N A T O P S
FLIGHT MANUAL

NAVY MODEL

EA-6A

AIRCRAFT

THIS PUBLICATION IS INCOMPLETE WITHOUT SUPPLEMENTAL NATOPS FLIGHT MANUAL NAVWEPS 01-85ADB-1A

THIS PUBLICATION SUPERSEDES NAVWEPS 01-85ADB-1 DATED 1 JULY 1965 AND CHANGES DATED 1 SEPTEMBER 1965 AND 1 DECEMBER 1965

ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER THE DIRECTION OF THE CHIEF OF THE BUREAU OF NAVAL WEAPONS

1 May 1966

6

LIST OF CHANGED PAGES ISSUED

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NOTE: The portion of the text affected by the current change is indicated by a vertical line in the outer margins of the page.

*The asterisk indicates pages changed, added or deleted by the current change.

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

LETTER OF PROMULGATION

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

2. This Manual is published for the purpose of standardizing ground and flight procedures, and does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory. However, to remain effective this manual must be dynamic. It must stimulate rather than stifle individual thinking. Since aviation is a continuing progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously formulated and incorporated. It is a user's publication, prepared by and for users, 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. Check lists 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.

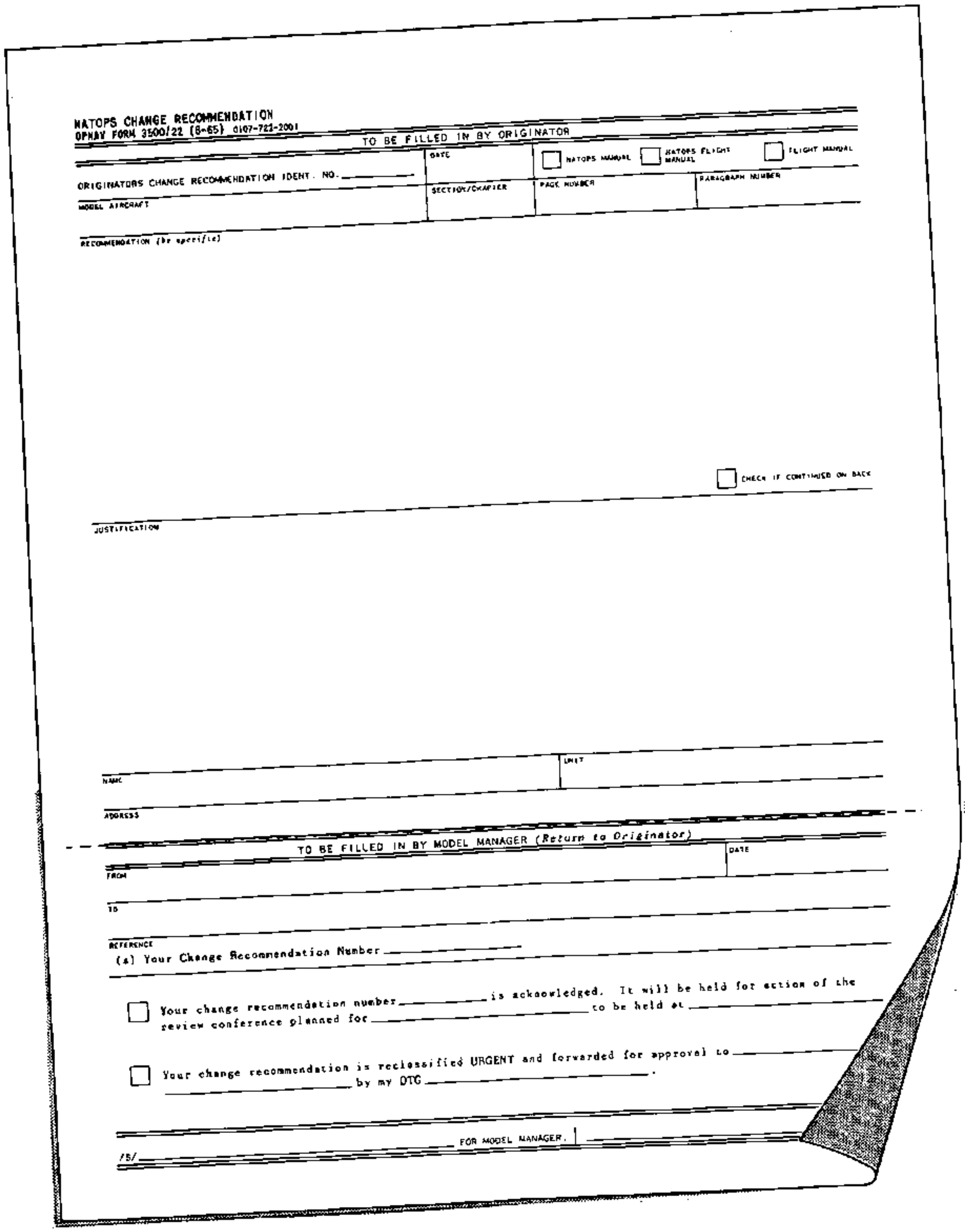
Paul H. Ramsey

PAUL H. RAMSEY
Vice Admiral, USN
Deputy Chief of Naval Operations (Air)

INTERIM CHANGE SUMMARY

NATOPS CHANGE NUMBER (CNO)	INTERIM CHANGE NUMBER (BuWeps)	PREVIOUSLY INCORPORATED	INCORPORATED IN THIS ISSUE ON PAGES INDICATED

ADB1-1002



NATOPS CHANGE RECOMMENDATION
OPNAV FORM 3500/22 (8-65) 0107-722-2001

TO BE FILLED IN BY ORIGINATOR

DATE

☐ NATOPS MANUAL ☐ NATOPS FLIGHT MANUAL ☐ FLIGHT MANUAL

ORIGINATORS CHANGE RECOMMENDATION IDENT. NO. ________

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MODEL AIRCRAFT

RECOMMENDATION (be specific)

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ADBI-1349

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* SEE SUPPLEMENTAL NATOPS FLIGHT MANUAL NAVWEPS 01-85ADB-1A

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SCOPE

As outlined in the Letter of Promulgation, the EA-6A NATOPS Flight Manual is authorized by the Chief of Naval Operations and is issued in conjunction with the Naval Air Training and Operating Procedures Standardization Program. Now for the first time, you have one manual that combines all the standardization procedures from NATOPS, with "user" knowhow, and all the latest information from the manufacturer, Grumman Aircraft Engineering Corporation, for both the Pilot and Electronic Countermeasures Operator (ECMO). Read this manual carefully from cover to cover. It's your responsibility to know everything in this manual. It is your "bible" on this aircraft.

SOUND JUDGEMENT

This manual provides the best available operating instructions for most circumstances, but no manual is a substitute for sound judgement. Multiple emergencies, adverse weather, or terrain may require modification of the procedures contained herein. You can handle emergencies best if you know everything about your aircraft.

STANDARDIZATION

Semi-annual NATOPS reviews will make certain that the information in this manual is sharp and up-to-date.

ARRANGEMENT

This manual is divided into eleven sections.

SECTION I - AIRCRAFT

Part 1 - GENERAL DESCRIPTION

Dimensions, cockpit layout, instrument panels and engine.

Part 2 - SYSTEMS

Engine description and operation and descriptive breakdown of system and system controls combined, including normal and emergency procedures.

Part 3 - AIRCRAFT SERVICING

Minimum turning radius, starting requirements, danger areas and power requirements.

Part 4 - AIRCRAFT OPERATING LIMITATIONS

Operating limitations for engine and airframe including structural limits.

SECTION II - INDOCTRINATION

Ground training, flight training, flight crew requirements, operating criteria, personnel flying equipment and flight personnel categories.

SECTION III - NORMAL PROCEDURES

Part 1 - BRIEFING/DEBRIEFING

Part 2 - MISSION PLANNING

Part 3 - SHORE-BASED PROCEDURES - PILOT

Procedures from scheduling to post-flight, to include night flying, FCLP and MLP.

Part 4 - CARRIER-BASED PROCEDURES - PILOT

Procedures as in shore-based, including CCA and carrier emergency signals.

Part 5 - SHORE/CARRIER-BASED PROCEDURES - ECMO

Procedures from scheduling to post-flight, to include system operation.

SECTION IV - FLIGHT PROCEDURES

Familiarization and transition, flight characteristics, stall speeds, stall/spins, formation and tactics, towing, air refueling, and flight test procedures.

SECTION V - EMERGENCY PROCEDURES

SECTION VI - ALL WEATHER OPERATIONS

Simulated and actual instruments, turbulence and thunderstorms, cold weather, tropic operations, and desert operations.

SECTION VII - COMMUNICATIONS EQUIPMENT AND PROCEDURES

Radio, navigation and visual signaling procedures, in-flight, ground and carrier deck.

SECTION VIII - WEAPONS SYSTEMS

Part 1 - THEORY OF OPERATION

A discussion of the theory of operation of those equipments relatively new to the fleet.

Part 2 - INTEGRATED ATTACK-NAVIGATION SYSTEM

Includes station loading where integral with the weapon system. Includes check procedures for weapon delivery systems.

SECTION IX - FLIGHT CREW COORDINATION

Including a general comment on the duties of the individual crew members.

SECTION X - NATOPS EVALUATION

SECTION XI - PERFORMANCE DATA

YOUR RESPONSIBILITY

NATOPS Flight Manuals are maintained current through an active manual change program. If you find anything you don't like about the manual, or if you have information you'd like to pass along to others, let us know. If you spot an error in the manual, bring it to our attention promptly.

HOW TO GET COPIES

To be sure of getting your manuals on time, order them before you need them. Early ordering will assure that enough copies are printed to cover your requirements. Automatic distribution is established by completing NAVWEPS Form 2126. If distribution problems are encountered, notify BUWEPS promptly so that corrective action can be taken.

NATOPS POCKET CHECK LISTS

The NATOPS Pilot's Pocket Check List (NAVWEPS 01-85ADB-1B) and NATOPS ECM Operator's Pocket Check List (NAVWEPS 01-85ADB-1C) provides in abbreviated form, essential information for operations of the EA-6A. The Check List is automatically distributed with the NATOPS Flight Manual. Changes to them are concurrent with, and dated the same as the NATOPS Flight Manuals.

NATOPS CHANGES

NATOPS changes (urgent and routine) are promulgated by the Office of CNO and will be in accordance with OPNAV Instructions 3510.9. These changes will normally be in message or letter form to expedite safety-of-flight changes to operating procedures. The details of these changes should be noted on the appropriate page(s) of the manual and logged in the applicable Interim Change Record.

BUWEPS INTERIM REVISIONS

Interim Revisions are promulgated by BUWEPS and may be received as a Naval message, or on a pre-printed Flight Manual Interim Revision form. The purpose of these revisions is to expedite new or revised operating limitations, restrictions, and other vital instructions involving the operation of the aircraft. The detailed changes should be noted on the appropriate page(s) of the manual and logged in the applicable Interim Revision Summary

INTERIM REVISION SUMMARY

The Interim Revision Summary, one for each volume, is provided for the purpose of maintaining a complete record of all interim-type changes against the EA-6A NATOPS Flight Manual. Each time the manual is revised, the Interim Revision Summary will be updated to indicate disposition and/or incorporation of previously issued interim-type changes. When a regular revision is received, the Interim Revision Summary should be checked to ascertain that all outstanding NATOPS changes and Interim Revisions have been formally incorporated; those not incorporated should be re-noted as applicable.

WARNINGS, CAUTIONS, AND NOTES

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

WARNING

Operating procedures, practices, etc. which will result in injury or death, if not carefully followed.

CAUTION

Operating procedures, practices, etc., which, if not strictly observed, will damage the equipment.

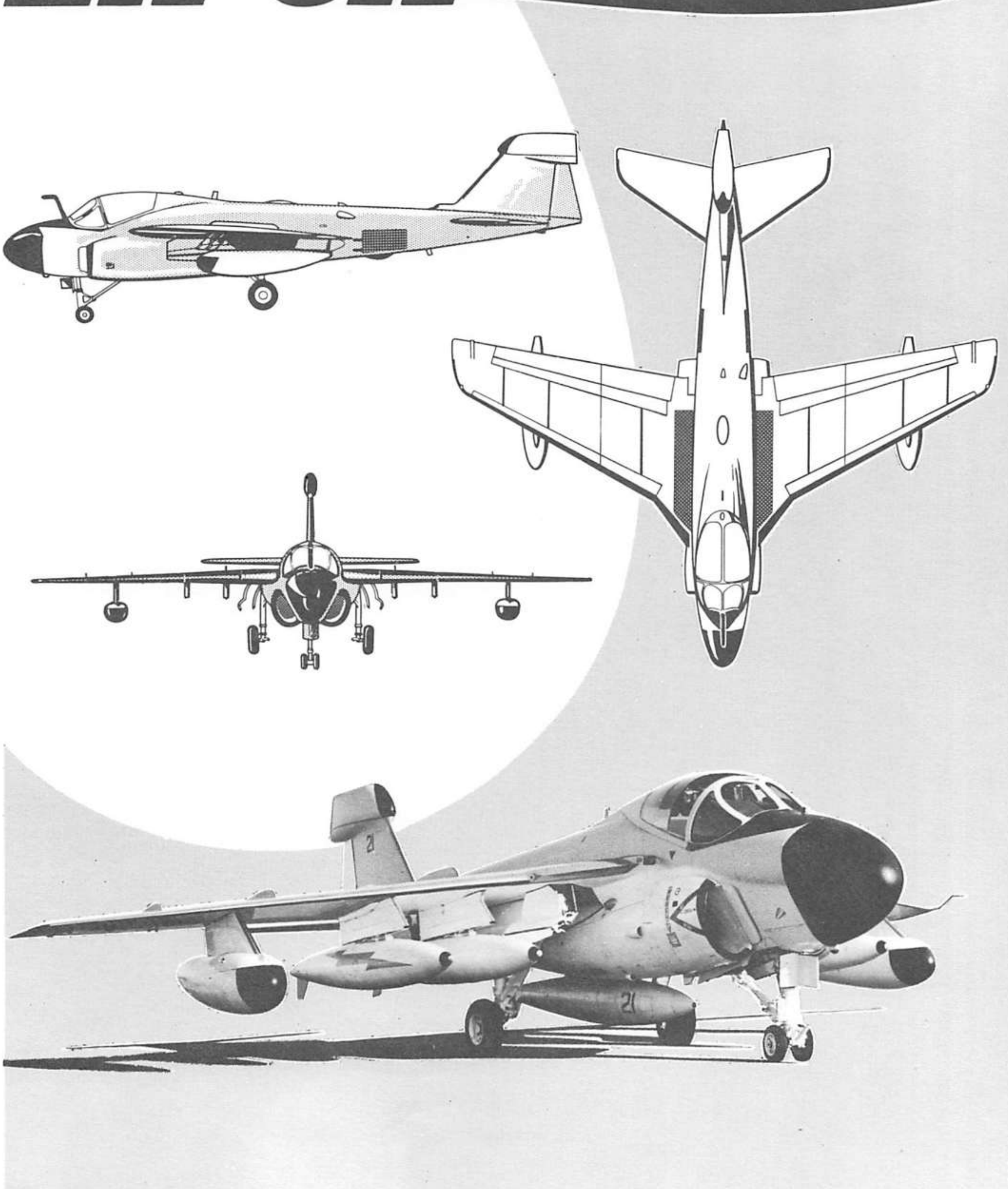
Note

An operating procedure, conditions, etc., which it is essential to emphasize.

CHANGE SYMBOLS

Revised test is indicated by a black vertical line in either margin of the page, like the one printed next to this paragraph. The change symbol shows where there has been a change. The change might be material added, material deleted, or information restated. The only way you can see just what changed is to compare the old and new pages as you insert changed material.

EA-6A INTRUDER



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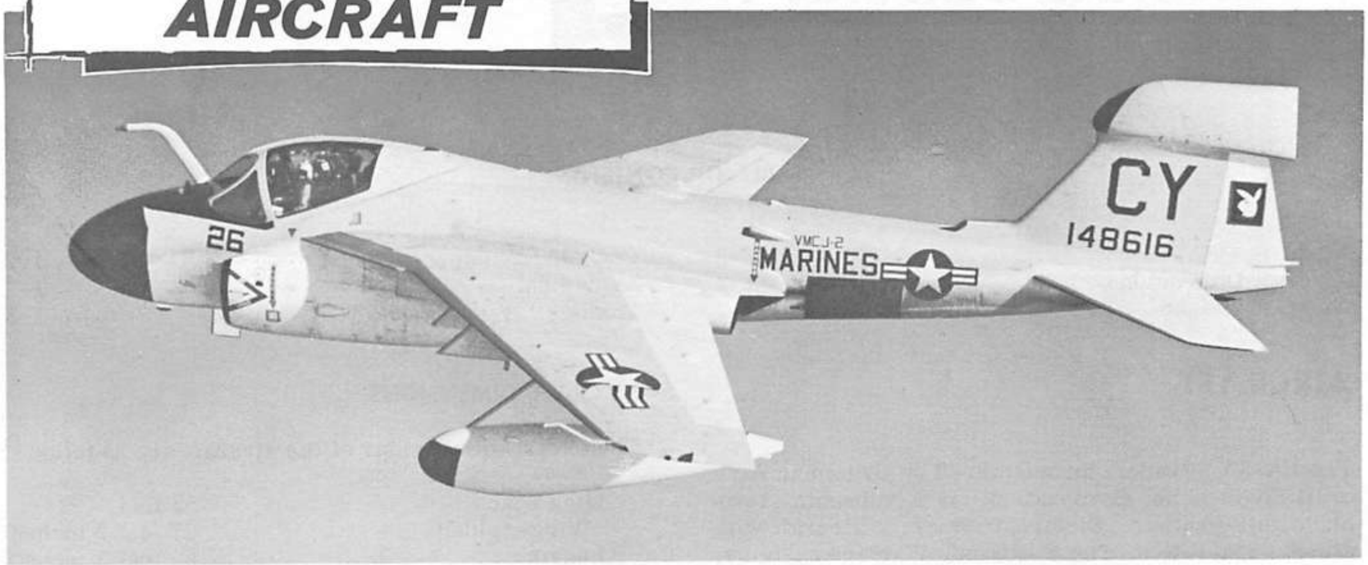
section I
AIRCRAFT



part 1
GENERAL DESCRIPTION

part 2
SYSTEMS

part 3
AIRCRAFT SERVICING

part 4
AIRCRAFT OPERATING LIMITATIONS

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part 1

GENERAL DESCRIPTION

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AIRCRAFT

The EA-6A Intruder, manufactured by Grumman Aircraft Engineering Corporation, is a subsonic, two-place, all-weather, Electronic Warfare aircraft with attack capabilities. The Electronic Warfare systems, coupled with a 7-1/2 ton payload capacity, results in a weapon system which can conduct electronic countermeasure missions and deliver a wide assortment of weapons without the crew ever seeing the ground or target. The ability to air refuel, or act as a tanker, adds to the mission versatility of the aircraft. Single point refueling accelerates the normal fueling process and increases turn around capabilities. The general arrangement is shown in figure 1-8.

The normal configuration of the aircraft, referred to as CLEAN throughout the Performance Data, Section XI, is with four wing pylons, a centerline store station, and an AN/ALQ-53 Electronic Countermeasures pod and pylon installed under each wing outboard of the wing fold. The ATTACK configuration is the same as the Clean configuration except the two AN/ALQ-53 pods and pylons are removed.

The aircraft is powered by two Pratt & Whitney, axial-flow, turbojet engines, and is characterized by a Dumbo nose and sweptback wings. The aircraft has arrested landing capabilities, and for a jet aircraft, has a relatively slow approach and landing speed. The aircraft, from a flight standpoint, is essentially a hydraulic aircraft. Generally, the hydraulic systems are controlled electrically; the major departures from this being the actuation of the flight control actuators, manual canopy operation, emergency landing gear actuation, and wheel brake operations. In these operations, the hydraulic selector valves and servo-actuators are directly positioned by the pilot.

All the major aircraft systems were designed to automatically isolate the lesser functions on a flight or mission in the event of any system malfunction. Complete failure of any system is virtually impossible under normal flying conditions. The aircraft is equipped with Martin-Baker ejection seats.

AIRCRAFT DIMENSIONS

The overall dimensions of the aircraft are as follows:

Wing Span	53 feet
Wings folded	25 feet 2 inches
Length	55 feet 3 inches
Height	16 feet 3 inches
Height while folding wings	21 feet 9 inches

Refer to Section I, Part 3, for ground clearances and turning radius.

AIRCRAFT WEIGHT

The zero fuel/zero store weight of the CLEAN aircraft is 29,000 pounds.

Note

The CLEAN configuration includes two AN/ALQ-53 ECM pods and pylons.

COCKPIT LAYOUT

The aircraft accommodates a two-man crew consisting of the pilot and electronic countermeasures operator in a staggered side-by-side seating arrangement. Figures 1-2 through 1-7 provide typical cockpit layout for the EA-6A.

ARMAMENT

The basic aircraft is configured with four wing pylons and a center store station for a total of five store stations. The wing pylons and the centerline store station house aero 7A-1 ejector racks, electrical connections for required stores, and fuel lines and valves for attaching drop tanks. The wing pylons also have mounting provisions for the aero 5A guided missile launcher and, with an adapter, the LAU 7A guided missile launcher. The aero 7A-1 ejector racks provided with the aircraft are capable of carrying conventional or special weapons, and rocket packs up to 3500 pounds per station. For a more detailed discussion of armament and the weapon system, refer to Section VIII of the NATOPS Supplemental Flight Manual NAVWEPS 01-85ADB-1A.

ENGINES

The aircraft is powered by two J52-P-6A, non-afterburning, axial-flow, turbojet engines (figure 1-1).

Each engine develops approximately 8,000 pounds rated sea level static thrust (installed). The engine has a split, twelve-stage, axial-flow compressor, a can-annular combustion chamber, and a split, two-stage turbine. An engine bleed control system minimizes the possibility of compressor stall by automatically unloading any unstable air conditions encountered in the compressor. As a safety feature, a bleed override control in the bleed control system prevents the opening of the bleed valves below 0.5 IMN. The compressed air supply for the aircraft is bled from the twelfth stage of the compressor. After initial engine start, part of this compressed air is used to drive the constant speed drive/starter (CSD/S) for starting the second engine. Twelfth-stage compressor bleed air is also used for CSD/S-oil cooling on the ground, CSD/S generator function, air conditioning, engine vortex removal jets, rain removal, and hydraulic tank pressurization. For a discussion of engine operation, refer to Section IV.

J52 ENGINE

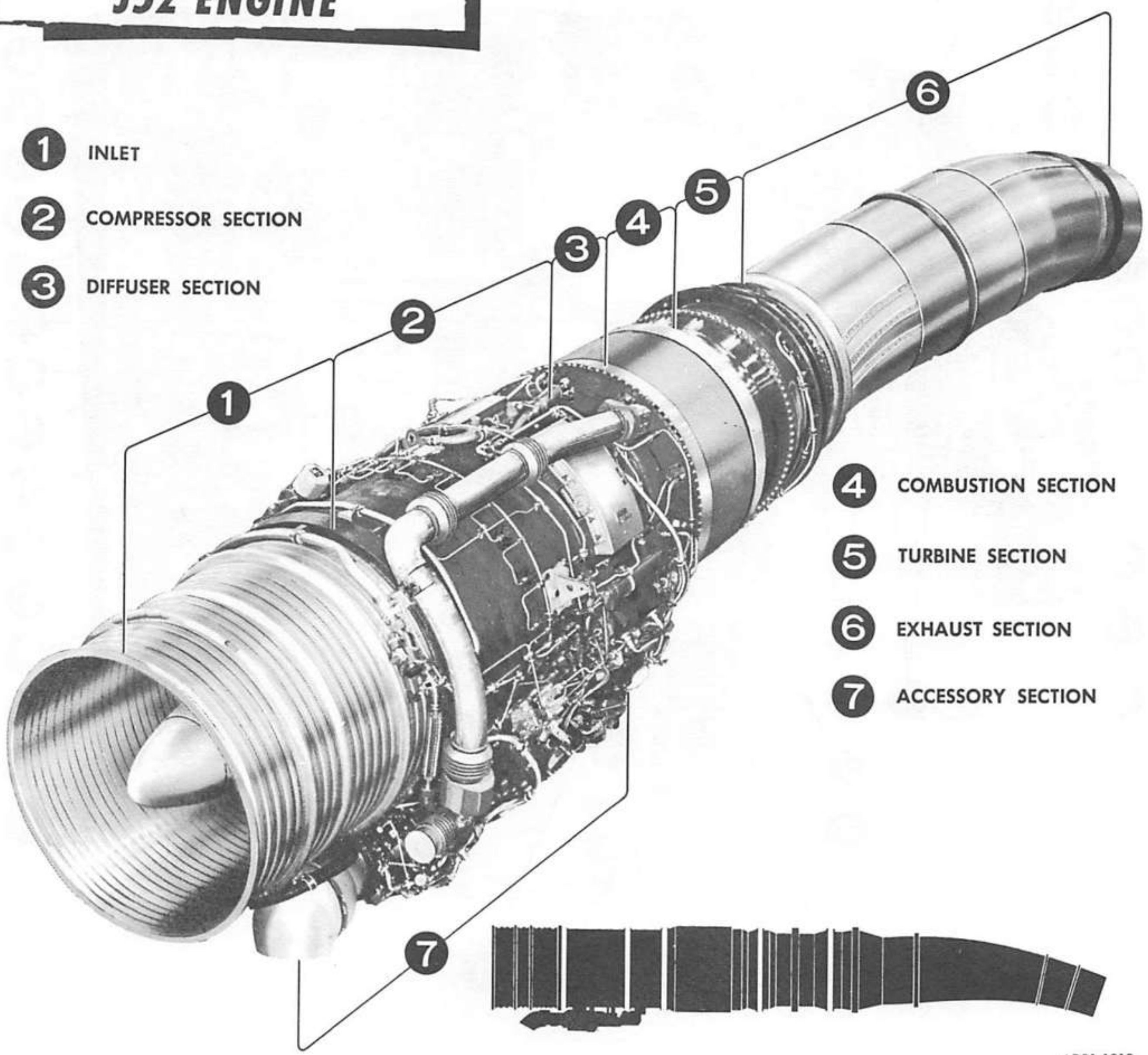

Figure 1-1

PILOT'S INSTRUMENT PANEL (TYPICAL)

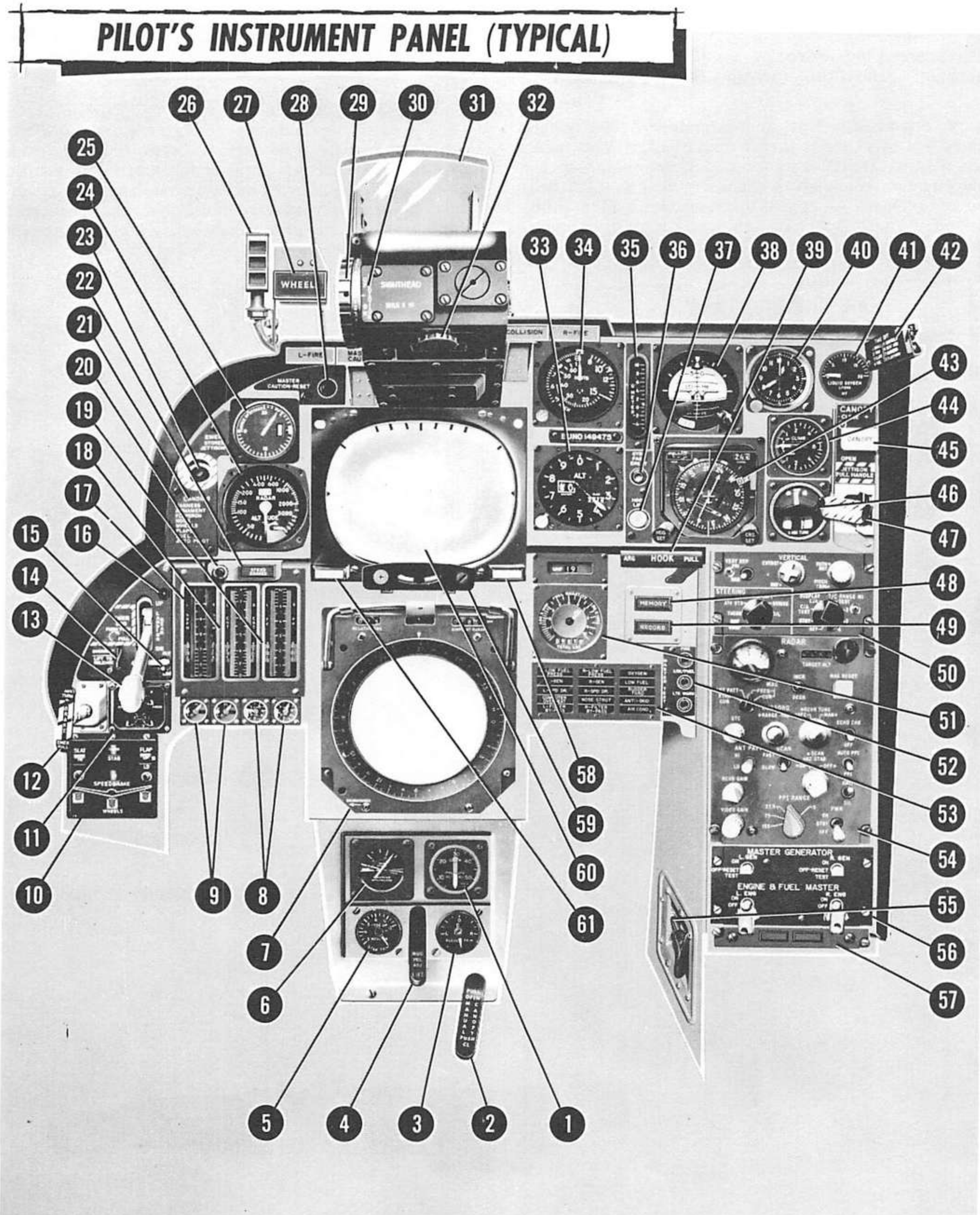

Figure 1-2 (Sheet 1)

1. CABIN PRESSURE ALTITUDE GAGE
2. MANUAL CANOPY CONTROL
3. RUDDER TRIM GAGE
4. RUDDER PEDAL ADJUST CONTROL
5. STABILIZER TRIM GAGE
6. AUXILIARY BRAKE CYCLE GAGE
7. RADAR SCOPE
8. OIL PRESSURE INDICATORS
9. POWER TRIM INDICATORS
10. INTEGRATED POSITION INDICATOR
11. HYDRAULIC PRESSURE INDICATOR
12. BRAKE SELECTOR HANDLE
13. LANDING GEAR HANDLE
14. LANDING GEAR OVERRIDE HANDLE
15. LANDING GEAR FLIGHT/LANDING SWITCH
16. WHEELS TRANSITION LIGHTS
17. ENGINE RPM INDICATOR
18. EXHAUST AS TEMPERATURE INDICATOR
19. FUEL FLOW INDICATOR
20. RADAR ALTIMETER LOW LEVEL WARNING LIGHT
21. LANDING CHECK LIST
22. SPEED BRAKE WARNING LIGHT
23. EMERGENCY STORES JETTISON BUTTON
24. RADAR ALTIMETER
25. ANGLE-OF-ATTACK INDICATOR
26. APPROACH INDEXER
27. WHEELS WARNING LIGHT
28. MASTER CAUTION RESET BUTTON
29. ELEVATION KNOB
30. OPTICAL SIGHT
31. REFLECTOR PLATE
32. FIXED RETICLE MASK CONTROL KNOB
33. COUNTER/POINTER ALTIMETER
34. MACH/AIRSPEED INDICATOR
35. "G" METER
36. GYRO FAST ERECT BUTTON
37. HOOK LIFT BUTTON
38. VERTICAL GYRO INDICATOR
39. HOOK RELEASE HANDLE
40. CLOCK
41. LIQUID OXYGEN GAGE
42. TAKE-OFF CHECKLIST
43. HORIZONTAL SITUATION INDICATOR
44. RATE-OF-CLIMB INDICATOR
45. CANOPY SWITCH
46. MD-1 TURN AND SLIP INDICATOR
47. CANOPY EMERGENCY JETTISON HANDLE
48. DOPPLER IN-MEMORY INDICATOR LIGHT
49. RECORD INDICATOR LIGHT
50. VERTICAL REFERENCE/STEERING MODE CONTROL PANEL
51. FUEL QUANTITY GAGE
52. MASTER TEST PANEL
53. ANNUNCIATOR PANEL
54. RADAR CONTROL PANEL
55. FOOT HEAT CONTROL
56. MASTER GENERATOR/ENGINE AND FUEL MASTER CONTROL PANEL
57. AN/ALQ-53 POD OVERHEAT INDICATORS
58. RADAR UPDATE INDICATOR
59. SLIP/SKID INDICATOR
60. VERTICAL DISPLAY INDICATOR
61. RADAR ATTITUDE REFERENCE INDICATOR

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Figure 1-2 (Sheet 2)

PILOT'S LEFT CONSOLE (TYPICAL)

1. FUEL MANAGEMENT CONTROL PANEL
2. CATAPULT GRIP (MASTER LIGHT SWITCH)
3. ICS BUTTON
4. SPEED BRAKE CONTROL SWITCH
5. MICROPHONE BUTTON
6. THROTTLES
7. SPIN RECOVERY SWITCH
8. AIR START BUTTONS
9. FLAP/SLAT LEVER
10. THROTTLE FRICTION LEVER
11. CRANK SWITCHES
12. EMERGENCY FLAP/SLAT SWITCH
13. ANTI SKID/FLAPERON POP-UP CONTROL PANEL
14. ARRESTING HOOK POSITION WARNING BYPASS SWITCH
15. RUDDER TRIM SWITCH
16. OXYGEN SWITCH
17. MASTER LIGHT CONTROL PANEL
18. RADAR SLEW CONTROL HANDLE
19. RADAR SLEW CONTROL PANEL
20. VENT SUIT — SEAT CUSHION CONTROL PANEL
21. OPTICAL SIGHT CONTROL PANEL

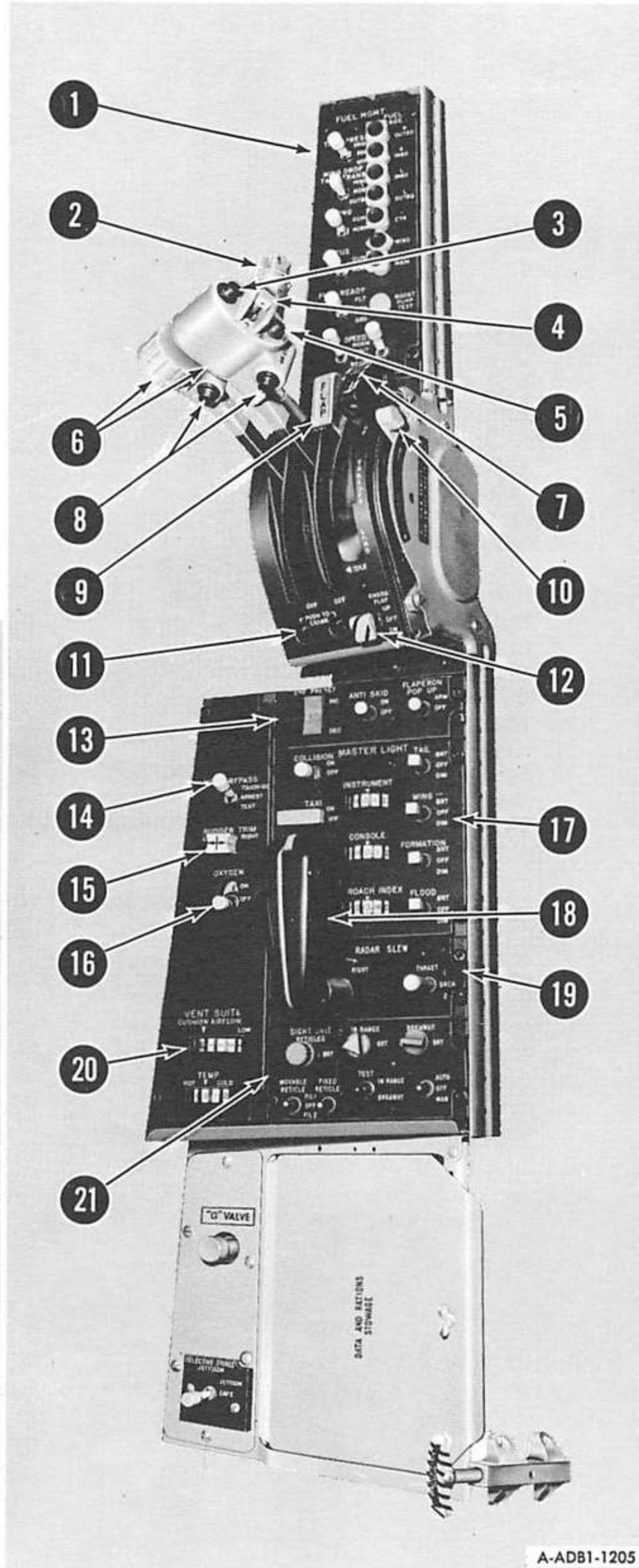

Figure 1-3

CENTER CONSOLE (TYPICAL)

1. AUTOPILOT CONTROL PANEL
2. UHF COMMUNICATIONS PANEL
3. TACAN PANEL
4. COMPASS CONTROL PANEL
5. MF-1 COMPASS STABILIZATION PANEL
6. DOPPLER RADAR PANEL
7. SIF CONTROL PANEL
8. AIR CONDITIONING CONTROL PANEL (INCLUDES ENGINE ANTI-ICE, WINDSHIELD WASH AND RAIN REMOVAL, AND PITOT HEAT)
9. WING FOLD CONTROL PANEL
10. IFF CONTROL PANEL
11. TRANSMITTER/RECEIVER CONTROL PANEL
12. CNI MASTER/CABIN DUMP/ANTENNA SELECTOR PANEL

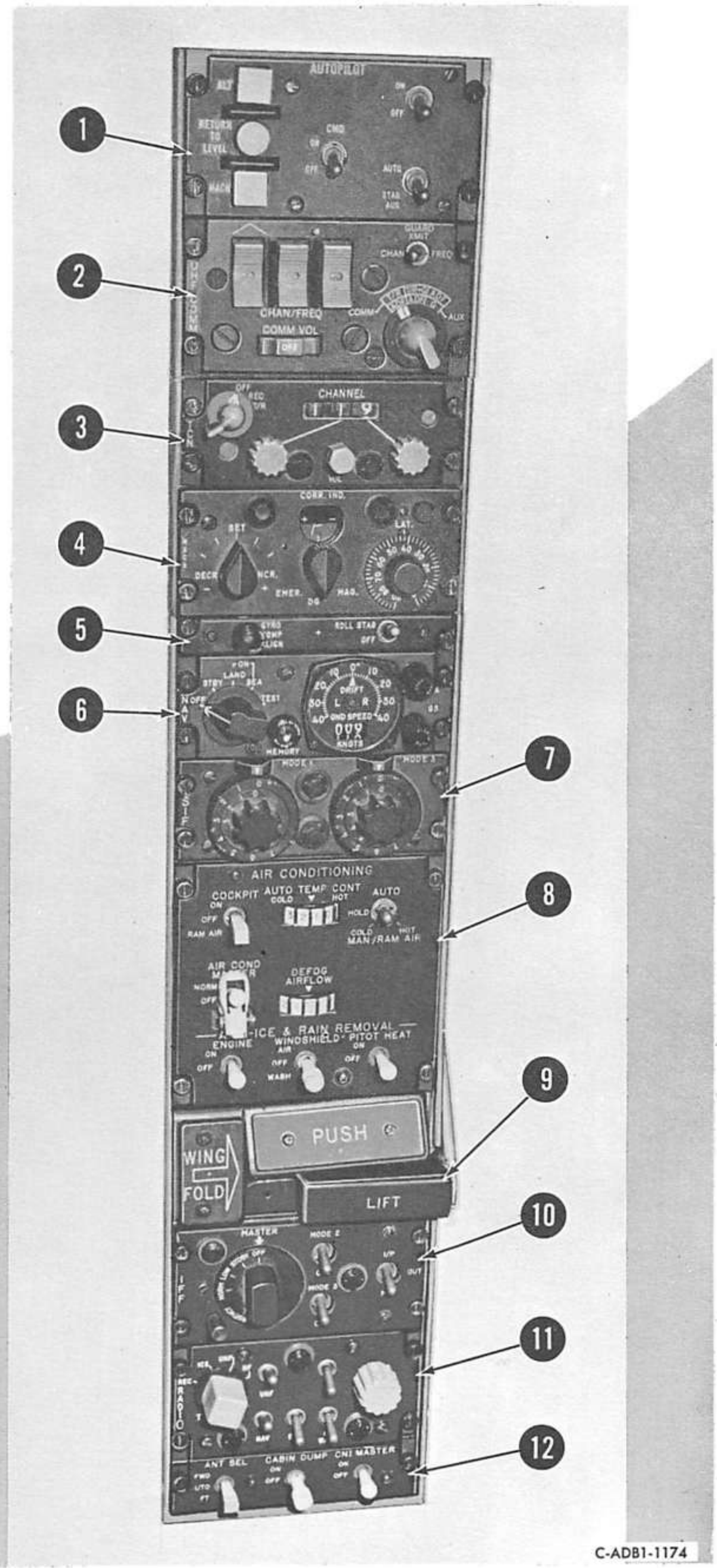

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Figure 1-4

AFT BULKHEAD CONSOLE (TYPICAL)

1. MAIN CIRCUIT BREAKER PANEL
2. ICS CONTROL PANEL
3. AUXILIARY UHF RECEIVER CONTROL PANEL

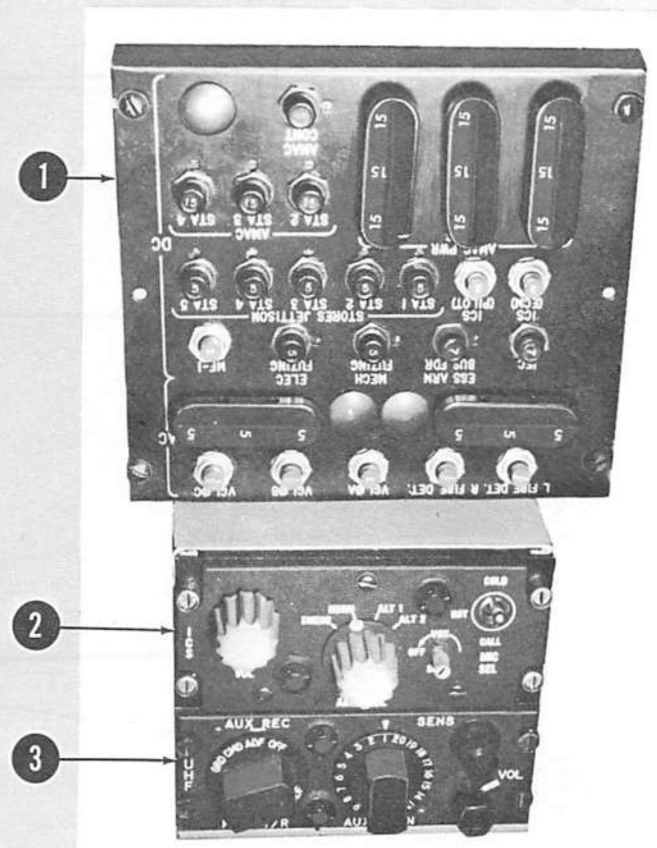

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Figure 1-5

ECM OPERATOR'S INSTRUMENT PANEL

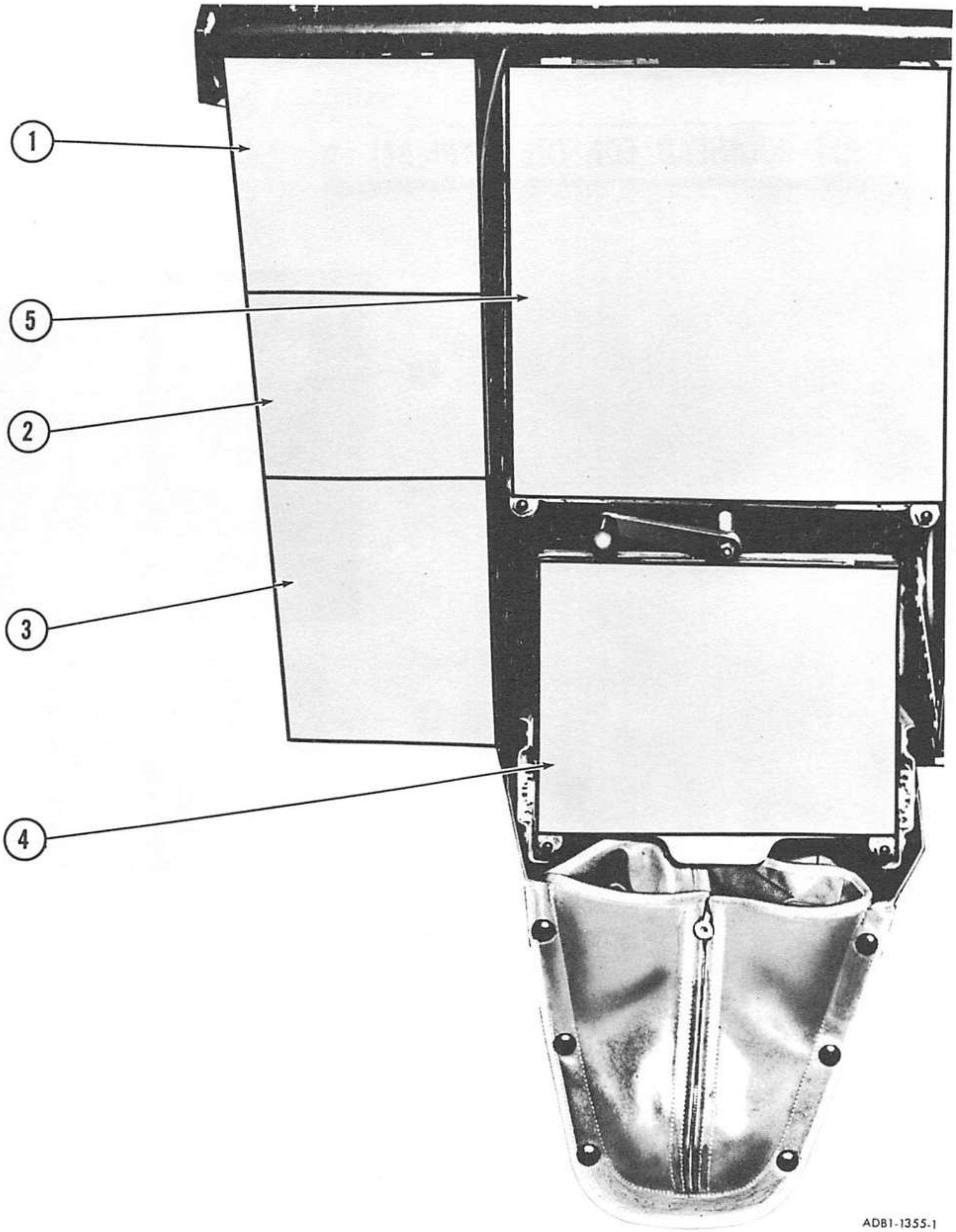
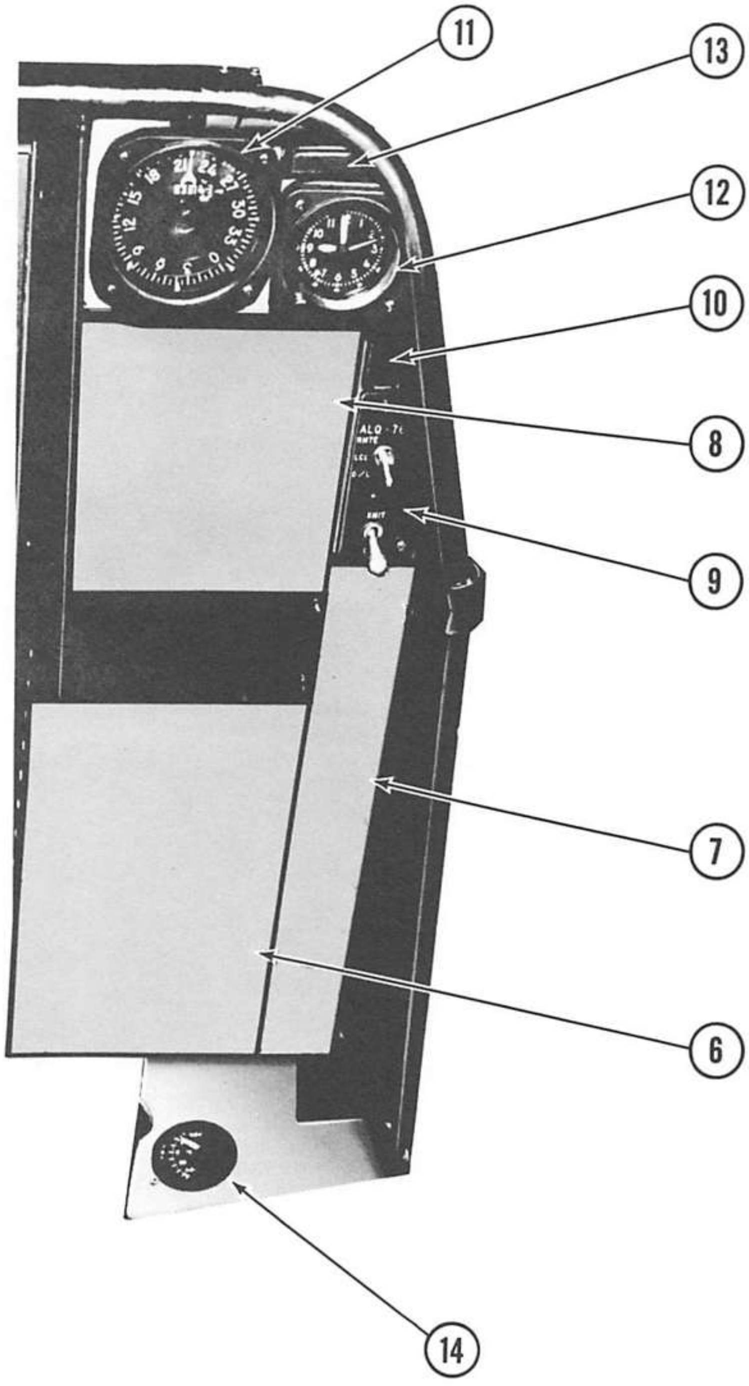


Figure 1-6 (Sheet 1)



1. ARMAMENT CONTROL PANEL
2. NAVIGATION CONTROL PANEL
3. AUTOMATIC CONTROL AN/ALQ-53
4. ANALYSIS INDICATOR AN/ALQ-53
5. PANORAMIC INDICATOR AN/ALQ-53
6. MANUAL CONTROL AN/ALQ-53
7. FREQUENCY BAND SELECTOR AN/ALQ-53
8. DECM PANEL
9. MASTER RADIATE SWITCH AN/ALQ-76
10. ECM FAULT LIGHT
11. ANTENNA STEERING INDICATOR AN/ALQ-76 (BDHI)
12. CLOCK
13. MASTER CAUTION LIGHT
14. OUTSIDE AIR TEMPERATURE GAUGE

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Figure 1-6 (Sheet 2)

ECM OPERATOR'S RIGHT CONSOLE (TYPICAL)

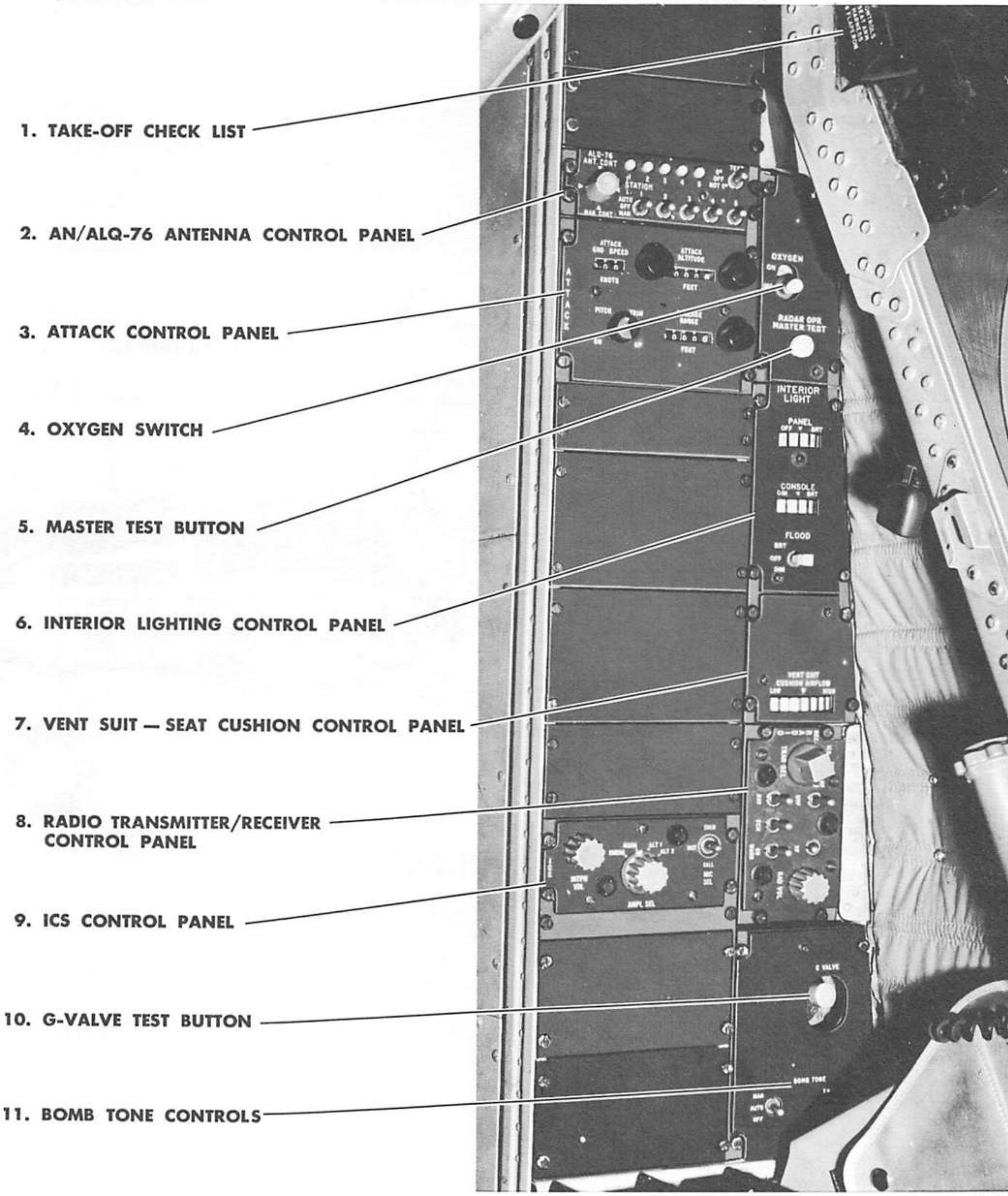

Figure 1-7

GENERAL ARRANGEMENT

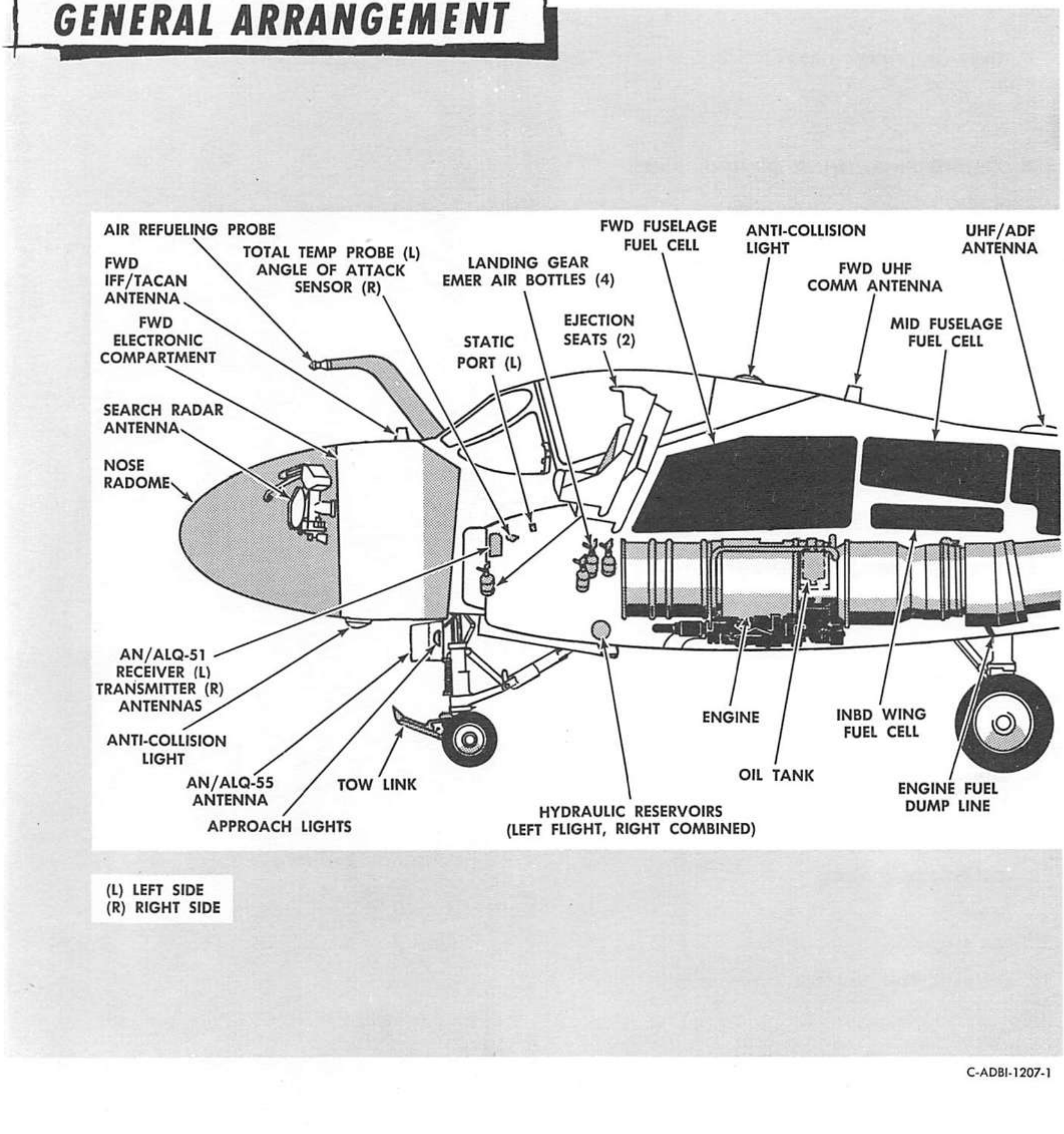

Figure 1-8 (Sheet 1)

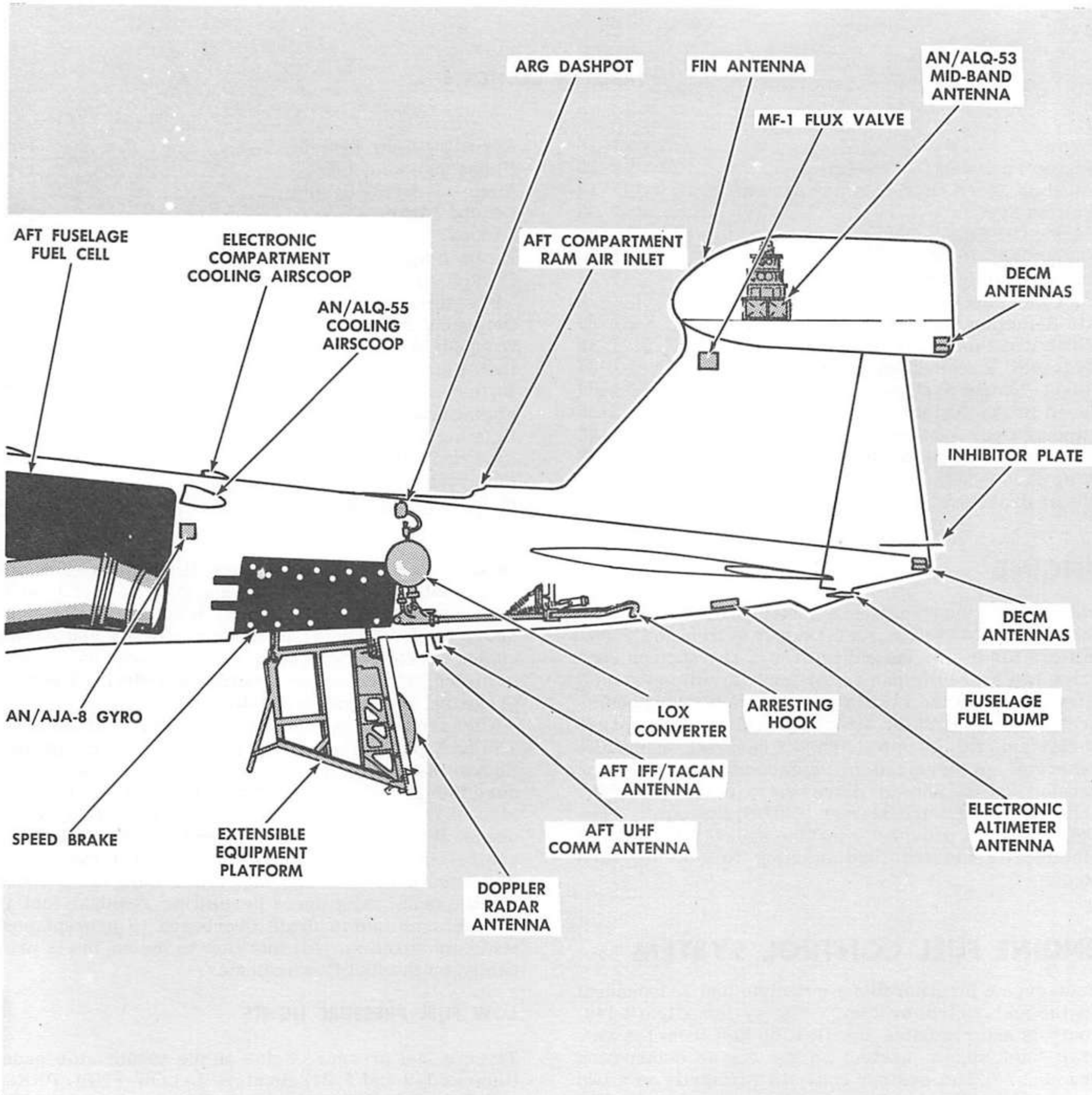

Figure 1-8 (Sheet 2)

part 2 SYSTEMS

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ENGINE

Each engine incorporates a fuel control system, an engine ignition system, an oil supply system and transmitters for the engine indicators. The engines each drive two hydraulic pumps for the hydraulic systems. Bleed air from the twelfth stage of each engine compressor is utilized for air conditioning, cabin pressurization, rain removal, vortex removal, hydraulic reservoir pressurization, wing and drop fuel tank pressurization and to drive the air turbine of the constant speed drive/starter (CSD/S) system. The CSD/S system provides constant speed drive for the electrical generators and starting torque for each engine.

ENGINE FUEL CONTROL SYSTEM

Each engine incorporates a complete and independent engine fuel control system. The system (figure 1-9) controls and regulates the flow of fuel from the aircraft fuel supply system to the engine combustion chamber. The system consists primarily of a two stage engine driven fuel pump, fuel control and a fuel pressurizing and dump valve. The engine driven fuel pump is located on the accessory drive gear box and supplies high pressure fuel to the engine fuel control. The two stages of the fuel pump are a centrifugal pump and a positive displacement gear pump. A fuel filter and filter by-pass are located between the two pump stages. Centrifugal pump failure under certain conditions is sensed by a pressure switch and will be indicated by a light in the cockpit. Filter by-pass is sensed by pressure switches which illuminate a light in the cockpit. Gear pump failure will result in an engine flame-out. The fuel control regulates fuel flow in response to throttle position. It automatically compensates for changes in density altitude and during engine acceleration prevents overspeed, over temperature, and compressor surge and stall. A burner pressure limiter automatically reduces fuel flow when burner pressure approaches the safe-limit of the case. The fuel pressurizing and dump valve permits fuel flow to the fuel distributor manifold when fuel pressure is high enough for engine operation. The dump side of the valve closes when the pressurizing valve opens. When the throttle is retarded to OFF, the fuel control cutoff valve stops the flow of fuel to the engine. With a fuel pressure drop, the pressurizing valve closes and the dump valve opens permitting residual fuel in the fuel manifold to drain overboard to prevent post shutdown cokeing. All fuel flow to the engine is presented on the fuel flow indicator.

LOW FUEL PRESSURE LIGHTS

The low fuel pressure lights on the annunciator panel (figures 1-9 and 1-27) displays L-LOW FUEL PRESS and R-LOW FUEL PRESS and are powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel. A pressure switch downstream of the centrifugal stage of the engine driven pump completes a circuit to the light when the pressure is below approximately 12 to 14 PSI. At lower altitudes the centrifugal stage of an engine driven pump or the main tank boost pump alone can maintain sufficient fuel pressure for engine operation and keep the light out. At higher altitude, failure of the centrifugal stage of an engine driven pump will

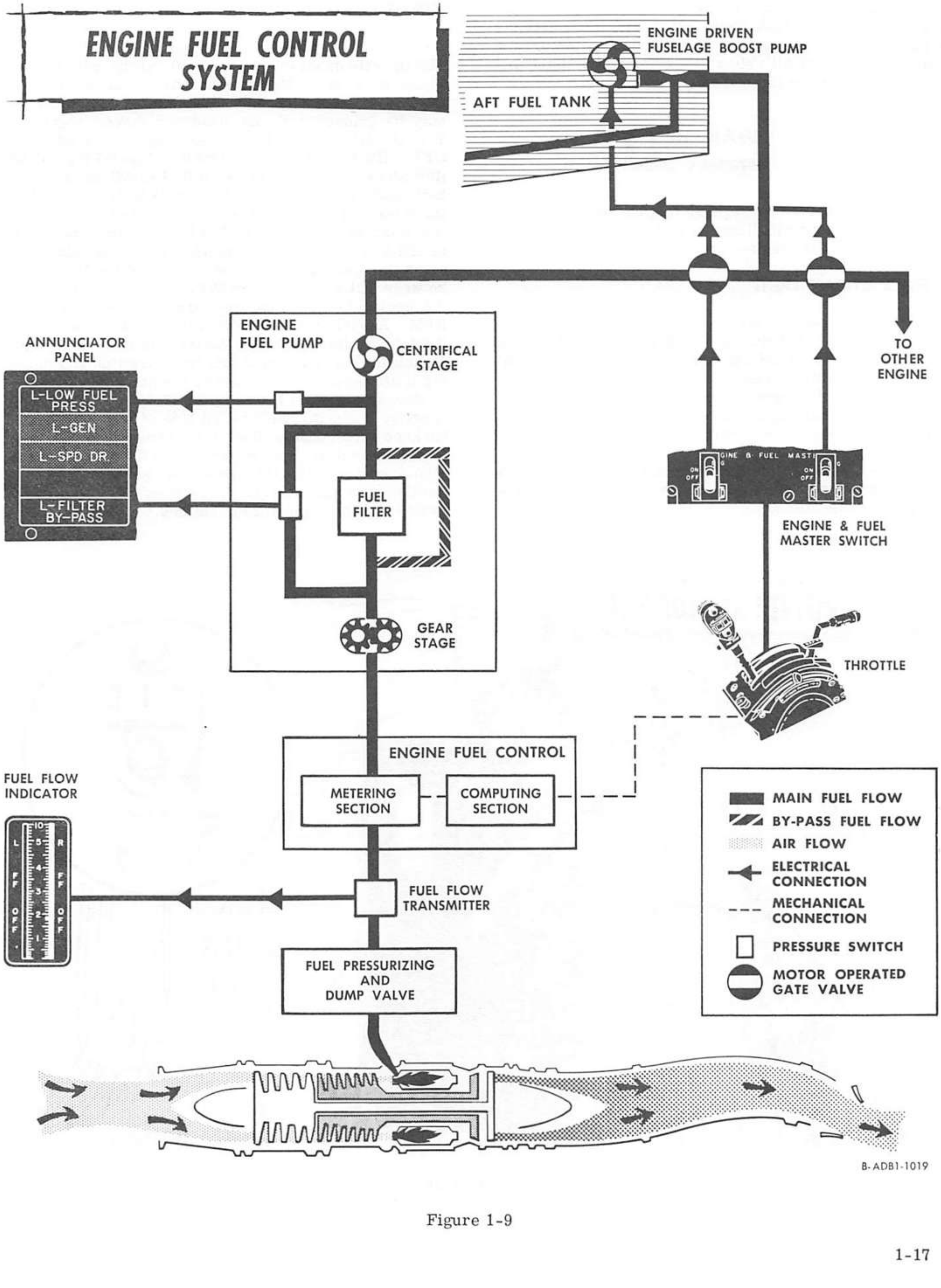

ENGINE FUEL CONTROL SYSTEM
ENGINE DRIVEN FUSELAGE BOOST PUMP
AFT FUEL TANK
ANNUNCIATOR PANEL
L-LOW FUEL PRESS
L-GEN
L-SPD DR.
L-FILTER BY-PASS
ENGINE FUEL PUMP
CENTRIFICAL STAGE
FUEL FILTER
GEAR STAGE
TO OTHER ENGINE
ENGINE & FUEL MASTER SWITCH
THROTTLE
ENGINE FUEL CONTROL
METERING SECTION
COMPUTING SECTION
FUEL FLOW INDICATOR
FUEL FLOW TRANSMITTER
FUEL PRESSURIZING AND DUMP VALVE
MAIN FUEL FLOW
BY-PASS FUEL FLOW
AIR FLOW
ELECTRICAL CONNECTION
MECHANICAL CONNECTION
PRESSURE SWITCH
MOTOR OPERATED GATE VALVE
B-ADB1-1019

Figure 1-9

illuminate the light for its respective engine, and failure of the main tank boost pump will illuminate the lights for both engines. A reduction in power and descent to lower altitude will extinguish the light and prevent an engine flame-out.

WARNING

Do not depress boost pump test button in flight as an engine will flame-out if the centrifugal stage of an engine driven pump has failed.

FILTER BY-PASS LIGHT

The filter by-pass lights on the annunciator panel (figures 1-9 and 1-27) displays L-FILTER BY-PASS and R-FILTER BY-PASS and are powered by the 28V DC essential bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel. Illumination of either light indicates the fuel filter for the respective engine is obstructed and fuel is flowing through the filter by-pass. A pressure switch completes a circuit to the light when a minimum of 5 PSI differential pressure exists between the inlet and outlet of the fuel filter.

THROTTLE QUADRANT

The throttle quadrant (figure 1-10) on the left console accommodates two throttles that are completely independent of each other and are arranged so that they may be gripped with one hand and moved together. The throttle travel has three placarded positions; OFF, IDLE and MAX POWER. The OFF position (full aft) mechanically closes a fuel cutoff valve in the fuel control and disarms the ignition system. The throttles must be moved outboard, forward, then inboard (around the horn) to IDLE. Moving from OFF to IDLE mechanically opens the fuel cutoff valve and arms the ignition system. Movement of the throttles, between IDLE and MAX POWER (full forward) varies the engine thrust from approximately 58 to 102.6% RPM. A friction lock lever on the inboard side of the throttle quadrant prevents the throttle from creeping. Moving the lever forward increases friction and moving it aft reduces friction. Both throttle knobs accommodate an air start button on the aft side for their respective engines. The inboard side of the right throttle knob accomodates the ICS button, speed brake switch and microphone button. The throttle quadrant also accommodates the assist spin recovery switch, the flap/slat selector lever, the emergency flap (slat) switch and the engine crank buttons.

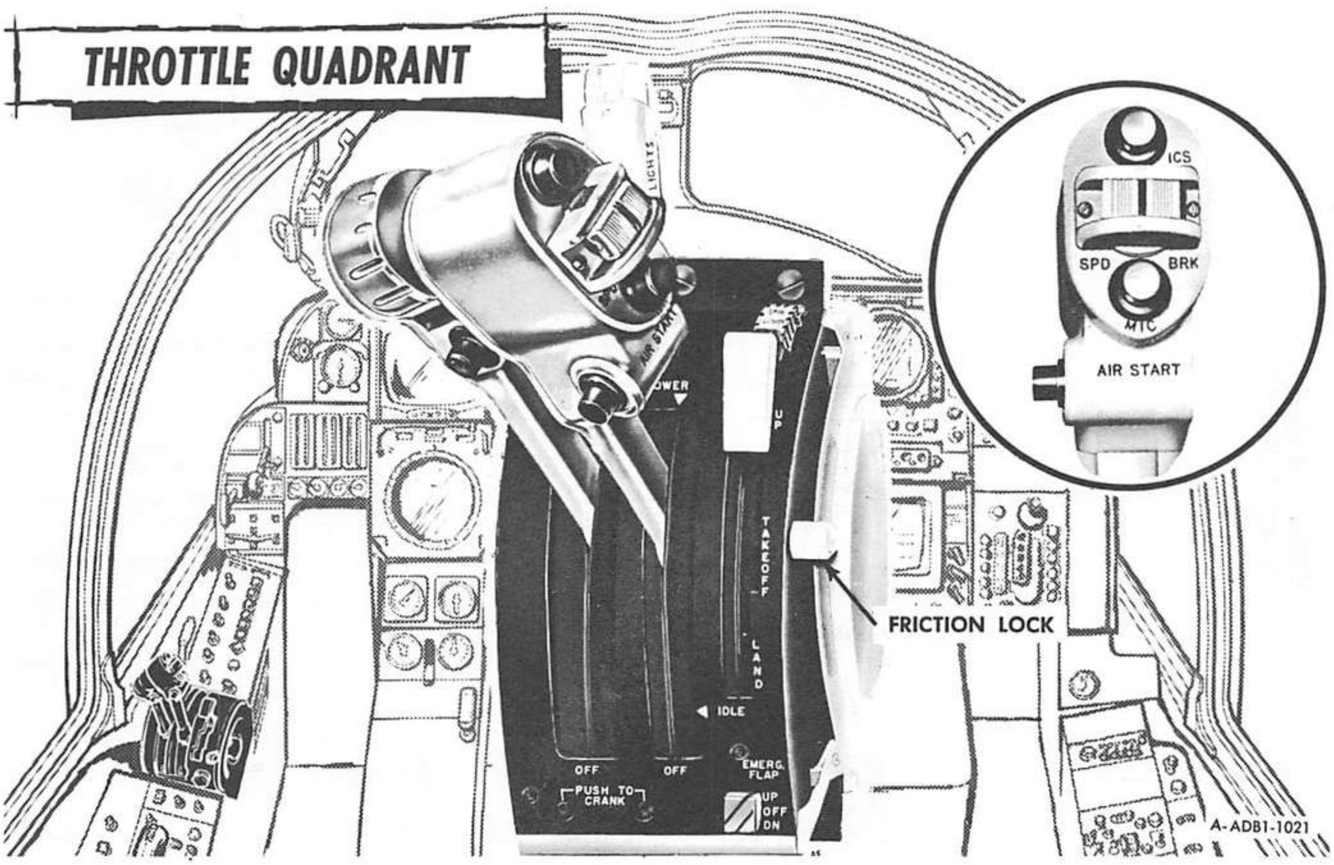


Figure 1-10

ENGINE AND FUEL MASTER SWITCHES

The ENGINE & FUEL MASTER switches (figure 1-11) identified as L. ENG and R. ENG are two position toggle switches with placarded positions ON and OFF and are guarded to the ON position. The ON position of either the left or right switch opens the aircraft fuel supply system shut-off (gate) valve, energizes the main tank fuel boost pump, provides power to the constant speed drive switch and energizes a holding relay which arms the starting circuits for the respective engine. The OFF position closes the aircraft fuel system shutoff (gate) valve, shuts off the main tank fuel boost pump and deenergizes the constant speed drive switch.

Note

It is necessary to cycle the engine and fuel master switch to OFF and return to ON in order to re-energize the start circuits once a start has been accomplished and the engine subsequently shut down.

CONSTANT SPEED DRIVE/ STARTER SYSTEM

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

SPEED DRIVE SWITCHES

The SPEED DRIVE switches on the fuel control panel (figure 1-12) identified as L and R are three position toggle switches with positions NORM, SHUTOFF and a momentary RESET. The NORM position directs essential 28V DC power to arm the engine crank switch and energize a solenoid to open the pneumatic regulator shutoff valve for engine cranking. The OFF position deenergizes the solenoid which permits the pneumatic regulator shutoff valve to close and prevents any CSD/S operation. The momentary RESET position is for ground operation of the generator without the engine operating. Positioning the switch to RESET momentarily, then to NORM directs essential 28V DC power to bypass the engine crank switch and energize the solenoid to open the pneumatic regulator shutoff valve which permits air pressure be used exclusively for driving the generator.

Note

If both generators become inoperative in flight the stand-by battery will keep the solenoid valve energized open (and the generators engaged) for 15 seconds.

SPEED DRIVE LIGHTS

The speed drive lights on the annunciator panel (figure 1-12) displays L-SPD DR and R-SPD DR and are powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel. Steady illumination of the light indicates failure, low oil pressure or high oil temperature for the respective CSD/S unit. Flashing of the light indicates CSD/S overspeed and the respective generator will become inoperative.

ENGINE CRANK BUTTONS

The engine crank buttons on the throttle quadrant (figure 1-10) are momentary push button switches placarded PUSH TO CRANK. The left or right button is used to initiate the start cycle in the respective engine. With the appropriate engine fuel and master switch ON and the speed drive switch in NORM, depressing a crank button completes a circuit and opens the pressure regulator shutoff valve on the respective CDS/S unit. This allows air pressure to drive the CSD/S unit for engine start. After engine start the crank circuit is deenergized. Both engines cannot be started simultaneously, however either engine can be started first.

ENGINE FUEL AND MASTER SWITCH

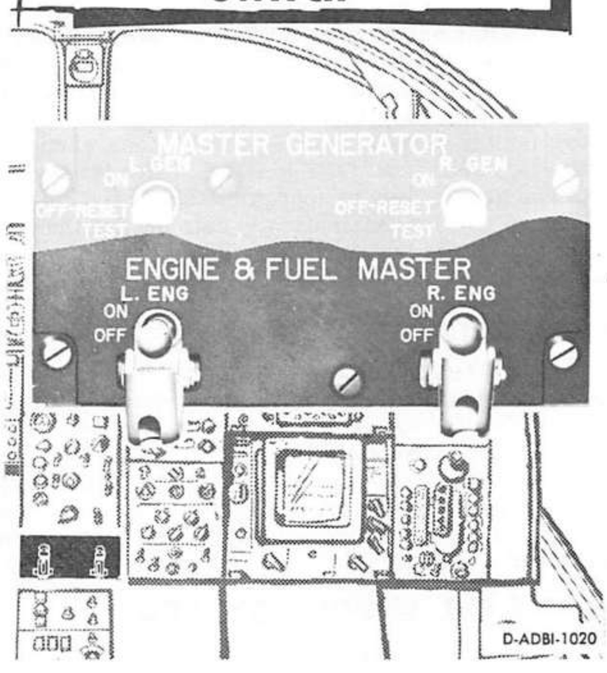


Figure 1-11

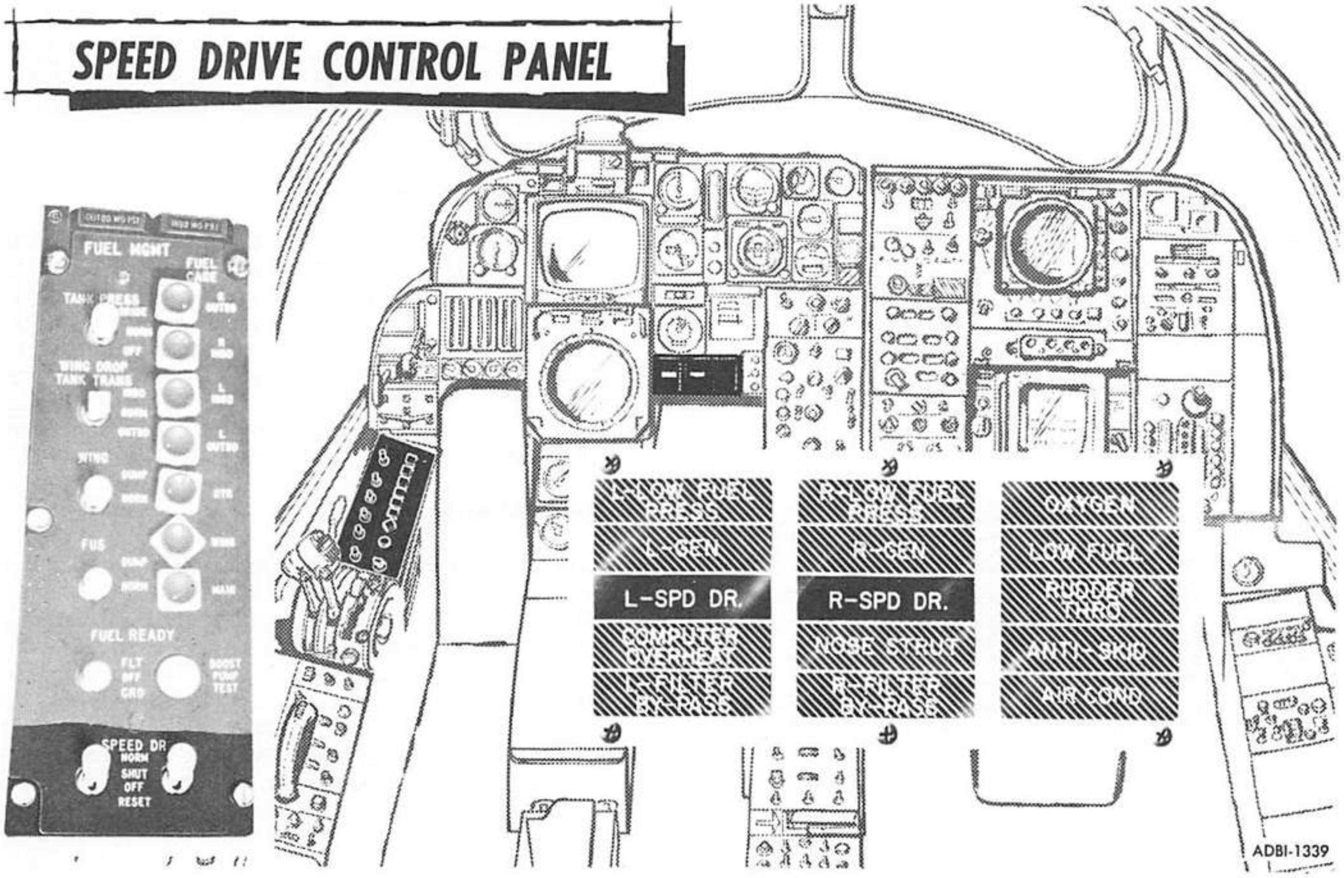


Figure 1-12

IGNITION SYSTEM

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

AIR START BUTTONS

The air start buttons on the aft face of each throttle grip (figure 1-10) provide high energy ignition to the respective engine for air start. When either button is held depressed, essential 115V AC power, through the L or R EMERG IGN circuit breaker on the pilots right circuit breaker panel, is provided to the ignition exciter unit which in turn provides high energy ignition through the number 4 and 7 igniters.

ENGINE OIL SUPPLY SYSTEM

Each engine is provided with a self-contained oil tank and high pressure oil system for lubrication of the engine bearings and accessory drives. Oil from the tank is pressurized by a pump in the accessory gear box to 45 ±5 PSI and is filtered and directed to the fuel-oil cooler and the oil nozzles in the bearing compartments. Oil will by-pass the filter or the fuel-oil cooler if either becomes blocked. Scavenger pumps return used oil to the tank. Air in the oil tank and bearing compartment is de-oiled at the centrifuge in the accessory gear box and excess internal pressure vented overboard. The oil tank has a usable capacity of 3.4 gallons. For servicing the oil tank refer to Servicing Data, figure 1-49.

ENGINE INDICATORS

The engine instruments are grouped together on the main instrument panel (figure 1-13). The RPM, EGT and FF indicators are dual, parallel tape, verticle scale instruments. Separate power trim indicators and oil pressure indicators are located immediately below the verticle scale indicators. All the instrument markings are white against a black background. When the instrument lights are illuminated, the markings appear red against a black background. See figure 1-52 for Instrument Markings, and figure 1-53 for Engine Operating Limitations.

RPM INDICATOR

The dual RPM indicator (figure 1-13) displays engine speed for each engine in percentage of the high pressure compressor rotor, based on 11,602 RPM as

100%. A verticle scale for each engine utilizing a multiplier of 10 is marked in 10% increments from 0 to 70%, and 1% increments on an expanded scale from 70 to 110%. A tachometer-generator driven by each engine generates a signal proportional to speed. In the indicator an amplifier and motor drives a gear train which moves tapes parallel to the scales to a point indicating engine RPM. The indicator is powered by the essential 26V AC bus through the L or R ENG INSTR circuit breaker on the pilot's left circuit breaker panel. In the event of loss of electric power to the indicator the word OFF appears on the face of the instrument.

EXHAUST GAS TEMPERATURE INDICATOR

The dual EGT (exhaust gas temperature) indicator (figure 1-13) displays exhaust gas temperature for each engine in degrees centigrade. A verticle scale for each engine utilizing a multiplier of 100 is marked in 50° increments, from 0 to 400°, 10° increments from 400° to 700° and 50° increments from 700° to 900°. A thermocouple sensor mounted in the exhaust gas stream of each engine produces a minute current proportional to temperature. In the indicator an amplifier and motor drives a gear train which moves tapes parallel to the scales to a point indicating engine EGT. The indicator is powered by the essential 26V AC bus through the L or R ENG INSTR circuit breaker on the pilot's left circuit breaker panel. In the event of loss of electrical power to the indicators the word OFF appears on the face of the instrument. See figures 1-52 and 1-53 for EGT limits.

FUEL FLOW INDICATOR

The dual fuel flow indicator (figure 1-13) displays fuel flow rate for each engine in pounds per hour. A vertical scale for each engine utilizes a multiplier of 100 and is marked in 100 PPH increments up to 5,000 and in 1,000 PPH increments from 5,000 to 10,000 PPH. A fuel flow transmitter installed on each engine between the control and the fuel pressurizing valve (figure 1-14) provides a signal to the indicator directly proportional to the mass rate of fuel flow. In the indicator an amplifier and motor drives a gear train which moves tapes parallel to the scales to a point indicating fuel flow. Both transmitters are powered by the essential 115V AC bus through the F FLOW XMTR circuit breaker on the pilot's left circuit breaker panel. The dual indicator is powered by the essential 26V AC bus through the F FLOW IND circuit breaker also on the pilot's left circuit breaker panel. In the event of loss of power to the indicator the word OFF appears on the face of the instrument.

ENGINE INDICATORS

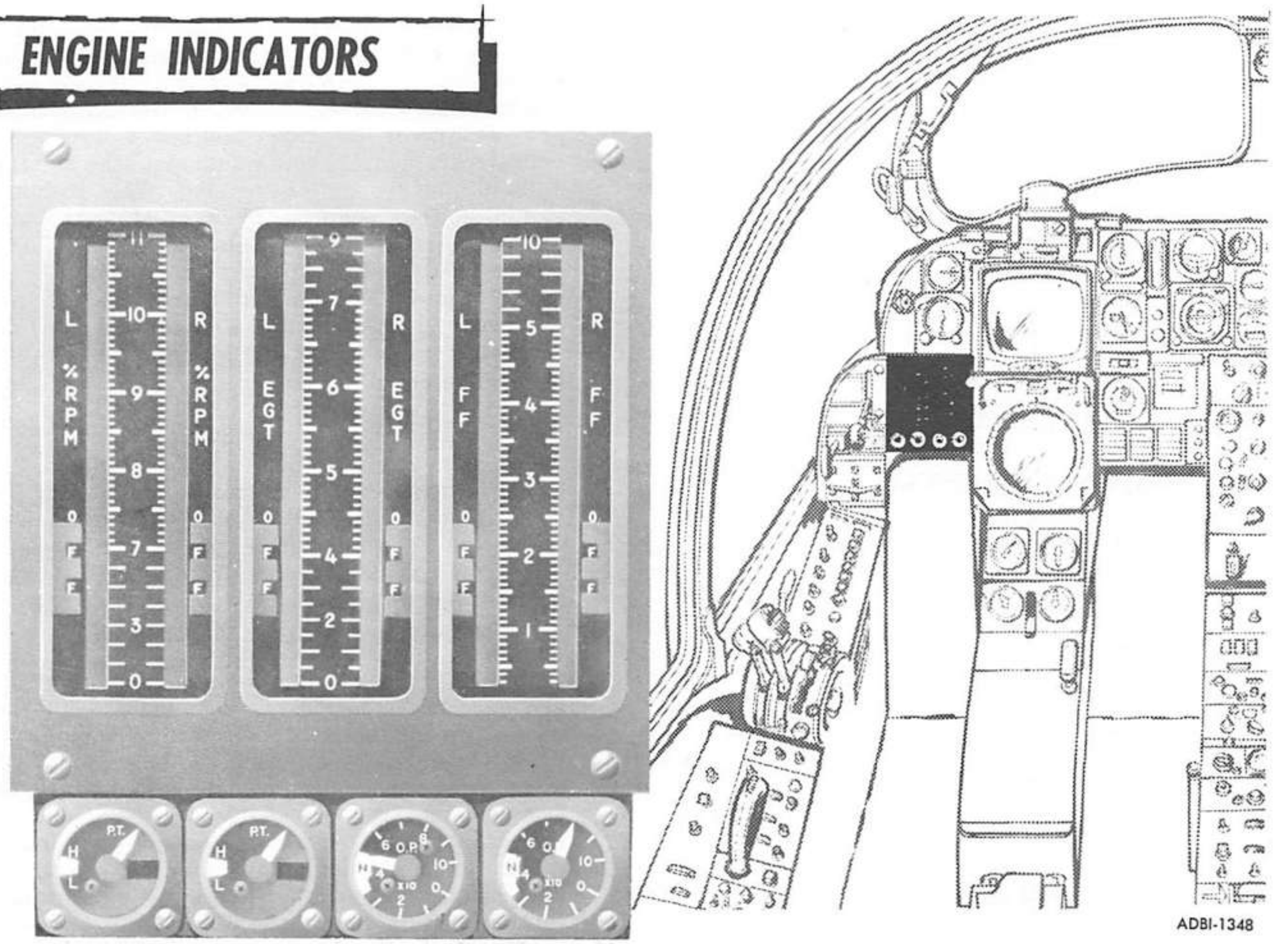


Figure 1-13

POWER TRIM INDICATOR

A power trim indicator for each engine (figure 1-13) displays temperature corrected pressure ratio. The face of each indicator is marked PT and accommodates a single pointer. A gray arc with the extremities marked H and L is centered at the 9 o'clock position. When the pointer indicates within the arc during the MAX POWER check prior to take-off the engine pressure ratio is satisfactory for take-off. Indications beyond the arc in the H or L area indicates the engine is over or under trimmed. Exhaust gas pressure transmitters on each engine, the total air temperature probe and the air data computer provide signals through the power trim computer to the indicators. The system is powered by the monitored 28V DC bus. In flight (weight off wheels) the indicators are inoperative and the pointers out of sight behind masks.

WARNING

For reduced wind over the deck conditions, or heavy gross weight take-offs, engine thrust is critical and the power trim indicator must be considered as a "go-no go" gage.

OIL PRESSURE INDICATOR

An oil pressure indicator for each engine (figure 1-13) displays oil pressure in pounds per square inch. The face of each indicator is marked OP and accommodates a single pointer. The scale is graduated in 10 pound increments from 0 to 100 PSI with an arc from 35 to 50 marked N. The engine mounted transmitters and the indicators are powered by the essential 26V AC bus through the L and R OIL PRESS circuit breakers on the pilot's left circuit breaker panel. See figures 1-52 and 1-53 for oil pressure limits.

CAUTION

Oil pressure warning lights are not provided.

FUEL SUPPLY SYSTEM

The aircraft fuel supply is carried in three fuselage tanks, inboard and outboard integral wing tanks and up to five external drop tanks (figure 1-14 and 1-15). The three fuselage tanks are identified individually as forward, mid and aft, and collectively as main. The forward and aft tanks are self-sealing. Fuel from the mid tank transfers by gravity directly to the forward tank. Fuel from the forward tank transfers by gravity through a line to the bottom of the aft tank. A CG control system maintains a favorable fuel distribution between the forward and aft tanks. The system is completely automatic in that it does not require attention on the part of the pilot. Gravity transfer of fuel from the forward tank to the aft tank through the gravity transfer line is proportional to the pressure drop through the transfer line inlet in the aft tank. A flow control jet in the line inlet varies this pressure drop inversely proportional to engine fuel flow demand. The bottom of the aft tank, called the inverted flight cell, is separated from the top of the tank by a horizontal deck. This cell contains 200 pounds of usable fuel which is adequate for any single maneuver. Mass controlled flapper valves permit fuel flow into the cell and prevent fuel flow out of the cell at G loadings of 0.0 and less. The cell contains the single electrically driven fuel boost pump that delivers fuel under pressure to both engine fuel control systems through motor operated shut-off (gate) valves. A venturi tube on the boost pump outlet controls the flow of fuel at the inlet of the gravity transfer line from the forward tank. The main tank boost pump is essential for inverted flight and serves as a back-up for the centrifugal element of the engine driven fuel pump.

All tanks are connected by a common manifold which serves for fuel transfer, air refueling and single point ground refueling. Cooled and regulated engine compressor bleed air directed into the wing and drop tanks forces the fuel through the manifold to the fuselage tanks (main tank).

ENGINE AND FUEL MASTER SWITCHES

The ENGINE & FUEL MASTER switches (figure 1-16) identified as L ENG and R ENG are two position toggle switches with placarded positions ON and OFF and are guarded to the ON position. The ON position of either the left or right switch deenergizes a primary 115V AC powered relay which permits essential 115V AC power to energize the main tank boost pump. The ON position also provides essential 28V DC power to open the fuel shut-off valve. The ON position also provides power to the constant speed drive switch and energizes a holding relay which arms the starting circuits for the respective engine. When both switches are in the OFF position, primary 115V AC power energizes a relay which opens the essential 115V AC power supply to the main tank boost pump, shutting it off. The OFF position also provides essential 28V DC power to close the fuel shut-off valve and deenergizes the speed drive and starting circuits for the respective engine.

Note

It is necessary to cycle the engine and fuel master switch to OFF and return to ON in order to re-energize the start circuits once a start has been accomplished and the engine subsequently shut down.

FUEL TRANSFER / PRESSURIZATION SYSTEM

During normal operation fuel transfers from the wing and drop tanks to the fuselage tanks when the nose gear is up and locked. Bleed air from the engines twelfth-stage compressors is cooled and directed to the wing and drop tanks through pressure regulators. The wing tanks are pressurized to 7 PSI and the drop tanks to 25 PSI. The air pressure in the tanks forces the fuel through the common manifold to the fuselage fuel tanks. (The higher pressure in the drop tanks forces them to transfer first.) Dual shut-off valves in the forward and aft fuselage tanks control the flow of transfer fuel. When a tank is full the valve is closed. When the level has dropped approximately three inches the valve opens to admit more fuel. This sequence begins wing and drop tank transfer at 6500 ±500 pounds fuel remaining in the fuselage tanks and that level will be maintained as long as transfer fuel is available. Failure of wing pressurization is indicated by illumination of the OUT WG PSI and/or the INBD WG PSI lights on the fuel management panel.

FUEL MANAGEMENT PANEL

The fuel management panel on the pilot's left console (figure 1-14) accommodates controls for pressurization and transfer of wing and drop tank fuel, selectors for fuselage, wing and drop tank fuel quantity indications, switches for fuel dumping and air refueling, and a boost pump test button.

Tank Pressurization Switch

The TANK PRESS switch on the fuel management panel (figure 1-16) is a three position toggle switch with positions placarded ORIDE, NORM and OFF that controls the wing tanks pressure regulators. The ORIDE position regulates wing tank air pressure at approximately 12 PSI regardless of landing gear position when airborne and approximately 7 PSI with weight on wheels. The NORM position regulates wing tank air pressure automatically at approximately 7 PSI and wing drop tank pressure at approximately 25 PSI when the nose gear is up and locked, and vents the wing tank when the gear is down. The OFF position opens the relief valve and vents the wing and drop tanks regardless of flight configuration or weight on wheels. The tank pressurization switch is used primarily for a preflight check of fuel transfer capability.

CAUTION

DO NOT POSITION WING TANK PRESS SWITCH TO ORIDE ON THE GROUND WHEN THE AIR COND MASTER SWITCH IS OFF as hot engine bleed air will enter the tanks.

Outbd/Inbd WG PSI Lights

The wing tank pressure lights on the fuel management panel (figure 1-16) displays OUTBD WG PSI and INBD WG PSI and are powered by the essential 28V DC bus. Illumination of either or both lights indicates air pressure in the respective wing tanks is below approximately 6 PSI and fuel is not transferring, or is transferring at a reduced rate. The light circuit is completed by pressure switches in the respective wing tanks.

Wing Drop Tank Transfer Switch

The WING DROP TANK TRANS switch on the fuel management panel (figure 1-16) is a three position toggle switch with positions placarded INBD, NORM and OUTBD. The INBD position permits fuel transfer from the inboard drop tanks by closing the outboard and centerline drop tanks shutoff valves. The NORM position permits fuel to transfer from all drop tanks simultaneously by opening all drop tank shutoff valves. The OUTBD position permits fuel to transfer from the outboard drop tanks by closing the inboard and centerline shutoff valves. All drop tanks are pressurized to 25 PSI except when the tank pressurization switch is positioned to OFF.

Fuel Ready Switch

The fuel ready switch on the fuel management panel (figure 1-16), is a three position toggle switch with positions placarded FLT, OFF and GRD that is used for receiving fuel in flight or for ground fueling. Placing the switch in FLT READY stops internal transfer of fuel by venting wing and drop tanks (and buddy tank) to permit the aircraft to receive fuel during air refueling operations. Fuel is taken on as it is during single-point ground fueling. In OFF, the valves return to their normal configuration, the GRD READY position.

Note

The normal flight position for this switch is OFF. Wing and drop tank fuel will not transfer if the FLT/GRD FUEL switch is in the FLT READY.

Low Fuel Pressure Lights

The low fuel pressure lights on the annunciator panel (figure 1-16) displays L-LOW FUEL PRESS and R-LOW FUEL PRESS and are powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel. A pressure switch downstream of the centrifugal stage of the engine driven pump completes a circuit to the light when the pressure is below 12 to 14 PSI. At lower altitudes the centrifugal stage of an engine driven pump or the main tank boost pump alone can maintain sufficient fuel pressure for engine operation and keep the light out. At higher altitude, failure of the centrifugal stage of an engine driven pump will illuminate the light for its respective engine, and failure of the main tank boost pump will illuminate the lights for both engines. A reduction in power and descent to lower altitude will extinguish the light and prevent an engine flame-out.

WARNING

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

Boost Pump Test Button

The boost pump test button on the fuel management panel (figure 1-16) placarded BOOST PUMP TEST is for ground checking the operation of the main tank boost pump and the centrifugal element of the engine driven pumps. When the button is depressed primary 115V AC power energizes a relay which opens the essential 115V AC power supply to the main tank boost pump shutting it off. Prior to engine start, the main tank boost pump test circuit is checked by depressing the button shutting off the electric driven main tank

AIRCRAFT FUEL SUPPLY SYSTEM

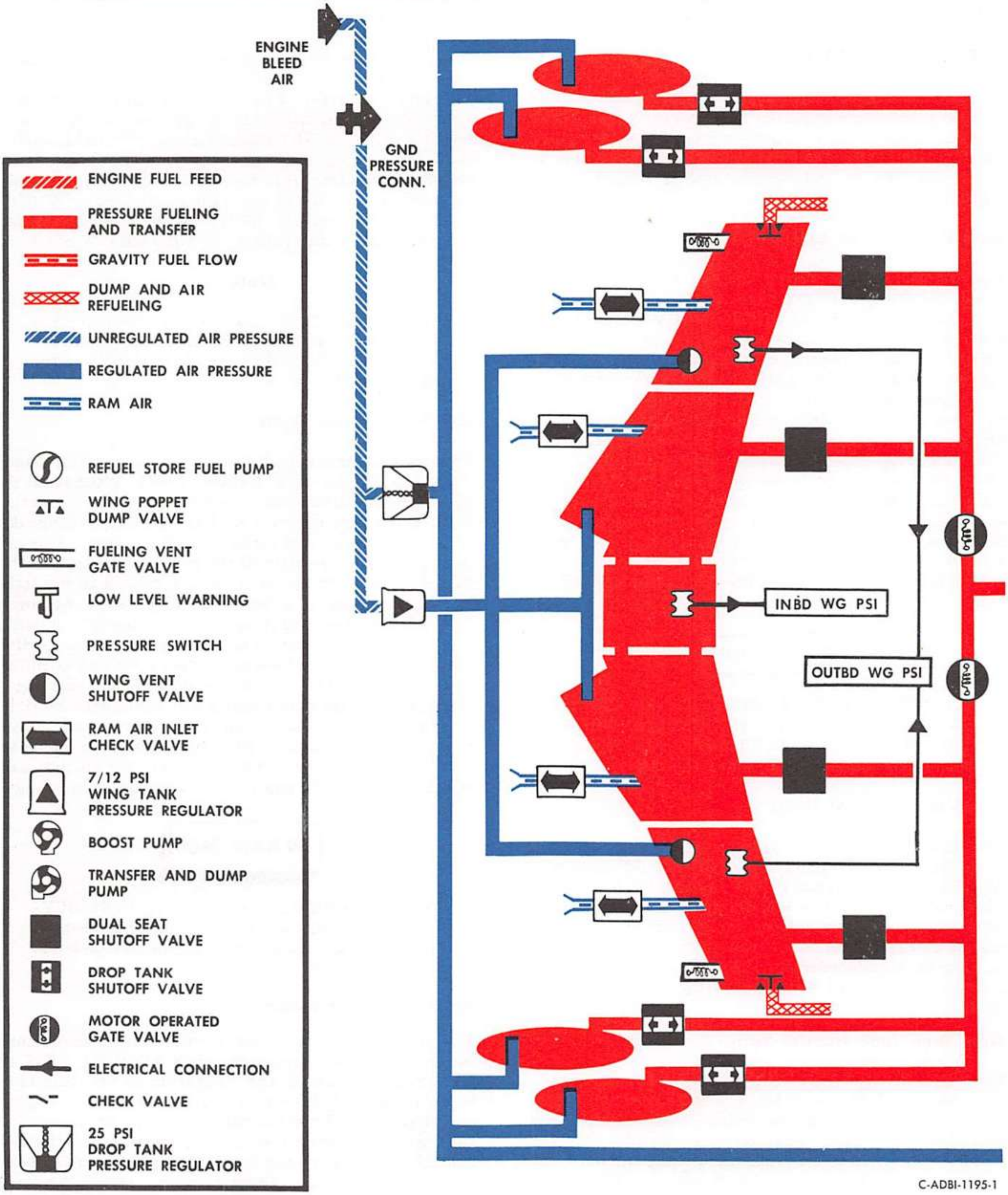


Figure 1-14 (Sheet 1)

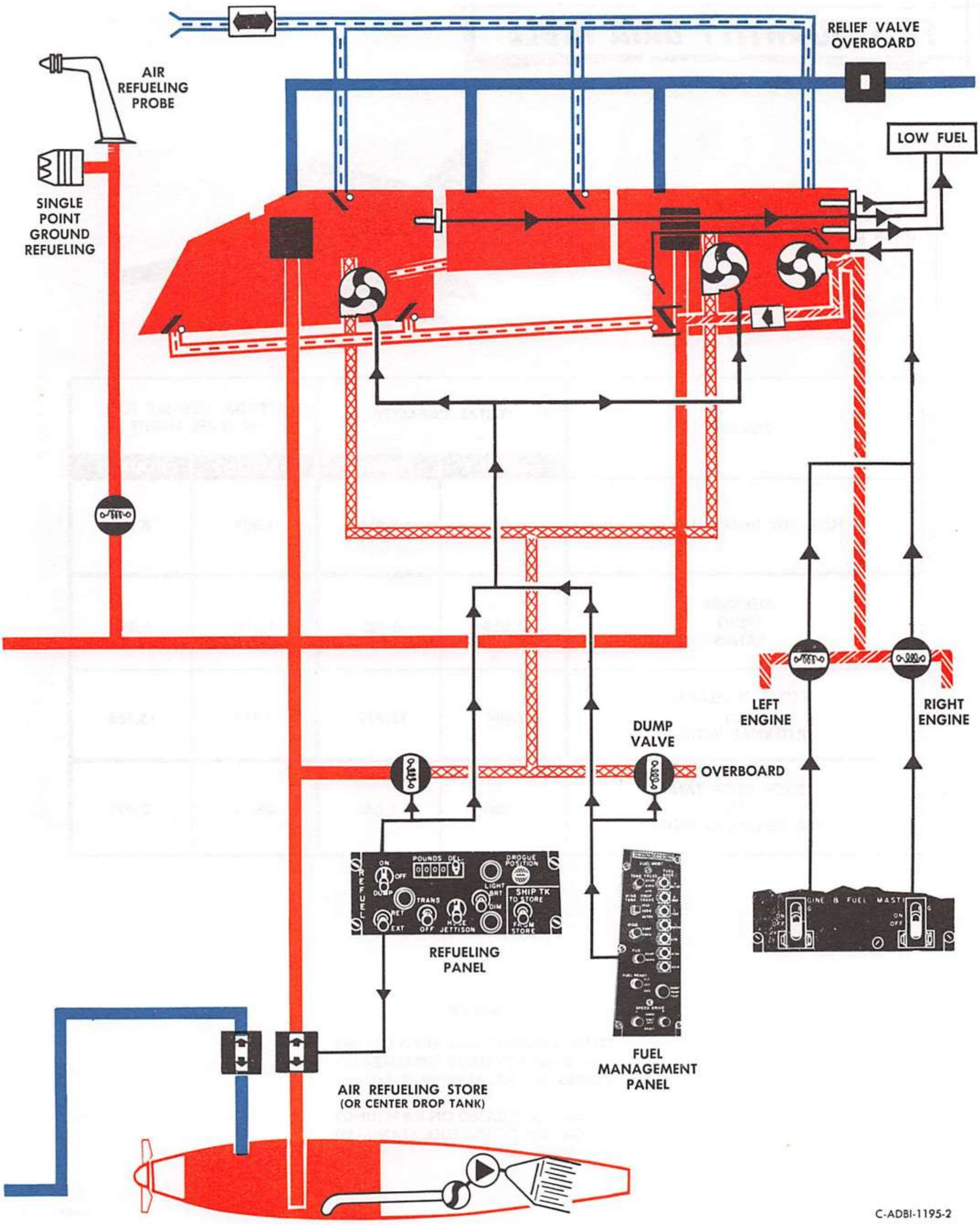
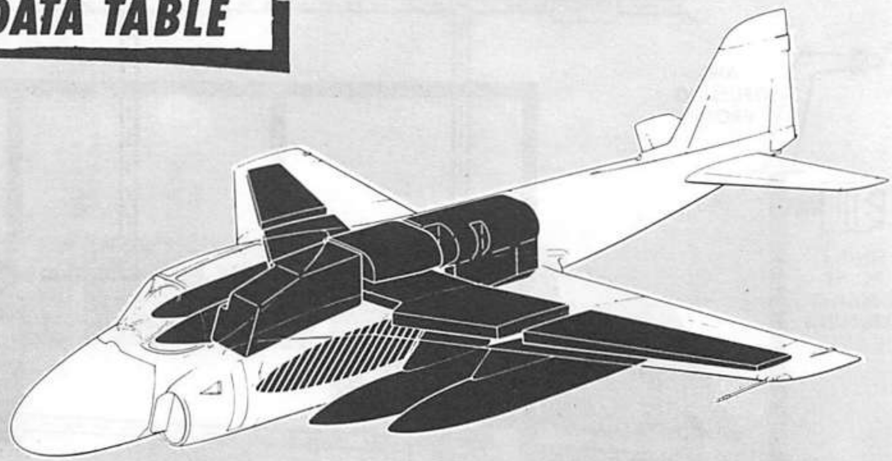


Figure 1-14 (Sheet 2)

FUEL QUANTITY DATA TABLE



DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

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

NOTE

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

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

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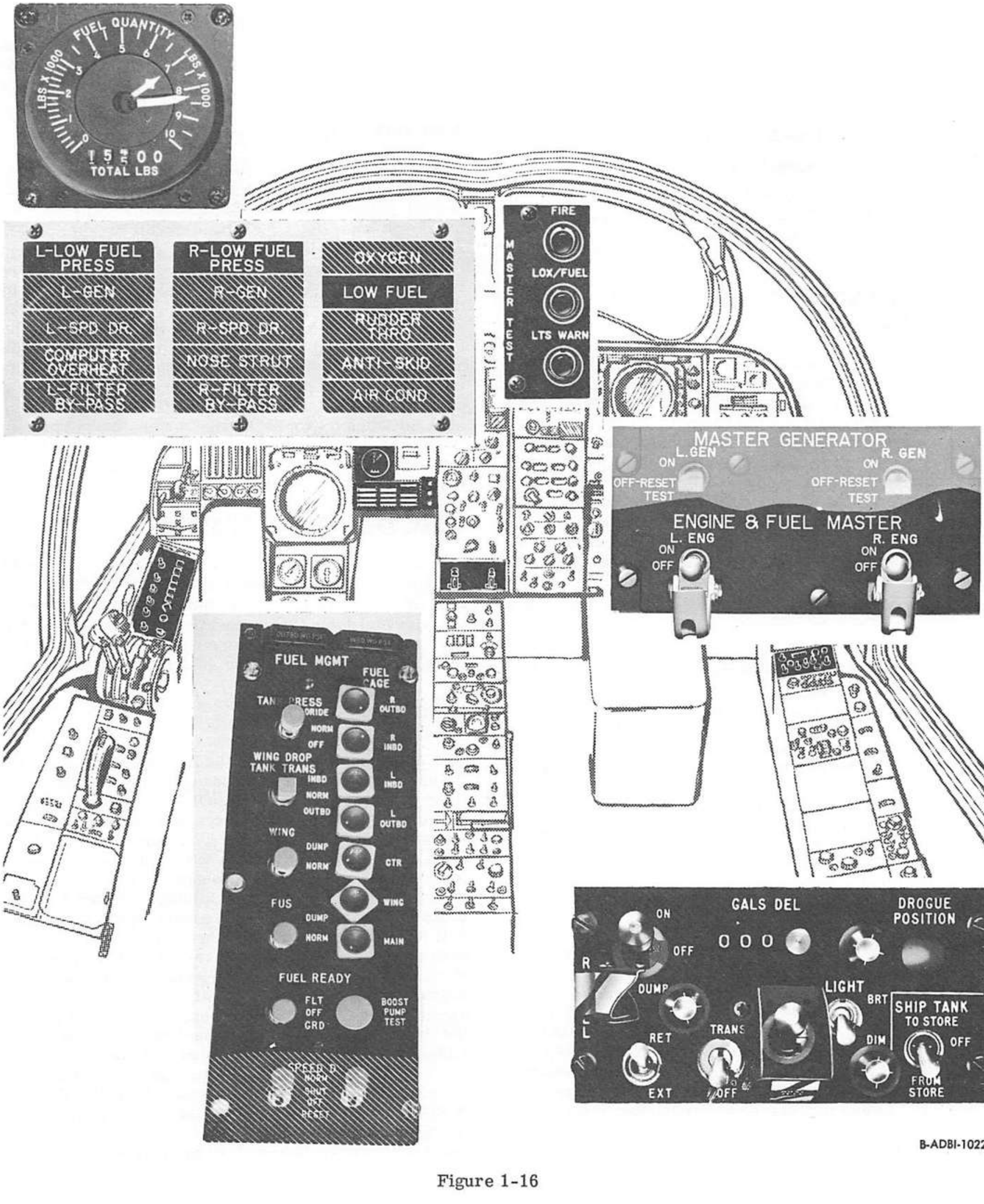
Figure 1-15

FUEL SUPPLY SYSTEM CONTROLS AND INDICATORS



B-ADBI-1022

Figure 1-16

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

WARNING

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

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity indicating system consists of fuel capacitance sensor units mounted in the fuel tanks, a fuel quantity gage, fuel quantity selector buttons, and an indicator test button. The capacitance sensor units compensate for changes in fuel density and present a signal to the gage proportional to fuel quantity in pounds. The system is powered by essential 28 V DC power through the TURN/SLIP circuit breaker on the pilot's right hand circuit breaker panel and essential 115V AC power through the LOX/F QTY circuit breaker on the pilot's left hand circuit breaker panel.

FUEL QUANTITY GAGE

The fuel quantity gage (figure 1-16) on the pilot's instrument panel displays three simultaneous indications of fuel quantity. A digital totalizer in the lower part of the instrument face provides continuous indication of total pounds of fuel on board exclusive of the air refueling store. Two rotating pointers indicate on a scale around the outer periphery of the gage that is graduated in increments of 200 pounds. The large pointer indicates pounds of fuel in the main tank. The small pointer indicates pounds of fuel in the main, wing or any of the five drop tanks (exclusive of the air refueling store) as selected by buttons on the fuel management panel.

FUEL GAGE SELECTOR BUTTONS

Seven FUEL GAGE selector buttons on the fuel control panel (figure 1-16) are placarded R OUTBD, R INBD, L INBD, L OUTBD, CTR, WING and MAIN. Depressing a particular button cancels the previous selection and selects that particular tank for presentation of fuel quantity on the fuel quantity indicator by the small pointer. The depressed button rotates 45 degrees and serves as a visual indication of the selected tank.

LOX/FUEL TEST BUTTON

The LOX/FUEL test button on the MASTER TEST panel (figure 1-16) is provided to test the operation of oxygen quantity gage, OXYGEN light and fuel quantity gage. Depressing the button causes the digital counter and the two pointers on the fuel quantity gage and the pointer on the liquid oxygen gage to move to zero and the OXYGEN light on the annunciator panel to illuminate.

LOW FUEL LIGHT

The low fuel level light on the annunciator panel (figure 1-16) displays LOW FUEL and is powered by the essential 28V DC bus through the TURN/SLIP circuit breaker on the pilot's right hand circuit breaker panel. At the time the light illuminates the fuel quantity in the main tank is 2,000 pounds, + 200-100 within the limits of 3 to 10° nose up. The fuel level is sensed by thermistors (figure 1-16) that when exposed to air complete a circuit. One thermistor is installed in the forward tank, and two thermistors are installed in the aft tank. For normal cruise attitude the lower thermistor in the aft tank when exposed to air completes a circuit and illuminates the LOW FUEL light. At nose high attitudes (8 to 10°), the upper thermistor in the aft tank and the thermistor in the forward tank are both exposed to air, completing a circuit and illuminating the low fuel light.

FUEL DUMPING SYSTEM

The aircraft incorporates a fuel dumping system to reduce weight and/or reduce fire hazard. The system consists of two complete and independent systems, the wing fuel dump system and the main fuel tank dump system. Either or both dumping systems may be selected by switches on the fuel management panel.

WING DUMP SWITCH

The WING dump switch on the fuel management panel (figure 1-16) is a two position toggle switch with positions placarded DUMP and NORM. The DUMP position closes the wing gate valves, pressurizes the wing tanks to 12 PSI and opens the wing dump valves. Fuel from any selected drop tank will continue to transfer to the wing tanks. The 25 pounds of pressure in the drop tanks will force any remaining fuel into the wing tanks. The 12 pounds of pressure in the wing tanks will force the fuel overboard through the wing tip dump outlets at the trailing edge of each wing tip. When air is sensed flowing through the wing transfer and shutoff valves the pressure regulator shuts off, wing ram air inlet check valves open admitting air that purges the wing tanks by carrying fuel vapors out the wing dump valves. Wing tank purging may be utilized after wing tanks have been emptied through normal use by positioning the wing dump switch to DUMP. The NORM position opens the wing tank gate valves, closes the wing tank dump valves, and permits the pressure regulator to operate and close the ram air inlet.

Note

- If the wing dump valves fail to actuate, positioning the TANK PRESS switch to ORIDE will provide an additional 5 PSI pressure that may aid in actuating the dump valves.
- Wing drop tank fuel may be transferred to the wing tanks during the wing fuel dumping process.
- Optimum wing fuel dumping is achieved at cruise attitude (4 to 4-1/2 degrees nose up) at which approximately 6300 pounds of fuel can be dumped from full wing tanks in five minutes. Approximately three minutes more is required to dump an additional 554 pounds of dumpable fuel.

Do not decelerate the aircraft as the fuel remaining will move forward in the wing, hence inboard and away from the dump outlets and dump flow will stop. At pitch attitudes lower than level flight, dumping becomes sporadic as the dump outlets in the rear of the tanks are uncovered.

FUSELAGE DUMP SWITCH

The FUS dump switch on the fuel management panel (figure 1-16) is a two position toggle switch with positions placarded DUMP and NORM. The DUMP position opens the main tank dump valve and energizes the transfer/dump pumps in the forward and aft tanks of the main tank. The pump in the aft fuel tank is powered by the primary 115V AC bus, and the pump in the forward tank is powered by the monitored 115V AC bus. The pumps will pump all fuel in the main tank in excess of 3600 pounds overboard through the dump outlet at the extreme aft end of the fuselage. This 3600 pounds of fuel is reserved for aircraft engine operation by standpipes on the transfer and dump pump inlets. The NORM position closes the main tank dump valve and shuts off the transfer/dump pumps.

Note

A full main tank will dump all fuel in excess of 3600 pounds in 3.5 to 4 minutes. In the event of a single transfer and dump pump failure, or a single generator failure which will result in loss of power to the forward pump, main tank fuel can still be dumped but the time required will be doubled.

If it is desired to dump fuel from the air refueling store, it may be transferred to the main tank during the fuselage fuel dumping process by positioning the ship tank switch to FROM STORE.

AIR REFUELING

The aircraft can receive fuel in flight from a drogue equipped tanker, or serve as a tanker and deliver fuel in flight to a probe equipped receiver aircraft.

AIR REFUELING (RECEIVER)

When aircraft is to be refueled in flight an air refueling probe is installed on the fuselage centerline forward of the windshield (figure 1-8). Prior to engaging the drogue of a tanker aircraft the FUEL READY switch must be positioned to FLT to depressurize wing and drop tanks. In flight the probe is connected to the drogue of a tanker aircraft. Fuel is pumped from the tanker through the probe to the common manifold that connects all the tanks. As each tank is filled, float operated shut-off valves shut off the incoming flow of fuel.

Note

When air refueling is completed the FUEL READY switch must be returned to the OFF position to pressurize the wing and drop tanks for fuel transfer.

AIR REFUELING (TANKER)

Installation of an air refueling store on the centerline station and a refuel control panel on the crew members right console enables the aircraft to serve as a tanker and supply fuel to other aircraft in flight. During air refueling as a tanker, drop tank and wing tank fuel is transferred to the main tank. The two dump and transfer pumps in the main tank can pump all fuel except 3600 pounds in the tanker to the refueling store. The refueling store can transfer fuel to a receiver aircraft at approximately 200 gallons (1360 pounds) per minute. See Section I, part 4, Operating Limitations for the operational envelope for air refueling.

Air Refueling Store

The air refueling store carried on the centerline station contains a constant speed ram air driven hydraulic pump, hydraulically driven fuel pump and hose reel, and a 50 foot hose with attached drogue and a 300 gallon (2040 pound) fuel cell. Fuel contained in the refueling store does not indicate on the fuel quantity gage. Amber and green lights on the aft end of the store are provided to signal information to the pilot of the receiver aircraft. Illumination of the amber light indicates the hose is fully extended and the receiver aircraft may engage the drogue. After engagement, when the receiver aircraft pushes the drogue forward sufficiently (3 to 6 feet) to permit the hose to reel in 2 feet the amber light will go out, indicating that the aircraft is in position to receive fuel. Illumination of the green light indicates that fuel is transferring from the tanker to the receiver aircraft. The transfer rate is approximately 200 gallons per minute.

Refuel Panel

The REFUEL panel when installed on the crew members right console (figure 1-16) contains all the controls and indicators that are used in conjunction with the air refueling store. All controls are powered by the primary 28V DC bus.

Ship Tank Switch

The SHIP TANK switch located on the lower right corner of the refuel panel (figure 1-16) is a three position toggle switch with positions placarded TO STORE, OFF and FROM STORE. The TO STORE position energizes the fuel transfer and dump pumps which pump fuel from the main tank to the refueling store. The pump in the aft fuel tank is powered by the primary 115V AC bus, and the pump in the forward tank is powered by the monitored 115V AC bus. The OFF position closes a shut-off valve which prevents fuel flow to or from the store. The FROM STORE position pressurizes the refueling store to 25 PSI and forces the fuel to flow to the main tank.

Refueling Master Switch

The refueling master switch on the refuel panel (figure 1-16) is a three position toggle switch with positions placarded ON, OFF and DUMP. The ON position unlocks the ram air turbine and unfeathers the blades permitting the air stream to drive the hydraulic pump. The OFF position locks the turbine and feathers the blades. The DUMP position is inoperative.

Drogue Switch

The drogue switch on the refuel panel (figure 1-16) is a two position toggle switch with positions placarded RET and EXT. The EXT position extends the drogue and the RET position retracts the drogue. The hose is automatically snubbed for the last several feet of extension and retraction.

Drogue Position Indicator

The DROGUE POSITION indicator on the refuel panel (figure 1-16) alternately displays RET, EXT and TRA. RET appears when the drogue is fully retracted. EXT appears when the drogue is fully extended. TRA appears during extension, retraction and after the receiver aircraft has made engagement and pushed the drogue forward sufficiently to permit the hose to reel in 2 feet.

Transfer Switch

The transfer switch on the refuel panel (figure 1-16) is a two position toggle switch with positions placarded TRANS and OFF. The TRANS position opens a control valve which permits the hydraulically driven fuel pump to operate. The TRANS position of the switch contains a holding relay and will not stay in the TRANS position unless the master switch is ON and the refueling store contains enough fuel to close a float switch. The fuel pump will not operate unless the hose is reeled in at least two feet. This feature stops fuel transfer prior to disengagement. The OFF position of the switch shuts off the pump.

Gallons Delivered Counter

The GALS DEL counter on the refuel panel (figure 1-16) is a digital counter that presents the quantity of fuel in gallons that has been transferred through the drogue hose to the receiver aircraft in increments of 2 gallons. A reset knob to the right of the read-out window is provided for resetting the counter to zero.

Hose Jettison Switch

The HOSE JETTISON switch on the refuel panel (figure 1-16) is a two position toggle switch with positions placarded OFF and HOSE JETTISON. The switch is guarded to the OFF position by a spring loaded channel guard and the toggle spring loaded into a detent. To move the switch from OFF to HOSE JETTISON the guard must be held up and the toggle pulled up then moved aft. The HOSE JETTISON position disconnects all electric power to the refueling store except the ship to tank switch circuits and fires a cartridge actuated hose cutter and crimper.

WARNING

DO NOT POSITION THE HOSE JETTISON SWITCH TO OFF AFTER HOSE JETTISONING as the turbine will unfeather and cause the hose to be pulled from the crimper and spill fuel in the store creating a fire hazard.

Light Switch

The LIGHT switch on the refuel panel (figure 1-16) is a two position toggle switch with positions placarded BRT and DIM. The switch positions select resistors in the light circuits and provides two intensities of illumination of the external indicator lights.

ELECTRICAL POWER SUPPLY SYSTEM

The normal power supply (figure 1-17) is provided by two engine driven 115V AC generators (alternators). Transformers and rectifiers incorporated in the power distribution system convert 115V AC power to 26V AC and 28V DC respectively as required for operation of various systems and components. Each engine normally drives one generator through a CSD/S (constant speed drive/starter) unit. DC power must be available to open the pneumatic pressure regulator for CSD/S operation. During single engine operation the generator on the inoperative engine is driven by the operating engine as long as adequate cross bleed air pressure is available. Each generator is controlled by a switch in the cockpit. If a generator's voltage or frequency is too high, or too low, it will automatically disconnect from the power distribution system. An emergency power supply for essential equipment is provided by a RAT (ram air turbine) generator. A 24V nickel-cadmium battery is provided as a standby source of DC power for the CSD/S and assist spin recovery system operation. An external power receptacle is provided for connecting ground power for starting engines, or operation of electrically powered systems.

ELECTRIC POWER DISTRIBUTION

Electric power is distributed to the various electrical components of the aircraft through a series of buses (figure 1-17). The generators are non-parallel in that at no time do both generators power the same bus at the same time. The left generator normally powers the monitored 115V AC bus, the monitored 26V AC bus through a transformer and the 28V DC bus through a rectifier. The right generator normally powers the primary and essential 115V AC buses, the primary 26V AC buses through a transformer and the primary and essential 28V DC buses through a rectifier. In the event of a partial power condition automatic electrical distribution transfer occurs through a series of relays, see figure 1-17. In the event the left generator becomes inoperative all three monitored buses will be deenergized. If the right generator becomes inoperative relays will automatically switch the power supply from the left generator to the three primary buses and the three essential buses and the three monitored buses will be deenergized. If both generators become inoperative relays will automatically switch the three essential buses to the emergency power supply. The RAT generator must be extended by the pilot to energize the emergency power supply.

Generator Switches

Each engine driven generator is controlled by a three position toggle switch on the master generator control panel (figure 1-18). The switches identified as L-GEN and R-GEN have placarded positions ON, OFF-RESET and a spring loaded TEST. The ON position connects generator current to the generator field for initial excitation. When generator power output is suitable the main line contactor closes, connecting the generator to the distribution system. The OFF-RESET position opens field exciter circuit and opens the main line contactor. The TEST position for maintenance use, energizes the generator but does not close the main line contactor and connect it to the distribution system.

Note

> If both engine driven generators become inoperative in flight only 15 seconds are available to position a generator switch to OFF-RESET then ON. If the RAT generator is extended and operating there is no time limit for resetting the generators. Repeated attempts may be made.

Generator Warning Lights

The generator warning lights on the annunciator panel (figure 1-18) display L-GEN and R-GEN and are powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel. Illumination of either light indicates the respective generator is inoperative.

Note

> When both generators are inoperative the generator lights will not illuminate unless the RAT driven emergency generator is extended and operating.

Circuit Breakers

Pushbutton type circuit breakers are provided to protect the power supply and electrical components. The numeral on the button indicates the amperage rating. Red buttons are for less than 5 amp rating and black for 5 amp and greater. An electrical overload will "pop" (open) the appropriate circuit breaker and isolate a circuit or component that draws too much current. The circuit breakers are installed in panels located throughout the aircraft. Some panels are located in the cockpit (figure 1-19) and other panels are external (figure 1-20).

CAUTION

> DO NOT HOLD IN CIRCUIT BREAKERS THAT REPEATEDLY POP OUT. Holding circuit breakers in defeat their purpose and may result in popping an external main circuit breaker resulting in a greater loss of power distribution.
>
> The gang (3 phase) circuit breakers can be reset so that 2 phases only are engaged. To prevent equipment malfunction, depress the gang bar on all 3 circuit breakers during pre-flight to ensure all 3 are reset.

EMERGENCY ELECTRICAL POWER SUPPLY

The emergency electrical power supply (figure 1-17) is provided by a RAT (ram air turbine) driven 115V AC generator. In the event the essential AC and DC buses are deenergized (as would be the case when both engine driven generators are inoperative) emergency transfer relays will automatically be positioned to connect the emergency electrical power supply to the essential buses. The pilot must manually extend the RAT generator. If an engine driven generator becomes operative again the emergency transfer relays will be energized and disconnect the emergency power supply.

RAT (Ram Air Turbine) Handle

The RAT (ram air turbine) handle (figure 1-18) is a "T" shaped handle placarded ELEC AIR TURBINE and located on the inboard side of the aft end of the left console. Pulling the handle up mechanically opens a valve that directs pressure from a hydraulic accumulator to a hydraulic actuator that extends the ram air driven generator into the air stream. When the handle is pushed in, combined hydraulic pressure retracts the generator and re-charges the accumulator.

Standby Battery

A 24V nickel-cadmium battery is provided as a standby source of electrical power for control of the CSD/S system and the assist spin recovery system. Normally the essential 28V DC bus provides power for these functions and keeps the standby battery charged (figure 1-17). If, however, the essential 28V DC bus is deenergized in flight (as would be the case if both engine driven generators become inoperative) the battery will keep a solenoid energized and the pneumatic regulator shut-off valve open and the CSD/S generator drive engaged for 15 seconds to permit generator reset. The battery will also be available for assist spin recovery.

ELECTRICAL POWER SUPPLY SYSTEM

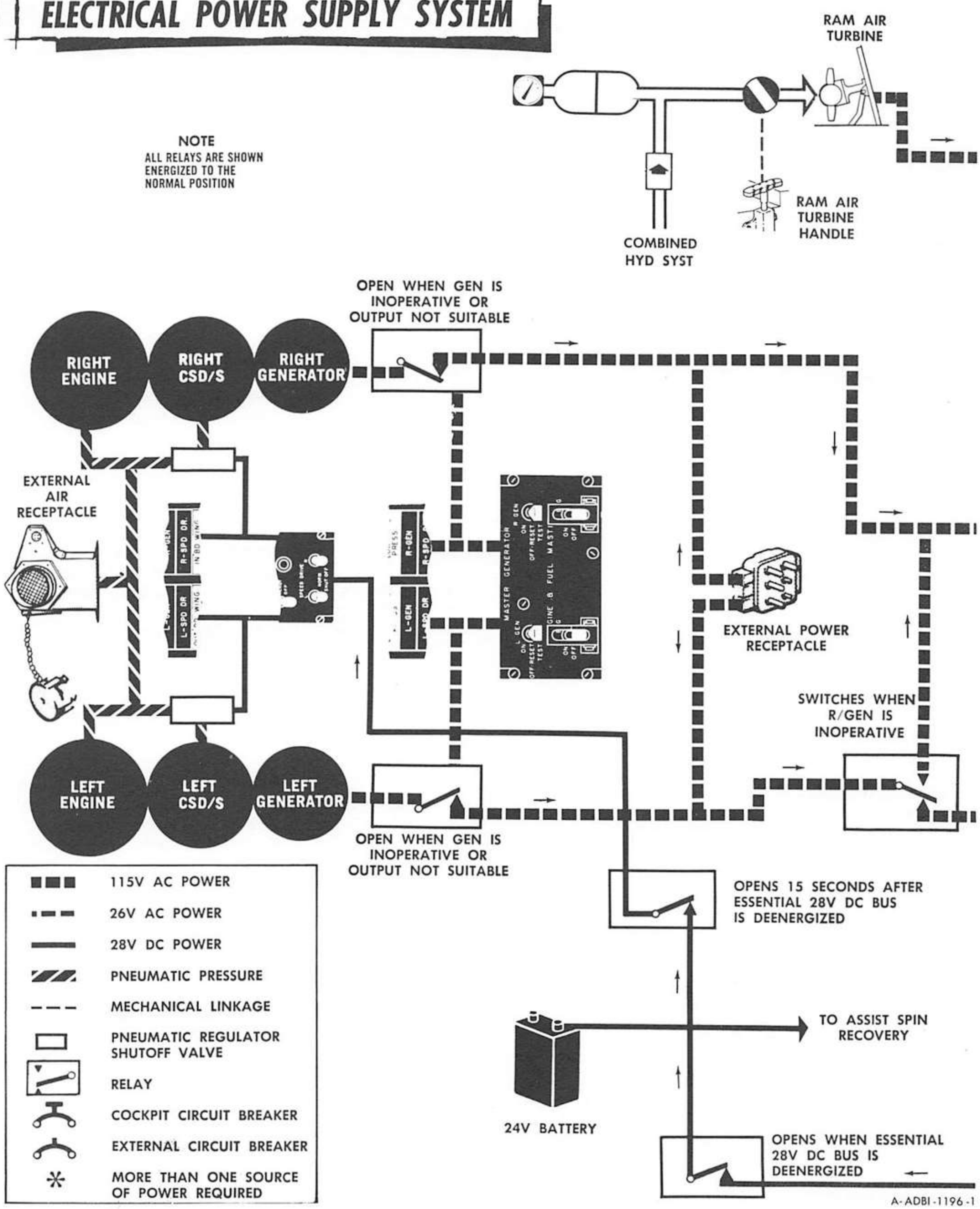


Figure 1-17 (Sheet 1)

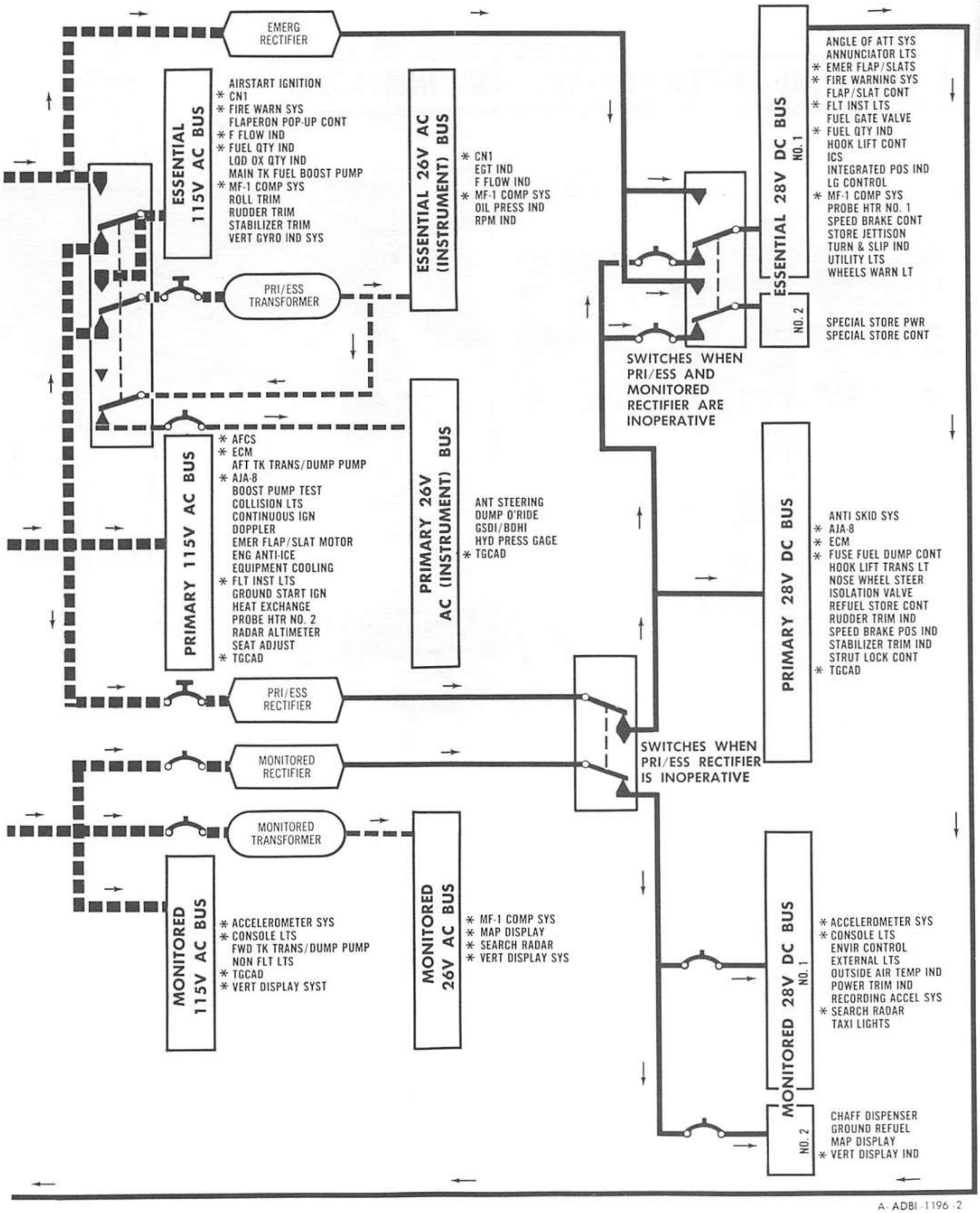


Figure 1-17 (Sheet 2)

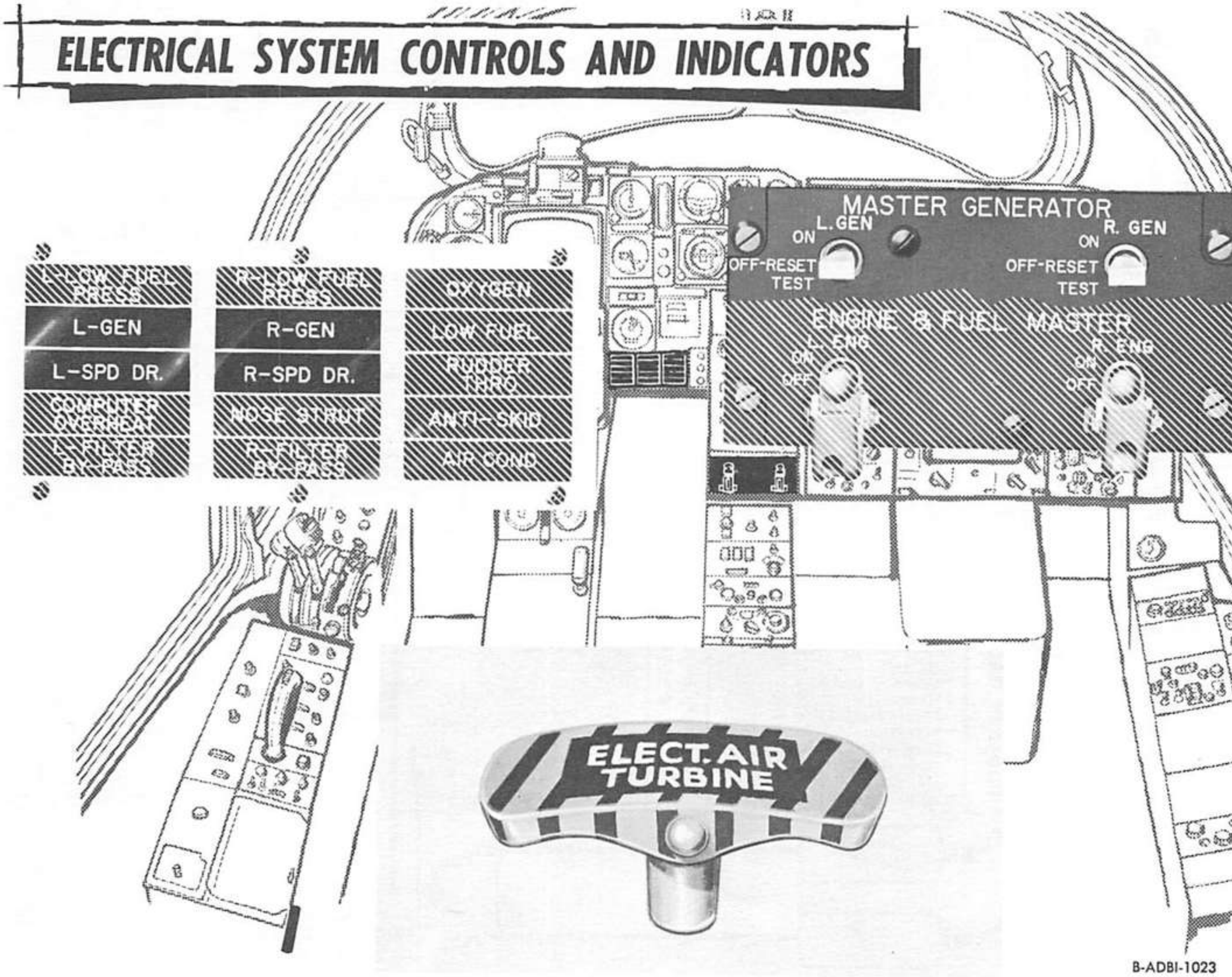

ELECTRICAL SYSTEM CONTROLS AND INDICATORS
L-LOW FUEL PRESS
L-GEN
L-SPD DR.
COMPUTER OVERHEAT
L-FILTER BY-PASS
R-LOW FUEL PRESS
R-GEN
R-SPD DR.
NOSE STRUT
R-FILTER BY-PASS
OXYGEN
LOW FUEL
RUDDER THRO
ANTI-SKID
AIR COND
MASTER GENERATOR
L.GEN
ON
OFF-RESET
TEST
R. GEN
ON
OFF-RESET
TEST
ENGINE & FUEL MASTER
L. ENG
ON
OFF
R. ENG
ON
OFF
ELECT. AIR TURBINE
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Figure 1-18

COCKPIT CIRCUIT BREAKER PANELS

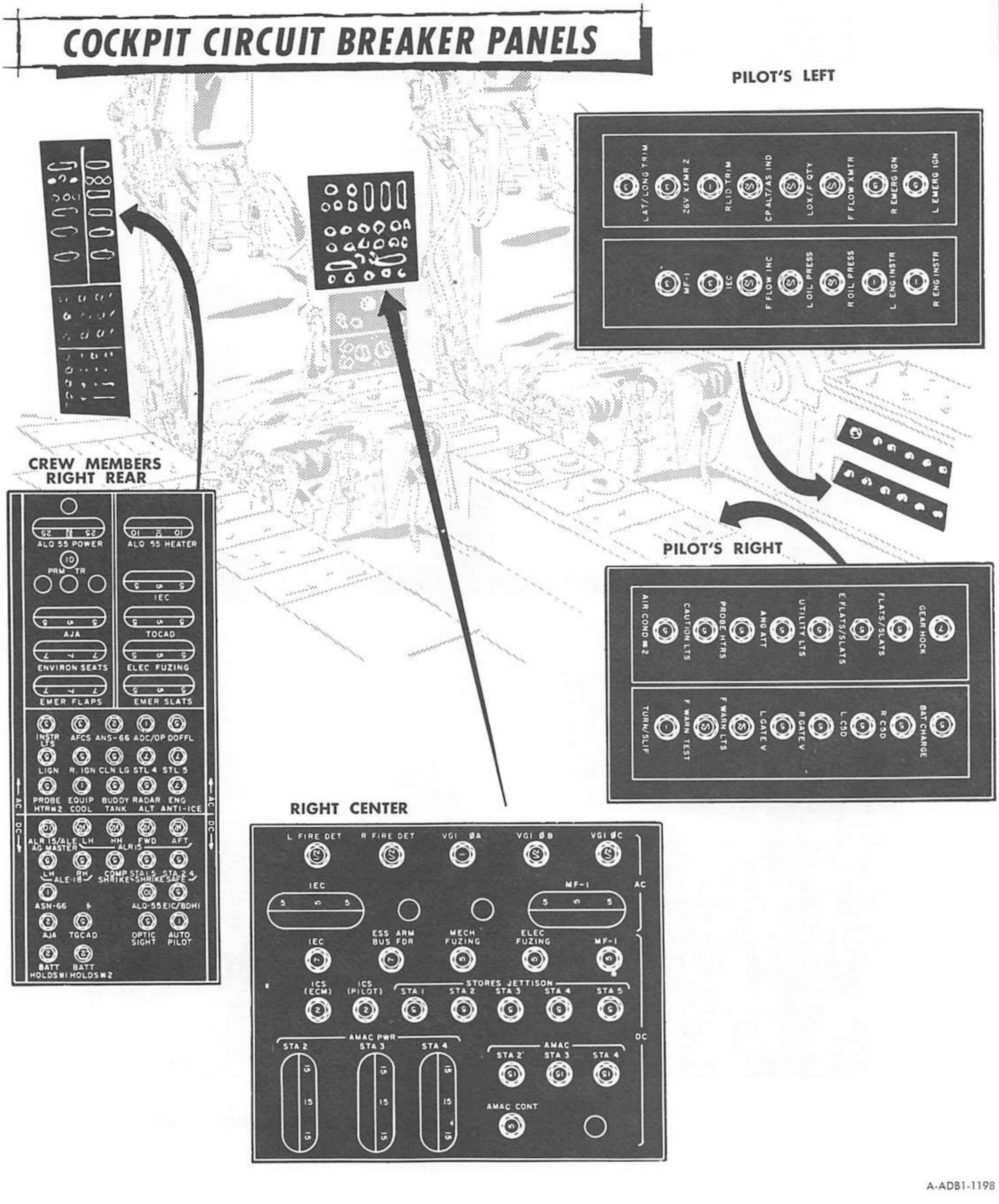


Figure 1-19

EXTERNAL CIRCUIT BREAKER PANELS

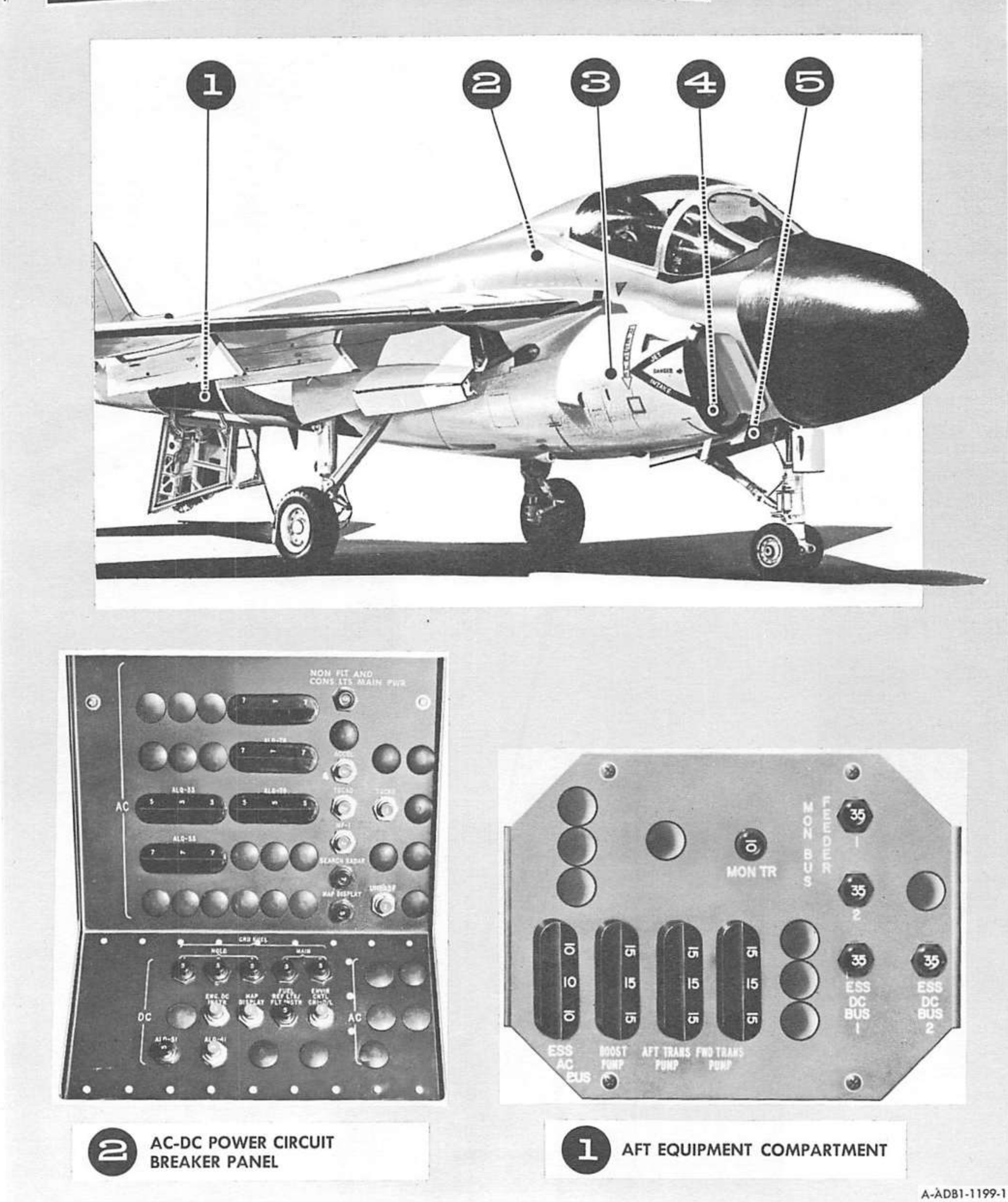
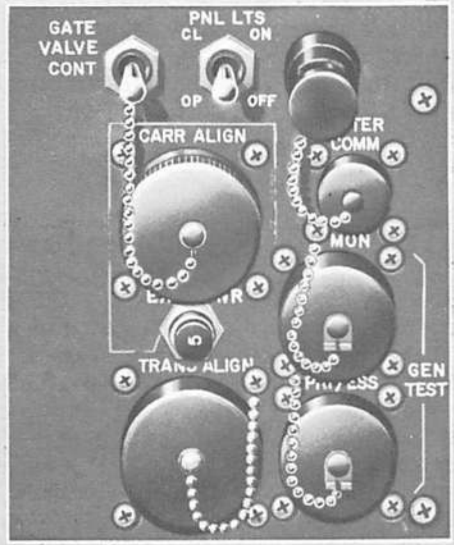
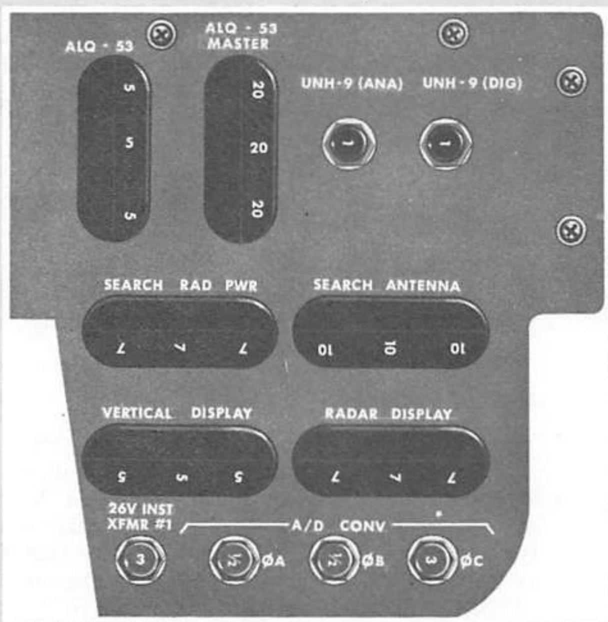


Figure 1-20 (Sheet 1)



3 EXTERNAL POWER RECEPTACLE PANEL



4 NOSE WHEEL WELL COMPARTMENT (AFT)

5 NOSE WHEEL WELL COMPARTMENT (FWD)

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Figure 1-20 (Sheet 2)

Note

If the RAT generator is extended and operating there is no time limit for resetting the generators, repeated attempts may be made.

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic power supply system (figure 1-21) consists of two systems, the flight hydraulic system and the combined hydraulic system. Each system is complete and independent of the other in that it has its own reservoir, pumps, plumbing and pressure gages. There are two hydraulic pumps serving each system. Each of the two aircraft engines drives one flight system pump and one combined system pump. In the event of a single engine failure, both systems will continue to operate.

WARNING

Either hydraulic system alone can power the flight controls throughout the flight envelope. However with flight hydraulic system failure above 0.9 IMN below 20,000 feet, extended speed brakes will result in Stabilizer Actuator Load Saturation. (See Section IV.)

CAUTION

- Failure of a single pump will possibly be followed by failure of the other pump in the same system due to contamination.
- Hydraulic pressure gages provide the only indication of pump or system failure, warning lights are not provided.

Normally both hydraulic systems independently power the primary flight controls through tandem actuators. (See Flight Control System in this Section.)

FLIGHT HYDRAULIC SYSTEM

The flight hydraulic system powers one side of the stabilizer, rudder, and flaperon tandem actuators and the AFCS actuators exclusively.

Combined Hydraulic System

The combined hydraulic system is divided into two subsystems by an isolation valve. The two systems are primary and secondary. The primary system which includes the reservoir, pumps and gages, powers one side of the stabilizer, rudder and flaperon tandem actuators and the speed brakes assist spin recovery and ram air turbine exclusively. The secondary system powers systems, that are not normally used during flight in the cruise configuration. See figure 1-21. After take-off when the cruise configuration has been established, the pilot by means of a toggle switch, closes the isolation valve. The closed valve stops the hydraulic power supply to the secondary system. In the event of a flight hydraulic system failure, the isolation valve will close automatically. The isolation valve is opened when extending the landing gear provided flight hydraulic system pressure is available. For systems normally powered by the combined secondary system and alternate power available for their operation, see Section V, Hydraulic System Failure Table.

Isolation Switch

The isolation switch on the landing gear control panel (figure 1-23) placarded ISOLATION is a two position toggle switch with positions FLT and LDG. The FLT position connects primary 28V DC electric power to energize and close a normally open solenoid valve. The closed solenoid valve shuts off flight hydraulic pressure to the isolation valve which closes through spring action. The closed isolation valve shuts off the combined hydraulic system pressure supply to the secondary system. The LDG position deenergizes and opens the solenoid valve permitting flight hydraulic system pressure (if available) to open the isolation valve. A bar on the landing gear handle prevents positioning the switch to FLT when the landing gear handle is in the DN position. If the switch is in the FLT position when the landing gear handle is positioned to DN, the bar will position the switch to LDG.

Note

- After take-off when the landing gear, flaps and slats are retracted, the isolation switch should be positioned to FLT.
- A flight hydraulic system failure will close the isolation valve regardless of the isolation switch position.
- If 28V DC primary bus power is not available the isolation valve will be open if flight hydraulic pressure is available regardless of switch position.

Hydraulic Pressure Gages

Four hydraulic pressure gages are incorporated in a single unit located on the pilots instrument panel (figure 1-2) and are powered by the primary 26V AC bus. The upper two gages, side by side and identified as FLT are for two engine driven pumps for the flight hydraulic system. The lower two gages, side by side, and identified as COMB are for the two engine driven pumps for the combined hydraulic system. Each indicator scale is a 120° arc with increment markers 30° apart. Each increment marker represent 1,000 PSI. The 3,000 PSI marker is accentuated. Pressure transmitters sense the hydraulic pressure of each pump and transmit electric signals to position the pointers on the scale of the respective indicators.

Hydraulic Hand Pump

A hydraulic hand pump with a telescoping handle is located on the right side of the pilots seat. The pump is used for ground operation of the canopy when the combined hydarulic system is inoperative, and for charging the auxiliary - emergency/parking brake accumulator. The pump utilizes the combined hydraulic reservoir for fluid supply and will deliver 3,000 PSI pressure. A gage in the cockpit indicates pressure/ volume in auxiliary brake applications. (See Wheel Brake System in this Section.) The pump is also operated from the nose wheel well by ground personnel for operation of the canopy, radome and extensionable equipment platform. See figure 1-21.

FLIGHT CONTROL SYSTEM

The flight control system consists of a pilot operated conventional control stick and rudder pedals. The primary flight control surfaces are: a one piece moveable stabilizer (slab) for pitch control, flaperons (spoilers) for roll control, and a rudder for yaw control. To provide satisfactory maneuvering control through the normal speed regime, increased rudder and stabilizer travel is provided at lower speeds as a function of the pilot selected flap position. A pilot selected assist spin recovery makes full stabilizer and rudder travel available regardless of flap position. The primary flight controls are actuated by tandem hydraulic actuators (two actuator cylinders in tandem with a common actuator shaft). Each cylinder is powered by a hydraulic system completely independent of the other. Normal hydraulic power is provided by the flight control hydraulic system and the combined hydraulic primary system. In the event either system fails, control of the aircraft is maintained by the other. Since the flight controls are fully powered and air loads are not transmitted back through the control linkage, "feel" is simulated by artificial feel devices. The devices consist of bob weights, rate dampeners and bungees and require no Mach or Q compensation. The bungees in effect spring load the controls to a "no load position". Trim is accomplished by pilot controlled electro-mechanical actuators that adjust the "no load" position of the bungee to the desired trim position. Stability augmentation (an AFCS function) further improves flight control by damping oscillations about the pitch, roll and yaw axes. Actuators for the Automatic Flight Control System are incorporated in each of the primary flight control systems. Semi-Fowler trailing edge wing flaps and leading edge flaps are hydraulically powered and electrically controlled. A three position flap selector lever conveniently positions both the flaps and the slats to up, or the optimum position for takeoff or landing. The flap position governs the stabilizer and rudder travel limits. Direct drive electric motors are incorporated for emergency operation of the flaps and slats. Fuselage mounted speed brakes are provided to produce drag and engine thrust deflection as desired by the pilot only when the landing gear is retracted. The speed brakes are hydraulically powered and electrically controlled. Flaperon pop-up is a secondary feature of the flaperons. When armed by the pilot prior to landing, both flaperons will extend on landing when the weight of the aircraft is on the right wheel and the throttle levers set at IDLE. The extended flaperons produce drag and spoil lift, reducing ground roll.

CONTROL STICK

The control stick is the pilot's manual control for pitch and roll. Moving the control stick aft moves the stabilizer leading edge down, resulting in an increase in nose up attitude. Conversely, moving the control stick forward moves the stabilizer leading edge up, resulting in an increase in nose down attitude. Moving the control stick left of neutral raises the left flaperon, resulting in lowering the left wing. Conversely, moving the control stick right of neutral raises the right flaperon, resulting in lowering the right wing. The control stick grip (figure 1-22) accommodates a conveniently located attack commit trigger, a five position pitch/roll switch, a weapon release button, a nose wheel steering button and the uncage boresight button. Movement between the stick grip and the stick permits integral switches to sense pilot input on the stick grip and automatically interrupt or disengage the pilot relief mode of the AFCS. The AFCS emergency disconnect button is located immediately below and forward of the stick grip.

RUDDER PEDALS

Conventional rudder pedals are used for yaw control by controlling the rudder and for taxiing by controlling nose wheel steering. The pedals accommodate the toe operated wheel brake hydraulic power control valves. (Refer to Wheel Brakes and Nose Wheel Steering in this section.) A foldaway foot rest is provided below and aft of each pedal.

Rudder Pedal Adjustment Lever

The rudder pedal adjustment lever on the bottom of the main instrument panel (figure 1-2) is placarded RUD PDL ADJ LIFT. Lifting the lever permits both rudder pedals to move full aft through spring action. Pushing the pedals forward while holding the adjustment lever up permits the pilot to adjust for the desired leg reach. The adjustment range is 9 inches in one inch increments. Releasing the adjustment lever while the pedals are held at the desired position locks the adjustment. The pedals are mechanically linked to prevent uneven adjustment.

STABILITY AUGMENTATION

Stability augmentation is the manual mode of the AFCS (Automatic Flight Control System) in that the pilot controls the aircraft by operating the flight controls. This mode improves control of the aircraft by damping oscillations about the pitch, roll and yaw axes. Rate gyros detect oscillations and generate signals which control hydraulic actuators that are in series with the pilot operated control linkage. The series actuators position the control valves of the flight control tandem actuators which provide control surface response without corresponding movement of the control stick or rudder. When stability augmentation is inoperative the series actuators act as fixed links in the control linkage. (Refer to Automatic Flight Control System in this section for complete description.)

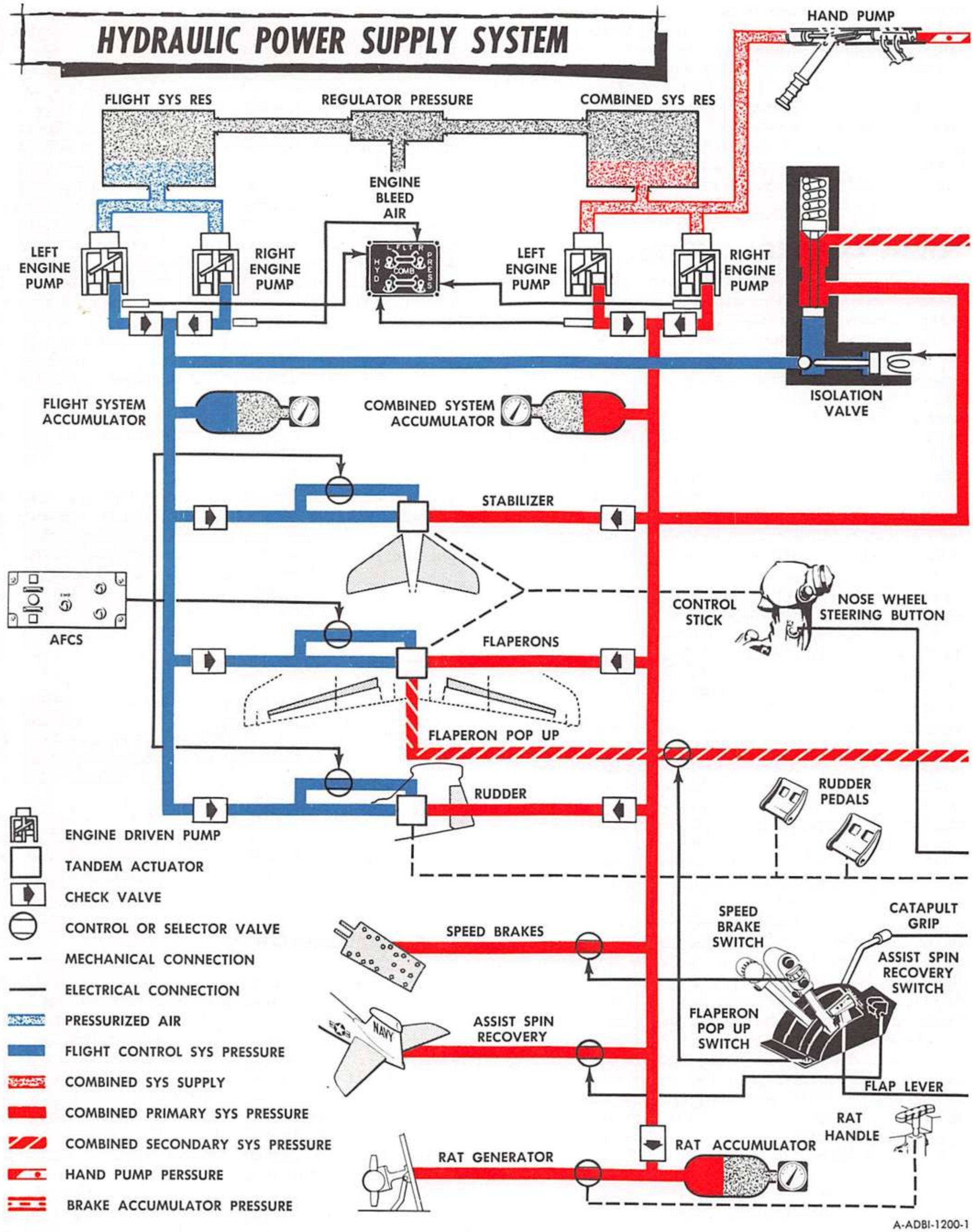


Figure 1-21 (Sheet 1)

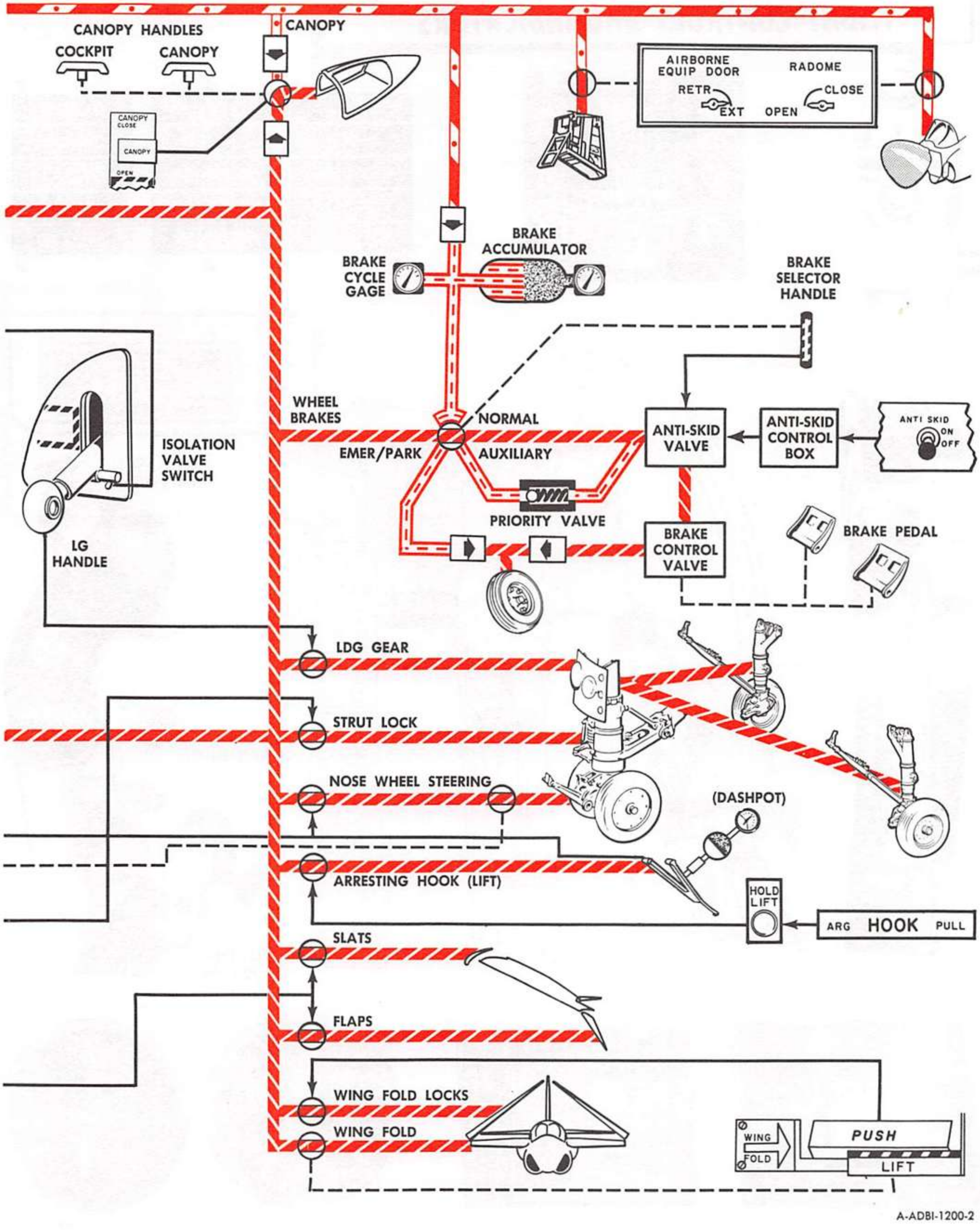


Figure 1-21 (Sheet 2)

FLIGHT CONTROLS AND INDICATORS

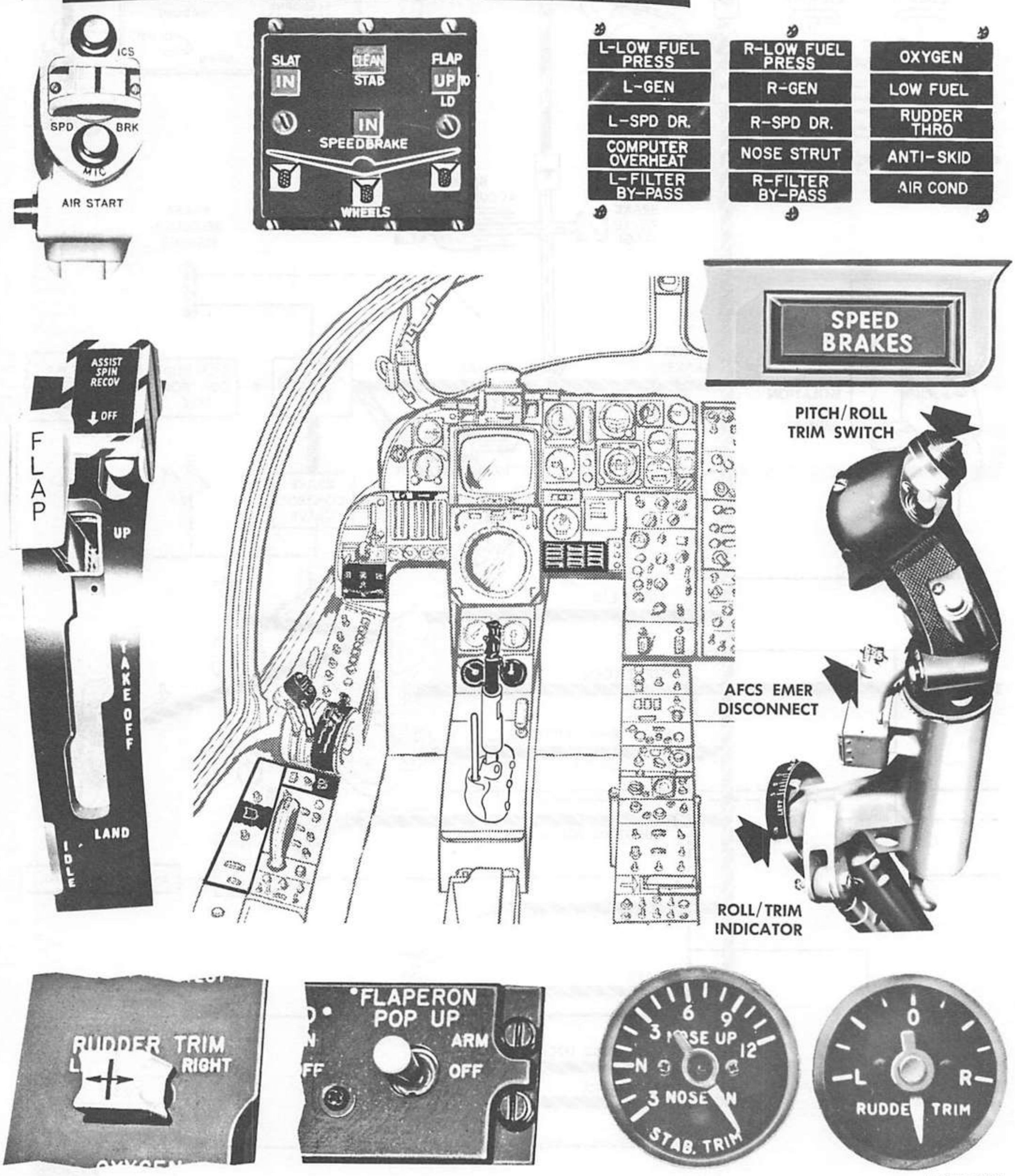


Figure 1-22

PITCH CONTROL SYSTEM

Pitch control is provided by a one piece stabilizer (slab). Fore and aft movement of the control stick transmitted by mechanical linkage operates the control valve of a tandem hydraulic actuator which moves the stabilizer. A follow-up linkage closes the control valve when the desired movement of the control surface has been obtained. Since the stabilizer is moved by hydraulic pressure and air loads are not transmitted back through the control linkage, feel is simulated by "artificial feel" devices. MANEUVERING FORCE is provided by a g-sensing bob weight at the base of the control stick, and in the control linkage. DYNAMIC PITCH DAMPING is provided by pitch acceleration bob weights located fore and aft of the center of gravity. STICK RATE DAMPING is provided by a leaf spring and eddy current damper. The eddy current damper is a magnetic mechanical device that produces resistance proportional to control stick velocity, therefore, the faster the stick is moved, the greater the force required to move it. In the event of failure, the damper can be over-ridden. STATIC FORCE FEEL is provided by a double acting bungee which in effect spring loads the control stick to a no load position. To move the control stick from the no load position a reasonably high break-out force is required. As the stick is moved towards full deflection the force required increases. This device is also used for pitch trim. An electro-mechanical actuator, in response to the pilot operated pitch trim switch (or signals from the AFCS), repositions the feel device to a new no-load position. To provide satisfactory pitch control through the normal speed regime both the stabilizer travel and trim limits are changed automatically as a function of the pilot selected flap position as follows:

Flap Position	Stabilizer Travel Limits	Stabilizer Trim Limits
Takeoff or Landing	1-1/2° LE up to 24° LE down	1/2° LE up to 22° LE down
UP	1-1/2° LE up to 9-1/2° LE down	3/4° LE up to 9-1/2° LE down

Stabilizer travel ratio is changed by a cable drive from the flap gear box. Available stabilizer travel and present trim setting are presented to the pilot by indicators in the cockpit. A pilot operated assist spin recovery switch will make full stabilizer travel limits and associated trim limits available at any speed regardless of flap position.

WARNING

- The assist spin recovery system should only be selected for spin recovery. Selecting assist spin recovery will cause the stabilizer to shift resulting in a pitch-up. At high speed this would result in excessive G-loads and at low speed, a possible stall.
- At high speed full stabilizer travel could result in structural failure.

Pitch/Roll Trim Switch

The pitch/roll trim switch on the stick grip (figure 1-22) is a five position switch spring loaded to the off (center) position. The up and down positions control pitch trim and the left and right positions control roll trim. The up and down switch positions control and electro-mechanical actuator that repositions the stabilizer feel device (bungee) to a new no load position. When the stabilizer has full travel available (flaps in the takeoff or landing position) the trim limits are 1/2° leading edge up to 22° leading edge down. When the stabilizer travel is restricted (flaps in the up position) the trim limits are 3/4° leading edge up to 9.5° leading edge down. Pitch trim is presented on an indicator on the pilot's lower center instrument panel immediately forward of the control stick (figure 1-2). The stabilizer trim actuator is powered by the essential 115V AC bus through the LAT/LONG TRIM circuit breaker on the left circuit breaker panel. (See Roll Control System in this Section for roll trim.)

Stabilizer Trim Indicator

The stabilizer trim indicator on the main instrument panel (figure 1-22) indicates the trimmed position of the stabilizer. The scale is calibrated in units from 3 units NOSE DOWN to 12 units NOSE UP. The indicator is powered by the primary 28V DC bus through the TURN/SLIP circuit breaker on the right circuit breaker panel.

Stabilizer Position Indicator

The stabilizer position indicator on the integrated position indicator on the main instrument panel (figure 1-22) indicates available stabilizer travel by presenting a symbol of a stabilizer for full travel, and the word "CLEAN" for restricted travel. The indicator is powered by the essential 28V DC bus through the CAUTION LIGHTS circuit breaker on the right circuit breaker panel.

WARNING

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

ROLL CONTROL SYSTEM

Roll control is provided by flaperons located on each wing immediately forward of the flaps. Each flaperon consists of two segments; one inboard and one outboard of the wing fold. Movement of the control stick left or right of neutral raises the flaperon (spoiler) on the side to which the stick has been moved while the opposite flaperon remains retracted (flush with the wing). Maximum flaperon deflection is 51°. When the control stick is moved left or right of neutral mechanical linkage operates the hydraulic control valve on the appropriate tandem actuator. A separate tandem actuator is provided for each flaperon. A follow-up device closes the control valve when the desired movement of the control surface has been obtained. Since the flaperons are moved by hydraulic power and air loads are not transmitted back through the control linkage, feel is simulated by "artificial feel devices". LATERAL RATE DAMPING is provided by an eddy current damper. The eddy current damper is a magnetic-mechanical device that produces resistance proportional to control stick velocity. Therefore, the faster the stick is moved, the greater the force required to move it. In the event of failure, the damper can be over-ridden. STATIC FORCE FEEL is provided by a double acting bungee which in effect spring loads the control stick to neutral. To move the control stick left or right of neutral a reasonably high break-out force is required. As the stick is moved toward full deflection, the force required increases. This device is also utilized for roll trim. An electro-mechanical actuator, in response to the pilot operated roll trim switch repositions the feel device to a new no-load position. A roll trim indicator, on the forward side of the control stick grip adapter, indicates roll trim (left or right). A secondary function of the flaperon is the pop-up feature which decreases landing roll.

Pitch/Roll Trim Switch

The pitch/roll trim switch on the stick grip (figure 1-22) is a five-position switch spring loaded to the off (center) position. The up and down positions control pitch trim and the left and right positions control roll trim. The left and right positions control an electro-mechanical actuator that repositions the flaperon feel device to a new no-load position. The trim rate is approximately 0.8° per second. Full trim travel is 9° up. The flaperon trim actuator is powered by the essential 115V AC bus through the LAT/LONG circuit breaker on the left circuit breaker panel.

Roll Trim Indicator

The roll trim indicator on the forward side of the stick grip adapter (figure 1-22) indicates the trimmed position of the flaperons. The scale is three units left and right of zero (neutral). The indicator is mechanically operated.

Flaperon Pop-Up Switch

The flaperon pop-up switch on the left console (figure 1-22) is a two position toggle switch placarded FLAPERON POP-UP, with positions ARM and OFF. Flaperon pop-up is a secondary feature of the flaperons and is used to decrease ground roll after landing by extending both flaperons. The ARM position arms a circuit that will be completed when the wings are spread, both throttles at IDLE, and the right weight on wheels switch is closed. When the circuit is completed it energizes and opens a solenoid operated hydraulic valve which ports combined hydraulic system secondary pressure to extend a spring loaded single acting hydraulic pop-up cylinder. Extension of the cylinder moves the linkage to the control valve of both flaperon tandem actuators which in turn extends both flaperons approximately 44°. The OFF position of the pop-up switch de-energizes the solenoid control valve relieving the hydraulic pressure in the pop-up cylinder, permitting the spring to retract the cylinder. Upon cylinder retraction the flaperons revert to control by the control stick. The flaperon control system is powered by the 115V AC essential bus through the LAT/LONG TRIM circuit breaker on the left circuit breaker panel.

Note

When flaperons are popped-up, lateral movement of the control stick is very limited.

RUDDER CONTROL SYSTEM

Rudder control is provided in response to movement of the rudder pedals. Movement of the rudder pedals, transmitted by mechanical linkage, operates the hydraulic control valve of the rudder tandem actuator which in turn moves the rudder. A follow-up linkage closes the control valve when the desired movement of the control surface has been obtained. Since the rudder is moved by hydraulic power and air loads are not transmitted back through the control linkage, feel is simulated by an artificial feel device. FORCE FEEL is provided by a double acting bungee which in effect spring loads the rudder pedals to the existing trim position. As the rudder pedals are moved from neutral a reasonable high break-out force is required. This device is also utilized for rudder trim. An electro-mechanical actuator, in response to the pilot operative rudder trim switch, repositions the feel device to a new no-load position. To provide satisfactory rudder control through the normal speed regime, the rudder travel limit is changed as a function of the pilot selected flap position. Normally, with the flaps full down, the rudder travel is 35° left and right. As flaps are retracted to 5°, rudder travel is limited, by a cam stop in proportion to flap position, from 35° to 4°. As the flaps are further retracted, available rudder travel remains 4°. Upon flap extension the available rudder travel schedule is reversed. Rudder travel stop cams are part of the rudder actuator, and are positioned by a cable driven by the flap gear box. In the event of cable failure a spring positions the rudder stop cams to make full rudder travel available at any speed regardless of flap position. The pilot operated spin recovery switch will also make full rudder travel available at any speed regardless of flap position.

WARNING

- Restricted rudder travel in flight at low speed will reduce rudder effectiveness and full travel at high speed could cause structural failure.
- Restricted rudder travel on the ground will limit nose wheel steering.

Rudder Trim Switch

The rudder trim switch on the left console (figure 1-22) is a three position toggle switch placarded RUDDER TRIM with positions LEFT, RIGHT and a spring loaded neutral. The switch contains an electro-mechanical actuator that repositions the rudder feel device (bungee) to a new no-load position. The rudder trim limits are not affected by change or rudder stop position. The rudder trim actuator is powered by the essential 115V AC bus through the RUD TRIM circuit breaker on the left console circuit breaker panel.

Rudder Trim Indicator

The rudder trim indicator, on the pilot's lower center instrument panel (figure 1-22), indicates the trimmed position of the rudder. The scale is calibrated in 4 units left and right of neutral. The indicator is powered by the primary 28V DC bus through the TURN/SLIP circuit breaker on the right circuit breaker panel.

Rudder Throw Caution Light

The rudder throw caution light on the annunciator panel (figure 1-22) displays RUDDER THRO. Illumination of the light indicates that more than 4° of rudder travel is available in the clean configuration (flaps up and right landing gear up and locked). The light is powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel.

WARNING

Use of excessive rudder travel at high speed May cause structural failure.

ASSIST SPIN RECOVERY SYSTEM

The assist spin recovery system enables the pilot to manually select full stabilizer and rudder travel limits regardless of flap position or airspeed.

Assist Spin Recovery Switch

The assist spin recovery switch on the left console (figure 1-22) is a two position guarded toggle switch with the guard placarded ASSIST SPIN RECOVERY and OFF, with an arrow pointing aft. The guard must be lifted before the switch can be moved forward. The ASSIST SPIN RECOVERY position directs essential 28V DC if available, or standby battery power to energize the spin recovery solenoid valve which ports combined hydraulic system pressure to extend the assist spin recovery actuator. Extension of the actuator shifts the stabilizer control linkage, and retracts the rudder stop cam making full stabilizer and rudder travel available regardless of speed or flap position. The OFF position, powered by the essential 28V DC bus through the GEAR/HOOK circuit breaker on the main circuit breaker panel, energizes the spin recovery solenoid valve which ports combined hydraulic system pressure to retract the assist spin recovery actuator. The stabilizer and rudder travel limits then return to the limits established by the flap position.

WARNING

- The assist spin recovery system should only be selected for spin recovery.
- Selecting assist spin recovery when not in a spin will cause the stabilizer to shift resulting in a pitch-up. At high speed this could result in excessive G-loads, and at low speed a possible stall. At high speed, unrestricted stabilizer and rudder travel could result in structural failure.

FLAP AND SLAT SYSTEM

The flaps and slats provide additional lift for takeoff and landing. In the UP (retracted) position the flaps form the trailing edge of the wings and the slats form the leading edge. Each flap and slat consists of two segments, one inboard and one outboard of the wing fold. The flap and slat actuating mechanisms are similar to, but independent of each other. However, they are both normally controlled by the flap selector lever and therefore operate in conjunction with each other. The flap selector lever actuates switches that electrically control separate hydraulic motors for the flaps and slats. Each of these hydraulic motors, through a gear box arrangement, drive a torque tube linkage. Flap torque tube linkage drives 8 screw jacks, 2 for each of the 4 flap segments. Slat torque tube linkage drives 6 screw jacks, 2 for each outboard slat segment and 1 for each inboard segment. Each of the hydraulic motors is controlled by a solenoid valve. Limit switches index both the flaps and the slats to the selected position by operating the respective hydraulic selector valve and hydraulic brake solenoid valve. The flap gearbox also actuates a cable that operates the stabilizer shifter and rudder stop mechanism. In the event combined hydraulic system secondary pressure is not available, individual electric motors will drive the torque tubes through the gear box. The electric motors are controlled by a pilot operated emergency flap switch.

Flap Position Indicator

The flap position indicator on the integrated position indicator (figure 1-22) is powered by the essential 28V DC bus through the CAUTION LIGHTS circuit breaker on the pilot's right circuit breaker panel. When the flaps are retracted the word "UP" appears. When extended to the take-off position a flap symbol pointing to the letters "T. O. " appears. When extended to the landing position a flap symbol pointing to the letters "L. D. " appears. During flap operation or if electric power is not available a barber pole appears.

Slat Position Indicator

The slat position indicator on the integrated position indicator (figure 1-22) is powered by the essential 28V DC bus through the CAUTION LIGHTS circuit breaker on the pilot's right circuit breaker panel. When the slats are fully retracted the work "CLEAN" appears.

When extended to the take-off and landing position a slat symbol appears. During slat operation, or if electric power is not available, a barber pole appears.

Flap Selector Lever

The flap selector lever on the throttle quadrant (figure 1-22) has a flap shaped handle displaying FLAP. The lever has three placarded positions, UP, TAKE-OFF and LAND. The selection of these positions controls the position of both the flaps and slats as follows:

Flap Selector Position	Flaps	Slats
UP	0°	0°
TAKEOFF	30°	27-1/2°
LAND	40°	27-1/2°

The flap position selector actuates switches that control the flap and slat hydraulic motors and hydraulic brake valves. Electric control power is provided by the essential 28V DC bus through the FLAPS/SLATS circuit breaker on the right circuit breaker panel. Hydraulic power is provided by the combined secondary system.

Note

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

Emergency Flap Switch

The emergency flap switch on the throttle quadrant (figure 1-22) is a three position, square shaped, toggle switch with position placarded UP, OFF and DN. The switch is provided primarily for flap and slat operation when combined hydraulic system secondary pressure is not available. The switch controls reversible electric motors on the gear boxes of both the flap and slat drive mechanisms. Electric power is provided by the primary 115V AC bus through the EMER FLAP gang circuit breaker for the flaps and through the EMERG SLATS gang circuit breaker for the slats. These circuit breakers are on the crewmember's right rear circuit breaker panel.

WARNING

Do not make emergency extension of flaps above 160 KIAS as the clutch will be damaged and the flaps will become inoperative.

CAUTION

- Allow 3 minute rest between emergency flap switch actuations. If necessary to cycle emergency flapswitch repeatedly, limit use to 5 cycles. One cycle is defined as 45 seconds extension, 3 minutes rest, 45 seconds retraction, 3 minutes rest. Abuse of motors will result in failure of the emergency actuators.
- The emergency flap switch should be returned to the OFF position when the desired flap/slat setting is obtained.
- Do not use the emergency flap switch for normal operation. The flap and slat motors will have service life and reliability reduced by continuous use.
- Do not use the emergency flap switch when wings are folded as slats will be damaged.

SPEED BRAKE SYSTEM

Speed brakes are located on each side of the fuselage immediately aft of the engine tailpipes. When closed they are flush and in contour with the fuselage. When extended, in addition to increasing drag they act as thrust spoilers. The speed brakes are hydraulically powered by the combined hydraulic system and electrically controlled by the essential 28V DC bus.

A pilot operated switch on the right throttle grip controls speed brake positioning provided all three landing gears are up and locked. When one or more landing gears are not up and locked the speed brakes will remain closed, or if open will close regardless of the switch position, provided hydraulic and electric power are available. Speed brake position is presented to the pilot by the integrated position indicator in the cockpit.

SPEED BRAKE SWITCH

The speed brake switch, on the right throttle grip (figure 1-22) placarded SPD BRK, is a three position slide type switch. The forward position is IN, the center position is HOLD, and the aft position (a momentary spring loaded position) is EXTEND. When all three landing gears are up and locked, the switch controls speed brake position as follows: When the switch is in the aft position the speed brakes will extend. When the switch is released it will move to the HOLD position and the speed brakes will remain extended. When the switch is positioned to the forward position the speed brakes will close. Partial speed brake extension is obtained by selecting the center position of the switch while the speed brakes are intransient. When the landing gear is extended, or if the up-lock for any of the three landing gears releases, the speed brakes will retract regardless of switch position. The speed brakes are powered by the combined primary hydraulic system and controlled electrically by the essential 28V DC bus.

WARNING

- Fully extended speed brakes will deteriorate performance to the extent that MILITARY POWER may not be sufficient to maintain level flight.
- For single engine operation it is imperative that speed brakes be retracted.

Note

- When the speed brakes are extended, and the switch in the center position, the speed brakes may creep towards the closed position.
- Do not use the center position to "hold" the speed brakes when they are closed.

Speed Brake Position Indicator

The speed brake position indicator, part of the integrated position indicator on the main instrument panel (figure 1-22), indicates speed brake position. Retracted speed brakes are indicated by the word IN. Fully extended speed brakes are indicated by black dots on a white background. Speed brakes in-transient (or loss of power to the indicator) is indicated by a barber pole. The indicator is powered by the primary 28V DC bus through the CAUTION LTS circuit breaker on the right circuit breaker panel.

Speed Brake Caution Light

The speed brake caution light on the main instrument panel (figure 1-22) immediately above the engine indicators, displays BRAKES and is powered by the primary DC bus. Illumination of the light indicates that the speed brakes are not fully closed. The light is operated by a switch actuated by the upper hinge of the right speed brake.

LANDING GEAR SYSTEM

The retractable tricycle landing gear consists of three air-oil struts with wheels. The nose gear (with dual wheels) retracts aft and upward into a nose wheel well. The main gears retract forward and upward and the lower struts rotate approximately 90° to fit the wheels into wells in the wing root area. In the retracted position, fairing doors enclose the gears in the wheel wells. Normal landing gear operation is hydraulically powered by the combined hydraulic secondary system and controlled electrically by the essential 28V DC

LANDING GEAR CONTROLS AND INDICATORS

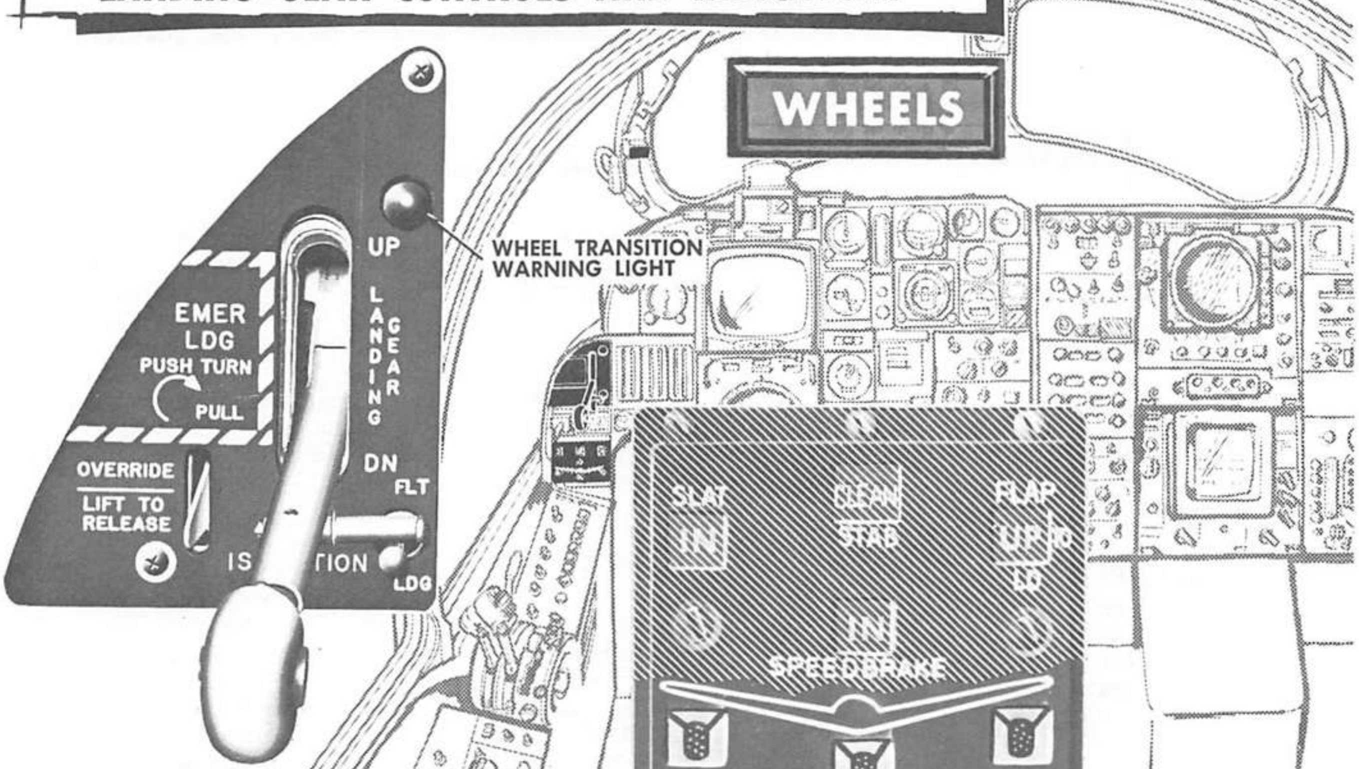


Figure 1-23

bus through a landing gear (position selector) handle. Inadvertent retraction of the landing gear on the ground is prevented by a landing gear downlock. The downlock releases when airborne, or may be overridden at any time by an override lever. Landing gear position and warning indicators are provided. An emergency landing gear extension system mechanically controlled and pneumatically power is provided.

LANDING GEAR HANDLE

The landing gear handle (figure 1-23) on the left side of the pilot's instrument panel has a wheel shaped white knob and is spring loaded past neutral to both the placarded UP and DN position. The handle controls normal retraction and extension as well as emergency extension of the landing gear. For normal operation the UP and DN position actuates switches that electrically control the landing gear hydraulic selector valve. Electric power is provided by the essential 28V DC bus through the GEAR/HOOK circuit breaker on the right circuit breaker panel. In the normal DN position a bar on the handle positions the isolation valve switch to the LDG (landing) position if it was inadvertently left in the FLT (flight) position. (See isolation valve switch under HYDRAULIC SYSTEM in this Section.) For emergency operation the landing gear handle is pushed in, rotated clockwise, then pulled. Pulling the handle pulls a cable that opens a pneumatic valve that initiates operation of the emergency landing gear extension system. To prevent retraction of the landing gear on the ground, a landing gear handle lock prevents moving the handle from the DN position. When the aircraft is airborne, a switch on the left main gear nutcracker completes a circuit which energizes a solenoid that disengages the lock. An override lever is also provided to mechanically release the lock.

CAUTION

> Above 8,000 feet, dump cabin pressurization before lowering the landing gear. Automatic pressurization begins at this altitude, and the possibility of jamming the nose gear door exists when the gear is extended with the aircraft pressurized.

Landing Gear Handle Downlock Override Lever

The landing gear handle downlock override lever, on the left side of the landing gear handle (figure 1-23), is placarded OVERRIDE and LIFT TO RELEASE, and is spring loaded to the down (normal) position. Lifting and holding the lever up, disengages the landing gear handle downlock and permits the handle to be moved to the UP position, regardless of weight on wheels or electrical circuit failure.

Note

> If upward pressure is applied to the landing gear before the override lever is lifted it will bind the override lever.

LANDING GEAR INDICATING AND WARNING SYSTEM

Landing Gear Position Indicators

The individual landing gear position indicators are provided on the integrated position indicator panel (figure 1-23). A symbol of an aircraft above the indicators readily identifies each gear. Each indicator displays a wheel symbol, barber pole (diagonal stripes), or the word "UP" which indicates the position of the gear as follows:

Wheel Symbol - Indicates the landing gear handle is in the DN position and the respective gear is down and locked.

UP - Indicates the landing gear handle is in the UP position, the respective gear is up and locked, and in the case of the main gears, the forward door is closed.

Barber Pole - Indicates the respective gear is not locked in a position compatible with the position of the landing gear handle, or that electrical power is not available. This indication is normal during landing gear transition.

Tow Link - The word "TOW LINK" appearing in the nose wheel position indicator window when the aircraft is airborne indicates the tow link is "not up and locked", or the nose wheel is cocked more than 30°.

The integrated position indicator is powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the right circuit breaker panel.

Wheels Transition Warning Light

The wheels transition warning light on the landing gear selector panel, not identified by placarded (figure 1-23), is a round red light powered by the 28V DC primary bus. Illumination of the light indicates that one or more of the gears are not locked in a position compatible with the position of the landing gear handle. This indication is normal during landing gear transition. If the light remains illuminated after retraction or extension of the gear it indicates one or more gears are unsafe.

Wheels Warning Light

The wheels warning light, located between the forward and left side windshields (figure 1-23), is a flashing red light that displays WHEELS and is powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the right circuit breaker panel. The light will flash whenever the flaps are down, either or both throttles are retarded to below approximately 85% RPM (throttle lever less than 24-1/2° above IDLE) and all three landing gears are not down and locked.

Note

If the landing configuration (flaps down and either or both throttles below approximately 85% RPM), if one or more landing gears are not down and locked, the WHEELS warning light will flash. If the landing gear handle is in the DN position, the wheel transition warning light will remain illuminated and the integrated position indicator will display a "barber pole" for the unsafe gear or gears and the approach light indexer will not illuminate.

LANDING GEAR EMERGENCY EXTENSION SYSTEM

A landing gear emergency extension system is provided for use in event the landing gear cannot be extended normally. Pneumatic pressure stored in four bottles provides sufficient pressure to extend all three landing gears. A single gage in the nose wheel well indicates the pressure in all four bottles. When the landing gear handle is pushed in, rotated clockwise, then pulled, a cable opens a valve on one of the pneumatic bottles. Pressure released from this bottle opens the valves on the other three bottles. Each of the bottles, connected to various components of the landing gear hydraulic system, open the landing gear doors and release the landing gear uplocks. The nose wheel is extended by pneumatic pressure and gravity. The main gears are extended by gravity alone. Dump valves actuated by pnuematic pressure vent the return side of all hydraulic actuators to the extend side preventing hydraulic lock opposing extension. When the landing gears are down the spring loaded down lock cylinders engage the down locks. If the landing gear handle is in the DN position and essential 28V DC power available, the landing gear indicating system will operate normally.

Note

When a landing gear emergency extension has been made, the landing gear cannot be retracted again until the dump valves have been reset on the ground.

NOSE WHEEL STEERING SYSTEM

Directional control of the aircraft on the ground is possible through nose wheel steering or conventional differential braking action. Shimmy damping is available in either mode of operation through the use of restrictors in the steering mechanisms. The nose wheel steering will power the lower strut barrel up to approximately 45° and return to center. To permit tighter turns with differential braking, the lower strut will disengage a spring loaded lock pin (tog-lock) at approximately 50° of lower strut rotation. The lower strut is now free to swivel and will remain so until the tog-lock is realigned and reengages the upper strut detent.

Nose wheel steering is engaged when the steering button on the control stick grip is depressed and the weight-on-wheels switch on the main landing gear is closed. Steering is also engaged automatically when the arresting hook is extended and the weight-on-wheels switch is closed. When selected, steer unit rotation is proportional to rudder pedal deflection, full pedal being required to obtain full 45° steering. Since full rudder pedal travel is obtained only with flaps extended, some rudder pedal restrictions may be experienced with flaps up (steering limits are unaffected),

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

When the tog-lock has been disengaged by turning past 50°, the steering switch will have no effect as long as the lower strut is free-swiveling. The reengaging jolt will again be mild or severe when the tog-lock reengages the detent depending on the relative position of the lower strut and the upper steering unit. Braking will sometimes be necessary to center the lower strut sufficiently to reengage the tog-lock. If the lock wheel steering is deflected when the main wheels leave the ground, accentering spring will center the nose wheel providing the tog-lock is engaged.

CAUTION

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

Nose Wheel Steering Button

The spring loaded nose wheel steering button on the pilot's control stick grip (figure 1-22), is used to engage normal nose wheel steering. When the nose wheel selector circuit is energized, the nose wheel steering selector valve is positioned to direct combined hydraulic system pressure to the steering control valve.

NOSE-TOW CATAPULT SYSTEM

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

In order to stow the tow link within the nose wheel well after landing gear retraction, a second tow link retraction stage is needed to raise the tow link to the full up position. This is done by mechanical linkage from the nose gear drag brace to the tow link. When the gear is extended, the linkage is moved out of the way and the two link drops to its intermediate position.

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

CATAPULT GRIP

The nose strut oleo is locked during catapult launches to ensure deck clearance when carrying large centerline stores and to minimize strut loads. This is accomplished by actuating the CATAPULT GRIP.

The catapult grip is a tubular metal handle located on the pilot's right console forward of the throttle quadrant (figure 1-24). The handle is marked CATAPULT GRIP and is equipped with a tow position switch placarded ON and OFF. This switch is the master control for all exterior lights on the aircraft. The switch is located on the end of the grip to allow the pilot to signal "READY TO LAUNCH" during night operations without releasing the grip.

During catapult operations, and after the shuttle has been engaged and the throttles advanced to TAKE OFF, the catapult grip is rotated 90° to the right and pulled up. The strut lock selector valve, actuated by the catapult grip, opens and directs combined system hydraulic pressure into the upper chamber of the nose gear shock strut. When pressure reaches 200 to 250

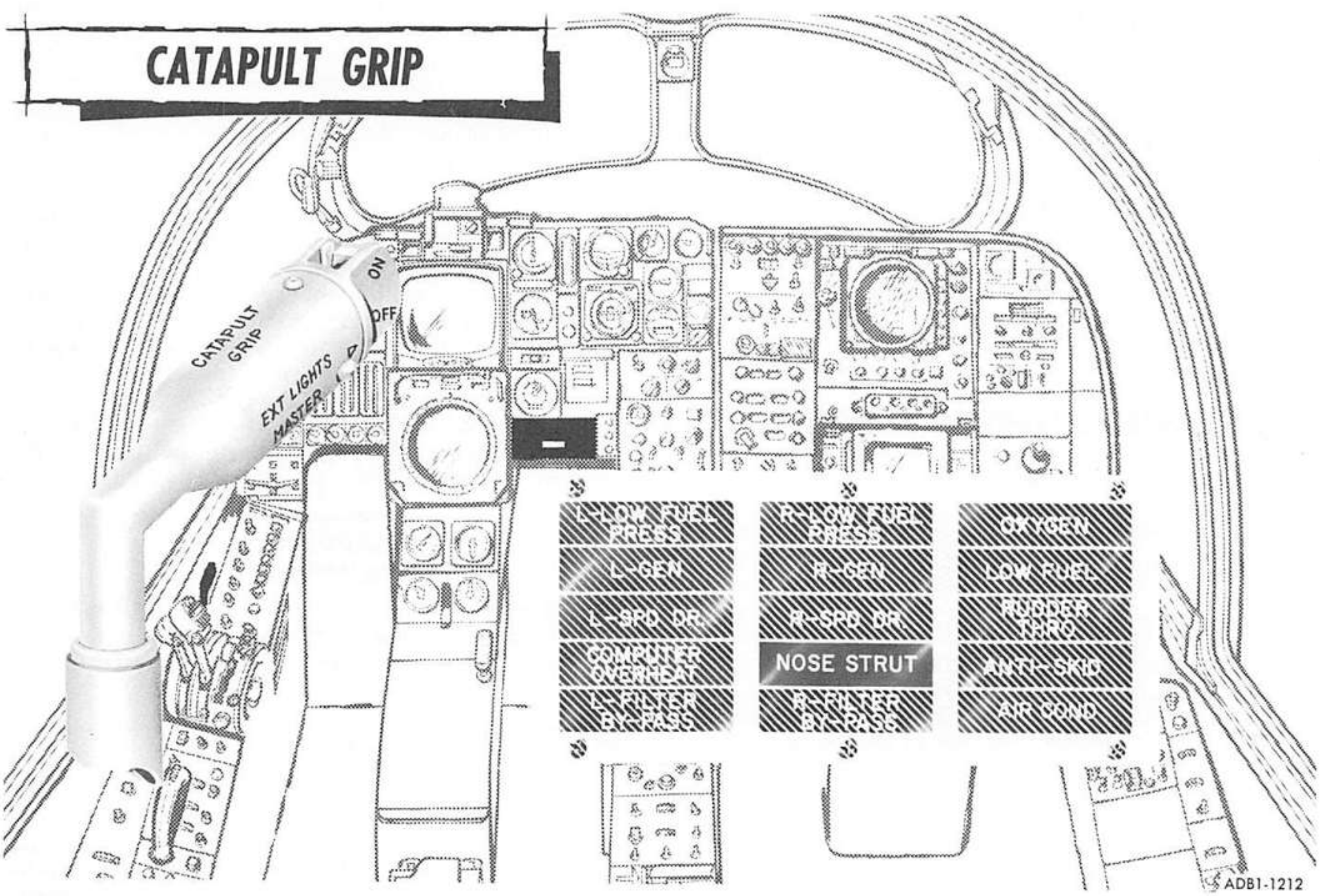


Figure 1-24

PSI the NOSE STRUT caution light on the annunciator panel (figure 1-24) illuminates. After pressure in the upper chamber reaches 2,200 PSI, the NOSE STRUT caution light extinguishes indicating that the nose strut is "HARD" and safe for catapult launch.

CAUTION

- The catapult grip MUST be held in the 90 degree position after the light extinguishes until completion of the launch.
- Illumination of the NOSE STRUT caution light after actuation of the catapult grip DOES NOT indicate a "safe to launch" condition. The proper sequence before signalling "READY FOR LAUNCH" is:
  Actuate catapult grip.
  Observe light illuminates and remains lit.
  Observe light extinguishes.

After launch, when the catapult grip is released, the strut lock selector valve closes the pressure port and vents the strut lock line to return allowing normal strut operation.

CAUTION

After a catapult launch, if the NOSE STRUT caution light remains illuminated with the gear down, or illuminates when the gear is extended prior to landing, it indicates that the nose shock strut has not returned to a "SOFT" condition and landing should be considered a "HARD NOSE STRUT" landing.

WING FOLD SYSTEM

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

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

WING FOLD HANDLE

The wing fold handle (figure 1-4) is mounted flush in the center console. The arm of the handle extends forward and down the right side of the console where it is attached to a pivot point. Actuation of the wing fold handle occurs in steps and is tied in with the wing lockpin switch.

Wing Lockpin Switch

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

WING FOLD

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

CAUTION

- Before folding wings, check flap selector lever-UP, emergency flap switch-OFF and visually check flaps, slats and flaperons for full retraction.
- When wings are folded, do not operate flap selector lever or emergency flap switch.
- When wings are folded, do not tow aircraft unless jury struts are installed.

WING SPREAD

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

CAUTION

After wing are spread, visually check flaps and slats for full retraction.

WHEEL BRAKE SYSTEM

The main wheel brakes are hydraulically powered multiple disk brakes. An artificial feel system is provided to simulate pedal forces. A brake selector handle is provided for pilot selection of normal, auxiliary or emergency/park brake operation. The normal brakes are powered by the combined secondary hydraulic system. The auxiliary and emergency/park brakes are powered by a hydraulic brake accumulator. The accumulator is pressurized by the hand pump system. Accumulator pressure is displayed on a brake cycle gage in number of brake cycles remaining. An anti-skid system is available only with normal brakes.

BRAKE SELECTOR HANDLE

The brake selector handle (figure 1-25) is a T-shaped handle displaying BRAKE that is used to select the mode of brake operation. The handle mechanically positions a three way valve for the brake modes as follows:

Normal Braking

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

Auxiliary Braking

With the brake selector handle in (full forward) and horizontal (rotated 90° clockwise) the brake selector valve ports brake accumulator hydraulic pressure to the brake control valves. The brake control valves actuated by the pilot's feet on the toe brakes meters hydraulic pressure to the wheel brakes. The anti-skid system will be inoperative even if it is switched on. Auxiliary brake applications are limited by the capacity of the accumulator and a priority valve. A fully charged accumulator will provide approximately 15 auxiliary brake applications. The priority valve reserves the last applications exclusively for emergency/park brake application.

Emergency/Park Brakes

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

CAUTION

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

Brake Cycle Gage

The brake cycle gage on the main instrument panel (figure 1-25) is a direct reading pressure gage connected to the brake accumulator. The scale is calibrated in number of brake cycles (applications) remaining. The red area below 4 marked EMER is reserved exclusively by a priority valve for emergency/park brake operation and it not available for auxiliary brake operation.

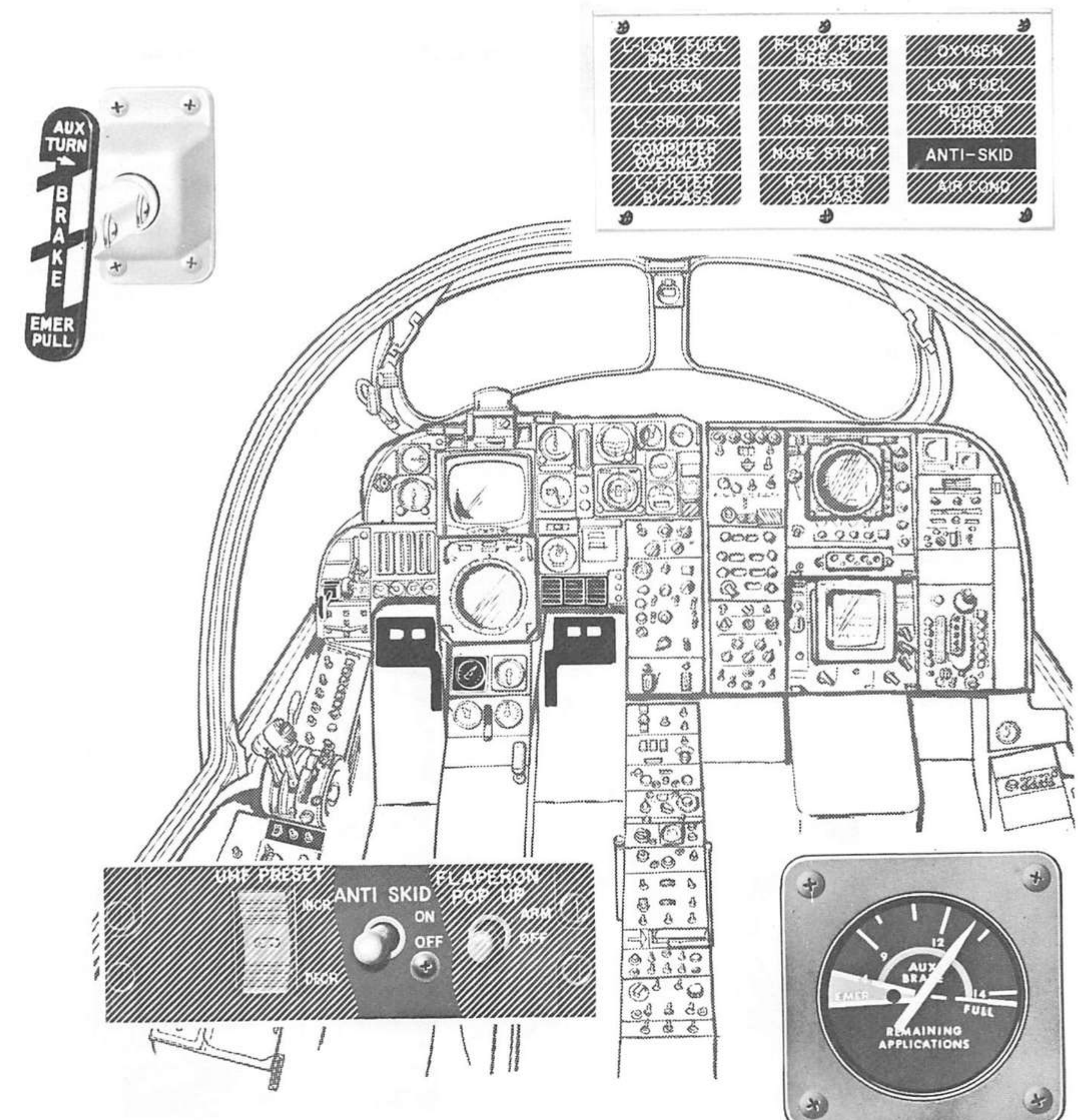
Note

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

ANTI-SKID SYSTEM

The anti-skid system used in conjunction with the normal brake system increases high speed braking efficiency. The system prevents landing with brakes locked and permits application of full brake pedal force before touchdown for obtaining minimum stopping distances. The possibility of tire blow-out is minimized and tire life and wheel balance is prolonged. The system is selected by a pilot operated toggle switch and powered by the primary 28V DC bus. The major components are skid detectors in each wheel axle, and anti-skid control box and an anti-skid control valve between each brake control valve and its respective wheel brake. The skid detectors senses wheel rotation speed and sends proportional signals to the anti-skid control box. An incipient skid is detected as a difference in wheel RPM. Under this condition the anti-skid valve for the slow turing wheel relieves hydraulic pressure permitting the wheel to rotate freely, then the pressure is reapplied over a short time interval (approximately 2 seconds). A locked wheel is detected when one wheel is not turning, and the other is turning above 150 RPM (approximately 13 miles per hour). Under this condition the brake pressure to the locked

WHEEL BRAKE CONTROLS AND INDICATOR



B-ADBI-1026

Figure 1-25

wheel is released, then reapplied at a slightly lower pressure. If a brake release signal exceeds 3.5 seconds the anti-skid system will become inoperative and the anti-skid light in the cockpit will illuminate.

Anti-Skid Switch

The anti-skid switch (figure 1-25) is a two position toggle switch with positions placarded ON and OFF. The ON position provides primary 28V DC power to energize the system provided the brake selector handle is in the NORMAL position. The OFF position de-energizes the system. If the ANTI-SKID light illuminates the system may be energized again by cycling the switch to OFF then ON.

Note

- Anti-skid is available only when normal brakes are selected.
- Anti-skid does not operate below 11 knots.
- Anti-skid is inoperative when the ANTI-SKID light is illuminated.
- Erratic anti-skid brake operation may indicate overheated brakes and impending brake lock.
- Use anti-skid for normal take-off and landings only. For taxiing the anti-skid switch should be OFF.

Anti-Skid Light

The anti-skid light on the annunciator panel (figure 1-25) displays ANTI-SKID and is powered by the essential 28V DC bus through the CAUTION LTS circuit breaker on the pilot's right circuit breaker panel. Illumination of the light indicates the anti-skid system is inoperative as a result of a brake release signal exceeding 3.5 seconds.

ARRESTING HOOK SYSTEM

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

Note

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

ARRESTING HOOK CONTROLS AND INDICATOR

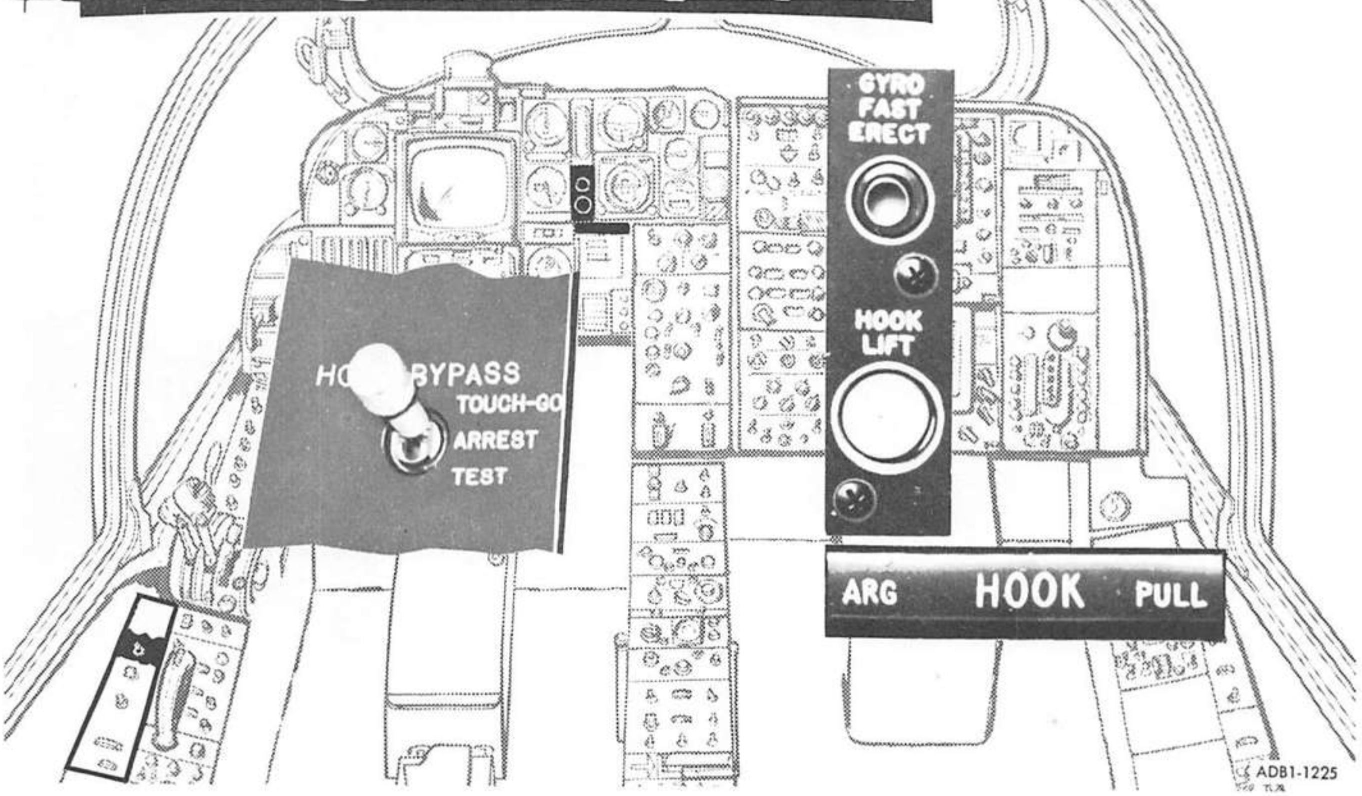


Figure 1-26

HOOK RELEASE HANDLE

The hook release handle on the pilot's instrument panel (figure 1-26) is marked ARG HOOK PULL and is shaped to be grasped by the fingers from the bottom. Pulling the handle aft pulls a cable that releases the hook uplock. (The aft position of the handle also disarms the hook lift switch circuit.) The hook is extended by dashpot pressure assisted by gravity. When the handle is released it is reset by spring action and the hook lift switch is re-armed.

HOOK LIFT BUTTON

The hook lift button on the pilot's instrument panel (figure 1-26) is placarded HOOK LIFT and incorporates an integral hook transition light. Depressing the button momentarily when the hook is extended energizes a solenoid valve that ports secondary hydraulic pressure to the arresting hook lift cylinder which retracts the hook. Electric power is provided by the essential 28V DC bus through the GEAR/HOOK circuit breaker on the pilot's right circuit breaker panel. A holding relay keeps the valve energized until the uplock engages.

WARNING

If the hook extends without the hook release handle being pulled, DO NOT DEPRESS THE HOOK LIFT BUTTON IF AN ARRESTED LANDING IS REQUIRED. If the hook extended as the result of a parted uplock release cable and is then retracted it cannot be extended again.

HOOK TRANSITION LIGHT

The hook transition light is incorporated in the hook lift button (figure 1-26) and powered by the primary 28V DC bus. The light illuminates during hook transition on both extension and retraction.

HOOK BYPASS SWITCH

The HOOK BYPASS switch on the pilot's left console (figure 1-26) is a three position toggle switch with position placarded TOUCH-GO, ARREST and TEST. The TOUCH-GO position used for non-arrested landings bypasses the flashing feature of the approach lights and indexer when the aircraft is in a landing configuration with the hook retracted. The ARREST position, used for arrested landings, arms the flashing feature of the approach lights and indexer for appropriate operation when a landing configuration is established. The TEST position tests the flashing circuit of the approach lights and indexer.

Dashpot Pressure Gage

The dashpot pressure gage on the left side of the aft fuselage is a direct reading gage that presents the pneumatic pressure in the dashpot.. The gage is calibrated in 500 pound increments from 0 to 2000 pounds. The 2000 pound increment is identified by the numeral 2. The normal pre-flight indication should be 1000 PSI with the hook retracted.

FLIGHT INSTRUMENTS

ANGLE OF ATTACK SYSTEM

The angle-of-attack system (figure 1-27) measures the angle between the longitudinal axis of the aircraft and the relative wind. A sensor on the right side of the fuselage forward of the wings consists of a probe that lines up with the airstream, and a potentiometer pick-off that converts the position of the probe to electrical signals. The signals are compared to a rebalance potentiometer and the error signal is used to drive a servo motor in the angle-of-attack instrument. The servo motor drives the instrument pointer and rotates a series of cam-actuated switches that control the visual presentations of angle-of-attack and approach indexer to the pilot and LSO. Sensor heat for icing conditions is controlled by the pitot heat switch in the cockpit.

Angle-Of-Attack Indicator

The angle-of-attack indicator is on the upper left side of the pilot's instrument panel (figure 1-27). The pointer is driven by a servo motor and rotates over a card graduated from 0 to 30 units. Optimum angle-of-attack for landing approach is marked by a light area at the 3 o'clock position on the instrument. The units do not reflect angle-of-attack in degrees. A readout window on the instrument face will indicate OFF if there is no power to the servo motors.

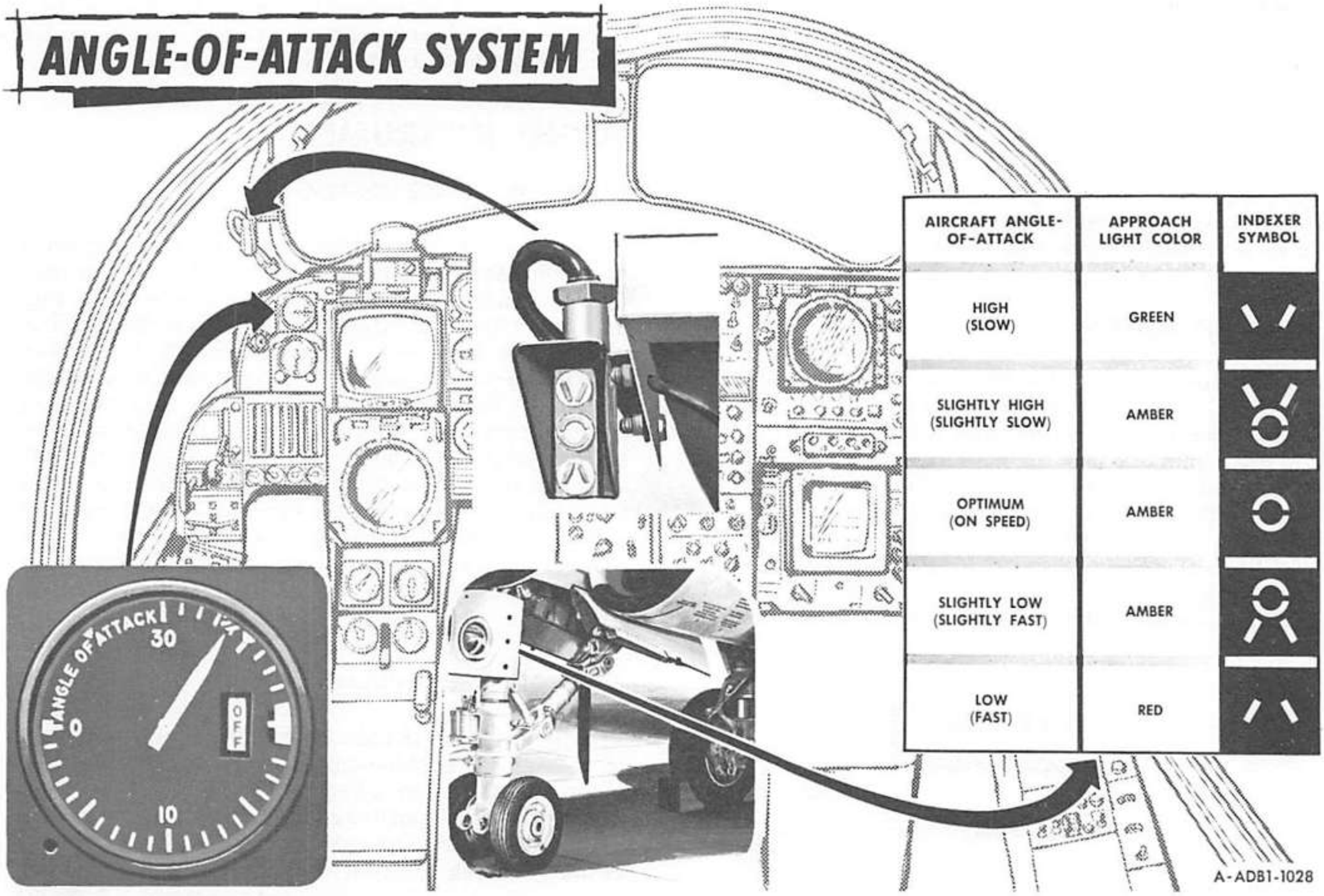
Approach Lights

The approach lights (figure 1-27) are controlled by switches actuated by the angle-of-attack indicator cam, and gives qualitative information on angle-of-attack to the LSO. The lights are on the forward nose wheel door, and are green (high angle-of-attack), amber (optimum angle-of-attack), and red (low angle-of-attack).

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

Approach Indexer

The can-operated switches in the angle-of-attack indicator also control the approach indexer (figure 1-27).. Three lamps glow red through apertures on the face of the indexer giving approach information. The upper arrow is for high angle-of-attack, the lower arrow for low angle-of-attack, and the circle if for optimum angle-of-attack. When both an arrow and circle appear, an intermediate position is indicated. During an arrested landing, with the hook by-pass switch in ARREST, the approach indexer will flash when the arresting hook is not in trail and the gear is extended.



AIRCRAFT ANGLE-OF-ATTACK	APPROACH LIGHT COLOR	INDEXER SYMBOL
HIGH (SLOW)	GREEN	
SLIGHTLY HIGH (SLIGHTLY SLOW)	AMBER	
OPTIMUM (ON SPEED)	AMBER	
SLIGHTLY LOW (SLIGHTLY FAST)	AMBER	
LOW (FAST)	RED	

Figure 1-27

Note

- The approach lights and approach indexer are inoperative until all gear are down and locked.
- To ensure that the approach index lights are operating, depress the lights warning button on the master test panel. Intensity of the approach indexer lights are adjustable using the approach indexer thumbwheel on the master lights panel.

PITOT-STATIC SYSTEM

The pitot-static head is on the leading edge of the left wing tip. Pitot pressure is impact air pressure developed as the result of the relative wind velocity and is measured at the opening in the forward end of the sensor. Static pressure, which is a function of altitude and temperature, is measure through a series of small openings on the side of the sensor. Pitot pressure is used in the air data computer and the airspeed/mach indicator. Static pressure is used in the air data computer, counter/pointer altimeter, airspeed/mach indicator, and vertical velocity indicator. To prevent or eliminate icing, the pitot-static sensor is electrically heated.

Pitot Heat Switch

A two-position pitot heat switch controls heat to pitot and static head, total temperature probe, angle of yaw and angle of attack probes. The switch is on the air conditioning control panel (figure 1-35) on the center console.

ALTIMETER (COUNTER/POINTER TYPE)

Static pressure from the pitot system controls the operation of the counter/pointer altimeter (figure 1-2). Static pressure inflates or deflates the aneroids in the instruments, moving the pointer and the 1000-foot altitude counter through mechanical linkages. The sea level barometric pressure may be set in manually through the use of the control knob on the lower left side of the instrument, and is read through the readout window on the instrument face. The instrument limits are from - 1000 to 80, 000 feet.

AIRSPEED/MACH INDICATOR

The airspeed/mach indicator (figure 1-2) is calibrated from mach 0. 5 to 2. 0 and 80 to 650 knots airspeed. Indicated airspeed is read under the pointer which rotates over a non-linear scale. The pointer is driven by the pressure differential derived from comparing pitot pressure with atmospheric (static) pressure. The mach number is read using the pointer and a rotating card calibrated with mach number. The card is rotated by static pressure from the pitot static system. By using the rotating card in conjunction with the pointer, the necessary relationship is established between indicated airspeed and atmoshperic pressure to produce a mach number. Maximum mach number and minimum airspeed indices are controlled by the mach limit knob on the lower left side of the instrument. The minimum airspeed index is set by rotating the knob and the maximum mach is set by pushing the knob in and rotating it. The inverted U-shaped command airspeed marker at the periphery of the instrument face is inoperative.

VERTICAL VELOCITY INDICATOR (RATE OF CLIMB)

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

TURN AND SLIP INDICATOR (MD-1)

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

VERTICAL GYRO INDICATOR (VGI) (MM-3)

The VGI (figure 1-2) indicates the pitch and roll attitude of the aircraft and is used as a secondary vertical reference. Indications are displayed by a sphere in relation to a fixed miniature aircraft symbol. The sphere is light-colored above the horizon black below the horizon, and is marked in 5° pitch increments in both directions, beginning at the horizon bar. Roll indications are given by a marker which moves around the periphery of the sphere. The marker moves across a linear scale which is graduated in 10° increments to 30° and then in 30° increments to 90°.

The sphere is positioned by servo-mechanisms that receive signals from a remote, independent gyro reference. A warning flag will appear when power to the indicator is lost, and will remain in sight for approximately one minute after initial power is applied. The flag does not indicate the condition of the instrument. A gyro fast-erect button (figure 1-2) below and left of the instrument speeds up the erection process. The gyro fast erect button must be depressed until erection is completed. The flag will be visible while the button is depressed.

Rolls through 360° are possible without tumbling the gyro. The gyro will flip 180° at 90° of pitch from straight and level flight, but will return to normal after passing through the extreme pitch angles. A pitch trim knob on the lower right face of the instrument is used to adjust the horizontal bar of the sphere to the fixed miniature aircraft.

Note

Gyros are subjected to abnormal precession after prolonged turns or manuevers.

G-METER

The G-meter (figure 1-2) displays the magnitude of normal accelerations in G-units. A sensor unit in the left wheel well transmits potentiometer pick-off information from the position of a spring-loaded mass to a servo motor. The servo motor positions the instrument marker, which moves along a vertical scale on the instrument face. The range of the instrument is -5G to +10G.

STANDBY COMPASS

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

LEGEND LIGHTS

Legend lights are provided as warning, caution and indicator lights. Illumination of the lights displays legends which are applicable to the particular system and condition the light is associated with. The location of the pilots lights is presented in figure 1-28. The description and function of each light is presented under the heading of the particular system in which it is incorporated.

FIRE WARNING LIGHTS

A fire warning light for each engine is located on opposite sides of the optical sight (figure 1-28). The lights will come on when the heat-sensing elements, which are placed where excessive heat is likely to

PILOT'S INDICATOR LIGHTS

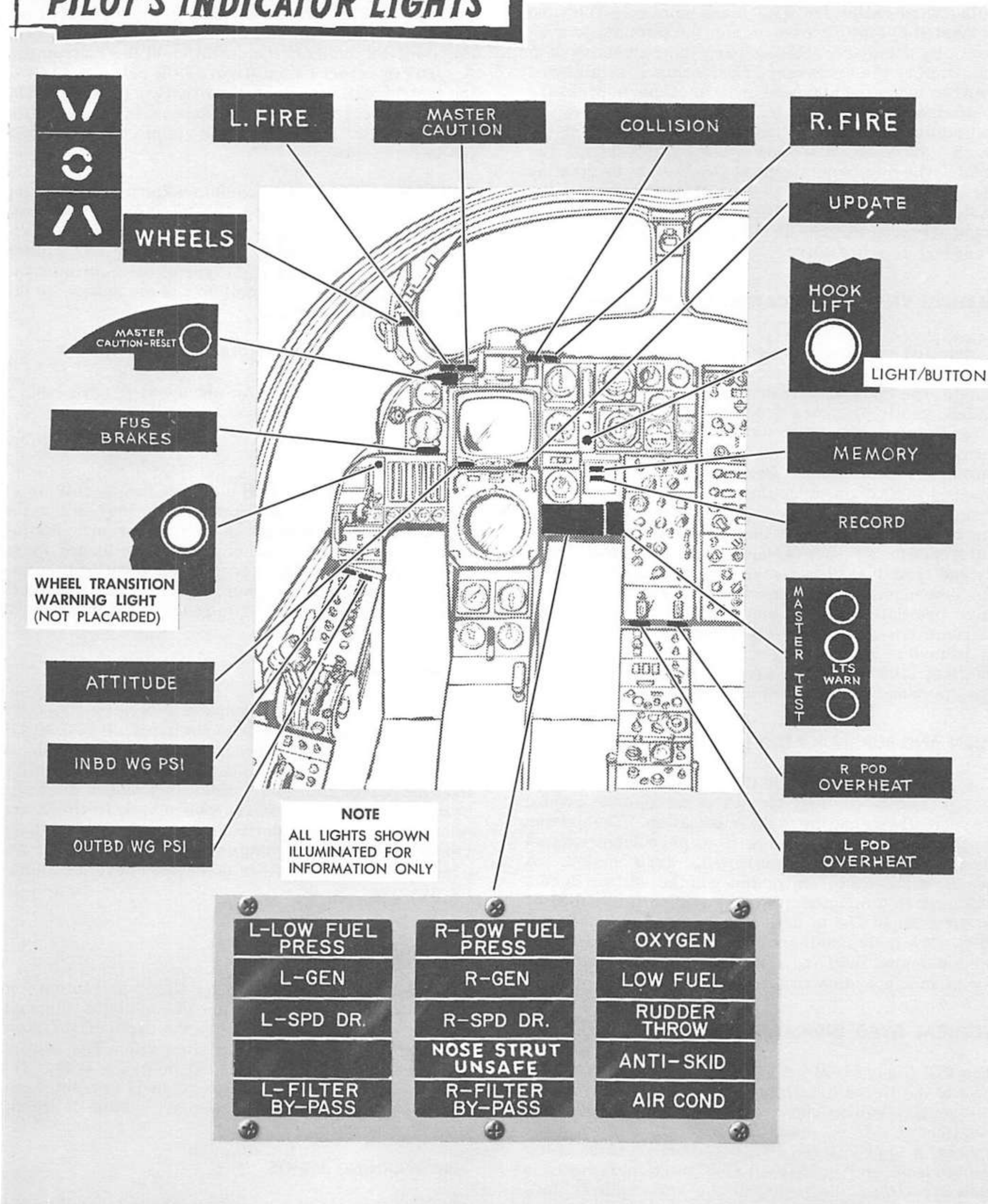


Figure 1-28

occur, are grounded. In the event of a fire, the semiconductor section of the sensing element heats up, decreasing resistance and grounding the circuit. The circuit can also be grounded by the fire test button on the master test panel.

Fire Press-To-Test Button

The fire press-to-test button is on the master test panel in the center of the pilot's instrument panel (figure 1-28). By depressing the fire press-to-test button, the ground circuit is completed to the fire warning lights, and the lights are illuminated. This provides a means of insuring proper operation of the circuitry.

ANNUNCIATOR PANEL

Caution lights for the various systems are on the annunciator panel, located on the lower center portion of the pilot's instrument panel (figure 1-28). Whenever a caution light on the annunciator panel comes on, the MASTER CAUTION lights will give a flashing indication. When the master caution lights are reset, the annunciator light will remain on until the discrepancy is corrected.

Master Caution Light And Reset Button

Two master caution lights, one located on the left side of the optical sight (figure 1-28), and the other above the ECM operator's DECM panel will give a flashing indication whenever a light on the annunciator panel illuminates. The master caution-reset button will turn the master caution light off, and rearm the circuit for any subsequent indication.

WARNING

Due to the proximity of the emergency stores jettison button, care should be exercised to prevent inadvertent stores jettisoning.

COLLISION LIGHT

The collision light gives a flashing yellow indication and indicates command pullup in conjunction with breakaway lights and the vertical display weapons symbol. The collision light is on the lower right side of the optical sight (figure 1-28).

CANOPY

The canopy can be opened with hydraulic pressure, jettisoned, or manually released. Hydraulic power for the canopy is generated by either the combined hydraulic system, or the hand pump hydraulic system. Hydraulic pressure is directed to the canopy actuating cylinder by the canopy selector valve in the nose wheel well. The selector valve can be positioned electrically or manually from the cockpit, or manually from the nose wheel well.

The canopy switch is the primary means of opening and closing the canopy. The manual canopy selector is mechanically linked to the canopy selector valve and will be automatically positioned to match the setting of the switch.

The solenoid hydraulic valve can be overridden by the manual canopy selector despite the position of the canopy switch.

WARNING

If the manual canopy selector handle is actuated with power ON, the position of the electrical switch will determine the canopy position when the handle is released.

For emergency jettison of the canopy, a line is opened from a precharged bottle to the pneumatically fired canopy jettison cartridge. The jettison system uses pressure from an explosive charge placed in the canopy actuating cylinder to jettison the canopy. When the charge is detonated, a rod within the piston rod will drive the canopy and its retaining mechanism off the canopy tracks.

Manual canopy removal is accomplished by pulling the manual release handle on the canopy beam or the external T-handles located on the aft end of the canopy. This disconnects the canopy from the actuating cylinder piston. The canopy can then be slid off the tracks and removed.

MANUAL CANOPY OPERATION

The canopy can be manually opened or closed from the nose wheel-well, or from the cockpit. The manual canopy selector handle is a "T" handle on the base of the control stick pedestal (figure 1-2), and has two positions. To open the canopy, pull the handle up, to close the canopy, push the handle down. The handle is mechanically linked to the canopy selector valve, which can also be actuated by a "T" handle in the nose wheel well. As in the electrical actuation of the valve, the hydraulic pressure can come from either the combined hydraulic system or the hand pump hydraulic system. The initial pressure opens the canopy seal control valve, dumping cockpit seal air pressure and freeing the canopy for opening.

Canopy Control Switch

A two-position canopy switch (figures 1-29), on the right side of the pilot's instrument panel, is used for normal operation of the canopy. The OPEN position of the switch energizes a solenoid on the canopy selector valve, positioning the valve to direct hydraulic pressure to the canopy actuating cylinder. Hydraulic pressure can originate from either the combined hydraulic secondary system or the hand pump hydraulic system. Initially, the hydraulic pressure opens the canopy seal selector valve, dumps the air pressure in the canopy seal and frees the canopy for opening.

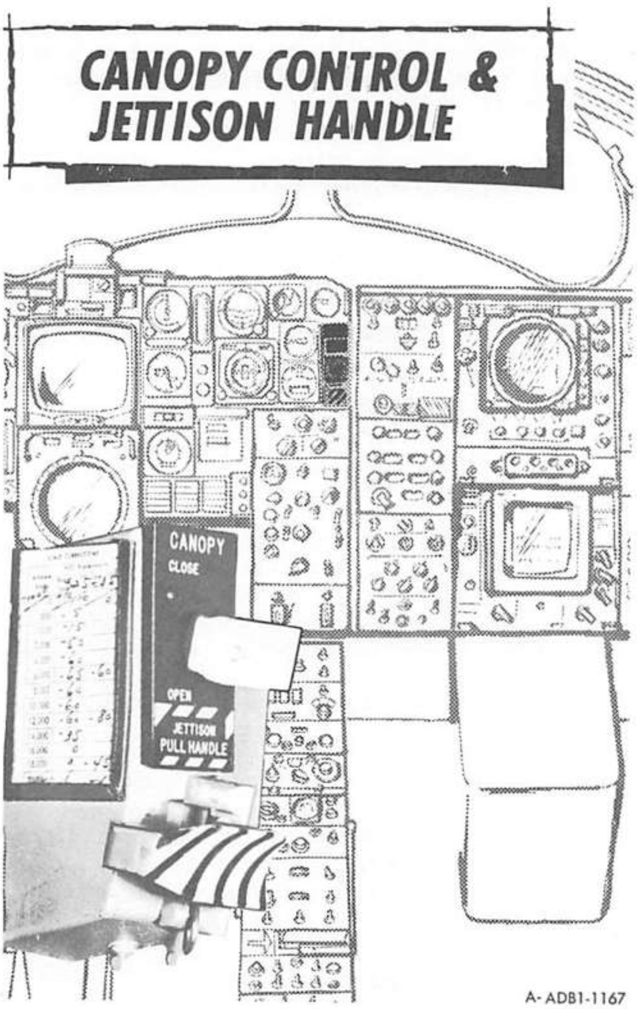


Figure 1-29

To close the canopy, place the switch in the CLOSE position. A solenoid on the canopy selector valve directs hydraulic fluid to the close side of the canopy actuating cylinder, and closes the canopy.

Canopy Jettison Handle

The canopy jettison handle (figure 1-29) on the right side of the pilot's instrument panel, or either of the external canopy jettison handles (figure 1-30) on each side of the aircraft, jettison the canopy by opening a line from a precharged bottle to pneumatically fire the canopy jettison cartridge. The external jettison handles are located inside access doors and are covered by guards. For detailed procedures on escape using canopy jettison, see Section V, EMERGENCY PROCEDURES, of this manual.

EJECTION SEAT

The aircraft is equipped with two Martin-Baker MK-GRU-5 ejection seats capable of providing safe, ground-level ejection in straight and level flight at a minimum of 100 KIAS as well as throughout the entire speed and altitude range of the aircraft.

WARNING

> At speeds in excess of 500 knots, straight and level flight, a minimum altitude of 100 feet is necessary for safe ejection.

A seat catapult with three cartridges provides sufficient force to eject the seat and occupant clear of the aircraft. Actuating an ejection handle draws a wedge-shaped sear out of the firing pin permitting the spring-loaded pin to strike the percussion primer of the primary cartridge. The flame of the primary cartridge successively ignites two auxiliary cartridges as the seat rises. Expanding gases then drive the intermediate and inner tubes upward, and eject the seat and occupant from the aircraft. See figure 1-31.

The seat is stabilized after ejection by a drogue chute that is deployed automatically. A smaller drogue chute (controller) is drawn from the pack by a metal piston fired from the drogue gun 1 second after seat ejection. The controller drogue chute then tows the stabilizer chute out of its container. The stabilizer chute is secured to the seat by a shackle scissor until released by the time release mechanism.

During ejection, the occupant is held in the seat by upper restraint straps, lap belt, and leg restraint cords. Deployment of the personnel parachute and separation of the occupant from the seat is delayed by the time release mechanism until the occupant has descended from the upper atmosphere, or has slowed enough to prevent excessive opening shock, or both.

The seat (figure 1-32) consists of a main beam assembly, two vertical and three horizontal members, plus the following components and assemblies: a drogue parachute container assembly with headrest, primary firing mechanism, and attached face curtain; drogue gun; time release mechanism; inertial reel mechanism and dual attached leg restraint cord assemblies; emergency oxygen bottle; ventilated back pad; parachute back pad; ventilated seat pad; PK-2 pararaft kit and lap belt assembly; and the seat bucket vertical and tilt adjustment acutators.

EJECTION CONTROLS

Face Curtain Handle

Note

> The primary means of ejection is through the canopy.

The automatic ejection sequence is initiated by pulling the face curtain handle located immediately aft and above the occupant's head (figure 1-32). When the face curtain handle is pulled, the firing mechanism is actuated and the primary cartridge is detonated. As the seat rises, the drogue gun and time release mechanism sears are extracted, and the emergency IFF is actuated.

Note

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

Secondary Firing Handle

The secondary firing handle is located on the front of the seat bucket, between the occupant's legs (figure 1-32). The sequence of personnel parachute deployment remains the same, since both the face curtain handle and the secondary firing handle initiate seat firing by extracting the sear from the ejection gun firing mechanism.

WARNING

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

Note

The seat is fired after 2-1/2 inches of secondary firing handle travel.

PARACHUTE

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

Time Release Mechanism

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

The time release mechanism comprises a G-controller, to prevent both the deployment of the personnel parachute and occupant separations from the seat at high-G forces, and an altitude-sensing barostat, to prevent premature deployment of the parachute at high altitudes. At approximately 10,000 feet and at deceleration of 4.5 G or less, the time release mechanism releases the drogue parachute from the shackle scissor, and through the personnel parachute withdrawal line deploys the pilot's personnel parachute. At the same time, the harness restraints, leg restraints, upper blocks of the personnel services disconnects, and face blind, are unlocked.

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

EXTERNAL CANOPY JETTISON

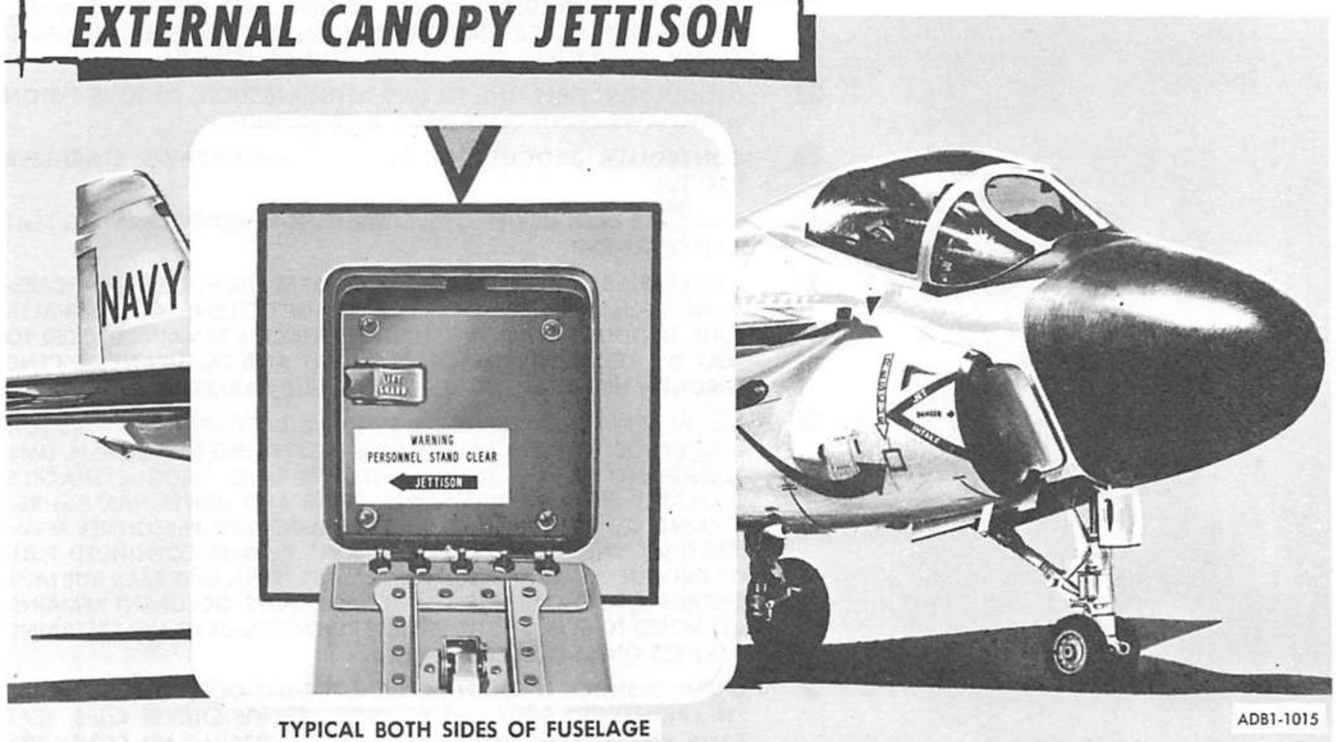
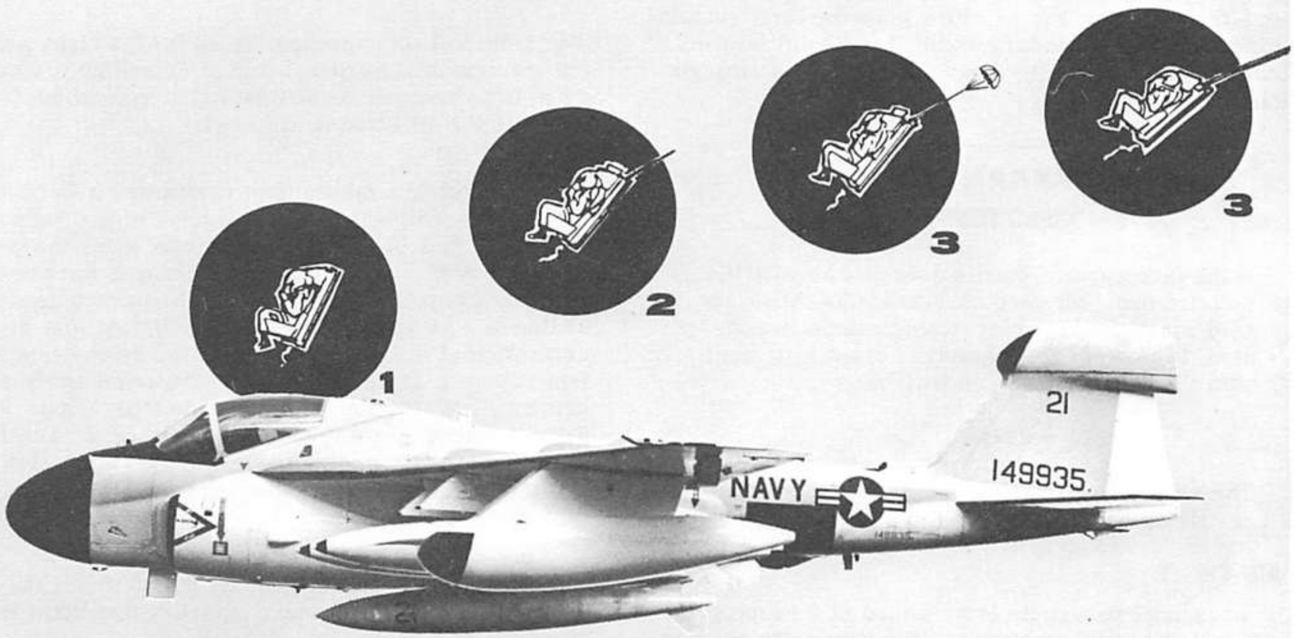


Figure 1-30

EJECTION SEQUENCE



1 ·· **INITIAL EJECTION:** EMERGENCY OXYGEN RELEASED, IFF SWITCH ACTUATED, SHOULDER HARNESS LOCKED, LEG RESTRAINTS WITHDRAWN AND LOCKED AND TIME RELEASE AND DROGUE GUN MECHANISMS ARE TRIPPED AS SEAT LIFTS OUT OF COCKPIT.

2 ·· DROGUE GUN FIRES ONE SECOND AFTER EJECTION; DROGUE PISTON WITHDRAWS CONTROLLER DROGUE PARACHUTE.

3 ·· CONTROLLER DROGUE DEPLOYS AND WITHDRAWS STABILIZER DROGUE.

4 ·· STABILIZER DROGUE DEPLOYS, STABILIZING AND DECELERATING SEAT AND OCCUPANT.

5 ·· **ABOVE 13,500 FEET:** BAROSTAT SECURES TIME RELEASE ESCAPEMENT MECHANISM UNTIL COMPLETION OF DESCENT TO LOWER ALTITUDE, DROGUE PARACUTE RETENTION SHACKLE REMAINS LOCKED TO SEAT BY RESTRAINT SCISSOR AND SEAT AND OCCUPANT DESCEND THROUGH HIGHER ALTITUDES ON DROGUE PARACHUTES ONLY.

6 ·· BELOW APPROXIMATELY 10,000 FEET AND DECELERATION OF 4.5 g OR LESS: BAROSTAT FREES TIME RELEASE ESCAPEMENT MECHANISM. TIME RELEASE MECHANISM SUBSEQUENTLY RELEASES DROGUE SHACKLE RESTRAINT SCISSOR, OCCUPANT'S UPPER AND LOWER HARNESS RESTRAINT, LEG RESTRAINTS AND UPPER BLOCKS OF PERSONNEL SERVICES DISCONNECTS. RELEASE OF SHACKLE PERMITS CONTINUED PULL OF DROGUE PARACHUTES ON LINK LINES TO RELEASE FACE CURTAIN RESTRAINT, AND MAIN PERSONNEL PARACHUTE. OCCUPANT REMAINS ATTACHED TO SEAT BY STICKER CLIP RETENTION OF LOWER RESTRAINT HARNESS ON SEAT BUCKET.

7 ·· OPENING SHOCK OF MAIN PARACHUTE PULLS OCCUPANT, SURVIVAL KIT AND LOWER RESTRAINT HARNESS FREE OF STICKER CLIPS. SEAT FALLS FREE. OCCUPANT DISCARDS FACE CURTAIN AND CONTINUES NORMAL PARACHUTE DESCENT.

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Figure 1-31 (Sheet 1)

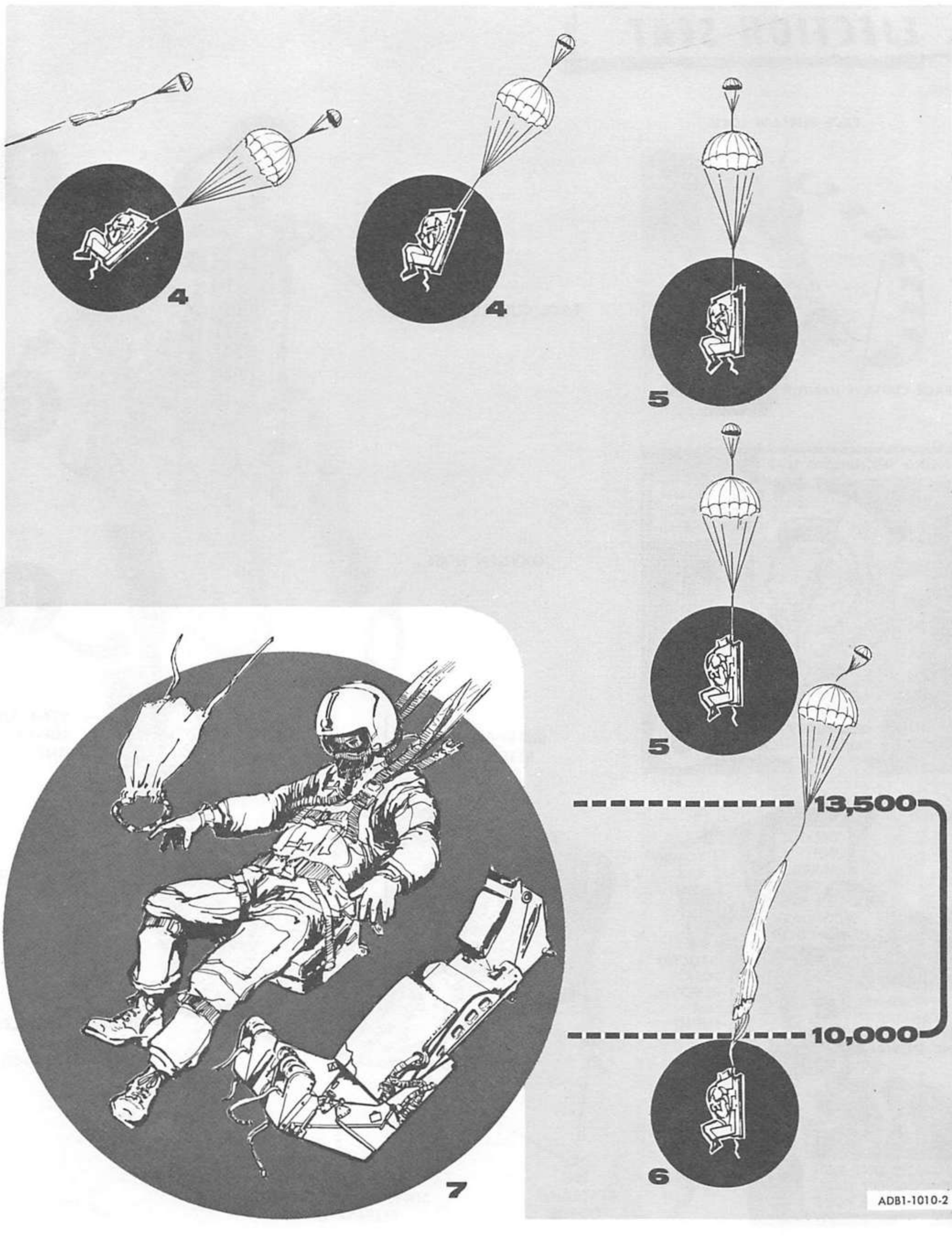

Figure 1-31 (Sheet 2)

EJECTION SEAT

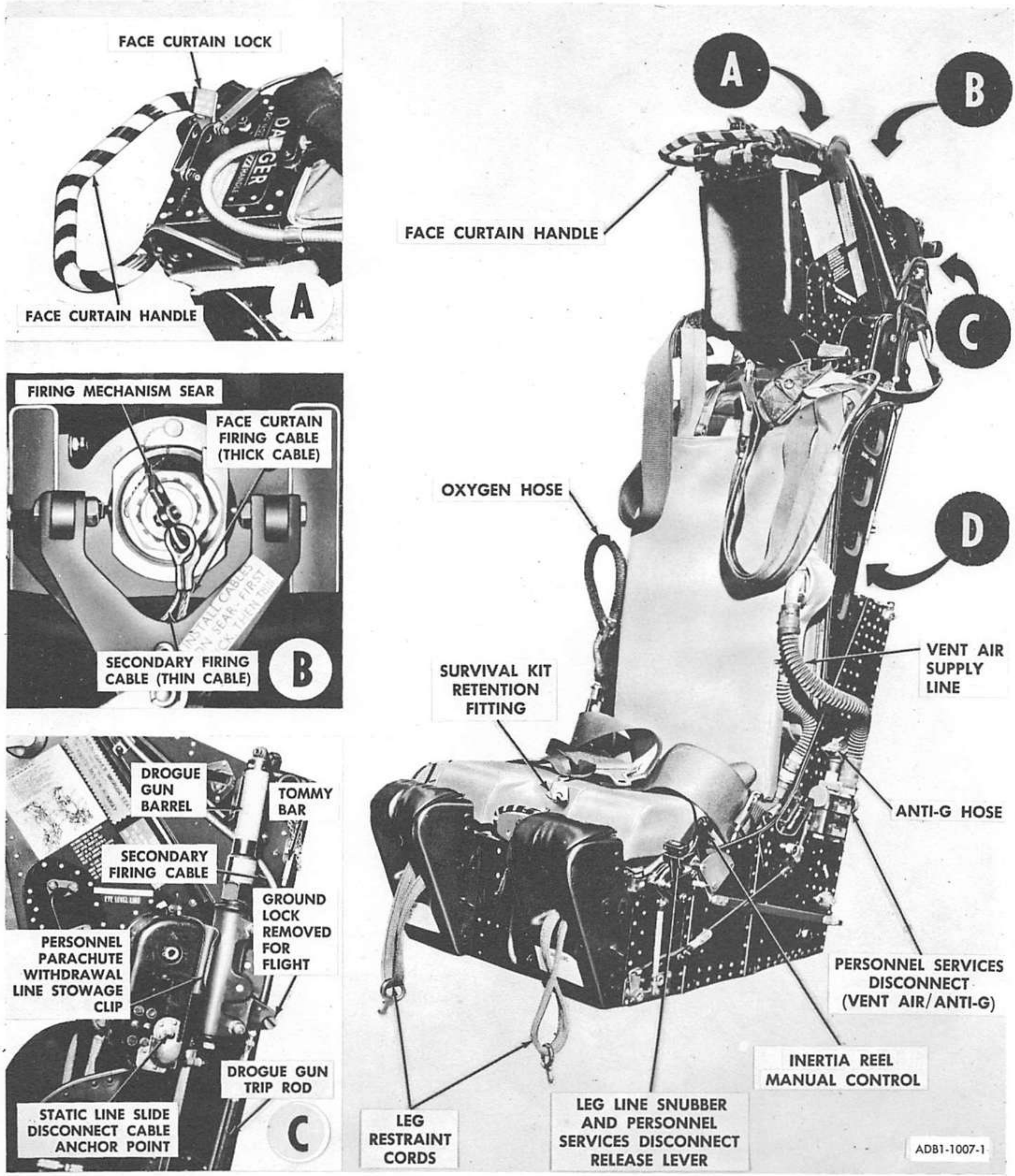

Figure 1-32 (Sheet 1)

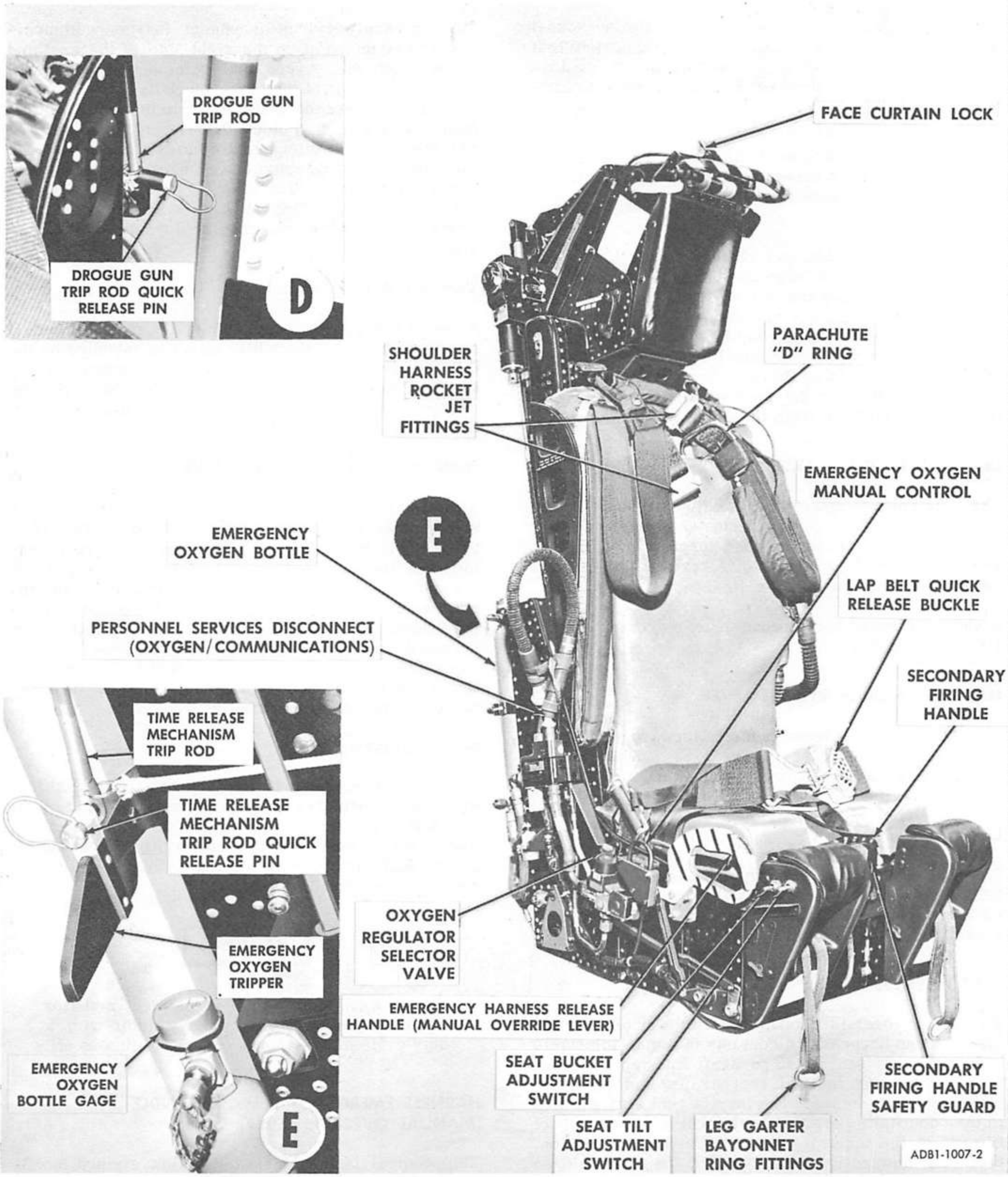

Figure 1-32 (Sheet 2)

EJECTION

High Altitude (Above 13,500 Feet)

To prevent premature deployment of the personnel parachute, the ejection seat has a barostat control that prevents scissor shackle release during the deployment sequence until the seat has fallen below an altitude of 13,500 feet.

The G-controller portion of this mechanism also prevents release of the scissor shackle release until the seat has been decelerated and stabilized by the drogue parachute.

Once the deceleration and altitude limits have been passed, the time release mechanism (barostat/G-controller) releases the scissor shackle, parachute retention straps, inertia reel straps, the face curtain, the dual leg restraints, the lap belt harness locks, and the upper locks of the personnel equipment. The occupant is then held to the seat by two sticker clips. The opening shock of the personnel parachute breaks the sticker lugs free from the clips.

Low Altitude (Below 13,500 Feet)

The time release mechanism is actuated upon ejection and initiation of the timing sequence begins immediately. When circumstances permit, the aircraft should be slowed to 200-220 KIAS prior to ejection to reduce the forces exerted on the body.

It should be noted that ground-level ejection requires 100 KIAS minimum.

LEG LINE SNUBBER RELEASE LEVER

The leg snubber release lever is forward on the left side of the seat bucket (figure 1-32). When moved forward, this control provides slack in the dual leg restraint cords.

LAP BELT

The lap belt is attached to the seat bucket by two lap belt locks and two sticker clips. The PK-2 pararaft kit is attached to the lap belt and stowed in the seat bucket under the seat pan.

SEAT HARNESS

The seat harness is compatible with a modified integrated torso harness and consists of a non-adjustable back pad, seat pan, PK-2 pararaft kit, lap belt, two shoulder harness inertial reel straps, and two parachute retention straps. The inertia reel straps attach to the occupant's personal equipment at the rocket jet fittings of the upper restraint straps. On ejection, they area automatically released by the time release mechanism. Dual leg restraint cords hold the occupant's legs securely against the thigh rest extensions on the front face of the bucket assembly. The leg garters are attached to the restraint cords by bayonet ring fittings.

PERSONNEL SERVICES DISCONNECTS

Oxygen/Communications Disconnect

The personnel services disconnects (oxygen/communications) is mounted on the right side of the seat and serves both the oxygen and communications lines. The disconnect is of the three-block design. The seat occupant's personnel oxygen and communication equipment terminates in a block that is plugged and locked into the top of the intermediate block of the seat. The aircraft oxygen and communications lines also terminates in this block. This block is unlocked by the time release mechanism and pulled free when the occupant separates from the seat upon deployment of the personnel parachute.

Vent Air/Anti-G Disconnect

A ventilation line (exposure suit back pad) and anti-G line personnel services disconnect is mounted on the left side of the seat. The disconnect is unlocked by the time release mechanism and pulled free when the occupant separates from the seat upon deployment of the personnel parachute.

INERTIA REEL LOCK/RELEASE LEVER

This control is located directly behind the leg line snubber release lever on the left side of the seat (figure 1-32). In the forward position, forward movement of the occupant is restricted and any slack created by rearward movement is taken up by the inertia reel. The control is locked in this position using the detent. In the spring-loaded center position, the occupant can move forward freely, unless the reel locks due to inertia force. If the reel locks, the control must be positioned to full aft (unlock) and returned to the center position.

SEAT ADJUSTMENT

Seat adjustment is controlled by two three-position, momentary contact switches (figure 1-32), on the right side of the right thigh support. The direction of switch movement corresponds to the direction of seat movement. Seat adjustment is limited to 5 inches of vertical movement and 10° of tilt.

CAUTION

The seat tilt and height adjustment actuator motor is an intermittent-duty motor with a duty cycle of 30 seconds on and 10 minutes off.

HARNESS EMERGENCY RELEASE HANDLE (MANUAL OVERRIDE LEVER)

This control is the black-and-yellow striped handle forward on the right side of the seat bucket (figure 1-32). In the forward (locked) position, the occupant and his personal equipment are secured to the seat. When the emergency harness release lever is lifted and moved to the aft (unlocked) position, the occupant and his personal equipment are disconnected from the seat with the exceptions of the sticker clips and the personnel parachute withdrawal line. The sticker clips and the personnel parachute withdrawal line are separated by grasping and pulling the left hand parachute riser. This requires approximately 40 pounds of pull. The emergency harness release handle simultaneously releases the lap belt harness locks, inertia reel straps, dual leg restraint cords, and the right and left personnel services disconnects.

WARNING

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

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

EMERGENCY OXYGEN

An emergency oxygen bottle (1800 PSI) attached to the right side of the ejection seat is automatically actuated on ejection. When the seat rises during ejection, a lever on the bottle is tripped by a striker arm, which opens the oxygen valve. The oxygen flows through the seat-mounted regulator, where it is metered through the normal oxygen inlet line.

Note

The emergency oxygen supply will last approximately 10 minutes.

Emergency Oxygen Manual Control

The emergency oxygen manual control is the green handle on the right side of the seat, immediately aft of the emergency harness release handle (figure 1-32). This control is used to actuate the emergency oxygen system if the normal system fails.

PARARAFT PK-2

The PK-2 pararaft survival kit (figure 1-33) is attached to the lap belt and stowed in the seat bucket under the seat pan. The survival kit contains a one-man life raft, and survival equipment.

Note

The PK-2 pararaft kit has a quick disconnect fitting that must be released to open the raft.

COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM

The cockpit air conditioning and pressurization system (figure 1-34) maintains cockpit temperature and pressure within the limits of crew safety and comfort. To accomplish this, the system forces a mixture of dehumidified refrigerated air and hot engine bleed air into the cockpit. A temperature control system, consisting of temperature switches, selectors, sensors and associated valves, and an electronic controller automatically maintain the mixture temperature after temperature selection is made. Correct cockpit pressure is controlled by a pressure-regulator and a safety valve. All controls for operating the system are on the air conditioning control panel (figure 1-34), with the exception of the cabin dump switch which is located on the cabin dump panel (figure 1-35).

COCKPIT AIR CONDITIONING

The cockpit is furnished with air at any desired temperature and at a pressure within safe limits by the cockpit air conditioning and pressurization system. The system receives hot air from the twelfth-stage of each engine compressor. This hot air is bled off the high-pressure compressor and is ducted to the refrigeration unit heat exchanger. The heat exchanger uses ram air, supplied by a scoop on the right wing leading edge, to remove heat from the engine bleed air. The cooled air passes through the mass flow control valve to the cooling turbine. Since the energy to drive the turbine is being extracted from the air, the temperature and pressure of the air is reduced further, providing the cockpit with a supply of refrigerated air. Mixing of the hot and refrigerated air is accomplished by means of dual temperature control valves - one in the hot line and one in the cold line - that share a common mounting. Either valve may be opened or closed a specified amount. Thus, the temperature of the cockpit air is regulated by a mixture of hot engine bleed air and refrigerated air. The mass flow control valve helps to stabilize temperature by regulating the flow to the cooling turbine. The result of this regulation is a readjustment of the dual temperature control valve. For example, if the cabin temperature decreases with the dual temperature control valve in the full cold position, the cold valve will begin to close. As this happens, the mass flow controller, located downstream from the turbine, senses a pressure rise and begins to close the mass control valve. This decreases the air flow to the cooling turbine and results in a decrease of turbine discharge flow and an increase in temperature. The dual temperature control valve readjusts to the new condition and the temperature is again stabilized. In the event of air conditioning system failure or shut down, ram air, ducted from the heat exchanger inlet scoop, is used for ventilation of the cockpit.

COCKPIT PRESSURIZATION

Air from the refrigeration unit enters the cockpit under sufficient pressure to provide adequate cockpit pressurization. Cockpit pressurization, automatically initiated at 8,000 feet, is controlled by the cockpit air pressure-regulator. The regulator controls

PK-2 PARARAFT

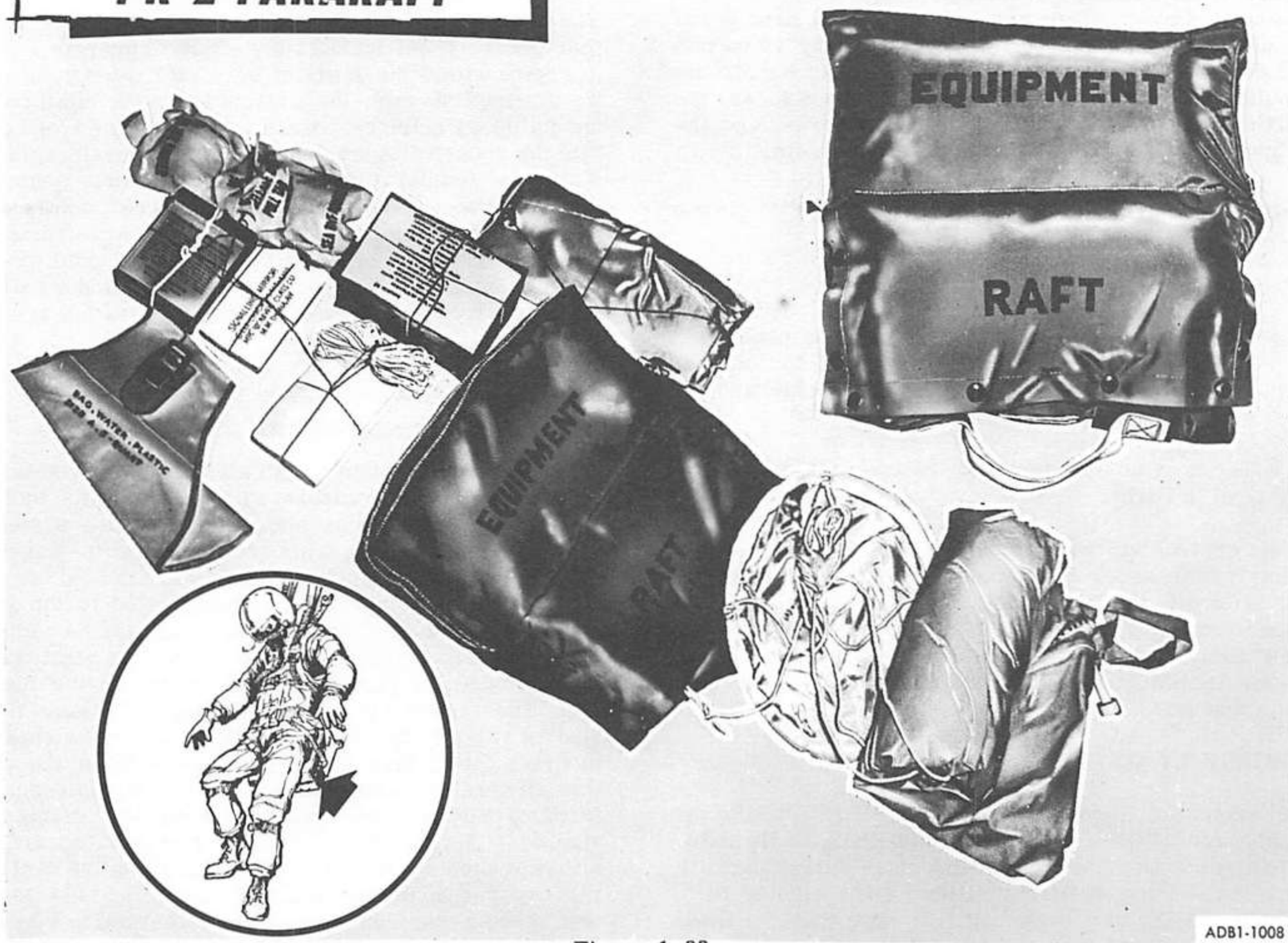

Figure 1-33

the discharge rate of the air from the cockpit. After the aircraft reaches 8,000 feet (figure 1-37), the regulator valve closes and maintains a cockpit altitude pressure of 8,000 feet until an aircraft altitude of 23,000 feet has been reached. Above an altitude of 23,000 feet the regulator maintains a 5 PSI pressure differential. The regulator discharge air assists in cooling various electronic equipment by dumping cockpit air into the nose compartment and nose wheel well. If the regulator should fail, the cockpit air pressure safety valve automatically dumps when the cockpit pressure exceeds 5.5 PSI pressure differential. The safety valve is also capable of negative pressure relief to prevent excessive negative pressure during dives, when the ambient pressure is increasing faster than cockpit pressure is increasing. The safety valve, which dumps into the atmosphere, may also be operated manually by the crew, if desired.

Air Conditioning Master Switch

The air conditioning master switch is a two-position (NORM and OFF-RESET) toggle switch on the air conditioning control panel (figure 1-34). The switch is guarded to the NORM position. With the canopy closed, placing the switch to NORM opens the electrical supply to the main bleed air shutoff valve, causes the valve to open and the air conditioning caution light (AIR COND) to go off. Hot engine bleed air is now available for operation of the various environmental systems. Placing the switch to the OFF position allows electrical power to be supplied to the shutoff valve, closing the valve, thus shutting off the supply of hot engine bleed air and preventing operation of the systems.

CAUTION

Fuel tank and anti-G suit pressurization lines by-pass the main bleed air shutoff valve. Do not actuate either the G-valve test button or the ORIDE position of the tank pressure switch unless the air conditioning master switch is in the NORM position.

Note

The hot engine bleed air line to the windshield washing and rain removal systems bypasses the main bleed air shutoff valve. The two systems may still be operated with the air conditioning master switch at OFF.

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

Air Conditioning Cockpit Switch

The cockpit switch, on the air conditioning control panel (figure 1-35) is a three-position toggle switch marked ON, OFF, and RAM-AIR. With an engine running, the canopy closed, and the air conditioning master switch at NORM, placing the cockpit switch ON engages the air conditioning and pressurization system by energizing the dual temperature control valve and deenergizing (opening) the cabin shutoff valve. Depending upon the setting on the automatic temperature control thumbwheel, conditioned air flows into the cockpit. Placing the cockpit switch OFF energizes (closes) the cabin shutoff valve, and drives the dual temperature control valve to the full hot position. This prevents any airflow to the cockpit. The RAM-AIR position closes the cabin shutoff valve and drives the dual temperature control valve to the full hot position. When the switch is in the RAM-AIR position, temperature is controlled manually using the manual/ram air switch.

Note

When the manual/ram air switch is actuated, cabin pressurization is maintained.

Automatic Temperature Control Thumbwheel

The automatic temperature control thumbwheel, on the air conditioning control panel (figure 1-35), enables the crew to adjust the cockpit air temperature. With the canopy closed and the other air conditioning and pressurization system controls appropriately positioned, the thumbwheel may be moved to any setting between 0 to 14. Rotating the thumbwheel automatically regulates the openings of the hot and cold sides of the dual temperature control valves, thus varying the cockpit air temperature. The temperature may be selected within a range of 18.8° to 29.9° C (55° to 85° F).

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

Manual Ram Air Switch

The manual ram air switch on the air conditioning control panel (figure 1-35) placarded MAN/RAM AIR, is a four-position toggle switch with positions AUTO, HOLD, COLD, and HOT. The AUTO position is selected to place the dual temperature control system in the automatic mode and thus allow control of the cockpit air temperature as selected by the automatic temperature control thumbwheel. Placing the switch to HOLD removes the dual temperature control valve from automatic control. The switch is spring-loaded to HOLD when AUTO is not selected. Momentarily holding the switch in COLD or HOT alters the positions of the hot and cold valves of the dual temperature control valves accordingly to change the cockpit air temperature. When released, the switch springs back to HOLD and the dual temperature control valve remains fixed.

The COLD and HOT positions should be toggled intermittently to avoid overshooting the desired position. The temperature of the air from either a ram air or refrigerated source can be controlled manually through this switch.

Cabin Dump Switch

The cabin dump switch (figure 1-36) is on the cabin dump panel on the center console and allows the crew to manually dump cabin pressure. Placing the switch ON allows electrical power to energize the cabin dump solenoid. This in turn causes the safety valve to open and the cabin pressure to be dumped. With the switch OFF, the cabin dump solenoid is deenergized, the valve is closed, and normal cabin pressure schedule is maintained.

AIR CONDITIONING LIGHT (AIR COND)

The air conditioning caution light on the annunciator panel (figure 1-28) indicates whether the main bleed air shut-off valve is open or closed and the air conditioning system engaged. The light illuminates when the air conditioning master switch is placed to OFF and the shut-off valve is energized (closed). The air conditioning light also illuminates if over-pressurization occurs upstream of the water separator. When this happens, the compartment cold valve opens and reduces pressure. After pressure is reduced, the valve closes and the light goes out. If over-pressurization recurs, the same sequence is repeated. When the air conditioning master switch is placed to NORM, the electrical supply to the shut-off valve is opened and the light goes off.

CAUTION

When the AIR COND caution light on the annunciator panel is on. the crew should take steps to protect the electronic equipment from overheating.

AIR CONDITIONING AND PRESSURIZATION SYSTEM

Automatic Operation

Note

The canopy must be closed to energize the air conditioning and pressurization system.

1. Air conditioning master switch - NORM
2. Cockpit air conditioning switch - ON
3. Man/Ram air switch - AUTO
4. Automatic temperature control thumbwheel - SET AS DESIRED

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

COCKPIT AIR CONDITIONING & PRESSURIZATION SYSTEM

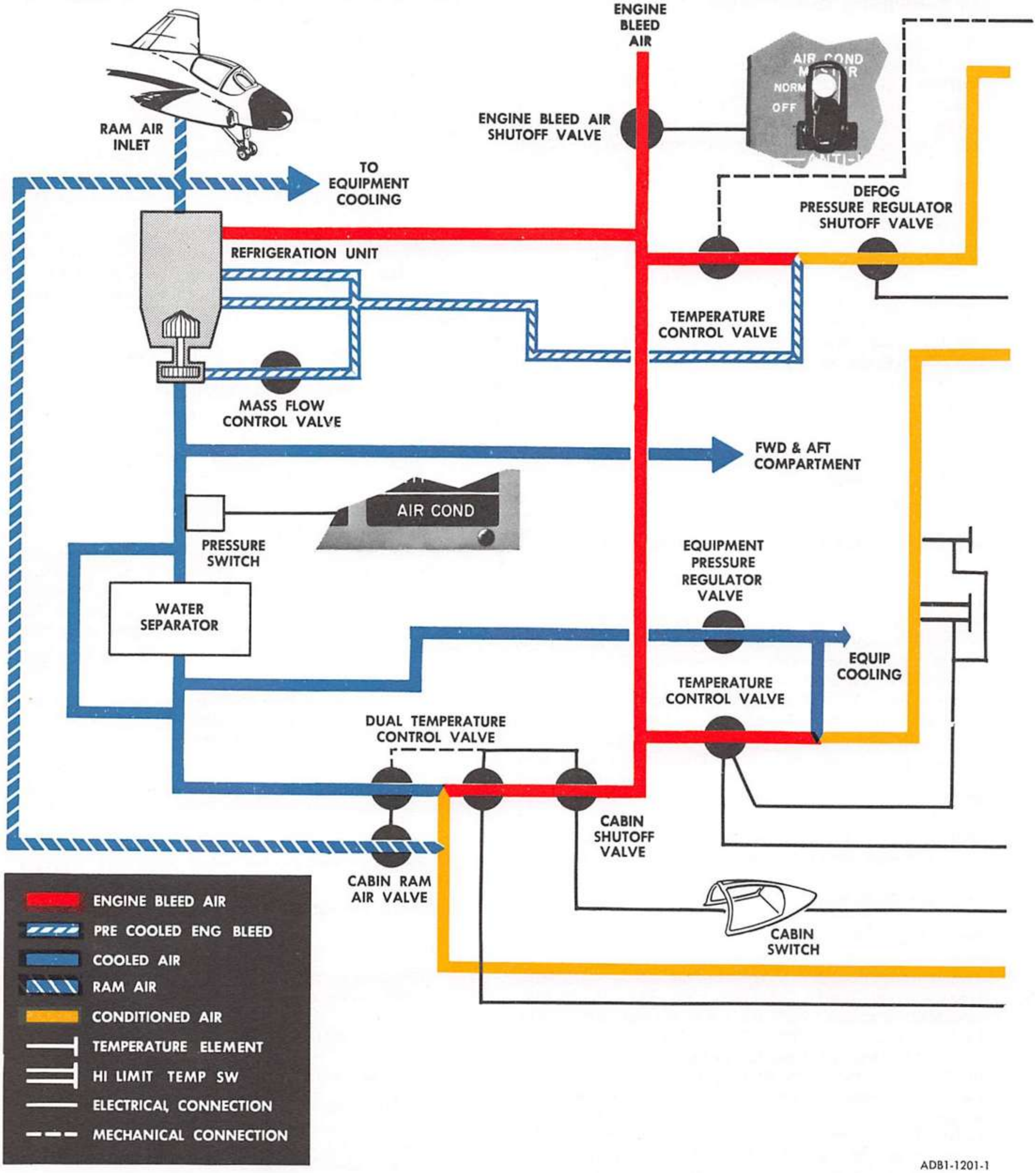

Figure 1-34 (Sheet 1)

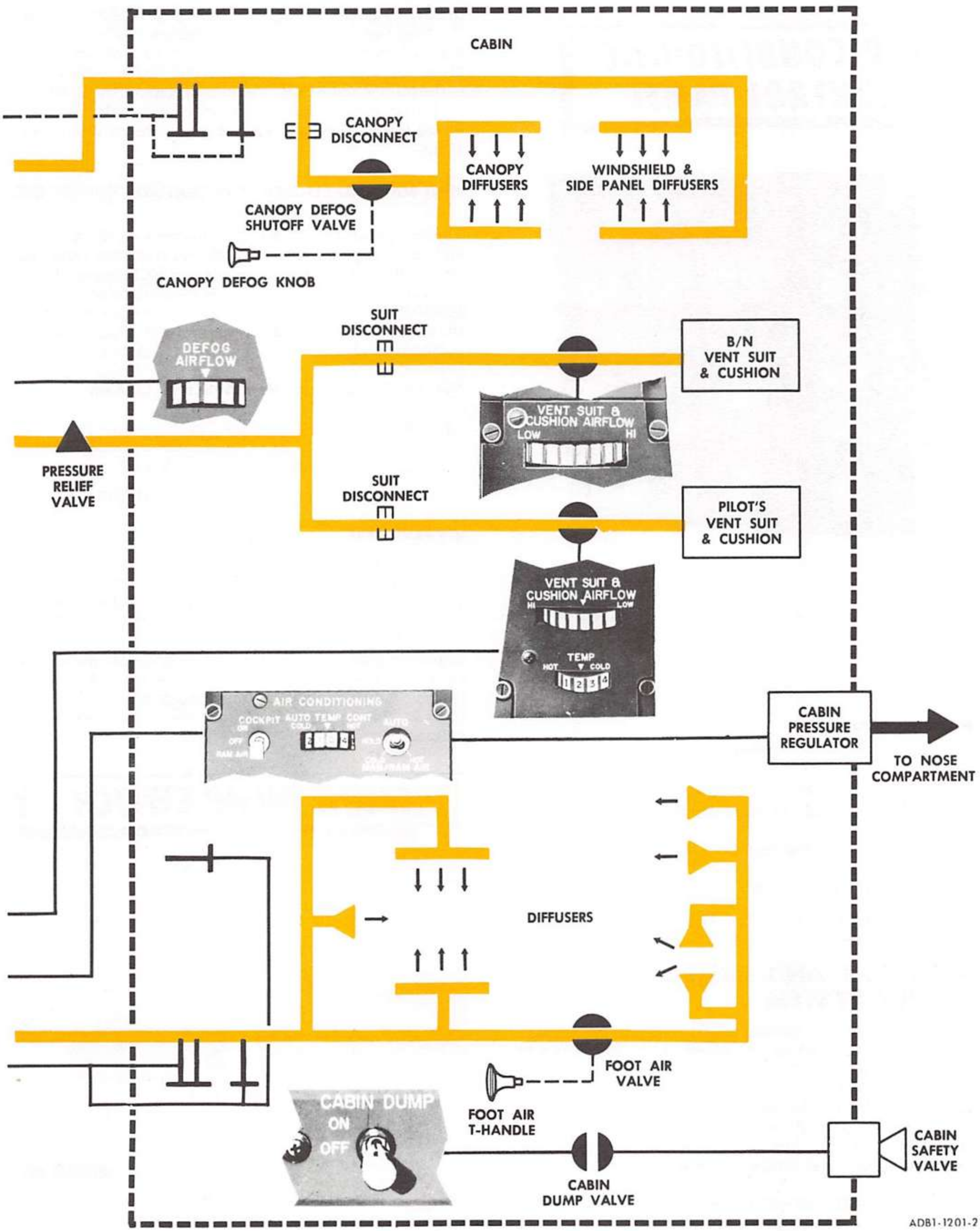

Figure 1-34 (Sheet 2)

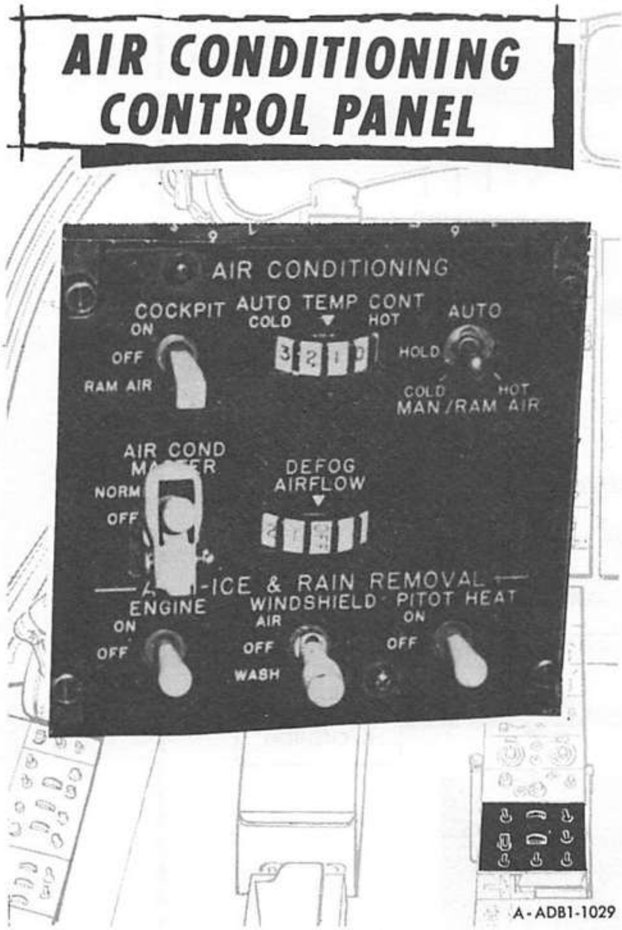

Figure 1-35

Manual Operation

Note

The canopy must be closed to energize the air conditioning and pressurization system.

1. Air conditioning master switch - NORM
2. Cockpit switch - ON
3. Man/Ram air switch - TOGGLE AS DESIRED then HOLD

VENT SUIT AND CUSHION AIR SUPPLY SYSTEM

The pilot and ECMO receive a mixture of dehumidified-refrigerated air and engine bleed air to the vent suit and seat cushions. The controls for the suit and seat cushions are on the vent suit and cushion control panel (figure 1-38). The ECMO has no temperature control; however he will receive air at the temperature selected by the pilot. The airflow thumbwheel should be set toward HI to get temperature controlled air.

VENT SUIT AND CUSHION AIRFLOW THUMBWHEEL

The pilot's airflow thumbwheel on the vent suit seat cushion control panel (figure 1-38) controls the amount of airflow to the pilot's vent suit and cushion. With the air conditioning master switch at NORM, rotating the thumbwheel toward HI energizes (opens) the flow control valve. This allows a mixture of hot engine bleed air and air from the refrigeration unit to pass to the pilot's and ECMO's vent cushions. The ECMO has a similar control but it has provisions only for regulating the airflow and cannot start the system operating.

VENT SUIT AND CUSHION TEMPERATURE THUMBWHEEL

The temperature (TEMP) thumbwheel on the vent suit and cushion panel (figure 1-38) controls the temperature of the airflow to the pilot's and ECMO's vent suits and cushions. With the air conditioning master switch at NORM, rotating the temperature thumbwheel to HOT or COLD sets the temperature which the vent suit temperature control system maintains.

Normal Operation of Vent Suit and Cushion

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

G-VALVE TEST

The G-valve test button is on the pilot's left console (figure 1-3), immediately aft of the vent suit and cushion airflow control. This button provides a means of testing the proper operation of the anti-G suit.

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

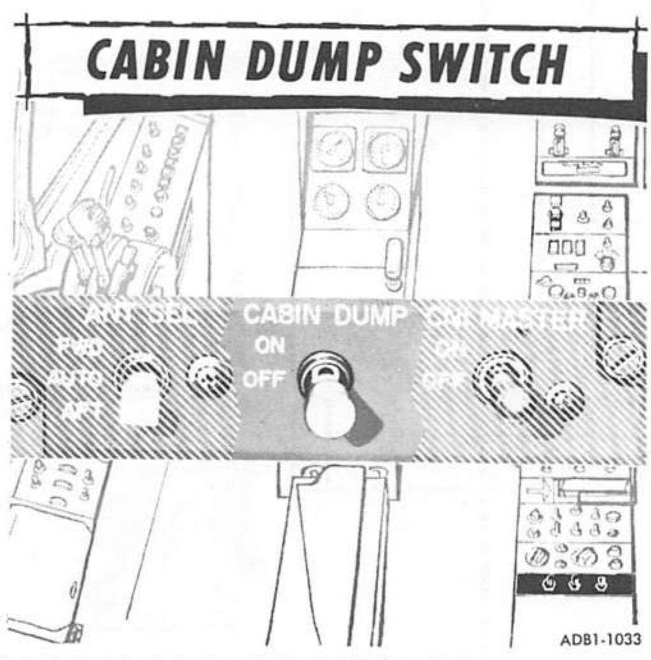

Figure 1-36

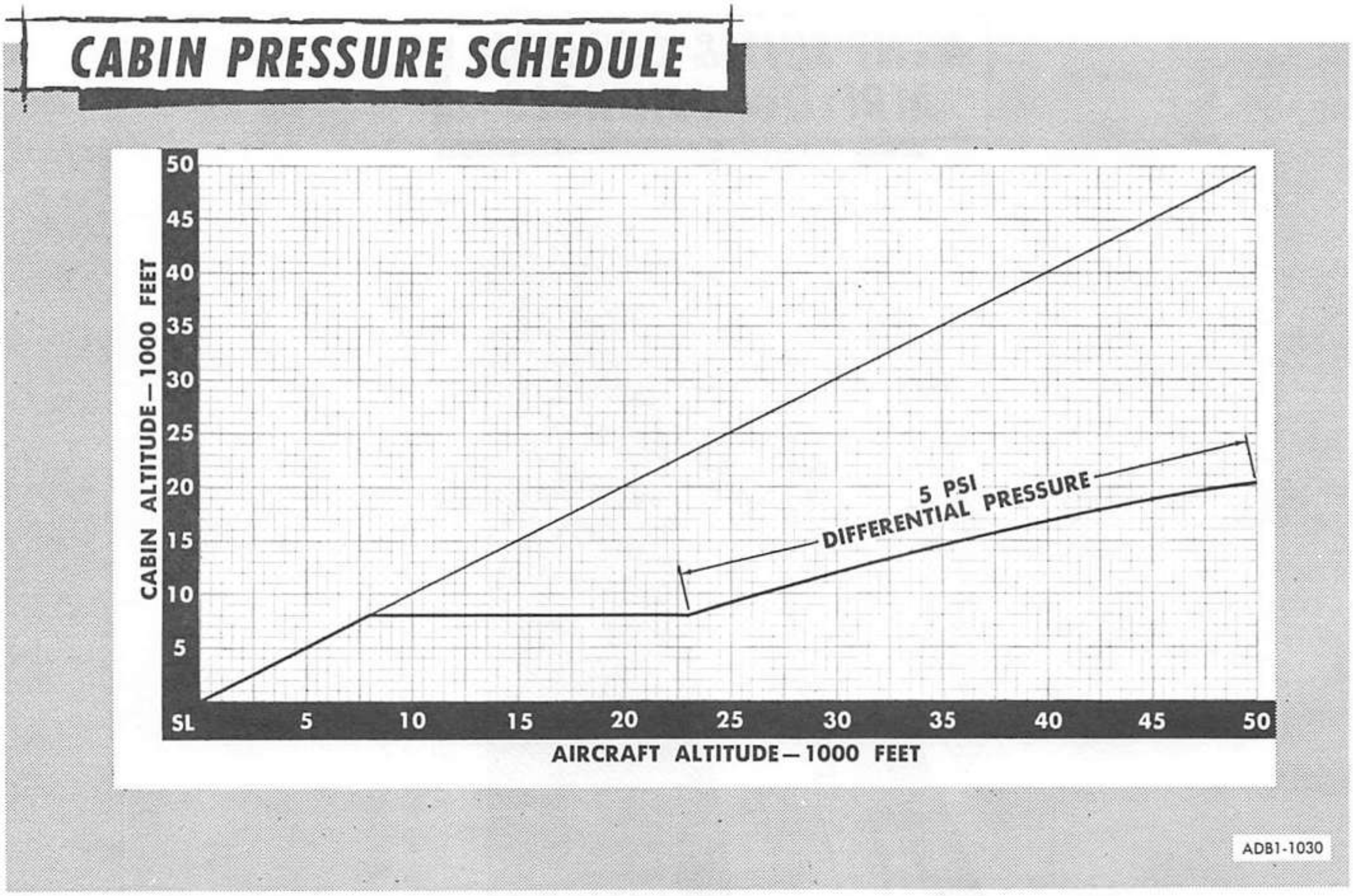

Figure 1-37

CAUTION

Ensure that the air conditioning master switch is in the NORM position prior to depressing the G-valve test button. Hot engine bleed air will be pumped through the anti-G suit if the test button is depressed when the air conditioning master switch is OFF

DEFOGGING SYSTEMS

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

Defog Airflow Thumbwheel

The defog airflow thumbwheel on the air conditioning control panel (figure 1-35), allows the crew to engage the defogging system and regulate the pressure of the defog air to the transparent cockpit areas. With the canopy closed and the air conditioning master switch at NORM, turning the thumbwheel to the right engages the defogging system. The defog pressure regulator shutoff valve becomes energized, opens the valve, and allows temperature-controlled air to flow through the system to the cockpit diffusers. As the thumbwheel rotation is continued, the flow of air to the transparent areas is increased. Conversely, rotating the thumbwheel to the left decreases the flow of air to these areas. The air supply to the canopy is automatically shut off when the canopy is opened.

CANOPY DEFOGGING

The defog airflow is directed to the windshield and side panels any time the system is operating. To direct defog airflow to the canopy, the canopy defog knob must be moved forward (ON). Before descending after prolonged cold soaking the defog airflow thumbwheel should be actuated toward HI and the defog knob should be moved to full ON (figure 1-39).

Canopy Defog Knob

A manual canopy defog knob (figure 1-39), on the upper center structure of the canopy, permits the crew to modulate, or shut off completely, portions of total defogging flow delivered to the canopy diffusers. This

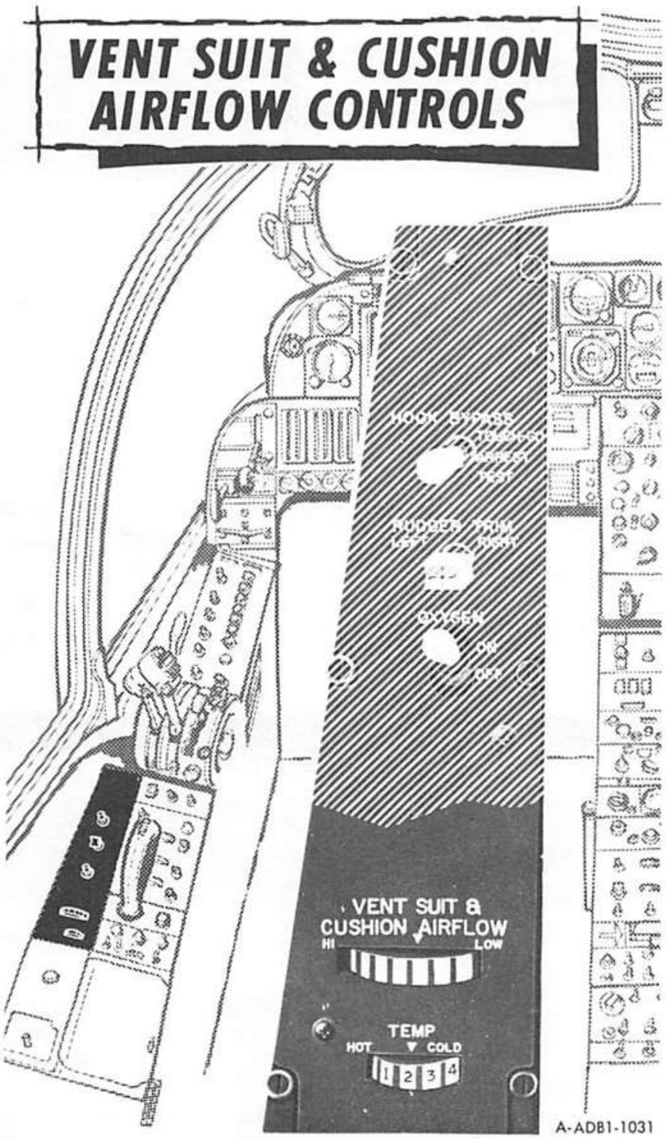

Figure 1-38

is accomplished by means of a push-pull cable connected to a butterfly valve. Moving the knob aft (OFF) decreases the airflow to the canopy and increases windshield airflow.

WINDSHIELD DEFOGGING SYSTEM OPERATION

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

WINDSHIELD WASHING SYSTEM

The windshield washing system cleans the windshield by directing a stream of 50% water-methyl alcohol mixture over the outside surface of the glass. The washing system uses engine bleed air, cooled through the auxiliary heat exchanger, to pressurize the fluid tank. The pressure in turn, forces the fluid through a series of nozzles immediately forward of the left windshield. The fluid is carried across the glass surface by the airstream. The windshield washing control valve oontrols the air flow to the tank and regulates the tank pressure while the system is operating. It also shuts down the system, and dumps tank pressure to ambient when the system is not in use. A description of the windshield switch is given under the rain removal (anti-ice) system.

WINDSHIELD WASHING SYSTEM OPERATION

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

RAIN REMOVAL (ANTI-ICE) SYSTEM

The rain removal system uses hot engine bleed air to remove ice and rain from the pilot's windshield. The rain removal pressure regulator shutoff valve controls the air flow to the windshield. When the valve becomes energized it opens, allowing hot engine bleed air to be discharged through a series of diffuser outlets in the rain removal nozzle and results in a wide stream of hot air over the pilot's windshield. The control for the rain removal system is on the air conditioning control panel (figure 1-35).

RAIN REMOVAL (ANTI-ICE) SYSTEM OPERATION

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

CAUTION

Operation of the rain removal system is not recommended on a dry windshield or above 360 KIAS.

Windshield Switch

The windshield switch on the air conditioning control panel (figure 1-35) has positions marked AIR, OFF and WASH. Placing the switch to WASH allows electrical power to energize the windshield washing control valve. The valve opens to permit regulated air pressure from the auxiliary section of the ram air heat exchanger to enter the fluid tank. The pressure exerted on the water-methyl alcohol mixture in the tank forces the fluid through five nozzles which directs a stream of fluid at the pilot's windshield. The stream remains constant and as the switch is spring-loaded to the OFF position will continue as long as the switch is held to WASH. Placing the switch to AIR energizes the rain removal pressure regulator shutoff valve. The valve opens allowing hot engine bleed air to be directed to the pilot's windshield.

EQUIPMENT COOLING SYSTEM

The equipment cooling system employs ram air, refrigerated air, and a controlled mixture of refrigerated air and hot engine bleed air to cool electronic equipment located in various sections of the aircraft. With an engine running and the air conditioning master switch at NORM, operation of the equipment cooling system is entirely automatic. Air flow is controlled by a combination of temperature sensors and flow control valves, by sonic venturi's and by the equipment cooling pressure regulator (figure 1-34).

COMPUTER OVERHEAT LIGHT

The computer overheat caution light is located on the annunciator panel (figure 1-28) and is inoperative.

ENGINE ANTI-ICING SYSTEM

An independent system for preventing or removing ice at the engine inlet guide vanes is provided on each engine. Hot air, taken directly from the compressor,

Figure 1-39

is ducted to the vane area when the pilot anticipates icing conditions. The engine anti-ice switch controls the engine anti-ice system (figure 1-35).

ENGINE ANTI-ICE SWITCH

The engine anti-ice switch is a two position toggle switch (ON and OFF) located on the air conditioning panel (figure 1-35). Placing the switch ON allows electrical power to energize the anti-icing air shutoff valve which opens and allows hot engine bleed air to be distributed to the guide vanes.

PITOT HEAT SWITCH

The pitot heat switch, on the air conditioning control panel (figure 1-35), is a two-position switch marked ON and OFF. Placing the switch ON allows electrical power to be supplied from the primary 28V DC bus to a resistance type heater in the pitot tube. It also energizes heaters in the angle-of-attack probe.

LIGHTING SYSTEMS

INTERIOR LIGHTING SYSTEM

The interior lighting system provides maximum controlled lighting for the instrument panels and consoles, and consists of the pilot's lighting system, ECM operator's lighting system, and the aft equipment bay dome light and switch. The pilot's lighting system consists of the flight instrument lights, console lights, indexer light, floodlights, kneeboard light, utility light, and daylight floodlights. The system provides the pilot

EQUIPMENT COOLING & PRESSURIZATION SYSTEM

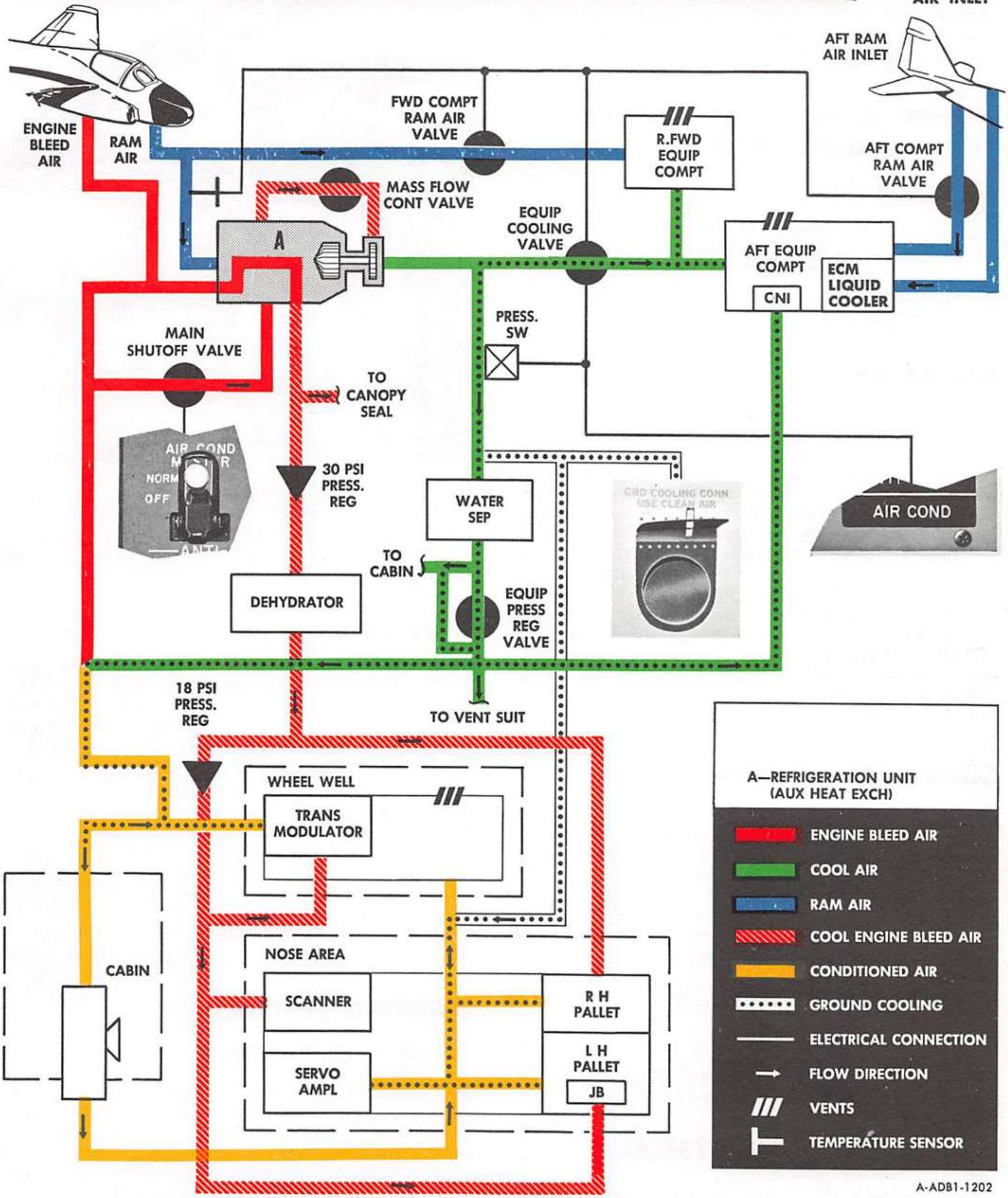

Figure 1-40

with complete control over the lighting of his instrument panel and consoles as well as the intensity of all caution and advisory lights. The ECM operator's lighting system, on the other hand, consists of the ECM operator's instrument panel lights, ECM operator's console lights, and the utility light. The system provides the ECM operator with complete control over the lighting of his instrument panel and console. In addition there is a rheostat controlled chart light equipped with a permanently installed red lens, available to the ECM operator. This light is mounted on the right forward frame of the canopy and provides light for the ECM operator's chart table. The aft equipment bay dome light and switch system is on the top of the aft equipment bay, and provides lighting of the bay for maintenance personnel. This light can be turned on only when external electrical power is supplied to the aircraft. Electrical power for lighting of all flight instruments is supplied by the essential 28V DC bus and the primary 115V AC bus, and power for lighting of all other instruments comes from the monitored 115V AC and 28V DC buses. Power for secondary flood lights is supplied by the essential bus. All controls for operation of the pilot's internal lighting system except the kneeboard, utility, and daylight floodlights are on the master light panel, and those used for the ECM operator's lighting system are on internal lights panel.

Daylight Floodlights

Four daylight floodlights are mounted on the canopy bow to minimize the possibility of flash blinding due to lightning or nuclear blast (with or without the radiation shield). Two 40-watt lamps are oriented to illuminate the pilot's and the ECM operator's instrument panels. Two 20-watt lamps illuminate the left and right consoles. The lights are controlled by a three-position switch on the aft side of the canopy bow. The positions of the switch are BRIGHT (forward), OFF (center), and DIM (aft).

Utility Lights

There are three utility lights in the cockpit. Two of the lights are on either side of the cockpit on the cockpit longerons. The third light is overhead on the canopy bow. Each light has an individual ON/OFF switch, a rheostat control, and the option of red or white filter and flood or spot illumination. Alligator clips and swivel mountings allow the lights to be placed in any convenient location for maximum utilization.

Pilot's Kneeboard Light

The pilot's kneeboard light is on the canopy bow and directs a beam of light to the pilot's right knee. The light is controlled by an individual ON/OFF switch mounted on the light.

Master Light Control Panel (Pilot's)

PILOT'S FLIGHT INSTRUMENT LIGHTS THUMBWHEEL

The INSTRUMENT lights thumbwheel is on the master light panel (figure 1-41) and controls the illumination of the flight instruments on the pilot's instrument panel and of the caution and advisory lights. Rotating the flight instrument thumbwheel to dim, illuminates the instruments at a low intensity, whereas with the thumbwheel at bright, they will illuminate with maximum intensity. Provisions are incorporated into the pilot's flight instrument lighting circuitry so that the flight instrument lights must be illuminated before lighting of non-flight instruments may be accomplished. This control also actuates the warning light dimming circuits.

PILOTS CONSOLE LIGHTS THUMBWHEEL

The CONSOLE thumbwheel on the master light panel (figure 1-41), controls the illumination of the pilot's left and center consoles and the optical sighthead elevation thumbwheel. With the flight instrument thumbwheel set at either dim or bright, rotating the console thumbwheel to dim, lights the instruments on the pilot's left and center consoles at a low intensity. Conversely, rotating the thumbwheel to bright allows the instruments to be illuminated at maximum intensity.

APPROACH INDEXER LIGHT THUMBWHEEL

The APPROACH INDEX thumbwheel on the master light panel (figure 1-41), controls the illumination of

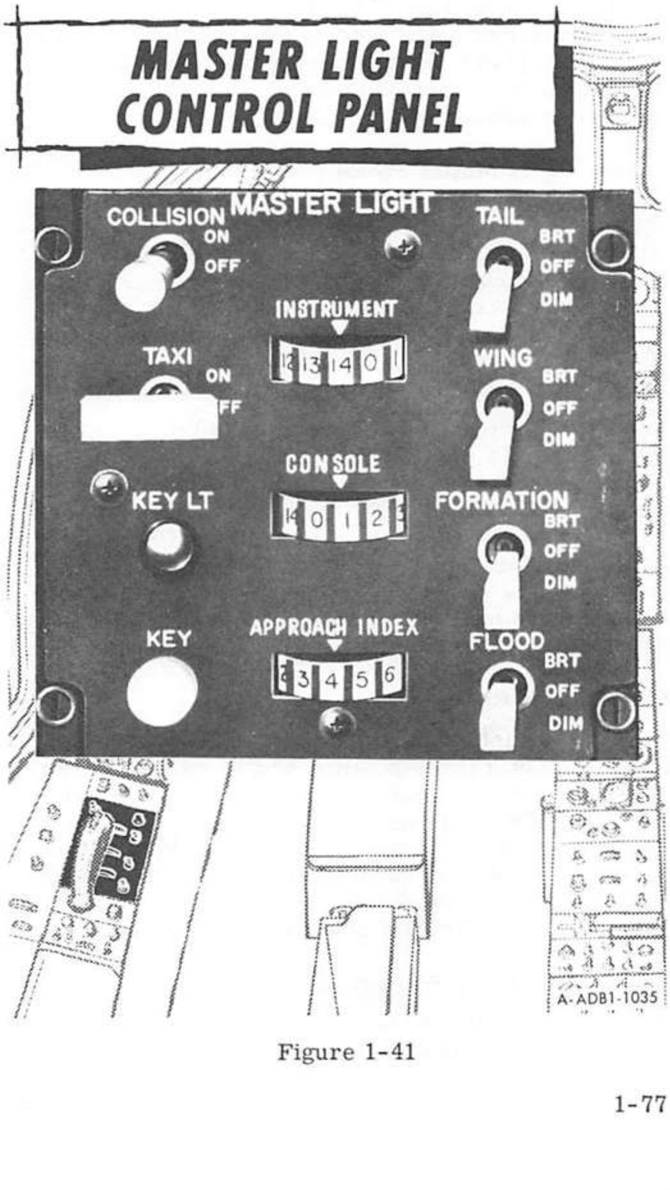

Figure 1-41

the approach light indexer. With the flight instrument thumbwheel set at either dim or bright, rotating the indexer thumbwheel to dim illuminates the indexer at a low intensity. Conversely, rotating the thumbwheel to bright illuminates the indexer at maximum intensity.

EXTERIOR LIGHTING

Position, formation, anti-collision, and taxi lights make up the exterior lighting system of the aircraft. The position lights are in the leading edge of the right and left wings, and in the tail of the aircraft. The position light in the right wing is green, the one in the left wing is red, and the tail light is white. A KEY LT indicator lamp and KEY pushbutton, on the master light panel (figure 1-41), allow the pilot to signal with the position lights. The formation lights are: a yellow light on either side of the fuselage (aft of the wing trailing edge), a red light on the left wing tip, and a green light on the right wing tip. Each of the wing tip formation lights contains two lenses; one in the upper portion of the wing tip and the other in the lower portion. Two anti-collision lights, one on the aft portion of the cockpit canopy and one on the underside of the nose section forward of the nose gear door fairing, are used on the aircraft. The nose gear light automatically goes off when the nose gear is extended. Each of the anti-collision lights contain two rotating lamps and a red lens. The taxi light is on the nose gear door fairing. All controls for the exterior lights are on the master light panel (figure 1-39), with the exception of the exterior lights master switch, which is on the catapult grip.

Exterior Lights Master Switch

The exterior lights master switch at the end of the catapult grip (figure 1-24) is a slide type switch with positions ON and OFF. No external lights except anti-collision and taxi light can be turned on until the exterior lights master switch has been positioned to ON.

Wing Light Switch

The WING switch on the master light panel (figure 1-41), controls the position lights on the right and left wings. The switch is a three-position toggle switch marked BRT, OFF, and DIM. With the exterior lights master switch actuated to ON, placing the wing position light switch to BRT turns the wing position lights on bright, using 28V DC power from the monitored bus. Placing the switch to DIM puts a resistor in series with the lights and dims them.

Tail Light Switch

The TAIL switch controls the position light on the tail. The switch is a three-position toggle switch, on the master light panel (figure 1-41) and is placarded BRT, OFF, and DIM. With the exterior lights master switch actuated to ON, placing the tail position light switch to BRT turns the tail position light on bright with 28 V DC from the monitored bus. Placing the switch to DIM illuminates the light at a dimmed intensity.

Key Light and Key Pushbutton

The KEY LT indicator lamp and KEY pushbutton, on the master light panel (figure 1-41), allow the pilot to signal with the position lights. Depressing the KEY pushbutton causes the position lights to go off. The KEY LT indicator lamp reproduces the signal being displayed by the position light. The KEY LT indicator must be illuminated by actuating the external lights master switch before external lighting can be accomplished.

Formation Light Switch

The FORMATION switch on the master light panel (figure 1-41) is a three-position toggle switch marked BRT, OFF, and DIM. The switch controls the formation lights on either side of the fuselage and at the left and right wing tips. With the external lights master switch actuated to ON, placing the formation light switch to BRT connects 28V DC power from the monitored bus to all formation lights. Selecting the DIM position of the switch dims the lights by putting a resistor is series with them.

Collision Light Switch

The COLLISION switch controls the anti-collision lights on the aft end of the canopy and the underside of the nose. The switch is a two-position toggle switch, located on the master light panel (figure 1-41), and has positions marked ON and OFF. Placing the collision light switch ON directs 115V AC power from the primary bus to the anti-collision lights.

Taxi Light Switch

The TAXI switch on the master light panel (figure 1-41), is a two-position, bar type switch marked ON and OFF. The switch controls the taxi light on the nose gear door fairing. Placing the switch ON allows electrical power to illuminate the light.

LIGHTING CONTROL PANEL (ECMO)

The INTERIOR LIGHT panel (figure 1-42) is located on the ECM operator's right console immediately aft of the oxygen control panel. The function of each of the control switches is provided in the following paragraphs.

Panel Light Control

The PANEL light control (figure 1-42) provides the ECM operator with a means of adjusting the intensity of the control panel lighting. The control provides an OFF and bright (BRT) position, with intermediate positions offering varying degrees of panel light intensity.

Console Light Control

The CONSOLE light control (figure 1-42) provides a means of adjusting the intensity of light to the ECM operator's right console. The control has DIM and bright (BRT) positions, with intermediate positions offering varying degrees of console light intensity.

Note

Lighting of the console cannot be accomplished until the panel light control has first been rotated ON.

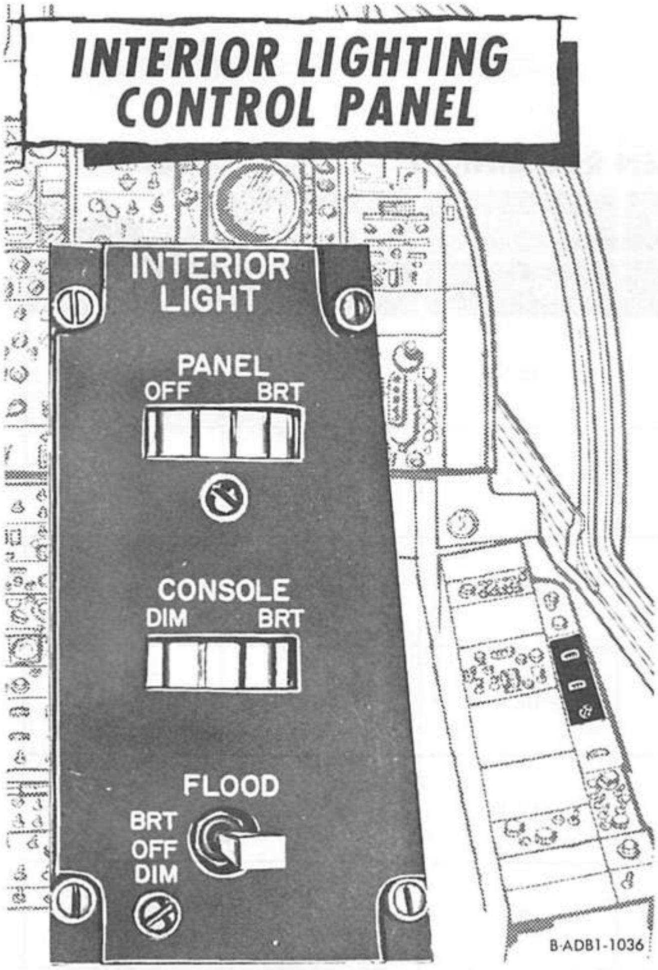

Figure 1-42

Floodlight Control Switch

The FLOOD switch (figure 1-42) is a three-position toggle switch that controls the floodlights below the canopy sill and below the glareshield. The switch provides for three operating conditions: bright (BRT), DIM, and OFF.

DAYLIGHT FLOODLIGHT SWITCH

The daylight floodlight switch (DAY FLOOD LTS) (figure 1-41) is a three-position (BRT, OFF, and DIM) switch on the aft side of the canopy bow that may be actuated by the pilot or ECM operator. When the switch is placed to BRT or DIM, two 40-watt lamps are oriented to illuminate the pilot's and ECM operator's instrument panels and two 20-watt lamps illuminate the left and right consoles. Under normal conditions, the daylight floodlight switch will be in the OFF position and should be used only when there is need for a high-intensity source of light.

ECM OPERATOR'S MASTER TEST BUTTON

This pushbutton control is located on the ECM operator's right console (figure 1-7) and provides the operator with a means of preflight testing of all advisory lights on the ECM operator's instrument panel and the right console. Upon application of external power, or after the engines have been started, depressing this button should cause all advisory lights to illuminate. The lights will go out when the pushbutton is released.

OXYGEN SYSTEM

The liquid oxygen system is designed to manufacture and deliver gaseous oxygen to the crew to enable them to operate above 10,000 feet altitude and to maintain peak body efficiency at altitudes above 5,000 feet. The system delivers oxygen mixed with cockpit ambient air up to an altitude of approximately 30,000 feet; however, the aircrewman can manually switch the regulator to 100% oxygen at any time. Above 30,000 feet cabin altitude an aneroid device in the system automatically closes off the entrance of ambient air. A safety feature built into the system precludes the possibility of 100% ambient air delivery by shutting off the air supply if the aneroid device fails. This forces the crew to select emergency oxygen. The oxygen source of the system is a supply of liquid oxygen stored in a 10-liter oxygen converter in the aft equipment compartment. In addition, the converter installation has provisions for the installation of a second similar converter for use during long-range missions. Systems pressure is maintained at 70 to 110 PSI by pressure closing valves on the converter and by a system relief valve. See figure 1-44 for oxygen duration.

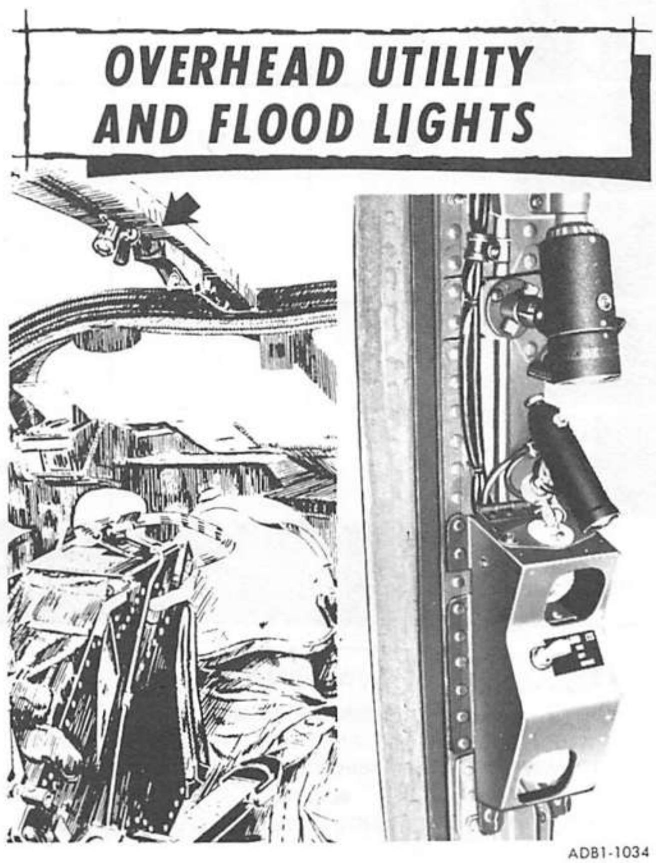

Figure 1-43

OXYGEN DURATION CHART

MAN HOURS OF OXYGEN REMAINING

CABIN ALTITUDE	10,000 FEET	15,000 FEET	20,000 FEET	25,000 FEET	30,000 FEET	35,000 FEET and above
LITERS	100% O_2	100% O_2	100% O_2	100% O_2	100% O_2	100% O_2
10	11.0	13.4	16.5	20.5	25.5	32.2
9	9.9	12.1	14.8	18.4	23.0	29.0
8	8.8	10.7	13.2	16.4	20.4	25.7
7	7.7	9.4	11.5	14.3	17.9	22.6
6	6.6	8.0	9.9	12.3	15.3	19.3
5	5.5	6.7	8.2	10.2	12.8	16.1
4	4.4	5.3	6.7	8.2	10.2	12.9
3	3.3	4.0	4.9	6.1	7.6	9.6
2	2.2	2.6	3.3	4.1	5.1	6.4
1	1.1	1.1	1.6	2.0	2.5	3.2
LESS THAN 1	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN					

WARNING

WHEN TWO PERSONS ARE USING OXYGEN, DIVIDE THE NUMBER OF HOURS REMAINING BY TWO.

NOTE

- DURATION DATA SHOULD BE USED AS A GUIDE ONLY SINCE OXYGEN CONSUMPTION VARIES WITH THE INDIVIDUAL.
- CONVERSION OF LIQUID O_2 TO GASEOUS O_2 IS 860 LITERS OF GASEOUS TO 1 LITER OF LIQUID O_2.
- CONSUMPTION RATES ARE BASED ON MIL 1-19326C (WEP) 1960.
- CONSUMPTION RATES SHOWN ARE FOR 1 MAN.

ADB1-1037

Figure 1-44

Liquid oxygen is converted to a gaseous oxygen and is delivered through a single line to the heat exchanger and plenum assemblies on the aft sloping bulkhead of the cockpit. In the plenum, conditioned oxygen is stored before being delivered through the shutoff valves to the seat-mounted personnel services disconnects. The diluter demand oxygen regulators, one at each seat, govern the pressure and flow of gaseous oxygen from the personnel services disconnect to the face mask of the seat occupant.

In addition to the liquid oxygen supply, each ejection seat is equipped with a cylinder of compressed oxygen capable of supplying emergency oxygen for approximately 10 minutes. Each seat is equipped with a pull-type lanyard for switching to emergency oxygen operation.

OXYGEN CAUTION LIGHT

The oxygen caution light on the annunciator panel (figure 1-28) indicates that sufficient pressure is not being maintained, or that the liquid oxygen content of the converter is two liters or less. When the oxygen pressure drops below 50 PSI, a pressure switch, attached to one of the oxygen pressure lines, is closed. This allows electrical power to illuminate the oxygen warning light.

Lox/Full Press-To-Test Button

Pressing the LOX-FUEL press-to-test button on the master test panel causes the oxygen quantity gage to drop to zero and the oxygen warning light to illuminate as the needle drops below the 2 liter mark.

OXYGEN REGULATOR

A diluter-demand oxygen regulator located on the right side of each ejection seat (figure 1-32) allows the pilot and the ECM operator to direct oxygen flow to their face mask as desired.

Oxygen Switch

The oxygen switches on the pilot's left console and ECM operator's right console are two position lever switches marked ON and OFF, and are used to control the flow of oxygen to the regulator. Lifting the lever handle out against the pressure of the lever handle spring disengages the lever from its notch and allows it to be placed ON. This opens the oxygen shut-off valve, permitting oxygen under pressure to flow through the valve. Placing the switch OFF closes the valve and all oxygen flow through the valve.

Oxygen Regulator Selector Knob

This control is located on the top of the regulator assembly (figure 1-32) and is used to position the internal valve assembly and the aneroid. The knob is rotated counterclockwise to the full UP position to get diluter-demand operation of the regulator. Rotating the knob clockwise repositions the valve, permitting 100% oxygen to flow to the mask.

WARNING

During in-flight emergencies such as cockpit or electrical fires, the oxygen regulator selector valve should be positioned for 100% oxygen flow to prevent smoke and fumes being inhaled.

OXYGEN QUANTITY GAGE

The oxygen quantity gage (figure 1-2) at the top right side of the pilot's instrument panel indicates the quantity of liquid oxygen in the converter. The gage reads 20 liters maximum so as to be usable when two converters are used. Oxygen duration is shown in figure 1-44.

EMERGENCY OXYGEN MANUAL CONTROL

A ring attached to the individual emergency oxygen bottle through a cable and linkage assembly on the right side of each ejection seat (figure 1-32) allows the pilot and ECM operator to actuate an emergency oxygen supply. Pulling the ring opens a valve allowing oxygen to pass through the regulator and on to the mask.

Note

The emergency oxygen supply is automatically actuated when the Martin-Baker seat is ejected.

AUTOMATIC FLIGHT CONTROL SYSTEM

The AFCS (Automatic Flight Control System) currently provides the aircraft with two modes of operation:

Stability Augmentation (STAB AUG).

Pilot Relief (AUTO) with sub-modes of Altitude-hold or Mach-hold.

Note

The Automatic Modes of Command (CMD) and RETURN TO LEVEL are presently inoperative.

AFCS CONTROL PANEL

The AFCS control panel placarded AUTO PILOT is located on the center console (figure 1-45). The panel accommodates the ON/OFF and AUTO/STAB AUG switches, the ALT and MACH hold buttons and the inoperative CMD switch and RETURN TO LEVEL BUTTON.

AFCS EMERGENCY DISCONNECT

The AFCS emergency disconnect displays AUTO PILOT OFF and is coded with yellow and black barber pole stripes. The disconnect is on a junction box immediately below and to the right of the control stick grip (figure 1-45). When the disconnect is actuated momentarily electric power is disconnected from all

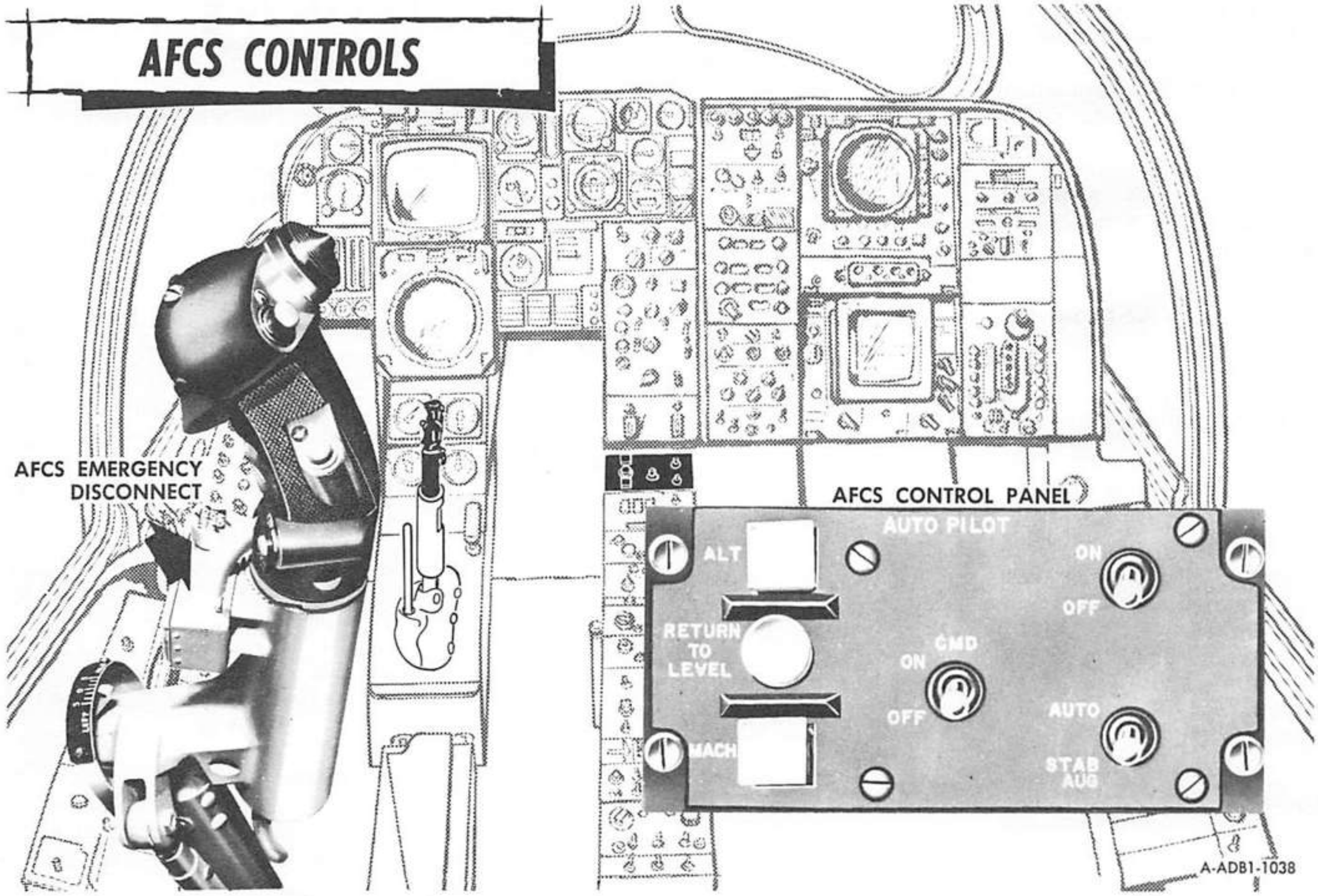

Figure 1-45

AFCS circuits and any engaged switches or buttons on the AFCS control panel automatically return to the off position.

WARNING

- In the event any unusual oscillations or vibrations are felt in the flight controls or any flight control malfunction is suspected, immediately actuate the AFCS emergency disconnect and eliminate the AFCS as a possible cause.
- When the AFCS emergency disconnect is actuated, if all the switches and buttons on the AFCS control panel do not automatically return to the OFF position, they should be positioned to OFF manually and/or the AUTO PILOT circuit breaker on the crew member's circuit breaker panel pulled out.

STABILITY AUGMENTATION MODE (STAB AUG)

Stability augmentation (STAB AUG) improves control of the aircraft by automatically damping oscillations about its pitch, roll and yaw axes, by actuating the stabilizer, flaperon and rudder proportional to pitch, roll and yaw rates respectively. Control surface deflections are not transmitted as movement of the control stick or rudder pedals. There is no evidence of stab-aug action at the control stick or rudder pedals except for the increased stability of the aircraft.

Stab-aug is considered as the manual mode of AFCS operation in that the pilot manually flies the aircraft by stick and rudder. It is also the basic mode in that the automatic mode supplements it.

Autopilot Switch

The autopilot switch on the AFCS control panel (figure 1-45) is an unidentified toggle switch with positions placarded ON and OFF. The ON position is a solenoid held position that engages the STAB AUG mode of AFCS provided electric power and flight hydraulic system pressure is available. The OFF position disengages stability augmentation and any other mode of AFCS operation that may have been selected. When the AFCS emergency disconnect is actuated, or if there is a loss of electric power, or a loss of flight hydraulic system pressure, the solenoid will release the switch from the ON position permitting it to move to OFF, disengaging STAB AUG and any other selected mode of AFCS operation.

Note

The autopilot switch should not be positioned to ON unless electric power has been available for at least 30 seconds to permit gyros to reach operating speed.

PILOT RELIEF MODES

The pilot relief (AUTO) mode is the basic, hands-off, operating mode of the AFCS. In the AUTO mode, the AFCS, in addition to retaining the three-axis damping of stab-aug, provides pitch attitude hold, and either roll attitude hold or heading hold, depending upon whether the AUTO mode is selected at bank angles of greater or less than 5°. The AFCS will operate as described above for any selected pitch angle between 25° nose-up and 60° nose down. Should the aircraft exceed these limits, the AFCS returns the aircraft to the nearest limit of the pitch angle range. Roll attitude hold operates in the same manner as pitch attitude hold. The AFCS holds any roll angle between 5° and 60°. If the 60° limits are exceeded, the AFCS will automatically return the aircraft to a 60° roll attitude. Aircraft heading is held fixed at the flight heading existing when the stick is released with AUTO mode engaged, provided the aircraft roll attitude is less than 5°. In the AUTO mode of operation, additional pilot relief functions are available to the pilot as desired. They include altitude hold and mach hold. In the normal mode of operation, the AFCS received attitude and heading information from the TGCAD and MF-1. Force switches in the base of the stick grip detect pilot applied forces (exceeding 1.1 pounds) to the stick grip and interrupt the AUTO mode. Upon release of the stick grip the AUTO mode will resume operation.

Note

- The heading hold function is engaged at bank angles of less than 5° when the manual control stick force is removed.
- The auto mode can be engaged when the servo assemblies of the air navigation computer pitch, roll and heading modules are aligned to within 2° of the TGCAD and MF-1 and the AC operating voltage of the AFCS is within limits.
- The manual trim switch, on the control stick is deactivated; but pitch is trimmed automatically. Rudder trim is available, as it is in all AFCS modes.

AUTO/STAB AUG SWITCH

The AUTO/STAB AUG switch on the AFCS control panel (figure 1-45) is a two position toggle switch with a solenoid held AUTO position and spring loaded to the STAB AUG position. The STAB AUG position (effectively an OFF position permits stab-aug operation with pilot operated pitch trim available. The AUTO position eliminates pilot operated pitch trim and engages pitch attitude hold, and either roll attitude hold or heading hold depending on the bank angle existing at the time of engagement. See preceeding paragraph. If the autopilot switch is moved to OFF the solenoid will release the AUTO/STAB AUG switch from the AUTO position permitting it to move to STAB AUG.

ALTITUDE HOLD MODE

The altitude-hold mode (a sub mode of AUTO) maintains the aircraft at the pressure altitude existing at the time of engagement. Changes in barometric pressure cause the air data computer to command pitch attitude changes to return the aircraft to the pressure altitude existing at the time of engagement. Force switches in the base of the stick grip detect pilot applied forces (exceeding 1.1 pounds) and disengage the ALTITUDE HOLD MODE.

Altitude Button

The altitude button on the AFCS control panel (figure 1-45) is a solenoid held pushbutton switch placarded ALT. Depressing the button engages the altitude-hold mode. The button will only remain depressed if the autopilot switch is ON and the AUTO/STAB AUG switch is in AUTO. If the Mach-hold button was previously depressed, it will disengage when the altitude button is depressed. The altitude button may be disengaged by pulling it up, or positioning the AUTO/ STAB AUG switch to STAB AUG momentarily, or by depressing the Mach button, or by applying force to the stick grip.

MACH HOLD MODE

The Mach-hold mode (a sub mode of AUTO) maintains the aircraft at the Mach number existing at the time of engagement within the limits of ±.02. Changes in Mach number cause the air data computer to command pitch attitude changes to return the aircraft to the Mach number existing at the time of engagement. Force switches in the base of the stick grip detect pilot applied forces (exceeding 1.1 pounds) and disengage the MACH HOLD MODE.

Mach Button

The Mach button on the AFCS control panel (figure 1-45) is a solenoid held pushbutton switch placarded MACH. Depressing the button engages the Mach-hold mode. The button will only remain depressed if the autopilot switch is ON and the AUTO/STAB AUG switch is in AUTO. If the alt-hold button was previously depressed, it will disengage when the Mach button is depressed. The Mach button may be disengaged by pulling it up, or positioning the AUTO/STAB AUG switch to STAB AUG momentarily, or by depressing the Altitude button, or by applying force to the stick grip.

COMMAND MODE

This mode is presently inoperative.

Command Switch

The command switch on the AFCS control panel (figure 1-45) placarded CMD is a two position toggle switch with positions ON and OFF. This switch is presently inoperative.

RETURN TO LEVEL MODE

This mode is presently inoperative.

Return to Level Button

The return to level button on the AFCS control panel (figure 1-45) is a pushbutton switch placarded RETURN TO LEVEL. This button is presently inoperative.

AFCS OPERATION

Note

- The autopilot switch should not be positioned to ON unless electric power has been available for at least 30 seconds to permit gyros to reach operating speed.
- Before engaging any AFCS modes verify normal operation of the manual flight control system and electric and hydraulic power supply systems and ensure that the aircraft is trimmed laterally and longitudinally.

1. To engage STAB AUG; autopilot switch - ON. Aircraft will be maneuvered normally by use of stick and rudder.
2. To engage the AUTO mode; With autopilot switch ON, AUTO/STAB AUG switch - AUTO. Again the aircraft is controlled normally by the control stick. When the control stick is released if the bank angle is less than 5°, the aircraft will be leveled automatically and will maintain the heading existing at the time of stick release. If the bank angle is greater than 5° the pitch attitude and bank angle will be maintained in a coordinated turn.
3. To engage ALTITUDE HOLD; Upon reaching the desired altitude with the autopilot switch ON, and AUTO/STAB AUG switch in AUTO, ALT button-Depress. (If Mach hold is engaged, it will disengage.) The aircraft will be maintained at the existing pressure altitude. Force applied to the control stick grip will interrupt altitude hold. When the stick grip is released, altitude hold will resume operation and maintain the new pressure altitude existing at the time of stick release.

CAUTION

Altitude hold should not be flown with bank angles greater than 30°.

Note

- It is recommended, but not mandatory, that the aircraft be in approximately level flight before engaging the ALT control.
- Do not utilize altitude hold to level off from a steep climb or dive maneuver, (i.e., rates of climb or descent exceeding 1000 feet per minute). Although the AFCS will eventually restore the airplane to level flight at the engaging altitude, it is more efficient to achieve approximately level flight manually at the desired altitude prior to selection of the altitude hold mode.

4. To engage MACH HOLD; After stabilizing the aircraft at the desired Mach number with the autopilot switch ON, and AUTO/STAB AUG switch in AUTO, MACH button - Depress. (If the ALT button is engaged, it will disengage.) The aircraft will maintain the existing Mach number. Force applied to the control stick grip will interrupt Mach hold. When the stick grip is released, Mach hold will resume operation and maintain the Mach Number existing at the time of stick release.

CAUTION

Do not engage mach hold mode while at bank angles greater than 30°.

Note

- The MACH HOLD function should be engaged only after the aircraft mach number has stabilized.
- During extended periods of mach hold operation at a constant throttle setting, the aircraft will climb slowly due to the loss of weight (fuel consumption). This is normal and may be corrected by reducing thrust.

MISCELLANEOUS EQUIPMENT

RADIATION SHIELDS

The aircraft may be equipped with manually operated radiation shields (figure 1-46) to completely shield off the glass enclosed portions of the cockpit. The shields present an opaque surface from which light and heat are reflected providing flight crew protection from flash blindness and heat during special weapons deliveries. The radiation shields may be closed or opened at will during flight.

The canopy radiation shield consists of two fixed and two movable panels of molded fiberglass at each side of the canopy, inside the enclosed area. The two sliding panels are suspended on a system of tracks and rollers between the canopy spine and a fixed side panel. When stowed, both movable panels telescope

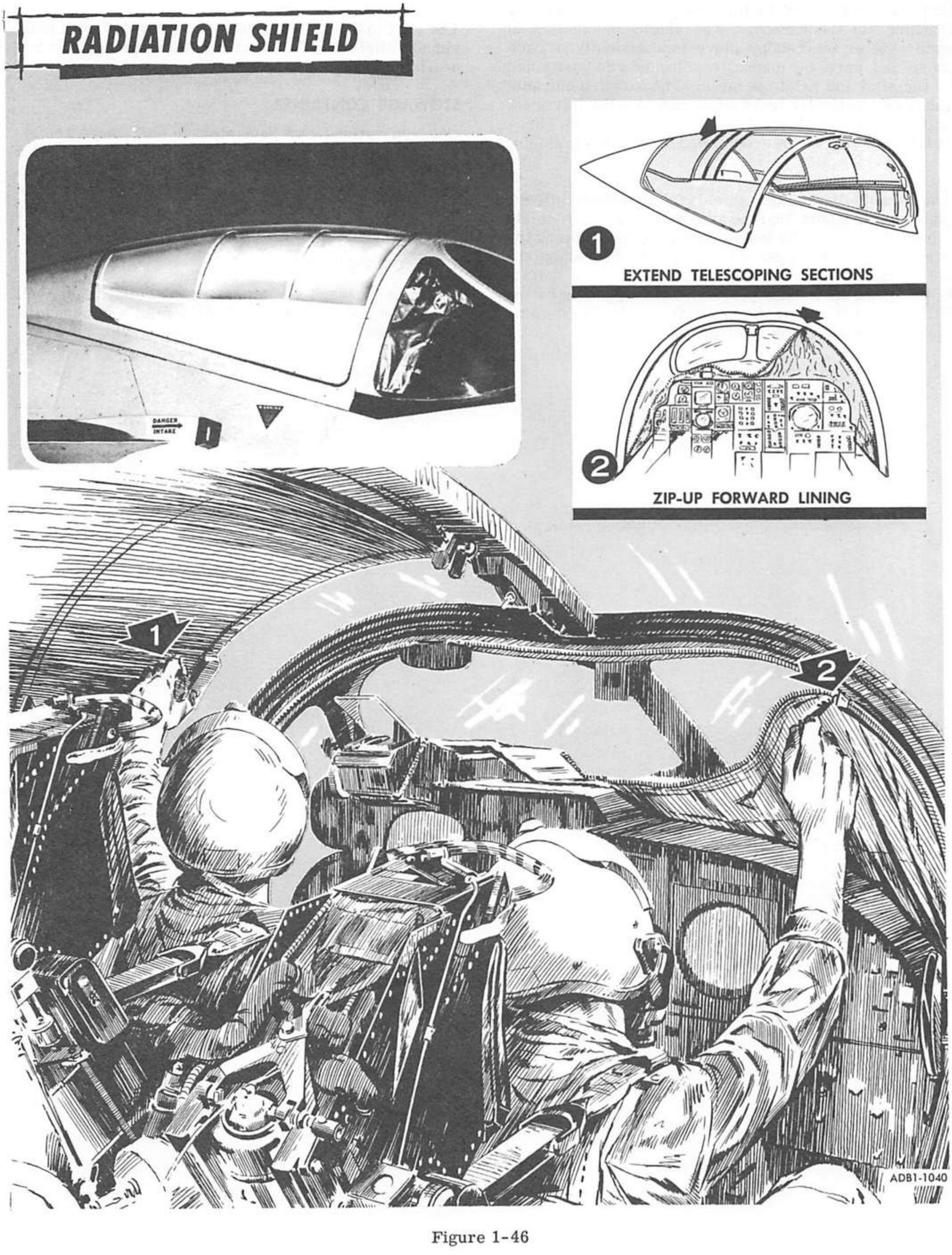
RADIATION SHIELD
DANGER
INTAKE
1
EXTEND TELESCOPING SECTIONS
2
ZIP-UP FORWARD LINING
1
2
ADB1-1040

Figure 1-46

inside a fixed aft panel. When the shields are in use, they extend forward to the canopy bow, completely blanking out the canopy. The shield assemblies in each side of the canopy move independently of each other and must be manually unlocked and positioned by the pilot and ECM operator. The forward movable panel automatically locks when moved to the full open, half open or full closed (canopy arch) position. Successful ejection can be accomplished through the shield.

The windshield radiation shield is an aluminized fiberglass cloth insert that is attached to a glare shield mounted on top of the instrument panel underneath the windshield. A zipper assembly attached along the entire inside of the windshield bow permits the curtain to be drawn up to this position when zipped up by the ECM operator and by the pilot. When closed, it completely shields off the windshield.

RELIEF TUBES

The pilot and ECM operator are provided with individual relief tubes. Both relief tubes are stowed beneath the crew member's seat.

STOWAGE CONTAINER

Covered rations and data storage containers are located on the pilot's left console aft of the optical sight control panel and on the ECM operator's right console. The containers are used to store rations and flight data. The containers have hinged covers and locking wing nuts.

THERMOS STOWAGE

Thermos stowage containers are located on the aft portion of the canopy and aft of the pilot's left console. These racks have a hinged and locking wing nut.

part 3
AIRCRAFT SERVICING

TABLE OF CONTENTS

CHARTS

AIRCRAFT SERVICING

The following servicing data (figure 1-47), is provided to lend assistance in the event the aircraft lands at a strange field or the maintenance crews are unfamiliar with the aircraft. See figure 1-50 for servicing diagram.

SERVICING DATA	
FUEL	MIL-J-5624 (JP-5 OR JP-4)
HYDRAULIC FLUID	MIL-H-5606
LIQUID OXYGEN	MIL-O-21749 TYPE II
OIL	MIL-L-23699*
WINDSHIELD WASH METHANOL	MIL-O-232D

*CAUTION: OIL, MIL-L-7808 SHOULD BE USED WHEN TEMPERATURE IS −40°C (−40°F)

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Figure 1-47

LAND OPERATION—MAIN WHEELS

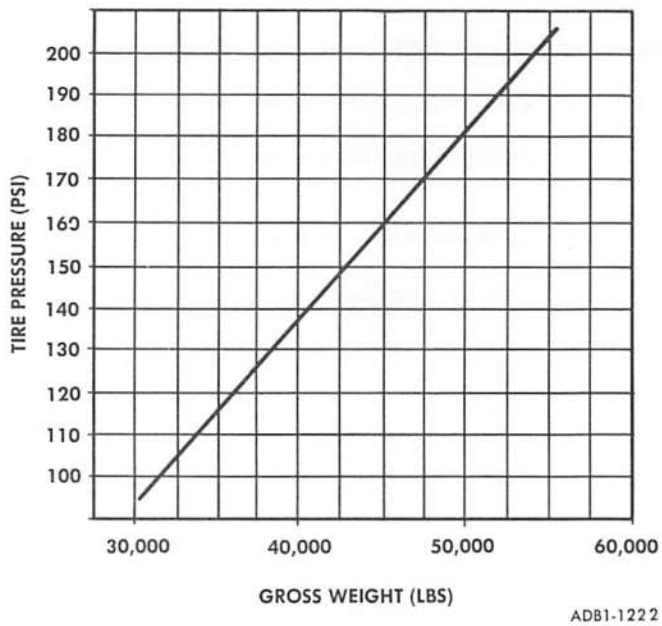


Figure 1-48

AIRCRAFT FUELING

The aircraft can be fueled and defueled on the ground through a single point pressure adapter (figure 1-50). The ground fueling and defueling operation is controlled at the fueling station control panel (figure 1-50). The switches on the fueling station control panel operate shutoff valves in the aircraft fuel system, thereby controlling fuel flow into or out of the internal fuel cells of the fuselage, integral wing tanks and air refueling store. The aircraft can be fueled with wings folded or spread. However, in order to empty the outboard wing tanks, the wings must be spread during defueling operations.

PNEUMATIC PRESSURES

1. Turbine accumulator precharge - 500 PSI
2. Combined hydraulic system accumulator precharge - 2000 PSI
3. Flight hydraulic system accumulator precharge - 2000 PSI
4. Wheel brake accumulator precharge - 800 ±50 PSI
5. Emergency landing gear extension - 2400 PSI (dry nitrogen)
6. Arresting hook dashpot - 1000 PSI (dry nigrogen)

7. Landing gear strut pressures:

   a. Nose gear - 350 PSI (dry nitrogen)

   b. Main gear - See strut nameplate

8. Minimum tire pressures are:

   a. Mains - 230 PSI (carrier) - As shown in figure 1-48 for land

   b. Nose - 290 PSI (carrier) - 175 PSI (land)

TIRE SIZES

Tire sizes for the aircraft are:

1. Mains - 36 x 11-24 P.R. Type VII

2. Nose - 200 x 5.5-12 P.R. Type VII

RESERVOIR CAPACITIES

1. Flight hydraulic system reservoir - 0.74 gals.

2. Combined hydraulic system reservoir - 3.34 gals.

3. Oxygen converter - 10 liters

4. Auxiliary oxygen converter - 10 liters

POWER UNITS

	PNEUMATIC STARTING	ELECTRICAL POWER	AIR CONDITIONING
SHORE BASED	GTC-85-28 GTC-85-72	NC-12, NC-10	NR-3, NR-4
SHIPBOARD	GTC-85-28 GTC-85-72	DECK EDGE POWER NC-10	NR-3, NR-5
STRANGE FIELD REQUIREMENTS	40-50 PSI AT 90 TO 91 LBS. PER MIN., 40° TO 60°F.	115/200V 400 CPS. AC 23 KVA.	3 PSI, 45 LBS PER MIN., 35 TO 50 F.

ADB1-1224

Figure 1-49

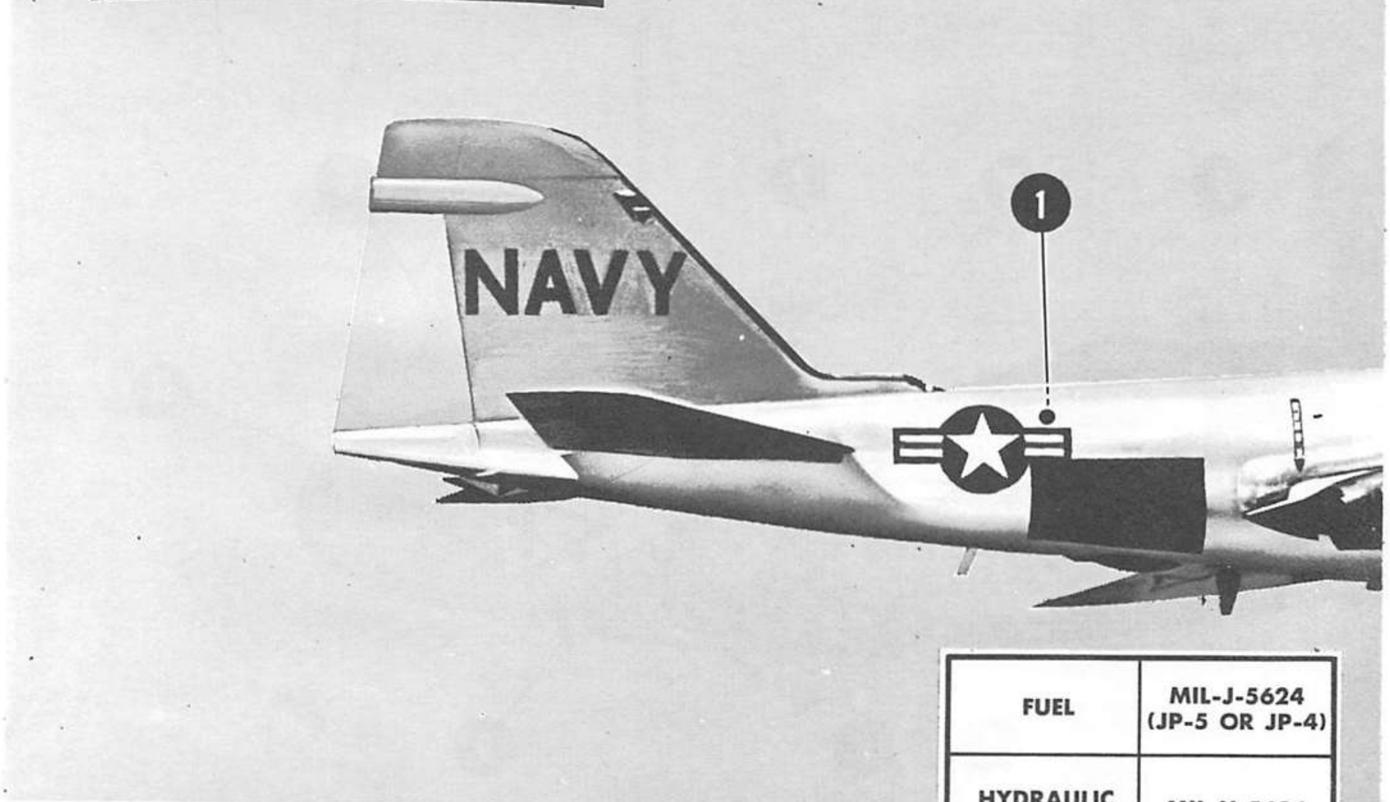
STARTING POWER REQUIREMENTS

Power requirements (figure 1-49) for ship and shore based operations are as follows:

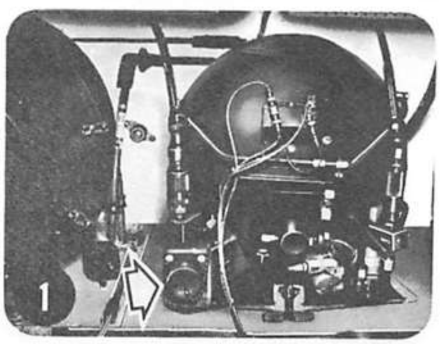
1. Pneumatic compressor - 100 pounds at 50 PSI. Starting electrical power - 23 KVA

2. BACE-ALL BLACK BOXES - 21 KVA

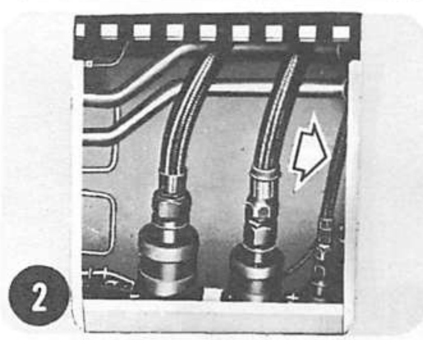
SERVICING DATA



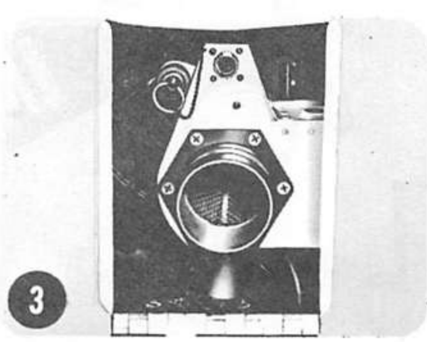
FUEL	MIL-J-5624 (JP-5 OR JP-4)
HYDRAULIC FLUID	MIL-H-5606
LIQUID OXYGEN	BB-O-925
OIL	MIL-L-7808
WINDSHIELD WASH METHANOL	MIL O-M-232D



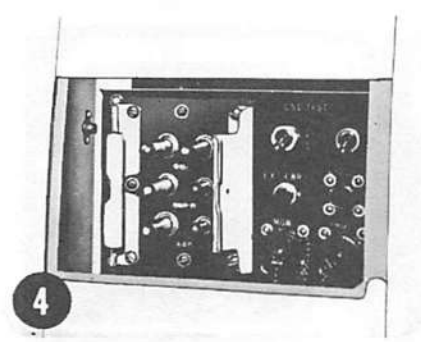
1 LIQUID OXYGEN FILLER VALVE



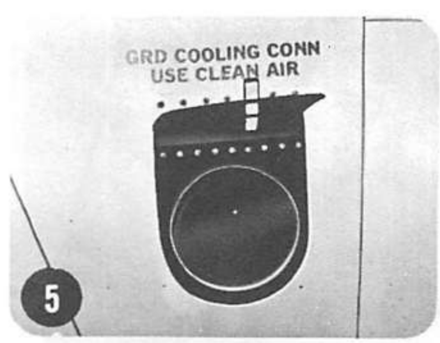
2 FLIGHT HYDRAULIC SYSTEM FILLER LINE (right side)



3 ENGINE STARTING RECEPTACLE



4 EXTERNAL ELECTRICAL RECEPTACLE



5 EXTERNAL COOLING AIR CONNECTION

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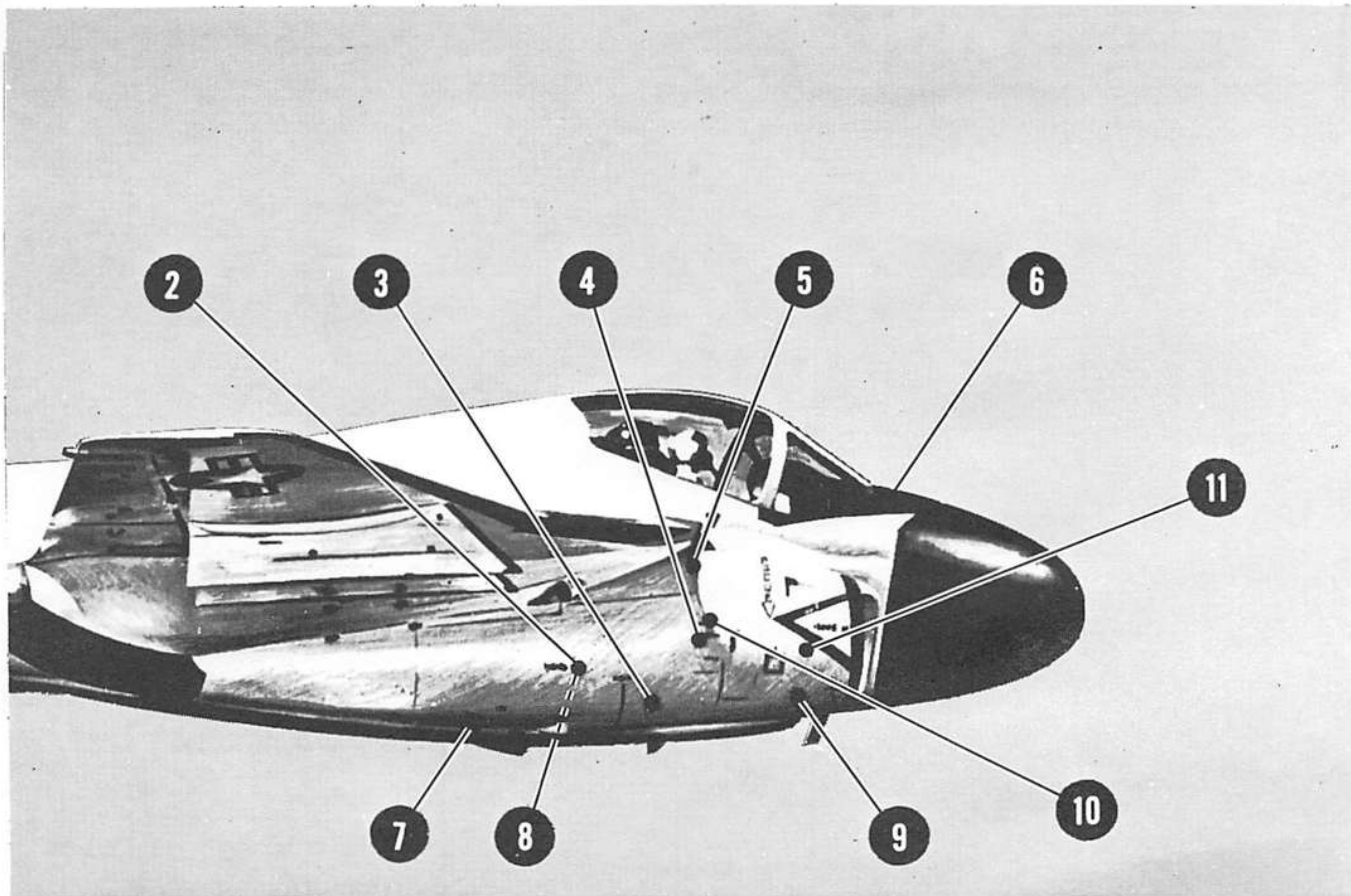
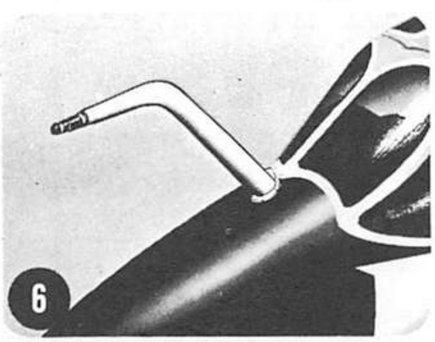
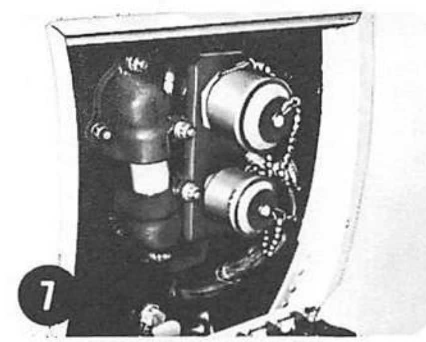
Figure 1-50 (Sheet 1)

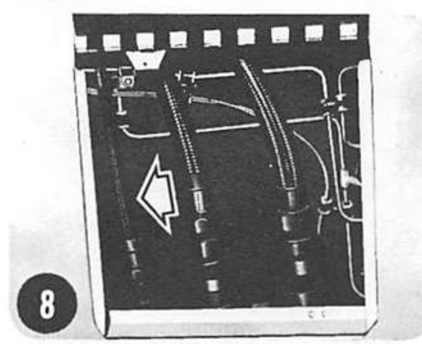




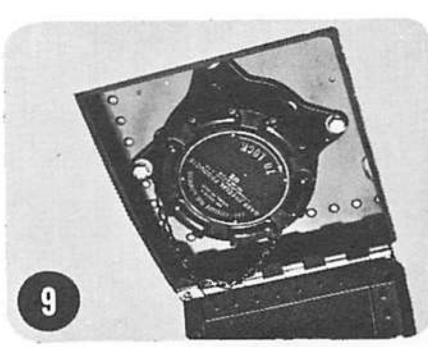
AIR REFUELING PROBE



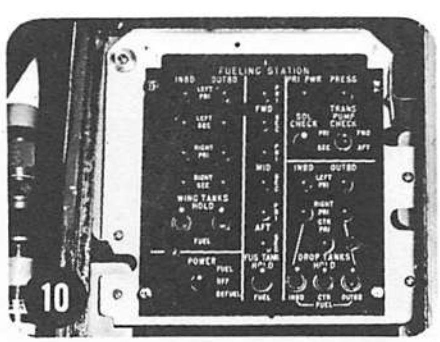
OIL SYSTEM FILLER



COMBINED HYDRAULIC SYSTEM FILLER LINE (left side)



AIRCRAFT FUELING RECEPTACLE



REFUELING STATION CONTROL PANEL

WINDSHIELD WASH TANK FILLER

ADB1-1042-2

Figure 1-50 (Sheet 2)

TURNING RADIUS AND GROUND CLEARANCE

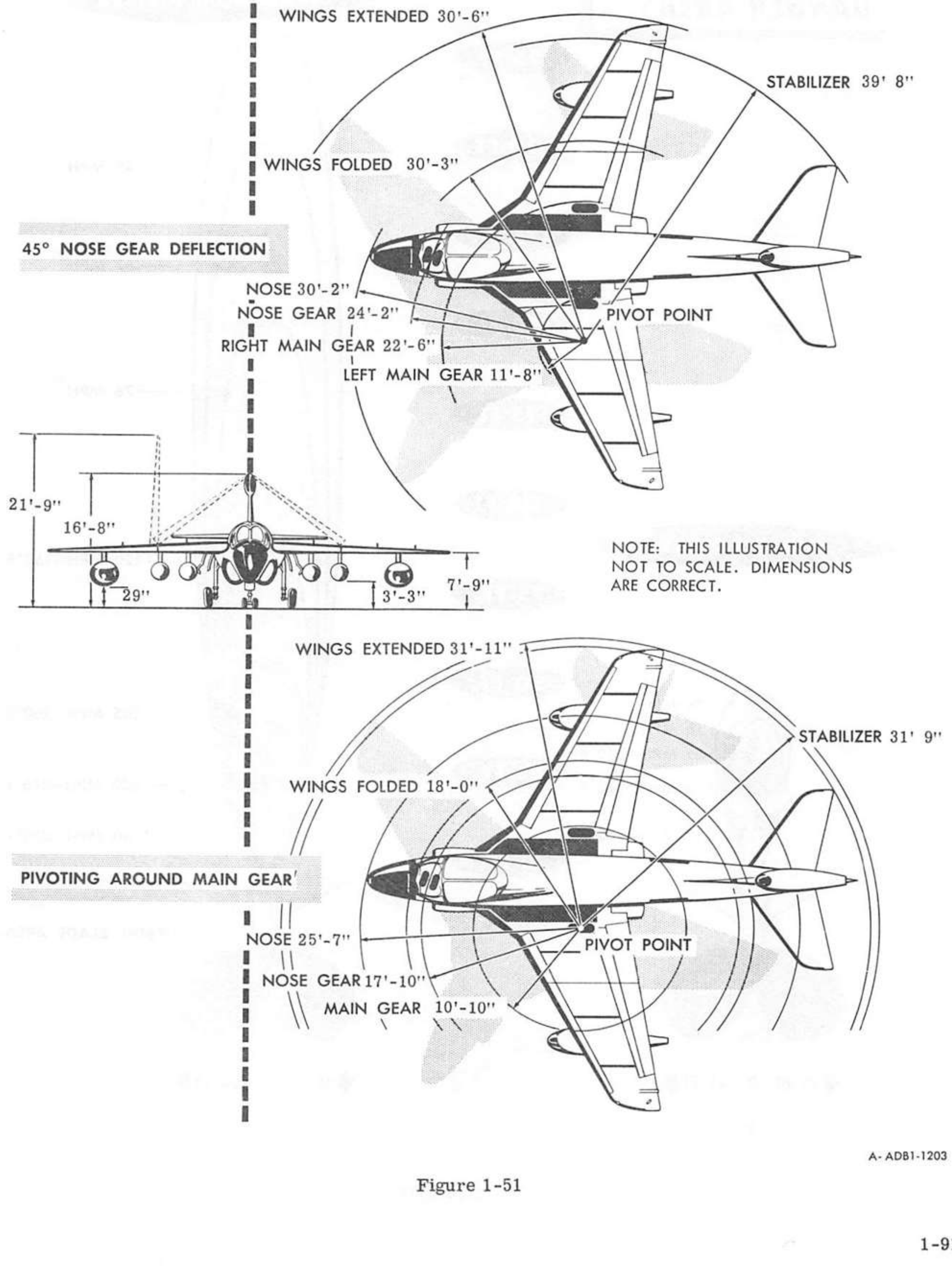


Figure 1-51

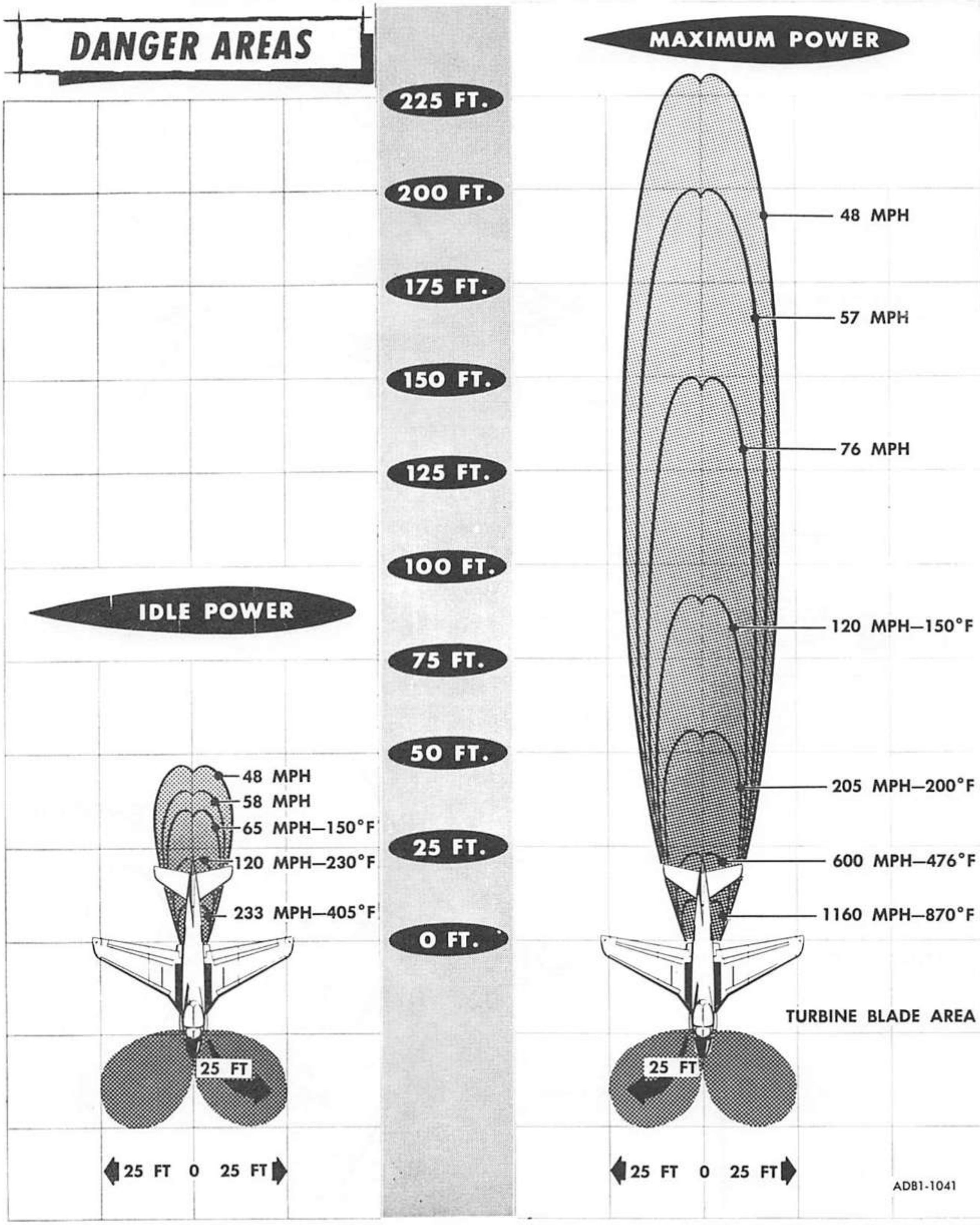

DANGER AREAS
MAXIMUM POWER
225 FT.
200 FT.
175 FT.
150 FT.
125 FT.
100 FT.
75 FT.
50 FT.
25 FT.
0 FT.
48 MPH
57 MPH
76 MPH
120 MPH—150°F
205 MPH—200°F
600 MPH—476°F
1160 MPH—870°F
TURBINE BLADE AREA
25 FT
25 FT 0 25 FT
IDLE POWER
48 MPH
58 MPH
65 MPH—150°F
120 MPH—230°F
233 MPH—405°F
25 FT
25 FT 0 25 FT
ADB1-1041

Figure 1-52

part 4

AIRCRAFT OPERATING LIMITATIONS

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INTRODUCTION

This section includes the aircraft and engine limitations that must be observed during normal operations.

Note

In the event any limits are exceeded the pilot will log the condition on the yellow sheet (OPNAV FORM 3760-2) to ensure corrective action or appropriate inspection.

ENGINE LIMITATIONS

Engine operating limitations are provided by instrument markings (figure 1-53) and in the engine operating limits table (figure 1-54).

AIRSPEED LIMITATIONS

MAXIMUM AIRSPEED LIMITS

See figure 1-55.

CAUTION

Flight with external stores is not permitted into the transonic buffet regime (MACH numbers greater than 0.83 M_i) due to a deterioration of aircraft longitudinal stability and control.

FLIGHT WITH INTERNAL WING FUEL

Flight with internal wing fuel - Maximum speed, all altitudes.

LANDNG GEAR AIRSPEED LIMITS

Landing gear retraction . . . . 200 KIAS
Landing gear extension . . . . 250 KIAS
Landing gear fully extended . . . . 250 KIAS

CANOPY AIRSPEED LIMIT

Opening canopy . . . . 200 KIAS
Canopy fully open . . . . 250 KIAS
Closing canopy . . . . 150 KIAS

FLAP/SLAT AIRSPEED LIMIT

TAKEOFF (30°) position . . . . 250 KIAS
LAND (40°) position . . . . 200 KIAS

CAUTION

If a wave-off is initiated with flaps in the LAND (40°) position, RETRACT FLAPS TO TAKEOFF (30°) POSITION PRIOR TO 200 KIAS. The flaps do not incorporate a "blow-back" feature and the actuating mechanism may be damaged structurally.

RAM AIR TURBINE AIRSPEED LIMIT

Extension . . . . Maximum Speed
Retraction . . . . 475 KIAS

SPEED BRAKES AIRSPEED LIMIT

Flight with speed brakes partially or fully open is permitted up to maximum speed.

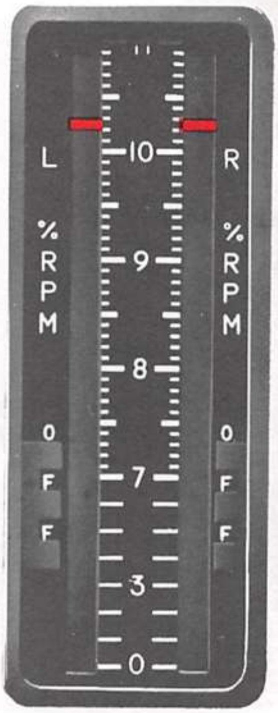
WARNING

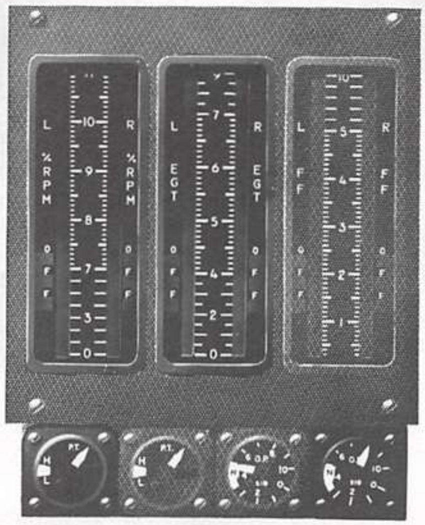
THE SPEED BRAKES MUST BE RETRACTED WHEN OPERATING AT NEAR STALL OR MINIMUM CONTROL AIRSPEEDS. The aircraft cannot be accelerated or maintained at constant airspeed in level flight with speed brakes extended regardless of engine power available.

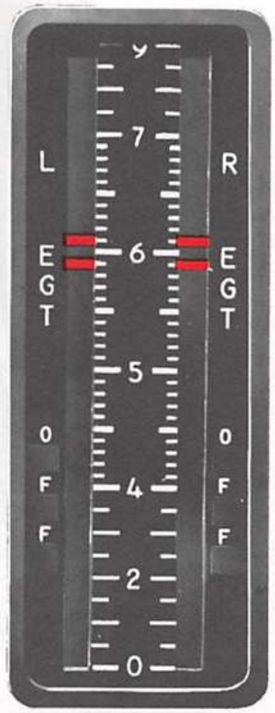
INSTRUMENT MARKINGS

ENGINE J52—P-6

BASED ON JP-5 FUEL







TACHOMETER		
102.6%	red	MAXIMUM OVERSPEED

EXHAUST TEMPERATURE		
610°C	red	MILITARY POWER
590°C	red	NORMAL RATED

POWER TRIM	
white	NORMAL RANGE

OIL PRESSURE		
35 PSI	red	MINIMUM (GROUND IDLE)
35-40 PSI	white	CAUTION
40-50 PSI	white	CONTINUOUS
50 PSI	red	MAXIMUM

ADB1-1073

Figure 1-53

ENGINE OPERATING LIMITS

ENGINE J52-P-6A

OIL: MIL-L7808C-1
FUEL: MIL-J5624D
GRADE: JP-5 OR JP-4

OPERATING CONDITION		OPERATING LIMITS	
THRUST SETTING	TIME LIMIT	MAXIMUM OBSERVED EXHAUST GAS TEMPERATURE (°C)	OIL PRESSURE (PSIG) NORMAL
MILITARY POWER	30 MINUTES	610	40-50
NORMAL RATED	CONTINUOUS	590	40-50
CRUISE 90% NORMAL RATED	CONTINUOUS	—	40-50
75% NORMAL RATED	CONTINUOUS	—	40-50
IDLE	CONTINUOUS	—	35 MINIMUM
STARTING	MOMENTARY (15 SEC)	455	
ACCELERATION	2 MINUTES	650	40-50

NOTES

ENGINE OVERSPEED IS 102.6% (11,900 RPM)

NORMAL OIL PRESSURE IS 40 TO 50 PSI. EXCEPT AT IDLE, OIL PRESSURES BETWEEN 35 AND 40 PSI ARE UNDESIRABLE AND SHOULD BE TOLERATED ONLY FOR THE COMPLETION OF THE FLIGHT, PREFERABLY AT A REDUCED THROTTLE SETTING. OIL PRESSURES BELOW NORMAL SHOULD BE REPORTED AS AN ENGINE DISCREPANCY AND SHOULD BE CORRECTED BEFORE THE NEXT TAKE-OFF. OIL PRESSURES BELOW 35 PSI ARE UNSAFE EXCEPT AT IDLE, AND REQUIRE THAT EITHER THE ENGINE BE SHUT DOWN OR A LANDING BE MADE AS SOON AS POSSIBLE, USING THE MINIMUM THRUST REQUIRED TO SUSTAIN FLIGHT.

A-ADBI-1074

Figure 1-54

AIRSPEED LIMITATIONS

SYMMETRICAL AND UNSYMMETRICAL FLIGHT
DATE: 1 FEB 1966
DATA BASIS: FLIGHT TEST

REMARKS
ENGINE(S): (2) J52-P-6 A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

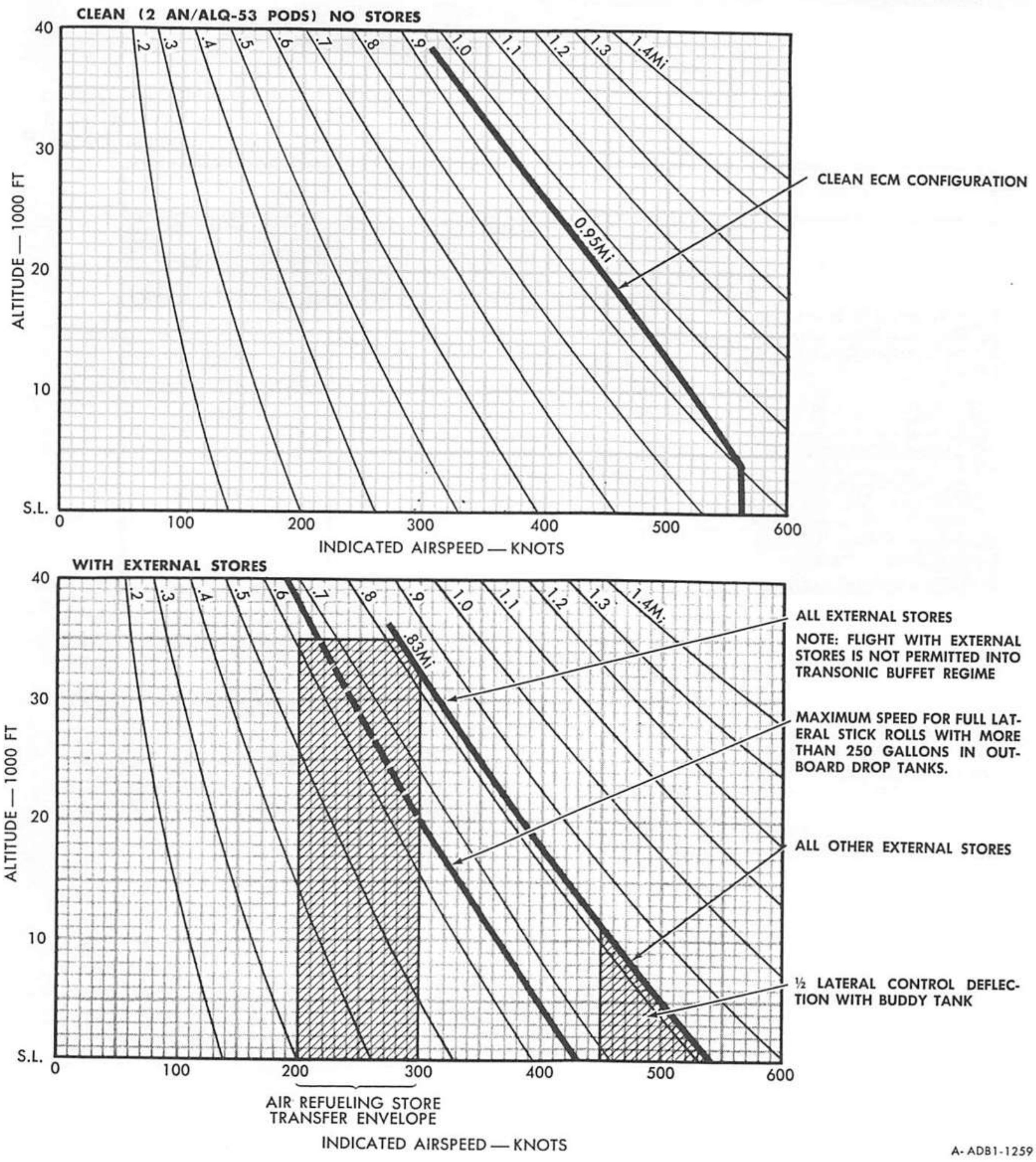


Figure 1-55

FLIGHT WITH SPIN RECOVERY SWITCH ACTIVATED

The spin recovery switch is for EMERGENCY USE ONLY.

WARNING

The assist spin recovery switch should be activated ONLY to effect recovery from a spin. Operation of the switch may impose an additional acceleration, which during an accelerated maneuver may overstress the aircraft or when operating at minimum airspeeds may pitch the aircraft UP into stall or heavy buffet.

CARRIER OPERATIONS

Carrier operations, catapult launches and arrested landings have been demonstrated to the gross weight limitation listed in this section.

MANEUVERS

PERMISSIBLE MANEUVERS

Note

All permissible flight maneuvers may be performed with the stability augmentation mode of AFCS ON or OFF unless otherwise noted.

Roll Maneuvers

Full abrupt throw, 360° level rolls and rolling pullouts are permitted through the entire speed envelope except as follows:

1. With a buddy air refueling store on station 3 containing any fuel, lateral control motion above 450 KIAS is limited to 1/2 stick deflection.
2. With external fuel tanks on stations 1 and/or 5 containing more than 1700 pounds of fuel, lateral control motion above 0.65M is limited to 3/4 stick deflection (this will enable the pilot to observe the present 150 degree/second rate of roll limit).

CAUTION

Care must be exercised when deflecting the flaperons as an increase in normal acceleration will result.

Symmetrical Maneuvers

1. Symmetric pullups through the permissible speed envelope are permitted up to load limit factor (G units) presented in figure 1-56 or into moderate buffet, whichever is less.

Sideslip Maneuvers

Full pedal/300 pound pedal force side slips are permitted through the entire flight envelope.

PROHIBITED MANEUVERS

1. Actuation of spin recovery switch.

WARNING

THE ASSIST SPIN RECOVERY SWITCH SHOULD BE ACTUATED ONLY TO EFFECT RECOVERY FROM A SPIN. Operation of the switch may impose an additional acceleration which during an accelerated maneuver may overstress the aircraft or when operating at minimum airspeeds may pitch the aircraft up into a stall or heavy buffet.

2. Intentional spins.
3. Large abrupt control reversals.
4. Inverted flight in excess of 30 seconds.
5. Zero G flight in excess of 10 seconds.
6. With a buddy air refueling store on station 3 containing any fuel, greater than 1/2 lateral stick deflection above 450 KIAS.
7. With external fuel tanks on station 1 and/or 5 containing more than 1700 pounds of fuel, greater than 3/4 lateral stick deflection above 0.65M.

ACCELERATION LIMITATIONS

1. The maximum permissible acceleration for the clean ECM and the maximum ECM configuration is presented in figure 1-56. For weights greater than design weight the design load factor should be reduced so that the product of load factor times the greater weight does not exceed the design load factor times the design weight. (As a rule of thumb - reduce load factor 0.1 G for each 1000 pounds above design weight.)
2. When flying in conditions of moderate turbulence, it is essential that accelerations due to deliberate maneuver be limited to 4.0 G in order to minimize the possibility of overstressing the aircraft as a result of the combined effects of gust and maneuvering loads.
3. Zero G to 2.0 G is permitted in the P/A configuration.

CENTER OF GRAVITY LIMITATIONS

MAXIMUM FORWARD CG

Gear up . . . . 22.5% MAC
Gear down (landing and take-off) . . . . 23.0% MAC

MAXIMUM AFT CG

All flight conditions 30.0% MAC

CAUTION

Extended duration flight at high angles of attack (low air speed) in the P/A configuration may result in an aft movement of the CG as a result of fuel transfering to the aft fuselage fuel tank due to the high nose up attitude of the aircraft

Note

Stability and control flight test data indicates that the P/A configuration neutral point, with large external stores, is at 28.7% MAC. Flight at CG position aft of 28.7% MAC results in slight negative force stability at approach airspeeds. Safety of flight has been shown at CG positions aft of 30.0% MAC as long as flight in this region is approached with caution.

GROSS WEIGHT LIMITATIONS

The maximum gross weights are as follows:

Field Take-off/Catapult Launches . . . 56,500 LB
Field Landing . . . . 45,000 LB
Arrested Landing . . . . 36,061 LB

CAUTION

Field or Arrested Landings are permitted up to design limit sink speed of 1,000 feet-per-minute at gross weights up to 36,061 pounds. At higher gross weights or with more than 4,000 pounds of external stores, only normal flared landings are permitted.

EXTERNAL STORE LIMITATIONS

External store limitations will be found in Section VIII of Supplemental NATOPS Flight Manual, NAVWEPS 01-85ADB-1A. In addition, carriage of the AN/ALQ-31A ECM pod on the outboard wing and fuselage centerline store stations (stations 1, 3, and 5) is permitted within the operating limits shown in figures 1-54 and 1-55.

CAUTION

AN/ALQ-31A pods should NOT be carried on the inboard store stations due to the pod-flap contact which results at the LAND (40°) setting.

ACCELERATION LIMITATIONS

AIRCRAFT CONFIGURATION: 38,000 LBS GROSS WEIGHT
DATE: 15 FEBRUARY 1966
DATA BASIS: FLIGHT TEST

CLEAN ECM — NO STORES

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

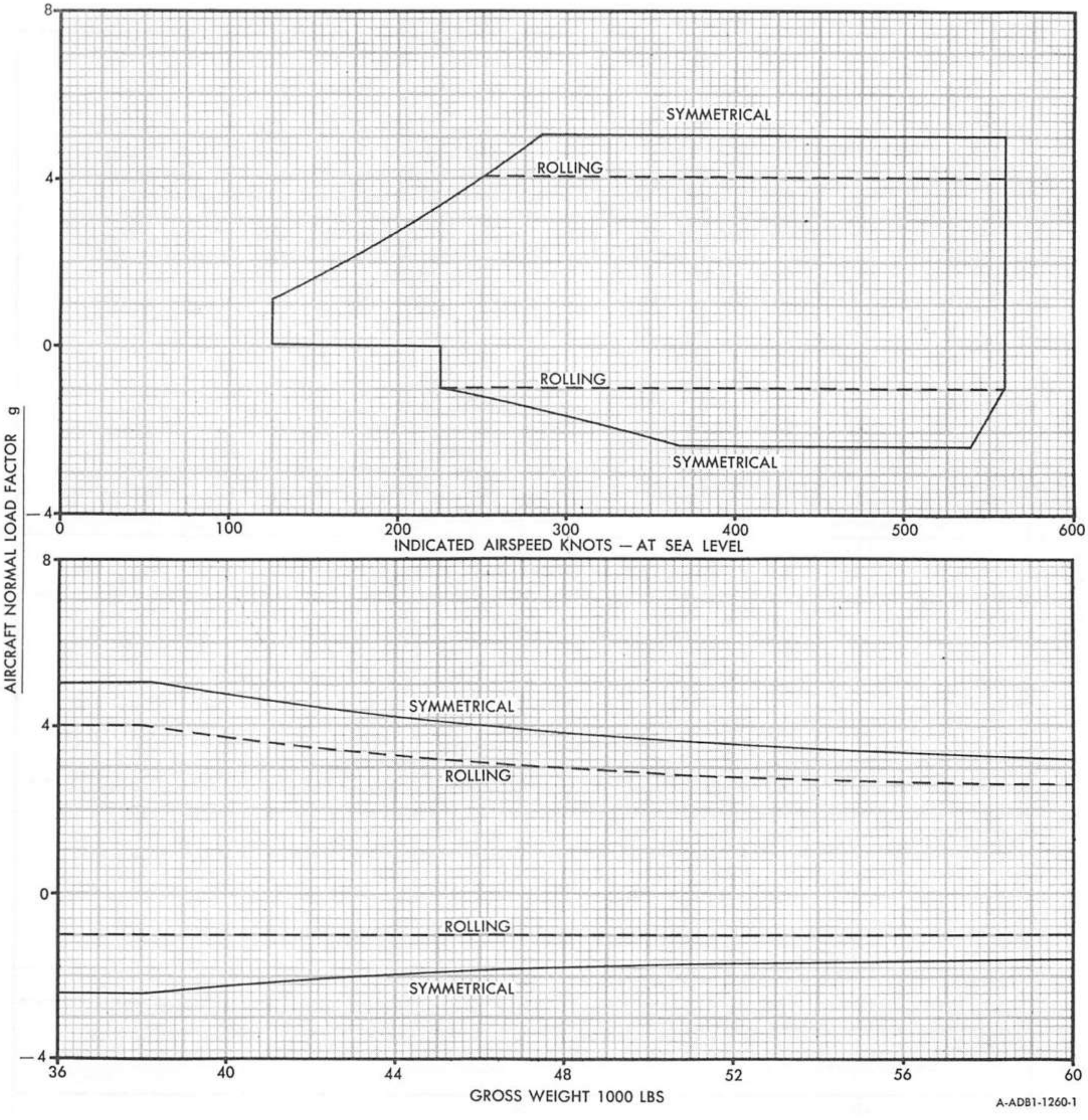


Figure 1-56 (Sheet 1)

ACCELERATION LIMITATIONS

AIRCRAFT CONFIGURATION: 41,000 LBS GROSS WEIGHT
DATE: 15 FEBRUARY 1966
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

WITH EXTERNAL STORES

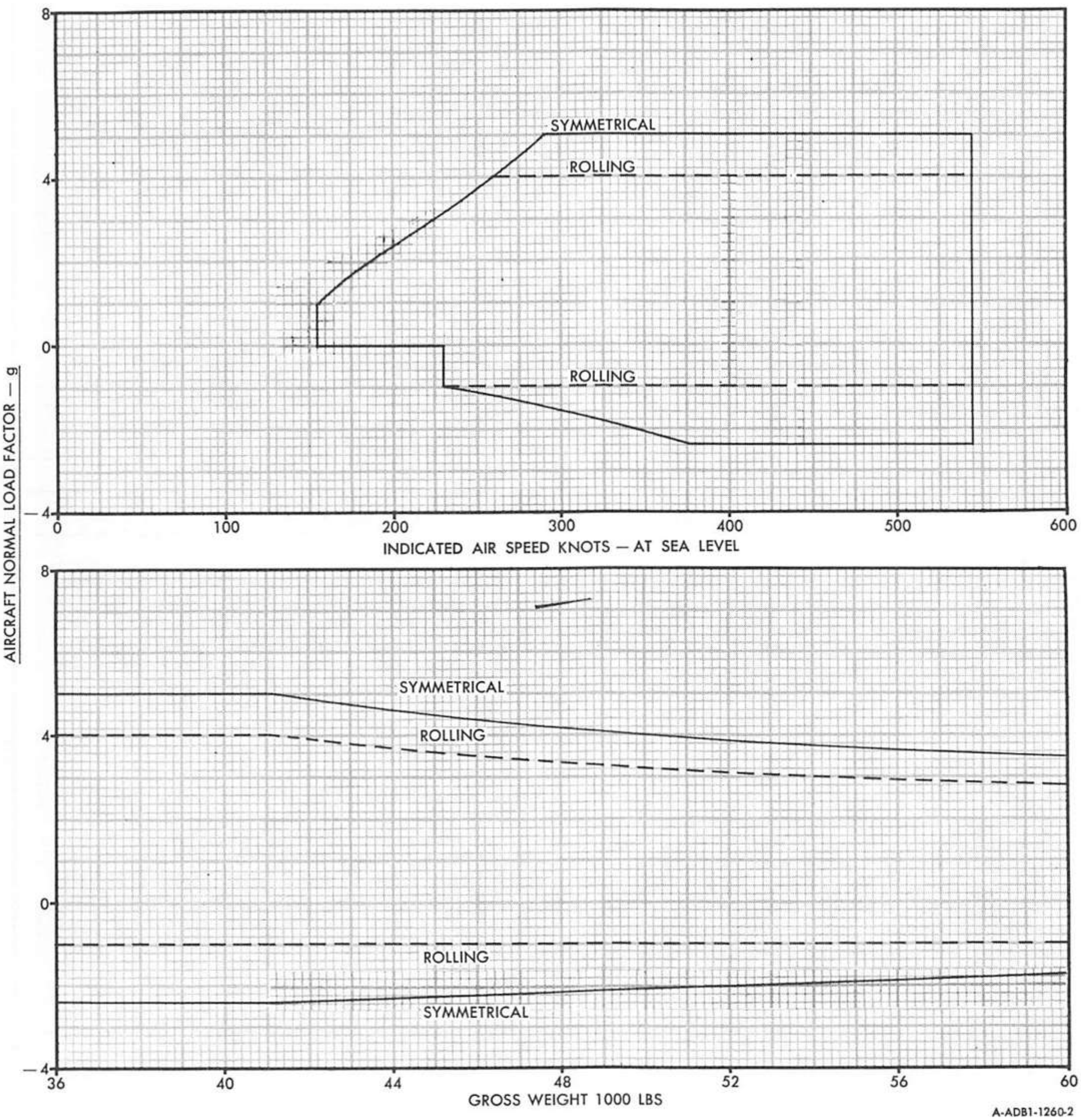
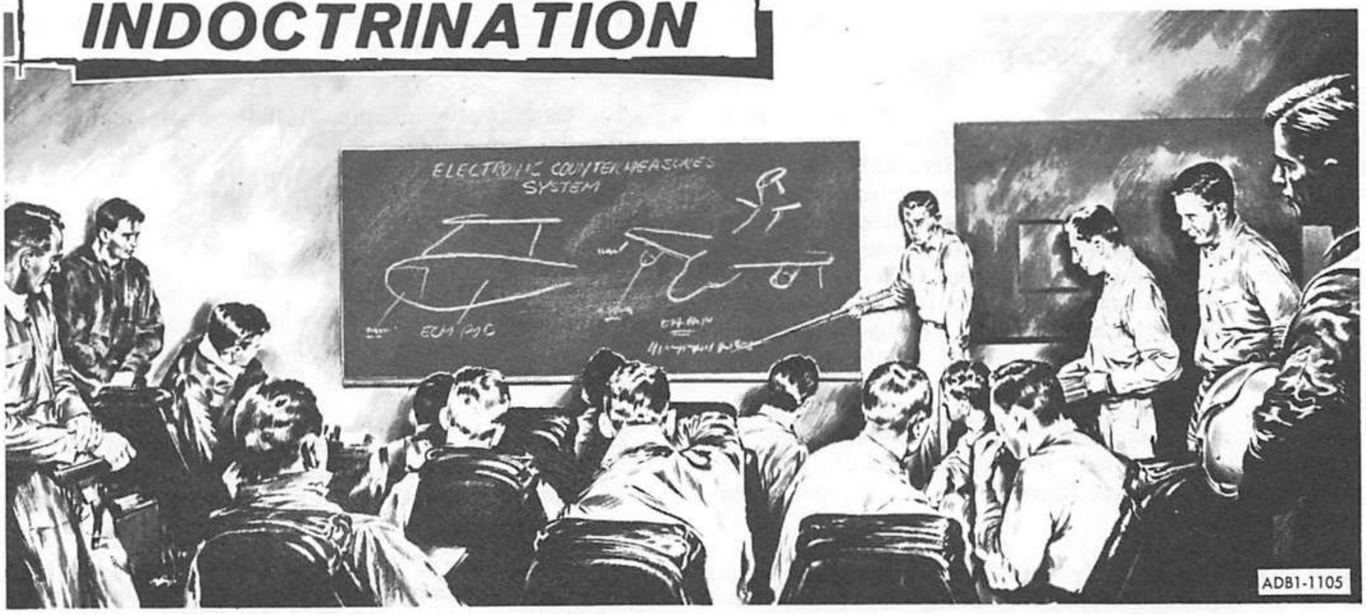


Figure 1-56 (Sheet 2)

section II INDOCTRINATION



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GROUND TRAINING SYLLABUS

Minimum Ground Training

The minimum ground training requirements for the EA-6A pilot and ECMO shall be successfully completed prior to flight and/or as follows:

1. NAMTD flight crew familiarization course or equivalent
2. NATOPS Flight Manual examination
3. Weapons system trainer (familiarization and emergency procedures, if available)
4. Safety and survival equipment check-out
5. Bailout and ditching procedures
6. Cockpit check-out and familiarization
7. Pre-flight check of the aircraft

FLIGHT TRAINING SYLLABUS

The flight training syllabus is designed to affect the orderly and expeditious qualification of pilots and ECM operators in flying the EA-6A as an aircraft and as a weapon system from both carrier and shore based installations. Since the scope and level of qualifications attained by individuals varies greatly between the initial flight training within the Naval Air Training Command and advanced attack training accomplished in fleet operational squadrons, no attempt is made to establish a flight training syllabus which would be satisfactory for all unit training programs.

CEILING/VISIBILITY REQUIREMENTS

In general, the following ceiling/visibility minimums for time-in-type apply:

Time-in-Type (hr)	Ceiling/Visibility (ft) (mi)
0-10	VFR
10-20	800/2; 900/1-1/2;1, 000/1
20-45	700/1; 600/2; 500/3
45 and above	field minimums

Where adherence to these minimums unduly hampers pilot training, Commanding Officers may waive time-in-type requirements for actual instrument flight, provided pilots meet the following criteria:

1. Have a minimum of 10 hours in model.

2. Complete 2 simulated instrument sorties.

3. Completed 2 actual or simulated TACAN penetrations.

MINIMUM FLIGHT QUALIFICATIONS

Where recent pilot experience in similar aircraft models warrant, Unit Commanding Officers may waive the minimum flight training requirements for basic qualifications. Minimum flight hour requirements to maintain pilot and ECM operator qualifications after initial qualification in each specific phase will be established by the Unit Commanding Officer. Crewmembers, (pilots and ECM operators), previously qualified in model and currently assigned to non-operational billets will be subject to the following criteria:

Must have a standardization check with the grade of "Conditionally Qualified" or better within the past 12 months, and must have flown 10 hours in model in the last 6 months.

Must have satisfactorily completed the ground phase of the standardization check including emergency procedures check and be considered qualified by the Commanding Officer of the unit having custody of the aircraft.

REQUIREMENTS FOR VARIOUS FLIGHT PHASES

Night

Not less than 10 hours in model.

Have a runway duty officer or qualified pilot in the right seat for initial night familiarization flight.

Cross Country

Have a minimum of 25 hours in model.
Have a valid instrument card.
Have completed one night familiarization flight.

Ferry

Ferry requirements are contained in OPNAVINST 3710.6 series.

For members of ferry squadrons, training requirements, check out procedures, evaluation procedures and weather minima shall be governed by the provisions contained in OPNAVINST 3710.6 series.

CARRIER LANDING QUALIFICATIONS

Commanding Officers will certify pilot's readiness for carrier landing qualifications in model in accordance with Type Commanders requirements.

REFRESHER QUALIFICATIONS

Once qualified, carrier landing qualifications will normally remain current for six months after the date of the last carrier landing in model. Refresher requirements to requalify are as follows:

1. Six to twelve months. Four day and two night arrested landings.

2. Over twelve months. Initial requirements both day and night.

OPERATING REQUIREMENTS

1. A pilot shall not make more than 10 arrested landings, nor fly more than three qualification flights or spend more than 8 hours in the cockpit in any one 24 hour period.

2. All pilots must be certified as day qualified by the Squadron Commanding Officer prior to commencing night carrier qualification landings.

3. A minimum of two satisfactory arrested landings shall be completed during the daylight hours preceding night qualification landings.

4. All night carrier operations shall be under control of carrier air traffic control center (CATCC).

MINIMUM CURRENCY REQUIREMENTS

A pilot and ECM operator shall normally remain current for as long as he regularly flies the aircraft and performs the mission required for the command. Pilots who during any six month period have not regularly flown the EA-6A, and have not regularly performed the mission required of the command shall be considered no longer currently qualified. Such pilots and second tour pilots requalifying in the EA-6A may be allowed to waive some of the basic training requirements at the discretion of the Unit Commanding Officer. Requalification shall consist of an appropriate check-out, including a flight familiarization phase and demonstration of the knowledge, skill, and capabilities required for qualification to the satisfaction of the Commanding Officer, certifying the requalification.

VIP/ORIENTATION FLIGHTS

Flights for the express purpose of orientation of Very Important Persons (VIP's), and other military or civilian personnel may be authorized by the Chief of Naval Operations. The flight crew shall consist of the Pilot in Command. The person being orientated shall be in the ECM operator's seat. In all cases where the VIP is not a member of, or is not in the direct employment of the U.S. Armed Services, he shall be required to complete a release or Waiver of Claim Against the United States prior to commencement of the flight, in accordance with current OPNAV instructions.

FLIGHT CREW MEMBERS ASSIGNMENTS

Each flight crew member shall be assigned by the Commanding Officer as to his specific responsibility and authority within the aircrew as follows:

Pilot

The pilot is assigned the responsibility for the safe and successful accomplishment of the assigned mission. His authority and responsibility shall be in accordance with the current OPNAV Instruction 3710.7 series. He shall sign the yellow sheet for custody of the aircraft prior to the flight, and shall report discrepancies in full upon termination of the flight. He is additionally responsible for furthering the training of the ECM operator flying with him, whether or not he is his regular assigned crewman. The pilot may delegate such duties as he deems necessary to the ECM operator insofar as functions within the cockpit, or preflight functions.

ECM Operator

The ECM operator normally functions as the data collection and dissemination source for the various EA-6A systems. The ECM operator will assist the pilot when necessary in performing the pre-flight inspection, mission planning, air refueling (tanker) operations, and weapon system checkout. During all operations, he will assume lookout responsibility on the right side of the aircraft. The ECM operator's specifie duties shall include, but not be limited to:

1. Performing the portion of the pre-flight inspection for which briefed. In particular, he will be responsible for pre-flight inspection of external stores/weapons and ECM equipments carried on store stations.

2. Performing the duties of tactical coordinator, maintaining an up-to-date tactical plot on targets. He will also have responsibility for the selection of particular weapons, and proper fuzing and arming sequences of the selected weapon.

3. Maintaining an up-to-date navigational plot and such logs as may be required by the mission and tactics performed, i.e., how-gozit chart, intelligence reports of interrogating radars, etc.

PERSONAL FLYING EQUIPMENT

The equipment indicated below will be worn or carried on all flights in the EA-6A aircraft unless other safety considerations or the design characteristics of the model aircraft dictate otherwise. All survival equipment will be secured in such a manner as to offer ready accessability during an emergency and to ensure retention during ejection or landing.

1. Flame retardant flight suit.

2. Identification tags.

3. Flight gloves.

4. Flight safety boots-field shoes - (ankle high lace type).

5. APH protective helmet.

6. Torso harness/M-3C life preserver

   The preserver shall be equipped in accordance with the applicable BUWEPS technical bulletin.

7. An approved survival knife and sheath.

8. Personal survival kit.

9. Oxygen mask. Oxygen shall be used at all times on all training and combat flights.

10. Exposure suit on all over-water flights when the water temperature is 59°F or below; when the outside air temperature is 32°F or below; or when the combined air-water temperature is 120°F or below. Exceptions to these requirements are as follows:

    a. Not required when the water temperature is above 50°F and within gliding distance of land.

    b. When high ambient cockpit temperatures would create a hazardous debilitating effect on the crew-members. Type Commanders are authorized to grant a waiver in accordance with current OPNAV Instructions 3710.9 series.

11. A pistol with tracer ammunition and/or a BuWeps approved signaling device, for all night flights, and for all flights, night or day, over water or sparsely populated areas.

12. Flashlight for all night and cross country flights.

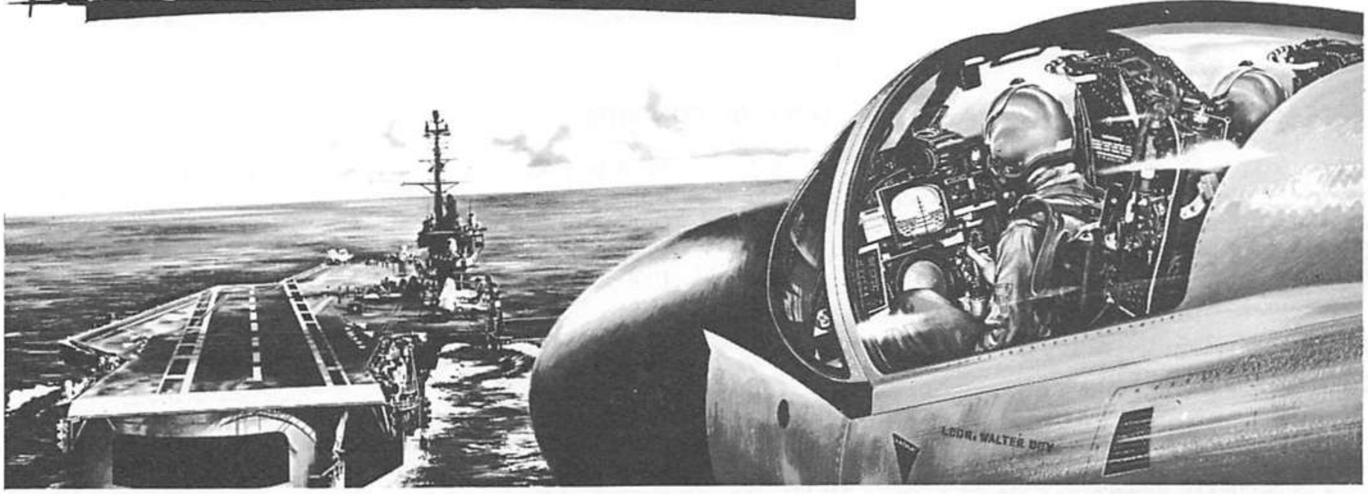
13. Anti-g suit for missions requiring high g forces.

14. Operational equipment appropriate to climate or the area.

15. Navigation packet.

16. Pocket Check List.

section III
NORMAL PROCEDURES



part 1
BRIEFING/DEBRIEFING

part 2
MISSION PLANNING

part 3
SHORE-BASED PROCEDURES - PILOT

part 4
CARRIER-BASED PROCEDURES - PILOT

part 5
SHORE/CARRIER BASED PROCEDURES - ECMO

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part 1

BRIEFING / DEBRIEFING

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BRIEFING/DEBRIEFING RESPONSIBILITIES

The Commanding Officer shall ensure that every flight crew is properly and adequately briefed on all facets of the assigned mission. Through the Operations Officer, he shall assign the appropriate personnel to brief each flight, according to the mission and anticipated conditions. To this end, the following persons shall be responsible:

OPERATIONS OFFICER

The Operations Officer shall be responsible to the Commanding Officer for ensuring that appropriate personnel are assigned to conduct specified portions of the briefing for each flight.

BRIEFING OFFICER

The Briefing Officer assigned on the Flight Schedule shall have the overall responsibility for coordinating and conducting a proper and adequate briefing of the flight. This responsibility will be assumed by the flight leader if a Briefing Officer has not been assigned.

SQUADRON DUTY OFFICER

The Squadron Duty Officer shall be responsible through the Operations Officer for:

1. Ensuring that flight personnel are equipped with proper flight clothing, navigational kits, flight packets, flight plans, and survival equipment as necessary.

2. Providing the latest weather information, and advising the flight of NOTAMS and exercises in the operating areas which might jeopardize the safety of the flight.

3. Ensuring that other personnel required for specific briefings, such as AIO, LSO, Ordnance Officer, and Meterologist, are present.

4. Keeping himself informed of the status of all aircraft, and assigning aircraft capable of performing the scheduled mission.

FLIGHT LEADER

The Flight Leader shall ensure that all members of his flight have received an adequate and proper briefing. He shall supplement each briefing as necessary.

PILOT IN COMMAND

Each Pilot in Command shall ensure that an adequate briefing has been obtained, and that his crew is fully prepared for the scheduled mission.

NON-OPERATIONAL BRIEFING

The Flight Leader may brief training, familiarization, and other similar flights where only NOTAMS, weather, and communications information are required. Air intelligence, navigation, communications, and other cognizant officers will ensure that information for each briefing is current and readily available to the flight leader.

OPERATIONAL BRIEFING

Flight crews shall be given complete, comprehensive briefings on all operations. The Briefing Officer shall work in conjunction with the Operations Officer, Air Intelligence Officer, and other officers concerned, in preparing the necessary information. He shall make optimum use of all graphic presentation devices, maps, charts, etc., which are available.

PRE-OPERATIONAL BRIEFING

Immediately prior to all operations of appreciable complexity and duration, a general information brief shall be given to familiarize personnel with the overall nature of the operation. The following topics shall be included:

1. The mission and objectives of the operation, and the part the squadron will play in carrying them out.

2. A brief chronological breakdown of how the operation will be conducted.

3. The geographical area in which the operations will be conducted.

4. The forces involved, both friendly and enemy, and how they will be deployed.

5. The rules of engagement set down by the governing operation order.

6. Search and rescue, EMCON, and other special communications procedures which will be used, including explanation of shackles and authenticators.

7. A discussion by the Briefing Officer of the principal attack tactics to be employed.

PRE-FLIGHT BRIEFING

These briefs are presented immediately before the launching of scheduled flights, and therefore must be carried out in the most expeditious manner. It is imperative that all pilots and ECM operators be in flight gear and otherwise ready for the briefing at the designated time. The brief shall include, but not be limited to the following:

Note

Information marked with an asterisk (*) shall be displayed on a status board in the briefing or ready room, and should be copied by pilots before commencement of the briefing.

1. Scheduling
   - *a. Event Number
   - *b. Take-off, recovery times and recovery order
   - *c. Aircraft-pilot/ECMO lineup
2. Mission
   - *a. Primary
   - b. Secondary
   - *c. Target assignment for each aircraft
   - d. Target description to include location, type, altitude, terrain and defenses
3. Navigation and Flight Planning
   - a. Takeoff
   - b. Climb-out instructions
   - c. Detailed flight route, including radar significant/visual check-points, navigational aids and ground controlling agencies (GCI, APC, etc.)
   - d. EMCON (doppler, radar altimeter, etc.)
   - *e. Time on station
   - f. Fuel management/bingo fuel
   - g. Retirement
   - h. Penetration
   - i. GCA or CCA
4. Communications
   - *a. Channels and frequencies
   - b. Reports required
   - c. Radio procedures and discipline
   - d. Visual signals
   - e. ADIZ procedures
   - *f. IFF/SIF
   - g. Authenticators and shackles
5. Participating units
   - *a. Voice calls and side numbers
   - b. Disposition/location
   - c. Utilization
   - d. Friendly subs and surface units
   - e. SAR
6. Operations
   - a. Instructions for coordinating other units
7. External Stores Configuration (*ECM, ordnance, fuel)
   - a. Loading
   - b. Safety
   - c. Arming, dearming and delivery
   - d. Restrictions on use
   - e. HUNG ordnance procedures
8. Weather - Base, enroute and target
   - *a. Wind: direction and velocity at surface and at applicable altitudes
   - *b. Cloud coverage: Present and forecast
   - *c. Visibility
   - *d. Sea state
   - *e. Water and air temperature (cold weather)
   - *f. Target weather
   - *g. Divert weather

*h. Contrail levels

9. Emergencies

   a. Abort

   b. Divert fields

   c. Low fuel state

   d. Foul deck and wave-off pattern

   e. Lost communications procedures

   f. Loss of visual contact with flight

   g. System failures

   h. Downed aircraft procedures

   i. SAR procedures

10. Miscellaneous

    a. Other units in the area

    b. Restricted or danger areas

    c. Current NOTAMS, bulletins, and safety of flight information

    d. Flight leader brief on take-off, climb-out, rendezvous, rendezvous frequency switch, landing procedures, etc.

part 2 MISSION PLANNING

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MISSION PLANNING

Detailed pre-flight planning is essential for the success of any attack mission, consistent with the time available and the nature of the assignment.

SPECIAL WEAPONS

Mission planning for special weapons delivery shall be in accordance with Chapter 3 of the NWIP 41-3, A-6A Nuclear Weapons Delivery Handbook, and with applicable NAVAIR instructions.

CONVENTIONAL WEAPONS

Conventional weapons deliveries fall generally into two types:

1. Preplanned strikes on specific targets.
2. Close air support, call fire or armed reconnaissance.

MISSIONS

Preplanned Strikes

Preplanned strikes on specific targets shall be planned in the same manner as special weapons deliveries.

Close Air Support, Call Fire and Armed Reconnaissance Strikes

Due to the tactical nature of these missions, detailed preplanning is unrealistic. Preplanning shall concentrate primarily on target area familiarization and review of weapons check lists and fuel planning aids.

part 3

SHORE-BASED PROCEDURES (PILOT)

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PREPARATIONS FOR FLIGHT

A thorough briefing shall be conducted concerning normal and emergency procedures, crew coordination, and cooperation through the planned mission. Refer to Section I, Part 4, Aircraft Operating Limitations, and Section XI, Performance Data, for flight restrictions and planning. For loading information, refer to the Handbook of Weight and Balance.

PREFLIGHT CHECK

BEFORE EXTERIOR INSPECTION

OPNAV 3760-2 (Yellow Sheet) - CHECK
Check yellow sheet to determine the flight status and servicing of the aircraft.

EXTERIOR INSPECTION

Perform the exterior inspection as outlined in figure 3-1.

ACCESS TO COCKPIT

See figure 3-2 for normal entry into the cockpit.

RIGHT SEAT INTERIOR CHECK FOR SOLO FLIGHT

1. Master arm switch - OFF AND LOCKED
2. Mechanical and electrical fuzing switches - OFF
3. Nuclear selector buttons - OFF AND LOCKED
4. Station selector buttons - OFF AND LOCKED
5. Ejection seat ground safety pins - REMOVED (5 PINS)
6. Face curtain and secondary firing handle guards - UP (LOCKED POSITION)
7. Circuit breakers - IN
8. Seat harness and strap - CHECKED
9. All loose gear - STOWED

CONTINUED ON NEXT PAGE

PREFLIGHT CHECK - CONTINUED

10. ECM power switch - OFF
11. AN/ALQ-55 selector switch - OFF
12. AN/ALQ-53 power switch - OFF
13. Right Seat - FULL AFT TILT

EJECTION SEAT CHECK

1. Ejection seat ground safety pins - REMOVE (5 PINS).
The five safety pins must be removed separately: face curtain locking mechanism, ejection gun, manual override, drogue gun and secondary firing handle guard. See figure 3-3, Ejection Seat Safety Pins.

WARNING

- Movement about the seat should be with caution and kept to a minimum. With the five safety pins removed, only the face curtain safety lock and the secondary firing handle guard prevent inadvertent firing of the seat.
- Do not use extra seat cushions on the ejection seat. This can result in serious back injuries if ejection becomes necessary.

2. Face curtain lock - UP (LOCKED POSITION)
3. Firing cables - CONNECTED (THIN ON TOP - THICK ON BOTTOM).
Check that both firing cables are attached to the firing mechanism sear and the secondary firing cable (thin cable) is located on top of the face curtain firing cable (thick cable).
4. Ejection seat cartridges - LOCK WIRED AND SEALED
5. Top latch mechanism indicator - CHECKED
6. Personnel parachute withdrawal line screw connector - CHECK.
Check that the personnel parachute withdrawal line screw connector is secure and that the withdrawal line is positioned over the firing cables.

WARNING

If the personnel parachute withdrawal line is not securely connected, automatic deployment of the parachute will not occur after ejection.

7. Drogue gun trip rod quick release pin - INSERTED
8. Slide disconnect static line cable - CONNECTED.
Check that the slide disconnect static line cable is connected to the retention lug by the link line pin.

WARNING

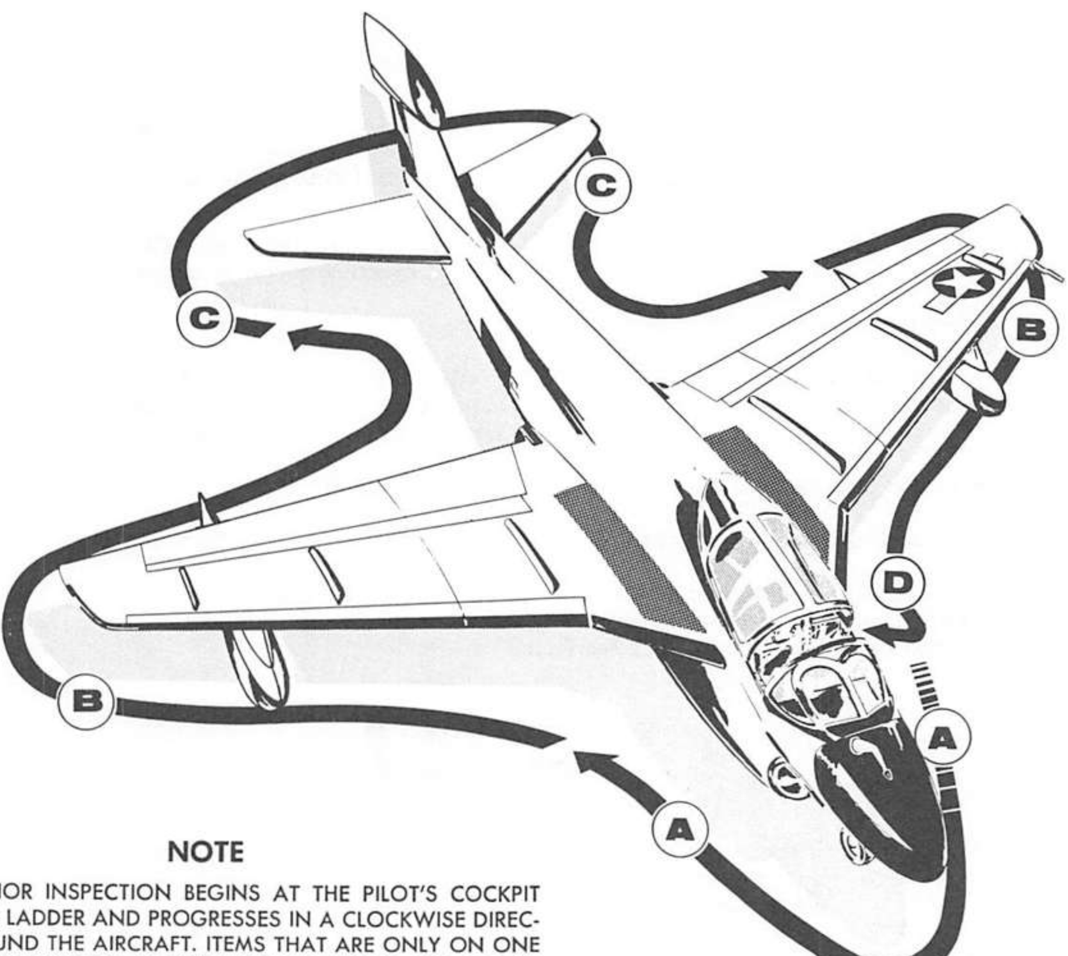
If the slide disconnect static line cable is not connected, manual separation from the seat with the personnel parachute is not possible.

CONTINUED ON NEXT PAGE

EXTERIOR INSPECTION

GENERAL CHECKS

THE FOLLOWING GENERAL CHECKS SHOULD BE PERFORMED THROUGHOUT THE EXTERIOR INSPECTION: CRACKS, DISTORTIONS, LOOSE FASTENERS; COVERS REMOVED; FUEL, OIL, HYDRAULIC LEAKS; ACCESS DOORS AND PANELS SECURELY FASTENED; AND EXTERNAL STORES SECURE.



NOTE

THE EXTERIOR INSPECTION BEGINS AT THE PILOT'S COCKPIT BOARDING LADDER AND PROGRESSES IN A CLOCKWISE DIRECTION AROUND THE AIRCRAFT. ITEMS THAT ARE ONLY ON ONE SIDE OF THE AIRCRAFT ARE SPECIFICALLY CALLED OUT AS LEFT SIDE (L) OR RIGHT SIDE (R). AFTER COMPLETION OF THE "AFT FUSELAGE AREA" CHECKS, REPEAT THE "CENTER FUSELAGE AND WING AREA" CHECKS FOR THE LEFT SIDE INSPECTION.

WHEN ECM EQUIPMENTS/WEAPONS ARE CARRIED ON EXTERNAL STATIONS, PREFLIGHT INSPECTION OF SAME, IS THE PRIMARY RESPONSIBILITY OF THE ECMO.

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Figure 3-1. (Sheet 1)

(A) NOSE AREA	1. TOTAL TEMPERATURE PROBE	CHECK (L)
	2. INTAKE DUCT AREA	CLEAR (L)
	3. RADOME	SECURE (L)
	4. AIR REFUELING PROBE	SECURED, IF INSTALLED
	5. NOSE GEAR	CHECK
	APPROACH, ANTI-COLLISION & TAXI LIGHTS	CHECK
	TIRES & SHOCK STRUT	PROPERLY INFLATED
	NOSE GEAR GROUND SAFETY LOCK	INSTALLED
	NOSE GEAR SHIMMY DAMPER	CHECK
	NOSE GEAR STEERING LINKAGE	CHECK
	NOSE GEAR DOOR LINKAGE	CHECK
	NOSE GEAR TIE DOWNS (MINIMUM OF TWO)	INSTALLED
	6. NOSE GEAR WHEEL WELL	CHECK
	LANDING GEAR EMERGENCY AIR GAGE	2450 PSI
	CIRCUIT BREAKERS	IN
	HAND PUMP HANDLE	SECURE
	SPLASH CURTAINS	SECURE
	RADOME AND EXTENSIBLE PLATFORM SELECTOR	CHECK
	7. INTAKE DUCT AREA	CLEAR (R)
	8. OUTSIDE AIR TEMPERATURE PROBE	CHECK (R)
	9. ANGLE-OF-ATTACK PROBE	CHECK (R)
	10. AIR CONDITIONING INLET	CLEAR
(B) CENTER FUSELAGE AND WING AREA	1. MAIN GEAR WHEEL WELL	CHECK
	2. MAIN GEAR	CHECK
	TIRE & SHOCK STRUT	PROPERLY INFLATED
	MAIN GEAR GROUND SAFETY LOCK	INSTALLED
	MAIN GEAR TIE DOWN (MINIMUM OF ONE)	INSTALLED
	JACK PADS	STOWED
	3. CENTER PYLON	SECURE
	4. WING PYLON	SECURE
	5. WING SLAT	SECURE
	6. PITOT TUBE	COVER REMOVED (L)
	7. FUEL RAM AIR INLET	CLEAR
	8. POSITION & FORMATION LIGHTS	CHECK
	9. WING FUEL DUMP-VENT LINE	CLEAR
	10. WING FLAP & FLAPERON	SECURE
	11. EXHAUST AREA	CLEAR
	12. SPEED BRAKES	CHECK
	13. SPEED BRAKE GROUND SAFETY LOCK	REMOVED
	14. DASHPOT INDICATOR	(1000 PSI) CHECK (L)
(C) AFT FUSELAGE AREA	1. RUDDER & STABILIZER	CHECK
	2. TAIL POSITION LIGHT	CHECK
	3. FUSELAGE FUEL DUMP-VENT LINE	CLEAR
	4. ARRESTING HOOK GROUND SAFETY LOCK	REMOVED
	5. ARRESTING HOOK	SECURE
	6. EXTENSIBLE EQUIPMENT PLATFORM	SECURE
	7. LIQUID OXYGEN VENT	CLEAR
	8. DOPPLER RADOME	SECURE
(D) TOP FUSELAGE WING, TAIL AREA	1. FUEL RAM AIR INLET	CLEAR
	2. AFT COMPARTMENT AIR INLET	SECURE
	3. ANTI-COLLISION LIGHT	CHECK
	4. RAM AIR TURBINE	SECURE

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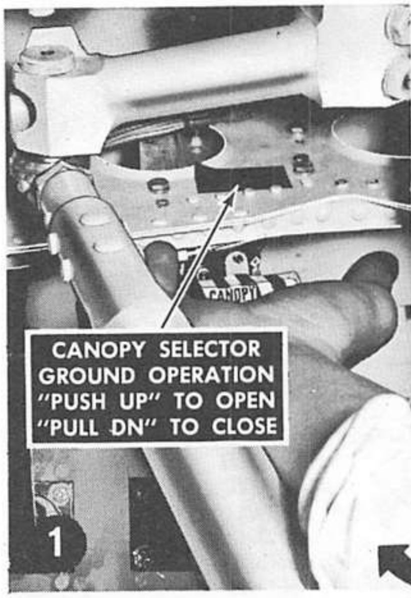
Figure 3-1. (Sheet 2)

ACCESS TO COCKPIT

MANUAL CANOPY OPENING



PUSH EXTERNAL CANOPY HANDLE UP.

CONNECT HAND PUMP HANDLE TO HAND PUMP. (45 CYCLES TO FULLY OPEN CANOPY)

TYPICAL BOTH SIDES OF FUSELAGE.

NORMAL ACCESS TO THE COCKPIT IS MADE VIA A BUILT-IN RETRACTIBLE BOARDING LADDER LOCATED AFT OF THE ENGINE INTAKE DUCT. THE RETRACTIBLE BOARDING LADDER IS LOWERED BY RELEASING THE PUSH PULL STEP RELEASE.

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Figure 3-2.

EJECTION SEAT SAFETY PINS

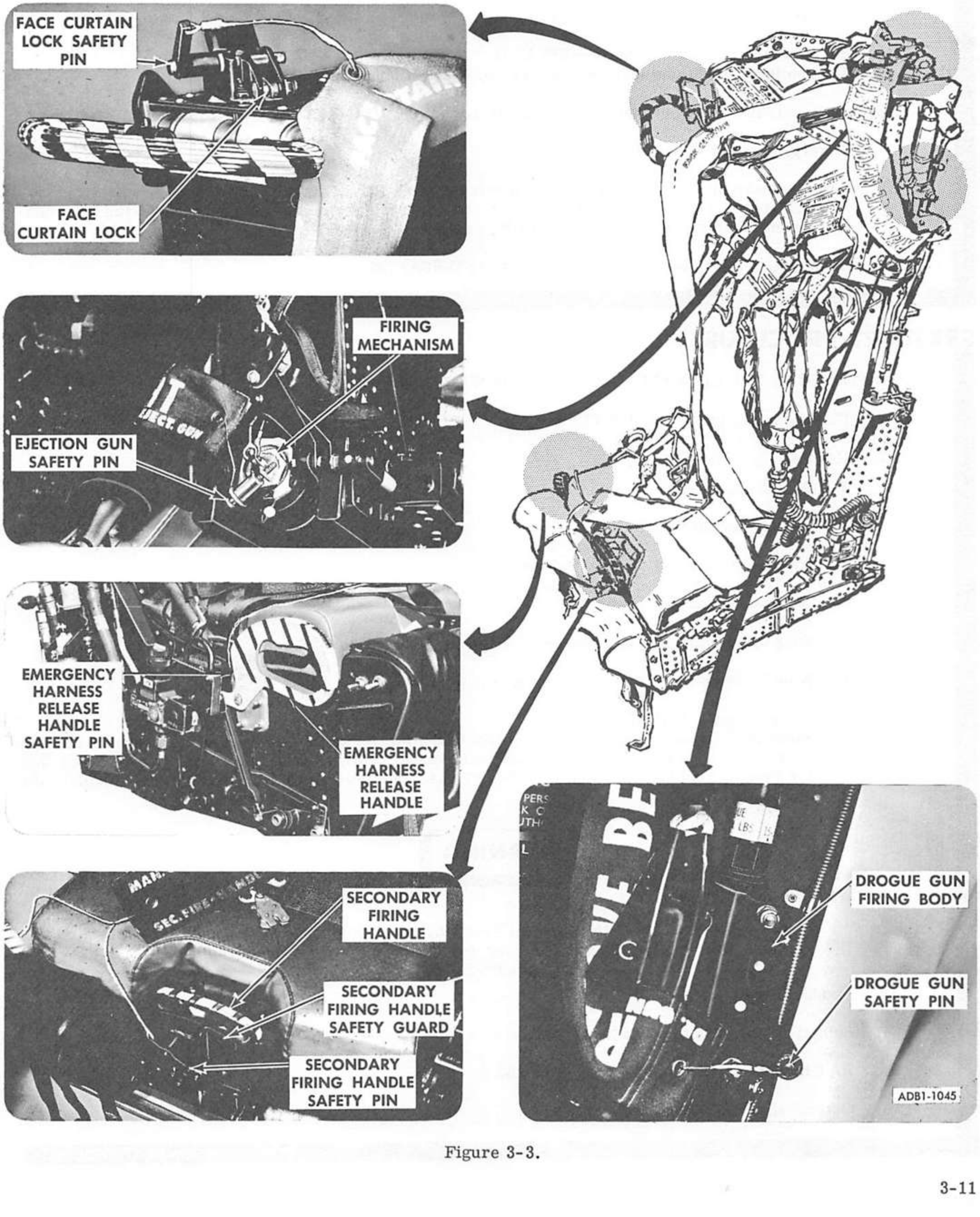


Figure 3-3.

EJECTION SEAT CHECK - CONTINUED

9. Parachute Attachment - VISUAL CHECK
10. Secondary firing handle safety guard - UP (LOCKED POSITION)
11. Leg restraint - ATTACHED TO DECK
12. Lap belt and shoulder harness - SECURE
    Pull on the lap belt and shoulder harness to check if firmly attached.
13. Left and right hand personnel services disconnects - CONNECTED
14. Emergency oxygen bottle - 1800 PSI
15. Time release mechanism trip rod quick release pin - INSERTED.
    Check that the time release mechanism trip rod quick release pin is inserted through the emergency oxygen lever with trip lever in the UP position.
16. Time release mechanism - LOCK WIRED AND SEALED

PRESTART PROCEDURES

UPON ENTERING THE COCKPIT - EXTERNAL POWER OFF

1. Canopy safety pins - REMOVED
2. Harnessing - FASTEN
    a. Attach leg lines.
    b. Attach shoulder harness.
    c. Attach lap belt and vertical straps.
    d. Snug up lap belt.
    e. Snug up forward vertical straps.
    f. Attach oxygen, communications, personnel services.
    g. Inertial reel - CHECK
       Position the inertial reel manual control to the full forward position and check that the inertial reel is locked. Position the inertial reel manual control to the full aft position to check that the inertial reel has unlocked and then release the inertial reel manual control handle to the neutral position.

WARNING

Do not connect the survival gear lanyard at this time. The survival equipment could hinder rapid evacuation of the cockpit during a ground emergency or ditching.

3. Rudder pedals - ADJUST
4. Selective stores jettison switch - SAFE
5. RAT handle - MATCHING RAT POSITION
6. Optical sight unit switches - OFF

CONTINUED ON NEXT PAGE

PRESTART PROCEDURES – CONTINUED

7. Lights and external master switch - AS DESIRED
8. Oxygen switch - OFF
9. Hook bypass switch - AS DESIRED
10. Anti-skid switch - OFF
11. Flaperon pop-up switch - OFF
12. Emergency flap switch - OFF
13. Throttles - OFF AND FRICTION ADJUSTED
14. Flap lever - UP
15. Assist spin recovery switch - GUARD DOWN (Switch OFF)
16. Speed drive switches - NORM
17. Fuel management panel - CHECK
18. Search radar - BRIGHTNESS CCW
19. Brake selector handle - OUT AND VERTICAL
20. Altimeter - SET TO FIELD ELEVATION
21. Canopy selector - OPEN

WARNING

If the canopy selector switch is in the closed position, the canopy will close when hydraulic pressure is applied to the system.

22. Vertical reference switch - PRI
23. Steering switch - TACAN
24. Contact analog switch - OFF
25. Search radar power switch - OFF
26. Navigational computer - OFF
27. Master arm switch - OFF AND LOCKED
28. Generator switches - ON
29. Engine and fuel master switches - OFF
30. Autopilot switch - OFF
31. UHF - ON (T/R+G) AND COMM VOLUME FULL UP
32. TCN - REC
33. MF-1 Compass - MAG (LAT dial to present latitude)
34. Roll stab switch - ROLL STAB

CONTINUED ON NEXT PAGE

PRESTART PROCEDURES - CONTINUED

35. Doppler - OFF
36. SIF - AS REQUIRED
37. Air conditioning cockpit switch - ON
38. MAN/RAM air switch - AUTO
39. Automatic temperature control thumbwheel - SET AT 0
40. Air conditioning master switch - NORM
41. Defog airflow thumbwheel - AS DESIRED
42. Engine anti-ice switch - OFF
43. Windshield rain removal switch - OFF
44. Pitot heat switch - OFF
45. Wing fold handle - MATCHING WINGS

CAUTION

If wings are folded, ensure that the wing fold handle is in the full forward position, as wings may spread as soon as hydraulic pressure is applied either during engine start or ground-rig operation.

46. IFF - STBY
47. RAD control panel - AS DESIRED
48. UHF antenna select - AUTO
49. Cabin dump switch - OFF
50. CNI master - OFF
51. UHF auxiliary channel - SET
52. ICS - AS DESIRED
53. Circuit breakers - IN

EXTERNAL POWER-ON

1. Seat - Adjust.
   a. Assume ejection position, sit erect, buttocks against backrest, head firmly against headrest, spine straight, thighs against seat pan.
   b. With left hand, reach up and grasp face curtain handle.
   c. Adjust seat height and tilt so that top of helmet just clears underside of face curtain handle.

CONTINUED ON NEXT PAGE

PRESTART PROCEDURES - CONTINUED

Note

Correct seat adjustment allows proper position for ejection and optimum vision over the nose of the aircraft and inside the cockpit.

2. Fuel tank quantity selectors - CHECK
3. Landing gear handle - DN (AND GEAR INDICATOR DOWN)
   Manually check that the landing gear handle is in the DN position.
4. Auxiliary brakes cycle gage - 15 CYCLES
   If the auxiliary brakes cycles gage does not indicate 15 cycles, manually pump with the hand pump handle until the gage indicates 15 cycles.
5. Fire warning system - TEST
   Depress the fire master test button and check illumination of the left and right fire warning lights.
6. LOX/FUEL TEST - TEST
   Depress the lox fuel master test button. Check that oxygen quantity gage drops to zero and that the oxygen warning light illuminates at approximately 2 liters. The pointer on the fuel quantity gage also moves towards zero, which is a functional test of the fuel quantity indicating system. This is not a test of the low fuel warning light.
7. Lights warning - TEST
   Check for illumination of all indicator lights.

BEFORE STARTING ENGINES

1. Wheels - CHOCKED
2. Fire bottle - MANNED
3. Intake and exhaust areas - CLEARED

WARNING

- Suction at the intake duct is sufficient to kill or severely injure personnel drawn into the intake duct.
- Danger areas aft of the aircraft are created by high exhaust temperature and velocities.

Whenever practicable, start and run up engines on paved surface to minimize the possibility of foreign objects being drawn into the compressor with resultant engine damage. Start the engines with the nose into or at right angles to the wind as exhaust temperatures may be aggravated by tail winds.

STARTING ENGINES

The engines cannot be started simultaneously, however, either engine can be started first. This procedure establishes starting the right engine (No. 2) first.

CONTINUED ON NEXT PAGE

STARTING ENGINES - CONTINUED

CAUTION

In the event any of the following indications occur during an attempted engine start, a malfunction is indicated and immediate action on the part of the pilot is required:

- Abnormal engine noise or sound
- Wet start (no light-off within 10 seconds after placing throttle to IDLE)
- Hot start (EGT exceeds 455°C)
- Hung start (RPM will not accelerate to IDLE)
- Oil pressure fails to rise to 35 PSI
- Fire warning light illuminates, or other indications of fire
- Speed drive caution light remains illuminated above 30% RPM

1. Engine and fuel master switches - ON
   Check annunicator panel to insure that the LOW FUEL PRESS caution lights are extinguished indicating fuel boost pump operation. Depress the boost pump test buttons and ensure that the LOW FUEL PRESS caution lights will come on and then go off again when the button is released.

2. Left engine and fuel master switch - OFF

3. Ground turbine compressor (GTC) - ON

4. GTC start air - AVAILABLE
   51 psi indicated available from ground crew

5. Right crank switch - DEPRESS THEN RELEASE

6. At 18% rpm, right throttle - IDLE

7. Fuel flow - 800 to 900 POUNDS PER HOUR

Note

- A hot start can be anticipated by observing a greater than normal starting fuel flow and exhaust temperature increase.
- Normally the EGT tape will ride evenly or slightly below the RPM tape during a start. Whenever the EGT exceeds the RPM a HOT START can be anticipated.

8. Exhaust temperature - UNDER 455°C

9. Oil pressure - 35 to 50 PSI

10. Idle rpm - STABILIZED
    Check idle rpm stabilized at approximately 58% to 61% rpm depending upon ambient conditions.

11. Hydraulic pressure - NORMAL

12. External compressed air source - DISCONNECT
    Signal ground crew to disconnect external compressed air source and receive crossbleed signal from ground crew.

13. Right generator - CHECK CAUTION LIGHT OUT

14. External electrical power - DISCONNECT
    Give external electrical power disconnect signal to ground crew, and receive confimation.

15. Hook - RAISE
    Hook will be down on the first flight of the day.

CONTINUED ON NEXT PAGE

STARTING ENGINES – CONTINUED

16. Left engine and fuel master switch - ON
17. Right throttle - ADVANCE TO 75% RPM TO SUPPLY STARTING AIR
18. Start left engine as per items 5 thru 11.
19. Right throttle - IDLE (AFTER LEFT ENGINE AT IDLE SPEED)
20. Left generator - CHECK CAUTION LIGHT OUT

AFTER STARTING ENGINES

1. Engine driven fuel pump - CHECK
   Depress the boost pump test button and check that LOW FUEL PRESS annunciator caution lights do not illuminate. Illumination of either light will indicate an engine driven fuel pump failure and the engine should be shut down.

   CAUTION

   In the event engine flames-out during this test, and to preclude engine fire, the appropriate engine fuel master switch should be positioned to OFF prior to releasing the fuel boost pump test button.

2. CNI - ON

   CAUTION

   Damage to the electronic equipment will occur if air conditioning is not available prior to operation of the electronic equipment.

3. Navigation equipment - STBY
4. Landing gear ground safety locks - OUT
   Check visually with ground crewman
5. Boarding ladder - STOWED
6. Oxygen switch - ON (WITH MASK AWAY FROM FACE DEPRESS THE ICS AND MIC BUTTONS)
7. Oxygen regulator - CHECK
   Turn counterclockwise to full up position to get diluter demand operation.
   Then turn oxygen regulator selector valve clockwise to the full down position to check 100% oxygen flow.
8. Oxygen mask - ATTACH
9. Oxygen regulator - 100%
10. G-valve test button - DEPRESS
    Momentarily depress the g-valve test button to check for instant g-suit pressurization.

    CAUTION

    Ensure that the air conditioning master switch is in the NORM position. Hot engine bleed air will be pumped through the anti-g suit if the test button is depressed when the air conditioning master switch is OFF.

11. Vent suit-seat cushion controls - AS DESIRED

CONTINUED ON NEXT PAGE

AFTER STARTING ENGINES-CONTINUED

WING SPREAD

1. Wing fold handle - AFT, TO FIRST STOP
2. Wing lock pin switch - LOCK
3. Wing fold handle - STOW
   Move the wing fold handle aft and down flush with the center console smartly with palm of the hand.
4. Wing fold warning flags - RETRACTED
   Check the retraction of the wing fold warning flags after the wing fold handle is stowed.

CAUTION

After wings are spread, visually check flaps and slats for full retraction.

BEFORE TAXIING

1. Wing fuel pressure - CHECK
   Place the tank pressure switch to ORIDE and check that both WING TK PRESS caution lights are out, then return tank pressure switch to NORM. The WING TK PRESS caution lights will come back on.

CAUTION

Ensure that the air conditioning master switch is in the NORM position. Hot engine bleed air will be pumped into the wing tank if the tank pressure switch is actuated to ORIDE when the air conditioning master switch is OFF.

2. Flight controls - CYCLE AND CHECK FOR DIRECTION AND NORMAL MOVEMENT OF THE STABILIZER AND RUDDER.
3. Wing flaps and slats - TAKEOFF
4. Flight controls - CHECK FOR EXTENDED MOVEMENT IN FULL DEFLECTION OF CONTROLS.
5. RAT - CHECK FOR EXTENSION AND RETRACTION.
6. Autopilot - CHECK
   Check for engagement in all modes, and for positive disengagement. With switch OFF, deflect control stick through full lateral throw.
7. Trim switches - CYCLE AND SET FOR TAKE-OFF
   Check control stick trim button and rudder trim switch at 0 units, flaperon at 0 units, and stabilizer set at 3 units nose up. Check that indicators correspond to switch movement and set for take-off.
8. Navigation equipment - CHECK
   Perform navigation equipment turn-on and functional check as outlined in Supplemental NATOPS Flight Manual, NAVWEPS 01-85ADB-1A.
9. Flight instruments - CHECK

TAXIING

1. Chocks - REMOVE
2. Brake selector handle - IN AND VERTICAL
   Push the brake handle in to release the parking brakes.

CONTINUED ON NEXT PAGE

AFTER STARTING ENGINES - CONTINUED

3. Brakes - TEST
   After initial roll, apply normal brakes and test operation.

4. Nose wheel steering - ENGAGE
   Engage nose wheel steering to minimize brake wear.

BEFORE TAKE-OFF

1. Canopy - CLOSED

Prior to taking the duty runway, the take-off check list (figure 3-4) should be completed using command response on the ICS.

PILOT'S CHECK LISTS

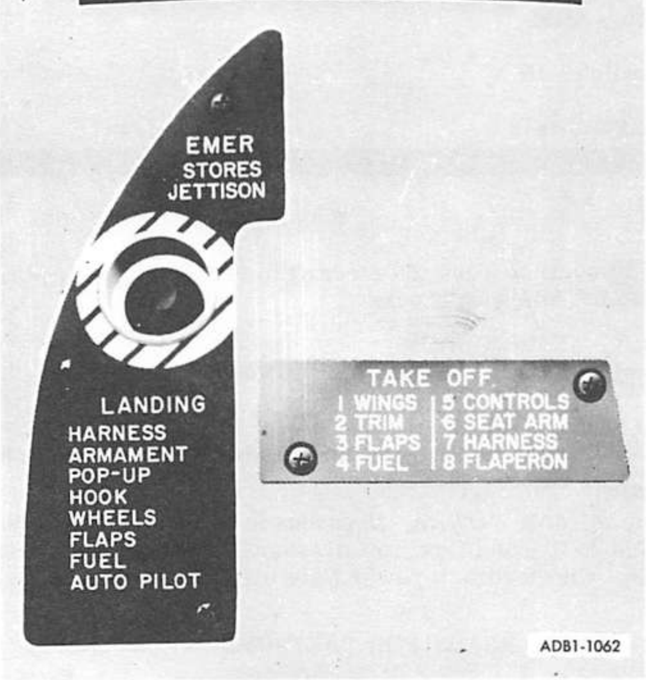


Figure 3-4.

2. Wings - SPREAD AND LOCKED (WING FOLD WARNING FLAGS - RETRACTED)

3. Trim - CHECK - RUDDER 0°
   FLAPERON 0°
   STABILIZER 3 UNITS NOSE UP

4. Flaps - TAKE-OFF
   Slats - DOWN
   Stabilizer shift - CLEAN

5. Fuel - QUANTITY - CHECKED
   TANK PRESSURE SWITCH - NORMAL
   WING PRESSURE LIGHTS - ILLUMINATED

6. Controls - FREE

CONTINUED ON NEXT PAGE

AFTER STARTING ENGINES—CONTINUED

7. Seats - ARMED
   Seat face curtain guard - DOWN (UNLOCKED)
   Secondary firing handle guard - ROTATE CLEAR (UNLOCKED)

WARNING

With the face curtain guard and the secondary firing handle guard unlocked, the seat is fully armed.

8. Harness - LOCKED

9. Flaperon pop-up switch - ARM AND CHECK
   Move the control stick from side to side and check flaperon movement. A 4-1/2 inch control stick deflection to either side corresponds to a 51.5° upward motion of either flaperon. With both throttles at IDLE, place the flaperon pop-up switch to the ARM position and the flaperons will pop up. Advancing either throttle past IDLE will cause the flaperons to return to the flush position.

10. Anti-skid switch - ARM

11. Speed brakes switch - IN

12. IFF/SIF - AS REQUIRED

TAKE-OFF (ASHORE)

After taxiing to the take-off position allow the aircraft to roll straight ahead to ensure nose gear alignment. Apply brakes and complete the following checks:

1. Pitot heat switch - AS REQUIRED
   Set pitot heat switch as required for existing weather conditions.

2. Engine anti-ice switch - AS REQUIRED.
   Set engine anti-ice switch as required for existing weather conditions.

3. Engines - CHECK
   Advance throttle to MAX POWER, flaperons in normal configurations, allow engine rpm to stabilize; observe that EGT, fuel flow, oil pressure, and hydraulic pressure gages are within proper operating limits. Check cockpit power trim indicator to ensure engine is developing proper take-off thrust.

4. ECM operator - CHECK READY FOR TAKE-OFF

5. Autopilot switch - STAB AUG OR OFF (AS DESIRED)

WARNING

Do not use AFCS in AUTO position for take-off. Adverse trim conditions or changes may occur.

6. Warning and indicator lights - OFF (ALL)

7. Nose wheel steering - ENGAGE

8. Brakes - RELEASE

9. Use nose wheel, then rudder, for steering.
   Use nose wheel steering for directional control until rudder becomes effective at approximately 50 KIAS.

10. Allow aircraft to fly off runway at take-off airspeed.

TAKE-OFF TECHNIQUE

Refer to Section XI - PERFORMANCE DATA for rotation speeds at various gross weights. A positive climb attitude at a moderate rate of climb (1,000 to 1,500 FPM) must be established before the landing gear is retracted. Flap/slats are raised prior to 200 KIAS. Maintain a moderate climb attitude until scheduled climb speed is attained. Refer to Section XI - PERFORMANCE DATA, for recommended climb schedule. Minimum run take-off will be the same as for normal take-off, except that the nose is raised at speeds recommended for minimum take-off. Ground run airspeed is then held constant. Refer to Section XI, PERFORMANCE DATA for maximum take-off effort.

CROSSWIND TAKE-OFF

The use of nose wheel steering and normal flight controls are adequate for crosswind take-offs up to 90 degrees and 25 knots. Refer to Section XI, PERFORMANCE DATA, for Crosswind Component Chart.

HEAVY GROSS WEIGHT TAKE-OFF

Use lift-off speed as recommended in Section XI - PERFORMANCE DATA for heavy gross weight take-off.

WET RUNWAY TAKE-OFF

CAUTION

Ingestion of significant amounts of water into the generator cooling scoop may result in the loss of generator(s).

AFTER TAKE-OFF—CLIMB

When the aircraft is definitely airborne:

1. Landing gear - UP (BELOW 200 KIAS)
   Place the landing gear handle in the UP position. Check that the wheels transition light comes on and then goes out. Check integrated position indicator for clean configuration. Check that the OUT'BD WING TK PRESS and INBD WING TK PRESS caution lights are extinguished.

   CAUTION

   The landing gear should be completely up and locked prior to exceeding 200 KIAS.

2. Flaps - UP (BELOW 200 KIAS)
   Retract flaps before reaching 200 KIAS. Check integrated position indication for flap UP and slat IN indication, and stabilizer shift indication.

3. Isolation valve switch - FLT
   After the landing gear, flaps, and slats have been fully retracted, place the isolation valve switch to the FLT position.

4. Accelerate to best climb speed. See Climb Characteristics Section IV, Flight Procedures, and Climb Performance, Section XI, Performance Data.

5. Trim for climb.

CRUISE

Cruise control data for various gross weights and configurations are contained in Section XI - PERFORMANCE DATA.

FLIGHT CHARACTERISTICS

Refer to Section IV - FLIGHT PROCEDURES for information on the flight characteristics of the aircraft.

DESCENT

Prior to descent, and after prolonged cold-soaking at high altitudes, the cockpit temperature should be increased and the defogging control turned ON. Normal penetration (letdown), as reflected in the descent charts in Section XI - PERFORMANCE DATA and are accomplished with 80% rpm at a descent speed of 250 KIAS. Speed brakes are extended and descent speed is maintained by adjusting the rate of descent.

For maximum-range glide, the descent speed (200 KIAS is maintained without the use of speed brakes. Prior to all descents the following checks should be performed:

1. Defog - ON
2. Oxygen - 100%
3. Speed brakes - AS DESIRED

WARNING

With fuselage speed brakes extended, the loss of effective thrust will present a serious deterioration in aircraft performance. During level off ensure that fuselage speed brakes have been retracted.

CAUTION

Do not actuate landing gear above 8,000 feet unless the cabin is depressurized.

BEFORE LANDING

The landing check list (figure 3-4) should be completed before landing (using command response technique over the ICS).

1. Harness - LOCKED
2. Armament - ALL SWITCHES OFF
3. Flaperon pop-up switch - ARM
4. Anti-skid switch - ON
5. Hook - AS REQUIRED
   To check hook UP, depress HOOK LIFT button. The isolation switch must be in the LDG position for this check.
6. Wheels - DOWN
7. Flaps/Slats - EXTEND
8. Integrated position indicator - CHECK
   Check that the landing gear is down and locked, speed brakes are in, stabilizer in power approach configuration, slats and flaps extended, and brake pressure available.

Note

Flaps will not go to the take-off position (30°) above approximately 180 KIAS; and flaps will not go to full extension (40°) above approximately 140 KIAS due to air loads. The flap indicator will display a barber pole until the airspeed is reduced.

9. Fuel - CHECK
   Check quantity and distribution of fuel remaining.
   Determine correct approach speed.
10. Fuel pressure override switch - NORM
    Wing tank pressure caution light - ILLUMINATED
11. Autopilot - STAB AUG OR OFF (AS DESIRED)

LANDING

Upon touchdown

1. Throttles - IDLE
2. Nosewheel steering - ENGAGE
3. Brakes - APPLY

CAUTION

Brakes will not normally be applied above 100 KIAS.

NORMAL LANDING

For a normal landing, fly the pattern as illustrated in figure 3-5. Enter the traffic pattern at pattern airspeed and altitude; adjust throttles as necessary. On the downwind leg, reduce power and extend the speed brakes and landing gear (below 220 KIAS). Extend the flaps after the landing gear is down. Check that the integrated position indicator shows landing gear down and locked; flaps and slats extended; speed brakes IN; and for the power approach configuration of the stabilizer.

Note

The landing gear is structurally stressed up to 250 KIAS. However, a barber pole will result if lowered above 220 KIAS.

After the landing gear is actuated, place the speed brake switch to the RET position.

The additional throw of the control surfaces provided by rudder and stabilizer in the power approach configuration offers positive aircraft control throughout the landing.

Reduce speed to appropriate airspeed and check for doughnut Angle of Attack and roll into base leg "ON SPEED" with a moderate rate of descent.

CAUTION

Check doughnut indication against airspeed on the downwind leg. To determine airspeeds for doughnut Angle of Attack for gross weights above the normal landing gross weight of 32,000 pounds, add two knots for each 1000 pounds beginning with 118 KIAS. This airspeed should give an "ON SPEED" approach indexer indication. If a discrepancy exists between the two indications, fly the instrument showing the higher airspeed indication.

Use the angle of attack indexer and maintain the "on speed" indication. Maintaining final approach power of approximately 82 to 84% at sea level rpm, and a 3° to 3-1/2° glide slope angle will provide a normal rate of descent (approximately 700 FPM).

Upon touchdown, retard throttles to idle for flaperon pop-up operation to hold aircraft firmly on the runway. For minimum rollout distance, drop the nose and use anti-skid braking. Use the rudder and nose wheel steering for directional control of the aircraft on the landing roll. Rudder control is effective on landing roll down to speeds of 50 KIAS. Aerodynamic braking may be employed to minimize brake wear.

CAUTION

If heavy braking is used during landing or taxi, do not use the parking brakes until the brake discs have cooled. Avoid prolonged brake applications to prevent the brake discs fusing.

If it is suspected that heavy or repeated braking has resulted in overheated brakes, taxi aircraft to designated "HOT BRAKE" area.

CROSSWIND LANDING

For crosswind components of 90 degrees up to 25 knots, the flaperon pop-up will hold the aircraft firmly on the runway upon touchdown. Positive directional control may be maintained by use of brakes and nose wheel steering.

CAUTION

Neutralize rudder pedals prior to engaging nose wheel steering.

HEAVY GROSS WEIGHT LANDINGS

As landing gross weight increases, the landing pattern should be expanded, and the approach and touchdown speeds will be increased as necessary to maintain doughnut on-speed indication. For gross weights above 36,000 pounds, the final approach speed should be planned for a minimum sink rate landing. In no case shall sink rate exceed 480 feet/minute.

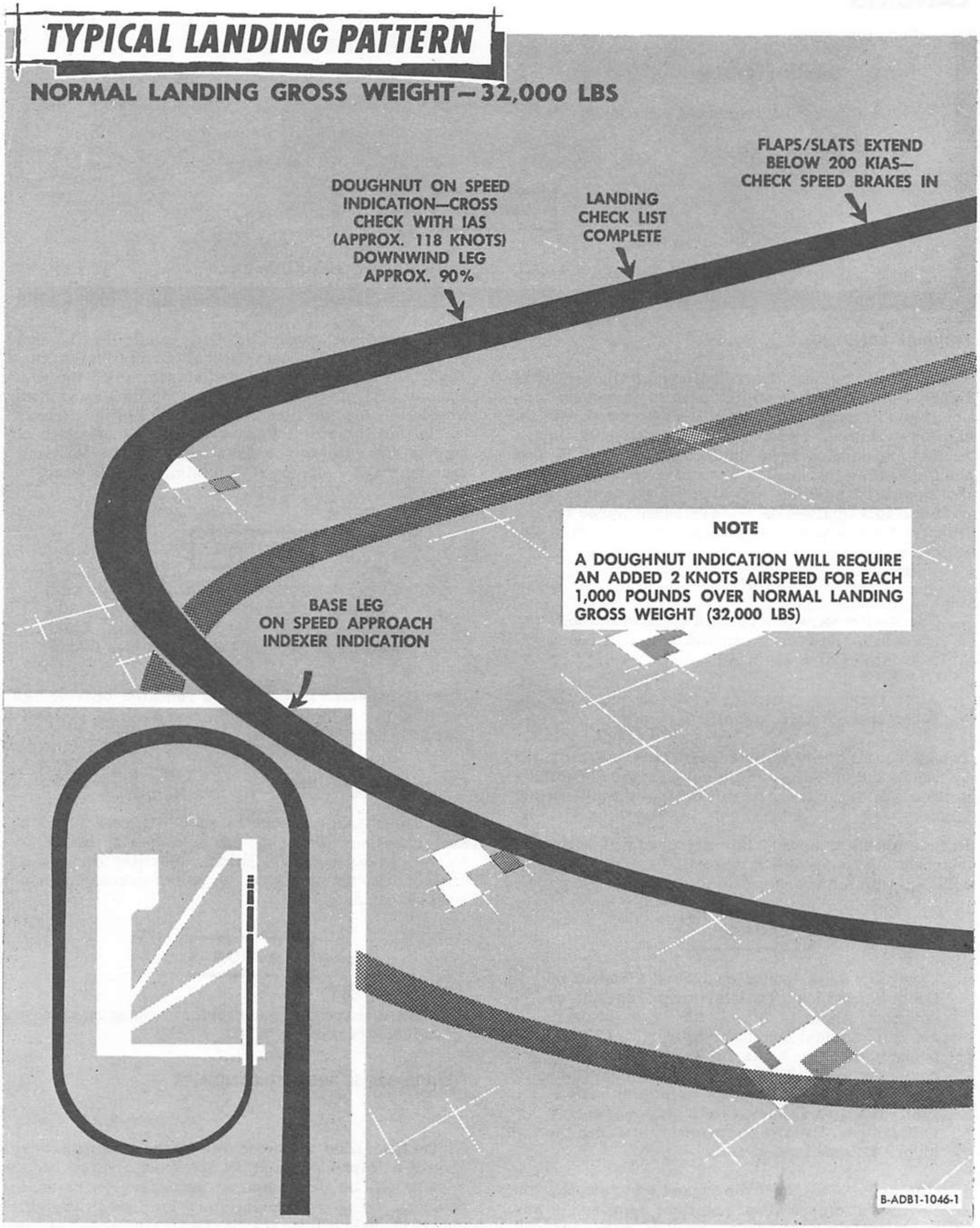


Figure 3-5. (Sheet 1)

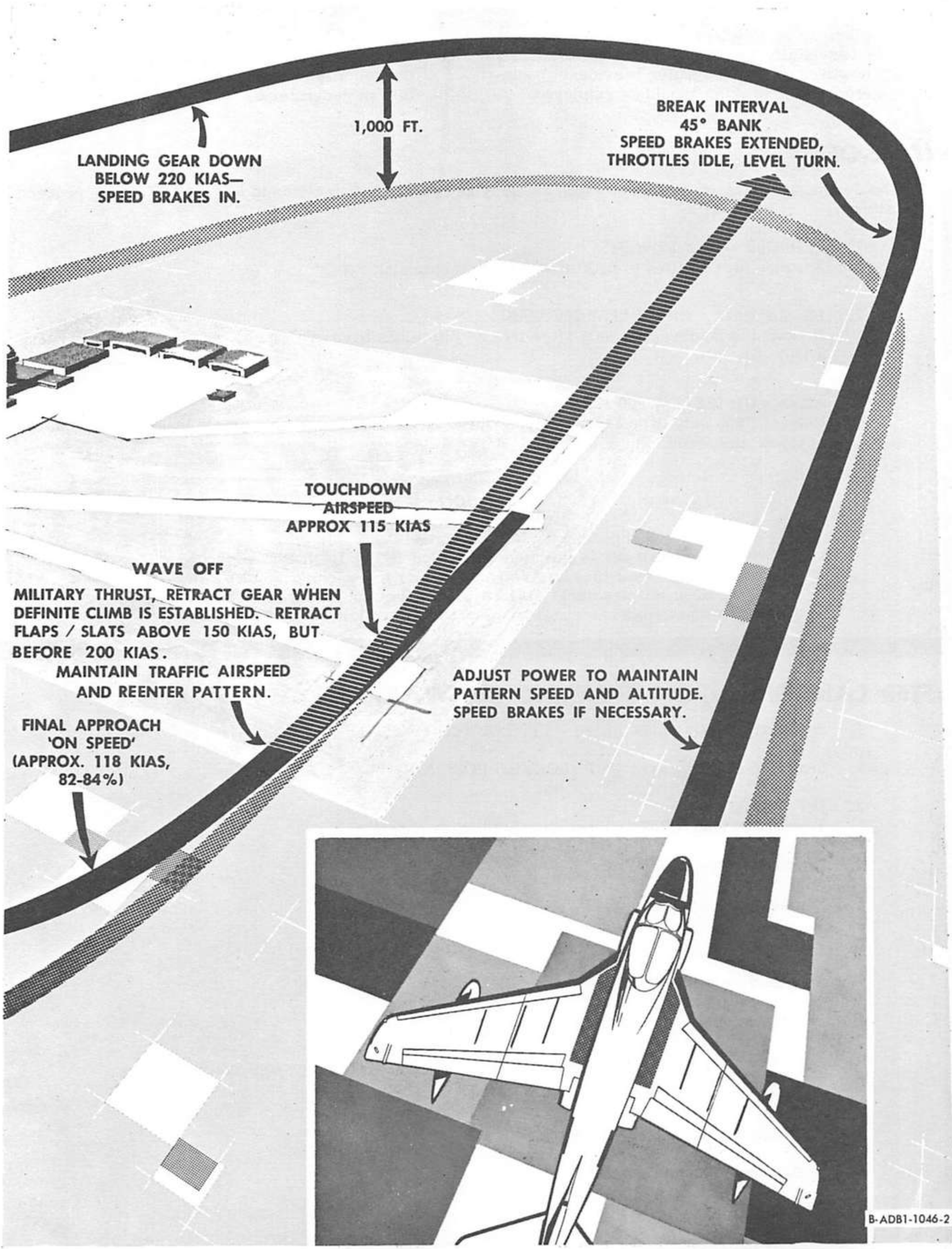


Figure 3-5. (Sheet 2)

WET RUNWAY LANDING

The procedure to be followed when landing on a wet runway is essentially the same as that for a normal landing. However, if standing water is evident or suspected, aerodynamic braking should be employed.

CAUTION

Ingestion of significant amounts of water into the generator cooling scoop may result in the loss of generator(s).

WAVE-OFF

The decision to wave-off should be made as early as possible. If decision to wave-off is made, proceed as follows:

1. Throttles - MAX POWER
   Advance the throttles to maximum power to stop sink rate.

2. Landing gear - UP (BELOW 200 KIAS)
   Retract the landing gear only after definite climb has been established, as touchdown may occur on a late wave-off.

3. Flaps - UP (BELOW 200 KIAS)
   Retract flaps only after adequate flying speed is attained to prevent altitude loss due to a loss of lift at lower airspeeds.

CAUTION

If a wave-off is initiated with flaps in the LANDING position, ensure that they are retracted prior to reaching 200 KIAS to prevent structural failure of the flap actuation mechanism. The flap drive system does not have a "blow-back" feature.

AFTER LANDING (UPON CLEARING RUNWAY)

1. Secondary firing handle guard - UP (LOCKED POSITION)
2. Seat face curtain guard - UP (LOCKED POSITION)
3. IFF - STBY
   Turn the IFF to STBY as soon after landing as possible.
4. Pitot heat switch - OFF
5. Engine anti-ice switch - OFF
6. Flaps - UP
7. Anti-skid switch - OFF

Note

The anti-skid switch should be turned OFF for any taxiing maneuvers.

8. Flaperon pop-up switch - OFF
9. Navigation equipment - OFF
10. Wing fold - AS REQUIRED

CONTINUED ON NEXT PAGE

AFTER LANDING (UPON CLEARING RUNWAY)

WING FOLD

1. Wing flaps/slats - UP
   Slats should be checked visually for retraction before the wings are folded. Check flap selector lever to UP and emergency flap switch to OFF.
2. Flaperon pop-up - OFF/CHECKED VISUALLY
3. Control stick - NEUTRAL
4. Wing fold handle - FORWARD TO FIRST DETENT
   Check wing fold warning flags extended at wing fold.
5. Wing lock pin switch - UNLOCK
6. Wing fold handle - FULL FORWARD

ENGINE SHUTDOWN

1. Wheels - CHOCKED
   Get signal from ground crew that wheels are chocked.
2. CNI master switch - OFF
3. Canopy - OPEN
4. Oxygen switch - OFF
5. Landing gear ground safety locks - INSTALLED

CAUTION

Do not shut down engines until landing gear ground safety locks are installed as the gear may inadvertently retract.

6. Throttles - IDLE, 3 to 5 minutes
   IDLE RPM stabilizes engine temperatures
7. Throttles - 75% RPM for 30 seconds, then OFF
   75% RPM for 30 seconds scavenges oil.
8. Engine and fuel master switches - OFF

CAUTION

Do not turn engine and fuel master switches to OFF until generators drop off the line.

part 4

CARRIER-BASED PROCEDURES (PILOT)

TABLE OF CONTENTS

FIELD MIRROR LANDING PRACTICE

PREFLIGHT INSPECTION

A normal preflight inspection (figure 3-1) will be conducted with specific attention being given to strut condition and extension. Check that the hook bypass switch is in the touch and go position.

PATTERN ENTRY

Call Paddles prior to pattern entry to conform Charlie time. Enter the break at 250 KIAS, at 800 feet above the terrain. When cleared to break and the proper interval of the aircraft ahead is assured, roll into a 60° banked turn, extend speed brakes, reduce power to IDLE, slow to 220 KIAS, extend gear, place speed brake switch to retract, drop flaps (below 200 KIAS), and maintain 800 feet until intercepting the downwind leg. On the downwind leg descend to 600 feet above the terrain. Slow to appropriate airspeed for gross weight and check airspeed against the angle of attack indicator to ensure proper calibration of the indicator and the indexer. At the 180° position, the angle-of-attack indicator should indicate "on speed". Aircraft in formation will take a 10-second break interval. Complete the landing check list prior to reaching the 180° position.

PATTERN

180° Position

Begin approach by turning 15 seconds past the abeam position so as to have 1-1/2 mile wings level groove. Commence a level 600 foot turn to final, maintaining optimum angle of attack.

90° Position

Maintain optimum angle of attack at 600 feet. Final adjustment to longitudinal trim should be made.

Final

At approximately 1-1/4 miles the meatball will appear in the center of the mirror, reduce power as necessary to start a rate of descent that will keep the meatball centered. Glide slope corrections should be made early by smooth changes in power and stick position as required to maintain a centered meatball and optimum angle of attack. Control altitude with the throttle and angle-of-attack (airspeed) with the stick. Once established on the glide slope, keep the scan going, cross checking meatball, lineup, and angle-of-attack, and make positive corrections, immediately but smoothly.

Landing

Keep the aircraft on the glide slope and centerline all the way down. Do not flare. When touchdown is made, add full power immediately and utilize the bolter technique described in the Carrier Based Procedures of this section. Climb straight ahead until reaching 300 feet. Turn downwind for the next pass when the aircraft ahead is approximately in the 10 o'clock position on the downwind leg.

Wave-Off

The pilot must initiate a wave-off whenever he believes his aircraft to be in an unsafe position. Anytime a wave-off is received, either by the wave-off lights or by radio, it is mandatory and will be answered with full military power and a transition to climbing attitude to prevent further loss of altitude.

Bingo Fuel

Recovery at home field will be with no less than 1450 pounds of fuel remaining.

NIGHT PATTERN

The night pattern and approach technique are generally the same as the day pattern with the following exceptions:

1. The pattern will be flown on instruments until visual acquisition of the "meatball" is made.
2. A straight-in CCA type approach at 600 feet above the surface will be made by extending the downwind leg 30 to 45 seconds past the normal abeam position used in the day pattern.

CARRIER-BASED PROCEDURES

The training program of fleet squadrons must be designed to give solid support to the premise that flight from a carrier deck is a routine event. The squadron will be afforded much less flexibility in the execution of the daily flight schedule aboard ship. The parent carrier will promulgate an air plan, based upon the operation order under which the ship is operating. If the operation order specifies "air group training" for a particular day, the squadron may express a preference in advance for the type of training for which it desires to be scheduled. However, once the air plan is published, changes are seldom permitted because of the complex planning activities the air department and air group must complete for the next days flight operation.

Prior to initial flight operations all pilots will receive an additional briefing from the ship's officers on the following subjects:

a. Flight and hangar deck procedures and signals.

b. Catapult procedures and signals.

c. Air group/squadron LSO will give a final briefing to all pilots.

Individual flight briefing will include all applicable items outlined above, with particular emphasis on weather and bingo fuel.

Standard carrier operating procedures will be adhered to as discussed in the following text.

PREFLIGHT

Day

Pilots will man aircraft when directed by Air Operations, normally 30 minutes prior to launch time. A normal preflight inspection should be accomplished with particular attention given to the landing gear, tires, hook and underside of the fuselage for possible damage.

Occasionally the aircraft assigned will be manned on the hangar deck. Unless the aircraft is already spotted on the elevator, it will be towed or pushed for access to the flight deck. The signal to stop a plane that is being moved by other than its own power is a whistle blast. Leave the hardhat off. Any whistle blast signifies an immediate stop. If the plane director is lost from view, stop. The aircraft will be raised to the flight deck level and either respotted or started on the elevator.

Note

> Brake cycles remaining should be kept at 12 or higher by use of the hydraulic hand pump in the cockpit.

Night

External preflight will be made utilizing a red-lensed flashlight. In addition to normal cockpit preflight, insure that external light switches are positioned to dim for post-start light check. The general rule of not showing white lights on the flight deck at night should be observed. The master exterior lights switch, and taxi light switch should always be in the OFF position prior to start. Set the cockpit and approach indexer lights as desired.

POST START

Day

Engines will normally be started 20 minutes prior to launch, and the customary functional checks will be performed. Do not let the plane directors hurry these checks. When ready, signal the plane director with a "thumbs up". Chocks and tiedowns will be removed upon signal by the plane director. Hold footbrakes regardless of parking position when tiedowns are removed.

Night

After normal system checks are completed, perform exterior lights check. When ready, signal the plane director with a vertical motion of the flashlight, meaning checks are completed and the aircraft is "up". If the aircraft is "down", make a horizontal motion with the flashlight.

TAXI

Day

Only emergency stop signals are used. Any signal from the plane director given from above the waist is intended for the pilot. Any signal given from below the waist is intended for deck-handling personnel. While taxiing, careful attention must be given to the director and his signals will be followed explicitly. Nose wheel steering requires the use of minimum power while taxiing. Taxi speed shall be slow at all times, especially on wet decks and approaching the catapult area. Be prepared to use the emergency brake should normal braking fail.

Night

During the night carrier-deck operations, the tempo of operations, both in volume and speed, is considerably reduced from day operations. Slow and careful handling of aircraft by both plane directors and pilots is mandatory. If the pilot has any doubt as to the plane director's signals, stop.

LAUNCH PROCEDURES

Day

Proper positioning on the catapult is easily accomplished if the entry is made with only enough power to maintain forward motion and the plane director's signals are followed explicitly. All functional checks will be performed prior to taxiing onto the catapult as practicable. After the tow link is dropped to the deck and the trail bar has been attached to the aircraft and checked by squadron maintenance personnel, the aircraft shall be taxiied up to the mouth of the lead-in track. The catapult director will then direct the pilot to approach the catapult track utilizing nose gear steering and brakes. Release nose wheel steering upon signal in the track, and as the aircraft rolls forward the tow bar will drop into the shuttle and the aircraft will stop in position for shuttle tension-up.

Night

Maneuvering the aircraft for catapult hook-up at night is identical to that used in day operations, however, it is difficult to determine your speed or motion over the deck. The pilot must rely upon, and follow closely, the plane director's signals.

CATAPULT LAUNCH

Day

Complete the check list and ensure that take-off flaps are set. Trim should be set in accordance with current launching bulletins. Upon receipt of the "tension-up and release-brakes" signals, advance throttle to full military power, grasp catapult grip, check engine and flight instruments and when satisfied the aircraft is ready, give an exaggerated salute to the catapult officer. Prior to launch, ensure that the head is firmly against the head rest. Normally, there will be a 2-4 second delay prior to catapult firing. Normal catapult launches provide a 10-15 knots excess in airspeed. The EA-6A leaves the catapult in the optimum attitude for level flight, if the trim-settings and the "hands off" technique specified in applicable launching bulletin have been used. After leaving the catapult, hold the established climbing attitude, (approximately the 3:00-o'clock position on the angle-of-attack indicator), with the control stick. Retract the landing gear after airborne. Retract the flaps below 200 KIAS. Throttle friction should be tight enough to prevent aft throttle movement. The angle-of-attack indicator provides valuable pitch indications for initial catapult rotation and should be used in conjunction with the attitude gyro, rate of climb indicator, and the altimeter.

CAUTION

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

Clearing turns immediately after launch from bow catapults are not normally made. Gentle turns to the left from waist catapults are required. If launching in instrument conditions or at night, no turns will be made off the catapults and launch interval shall be maintained by the ship.

Night

Upon receipt of the "tension up and release brakes" signal, advance throttles to full military power, grasp catapult grip, and check engine and flight instruments. When ready to launch, place external light master switch ON. After launch, the "hands-off" catapult technique will establish a positive climbing attitude. As in the day launch, angle-of-attack system must be used in conjunction with the attitude gyro, the rate of climb indicator, and the altimeter. The ECM operator will assist in monitoring the flight instruments until climbing through 2500 feet.

CATAPULT LAUNCH ABORT PROCEDURES

Day

If, after turn-up on the catapult, the pilot determines that the aircraft is down, he so indicates by shaking his head from side to side at the catapult officer or notifying PRI-FLY by radio that the aircraft is down. Never raise the hand into view to give a "thumbs down" or make any motion that might be construed as a salute. After the catapult officer observes the NO-GO signal he will then cross his forearms over his face. This signal will be followed by the standard release-tension signal. The catapult officer will then step in front of the wing of the aircraft giving the throttle back signal. Then and only then, will the power be reduced. If the aircraft goes down after the launch signal has been acknowledged, indicate so by shaking head from side to side. Also, transmit "SUSPEND-SUSPEND, #1 catapult, aircraft is down", on land/launch frequency.

Night

The pilot's NO-GO signal for night catapult launch consists in not turning his exterior lights on. The pilot should also call on land/launch frequency "SUSPEND #1 catapult: aircraft is down". Maintain full military power until the catapult officer walks in front of the wing and give the throttles back signal.

PATTERN

Day

(VFR CONDITIONS): Set pattern entry (figure 3-6)to 180° position. The day VFR carrier pattern is entered hook down at 800 feet, 250 KIAS, flying in right echelon parallel to the ship's course (FOXTROT CORPEN) close aboard to starboard. The lead aircraft will break at the bow of the ship of take interval on traffic already in the pattern. At the break, the leader shall break smartly to 60° of bank, extend speed brakes, reduce power to IDLE, slow to 220 KIAS, extend the landing gear, place the speed brakes switch to RET, drop the flaps below 200 KIAS, and maintain 800 feet until intercepting the downwind leg at one mile abeam. Then descend to 600 feet and slow to the appropriate airspeed for gross weight and compare airspeed and angle-of-attack indicators for proper indications. At the 180° position the angle-of-attack should be "on-speed". Subsequent aircraft in the flight shall break at 17-second intervals. Complete the landing check list prior to the 180° position (flaperon pop-up and anti-skid switches OFF).

Night — (Day IFR Conditions)

All night or day IFR recoveries will normally be made utilizing TACAN/CCA approaches. Aircraft will be recovered in accordance with the latest COMNAV AIRLANT/COMNAV AIRPAC CCA instructions.

CARRIER LANDING PATTERN

MAXIMUM LANDING GROSS WEIGHT - 36,061 LBS.

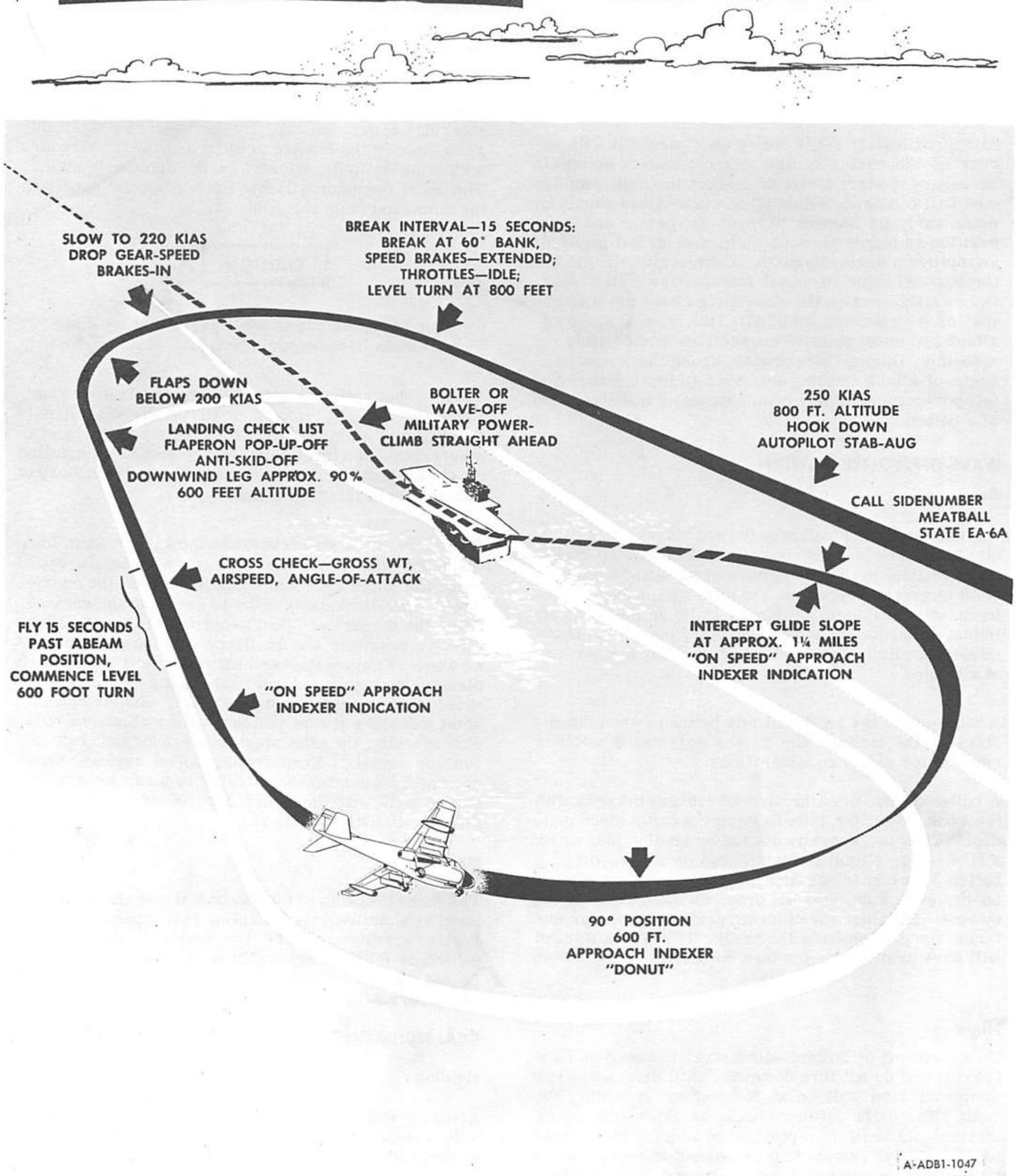


Figure 3-6

APPROACH

Begin the approach by turning approximately 15 seconds past the 180° position so as to have a 1-1/2 mile wings level groove (figure 3-6). Report at the 180° position with side number and state. Maintain 600 feet from the abeam position to "meatball" acquisition, which should occur wing level on final at approximately 1-1/4 miles. Check gross weight, longitudinal trim for 6 units nose up; depending upon the gross weight.

At approximately 1-1/4 miles the "meatball will appear in the center of the mirror; reduce power as necessary to start a rate of descent that will keep the meatball centered. Glide slope corrections should be made early by smooth changes in power and stick position as required to maintain a centered meatball and optimum angle-of-attack. Control altitude with the throttle and angle-of-attack (airspeed) with the stick. Once established on the glide slope, keep the scan going, cross checking meatball, line up and angle-of-attack and make positive corrections immediately but smoothly. During the approach, cross check meatball, angle-of-attack and line-up, down to touchdown. Add full power immediately upon touchdown in anticipation of a bolter.

WAVE-OFF/BOLTER PATTERN

Day

Wave-offs will be straight up the angle deck when given close-in. Pilots must bear in mind that a late wave off is critical in that the chance of an inflight engagement is great. Therefore, the pilot will, upon receiving a wave-off signal either by radio or the wave-off lights, immediately add full military power and transition to a climbing attitude to prevent any further loss of altitude.

A wave-off to the right will only be made when "overshooting the landing line to the extreme", or other reasons for safety considerations.

A bolter occurs when the aircraft touches the deck with the hook down, but fails to engage a cross-deck pendent. This is generally caused by landing long or by a hook-skip. Climb straight ahead on a wave-off or a bolter, then turn to parallel the ship's recovery course on the port side. Do not cross the bow while flying upwind. Be alert for other aircraft launching or entering the pattern from the break. The aircraft ahead will have priority for the turn downwind.

Night

On a wave-off or bolter, climb straight ahead on final bearing and do not turn downwind until directed. The downwind turn will be at 600 feet not exceeding 30° bank. The night pattern should be flown entirely on instruments until in a position to acquire the "meatball" visually. However, it is prudent to remain alert to the transmissions of other aircraft and to make a brief visual check when it becomes apparent another aircraft is in close proximity.

ARRESTED LANDING AND EXIT FROM THE LANDING AREA

Day

Upon touchdown, advance the throttles to full military power. As soon as arrested, throttles to IDLE and raise the arresting hook. Raise the flaps and allow the aircraft to roll back allowing the arresting hook to disengage from the pendent. Utilizing nose wheel steering, cross the foul line as soon as practicable when leaving the landing area by angling to starboard within the latitude allowed by the director's signal. The ECM operator will fold the wings upon receiving the command from the pilot.

CAUTION

Before folding the wings, ensure that the flaps and slats have been retracted.

Prior to shutdown, the aircraft should be "cleaned up". Keep the engines running until the director signals "chocks are in place", and "cut engine". Landing gear safety pins and a three point tiedown should be installed prior to shutdown. Be prepared to used auxiliary or emergency braking if necessary.

If the aircraft is struck below to the hangar deck, keep the canopy closed and the oxygen mask on until dropped from the flight deck and signalled to shut the engines down. Open the canopy prior to securing the engines. After the engines are "cut", normal braking will lose effectiveness and the auxiliary braking system must be used. Remove the hard hat and follow the aircraft director's signals. Aircraft handling personnel will move the aircraft from this point. Engine rundown noise will make it very difficult to hear whistle signals, consequently, the pilot must be alert for both hand and whistle signals. Keep rolling speed slow and under control by simultaneous use of brakes, keeping the cycles at 12 with the hand pump. Whenever the plane director is not in sight, stop.

Night

The same procedures for day operations should be utilized at night with the exception that immediately following arrestment place the 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.

CCA TECHNIQUES

Holding

Aircraft will normally hold individually at 250 KIAS with the arresting hook down. Five minutes prior to penetration the defog should be turned on and maximum comfortable cabin temperature should be maintained to prevent possible fogging of the windscreen and canopy.

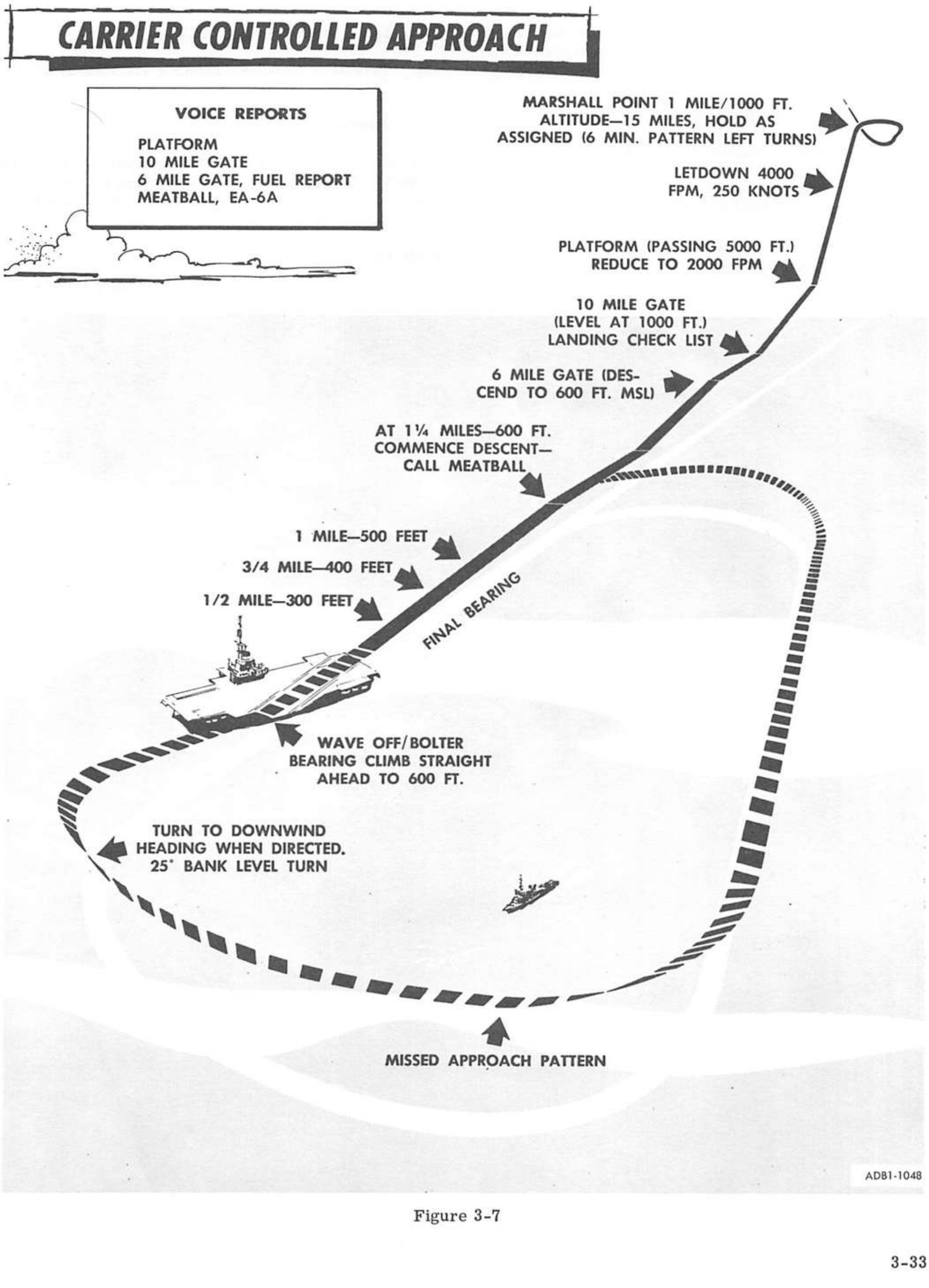

CARRIER CONTROLLED APPROACH
VOICE REPORTS
PLATFORM
10 MILE GATE
6 MILE GATE, FUEL REPORT
MEATBALL, EA-6A
MARSHALL POINT 1 MILE/1000 FT. ALTITUDE—15 MILES, HOLD AS ASSIGNED (6 MIN. PATTERN LEFT TURNS)
LETDOWN 4000 FPM, 250 KNOTS
PLATFORM (PASSING 5000 FT.) REDUCE TO 2000 FPM
10 MILE GATE (LEVEL AT 1000 FT.) LANDING CHECK LIST
6 MILE GATE (DESCEND TO 600 FT. MSL)
AT 1¼ MILES—600 FT. COMMENCE DESCENT—CALL MEATBALL
1 MILE—500 FEET
3/4 MILE—400 FEET
1/2 MILE—300 FEET
FINAL BEARING
WAVE OFF/BOLTER BEARING CLIMB STRAIGHT AHEAD TO 600 FT.
TURN TO DOWNWIND HEADING WHEN DIRECTED. 25° BANK LEVEL TURN
MISSED APPROACH PATTERN
ADB1-1048

Figure 3-7

Penetration

The aircraft will depart holding allowing approximately 700 pounds of fuel for the penetration and approach. Penetration will be accomplished as follows:

1. Throttles - RETARD TO 80%
2. Nose over to establish a 4,000 feet-per-minute rate of descent.
3. Airspeed - MAINTAIN 250 KIAS
4. Speed brakes - ADJUST TO MAINTAIN 250 KIAS AND 4,000 FEET-PER-MINUTE RATE OF DESCENT.

At Level-Off Altitude

5. Speed brakes - RETRACT
6. Throttles - ADJUST POWER TO MAINTAIN 200 KIAS

Final Approach

The pilot will continue to fly on instruments until the meatball is intercepted. The ECM operator will normally maintain a visual lookout and will call meatball to the pilot on the ICS.

CARRIER EMERGENCY SIGNALS

For carrier emergency signals see figure 5-8.

part 5
SHORE/CARRIER BASED PROCEDURES - ECMO

TABLE OF CONTENTS

PREPARATION FOR FLIGHT

Accomplishing the preflight inspection of the ECM, bombing and navigation systems will be the prime responsibility of the ECM operator prior to each mission. This inspection will include a review of ground crew and armament personnel actions regarding the weapons system and inspection of all ECM and weapon installations.

A thorough crew briefing will be conducted prior to accomplishing this inspection. This briefing will familiarize the crew with the type of mission being conducted, emergency procedures, crew coordination, and individual responsibility and cooperation throughout the planned flight.

Note

- All procedures contained in the following pages pertain only to the responsibilities of the ECM operator. Cockpit preflight inspection should be conducted by the pilot and the ECM operator simultaneously to ensure that all steps are successfully completed, and to satisfy individual crew requirements.
- For special stores information, refer to supplemental Handbook, Special Stores NAVWEPS 01-85ADA-13.

PREFLIGHT CHECK

BEFORE EXTERIOR INSPECTION

1. Check yellow sheet (OPNAV 3760-2) and weapon system status.
2. External power - OFF.

EXTERIOR INSPECTION

Perform exterior inspection as outlined in figure 3-8.

ACCESS TO COCKPIT

See figure 3-9 for normal entry into the cockpit.

EJECTION SEAT CHECK

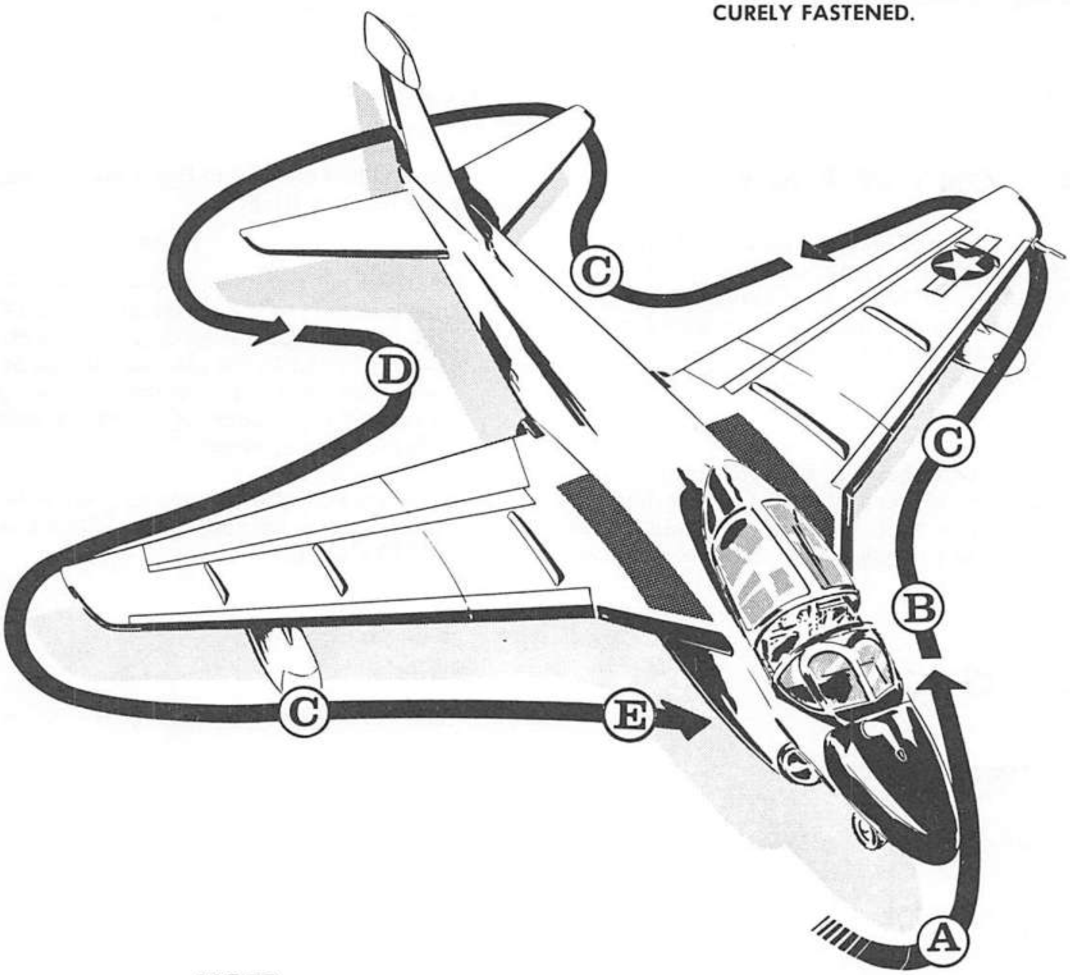
1. Ejection seat ground safety pins - REMOVE (5 PINS)
The five safety pins must be removed separately: face curtain locking mechanism, ejection gun, manual override, drogue gun and secondary firing handle guard. See figure 3-10, Ejection Seat Safety Pins.

CONTINUED ON NEXT PAGE

EXTERIOR INSPECTION

GENERAL CHECKS

THE FOLLOWING GENERAL CHECKS SHOULD BE PERFORMED THROUGHOUT THE EXTERIOR INSPECTION: CRACKS, DISTORTIONS, LOOSE FASTENERS AND FITTINGS; COVERS REMOVED SHOULD BE SECURED, FUEL, OIL AND HYDRAULIC LEAKS; ACCESS DOORS AND PANELS SECURELY FASTENED.



NOTE

The exterior inspection begins at the nose of the aircraft and progresses in a counter-clockwise direction around the aircraft. Items that are on both sides of the aircraft are called out as a repeated letter index, i.e. "C".

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Figure 3-8 (Sheet 1)

WEAPONS CONFIGURATION

(C) WEAPONS STATIONS

GENERAL CHECKS—AERO 7A

1. SEAR INDICATOR .... CHECK POSITION
2. SWAY BRACES .... SECURE
3. EJECTOR FOOT .... SET
4. ARMING WIRES .... CHECK
5. ELECTRICAL CONNECTORS .... INSTALLED AND SECURE
6. BREECH CHAMBER .... LOADED AND SECURE
7. PYLON DOOR .... SECURE
8. EJECTOR RACK SAFETY PIN .... INSTALLED

GENERAL CHECKS—AERO 5A

1. JETTISON GUN PISTON .... SAFETY WIRED
2. ELECTRICAL DISCONNECT RECEPTACLE CHECK AND SECURE
3. SHEAR PIN .... CHECK PROPER TYPE
4. FORWARD UMBILICAL RECEPTACLE .... CHECK
5. AFT UMBILICAL RECEPTACLE .... CHECK
6. PRIMER RECEPTACLE .... CHECK

GENERAL CHECKS—LAU-7/A

1. AFT FAIRING ASSEMBLY .... CHECK NITROGEN CYLINDER
2. PRESSURE GAUGE .... ABOVE 2200 POUNDS
3. SAFETY PIN .... INSTALLED

AIR REFUELING STORE

1. STORE PROPELLER .... CHECK
2. HYDRAULIC OIL LEVEL .... CHECK
3. POD FUEL QUANTITY .... CHECK
4. DROGUE .... CHECK
5. ELECTRICAL HOOK UP .... CHECK

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Figure 3-8 (Sheet 2)

EXTERNAL ECM CONFIGURATION

B. WEAPONS STATIONS

1. WING PYLONS....SECURE
2. ACCESS PANELS....SECURE

GENERAL CHECKS — ECM PODS

1. RAM AIR INTAKE....CLEAR
2. PROPELLER AND SPINNER....CHECK
3. EXTERNAL ANTENNAS....CHECK
4. ACCESS PANELS....SECURE
5. GROUND LIFTING ATTACHMENTS....REMOVED
6. SWAY BRACES....SECURE
7. UMBILICAL CABLES....ATTACHED AND SECURE

GENERAL CHECKS — CHAFF DISPENSERS

1. RAM AIR INTAKES....CLEAR
2. ACCESS PANELS....SECURE
3. CHAFF....THREADED AND VISIBLE
4. SWAY BRACES....SECURE
5. UMBILICAL CABLES....ATTACHED AND SECURE

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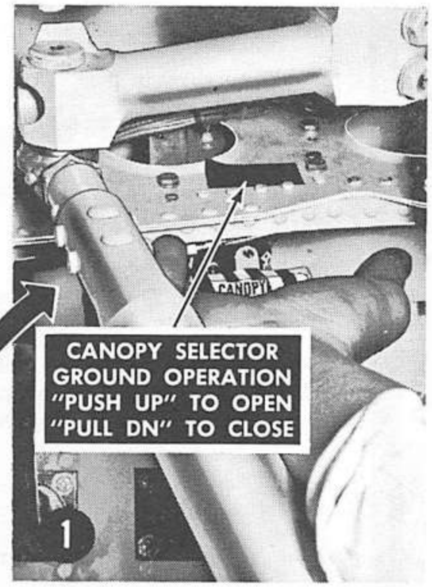
Figure 3-8 (Sheet 3)

ACCESS TO COCKPIT

TYPICAL BOTH SIDES OF FUSELAGE.

NORMAL ACCESS TO THE COCKPIT IS MADE VIA A BUILT-IN RETRACTABLE BOARDING LADDER LOCATED AFT OF THE ENGINE INTAKE DUCT. THE RETRACTABLE BOARDING LADDER IS LOWERED BY RELEASING THE PUSH – PULL STEP RELEASE.

MANUAL CANOPY OPENING



PUSH EXTERNAL CANOPY HANDLE UP.

CONNECT HAND PUMP HANDLE TO HAND PUMP. (45 CYCLES TO FULLY OPEN CANOPY)

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Figure 3-9

EJECTION SEAT CHECK–CONTINUED

WARNING

- Movement about the seat should be with caution and kept to a minimum. With the five safety pins removed, only the face curtain safety lock and the secondary firing handle guard prevent inadvertent firing of the seat.
- Do not use extra seat cushions on the ejection seat. This can result in serious back injuries if ejection becomes necessary.

2. Face curtain lock - UP (LOCKED POSITION)

3. Firing cables - CONNECTED (THIN ON TOP - THICK ON BOTTOM)
   Check that both firing cables are attached to the firing mechanism sear and the secondary firing cable (thin cable) is located on top of the face curtain firing cable (thick cable).

4. Ejection seat cartridges - LOCK WIRED AND SEALED

5. Top latch mechanism indicator - CHECKED

6. Personnel parachute withdrawal line screw connector - CHECK.
   Check that the personnel parachute withdrawal line screw connector is secure and that the withdrawal line is positioned over the firing cables.

WARNING

If the personnel parachute withdrawal line is not securely connected, automatic deployment of the parachute will not occur after ejection.

7. Drogue gun trip rod quick release pin - INSERTED

8. Slide disconnect static line cable - CONNECTED.
   Check that the slide disconnect static line cable is connected to the retention lug by the link line pin.

WARNING

If the slide disconnect static line cable is not connected, manual separation from the seat with the personnel parachute is not possible.

9. Parachute Attachment - VISUAL CHECK

10. Secondary firing handle safety guard - UP (LOCKED POSITION)

11. Leg restraint - ATTACHED TO DECK

12. Lap belt and shoulder harness - SECURE
    Pull on the lap belt and shoulder harness to check if firmly attached.

13. Left and right hand personnel services disconnects - CONNECTED

14. Emergency oxygen bottle - 1800 PSI

15. Time release mechanism trip rod quick release pin - INSERTED.
    Check that the time release mechanism trip rod quick release pin is inserted through the emergency oxygen lever with trip lever in the UP position.

16. Time release mechanism - LOCK WIRED AND SEALED

EJECTION SEAT SAFETY PINS

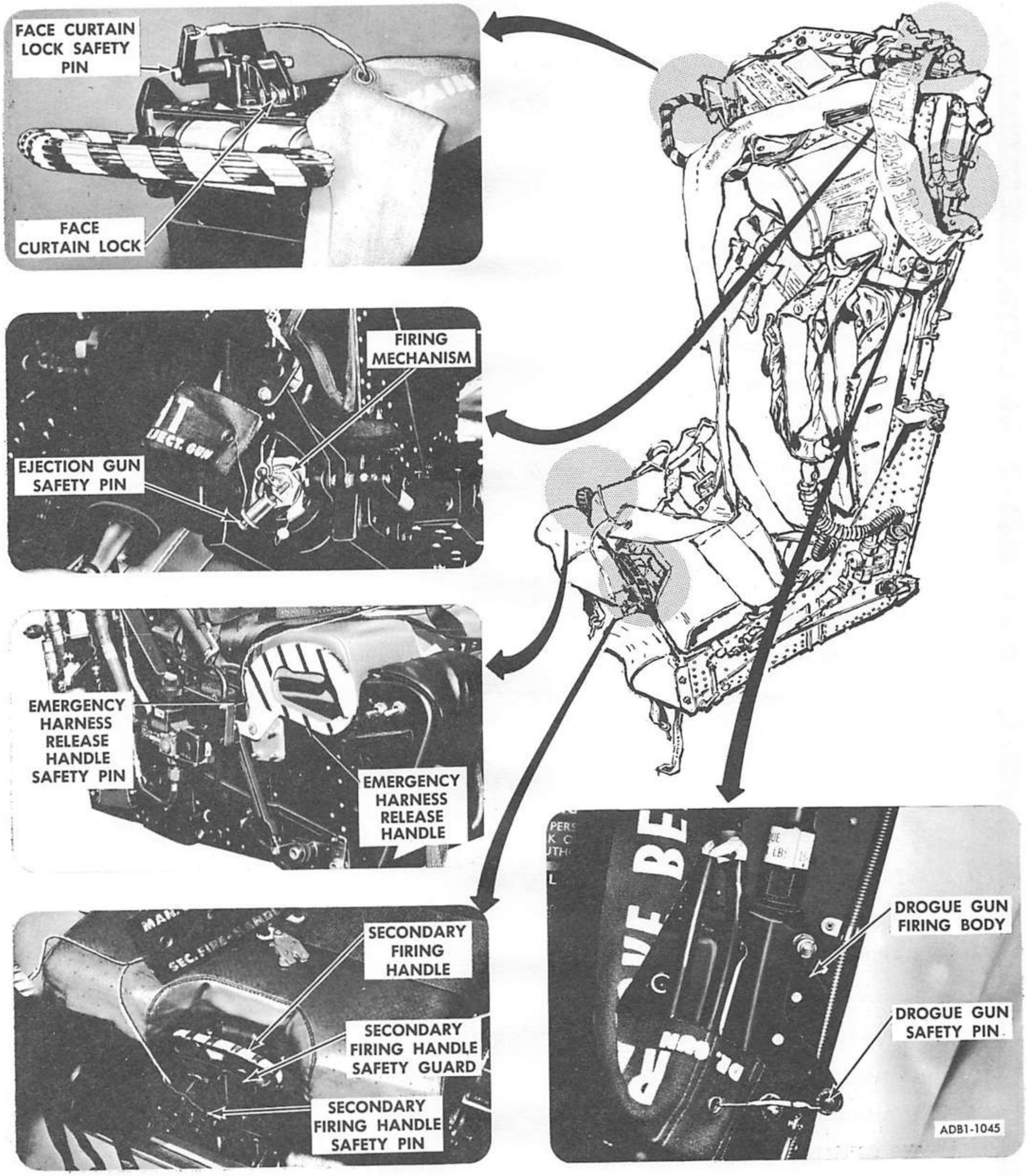


Figure 3-10

INTERIOR INSPECTION

UPON ENTERING THE COCKPIT, MAKE THE FOLLOWING SAFETY CHECKS

1. Master arm switch - OFF AND LOCKED
2. Mechanical and electrical fuzing switches - OFF
3. Nuclear selector buttons - OFF AND LOCKED
4. Station selector switches - OFF AND LOCKED

BEFORE EXTERNAL ELECTRICAL POWER IS CONNECTED

1. DECM master switch - OFF
2. Chaff switch - OFF
3. AN/ALQ-55 selector switch - OFF
4. AN/ALQ-55 switch guard - DOWN AND WIRED (switch OFF)
5. AN/ALQ-76 transmitter switch - OFF
6. ICS amplifier selector switch - NORM
7. Radio transmitter selector switch - ICS
8. Refueling switch - OFF (WHEN INSTALLED)
9. Interior lights - OFF
10. Circuit breakers - IN
11. CNI (IEC) master switch - OFF
12. AN/ALQ-53 power switch - OFF
13. AN/ALQ-53 manual slew switch - ON
14. Navigational computer function switch - OFF
15. Bomb tone - AUTO
16. Airconditioning
    a. Cockpit - ON
    b. Master - NORMAL
17. Cabin dump - OFF
18. Antenna selector - AUTO

AFTER STARTING ENGINES

1. Harnessing - FASTEN
    a. Attach leg lines
    b. Attach shoulder harness
    c. Attach lap belt and vertical straps
    d. Snug up lap belt
    e. Snug up forward vertical straps (if adjustable)

CONTINUED ON NEXT PAGE

INTERIOR INSPECTION CONTINUED

f. Attach oxygen, communications, and personnel services

g. Snug up harness shoulder straps

WARNING

Do not connect the survival gear lanyard at this time. The survival equipment may hinder rapid evacuation of the cockpit during a ground emergency or ditching.

2. Seat - ADJUST

a. Assume ejection position, sit erect, buttocks against backrest, head firmly against headrest, spine straight, thighs against seat pan.

b. With left hand, reach-up and grasp face curtain handle.

c. Adjust seat height and tilt so that top of helmet just clears underside of face curtain handle.

Note

Above procedure ensures proper positioning for ejection and optimum vision over the nose of the aircraft and inside the cockpit.

3. Oxygen switch - ON (WITH MASK AWAY FROM FACE DEPRESS THE ICS AND MIC BUTTONS)

4. Oxygen regulator - CHECK
Turn counterclockwise to full up position to get diluter demand operation.
Then turn oxygen regulator selector valve clockwise to the full down position to check 100% oxygen flow.

5. Oxygen mask - ATTACH

6. Oxygen regulator - 100%

7. G-valve test button - DEPRESS
Momentarily depress the g-valve test button to check for instant g-suit pressurization.

CAUTION

Ensure that the air conditioning master switch is in the NORM position. Hot engine bleed air will be pumped through the anti-g suit if the test button is depressed when the air conditioning master switch is OFF.

8. Vent suit - seat cushion controls - AS DESIRED

BEFORE TAXIING

1. AN/ALQ-53 power switch - ON

2. Doppler radar selector switch - STBY
Perform preflight self test then return switch to STBY.

3. Navigational computer function switch - STBY
After warm-up period, perform bearing and range check, insert navigation information then return switch to STBY.

BEFORE TAKE-OFF

1. Seat face curtain lock - DOWN (UNLOCKED)
2. Secondary firing handle guard - ROTATE CLEAR (UNLOCKED)

WARNING

With the face curtain guard and the secondary firing handle guard unlocked, the seat is fully armed.

3. Harness - LOCKED

PRIOR TO LANDING

1. All DECM power switches - OFF
2. AN/ALQ-53 power switch - ON
3. AN/ALQ-53 manual slew switch - ON
4. Harness - LOCKED
5. Oxygen regulator - 100%

AFTER LANDING (UPON CLEARING THE ACTIVE RUNWAY)

1. Secondary firing handle guard - ROTATE UP (LOCKED)
2. Seat face curtain lock - UP (LOCKED)
3. Navigational computer function switch - STBY
4. Doppler radar selector switch - STBY

IN CHOCKS

1. Oxygen switch - OFF
2. Panel lights - OFF
3. AN/ALQ-53 power switch - OFF
4. Navigational computer function switch - OFF
5. Doppler radar selector switch - OFF

section IV
FLIGHT PROCEDURES

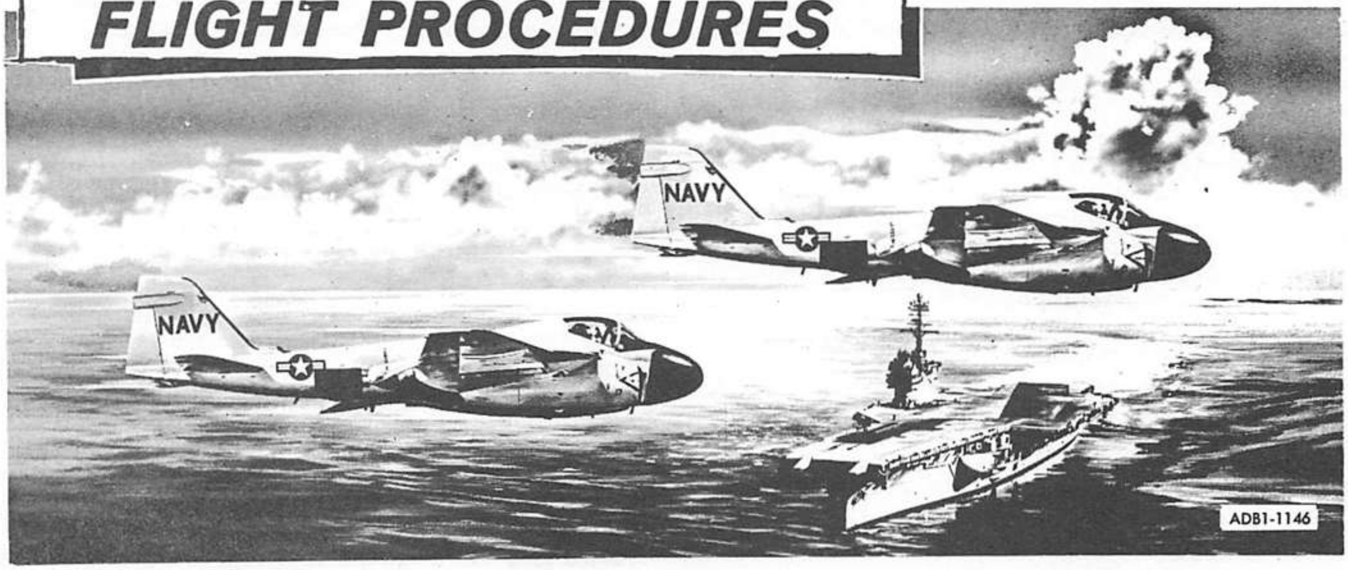


TABLE OF CONTENTS

FLIGHT PROCEDURES

As an overall assessment of the flight characteristics of aircraft, the aircraft is fully controllable in all normal speeds and maneuvers. The stall warnings are generally characteristic of slower, conventional aircraft, and landing speed is relatively slow. The EA-6A is adequately powered, which is reflected in its take-off and climb acceleration, and in its ability to carry a substantial store load safely.

ENGINE OPERATION

COMPRESSOR STALL

Compressor stalls result when one or all of the compressor blades are operating at too high an angle-of-attack. Normally, the compressor blades are kept in a desirable angle-of-attack by maintaining air velocity in proportion with engine RPM. Hence, anything that would affect inlet air velocity or engine RPM will either increase or decrease the possibility of a compressor stall. In the J-52 engine, compressor stalls are minimized automatically by the compressor bleed system and the fuel control system, but pilot technique can also directly affect the possibility of a compressor stall.

Stall Warnings

Compressor stall warnings vary greatly in degree and intensity. Pulsations through the airframe and retorts from the engine are the most obvious warnings. The noises from the engine can vary from low intensity pops to loud bangs. The most subtle indication is the inability of the engine to respond to forward throttle movement.

Minimizing Compressor Stalls

The engine bleed control system is used to maintain a desirable angle-of-attack on the compressor blades by maintaining a proper relationship between inlet-air velocity and engine RPM. Since low compressor static pressure is related to engine RPM, and inlet-air pressure is related to inlet-air velocity, the automatic functions of the engine bleed control system can be based on a predetermined schedule of desirable low compressor static pressure and inlet-air pressure ratios. This approach is used in this engine.

When the bleed control senses an unstable pressure ratio, twelfth-stage compressor bleed air pressure is transmitted to a series of 15 intercompressor bleed valves, opening the bleed valves. The unstable air in the low compressor section is then dumped into the engine compartment, tending to artificially restore the air inlet velocity/rpm relationship. "Artificially" applies here because engine rpm remains high, but the compressing effect of the turbine is reduced to a value that would be obtained normally by a lower compressor rpm. Bleeding the air overboard also results in a slight power loss which affects engine performance. To eliminate this power loss at low altitudes, the bleed override control automatically locks out any signal from the pressure ratio bleed control below approximately 0.5 IMN, allowing the compressor bleed valves to remain closed. Another automatically operated safe-guard against a compressor stall is contained in the engine fuel control system. Since the engine is more susceptible to compressor stalls at low inlet-air temperature and at certain rpm's, it is necessary to limit acceleration fuel flow schedules to avoid a stall. If fuel is introduced at a rate that will increase pressure before an inlet pressure, air flow, and rpm increase, the burner pressure will increase to a point where air flow is blocked through the engine, causing the compressor to stall. The engine fuel control senses the condition of rpm and inlet temperature and schedules a corrected amount of fuel to minimize the possibility of a critical burner pressure.

It would seem that these automatic functions for preventing a compressor stall would be enough to eliminate a stall. However, the engine was set up only for normal operation. One variable not covered by engine adjustments is pilot technique. When operating in conditions marginal for compressor stalls, the responsibility remains with the pilot to aid the automatic functions rather than to rely on them. The flight conditions which can cause a compressor stall must be kept in mind and erratic or abrupt throttle movements must be avoided. An air refueling hookup is a good example where throttle technique could be overlooked. During flight attitudes which affect air inlet flow, throttle technique is even more important, due to the added factor of distortion at the air inlet. If poor throttle technique, marginal flight attitudes, and uncoordinated flight are combined, the conditions are ideal for a compressor stall.

Lessening the Stall Effect

Several techniques can be employed to reduce a compressor stall effect. If a rising EGT accompanies the RPM drop, this is an indication of a stall produced by an improper fuel schedule. Slowly retard the throttle to prevent engine damage, then slowly advance the throttle to the desired thrust level. Avoid erratic throttle movements. If the stall resulted from excessive distortion of air flow at the air inlet, and a drop in rpm without a rising EGT is observed, increasing the thrust setting to about 90%, or increasing the airspeed by decreasing rate of climb, or dropping the nose will usually eliminate the stall. Be especially careful to maintain coordinated flight. If the stall is uncontrollable, shut down the engine. Although a compressor stall is not normally dangerous, if the stall continues, it could cause engine damage.

ENGINE RATINGS

Engine ratings were not set up as limits which, if exceeded, would result in the engine falling apart. Overall engine life for a particular installation is first determined. This life is broken down into percentages which reflect the time used at different thrust settings. With this information, allowable limits are set. In normal engine life, when engine time is used up, the engine is ready for overhaul. The overhaul times are used to plan logistical support of the aircraft. If premature breakdowns occur, this can seriously affect squadron strength by causing shortages of necessary items. A better understanding of engine ratings will prevent a pilot from inadvertently exceeding engine limits and will bring into focus the real reason engine limits are set.

CREEP

Creep is a condition that results from the progressive distortions of turbine blades caused by operational stresses and heat. Essentially, the overhaul time limit corresponds to the creep limit. The acceleration of creep increases with high thrust settings; hence, the primary purpose of a time limit is to prevent excessive creep. The important secondary time factor is cooling. Since heat also increases creep, merely reducing a throttle setting to maintain a published time limit defeats the purpose of the limit. A desirable situation for cooling would be to operate the engine at a lower thrust rating, at least as long as it is operated at an advanced thrust, before returning again to an advanced thrust. In summary, creep progresses additively, resulting in a limit in engine hours. Abuse of the engine only accelerates the consumption of engine time, and momentary operation at low thrust settings, to avoid exceeding published limits, does not alter the problem of engine life at high thrust settings.

EXHAUST GAS TEMPERATURE

Excessive heat in addition to accelerating creep, also causes deformation of sheet metal parts and, if allowed to persist, will result in sagging and subsequent structural failure. Consequently, exhaust gas temperature is the most important factor in engine durability. This does not mean exhaust gas temperature (EGT) is to be used as a limit in place of a time at maximum thrust settings. However, always reduce a thrust setting to maintain an EGT limit. In its normal function, the exhaust gas temperature conveys information on how well the engine is performing at a desired thrust setting. Normally, exhaust gas temperature will be kept within limits by the fuel control. If temperatures still increase or stabilize at too high a temperature, use slower throttle movements or retard the throttle. Whenever possible, operate the engine at a lower thrust setting as long as it has been operated at an advanced thrust. Whenever the exhaust gas temperature becomes uncontrollable, shut down the engine. Excessive temperatures should be noted for maximum reached and for the length of time at the overtemperature. The temperatures should be reported as a discrepancy for appropriate maintenance action.

Exhaust Gas Temperature and Inlet Icing

Exhaust gas temperature will begin to increase in an icing condition, usually as a result of decreased airflow through the engine. The decreased airflow is sensed by the fuel control, resulting in an increased fuel flow to the combustion chamber. This causes the EGT to rise. Since a rise in EGT follows the buildup of ice, EGT is not a reliable indication of the beginning of ice formation at the air-inlet.

FLAME OUT

A single engine flame-out is not normally a dangerous situation. Nevertheless, the cause of the flame-out should be ascertained to prevent a similar occurrence at critical altitudes and airspeeds. A flame-out usually occurs if the fuel-air-ratio is either too rich, or too lean to maintain combustion. The fuel control unit automatically responds to varying conditions to maintain a proper ratio. However, severe changes in normal flight conditions, such as those which result in compressor stalls, heavy moisture ingestion, or excessive throttle movements at altitude, can exceed the fuel control's ability to react, and will probably result in a flame-out.

Indications of a flame-out are a loss of thrust, dropping exhaust gas temperature, and dropping rpm. An air start should be initiated as soon as possible while engine RPM is still high. Attempt to avoid the conditions that set up the flame-out initially. If the flame-out occurs during an icing condition, or during moisture ingestion, use the air start switches for the duration of the condition. However, the starting ignition should not be used indiscriminately, because premature breakdown of the igniter plugs will result. If it is determined that the flame-out resulted from an engine malfunction, shut down the engine.

Cooling Before Shutdown

Except for emergency or operational necessity the engines should be operated at idle for 3 to 5 minutes before shutdown to allow engine temperature to stabilize.

Smoke After Shutdown

If smoke is emitted from the engine after shutdown, determine the cause. White vapor indicates fuel vaporization. This does not harm the engine, but is potentially dangerous because of the fire hazard in the immediate area. If heavy black smoke is emitted, this is indicative of burning oil or fuel. If the GTC is available, crank the affected engine. If the smoke persists, use fire fighting equipment to extinguish the fire.

FUEL MANAGEMENT

Since fuel transfer occurs as the result of differential air pressure within the fuel tanks and gravity flow, fuel management is directly related to pressure regulation. Overall fuel management is handled automatically when the wind drop tank transfer switch is in the normal position. It has been found however, that by controlling fuel from the drop tanks, the range of the aircraft can be increased.

By using fuel from two drop tanks at a time, and then jettisoning the empty tanks, the aircraft reaches a cleaner configuration in the shortest time. The wing drop tank transfer switch (WING DROP TANK TRANS) selects the transfer from the wing drop tanks. Fuel can be selectively transferred from either the outboard or inboard tanks, or all drop tanks simultaneously.

Throughout all fuel transfer, pressure at 25-psi is maintained on the drop tanks. Therefore, selective fuel transfer is accomplished by allowing fuel flow from selected tanks only. In selecting transfer from the outboard tanks, move the wind drop tank transfer switch to outboard (OUTBD). The shutoff valves from the inboard tanks and centerline drop tank prevent fuel transfer from these tanks. By selecting the inboard (INBD) position, the opposite sequence will occur with the centerline drop tank remaining closed. In the NORM position, the drop tank shutoff valves are opened, allowing automatic simultaneous fuel transfer from the tanks. In the event of an electrical failure, the shutoff valves will open, allowing normal automatic transfer.

When the air refueling pod is attached, the SHIP TANK switch must be used to transfer fuel from the centerline store position. The centerline shutoff valve, used in centerline drop tank transfer is now controlled by the ship tank switch. When placed in the FROM STORE position, the centerline store shutoff valve opens. Pressure, regulated to 25-psi, then forces the fuel out of the air refueling pod to the forward fuselage tank. The center position of the switch corresponds to OFF.

Through the use of the tank pressure switch on the fuel management panel, the wind and drop tanks can be pressurized on the ground or transfer can be stopped in flight. The switch positions and their functions are covered in Section I under Ship Tank Switch.

Wing Tank Purging System

Purging begins automatically after a wing tank fuel dumping operation. When the tanks are drained through normal usage, purging begins when the wing switch is placed to DUMP. Purging will continue as long as the wing switch remains in DUMP.

Spring-loaded, zero-leak check valves are used for purging. The valves are set to open at 0.5-psi pressure differential. When air is sensed in the wing tank shutoff valves, a signal is sent to the wing tank pressure regulator shutting off pressure to the wing tanks. When the check valves sense the preset pressure differential, the valves open, purging the tanks. The fuel vapors are evacuated through the wing dump valves which are electrically opened when the wing dump switch is actuated.

Note

If the wing dump valves fail to actuate, the ORIDE position will provide an additional 5-psi pressure that may aid in actuation of the dump valve.

CLIMB CHARACTERISTICS

A typical climb schedule for the basic aircraft is 350 KIAS to IMN 0.75. For best fuel consumption, military power should be maintained during a climb. Longitudinal stability is positive throughout the climb regime.

STALLS

Refer to Section XI, PERFORMANCE DATA, for take-off and landing speeds for various aircraft weights. The figures in the following paragraphs are given for flaps down stall approach rates of 0.5 knots per second. Faster approach rates will give slightly lower minimum speeds. Awareness of the onset of prestall buffet will vary from pilot to pilot since it will be superimposed on the constant, light, flaps down buffet already present. This constant buffet will decrease in intensity with decreasing speed until onset of the prestall buffet which will be easily perceptible. Recovery from all stalls is immediate with forward stick input. No excessive altitude loss is encountered unless stall penetration is continued until secondary stall characteristics of sharp roll off and increased yaw are encountered. See figures 4-1 and 4-2, Stall Speeds.

WARNING

Stall characteristics and airframe buffet are the same with speed brakes extended or retracted. Therefore it will be necessary that the pilot visually check the speed brake position indicator to determine that the speed brakes are retracted prior to operating at airspeeds near stall or minimum control.

TAKE-OFF

With full power and 30° flaps, prestall buffet will be encountered 12 to 14 knots prior to stall. The latter is defined by pitch oscillations with full aft stick. If the pitch oscillations are allowed to build up, a deep penetration of the stall will result in a sharp rolloff or a moderate "slice" in either direction.

POWER APPROACH

With power for level flight and full flaps, onset of prestall buffet occurs at about 9 knots prior to stall. Pitch oscillations begin a few knots prior to the stall, and the stall itself is characterized by a slight nose down pitch with a mild yaw and roll off in either direction.

LANDING

With idle power and full flaps, prestall buffet occurs 5 knots prior to stall. The latter is defined by slight pitch oscillations with full aft stick.

WAVE-OFF

With full power and full flaps, onset of buffet occurs 8 knots prior to stall. An extremely nose high attitude at a reduced gross weight is a notable feature of this stall approach. At the stall, slight reversal of the longitudinal force gradient occurs in conjunction with mild yawing tendencies in either direction. As in the take-off stall, a deep penetration will result in increased yawing and roll-off.

ACCELERATION RESTRICTIONS

There is a marked decrease in acceleration with the speed brakes extended. For example, limited acceleration is possible at low operating speeds and low gross weight, however, at approximately 145 KIAS the aircraft, with both engines at full thrust, stabilizes at a zero rate of climb. When the airspeed is reduced to 140 KIAS you will find a sink rate of approximately 300 feet per minute. This decrease in acceleration capabilities results from the thrust spoiling affect of the speed brakes.

WARNING

- With speed brakes extended, the loss of effective thrust will present a serious deterioration in performance. Even the application of MIL power may not be sufficient to maintain level flight.
- When operating under single engine conditions ensure that the speed brakes have been retracted.

SPINS

Intentional spins are prohibited.

ERECT SPINS

The EA-6A is not prone to enter unintentional spins. To attain a spin, the controls must be intentionally held in the pro-spin positions. The pro-spin control positions are full aft stick, full rudder, and neutral flaperons.

The erect spins require about 1-1/2 turns to become fully developed. The initial 1-1/2 turns, the incipient spin phase, are more disorienting than the fully developed spin due to the rolling, pitching, and yawing motions in conjunction with a changing load factor. Recovery from the incipient spin phase, as well as from other post stall gyrations, is normally effected by neutralizing or releasing the controls, but in some cases lateral stick deflection is necessary to stop the rolling motion.

The fully developed erect spin is a low-speed, high angle-of-attack, autorotative spin. The most critical spin is one with asymmetric power: idle power on the engine on the outside of the spin and 80% RPM or

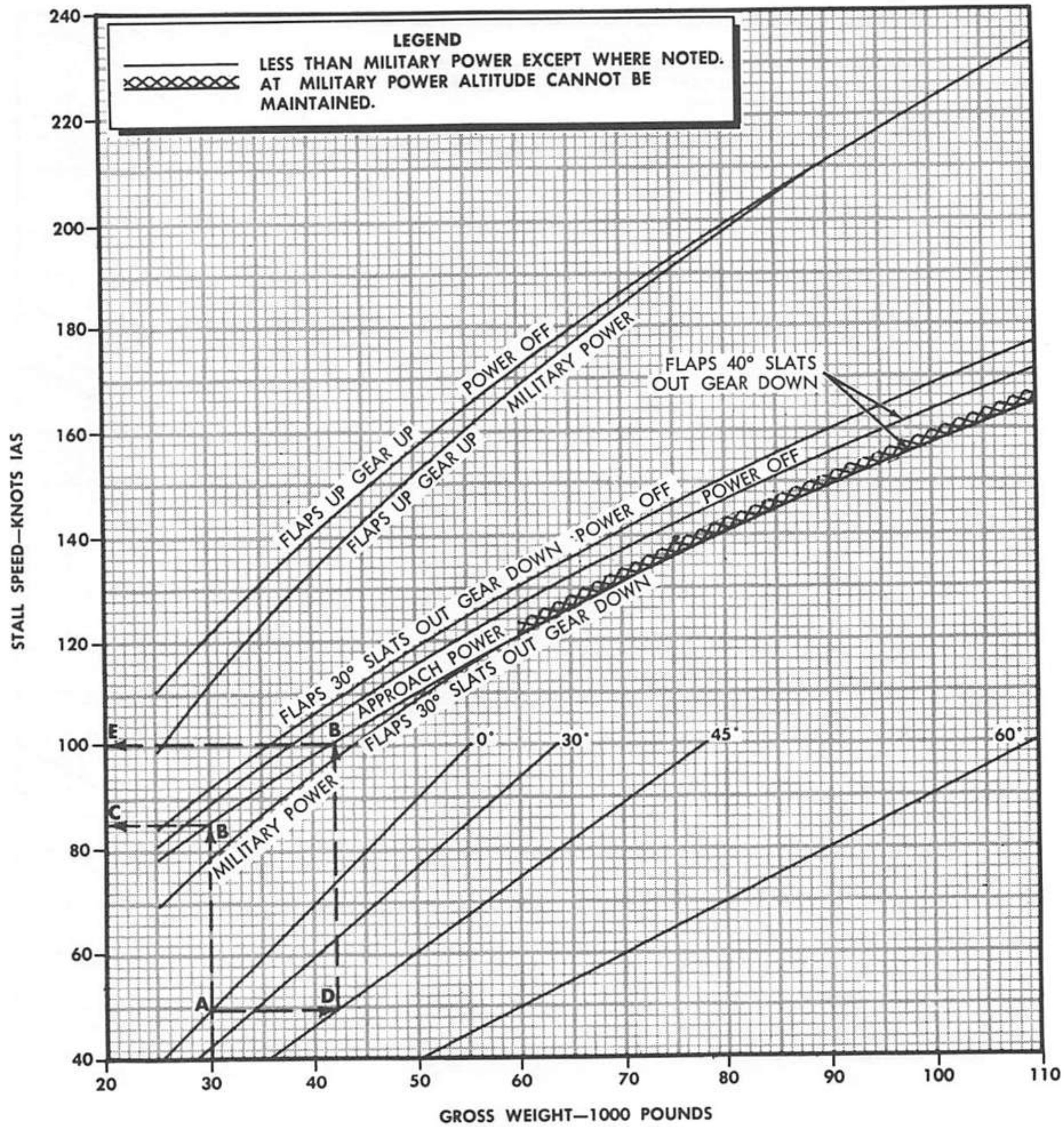
STALL SPEEDS

SEA LEVEL

AIRCRAFT CONFIGURATION
CLEAN
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS
DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



EXAMPLE:

LANDING FLAPS AND GEAR EXTENDED APPROACH POWER
A. GROSS WEIGHT = 30,000 LB
B. LANDING CONFIGURATION REFLECTOR LINE
C. STALL SPEED = 85 KNOTS
D. BANK ANGLE = 45°
E. STALL SPEED = 100 KNOTS

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Figure 4-1

STALL SPEEDS

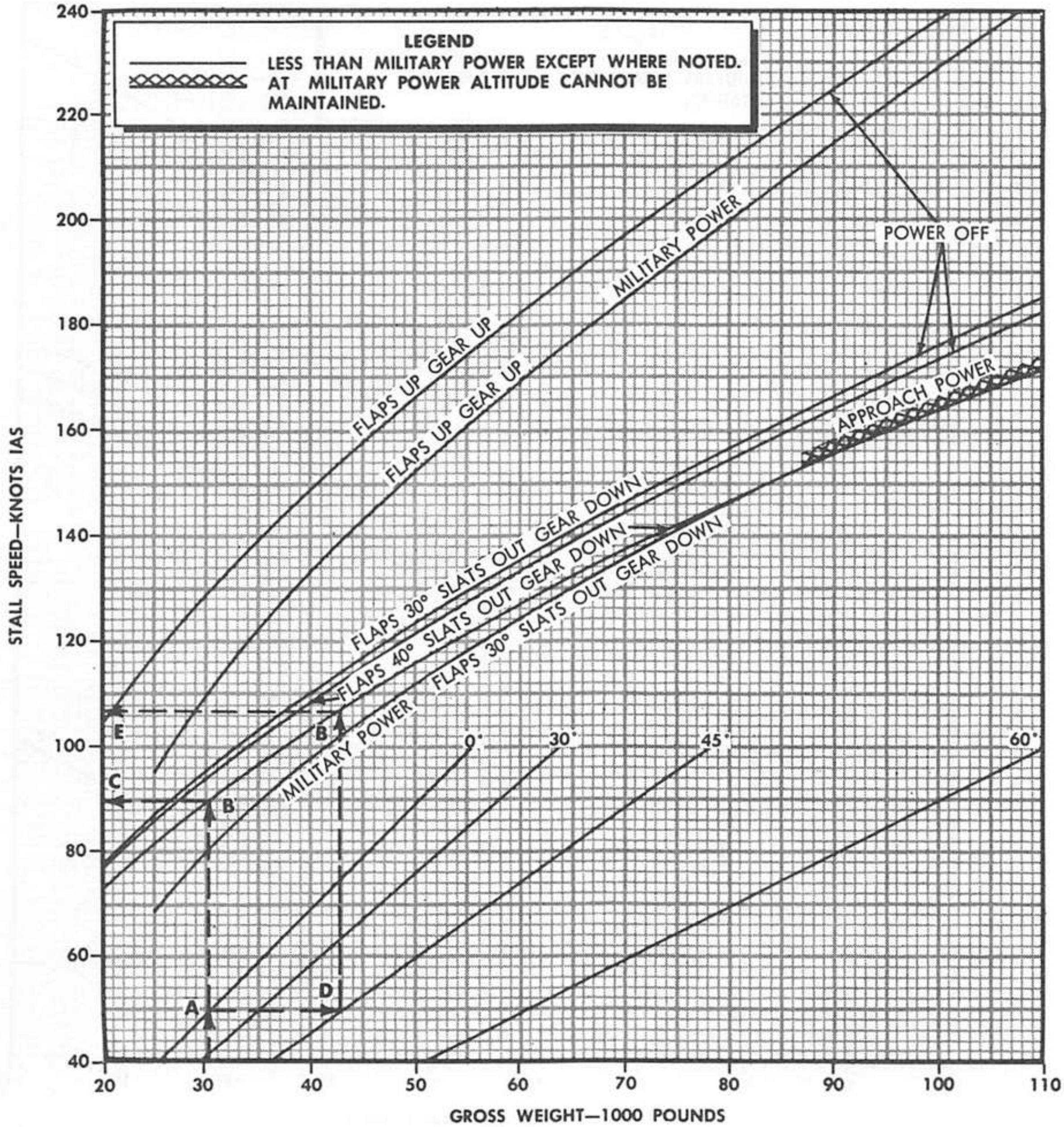
SEA LEVEL

AIRCRAFT CONFIGURATION
CLEAN PLUS (5) 300 GAL. TKS.
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



EXAMPLE:

LANDING FLAPS AND GEAR EXTENDED APPROACH POWER
A. GROSS WEIGHT = 30,000 LB
B. LANDING CONFIGURATION REFLECTOR LINE
C. STALL SPEED = 85 KNOTS
D. BANK ANGLE = 45°
E. STALL SPEED = 107 KNOTS

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Figure 4-2

greater on the engine on the inside of the spin. The erect spins, with the exception of the asymmetric power spins, are recoverable with cruise control throws but may require up to five recovery turns. An assist spin recovery switch (ASSIST SPIN RECOV figure 1-2) has been provided to permit the attainment of the landing configuration controls throws (±35° rudder and 24° stabilizer leading edge down), while in the clean configuration. Use of the extended control throws provides recovery in 1-1/2 turns from all spins.

WARNING

- The ASSIST SPIN RECOV switch should be activated ONLY to effect recovery from a spin. Operation of the switch may impose an additional acceleration, which during an accelerated maneuver may overstress the aircraft, or when operating at minimum airspeeds may pitch the aircraft up into stall or heavy buffet.
- Reselection of cruise control throws after spin recovery should be done below 300 KIAS while anticipating a nose-down trim change.

Altitude Loss During Spins

The altitude loss in the fully developed erect spin is 1,300 to 1,500 feet per turn. The altitude loss from the initiation of recovery to level flight with a 2.5 to 3.0g roundout is approximately 9,000 feet.

Spin Characteristics

The erect spin is characterized by the airspeed indication fluctuating rapidly from less then 80 KIAS up to 120 KIAS, the turn needle indicating a steady full needle deflection turn, and the accelerometer showing 0.0 to +0.3g. The rotation is oscillatory enough to cause the ball in the turn and slip indicator to slide back and forth and to be of no use to the pilot. The airframe buffet level is low and the predominant aircraft motion is yaw. The spin rotation rate is 3.2 to 3.5 seconds per turn and no severe forces are imposed on the pilot. The angle-of-attack varies from 65° to 80°. The aircraft pitch attitude oscillates from 10° to 60° nose down. Engine compressor stalls are audible to the pilot and occur at the rate of 10 per second. The exhaust gas temperatures will increase rapidly to over 700°C if the engine RPM is greater than 88 to 90%. The engine RPM will drop to below flight idle resulting in loss of the aircraft electrical system if the engine RPM is less than 80%. The electric ram air turbine will not operate in an erect spin. The automatic flight control system, the position of speed brakes, and the aircraft CG location do not noticeably affect the spin characteristics.

Erect Spin Recovery

The first step in recovery from all erect spins is to determine the spin direction. This is best accomplished by reference to the turn needle. The following steps should then be taken:

1. Apply full rudder pedal deflection in the direction opposite to the spin (rudder opposite the direction that the turn needle is indicating).
2. Hold the control stick full aft and neutral laterally.
3. Simultaneously with application of spin recovery controls, or as soon as possible, select the extended control throws with the ASSIST SPIN RECOV switch.
4. Adjust the throttles to provide 80 to 85% RPM. Adjusting the throttles to a point where they are parallel to the pilot's vertical axis results in the desired power setting without the requirement to monitor the RPM indicator.
5. When rotation ceases, immediately neutralize the rudder and move the control stick forward to at least the neutral position. Failure to neutralize the controls as soon as spin rotation has ceased will result in violent lateral snaps, causing the aircraft to assume a steeper nose down position and require more altitude for recovery to level flight.
6. Return the ASSIST SPIN RECOV switch to the cruise control throw position after return to level flight and at or below 300 KIAS.

Recovery will occur in 1 to 1-1/2 turns. If turn reversals are encountered while neutralizing the controls, release the controls and the aircraft will fly itself out. The flaperons are not effective during erect spins.

INVERTED SPINS

A-6A inverted spins have been unobtainable (contractor demonstration and NATC tests) with the normal cruise control throws, but have been induced by using the extended control throws. The inverted spins require 1 to 1-1/2 turns to become fully developed. Recovery from the initial 1 to 1-1/2 turns, the incipient spin phase, is effected by neutralizing or releasing the controls, but in some cases lateral stick deflection is necessary to stop the rolling motion.

The fully developed inverted spin is a low-speed, high negative angle-of-attack, autorotative spin. All the inverted spins are recoverable with cruise control throws but may require up to 3-1/2 turns. Use of the extended control throws provides recovery in about 1 turn from all inverted spins.

Altitude Loss During Spins

The altitude loss in the fully developed inverted spin is 1,000 to 1,300 feet per turn. The altitude loss from the initiation of recovery to level flight is approximately 9,000 feet with a 2.5 to 3.0g roundout.

Inverted Spin Characteristics

The inverted spin is characterized by the airspeed indication fluctuating from less then 80 KIAS up to 100 KIAS, an accelerometer indication of -1.0g, the turn needle showing a full needle deflection turn, and the ball remaining in the side of the cage opposite to the direction indicated by the turn needle. The spin rotation rate is 3.5 seconds per turn. The angle-of-attack is steady -55°. The aircraft pitch attitude oscillates from 0° to 35° below the horizon. Engine compressor stalls occur as described for erect spins. The electric ram air turbine will operate satisfactorily during inverted spins.

Inverted Spin Recovery

Determine the spin direction by reference to the turn needle, then take the following steps:

1. Apply full rudder pedal deflection in the direction opposite to the spin.
2. Hold the control stick full forward and neutral laterally.
3. Simultaneously with application of spin recovery controls, or as soon as possible, select the extended control throws with the ASSIST SPIN RECOV switch.
4. Adjust the throttles to 80 to 85% RPM.
5. Neutralize the controls as soon as spin rotation ceases.
6. Return the ASSIST SPIN RECOV switch to the cruise control throw position after return to level flight and at or below 300 KIAS.

Recovery will occur in about 1 turn. Turn reversals have not been encountered during forward stick recoveries from inverted spins. The flaperons are not effective during inverted spins.

SPIN RECOVERY ON INSTRUMENTS

Recovery on instruments from erect and inverted spins can be effected using the following technique:

1. Determine the direction of spin by reference to the turn needle. Determine if spin is inverted or erect by reference to the accelerometer.
2. Apply full rudder pedal deflection in the direction opposite to the turn needle.
3. Apply full aft stick for recovery from an erect spin and full forward stick for recovery from an inverted spin.
4. Simultaneously with application of recovery controls, or as soon as possible, select extended control throws.
5. Adjust the throttles to provide 80 to 85% RPM.
6. Hold spin recovery controls for a count of 3, or 3 seconds, then release the controls to neutral. Monitor the airspeed, turn needle, accelerometer, and gyro horizon for indication of spin recovery.
7. Return to level flight using the gyro horizon and turn needle for attitude reference.
8. Select cruise control throws after return to level flight and at or below 300 KIAS.

Recovery from all inverted spins will normally occur when the controls are released to neutral. The recovery from all erect spins will occur within 1 turn after release of the controls to neutral.

After activating the ASSIST SPIN RECOV switch the flight controls must be held in the spin recovery position for a count of 3 or 3 seconds, and then released to neutral because the inherent lag in the turn and slip indicator is too great for it to be used to determine when spin rotation has ceased. Holding the spin recovery controls for 3 seconds provides about one spin recovery turn which is enough to cause the spin recovery to progress to a point where the aircraft will recover "hands-off" within an additional one-half turn. Waiting until the turn needle begins to move toward the centered position before neutralizing the controls results in a series of reversals and the aircraft will not recover due to late neutralizing of the flight controls.

A momentary loss of electrical power will not adversely affect the performance of the gyro horizon or the turn and slip indicator. The turn needle will continue to indicate the correct direction of turn for 9 seconds after electrical power failure.

FLIGHT CONTROLS

A movable slab stabilizer, flaperon wing spoiler and conventional rudder provide effective control over the operational range of the aircraft. The control surfaces are positioned by irreversable hydraulic actuators linked to the stick and rudder peddles by a proportional follow-up linkage. Control force feel is provided entirely by mechanical devices such as bungees and bobweights, and requires no mach or "q" compensations. Control trim is accomplished electrically by shifting the feel system neutral position in each system.

The stabilizer travel is increased for flaps-down flight in a programmed manner so that trim change with flap deflection is minimized. Stabilizer shift is accomplished by a cable drive from the flap motor and is designed to remain at either full flaps down or flaps up gearing, should the shift cable fail. Stabilizer travel is 1.5° leading edge up, to 9.6° leading edge down in the flaps-up configuration, and 1.5° leading edge up, to 24° leading edge down for flaps-down operation, with full stick travel. Selection of the assist spin recovery drives the same shift mechanism.

WARNING

Selection of the assist spin recovery results in a stabilizer shift in the pitch-up direction. At high speeds, this would result in excessive g-loads, and at low speeds, could pitch the aircraft into a stall.

Rudder travel is increased for flaps-down flight by withdrawing stops in the rudder control linkage. Rudder travel is reduced to 4° with flaps up, and increases to 35° flaps down, or with the assist spin recovery selected. Rudder travel is proportional to rudder deflection in each case.

Rudder stop withdrawal is accomplished by a cable drive from the flap motor. In the first 5° of flap extension, rudder travel remains restricted (4°). Between 5° and 25° of flap extension, proportionally greater rudder travel is obtained (4° to 35°). Above 25° of flap extension, the rudder remains at full travel (35°).

The rudder stops shift to full open if the cable fails. Selection of the assist spin recovery switch accomplishes the stop withdrawal by the same mechanism as (full) flap extension.

After landing, the flaperon pop-up feature, as well as the flaps and slats, act together to effectively kill lift and increase drag to decrease landing roll.

LEVEL FLIGHT

No unusual characteristics will be noted in level flight. Control response is excellent. Longitudinal stability is positive up to 0.84 IMN where a reverse stability regime is gradually entered. This transonic trim change or "tuck-under" is common to swept wing jets of this type and is considered mild and completely controllable. Positive stability is regained at 0.92 IMN and above.

Loss of either engine will not compromise control or stability. Engine thrust lines pass close to aircraft C.G. and minimum single engine control speeds are within 3 to 5 knots of the normal two engine stall speeds. Single engine control speed is limited by pre-stall buffet, slight lateral and longitudinal oscillations and close to full lateral and directional control deflections. Single engine operation with speed brakes extended will result in the reversal of roll and yaw characteristics. With the application of power to the operating engine, the aircraft has a tendency to turn into and roll towards the operating engine, instead of into the dead engine. This condition results from the deflected thrust by the speed brakes.

WARNING

When operating under single engine conditions ensure that the speed brakes have been retracted.

PILOT INDUCED LATERAL OSCILLATION

With the AFCS operating in STAB/AUG at airspeeds in excess of 450 KIAS, moderately abrupt lateral stick displacement or reversal may induce an oscillation in roll of 20-30 degrees per second. This oscillation is sustained by the pilot displacing the stick and may be stopped immediately by neutralizing the stick. The lateral oscillation increases in intensity from 450 KIAS to limit speed but is not divergent or destructive throughout the flight envelope. The oscillation will not normally be experienced in maneuvering flight.

DIVES

Dive entries may be either pushovers or split-S type. In either case, transition through the transonic trim changes will be rapid. At about 0.90 IMN, reduced lateral control effectiveness and slightly negative dihedral effect will be encountered. The latter phenomenon will not be noted unless rudder deflection are made. The basic airframe is not restricted in dive angle or maximum speeds but certain store configurations may require limits. See applicable restriction curves in Section XI. Dive recoveries may be made either clean or with speed brakes. Trim changes with speed brakes are slight, but it should be remembered that as speed is reduced, trim changes and/or gusts may add to the existing g's during pullouts at the bottom of the dives.

Speed brake extension changes airflow over the stabilizer area and renders precise g control more difficult at high speeds.

CAUTION

In recovering from supersonic dives, do not extend the speed brakes if the flight hydraulic system is inoperative.

STABILIZER ACTUATOR LOAD SATURATION

Failure of the flight hydraulic system at speeds above 0.90 IMN below 20,000 feet can produce a potential stabilizer actuator saturation if the fuselage speed brakes are extended. With brakes extended a mild uncontrolled nose up pitch will be encountered. Pilot correction of forward stick will not be effective until speed is further reduced. When speed is reduced, a violent nose down pitch will be experienced when the stabilizer actuator again responds to the control stick displacement.

Note

Ample longitudinal control is available from the combined system when fuselage speed brakes are retracted.

A safe and prompt deceleration from this flight region can be effected by a normal speed brakes retracted pullout.

In a combined hydraulic system failure the speed brakes will not extend.

SINGLE ENGINE OPERATION

FLIGHT CHARACTERISTICS

For normal flight conditions there is ample lateral and directional control for maximum asymmetric engine thrust operation. Minimum single-engine control speed, with flaps retracted is obtained at approximately the onset of pre-stall buffet at 5 to 10 knots before stall, and is characterized by an increasing wing heaviness which requires full lateral control at minimum speed. Minimum single engine control speed with flaps extended (either TAKE-OFF or LANDING) is approximately 105 KIAS at sea level, at normal landing gross weights. Minimum speed is characterized by an increasing wing heaviness toward the dead engine which requires nearly full lateral and rudder control to correct.

Extending the flaps will withdraw the 4° rudder limit stops, allowing the rudder to deflect up to 35°. This increase or decrease of the directional control range should be anticipated when flaps are extended or retracted during single engine operations.

Extending the speed brakes during single engine operation will produce a reverse effect on yaw and roll characteristics. The aircraft will tend to yaw and roll into the operating engine when brakes are deflected.

WARNING

- o Do not use the spin recovery switch to obtain increased control throws.
- o Extension of the speed brakes drastically reduces performance.
- o During single-engine operation, ensure that the speed brakes have been retracted.

FLIGHT PERFORMANCE

Refer to Section XI, Performance Data, for qualitative single engine performance information.

WARNING

An engine failure will produce a rate of descent in excess of 700 FPM in take-off configuration at maximum operational take-off weight - 56,500 lbs. sea level. Upon failure of an engine the pilot should immediately jettison all external stores to reduce gross weight and drag sufficiently for positive rate of climb. The landing gear and flaps can be retracted and excess fuel dumped if desired. Refer to TAKE-OFF Refusal Speeds, SECTION XI, Part 3.

Note

External stores cannot be jettisoned until wheels are off the ground.

FLIGHT WITH EXTERNAL LOADS

Handling qualities of the aircraft with stores loaded varies with their weight, shape, and distribution. Spanwise loading increases roll inertia noticeably, with accompanying reduction in roll acceleration. For all store configurations, lateral control is still satisfactory. Longitudinal control and stability is least affected by addition of stores.

Stores with large diameters, such as fuel tanks and the air refueling pod, cause added airframe buffet during flight above normal cruise speeds, and during increased g-loads. The authorized store configurations and limitations are found in Section VIII of Supplemental NATOPS Flight Manual, NAVWEPS 01-85ADB-1A.

FORMATION AND TACTICS

RENDEZVOUS

Turning Rendezvous

The turning rendezvous is made at 300 KIAS (unless otherwise briefed). After all aircraft are in a loose-trail position, the leader commences a 180 degree turn, using 30 degrees of bank. Each member of the flight waits until the aircraft ahead passes through a 30 degree bearing from his 12 o'clock position, and then rolls into a 45 degree banked turn to the inside of the leader's turn. When the leader bears 45 degrees relative to the joining aircraft, wingmen ease turn as necessary to maintain the 45 degree bearing until joined either on the preceding aircraft or the flight. Wingmen may add power to gain no greater than a 20-knot speed advantage over the leader, to avoid overshooting. As the aircraft approach the leader, the closure rate is adjusted so as to join on the man ahead or on the inside of the leader's turn. After joining on the inside of the leader, a cross-under is made to the outside, assuming normal wing positions.

Circling Rendezvous

A circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals. The pattern is normally a starboard orbit, using 30 degrees of bank around a geographic fix. Altitude must be specified and airspeed will be 300 KIAS (unless otherwise briefed). Upon arrival, each aircraft flies directly over the fix, slightly below the rendezvous altitude, to provide altitude separation upon entry into the pattern. The first aircraft to arrive should establish the orbit. Subsequent aircraft should be able to sight other aircraft in the circle from directly over the fix. When sighted, a hard turn in the direction of the orbit turn should be made to establish a 45 degree bearing relative to the joining aircraft. Vary the bank as necessary to maintain the bearing until joined. Do not use an airspeed advantage in excess of 15 knots. As the leader is closed, check closure rate so as to stop on the inside of the turn; then cross under to a normal wing position on the outside.

Tacan-Circling Rendezvous

A TACAN-circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals and it is not possible to use a geographic fix (at sea or above an overcast). The pattern will be a starboard orbit tangent to the designated tacan radial, at a specified distance and altitude. Normally, each pilot flies outbound on the assigned radial, maintaining the briefed climb schedule or rendezvous speed. Upon reaching the join-up circle, each pilot commences a starboard orbit, using 30 degrees of bank (or more) until visual contact is made with the Flight Leader. If necessary, request the leader's position. The leader will state his position around the orbit, using the figures 1, 2, 3, or 4, corresponding to 000 degrees, 090 degrees, 180 degrees, and 270 degrees, respectively, relative to the designated radial, as shown in figure 4-3. Each pilot then plans his turn to cut across the orbit for rendezvous. ADF may be used to assist in picking up the leader.

Running Rendezvous

A running rendezvous is effected by closing from the rear on a prebriefed heading or radial. This rendezvous should be accomplished with the leader climbing 300 KIAS and 93 percent RPM (unless otherwise briefed). If it is to be made level, the leader should normally be at 300 KIAS at the designated altitude.

ADF Running Rendezvous

The ADF rendezvous is useful for joining aircraft under all conditions, and particularly during a straight-course running rendezvous. The procedure to be used for the latter is as follows:

1. Trailing aircraft select ADF position on 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 needle points 5° 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.

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 needle on the nose when the leader transmits. From the change in azimuth of the number-1 needle between short counts, approaching aircraft will be able to determine their proximity to the lead aircraft. Approaching the Flight Leader, the needle will change more degrees in azimuth between counts, requiring larger corrections to keep the leader on the nose. At this time, the leader can probably be detected visually and a standard rendezvous completed.

Low-Visibility Rendezvous/Rendezvous on Different Model Aircraft

This type of rendezvous should be performed in emergency situations only when directed by higher authority or when the urgency of the mission dictates. The rendezvousing aircraft should be flown at a safe maneuvering airspeed. The initial procedures will be as previously described for standard rendezvous. However, the latter stages should be modified as outlined below.

1. Establish radio contact, if possible, and determine indicated airspeed and intended flight-path of the aircraft to be joined.
2. Place all lights on BRIGHT (if applicable).
3. Rendezvous about 1000 feet out, slightly aft of abeam (4 or 8 o'clock) the lead aircraft.
4. Close cautiously, while assuring constant nose-to-tail clearance. Maintain a constant relative bearing. Changes in relative bearing will cause foreshortening or lengthening of the aircraft fuselage and make determination of closure rate difficult.
5. A rendezvous on a different model aircraft and/or in low-visibility conditions is extremely conducive to vertigo. A high degree of caution and good judgment must be exercised throughout the rendezvous. At no time should a rapid-closing situation be allowed to develop.

Safety Rules for Rendezvous

1. During all rendezvous, safety shall be the prime consideration.
2. Keep all aircraft ahead constantly in view and join in order.
3. During rendezvous, only enough step down 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.

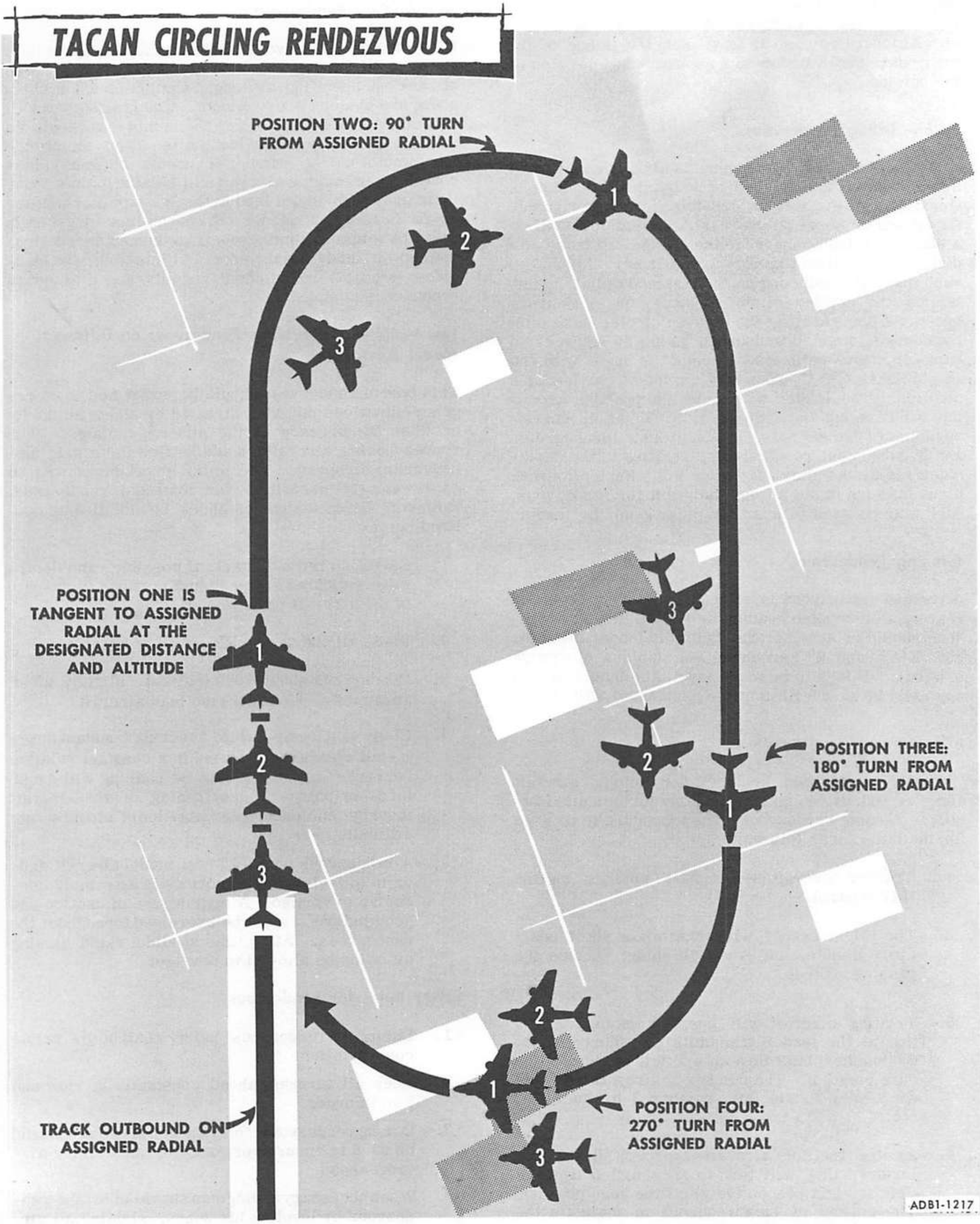
TACAN CIRCLING RENDEZVOUS
POSITION TWO: 90° TURN FROM ASSIGNED RADIAL
POSITION ONE IS TANGENT TO ASSIGNED RADIAL AT THE DESIGNATED DISTANCE AND ALTITUDE
POSITION THREE: 180° TURN FROM ASSIGNED RADIAL
POSITION FOUR: 270° TURN FROM ASSIGNED RADIAL
TRACK OUTBOUND ON ASSIGNED RADIAL
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Figure 4-3

5. To avoid overshooting, all relative motions should be stopped when joining on an inside wing position. A crossunder to the outside may then be made.

6. During a running rendezvous, use caution in the final stage of join-up, as relative motion is difficult to discern when approaching from astern.

FORMATION

Free-Cruise Formation (Four-Plane Division)

This formation will normally be employed for all operations away from home base, unless another formation is signaled. Within each section, the wingman's position is 30 degrees abaft the section leader's beam, with sufficient distance abeam to clear the wing tips and sufficient distance astern to clear the tail of the lead aircraft.

The vertical stepdown of the wingman will be sufficient to clear the leader's aircraft and jet wash. The second section leader's position is approximately 30° abaft the division leader's beam and slightly stepped down. The second section leader must maintain a distance out on the assigned bearing line which will provide clearance with the lead section wingman and which will also permit visual communciations between division leader and section leader. During steep turns or hard maneuvering, the second section and wingmen, within each section are free to slide as necessary to avoid large power changes.

Parade Formation (Four-Plane Division)

This formation will normally be employed when the flight is operating in the vicinity of home base and in conditions of low visibility. The parade formation position is obtained by the wingmen and section leader maintaining a position slightly stepped down with 3 to 5 feet of lateral clearance between wing tips on a bearing matching the sweep back of the wing leading edge. Sliding during turns is not permitted.

AIR REFUELING

BEFORE TAKE-OFF

1. Ship/tank switch . . . . OFF
2. Drogue position switch . . . . RET
3. Refueling master switch . . . . OFF
4. Fuel transfer switch . . . . OFF
5. Light switch . . . . (Day)BRT (Night)DIM
6. Gallons delivered indicator 000
7. Hose jettison switch . . . . OFF

DROGUE EXTENSION

1. Refueling master switch . . . . ON
2. Drogue switch . . . . EXT
   Drogue position will read EXT, when drogue reaches full trail position.
3. Ship/tank switch . . . . TO STORE
4. Exterior lights . . . . DIM
5. Anti-collision light . . . . OFF

RECEIVER HOOK-UP AND REFUELING

After the receiver aircraft engages and moves forward in relation to the tanker enough to extinguish the amber light on the store, the drogue position indicator will read TRA. The ECM operator then places the fuel transfer switch to TRANS to start the flow of fuel.

Stopping Fuel Transfer

Fuel transfer may be stopped at any time by placing the fuel transfer switch to OFF.

CAUTION

Refueling cannot be stopped by placing the refueling master switch in the OFF position. Refueling will stop if the receiver aircraft backs off enough for the amber light to come on or if the probe disengages. In either case, the drogue position indicator window will change from TRA to EXT.

To stop transfer to the store, turn the ship/tank switch to OFF.

DROGUE RETRACTION

1. Fuel transfer switch . . . . OFF
2. Airspeed . . . . 250 KIAS OR LESS
3. Drogue switch . . . . RET

Note

If the drogue cannot be fully retracted at 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.

TRANSFER FROM STORE TO TANKER

If it is desired to transfer fuel from the refueling store to the tanker, place the ship/tank switch to FROM STORE.

BEFORE LANDING

1. Ship/tank . . . . OFF
2. Drogue switch . . . . RET
3. Drogue position indicator. . . . . RET
4. Refueling master switch . . . . OFF
5. Fuel transfer switch . . . . OFF

JETTISONING THE FUELING STORE

The air refueling store may be jettisoned electrically in the same manner as other external stores.

WARNING

Do not jettison fueling store above 300 KIAS.

EMERGENCY OPERATION

Refer to Emergency Procedures, Section V of this manual.

TANKER SAFETY PRECAUTIONS

WARNING

- Do not start the turbine or extend or retract the drogue when over populated areas or when other aircraft are close abeam or behind.
- Do not extend the drogue when a store hydraulic leak has been observed.
- Do not actuate the speedbrakes during any part of the refueling operation.
- Once the hose jettison switch is actuated do not return it to the OFF position. Inadvertent cycling of this switch will cause a dangerous condition in the store.

AIR REFUELING STORE LIMITATIONS

1. Maximum speed for unfeathering is 300 KIAS. For extension of the drogue and refueling, maximum speed is 300 KIAS or 0.80 IMN.
2. Maximum speed for drogue retraction is 250 KIAS.

PILOT TECHNIQUE

Air refueling can be accomplished within a wide range of altitude and airspeed. Successful engagements have been made between Sea Level and 35,000 feet at airspeeds between 190 and 300 KIAS. The optimum airspeed for engagement is approximately 230 KIAS. Use of optimum airspeed will assist the receiver in escaping heavy buffeting caused by the tanker slipstream and jet exhaust.

A closure rate in excess of 5 knots may induce hose whip. If hose whipping or kinking occurs during normal receiver hook up, disengagement should be made immediately and store inspected for hose tension regulator malfunction.

Thermal turbulence from the deck may be annoying when hooking up at very low altitudes due to oscillatory drogue motion.

1. The receiver pilot should move into a position 20 feet behind and below the drogue, on a plane with the trailing drogue, 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 burned out bulb. Trim the aircraft slightly nosedown to remove any slop or break-out force from the horizontal stabilizer control system, and move forward and up until the tip of the probe is approximately 5 to 10 feet behind and 2 to 3 feet below the drogue. Pause here long enough to get stabilized, then add enough power to close and engage the probe at a closure speed of about 3 knots. The probe and drogue are primary visual references. Closure speeds in excess of 5 knots may cause hose whip with ensuing damage. Misalignment at high closure speeds may cause damage to radome or canopy. If the drogue is missed, stay below the drogue and back straight out until the drogue is in sight.
2. After engaging the drogue, continue to push in the hose until the amber light is out. After the amber light goes out, the receiver calls "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 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 hose centered slightly above the lip of the aft end of the store.
3. Breakaway is accomplished by the receiver aircraft 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. When the receiver aircraft is clear of the area behind the hose and drogue, call "CLEAR."

NIGHT REFUELING

Night refueling is performed in the same manner as during the day. The tanker should have all exterior lights DIM and the anti-collision lights off. The buddy store lights should be on DIM. The amber lights located on the outboard pylons of the tanker aircraft are used for reference during night refueling. A white light located in the underside of the tanker fuselage will illuminate the refueling hose.

Take up an initial position on the tanker and use the same procedures described in this section for day refueling. When in position aft of the drogue, correct altitude can be determined by referring to the amber pylon lights. The receiver aircraft lights should be on BRIGHT and the anti-collision light ON.

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.

WARNING

Do not engage the AUTO mode of the AFCS while air refueling.

FLIGHT TEST PROCEDURES

Only those pilots designated in writing by the Squadron Commanding Officer will flight test squadron aircraft. Test flights must be flown under VFR conditions from take-off until the completion of applicable test procedures. Flight Test Procedures will be in accordance with the Periodic Maintenance Requirements Manual, NAVWEPS 01-85ADB-6. This manual is the controlling document for the planning and accomplishment of related worktasks through all levels of maintenance.

FAMILIARIZATION AND TRANSITION

Procedures for the accomplishment of transition and familiarization training are promulgated by the Unit Commander through the Operations Officer. The amount of time required to complete transition and familiarization will vary, depending upon the experence level within each crew category. The training of each crew and each squadron should be directed toward improving crew coordination in the complete weapons system.

The training syllabus will be in accordance with the outline in Section II, Indoctrination.

section V
EMERGENCY PROCEDURES

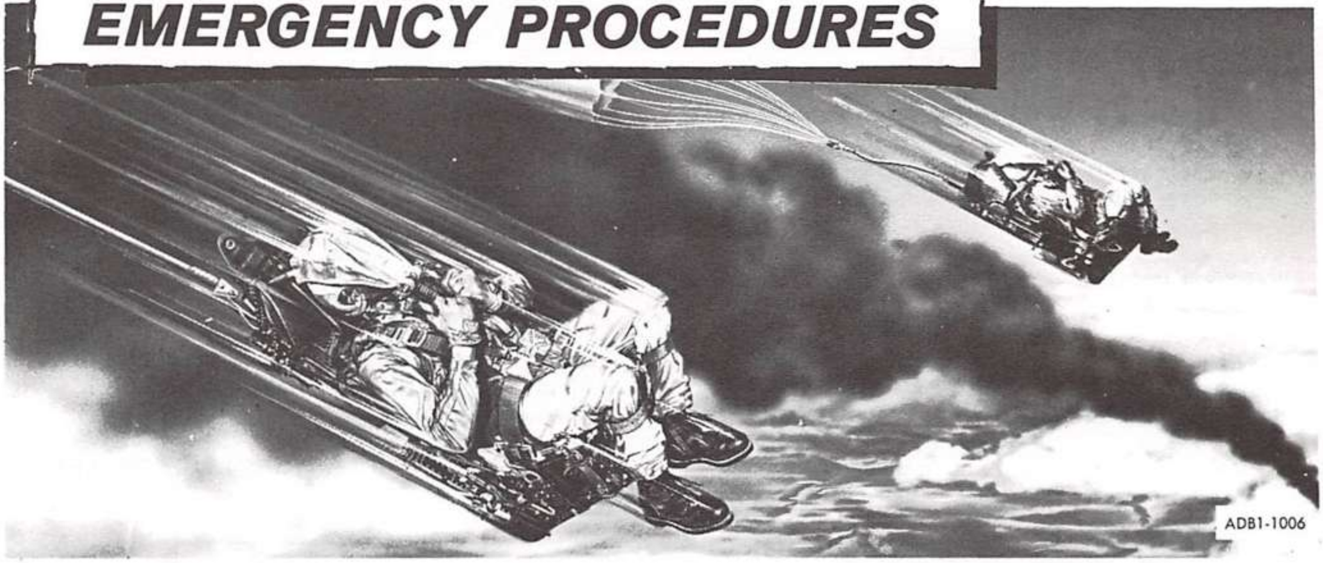
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TABLE OF CONTENTS

INTRODUCTION

Knowledge of the aircraft and emergency procedures must be reviewed on a regular basis to ensure that the crew will take the correct course of action when faced with difficulties. The initial training should be thorough in this respect. Above all, the crew must recognize and admit the emergency situation, then take positive steps in accordance with recommended procedures of good airmanship.

Due to the many situations that can arise concerning emergencies, it is impossible to set an absolute policy. The crew must weigh all the factors of a given situation and then take appropriate action for the particular situation. This manual discusses and preplans some likely courses of action and the recommended way of handling certain emergencies.

The emergency procedures section should be referred to on a continuing basis. Reference to emergency procedures promulgated in NWP-41 are also required.

Note

As soon as possible, the pilot should notify the ECM operator of the emergency and the intended action.

GROUND EMERGENCIES

ENGINE STARTING MALFUNCTIONS

If any of the following indications occur during an engine start, a malfunction exists and immediate action is required:

Wet Start (no light-off within 10 seconds of placing throttle to IDLE)

Hot Start (EGT exceeds 445°C)

Hung Start (RPM fails to accelerate to IDLE)

Fire Warning light, or other indications of fire

Proceed as follows:

1. Throttle - OFF (affected engine)
2. Allow engine to continue cranking for 30 seconds if starter mode is still engaged. The CSD/S starter mode automatically disengages at 48 to 50% RPM.
3. Engine and fuel master switches - OFF

CAUTION

Attempt restart only if cause is determined to be other than an engine malfunction and the maximum start temperature has NOT been exceeded.

EMERGENCY ENGINE SHUTDOWN

In the event of an extreme emergency, where continued engine operation is undesirable, the engines can be shut down most expeditously as follows:

1. Throttles - OFF
2. Engine and fuel master switches - OFF

TAKE-OFF EMERGENCIES

The take-off phase of flight is critical in that it affords the pilot a very short period of time in which a decision must be reached to continue or abort the take-off. The pilot must have fixed firmly in mind the best course of action to be taken in any given situation. Prior to each flight the pilot should know:

1. Lift-off airspeed and take-off ground roll.
2. Refusal speed and distance, or line check speed and distance.
3. Single engine performance (refer to Section XI - PERFORMANCE DATA).
4. Availability, and location of arresting/abort gear.
5. Surrounding terrain and obstructions.

Note

During any take-off emergency where a safe abort cannot be accomplished and take-off is impossible, ejection is possible above 100 KIAS.

ENGINE FAILURE OR FIRE-TAKE-OFF ABORTED

If either engine fails or a fire warning light illuminates during the take-off run, abort immediately if sufficient runway is available.

1. Throttles - IDLE (THROTTLE OF AFFECTED ENGINE-OFF)

WARNING

Use caution when securing the starboard engine to prevent inadvertant shut down of both engines. If both engines are secured, anti-skid, nose-wheel steering, flaperon pop-up and normal braking will be lost.

2. Engine and fuel master switch (affected engine) - OFF
3. Brakes - APPLY
4. Nose wheel steering - ENGAGE

If an arrested rollout is to be made:

5. Arresting hook - DOWN
6. Aim for center of runway
7. Canopy - OPEN AFTER ARRESTMENT

ENGINE FAILURE — TAKE-OFF CONTINUED

If an engine fails immediately after take-off, lateral and directional control of the aircraft can be maintained if airspeed remains at least 5 to 10 knots above stalling speed. However, the ability to maintain altitude or to climb depends upon gross weight, air density and ambient temperature. Since the pilot's reactions will depend upon the conditions mentioned above, after take-off, and at critical airspeeds with heavy gross weights, the pilot must complete the following if level flight cannot be maintained:

1. Operating engine - Max. Thrust (power)
2. For fire warning light - Throttle - OFF (affected engine)
3. External stores - JETTISON

4. Landing gear - UP, AFTER AIRBORNE
5. Establish single - engine climb
6. Wing and fuselage fuel - DUMP
7. Continue flight straight ahead. Attempt no turns until safe airspeed and altitude are attained.
8. Flaps - UP (AFTER SAFE AIRSPEED IS ATTAINED)
9. For failure other than mechanical - ATTEMPT AN AIR START. Throttle (failed engine) - OFF

For obvious mechanical failure:

10. Throttle (failed engine) - OFF
11. Engine and fuel master switch (failed engine) - OFF
12. Climb to 10, 000 feet overhead, landing as soon as possible. Utilize the Precautionary Approach Pattern (Figure 5-1).

WARNING

- Prior to each flight refer to Single Engine Performance Charts (Section X1).
- Landing should not be attempted until fuel has been dumped or burned down.

IN-FLIGHT EMERGENCIES

SINGLE ENGINE FLIGHT CHARACTERISTICS

WARNING

At certain gross weights and ambient temperatures the aircraft will NOT fly on one engine in the take-off or landing phase of flight. The applicable single engine graphs should be referred to prior to each flight.

Because of the location of the engines relative to the centerline of the aircraft, only a slight rudder deflection is required to prevent yaw toward the failed engine at normal speeds. Minimum single-engine control speed varies with gross weight, flap setting, and the landing gear position. The aircraft is designed so that on one system (hydraulic, pneumatic, electrical, etc.) is dependent on a specific engine. Therefore, loss of an engine will not result in a loss of any complete system. Refer to Section XI, for single engine performance data.

WARNING

During single engine operation the speed brakes should be retracted, if extended. Speed brakes preclude flying on one engine, and could contribute to confusion by causing the pilot to conclude that the operating engine is the failed engine because of the reverse yaw response to the aircraft with the application of power.

ENGINE FAILURE

Jet engine failures can be caused by improper fuel scheduling due to a malfunction of the fuel control system or to incorrect techniques used during certain critical flight conditions. If engine failure is due to either of these causes, an air start can usually be accomplished provided time and altitude permit. If engine failure can be attributed to some obvious mechanical failure within the engine, air starts should not be attempted.

SINGLE ENGINE FAILURE DURING FLIGHT

In the event an engine fails, perform the following:

1. Speed brakes - CLOSED
2. Positively determine which engine has failed.
3. For failure other than mechanical - ATTEMPT AIR START

If no relight, or failure mechanical:

4. Engine and fuel master switch (failed engine) - OFF
5. Stores - JETTISON (IF NECESSARY)
6. Dump fuel to minimum safe level before extending gear and flaps. See Fuel Dumping System Section I.
7. Land as soon as practicable.

DOUBLE ENGINE FAILURE DURING FLIGHT

The possibility of a double engine failure (Figure 5-2) is very remote, however, if such a situation should occur, proceed as follows:

1. Below 5000' convert airspeed to altitude. Deplete airspeed by gaining altitude.
2. RAT handle - PULL
3. Transmit MAY DAY
(Transmit MAY DAY on last frequency assigned and guard frequencies - Give position, situation and intentions).
4. Attempt air start.

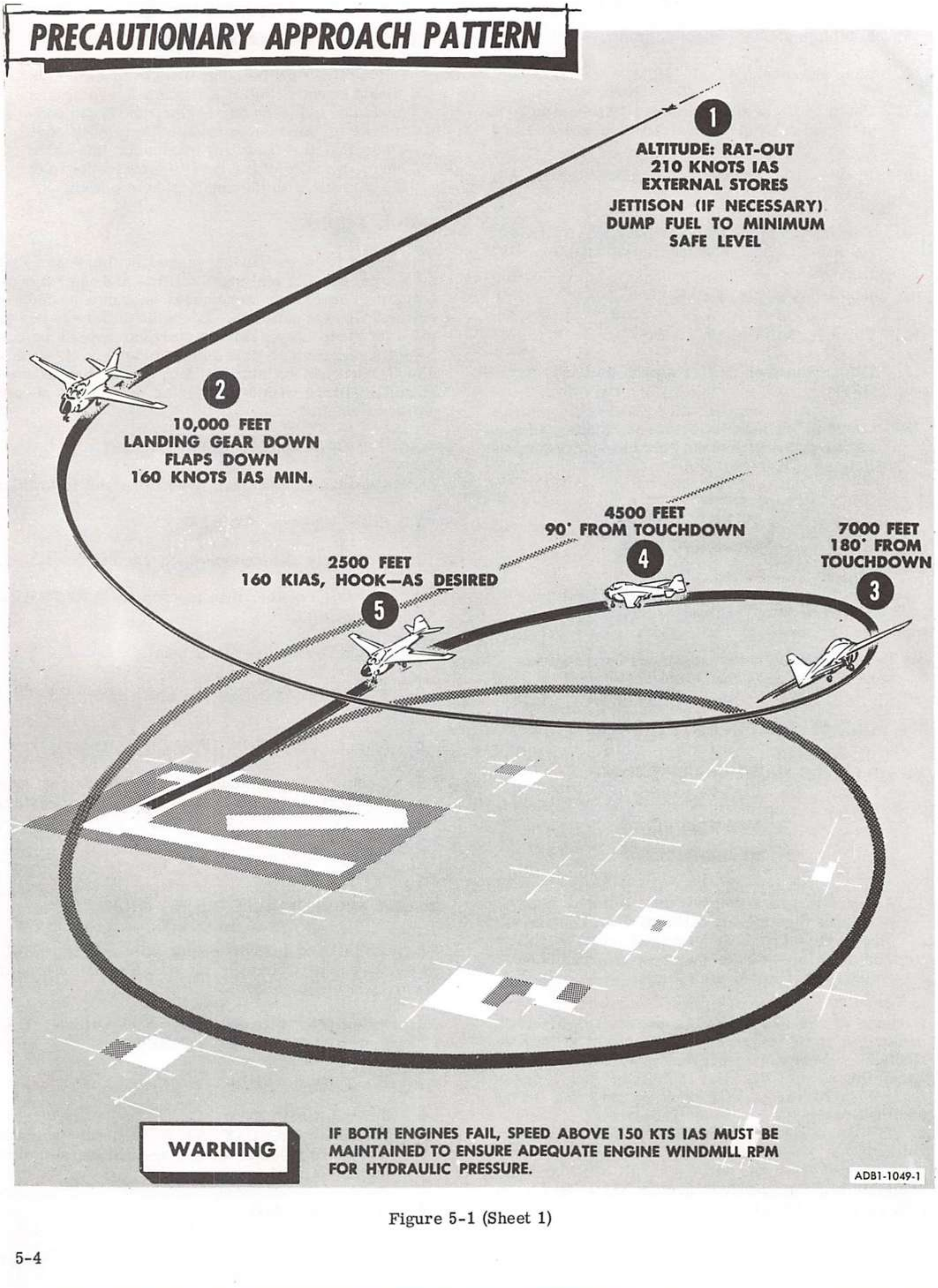


Figure 5-1 (Sheet 1)

PRECAUTIONARY APPROACH PATTERN (PREPARED SURFACE)

A PRECAUTIONARY LANDING IS ADVISABLE WHEN: FUEL STATE IS LOW OR QUESTIONABLE, THE RELIABILITY OF AN ENGINE IS IN DOUBT, OR UPON FAILURE TO ACCOMPLISH AN AIR START.

1. AT ALTITUDE

When performing a precautionary landing, proceed as follows:

1. RAT-PULL
2. Throttles—AS REQUIRED
3. External stores — JETTISON (if necessary)

WARNING

Before jettisoning external stores, ensure that the safe button on the fuzing control panel has been depressed (SAFE light illuminated and the AIR and GND buttons locked); and the mechanical nose-tail switch to the safe position. This prevents the jettisoning of armed stores.

4. Gliding speed—ESTABLISH 210 KIAS.

2. HIGH KEY

This is a position 10,000 feet above terrain in the direction of landing, slightly to the starboard side of intended landing point. At this position accomplish the following:

5. Landing gear—DOWN
6. Airspeed—ESTABLISH 160 KIAS.
7. Shoulder harness—LOCKED

3. LOW KEY

This is a downwind position 7000 feet above the terrain, 180° from the direction of landing, and abeam of the intended landing point from which turn to base is made.

4. TURN TO FINAL

This is a position 4500 feet above the terrain, 90° from the intended landing point, and approximately 1½ miles from end of runway from which turn to final is made.

5. FINAL APPROACH

Set up a straight in approach commencing approximately 1 mile from the end of runway at 2500 feet above terrain.

- Arresting hook-down for arrested landing.
- Maintain 160 KIAS on final prior to flare out.
- Touchdown 120-130 KIAS.

ADB1-1049-2

Figure 5-1 (Sheet 2)

MAXIMUM GLIDE DISTANCE

WITH ENGINES WINDMILLING

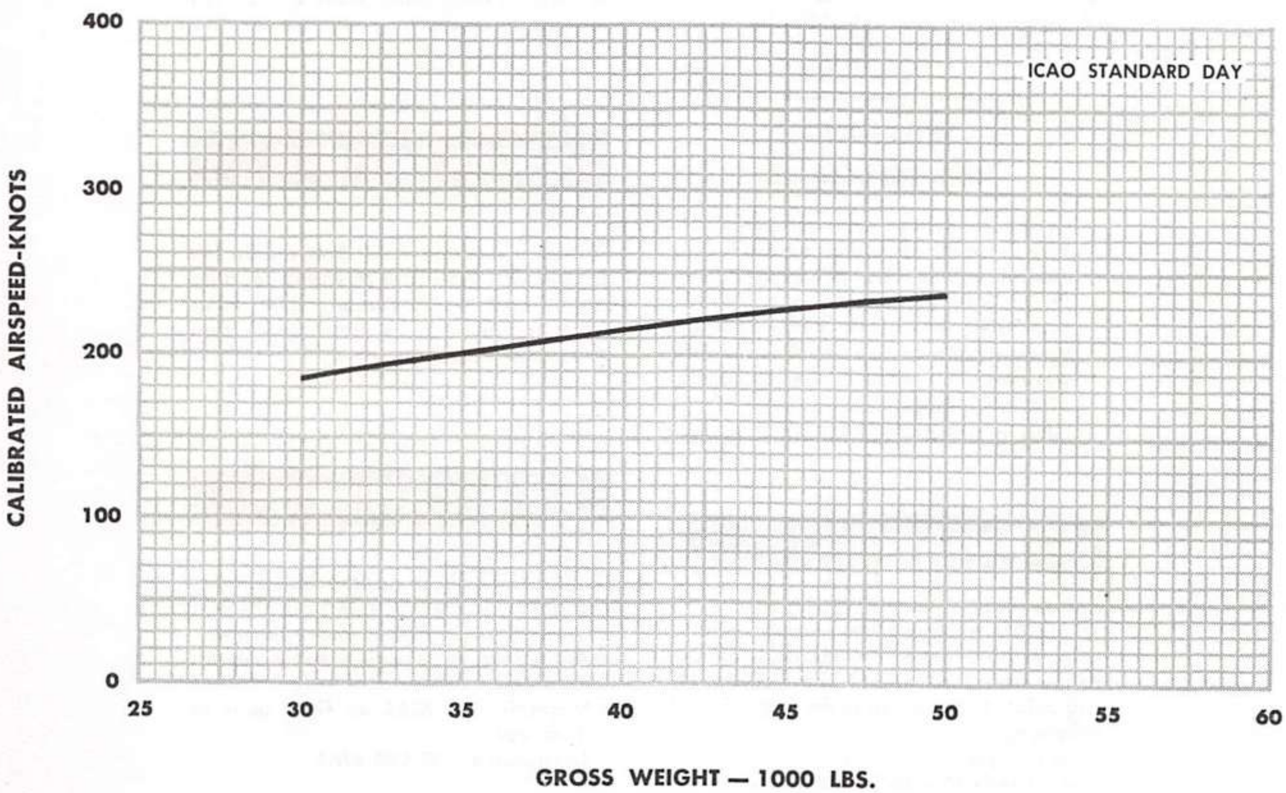
AIRCRAFT CONFIGURATION
CLEAN

NOTE:
GLIDE RATIO 9:1

NOTE
CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

WARNING
150 KIAS MUST BE MAINTAINED TO ENSURE ADEQUATE ENGINE WINDMILL RPM FOR HYDRAULIC PRESSURE

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED



ADB1-1197

Figure 5-2

WARNING

If air start is not completed upon reaching 1500 feet minimum altitude and/or 150 KIAS minimum, EJECTION IS MANDATORY.

5. EJECT

DOUBLE ENGINE FAILURE DURING FLIGHT (LOW ALTITUDE/LOW AIRSPEED)

1. Convert excess airspeed to altitude.

WARNING

If air start is not completed upon reaching 1500 feet minimum altitude and/or 150 KIAS minimum, EJECTION IS MANDATORY.

2. EJECT

AIR START

In general, air start capability is increased by higher airspeeds and low altitudes. Refer to the air start envelope (Figure 5-3).

If one or both engines flame out, do not delay the air-start attempt.

If 10 seconds have not elapsed:

1. Air start button - DEPRESS AND HOLD

If 10 seconds have elapsed:

2. Throttle (failed engine) - OFF
3. Air start button - DEPRESS AND HOLD.
4. Throttle (failed engine) - IDLE
   Go around the horn with the air start button depressed. Wait 60 seconds for indication of start.
5. Throttle (after start) - ADJUST AS REQUIRED

FIRE WARNING LIGHT ILLUMINATED

1. Speed brake - CLOSED
2. Throttle (affected engine) - OFF

CAUTION

Even if the Fire Warning Light goes out, DO NOT attempt restart on affected engine.

3. Check for positive FIRE indications, explosion or vibration, abnormal engine instrument readings, smoke or fumes in cockpit, burning odor in oxygen, trailing smoke, or verification from another aircraft or the tower.

If fire indications are positive:

4. EJECT

If no other indication of fire:

5. Land as soon as possible

ELECTRICAL FIRE OR SMOKE IN THE COCKPIT

Circuit breakers protect most circuits and can be used to isolate most electrical failures. Due to the electrical complexity of the aircraft however, electrical fires may occur and immediate action is required. Some electrical fires may be identified visually, and the affected circuit de-energized.

Note

Putting the oxygen regulator to NORMAL momentarily, then returning to 100%, may help identify the type and source of smoke and fumes by smell.

If the cause of the malfunction cannot be immediately determined, further steps may be necessary. These will depend on the intensity of the smoke and the circumstances under which the aircraft is operating. Should symptoms of an electrical fire occur, and the cause cannot be determined, proceed as follows:

1. Oxygen - 100%
2. All electrical switches - OFF
   Ensure that the following switches in particular have been positioned to OFF: Search Radar, ECM equipment, VDI, and the PHD.
3. Air conditioning master switch - OFF
   The possibility exists that smoke and fumes symptomatic of an electrical fire may have originated in the air conditioning system.

If symptoms of fire persist:

4. RAT handle - PULL
5. Generators - OFF
   The possibility exists that the RAT may be inoperative, and may not assume the electrical load of the essential bus. The best indication of this is failure of the generator caution light to illuminate. Should this occur, generators, must be turned back on within 15 seconds, or they will be lost for the remainder of the flight.
6. Air conditioning master switch - ON.
7. ESSENTIAL electrical switches and circuit breakers - ON
   Selectively reposition the electrical switches and circuit breakers ON, beginning with the most essential equipment first.

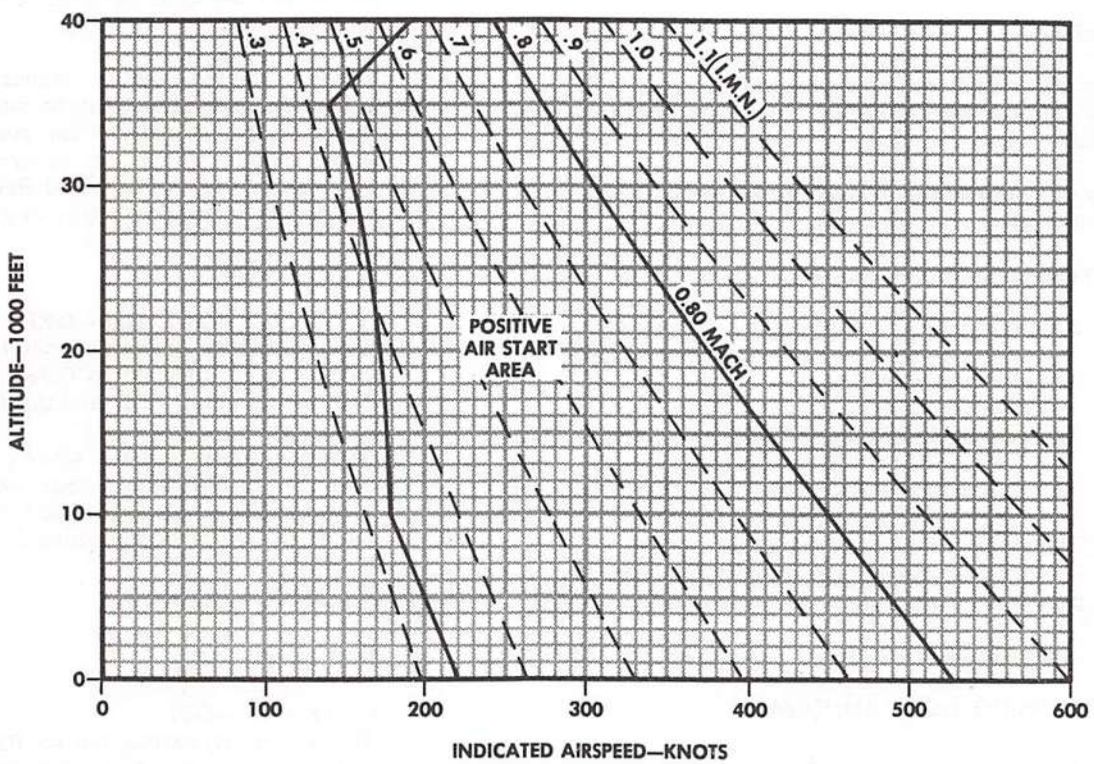
AIR START ENVELOPE

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS

REMARKS
ENGINE(S): (2) J52-P-6A

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1208

Figure 5-3

8. Isolate affected equipment.
9. Affected equipment - OFF
10. Circuit breaker (affected equipment) - PULL (IF AVAILABLE)

CAUTION

Do not attempt to actuate the affected equipment circuit breaker until the cause of the fire has been determined and corrected by qualified maintenance personnel.

11. Land as soon as practicable.

CAUTION

Operation of the CNI package requires air conditioning. If operated with air conditioning OFF for periods in excess of 5 minutes, equipment may be damaged.

ELIMINATION OF SMOKE AND FUMES

To eliminate smoke and fumes from the cockpit, proceed as follows:

1. Air conditioning cockpit switch - RAM AIR
2. MAN/RAM air switch - COLD
3. Descend to below 25,000 feet.
4. Cabin dump switch - ON

EJECTION

Whenever ejection is contemplated, regardless of the situation, the pilot will notify the ECM operator, either by ICS or by visual signals if the ICS fails. The command to eject will be signalled visually by raising the arms above the head in an exaggerated act of grasping the face curtain handle. This signal will be repeated twice, and every effort should be made to ensure it is understood. Immediate compliance is sufficient acknowledgment. The ECM operator should eject first: the pilot should eject immediately after the ECM operator. Ejection should be accomplished through the canopy.

WARNING

- Do not eject simultaneously. The seats eject parallel to each other, and parachute entanglement could result.
- Ejection may be difficult once the canopy is broken due to wind blast, and the pilot should minimize this difficulty by grasping the face curtain handle prior to the ECM operator's ejection.
- Do not use extra seat cushions on the ejection seat. This can result in serious back injuries if ejection becomes necessary.

Note

- Successful ejection can be made with the radiation shield in place.
- Seat tilt has no effect on ejection.

Escape from the aircraft in flight should be made with the ejection seat. The basic seat ejection procedures are shown in figure 5-4.

PRE-EJECTION PROCEDURES

1. PILOT ALERT CREWMEMBER
2. Time permitting, accomplish the following:
    a. Airspeed - REDUCE TO 220 KIAS OR LESS
    b. Transmit - MAY DAY (POSITION, SITUATION AND INTENTIONS)
    c. IFF - SQUAWK EMERGENCY AND MODE III CODE 77
    d. Helmet, chin straps - TIGHT
    e. Helmet visor - DOWN
    f. Oxygen mask - TIGHT
    g. Cabin dump switch - On (ABOVE 30,000 FEET)
    h. ASSUME EJECTION POSITION
    i. CANOPY - JETTISON AS DESIRED
3. ORDER CREWMEMBER TO EJECT
4. EJECT
   PULL FACE CURTAIN HANDLE with both hands so curtain covers face.

CORRECT BODY POSITION FOR EJECTION

Before accomplishing the necessary ejection procedures (figure 5-4), it is recommended that the occupant establish correct body position for ejection as follows:

a. Sit erect in seat.
b. Buttocks against backrest.
c. Head firmly against headrest and below face curtain handle.
d. Spine straight.
e. Thighs firmly against seat pan.
f. Harness properly adjusted and tight.

EJECTION

BEFORE EJECTION

ALERT CREW MEMBER.

WHENEVER EJECTION IS CONTEMPLATED, REGARDLESS OF THE SITUATION, THE PILOT WILL NOTIFY THE CREW MEMBER, EITHER BY ICS OR BY VISUAL SIGNALS IF THE ICS FAILS.

TIME PERMITTING, ACCOMPLISH THE FOLLOWING.

1. AIRSPEED — REDUCE TO 220 KIAS OR LESS, MAINTAIN FLYING SPEED
2. TRANSMIT — MAYDAY (POSITION, SITUATION AND INTENTION)
3. IFF — SQUAWK EMERGENCY AND MODE III CODE 77
4. HELMET, CHIN STRAPS — TIGHT, VISOR — DOWN
5. OXYGEN MASK — TIGHT
6. HARNESS PROPERLY ADJUSTED AND TIGHT
7. CABIN DUMP SWITCH — ON (ABOVE 30,000 FT.)
8. ASSUME EJECTION POSITION

   SIT ERECT, BUTTOCKS AGAINST BACKREST, HEAD FIRMLY AGAINST HEADREST, SPINE STRAIGHT, THIGHS AGAINST SEAT PAN.

WARNING POSITIONING THE LEGS AFT PRIOR TO EJECTION WILL CAUSE THE SPINE TO FLEX AND WILL INCREASE THE POSSIBILITY OF SPINAL INJURY.

9. CANOPY — JETTISON AS DESIRED

   CANOPY MUST BE FULLY CLOSED OR JETTISONED PRIOR TO EJECTION. EJECTION MAY BE ACCOMPLISHED THROUGH THE CANOPY.

WARNING WITH THE CANOPY IN THE OPEN POSITION THE CANOPY BULKHEAD IS ALMOST DIRECTLY OVER BOTH EJECTION SEATS, THUS PREVENTING A SUCCESSFUL EJECTION.

SEAT TILT HAS NO EFFECT ON EJECTION.

EJECTION PROCEDURE

1. ORDER CREW MEMBER TO EJECT.

THE ORDER WILL BE SIGNALLED VISUALLY BY RAISING THE ARMS ABOVE THE HEAD IN AN EXAGGERATED ACT OF GRASPING THE FACE CURTAIN HANDLE. THIS WILL BE REPEATED TWICE, AND EVERY EFFORT SHOULD BE MADE TO ENSURE IT IS UNDERSTOOD. IMMEDIATE COMPLIANCE IS SUFFICIENT ACKNOWLEDGMENT. THE CREW MEMBER SHOULD EJECT FIRST; THE PILOT SHOULD EJECT IMMEDIATELY AFTER.

EJECTION MAY BE DIFFICULT ONCE THE CANOPY IS BROKEN DUE TO WIND BLAST, AND THE PILOT SHOULD MINIMIZE THIS DIFFICULTY BY GRASPING THE FACE CURTAIN HANDLE PRIOR TO THE CREW MEMBER'S EJECTION.

WARNING DO NOT EJECT SIMULTANEOUSLY. THE SEATS EJECT PARALLEL TO EACH OTHER, AND PARACHUTE ENTANGLEMENT COULD RESULT.

2. EJECT

GRASP FACE CURTAIN HANDLE WITH BOTH HANDS (PALMS DOWN) ELBOWS TOGETHER, AND PULL OUT AND DOWN SMARTLY SO THAT CURTAIN COVERS FACE.

IF SEAT FAILS TO EJECT:

CONTINUE TO HOLD FACE CURTAIN HANDLE WITH LEFT HAND AND GRASP SECONDARY HANDLE WITH RIGHT HAND AND PULL UP SMARTLY.

IF SEAT STILL FAILS TO EJECT: USE MANUAL BAILOUT PROCEDURE.

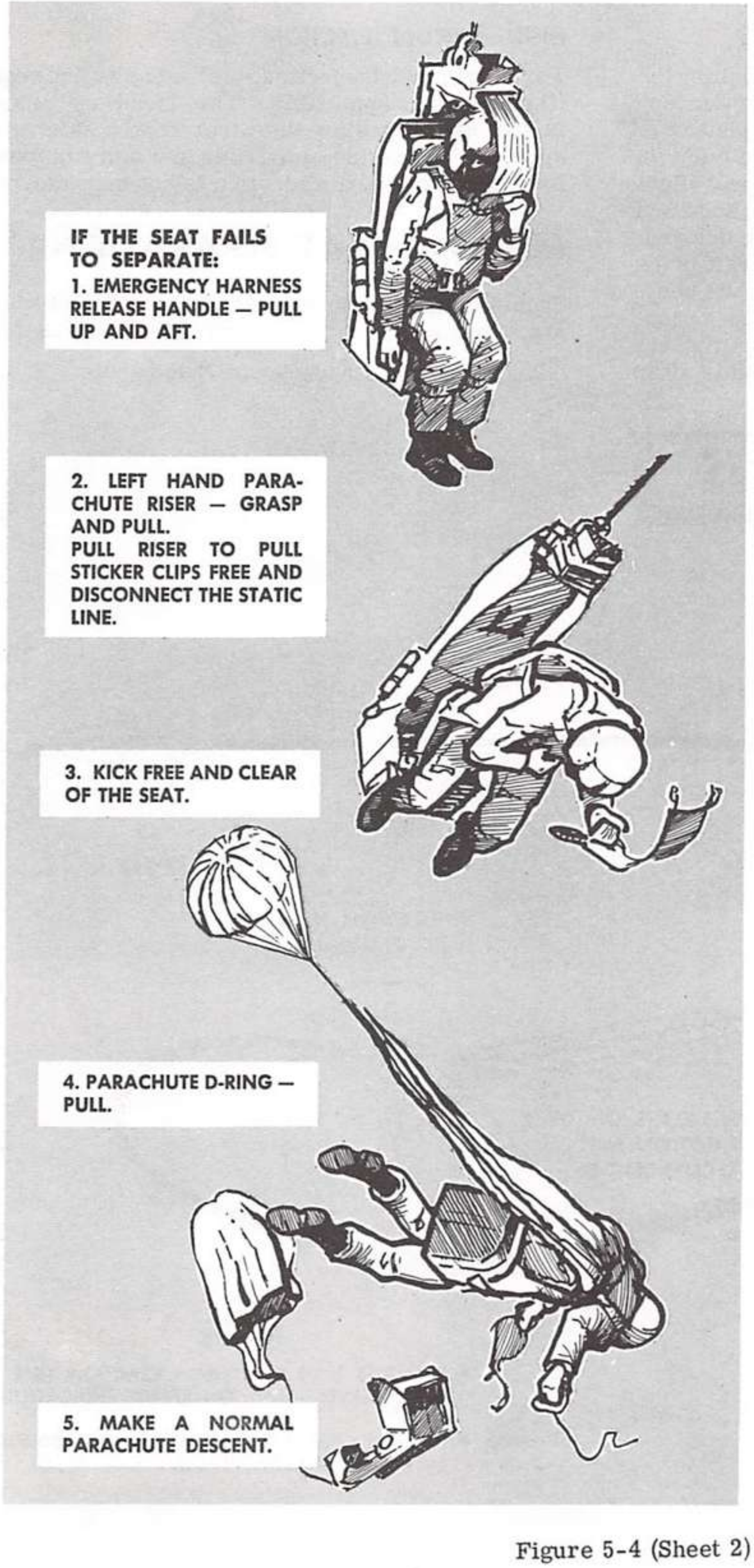
IF UNABLE TO REACH FACE CURTAIN HANDLE:

GRASP SECONDARY FIRING HANDLE WITH ONE HAND AND GRASP WRIST WITH OTHER HAND AND PULL UP SMARTLY.

D-ADA1-42-1

Figure 5-4 (Sheet 1)

AFTER EJECTION



NORMAL PARACHUTE DESCENT

1. OXYGEN MASK — REMOVE.
2. ATTACH SURVIVAL KIT RETENTION FITTING TO THE INTEGRATED HARNESS SURVIVAL KIT RETENTION STRAP.
3. OPEN LAP BELT (MAY BE DELAYED UNTIL AFTER LANDING IF DESIRED).
4. INFLATE LIFE PRESERVER (IF WATER LANDING ANTICIPATED).
5. SHOULDER HARNESS ROCKET JET FITTINGS — DISCONNECT IMMEDIATELY AFTER LANDING OR WATER ENTRY.
6. CONNECT THE SURVIVAL KIT YELLOW LANYARD TO THE HELICOPTER HOIST FITTING ON THE INTEGRATED HARNESS. (IN WATER.)
7. SURVIVAL KIT — RELEASE AND PULL OUT. RELEASE THE SURVIVAL KIT QUICK DISCONNECT FITTING ON THE FORWARD FACE OF THE SURVIVAL KIT CONTAINER AND EXTRACT THE SURVIVAL KIT.

D-ADA1-42-2

Figure 5-4 (Sheet 2)

WARNING

Positioning the legs aft prior to ejection will cause the spine to flex and will increase the possibility of spinal injury.

LOW ALTITUDE EJECTION

Ejection at low altitudes is accomplished by pulling the nose of the aircraft above the horizon ("zoom up" maneuver). This maneuver affects the trajectory of the ejection seat and provides a greater increase in altitude than if ejection is performed in a level flight attitude. If the aircraft is in a descending attitude and cannot be pulled out, ejection should not be delayed. When circumstances permit, slow the aircraft prior to ejection to reduce the forces exerted on the body. Below 2,000 feet, as a backup to automatic operation, the manual release handle and personnel parachute D-ring should be actuated as soon as possible after ejection.

WARNING

Flight test demonstrations have shown that "zoom up" within certain airspeed and sink rate limitations will result in a loss of altitude rather than a gain. Refer to Ejection Capabilities (figure 5-5).

HIGH ALTITUDE EJECTION

For a high altitude ejection, the basic ejection sequence (figure 5-6) is applicable. The "zoom up" maneuver is still useful to slow the aircraft to a safer ejection speed, or to provide more time and more distance, as long as an immediate ejection is not mandatory.

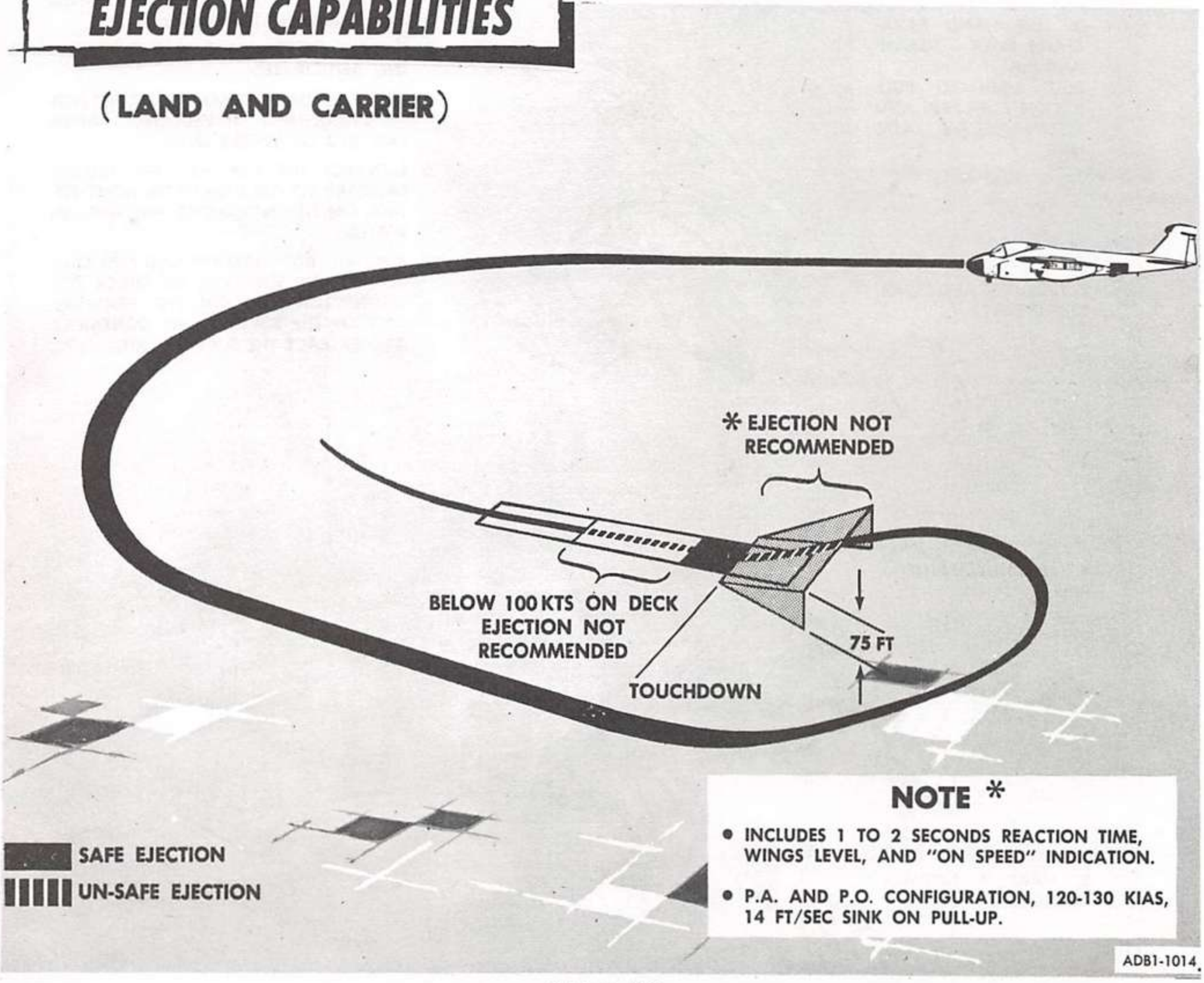
MANUAL SEAT SEPARATION

Should the automatic release mechanisms fail to operate, manually separate from the seat as follows:

1. Emergency harness release handle - PULL UP AND AFT

EJECTION CAPABILITIES

(LAND AND CARRIER)



NOTE *

- INCLUDES 1 TO 2 SECONDS REACTION TIME, WINGS LEVEL, AND "ON SPEED" INDICATION.
- P.A. AND P.O. CONFIGURATION, 120-130 KIAS, 14 FT/SEC SINK ON PULL-UP.

Figure 5-5

WARNING

When the emergency harness release handle is actuated, the occupant and his personal equipment are disconnected from the seat, with the exception of the sticker clips and personnel parachute withdrawal line.

2. Left hand parachute riser - GRASP AND PULL
   Grasp the left hand parachute riser to help pull the parachute off the seat.

3. Kick free and clear of the seat.
   Approximately 40 pounds force is required to kick free from the seat.

4. Parachute D-ring - PULL

5. Make a normal parachute descent.

6. Survival kit retention fitting - ATTACH

EJECTION SEAT FAILURE (MANUAL BAILOUT)

WARNING

It is not recommended that manual bailout be considered below 2,000 feet.

Manual bailout from high-performance aircraft is extremely hazardous, even under most favorable conditions (level flight, slow airspeeds, and optimum altitude), and is considered a "last ditch" method of escape. However, if the seat cannot be ejected and ditching is not feasible, the following bailout procedures are suggested:

1. Oxygen, communication and g-suit hose connections - DISCONNECT.

2. Canopy - JETTISON

3. Trim the aircraft for nose down attitude and pull the stick back to establish climbing attitude. Roll inverted maintaining positive g-load until inverted.

WARNING

If the aircraft is not controllable attempt bailout over the side.

4. Harness release handle - PULL AND SEPARATE FROM THE SEAT

5. Once inverted - RELEASE THE STICK

When clear of the aircraft, and below 10,000 feet:

6. Parachute D-ring - PULL

WARNING

If bailout is essential over 10,000 feet, a free fall is a must until an altitude below 10,000 feet is reached, since the emergency oxygen bottle is attached to the seat and oxygen will not be available.

AFTER PARACHUTE DEPLOYMENT

1. Oxygen mask - REMOVE

2. Attach survival kit retention fitting to the integrated harness survival kit retention strap.

3. Connect the survival kit yellow lanyard to the ring on the life preserver.

4. Upon landing - DISCONNECT BOTH SHOULDER HARNESS ROCKET JET FITTINGS SIMULTANEOUSLY TO DISENGAGE THE PARACHUTE.

Water Landing

1. Upon landing - DISCONNECT BOTH SHOULDER HARNESS ROCKET JET FITTINGS SIMULTANEOUSLY TO DISENGAGE THE PARACHUTE.

2. Lap belt - OPEN

3. Inflate life preserver

4. Survival kit - RELEASE AND PULL OUT
   Release the survival kit quick disconnect fitting on the forward face of the survival kit container and pull out the survival kit.

5. Inflate the life raft and secure the emergency equipment.

EMERGENCY JETTISONING

EXTERNAL STORES

WARNING

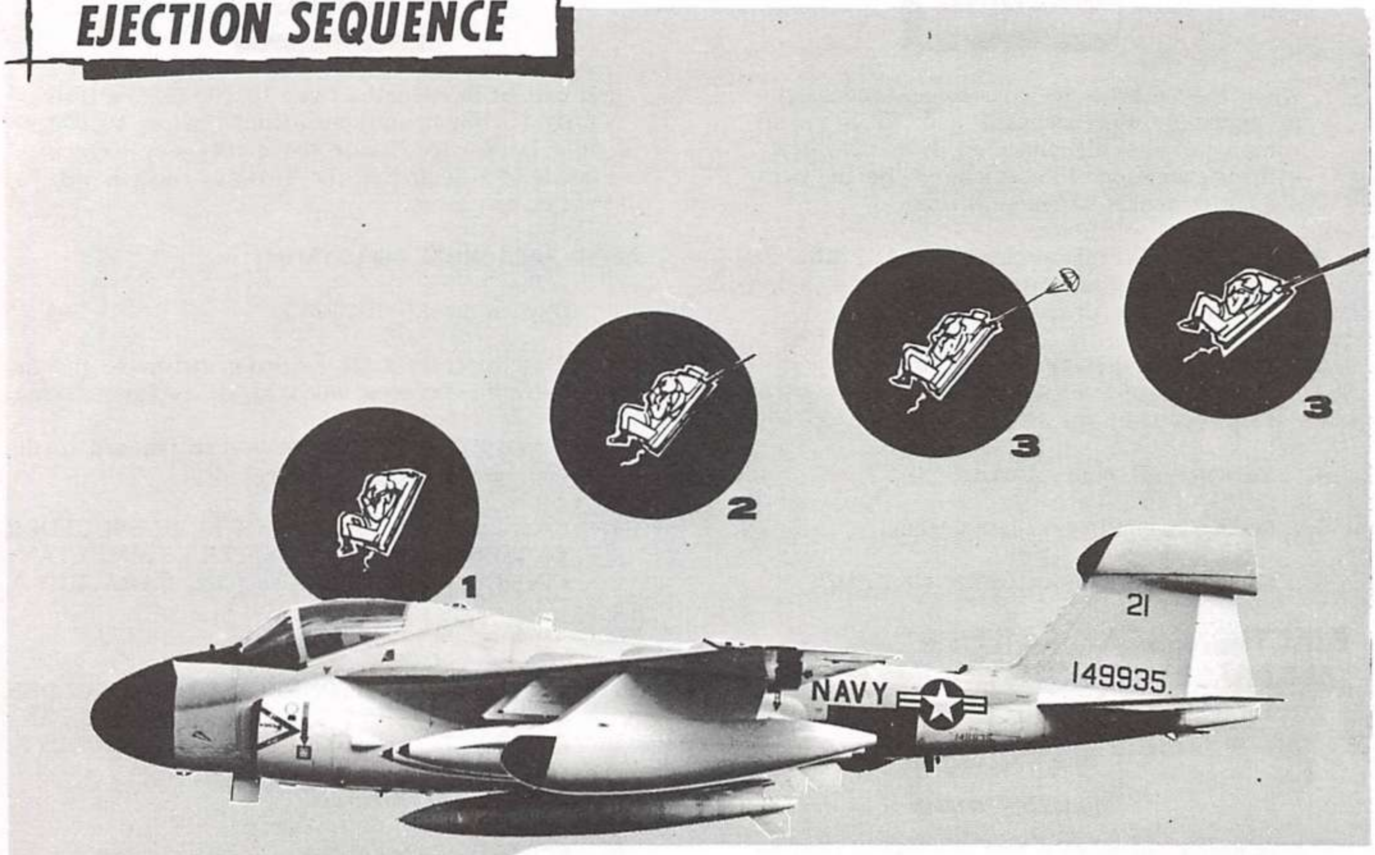
Before jettisoning external stores, ensure that the safe button on the fuzing control panel has been depressed (SAFE light illuminated and the AIR and GND buttons locked); and the mechanical nose-tail switch to the safe position. This prevents the jettisoning of armed stores.

1. Emergency stores jettison button - DEPRESS
   Hold button down for one second, or until separation is felt.

Note

70% of the weight must be off the wheels for emergency jettisoning of external stores.

EJECTION SEQUENCE



1 •• INITIAL EJECTION: EMERGENCY OXYGEN RELEASED, IFF SWITCH ACTUATED, SHOULDER HARNESS LOCKED, LEG RESTRAINTS WITHDRAWN AND LOCKED AND TIME RELEASE AND DROGUE GUN MECHANISMS ARE TRIPPED AS SEAT LIFTS OUT OF COCKPIT.

2 •• DROGUE GUN FIRES ONE SECOND AFTER EJECTION; DROGUE PISTON WITHDRAWS CONTROLLER DROGUE PARACHUTE.

3 •• CONTROLLER DROGUE DEPLOYS AND WITHDRAWS STABILIZER DROGUE.

4 •• STABILIZER DROGUE DEPLOYS, STABILIZING AND DECELERATING SEAT AND OCCUPANT.

5 •• ABOVE 13,500 FEET: BAROSTAT SECURES TIME RELEASE ESCAPEMENT MECHANISM UNTIL COMPLETION OF DESCENT TO LOWER ALTITUDE, DROGUE PARACUTE RETENTION SHACKLE REMAINS LOCKED TO SEAT BY RESTRAINT SCISSOR AND SEAT AND OCCUPANT DESCEND THROUGH HIGHER ALTITUDES ON DROGUE PARACHUTES ONLY.

6 •• BELOW APPROXIMATELY 10,000 FEET AND DECELERATION OF 4.5 g OR LESS: BAROSTAT FREES TIME RELEASE ESCAPEMENT MECHANISM. TIME RELEASE MECHANISM SUBSEQUENTLY RELEASES DROGUE SHACKLE RESTRAINT SCISSOR, OCCUPANT'S UPPER AND LOWER HARNESS RESTRAINT, LEG RESTRAINTS AND UPPER BLOCKS OF PERSONNEL SERVICES DISCONNECTS. RELEASE OF SHACKLE PERMITS CONTINUED PULL OF DROGUE PARACHUTES ON LINK LINES TO RELEASE FACE CURTAIN RESTRAINT, AND MAIN PERSONNEL PARACHUTE. OCCUPANT REMAINS ATTACHED TO SEAT BY STICKER CLIP RETENTION OF LOWER RESTRAINT HARNESS ON SEAT BUCKET.

7 •• OPENING SHOCK OF MAIN PARACHUTE PULLS OCCUPANT, SURVIVAL KIT AND LOWER RESTRAINT HARNESS FREE OF STICKER CLIPS. SEAT FALLS FREE. OCCUPANT DISCARDS FACE CURTAIN AND CONTINUES NORMAL PARACHUTE DESCENT.

ADB1-1010-1

Figure 5-6 (Sheet 1)

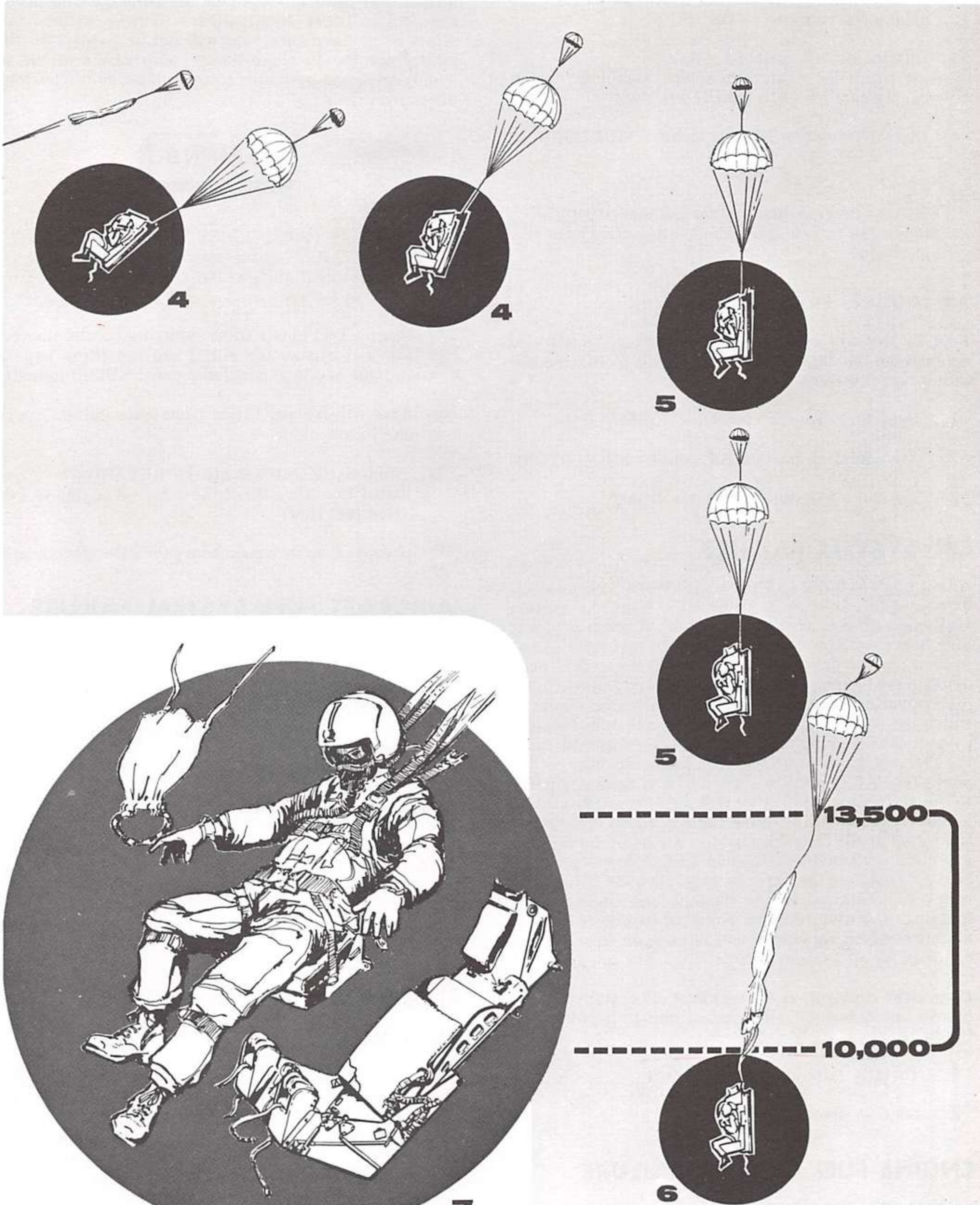


Figure 5-6 (Sheet 2)

If step 1 fails, proceed as follows:

2. Master arm switch - ON

3. Station select switches - ON
   Position the 5 station select switches on the armament panel to the ON position.

4. Selective stores jettison switch - JETTISON

Note

The landing gear must be up and locked before stores can be released using the selective jettison switch.

AIR REFUELING STORE

Fuel in the air refueling store must be jettisoned through the fuselage dump system only, utilizing the following procedure:

1. Drop tank transfer switch - NORM

2. Air refueling tack select switch - FROM STORE

3. Fuselage fuel select switch - DUMP

OIL SYSTEM FAILURE

An oil system failure is recognized by a decrease of, or a complete loss of oil pressure. If an oil system malfunction has caused prolonged oil starvation of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression of failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as: condition of bearings prior to the starvation, operating temperatures of bearings, and bearing loads. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration. When the vibration becomes moderate to heavy, complete seizure is only seconds away. In order to minimize engine damage and conserve remaining operating time for possible emergencies, the affected engine should be shut down upon first recognition of an oil system failure.

Upon first recognition of sustained oil system failure, (above or below oil pressure limits), perform the following:

1. Throttle (affected engine) - OFF

2. Land as soon as possible.

ENGINE FUEL SYSTEM FAILURE

ENGINE FUEL PUMP FAILURE

Failure of the entire two-stage engine fuel pump will result in engine flameout due to fuel starvation. Gear stage (high pressure pump) failure will result in a flameout; failure of the centrifugal stage (low pressure engine boost pump) alone will have little or no effect on performance, and will not be evident to the pilot since the fuselage boost pump will continue to supply adequate pressure to the inlet side of the high pressure pump.

WARNING

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

If the engine fuel pump filter becomes contaminated, fuel flow will bypass the filter and the filter bypass caution light on the annunciator panel will iilluminate.

Should the filter bypass light illuminate inflight, perform the following:

1. Throttle (affected engine) - RETARD
   Retard the throttle of the affected engine to reduce fuel flow.

2. Avoid large or unnecessary throttle movements.

AIRCRAFT FUEL SYSTEM FAILURE

FUSELAGE BOOST PUMP FAILURE

If the electrically driven fuselage boost pump fails, fuel will still be supplied to the engine fuel pump by suction feed (below 20,000 feet). If the fuel flow demands of the engines cannot be met by suction feed, loss of thrust may result when above 20,000 feet.

TRANSFER PUMP FAILURE

Failure of one transfer pump will result in a 50% reduction of fuel flow for either fuselage fuel dumping or fuselage fuel transfer to the air refueling pod. If both transfer pumps fail, fuselage fuel dumping and fuselage fuel transfer to the air refueling pod cannot be accomplished.

ELECTRICAL SYSTEM FAILURE

SINGLE GENERATOR FAILURE

Failure of one generator will be noted by illumination of either the L-GEN or R-GEN caution light on the annunciator panel. The light will indicate which generator has failed. Failure of either generator will result in loss of the monitor bus power. In the event of generator failure, proceed as follows:

1. Generator switch (affected generator) - RESET, THEN ON

2. Check generator caution light - OUT

Repeated attempts may be made to reset generator.

If generator caution light remains illuminated:

3. Generator switch (affected generator) - OFF

4. Land as soon as practicable.

5. For instrument night approach, RAT handle - PULL

DOUBLE GENERATOR FAILURE

When both generators fail, both generator caution lights will be out and all AC power will be lost. All DC power, except battery power for canopy jettisoning, generator reset, and spin recovery, will also be lost. Upon the loss of both generators, immediately perform the following:

1. RAT handle - PULL

Note

If the RAT generator is inoperative, you have 15 seconds to place the generators back on the line. Beyond 15 seconds, it will be impossible to reset the generators.

2. Generator switches - RESET, THEN ON

3. Check generator caution lights - OUT

If generator caution lights remain illuminated:

4. Land as soon as possible.

SPD DR LIGHT ILLUMINATED

Illumination of the L or R-SPD DR light on the annunciator panel indicates a failure of the constant speed drive/starter (CSD/S). A steady illuminated light indicates high oil temperature, low oil pressure, or CSD/S failure. A flashing light indicates CSD/S overspeed. If the constant speed drive/starter fails, perform the following:

1. SPD DR light flashing - REDUCE RPM - RESET SPEED DRIVE

If SPD DR light continues to flash:

2. Speed Drive switch (affected CSD/S) - OFF

If SPD DR light illuminated steady:

1. Speed drive switch (affected CSD/S) - OFF

HYDRAULIC SYSTEM FAILURE

SINGLE HYDRAULIC PUMP FAILURE

The loss or any one hydraulic pump will be indicated on the hydraulic pressure indicator and will not present any flight control problems.

CAUTION

Failure of one pump may result in failure of the other pump in the same system.

1. Land as soon as practicable.

FLIGHT OR COMBINED HYDRAULIC SYSTEM FAILURE

Loss of either the flight or combined hydraulic system allows the one operating system to assume full demand of the stabilizer, rudder, and flaperons. See figure 5-7.

WARNING

Either the combined primary or the flight hydraulic system alone will power the flight controls throughout the flight envelope except at high IMN and at low altitudes with the speed brakes extended.

With the failure of either hydraulic system, hydraulic operation of the following systems will not be available:

Canopy	Landing Gear
Wing Slats	Nose Wheel Steering
Wing Flaps	Anti-Skid
Flaperons Pop-up	Normal Brakes
Wing Fold	Arresting Hook (retraction)
Strut Lock	

With a flight hydraulic system failure, the AFCS will also be inoperative.

With a combined hydraulic system failure, the following will also be inoperative:

Speed Brakes
Assist Spin Recovery
RAT Retraction

If either the flight or combined hydraulic system fails, proceed as follows:

1. Land as soon as possible.

2. Utilize field arresting gear, if available.

3. Wing and fuselage fuel - DUMP

4. Prior to landing:

   a. Slow to 180 KIAS
   Flap handle - TAKE-OFF
   Flaps/Slats - EXTEND ELECTRICALLY

CAUTION

Observe speed limitations for electric extension of flaps.

HYDRAULIC SYSTEM FAILURE TABLE

SINGLE SYSTEM FAILURE

IN THE EVENT OF A FLIGHT HYDRAULIC SYSTEM FAILURE OR A COMBINED HYDRAULIC SYSTEM FAILURE SYSTEMS WILL BE OPERATIVE OR INOPERATIVE AND POWERED BY AUXILIARY OR EMERGENCY SYSTEMS AS INDICATED.

<table>
<tr><th>SYSTEM</th><th>FLIGHT HYDRAULIC SYSTEM FAILURE</th><th>COMBINED HYDRAULIC SYSTEM FAILURE</th><th>AUXILIARY OR EMERGENCY OPERATION</th></tr>
<tr><td>STABILIZER
RUDDER
FLAPERONS</td><td>OPERATIVE
(POWERED BY COMBINED HYDRAULIC SYSTEM)</td><td>OPERATIVE
(POWERED BY FLIGHT HYDRAULIC SYSTEM)</td><td></td></tr>
<tr><td>AFCS</td><td>INOPERATIVE</td><td>OPERATIVE</td><td>NONE</td></tr>
<tr><td>WING FLAPS
WING SLATS</td><td></td><td></td><td>OPERATED ELECTRICALLY</td></tr>
<tr><td>LANDING GEAR</td><td></td><td></td><td>EXTENDED PNEUMATICALLY</td></tr>
<tr><td>WHEEL BRAKES</td><td rowspan="3" colspan="2">INOPERATIVE
WITH EITHER
FLIGHT OR COMBINED
HYDRAULIC SYSTEM
FAILURE</td><td>ACCUMULATOR PRESSURE</td></tr>
<tr><td>CANOPY</td><td>HYDRAULIC HAND PUMP</td></tr>
<tr><td>FLAPERON POP-UP
NOSE WHEEL STEERING
ARREST HOOK LIFT
STRUT LOCK
WING FOLD</td><td>NONE</td></tr>
<tr><td>SPEED BRAKE
ASSIST SPIN RECOVERY</td><td>OPERATIVE</td><td>INOPERATIVE</td><td></td></tr>
<tr><td>ELECTRIC RAT</td><td></td><td></td><td>EXTENDED BY ACCUMULATOR</td></tr>
</table>

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Figure 5-7

b. Slow to 150 KIAS
Landing gear - LOWER BY EMERGENCY SYSTEM

c. Brake selector handle - TURN 90° CLOCKWISE
Check that auxiliary brake cycle gage intricates 15 cycles.

Note

Except with complete loss of combined hydraulic system fluid, the brake accumulator can be recharged. Availability of fluid may readily be determined by operating the hand pump and noting an increase indication on the brake pressure gage or back pressure on the pump handle. The ECMO shall assist the pilot in this operation.

5. Make a normal landing approach.

6. After landing:

   a. Utilize aerodynamic braking to decelerate

   b. Use minimum number of brake applications (to prevent depletion of brake accumulator).

   c. Clear runway. DO NOT attempt to taxi.

COMPLETE HYDRAULIC SYSTEM FAILURE

If complete hydraulic system failure occurs, all normal flight controls will be inoperative. Upon initial detection of hydraulic pressure loss or gage fluctuation, the pilot shall reduce airspeed and attempt to establish level flight.

1. If aircraft is uncontrollable - EJECT

Note

Partial control of the aircraft may be maintained with a complete hydraulic system failure by use of differential thrust.

SPEED BRAKE SYSTEM EMERGENCY OPERATION

Should an electrical system failure occur with the speed brakes extended, the speed brakes will be automatically retracted by combined hydraulic system pressure. In the event of a combined hydraulic system failure, the speed brakes will be retracted by air loads when the speed brakes switch is moved forward. When the electrical and combined hydraulic systems both fall, the speed brakes will retract by air loads.

SPEED BRAKE RETRACTION FAILURE

In the event the speed brakes cannot be retracted in flight, proceed as follows:

At low altitude and low airspeed:

1. RAT handle - PULL
2. Generator switches - OFF

If speed brakes do not retract:

1. Generator switches - ON
2. Stores - JETTISON (IF NECESSARY)
3. Dump fuel to reduce gross weight.
4. If level flight cannot be maintained - EJECT

If altitude and/or airspeed permit:

1. Landing gear - EXTEND

Note

If above 8, 000 feet, dump cabin pressure prior to extending the landing gear.

If speedbrakes fail to retract:

2. Landing gear - RETRACT
3. RAT handle - PULL
4. Generator switches - OFF

If speedbrakes do not retract:

1. Generator switches - ON
2. Stores - JETTISON (IF NECESSARY)
3. Dump fuel to reduce weight.
4. RAT handle - STOW
5. If level flight cannot be maintained - EJECT

LANDING EMERGENCIES

SINGLE ENGINE LANDING

A single engine landing is basically the same as a normal landing (figure 3-5) except that the pattern is expanded to avoid steep turns and take-off flaps are utilized.

WARNING

- Single engine performance at high gross weights and high ambient temperatures is critical.
- Ensure that the speed brakes have been retracted during single engine landing operation.

1. Fly a wider than normal pattern.
2. Landing gear handle - DN
3. Flap lever - TAKE-OFF

WARNING

Do not use LAND FLAPS for single-engine landing.

4. Establish at least a one-mile straight-in, final approach.
5. Maintain a slightly fast approach speed (4:00 o'clock position on AOA indicator).
6. Maintain a reduced rate of descent.
7. Make a normal touchdown and rollout.

FLAPS OR SLATS FAIL TO EXTEND NORMALLY

Above 180 KIAS (approximately), the flaps will not extend to the TAKE-OFF (30%) position. Above 145 KIAS (approximately), they will not extend to the full down or LAND position. In either situation, the flap indicator will indicate a barber-pole situation until the airspeed is reduced.

CAUTION

Do not extend the flaps electrically beyond TAKE-OFF (30%) in EMERGENCY above 145 KIAS.

1. Airspeed - 180 KIAS
2. Flap lever - TAKE-OFF
3. Emergency flap switch - DOWN until flaps indicate TO (30%), then OFF

NO—FLAPS AND/OR NO—SLATS LANDING

A no-flaps and/or no-slats landing is basically the same as a normal landing (figure 3-5), except that the pattern is expanded to avoid steep turns; the downwind, base leg, and final approach speeds are higher.

1. Wing and fuselage fuel - DUMP
2. Fly a wider-than-normal pattern.
3. Flap lever - UP

WARNING

- Expanded rudder and stabilizer throw are not available with flaps retracted and are not necessary for landing in this configuration.
- Do not arm the assist spin recovery switch to achieve expanded throw of the stabilizer and rudder (PA configuration).

FLAPS TAKE-OFF — SLATS UP LANDING

1. Wing and fuselage fuel - DUMP
2. Fly traffic pattern slightly wider than normal
3. Flap lever - TAKE-OFF

WARNING

Extension of the flaps will produce a characteristic of strong alternate wing drooping and abrupt pitch-up prior to stall.

Note

Extension of either flaps or slats will reduce the stall speed approximately 10 knots below the clean stall speed.

4. Fly slightly faster approach.

NO FLAPS — SLATS DOWN LANDING

Slats only landing is basically the same as a normal landing, except the approach speed will be faster.

WARNING

During wave-off or bolter in this configuration, overrotation must be avoided due to pitch-up occurring.

FORCED LANDING

WARNING

It is recommended that forced landings be made with the landing gear extended, regardless of the terrain. A greater injury hazard is present whenever emergency landings are made with the landing gear retracted. Increased airspeed or nose-high angle of impact during landings with the landing gear retracted contributes greatly to crew injuries and aircraft damage. The nose high attitude cause the aircraft to slap the ground which high attitude causes the crew to possible spinal injuries. Less injury and less aircraft damage will result with the gear extended.

It is not recommended that a landing on unprepared surfaces be attempted with this aircraft; the crew should EJECT. If a forced landing is unavoidable, proceed as follows:

1. RAT handle - PULL IF REQUIRED
2. If time and conditions permit, dump and burn down to 800 pounds fuel.

3. External stores - JETTISON

4. Landing gear - DOWN AND LOCKED
Use landing gear emergency system (airspeed under 150 KIAS - altitude below 8,000 feet), if necessary.

5. Flaps - EXTEND
Use flaps and slats emergency if necessary.

6. Helmet visor - DOWN, CHIN STRAP TIGHTEN.

7. Lap belt - TIGHTEN

8. Shoulder harness - LOCKED

9. Make normal approach.

10. Canopy - JETTISON
Jettison canopy prior to touchdown.

Upon touchdown:

11. Throttles - OFF

12. Engine and fuel master switches - OFF

LANDING GEAR HANDLE UP — INDICATES UNSAFE

With the landing gear handle in the UP position, if the wheels transition light illuminates and/or the integrated position indicator displays a barber pole for any of the three landing gears, proceed as follows:

1. If both flight and combined hydraulic system pressure is available, isolation valve switch - LDG

2. If either flight or combined hydraulic system system pressure is not available, or gear continues to indicate unsafe with the isolation valve in the LDG position - OBSERVE THE GEAR EXTENSION SPEED LIMIT (250 KIAS)

LANDING GEAR HANDLE DOWN — INDICATES UNSAFE

Gear extension failures may be due to electrical, hydraulic, mechanical, or cabin pressurization failures. The gear will not extend normally if combined secondary hydraulic pressure or 28V DC essential electrical power is not available. Without 28V DC power, the wheel transition light will be inoperative and the wheel position indicator will indicate unsafe (even when the wheels are down and locked). Therefore, when the landing gear handle is moved to the DN position and all gears do not extend and indicate down and locked, accomplish as many of the following steps as necessary:

1. GEAR/HOOK circuit breaker - check IN

2. Cabin dump switch - ON

3. Landing gear handle - Cycle repeatedly, then leave in DN position

4. Flap lever - TAKE-OFF, and accelerate to 250 KIAS and apply positive and negative G's.

5. Airspeed - Reduee to below 150 KIAS

If any gear still fails to indicate down and locked:

6. Have visual gear position check made by tower on a fly-by, or by another aircraft.

7. a. If both main gear are down, landing gear handle - LEAVE DN, push in, rotate 90 degrees clockwise then pull out.

   b. If one main gear is retracted, landing gear handle - UP, when extended gear has retracted, rotate handle 90 degrees clockwise then pull out.

Note

When a landing gear emergency extension has been made, the landing gear cannot be retracted again until the dump valves have been reset on the ground.

8. If necessary; the high speed and low speed runs (steps 4 and 5) may be repeated, have visual gear position check made and make appropriate landing for reported condition.

Note

- If all gears are down and a main gear indicates unsafe, a soft "touch-and-go" landing may lock the unsafe gear.
- If a landing gear is down and indicates unsafe, and is visually checked down, an arrested landing is recommended.

LANDING WITH GEAR UP OR CONFIRMED UNSAFE

1. Request foam on the runway.

2. Request arresting gear and Landing Signal Officer.

3. Lighten the aircraft by dumping and burning off excess fuel to approximately 1,000 - 1,500 pounds.

4. External tanks - RETAIN IF EMPTY

5. Stores - JETTISON

6. Arresting hook - DOWN

7. Flaps - DOWN

8. Canopy - OPEN

WARNING

Safe ejection is impossible with the canopy open. If ejection is required, canopy must be jettisoned or closed before actuating the firing mechanism.

If nose gear is up, confirmed unsafe, or cocked:

9. Flaperon pop-up switch - OFF

10. Fly reduced rate of descent utilizing a Landing Signal Officer if available. Do not let the nose fall through

11. Touchdown short of mid-field arresting gear on runway centerline with power on. Hold nose wheel off the runway with aft stick force (aerodynamically). Maintain 90 KIAS nose-high attitude until the arresting gear is engaged.

12. Throttles - OFF (AFTER ENGAGING THE ARRESTING GEAR)

13. Engine fuel master switch - OFF

If both main gear, or all gear are up or confirmed unsafe:

14. Utilize steps 1 through 9.

15. Touchdown just short of midfield arresting gear on runway centerline.

16. Throttles - OFF AFTER TOUCHDOWN

17. Engine fuel master switches - OFF

If one main gear is up - or confirmed unsafe:

18. Utilize steps 1 through 7.

19. Flaperon pop-up switch - OFF

20. Touchdown just short of midfield arresting gear on runway centerline with power on. Maintain flying speed to keep wing from falling through (105-115 KIAS) until the arresting gear is engaged.

21. Throttles - OFF (AFTER ENGAGING THE ARRESTING GEAR).

22. Engine fuel master switches - OFF

WARNING

If arresting gear is not available, land on the side of the runway opposite the failed or unsafe main gear.

BARRICADE ENGAGEMENT

Any one or combinations of the above or other emergency conditions may dictate a barricade engagement. If use of barricade is required, the following procedures are recommended:

1. Lower hook if possible. Hook will assist the barricade in stopping the aircraft and will help keep the aircraft on deck at barricade entry.

2. Jettison stores if possible. Stores may be torn loose during barricade engagement and present a hazard to the flight deck crew. A successful barricade engagement may be made if unable to jettison stores.

3. Fly a normal approach; on speed, centerline and meatball.

4. Barricade entry must be with three wheels on deck to ensure that the refueling probe passes under the upper load straps.

5. Anticipate loss of meatball for a short period of time during latter part of approach; barricade stanchions may obscure.

BLOWN TIRE

A situation may occur when the pilot must land with a blown tire, or the tire may rupture during ground roll. A blown tire at high speed will require immediate control action to keep the aircraft aligned with the runway. The following procedures are applicable:

1. Utilize field arresting gear if available.

If arresting gear is not available.

1. Anti-skid - OFF

2. Make normal final approach.

3. Land on side of runway opposite blown tire.

4. Touch down with weight on undamaged tire.

5. Lower nose gear to runway and use nose gear steering for directional control.

6. Use light opposite braking to slow aircraft.

7. Fire equipment available, engines - SHUTDOWN If possible, do not shut down engines until adequate fire fighting equipment is available.

CAUTION

The damaged wheel may be either on fire or very hot, and fuel drained overboard after engine shutdown could contact the hot wheel, possibly causing fire.

DITCHING

Ditching the aircraft should be the pilot's last choice. All survival equipment is carried by the crewmember and ejection is therefore advisable. However, if altitude and situation demand ditching, the procedures set forth on the Ditching Chart (figure 5-8) are believed to be the fastest and safest way of evacuating the cockpit.

DITCHING CHART

CREW MEMBER	DUTIES BEFORE IMPACT	DUTIES AFTER IMPACT (CANOPY OUT OF WATER)	DUTIES AFTER IMPACT (AIRCRAFT SINKING WITH CANOPY UNDER WATER)
PILOT	1. ECMO—ALERT. 2. External stores—JETTISON. 3. Landing Gear—UP. 4. Flap lever—LAND. 5. Arresting hook—DOWN. 6. Helmet visor—DOWN. 7. Oxygen regulator selector valve—100% O_2. 8. Oxygen mask—TIGHTEN. 9. Shoulder harness—LOCKED. 10. Lap belt—TIGHTEN. 12. Canopy—JETTISON. 13. Fly parallel to swell pattern. 14. Attempt touch down along wave crest. 15. When arresting hook contacts water—SHUT DOWN ENGINES	1. Canopy—JETTISON (if not jettisoned before impact). 2. Emergency harness release handle—PULL UP & AFT. 3. Shoulder harness rocket jet fittings—RELEASE. 4. Oxygen mask—REMOVE. 5. Stand up with survival kit. 6. See that ECMO is clear of aircraft. 7. Abandon aircraft and swim clear. Inflate life preserver. 8. Attach survival kit retention fitting to the integrated harness survival kit retention strap. 9. Connect the survival kit yellow lanyard to the ring on life preserver. 10. Lap belt—OPEN. 11. Release quick disconnect fitting on the forward face of the survival kit container and pull out survival kit. 12. Inflate life raft and secure emergency equipment. 13. Tie rafts together.	1. Secondary firing handle — GRASP HANDLE. 2. After canopy implosion—PULL UP SECONDARY FIRING HANDLE TO EJECT. 3. Shoulder harness rocket jet fittings—RELEASE. 4. Kick free of seat, inflate life preserver. 5. Oxygen mask — REMOVE & EXHALE SLOWLY. 6. After reaching surface of water, attach survival kit retention fitting to the integrated harness survival kit retention strap. 7. Connect the survival kit yellow lanyard to the ring on life preserver. 8. Lap belt—OPEN. 9. Release quick disconnect fitting on the forward face of the survival kit container and pull out survival kit. 10. Inflate life raft and secure emergency equipment. 11. Tie rafts together.
ECMO	1. Acknowledge pilot's ditching order. 2. Make radio distress call. 3. IFF-EMERGENCY, MODE 3-CODE 77 4. ECMO work table—STOW. 5. Helmet visor—DOWN. 6. Oxygen regulator selector valve—100 O_2. 7. Oxygen mask—TIGHTEN. 8. Shoulder harness—LOCKED. 9. Lap belt—TIGHTEN. 10. Seat recline—FULL AFT.	1. Emergency harness release handle—PULL UP & AFT. 2. Shoulder harness rocket jet fittings—RELEASE. 3. Oxygen mask—REMOVE. 4. Stand up with survival kit. 5. See that pilot is clear of aircraft. 6. Inflate life preserver, abandon aircraft and swim clear. 7. Attach survival kit retention fitting to the integrated harness survival kit retention strap. 8. Connect the survival kit yellow lanyard to the ring on life preserver. 9. Lap belt—OPEN. 10. Release quick disconnect fitting on the forward face of the survival kit container and pull out survival kit. 11. Inflate life raft and secure emergency equipment. 12. Tie rafts together.	Same as for pilot.

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Figure 5-8

WHEEL BRAKE ANTI-SKID SYSTEM FAILURE

If erratic braking is experienced, or the anti-skid annunciator light is illuminated, proceed as follows:

1. Anti-skid switch - OFF

CAUTION

The brakes should be released before the anti-skid system is disengaged to prevent the possibility of skidding.

BRAKE SYSTEM EMERGENCY OPERATION

In the event of either a flight or combined hydraulic system failure or loss of brake action, the aircraft can be stopped by using auxiliary or emergency braking.

1. Brake selector handle - TURN 90° CLOCKWISE. Check that the auxiliary brakes cycles gage indicates approximately 15 cycles. If the gage indication is considerably less than 15 cycles, manually pump with the hand pump.

CAUTION

The anti-skid feature of the aircraft will be inoperative when the brake selector handle is turned 90° clockwise.

2. Allow the aircraft to decelerate using aerodynamic braking. Delay using wheel brakes as long as safety will permit, thus allowing the aircraft to decelerate as much as possible. Avoid pumping brakes.

If the auxiliary brake applications are exhausted:

3. Utilize abort gear if available.

If arrestment is unsuccessful:

4. Brake selector handle - PULL OUT
   Modulation of the brake selector handle will provide approximately 2 brake applications after the brake selector handle is pulled out.

Note

It is possible to recharge the auxiliary/emergency brake accumulator by manually pumping with the hand pump handle during rollout.

HOT BRAKES

If it is suspected that heavy or repeated braking has resulted in overheated brakes, taxi aircraft to nearest designated "HOT BRAKE" area.

CARRIER EMERGENCY SIGNALS

WITHIN VISUAL RANGE OF SHIP

AIRCRAFT TO SHIP

EMERGENCY	SIGNAL
Immediate landing is required.	Fly close aboard port side of ship with hook down, lights bright and steady if at night.
Immediate landing is required while in the landing pattern.	Rock wings from the 45-degree position until in the groove, or from 5 miles to 1-1/2 miles if on a CCA or straight-in approach in daylight. At night, rapidly flash lights at one mile and at one-half mile.
Emergency landing is not required.	Fly close aboard starboard side of ship with hook up, lights bright and flashing if at night.

SHIP TO AIRCRAFT

SIGNAL	MEANING
Blinking green light from tower.	Burn down and land.
Blinking red light.	Maximum conserve, stay within visual distance of ship.
Flashing green cut lights on mirror and/or all runway lights on.	A ready and clear deck.
Runway lights out with center line lights on or off.	Foul deck.
Flashing green cut and red wave-off lights on mirror and turning off and on of runway lights.	Aircraft in groove proceed to divert field.

NOT WITHIN VISUAL RANGE OF SHIP

AIRCRAFT TO SHIP

SIGNAL	MEANING
Right-hand triangular pattern, one-minute legs.	Only radio receiver operating.
Left-hand triangular pattern, one-minute legs.	Transmitter and receiver inoperative.
MODE II IFF.	Communication failure.
I/P fuction with Mode II.	Communication failure, pilot proceeding to alternate marshal at assigned holding altitude.

NOTE: Controllers will use various IFF codes and modes to obtain amplifying information from the pilot in case of radio transmitter failure.

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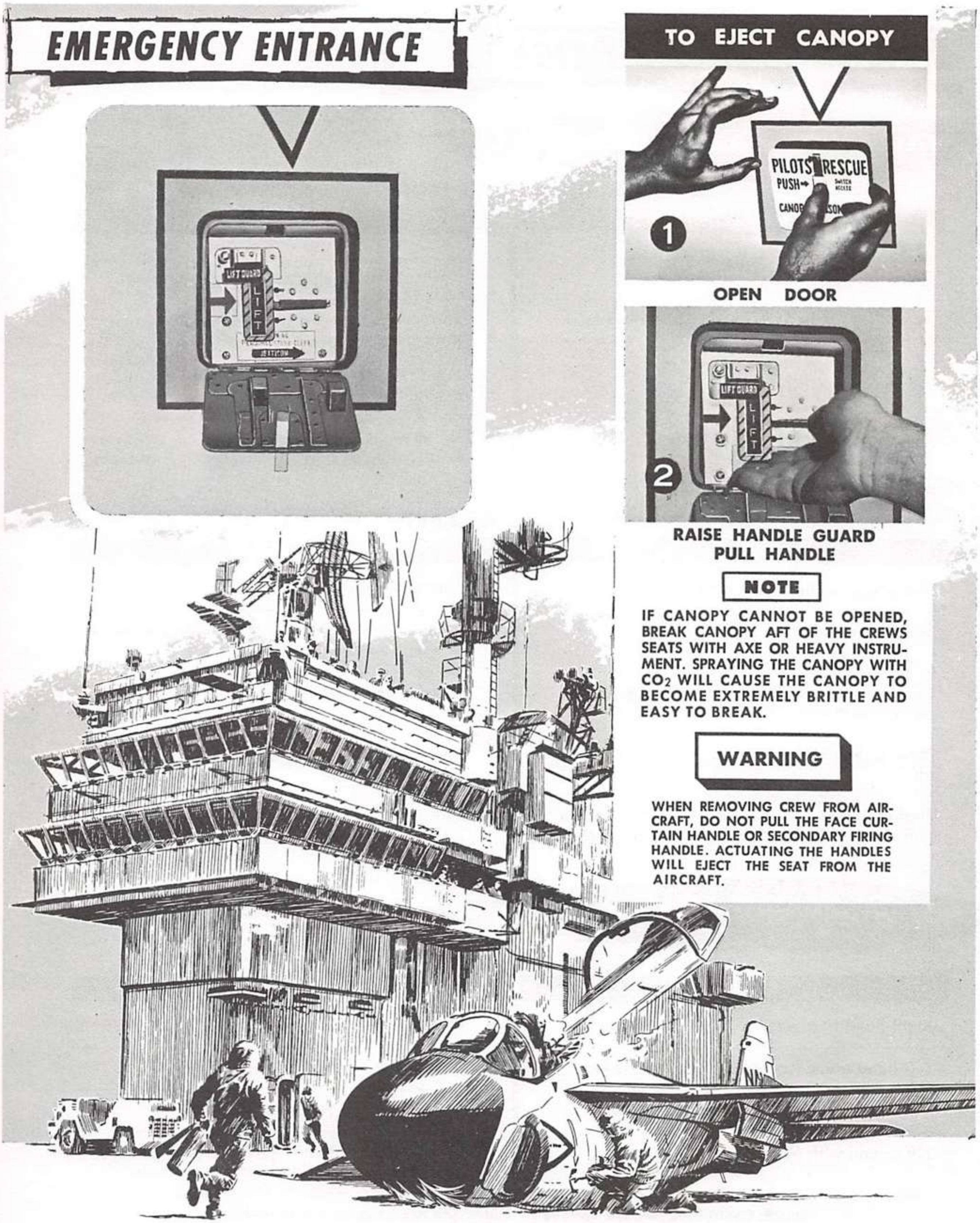
Figure 5-9



TYPICAL BOTH SIDES OF FUSELAGE

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Figure 5-10

section VI
ALL WEATHER OPERATION

TABLE OF CONTENTS

INSTRUMENT FLIGHT PROCEDURES

The following procedures are general approach techniques which are modified to reflect the specific techniques used for this aircraft. Standard navigational aids include TACAN and UHF-ADF. IFF and SIF are used for radar identification. An automatic flight control system can be used to relieve pilot fatigue and can be combined with other electronic gear to provide automatic and semiautomatic operation for accurate navigation in all weather conditions at all altitudes. There is further discussion on navigation equipment in the Supplementary NATOP'S Flight Manual NAVWEPS 01-85ADB-1A.

FLIGHT PLANNING

Clearance delays, prolonged operation at low altitudes and low airspeeds, and holding and stacking, demand a more critical approach to flight planning than would be necessary in VFR conditions. Particular attention should be paid to flight information publications and NOTAMS, and you should be thoroughly familiar with the weather and its possible changes at your destination and alternates.

Prior to entering the aircraft a thorough pre-flight should be performed emphasizing any particular procedures needed for the existing weather conditions. If in icing conditions, pitot heat should be on. If windshield anti-icing is being used, it will be turned off just prior to take-off.

NIGHT FLYING

The following checks and information are in addition to those given for normal instrument flight.

On Entering the Aircraft

1. Interior lighting . . . . ADJUST

Note

For night catapult launches, place instrument panel emergency floodlights to DIM to provide instrument panel lighting if normal instrument lights fail.

2. Emergency floodlights . . . . CHECK
3. Navigation and exterior lights. . . . . . CHECK
4. Flashlight . . . . CHECK

VFR Conditions

1. Exterior lights. . . . . BRIGHT
2. Anti-collision lights . . . . ON

During formation flights, set lights as desired.

IFR Conditions

During night instrument conditions, the anti-collision lights should be turned OFF due to vertigo effect of flashing light reflections from surrounding clouds.

INSTRUMENT TAKE-OFF

Before Taxi

1. Determine that UHF communications channels are pre-set for tower control, departure control, FAA frequencies, etc.

2. Check and set all navigation equipment for proper operation.

Before Instrument Take-Off

Steps 1 and 2 are performed if climb out through precipitation or clouds is anticipated.

1. Engine anti-ice switch . . . . ON
2. Pitot heat switch . . . . ON
3. VDI pitch trim . . . . ADJUST 4° BELOW HORIZON
4. HSI heading set and course set . AS REQUIRED
5. Take-off check list . . . . COMPLETE

Instrument Take-Off and Transition

Align aircraft with the runway and check VDI and HSI.

1. Use nose wheel steering until 70 KIAS.

CAUTION

Ingestion of significant amounts of water into the generator cooling scoop may result in the loss of generator(s).

2. At lift-off speed, rotate aircraft to 4° nose up.
3. Establish a positive rate of climb and raise landing gear.
4. Raise flaps when comfortably airborne, but not below 150 KIAS.
5. At 150-165 KIAS establish a 10° - 12° nose up attitude.

Note

If possible, turns should be avoided until 250 KIAS or 1,000 feet is reached. All turns should be limited to 30° of bank. The take-off should be smooth throughout.

INSTRUMENT CLIMB

A simplified climb schedule as outlined below may be used. However, for accurate climb schedules versus gross weight and airplane configuration, refer to the climb charts in Section XI - PERFORMANCE DATA.

1. Maintain 10 - 12° nose-up attitude until reaching 300 KIAS.
2. Vary pitch attitude as necessary to maintain 350 KIAS until reaching 0.72 IMN.
3. Vary pitch attitude as necessary to maintain 0.72 IMN to cruise altitude.

For best fuel economy, military power should be used throughout the climb. Mach number should be closely monitored to preclude the necessity for adverse pitch changes due to mach effect(0.84 to 0.92 IMN).

When in the clear, or on top:

4. Engine anti-ice switch . . . . OFF
5. Pitot heat switch . . . . OFF

INSTRUMENT CRUISING FLIGHT

After levelling off from climb:

1. Establish cruise mach number.
2. Adjust power.
3. Adjust VDI pitch trim markers for level flight.

Turns

Instrument turns should be limited to 30° of bank. Store loading will affect the response characteristic of the aircraft in turns; however, awareness of this characteristic is sufficient to eliminate any over-controlling. Half standard rate turns, (approximately 30° angle of bank), are recommended above 19,000 feet.

Steep turns should be avoided if at all possible. If a steep turn is necessary, anticipation of the aircraft reaction becomes most important in retaining precise control. Bear in mind that the attitude indicator will process in steep turns and that airspeed and pitch should be closely monitored throughout.

HOLDING

Holding patterns may be flown at most altitudes at approximately 220 KIAS. For more accurate holding speeds refer to the maximum endurance charts in Section XI - PERFORMANCE DATA. Turns should be limited to 30° bank (single needle width) in the pattern.

INSTRUMENT DESCENT

1. Increase the defog and cabin temperature controls. (5 minutes prior to making descent.)
2. Engine anti-ice switch - ON (PENETRATING THROUGH CLOUDS).
3. Pitot switch - ON (PENETRATING THROUGH CLOUDS or PRECIPITATION).
4. Speed brakes - OUT.
5. Penetration airspeed - 250 KIAS (4,000-6,000 FPM DESCENT).

INSTRUMENT APPROACHES

Typical patterns on instrument approaches appear in figures 6-1 to 6-4. Adjust final approach speeds as necessary for a safe approach. Airspeed and configuration should be set up prior to descent on final. Do not begin lowering the gear or the flaps/slats above 250 KIAS. Lower the gear first, followed by the flaps/slats, allowing the airspeed to drop off to 150 KIAS during flaps/slats extension. If it becomes necessary to use engine anti-ice during the approach, allow for the slight reduction of power which results because of tapping compressor bleed air for the anti-ice system. The aircraft handles well through all speeds in the approach with adequate stall warning if a stall condition should arise. In the event of a missed approach, apply military thrust and retract the gear as soon as level-off is achieved. When the airspeed reaches 150 KIAS retract the flaps. Continue the missed approach as directed, being careful not to exceed the missed approach altitude or to build up excessive airspeed. Establish a climb at 250 KIAS and limit turns to 30° of bank.

GCA (PAR) APPROACHES

1. Descend to GCA pick-up altitude and slow to 200 KIAS. With gear and flaps down, fly the pattern at 17 units angle-of-attack (3:30 position on the indicator).

2. On final approach, maintain 20 units angle-of-attack or "donut" airspeed. Approaching the glide path, reduce power as necessary to maintain 500-700 FPM rate of descent.

ICE AND RAIN

ICING

Icing conditions should be avoided whenever possible. Before flight, check freezing levels and areas of probable icing from weather service. If ice starts to form

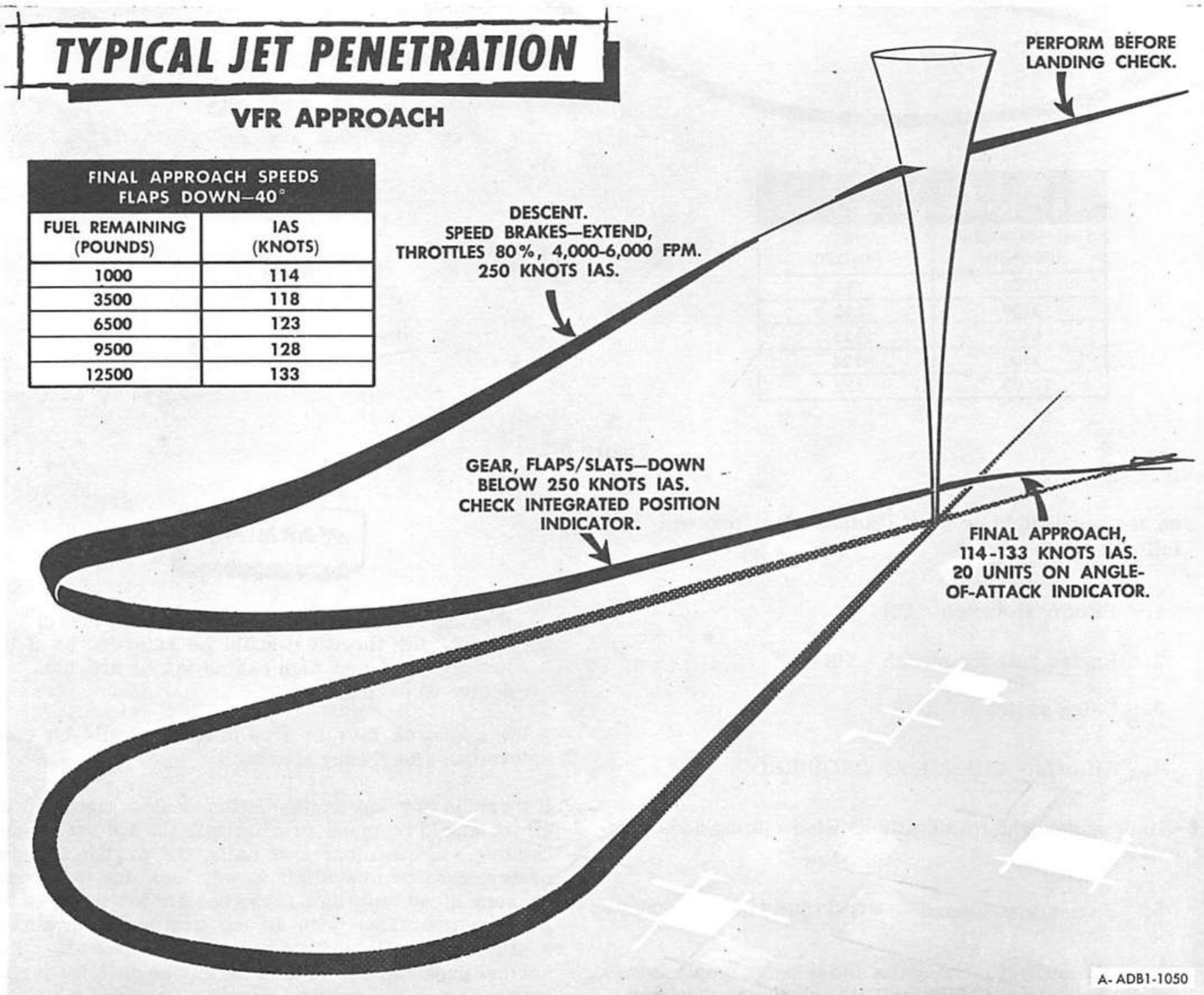
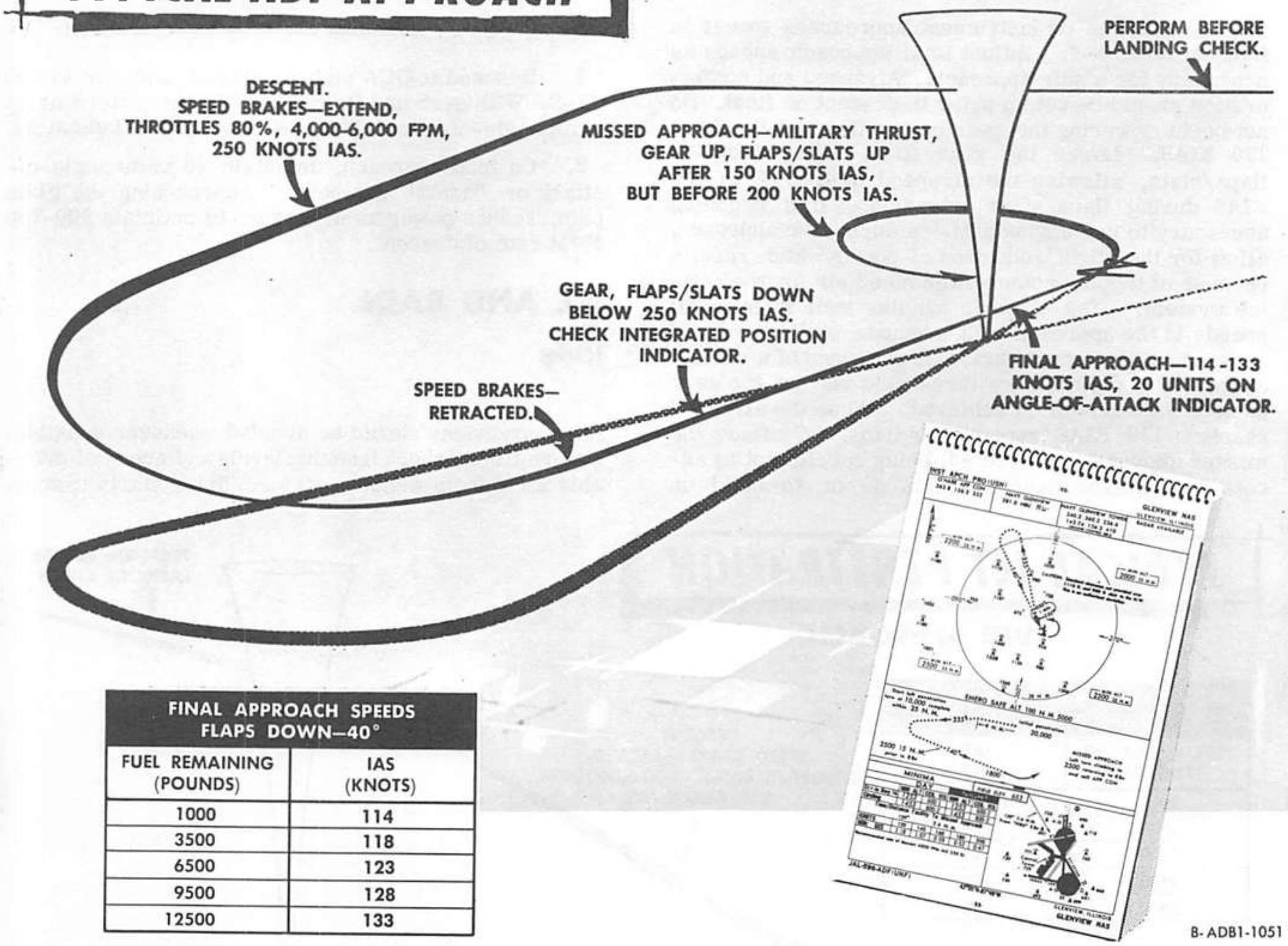


Figure 6-1

TYPICAL ADF APPROACH



FINAL APPROACH SPEEDS FLAPS DOWN—40°	
FUEL REMAINING (POUNDS)	IAS (KNOTS)
1000	114
3500	118
6500	123
9500	128
12500	133

Figure 6-2

on the windshield or wing leading edge, proceed as follows:

1. Pitot heat switch - ON
2. Engine anti-ice switch - ON
3. Defog switch - ON
4. Altitude - CHANGE AS REQUIRED

Climb or descent to an altitude where icing does not exist.

5. Engine instruments - MONITOR FREQUENTLY

Carefully monitor tachometer and exhaust temperature indicator, as a reduction of RPM or an increase in exhaust temperature accompanied by a loss of thrust is an indication of engine icing.

WARNING

If exhaust temperature increases with loss of thrust, the throttle should be retarded as a low airspeed and high engine speed are conducive to engine icing.

A low approach into an area of icing should be considered an emergency approach.

If there is any ice accumulation on the aircraft, an effort should be made to eliminate the ice before decending. Remember that using the engine anti-ice system results in a slight power loss due to a compressor bleed tap which furnishes air for the system. An approach flown with an ice accumulation plus a a slight-power loss becomes doubly critical. The normal procedure is to turn off engine anti-ice during approaches. If a critical situation requires a change in this procedure, you should be aware of these factors affecting flight.

RAIN

Whenever rain is encountered and icing is possible use engine and pitot anti-ice as necessary.

Windshield Rain Removal

Windshield rain removal has been found to be marginal when flying through moderate to heavy precipitation. Rain removal during ground taxiing operations is satisfactory. The windshield rain removal system is somewhat effective in de-icing the windshield.

CAUTION

Operation of the rain removal system is not recommended on a dry windshield. Use of the system on a dry windshield could result in;

a. Foreign materials being baked on the glass.

b. Above 350 KIAS, windshield distortion and failure might occur.

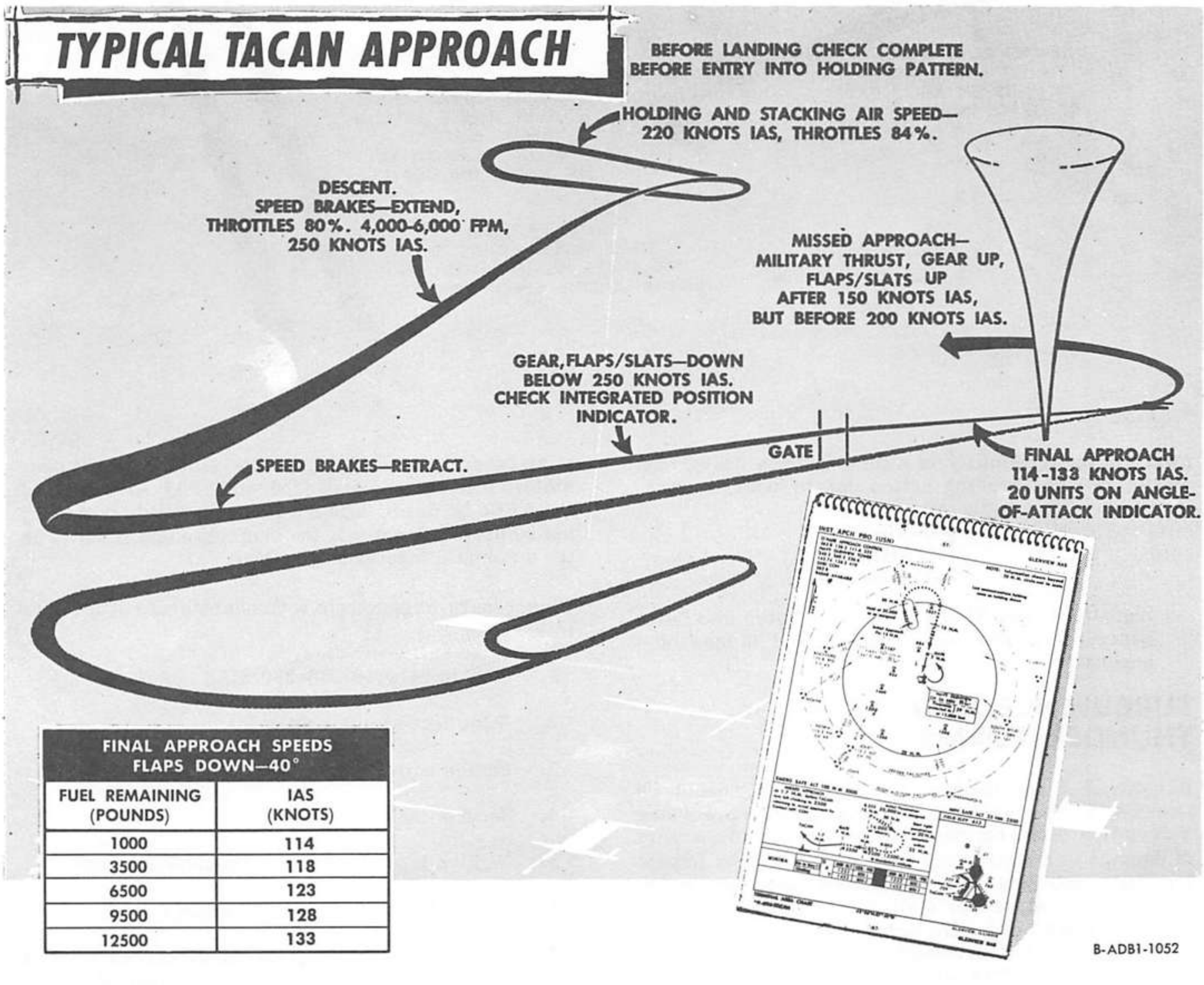
FLAME-OUTS

Preliminary flights through heavy rains have not resulted in flame-outs. However, if a flame-out should occur, commence air start procedures and attempt to get out of the rain area. No compressor stalls due to ice ingestion or ice build ups have occurred to date. In the event of this occurrence, throttle back, and turn on the engine anti-ice switch.

Attempt to go out of the icing area if possible. If ice ingestion is experienced on any flight be sure to inspect the engine after landing.

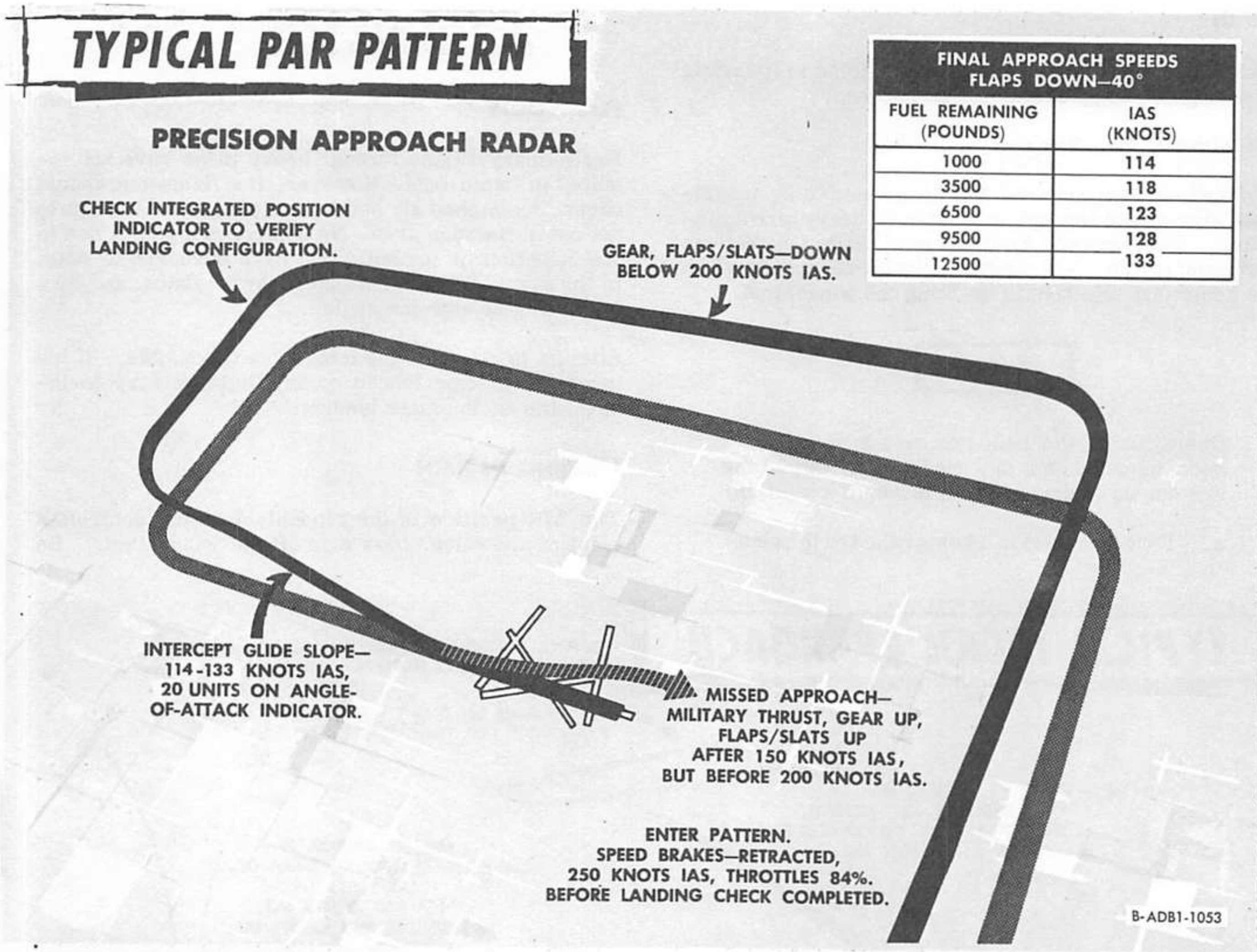
LANDING IN RAIN

The AIR position of the windshield switch controls a blast of air which blows rain off the windshield. Be



FINAL APPROACH SPEEDS FLAPS DOWN—40°	
FUEL REMAINING (POUNDS)	IAS (KNOTS)
1000	114
3500	118
6500	123
9500	128
12500	133

Figure 6-3



FINAL APPROACH SPEEDS FLAPS DOWN—40°	
FUEL REMAINING (POUNDS)	IAS (KNOTS)
1000	114
3500	118
6500	123
9500	128
12500	133

Figure 6-4

aware of the possibility of a flameout in a heavy rain and of reduced braking action due to a wet runway.

CAUTION

Ingestion of significant amounts of water into the generator cooling scoop may result in loss of generator(s).

TURBULENCE AND THUNDERSTORMS

Intentional flight through thunderstorms should be avoided, unless the urgency of the mission precludes a deviation from course, due to the high probability of damage to the airframe and components by impact ice, hail, and lightning. Flameouts, due to water ingestion, or compressor stalls due to rapidly changing flight attitudes, may also occur. The radar provides a means of navigation between, or around storm cells. If circumnavigating the storm is impossible, penetrate the thunderstorm in the lower third of the storm cell, away from the leading edge of the storm cloud if possible. It is recommended that the STAB AUG mode of the AFCS be used. The AUTO mode should definitely not be used. Damage to the controls could result with the automatic functions operating.

If necessary to penetrate a thunderstorm, proceed as follows:

1. Slow to between 230-280 KIAS.
2. Pitot heat switch - ON.
3. Engine anti-ice switch - ON.
4. Secure loose equipment.
5. Tighten lap belt and lock shoulder harness.
6. Turn all cockpit lights on BRIGHT.
7. Fly the attitude and heading indicators primarily while in extreme turbulence, because altimeter and airspeed will fluctuate.

Note

During severe icing conditions the pilot can expect to lose airspeed indications even with the pitot heat on. GCI stations, if available, can aid the pilot with tracking assistance through thunderstorm areas.

Severe turbulent air at high altitudes may cause the inlet airflow distribution to exceed acceptable limits of the engine, thereby inducing compressor stalls.

To avoid compressor stalls during flight in turbulent air, maintain 230-280 KIAS at all altitudes.

Severe compressor stalls can result in engine flame-out. If severe stalls are encountered, proceed as follows:

1. Throttles - IDLE
2. Airspeed - INCREASE BY LOWERING NOSE.

Compressor stalls are generally accompanied by increased exhaust gas temperature. If temperature exceeds allowable limits, perform shutdown procedure and accomplish an air-start as soon as practical.

COLD WEATHER PROCEDURES

A careful pre-flight will eliminate many potential hazards found in cold weather operations. Inspect engine intakes for accumulation of ice and snow. If possible, pre-heat the engine, for easier engine starts. When removing ice and snow from the aircraft surfaces, be careful not to damage the aircraft. Also use precautions not to step on any no step surfaces which could be covered with ice or snow. Check the pitot static tube for ice as well as the fuel presurization ram/air intakes, and yaw, pitch, and angle-of-attack transducers.

Moisture in the fuel system greatly increases operational problems in cold weather. At lower temperatures, the water-dissolving capacity of fuel is greatly reduced and will result in considerably more water accumulation (as much as several gallons of water to 1,000 gallons of fuel). If the water separation occurs at below freezing temperature, the water will crystallize on fuel drains and internal valves. Any water accumulation will settle to the bottom of the tanks and freeze up the fuel drains.

Normal operating procedures as outlined in Section III - NORMAL PROCEDURES should be adhered to with the following additions and exceptions:

PRE-FLIGHT

1. Check entire aircraft to ensure that all snow, ice, or frost is removed.

WARNING

Snow, ice, and frost collections on the aircraft surface are a major flight hazard. The result of this condition is a loss of lift and increased stall speeds.

2. Shock struts and actuating cylinders - FREE OF ICE AND DIRT.
3. Fuel drain cocks - FREE OF ICE AND DRAIN CONDENSATION.
4. Pitot tube - ICE AND DIRT REMOVED.
5. Exterior protective covers - REMOVED.

WARM UP AND GROUND CHECK

Be sure that the aircraft is adequately chocked before engine start. Normal starting procedures will start the engines in cold weather.

In severly cold weather, allow a short time for warm up before increasing RPM out of the idle range. If oil pressure is low or fails to come up in a reasonable length of time, shut down. Attempt another start after heating the engines.

CAUTION

If abnormal sounds or noises are present during starting, discontinue starting and apply intake duct preheating for 10-15 minutes.

TAXIING

1. Avoid taxiing in deep or rutted snow since frozen brakes will likely result.
2. Increase the spacing between aircraft while taxiing at sub-freezing temperatures to ensure safe stopping distance, and to prevent icing of aircraft surfaces by melted snow and ice blown by the jet blast of a preceding aircraft.

TAKE-OFF

Thrust available will be noticeably greater in cold temperatures during the take-off run.

CAUTION

- Prior to initial take-off roll, ensure that all instruments are sufficiently warmed up. After take-off cycle landing gear to free the gear from the possibility of freezing in the wheel wells.
- Do not actuate the landing gear above 8,000 feet unless the cockpit is depressurized.

LANDING

Use anti-skid during the landing roll.

Note

Hard braking on ice or wet runways, even with anti-skid system on, may result in dangerous skidding conditions.

BEFORE LEAVING AIRCRAFT

Leave canopy partly open, unless weather prevents, to permit circulation. This helps prevent canopy cracking from differential cooling and decreases windshield and canopy frosting.

HOT WEATHER AND DESERT PROCEDURES

Check for accumulation of sand or dust in the intakes and transducers. Normal starting procedures will be employed.

Normal operating procedures as outlined in Section III - NORMAL PROCEDURES should be adhered to with the following additions and exceptions:

1. Expect higher temperatures than normally obtained in operating ranges.
2. Engine ground operation should be minimized as much as possible.

CAUTION

Do not attempt take-off or engine operation in a sand storm or dust storm, if avoidable. Park aircraft crosswind to prevent sand or dirt from blowing into the intake and exhaust ducts, and subsequently causing engine damage.

TAKE-OFF

The take-off distances are increased by ambient temperature increases. Check required take-off distance charts in Section XI - PERFORMANCE DATA.

LANDING

Anticipate a slightly longer landing distance and the possibility of turbulence due to thermal action of the air close to the ground. Use the defogger, if necessary, in warm humid weather.

SHUTDOWN

Open the canopy slightly if the weather and environment permits. Do not place objects near the cockpit windows to avoid the possibility of cracking the windows due to a concentration of radiant energy. Check all protective covers installed.

section VII
COMMUNICATIONS EQUIPMENT AND PROCEDURES

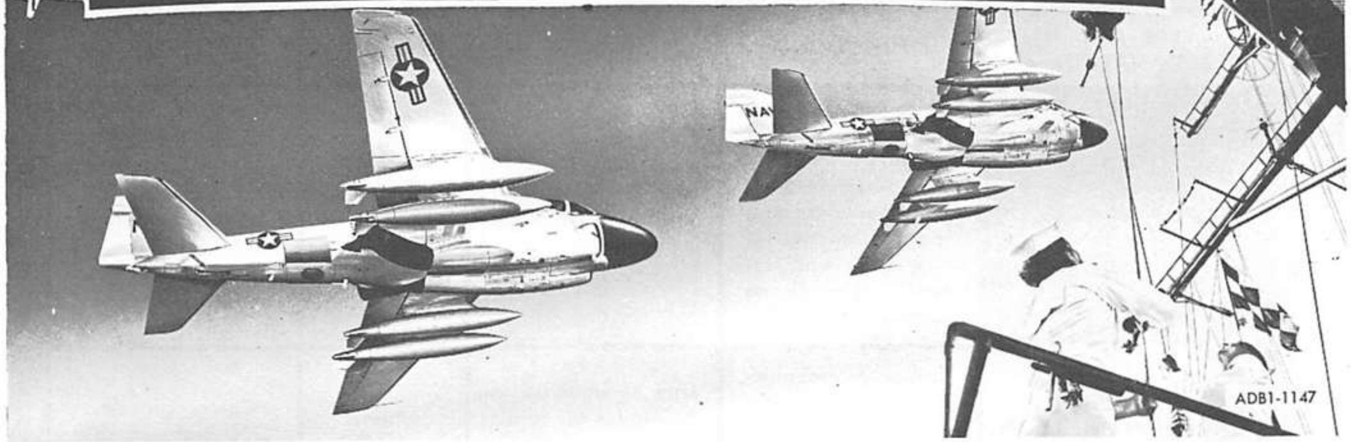


TABLE OF CONTENTS

INTEGRATED ELECTRONIC CENTRAL (CNI) SYSTEM

The integrated electronic central system provides the overall communication, navigation, and identification functions of the aircraft. Communications equipments include the UHF receiver-transmitter, and an auxiliary UHF receiver unit operating in conjunction with the intercommunications set (ICS). Navigation is provided by the tactical air navigation system (TACAN), and by automatic direction finding equipment (ADF). Identification information and control is provided by the IFF and SIF equipments. See figure 7-1 for communications and associated electronic equipment. The CNI (IEC) master power switch is located on the cabin dump panel (figure 7-2).

CAUTION

During all IEC operation, it is necessary that adequate cooling air be supplied to the equipment. Operation of the equipment without the necessary cooling air will result in permanent damage to the equipment.

INTERCOMMUNICATIONS SET (ICS)

The ICS is considered the communications center of the aircraft, and provides the necessary amplification of microphone signals for radio transmission and reception, and ground interphone communications. It also provides the necessary amplification of radio receiver outputs for voice reception, navigation information, and warning reception.

ICS OPERATION

Operation of the ICS is controlled by the ICS control panels on the aft bulkhead above the center console (figure 7-3) and the ECM operator's right console (figure 7-4). For operation of the ICS system, the CNI master power switch (figure 7-2), must be positioned to ON.

ICS CONTROL PANEL

Amplifier Selector Switch

This four-position selector is marked AMPL SEL (figures 7-3 and 7-4) and is located in the center of the ICS control panel. During ICS operation, this switch should be positioned to normal (NORM). If difficulty is experienced in hearing radio/ICS when the switch is in the normal position, reposition the AMPL SEL to ALT 1 or ALT 2 (alternate channels). Should the signal remain difficult to read in either of the alternate channels, position the AMPL SEL switch to emergency (EMERG) to bypass a probably faulty receiver amplifier. During normal operation,

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

TYPE AND DESIGNATION		FUNCTION	RANGE	OPERATION	LOCATION OF CONTROLS
INTERPHONE AN/AIC-14		Voice communications in cockpit or cockpit to ground crew personnel. Miscellaneous warning tones from weapons, ECM, and obstacle avoidance systems.	Within the aircraft and ground crew personnel.	Pilot, ECMO Ground Crew Personnel	Center console, ECMO right console, ground crew plug-in at external power panel on the right nacelle.
INTEGRATED ELECTRONIC CENTRAL (IEC) AN/ASQ-57	UHF COMMUNICATIONS RADIO	Radio communications between aircraft and ship, aircraft and shore, or between aircraft.	Line of sight up to 350 miles air to air depending upon altitude.	Pilot, ECMO	Center console, ECMO Right console.
	AUXILIARY UHF RECEIVER	Auxiliary UHF receiver.	Line of sight up to 350 miles air to air depending upon altitude.	Pilot, ECMO	Aft bulkhead above Center console.
	DIRECTION FINDER GROUP (ADF)	Indicates bearing of, and homes on UHF signal sources.	Line of sight up to 350 miles air to air depending upon altitude.	Pilot, ECMO	Center console.
	IFF	Identifies aircraft as friend or foe.	Line of sight up to 200 miles.	Pilot, ECMO	Center console.
	SIF	Provides specific identification of separate aircraft or of a single aircraft within a group. Transmits coded signals in reply to coded interrogations.	Line of sight up to 200 miles.	Pilot, ECMO	Center console.
	TACAN	Indicates distance and bearing of suitably equipped ground stations and determines identity of beacon.	Line of sight distances up to 196 miles depending upon altitude.	Pilot, ECMO	Center console.
RADAR ALTIMETER AN/APN-141		Indicates distance in feet from aircraft to ground.	0-5000 feet	Pilot	Pilot's instrument panel.

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Figure 7-1

CNI MASTER SWITCH

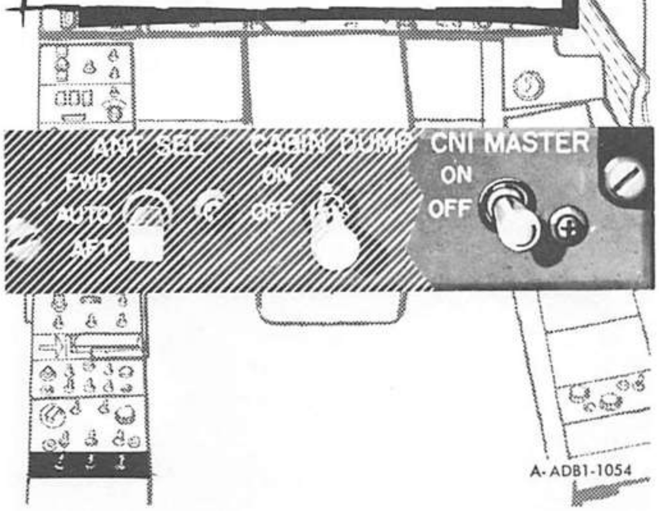


Figure 7-2

ICS CONTROLS - PILOT

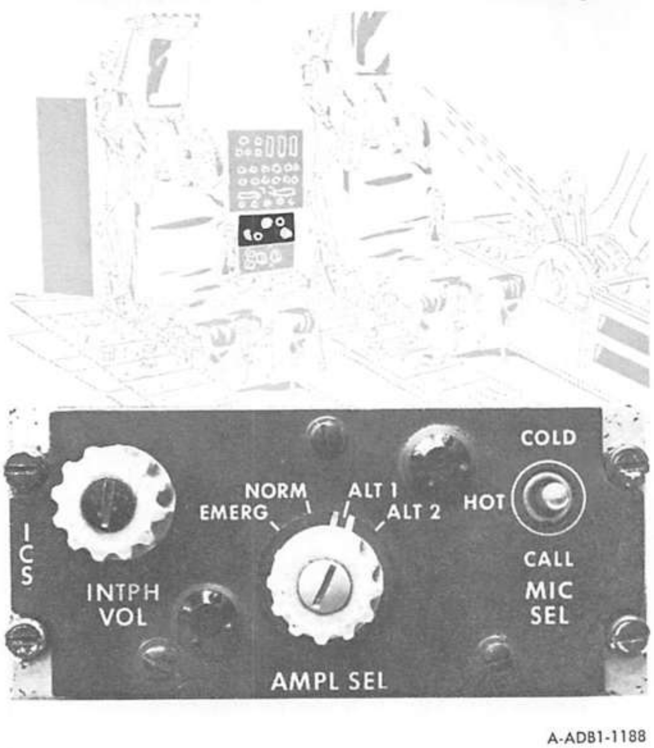


Figure 7-3

it may be necessary for both crewmembers to switch to one of the emergency settings at the same time. During certain amplifier failures, this mode of operation will present the only effective method of maintaining communications.

Note

With the AMPL SEL switch in the EMERG position all conversation between crew members will be transmitted over the air.

Interphone Volume Control

The interphone volume (INTPH VOL) control knob is located on the ICS panel (figures 7-3 and 7-4) and provides means of adjusting the individual audio level of the intercommunications signals heard in the headsets. The audio level of the sidetones heard may also be adjusted using this control. When the AMPL SEL control is in the normal (NORM) position, the signals received from the radio receivers will not be affected by the operation of this control.

Microphone Selector Switch

The microphone selector switch (MIC SEL) is a three-position toggle switch located on the ICS control panel (figures 7-3 and 7-4). The switch is placarded COLD, HOT, and CALL. In the COLD position, both microphones are disconnected, and transmission cannot be accomplished without depressing the ICS switch on the pilot's throttle or the ECM OPERATOR'S foot rest. When the switch is positioned to HOT, the individual microphone is energized, and transmission is possible without actuation of the press-to-transmit switch at either

ICS CONTROLS - ECMO

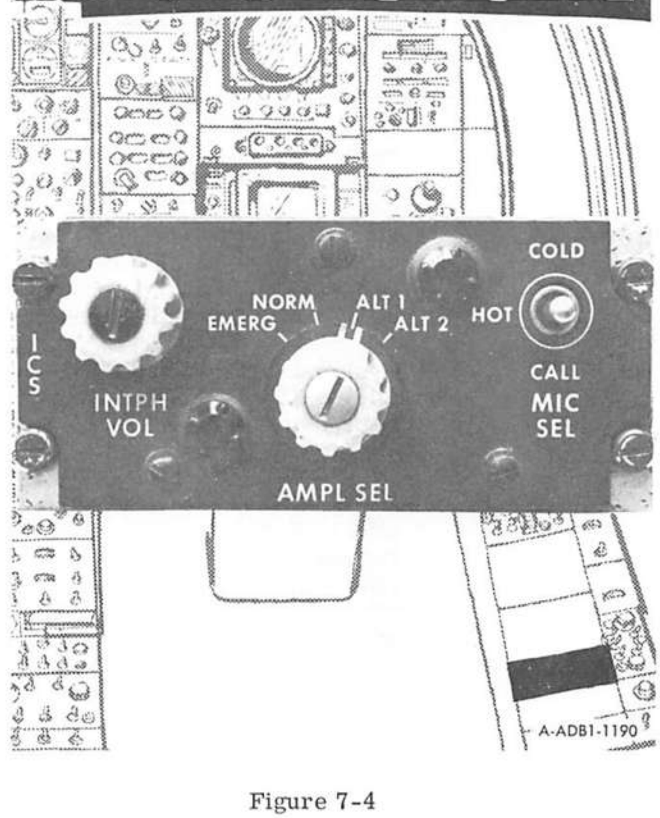


Figure 7-4

crew members' location. The CALL position is inoperative in this aircraft.

Microphone, ICS and Recorder Switches

Press-to-transmit microphone (MIC) and interphone (ICS) switches are provided to permit radio transmission through the IEC(CNI) system, and interphone communication between the crew members. For the pilot, microphone (MIC) and interphone (ICS) pushbuttons are located on the head of the throttle control. The ECM operator's combined microphone and interphone (MIC/ICS) switch is located on the operator's right foot rest. The ECM operator's left foot rest is equipped with a recorder (REC) press-to-run/talk switch which, when depressed, inhibits the 1000 cycle tape speed reference tone and records ECM equipment and interphone inputs.

RADIO CONTROL PANEL (RAD)

The radio control panel located on center console and the ECM operator's right console (figure 7-5) are placarded RAD and provide means of selecting transmitter operation, and means of monitoring audio outputs of the aircraft communications and electronic warfare equipments.

TRANSMITTER SELECTOR SWITCH

The transmitter selector switch (TRAN SEL) is a rotary switch with four placarded positions (REC-ICS-UHF-HF). The switch position selected by each crew member has the effect of connecting the output of his microphone to the various systems in the aircraft. In the case of the REC position the pilot's and the ECM operator's panels each have a different effect to allow better tactical usage of the equipments. The following table describes the function of each switch position and the action required by each crewmember to operate in the selected mode.

Figure 7-5

TRAN SEL SWITCH POSITION FUNCTIONS

	PILOT	ECM OPERATOR
REC	Pilot hears all ECMO voice to the recorder. Depressing ICS switch connects pilot's voice to recorder and ICS system. (1,000 cycle tape speed reference tone is inhibited)	The ECMO's mike is connected directly to recorder. (1,000 cycle tape speed reference tone is inhibited)
ICS	Depressing ICS switch connects pilot to ECMO via ICS system.	Depressing MIC/ICS switch connects ECMO to pilot via ICS system.
UHF	Depressing ICS switch connects pilot to ECMO via ICS system. Depressing MIC switch connects pilot to UHF transmitter.	Depressing MIC/ICS switch connects ECMO to UHF transmitter.
HF	Depressing ICS switch connects pilot to ECMO via ICS system. Depressing MIC switch connects pilot to HF transmitter.	Depressing MIC/ICS switch connects ECMO to HF transmitter.
NOTE: In any position, when the ECMO depresses his REC (left) footswitch the ECMO's mike output is provided for recording by an analog recorder. (1,000 cycle tape speed reference tone is inhibited).		

RADIO CONTROL (AUDIO) SWITCHES

The radio control panels (figure 7-5) are equipped with five audio control toggle switches (UHF-HF-NAV-ECM-OB WARN) which provide the capability to the crewmembers of monitoring selected audio circuits. With these switches in their off positions (pilot's panel switches-AFT, ECM operator's panel switches-INBOARD) and audio is present the pilot will hear ICS and AN/ALR-15 ECM warning tone and the ECM operator will hear ICS and AN/ALQ-53 ECM tone. When the NAV switch is turned on, the audio from the TACAN and the auxiliary receiver can be monitored. When the pilot's ECM switch is on, the AN/ALQ-53 ECM tone as well as the AN/ALR-15 warning tone is heard by the pilot. Placing the ECM operator's ECM switch on allows the operator to hear the AN/ALR-15 ECM warning tone as well as the AN/ALQ-53 ECM tone. The OB WARN switch when placed to the on position provides a warning tone generated by the terrain clearance equipment, and when used with the BOMB TONE switch (ECM operators right console) permits monitoring of the signal being transmitted over the UHF communications equipment.

BOMB TONE

A "bomb tone" signal is provided to the crew to denote the IP or pull-up point and weapon release and may be transmitted over the UHF communications equipment for mission monitoring by "home plate" or other installation. The bomb tone, generated in the armament release system, comes on at the IP or release point and goes off at weapon release. The tone may be used during practice bombing or actual weapon release.

Note

- In order to hear and/or transmit the bomb tone, the armament control panel MASTER ARMT switch must be placed to ON or PRAC (practice) and the AUTO-MAN switch to AUTO.
- Control of bomb tone audio provided to the headsets is by use of the OB WARN switch on the ICS control panels figures 7-3 and 7-4.

BOMB TONE SWITCHES

The G VALVE/BOMB TONE panel, on the ECM operator's right console (figure 7-6), is equipped with two toggle switches placarded BOMB TONE which control the activation and transmission of the bomb tone.

The three position switch placarded MAN-AUTO-OFF provides control of the bomb tone generated in the armament system. When the switch is placed to the OFF position, the bomb tone cannot be heard by the crew and is not available for transmission. In the AUTO position, the tone is available for monitoring and transmission (as controlled by the armament system) and will come on at the IP or pull-up point and go off at weapon release. The MAN position provides a continuous tone which is not controlled or interrupted by the armament system. Placing the switch to MAN provides a continuous tone for transmission over the UHF communications equipment to provide an aircraft tracking beacon for emergency or tactical purposes.

The functions of the bomb tone switches and the radio control panel OB WARN switch during normal operation are described in the following table.

Note

The OB WARN switch has two positions, one placarded OB WARN and the other unplacarded. The unplacarded position is indicated in the table by the word ON.

MODE	SWITCH POSITIONS
Hear and transmit	BOMB TONE - AUTO & XMIT OB WARN - ON
Hear and not transmit	BOMB TONE - AUTO & NORMAL OB WARN - ON
Not hear and transmit	BOMB TONE - AUTO & XMIT OB WARN - OB WARN
Not hear and not transmit	BOMB TONE - OFF
FOR BEACONING	
Hear and transmit	BOMB TONE - MAN & XMIT OB WARN - ON
Not hear and transmit	BOMB TONE - MAN & XMIT OB WARN - OB WARN

ICS/RADIO PREFLIGHT CHECK

The controls at both the pilot's and ECM operator's position should be set in the following manner to check the equipment before take-off:

SWITCH	POSITION
Transmitter selector	ICS
Radio volume	ROTATE COUNTER CLOCKWISE
Receiver switches (ALL)	OFF
Interphone volume	ROTATE COUNTER CLOCKWISE
Amplifier selector	NORM
Microphone selector	COLD

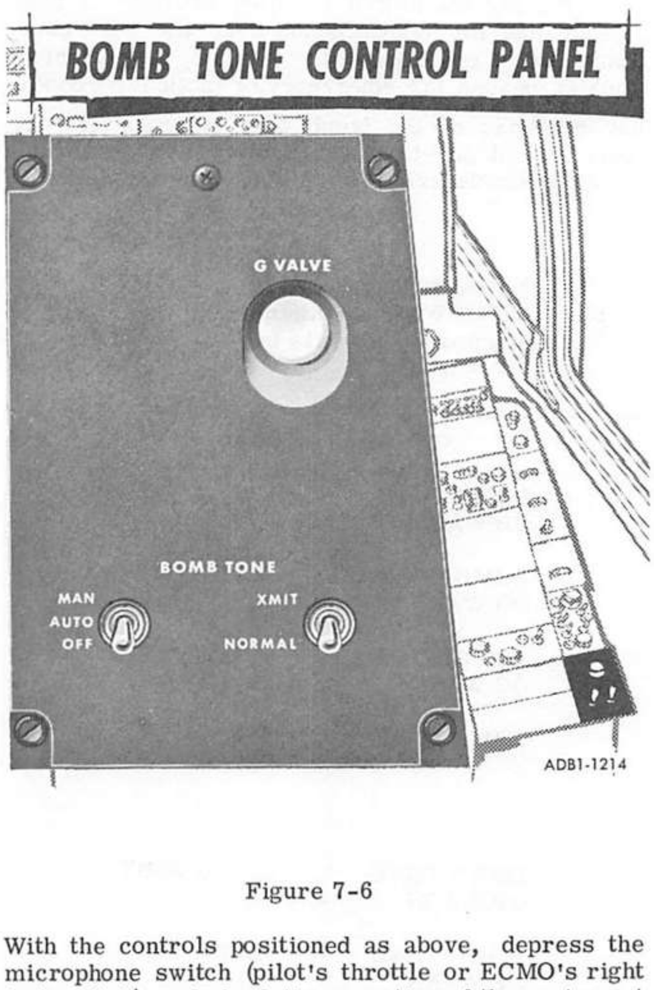


Figure 7-6

With the controls positioned as above, depress the microphone switch (pilot's throttle or ECMO's right foot switch), and check the operation of the equipment by talking into the microphone. Rotate the volume controls maximum clockwise to ensure that they are operating properly. Switch to the ALT 1 and ALT 2 positions to ensure proper operation. Place transmitter selector to UHF and AMPL SEL to EMERG and ensure that UHF side tones are heard on the ICS.

UHF COMMUNICATIONS RADIO

The UHF communications radio provides two-way voice communication in the frequency range of 225.0 to 399.9 megacycles between aircraft and ground station or between aircraft. It also performs ADF (automatic direction finding) for visual presentation of bearing information. Complete operation can be maintained by either the pilot or ECM operator through the UHF communications and UHF auxiliary control panels on the center console. The control provides operation on any one of 1,750 frequencies between 225.0 and 399.9 megacycles. Twenty of these frequencies are preset as channels. In addition to the preset frequencies, a manual means of frequency channel selection is available.

UHF COMMUNICATIONS CONTROL PANEL

Channel Frequency Switches

Three touch-tuning slewing switches (figure 7-7) marked CHAN/FREQ on the UHF communications

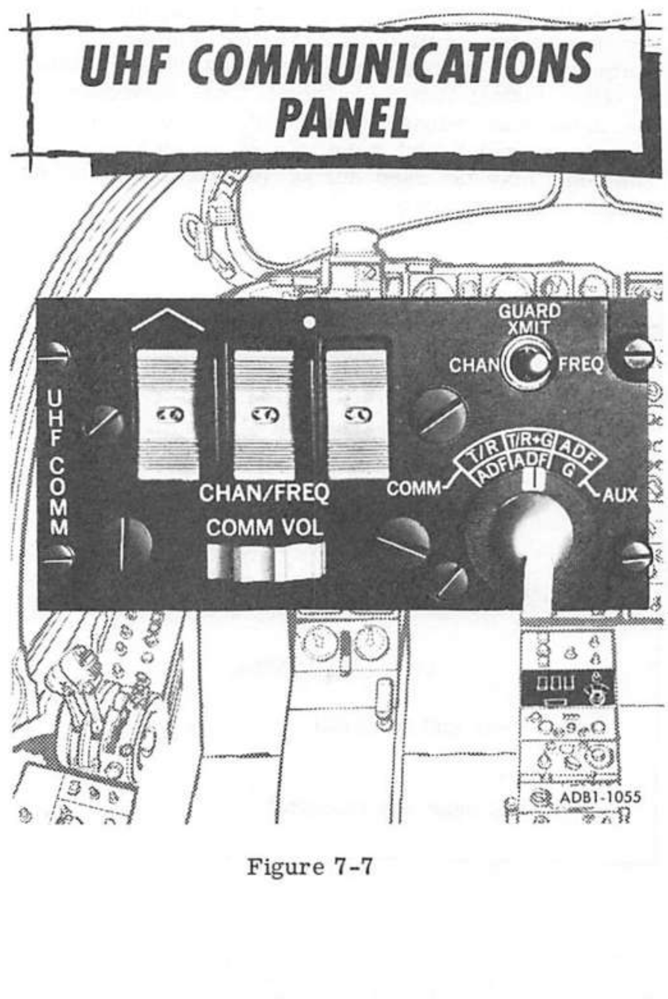


Figure 7-7

control panel, are used to manually adjust the operating frequency of the receiver-transmitter. Pressing on the forward portion of the rocker causes the UHF communications frequency to increase to the desired frequency. Releasing the touch-tuning slewing switch stops the slewing action. Pressing the switch or switches to the down position decreases the UHF communication frequency and the indication. The switch on the right selects the tenths-of-megacycles, and the middle switch selects the megacycle to be used and displayed on the frequency channel indicator. The switch on the left controls the tenths and hundreths of megacycles of the channel number, depending upon the position of the masking mode switch.

Masking Mode Switch

The masking mode (GUARD XMIT) switch (figure 7-7) is a three-position toggle switch on the forward right corner of the UHF communications control panel. When in the channel (CHAN) position, the frequency channel indicator displays the two-digit (tenths and units masked) channel number selected by the touch-tuning slewing switches. In the GUARD position, the frequency channel indicator displays a guard transmit mask over the digits, labeled GUARD. In the FREQ position, the frequency channel indicator displays one of 1,750 possible UHF communications frequencies, between 225.0 and 399.0 megacycles. To enter a selected channel (15 for example) position the masking mode switch to CHAN and press forward on the left slewing switch until 15 is read on the UHF frequency indicator on the pilot's instrument panel. To manually set any frequency between 225.0 and 399.9 mc, place the guard transmit switch to FREQ and press the touch-tuning switches until the UHF frequency indicator shows the desired frequency.

Command Auxiliary Selector Switch

The command auxiliary selector switch, placarded COMM AUX (figure 7-7), is a three-position, double-row selector, which selects the combination of functions to be performed by the main UHF communications receiver-transmitter and auxiliary receivers. The top row of positions indicates the function performed by the UHF communications receiver-transmitter, while the bottom row indicates the functions of the auxiliary receiver. In the first position, T/R-ADF, the main UHF communications receiver is in the usual transmit-receive function, while the auxiliary receiver is operating as an ADF receiver. In the T/R+G-ADF position, the main UHF communications receiver-transmitter is operating normally with the additional operation of a guard receiver, and the auxiliary receiver is performing the ADF function. With the COMM AUX selector in the ADF/G position, the main UHF communications receiver is performing the ADF function while the auxiliary (figure 7-8) is serving as a guard receiver.

AUXILIARY RECEIVER (UHF)

An auxiliary receiver operates in conjunction with the main receiver-transmitter under normal conditions and operates as an emergency receiver in the event of a failure in the main receiver-transmitter. The auxiliary receiver can be used as a conventional radio receiver for reception of AM radio signals in the frequency range of 265.0 to 284.9 mc or as an ADF receiver for reception of radio signals in the same frequency range. The operating channels from 1 to 20 are selected on the UHF auxiliary receiver control panel figure 7-8.

Auxiliary Receiver Control Panel

The auxiliary UHF receiver control panel (figure 7-8) is located on the aft bulkhead of the cockpit between the crew seats. The panel, marked UHF, is equipped with four controls placarded SENS-VOL-AUX CHAN-AUX REC/MAIN T/R. The rotary knob placarded VOL, controls the volume of the auxiliary receiver.

The rotary channel selector switch placarded AUX CHAN controls selection of the operating channel for the auxiliary UHF receiver. The knob is marked numbers 1 through 20 around the outer perimeter of the knob. Channel selection is made by bringing the number of the desired channel under the triangular index mark at the top of the control panel.

Note

The auxiliary channel (AUX CHAN) selector and the volume (VOL) control are the only operative controls on the UHF control panel. The function selector (AUX REC-MAIN T/R) and the sensitivity (SENS) control are inoperative.

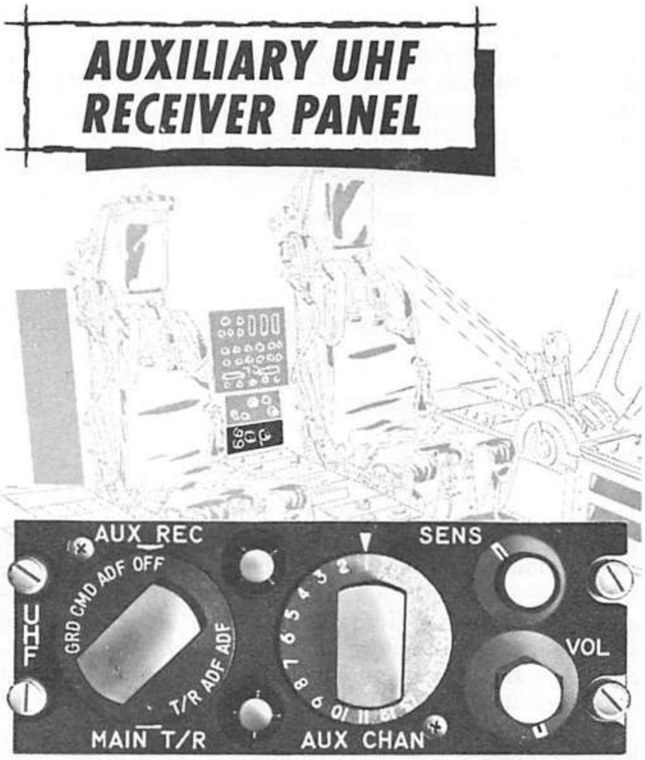


Figure 7-8

ANTENNA SELECTOR SWITCH

The antenna selector switch is marked ANT SEL, and is located on the cabin dump panel (figure 7-9). This switch provides selection of either the forward or aft UHF blade antenna during UHF reception and transmission. The antenna selector switch operates a coaxial switch for selection of the desired antenna. There are three modes of operation:

1. Forward antenna - FWD
2. Aft antenna - AFT
3. Automatic - AUTO

In the FWD position, the pilot manually overrides the automatic mode and selects the forward blade antenna. In the AFT position, the pilot manually selects the aft blade antenna. In the AUTO mode, the forward and aft antennas are time-shared until lock-on. During the lock-on, the antenna producing the strongest signal is utilized. A memory function in the automatic antenna selector causes transmission on the antenna last used for reception.

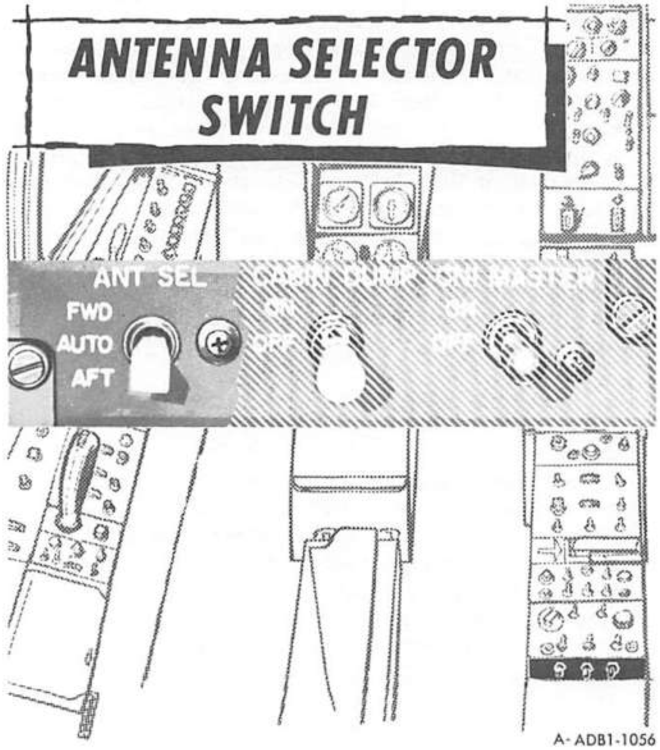


Figure 7-9

TACTICAL AIR NAVIGATION (TACAN)

The TACAN equipment of the IEC system consists of a short-range navigation radio that converts radio signals into visual displays of azimuth and range. The azimuth and range signals are displayed on the horizontal situation indicator (HSI) on the pilot's instrument panel. The receiver-transmitter is used in conjunction with a receiver-transmitter located at a ground site or aboard ship. The signals used for azimuth measurement originate at the surface beacon, are radiated by a rotating antenna, and are displayed on the HSI. A pulse signal from the TACAN transmitter in the aircraft triggers a responding pulse from the ground station; the time lapse between the initial pulse and response pulse is translated into distance and displayed in nautical miles on the HSI. The maximum range of TACAN is approximately 195 nautical miles; however, bearing information is accurate beyond this range under most conditions. All controls for the equipment are on the TACAN control panel (figure 7-10).

TACAN CONTROL PANEL

Function Selector Knob

The function selector knob has three positions: OFF, REC (receive), and T/R (transmit-receive). In the OFF position, there is no power applied to the TACAN equipment. In the REC position, pulse signals are not transmitted and no range information is received. Only bearing data is received and displayed. Both range and bearing are received and displayed when the switch is positioned to T/R.

Volume Knob

This control adjusts the volume of the station identification signal heard in the pilot's and ECM operator's headsets. The signal is transmitted in international Morse code, with a three-letter designation representing the station's call letters.

Channel Selector Knob

The desired operating TACAN channel is selected by two selector knobs. The left knob selects the first two digits of the desired channel, and the right knob selects the last digit. All digits are displayed through the channel digit display window.

HORIZONTAL SITUATION INDICATOR

The horizontal situation indicator (HSI) (figure 7-11), on the pilot's instrument panel, provides range and bearing information, and the course deviation. TACAN bearing (azimuth) information is provided by the small needle head (bug), which moves around the perimeter of the compass card. The HSI needles are identified by the difference in shape: the TACAN needle is a solid triangular indicator; the UHF needle is a broken triangular indicator. When the command radio is in the ADF mode (COMM AUX selector in the ADF/G position), the UHF indicator reflects the magnetic bearing to the selected UHF transmitter. The TACAN indicator reflects the magnetic bearing to the selected TACAN station. The displacement of the UHF or TACAN needle indicates the heading of the aircraft with respect to the individual ground installation. The course bar on the HSI shows the direction of the ground site with respect to the aircraft.

TACAN CONTROL PANEL

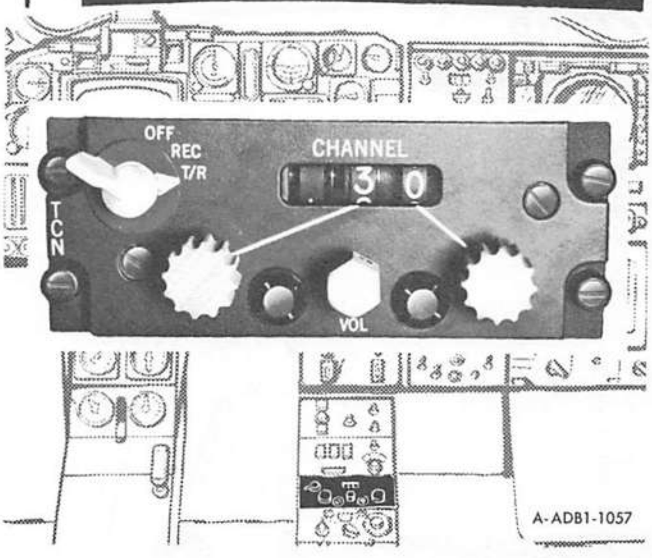


Figure 7-10

When the radio signal is not readable, a red OFF flag appears in the window on the face of the instrument and a mask covers the numerals. A range display in the upper left corner shows the number of nautical miles away from the station. An arrow will simultaneously indicate a TO or FROM direction, depending on whether the aircraft is flying toward or away from the ground station. The heading set knob manually adjusts the heading marker. With the course set (CRS SET) knob, the pilot can set in the desired course.

RADAR ALTIMETER SYSTEM (AN/APN -141(V))

The radar altimeter system is a pulsed, range-tracking radar that measures the surface or terrain clearance below the aircraft. The radar altimeter operates in the range of 10 to 5,000 feet and the altitude information is continuously presented to the pilot on the RADAR ALTITUDE indicator located on the left side of the pilot's instrument panel (figure 1-2). When the aircraft is above 5,000 feet the OFF flag appears and the pointer goes behind a mask to prevent the pilot from using the indication.

RADAR ALTITUDE INDICATOR

This indicator is located on the pilot's instrument panel (figure 1-2) and contains the only operating control in the system. A control knob located on the lower left-hand side of the indicator controls power to the system, low-altitude limit index pointer and self test provisions. Rotating the knob clockwise applies power placing the system in operation. By further rotating the control, the pilot can position a low-altitude limit index pointer, located on the outer edge of the dial, to any desired setting. While airborne, depressing the control knob actuates a self-test feature causing the altitude pointer to indicate 5±5 feet if the system is functioning properly. This self-test feature is only operative while the aircraft is flying at an altitude below 14,000 feet. When the aircraft is on the ground, the weight-on-wheels switch actuates the self-test function continuously; and depressing the control knob will have no effect on the equipment. Above 14,000 feet, the radar altimeter system is automatically disabled by a barometric pressure switch.

Radar Altitude Low Level Warning Light

A red press-to-test radar altitude low level warning light is provided on the pilot's instrument panel (figure 1-2) below the radar altimeter indicator. The altitude above the surface at which the light illuminates is controlled by the knob on the front of the radar altimeter indicator. The low level limit is set, prior to or during flight, using the control knob and index pointer. Whenever the aircraft descends to or below the selected altitude, the low level warning light will illuminate. The light extinguishes when the aircraft ascends to an altitude above the low level altitude selected.

COMPASS SYSTEM (MF-1)

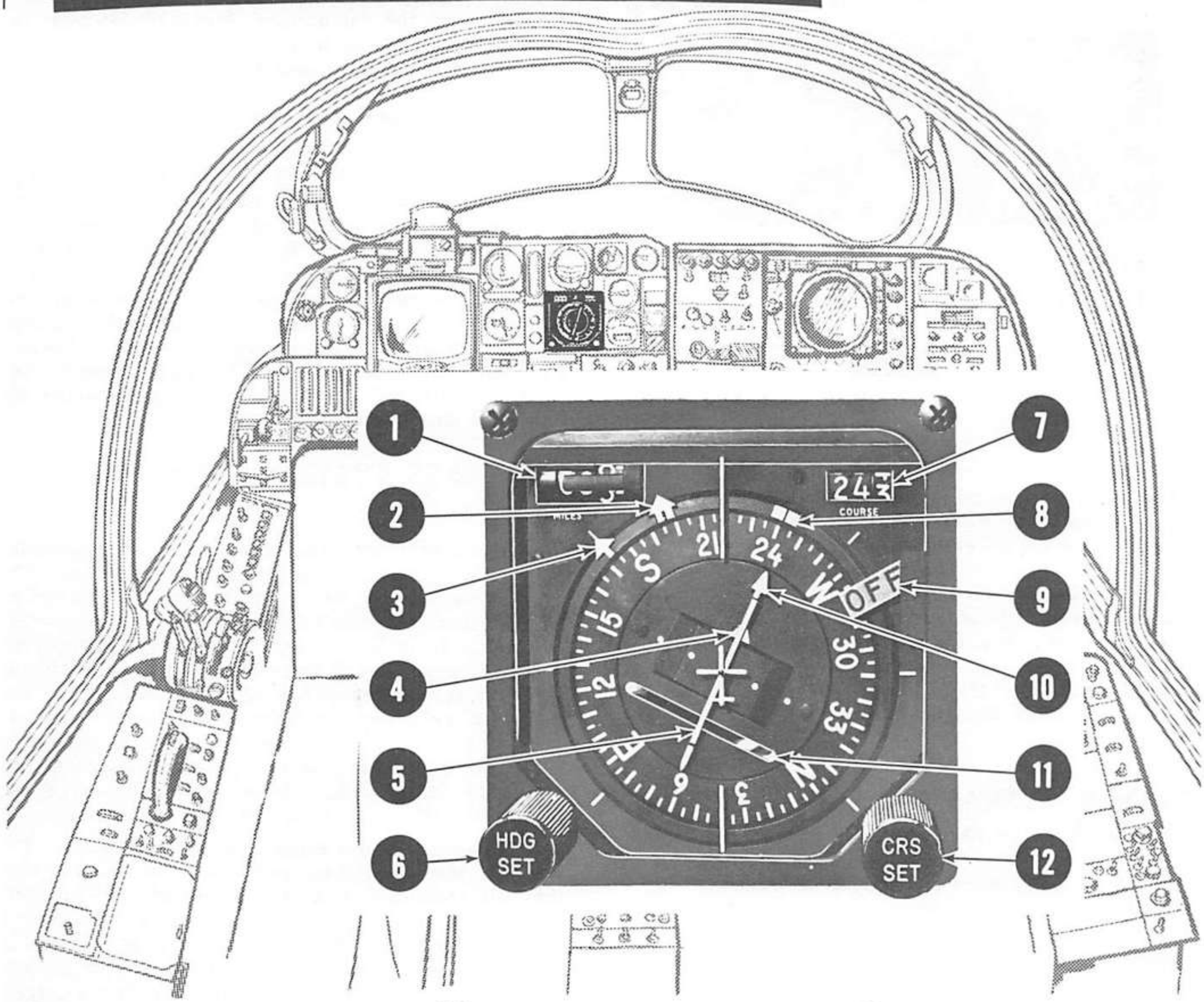
The MF-1 Roll Stabilized Compass System provides certain navigational capabilities for the aircraft. The system consists of both magnetic and inertial references that are essential for all latitude navigation. The inertial reference element is the roll stabilized directional gyro, which provides the proper static and dynamic accuracies in all regions of the earth. The magnetic reference element is the remote compass transmitter, which provides a long-term reference having good accuracy in regions where magnetic information is reliable. Both these references are combined in the roll stabilized compass system.

This system provides three modes of operation. The first is the directional gyro mode and utilizes only the roll stabilized directional gyro as a heading reference. This method of navigation is mandatory in the polar regions, where grid navigation is used. A means is provided for the introduction of latitude correction, necessary to compensate for apparent gyro drift due to the earth's rotation. Levelling of the roll stabilized directional gyro is maintained at all times to prevent the directional gyro from tumbling during turn maneuvers.

The second mode of operation is the magnetic mode (slaved directional gyro) and utilizes both the roll stabilized directional gyro and the remote compass transmitter. The roll stabilized directional gyro is the short-term reference, furnishing stable heading information with very little delay. The remote compass transmitter is the long-term or average reference that slowly corrects the directional gyro information. Such corrections occur when gyro heading is in error due to drift.

The third mode of operation is the emergency mode and utilizes only the remote compass transmitter. This mode is used when the roll stabilized directional gyro or the azimuth servo loop malfunctions.

HORIZONTAL SITUATION INDICATOR



1. DISTANCE COUNTER
2. BEARING POINTER (ADF)
3. BEARING POINTER (TACAN)
4. TO-FROM ARROW
5. COURSE BAR
6. HEADING SELECT KNOB
7. SELECTED COURSE COUNTER
8. HEADING SELECT MARKER
9. POWER OFF WARNING FLAG
10. SELECTED COURSE ARROW
11. COURSE BAR SLOT
12. COURSE SELECT KNOB

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Figure 7-11

COMPASS CONTROL PANEL

Latitude Correction Dial

The latitude correction dial is on the roll stabilized compass system panel (figure 7-12) on the center console and is placarded LAT. The dial is used to reduce gyro errors when the mode selector switch is in DG or MAG position. The dial, after being set to take-off latitude, may be up-dated in flight as necessary.

Mode Selector Switch

The mode selector switch, placarded EMER-DG-MAG, defines compass function. The normal position is MAG. Turning the switch from MAG to DG or EMER and back to MAG provides automatic synchronization of the compass to aircraft heading. The DG position is used when magnetic information is unreliable, and the EMER position is used only when DG position malfunctions.

Slew Control Switch

The slew control switch is placarded SET and is used to position the compass output to a desired heading. This switch is used only when the mode switch is in DG position and arbitrary heading selections are necessary (grid navigation). It may be used to manually align the system if autosynchronization fails, or to trim the system if turning maneuvers are made with the ROLL STAB switch to the OFF position.

COMPASS CONTROL PANEL

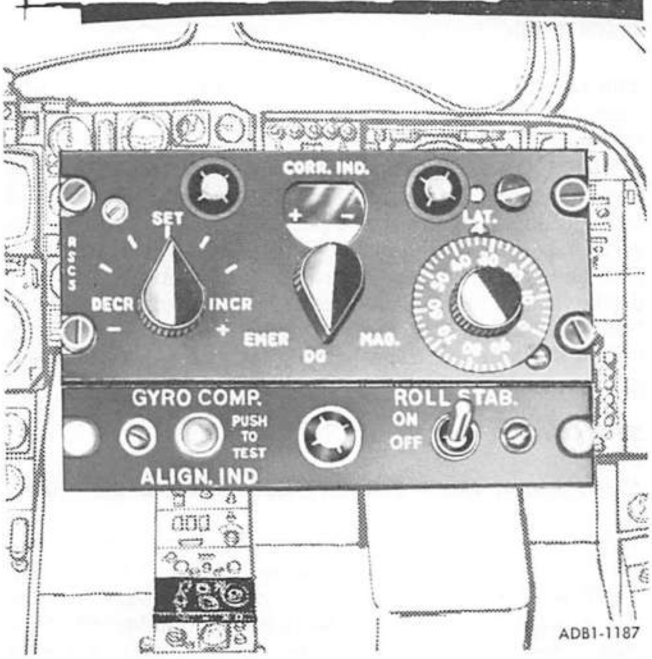

Figure 7-12

Correspondence Indicator

The correspondence indicator (CORR. IND.) shows the difference between the remote compass transmitter and the directional gyro when the mode selector switch is in the MAG position. The indicator should be centered if accurate headings are to be maintained. Small oscillations of the indicator are normal.

When the mode selector switch is in the DG position, the correspondence indicator is proportionately deflected by latitude; i.e., 0° latitude centers the needle; 90° latitude provides full deflection. The direction of deflection will be determined by the hemisphere selector; i.e., N (northern hemisphere) is + on the correspondence indicator.

The indicator remains in the center position when the mode selector switch is in the EMER position.

Hemisphere Selector

The hemisphere selector (adjustment screw on panel) determines direction of latitude dial corrections to the gyro. The indicator should read N for northern hemisphere and S for southern hemisphere operation.

ALIGNMENT/STABILIZATION PANEL

Roll Stabilization Switch

The ROLL STAB switch energizes the compass roll stabilization feature to eliminate compass error during banked turns. The normal position for the switch is ON.

Roll Stabilization Alignment Indicator

The roll stabilization alignment indicator determines if roll stabilization is operating properly. With the aircraft in level flight and the roll stabilizer in the ON position, the ALIGN IND should not light when depressed. When the aircraft is in a bank of more than 6° ±2° and the ALIGN IND indicator is depressed it should illuminate. The ALIGN IND indicator should not illuminate when the ROLL STAB switch is in the OFF position.

IDENTIFICATION RADAR (IFF-SIF)

The IFF and SIF portions of the IEC work together to form the radar identification system. The system provides automatic selective identification of the aircraft when properly challenged by surface or airborne radar sets. The system also provides momentary identification of position and transmits emergency upon Mode 1 interrogation. In operation, the radar identification system receives interrogation signals, and automatically transmits coded response signals to the source of the challenge, where this response is displayed together with associated radar information (such as aircraft, etc.,) on ground or airborne radar scopes. The proper reply identifies the target as being friendly.

The radar identification control panels (figure 7-13), marked IFF and SIF, are located on the center console. The control panels contain the system master switch, two mode switches, two code selector switches, and an identification-of-position (I/P) switch.

Note

The radar identification system can also be preset on the ground for Mark X (IFF) operation. In Mark X operation, the selective identification feature (SIF) is eliminated, rendering the code selector switches inoperative.

IFF CONTROL PANEL

System Master Switch

The system master switch has five positions; OFF, STDBY, LOW, NORM AND EMERGENCY. In the OFF position, the identification system is deenergized. In the STDBY position, power is supplied to the set, but the receiver portion is not sensitized and no replies can be transmitted. Selecting the LOW position causes the receiver to operate at reduced sensitivity (the transmitter is not affected), and replies will be transmitted upon receipt of strong interrogation signals. Positioning the switch to NORM selects maximum receiver sensitivity, and the transponder will operate at maximum performance. In the EMERGENCY position the receiver has maximum sensitivity and a distinctive code train is transmitted on Mode 1. When the system master switch is turned on, the equipment is automatically set for Mode 1 operation.

IFF-SIF PANELS

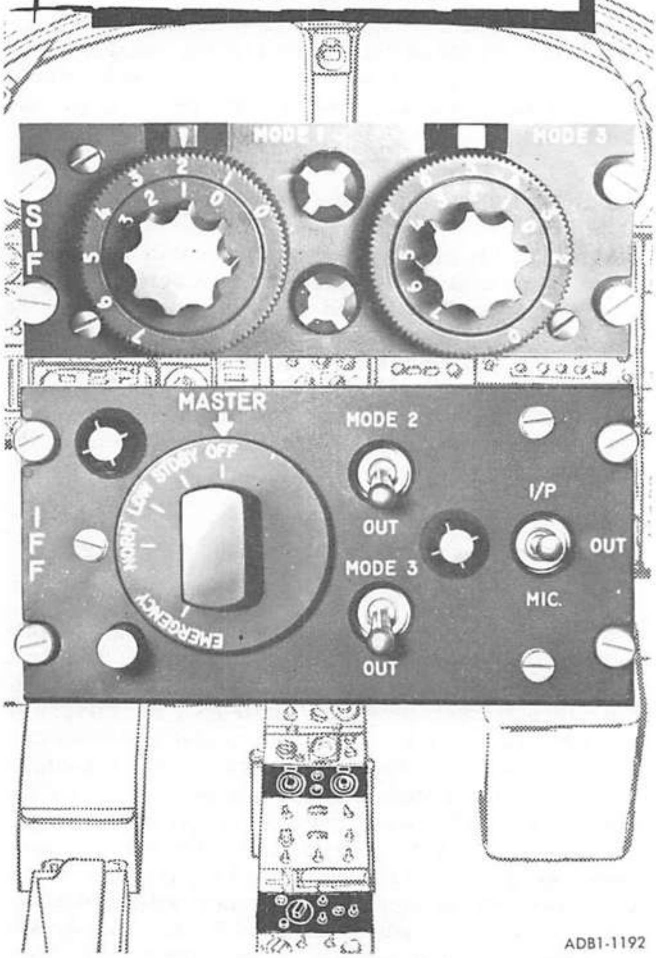

Figure 7-13

Note

GCI facilities are the normal users of Mode 1.

Mode 2/Out Switch

The two-position MODE 2/OUT switch is used to select MODE 2 interrogation-response. The OUT position of the switch corresponds to the off position of MODE 2.

Note

With the United States the MODE 2 position is used by the Air Defense Command.

Mode 3/Out Switch

The MODE 3/OUT switch selects MODE 3 interrogation-responses. The OUT position of the switch corresponds to the OFF position of MODE 3.

Note

The MODE 3 function is used by Air Traffic Control for terminal area and enroute control of aircraft.

IP/OUT/MIC/Switch

The IP/OUT/MIC switch is a three-position switch used to reply to MODE 1 interrogations. This switch is momentary in the I/P position and will respond to MODE 1 interrogations as long as the switch is held to the I/P position, plus an additional 30 seconds of transmission upon release of the switch. When this switch is positioned to MIC, MODE 1 interrogations are answered when the microphone button (UHF) is depressed, plus an additional 30 seconds upon release. Use of the I/P or MIC position essentially doubles whatever code train that has been selected, giving positive identification of position.

SIF CONTROL PANEL

Mode 1 and Mode 3 Rotary Code Selector Switches

The coder group (SIF) control panel consists of two sets of coaxial switches placarded MODE 1 and MODE 3. Translucent numbers placed on the skirts of the rotary switches mark the setting of the selected coded pulse train. The numbering of the code selector switches permit the selection of any of 32 code combinations for MODE 1 and 64 code combinations for MODE 3.

Mode 3 Emergency Code

The most important function of Mode 3 is that it is the civilian emergency mode. The most similar code in Mode 3 to the normal Mode 1 EMERGENCY code train is code 77. Whenever an emergency is declared, the pilot should select MODE 3, code 77 in addition to the normal EMERGENCY function to ensure the most widespread coverage, (including ATC, Approach Control, etc.).

SIF MODE 2 ROTARY SWITCH (AFT ELECTRONICS EQUIPMENT COMPARTMENT)

Code selections for Mode 2 are provided by four rotary switches located in the aft electronics equipment compartment. A total of 4,096 codes are available for use in Mode 2. However, these codes must be preset on the ground and the pilot has no control over them from the cockpit.

IFF/SIF OPERATION

1. Rotate the master switch to STDBY to maintain the equipment inoperative, but ready for instant use.

2. Rotate the master switch to NORM to place the equipment in operation.

Note

- The low position of the master switch should not be used unless directed.

- Mode 1 is in operation when the master switch is in NORM.

3. Set Mode 2 and Mode 3 switches OUT unless otherwise directed.

4. Set Mode 1 and Mode 3 code selector switches as directed.

5. For emergency operation, press the dial stop and rotate the master switch to EMERGENCY.

The system will then transmit a distinct coded distress signal upon any Mode 1 interrogation.

WARNING

The emergency position will transmit on MODE 1 only. Therefore, when selecting EMERGENCY, also use MODE 3 code 77 to attract the most widespread attention (ATC, Approach Control, etc.).

IN-FLIGHT VISUAL COMMUNICATIONS

Communications between aircraft are visual whenever practicable, if operations permit. Flight leaders shall ensure that all pilots in the formation receive and acknowledge signals when given. The visual communications section of NWP-41 must be reviewed and practiced by all pilots and ECM operators. For ease of reference, common visual signals applicable to flight operations in EA-6A aircraft are contained in figure 7-14.

GROUND HANDLING SIGNALS

Communications between the aircraft and ground crew personnel are visual whenever practicable, if operations permit. The visual signals illustrated in figure 7-15 should be reviewed and practiced by all pilots and ECM operators.

IN-FLIGHT VISUAL COMMUNICATIONS

GENERAL CONVERSATION

MEANING	SIGNAL	RESPONSE
Affirmative (I understand).	Thumb up, or nod of head.	
Negative (I do not know).	Thumb down, or turn of head from side to side.	
Question (repeat). Used in conjunction with another signal, this gesture indicates that the signal is interrogatory.	Hand cupped behind ear as if listening.	As appropriate.
Wait.	Hand held up with palm outward.	
Ignore last signal.	Hand waved in an erasing motion in front of face, with palm turned forward.	
Perfect, well done.	Hand held up, with thumb and forefinger forming an 0 and remaining three fingers extended.	
Numerals, as indicated.	With forearm in vertical position, employ fingers to indicate desired numerals 1 through 5. With forearm and fingers horizontal, indicate number which, added to 5, gives desired number from 6 through 9. A clenched fist indicates zero.	A nod of the head (I understand). To verify numerals, addressee repeats. If originator nods, interpretation is correct. If originator repeats numerals, addressee should continue to verify them until they are understood.
Take over communications.	Tap earphones, point to plane, and hold up one finger.	Execute.

CONFIGURATION CHANGES

MEANING	SIGNAL	RESPONSE
Lower landing gear.	Rotary movement of hand in cockpit, as if cranking wheels.	Execute.
Lower arresting gear hook.	Leader lowers hook.	Wingman lowers arresting gear hook. Leader indicates wingman's hook is down with thumb up signal.
Extend or retract flaps or speed brakes as appropriate.	Open and close four fingers and thumb.	

FUEL AND ARMAMENT

MEANING	SIGNAL	RESPONSE
How much fuel have you?	Raise fist with thumb extended in a drinking position.	Indicate fuel in tens of gallons or hundreds of pounds by finger numbers.
Arm or safety ordnance.	Pistol cocking motion with either hand.	Execute and return signal.
1—Arm or safety tanks as applicable; 2—how many tanks do I have? 3—I am unable to drop.	1 — Shaking fist; 2 — followed by question signal; 3 — followed by nose-held signal.	1—Execute and return signal; 2—indicate with appropriate finger numerals; 3—nod head (I understand).

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Figure 7-14 (Sheet 1)

FORMATION

MEANING	SIGNAL	RESPONSE
1—I have completed my take-off Check-off and am, in all respects ready for take-off; 2—I have completed my take-off check list and am, in all respects, ready for a section take-off; 3—take-off path is clear, I am commencing take-off.	1 — Section take-off leader raises arm (either) over head; 2—wingman raises arm over head; 3—leader lowers arm.	1—Stands by for reply from wingman, holding arm over head until answered; 2—wingman lowers arm and stands by for immediate section take-off; 3 — executes section take-off.
Leader shifting lead to wingman.	Leader pats self on head points to wingman.	Wingman pats head and assumes lead.
Leader shifting lead to division designated by numerals.	Leader pats self on head points to wingman and holds up two or more fingers.	Wingman relays signal; division leader designated assumes lead.
Take cruising formation.	Thumb waved backward over the shoulder.	Execute.
I am leaving formation.	Any pilot blow kiss.	Nod (I understand).
Aircraft pointed out leave formation.	Leader blows kiss and points to aircraft.	Execute.
Directs plan to investigate object or vessel.	Leader beckons wing plane, then points to eye, then to vessel or object.	Wingman indicated blows kiss and executes.
Refers to landing of aircraft, generally used in conjunction with another signal; 1—I am landing; 2 — directs indicated aircraft to land.	Landing motion with open hand; 1—followed by patting head; 2 — followed by pointing to another aircraft.	1—Execute; 2—execute.
a. Join up or break up, as appropriate. b. On GCA/CCA final: Leader has runway/ship in sight.	Flashing external lights.	a. Comply. b. Wingman repeats, indicating runway/ship in sight. Ship: Leader waves-off wingman lands. Field: When runway conditions preclude a safe section landing leader will wave-off.
Wingman takes the lead.	Leader shines flashlight on hardhat, then shines light on wingman.	Wingman shines flashlight at leader, then on his hardhat. Turns external light to DIM and STEADY and assumes lead.

FORMATION SIGNALS MADE BY AIRCRAFT MANEUVER

COMBAT OR FREE CRUISE

MEANING	SIGNAL	RESPONSE
Single aircraft cross under in direction of wing dip.	Single wing dip.	Execute.
Section cross under.	Double wing dip.	Execute.
Close up.	Series of small zooms.	Execute.
Join up; join up on me.	Series of pronounced zooms	Expedite join-up.

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(Figure 7-14 (Sheet 2)

DECK/GROUND HANDLING SIGNALS

1 FINGER ···· GTC START

2 FINGERS···· AIR PRESSURE AVAILABLE TO AIRCRAFT

3 FINGERS···· CUT GTC— DISCONNECT

RESPONSE···· 3 FINGERS CLEAR TO START EITHER ENGINE

START ENGINES

LEFT INDEX FINGER TO THE NOSE, RIGHT HAND PALM OUT IN A "STOP" MOTION.

ENTERING "Y"
(STOP NOSE GEAR STEERING)

TOW BAR IS LOWERED.

TOW BAR LOWERED

LEFT ARM PULLED UP/DOWN ALONG LEFT SIDE.

RAM AIR TURBINE

CARRIER FLIGHT DECK PERSONNEL COLOR CODING

RED SHIRTS .... ORDNANCE, FUEL HANDLING AND CRASH CREW

YELLOW SHIRTS .... PRI FLY, PLANE DIRECTORS, CATAPULT OFFICER AND ARRESTMENT OFFICER

BLUE SHIRTS .... PLANE HANDLERS (PUSHERS CHOCK MEN, ETC.)

GREEN SHIRTS .... AIRCRAFT MAINTENANCE, CATAPULT CREW, ARRESTMENT CREW

BROWN SHIRTS .... PLANE CAPTAINS

WHITE SHIRTS .... MEDICAL

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Figure 7-15

section VIII

THE WEAPONS SYSTEM

ADB1-1230

SEE SUPPLEMENTAL NATOPS FLIGHT MANUAL NAVWEPS 01-85ADB-1A

section IX

FLIGHT CREW COORDINATION

TABLE OF CONTENTS

CREW DUTIES

PILOT'S DUTIES

The pilot's duties - flying the aircraft and operating applicable auxiliary equipments - are discussed in Sections III, IV, V, VI, and VII of this publication.

ECM OPERATOR'S DUTIES

The primary duty of the ECM operator is to operate the electronic warfare and weapons delivery systems and the air-to-air refueling controls (when operating as tanker) so that, together, the pilot and ECM operator can conduct the assigned mission under all weather conditions. The ECM operator should assist the pilot so lengthy procedures may be quickly and accurately completed, resulting in a well-conducted mission.

For specific ECM operator's duties, refer to Section VIII, SUPPLEMENTAL NATOPS Flight Manual, NAVWEPS 01-85ADB-1A.

section X
NATOPS EVALUATION

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NATOPS EVALUATION

CONCEPT

The operating procedures prescribed in this manual represent the optimum method of operating the EA-6A aircraft. The standardization check is intended to evaluate individual and unit compliance with these procedures. The check will be accomplished by observing and grading individual/unit adherence to standard operating procedures on a continuing basis. The standardization evaluation check is tailored to satisfy the requirements of the various employment categories of an EA-6A squadrons and is intended to provide the flexibility necessary for implementation under most operating conditions. The check, whether performed by the standardization instructor or the standardization evaluator, is designed to aid the unit commanding officer in improving individual/unit combat readiness through observation and constructive comments. The standardization evaluation program is applicable to all pilots and ECM operators maintaining a current flight status in the EA-6A series aircraft.

APPLICABILITY

Areas to be observed/graded that are applicable to the individual pilot and ECM operator, as well as areas of dual responsibility, are indicated throughout the ground and flight evaluation phases of this section. Critical area / sub-areas are specially noted where applicable.

IMPLEMENTATION

Standardization evaluation checks will be administered to all pilots and ECM operators as specified by current directives, and in accordance with this section. Standardization checks and annual instrument checks will not be combined.

RESPONSIBILITIES

Specific responsibilities of standardization instructors and standardization evaluators in the implementation of the standardization evaluation program are outlined in the following paragraphs.

STANDARDIZATION INSTRUCTOR

1. Implement and coordinate an aggressive and continuing standardization education and evaluation program pertaining to all aspects of standard operating procedures.

2. Enhance the educational benefits of the standardization program by flying with all squadron crewmembers as often as possible.

3. Administer the standardization evaluation check to each squadron crewmember at least once each year.

STANDARDIZATION EVALUATOR

1. Advise and assist squadron standardization instructors in all phases of the program.

2. Administer standardization evaluation checks and standardization evaluation inspections as directed by the applicable Type Commander.

DEFINITION OF TERMS

Terms commonly used throughout this section are defined as to their specific meaning with regard to the standardization evaluation program.

Grading Criteria

The parts of this section that prescribe the standards to be used in determining grades as a result of the performance observed or recorded during standardization evaluation checks.

Qualified

The desired professional standard demonstrated by a pilot or ECM operator which indicates optimum knowledge of, and compliance with, the standard operating procedures set forth in the NATOPS Flight Manual, NWP/NWIP's, and other applicable publications.

Conditionally Qualified

That standard demonstrated by a pilot or ECM operator indicating satisfactory knowledge of, and compliance with, standard operating procedures set forth in the NATOPS Flight Manual, NWP/NWIP's and other applicable publications. Conditionally Qualified shows satisfactory adherence with few minor deviations, indicating a need for further standardization.

Unqualified

That standard demonstrated by a pilot or ECM operator showing either unsatisfactory knowledge of or non-adherence to, standard operating procedures as set forth in the NATOPS Flight Manual, NWP/NWIP's, and other applicable publications.

Standardization Evaluation Recheck

A standardization check administered to a pilot or ECM operator who has been placed in an "unqualified" status. Only those areas in which an unsatisfactory level of knowledge or degree of non-adherence to prescribed procedures was exhibited will be observed during this check.

Emergency

An aircraft component or system failure, or condition that requires instantaneous recognition, analysis, and proper action.

Malfunction

An aircraft component or system failure, or condition that requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

Area

A routine of flight preparation, flight, and post-flight procedures which is observed and graded during a standardization evaluation flight.

Critical Area

Any major area or sub-area which covers items of significant importance to the overall mission requirement, or the marginal performance of which would jeopardize safe conduct of the flight. These areas will be specially noted throughout this section.

The standardization evaluation section of this manual will be further developed as the standardization evaluation procedures, applicable to the EA-6A aircraft, are implemented.

Question Banks

A categorized list of questions and answers prepared and kept current by the model manager for use by Standardization Evaluators/Instructors in conducting standardization training. Written examinations portions of Standardization Evaluation Checks will be taken exclusively from Question Banks.

GROUND EVALUATION

The ground phase will consist of an oral examination of aircraft systems and pre-flight inspection capability, written examination (open and closed book), and an OFT/WST procedures check. Applicable portions of the OFT/WST procedures check for the ECM operator are noted with an asterisk. This portion may be conducted orally either in the cockpit of the aircraft or on the deck.

ORAL EVALUATION

An oral examination of the pilot's pre-flight inspection capability will be conducted in addition to the normal pre-flight inspection prior to the STAN/EVAL flight. The oral examination may be conducted during pre-flight, or it may be administered separately, and pre-flight made unobserved in order to facilitate making launch time. This examination is designed to evaluate the examinee's overall knowledge of the aircraft's systems and components, and his ability to recognize malfunctions or improper preparations for flight.

Pre-flight will be conducted in accordance with NAVWEPS 01-85ADB-1B (NATOPS PILOT'S POCKET CHECK LIST).

WRITTEN EXAMINATION

Due to the close coordination required between pilot and ECM operator in the EA-6A aircraft, both crewmembers should have complete knowledge of all aircraft systems and procedures. For this reason, question banks are not categorized as to crewmember. Individual instructors may emphasize particular categories on pilot and ECMO examinations, however, all categories must be covered on both.

Pilot and ECM operator open and closed book examinations do not encompass the ECM systems. Testing on the ECM systems components will be accomplished as training is received.

OPEN BOOK EXAMINATION

The open book examination will be composed of not less than 25 questions selected by the examiner from this category of the pilot's Question Bank. Questions in this category are based on tables, graphs, charts, figures, and other information not conducive to memorization.

CLOSED BOOK EXAMINATION

The closed book examination will consist of not less than the number of questions indicated below for each category. The questions will be selected by the examiner from the Closed Book portion of the Question Bank.

1. NATOPS Flight Manual/Supplement 20
2. Emergency Procedures and Malfunctions . 20

OFT/WST PROCEDURES CHECK

The OFT/WST (if available) will be utilized to evaluate the pilot's knowledge and performance of normal procedures, and reaction to simulated emergencies and malfunctions. In areas where WST is not available, this portion may be conducted orally either in the cockpit of the aircraft, or on deck. The following list of procedures and conditions are those which will be simulated and/or discussed in the course of the check.

Interior Inspection (Pocket Checklist) Engine Starting Procedures

1. Wet Start
2. Hot Start
3. Fire During Start
4. Normal Start
5. Abnormal Oil Pressure (High & Low)

Pre-Taxi Procedures

Pre-Takeoff Procedures

Takeoff

1. Fire Warning Light
2. Loss of Engine
3. CSD/S Light
4. High/Low Oil Pressure

After Takeoff

1. Slats/Flaps fail to retract
2. Barberpole gear indication after retraction
3. Loss of engine after gear and flap retraction (above 170 KIAS)

During Flight

1. Oil pressure failure (High/Low/Fluctuating)
2. CSD/S Light
3. Generator Failure
4. Flight Hydraulic Failure
5. Combined Hydraulic Failure
6. Speedbrake will not retract
7. Oxygen Light
8. Air Start
9. Fire Warning Light
   a. No other indications of fire
   b. Other indications, Light stays on
10. Maximum Endurance/Maximum Range

*11. Ejection

*12. Manual Bailout

13. Electrical Fire
14. Engine Instrument Failure (EGT, RPM, FF)
15. Engine Icing

16. Loss of Pitot/Static Instruments
17. Surging Engine
18. Smoke/Fumes in Cockpit
19. Air Conditioning Full Hot
*20. Ditching

Landing

1. Unsafe main or nose gear indication
2. One main gear confirmed up
3. Runaway nose-down trim
4. Hydraulic Failure (combined and/or flight)

FLIGHT EVALUATION

The Flight Evaluation is designed to measure the degree of standardization demonstrated by the pilot or ECM operator being evaluated. It is not intended to measure technique beyond a point necessary to ensure safe completion of the mission. Within reasonable limits, any individual evaluated should be able to attain a grade of Qualified, based on demonstrated knowledge without regard to special proficiency or technique.

All phases of the Ground Evaluation must be completed prior to commencement of the Flight Evaluation.

The Flight Evaluation may be completed on any flight which will permit the examinee to demonstrate standard procedures in the preparation for and execution of a representative type of mission for the model aircraft concerned. With the concurrence of the Evaluator/Instructor, the unit concerned may select the mission which is best suited to aircraft configuration, training phase, target facilities, etc. Only those areas which are required by the particular mission and which can be actually observed by the Evaluator/Instructor will be graded.

Due to the difficulty of grading in the EA-6A aircraft, the ECM Operator Flight Evaluation may be flown in the WST, when available.

SAFETY CONSIDERATIONS DURING STANDARDIZATION /EVALUATION FLIGHTS

Due to the broad significance of safety, it is impractical to list all contingencies which may fall under the general category of grading criteria in safety. Generally, mission success is subject to compromise when there are any safety infractions, omissions, or deviations beginning with mission planning and ending with the post flight debriefing. The following provide additional guidance in these areas:

1. Violations of pertinent directives or procedures which have a direct bearing on the safe completion of the mission or negligence in following any procedure or directive which jeopardizes the safety of the pilot or aircraft, will constitute an overall grade of Unqualified. The degree of jeopardy involved, in the absence of specific directive, must be determined by the Instructor/Evaluator, based on good judgment and experience.

2. The latitude given the examiner in grading safety items must be exercised with care. The examiner must observe a discrepancy which directly contributes to an unsafe condition to justify an overall grade of Unqualified for safety reasons.

3. When an inflight safety discrepancy is imminent, and the pilot appears unaware of the condition, or has not taken the appropriate action, the examiner will correct the situation by directing that action be taken. Safety of flight cannot and must not be compromised due to the reluctance on the part of the examiner to correct any discrepancy.

4. If a grade of Unqualified is given for safety reasons, the examiner will include a written statement, describing the deficiency, and append same to the NATOPS STAN/EVAL form. The statement should be clearly titled "Safety Discrepancy".

USE OF JUDGEMENT ON STANDARDIZATION/ EVALUATION FLIGHTS

The grading criteria establishes standards for grading pilot performance, but does not relieve the Evaluator/Instructor from using good judgment based on experience. In those items where a pilot fails to meet the minimums set forth in the grading criteria but the examiner, through past experience and judgment, knows the discrepancy to have been caused by other factors, such as weather, turbulence, or partial malfunction of aircraft or weapons system, he may assign a grade of Qualified. A note to this effect will be included on the grading form.

Except for an obviously unsafe act, which will automatically and immediately terminate the flight, the examiner should not attempt to determine during the flight whether the examinee is passing or failing, but should compute final outcome, based on grading criteria, only on completion of the flight.

Minor Discrepancies 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 or the 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 individual being checked is alert in applying corrective action and the deviation does not jeopardize the safety of the pilot or the aircraft. Cumulative momentary deviations will result in downgrading, however.

GRADING AREAS/SUBAREAS

Areas in which adherence to standardized operating procedures can be observed are listed below, and entered on the pilot or ECM operator grading sheets. These areas are broken up into Subareas, as listed below, for guidance in grading.

PILOT GRADING AREAS/SUBAREAS

Flight Planning

Flight Planning
Briefing
Personal Flying Equipment

Preflight Inspection

Aircraft Acceptance

Taxi

Pre-Taxi Procedures
Taxi
Arming
Pre-Takeoff
Clearances/Communications

Takeoff

Visual Controls Check
Takeoff Check List
Lineup (and Interval, if applicable)
Liftoff
Post-takeoff

Departure Procedures (as applicable)

IFR
VFR

Rendezvous (if applicable)

Enroute Procedures

IFR Navigation
VFR Navigation

Target Procedures

Air Refueling (where practicable)

Rendezvous
Communications
Refueling Procedures

Instrument Approach (Actual or Simulated)

Holding
Penetration
GCA
Missed Approach/Waveoff

VFR Landing

Pattern Entry
Approach
Landing

Emergency Procedures

Normally, the OFT/WST check will be utilized for assigning a grade in emergency procedures. If, however, some occurrence during the flight requires the actual use of emergency procedures, this area will receive a grade, based on examinees performance.

Post-Flight Procedures

De-arming (where required)
Taxi
Debriefing/Yellow Sheet

Aircraft Control

In accordance with guidelines stated in Flight Evaluation, page 10-6.

Communications

Radio
Visual
IFF/SIF

ECM OPERATOR GRADING AREAS/SUBAREAS

Flight Planning

Route Planning
Navigation System Planning
Target Brief

Pre-Flight Procedures

Aircraft Acceptance
Weapons System Turn-on and Checks

Enroute Procedures

Weapons System Operation
Navigation Procedures

Degraded System Operation

Inflight Refueling Operation

Emergency Procedures

Post Flight Procedures

Debriefing Procedures

GRADING INSTRUCTIONS

The results of each phase of the evaluation will be entered in the proper section of the grading sheet upon completion of that particular phase. The criteria for determining adjectival grades in each area are outlined below.

ORAL EXAMINATION

1. QUALIFIED - Demonstrates adequate knowledge of aircraft systems operation to carry out basic missions successfully. Exterior and interior inspections carried out in accordance with current NATOPS procedures, with only minor errors or omissions which would not affect mission accomplishment or safety.

2. UNQUALIFIED - Shows obvious lack of understanding of aircraft systems operation. Reveals weakness that could result in unsuccessful or unsafe operation of the aircraft. Omits items during preflight inspection which could jeopardize the success or safety of the mission.

WRITTEN EXAMINATION

Open Book Examination

QUALIFIED - Minimum grade of 3.5 is required.

Closed Book Examination

QUALIFIED - Minimum grade of 3.6 on Emergency Procedures portion; minimum grade of 3.3 on all other sections.

OFT/WST GRADING CRITERIA (PILOT ONLY)

Normal Procedures

1. QUALIFIED - Demonstrated adequate knowledge of procedures with minor deviations and/or omissions.
2. UNQUALIFIED - Exhibits obvious lack of knowledge of procedures which result in serious or numerous oversights affecting safety or mission completion.

Emergency Procedures

1. QUALIFIED - Recognizes emergencies promptly, analyzes them properly, and takes the proper corrective action. Slow reaction in situations which cannot be realistically simulated will justify failure of this section.

2. UNQUALIFIED - Demonstrates improper, or unsafe cockpit procedures. Fails to recognize emergencies, overlooks probable or possible causes, or takes improper corrective action. Slow to act in obvious situation which require immediate action until the condition is no longer remediable.

FLIGHT EVALUATION GRADING CRITERIA

The Flight Evaluation Section of the STAN/EVAL Worksheets should be used for collection of information during the flight. Adjectival grades for all the subareas and areas evaluated during the flight check should then be determined and entered in the STAN/EVAL Worksheets. To determine area grade for areas containing two or more subareas, numerical weight factors will be assigned to the adjectival grades, as follows:

Qualified 2

Conditionally Qualified 1

Unqualified. 0

When all subareas/areas have been assigned a numerical weight factor, the following formula will be used to determine area and/or the overall Flight Evaluation grade.

Sum of Subarea (or Area) numerical values
Number of Subareas (or Areas) evaluated

equals Area (or final) grade.

To convert final numerical grade to adjectival the following guide lines will apply:

2.0 - 1.5 -- Qualified
1.49 - 1.1 -- Conditionally Qualified
1.09 - 0 -- Unqualified

The criteria for determining subarea adjectival ratings are outlined below:

PILOT GRADING CRITERIA

FLIGHT PLANNING

Qualified	Flight was planned in accordance with local, FLIP, OPNAV, and other governing instructions for the type of mission. Special factors which affect the mission (fuel management, weather, winds, etc.) should have been obtained and recorded, if applicable.
Conditionally Qualified	Same as Qualified, except with minor omissions or errors, none of which adversely affects successful completion of the mission or jeopardizes safety.
Unqualified	Flight planning was incomplete and resulted in discrepancies which whould prevent successful completion of the mission or jeopardize safety.

BRIEFING

Qualified	Adequately covered all applicable items and presented briefing in an acceptable manner.
Conditionally Qualified	Used prescribed briefing guide but omitted one or more applicable items, none of which would affect successful mission completion or jeopardize safety.

Unqualified	Did not use briefing guide. Briefing was inadequate to safely or successfully complete mission.

PERSONAL FLYING EQUIPMENT

Qualified	Has all required items of personal equipment necessary for the mission and area over which the flight is to be conducted.
Unqualified	Does not possess all required items of personal flying equipment.

PREFLIGHT INSPECTION

AIRCRAFT ACCEPTANCE

Qualified	Checks the ten previous yellow sheets (if available) for previous discrepancies and corrective action.

ARMING (IF APPLICABLE)

Qualified	Observed local arming procedures and safety precautions.
Unqualified	Obvious lack of knowledge or noncompliance with local arming procedures or safety precautions.

PRE-TAKEOFF

Qualified	Executes engine runup and completes necessary checks as indicated by proper takeoff configuration.
Unqualified	Engine runup not performed. Obvious failure to use check list indicated by improper takeoff configuration.

CLEARANCE/COMMUNICATIONS

Qualified	Taxi, takeoff, ATC clearances (if applicable) requested in timely manner with a minimum of transmissions required to understand clearance. Complies with instructions given. Read back of ATC clearance (if required) is generally correct.
Conditionally Qualified	Delay incurred due to failure to make timely request for taxi, takeoff or ATC clearance. Transmissions are repeatedly incomplete requiring additional questions and calls. Repeated transmissions required to understand simple clearance.
Unqualified	Any unsafe act due to non-compliance with taxi or takeoff clearance. Cannot communicate information or understand clearances without superfluous time and words.

TAKEOFF

VISUAL SAFETY CHECK

Qualified	Visually checks adjacent aircraft for proper configuration leaks, etc., prior to takeoff.
Unqualified	Does not make required safety check.

LINEUP AND TAKEOFF INTERVAL

Qualified	Lineup and takeoff interval are appropriate for existing conditions.
Conditionally Qualified	Minor deviation from specified procedures for lineup or takeoff interval but not to the extent of being unsafe.
Unqualified	Lineup and/or takeoff interval is unsafe.

DIRECTIONAL CONTROL

Qualified	Good directional control is evident during takeoff roll.
Conditionally Qualified	Improper use of brakes or poor directional control.
Unqualified	Directional control is unsafe.

LIFTOFF

Qualified	Transition to takeoff attitude and liftoff executed smoothly and without severe rotation.
Conditionally Qualified	Over controls or rough attitude control during or after liftoff.
Unqualified	Rotation to takeoff attitude or attitude control after takeoff is so erratic as to be unsafe.

AFTER TAKEOFF

Qualified	Retraction of wheels and flaps is safely accomplished.
Conditionally Qualified	Erratic aircraft control during retraction of wheels and flaps.
Unqualified	Unsafe aircraft control during retraction of wheels and flaps.

DEPARTURE PROCEDURES

IFR DEPARTURE

Qualified	Departure executed in accordance with clearance.
Conditionally Qualified	Same as qualified except for minor deviations not constituting a violation of the clearance.
Unqualified	Major deviation constituting a violation of the clearance. Airspeed or attitude unsafe.

VFR DEPARTURE

Qualified	Departure executed in accordance with local traffic rules and clearance.
Conditionally Qualified	Same as qualified except for minor deviation.
Unqualified	Violates local traffic rules to the extent of being unsafe.

RENDEZVOUS

RENDEZVOUS PROCEDURES

Qualified	Executes rendezvous safely and in accordance with procedures as briefed or currently prescribed.
Conditionally Qualified	Same as Qualified but with minor errors in technique.
Unqualified	Rendezvous executed in a manner that indicates lack of knowledge and technique required. Resulting delay adversely effects or precludes accomplishment of the briefed mission. Rendezvous is unsafe.

ENROUTE PROCEDURES

IFR PROCEDURES

Qualified	Complies with clearance and instructions given by controlling agency.
Conditionally Qualified	Same as Qualified except for minor deviations not constituting a violation of the clearance.
Unqualified	Major deviation constituting a violation of the clearance.

VFR PROCEDURES

Qualified	Maintains cruising Mach, altitude, and/or heading as briefed or as dictated by governing regulations and existing conditions.
Conditionally Qualified	Generally maintains a cruising Mach, altitude and/or heading less-than-optimum for existing conditions but which would not prevent successful completion of the mission.
Unqualified	Does not meet the criteria for Conditionally Qualified. Demonstrates an obvious lack of knowledge of basic requirements or regulations which adversely affects mission completion or safety.

TARGET PROCEDURES

Qualified	Conforms to prebriefed procedures for mission operation and target area.
Conditionally Qualified	Same as Qualified except for minor deviations or omissions.
Unqualified	Nonconformance with prebriefed procedures for mission operation and target area. Any unsafe act.

RENDEZVOUS PROCEDURES

Qualified	Executes rendezvous safely and in accordance with procedures as briefed or currently prescribed.
Conditionally Qualified	Same as Qualified, but with minor errors in technique.
Unqualified	Rendezvous executed in a manner that indicates lack of knowledge and technique required. Rendezvous is unsafe.

AIR REFUELING

RENDEZVOUS

Qualified	Minimum radio communications. Good join-up procedures.
Conditionally Qualified	Excessive radio communications. Poor join-up with tanker.
Unqualified	Failed to rendezvous with tanker. Formation dangerous. Any unsafe act.

REFUELING PROCEDURES

Qualified	Followed prescribed procedures for hookup and breakway.
Conditionally Qualified	Same as Qualified with minor deviations or omissions.
Unqualified	Endangered self or other aircraft. Doesn't know or follow prescribed procedures.

INSTRUMENT APPROACH

HOLDING

Qualified	Entered holding pattern in accordance with current directives. Remained within pattern limits.
Conditionally Qualified	Same as Qualified except with minor deviations. Aircraft control erratic.
Unqualified	Unorthodox pattern entry. Cannot remain in prescribed pattern. Unsafe altitude or airspeed.

PENETRATION

Qualified	Complies with prescribed procedures and instructions received. Tracking procedure is good. Levels off smoothly at the prescribed altitude.
Conditionally Qualified	Same as Qualified except for minor deviations from procedures and/or instructions received not affecting flight safety.
Unqualified	Does not meet the criteria for Conditionally Qualified.

GCA

Qualified	Follows all instructions without delay or deviation. Transitions to landing configuration observing airspeed limits for gear and flap extension. Responds promptly and smoothly to corrections by final controller resulting in only minor deviation from glide slope and heading.
Conditionally Qualified	Same as Qualified but with deviations which do not affect safety of flight and does not result in a wave-off.
Unqualified	Exceeds the criteria for Conditionally Qualified or is waved-off.

MISSED APPROACH

Qualified	Follows missed approach procedure as published or instructed. Does not descend below minimum altitude. Maintains good control from transition to climb and throughout aircraft configuration change with only minor deviations.
Conditionally Qualified	Same as Qualified except occasionally overcontrols during transition and/or other deviations not jeopardizing safety of flight.
Unqualified	Does not meet the criteria for Conditionally Qualified.

VFR LANDING PATTERN

PATTERN ENTRY

Qualified	Pattern entry and break executed as prescribed by local traffic rules and/or instructions received from controlling agency. Local HUNG Ordnance procedures complied with (if applicable).
Conditionally Qualified	Same as Qualified with minor deviations not jeopardizing safety.
Unqualified	Does not meet the criteria for Conditionally Qualified. Poorly planned or improperly executed entry to the traffic pattern. Obvious lack of knowledge of or compliance, with local HUNG Ordnances procedures (if applicable).

APPROACH

Qualified	Conforms to prescribed procedures for pattern and transitioning to landing configuration.
Conditionally Qualified	Same as Qualified with minor deviations from pattern altitude or airspeed, but not to the extent of being unsafe. Forgets speedbrakes.
Unqualified	Does not meet criteria for Conditionally Qualified. Exceeds gear and flaps extension airspeed limitations or fails to lower landing gear prior to the 180° position.

LANDING

Qualified	Adequate straight away on final to determine degree of crosswind effect. Touchdown is effected a safe distance down the runway without a noticeable flare. Mirror is used where available. Flaps are retracted promptly after touchdown. Good directional control during roll-out.
Conditionally Qualified	Same as Qualified except minor deviations not considered unsafe. Did not use mirror (if available). Flared on landing. Did not retract flaps promptly after touchdown.
Unqualified	Does not meet the criteria for Conditionally Qualified.

EMERGENCY PROCEDURES

Qualified	Properly analyzes the emergency situation (if any actually occur) and takes appropriate action without deviation, error, or omission.

Conditionally Qualified	Same as Qualified except all required action accomplished safely but not in the correct sequence.
Unqualified	Failed to recognize obvious emergency or deviated from specified procedures to the extent of endangering safety of flight.

POST FLIGHT PROCEDURES

TAXI

Qualified	Taxi is completed safely and at proper interval for existing conditions. Complies with prebriefed or specified procedures.
Unqualified	Does not meet the criteria for Qualified. Any unsafe act.

YELLOW SHEETS

Qualified	OPNAV 3760.2 (YELLOW SHEET) completed without errors or omissions.
Conditionally Qualified	Same as Qualified except minor omissions that have no safety significance.
Unqualified	Failed to record safety of flight discrepancy.

DEBRIEFING

Qualified	Examinee thoroughly debriefs the mission. Complete error analysis with definite corrective action prescribed if indicated.
Conditionally Qualified	Minor omissions. Inadequate error analysis.
Unqualified	Inadequate debriefing with major items omitted. No error analysis. Corrective action omitted.

AIRCRAFT CONTROL (APPLIES TO ENTIRE FLIGHT)

Qualified	Good leader. Smooth on controls. Considerate of wingman. Wingman would have no problem maintaining position.
Conditionally Qualified	Rough on controls. Has little consideration for wingman. Not unsafe.
Unqualified	Very rough on controls. Would be unsafe as formation leader in IFR conditions. No consideration for wingman. Any unsafe maneuvers.

COMMUNICATIONS

R/T PROCEDURES

Qualified	Complies with procedures prescribed by Military and FAA Regulations. Transmissions are made correctly on the proper frequency without interruption of other transmissions. Monitored frequencies and/or facilities at appropriate time. Transmissions are received, understood, properly acknowledged and complied with. Familiar with communications equipment and facilities. Utilizes backup facilities without hesitation.
Conditionally Qualified	Same as Qualified, except for minor deviations or delays which indicate lack of thorough familiarity with procedures, equipment or facilities, but which do not preclude successful completion of mission or jeopardize safety.
Unqualified	Fails to transmit or receive mandatory reports through omission or lack of familiarity with equipment or procedures. Any violation of Military or FAA Regulations. Any violation of safety.

VISUAL SIGNALS (WHERE APPLICABLE)

Qualified	Uses standard visual signals correctly and without confusion. No delay due to questionable signals.
Conditionally Qualified	Same as Qualified, except for minor deviation or delay.
Unqualified	Uses non-standard signals resulting in misinterpretation and confusion. Excessive delays or mission success jeopardized due to use of questionable signals.

IFF/SIF PROCEDURES

Qualified	Complies with current directives and instructions from ATC during flight.
Unqualified	Fails to use equipment properly, resulting in confusion and undue delay. Obvious lack of knowledge of IFF/SIF procedures.

ECM OPERATOR GRADING CRITERIA

FLIGHT PLANNING

Qualified	Route laid out on current WAC/ ONC and/or Sectional Aeronautical charts. Navigation system inputs properly figured and recorded.
Conditionally Qualified	Same as Qualified, with minor omissions or errors, none of which precludes successful completion of the missions.
Unqualified	Flight planning incomplete, omissions or discrepancies which would result in serious derogation of mission objectives.

PRE-FLIGHT PROCEDURES

Qualified	Preflight inspection of weapons system components, switches, circuit breakers etc., in accordance with ECM operator's pocket checklist. Proper weapons system turn-on and check procedures completed.
Conditionally Qualified	Followed prescribed procedures, but omitted one or more checks which would not, in themselves, preclude successful weapons system operation.
Unqualified	Improper procedure for checking weapons system, or omission of some major item(s) which could seriously degrade or preclude mission success.

ENOUTE PROCEDURES

WEAPONS SYSTEM OPERATION

Qualified	Demonstrates knowledge and ability to apply correct operating procedures for weapons system controls and indicators.
Conditionally Qualified	Same as Qualified, but with minor discrepancies and/or omissions which deviate from the most expeditious performance of the mission, but still allow its completion.
Unqualified	Failure to utilize, or improper utilization of, some necessary portion of the weapons system, resulting in non-completion of the mission, or seriously degrading mission objectives.

NAVIGATION PROCEDURES

Qualified	Backs up all navigation system work with time/distance/heading computations with continuous monitoring for use in the event of system malfunction.
Conditionally Qualified	Same as Qualified but with momentary deviations or partial omissions which do not hinder successful completion of the mission.
Unqualified	No navigation back-up, precluding successful completion of mission.

DEGRADED SYSTEM OPERATION

Qualified	Demonstrated ability to analyze equipment malfunctions and attempted successful mission completion with partial equipment operation.
Unqualified	Inability to analyze and operate weapons system under conditions described above.

INFLIGHT REFUELING OPERATION

Qualified	Demonstrated a complete knowledge of safe operating procedures during inflight refueling.
Conditionally Qualified	Demonstrated safe operation of the inflight refueling system, with minor errors, none of which constitute a flight hazard.
Unqualified	Obvious errors during inflight refueling which could, if not corrected, hazard safety of operation.

FINAL GRADE DETERMINATION

The final grade assigned for the STAN/EVAL Check will be the grade assigned for the Flight Phase, except that if the minimum standard for any part of the ground phase is not attained, a final grade of Unqualified will be assigned for the entire STAN/EVAL Check, and so entered in that block of the STAN/EVAL report.

WORKSHEETS

The Written/Oral Examination Worksheet, the OFT/WST Procedures Worksheet, and the Flight Evaluation Worksheet will be used as applicable in administering all phases of the STAN/EVAL checks, determination of grades, preparation of the STAN/EVAL report and critique. Specific results of individual parts of the check which are indicative of deficiencies in the level of required pilot/crewmember knowledge or degree of adherence to standard procedures should also be recorded.

REPORT FORM

The STAN/EVAL Report Form (page 10-13) will be used to report the complete results of the STAN/EVAL check. Upon completion of the check and critique, the applicable sections of the report will be prepared by the Evaluator/Instructor for each pilot of ECM operator checked. All areas/subareas graded as Unqualified must be amplified in the Remarks column. The original of the completed report will be delivered to the examinee's Commanding Officer for review and comment.

RECORDS

The Standardization Evaluation Report will be retained by the squadron for a period of one year after completion, or until a subsequent check has been completed. Upon successful completion of a Standardization Evaluation Check, an entry to that effect will be made on the "Qualifications and Achievement" page of the individual's Aviator's Flight Log book by the Evaluator/Instructor conducting the check.

CRITIQUE

The critique is the terminal point in the STAN/EVAL Check, and will be given by the Evaluator/Instructor administering the check. The critique involves processing data collected and oral presentation of the Standardization/Evaluation Report. Deviations from standard procedures will be covered in detail using all collected data and worksheets as a guide. Upon completion of the critique, the pilot or ECM operator will receive the completed Standardization/Evaluation Report for certification and signature. The completed Standardization/Evaluation Report will then be presented to the unit Commanding Officer.

FORMS

Sample Standardization Evaluation Check forms are depicted on pages 10-13, 10-14 and 10-15. Page 10-13 is common to both crewmembers.

These forms may be reproduced locally, pending availability in the Navy supply system.

NATOPS EVALUATION REPORT
OPNAV FORM 3510-8 (9-65) 0107-723-0000

NAME (Last, first initial)		GRADE	SERVICE NUMBER
SQUADRON/UNIT	AIRCRAFT MODEL		CREW POSITION
TOTAL PILOT/FLIGHT HOURS	TOTAL HOURS IN MODEL		DATE OF LAST EVALUATION

NATOPS EVALUATION

REQUIREMENT	DATE COMPLETED	GRADE Q	CQ	U
OPEN BOOK EXAMINATION				
CLOSED BOOK EXAMINATION				
ORAL EXAMINATION				
*EVALUATION FLIGHT		OVERALL FINAL GRADE		
FLIGHT DURATION	AIRCRAFT BUNO			

REMARKS OR EVALUATOR/INSTRUCTOR

☐ CHECK IF CONTINUED ON REVERSE SIDE

GRADE, NAME OF EVALUATOR/INSTRUCTOR	SIGNATURE	DATE
GRADE, NAME OF EVALUEE	SIGNATURE	DATE

REMARKS OF UNIT COMMANDER

RANK, NAME OF UNIT COMMANDER	SIGNATURE	DATE

*WST, OFT, COT, or cockpit check in accordance with OPNAVINST 3510.9 (effective edition).

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EA-6A PILOT FLIGHT EVALUATION GRADING FORM

AREA	SUBAREA GRADES						AREA GRADE
	(1)	(2)	(3)	(4)	(5)	(6)	
a. Flight Planning							
b. Pre-Flight Insp.							
c. Taxi							
d. Take-Off							
(1) VFR							
(2) IFR							
e. Dept. Procedures							
f. Rendezvous							
g. Enroute Proced.							
(1) Radar Interpretation							
(2) Radar Terrain Avoidance							
(3) Airways Flt.							
h. Target Procedures							
i. Air Refueling							
j. Inst. Approach							
k. VFR Landing							
l. Emerg. Procedures							
m. Headwork							
n. Post Flight Proced.							
o. Aircraft Control							
p. Communications							

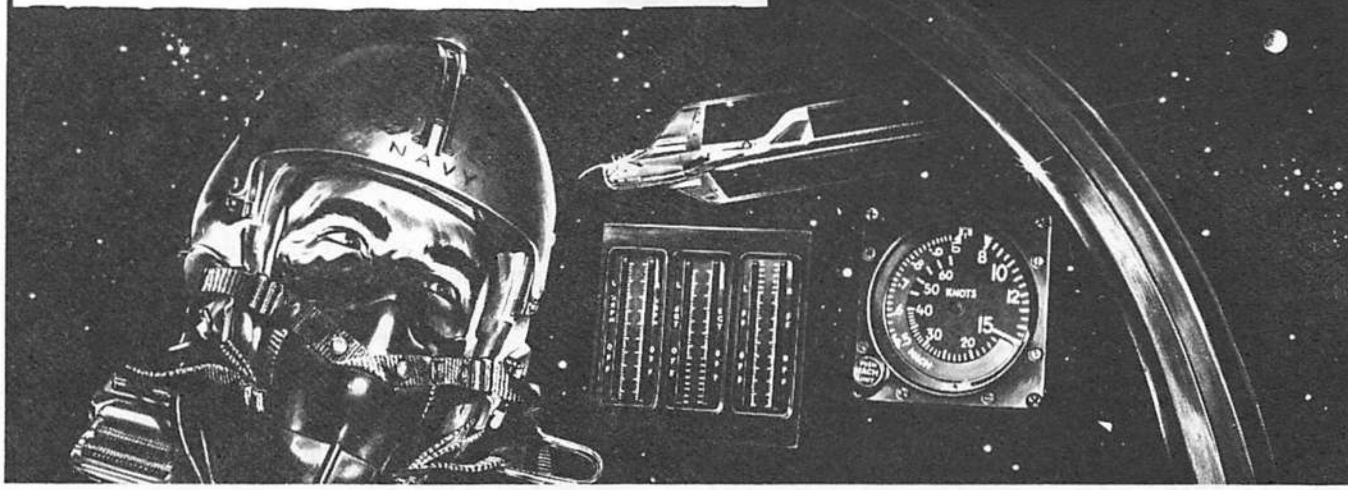
Area Total ____________
No. Areas Graded ____________
Numerical Average ____________
Flight Phase Adjective Grade ____________

EA-6A ECM OPERATOR FLIGHT EVALUATION GRADING FORM

AREA	SUBAREA GRADES						AREA GRADE
	(1)	(2)	(3)	(4)	(5)	(6)	
a. Flt. Planning							
b. Pre-Flt. Procedures							
c. Enroute Procedures							
(1) Equipment Operation							
(2) Target-Identification							
(3) Navigation							
d. Degraded System Operation							
e. Inflight Refueling							
f. Emerg. Procedures							
g. Headwork							
h. Post Flt. Procedures							
i. Comm.							
j. Debrief Procedures							

Area Total ____________
No. Areas Graded ____________
Numerical Average ____________
Flight Phase Adjective Grade ____________

section XI
PERFORMANCE DATA



* SEE SUPPLEMENTAL NATOPS FLIGHT MANUAL NAVWEPS 01-85AD B-1A

ADB1-1145

part 1
INTRODUCTION

TABLE OF CONTENTS

CHARTS

Sections I and XI of this manual contain the unclassified charts formerly located in the Supplemental NATOPS Flight Manual, NAVWEPS 01-85ADB-1A. They are:

Section I, Part 4

Part 2 . . . . Aircraft Operating Limitations

Section XI

Part 1 . . . . Introduction
Part 3 . . . . Take-Off
Part 8 . . . . Descent
Part 9 . . . . Landing

The CLASSIFIED charts will be found in the Supplemental NATOPS Flight Manual, NAVWEPS 01-85ADB-1A. They are:

Section XI

Part 4 . . . . Climb
Part 5 . . . . Range
Part 6 . . . . Endurance
Part 10 . . . . Combat Performance
Part 11 . . . . Mission Planning

Performance data are presented in graphical and profile charts. Maximum range and endurance operations are presented in profile charts. Takeoff, climb, nautical miles per pound of fuel, descents, landing, and maximum power operation data are presented in graphical charts. Profile charts integrate much of the information provided in the graphical chart for ease in flight planning computations. These charts are based on the recommended climb-cruise performance shown for the specific aircraft configuration. The basic aircraft configuration, referred to in this section as "CLEAN", is with four wing pylons, a centerline store station, and an AN/ALQ-53 ECM pod and pylon installed under each wing outboard of the wing fold. The CLEAN configuration is designed to perform the basic mission of the aircraft. To accomplish the secondary mission of the aircraft the AN/ALQ-53 pods and pylons are removed and this configuration of the EA-6A is designated "ATTACK".

CAUTION

When using the performance charts in this section, it must be remembered that the normally accepted definition of CLEAN (no external stores on the wings) does not apply. In the configuration description section of the charts the terms "CLEAN" and "ATTACK" are used and where the computations are based on the carrying of stores the quantity and type of store is included in the heading.

Direct interpretation of fuel and time required for any given distance, while flying the recommended schedules, is available using the profile presentation. The graphical charts should be used when other than the recommended schedules are maintained. The fuel used and subsequent decrease in gross weight is computed in the presentation. Graphical charts should be utilized where more accurate interpretations for flight planning is required. The complete operating speed range for the aircraft is given on these charts. All charts are based on ICAO standard day conditions except those used for takeoff and landing where temperature corrections for nonstandard atmosphere have been included. Performance charts are based on data obtained using J52-P-6A engines, and JP-5 fuel.

Note

The indication of the fuel quantity indicator presents the readings of actual fuel weight remaining. This is accomplished by means of compensator readings regardless of changes in the specific density due to temperature changes. Therefore, adjustment for various fuel densities is not necessary.

AIRSPEED CONVERSION

The Airspeed Conversion Chart (figures 11-1 and 11-2) provides a means of converting calibrated airspeed to true mach number and true airspeed.

INDICATED AIRSPEED

Indicated airspeed (IAS) is the uncorrected airspeed read directly from the cockpit indicator when the ADC is inoperative.

CALIBRATED AIRSPEED

Calibrated airspeed (CAS) is indicated airspeed corrected for static source error.

EQUIVALENT AIRSPEED

Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility effect.

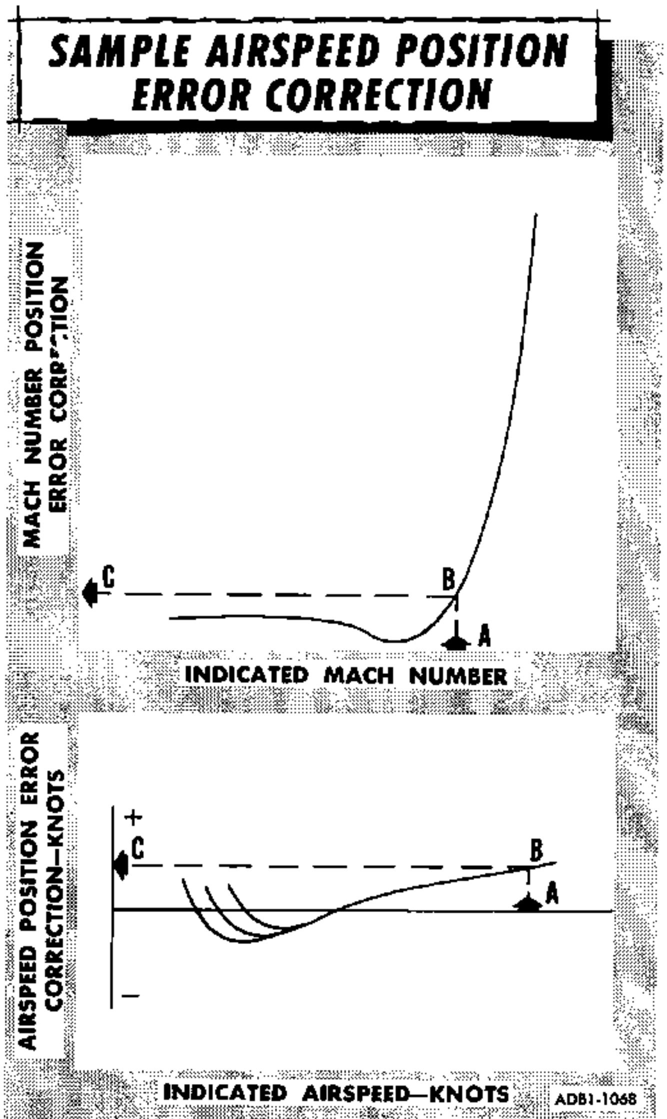
TRUE AIRSPEED

True airspeed (TAS) is equivalent airspeed corrected for atmospheric density. Refer to Airspeed Conversion, figure 11-1 and 11-2.

AIRSPEED POSITION ERROR CORRECTION

These charts (figures 11-4 and 11-5) provide a direct-reading conversion from indicated airspeed to airspeed position error (correction to be added to obtain calibrated airspeed) and from indicated mach number to mach number position error correction.

SAMPLE PROBLEM



AIRCRAFT CONFIGURATION: ALL CONFIGURATIONS, ALL GROSS WEIGHTS

A.	Indicated mach number	0.80
B.	Reflector line	
C.	Mach number correction (To be added to correct instrument reading.)	-0.01

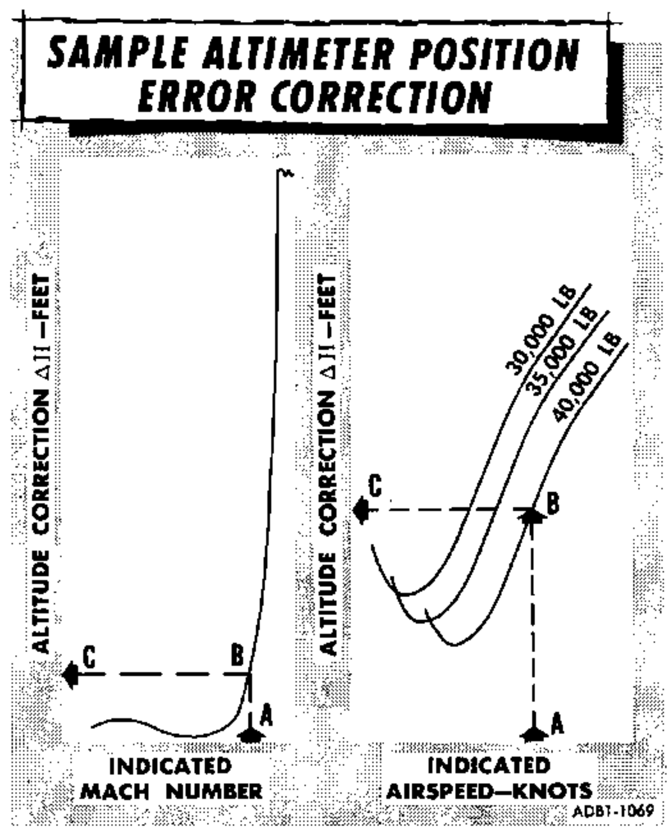
AIRCRAFT CONFIGURATION: CLEAN

A.	Indicated airspeed	200 Kts.
B.	Gross weight	40,000 Lbs.
C.	Airspeed correction (To be added to correct instrument reading.)	-2 Knots

ALTIMETER POSITION ERROR CORRECTION

These charts (figures 11-6 thru 11-8) provide ΔH corrections for various indicated airspeed (or indicated mach number) gross weight combinations.

SAMPLE PROBLEM



AIRCRAFT CONFIGURATION: ALL CONFIGURATIONS, ALL GROSS WEIGHTS

A.	Indicated mach number	0.55
B.	Reflector line	

C. Altitude Correction (To be added to correct instrument reading.) +40 Ft.

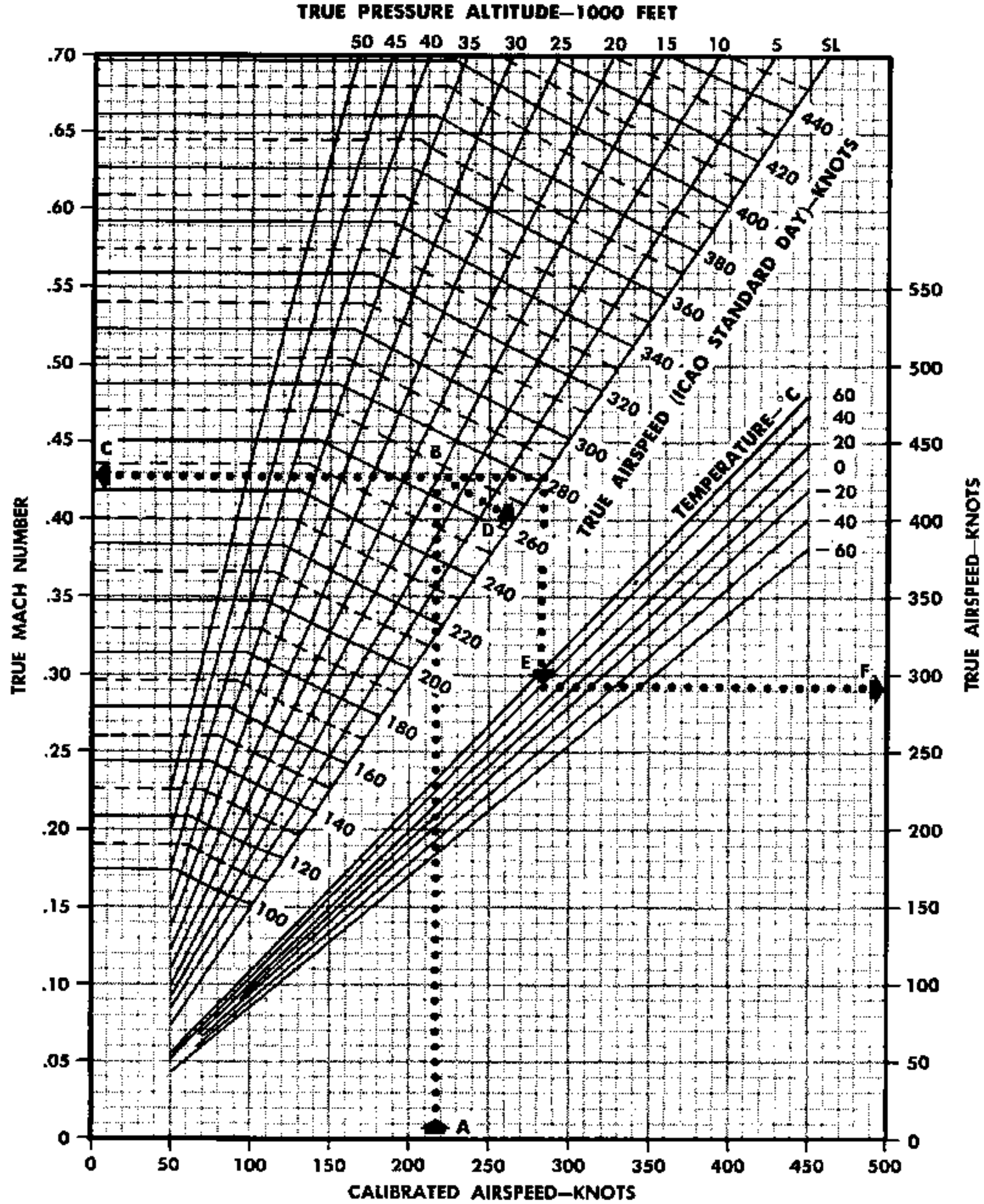
AIRCRAFT CONFIGURATION: GEAR AND FLAPS DOWN

A. Indicated airspeed 180 Kts.

B. Gross Weight 40,000 Lbs.

C. Altitude correction (To be added to correct instrument reading.) 20 Ft.

AIRSPEED CONVERSION



SAMPLE PROBLEM

A. CALIBRATED AIRSPEED . . . . = 215 KNOTS
B. PRESSURE ALTITUDE . . . . = 15,000 FEET
C. TRUE MACH NUMBER . . . . = .428
D. TRUE AIRSPEED (ICAO STANDARD DAY) . . = 268 KNOTS
E. AMBIENT TEMPERATURE . . . . = 30°C
F. TRUE AIRSPEED . . . . = 290 KNOTS

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Figure 11-1

AIRSPEED CONVERSION

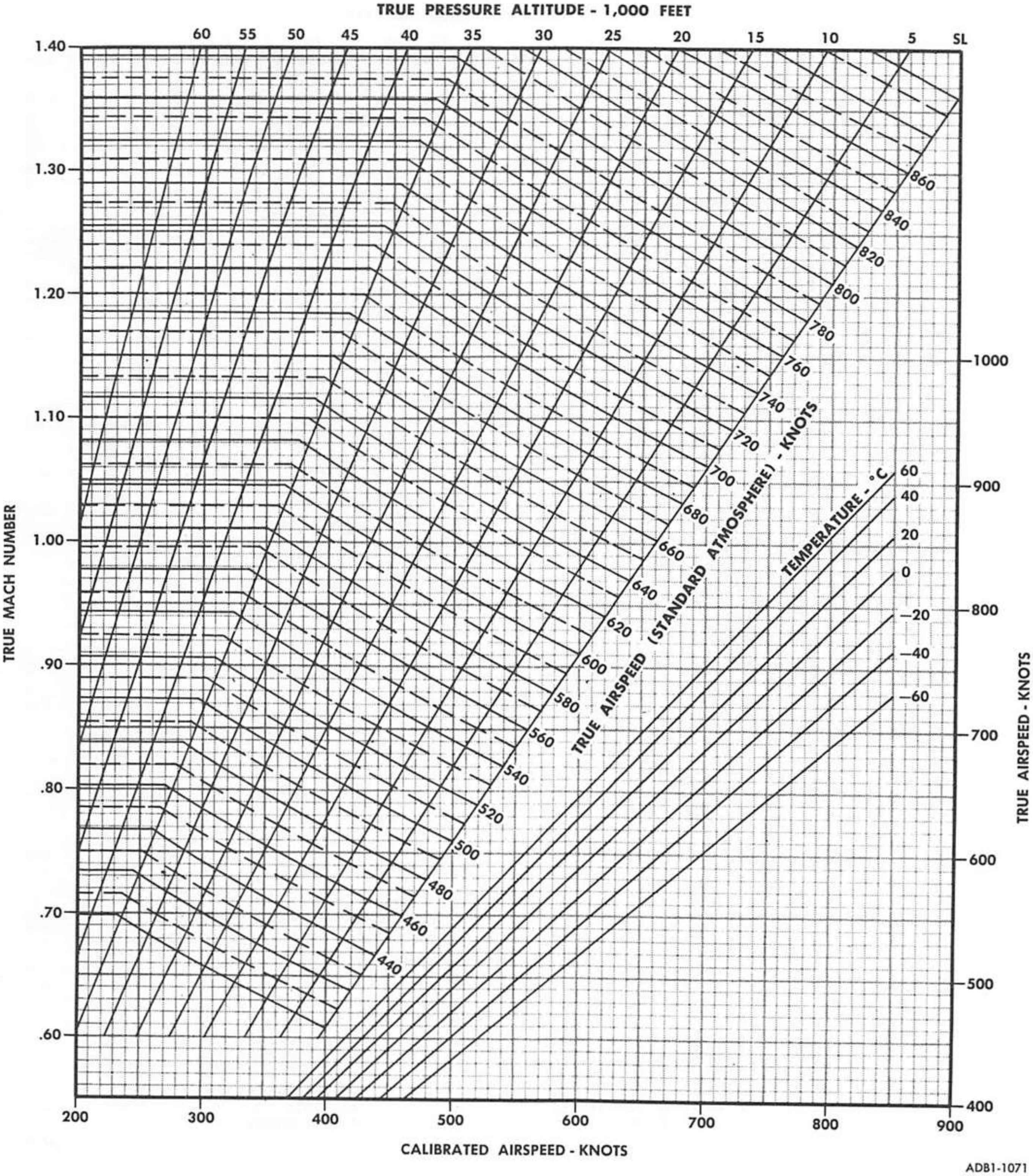


Figure 11-2

STANDARD ALTITUDE TABLE

STANDARD SEA LEVEL AIR:
T=15° C.
P=29.921 IN. OF Hg.

W=.07648 LB/CU. FT. ρ_o=.0023769 SLUGS/CU. FT.
1" OF Hg.=70.727 LB/SQ. FT.=0.4912 LB/SQ. IN.
A_o=1117 FT./SEC. (661.7 KNOTS) (A_o)
σ=DENSITY RATIO

THIS TABLE IS BASED ON ICAO STANDARD ATMOSPHERE FROM NACA TN NO. 3182

ALTITUDE FEET	DENSITY RATIO ρ/ρ_o	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE DEG. C	TEMPERATURE DEG. F	SPEED OF SOUND RATIO A/A_o	SPEED OF SOUND KNOTS	PRESSURE IN. OF Hg	PRESSURE RATIO P/P_o
0	1.0000	1.000	15.0	59.0	1.000	661.7	29.92	1.0000
1000	.9711	1.015	13.0	55.4	.997	659.5	28.86	.9644
2000	.9428	1.030	11.0	51.9	.993	657.2	27.82	.9298
3000	.9151	1.045	9.0	48.3	.990	654.9	26.82	.8962
4000	.8881	1.061	7.1	44.7	.986	652.6	25.84	.8637
5000	.8617	1.077	5.1	41.2	.983	650.3	24.90	.8320
6000	.8359	1.094	3.1	37.6	.979	647.9	23.98	.8014
7000	.8107	1.111	1.1	34.0	.976	645.6	23.09	.7716
8000	.7860	1.128	-0.8	30.5	.972	643.3	22.23	.7428
9000	.7620	1.146	-2.8	26.9	.969	640.9	21.39	.7148
10000	.7385	1.164	-4.8	23.3	.965	638.6	20.58	.6877
11000	.7156	1.182	-6.8	19.8	.961	636.2	19.79	.6614
12000	.6932	1.201	-8.8	16.2	.958	633.9	19.03	.6360
13000	.6713	1.221	-10.8	12.6	.954	631.5	18.29	.6113
14000	.6500	1.240	-12.7	9.1	.951	629.1	17.58	.5875
15000	.6292	1.261	-14.7	5.5	.947	626.7	16.89	.5643
16000	.6090	1.282	-16.7	2.0	.943	624.3	16.22	.5420
17000	.5892	1.303	-18.7	-1.6	.940	621.9	15.57	.5203
18000	.5699	1.325	-20.7	-5.2	.936	619.4	14.94	.4994
19000	.5511	1.347	-22.6	-8.8	.933	617.0	14.34	.4791
20000	.5328	1.370	-24.6	-12.3	.929	614.6	13.75	.4595
21000	.5150	1.394	-26.6	-15.9	.925	612.1	13.18	.4406
22000	.4976	1.418	-28.6	-19.5	.921	609.6	12.64	.4223
23000	.4807	1.442	-30.6	-23.0	.918	607.2	12.11	.4046
24000	.4642	1.468	-32.5	-26.6	.914	604.7	11.60	.3876
25000	.4481	1.494	-34.5	-30.1	.910	602.2	11.11	.3711
26000	.4325	1.521	-36.5	-33.7	.906	599.7	10.63	.3552
27000	.4173	1.548	-38.5	-37.3	.903	597.2	10.17	.3398
28000	.4025	1.576	-40.5	-40.9	.899	594.6	9.725	.3250
29000	.3881	1.605	-42.5	-44.4	.895	592.1	9.297	.3107
30000	.3741	1.635	-44.4	-48.0	.891	589.6	8.885	.2970
31000	.3605	1.665	-46.4	-51.6	.887	587.0	8.488	.2837
32000	.3473	1.697	-48.4	-55.1	.883	584.4	8.106	.2709
33000	.3345	1.729	-50.4	-58.7	.879	581.9	7.737	.2586
34000	.3220	1.762	-52.4	-62.2	.876	579.3	7.382	.2467
35000	.3099	1.796	-54.3	-65.8	.872	576.7	7.041	.2353
36000	.2981	1.832	-56.2	-69.4	.868	574.0	6.712	.2243
37000	.2844	1.875	-56.5	-69.7	.867	573.8	6.397	.2138
38000	.2710	1.921	-56.5	-69.7	.867	573.8	6.097	.2038
39000	.2583	1.968	-56.5	-69.7	.867	573.8	5.811	.1942
40000	.2462	2.016	-56.5	-69.7	.867	573.8	5.538	.1851
41000	.2346	2.065	-56.5	-69.7	.867	573.8	5.278	.1764
42000	.2236	2.115	-56.5	-69.7	.867	573.8	5.030	.1681
43000	.2131	2.166	-56.5	-69.7	.867	573.8	4.794	.1602
44000	.2031	2.219	-56.5	-69.7	.867	573.8	4.569	.1527
45000	.1936	2.273	-56.5	-69.7	.867	573.8	4.355	.1455
46000	.1845	2.328	-56.5	-69.7	.867	573.8	4.151	.1387
47000	.1758	2.385	-56.5	-69.7	.867	573.8	3.956	.1322
48000	.1676	2.443	-56.5	-69.7	.867	573.8	3.770	.1260
49000	.1597	2.502	-56.5	-69.7	.867	573.8	3.593	.1201
50000	.1522	2.563	-56.5	-69.7	.867	573.8	3.425	.1145
51000	.1451	2.625	-56.5	-69.7	.867	573.8	3.264	.1091
52000	.1383	2.689	-56.5	-69.7	.867	573.8	3.111	.1040
53000	.1318	2.755	-56.5	-69.7	.867	573.8	2.965	.0991
54000	.1256	2.822	-56.5	-69.7	.867	573.8	2.826	.0944
55000	.1197	2.890	-56.5	-69.7	.867	573.8	2.693	.0900

AD61-1072

Figure 11-3

AIRSPEED POSITION ERROR CORRECTION

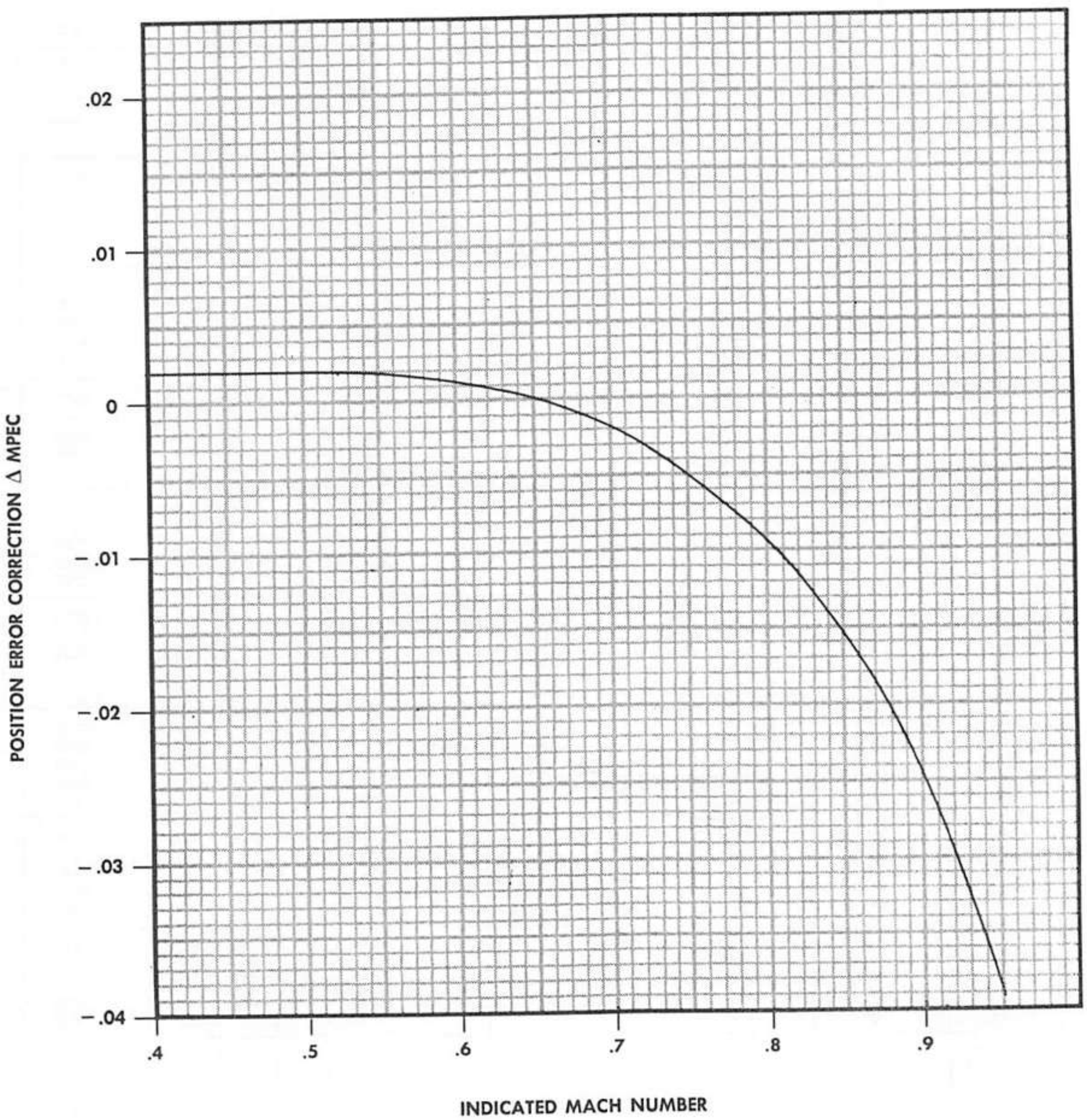
GUIDE

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
ALL GROSS WEIGHTS

DATE: 1 FEBRUARY 1966
DATA BASIS: PRELIMINARY FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT INSTRUMENT READING

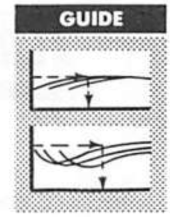
FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1—1327

Figure 11-4

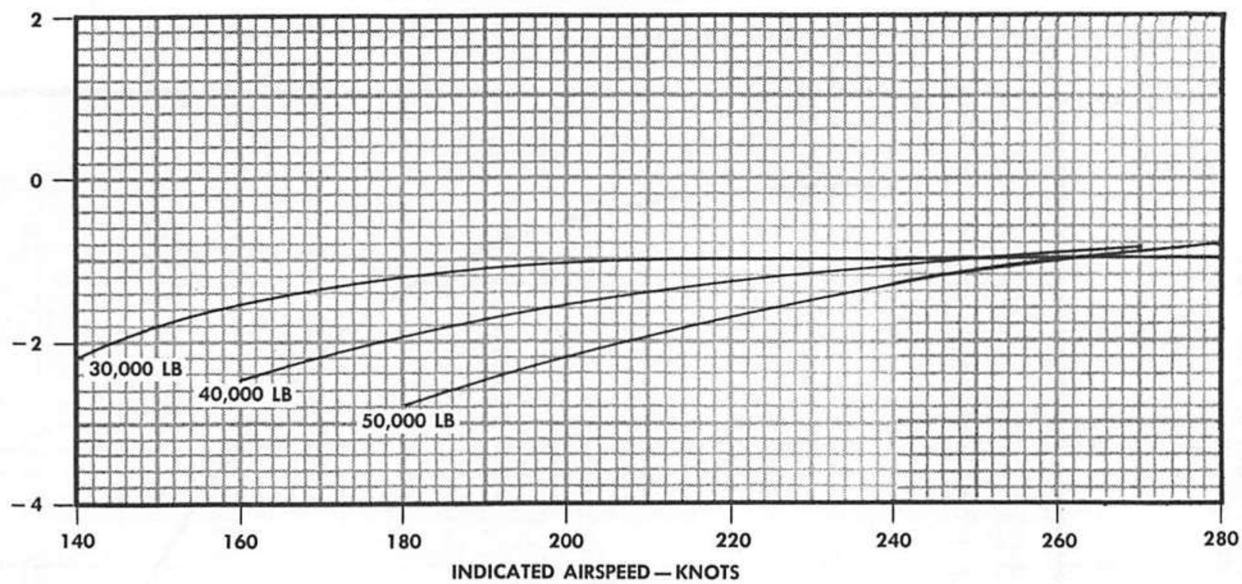
AIRSPEED POSITION ERROR CORRECTION

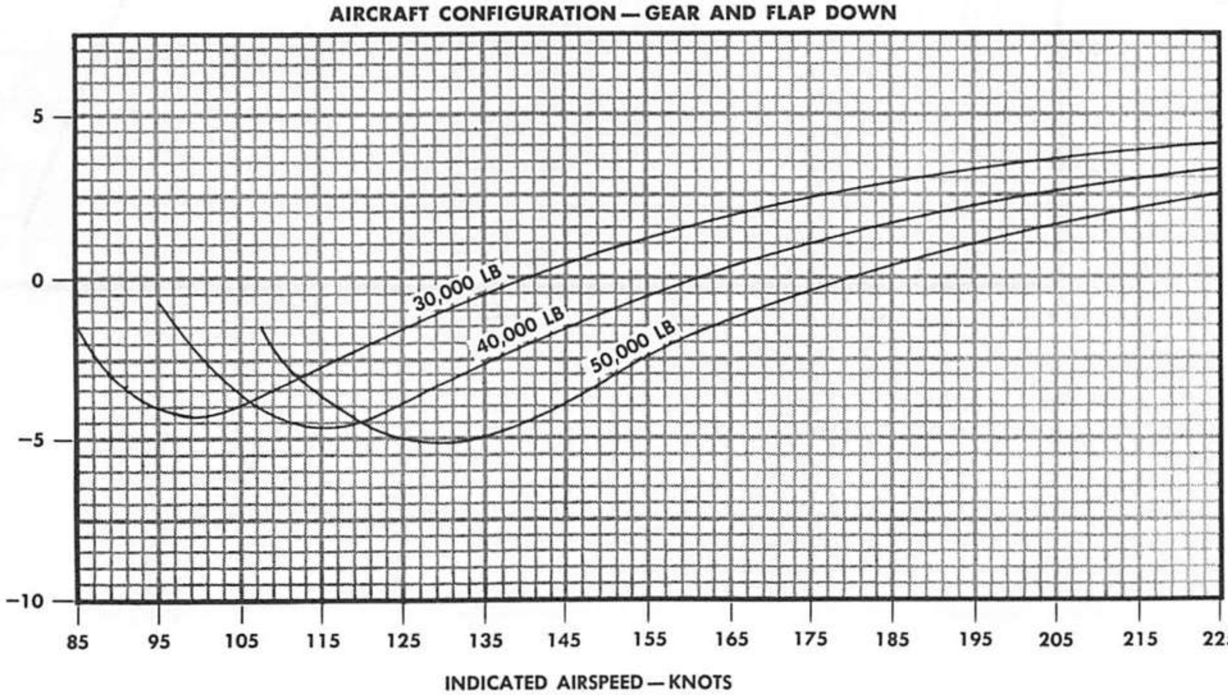


DATE: 1 FEBRUARY 1966
DATA BASIS: PRELIMINARY FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT INSTRUMENT READING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL





ADB1—1328

Figure 11-5

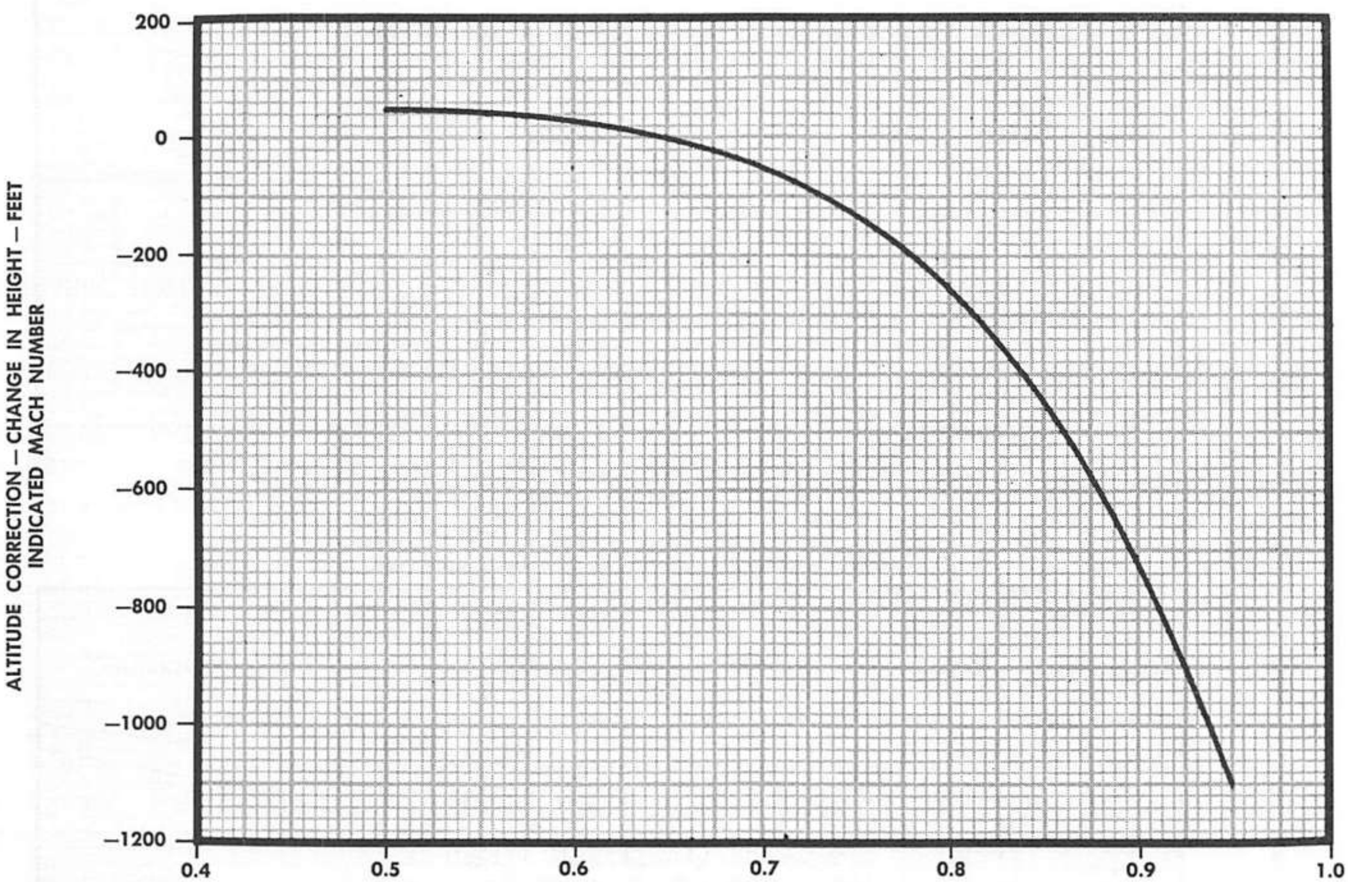
ALTIMETER POSITION ERROR CORRECTION

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
ALL GROSS WEIGHTS

DATE: 1 FEBRUARY 1966
DATA BASIS: PRELIMINARY FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT INSTRUMENT READING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1346

Figure 11-6

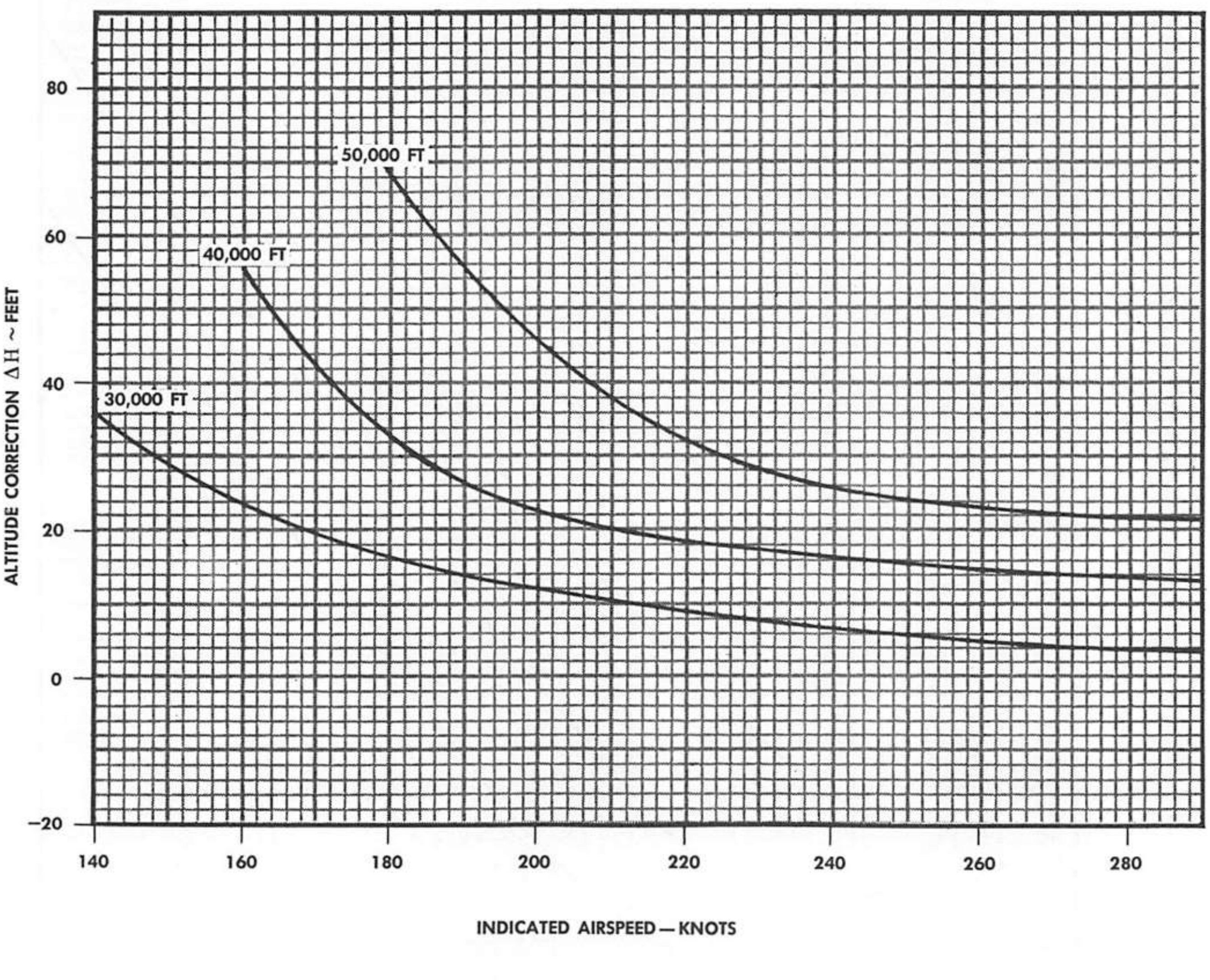
ALTIMETER POSITION ERROR CORRECTION

AIRCRAFT CONFIGURATION
CLEAN
SEA LEVEL

DATE: 1 FEBRUARY 1966
DATA BASIS: PRELIMINARY FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT INSTRUMENT READING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1—1329

Figure 11-7

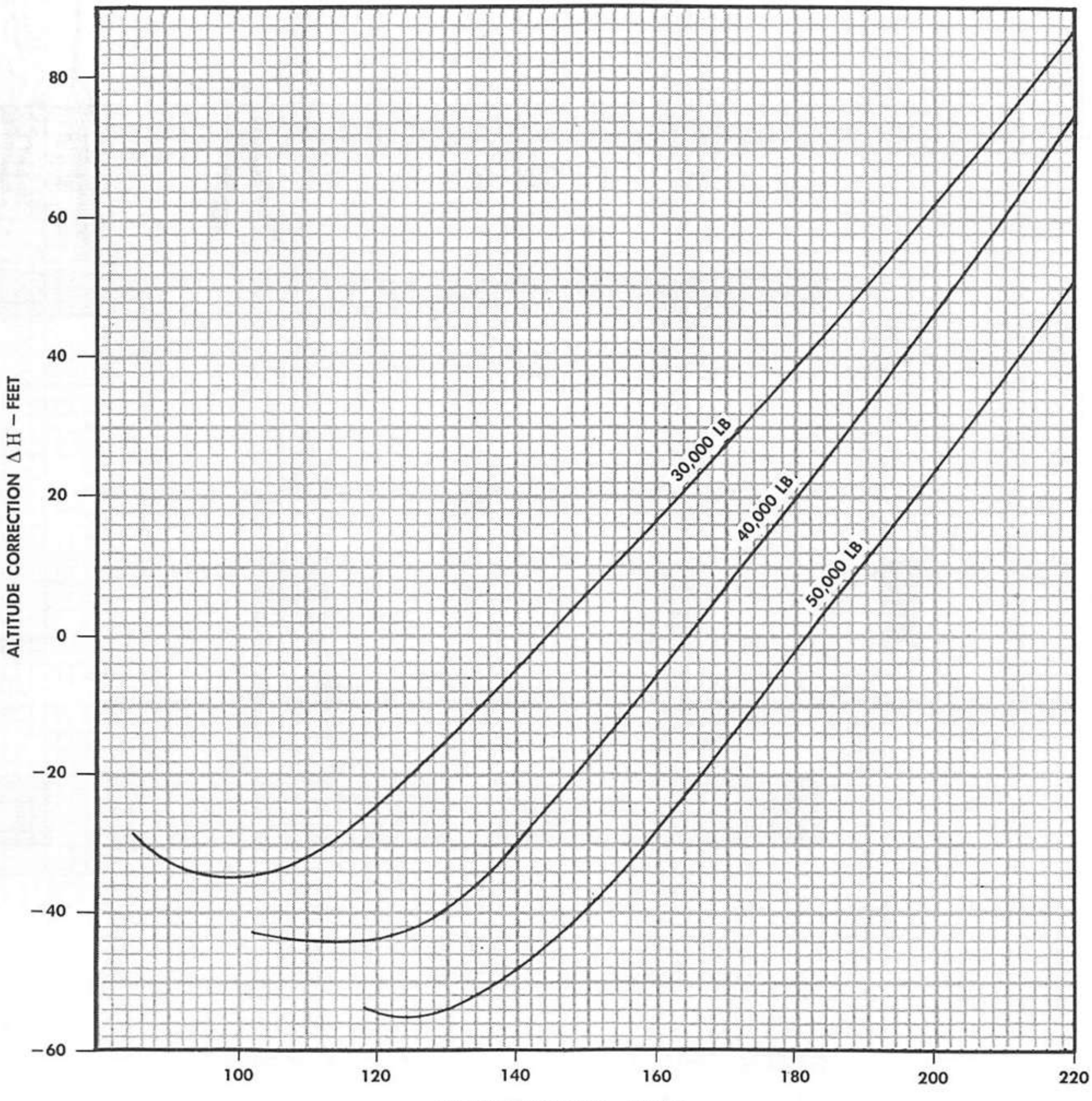
ALTIMETER POSITION ERROR CORRECTION

AIRCRAFT CONFIGURATION
GEAR AND FLAPS
DOWN
SEA LEVEL

DATE: 1 FEBRUARY 1966
DATA BASIS: PRELIMINARY FLIGHT TEST

REMARKS
ADD CORRECTION TO CORRECT INSTRUMENT READING

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1—1330

Figure 11-8

part 3

TAKE-OFF

TABLE OF CONTENTS

CHARTS

REFUSAL SPEED CHARTS

The maximum refusal speed chart (figure 11-9) presents the maximum speed at which engine failure permits stopping at the end of the runway and is used during take-off planning. Stopping distance is based upon using anti-skid braking and flaperon pop-up.

Use

Enter the chart at the aircraft gross weight and proceed horizontally to the intersection of the pressure altitude. Descend to intersect the temperature scale and proceed horizontally to intersect the total runway length. From the total runway length intersection, descend to the base of the chart to read maximum refusal speed.

Sample Problem

AIRCRAFT CONFIGURATION: GEAR DOWN, TAKE-OFF FLAPS, MILITARY POWER

A.	Take-off gross weight	40,000 Lbs.
B.	Pressure altitude	Sea Level
C.	Temperature	60° F
D.	Length of actual runway	6,000 Ft.
E.	Refusal speed	132 Kts.

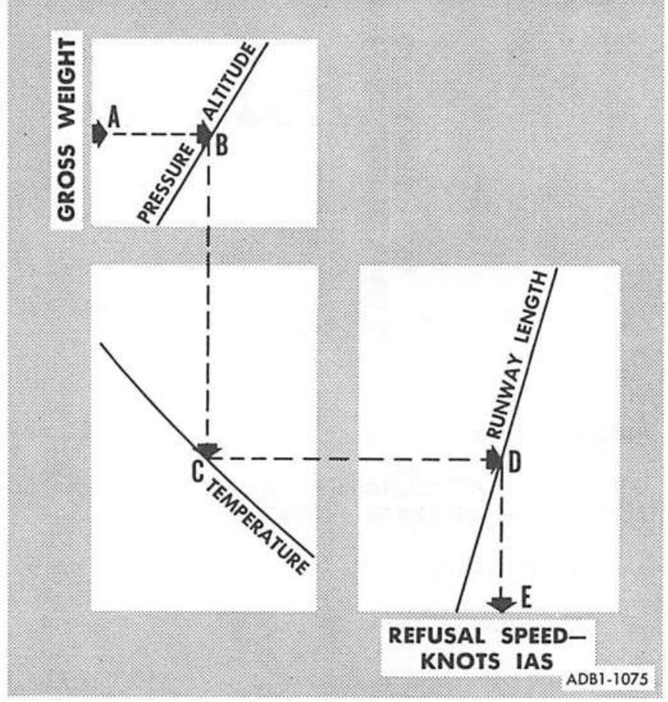
TAKE-OFF DISTANCE CHARTS

TAKE-OFF DISTANCE (NORMAL)

Take-off ground run distances and distance required to clear a 50 foot obstacle using military power is shown in the Take-off Distance Chart figure 11-10.

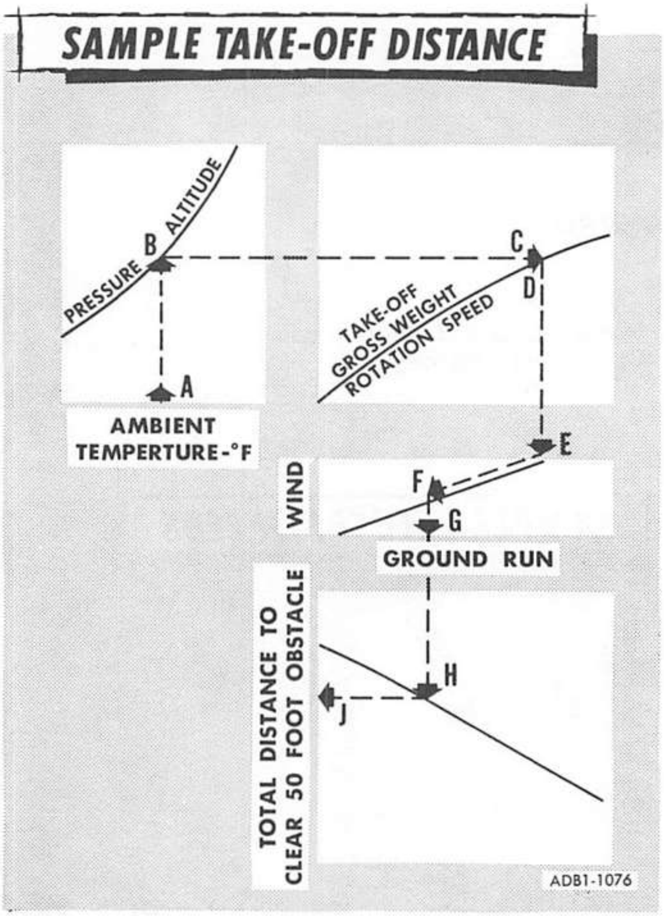
The distances are computed for normal take-off technique on a hard, dry runway. Temperature, pressure altitude, gross weight, and head winds are plotted variables. The charts may be used for any configuration considering gross weight. Lift-off airspeeds (IAS) are shown on the gross weight lines.

SAMPLE REFUSAL SPEEDS



Use

Enter the chart at the temperature scale, proceeding vertically to intersect the pressure altitude. Proceed horizontally to the take-off gross weight and read take-off airspeed. Descend to the base line for wind effect and apply effective wind. Descend to the ground run scale reading ground run distance required for lift-off and further to the reflector line for reading total distance required to clear a 50 foot obstacle.



Sample Problem

AIRCRAFT CONFIGURATION: GEAR DOWN, TAKE-OFF FLAPS, MILITARY POWER

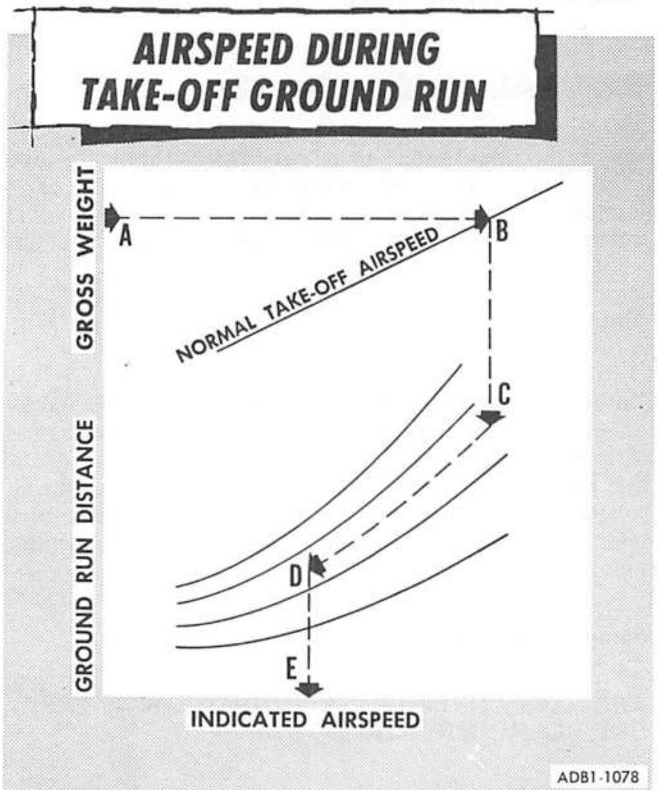
A.	Temperature	60° F
B.	Pressure Altitude	2,000 Ft.
C.	Take-off gross weight	40,000 Lbs.
D.	Take-off airspeed (IAS)	127 Kts.
E.	Wind base line	
F.	Effective headwind	10 Kts
G.	Take-off ground run distance	2,760 Ft.
H.	Reflector line	
J.	Distance required to clear a 50 foot obstacle	3,500 Ft.

AIRSPEED DURING TAKE-OFF GROUND RUN

The airspeed during take-off ground run chart (figure 11-11) presents a plot of ground run distance versus indicated airspeed. Guide lines are used to indicate any momentary distance-speed relationship such as: Line distance at maximum refusal speed, speed at any runway marker or take-off ground run for other than normal take-off speed.

Use

Enter the chart at the gross weight scale and proceed horizontally to intersect the normal take-off airspeed curve. Descend vertically to the ground run distance required for a normal take-off (figure 11-10). By following the appropriate guide line any combination of ground run distance versus airspeed may be read.



Sample Problem

AIRCRAFT CONFIGURATION: GEAR DOWN, TAKE-OFF FLAPS, MILITARY POWER

A.	Take-off gross weight	40,000 Lbs.
B.	Intersect normal take-off airspeed curve	
C.	Normal take-off run (figure 11-10)	2,800 Ft.
D.	Ground run distance	2,000 Ft.
E.	Indicated airspeed	114 Kts.

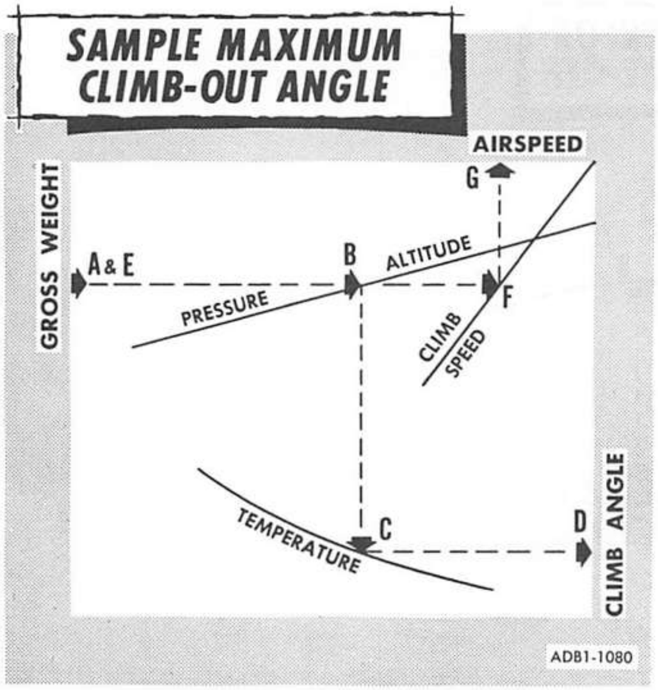
MAXIMUM CLIMB-OUT ANGLE CHARTS

The maximum climb-out angle chart (figure 11-12) presents the maximum climb-out angle obtained in a take-off configuration. Maximum climb-out angle is based on the airspeed (optimum) indicated for the aircraft gross weight on take-off.

Use

Enter the chart at the aircraft gross weight and proceed horizontally to intersect the appropriate pressure altitude. Descend to intersect the temperature scale, and proceed horizontally to read maximum climb-out angle.

Re-enter the chart at the aircraft gross weight, and proceed horizontally to intersect the climb speed guide line. From this point, project vertically and read indicated airspeed.



Sample Problem

AIRCRAFT CONFIGURATION: GEAR DOWN, TAKE-OFF FLAPS, MILITARY POWER AND NO EXTERNAL STORES

A.	Take-off gross weight	40,000 pounds
B.	Pressure altitude (NO EXTERNAL STORES)	Sea Level
C.	Temperature	60° F
D.	Climb-out angle	11.5°
E.	Take-off gross weight	40,000 pounds
F.	Climb speed guide line	Intersect
G.	Optimum speed (IAS)	149 Knots

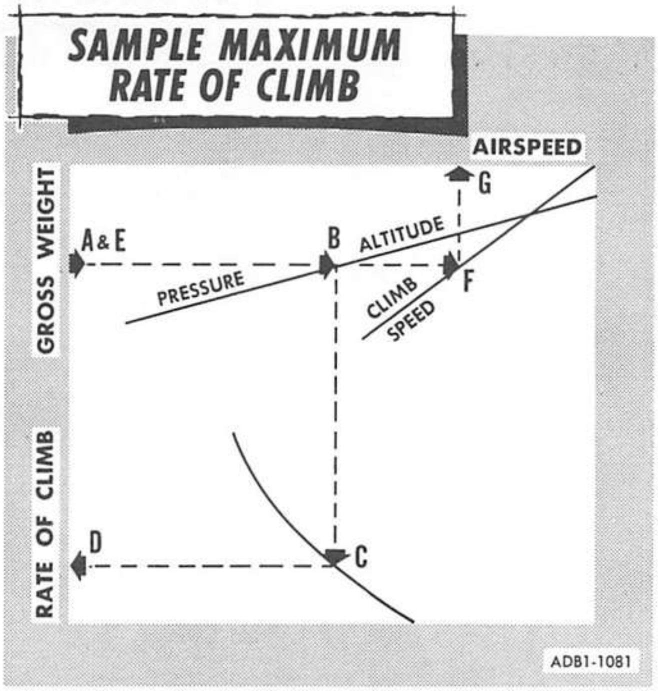
MAXIMUM RATE OF CLIMB CHART

The maximum-rate-of-climb chart (figure 11-13) presents the maximum rate of climb obtainable in a take-off configuration. Maximum-rate-of-climb is based on the airspeed (optimum) indicated for the aircraft gross weight on take-off.

Use

Enter the chart at the aircraft gross weight and proceed horizontally to intersect the appropriate pressure altitude. Descend to intersect the temperature scale, and proceed horizontally to read maximum-rate-of-climb.

Re-enter the chart at the aircraft gross weight, and proceed horizontally to intersect the climb speed guide line. From this point, project vertically and read indicated airspeed.



Sample Problem

AIRCRAFT CONFIGURATION: GEAR DOWN, TAKE-OFF FLAPS, MILITARY POWER AND NO EXTERNAL STORES

A.	Take-off gross weight	40,000 pounds
B.	Pressure altitude (NO EXTERNAL STORES)	Sea Level
C.	Temperature	60° F
D.	Rate-of-climb	3,050 FPM
E.	Take-off gross weight	40,000 pounds
F.	Climb speed guide line	Intersect
G.	Optimum speed (IAS)	149 Knots

CLIMB PERFORMANCE AFTER TAKE-OFF (SINGLE ENGINE)

The climb performance after take-off (single engine) charts (figures 11-14 thru 11-16) present the single engine climb performance at sea level, gross weight of 45,432 pounds and the aircraft in a clean configuration. Rate-of-climb is given as a function of airspeed and temperature.

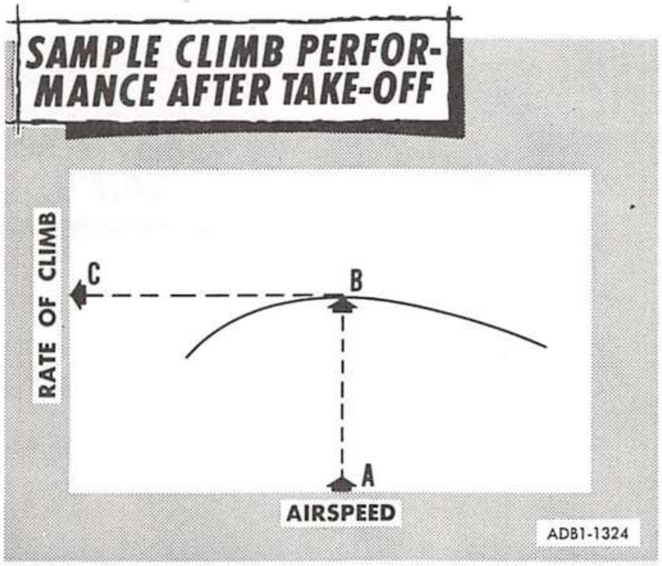
Use

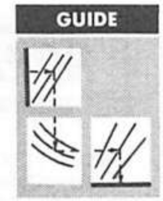
Enter the chart at the desired climb airspeed, and project vertically to intersect the temperature curve. From this intersection, proceed horizontally and read rate-of-climb at sea level.

Sample Problem

AIRCRAFT CONFIGURATION: FLAPS 30°, GEAR DOWN

A.	Airspeed (CAS)	140 Knots
B.	Temperature	0° F
C.	Rate-of-climb	500 FPM





MAXIMUM REFUSAL SPEEDS

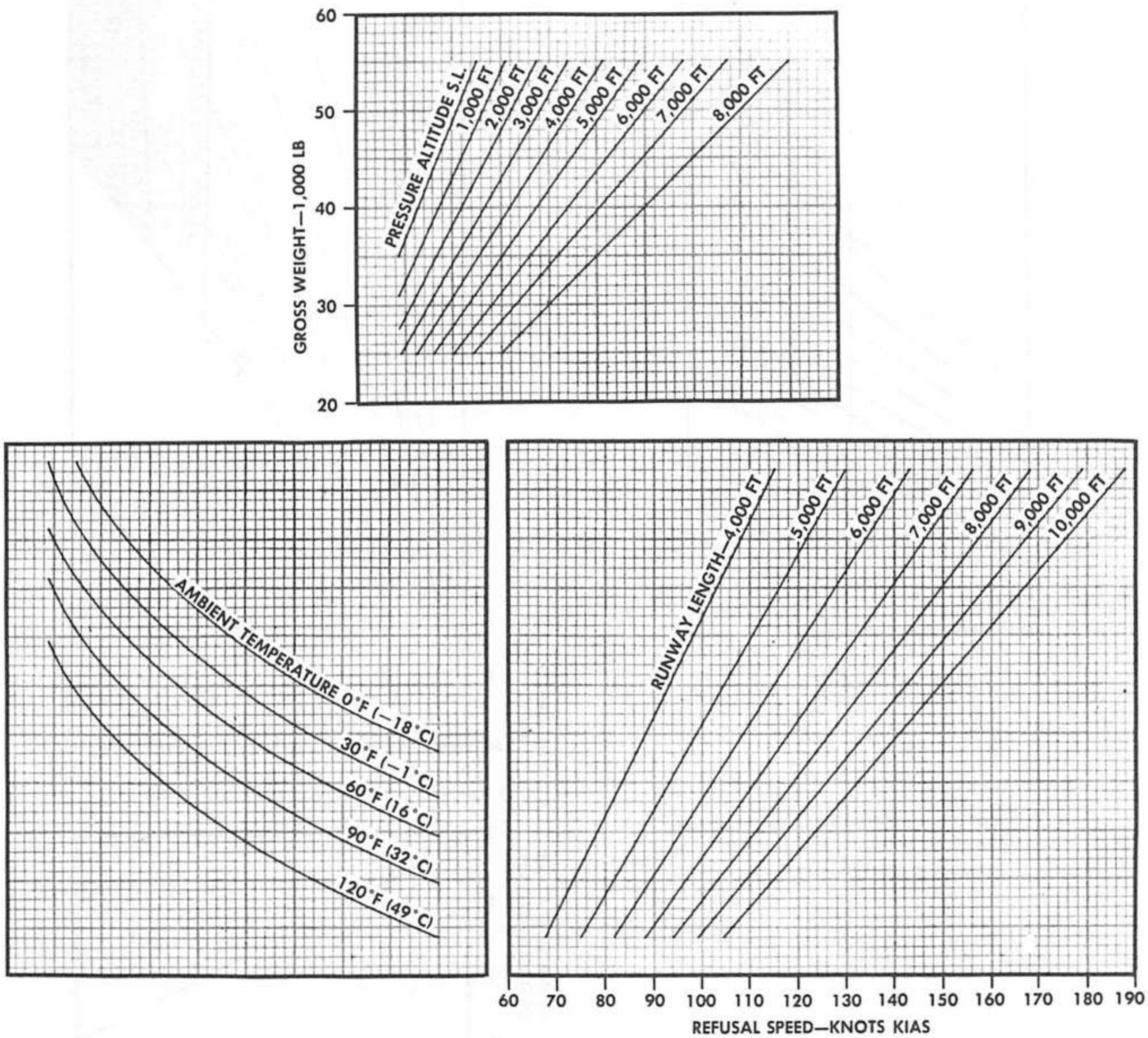
AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
TAKE-OFF FLAPS, GEAR DOWN

MILITARY POWER
HARD DRY RUNWAY

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1175

Figure 11-9

NORMAL TAKE-OFF DISTANCE

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
TAKE-OFF FLAPS, GEAR DOWN

MILITARY POWER
HARD DRY RUNWAY

REMARKS
ENGINE(S): (2) J52-P-6A

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

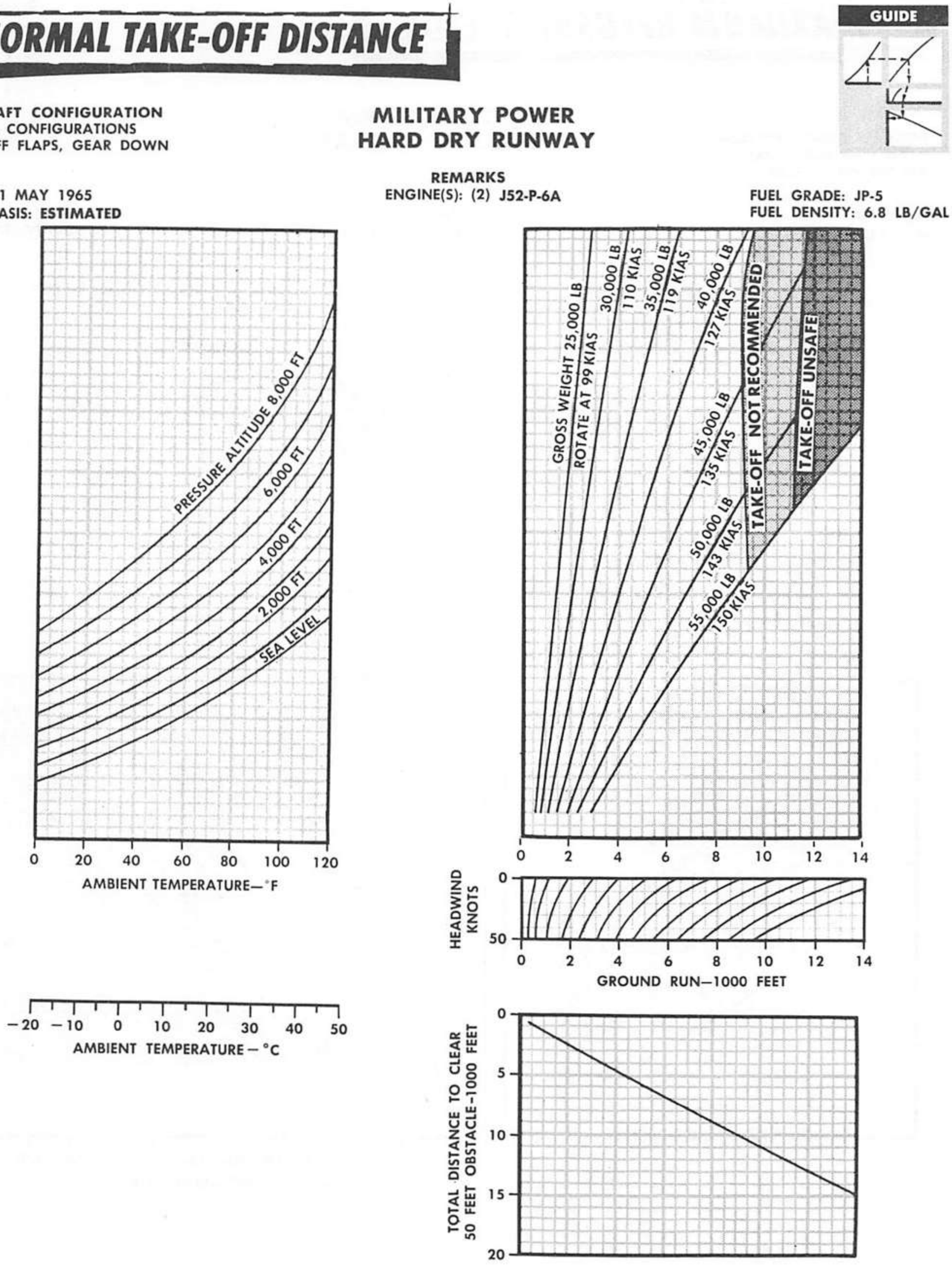


Figure 11-10

VELOCITY DURING TAKE-OFF GROUND RUN

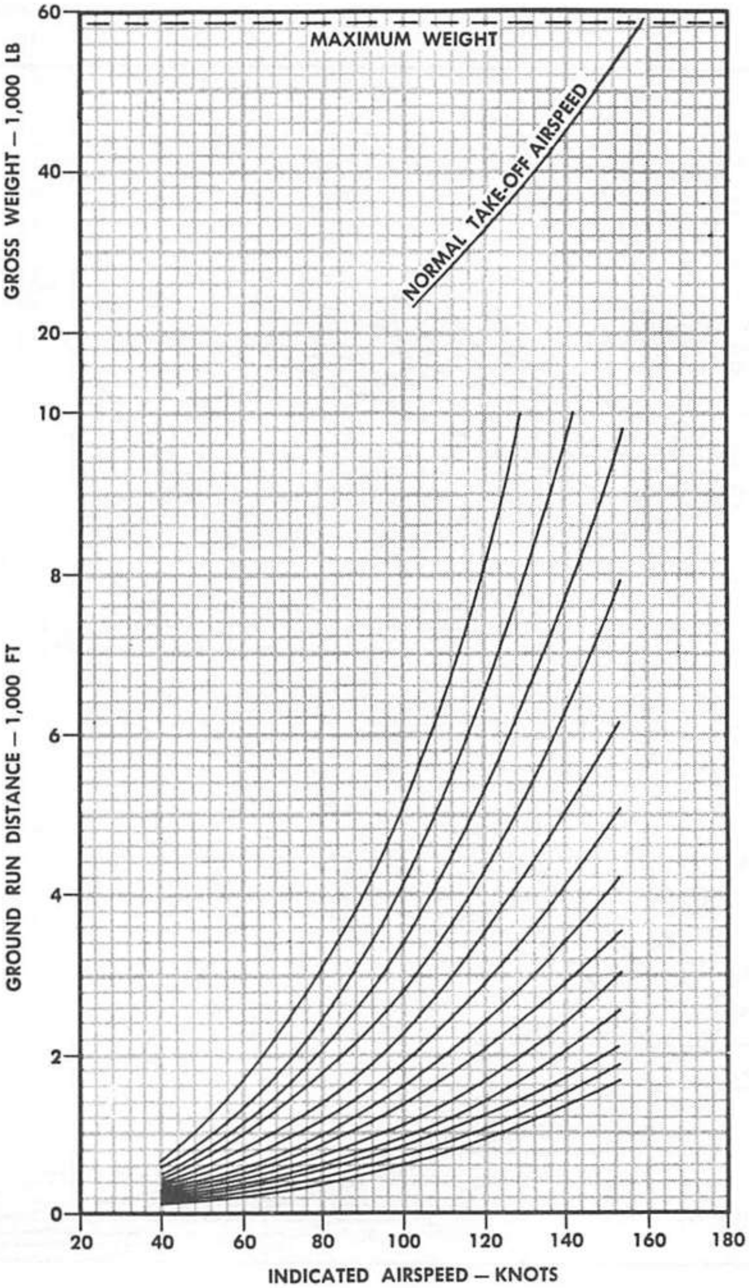
MILITARY POWER
HARD DRY RUNWAY

AIRCRAFT CONFIGURATION
ALL CONFIGURATIONS
TAKE-OFF FLAPS, GEAR DOWN

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1177

Figure 11-11

MAXIMUM CLIMB-OUT ANGLE

GUIDE

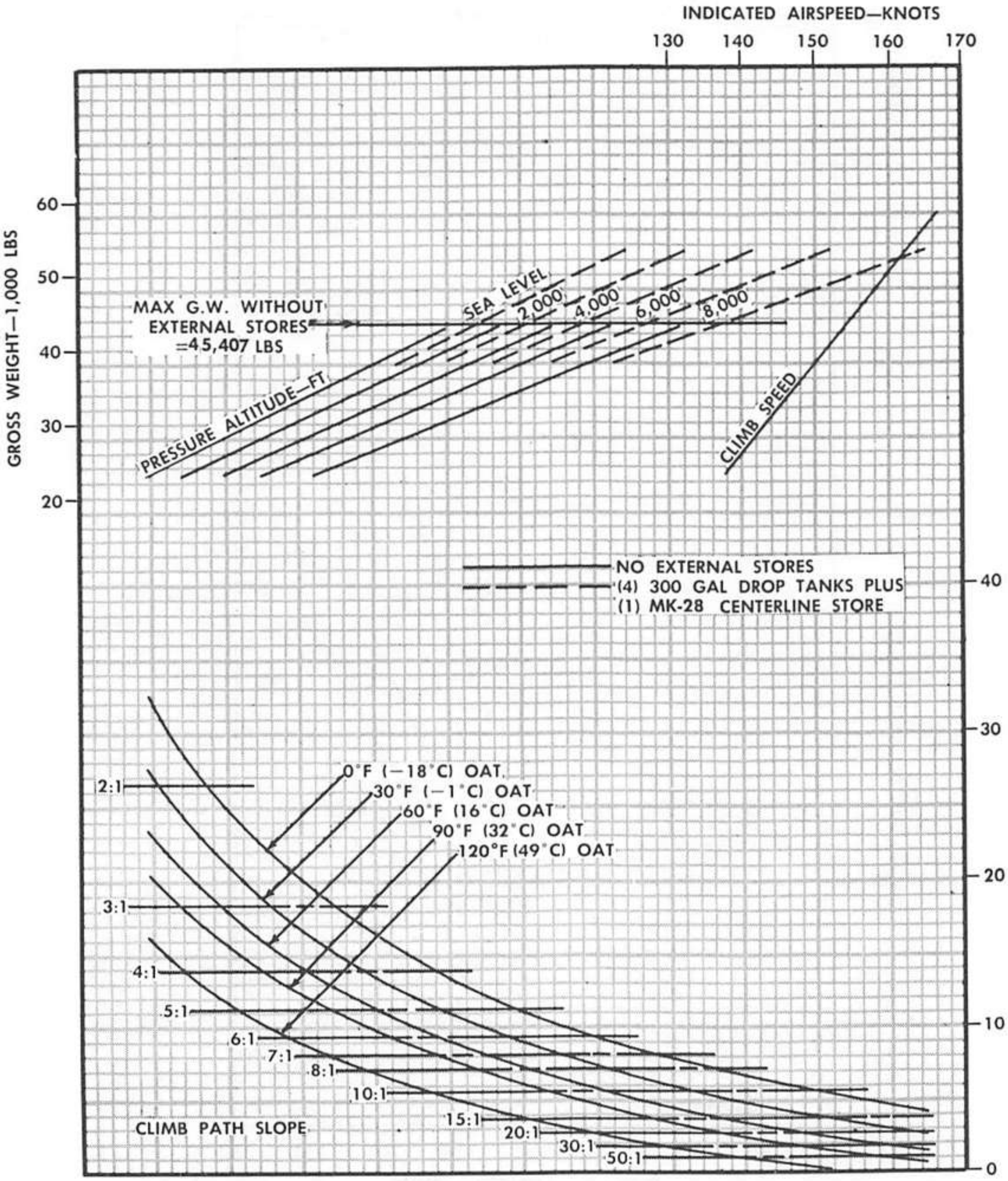
MILITARY THRUST

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): 2 J52-P-6A

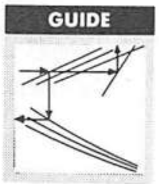
FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1178

Figure 11-12

MAXIMUM RATE OF CLIMB (INSTANTANEOUS)



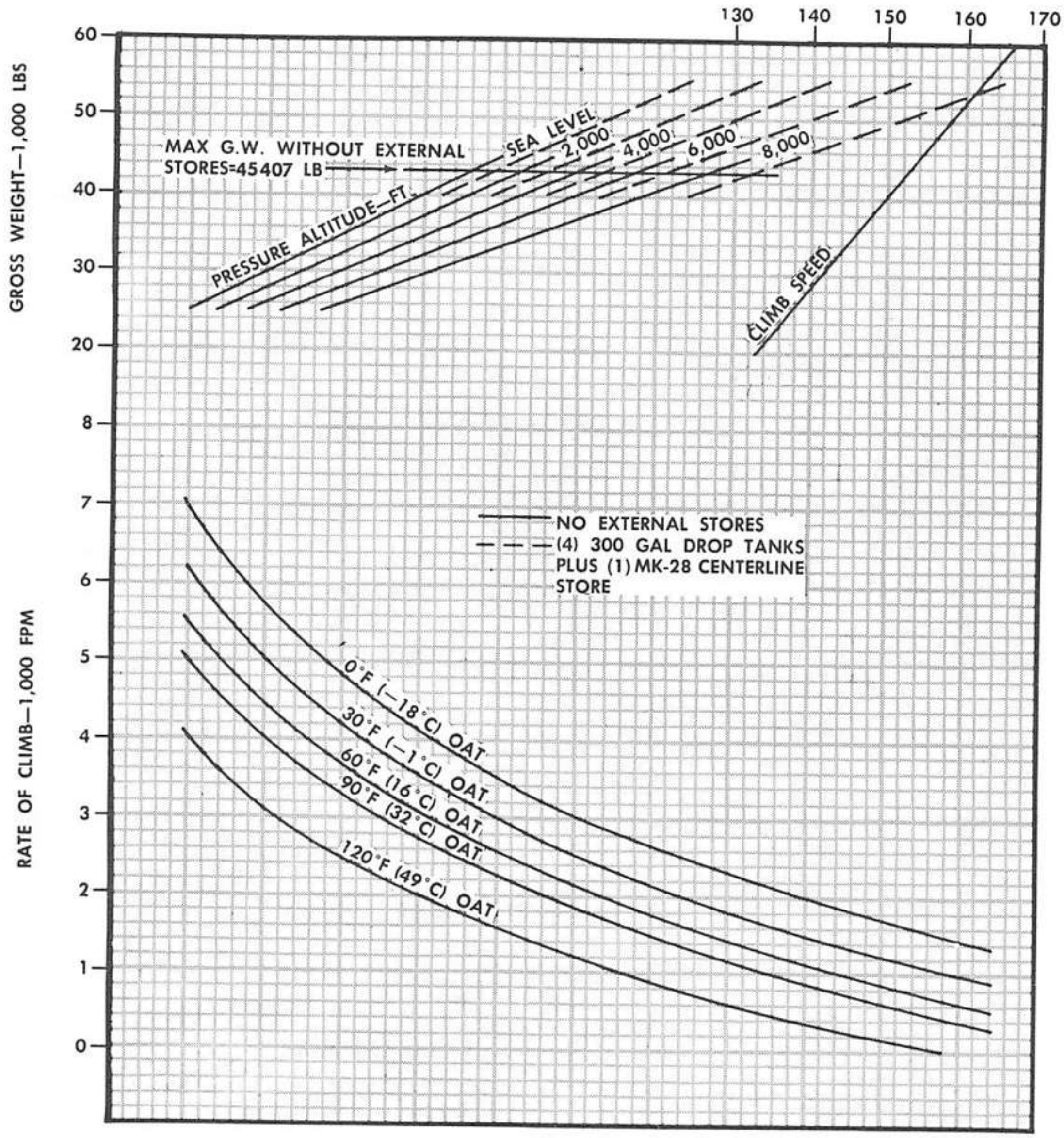
MILITARY POWER

AIRCRAFT CONFIGURATION
TAKE-OFF FLAPS, GEAR DOWN

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1179

Figure 11-13

CLIMB PERFORMANCE AFTER TAKE-OFF

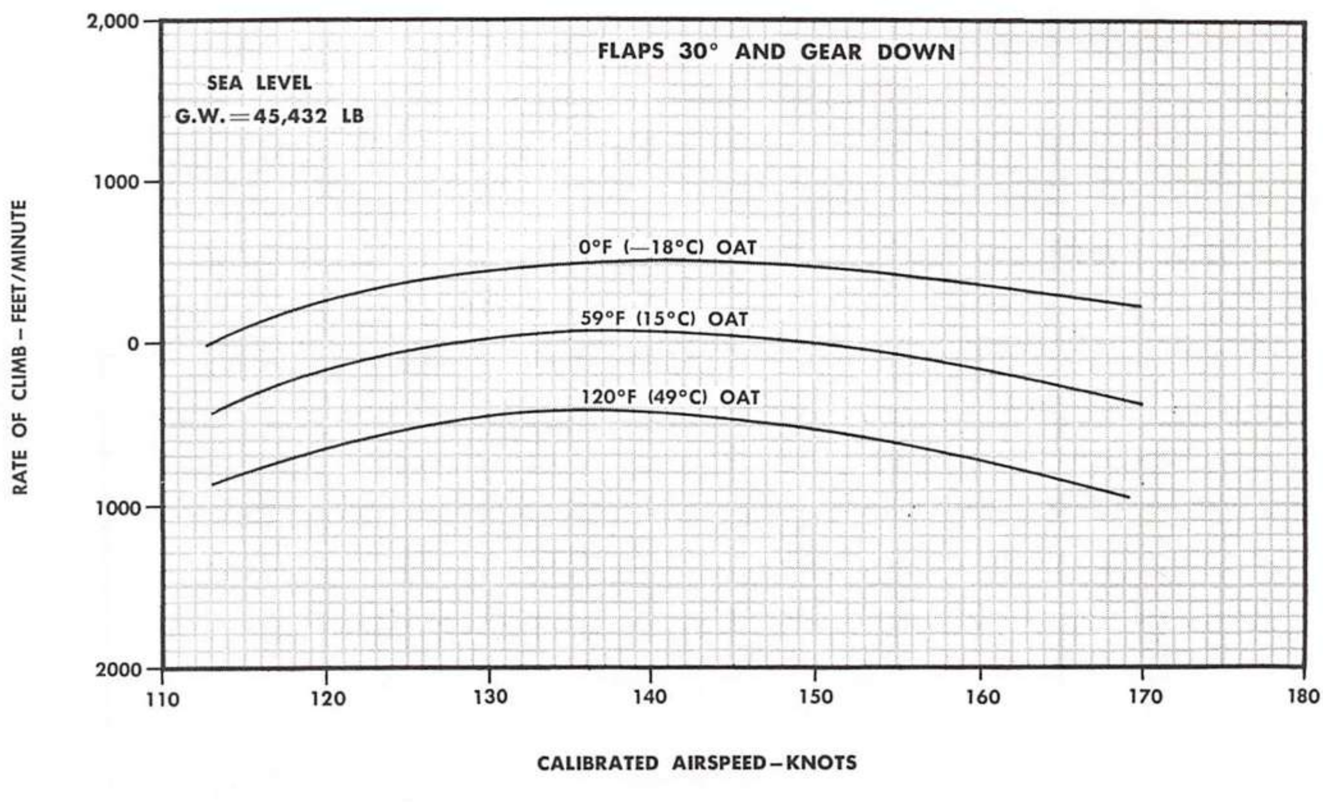
MILITARY POWER
SINGLE ENGINE

AIRCRAFT CONFIGURATION
CLEAN
FLAPS 30° GEAR DOWN
NOTE: CLEAN CONFIGURATION INCLUDES
(2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 JULY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): 2 J52-P-6A
SINGLE ENGINE OPERATION
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1249

Figure 11-14

CLIMB PERFORMANCE AFTER TAKE-OFF

MILITARY POWER
SINGLE ENGINE

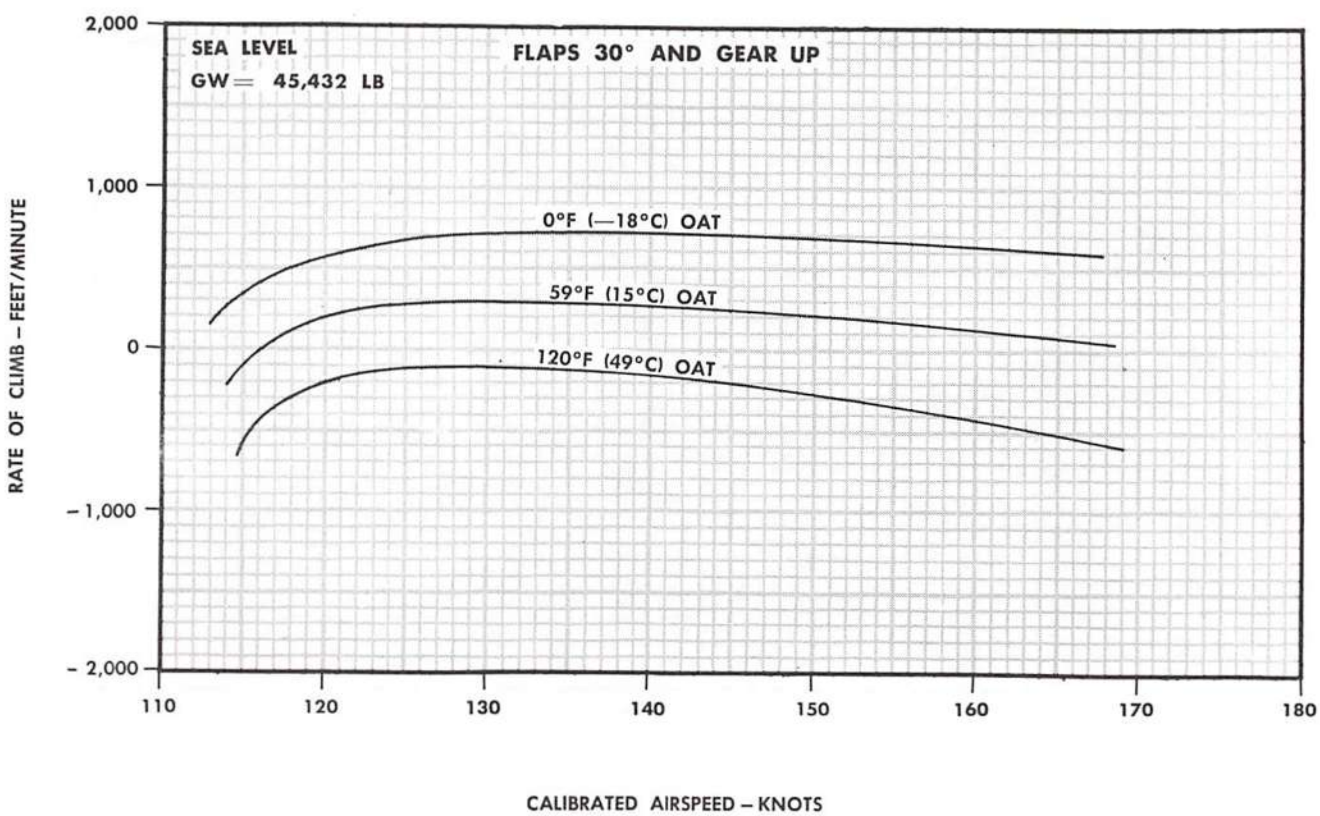
AIRCRAFT CONFIGURATION
CLEAN

FLAPS 30° GEAR UP
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 JULY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
SINGLE ENGINE OPERATION
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1250

Figure 11-15

CLIMB PERFORMANCE AFTER TAKE-OFF

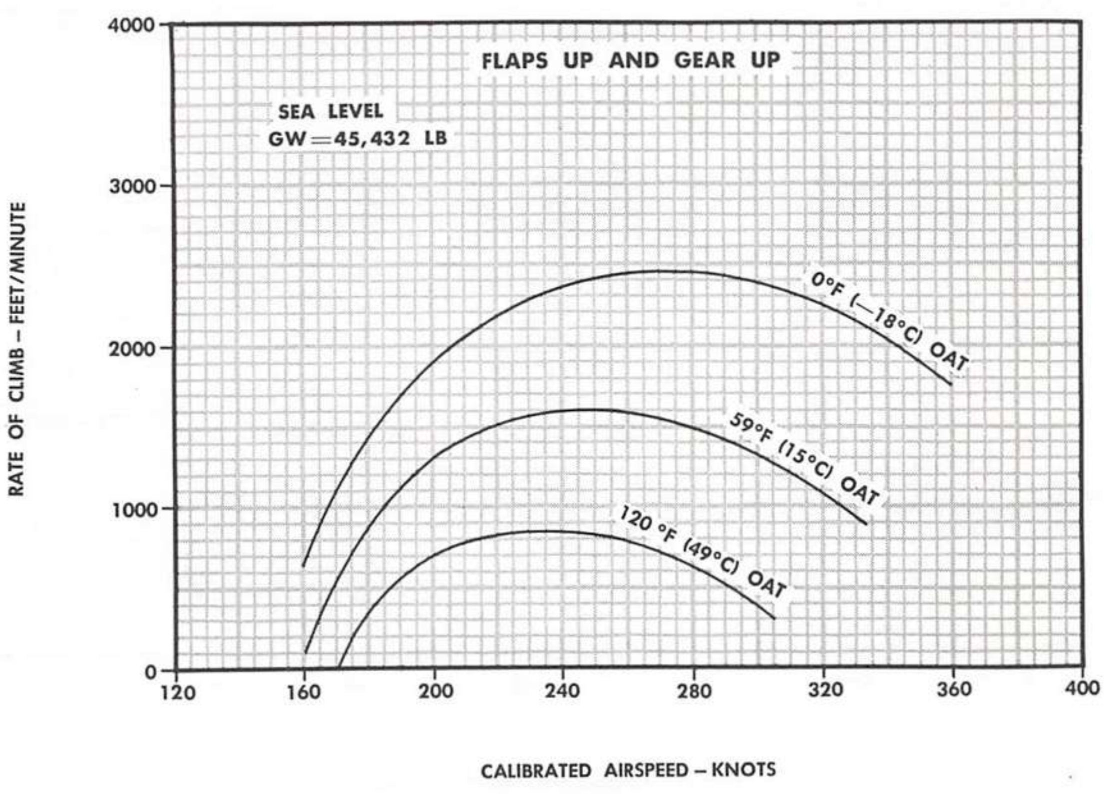
MILITARY POWER
SINGLE ENGINE

AIRCRAFT CONFIGURATION
CLEAN
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 JULY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): 2 J52-P-6A
SINGLE ENGINE OPERATION
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



ADB1-1251

Figure 11-16

part 8
DESCENT

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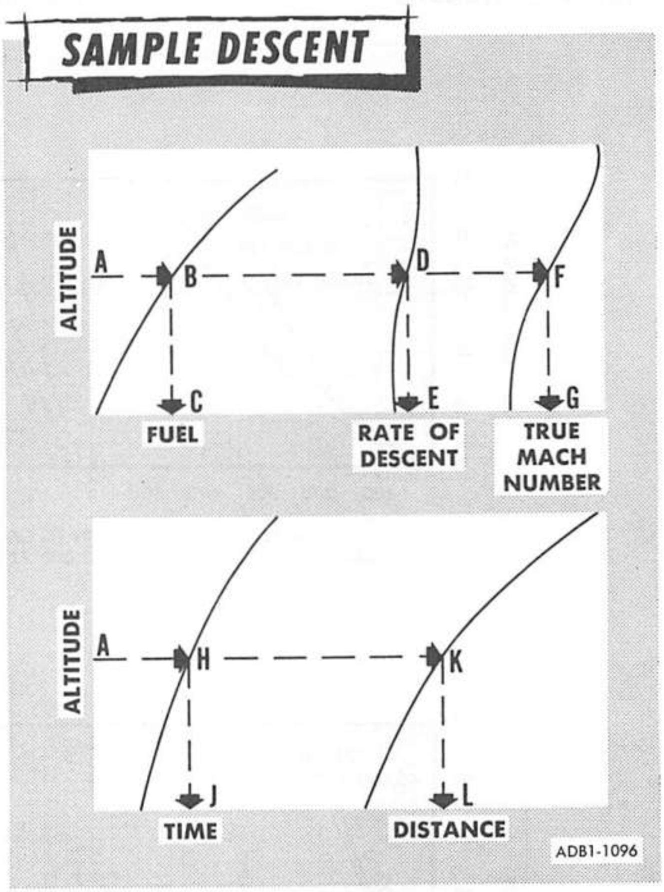
CHARTS

RANGE DESCENT

The maximum range descent schedules presented in figure 11-17 and 11-18 provide the fuel consumed, time, distance covered, rates of descent, and recommended constant airspeeds (with corresponding mach numbers) required to obtain maximum range during idle power descent. The normal landing descents in figures 11-19 and 11-20 correspond to a normal let-down with recommended airspeeds, throttle settings and mach numbers.

Use

Enter the top graph at the descent altitude and proceed horizontally to intersect all three reflector lines for the applicable gross weight. From the intersection of the first reflector line, proceed vertically to the base of the graph to read fuel consumption; from the intersection of the second reflector line, proceed vertically to the base of the graph to read rate of descent; from the intersection of the third reflector line, note constant airspeed for descent and proceed vertically to the base of the graph to read corresponding mach number. Enter the bottom graph at the descent altitude and proceed horizontally to intersect both reflector lines for the applicable gross weight. From the intersection of the first reflector line, proceed vertically to the base of the graph to read time to descend; from the intersection of the second reflector line, proceed vertically to the base of the graph to read distance travelled during descent.

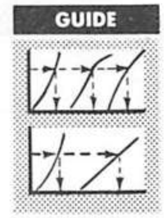


Sample Problem (Maximum Range)

AIRCRAFT CONFIGURATION: CLEAN

A.	Enter top graph at known altitude	30,000 feet
B.	Gross weight reflector line	30,000 pounds
C.	Fuel required for descent	300 pounds
D.	Gross weight reflector line	30,000 pounds
E.	Initial rate of descent	2500 fpm
F.	Gross weight reflector line	30,000 pounds
G.	Initial mach number corresponding to constant descent speed (181 kts. CAS)	0.50
H.	Gross weight reflector line (bottom graph)	30,000 pounds
J.	Total time required	15.9 minutes
K.	Gross weight reflector line	30,000 pounds
L.	Distance traveled	63 miles

MAXIMUM RANGE DESCENT



IDLE POWER

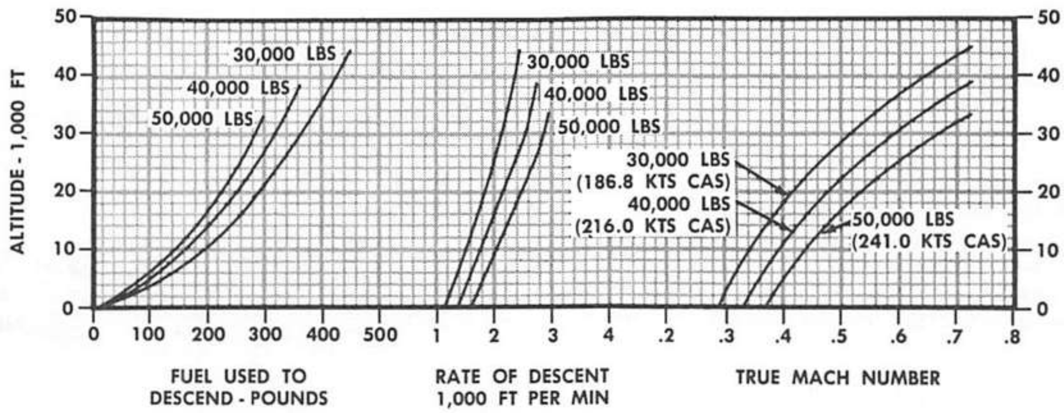
AIRCRAFT CONFIGURATION
ATTACK CONFIGURATION
(NO STORES)

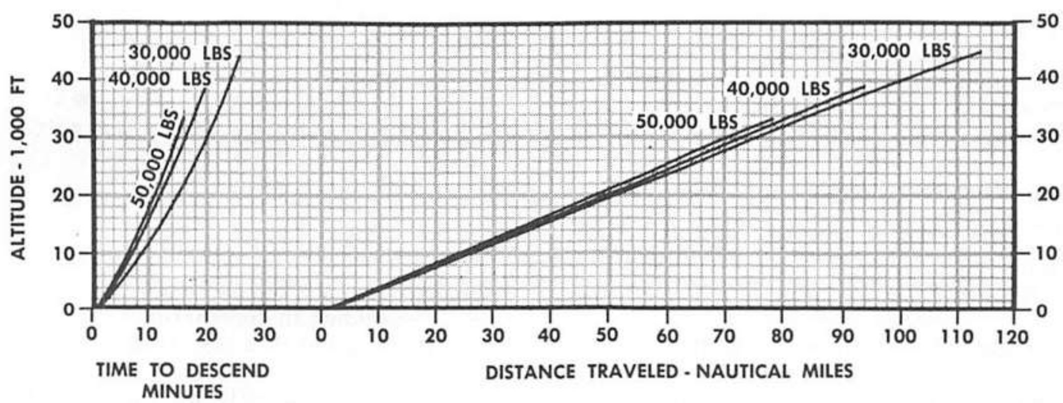
NOTE: ATTACK CONFIGURATION IS LESS (2) AN/ALQ-53 WING POD AND PYLONS

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

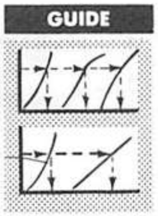




ADB1-1122

Figure 11-17

MAXIMUM RANGE DESCENT



IDLE POWER

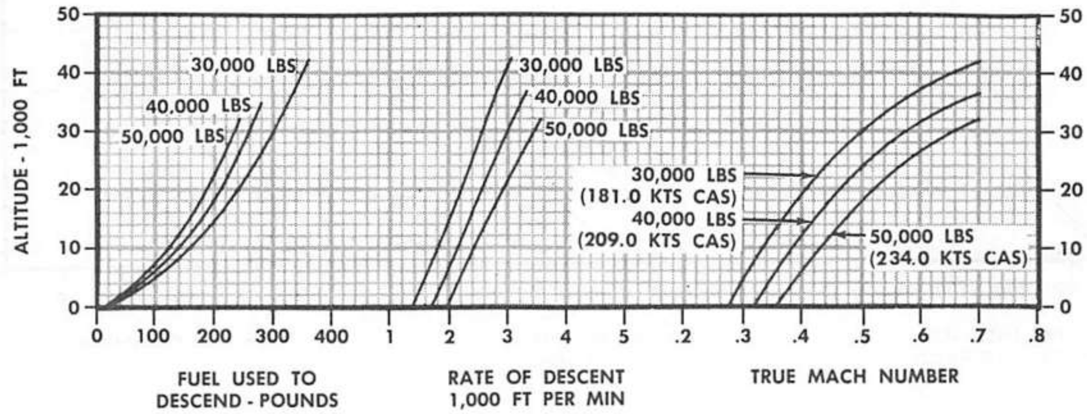
AIRCRAFT CONFIGURATION
CLEAN PLUS (5) 300 GAL. TKS.

NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



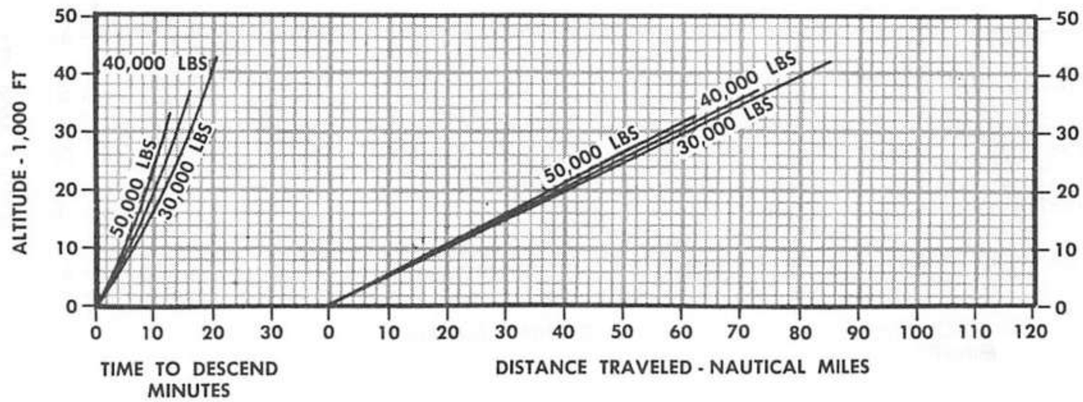


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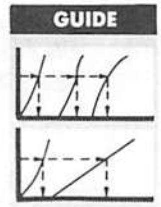
Figure 11-18

NORMAL DESCENT



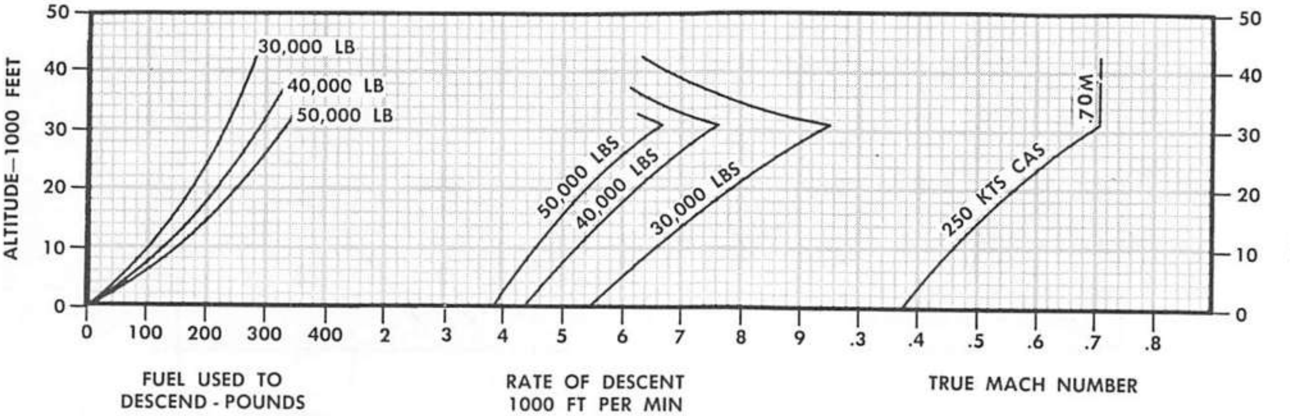
250 KTS CAS
80% RPM
FUSELAGE BRAKES EXTENDED

AIRCRAFT CONFIGURATION
CLEAN PLUS (5) 300 GAL. TKS.
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



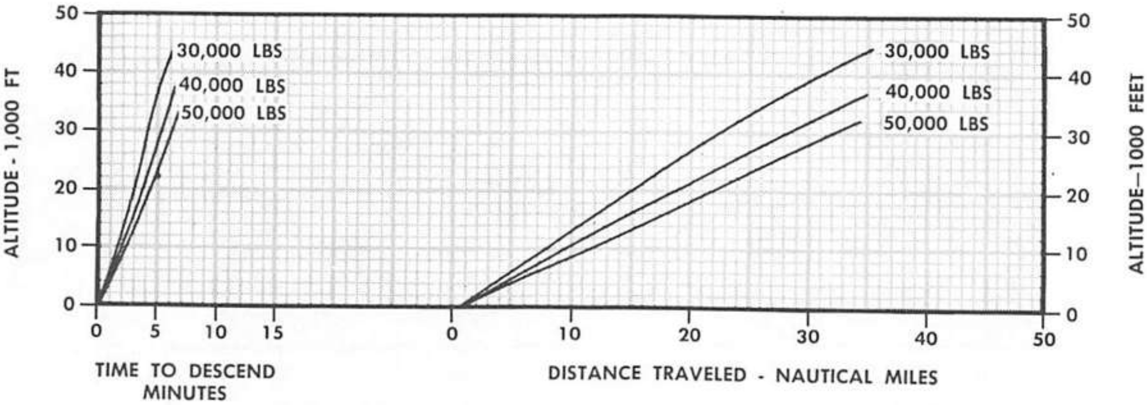


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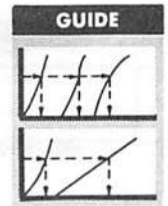
Figure 11-19

NORMAL DESCENT



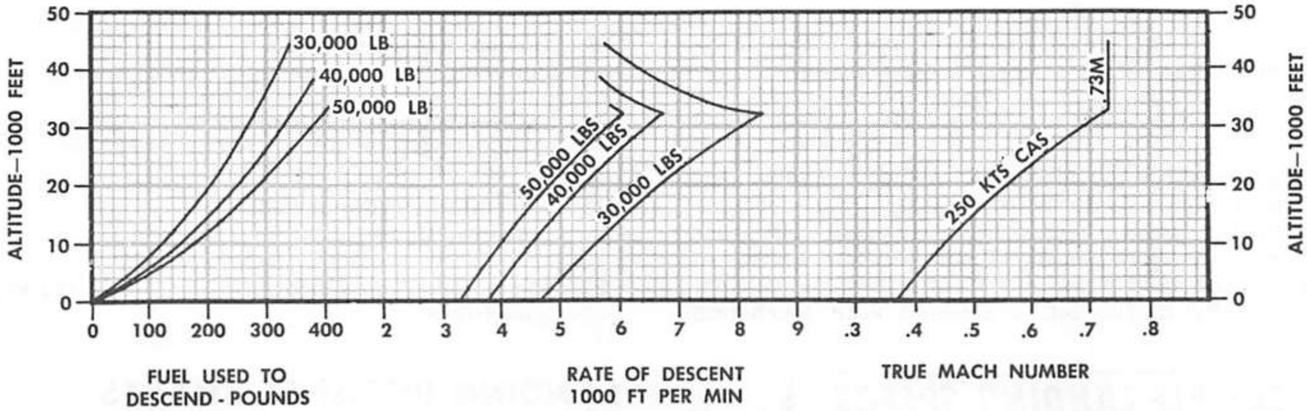
FUSELAGE BRAKES EXTENDED
250 KTS CAS
80% RPM

AIRCRAFT CONFIGURATION
ATTACK CONFIGURATION
(NO STORES)
NOTE: ATTACK CONFIGURATION IS LESS
(2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A
ICAO STANDARD DAY

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



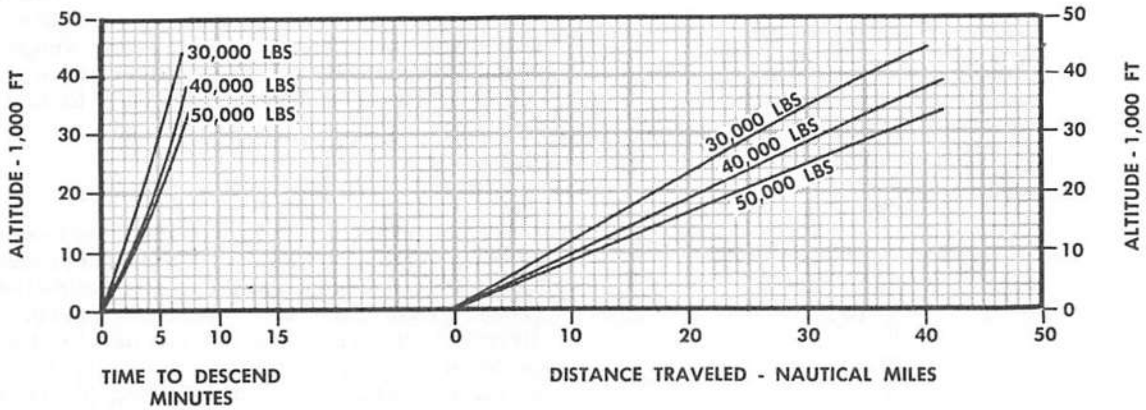


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Figure 11-20

part 9

LANDING

TABLE OF CONTENTS

CHARTS

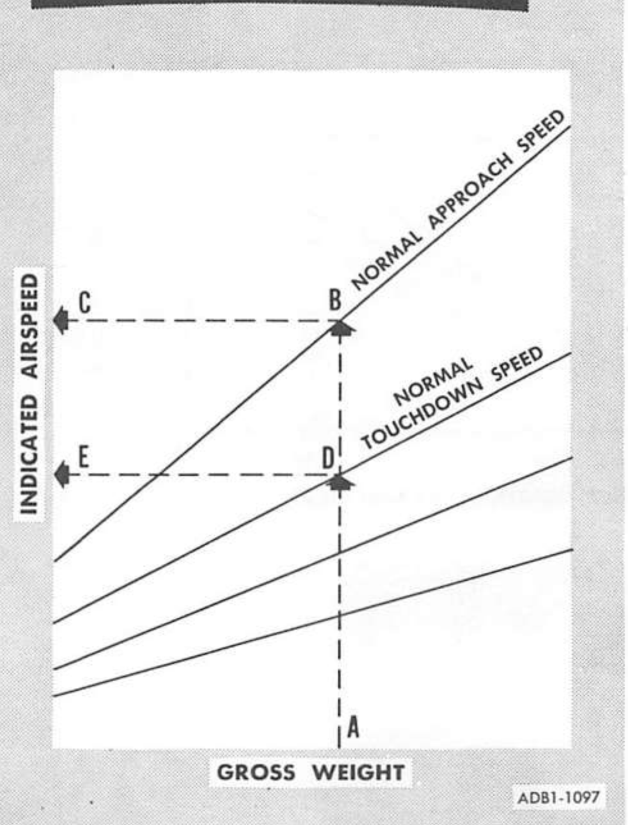
LANDING SPEEDS CHART

The Landing Speeds Chart (figure 11-21) shows recommended approach speed curves and touchdown speed curves for the various gross weights of the aircraft and for normal and minimum distance landing technique.

Use

Enter the chart at estimated landing gross weight. Proceed vertically to the normal approach speed reflector line and project horizontally to the left scale to read approach speed. From the intersection of the normal touchdown speed reflector line, project horizontally to the left scale and read touchdown speed.

SAMPLE LANDING SPEEDS



Sample Problem

A. Estimate landing gross weight — 31,400 Lbs.

B. Normal approach speed reflector line

C. Recommended approach speed (IAS) — 116 Kts.

D. Normal touchdown speed reflector line

E. Recommended touchdown speed (IAS) — 114 Kts.

LANDING DISTANCE CHARTS

Landing distances, ground roll, and total distance required to clear a 50-foot obstacle, are shown in figure 11-22 for normal landing. The following conditions are considered: Landing on a hard, dry runway; temperature in °F and °C; pressure altitude, sea level through 8,000 feet; gross weight, 25,000 pounds through 40,000 pounds; touchdown speeds for each gross weight; headwind effect, 0 to 50 knots.

Use

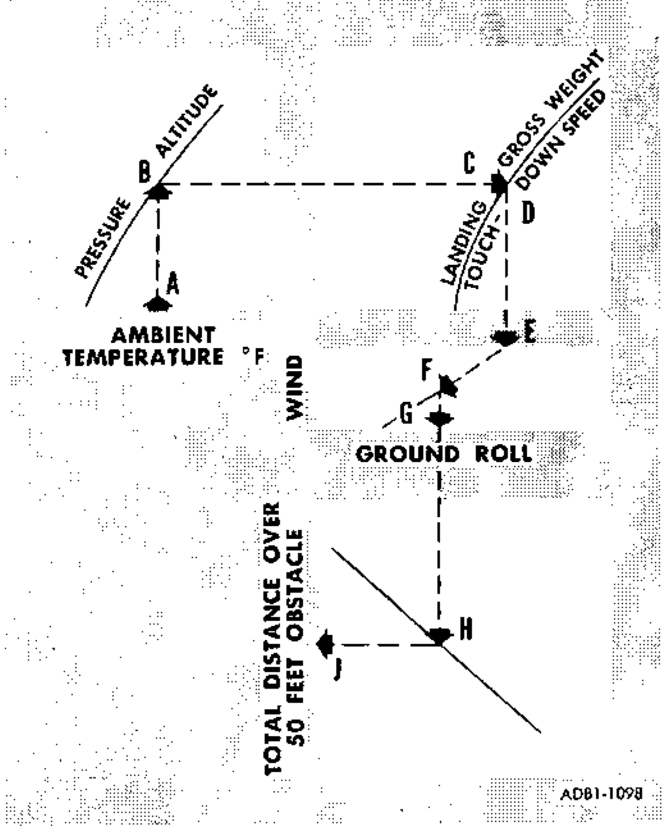
Enter the chart at given surface temperature, proceeding vertically to intersect station pressure altitude. Proceed horizontally to the estimated landing gross weight and read touchdown speed. Descend directly to the wind base line and parallel the nearest guide line to apply effective wind. From this point, descend vertically to read landing ground roll distance and further to the reflector line to read total distance required to clear a 50-foot obstacle.

Sample Problem

A. Temperature — 60° F

B. Pressure Altitude — 2,000 Ft.

SAMPLE LANDING DISTANCE



C.	Gross weight	32,000 Lbs.
D.	Touchdown speed (KIAS)	112 Kts.
E.	Wind base line	
F.	Effective headwind	10 Kts.
G.	Landing ground roll distance	1,710 Ft.
H.	Reflector line	
J.	Distance required to clear a 50-Foot obstacle	2,950 Ft.

LANDING SPEEDS

AIRCRAFT CONFIGURATION
CLEAN
LANDING FLAPS, GEAR DOWN
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS

DATE: 1 MAY 1965
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) J52-P-6A

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

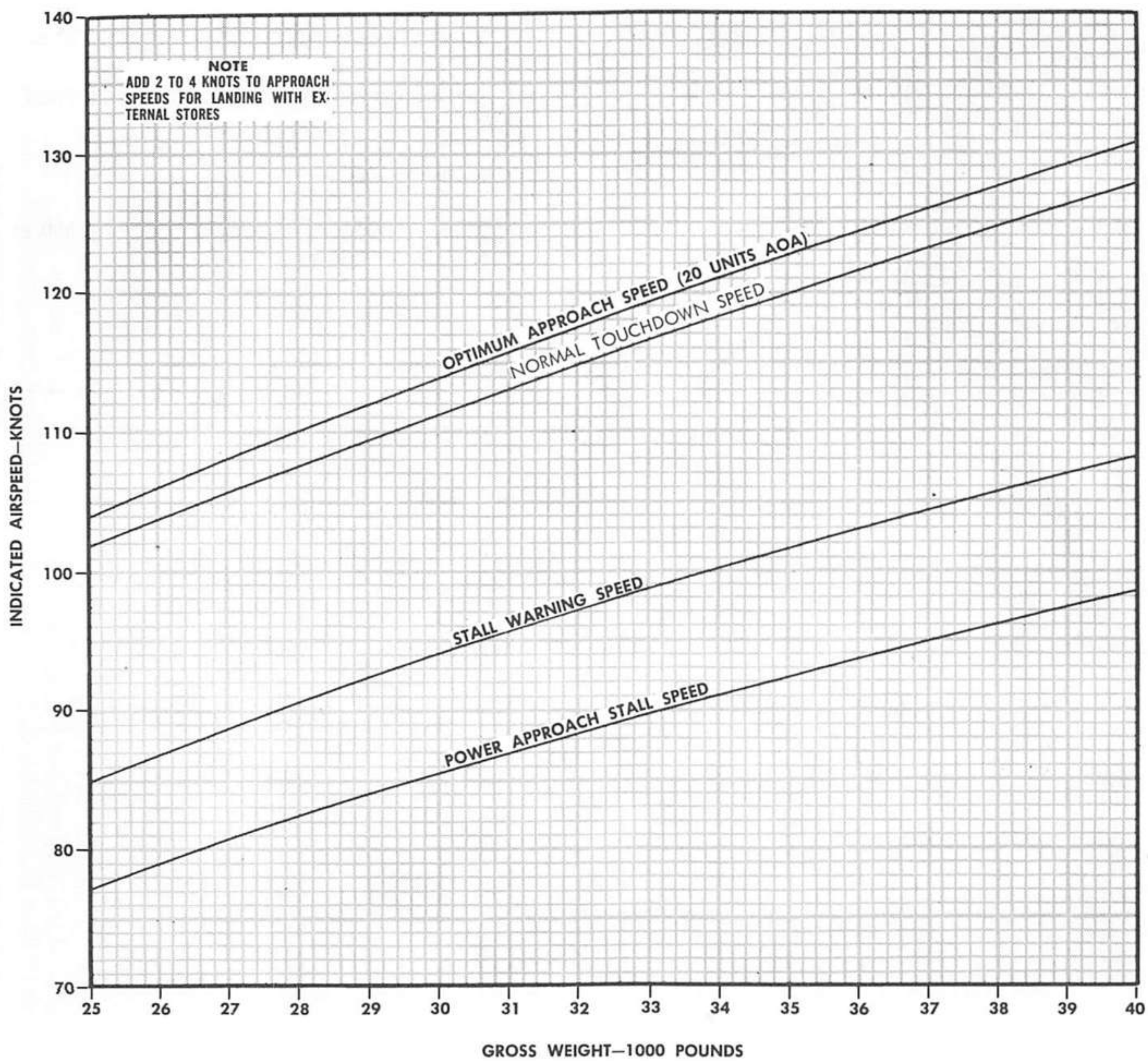


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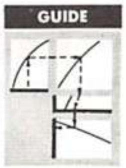
Figure 11-21

NORMAL LANDING DISTANCE



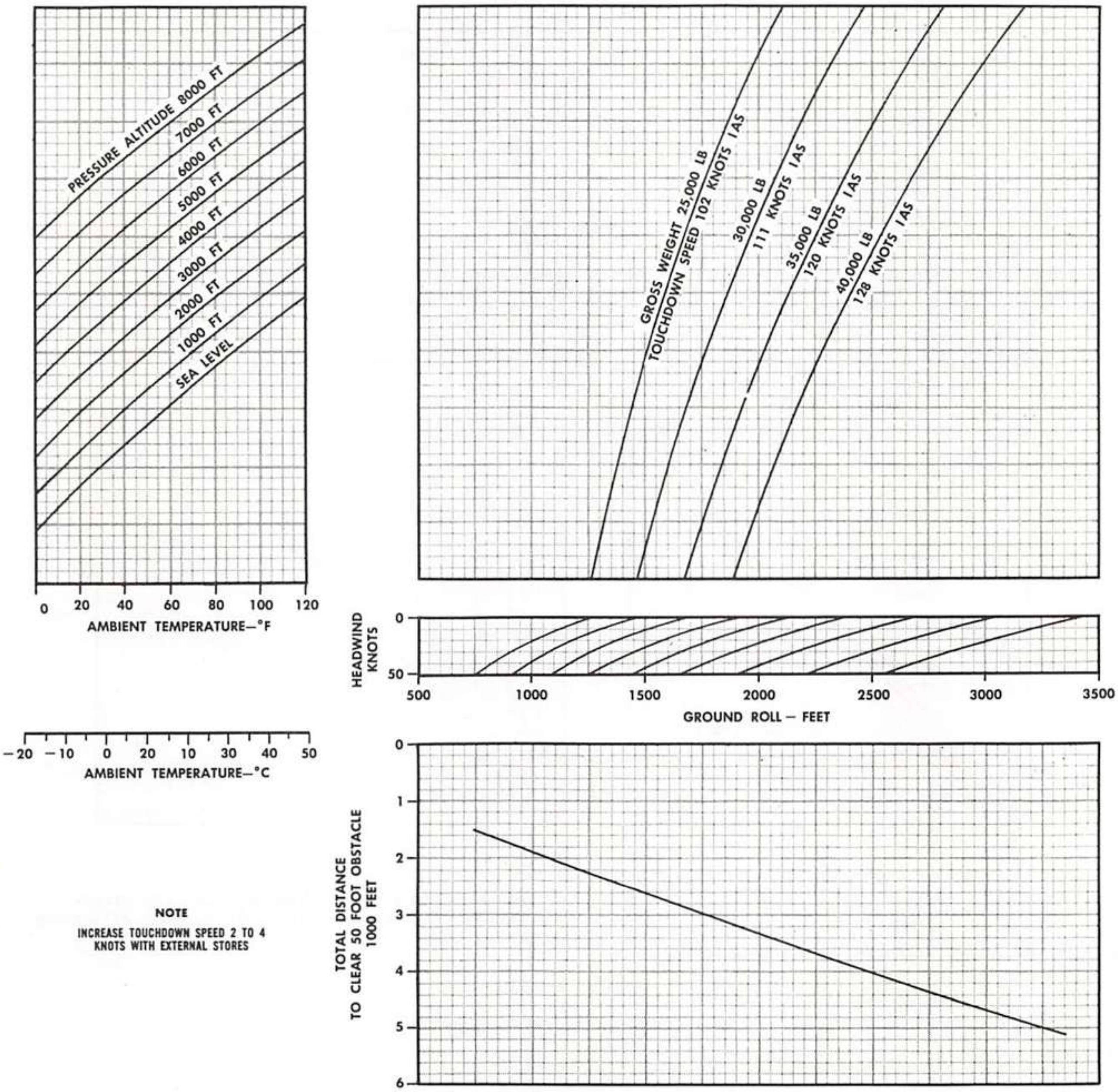
AIRCRAFT CONFIGURATION
CLEAN
NOTE: CLEAN CONFIGURATION INCLUDES (2) AN/ALQ-53 WING PODS AND PYLONS
LANDING GEAR, FLAPS—DOWN
FLAPERON POP-UP, ANTI-SKID UTILIZED

DATE: 1 MAY 1965
DATA BASIS: **ESTIMATED**

HARD DRY RUNWAY

REMARKS
ENGINE(S): (2) J52-P-6A

FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL



NOTE

INCREASE TOUCHDOWN SPEED 2 TO 4 KNOTS WITH EXTERNAL STORES

ADB1-1180

Figure 11-22

ANGLE-OF-ATTACK RELATIONSHIP

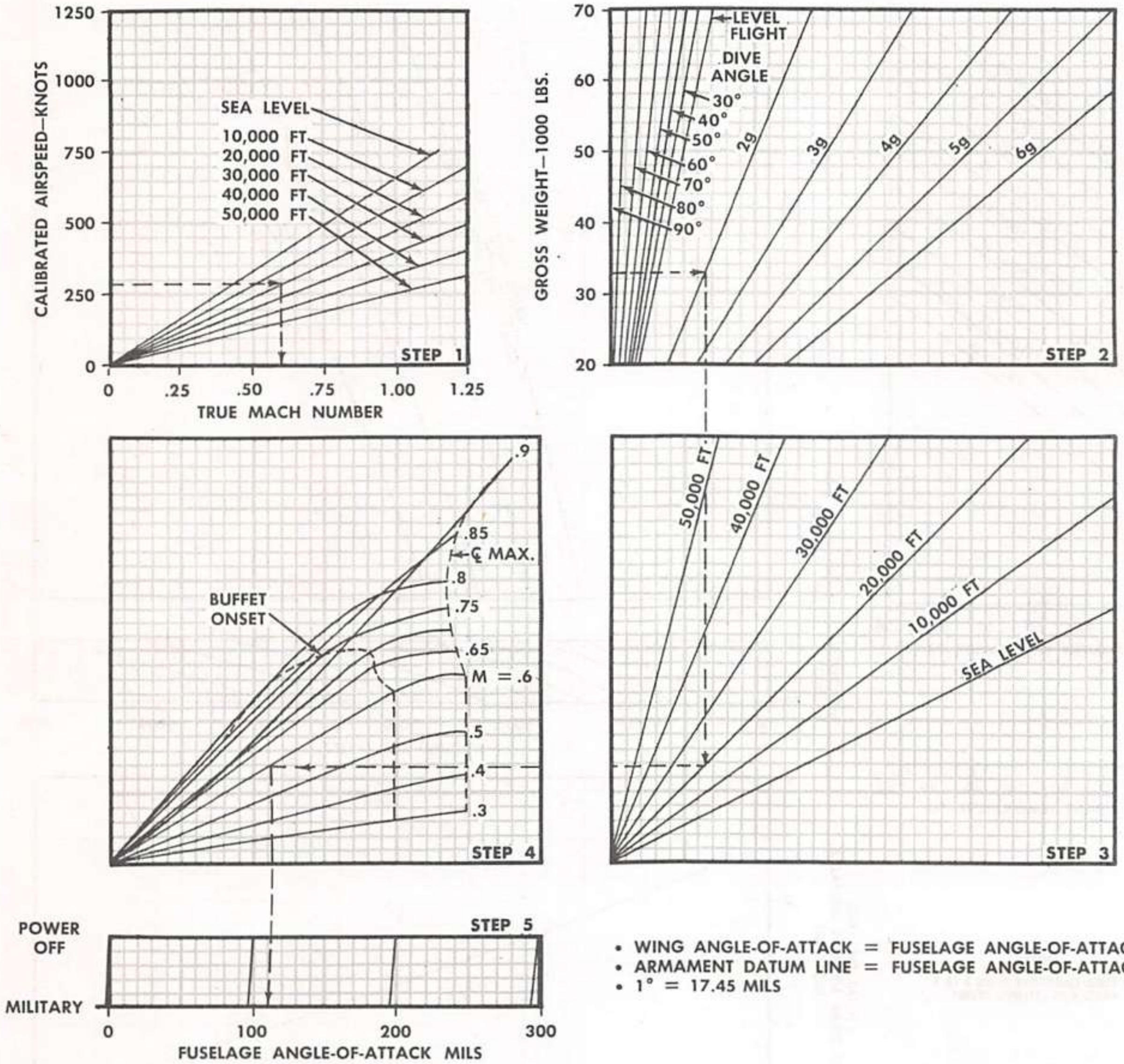
ALL CONFIGURATIONS

EXAMPLE: STEP 1

CALIBRATED AIRSPEED = 275 KNOTS
ALTITUDE = 20,000 FT.
MACH NUMBER = .6

EXAMPLE: STEP 2

GROSS WEIGHT = 32,500 LBS.
LOAD FACTOR = 2g
ALTITUDE = 20,000 FT.
MACH NUMBER = .6
FUSELAGE ANGLE OF ATTACK = 111 MILS



- WING ANGLE-OF-ATTACK = FUSELAGE ANGLE-OF-ATTACK
- ARMAMENT DATUM LINE = FUSELAGE ANGLE-OF-ATTACK—0.6°
- 1° = 17.45 MILS

A-ADB1-1154

Figure 11-23

ALPHABETICAL INDEX

A

B

C

D

*Indicates Illustration

E

F

G

*Indicates Illustration

H

L

M

N

O

P

*Indicates Illustration

*Indicates Illustration

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