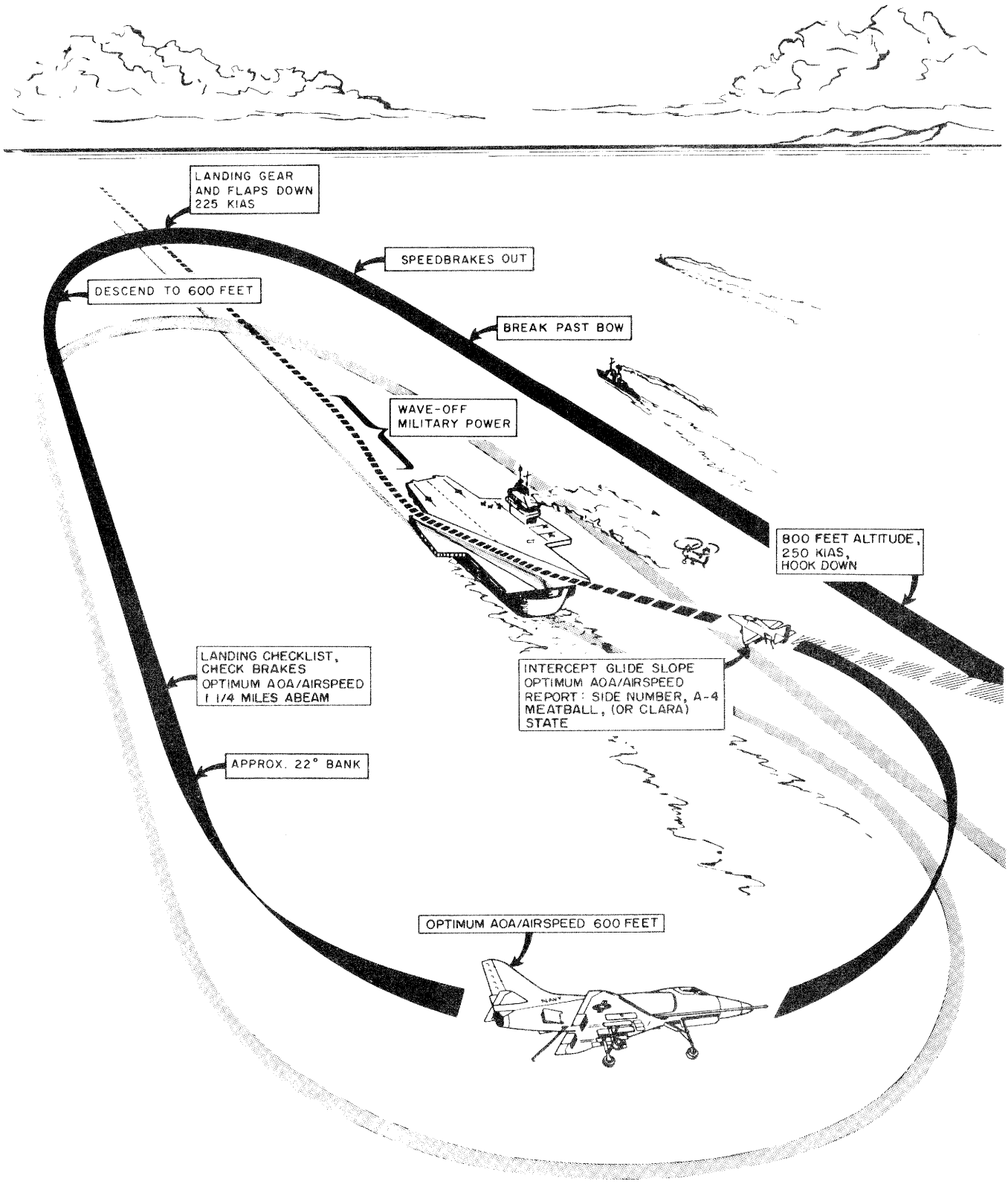


Figure 3-5. Typical Carrier Landing Patterns

CAUTION

Rotation of the aircraft to an exaggerated nose high attitude on a waveoff lowers the arresting hook beyond normal reach and can result in an inflight 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.

ARRESTING LANDING AND EXIT FROM 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. During rollback, make one smart application of the left brake to cause the nose to swing to the right. Apply power in anticipation of the "come ahead" by the director unless a "pullback" is signaled. Hold both brakes when signaled by the director and apply power (about 70 percent), in anticipation of the "come ahead" signal, unless pullback is indicated by the director. If pullback 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 increasing power to about 70 percent.

NEW NEW

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. Be careful when applying power and brakes, since water, oil, or hydraulic fluid spillage is often on the flight deck.

POSTLANDING PROCEDURES

While 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, since noise level is normally high, remain alert for either hand or whistle signals from aircraft handing 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 initial tiedown has been accomplished.

NIGHT OPERATIONS

Flight Deck

PREFLIGHT

External preflight will be made utilizing a red-lensed 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 before start. Wing and tail lights should be set in BRT/STDY position for the poststart checks. Instrument lights and console lights should be turned ON. Direct cockpit emergency floodlights on instrument panel and kneeboard as desired.

POSTSTART

Adjust cockpit light intensity to desired level. After normal systems checks are completed, perform exterior lights check. Move the master exterior lights switch to ON momentarily. Upon completion of exterior lights check, place master exterior lights switch to the OFF position.

TAXI

Slow and careful handling of aircraft by both plane directors and pilots is mandatory. If the pilot has any doubt as to the plane director's signals, STOP!

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. When satisfied that the aircraft is ready for launch, the pilot signifies ready by placing the master exterior lights switch to the ON position. The pilot must be prepared to establish a wings-level climbing attitude on instruments. An initial attitude of 12 degrees noseup is recommended.

Cross check angle of attack, airspeed, and other appropriate instruments. Do not rely solely upon one instrument. Ensure that 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.

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 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 light 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 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, to break off from the flight, and to 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 ft/min., 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 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 whether the wingman lands successfully. He 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 leader, should he bolter or waveoff. The wingman should not detach unless he has the meatball in sight. Necessary visual signals are contained in figure 7-5.

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 inflight 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, stay well clear of the plane-guard helicopter.

Carrier Emergency Signal

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 -2200 to +3000 feet, and no more than 15 knots of direct crosswind.

NEW NEWEW NEW

WARNING

2500 pounds of external stores must be carried when operating from dolly forward tow point.

Day Operations

GENERAL

Preflight, start, and poststart checks shall be accomplished in accordance with normal field procedures and the additions noted.

PREFLIGHT

1. Record the expected gross weight of the aircraft for catapult launch on the nose gear door.

2. Ensure that the tension bar retainer clip is installed securely and is in good condition.

START

1. Start engine sufficiently ahead of time to allow for taxi, catapult launches, and rendezvous before proceeding on the assigned mission.

POSTSTART

1. Set the emergency-jettison armament switch to the proper position prior to taxi.

2. Set trim and flaps as follows:

a. Aileron – stick centered, ailerons symmetrical, tab faired ±1/5 inch

b. Rudder – 0 degrees

c. Horizontal Stabilizer – 5 degrees ANU

d. Flaps – Half.

TAXI

1. Taxiing on advanced airfields presents little difficulty provided attention is given to keeping speed under control.

2. Taxi 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, use both brakes together 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 due to 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 area 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 over-stressing the tension bar.

4. After the aircraft is properly positioned and the holdback engaged, the taxi director will signal for the pilot to release 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. Recheck 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 in order 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 holdback 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.

3. A cold shot can result from inadequate catapult engine acceleration, early catapult cutoff, failure of the capstan brake to release completely, or failure of the dolly jaws. If an abort is attempted and the dolly moves ahead of the aircraft, 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 break 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 assured, 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, 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

Use extreme caution 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, care must be taken to prevent engagement of the dolly arrester ropes with the aircraft's tailhook. 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, check acceleration time and instruments. When engine stabilizes initially, 103.6 percent rpm and 580°C EGT are minimum acceptable for launch. 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 altitude, retract flaps at no lower than 170 KIAS. When climbing through 2500 feet, adjust lights and radio as briefed.

NEW

PART 5

HOT REFUELING PROCEDURES

HOT REFUELING PROCEDURES

The following procedures shall be strictly adhered to by pilots and ground personnel when refueling 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 pit area.

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 the 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 the 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. The drop tank pressurization switch shall be placed in the OFF position.

5. Fuel transfer bypass switch is OFF.

CAUTION

Ensure that fuel dump switch is in the OFF position prior to refueling.

6. The work stand will be positioned in front of the air refueling probe and the wheels will be locked.

7. The nozzle operator shall attach the nozzle adapter to the probe.

8. When ready to commence fueling, the pilot will signal the pit coordinator 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 applies 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 the 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 the Handbook Maintenance Instructions (NAVAIR 01-40AVA-2-1). 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 tanks fueling switch in the ON position, or the pilot will place the drop tank pressurization switch in the FLIGHT 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 pressure cannot be felt coming from the vent mast, the refueling operation shall be secured immediately.

5. When fueling is completed, the pilot will signal the pit coordinator by a "cut" signal in the daytime and by flashlight at night. The pit coordinator, in turn, 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 hose.

Note

The rotating beacon will be used as an emergency fuel cut off 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.

PART 6
FUNCTIONAL CHECKFLIGHT PROCEDURES

GENERAL

CHECKPILOTS

The most important single factor in getting good checkflights 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.

CHECKFLIGHTS AND FORMS

Checkflights 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 checkflight checklists are promulgated separately.

FUNCTIONAL CHECKFLIGHT REQUIREMENTS

The functional checkflight shall be performed after the completion of the calendar maintenance requirements using the applicable Functional Checkflight Checklists. This section contains a detailed description of the checkflight requirements, sequenced in the order in which they will be performed. Checkflight personnel shall familiarize themselves with these requirements prior to the flight. NATOPS procedures shall apply during the entire checkflight.

CONDITIONS REQUIRING FUNCTIONAL CHECKFLIGHTS

Checkflights are required under the following conditions (after the necessary ground check and prior to release of the aircraft for operational use):

A. Completion of aircraft rework (required checkflight items are prefixed A).

B. Reinstallation of engine (required checkflight items are prefixed B).

C. Reinstallation of fuel system components (required checkflight items are prefixed C).

D. When fixed flight surfaces have been installed, movable flight control surfaces replaced, removed for major repairs or rigged. When primary control cables, rods, or tubes have been replaced, or rigged; or when control system components have been adjusted and where improper adjustment or installation could adversely affect flight characteristics or result in loss of aircraft control (required checkflight items are prefixed D).

Note

- The requirement for a checkflight, under circumstances other than those specified in the preceding, 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.

- Local commands shall set minimums for check requirements for profiles A through D, using the minumums as set forth in the preceding as a guideline.

CHECKFLIGHT PROCEDURES

Note

For preflight, starting and pretaxi procedures refer to Section III

PROFILE

A D

POST-START CHECKS

1. Normal poststart and plane captain checks.

   a. Wing Spoilers

      Normal Operation (ARM position) (Actuation should occur with landing gear struts compressed, and throttle below 70 percent position.)

   b. Normal Trim (See Trim Control Check Below.)

   c. Horizontal Stabilizer Override Lever
      Overrides the stick trim button in both directions.

Normal Trim Control Checks

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, using predetermined signals to ensure correlation between trim settings and cockpit trim indicators.

Note

Ensure that tab moves up when its aileron moves down - in the right wing down direction.

Maximum Aileron Followup Tab Deflection

When an inflight power disconnect is to be performed the trim system should be actuated on the ground so that the tab may be visually checked by the pilot at the 5 degrees up and the 5 degrees down (from faired-with-aileron) positions. This is to facilitate the pilot's subsequent inflight check (prior to pulling the disconnect) that the tab is within these limits. Five degrees deflection of the tab is difficult to determine, therefore ground personnel should be briefed as to what is required and should use a means of measuring to definitely establish these settings. (AIR-530311B)

Rigging Check

Prior to taxi, and as part of the normal trim and rigging test, the following procedures should be accomplished:

a. Assisted by ground personnel, trim both ailerons symmetrically (i.e., both above or below an equal amount relative to the wing).

NEW

b. Check the aileron followup tab for not more than 5-degree (11/32-inch) deflection when the ailerons are trimmed symmetrically. After maintenance affecting tab "in-trim" setting, the tab should be faired with its aileron for the initial flight check.

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 above checks, it is probably out of rig and the aircraft should not be flown.

PROFILE	
A	2. APG-53A Radar - CHECK Perform radar preflight check in accordance with Section I, part 2.
A	3. Elapsed Time Clock - CHECK Perform elapsed time clock preflight check in accordance with Section I, Part 2.
A	4. Standby Compass - CHECK a. Heading error ±3.0 degrees of BDHI after magnetic deviations compensation. b. Check fluid level.
A	5. 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.
A	6. Airspeed and Mach - CHECK Indices movable.
A	7. Pressure Altimeter - CHECK Allowable scale error (±75 feet)
A	8. Vertical Velocity Indicator - CHECK Needle indicates 0± 100 ft per min.
A	9. 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 within 90±10 seconds. (2) Automatic synchronization 12 ± 3 seconds after flap 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.)

PROFILE		
		d. Indicator Display (Heading Accuracy)
		(1) AAI within 3.5 degrees of ID-663 BDHI indication.
		(2) BDHI within ±3.0 degrees of actual 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.
A		10. Standby Attitude System - CHECK
A		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 press-to-test is pressed, and warning light operates when indication is 0-1 liter.
A		12. Cabin Altimeter - CHECK
		a. Sea level ±200 feet.
		b. 5000 feet elevation ±300 feet.
A		13. Navigation Computer.
		Check for proper operation. Set and operate as follows:
		a. Range error should be twelve miles ±1 percent.
		b. Balance error should be eight miles maximum.
		c. Bearing error is calculated by using formula:
		$\frac{57.3\ (10 \pm 1\ \text{percent range})}{\text{Range}}$
A	D	14. Flight Control Disconnect - Ground Check Procedure.
A		15. Canopy Locking Feature.
		Check the following:
		a. Ensure positive over center detent lock.
		b. Check that lower portion of canopy latch hook extends 1/8 inch beyond forward edge of latch roller.
A		16. Automatic Flight Control System - CHECK
		Perform complete preflight checks in accordance with Section I, Part 2.

PROFILE	
	TAXI CHECKS
A	17. Brakes.
	a. Brake pedal travel 1 1/2 inches maximum prior to braking action.
	b. Power check 85 percent and under, no aircraft forward movement. Spongy, chattering, fading, or dragging brake unacceptable.
A	18. Turn-and-Slip Indicator.
	a. Check turn needle operation while taxiing.
	b. Check ball movement while taxiing.
A	19. BDHI/AJB-3.
	a. Check for freedom of movement.
	b. BDHI and AJB-3 headings within 3 degrees of actual magnetic heading.
A	20. ARN-52 TACAN.
	a. Check bearing accuracy ±1.0 degree from designated point on airfield.
	b. Check DME operation.
A	21. ARR-69 UHF/ADF.
	a. Allow 3-minute warmup.
	b. Check bearing accuracy from designated point on airfield.
	PRETAKEOFF CHECKS
A B C D	22. Takeoff Checklist.
	Perform takeoff checklist in accordance with this manual.
A B C	23. Manual Fuel Control Checks.
	a. Check manual fuel control for J65 engine as follows:
	(1) Switch to MANUAL fuel control to IDLE rpm and check fuel flow (1100-1300 pph).
	(2) Check that manual fuel control light is ON.
	CAUTION
	If necessary, slowly advance throttle to minimum of 51 percent to protect CSD.
	(3) Slowly advance throttle to obtain approximately 85 percent rpm (adequate power for flight).
	(4) Retard throttle to IDLE and check ground idle fuel flow (1100-1300 pph).
	(5) As engine decelerates through 60 percent rpm, switch to PRIMARY fuel control and check fuel flow drop to deceleration fuel flow (approximately 600-800 pph).
	(6) Check that manual fuel control light is OFF.

PROFILE

A B C

24. Air Start Switch Check.

a. Fuel Control Switch - PRIMARY

b. Throttle - IDLE

c. Air Start Switch - ON (momentarily)

CAUTION

Air start switch should be in the ON position only momentarily. Prolonged idle with the air start switch on may cause damage to the combustion chamber liner.

d. Fuel Flow Gage - Check for momentary decrease (100 to 150 PPH) in fuel flow. (150 PPH maximum drop)

e. Air Start Switch - OFF

CAUTION

Lack of fuel flow decrease may indicate either continuous primer fuel (and possible hot section damage) or inability to effect an air start.

TAKEOFF

A B C

25. Engine Acceleration From Idle Check.

Note

For individual engine limitations refer to Section I, Part 4 of this manual.

a. Jam Acceleration Check (15 seconds maximum) - RECORD (IDLE to MILITARY RPM)

b. At Liftoff

(1) RPM - RECORD

(2) EGT - RECORD

(3) Fuel Flow - RECORD

(4) Oil Pressure - RECORD

PROFILE	
	CLIMB
	Note For purposes of Functional Check flights, a climb schedule of 300 KIAS to 0.72 IMN is recommended.
A B C	26. Climbing through 16,000 feet.
	a. RPM - RECORD
	b. EGT - RECORD
	c. Fuel Flow - RECORD
	d. Oil Pressure - RECORD
	e. Pressurization - RECORD (8,000 ±1,000 feet)
A B C	27. Climbing through 26,000 feet.
	a. RPM - RECORD
	b. EGT - RECORD
	c. Fuel flow - RECORD
	d. Oil Pressure - RECORD
	e. Pressurization - RECORD (14,000+1,300 - 1,800 feet)
	LEVEL AT 36,000 FEET
A B C	28. Airspeed/Mach - RECORD (Indication of 237 ±2 KIAS at 0.72 IMN.)
A B C	29. Military.
	a. RPM - RECORD
	b. EGT - RECORD
	c. Fuel Flow - RECORD
	d. Oil Pressure - RECORD
A B C	30. Idle (180 KIAS minimum).
	a. RPM - RECORD
	b. EGT - RECORD
	c. Fuel Flow - RECORD
	d. Oil Pressure - RECORD
	e. Pressurization - RECORD (20,000+1,600, -2,600 feet)
A B C	31. Jam Acceleration Check (20 seconds maximum)
	DESCENDING TO 15,000 FEET
A D	32. Flight Control Check.
	Noseover to obtain 0.90 IMN and check flight controls for proper response. Observe Flight Manual restrictions shown in Section I, Part 4.

PROFILE	
	CAUTION Do not exceed 0.90 IMN with external tanks installed.
A B	33. Anti-G System - CHECK
A	34. Accelerometer Proper functioning and recording while pulling positive and negative g's.
	LEVEL AT 15,000 FEET
A	35. Speedbrakes. Check in 1.0g-flight at 400 KIAS. a. Open (3 seconds maximum). b. Close (3 seconds maximum). c. Pitch (open +1.0g, -0.5g maximum; close -0.5g maximum). d. Yaw (1/2 ball). e. Roll (5 degrees per second maximum).
A	36. AJB-3 All Attitude Indicator (AAI) 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 degree. b. Directional Gyro. (1) Fly cardinal headings by reference to the BDHI. Push to sync. Synchronization needle oscillations allowed about midposition. Record correspondent headings from AJB-3A (tolerance ±4 degrees) and wet compass (tolerance ±3 degrees after magnetic deviation compensation) heading. (2) After 360-degree, 4-minute turn, press sync button to check precession. A 2.0-degree heading error is acceptable.
A	37. Standby Attitude Indicator. a. Vertical Gyro. (1) Precession after takeoff turns ±4.0-degrees roll. (2) Precession after 180-degree, 4-minute turn (from indication at start of turn); ±3.0 degrees in pitch or roll. (3) Erection Time Normal 1.5 to 2.5 degrees per minute. Manual (do not hold erection switch over 120 seconds maximum) not less than 0.5 degree per second.

PROFILE	
	b. Indicators
	(1) Jitter and/or hangup ±1.0 degree maximum.
	(2) Attitudes over 82 degrees in pitch will result in 180-degree roll indication.
	(3) Difference between AAI and standby ±3.0 degrees maximum.
	Note Check should be made upon returning to same airspeed and attitude as original setting.
	(4) Maximum difference between indicators 2 degrees after normal erection.
A	38. ARC 51/ADF Function.
	a. Reading error ±5.0 degrees off the nose sector and within 20 degrees all other sectors.
	b. Hunting error ±1.0 degree.
A	39. ARR-69 ADF/CMD Function.
	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.
	e. Bearing error (2.0 degrees maximum)
	f. Range error
	(1) 0 to 195 miles (1 mile, or 1 percent of distance traveled).
	(2) 195 to 2,000 miles (5 miles, plus 1 percent of distance traveled).
A	40. APX-64/APX-72 IFF - CHECK
	a. Check identification modes with available interrogating stations.
	b. Check emergency feature.
A	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.

PROFILE	
A	42. Navigation Computer Set (ASN-19A).

a. Set and operate as outlined in current NATOPS manual. Check for proper operation.

(1) Range Error - 12 miles ±1 percent.

(2) Balance Error - 8 miles maximum.

(3) Bearing Error -

Use formula $\frac{57.3\ (10+1\ \text{percent range})}{\text{Range}}$

A B 43. Drop Tank Transfer - CHECK

a. Ensure all external fuel tanks transfer properly.

b. Ensure all external fuel quantity can be monitored.

A B C 44. Jam Acceleration Check (180 KIAS minimum).

a. Idle

(1) RPM - RECORD

(2) EGT - RECORD

(3) Fuel Flow - RECORD

(4) Oil Pressure - RECORD

(5) Pressurization - RECORD (8,000 ±1,000 feet)

b. Jam Acceleration Check (IDLE to MILITARY) - RECORD TIME

c. Military

(1) RPM - RECORD

(2) EGT - RECORD

(3) Fuel Flow - RECORD

(4) Oil Pressure - RECORD

A D 45. 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)).

PROFILE A	PROFILE D	

c. Wing Slats - CHECK

Wing slats should commence opening at approximately 200 KIAS, or 1/2 open at optimum AOA, and are fully open at stalling speed.

d. 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 pressed.

(3) Record fuel weight and airspeed at optimum AOA. See figure 11-40 for airspeed/angle-of-attack relationship.

e. Flap Blowback - CHECK

Indication of flap blowback should occur at approximately 230 KIAS. Maximum permissible speed without flap blowback indication is 240 KIAS.

f. Wheels Warning Light - CHECK

Check to ensure that the wheels warning light flashes when the flap handle is out of the UP detent, the wheels are not down and locked and throttle is retarded below approximately 92% rpm. Advance the throttle to exeed 92% rpm; the wheels warning light should go off.

A D

46. 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

PROFILE
A

(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 wing-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 4,500 fpm (will not engage).

(2) Steady state climb or dive under 3,500 fpm (must engage).

(3) Damping upon engagement during climb or dive (1- to 1/10-cycle 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

Longitudinal/Lateral (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 and while using heading hold, preselect heading or attitude hold modes (±0.5-degree lateral at approximately 2 to 4 cps. No pitch oscillation).

PROFILE
A

(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 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).

A

47. APG-53A Radar - CHECK

a. Search Mode

(1) Range Flags

(2) Range

(3) Gain, Brilliance, Storage

b. Terrain Clearance (Profile Mode).

(1) Range Flags

(2) Terrain Clearance Line

(3) Range (Long) . . . 16 miles minimum

(4) Obstacle Warning

(5) Boresight

c. Plan Mode

(1) Boresight

(2) Range Flags

(3) Range (Long) . . . 16 miles minimum

(4) Gain, Detail

d. Air to Ground Mode (20° Dive)

(1) Lockon . . . 7.5 to zero miles

(2) Range Bar . . . 7.5 to zero miles

(3) Lockon . . . 8,000 yards minimum

PROFILE
A
A

e. General Performance

(1) Focus

(2) Radar Induced UHF Static

48. Low Altitude Bombing System AJB-3A

Note

- Initiate LABS check at lowest safe altitude, consistant with local area restrictions.
- Function selector to LABS. Minimum 3 minutes prior to performing LABS check (all models).

a. Check the AJB-3A bombing mode (LABS) as follows:

(1) Enter straight and level flight.

(2) Climb to desired altitude (1000 to 5000 feet).

(3) Check the following switch positions:

(a) Master arm to ON.

(b) All station selector switches to OFF.

(c) Pitch angle selector switch to T/OS.

(d) Function selector switch to LABS.

(e) LABS timer to 5.0 seconds.

(4) Accelerate to 500 KIAS, depress pickle button and elapsed time clock button simultaneously. At 4.0 seconds elapsed time clock, check that the LABS aural warning tone is heard. Shift to bombing mode (AJB-3 indicator will jump slightly) at 5.0 seconds elapsed time clock. Record any difference between LABS timer and elapsed time clock. Smoothly execute a 4 g maneuver, matching g programer with linear g-meter. Abrupt cessation of LABS aural tone will indicate release at approximately 120 degrees nose up.

(5) After roll out and upon return to straight-and-level flight, check following switch positions:

(a) Master arm switch to OFF.

(b) All station selector switches to OFF.

(c) Function selector switch to OFF.

Note

Record any deviation from optimum in LABS AJB-3 indicator, aural tone, g programmer or linear g meter.

PROFILE	
	DESCENDING TO 6000 FEET
A	49. Vertical Velocity Indicator (VVI) - CHECK
	a. ±300 fpm during 2,000 fpm climb or descent.
	6000 FEET AND BELOW
A B C	50. Carrier Check.
	6,000 feet at 150 KIAS, approximately 75-percent rpm with gear and flaps down.
	a. Jam Acceleration Check - RECORD TIME
A	51 Radar Altimeter - CHECK
	a. Cross check with pressure altimeter for approximate correlation.
	b. Dropout should not occur at pitch angle less than 50 degees, or bank angle less than 30 degrees.
	c. Operation
	(1) Above 6,000 feet (pointer remains behind mask). (Off flag is in view.)
	(2) Below 5,000 feet (smooth tracking of terrain clearance without flicker or off flag).
	(3) Warning light (on when aircraft is below present terrain clearance altitude ±10 feet or 10 percent, whichever is greater).
	(4) Self-test (press control knob and indicator reads 5 ±5 feet.)
	CLIMBING TO 15,000 FEET
A B C	52. 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.
	LEVEL AT 15,000 FEET
A D	53. Trim - CHECK
	a. At 300 KIAS, trim aircraft for hands-off, straight and level flight (2000 to 4000 pounds fuel load recommended) - 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).

PROFILE A	PROFILE D	
		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 free play (1/4 inch maximum).

Note

Force measurements are given for guidance in making qualitative estimates only.

A		54. 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. Drop out 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 fadeout. 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 generator bypass switch operation.
A	D	55. Flight Control Disconnect (winds permitting).
		a. Emer generator and horiz override check (if step 54 not performed).

WARNING

Do not attempt flight control disconnect check if operating on emergency generator, except in case of an emergency.

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.

PROFILE

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.

A D

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.

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.

Under NO circumstances will the disconnect check be performed with an assymmetrical wing loading. It may be necessary to perform the check with external drop tanks installed; but it should be ensured that the tanks 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 5-degrees maximum deflection from faired with the aileron (port aileron). Five-degrees deflection of the followup tab from faired with the aileron is approximately 11/32 inch, and may be determined during the normal preflight check as outlined previously. This 5-degree limit applies to all present models of the aircraft. If the followup tab is deflected more than 5 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 of 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.

PROFILE
A D

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 of 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 and 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 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 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, this 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; the throttle should be retarded to idle to reduce airspeed.

In the case 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 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 e.

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 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.

PROFILE	
A	D

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, and the spoiler switch should be placed in the ARM position.

A	D

Upon completion of the flight, a notation 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—MAKE STRAIGHT-IN APPROACH (IF ITEM 55 PERFORMED)

A	56. Brake operation - CHECK
A	57. Ground Handling - CHECK

AFTER LANDING

A	58. Oxygen Consumption - CHECK
A B C	59. Engine Oil Quantity - CHECK
A B C	60. Secure engine using throttle.

a. Record engine rundown time.

SECTION IV

FLIGHT CHARACTERISTICS AND FLIGHT PROCEDURES

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PART 1

FLIGHT CHARACTERISTICS

INTRODUCTION

The flight characteristics of the aircraft as described in this section are based, wherever 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 handbook, the latest service directives and technical orders concerning this aircraft should be consulted regularly to keep abreast of pertinent information.

Figures 4-1 and 4-3 are based on calculations from flight testing of the A-4B for stick forces and angle-of-attack relationship with speedbrakes closed. Calculations and flight testing indicate that the flight characteristics of the A-4C/L are similar to the A-4B aircraft.

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 tendency to 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.) 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 the approach to the landing. If the stabilizer actuator should fail while the airplane is trimmed for high speed flight, a landing can be accomplished by flying the airplane onto the runway with the flaps retracted, at an airspeed which assures 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. Additional elevator effectiveness is available by burning down to 600 pounds of fuel remaining to provide a greater aft CG condition.

Retrimming of 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 airplane 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. See figure 4-2 for CG chart. NEW

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 moment.

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

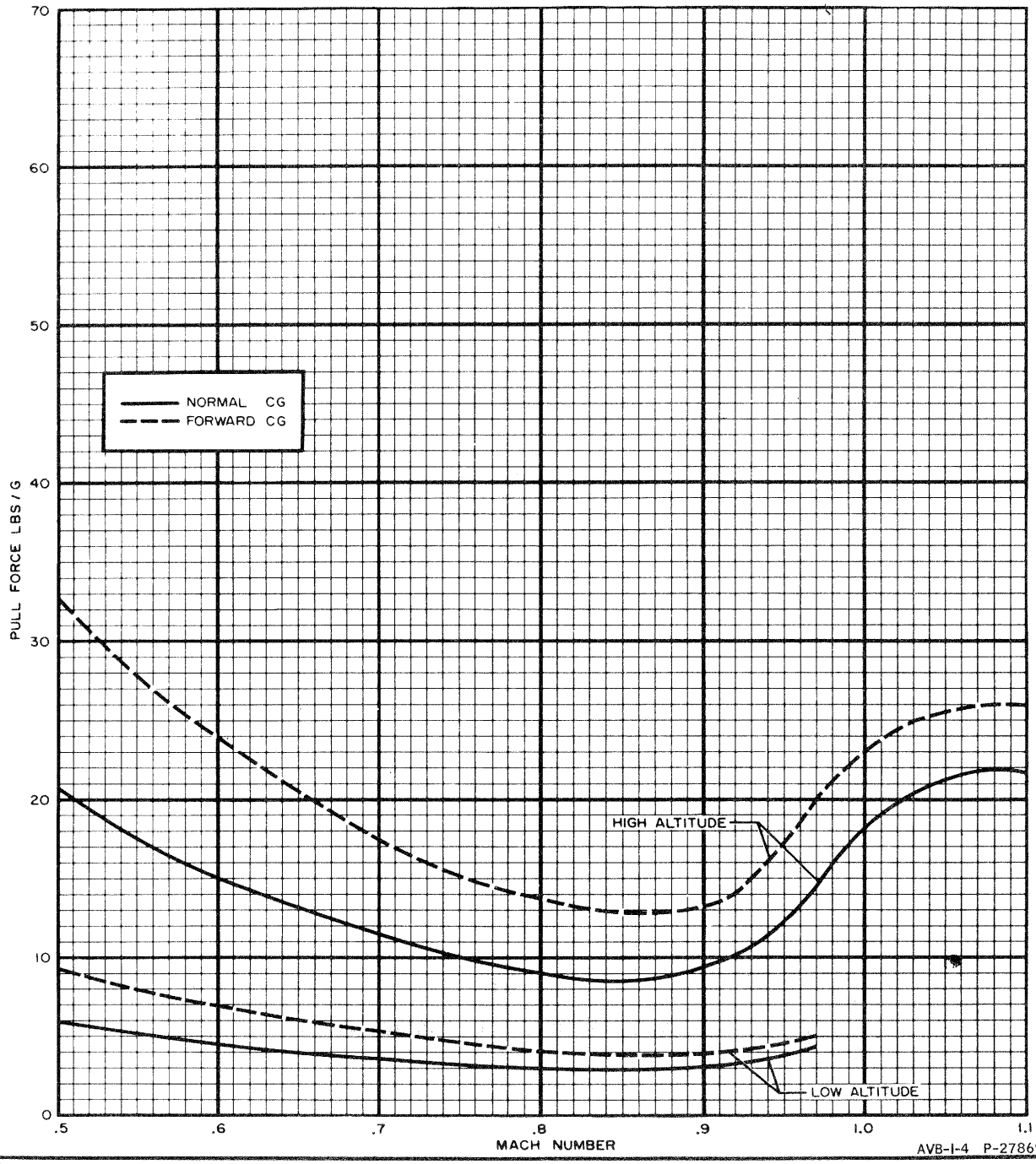
Operation of the speedbrakes results in changes in trim characterized by a noseup pitch when opened and a nosedown pitch when closed. To counter this characteristic, a speedbrake-elevator interconnect is installed which physically displaces the elevator when the speedbrakes are operated. This interconnect 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 be required when the speedbrakes are operated. The degree of this trim change will be a function of airspeed. For further information on the use of speedbrakes, refer to DIVING in this section.

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 DIAGRAM



REMARKS:

Pull force is the pilot effort required to produce 1g change in load factor.

DATA AS OF: 1 August 1956

DATA BASIS: Calculations

Figure 4-1. Stick Forces

TYPICAL CENTER-OF-GRAVITY TRAVEL

APPROACH CONFIGURATION
GEAR DOWN — FLAPS FULL DOWN

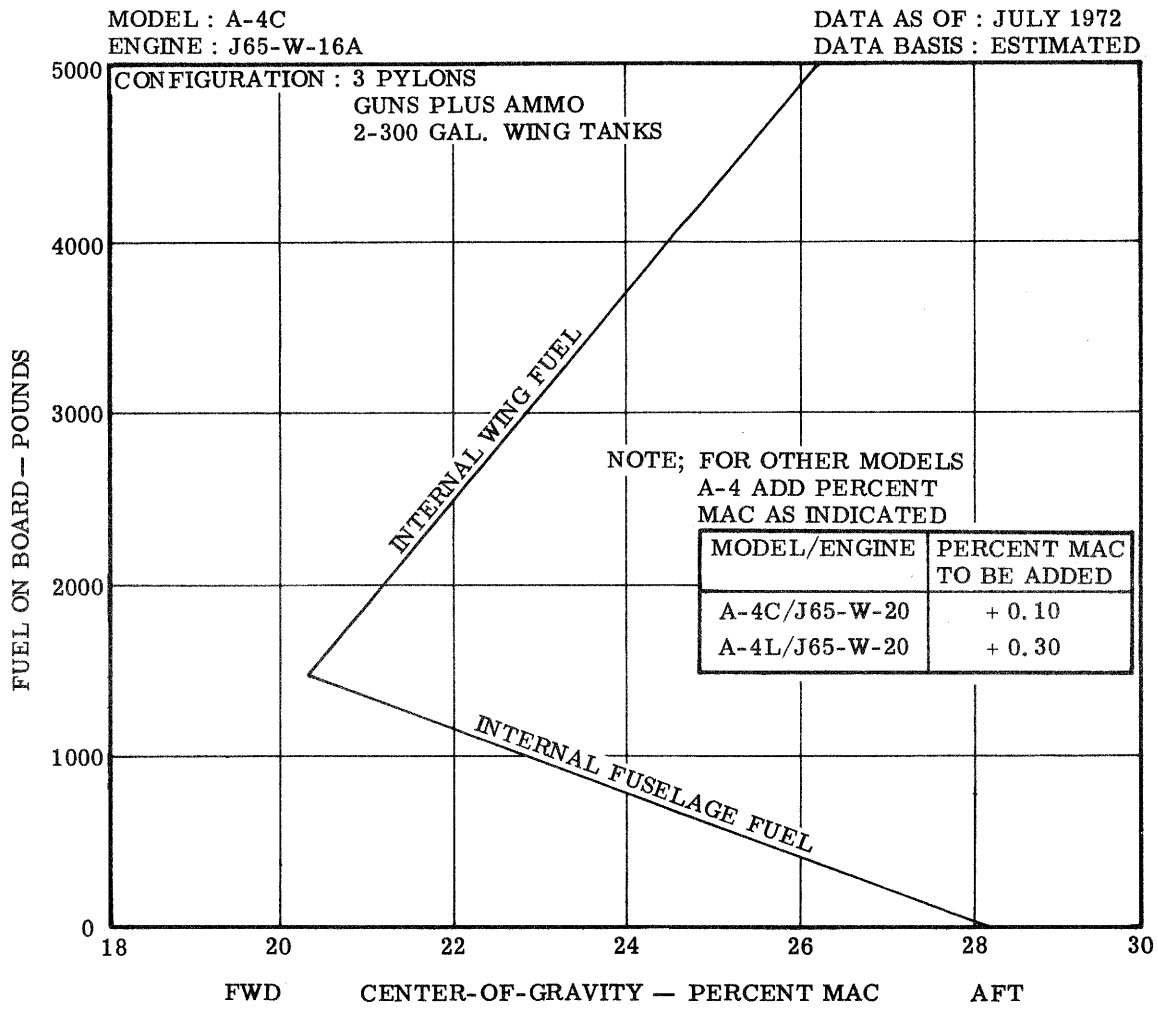


Figure 4-2. Typical Center-of-Gravity Travel

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 center of gravity 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 4-1). 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 accelerated recoveries from dives at supersonic speeds, a marked pitchup, proportional to existing load factor, 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, maintaining constant stick force as speed drops off to 0.85 IMN 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 most severe for full aft stick. At altitudes above 15,000 feet, and at high load factors, aircraft buffet will be encountered above 0.95 to 0.98 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 0.95 IMN 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.

Transonic Maneuvering

Pullouts or accelerated maneuvers in the transonic range are characterized by abrupt random wing drop accompanied by general aircraft buffet. Large changes in bank angle may require momentary relaxation of load factor in order to level the wings and continue the pullout. The magnitude of the wing drops and intensity of the buffeting is generally proportional to the load factor developed.

Diving

The diving characteristics of the aircraft are normal except when steep dives are conducted in the clean configuration 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, limiting the g available even with full aft stick.

Dive recovery nomographs are provided on figure 4-4. Figure 4-4, sheet 1 shows the altitude loss after the load factor is applied and sheet 2 shows the altitude lost during pilot reaction time. The above two values must be added to determine the total loss in altitude from initiation of the dive recovery to level flight. The altitude loss given is for a constant airspeed pullout. Flight tests have shown actual altitude loss to be 1,000 feet to 2,000 feet greater than computed values due to aircraft acceleration at high power settings or steep dive angles.

WARNING

Figure 4-4 (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. Speedbrakes are partially effective up to maximum speed capabilities of the aircraft; however a slow uncommanded roll may occur at airspeeds above 440 KIAS due to asymmetric speedbrake extension. The roll is easily countered by small lateral inputs.

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 pitchup will occur as the airspeed drops below approximately Mach 0.94, increasing the chance of structural overstress.

If the speedbrakes are used before entering the dive, airspeeds will be limited to lower values where the increase in stick forces will not be severe.

Note

The speedbrakes will begin to "blowback" at approximately 490 KIAS.

FLIGHT WITH POWER CONTROL DISCONNECTED

Power control disconnection above 300 KIAS or Mach 0.80 whichever is lower should be avoided if at all possible. Reduce thrust and open speedbrakes to decrease airspeed to 200 KIAS before disconnecting. If feasible, trim aircraft laterally prior to disconnect. 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, 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 increases, making the aircraft once more controllable. (Refer to Section I, Part 2, HYDRAULIC POWER DISCONNECT.)

FLIGHT WITH EXTERNAL STORES

Flight characteristics with external stores aboard are satisfactory. Takeoffs may require horizontal stabilizer settings up to 8 degrees noseup because of the changed center of gravity. Adequate control is available to hold the wings level during landing with an asymmetrical loading up to 1200 pounds on either wing station. 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 the Weight and Balance Data Handbook, AN 01-1B-40, for permissible cg limits

With asymmetrical loadings, simple elevator control displacement induces roll as well as pitch. With flight control hydraulic power available, aileron control is sufficient to counteract roll induced by elevator control displacement. With the flight control disconnected, 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 the flight control disconnected, longitudinal control should be minimized and airspeed should not exceed 200 KIAS, with asymmetrical loadings. (Refer to HYDRAULIC POWER DISCONNECT, section I, part 2, and also to section V, for additional information on asymmetrical loadings.)

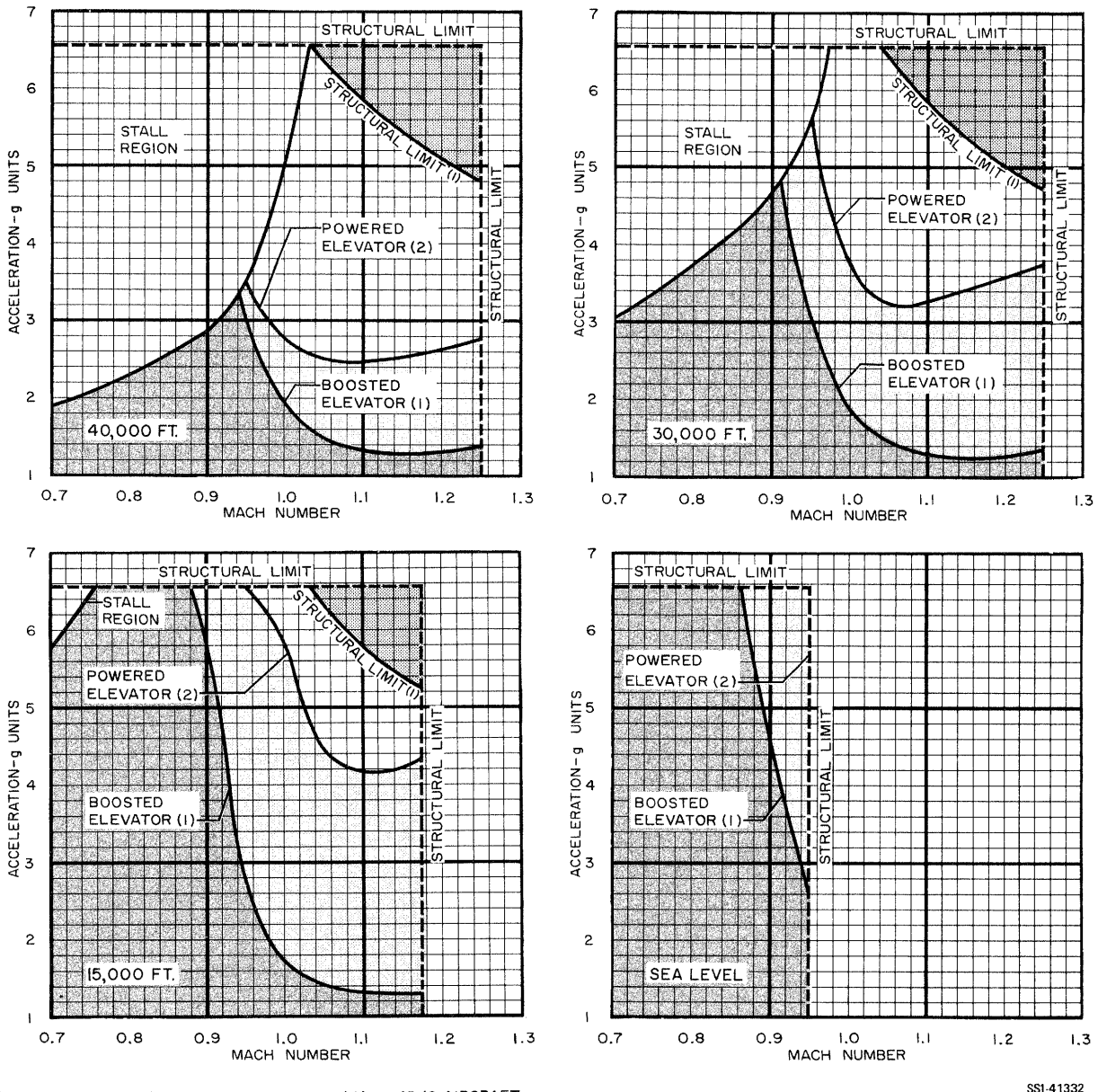
With asymmetric store loadings, the following recommendations are made:

1. A straight-in approach should be made with a known or suspected asymmetrical load. Increased wing drop may be experienced if a break is made into the heavy wing. This condition greatly decreases available aileron deflection for lateral attitude control as the aircraft transitions from break airspeed to landing pattern airspeed.

2. The minimum approach speed should 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.

AVAILABLE MANEUVERABILITY

GROSS WEIGHT 13,316 POUNDS



(1) A-4A AIRCRAFT (2) A-4B/C AIRCRAFT

SS1-41332

REMARKS:

Airplane trimmed for 1 g.
C.G. @ 22.6% M.A.C.

DATA AS OF: 15 August 1956

DATA BASIS: Wind tunnel tests and contractor's flight tests

Figure 4-3. Available Maneuverability

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. Crosswind landings should 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.

Aileron Rolls

During and upon termination of high rate aileron rolls (above 200 degrees per second) in the high speed low altitude region, abrupt pitch down will be noted. This pitch down, though uncomfortable, is structurally safe and aircraft structure limits will not be exceeded provided 360 degrees of roll is 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, stick back pressure should be relaxed.

Rolling Pushovers

During recoveries from high rate rolling pushovers in the high and medium speed low altitude region, a marked pitchdown will be noted. In a stabilized dive of 45 degrees or greater, the decreased normal load factor gives the same effect as a pushover. Recovery from high-rate rolls in these regions will also cause a pitchdown.

WARNING

This pitchdown may exceed the structural limits of the aircraft.

High Angle-of-Attack Pitchup

During flight with center-of-gravity locations aft of 27 percent MAC, high angle-of-attack pitchup may be encountered when applying positive g's. This pitchup is normally preceded by buffet onset and a buildup of buffet intensity. The pitchup manifests itself by a rapid increase in positive g 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 low altitudes (below 15,000 feet) and high speeds (above Mach 0.80), limit load factor precludes the aircraft from encountering pitchup. Between 0.50 and 0.80 Mach number with a center-of-gravity of 27 percent, it is possible to attain pitchup when maneuvering near limit load factor. At intermediate altitudes (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 relaxing back pressure. 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.

HIGH ANGLE-OF-ATTACK CHARACTERISTICS

NEW NEW NEW NEW NEW NEW NEW NEW

Stall

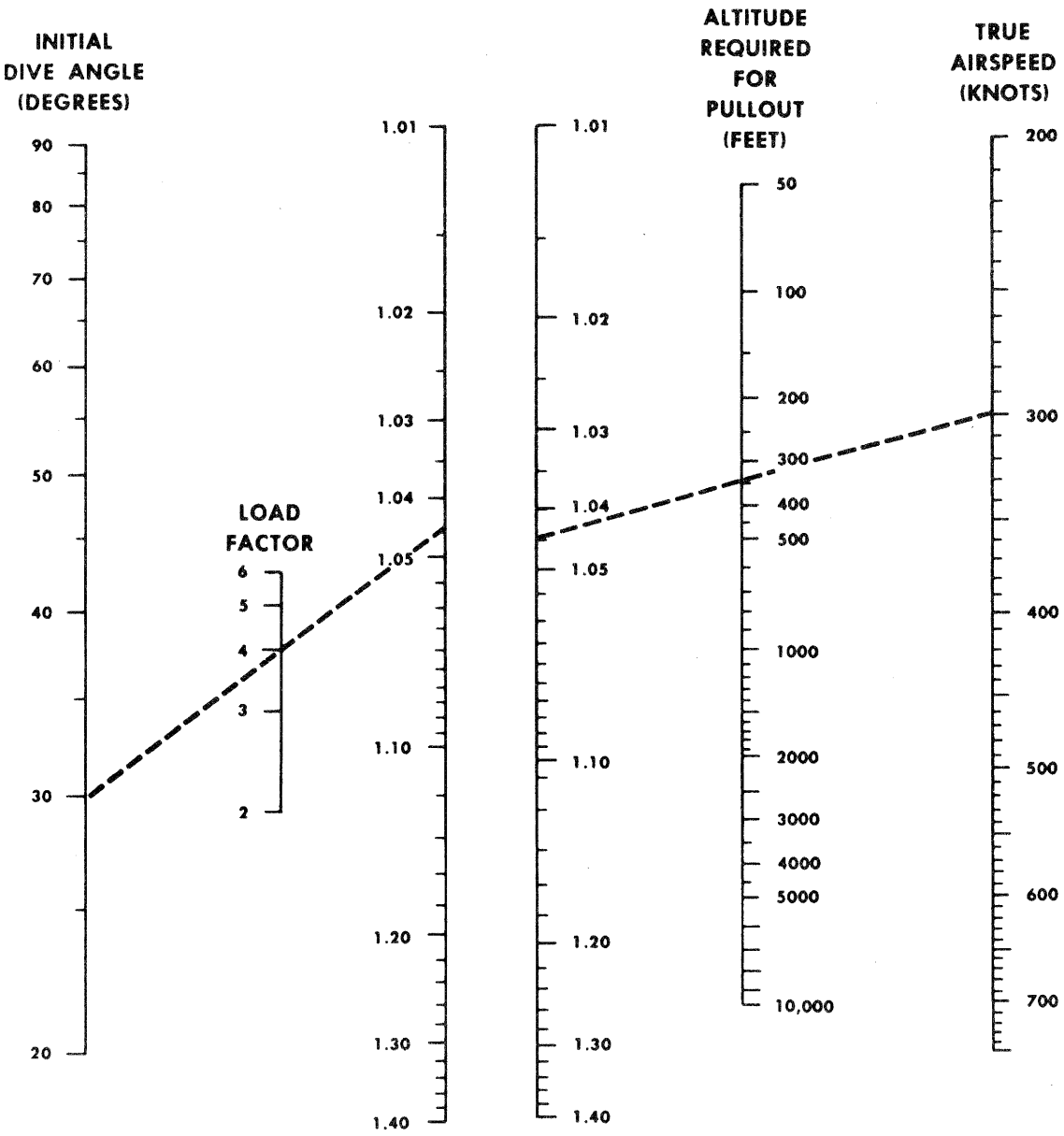
Stall Characteristics are normal in all configurations. The conventional technique of decreasing angle-of-attack with forward stick, simultaneously adding full power, then leveling the wing should be used to recover from a stalled condition. Optimum angle of attack is recommended for recovery from nose-high 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 4-5.

Note

Asymmetric slat extension may require full lateral control to maintain wings level when airspeed is approximately 5 knots above stall.

DIVE RECOVERY

ALTITUDE LOSS DURING CONSTANT G PULLOUT



NOTE:

$$\Delta h = 0.08856\, V_T^2 \ln\left(\frac{n - \cos\gamma}{n - 1}\right)$$

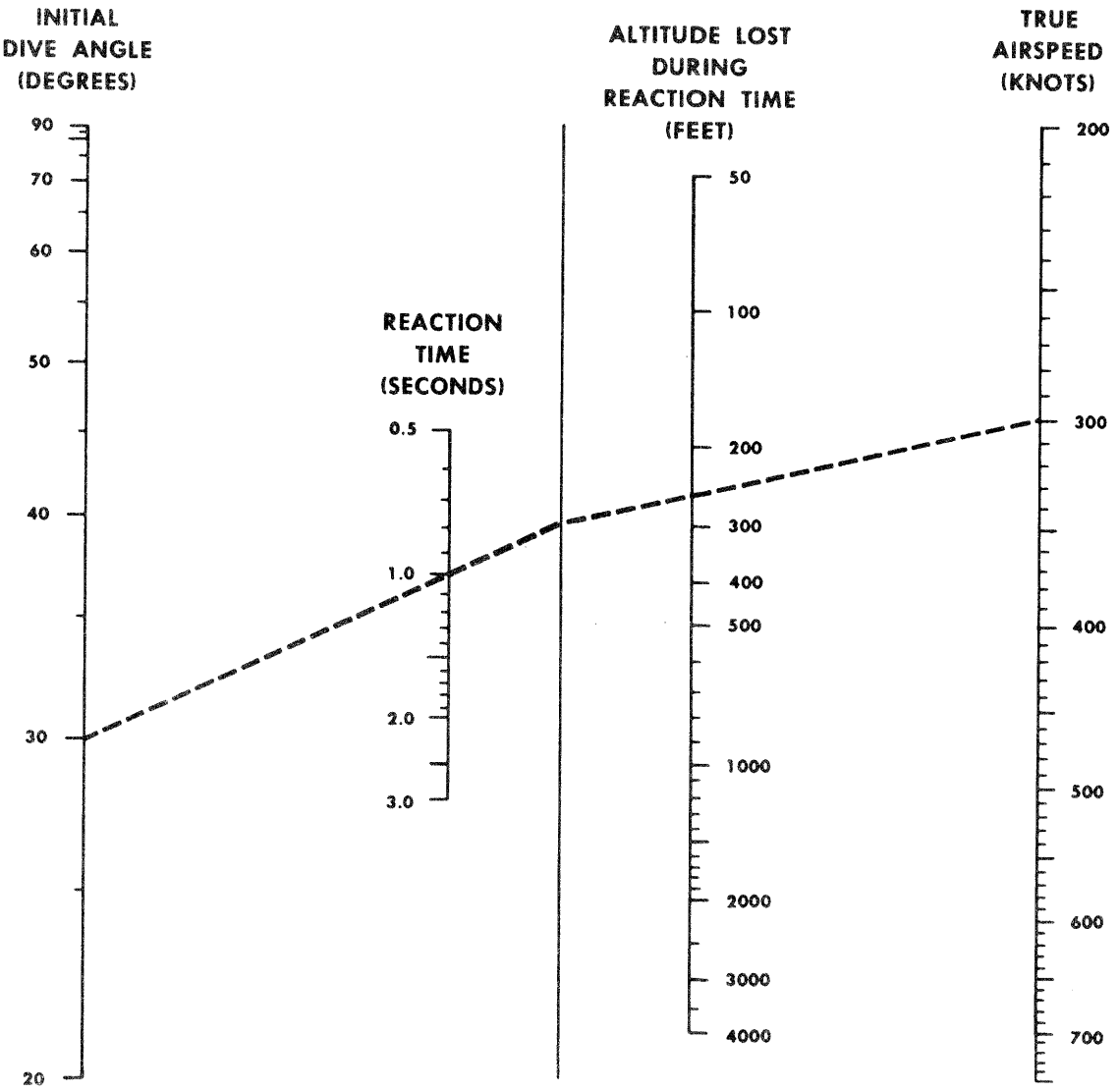
Δh = Altitude Lost (ft)
V_T = True Airspeed (kn)
n = Normal load factor
γ = Flight Path Angle

AVB-1 P-40738-1

Figure 4-4. Dive Recovery Chart (Sheet 1)

DIVE RECOVERY

ALTITUDE LOSS DURING PILOT REACTION TIME



NOTE:

$\Delta h = 1.689\, V_T \times \Delta T \ \text{Sin}\ \gamma$

Δh = Altitude Lost (ft)

V_T = True Airspeed (kn)

ΔT = Reaction Time (sec.)

γ = Flight Path Angle (deg.)

AVB-1 P-40739-1

Figure 4-4. Dive Recovery Chart (Sheet 2)

Accelerated Stalls

Accelerated stalls are preceded by adequate stall warnings in the form of general airframe buffeting. Recovery is easily accomplished by relaxing aft stick. A light buffet occurs just prior to slat opening. After the slats open, the buffeting disappears until the AOA approaches the accelerated stall, 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.

Nose-High Recovery

During maneuvering flight, nose-high, low airspeed conditions may be encountered that necessitate termination of the maneuver and recovery to the normal flight regime. Recoveries from such conditions with airspeed above 100 KIAS are most effectively accomplished by attempting to maneuver the aircraft under positive g to the nearest horizon. Once airspeed decreases below 100 KIAS, the pilot must accept the aircraft attitude and proceed as follows:

Hold and visually check controls in neutral with longitudinal control slightly aft.

Reduce power below 80 percent RPM.

Ensure pitch trim is set between 0 and 4 degrees aircraft nose up.

In most instances, the aircraft will pitch to a nose-down attitude and undergo a few random roll and yaw oscillations at low airspeed. During the nosedown pitch, the nose may pass through the vertical (nose-down) position in pendulum fashion, momentarily attaining an inverted attitude, before stabilizing in a near vertical nose-low dive with rapidly increasing airspeed. Minor engine compressor stalls during the post stall gyrations may occur as rapid staccato banging. When they occur, they should serve as an added warning to neutralize controls and retard the throttle to below 80 percent RPM.

CAUTION

While the aircraft normally recovers from all zero/low-airspeed conditions if the controls are held neutral, it may occasionally enter a nose-low roll with increasing airspeed. When this occurs, opposite aileron and rudder may be required to stop the roll.

Any occasion of low airspeed or high angle of attack should be considered as a period of increased spin susceptibility, and the aircraft should be manuevered with caution. The A-4 series aircraft are not particularly spin prone, and nose-high/low airspeed maneuvers can be performed safely. However, post stall gyrations and the ensuing dive recovery could easily result in large altitude loss.

CAUTION

During the post stall gyrations associated with the controls neutral recovery, the pilot is in a zero or negative g condition and the motions often appear similar to those experienced in an inverted spin. Do not apply spin recovery controls until a spin is confirmed by a sustained yaw rate with low airspeed and a pegged angle of attack.

WARNING

Intentional vertical nose-high, zero-airspeed conditions should not be entered with fuel remaining in the external drop tanks. Loss of the external tanks and structural damage to the aircraft may result should an inverted spin occur.

Following the transition to near vertical nose-down attitude at low airspeed, the leading edge slats may become fully extended and remain aerodynamically locked in that position as airspeed increases. When both slats remained extended during flight tests, light buffet was encountered, but little degradation in flying qualities resulted. If only one slat remained locked in the fully extended position, the aircraft commenced a roll away from the extended slat. The roll rate increased as airspeed increased in the dives; however, the aircraft was controllable, requiring approximately one-half aileron and rudder in the direction of the extended slat to drop the roll and maintain wings lever flight. Application of load factor for dive recovery with one slat aerodynamically locked out will again cause a roll away from the extended slat unless aileron (lateral stick) is maintained into the extended slat. If both leading edge slats remain locked out following a vertical recovery, effect dive pullout with the minimum g required and decelerate in a mild climb. If only one slat remians locked out, unload the aircraft and stop the roll using aileron and rudder. Maintain or increase the lateral control input while effecting dive pullout with the minimum g required. Following dive recovery and while decelerating in a mild climb, the slat(s) will resume normal operation at approximately 200 KIAS.

CAUTION

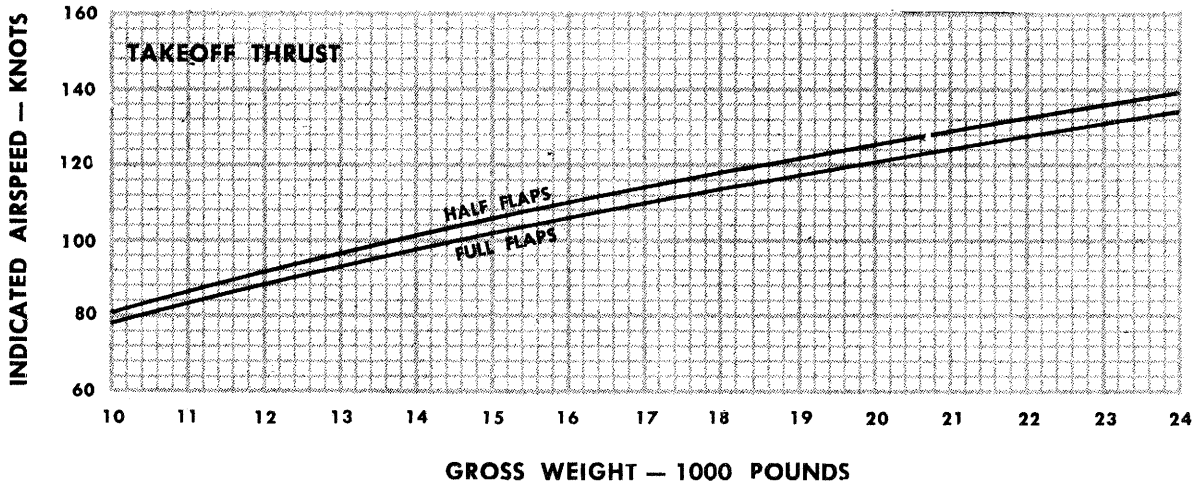
Rapid aft stick application and/or high g levels, if required for dive recovery, may cause structural failure of the locked out slat(s). Additionally, g application with an asymmetric slat condition may cause an uncontrollable roll which cannot be stopped until the g level is reduced.

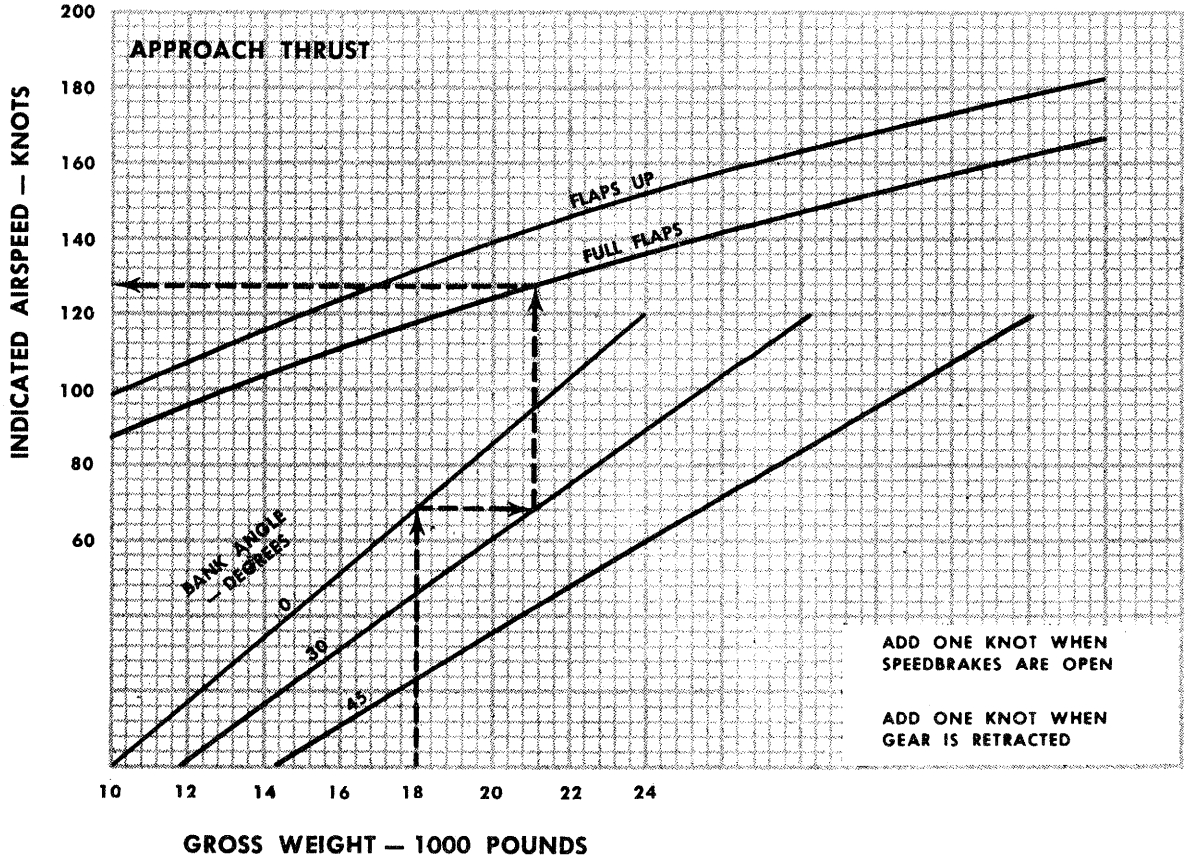
STALL SPEED

SPEED BRAKES RETRACTED
GEAR DOWN

MODEL: A-4C/L
ENGINE: J65-W-20

DATA AS OF: 15 JUNE 1972
DATA BASIS: ESTIMATED





SS1-41333

Figure 4-5. Stall Speeds

DEPARTURE

Characteristics and Procedures

The A-4 series aircraft are not departure prone; however, departures from controlled flight occur primarily as a result of nose-high, low airspeed conditions or accelerated stalls caused by asymmetric slat extension. Departures resulting from nose-high, low airspeed conditions are initially characterized by large uncommanded nosedown pitch rates (up to 70 deg/sec), followed by random roll and yaw post stall gyrations. Accelerated departures caused by asymmetric slat extension result in high roll rates. Lateral or longitudinal control inputs aggravate aircraft motion and can result in large yaw excursions, prolonging the out-of-control flight condition.

Once a state of out of control is accepted, whether entered from lg or accelerated flight, the proper corrective action is:

Hold and visually check controls in neutral with longitudinal control slightly aft.

Reduce power below 80 percent RPM

Ensure pitch trim is set between 0 and 4 degrees aircraft nose up.

WARNING

An incorrect stabilizer trim setting (greater than 6 degrees nose up or less than zero) is the same as intentionally holding aft or forward stick during the post stall gyrations. The slightly aft stick postition for recovery is dependent upon correct stabilizer trim.

The pilot must accept the random roll and yaw oscillations associated with the out-of-control condition. Intentional or inadverant control inputs will increase the magnitude of roll and yaw excursions, prolonging the departure, and possibly result in spin entry.

Spin verification can only be accomplished by waiting with controls held neutral, to see if the post stall gyrations cease. Do not apply spin recovery controls until a spin is confirmed by a sustained yaw rate (direction determined by the turn needle) with low airspeed (below 200 KIAS) and a pegged angle of attack. Certain post stall gyrations exhibiting high roll rates at zero or negative g are easily confused with an inverted spin. In this case, the angle of attack is oscillating and airspeed continually increases. If airspeed is increasing through 200 KIAS, the aircraft is definitely not spinning. following departure, maintain controls neutral during the post stall gyrations; monitor angle of attack, airspeed and altitude; and commence dive recovery as airspeed is increasing through 200 KIAS. If residual roll exists at 200 KIAS, stop the roll with aileron and then commence dive recovery.

SPIN CHARACTERISTICS

The following steps summarize spin recovery procedures and apply for all loading conditions of A-4 aircraft.

1. Neutralize flight controls and physically hold centered (visually check position of the stick).

2. Retard throttle to IDLE.

3. Check trim setting and retrim aircraft to between 0° and 4° with nose up.

4. Determine type of spin (erect or inverted) by reference to the AOA indicator and direction of spin by reference to the turn needle.

5. Apply and maintain recovery controls:

Aileron - Full with turn needle deflection if spin is erect.

Aileron - Full opposite turn needle deflection if spin is inverted.

Rudder - Full opposite to turn needle deflection.

Stick - Neutral to slightly aft.

6. Neutralize controls when rotation stops and recover from the ensuing dive at a maximum of 18 to 20 units angle of attack.

Out-of-Control Flight

Generally, out-of-control flight can be divided into three phases:

Departure (Post-Stall Gyration)

When the aircraft, as a 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 do not result in the normal aircraft response.

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.

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 a cyclic fashion. The yaw rate is sustained and angle of attack is above stall, in either a positive or negative direction.

Note

The result of the Navy spin evaluation of the TA-4F are used for the following discussion and are considered applicable to all A-4/TA-4 models.

Erect Spin Characteristics

The aircraft is reluctant to enter full developed erect spins unless pro-spin controls are applied and maintained. Pro-spin controls for erect spins are full aft longitudinal stick, rudder in the direction of spin, and aileron neutral or opposite the applied rudder, although in certain loading/cg conditions the aircraft has been known to spin with only fully 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° nose down to near level with the horizon. There are frequent hesitations in spin rotation and the aircraft sometimes turns in a direction opposite to rudder. No sustained yaw rate develops, airspeed usually increases as the spin continues, and angle of attack varies from 20 to 30 units.

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 of 2,000 to 7,000 ft 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 fpm.

Erect spins entered from an accelerated stall have the same characteristics as those entered from 1.0 g flight, except that more violent snap-roll 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 between 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 20 units. There is no hesitation in spin rotation, and the spin rotation and the spin rate is fast: 3 to 4 seconds per turn with an altitude loss of 1,200 to 1,500 feet per turn. Recovery from this spin mode will be slower than recovery from the previously described erect steep oscillatory mode. See figure 4-6 for erect spin data.

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 4-6. A-4 Spin Recovery

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 4,000 to 5,000 feet may be needed to stop the spin and an additional 4,000 to 5,000 feet are required to pull out. Recovery from a departure may be accomplished with altitude losses varying from 0 to 7,000 feet depending on the entry conditions and pitch attitude on recovery.

Inverted Spin Characteristics

The aircraft is usually reluctant to enter an inverted spin unless pro-spin controls are applied and maintained. Inverted spins have been attained with (1) full forward stick and full rudder in the direction of spin and (2) full aft stick, full rudder in direction of 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 indicator 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, 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 1,200 ft per turn. Negative load factors of over -2.5 g have been experienced during inverted spins. See figure 4-6 for inverted spin characteristics.

Spin Recovery

Neutralization of all flight controls will facilitate recovery during the departure of incipient phase of a 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 any 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 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 stall quite likely: Higher power settings result in higher energy, and therefore more severe compressor stalls.

CAUTION

Following departure from controlled flight, the throttle should be set at IDLE to make compressor stalls less likely.

Large nose-up stabilizer trim settings have sometimes impeded the recovery from erect spins. In addition, nose-up 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° aircraft nose-up after departing controlled flight while maintaining neutral 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 recovery is effected or both angle of attack and turn needle are pegged then apply and maintain recovery controls.

The recovery controls for an erect spin 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. The ailerons are the most effective and most important control for recovery. When spin rotation stops, neutralize all controls. The airplane will be in a nose down attitude.

The recovery controls for an inverted spin 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 nose down altitude. 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. Spin recovery controls are summarized in figure 4-6.

Note

With recovery controls properly maintained, recovery from a full 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. Attitude loss can be minimized by applying g as necessary to maintain airspeed at about 230 knots and angle of attack at 18 to 20 units. A loss of 4,000 ot 5,000 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.

FLIGHT CHARACTERISTICS ON AUTOMATIC FLIGHT CONTROL SYSTEM

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. See Section I, Part 4, for AIRSPEED LIMITATIONS while operating on AFCS and the complete AFCS speed envelope.

Certain flight characteristics of the AFCS are inherent in its detail design and constitute normal performance. Flight characteristics that are evident to the pilot are discussed in the following paragraphs.

Wing Down Phenomena on Heading Hold

There are particular circumstances that 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 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 from the AFCS. 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 angle 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 stablizied, 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 Rollin

During the preselect heading rollin, a slight hesitation or loss of rolling rate may occur at approximately 20 degrees of banked attitude. This is a normal phenomena which is not detrimental to the performance of these circuits.

Preselect Heading "Steppy" Rollout

During the preselect heading rollout, a tendency to rollout 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 stabilizer. 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 the 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. 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 - crosscheck.

AFTER LANDING

Perform the following checks and actions:

1. Throttle - reposition 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 glide slope corrections are made by changing aircraft attitude. Since this technique violates the basic rule that altitude is primarily controlled by throttle, practice is required to develop proper control habit 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 ovveride the APC.

ANGLE-OF-ATTACK RELATIONSHIP

The angle-of-attack relationship for the entire operational envelope of the aircraft is portrayed in figure 4-7.

ANGLE-OF-ATTACK RELATIONSHIP

SPEEDBRAKES CLOSED

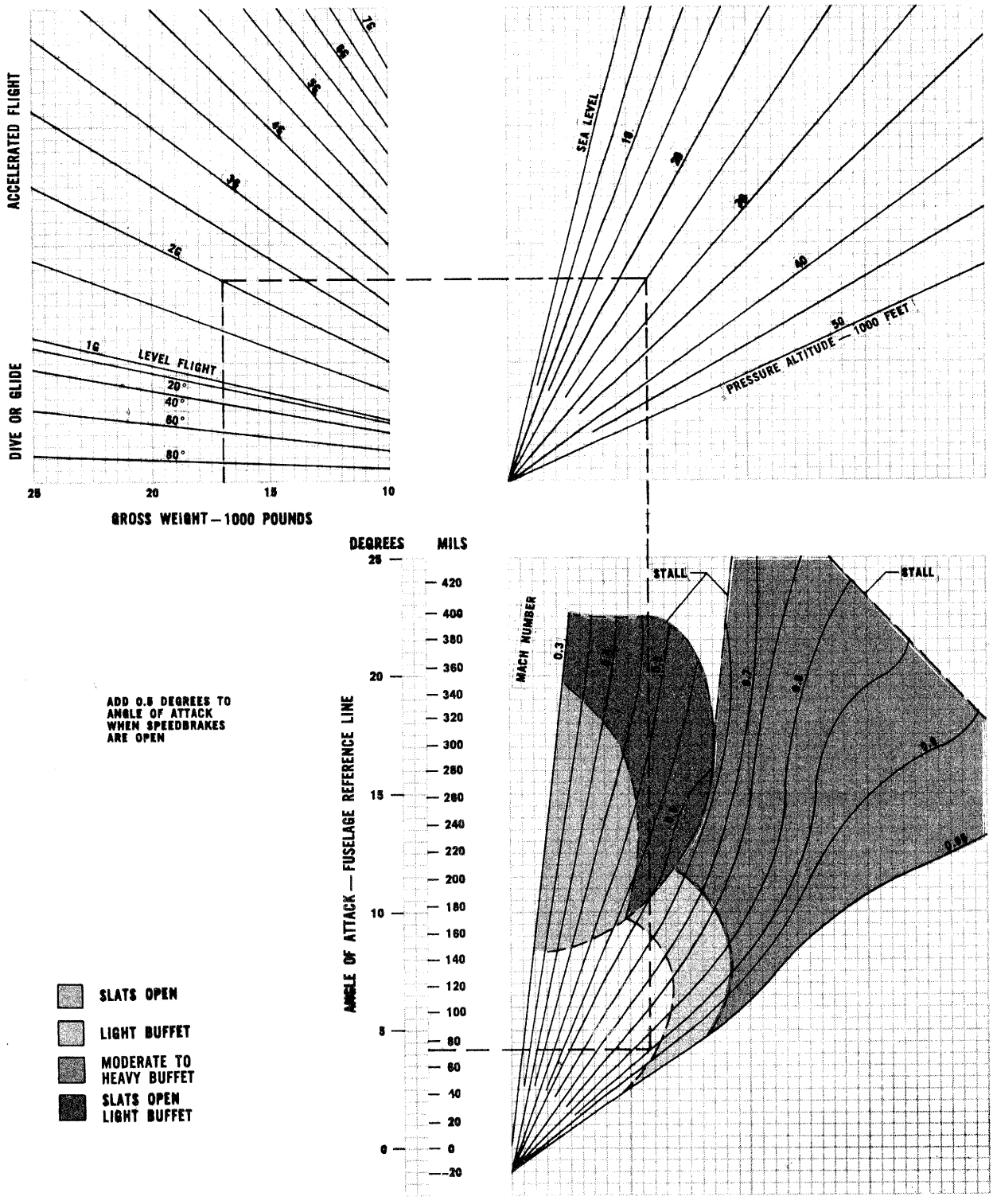


Figure 4-7. Angle-of-Attack Relationship (Sheet 1)

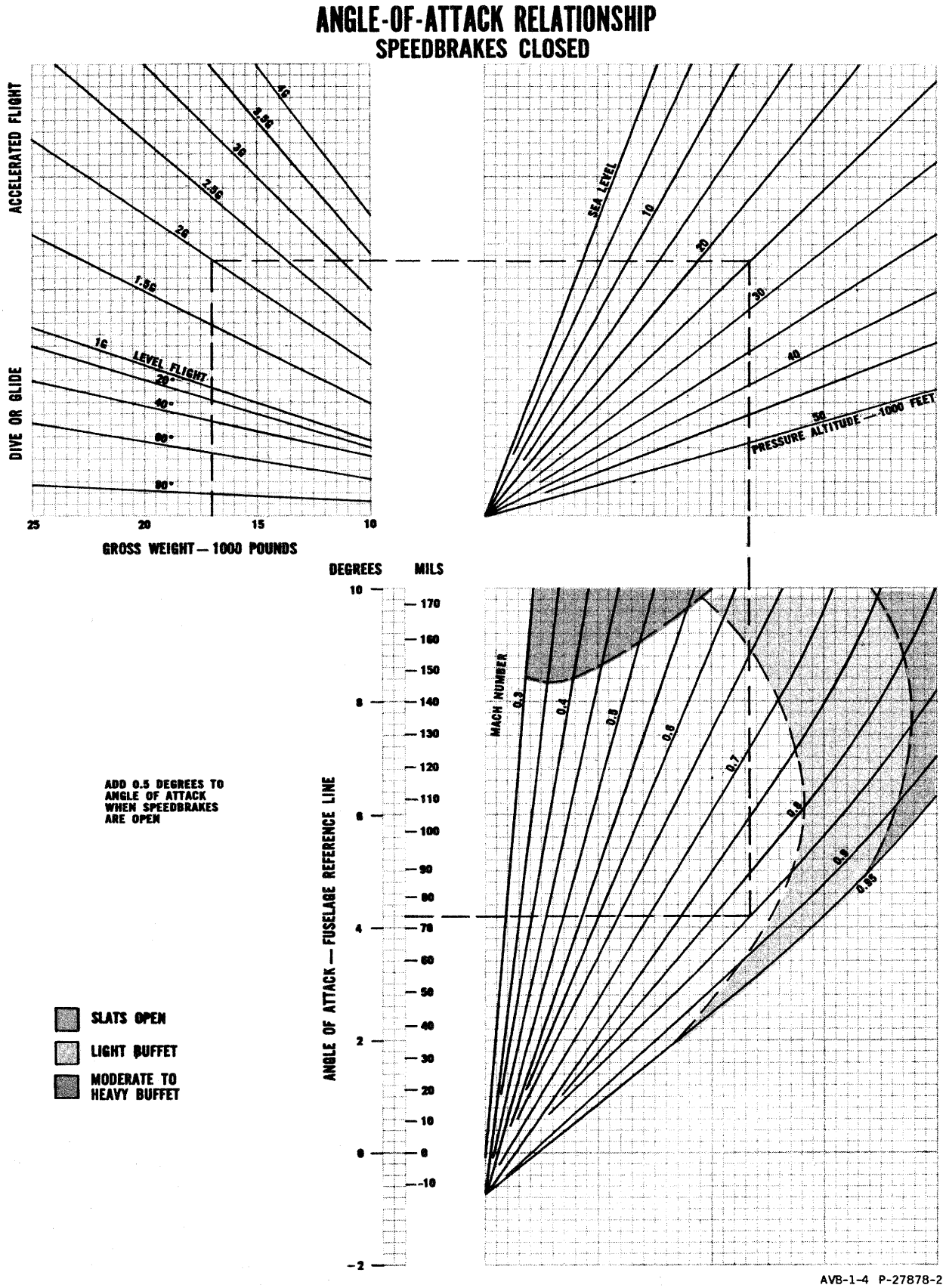


Figure 4-7. Angle-of-Attack Relationship (Sheet 2)

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-4 aircraft.

Familiarization (fam) flights should be designed to acquaint the pilot with the flight characteristics of the A-4 while it is flown at various attitudes, altitudes, and configurations.

Procedures

The following procedures shall be followed for the first fam flight, in addition to those required for other flights.

BEFORE FLIGHT

The chase pilot shall accompany the fam pilot during his preflight inspection and start. The fam pilot shall be the lead aircraft on the 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 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-4 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 fam 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

Specific cruise control techniques are found in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T). General cruise control data is contained in Section XI. Additional comments and suggestions follow.

CLIMB

Acceleration to initial climb speed should be effected before 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. Each pilot should develop his ability to judge distances on the ground from his position at altitude. This 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

Before descent, adjust cabin temperature and defrost air as necessary to prevent windshield frost.

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, Part 7.

NEW NEW

MINIMUM FUEL

Minimum fuel for final landing shall be as defined in OPNAV 3710.7 series. In no case shall this state be less than that required for 800 pounds fuel remaining after final landing.

FORMATION AND TACTICS

Procedures for specific maneuvers are promulgated in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-IT). The following instructions apply to this aircraft.

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 resistant 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 in order 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 should be utilized as the correct bearing (38 degrees) 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 done both 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 join-up 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 he will request the leader's position. The leader will then state his position in the orbit pattern using the numbers 1, 2, 3, or 4 (corresponding to 000, 090, 180, and 270 degrees, respectively), relative to the orbit point as shown in figure 4-8. 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 is the most dangerous type rendezvous due to lack of adequate depth perception and sense of closure rate by the joining pilot. Strict compliance with proper procedures are required. 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 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 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.

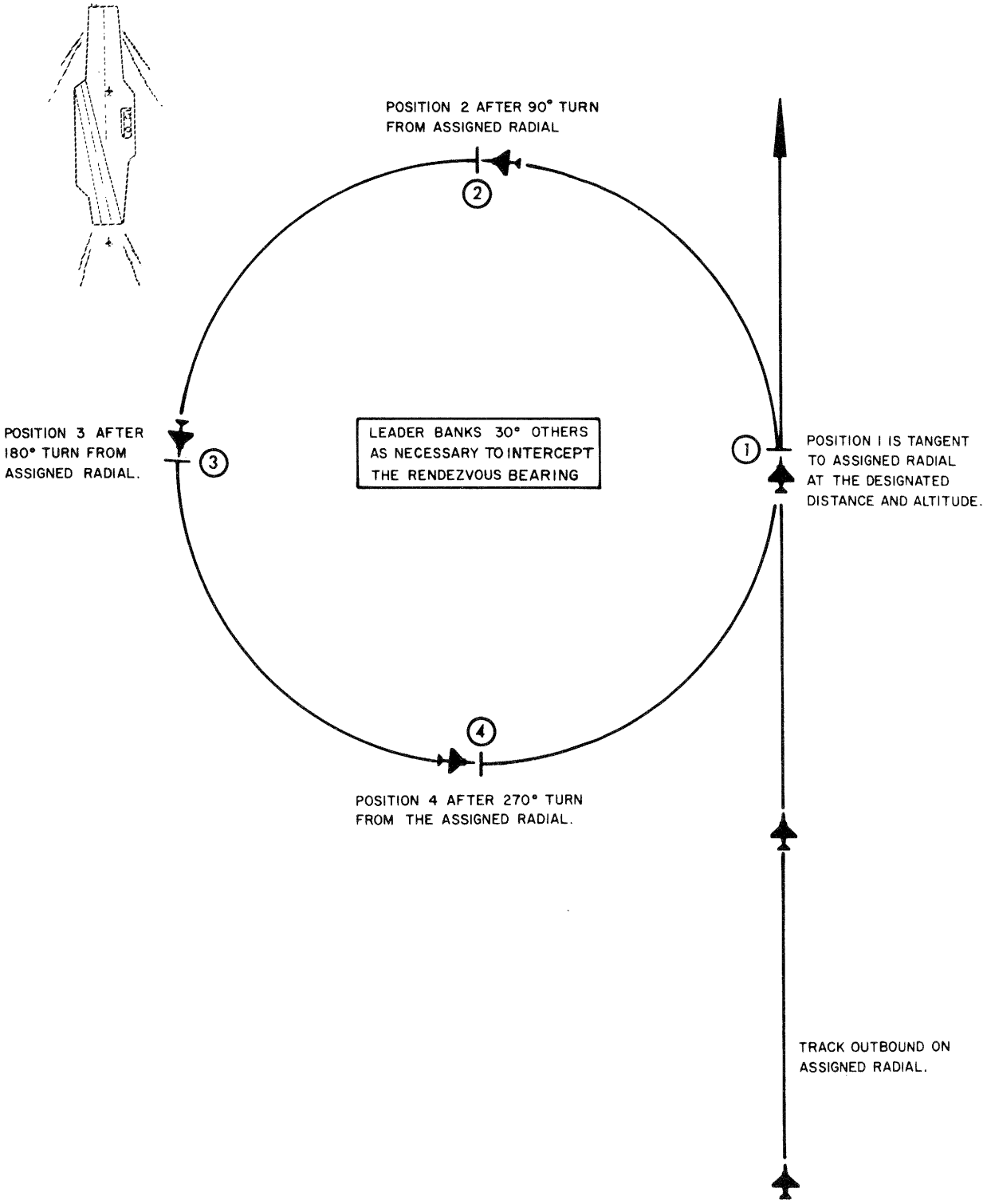


Figure 4-8. TACAN Circling Rendezvous

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 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 number 1 pointer points 5 degrees left or right of the nose position. The number 2 aircraft will hold the leader to his left, number 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.

5. 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 pointer, rotates continuously).

If A/A operation is desired between two aircraft, the channels selected must be separated by exactly 63 channels; i.e., number 1 aircraft set to channel 64, number 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 198 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 number 1 pointer on the nose when the leader transmits. From the change in azimuth of the number 1 pointer between short counts, approaching aircraft will be able to determine their approximity to the lead aircraft. Approaching the flight leader, the pointer 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 dicatates. 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 on BRT/FLASH (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 will 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 motion 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 joining-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 line up on a parade bearing with enough lateral clearance to provide separation between aircraft in case the leader experiences a blown tire or is required to abort on takeoff. When the section is in position, the flight leader will give a one finger turnup signal and both pilots will turn up 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-degrees noseup trim is permissible.

A raised hand will be signaled by each pilot when the checks are accomplished and the pilot is ready for takeoff. The leader will then drop his hand smartly out of view at brake release for commencement of takeoff roll. The leader will smoothly advance power to military and then reduce power approximately 2 percent. The wingman will adjust his power as necessary 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 automatically (170 KIAS minimum). 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.

Note

NEW

Using the leaders wing leading edge as the parade bearing may be preferable during periods of prolonged formation flying, IFR, or night time.

NEW

FOUR PLANE DIVISION (FINGERTIP FOUR). No. 3 aircraft flies identical position on the 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 on No. 1 and 3.

ECHELON. All aircraft are on the same side of the leader. No. 3 and 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 about 35 to 40 degrees aft of abeam the leader (a bearing generating from the leading edge of the leader's wing which is 38 degrees). The wingman's distance out on bearing may vary between 50 to 100 feet depending upon the mission. This will always provide for a minimum of 10 feet of 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. He should not cruise in the leaders 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 no signals can be passed while he is there.

DIVISION. The bearing of the section leader from the leader is the same as that of the wingman. He will maintain adequate distance on bearing to give him a minimum of 10 feet of 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 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-foot nose-to-tail position 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 should consider the number of aircraft in the formation. Since the leader decelerates first on the climb, a power reduction will probably be necessary initially; and in dives an initial power increase will be required, since the leader accelerates first.

AIR REFUELING

Refer to figure 4-9 for tanker panel configurations.

PRESTART

1. Refueling master switch . . . . OFF
2. Gallons delivered indicator set to 000
3. Drogue position switch . . . . RET
4. Fuel transfer switch . . . . . OFF
5. Hose jettison switch . . . . . OFF (FORWARD)
6. Light switch . . . . . BRT (DAY); DIM (NIGHT)
7. Ship-tank switch . . . . . OFF

POST START

1. Ship-tank switch . . . . . FROM STORE
2. 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 the PRESS-TO-TEST light to test bulb.

3. Ship-tank switch. . . . . OFF

Drogue Extension

1. Refueling master switch. . . . .ON
2. Drogue switch . . . . . .EXT

Note

Be prepared for small trim changes as the drogue is extended.

3. Drogue position will read . . . .EXT, WHEN DROGUE REACHES 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 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 FLIGHT 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-hand console, ensure that the SHIP-TANK switch is in the OFF position before engaging in air refueling. On all aircraft reworked per A-4 ASC 209, ensure that the EMERGENCY WING TANK TRANSFER switch is in the OFF position before engaging in air refueling.

STOPPING FUEL TRANSFER

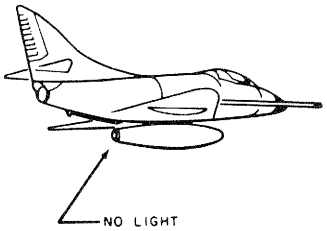
To halt fuel transfer to the receiver at any time, turn fuel transfer switch to OFF.

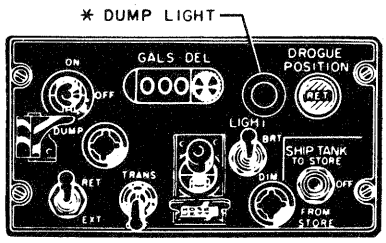
Note

Refueling cannot be stopped by placing the refueling master switch to OFF. Refueling will stop if the receiver aircraft backs off enough for the amber light to come on, or if the probe disengages. In either case, the drogue position indicator window will change from TRA to EXT.

To halt fuel transfer to the store, turn SHIP-TANK switch to OFF.

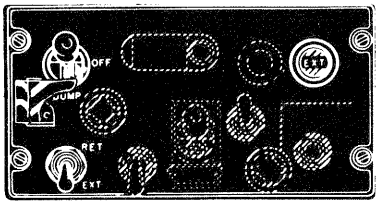
TANKER PANEL CONFIGURATION PRIOR TO AIR REFUELING





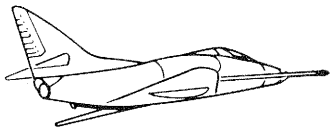
REFUELING MASTER SWITCH ..... OFF
FUEL COUNTER 000
DROGUE POSITION INDICATOR ..... RET
DROGUE POSITION SWITCH ..... RET
TRANSFER SWITCH ..... OFF
HOSE JETTISON SWITCH (OFF = FORWARD)
LIGHT SWITCH ..... (DAYTIME) BRT
SHIP TANK SWITCH ..... OFF

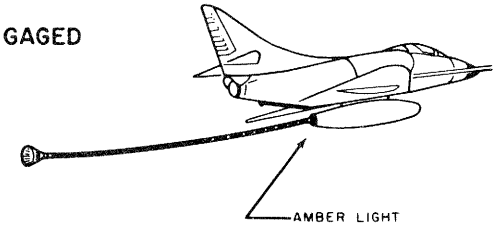
* BY ACCESSORY CHANGE NO. 1



REFUELING MASTER SWITCH ..... ON
DROGUE POSITION SWITCH ..... EXT
DROGUE POSITION INDICATOR ..... EXT

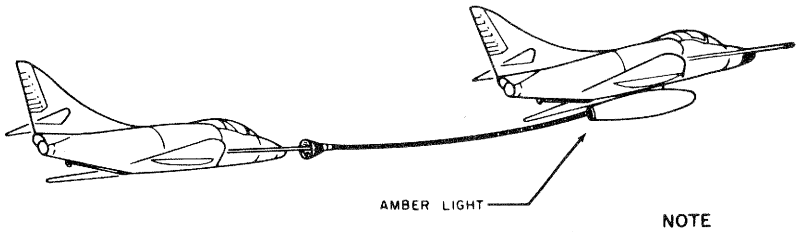
DROGUE EXTENDED – NOT ENGAGED

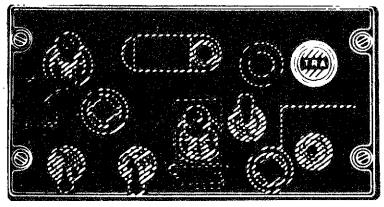




NOTE
ON POSITION OF REFUELING MASTER SWITCH UNFEATHERS RAM AIR TURBINE FOR STORE'S HYDRAULIC PRESSURE

ENGAGED – BEFORE FUEL TRANSFER





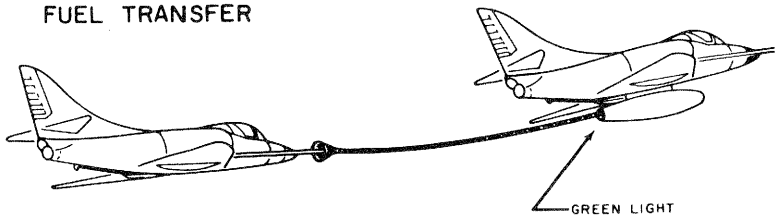
DROGUE POSITION INDICATOR ..... TRA

NOTE
COUPLING OF PROBE WITH DROGUE WHILE TRANSFER SWITCH IS OFF CAUSES DROGUE POSITION INDICATOR TO SHOW (TRA) MEANING READY TO TRANSFER.



TRANSFER SWITCH ..... TRANS
FUEL COUNTER ..... (COUNTS GALLONS)

FUEL TRANSFER

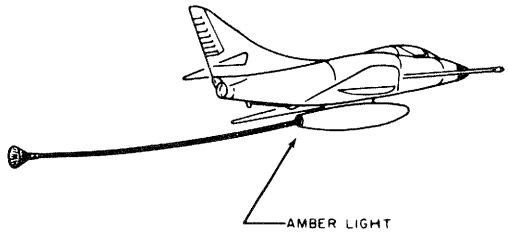


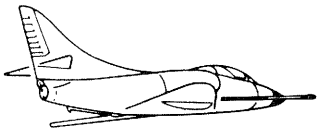
NOTE
GALLONS COUNTER CONFIRMS FUEL TRANSFER TO TANKER PILOT. GREEN LIGHT CONFIRMS FUEL TRANSFER TO RECEIVER PILOT.

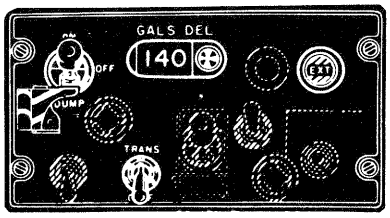
AVB-1 P-40741-1

Figure 4-9. Tanker Operation - Air Refueling (Sheet 1)

DISENGAGEMENT

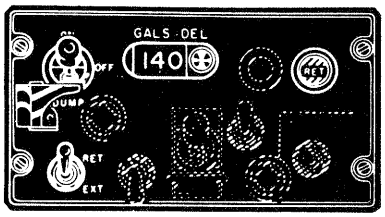






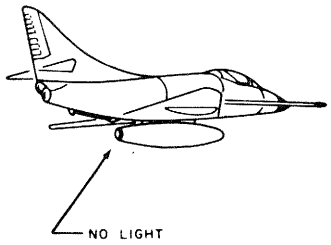
REFUELING MASTER SWITCH ..... ON
TRANSFER SWITCH ..... OFF
DROGUE POSITION INDICATOR ..... EXT

DROGUE RETRACT

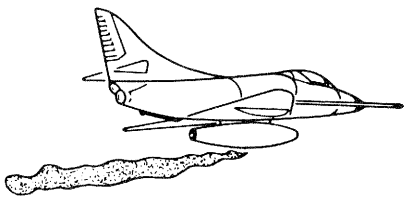


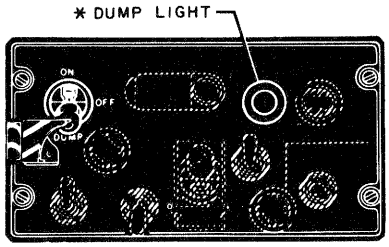
REFUELING MASTER SWITCH ..... ON
DROGUE POSITION SWITCH ..... RET
DROGUE POSITION INDICATOR ..... RET

AFTER DROGUE RETRACT
REFUELING MASTER SWITCH ..... OFF



FUEL DUMP



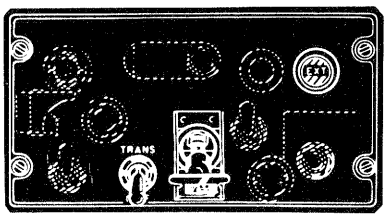


REFUELING MASTER SWITCH ..... DUMP
(ALL OTHER SWITCHES SAME AS
NORMAL PANEL CONFIGURATION)

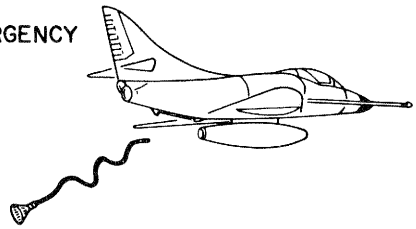
NOTE
FUEL DUMPING SHOULD ALWAYS BE DONE PRIOR TO ANY ARRESTED LANDING EITHER AFLOAT OR ASHORE.

* BY ACCESSORY CHANGE NO. 1

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.

AVB-1 P-40742-1

Figure 4-9. Tanker Operation - Air Refueling (Sheet 2)

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 about 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 WING

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 drop tanks 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 about 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 tank 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, 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 dumped 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 an arrested landing to ensure that the store is empty. Ensure that dump valve is closed prior to landing.

Jettisoning the Fuel Store

The air refueling store may be jettisoned electrically in the same manner as other external tanks. (Refer to section VIII.)

Emergency Operation

Refer to EMERGENCY PROCEDURES, Section V.

Tanker Safety Precautions

WARNING

- Do not start the turbine or extend or retract the drogue when over populated areas or when other aircraft are close abeam or behind.
- Do not extend the drogue 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.

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 airplane is in a nosedown attitude.

- 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 forward OFF position. Inadvertent cycling of this switch will cause internal damage to the store and may create a fire hazard.

NEW NEW NEW NEW NEW NEW NEW

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
7. No nose down attitudes
8. Angle of bank shall not exceed 45 degrees.

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.

Note

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

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 knots. 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 receiver hookup, disengagement should be made immediately and the store be 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 console. Accessory Change No. 33 adds white lights in the aft section of the air refueling store and on the periphery of the drogue.

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 2 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.

WARNING

When receiving fuel from a KC-135 aircraft the maximum total fuel on board 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 the inadequate pressure regulation of KC-135 aircraft tanker systems.

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 has 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 turnup signal).

3. The tanker will unfeather, ensuring airspeed is 250 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 trubine 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 the 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 air conditioning to RAM while in flight refueling. If fuel is ingested into the engine from a leaking drogue, it may appear in the cockpit as white smoke. Immediately disengage if smoke appears in the cockpit. If refueling at an altitude of 10, 000 feet or below, turn air conditioning to RAM prior to plug-in, to prevent possible ingestion of fuel vapor into the cockpit if a malfunction occurs.

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 pilot when 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, use caution during engagement, as hose tensioning and reel-in may be inoperative. The most likely cause, however, is a burnt-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 "hose whip, "with ensuing 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 too 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 two 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 TRANS position and transfer 2 to 4 gallons 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 explosions 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 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 number 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-foot separation. When the tanker pilot observes the entire flight (and escort) in this position, he will retract the drogue and feather the 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.

NIGHT FLYING PROCEDURES

Night flying procedures are identical to day procedures with the exceptions 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 aircraft 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 in order 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.

Note

The LIGHTS BRT/DIM switch on the air refueling store control panel affects only the amber and green lights. The white lights (added by Accessory Change No. 33), which illuminate the hose immediately aft of the store, come on when the drogue position switch is placed in the EXT position and go off when the switch is placed in the RET position. The four white lights on the drogue are actuated by the air-driven generator and come on whenever the drogue is extended into the air stream.

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 A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

SECTION V
EMERGENCY PROCEDURES

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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 the OFT/WST are ideally suited for realistic simulation of almost all emergencies that may be experienced. Above all, the pilot must be able to recognize emergency situations, analyze the possible courses of action, select the best one, and then take the action necessary in accordance with the procedures of good airmanship.

1. NWP 41 (series) contains general considerations which are applicable in various emergency situations.

2. NWP 37 (series) discusses SAR organization and procedures.

3. FLIP #IFR Enroute Supplement covers current procedures for two-way radio failure, recommended procedures for any emergency phase (uncertainty, alert, distress, lost), and procedures for use with rescue interceptor, both day and night.

4. Operation Plans and orders of carrier-force Commanders and Commanders of other forces using aircraft contains provisions for handling aircraft in distress and for rescue of personnel.

5. When an emergency is experienced while operating within the continental limits of the United States, the IFF-function select knob will be placed in EMERGENCY position, with mode-3 switch forward and mode-1 code 00 and mode-3 code 77 set on SIF control panel, unless otherwise directed by competent authority.

This chapter contains the specific step-by-step procedures to be used for all emergencies likely to be encountered in the A-4C/L. Use information as the primary guide for studying remedial procedures for various emergencies. The information contained in other sections of this manual must be used to acquire additional knowledge of systems operation and malfunctions.

In general, the emergencies a pilot will encounter fall into one of four categories, these are: Ground Emergencies, Takeoff Emergencies, Inflight 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; e.g., compounded emergencies, facilities available, weather factors, etc. 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

HOT START

Any start during which the exhaust gas temperature, (EGT) exceeds 720° C is a hot start. If the starting limit seems likely to be exceeded, immediately move the throttle to OFF. Before attempting another start, have maintenance personnel check the overboard drain to make sure that fuel has drained completely from the combustion chamber.

CAUTION

If engine exhaust gas temperature (EGT) exceeds 720°C, the engine must be subjected to a hot section inspection.

FALSE/HUNG START

When the engine lights off normally and the EGT remains within limits, but the rpm does not increase to IDLE, a false start is indicated. If the rpm does not reach IDLE within 120 seconds after moving the throttle to IDLE, retard the throttle to OFF and signal to cut off GTC air to the starter. Have ground crew investigate the cause of the false start prior to making another start attempt.

WET STARTS

A wet start will occur when engine light off is not obtained within 15 seconds after moving the throttle to IDLE. When this occurs, there will be no EGT indication and fuel vapor will emit from the tailpipe. When a wet start is determined by ground personnel, retard the throttle to the OFF position and proceed with clear engine procedure.

CLEAR ENGINE PROCEDURE

Inspect aft fuselage for fuel, if no fuel exist proceed as follows:

1. Throttle . . . . . OFF
2. GTC air . . . . . APPLIED
3. Engine . . . . . WINDMILL 15 TO 20 SECONDS
4. GTC air . . . . . OFF

Engine Fire During Start

1. Throttle . . . . . OFF
2. Manual fuel shutoff cont . . . . . EMERG OFF
3. GTC air . . . . . APPLIED
4. If fire continues . . . . ABANDON AIRCRAFT
5. Ground personnel . . . . USE CO_2 AT INTAKE

Wing or Accessory Section Fire

If ground personnel determine that fire is in the wing or accessory section, they should signal 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. Throttle OFF or IDLE, as needed, and transmit "(identification) BRAKE FAILURE" if possible before electrical power is lost after shutdown.

2. Drop arresting hook and, if at night on flight deck, turn on exterior lights.

3. Allow the aircraft to coast to a stop. In the event of a single-brake failure, use the remaining brake to stop the aircraft. Ground loop, if required to remain on taxiway or flight deck.

4. Retract the landing gear as a last resort to stop the aircraft, if circumstances warrant.

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 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 before moving.

3. If operational necessity requires immediate takeoff, leave the landing gear extended at least 3 minutes after takeoff to provide sufficient cooling of wheel assembly to prevent explosive failure. (Refer to NAVAIR Instruction 01-10-506 series for additional information on this subject.)

TAKEOFF EMERGENCIES

Catapult Emergencies

Certain emergencies may occur during the catapult launching sequence which do not necessarily require an immediate ejection by the pilot. Among these are: Pre-mature Hold-Back Separation, Bridle Failure or Catapult Hook Failure. Should such a situation occur and should sufficient deck space be available, the pilot may be able to save the aircraft. In order to be able to react quickly and positively when confronted with a problem of this nature, the pilot must anticipate such a malfunction during the launching evolution.

Should an emergency of this type occur the following procedure is recommended:

1. THROTTLE . . . . . .OFF

2. BRAKES. . . . . FULL APPLICATION

3. If aircraft cannot be stopped, EJECT prior to aircraft leaving flight deck.

Jettison of Stores

Jettison of stores should be considered in those situations where a successful takeoff becomes questionable if continued in present configuration. Stores may be jettisoned using either main or emergency generator power. Select the desired position on the emergency jettison select switch and pull the emergency bomb release handle.

Nose Pitchup On Takeoff

Nose pitchup on takeoff may be due to either runaway noseup trim or a partial disconnect of the elevator power system. Specific procedures to counter either of these malfunctions are published in this emergency procedures section, but the pilot must react successfully to the immediate problem of nose pitchup to maintain control of the aircraft and provide time for determination of the exact nature of the malfunction. Limited forward stick travel, in the case of the partial disconnect, and limited elevator effectiveness, in the case of runaway noseup trim, cause excessive nose pitchup as the aircraft accelerates through approximately 170 KIAS and the flaps are raised.

To regain control of the aircraft, the pilot must immediately lower the flaps while reducing airspeed to the minimum required for safe flight by maintaining a controllable climbing attitude and adjusting the power setting as necessary. The judicious use of bank angle may be advantageous and necessary in assisting the pilot to control the nose high attitude. The jettisoning of external stores will reduce aircraft gross weight and stall airspeed. Once controlled flight is ensured, the pilot shall comply with the applicable emergency procedures for the partial disconnect of the elevator power system or runaway noseup trim.

WARNING

Should the angle of attack approach that for a stall, excessive altitude loss and sink rate may develop and thereby preclude a safe ejection.

Flaps-Up Takeoff

Half flaps are recommended for all field takeoffs. If the flaps malfunction or the flap switch is left in the UP position, a takeoff can be made safely providing takeoff speed does not exceed the safe tire limit of 175 knots groundspeed.

CAUTION

Do not exceed the safe tire limit speed of 175 knots groundspeed.

A flaps-up takeoff may be accomplished by increasing the half-flap takeoff speed (figures 11-8 and 11-48) from 7 knots at 18,000 pounds to 8-1/2 knots at 22,000 pounds. This increase in takeoff speed results in an increase in ground run distance of from 200 feet to 400 feet respectively.

The safe tire speed limit of 175 knots groundspeed limits the maximum weight at which flaps-up takeoffs may be safely completed. The maximum weight is that weight at which the flaps-up takeoff speed is 175 knots groundspeed.

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 RPM/EGT, 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 carry out an abortive takeoff, the pilot must be aware of the location of airfield facilities which may be at his disposal. Effects of wind component must be considered.

A takeoff abort shall be accomplished by use of arresting gear when available, unless it is certain the aircraft will be stopped or slowed to taxi speed by normal braking on the runway remaining. The procedures 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

Best deceleration will occur by placing the throttle to OFF (A-4C);or by placing the throttle to IDLE until below 80 KIAS and then by placing the throttle to OFF (A-4L).

b. Speedbrakes OPEN

c. Ensure spoilers ARMED (A-4L)

d. Stick forward

e. Simultaneously with above steps, broadcast "(identification) aborting takeoff, " to warn following aircraft and tower.

f. Flaps as set

g. 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.

h. 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 abort gear is available the following procedures should be used:

a. Throttle to OFF.

Note

Best deceleration (A-4L) will occur by placing the throttle to IDLE until 80 KIAS and then by placing the throttle to OFF.

b. 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.

c. Speedbrakes OPEN, insure spoilers ARM (A-4L), 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.

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 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.

Maximum Braking Procedure

When the nose wheel is firmly on the runway and excessive crosswind does not exist, immediate moderately heavy braking should be applied. Steady braking (no brake pedal pumping) should be maintained throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases. If pedal pressure is lost, pump brake momentarily in an attempt to regain pressure.

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 up wing side should be reduced to prevent tire blow out. 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.

2. At high gross weights where takeoff distance utilizes most of the runway available, 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 liftoff cannot be accomplished before reaching the end of the runway.

3. If a successful takeoff is made with a blown main or nose tire, delay retraction of the landing gear until rotation has ceased. If possible, get a visual check of the tire condition by another aircraft to determine whether or not retraction can be safely accomplished without having the wheel hanging up in the wheelwell. 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 Noseup Trim

NEW NEW NEW NEW NEW NEW NEW NEW

Runaway noseup trim on takeoff may not be apparent until the takeoff has been accomplished and should pose minimal control problems unless the aircraft is allowed to accelerate through approximately 170 KIAS and the flaps raised. At this point, excessive nose pitchup will be encountered and, although the stick may be pushed fully forward, the elevator will not have the authority to override the horizontal stabilizer trimmed to the full noseup position. Should this situation be encountered, proceed as follows:

1. Position flaps full down.

2. Maintain a minimum safe airspeed with attitude and power adjustment as necessary.

3. Use manual trim override to reposition longitudinal trim to the desired setting. If trim continues to runaway, deactivate stick trim by deploying emergency generator or by using the horizontal trim disconnect switch if installed.

4. Jettison external stores, if required.

5. Burn down and land.

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. In this case, foresight can prevent this situation. Use the takeoff checklist on the instrument panel immediately before takeoff roll and glance at the trim indicators when approaching liftoff distance. An added precaution is to ensure that the stick is grasped in such 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 on takeoff, and the airspeed is less than 90 KIAS, abort the takeoff. In the event of a confirmed engine failure, fire, or structural failure on takeoff, and the airspeed is above 90 knots on the ground or when airborne, EJECT unless the aircraft can be stopped on the remaining runway.

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, this section.

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 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 before 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 . . . . . EMERG OFF
7. Land straight ahead.

Refer to FORCED LANDINGS, this section.

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 burn down below maximum permissible landing gross weight and land.

CAUTION

Avoid contacting the landing gear handle when using the emergency bomb release handle, landing gear handle guard malfunction may result in inadvertent lowering or raising of the landing gear.

Retraction Safety Solenoid Inoperative

To raise the gear with the retraction safety solenoid inoperative:

1. Obtain a visual check of main landing gear mounts to ensure proper strut extension.

CAUTION

Retraction safety solenoid failure may be because the port main landing gear strut is not fully extended. If an attempt is made to raise the landing gear when this 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 malfunction.

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 the 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. Proceed as indicated:

Main Gear Unsafe or Down, Gear Handle UP

1. Maintain 225 KIAS or less.

NEW 2. Obtain visual check. If gear up and doors flush, cycle the gear in an attempt to obtain an up indication. Continue the mission.

3. If unable to get an UP indication by cycling, get a visual check by aircraft or ground personnel. Continue the mission if the gear doors are closed and flush with aircraft. Otherwise, burn down and land.

Nose Gear Unsafe or Down, Gear Handle UP

1. Maintain 225 KIAS or less.

2. Get a visual check by other aircraft or ground personnel to determine whether nose gear door is closed and flush with the aircraft. Cycle the gear, if the door is reported to be closed, in an attempt to get an UP indication. Continue the mission.

3. Whenever a visual check cannot be made, lower the gear as soon as practicable, burn down and land. Do not cycle the gear.

4. In the event a visual check indicates that the nose gear is not fully retracted or that the nosewheel door is not fully closed, do not cycle. Lower the gear as soon as practicable, burn down and land.

INFLIGHT 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, and adding throttle too fast while operating in MANUAL fuel control.

1. Reduce power as necessary to regain normal operation. If chugs/stalls persist, increase airspeed by diving.

2. If PRIMARY fuel control failure is suspected, shift to MANUAL.

3. If icing is suspected, shift to MANUAL and change altitude, if possible.

4. If pilot-induced and no other adverse symptoms are apparent, continue the flight and record the circumstances upon return.

RPM/EGT MALFUNCTIONS

Fluctuating rpm not corresponding to similar indications of fuel flow 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 flowmeter or EGT 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

Maintaining EGT within operating limits at altitudes of approximately 20,000 feet and above for the J65-W-20 may require retarding the throttle. This requirement is acceptable if the rpm varies linearly with altitude up to maximum operating altitude, and if rpm need not be reduced below 100.3 percent. If engine performance does not meet this criteria or EGT is abnormally high at other power settings, it indicates a loss of engine efficiency due to increased friction (bearing failure, turbine rub, etc), damaged blading, or incorrect tailpipe nozzle area. Attempt to maintain EGT within limits; however, do not reduce rpm below that necessary to maintain flight, providing overtemping is the only malfunction 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 a setting commensurate with altitude. Avoid zero g, negative g, or inverted flight. Ensure positive g during speedbrake operation.

ENGINE-DRIVEN FUEL PUMP FAILURE

Either gear stage of the engine-driven fuel pump is capable of supplying the engine with enough fuel for

all operations. If one gear stage fails, a bypass routes the fuel flow around the defective gear stage, allowing the other stage to function without interference. There will be no indication to the pilot of such a failure. If both gear stages fail, a flameout will occur and no relight is possible.

THROTTLE LINKAGE FAILURE

If the throttle linkage breaks between the cockpit and the engine fuel control unit (at throttle setting of IDLE or above), the fuel control will automatically seek about 87 percent rpm (with fuel control in PRIMARY). This will normally provide sufficient thrust to maintain flight. If 87 percent will not maintain flight proceed as follows:

1. Retract speedbrakes, wheels, and flaps.
2. Increase airspeed, if feasible, to maximum endurance airspeed or faster.
3. If still unable to maintain altitude, jettison stores as necessary.

For landing procedures, see LANDING, OTHER FAILURES, this section.

LOSS OF THRUST

Possible causes are inadvertent reduction of throttle by the fuel control balance mechanism (or broken throttle linkage), PRIMARY fuel control failure, or icing.

1. Check the throttle for position and engine response.
2. Shift to MANUAL fuel control unless other action is indicated. (See FUEL CONTROL MALFUNCTIONS, this section.)
3. If icing is suspected, shift to MANUAL and change altitude.
4. If flameout occurs, secure engine and perform air start. (Refer to AIRSTART, this section.)
5. For loss of thrust occurring under low altitude/high airspeed conditions, refer to LOW ALTITUDE LOSS OF THRUST/FLAMEOUT, below.

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 the engine has actually flamed-out or whether it is still running at or near IDLE. Because of this, and the fact that the time available usually precludes a complete AIRSTART, the following procedure is recommended:

1. Commence zoom climb.
2. Extend emergency generator NEW
3. Match throttle position with indicated rpm.
4. Fuel control switch . . . . . .MANUAL
5. Airstart switch . . . . . ON
6. Cautiously advance throttle and ascertain restoration of thrust.
7. If engine fails to respond adequately, and peak altitude at zoom apex is less than 5000 feet, EJECT. If time and altitude permit, establish 175 to 360 KIAS below 20,000 feet and commence AIRSTART procedures.

FUEL CONTROL MALFUNCTIONS

A malfunction of the fuel control may result in fluctuating rpm, EGT, and fuel flow; a sudden drop in fuel flow; inability to accelerate the engine above 78 to 82 percent (rpm hangup); or a complete loss of power. When any of these occur and the engine is still running, proceed as follows:

1. Throttle . . . . . .IDLE
2. Fuel control switch . . . . . .MANUAL
3. Advance throttle slowly and smoothly to the desired setting. Use caution in manipulating throttle to prevent overspeeding, excessive EGT, or flameout.

When shifting to MANUAL, the throttle must be positioned at IDLE or to a setting that will result in the same or less rpm in MANUAL than that existing at the time MANUAL is selected, otherwise severe overspeeding, overtemping, or flameout may occur. At 6000 feet or below, MANUAL may be selected safely at MILITARY throttle setting only if the rpm is at MILITARY. If the rpm is less than MILITARY, the throttle must be reduced accordingly, before selecting MANUAL to assure continued operation. Above 6000 feet, always retard the throttle to IDLE before shifting. At 35,000 feet, military power in MANUAL is achieved with the throttle about 1/2-inch forward of the IDLE detent. Consequently, shifting to MANUAL with the throttle positioned

farther forward than 1/2-inch from IDLE will assuredly result in overspeed, overtemp, or flameout. At high altitudes, small movements of the throttle may result in large changes in rpm and EGT. Do not return to PRIMARY fuel control operation while in flight if the shift to MANUAL was due to fuel control malfunctioning. If the shift was made for the purpose of practicing switchovers, return to PRIMARY as follows:

1. Throttle . . . . . .IDLE
2. Fuel control switch . . . . . PRIMARY
3. Advance throttle as desired.

Fuel control acceleration hangup occurs in the 78 to 82 percent rpm range, usually after prolonged flight at high altitude. Occasionally, hangup will not be present at the end of the flight, but will occur before launching on the flight, subsequent to the cold-soak. Modified fuel controls have practically eliminated this failure, but the pilot should always be prepared for its occurrence during an approach, even though the prescribed landing pattern acceleration check has been performed. Shifting to MANUAL fuel control will restore the ability to accelerate above the hangup range.

When operating in MANUAL fuel control, a failure or interruption of electrical power will cause the fuel control to shift to PRIMARY. If operating on emergency generator and in MANUAL fuel control because of a PRIMARY malfunction, the following circumstances may cause a flameout:

1. Airspeeds below 120 KIAS (140 KIAS if not reworked per Accessory Change 88).
2. The Emergency Generator Bypass Switch is repositioned.

ABNORMAL OIL PRESSURE

If abnormal oil pressure indications are noted, gradually adjust engine speed to approximately 87 percent, proceed to the nearest suitable landing facility, and execute a precautionary approach to landing. The reduction of engine speed below that necessary for level flight is not recommended until landing on the runway is assured, 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 1 minute.
- Electrical power failure will cause the oil pressure gage to be inoperative. This will occur, however, in conjunction with other symptoms of electrical failure.

Engine Failure

Symptoms of imminent engine failure, singly or in combination, are:

1. Loss of thrust not due to throttle movement or icing.
2. Fluctuating rpm and EGT not eliminated by shifting to MANUAL fuel control.
3. Abnormally high EGT in relation to engine rpm.
4. Oil pressure dropping, or less than 24 psi.
5. Abnormal vibration, or loud or explosive sound(s) apparently emanating from the engine.

If any of the above symptoms appear, gradually adjust power to the minimum rpm consistent with the requirements of level flight and land as soon as possible, executing the precautionary approach, described in this section, at the nearest suitable landing facility. If the symptom is loss of oil pressure, or if bearing failure is suspected, any throttle change may cause complete bearing failure and engine seizure. However, 87 percent rpm is recommended, if feasible. Do not reduce engine rpm below that necessary for level flight until landing on the runway is assured or until the decision is made to eject, as increased engine friction may prevent the engine from accelerating once the throttle has been retarded. With a bearing failure, operation at a very low power setting may actually hasten engine seizure.

Procedure on Encountering Engine Failure

LOW ALTITUDE

Refer to LOW ALTITUDE LOSS OF THRUST/ FLAMEOUT, this section.

FLAMEOUT

In the event of a flameout, proceed as follows:

1. Throttle . . . . . .OFF
2. Emergency generator . . . . . .EXTEND
3. Check for evidence of fire. (Refer to FIRE, this section.)
4. If fire is present or existed before shutdown, do not attempt to restart the engine. (See EJECTION, this section.)

5. If no fire exists, start the engine as described below.

AIRSTART

1. Throttle . . . . . OFF

2. Emergency generator . . . . . EXTEND

Note

Ensure that NORMAL/BYPASS switch is in NORMAL position.

3. Fuel control switch . . . . . MANUAL

Note

Avoid negative g flight to prevent air being trapped in the engine-driven fuel pump inlet line and to minimize fire hazard.

4. If practicable, descend to 20,000 feet or below, at best glide speed. (See figure 5-1.)

5. Successful relights can be accomplished from 175 KIAS to 360 KIAS below 22,000 feet.

Note

The most consistent relights can be obtained at 200 ± 25 KIAS, below 22,000 feet.

6. Airstart switch . . . . . ON

7. Position throttle at 500 pph fuel flow. Slowly advance throttle to a maximum of 1000 pph. Do not increase throttle beyond this point until light-off is obtained. When fuel flow rate is not known (inoperative or missing fuel flow indicator), position throttle midway between OFF and IDLE.

8. If equipped with operating fuel flowmeter and no fuel flow is observed when throttle is positioned as indicated in step 7, recheck fuel control MANUAL, manual fuel shutoff control NORM. If this does not provide fuel, open throttle toward MIL until fuel flow is indicated. If still unable to indicate fuel flow, further starting attempts will be futile.

9. After relight (for any configuration), throttle should be retarded, if necessary, to maintain EGT within limits. Do not advance throttle beyond

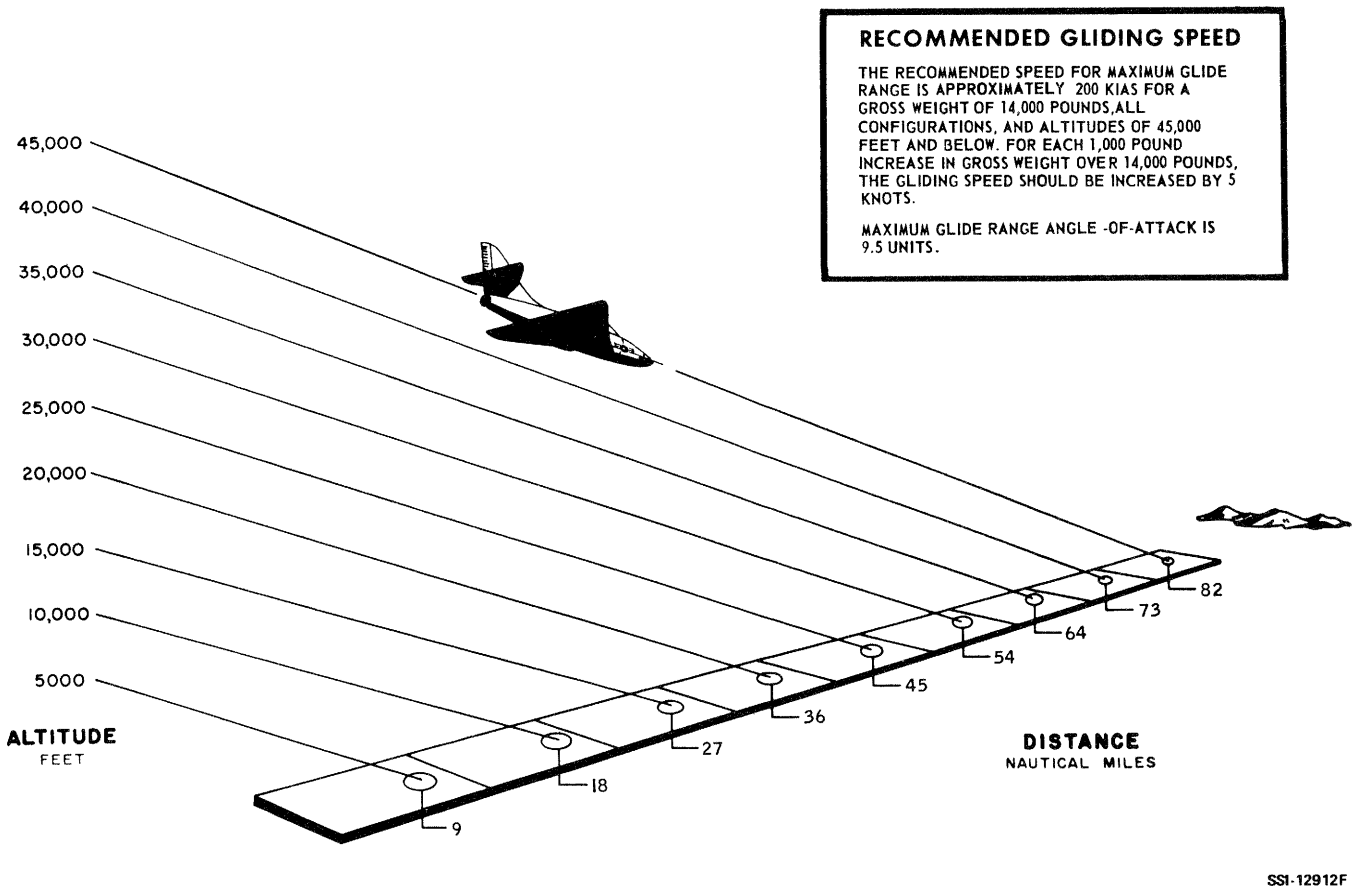


Figure 5-1. Maximum Glide

specified setting until EGT peaks and starts down. Then advance throttle to IDLE, maintaining EGT within limits.

10. Advance throttle slowly and smoothly to desired setting, maintaining EGT within limits. As engine accelerates and rpm approaches 80 percent, EGT sensitivity to throttle movement will be greatest.

11. Airstart switch . . . . . OFF

12. If relight does not occur within 30 seconds (JP-4) or 45 seconds (JP-5), retard throttle to the OFF position. Turn airstart switch OFF and wait 10 seconds to permit airflow through the engine to purge fuel from the combustion chamber and tailpipe before attempting another start. Optimum relight range of fuel flow is 500 to 850 pph. JP-4 lights more readily at the lower part of the fuel flow range; JP-5 at the higher part.

NEW NEW NEW

MAXIMUM GLIDE - ENGINE WINDMILLING

The recommended speed for maximum gliding range is approximately 200 KIAS for a gross weight of 14,000 pounds, all configurations, and altitudes up to 45,000 feet. See figure 5-1 for approximate gliding ranges from various altitudes. For each 1000 pounds increase over 14,000 pounds, increase airspeed by 5 knots. The maximum gliding range angle of attack is 9.5 units.

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. However, failure of the sensing elements or moisture in the FIRE warning relay will also cause the FIRE warning light to illuminate. 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. (Sensing-element failures may occur during prolonged periods of airframe buffeting caused by low-altitude operation with speedbrakes out at high power settings, such as burning down to make an early recovery time at landing weight.) FIRE warning relay malfunctions occur frequently after parked aircraft have been subjected to heavy rains. 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 tail pipe 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 illuminates, 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 out 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. (See EJECTION, this section.)

FIRE WARNING LIGHT - NO OTHER INDICATIONS OF FIRE

1. Throttle . . . . . Minimum required for flight.

2. Be alert for other indications of fire. Whenever possible, get a visual check for smoke or flames from the wingman or other personnel. 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 out-

lined in preceding writeup, FIRE WARNING LIGHT - OTHER INDICATIONS OF FIRE.

3. Deploy the emergency generator. This will remove electrical power from the press-to-test relay. If the FIRE warning light is extinguished, the fire warning system will operate on the emergency generator.

4. If there is no other indication of fire, it is most likely that a false FIRE warning light indication exists.

5. If main generator operation is required, place EMER GEN bypass switch to BYPASS, and expect the FIRE warning light to illuminate due to a faulty press-to-test relay.

6. 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 the 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 the procedure for electrical fire, if indicated.

3. If the 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 the fire is extinguished, turn ON only necessary equipment, one at a time. If the offending circuit is again energized, secure it.

4. If the fire cannot be extinguished in the above manner, the pilot must decide whether to land as soon as possible or EJECT.

5. If landing is made, take short field arresting gear if available. Secure engine upon coming to a stop.

CAUTION

After landing with the emergency generator deployed, an operating main generator will again take the load. An electrical fire previously extinguished by deploying the emergency generator will probably reignite unless the engine is shut down after coming to a stop.

Smoke or Fumes

There are several sources of smoke or irritating fumes in the cockpit. These are:

1. The air conditioning system.

2. The bleed-air line may not be connected to the g suit valve, or there may be an improper assembly of the valve.

3. A torn canopy seal.

4. The bleed-air line may not be connected to the turn and slip indicator.

5. An electrical fire in the cockpit.

Note that selecting RAM on the cabin pressure switch will correct only the smoke or fumes from the first source listed, while all others 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.

2. Select RAM.

3. Extend emergency generator.

4. Secure unnecessary electrical equipment.

5. 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 temperature, jettison the canopy.

6. 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.

a. Serious, uncontrolled fire.

b. If the aircraft is in uncontrolled flight at 10,000 feet AGL or below.

c. When engine flameout occurs below 1500 feet AGL and 250 KIAS.

d. If repeated relight attempts are not successful between 20,000 and 10,000 feet, eject by 10,000 feet AGL.

e. If still on first or second relight attempt when passing through 10,000 feet AGL and it appears that a relight is likely, airstart attempt may be continued to a minimum of 5000 feet AGL.

f. Certain landing gear configurations. (See figure 5-10.)

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 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 5-2.)

Ejection may be accomplished on the ground at 0 airspeed and above, and at all other altitudes and airspeeds within the flight range of the aircraft, 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 5-6) from the charts, dive angle and angle-of-bank chart altitudes are additive up to 60-degree dive. In dives steeper than this, bank angle is negligible. The possibility of injury to shoulders and hips from flailing, and wind-blast damage to personal gear, and possible injury from parachute opening shock, makes it imperative that the airspeed be reduced to 350 KIAS or less before ejection, whenever possible. Inverted and severe yaw positions should be corrected, if feasible, before ejection and every attempt should be made to reduce speed. NEW

Usually the pilot will have time enough to accomplish several things to prepare himself for a successful ejection before pulling the face curtain. However, when an emergency condition requiring ejection is such that ejection must be made without hesitation, simply grasp the face-curtain (or lower ejection handle) and pull forcefully to the fullest extent until seat ejects.

ZERO—ZERO Ejection Sequence

See figures 5-3 through 5-5.

Controlled Ejection

The following procedure is recommended, if time permits:

1. Throttle . . . . . IDLE

2. Slow the aircraft as much as possible.

2A. Seat . . . . . OPTIMUM POSITION NEW

3. Emergency generator . . . . . AS REQUIRED

4. IFF . . . . . EMERGENCY

5. Transmit MAYDAY position report.

6. Shoulder harness. . . . . LOCKED

7. Visor . . . . . DOWN

8. Air conditioning press switch . . . . . RAM

9. Leave feet on the rudder pedals. Sit erect, with spine straight and head firmly against the headrest.

10. Grasp the face curtain with both hands and pull forcefully to its fullest extent. The canopy interlock prevents firing of the catapult before the canopy is jettisoned. Consequently, if the curtain is pulled very fast, a pause or stop may be felt. If this occurs, the force of continued pull on the face curtain may be less than that necessary for seat ejection. It will then be necessary for the pilot to jerk as hard as possible on the face curtain in order to obtain maximum pull-force. If the seat still does not fire, release the face curtain and apply a strong, steady, two-handed pull on the lower ejection handle. Normally, the canopy should jettison when the face curtain is pulled over the helmet, and the catapult should fire when the face curtain passes the nose or chin. NEW NEW

11. If pulling the face curtain (or lower ejection handle) fails to jettison the canopy, substitute the following emergency procedure:

a. Retain a firm grip on the face curtain (or lower ejection handle) with one hand, but do not pull it further out. Hold elbow inboard.

b. PULL canopy jettison handle firmly.

c. After the canopy jettisons, continue pulling the face curtain (or lower 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 it manually, if airspeed is in excess of 125 KIAS.

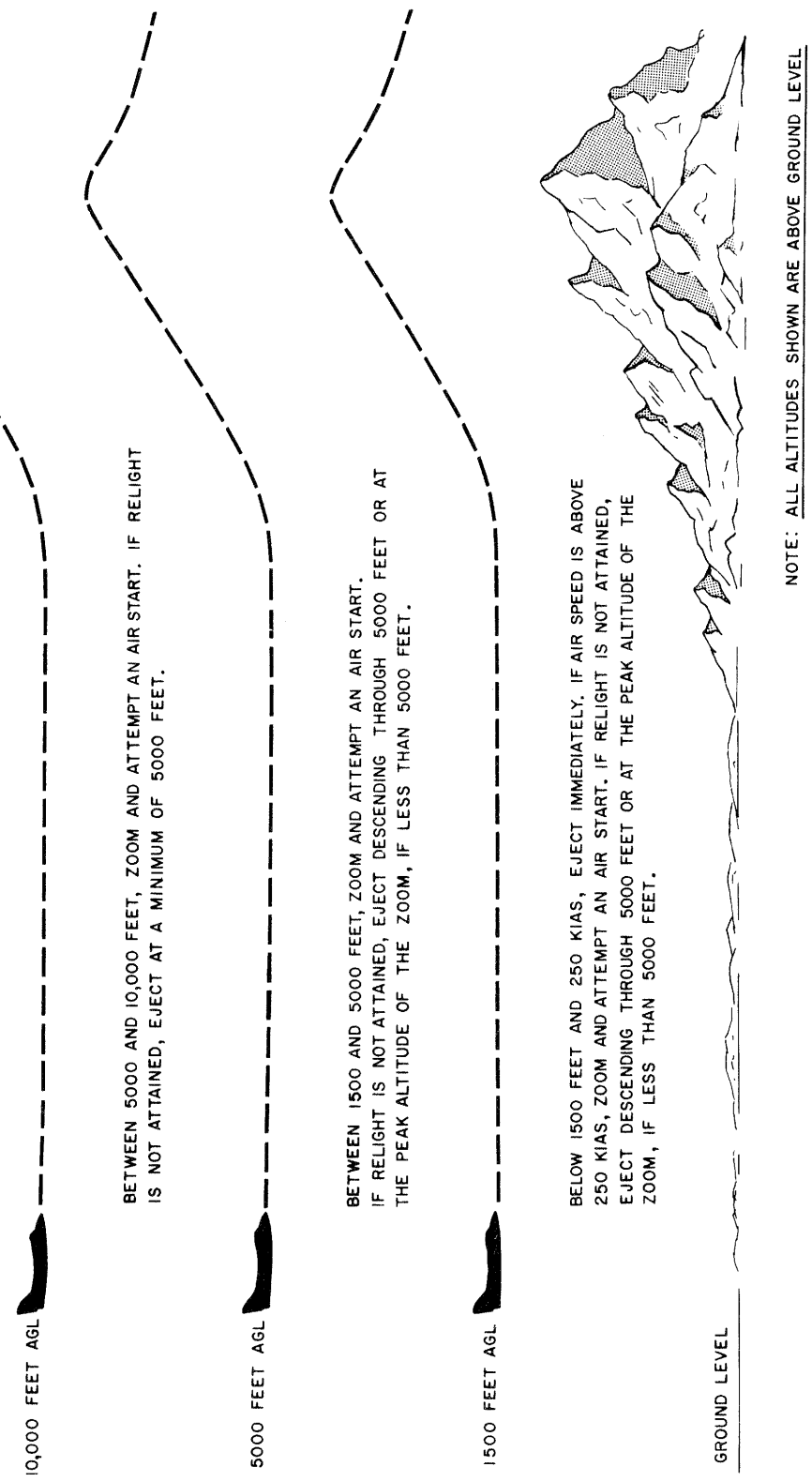


Figure 5-2. Summary of Flameout Action

WARNING

Beware of a rapid rearward movement of the canopy lever when this is done.

Retain the face curtain (or lower ejection handle) with one hand during this procedure.

12. If ejection occurs above the preset altitude, the parachute will not deploy automatically until after descent below the preset altitude (14,000±500). If ejection occurs below the preset altitude and the automatic barometric ripcord-actuator seems not to function (i.e., after the time delay of 0.75 seconds), NEW open the parachute with the parachute ripcord when clear of the seat. The parachute ripcord overrides the barometric release. If high-altitude ejection is made, free-fall to approximately 14,000± 500 feet before opening the parachute. If the parachute must be opened manually after a high-speed ejection, wait at least 4 seconds after ejection to permit speed to reduce.

13. In the event the integrated harness is not automatically released following ejection, seat separation may be accomplished while falling by pulling the emergency restraint release, located on the right side of the pilot's seat. Lean forward to clear the chute from the back of seat and push clear of the seat. Actuation of the emergency restraint release following ejection will disconnect the automatic parachute-actuator, and will therefore require manual pulling of the parachute ripcord.

14. The emergency oxygen bottle will be actuated automatically upon ejection. However, should the oxygen appear not to be flowing, pull the emergency oxygen actuator on the left front inside corner of the seat pan.

15. At about 10,000 feet altitude, but before contact, the oxygen mask should be removed and the oxygen/radio hose disconnected.

NEW 16. Disconnect the left seat pack Koch fitting. Pull the seat back to the right and locate the life raft lanyard snap. Connect this snap to the right torso harness lapbelt raft release or the helicopter hoist ring, if worn. If descending into water, inflate the life preserver prior to entry.

17. In the event a parachute landing is made into water or in a high wind which prevents normal spilling of the parachute canopy, disconnect both quick-disconnect fittings that attach riser to the torso-harness suit, thus jettisoning the parachute canopy. Do not disconnect the parachute-riser releases until after contact with ground or water.

IMMEDIATE EJECTION

During any combined low altitude/low airspeed conditions, as in the landing pattern or immediately after launch, the use of the lower ejection handle should be considered the primary means of ejection. Continue to fly the aircraft with the right hand, keeping wings level and maintaining altitude or the lowest possible sink rate, while initiating ejection sequence with the left hand.

WARNING

Actuation by lower ejection handle may require between 85 and 100 pounds of pull. Some pilots may require both hands to pull lower ejection handle or may have to use the face curtain as a primary means of initiating ejection under all conditions.

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 emergency restraint release and then the parachute ripcord immediately after ejection.

Seat/pilot separation is initiated in the ejection sequence at the time the bellcrank mechanism rotates, retracting the three yellow harness release pins and releasing both the face curtain and lower ejection handle from the seat. The pilot and parachute are now disconnected from the seat.

(Text continued on page 5-24)

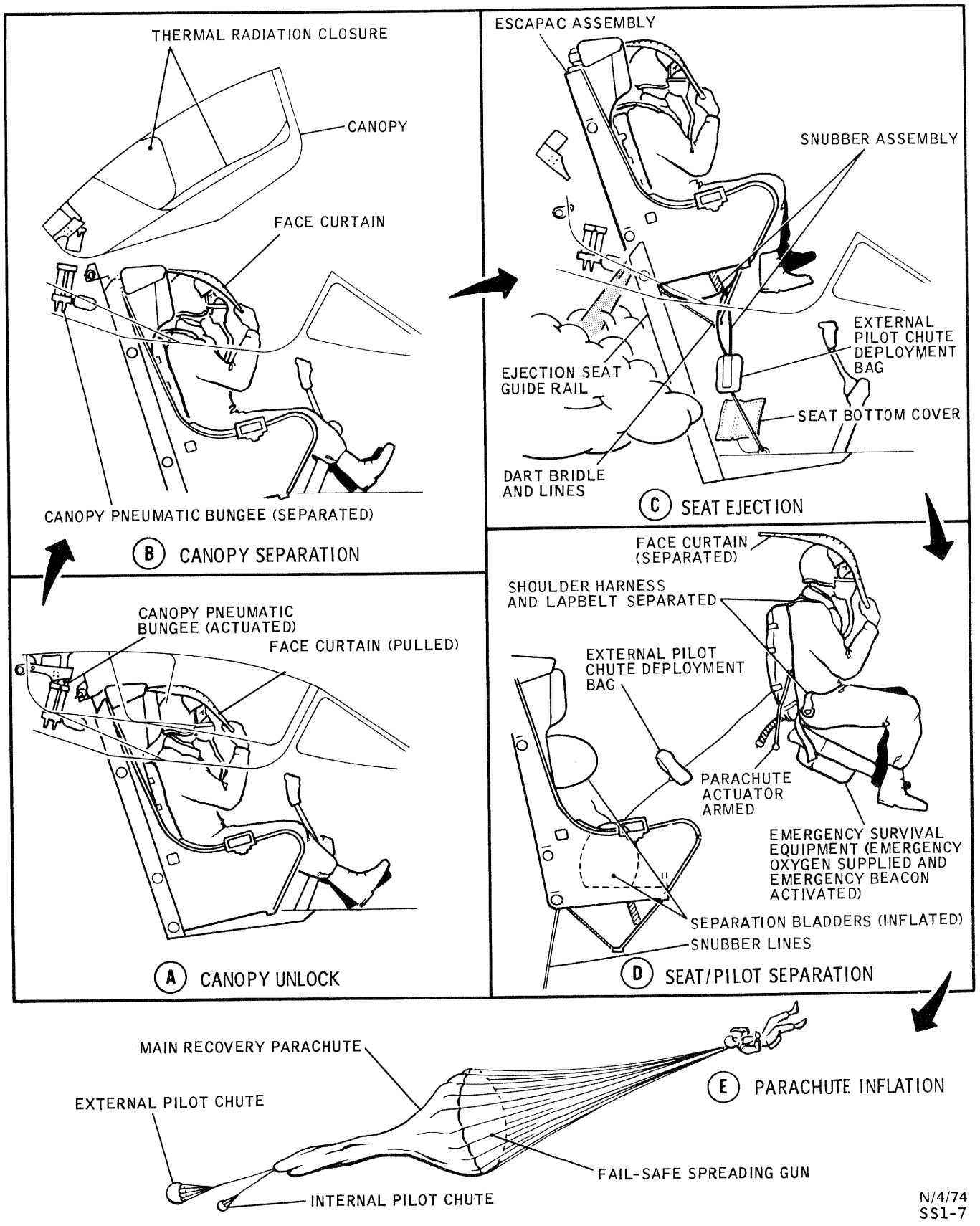


Figure 5-3. Zero–Zero Ejection Seat Sequence
(Escapac 1A-1 With Stencil Modification)

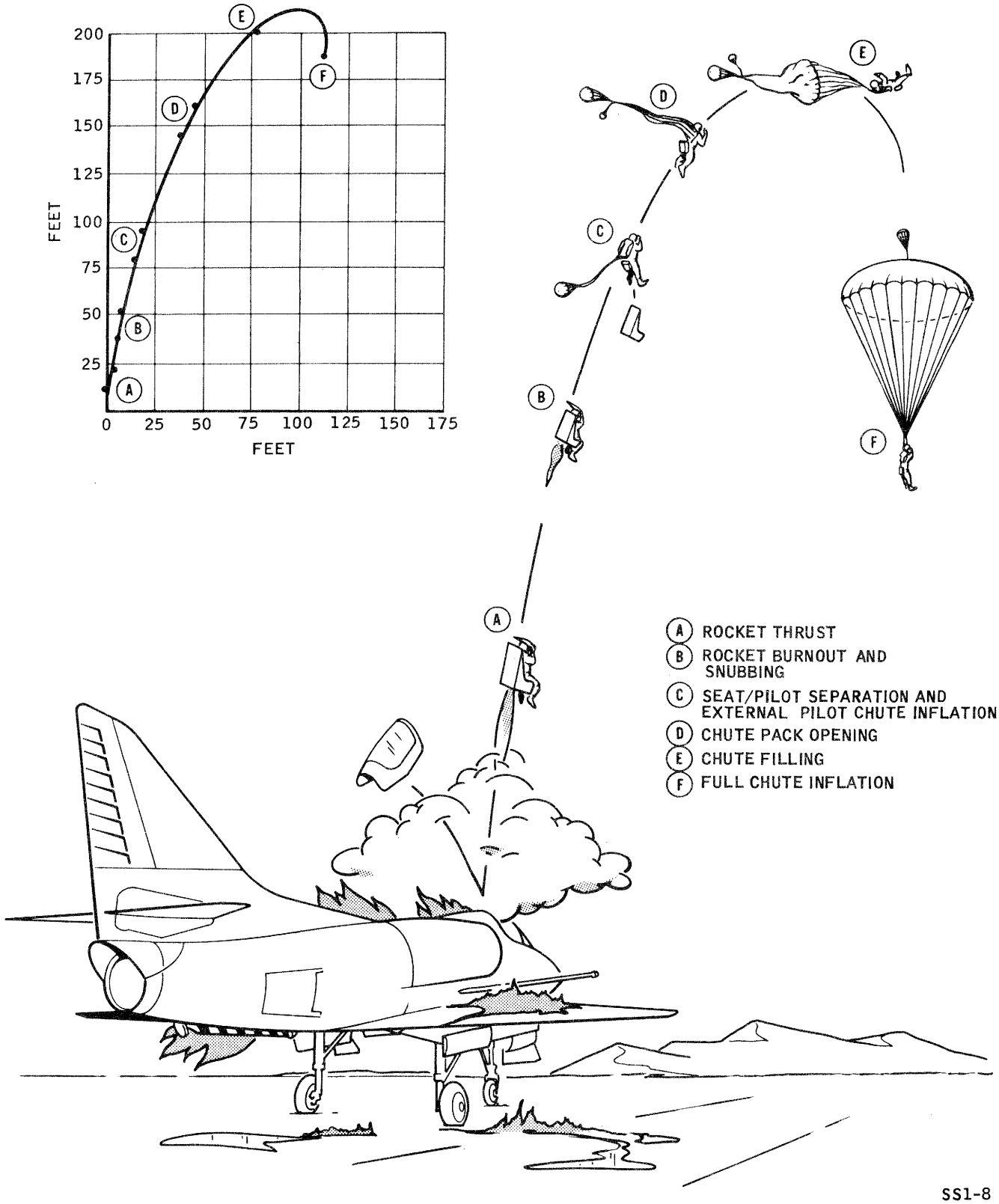


Figure 5-4. Zero-Zero Ejection Seat-0-Knot Trajectory (Escapac 1A-1 With Stencil Modification)

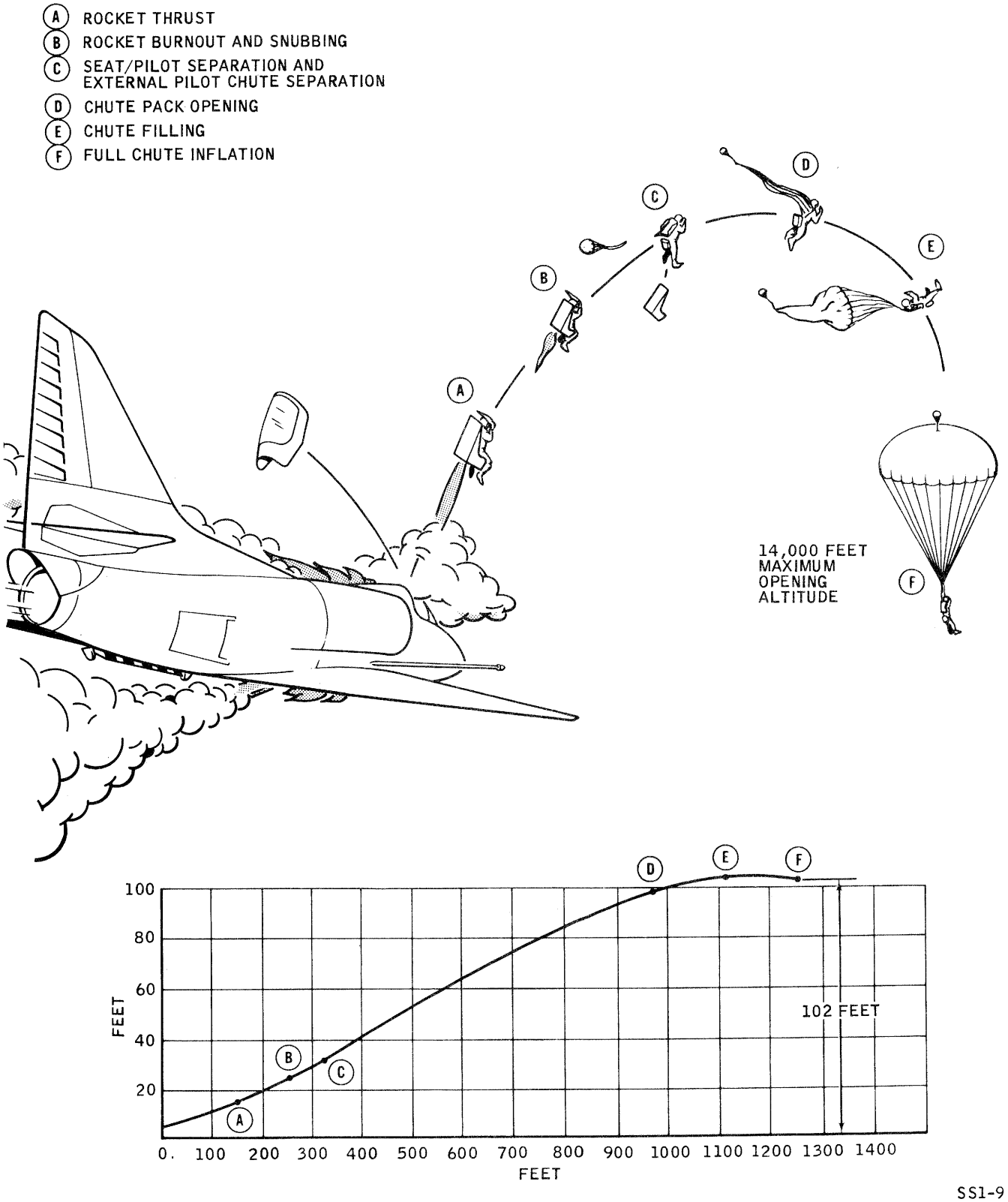
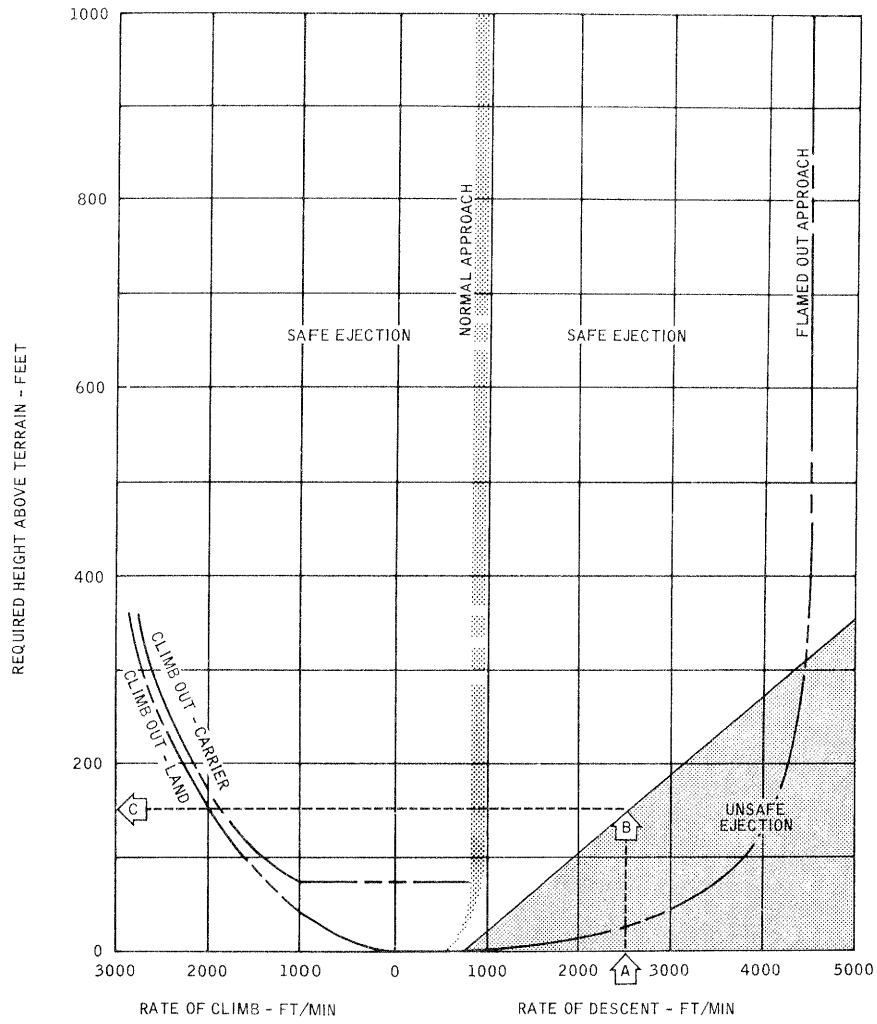


Figure 5-5. Zero-Zero Ejection Seat-600-Knot Trajectory (Escapac 1A-1 With Stencil Modification)

TERRAIN CLEARANCE FOR SAFE EJECTION
ZERO - ZERO EJECTION SEAT

WINGS LEVEL
90 TO 200 KNOTS



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed Out Approach are typical curves shown for reference only.
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 $\pm 15^{0}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
3. These curves are based on the 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 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)

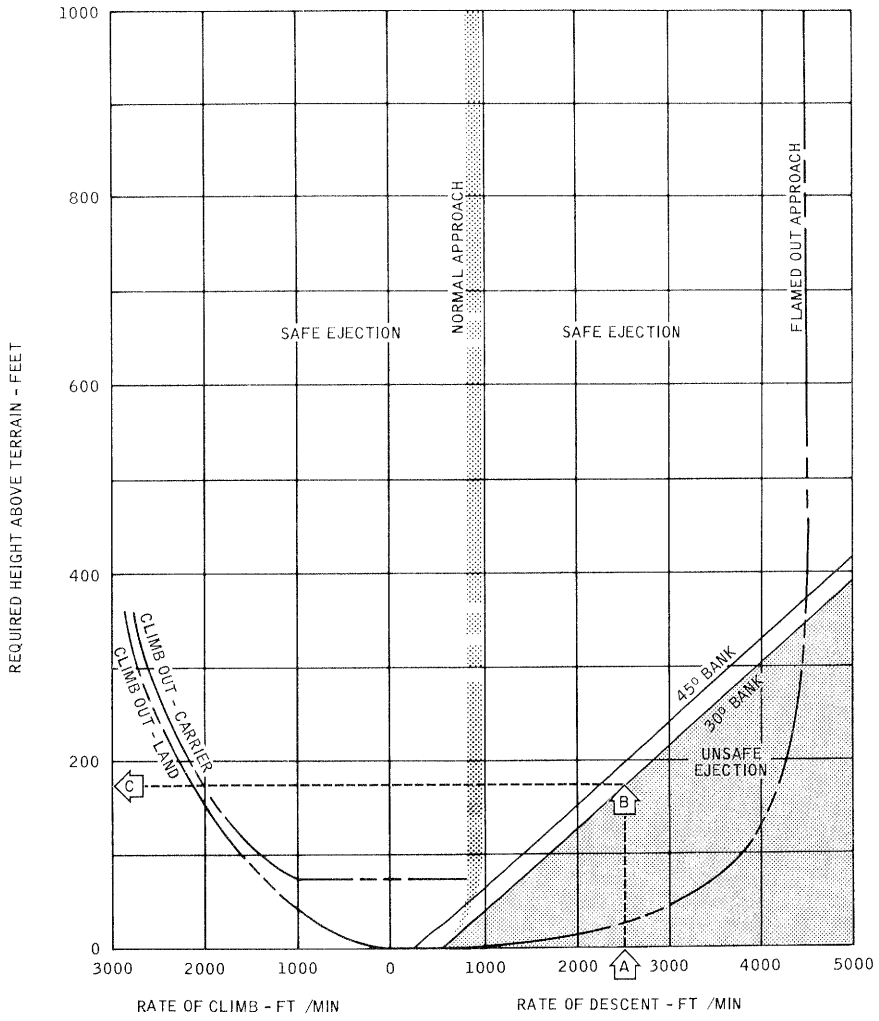
DATA AS OF: 2 January 1968
DATA BASIS: Test results

SS1-10

Figure 5-6. Terrain Clearance for Safe Ejection (Sheet 1)

TERRAIN CLEARANCE FOR SAFE EJECTION
ZERO - ZERO EJECTION SEAT

30° TO 45° BANK
90 TO 200 KNOTS



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed 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.
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 January 1968

DATA BASIS: Test results

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

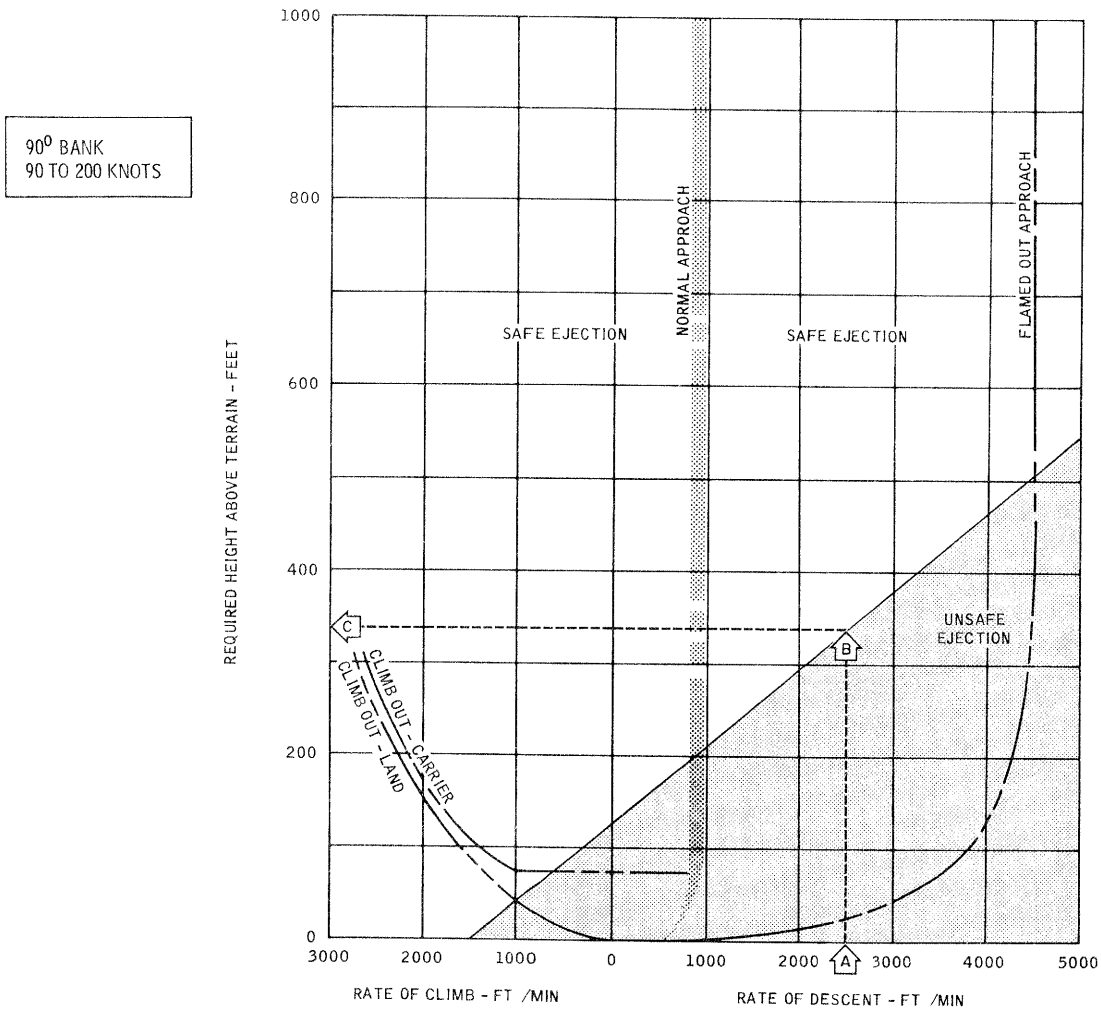
1. Enter chart at 2500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 180 feet minimum height above terrain. (C)

SS1-11

Figure 5-6. Terrain Clearance for Safe Ejection (Sheet 2)

TERRAIN CLEARANCE FOR SAFE EJECTION

ZERO - ZERO EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flamed 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 $\pm 15^0$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
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 January 1968

DATA BASIS: Test results

EXAMPLE:

To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min.

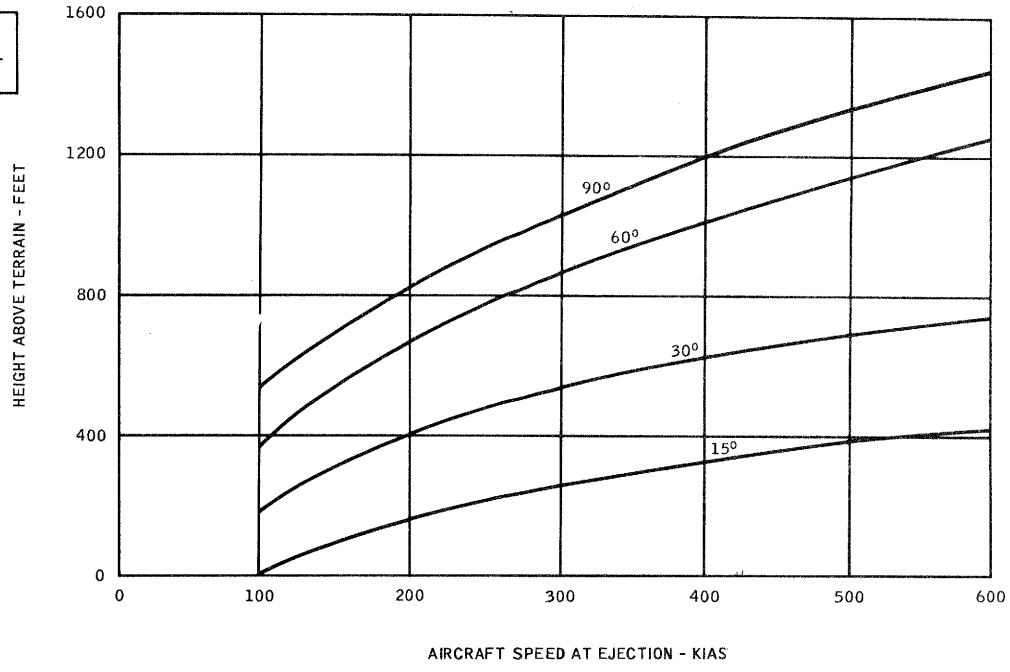
1. Enter chart at 2500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 340 feet minimum height above terrain. (C)

SS1-12

Figure 5-6. Terrain Clearance for Safe Ejection (Sheet 3)

TERRAIN CLEARANCE FOR SAFE EJECTION
ZERO - ZERO EJECTION SEAT

DIVE - WINGS LEVEL



REMARKS: These curves do not include pilot's reaction time or safety factor.

DATA AS OF: 2 January 1968

DATA BASIS: Test results

SS1-13

Figure 5-6. Terrain Clearance for Safe Ejection (Sheet 4)

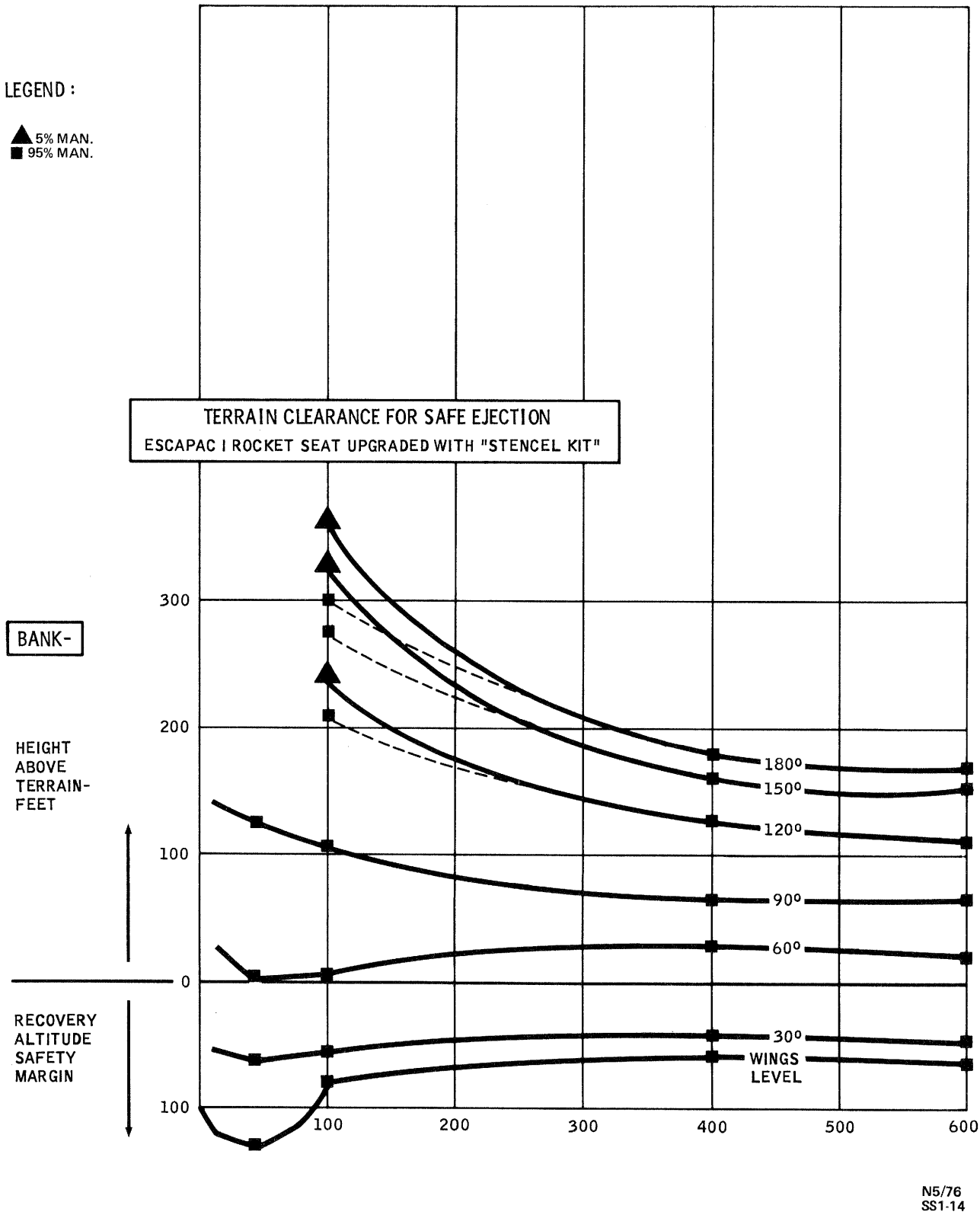


Figure 5-6. Terrain Clearance for Safe Ejection (Sheet 5)

LOW ALTITUDE OVER WATER EJECTION

When ejecting over water the following procedure should be followed after the parachute has opened:

1. Inflate your life preserver.

2. Disconnect the left seat pack rocket fastener. Locate and attach the life raft lanyard snap to torso harness.

Note

With the HSSP seat (soft pack), the life raft/survival equipment is removed by: first, pulling the raft release which opens the pocket containing the life raft/survival equipment; second, pulling the raft out of its container and inflating it by pulling the actuating handle; then, finally, removing the survival equipment from the pocket.

3. Orient yourself to location of riser release fittings.

4. Ascertain that your emergency oxygen supply is working and retain your mask for underwater breathing.

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 emergency oxygen actuator on seat pan for emergency oxygen.

2. Disconnect console oxygen and antiblackout hoses.

3. Cabin pressure to RAM.

4. Jettison the canopy.

5. Pull the emergency restraint release handle to separate from the seat.

6. Lean forward to clear the parachute past the headrest.

7. Trim the aircraft full nosedown.

8. Hold arms against body and let stick snap forward.

9. When clear of the aircraft and below approximately 14,000 feet, pull the parachute ripcord.

STRUCTURAL FAILURE OR DAMAGE (INCLUDING BIRD-STRIKES)

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 the aircraft is available for continued flight. If not, eject.

3. If able to control the aircraft, climb to minimum recommended ejection altitude (10,000 feet or higher) at a reduced airspeed to prevent further damage.

4. Operate the engine at the minimum setting required to maintain level flight or slow climb if it is suspected that foreign objects may have entered the engine. Ingesting a bird usually will not damage the engine blading, but may plug up the 5th stage bleed air ports resulting in ineffective lubrication of the center and rear main bearings and subsequent engine seizure.

5. Whenever possible, request a visual inspection by another aircraft to assist in evaluating the damage sustained.

6. Examine the slow-flight characteristics of the aircraft in the landing configuration at 10,000 feet, or above, before attempting a landing. DO NOT 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 the sides of the fuselage forward of the engine-intake ducts.

SYSTEMS FAILURES

Hydraulic Systems Failure

Either the utility or the control hydraulic system warning light coming 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 alone, actuations of various units normally operated by utility system pressure will cause a temporary decrease in the effectiveness of the flight controls.

WARNING

- If a hydraulic system is lost in flight be alert for evidence of fire, due to the possibility of an engine-section fire.
- Do not attempt maneuvers requiring high control forces (such as high-speed pull-outs) when it is known that one or both of the systems are inoperative.

COMPLETE HYDRAULIC FAILURE

In the event of a complete hydraulic system failure, as defined above, 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 the 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 immediately, if necessary.

6. Terminate the flight as soon as practicable.

7. When the crosswind component exceeds 8 knots, an arrested landing is recommended to minimize ground handling problems and fire hazard due to possible hydraulic leak during landing rollout. NEW

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 excessive longitudinal stick motion.

3. Plan approach to ensure that crosswind component is under heavier wing, if possible.

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.

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 fully out (about 1 foot) with a rapid and positive motion. This action will assure 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 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.

UTILITY HYDRAULIC FAILURE

Loss of the utility hydraulic system will require emergency extension of the landing gear. Flaps, speedbrakes, spoilers (A-4L), AFCS and hook (retract) will not be available. An arrested landing is recommended and gear pins should be installed as soon as possible.

NEW NEW

Note

If an arrested landing is not available, an increased landing roll of approximately 100 percent can be expected in a no flap, no speedbrake, no spoiler configuration.

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 icing, blown fuse, generator drive transmission in underspeed condition or inoperative, and/or other mechanical or electrical discrepancies. Partial failures may result in loss of one or more phases of ac, or reduced or fluctuating frequency or voltage, and may be impossible to detect from cockpit indications. The most likely signs of a partial failure will be TACAN unlocking and spinning, loss of air conditioning, erroneous attitude presentation on the gyro horizon with or without an OFF warning flag indication, or abnormally slow trim motor 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 indications of impending generator drive transmission failure. Under this condition, continued throttle manipulation can induce dc transformer-rectifier fuse failures.

It is recommended that throttle manipulation be reduced to the minimum. If symptoms persist, deploying the emergency generator will prevent loss of fuses, but the airspeed must be maintained at **or above 145 KIAS gear down or 165 KIAS gear up for proper operation of the emergency generator.** 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. Fuel Boost . . . . . OUT
2. Oil Pressure . . . . . OUT
3. Landing gear indicators . . . . . UNSAFE
4. Flap position indicator. . . . . OFF
5. Gyro horizon/AJB-3 . .OFF, FLAG VISIBLE
6. Trim position indicators. . . . . OFF SCALE
7. UHF/TACAN . . . . . INOPERATIVE
8. 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 NORMAL/BYPASS switch must be at NORMAL. If electrical power is not partially restored when the emergency generator is extended, ensure that the NORMAL/BYPASS switch is in NORMAL.

Note

It the emergency generator fails to deploy when the handle is pulled, apply positive "g's" in an attempt to dislodge the unit.

To prevent damage to the emergency generator, do not release the emergency generator at airspeeds above 500 knots 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, the following precautions should be observed during operation with the emergency generator extended:

1. During flight at night or in adverse weather conditions, an indicated airspeed in excess of 165 KIAS should be maintained until the flight can be maintained by visual reference.

2. After deployment of the emergency generator, land as soon as practicable, as lengthy operation of this unit can seriously deteriorate its performance.

3. **During landing approaches, an indicated airspeed of 145 KIAS gear down or 165 KIAS gear up should be maintained as long as power for the operation of the horizontal stabilizer actuator is desired.**

4. Advise tower that radio will be lost during landing rollout.

Note

- Emergency generator power to operate the angle-of-attack probe/vane, and the nesa glass heater will not be avaliable when the landing gear is down. Power may be restored by first retracting the wheels and then cycling the emergency generator bypass switch.
- Failure of the dc transformer-rectifier is indicated when dc powered equipment malfunctions at the same time that ac equipment functions normally. When this is clearly diagnosed, select the emergency generator bypass position.

When an icing condition or heavy rain is the cause for extending the emergency generator, remember that the use of the NORMAL/BYPASS switch will restore normal electrical system operation, once the aircraft is clear of such conditions.

NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW

DC CONVERTER FAILURE

When dc equipment is lost (normal elevator trim, TACAN, fire warning PTT, wheels and flap indicators, UHF controls, and fuel gage indicating main cell quantity only) while ac equipment (seat actuator) functions normally, a dc converter failure is identified as the problem.

The appropriate action is to secure all unnecessary electrical equipment, then deploy the emergency generator in the BYPASS position utilizing the NORM position only for the time required to determine necessary information from dc equipment such as TACAN (heading), UHF (necessary communications), gear down (wheels down and AOA indications).

Note

Operating primarily in the BYPASS position in necessitated by the fact that deployment of the emergency generator merely connects ac power from a different source to the dc converter through another set of fuses. The original malfunction causing dc equipment loss is again a possibility at any time while in the NORM position.

If no dc equipment is regained with the emergency generator deployed utilizing the NORM position, return to the BYPASS position.

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 other aircraft.

INTERIOR LIGHTS FAILURE

If interior lighting is lost, use the cockpit emergency-floodlights or a flashlight to illuminate the instruments or the console.

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. ARA-25 homing feature.
3. UHF-DF steer.
4. Mileage indication may be used to find the station as follows:
   a. Identify the station.
   b. Turn as necessary to stop mileage and establish an arc from the station.
   c. Note the RMI heading at the wingtip which is thought to be in the direction of the station.
   d. Turn left or right toward the noted heading.
   e. If mileage increases, turn to the reciprocal heading. Otherwise, continue inbound to half the initial distance and repeat the previous three steps until the DME reading is 20 miles or less. Then continue inbound on the predetermined heading. Observe the station passage and range when the 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

This is recognized by an erroneous lock-on by the No. 2 pointer, by erroneous mileage, and by usually garbled identification. Use DR 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 pointer 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 pointer on the nose of the aircraft.

1. Change channels so as to unlock the No. 2 pointer, 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 pointer and fly to the station, observing DME closure rate.

3. Use ARA-25 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 in correct north or south latitude 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 nose-up 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, nose-down 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 handle again.

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 assures adequate control. Landing with the flaps retracted is recommended due to the nose-down 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. Trim . . . . . CHECK INDICATOR
2. Manual Override . . ACTUATE OPPOSITE TO RUNAWAY
3. If runaway condition continues . . EXTEND EMERGENCY GENERATOR
4. Remain on hydraulic power control system.
5. If unable to retrim and trim is stuck at or near the full nose-up position:
   A. Reduce speed
   B. Lower flaps

Note

If the runaway trim occurs at high airspeed, aircraft G loading will rapidly increase as the trim approaches full nose up. If the control stick is not restrained it may move fully forward due to the effect of the bob weight.

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 the emergency generator.

2. Remain on the hydraulic power-control system.

3. Reduce speed.

With the trim jammed at a maximum deflection in either direction, the forces required to return the stick to neutral will be moderate.

WARNING

Do NOT disconnect the 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 the emergency generator.

2. Remain on the hydraulic power-control system.

3. Reduce speed.

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 a "Hard Over" condition occurs, whether operating with AFCS in STANDBY or OFF, proceed as follows:

1. Depress the autopilot override button on the 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 the emergency generator.

4. If normal aileron trim is not restored upon disengagement of the AFCS, moving the AFCS aileron trim NORM/EMER switch to EMER should restore normal operation.

Note

Do not actuate the 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 the stick smartly.** It may require as much as 50 pounds of force or more to free the controls.

2. **If unable to free the controls, fly with the** trim tabs and rudder to an altitude below the freezing level and repeat the above procedure.

The possibility of experiencing this condition can be minimized by setting the horizontal stabilizer trim to 0 degree before engine shutdown to prevent rain and spray entering the elevator control mechanism area when the aircraft is on the deck, and by moving the controls through full travel just before takeoff.

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. Emergency speedbrake 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, they 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 by using the flowmeter and the best estimate of fuel remaining. If in company with other aircraft, and the initial fuel load and the 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 initial indication of fuel transfer pump failure will be an illuminated fuel transfer caution light. When this light remains illuminated, assume that the usable fuel remaining is either approximately 1400 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 removed 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. In aircraft with ASC 317 incorporated, the drop tank fuel may be transferred directly to the fuselage cell without first filling the wing tank by moving the FUEL TRANSFER BYPASS switch to FUS ONLY.

When drop tank fuel has been exhausted in the aircraft incorporating ASC 209, move the emergency transfer switch to 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, move the drop tank transfer switch to 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, move the ship-tank switch on the refueling control panel to the FROM STORE position to prevent wing fuel from flowing into store when 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 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. Secure EMERG TRANS prior to landing.

Note

Emergency transfer is not available on emergency generator. Wing transfer bypass and fuel dump are available.

FUSELAGE TANK FLOAT VALVE FAILURE

If the fuselage tank float valve sticks in the closed position, the fuel transfer caution light will not illuminate, 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 the tanks are pressurized, this will not normally occur until external fuel is depleted as the fuel will continue to transfer to the fuselage tank through the air refueling plumbing. Whenever 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 position.

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 still recommended since there is a possibility that the valve will stick again.

3. If the above action is not practicable or is unsuccessful, and ASC-209 is incorporated in the aircraft, move the emergency transfer switch to EMER TRANS and proceed as described for FUEL TRANSFER PUMP FAILURE, this section. 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

NEW NEW NEW NEW NEW

1. Drop tank transfer switch . .PRESSURIZE

2. Emergency transfer . . . . . OFF

3. Fuel transfer bypass. . . . . NORMAL

4. If still no transfer, emergency generator . . . . . DEPLOYED

When drop tank transfer is complete:

5. Emergency generator bypass switch . . . . . BYPASS

If transfer still not possible after emergency generator deployed:

6. Wing fuel may be burned or dumped. A minimum rate of descent landing ashore should be made.

7. If landing aboard ship, jettison drop tanks.

NEW NEW NEW

Note

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

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. Turn the oxygen switch OFF and pull the green ring. Descend rapidly to a cabin altitude of 10,000 feet or below.

2. Remove the mask if unable to breathe or when bailout 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.

AN/AJB-3 Failure

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 or the loss of the C phase of ac. If the A, B, or A and B phase are lost, the indicator will continue to function for an indefinite period without the OFF flag indication, although the information presented may be erroneous. Many other failures can occur that will not be indicated by the OFF flag. Marginal backup instrumentation is provided by the standby gyro, turn and slip, magnetic compass, etc., to permit continued flight in an emergency situation.

Note

Intentional flight in instrument conditions with any type of AJB-3 failure should be avoided whenever possible.

Pitot-Static System Failure

When airspeed indications are lost or 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, turn the cockpit pressurization switch to 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. Altitudes below 5000 feet may be determined if the aircraft has an operating radar altimeter.

Air Conditioning Temperature Control Failure

Occasionally, malfunctions will occur which cause the air conditioning system to provide either full-hot or full-cold air to the cockpit. Manual positions are provided for the temperature control knob for pilot selection of a desired temperature level. If the manual temperature is inoperative and the pilot becomes uncomfortably hot or cold, the NORMAL/RAM switch should be turned to RAM. If it is not practical to operate in RAM, adjusting the eyeball diffusers and defrost control to minimize airflow, or changing altitude, should extend the period the adverse temperature can be endured. Use minimum rpm required for flight. Land before debilitating effects reduce the pilot's capability to do so safely. If the cockpit temperature is unbearable and the pilot is unable to switch to RAM operation, the canopy should be jettisoned as a last resort if this would improve the situation.

Loss of Canopy

When the canopy is lost/jettisoned after takeoff or in flight, slow to 200 KIAS or below. Since control surface 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 suitable facility. In the event existing conditions preclude descent to acceptable temperatures, the pilot should elect to eject prior to becoming incapacitated.

Note

After canopy loss/jettison, the pilot should be alert for inadvertent ejection if the face curtain deploys into the airstream.

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, lift the hose jettison switch, and move switch 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 speeds in excess of 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. Jettisoning the hose and drogue is necessary only if indicated by other considerations, such as field arrestment required, decreased drag necessary for safe return, etc.

2. Carrier-based. Jettison the hose and drogue, if possible, before landing. Make a normal approach. Advise the ship of the condition so that the flight deck personnel can be warned.

STORE HYDRAULIC FAILURE

Any evidence of a hydraulic leak observed during refueling operation should immediately be reported to the tanker pilot and the store 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 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. Move the drogue position switch to RET.

2. Extend emergency generator.

3. Refueling master switch OFF.

4. Select generator BYPASS and regain main generator.

Note

The store may be dumped but do not move the refueling master switch to ON.

The above procedure is recommended to reduce the fire hazard created by actuation of the hose jettison switch. A secondary procedure is:

1. Move the drogue position switch to RET.

2. Operate the hose jettison switch to JETTISON and leave in this position until after engine shutdown.

LOSS OF STORE FEATHERING CONTROL

1. 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 get a RET indication. If not successful, slow to 200 KIAS or 0.08 IMN for the remainder of the flight. After a shore-based landing, the drogue will probably trail out and sustain damage. Aboard ship, make a normal approach. Advise the ship of possible necessity to tie up or carry the drogue as aircraft is taxied from landing area.

2. With the store unfeathered and the drogue indicating EXT or TRA, the drag index is greatly increased. If fuel consumption is critical, consider jettisoning the hose to reduce drag.

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 the instructions given.

13. When oriented and the decision is made as to destination, use maximum-range airspeed to get there.

With Receiver Only:

1. Same as above, if applicable.

2. Fly two triangles to the right (1-minute legs). Repeat this pattern every 10 minutes. Meanwhile, maintain estimated best course.

3. Monitor the GUARD channel and comply with the instructions given by the responding station.

Without Radio:

1. Same as above, if applicable.

2. Fly two triangles to the left (1-minute legs). Repeat this pattern every 10 minutes. Meanwhile, maintain estimated best course.

3. Maintain lookout for an interceptor. Refer to FLIP planning document or enroute-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 instructions.

Downed Plane Procedures

SINGLE AIRCRAFT

If the situation permits, before ejection, crash landing, or ditching, make every effort to switch IFF/SIF codes to EMERGENCY settings and send a MAYDAY message on the GUARD channel. 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 a ground station, preferably a GCI site or radar-control agency. Switch IFF/SIF to EMERGENCY and UHF to GUARD.

2. Make every effort to follow the 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 in order to direct rescue planes or boats to the scene.

3. Maintain sufficient altitude to assure radio contact with the rescue facility.

4. If necessary, request the assistance of other aircraft to maintain communications with and continuous surveillance of the survivor.

5. Leave the area with sufficient fuel remaining to POSITIVELY ensure return to base or an alternate field.

DIVISION

Everything previously mentioned 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. These are:

1. The other member of the section in which the downed pilot was flying will follow the pilot during his descent and circle the survivor at low altitude and at 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 the ground or water.

5. Turn off the emergency IFF/SIF code when departing from the 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 degrees 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, waveoff (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 side 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 the 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 to the wing rock a series of rapid, manual flashes with the external lights on BRT/STDY.

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, ascertain that the runway is clear by attempting to alert the tower before landing. Alert tower by making a low pass parallel to the lighted runway, close aboard the tower and jazzing the throttle. Land, if possible, when the pattern is clear of traffic.

SECTION OF AIRCRAFT (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 7-2 for light signals. Aboard ship, hook will be lowered prior to departing marshal. Bolter and waveoff are same as for day.

Precautionary/Flameout Approaches NEW

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. A safe ejection may be made throughout the flameout approach by reducing the rate of descent prior to initiating ejection. NEW

HIGH PRECAUTIONARY/FLAMEOUT APPROACH

The approach is depicted in figure 5-7. The pattern consists of a 270-degree approach, with check points at the initial, 180-degree, and 90-degree positions. The optimum airspeed of 200 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 pounds weight increase above 14,000 pounds. The minimum acceptable airspeed during the approach until flare is 170 KIAS. However, airspeeds below 200 KIAS make the landing flare more critical. The high precautionary/flameout approach should be used only when the following criteria are met: NEW

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 of less than 15 kts.

THE PATTERN

1. Entry. Entry into the high precautionary/flameout approach pattern should be executed to

FLAMEOUT APPROACHES

If it is impossible/impracticable to abandon the aircraft, a flameout approach and landing may be attempted utilizing the following techniques and procedures. Simulated flameout approaches are prohibited.

FLAMEOUT APPROACH AND LANDING

The flameout approach is illustrated in figure 5-7. The pattern consists of a 270-degree approach with check points at high key, low key, 90-degree position and final. The optimum airspeed of 200 KIAS is suitable for gross weights up to 16,000 pounds with or without empty external drop tanks and/or empty multiple ejector racks. The minimum acceptable airspeed prior to the flare is 190 KIAS, and the minimum acceptable airspeed after the flare is commenced until in close proximity to the runway is 180 KIAS. However, pattern airspeeds below the optimum value of 200 KIAS make the flare more critical.

THE PATTERN

ENTRY. Entry into the flameout approach pattern should be executed to arrive at high key with the emergency generator and landing gear extended and the aircraft trimmed for 200 KIAS. Gross weight reduction should be accomplished prior to arrival at high key by dumping fuel and/or jettisoning of external stores as necessary.

Note

With an actual flameout the fuel dump rate will be significantly reduced.

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 high key position. 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 high key, landing gear extension may be delayed to low key only.

HIGH KEY. The high key position is a point over the runway approximately 2500 feet from the approach end, heading 90 degrees relative to the runway heading. Optimum altitude is 7500 feet AGL with the emergency generator and landing gear extended, flaps up, the shoulder harness locked. A slightly delayed turn using 25-30 degrees of bank angle should be used to arrive at the proper low key position.

LOW KEY. The low key position is approximately 1-1/2 miles abeam a point 4000 feet short of the approach end of the runway, 4500 feet AGL, 200 KIAS, heading 180 degrees from direction of intended landing. Compass heading is a good reference to determine the low key position when checking altitude. The turn should never be stopped to dissipate excess altitude nor the airspeed reduced below 190 KIAS in an attempt to regain lost altitude. Check gear handle down and arm spoilers. Approximately 45 to 50-degree bank angles will be necessary to arrive at a proper 90-degree position.

90-DEGREE POSITION. The 90-degree position is approximately 1-1/2 miles from the approach end of the runway, 3000 feet AGL, 200 KIAS, landing gear locked down. From this position, bank angle can be varied to effect satisfactory lineup and arrival at a proper final position. 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 up to and including the flare.

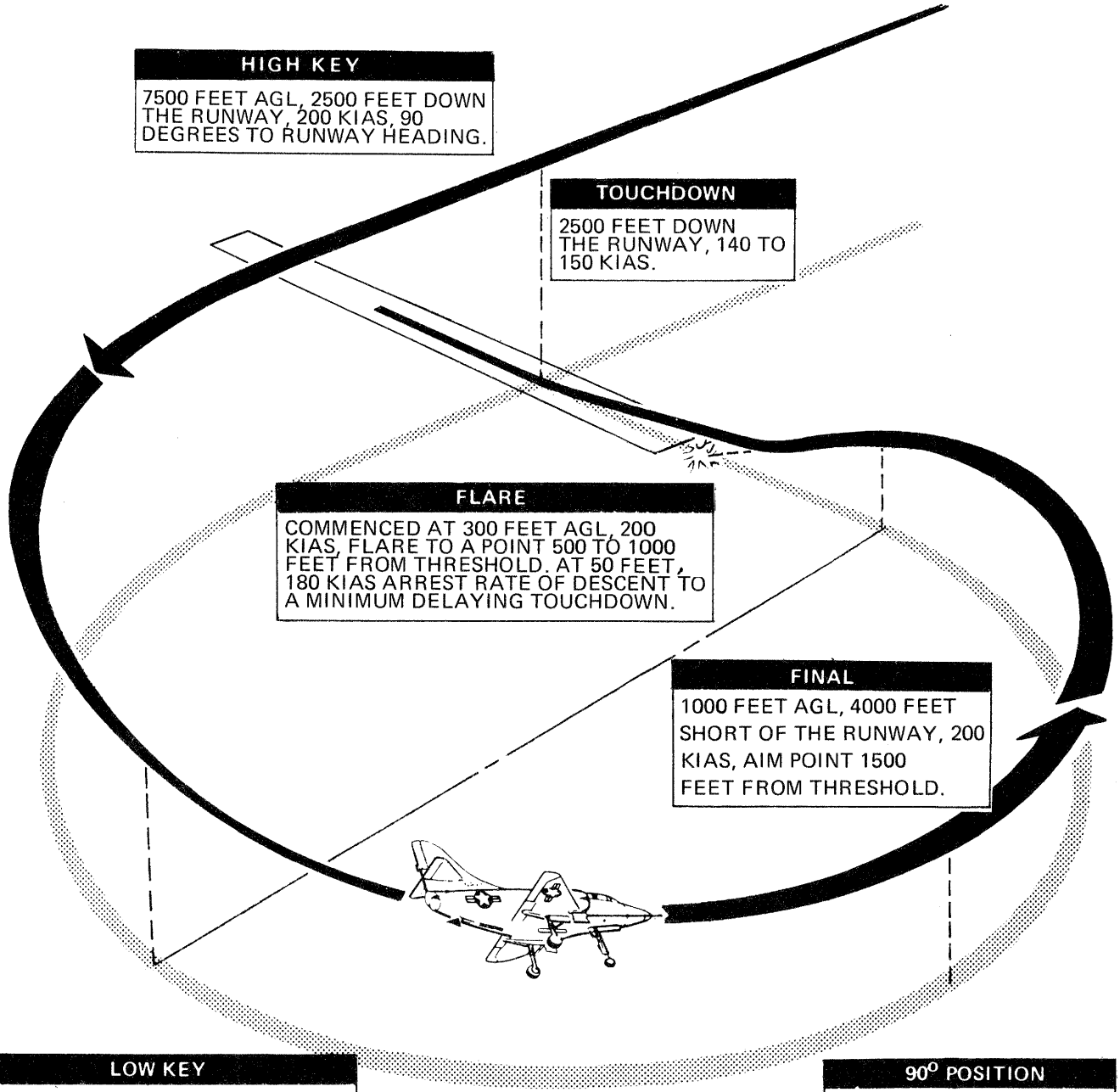
FINAL. Final approach position is 4000 feet from the approach end of the runway, 1000 feet AGL, 200 KIAS, and wings level. On final, the projected airplane flight path will intercept a point approximately 1500 feet short of the approach end of the runway. If high, altitude should be dissipated by nosing over slightly permitting airspeed to increase. Minimum airspeed to the flare is 190 KIAS.

FLARE. The flare phase of the approach is the most critical and requires optimum pilot technique. The flare is commenced at 250 to 300 feet AGL, 200 KIAS at a rate of rotation which quickly reduces the rate of descent to approximately 1000 feet/min and establishes the airplane on a glideslope that intercepts a point 500 to 1000 feet down the runway at 150 feet AGL. The airspeed is allowed to dissipate to 180 KIAS (170 KIAS minimum), prior to commencing the final portion of the flare. At approximately 50 feet AGL over the runway, 180 KIAS, the rate of descent should be reduced to a minimum, delaying aircraft touchdown to a point approximately 2500 feet down the runway at 140 to 150 KIAS. This flare and resulting minimum sink rate landing are similar to that of a normal flared field landing from a 3-degree glideslope with excess airspeed. Airspeed dissipates very rapidly (power off) during the flare.

LANDING. The optimum touchdown speed range is 140 to 150 KIAS. Approximately 6500 feet of runway will be required for stopping. Airspeeds below 140 KIAS should be avoided to prevent a hard landing. A safe landing can be accomplished at touchdown airspeeds as high as 165 KIAS if sufficient runway is available. 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 taxi speed. If insufficient runway is available, the arresting hook should be extended for emergency arresting gear engagement. NEW

PATTERN NOTES:

1. OPTIMUM APPROACH CONFIGURATION - LANDING GEAR DOWN, FLAPS UP, EMERGENCY GENERATOR OUT, S/B IN.
2. MAXIMUM GROSS WEIGHT– 16000 LBS.
3. AIRSPEED RANGE– 190 TO 220 KIAS UNTIL INITIAL FLARE; 170 KIAS MINIMUM UNTIL FINAL FLARE.
4. ALTITUDE RANGE– MINUS 500 FEET IS ACCEPTABLE FOR PATTERN CHECK POINTS UP TO THE FLARE. MINIMUM FLARE ALTITUDE –250 FT AGL
5. WIND CORRECTION– DISPLACE HIGH KEY INTO THE WIND 1000 FEET AND THE AIM POINT ON FINAL 250 FEET FOR EVERY 5 KTS OF HEADWIND.



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Figure 5-7. Flameout Approach

ADDITIONAL CONSIDERATIONS. Effort must be made to fly the optimum pattern, and many variables must be considered. Some considerations which must be taken into account are:

Effects of Wind. Wind velocity and direction is of vital importance during the flameout approach. For every 5-knot increment of headwind the touchdown point will be displaced approximately 1000 feet if uncorrected. Correction for the wind should be effected by varying bank angle to maintain the optimum positions required by the pattern. In addition, the high key position should be displaced in the wind by 1000 feet for every 5 knots of headwind. This pattern displacement decreases throughout the approach until the correction on final is reduced to approximately 250 feet per 5 knots of wind for the aim point on final. For example, a 10-knot headwind will require the high key position to be displaced 2000 feet into the wind or 4500 feet down the runway, and the initial aim point on final will be only 1000 feet short of the runway threshold instead of 1500 feet. The touchdown point will remain essentially unchanged.

Altitude/Airspeed Adjustment. Altitudes as low as 500 feet below optimum can be compensated for by varying bank angle during the approach and by changing the basic pattern; i.e., closer low key position, 90-degree position, or delay in lowering the landing gear. However, the initial flare must be commenced wings level by 250 to 300 feet AGL to ensure a safe flare, and the gear handle must be placed in the down position by the low key to ensure the gear are down on final. Bank angle/turn rate should be decreased during an approach except to correct for crosswind conditions. Required pattern changes can only be determined by continuous analysis of ground track position, airspeed, and altitude.

Airspeed should never be decreased below 190 KIAS prior to the flare 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 and allowing airspeed to increase, rather than by adjusting pattern.

Effects of Aircraft Configuration Changes. The flameout approach pattern was based on a standard A-4 configuration of two empty 300-gallon drop tanks on stations 2 and 4. Tests have shown that the pattern can be flown with high drag configurations up to and including two MER and a 300-gallon centerline drop tank. However, the flare characteristics at the higher drag counts are more critical due to the increased rate of energy dissipation during the flare and require more exacting pilot techniques. Therefore, the external drag configuration should be reduced to a drag count equal to or less than the standard configuration.

FLIGHT CHARACTERISTICS WITH ENGINE FAILURE

1. 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 must be selected in the event of engine seizure and provides adequate controllability, but the rapid control response required for high crosswind landing is lost.

2. Speedbrake Actuation. Manual speedbrake retraction requires less than 2 seconds and causes no adverse trim changes.

3. 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.

FLIGHT CHARACTERISTICS WITH SEIZED ENGINE

The following rate-of-descent data with a seized engine are for the A-4C/L configured with 3 pylons, guns, and two 300-gallon external fuel tanks with gear down, speedbrakes closed, and flaps up. These data are presented for an aircraft weight of 14,000 pounds, and a speed of 180 KIAS. For weights greater than 14,000 pounds, add 5 KIAS airspeed and 100 FPM for each 1000-pound increase.

Pressure Altitude Feet	Rate of Descent FPM	
	A-4C	A-4L
20,000	4705	4720
15,000	4335	4350
10,000	4025	4040
5,000	3745	3760
0	3485	3500

PRECAUTIONARY APPROACH

The precautionary approach is depicted in figure 5-8. It may be used whenever circumstances make it desirable, such as loss of oil pressure or other engine difficulties which make it undesirable to reduce rpm. The variations in pattern entry and altitude allow a wide margin of flexibility. A suitable field for a precautionary approach is one with a minimum of 8000 feet of hard-surfaced runway. Select a field with crash equipment and arresting gear, if practicable.

1. Entry. Approaches to the field for a precautionary approach are divided into upwind or downwind categories. If upwind of the landing runway, plan to pass through a normal left or right base at 2000 feet AGL, executing a 180-degreee approach slightly deeper than a normal landing approach, and intercepting the depicted flight path on the final. If downwind of the landing runway, plan a modified straight-in approach to intercept the depicted flight path.

2. Straight-In Approach: If a straight-in precautionary approach 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 the desired point in landing configuration--gear down, flaps down, speedbrakes as necessary. Have the aircraft "dirty" by 1-1/2 miles from touchdown, if possible. Turn the gunsight ON and set 110 mils. At the initial point (or wherever the precautionary approach 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 180 knots. The rate of descent will be 1500 to 1800 feet/minute, depending on the wind.

3. Final Approach and Landing. An ejection attempt at low altitude in this approach leaves little margin for error. If ejection is decided upon, reduce the descent rate as much as possible and attempt to eject while wings are level. Do not descend below 200 feet AGL until 1000 feet from the end of the runway. This final check point is the first point in the precautionary approach from which a safe landing on the runway can be made if the engine fails.

NEW Just short of the end of the runway, reduce power as necessary, flare to reduce rate of descent and dissipate airspeed, and land. After touchdown, secure the engine. If necessary, drop the hook 1000 feet before engaging arresting gear.

EJECTION

If the engine fails at any point in the precautionary approach above the minimum safe-ejection altitude, the pilot will eject unless unusual circumstances clearly indicate to him that the cause of safety to himself and others will be better served by continuing the approach flamed-out, rather than by ejection.

Landing-Use of Field Arresting Gear

Many types and modifications of field arresting gear are in service, all of which differ in maximum permissible engaging speed, maximum off-center engagement limit, etc.

All field arresting gear possesses a pendant and a braking device (i.e., hydraulic brake, rotary drum brake, water squeeze, or heavy chain). Depending primarily on the braking device, the device may be bidirectional or unidirectional.

WARNING

Engagement of unidirectional arresting gear in the wrong direction may cause severe aircraft damage. Engagement of chain drag gear in the wrong direction poses an additional threat to men and equipment in the area.

Field arresting gear is classified according to location on the runway. See figure 5-9.

1. Short field gear: located 1500 to 2500 feet from the approach end.

2. Midfield Gear: Located near the halfway point of the runway. Usually requires prior notification in order to rig for arrestment in the direction desired.

3. Abort Gear: Located 1500 to 2500 feet short of the upwind end of the duty runway and usually will be rigged for immediate use.

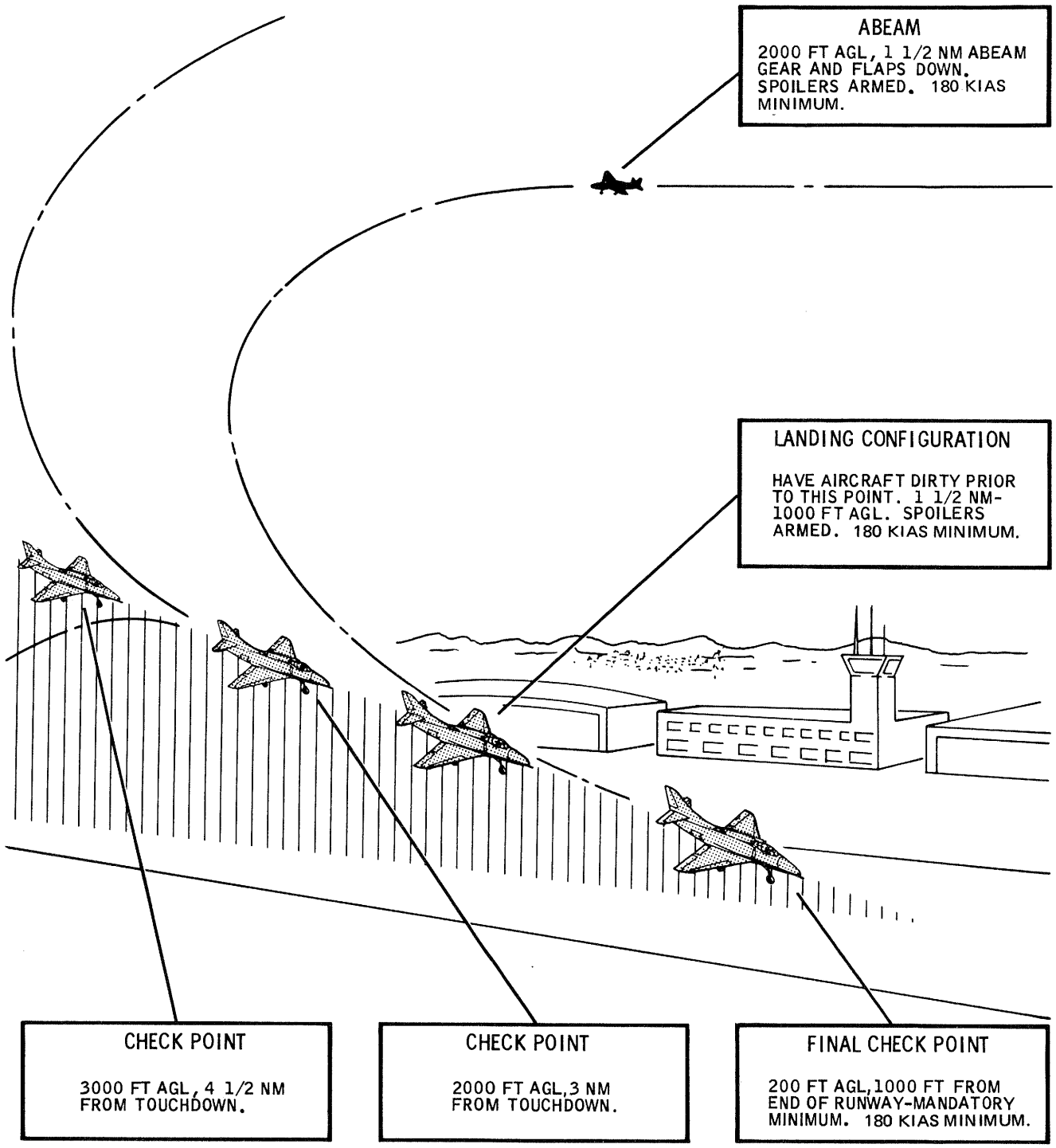
4. Overrun Gear: Located shortly past the upwind end of duty runway. Usually will be rigged for immediate use.

5. Field Barriers: At many bases a cable or jet barrier is placed in the overrun and usually rigged.

Compatability of the A-4 Aircraft with this type of gear has not been flight tested, but engineering analysis has resulted in the following recommended procedures:

a. Planned use, such as a long field arrestment is recommended only when no other type of arresting gear is available. Do not engage with fuel in the drop tanks.

b. Emergency use, such as a takeoff abort, would probably be unavoidable because the system is normally rigged. However, the hook should be lowered to increase the probability of arrestment.



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.

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Figure 5-8. Precautionary Approach

TYPE OF ARRESTING GEAR	MAXIMUM ENGAGING SPEED KNOTS			MAXIMUM OFF-CENTER ENGAGEMENT FEET
	SHORT FIELD LANDING GROSS WEIGHT UP TO 14,500 LBS. (d,c)	LONG FIELD LANDING GROSS WEIGHT 14,600-16,000 LBS. (f)	ABORTED TAKEOFF GROSS WEIGHT 16,100-24,500 LBS. (h)	
M-2	130(c)	130(c)	117(c)	20
E-14-1	147(b)	160(c)	152(a)	35
E-27	159(b)	159(b)	163(c)	20
E-15 (200 ft SPAN)	150(b)	150(a)	144(a)	20
E-15 (300 ft SPAN)	176(b)	176(b)	174(a)	40
M-21	151(a)	151(a)	147(a)	10
E-28	155(a)	155(a)	150(a)	40
E-5 (STD CHAIN)	143(b)	150(c)	150(c)	(g)
E-5-1 (STD CHAIN)	143(b)	163(a)	163(a)	(g)
E-5 (HEAVY CHAIN)	141(b)	150(c)	150(c)	(g)
E-5-1 (HEAVY CHAIN)	141(b)	164(a)	163(a)	(g)
BAK-6	160(c)	160(c)	160(c)	15
BAK-9	160(c)	160(c)	160(c)	30
BAK-12	160(c)	160(c)	160(c)	50

NOTES:

(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 arresting gear capacity.
(d) Maximum of 3.0 degree glide slope.
(e) Consult appropriate section for recommended approach speed.
(f) Flared or minimum rate of descent landing.
(g) Off-center engagement may not exceed 25% of the runway span.
(h) Data provided in the aborted takeoff column may be used for emergency high gross weight arrestments.

Figure 5-9. Emergency Field Arrestment Data

Location and capability of field arresting gear is of paramount importance to the pilot. Capability is delineated in figure 5-9. Location is contained in the FLIP Enroute Supplement and other publications.

WARNING

- The decision to abort due to known existence of available arresting gear shall be based on the nature of the emergency.
- If off center conditions are encountered approaching the arresting gear, do not attempt to regain the runway centerline; engage the arresting gear parallel to the runway centerline.

Upon determination that an arrested landing is to be made, determine the type of arrestment to be made, the aircraft ETA at the field, and special requirements such as runway foaming, etc. Advise the tower of the decisions made as soon as possible to facilitate preparation of the runway and crash crew equipment set up. Use of a radio equipped LSO/RDO for all fly-in engagements is recommended.

CAUTION

Foam retains its characteristics for approximately 10 minutes.

Engagement of field arresting gear should be made at minimum speed practicable, on centerline, paralleling runway centerline. Engagement should be accomplished with feet off the brakes, harness locked, and all three wheels on the ground. Brakes should be applied after the aircraft stops to avoid two-blocking the arresting gear at idle power. If the field arresting gear is to be used at night the pendant should be illuminated and use of the taxi light is recommended.

Short Field Arrestments

The short field arrestment provides minimum rollout and minimum directional control problems while retaining waveoff capability if the pendant is missed. Short or midfield gear should be utilized when available.

Plan the approach to touch down just short of the gear, on centerline at optimum airspeed with hook extended. Upon touch down, maintain approach power until engagement is effected. When the hook is positively engaged, retard throttle to idle or secure the engine as indicated.

Long Field Arrestments

The long field arrestments are used in stopping the aircraft when the runway remaining is inadequate. The long field arrestment is used for stopping aircraft when runway remaining is insufficient and directional control is no problem. Inform the tower as soon as possible that a long field arrestment is to be made.

Lower the hook 1000 feet prior to the pendant to preclude weakening of the hook point. Engagement should be accomplished on centerline, at minimum speed, parallel to runway heading. Shutdown of the engine may be accomplished at 80 knots provided directional control is not a problem.

Landing With Landing Gear Malfunctions

Figure 5-10 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.

CARRIER BARRICADE ENGAGEMENT

The barricade will be used for all carrier landings with landing gear malfunctions. Consult the Flight Manual 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 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 to the pilot.

FIELD ARRESTMENTS

Always request the assistance of an LSO. When the arrestment is to be made at night, have the position of the arresting gear 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.

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	No	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 the gear and divert ashore if feasible. Retain and land on empty tank/tanks, empty rocket packs, or other lightweight inert stores, with exception of the air refueling store. Jettison the 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 the wing fuel is expended and the fire hazard minimized.

Notes:

1. Crossdeck pendant configuration shall be in accordance with current recovery bulletins.
2. If time considerations preclude the removal of crossdeck pendants, land with the hook up to prevent severe nose-down rotation, should arrestment occur before barricade engagement.
3. Make a flat approach at normal approach speed. Touch down lightly, with a low sink rate. Use LSO control.
4. Have cross deck pendant removed due to danger of refueling probe picking up pendant.
5. Burn down to 600 pounds before landing.
6. Make a short field arrestment from a flat approach at normal approach speed. Trim full NOSEUP approaching touchdown. At touchdown, do not retard throttle. Hold noseup 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 before the arresting gear. Grease this one on holding the wings level as long as possible with lateral stick. 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 NOSEUP approaching touchdown. At touchdown, secure the engine. Lower the nose slowly before elevator effectiveness is lost.
9. Ejection is mandatory without two drop-tanks installed.

Figure 5-10. Guide to Emergency Landings with Landing Gear Malfunctions

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 before the complete loss of pressure. When this is observed and it is practical to do so, slow to 130 to 225 KIAS 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. (See HYDRAULIC SYSTEMS FAILURE, this section.)

If 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 before utility system failure.

Because the wheelbrakes are completely independent of the aircraft's hydraulic system, the pilot should realize that he will have brakes even though he makes a field landing with complete hydraulic failure. Should the pilot have a complete hydraulic failure, he can also extend his arresting hook. Compressed air pressure and the weight of the arresting hook cause extension when the arresting hook handle is moved to the DOWN position. However, the pilot cannot retract the arresting hook without hydraulic pressure.

The arresting hook should not be extended in flight unless a short field arrestment is planned. If a long field arrestment becomes necessary, lower the hook 1000 feet prior to the arresting gear to preclude dragging the hook on the runway, which may damage it to an unusable extent.

An arrested landing is recommended whenever possible to minimize fire hazard due to possible hydraulic leak. The engine should be secured immediately.

Note

If an arrested landing is not available, an increased landing roll of approximately 100 percent can be expected in a no flap, no speedbrake, no spoiler configuration.

EMERGENCY LANDING GEAR EXTENSION

Utility hydraulic system failure will necessitate lowering the landing gear with the emergency release system as follows:

1. Airspeed . . . . . 130 to 225 KIAS
2. Landing gear handle . . . . . DOWN
3. Emergency landing gear release . . . . . PULL
4. If landing gear fails to extend, apply moderate negative g loading for 2 to 3 seconds.
5. If landing gear still 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 gear-down 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 emergency landing gear extension procedure.

1. Main Gear Only Unsafe, Gear Handle Down

a. Maintain 225 KIAS or less.

b. If practicable, obtain a visual check from another aircraft or from qualified ground personnel to determine if the cause is a faulty indication or that the gear is actually not down and locked.

c. 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 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 get a DOWN indication. As soon as both mains indicate down, cease cycling. (The nose gear extension may require as much as two 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 paragraph entitled 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 gear and proceed in accordance with figure 5-10 for the particular situation that exists.

2. Nose Gear Only Unsafe, Gear Handle Down

a. Maintain 225 KIAS or less.

b. Cycle gear.

c. Obtain visual check. If nose gear door is not open, utilize emergency landing gear extension procedures.

d. If door is visually checked open and gear is hung in well, raised gear, apply and maintain positive g, and lower gear.

e. If nose gear door is visually checked open with nose gear unsafe, increase airspeed (350 KIAS) and apply positive g.

f. If nose gear is still unsafe, attempt to raise all three gear, and proceed in accordance with gear malfunction landing guide (figure 5-10).

g. If unsafe indication still exists although visually checked down, make an arrested landing.

h. If arresting gear is not available, make a normal landing.

i. Ensure that gear pins are installed prior to securing engine.

3. Visual Checking that the Landing Gear is Down and Locked. For inflight 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 mid-point 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 gear and proceed in accordance with figure 5-10 for the particular situation that exists.

4. Landing Gear Does Not Indicate Down and Locked with Gear Doors Extended.

a. If gear fails to fully extend, raise landing gear handle to UP position. Apply moderate negative g, maintaining 225 KIAS maximum. While maintaining negative g, extend speedbrakes and lower gear handle.

b. If there is still no down and locked indication with the gear doors extended, slowly increase airspeed to a maximum of 350 KIAS to obtain a down and locked indication. Particular attention must be made to keep the aircraft in balanced flight.

LANDING – NO FLAPS

When unable to extend the flaps for landing, fly optimum angle of attack (optimum AOA is 10 to 15 KIAS above full flap approach speed). Fly slightly wider pattern about 1-1/2 miles abeam. For shipboard recovery, observe the maximum engaging 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, if possible.

SPOILER MALFUNCTION

If spoilers deploy 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.

5. Use full flaps with gear down.

6. Keep speedbrakes closed.

7. Expect excessive approach speed.

8. Use arresting gear where practical.

If one spoiler fails to open during landing roll, proceed as follows:

1. Control swerving with corrective rudder, brakes, and aileron, as required.

2. When control is regained, place spoiler switch in OFF.

LANDING WITH AN ASYMMETRIC LOAD

With asymmetric loads, landings should be made upwind or downwind, whichever is required to put the crosswind component under the heavy wing, providing other factors are considered, such as runway length and gross weight, and that the rollout will be shortened appreciably 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 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 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. With asymmetric loading, the maximum 90 degree crosswind component under the loaded (heavy) wing is 15 knots. Landing with any amount of crosswind under the unloaded (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 long straight final should be utilized. If the utility 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 LOAD (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 125 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 of 140 to 145 knots.

LANDING WITH RUNAWAY NOSEDOWN TRIM

In the event a landing must be made with full NOSE-DOWN trim which cannot be corrected by use of the horizontal-stabilizer MANUAL OVERRIDE, proceed as follows:

1. Burn down to 1000 pounds fuel remaining.

2. At a safe altitude, place the aircraft in landing configuration. Wing flaps should not be extended.

3. Cautiously reduce airspeed to a reasonable approach speed commensurate with the runway length available for stopping. The airspeed selected should also provide 2 inches of additional backstick for use if gusts or turbulence cause a nosedown pitch during the approach. Landing may be made as soon as the above conditions are met. (At 600 pounds fuel remaining, CG should have moved aft far enough to provide the requisite 2 inches excess backstick at optimum approach speed (DONUT) with the flaps retracted. Extending the flaps will reduce the amount of backstick available.)

Note

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 speeds.

LANDING – KNOWN BRAKE FAILURE

Landing with one or both brakes inoperative should be treated as follows. If arresting gear is available, make a short field arrestment, preferably 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 light-weight inert stores.

When landing aboard ship with known brake failure, maintain power above 80 percent and leave hook down and engaged with crossdeck pendant until tow bar 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 in LANDING-KNOWN BRAKE FAILURE. If it is not practical to do so, and arresting gear is available, extend the arresting hook approximately 1000 feet before engagement. Attempt to engage on the centerline. It may be desirable to maintain sufficient airspeed to provide rudder effectiveness for directional control. Where no arresting gear is available and waving off is not feasible, retract the landing gear and secure the engine if it is apparent that the aircraft will not remain on the prepared surface. The decision to jettison inflammable external stores and/or retract the landing gear must be made and action taken, before securing the engine. If airspeed is in excess of 90 knots, ejection is another alternative to be considered.

LANDING WITH A BLOWN MAIN TIRE

Little difficulty should be experienced in landing with a blown main tire. If it is known before landing that the tire is blown, a short field arrestment is recommended. If there is no arresting gear available, NEW secure the engine in non-spoiler aircraft 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 before engagement. More braking effectiveness can be obtained from a good tire than a blown one; consequently, it is poor technique to intentionally blow the good tire.

LANDING WITH A BLOWN NOSE TIRE

When landing with a blown nose tire, a short field arrestment is recommended. Obtain a positive hook-down 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 NOSEUP just before 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, secure the engine on touchdown, and lower the nose gear slowly before elevator effectiveness is lost. Little difficulty should be experienced with this landing, with or without arresting gear available.

LANDING WITH THROTTLE LINKAGE BROKEN

AIRFIELD. If the throttle linkage breaks on aircraft incorporating J65 Engine Bulletin 240, the engine fuel control unit (unless it is at idle) automatically seeks approximately 87 percent rpm position. Normal flight can be maintained. Maximum rate of climb can be attained at 210 knots (clean configuration). Field landings and waveoffs can be accomplished. The approach should be made without external stores (except drop tanks).

Perform the landing pattern checks as for a normal landing and fly the normal field landing pattern, with the following exceptions:

1. Downwind leg.

GEAR DOWN, FULL FLAPS, slightly wider than normal.

Use the speedbrakes to control airspeed.

Airspeed should be 5 to 10 knots above the optimum for gross weight.

2. Final approach.

Fly a long flat approach, 5 to 10 knots above the optimum.

Use the speedbrakes to control airspeed.

Do not let airspeed fall below the optimum approach speed or permit a sink-rate to develop in excess of that required to reach the desired touchdown point.

Fly a long flat approach, 5 to 10 knots above the optimum.

Use the speedbrakes to control airspeed.

Do not let airspeed fall below the optimum approach speed or permit a sink-rate to develop in excess of that required to reach the desired touchdown point.

3. After touchdown.

NEW Drop hook 1,000 feet prior to first available arresting gear. **Lift the guard and move the manual fuel shutoff knob outboard and aft into the EMERG OFF detent. (The time interval from the actuation of the manual fuel control knob until initial engine deceleration is approximately 4 seconds (fuel burnoff). This delay (fuel burnoff) tends to increase the landing rollout, but is offset by the absence of idle thrust after the engine runs down.**

4. Waveoff.

Speedbrakes . . CLOSE.

Fly donut airspeed.

Landing gear . . . UP when the sink rate is stopped.

Keep the flaps fully extended until the climb rate is established, then slowly milk them up.

CARRIER. If fuel permits, divert. Otherwise make practice passes with the hook up, similar to that specified above. With 13,000 pounds or less gross weight, 87 percent rpm should provide sufficient thrust for a bolter if airspeed is not permitted to fall below the optimum for the particular aircraft gross weight. If unable to control the aircraft well enough to effect a safe landing, eject.

Landing at High Gross Weight

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, NEW power and attitude should be adjusted to touchdown with a **minimum rate of descent. 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 glideslope 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. Provided that 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. Before any wheels-up landing, the canopy and 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. Adjust the seat to approximately the midposition to afford maximum protection from the load-limiting device. Remain braced until the shocks stop. Use the normal approach speeds throughout the landing pattern and attempt to touch down at, or slightly above, the normal landing speed.

EMERGENCY EXIT

If it is necessary that the pilot leave the aircraft immediately, the canopy should be jettisoned by pulling the canopy jettison handle and then pulling the harness release handle. Observe the following precautions:

1. After pulling the harness release handle, the oxygen hose must be manually disconnected from the console before departing the cockpit.

2. The canopy can be jettisoned from the aircraft with the manual canopy lever in any position.

3. Do not pull the harness release handle while the aircraft is moving.

4. If time permits, safety the ejection controls by pulling the safety handle on the pilot's headrest to the DOWN and LOCKED position to preclude inadvertent ejection after the aircraft has come to rest.

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 5-11.)

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 will jettison the canopy regardless of the position of the canopy handle.

NEW

WARNING

When the canopy is jettisoned, the seat catapult interlock is extracted and care must be exercised to avoid firing the seat catapult charge. Pull the seat catapult safety handle down before removal of the pilot from the seat.

To release the pilot from the seat without the parachute and survival equipment attached, unfasten the harness rocket-jet 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 feasible. Whenever possible, ditch while power is still available.

If power is not available, the pilot must necessarily choose between either 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 water ditching is imminent:

1. Shoulder harness . . . . . LOCKED
2. Landing gear . . . . . UP
3. Jettison all external stores.
4. Wing flaps . . . . . DOWN
5. Place seat in the midposition.
6. IFF/SIF . . . . . EMERGENCY
7. Transmit MAYDAY position report.
8. Helmet visor over the eyes.
9. Emergency oxygen (just before touchdown) . . . . . PULL
10. All armament switches . . . . . SAFE
11. Canopy . . . . . JETTISON
12. Arresting hook DOWN to feel for the water.

Land into the wind, if there are no swells, and in light seas. 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. If canopy-jettison system malfunctions, the pilot can open the canopy by 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 fittings. Pull with the hands on the upper edge of the windshield bow and push with the feet to escape.

In extreme circumstances, the pilot also has two other methods of getting through the canopy: by using either his service revolver or his survival knife to crack it open. 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 covered as possible for protection from flying plexiglass. 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. Attempting to exit by releasing the Koch quick-disconnect fittings will also require manually disconnecting the pilot-to-seat-pan oxygen/communication connection on the torso harness. Because this method requires breaking 5 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 before surfacing should prevent head-down flotation.

The aircraft is equipped with an UNDERWATER CANOPY JETTISON RELIEF-VALVE, which facilitates removal of the canopy under water. It is recommended, however, that the canopy be jettisoned by pulling the canopy jettison handle before submersion.

UNDERWATER ESCAPE PROCEDURE

1. Remain braced until all shocks stop.
2. Emergency oxygen supply . . . . . ON
3. Disconnect the oxygen hose from the left console.
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.
7. Pull forward with the hands on the top of the windshield bow and push with the feet.
8. When clear of the cockpit, inflate flotation gear.

WARNING

Do not inflate flotation gear until clear of the cockpit as inflated gear may trap the pilot in the cockpit.

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 as they are in critical supply. Proper oxygen mask fit will prevent water from seeping in during the critical underwater escape.

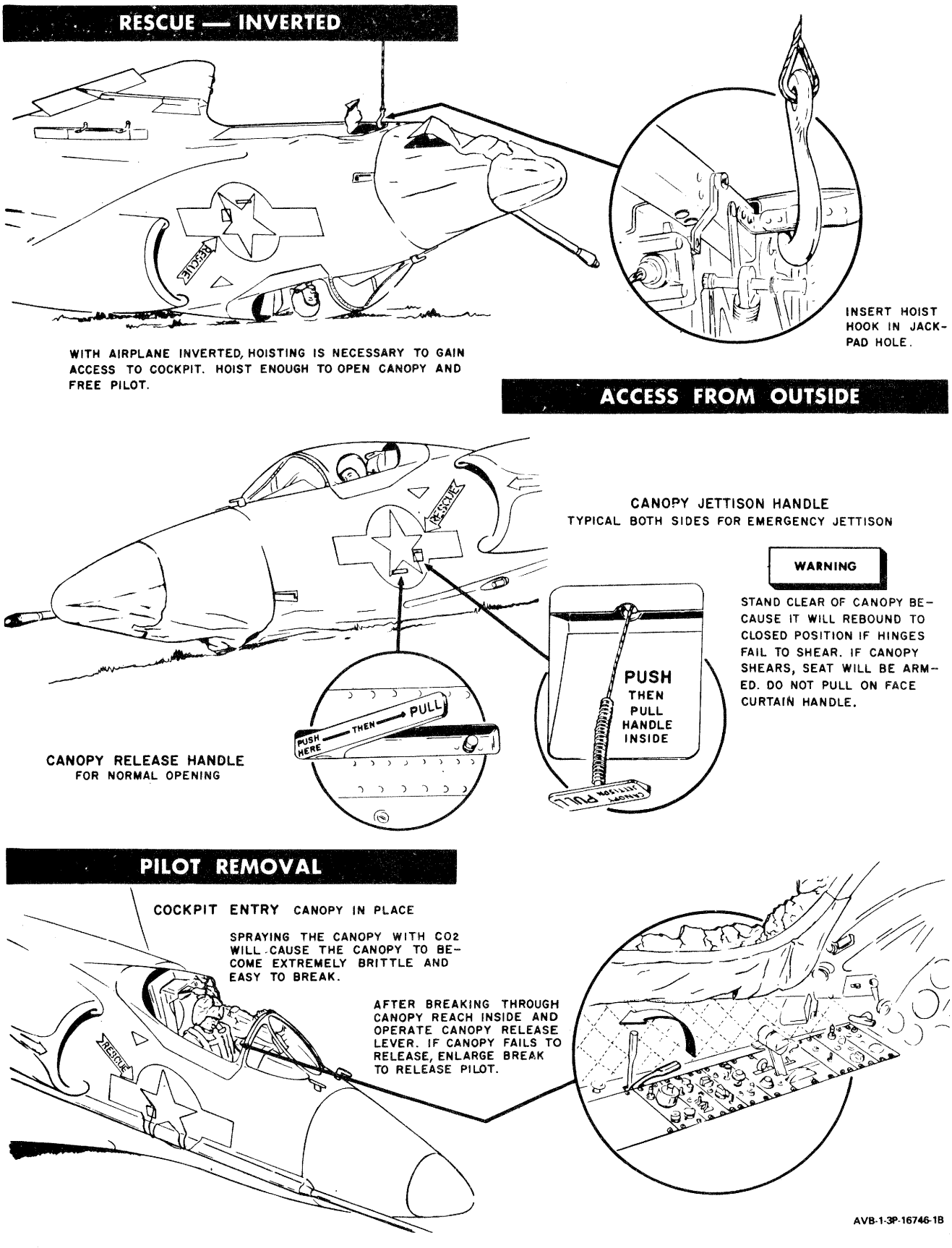


Figure 5-11. Emergency Entrance

SECTION VI

ALL-WEATHER OPERATION

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INTRODUCTION

Discussions of special techniques and procedures for operation in adverse weather necessarily includes some instructions found in other sections of this manual. 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 as a supplement to 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 pre-flight 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 the altimeter and record the altimeter error (if any) to insert at destination.

8. Adjust the all-attitude indicator/gyro.

9. Set clock.

10. Make mandatory autopilot preflight checks.

11. Check for 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.

TAKEOFF

When in takeoff position and lined up with the runway:

1. Check compass SLAVED and in sync.

2. Check all-attitude indicator/gyro for correct operation.

3. Turn on pitot heat switch as required. Do not prolong pitot heat use on the ground.

4. Advance throttle, maintaining directional control with brakes 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 following procedures are to be used in performing basic instrument maneuvers in the A-4.

CLIMB SCHEDULE

Climb schedule for basic instrument flights will be 300 KIAS to 0.70 IMN to 240 knots minimum at higher altitudes.

Note

Although 300 KIAS is the preferred climb speed, when feasible climb speed will conform to local procedures.

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 degrees, 45 degrees, 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 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

See figure 6-1 for 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.

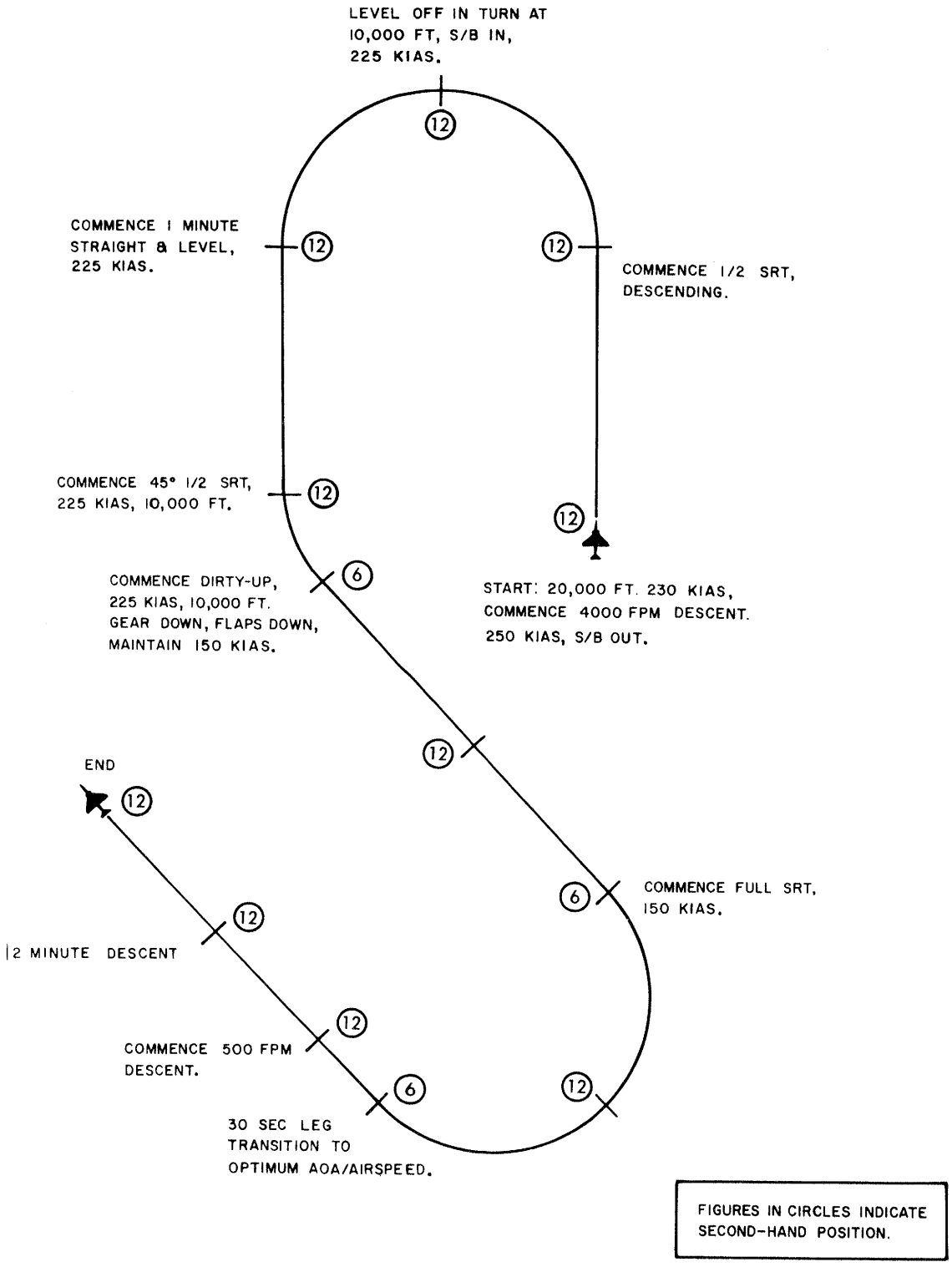


Figure 6-1. Yankee Pattern

JET PENETRATIONS

A penetration is a maneuver which combines a high rate of descent with a constant airspeed and maintains the aircraft within a specified 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 (include altimeter error noted prior to takeoff)
4. Shoulder harness .	LOCKED
5. Pitot heat	AS REQUIRED

CLEAN PENETRATION. The clean penetration is conducted at 250 KIAS, speedbrakes OUT, and a rate of descent of 4000 to 6000 fpm. This will require an initial power setting of about 80 percent. At penetration fix and 230 KIAS, the nose is lowered to about 7 degrees nosedown to start penetration. As airspeed reaches 245 knots, speedbrakes are extended. Maintain 250 knots 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 shall be lowered in order to reach the final approach fix in a landing configuration at desired approach speed.

NEW

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 knots, wheels and flaps DOWN, speedbrakes OUT, and a rate of descent of 3000 to 5000 fpm. Just prior to reaching initial penetration fix, slow to 225 knots 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 knots. Start transition to level flight about 1500 feet above the desired altitude.

GROUND CONTROLLED APPROACH

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.

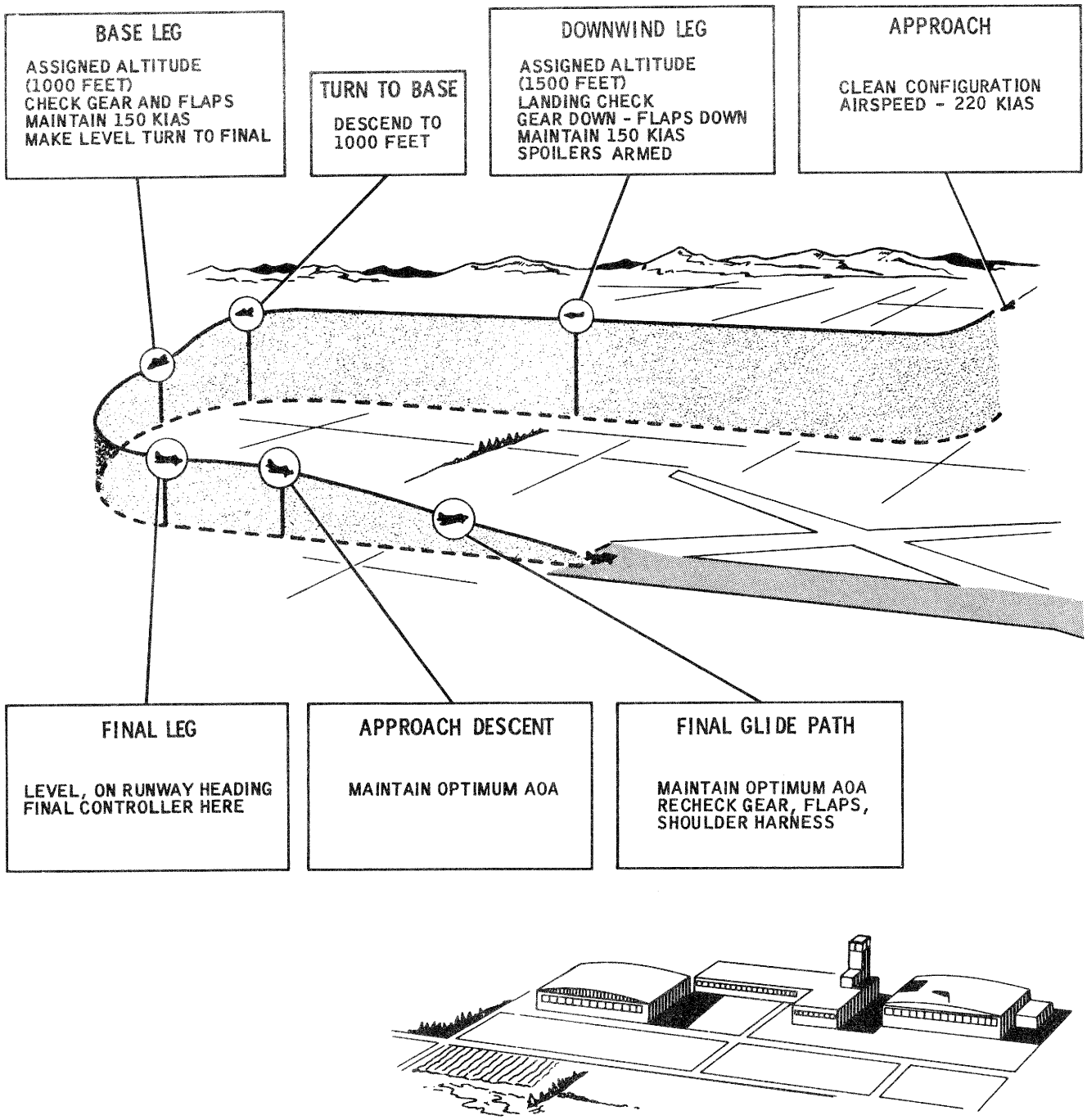
2. Do not exceed 15 degrees bank on final approach. Use positive rudder control in all turns.

The relatively small reflecting surfaces of the A-4 design may make it difficult, when precipitation is heavy, 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 on 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:

Ground Speed	Rate of Descent
150	795
140	745
130	690
120	635
110	585

Generally, a 700 fpm rate of descent is most common, with 100 fpm change per 20 knots change in ground speed. Change ROD by 100 fpm for each 1/2-degree variation from a 3-degree glideslope.



NOTES:
ALL TURNS STANDARD RATE.
ALL ALTITUDES ARE TERRAIN CLEARANCE.
AVERAGE FUEL CONSUMPTION: 400 POUNDS (INCLUDING PENETRATION).
AVERAGE TIME: 8 MINUTES (INCLUDING PENETRATION).

SS1-41339-B

Figure 6-2. Typical Ground Controlled Approach

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 rate of climb and altimeter, raise the gear and commence a turn if required. Do not raise the flaps until the wings are level and airspeed is 170 knots minimum. When the controller advises "Waveoff, tower instruction," this is a mandatory waveoff.

Simulated Instruments

All simulated instrument flight shall be accompanied by a safety pilot who will maintain a chase position as follows: 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 descend below 300 feet AGL. The lead aircraft will go contact at 500 feet AGL. For level turns in the pattern, it will be 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.

Section Penetrations/GCA

Section penetrations and/or GCA's will be necessary when certain 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 Section VII, figure 7-2. 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 rollout 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.

- If section landings must be made on slick runways or where significant crosswinds exist, extreme caution must be exercised during lineup, touchdown, and rollout.

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 shall be 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 have to 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.

This approach should be made only when unable to maintain visual contact with the ground.

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 ARTCC on assigned frequency to assist in circumnavigation of storm centers.

Flights which are conducted at high altitudes following climbout through rain or in 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.

WARNING

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.

Note

Climbing through heavy rain to freezing altitudes will often result in temporary failure of the A-4 main generator. Pilots should be well apprised of the effect such a loss will have on their ability to continue flight to destination under instrument conditions. Usually, descending to below the freezing level will restore normal operations.

Two kinds of icing may be encountered in flight: aircraft icing or 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 tail pipe 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. However, this shift to manual fuel control may cause "rich blowout" if the throttle is not first returned to IDLE. Returning the throttle to IDLE is necessary even though engine rpm is already at altitude idle.

CAUTION

The engine is not equipped with anti-icing equipment.

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 and 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 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 it to NORMAL after 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 would result.

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.

WINDSHIELD WIPER

On aircraft incorporating ASC 218, a windshield wiper is provided for improved visibility when encountering rain. Refer to Windshield Wiper System, Section I, Part 2, for additional information. Antifogging compound and rain repellant is available and should be used on windshield and canopy in accordance with the HMI.

Flight in Turbulence and Thunderstorms

Flights through known areas of clear icing or severe turbulence should not be conducted.

Turbulence

The key to flying in turbulent air is to "fly attitude." Reduce airspeed to approximately 250 knots, fly the all-attitude indicator/gyro and pay less attention to altitude changes.

THUNDERSTORMS

Whenever possible, thunderstorms should be bypassed. In the event a thunderstorm penetration is unavoidable, the following procedures have been thoroughly tested and proven 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

Pitot heat ON.

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 least 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 on 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 lightning. Do not allow these conditions to cause undue concern.

OPERATING 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.

WARNING

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 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. Remove ice carefully 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 (if ASC 194 is incorporated).

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 assure correct operation.

5. Cabin temperature knob as desired.

6. Use caution 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. 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.

2. Avoid taxiing through melted snow or slush caused by the jet blast of other aircraft, to prevent accumulation of ice on the aircraft surfaces.

3. 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.

4. 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.

- Should fog or snow in the cockpit obscure the instruments, the cabin temperature knob should be turned to MAN HOT.

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 gives the maximum runway available, requires a minimum of braking, and allows landing at the lowest airspeed.

WARNING

Ice present on wing surface may significantly increase stalling speed even if slats operate normally. Approach speed should be held above optimum if ice is detected. Consider arrested landing if higher than normal approach speed is utilized.

LANDING

When landing on snow, 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. 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, if crosswinds are not a factor, leave flaps down and speedbrakes extended for increased drag and braking effectiveness and shortened rollout. The proper braking technique is light tapping of the pedals. If the aircraft starts to skid, the brakes should be released and tapping resumed after the aircraft again tracks normally. NEW

Hard braking on icy or wet runways may result in dangerous skidding or fishtailing.

Be certain to turn the pitot heater 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 if 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, corrosion, 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.

Note

Ensure that the canopy restraint strap is attached to the right-hand canopy latching hook prior to taxiing with the canopy in the open position.

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 jets. An increase in temperature of 1 degree centigrade 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.

Note

When operational conditions require takeoffs where computed takeoff distance places the aircraft in the region labeled TAKEOFF IS MARGINAL on the chart, liftoff speed should be increased approximately 5 to 10 KIAS, 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.

NEW NEW NEW NEW

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 head, canopy, and intake and exhaust ducts.

SECTION VII

COMMUNICATIONS PROCEDURES

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General 7-1
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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 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.

RADIO COMMUNICATIONS

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 follow, 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 transmissions 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 about 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 radio or IFF frequency codes below 2500 feet under 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 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, panel signals, pyrotechnics, miscellaneous, ground search-party signals, and RESCAP rescue 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, and which are contained in this manual, are as follows:

1. Starting and poststart signals . . Figure 7-1

2. No-radio-penetration/instrument-approach signals . . . . . Figure 7-2

3. Flight signals between aircraft:

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   Takeoff, changing lead, leaving formation, breakup, and landing . . . . . Figure 7-4

   Formation Signals . . . . . Figure 7-5

   Electronic communications and navigation . . . . . Figure 7-6

   Armament . . . . . Figure 7-7

   Aircraft and engine operation . . . . . Figure 7-8

   Air Refueling . . . . . Figure 7-9

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4. Postflight ground crew to pilot signals . . . . . Figure 7-11

5. Arming and dearming 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 the controlling of 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; re-form; remain within signal distance until further notice. (When the delay in recovery will be for more than five 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.
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; land aircraft in water or eject.

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
1. Pilot holds one finger vertically.	Same	Start GTC. Apply electrical power.	P/C executes.	Same
2. P/C 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 illuminated. 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 probe. 2. Ground-controlled start: Engine rpm is midway between START and IDLE. P/C close GTC air valve and remove starting probe.	1. P/C checks for GTC hose collapse, removes starter probe, and secures access panel. 2. P/C closes GTC air valve, checks for hose collapse, removes starter probe, and secures access panel. 3. P/C visually inspects probe tip after removal of probe from engine to ensure that probe ratchet is properly secured by its retaining nut and cotter key. If any of these parts are missing from probe tip, immediately have engine shut down and inspected for missing parts and foreign object damage.	Same

Figure 7-1. Starting and Poststart Signals (Sheet 1)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
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 moves throttle to OFF.	Same
6. Pilot makes opening and closing motion of thumb and forefinger, with remaining fingers extended.	Same	P/C flash generator field.	P/C executes.	Same
7. 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 gage/ gages.	Pilot acknowledges with thumbs-up.	Pilot moves horizontally held flashlight up and down several times.
8. 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
9. 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. (Some MER configurations limit flap travel.) 2. Full retraction and security. If satisfactory, give pilot thumbs-up after check is complete.	Same
10. 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

Figure 7-1. Starting and Poststart Signals (Sheet 2)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
11. 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
12. P/C holds hand in front and: Suddenly lowers other fist, with thumb extended downward to meet horizontal palm of extended hand, or Suddenly raises other fist, with thumb extended upward to meet horizontal palm of extended hand. NOTES 2 & 3	Same, except points flashlight vice thumb toward extended palm of hand in direction desired. NOTES 2 & 3	1. Lower arresting hook. 2. Raise arresting hook.	Pilot executes. P/C checks: 1. Hook down and for effective snubber action. 2. Hook retracted and centered. If satisfactory, give pilot thumbs-up after check is completed.	Same
13. P/C holds one finger aloft. NOTE 4	Same, illuminated by flashlight. NOTE 4	Cycle and set rudder trim to 0°, using trim indicator.	Pilot executes. 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 gives next sequential signal. Pilot checks indicator for possible error and note.	Pilot: same. P/C: same, except use flashlight vice finger to indicate direction elevator must be moved.
14. 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° noseup, using trim indicator. (If setting other than 8° noseup trim is desired, pilot shall inform P/C of desired setting prior to start.)	Pilot executes. P/C indicates trim setting by numerical hand signal. Pilot check indicator for possible error, note same, and correct trim setting if required.	Pilot: same. P/C: Same, except use flashlight vice finger to indicate direction elevator must be moved.

Figure 7-1. Starting and Poststart Signals (Sheet 3)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
15. 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 executes. P/C signal cycling of aileron trim and set ailerons symmetrical (both equally up, down or even) and tab at ±1/5 inch.	Same
15a. P/C gives two finger turn-up then holds thumb and forefinger together, palm down, and moves hand in fore and aft motion.	Same, illuminated by flashlight.	Pilot advance throttle to 70% RPM while P/C places palm over vent mast. Pilot activates emergency transfer for 10 to 15 seconds then off. P/C gives thumbs-up or thumbs-down.	Pilot executes.	Same
16. P/C holds four fingers aloft. P/C holds five fingers aloft.	Same, illuminated by flashlight. Same, illuminated by flashlight.	Pressurize drop tanks and/or buddy store. P/C checks pressurization. Depressurize drop tanks and/or buddy store. P/C check depressurization.	Pilot executes. Pilot executes.	Same Same
17. Pilot points one finger at eye.	Same	P/C checks all exterior lights BRIGHT; then DIM. (Modify locally as necessary, according to situation.)	P/C executes. Gives pilot thumbs-up after checking lights BRT, then check on DIM.	Same
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 acknowledges 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 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.	Use flashlight vice hand.	Check ejection control safety handle in desired position.	Pilot checks handle.	Same
22. P/C gives 1-finger turnup when cleared by flight deck director.	Same, except make signal with wand.	You are cleared for turn-up for fuel control check.	Pilot executes fuel control check.	Same

Figure 7-1. Starting and Poststart Signals (Sheet 4)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
23. P/C extends arms bent 90 degrees so hands are level in front of chest. Places right palm on top of left hand, and with a positive movement raises right hand and lowers left hand.	Same, except with wands.	Can I move INT/EXT switch to EXT position?	Pilot give thumbs-up (YES) or thumbs-down (NO).	Same
24. Plane director puts forefinger on end of nose then gives a thumbs-up.	Same, except flashlight used instead of fingers.	Tiller bar 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 in direction of aircraft movement.	Same, except with flashlight.	Tiller bar disconnected. Pilot will assume directional control.	Head nod. Pilot assumes directional control.	Same
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
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

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 visually checked by the P/C to ensure that no hazard exists to personnel.
3. Normally, these hand signals will be given in close sequence without hesitation, i.e., flaps, speedbrakes, etc. The pilot shall hold up both hands to prevent actuation of hydraulically operated systems while the plane captain 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 operations where ordnance configurations limit flaps extension to less than full deflection this check may be conducted using less than full flap extension.

Figure 7-1. Starting and Poststart Signals (Sheet 5)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Open and close 4 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 7-2. No-Radio-Penetration/Instrument-Approach Signals

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 "∞" sign.	Same with wands	You are on fire	As required

Figure 7-3. General Signals

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/FLSH. 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.
Wingman pats self on head, then points to self.	1. Wingman turns lights DIM/STEADY, ANTI-COLLISION LIGHT OFF 2. If lights INOP, wingman points flashlight at lead, then at his own helment.	I desire to take lead	NIGHT: Lead aircraft turns lights on BRT/STEADY, ANTI-COLLISION lights ON, assumes wingman position. DAY: Lead pats self on head, points to wingman, assumes wingman position.
Leader pats self on head and holds up two or more fingers.		Leader shifting lead to division designated by numerals.	Wingman 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.

NEW NEW NEW NEW

Figure 7-4. Takeoff, Changing Lead, Leaving Formation, Breakup and Landing (Sheet 1)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
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 7-4. Takeoff, Changing Lead, Leaving Formation, Breakup and Landing (Sheet 2)

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.

Figure 7-5. Formation Signals (Sheet 1)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
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 on me.	Execute.
Rocking of wings by leader.		Prepare to attack.	Execute preparation to attack.
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 step-down 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 7-5. 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-numerals, number of channels to which shifting.		Shift to radio frequency indicated by numerals.	Repeat signal and execute.
Tap earphones, extend forearm vertically, and rotate fingers, formed as if holding a grapefruit followed by 4 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-numerals.
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-numerals. The first three numerals indicate magnetic bearing and the last two or three, distance.
Vertical hand, with 4 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 4 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-numerals.		Switch to TACAN station indicated.	Repeat and execute.

Figure 7-6. Electronic Communications and Navigation (Sheet 1)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Hand held up. First and fourth fingers extended, moved in fore-and-aft chopping motion, followed by:			
1. 4 numbers.		1. Set up UHF/ADF on frequency indicated.	1. Repeat signal and execute.
2. Question signal.		2. What is UHF/ADF bearing?	2. Repeat chopping motion, followed by wait, or three numerals indicating magnetic bearing.
3. Up or down signal.		3. My UHF/ADF is up or down.	3. Thumbs up or nod ("I understand").
Two fingers pointed toward eyes (meaning IFF signals), followed by:			Repeat, then execute.
1. "CUT".		1. Turn IFF to "STANDBY".	
2. 3-digit numerals.		2. Set mode and code indicated: first numeral-mode, second and third numerals code.	
1. Open hand held up, fingers together, moved in fore-and-aft chopping motion (by leader).		1. Course to be steered is present compass heading.	1. Nod of head ("I understand").
2. Followed by question signal.		2. What is your compass heading?	2. Repeat signal and give compass heading in finger-numerals.
3. Followed by three-finger numerals.		3. My compass heading is as indicated by finger-numerals.	3. Nod or clarify, as appropriate.
Tap oxygen mask (or earphones) and give thumbs down.	Turn wing and tail lights BRT/FLSH.	I have UHF transmitter (or receiver) failure.	Execute no radio procedure as briefed. Attempt contact on guard if necessary.

Figure 7-6. 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-numerals. 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-numerals. 3. Nod head ("I understand").
Pistol cocking motion with either hand, followed by fore-and-aft pulling motion with a clenched fist.		Jettison external stores.	Repeat signal and execute.
	1. Rotating beacon ON and OFF by lead aircraft. 2. Rotating beacon turned ON for second time (allow time for setting up switches).	1. Set up your switches for jettison. 2. You are cleared to drop.	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 7-7. Armament

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
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 speedbrakes, as appropriate.	Repeat signal. Execute upon head nod from leader or when leader's speedbrakes extend/retract.

Figure 7-8. Aircraft and Engine Operation

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
One finger turn-up 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 7-9. Air Refueling

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Arm bent across forehead as if weeping: 1. Followed by HEFOE signal and code. 2. Followed by landing signal.	Series of dots with external lights followed by: 1. HEFOE signal and code. 2. HEFOE signal and code, followed by wheels-signal.	I am in trouble. 1. I am having trouble with indicated system. 2. I must land immediately.	Escort disabled plane, assuming lead if indicated, and return to base or nearest suitable field.
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 7-10. Emergency Signals Between Aircraft

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 7-11. Postflight Ground Crew to Pilot Signals

ARMING

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
1. Arming 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 arming supervisor after checking switch positions. (Hands remain in view during check and hookup).
2. Arming supervisor: points at crew member (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 stray voltage exists. Night: Vertical sweep with flashlight indicates no stray voltage. Horizontal sweep indicates stray voltage.
3. Arming supervisor: Raise 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 areas. Thumbs down if a malfunction exists. Night: Same as step 2 above.
4. Arming supervisor gives 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: Pistol cocking motion with either hand. 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 clear of aircraft.	Pilot: Acknowledge with similar signal.

Figure 7-12. Arming and Safing Signals

SECTION VIII

WEAPONS SYSTEMS

TABLE OF CONTENTS

Armament Equipment 8-1
External Stores Release Equipment 8-4
Station Loading 8-7

ARMAMENT EQUIPMENT

General

This section will describe the armament equipment required to release external stores and a basic description of the gunsight. A more complete description of the weapons system is contained in the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T. The NATOPS Flight Manual is incomplete without the Tactical Manual.

All stores are carried externally on three racks and the A-4 is capable of carrying a wide variety of ordnance. A four-hook ejector bomb rack is installed on the center line (fuselage) station, and two-hook ejector racks are provided on the wing stations. The centerline rack (AERO-7A) can be used to carry stores which require either 30-inch or 14-inch suspension. Wing racks (AERO-20A) are provided with 14-inch suspension only.

Armament Panel

Control of all armament is effected through the armament panel located below the instrument panel. (See figures 8-1 and 8-2.)

MASTER ARMAMENT SWITCH

All armament equipment is controlled by the master armament switch (figures 8-1 and 8-2), except the emergency jettison of external stores. The armament circuits can be energized only when this switch is ON. An armament safety circuit prevents operation of the armament system when the landing gear handle is down.

STATIONS SELECTOR SWITCHES

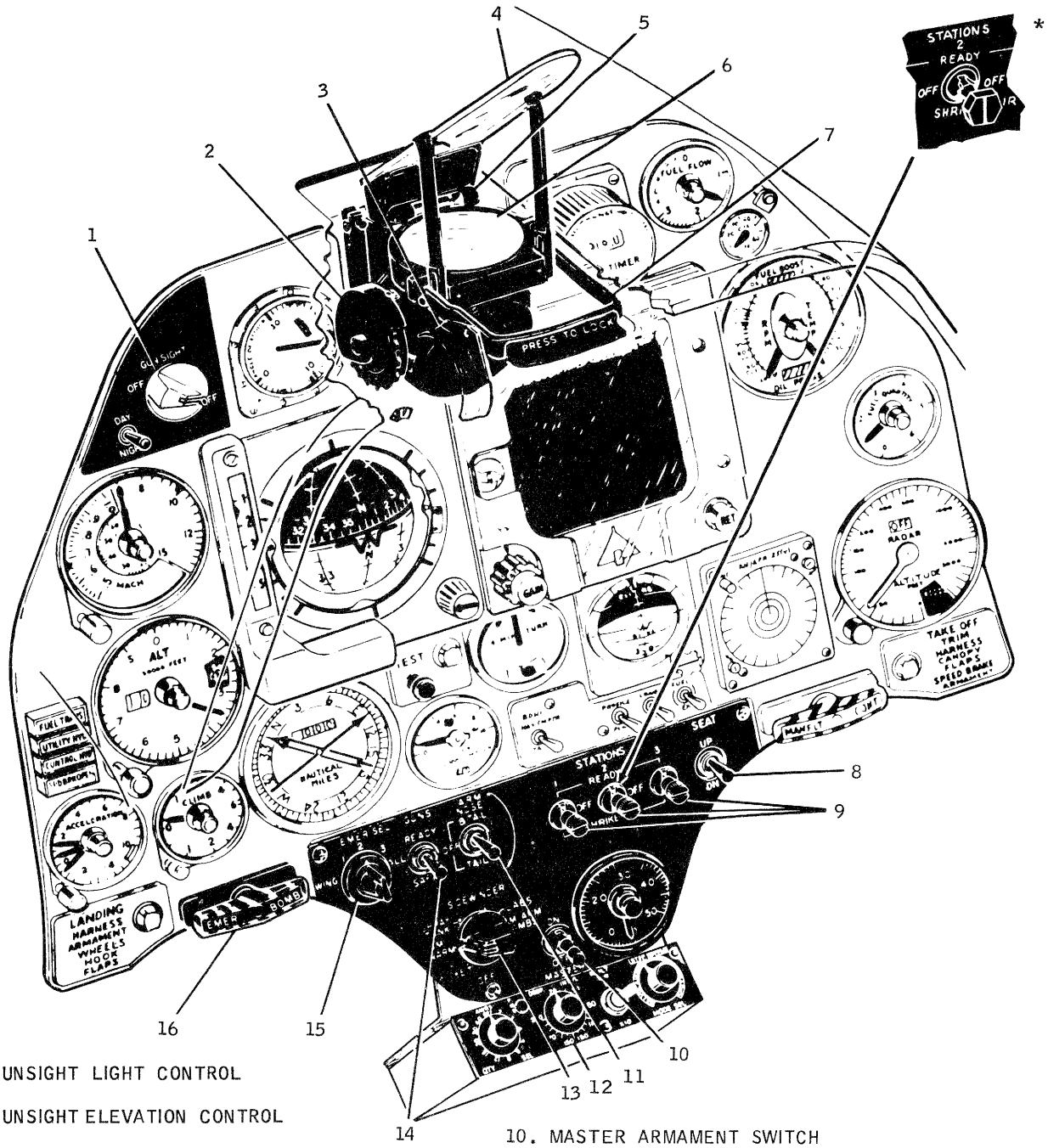
Three STATIONS selector switches (figures 8-1 and 8-2) provides selection of any station or combination of stations for firing or release (except for emergency release) of external stores. The switches are lever-lock toggle switches and in A-4C/L aircraft are identified by a number (1, 2, and 3) above each switch that corresponds to the external station it controls. NEW NEW NEW NEW

A-4C/L aircraft STATIONS selector switches have two positions marked READY and OFF. In A-4C/L aircraft reworked per A-4 AFC 365, the STATIONS selector switches are three position switches marked READY, OFF, and SHRIKE PAIR.

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.

In A-4C/L aircraft reworked per A-4 AFC 438, each selector switch incorporates a locking cap on the switch lever (figures 8-1 and 8-2) to enable locking the select switches in OFF position thereby preventing inadvertent switch actuation. When the NEW NEW



1. GUNSIGHT LIGHT CONTROL
2. GUNSIGHT ELEVATION CONTROL
3. ELEVATION CONTROL GUARD
4. GUNSIGHT REFLECTOR PLATE
5. SKID INDICATOR
6. GUNSIGHT
7. ELEVATION CONTROL LOCKING YOKE
8. SEAT ADJUSTMENT SWITCH
9. STATIONS SELECTOR SWITCHES
10. MASTER ARMAMENT SWITCH
11. BOMB ARMING SWITCH
12. AIRCRAFT WEAPON RELEASE SYSTEM CONTROL PANEL (AWE-1)
13. FUNCTION SELECTOR SWITCH
14. GUN SWITCH
15. EMERGENCY SELECTOR SWITCH
16. EMERGENCY BOMB RELEASE HANDLE

N/4/74
SS1-12924-1G

*Aircraft reworked per A-4 AFC 527.

Figure 8-1. Typical Gunsight and Armament Panel-A-4C

switch is in the OFF position and the locking cap is turned one-quarter turn clockwise (cap stripe horizontal), the lever-lock switch lever cannot be actuated. A one-quarter turn counterclockwise (cap stripe vertical) unlocks the lever-lock switch lever allowing it to be pulled and the switch placed in the desired position.

In A-4C/L aircraft reworked per A-4 AFC 527, STATIONS 2 (centerline) switch incorporates a hexagon shaped locking knob (figures 8-1 and 8-2) to make the switch more easily identifiable from adjacent switches. This modification does not change the manner in which the select switch locking/unlocking feature operates.

FUNCTION SELECTOR SWITCH

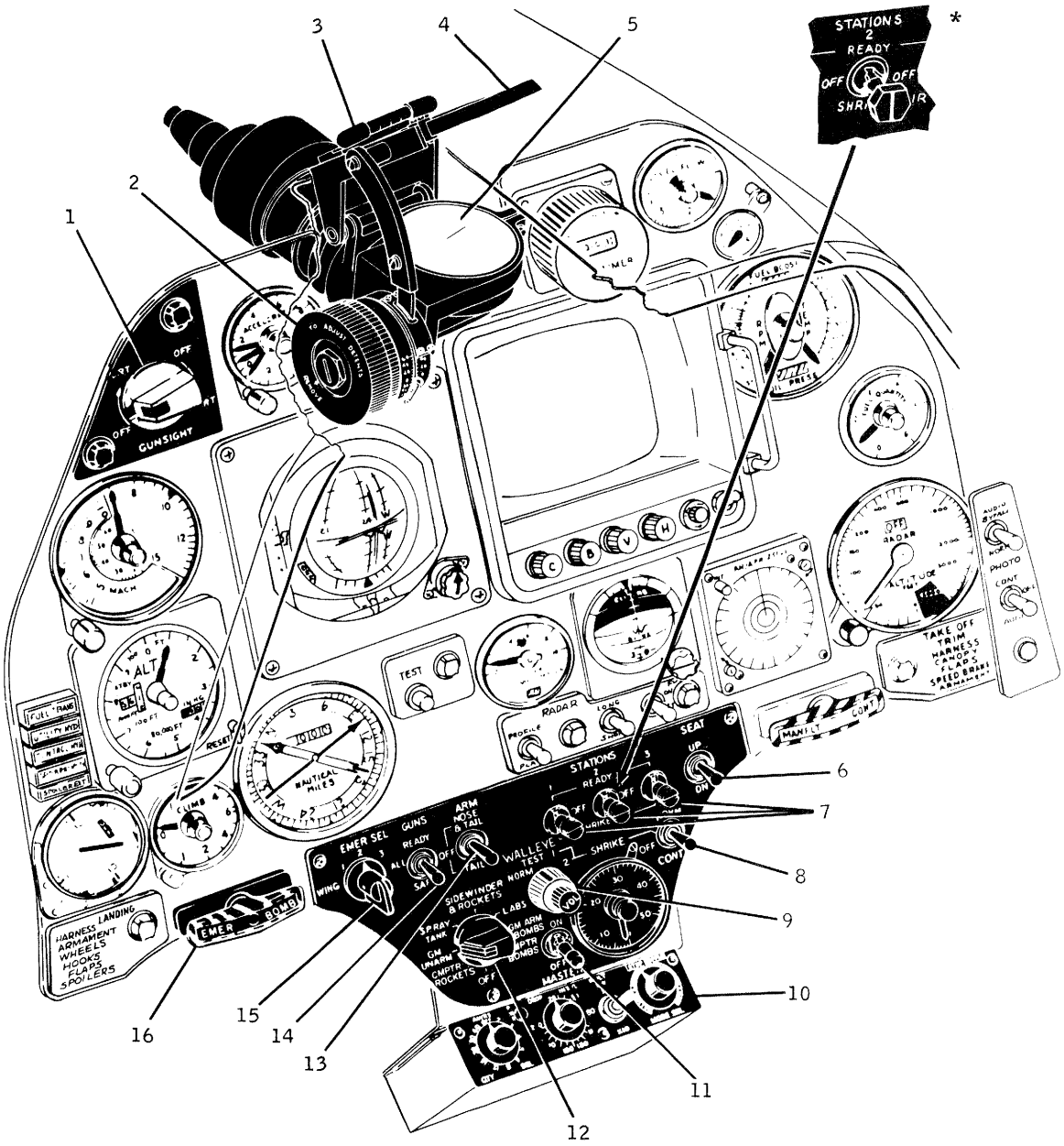
A rotary SELECT switch is provided for selection of ordnance to be released. The switch may be set in any of eight separate detents, and must be turned counterclockwise to the OFF position.

Control Stick Switches

The control stick grip (figure 8-3) contains the bomb release button, gun-rocket trigger, missile guidance switch, trim switch, and an autopilot override button.

Armament Safety Circuit Disabling Switch

When the aircraft is on the ground, an alternate circuit may be energized for the purpose of checking the armament system. This circuit is engaged by momentarily closing the armament safety toggle



1. GUNSIGHT LIGHT CONTROL
2. GUNSIGHT ELEVATION CONTROL
3. SKID INDICATOR
4. GUNSIGHT REFLECTOR PLATE
5. GUNSIGHT
6. SEAT ADJUSTMENT SWITCH
7. STATIONS SELECTOR SWITCHES
8. SIDS CONT-NORM MODE SWITCH
9. WALLEYE-NORM TEST SWITCH
10. AIRCRAFT WEAPON RELEASE SYSTEM CONTROL PANEL (AWE-1)
11. MASTER ARMAMENT SWITCH
12. FUNCTION SELECTOR SWITCH
13. BOMB ARMING SWITCH
14. GUN SWITCH
15. EMERGENCY SELECTOR SWITCH
16. EMERGENCY BOMB RELEASE HANDLE

N/4/74
SS1-12924-2H

*Aircraft reworked per A-4 AFC 527.

Figure 8-2. Typical Gunsight and Armament - A-4L

switch, located on the outboard side of the right wheelwell. Raising the landing or placing the master armament switch in OFF will restore the armament safety circuit to normal operation.

Gunsight

A lighted gunsight (figures 8-1 and 8-2) is provided for gunnery and for rocket and bomb aiming. The gunsight, mounted on the top center of the glare-shield, contains one ladder-type reticle and a glass reflector to superimpose the reticle image upon the target.

GUNSIGHT ELEVATION CONTROL

A sight elevation knob (figures 8-1 and 8-2), on the left side of the gunsight, controls the glass reflector angle for increasing or decreasing the lead of the reticle. The locking yoke must be lifted before turning the sight elevation knob. Aircraft reworked per AFC 451 have improved braking action on the sight elevation adjustment mechanism to prevent loss of boresight from flight vibration and landing shock.

CAUTION

Be sure to unlock the yoke before attempting to rotate the elevation control knob. Failure to do so may damage the mechanism and result in sight elevation errors.

After turning the elevation control knob to the desired lead, press the locking yoke firmly against the sight body to lock the reflector plate struts.

CAUTION

Press on the yoke proper; do not press on the guard attached to the locking yoke.

GUNSIGHT RETICLE LIGHT CONTROL

A single rotary knob located on the upper left corner of the instrument panel, identified as GUNSIGHT, serves as the gunsight reticle light control. By rotating the knob, either of two filaments may be selected for lighting. Light intensity can be adjusted between OFF and BRIGHT positions for either filament.

Effectivity: All aircraft reworked per A-4 AFC 353-III, have a 2-position toggle switch labeled DAY-NIGHT located adjacent to the gunsight reticle light control. When the switch is in the DAY position, a gunsight light resistor circuit (also added per A-4 AFC 353-II) 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 variance controlled by the reticle light control rheostat.

EXTERNAL STORES RELEASE EQUIPMENT

Description

Release of 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 bomb clear of the aircraft. The ejector foot is located aft of center on the bomb rack in order to counteract the twisting moment on the bomb caused by drag forces in high-speed flight. Each rack contains two cartridges. One firing circuit is for normal release, and the second is for emergency release with both cartridges being fired by either circuit.

Bomb Release Button

The bomb release button (figure 8-3), used for releasing bombs and other external stores, is located on the left side of the control stick grip and is identified by the letter B. The bomb release button functions only when operating on the main generator.

Emergency Selector Switch

The EMER SELECT switch (figures 8-1 and 8-2), located adjacent to the emergency bomb release handle, provides selection of WINGS, CENTER, or ALL stations when jettisoning stores with the emergency bomb release handle. This switch functions with the main or emergency generator in operation. In aircraft reworked per A-4 AFC 344, the emergency selector switch is a rotary-type switch

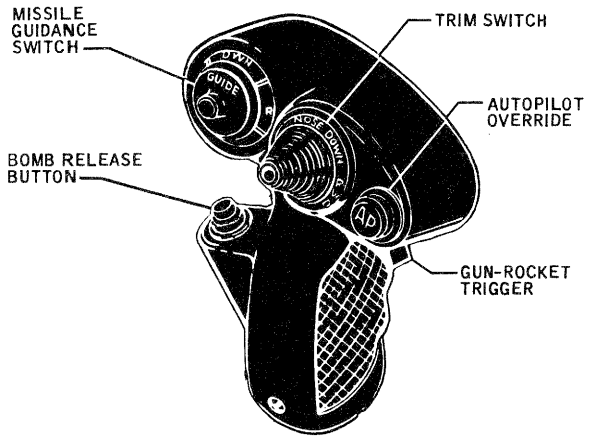


Figure 8-3. Control Stick Switch

A-4 AIRCRAFT REWORKED PER A-4 AFC 365

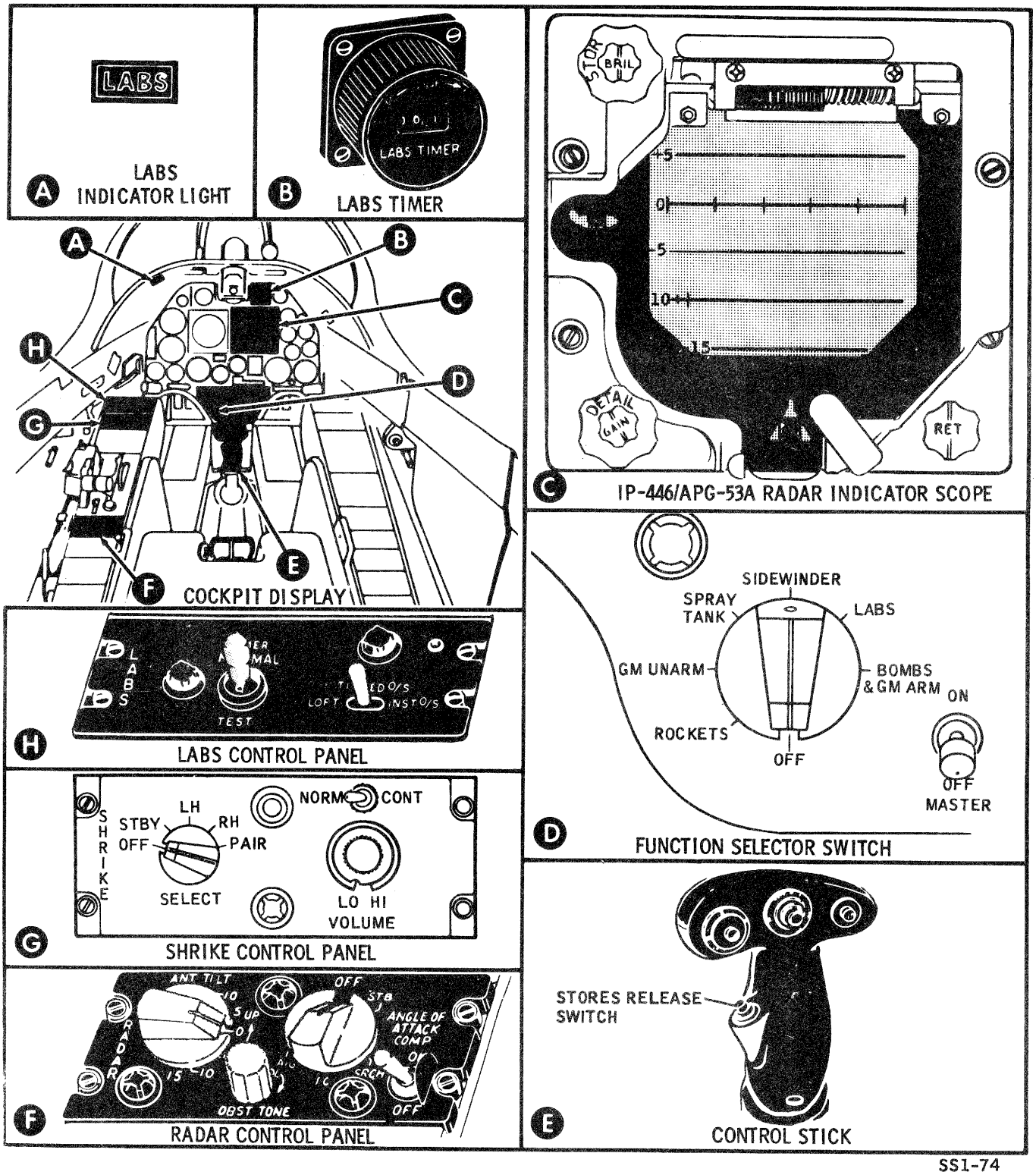


Figure 8-4. Shrike Missile System

(figure 8-2) and provides selection of WING, 1, 2, 3 or ALL stations when the emergency bomb release handle is pulled.

Emergency Bomb Release Handle

An emergency bomb release handle (figures 8-1 and 8-2) on the lower left side of the armament panel is used to jettison external stores. 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 the emergency generator. Stores selected by the emergency selector switch may be released irrespective of the position of the landing gear control or master armament switch.

Releasing External Stores

NORMAL RELEASE (INOPERATIVE ON EMERGENCY GENERATOR)

1. Function selector switch . . . . . BOMBS & GM ARM
2. Stations select switches . . . . . READY AS DESIRED
3. Master armament switch . . . . . ON
4. Bomb release (B) button . . . . . DEPRESS

EMERGENCY RELEASE

1. Emergency select switch . . . WING, CENTER, OR ALL (AS REQUIRED)
2. Emergency bomb release handle . . . . . PULL

CAUTION

When the emergency bomb release handle is used to release wing stores only (emergency select switch set on WING), make sure the center station selector switch is in OFF position to prevent an electrical feedback through the normal bomb release circuit and inadvertent release of the center store.

CONVENTIONAL ORDNANCE RELEASE COMPUTER SYSTEM (CORC)

Effectivity: All aircraft reworked per A-4 AFC 328, have a conventional ordnance release computer system (CORC) installed. The CORC system (figure 1-6) is a dive bombing release system designed to improve accuracy in the delivery of bombs and rockets. The CORC system is based on alignment of a radar beam with the gunsight line of sight by use of a radar tilt control to set the radar at the same lead angle as the gunsight. The CORC computer uses parameters of range, pitch angle, angle-of-attack, and true airspeed to compute an optimum release point. The green indicator light, mounted on the gunsight, comes on to indicate that the aircraft is approaching the weapon release point. At this time the pilot presses and holds the release button, and the computer determines the optimum release moment and automatically releases the selected ordnance. A yellow indicator light, also mounted on the gunsight, indicates no lock on or premature release time, and the computer will not release the selected ordnance. The brilliance of the indicator lights is controlled by a tandem-mounted rheostat on the gunsight light panel. The rheostat receives its power from the armament bus. Any further description of the equipment or its function will be covered in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

Shrike Missile System (AGM-45A)

The Shrike missile system (figure 8-4) incorporates additional components that are interconnected to the existing aircraft radar and armament components to provide a Shrike Improved Display System (SIDS). The SIDS, combined with other aircraft installations, provides the capability of locating ground radar emitters and of selecting, aiming, and launching Shrike missiles.

The SIDS is used both for locating radar targets in areas containing numerous radar emitters and for selecting a specific target for aiming the Shrike missle during launch. The IP-446/APG-53A radarscope is utilized in conjunction with the SIDS as the radar-site-locating and missile-aiming unit of the Shrike missile system. The radarscope is normally used for the aircraft radar and terrain clearance presentations of the AN/APG-53A radar system, but the radarscope may be switched to the SIDS for the Shrike missile system whenever required. The time-sharing of the radarscope is accomplished by switching to either system through a coaxial switch. When the radarscope is switched to the missile system, radar targets are presented as blips that indicate the location of the radar sites in relation to the aircraft. One of two modes, normal (NORM) or continuous (CONT), may be placed on the radarscope for display. The NORM or CONT mode is controlled by a switch on the SHRIKE control panel. The switch provides

the capability of selecting a continuous signal train or a pulse repitition from the SIDS signal conditioner. The SIDS signal conditioner logic circuit operates when the switch is in the NORM position. The SIDS signal conditioner receives the DF output signals from the computer inside the Shrike missile, senses when a target pulse repetition frequency (PRF) is relatively free of other radar signals, and sends the conditioned signal to the radarscope display as an electronic blip.

One blip (target) will be displayed on the radarscope when in the NORM mode; however, the blip may change position when a stronger signal is received from another radar emitter. An audio tone is sent to the pilot's headset when the target blip is shown so that the pilot hears and sees the target data as presented by the SIDS. There is no radarscope display in the NORM mode unless a target is present that meets the SIDS signal conditioner logic requirements.

The SIDS signal conditioner logic is bypassed in the CONT mode and all targets picked up by the Shrike missile computer are shown on the radarscope. In the CONT mode, target blips may be present on the radarscope at all times, but true target direction is not indicated until a tone is furnished to the pilot's headset. An audio signal volume control, located on the Shrike control panel, adjusts the tone volume to the pilot's headset.

The Shrike missiles may be fired singly or in pairs (ripple-fired). Single firing is accomplished by selecting and firing one missile, then the other. The single or pair firing capability is provided by the Shrike select switch located on the Shrike control panel. A delay-fire timer relay in the Shrike relay box acts as an intervalometer and is adapted into the Shrike missile system to provide the pulse-firing sequence for firing the missiles in pairs. The missile supplying the target information fires first; then, the delay-fire timer supplies the time interval before a pulse is sent to fire the other missile.

SHRIKE CONTROL PANEL

The Shrike control panel contains a five-position, rotary switch labeled SELECT; a two-position, toggle switch labeled NORM-CONT; and a rotary volume control, labeled VOLUME. The SELECT switch has placarded positions OFF, STBY, LH, RH, and PAIR and controls the firing circuits to the Shrike missile. The NORM-CONT control switch selects either a normal mode in which the most suitable radar signal is displayed or a continuous mode in which all radar signals are displayed.

The VOLUME control adjusts the target signal volume to the pilot's headset when a radar emitter target has been acquired. Any further description of the equipment or its function will be covered in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

STATION LOADING

Refer to A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T).

SECTION IX

FLIGHT CREW COORDINATION

NOT APPLICABLE TO THIS AIRCRAFT

SECTION X

NATOPS EVALUATION

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CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating A-4C/L aircraft. The NATOPS Evaluation is inintended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatability 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 the A-4/TA-4 shall be evaluated in accordance with OPNAVINST 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 reevaluation. 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. NEW
- Pilots attending a formal course of RCVW training shall be considered (as a minimum) conditionally NATOPS Qualified for a period of one year provided all required phases of instruction are completed. If practical, RCVW graduates will be fully NATOPS Qualified (ground and flight evaluation) 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 noted 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 assure 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 NATOPS 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 simulate 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 model A-4. 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 (flip-flop, gage, or both), low, fluctuating, 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. Transformer Rectifier Failure (primary or main).
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. 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. NEW
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.

Open Book Examination. To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.5.

Closed Book Examination. To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.3.

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 outlined in mission evaluation.

The Flight Evaluation will be flown in daylight conditions to facilitate observations and grading by the Evaluator/Instructor, 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 Flight

Due to the broad significance of safety, it is impractical to list all contingencies without at the same time developing a much too lengthy 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 Evaluator/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 Inflight 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 on NATOPS Evaluation Flight

The grading criteria establishes 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 then 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 in 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 down-grading.

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. Enroute Procedures.

Approach and Landing.*

1. Pattern Entry.
2. Approach.

Emergency Procedures.

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 objective 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, in this section.

Flight Evaluation Grade Determination

The following procedure shall be used in determining the Flight Evaluation grade: A grade of Unqualified in any criteria 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 numerals 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: $\frac{4+2+4+2+4}{5} = \frac{16}{5} = 3.20$ Qualified (Add subarea numerical equivalents)

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 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:

QUALIFICATION			DATE	SIGNATURE	
NATOPS EVAL.	(A/C MODEL)	(CREW POSIT.)	(DATE)	(AUTHENTICATING SIGNATURE)	(UNIT WHICH ADMINISTERED EVAL.)

NATOPS EVALUATION 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.

Open Book

NEW 1. For a typical empty aircraft including the pilot, oil, pararaft, and two empty 300-gallon external tanks, the approximate weight is_____pounds for the A-4C and_____pounds for the A-4L.

2. What are the four ladder lights on the left side of the instrument panel?

NEW 3. The thrust of the Wright J65-W-20 engine is rated at_____pounds at 104.6% rpm at standard sea level static conditions.

4. The centrifugal switch in the ignition generator closes at_____percent rpm, stopping ignition and closing the fuel priming valve.

5. What does a glowing manual fuel control warning light indicate?

6. The Engine Performance Indicator provides information concerning:

   a._____b._____c._____d._____

7. The capacity of the oil tank is_____gallons.

8. After use, oil from the_____main bearing and the_____main bearing is vented overboard.

9. The internal fuel supply is carried in_____tanks containing a total of_____US gallons.

10. A fuel transfer light will indicate that_____.

11. What is the source of power for the fuel transfer pump in the wing tank?

12. How is drop tank fuel transferred in the event of an electrical failure?

13. What is the proper procedure for using the emergency fuel transfer system with a centerline drop tank installed?

14. Fuel will be supplied to the engine for approximately_____seconds during flights involving negative g's.

15. Fuel will dump initially at the rate of approximately_____gallons per minute.

16. Will the fuel boost pump operate on the emergency generator?

17. When the Fuel Boost Pressure Indicator reads OUT, it indicates that pressure is below_____psi.

18. What indicated airspeed in level flight will give the most accurate fuel quantity reading?

19. Assuming that there is fuel in the wing tanks, the fuel quantity gage will no longer indicate total internal fuel when the fuel in the fuselage tank falls below what level?

20. What precautions must be taken if the aircraft is to be pressure fueled and electrical power is not available? Why?

21. Electrical power will be provided by the emergency generator only if the emergency generator bypass switch is in_____.

22. Electrical circuits in the A-4 are protected by (a. circuit breakers, b. fuzes, c. circuit breakers and fuzes).

23. What components are operated by the utility hydraulic system?

24. Where are the hydraulic system pressure gages located?

25. What is the purpose of the followup tab on the left aileron?

26. To what control surfaces is trim available with the emergency generator extended?

27. What are the trim limits on the horizontal stabilizer?

28. What caution must be observed when operating the horizontal stabilizer manual override lever?

29. Automatic retraction or "blowback" of the wing flaps commences at approximately_____KIAS.

30. The wing slats are controlled (a. aerodynamically, b. hydraulically, c. electrically, d. none of these).

31. The speed brakes begin to blow back at an indicated airspeed of approximately_____KIAS.

32. How can intermediate speedbrakes positions be selected?

33. What is the purpose of the vortex generators?

34. When does the speedbrake ladder light come on?

35. The wing slats will start to extend at approximately_____knots and are opened fully at_____.

36. In the event of a main generator failure, how may the speedbrakes be opened?

37. What extends and locks the landing gear when the EMER LDG GR release handle is pulled?

NEW 38. What is the normal air pressure in the arresting hook holddown cylinder?

39. What effect will a complete utility hydraulic system failure have on the wheelbrake system? Why?

40. How can the pilot best confirm that the canopy is closed and latched?

41. In the event the aircraft is submerged with the canopy closed, what assists the pilot in overcoming the water pressure holding the canopy closed?

42. At an airspeed of_____knots or above, the canopy shears when it is opened by the normal canopy opening lever.

43. The capacity of the liquid oxygen system is_____liters.

44. A red light will illuminate in the liquid oxygen quantity indicator when the quantity falls below_____liter(s).

45. Assuming the use of a properly fitted mask and a cabin pressure altitude of 15,000 feet, 3 liters of liquid oxygen should provide oxygen for_____hours.

46. The emergency oxygen pressure gage should register_____psi when the bottle is filled.

47. The duration of the emergency oxygen supply is approximately_____to_____minutes, dependent upon the altitude.

48. Which flight instruments are connected to the pitot-static system?

49. Which flight instrument is operated by engine compressor bleed air pressure?

50. What flight instruments are operated electrically?

51. When will the OFF flag appear in the radar altimeter indicator?

52. What are the pitch and bank angle limitations for reliable operation of the radar altimeter?

53. If the compass card on the BDHI is out of sync, will the number 1 (AN/ARA-25) pointer indicate relative bearing from the aircraft?

54. If the compass card on the BDHI is out of sync, will the number 2 (TACAN) pointer indicate relative bearing from the aircraft?

55. Operation of the AFCS is unrestricted above _____.

56. "Hands Off" operation of the AFCS is permitted between 1000 feet and 7500 feet if _____ _____.

57. Minimum altitude for operation of the AFCS is_____.

58. The AFCS is an electrohydraulic system requiring _____ electrical power.

59. The AFCS hydraulic servos require_____hydraulic power.

60. The AFCS standby switch should be in STANDBY at least_____seconds prior to engaging the STAB AUG or AFCS main engage switch.

61. The AFCS altitude hold switch cannot be engaged in climbs or descents in excess of_____feet per minute.

62. What mode, if any, of the AFCS may be engaged when the AFCS aileron trim switch is in the emergency position?

63. What do the indicators, R, Y, P on the AFCS preflight test panel measure?

64. Is the control stick trim button operative when the AFCS is engaged?

65. List five AFCS modes.

66. The AFCS automatically disengages when the normal load factor approaches_____positive g or _____ negative g.

67. What are the eight ways to disengage the AFCS?

68. How can the pilot control the intensity of the angle-of-attack indexer?

69. The angle-of-attack reading for maximum endurance at all altitudes (no external stores) is_____ units.

70. During extended ground operations (in excess of 30 minutes) what precautions must be taken to prevent damage to the AN/ASQ-17B electronics package?

71. The frequency range of the AN/ARC-27A is_____through_____megacycles.

72. The UHF remote channel indicator is powered through the_____rotary selector switch.

73. The AN/ARC-27A should be permitted to warm up for_____seconds before attempting to transmit.

74. Can the AN/APX-6B transponder operate on the power from the emergency generator?

75. A compass error of_____degrees will peg the sync needle of the compass system.

76. If TACAN Air-to-Air operation is desired between two aircraft, the channels selected must be separated by exactly_____channels.

77. The AN/ARA-25 operates in conjunction with the AN/ARC-27A UHF radio to provide a continuous directional indication of the source of signals received in the 225 to 400 megacycle band. True or False? (A-4C only.)

NEW

NEW 78. When the emergency generator is extended, _____, _____, _____, and the compass system are the only navigational aids available to the pilot. (A-4C only)

79. _____wind direction must be set into the AN/ASN-19A computer for accurate information.

80. The AN/ASN-19A computer assumes an input of_____knots minimum TAS, even at lower airspeeds.

81. The operational range of the AN/ASN-19A computer is_____° north to_____° south.

82. The maximum wind velocity input on the AN/ASN-19A is_____knots.

83. During daylight, why should the instruments light switch be in the OFF position?

84. When the master exterior lights switch is ON, the external approach lights are dimmed. True of False?

85. Cockpit pressurization equals atmospheric pressure from ground level to_____feet. The cockpit pressure at_____feet then is maintained to an altitude of_____feet. From this point on up, a differential of_____psi above existing atmospheric pressure is maintained.

86. In order to prevent excessive differential in the cockpit, a relief valve opens at a positive pressure differential of_____psi and at a negative differential of_____psi.

87. What prevents frosting of the bullet-resistant glass center panel of the windshield?

88. What precaution should be taken to prevent the windshield center panel from fogging when the emergency generator is extended?

89. The Mk 12 Mod 0 20mm gun fires ammunition_____and has a rate of fire of_____rounds per minute for short bursts.

NEW 90. The EMER SELECT switch provides selection of_____, _____, _____, _____, or_____ for A-4L stations when jettisoning stores with the emergency bomb release handle.

91. What is the fuel capacity of the air refueling store?

92. The operational envelope of the refueling store with the drogue extended is limited to_____KIAS or _____ Mach, whichever is lower, at altitudes up to 35,000 feet.

93. What does the amber light on the left side of the refueling store indicate?

94. What oil is required for the Wright J65-W-20 engine?

95. Checking the engine oil system should be accomplished with engine running or within_____minutes after shutdown.

96. If recovery of oil pressure is not accomplished in_____seconds following any temporary loss, the flight should be terminated as soon as practicable.

97. Minimum requirements before actual instrument flight in the A-4 include_____hours in the A-4 in the last 6 months and at least one flight in the last_____days.

NEW 98. For field arrestments, one should always request the assistance of an LSO. True or False?

NEW 99. Because of the fire hazard associated with utility hydraulic system failure, how should the landing phase of the flight be conducted?

100. After moving the throttle to IDLE, there should be an indication of lightoff within_____seconds.

101. Individual takeoffs will be made when the crosswind component exceeds_____knots.

102. On takeoff roll, the rudder becomes effective for directional control at approximately_____knots.

103. After takeoff, raise the flaps at_____KIAS or above.

104. How may the pilot control fuel flow to his drop tanks when "hot" refueling?

105. Approximately how much altitude is lost during proper spin recovery?

106. Unless otherwise briefed, the speed for a rendezvous is_____KIAS.

107. If conditions require a section landing, where should the wingman establish landing interval?

108. What is the proper braking technique when landing on snow, wet or ice-covered runways?

NEW 109. Assuming a gross weight of 13,000 pounds full flaps down, and angle-of-attack at 17.5 units, what should be the indicated airspeed.

Closed Book

NEW 1. An airspeed of _____to_____below 20,000 feet should be used for an airstart.

2. The maximum EGT for starting is_____°C.

3. Minimum allowable oil pressure at IDLE rpm is_____psi.

4. Steady state operation in the 60 to_____percent rpm range should be avoided except when required by operational necessity.

5. During starting and initial runup, the maximum allowable oil pressure is_____psi.

NEW 6. The maximum EGT acceptable for 30 minutes at 104.6% rpm is_____°C.

7. The maximum EGT and rpm acceptable for normal continuous operation are_____°C and _____% rpm.

8. The maximum EGT at idle rpm is_____°C.

9. Minimum requirements before actual instrument flight in the A-4C/L include at least one flight in the A-4 in the last_____days.

10. In starting, move the throttle to IDLE_____seconds after GTC air is supplied.

11. The AN/ARC-27A should be permitted to warm up a minimum of_____seconds before depressing microphone switch to transmit.

12. During poststart checks the plane captain holds four fingers aloft. What should the pilot do?

13. The recommended maximum crosswind component for takeoff is_____knots.

14. The maximum time for acceleration from IDLE to MILITARY rpm is_____seconds.

15. The maximum time for acceleration from 75 percent to MILITARY rpm is_____seconds.

16. What flight control trim is available when operating on the emergency generator?

17. The TACAN is available when operating on the emergency generator. True or False?

18. IFF/SIF is available when operating on the emergency generator. True or False?

19. The arresting hook can be lowered, even when utility hydraulic system pressure is lost. True or False?

20. The turn and slip indicator is powered by either the main or emergency generator. True or False?

21. The maximum airspeed for windshield wiper operation is_____knots.

22. The maximum recommended gross weight for field takeoff is_____pounds.

23. The maximum recommended gross weight for a field landing (minimum rate of descent) is_____pounds.

24. The stabilizer trim should be set to_____degrees prior to securing the engine.

25. A pilot should eject if a confirmed spin occurs below_____ feet AGL.

26. For erect or inverted spin, apply full rudder against the spin. True or False?

27. During a TACAN circling rendezvous, the position after 270° turn from the assigned radial is called position _____.

28. The turning rendezvous is made at _____ KIAS (unless otherwise briefed).

29. The maximum speed for flight with the emergency generator extended is_____ knots or 0.91 Mach, whichever is lower.

30. During a start, if EGT exceeds_____°C, engine must be subjected to a hot section inspection.

31. Using the rocket-catapult seat, ejection may be accomplished on the ground at_____ KIAS and above.

32. The fuel control switch should be in the_____position for the first airstart attempt.

33. If practicable, a pilot should descend to_____feet or below prior to commencing an airstart.

34. For an airstart, the optimum relight range of fuel flow is_____to____pph.

35. The recommended speed for maximum gliding range is approximately_____KCAS for gross weights up to 12,000 pounds, clean configuration.

36. If the FIRE warning light comes on, but there are no other indications of fire, the flight may continue on its normal mission. True or False?

37. The wheelbrakes are completely independent of the utility hydraulic system. True or False?

38. It is possible to jettison stores using either the main or emergency generators. True or False?

39. If the nose gear will not indicate UP after takeoff, and a visual check cannot be made, the pilot should recycle the gear in an attempt to get an UP indication. True or False?

40. If the throttle linkage fails, the fuel control will automatically seek about_____% rpm, if fuel control is in PRIMARY.

41. If one gear stage fails in the engine-driven fuel pump, the fuel pump failure warning light should come on. True or False?

42. When shifting to MANUAL fuel control above 6000 feet, how far should the throttle be retarded?

43. The emergency oxygen bottle is actuated automatically upon ejection. True or False?

44. Under what conditions, if any, should the alternate ejection handle be considered the primary means of ejection?

45. Bailout from the A-4 is considered a "last resort" method of escape. True or False?

46. When ejecting through the canopy, the pilot should ensure that the face curtain is held down over his face until he is well clear of the aircraft. True or False?

47. During an ejection, the pilot is separated from the seat by separation_____.

48. Airspeed should be reduced to_____KIAS or less before ejection, whenever possible.

49. If descending into water, the life preserver should be inflated prior to entry. True or False?

50. The canopy may be removed by the force of the airstream by unlatching it manually, if airspeed is in excess of_____KIAS.

51. The rudder is the only control that will stiffen if the flight control hydraulic system is lost, since it is not powered by the utility hydraulic system. True or False?

52. In the event of a complete hydraulic failure, airspeed should be reduced to_____KIAS, if possible.

53. When operating with the emergency generator extended during flight at night or in adverse weather conditions, an airspeed in excess of_____KIAS should be maintained until the flight can be maintained by visual reference.

54. In the event of runaway longitudinal trim, the pilot should first extend the emergency generator to stop the runaway. True or False?

55. If aileron trim runaway has been experienced, the pilot should disconnect the flight control system to relieve any tendency of the aircraft to roll. True or False?

56. Speedbrakes can be opened or closed in the event of a complete electrical failure. True or False?

57. Whenever the fuel transfer light illuminates and remains on, a pilot should assume that the usable fuel remaining is either_____pounds or the indicated fuel quantity, whichever is less.

58. It is normal for the fuel transfer light to illuminate when the engine rpm is below 70%. True or False?

59. If the drop-tank fueling switch in the aft engine compartment is not placed in the OFF position before takeoff, how may drop-tank transfer be accomplished in the air?

60. The initial point on a high precautionary/flameout approach is_____feet AGL.

61. The minimum acceptable airspeed during a high precautionary/flameout approach until flare is_____ KIAS.

62. For a high precautionary/flameout approach, the selected landing point should be_____feet down the runway.

63. For a straight-in low precautionary approach, the initial point is_____feet AGL at 4 1/2 nautical miles from the touchdown point.

64. When landing without flaps,_____ knots should be added to the normal pattern and approach speeds.

65. After lowering the landing gear by the emergency release system, the landing gear can be raised by means of the landing gear handle, if utility hydraulic system pressure is available. True or False?

66. With any asymmetric load, the maximum permissible crosswind is_____ knots.

67. Landing with runaway nosedown trim should be made with half flaps down and speedbrakes in. True or False?

68. If one main gear tire is blown on landing, the pilot should attempt to blow the other main gear tire to provide a balanced condition. True or False?

69. What is the recommended procedure for landing with a known brake failure, if arresting gear is not available.

70. If landing with a stuck slat and angle-of-attack is not available, add_____ knots to the normal approach speed.

71. The canopy can be jettisoned from the aircraft with the manual canopy lever in any position. True or False?

72. When ditching at sea, the landing gear should be extended to help "feel" for the water and to absorb some of the initial impact force. True or False?

73. A clean jet penetration is conducted at_____ KIAS.

74. When making a section GCA, the wingman should drop back to establish a landing interval only when the runway has been acquired visually. True or False?

75. The attitude indicator is more important than the altimeter and airspeed indicator when flying in thunderstorms. True or False?

76. When a pilot holds his clenched fist to his helmet-visor, then holds up two fingers, it means he is having trouble with his _____ system.

77. Intentional spins are prohibited in the A-4. True or False?

78. What is the signal for flashing the generator field?

79. The maximum crosswind component for section takeoffs is _____ knots.

80. The EXT/INT power switch should be placed in the _____ position prior to shut down.

81. On a catapult launch, the pilot should rotate the aircraft to a climbing attitude of approximately _____ degrees on the attitude gyro.

82. Minimum acceptable engine performance for catapulting is_____% rpm and_____°C EGT.

83. The optimum airspeed for air refueling engagement is_____KIAS.

84. During a start, if the time from lightoff to IDLE exceeds_____seconds, the throttle should be retarded to OFF and the starter deactivated.

85. If operational necessity requires a takeoff to be made with known hot brakes, the landing gear should be left extended at least_____minutes after takeoff to provide sufficient cooling of the wheel assembly.

86. What should be done with the wing flaps when aborting a takeoff?

87. What can be done to correct a "hang-up" in the 78 to 82% rpm range?

88. What percent rpm is recommended if oil pressure is lost in flight?

NEW 89. Prior to ejection, the pilot should place his feet on the rudder pedals and sit erect, with spine straight and head firmly against the headrest. True or False?

90. If flameout occurs below 1500 feet and 250 KIAS, what should the pilot do?

91. The maximum asymmetrical load for field landing is_____pounds.

92. The recommended airspeed for flying in thunderstorms or other turbulence is_____knots.

93. On a waveoff, flaps should not be raised below_____knots.

94. A "dirty" instrument penetration is performed at_____knots.

95. The maximum angle of bank in a GCA pattern is_____°.

96. At the 90-degree position in a high precautionary approach, the altitude should be_____AGL and the airspeed_____KIAS.

97. The EMER SPEEDBRAKE control is pulled up to close the speedbrakes. True or False?

98. The horizontal stabilizer is operated electrically to provide longitudinal trim. True or False?

99. The pitot heater will not function when the weight of the aircraft is on the landing gear. True or False?

100. During a practice GCA, the lead pilot will go contact at_____feet AGL.

SECTION XI
PERFORMANCE DATA

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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 several parts to present performance data in proper sequence for preflight Planning.

Part 1 (General) and Part 10 (Mission Planning) contain data pertinent to the entire section. Sample problems and charts are provided (in parts 1 through 10 only) to present the sequence of steps required to find the proper values and solution of a given problem. Performance data is presented in graphical type charts for ICAO standard day conditions. In some instances, temperature corrections for nonstandard atmosphere have been included.

PART 1
GENERAL

PERFORMANCE DATA BASIS

Performance data is based on flight test data obtained from NATC Patuxent River fuel consumption tests. 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_o	Ratio of speed of sound at altitude to speed of sound at sea level, ICAO standard day
ac	Alternating current
Amb	Free stream static condition
ADF	Automatic direction finding
Alt.	Altitude
^oC	Degrees Centigrade
CAS or V_c	Calibrated airspeed = IAS corrected for position error
CG	Center of gravity
dc	Direct current
Deg	Degrees
EAS or V_e	Equivalent airspeed = CAS corrected for compressibility effect
EGT	Exhaust Gas Temperature
EPI	Engine Performance Indicator
EPR	Engine Pressure Ratio
^oF	Degrees Fahrenheit
Flt	Flight
FPM or fpm	Feet Per Minute
Freq	Frequency
Ft or ft	Feet
g	Gravity Force
GTC	Ground Turbine Compressor
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
Kn	Knot
lb	Pound
M	Mach Number
MAX	Maximum
min	Minutes
n	Normal load factor
mm	Millimeter
NM or N.Mi.	Nautical Miles
OAT	Outside Air Temperature
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
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" (eg, gross weight)
δ or P/P_o	Delta – Ratio of static air pressure to ICAO standard sea level static air pressure
μ	Mu – Coefficient of rolling friction
ρ	Rho – Density of atmosphere in slugs/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 at any altitude to absolute temperature at sea level, ICAO standard day

DRAG INDEX SYSTEM

The drag index system permits the presentation of performance data for a number of external store loadings. Each item of the external store configuration, such as a bomb, tank, pylon, or multiple bomb adapter, is assigned a drag number whose value depends on the size and shape of the item and its location on the aircraft. The summation of these individual drag numbers, for a particular loading, defines the drag index for that configuration. This index, when applied to the performance charts, defines the performance of that configuration.

Nontactical external store drag numbers are shown in figure 11-1. For additional store drag index numbers, refer to A4/TA4 Tactical Manual, NAVAIR 01-40AV-1T. Note that the drag numbers for a given store depend on the store station on which they are carried. The drag index of the clean aircraft includes the drag of the centerline pylon, but no guns or wing pylons.

SAMPLE PROBLEM (A-4C)

Drag Indexes

Assume that the external configuration consists of an air refueling store on the centerline and two 300 gallon fuel tanks.

External Store Item	Drag Index	Weight (Pounds)	
Clean aircraft (A-4C)	0	--	N E W
Two MK-12 20mm guns	7	315	
Air refueling store	30	*719	
Two wing pylons	12	136	
Two 300 gal fuel tanks	28	*414	N E W
Total drag index	77	1584	

*Less Fuel

AIRSPEED CORRECTIONS

Several corrections must be made to the airspeed indicator reading to obtain the true airspeed of the aircraft. The first correction is for the error which develops from the airspeed indicating system installation. This correction is known as position error and is shown in figure 11-6. The correction for position error is applied to indicated airspeed to obtain calibrated airspeed. To convert calibrated airspeed to true airspeed and true Mach number, figure 11-2 is provided. True Mach number for an indicated Mach number may also be determined from figure 11-7.

SAMPLE PROBLEM (A-4C)

AIRSPEED-CORRECTION FOR POSITION ERROR

(For figure 11-6)

(A) Indicated airspeed 475 Kts

(B) Indicated pressure altitude 20,000 Ft

(C) ΔV - Correction to be added 5 Kts

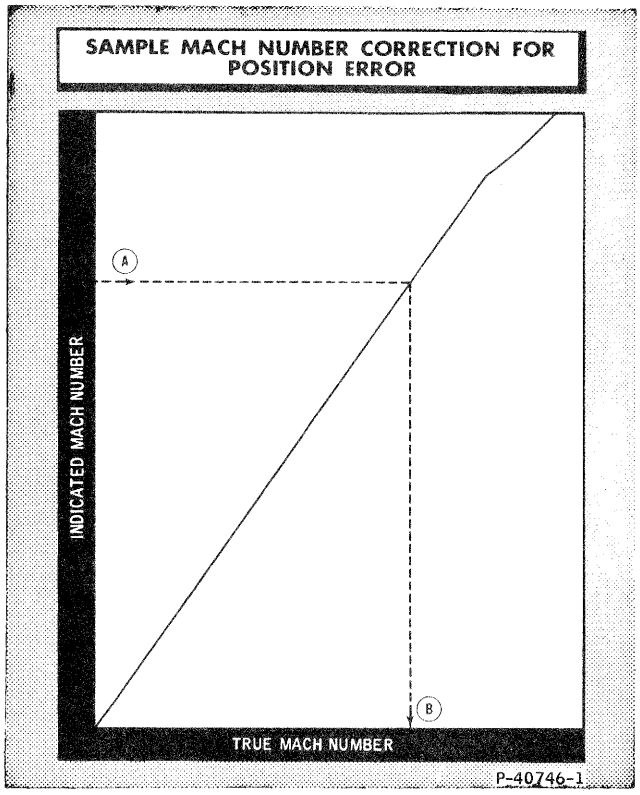
Calibrated airspeed 480 Kts

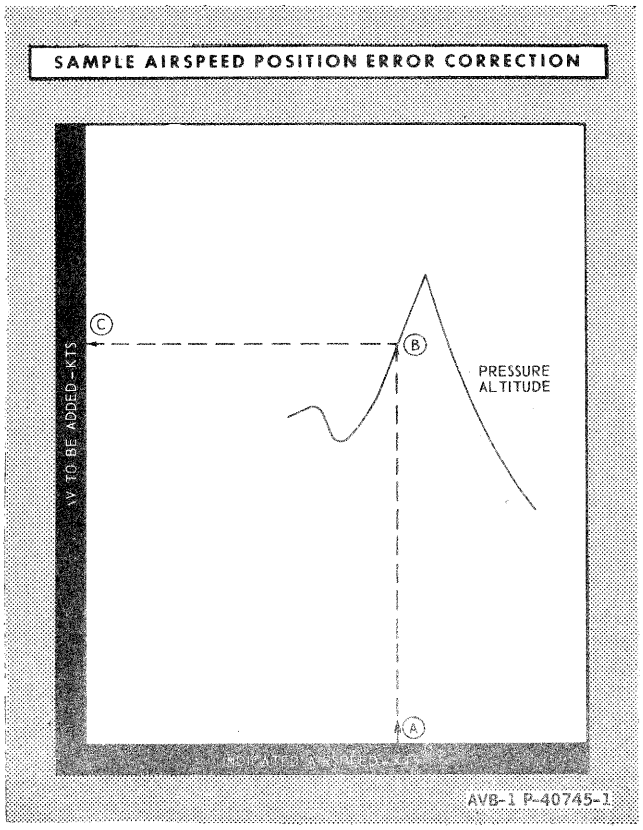
Mach Number Correction For Position Error

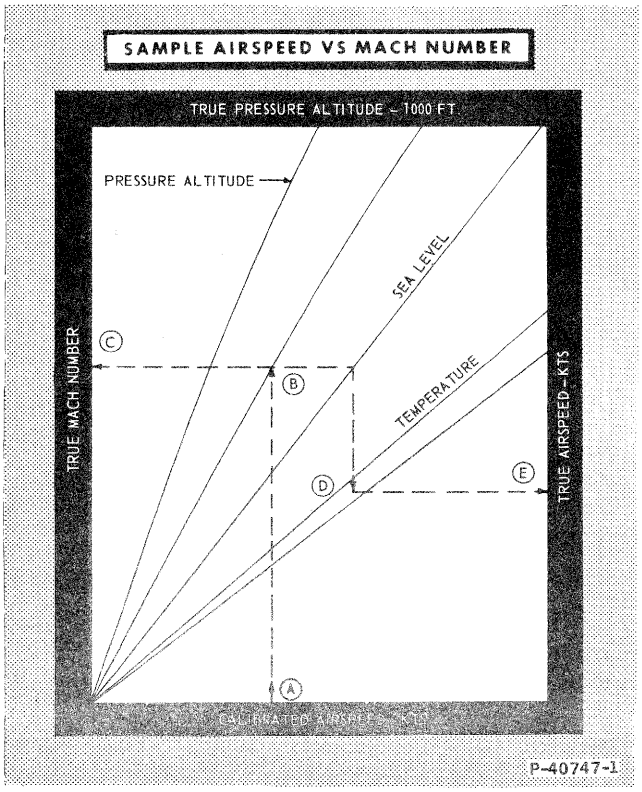
(For figure 11-7)

(A) Indicated Mach Number . . . . . 1.00 M

(B) True Mach Number . . . . . 0.945 M







Airspeed Conversion

(For figure 11-2)

(A) Calibrated airspeed . . . . . 360 Kts

(B) True Pressure Altitude . . . . . 25,000 Ft

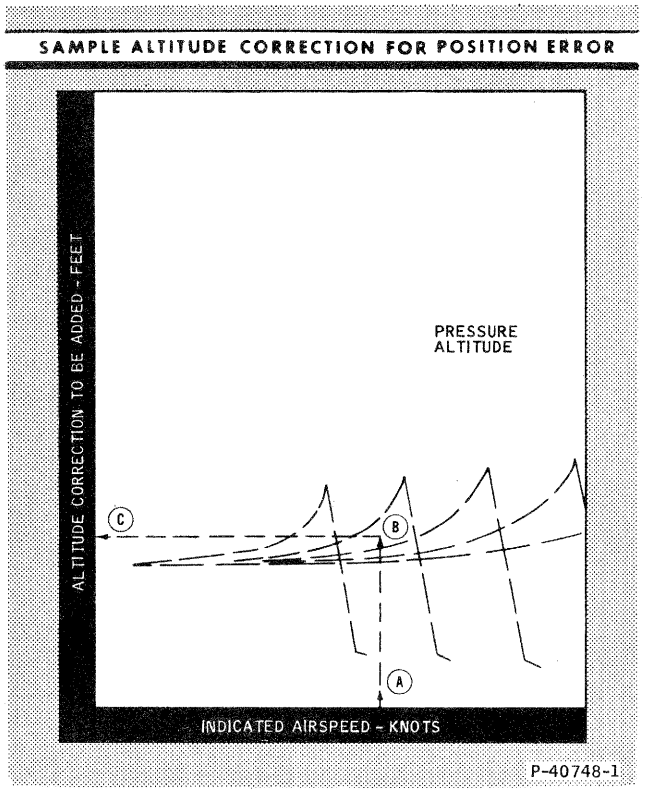
(C) True Mach Number . . . . . 0.85 M

(D) OAT. . . . . $20^{o}C$

(E) True Airspeed . . . . . 569 Kts

ALTIMETER CORRECTIONS

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 11-6.



SAMPLE PROBLEM (A-4C)

ALTITUDE CORRECTION FOR POSITION ERROR

(For figure 11-6)

(A) Indicated airspeed . . . . . 475 Kts

(B) Indicated pressure altitude . . . . . 20,000 Ft

(C) Δh - correction to be added . . . . . 150 Ft

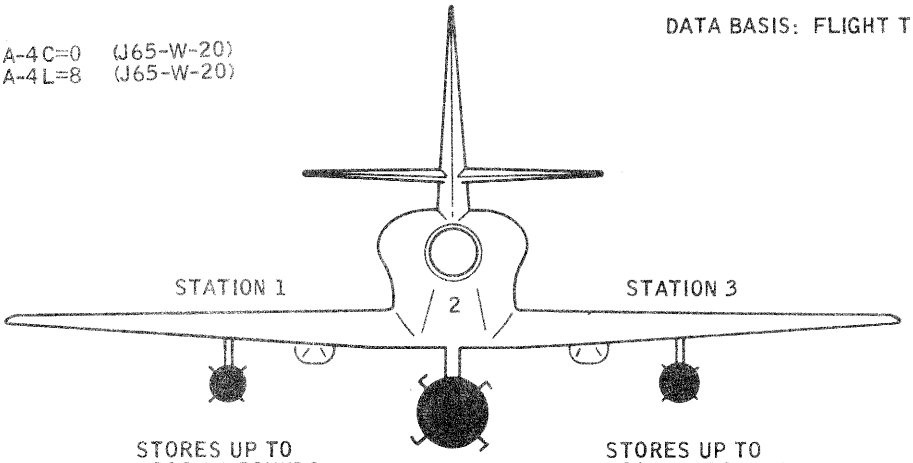
(D) True pressure altitude . . . . . 20,150 Ft

STORE DRAG INDEXES AND GROSS WEIGHTS

CLEAN AIRCRAFT CONFIGURATION (LESS GUNS AND WING PYLONS)

DRAG INDEX:
MODEL A-4C=0 (J65-W-20)
A-4L=8 (J65-W-20)

DATA BASIS: FLIGHT TEST (NAVY)



NEW

SEE SHEET 3 FOR NOTES (1) THRU (3)

AIRCRAFT WEIGHT (POUNDS)

	J65-W-20 ENGINE	
	A-4C	A-4L
WEIGHT EMPTY	9903 (7)	10311 (7)
USEFUL LOAD		
CREW	180	180
FUEL TRAPPED IN SYSTEM (JP-5)	46	48
OIL		
USABLE	30	30
TRAPPED IN SYSTEM	3	3
ARMAMENT		
GUN INSTALLATION (NO AMMUNITION)	316	315
ARMOR	-	101
CENTERLINE RACK AND FAIRING	75	73
EQUIPMENT		
LOX	43	43
PARAKIT	19	19
SEAT PAN	8	8
PARACHUTE	25	25
REFUELING PROBE	46	46
THERMAL SHIELD	10	10
ECM	-	397
OPERATING WEIGHT	10,704	11,609

SS1-40933-C

Figure 11-1. Drag Indexes (Sheet 1)

GUNS AND SUSPENSION EQUIPMENT	APPROX. WEIGHT LB/EACH	DRAG INDEX AT STORE STATION		
		1	2	3
Two MK 12 Guns and 200 Rounds Ammo.	457		7	
One AERO -20A Rack-Pylon	68	6		6
AERO -1A Adapter				
AERO -3A Launcher				
AERO -5A Pylon-Launcher		7	7	7
AERO-5A-1 Launcher-Adapter	*99	7	7	7
A/A37B-1 MBR	159	14	14	14
A/A37B-3 PMBR	87			
TER-7	*105	13	13	13
MER-7	*223	25	25	25
LAU-24/A Launcher				
MK 51 Bomb Rack				

* Changed by NAVAIRSYSCOM letter dated 10 April 1969

Figure 11-1. Drag Indexes (Sheet 2)

EXTERNAL STORES	SUSPENSION	NO. OF STORES	APPROX. WEIGHT LB/EACH	DRAG INDEX AT STORE STATION		
				1	2	3
150 Gal. Fuel Tank; Full/ Empty (2)	AERO-20A, -7A	1	*1156/136	10	10	10
300 Gal. Fuel Tank (Bobtail) Full/Empty (2)	AERO-7A	1	2223/183		15	
300 Gal. Fuel Tank (4 Fins); Full/Empty (2)	AERO-20A	1	*2239/199	14		14
400 Gal. Fuel Tank; Full/ Empty (2)	AERO-7A	1	2960/240		20	
300 Gal. Air Refueling Store Tank; Full/Empty	AERO-7A	1	2740/719		30/119(3)	
GTC-85 Pod-Mounted; Full/ Empty	AERO-20A, -7A	1	700/650	19	21	19
MK 104	AERO-7A	1			13	
MK 106 MOD 3	A/A37B-3 PMBR	6	30	X	X	X
MK 76 MOD 5 with MK 14 Lug	A/A37B-3 PMBR	6	150	X	X	X

NEW NEW NEW

* Changed by NAVAIRSYSCOM letter dated 10 April 1969

NOTES: 1. Except as noted in A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T.

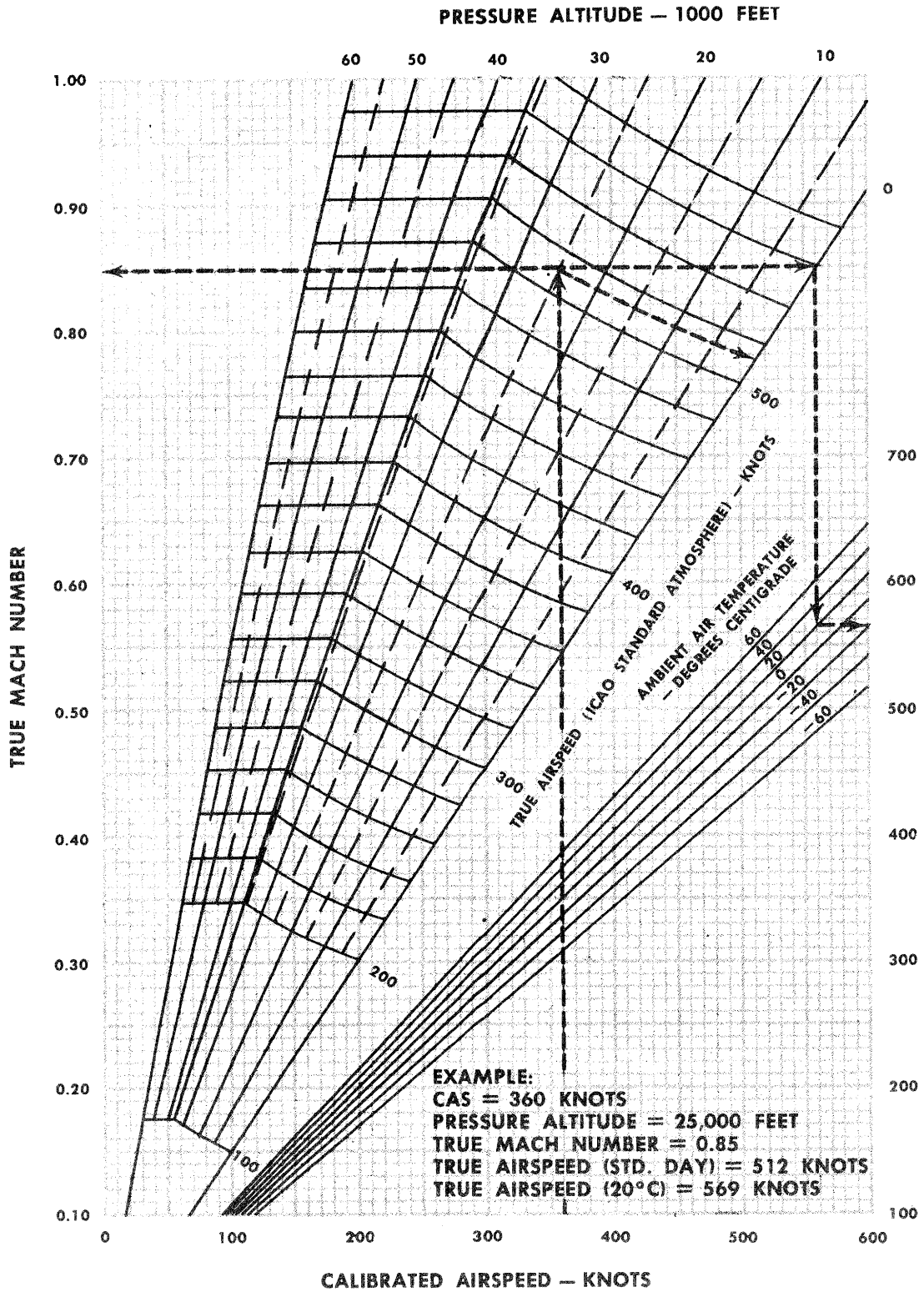
2. Full tank weight for JP-5 fuel.

3. Hose and drogue retracted/extended.

X Indicates drag index not determined.

Figure 11-1. Drag Indexes (Sheet 3)

AIRSPEED CONVERSION



P-40763-1

Figure 11-2. Airspeed Versus Mach Number

DENSITY ALTITUDE CHART

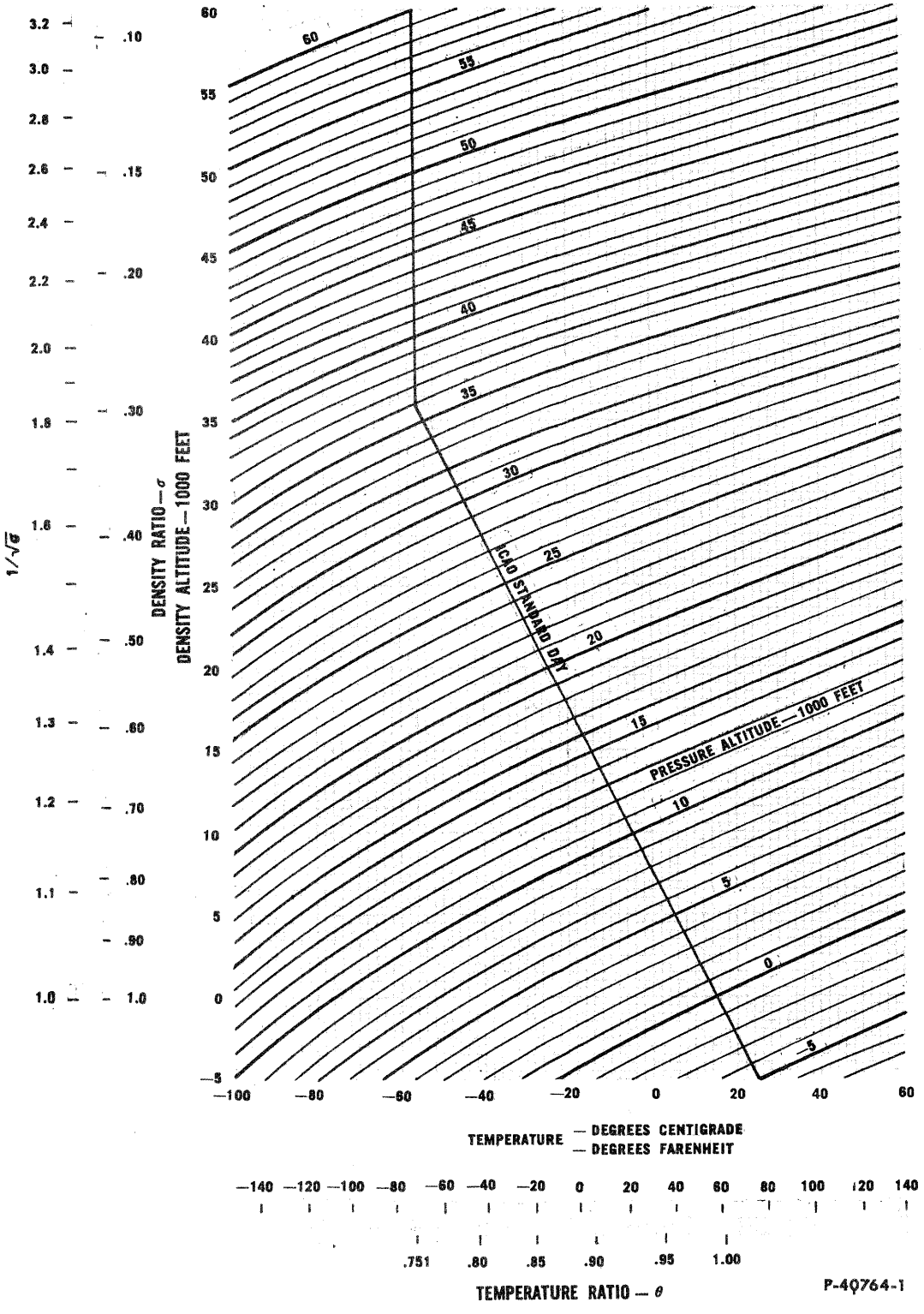


Figure 11-3. Density Altitude Chart

DEGREES CENTIGRADE	DEGREES FAHRENHEIT	DEGREES CENTIGRADE	DEGREES FAHRENHEIT	DEGREES CENTIGRADE	DEGREES FAHRENHEIT
-75	-103.0	-33	-27.4	9	48.2
-74	-101.2	-32	-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

ICAO STANDARD ALTITUDE CHART

ALTITUDE FEET	DENSITY RATIO $\sigma=\rho/\rho_o$	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE DEG. C	TEMPERATURE DEG. F	TEMPERATURE RATIO $\theta=T/T_o$	SPEED OF SOUND RATIO a/a_o	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	.9711	1.0148	13.019	55.434	.9931	.997	28.856	.9644
2000	.9428	1.0299	11.038	51.868	.9862	.993	27.821	.9298
3000	.9151	1.0454	9.056	48.302	.9794	.990	26.817	.8962
4000	.8881	1.0611	7.075	44.735	.9725	.966	25.842	.8637
5000	.8617	1.0773	5.094	41.169	.9656	.983	24.896	.8320
6000	.8359	1.0938	3.113	37.603	.9587	.979	23.978	.8014
7000	.8106	1.1107	1.132	34.037	.9519	.976	23.088	.7716
8000	.7860	1.1279	-0.850	30.471	.9450	.972	22.225	.7428
9000	.7620	1.1456	-2.831	26.905	.9381	.969	21.388	.7148
10,000	.7385	1.1637	-4.812	23.338	.9312	.965	20.577	.6877
11,000	.7156	1.1822	-6.793	19.772	.9244	.961	19.791	.6614
12,000	.6932	1.2011	-8.774	16.206	.9175	.958	19.029	.6360
13,000	.6713	1.2205	-10.756	12.640	.910€	.954	18.292	.6113
14,000	.6500	1.2403	-12.737	9.074	.9037	.951	17.577	.5875
15,000	.6292	1.2606	-14.718	5.508	.8969	.947	16.886	.5643
16,000	.6090	1.2815	-16.699	1.941	.8900	.943	16.216	.5420
17,000	.5892	1.3028	-18.680	-1.625	.8831	.940	15.569	.5203
18,000	.5699	1.3246	-20.662	-5.191	.8762	.936	14.942	.4994
19,000	.5511	1.3470	-22.643	-8.757	.3694	.932	14.336	.4791
20,000	.5328	1.3700	-24.624	-12.323	.8625	.929	13.750	.4595
21,000	.5150	1.3935	-26.605	-15.889	.8556	.925	13.184	.4406
22,000	.4976	1.4176	-28.586	-19.456	.8487	.921	12.636	.4223
23,000	.4807	1.4424	-30.586	-23.022	.8419	.918	12.107	.4046
24,000	.4642	1.4678	-32.549	-26.588	.8350	.914	11.597	.3876
25,000	.4481	1.4938	-34.530	-30.154	.8281	.910	11.104	.3711
26,000	.4325	1.5206	-36.511	-33.720	.8212	.906	10.627	.3552
27,000	.4173	1.5480	-38.493	-37.286	.8144	.902	10.168	.3398
28,000	.4025	1.5762	-40.474	-40.852	.8075	.899	9.725	.3250
29,000	.3881	1.6052	-42.455	-44.419	.8006	.895	9.297	.3107
30,000	.3741	1.6349	-44.436	-47.985	.7937	.891	8.885	.2970
31,000	.3605	1.6654	-46.417	-51.551	.7869	.887	8.488	.2837
32,000	.3473	1.6968	-48.399	-55.117	.7800	.883	8.106	.2709
33,000	.3345	1.7291	-50.379	-58.683	.7731	.879	7.737	.2586
34,000	.3220	1.7623	-52.361	-62.249	.7662	.875	7.382	.2467
35,000	.3099	1.7964	-54.342	-65.816	.7594	.871	7.041	.2353
36,000	.2981	1.8315	-56.323	-69.382	.7525	.867	6.712	.2243
36,089	.2971	1.8347	-56.500	-69.700	.7519	.867	6.683	.2234
37,000	.2844	1.8753	↓	↓	↓	↓	6.397	.2138
38,000	.2710	1.9209	↓	↓	↓	↓	6.097	.2038
39,000	.2585	1.9677	↓	↓	↓	↓	5.811	.1942
40,000	.2462	2.0155	↓	↓	↓	↓	5.538	.1851
41,000	.2346	2.0645	↓	↓	↓	↓	5.278	.1764
42,000	.2236	2.1148	↓	↓	↓	↓	5.030	.1681
43,000	.2131	2.1662	↓	↓	↓	↓	4.794	.1602
44,000	.2031	2.2189	↓	↓	↓	↓	4.569	.1527
45,000	.1936	2.2728	↓	↓	↓	↓	4.355	.1455
46,000	.1845	2.3281	↓	↓	↓	↓	4.151	.1387
47,000	.1758	2.3848	↓	↓	↓	↓	3.956	.1322
48,000	.1676	2.4428	↓	↓	↓	↓	3.770	.1260
49,000	.1597	2.5022	↓	↓	↓	↓	3.593	.1201
50,000	.1522	2.5630	↓	↓	↓	↓	3.425	.1145
51,000	.1451	2.6254	↓	↓	↓	↓	3.264	.1091
52,000	.1383	2.6892	↓	↓	↓	↓	3.111	.1040
53,000	.1318	2.7546	↓	↓	↓	↓	2.965	.0991
54,000	.1256	2.8216	↓	↓	↓	↓	2.826	.0944
55,000	.1197	2.8903	↓	↓	↓	↓	2.693	.0900
56,000	.1141	2.9606	↓	↓	↓	↓	2.567	.0858
57,000	.1087	3.0326	↓	↓	↓	↓	2.446	.0818
58,000	.1036	3.1063	↓	↓	↓	↓	2.331	.0779
59,000	.09877	3.1819	↓	↓	↓	↓	2.222	.0743
60,000	.09414	3.2593	↓	↓	↓	↓	2.118	.0709
61,000	.08972	3.3386	↓	↓	↓	↓	2.018	.0675
62,000	.08551	3.4198	↓	↓	↓	↓	1.924	.0643
63,000	.08150	3.5029	↓	↓	↓	↓	1.833	.0613
64,000	.07767	3.5881	↓	↓	↓	↓	1.747	.0584
65,000	.07403	3.6754	-56.500	-69.700	.7519	.867	1.665	.0557

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft
= 0.4912 lb per sq in.

DATA BASIS: NACA Technical Note No. 3182

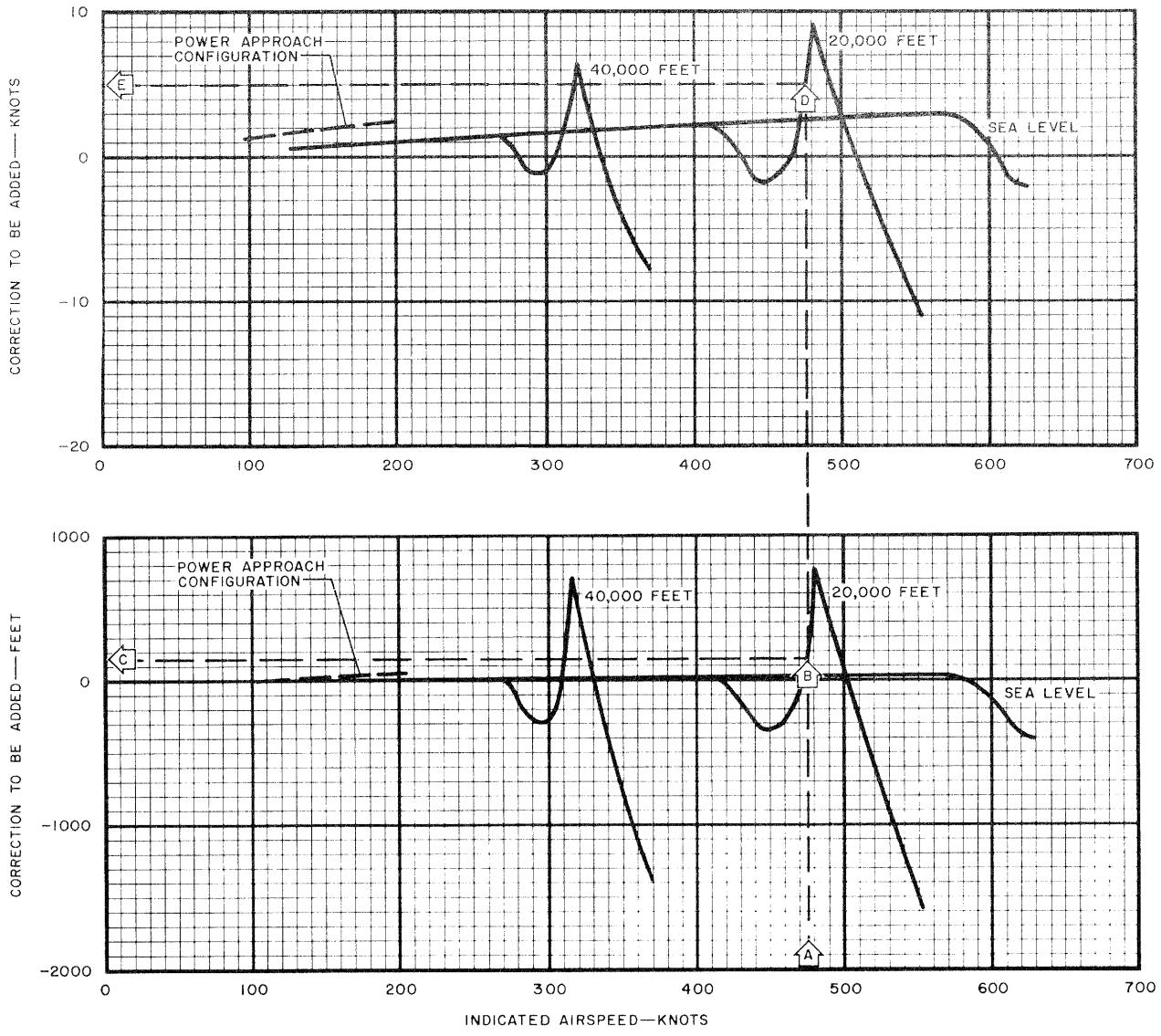
(2) ICAO Standard Sea Level Air
t_o = 15°C
P_o = 29.921 in. of Hg
a_o = 661.8 knots
ρ_o = .0023769 slug per cu ft

Figure 11-5. ICAO Standard Altitude Chart

AIRSPEED AND ALTITUDE CORRECTION FOR POSITION ERROR

MODEL: A-4C

PROBE ON



EXAMPLE:

Assume Indicated Airspeed of 475 knots and Indicated Pressure Altitude of 20,000 feet.

(1) Enter chart at 475 knots IAS (A). Sight upward to the 20,000 foot curve for the correction desired; altitude (B) or airspeed (D).

(2) Sight horizontally to the left from (B) or (D) and read altitude correction = +150 feet (C) or airspeed correction = +5 knots (E).

(3) Pressure altitude = (20,000 + 150 = 20,150) feet.

(4) Calibrated airspeed = (475 + 5 = 480) knots.

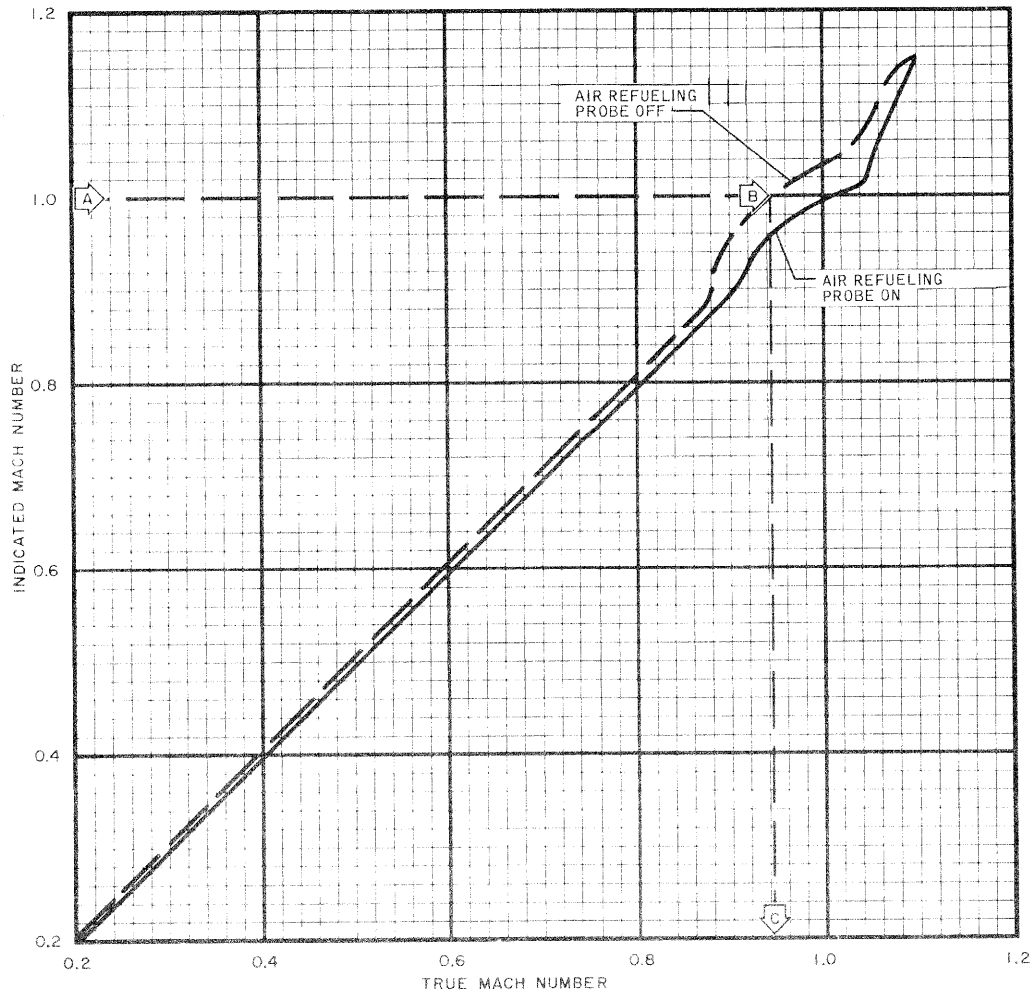
DATA AS OF: 24 April 1959

DATA BASIS: Contractor Flight Test

Figure 11-6. Airspeed and Altitude Correction for Position Error

MACH NUMBER CORRECTION FOR POSITION ERROR

MODEL: A-4C



P-14575-1R

EXAMPLE:

Assume Indicated Mach Number is 1.0

(1) Enter chart at 1.0 IMN (A). Sight horizontally to curve (B).

(2) Sight downward to True Mach Number scale and read TMN 0.945 (C).

DATA AS OF: 24 April 1959

DATA BASIS: Contractor Flight Test

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 influence 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 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 additional 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.

Takeoff Distance — No JATO

Operational takeoff distance and total distance to clear a 50-foot obstacle, without JATO assist, are shown on figure 11-8. Also shown is recommended takeoff speed. 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 that there is a region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area where the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limit speed of 175 knots groundspeed may be exceeded. Since temperature and altitude are not independent, the boundary lines in this box are shown for extreme altitude-temperature combination. A more detailed explanation of the marginal region is given in the following paragraphs 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 is described in the following example.

Note

When operational conditions require takeoffs where computed takeoff distance places the aircraft in the region labeled TAKEOFF IS MARGINAL on the chart, liftoff speed should be increased approximately 5 to 10 KIAS, 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

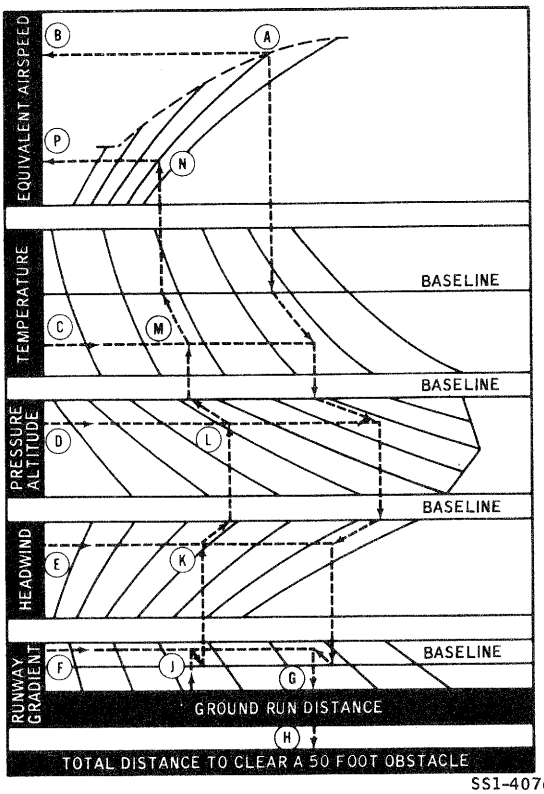
(For Figure 11-8)

(A)	Takeoff weight	20,000 lb
(B)	Takeoff airspeed	146 kn
(C)	Ambient runway air temperature	32°C
(D)	Runway pressure altitude	2000 ft
(E)	Headwind	8 kn
(F)	Runway gradient	-1%
(G)	Ground run distance	Approx 5000 ft
(H)	Total distance to clear a 50 foot obstacle	5650 ft

Line Speed Check

A line speed check is a simple procedure for ascertaining that aircraft acceleration during takeoff is normal, sufficiently early in the takeoff run to allow normal braking to stop the aircraft on the runway. Select 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 applying the corrections for variation from standard conditions.

SAMPLE TAKEOFF DISTANCE



SS1-40766-A

(J) Runway gradient . . . . . -1%

(K) Headwind . . . . . 20 kn

(L) Runway pressure altitude . . . . . 2000 ft

(M) Ambient runway air temperature . . . . . $32^{o}C$

(N) Takeoff weight . . . . . 20,000 lb

(P) Equivalent airspeed . . . . . 111.5 kn

Maximum Takeoff Weight — With or Without JATO

The maximum takeoff weight shown on 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 groundspeed shall not be exceeded.

NATC flight test of the Model A-4E shows that the above criteria, when met, will provide acceptable climbout characteristics. Since JATO burnout occurs at lift-off this chart is valid with and without JATO assist.

SAMPLE PROBLEM

MAXIMUM TAKEOFF WEIGHT

(For figure 11-9)

NEW

(A) Ambient runway air temperature . . . . . 35°C

(B) Runway pressure altitude . . . . . 4000 ft

(C) Maximum takeoff weight . . . . . 21700 lb

NEW

JATO Firing Delay and 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. produces the shortest takeoff distance

2. 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 to 3 pounds pull at 24,500 pounds. This stick force is not objectionable since a reduction

in angle of attack is required to maintain airspeed or to continue acceleration.

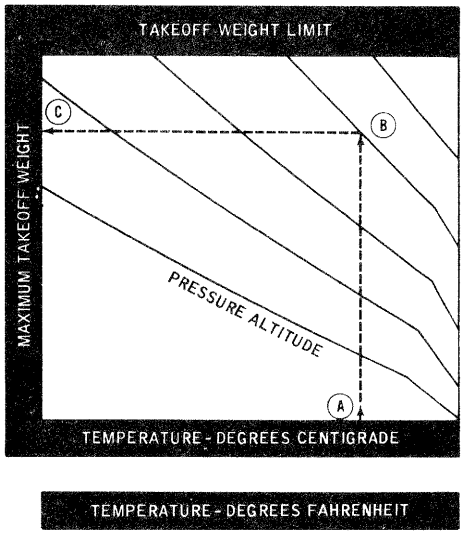
It is recommended that the firing point be established by distance markers alongside the runway. This recommendation is made for the following reasons:

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 the 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 recommended above.

SAMPLE MAXIMUM TAKEOFF WEIGHT



SS1-40767-A

The takeoff airspeeds and distances are based on NATC flight test data of the Model A-4E aircraft. Note that there is a region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area where the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limit speed of 175 knots groundspeed 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 in the Maximum Takeoff Weight section. 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 kn

(C) Ambient runway air temperature . . . . . 30°C

(D) Runway pressure altitude . . . . . 2000 ft

(E) Headwind . . . . . 10 kn

(F) Runway gradient . . . . . -1%

(G) JATO firing distance . . . . . 1700 ft

JATO TAKEOFF DISTANCE

(For figure 11-11)

(H) Takeoff weight . . . . . 20,000 lb

(J) Takeoff airspeed . . . . . 146 kn

(K) Ambient runway air temperature . . . . . 30°C

(L) Runway pressure altitude . . . . . 2000 ft

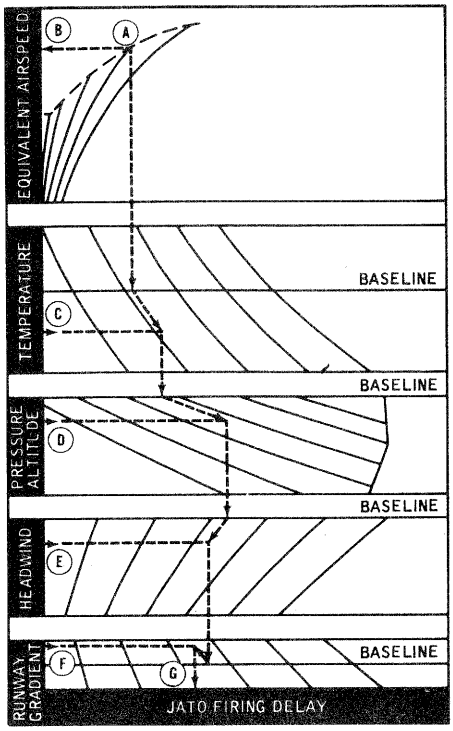
(M) Headwind . . . . . 10 kn

(N) Runway gradient . . . . . -1%

(P) Ground run distance . . . . . 2700 ft

(Q) Total distance to clear a 50 foot obstacle . . . . . 4500 ft

SAMPLE JATO FIRING DELAY



SS1-40768-A

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 11-13 present this data for engine failure during a MILITARY thrust takeoff without JATO. 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.

SAMPLE PROBLEM

Takeoff Refusal Speed (For Figure 11-12)

(A) Runway temperature . . . . . 30°C

(B) Runway pressure altitude . . . . . 4,000 ft

(C) Transfer scale 1.51

(D) Field length . . . . . 10,000 ft

(E) Takeoff weight . . . . . 20,000 lb

(F) Headwind . . . . . 10 kn

(G) Runway gradient . . . . . -1%

(H) Takeoff refusal speed . . . . . 107 KIAS NEW

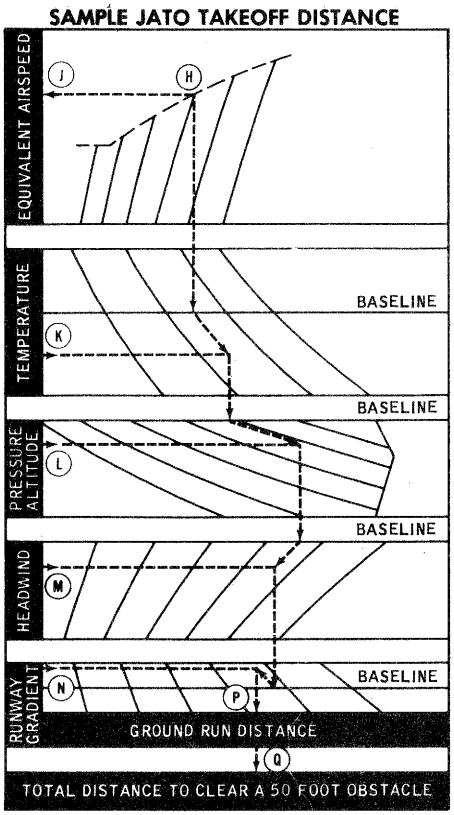
Brake-On Speed Check (For Figure 11-14)

(J) Brake-on speed . . . . . above 190 KIAS

Note

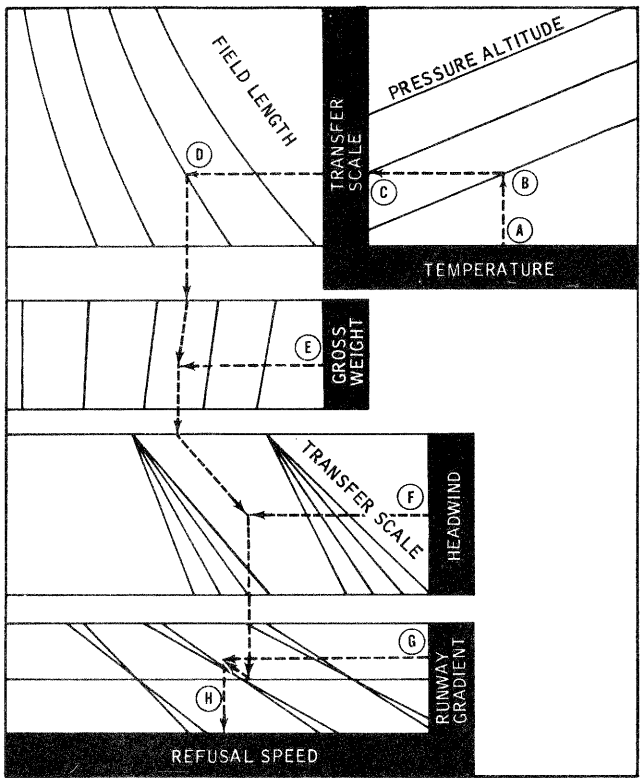
If brake-on speed is less than takeoff refusal speed, brakes should not be applied until aircraft has decelerated to brake-on speed.

SAMPLE JATO TAKEOFF DISTANCE



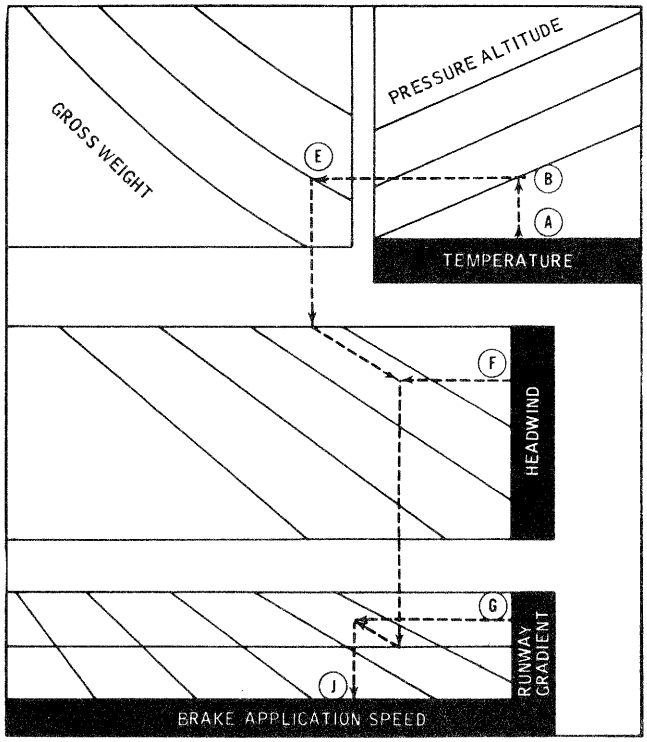
SS1-40769-A

SAMPLE TAKEOFF REFUSAL SPEED



SS1-40770-A

SAMPLE BRAKE APPLICATION SPEED

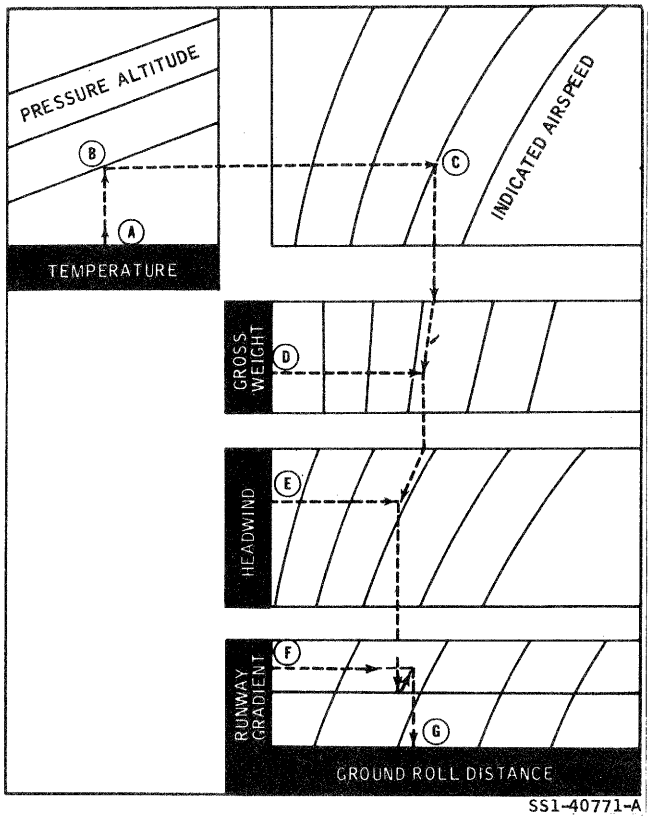


SS1-6

Stopping Distance

The stopping distance chart (figure 11-15) is included primarily for use if the takeoff should be aborted. 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. Because of negligible difference in rollout distance for flap position setting, it is recommended the flaps be left in the position selected for takeoff to minimize pilot diversion during this critical stage of operation when aborting the takeoff. Shutting down the engine and opening the speed brakes would shorten the rollout considerably.

SAMPLE STOPPING DISTANCE



SS1-40771-A

SAMPLE PROBLEM

Stopping Distance (For Figure 11-15)

(A) Runway temperature . . . . . 30°C

(B) Runway pressure altitude . . . . . 2600 ft

(C) Indicated airspeed at abort Approx 125 KIAS

(D) Aircraft gross weight . . . . . 20,000 lb

(E) Headwind . . . . . 20 kts

(F) Runway gradient . . . . . +1%

(G) Stopping distance . . . . . 3500 ft

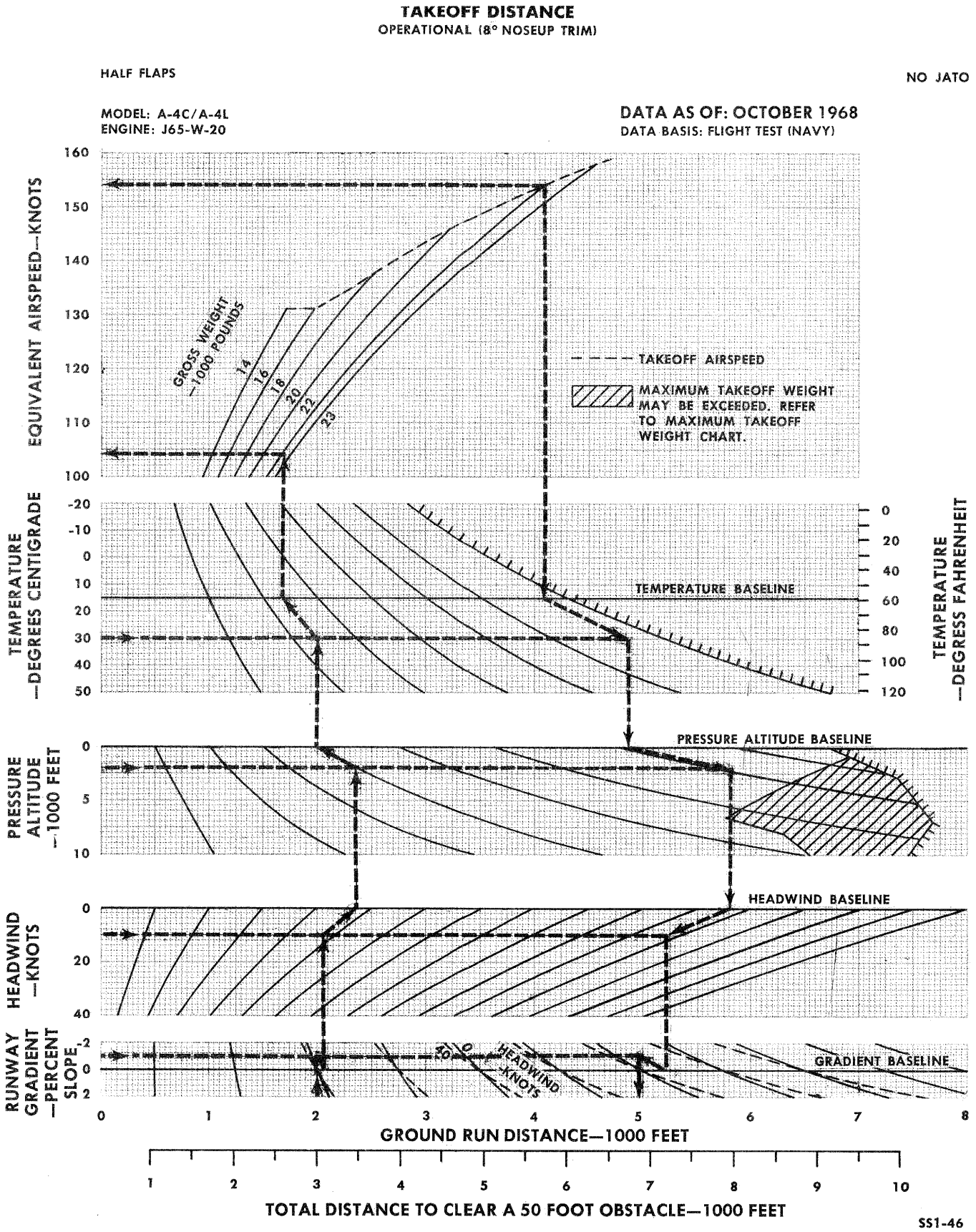


Figure 11-8. Takeoff Distance

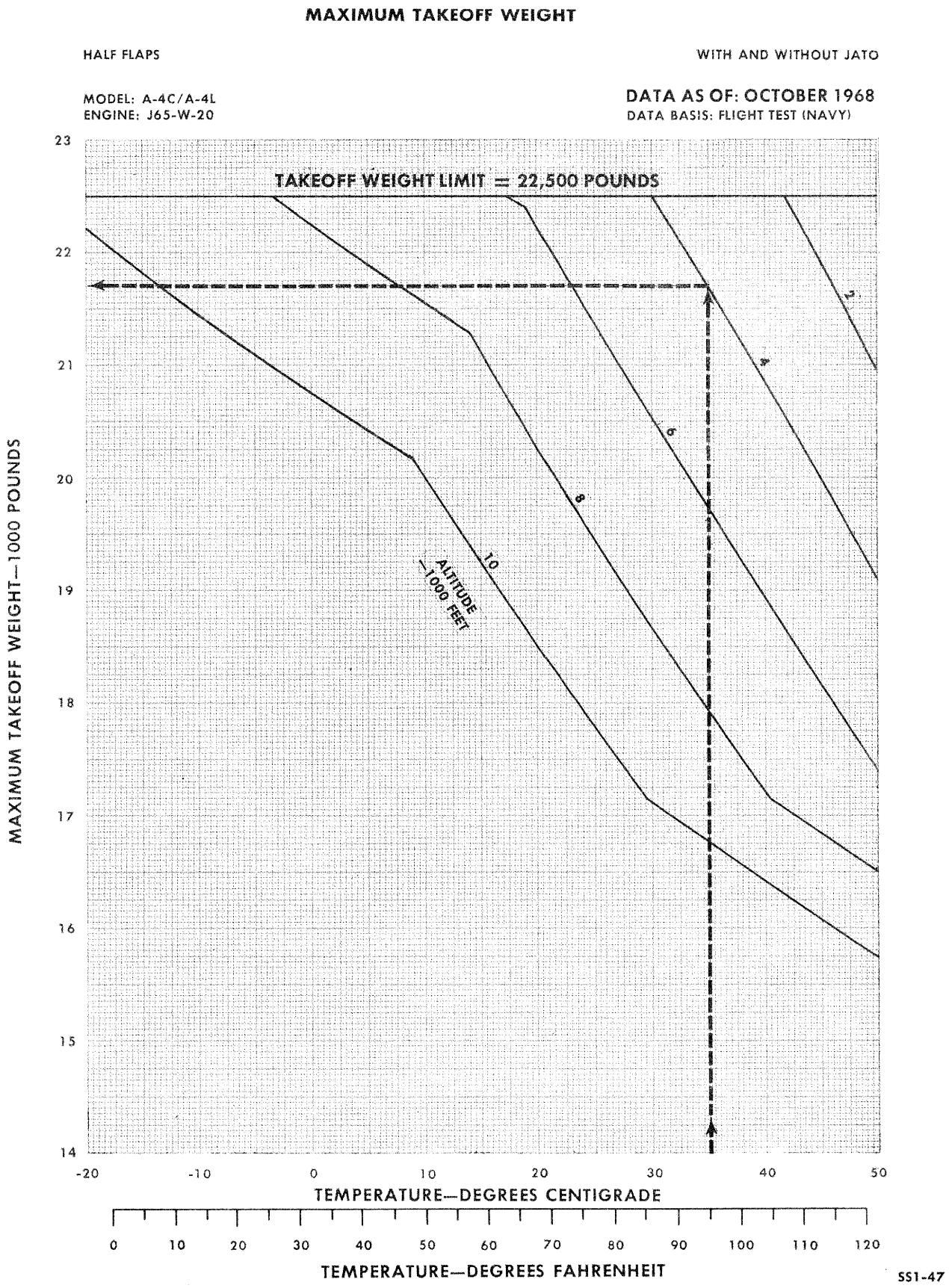


Figure 11-9. Maximum Takeoff Weight

JATO FIRING DELAY

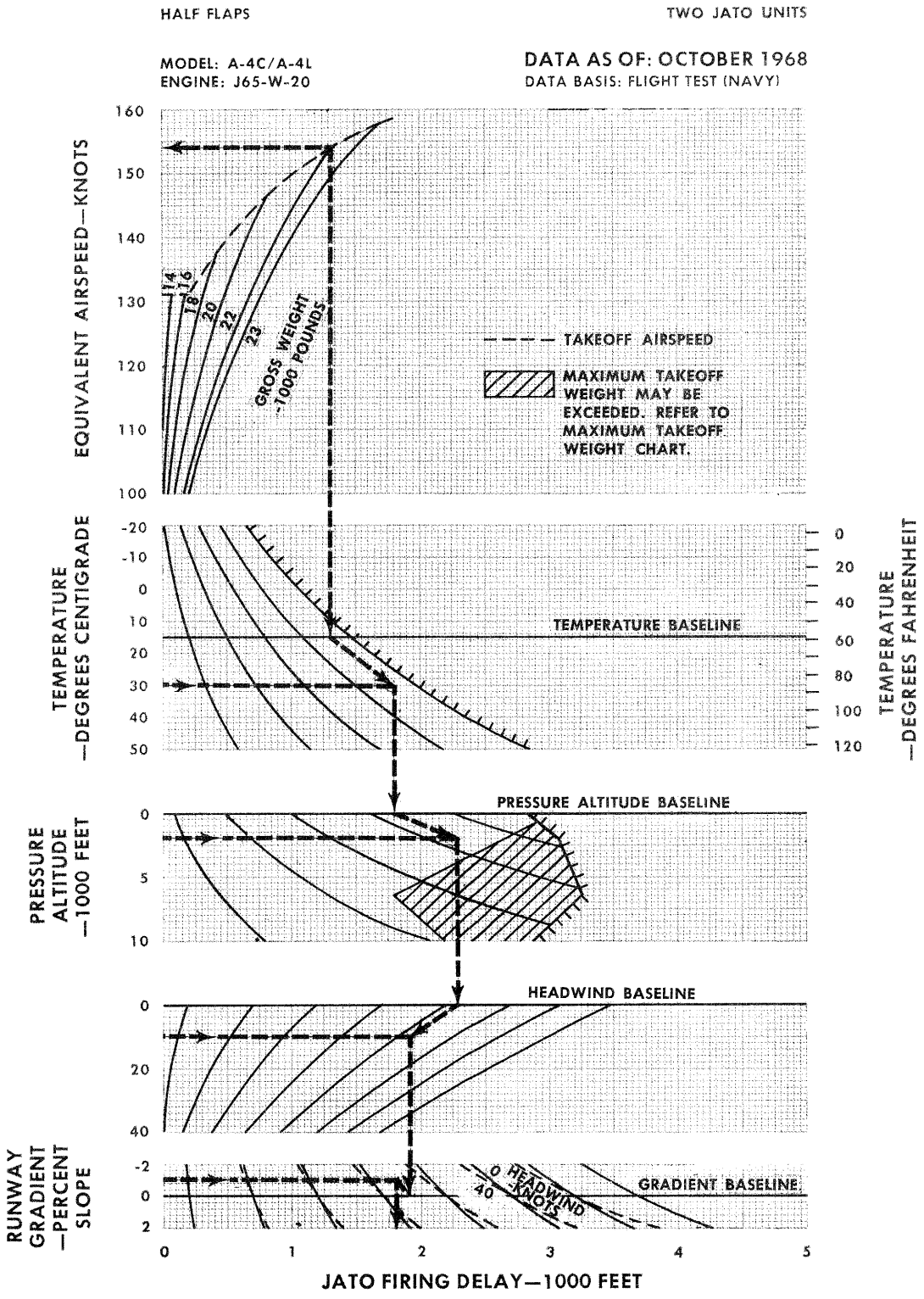


Figure 11-10. JATO Firing Delay

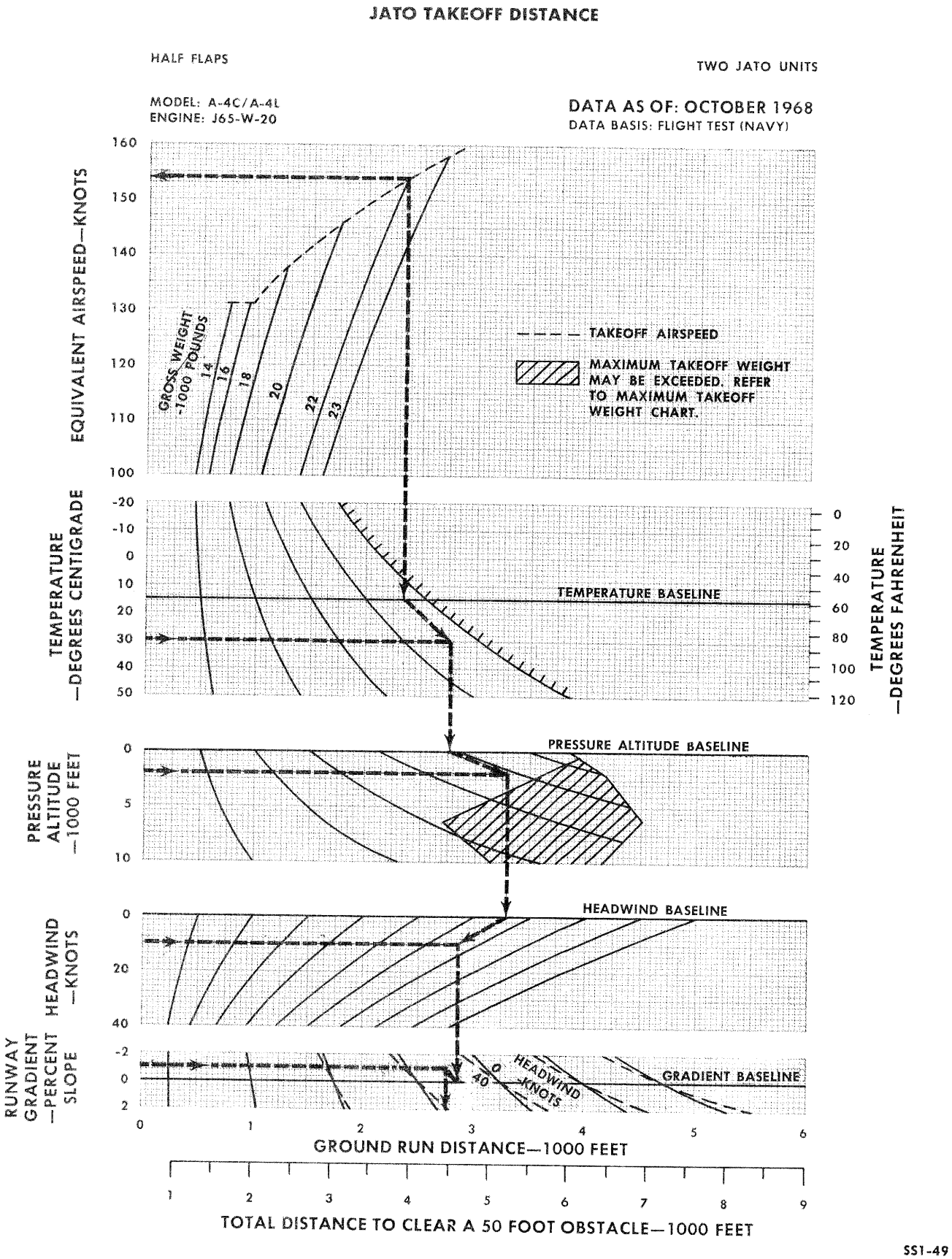


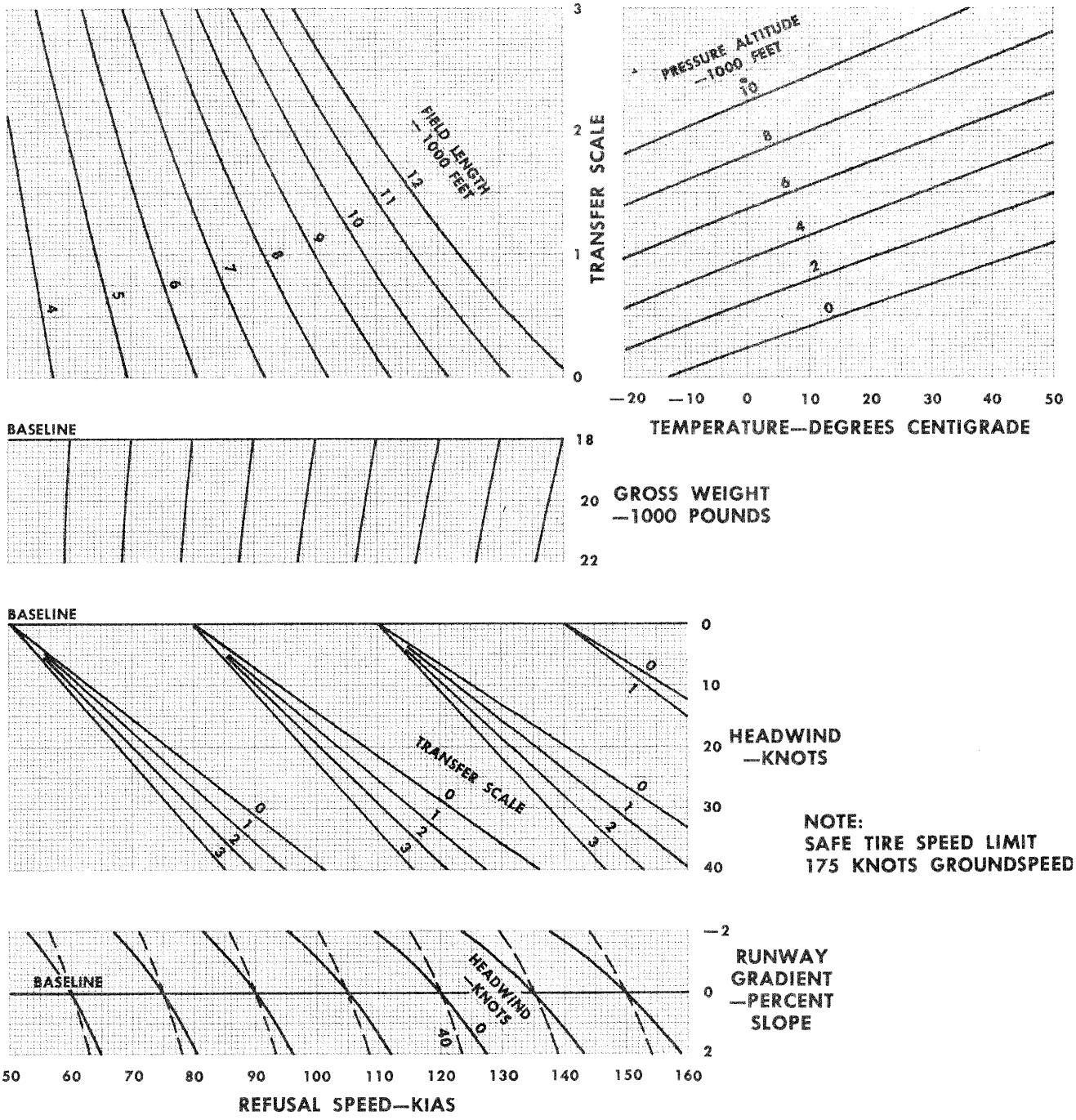
Figure 11-11. JATO Takeoff Distance

TAKEOFF REFUSAL SPEEDS

HALF FLAPS
SPEEDBRAKES OPEN
SINGLE DISC BRAKES

MODEL: A-4C
ENGINE: J65-W-20

DATA AS OF: NOVEMBER 1968
DATA BASIS: ESTIMATED



SS1-50-A

Figure 11-12. Takeoff Refusal Speeds A-4C

TAKEOFF REFUSAL SPEEDS

HALF FLAPS
SPEEDBRAKES OPEN
SPOILERS OPEN

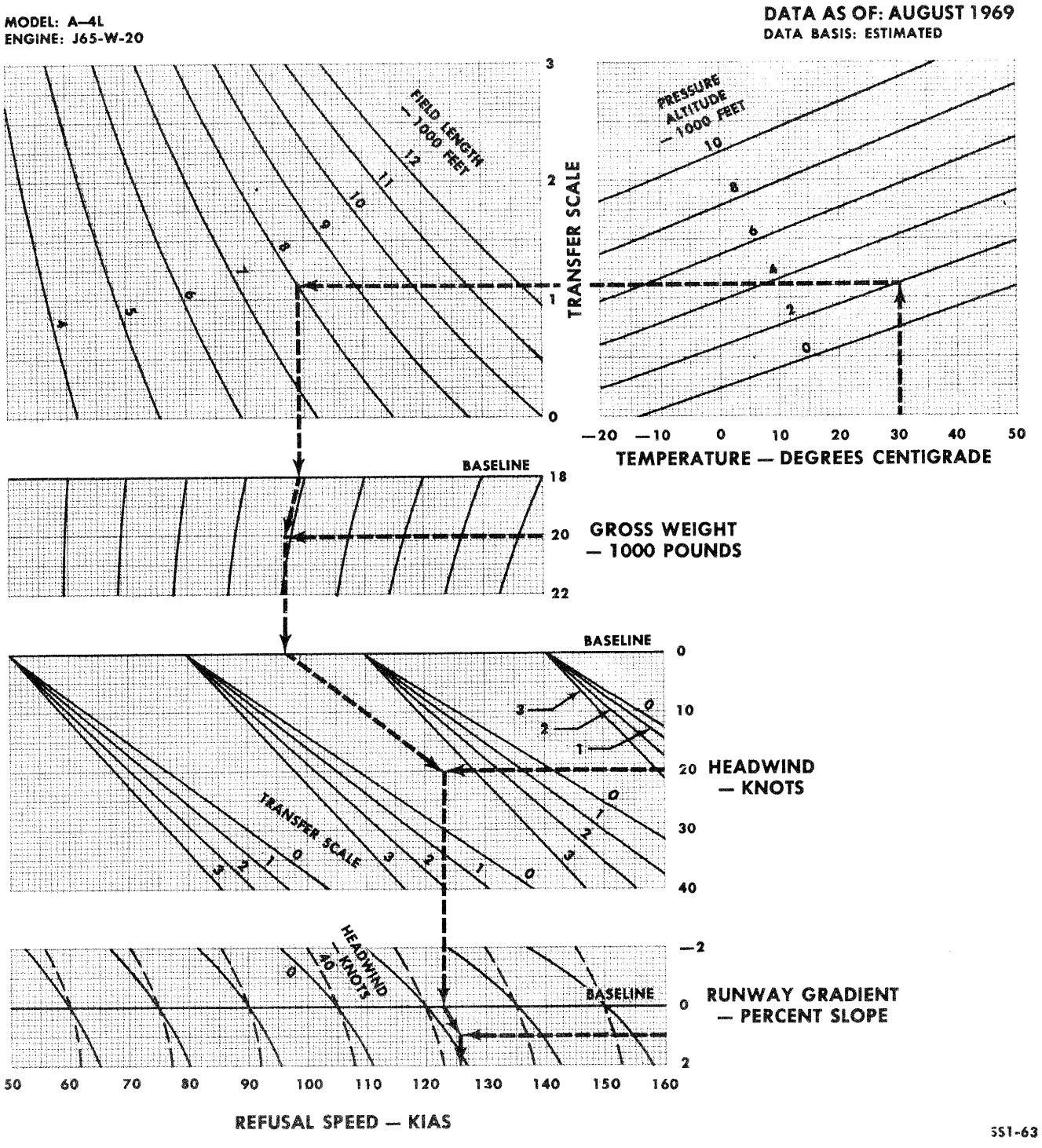
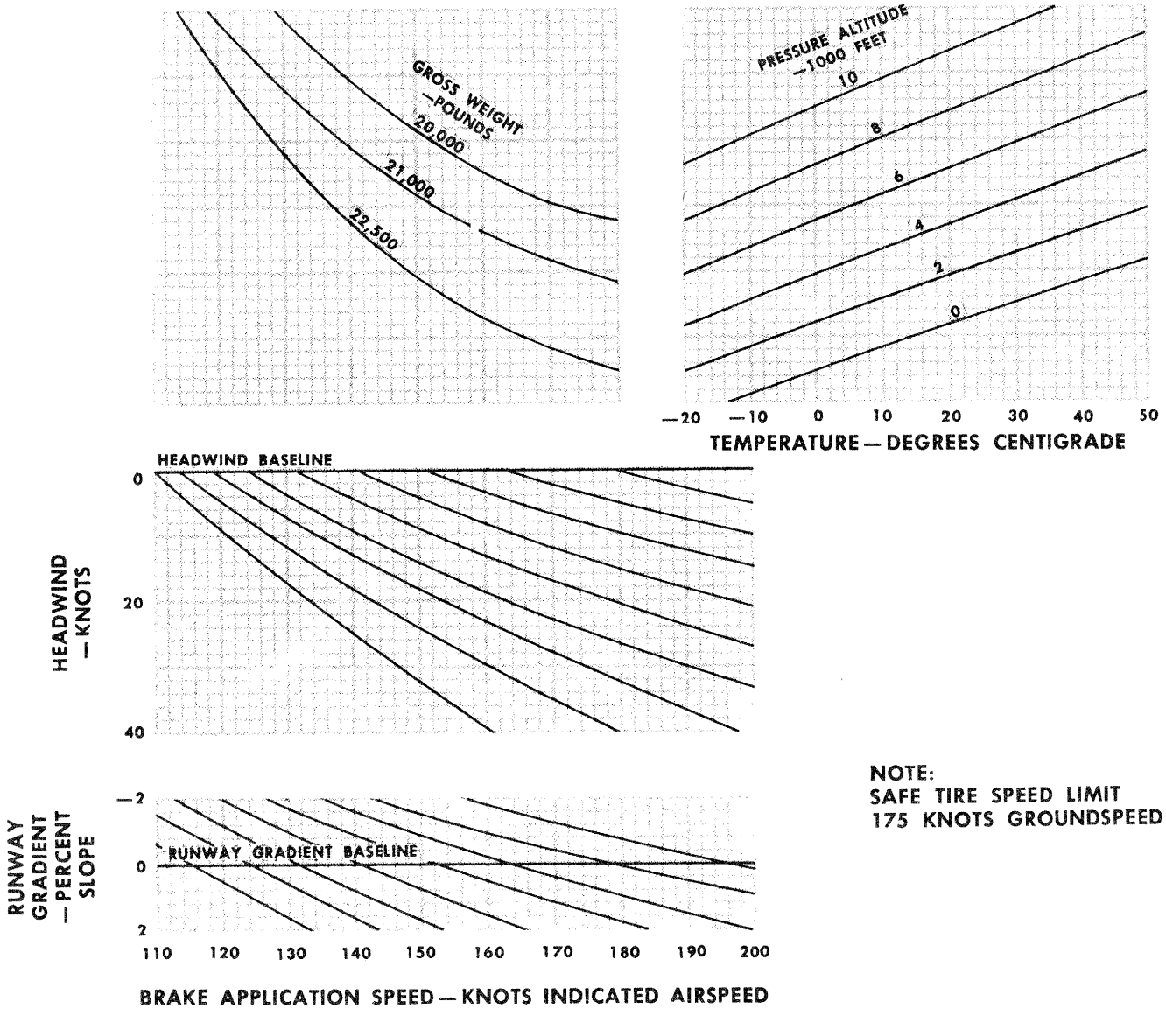


Figure 11-13. Takeoff Refusal Speeds A-4L

ABORTED TAKEOFF
BRAKE APPLICATION SPEED
HALF FLAPS
SPEEDBRAKES OPEN
SINGLE DISC BRAKES

DATA AS OF: 15 MARCH, 1967
DATA BASIS: ESTIMATED



NOTE:
SAFE TIRE SPEED LIMIT
175 KNOTS GROUNDSPEED

SS1-3-B

Figure 11-14. Aborted Takeoff Brake Application Speeds

STOPPING DISTANCE

HALF FLAPS
SPEEDBRAKES OPEN
SINGLE DISC BRAKES

MODEL: A-4C
ENGINE: J65-W-20

DATA AS OF: NOVEMBER 1968
DATA BASIS: ESTIMATED

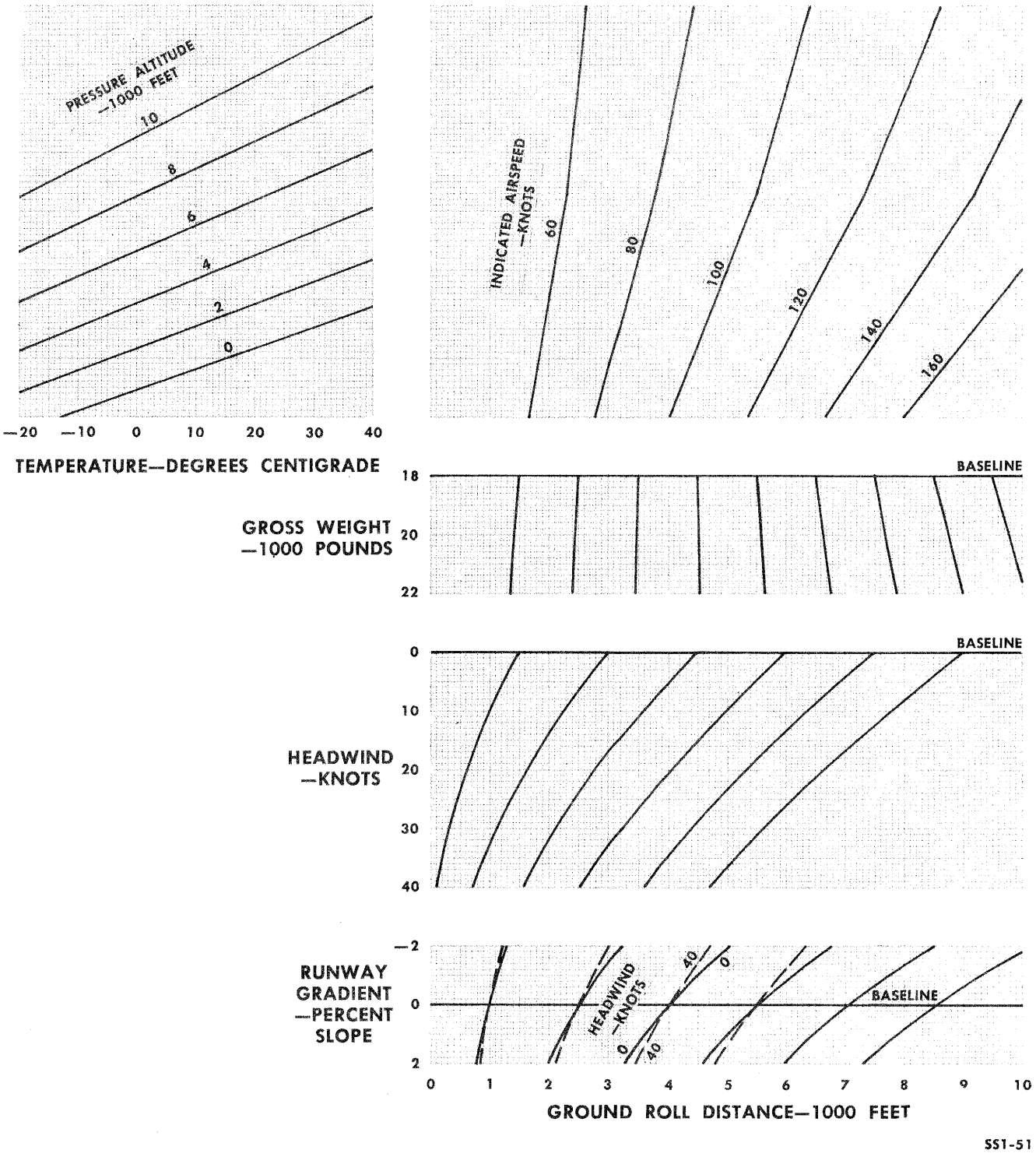


Figure 11-15. Aborted Takeoff Stopping Distance (A-4C) (Sheet 1)

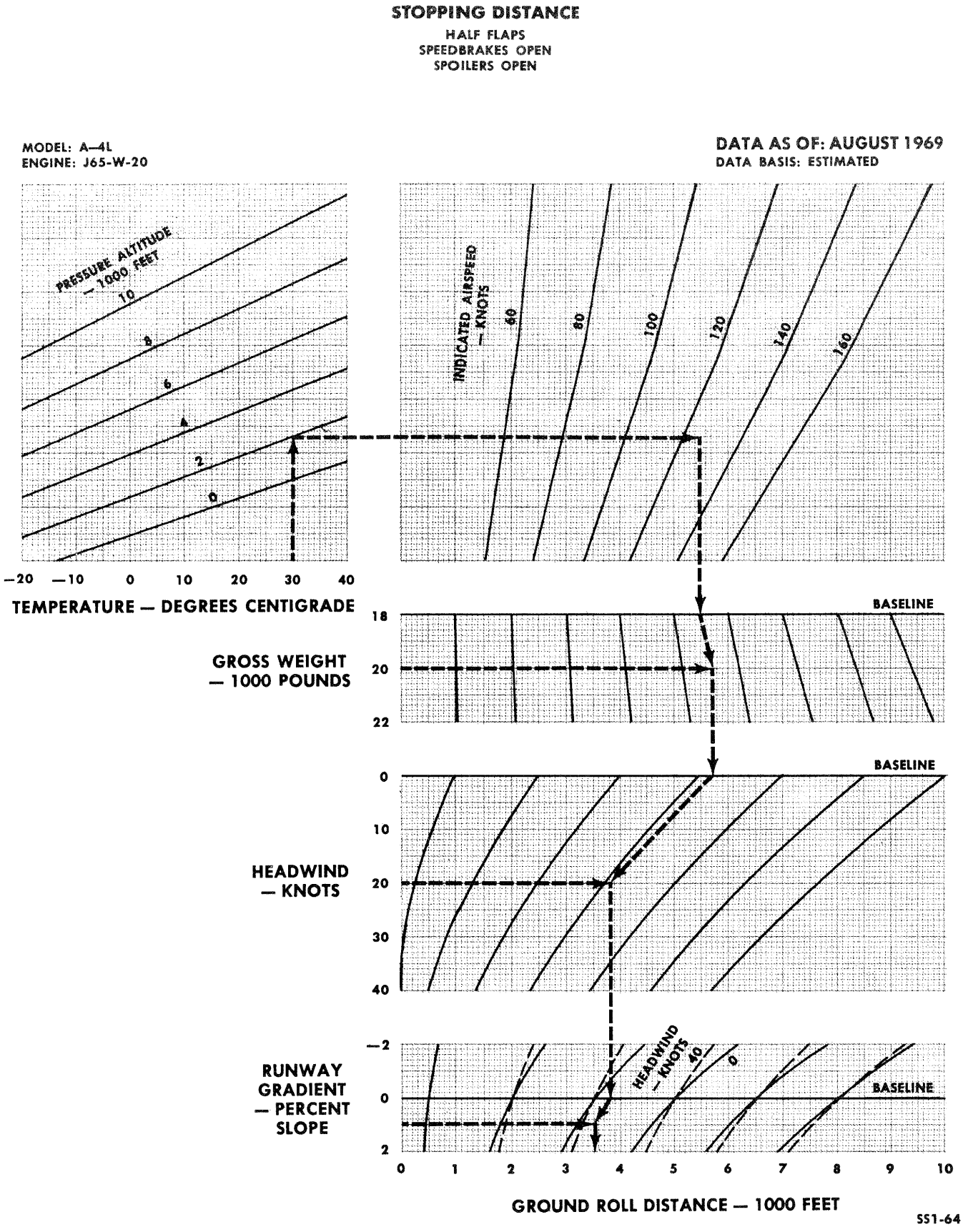


Figure 11-15. Aborted Takeoff Stopping Distance (A-4L) (Sheet 2)

PART 3

CLIMB

CLIMB

Climb charts (figures 11-16 thru 11-19) 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 method of presenting data for fuel, distance, and time charts are identical. Therefore, only one sample problem is shown. This performance data is based on the climb speeds shown in figure 11-16.

SAMPLE PROBLEM

Climb Speed Schedule

(For figure 11-16)

(A) Cruise altitude . . . . . 25,000 ft

(B) Drag index 50

NEW (C) Climb speed . . . . . 305 kts

Climb Fuel

(For figure 11-17)

(A) Initial gross weight . . . . . 16,000 lb

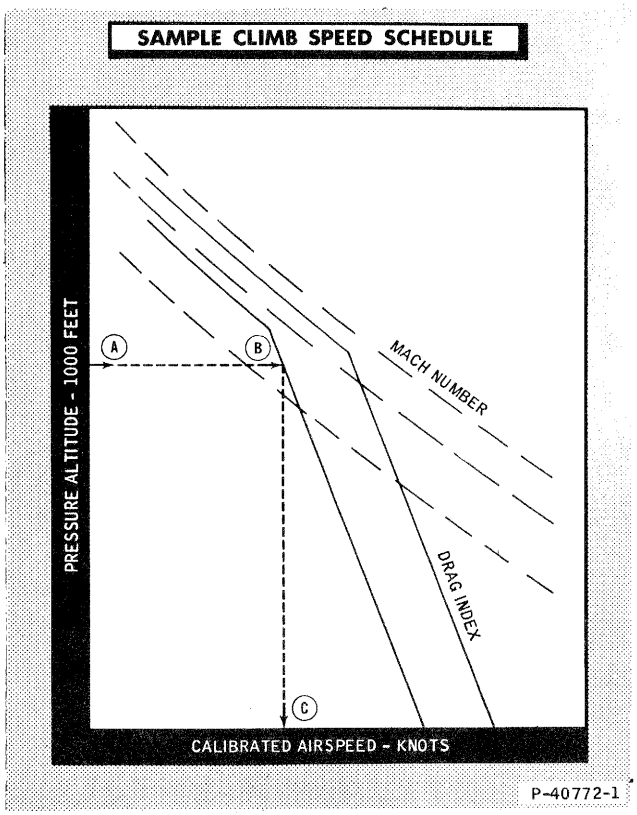
(B) Cruise altitude. . . . . 25,000 ft

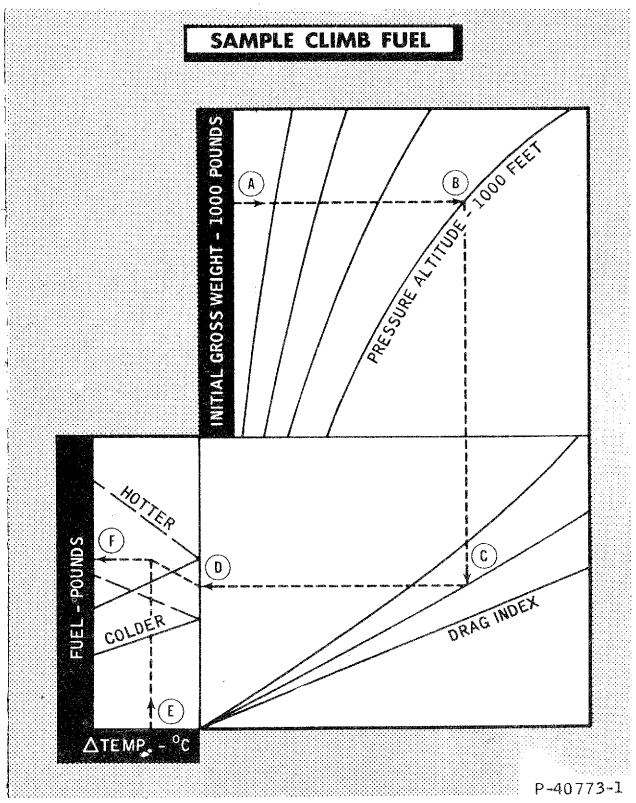
(C) Drag index 50

(D) Temperature base line

(E) Temperature deviation from ICAO standard day . . . . . 10°C

NEW (F) Fuel to climb from sea level . . . . . 580 lb





COMBAT CEILING, CRUISE CEILING, AND OPTIMUM CRUISE ALTITUDE

This chart presents the maximum altitude for practical operation, cruise ceiling, and the optimum

cruise altitude; the altitude that will produce the maximum distance per pound of fuel. At higher drag indexes the aircraft is thrust limited and can not reach optimum cruise altitude. Note that as fuel is burned off and the aircraft becomes lighter in weight the optimum cruise altitude and combat ceiling increase. The complete range of operating gross weights and drag indexes are included.

SAMPLE PROBLEM

Combat Ceiling, Cruise Ceiling and Optimum Cruise Altitude

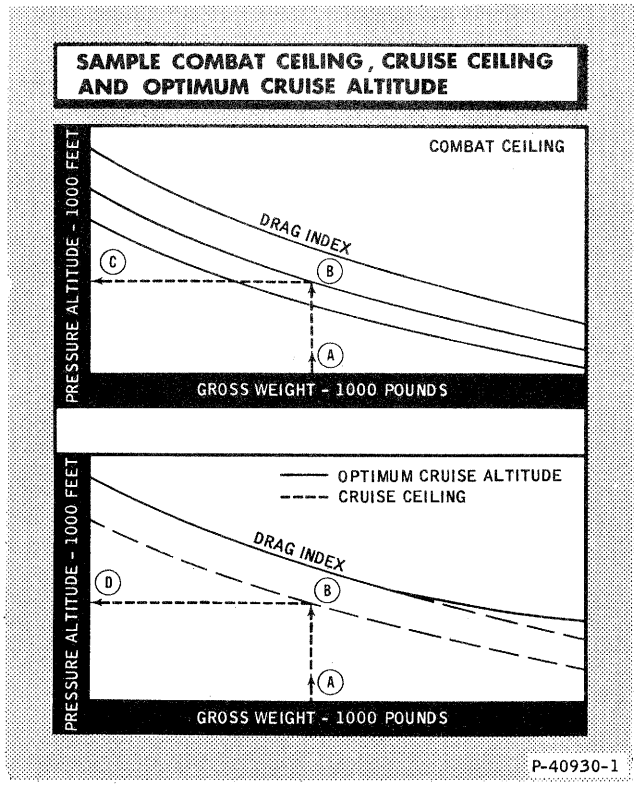
(For figure 11-20)

(A) Aircraft gross weight . . . . . 16,000 lb

(B) Drag index 50

(C) Combat ceiling . . . . . 40,400 ft

NEW (D) Optimum cruise altitude . . . . . 35,500 ft



CLIMB SPEED SCHEDULE
MILITARY THRUST

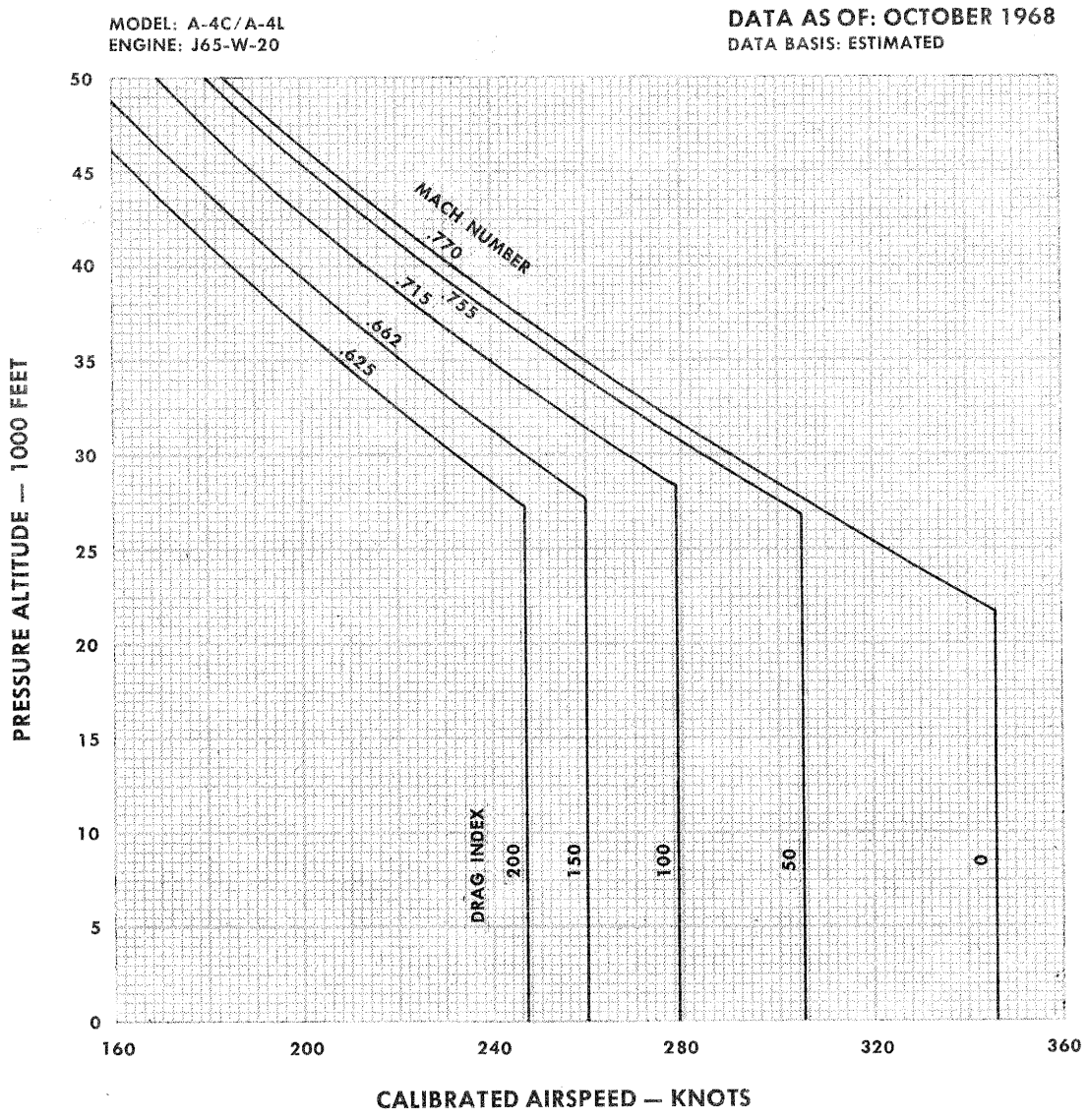
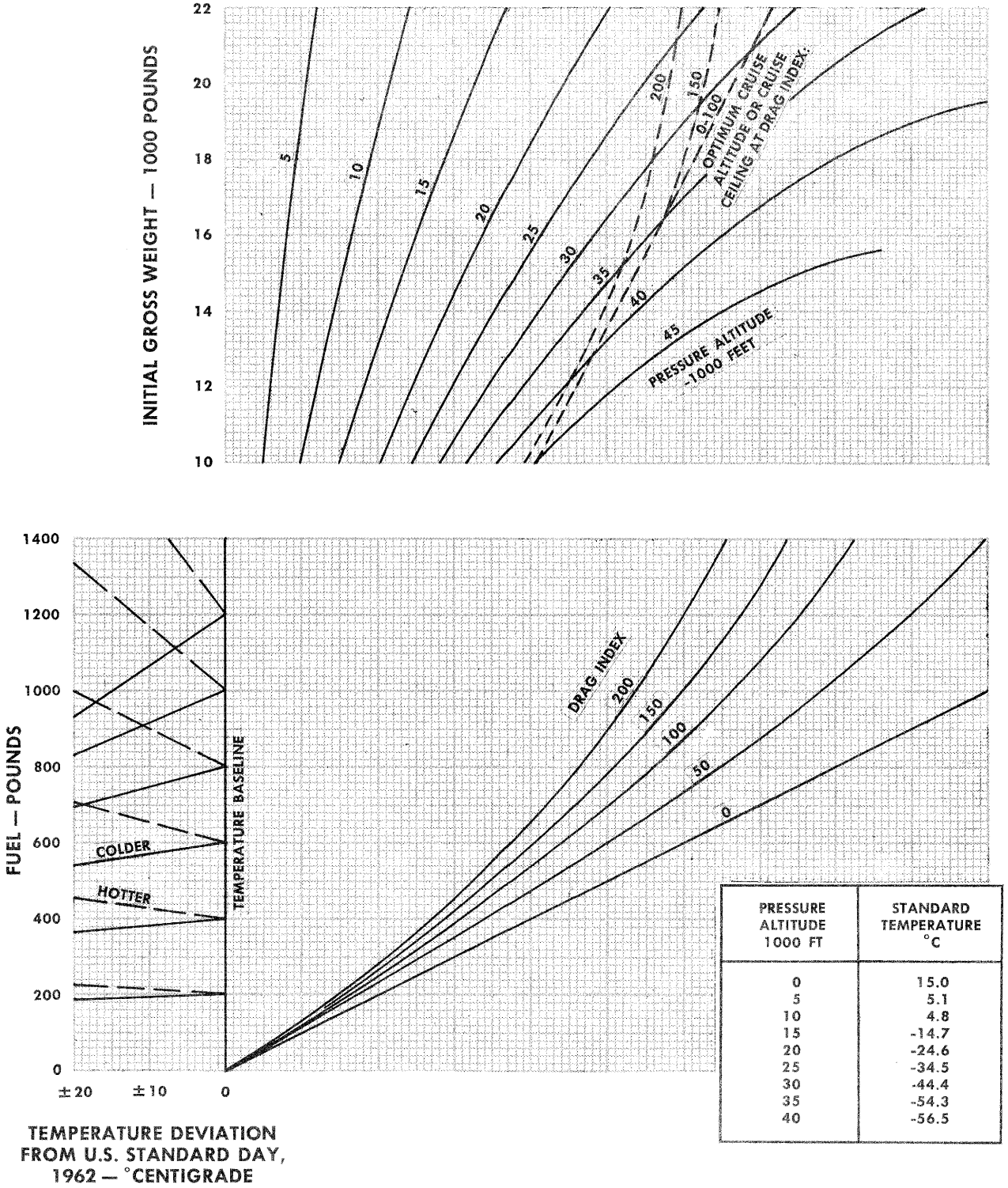


Figure 11-16. Climb Speed Schedule

CLIMB FUEL
MILITARY THRUST

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED



PRESSURE 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

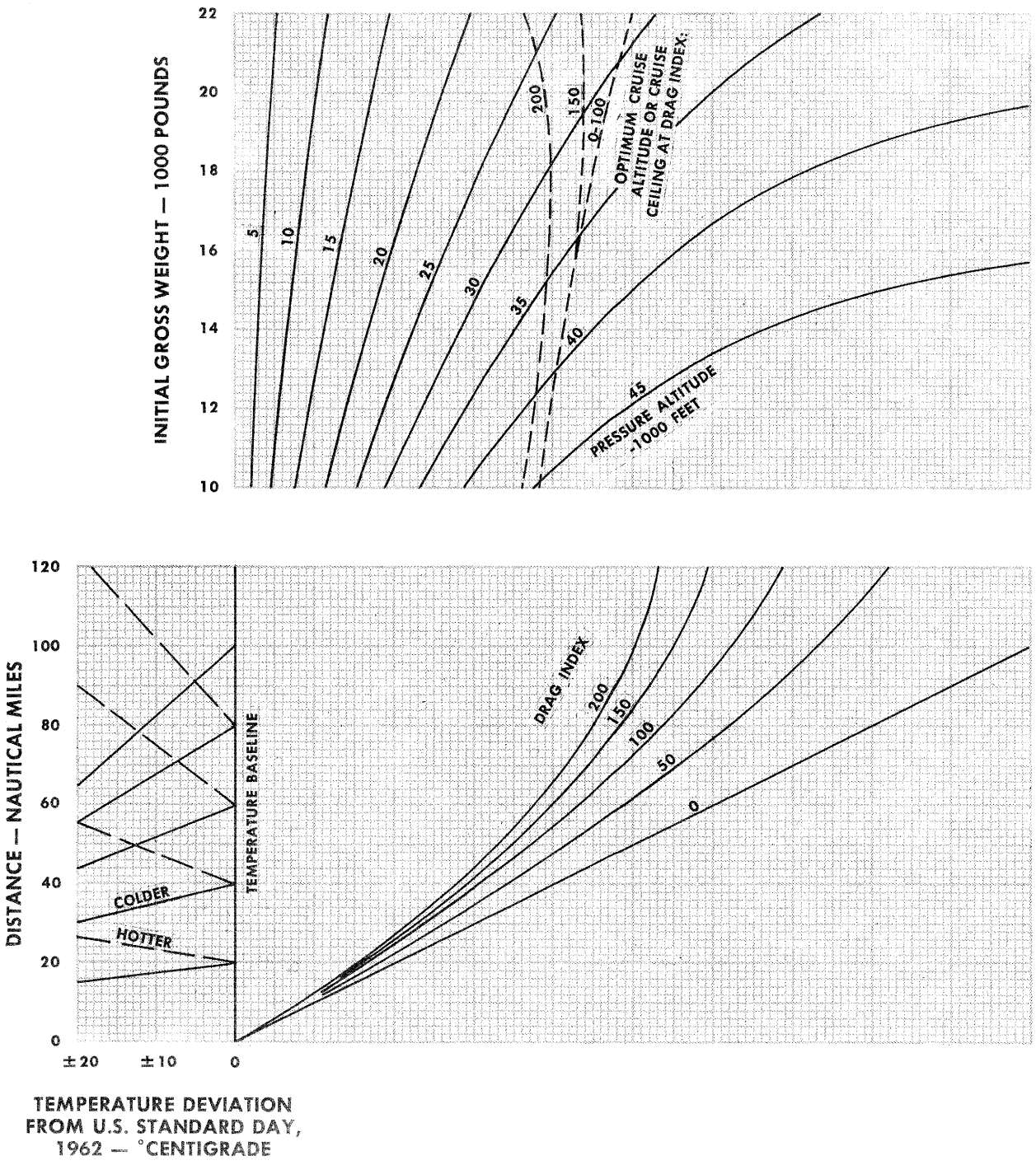
SS1-53

Figure 11-17. Climb Fuel

CLIMB DISTANCE
MILITARY THRUST

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED



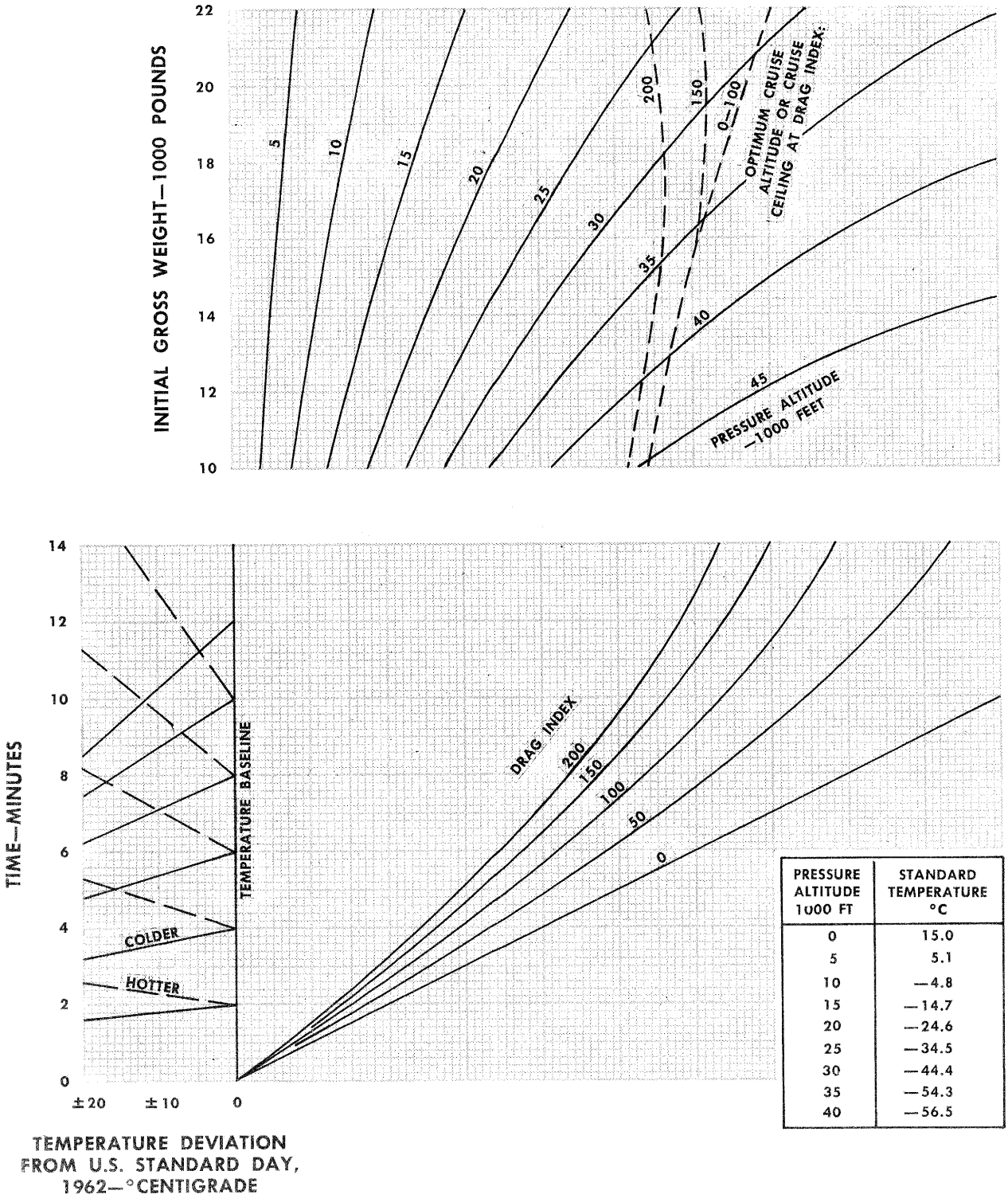
SS1-54

Figure 11-18. Climb Distance

CLIMB TIME
MILITARY THRUST

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED



PRESSURE 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

SS1-55

Figure 11-19. Climb Time

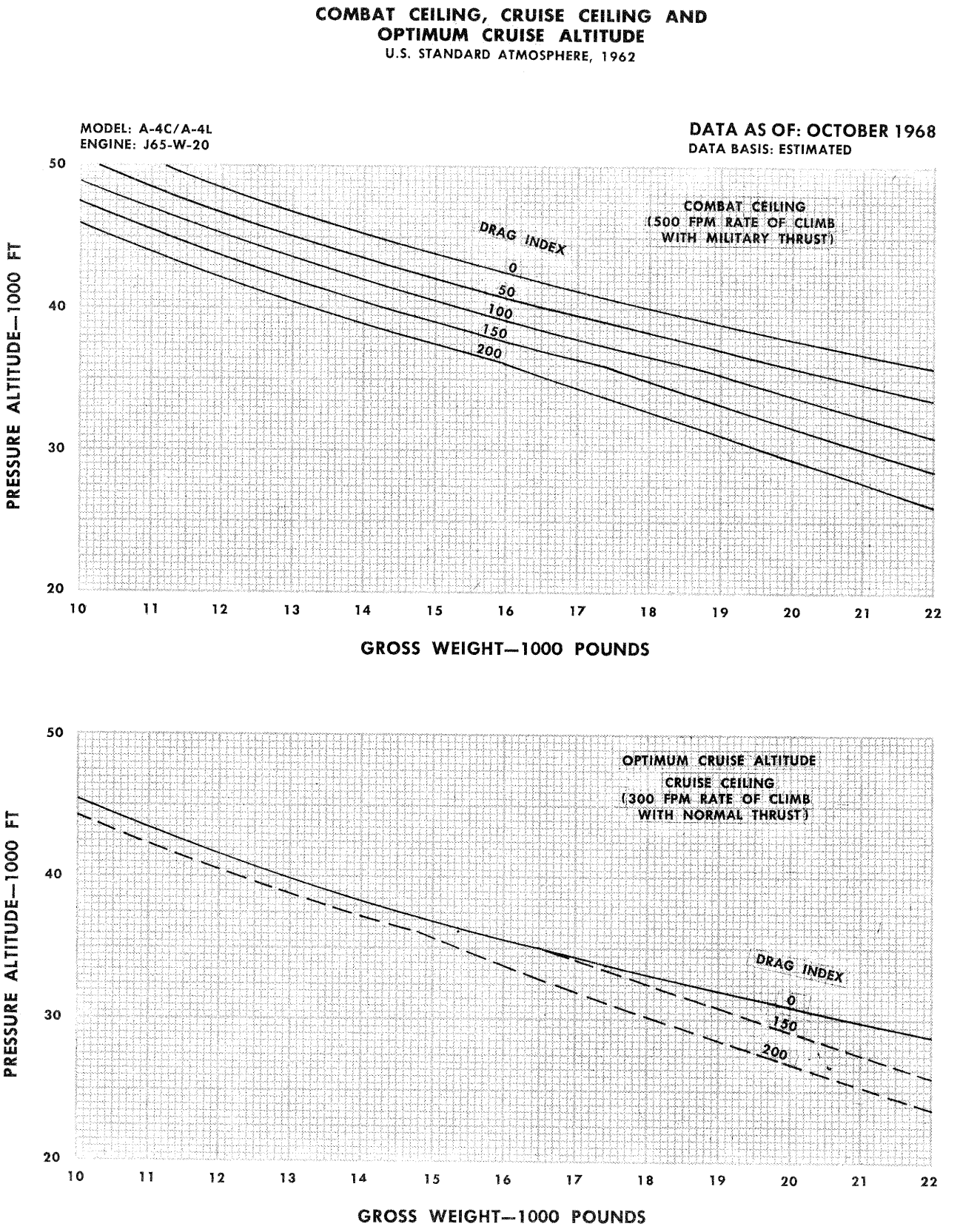


Figure 11-20. Combat Ceiling, Cruise Ceiling, and Optimum Cruise Altitude

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 windspeeds up to 120 knots from any relative wind direction for aircraft speeds of 350 to 550 knots (TAS).

Use

Determine the relative wind direction by measuring (in a clockwise direction from the fuselage reference line) the angular difference between the aircraft heading and the true wind direction. At a given wind direction, windspeed, 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 both 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 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 understands the proper procedure to obtain the maximum endurance with the available fuel. Fouled Deck Endurance chart is shown in figure 11-29.

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 for the clean configuration plus two empty wing pylons and guns. Climb speeds and airspeeds for maximum range 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 described under "If you are at" to sea level. A 250-pound allowance is included for approach and landing.

Figure 11-23, Bingo Range is provided for an aircraft configuration of guns, three pylons, and two 300-gallon external fuel tanks. The procedures for the use of this chart are identical to those for the Fouled Deck Range; however, an 800-pound fuel allowance is included in this chart for approach and landing.

LONG-RANGE CRUISE

The Long-Range Cruise chart is shown in figure 11-24. Long-range cruise is defined as the higher Mach number that will result in 99 percent of the maximum miles per pound of fuel. Optimum long-range cruise altitude is the altitude that will produce the maximum distance per pound of fuel at the long-range cruise condition. Essentially, long-range cruise permits an increase of 15 to 25 knots in airspeed for an increase of 1 percent in fuel consumption. To use this chart, average gross weight, cruise altitude, and drag index must be known for a given cruise leg. With these known conditions, long-range cruise Mach number, engine power setting in terms of percent of maximum rpm, and specific range (nautical miles/1000 pounds of fuel) can be determined.

Optimum long-range cruise altitude or cruise ceiling lines are superimposed on the pressure altitude lines. Note that at higher drag indexes the aircraft is thrust limited and cannot reach optimum long-range cruise altitude. In these cases, therefore, optimum long-range cruise altitude is limited by cruise ceiling (300 feet per minute rate of climb with normal thrust).

SAMPLE PROBLEM (For Figure 11-24)

Long-Range Cruise at Constant Altitude

(A) Average gross weight . . . . . 20,000 lb

(B) Cruise altitude . . . . . 20,000 ft

(C) Drag index 100

(C) Mach number 0.615

(D) Cruise altitude . . . . . 20,000 ft

(E) Temperature Deviation From Standard . . . . . +10°C

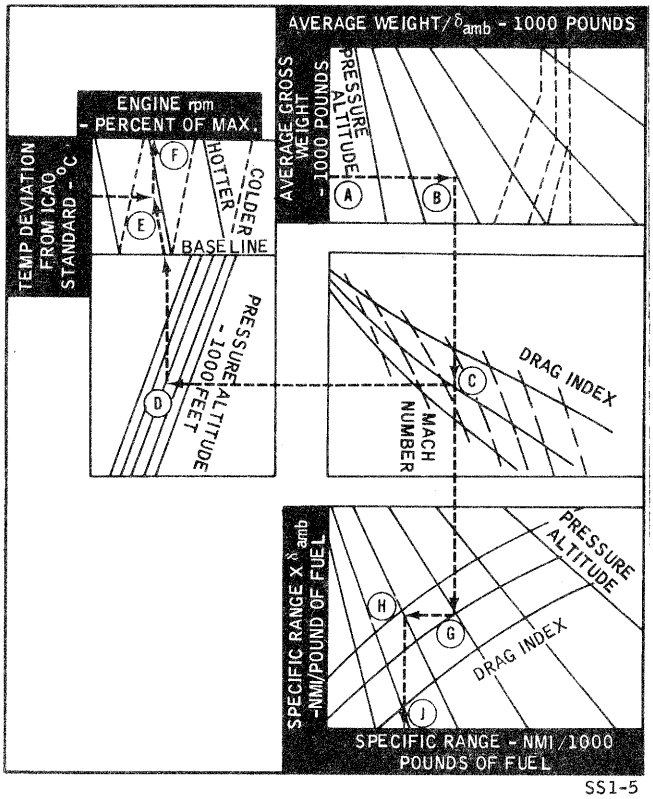
(F) Engine rpm (Percent of maximum) 93%

(G) Drag index 100

(H) Cruise altitude . . . . . 20,000 ft

(J) Specific range. . . . . 125 NMi/1000 lb of fuel

SAMPLE LONG RANGE CRUISE



SS1-5

MAXIMUM RANGE CRUISE

The Maximum Range Cruise charts present the necessary mission planning data to set up cruise schedules for a constant or optimum altitude. The average gross weight for a given cruise leg at the mission should be used. The user must know the average gross weight, drag index, cruise altitude, relative wind, and the distance to be covered. It is then possible to determine from the charts true Mach number, true airspeed, time enroute, nautical miles per pound, fuel flow, and total fuel required. Optimum cruise altitude (best range), and cruise ceiling lines are superimposed on the pressure altitude plot. The data is based on maximum range speeds.

SAMPLE PROBLEM

Maximum Range Cruise — Time and Speed

(For figure 11-25)

(A) Average gross weight for cruise leg . . . . . 18,000 lb

(B) Cruise altitude . . . . . 20,000 ft

(C) Drag index 50

(D) True Mach number 0.61

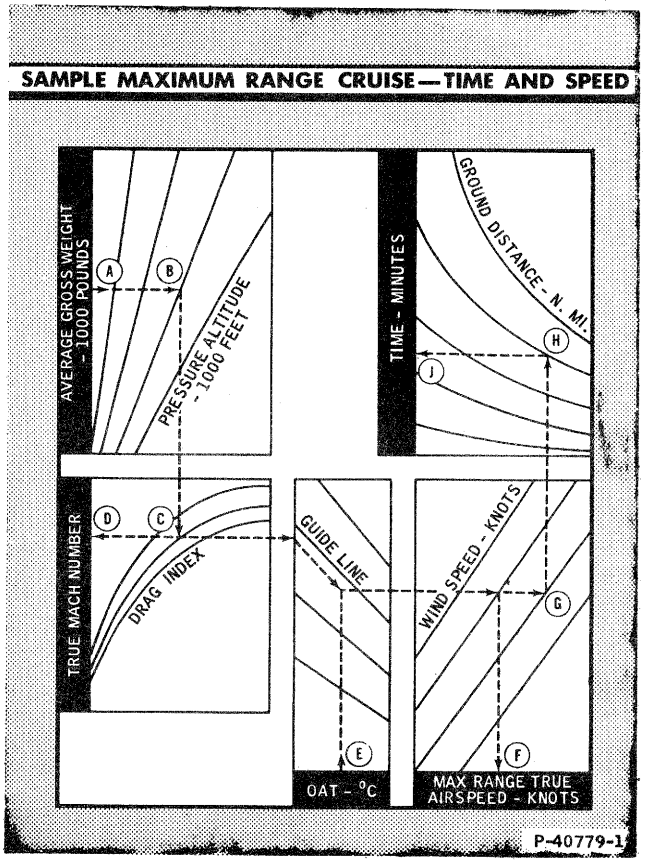
(E) OAT at cruise altitude . . . . . -25° C

(F) True airspeed . . . . . 470 kts

(G) Tailwind . . . . . 50 kts

(H) Ground distance . . . . . 164.5 NM

(J) Time . . . . . 21 min



P-40779-1

Maximum Range Cruise — Fuel

(For figure 11-26)

(K) Average gross weight for cruise leg . . . . . 18,000 lb

(L) Cruise altitude . . . . . 20,000 ft

(M) Drag index 50

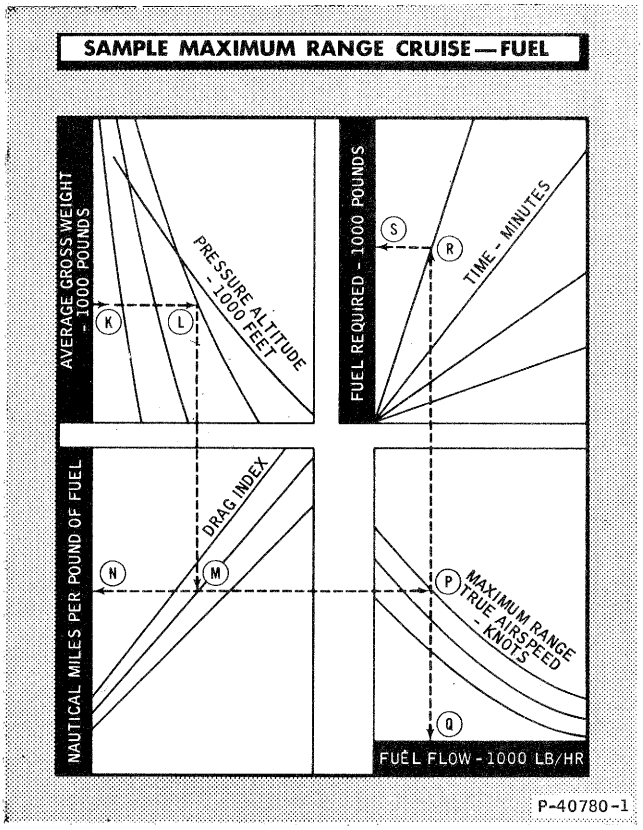
NEW (N) Specific range . . . . . 0.148 NMi lb

(P) True airspeed . . . . . 376 kts

NEW (Q) Fuel flow . . . . . 2500 lb/hr

(R) Time . . . . . 21 min

NEW (S) Total fuel required . . . . . 900 lb



NAUTICAL MILES PER POUND OF FUEL

Nautical miles per pound of fuel charts graphically present cruise data throughout the gross weight, airspeed, and drag index range of the aircraft. By entering the charts with average aircraft gross weight, the cruise altitude, and the true Mach number, it is possible to obtain true airspeed, nautical miles per pound, and referred engine RPM. It is recommended RPM 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 11-27, sheet 1)

(A) Average gross weight . . . . . 18,000 lb

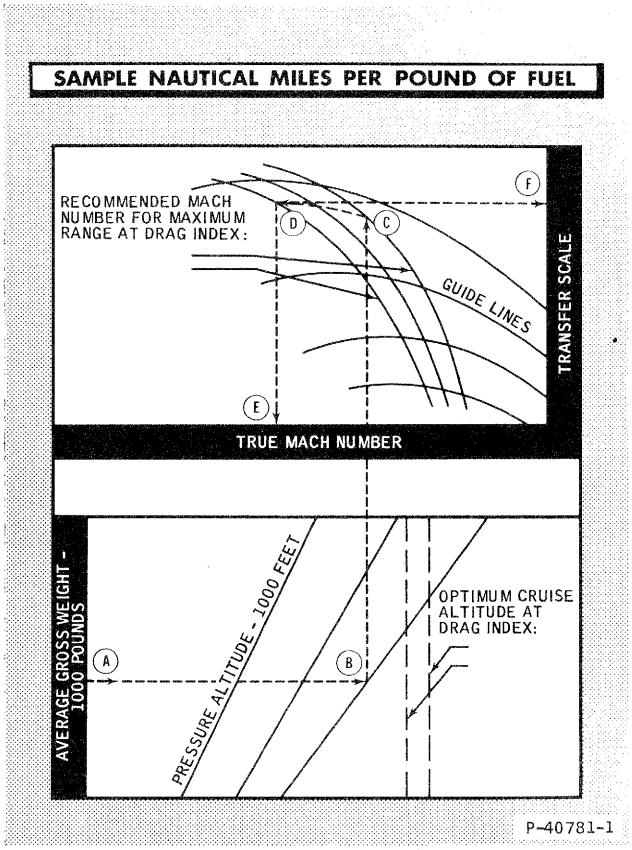
(B) Cruise altitude . . . . . 20,000 ft

(C) Drag index - 0 line

(D) Drag index 100

(E) Mach number for maximum cruise range 0.615

NEW (F) Thrust required/δ amb - clean a/c . . 3.80



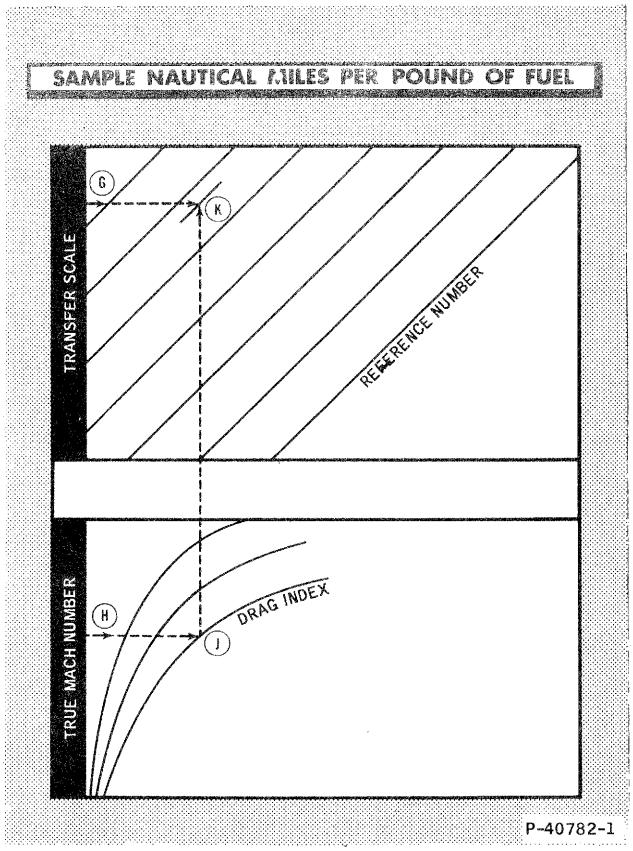
(For figure 11-27, sheet 2)

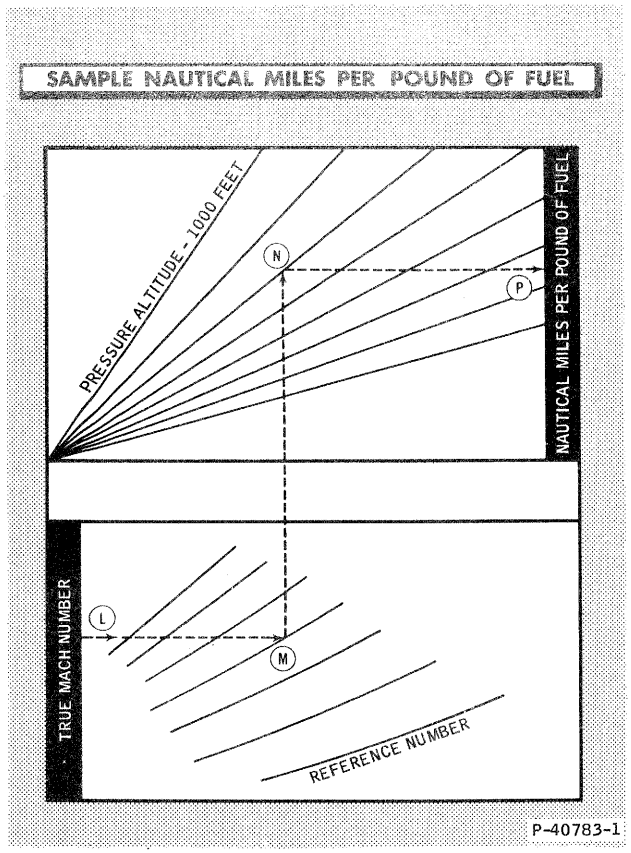
(G) Thrust required/δ amb - clean a/c . . 3.50

(H) Mach number for maximum range cruise 0.577

(J) Drag index 100

(K) Total thrust required/δ amb 4.80





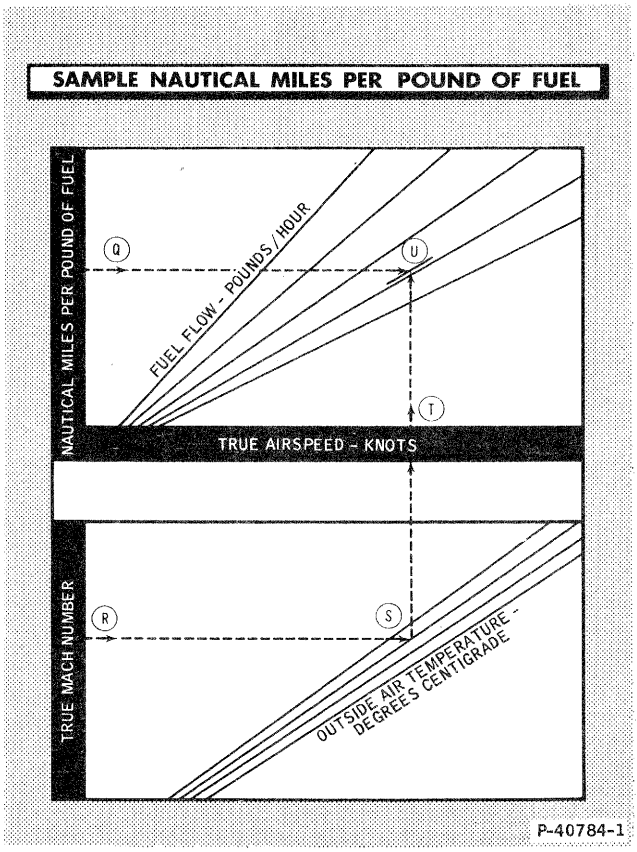
(For figure 11-27, sheet 3)

(L) Mach number for maximum range cruise 0.577

(M) Total thrust required/δ amb 4.80

(N) Cruise altitude . . . . . 20,000 ft

(P) Nautical miles per pound of fuel 0.138N.Mi/lb



(For figure 11-27, sheet 4)

(Q) Nautical miles per pound of fuel 0.138N.Mi/lb

(R) Mach number for maximum range cruise 0.59

(S) OAT at cruise altitude . . . . . -20°C

(T) True airspeed . . . . . 365 kts

(U) Fuel flow . . . . . 2600 lb/hr

(For figure 11-28)

(V) Total thrust required/δ amb 4.80

(W) Mach number for maximum range cruise 0.577

(X) Referred RPM (RPM/$\sqrt{\theta}$amb) 7900

θamb (Temperature ratio, see figure 11-3). 0.8785

$\sqrt{\theta}$amb. 0.9373

RPM. 7405

(Y) %RPM (RPH x 100/8300) 89.2%

The above example was provided for maximum range at a given altitude. In order to assist the user in a more complete understanding of how to use the chart (figure 11-27, sheet 1), an additional example for fixed Mach number cruise is provided.

(For figure 11-27, sheet 1)

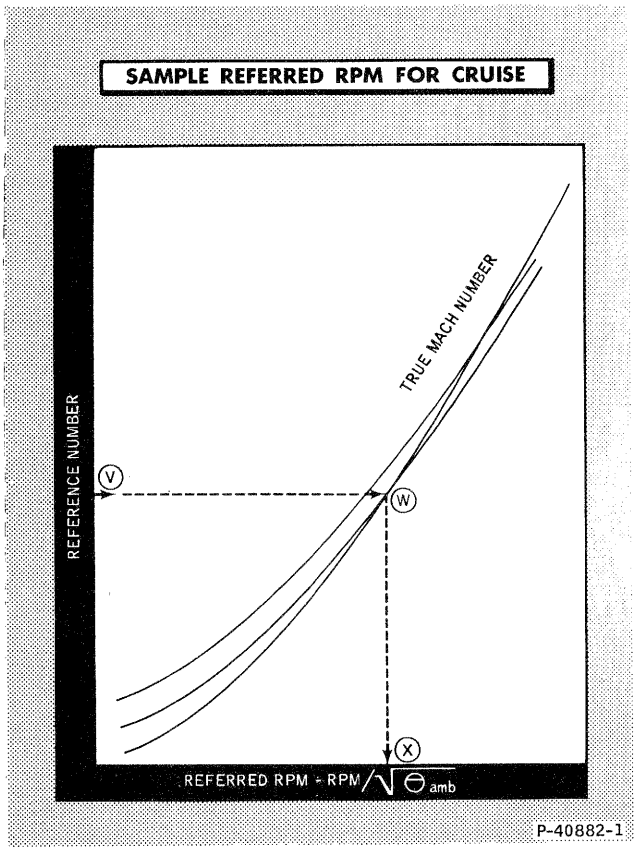
(A) Average gross weight . . . . . 16,000 lb

(B) Cruise altitude . . . . . 25,000 ft

(C) Drag index - 0 line

(X) Cruise Mach number 0.80

(Y) Thrust required/δ amb - clean a/c. 5.20



RANGE FACTOR CHART

RELATIVE WIND—DEGREES	TAS KNOTS	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

SS1-57

Figure 11-21. Range Factor Chart

FOULED DECK RANGE

Drag Index = 19
Aircraft Weight (Less Fuel)= 10, 840 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel For Landing = 250 Pounds

Model: A-4C
Engine: J65-W-20

Data as of:
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	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	210	40,000	493	220	291	40,000	526	220	396	40,000	554	220
1900	169	40,000	389	220	236	40,000	419	220	322	40,000	448	220
1700	149	40,000	335	220	208	40,000	366	220	285	40,000	394	220
1500	128	40,000	280	220	180	40,000	311	220	247	40,000	339	220
1300	108	40,000	224	215	153	40,000	254	220	210	40,000	284	220
1100	87	35,000	165	220	125	40,000	197	215	172	40,000	227	220
900	67	30,000	107	220	96	35,000	138	220	134	40,000	169	215
700	46	20,000	62	245	68	25,000	81	230	96	30,000	105	220
500	26	10,000	28	260	40	15,000	42	250	57	20,000	57	245
	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 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	512	40,000	577	220	571	40,000	585	220	593	40,000	593	220
1900	417	40,000	471	220	463	40,000	480	220	488	40,000	488	220
1700	369	40,000	417	220	410	40,000	425	220	434	40,000	434	220
1500	321	40,000	362	220	357	40,000	371	220	379	40,000	379	220
1300	272	40,000	306	220	304	40,000	315	220	323	40,000	323	220
1100	223	40,000	250	220	250	40,000	258	220	266	40,000	266	220
900	173	40,000	192	215	195	40,000	200	215	208	40,000	208	220
700	123	35,000	131	220	139	40,000	142	215	150	40,000	150	215
500	—	—	—	—	—	—	—	—	—	—	—	—

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle - Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	330		185	250
10,000	330		185	340
20,000	330		185	410
30,000		0.77	185	530
35,000		0.77	185	590
40,000		0.77	185	640

Figure 11-22. Fouled Deck Range (Sheet 1)

FOULED DECK RANGE

Drag Index = 27
Aircraft Weight (Less Fuel) = 11,745 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel for Landing = 250 Pounds

Model: A-4L
Engine: J65-W-20

Data as of: September 1969
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	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	203	40,000	446	220	280	40,000	474	225	377	40,000	502	225
1900	163	40,000	350	220	228	40,000	379	220	307	40,000	407	220
1700	144	40,000	302	220	201	40,000	330	220	272	40,000	358	220
1500	124	40,000	252	220	174	40,000	280	220	236	40,000	308	220
1300	104	40,000	202	220	147	40,000	230	220	200	40,000	258	220
1100	85	35,000	149	220	121	40,000	179	220	164	40,000	207	220
900	65	25,000	97	230	94	30,000	124	225	128	40,000	156	220
700	45	20,000	58	245	66	25,000	78	230	92	30,000	102	225
500	25	10,000	27	260	39	15,000	40	250	56	20,000	56	245
	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 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2300	484	40,000	525	225	526	40,000	535	225	542	40,000	542	225
1900	395	40,000	430	225	430	40,000	439	225	447	40,000	447	225
1700	351	40,000	381	220	382	40,000	390	220	398	40,000	398	225
1500	306	40,000	331	220	334	40,000	340	220	349	40,000	349	220
1300	260	40,000	281	220	285	40,000	290	220	299	40,000	299	220
1100	214	40,000	230	220	235	40,000	240	220	248	40,000	248	220
900	168	40,000	179	220	185	40,000	188	220	197	40,000	197	220
700	121	35,000	126	220	134	40,000	135	220	144	40,000	144	220
500	74	30,000	74	225	--	40,000	--	--	--	--	--	--

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	320	--	190	250
10,000	320	--	190	335
20,000	320	--	190	400
30,000	--	0.77	190	495
35,000	--	0.79	190	545
40,000	--	0.79	190	590

Figure 11-22. Fouled Deck Range (Sheet 2)

BINGO RANGE

Drag Index = 46
Aircraft Weight (Less Fuel) = 11,254 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4C
Engine: J65-W-20

Data as of:
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	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	181	40,000	387	220	250	40,000	438	220	337	40,000	468	220
2500	163	40,000	341	220	224	40,000	389	220	303	40,000	418	220
2300	144	40,000	295	220	199	40,000	339	220	269	40,000	369	220
2100	125	40,000	248	220	173	40,000	288	220	235	40,000	318	220
1900	106	40,000	200	220	147	40,000	236	220	201	40,000	266	220
1700	86	40,000	152	220	121	40,000	184	220	166	40,000	214	220
1500	67	30,000	101	225	95	35,000	132	220	132	40,000	161	220
1300	48	15,000	63	245	69	25,000	82	230	97	35,000	108	220
1100	29	5,000	32	270	43	15,000	48	245	62	20,000	62	240
	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 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	428	40,000	493	220	497	40,000	503	220	512	40,000	512	220
2500	385	40,000	443	220	448	40,000	454	220	463	40,000	463	220
2300	343	40,000	395	220	398	40,000	404	220	413	40,000	413	220
2100	300	40,000	344	220	348	40,000	353	220	363	40,000	363	220
1900	257	40,000	292	220	298	40,000	302	220	319	40,000	319	220
1700	213	40,000	240	220	247	40,000	250	220	265	40,000	265	220
1500	169	40,000	187	220	195	40,000	197	220	206	40,000	206	220
1300	124	35,000	134	220	143	35,000	143	220	152	40,000	152	220
1100	79	30,000	79	225	90	35,000	90	220	—	—	—	—

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle - Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	310		185	800
10,000	310		185	885
20,000	310		185	945
30,000		0.76	185	1040
35,000		0.76	185	1080
40,000		0.76	185	1120

Figure 11-23. Bingo Range Chart (Sheet 1)

BINGO RANGE

Drag Index = 54
Aircraft Weight (Less Fuel) = 12,159 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance for Landing = 800 Pounds

Model: A-4L
Engine: J65-W-20

Data as of: September 1969
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET				IF YOU ARE 20,000 FEET			
	Range At Sea Level	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 20,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	176	40,000	355	220	242	40,000	384	220	323	40,000	408	225
2500	158	40,000	314	220	217	40,000	342	220	291	40,000	367	220
2300	139	40,000	272	220	193	40,000	300	220	259	40,000	325	220
2100	121	40,000	229	220	168	40,000	257	220	226	40,000	283	220
1900	102	40,000	185	220	142	40,000	214	220	194	40,000	240	220
1700	84	35,000	140	225	119	40,000	169	220	161	40,000	196	220
1500	65	30,000	97	230	94	35,000	124	225	128	40,000	151	220
1300	47	20,000	60	240	69	25,000	80	235	95	30,000	104	230
1100	28	10,000	31	255	44	15,000	45	245	62	25,000	62	235
	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 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 35,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 40,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	406	40,000	432	225	431	40,000	441	225	448	40,000	448	225
2500	366	40,000	391	225	391	40,000	399	225	406	40,000	406	225
2300	327	40,000	349	220	350	40,000	357	220	365	40,000	365	225
2100	287	40,000	306	220	308	40,000	314	220	322	40,000	322	220
1900	247	40,000	262	220	266	40,000	271	220	279	40,000	279	220
1700	206	40,000	218	220	223	40,000	227	220	235	40,000	235	220
1500	165	40,000	174	220	180	40,000	183	220	191	40,000	191	220
1300	123	40,000	129	220	136	40,000	137	220	146	40,000	146	220
1100	82	30,000	82	230	91	35,000	91	225	100	40,000	100	220

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	300	--	190	800
10,000	300	--	190	880
20,000	300	--	190	940
30,000	--	0.75	190	1015
35,000	--	0.75	190	1055
40,000	--	0.77	190	1090

Figure 11-23. Bingo Range Chart (Sheet 2)

BINGO RANGE

Gear Down

Drag Index = 376
Aircraft Weight (Less Fuel) = 11,254 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4C
Engine: J65-W-20

Data as of:
Data Basis: Estimated

FUEL On BOARD - POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 5,000 FEET			
	Range at Sea Level	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 5,000 Ft	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	116	35,000	184	190	135	35,000	193	190
2500	104	35,000	162	190	121	35,000	171	190
2300	92	35,000	139	190	107	35,000	148	190
2100	80	35,000	116	190	94	35,000	125	190
1900	67	30,000	93	185	80	30,000	102	185
1700	55	25,000	71	180	66	30,000	79	185
1500	43	15,000	51	195	52	20,000	58	185
1300	31	5,000	33	205	38	15,000	39	195
1100	19	5,000	19	205	23	5,000	23	205
	IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 15,000 FEET			
	Range at 10,000 Ft	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 15,000 Ft	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	154	35,000	203	190	175	35,000	211	190
2500	138	35,000	180	190	158	35,000	189	190
2300	123	35,000	157	190	140	35,000	166	190
2100	107	35,000	134	190	122	35,000	143	190
1900	91	35,000	112	190	105	35,000	120	190
1700	75	30,000	88	185	87	35,000	96	185
1500	59	30,000	66	185	69	30,000	74	185
1300	43	20,000	45	185	51	25,000	51	180
1100	27	15,000	27	195	32	15,000	32	195

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle Speedbrakes Closed	Start Letdown from Altitude with Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	220		155	890
5,000	220		155	835
10,000	220		155	860
15,000	220		155	880
20,000	220		155	900
25,000		0.50	155	925
30,000		0.50	155	950
35,000		0.50	155	970

Figure 11-23. Bingo Range Chart (Sheet 3)

BINGO RANGE
Gear Down

Drag Index = 384
Aircraft Weight (Less Fuel) = 12,159 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4L
Engine: J65-W-20

Data as of: September 1969
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 5,000 FEET			
	Range At Sea Level	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 5,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	113	35,000	174	190	131	35,000	181	191
2500	101	35,000	154	190	118	30,000	171	190
2300	89	35,000	132	190	105	30,000	141	190
2100	78	30,000	112	190	91	30,000	120	190
1900	66	30,000	91	190	78	30,000	100	190
1700	54	25,000	70	190	64	30,000	79	190
1500	42	20,000	51	190	51	20,000	59	190
1300	30	15,000	34	200	37	15,000	40	200
1100	18	5,000	19	210	23	10,000	24	210

FUEL ON BOARD – POUNDS	IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 15,000 FEET			
	Range At 10,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude	Range At 15,000 Ft	Optimum Altitude	Range At Optimum Altitude	KCAS At Optimum Altitude
	Nmi	Feet	Nmi	Knots	Nmi	Feet	Nmi	Knots
2700	151	35,000	192	190	171	35,000	200	190
2500	136	35,000	172	190	154	35,000	179	190
2300	121	35,000	150	190	137	35,000	158	190
2100	106	35,000	129	190	120	35,000	137	190
1900	90	30,000	108	190	103	30,000	116	190
1700	75	30,000	87	190	86	30,000	95	190
1500	60	25,000	66	190	69	30,000	74	190
1300	44	20,000	46	190	52	25,000	53	190
1100	29	15,000	29	200	34	15,000	34	200

Pressure Altitude	Climb Speed Military Thrust	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	KCAS	Pounds
Sea Level	220	160	800
5,000	220	160	835
10,000	220	160	860
15,000	220	160	880
20,000	220	160	905
25,000	205	160	925
30,000	180	160	945
35,000	160	160	970

Figure 11-23. Bingo Range Chart (Sheet 4)

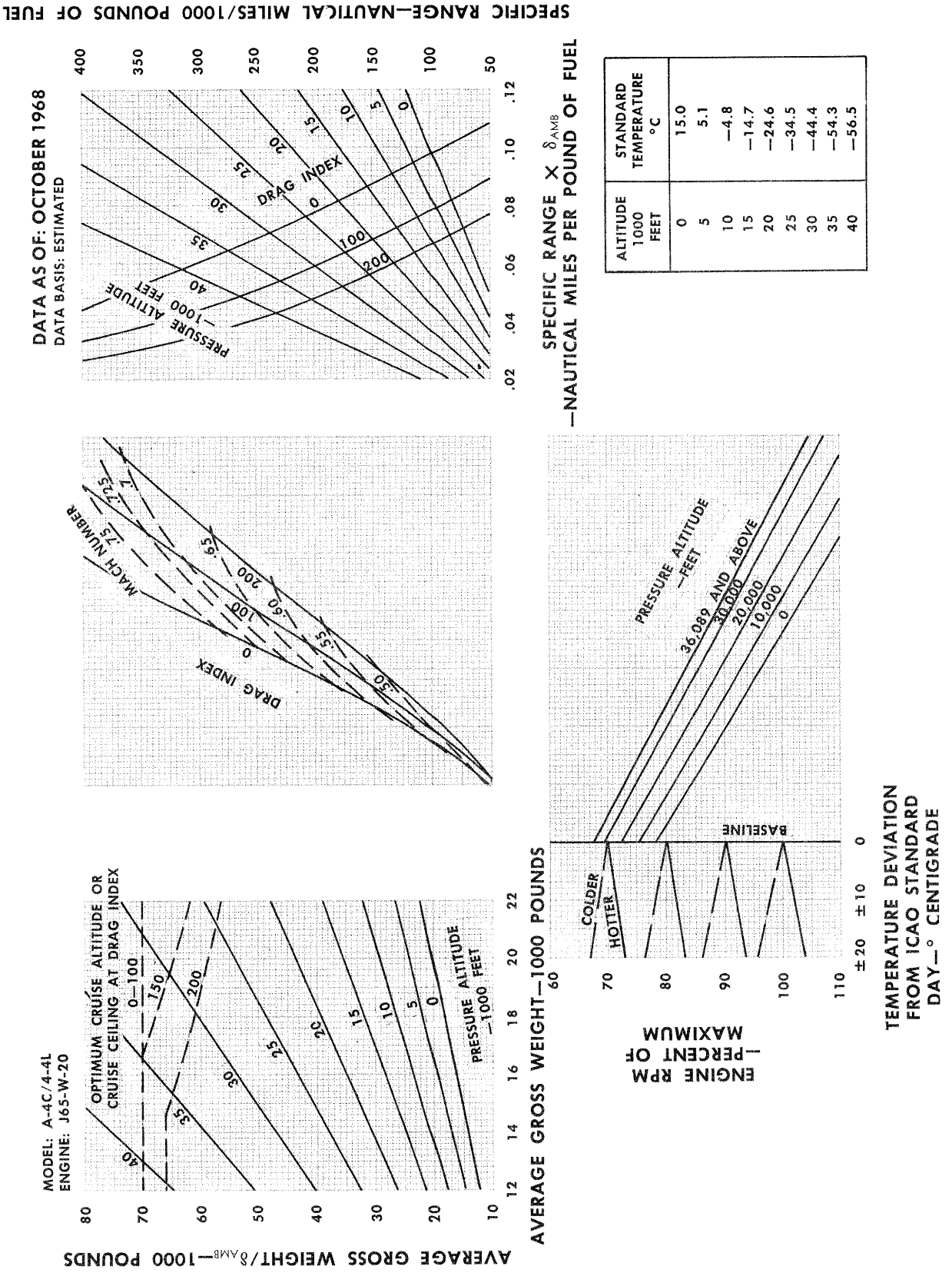


Figure 11-24. Long Range Cruise

MAXIMUM RANGE CRUISE
TIME AND SPEED

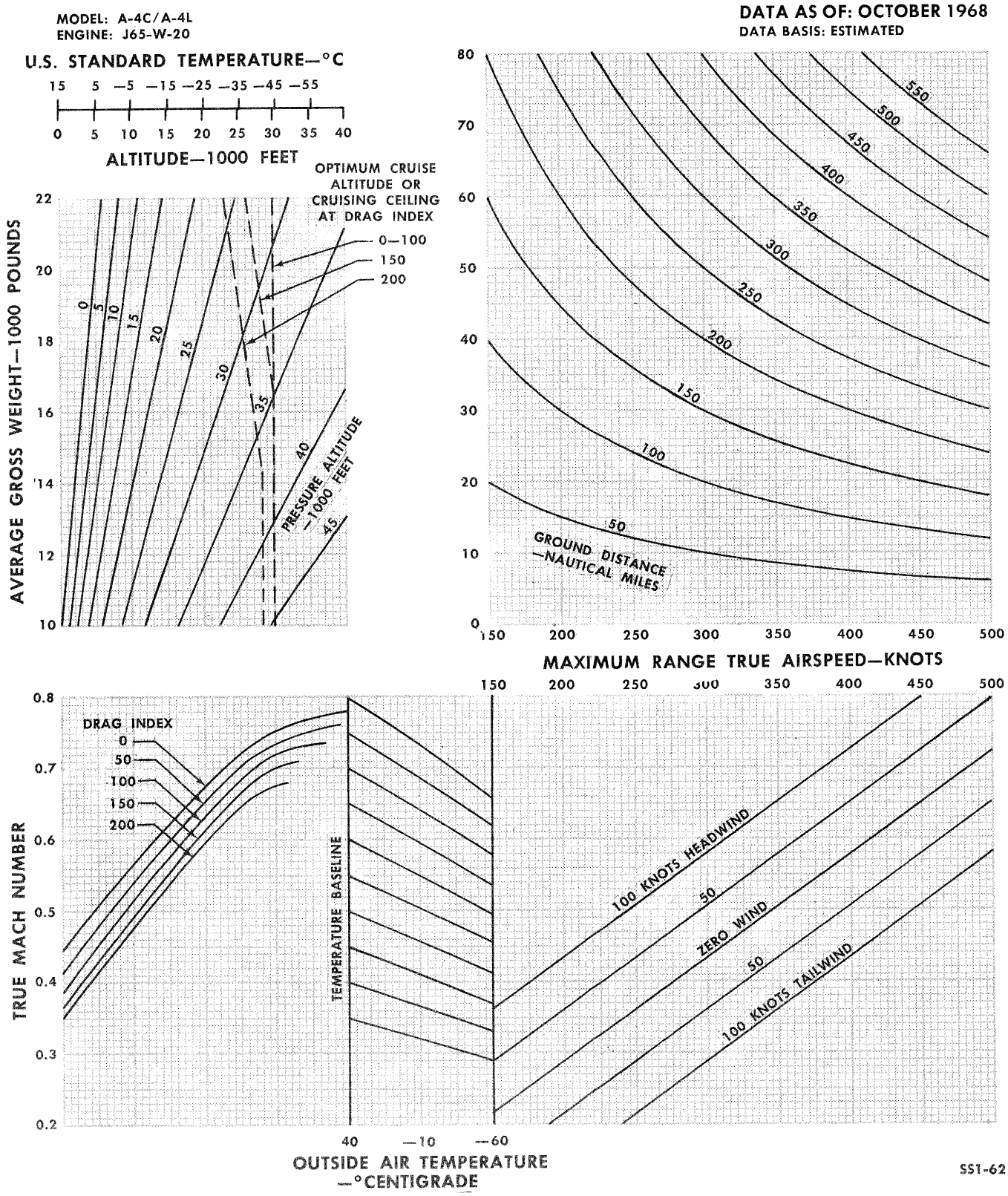


Figure 11-25. Maximum Range Cruise – Time and Speed

MAXIMUM RANGE CRUISE
FUEL

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED

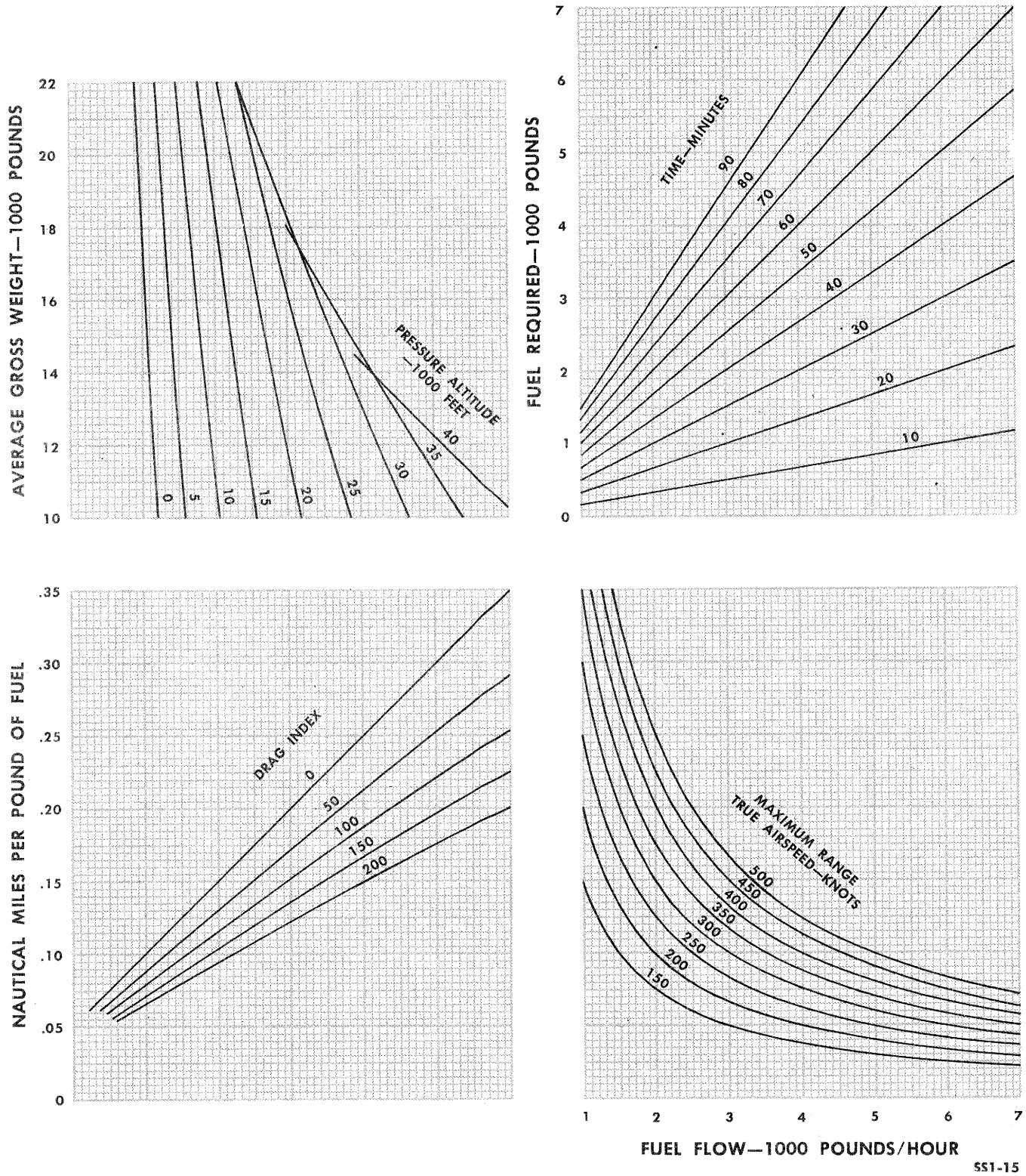
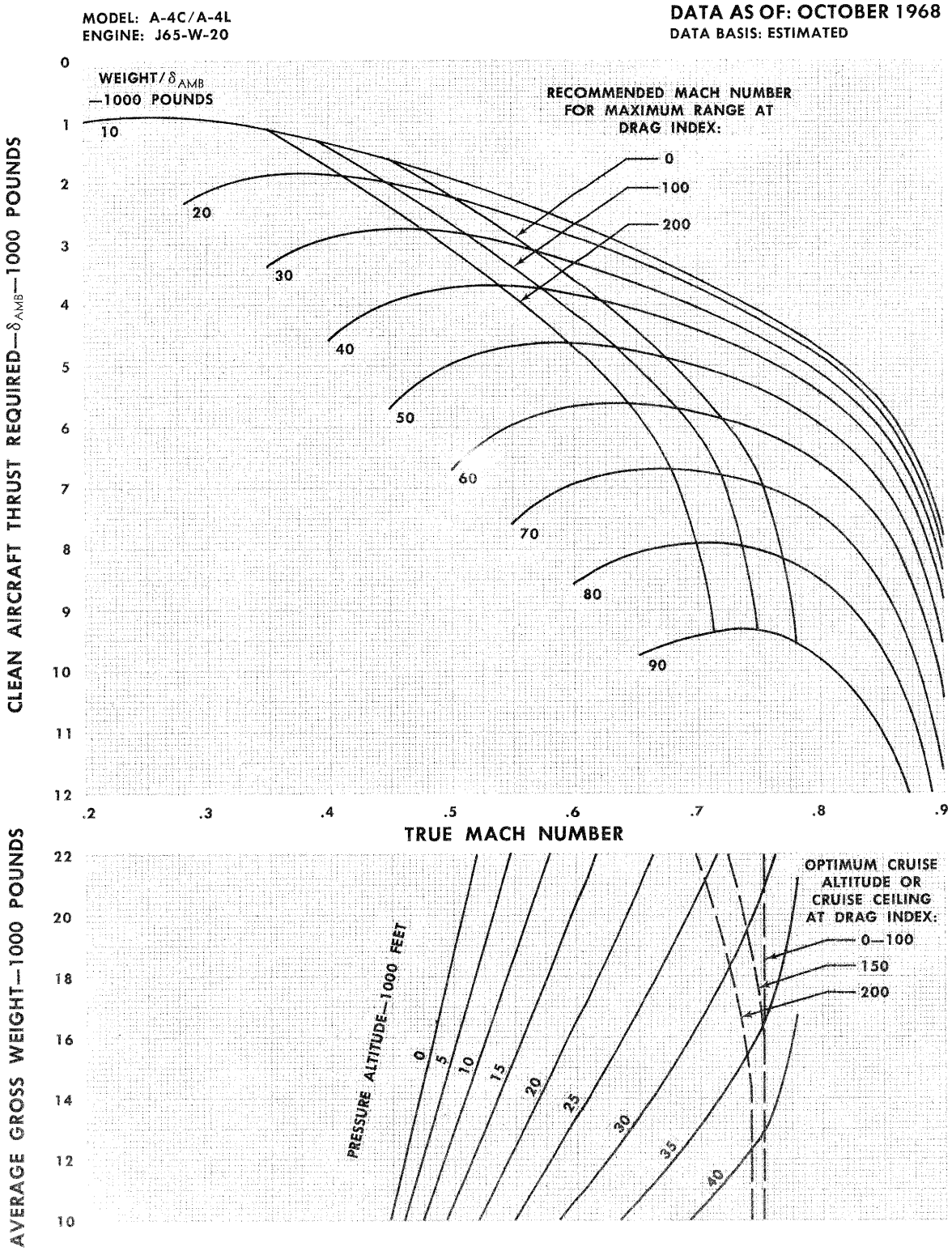


Figure 11-26. Maximum Range Cruise – Fuel

NAUTICAL MILES PER POUND OF FUEL



SS1-20

Figure 11-27. Nautical Miles Per Pound of Fuel (Sheet 1)

NAUTICAL MILES PER POUND OF FUEL

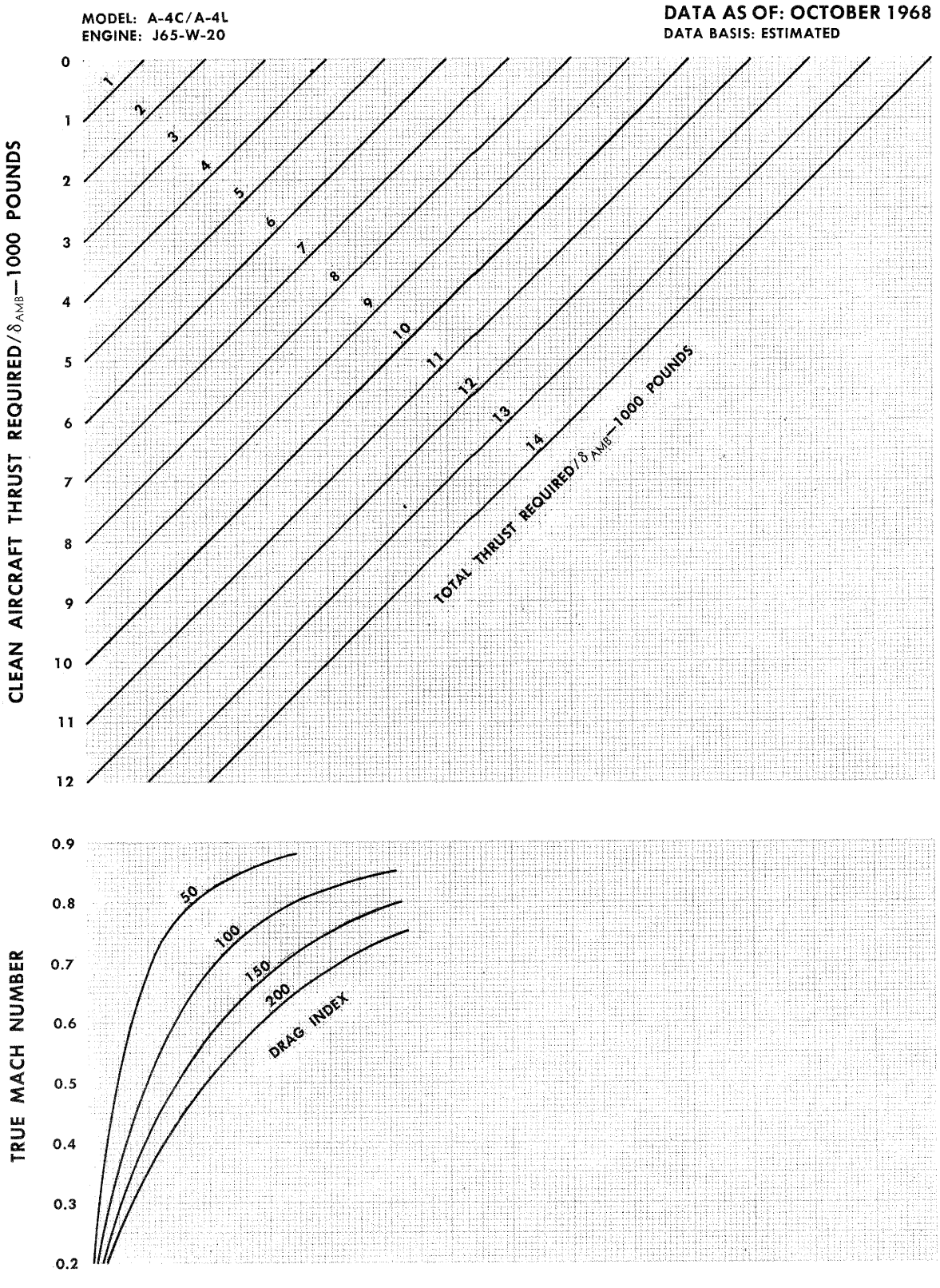


Figure 11-27. Nautical Miles Per Pound of Fuel (Sheet 2)

NAUTICAL MILES PER POUND OF FUEL

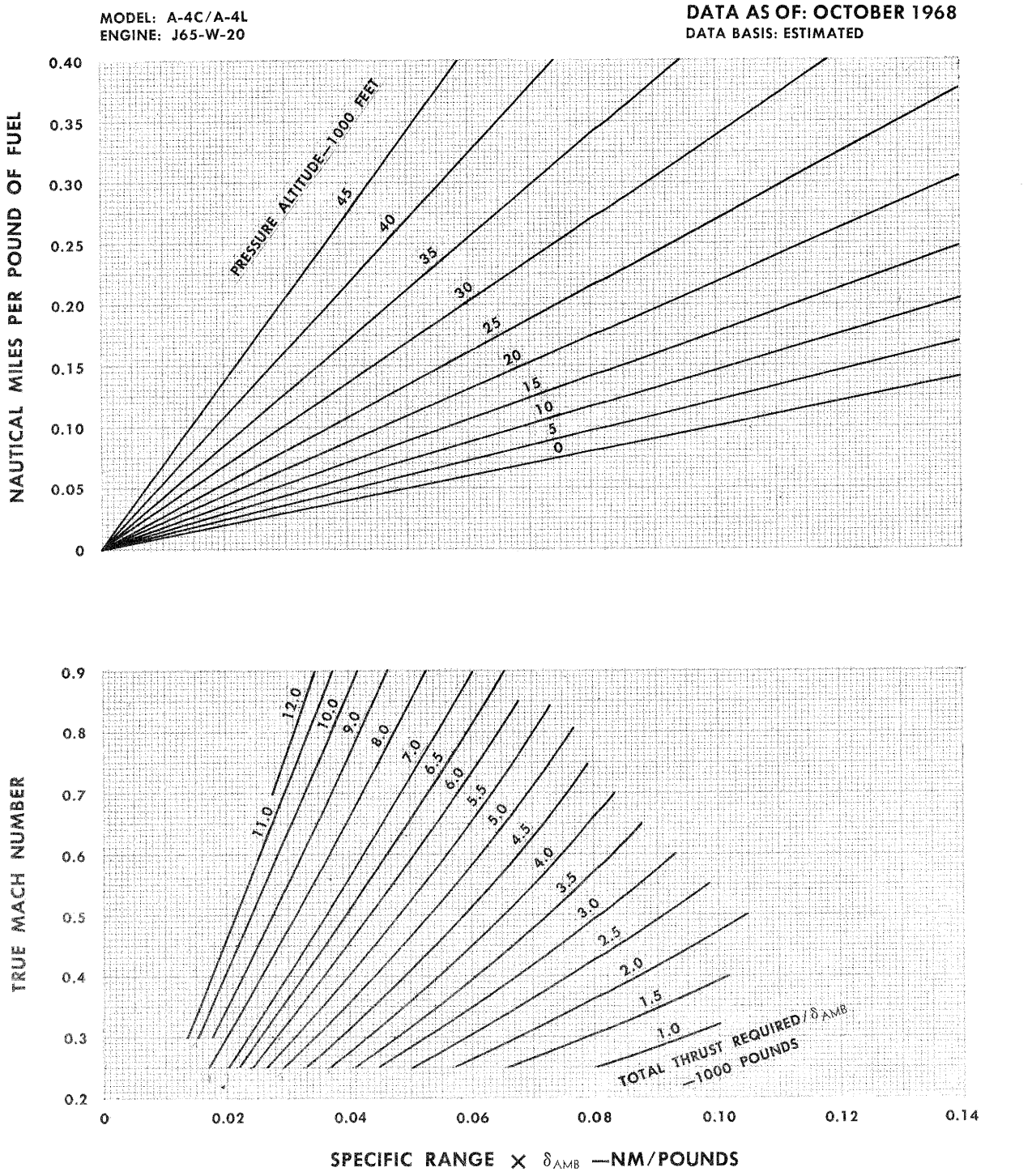
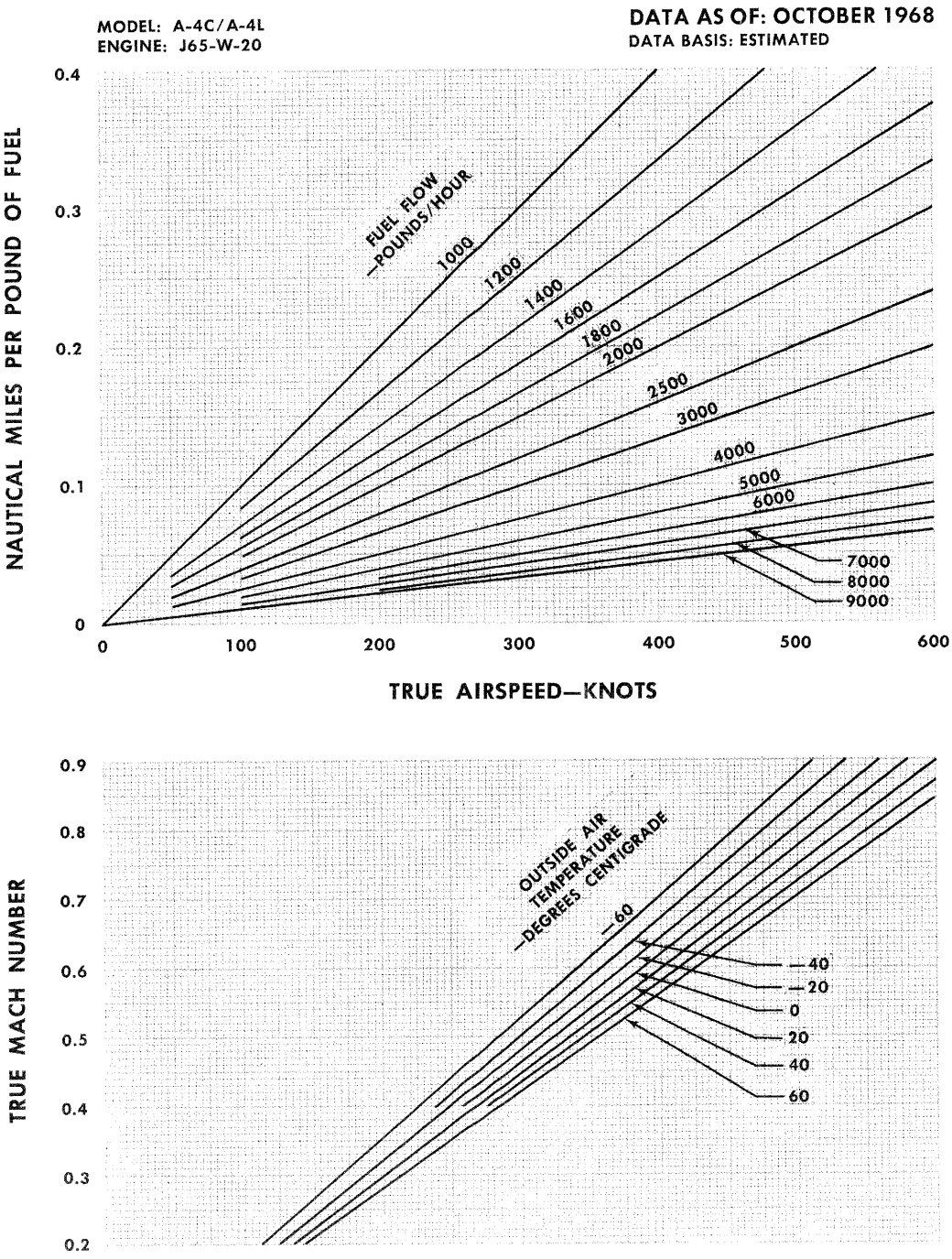


Figure 11-27. Nautical Miles Per Pound of Fuel (Sheet 3)

NAUTICAL MILES PER POUND OF FUEL



SS1-23

Figure 11-27. Nautical Miles Per Pound of Fuel (Sheet 4)

REFERRED RPM FOR CRUISE

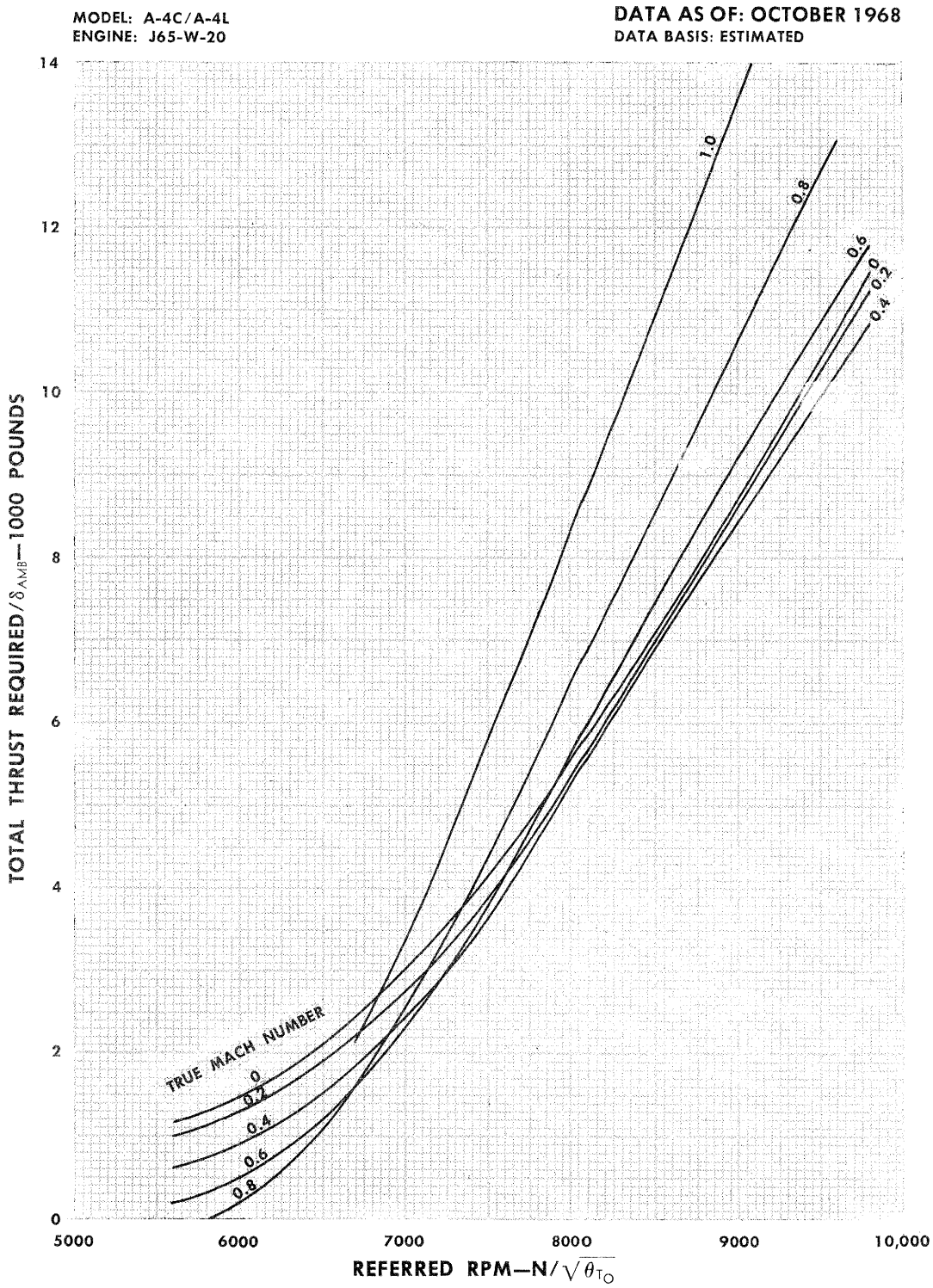


Figure 11-28. Referred RPM for Cruise

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 both the pilots and the air officer to be aware of the endurance 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 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 11-29) tabulates the endurance times for various quantities of fuel on board at both the initial altitude and the optimum altitude for an aircraft configured with three pylons and guns. The endurance values are given in minutes and for the optimum altitudes, include the time required for a military 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 naturally include only the descent time as no climb is required. Climbing airspeeds and recommended airspeeds for maximum endurance are included on the chart together with descent instructions. The time at which the descent should be started is given in terms of fuel on board, which includes the 250 pounds necessary for landing. Figure 11-30, Bingo Endurance is provided for an aircraft configuration of guns, three pylons, and two 300-gallon external fuel tanks. The procedures for the use of the chart are identical to those for the Fouled Deck Endurance; however, an 800-pound fuel allowance is included in this chart for approach and landing.

MAXIMUM ENDURANCE

The endurance chart provides a means of determining the optimum endurance Mach number and the fuel required to loiter at a given altitude for a specified length of time. The optimum Mach number is shown as a function of average gross weight, bank angle, pressure altitude, and drag index. Fuel required is presented as a function of average gross weight, bank angle, pressure altitude, loiter time, and drag index.

SAMPLE PROBLEM

Maximum Endurance Speed

(For figure 11-31)

(A) Average gross weight . . . . . 17,000 lb

(B) Bank angle . . . . . 15 deg

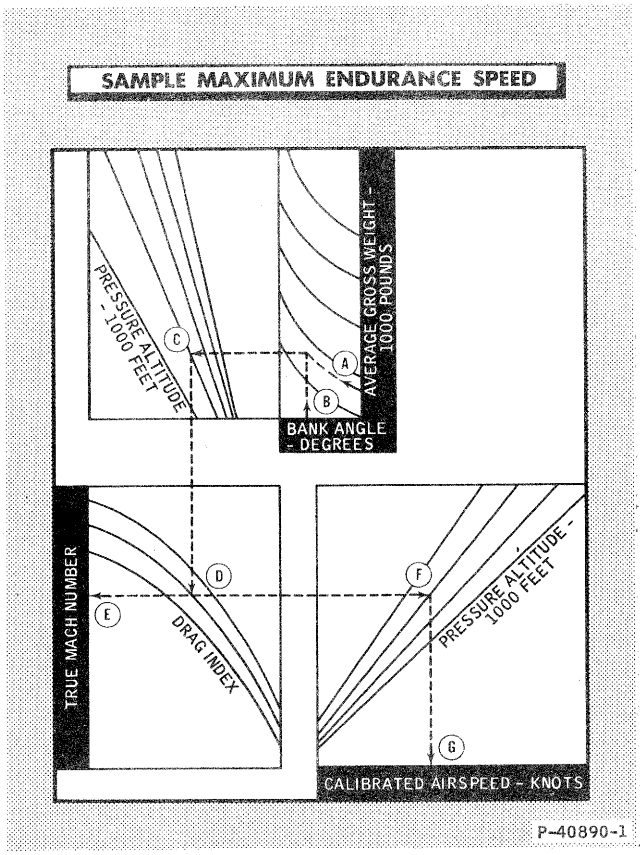
(C) Loiter altitude . . . . . 10,000 ft

(D) Drag Index 100

(E) Optimum Mach number . . . . . 0.37 NEW

(F) Loiter altitude . . . . . 10,000 ft

(G) Loiter airspeed . . . . . 210 KCAS NEW



Maximum Endurance Fuel

(For figure 11-32)

(H) Average gross weight . . . . . 17,000 lb

(J) Bank angle . . . . . 15 deg

(K) Loiter altitude . . . . . 10,000 ft

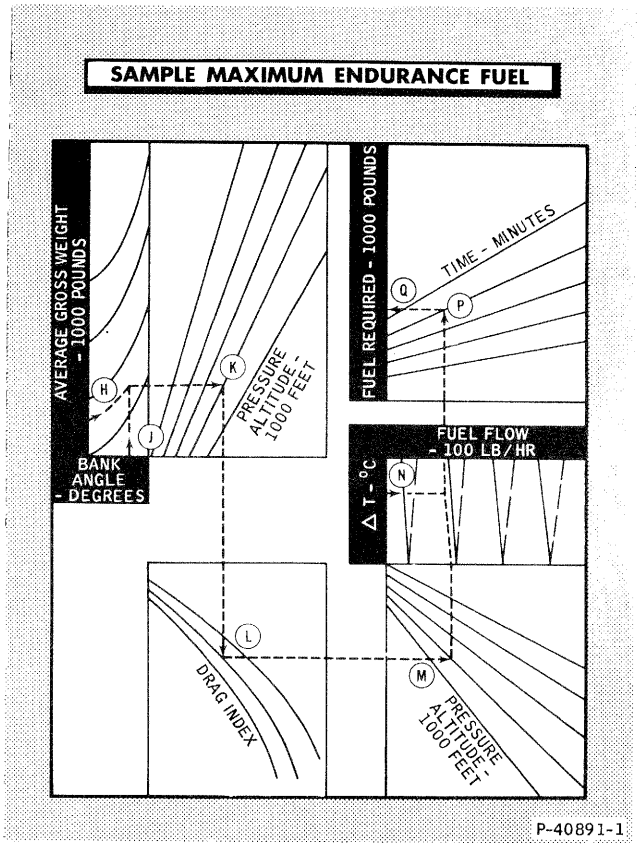
(L) Drag index 100

(M) Loiter altitude . . . . . 10,000 ft

(N) Temperature deviation from standard day . . . . . +10°C

(P) Loiter time . . . . . 30 min

NEW (Q) Fuel required . . . . . 15,000 lb



FOULED DECK ENDURANCE

Drag Index = 19
Aircraft Weight (Less Fuel) = 10,840 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel For Landing = 250 Pounds

Model: A-4C
Engine: J65-W-20

Data as of:
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	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2300	55	35,000	87	195	70	35,000	92	195	86	35,000	97	195
1900	45	35,000	70	190	57	35,000	75	190	70	35,000	80	195
1700	39	35,000	61	190	51	35,000	66	190	63	35,000	71	190
1500	34	35,000	52	190	44	35,000	57	190	55	35,000	62	190
1300	29	35,000	43	190	38	35,000	48	190	47	35,000	53	190
1100	23	35,000	34	190	31	35,000	39	190	39	35,000	44	190
900	18	30,000	24	190	24	35,000	29	190	31	35,000	34	190
700	12	20,000	15	185	17	20,000	19	185	23	30,000	24	190
500	7	5,000	8	180	11	15,000	11	185	15	20,000	15	185
	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 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2300	98	35,000	101	195	102	35,000	102	195	100	35,000	102	195
1900	82	35,000	84	195	85	35,000	85	195	84	35,000	85	195
1700	73	35,000	75	195	76	35,000	76	195	76	35,000	76	195
1500	64	35,000	66	190	67	35,000	67	190	67	40,000	67	190
1300	55	35,000	57	190	58	35,000	58	190	59	40,000	59	190
1100	46	35,000	48	190	49	35,000	49	190	50	40,000	50	185
900	37	35,000	38	190	40	35,000	40	190	41	40,000	41	185
700	28	35,000	29	190	30	40,000	31	185	32	40,000	32	185
500	–	–	–	–	–	–	–	–	–	–	–	–

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle - Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	330		185	250
10,000	330		185	340
20,000	330		185	410
30,000		0.77	185	530
35,000		0.77	185	590
40,000		0.77	185	640

Figure 11-29. Fouled Deck Endurance (Sheet 1)

FOULED DECK ENDURANCE

Drag Index = 27
Aircraft Weight (Less Fuel) = 11,745 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel For Landing = 250 Pounds

Model: A-4L
Engine: J65-W-20

Data as of: September 1969
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	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots
2300	53	35,000	78	195	67	35,000	82	200	80	35,000	87	200
1900	43	35,000	63	195	55	35,000	67	165	66	35,000	72	195
1700	38	35,000	55	195	48	35,000	59	195	59	35,000	64	195
1500	33	35,000	47	195	42	35,000	51	195	51	35,000	56	195
1300	27	35,000	38	195	36	35,000	43	195	44	35,000	48	195
1100	22	35,000	30	195	30	35,000	35	195	37	35,000	39	195
900	17	25,000	21	190	23	30,000	26	195	29	35,000	31	195
700	12	15,000	14	190	17	20,000	18	190	22	30,000	22	195
500	7	10,000	7	190	10	15,000	10	190	14	20,000	14	190
	IF YOU ARE AT 30,000 FEET				IF YOU ARE AT 35,000 FEET				IF YOU ARE AT 40,000 FEET			
	Endurance 30,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots
2300	91	35,000	91	200	93	35,000	93	200	89	35,000	93	200
1900	75	35,000	76	200	77	35,000	77	200	75	35,000	77	200
1700	67	35,000	68	195	70	35,000	70	195	68	35,000	70	195
1500	60	35,000	60	195	62	35,000	62	195	61	35,000	62	195
1300	51	35,000	52	195	54	35,000	54	195	53	35,000	54	195
1100	43	35,000	44	195	45	35,000	45	195	46	40,000	46	190
900	35	35,000	35	195	37	35,000	37	195	38	40,000	38	190
700	26	35,000	27	195	28	35,000	28	195	30	40,000	30	190
500	18	30,000	18	195	--	--	--	--	--	--	--	--

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	320	--	190	250
10,000	320	--	190	335
20,000	320	--	190	400
30,000	--	0.77	190	495
35,000	--	0.79	190	545
40,000	--	0.79	190	590

Figure 11-29. Fouled Deck Endurance (Sheet 2)

BINGO ENDURANCE

Drag Index = 46
Aircraft Weight (Less Fuel) = 11,254 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4C
Engine: J65-W-20

Data as of:
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	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	48	35,000	70	195	61	35,000	74	195	73	35,000	79	195
2500	43	35,000	62	195	55	35,000	67	195	66	35,000	71	195
2300	38	35,000	55	195	49	35,000	59	195	59	35,000	64	195
2100	33	35,000	47	190	43	35,000	52	195	52	35,000	56	195
1900	28	35,000	39	190	37	35,000	44	190	45	35,000	48	195
1700	23	35,000	31	190	30	35,000	36	190	38	35,000	41	190
1500	18	30,000	23	190	24	35,000	28	190	31	35,000	32	190
1300	13	15,000	15	185	18	25,000	19	190	23	35,000	24	190
1100	8	5,000	8	185	12	15,000	12	185	16	20,000	16	190
	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 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	83	35,000	83	195	84	35,000	84	195	82	35,000	84	195
2500	75	35,000	75	195	77	35,000	77	195	75	35,000	77	195
2300	68	35,000	68	195	69	35,000	69	195	68	35,000	69	195
2100	60	35,000	60	195	62	35,000	62	195	61	35,000	62	195
1900	52	35,000	53	195	54	35,000	54	195	54	35,000	54	195
1700	44	35,000	45	195	46	35,000	46	195	46	40,000	46	190
1500	36	35,000	37	190	38	35,000	38	190	39	40,000	39	190
1300	28	35,000	28	190	30	35,000	30	190	31	40,000	31	190
1100	20	30,000	20	190	22	35,000	22	190	–	–	–	–

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle - Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	310		185	800
10,000	310		185	885
20,000	310		185	945
30,000		0.76	185	1040
35,000		0.76	185	1080
40,000		0.76	185	1120

Figure 11-30. Bingo Endurance (Sheet 1)

BINGO ENDURANCE

Drag Index = 54
Aircraft Weight (Less Fuel) = 12,159 Pounds
All Pylons, Guns (No Ammo) and Two 300 Gallon External Tanks
Reserve Fuel Allowance for Landing = 800 Pounds

Model: A-4L
Engine: J65-W-20

Data as of: September 1969
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	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 20,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots
2700	46	30,000	63	200	58	30,000	68	200	68	30,000	72	200
2500	41	30,000	56	200	52	30,000	61	200	62	30,000	65	200
2300	36	30,000	49	200	46	30,000	54	200	55	30,000	58	200
2100	32	30,000	42	200	41	30,000	47	200	49	30,000	51	200
1900	27	30,000	35	195	35	30,000	40	195	42	30,000	44	200
1700	22	30,000	28	195	29	30,000	32	195	36	30,000	37	195
1500	17	25,000	21	195	23	25,000	25	195	29	30,000	30	195
1300	12	15,000	14	190	17	20,000	18	195	22	30,000	22	195
1100	7	10,000	8	190	11	15,000	11	190	15	20,000	15	195
	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 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 35,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 40,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots	Min.	Feet	Min.	Knots
2700	76	30,000	76	200	76	35,000	76	200	74	35,000	76	200
2500	69	30,000	69	200	70	35,000	70	200	68	35,000	70	200
2300	62	30,000	62	200	63	35,000	63	200	62	35,000	63	200
2100	55	30,000	55	200	56	35,000	56	200	55	35,000	56	200
1900	48	30,000	48	200	49	35,000	49	200	49	35,000	49	200
1700	41	30,000	41	200	42	35,000	42	195	42	35,000	42	195
1500	34	30,000	34	195	35	35,000	35	195	36	40,000	36	195
1300	26	30,000	26	195	28	35,000	28	195	29	40,000	29	190
1100	19	30,000	19	195	20	35,000	20	195	22	40,000	22	190

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	300	--	190	800
10,000	300	--	190	880
20,000	300	--	190	940
30,000	--	0.75	190	1015
35,000	--	0.77	190	1055
40,000	--	0.77	190	1090

Figure 11-30. Bingo Endurance (Sheet 2)

BINGO ENDURANCE

Gear Down

Drag Index = 376
Aircraft Weight (Less Fuel) = 11,254 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance For Landing = 800 Pounds

Model: A-4C
Engine: J65-W-20

Data as of:
Data Basis: Estimated

FUEL ON BOARD - POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 5,000 FEET			
	Endurance At Sea Level	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 5,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	38	20,000	44	160	42	20,000	46	160
2500	34	20,000	39	160	38	20,000	41	160
2300	30	20,000	34	160	34	20,000	36	160
2100	27	15,000	30	160	30	20,000	31	160
1900	23	15,000	25	155	26	15,000	26	160
1700	19	10,000	20	155	21	15,000	22	155
1500	14	5,000	15	155	17	10,000	17	155
1300	10	5,000	11	155	12	5,000	12	155
1100	6	5,000	6	155	8	5,000	8	155
	IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 15,000 FEET			
	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 15,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	46	20,000	48	160	49	20,000	49	160
2500	41	20,000	43	160	44	20,000	45	160
2300	37	20,000	38	160	40	20,000	40	160
2100	32	20,000	33	160	35	20,000	35	160
1900	28	15,000	28	160	30	20,000	30	160
1700	23	15,000	23	155	25	15,000	25	160
1500	18	10,000	18	155	20	15,000	20	155
1300	14	10,000	14	155	15	15,000	15	155
1100	9	10,000	9	155	10	15,000	10	155

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle - Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	Mach No.	KCAS	Pounds
Sea Level	220		155	800
5,000	220		155	835
10,000	220		155	860
15,000	220		155	880
20,000	220		155	900
25,000		0.50	155	925
30,000		0.50	155	950
35,000		0.50	155	970

Figure 11-30. Bingo Endurance (Sheet 3)

NAVAIR 01-40AVE-1

BINGO ENDURANCE

Gear Down

Drag Index = 384
Aircraft Weight (Less Fuel) = 12,159 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel Allowance for Landing = 800 Pounds

Model: A-4L
Engine: J65-W-20

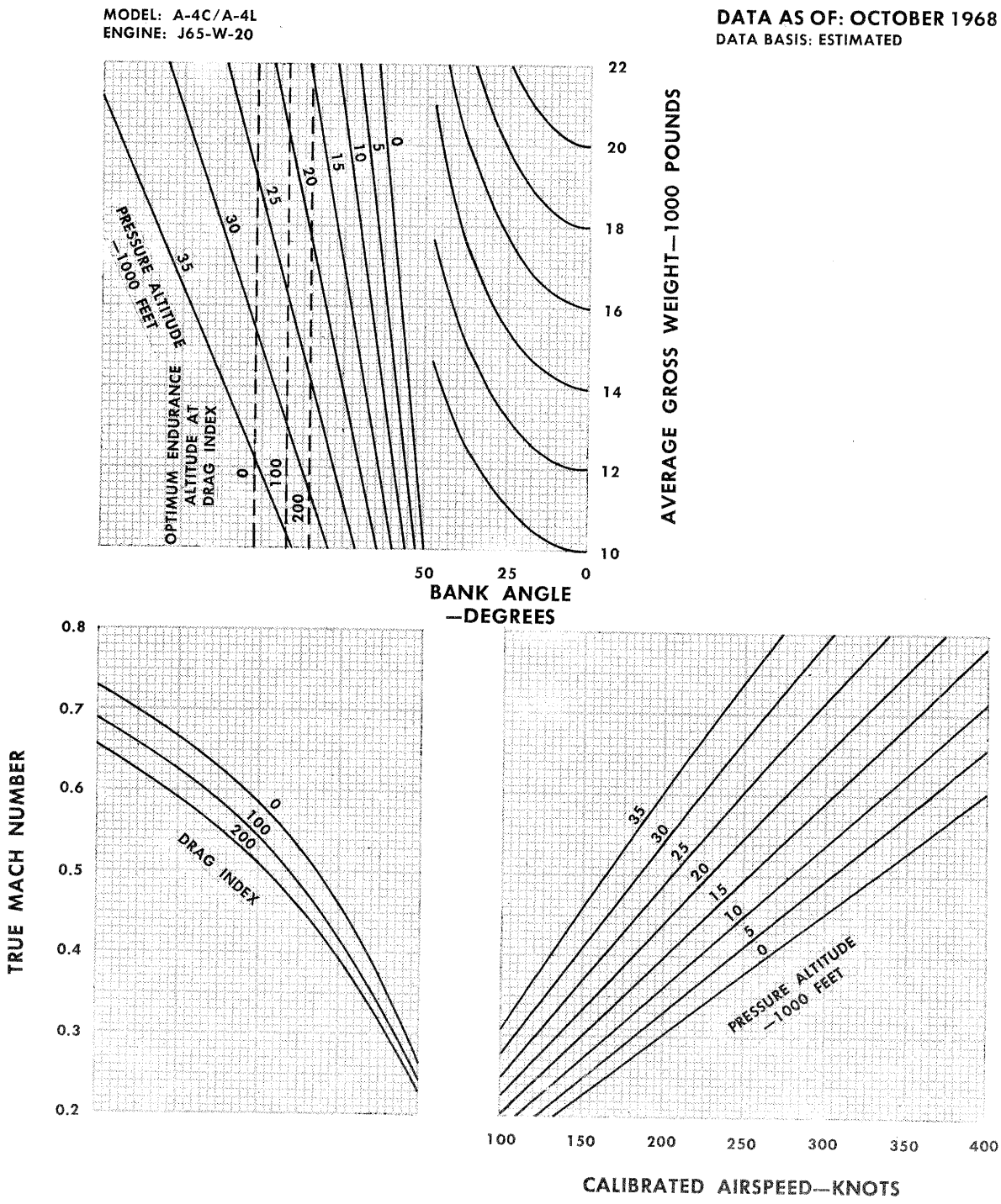
Data as of: September 1969
Data Basis: Estimated

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 5,000 FEET			
	Endurance At Sea Level	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 5,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	36	20,000	41	165	40	30,000	41	165
2500	33	15,000	37	165	36	30,000	37	165
2300	29	15,000	33	165	32	25,000	33	160
2100	25	15,000	28	160	28	20,000	30	160
1900	21	15,000	24	160	24	20,000	25	160
1700	18	10,000	19	160	20	20,000	20	160
1500	14	10,000	15	160	16	15,000	16	160
1300	10	5,000	10	160	12	10,000	12	160
1100	6	5,000	6	160	7	5,000	7	160
	IF YOU ARE AT 10,000 FEET				IF YOU ARE AT 15,000 FEET			
	Endurance At 10,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude	Endurance At 15,000 Ft	Optimum Altitude	Endurance At Optimum Altitude	KCAS At Optimum Altitude
	Minutes	Feet	Minutes	Knots	Minutes	Feet	Minutes	Knots
2700	44	20,000	45	165	46	20,000	46	165
2500	39	20,000	40	165	42	20,000	42	165
2300	35	15,000	36	165	38	20,000	38	165
2100	31	15,000	32	165	33	20,000	33	165
1900	27	15,000	27	165	29	15,000	29	165
1700	22	15,000	23	160	24	15,000	24	165
1500	18	15,000	18	160	20	15,000	20	160
1300	13	10,000	13	160	15	15,000	15	160
1100	9	10,000	9	160	10	15,000	10	160

Pressure Altitude	Climb Speed Military Thrust	Descent Speed Engine Idle – Speedbrakes Closed	Start Letdown From Altitude With Fuel Remaining
Feet	KCAS	KCAS	Pounds
Sea Level	220	160	800
5,000	220	160	835
10,000	220	160	860
15,000	220	160	880
20,000	220	160	905
25,000	205	160	925
30,000	180	160	945

Figure 11-30. Bingo Endurance (Sheet 4)

MAXIMUM ENDURANCE SPEED



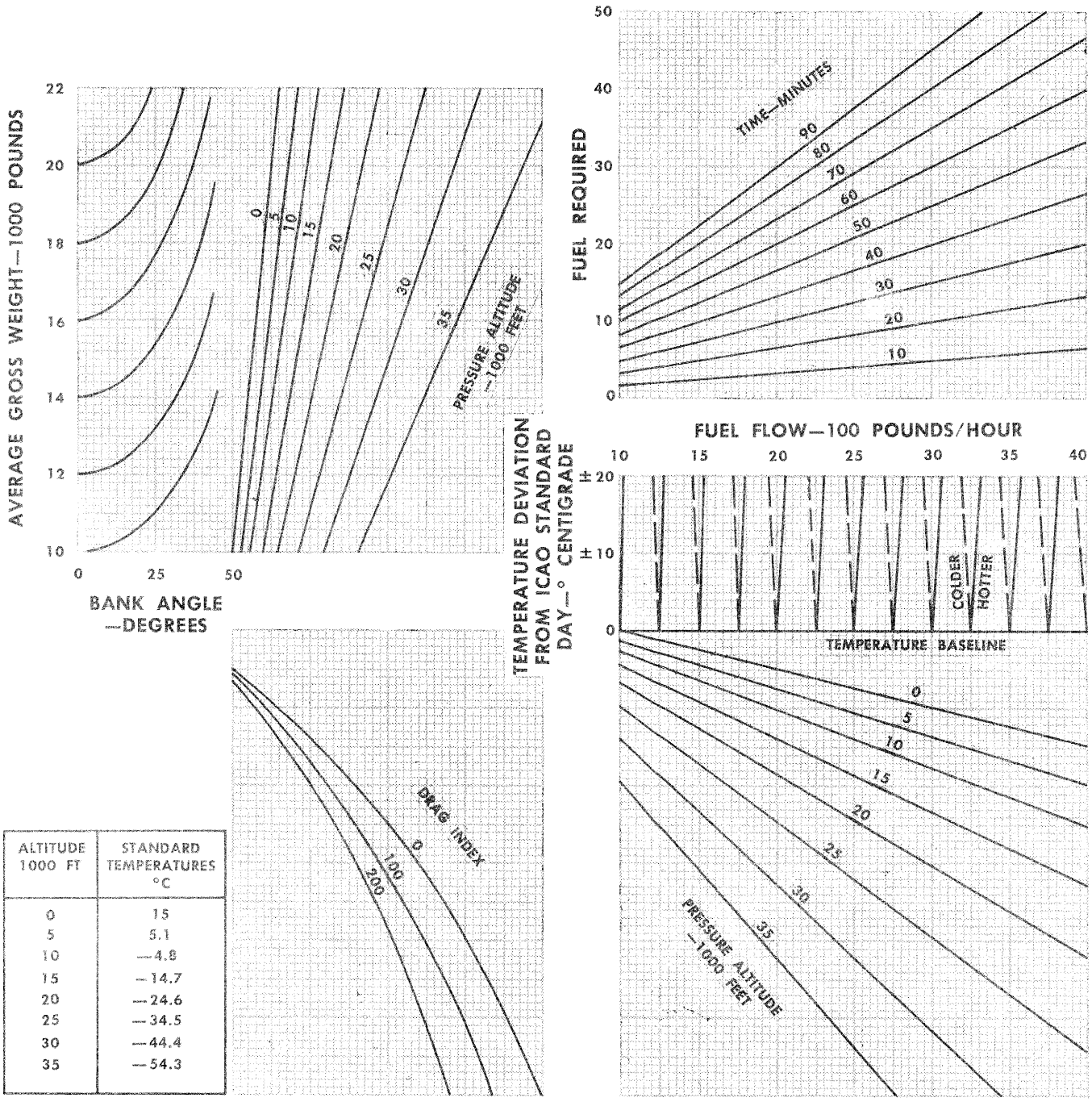
SS1-27

Figure 11-31. Maximum Endurance Speed

MAXIMUM ENDURANCE FUEL

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED



ALTITUDE 1000 FT	STANDARD TEMPERATURES °C
0	15
5	5.1
10	—4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3

SS1-28

Figure 11-32. 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, two 300-gallon external fuel tanks on the wing station and two 20-mm guns.

Tanker Speed Envelope

The operating speed envelope of the tanker aircraft, both with hose and drogue extended and retracted, is shown on figure 11-33. The airspeed of the tanker when the hose and drogue is extended, is limited to a minimum calibrated airspeed of 200 knots and a maximum calibrated airspeed of 300 knots.

SAMPLE PROBLEM

Tanker Speed Envelope

(For figure 11-33)

(A) Pressure altitude . . . . . 20,000 ft

(B) Gross weight - hose and drogue extended . . . . . 22,000 lb

NEW (C) Minimum refueling Mach number . . . . . 0.51 M

(D) Maximum refueling calibrated airspeed . . . . . 300 kts

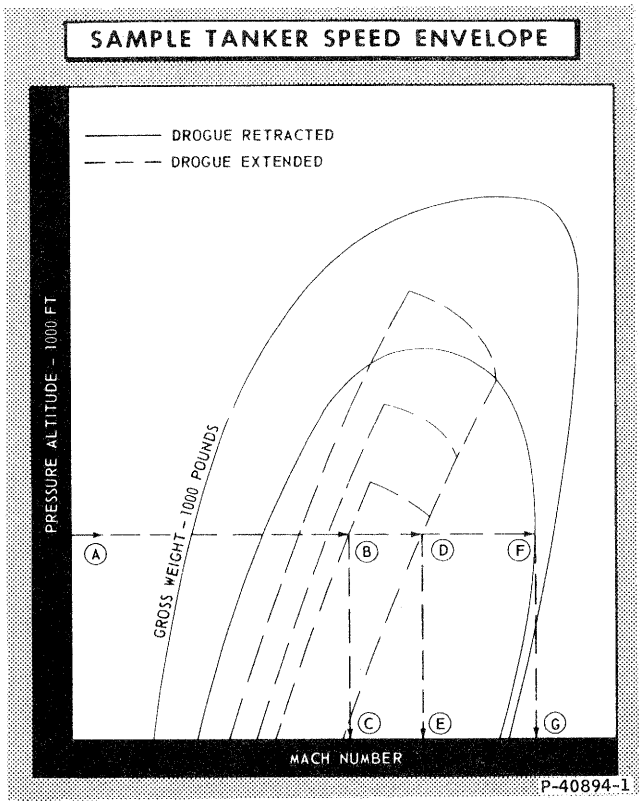
(E) Maximum refueling Mach number . . . . . 0.67 M

(F) Gross weight - hose and drogue retracted . . . . . 22,000 lb

(G) Maximum Mach number . . . . . 0.835 M

Tanker Fuel Available for Transfer

The tanker fuel available for transfer is shown in figure 11-34 for operation with JP-4 and JP-5 fuel. For a refueling radius of less than 290-310 N. Mi. the tanker is unable to consume all of the 320 gallons of nontransferable fuel. Therefore, if refueling is accomplished at less than 300 N. Mi. and all of the available fuel is transferred to the receiver, the tanker will return to base with an excess of reserve fuel.



SAMPLE PROBLEM

Tanker Fuel Available For Transfer

(For figure 11-34)

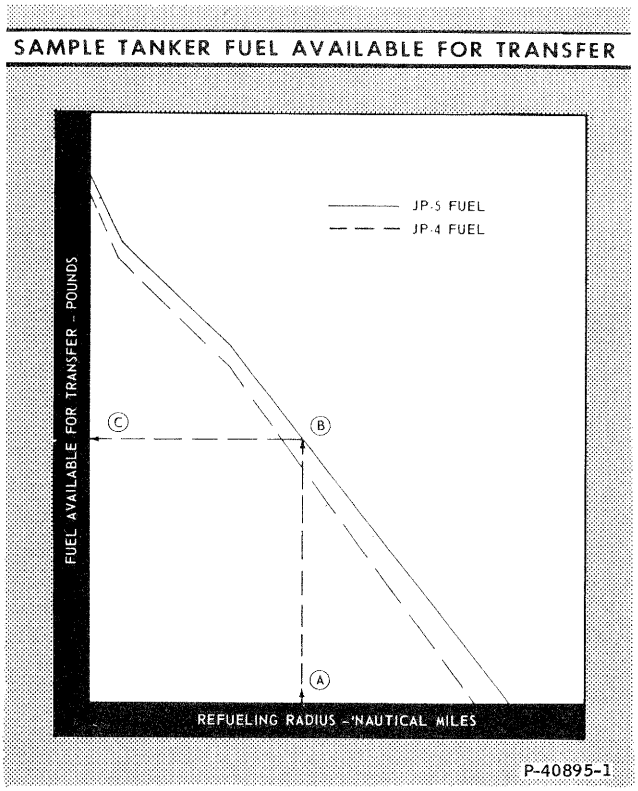
(A) Refueling radius . . . . . 500 N. Mi.

(B) JP-5 fuel line . . . . . S1 2000 NEW
S2 875

(C) Fuel available for transfer . . . . . 3750 lb

Tanker Fuel Transfer Time

The relationship of fuel transferred to receiver versus elapsed time is presented in figure 11-35. The flow rate to the receiver aircraft is 180-gallons per minutes. After 2.8 minutes, refueling is temporarily discontinued to allow the refueling store to fill from the external fuel tanks. After 2.5 minutes, refueling operation may be resumed. If less than 5900 pounds of JP-5 fuel is being transferred, refueling may be resumed in less than 2.5 minutes. The internal



transfer rate of tanker fuel from the external fuel tanks and wing tanks to the refueling store limits the amount of fuel (875 gallons) that can be transferred to the receiver during a continuous refueling operation. If more than 875 gallons is to be transferred to the receiver, refueling must be discontinued for a period of approximately 28 minutes, to allow the refueling store to be replenished from the tanker internal fuel before fueling can be resumed.

SAMPLE PROBLEM

Tanker Fuel Transfer Time

(For figure 11-35)

(A) Fuel transferred to receiver (JP-5) . . . . . 4000 lb

(B) JP-5 fuel flow line

(C) Elapsed time . . . . . 3.56 min

(D) Point where refueling is resumed . . . . . 3.25 min

(E) Point where refueling is temporarily discontinued . . . . . 2.85 min

Fuel Consumption of Tanker During Air Refueling

The tanker fuel consumption with the hose and drogue extended is presented in figure 11-36 for two pressure altitudes and range of operating airspeeds.

SAMPLE PROBLEM

Fuel Consumption of Tanker During Air Refueling

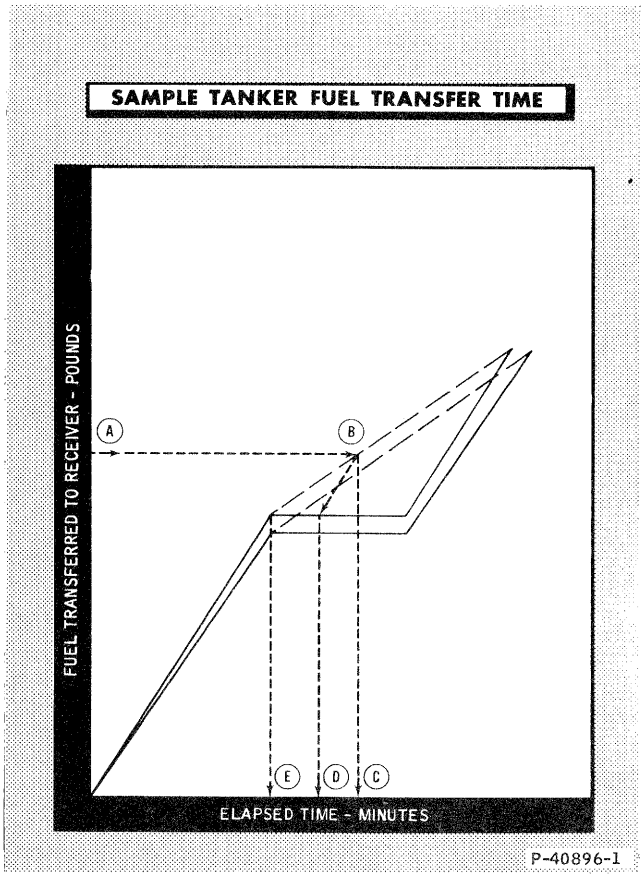
(For figure 11-36)

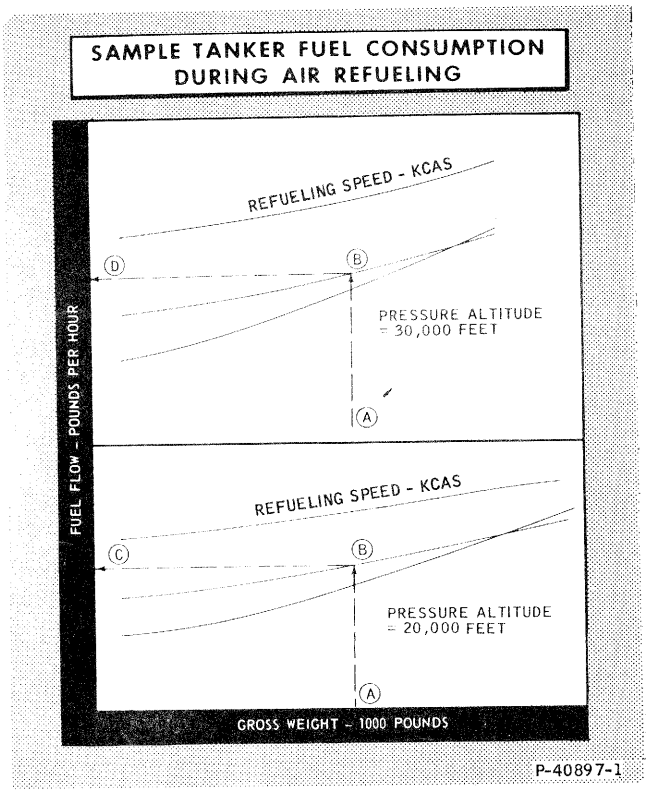
(A) Gross weight . . . . . 18,000 lb

(B) Refueling speed . . . . . 250 KCAS

(C) Fuel flow - - 20,000 ft. . . . . 2970 lb/hr

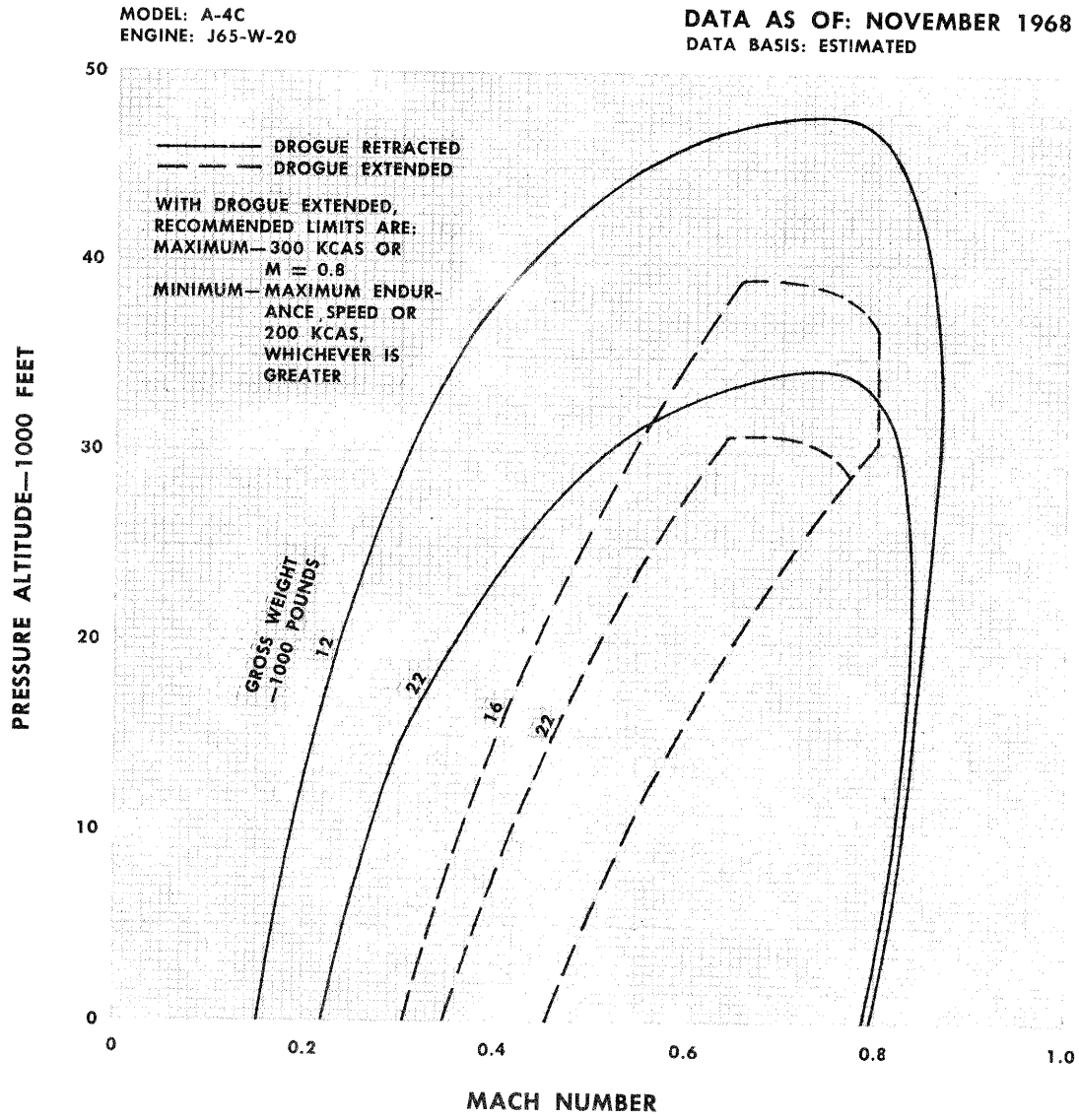
(D) Fuel flow - - 30,000 ft. . . . . 3070 lb/hr




SAMPLE TANKER FUEL CONSUMPTION
DURING AIR REFUELING
REFUELING SPEED - KCAS
D
B
PRESSURE ALTITUDE
= 30,000 FEET
A
REFUELING SPEED - KCAS
C
B
PRESSURE ALTITUDE
= 20,000 FEET
A
FUEL FLOW - POUNDS PER HOUR
GROSS WEIGHT - 1000 POUNDS
P-40897-1

TANKER SPEED ENVELOPE

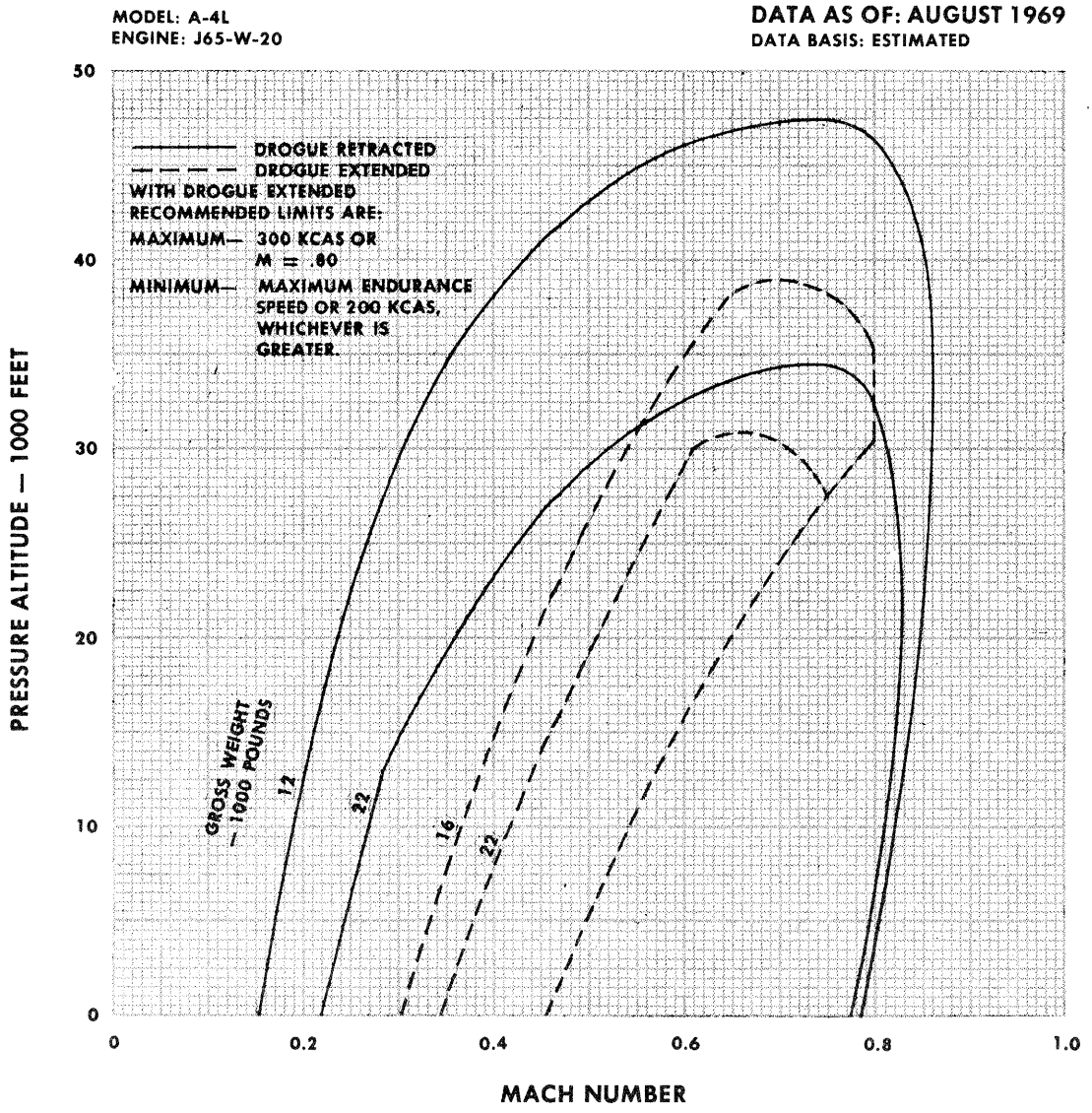
TANKER CONFIGURATION
1 300-GALLON REFUELING STORE PLUS 2 300-GALLON TANKS
3 PYLONS AND GUNS



SS1-29

Figure 11-33. Tanker Speed Envelope (Sheet 1)

TANKER SPEED ENVELOPE
TANKER CONFIGURATION
1—300 GALLON REFUELING STORE PLUS 2—300 GALLON TANKS
3 PYLONS AND GUNS



SS1-65

Figure 11-33. Tanker Speed Envelope (Sheet 2)

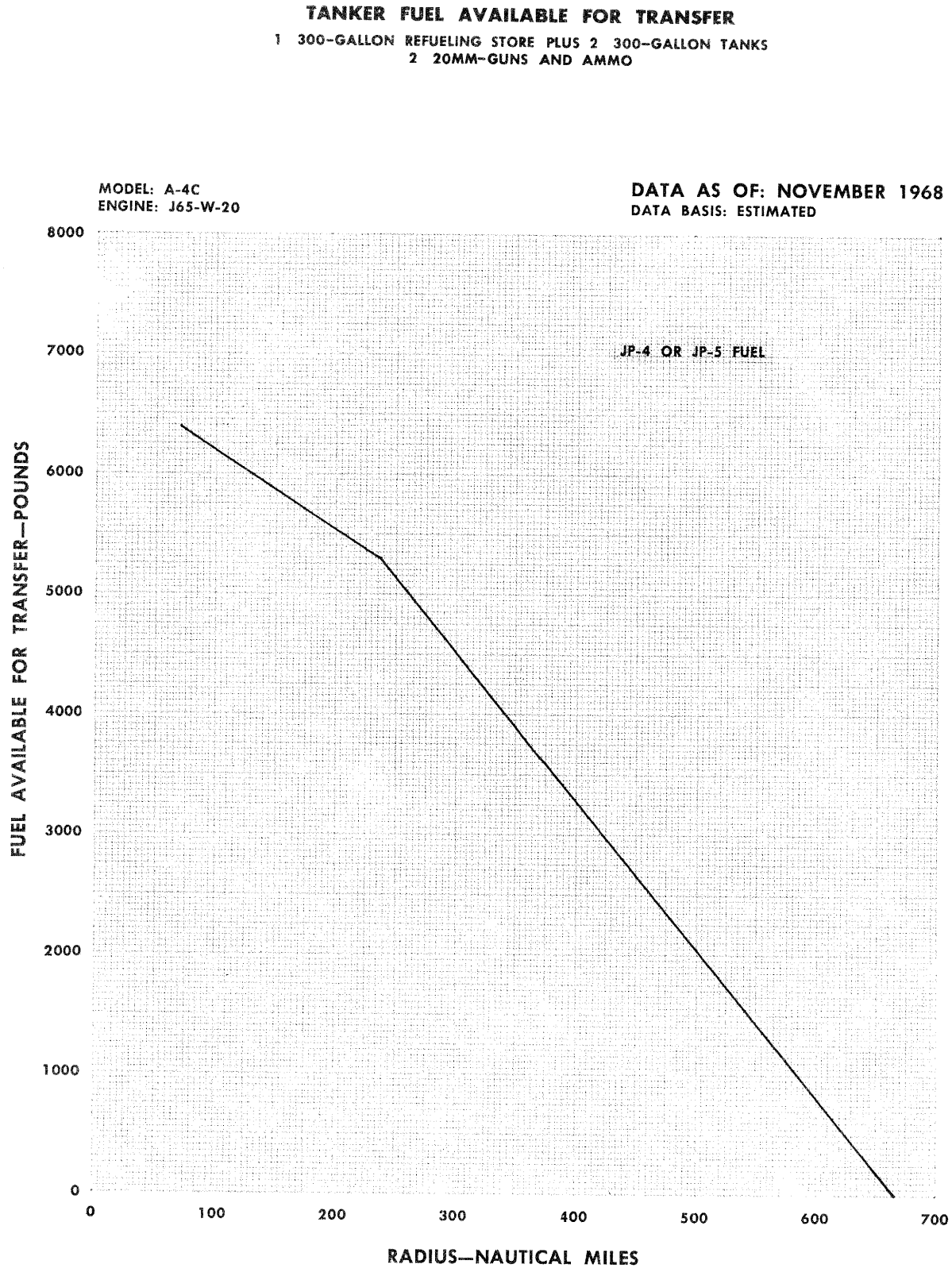


Figure 11-34. Tanker Fuel Available for Transfer (Sheet 1)

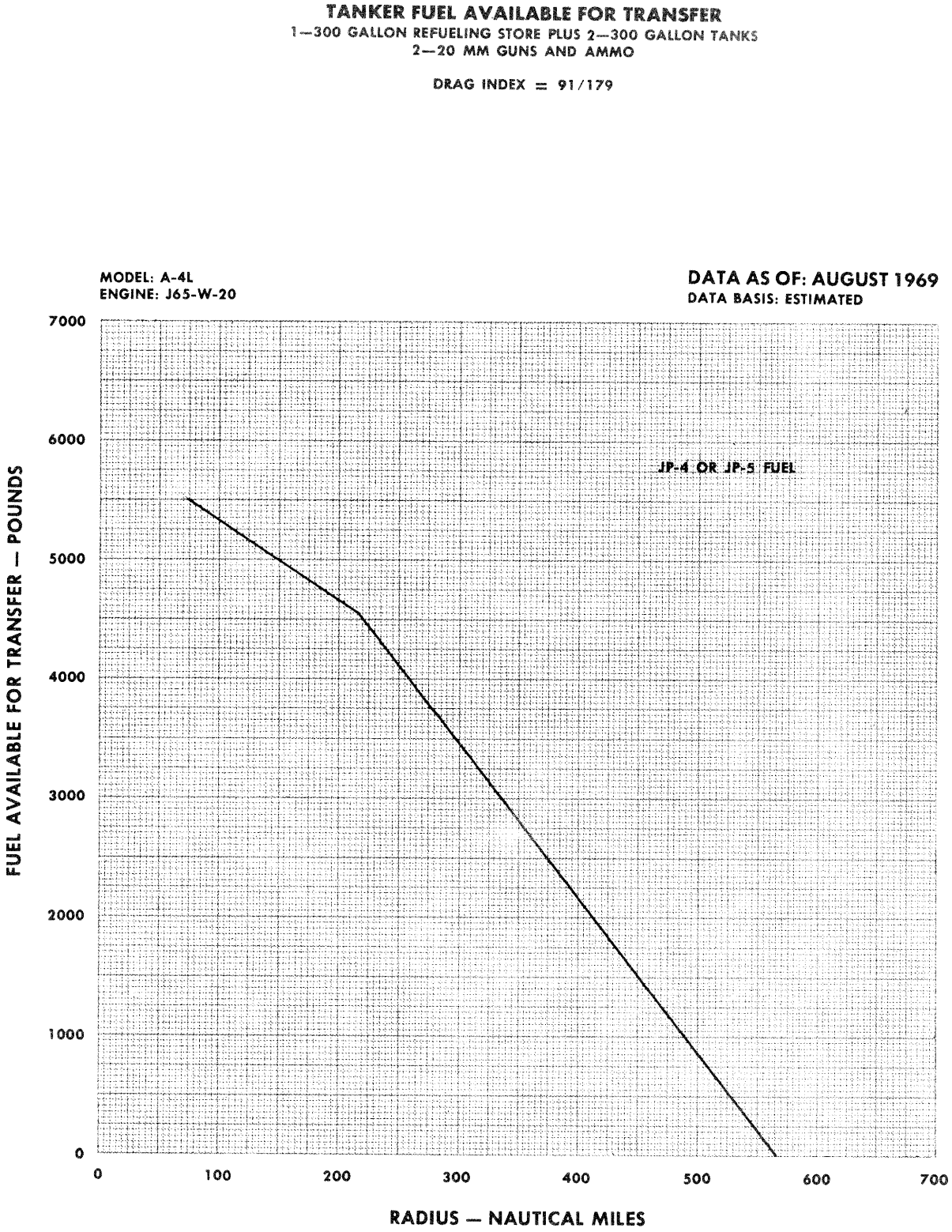
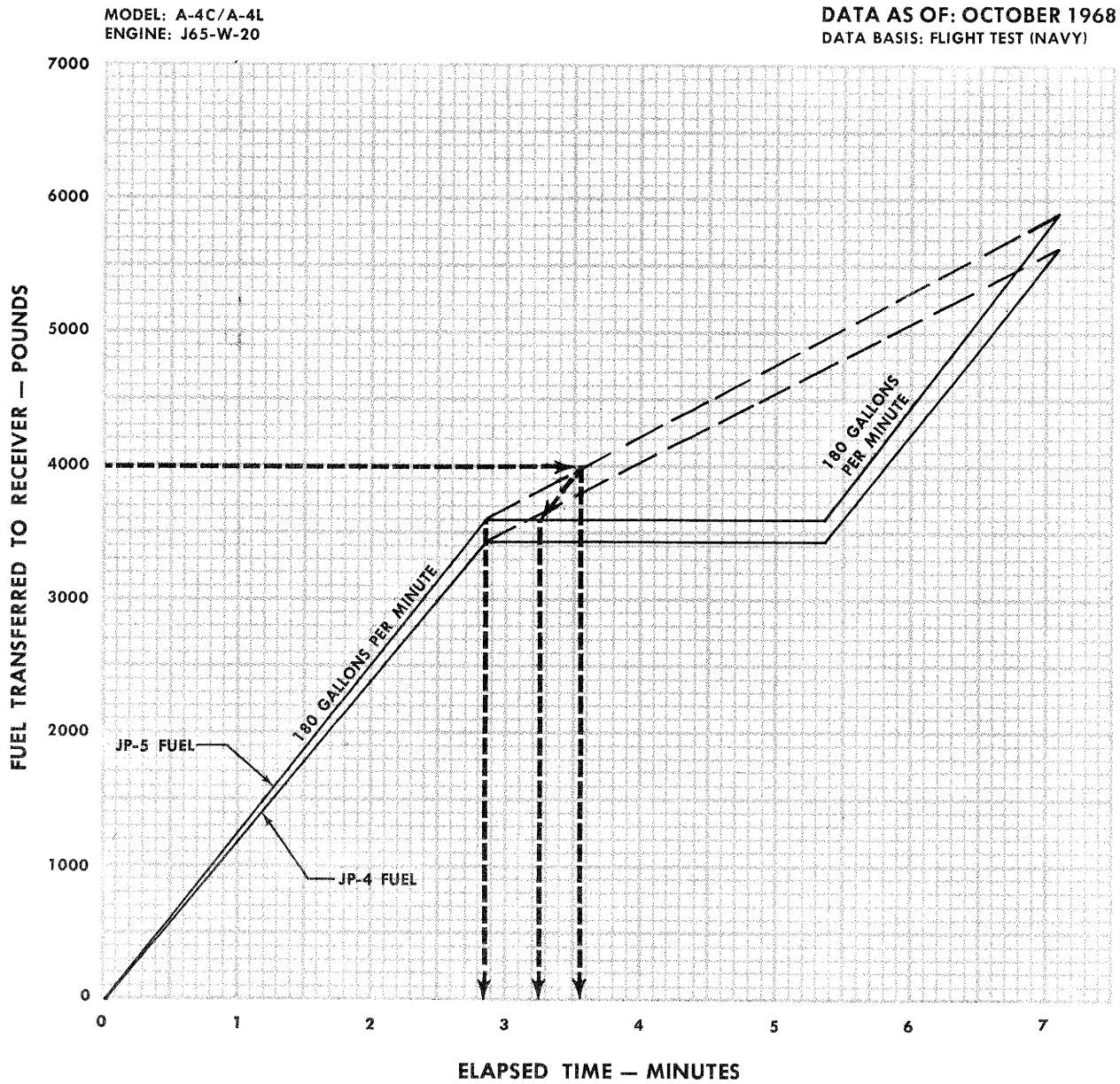


Figure 11-34. Tanker Fuel Available for Transfer (Sheet 2)

TANKER FUEL TRANSFER TIME
1 300-GALLON REFUELING STORE PLUS 2 300-GALLON TANKS
2 20-MM GUNS
DRAG INDEX = 91/179



SS1-31

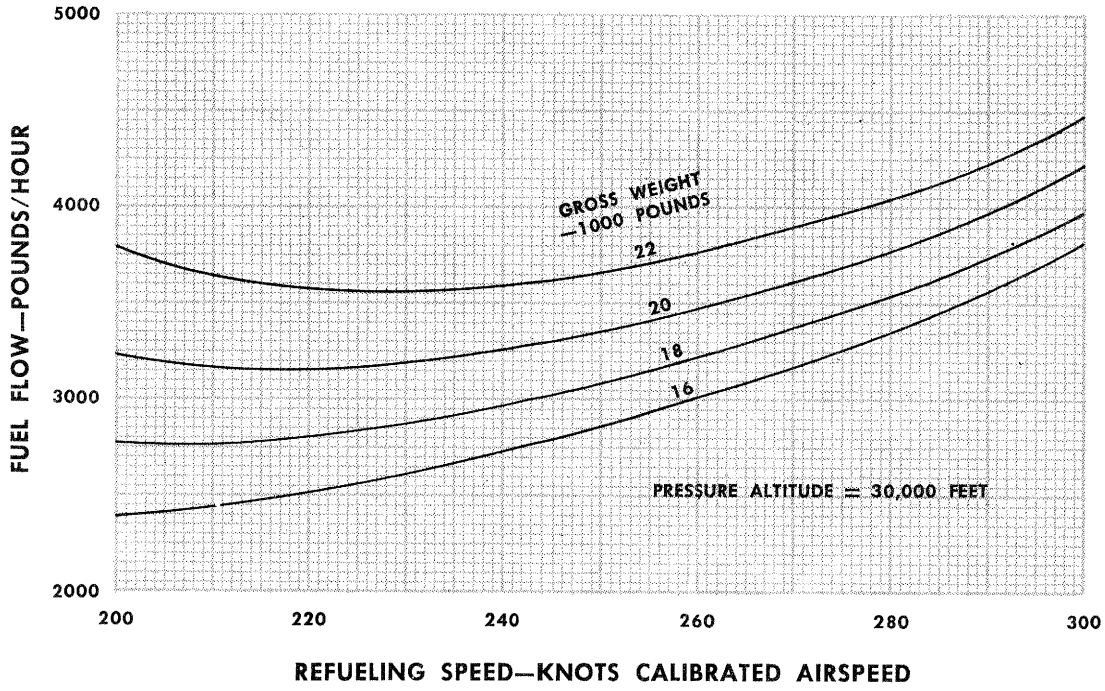
Figure 11-35. Tanker Fuel Transfer Time

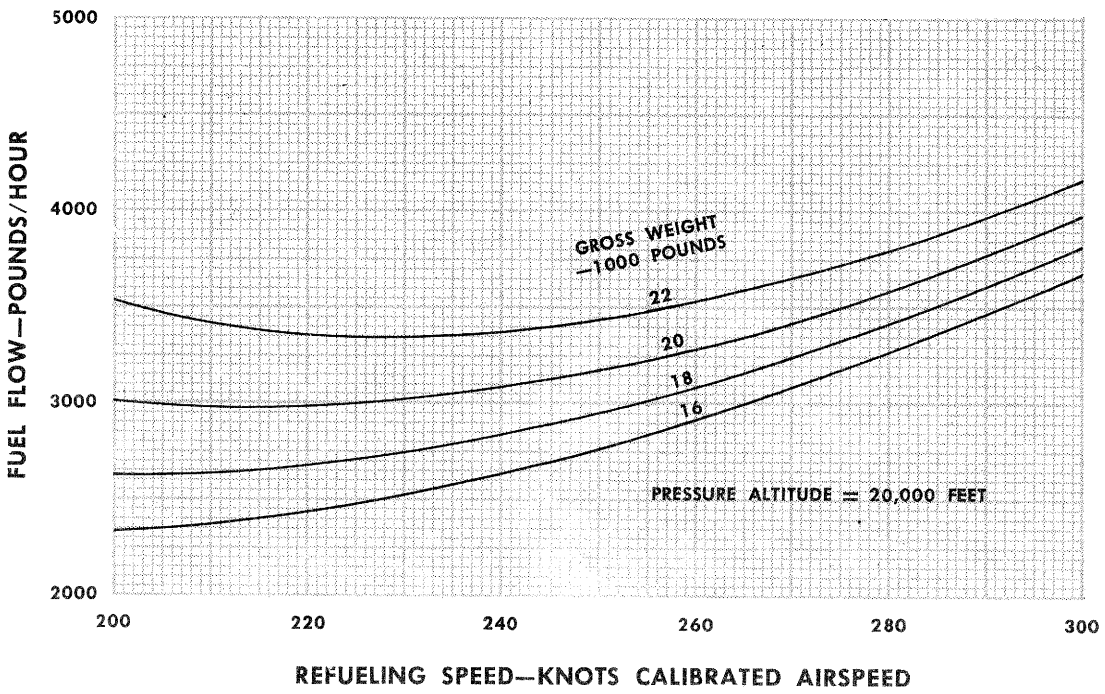
FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

1 300-GALLON REFUELING STORE PLUS 2 300-GALLON TANKS
3 PYLONS AND GUNS

MODEL: A-4C
ENGINE: J65-W-20

DATA AS OF: NOVEMBER 1968
DATA BASIS: ESTIMATED





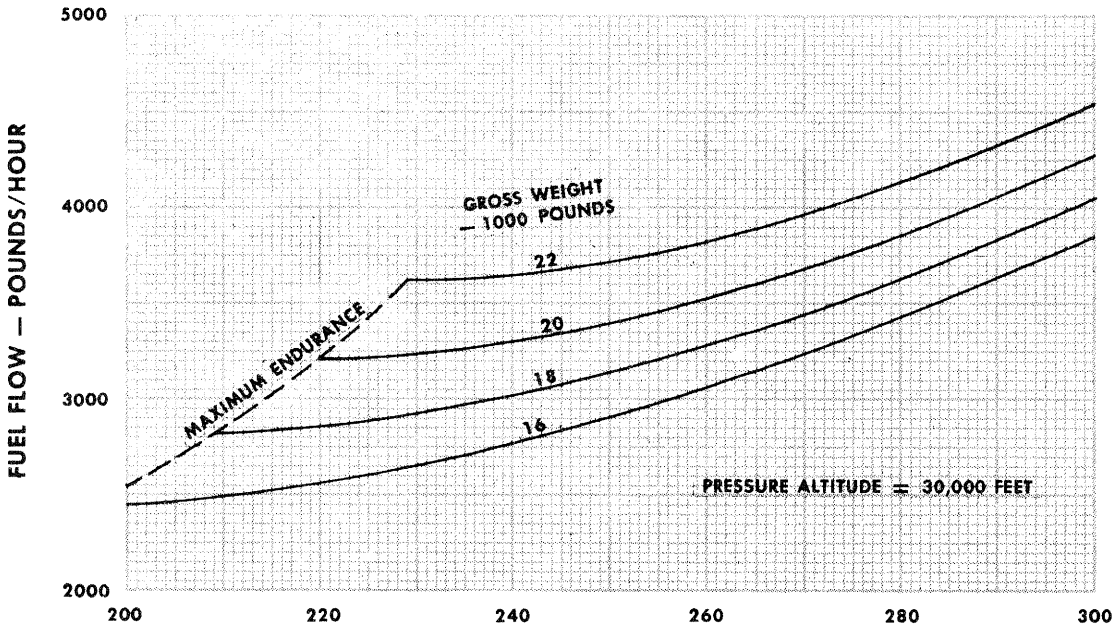
SS1-32

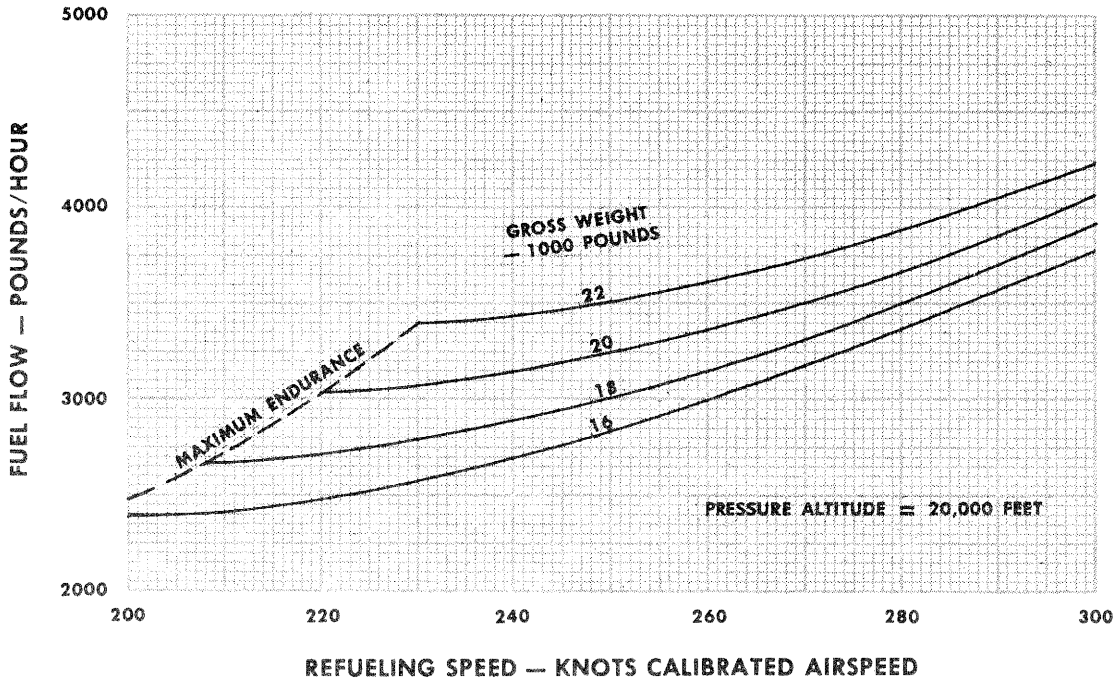
Figure 11-36. Fuel Consumption of Tanker During Air Refueling (Sheet 1)

FUEL CONSUMPTION OF TANKER DURING AIR REFUELING
1—300 GALLON REFUELING STORE PLUS 2—300 GALLON TANKS
3 PYLONS AND GUNS

MODEL: A-4L
ENGINE: J65-W-20

DATA AS OF: AUGUST 1969
DATA BASIS: ESTIMATED





SS1-67

Figure 11-36. Fuel Consumption of Tanker During Air Refueling (Sheet 2)

PART 7
DESCENT

MAXIMUM RANGE DESCENT

Graphical data is presented in figures 11-37 through 11-39 for a maximum range descent using idle thrust and 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

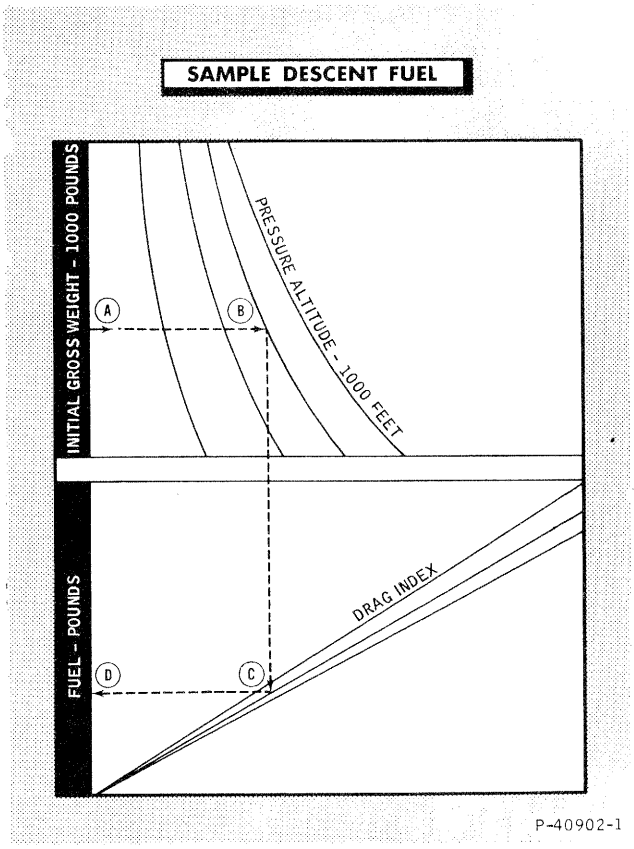
(For figure 11-37)

(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 . . . . . 270 lb



DESCENT FUEL
IDLE THRUST

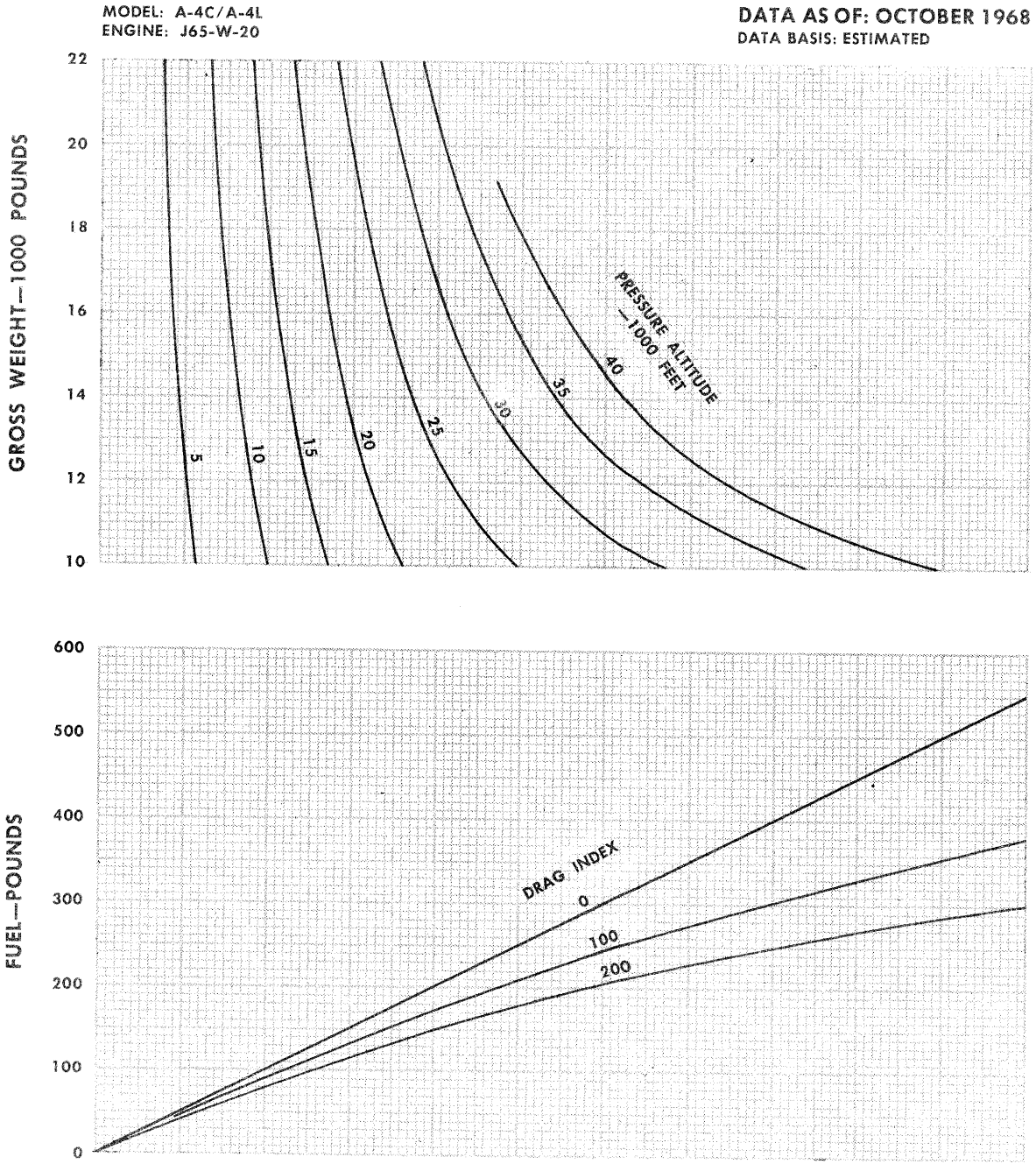
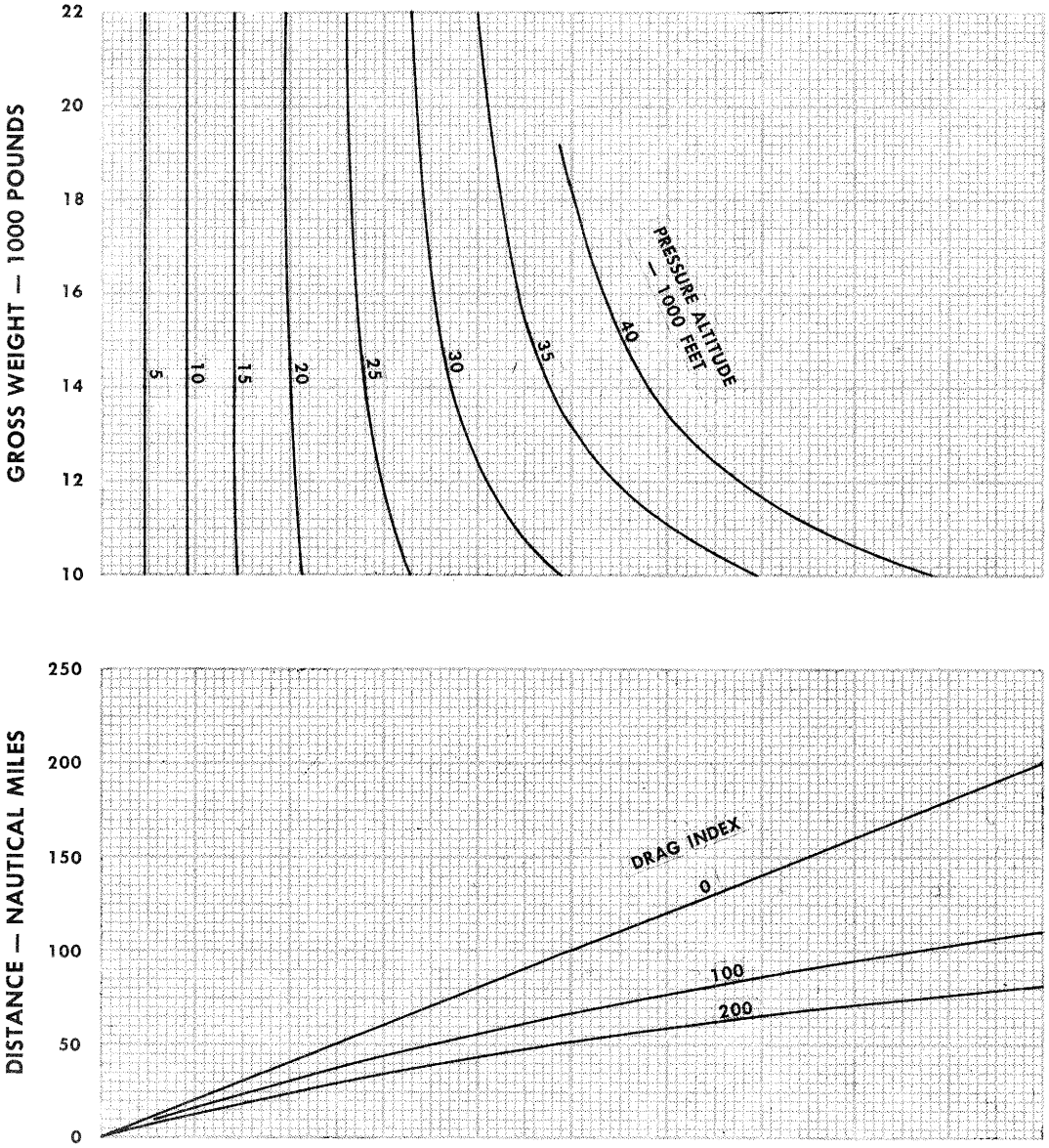


Figure 11-37. Descent Fuel

DESCENT DISTANCE
IDLE THRUST

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED



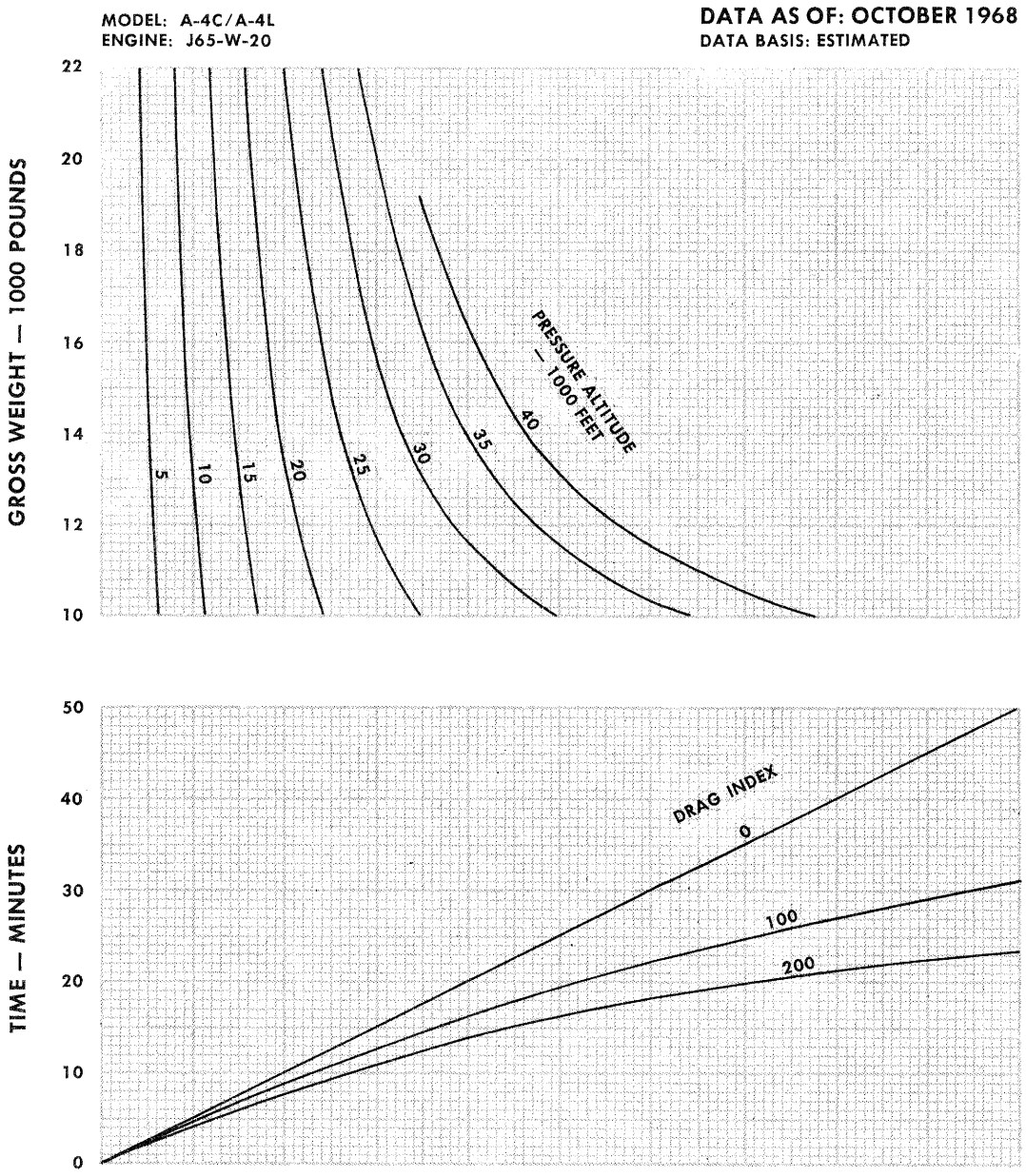
DESCENT SPEED SCHEDULE — KCAS

DRAG INDEX	GROSS WEIGHT — 1000 POUNDS						
	10	12	14	16	18	20	22
0	175	195	210	220	235	250	260
100	160	180	190	205	215	230	240
200	155	165	180	190	205	215	225

5S1-34

Figure 11-38. Descent Distance

DESCENT TIME
IDLE THRUST



SS1-35

Figure 11-39. Descent Time

PART 8
LANDING

LANDING

Approach speeds, stall speeds for the landing configurations, and corresponding angle-of-attack units are presented on figure 11-40. If the angle-of-attack indication of 17.5 units does not produce the indicated airspeed for the configuration computed from figure 11-40, recheck the aircraft configuration. If the appropriate configuration is established, disregard the angle-of-attack indication and make the approach at the computed airspeed from figure 11-40.

The landing ground roll of the aircraft is dependent upon runway pressure altitude, outside air temperature, the force of the headwind, flap deflection, runway gradient and braking action. The ground roll distance, as given on figure 11-41, is calculated assuming maximum braking action without skidding the tires, and aerodynamic braking produced with wing flaps at any setting. Three graphs are provided for the correction of landing distance for various runway conditions including hard dry, wet, snow covered and icy runways. The distance to clear a 50-foot obstacle is measured horizontally from the 50-foot obstacle to the end of rollout and is obtained by adding 715 feet to the ground roll distance, assuming a standard 4-degree glide slope. Obviously, if the obstacle is situated at a distance from the runway which is greater than the ground distance (715 feet) required to descend from 50 feet, it will have no effect on the usable runway length. If the obstacle is very near the runway, that portion of runway length consumed in the descent from 50 feet may not leave enough distance to brake to a stop. Flap deflection, runway gradient, and runway surface condition corrections may be obtained directly from the landing distance graphs.

Note

Landing distance charts are based on landing at optimum approach speed.

SAMPLE PROBLEM

Approach Speed

(For figure 11-40)

(A) Gross weight . . . . . 12,000 lb

(B) Stall speed (Full flaps) . . . . . 99 KIAS
Angle-of-attack . . . . . 25.4 units

(C) Approach speed (Full flaps) . . . . . 116.5 KIAS
Angle-of-attack . . . . . 17.5 units

SAMPLE PROBLEM

Landing Distance

(For figure 11-41)

Runway Condition: Wet

(A) Outside air temperature . . . . . 15°C

(B) Runway pressure altitude. . . . . 2000 ft

(C) Aircraft landing weight . . . . . 12,000 lb

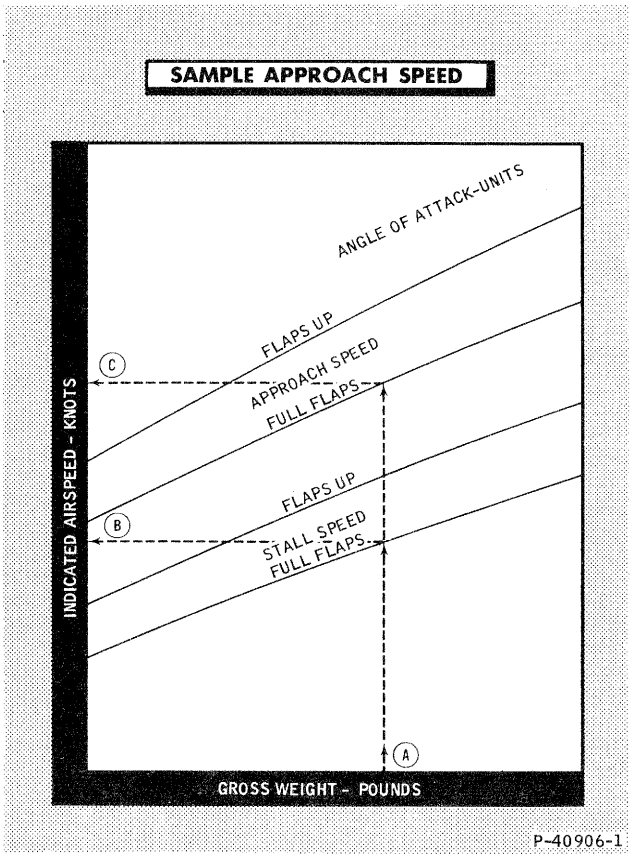
(D) Flap deflection . . . . . HALF

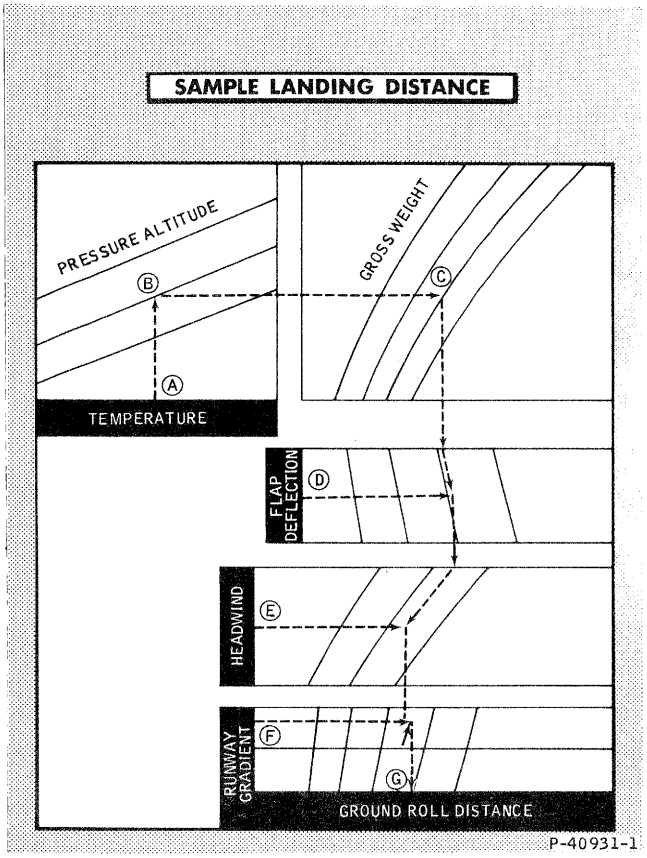
(E) Headwind . . . . . 15 kts

(F) Runway gradient . . . . . -2%

(G) Ground roll distance . . . . . 5200 ft

Total Distance to clear a 50-foot obstacle with 4-degree glide slope . . . . . 6115 ft

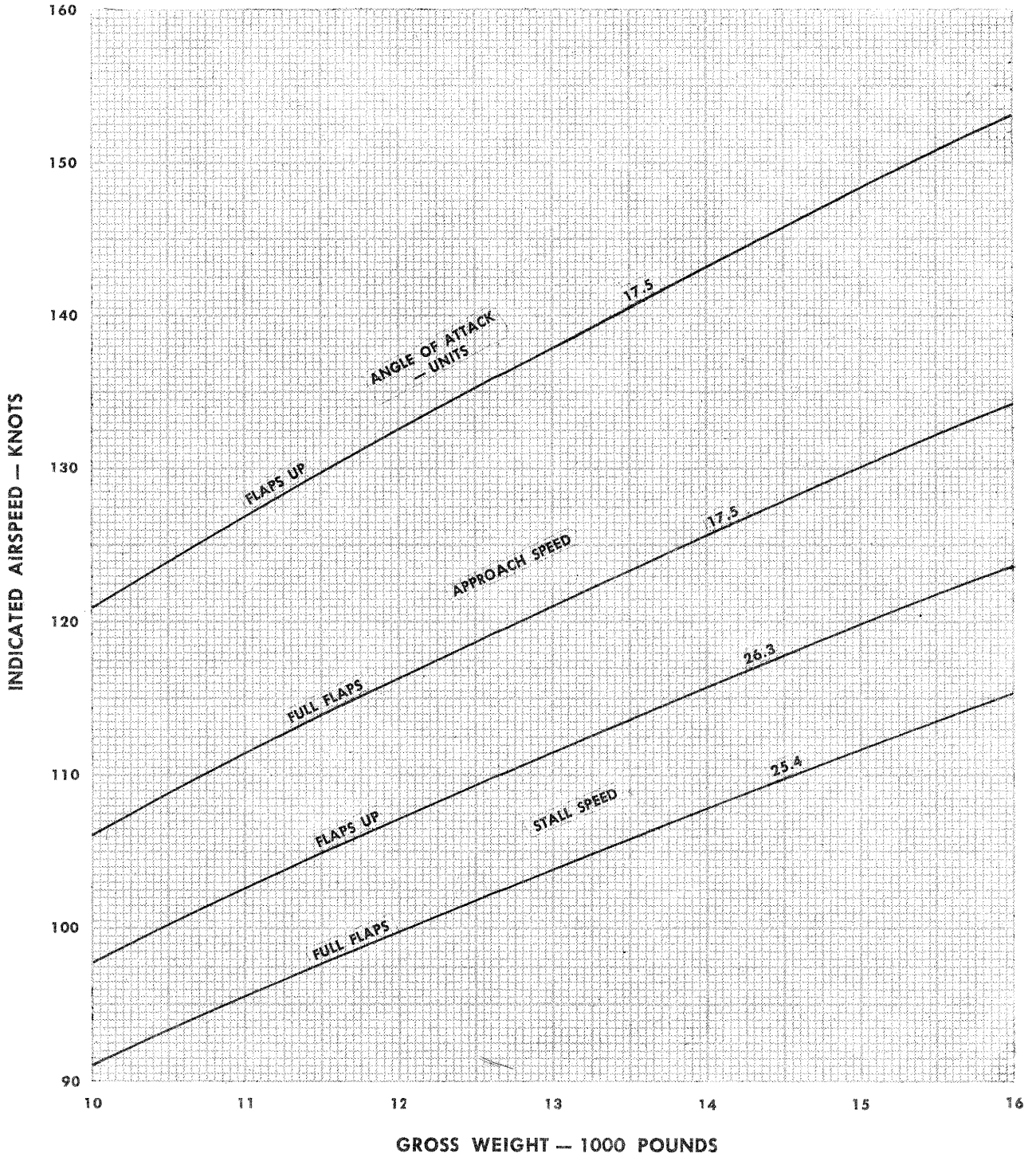

SAMPLE APPROACH SPEED
ANGLE OF ATTACK-UNITS
FLAPS UP
APPROACH SPEED
FULL FLAPS
FLAPS UP
STALL SPEED
FULL FLAPS
C
B
A
INDICATED AIRSPEED - KNOTS
GROSS WEIGHT - POUNDS
P-40906-1


SAMPLE LANDING DISTANCE
PRESSURE ALTITUDE
GROSS WEIGHT
B
C
A
TEMPERATURE
FLAP DEFLECTION
D
HEADWIND
E
RUNWAY GRADIENT
F
G
GROUND ROLL DISTANCE
P-40931-1

APPROACH SPEED
GEAR DOWN — SPEEDBRAKES OPEN
THRUST REQUIRED TO MAINTAIN 4° GLIDE SLOPE

MODEL: A-4C/A-4L
ENGINE: J65-W-20

DATA AS OF: OCTOBER 1968
DATA BASIS: ESTIMATED



SS1-36

Figure 11-40. Approach Speed

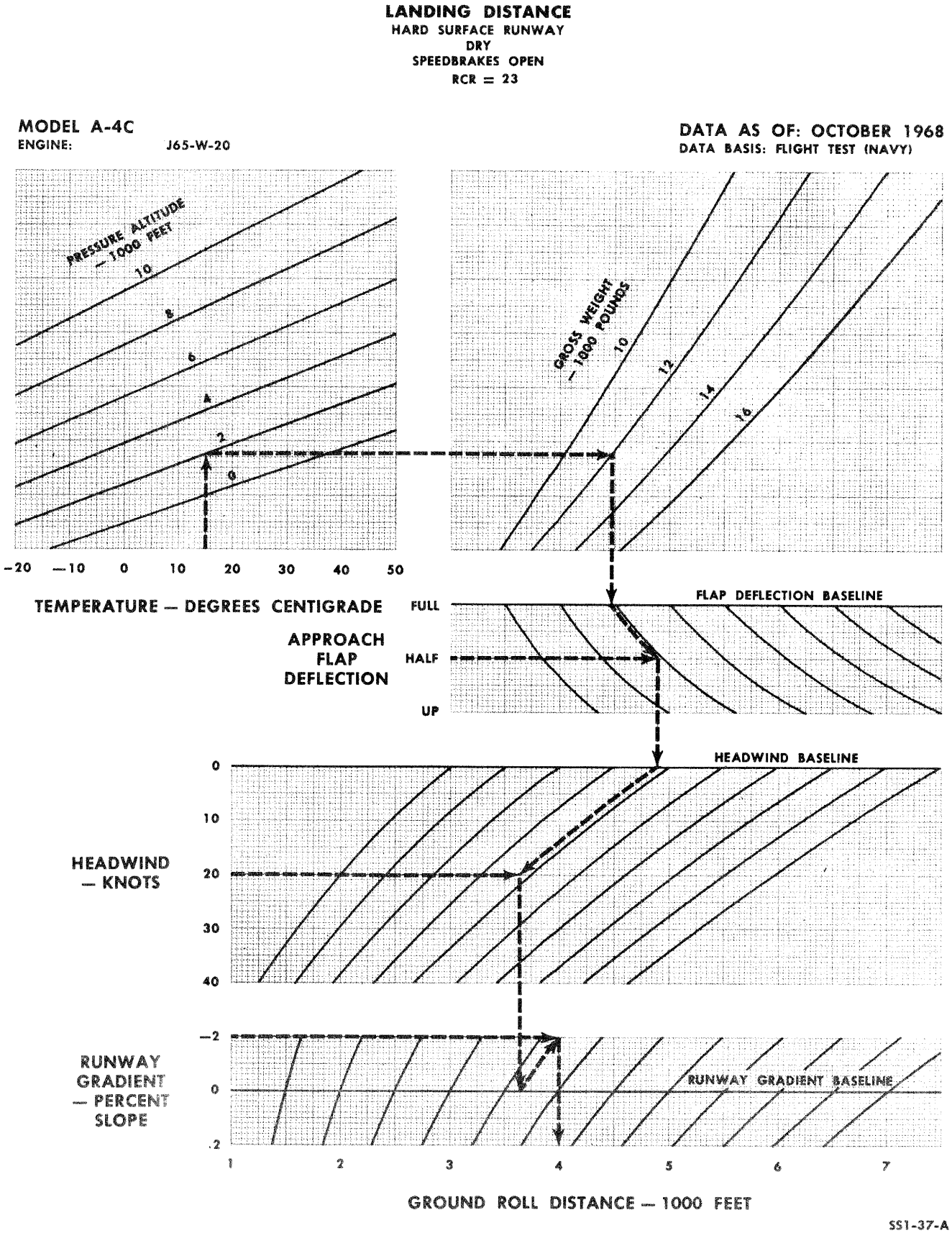


Figure 11-41. Landing Distance (Sheet 1)

LANDING DISTANCE
HARD SURFACE RUNWAY
DRY
SPEEDBRAKES AND SPOILERS OPEN
RCR = 23

MODEL: A-4L
ENGINE: J65-W-20

DATA AS OF: AUGUST 1969
DATA BASIS: FLIGHT TEST (NAVY)

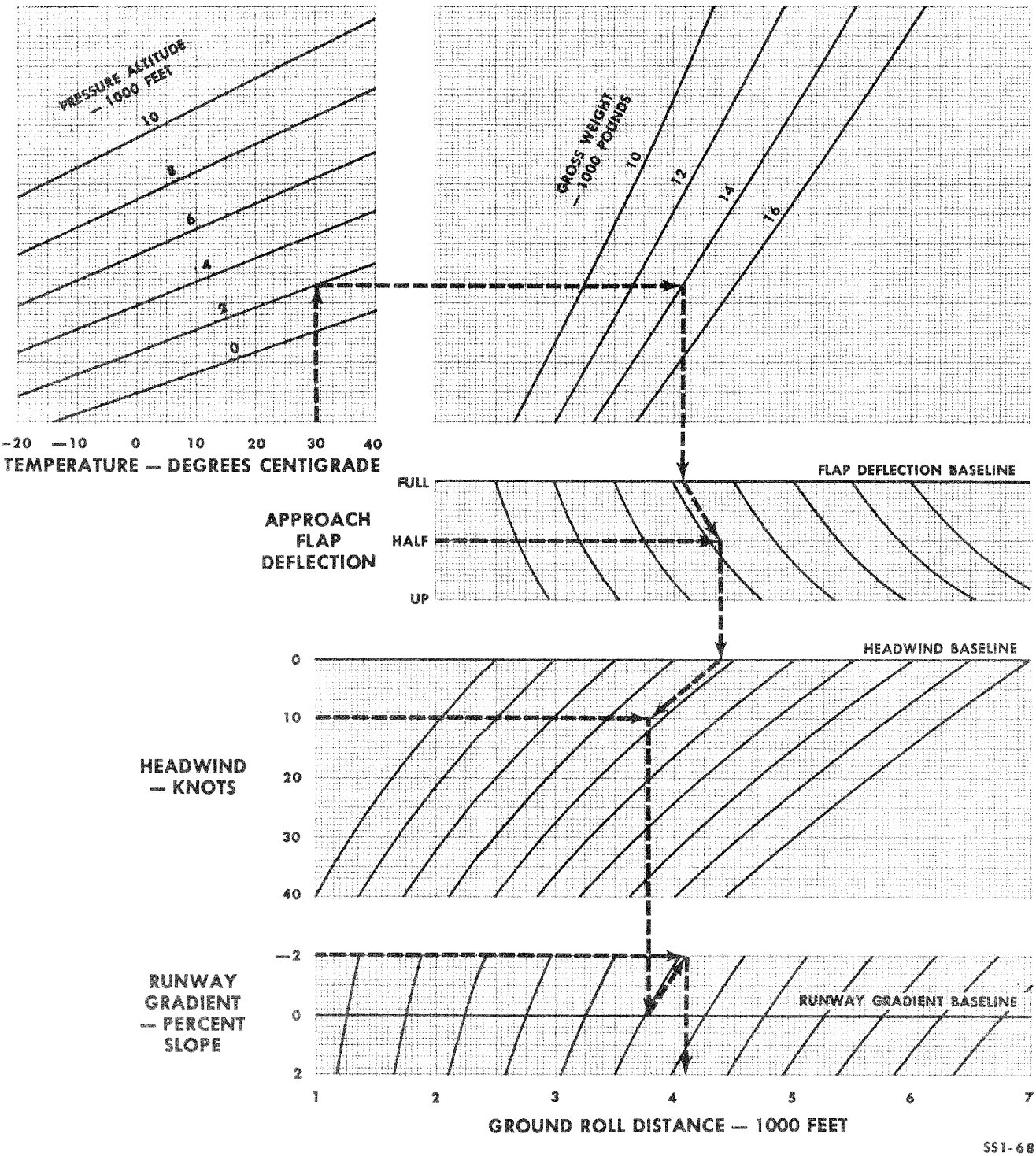


Figure 11-41. Landing Distance (Sheet 2)

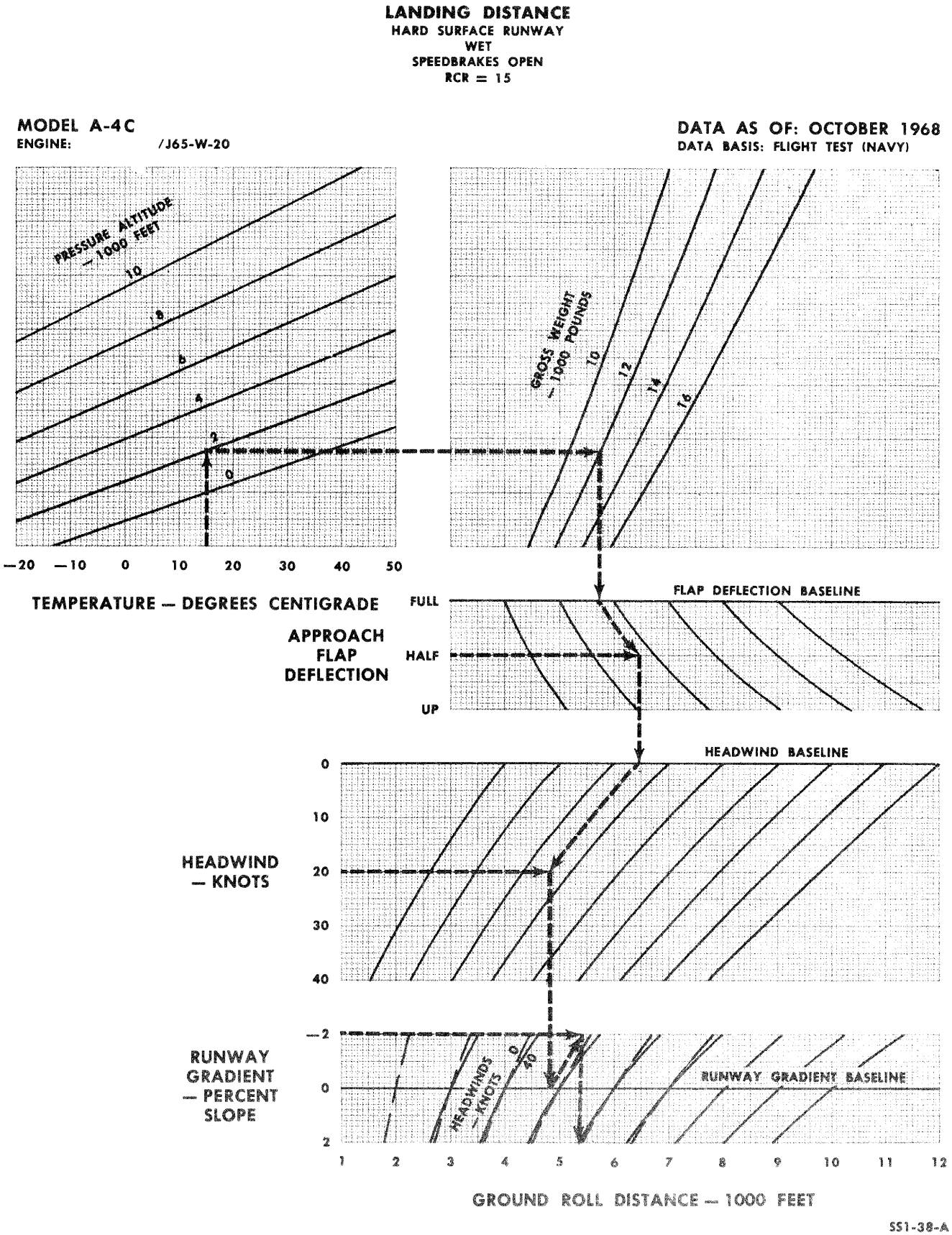
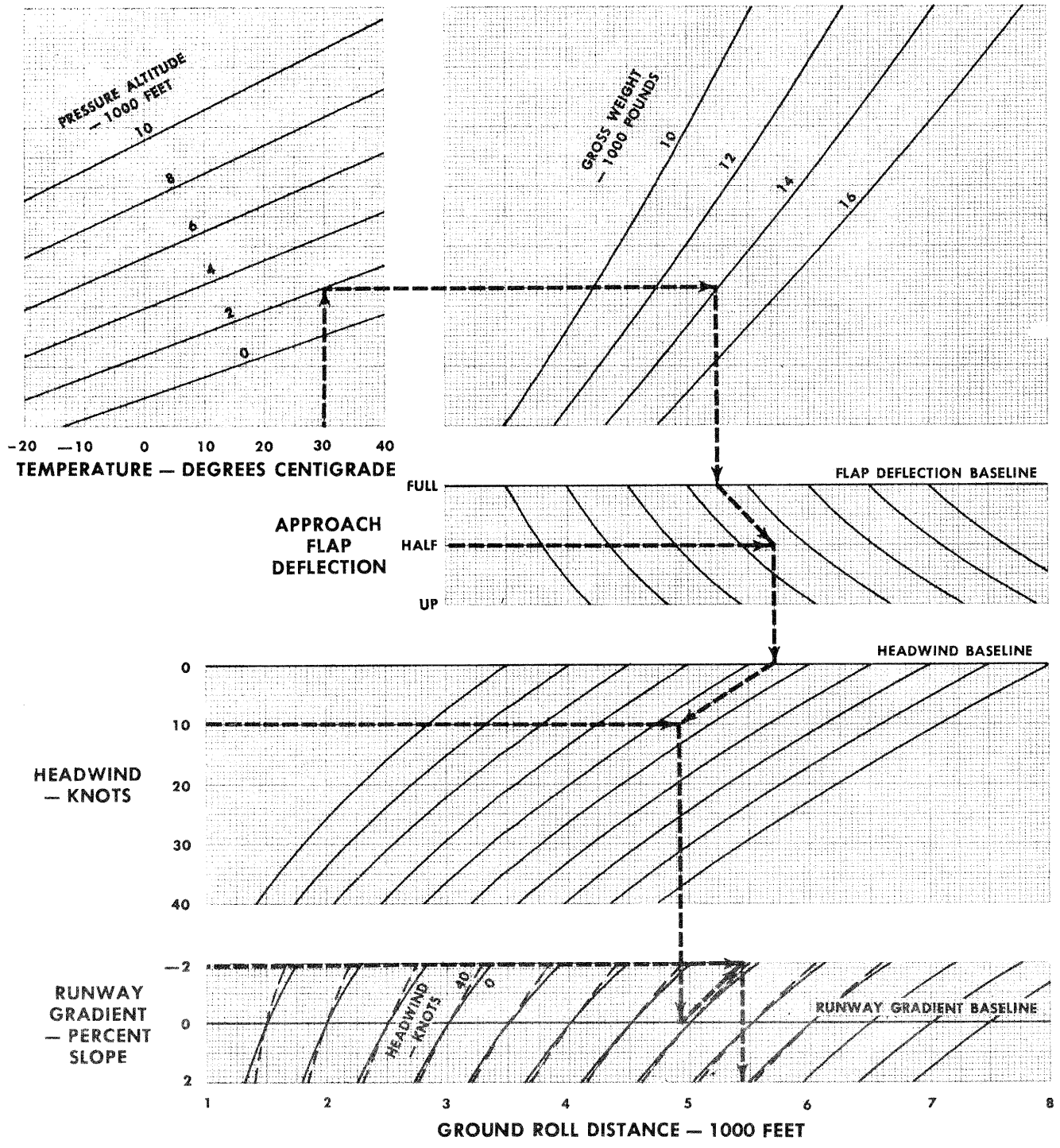


Figure 11-41. Landing Distance (Sheet 3)

LANDING DISTANCE
HARD SURFACE RUNWAY
WET
SPEEDBRAKES AND SPOILERS OPEN
RCR = 15

MODEL: A-4L
ENGINE: J65-W-20

DATA AS OF: AUGUST 1969
DATA BASIS: FLIGHT TEST (NAVY)



SS1-69

Figure 11-41. Landing Distance (Sheet 4)

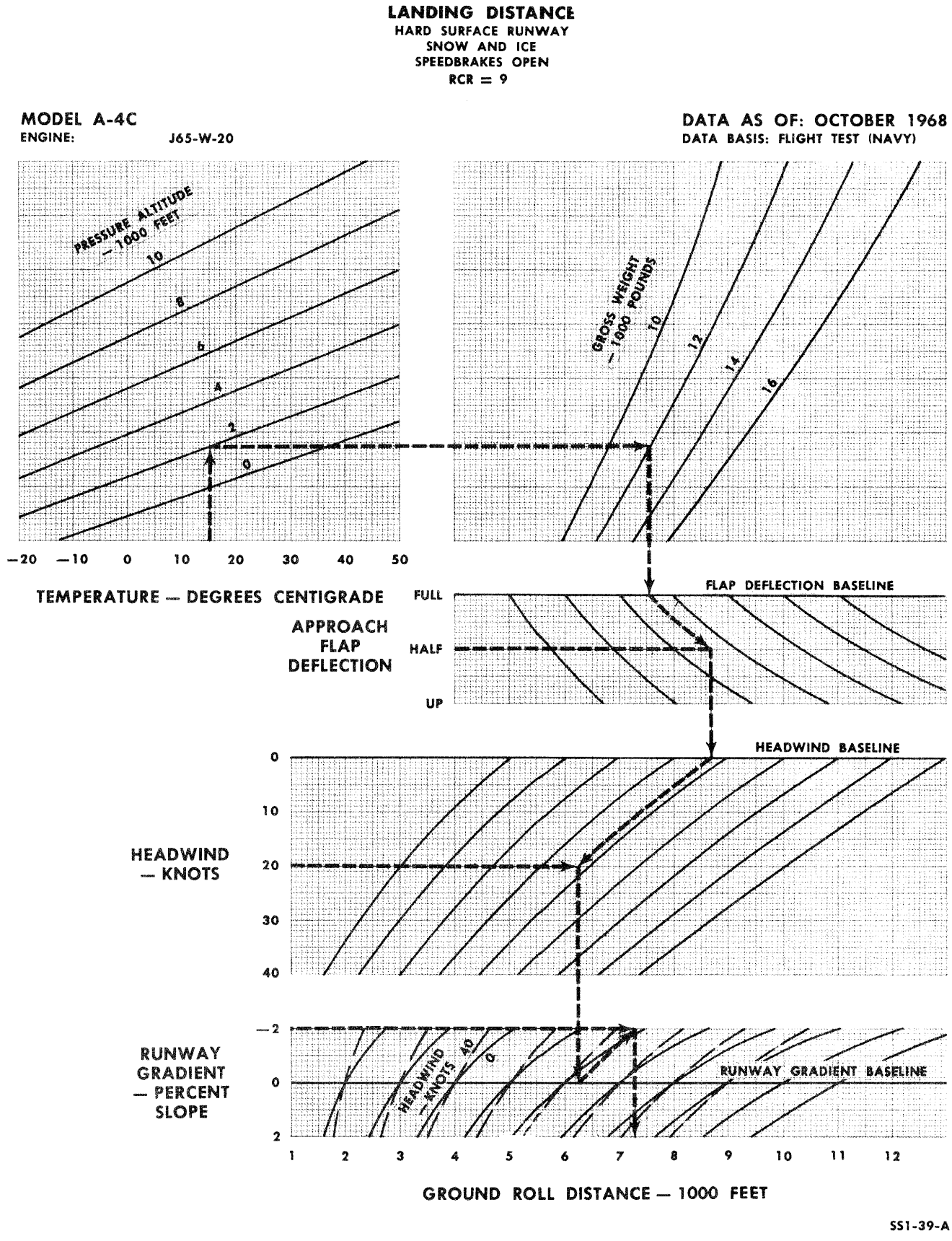


Figure 11-41. Landing Distance (Sheet 5)

LANDING DISTANCE
HARD SURFACE RUNWAY
SNOW AND ICE
SPEEDBRAKES AND SPOILERS OPEN
RCR = 9

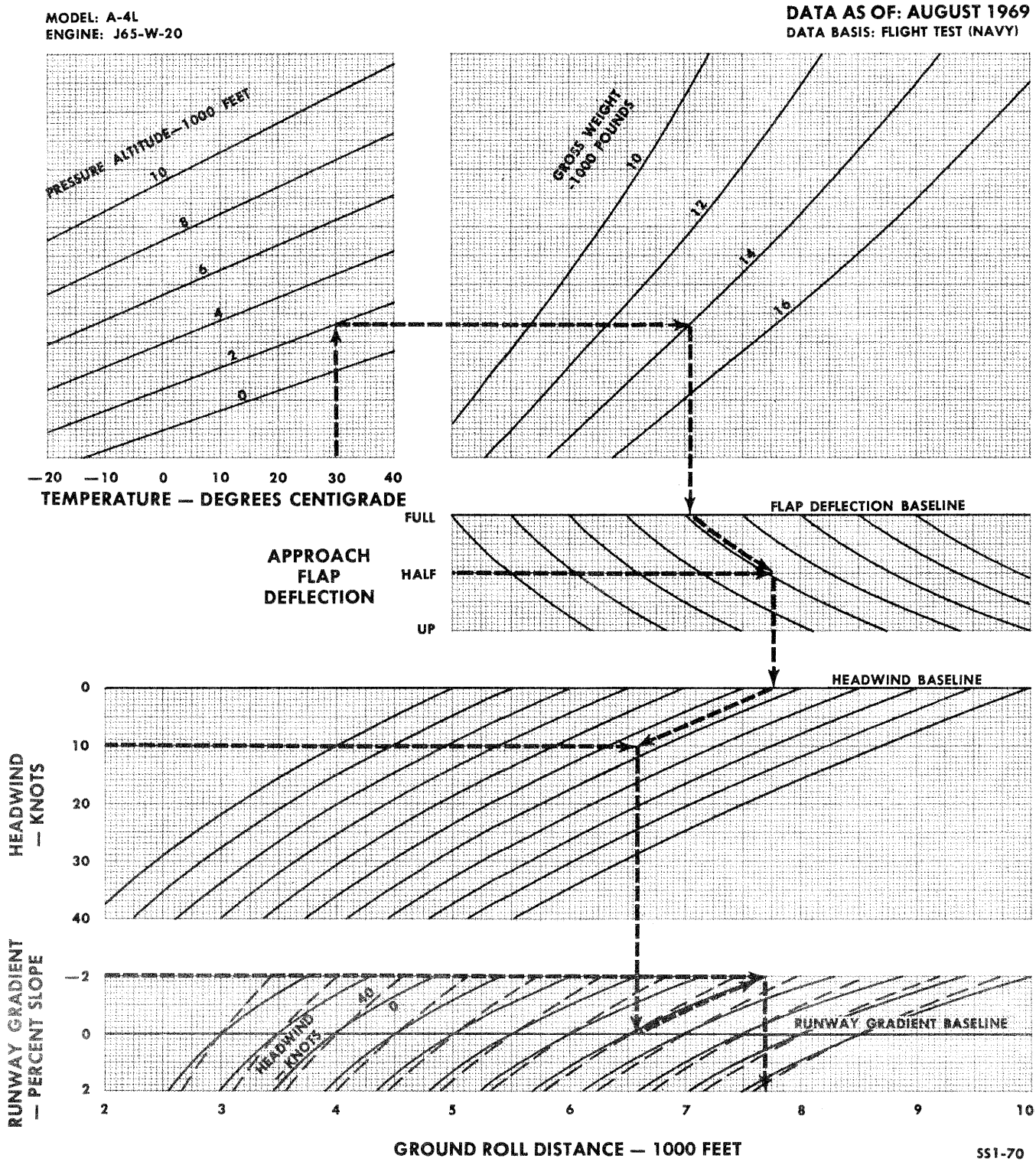


Figure 11-41. Landing Distance (Sheet 6)

PART 9
COMBAT PERFORMANCE

COMBAT PERFORMANCE

This part contains the performance charts associated with the combat phase of the mission. Maximum Mach number, turning radius, and maneuverability data are included.

Turning Radius

NEW NEW The turning radius nomograph, figure 11-42, 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 11-43, 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 PROBLEM

Turning Radius

(For Figure 11-42)

NEW NEW NEW NEW NEW From Maneuverability Sample Problem (figure 11-43)

Calibrated airspeed at sea level, gross weight 14,000 pounds . . . . . .490 kn

(A) Normal load factor at buffet onset (Bank Angle = 78 Degrees) . . . . . 3.1 g

(B) True airspeed (figure 11-2) . . . . . .490 kn

(C) Turning radius (figure 11-42) . . . . . 790 ft

(D) Heading change . . . . . .90 deg

(E) Distance traveled in turn . . . . . .1500 ft

Maneuverability

Low altitude maneuverability characteristics of the A-4C/L aircraft are shown on figure 11-43 (Sheets 1 and 2) as a function of altitude, weight, load factor, airspeed, drag index, and angle-of-attack. Superimposed on the graph are lines showing stall, buffet onset, and structural limits. All data presented is based on the engine developing military thrust.

SAMPLE PROBLEM

Maneuverability

(For figure 11-43, sheet 2)

(A) Calibrated airspeed at sea level, gross weight 14, 000 pounds . . . . . .280 kn

(B) Normal load factor at buffet onset . . . . . .4.92 g

(C) Normal load factor at stall . . . . . .5.73 g

Maximum Mach Number

Level flight maximum Mach number, at military thrust, is shown on figure 11-44 as a function of drag index and gross weight at altitudes of sea level and 10, 000 feet. Corresponding fuel flow data is shown on figure 11-45.

SAMPLE PROBLEM

Maximum Mach Number

(For Figure 11-44)

(A) Drag index 60

(B) Gross weight at sea level . . . . . .18, 000 lb

(C) Mach number 0.80

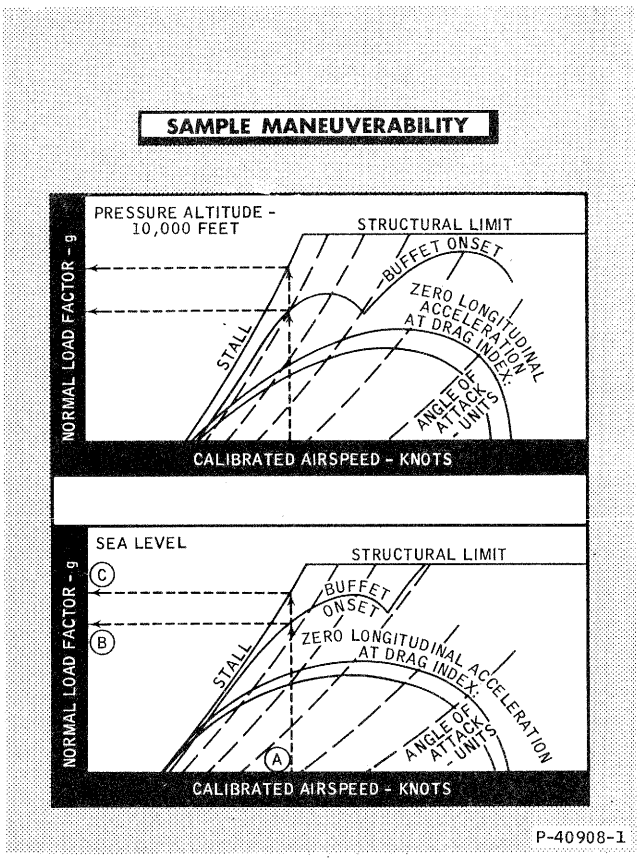
Military Fuel Flow

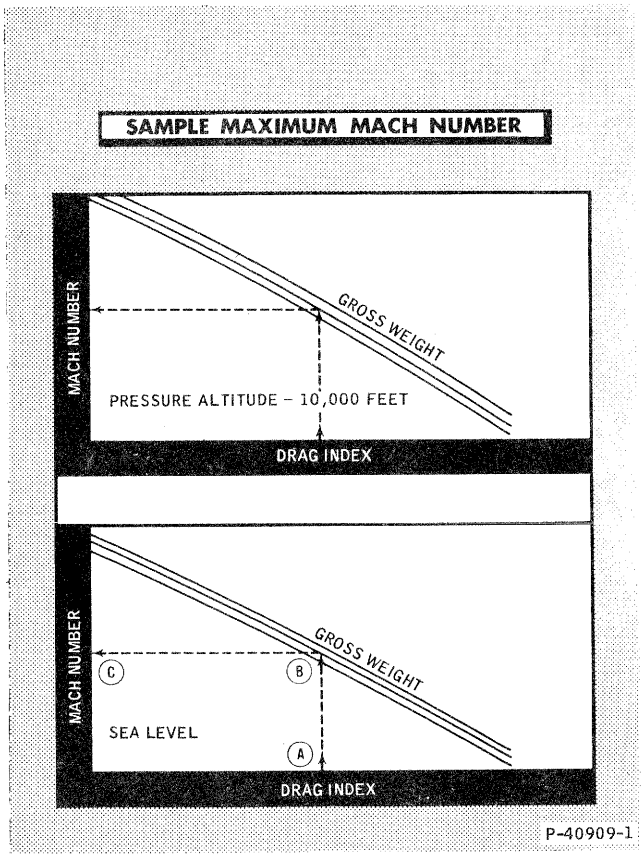
(For figure 11-45)

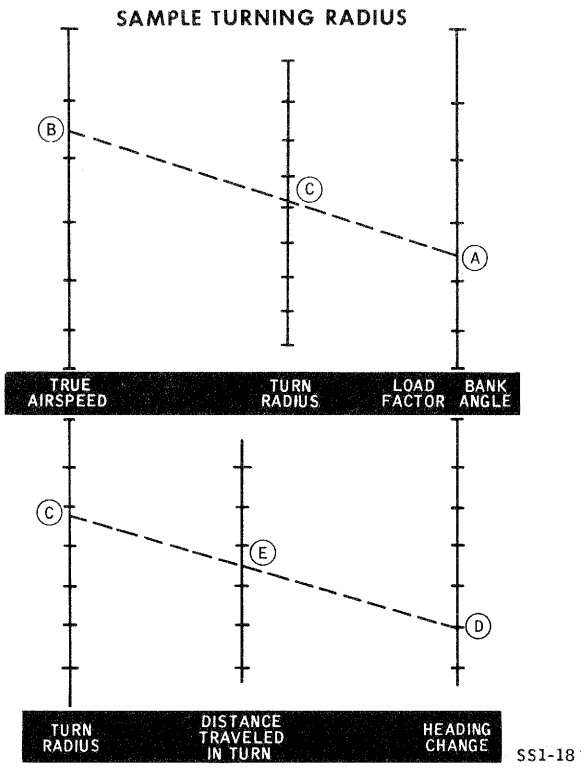
(A) Pressure altitude . . . . . 10, 000 ft

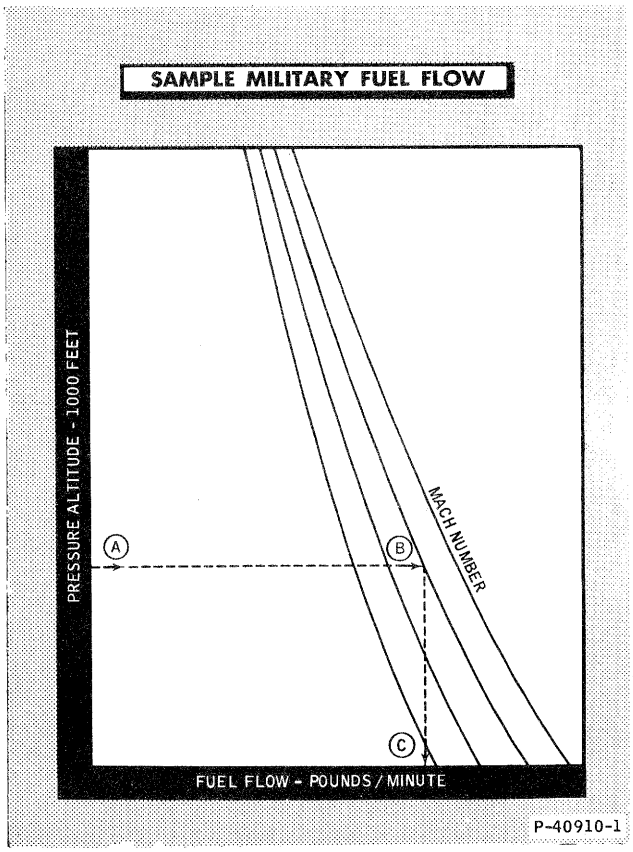
(B) Mach number 0.80

(C) Fuel flow . . . . . 123 lb/min


SAMPLE MANEUVERABILITY
PRESSURE ALTITUDE - 10,000 FEET
STRUCTURAL LIMIT
BUFFET ONSET
ZERO LONGITUDINAL ACCELERATION AT DRAG INDEX:
STALL
ANGLE OF ATTACK - UNITS
NORMAL LOAD FACTOR - g
CALIBRATED AIRSPEED - KNOTS
SEA LEVEL
STRUCTURAL LIMIT
BUFFET ONSET
ZERO LONGITUDINAL ACCELERATION AT DRAG INDEX:
STALL
ANGLE OF ATTACK - UNITS
NORMAL LOAD FACTOR - g
CALIBRATED AIRSPEED - KNOTS
P-40908-1


SAMPLE MAXIMUM MACH NUMBER
MACH NUMBER
GROSS WEIGHT
PRESSURE ALTITUDE - 10,000 FEET
DRAG INDEX
MACH NUMBER
GROSS WEIGHT
SEA LEVEL
DRAG INDEX
P-40909-1


SAMPLE TURNING RADIUS
TRUE AIRSPEED
TURN RADIUS
LOAD FACTOR
BANK ANGLE
TURN RADIUS
DISTANCE TRAVELED IN TURN
HEADING CHANGE
SS1-18


SAMPLE MILITARY FUEL FLOW
PRESSURE ALTITUDE - 1000 FEET
MACH NUMBER
FUEL FLOW - POUNDS / MINUTE
P-40910-1

TURNING RADIUS

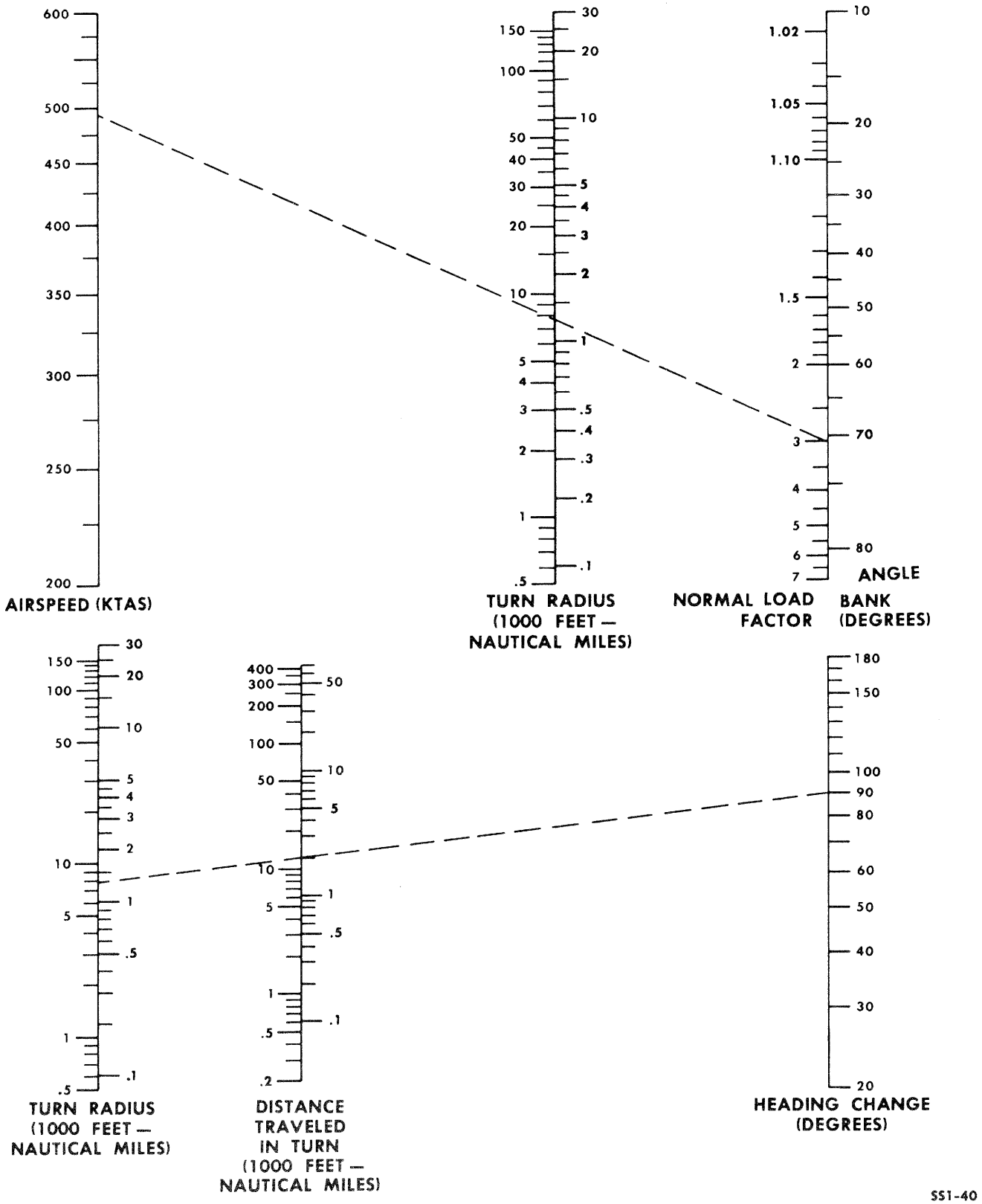


Figure 11-42. Turning Radius

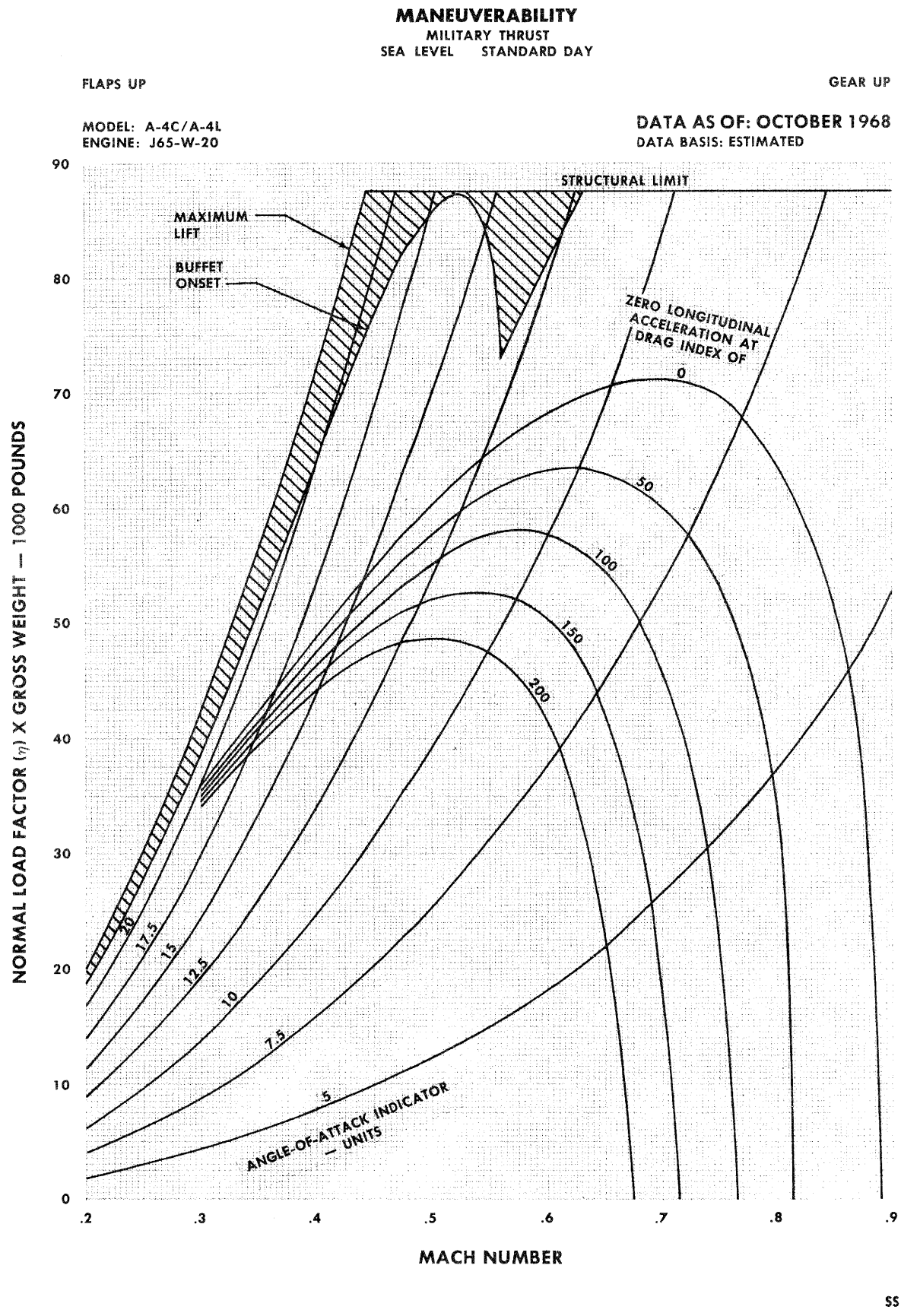


Figure 11-43. Maneuverability (Sheet 1)

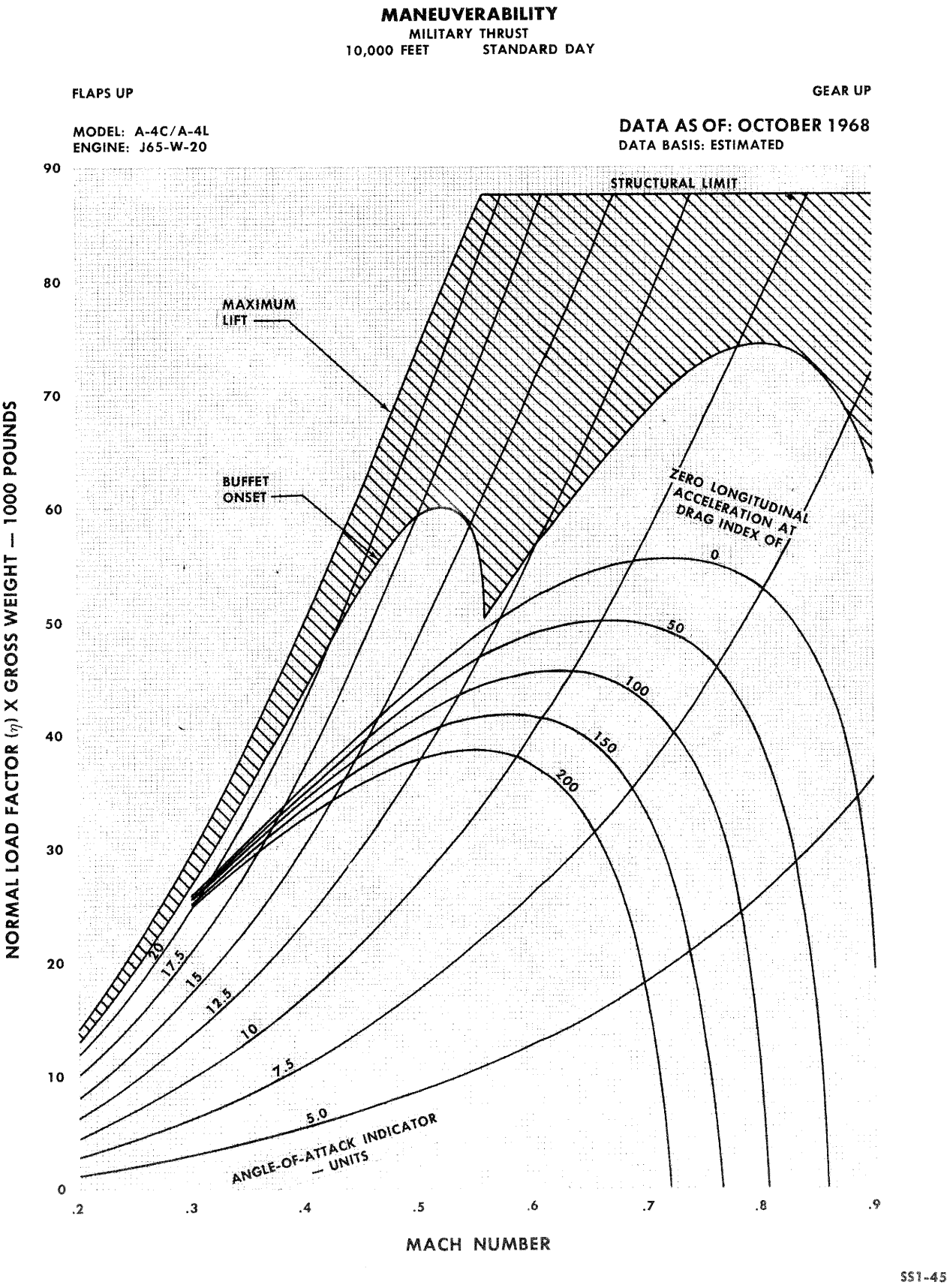
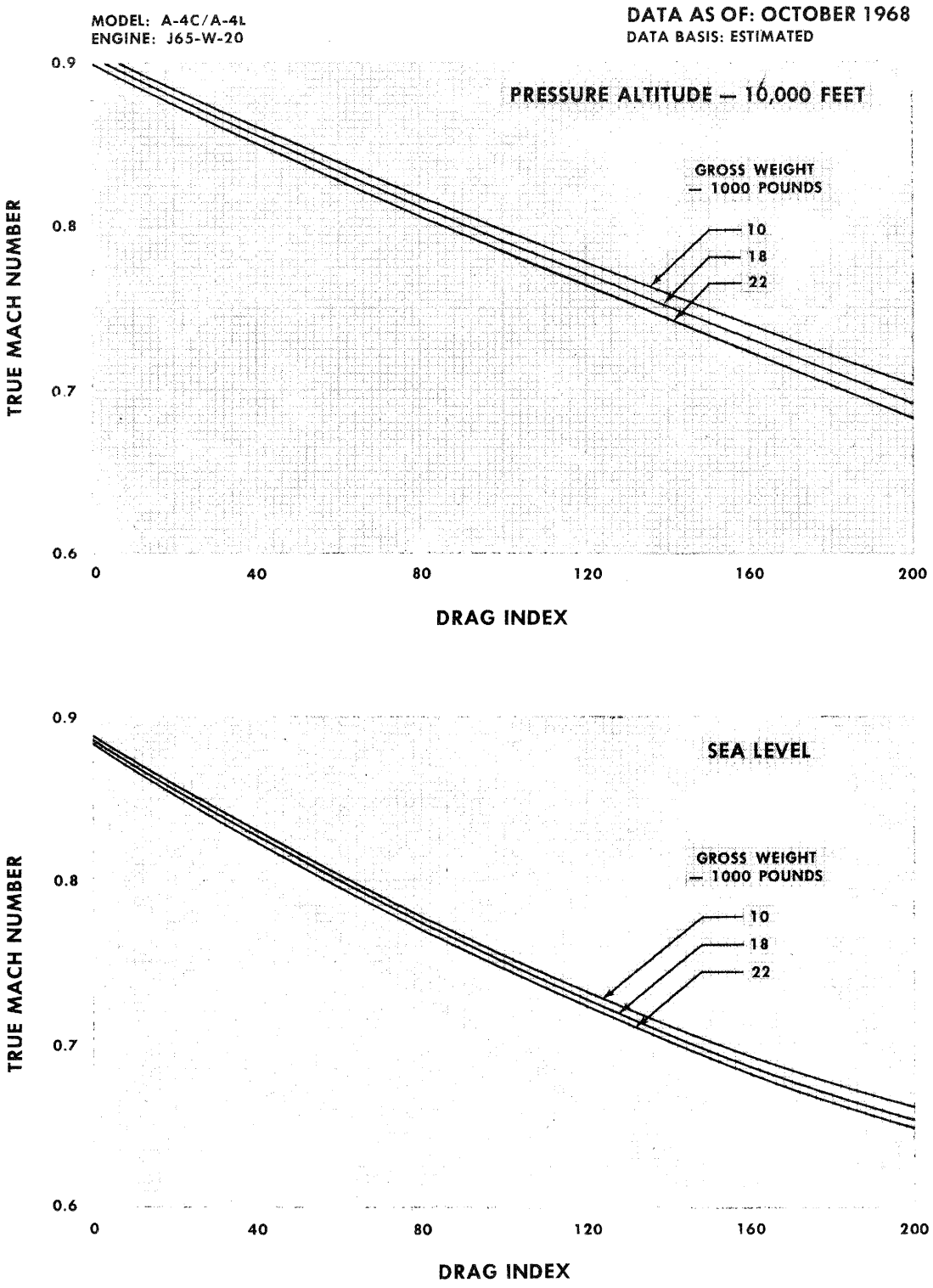


Figure 11-43. Maneuverability (Sheet 2)

MAXIMUM MACH NUMBER
MILITARY THRUST
U.S. STANDARD ATMOSPHERE, 1962



SS1-42

Figure 11-44. Maximum Mach Number

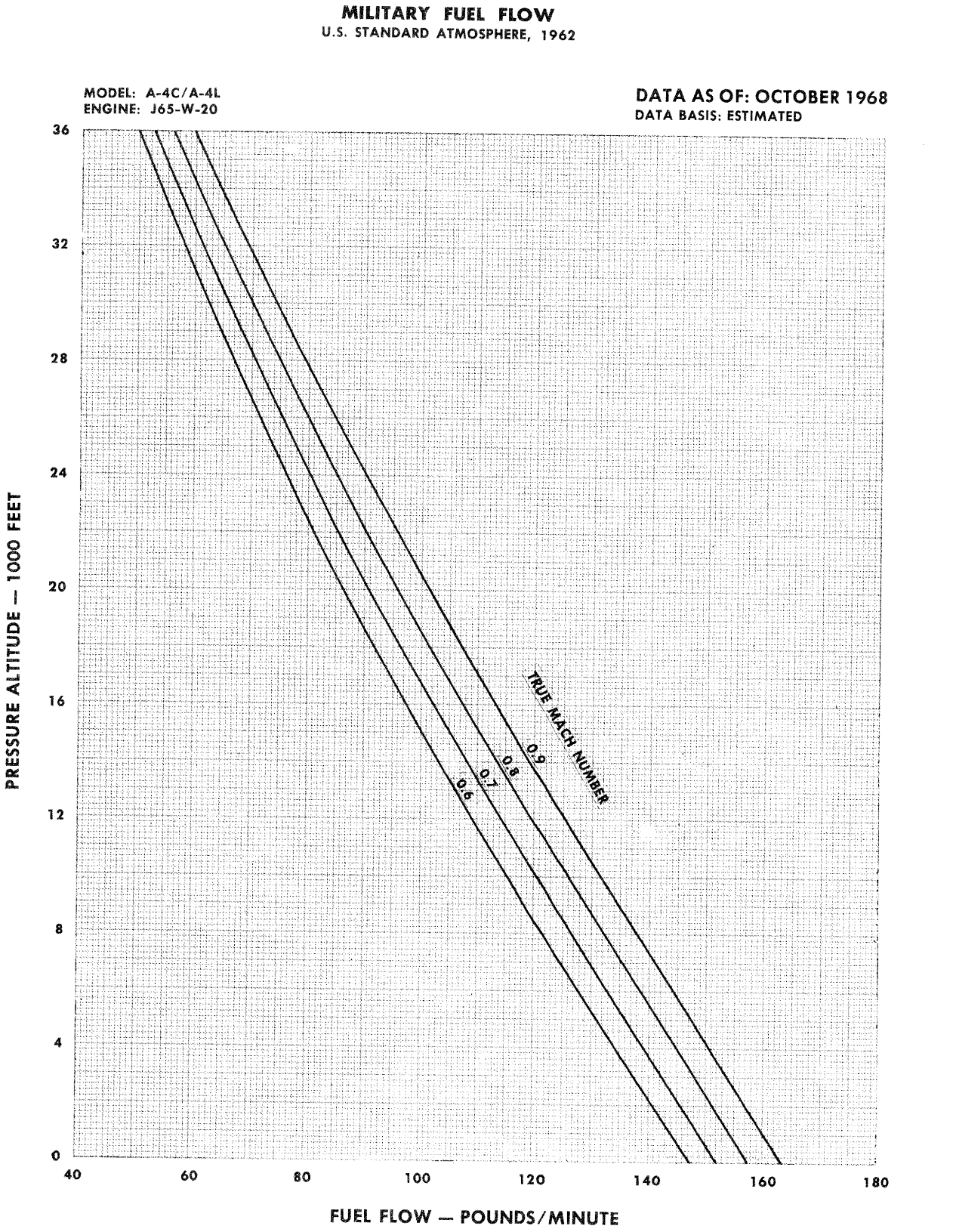


Figure 11-45. Military Fuel Flow

PART 10
MISSION PLANNING

MISSION PLANNING

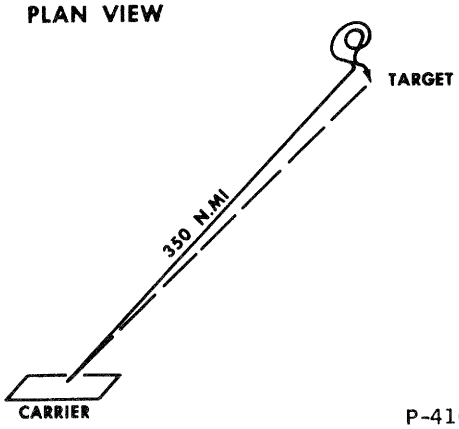
Optimum use of the aircraft to obtain maximum performance at a minimum rate of fuel consumption requires careful preflight planning for the mission. One of the most important phases of mission planning is the determination of the maximum radius of action from the carrier which will allow return with an adequate fuel reserve. See figure 11-46.

To find the maximum radius, a combat plan must be formulated in advance and a loiter or hold altitude and distance 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 Section XI, Parts 1 thru 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 20,000 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 6 X 300-pound Snakeye bombs. Return to the carrier, at maximum range cruise altitude, with 800 pounds of reserve fuel. Following is a plan view.



P-41019-1

Assumptions and Comments

a. Aircraft takeoff gross weight, with fuel and stores, is 22,349 pounds.

b. The aircraft zero fuel and payload weight is 10,192 pounds. Usable fuel weight is 7480 pounds.

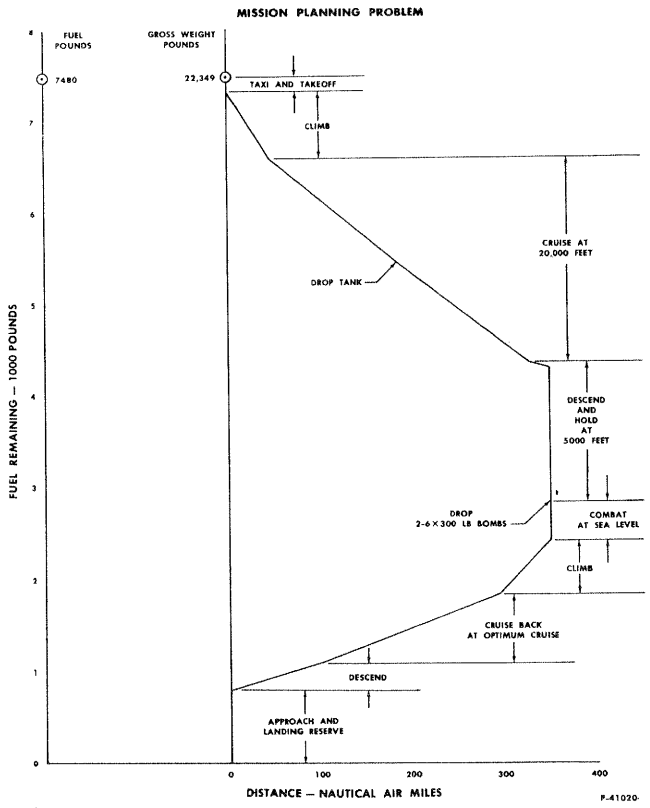
c. Assume zero wind and ICAO standard day conditions.

d. Assume the gun ammunition is not fired during mission.

e. The difference between outbound, combat, return, and reserve fuel and takeoff usable fuel defines the amount of fuel available to hold on station.

f. Assume a combat allowance of 3 minutes to drop the bombs at the target.

The graphic solution of the problem is introduced at this point so that the pilot can see the complete 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 Indexes

(From figure 11-1 and A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T)

ITEMS	DRAG INDEX	WEIGHT (pounds)
Zero fuel, Zero payload weight	14.0	10,192
2-MK 12 20MM guns and ammo.	6.7	459
2-Wing pylons	12.0	117
2-A/A37B-1 multiple bomb adapters	28.0	318
1-300-gallon bobtail fuel tank on centerline	15.0	183
2-6X300 pound MK 81 Snakeye bombs	55.6	3600
Internal fuel (800 gallons JP-5)		5440
External fuel (300 gallons JP-5)		2040
TAKEOFF TOTALS	131.3	22,349
Drop 300 gallon tank	-15.0	-183
TOTAL	116.3	
Drop bombs	-55.6	-3600
TOTAL	60.7	
Fuel used (internal)		-5440
Fuel used (external)		-2040
TOTAL		11,086

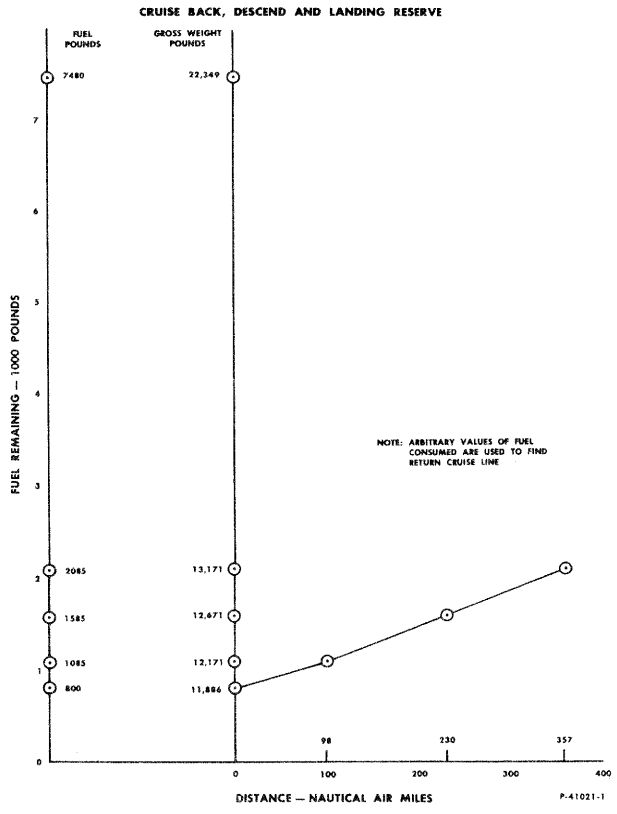
Approach and Landing Reserve Allowances

The landing reserve is assumed to be 800 pounds which will permit sea level landing pattern operation for 15 to 20 minutes.

Descend from Optimum Cruise Altitude to Sea Level

The time, fuel, and descent distance can be determined from the descent figures (see figures 11-37 thru 11-39). The drag index for this configuration is 60.7 with two MCBR's installed. Assume the gross weight at the beginning of the letdown is equal to the gross weight with reserve fuel (11,886 lb = 11,086 lb + 800 lb). The optimum cruise altitude for this weight and drag index is read from figure 11-20.

WEIGHT (pounds)	TIME (minutes)	OPTIMUM CRUISE ALTITUDE	DISTANCE (N. Mi.)	FUEL (pounds)
11,886	21.5	41,500	98	285



Return at Optimum Cruise Altitude

The optimum cruise altitude fuel requirements can be determined from figure 11-27. The drag index is 60.7 and the gross weight at end of cruise is 12,171 lb. (11,086 lb + 800 lb + 285 lb). Assume arbitrary cruise fuel increments and construct the return fuel-distance line as shown on the graph.

FUEL INCREMENT (pounds)	AVERAGE WEIGHT (pounds)	OPTIMUM CRUISE ALTITUDE (feet)
500	12,421	40,900
500	12,921	40,100

OPTIMUM CRUISE MACH NUMBER	N. Mi./POUND OF FUEL
0.745	0.264
0.745	0.265

DISTANCE INCREMENT (N. Mi.)	FUEL FLOW lb./hr.	RPM $\sqrt{\theta}$amb	RPM
132	1620	8780	6600
127	1680	8780	6600

Taxi, Takeoff, and Acceleration

The first portion of the graph was constructed by working backwards from the landing reserve. The remainder of the plot can be developed starting at the taxi-takeoff condition. Takeoff gross weight is 22,349 pounds with a corresponding drag index of 131.3. Assume one minute taxi fuel flow at 15 lb/min and takeoff-acceleration allowances of 150 lb. fuel used and 1 N.Mi. covered.

Climb to 20,000 feet Cruise Altitude

The time, fuel, and distance to climb values are read from figures 11-17 thru 11-19 at a drag index of 131.3 and an initial climb of 22,184 pounds (22,349 lb, -15 lb, -150 lb).

INITIAL WEIGHT (pounds)	FUEL (pounds)	DISTANCE (N. Mi.)	TIME (minutes)
22,184	725	44	7.4

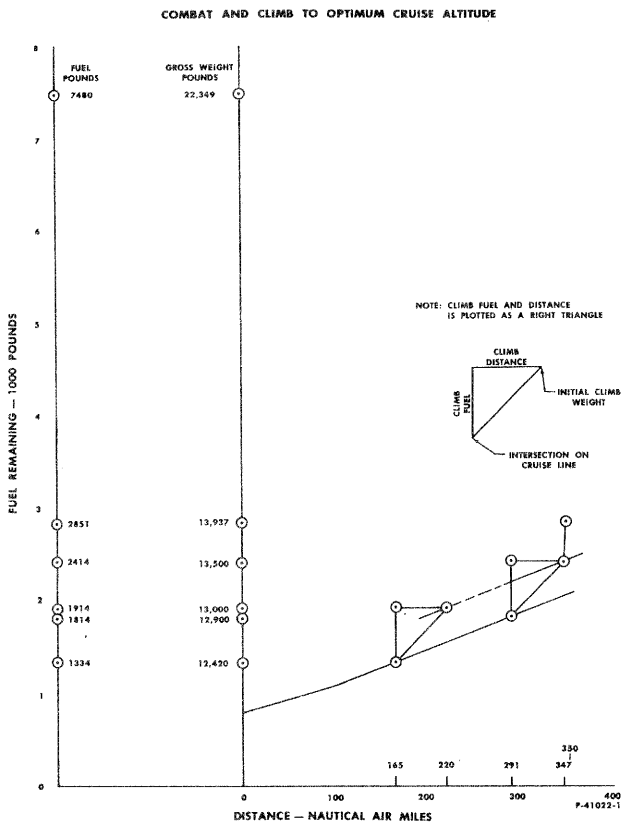
Cruise Out at 20,000 feet Altitude

The initial cruise out weight is 21,459 pounds (22,184 - 725 lb.) and the drag index is 131.3. The fuel remaining in the 300 gallon drop tank is 1150 pounds (2040 lb, -15 lb, -150 lb, -725 lb) and will be consumed during the initial portion of the cruise out leg. The average weight is 20,884 pounds (21,459 lb, - 1150/2 lb). Read the nautical miles per pound of fuel of 0.121 from figure 11-26. The cruise out distance, with the drop tank fuel, is 139 N. Mi. (0.121 N. Mi./lb X 1150 lb). The external fuel tank is dropped and the aircraft weight is 20,126 pounds (21,459 lb, - 1150 lb, - 183 lb) at a drag index of 116.3. Assume arbitrary cruise fuel increments and continue to construct the cruise out line on the graph.

Climb to Optimum Cruise Altitude

The time, fuel, and climb distance can be determined from figures 11-17 thru 11-19. Assume two arbitrary initial climb weights of 12,500 and 13,000 pounds and read the values at drag index of 60.7. Construct right triangle fuel-distance lines on the graph beginning at the appropriate fuel consumed values corresponding to weights of 12,500 and 13,000 pounds.

INITIAL WEIGHT (pounds)	FUEL (pounds)	DISTANCE (N. Mi.)	TIME (minutes)
13,000	580	55	8.3
13,500	600	56	8.4



Combat

A three-minute sea level maximum speed combat allowance is assumed to expend the Snakeye bombs over the target. To permit a conservative fuel allowance, it is assumed the bombs have been dropped prior to combat and the drag index is 60.7. The variation is maximum speed with aircraft gross weight, at sea level, is negligible. Therefore, assume a gross weight of 13,500 pounds. Read the maximum Mach number of 0.79 from figure 11-44 and the fuel flow, at that Mach number, of 137 lb/min from figure 11-45. Assume no distance covered during combat and plot these values on the graph.

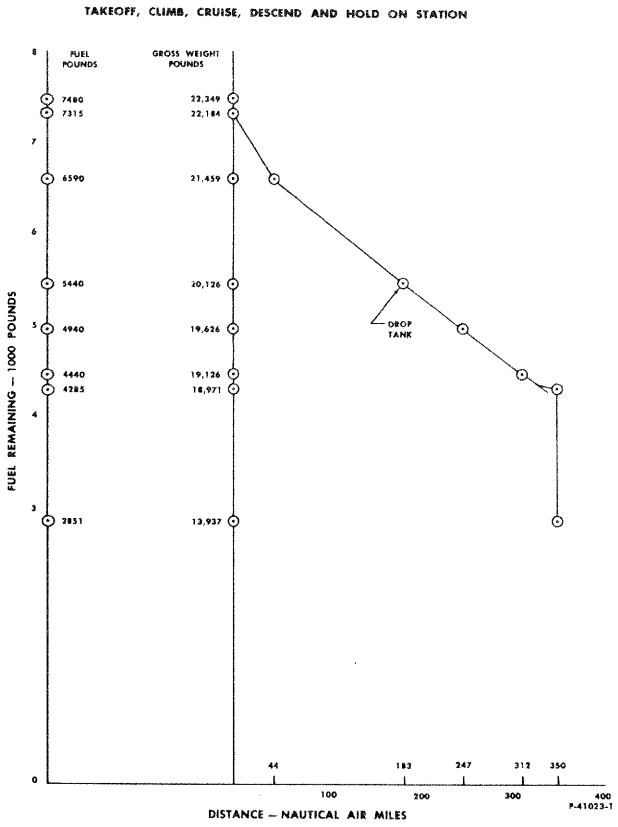
FUEL INCREMENT (pounds)	AVERAGE WEIGHT (pounds)	N. Mi./lb OF FUEL	DISTANCE INCREMENT (N. Mi.)
500	19, 876	0.128	64
500	19, 376	0.130	65

Descend to 5000 feet Altitude

Assume the initial descent weight is equal to the weight of the aircraft at a distance of 350 N. Mi. on the cruise out leg; 18, 971 pounds (22, 349 lb, - 7480 lb, - 183 lb, + 4285 lb). The drag index is 116.3. The time, fuel, and distance to descend, found on figures 11-37 thru 11-39, is 5.2 minutes, 65 pounds and 23 nautical miles.

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. Initial gross weight is 18, 971 pounds (read from the graph at 350 N. Mi.) and a drag index of 116.3. The fuel remaining for loiter, read from the graph, is 1434 pounds. Therefore, the average loiter weight is 18, 254 pounds (18, 971 lb, - 1434 lb./2). It is assumed that the holding condition will be flown in a race track pattern and the average bank angle is 15 degrees. From figure 11-32, for the above conditions, read the maximum endurance (loiter, hold, time on station) time of 31.9 minutes.



TAKEOFF AND LANDING DATA CARD

Certain items of takeoff performance can be entered on the takeoff data card for convenient reference. Entries illustrated on figure 11-47 are from the sample mission problem and may be read from figures 11-8 thru 11-15. Normal landing performance data is also available in Part 8.

SUMMARY OF SAMPLE MISSION

SEGMENT	INITIAL WEIGHT -LB.	FUEL -LB.	TIME -MIN.	DISTANCE -N. MI.	
TAKEOFF	22,349	165	1.0	1	
CLIMB TO 20,000 FT.	22,184	725	7.4	44	CLIMB SPEED (ALT-1000 FT. / KCAS): 0 / 290; 10 / 280; 20 / 265
CRUISE AT 20,000 FT. (with tank)	21,459	1150	22.4	139	CRUISE SPEED-KCAS: 280; RPM: 7100; FUEL FLOW -LB/HR: 3100
CRUISE AT 20,000 FT. (tank dropped)	20,126	1090	23.6	143	CRUISE SPEED-KCAS: 270; RPM: 6950; FUEL FLOW -LB/HR: 2800
DESCEND TO 5000 FT.	19,036	65	5.2	23	DESCENT SPEED-KCAS: 225
HOLD AT 5000 FT.	18,971	1434	31.9	0	LOITER SPEED-KCAS: 230; RPM: 6690; FUEL FLOW -LB/HR: 2700
COMBAT AT S.L.	13,937	411	3.0	0	MACH NO.: 0.79; FUEL FLOW-LB/HR: 8220
CLIMB TO OPT. ALTITUDE (Optimum Alt. = 39,100 Ft.)	13,526	600	8.4	56	CLIMB SPEED (ALT-1000 FT. / KCAS MACH NO.): 0 / 330; 10 / 315; 20 / 305; 30 / 0.75; 40 / 0.75
CRUISE BACK AT OPT. ALT. (Final Alt. = 41,300 Ft.)	12,926	755	27.7	196	CRUISE SPEED (MACH / KCAS): 0.745 / 220; RPM: 6600; FUEL FLOW -LB/HR: 1630
DESCENT TO SEA LEVEL	12,171	285	21.5	98	DESCENT SPEED-KCAS: 190
APPROACH AND LANDING RESERVE	11,886	800	---	---	
TOTAL		7480	152.1	700	

Figure 11-46. Summary of Sample Mission

TAKEOFF AND LANDING DATA CARD

CONDITIONS

Gross Weight	22,349 LB
Runway Length	9000 FT
Runway Temperature	+6° C
Pressure Altitude	2000 FT
Runway Wind Component	+10 KN

TAKEOFF

Acceleration Check	106 KN, 2000 FT
Takeoff Speed	158 KIAS
Ground Run	5300 FT
Total Distance to clear 50-foot obstacle	7800 FT
Refusal Speed	KIAS
Stopping Distance	FT

CONDITIONS

Gross Weight	11,886 LB
Runway Length	8500 FT
Runway Temperature	+20° C
Pressure Altitude	3000 FT
Flap Deflection	FULL
Runway Wind Component	+5 KN
Braking Coefficient	WET CONCRETE
Runway Gradient	-2%

LANDING

Approach Angle-of-Attack	19.0 UNITS
Final Approach Speed	120 KIAS
Touchdown Speed	120 KIAS
Landing Ground Roll	4000 FT
Distance over 50-foot obstacle	4715 FT

Figure 11-47. Takeoff and Landing Data Card

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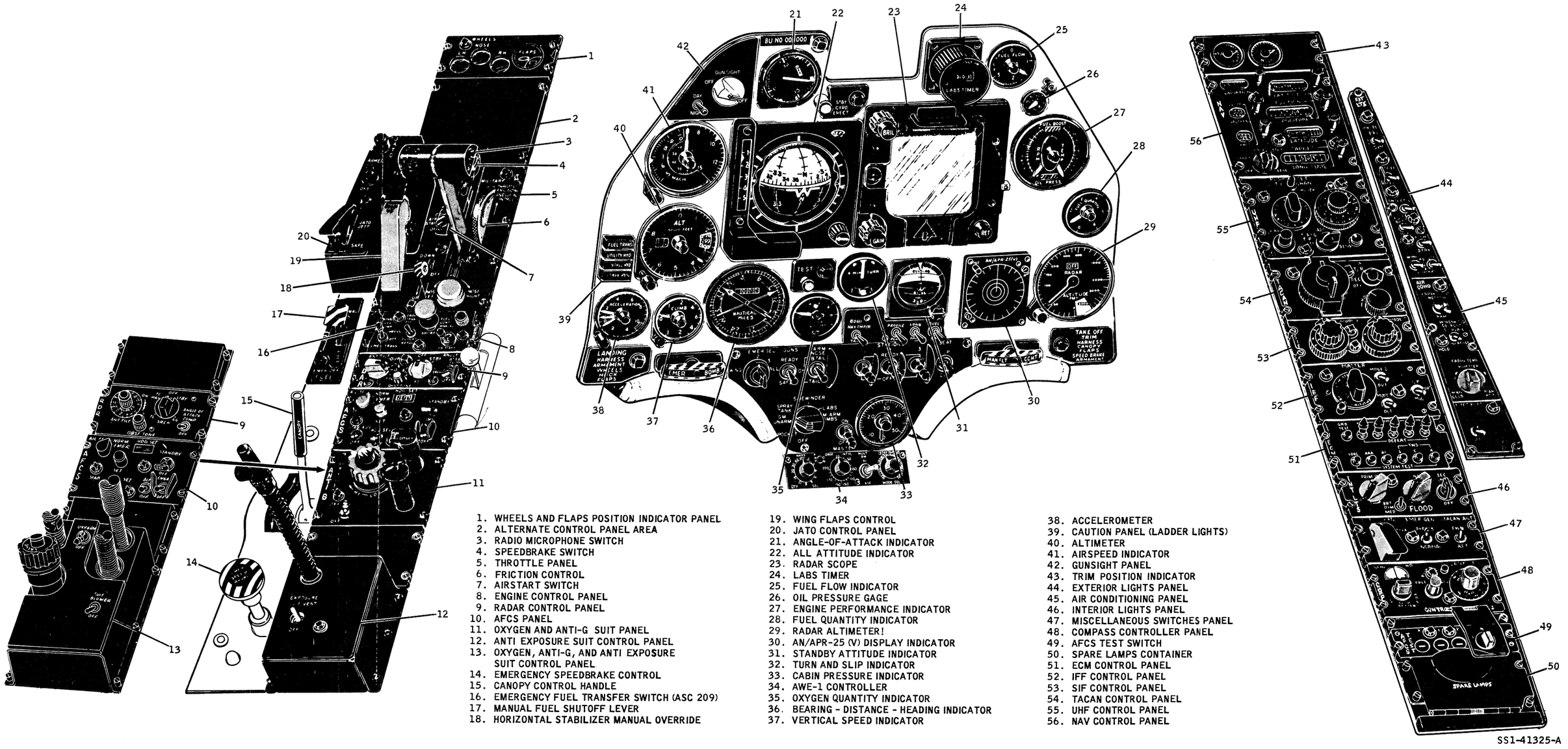
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APPENDIX A

FOLDOUT ILLUSTRATIONS

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22. ALL ATTITUDE INDICATOR
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55. UHF CONTROL PANEL
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Figure A-1. Typical Instrument Panel and Consoles — A-4C/L

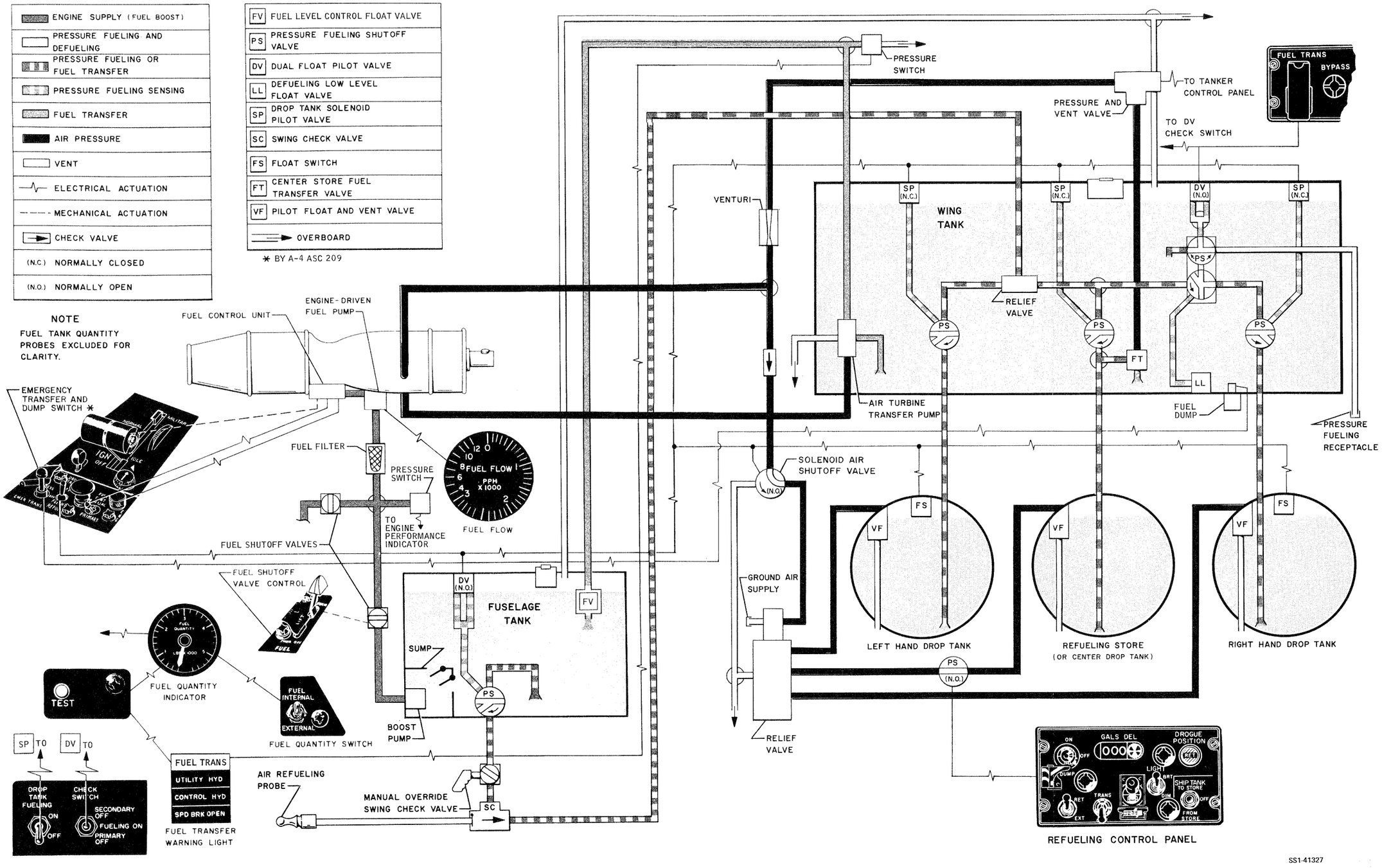


Figure A-2. Fuel System — A-4C

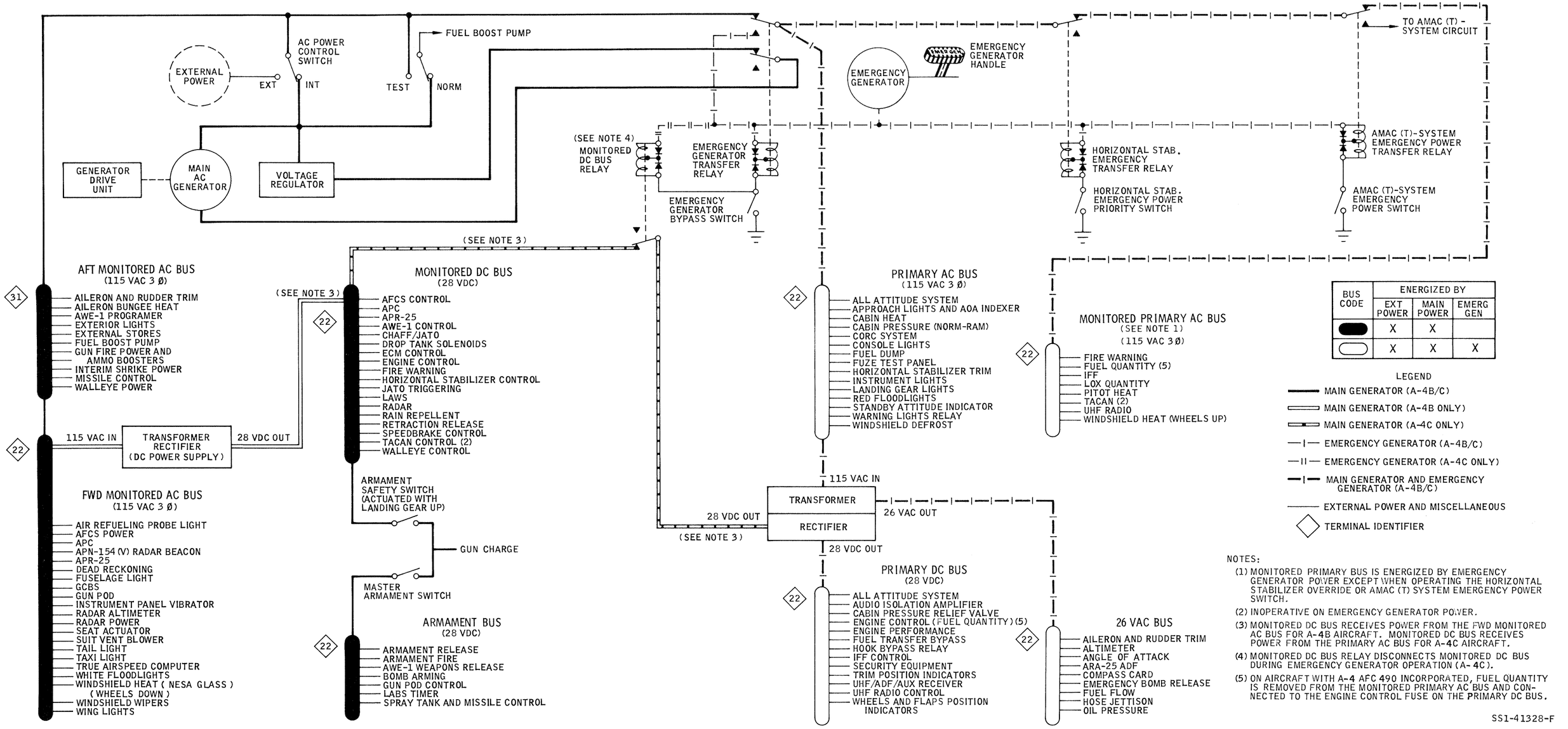


Figure A-3. Electrical System — A-4C

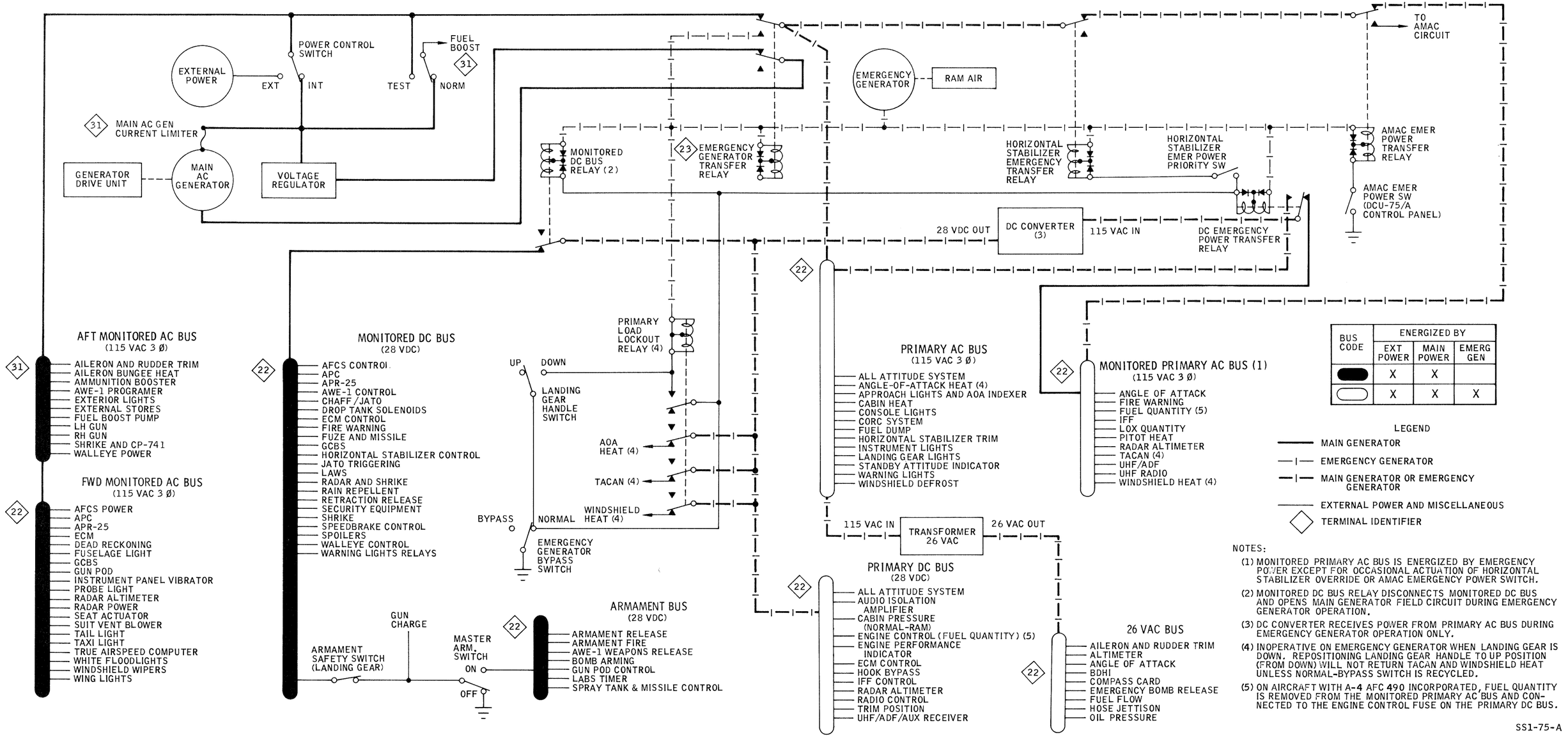


Figure A-4. Electrical System — A-4L

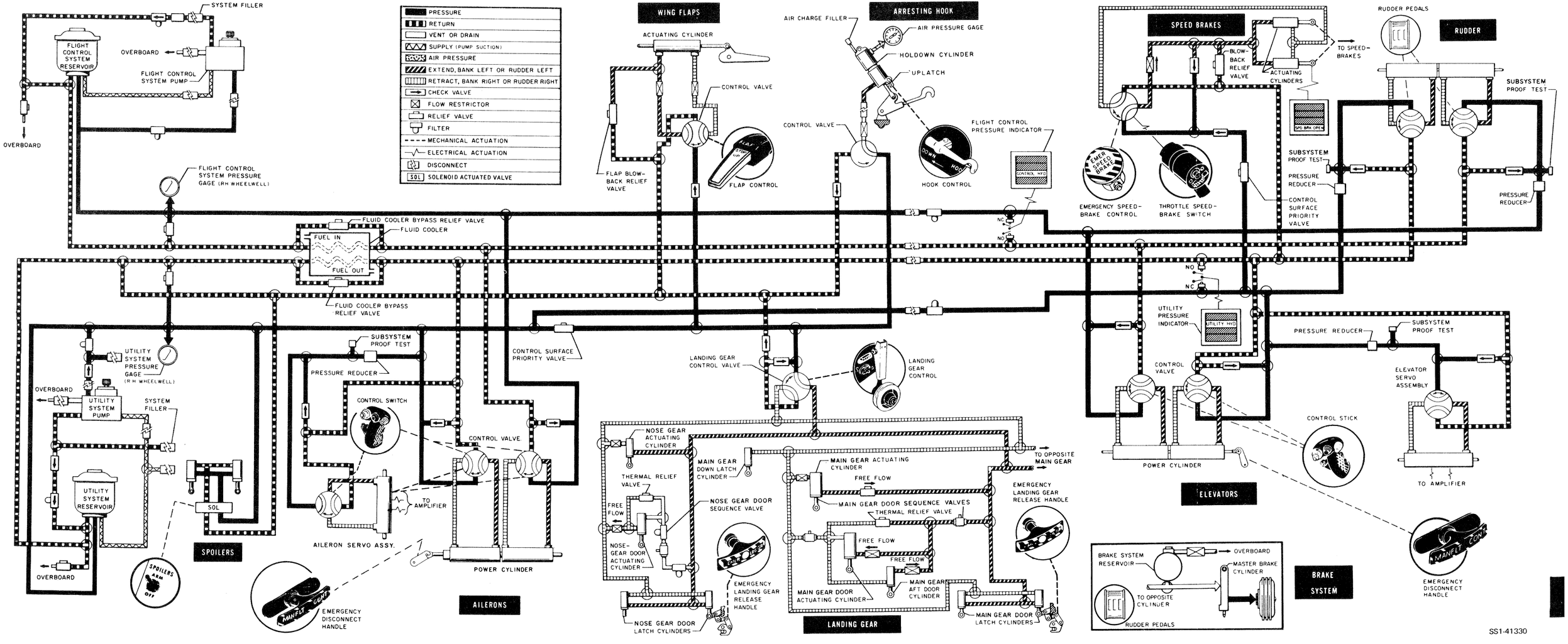


Figure A-5. Hydraulic System — A-4C/L