11 OF 25

NAVAIR 01-45HHE-1

NATOPS FLIGHT MANUAL

NAVY MODEL

F-8H AIRCRAFT

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

TO: ALL PILOTS
FM: OPS

REF: 1. COMNAVAIRPAC 032212Z OF JUNE 1968 IS QUOTED FOR COMPLIANCE.

"RELATED INSTRUCTIONS: FLIGHT RESTRICTIONS ALL F-8H OPERATORS:

A. DO NOT DUMP CABIN PRESSURE IN EXCESS OF 250 KIAS UNLESS EMERENCY CONDITIONS REQUIRE. IF CABIN PRESSURE IS DUMPED ABOVE 250 KIAS REDUCE AIRSPEED ASAP. THESE RESTRICTIONS EFFECTIVE UNTIL NEW RESEALING INSTRUCTIONS ARE PROMULGATED. ENTIRE FUEL CELL CAVITY PRESSURIZATION SYSTEM UNDER EVALUATION PRESENT TIME AND INSTRUCTIONS WILL BE PROMULGATED ASAP. KNOWN FAILURES IN ONLY TWO AIRCRAFT TO DATE. CAUTION NOTE: FIRST INDICATION TO PILOT OF FUEL CELL COLLAPSE WILL BE MAIN FUEL INDICATION IRREGULARITIES. COLLAPSE OF CELL WILL DAMAGE QUANTITY PROBE. IF CABIN PRESSURIZATION DUMPED ABOVE 400 KIAS FUEL CELL WOULD NOT COLLAPSE INSTANTEOUSLY DUE TO FUEL REMAINING IN CELL. POSSIBILITY EXISTS THAT COLLAPSE WOULD NOT CONTINUE IF KIAS IS REDUCED BELOW 400 KIAS ASAP. IF ENCOUNTERED, USE SPEED BRAKE TO REDUCED AIRSPEED, RETARD THROTTLE SLOWLY, AND LAND ASAP."

CHANGE NOTICE

THESE ARE SUPERSEDING OR SUPPLEMENTARY PAGES TO SAME PUBLICATION OF PREVIOUS DATE

Insert these pages into basic publication
Destroy superseded pages

NATOPS FLIGHT MANUAL

NAVY MODEL

F-8H AIRCRAFT

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

1 May 1967
Changed 1 December 1967

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

LETTER OF PROMULGATION

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

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

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

Thomas F. Connolly

THOMAS F. CONNOLLY
Vice Admiral, USN
Deputy Chief of Naval Operations (Air)

INTERIM CHANGE SUMMARY

CHANGE NUMBER	CHANGE DATE	PAGES AFFECTED	PURPOSE
1	8-23-67	Outstanding	Adds lateral oscillation warning to Section IV, part 2.
2	11-15-67	Page 112	Changes operating weights in Section I, Part 4
4	2 FEB 68	Pg 112	Daniel P. Spikowski
3	19 SEP 68	"	OPERATING WEIGHTS
5	"	"	" "
6	"	151-214	CLOSE IN WAVE OFF
7	"	192A	CHECK VALVE FOR PC FAILURE

CONTENTS

SCOPE

The NATOPS Flight Manual is published by the authority of the Chief of Naval Operations and under the direction of the Commander, Naval Air Systems Command, in conjunction with the Naval Air Training and Operating Procedures Standardization (NATOPS) Program. It combines the "user" developed operating procedures with the latest information from the manufacturer. Read this manual carefully from cover to cover. It's your responsibility to have a complete knowledge of its contents.

SOUND JUDGMENT

This manual provides the best available operating instructions for most circumstances, but no manual is a substitute for sound judgment. Multiple emergencies, adverse weather, or terrain may require modification of the procedures contained herein.

ARRANGEMENT

The manual is divided into eleven sections as follows:

Section I, AIRCRAFT, consists of four parts which describe the aircraft, its systems, servicing requirements, and operating limitations. Part 1 provides a general description of the aircraft, console and instrument board illustrations, and a description of the engine and afterburner. Part 2 describes aircraft systems, excluding tactical systems, and presents specialized system operating procedures. Part 3 provides servicing and handling information for operating from strange fields. Part 4 provides aircraft operating limitations. Some additional limitations applying to specialized operations are found in sections III, IV, and V, and in other parts of this section.

Section II, INDOCTRINATION, summarizes all requirements necessary for qualification in the F-8. Ground training, flight training, flight qualification, and personnel flying equipment requirements are included in this section.

Section III, NORMAL PROCEDURES, provides recommended procedures for operating the aircraft under normal conditions. Part 1 contains briefing and debriefing procedures. Part 2 provides mission planning. Part 3 presents complete shore-based ground and flight procedures. Part 4 presents only those procedures peculiar to carrier operation.

Section IV, FLIGHT PROCEDURES AND CHARACTERISTICS, consists of two parts. Part 1 contains procedures for transition and familiarization, parade and tactical formation, formation rendezvous, inflight refueling, and flight test. Part 2 provides aircraft flight characteristics and recommended pilot techniques.

Section V, EMERGENCY PROCEDURES, is divided into four parts covering ground emergencies (part 1), takeoff emergencies (part 2), inflight emergencies (part 3), and landing emergencies (part 4).

Section VI, ALL-WEATHER OPERATION. Parts 1 and 2 provide simulated and actual instrument procedures. Part 3 covers flight in icing conditions, rain, snow, thunderstorms and turbulence, cold weather, hot weather and desert.

Section VII, COMMUNICATIONS PROCEDURES, contains information on radio discipline and procedures, and hand signals.

SECTION VIII, WEAPON SYSTEMS, contains descriptions of, and normal operating procedures for, the fire control system, guns, and other weapon systems.

Section IX, FLIGHT CREW COORDINATION, is not applicable to the single-place F-8.

Section X, STANDARDIZATION EVALUATION, describes the standardization program and presents requirements for ground and inflight evaluation. The section also provides grading criteria, information pertaining to records and reports, the evaluation question bank, and evaluation forms.

Section XI. PERFORMANCE DATA, contains charts and other data from which aircraft performance can be determined.

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. Procurement of manuals may be effected in accordance with NAVSUP Publication 2002, Section VIII, Part C. Additional information is presented on page A of this manual.

NATOPS POCKET CHECK LISTS

The NATOPS Pocket Check Lists provide essential information in abbreviated form for operation of this aircraft. These Check Lists may be obtained in the same manner as the NATOPS Flight Manual. Changes to them are concurrent with, and dated the same as, the NATOPS Flight Manuals.

UP-DATING THE MANUAL

To ensure that the manual contains the latest procedures and information, a review conference will be held periodically as necessary.

YOUR RESPONSIBILITY

NATOPS Flight Manuals are kept current through an active manual change program. If you find anything you don't like about the manual, if you have information you'd like to pass along to others, or if you find an error in the manual, submit a change recommendation to the Model Manager.

FLIGHT MANUAL INTERIM CHANGES (FMIC)

Flight Manual Interim Changes (FMIC'S) are changes or corrections to the NATOPS Flight Manuals, Pocket Check Lists, and Supplementary publications promulgated by CNO or NAVAIR. FMIC'S may be received by the individual custodian as a printed page or pages, or by the command as a Naval Message. After the completion of the action directed by a printed FMIC, it shall be retained in front of the flyleaf of the manual unless the FMIC contains authorization to discard the page.

INTERIM CHANGE SUMMARY

The Interim Change Summary in each manual is provided for the purpose of maintaining a complete record of all FMIC'S issued to the manual. Each time the manual is changed or revised, the Interim Change Summary will be up-dated to indicate disposition and/or incorporation of previously issued FMIC'S. When a regular change is received, the Interim Change Summary should be checked to ascertain that all outstanding FMIC's have been either incorporated or cancelled. Those not incorporated should be re-entered and noted as applicable.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAV Instruction 3510.9 series. Change recommendations of an URGENT (safety of flight etc.) nature should be submitted directly to the NATOPS Advisory Group member in the Chain of Command by priority message.

Routine change recommendations are submitted to the Model Manager on OPNAV Form 3500/22.

Address routine changes to: VF 124
Miramar NAS
California

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, condition, etc., which is essential to emphasize.

CHANGE SYMBOLS

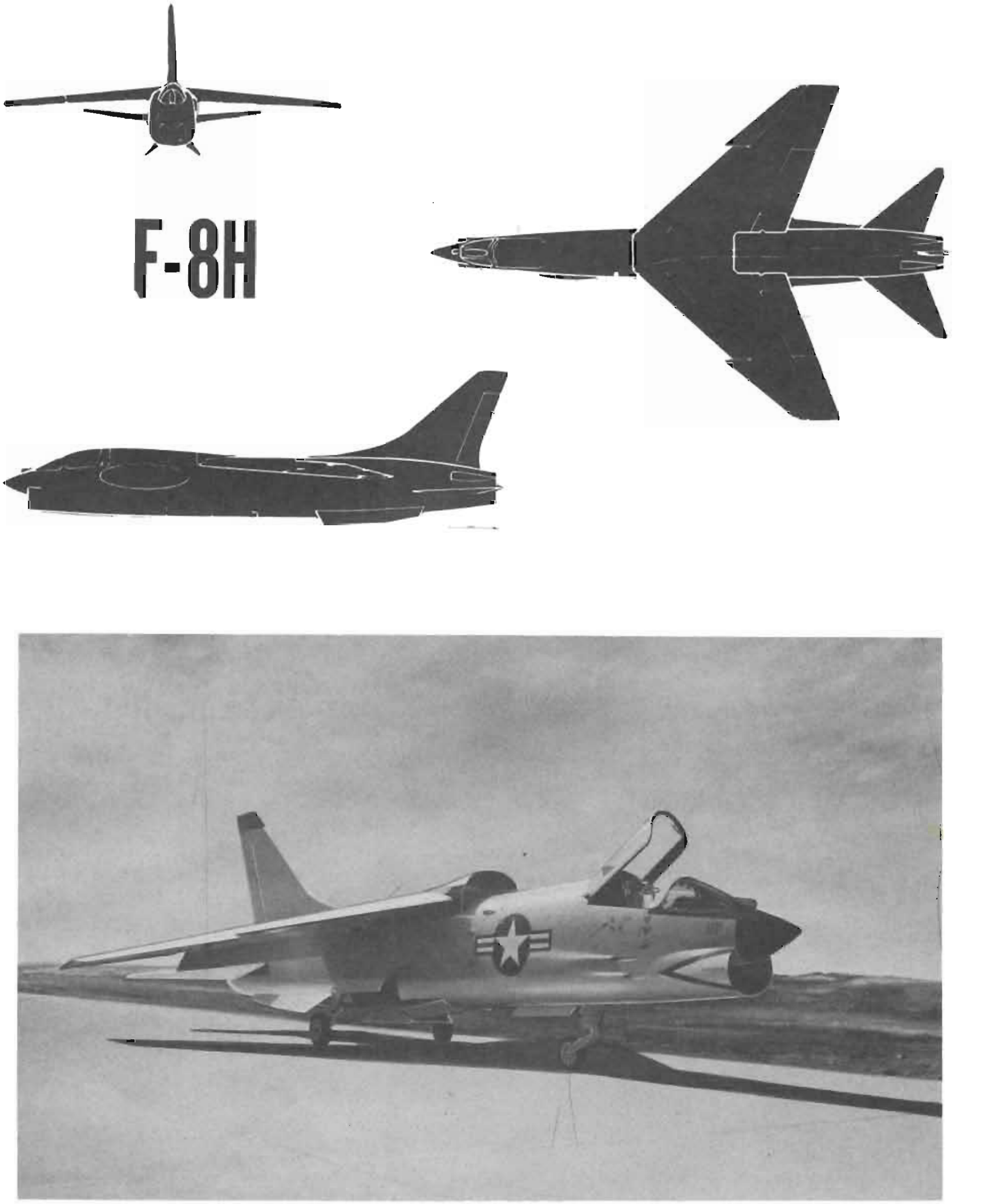
Revised text is indicated by a black vertical line in either margin of the page, like the one printed next to this paragraph. The change symbol shows where there has been a change. The change might be material added or information restated.

SERVICE CHANGE SUMMARY

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

Service Change (Type Change and Change Number)	*Description*	*Visual Identification*
Aviation Clothing and Survival Equipment Bulletin 22-61	Modifies MK-F5 ejection seat to provide a ground-level escape capability and redesignates to MK-F5A	Orange decal on LH side of drogue parachute container with minimum ejection capability and "ACSEB 22-61" printed thereon
Aircrew Systems Change No. 19	Incorporates visual indicator type top latch mechanism and visual ejection seat alignment indicators for verifying security of the ejection seat installation in the aircraft	Visual indicating type top latch mechanism and red-painted trip rods for the drogue gun and timed release mechanism
Aircrew Systems Change No. 56	Adds indicator on bottom of drogue gun firing mechanism for verifying that firing mechanism is cocked	Presence of indicator
Airframe Change No. 487	Adds circuit to flash radar scope indicator lights, warning pilot of low altitude or fire during "head in boot" flying	
Airframe Change No. 490 (Part IV)	Adds Shoehorn India equipment to F-8H aircraft	Adds ECM control panels to right-hand console
Airframe Change No. 491	Converts MK-F5A seat to MK-F7 designation by adding a rocket capability and an RSSK-6 survival kit. Modified seat provides an improved escape envelope for ejection at minimum altitude and airspeed	Decal on left-hand side of seat headbox reads "MK-F7" and indicates seat capability
Airframe Change No. 493	Add stores release switch and 3-position gun switches	Presence of 3-position gun switches above the left-hand console
Airframe Change No. 499	Provides protective armor in fuselage and vertical tail. Protects critical flight control components, engine and pilot	By reference to log entry
Airframe Change No. 502	Adds speech security equipment to F-8H aircraft	Adds speech security equipment controls to LH longeron switch panel
Airframe Change No. 503	Adds smoke abatement system	Presence of smoke abatement switch on throttle quadrant

Service Change (Type Change and Change Number)	*Description*	*Visual Identification*
Airframe Change No. 506	Modifies armament pneumatic system and feed chutes. Minimizes pneumatic system pressure loss and reduces excessive flexure of flexible feed chutes	Presence of manual control valve adjacent to the vent screen in each gun bay
Martin-Baker ECP 159	Raises altitude limiter minimum altitude for barostatic opening of parachute from 10,000 feet to 11,500 feet	ECP 159 entry in ejection seat logbook
Airframe Change No. 520	Installs check valves at UHT actuators to reduce the violence of pitchover at the time of complete loss of both pc systems. Provides pilot additional time and more favorable g environment for ejection.	



AX-146-2-67

Figure 1–1

section I
aircraft

CONTENTS

PART 1 — AIRCRAFT AND ENGINE

PART 2 — SYSTEMS

CONTENTS (Continued)

PART 3 — AIRCRAFT SERVICING AND HANDLING

PART 4 — AIRCRAFT OPERATING LIMITATIONS

PART 1—AIRCRAFT AND ENGINE

AIRCRAFT

DESCRIPTION

The F-8H is a single-place, carrier- or land-based supersonic aircraft equipped with radar to provide an all-weather combat capability. The airplane is equipped to carry wing stores which further increases its combat capability.

The aircraft (figure 1–1) is identified by a long slender fuselage with a large air intake duct mounted under the nose section, and two ventral fins mounted on the lower aft section. A thin, swept-back, two-position wing is mounted high on the fuselage and is raised for takeoff and landing. The wing contains an integral fuel cell and incorporates flaps, ailerons (which also serve as flaps when the wing is raised) and a full-span leading edge droop. The entire horizontal tail moves as a unit to provide elevator control. A single, large speed brake is mounted on the fuselage underside just forward of the main landing gear. Figure 1–2 presents the general arrangement of the aircraft.

Cockpit instrument board and consoles are illustrated in figures 1–3 through 1–5.

After AFC 499 provisions are made for the installation of armor plating in the nose bulkhead area, cockpit area, engine gear box and accessory area, and around power control units in the empennage and wing.

PRINCIPAL DIMENSIONS AND WEIGHT

Wing	
Span, maximum	35 ft 8 in.
Span, wings folded	22 ft 6 in.
Chord (streamwise)	
At root	16 ft 10 in.
At construction tip (theoretical extended section at tip)	4 ft 8 in.
Mean geometric	141.4 in.
Incidence at mean aerodynamic chord	–1°
Sweepback of ¼ chord line	42°
Dihedral	–5°
Aspect ratio	3.4
Tail	
Horizontal	
Span	18 ft 2.4 in.
Sweep of ¼ chord line	45°
Dihedral	5° 25′
Aspect ratio (including enclosed fuselage area)	3.5
Vertical	
Sweep of ¼ chord line	45°
Aspect ratio	1.5
Height (overall, static ground position; this height will not be exceeded with the wings folded)	15 ft 9.1 in.
Length (overall, static ground position)	55 ft 3.2 in.
Approximate weight (less usable fuel, ammunition, pylons and stores, and pilot)	19,800 lb*

Note

Refer to AN 01-1B-40, Handbook of Weight and Balance for specific airplane weight.

*Includes weight of following AFCs:

491 (MK-F7 Rocket Seat), 502 (Juliet), 503 (Smoke Abatement) and 506 (Improves Pneumatic System and Modifies Gun Feed Chutes)	approx 170 lb
490 (Shoehorn)	approx 350 lb
499 (Protective Armor Provisions)	approx 50 lb

(When a full load of armor plate is carried add an additional 500 lb.)

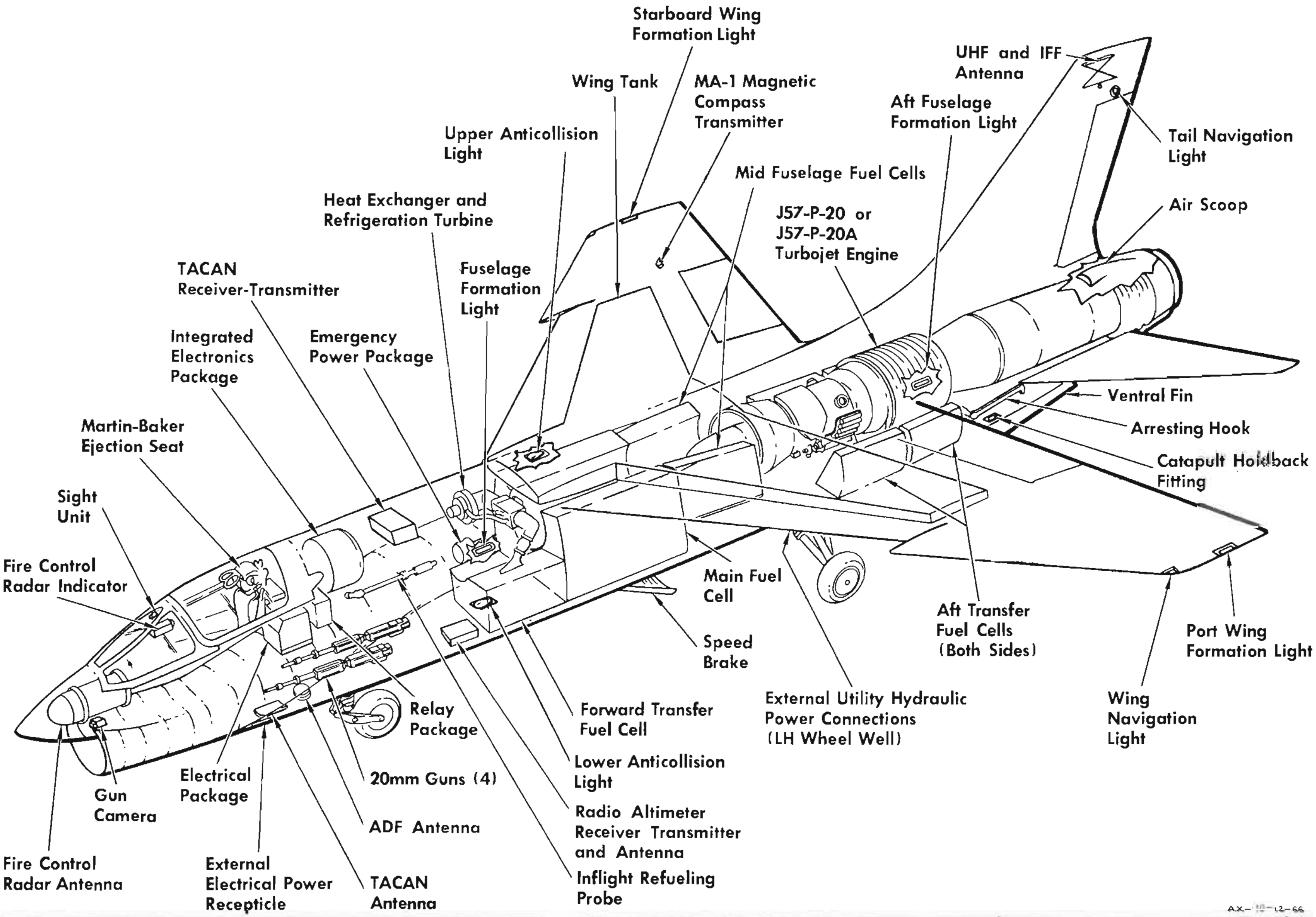
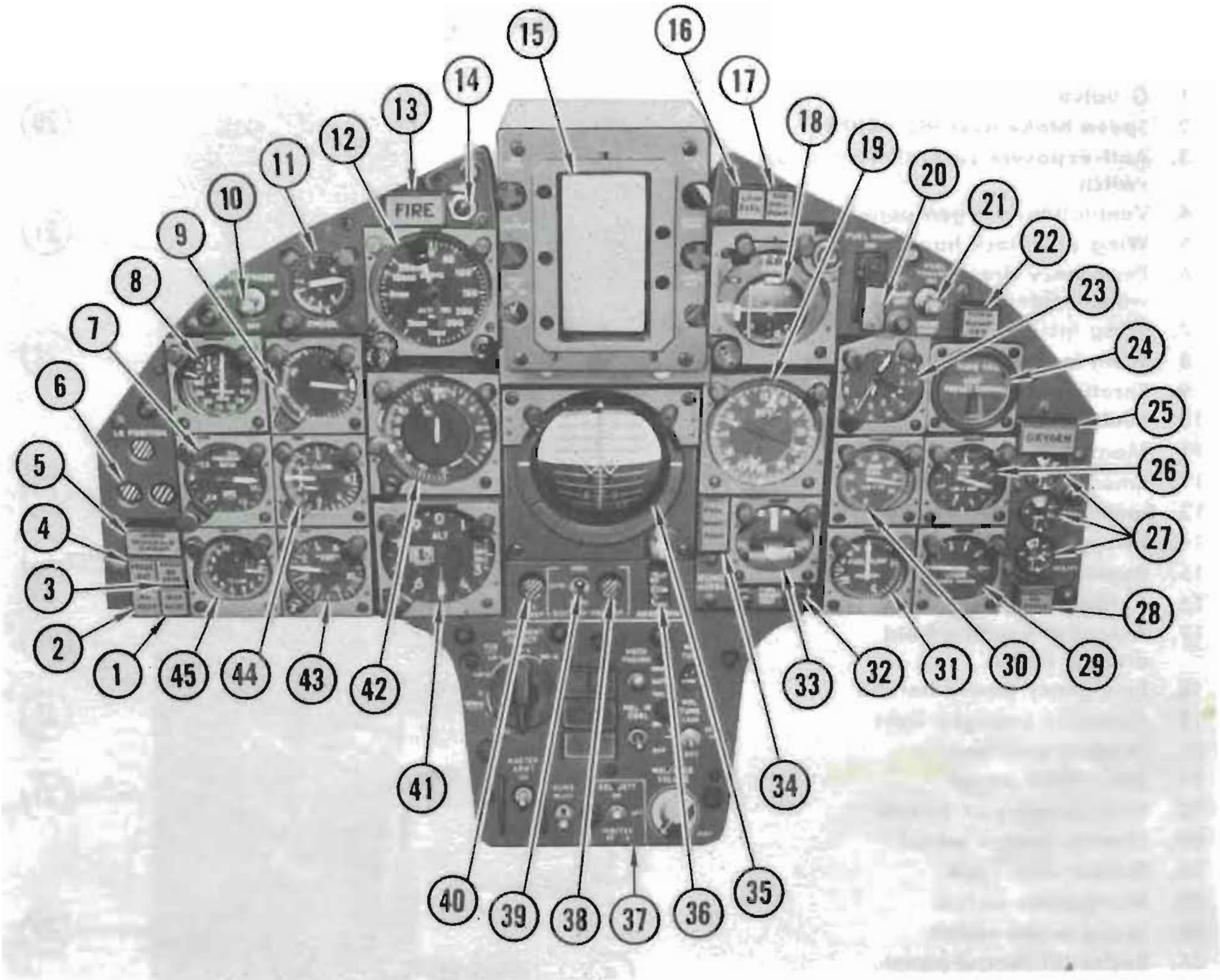

Starboard Wing Formation Light
Wing Tank
MA-1 Magnetic Compass Transmitter
UHF and IFF Antenna
Aft Fuselage Formation Light
Tail Navigation Light
Upper Anticollision Light
Mid Fuselage Fuel Cells
Heat Exchanger and Refrigeration Turbine
J57-P-20 or J57-P-20A Turbojet Engine
Air Scoop
TACAN Receiver-Transmitter
Fuselage Formation Light
Integrated Electronics Package
Emergency Power Package
Ventral Fin
Arresting Hook
Martin-Baker Ejection Seat
Catapult Holdback Fitting
Sight Unit
Fire Control Radar Indicator
Main Fuel Cell
Speed Brake
Aft Transfer Fuel Cells (Both Sides)
Port Wing Formation Light
Relay Package
Forward Transfer Fuel Cell
External Utility Hydraulic Power Connections (LH Wheel Well)
Wing Navigation Light
Electrical Package
Gun Camera
20mm Guns (4)
Lower Anticollision Light
ADF Antenna
Radio Altimeter Receiver Transmitter and Antenna
Fire Control Radar Antenna
External Electrical Power Recepticle
TACAN Antenna
Inflight Refueling Probe

Figure 1–2

INSTRUMENT BOARD



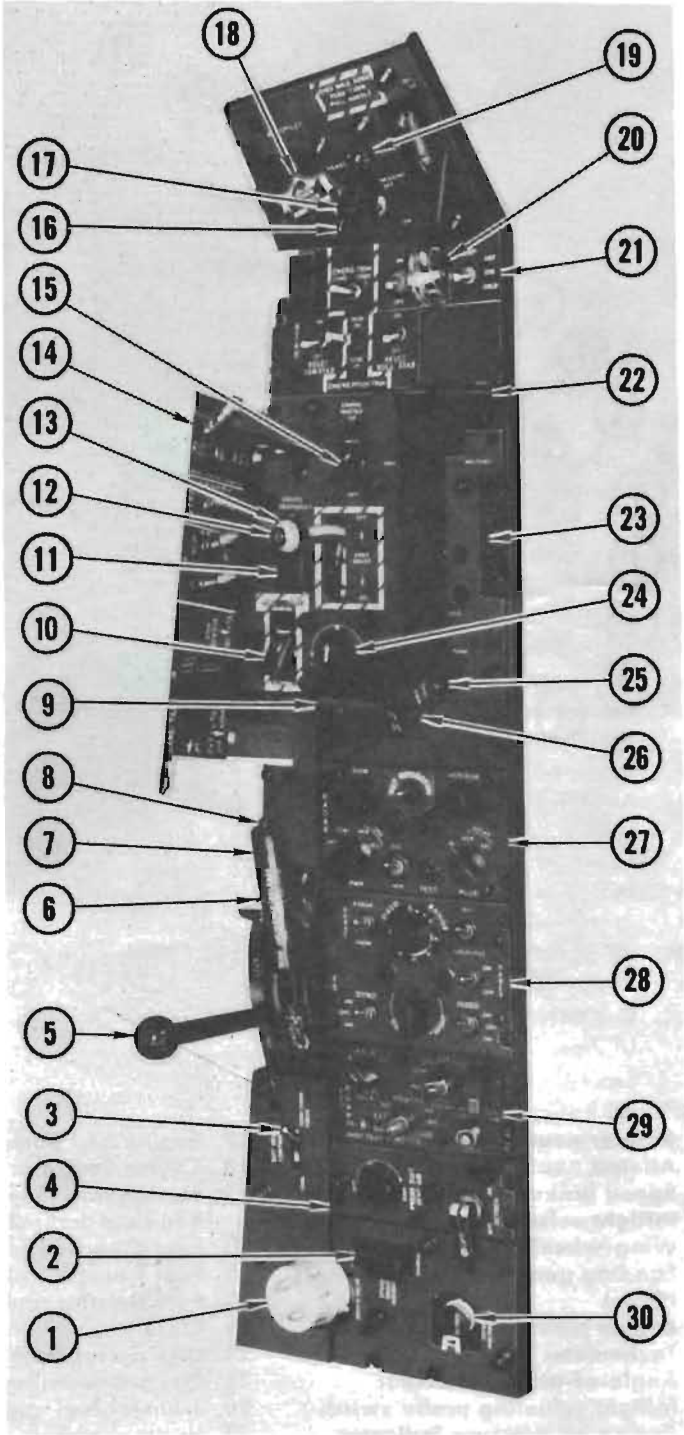
1. Rudder neutral trim light
2. Aileron neutral trim light
3. Speed brake light
4. Inflight refueling probe light
5. Wing-wheels-droop warning light
6. Landing gear position indicators (three)
7. Engine pressure ratio indicator
8. Tachometer
9. Angle-of-attack indicator
10. Inflight refueling probe switch
11. Engine oil pressure indicator
12. Radio altitude indicator
13. Fire warning light
14. Fire warning test switch
15. Fire control radar scope*
16. Fuel low-level warning light
17. Engine fuel pump warning light
18. Course indicator
19. Navigation (bearing-distance-heading) indicator
20. Fuel dump switch
21. Fuel transfer switch
22. Fuel transfer pump caution light
23. Clock
24. UHF preset channel indicator
25. Oxygen warning light
26. Transfer fuel quantity indicator
27. Hydraulic pressure indicators
28. Engine oil and hydraulic pressure warning light
29. Liquid oxygen quantity indicator
30. Main fuel quantity indicator
31. Fuel flow indicator
32. Fuel quantity test switch
33. Turn-and-bank indicator
34. Fuel boost pumps warning light
35. Attitude indicator
36. Nose trim indicator
37. Armament panel
38. Duct bypass door indicator
39. Duct bypass door switch
40. Leading edge droop indicator
41. Altimeter
42. Airspeed-Mach number indicator
43. Acceleration indicator
44. Rate-of-climb indicator
45. Exhaust temperature indicator

AX-5-12-66

Figure 1–3

LEFT CONSOLE

1. G valve
2. Speed brake override switch
3. Anti-exposure coverall ventilation switch
4. Ventilation/oxygen panel
5. Wing downlock handle
6. Emergency droop and wing incidence guard
7. Wing incidence handle
8. Wing incidence release switch
9. Throttle
10. Fuel control switch
11. Manual fuel control light
12. Emergency brake handle
13. Smoke abatement switch
14. Left-hand switch panel
15. Engine master switch
16. Autopilot master switch
17. Autopilot heading hold disable switch
18. Emergency power handle
19. Autopilot engaged light
20. Landing gear handle
21. APC/TRIM panel
22. Throttle catapult handle
23. Throttle friction wheel
24. Rudder trim knob
25. Microphone switch
26. Speed brake switch
27. Radar set control panel
28. Fire control panel
29. Fuse control panel
30. Oxygen disconnect

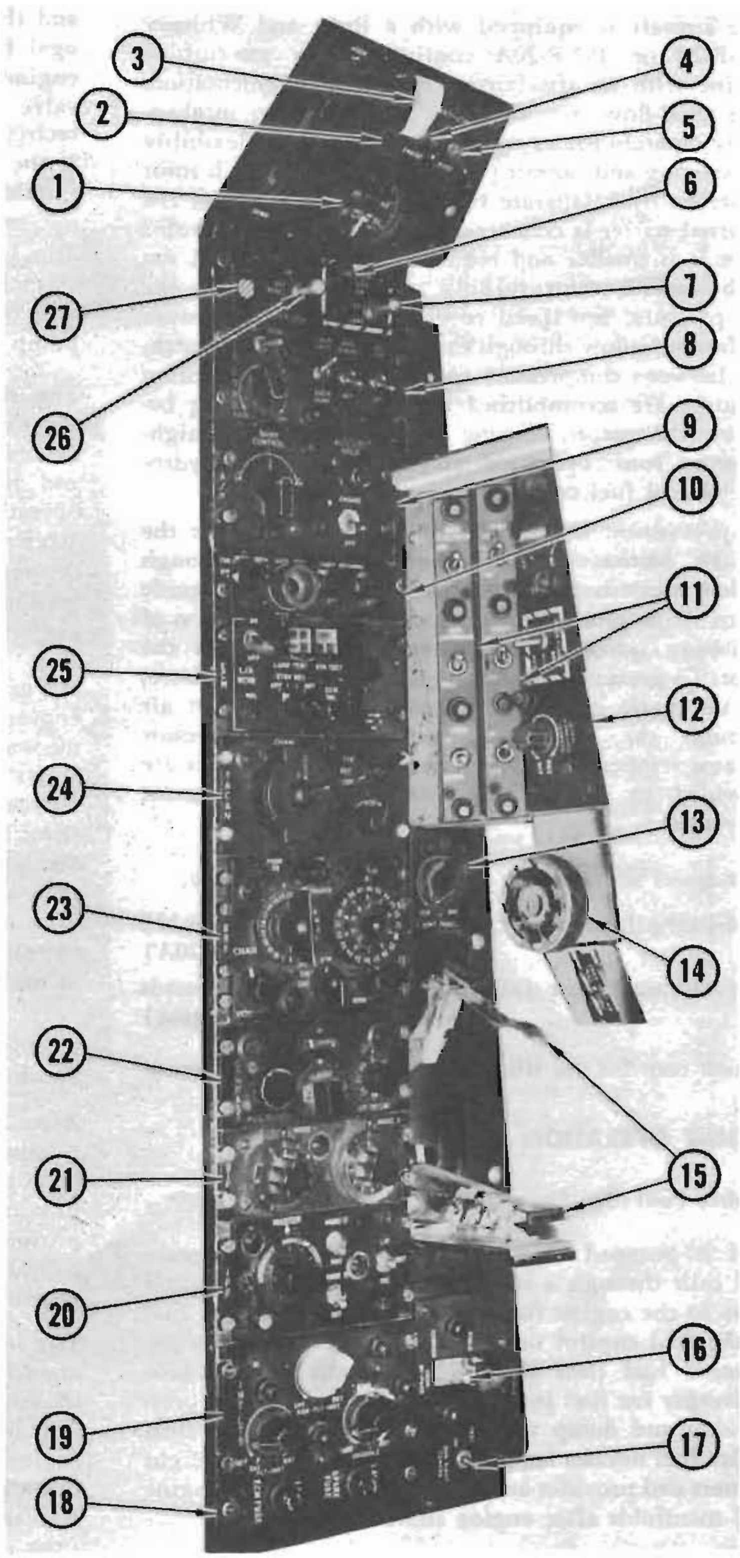


AX-7-10-67

Figure 1-4

RIGHT CONSOLE

1. Cockpit pressure altimeter
2. Engine anti-icing indicator lights
3. Arresting gear handle
4. Engine anti-icing switch
5. Pitot heat switch
6. Emergency power indicator light
7. Emergency generator switch
8. Air-conditioning panel
9. Autopilot control panel
10. Chaff dispenser control panel
11. Exterior lights control panel
12. Interior lights control panel
13. Armament panel dimming knob
14. Cockpit emergency air ventilation knob
15. Wingfold controls
16. Approach light hook bypass switch
17. Gunsight camera test switch
18. ECM fuse panel
19. Instrument-console light panel
20. IFF panel
21. Coder (SIF) group panel
22. Compass panel
23. UHF panel
24. TACAN panel
25. ECM control panel
26. Master generator switch
27. Main generator indicator



AX-6-10-67

Figure 1–5

ENGINE AND AFTERBURNER

DESCRIPTION

The aircraft is equipped with a Pratt and Whitney J57-P-20 or J57-P-20A continuous-flow gas-turbine engine with an afterburner for thrust augmentation. The axial-flow compressor is split into two mechanically separate rotors which provide greater flexibility for starting and permit part load operation. Each rotor is driven by a separate turbine. During starting, the external starter is connected to the high-pressure rotor since it is smaller and requires less torque. With the high-pressure rotor turning at governed speed, the low-pressure, low-speed rotor rotates so as to ensure optimum airflow through the compressor. Flow matching between compressors and turbines and prevention of surge are accomplished by interstage bleeding between the rotors. Engine speed is based on high-pressure rotor operation and is varied by a hydro-mechanical fuel control unit.

Ice prevention is provided by hot air, bled from the diffuser section of the engine and routed through hollow sections in the engine inlet struts and guide vanes. An engine anti-icing switch permits selection of anti-icing system operation at the discretion of the pilot. To prevent an excessive decrease in performance, an automatic regulator reduces the flow of hot air through the anti-icing system when compressor exhaust temperature rises. Cockpit indicator lights are provided to reduce the possibility of inadvertent operation.

Test stand static thrust ratings of the engine are:

Military thrust..................10,700 pounds (J57-P-20)
11,400 pounds (J57-P-20A)

Maximum thrust (afterburner)..........18,000 pounds (either engine)

Engine controls are illustrated and described in figure 1-6.

ENGINE OPERATION

Engine Fuel *(See figure 1–7.)*

Fuel is pumped from the main and forward main fuel cells through a motor-driven engine fuel shutoff valve to the engine fuel pump. The pump directs fuel to the fuel control unit for automatic fuel metering. Metered fuel then passes through the oil-fuel heat exchanger for fuel preheating and oil cooling. A pressurizing and dump valve directs the fuel to six dual orifice fuel nozzles for atomization in each of the eight burners and provides an overboard drain for the engine fuel manifolds after engine shutdown.

The engine-driven fuel pump serves both the engine and the afterburner. The pump consists of a centrifugal booster stage and separate gear stages for the engine and afterburner. The pump mounts a transfer valve which routes afterburner fuel to an internal recirculating line when the afterburner is not in use. If the engine stage of the pump fails completely, the transfer valve automatically transfers afterburner stage output to the engine fuel control unit and reduces fuel flow to the afterburner fuel control unit during high thrust conditions. Complete failure of the engine stage will be indicated by illumination of the engine fuel pump warning light.

The fuel control unit provides a speed governing control by metering fuel to compensate for variations in ambient conditions, compressor inlet temperature, and burner pressure to maintain optimum engine operation for various throttle settings. During rapid acceleration, the unit limits fuel flow to prevent surge, overtemperature and overpressure. During rapid deceleration, a minimum fuel flow is maintained to prevent engine flameout.

If a malfunction occurs in the automatic metering unit, engine operation may be continued by switching to manual fuel control. With the fuel control switch in MANUAL, all automatic fuel metering functions are reduced and fuel flow is manually controlled by throttle movement. Care should be exercised when accelerating. Compressor stalls and overtemperature may result if throttle movement is too rapid. At normal climb airspeeds, EGT will increase with an increase in altitude. Throttle settings must be reduced as necessary to remain within allowable EGT limits.

Smoke Abatement

After AFC 503 a smoke abatement system is provided to minimize visual detection during tactical operations by eliminating gas turbine engine exhaust smoke. Approximately one gallon of usable Combustion Improver -2 (CI-2) additive, contained in a tank in the right-hand engine bay, is injected into the main fuel system on pilot demand for this purpose.

The smoke abatement additive is introduced into the main fuel system between the engine shutoff valve and the engine driven fuel pump. (See figure 1–7). A continuous flow of fuel from the pressure side of the engine fuel pump through an injector provides the force, or motive flow, necessary to inject the additive. A solenoid valve is installed between the CI-2 tank and the injector. This solenoid valve is controlled at pilot's discretion by an OFF-ON switch located on the throttle quadrant.

Note

Flight operation or servicing of the smoke abatement system is not recommended if, before starting the engine, the surface air temperature is 30°F (–1.1°C) or less. The problem is created by the fact that CI-2 freezes to a solid state at 28°F (–2.2°C). If the engine is started at a higher temperature and the airplane flown in to lower temperature air (such as high altitudes), the CI-2 will not freeze because of residual heat in the engine bay where the smoke abatement tank is located. If an attempt is made to use the system with the CI-2 frozen, damage is not anticipated. However, operation would be degraded.

Engine Oil *(See figure 1–8.)*

Oil is supplied from a tank by direct gravity feed to an engine-driven gear-type pump and directed to the main engine bearings and to the accessory drives for pressure lubrication.

Note

During zero or negative g conditions, oil pressure fluctuations may be apparent. The fluctuations are normal and should damp out within approximately 30 seconds after resuming positive g conditions.

The oil is pumped from the engine by six gear-type scavenge pumps. Oil temperature is stabilized by a thermostatic bypass valve which senses oil temperature and permits oil to flow through or bypass an oil-fuel heat exchanger. Oil is returned to the tank from the valve or heat exchanger.

ENGINE CONTROLS

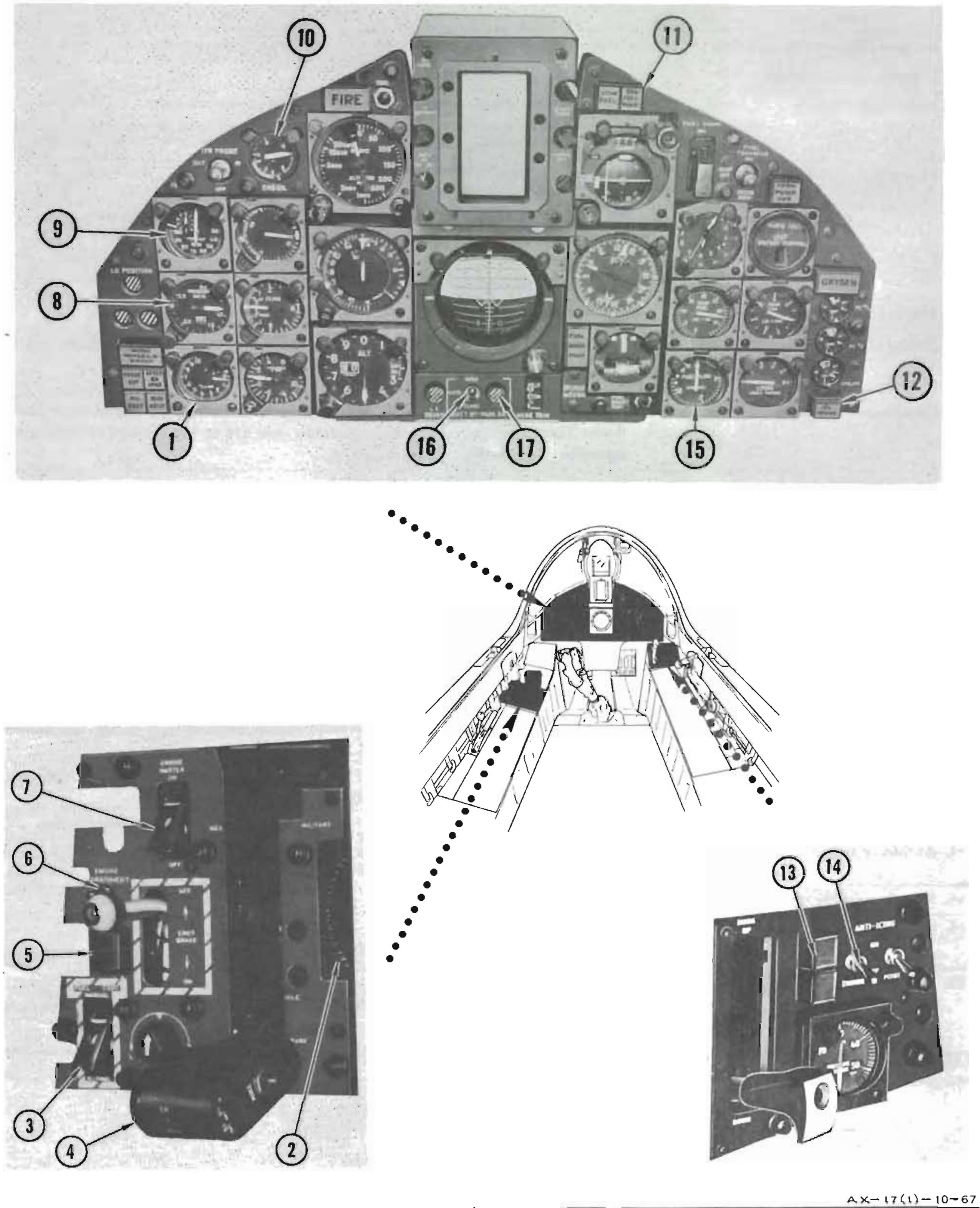


Figure 1-6 (Sheet 1)

ENGINE CONTROLS

Nomenclature	*Function*
1. Exhaust temperature indicator	Indicates average engine exhaust gas temperature in degrees centigrade.
2. Throttle friction wheel	Rotate to adjust throttle friction.
3. Fuel control switch	NORMAL — activates automatic fuel metering of fuel control unit. MAN — bypasses automatic fuel metering of fuel control unit, giving manual control with throttle position. SET FOR 5M ⇒ DROP WHEN SWITCHED AT SEA LEVEL
4. Throttle	OFF — shuts off fuel flow from fuel control unit. CRANK — momentary position, initiates engine ground cranking cycle. IGNITE — momentary position, energizes ignition timer for engine starting. IDLE — adjustable stop, prevents inadvertent retarding to OFF. MILITARY — selects maximum thrust without afterburner. MAX — placed outboard, selects maximum thrust with afterburner.
5. Manual fuel control light	Light on when fuel control unit in manual throttle.
6. Smoke abatement switch†	ON — opens solenoid valve permitting CI-2 additive to be injected into main fuel system to eliminate exhaust smoke. OFF — closes solenoid valve.
Continuous engine ignition switch *	ON — momentary position, initiates engine ignition and energizes continuous ignition timer. Timer automatically shuts off ignition after 4½ to 5½ minutes of continuous operation. Switch is spring-loaded to off.
7. Engine master switch	ON — accomplishes the following: 1. Admits aircraft fuel to engine driven pump by opening engine fuel shutoff valve. 2. Energizes crank and ignite switches. 3. Energizes temperature sensing element of oil cooler door temperature control unit. 4. Energizes boost pumps. 5. Energizes fuel transfer switch.
8. Engine pressure ratio indicator	Indicates ratio of turbine outlet pressure to engine inlet pressure.
9. Tachometer	Indicates high-pressure rotor speed by percent based on 9,976 rpm as 100%.
10. Engine oil pressure indicator	Indicates oil pressure in psi.
11. Engine fuel pump warning light COMES ON @ 10.5 PSI OR LESS	On indicates insufficient fuel pressure from engine stage of fuel pump and engine operating from afterburner stage.
12. Engine oil/hydraulic pressure warning light	On indicates low pressure in one of the following systems: engine oil, utility hydraulic, or either power control hydraulic system.
13. Anti-icing indicator lights	ON — (LH ON or RH ON) indicates corresponding engine anti-icing valve is open.
14. Anti-icing switch	ON — opens two engine-mounted motor-actuated valves to permit hot engine bleed air to flow through the engine inlet guide vanes for prevention of ice formation.
15. Fuel flow indicator	Indicates rate of engine (but not afterburner) fuel flow in pounds per hour.
16. Oil cooler door switch	AUTO — normal position; system automatically controlled. OPEN and CLOSE — permits positioning of oil cooler door if automatic control fails.
17. Oil cooler door indicator	OPEN — indicates oil cooler door open. CLOSE — indicates oil cooler door closed. Barberpole indicates door in intermediate position or electrical power not connected.

*Airplanes with AFC 451 but without AFC 503 (AFC 503 changes the switch).
†Airplanes with AFC 503.

AX-17(2)-10-67

Figure 1-6 (Sheet 2)

ENGINE FUEL

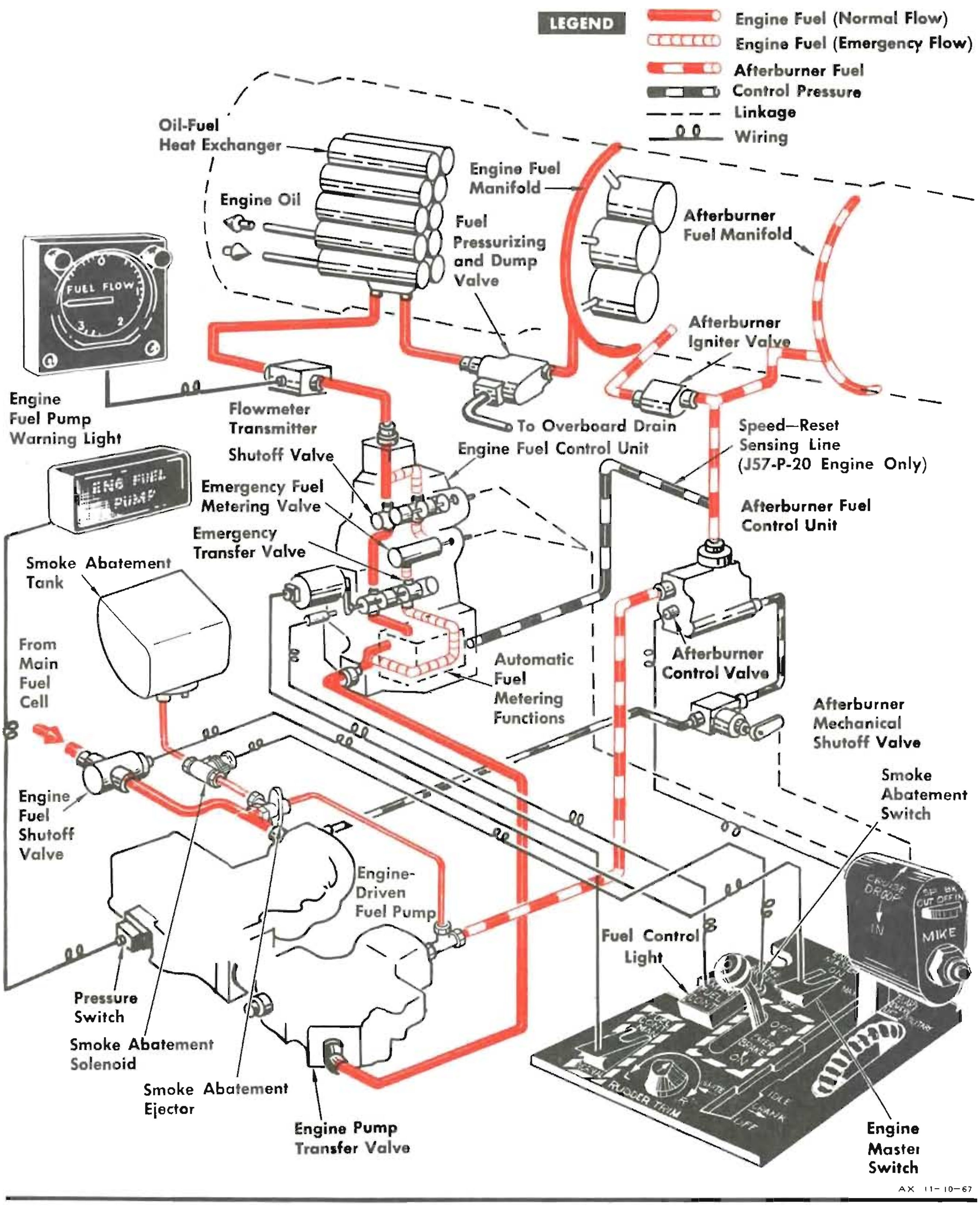


Figure 1–7

ENGINE OIL

USE MIL L 23699 OR MIL L 7808 CDE

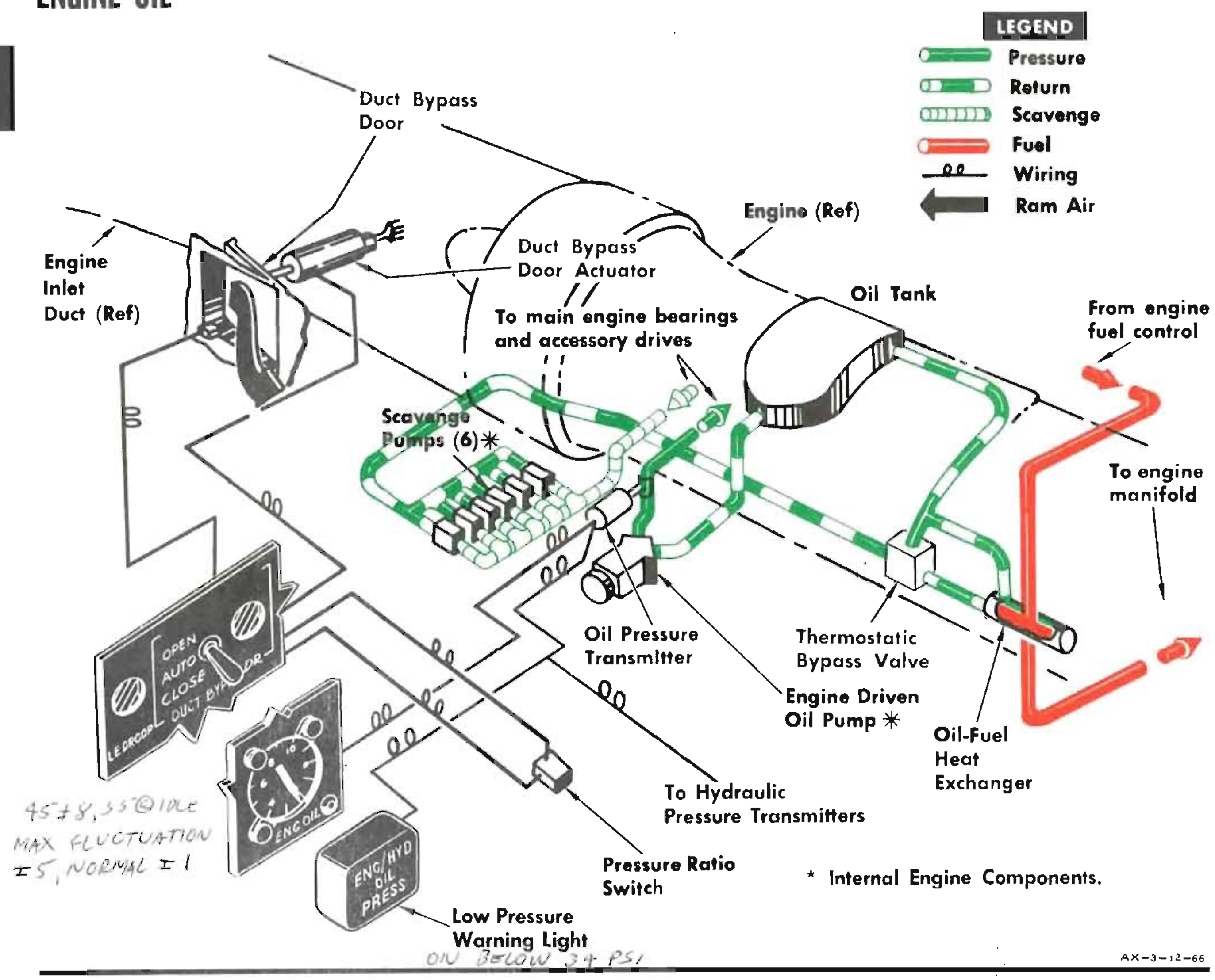


Figure 1–8

A low pressure warning light comes on in the cockpit when the oil pressure drops below 34 psi. The warning light also indicates a low-pressure condition in the power control or utility hydraulic systems. The engine and hydraulic pressure indicators should be referred to when the warning light comes on.

Total system capacity is 5 gallons. OIL MUST BE CHECKED WITHIN 5 MINUTES OF SCAVENGE, SERVICED IN 10.

Duct Bypass Door

The duct bypass door, formerly the oil cooler door, is opened by a pressure ratio switch to relieve ram-air pressure in the intake duct. The door opens automatically in the 1.60 to 1.74 IMN speed range unless a missile is installed on the upper left-hand dual-pylon station. A three-position switch in the cockpit provides manual control of the door. The switch is normally positioned in AUTO with the OPEN and CLOSE positions used only if the pressure ratio switch fails to position the door. Do not manually open the door if a missile is installed on the upper left-hand dual-pylon station. Opening the door under this condition will disrupt airflow into the left-hand afterburner cooling scoop. This could cause destruction of the engine exhaust nozzle through overtemperature. Duct bypass door position will be indicated in the cockpit by a duct by-pass door indicator. NO OIL COOLING FUNCTION

Engine Operating Limitations

Refer to section I, part 4 for engine operating limits.

Compressor Stalls CR ON DECK IS 10.5-1 @ 350 KTS IS 12-1

Compressor stalls result from conditions under which engine compressor blades operate at an excessive angle of attack in much the same way as stalling occurs on an airplane wing. Although compressor stalls may be caused by engine damage or accessory malfunctions, they are more commonly associated with high-altitude operation. Stalls may occur in either the high- or low-pressure compressors of the engine and are accompanied by an eventual engine speed drop to between 40% and 60% rpm. Some stalls do not make themselves known by noise or surges, but result in not being able to accelerate the engine, or loss of rpm with no movement of the throttle. At the other extreme, stalls may be characterized by severe vibration and a loud banging noise. It is often difficult at high altitude for the pilot to determine whether a compressor stall or an engine flameout has occurred; exhaust gas temperature is the most positive indicator.

Compressor stall recovery may be accomplished by retarding the throttle to idle to reduce the amount of fuel admitted to the engine and increasing airspeed to admit more air into the engine. It may be necessary to sacrifice as much as 10,000 feet to obtain recovery below 50,000 feet and even more at higher altitudes. Exhaust gas temperature must be monitored and if it exceeds the limits, the engine must be shut down.

Airstart may be accomplished as soon after shutdown as practical. However, increased airspeed and lower altitude are favored for the relight. Aircraft electrical power will be available if engine windmilling speed is high enough (at 220 KIAS the generator drops off the line 8 to 10 seconds after flameout); otherwise, the emergency power package should be extended. Engine windmilling speed is presented in figure 1–9. Cockpit pressurization may fluctuate as ignition occurs.

Acceleration stalls, or "chug stalls," are not normally experienced in this aircraft. If unstable engine conditions persist and exhaust temperature does not return to normal following a stall, land as soon as practical. Continued engine operation with unstable engine conditions is dangerous. RAM EFFECT CAUSE + DUCT PRESSURE @ 450 KTS & ABOVE

AFTERBURNER OPERATION

Afterburner operation is initiated when the microswitch in the throttle quadrant is actuated by placing the throttle outboard in the afterburner detent. The switch energizes a solenoid in the afterburner fuel control unit permitting fuel to flow through the control unit. The afterburner fuel control unit automatically meters this fuel for changes in burner pressure as affected by throttle movement and altitude changes. The metered fuel is then directed to the afterburner fuel nozzles and to the afterburner igniter valve. The igniter valve directs a charge of this fuel into number 3 burner can. A flame streak then passes through the turbine into the afterburner section and ignites the fuel discharged by the afterburner fuel nozzles. At the same time, the igniter valve sends a compressor bleed air signal to the afterburner exhaust nozzle control to open the exhaust nozzles. The afterburner is normally ignited at MILITARY thrust; however, it may be ignited at any point above the afterburner aft detent stop.

A speed-reset feature is incorporated in the J57-P-20 engine to provide automatic retrimming of the engine fuel control for optimum afterburner conditions. A fuel pressure sensing line senses afterburner fuel control outlet pressure and causes a servomechanism in the engine fuel control unit to increase the engine fuel flow when afterburning is initiated. Significant increases in engine pressure ratio, engine speed, and turbine outlet temperature occur when speed-reset occurs. J57-P-20A engines have no speed-reset feature, but are uptrimmed to equal J57-P-20 performance in afterburner and to exceed it in military thrust setting. Normally, no trim changes are associated with afterburner ignition but an immediate increase in airspeed will be evident at all altitudes. Thrust may be varied during afterburner operation by varying throttle position in the afterburner detent.

STABILIZED ENGINE WINDMILLING SPEED —

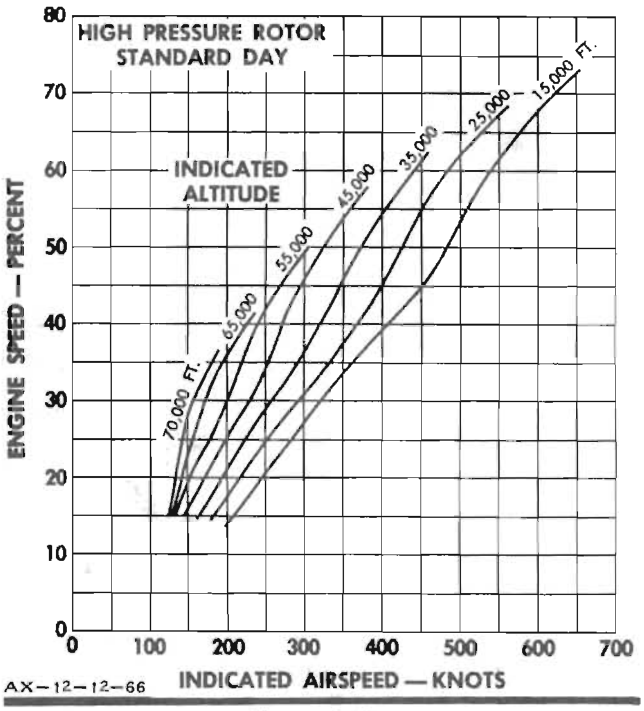


Figure 1–9

AFTERBURNER EXHAUST NOZZLE

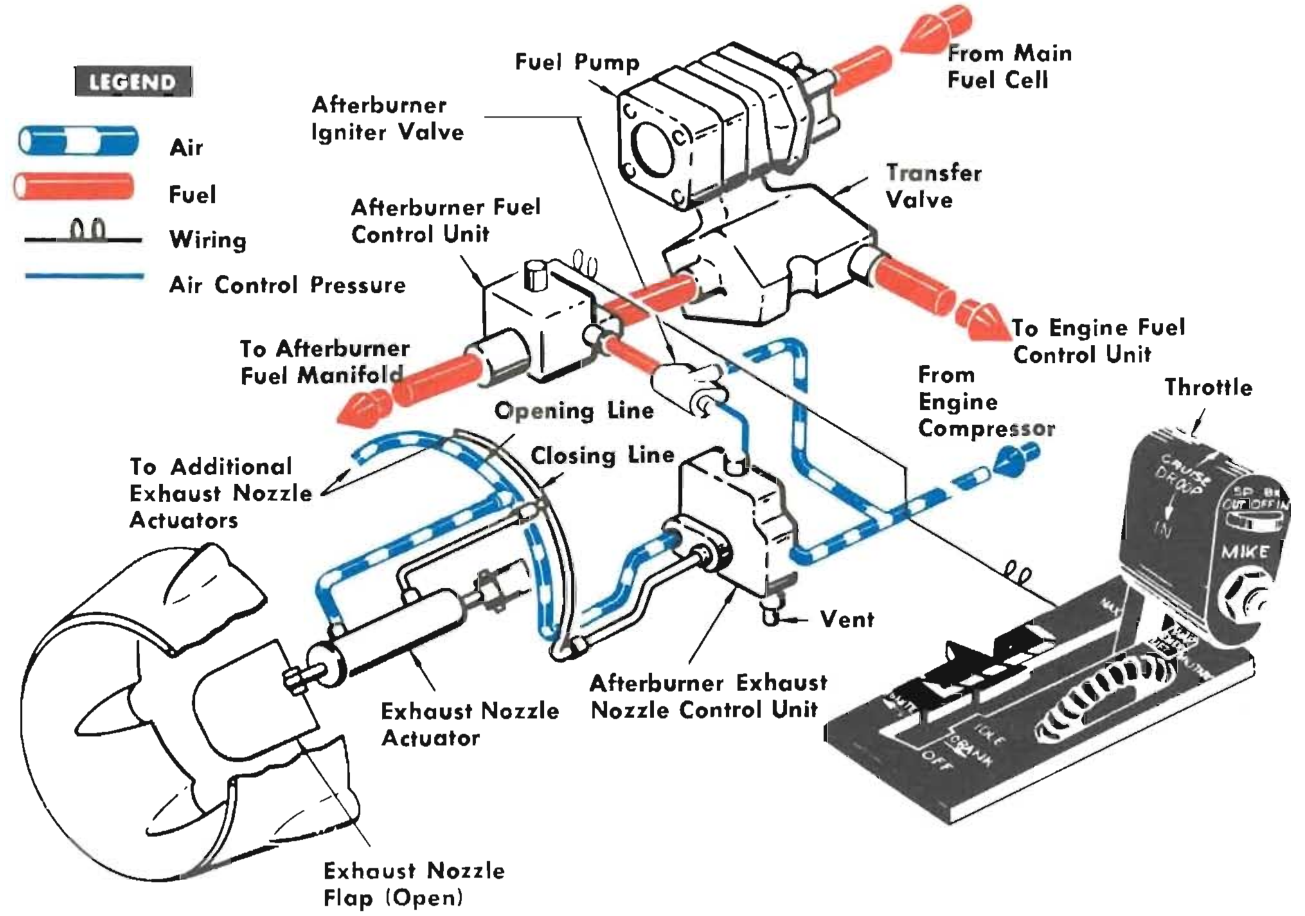


Figure 1–10

At, or above, an altitude of approximately 40,000 feet, afterburner lightoff may not be obtained on the first attempt using JP-4 fuel. If first attempt is unsuccessful, place throttle in MILITARY and wait 15 seconds before reselecting afterburner. This delay is necessary because vaporization of JP-4 in the fuel manifold creates a pressure which resists recycling of the afterburner igniter. This delay is not necessary when using the less volatile JP-5 fuel. A relight should be obtained within two attempts if the engine is operating normally. Afterburner lightoff is most reliable above 0.85 IMN and below 40,000 feet.

Afterburner Exhaust Nozzle *(See figure 1–10.)*

The exhaust nozzle area is automatically increased when an air signal from the afterburner igniter valve positions the exhaust nozzle actuator control to direct engine compressor bleed air to the eight exhaust nozzle flap actuators. The actuators are mechanically linked to the exhaust nozzle flaps and hold the flaps open during afterburner operation. When afterburner is stopped, the exhaust nozzle control unit directs air to the actuators to close the flaps and hold them closed. If the exhaust nozzle fails to close, there will be a thrust loss of approximately 20% at MILITARY. In such a case, throttle settings approximately 3% to 5% rpm higher will be required to maintain approach thrust. Selection of afterburner will restore full-thrust operation if required for a wave-off. The exhaust nozzle flaps open automatically whenever the throttle is at the IDLE stop and close when the throttle is advanced out of IDLE.

The engine is equipped with a nozzle-closed lightoff (NCL) system. The NCL system, installed primarily to improve lightoff characteristics at high altitudes, prevents momentary loss of thrust during afterburner lightoff at all altitudes by delaying exhaust nozzle opening until lightoff has occurred. This feature is particularly advantageous when afterburner is selected in taking a wave-off.

PART 2 — SYSTEMS

AIR-CONDITIONING

DESCRIPTION

The air-conditioning system provides the following services:

- Cockpit temperature control and pressurization.
- Ventilation for the anti-exposure coverall.
- Windshield defogging and rain removal.
- Automatic pressurization and cooling of the integrated electronic package.
- Automatic cooling of the unpressurized electronic compartment.
- Automatic pressurization of the fuselage fuel cells and wing tank.
- Automatic pressurization and cooling of the radar set.

Hot bleed air from the engine compressor section is directed through the air-conditioning unit which cools this air by means of a heat exchanger and an expansion-turbine refrigeration unit. The heat exchanger reduces the temperature of the engine bleed air by transferring heat through coils to ram air from the engine intake duct. The refrigeration unit further cools some of the warm air from the heat exchanger by expansion through the turbine.

Air flow to the air-conditioning unit is shut off by the bleed air shutoff valve when the pilot dumps cockpit pressure, resulting in loss of all air-conditioning and pressurization functions except for radar and pressurized electronics package pressurization.

The temperature of the air entering the cockpit is controlled by mixing hot air from the temperature control bypass valve with cold air from the turbine. When automatic control is selected, the cockpit temperature controller automatically regulates operation of the bypass valve to maintain the temperature selected by the pilot. With manual control selected, the pilot controls the bypass valve directly by adjusting the cockpit temperature knob for each change in flight conditions.

The cockpit air pressure regulator automatically regulates pressurization of the cockpit at altitudes above 8,000 feet by limiting outflow of air into the nose cone. (See figure 1–11 for cockpit pressurization schedule.)

The cool air that passes through the cockpit air pressure regulator is vented overboard through vents in the nose cone. Negative cockpit pressure is automatically limited to 0.25 psi maximum, and positive pressure is automatically limited to 5.5 psi maximum by the cockpit air safety valve. This valve also opens to depressurize the cockpit when the pilot elects to dump cockpit pressure.

COCKPIT PRESSURIZATION

AIR COND SWITCHES ARE PNEUMATICALLY OPERATED ⇒ ELEC PWR NOT REQ. CP TEMP GOES FULL COLD WHEN USING RAT SO GET DEFOG ON AS SOON AS RAT GOES OUT.

RAIN REMOVE & CP TEMP ARE ONLY 2 NON PNEUM CONTROLS

ELECTRONICS COOLING ALWAYS AVAILABLE THRU RAM AIR

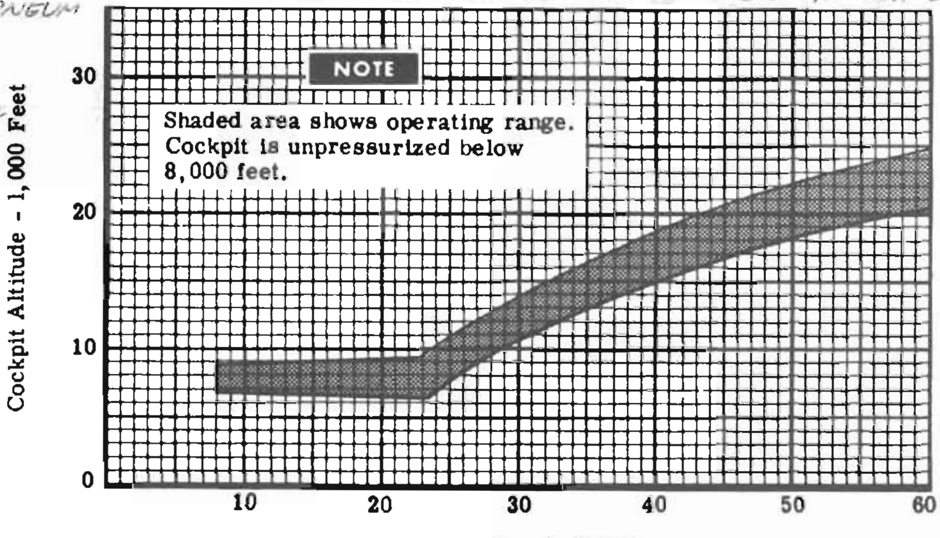


Figure 1–11

AIR CONDITIONING CONTROLS (TYPICAL)

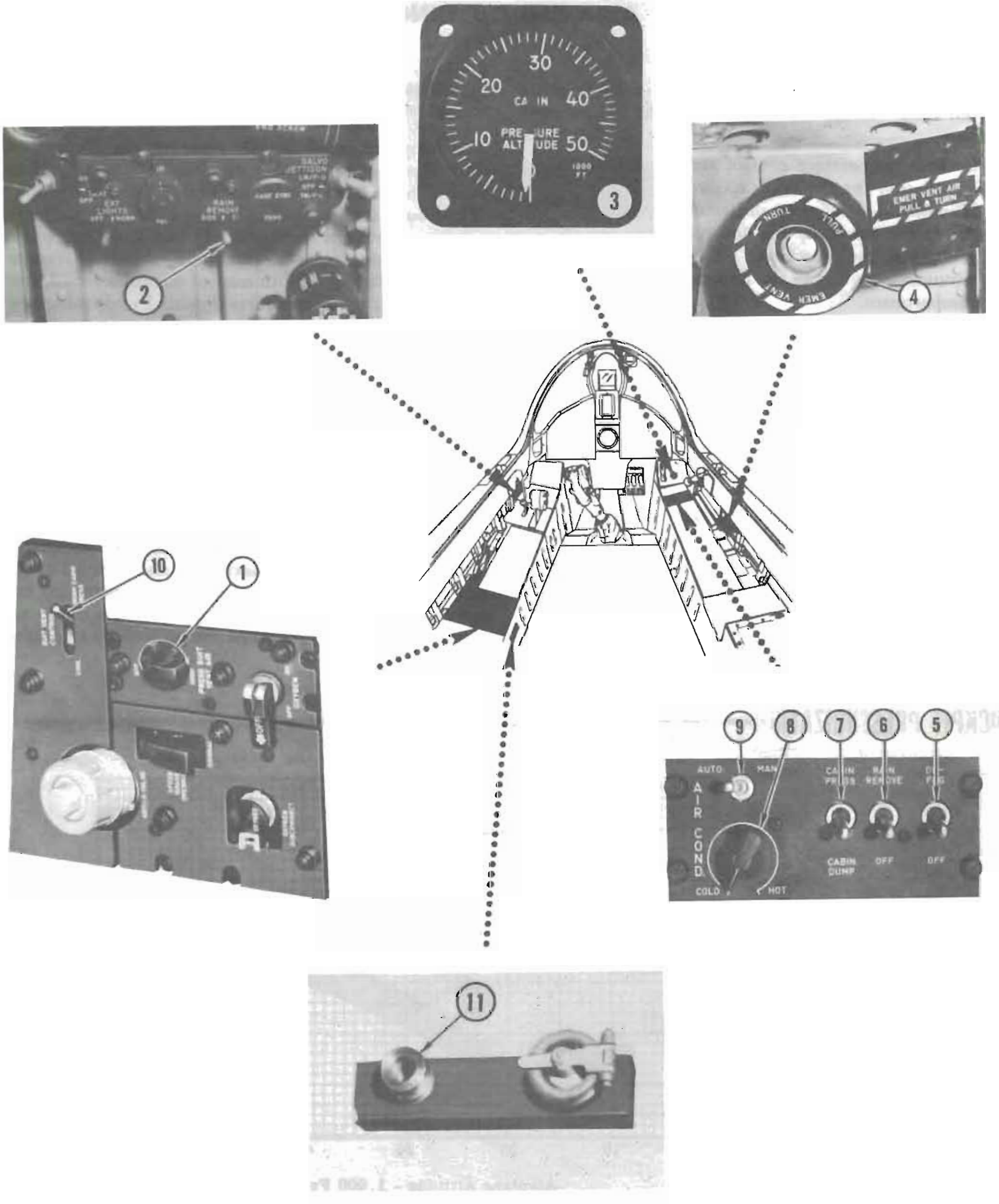


Figure 1-12 (Sheet 1)

AIR CONDITIONING CONTROLS (TYPICAL)

Nomenclature	*Function*
1. Antiexposure coverall vent valve (decaled PRESS SUIT VENT AIR)	OFF to HIGH range — regulates the volume of ventilating air flowing into the anti-exposure coverall from the air-conditioning system or from an external air supply. OFF — stops the flow of ventilating air.
2. Rain removal selector switch	SIDE — directs high velocity stream of warm air across the left-hand side panel to deflect rain. CTR — directs high velocity warm air over center windshield panel to deflect rain.
3. Cockpit pressure altimeter	Indicates cockpit pressure altitude.
4. Cockpit emergency ventilation knob	Pulled and rotated to control volume of ram airflow into cockpit for emergency ventilation.
5. Defogger switch	DEFOG — directs hot airflow to windshield and side panels through windshield manifolds.
6. Rain removal switch	RAIN REMOVE — directs high velocity stream of warm air across windshield or left-hand side panel to deflect rain.
7. Cockpit pressure switch	CABIN PRESS — provides pressurization for cockpit and air pressure for wing fuel transfer. CABIN DUMP — dumps cockpit pressure and shuts off engine bleed air to air-conditioning unit, thus stopping all airflow from air-conditioning unit.
8. Temperature knob	COLD to HOT range selects temperature of conditioned air entering cockpit and anti-exposure coverall.
9. Manual override switch	AUTO — permits cockpit inlet air temperature to be automatically controlled to the controller knob setting. MAN — permits cockpit inlet air temperature to be manually controlled by the pilot.
10. Antiexposure coverall ventilation switch (decaled SUIT VENT CONTROL)	NORM CABIN PRESS — directs temperature controlled air to both antiexposure coverall and cockpit. COOL — shuts off temperature controlled air to cockpit and directs air to antiexposure coverall.
11. Coverall ventilating air connection	Serves as receptacle for antiexposure coverall air-line.

AX-18(2)-1-67

Figure 1-12 (Sheet 2)

Compressor bleed air is directed from the engine bleed air control manifold to the radar and integrated electronics package for pressurization. Air circulation (internal cooling) within the package is provided by an internal fan. External cooling is provided by ram air circulated around the outside of the package. If pressurization is lost due to engine flameout or a system malfunction, a check valve traps the pressure in the package.

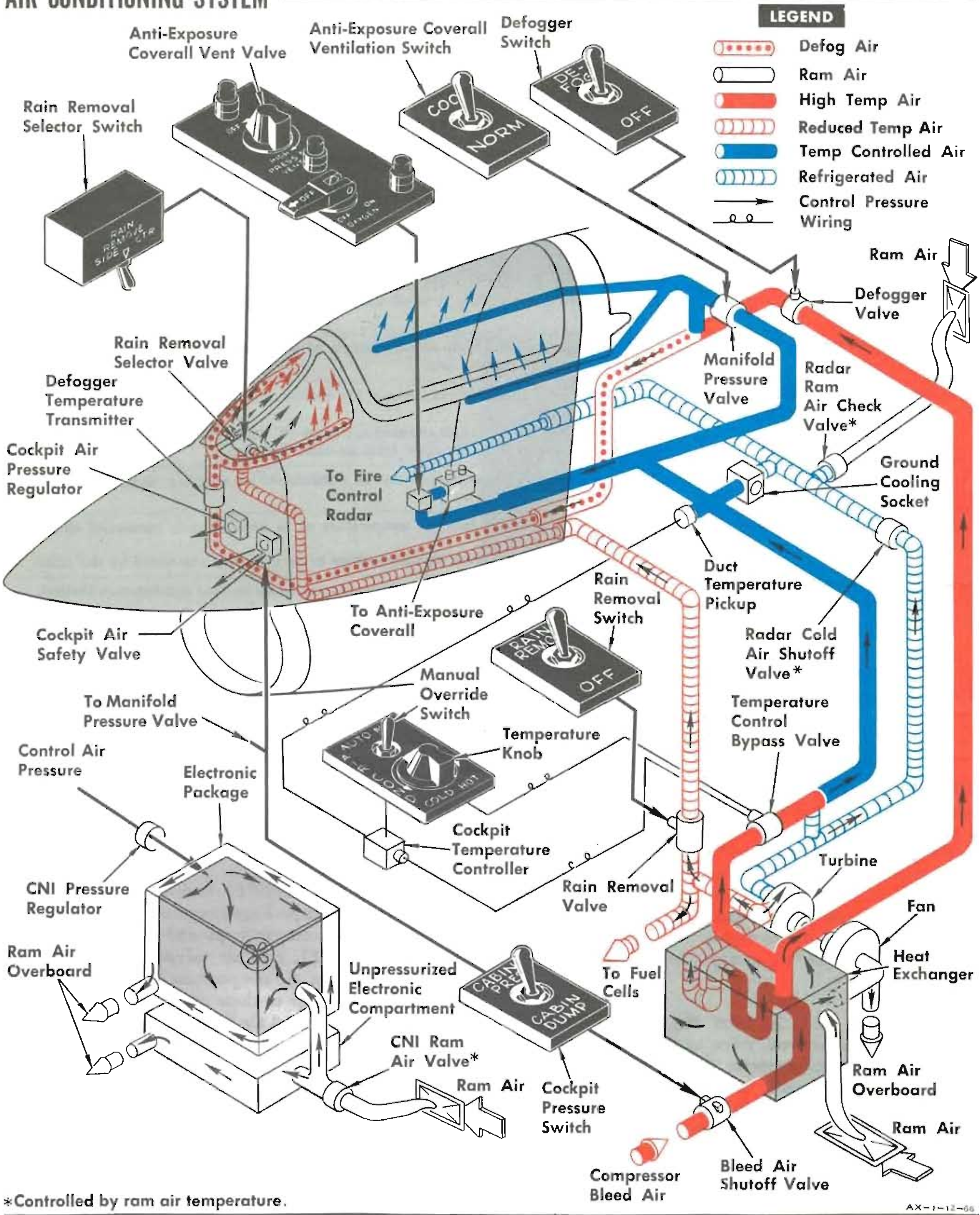
Warm air flows directly from the heat exchanger through the rain removal valve and is discharged at high velocity on the exterior of the windshield or the left-hand side panel for rain removal. Fog is removed from the inside of the windshield by directing hot air from the heat exchanger through the defogger valve and mixing this air with cool air from the air-conditioning unit. This air is then discharged on the windshield side panels through the windshield manifolds. Air from the heat exchanger is also used to pressurize the fuselage fuel cells and wing tank. (Refer to FUEL CELL PRESSURIZATION AND VENTING, this section.)

Ram air up to 60°C (140°F) is directed to cool the integrated electronics package (externally), the unpressurized electronic compartment and the radar unit. Above 60°C (140°F), ram air valves, receiving their signal from the ram air temperature transmitter, shut off the flow of ram air to these units. A radar cold air valve opens to allow cool air from the air-conditioning unit to flow to the radar.

External air for ground cooling of both the radar and the anti-exposure coverall is connected to a ground cooling socket in the radio compartment. A system schematic is presented in figure 1-13.

Air-conditioning controls are illustrated and described in figure 1-12.

AIR CONDITIONING SYSTEM



*Controlled by ram air temperature.

Figure 1–13

AIR CONDITIONING CONTROLS (TYPICAL)

Nomenclature	*Function*
1. Antiexposure coverall vent valve (decaled PRESS SUIT VENT AIR)	OFF to HIGH range — regulates the volume of ventilating air flowing into the anti-exposure coverall from the air-conditioning system or from an external air supply. OFF — stops the flow of ventilating air.
2. Rain removal selector switch	SIDE — directs high velocity stream of warm air across the left-hand side panel to deflect rain. CTR — directs high velocity warm air over center windshield panel to deflect rain.
3. Cockpit pressure altimeter	Indicates cockpit pressure altitude.
4. Cockpit emergency ventilation knob	Pulled and rotated to control volume of ram airflow into cockpit for emergency ventilation.
5. Defogger switch	DEFOG — directs hot airflow to windshield and side panels through windshield manifolds.
6. Rain removal switch	RAIN REMOVE — directs high velocity stream of warm air across windshield or left-hand side panel to deflect rain.
7. Cockpit pressure switch	CABIN PRESS — provides pressurization for cockpit and air pressure for wing fuel transfer. CABIN DUMP — dumps cockpit pressure and shuts off engine bleed air to air-conditioning unit, thus stopping all airflow from air-conditioning unit.
8. Temperature knob	COLD to HOT range selects temperature of conditioned air entering cockpit and anti-exposure coverall.
9. Manual override switch	AUTO — permits cockpit inlet air temperature to be automatically controlled to the controller knob setting. MAN — permits cockpit inlet air temperature to be manually controlled by the pilot.
10. Antiexposure coverall ventilation switch (decaled SUIT VENT CONTROL)	NORM CABIN PRESS — directs temperature controlled air to both antiexposure coverall and cockpit. COOL — shuts off temperature controlled air to cockpit and directs air to antiexposure coverall.
11. Coverall ventilating air connection	Serves as receptacle for antiexposure coverall air-line.

AX-1B(2)-1-67

Figure 1–12 (Sheet 2)

Compressor bleed air is directed from the engine bleed air control manifold to the radar and integrated electronics package for pressurization. Air circulation (internal cooling) within the package is provided by an internal fan. External cooling is provided by ram air circulated around the outside of the package. If pressurization is lost due to engine flameout or a system malfunction, a check valve traps the pressure in the package.

Warm air flows directly from the heat exchanger through the rain removal valve and is discharged at high velocity on the exterior of the windshield or the left-hand side panel for rain removal. Fog is removed from the inside of the windshield by directing hot air from the heat exchanger through the defogger valve and mixing this air with cool air from the air-conditioning unit. This air is then discharged on the windshield side panels through the windshield manifolds. Air from the heat exchanger is also used to pressurize the fuselage fuel cells and wing tank. (Refer to FUEL CELL PRESSURIZATION AND VENTING, this section.)

Ram air up to 60°C (140°F) is directed to cool the integrated electronics package (externally), the unpressurized electronic compartment and the radar unit. Above 60°C (140°F), ram air valves, receiving their signal from the ram air temperature transmitter, shut off the flow of ram air to these units. A radar cold air valve opens to allow cool air from the air-conditioning unit to flow to the radar.

External air for ground cooling of both the radar and the anti-exposure coverall is connected to a ground cooling socket in the radio compartment. A system schematic is presented in figure 1–13.

Air-conditioning controls are illustrated and described in figure 1–12.

AIR CONDITIONING SYSTEM

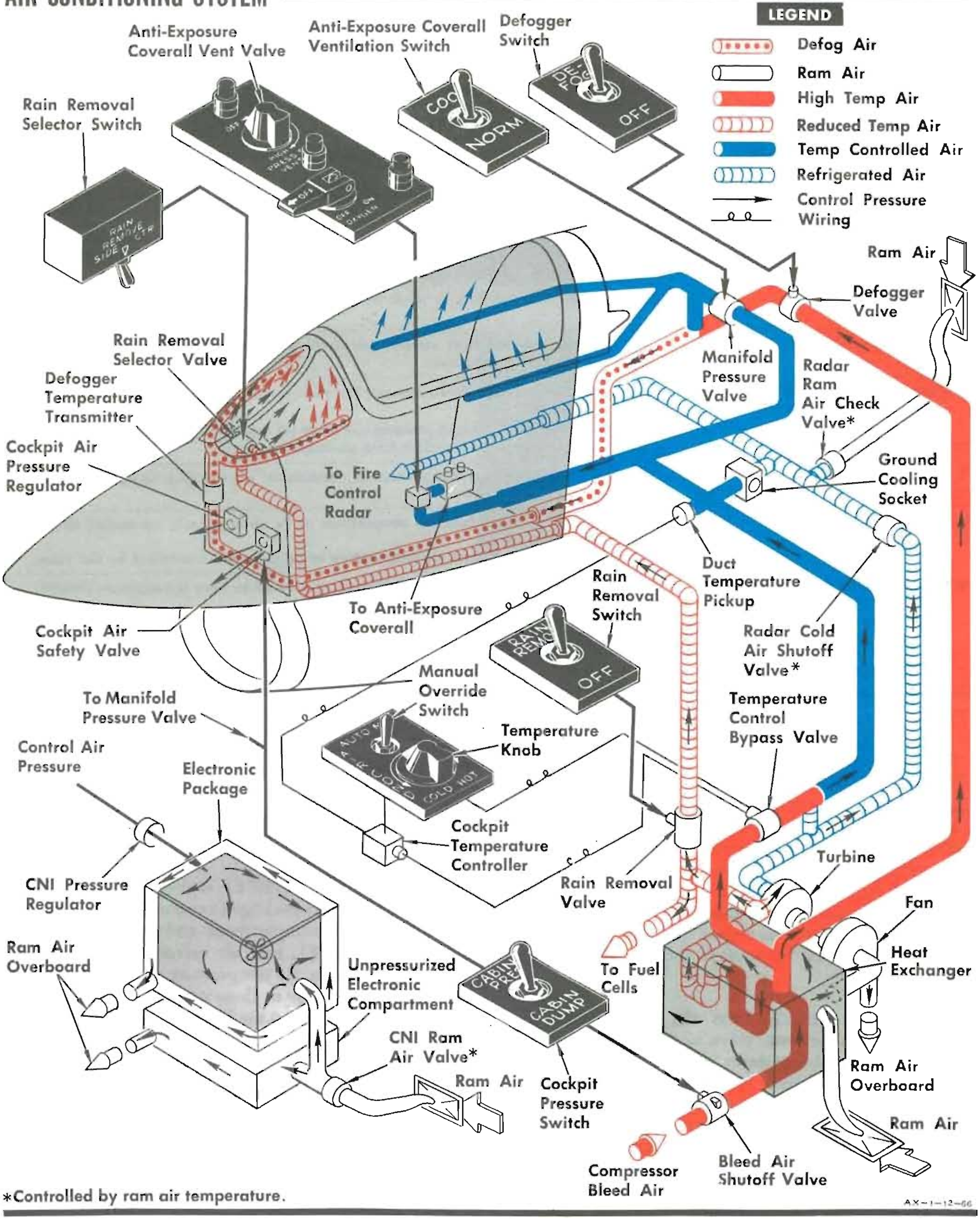


Figure 1–13

NORMAL OPERATION

Air-Conditioning and Pressurization

(See figure 1–12.)

To operate the air-conditioning and pressurization system, position controls as follows:

1. Cockpit pressure switch — CABIN PRESS
2. G Valve — AS DESIRED
3. Antiexposure coverall ventilation switch — NORM CABIN PRESS
   - Place the switch in NORM CABIN PRESS unless there is a requirement for ground cooling of the antiexposure coverall. If this requirement exists, place the switch in COOL until ready for takeoff, then return it to NORM CABIN PRESS. Only in NORM CABIN PRESS can full cockpit pressurization be obtained.
4. Manual override switch — AUTO
5. Temperature knob — AS DESIRED

If it is desired to repressurize the cockpit at any altitude:

1. Throttle — IDLE
2. Cockpit emergency ventilation — OPEN
3. Cockpit pressure switch — CABIN PRESS
4. Throttle — CRUISE RPM
5. Cockpit emergency ventilation — CLOSE

Defogging

The defogging system may be operated continuously to provide additional cockpit heat during loiter or cruise above 30,000 feet. If fogging occurs, proceed as follows:

1. Defogger switch — DEFOG
   - During negative g operation, long periods of cruise, or at supersonic speeds, oil vapor or smoke may be emitted from the air-conditioning system when the defogger switch is turned on.
2. Temperature knob — HOT
3. Throttle — 90% RPM MINIMUM
   - After fog clears, reduce throttle to desired position and adjust cockpit temperature as desired.

Rain Removal

Operate the rain removal system as required during takeoff and landing.

1. Rain removal selector switch — SIDE or CTR
2. Rain removal switch — RAIN REMOVE
   - Do not operate the rain removal system above 200 KIAS or the windshield and air-conditioning cooling turbine may be overheated. Overheating may cause the windshield to crack.
   - If left on after takeoff, a considerable reduction in cockpit pressurization will occur as altitude is gained.
   - If the rain removal system has not been operated for several flights, oil accumulation in the system may result in oil being blown on the windscreen when the system is first activated.

ANGLE-OF-ATTACK INDICATING

DESCRIPTION

The angle-of-attack indicating system and the approach lights provide the pilot and the landing signal officer with visual indications of aircraft angle of attack. Indications are presented on the angle-of-attack indicator under all flight conditions and may be used for such purposes as stall warning and for establishing maximum endurance flight altitudes. For convenience in controlling airspeed in landing approaches, indicator readings are supplemented by lights on the angle-of-attack approach indexer which is mounted on the windshield frame. The approach lights, mounted on the nose gear flipper door, provide the LSO with a similar indication of angle of attack as illustrated in figure 1–14. (Refer to EXTERIOR LIGHTS this section, for additional information concerning approach light operation.) Electrical power for the angle-of-attack indicating system is supplied by the emergency dc bus.

The angle-of-attack transducer, located on the right-hand side of the fuselage, transmits to the indicator a signal representing the relative angle of the fuselage to the airstream. This information is presented to the pilot as the position of the indicator pointer over a scale reading from 0 to 30. Each unit on the indicator dial is equal to 1.5° of indicated angle of attack or approximately 5 knots indicated airspeed in the region

ANGLE-OF-ATTACK INDICATIONS

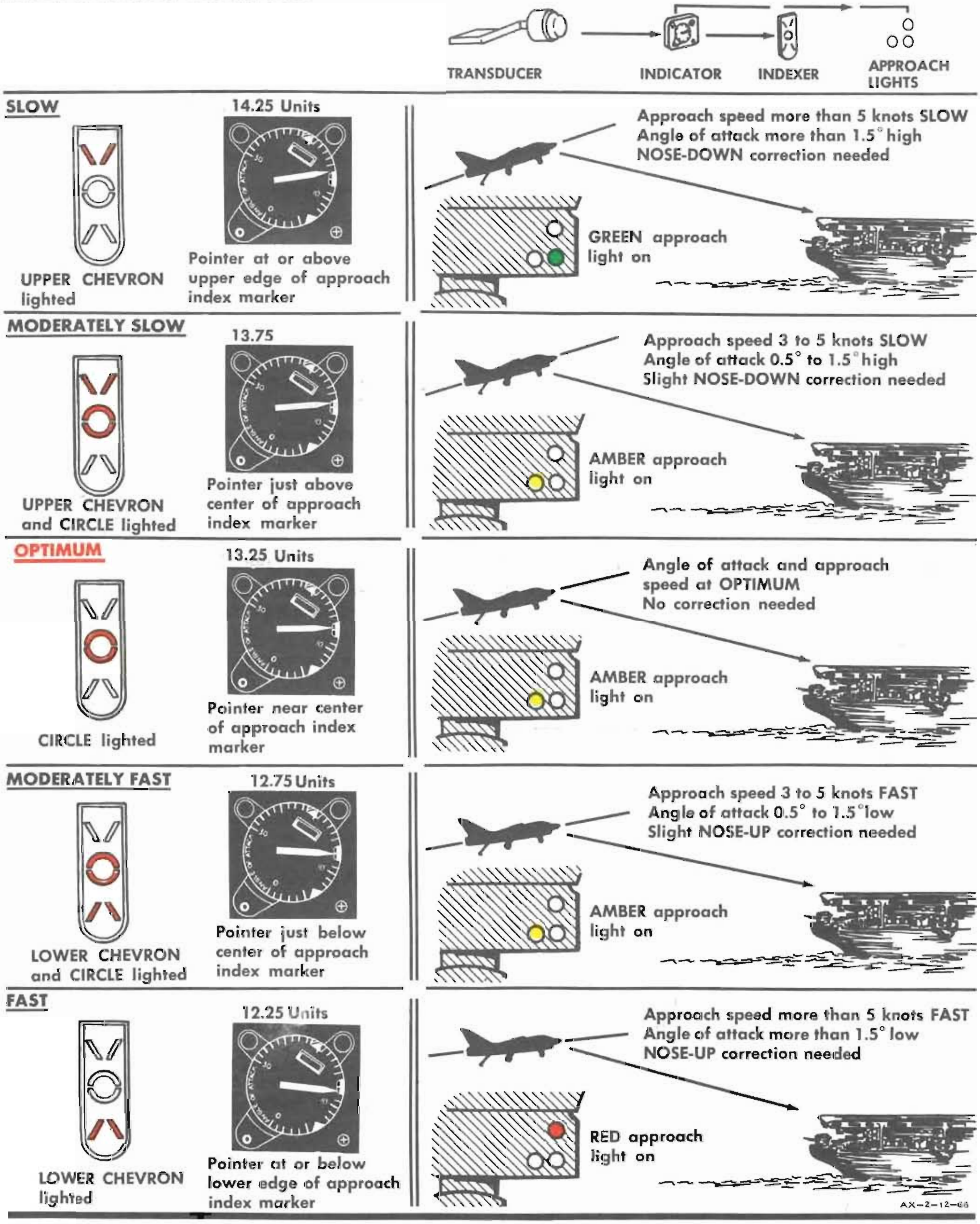


Figure 1–14

of the optimum approach angle of attack. The transducer also supplies information to the approach power compensator system computer. (Refer to APPROACH POWER COMPENSATOR SYSTEM this section.)

The angle-of-attack indicator controls operation of the approach indexer and the approach lights to provide indications of high, optimum, and low angle of attack in the landing condition. The indexer and approach lights are operated relative to pointer movement about the reference index marker at the 3 o'clock position on the indicator (figure 1–13).

The angle-of-attack system is ground boresighted and the indicator dial is set so that an indication of 13.25 units, corresponding to the optimum approach angle of attack, coincides with the center of the approach index marker at the 3 o'clock position. If the aircraft is flown so that the indicator pointer is held at an indication of 13.25 units (centered on the approach index marker) the optimum approach speed for any aircraft gross weight within the allowable limits will result. A preflight check should be made as prescribed in figure 3–1 to assure that the angle-of-attack vane or arm is not bent.

NORMAL OPERATION

CAUTION

The cockpit emergency ventilation port must be closed when using the angle-of-attack system as a flight reference. The port, when open, disturbs air flow, resulting in erroneous angle-of-attack indications and faulty operation of the approach power compensator system.

An inflight check of the angle-of-attack system may be made as follows:

1. Descend below 5,000 feet and maintain straight and level flight.
2. Raise wing and lower landing gear.
3. Stabilize airspeed at recommended value for aircraft gross weight corresponding to 13.25 units (figure 3–12).
4. Angle-of-attack indicator pointer should indicate 13.25 units.

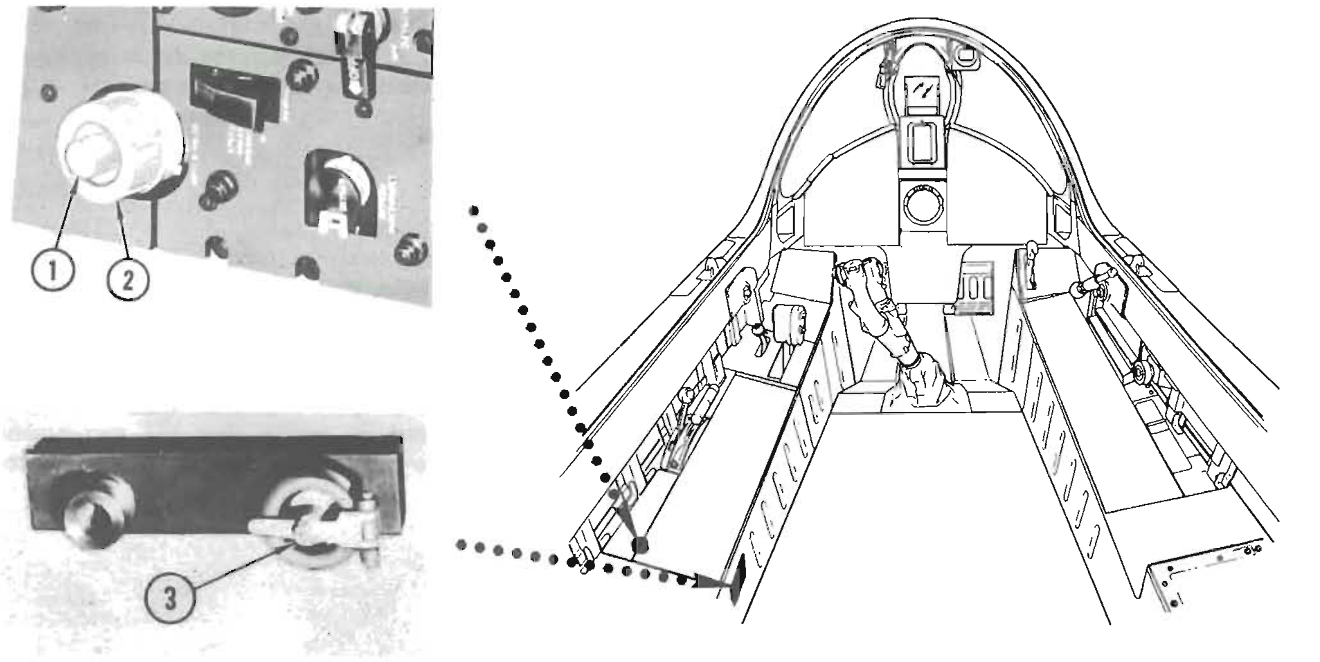
The approach indexer lights function only when the landing gear handle is in WHLS DOWN and the approach indexer dimming knob is rotated out of the OFF position. Indexer light brightness is controlled by positioning the approach indexer dimming knob on the left-hand console as desired between OFF and BRT.

Since the indexer will be used as the principal reference for controlling airspeed in landing approaches, it is advisable to check operation at the beginning of the landing approach by making a slight porpoising maneuver and observing that all of the indexer lights operate in the proper sequence. Also observe the airspeed indicator to verify that the recommended angle of attack corresponds to the correct approach airspeed.

The approach is flown by coordinating throttle and stick movements to establish the desired glide path at optimum angle of attack. The stick is used to bring angle of attack to the optimum value, as indicated by illumination of the indexer circle (donut). As angle of attack goes high or low, with resulting decrease or increase in airspeed, the indexer upper or lower chevron will be illuminated to point the direction in which the nose should be moved to return to the optimum angle of attack. The throttle is manipulated to control rate of descent so as to establish the desired glide path. The relationships of the various indications to angle of attack and airspeed are shown in figure 1–14.

If the indexer lights fail, the approach may be flown with reference to angle-of-attack indicator readings. In this case, attitude is corrected to keep the indicator pointer as close as possible to the center of the 3 o'clock reference index. Indications above and below the index indicate that the approach is being made more than 5 knots slow or fast.

ANTIBLACKOUT CONTROLS



Nomenclature	*Function*
1. G valve button	Depressed and released, permits inflating the suit for body massage to lessen fatigue and to check operation of G valve. If valve tends to stick or fails to close, it should be replaced.
2. G valve	HI — supplies a pressure of 1.5 psi for each g over 1.75g up to 10 psi. LO — supplies a pressure of 1 psi for each g over 1.75g up to 10 psi.
3. Anti-g connection	Serves as quick-disconnect for anti-g suit line.

AX-19-1-67

Figure 1–15

ANTIBLACKOUT

DESCRIPTION

Antiblackout pressure is automatically supplied by routing engine bleed air through the G valve and into the pilot's suit. The G valve, opened by centrifugal force, regulates suit pressure as g-loads are applied or reduced. A HI and LO range may be manually selected.

The antiblackout connection is made at the pilot's services disconnect located on the left console. The antiblackout line is routed from the G valve through the base of the console to the disconnect. The antiblackout fitting at the disconnect serves the anti-g suits worn with flight coveralls.

Antiblackout controls are illustrated and described in figure 1–15.

APPROACH POWER COMPENSATOR

DESCRIPTION

The approach power compensator system consists of a computer, an accelerometer, a servo amplifier, a servo actuator, a pilot's control panel and the existing angle-of-attack detector. The computer, servo amplifier and accelerometer are located in the left-hand wheel well. The servo actuator is located in the engine bay (left-hand side). Electrical power for the system is supplied by the secondary ac and dc buses.

The system is designed for use when the aircraft is in the landing (wing-up) configuration. The aircraft can be flying straight and level, climbing, descending or turning at the time of engagement. Upon landing, the system will disengage automatically.

The system senses deviations in normal acceleration and angle of attack that would slow down or speed up the aircraft from its best approach airspeed. These deviations initiate automatic corrections through the system to alter the engine power setting. During a normal approach using the APC, the system should maintain airspeed within a range of ±4 knots in light to moderate turbulence.

System components operate as follows: The system accelerometer and angle-of-attack detector supply their respective information to the system computer. When normal acceleration is 1 g and the angle of attack is optimum for a landing approach, the computer sends no corrective signal and the throttle position does not change. When acceleration and angle of attack deviate from these values, the deviations are interpreted by the computer as either offsetting each other or as requiring a change of engine power setting. If a power change is required, the computer sends an electrical signal to the servo amplifier. The amplified signal is then sent to the servo actuator. The servo actuator moves the engine fuel control cross-shaft, mechanically changing engine power and throttle position.

The system will not retard the throttle below approximately 75% rpm. Upon touchdown, compression of the main landing gear shock strut actuates the deck compress switch to cause the system to disengage automatically, leaving the throttle at approach power. The system will also disengage if the throttle is overridden with a force of 12 to 22 pounds in either direction, or if the landing gear is raised with the system in operation. The system may disengage inadvertently if throttle friction is excessive.

The system is normally maintained in operation by an engage switch, which is magnetically held in ON against spring tension by a holding coil. The switch springs back to OFF anytime power is removed from the holding coil. This occurs under the conditions described for disengagement in the preceding paragraph. If the 12- to 22-pound throttle force will not disengage the system, the system can be disengaged by turning off the engage switch unless the engage switch itself has failed or the servo actuator gears are jammed. If the system does not disengage when the airplane touches down, it can be disengaged by turning off the engage switch or overriding the throttle.

If certain gears in the servo actuator jam, the throttle will be stuck until a shear pin in the actuator output shaft is sheared. Applying a force of 36 to 53 pounds to the throttle will shear the pin. (It is preferable to shear this pin with a forward throttle force to avoid retarding the throttle to OFF.)

If the engage switch fails in ON, normal throttle override will not disengage the system, and it may not be possible to shear the pin. If the APC cannot be disengaged by any other method, turn off power to the system (master generator switch — OFF) and extend the power package to regain emergency and primary buses.

Even though the system automatically disengages with weight on the gear or with the landing gear retracted, it can be placed into operation if the engage switch is placed on and held there. This action is not recommended.

Since engine performance varies with ambient air temperature, the system has a three-position temperature switch to compensate for this effect. This switch must be placed in COLD below 4°C (40°F), in STD from 4°C (40°F) to 27°C (80°F), or in HOT above 27°C (80°F).

System controls are illustrated and described in figure 1–16.

NORMAL OPERATION

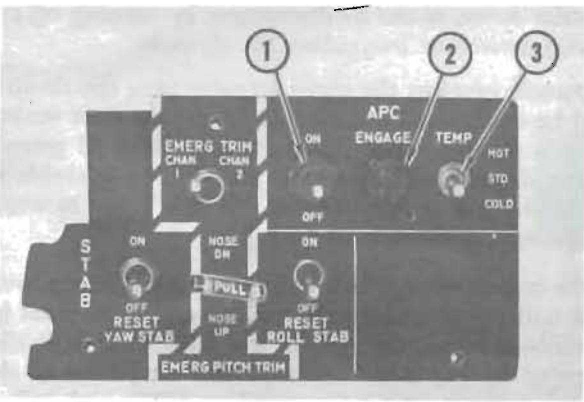
Before Landing

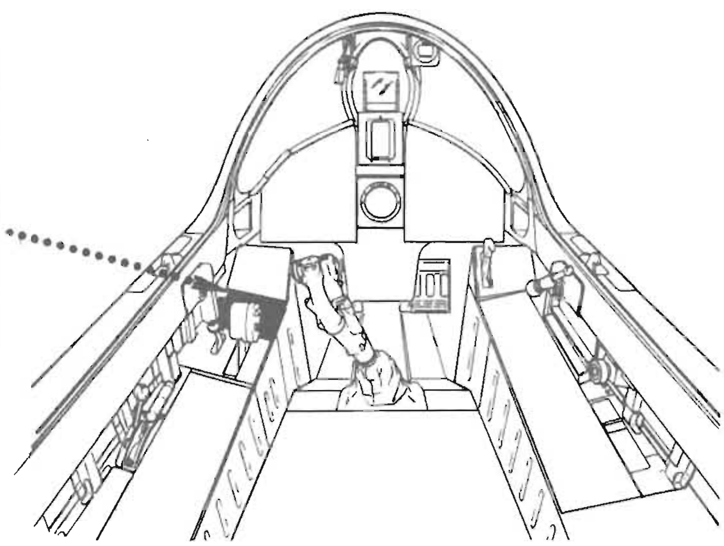
WARNING

Do not engage the system with the fuel control switch in MANUAL. Automatic throttle movements associated with system operation are rapid which could result in compressor stall and engine flameout.

1. Aircraft — LANDING CONFIGURATION
2. Throttle friction wheel — MINIMUM FRICTION
3. Fuel control switch — NORMAL
4. Cockpit emergency ventilation knob — CLOSED
   - If the emergency ventilation port is open, airflow around the angle-of-attack vane will be disturbed resulting in erroneous system inputs.
5. Temperature switch — HOT, STD, or COLD (according to ambient air temperature).

APPROACH POWER COMPENSATOR CONTROLS





Nomenclature	*Function*
1. Engage switch	ON — engages system to correct for deviations to normal acceleration and angle-of-attack during approach. OFF — disengages system.
2. Engage indicator light	On, indicates system engaged.
3. Temperature switch	HOT — compensates for ambient temperatures above 27°C (80°F). STD — normal position when ambient temperature is between 4°C (40°F) and 27°C (80°F). COLD — compensates for ambient temperatures below 4°C (40°F).

AX-4-12-66

Figure 1–16

6. Engage switch — ON (engaged)
7. Engage indicator light — ON
8. Throttle — OBSERVE MOVEMENT
   - If it is desired to disengage the system, the engage switch can be placed in OFF or the throttle can be pushed or pulled to manually overpower the system.
9. Check that optimum angle of attack is obtained when airspeed stabilizes at the recommended approach value.

After Landing

1. Throttle — Reposition as required
   - System will disengage at touchdown, leaving throttle at approach power.
2. Engage indicator light — OFF
   - Check that light has gone out automatically.
3. Engage switch — OFF
   - Check that switch has moved to OFF position automatically.

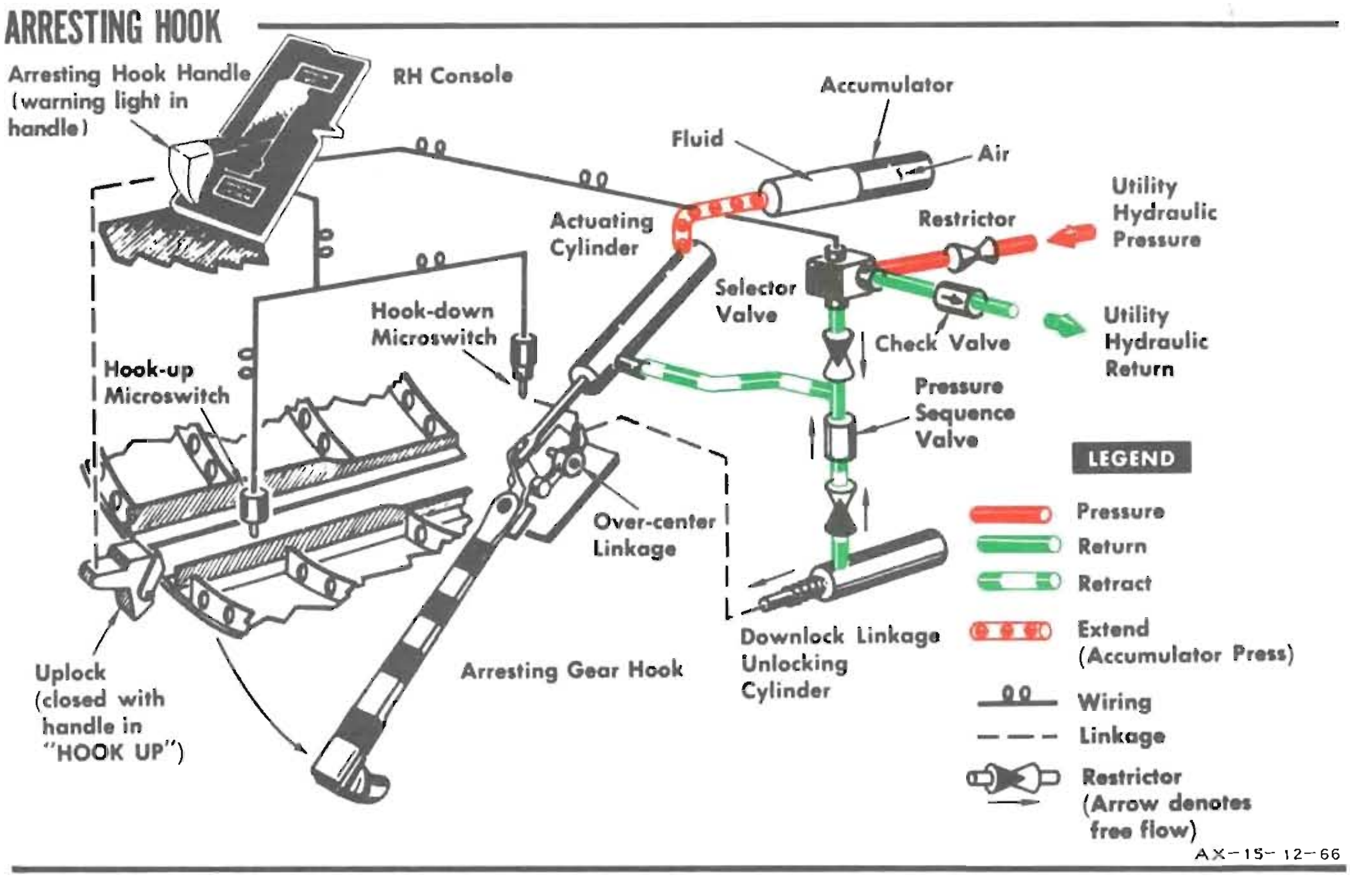


Figure 1–17

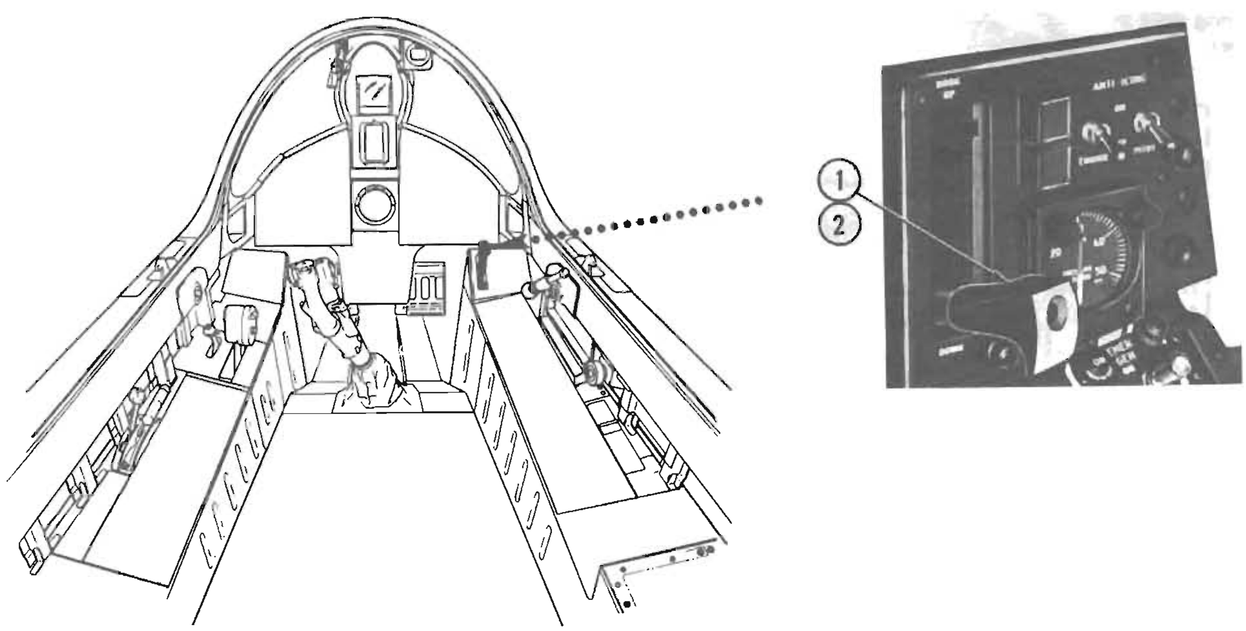
ARRESTING HOOK

DESCRIPTION

The arresting hook (figure 1–17) is retracted by utility hydraulic pressure and extended by pressure from an accumulator. The hook is normally held retracted by hydraulic pressure, and with loss of hydraulic pressure, by a mechanical uplock latch. The hook is held extended by overcenter locking-gear linkage which is connected to a spring-loaded linkage unlocking cylinder. Approximately 8 seconds are required to fully extend the hook. If accumulator pressure is lost, the hook will drop into position when the arresting hook handle is placed in HOOK DOWN.

Arresting hook controls are illustrated and described in figure 1–18.

ARRESTING HOOK CONTROLS



Nomenclature	Function
1. Arresting hook handle	HOOK DOWN — relieves hydraulic pressure, retracts uplock latch, and extends hook. HOOK UP — energizes selector valve, positions uplock latch, and retracts hook.
2. Arresting hook warning light (in arresting hook handle)	ON — Arresting hook handle and hook positions do not agree.

AX-20-1-67

Figure 1-18

LIMITED TO 350 KTS : .75 MAX
15 FAIRING DOORS INSTALLED

3 THINGS TOGETHER OR INDIVIDUALLY
LOWER THE HOOK:
PRELOADED ACCUMULATOR
HOOK WEIGHT
DOWN-LOCK UNLOCK CYLINDER SPRING

ELECTRICAL PWR REQUIRED TO
RAISE HOOK

HOOK WILL NOT FAIL SAFE DOWN
UNLESS BOTH UTIL HYDRAULIC PRESS
AND ACTUATOR CABLE ARE LOST

AUTOMATIC PILOT

DESCRIPTION

The autopilot is operated electrically and is energized by the secondary ac and dc buses. Although the autopilot and the flight stabilization systems operate independently of each other, they use common amplifiers and actuators (see figure 1–20). The autopilot controls the aircraft only in the roll and pitch axes, with the yaw stabilization system and the aileron-rudder interconnect providing any needed yaw control. In the normal mode of operation, the autopilot maintains either the roll and pitch attitude existing when the autopilot is engaged or subsequently commanded by the bank controller and pitch trim knob. The bank controller permits the pilot to perform banked turns under autopilot control. Additional modes of autopilot operation provide for automatic altitude holding and heading holding.

Autopilot controls are illustrated and described in figure 1–19.

Bank Controller

The bank control function of the autopilot permits the pilot to perform banked turns, with the autopilot engaged, at bank angles up to 70°. The autopilot automatically maintains the roll attitude selected by the pilot with the bank control knob. The bank angle commanded by the autopilot will be limited to 78°. If bank angle exceeds 78° due to system malfunction or stick movement, the autopilt will disengage.

Heading Hold

The heading hold function of the autopilot is connected with the MA-1 compass gyro and operates to maintain any selected heading. If the aircraft deviates from the selected heading, the heading hold circuits will command a banked turn until the aircraft returns to the heading reference maintained by the MA-1 compass directional gyro. If the compass is inoperative or the gyro is precessing, the heading hold function may be disengaged by a switch located on the autopilot panel in order to prevent the aircraft from continually seeking the selected heading. When the bank controller is actuated to select an angle of bank greater than 5°, and the aircraft responds, the heading hold function will automatically disengage, then reengage when the wings are within 5° of level.

Altitude Hold

The altitude hold function of the autopilot operates to maintain the aircraft at the pressure altitude existing when the altitude hold mode is engaged. Before engagement of the altitude hold function, a barometric altitude controller follows changes in pressure altitude as the aircraft climbs or dives. At engagement, the condition established by the altitude controller becomes the reference pressure altitude, and the controller senses changes in altitude above and below the reference altitude and originates correction signals that are sent to the pitch amplifier.

NORMAL OPERATION

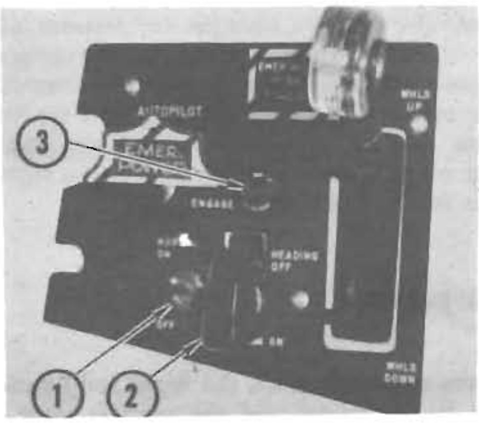
To operate the automatic pilot, the flight stabilization system must be operating, and the aircraft must be in the clean condition (wing down) operating on normal electrical power. The aircraft must be in trimmed flight at the time the autopilot is engaged or the exact conditions of engagement will not be held. Refer to section IV, part 2 for additional information concerning flight characteristics with the autopilot engaged, and to figure 1–21 for typical mission illustration. When the aircraft is safely airborne, proceed as follows:

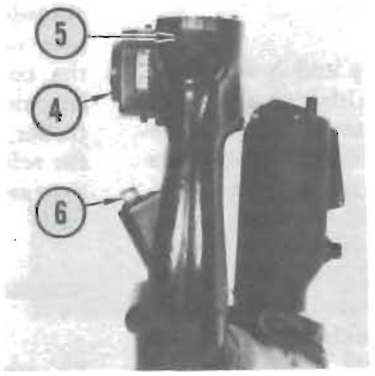
1. Autopilot master switch — ON
2. Autopilot engage-disengage switch — DEPRESS
   - Attain climb speed schedule and trim the aircraft for a climb, then depress the engage-disengage switch to engage the autopilot.

After reaching the desired altitude:

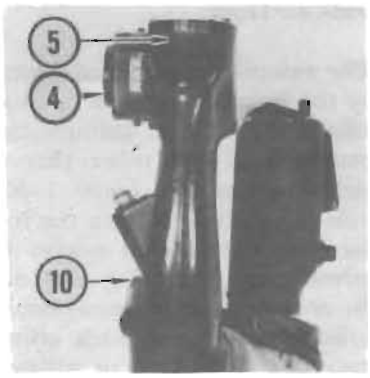
1. Autopilot engage-disengage switch — DEPRESS
   - Depressing the switch will disengage the autopilot.
2. Trim the aircraft for straight and level flight on the desired heading.
3. Autopilot engage-disengage switch — DEPRESS
   - Depressing the switch will engage the autopilot.
   - The heading hold function is automatically placed into operation when the autopilot is engaged, unless the heading hold disable switch has been intentionally turned off. Use the bank controller to make heading corrections.
   - If bank angle exceeds 78°, the autopilot will disengage automatically.
4. Altitude hold switch — AS DESIRED
   - Below an altitude of 25,000 feet, do not perform transonic decelerations on altitude hold at rates faster than those produced with military thrust.

AUTOPILOT CONTROLS

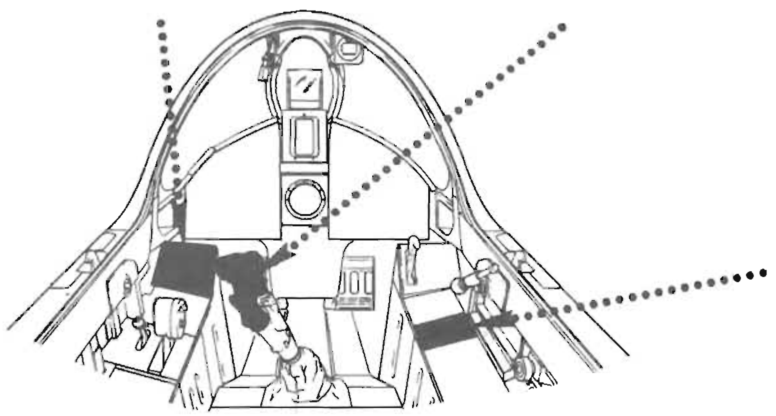


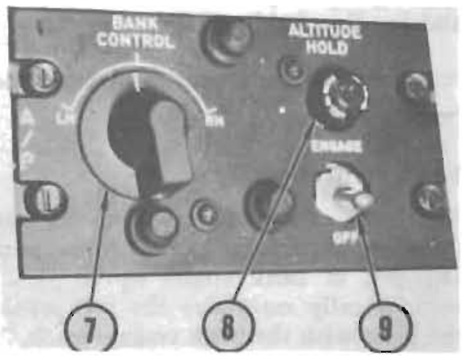


Aircraft without stores release switch



Aircraft with stores release switch





Nomenclature	*Function*
1. Autopilot master switch	ON — energizes autopilot system for engagement with engage-disengage switch. OFF — deenergizes autopilot system.
2. Heading hold disable switch	ON (guarded position) — heading hold function is engaged when autopilot is engaged. OFF — disengages heading hold function.
3. Autopilot engage light	On, indicates that the autopilot is engaged.
4. Pitch trim knob	Controls pitch reference attitude when autopilot is engaged.
5. Roll trim knob	Provides vernier control of roll reference attitude when autopilot is engaged with the heading hold disengaged.
6. Engage-disengage switch*	Pushed once, engages autopilot in normal mode. Pushed a second time, disengages autopilot.
7. Bank control knob	Rotated left or right, with autopilot engaged, controls roll attitude (bank angle) within autopilot limits in proportion to amount of rotation. With autopilot disengaged, knob follows roll motions of aircraft.
8. Altitude hold engage light	On, indicates that altitude hold function is engaged.
9. Altitude hold engage switch	ENGAGE — engages altitude hold function of autopilot when normal mode is engaged. OFF — disengages altitude hold function.
10. Autopilot/nose gear steering engage-disengage switch†	Pushed once, with wing down, engages autopilot in normal mode. Pushed a second time, disengages autopilot.

*Aircraft without stores release switch.
†Aircraft with stores release switch.

AX-16-12-66

Figure 1-19

AUTOPILOT OPERATION

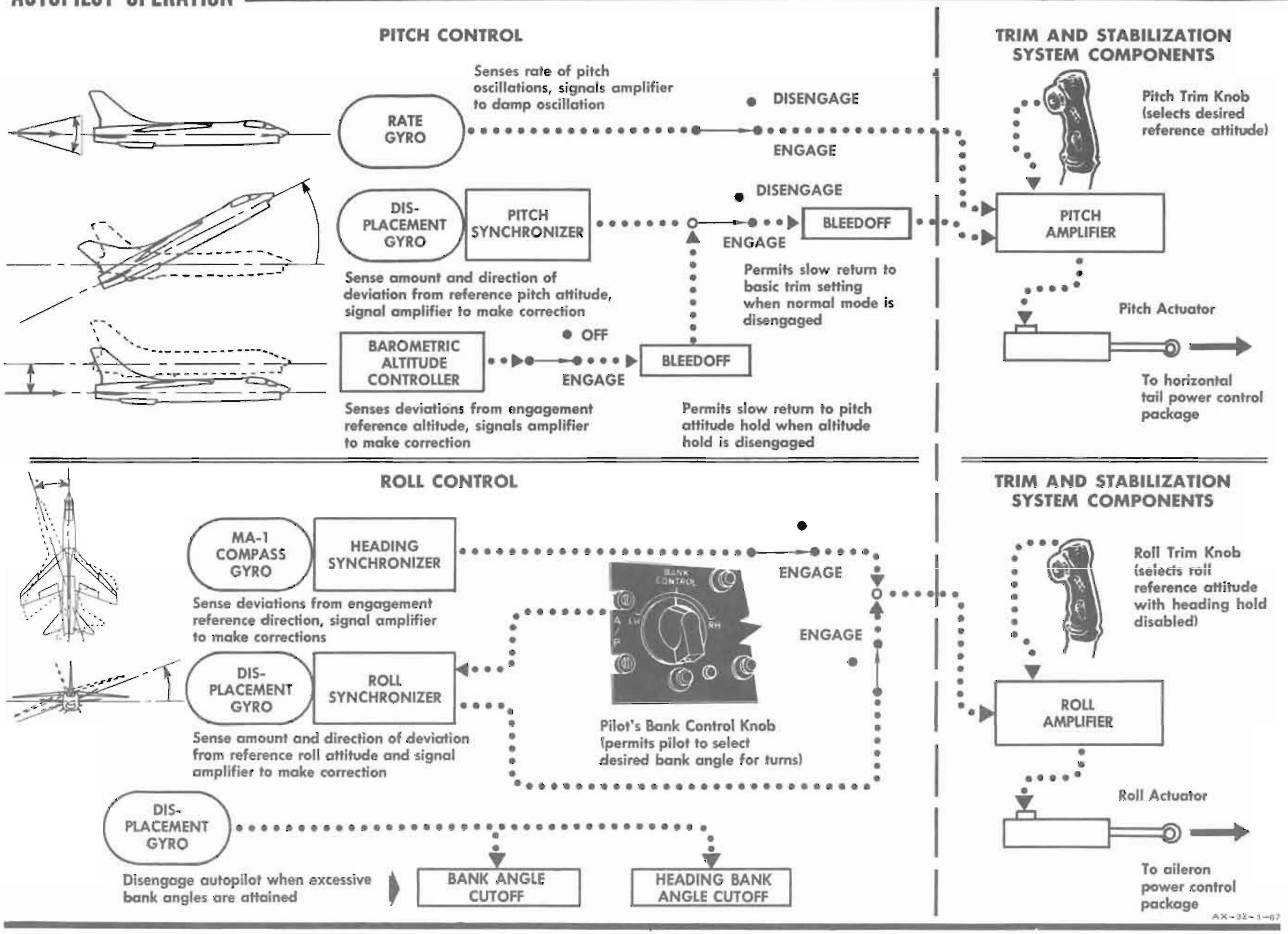


Figure 1–20

AUTOPILOT MODES
(TYPICAL MISSION)

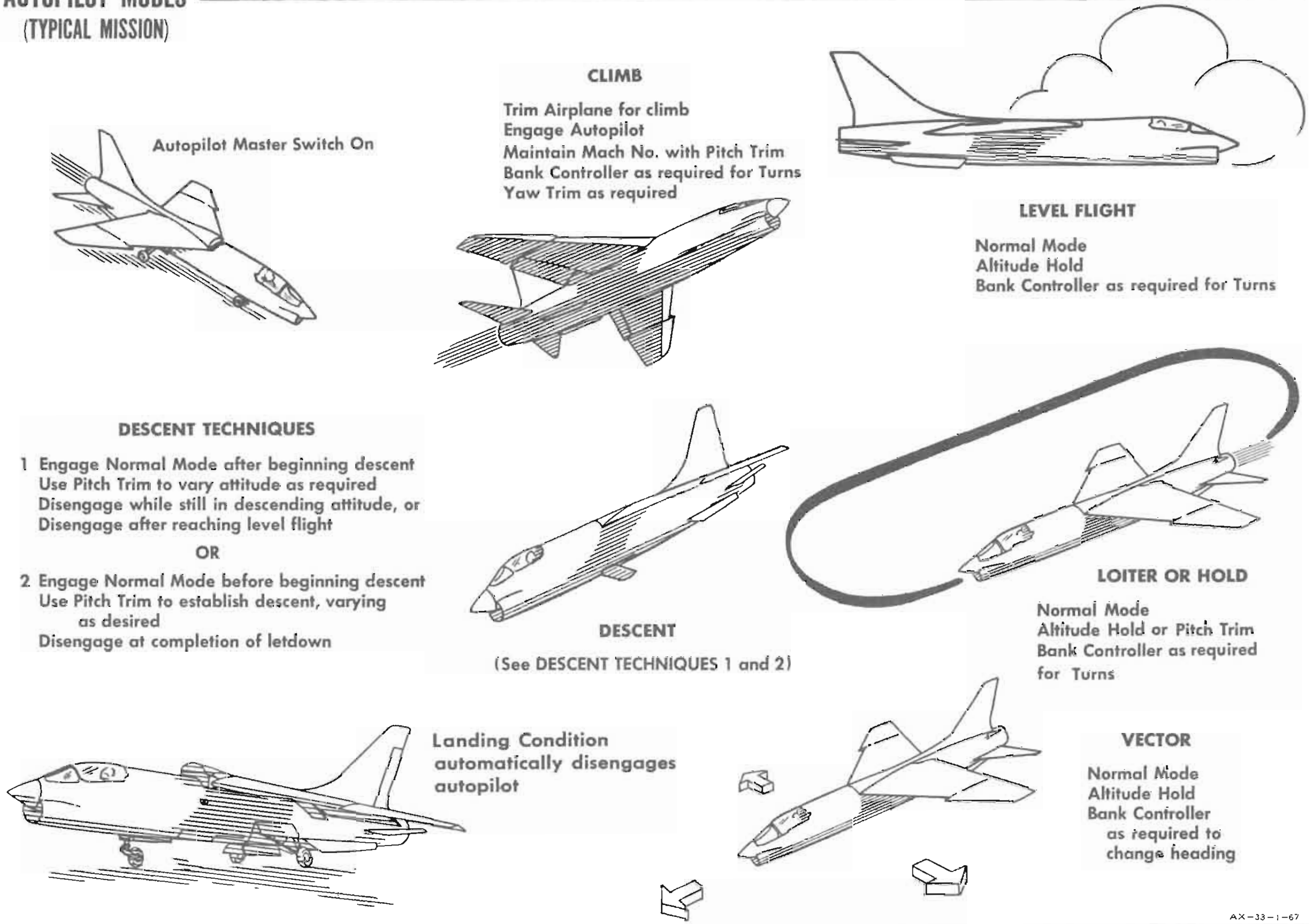


Figure 1-21

ATTITUDE LIMITATIONS

The attitude limitations for engagement of the autopilot are as follows:

Normal mode may be engaged at any pitch attitude from +15° nose up to −50° nose down if heading hold is on; otherwise ±50°, and at any roll attitude up to 70° right or left. Depending on heading, the aircraft may begin to wallow as pitch attitude increases above 15° while operating on heading hold.

Altitude hold may be engaged at any roll attitude up to 70° right or left and at rates of climb or dive up to 2,000 feet per minute.

Heading hold is engaged any time normal mode is selected and wing position is within 5° of level, unless the heading hold switch has been placed in OFF.

TRIMMING LIMITATIONS

Pitch trim may be used while in normal mode to make small changes in pitch attitude, but is not recommended as a method of changing altitude. To change altitude, turn altitude hold function off, fly the aircraft on normal control to the new altitude, then reengage the altitude hold function. The autopilot will disengage if emergency pitch trim is used.

USE OF STICK

With the autopilot engaged in the normal mode, the application of stick force will change pitch or roll attitude without affecting the pitch or roll attitude reference maintained in the autopilot. Upon release of the stick force, the aircraft will *abruptly* return to the attitude at which the automatic pilot was engaged. The use of stick force, therefore, is not recommended as a method of changing attitude or altitude (with altitude hold disengaged). Disengaging the autopilot, maneuvering as desired, and then reengaging the autopilot at the new altitude or attitude will result in smoother operation. Should the aircraft be flown off heading or altitude (altitude hold ON) with stick force, it will immediately return to the engagement heading and/or altitude when stick force is relaxed.

DISENGAGEMENT

When disengaging the autopilot at flight conditions nearly equal to those that existed at engagement, no transients will occur. On the other hand, if flight conditions have changed so that there is disagreement between pitch trim wheel setting and the position of the horizontal tail as commanded by the autopilot, the tail will move smoothly to agree with the pitch trim wheel. This action will appear to the pilot as a slow trim change to be corrected in the usual manner. If large changes in flight conditions have occurred prior to disengagement, allow at least 30 seconds before reengaging the autopilot. This will allow for complete bleed off of pitch attitude or altitude errors.

Either intentional or inadvertent disengagement of the autopilot results in a return to preengagement pitch and roll trim conditions.

NECESSARY FOR AUTOPILOT OPERATION:
AC POWER
YAW STAB ON
ROLL STAB ON
EMERG TRIM HANDLE IN
AP MAG SWITCH ON
WING DOWN
LEVEL FLIGHT ±28°
ENGAGE SWITCH PRESSED
BOTH PC'S UP ENOUGH TO PWR STABS

CANOPY

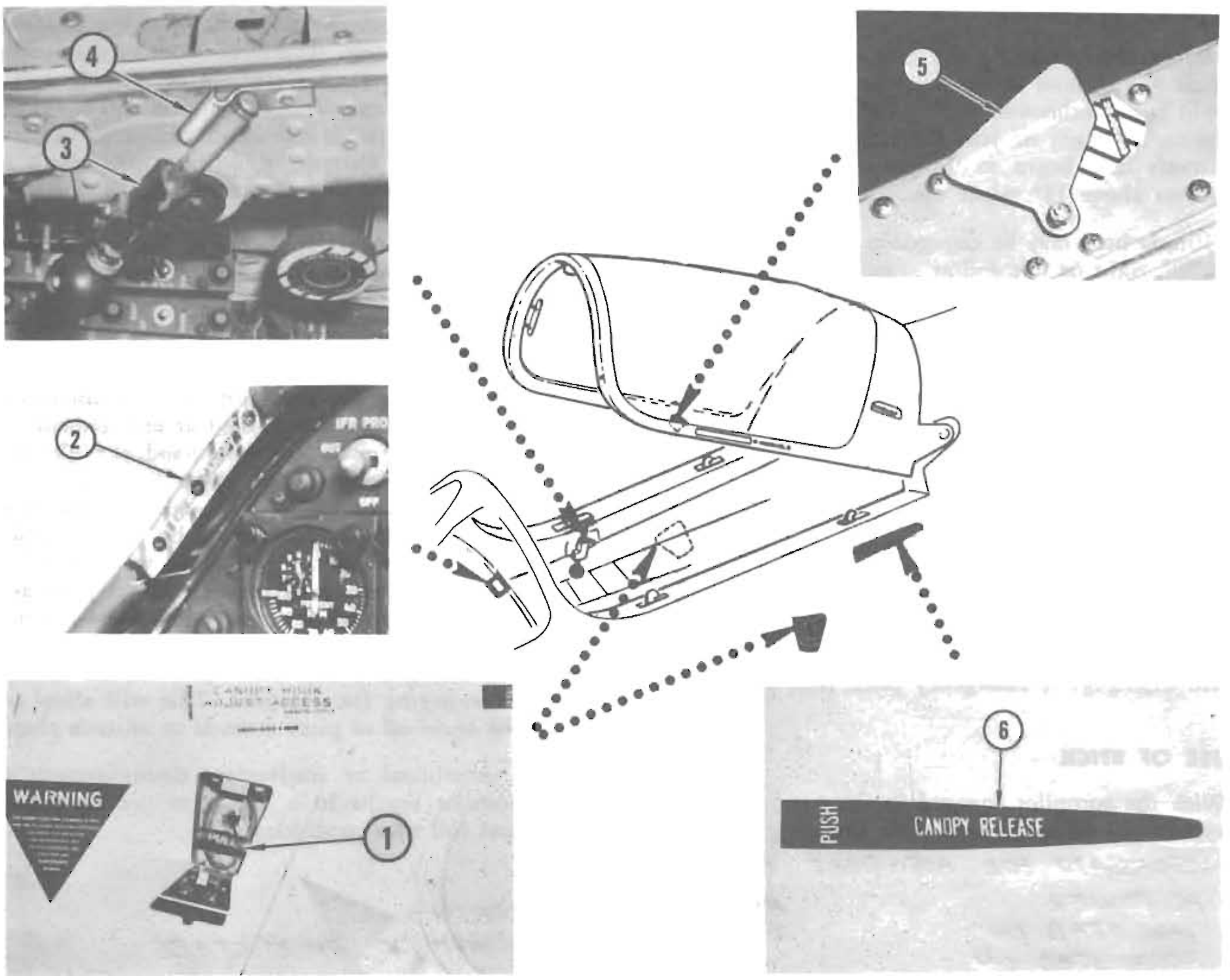
DESCRIPTION

The one-piece clamshell-type canopy is attached to the aircraft by pivots or arms at the aft end of the canopy. A counterbalance strut is provided to aid the pilot in raising and lowering the canopy without the aid of power devices. Cockpit pressure sealing is provided by a striker and diaphragm arrangement. The canopy is locked in the closed position by four rotating hook latches that can be operated from either inside or outside the cockpit.

A cartridge-operated emergency canopy actuator provides for canopy jettisoning in landing emergencies, ditching, ground rescue and as part of the ejection sequence. Pulling the ejection seat face curtain handle, the secondary firing handle, or the emergency canopy jettison handle while in flight fires the canopy actuator cartridge. This blows open the canopy locks and forces the canopy up into the airstream where it is separated from the aircraft by air loads. On the ground, pulling the emergency canopy handle or either of the two exterior rescue handles fires the actuator to release the locks and forcibly open the canopy. If the aircraft has little or no forward speed, the canopy may not leave the cockpit area.

Canopy controls are illustrated and described in figure 1–22.

CANOPY CONTROLS



Nomenclature	*Function*
1. Rescue handles	Pulled out to full length of lanyard, fires canopy actuator to release canopy locks and open canopy.
2. Emergency canopy jettison handle	Pulled out fully, fires canopy actuator to release canopy locks, and opens canopy.
3. Interior canopy release handle	Open canopy — extend handle, pull aft and manually open canopy. Close canopy — pull and hold handle aft while manually closing canopy and then push handle fully forward. Stow handle.
4. Canopy handle lock indicator	Stripes visible — canopy handle not stowed. Stripes not visible — canopy handle in fully locked position and handle stowed.
5. Canopy lock indicator	Indicates canopy locks in locked or unlocked position.
6. Exterior canopy release handle	Open canopy — push forward end of handle, grasp aft end and pull outboard. Open canopy manually. Close canopy — close canopy manually and push aft end of handle inboard.

AX-21-1-67

Figure 1–22

MK-F5, -F5A EJECTION SEATS

DESCRIPTION

Before AFC 491, the airplane is equipped with a Martin-Baker MK-F5 or MK-F5A ejection seat (illustrated in figure 1–41). The minimum ejection altitude for the MK-F5 seat is 50 feet at an airspeed of 120 knots in level or climbing flight. The MK-F5A seat has an improved ejection capability and is readily identified by an orange decal, located on the left-hand side of the drogue parachute container (figure 3–3), which reads as follows:

Martin-Baker MK-F5A Seat
Ejection Seat Capability
120 knots — Min on Runway
ACSEB 22-61

The low-level escape capability of the MK-F5 or MK-F5A ejection seat is obtained through the use of a telescoping long-stroke ejection gun to achieve high seat velocity. The telescoping gun makes high velocities possible with acceptable peak acceleration and rate of increase of acceleration. The use of drogue parachutes to stabilize and decelerate the seat and occupant and to deploy the pilot's parachute further ensures controlled action under all ejection conditions.

The seat is equipped with a pilot's restraint harness that accommodates standard suits with integrated harness provisions, but employs a special Martin-Baker parachute packed in "horseshoe" form and positioned behind the pilot's shoulders. This parachute position is used to permit positive parachute deployment at the moment the pilot is released from the seat. A leg restraint system is provided to prevent leg injuries during ejection. The leg restraint lines, one for each leg, are secured to the airframe and to the seat. The lines are routed through the pilot's leg restraint garters, two garters for each leg, so as to draw the legs back against the front of the seat during ejection. The pilot's legs are restrained until release occurs before deployment of the personnel parachute.

The seat bucket accommodates a PK-2 pararaft kit and CV15-416070 seat pan assembly or an RSSK-6 survival kit. The seat pan or survival kit contains the emergency oxygen bottle. Seat height adjustment is provided by an electrical actuator that raises or lowers the bottom portion of the seat with respect to the upper portion. A wedge-pad mounted above the parachute pack serves as the pilot's headrest, and there is no headrest adjustment. An adjustable backpad cushion ensures proper posture for the occupant.

The upper housing of the seat contains the controller and stabilizer drogue parachutes and serves as a mounting for the face curtain handle and the canopy interrupter release handle. The housing is peaked at the top to ensure proper penetration of the canopy in a through-the-canopy emergency ejection. The drogue parachutes are deployed by the action of a drogue gun piston that is fired automatically during ejection to drag the 22-inch controller drogue into the slipstream. The 5-foot stabilizer drogue is automatically drawn into the slipstream and deployed by the controller drogue.

An acceleration limiter (g-controller) and an altitude limiter (barostat) delay operation of the seat timed release mechanism to control deployment of the 24-foot personnel parachute under varying ejection conditions. The g-controller delays the parachute deployment and harness release sequence until the seat and pilot decelerate to approximately 4 g. The altitude limiter delays the sequence until the seat and pilot have descended to a minimum pressure altitude of 10,000 feet.*

A pilot's services disconnect, mounted on the left console, holds the antiblackout line and the anti-exposure coverall ventilating air line in position to ensure proper separation at ejection. The oxygen supply line from the seat pan is separately connected to the oxygen receptacle on the left console. Provision is made for automatic actuation of the emergency oxygen supply upon ejection. Communications connection between the pilot's equipment and the aircraft is automatically completed when the oxygen line is connected to the console fitting.

Ejection seat controls are illustrated and described in figure 1–23 Ejection seat components are illustrated in figure 1–24.

NORMAL OPERATION

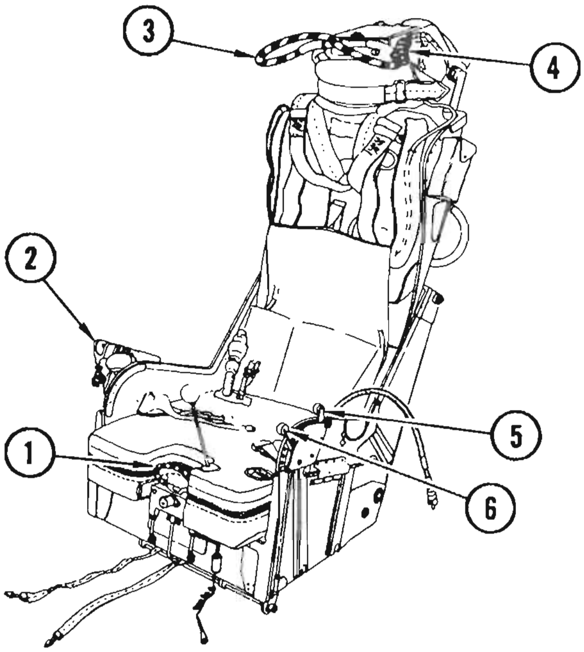
See figure 1–25 for a description of the ejection sequence and figure 1–26D for a list of pilot's equipment that may be used with the Martin-Baker seat.

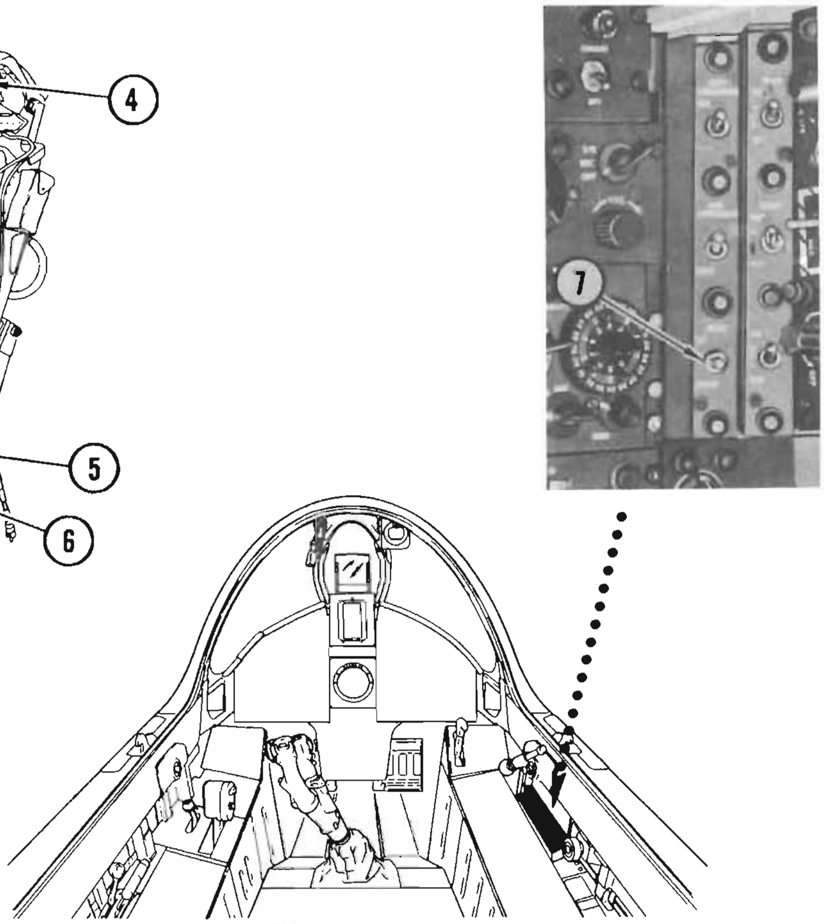
EMERGENCY RELEASE FROM THE SEAT

In landing emergencies, in ditching, and in the event of the automatic release failing to function in ejection, the pilot can release himself, his parachute, and his survival equipment from the seat by pulling the emergency harness release handle. Pulling the handle releases the leg restraint lines and the lap and shoulder harness, and trips the guillotine which cuts the link-line that connects the stabilizer drogue parachute to the pilot's parachute withdrawal line. Separation of the pilot from the seat should break the pilot's services connections at the disconnect on the left console. Parachute deployment under these conditions is attained by pulling the parachute ripcord D-ring on the left shoulder harness strap. When ditching, the pilot should release the shoulder harness fittings before pulling the emergency harness release handle, and should manually separate the pilot's service connections to ensure separation.

*On seats with Martin-Baker ECP 159 incorporated, the minimum altitude for barostatic opening of the parachute is raised to 11,500 feet.

MK-F5, -F5A EJECTION SEAT CONTROLS



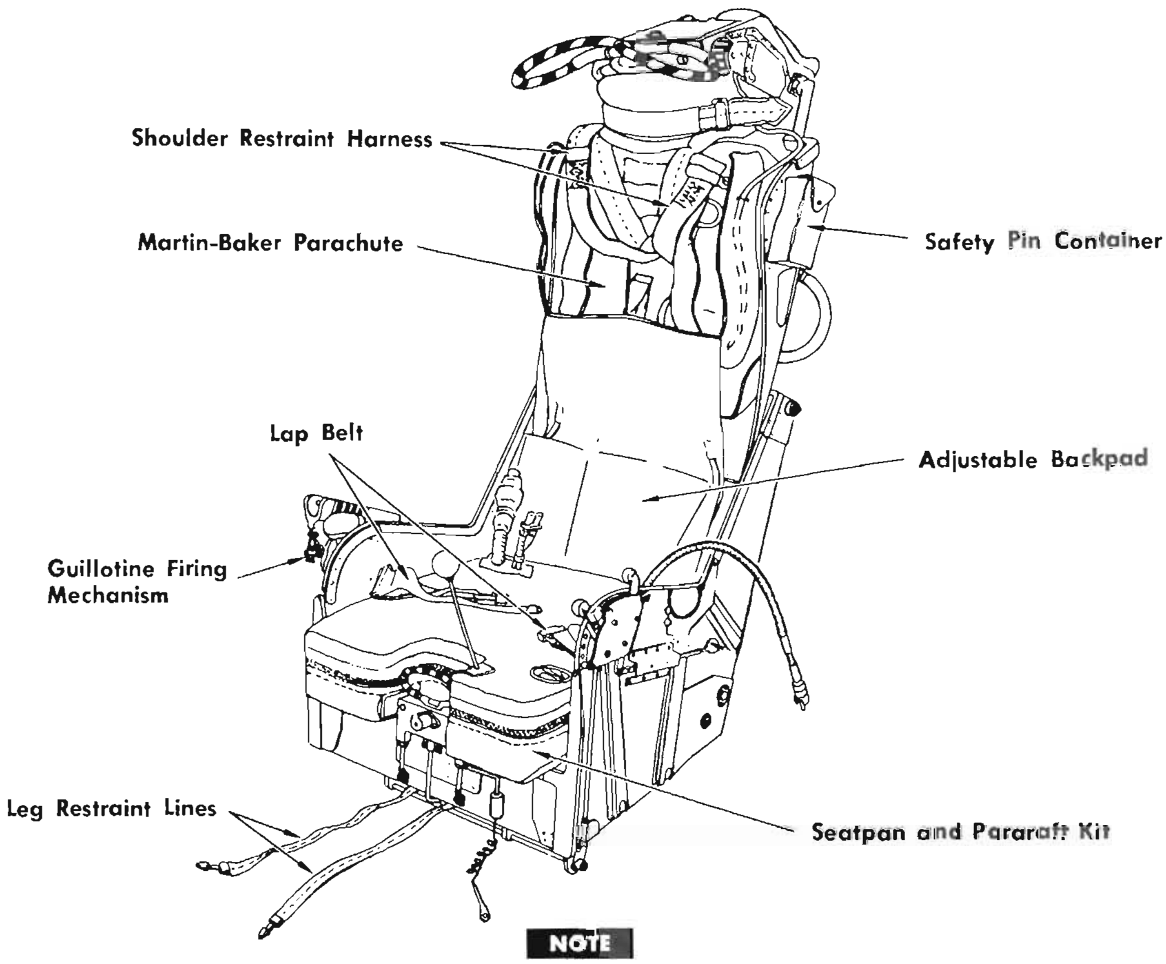


Nomenclature	*Function*
1. Secondary firing handle	Pulled upward fully, jettisons canopy and ejects seat.
2. Emergency harness release handle	Button pressed, handle rotated sharply aft, releases integrated harness, leg restraint lines, and parachute from seat, permitting the pilot to leave the seat with parachute and full survival equipment.
3. Face curtain handle	Pulled down fully, jettisons canopy and ejects seat.
4. Canopy interrupter handle	Pulled fully forward, bypasses canopy firing and overrides interrupter, permitting complete travel of the face curtain or secondary firing handle to eject the seat through the canopy.
5. Shoulder harness lock lever	Pulled aft against tension, unlocks shoulder harness inertia reel so that the pilot may lean forward. Neutral position holds unlocked condition. Pushed to forward position, locks inertia reel to prevent any forward motion of the pilot.
6. Leg restraint release lever	Pushed forward, releases leg restraint snubber to permit additional length of line to be pulled out. Pulled aft, releases leg restraint line plug in fitting from front seat to permit normal exit from aircraft.
7. Seat adjustment switch	UP or DOWN raises or lowers seat pan to desired height.

AX-22-8-67

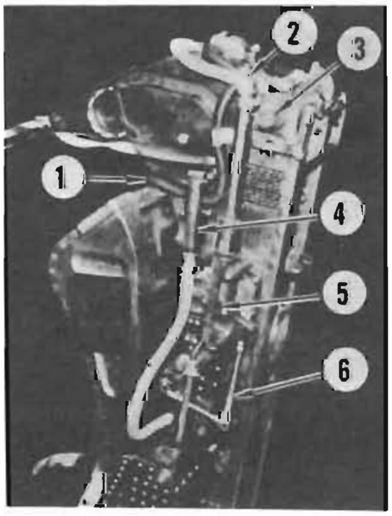
Figure 1-23

MK-F5, -F5A EJECTION SEAT COMPONENTS

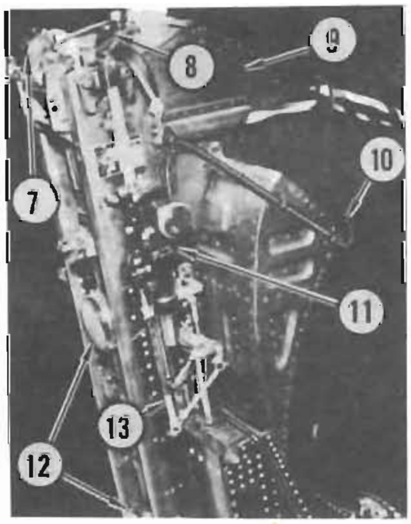


NOTE

Ejection seat controls are described separately in figure 1-23.



1. Link-line
2. Controller drogue parachute withdrawal line
3. Top latch mechanism
4. Emergency release guillotine
5. Drogue gun
6. Drogue gun trip rod
7. Canopy interrupter
8. Drogue shackle scissors
9. Controller and stabilizer drogue parachute container
10. Handle restraint strap*
11. Timed release mechanism (including barostat and g-controller)
12. Seat catapult secondary charges
13. Timed release trip rod



*With BACSEB 9-63.

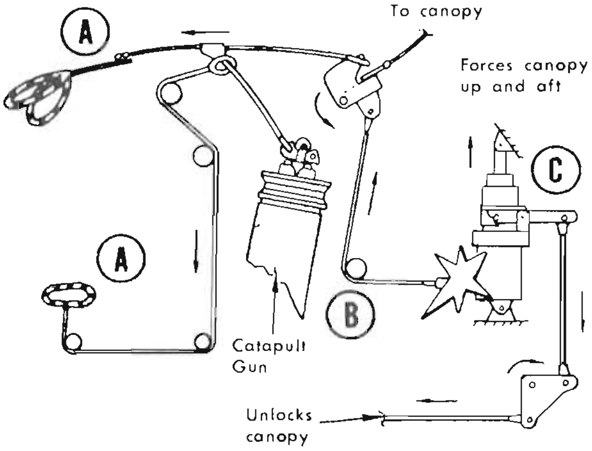
AX-23-8-67

Figure 1-24

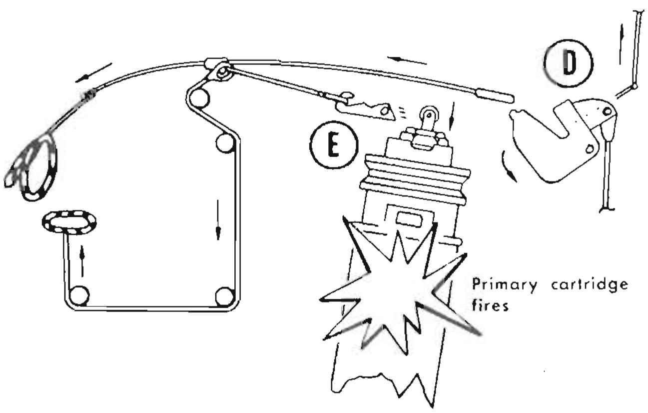
MK-F5, -F5A EJECTION SEQUENCE

LOW-ALTITUDE SEQUENCE
(BELOW 10,000 FEET*)

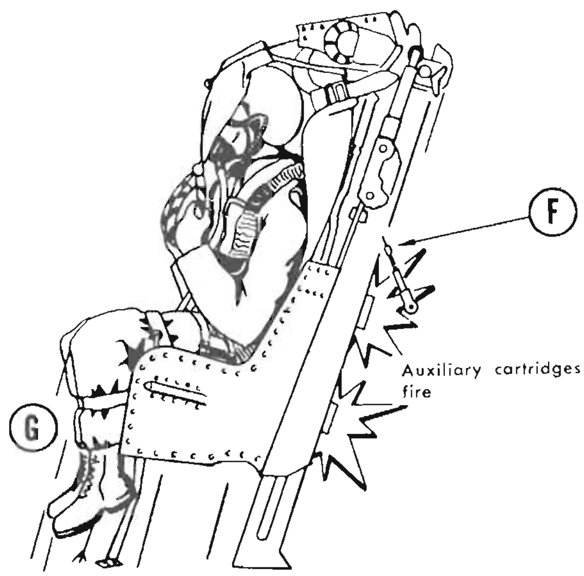
1 When either the face curtain handle or the secondary firing handle (A) is pulled, initial travel of the handle pulls the canopy firing cable (B) to fire the emergency canopy actuator (C), which opens the canopy locks and jettisons the canopy.



2 As the canopy separates from the aircraft, it pulls a lanyard to withdraw a pin from the canopy interrupter (D), permitting the interrupter to release either ejection control (face curtain or secondary firing handle) for further travel. Continued motion of the ejection control withdraws the catapult firing sear (E) at the top of the catapult to fire the seat primary cartridge.



3 As the seat begins to move upward, the drogue gun firing mechanism and timed release mechanism trip rods are pulled free and both mechanisms are armed (F); the drogue gun is fired after 1-second delay (0.5-second delay MK-F5 seat). Initial motion of the seat also causes the leg restraint lines, which are secured to the airframe by shear pins, to be drawn up to place the pilot's legs in the proper position against the front face of the seat (G). The leg restraint snubber in the bottom of the seat holds the pilot's legs in the restrained position until harness release occurs. When the seat is fired, the pilot's services are automatically disconnected and the IFF is automatically switched into operation in the emergency mode. The Shoehorn destruct switch is actuated as the seat leaves the aircraft. As the seat rises, the auxiliary cartridges are automatically fired to increase seat velocity.



*Below 11,500 feet with Martin-Baker ECP 159 incorporated.

AX-34(1)-8-67

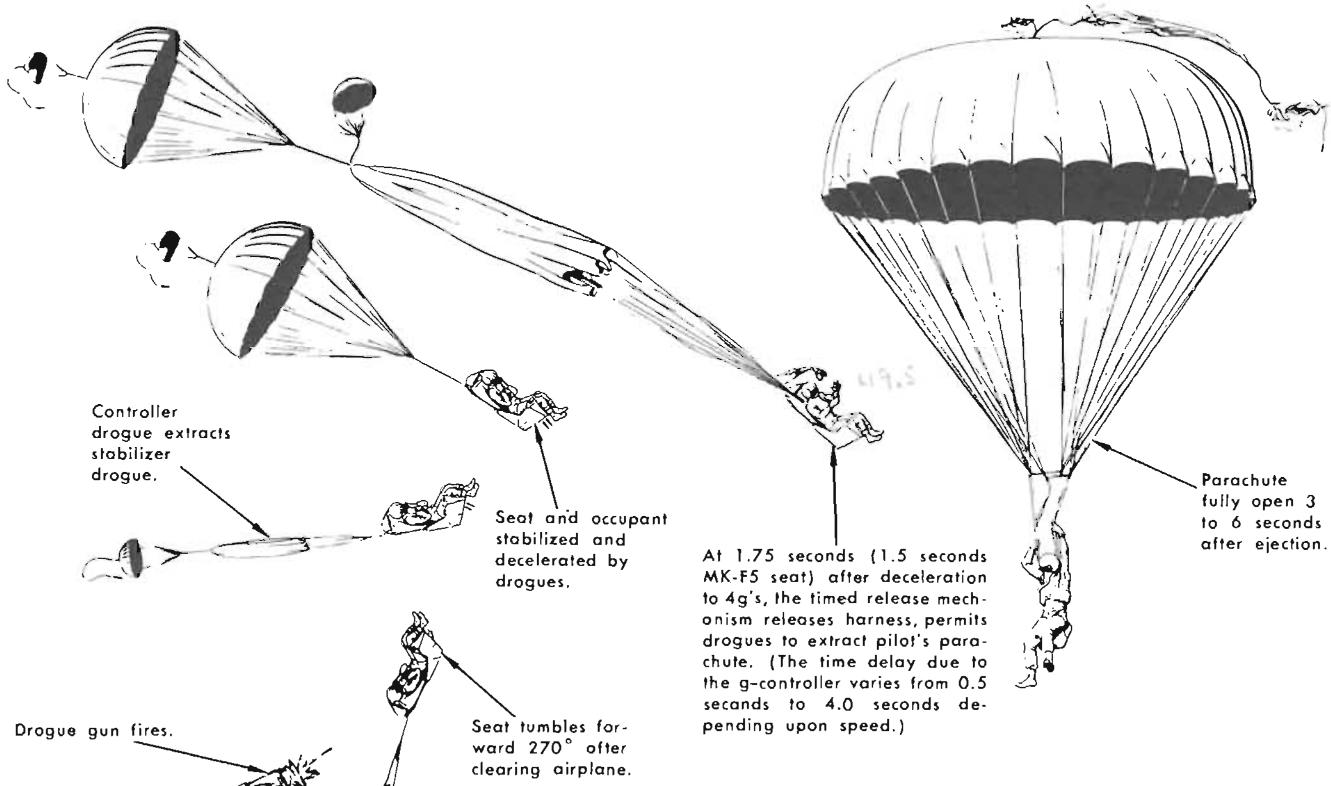
Figure 1-25 (Sheet 1)

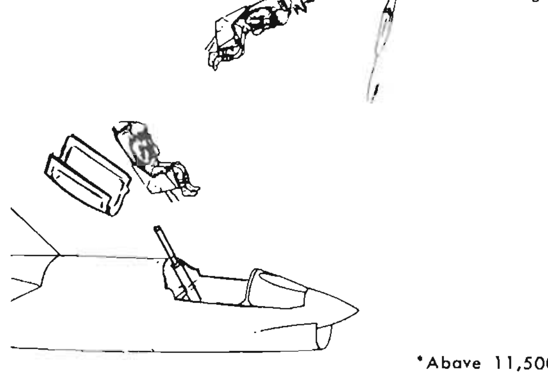
MK-F5, -F5A EJECTION SEQUENCE

4 The drogue gun ejects a piston which withdraws the controller drogue from the seat upper housing and pulls it into the slipstream where it tilts the seat into a horizontal attitude and, in turn, withdraws the stabilizer drogue.

5 The timed release mechanism, which is armed by initial seat movement, releases the drogue shackle scissors and permits the drogues to withdraw and deploy the pilot's parachute 1.75 seconds (1.5 seconds MK-F5 seat) after acceleration reduces to 4.0 g's. The higher the speed, the longer the g-controller prevents operation of the timed release mechanism. This permits the seat and pilot to decelerate to safe speed before the parachute is deployed. The timed release mechanism also actuates the integrated harness release devices to allow the pilot to be separated from the seat by the drag of the parachute.

6 To prevent the pilot from delaying seat separation by holding onto the face curtain longer than is desirable, the curtain is freed from the seat when the parachute deploys. To ensure clean separation of the pilot and seat, two friction fastenings (sticker tabs) briefly restrain the pilot in the seat after harness release occurs.





HIGH ALTITUDE SEQUENCE

(ABOVE 10,000 FEET*)

Operation of the Martin-Baker seat in high-altitude ejections is similar to that at low altitudes except that a barometric altitude limiter (barostat) prevents the timed release mechanism from deploying the pilot's parachute until the pilot and seat have descended to approximately 10,000 feet* pressure altitude. During the descent the drogues stabilize and slow the seat and the pilot is automatically supplied with oxygen from the emergency supply in the seat pan. At 10,000 feet*, the altitude limiter releases the timer and permits parachute deployment and harness release to occur as in a low-altitude ejection.

*Above 11,500 feet with Martin-Baker ECP 159 incorporated.

AX-34(2)-8-67

Figure 1-25 (Sheet 2)

Figure 1-26 deleted.

MK-F7 EJECTION SEAT

DESCRIPTION

After Airframe Change 491, the ejection system utilizes the Martin-Baker MK-F7 ejection seat, equipped with an RSSK-6 survival kit. The system provides the pilot with a means of escape from the aircraft with no minimum airspeed or altitude requirement except for limits imposed by sink rate and bank or dive angles. (Information to be supplied later.) The escape capability of the MK-F7 ejection seat is obtained through the use of two major components: a telescoping, long-stroke ejection gun, which propels the seat from the aircraft, and a rocket motor which ignites after the seat has traveled six feet upward. The rocket pack makes high velocities possible with accelerations reduced from those obtained from a pure ejection gun type seat. The use of drogue parachutes to deploy the pilot's parachute ensures controlled action under all ejection conditions.

The MK-F7 seat is created by adding a rocket capability to the MK-F5A seat. Basically, the conversion (AFC 491) consists of replacing the seat bucket with a similar seat bucket having a rocket motor mounted on the bottom. The parachute support and parachute are replaced by a new support and parachute. A power harness retractor mechanism is installed to ensure correct pilot positioning at ejection.

The seat is equipped with a pilot's shoulder restraint harness that accommodates standard suits with integrated harness provisions. A Skysail E parachute packed in a hardshell container is positioned behind the pilot's shoulders. This parachute location was selected to permit positive parachute deployment at the moment the pilot is released from the seat. The shoulder restraint harness is equipped with a power retractor mechanism which positions the pilot before ejection to ensure proper center-of-gravity position of the ejected mass. When the face curtain is pulled, the shoulder restraint harness power retractor cartridge is fired. Expanding gases from the cartridge supply the energy to spin a reel and draw the pilot back against the seat in a safe position for ejection. Leg restraint lines, one for each leg (two garters), are secured to the airframe and to the seat and are routed through the pilot's leg restraint garters so as to draw the legs back against the front of the seat during ejection. The pilot's legs are restrained until release occurs before deployment of the personnel parachute.

The seat bucket accommodates an RSSK-6 survival kit. The kit is in two halves. The upper half contains an emergency oxygen bottle, which is automatically actuated by a cable attached to the cockpit structure as the seat moves upward during the ejection sequence. The bottle may also be actuated at any time during flight when emergency oxygen is required, such as following normal oxygen system failure. In such cases, the bottle is manually actuated by pulling the emergency oxygen lanyard. The bottom half of the kit contains a life raft, a radio transmitter and a survival equipment bag. The radio transmitter is switched on automatically either by displacement of the seat during the ejection sequence, or by pulling upon the automatic emergency oxygen lanyard. Either action will result in a strong emergency beacon signal being transmitted on Guard channel frequency.

After ejection and subsequent parachute deployment, when time and altitude permit, pulling up on the release handle on the right-hand side of the survival kit will allow the bottom half of the kit to separate from the top half and fall the length of a retaining lanyard, deploying and inflating the life raft. This deployment allows the bottom half of the kit, survival equipment and life raft, to contact the surface first.

WARNING

A small pilot utilizing the MK-F7 ejection seat should raise the seat as high as practical while on the ground and in the traffic pattern. This is to ensure a favorable ejection seat center-of-gravity position. In the somewhat unlikely event that a small pilot had the seat fully lowered and was forced to eject at close to zero-zero conditions, a safe ejection could be jeopardized due to unfavorable seat cg position.

Seat height adjustment is provided by an electrical actuator that raises or lowers the bottom portion of the seat with respect to the upper portion. The parachute container serves as the pilot's headrest and backrest. There is no headrest adjustment. A backpad cushion ensures proper posture for the occupant.

The upper housing of the seat contains the controller and stabilizer drogue parachutes and serves as a mounting for the face curtain handle and the canopy interrupter release handle. The housing has breaker points mounted on each side of the headbox to ensure proper penetration of the canopy in a through-the-canopy emergency ejection. The drogue parachutes are deployed by the action of a drogue gun piston that is fired automatically during ejection to drag a 22-inch controller drogue into the slipstream. A 5-foot stabilizer drogue is automatically drawn into the slipstream and deployed by the controller drogue.

Deployment of the personnel parachute begins 2.25 seconds after initial seat movement unless delayed by the altitude limiter (barostat). If above approximately 11,500 feet, the altitude limiter will delay opening until passing through that altitude.

A pilot's services disconnect, mounted on the left console, holds the antiblackout line and the anti-exposure coverall ventilating air line in position to ensure proper separation at ejection. The oxygen supply line from the seat pan is separately connected to the oxygen receptacle in the left console. Communications connection between the pilot's equipment and the aircraft is automatically completed when the oxygen line is connected to the console fitting.

Ejection seat controls are illustrated and described in figure 1–26A. Ejection seat components are illustrated in figure 1–26B.

OPERATION

The ejection procedure is described and illustrated in Section V. See figure 1–26D for a description of the ejection sequence and figure 1–26C for a list of pilot's equipment that may be used with the Martin-Baker seat.

EMERGENCY RELEASE FROM THE SEAT

In landing emergencies, in ditching, and in the event of the automatic release failing to function in ejection, the pilot can release himself, his parachute, and his survival equipment from the seat by pulling the emergency harness release handle. Pulling the handle releases the leg restraint lines and the lap and shoulder harness, and trips the guillotine which cuts the linkline that connects the stabilizer drogue parachute to the pilot's parachute withdrawal line. Separation of the pilot from the seat should break the pilot's services connections at the disconnect on the left console. Parachute deployment under these conditions is attained by pulling the parachute ripcord D-ring on the left shoulder harness strap. When ditching, the pilot should release the shoulder harness fittings before pulling the emergency harness release handle, and should manually separate the pilot's services connections to ensure separation.

ELECTRICAL SUPPLY

DESCRIPTION

The system flow and distribution is illustrated in figure 1–27.

In normal operation, all electrical power is supplied by a 20-kva ac generator which is engine driven through a constant-speed drive unit. The main generator supplies a three-phase ac output at 115/200 volts, 400 cycles. Main generator output voltage and frequency are automatically monitored by a supervisory system for protection against improper operating conditions.

If the system goes off the line because of a fault, the supervisory system can be reset by the pilot. If the fault remains, the system may be reset manually but will trip off again. If the fault is cleared, normal system operation will resume.

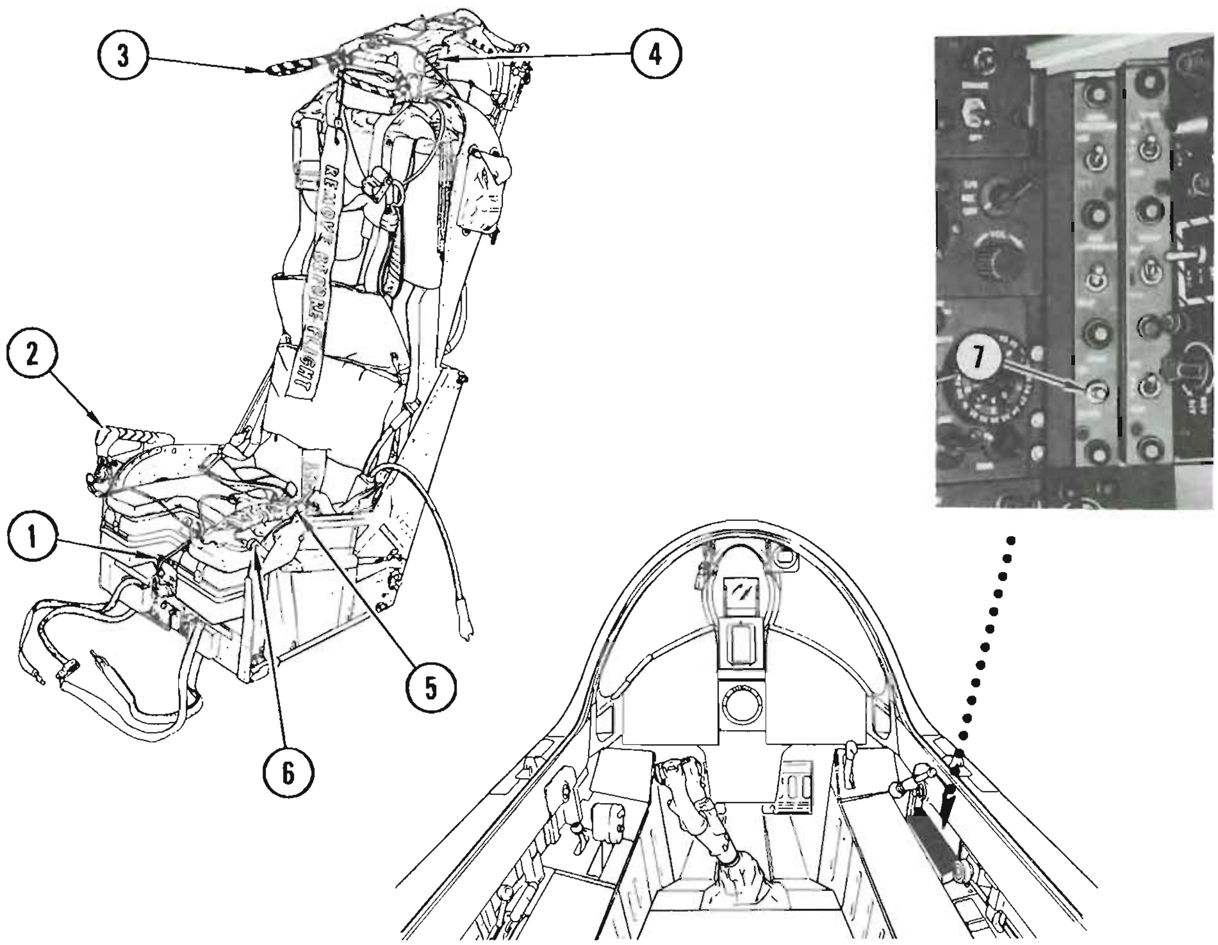
DC power for all needs is obtained from a 150-ampere transformer-rectifier which supplies power to the dc buses during operation on either external or main generator electrical power.

Emergency electrical power is supplied by ram-air-driven ac and dc generators in the emergency power package, which is extended by pneumatic system pressure. The ac generator is rated at 2.5 kva and delivers 115/200-volt, 360- to 440-cps, 3-phase ac power to the primary and emergency ac buses. The dc generator is rated at 10 amperes and delivers regulated 28-volt dc power to the emergency and primary dc buses.

If a flameout occurs, engine windmilling speed may not be adequate to drive the main generator to operating speed. If main generator indicator indicates power failure (barberpole), power from the emergency generators must be used for engine ignition for an airstart. After an airstart, the main generator will automatically supply power to the secondary buses (master generator switch in ON) but will not supply power to the emergency bus or the primary bus until the emergency generator switch is placed in OFF.

Electrical supply system controls are illustrated and described in figure 1–28.

MK-F7 EJECTION SEAT CONTROLS



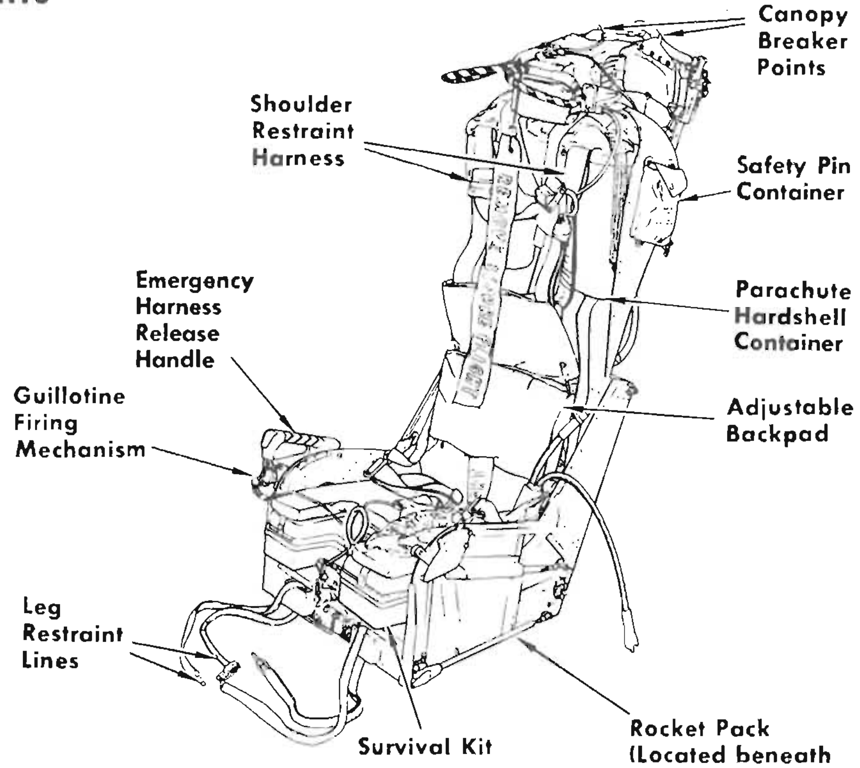
Nomenclature	*Function*
1. Secondary firing handle	Pulled upward fully, jettisons canopy and ejects seat.
2. Emergency harness release handle	Button pressed, handle rotated sharply aft, releases integrated harness, leg restraint lines, and parachute from seat, permitting the pilot to leave the seat with parachute and full survival equipment.
3. Face curtain handle	Pulled down fully, jettisons canopy and ejects seat.
4. Canopy interrupter handle	Pulled fully forward, bypasses canopy firing and overrides interrupter, permitting complete travel of the face curtain or secondary firing handle to eject the seat through the canopy.
5. Shoulder harness lock lever	Pulled aft against tension, unlocks shoulder harness inertia reel so that the pilot may lean forward. Neutral position holds unlocked condition. Pushed to forward position, locks inertia reel to prevent any forward motion of the pilot.
6. Leg restraint release lever	Pushed forward, releases leg restraint snubber to permit additional length of line to be pulled out. Pulled aft, releases leg restraint line plug in fitting from front seat to permit normal exit from aircraft.
7. Seat adjustment switch	UP or DOWN raises or lowers seat pan to desired height.

AX-160-8-67

Figure 1-26A

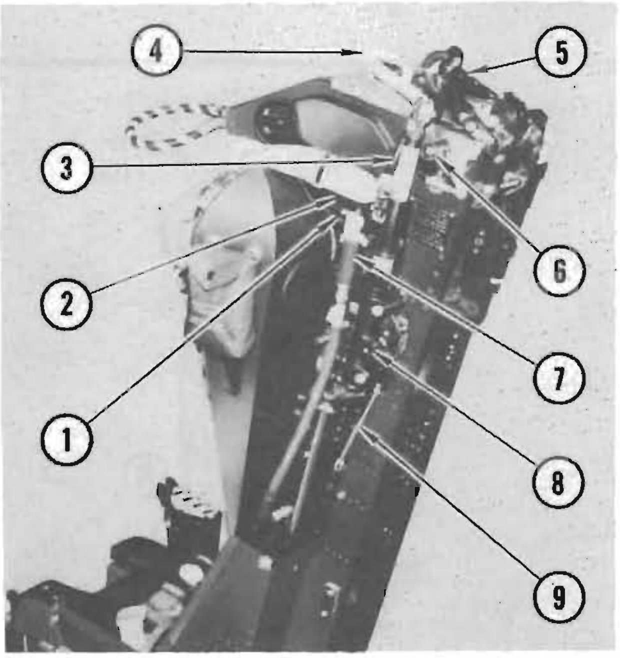
MK-F7 EJECTION SEAT COMPONENTS

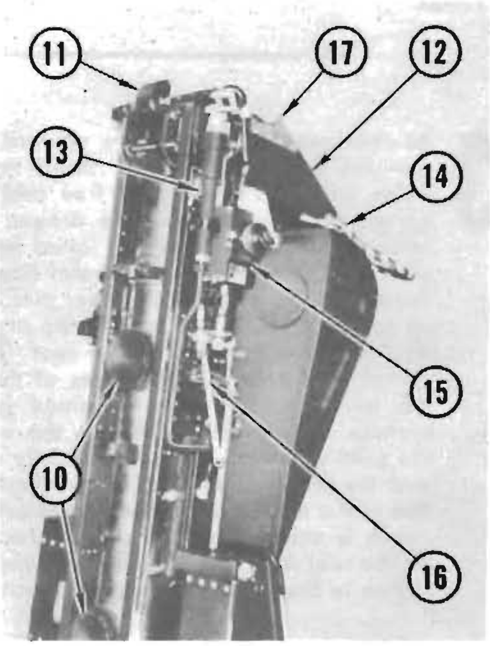
1. Parachute withdrawal line
2. Parachute locking pin withdrawal line
3. Link-line
4. Controller drogue parachute withdrawal line
5. Drogue shackle scissors
6. Top latch mechanism
7. Emergency release guillotine
8. Drogue gun
9. Drogue gun trip rod
10. Seat catapult secondary charges
11. Canopy interrupter
12. Controller and stabilizer drogue parachute container
13. Power retractor gun
14. Handle restraint bungee
15. Timed release mechanism (including barostat and g controller)
16. Timed release trip rod
17. Canopy breaker points



NOTE

Ejection seat controls are described separately in Figure 1–26A.





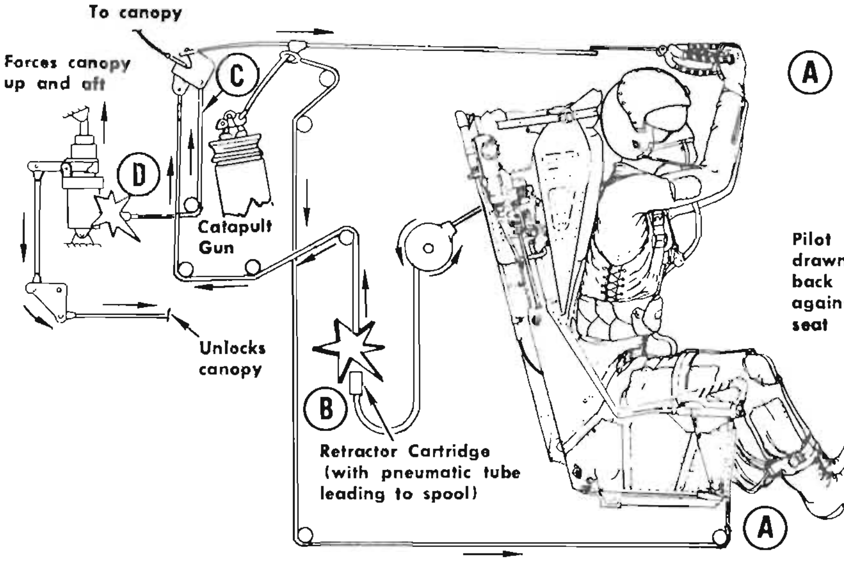
AX–161–8–67

Figure 1–26B

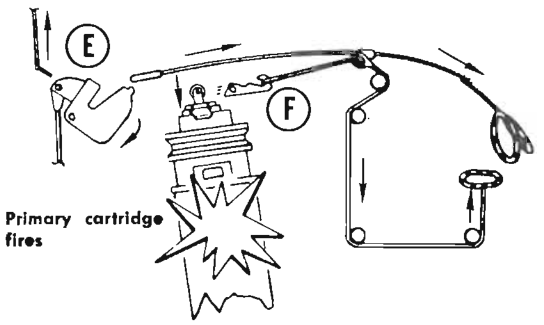
MK-F7 EJECTION SEQUENCE

LOW-ALTITUDE SEQUENCE
(BELOW 11,500 FEET)

1 When either the face curtain handle or the secondary firing handle (A) is pulled, initial travel of the handle fires the shoulder harness power retractor cartridge (B) drawing the pilot back against the seat in a safe position for ejection. At the same time, the canopy firing cable is pulled (C), firing the emergency canopy actuator (D) which opens the canopy locks and jettisons the canopy.



2 As the canopy separates from the aircarft, it pulls a lanyard to withdraw a pin from the canopy interrupter (E) , permitting the interrupter to release either ejection control (face curtain or secondary firing handle) for further travel. Continued motion of the ejection control withdraws the catapult firing sear (F) at the top of the catapult to fire the seat primary cartridge. As the seat rises, heat from the primary cartridge fires auxiliary cartridges in rapid succession to increase seat velocity.



3 As the seat begins to move upward, the drogue gun firing mechanism and timed release mechanism trip rods are pulled free and both mechanisms are armed (G) ; the drogue gun is fired after a 0.75-second delay. Initial motion of the seat also causes the leg restraint lines, which are secured to the airframe by shear pins, to be drawn up to place the pilot's legs in the proper position against the front face of the seat (H) . The leg restraint snubber in the bottom of the seat holds the pilot's legs in the restrained position until harness release occurs. When the seat is fired, the pilot's services are automatically disconnected and the IFF is automatically switched into operation in the emergency mode. The Shoehorn destruct switch is actuated as the seat leaves the aircraft. As the seat rises, the auxiliary cartridges are automatically fired to increase seat velocity.

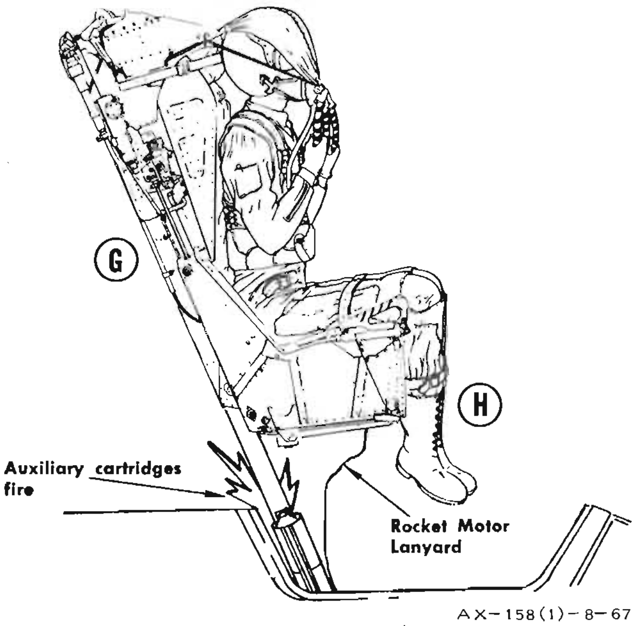


Figure 1–26C (Sheet 1)

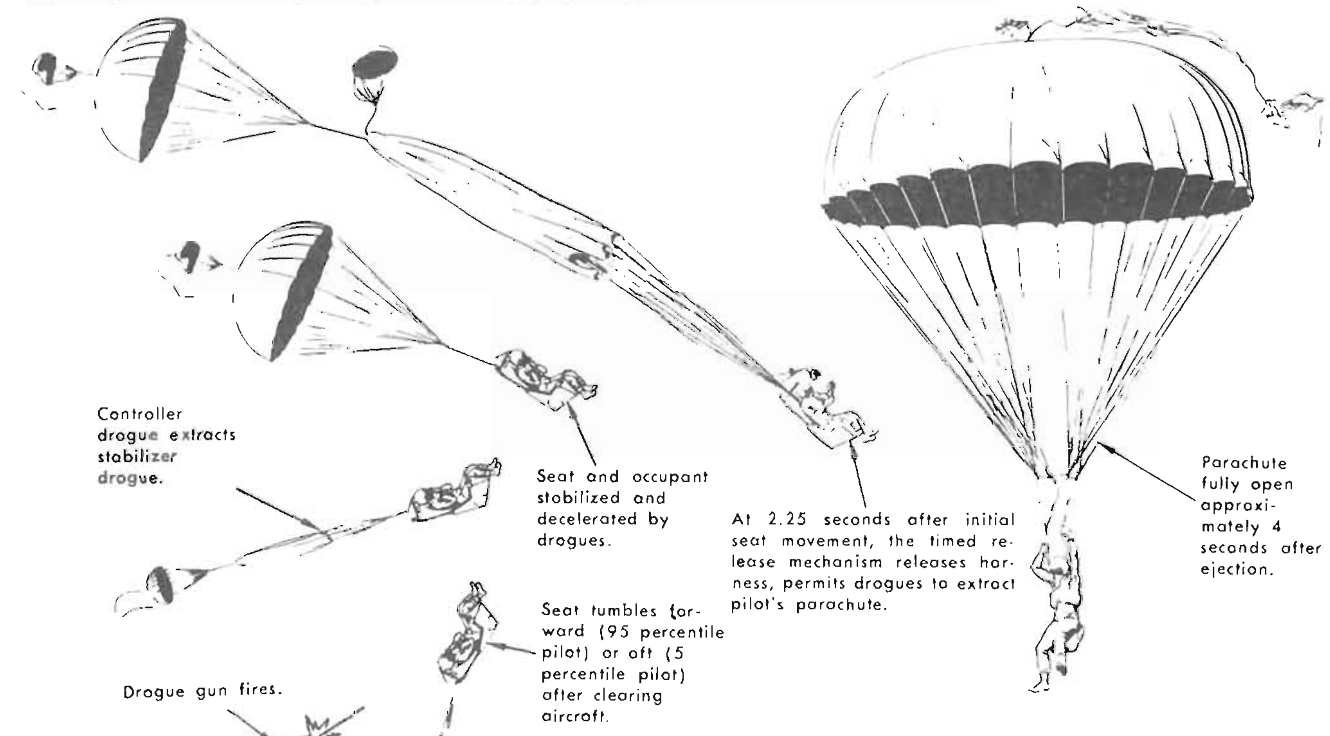
MK-F7 EJECTION SEQUENCE

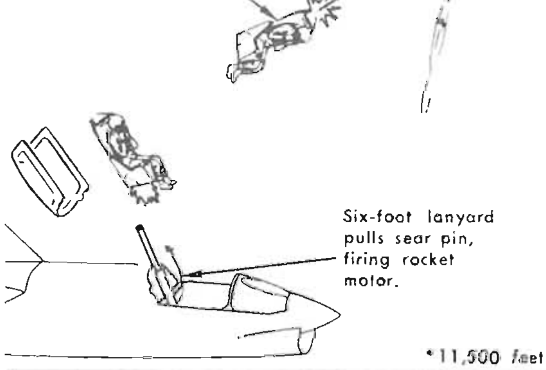
4 When the ejection seat has lifted the length of the rocket motor firing lanyard (six feet), the lanyard withdraws a sear from the rocket motor initiator, firing the rocket motor.

5 The drogue gun ejects a piston which withdraws the controller drogue from the seat upper housing and pulls it into the slipstream where it tilts the seat into a horizontal attitude and, in turn, withdraws the stabilizer drogue.

6 The timed release mechanism, which is armed by initial seat movement, releases the drogue shackle scissors and permits the drogues to withdraw and deploy the pilot's parachute 2.25 seconds after initial seat movement. The timed release mechanism also actuates the integrated harness release devices to allow the pilot to be separated from the seat by the drag of the parachute.

7 To prevent the pilot from delaying seat separation by holding onto the face curtain longer than is desirable, the curtain is freed from the seat when the parachute deploys. To ensure clean separation of the pilot and seat, two friction fastenings (sticker tabs) briefly restrain the pilot in the seat after harness release occurs.





HIGH ALTITUDE SEQUENCE
(ABOVE 10,000 FEET*)

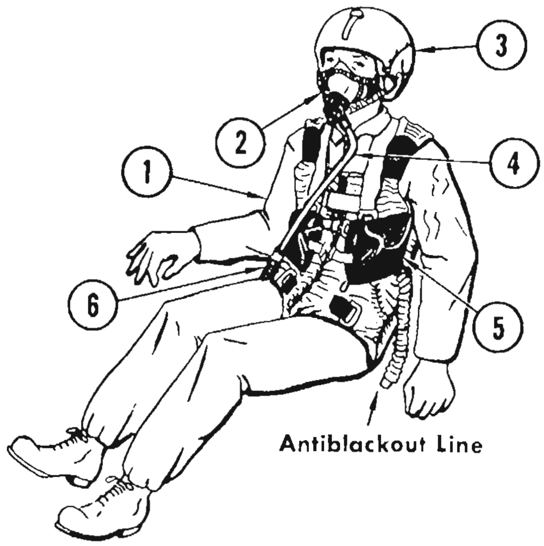
Operation of the Martin-Baker seat in high-altitude ejections is similar to that at low altitudes except that a barometric altitude limiter (barostat) prevents the timed release mechanism from deploying the pilot's parachute until the pilot and seat have descended to approximately 10,000 feet* pressure altitude. During the descent the drogues stabilize and slow the seat and the pilot is automatically supplied with oxygen from the emergency supply in the seat pan. At 10,000 feet*, the altitude limiter releases the timer and permits parachute deployment and harness release to occur as in a low-altitude ejection.

*11,500 feet with Martin-Baker ECP 159 incorporated.

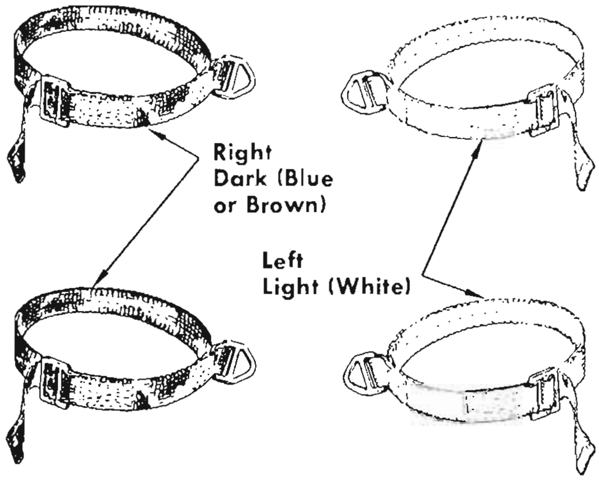
AX-158(2)-8-67

Figure 1-26C (Sheet 2)

PILOT'S EQUIPMENT

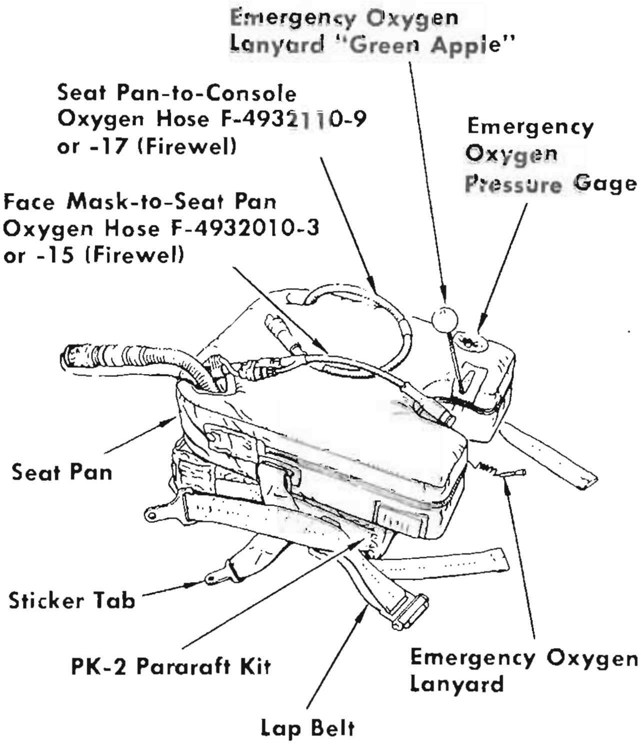


1. Standard flight coveralls, MS22015 torso harness, and type Z-3 anti-g suit
   or
   Type Z-2 anti-g coveralls and MS22015 torso harness
   or
   S-470 integrated coveralls and type Z-3 anti-g suit
   or
   MK-5A anti-exposure coverall and type Z-4 anti-g suit
2. Type A 13-A face mask
3. Type APH-5 helmet
4. Mini-Reg hose
5. MK-3C flotation vest
6. Oxygen hose F-4932010-3 or -15 (Firewel)

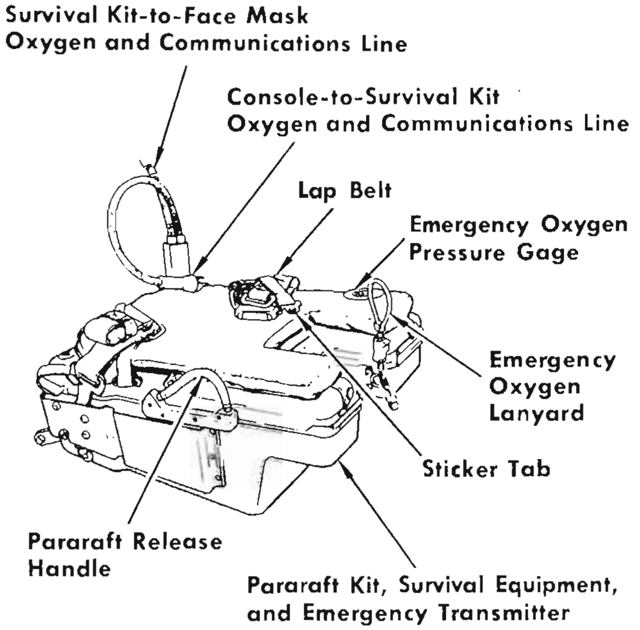


Martin-Baker color-coded leg restraint garters

FOR USE IN MARTIN-BAKER EJECTION SEAT



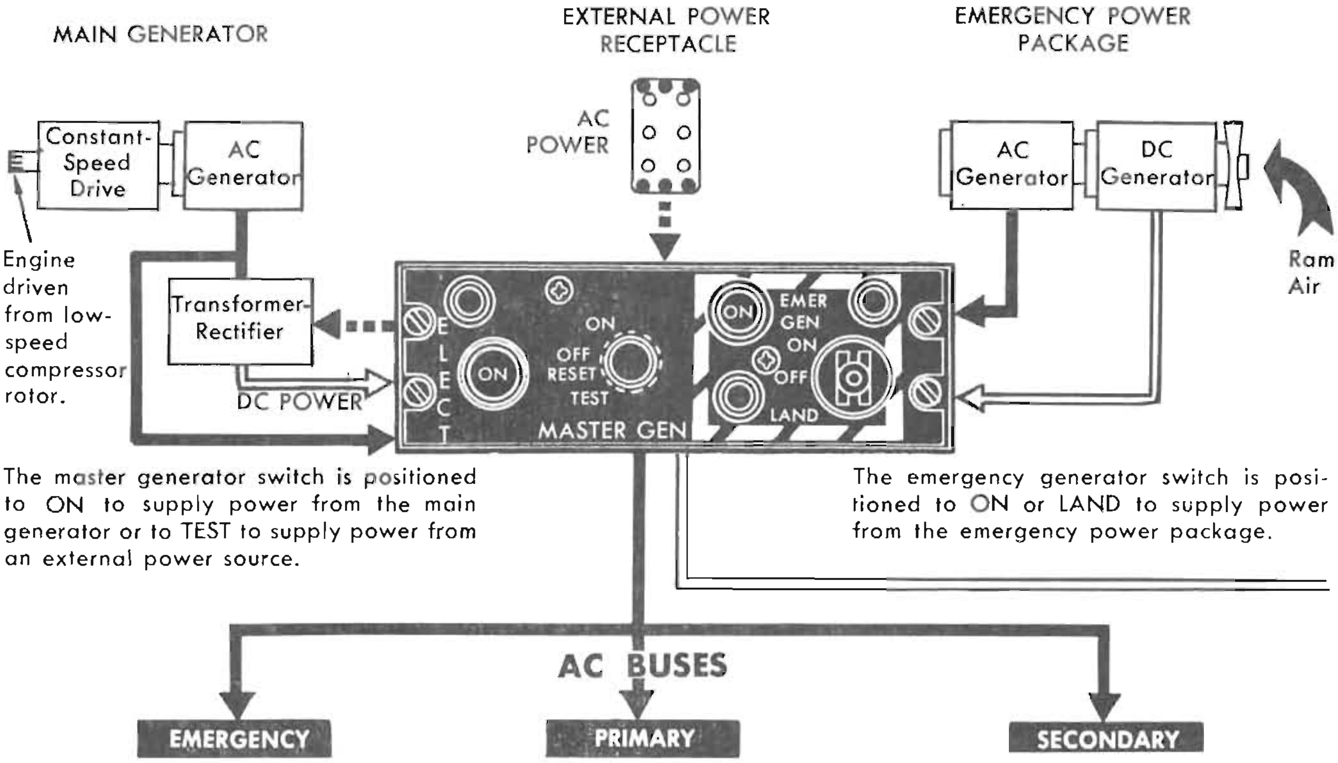
CY15-416070 Seat Pan/PK-2 Pararaft Kit
(or RSSK-6 Shown Below)



AX-35-8-67

Figure 1-26D

ELECTRICAL SUPPLY



EMERGENCY

Altimeter vibrator
Attitude indicator
Emergency pitch trim
Instrument transformer:
- Engine fuel flow
- Engine oil pressure
- Hydraulic pressure
- Navigation indicator

Pitch trim
Primary interior lights
Roll trim and stabilization
Wing position lights

PRIMARY

Cockpit temperature control
Forward main fuel pump (Boost)
Integrated electronics package
- ADF radio
- IFF radar identification
- UHF Command radio

MA-1 compass
Main fuel quantity
Oxygen quantity
Pitot heat
TACAN radio
Tail position light
Transfer fuel quantity
Yaw trim and stabilization

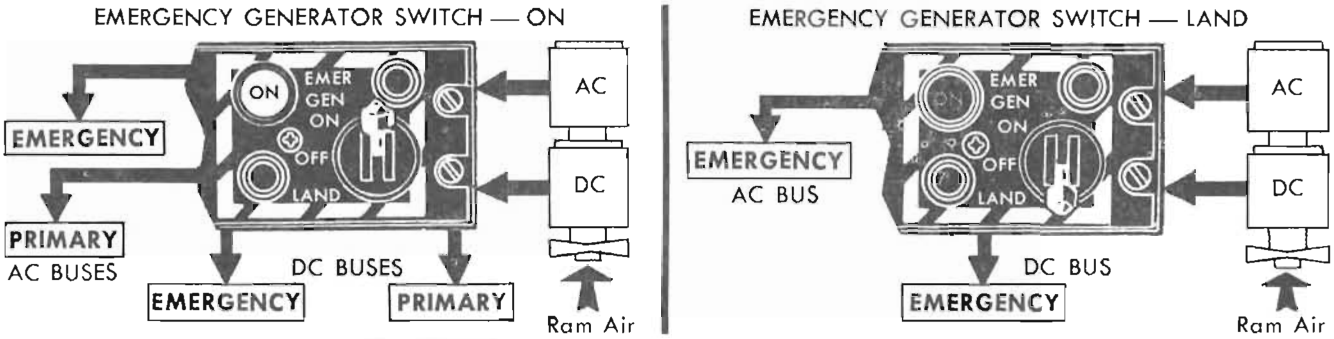
SECONDARY

Aft main fuel pump (Boost)
Aft transfer fuel pump
Air bottle heaters
AN/ALQ-51
Anti-collision lights
Approach power compensator system
Autopilot
Center main fuel pump (Boost)
Duct bypass door actuator
Engine pressure ratio indicator
Fire control system
Formation lights
Forward transfer fuel pump
Gun interlock
Inflight refueling probe light
Inverted flight fuel pumps
IR detector
Main cell forward wall fuel pump
Missile power
Radar
Radar altimeter
Radar recorder
SEAM system
Seat adjustment
Secondary interior lights

AX-134(1)-10-67

Figure 1-27 (Sheet 1)

ELECTRICAL SUPPLY



DC BUSES - 28 VDC

EMERGENCY

Angle of attack indicator and indexer
Approach lights
Emergency spot light
Engine fuel pump warning light
Engine fuel shutoff valve
Engine ignition
Engine oil/hydraulic pressure warning light
Exterior light control
Fire detector
Flood lights
Fuel control unit changeover
Landing gear position indicators
Landing gear warning light
Leading edge droop
Manual fuel control light
Roll trim and stabilization
Stabilization warning lights
Transfer fuel pump warning light
Wing fuel dump valves
Wing pressurization
Wing-wheels-droop warning light

PRIMARY

Afterburner fuel control
Emergency generator warning light
Engine cranking control
Integrated electronics package
- ADF radio
- IFF radar identification
- UHF command radio

Jettison (salvo)
Jettison (selective)
MA-1 compass
Speech security equipment
Speedbrake
TACAN radio
Yaw trim and stabilization

SECONDARY

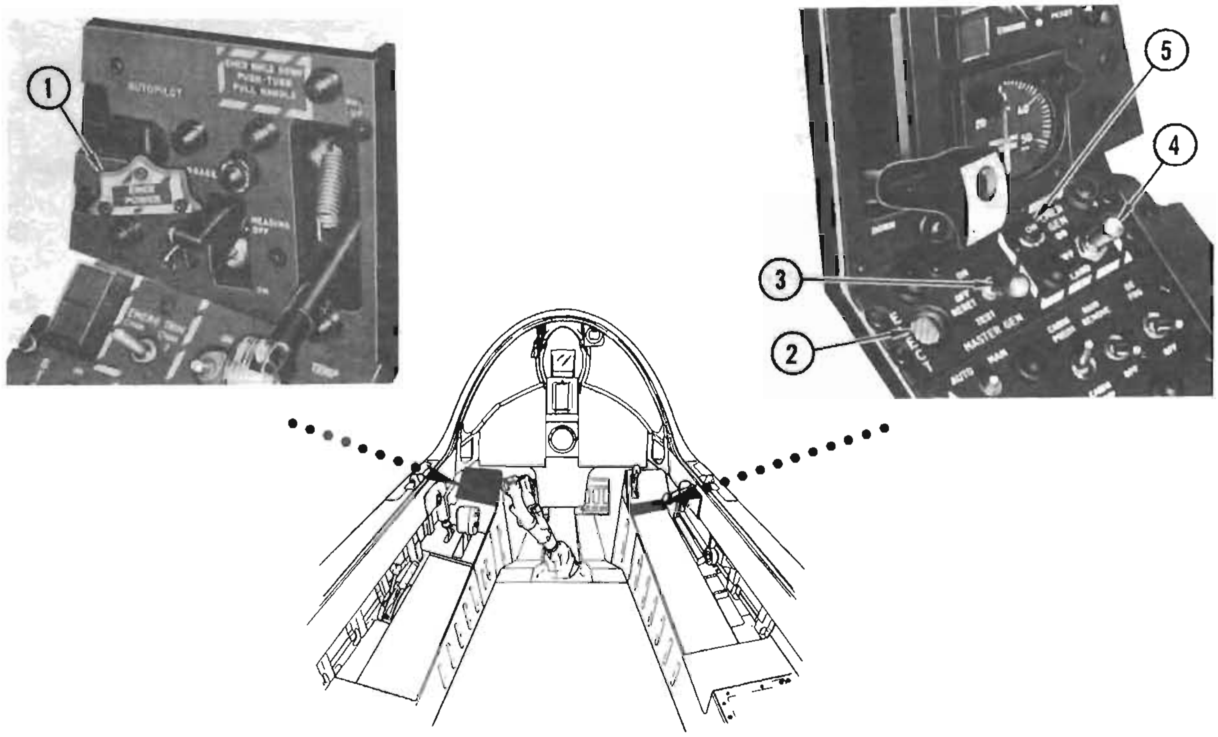
AN/ALQ-51A ECM
Approach lights flasher
Approach power compensator system
Armament bus
Arresting gear
Automatic ignition
Autopilot
Boost pumps
Chaff dispenser
Continuous engine ignition
Duct bypass door control and indicator
Electronic package fan
Engine anti-icing
Engine cranking air valve
Fire control system
Fuel boost pumps warning light
Fuel low level warning light
Fueling valves
Gun camera
Gun vent doors
Inflight refueling system
IR detector
Landing and taxi light
Landing gear down lock solenoid
Launch/alert
Missile cooling
Missile firing
Missile power
Neutral trim indicators
Nose gear steering
Oxygen warning light
Radar
Radar altimeter
Radar recorder
SEAM system
Smoke abatement
Statistical accelerometer
Wing selector valve lock
Wingfold sequencing

DON'T FOLD WINGS AFTER LANDING ON THE RAT

AX-134(2)-10-67

Figure 1–27 (Sheet 2)

ELECTRICAL SUPPLY SYSTEM CONTROLS



Nomenclature	*Function*
1. Emergency power handle	Pulled, extends emergency power package. Package cannot be retracted in flight. (Refer to POWER CONTROL HYDRAULIC SUPPLY for information on emergency hydraulic pump.)
2. Main generator indicator	ON — indicates that main ac generator is producing electrical power within proper limits. Barberpole indicates that main ac generator is not operating properly and is not connected to the buses.
3. Master generator switch	ON — connects power from the main ac generator or from external power source to ac buses and to transformer-rectifier (dc power to buses). In this position, transfer from external power to aircraft power is automatic when the main generator voltage and frequency are within the prescribed limits. TEST — connects external ac power to the ac buses, to the transformer-rectifier (dc power to buses), and disconnects generator power from ac and dc buses (main generator indicator will still be operating). OFF–RESET — disconnects main generator or external power from buses. Readies electrical system for reset when placed in ON or TEST.
4. Emergency generator switch	ON — (emergency power package extended) connects power from emergency generators to emergency and primary ac and dc buses. LAND — (emergency power package extended) connects power from emergency generators to only the emergency ac and dc buses. This decreases electrical load on the emergency power package to improve package performance at low airspeeds. OFF — disconnects emergency electrical power from buses.
5. Emergency power indicator light	ON — (emergency generator switch in ON) indicates that power is being supplied by emergency generators and serves as a reminder to place emergency generator switch in LAND (with engine running) prior to landing, or in OFF if making a flameout landing. Off indicates emergency generator switch is in LAND or OFF.

AX-26-1-67

Figure 1–28

EXTERIOR LIGHTS

DESCRIPTION

The exterior light system consists of fuselage- and wing-mounted low-intensity formation lights, anti-collision lights, carrier landing approach lights, a land/taxi light, conventional position (navigation) lights, and an inflight refueling probe illuminating light.

The fuselage-mounted formation lights are amber strip lights positioned to ensure visibility over a wide range of formation positions. The wing-mounted formation lights are red and green light-emitting panels installed on the wing tips just aft of the normal wing position lights to permit wing attitude to be observed from positions aft and above or below the aircraft. Both the wing and fuselage formation lights are powered from the secondary ac bus and will not be available when operating on emergency electrical power.

The anticollision lights are high-intensity red lights mounted on the top and bottom of the fuselage at the centerline. These lights, which are powered from the secondary ac bus, flash off and on approximately 80 times per minute.

The conventional red and green wing position lights are powered from the emergency ac bus. When operating on emergency electrical power, these lights will burn only when DIM is selected with the wing light switch. The white tail position light is powered from the primary ac bus. When operating on emergency electrical power, these lights are available only when the emergency generator switch is in the ON position.

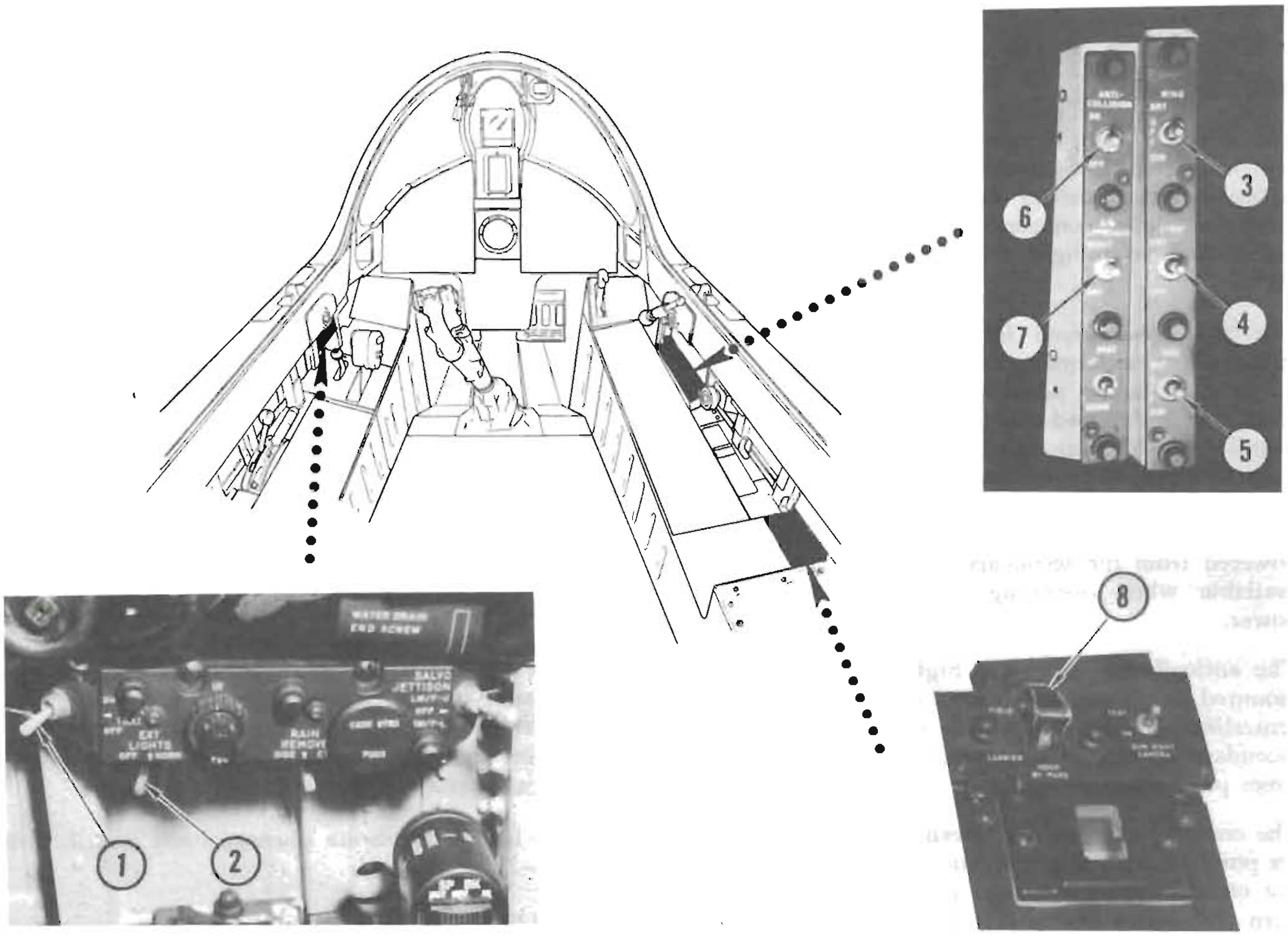
The land/taxi light, mounted on the right main gear strut, is a high-intensity white light powered from the secondary dc bus. The light is not available when operating on emergency electrical power.

The separate red, green and amber approach lights are mounted on the nose gear flipper door and are powered, through the angle-of-attack indicating system, from the emergency dc bus. The approach lights come on automatically when the landing gear handle is placed in WHLS DOWN and weight is off the gear, regardless of the position of the exterior lights switch. An approach light hook bypass circuit permits selection of approach light operation for either carrier landings or for field landings (field mirror landing practice). Refer to ANGLE-OF-ATTACK INDICATING, this section, for information concerning sequence of approach light operation. An exterior light master control circuit is provided with a switch located above the throttle to permit signaling to catapult officer and for rapid turn-out of all exterior lights in tactical operations that require blackout.

Exterior light controls are illustrated and described in figure 1–29.

Refer to INFLIGHT REFUELING for description and operation of the inflight refueling probe illuminating light.

EXTERIOR LIGHT CONTROLS



Nomenclature	Function
1. Land/taxi light switch	ON — turns on taxi light when landing gear handle is in WHLS DOWN.
2. Exterior light switch	NORM — energizes exterior master control light switch circuit to permit selection of desired exterior lights.
3. Wing light switch	BRT* — causes wing navigation lights to burn brightly. DIM* — causes wing navigation lights to burn dimly.
4. Strip light switch	BRT — causes all formation lights to burn brightly. DIM — causes all formation lights to burn dimly.
5. Taillight switch	BRT* — causes tail navigation lights to burn brightly. DIM* — causes tail navigation lights to burn dimly.
6. Anticollision light switch	ON — turns on red anticollision lights.
7. Approach light dimming switch	DAY — selects bright lighting of approach lights for daylight operations. NIGHT — selects dim lighting of approach lights for night operations, except when on emergency power.*
8. Approach light hook bypass switch	CARRIER — causes approach lights to flash if arresting hook is not down when landing gear handle is in down position and no weight is on the gear. The lights will not flash when operating on emergency electrical power. FIELD — permits approach light to burn steadily for field mirror landing practice when arresting hook is up, landing gear handle is in down position, and weight is not on the gear.

*With exterior light switch in ON.

AX-30-1-67

Figure 1–29

FIRE DETECTOR

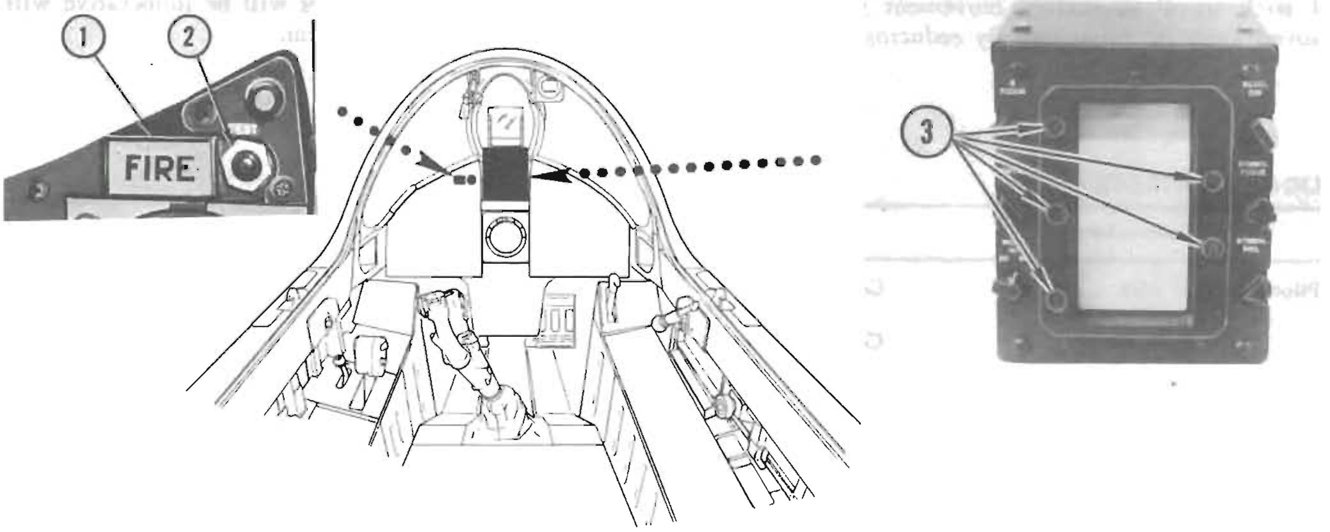
DESCRIPTION

Abnormally high temperatures in the engine or afterburner compartments is sensed by the system, resulting in illumination of the fire warning light. The system is comprised of the warning light, detection control assembly and heat sensing elements. Electrical power is provided by the emergency dc bus. The system will operate any time the master generator switch is in ON or TEST with the engine running or with external electrical power connected.

In aircraft after Airframe Change 487 unlighted radar indicator lights flash whenever the fire warning light or low altitude limit light comes on. The feature is intended to warn the pilot during "head-in-boot" flying. The landing gear handle must be in the WHLS UP position for the indicator lights to flash.

Fire detector system controls are illustrated and described in figure 1–30.

FIRE DETECTOR SYSTEM CONTROLS



Nomenclature	*Function*
1. Fire warning light	Light on (FIRE) indicates fire or overheat condition in engine bay or afterburner compartment area.
2. Fire warning test switch	Depressed, checks system circuit continuity and operation of fire warning light.
3. Radar information lights	Flashing of information lights not already lighted indicates fire warning light or altitude limit light is on.*

*Aircraft after Airframe Change No. 487.

AX-41-1-67

Figure 1–30

FLIGHT CONTROLS

DESCRIPTION

The flight control system uses the control stick and rudder pedals to operate mechanical linkage to position the slider valves of hydraulic power control cylinders. In response to this movement the slider valves, through mechanical linkage of the power control cylinders to the control surfaces (aileron, horizontal tail, and rudder), cause movement of the desired surface. As this irreversible system has no airload feedback to the control stick or rudder pedals, artificial "feel" is introduced into the system by feel springs, bobweights, and viscous dampers. The amount of simulated feel introduced is proportional to the amount of surface deflection. The feel springs return the control stick or rudder pedal to neutral after the stick or pedal has been actuated and released. Movement of the control surfaces is also controlled by the trim and stabilization system. Operation of this system does not affect the neutral position of the control stick or the rudder pedals.

An assembly of links and levers in the horizontal tail pushrod system reduces control sensitivity in the vicinity of neutral stick position by changing the ratio of stick travel to surface movement as the stick is moved away from neutral. By reducing surface travel for a given stick displacement, the variable gain linkage eliminates high pitch corrections at high airspeeds.

When the wing is raised to the landing position, the ailerons and flaps are automatically drooped 20° from the cruise neutral position. This is accomplished by means of mechanical linkage from the wing to the aileron power control hydraulic slider valves and the flap segment inboard of the ailerons. Aileron droop and flap action provide increased lift and stability when the wing is raised and the wing leading edge is extended.

A wing spoiler control surface is installed flush with the upper surface of the wing forward of each aileron to increase rate of roll at low altitudes and high airspeed. The spoilers are slaved directly to aileron control and function in both the clean condition and landing condition. When the aileron is deflected more than 2° above the aileron clean condition neutral, the spoiler control surface is deflected an amount proportional to aileron deflection. Maximum spoiler deflection is 49°. Mechanical linkage from the aileron power control package positions a slider valve, allowing PC 2 hydraulic pressure to actuate the spoiler control surface. The spoilers will be inoperative with loss of PC 2 hydraulic system.

FLIGHT CONTROLS

Nomenclature	*Function*
Pilot's control stick	Controls aileron deflection of 15° up and 45° down in landing condition (wing raised and ailerons drooped). Controls aileron deflection of 15° up and 15° down in clean condition (wing lowered and aileron cruise neutral restored). Overridable clean condition stops are encountered at 9½°. Controls horizontal tail deflection between 26° 30′ nose up and 6° 45′ nose down.
Rudder pedals	Control rudder displacement between 17° left and right of neutral with wing raised. Control rudder displacement between 6° left and right of neutral with wing down.
Rudder pedal adjustment crank	Rotated right or left adjusts rudder pedal assembly fore or aft.

FLIGHT INSTRUMENTS

ATTITUDE INDICATOR

This indicator (35, figure 1–3) presents a pictorial indication of the aircraft pitch and roll attitude with respect to the real horizon. The system functions throughout 360° of roll attitude, but is limited to ±82° from the horizon in pitch attitude. A gyro caging switch is not provided because the system gravity-sensing erection circuit corrects induced errors at a rate of approximately 1° per minute. The indicator is operative any time the aircraft electrical circuits are energized. The OFF flag will appear when ac power is removed. A pitch trim knob, located on the face of the indicator, is provided for the purpose of setting the artificial horizon to the "zero pitch" position when in level flight attitude.

TURN-AND-BANK INDICATOR

The gyro of this indicator (34, figure 1–3) is operated by bleed air from the engine compressor section.

ACCELERATION INDICATOR

This indicator (43, figure 1–3) is self-contained and indicates continuously the existing g-load on the aircraft during flight. It also indicates the maximum positive and negative loads that were imposed on the aircraft during any particular flight period.

AIRSPEED — MACH NUMBER INDICATOR

This pitot-static pressure indicator (42, figure 1–3) provides indicated airspeed readings of 80 to 850 knots and indicated Mach number readings of 0.4 to 2.5. An airspeed correction card provides calibrated air speed data. Conventional pitot tube anti-icing is provided.

RATE-OF-CLIMB INDICATOR

This indicator (44, figure 1–3), operated by static pressure, provides rate-of-climb and rate-of-descent information in feet-per-minute.

ALTIMETER

This instrument (41, figure 1–3), operated by static pressure, indicates pressure altitude based on the barometric pressure of a given station previously set on the barometric scale of the instrument. The altimeter permits readings to 80,000 feet.

An instrument vibrator is incorporated in the altimeter to prevent erroneous readings caused by sticking of the indicator. Vibrator electrical power is supplied by the emergency ac bus. A momentary lag will occur as the needle passes zero on each revolution during a descent with the vibrator inoperative. This lag may be overcome by a light tap on the instrument face as the needle approaches zero each time. After level flight is attained, altimeter reading will become normal.

ANGLE-OF-ATTACK INDICATOR

The indicator (9, figure 1–3) provides continuous angle-of-attack indications for use primarily as an aid in controlling attitude and, hence, in controlling airspeed in landing approaches. The indications can also be used in establishing various other flight conditions. The indicator also controls operation of the angle-of-attack approach indexer and the approach lights. Refer to ANGLE-OF-ATTACK INDICATING, this section, for details of system operation.

FUEL SYSTEM

DESCRIPTION

Refer to figure 1–31 for system illustration.

Fuel is supplied to the engine from the main fuel cell, through the engine fuel shutoff valve, by six fuel boost pumps. Four of these pumps operate at all times when the engine master switch is on and provide proper fuel flow for all upright flight attitudes. Two of the boost pumps are controlled by an attitude switch to supply fuel at inverted attitude. The inverted flight boost pumps operate when pitch attitude exceeds 130° nose up or 10° nose down, or when roll attitude exceeds 90°. Only the forward main fuel boost pump operates when electrical power is being supplied by the emergency power package with the emergency generator switch in ON. With the emergency generator switch in LAND, none of the boost pumps operate and flight operation must be restricted to avoid flameouts. Fuel from the midfuselage cells of the main system flows into the main cell by gravity feed.

The transfer fuel system, composed of forward and aft fuselage fuel cells and the wing tank, semiautomatically sequences flow of transfer fuel to the main cell. Optimum center-of-gravity conditions are maintained provided the transfer switch is in the proper position. Float valves in the main cell open to admit fuel from the transfer system when the main cell fuel level drops to a predetermined point. Forward and aft fuselage fuel is transferred under pump pressure. Wing fuel is transferred by air pressure supplied by the air-conditioning system. The transfer fuel pumps automatically shut off when the inverted flight boost pumps are operating.

Fuel system controls are illustrated and described in figure 1–32.

FUEL QUANTITIES

Fuel load indications will vary depending upon temperature and type of fuel used. Under extreme temperature changes, gage readings can vary as much as 10% (6% gage tolerance and 4% fuel density change) of the average quantities.

With partial refueling selected (fuel selector switch in REFUEL PARTIAL), the main system cells will be fueled to the transfer level and the transfer system will be completely refueled for a total fuel load of 1,255 gallons. With only main cell refueling selected (fuel selector switch in REFUEL MAIN CELL), the main cell will be completely refueled (425 gallons). On some aircraft, the solenoid-operated check valves between the main fuel cell and the midfuselage cells are being replaced with acceleration check valves. On these aircraft, placing the refueling selector switch in REFUEL MAIN CELL will refuel the midfuselage cells in addition to the main cell for a total fuel load of 513 gallons.

Any desired fuel load can be attained by selecting REFUEL TOTAL, fueling to full load, then defueling to the desired quantity.

FUEL WEIGHTS

Fuel Cell	*Pounds — JP-4*	*Pounds — JP-5*	*US Gallons*
	Main Fuel System		
Main	2,762.5	2,890.0	425
Left-hand midfuselage	286.0	299.2	44
Right-hand midfuselage	286.0	299.2	44
MAIN SYSTEM TOTAL	3,334.5	3,488.4	513
	Transfer Fuel System		
Left-hand fwd transfer (aft fuselage)	292.5	306.0	45
Right-hand fwd transfer (aft fuselage)	292.5	306.0	45
Left-hand aft transfer	266.5	278.8	41
Right-hand aft transfer	266.5	278.8	41
Wing tank	3,718.0	3,889.6	572
Forward fuselage	591.5	618.8	91
TRANSFER SYSTEM TOTAL	5,427.5	5,678.0	835
TOTAL AIRCRAFT FUEL	8,762.0	9,166.4	1,348

FUEL CELL PRESSURIZATION AND VENTING

Pressurization and venting maintain a constant pressure in the fuel cells and cell cavities during climbs, dives, fueling, defueling, and fuel transfer. Air pressure is used to transfer wing tank fuel. Pressure in all the cells prevents excessive fuel loss due to boiling at high altitude.

Pressurized air is bled from the engine compressor section and cooled by the air-conditioning system. The air passes through a check valve to the combined wing tank pressure regulator and relief valve and to the fuselage cells pressure regulator. The regulators admit the air to the fuel cells and wing tank as required. A check valve is installed in each pressure line to prevent fuel transfer between the cells and to keep fuel from entering the regulators. For all flight conditions except negative g, an emergency airscoop automatically admits ram air to pressurize the fuselage cells if the pressure regulator fails in the closed position, or the air-conditioning system is shut off. An emergency ram-air scoop prevents negative pressures in the wing tank.

The wing tank pressure regulator is electrically controlled to permit selection of fuel transfer conditions by the pilot. When the fuel transfer switch is placed in ON or PUMP OFF, the pressure regulator admits air to the wing tank at sufficient pressure to cause wing fuel to flow to the main cell when the condition of main cell fuel level and aft transfer fuel boost pressure permit. Placing the fuel transfer switch in PRESS DUMP shuts off the flow of air to the wing tank and vents the existing pressure to discontinue transfer of wing fuel. Slight positive pressure is maintained at all times to prevent boiling. Upon loss of normal wing tank pressurization (air-conditioning system failure or shutdown or cockpit pressure switch placed in CABIN DUMP), wing tank fuel transfer is negligible.

The fuselage fuel cells are vented overboard through interconnected lines to a vent mast on the fuselage left-hand midsection. The common vent line is connected to a pressure relief valve which relieves cell pressure above 1.0 ($\pm$0.25) psi to prevent excessive pressures if the fuselage cells pressure regulator fails in the open position. A float valve in the main cell prevents main cell fuel from being vented overboard during maneuvering flight by shutting off fuel transfer when the vent outlet is covered. Check valves are installed in the other cell vent lines to prevent fuel from entering the vent lines during maneuvering or inverted flight.

FUEL SYSTEM MANAGEMENT

For takeoff, the fuel transfer switch is placed in ON which energizes the forward and aft transfer pumps and pressurizes the wing tank. Flow of transfer fuel to the main fuel cell is then automatically sequenced until all transfer fuel is consumed. Sequencing is obtained through variations in fuel line sizes and pressures to maintain aircraft center-of-gravity within limits at all times. The forward transfer cell empties first, the aft transfer cells empty second, and the wing tank empties last. The aircraft then consumes main cell fuel until landing. During transfer from the aft cells, there will be a noticeable transfer from the wing tank.

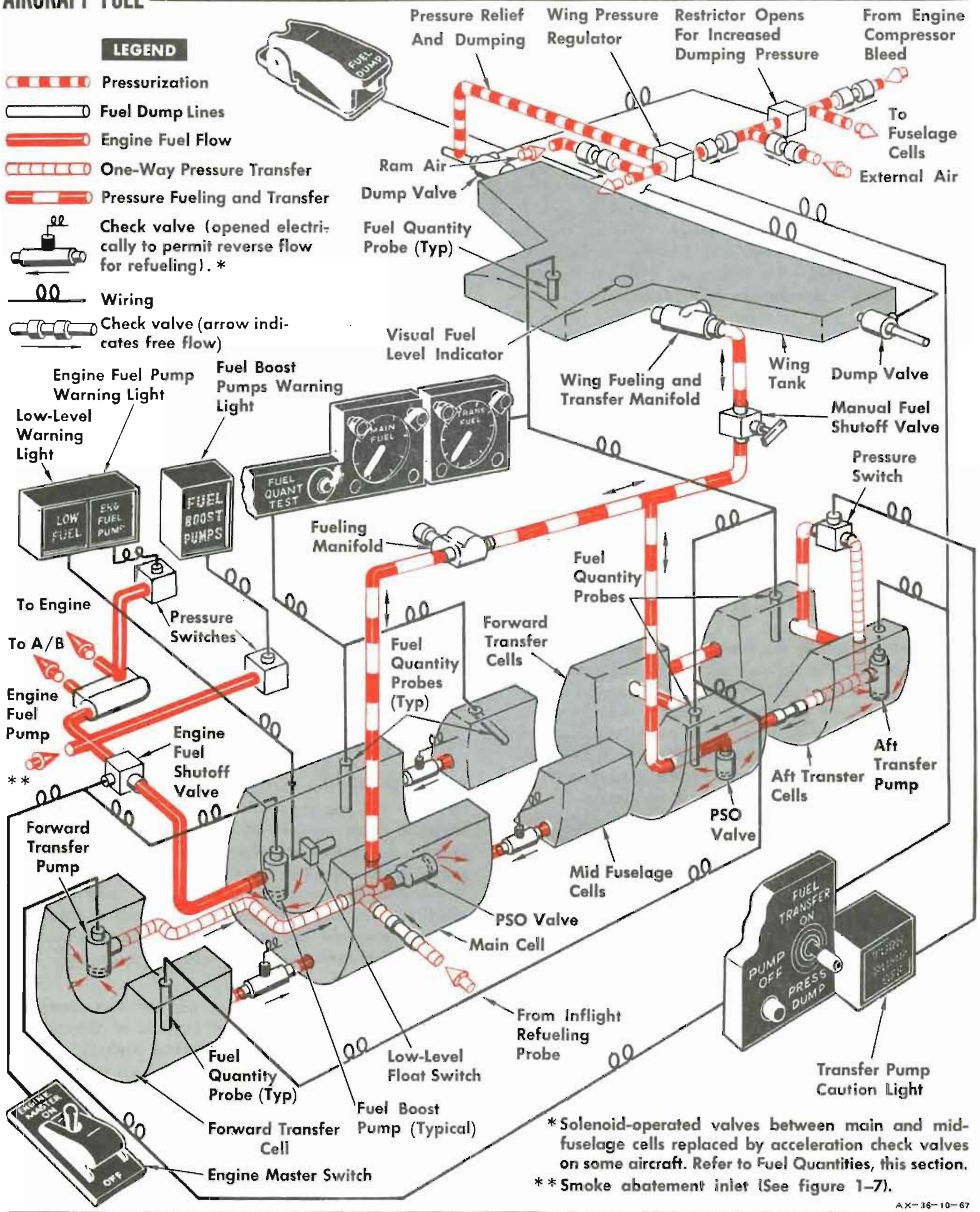
Failure of the aft transfer pumps (or loss of main electrical power) will result in as much as 1,200 pounds of aft transfer fuel being trapped in the cells, while forward transfer fuel will gravity feed to the main cell upon loss of power or pump failure. Wing tank fuel transfer will continue in such cases.

In level cruising flight, intermittent illumination progressing to steady illumination of the transfer pump caution light provides usable indication that the fuselage transfer fuel cells are empty. When the transfer cells are empty, there will be from 1,500 pounds to 3,000 pounds of wing tank fuel remaining, depending upon when the transfer pumps are turned on. When the transfer pump caution light comes on under these conditions, turn the pumps and light off by placing the fuel transfer switch in PUMP OFF. For operational convenience, the transfer fuel quantity indicator is marked with an orange reference mark at 2,000 pounds fuel remaining (the nominal transfer quantity at which the fuselage transfer cells empty). This is a reminder to turn the transfer pumps off.

When the transfer pumps are turned off, wing fuel transfer will continue until the wing tank is empty. In some cases, because of slight inaccuracies in fuel gaging, wing fuel transfer will continue for a short period even after the transfer fuel quantity indicator reads zero. To prevent wing tank air from entering the fuel lines, two pressure shutoff valves in the wing fueling manifold are automatically closed when the wing tank is empty or a fuel outlet is uncovered.

If the fuselage pumps are turned off too soon (as might be the case if turned off because of the caution light flickering during maneuvering flight), a small amount of fuel may be trapped in the aft cells. If this occurs, there will be an indication of transfer fuel

AIRCRAFT FUEL



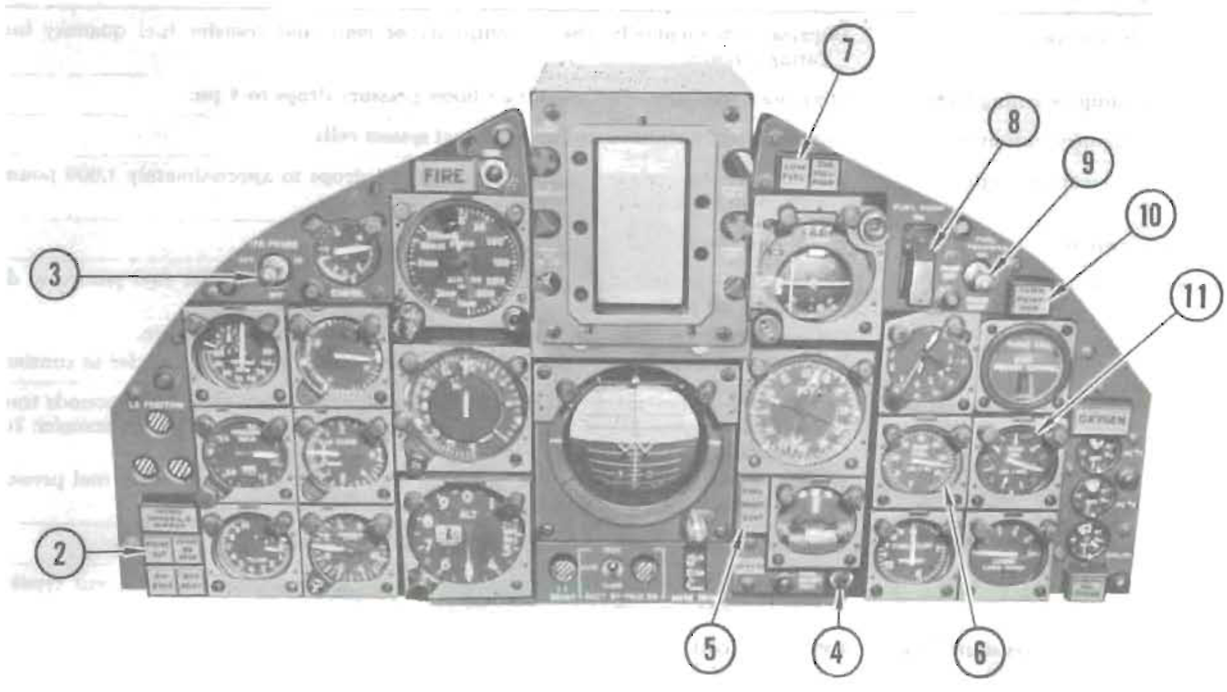
* Solenoid-operated valves between main and mid-fuselage cells replaced by acceleration check valves on some aircraft. Refer to Fuel Quantities, this section.

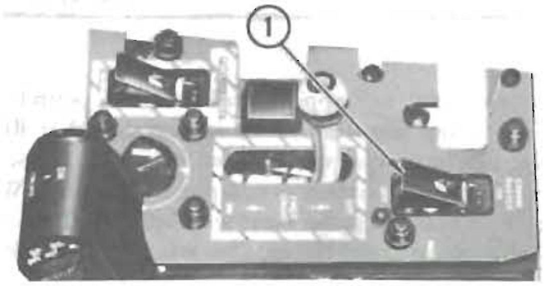
** Smoke abatement inlet (See figure 1-7).

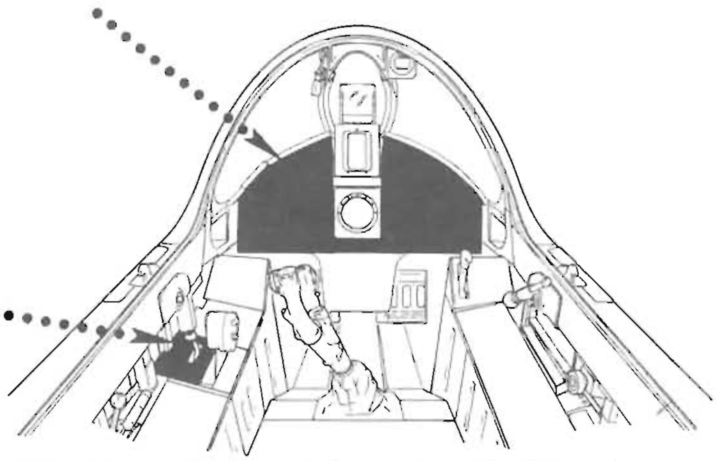
AX-36-10-67

Figure 1-31

FUEL SYSTEM CONTROLS







Nomenclature	*Function*
1. Engine master switch	ON — energizes fuel boost pumps, attitude switch (which controls inverted flight boost pumps) and fuel transfer switch.
2. Inflight refueling probe out light	On, indicates probe door is open. Off, indicates probe door is closed.
3. Inflight refueling probe switch	OUT — opens probe door, extends probe, deenergizes the transfer fuel system, and relieves wing tank pressure. Probe illuminating light will come on when probe door opens if exterior light switch is in NORM. IN — retracts probe, closes probe door, energizes the transfer fuel system, and repressurizes wing tank. Probe illuminating light will go out when probe door closes. OFF — deenergizes probe door valve and energizes the transfer fuel system.

AX-24(1)-1-67

Figure 1–32 (Sheet 1)

FUEL SYSTEM CONTROLS

Nomenclature	*Function*
4. Fuel quantity test switch	Depressed momentarily, checks continuity of main and transfer fuel quantity indicating circuits.
5. Fuel boost pumps warning light	FUEL BOOST PUMPS — on when fuel boost pressure drops to 4 psi.
6. Main fuel quantity indicator	Indicates total weight of fuel in main fuel system cells.
7. Fuel low level warning light	LOW LEVEL — on when fuel level in main cell drops to approximately 1,000 pounds (JP-5) in level flight.
8. Fuel dump switch	DUMP — jettisons fuel from wing tank.
9. Fuel transfer switch	PRESS DUMP — relieves wing tank pressure and shuts off transfer fuel pumps to discontinue all fuel transfer. ON — energizes transfer fuel pumps and provides wing tank pressure. PUMP OFF — shuts off transfer fuel pumps but permits wing fuel transfer to continue.
10. Transfer fuel pump caution light	TURN PUMP OFF — steady light with fuel transfer switch on, over 3,500 pounds transfer fuel remaining and aircraft in normal flight attitude indicates transfer fuel pump failure. Intermittent lighting progressing to steady indicates aft fuselage transfer fuel pressure drop induced by maneuvers or low level in aft fuselage transfer cells.
11. Transfer fuel quantity indicator	Indicates total weight of fuel in transfer fuel system cells .
Fuel selector switch (left main wheel well)	Positions fuel valves during central-point fueling for selection of different types of fuel loads or for defueling. POWER OFF is the flight position.
Wing tank manual fuel shutoff valve (left main wheel well)	OPEN — allows normal operation of fuel system. *Engine cannot be started nor fuel transferred from or to wing tank unless valve is in this position.* CLOSE — prevents leakage of fuel from wing to main cell while aircraft is secured; also, aids defueling of main system after wing is empty by stopping airflow from wing.
Wing tank visual quantity indicator (left wing leading edge)	Appearance of red spherical float indicates wing tank is full.

AX-24(2)-1-67

Figure 1–32 (Sheet 2)

remaining late in the flight when all fuel transfer would normally have been completed. This fuel can be pumped out by placing the fuel transfer switch in ON for a brief period. Maintaining a nose-up attitude will aid in pumping out the aft cells.

WARNING

Aircraft loss from main fuel depletion can result from fuel transfer failure in conjunction with either misread quantity indications or failure to monitor main fuel quantity. Main fuel quantity must be regularly checked for proper indication except during maneuvering flight. Do not mistake transfer quantity gage (500-pound graduations) as main fuel quantity gage (100-pound graduations).

Excluding afterburner operation at high Mach numbers (see note), the main fuel quantity indicator during flight at normal cruise attitude should read 2,400 to 2,700 pounds until the transfer fuel system is empty. The main system quantity indicator may read below 2,400 pounds during prolonged nose-down attitudes and when there are approximately 1,500 pounds remaining in the transfer system in certain other flight profiles. But in no case shall it read below 2,200 pounds before the transfer system is completely emptied. With the transfer fuel from the fuselage depleted, there will be negligible transfer from the wing in nose-down attitudes. Normal wing transfer will be regained with a return to normal flight attitude. The main system quantity may indicate between 2,200 to 3,100 pounds depending upon the flight profile.

Note

During afterburner operation at high Mach numbers, the transfer fuel system may not supply sufficient fuel to the main cell to hold the fuel level in the main cell at the transfer level. Upon termination of afterburning, the transfer system will refill the main cell to the transfer level or until the transfer system is empty. The transfer rates are sufficient to prevent the main cell from being run dry while there is still transfer fuel available. With continuous maximum engine demand the main system will contain approximately 898 pounds when the transfer system empties.

The main fuel quantity indicating system will indicate accurately only in steady wing-level flight between 20° nose-up and 10° nose-down. The transfer fuel quantity indicating system, a capacitance system designed for use in cruise control, will be accurate only between 10° nose-up and 4° nose-down.

The fuel low-level warning light will be on when the fuel in the main cell is at approximately 1,000 pounds. The light will indicate accurately at aircraft attitudes between 25° nose-up and 25° nose-down.

The fuel flow indicator, which indicates engine fuel flow in pounds per hour, may momentarily indicate zero flow when the throttle is retarded to IDLE from a high power setting. Should the indicator continue to reflect zero flow at a sustained IDLE power setting, advancing the throttle momentarily to obtain a higher fuel flow rate may restore proper indications.

WING TANK FUEL DUMPING

An electrically operated variable orifice restrictor, installed upstream of the wing tank pressure regulator, controls wing tank air flow for pressurization or provides a high fuel dump rate by allowing a greater air flow to the wing tank during fuel dumping. Two electrically operated dump valves, one in each outboard corner of the wing tank, permit fuel to be dumped overboard. Placing the fuel dump switch in DUMP fully opens the restrictor and opens the dump valves. After fuel has been dumped, the fuel dump switch should be placed in OFF.

Note

A nose-up attitude must be maintained to obtain the maximum rate of fuel dumping. Engine power setting is also critical during the dump cycle and 87% rpm or above will always ensure a maximum rate of fuel dumping. A power setting of 80% or less with a nose-down attitude may stop fuel dumping completely.

When the cockpit pressure switch is placed in CABIN DUMP, wing tank fuel dumping may be accomplished at a reduced rate under pressure supplied by the wing tank emergency ram-air scoop.

IF FUEL BOOST LIGHT GOES OUT AS ENGINE MASTER GOES ON, THE MAIN FUEL SHUT-OFF VALVE IS OPEN.

GRAVITY SUCTION CK VALVE IN MAIN CELL IF ALL BOOST PUMPS ARE OFF

FORWARD FLOOR MOUNTED BOOST PUMP (ON PRIME BUSS) CAN BE POWERED BY THE RAT. OTHERS ARE ON THE SEC BUSS.

INVERTED FLIGHT PUMP IS A −G PUMP. THE ATTITUDE SWITCH THAT CUTS IT IN TURNS OFF THE XFER SYSTEM.

THE MANUAL WING SHUT OFF VALVE CUTS OUT THE CRANK HOLDING FUNCTION IF POSITIONED CLOSED. AIR STARTS ARE NOT POSSIBLE IF IT'S OPEN.

THE SPRING LOADED CK VALVE BETWEEN AFT MAIN AND LER MID FUSELAGE CELLS PREVENTS BACK FLOW DURING CAT SHOTS

ALL FUEL CELLS ARE 1.5 PSID WING IS PRESSURIZED TO 6 FOR XFER.

WHEN PRESS DUMP IS SELECTED WING GOES FROM 6 PSID TO 1.5 PSID.

THE BLADDERS BLOW @ 4.5-5 PSID.

LO FUEL LITE IS ON SECONDARY BUSS

XFER SET TO START @ 2700 IN MAIN.

AT 1000 LEVEL IN AFT MAIN 600 WILL GRAVITY DRAIN FROM FORWARD MAIN.

LARGE AIR FLOW FROM VENTRAL VENT ⇒ FUSELAGE PRESS REG IS TRYING TO PRESSURIZE FUSELAGE TANKS TO 1 ATMOSPHERE PSID.

FUEL DUMP SWITCH WILL REPRESSURIZE WING FOR FAST DUMP EVEN IF PRESS DUMP HAS BEEN SELECTED.

PSO CHECK LOADS ARE 200 & 300 FOR PRIMARY & SECONDARY

REFUEL PARTIAL FILLS ALL CELLS BUT MAIN WHICH GOES TO PARTIAL (XFER - 2700) LEVEL.

A/C REQUIRES EXT PWR OR PROBE OUT FOR SINGLE POINT REFUEL.

PROBE CONTROL

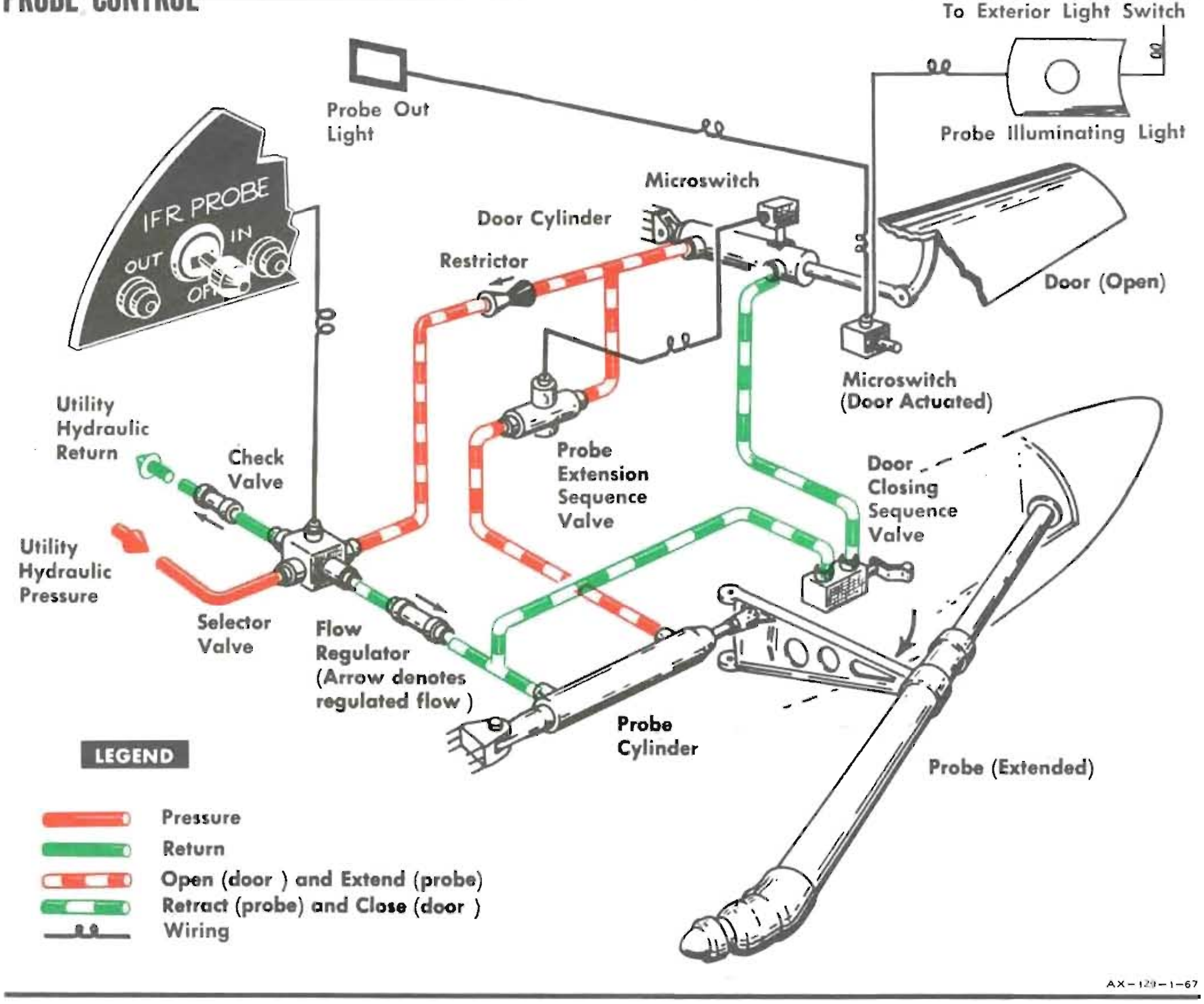


Figure 1–33

INFLIGHT REFUELING

DESCRIPTION

Note

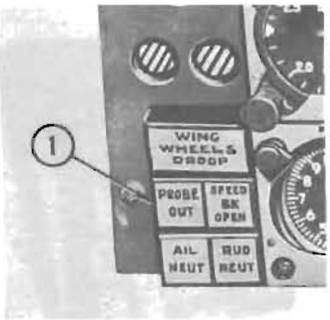
The inflight refueling system should be ground checked for leaks before a flight on which firing of guns is anticipated following inflight refueling.

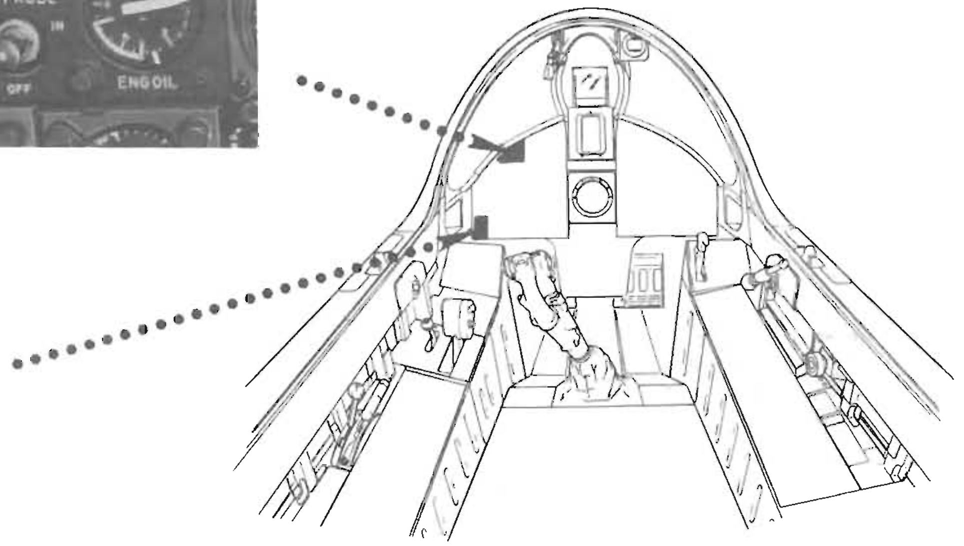
A retractable probe (figure 1–33), mounted in a well on the left side of the fuselage, is extended and retracted by utility hydraulic pressure. Placing the inflight refueling probe switch in OUT deenergizes the transfer pump, depressurizes the wing tank, positions the fuel valves to accept fuel, opens the probe fairing door, and extends the probe. The inflight refueling probe out light on the instrument board will also be illuminated when the fairing door opens. With the probe engaged in the tanker's drogue, fuel is admitted into the aircraft fuel system. If desired, partial refueling of the main cell up to the transfer level can be performed with the inflight refueling probe switch in OFF. Total time for refueling depends upon fuel

INFLIGHT REFUELING CONTROLS

40-60 PSI RECOMMENDED. TOO HIGH FUELING PRESSURE CAUSES A/C TO BE LIGHT FUELED BY SEVERAL HUNDRED POUNDS.

FULL LOAD TAKES 5-6 MINUTES





Nomenclature	Function
1. Inflight refueling probe out light	On, indicates probe door is open. 350 KTS OR .92 MAX Off, indicates probe door is closed.
2. Inflight refueling probe switch	OUT — opens probe door, extends probe, deenergizes the transfer fuel system and relieves wing tank pressure. Probe illuminating light will come on when probe door opens if exterior light switch is in NORM. SETS UP FOR TOTAL LOAD IN — retracts probe, closes probe door, energizes the transfer fuel system and repressurizes wing tank. Probe illuminating light will go out when probe door closes. OFF — deenergizes probe door valve and energizes the transfer fuel system.

AX-37-1-67

Figure 1–34

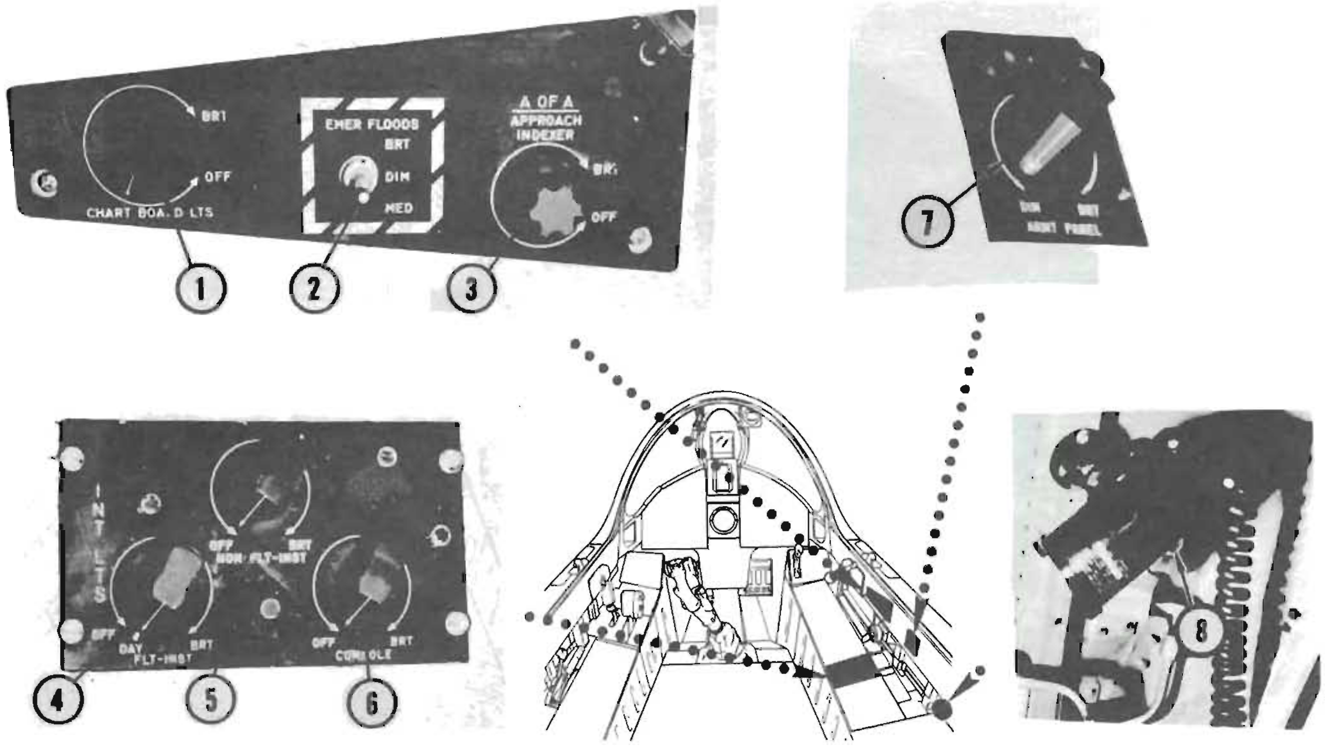
on board when fueling commences and type of tanker supplying fuel. When the desired amount of fuel has been taken aboard, as indicated by the fuel quantity indicators, a slight reduction in airspeed will disengage the probe. Holding the inflight refueling probe switch in the IN position will reenergize the transfer system and reposition the fuel valves for normal operation, retract the probe, and close the fairing door. Hold the switch IN for 5 seconds after the probe out light goes off before releasing to OFF. Releasing the switch to OFF will deenergize the door selector valve.

The inflight refueling system is powered from the secondary dc bus. In the event of an electrical system failure requiring extension of the emergency power package, inflight refueling can not be accomplished.

A probe illuminating light, flush mounted on the left-hand side of the fuselage just below the windshield side panel, serves to illuminate the refueling probe tip and the tanker drogue during night operations. The light comes on when the probe fairing door is opened with the exterior light switch in NORM.

Refer to section IV, part 1, for inflight refueling techniques and procedures. System controls are illustrated and described in figure 1–34.

INTERIOR LIGHT CONTROLS



Nomenclature	Function
1. Chartboard light dimming knob	Rotated between OFF and BRT, turns on and controls intensity of chartboard floodlights.
2. Emergency floodlight switch	Effective when console lights dimming knob is in position other than off. DIM — intensity of floodlights at dim, comes on when console lights are on. MED — raises intensity of floodlights to a medium level. Turns on instrument and gyro horizon indicator lights. BRT — places floodlights, instrument and gyro horizon lights at high intensity.
3. Approach indexer dimming knob	Rotated between OFF and BRT, turns on and controls intensity of angle-of-attack approach indexer lights.
4. Flight instrument light dimming knob	DAY — selects light intensity of all warning and indicator lights, turns off primary instrument lights. Rotated between OFF and BRT, switches warning and indicator lights to low intensity and controls intensity of primary instrument lights.
5. Nonflight instrument light dimming knob	Rotated between OFF and BRT, controls intensity of secondary instrument lights.
6. Console light dimming knob	Rotated between OFF and BRT, turns on and controls intensity of the following lights: All console-mounted panels Armament panel Exterior light control panel Gyro caging switch panel Hook bypass switch panel Landing checklist Takeoff checklist Also turns on console floodlights but does not control their intensity.
7. Armament panel dimming knob	Rotated between DIM and BRT, controls intensity of lighting on edge-lighted armament panel when console lights are on.
8. Spotlight switch	ON — turns on spotlight.

AX-127-1-67

Figure 1–35

INTERIOR LIGHTS

DESCRIPTION

The interior lighting system provides optimum illumination of all indicators, panels and panel nomenclature for night or foul-weather flying. Glare-free illumination of panel nomenclature is provided on the instrument board and on most of the console-mounted panels through use of edge-lighting. Separate dimming controls are provided for the console lights and for the instrument lights to ensure flexibility in selection of lighting intensity. Separate dimming controls are also provided for the chartboard lights, the approach indexer and for the armament panel. Two instrument light circuits are provided, the first for primary flight instruments and the second for secondary flight instruments and position indicators. Emergency floodlights are provided for both consoles and the instrument board. A spotlight mounted above the right-hand console can be lifted from its holder and used like a flashlight. There is an on–off switch on the spotlight.

The interior lighting is divided into primary lighting, powered from the emergency ac bus, and secondary lighting, powered from the secondary ac bus, as follows:

Primary Lights

- Airspeed-Mach number indicator
- Instrument board emergency floodlights

Primary Lights (Continued)

- Altimeter
- Attitude indicator
- Chartboard lights
- Course indicator
- Console emergency floodlights
- Navigation indicator
- Radar altitude indicator
- Rate of climb indicator
- Tachometer
- Turn and bank indicator

Note

> Only the primary lighting is available when operating on emergency electrical power.

Secondary Lights

- Accelerometer
- Angle-of-attack indicator
- Armament panel
- Clock
- Cockpit pressure altimeter
- Console panel lights (all)
- Engine oil pressure indicator
- Exhaust temperature indicator
- Fire test panel
- Fuel flow indicator
- Fuel panel
- Hydraulic system panel
- Inflight refueling panel
- Landing and takeoff checklists
- Landing gear panel and position indicators
- Leading edge droop indicator
- Oxygen quantity indicator
- Main fuel quantity indicator
- Missile release indicator
- Duct bypass door indicator
- Pressure ratio indicator
- Standby compass
- Transfer fuel indicator

Interior lighting controls are illustrated and described in figure 1–35.

NOSE: LOCKED DOWN BY OVER CENTER MECH: BLOWN THRU ACTUATING CYLINDER
MAIN: LOCKED BY MECH FINGERS: DOORS ONLY ARE BLOWN, AIR & GRAV DOWNS MAINS.

LANDING GEAR

DESCRIPTION

Normal operation is accomplished by means of utility hydraulic system pressure. Two doors covering each main gear automatically unlock and open when gear extension is selected. A third main gear door (fairing) and the nose gear doors are mechanically linked to the gear and extend with it. In emergency extension of the gear, pneumatic system pressure unlocks and extends the main gear doors, unlocks the main gear, and extends and locks the nose gear. The main gear falls by its own weight and is locked by airloads acting on it. A down-lock solenoid safety circuit prevents accidental gear retraction while weight is on the left-hand main gear. This circuit can be overridden to permit emergency retraction.

The pneumatic system is normally used to extend the landing gear following loss of utility hydraulic pressure. However, the pneumatic system also can be effective in extending the gear in some cases where utility hydraulic pressure remains but has proven ineffective in extending the gear. This would be the case, for example, if the landing gear hydraulic selector valve became jammed (the pneumatic system has its own selector valve) or if the hydraulic return lines had become restricted (use of the pneumatic system causes hydraulic return fluid to be relieved overboard).

A mechanical linkage will center the nose gear during retraction provided the nose gear is within 30° of center position. If the nose gear is turned beyond the 30° limit, the landing gear handle can be raised and the main gear will retract, but the nose gear will remain extended due to interference between the centering linkage and the strut. The main gear must be extended and the nose gear steering switch depressed. This moves the nose gear toward center to permit the mechanical centering mechanism to center and release the nose gear for retraction.

Refer to figure 1–36 for system illustration. System controls are illustrated and described in figure 1–37.

The armament system is dearmed when the landing gear handle is down, and the approach lights are energized when the gear is extended.

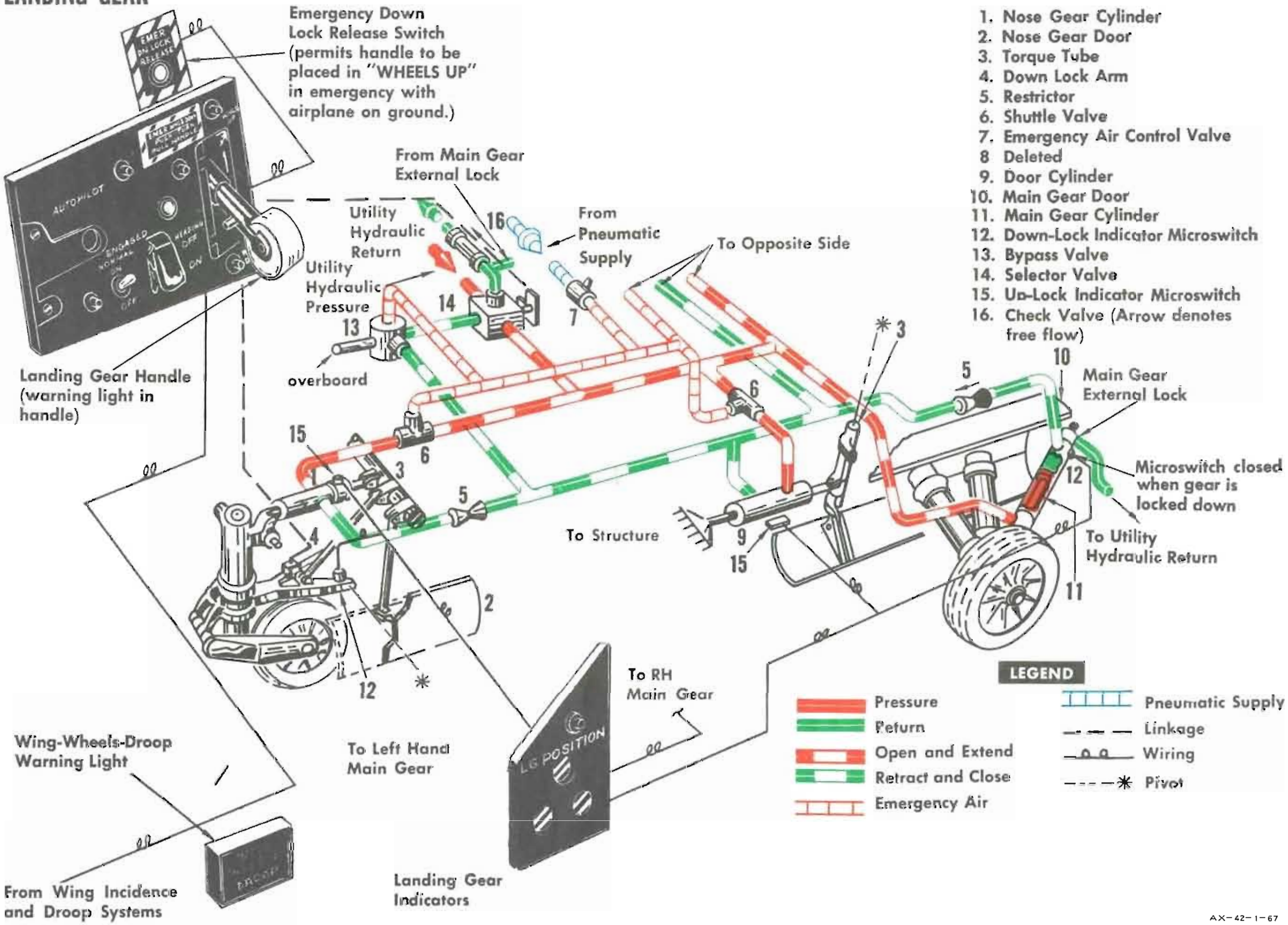
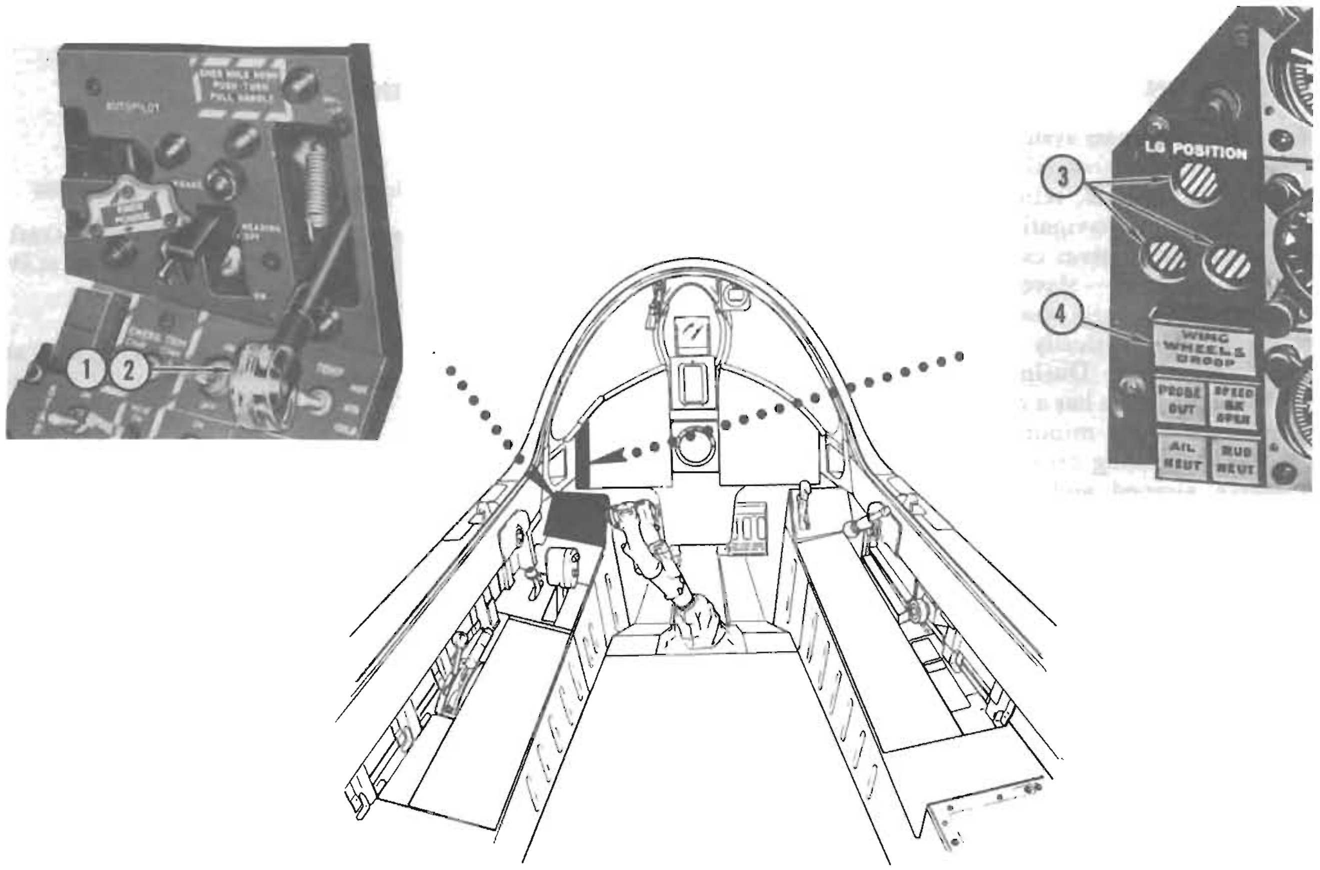

Emergency Down Lock Release Switch (permits handle to be placed in "WHEELS UP" in emergency with airplane on ground.)
EMER DN LOCK RELEASE
AUTOPILOT
ENGAGED
NORMAL
ON
OFF
HEADING
ON
From Main Gear External Lock
Utility Hydraulic Return
Utility Hydraulic Pressure
From Pneumatic Supply
To Opposite Side
overboard
Landing Gear Handle (warning light in handle)
To Structure
1. Nose Gear Cylinder
2. Nose Gear Door
3. Torque Tube
4. Down Lock Arm
5. Restrictor
6. Shuttle Valve
7. Emergency Air Control Valve
8 Deleted
9. Door Cylinder
10. Main Gear Door
11. Main Gear Cylinder
12. Down-Lock Indicator Microswitch
13. Bypass Valve
14. Selector Valve
15. Up-Lock Indicator Microswitch
16. Check Valve (Arrow denotes free flow)
Main Gear External Lock
Microswitch closed when gear is locked down
To Utility Hydraulic Return
To RH Main Gear
To Left Hand Main Gear
LG POSITION
Wing-Wheels-Droop Warning Light
From Wing Incidence and Droop Systems
Landing Gear Indicators
LEGEND
Pressure
Return
Open and Extend
Retract and Close
Emergency Air
Pneumatic Supply
Linkage
Wiring
Pivot
AX-42-1-67

Figure 1-36

LANDING GEAR CONTROLS



Nomenclature	*Function*
1. Landing gear handle	WHLS UP — with aircraft airborne and nose gear centered, retracts and locks gear in up position. WHLS DOWN — extends and locks gear in down position. Emergency extension (pneumatic) is obtained by placing handle in WHLS DOWN, pushing in, rotating clockwise, and pulling aft. Landing gear handle must be placed in WHLS DOWN for nose gear down lock and indication.
2. Landing gear warning light (in landing gear handle)	On, indicates position of one or more gears differs from selected position, or gear moving to selected position. Off, indicates all gears locked in position indicated by handle position.
3. Landing gear position indicators (three)	UP — indicates corresponding gear up and locked. Miniature wheel, indicates corresponding gear down and locked. Barberpole, indicates position of corresponding gear differs from selected position, gear moving to selected position, or electrical power not connected.
4. Wing-wheels-droop warning light	Flashing (WING-WHEELS-DROOP) when: Landing gear handle up — wing not down and locked Landing gear handle down — wing not up Wing down — one or more land droop pistons unlocked
Emergency downlock release switch (inboard side forward LH console)	*For Emergency Use Only.* Up, permits moving landing gear handle to WHLS UP while aircraft is on ground (nose gear need not be centered).

AX-122-1-67

Figure 1–37

MA-1 COMPASS

DESCRIPTION

The MA-1 compass system combines the action of the remote compass transmitter and the directional gyro to provide accurate, reliable, and continuous azimuth headings on the navigation (bearing-distance-heading) indicator. The system can be set to operate by either of two methods — slaved or free gyro. The slaved method is normally used since inherent gyro drift errors are automatically corrected by the remote compass transmitter. During operation by the slaved method the system has a normal slaving rate of approximately 1½° per minute. For example, if aerobatics cause a 3° heading error, the directional gyro will be properly aligned and the navigation indicator will read true magnetic heading in about 2 minutes.

There are times when the remote compass transmitter is not dependable, such as when making sustained turns, or when flying in polar regions or near large masses of iron. If it is likely that the compass transmitter will be subjected to such magnetic disturbance for more than 1 or 2 minutes, the free gyro method should be used. When this method is used the compass transmitter is disconnected from the directional gyro, and since the directional gyro is then subjected to a drift of less than 4° per hour, the navigation indicator should be reset whenever an accurate heading can be obtained.

A standby compass mounted on the windshield frame indicates magnetic heading.

CAUTION

With the gunsight camera installed and the camera motor operating, the standby compass is unreliable.

MA-1 compass controls are illustrated and described in figure 1–38.

NORMAL OPERATION

Slaved Method

1. Power failure indicator flag — NOT SHOWING
2. Mode selector switch — AFTER 2-MINUTE WARMUP, PLACE IN SLAVED
3. Setting knob — PULL OUT AND SET
   - Turn until white bar of synchronizing indicator is centered under arrow.

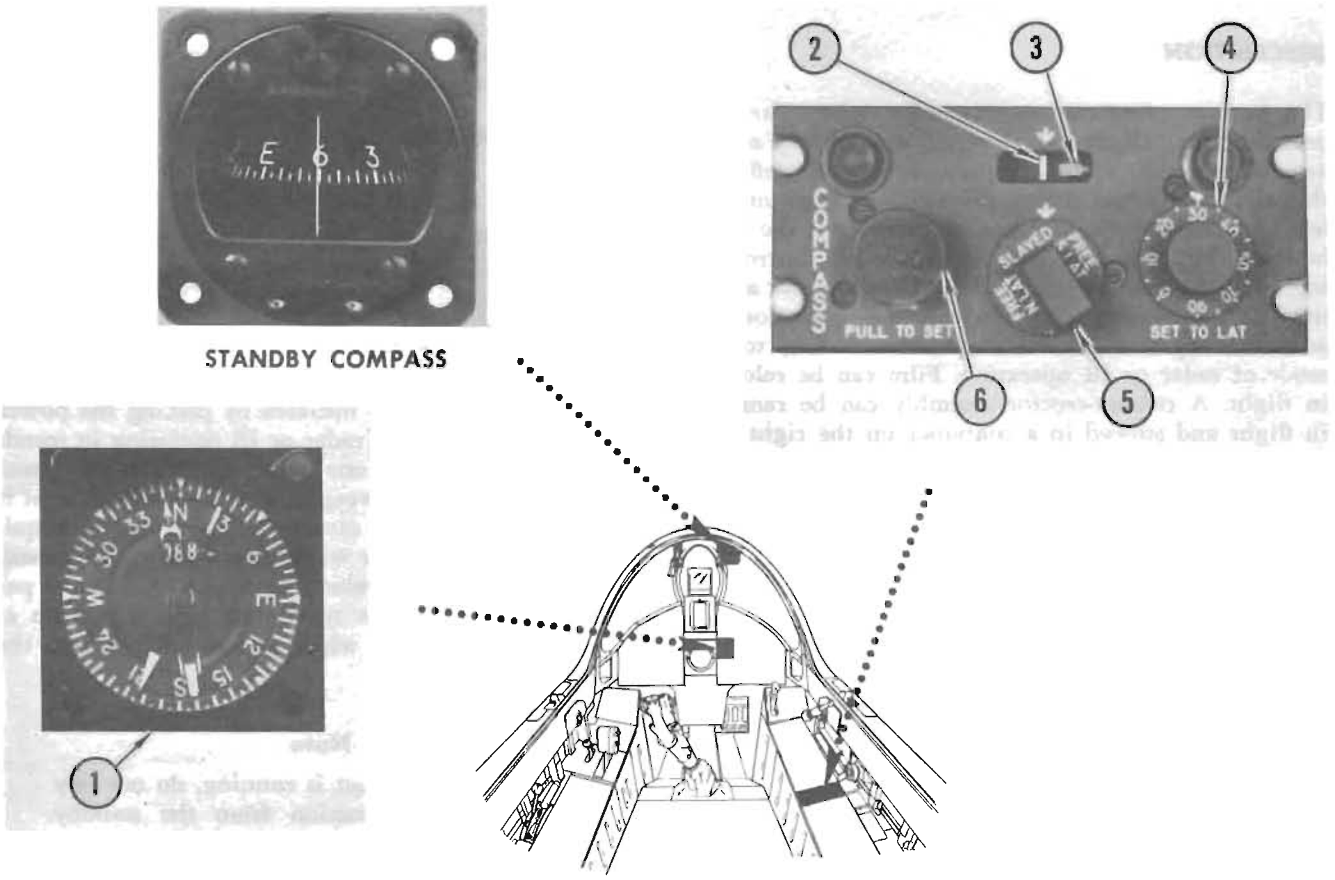
CAUTION

The white bar must move to the right with clockwise rotation or to the left with counterclockwise rotation of the compass setting knob. If it does not, the navigation indicator compass card will reflect an erroneous indication. Continue rotation of knob until white bar moves in correct direction and is centered.

Free Gyro Method

1. Power failure flag — NOT SHOWING
2. Mode selector switch — FREE N. LAT or FREE S. LAT
   - After 2-minute warmup, set selector to hemisphere in which you are flying.
3. Compass setting knob — PULL OUT AND SET
   - Turn until navigation indicator reads desired heading. (Ignore synchronizing indicator).
4. Latitude setting knob — SET
   - Turn knob to latitude at which you are flying.

COMPASS CONTROLS



Nomenclature	*Function*
1. Navigation (bearing-distance-heading) indicator	Top index indicates aircraft magnetic heading on compass card.
2. Synchronizer indicator	Alignment of the white bar of the synchronizing indicator with the arrow above the window (by turning compass setting knob) indicates that the compass system is "slaved in" and correctly synchronized. Constant oscillation of the white bar is a normal condition and provides another check that the system is operating normally.
3. Power failure flag	OFF — indicates that power is not connected to system. (Flag disappears 5 to 10 seconds after power is turned on.)
4. Latitude setting knob	Adjusts system to the degree of latitude at which you are flying, when operating system by free gyro method. This compensates for apparent drift of gyro due to earth's rotation.
5. Mode selector switch	SLAVED — connects remote compass transmitter to system which constantly corrects gyro drift. FREE N. LAT — disconnects remote compass transmitter from system to allow free gyro operation north of equator. FREE S. LAT — disconnects remote compass transmitter from system to allow free gyro operation south of equator.
6. Compass setting knob	Pulling and turning (clockwise or counterclockwise as applicable) when operating system by slaved method, synchronizes directional gyro with remote compass transmitter and aligns navigation indicator compass card with exact magnetic heading of aircraft. Pulling and turning when operating system by free gyro method adjusts navigation indicator compass card to any desired heading.

AX-27-1-67

Figure 1–38

DATA RECORDING CAMERA SET KS-76A

DESCRIPTION

The data recording camera set photographs radarscope presentations (IR or radar) on 16 mm film as an aid to pilot training. The scope presentations are reflected through a periscope that covers the scope face, into the lens of a camera which is mounted on top of the scope housing. The periscope may be adjusted to control the intensity of the scope image to the pilot without affecting the scope image to the camera. An intervalometer automatically varies camera speed according to the mode of radar or IR operation. Film can be reloaded in flight. A camera-erector assembly can be removed in flight and stowed in a container on the right console to improve forward visibility. Electrical power is supplied by the secondary ac and dc buses.

Camera controls and components are illustrated in figure 1–39.

BEFORE OPERATING

Before using the camera set, adjust the radar set to the minimum intensity compatible with an acceptable presentation (excessive intensity will cause apparent defocusing or overexposure). Make all further adjustments with the variable red polaroid control or the intensity polaroid control. Install the viewing hood provided for use with the camera set if radarscope observations are to be made and the camera set used with bright sunlight entering the cockpit.

TITLING

If desired, a mission title can be placed at the beginning of the film at some time before initiating the radar or IR intercept. Using a grease pencil, write the desired information on a transparent titler that comes with the camera set or on a similar clear piece of plastic. Insert the titler in the titler slot, and proceed as follows to photograph the title on one frame of the film:

1. Scope presentation — SEARCH MODE
2. Titler — INSERT
3. Power switch — ON
4. Test switch or radar acquisition switch — HOLD DEPRESSED (3 to 5 seconds), then RELEASE
5. Power switch — OFF for approximately 15 seconds, then ON
6. Test switch or radar acquisition switch — HOLD DEPRESSED (2 to 3 seconds), then RELEASE
7. Titler — REMOVE

Note

If not desired to continue filming the search mode after titling, return power switch to OFF.

NORMAL OPERATION

Operation of the set is initiated by placing the power switch in ON with the radar or IR operating in search mode. In search mode, one frame of the film is exposed during each azimuth sweep. A green camera-on light is illuminated when the camera is operating. In acquisition or track mode, or with the test switch depressed, the intervalometer increases film rate to 3.3 frames per second. An amber film remaining light comes on at a predetermined point which is 5 to 15 feet from the end of the film.

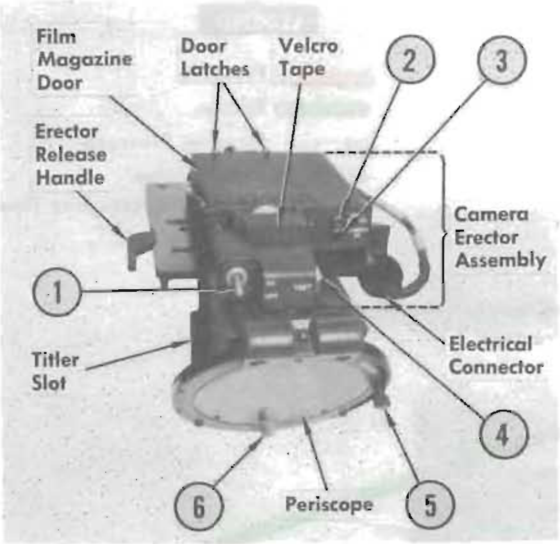
Note

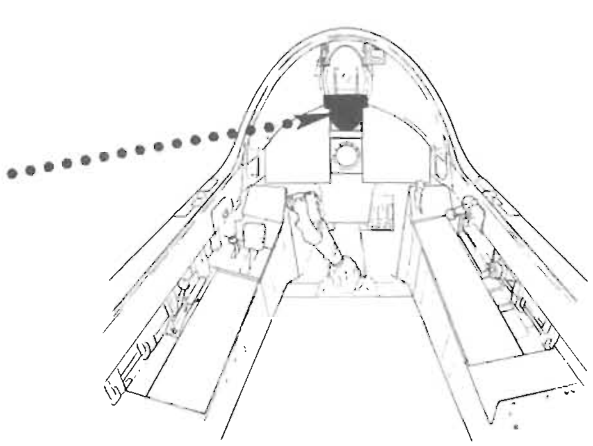
When the camera set is running, do not rely on bearing information from the standby compass. The camera motor produces a magnetic disturbance which causes the compass to deflect.

INFLIGHT FILM RELOADING

The film is contained in a magazine for ease in reloading the camera during flight. The camera is mounted on a movable erector assembly which must be rotated horizontally to provide room for reloading. Rotate the camera-erector assembly (maximum rotation is 180°) and squeeze the film magazine door latches together. The spring loaded door will open, permitting the magazine to be detached from the door by pulling the magazine straight back. Whenever the door is opened, the mechanism controlling the film remaining light is automatically reset to 50 feet, the capacity of the film magazine. (Because of this automatic resetting feature, a reliable indication of film remaining is not available when a partially run magazine is installed.) The new magazine must be installed in the camera with the recessed sprocket gear on the bottom left side of the magazine. Slide the magazine in (without using excessive force) until it is positioned against the stops. To ease installation, place

DATA RECORDING CAMERA SET CONTROLS AND COMPONENTS





Nomenclature	Function
1. Power switch	ON — initiates set operation with radar or IR in search, track or acquisition modes, or when test switch is depressed.
2. Film remaining light	On, indicates five to fifteen feet of film remaining (exact footage at which light illuminates is preselected).
3. Camera-on light	On, indicates camera operating.
4. Test switch	Depressed, permits camera operation to be tested without scope presentation.
5. Intensity polaroid control	Rotated, varies light intensity of image seen by pilot.
6. Variable red polaroid control	Rotated, varies redness of image seen by pilot.

AX–25–1–67

Figure 1–39

the power switch in ON before closing the door. The switch can be returned to OFF after the door has been closed. The door will not close if the magazine has been installed improperly.

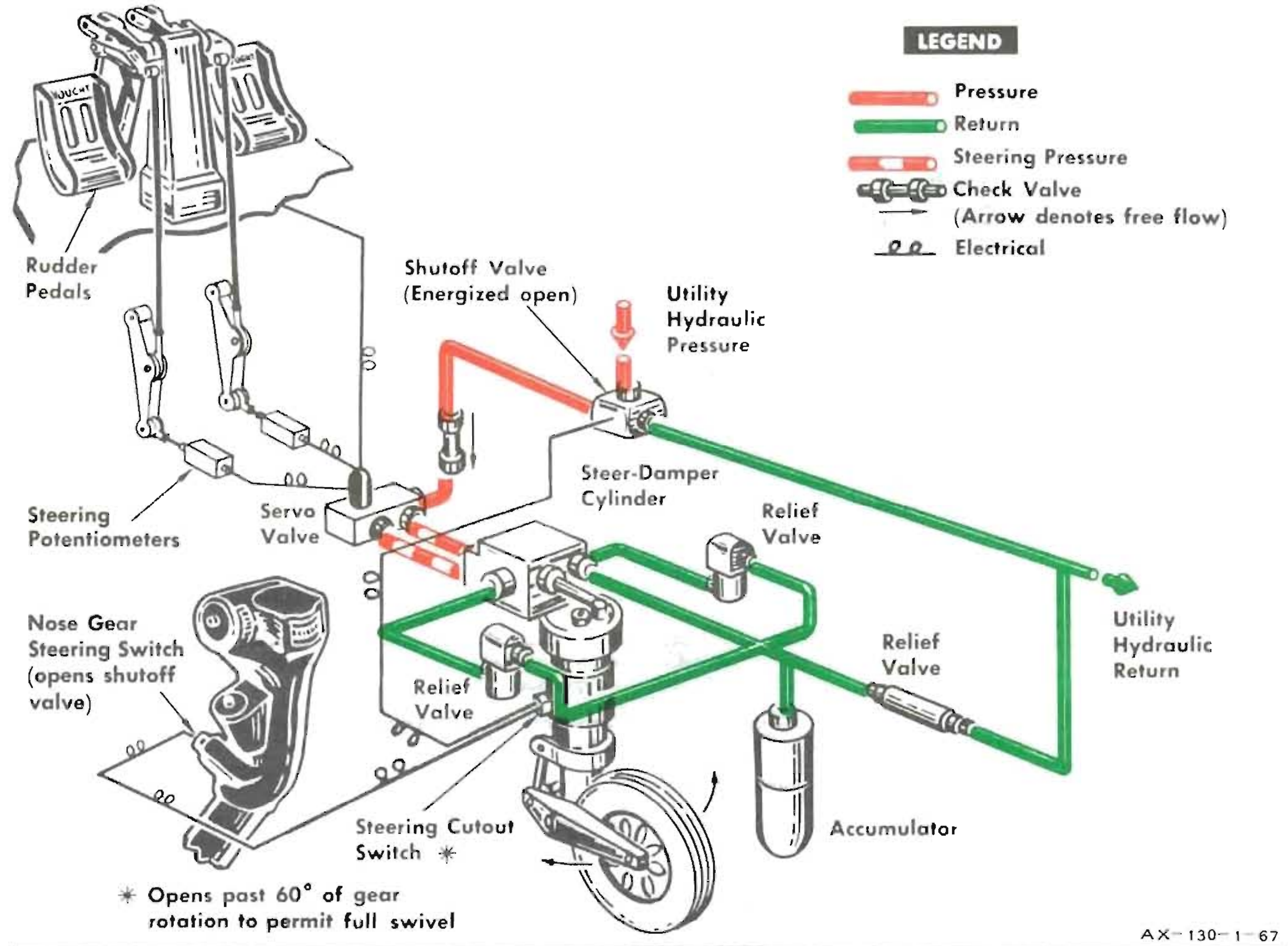
Note

Make sure (by feel and by visual alignment of the white stripe below the power switch with the corresponding stripe on the periscope) the camera-erector assembly ball detent snaps into position when the assembly is swung back to its normal recording position. Failure to detent properly (going past the detent position is the most probable cause of misalignment) will result in optical misalignment and, consequently, poor pictures.

CAMERA-ERECTOR REMOVAL AND STOWAGE

During flight, the camera-erector assembly is removed for stowage by disconnecting the camera electrical connector, securing the connector on the Velcro tape, pulling out on the erector release handle and lifting the assembly off the periscope. If continued radar viewing is desired after the camera-erector assembly has been removed and stowed, an opening in the top of the periscope (housing the ambient light attenuator lens) must be covered to prevent sunlight from entering the periscope. A cover provided for this purpose is attached by Velcro tape to the outside of the camera-erector stowage container when not in use. Erector assemblies are not interchangeable.

NOSE GEAR STEERING



LOWERING WING AFERS SWITCH TO AUTO PILOT ENGAGE. NGS WON'T ENGAGE WITH WEIGHT OFF GEAR

Figure 1–40

NOSE WON'T RETRACT WITH GEAR COCKE > 30°

NOSE GEAR STEERING

DESCRIPTION

The nose gear steering system (figure 1–40) provides directional control on the ground. The system also provides for automatic shimmy damping and powered centering of the nose gear.

Mechanical centering is provided for a nose gear off center condition up to 30° right or left. If travel beyond 30° exists the gear cannot be fully retracted. In this case powered centering is made available by reextending the gear and depressing the steering switch, which drives the nose gear to the centered position regardless of rudder pedal position.

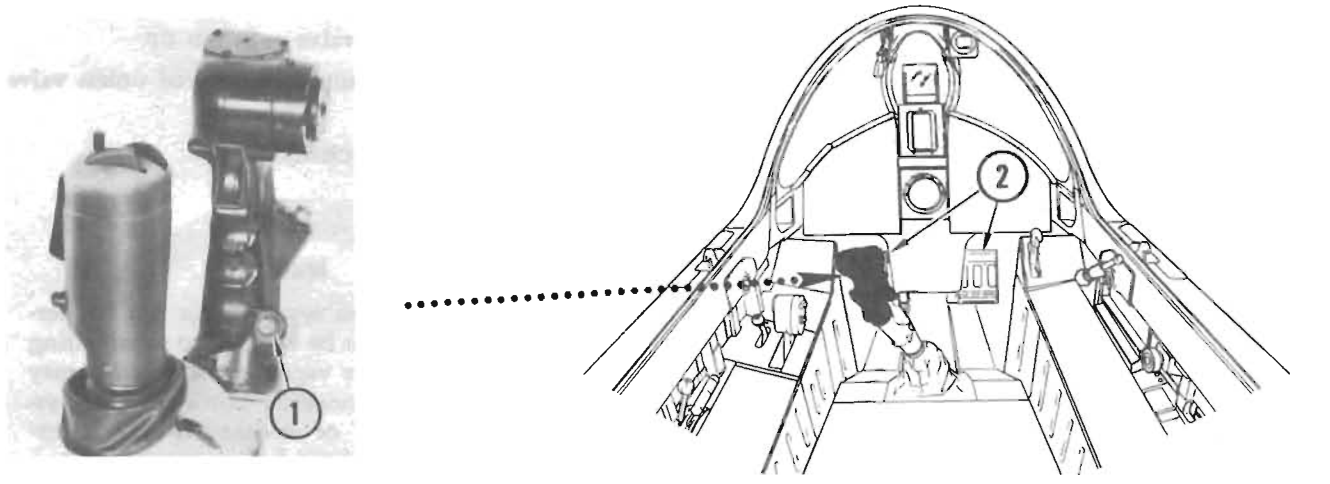
The damping function is automatically accomplished by the steer-damper servo cylinder. An accumulator is provided to prevent cavitation during damping operation due to unequal piston area displacements.

Unpowered 360° nose gear swivelling is available when the steering system is not actuated. The steering system can be energized only when the aircraft weight is on the main landing gear and the nose gear is down and locked. Nose gear steering is not available when operating on emergency electrical power or when the utility hydraulic system has failed.

Steering is made available by depressing a nose gear steering switch on the stick grip. With the switch depressed, steering is obtained through movement of the appropriate rudder pedal.

After Airframe Change No. 493, the autopilot engage–disengage switch becomes the stores release switch and

NOSE GEAR STEERING CONTROLS



Nomenclature	Function
1. Nose gear steering switch*	Depressed while taxiing, directs hydraulic pressure to steer-damper cylinder. Steering is effective when rudder pedals are moved. Depressed after takeoff, directs hydraulic pressure to steer-damper cylinder to center nose gear if automatic centering has not been effective, permitting gear to be retracted.
Autopilot/nose gear steering engage-disengage switch†	Depressed while taxiing, with wing up, directs hydraulic pressure to steer-damper cylinder. Steering is effective when rudder pedals are moved. Depressed after takeoff, directs hydraulic pressure to steer-damper cylinder to center nose gear if automatic centering has not been effective, permitting gear to be retracted.
2. Rudder pedals	Control steering with steering switch depressed.

*Aircraft without the stores release switch.
†Aircraft with the stores release switch.

AX-131-1-67

Figure 1–41

the nose gear steering switch serves both the autopilot and nose gear steering. With the wing down, the steering switch is used to engage and disengage the autopilot. Nose gear steering is unavailable with the wing down. With the wing raised, the steering switch energizes the steering system. On aircraft without the stores release switch, partial nose gear steering is available when the wing is down.

With the steering switch depressed, utility hydraulic pressure is admitted to the steer-damper cylinder to rotate the nose gear. Powered steering is limited to 60° right or left by a steering cutout switch, which opens to deenergize the system whenever the nose gear rotates more than 60° in either direction.

System controls are described in figure 1–41.

OXYGEN

DESCRIPTION

Pure gaseous oxygen is supplied by a 5-liter vacuum-insulated liquid oxygen converter through the pilot's oxygen valve on the left-hand console to the miniature regulator of the modified face mask. This regulator delivers a constant positive safety pressure during use. Above 35,000 feet, the mask-mounted regulator will automatically deliver the required pressure for pressure breathing in the event cabin pressurization is lost. Figure 1–42 presents a graphic illustration of oxygen duration.

An emergency oxygen supply in the seat pan provides breathing oxygen upon manual actuation while in the cockpit or upon automatic actuation in the case of ejection from the aircraft.

The emergency oxygen supply can be activated by either of two means. A "green apple" located at the forward edge of the seatpan permits manual operation of the emergency oxygen supply. A separate lanyard is attached to the structure of the aircraft so as to activate the oxygen bottle automatically upon ejection.

Oxygen controls and indicators are illustrated and described in figure 1–43.

NORMAL PROCEDURE

Before each flight, check the following:

1. Vent and buildup valve — BUILD UP
   - Access panel cannot be secured unless valve is in BUILD UP.
2. System quantity — CHECKED

Note

The liquid oxygen system must not be permitted to go dry or be exposed to surrounding atmosphere. Water vapors or other gases may condense in the converter bottle, causing system malfunction or contamination. If exposure to atmosphere has occurred for any extended period, the system should be purged with hot dry nitrogen prior to use.

3. Pilot's oxygen valve — OFF
4. Oxygen warning light — ON

OXYGEN DURATION

CABIN ALTITUDE FEET	GAGE INDICATION - LITERS						
	5	4	3	2	1	1/2	Below 1/2
40,000 & Above	30:18	24:12	18:12	12:06	6:00	—	Descend Below 10,000 Feet
35,000	18:30	14:48	11:06	7:24	3:42	1:48	
30,000	13:36	10:54	8:12	5:24	2:42	1:24	
25,000	10:12	8:12	6:12	4:06	2:00	1:00	
20,000	8:00	6:24	4:48	3:12	1:36	:48	
15,000	6:24	5:06	3:48	2:36	1:18	:36	
10,000	5:00	4:00	3:00	2:00	1:00	:30	
5,000	4:12	3:18	2:30	1:36	:48	:24	
Sea Level	3:30	2:48	2:06	1:24	:42	:18	

Consumption data per Specification MIL-1-19326 (AER) taken from NAVAER 03-50-517.

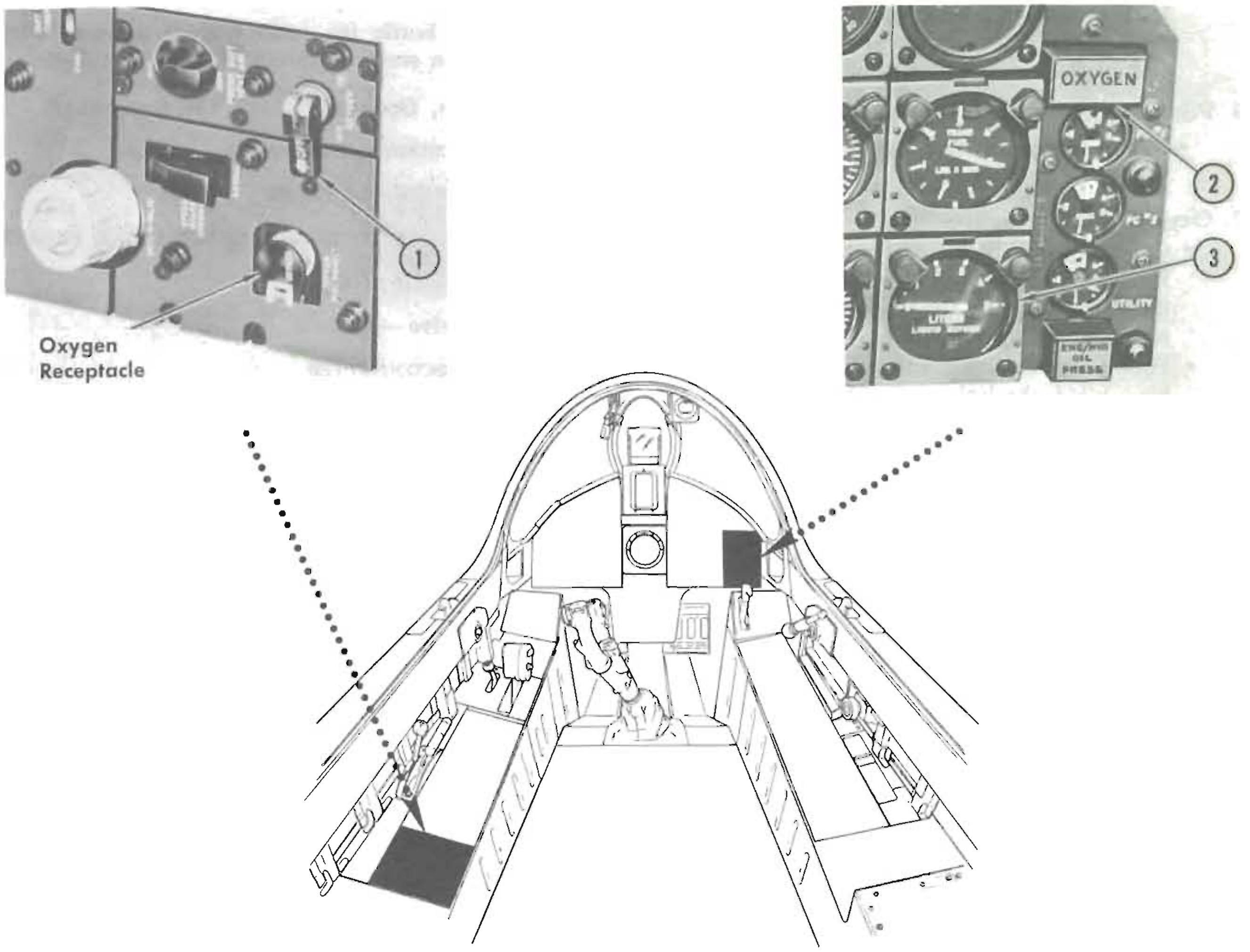
NOTE

Duration is given in hours and minutes.
Consumption data assumes the use of properly fitted oxygen equipment
Face mask leakage will decrease tabulated duration

AX-43-1-67

Figure 1–42

OXYGEN CONTROLS



Nomenclature	Function
1. Oxygen valve	OFF — closes oxygen supply. ON — opens oxygen supply.
2. Oxygen warning light	On (OXYGEN) when liquid oxygen quantity is at, or below, ½ liter or when oxygen pressure drops in line to oxygen receptacle.
3. Liquid oxygen quantity gage	Reflects quantity of liquid oxygen in converter.
Emergency bottle pressure gage (located in forward left-hand portion of seat pan)	Indicates emergency bottle pressure.
Vent and buildup valve (in area behind liquid oxygen filler valve access panel on right side of nose section)	BUILD-UP — normal position. Close system for automatic buildup of operating pressure. VENT — opens system to allow venting during refilling.

AX-28-1-67

Figure 1–43

5. Mask connections — CONNECTED
   - Connect face mask hose to hose leading from aft right-hand side of seat pan. Connect hose leading from aft left-hand side of seat pan to the oxygen receptacle to complete the connection to the aircraft supply.
6. Pilot's oxygen valve — PROPER OPERATING POSITION
   - Allow oxygen to flow before placing mask to face.
7. Oxygen warning light — OFF
   - Check oxygen flow by breathing several times. If difficulty in breathing is experienced, the face mask regulator or the oxygen supply system is not functioning properly.
   - Following servicing in which the bottle has been filled, the light will sometimes illuminate intermittently.
8. Oxygen connections — CHECKED
   - Complete or intermittent loss of radio communications or illumination of the oxygen warning light may indicate that oxygen connections are not fully engaged.
9. Emergency bottle — CHECKED
   - Check bottle for 1,800 pounds pressure when ejection seat is inspected before each flight.

During flight, frequently check the following:

1. Gage indication — OXYGEN REMAINING
2. Mask — CHECK FOR LEAKS
3. Breathing tube coupling — CHECK FULLY ENGAGED

Upon completion of flight:

1. Oxygen valve — OFF
2. Mask — DISCONNECTED
   - If flow continues from mask after shutoff, check for possible inadvertent actuation of the emergency system. If the system has been actuated, disconnect supply hose before emergency supply is depleted. If supply is allowed to become depleted, system will require purging.

POWER CONTROL HYDRAULIC SUPPLY

DESCRIPTION

The two power control hydraulic systems (figure 1–44), PC 1 and PC 2, each supply hydraulic pressure at 3,000 psi. The systems are completely separate and operate independently of each other. Both systems function in the same manner through identical components and act together to operate the flight control surfaces through the slider valves of the surface power control cylinders. The slider valves, positioned by the control stick, the rudder pedals or the trim and stabilization system servo actuators control the direction and amount of control surface deflection. The use of dual power control hydraulic control systems ensures full controllability of the aircraft in case of failure of one of the systems.

The only difference in operation of the two systems is that the aileron spoilers and the yaw stabilization system operate only off the PC 2 system, while roll stabilization operates only off the PC 1 system. An emergency hydraulic pump in the emergency power package is connected to the PC 1 hydraulic circuit to permit pressurization of the PC 1 system in case of a failure that does not involve loss of fluid from the system (pump failure). The emergency pump is placed in operation whenever the emergency power package is extended, but the pump will pressurize the system only when normal system pressure has been lost.

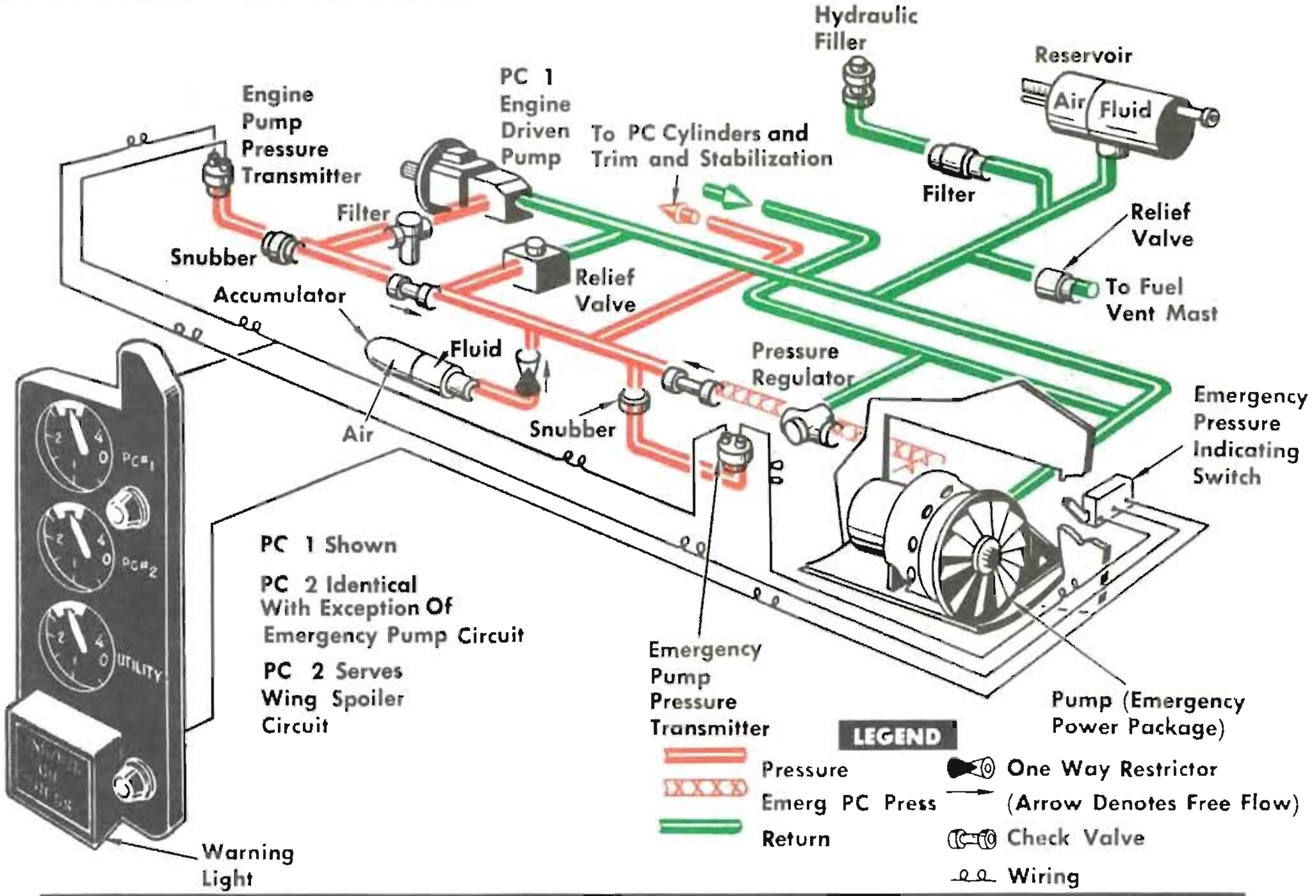
Refer to section V for procedure to be employed upon failure of the power control hydraulic systems; to section I, part 4, for flight restrictions imposed with one PC system inoperative; and to section IV, part 2, for flight characteristics encountered when operating on only one PC system.

Note

> The engine oil/hydraulic pressure warning light will illuminate when either PC pressure drops below 1,500 psi, when the utility hydraulic pressure drops below 700 psi or when the engine oil pressure drops below 34 psi.

Power control system controls are illustrated and described in figure 1–45.

POWER CONTROL HYDRAULIC SUPPLY



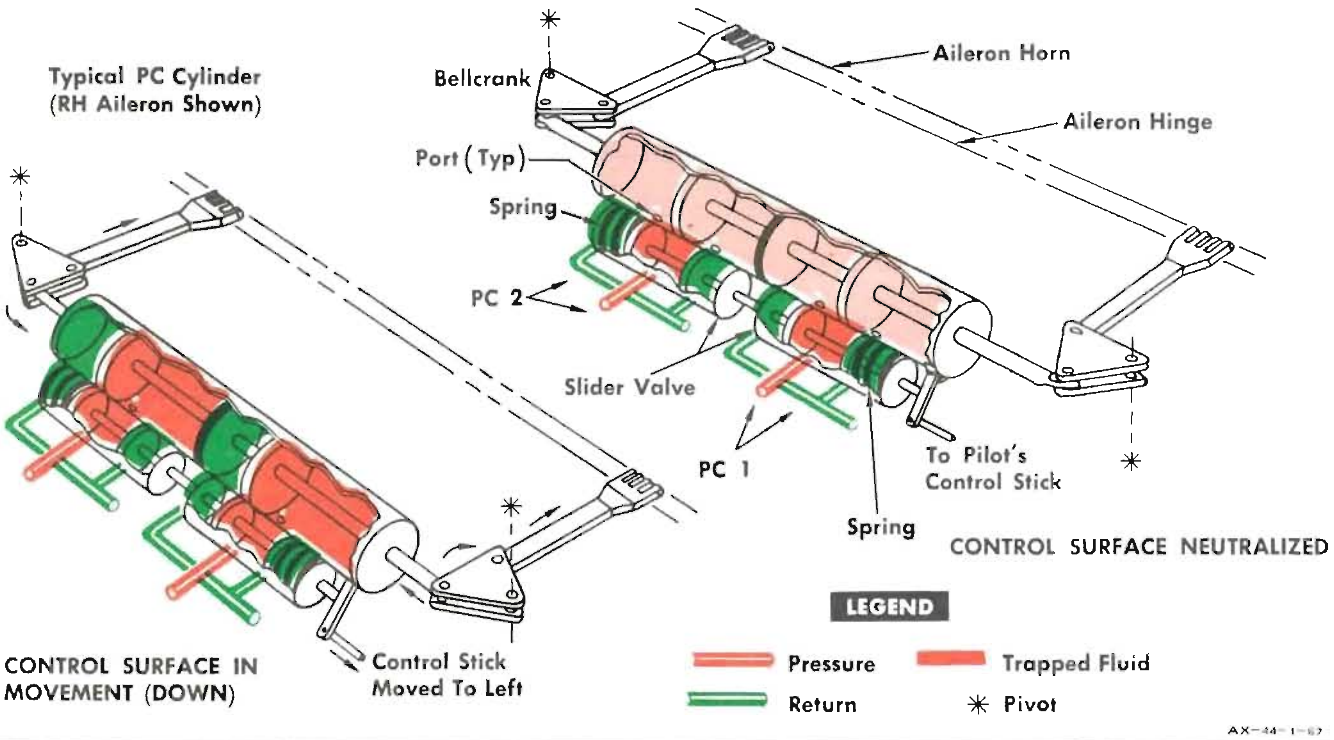
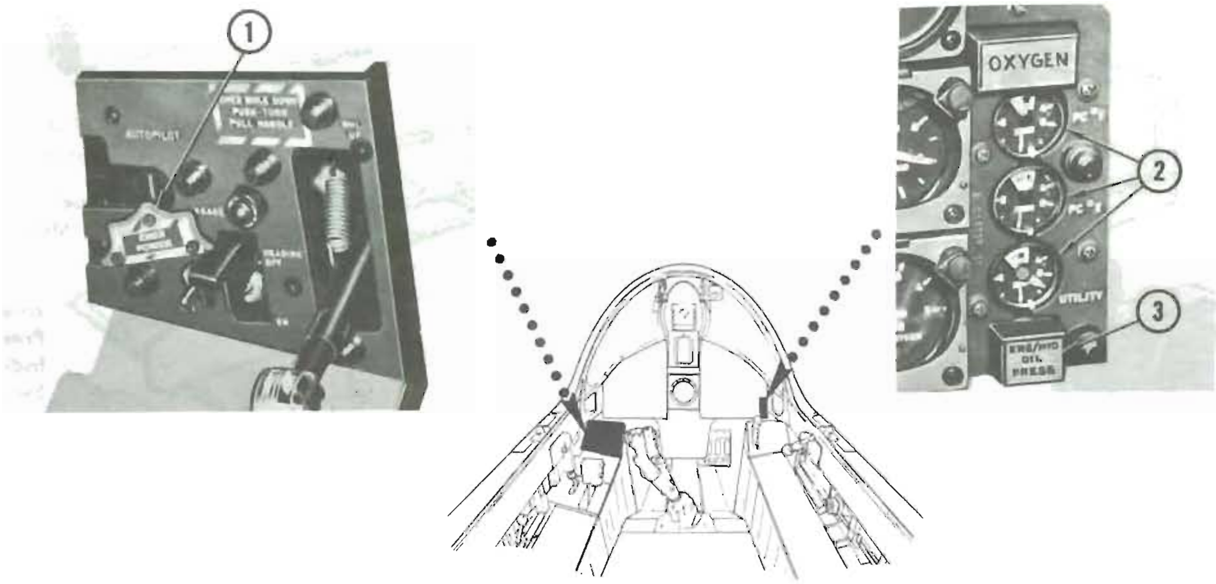


Figure 1–44

POWER CONTROL SYSTEM CONTROLS



Nomenclature	*Function*
1. Emergency power handle	Pulled to extend emergency power package and connect emergency hydraulic pump to PC 1 system. (Refer to ELECTRICAL SUPPLY for information on emergency generators.)
2. Hydraulic pressure indicators	Indicate pressure in power control systems.
3. Engine oil/hydraulic pressure warning light	On (ENG/HYD OIL PRESS) when pressure drops excessively in either power control system, utility hydraulic or engine oil system.

AX–125–1–67

Figure 1–45

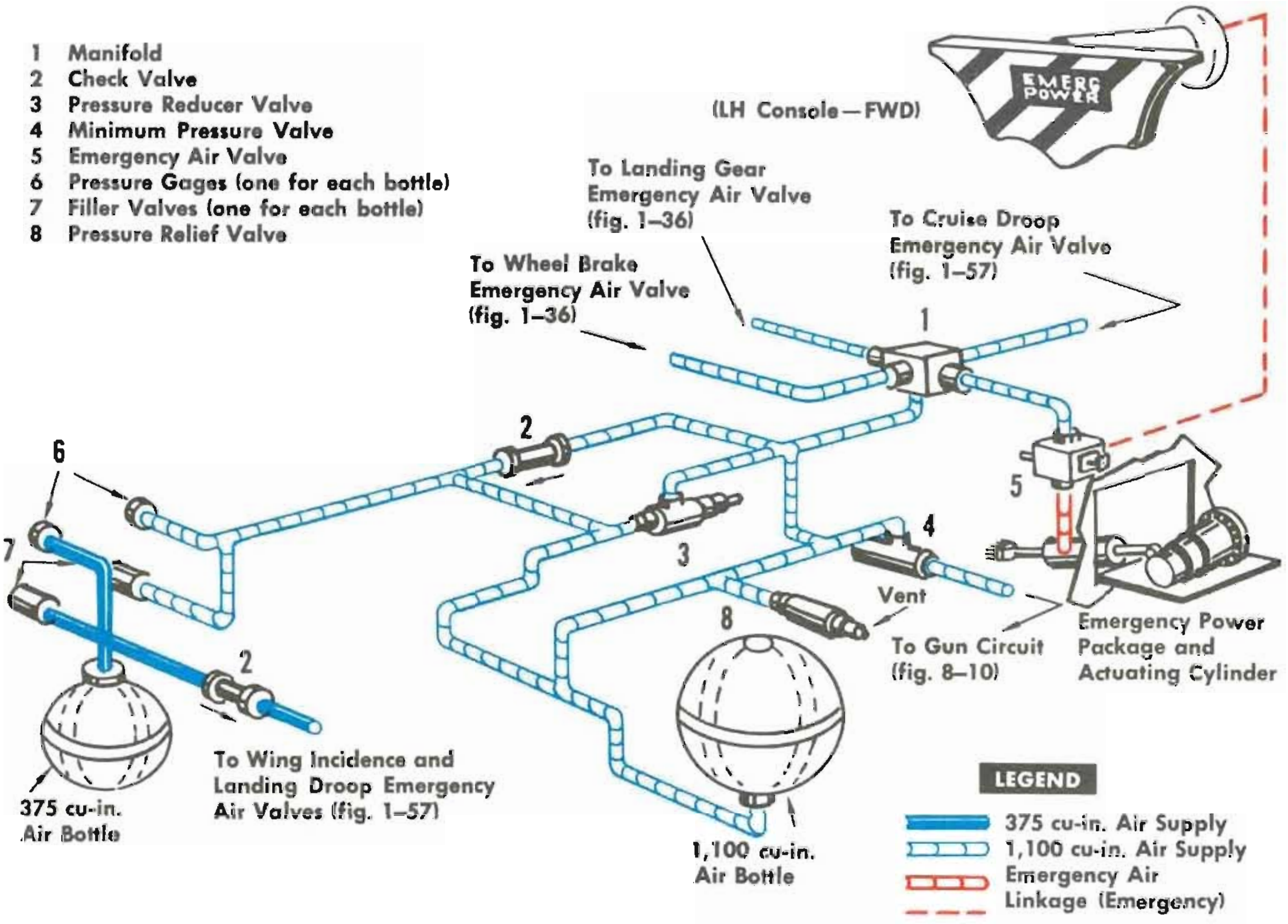
PNEUMATIC SUPPLY

PC ACCUMULATORS DON'T PRESSURIZE FROM 16TH STAGE AIR — GROUND SERVICE IS REQUIRED.

DESCRIPTION

This system (figure 1–46) supplies air from two high-pressure bottles for operation of the circuits listed. There is no cockpit indication of air bottle pressures. Bottle pressures are checked before flight during the exterior inspection (figure 3–1). (Refer to part 3, this section, for servicing information.)

PNEUMATIC SUPPLY



Pneumatic Circuit	Function
	1,100-Cu-In. Air Bottle Circuits
Gun charging	To arm guns.
Gun vent doors	To open and close doors.
Emergency power package	For extension of package.
Landing gear	For emergency extension of landing gear.
Wheel brakes	For emergency operation of wheel brakes.
Wing leading edge	For emergency extension of cruise droop side of wing leading edge dual-element cylinders.
	375-Cu-In. Air Bottle Circuits
Two-position wing	For emergency raising of two-position wing.
Wing leading edge	For emergency extension of landing droop side of wing leading edge dual-element cylinders.

AX-126-1-67

Figure 1–46

RADIO EQUIPMENT

DESCRIPTION

The aircraft is equipped with UHF command radio, ADF, TACAN, radio altimeter, and IFF radar. An integrated electronics package provides a cooled and pressurized housing for the UHF, ADF, and IFF components.

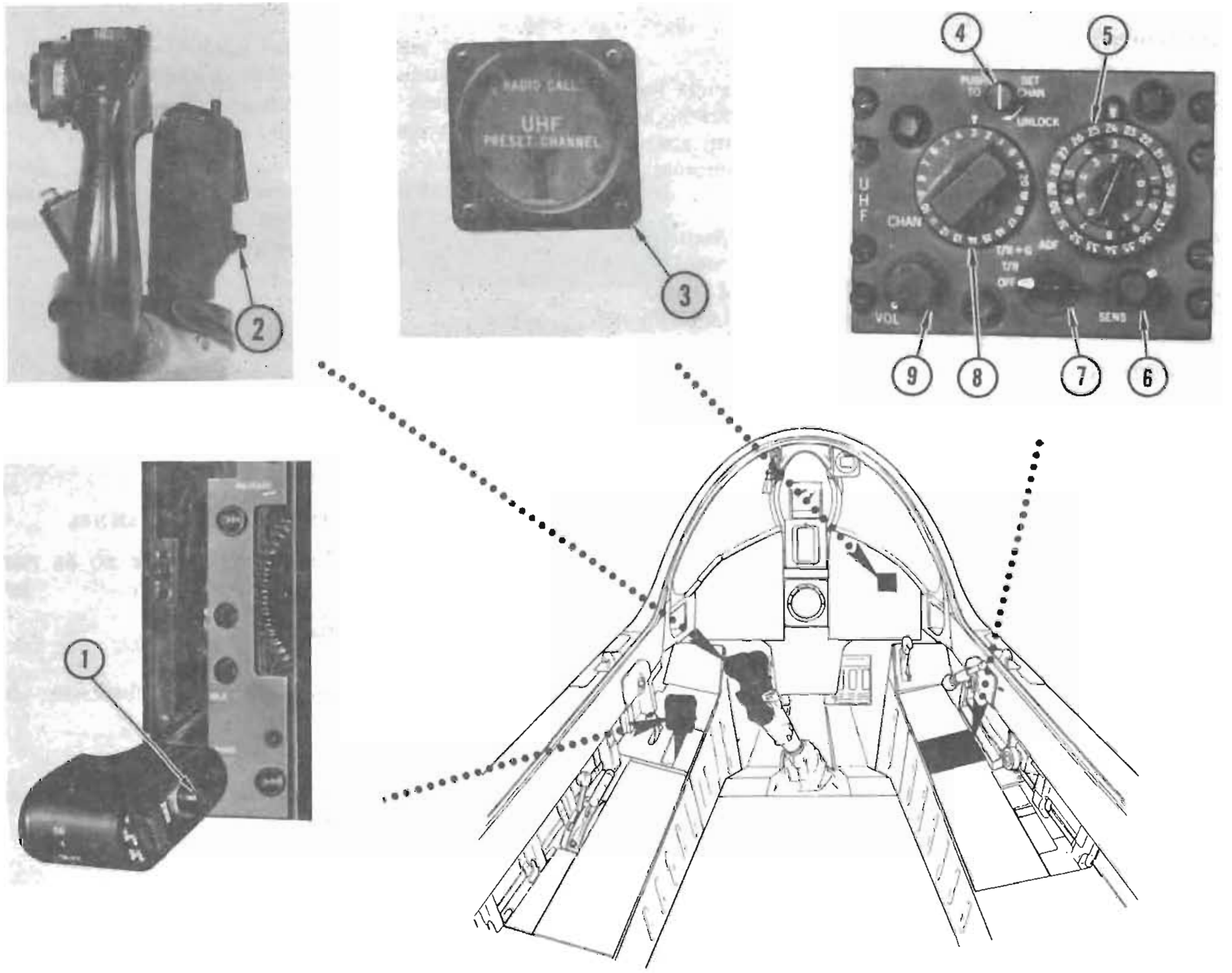
Primary ac and dc bus power is connected to the modified UHF receiver-transmitter, IFF receiver-transmitter, and an ADF electronic control amplifier in the electronic package through the UHF function switch (figure 1–47).

Compressor bleed air is directed to the integrated electronics package for pressurization, and cooling is provided by ram air circulated around the outside of the package. An internal fan, powered by secondary ac bus power, provides air circulation within the package. If pressurization is lost due to engine flameout or a system malfunction, a check valve traps the pressure in the package. Tests have shown that the electronic package may be operated for extended periods of time without the internal fan in operation with no damage to the equipment. However, continuous use of the integrated electronic package equipment without forced air cooling may result in damage from overheating. During ground operation, do not operate the UHF, IFF, or ADF systems longer than 30 minutes. When this limit has been reached, shut the equipment off and wait 30 minutes before continuing operation.

ELECTRONIC EQUIPMENT

Type	*Designation*	*Function*	*Range*	*Location of Controls*
Direction Finder (ADF) Group	AN/ARA-25 (modified)	Indicates bearing of received rf signals	Line of sight	UHF panel (right console)
Radar Identification (IFF) Set	AN/APX-6B (modified)	Identifies aircraft as friendly when challenged.	Line of sight	IFF panel (right console)
	AN/APA-89	Coder group for IFF.	Line of sight	SIF panel (right console)
Radio Navigation (TACAN) Set	AN/ARN-21D	Provides range and bearing information in reference to a selected beacon.	Line of sight	TACAN panel (right console)
UHF Command Radio Set	AN/ARC-27A	Two-way voice communication.	Line of sight	UHF panel (right console) Throttle grip Radar control grip

COMMAND RADIO CONTROLS



Nomenclature	*Function*
1, 2. Microphone switch	Puts receivers in standby and operates transmitter.
3. Preset channel indicator	Indicates which of 20 preset channels is selected for operation.
4. Channel setting button	Locks preset frequencies in related channels for automatic channel selection.
5. Frequency selector dials	Used for selecting frequency when channel selector switch is at M or for presetting frequencies in channels selected by channel selector switch.
6. Sensitivity trim switch	Adjusts receiver sensitivity.
7. Function switch	T/R — puts main receiver in operation and transmitter in standby. T/R + G — puts main and guard receivers in operation and transmitter in standby. ADF — puts direction finder group (AN/ARA-25) in operation. OFF — turns off AN/ARC-27A and AN/APX-6B sets.
8. Channel selector switch	M — permits manual selection of frequency channels. G — permits reception and transmission on guard channel. At all other positions, permits selection of 20 preset channels.
9. UHF volume control knob	Controls headset volume.

AX-29-1-67

Figure 1—47

COMMAND RADIO SET AN/ARC-27A

DESCRIPTION

This set provides the pilot with 1,750 channels for radio-telephone communications in the ultra-high-frequency range (225.0 to 399.9 mc). Twenty channels and a guard channel can be preset for automatic selection.

After AFC 502, TSEC/KY-28(V-2), Speech Security Equipment is installed in the aircraft and is used in conjunction with the AN/ARC-27A Command Radio. Refer to Section I Confidential Supplemental NATOPS Manual for detailed information on the Speech Security system.

Command radio set controls are illustrated and described in figure 1-47.

NORMAL OPERATION

1. Function switch — T/R or T/R + G
   - Allow a 1-minute warmup time before attempting to transmit.
2. Channel selector switch — DESIRED CHANNEL
3. UHF volume control knob — ADJUSTED
4. Sensitivity trim knob — ADJUST
   - Sensitivity must be adjusted for each frequency (except guard, which is preset) to assure maximum reception.
   - Rotate sensitivity trim knob clockwise until a background noise is heard, then slowly rotate the knob counterclockwise. Stop rotation the instant the background noise disappears.
   - To increase reception range, it may occasionally be necessary to adjust sensitivity to a point where background noise is audible.

CHANNEL PRESET PROCEDURE

Channel presetting is a mechanical procedure which does not require electrical power.

1. Channel selector switch — DESIRED CHANNEL
2. Frequency selector dials — FREQUENCY TO BE PRESET
3. Channel setting button — SET
   - Turn button one-quarter turn clockwise, depress and release.
   - Channel is correctly preset if index line assumes a vertical position.

DIRECTION FINDER (ADF) GROUP AN/ARA-25

DESCRIPTION

The AN/ARA-25 direction finder group operates in conjunction with the UHF command radio set. ADF signals are received by the main receiver of the command set, and a command set control is used for operating the ADF system.

ADF controls are illustrated and described in figure 1–48.

NORMAL OPERATION

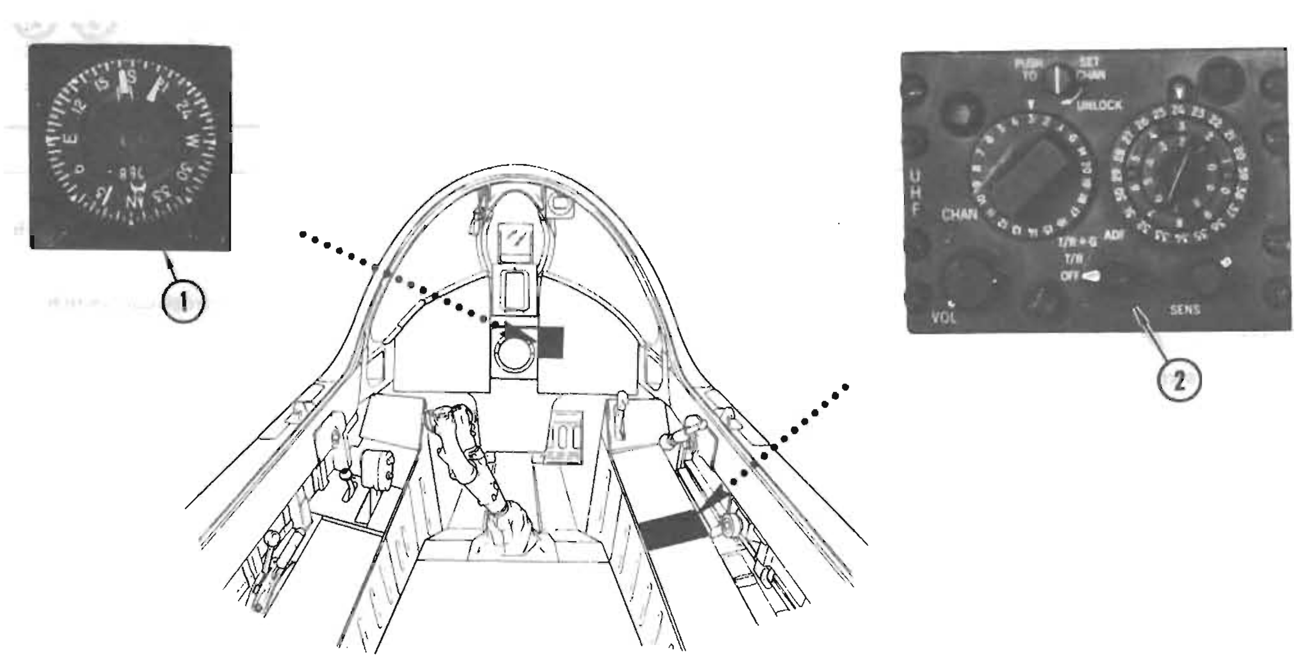
To start operation:

1. UHF function switch — ADF
2. Channel selector switch — DESIRED CHANNEL

To stop operation:

1. UHF function switch — ANY POSITION EXCEPT ADF

ADF CONTROLS

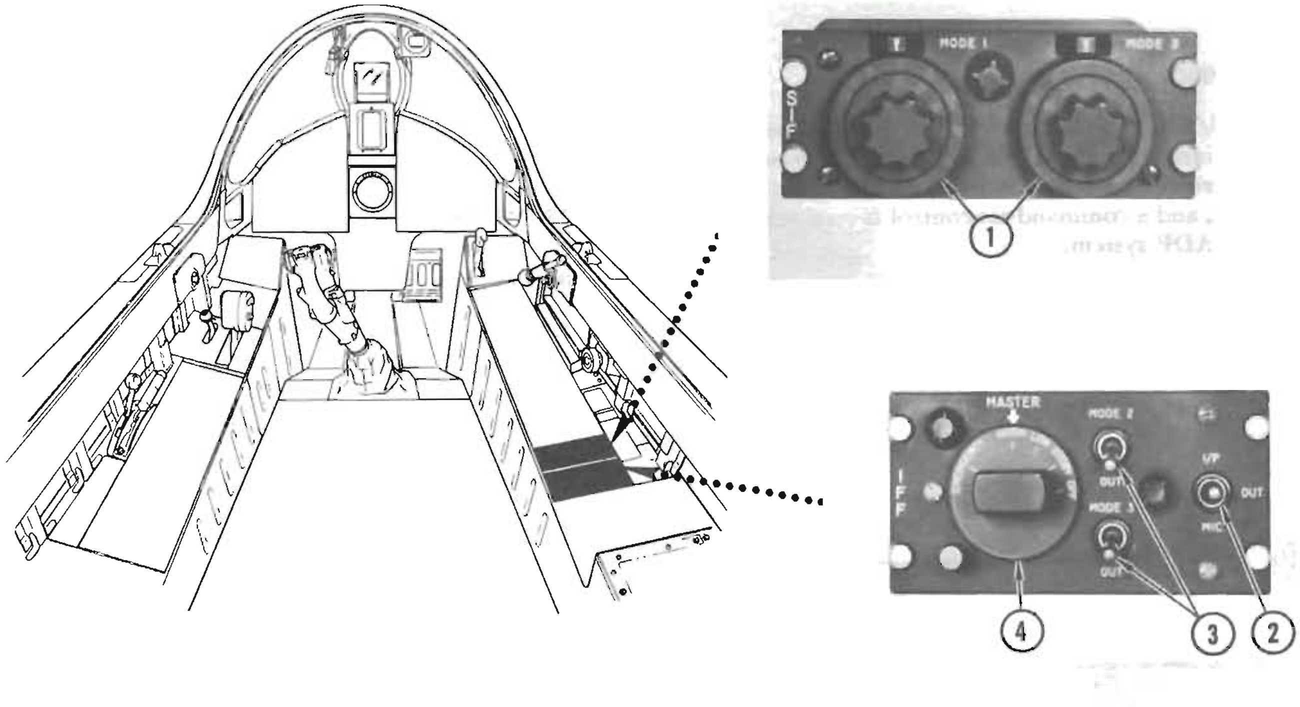


Nomenclature	Function
1. Navigation (bearing-distance-heading) indicator	Pointer No. 1 indicates magnetic bearing of UHF station in relation to aircraft.
2. UHF function switch	ADF — starts direction finder group operation.

AX-31-1-67

Figure 1–48

IFF RADAR CONTROLS



Nomenclature	*Function*
1. Code selector dials	Permit selection of mode codes as determined by mission.
2. I/P switch	I/P — provides reply impulse for approximately 30 seconds, after releasing switch, in mode 1 or mode 3 interrogation. OUT — deenergizes circuit. MIC — transfers reply impulse activation from I/P switch to microphone switch.
3. Mode switches	Permit selection of reply signals and codes.
4. Master switch	OFF — deenergizes set. STDBY — energizes receiver-transmitter for immediate operation if UHF function switch is in a position other than OFF. LOW — provides partial receiver sensitivity in the presence of strong nearby interrogations. NORM — allows full receiver sensitivity to provide maximum performance. EMERGENCY — provides full receiver sensitivity and allows special emergency replies to be transmitted when a mode 1 or mode 3 interrogation is received. A pushbutton guard (next to the master switch) prevents accidentally switching the AN/APX-6B into emergency operation.

AX-38-1-67

Figure 1–49

IDENTIFICATION SET AN/APX-6B CODER GROUP AN/APA-89

DESCRIPTION

The AN/APX-6B identification set is an airborne transponder used in conjunction with the AN/APA-89 coder group to provide a system of electronic identification and recognition. The purposes of the equipment are:

- To identify the aircraft in which it is installed as friendly when correctly challenged by friendly shore, shipboard, and airborne radars.
- To permit surface tracking and control of aircraft in which it is installed.
- To transpond automatically with an emergency reply signal following ejection, providing UHF function switch is in any position except OFF.

The use of the AN/APA-89 coder permits changing of mode 1 and 3 codes from cockpit; mode 2 is preset. Mode 1 code is on anytime the UHF and IFF switches are in any position except OFF. Modes 2 and 3 are energized by switches on IFF panel.

IFF controls are illustrated and described in figure 1–49.

NORMAL OPERATION

To place the AN/APX-6B and AN/APA-89 equipment in operation, proceed as follows:

1. UHF function switch — Any position except OFF
2. IFF master switch — STDBY for 3 minutes then NORM
3. Mode switches (IFF and coder) — Position determined by mission
4. IFF I/P switch — OUT

Note

AN/APX-6B should be energized (master switch in NORM, LOW, or STDBY) during every flight to minimize the possibility of package failure due to moisture condensation.

RADAR SET (RADIO ALTIMETER) AN/APN-22

DESCRIPTION

The AN/APN-22 radar set is a microwave radio altimeter which is designed to measure the terrain clearance of the aircraft without the necessity for externally mounted equipment. The equipment operates in the 4200- to 4400-mc band and is designed to provide reliable operation from 0 to 10,000 feet over land and 0 to 20,000 feet over water. This equipment is accurate to 2 feet from 0 to 40 feet and 5% of the indicated terrain clearance from 40 to 20,000 feet.

The radio altimeter may be set to provide a reference for flight at constant terrain height or to provide a warning of descent below a preset terrain clearance up to 20,000 feet. The adjustable index marker (bug) at the outside of the scale can be positioned at the desired reference height by turning the on-limit knob.

On aircraft after Airframe Change 487, unlighted indicator lights on the radarscope flash whenever the altitude limit light or fire warning light is on. The feature is intended to warn the pilot of these conditions during "head-in-boot" flying. The landing gear handle must be in WHLS UP for the indicator lights to flash.

A reliability circuit disables the indicator when the signal is too weak, and the head of the pointer will assume an offscale position behind the dropout mask below the 0 scale mark.

WARNING

Radio altimeter indications become erroneous at airspeeds over 300 KIAS. Aircraft bank angles of more than 30° will cause the pointer to become erratic and assume the offscale position.

Radio altimeter controls are illustrated and described in figure 1–50.

NORMAL OPERATION

To start operation:

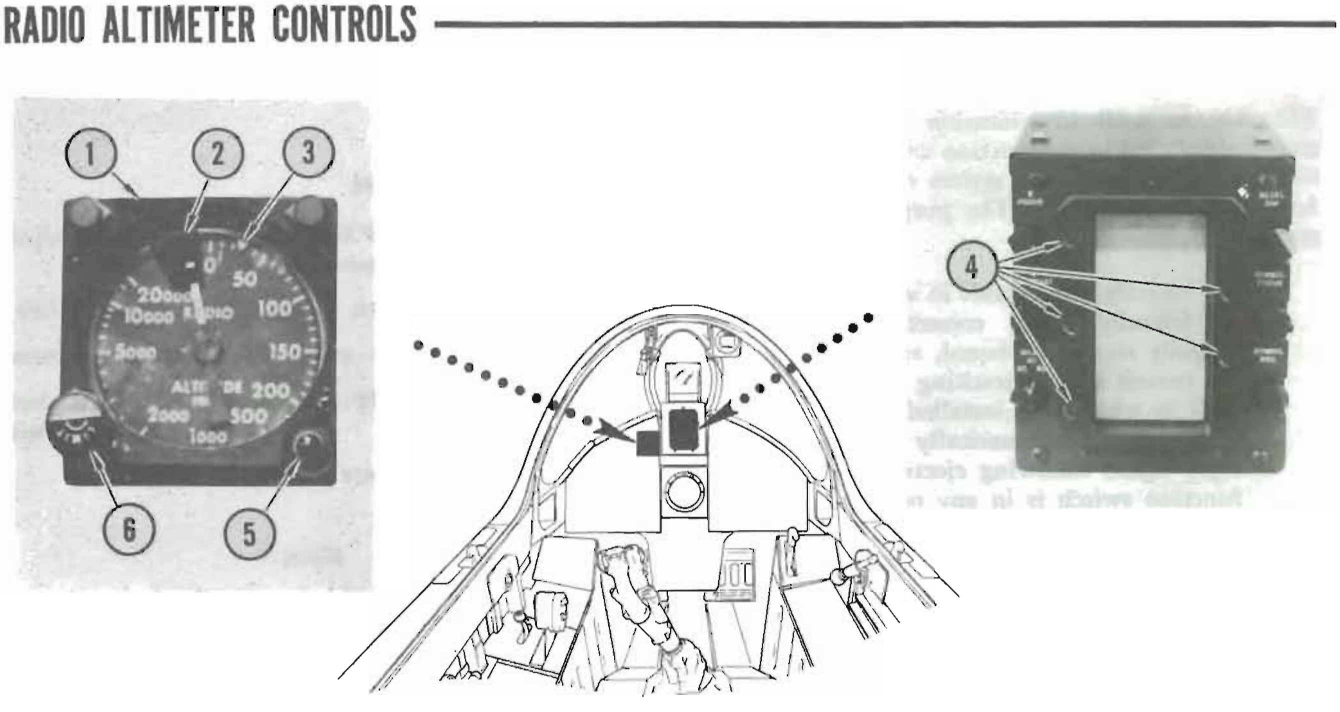
1. On-limit knob — ON

CAUTION

Allow at least 12 minutes warmup time after starting the equipment to ensure final accuracy.

2. On-limit knob — SET TO DESIRED HEIGHT
3. Limit light — ON (if below designated height)

RADIO ALTIMETER CONTROLS



Nomenclature	Function
1. Radio altitude indicator	Indicates terrain clearance on a scale with increments that vary from 10 feet, at low levels, to 5,000 feet, at high levels.
2. Dropout mask	Indicates unreliable signal when pointer assumes off scale position behind mask.
3. Index marker	Indicates reference height selected by the pilot.
4. Radar information lights	Flashing of information lights not already lighted indicates aircraft is below height indicated on marker or fire warning light is on.*
5. Limit light	On — if aircraft is below height indicated by index marker. Off — if aircraft is above height indicated by index marker.
6. On-limit knob	Initial clockwise rotation — turns set on. Further clockwise turning increases setting of height index marker. Turned counterclockwise — decreases setting of height index marker. Turned fully counterclockwise turns set off.

*Aircraft after Airframe Change No. 487.

AX-39-1-67

Figure 1–50

RADIO NAVIGATION (TACAN) AN/ARN-21D

DESCRIPTION

The signal transmitted by the surface beacon contains reference (fixed) and variable bearing information, the range reply signal, and the station identification signal.

The aircraft receiver-transmitter compares the difference between the fixed and the variable bearing signals, and transmits the resulting bearing signal to pointer No. 2 of the navigation (bearing-distance-heading) indicator.

The slant range in nautical miles from the aircraft to the surface beacon is determined from the time it takes a coded interrogation signal from the receiver-transmitter to reach the surface beacon and the time required for a reply. The resulting computation is shown in the range indicator window of the navigation indicator.

Station identification signals are received in the headset in the form of Morse code identifying characters. TACAN is operative on emergency generator power when emergency generator switch is in ON.

CAUTION

When operating in the air-to-air mode, if more than one aircraft in a formation is interrogating another distant aircraft on the same channel, the distance information displayed in the interrogated aircraft may be unreliable.

The set also furnishes range information between two similarly equipped aircraft simultaneously operating 63 channels apart on the bilateral air-to-air mode.

Controls are illustrated and described in figure 1–51.

NORMAL OPERATION

1. Master switch — REC (bearing only)
   — T/R (bearing and range)
   — A/A (air-to-air range)
   - Allow 90-second warmup.
2. Channel selector knobs — DESIRED CHANNEL
3. Volume control — MIDPOINT OF RANGE

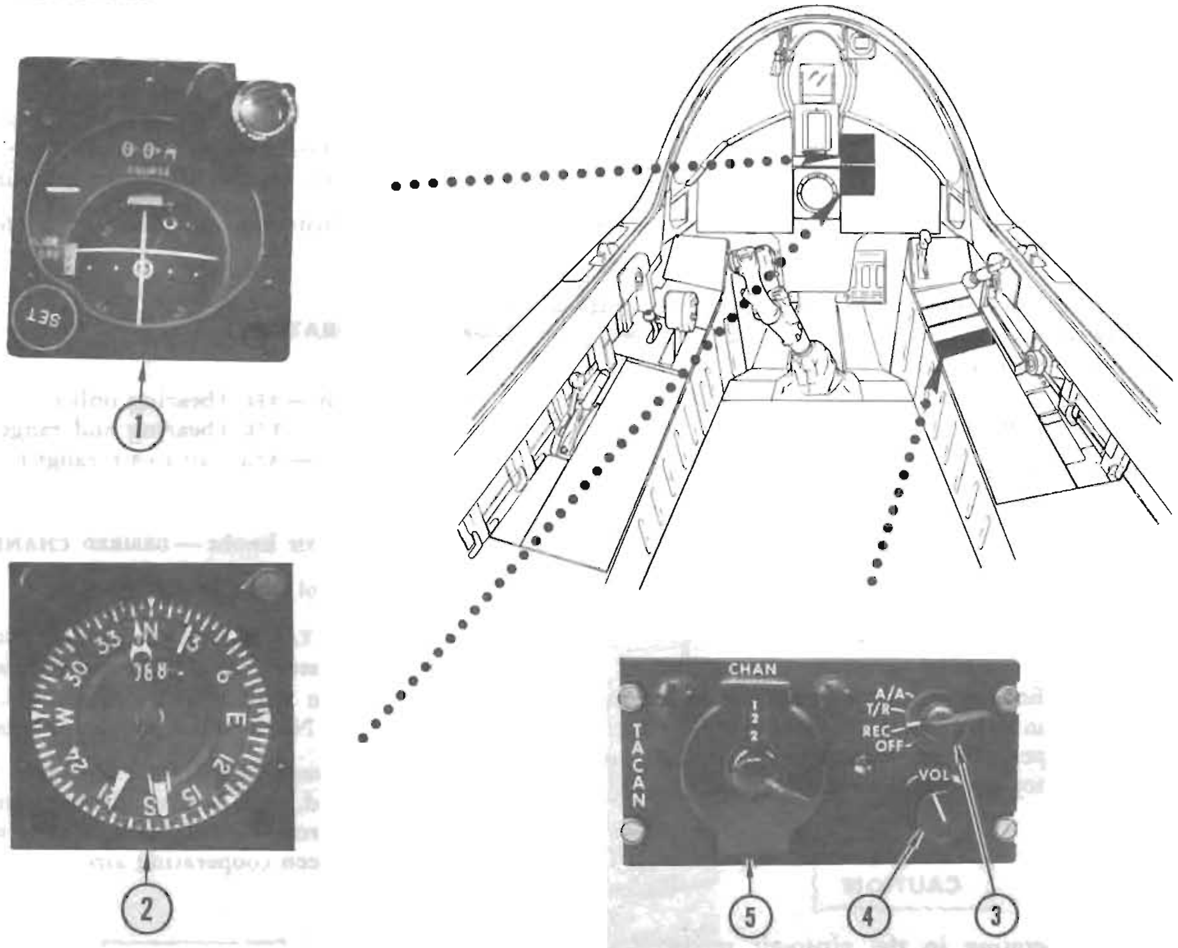
If either REC or T/R is selected, pointer No. 2 of the navigation indicator should stop and indicate bearing of surface beacon with relation to aircraft. If A/A is selected, pointer No. 2 will continue to rotate.

If T/R position was selected, the range dials will rotate for a short period, then stop to display slant range of surface beacon from aircraft. If A/A is selected, only slant range between cooperating aircraft is displayed.

CAUTION

Turn the TACAN set off at altitudes above 50,000 feet to prevent damage to equipment as a result of arcing.

TACAN CONTROLS

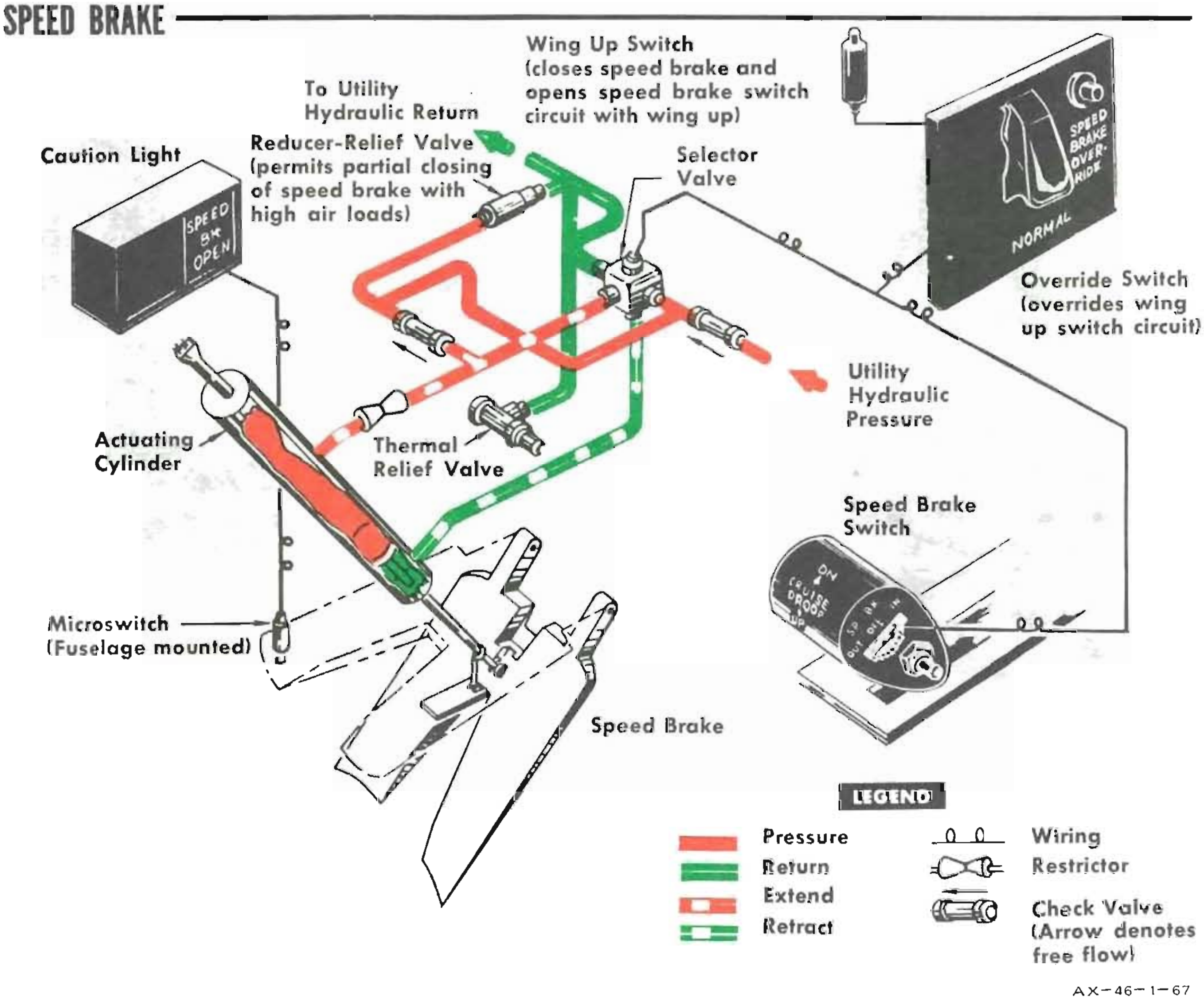


Nomenclature	Function
1. Course indicator	Vertical bar shows position of aircraft in relation to the set course. To-from window indicates whether selected course will take aircraft to or from the station. Course set knob permits setting of course heading in course window. Relative heading needle indicates angle between magnetic heading of aircraft and selected course. Warning flags show as result of power failure or loss of station signal. Horizontal bar not used.
2. Navigation (bearing-distance-heading) indicator	Pointer No. 2 indicates magnetic bearing of TACAN surface beacon with relation to aircraft. Numerals in window display slant range (nautical miles) to surface beacon station or air-to-air slant range† (nautical miles) to cooperating aircraft.
3. Master switch	OFF — deenergizes radio set. REC — energizes bearing circuit only. T/R — energizes both bearing and range circuits. A/A — energizes air-to-air range circuits.
4. Volume control knob	Controls volume of audible signal to headset.
5. Channel selector switch	Combined settings of both knobs select desired channel.

AX-40-1-67

Figure 1–51

SPEED BRAKE



SPEED BRAKE WILL BE CLOSED
BY THE FOLLOWING:
SWITCH TO IN
RAISE THE WING
OVERRIDE TO NORMAL, WING UP
LOST ELECTRICAL PWR
WEIGHT ON LEFT MAIN SWITCH
INCREASE AIR LOAD BY GOING 1.5,760 KTS

Figure 1–52

SPEED BRAKE

DESCRIPTION

The speed brake is operated by utility hydraulic pressure and can be fully or partially extended. The brake is automatically closed and the speed brake switch circuit is broken by the wing-up switch when the wing is raised. An override circuit permits brake extension with the wing up.

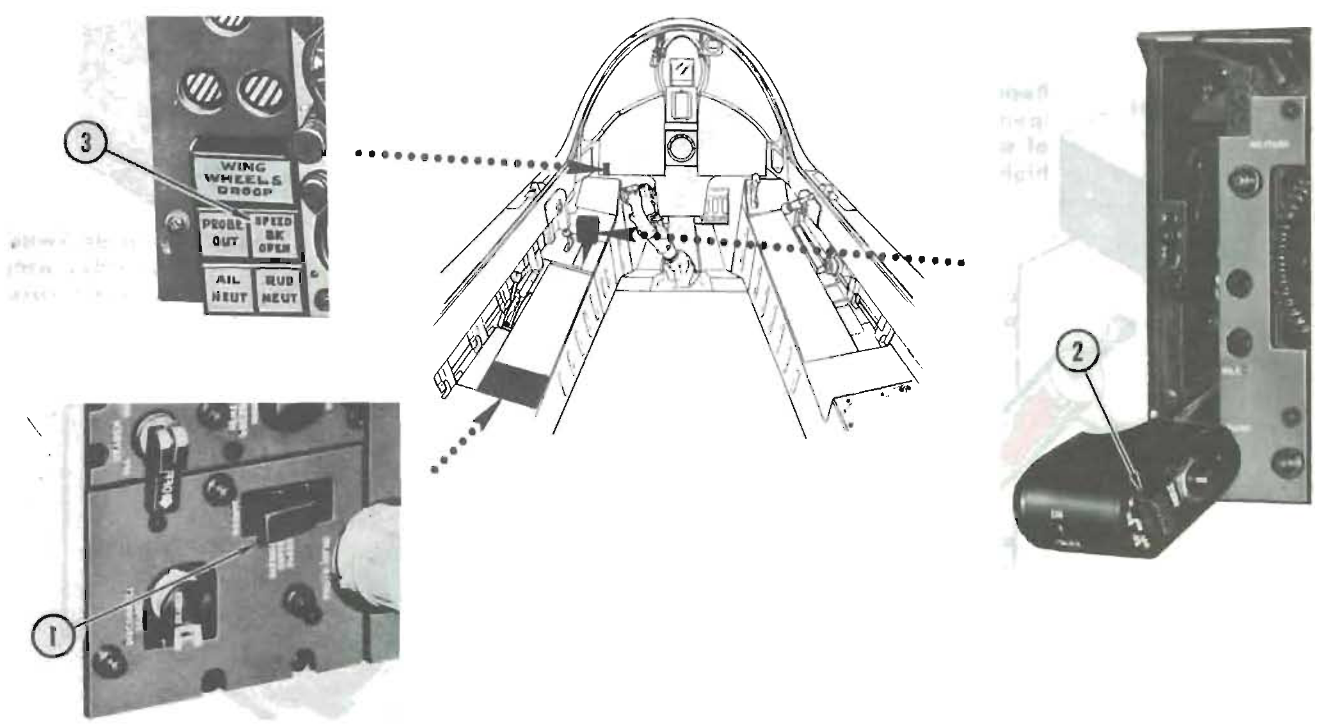
To prevent the brake from contacting the runway when the override feature is used, the pilot must remember to retract the brake before touchdown.

The speed brake will partially close when excessive airloads exerted on the extended surface neutralize hydraulic pressure and cause a pressure relief valve to open. The brake is prevented from being fully extended by the same function at very high speeds. As airspeed decreases the brake can be further extended.

With loss of main generator electrical power the speed brake automatically closes and is inoperative until electrical power from the emergency power package is connected (emergency generator switch in ON). During ground operations, a safety circuit prevents opening of the speed brake when weight of the aircraft is on the main gear.

The system is illustrated in figure 1–52. System controls are illustrated and described in figure 1–53.

SPEED BRAKE CONTROLS



Nomenclature	*Function*
1. Speed brake override switch	OVERRIDE — permits extension of speed brake (by use of speed brake switch) with wing raised. NORMAL — is normal flight position.
2. Speed brake switch	OUT — extends speed brake. OFF — holds speed brake in any extended intermediate position. IN — closes and holds speed brake closed.
3. Speed brake light	On (SPEED BK OPEN), indicates speed brake is open.

AX-118-1-67

STABS DAMP, AP CORRECTS

Figure 1-53

TRIM AND STABILIZATION

DESCRIPTION

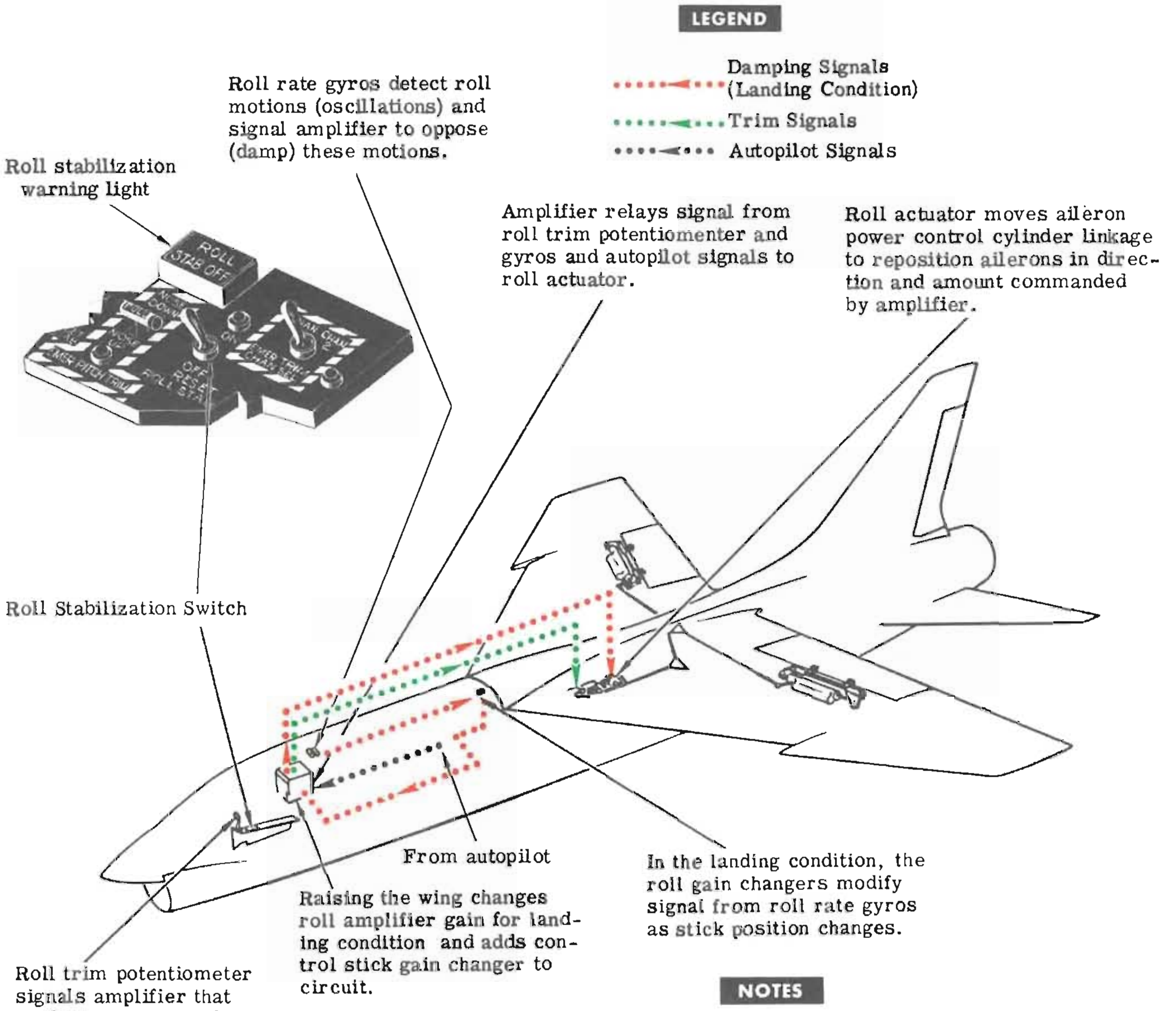
This system senses flight deviations about the yaw and roll axes and automatically applies corrective stabilization signals to the control system. Normal yaw, pitch and roll trimming, and emergency pitch trimming are provided through cockpit controls.

Roll stabilization signals are automatically initiated by roll rate gyros. Yaw stabilization and "stiffening" signals are initiated by lateral accelerometers. The stabilization functions can be turned off and on by controls on the left-hand console. Roll and pitch trim knobs are located on the stick grip and the rudder trim knob is on the left-hand console. Pitch trim is calibrated with the wing in the landing condition and the control stick in neutral. With the wing in the clean condition, full nose up trim at the control surface is reached prior to full movement of the control knob. Movement of the trim knob does not affect the position or feel of the control stick.

System operation is illustrated in figure 1-54. System controls are illustrated and described in figure 1-55.

TRIM AND STABILIZATION

ROLL TRIM AND DAMPING



NOTES

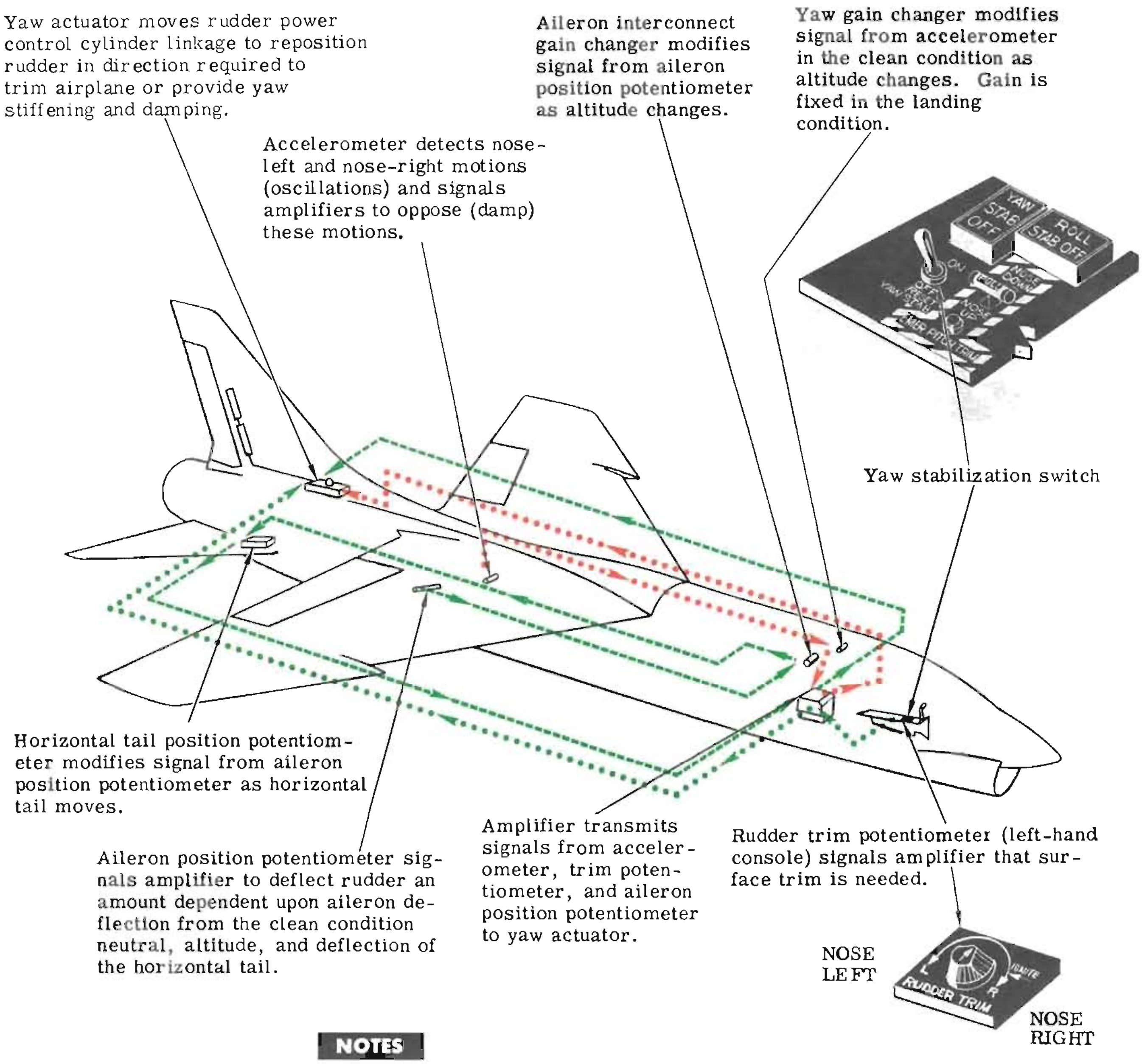
1. Roll trim and damping operates electrically from emergency buses and hydraulically from PC No. 1 system.
2. A monitor system maintains a constant check of roll actuator. If the two channels within the actuator get more than 20% out of agreement, the monitor shuts off the system and it locks in neutral.
3. With the emergency power package extended and the emergency generator switch in LAND, the roll monitor is overridden. To prevent energizing a malfunctioning system (if the monitor has previously shut off the system because of a malfunction and the system could not be reset), the roll stabilization switch should be placed in OFF before the emergency generator switch is placed in LAND.
4. No emergency roll trim is provided because the electrohydraulic actuator will lock at neutral if electical or hydraulic power is lost.

AX-47-1-67

Figure 1-54 (Sheet 1)

TRIM AND STABILIZATION

YAW TRIM AND DAMPING



NOTES

1. Yaw trim and damping operates electrically from primary buses and hydraulically from PC No. 2 system.
2. This system incorporates dual servo channels with dual components throughout.
3. No emergency yaw trim is provided because the actuators will lock at neutral if electrical or hydraulic power is lost.
4. A monitor system maintains a constant check of yaw actuator. If the two channels within the actuator get more than 20% out of agreement, the monitor shuts off the system and it locks in neutral.

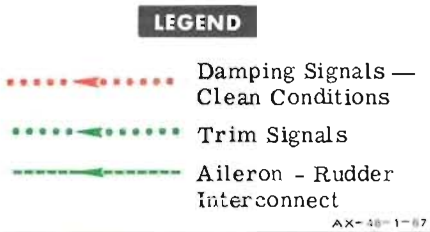
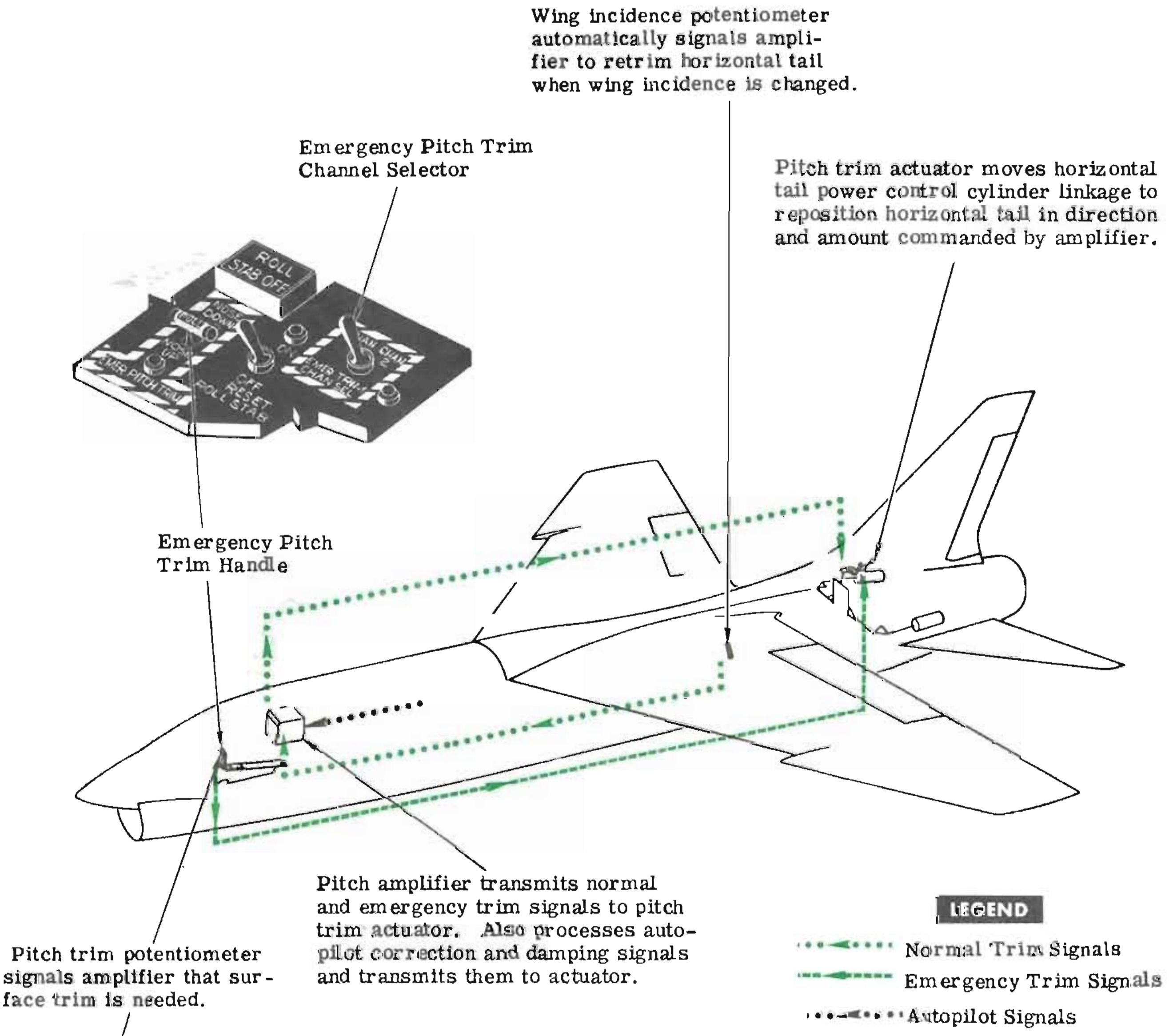


Figure 1–54 (Sheet 2)

TRIM AND STABILIZATION

PITCH TRIM



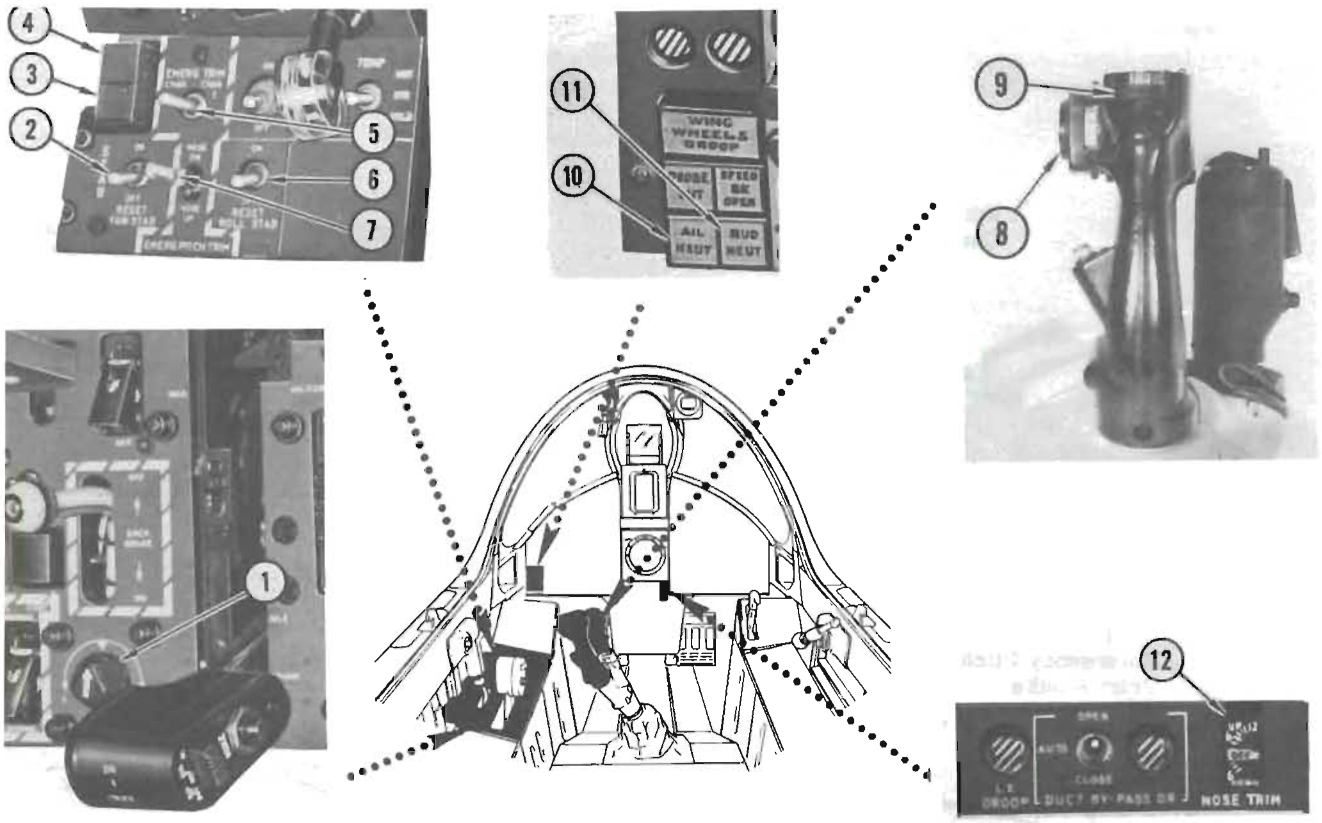
NOTES

1. Normal and emergency trim circuits are powered from the emergency ac bus
2. The dual channel pitch trim system includes a two-channel amplifier and a dual electro- mechanical screwjack which acts as an extendible link in the control linkage to the horizontal tail power control cylinder.
3. Pitch damping is provided only with autopilot engaged.
4. Actuation of the emergency pitch trim handle automatically disengages the autopilot.

AX-49-1-67

Figure 1-54 (Sheet 3)

TRIM AND STABILIZATION CONTROLS



Nomenclature	*Function*
1. Rudder trim knob	Rotated left or right adds corresponding yaw trim.
2. Yaw stabilization switch	OFF RESET — shuts off yaw damping and trim circuits, and resets system after cut-out by comparator circuit. ON — makes hydraulic power available for yaw trim damping.
3. Roll stabilization warning light	Light on (ROLL STAB OFF) indicates system not operating. Light off indicates system operating.
4. Yaw stabilization warning light	Light on (YAW STAB OFF) indicates yaw stabilization system not operating. Light off indicates system operating.
5. Emergency pitch trim channel selector switch	Allows selection of either of the two pitch trim channels when emergency pitch trim has been selected.
6. Roll stabilization switch	OFF-RESET shuts off roll damping and trim circuits, and resets system after cutout by comparator circuit. Also causes autopilot to disengage (in both axes) if in operation. ON makes hydraulic power available for roll damping and trim.
7. Emergency pitch trim handle	Pulled, cuts off normal pitch trim and places emergency trim circuit in standby. Also causes autopilot to disengage in both axes if in operation. NOSE DOWN or NOSE UP — adds desired trim to horizontal tail through emergency trim channel selected with emergency pitch trim channel selector switch.

AX-117(1)-1-67

Figure 1–55 (Sheet 1)

TRIM AND STABILIZATION CONTROLS

Nomenclature	*Function*
8. Pitch trim knob	Rotated forward (nose down) or aft (nose up) adds pitch trim. (Calibrated in degrees of trim for wing up position.)
9. Roll trim knob	Rotated left or right, adds corresponding roll trim.
10. Aileron neutral trim light	On (AIL NEUT) indicates ailerons at 20° droop neutral (0° trim). Light off indicates ailerons not in neutral. Light inoperative with weight off landing gear.
11. Rudder neutral trim light	On (RUD NEUT) indicates rudder in neutral (0° trim). Light off indicates rudder not in neutral. Light inoperative with weight off landing gear.
12. Nose trim indicator	OFF — indicates instrument inoperative. (Deenergized with weight off landing gear.) Degrees UP or DOWN indicates amount of pitch trim attained by the control surface with stick in neutral and wing up. Pitch trim available exceeds the limits of the indicator, but the indications are true within limits.

AX-117(2)-1-67

Figure 1–55 (Sheet 2)

TWO-POSITION WING

DESCRIPTION

The two-position wing provides increased visibility at low takeoff and landing speeds by permitting the angle-of-attack of the wing to be increased without increasing the fuselage angle. The wing leading edge and ailerons are automatically drooped when the wing is raised to provide increased lift and stability during takeoff and landing.

The wing is normally raised or lowered and the leading edge simultaneously extended to or retracted from the landing droop position by utility hydraulic system pressure. If hydraulic pressure is lost, the wing can be raised and the leading edge extended to the landing droop position by pneumatic system pressure.

Figure 1–56 illustrates changes automatically effected by raising or lowering the wing. Figure 1–57 presents the system schematically. Two-position wing controls are presented in figure 1–58.

The wing actuating cylinder has both a mechanical downlock, controlled by the downlock handle, and an integral locking mechanism. The downlock handle must be fully engaged in the UNLOCK detent before the wing incidence handle is actuated. Positioning the wing incidence handle with the downlock handle out of detent will cause misalignment of wing cylinder mechanical downlock and binding of handles. During subsequent wing DN selection, mechanical interference between retracting cylinder and mechanical downlock will prevent further hydraulic or pneumatic operation of the wing and leading edge.

With a force applied to the handle, it will be possible to move the handle toward the LOCK detent, due to action of spring struts in the rigging, but not sufficiently so as to engage the detent. When the downlock handle is in LOCK, a cam is positioned to prevent the wing incidence handle from being placed in UP.

The wing cylinder internal lock locks the cylinder in position when it is not actuated or when pressure is lost. During wing positioning, the lock will engage if g forces are applied due to hydraulic pressure being neutralized. The wing will continue movement when g forces are removed.

The wing hydraulic selector valve has a solenoid-operated dual lock latch, which locks the valve in the up or down position and is controlled by the release switch. The dual lock latch is engaged when energized by secondary bus power and is unlocked by spring action when the circuit is broken by depressing the release switch or when electrical power is lost.

The wing leading edge is drooped by six actuating cylinders. Normal operating pressure is supplied by the utility hydraulic system. Each cylinder is divided into two elements by a wall inside the cylinder barrel, and each has two pistons. One piston rod extends from each end of the cylinder barrel, with one rod connected (directly or indirectly) to the wing and the other to the leading edge. Both elements of the cylinder are used to obtain the land (full) droop position and only one element is used to obtain the cruise droop position. One piston (in the cruise element) is controlled by the cruise droop selector valve which is actuated electrically by the cruise droop switch (throttle grip). The other piston (in the land droop element) is controlled by a hydraulic valve which is actuated by direct linkage from the wing incidence handle in the cockpit. When the wing incidence handle is put in the UP position, the cruise droop selector valve is energized to include the operation of the cruise elements in obtaining full extension of the leading edge to the land droop position.

Mechanical locks in the land droop elements provide droop locking. Emergency land droop can be obtained by using the pneumatic system. However, there is no emergency provision for obtaining cruise droop.

NORMAL OPERATION

To raise the wing and extend the leading edge, proceed as follows:

1. Wing downlock handle — UNLOCK
2. Wing incidence release switch — DEPRESS
3. Wing incidence handle — UP

To lower the wing and retract the leading edge:

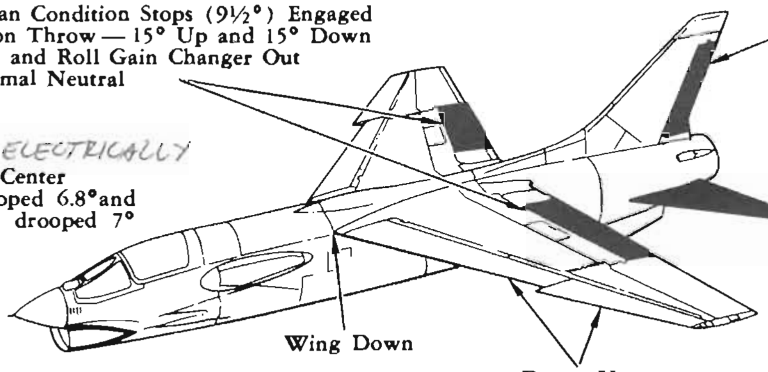
1. Wing incidence release switch — DEPRESS
2. Wing incidence handle — DN
3. Wing downlock handle — LOCK

To raise the wing and extend the droop pneumatically:

1. Wing downlock handle — UNLOCK
2. Wing incidence handle — DN
3. Emergency droop and wing incidence guard—RAISE
4. Wing incidence release switch — DEPRESS
5. Wing incidence handle — Full forward to extend droop, then inboard and aft to EMERG UP

WING INCIDENCE CHANGE

CLEAN CONDITION −1° INCIDENCE



LANDING CONDITION +7° INCIDENCE

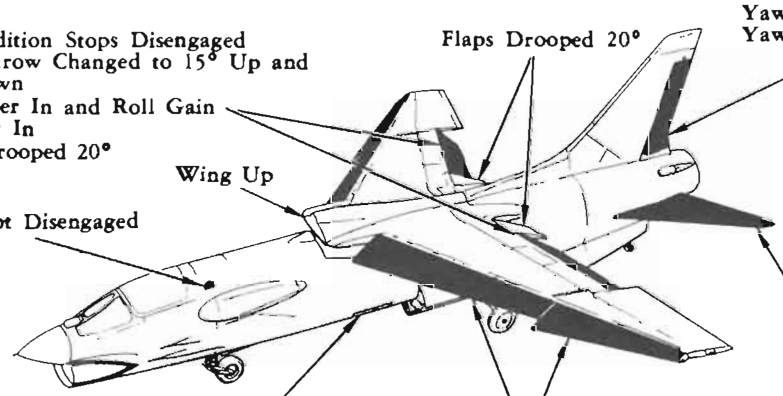


Figure 1–56

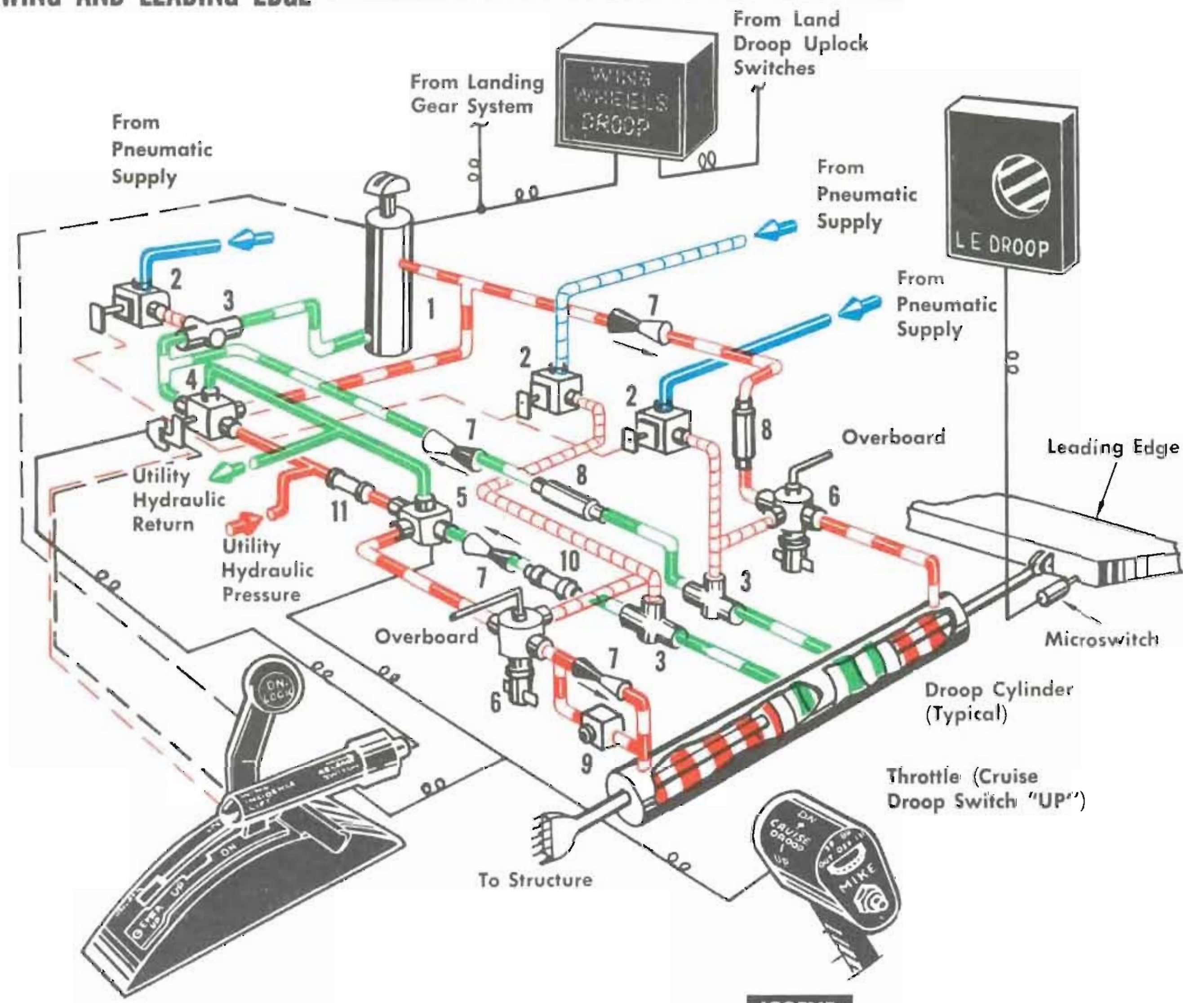
6 MECH LOCKS HOLD LAND DROOPS UP, 4 HOLD IT DOWN ⇒ 10 LOCK SWITCH + 1 DROOP SWITCH THAT CONTROL THE DROOP POSITION INDICATOR.

DON'T OPERATE DROOPS OVER 500 KTS, DON'T EXCEED 550 WITH DROOPS DOWN.

NO MECH LOCKS ON CRUISE DROOPS

UNLOCK WING BEFORE BLOWING DROOPS OR WING CAN'T BE RAISED EITHER NORMALLY OR PNEUMATICALLY.

WING AND LEADING EDGE



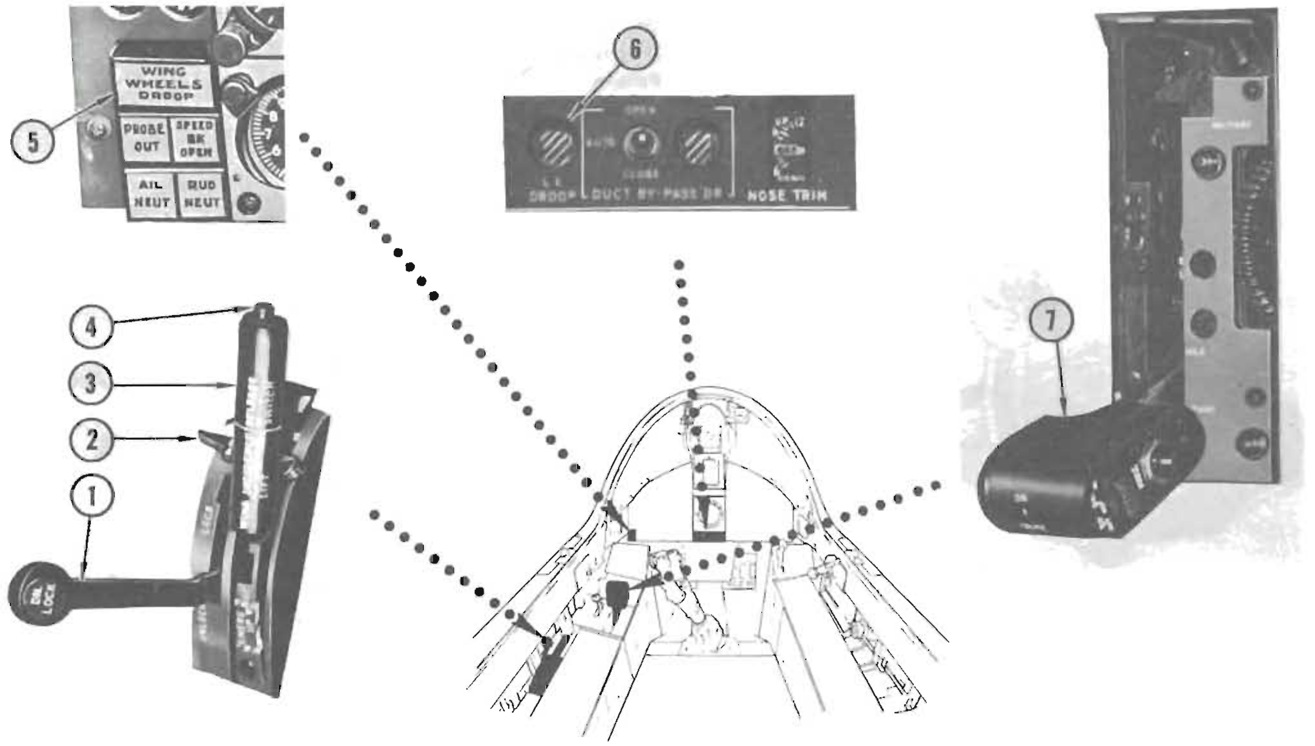
1 Wing Incidence Cylinder (wing down)
2 Emergency Air Valve
3 Shuttle Valve
4 Selector Valve (Mechanically Operated)
5 Selector Valve (Solenoid Operated)
6 Bypass Valve
7 Restrictor (Arrow denotes free flow)
8 Sequence Valve
9 Pressure Relief Valve
10 Restrictor Relief Valve
11 Check Valve

LEGEND

- Pressure
- Return
- Lower (wing) and Retract (leading edge)
- Raise (wing) and Extend (leading edge)
- Emergency Air
- Pneumatic Pressure
- Linkage (Red denotes emergency)
- Wiring

Figure 1-57

TWO-POSITION WING CONTROLS



Nomenclature	*Function*
1. Wing downlock handle	UNLOCK — unlocks wing cylinder mechanical downlock and permits movement of the wing incidence handle. LOCK — with wing incidence handle in DN, locks wing in down position and turns out wing-wheels or wing-wheels-droop warning light with gear retracted and landing droop locked up.
2. Emergency droop and wing incidence guard	Raised, permits moving wing incidence handle to EMERG UP to raise wing. Raised, permits moving wing incidence handle forward to blow landing droops down.
3. Wing incidence handle	UP and DN — positions wing and leading edge selector valves for raising or lowering of wing and simultaneous extension or retraction of leading edge (see figure 1–43 for other changes taking place automatically when wing is raised or lowered) when related controls are properly positioned.
4. Wing incidence release switch	Held depressed, unlocks wing hydraulic selector valve to permit positioning of wing incidence handle.
5. Wing-wheels-droop warning light	Flashing (WING-WHEELS-DROOP) when: Landing gear handle up — wing not down and locked Landing gear handle down — wing not up Wing down — one or more land droop pistons unlocked
6. Leading edge droop indicator	UP — indicates leading edge in clean position or in travel toward the cruise droop position. DN — indicates leading edge in cruise droop position or in travel toward the clean position, or land droop pistons mechanically locked in land droop position Barberpole indicates one or more land droop pistons unlocked, or electrical power not connected. Indication will normally occur during wing transition, but will not occur when cycling droops between cruise and clean position.
7. Cruise droop switch	DOWN — extends leading edge to cruise position with wing incidence handle in DN position. UP — retracts leading edge from cruise droop to clean position with wing incidence handle in DN position.

AX–119–1–67

Figure 1–58

WHEEL BRAKES

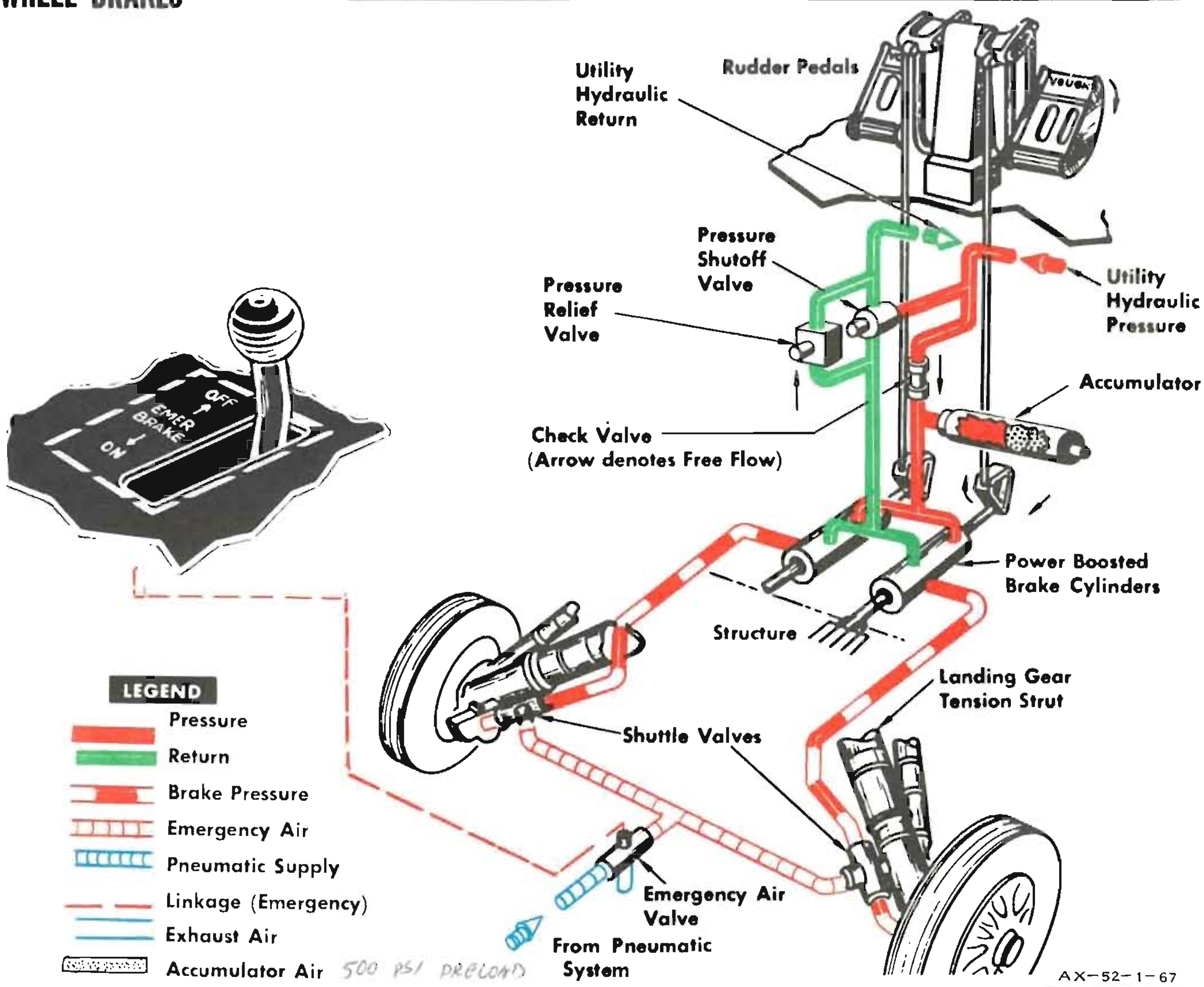


Figure 1–59

WHEEL BRAKES

DESCRIPTION

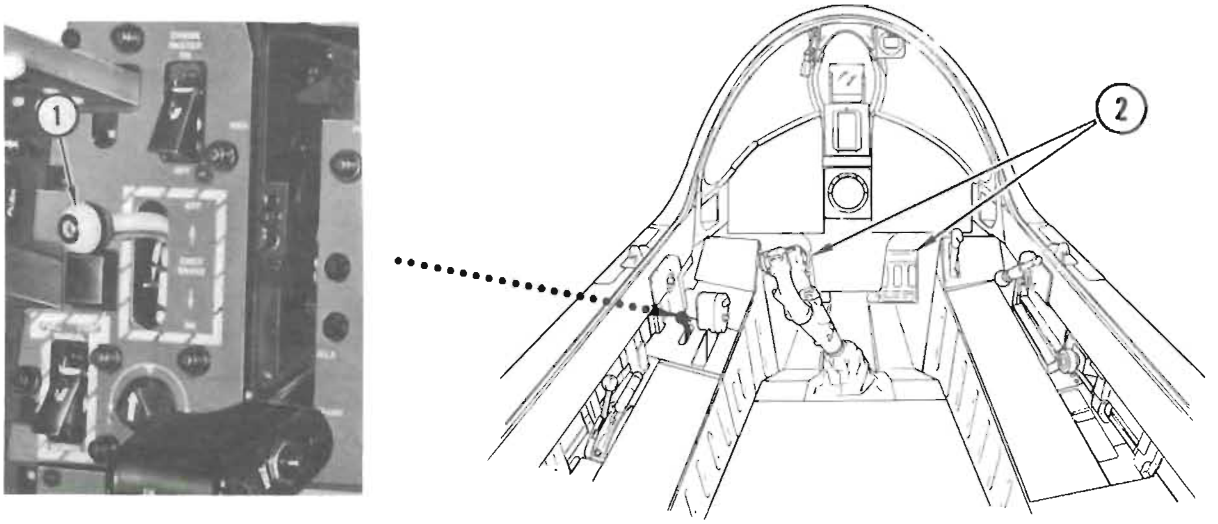
The self-adjusting wheel brakes are normally actuated by utility hydraulic system pressure. Mechanical linkage from the rudder pedal tips actuates the piston in the power-boosted brake cylinder which hydraulically operates the brake assemblies. The force applied to the rudder pedal tips governs the amount of braking action. A brake accumulator provides hydraulic pressure for approximately 6 to 12 "boosted" brake applications when utility system pressure is not available.

∴ DON'T PUMP BRAKES WHEN DEPENDING ON ACCUMULATOR. THE HAND PUMP IN STBD WHEEL WELL IS USED TO CHARGE THE ACCUMULATOR.

Manual (no boost) operation of the brakes is possible for ground handling without the engine running and with brake accumulator pressure depleted. If all brake hydraulic pressure is lost a pneumatic metering system provides emergency brake pressure. Differential braking action (applying pressure to one brake at a time) is not possible when using pneumatic pressure.

A system schematic is presented in figure 1–59. System controls are illustrated and described in figure 1–60.

WHEEL BRAKE CONTROLS

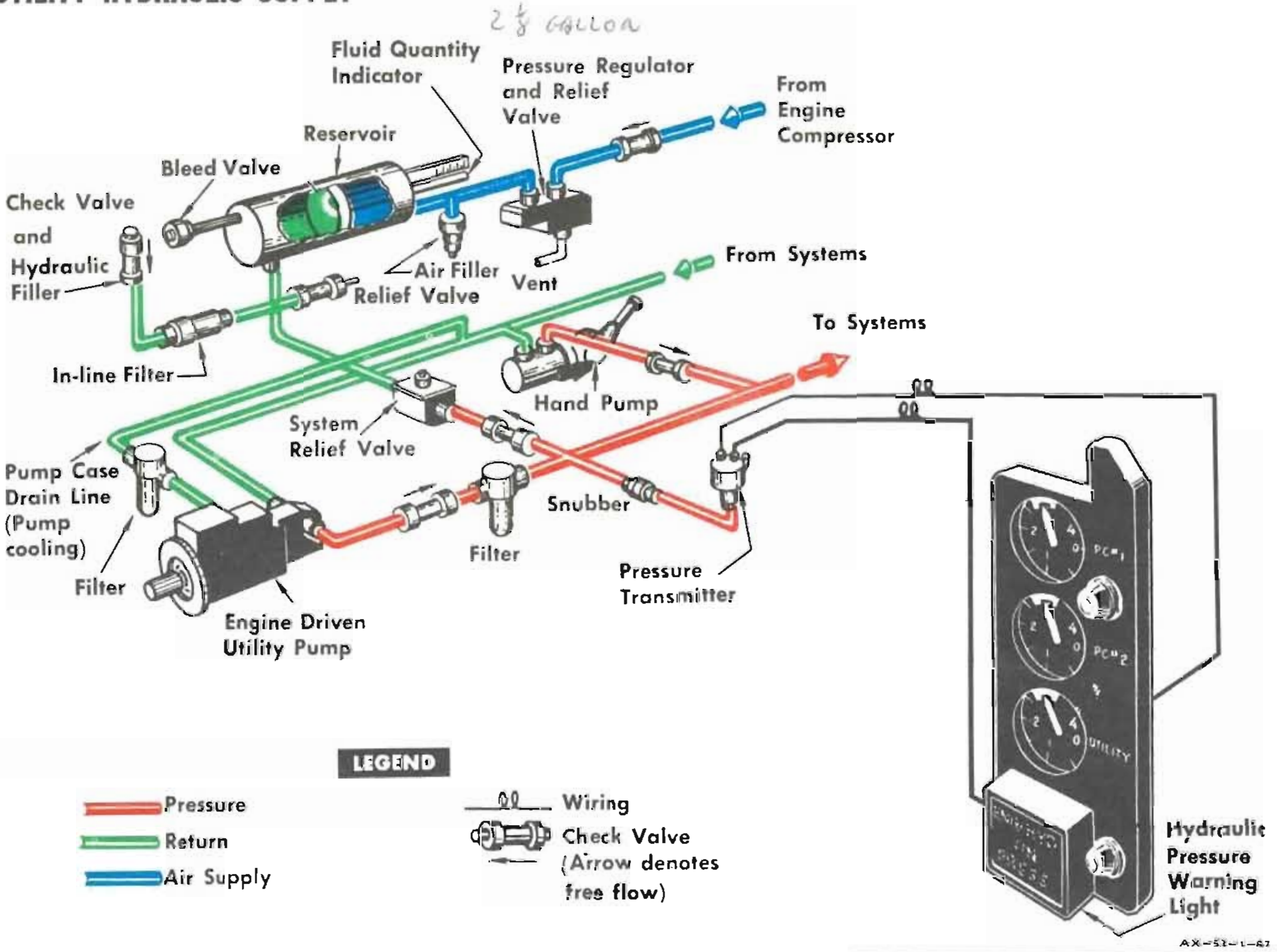


Nomenclature	Function
1. Emergency brake handle 675 PSI MAX	Pulled toward ON, directs pneumatic pressure to both wheel brake cylinders simultaneously. Pressure is proportional to handle movement. (If emergency brake system is used, hydraulic brake system must be bled before flight.) MAX MAN IS 200 P OFF — shuts off pneumatic pressure and releases brakes. 600 PSI MAX NORMAL
2. Rudder pedals	Depressing tips directs hydraulic pressure to wheel brake cylinders in proportion to amount of force applied.

AX-121-1-67

Figure 1-60

UTILITY HYDRAULIC SUPPLY



RESERVOIR HAS 35 ± 2 LB AIR PRELOAD
5 GAL IS TOTAL SYSTEM CAP

Figure 1–61

UTILITY HYDRAULIC SUPPLY

DESCRIPTION

The system, illustrated in figure 1–61, provides hydraulic power to operate the following systems:

Arresting Hook	Speed Brake
Fire Control Radar Antenna	Two-Position Wing
Inflight Refueling Probe	Wheel Brakes
Landing Gear	Wingfold
Nose Gear Steering	Wing Leading Edge

An engine-driven hydraulic pump supplies pressure (3,000 psi) for the operation of the utility hydraulic circuits. Hydraulic pressure failure will be indicated by illumination of the engine oil/hydraulic pressure warning light.

Illumination of the engine oil/hydraulic pressure warning light indicates that the utility hydraulic pressure has dropped below 700 psi, either PC hydraulic pressure has dropped below 1,500 psi, or the engine oil pressure has dropped below 34 psi. If illumination occurs, check hydraulic pressure and oil pressure indicators to verify the system affected.

Note

Utility hydraulic pressure may surge to 3,500 psi when any of the systems are actuated.

There is no utility hydraulic emergency system. Emergency operation of major utility circuits is provided by air pressure from the pneumatic system. A hydraulic pressure indicator indicates utility pressure.

Refer to part 3, this section, for servicing information.

WINGFOLD

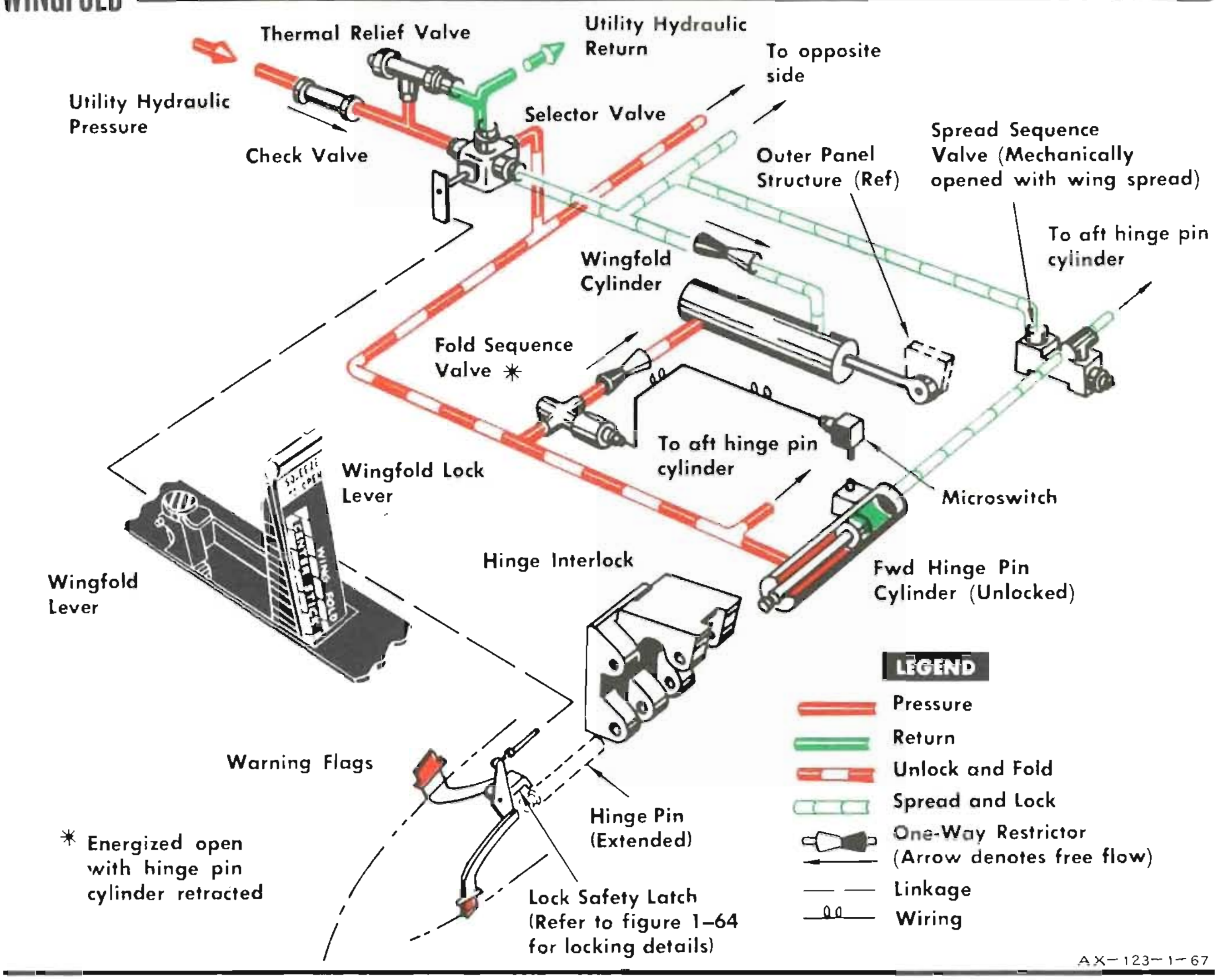


Figure 1-62

WILL NOT OPERATE WITHOUT ELEC POWER

WINGFOLD

DESCRIPTION

A wingfold schematic is presented in figure 1-62.

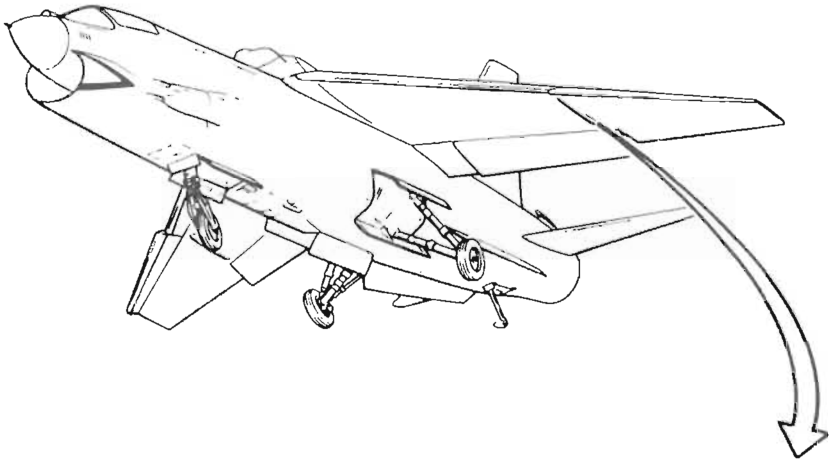
The wing outer panels are folded or spread by utility hydraulic pressure. They may be folded or spread with the wing raised or lowered. When the wings are folded, red warning flags (figure 1-63) are extended mechanically and the lock safety latches are released. At the same time a selector valve is mechanically positioned to supply hydraulic pressure to the hinge pin cylinders and the wingfold cylinders. The hinge pin cylinders retract the hinge pins. The wingfold cylinders are not actuated until the retracting hinge pins energize microswitches which open the fold sequence valves, permitting the wingfold cylinders to fold the outer panels.

During spreading the folding sequence is reversed. The wing is mechanically locked in the spread position by the wing hinge pins and the lock safety latches. The warning flags will be visible any time the lock safety latches are not engaged.

Inspection ports are provided to permit a visual check of the wing hinge pin and lock mechanism to ascertain a positive wing-lock condition. (Refer to figure 1-64.)

Wingfold controls are illustrated and described in figure 1-65.

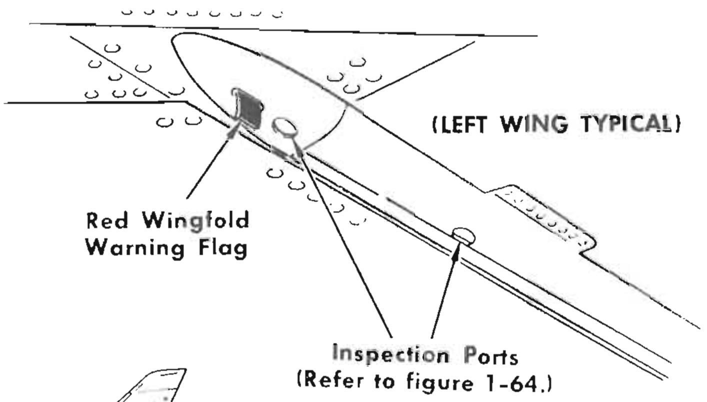
WINGFOLD WARNING FLAGS



WARNING

The wings are NOT LOCKED in the spread position if the warning flags are visible. Check both left and right.

Do not clear the airplane for flight if any warning flag is visible.



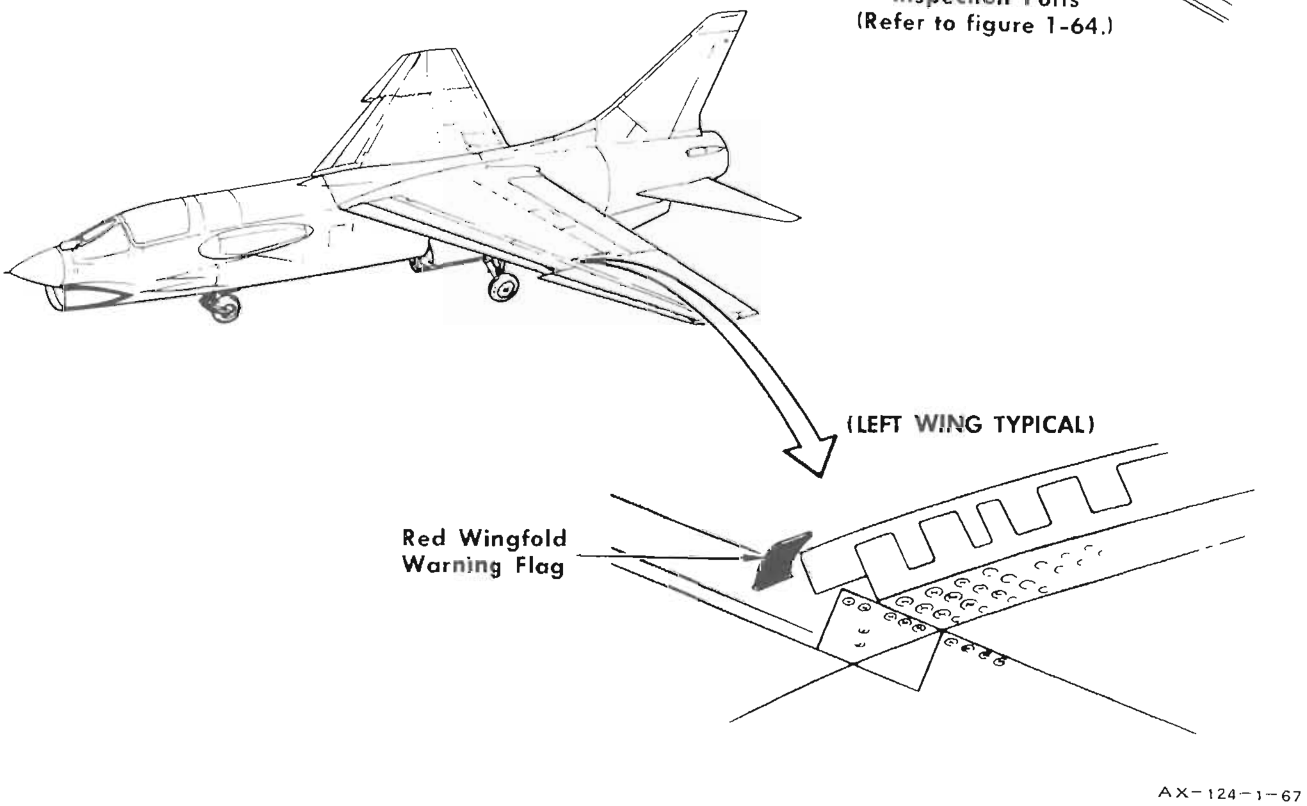
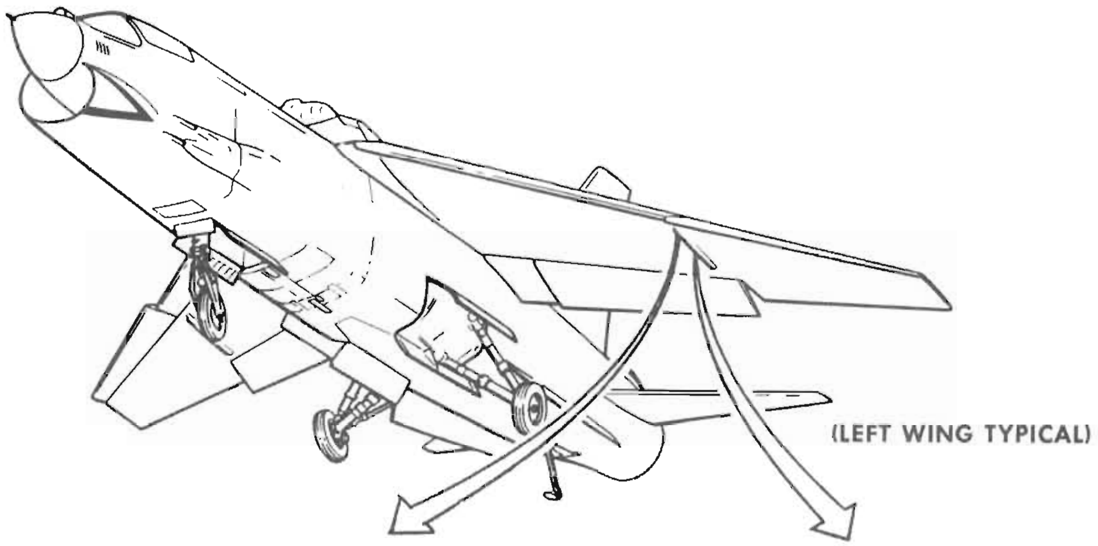
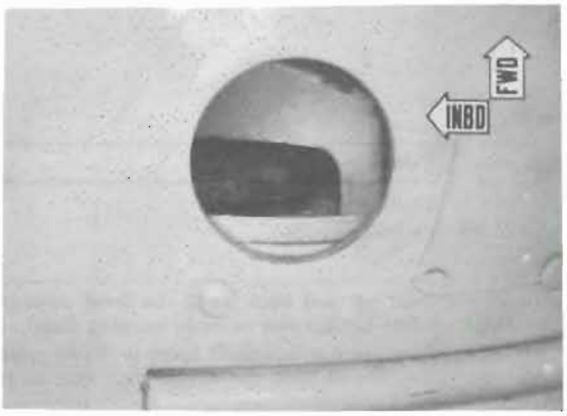


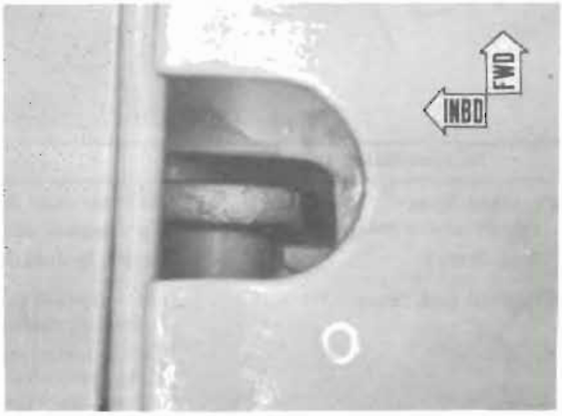
Figure 1–63

WINGFOLD SAFETY INSPECTION PORTS

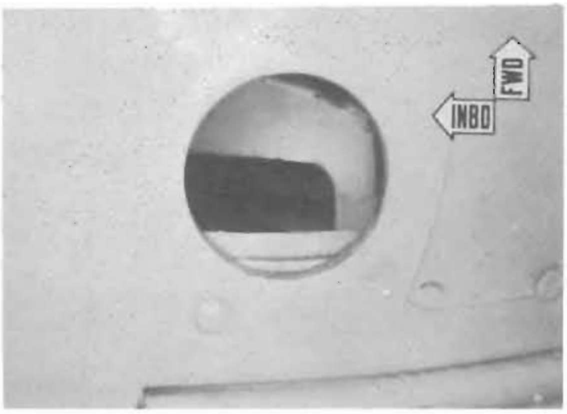




LATCHED
Forward Port



LATCHED
Aft Port



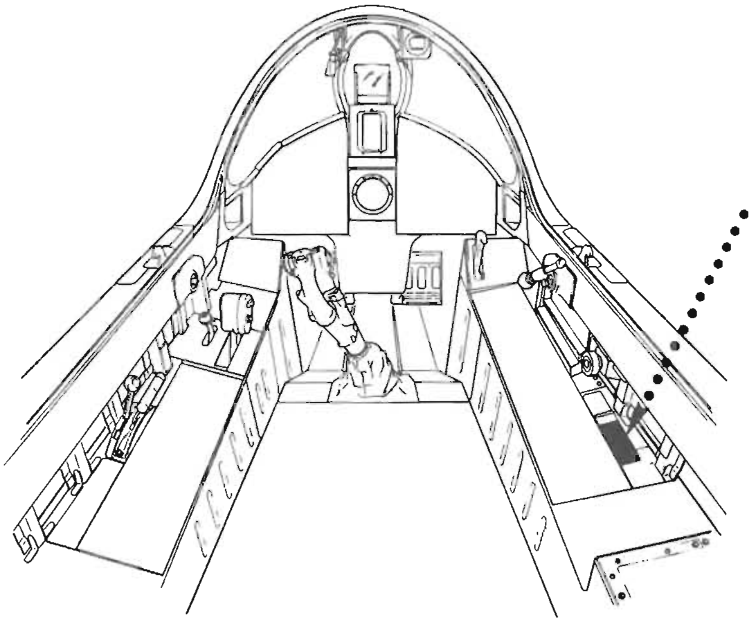
UNLATCHED
Forward Port

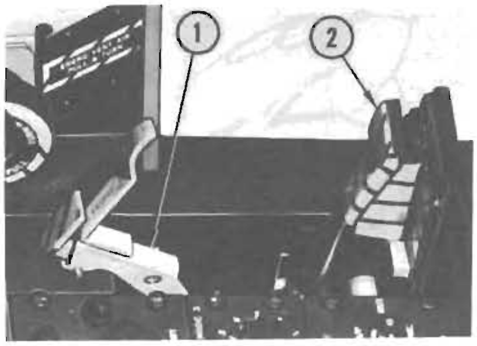
UNLATCHED
Aft Port

AX-54-1-67

Figure 1–64

WINGFOLD CONTROLS





ALSO DEPRESSURIZES DUMP CHANNEL SEALS

Nomenclature	*Function*
1. Wingfold lever (stows under wingfold lock lever)	*Ailerons must be neutral.* Do not deflect stick during folding. Up (squeeze and pull up), hydraulically folds wings. Down, hydraulically spreads wings.
2. Wingfold lock lever	Up (depress tab, squeeze latch and pull up and back until the lever engages the detent) mechanically releases lock safety latches and extends warning flags . Down (only after wings fully spread by placing wingfold lever in down position) mechanically positions lock safety latches to lock the hinge pins and to retract warning flags.
Warning flags (figure 1–63.)	Extended, indicates hinge pins are not locked. Retracted, indicates hinge pins are locked.

AX–120–1–67

Figure 1–65

MISCELLANEOUS EQUIPMENT

CATAPULT PROVISIONS

A catapult pin on the underside of the fuselage front section transmits the thrust of the catapult to the aircraft structure. The holdback pin on the underside of the fuselage aft section restrains the aircraft during the buildup of thrust, then releases it when a breakable link snaps. The throttle catapult handle on the left-hand console permits the throttle lever to be held in full forward position during catapult acceleration without locking the throttle lever.

REAR VISION MIRRORS

Three adjustable rear vision mirrors are mounted inboard on the canopy frame.

MAP CASE

A fixed map case is mounted on the inboard side of the left-hand console. A removable map case is mounted on the inboard side of the right-hand console.

GUN CAMERA PROVISIONS

Inflight recording of gunfiring performance is provided by a gunstrike camera installed in the nose section to photograph action along the gun boresight line. The camera is started automatically when the trigger is depressed to the first detent for gun firing. Film capacity of the camera permits approximately 44 seconds of recording. The camera has 3 seconds of overrun.

PART 3 — AIRCRAFT SERVICING AND HANDLING

SERVICING

Refer to NAVAIR 01-45HHD-2-1, General Information and Servicing, for permissible panel removal and detailed servicing instructions. Figure 1-66 illustrates aircraft servicing points.

FUELING

Authorized fuels are listed under FUEL GRADE in part 4 of this section.

If the fueling facility is not equipped with a flowmeter, only procedural checkpoints applicable to aircraft fuel quantity gages will be used. The aircraft main and transfer indicating systems must be operating properly to obtain valid checks.

A pumping pressure of 40 to 60 psi should be used with a flow rate not to exceed 300 gpm.

No radio or radar activity is permissible within a radius of 75 feet during refueling. Check that the aircraft and fuel truck are properly grounded. Discharge any static electricity from the fuel nozzle before attaching it to the fueling manifold.

Failure of the vent system during fueling can cause cell rupture and structural damage.

To prevent the possibility of fuel cell rupture and structural damage, fuel venting must be monitored during the fueling process. Wing cell venting is monitored by a man utilizing a gage and hose assembly connected to the wing. Fuselage cell venting is monitored by a second man stationed at the fuselage vent. Connect the hose to the pressure sensing line quick-disconnect fitting located in the right-hand wing access panel and hang the gage in the left gear well. Station the man at the fuselage vent (located in the left-hand ventral fin) to check vent airflow during fueling. Check venting by holding the hand near the vent and feeling airflow. Do not block the vent by holding cupped hand over it. At the start of the cycle, after completing the primary and secondary checks, there will be a strong continuous flow of air from the fuselage vent with a barely detectable indication on the wing pressure gage. As the airflow from the fuselage vent decreases, wing vent pressure will rise to 1¼ to 1½ psi if the system is operating properly. Should the gage reading exceed 1½ psi, stop fueling immediately.

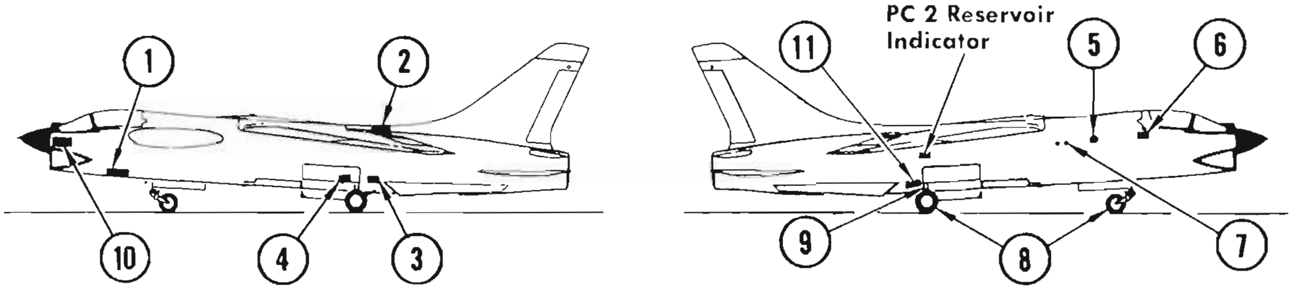
If the aircraft is fueled with the fuselage aft section removed, check fuselage cells vent airflow at vent line disconnect on upper left-hand side of disconnect bulkhead. If engine has been run with aft section removed, the CV15-206325-1 drain hose must be removed from the vent line before fueling. If aircraft is fueled with the wings folded, check wing vent airflow at fuel dump line (donut) seal on right-hand wingfold rib.

All fueling personnel should be properly instructed before attempting refueling operation. The complete fueling procedure cannot be accomplished while the engine is in operation and is supplying electrical power since primary and secondary checks require external ac power with the master generator switch in TEST. Pressure fueling on the deck with the engine in operation and internal power being supplied should be limited to one such cycle between normal ground fueling operations. During every pressure fueling on the deck, with or without the engine operating, the vents must be checked. During every pressure fueling without the engine operating, primary and secondary checks must be performed in accordance with the fueling procedure. To permit complete fueling with the engine operating, the inflight refueling probe must be extended and the inflight refueling probe switch left in the OUT position; or external power must be applied with the IFR probe in and with the probe switch in the OFF position. There must be enough wind across the deck to dissipate fuel fumes from the wing and fuselage vent outlets.

Fueling Procedure — Static

1. Check that fueling nozzle, aircraft and fueling unit are grounded.
2. Place engine master, fuel dump, all radio/radar, inflight refueling probe, emergency generator and master generator switches in OFF.
3. Connect external electrical power.
4. Place master generator switch in TEST.
5. Open manual shutoff valve in wing fuel transfer line. Rotate fuel selector switch to CHECK SECONDARY. Check flowmeter and aircraft main transfer fuel quantity gages.
6. Attach fueling nozzle to fueling manifold. If nozzle has manual lever, lever must be locked fully open. Start fuel flowing into aircraft.

SERVICING POINTS



1. Electrical power
2. Engine oil
3. Engine starter
4. Fuel system (central-point fueling)
5. Utility hydraulic system
6. Oxygen system
7. Pneumatic system
8. Tires
9. Power control hydraulic systems (PC 2 shown, PC 1 in same location in LH wheel well)
10. Nitrogen system
11. Smoke abatement system

AX-128-10-67

Figure 1-66

7. Fuel flow must stop before fuel admitted to aircraft exceeds 45 gallons on flowmeter, or 300 pounds total increase on gages. If fuel flow does not stop, disconnect nozzle immediately and notify proper maintenance personnel.

Note

This step is performed to prime the shutoff system.

8. Check flowmeter and aircraft main and transfer fuel quantity gages. Rotate fuel selector switch to CHECK PRIMARY. Fuel flow must stop before additional 30 gallons on flowmeter or 200 pounds on gages is admitted to aircraft. If fuel does not stop, disconnect nozzle immediately and notify proper maintenance personnel. Monitor flowmeter and gages for no less than 30 seconds. If flow rate after shutoff exceeds 3 gallons per minute on flowmeter or 20 pounds per minute on gages, disconnect nozzle and notify proper maintenance personnel.
9. Rotate fuel selector switch to CHECK SECONDARY and with switch in this position, repeat check of step 8.
10. If steps 8 and 9 are acceptable, rotate fuel selector switch to fuel load desired. While monitoring fuselage and wing vents, complete desired fueling.
11. Remove nozzle, place master generator switch in OFF and remove external electrical power.
12. Rotate fuel selector switch to the OFF position.

Fueling Procedure (Hot Refueling) External Power

1. Check that fueling nozzle, aircraft and fueling unit are grounded.
2. With pilot in the aircraft and engine running, turn master generator, all radio/radar, fuel dump, inflight refueling probe, and electrical switches off.
3. Connect electrical power.
4. Place master generator switch in TEST. Primary/secondary fueling checks can be accomplished while the engine is in operation with external power supplied and master generator switch in the test position. If primary/secondary checks are not satisfactory, discontinue hot refueling and notify proper maintenance personnel.
5. Refueling procedure remains the same as steps 5 through 12 under Fueling Procedure — Static. No restriction is placed on this refueling procedure providing satisfactory primary/secondary checks are completed.

Fueling Procedure (Hot Refueling) Aircraft Power

1. Check that fueling nozzle, aircraft and fueling unit are grounded.
2. With pilot in the aircraft and engine running, turn radio/radar, fuel dump, and electrical switches to off.
3. Extend inflight refueling probe and leave probe switch in out position and generator switch ON.
4. Attach fueling nozzle to fueling manifold. Start fuel flowing into aircraft. Fuel vents must be checked during this and all ground refueling operations.

CAUTION

Primary/secondary fueling checks require external ac power and cannot be accomplished while engine is in operation and supplying electrical power. Refueling to full load should be limited to one such cycle between normal ground fueling operations.

5. Complete desired fueling. For a full load fueling will automatically cease at completion.

ENGINE OIL SYSTEM

Service the engine oil system with gas turbine lubricating oil, MIL-L-23699(Wep). Do not overfill. Check oil level within 5 minutes after engine shutdown. If this is not practical, operate engine for a minimum of 30 seconds at 75% rpm before checking oil level. If checked at any other time, an erroneous reading will be obtained.

When changing oil, the required oil quantity is approximately 5 gallons.

OXYGEN SYSTEM

Service oxygen system with MIL-O-21749 (grade A, type I; or type II) liquid oxygen only. Liquid oxygen boils at −183°C (−297.4°F). Keep oxygen away from oil, grease, or other combustible materials. Ensure adequate ventilation.

UTILITY HYDRAULIC SYSTEM

Service the system with red hydraulic fluid, MIL-H-5606A and dry air or nitrogen. Use only hydraulic fluid manufactured by one of the companies listed below with the correct identification as shown.

Manufacturer	*Identification*	*Qualification Reference*
American Oil and Supply Company	PQ 1296	WCLT R59-47
Bray Oil Company	Brayco 756 Code P-190	WCRT R55-11
	Brayco 756A	ASRCE 61-88
	Brayco 756B	ASRCE 61-89
California Texas Oil Company	Caltex RPM No. 2	TSEAM 047-7
	PED 2585	ASRCE 61-92
	TL-3969 Code 662	WCLT R59-17
Humble Oil and Refining Company	Univis J-43 Code WS2997	WCRT R55-140
Golden Bear Oil Company	Code 566	WCRT R55-42
Pennsylvania Refining Company	Code 3587	WCLT R58-41
	Code 4751	ASRCE 61-65
Royal Lubricants Company	Rayco 756	WCRT R55-11
	Rayco 756A	ASRCE 61-90
	Rayco 756B	ASRCE 61-91
Shell Oil Company	Aeroshell No. 4	WCLT R58-42
Socony-Mobil Oil Company	Mobil RL-102A	TSEAL 4-044-61
Standard Oil Company of California	RPM No. 2	
	312798B-R	TSEAM 047-7
	PED 2585	ASRCE 61-92
Texaco Incorporated	TL-3969 Code 662	WCLT R59-17

POWER CONTROL HYDRAULIC SYSTEMS

Service the systems with red hydraulic fluid, MIL-H-5606A and dry air or nitrogen. Use only the hydraulic fluids listed under UTILITY HYDRAULIC SYSTEM.

PNEUMATIC SYSTEM

Service with dry air or nitrogen to the pressures listed on the appropriate system decal.

TIRES

Service with dry air or nitrogen as follows:

Main gear — With aircraft gross weight less than 30,000 pounds:
300 psi (land or FMLP)
400 psi (carrier)
— With aircraft gross weight 30,000 pounds or greater:
365 psi (land)
400 psi (carrier or FMLP)

Nose gear — With aircraft gross weight less than 30,000 pounds:
165 psi (land)
265 psi (carrier or FMLP)
— With aircraft gross weight 30,000 pounds or greater:
265 psi (land, carrier, or FMLP)

*Set to low pressure ratio.

HANDLING

EXTERNAL ELECTRICAL POWER REQUIREMENTS

115-volt, 400-cycle, 3 phase ac

ENGINE STARTER REQUIREMENTS

Engine starting requires one of the following starting units:

GTC-85 or GTE-85 gas turbine compressor
MD-1A jet starting trailer*
USAF Model MA-1TA gas turbine compressor
USAF Model MA-2 gas turbine compressor*
Boeing Model 502 gas turbine compressor

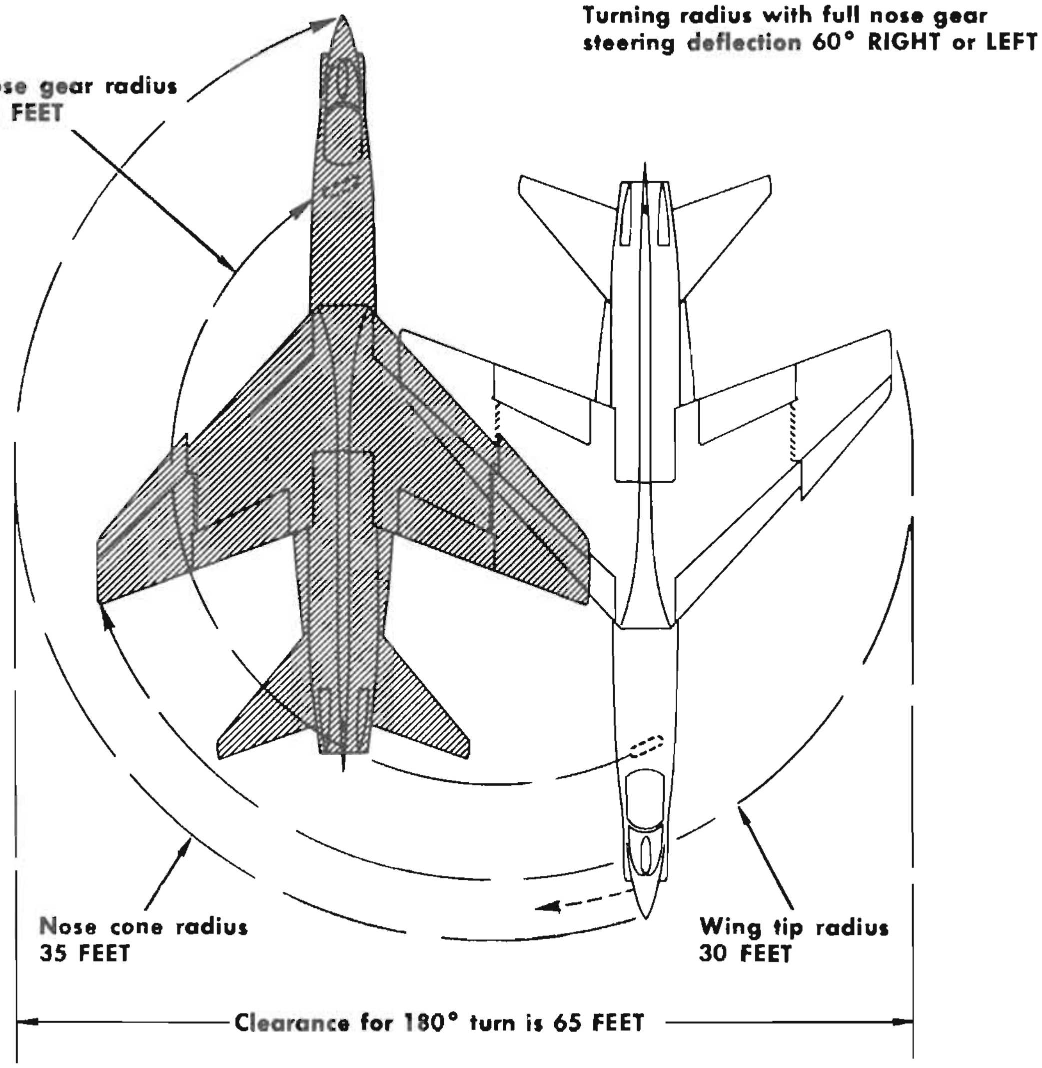
MINIMUM TURNING RADIUS

Minimum turning radius and approximate ground clearances while taxiing are illustrated in figure 1–67

DANGER AREAS

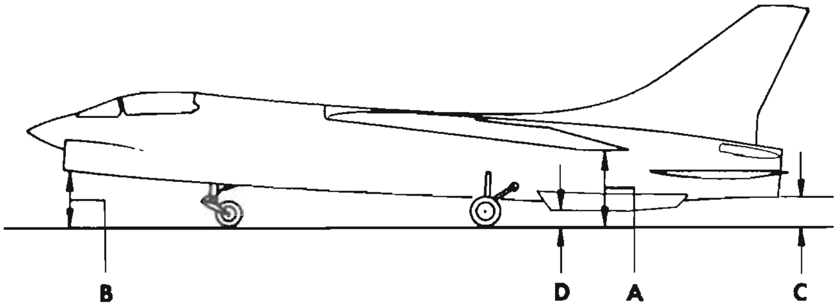
Exhaust, inlet, turbine, and noise danger areas are illustrated in figure 1–68.

MINIMUM TURNING RADIUS
(TAXIING)



APPROXIMATE GROUND CLEARANCES*

A — Wing tip (wing down)	5 FEET 6 INCHES
(wing up)	3 FEET 6 INCHES
B — Duct lip	3 FEET 9 INCHES
C — Tail cone	2 FEET
D — Ventral fin	1 FOOT 4 INCHES



* Clearances vary slightly with aircraft loading and strut and tire servicing.

AX-55-1-67

Figure 1-67

DANGER AREAS – ENGINE GROUND OPERATION

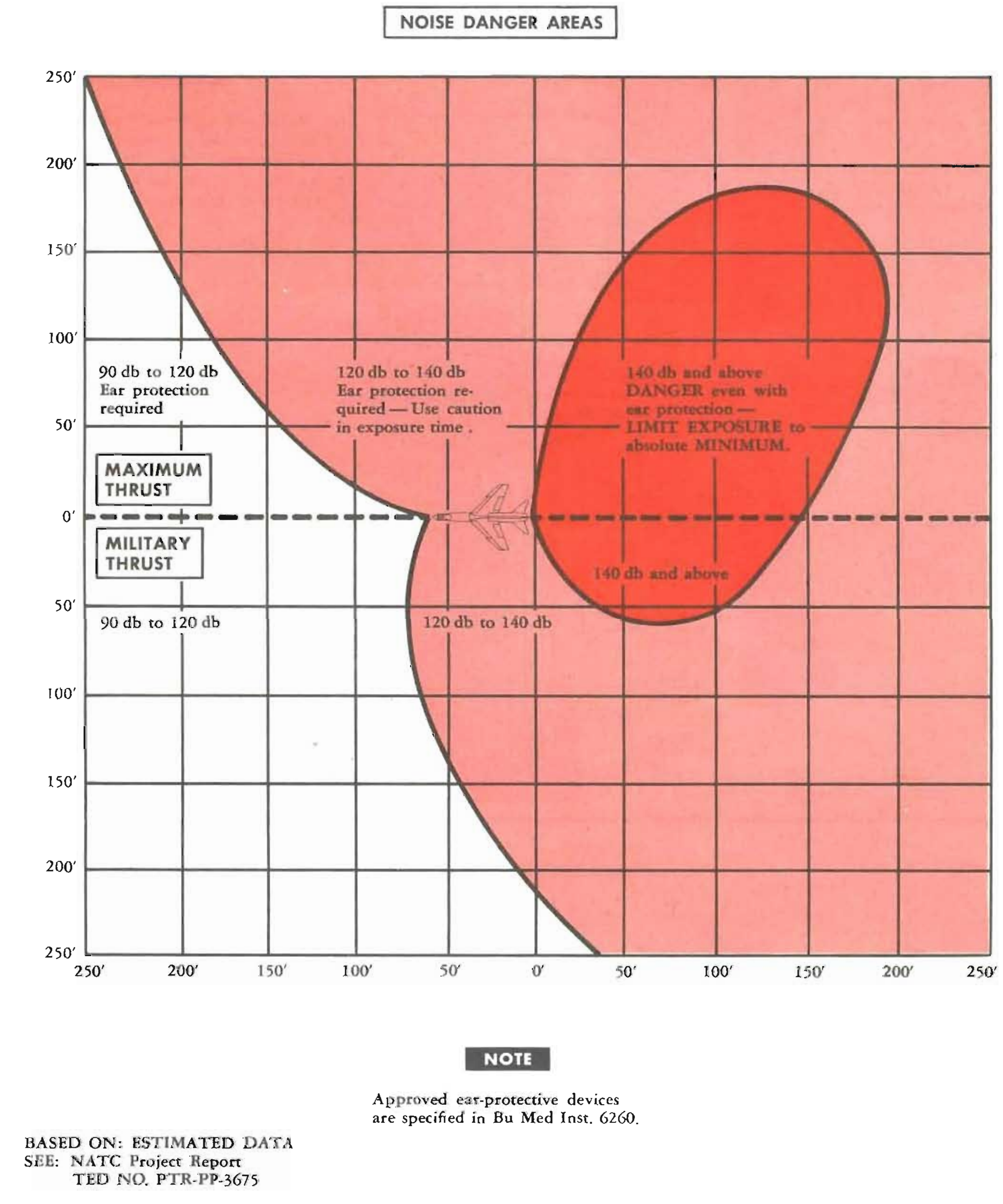


Figure 1–68 (Sheet 1)

DANGER AREAS – ENGINE GROUND OPERATION

EXHAUST, INLET, AND TURBINE DANGER AREAS

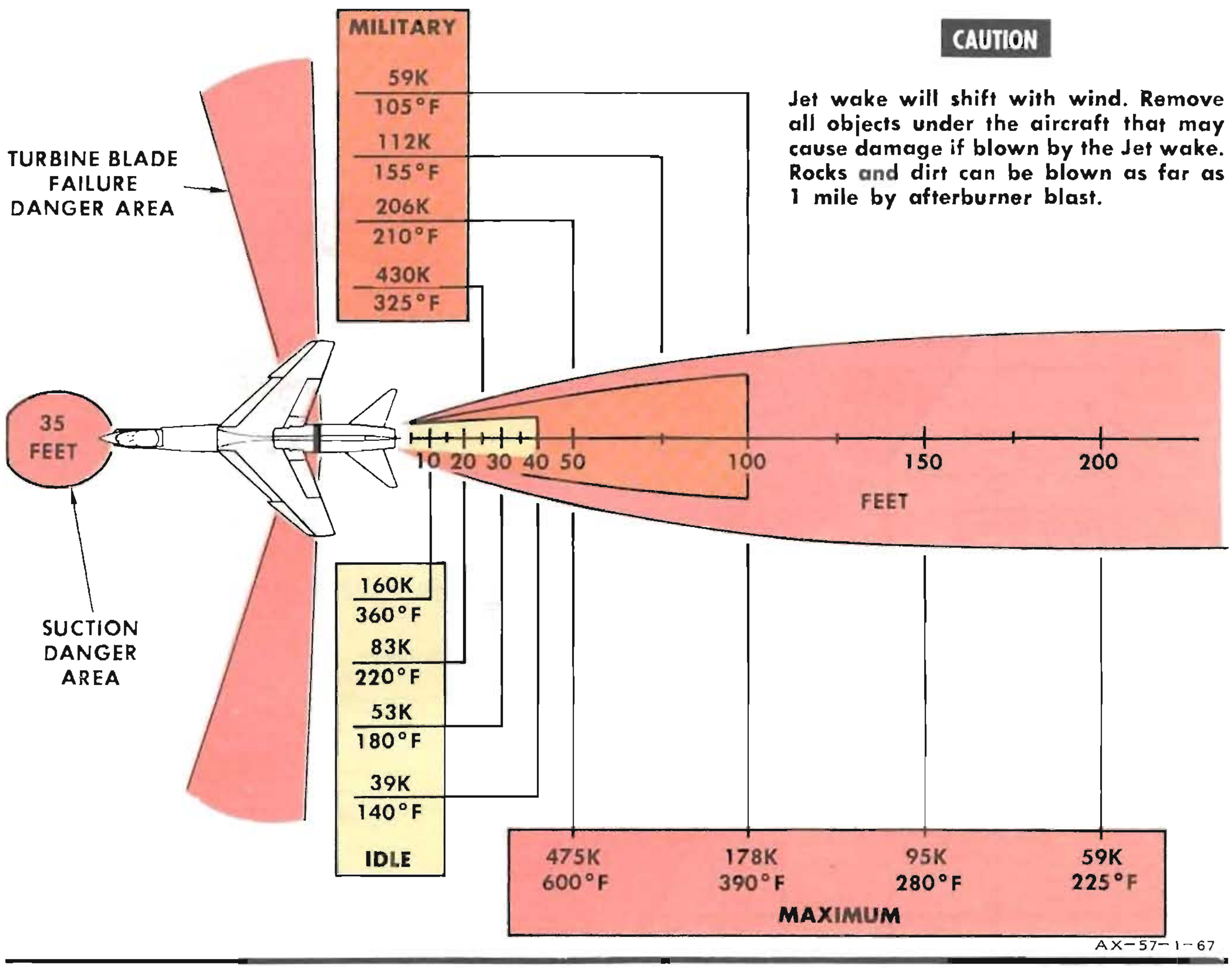


Figure 1–68 (Sheet 2)

PART 4—AIRCRAFT OPERATING LIMITATIONS

Note

Refer to the F-8 Tactical Manual NAVAIR 01-45HHA-1T (Confidential) for limitations dealing with the carriage of wing stores.

INTRODUCTION

This section specifies limitations that must be observed during the normal operation of the airplane. They are derived from actual flight tests and demonstrations. Refer to Supplemental NATOPS Flight Manual for additional information.

Limitations which are merely associated with a certain technique or specialized phase of operation are discussed appropriately in sections III, IV, and V and in other parts of this section.

INSTRUMENT MARKINGS

The operating limits indicated by flight and engine instruments are illustrated in figure 1–69. These limits are not all repeated in the text. Should engine overtemperature or overspeed occur in excess of limitations listed, the engine should be shut down as soon as possible and the required maintenance inspection be performed before further operation.

AIRSPEED LIMITATIONS

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

With arresting hook, landing gear, and speed brake retracted, wing leading edge droop retracted and wing down .... Refer to the Supplemental NATOPS Flight Manual

With leading edge cruise droop
- Extending or retracting .... 500 KIAS
- Extended .... 550 KIAS

With wing down and leading edge landing droop extended pneumatically .... 300 KIAS

With leading edge droop unlocked (barberpole indication) .... 300 KIAS

For extension of emergency power package .... 690 KIAS or 1.50 IMN, whichever is less

Note

Refer to EMERGENCY POWER PACKAGE in section IV for handling characteristics when extending the package above 500 KIAS.

With wing up, landing gear extended .... 220 KIAS

Note

Do not exceed 220 KIAS until a positive indication of manual wing incidence locking is observed.

With arresting hook extended .... 350 KIAS

With speed brake extended .... 1.50 IMN

For operation of inflight refueling probe .... 350 KIAS or 0.92 IMN, whichever is less

POWER CONTROL HYDRAULIC SYSTEM

With one power control hydraulic system inoperative, operation is restricted to the following limits:

Maximum airspeed — 600 KIAS or 0.92 IMN, whichever is less

Maximum acceleration — (PC 1 out) 4.0 g
— (PC 2 out) same as yaw stab out (refer to Supplemental NATOPS Flight Manual.)

Bank angle is not to exceed 90°.

No abrupt flight control movements.

No slipping or skidding.

When operating on emergency power control hydraulic pressure with no electrical load on the generator (as in a dead-engine approach and landing), the minimum airspeed for adequate flight control response is 140 KIAS. With the emergency generator switch in LAND under the same circumstances, minimum airspeed is 145 KIAS.

INSTRUMENT MARKINGS

BASED ON JP-5 FUEL

ACCELERATION

Refer to figures 1-1 through 1-3, Supplemental NATOPS Flight Manual.

OIL PRESSURE

37 to 53 psi - Normal range

45 ± 8

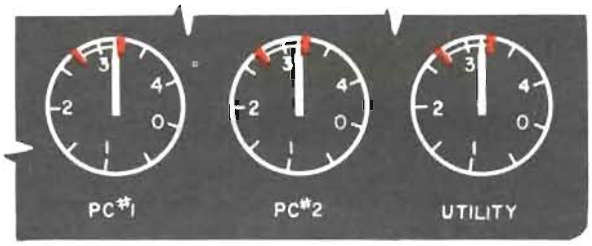
ENGINE SPEED

106.3% - Absolute maximum rpm
68 to 70% - Sea level idle rpm

HAVE 2 90% @ 15 OR+

TRANSFER FUEL QUANTITY

Transfer pump should be turned off at approximately 2,000 lbs. fuel remaining, providing the transfer fuel pump caution light is illuminated steadily.



HYDRAULIC PRESSURE

2,800 to 3,200 psi – Normal range

280-40 NORMAL IDLE
320-40 NORMAL START

START LIMIT

EXHAUST TEMPERATURE

	J57-P-20	J57-P-20A
Above ↑ 30,000 ft.	Maximum (afterburner) - 665°C 15 MIN Military - 655°C	Maximum (afterburner) - 665°C 15 MIN Military - 665°C 30 MIN ACCEL 675
30,000 ft. ↓ Below	Maximum (afterburner) - 635°C Military - 625°C	Maximum (afterburner) - 635°C 15 MIN Military - 635°C 30 MIN ACCEL 675°

AX-58-1-67

Figure 1-69

TRIM AND STABILIZATION SYSTEM

In the clean condition, with only the roll stabilization system inoperative, restrictions are not changed from basic aircraft restrictions. With yaw stabilization and rudder-aileron interconnect systems inoperative, the following restrictions apply:

Maximum airspeed — 675 KIAS or 1.50 IMN, whichever is less

Aileron deflection — Limited to clean condition stops and 180° roll. No abrupt lateral stick movement.

Maximum permissible load factors — Refer to the Supplemental NATOPS Flight Manual.

With any of the stabilization systems inoperative, the maximum permissible speed in the landing configuration is 180 KIAS.

MANEUVERS

Refer to the Supplemental NATOPS Flight Manual.

ACCELERATION LIMITATIONS

Refer to the Supplemental NATOPS Flight Manual.

FUEL SYSTEM ACCELERATION LIMITATIONS

The fuel system is not designed to operate at zero g for extended periods. However, the system will function properly during rapid transient periods between positive and negative accelerations.

To ensure adequate fuel flow to the engine at all times, flight in the range from +0.3 g to –0.3 g is restricted to rapid transient conditions only.

Avoid prolonged operation in the g ranges listed in figure 1–70.

FUEL AVAILABILITY

The following minimum fuel quantities must be maintained in the main fuel system to prevent flameout under the operating conditions stated:

Level flight	Military thrust	150 pounds
	Maximum thrust	300 pounds
Best glide ratio	Idle thrust	150 pounds
Normal landing attitudes	Military thrust	50 pounds
	Maximum thrust	300 pounds
90° climb	Military thrust	1,000 pounds
	Maximum thrust	2,000 pounds
70° climb	Military thrust	800 pounds
	Maximum thrust	1,500 pounds
Nose down attitudes	Military thrust	150 pounds
	Maximum thrust	1,000 pounds

Note

Since there is no instrument that indicates the very high afterburner fuel flow rate, monitor main system fuel quantity carefully when using afterburner following depletion of transfer fuel.

During operation in the allowable negative g range, fuel flow is not sufficient to maintain military thrust

FUEL SYSTEM ACCELERATION LIMITATIONS

Note

With 1,500 pounds or more of main fuel, adequate fuel flow is available for sustained operation at military thrust or less at any altitude and any Mach number while in the g range of +0.3 and above or in the range of –0.3g and below.

Power Setting	*Main Fuel Quantity*	*Altitude*	
		Below 45,000 ft	*Above 45,000 ft*
MILITARY	More than 1,500 pounds	+0.3g to –0.3g*	+0.3g to –0.3g*
MILITARY	Less than 1,500 pounds	+0.3g and below*	+0.3g and below*
MAXIMUM	More than 2,200 pounds	+0.5g to –1.0g*	+0.3g to –1.0g*
MAXIMUM	Less than 2,200 pounds	+0.5g and below*	+0.3g and below*

*Avoid prolonged operation in these g ranges.

AX–59–1–67

Figure 1–70

ENGINE OPERATING LIMITATIONS

NOTE

Limitations apply to both J57-P-20 and J57-P-20A engines unless otherwise designated.

Operating Condition	*Max Rpm (%)*	*Max Exhaust Gas Temp (C°)*		*Time Limits*	*Oil Pressure Normal Range (psi)*
		Below 30,000	*Above 30,000*		
Starting	——	610	610	Momentary	——
Idle	——	340	——	Continuous	35 minimum
Acceleration*	——	675	675	4 minutes	45 (±8)
Military Thrust (J57-P-20)	106.3	625	655	30 minutes	45 (±8)
Military Thrust (J57-P-20A)	106.3	635	665	30 minutes	45 (±8)
Maximum Thrust (Afterburner)	106.3	635	665	5 minutes takeoff and ground operation 15 minutes in flight	45 (±8)
Normal Rated Thrust	106.3	560	580	Continuous	45 (±8)
Zoom Climb above 50,000 feet	——	——	665	——	30 minimum (momentary)

*Following engine acceleration, a thrust and temperature overshoot may be experienced. During this overshoot exhaust temperature must remain within engine acceleration limits.

AX-60-1-67

Figure 1-71

with less than 1,500 pounds of fuel in the main system or to maintain maximum thrust with less than 2,200 pounds of fuel in the main system.

In shallow dives (less than 10°), 1,400 pounds of wing tank transfer fuel will not be available because the fuel outlets are at the aft end of the tank.

In dives exceeding 10°, the transfer booster pump shuts down and neither wing tank nor transfer fuselage fuel is available during the dive.

No intentional slips or skids are permitted below 35,000 feet during afterburner operation with less than 2,000 pounds of main fuel.

ENGINE LIMITATIONS

Note

Refer to the Supplemental NATOPS Flight Manual for classified limitations.

ENGINE OPERATION

For engine operating limitations, refer to figure 1-71.

If engine pump warning light is on, use afterburner only in an emergency.

To maintain adequate cooling for the engine compartment, observe the limitations presented under COOLING FLOW LIMITATIONS.

OVERTIME ENGINE OPERATION

Engines should not normally be operated beyond the specified time limitations for maximum thrust and military thrust; however, if this becomes necessary for a particular mission, the engine should be operated continuously for the required period of use. Overtime operation can be sustained without immediate adverse results but *the total operating life of the engine will be shortened.* Operating continuously for one slightly longer period instead of using two or more shorter periods will avoid an additional heat cycling of the engine, which is detrimental to engine life.

COOLING FLOW LIMITATIONS FOR TARGET TOWING

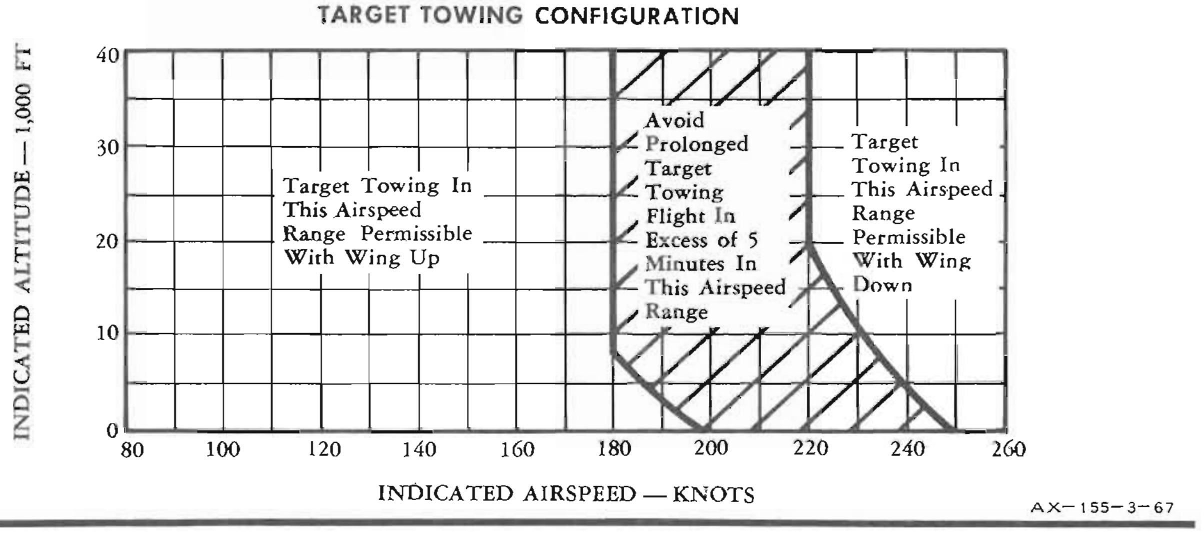


Figure 1–72

FUEL GRADE

Note

F-34, F-35, F-40 and F-45 fuels shall not be defueled into JP-5 (F-44) fuel storage on aircraft carriers because of their low flash points.

Approved fuels are:

Ashore
- Primary grade
  - JP-5 (F-44)
- Acceptable alternates
  - JP-4 (F-40)
  - F-34 (Commercial grade Jet A-1)
- Emergency fuels†
  - AvGas grades 100/130 (F-18) and 115/145 (F-22)
  - F-35*
  - F-42*
  - F-45*

Afloat
- Primary grade
  - JP-5 (F-44)
- Emergency fuels†
  - AvGas grades 100/130 (F-18) and 115/145 (F-22)

COOLING FLOW LIMITATIONS

Ram air from the engine inlet duct is used for cooling many compartments and components, the most important being the engine compartment, air conditioning compartment, electronic compartment and radar unit. During most flight conditions, the ram air pressure in the inlet duct is greater than ambient pressure, and air will flow from the inlet duct into the various compartments. On the ground and during flight at low airspeed with a high engine power setting, the cooling air flow reverses. Under these conditions, engine suction creates a low-pressure area in the inlet duct causing air to flow from the compartments into the inlet duct.

There are certain flight conditions for which the engine suction exactly matches the ram air pressure in the duct, and there will be no cooling flow. The flight conditions for no cooling depend on airspeed, altitude and engine power setting, but generally occur only during transient conditions, such as climb or landing approach. However, there are three steady-state flight conditions that can cause reduced or no cooling from the inlet duct and are therefore restricted. These are:

- Flight in the landing condition above 175 KIAS, limited to 5 minutes.
- Flight in the clean condition below 200 KIAS, limited to 5 minutes.
- Target towing, limited as shown in figure 1–72.

---

*May not be used for high altitude maximum range missions because of relatively high fuel freeze temperature.

†Use of emergency fuel imposes restrictions which are required to prevent excessive fuel cell pressures or to prevent flameout due to booster pump cavitation. Emergency fuel restrictions, none of which apply to the primary or acceptable alternate fuels, are as follows:

- No afterburner operation above 6,000 feet or above 300 KIAS.
- Maximum rate-of-climb, 1,500 feet per minute.
- If less than 2,200 pounds of emergency fuel remains in the transfer system prior to reaching 10,000 feet, do not exceed this altitude. This restriction does not apply when this fuel loading is reached at altitudes above 10,000 feet.

CENTER-OF-GRAVITY LIMITATIONS

The center of gravity of the airplane will remain within acceptable limits if fuel sequencing is normal. Refer to section V for effects of the center of gravity exceeding aft limits as a result of fuel transfer system failures. Minimum takeoff distance and airspeed is increased when the center of gravity is forward of 20% MAC (refer to TAKEOFF PLANNING INFORMATION, section XI). Takeoff center-of-gravity locations forward of 20% will occur with most external store configurations. Refer to the Handbook of Weight and Balance Data AN 01-1B-40 to determine actual center-of-gravity location.

WEIGHT LIMITATIONS

The maximum ~~recommended~~ AUTHORIZED gross weights are as follows:

- Field takeoff .... 34,280 pounds
- Field landing (minimum rate of descent) .... 26,000 pounds
- Field landing (other than minimum rate of descent), FMLP and field arrested landing (fly-in) .... ~~22,000~~ 24,000 pounds
- Field arrested landing (roll-in) .... 24,000 pounds
- Catapulting .... ~~29,500~~ 34,000 pounds
- Carrier landing and carrier arrestments .... ~~22,000~~ 24,000 pounds
- Barricade engagements .... 22,000 pounds

A/C IS UNSTABLE ABOVE 170 KTS IN LDG CONFIG WITH STABS OFF

ALL ORDNANCE RUNS MADE DROOPS UP.
UNSAFE DROOPS ⇒ 300 KTS, 3.5 G MAX

6.4 SYM, 5.1 ROLLING, 2.4 NEG WITH 26 000 #, 25000 FT OR LESS IS MAX

Roll-in field arrested landing restrictions require that the landing touchdown be at least 500 feet from the arresting wires, airplane ground speed at arrestment must be less than 148 knots, and all three landing gears must be in contact with the runway at hook engagement. Allowable combinations of weight and/or speed of F-8 aircraft can exceed capacity limits of some field arresting installations. Applicable arresting gear bulletins must be observed.

CAUTION

With full fuel and ammunition load, the maximum gross takeoff weight of 34,280 pounds can be exceeded with some combinations of external stores. Refer to AN 01-1B-40 Handbook of Weight and Balance for specific aircraft weight and to figure 1–73 for station weights for various combinations of stores. If the total weight exceeds 34,280 pounds, wing fuel may be removed to reduce the gross weight. Do not remove more than 3,000 pounds of wing fuel or the center of gravity will move forward of the takeoff limit.

EXTERNAL ARMAMENT

WEIGHT AND COMPATIBILITY TABLE — LIVE STORES

This table lists wing and fuselage store configurations and provides several weights for each configuration useful in mission planning. To use the table, select desired wing store and quantity in left vertical column headed "WING STORE" and the desired fuselage store and quantity to the right of "FUSELAGE STORE." At the intersection of the two choices is a weight which is the total loaded weight of one side of the aircraft. For a symmetrically loaded aircraft, double this weight to determine total weight added to the aircraft by all stores and supporting equipment. For an asymmetrically loaded aircraft (mixed store loading), locate the weight of each side separately, then add the two weights to determine total weight added by all stores and supporting equipment. (Refer to Note 5:) Any wing store configuration shown can be carried without fuselage stores, or vice versa. Station weight is defined in Note 1.

NOTE

Refer to External Armament Limitations, F-8 Tactical Manual, NAVAIR 01-45HHA-1T, for additional information.

WING STATION LOAD (ONE SIDE ONLY)		FUSELAGE LOAD (ONE SIDE ONLY)			
RACK AND STORE	STATION WEIGHT Note 1	One Side-winder (210 lb) Note 2 Station Wt 313 lb	Two Zuni Rkts in Zuni packs (107 lb each) Station Wt 365 lb	Two Side-winders (210 lb each) Note 2 Station Wt 670 lb	Four Zuni Rkts in two Zuni packs (107 lb each) Station Wt 774 lb
AERO 7A-1 EJECTOR BOMB RACK WITH:					
One AN-M64A1 GP Bomb (565 lb)	813 lb	1,126 lb	1,178 lb	1,483 lb	1,587 lb
One MK 83 Bomb (985 lb)	1,212 lb	1,525 lb	1,577 lb	1,882 lb	1,986 lb
One AN-M65A1 Bomb (1,205 lb)	1,432 lb	1,745 lb	1,797 lb	2,102 lb	2,206 lb
One MK 84 Bomb (1,970 lb)	2,197 lb	2,510 lb (Note 5)	2,562 lb (Note 5)	2,857 lb (Note 4)	2,971 lb (Note 5)
One AN-M66A2 Bomb (2,207 lb)	2,434 lb	2,747 lb (Note 5)	2,799 lb (Note 5)	3,104 lb (Note 5)	3,208 lb (Note 5)
One MK 77 Mod 1, 2 Fire Bomb (520 lb)	747 lb	1,060 lb	1,112 lb	1,417 lb	1,521 lb
One MK 79 Mod 1 Fire Bomb (912 lb)	1,139 lb	1,452 lb	1,504 lb	1,809 lb	1,913 lb
One Aero 7D Rocket Pack (431 lb with 19 rds 2.75-in. FFAR)	658 lb	971 lb	1,023 lb	1,328 lb	1,432 lb
One LAU-3A/A Rocket Pack (417 lb with 19 rds 2.75-in FFAR)	644 lb	957 lb	1,009 lb	1,314 lb	1,418 lb
One Aero 6A-1, -2 Rocket Pack (173 lb with 7 rds 2.75-in. FFAR)	400 lb	713 lb	765 lb	1,070 lb	1,174 lb
One LAU-32A/A or LAU-32B/A Rocket Pack (173 lb with 7 rds 2.75-in. FFAR)	400 lb	713 lb	765 lb	1,070 lb	1,174 lb
One LAU-10/A Rocket (533 lb with 4 Zuni rockets)	760 lb	1,073 lb	1,125 lb	1,430 lb	1,534 lb
A/A37B-1 MULTIPLE BOMB RACK WITH:					
Four MK 81 Bombs (260 lb each) Note 3	1,426 lb	1,739 lb	1,791 lb	2,096 lb (Note 4)	2,200 lb
Four MK 82 Bombs (527 lb each) Note 3	2,494 lb	2,807 lb (Note 4)	2,859 lb (Note 5)	3,164 lb (Note 5)	3,268 lb (Note 5)
Four MK 81 Snakeye I Bombs (300 lb each) Note 3	1,586 lb	1,899 lb	1,951 lb	2,256 lb	2,360 lb
Four MK 82 Snakeye I Bombs (565 lb each) Note 3	2,646 lb	2,959 lb (Note 5)	3,011 lb (Note 5)	3,316 lb (Note 5)	3,420 lb (Note 5)
Four AN-M88 Frag Bombs (231 lb each) Note 3	1,310 lb	1,623 lb	1,675 lb	1,980 lb	2,084 lb
Four AN-M81 Frag Bombs (277 lb each) Note 3	1,494 lb	1,807 lb	1,859 lb	2,164 lb	2,268 lb
Four AN-M57A1 GP Bombs (289 lb each) Note 3	1,542 lb	1,855 lb	1,907 lb	2,212 lb	2,316 lb

NOTE

Notes are presented on sheet 3.

AX-136(1)-1-67

Figure 1-73 (Sheet 1)

EXTERNAL ARMAMENT

WING STATION LOAD (ONE SIDE ONLY)		FUSELAGE LOAD (ONE SIDE ONLY)			
RACK AND STORE	STATION WEIGHT Note 1	One Sidewinder (210 lb) Note 2 Station Wt 313 lb	Two Zuni Rkts in Zuni packs (107 lb each) Station Wt 365 lb	Two Sidewinders (210 lb each) Note 2 Station Wt 670 lb	Four Zuni Rkts in two Zuni packs (107 lb each) Station Wt 774 lb
A/A37B-5 TRIPLE EJECTOR BOMB RACK WITH:					
Three MK 81 LDGP Bombs (260 lb each) Note 6	1,112 lb	1,425 lb	1,477 lb	1,780 lb	1,886 lb
Three MK 81 Snakeye Bombs (300 lb each) Notes 6 and 7	1,232 lb	1,545 lb	1,597 lb	1,902 lb	2,006 lb
Three MK 82 LDGP Bombs (527 lb each) Note 6	1,913 lb	2,226 lb	2,278 lb	2,583 lb (Note 5)	2,687 lb (Note 5)
Three MK 82 LDGP Bombs Snakeye Tails (565 lb each) Notes 6 and 7	2,027 lb	2,340 lb	2,392 lb	2,687 lb	2,801 lb
Two MK 83 LDGP Bombs (985 lb each) Notes 8, 9	2,302 lb	2,615 lb	2,667 lb	2,972 lb (Note 5)	3,076 lb (Note 5)
Three AN-M57A1 GP Bombs with conical or unretarded Snakeye tails (289 lb each) Note 6	1,199 lb	1,512 lb	1,564 lb	1,869 lb	1,973 lb
Three AN-M81 Frag Bombs with conical or unretarded Snakeye tails (277 lb each) Note 6	1,163 lb	1,476 lb	1,528 lb	1,833 lb	1,937 lb
Three AN-M88 Frag Bombs with conical or unretarded Snakeye tails (231 lb each) Note 6	1,025 lb	1,338 lb	1,390 lb	1,695 lb	1,799 lb
One MK 77 Mod ½ Fire Bomb (520 lb) Note 10	852 lb	1,165 lb	1,217 lb	1,522 lb	1,626 lb
Two LAU-10/A Rocket Packs (533 lb each) Note 11	1,398 lb	1,711 lb	1,763 lb	2,068 lb	2,172 lb
Two LAU-3A/A Rocket Packs (417 lb each) Note 11	1,166 lb	1,479 lb	1,531 lb	1,836 lb	1,940 lb
Two LAU-32A/A or LAU-32B/A Rocket Packs (173 lb each) Note 11	678 lb	991 lb	1,043 lb	1,340 lb	1,452 lb
Two LAU-56/A Rocket Packs (173 lb each) Note 11	678 lb	991 lb	1,043 lb	1,340 lb	1,452 lb
A/A37B-6 MULTIPLE EJECTOR BOMB RACK WITH:					
Six MK 81 LDGP Bombs (260 lb each) Note 6	2,010 lb	2,323 lb	2,375 lb	2,680 lb (Note 5)	2,784 lb (Note 5)
Six MK 81 Snakeye Bombs (300 lb each) Notes 6 and 7	2,250 lb	2,563 lb (Note 5)	2,615 lb (Note 5)	2,920 lb (Note 5)	3,024 lb (Note 5)
Four MK 82 LDGP Bombs (527 lb each)	2,558 lb	2,871 lb (Note 5)	2,923 lb (Note 5)	3,228 lb (Note 5)	3,332 lb (Note 5)
Four MK 82 LDGP Bombs Snakeye tails (565 lb each)	2,710 lb	3,023 lb (Note 5)	3,075 lb (Note 5)	3,380 lb (Note 5)	3,484 lb (Note 5)
Two MK 83 LDGP Bombs (985 lb each) Notes 8, 9	2,420 lb	2,733 lb (Note 5)	2,785 lb (Note 5)	3,090 lb (Note 5)	3,194 lb (Note 5)
Six AN-M57A1 GP Bombs with conical or unretarded Snakeye tails (289 lb each) Note 6	2,184 lb	2,497 lb (Note 5)	2,549 lb (Note 5)	2,854 lb (Note 5)	2,958 lb (Note 5)
Six AN-M81 Frag Bombs with conical or unretarded Snakeye tails (277 lb each) Note 6	2,112 lb	2,425 lb	2,477 lb	2,782 lb (Note 5)	2,886 lb (Note 5)

NOTE

Notes are presented on sheet 3.

AX–136(2)–1–67

Figure 1–73 (Sheet 2)

EXTERNAL ARMAMENT

WING STATION LOAD (ONE SIDE ONLY)		FUSELAGE LOAD (ONE SIDE ONLY)			
RACK AND STORE	STATION WEIGHT Note 1	One Side-winder (210 lb) Note 2 Station Wt 313 lb	Two Zuni Rkts in Zuni packs (107 lb each) Station Wt 365 lb	Two Side-winders (210 lb each) Note 2 Station Wt 670 lb	Four Zuni Rkts in two Zuni packs (107 lb each) Station Wt 774 lb
A/A37B-6 MULTIPLE EJECTOR BOMB RACK WITH:					
Six AN-M88 Frag Bombs with conical or unretarded Snakeye tails (231 lb each) Note 6	1,836 lb	2,149 lb	2,201 lb	2,506 lb (Note 5)	2,610 lb (Note 5)
Two MK 77 Mod ½ Fire Bombs (520 lb each) Note 10	1,490 lb	1,803 lb	1,855 lb	2,160 lb	2,264 lb
Two LAU-10/A Rocket Packs (533 lb each) Note 11	1,516 lb	1,829 lb	1,881 lb	2,186 lb	2,290 lb
Two LAU-3A/A Rocket Packs (417 lb each) Note 11	1,284 lb	1,597 lb	1,649 lb	1,954 lb	2,058 lb
Two LAU-32A/A or LAU-32B/A Rocket Packs (173 lb each) Note 11	796 lb	1,109 lb	1,161 lb	1,466 lb	1,570 lb
Two LAU-56/A Rocket Packs (173 lb each) Note 11	796 lb	1,109 lb	1,161 lb	1,466 lb	1,570 lb

NOTES

1. Station weight is store weight plus the weight of all equipment (pylon and racks or launchers) necessary to fire or release the store.
2. AIM-9B (164 lbs), AIM-9D (178 lbs) and AIM-9C (210 lbs) missiles may be used. Table reflects AIM-9C weight.
3. Bombs loaded on the multiple bomb rack (MBR) need not necessarily occupy positions corresponding to the dropping sequence of the rack. (See illustrations of MBR dropping sequence.) Under present limitations, carriage of bombs on the inboard stations of the MBR is not permitted. If only two bombs are loaded on the MBR, they should occupy stations 1 and 2. Additional bombs shall be loaded on the outboard stations only. Dependent upon release mode employed, additional trigger squeezes may be required to bypass vacant inboard MBR stations. The MBR dropping sequence is independent of which (LH or RH) pylon the rack has been attached to.
4. Use of AIM-9D or AIM-9C missiles (weight shown) may result in exceeding the limitation described in Note 5. This limitation can not be exceeded using AIM-9B missiles.
5. Configuration may exceed maximum allowable takeoff gross weight. Refer to "Weight Limitations."
6. If the inboard MER/TER stations are to be loaded (3 stores on TER, 6 stores on MER) and a dual pylon is installed on the RH fuselage, the lower launcher must not be installed on the pylon. In this case, subtract weight of the launcher and associated (Sidewinder or Zuni) store from the total weight. If a launcher and store is installed on the lower pylon, the inboard station of the TER or the forward-inboard station of the MER must not be loaded. In this case, subtract the weight of one store from the total weight.
7. May be carried and released from inboard MER/TER stations in unretarded mode only.
8. Load forward-center and aft-outboard MER stations.
9. Do not load these stores on inboard stations of MER/TER.
10. Load aft-center and/or forward-center MER stations and TER center stations only.
11. Load the forward-center and forward-outboard MER stations or the center and outboard TER stations.

AIRCRAFT/EQUIPMENT WEIGHT

Approximate Aircraft Weight Refer to Section I, Part 4 Principal Dimensions and Weight Table.

Aero 7A-1 Ejector Bomb Rack (Used with all wing stores) .... 52 lb

Wing Pylon .... 175 lb

MBR (A/A37B-1 Multiple Bomb Rack) .... 159 lb

TER .... 105 lb
MER .... 223 lb

Ammunition (500 Rounds) .... 355 lb

Full Fuel Load (JP-5) .... 9,167 lb

LAU-7/A Launcher (Fuselage) .... 90 lb

Aero 3A Launcher (Used with AIM-9B) .... 49 lb

2.75" FFAR .... 18.5 lb

AX-136(3)-10-67

Figure 1-73 (Sheet 3)

EXTERNAL ARMAMENT

WEIGHT AND COMPATIBILITY TABLE — PRACTICE BOMBS AND PARACHUTE FLARES

This table lists practice bombs and parachute flare configurations for the attack airplane and provides store and station weights for these configurations useful in mission planning. For a symmetrically loaded aircraft, double the station weight to determine total weight added to the aircraft by wing stores and supporting equipment. For an asymmetrically-loaded aircraft (mixed store loading), add the separate station weights. Station weight is defined in Note 1.

WING STORE (ONE SIDE ONLY)	STATION WEIGHT Note 1
One MK 86 Practice Bomb* (217 lbs) Note 2	444 lbs
Two MK 86 Practice Bombs† (217 lbs each) Notes 2 and 3	820 lbs
One MK 87 Practice Bomb* (333 lbs) Note 2	560 lbs
Two MK 87 Practice Bombs† (333 lbs each) Notes 2 and 3	1,052 lbs
One MK 88 Practice Bomb* (783 lbs) Note 2	1,010 lbs
Four MK 76 Mod 4 Practice Bombs‡ (25 lbs each)	692 lbs
Six MK 76 Mod 4 Practice Bombs§ (25 lbs each)	464 lbs
Four MK 106 Mod 2/3/4 Practice Bombs‡ (5 lbs each)	612 lbs
Three MK 89 Mod 0/1 Practice Bombs§ (57 lbs each) Note 4	485 lbs
Four MK 24 Mod 2A/3 Parachute Flares§ (27 lbs each) Note 5	422 lbs

*Attached to the Aero 7A-1 Ejector Bomb Rack
†Attached to the A/A37B-1 Multiple Bomb Rack
‡Loaded in the Aero 8A-1 Practice Bomb Container
§Attached to the A/A37B-3 Practice Multiple Bomb Rack

Aero 8A-1 Practice Bomb Container .... 365 lbs
A/A37B-3 Practice Multiple Bomb Rack .... 87 lbs
A/A37B-1 Multiple Bomb Rack .... 159 lbs
Aero 7A-1 Ejector Bomb Rack (Used with all wing stores) ..... 52 lbs

NOTES

1. Station weight is store weight plus the weight of all equipment (pylons and racks or launchers) necessary to fire or release the store.
2. Weight is for practice bomb loaded with wet sand.
3. MK 86 and MK 87 practice bombs may be carried only on stations 1 and 2 (the centerline stations) of the multiple bomb rack due to tail fin interference.
4. MK 89 Mod 0/1 practice bombs will fit only on stations 2, 3, and 4 of the A/A37B-3 practice multiple bomb rack.
5. Carriage of flares on inboard stations of the practice multiple bomb rack is not permitted due to possible flare/airplane collisions after release.

AX-136(4)-1-67

Figure 1-73 (Sheet 4)

section II

indoctrination

CONTENTS

GROUND TRAINING REQUIREMENTS

The overall ground training syllabus for each activity varies according to local conditions, field facilities, requirements from higher authority, and the immediate unit commander's estimation of squadron readiness. However, in order to ensure that all F-8 pilots are properly indoctrinated, thoroughly briefed, and adequately prepared to fly the aircraft, certain specific courses must be standardized. An outline of those courses and subjects which are required for all F-8 pilots is presented below. Also presented are the subjects upon which continued ground training is based. The frequency and number of hours devoted to each course depends upon the progress and circumstances pertaining to each command.

GENERAL REQUIREMENTS

Prior to familiarization flights in the F-8, the FAM pilot must:

1. Possess a current medical clearance.
2. Meet physiological requirements of the current edition of OPNAV Instruction 3740.3.
3. Complete the F-8 NAMT Pilot's Familiarization Course consisting of approximately 40 hours of instruction.

4. Receive lectures on the following subjects from the RCVW or an operating F-8 squadron:

Powerplants
Electrical system
Fuel system
Hydraulic and pneumatic systems
Ejection seat, canopy, and pressurization.
Variable incidence wing
Flight controls and emergency power package
Trim and stabilization
Emergency procedures
Flight characteristics and operating limitations to include high speed, high altitude flight
Stall and spins (including LTV movie)
Preflight and hand signals
Local area and facilities

5. Complete a torso harness suspension drill.
6. Satisfactorily complete a minimum of two procedures trainer flights within two weeks of first FAM flight.
7. Practice a dry-run ejection in an F-8 ejection seat.
8. Satisfactorily complete a blindfold cockpit check.
9. Complete a supervised engine start and taxi checkout.
10. Satisfactorily complete test on F-8 operating limits, normal and emergency procedures, and aircraft systems.
11. Complete an appropriate course rules examination.

SUPPLEMENTAL REQUIREMENTS

The following subjects as guidelines should be included in the normal ground school syllabus which is supplemental and complementary to the flight training.

1. Technical subjects

NATOPS Flight Manual
Aircraft maintenance manuals
Fire control system manuals
Ordnance
Auxiliary equipment
Aerodynamics

2. Tactical subjects

NWP and NWIP
F-8 Tactical Manual
Tactics publications
Rules of engagement

3. Instrument flight planning cross-country navigation

Flight planning
Rest computer
Current OPNAV Instruction P3710 series
DR NAV
Special equipment

4. Flight safety

AAR REVIEWS
Emergency procedures
Flight safety equipment
Use of emergency arresting gear

5. Intelligence

Military situation in theaters
Functions and organization of Air Intelligence
Security of information
Aircraft recognition
Maps, charts, and aerial photographs
Enemy aircraft aerial tactics
Amphibious operations
Intelligence reports
F-8 versus enemy fighter and bomber briefs

6. Communications

Types of communications
Brevity code
Applicable communications, NWP, NWIP, ACP
Authenticator tables

7. Survival

Physiological and medical aspects
Physical fitness and first aid
Survival on land/sea
Pilot rescue techniques

FLIGHT TRAINING

The geographic location, the specific flight training concept, local command restrictions, and other factors influence the actual flight syllabus and the sequence in which it is completed. This training is accomplished in the CRAW and/or squadron.

FLIGHT QUALIFICATION REQUIREMENTS

FAMILIARIZATION PHASE REQUIREMENTS

The following criteria will be met before specific flight phases.

1. Prior to the familiarization phase, all pilots will have:
   - Completed the ground training syllabus covered under GENERAL REQUIREMENTS
   - Prior landings in a swept-wing aircraft
   - Satisfactorily completed three OFT/WST procedures familiarization flights, at least two of which must have been within two weeks of the first familiarization flight

section III
normal procedures

CONTENTS

PART 1 — BRIEFING/DEBRIEFING

PART 2 — MISSION PLANNING

PART 3 — SHORE-BASED PROCEDURES

PART 4 — CARRIER-BASED PROCEDURES

PART 1 — BRIEFING/DEBRIEFING

BRIEFING

The flight leader is responsible for ensuring that all flight members are properly briefed on the operation and conduct of the mission. The briefing will be conducted using a briefing guide and a syllabus card, if applicable. Each pilot in the flight will maintain a kneepad and will record flight numbers, call signs, and all other data necessary to assume the lead and complete the assignment if it should become necessary. The following information will be covered during the briefing:

GENERAL

Aircraft assigned, call signs
Engine start, taxi, and takeoff times
Visual signals and rendezvous instructions

MISSION

Primary
Secondary
Operating area
Control agency
Time on station or over target

WEAPONS

Loading
Safety
Arming, dearming
Duds
Special routes with ordnance aboard
Minimum pull-out altitude
Jettison area
Tow/escort

COMMUNICATIONS

Frequencies
Radio procedure and discipline
Navigational aids
Identification and ADIZ procedures

WEATHER

Local area
Local area and destination forecasts
Weather at alternate
High altitude weather for jet stream, temperature, and contrail band width

NAVIGATION AND FLIGHT PLANNING

Takeoff
Climbout
Mission route, including ground controlling agencies (GCI, APC, etc.)
Fuel/oxygen management
Marshall/holding
Penetration
GCA or CCA
Recovery

EMERGENCIES

Aborts
Divert fields
Bingo and low-state fuel
Wave-off pattern
Ready deck
Radio failure
Loss of visual contact with flight
SAR procedures
System failures

AIR INTELLIGENCE AND SPECIAL INSTRUCTIONS

Friendly and enemy force disposition
Current situation
Targets
Safety precautions

2. A qualified chase pilot will be assigned for a minimum of four familiarization flights.

3. An F-8 experienced RDO or instructor chase pilot will monitor all familiarization landings.

ADDITIONAL PHASE REQUIREMENTS

Additional requirements for various phases are:

1. Instruments (Actual)
   - Be basic instrument qualified in series:
     Three satisfactory simulated instrument sorties
     Three satisfactory TACAN penetrations
     Five satisfactory GCA approaches
   - Have satisfactorily completed an instrument progress check on the instrument training portion of the aircraft series training syllabus and an in-type instrument check
2. Night
   - Be instrument qualified in series
3. Cross-Country
   - Have 25 hours in series
   - Be instrument qualified in series
   - Have completed a servicing checkout
   - Have had at least one night familiarization flight
4. Air-to-Air Gunnery
   - Have 25 hours in series
   - Perform gun camera flights until considered qualified for live gunnery.
5. Carrier Qualification
   - Day qualification:
     Have completed 8 FMLF periods
     Have a minimum of 50 hours in series
   - Night qualification:
     Have completed 15 night FMLP periods
     Be day carrier qualified
     Make a minimum of two day traps during the day of night qualification and have had a minimum of five day traps during the preceding ten days

CURRENCY, AIRCRAFT FERRY, AND REQUALIFICATION REQUIREMENTS

To be considered qualified in the F-8, the pilot must meet the following requirements:

Total Time in F-8 Series	*Pilot must have flown . . .*	*Within last . . .*
10 – 100 hours	5 hours	3 months
100 – 300 hours	10 hours	6 months
300 hours or more	10 hours	12 months

If these requirements are not met, familiarization phase requirements with the exception of NAMT must be completed.

Training requirements, checkout procedures, evaluation procedures, and weather minima for ferry squadrons are governed by the provisions contained in OPNAV Instruction 3710.6 series.

GENERAL REQUIREMENTS

Any pilot not flying for a two-week period after commencing a training syllabus will complete at least one OFT/WST or COT procedures trainer flight (if available) prior to his next F-8 flight. Any pilot not flying the F-8 for a two-week period will be required to fly a day flight prior to any F-8 night flight.

Note

Commanding Officers are authorized to waive minimum flight requirements and/or OFT/WST or COT training where recent experience in similar models warrants.

PERSONAL FLYING EQUIPMENT

The following equipment will be worn or carried on all flights unless other safety considerations indicate otherwise. All flying equipment will be modified in accordance with current Aviation Clothing and Survival Equipment Bulletins.

1. Antibuffet helmet.
2. Oxygen mask.
3. Anti G suit.
4. Flight suit.
5. Ankle-high laced boots.
6. Life vest.
7. Integrated torso harness.
8. Sheath knife and shroud line cutter.
9. A red lens flashlight (for all night and cross-country flights).
10. A pistol with tracer ammunition, or BuWeps approved substitute, for all over-water flights, night flights, and flights over sparsely populated areas.
11. Flight gloves.
12. Identification tags.
13. Anti-exposure coverall on all over-water flights when the water temperature is 59°F (15°C) or below; or OAT is 32°F (0.00°C) or below; or when the combined air/water temperature is 120°F (48.89°C) or below. Exceptions to these requirements are as follows:

    Not required when the water temperature is above 50°F (10°C) and aircraft is within gliding distance of land.

When high ambient cockpit temperature would create a hazardous debilitating effect on the pilot, type commanders are authorized to grant a waiver.

14. Survival kit.
15. Operational equipment appropriate to climate or the area.
16. Navigation packet.
17. Pocket checklist.

Survival equipment will be secured in such a manner as to offer ready accessibility and to ensure retention during ejection or landing.

OPERATING AREA BRIEFING

Prior to air operations in and around a new area, it is mandatory that a comprehensive briefing be given covering (but not limited to) the following:

Bingo Fields

Instrument approach facilities
Runway length and arresting gear
Terrain and obstructions

Emergency Fields

Fields suitable for landing but without required support equipment
Instrument approach facilities
Runway length and arresting gear
Terrain and obstructions

SAR Facilities

Type
Frequencies
Location

DEBRIEFING

Immediately after the flight, all pilots will assemble for a debriefing and critique. It will be conducted or supervised by the flight leader and will cover the following:

- Interrogation by an intelligence officer if applicable
- General discussion covering all phases of the flight
- Operational and tactical information that can be given to squadron operations for relay to flight leaders of subsequent flights (include weather, etc.)
- Critique of breakups and landings

The importance of the postflight debriefing and critique cannot be stressed too highly. To derive maximum benefit, constructive criticism and suggested improvements to doctrine, tactics, and techniques should be given and received with frankness, purpose, and in the spirit of improving the proficiency of the unit as well as the individual pilot.

PART 2 — MISSION PLANNING

Refer to section XI, NWIP 41-2, and the F-8 Tactical Manual for detailed instructions concerning mission planning.

PART 3 — SHORE-BASED PROCEDURES

LINE OPERATIONS

ACCEPTING THE AIRCRAFT

Check the yellow sheet for flight status, fuel load, configuration and armament loading. Review at least the ten previous B sections for the discrepancies noted and the corrective action taken. When satisfied with the yellow sheet information, sign the applicable portions and proceed with the exterior inspection.

EXTERIOR INSPECTION

The exterior inspection is presented in figure 3–1, and is reproduced in the pocket checklist. During flight operations away from the parent organization, ensure that the following additional systems postflight and servicing procedures are completed:

Engine accessory gear drive oil level
Constant speed drive generator
Viscous dampers
Generator turbine oil level
Wing fuel quantity (external indications)
Liquid oxygen system
Hydraulic systems

The airplane may be cleared for flight with fasteners missing from access doors and panels provided that the following restrictions are observed:

- No fastener shall be missing from any door or panel in the cockpit area. Missing fasteners could affect cockpit pressurization.
- Not more than 10% of the total fasteners in any row on any door or panel may be missing. Two fasteners in a row of 20 or more fasteners may be missing only when the two missing fasteners are separated by two installed fasteners.
- The first and last fastener in any row must be installed. No fastener may be missing from the leading edge of any door or panel if an unfastened gap longer than three inches is created.
- No fastener which performs a secondary function of supporting a bracket or other equipment may be missing.

COCKPIT ENTRY *(See figure 3–2)*

The canopy is opened manually by the canopy release handle, located on the left side of the fuselage directly below the canopy frame. Depress the forward part of the handle, grasp the handle arm and pull forward to unlock the canopy. Raise the canopy by using the handle on the canopy frame.

COCKPIT CHECKS

Perform the following checks before connecting external power:

General

1. Ejection system — INSPECTED as outlined in figure 3–3 (MK-F5, -F5A seat) or 3–3A (MK-F7 seat)
2. Rudder pedals — ADJUSTED

Left Side

3. Pilot's services — CONNECTED
4. G valve knob — AS DESIRED
5. Speed brake override switch — NORMAL
6. Antiexposure coverall ventilation switch — NORM CABIN PRESS
7. Antiexposure coverall ventilation knob — AS DESIRED
8. Emergency droop and wing incidence guard — DOWN
9. Wing incidence handle — MATCH WING POSITION
10. Fuze function switch — SAFE
11. Radar power switch — OFF
12. Approach power compensator switch — OFF
13. Fuel control switch — NORMAL
14. Rudder trim knob — NEUTRAL
15. Throttle — OFF
16. Speed brake switch — IN
17. Cruise droop switch — UP
18. Throttle friction wheel — ADJUST
19. Emergency brake handle — OFF

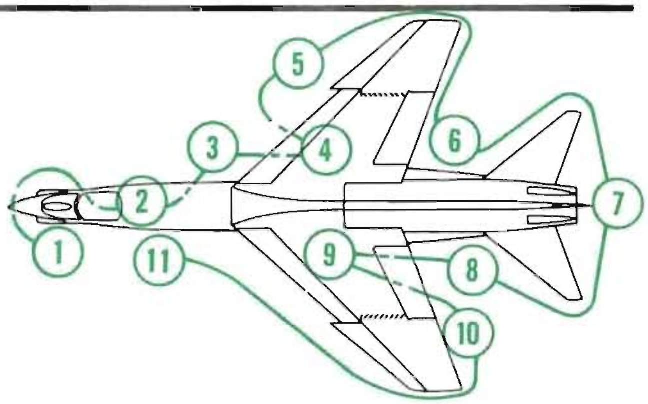
19A. Smoke abatement switch — OFF

20. Engine master switch — OFF
21. Land/taxi light switch — OFF
22. Exterior light switch — OFF

22A. Speech Security controls — AS REQUIRED

23. Salvo jettison switch — OFF
24. Yaw stabilization switch — OFF RESET

EXTERIOR INSPECTION



1 NOSE SECTION

Access doors and panels	SECURED*
Pitot cover	REMOVED
Nose cone	SECURED
Intake duct	NO OBSTRUCTION, WRINKLES, OR MISSING RIVETS
A/A transducer vane	NO DAMAGE
Oxygen filler	CAP SECURE, ON BUILDUP, COVER CLOSED
Gun camera window	NO DAMAGE
Emergency air vent	CLOSED
IR receiver	CLEAN, NO DAMAGE

2 NOSEWHEEL WELL

Nose gear doors	SECURE
Nose gear	STRUT, TIRE
Approach lights	NO DAMAGE, LENSES CLEAN
Downlock	INSTALLED
Armament disable switch	GUARD DOWN
Underside of fuselage	NO HYDRAULIC LEAKS

3 RIGHT FORWARD FUSELAGE

Pylons and launchers	SECURED
Ordnance	SECURED, SAFETY PINS INSTALLED
Formation light	NO DAMAGE
Static ports	CLEAR
Hydraulic reservoir	PROPER SERVICE
Pneumatic gages	PROPER PRESSURE
Underside of fuselage	NO FLUID LEAKS
Lower anticollision light	NO DAMAGE
Access doors and panels	SECURED*
Speed brake	NO DAMAGE OR FLUID LEAKS

4 RIGHT MAIN WHEEL WELL

Gear door and actuator	SECURE, NO CRACKS
Wheel well	NO HYDRAULIC LEAKS
Gear	STRUT EXTENSION, TIRE INFLATION
Brake pucks	WITHIN LIMITS
Wheel bolts	SECURE, NONE MISSING
Landing taxi light	NO DAMAGE
Fuel system vent port	NOT COVERED
Downlock	INSTALLED
PC accumulator	NO LEAKS
Tiedown ring	FLUSH
Gear-up lockpin	SECURE
Uplock roller	NO BINDING
Main fuel line	NO LEAKS
Chaff disable power switch pin	INSTALLED

5 RIGHT WING

Check general condition	NO FLUID LEAKS
Access doors and panels	SECURED*
Leading edge	NO DAMAGE OR HYDRAULIC LEAKS
Wing hinge pins	LOCKED (PANELS SPREAD AND LOCKED)
Wingfold warning flags	RETRACTED (PANELS SPREAD AND LOCKED)
Donut seal	NOT LEAKING OR DEFORMED
Formation light	NO DAMAGE
Position light	NO DAMAGE
Aileron	NO DAMAGE OR LEAKS, BATTEN REMOVED
Spoiler	NO DAMAGE
Flap	NO DAMAGE
External stores	CHECK SECURITY OF RACKS, RAILS AND LAUNCHERS

6 RIGHT AFT FUSELAGE

PC No. 2 reservoir	PROPER SERVICING
Access doors and panels	SECURED*
Fuel cell cavity vent ports	NO OBSTRUCTION
Right ventral fin	SECURE, NO DAMAGE
Underside of fuselage	NO FLUID LEAKS
Formation lights	NO DAMAGE

7 EMPENNAGE AND TAIL CONE

Tail hook	SECURE, NO LEAKS
Horizontal tail	NO DAMAGE
Vertical tail	NO DAMAGE
Rudder	NO DAMAGE, BATTEN REMOVED
Position light	NO DAMAGE
Tailpipe	NO WRINKLES OR CRACKS, COLOR NORMAL
Nozzle bearings	NO RUST OR BINDING
Nozzle flaps	NO DAMAGE, BINDNG OR RUST ON LINKAGE.
Upper wing surfaces	PANELS SECURE, NO WRINKLING OR BUCKLING

8 LEFT AFT FUSELAGE

Repeat step 6

Fuel vent	NO OBSTRUCTION
PC No. 1 reservoir	PROPER SERVICING

9 LEFT MAIN WHEEL WELL

Repeat step 4

Wing fuel manual shutoff valve	OPEN
Fuel selector switch	POWER OFF
Pressure fueling cap	SECURED
Hydraulic hand pump handle	STOWED

10 LEFT WING

Repeat step 5

11 LEFT FORWARD FUSELAGE

Access doors and panels	SECURED*
Formation light	NO DAMAGE
Upper anticollision light	NO DAMAGE
Pylons and launchers	SECURED
Ordnance	SECURED, SAFETY PINS INSTALLED
Canopy	CRAZING OR CRACKS WITHIN LIMITS

* Refer to EXTERIOR INSPECTION paragraph for information on allowable missing fasteners.

AX-62-10-67

Figure 3-1

COCKPIT ENTRY

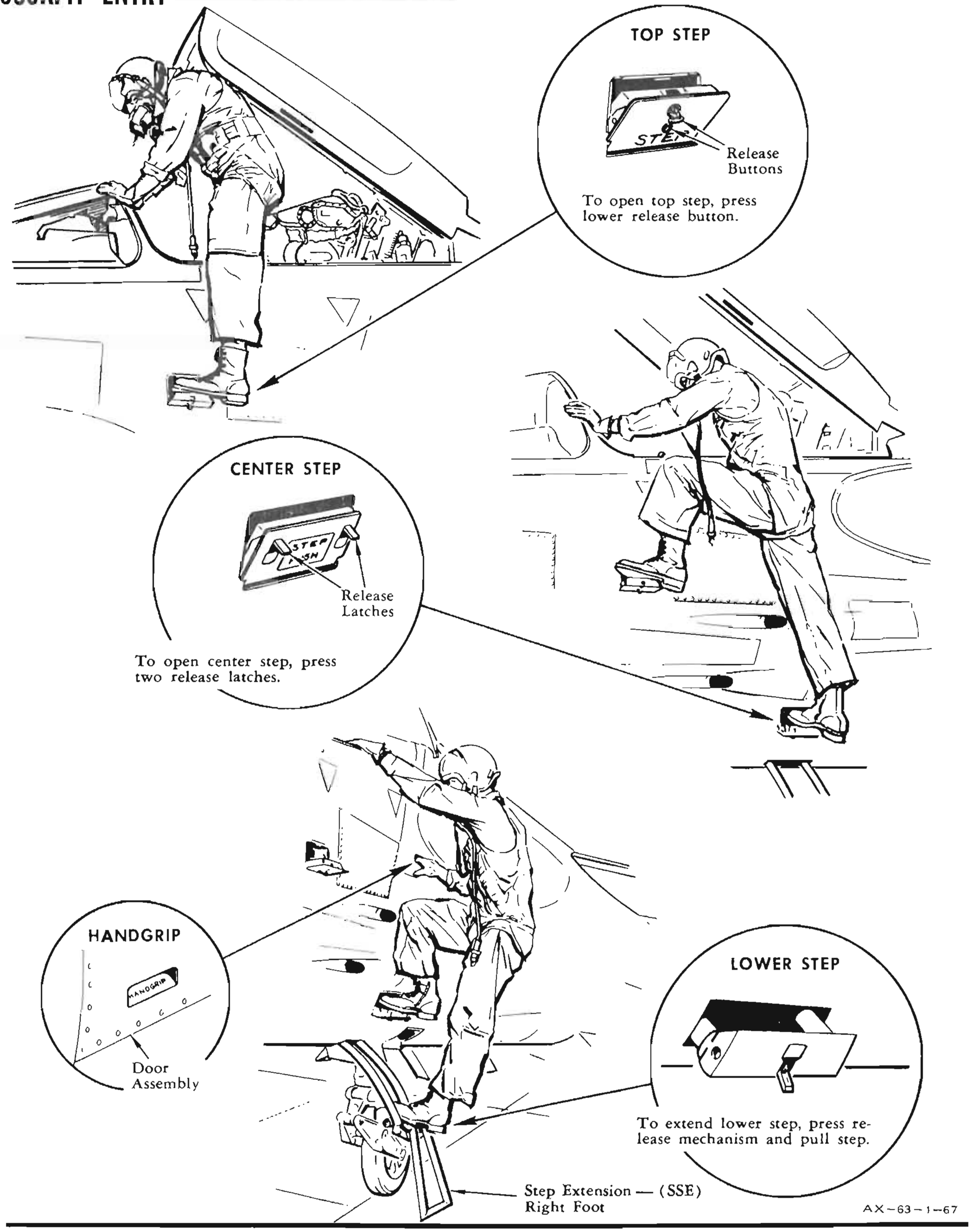


Figure 3–2

MK-F5, -F5A EJECTION SYSTEM INSPECTION

WARNING

Ensure that all six ejection system safety pins (sheet 3) are installed before entering the airplane.

BEFORE ENTERING SEAT, CHECK:

1 Check seat type (MK-F5 or -F5A) to determine ejection capability.

1A Canopy interrupter release handle stowed.

2 Link line passed through guillotine trap (yellow door) and connected to parachute withdrawal line with no gap between connector halves.

2A Top latch plunger not protruding from end of top latch housing*.

2B Indicator plunger flush with end of top latch plunger*.

3 Parachute D-ring stowed.

4 Shoulder harness—to ensure proper attachment.

4A Check that the indicator on the bottom of the drogue gun firing mechanism extends about one-half inch from the bottom of the mechanism. This indicates the mechanism is cocked†

5 Drogue gun trip rod (LH side) pinned to bulkhead behind seat. Red painted section of triprod not showing (should be covered by trip rod outer barrel)*.

6 Face curtain handle stowed.

7 Face curtain firing cable undamaged and connected to ejection gun sear.

8 Canopy interrupter cable undamaged, properly routed, and connected to interrupter release pin and to canopy bulkhead.

9 Drogue parachute withdrawal line routed as shown and lying aft and below level of canopy breaker points.

10 Timed-release mechanism trip rod (RH side) pinned to bulkhead behind seat. Red painted section of trip rod not showing (should be covered by trip rod outer barrel)*.

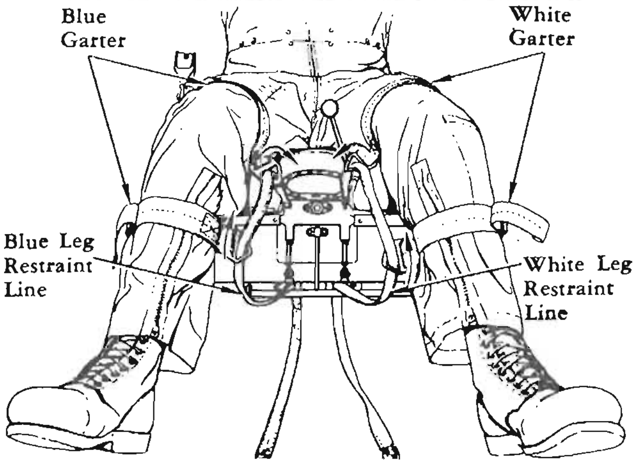
11 Emergency harness release handle stowed and attached to guillotine firing mechanism.

12 Lap harness — to ensure proper attachment.

13 Emergency oxygen bottle pressure. Emergency oxygen bottle lanyard secured to structure, lanyard quick-disconnect locked, and lanyard not fouled on seat or cockpit floor.

14 Pull the first group of safety pins in the following order:
   a. Canopy actuator initiator pin
   b. drogue gun pin
   c. ejection gun pin
(Pins and locations are illustrated in sheet 3.)

†Seats with Air Crew Systems Change No. 56.
*Seats with Air Crew Systems Change No. 19.



AFTER ENTERING SEAT, CHECK:

15 Secondary firing handle stowed.

16 Leg restraint lines pulled to check snubber action.

17 Emergency canopy jettison handle stowed.

18 Remove remaining safety pins in the following order:
   a. Guillotine firing mechanism pin
   b. Secondary firing handle pin
   c. Face curtain pin (plane captain may remove)
(Pins and locations are illustrated in sheet 3.)

19 Hand safety pins to plane captain who will display the six pins prior to stowing them in the safety pin container.

20 Route leg restraint lines as shown and attach plug-in fittings to front of seat. The leg restraint lines must be hooked up at all times during flight to ensure that the legs will be restrained in the aft position following ejection. This will prevent leg injury and enhance seat stability by preventing the legs from flailing.

WARNING

Do not cross the leg restraint lines or pass them around the control stick. Misrouted lines can result in serious pilot injury upon ejection.

21 Push leg restraining release lever and extend legs to normal operating position. If too much line has been released from the restraint snubber, raise the seat and have plane captain manually pull the line from the aft side of the snubber.

WARNING

Too much slack will hinder release of the leg restraint lines.

AX-116(1)-8-67

Figure 3-3 (Sheet 1)

MK-F5, -F5A EJECTION SYSTEM INSPECTION

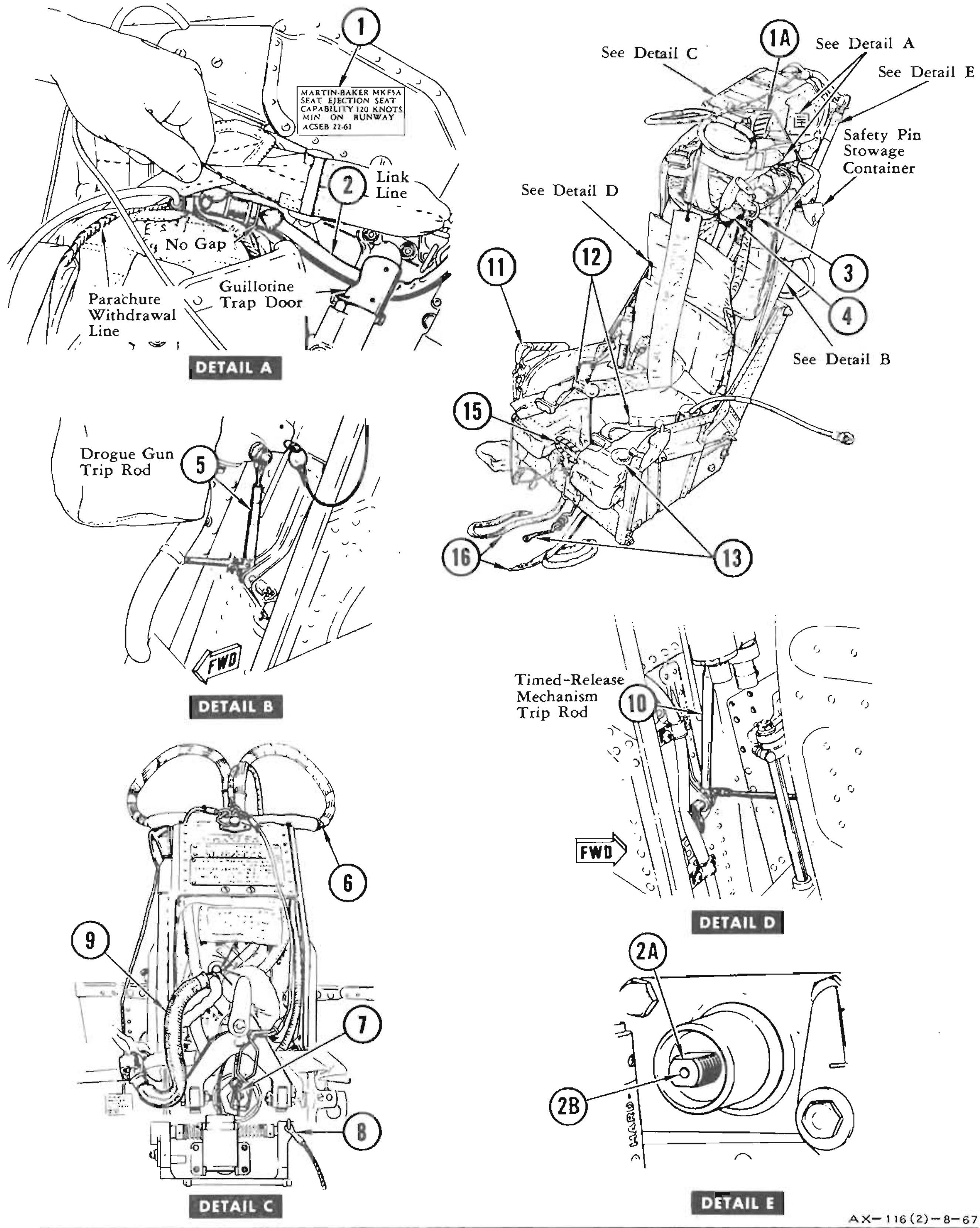


Figure 3–3 (Sheet 2)

MK-F5, -F5A EJECTION SYSTEM INSPECTION

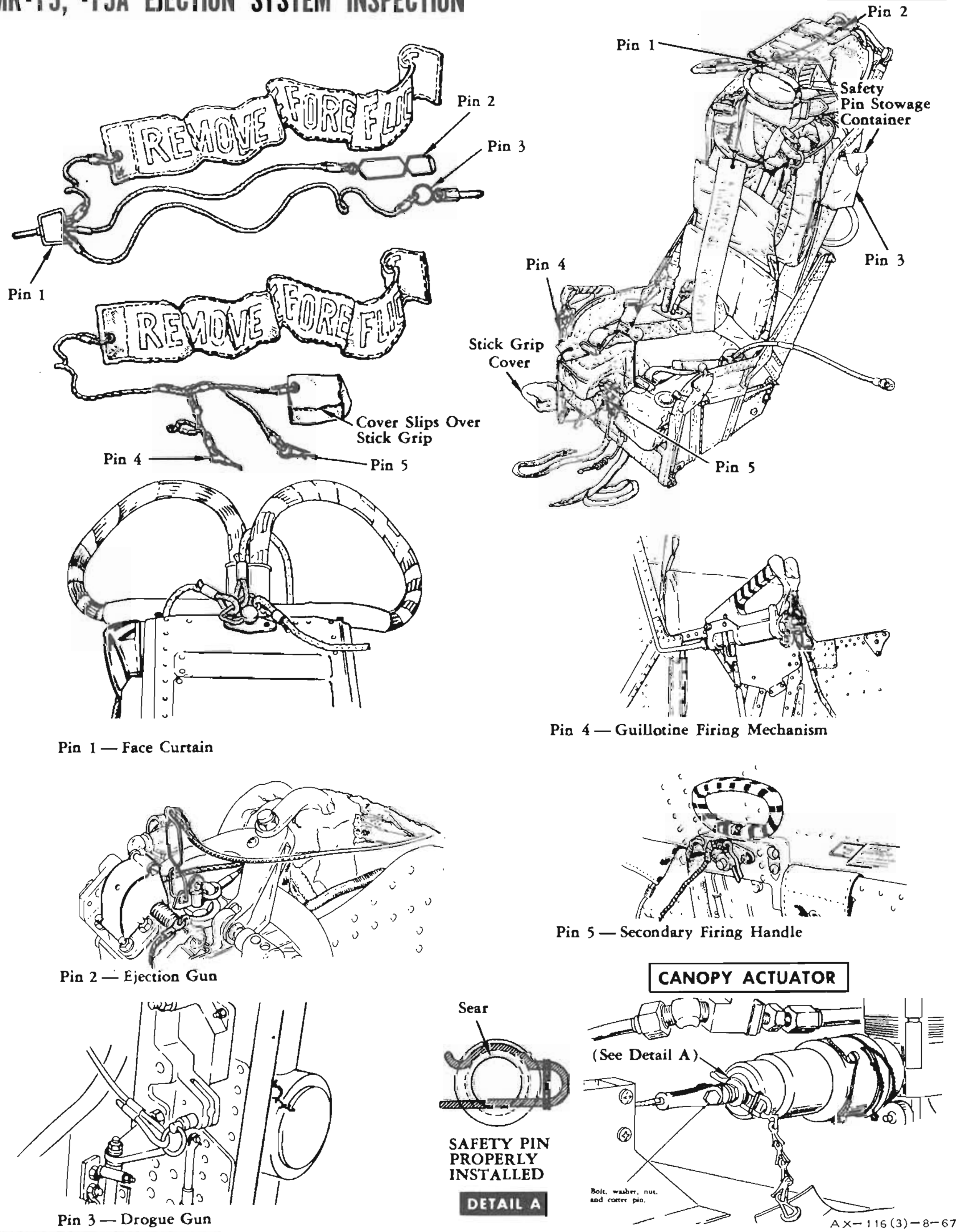


Figure 3-3 (Sheet 3)

MK-F7 EJECTION SYSTEM INSPECTION

WARNING

Ensure that all seven ejection system safety pins (sheets 3 and 4) are installed before entering airplane.

BEFORE ENTERING SEAT, CHECK:

1 Check seat type to determine ejection capability.

1A Canopy interrupter release handle stowed.

2 Link line passed through guillotine trap (yellow door) and connected to parachute withdrawal line with no gap between connector halves. Assure parachute locking pin withdrawal line is free of guillotine trap door.

2A Top latch plunger not protruding from end of top latch housing.

2B Indicator plunger flush with end of top latch plunger.

3 Parachute D-ring stowed.

4 Shoulder harness — to ensure proper attachment.

4A Check that the indicator on the bottom of the drogue gun firing mechanism extends about one-half inch from the bottom of the mechanism. This indicates the mechanism is cocked.

5 Drogue gun trip rod (LH side) pinned to bulkhead behind seat. Red painted section of trip rod not showing (should be covered by trip rod outer barrel).

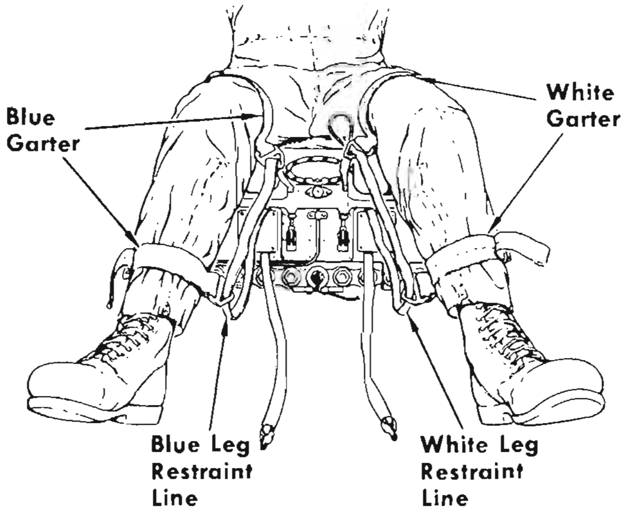
5A Rocket firing lanyard properly inserted in tie-down fitting. (Fitting is located on floor and is visible to pilot by viewing down the rear of the left hand side of the seat.)

6 Face curtain handle stowed.

7 Face curtain firing cable undamaged and connected to ejection gun sear.

8 Canopy interrupter cable undamaged, properly routed, and connected to interrupter release pin and to canopy bulkhead.

9 Drogue parachute withdrawal line routed as shown and lying aft and below level of canopy breaker points.



10 Timed-release mechanism trip rod (RH side) pinned to bulkhead behind seat. Red painted section of trip rod not showing (should be covered by trip rod outer barrel).

11 Emergency harness release handle stowed and attached to guillotine firing mechanism.

12 Lap harness — to ensure proper attachment.

13 Emergency oxygen bottle pressure. Emergency oxygen bottle lanyard secured to structure, lanyard quick-disconnect locked, and lanyard not fouled on seat or cockpit floor.

14 Pull the first group of safety pins in the following order:

a. Canopy actuator initiator pin
b. Drogue gun pin
c. Power retractor gun pin
d. Ejection gun pin

(Pins and locations are illustrated in sheets 3 and 4.)

AFTER ENTERING SEAT, CHECK:

15 Secondary firing handle stowed.

16 Leg restraint lines pulled to check snubber action.

17 Emergency canopy jettison handle stowed.

18 Remove remaining safety pins in the following order:

a. Guillotine firing mechanism pin
b. Secondary firing handle pin
c. Face curtain pin (plane captain may remove)

(Pins and locations are illustrated in sheet 4.)

AX-159(1)-8-67

Figure 3–3A (Sheet 1)

MK-F7 EJECTION SYSTEM INSPECTION

19 Hand safety pins to plane captain who will display the seven pins prior to stowing them in the safety pin container.

20 Route leg restraint lines as shown and attach plug-in fittings to front of seat. The leg restraint lines must be hooked up at all times during flight to ensure that the legs will be restrained in the aft position following ejection. This will prevent leg injury and enhance seat stability by preventing the legs from flailing.

WARNING

Do not cross the leg restraint lines or pass them around the control stick. Misrouted lines can result in serious pilot injury upon ejection.

21 Push leg restraining release lever and extend legs to normal operating position. If too much line has been released from the restraint snubber, raise the seat and have plane captain manually pull the line from the lower side of the snubber.

WARNING

Too much slack will hinder release of the leg restraint lines.

A small pilot utilizing the MK-F7 ejection seat should raise the seat as high as practical on the ground and in the traffic pattern. This is to ensure a favorable ejection seat center-of-gravity position. In the somewhat unlikely event that a small pilot had the seat fully lowered and was forced to eject at close to zero-zero conditions, a safe ejection could be jeopardized due to unfavorable seat cg position.

22 Small pilot: Raise the seat to the highest position practical.

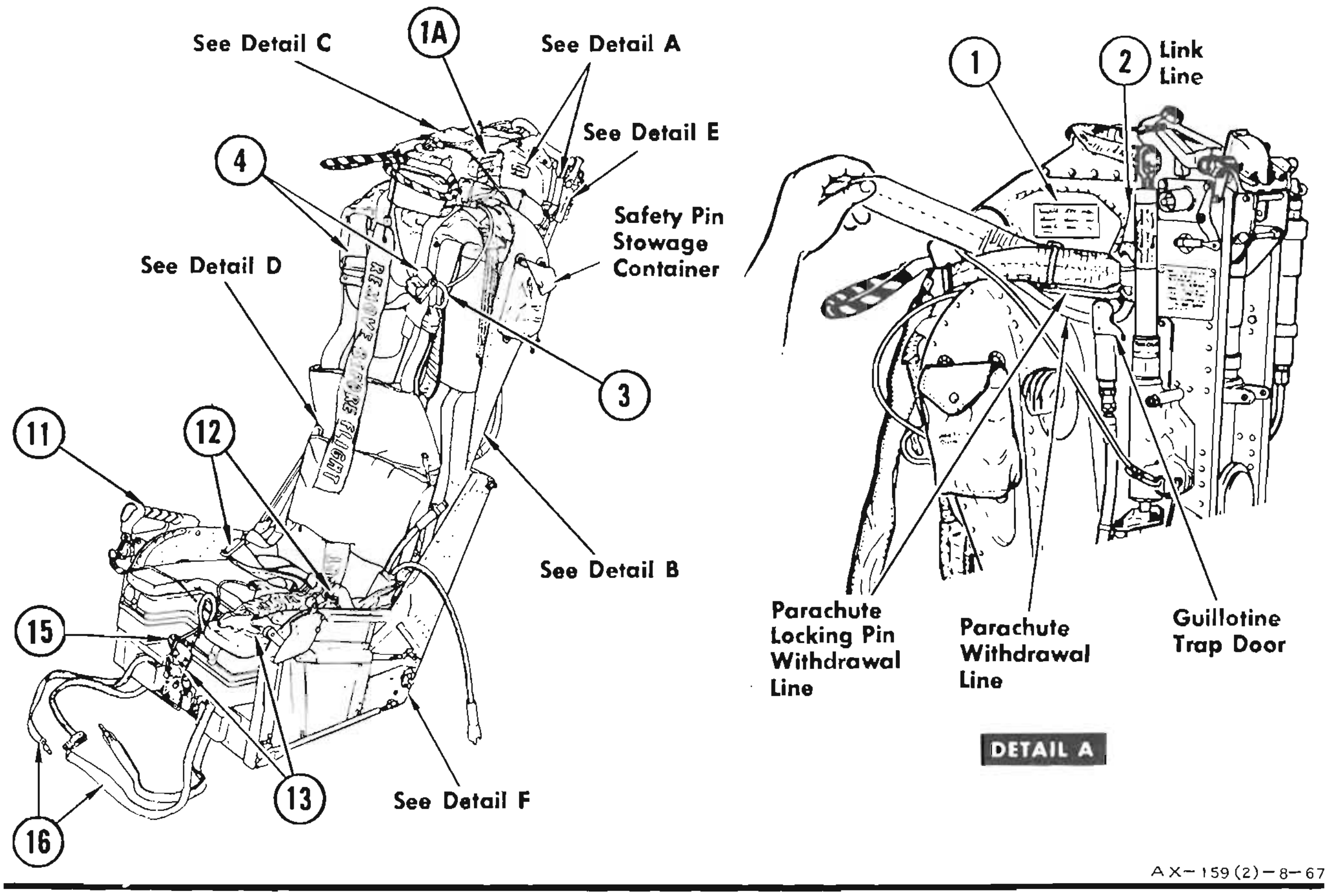


Figure 3-3A (Sheet 2)

MK-F7 EJECTION SYSTEM INSPECTION

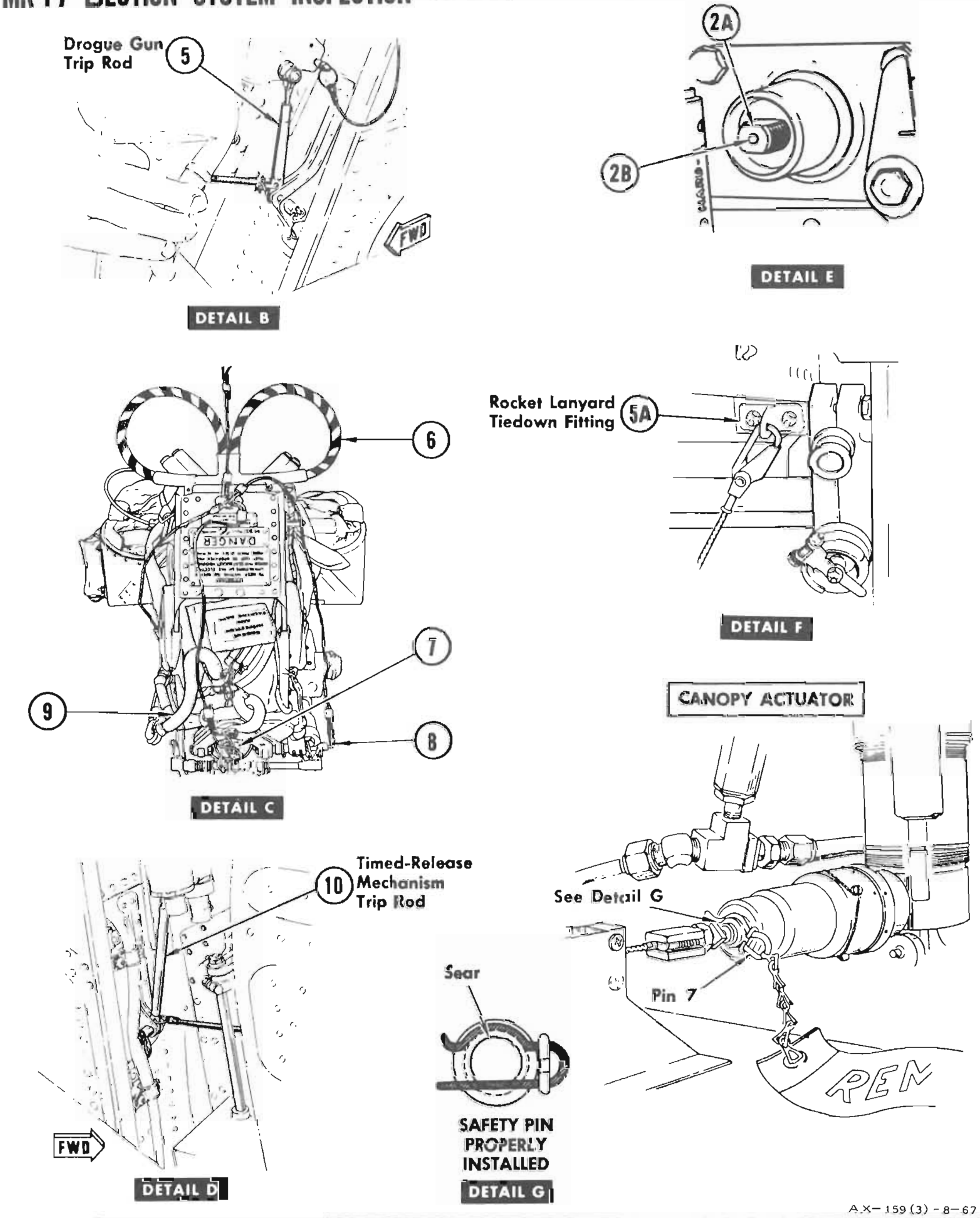


Figure 3-3A (Sheet 3)

MK-F7 EJECTION SYSTEM INSPECTION

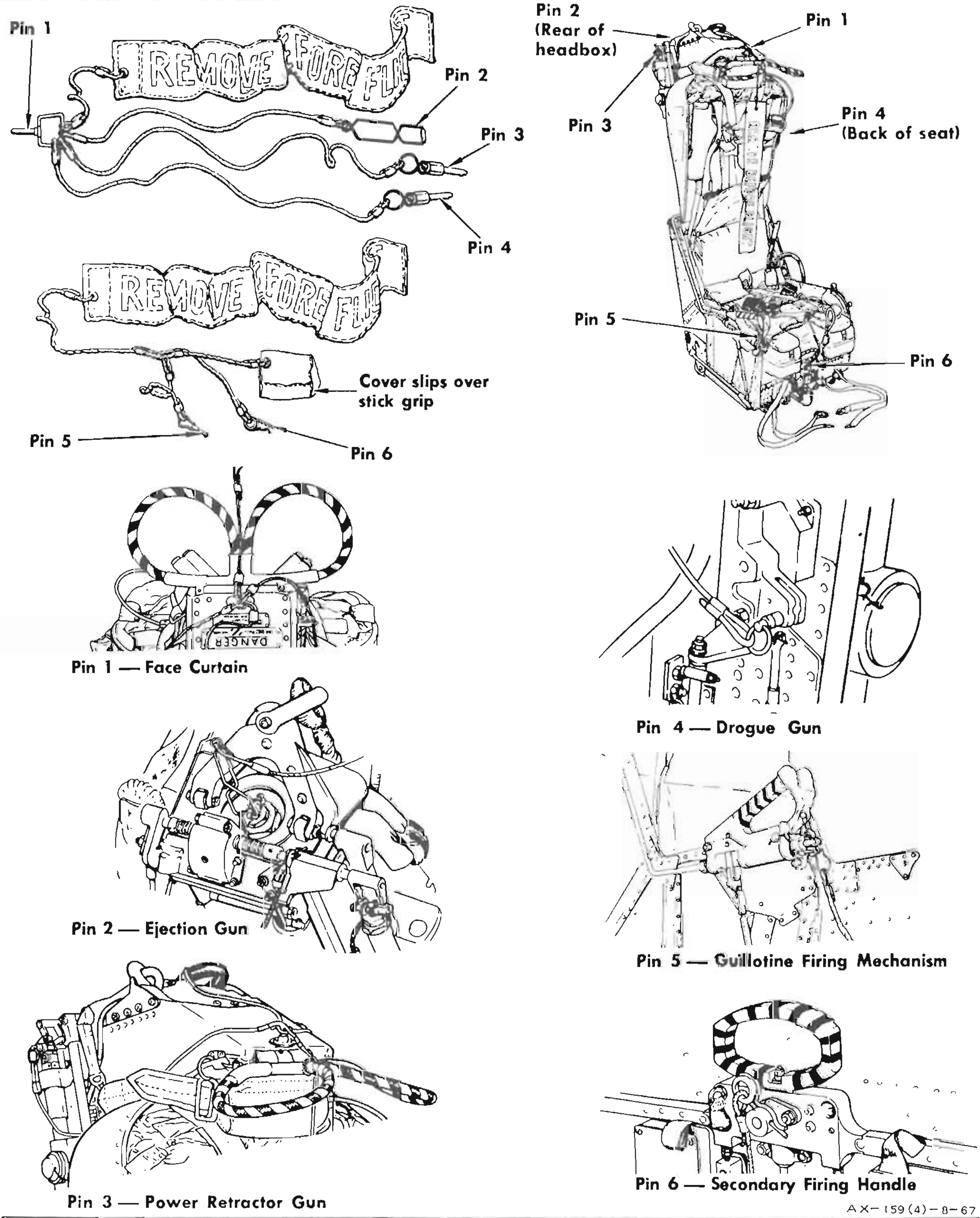


Figure 3–3A (Sheet 4)

25. Roll stabilization switch — OFF RESET
26. Emergency pitch trim handle — STOWED
27. Emergency power handle — STOWED
28. Autopilot master switch — OFF
29. Landing gear handle — WHLS DOWN
30. Emergency downlock release switch — OFF

Instrument Board

31. Inflight refueling probe switch — OFF
32. Radio altimeter — OFF
33. Duct bypass door switch — AUTO
34. Fuel dump switch — OFF
35. Fuel transfer switch — OFF
36. Armament selector switch — OFF
37. Mechanical fusing switch — SAFE
38. Master armament switch — OFF
39. Gun arming switch — SAFE
40. Selective jettison switch — OFF

Right Side

41. Arresting gear handle — HOOK UP
42. Engine anti-icing switch — OFF
43. Pitot heat switch — OFF
44. Master generator switch — OFF RESET
45. Emergency generator switch — OFF
46. Air-conditioning manual override switch — AUTO
47. Cockpit temperature knob — AS DESIRED
48. Cockpit pressure switch — CABIN PRESS
49. Rain removal switch — OFF
50. Defogger switch — OFF
51. Autopilot altitude hold switch — OFF
52. TACAN master switch — OFF
53. UHF function switch — OFF
54. IFF master switch — OFF
55. Cockpit emergency ventilation knob — CLOSED
56. Instrument and console lights — AS DESIRED

Stick Grip

57. Pitch trim knob — NEUTRAL
58. Roll trim knob — NEUTRAL
59. Radar control grip — LOCKED

STARTING ENGINE

Prestart Check

1. Starting equipment in position.
2. Fire guard standing by.
3. Danger areas (figure 1-68) clear.
4. External power — CONNECTED
   - Give plane captain one-finger signal. When signal is returned, place master generator switch to TEST.
5. Landing gear indicators — DOWN
   - If landing gear indicators do not show the gear down, a possible electrical malfunction exists. However, a down indication can usually be obtained by cycling the master generator switch between TEST and OFF several times.
   - Do not crank the engine until a positive down indication is received for all landing gear.
6. Main fuel shutoff valve — CHECK
   - Give the plane captain the drinking signal. When he is at the starboard wheel well, place the engine master switch ON.
   - Plane captain will check that the main fuel shutoff valve opens and will signify proper operation by a thumbs-up signal.
7. Pitot heat — CHECKED
8. Manual fuel control light — OFF
9. Fuel pump warning light — ON
10. Engine oil/hydraulic pressure warning light — ON
11. Fuel low level warning light — OFF (press to test)
12. Fire warning light — OFF (press to test)
13. Warning lights — PRESS TO TEST
    - Press to test any warning lights not illuminated

Starting Engine (Pilot Controlled)

1. External starting source — CONNECTED
   - Give the plane captain the two-finger signal. He will check with the GTC operator and will return the signal when ready for start.
2. Throttle — CRANK (momentarily)
   — IGNITE (at 5% rpm)
   — IDLE (at 12% rpm)
   - The ignition circuit remains energized for 30 to 40 seconds.
   - Ignition normally occurs within 3 seconds.
   - Acceleration to idle rpm is normally attained 40 to 45 seconds after throttle is placed in IDLE.
3. Engine instruments — CHECK
   - After placing the throttle in idle during engine start, the PC-1, PC-2, and utility hydraulic pressures will rise rapidly to operating pressures. The engine oil/hydraulic pressure warning light should remain on, since the oil pressure will still be below 34 psi (generally about 20 psi). If the light goes out as soon as the hydraulic system pressures are up and the oil pressure is still below 34 psi, a malfunctioning oil pressure switch is indicated.
   - Check EGT, oil pressure indicators, and tachometer for proper indication and that limitations are not exceeded.
4. External starting source — REMOVED
   - Starter air supply should automatically shut off between 46% and 53% engine rpm. When the engine reaches 40% to idle rpm, give the plane captain the two-finger unplug signal. The GTC will be disconnected.

5. External electrical power — DISCONNECTED
   - When the engine stabilizes at idle rpm and main generator indicator shows ON, turn master generator switch OFF.
   - Give the plane captain the one-finger unplug signal and ensure external electrical power disconnected.
6. Master generator switch — ON
7. Main generator indicator — ON
8. Attitude indicator — OFF not showing
9. Engine, fuel, and hydraulic warning lights — OFF
   - Fuel pump warning light — OFF
   - Fuel boost pumps warning light — OFF
   - Engine oil/hydraulic pressure warning light — OFF

CAUTION

If throttle is inadvertently retarded to OFF, do not advance throttle to regain light as a hot start or fire will result. Allow a 30-second fuel drainage period, purge engine, and repeat STARTING ENGINE procedure. Retard throttle to OFF immediately if engine flames out. The aircraft is down until the cause is determined.

Normally, no engine warmup is required. After the engine has stabilized to idle conditions, the throttle may be advanced to full power. At ambient temperatures below −35°C (−31°F), operate engine at idle for 2 to 5 minutes before making higher power settings.

10. Communications and navigation equipment — ON

Starting Engine (Ground Controlled)

The ground crew will notify the pilot that the start will be ground controlled before cranking is initiated. Give the two-finger signal for the ground crew to initiate cranking. Move the throttle to CRANK, to IGNITE at 5% rpm, and then follow the normal engine starting procedure.

When the start is ground controlled, automatic shutoff of the starter air supply will not occur. Give the two-finger unplug signal at 40% to idle rpm so the ground crew can shut off the starter air supply.

CAUTION

If throttle is inadvertently retarded to OFF, do not advance throttle to regain light as a hot start or fire will result. Allow a 30-second fuel drainage period, purge engine, and repeat STARTING ENGINE procedure. Retard throttle to OFF immediately if engine flames out. The aircraft is down until cause is determined.

Normally, no engine warmup period is required. After the engine has stabilized at idle, the throttle may be advanced to full power. At ambient temperatures below −35°C (−31°F), operate engine at idle for 2 to 5 minutes before making higher power settings.

UNSATISFACTORY ENGINE STARTS

Hot Start

If exhaust gas temperature exceeds 450° C but does not exceed 610° C during starting, check engine and starter system for cause of trouble before next starting attempt. If EGT exceeds 610° C during starting, engine should be checked for cause of trouble and possible damage. Perform PURGING ENGINE procedure before next starting attempt.

Aborted Start

If engine fails to ignite within 20 seconds after the throttle is placed in IDLE, place the throttle and master generator switch in OFF. The engine should be checked for cause of trouble. If necessary, perform PURGING ENGINE procedure before next starting attempt.

FALSE START OR HUNG START

If the engine ignites but engine speed remains below idle (68% to 70% rpm) and the exhaust gas temperature remains below 610° C, perform one of the following procedures:

Below 25% rpm:

1. Throttle — OFF
2. Master generator switch — OFF
3. Troubleshooting should be performed on the defective starter system.

Above 25% rpm:

1. Fuel control switch — MANUAL
2. Advance throttle slowly, if necessary, to obtain idle rpm.
3. Fuel control switch — NORMAL

CAUTION

After a false or hung start on the ground, a check should be performed to ensure that all excess fuel is drained out of the afterburner section. Fuel will leak out of the afterburner flanges and into the tail cone shroud and afterburner compartment. The shroud and afterburner section should be cleaned by flushing out fuel through drains in the tail and afterburner compartment. A check should then be made to ensure that no fuel remains that would cause an aft section fire during subsequent engine starting.

If false or hung starts persist, engine should be checked for cause of trouble.

PURGING ENGINE

To clear the engine of trapped fuel or vapors, the pneumatic starter is installed and the following operations performed:

Note

If strong tailwinds exist, it may be necessary to turn the airplane into the wind prior to purging the engine.

1. External electrical power — CONNECTED
2. Master generator switch — TEST
3. Throttle — OFF
4. Fuel control switch — NORMAL
5. Engine master switch — ON
6. When signal from ground crewman indicates that starter cart has reached proper load speed, place the throttle in CRANK momentarily.
7. In 15 to 20 seconds place master generator switch in OFF
8. Engine master switch — OFF

Note

Allow 30 seconds for fuel to drain before starting engine.
Operation of the integral starter is limited to 1 minute. After two unsuccessful starting cycles, a 15-minute cooling period is required before attempting a third start.

GROUND CHECKS

Note

For each 5 minutes of static ground operation, cycle wing and flight controls to prevent overheating of hydraulic fluid.

Initial Check

1. Boost pump pressure — CHECKED
   - Give plane captain the drinking signal. He will check the boost pump pressures and if satisfactory give a thumbs-up signal.
2. Fuel transfer switch — ON
   - Observe flicker of transfer pump caution light (flight instrument light rheostat must be OFF).
3. Fuel flow — CHECKED
   - Occasionally the fuel flow indication may appear abnormal for idle (more than a 1,000 pph error). This is usually a phase error in the gage and can be corrected as follows:
     a. After ensuring that the danger areas are clear, advance the throttle until the fuel flow needle has rotated clockwise to 0.
     b. Place master generator switch OFF.
     c. Retard throttle to IDLE and allow engine to stabilize.
     d. Place master generator switch ON.
     e. Check main generator indicator ON and attitude indicator off flag not showing.
     f. Fuel flow should now read normal. If not, repeat procedure.
4. Landing gear downlocks — REMOVED
   - The plane captain will display the three downlocks after removal.
5. Fuel quantity test switch — PRESS
   - Main and transfer fuel quantity indicators drop to zero, and return to original readings when released.
6. Hydraulic pressures — CHECKED, WARNING LIGHT OFF
   - All pressure gages read 3,000 (±200) psi.
7. Stab switches — OFF, lights ON
8. Stab switches — ON, lights OFF
9. Cockpit switches — AS DESIRED

Manual Fuel Switch Check

1. Throttle — IDLE
2. Fuel control switch — MANUAL
   - Modulate throttle to keep engine rpm between 65% and 74% to prevent the possibility of engine damage during acceleration.
3. Manual fuel control light — ON
4. Throttle — ADVANCE
   - Check for engine response.
5. Throttle — IDLE
6. Fuel control switch — NORMAL
7. Manual fuel control light — OFF

With Wing Down

Refer to section VII for information concerning hand signals.

1. Emergency pitch trim — CHECK
   - Raise the emergency pitch trim T-handle upon signal from the plane captain.
   - When directed, move the T-handle to obtain full UHT trim in each direction (both trim channels must be utilized to obtain full throw).
   - Monitor the nose trim indicator for movement in the proper direction.
   - Zero the trim and stow the T-handle.
   - After the T-handle is stowed, check the nose trim indicator for a value equal to the stick pitch trim knob setting plus 5°.
2. Control surfaces — CYCLE
   - On signal from the plane captain, "wipe out the cockpit" with the control stick.
   - Follow a rectangular pattern and ensure that the stick contacts all lateral and longitudinal stops.
   - The plane captain will ensure that all controls move properly.

Note

If control binding occurs, maintain the binding position and notify maintenance personnel. Do not release control pressure, change configuration, or shut down until a thorough inspection has been made.

3. Aileron-rudder interconnect — CHECK
   - Apply full aileron in each direction while holding rudder pedals neutral.
   - Check that rudder neutral light flashes as ailerons are moved.
   - The plane captain will check rudder deflection in a direction opposite to aileron movement.
4. Cruise droop operation — CHECK
   - Check the leading edge droop indicator UP.
   - On signal from the plane captain, place cruise droop switch DOWN.
   - Observe droop movement and check leading edge droop indicator DOWN.
   - Leave the cruise droop switch in the DOWN position.
5. Autopilot — CHECK
   - Engage autopilot and check for normal operation.
   - Turn off the roll stab switch and check that the autopilot disengages and the autopilot light goes out. Return the roll stab switch to ON and reengage the autopilot. Raise the emergency pitch trim handle and check that the autopilot disengages and the autopilot light goes out. Stow the handle and reengage the autopilot. As the wing is raised, check that the autopilot disengages and the autopilot light goes out.
6. Wing — RAISE
   - On signal from the plane captain, unlock the wing and try to place the wing incidence handle to the UP position without first depressing the release switch. Do not use excessive force.

WARNING

If the wing incidence handle moves, down the aircraft. There should be no forces opposing the movement of the wing incidence handle when the button is depressed, nor should there be any forces which would tend to move the handle unassisted when it is out of either detent. If any such forces are noted, the proper rigging and condition of the incidence control cable should be investigated.

   - Depress the release switch and move the wing incidence handle to UP.
   - Observe that the leading edge droop, flaps, and horizontal tail move to the landing condition.
   - Check that the nose trim indicator has automatically corrected to a value corresponding to that of the stick pitch trim knob.
   - Place hands outside the cockpit and have the plane captain check the wing well for leaks, damage, or foreign objects.

With Wing Up

7. Angle of attack system — CHECK
   - Move transducer vane (RH side of fuselage, just aft of emergency vent door) through entire range, noting operation of the angle-of-attack indicator and indexer. Cross-check indexer and indicator within the approach range (figure 1–14)
8. Control surfaces — CYCLE
   - On signal from the plane captain, cycle the control surfaces.
   - Check that the clean condition stops have disengaged.
9. Aileron-rudder interconnect — CHECK
   - Apply full aileron in each direction while holding rudder pedals neutral.
   - Rudder should not move from neutral.
10. Rudder trim — CHECK
    - On signal from the plane captain, rotate the rudder trim knob full left, full right, then to zero.
    - Check that the rudder neutral trim light is on.
11. Aileron trim — CHECK
    - On signal from the plane captain, rotate the roll trim knob full left, full right, then to zero.
    - Check action of ailerons and that the aileron neutral trim light is on when trim is at zero
12. Normal pitch trim — CHECK
    - On signal from the plane captain, rotate the pitch trim knob to obtain full nose-down trim, full nose-up trim, and then to zero. Plane captain will visually check each UHT for zero trim position.
    - Numerical values of the nose trim indicator should closely correspond to the values of the stick pitch trim knob.
13. Viscous damper — CHECK
    - On signal from the plane captain, push the control stick fully forward. When released, the stick should reposition smoothly to its original position.
    - Repeat the check, releasing the stick from the full aft position.
    - If the stick snaps back, or overshoots its original position, down the aircraft.
14. Exhaust nozzle — CHECK
    - The plane captain will assume a position to the rear of the aircraft.
    - On signal, advance the throttle briefly to a maximum of 75% rpm and return it to IDLE.
    - The plane captain will confirm proper exhaust nozzle operation.
15. Brakes — CHECK
    - On release brake signal from plane captain, pump brake pedals and release.

- Plane captain will check the brake discs for freedom of movement.

16. Arresting hook — CHECK
    - On signal from plane captain, place arresting hook handle in HOOK DOWN.
    - Place arresting hook handle in HOOK UP when cleared by plane captain.
    - Observe arresting hook warning light for proper operation.
17. Inflight refueling probe — CHECK BY CYCLING IF USE IS CONTEMPLATED
    - On signal from the plane captain, extend the probe.
    - Check probe out light on.
    - The plane captain will inspect the probe for integrity and for proper operation.
    - Retract the probe on signal from the plane captain and hold the probe switch IN for 5 seconds after the probe out light goes off.
    - Check probe out light off.
18. Wing — FOLDED (if necessary)
    - Turn the roll stab switch off and center the control stick.
    - Pull wingfold lock lever up and back until it engages the detent.
    - Raise the wingfold lever to fold the outer wing panels.
    - Do not taxi long distances with the wing panels folded.
    - Never actuate any of the wingfold controls without utility hydraulic pressure.
19. Wing — SPREAD AND LOCKED
    - Turn the roll stab switch off and center the control stick.
    - Place wingfold lever down to spread outer wing panels.
    - Place wingfold lock lever down to lock the hinge pins.

WARNING

If wingfold lock lever springs back during operation or an excessive force is required to move the lever to the lock position, down the aircraft. The wingfold lock system must be checked for proper operation and rigging before flight.

- Plane captain will check that red warning flags are retracted and visually check that the hinge pins are locked.

20. Canopy — CLOSE, LOCK, STOW HANDLE
    - Turn cockpit pressurization and defog off.
    - Pull canopy down and hold with left hand.
    - Actuate canopy locking handle full aft, then full forward, making certain that full travel has been achieved (over center).
    - Check canopy lock indicator for locked indication.
    - Stow locking handle.
    - Turn on cockpit pressurization.
21. Oxygen — CHECK

TAXI AND TAKEOFF

TAXIING

1. Fuel control switch — NORMAL
    - Do not taxi with the fuel control switch in MANUAL.
2. Throttle — 70% to 80% rpm
    - Clear area fore and aft before adding power.
    - The aircraft will normally move at 70% rpm with the brakes released.
3. Brakes — RELEASE
4. Throttle — AS DESIRED
    - Idle power should be adequate for normal operation.
    - Do not ride the brakes or use excessive differential braking during normal taxi.
    - If the aircraft tends to pull laterally in one direction, return to the line.
    - Do not taxi with the canopy open at airspeeds greater than 60 KIAS. When opening canopy, manually restrain to prevent combination of rotational velocity and air loads from shearing canopy actuator rod end shear pin.
5. Nose gear steering — CHECK
    - Neutralize the rudder pedals before depressing the nose gear steering switch or the nosewheel will be abruptly displaced in the direction of rudder deflection.
    - If the aircraft turns with nose gear steering engaged and the rudder pedals in neutral, return to the line.
    - Steering will disengage above 60° angle of deflection. Brakes and power will be required to bring the nosewheel within the controlled steering limits.
    - If steering is sluggish, cycle the rudder pedals or make gentle S turns to build up accumulator pressure.
6. Magnetic compass — CHECK
    - Check for indication of proper direction and for freedom of movement.

7. Turn and bank indicator — CHECK
   - Check that needle moves in the direction of turn and that the ball is free in the race.

TAKEOFF

Refer to section XI for takeoff distances and speeds required at varying gross weights, temperatures, and field elevations. Maximum thrust (CRT) is recommended for takeoffs at gross weights in excess of 30,000 pounds or if more than 10,000 feet of runway would be required using military thrust.

Instrument Checklist

1. Altimeter — SET
2. Radio altimeter — ON
   - Allow at least 12 minutes warmup time to ensure final accuracy.
3. Airspeed indicator — ZERO
4. Vertical speed — ZERO
5. Gyro horizon — ERECT AND SET
6. Clock — RUNNING AND SET
7. MA-1 compass — SET
   - Check that white synchronizing bar moves to the left with counterclockwise rotation of compass setting knob and to the right with clockwise rotation.
8. TACAN — ON
9. Course indicator — SET AS DESIRED
10. ADF — CHECK
11. IFF/SIF — AS DESIRED
12. Pitot heat — ON
13. Engine anti-ice — AS REQUIRED
14. Rain removal — AS REQUIRED
15. Engine pressure ratio indicator — SET
    - Set the EPR indicator counter to the minimum acceptable value for existing ambient temperature (figures 3–4 and 3–5).

Takeoff Checklist

The takeoff checklist will be completed prior to takeoff. Figure 3–6 presents the short, cockpit-mounted checklist.

1. Fuel — CHECKED
   - Check for proper quantity in the main and transfer systems.
   - Check fuel transfer switch ON.
   - Check fuel control switch NORMAL and manual fuel control light out.

THRUST CHECK DATA — J57-P-20

°F	MINIMUM PRESSURE RATIO	°C	°F	MINIMUM PRESSURE RATIO	°C
−38	2.86	−38.9	40	2.48	4.4
−36	2.85	−37.8	42	2.47	5.6
−34	2.84	−36.7	44	2.46	6.7
−32	2.83	−35.5	46	2.45	7.8
−30	2.82	−34.4	48	2.44	8.9
−28	2.81	−33.3	50	2.43	10.0
−26	2.80	−32.2	52	2.42	11.1
−24	2.79	−31.1	54	2.41	12.2
−22	2.78	−30.0	56	2.40	13.3
−20	2.77	−28.9	58	2.39	14.4
−18	2.76	−27.7	60	2.38	15.6
−16	2.75	−26.6	62	2.37	16.7
−14	2.74	−25.5	64	2.36	17.8
−12	2.73	−24.4	66	2.35	18.9
−10	2.73	−23.3	68	2.34	20.0
−8	2.72	−22.2	70	2.33	21.1
−6	2.71	−21.1	72	2.32	22.2
−4	2.70	−20.0	74	2.31	23.3
−2	2.69	−18.8	76	2.30	24.4
			78	2.29	25.6
0	2.68	−17.8			
			80	2.28	26.7
2	2.67	−16.7	82	2.27	27.8
4	2.66	−15.6	84	2.26	28.9
6	2.65	−14.4	86	2.24	30.0
8	2.64	−13.3	88	2.23	31.1
10	2.63	−12.2	90	2.22	32.2
12	2.62	−11.1	92	2.21	33.3
14	2.61	−10.0	94	2.20	34.4
16	2.60	−8.9	96	2.19	35.6
18	2.59	−7.8	98	2.18	36.7
20	2.58	−6.7	100	2.17	37.8
22	2.57	−5.6	102	2.16	38.9
24	2.56	−4.4	104	2.15	40.0
26	2.55	−3.3	106	2.14	41.1
28	2.54	−2.2	108	2.13	42.2
30	2.53	−1.1	110	2.12	43.3
32	2.52	0	112	2.11	44.4
34	2.51	1.1	114	2.10	45.6
36	2.50	2.2	116	2.09	46.7
38	2.49	3.3	118	2.07	47.8

AX-64-1-67

Figure 3–4

THRUST CHECK DATA — J57-P-20A

°F	MINIMUM PRESSURE RATIO	°C
-38	2.99	-38.9
-36	2.98	-37.8
-34	2.97	-36.7
-32	2.97	-35.5
-30	2.96	-34.4
-28	2.95	-33.3
-26	2.94	-32.2
-24	2.93	-31.1
-22	2.92	-30.0
-20	2.91	-28.9
-18	2.90	-27.7
-16	2.89	-26.6
-14	2.88	-25.5
-12	2.86	-24.4
-10	2.85	-23.3
-8	2.84	-22.2
-6	2.84	-21.1
-4	2.83	-20.0
-2	2.82	-18.8
0	2.81	-17.8
2	2.80	-16.7
4	2.79	-15.6
6	2.77	-14.4
8	2.76	-13.3
10	2.75	-12.2
12	2.74	-11.1
14	2.73	-10.0
16	2.72	-8.9
18	2.71	-7.8
20	2.70	-6.7
22	2.69	-5.6
24	2.68	-4.4
26	2.67	-3.3
28	2.66	-2.2
30	2.65	-1.1
32	2.64	0
34	2.63	1.1
36	2.62	2.2
38	2.61	3.3

°F	MINIMUM PRESSURE RATIO	°C
40	2.60	4.4
42	2.58	5.6
44	2.57	6.7
46	2.56	7.8
48	2.55	8.9
50	2.54	10.0
52	2.53	11.1
54	2.52	12.2
56	2.51	13.3
58	2.50	14.4
60	2.48	15.6
62	2.47	16.7
64	2.46	17.8
66	2.45	18.9
68	2.44	20.0
70	2.43	21.1
72	2.42	22.2
74	2.41	23.3
76	2.40	24.4
78	2.39	25.6
80	2.38	26.7
82	2.37	27.8
84	2.36	28.9
86	2.35	30.0
88	2.34	31.1
90	2.33	32.2
92	2.32	33.3
94	2.31	34.4
96	2.29	35.6
98	2.28	36.7
100	2.27	37.8
102	2.26	38.9
104	2.25	40.0
106	2.24	41.1
108	2.23	42.2
110	2.22	43.3
112	2.21	44.4
114	2.20	45.6
116	2.19	46.7
118	2.18	47.8

AX-65-1-67

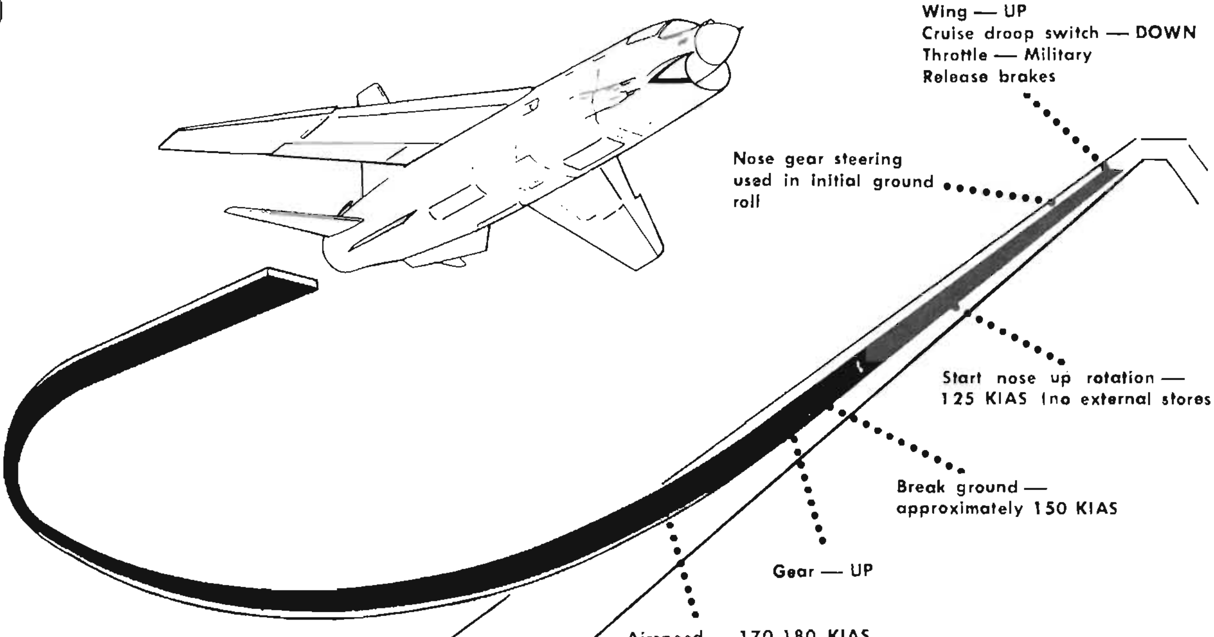
Figure 3-5

2. Wing — SPREAD AND LOCKED
   - Visually check that wings are spread.
   - Check wingfold lock lever down.
3. Wing — RAISED
   - Check wing incidence handle up.
   - Visually check that the wing is raised and that the landing droop is extended.
   - Check wing-wheels-droop warning light OFF.
   - Check cruise droop selected.
4. Yaw and roll stab lights — OFF
   - Check stabilization switches ON, lights off.
5. Trim — SET FOR TAKEOFF
   - Set pitch trim 0° to 3° nose up (1° nose up for CRT takeoff), rudder and aileron trim neutral.
   - Check trim neutral lights on.
6. Speed brake — RETRACTED
   - Check speed brake switch UP and light off.
7. Harness — LOCKED, ALL SAFETY PINS REMOVED
   - Check shoulder harness lock lever locked in the forward position.
   - Strain against the harness to ensure that it is locked.
8. Compass — SET

TAKEOFF CHECKLIST
(COCKPIT MOUNTED)

Figure 3-6

TAKEOFF (TYPICAL)



NOTE

Speeds are for military thrust takeoff at gross weight of 28,000 pounds. At takeoff gross weights greater than 28,000 pounds, increase wing lowering speed approximately 3 knots for each additional 1,000 pounds. Refer to section XI for additional data at other gross weights.

WARNING

The gear must be retracted and the wing must be down and locked before reaching 220 KIAS.

AX-67-1-67

Figure 3-7

9. Canopy — CLOSED, LOCKED, HANDLE STOWED, GUST LOCK REMOVED
   - Check canopy fully closed with locking handle in full forward position and stowed.
   - Check canopy gust lock removed and stowed.
10. Cockpit pressurization — ON
11. Anticollision lights — ON
12. Antiexposure coverall ventilation switch — NORM CABIN PRESS

WARNING

A small pilot utilizing the MK-F7 ejection seat should raise the seat as high as practical while on the ground and in the traffic pattern. This is to ensure a favorable ejection seat center-of-gravity position. In the somewhat unlikely event that a small pilot had the seat fully lowered and was forced to eject at close to zero-zero conditions, a safe ejection could be jeopardized due to unfavorable seat cg position.

12A. With the MK-F7 ejection seat installation, small pilots should raise the seat to the highest position practical.
   - The seat can be lowered after takeoff if desired.

13. Continuous engine ignition switch — ON
   - Place switch ON just before advancing throttle for power check.

Takeoff (MRT/CRT)

Refer to figure 3-7 for illustration of typical takeoff.

1. Throttle — MILITARY
   - Advance throttle to MILITARY
   - If brakes do not hold, return to the line.

2. Engine instruments — CHECK
   - Check engine oil pressure and EGT for indications within limits.
   - Check that the engine pressure ratio equals or exceeds the preset value. If it does not, the engine is not acceptable for flight.
   - Check engine speed within limits. If 106.3% rpm is exceeded, return to the line. If 106.3% rpm is exceeded during or after takeoff, reduce thrust to the minimum acceptable for flight, and land as soon as practicable.
   - Check hydraulic pressures within limits.

3. Brakes — RELEASE
   - Release brakes and nose gear steering if engaged. Nose gear steering should not be engaged during any portion of the takeoff roll except in an emergency situation.
   - For afterburner takeoffs, move throttle sharply to the outboard detent after releasing brakes. A noticeable increase in thrust and acceleration will occur as the afterburner ignites. Abort the takeoff if the afterburner fails to ignite. A rapid pressure ratio rise without subsequent decrease, and rapid rise in exhaust temperature accompanied by a decrease of 4% rpm indicates that the exhaust nozzle flaps have failed to open. Stop afterburning immediately.
   - Maintain directional control with differential braking until the rudder becomes effective (approximately 60 KIAS)
   - At 125 KIAS (no external stores), ease the nose wheel off the runway to establish takeoff attitude. Refer to section XI for takeoffs with external stores.
   - The aircraft will become airborne at approximately 150 KIAS.
4. Landing gear — RETRACT
   - After a positive climb has been established, move the landing gear handle to WHLS UP. Check the landing gear position indicators UP and the warning light in the gear handle out.
   - Do not hold the nose gear steering switch depressed while retracting the gear. If the nose gear fails to retract fully, lower the landing gear and depress the nose gear steering switch to center the nosewheel. Release the switch and move the landing gear handle to WHLS UP.
   - Do not exceed 220 KIAS until the landing gear is up and locked.
   - If hot brakes are suspected, leave the landing gear down for 5 minutes to allow the wheel assembly to cool.
5. Wing — LOWER AND LOCK
   - Lower the wing at a minimum altitude of 100 feet (200 feet during FAM stage) in a positive climb at 170 to 180 KIAS. Increase lowering speed approximately 3 knots for each 1,000 pounds in excess of 28,000 pounds.
   - Depress the wing incidence release switch.
   - Place the wing incidence handle DN.
   - Observe wing transition to full down and that the landing droop retracts.
   - Actuate the wing downlock handle to LOCK and note that the wing-wheels-droop warning light goes out. Do not force the downlock handle forward. Wait until it moves easily. If the handle cannot be placed in LOCK, or the wing-wheels-droop light remains on, recycle the wing.
   - Do not exceed 220 KIAS until the wing is down and locked.

ALLOWABLE CROSSWINDS FOR TAKEOFF AND LANDING

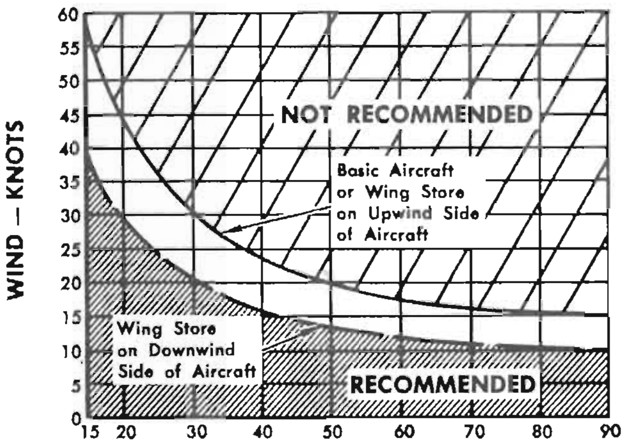


Figure 3–8

   - Wing transition will require very little stick movement if proper trim is used for takeoff.
6. Droop indicator — NO BARBERPOLE
   - If indicator shows the droop unlocked (barberpole), do not exceed 300 KIAS or an acceleration range of 0 to 3.5 g.
7. Fuel transfer switch — ON
   - Check fuel transfer switch ON and note pump light is out.
   - Observe that main fuel gage holds between 2,200 and 3,100 pounds during fuel transfer.

Crosswind Takeoff (MRT/CRT)

Refer to figure 3–8 for allowable crosswinds for takeoff. The allowable crosswinds are reduced when carrying a heavy asymmetric wing store on the downwind side of the aircraft because of aileron trim requirements.

The aircraft tends to roll into the downwind wing and turn into the wind because of the narrow wheel tread and high vertical fin. However, the ailerons become effective at low speed and are effective in reducing the heel angle.

During takeoff, oppose rolling tendency with aileron, while maintaining directional control with the brakes until the rudder becomes effective. In extreme crosswinds, keep the nosewheel on the runway until flying speed (approximately 150 KIAS) is obtained; then lift the aircraft from the runway. This technique decreases the lift generated while on the runway, minimizing the tendency of the aircraft to drift laterally.

Whenever practical, takeoffs under substantial crosswind conditions should be individual rather than section.

Formation Takeoffs (MRT/CRT)

Formations will normally take off in two-aircraft sections. If a flight of four aircraft is involved, the second section will delay the takeoff roll until the first section becomes airborne. Should either aircraft of a section abort, a radio transmission will be made stating "——(call sign) aborting." The other aircraft will continue the takeoff unless the abort occurs early in the takeoff roll.

The section leader will line up on the downwind side of the runway. The wingman will form in echelon with a wingtip separation of approximately 10 feet which will be maintained throughout takeoff.

When both aircraft are in position, the leader will give a two-finger signal to complete the takeoff checklist and the engine turnup. When these checks are completed, each pilot will visually check the exterior of the other's aircraft. A thumbs-up signal will be given when ready for takeoff.

After receiving the thumbs-up signal from the wingman, the leader will decrease rpm 1% and raise his hand to a vertical position. To commence takeoff roll, the leader will simultaneously drop his hand and release the brakes. If afterburner is to be used, it will be selected by both pilots when the leader turns his head smartly to the left. Minor adjustments to power setting may be made by the leader to compensate for mismatched aircraft.

During the takeoff, the leader will monitor the progress of the wingman. When both aircraft are definitely airborne, the leader will retract his landing gear without signaling. When the leader observes the wingman's gear retracted, he will place his head against the headrest as the preparatory signal for lowering the wing. Both pilots will lower the wing when the leader nods his head smartly forward. Afterburner, if used, will be deselected simultaneously by both pilots when the leader nods his head smartly to the right.

Scramble Takeoffs

Aircraft scrambles will generally occur under varying conditions of radio silence.

When assuming an alert posture that may result in actual launching of the aircraft, conduct the normal preflight, start and poststart checks. If practicable, conduct radio checks with the controlling agencies and the other aircraft of the flight. Check radar operation, observing ground radiation safety precautions. Shut down the engine, but leave the aircraft as ready for flight as possible. Check that ground equipment is positioned to provide for rapid removal during scramble.

If the radio is being monitored to receive the scramble order, observe the ground operating limitations (section I, part 2).

When the scramble order is received, restart the engine and ensure that all gear downlocks and safety pins are removed. When ground crew and equipment are clear, taxi expeditiously, but safely. Energize all electrical and electronic equipment.

Complete the takeoff checklist and the engine turnup check before takeoff.

CLIMB, CRUISE AND DESCENT

CLIMB

Refer to section XI for climb speed schedules, distances covered during climb, and climb rates.

Climbs are initiated with the aircraft in a clean or cruise droop condition. If climb is initiated in clean condition, select cruise droop as airspeed drops below 300 KIAS.

If afterburner is used for takeoff and a CRT climb is to be made, establish a steady-state climb of 450 KIAS until intercepting 0.92 IMN. If an MRT climb is desired, secure the afterburner at a minimum airspeed of 300 KIAS and establish a steady-state climb of 350 KIAS until intercepting the climb schedule, During the climb, it may be necessary to modulate the throttle to maintain operation within exhaust gas temperature limits.

CRUISE

Refer to section IV, part 2, for a description of flight characteristics, to section I, part 2 for fuel management information, and to section XI for cruise data.

DESCENT

Refer to section XI for time, fuel, distance and rate of descent data for both maximum range and constant speed descents and to section IV for dive recovery information.

Before Descent Checklist

1. Altimeter — SET
2. Defogger switch — DEFOG
   - To avoid fogging during rapid descent, place defogger switch to DEFOG at least 5 minutes prior to descent.
3. Cockpit temperature — AS DESIRED
4. Pitot heat — ENSURE ON
5. Engine anti-ice — AS REQUIRED
6. Fuel — QUANTITY CHECKED
7. Autopilot — AS REQUIRED

LANDING CHECKLIST (COCKPIT MOUNTED)

Figure 3–9

Before Entering Traffic Pattern

1. Speed brake override switch — NORMAL
2. Shoulder harness — LOCKED

WARNING

A small pilot utilizing the MK-F7 ejection seat should raise the seat as high as practical while on the ground and in the traffic pattern. This is to ensure a favorable ejection seat center-of-gravity position. In the somewhat unlikely event that a small pilot had the seat fully lowered and was forced to eject at close to zero-zero conditions, a safe ejection could be jeopardized due to unfavorable seat cg position.

2A. With the MK-F7 ejection seat installation, small pilots should raise the seat to the highest position practical.

3. Fuel — QUANTITY CHECKED
4. Cruise droop — OUT
5. Armament switches — OFF
6. Radar power switch — NORMAL
7. Radar mode switch — IR
8. Radar range selector switch — 60 MILES

TRAFFIC PATTERN AND LANDING

TRAFFIC PATTERN

Refer to section I, part 4 for maximum recommended landing gross weights.

Enter the traffic pattern in a clean condition with cruise droop extended. At 250 KIAS (minimum) to 350 KIAS, execute a level break. Perform cockpit check (cockpit mounted checklist presented in figure 3-9) as follows:

WARNING

To avoid inadvertent engine shutdown, maintain inboard pressure on the throttle when reducing the throttle toward idle.

1. Throttle — 75% MINIMUM RPM
2. Speed brake — AS REQUIRED
3. Landing gear — DOWN
   - At 220 KIAS, move the landing gear handle to WHLS DOWN.
   - Check indicators down and the warning light in the gear handle off.
4. Speed brake switch — IN
   - Check that the speed brake light goes out.
5. Wing — RAISE
   - Raise the wing after lowering gear.
   - Unlock the wing downlock handle.
   - Depress the wing incidence release switch.
   - Move the wing incidence handle up.
   - Check the wing-wheels-droop warning light — OFF.
6. Leading edge droop — CHECK FULL DOWN
   - Visually check droop in landing condition.
   - Check droop indicator DN.
7. Arresting hook — AS REQUIRED
   - If hook is to be used for an arrested landing, check that the hook warning light is out.
8. Hook bypass switch — AS REQUIRED
   - For unarrested landings, place the hook bypass switch in FIELD to prevent approach lights from flashing due to retracted hook.
9. Continuous engine ignition — ON

FIELD LANDING

See figure 3–10 for typical field landing pattern. Refer to section XI for landing speeds and ground roll distances. Permissible acceleration range in the landing configuration is 0 to 2.0 g.

When making familiarization landings, use center-of-gravity loadings forward of 32% (refer to Handbook of Weight and Balance) and do not attempt to closely control the point of touchdown. Enter the downwind leg of the traffic pattern for final landing with a minimum of 1,000 pounds of fuel remaining.

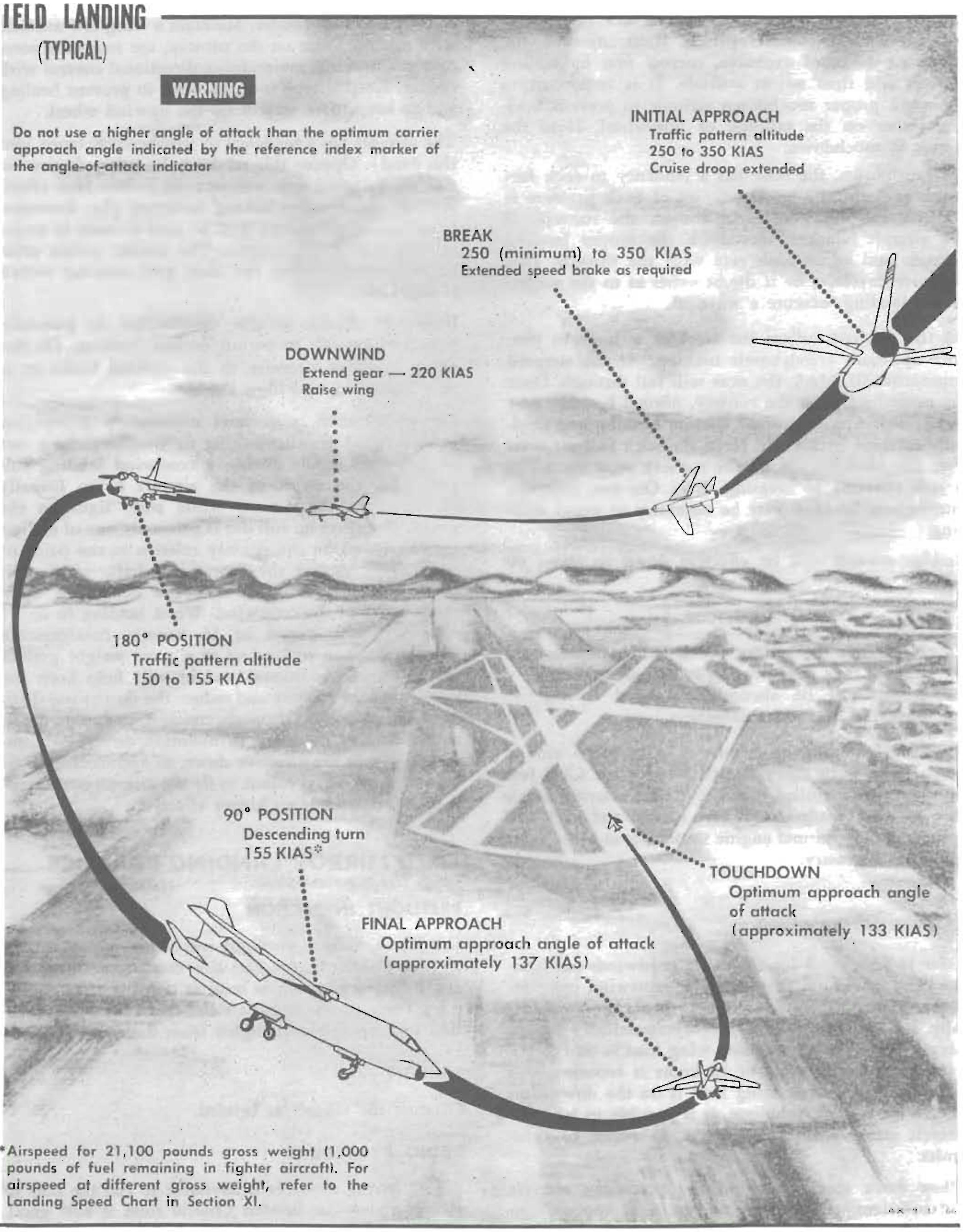
At the 180° position, the aircraft should be wings level, 145 to 150 KIAS, with sufficient power to maintain altitude and airspeed. Adjust the 180° position to permit approximately ¾ mile of straightaway on the final approach. Plan the turn from the 180° position to reach the 90° position at 500 feet above field elevation, with the angle-of-attack indexer circle (donut) illuminated and the power at approximately 85%. Check the cockpit emergency ventilation port closed to obtain accurate readings from the angle-of-attack indicating system.

If a mirror is available on the landing runway, fly a standard FMLP approach from the 90° position to touchdown. If no mirror is available, set up a power-on rate of descent with the angle-of-attack indexer indicating a circle (donut), and aim for a touchdown

FIELD LANDING
(TYPICAL)

WARNING

Do not use a higher angle of attack than the optimum carrier approach angle indicated by the reference index marker of the angle-of-attack indicator



*Airspeed for 21,100 pounds gross weight (1,000 pounds of fuel remaining in fighter aircraft). For airspeed at different gross weight, refer to the Landing Speed Chart in Section XI.

Figure 3–10

point 500 to 700 feet beyond the runway threshold. Use the throttle primarily to control rate of descent, and the stick to control attitude. If, at any time, the sink rate becomes excessive, correct first by adding power, and then adjust attitude. It is important to maintain proper touchdown attitude to prevent landing either on the tailpipe or nosewheel. Hold the donut to touchdown.

On touchdown, the nose has a tendency to rock forward, and unless a small amount of back pressure is applied, the nosewheel will contact the runway. If the aircraft bounces, reestablish the proper landing attitude and adjust sink rate with the throttle. If a porpoise develops, or if doubt exists as to the success of the landing, execute a wave-off.

On the roll out, adjust the fuselage attitude to produce optimum aerodynamic braking. As the airspeed approaches 90 KIAS, the nose will fall through. Once the nosewheel is on the runway, normal braking may be applied. Apply constant friction braking and gradually increase back stick. Keep the stick full aft even after the nosewheel is on the runway since the UHT is still effective in creating drag. On wet runways, intermittent braking may be necessary to avoid skidding.

Rudder control will be effective down to about 60 KIAS.

CAUTION

> Neutralize the rudder pedals before depressing the nose gear steering switch or the nosewheel will be abruptly displaced in the direction of rudder deflection.

At normal landing gross weight, elect to go around when speed is in excess of 105 KIAS with 4,000 feet of runway remaining. Failure of the exhaust nozzle to open may result in excessive runout and high taxi speed. Employ normal engine shutdown to avoid these effects, if necessary.

CROSSWIND LANDING

Refer to figure 3–8 for allowable crosswinds for landing. The maximum perpendicular crosswind component recommended for landing is 15 knots for symmetrically loaded aircraft and for asymmetrically loaded aircraft when the asymmetric wing load is on the upwind side. A maximum of 10 knots is recommended when the asymmetric wing load is on the downwind side. With proper technique, it is possible to land the aircraft safely with a component in excess of these limits.

Allow extra spacing behind the preceding aircraft and sufficient straightaway on the final approach to establish a stable crab/wing low approach. Maintain normal approach speed, and line up so that touchdown will be on the upwind side of the runway.

Just before touchdown, align the aircraft with the runway by using rudder. Maintain a wing low attitude with aileron. Once on the runway, use moderate aerodynamic braking, maintaining directional control with rudder. Keep aileron into the wind to prevent heeling and to keep more weight on the upwind wheel.

The aircraft has a tendency to weathercock (turn into the wind). Oppose this tendency by using downwind rudder. As speed decreases and the rudder loses effectiveness, the weathercocking tendency also decreases. Nose gear steering may then be used to assist in maintaining directional control. The rudder pedals must be neutralized before the nose gear steering switch is depressed.

Below 80 KIAS, weight distribution is generally equalized enough to permit normal braking. Do not apply excessive pressure to the upwind brake or it may lock, skid, and blow the tire.

Downwind drift, sometimes erroneously interpreted as downwind weathercocking or weathercocking out of the wind occurs during a crosswind landing roll out. It is the result of the aircraft being literally blown across the runway while still "light on the gear." The effect on roll out is primarily one of ending up downwind on the runway relative to the point of touchdown. Accept the downwind drift, which will occur to a greater or lesser extent depending upon the severity of the crosswind. When landing in severe crosswinds (in excess of 15 knots), consideration should be given to landing at a gross weight greater than normal. Additional weight will help keep the aircraft on the runway and reduce the downwind drift. When the nose falls through, continue to apply aileron and rudder as necessary to maintain directional control. Ailerons are effective down to approximately 60 KIAS. Above all, continue to fly the aircraft until aerodynamic control is no longer effective.

FIELD MIRROR LANDING PRACTICE

PREFLIGHT INSPECTION

Conduct a normal preflight inspection and give special attention to strut and tire condition. Check the angle-of-attack system as soon as possible after engine start. Place the hook bypass switch in the FIELD position to keep approach lights from flashing.

TAKEOFF

Conduct the takeoff as briefed.

RADIO PROCEDURE

Before letting down, it is advisable to call the LSO to ascertain that the briefed Charlie time is still good. The approach to the field will usually be controlled by tower personnel who will advise when to switch to control frequency. Do not make approaches without radio contact with the LSO, and do not remain in the pattern without a radio receiver.

Give the following report upon reaching the meatball acquisition point and on each subsequent pass:

Aircraft call sign
Fuel state (nearest 100 pounds)
"Crusader"
"Meatball"

If the meatball is not visible, transmit the code word "Clara" to the LSO.

PATTERN

Refer to the LSO NATOPS Manual for further pattern information, and to section I, part 4 for maximum recommended gross weight at touchdown.

The break interval will be approximately 12 to 16 seconds. Initiate subsequent turns in the downwind portion of the pattern when the preceding aircraft bears 60° relative.

Fly a race track pattern with the 180° position approximately 1¼ miles abeam at an altitude of 500 feet above the terrain. Perform cockpit checks and cross check the airspeed indicator with the angle-of-attack indicator while on downwind. Although the airspeed indicator is more than adequate for attitude control, use the angle-of-attack indicator as the primary instrument for this purpose. Check the emergency cockpit ventilation port closed or angle-of-attack indications may be erroneous. Adjust the length of the groove to give a wings-level descent on the glide slope of 18 to 20 seconds (about ¾ mile).

Recommended airspeed at the 180° position is approximately 145 KIAS. From the 180° position, an increase in power is required to effect a constant altitude turn to the 90° position. At this point, you should pick up the meatball.

As the aircraft is rolled wings level in the groove, reduce power slightly to intercept the glide slope. Ideally, the meatball will be centered when rolling wings level and the required descent initiated immediately. In any event, center the meatball before starting the descent.

APPROACH AND LANDING

A poor approach rarely results in a good landing. A good pass on the mirror requires:

Angle of attack and/or speed commensurate with landing gross weight.
Meatball in the center of the mirror/lens face.
Aircraft lined up with the runway (or simulated carrier) centerline.

At the point where the meatball is first observed during the turn to final approach, the difference between a Roger and a high or low indication is 75 feet. At the ramp, the difference is 5.5 feet and at touchdown, only 2 feet. As a pass progresses down the groove, smaller corrections are required to move the meatball a certain distance on the mirror face. A 3.25° glide slope is normally used during FMLP to approximate the rate of descent encountered when landing aboard a carrier. Any time the meatball is lost close in, initiate a wave-off. Maintain the optimum angle of attack. Do not overrotate, and do not turn.

In the FMLP pattern, do not commence another approach with 1,000 pounds of fuel or less remaining.

All procedures and techniques that apply to day FMLP apply to night FMLP. Exterior lights should be on bright and anticollision lights as desired. For night CCA pattern, refer to carrier air traffic control manuals.

FIELD ARRESTMENTS

There are several types of field arresting gear. These include the anchor chain cable, water squeezer and the MOREST type equipment. At most Air Force bases, and many USN/USMC fields, there is some form of jet barrier, usually a Davis type. It is imperative to know the type and location of the arresting gear in use.

In general, engage the arresting gear, or barrier, on the runway centerline at as slow a speed as possible. Where runway remaining beyond the arresting gear is insufficient for normal stopping, maintain sufficient airspeed to permit a wave-off in the event of a hook-skip. If the arrestment is to be made at night, request to have the position of the arresting gear illuminated.

WAVE-OFF

When executing a wave-off, place the throttle in MRT (or CRT if required). Leave the landing gear and wing in the landing condition and level the wings while maintaining optimum angle of attack.

TOUCH-AND-GO LANDING

When making a touch-and-go landing, allow all three wheels to make firm contact with the runway, then follow normal takeoff procedures.

AFTER LANDING

AFTER-LANDING CHECK

1. Canopy — OPEN
   - Do not open the canopy in excessive wind conditions.
   - Turn cockpit pressurization and defog off.
   - If cockpit altitude indicator shows a negative reading (indicating cockpit is pressurized), open the emergency ventilation knob to relieve cockpit pressure before opening canopy.

- Open canopy only after clearing the landing runway.
- Place left hand on canopy rail. Unlock canopy and immediately place right hand on right canopy rail.
- Monitor canopy opening by holding canopy rails to prevent excessive opening speed and possible overtravel which will shear the canopy actuator rod-end shear pins.
- Turn radar off since maximum coling is not available with the canopy open.

2. Trim knobs — NEUTRAL
3. Rain removal switch — OFF
4. Engine anti-ice — OFF
5. Pitot heat — OFF
6. Anticollision lights — OFF
7. Yaw and roll stab switches — OFF RESET

BEFORE SHUTDOWN

1. Wing — DOWN
   - Check wing-wheels-droop warning light flashing with wing down.
2. Cruise droop switch — UP
3. Wingfold — AS DESIRED
   - If wing panels are to be folded, the ailerons must be centered, yaw and roll stab switches off.
4. Landing gear ground locks — INSTALLED
5. Communications and navigation switches — OFF

STOPPING ENGINE

1. Throttle — OFF
   - When the engine has been operated at high power settings for an appreciable length of time, operate at 80% rpm for 3 to 5 minutes to allow time for cooling. This prevents seizure of the rotors.
   - Prior to shutdown, stabilize engine at 75% rpm for at least 30 seconds to scavenge the oil.
   - Check tachometer for free engine deceleration.
   - Plane captain will signal engine cut after gear downlocks have been installed and wheel chocks are in place.
2. Master generator switch — OFF
   - Place switch off by the time the engine decelerates to 45% rpm.
3. Engine master switch — OFF
   - Do not shut engine down with the engine master switch except in an emergency or damage to the engine-driven fuel pump may result from cavitation.
4. Oxygen — OFF
   - If flow continues from mask after shutoff, check for possible inadvertent actuation of the emergency bottle. If bottle is actuated, do not disconnect supply hose until emergency supply is depleted.

BEFORE LEAVING AIRCRAFT

1. All electrical switches — OFF
2. Ejection seat pins — INSTALLED (5)
3. Canopy actuator safety pin — INSTALLED (1)
4. Wheels — CHOCKED
5. Perform postflight walkaround inspection.

NIGHT FLYING

The instructions contained in the following paragraphs are supplemental to those covered in the normal VFR or IFR flight procedures.

PREFLIGHT

After starting the engine, check operation of all interior and exterior lights with the exception of the land/taxi light which is not checked in the chocks.

Turn on the position lights during the period 30 minutes before official sunset until 30 minutes after official sunrise or at any time when the prevailing visibility as seen from the cockpit is less than three miles. (This applies to aircraft in flight or operated on the ground, or if stationary and likely to cause a hazard.)

TAXIING

Taxi with caution and use the taxi light as necessary.

TAKEOFF

Perform the takeoff using the same techniques and procedures used during day flight, but be prepared for transition to complete instrument flight immediately upon leaving the runway. It is common to experience distracting reflections of ground lighting from the gunsight glass and windshield.

FORMATION

The basic principles of formation remain unchanged. However, exercise extra vigilance since it is difficult to accurately determine depth, closure rate, and relative motion. Fly a rendezvous bearing that is slightly aft and more stepped down than that employed during daytime operation. Rendezvous speed must be prebriefed.

Reduce the closure rate. If recognized to be dangerously high, immediately break off the rendezvous to assure separation. Cross under and to the outside of the leader's turn. When in formation, fly a position further aft and more stepped down to compensate for a lack of depth perception and visual references.

Except for the last aircraft, exterior lights will be on dim and the anticollision lights will be off. The last aircraft will have lights set to bright with the anticollision lights on unless the tactical situation dictates otherwise (during actual weather penetrations, etc).

During night landings, fly the angle-of-attack and airspeed indicators, and use a mirror if available.

Visual signals for lead change at night:

- With two aircraft — Lead aircraft switches lights to BRIGHT, and flashes them. Wingman switches lights to DIM when he accepts the lead.
- With more than two aircraft — Leader places flight in echelon and proceeds as described for two aircraft.
- With external light failure — Use flashlight procedures presently in effect.

PART 4 — CARRIER-BASED PROCEDURES

BRIEFING

Briefings will include the items outlined in the briefing guide, with particular emphasis placed upon bingo procedures, carrier's probable launch and recovery course, position in force, PIM, and ready deck. Operations Department and Air Department briefings covering the following procedures are required prior to actual carrier air operations:

Deck Handling
Air operations
Communications
Catapult launch
CATCC
SAR

Prior to initial night operation, additional briefings concerning night operations will be given by the flight deck officer, catapult officer, arresting gear officer, and the landing signal officer. The ready room will be lighted for night adaptation (red lights) during briefing. In addition, pilots may wear night adaptation glasses while going from the ready room to the flight deck to prevent loss of night vision.

FLIGHT DECK OPERATION

PREFLIGHT

Man the aircraft when directed by air operations (generally not in excess of 30 minutes prior to launch time). Conduct a normal preflight with particular emphasis given to the condition of the landing gear, shock struts, tires, arresting hook, and to the underside of the fuselage for launching pendant or arresting cable damage. A complete inspection of the aft fuselage may not always be possible due to aircraft spotting.

Leave the tiedowns installed until the engine is started. During night operation, conduct the exterior preflight using a red-lensed flashlight. Ensure that the exterior light switches are properly positioned for a poststart light check. Observe the general rule of not showing a white light on the flight deck at night. Ensure that the land/taxi light switch is off prior to connecting external electrical power. Set all colored lights to DIM, and rotate the instrument and console lights out of OFF. This will prevent daytime illumination of the red and amber system lights when external power is applied. Emergency flood lights, chartboard lights, and extension lights may be used as desired.

ENGINE START

Engines will normally be started 10 minutes before launch time. Perform the system functional checks thoroughly. Adjust the rudder pedals and be prepared to hold the brakes when the tiedowns are removed.

POSTSTART

Adjust cockpit light intensity to desired level. Conduct an exterior lights check and then the systems checks outlined in normal procedures. Be ready to taxi when directed. As the carrier turns into the wind, either close the canopy or secure it with a lanyard to prevent damage by wind or jet blasts. Spread the outer wing panels on signal from plane director as soon as possible after engine turnup to prevent damage to the wingfold casting. Cycle inflight refueling probe and check probe out light operation.

TAXI

Normally, any signal by the plane director that is above his waist is intended for the pilot; any signal below the waist is intended for deck handling personnel.

Taxiing aboard ship is similar to taxiing ashore. Nose gear steering permits the aircraft to be maneuvered easily and should be used to prevent the nose gear from castering and the nose from swaying with the ship's roll. Keep taxi speeds under control, particularly in the landing area where the deck is slippery from cable lubricant. Use both brakes to stop sideways motion of the nose, since use of a single brake will only provide a different pivot point and the sideways motion will continue.

During night deck operation, the tempo is considerably reduced from daytime operation. Slow and careful handling by aircraft directors and pilots is mandatory. If any doubt exists as to the plane director's signal, stop the aircraft.

HANGAR DECK OPERATION

Occasionally, the assigned aircraft will be manned on the hangar deck. Follow the same procedures as those concerning flight deck operation. If the aircraft is not already on the elevator, it will be towed or pushed (with the pilot in the cockpit) into position to be raised to the flight deck. The signal to stop an aircraft that is being moved by other than its own power is either a hand signal or a whistle blast. The whistle blast signifies an immediate or emergency stop. Leave canopy open and the hard hat off to ensure hearing the whistle and keep the plane director in sight at all times. If unable to see the plane director, or if in doubt of safe aircraft movement, stop the aircraft immediately.

LAUNCH OPERATIONS

Refer to the applicable aircraft launching bulletin for offcenter spotting and launching limitations, and for minimum permissible endspeeds. Refer to CARRIER OPERATING LIMITATIONS, section I, part 4 for launching limitations with wing stores.

CATAPULT HOOKUP

Current deck procedures aboard CVA class carriers provide for astern and angling approaches to both forward and waist catapults. Approach the catapult track slowly, lightly riding the brakes, with the nose gear steering engaged. Watch the plane director's signals, using peripheral vision to sight down the catapult track. Anticipate the initial hold immediately after the nosewheel drops over the shuttle. The come ahead signal will be received after the tension bar is placed in the holdback. Use very slow movement to prevent overstressing the tension bar.

At night, it is very difficult to determine speed or motion over the deck. Rely on the plane director's signals and follow them closely. As the catapult is approached, the plane director should position himself forward of the aircraft and remain stationary. Use him as a visual reference to determine aircraft movement. It is very difficult to properly spot the aircraft on the catapult when the carrier is in a turn or listing.

During all catapult hookups, personnel designated as checkers will visually inspect the aircraft to ensure that it is suitable for flight. The inspection includes, but is not limited to: Checking the entire aircraft for evidence of fuel or hydraulic leaks; security of access panels; proper extension of struts; condition of the hook point; relative symmetry of control surfaces; proper UHT trim setting; wheels, wheel wells, and tires for damage or foreign matter; a positive check of wing hinge pin locks; and that the wing is raised.

TRIM SETTINGS

The recommended horizontal tail trim setting for catapult launching is a function of center-of-gravity position and end airspeed. The following trim setting recommendations are the results of tests conducted at the Naval Air Test Center, Patuxent River, Maryland. These settings can be checked at altitude by trimming the aircraft for level flight at reduced airspeed at the weight involved with wheels down and wing incidence handle up and power settings as near to takeoff conditions as practicable:

CATAPULT TRIM SETTING

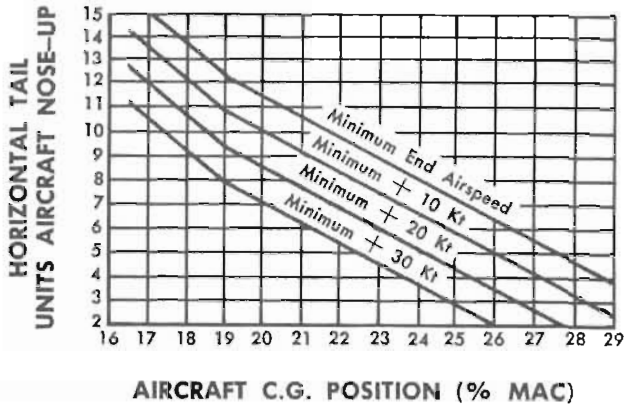


Figure 3-11

SYMMETRICAL LOADING

Rudder trim — 0

Aileron trim — 0

Horizontal tail trim — Refer to figure 3-11

ASYMMETRICAL LOAD OF 2,000 LB AT 30,000 LB GROSS WEIGHT

Rudder trim — 0

Aileron trim — 5 units (full aileron trim) unloaded wing down and expected end airspeed above 160 KIAS. When expected end airspeeds less than 160 KIAS are anticipated, approximately 5 pounds aileron stick force is required at the end of the power stroke to maintain wings level.

CATAPULT LAUNCH (MRT)

Complete all cockpit checks, except for engine turnup, prior to catapult hookup and tensioning. On run-through-the-deck periods, actuate the controls and positively check that the aileron and rudder neutral trim lights illuminate as the control surfaces pass through neutral. Failure of either light to illuminate is a downing discrepancy unless the controls are near center and it can positively be established that the fault lies in the indicating circuit. During the control check, flight deck personnel will note freedom and response of all control surfaces, that they return to relative symmetry when pressures are released, and that the UHT trim is properly set.

Upon receipt of the standard tensioning signal, apply military thrust and at the same time release the brakes and nose gear steering. When the turnup signal is received from the catapult officer, thoroughly check all engine instruments. Grip the throttle and the catapult handgrip firmly. When satisfied that the aircraft is functioning properly, place your head against the headrest, salute, and wait. Normally, a 3 to 5 second delay will occur before the catapult fires.

Normal catapult launches provide 10 to 15 knots excess end-speed. The aircraft leaves the catapult in a near-level attitude. A slight nose-up rotation may be beneficial, depending upon degree and angle of deck pitch and the UHT trim setting. Retract the landing gear and *lower the wing according to land-based procedures.* Clearing turns off the catapult will depend upon the ship's catapult configuration and the policy established within the air wing. Check alignment of the BDHI (bearing-distance-heading indicator) once in stabilized flight.

CATAPULT LAUNCH (CRT)

The afterburner is not used under normal launch conditions and is not recommended at night. The catapult officer must know when an afterburner launch is to be made.

After reaching MRT and upon receipt of the two-finger turnup signal, check the engine instruments. When the catapult officer signals with 5 fingers (open hand towards the pilot), assume position for launch, select afterburner, check engine instruments, and salute. The catapult officer observes afterburner light and pilot's salute, then gives the fire signal. It is recommended that a minimum speed of 300 KIAS be obtained before deselecting afterburner.

NIGHT CATAPULT LAUNCH

Follow the same cockpit procedures and signals used during a daytime launch. When satisfied the aircraft is ready for launch, signal the catapult officer by placing the exterior lights master switch to ON.

Be prepared to establish a wings level, climbing attitude on instruments. A 5° to 7° nose-up rotation is recommended after clearing the catapult. Do not make clearing turns. When established in a wings level climb, retract the landing gear. Lower the wing at a minimum altitude of 500 feet. At 2,500 feet, or above, turn exterior lights to bright and turn on anticollision lights.

AIRCRAFT OR CATAPULT MALFUNCTION

If, after establishing power at MRT or CRT, it is determined the aircraft is down, signal this fact to the catapult officer by shaking the head from side to side. Never raise a hand into the catapult officer's view to give a thumbs down signal or it may be misconstrued to be a salute and the catapult will be fired.

The catapult officer will relay a no-go situation to the deck edge catapult operator by crossing his forearms in front of his face. He will then give the release tension signal and walk in front of the wing to give the throttle back signal. Then, and only then, reduce the throttle to idle.

The same signals will be used to signify a catapult malfunction. Leave the throttle at MRT/CRT until the catapult officer walks in front of the wing and signals for power to be reduced to idle.

If a no-go situation arises during night operation, do not turn on the exterior lights. Call on the land/*launch frequency and advise that* "——(call sign) on catapult number —— is down." Maintain MRT until the catapult officer walks in front of the wing and gives the signal to reduce power.

LAUNCHING CHARACTERISTICS

When spotted off center, the aircraft oscillates directionally during the catapult power stroke. The oscillations increase in magnitude with increasing forward center-of-gravity position, increasing main gear off-center distance and decreasing catapult pressures. Yaw will be noticed during the power stroke which will increase and reverse direction twice as the aircraft travels down the catapult. As the aircraft leaves the catapult, it tends to roll in the direction of the yaw. When spotted 6 inches off center (using minimum catapult pressures with a 20% MAC center of gravity), approximately one-half lateral stick deflection will be necessary to stop the roll. This control input is a natural reaction and should cause no difficulty.

MINIMUM END AIRSPEED LAUNCHING

Minimum end airspeed is determined by ability to rotate the aircraft to the optimum angle of attack when the gross weight is less than 25,000 pounds. At greater gross weights, proximity to the speed at which the aircraft drag is equal to or greater than the engine thrust becomes the limiting factor.

At gross weights below 25,000 pounds, sink-off-bow will be about 10 feet with moderate rotation required to prevent excessive sink. Do not overrotate. Avoid the use of excessive nose-up trim which will cause a high rate of rotation requiring rapid forward stick to avoid stall. Very light buffet will be encountered during rotation. Acceleration is reduced but comfortable, and as the usual end airspeed is attained acceleration becomes normal.

At gross weights above 25,000 pounds, moderate rotation will prevent sink-off-bow. Very light buffet will be encountered, and acceleration is reduced but comfortable.

CARRIER LANDING

Refer to field carrier landing practice, this section, for additional information, to figure 3–12 for illustration of typical carrier landing, and to section I, part 4 for carrier operating limitations.

While maneuvering to enter the traffic pattern, attempt to determine the sea state. This information will be of value in predicting problems that may be encountered during the ensuing approach and landing.

If the sea state is smooth, the carrier is creating all (or most) of the wind over the deck by hard steaming. Avoid entering the pattern at gross weights near the maximum since the approach speed could exceed the maximum engaging speed. Expect the wind to be down the axial deck which will result in a 10° crosswind when lined up with the angled deck. Stack wash will be encountered, so expect some turbulence when approaching the ship's wake. Pay particular attention to lineup.

With a moderate sea state, the carrier should be able to place the wind down the angled deck so lineup will not be a problem. As the wind over deck increases, additional power will be required to fly a proper approach.

If blowing spray is observed the sea state is rough and the carrier will be steaming to maintain steerageway. The wind over deck will be gusty which will necessitate more frequent power and control corrections to maintain the glide slope. Turn earlier at the 180° position to avoid being long in the groove.

PATTERN

Enter with a level break from a course parallel to Foxtrot Corpen, close aboard the starboard side of the ship at 800 feet MSL. If in formation, maintain a break interval of 12 to 16 seconds. When on downwind leg, descend to 600 feet and perform cockpit check. Cross-check angle of attack and airspeed indicators for 13 units angle of attack and proper airspeed. Check cockpit emergency ventilation port closed before using angle of attack indications. Fly a racetrack pattern with the 180° position approximately 1¼ miles abeam (check distance with TACAN, if desired) at 600 feet MSL. With a 30-knot wind over deck, begin the 180° turn to the final approach when approximately abeam the LSO platform. To be lined up with the angled deck centerline, roll out immediately to the right of the ship's wake. When the meatball is acquired, transmit call sign, fuel state (nearest 100 pounds), "Crusader," and "meatball." Signify no meatball by transmitting the code word "Clara."

GLIDE SLOPE

The physical glide slope projected from the ship is approximately 4°. Due to the wind over the deck, the aircraft flies approximately a 3.25° slope through the air. However, at any given point in the approach, the pilot is looking at the ship on a 4° slope. This, of course, gives the pilot the feeling that he is too high. This feeling should be disregarded, and only the meatball should be relied upon for proper glide slope control. Closure rate on the ship is on the order of 105 knots, whereas on the field, closure rate is usually equal to true airspeed (light wind). This difference in "distance/time" relationship further emphasizes the need for looking at, and flying the meatball all the way to touchdown, rather than estimating power required by looking at the deck. It is necessary to carry a little more power on the glide slope on the ship than ashore, in order to maintain the proper glide slope and airspeed.

FLYING THE MEATBALL

The approach power compensator should not be used if operating in manual fuel control or if the wing cannot be raised.

CAUTION

It may become desirable to make a manual approach, instead of an APC approach, under unfavorable approach conditions such as gusty or extremely high winds.

The technique for flying the meatball during steady deck operation approximates that used during FMLP. However, with increasing rough seas the glide slope varies, particularly in the vertical plane. The glide slope is stabilized only to the extent that it passes through a point in space 1,800 to 2,200 feet astern (approximately half way out on the final approach). As the deck pitches, the glide slope deflects as necessary to remain focused on this point. It is apparent that the vertical movement of the glide slope increases in magnitude as distance from the focal point increases. Therefore, the technique used to fly the meatball when the deck is pitching varies with position on the final approach.

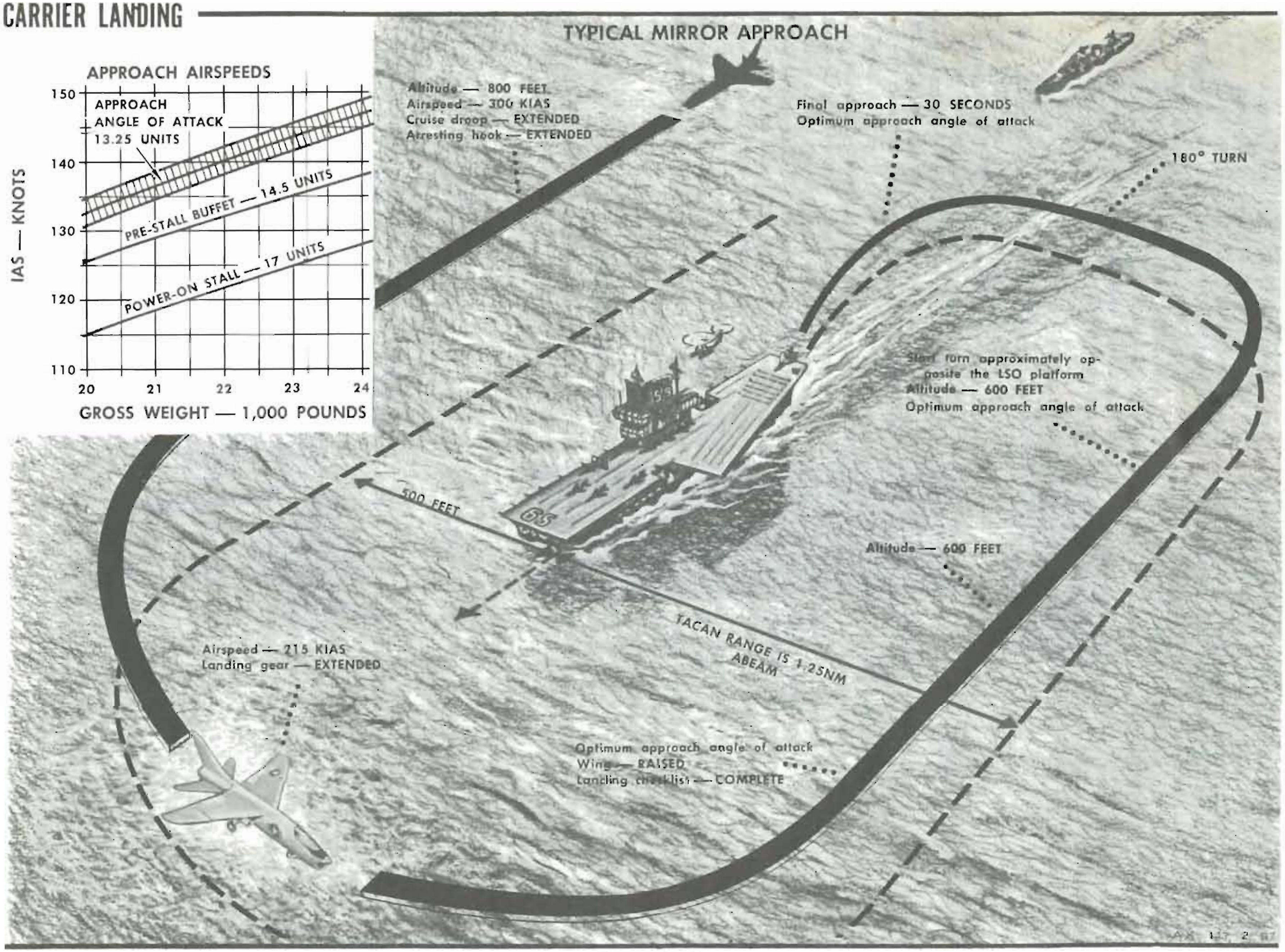

TYPICAL MIRROR APPROACH
APPROACH AIRSPEEDS
APPROACH ANGLE OF ATTACK 13.25 UNITS
PRE-STALL BUFFET — 14.5 UNITS
POWER-ON STALL — 17 UNITS
IAS — KNOTS
150
140
130
120
110
20
21
22
23
24
GROSS WEIGHT — 1,000 POUNDS
Altitude — 800 FEET
Airspeed — 300 KIAS
Cruise droop — EXTENDED
Arresting hook — EXTENDED
Final approach — 30 SECONDS
Optimum approach angle of attack
180° TURN
Start turn approximately opposite the LSO platform
Altitude — 600 FEET
Optimum approach angle of attack
500 FEET
Altitude — 600 FEET
TACAN RANGE IS 1.25NM ABEAM
Airspeed — 215 KIAS
Landing gear — EXTENDED
Optimum approach angle of attack
Wing — RAISED
Landing checklist — COMPLETE

Figure 3-12

Initial Approach

After rolling wings level on the final approach, begin a rate of descent of approximately 600 feet per minute. Average out the meatball movement. Maintain a glide path that shows the same degree, or distance, of meatball movement above and below the datum lights.

Middle Approach

As the aircraft progresses into the middle third of the approach, meatball movement due to carrier pitch is at a minimum. Use this part of the approach to advantage. Adjust power carefully and establish the proper rate of descent.

Final Approach

As the aircraft moves into the final third of the approach, the meatball will again begin to cycle on the optical landing system. Hold the power setting and the rate of descent established during the middle third of the approach, unless instructed otherwise by the LSO. If the meatball goes high when approaching the ramp, do not attempt to center it. The ramp could be cycling down, and an increased rate of descent, coupled with a rising ramp on touchdown, could exceed aircraft design limits. If the meatball starts to go low, add power to stop it. In this case, the aircraft could be descending below the glide path, or the ramp could be cycling up. In either event, the aircraft is getting too close to the ramp and the only correction is power. Accept the fact that wave-off and bolter rates increase when landing with a pitching deck. The higher rates are acceptable, particularly when the alternatives are considered (hard landings, ramp contacts, etc).

FOULED-DECK WAVE-OFF

Don't anticipate a fouled-deck wave-off. Aircraft will repeatedly clear the landing area fractions of a second before the wave-off point is reached, and a clearance to land will be received. Let the LSO give the wave-off.

Wave-off characteristics are good and the engine accelerates from approach thrust (about 84% rpm) to military thrust in about 2.5 seconds.

CLOSE-IN WAVE-OFF

Avoid a close-in wave-off whenever possible. However, if it becomes necessary, move the throttle smartly to MRT or CRT and maintain optimum angle of attack. Do not overrotate. Maintain a wings level flight attitude.

WARNING

Accept a touchdown short of the number one cross-deck pendent, accept a bolter, but do not overrotate and do not turn. In the event of a ramp strike, do not select afterburner unless necessary to attain or maintain flying speed.

BINGO FUEL

When the bingo fuel state is reached, clean up the aircraft and depart on course. Do not orbit the carrier awaiting instructions. Fly towards the bingo field and if you are in doubt as to the exact heading, ask for it prior to switching frequency. Shipboard control may be contacted for radar monitoring. Check heading to the bingo field with control and ensure that the BDHI is set properly. If possible, relay a "feet dry" message to the ship.

ARRESTMENT OPERATIONS

Fly the aircraft on the glide slope all the way to touchdown and do not attempt a flare. Add power to MRT as the aircraft touches down. When forward motion has ceased, reduce power to idle and allow the aircraft to roll aft. Apply brakes on signal and immediately add taxi power. Hold brakes to arrest forward movement and raise the hook when directed. When the come ahead signal is received, release brakes and expedite exit from the landing area. Use brakes for initial directional control and engage nosewheel steering after forward motion is established. When clear of the landing area, turn stabs off and fold outer wing panels on signal.

While the hook is retracting, the aircraft must remain static or a reengagement is likely. If a reengagement occurs, reduce power, drop the hook when directed, and allow the aircraft to be pulled aft. Raise the hook again on signal.

Normally, all night recoveries will be from CATCC controlled approaches. The LSO will assume control when the aircraft is approximately one mile from the ramp. Exterior lights should be on bright with the anticollision lights off. Following arrestment, reduce power to idle and immediately turn off the exterior lights. Allow the aircraft to roll aft, apply brakes, raise the hook when directed, and taxi slowly out of the landing area. Do not stare at the director's wands, but use them as the center of a scan pattern. When clear of the landing area, signal aircraft status to flight deck control.

POSTFLIGHT

Taxi the aircraft as directed. Do not use excessive power. Keep the engine running until the chocks and at least one tiedown are installed. Landing gear downlocks should also be installed prior to engine shutdown. Execute a normal shutdown when the cut signal is received. Always control canopy opening rate by holding the rails with both hands. Install the lanyard before opening the canopy since wind across the deck makes it difficult to do so after the canopy has been opened.

If the aircraft is to be spotted on the hangar deck, open the canopy and remove the hard hat as you are descending on the elevator. Normally, taxi the aircraft from the elevator into the hangar bay. Expect the cut signal when clear of the elevator. Lower the wing and raise the droop prior to engine rundown. From this point, aircraft handlers will move the aircraft. Keep speed under control and be alert for stop signals. Hold the brakes after being spotted until a 3-point tiedown has been completed.

section IV

flight procedures and characteristics

CONTENTS

PART 1 — FLIGHT PROCEDURES

PART 2 — FLIGHT CHARACTERISTICS

PART 1—FLIGHT PROCEDURES

This section standardizes general flight and operating procedures to minimize confusion, maintain air discipline, and to achieve maximum effectiveness in the air. The general briefing guide (section III, part 1) will be used to brief each flight. Any mission not covered by the briefing guide must be briefed by a qualified individual who has thorough knowledge of all aspects of the mission.

TRANSITION AND FAMILIARIZATION

The paragraphs below contain operational information which will be used in conjunction with normal procedures during the FAM stage of training.

BRIEFING

The familiarization briefing will be all-inclusive and will cover all emergency procedures contained in section V.

PREFLIGHT

The chase pilot, or another qualified pilot, will monitor the FAM pilot during his first preflight inspection.

START

The chase pilot, or another qualified pilot, will monitor the FAM pilot's first flight start and poststart checks.

TAXI

The FAM pilot should call for taxi instructions and lead the flight to the runway.

TAKEOFF

The FAM pilot will call for takeoff instructions when ready, and will be the lead aircraft for the takeoff.

INFLIGHT

During the FAM stage, the FAM pilot is required to call off the individual items of the 3-point checklist (Fuel Transfer Switch — ON, Wing — Down and Locked, and Cabin Pressurization — ON) when he reports completion of the checklist to the chase pilot.

The FAM pilot will perform all prebriefed maneuvers, to obtain a general feel of the aircraft in both clean and dirty configurations.

FAM flights will be planned so that approximately 2,000 pounds of fuel remain upon return to the home field. Fuel remaining checks will be given by stating main fuel quantity first and transfer quantity second, eg, two eight and one six (2,800 pounds main and 1,600 pounds transfer).

RETURN TO THE FIELD AND LANDINGS

The FAM pilot will lead the flight back to the home field and will make the required radio calls to the tower. The chase pilot will fly a wing position that enables him to closely monitor the FAM pilot's landing pattern and approach to coach him as necessary. A chase pilot, or a qualified RDO, must be available while a FAM pilot is practicing landings, and two-way radio contact must be maintained. If these conditions are not satisfied, the FAM pilot will make a final landing on the first acceptable approach. A final landing will be made when the FAM pilot's fuel state at the 180° position first reaches 1,200 pounds or less.

CONFIDENCE MANEUVERS

Aileron rolls, loops, Immelmann turns, and Cuban eights will be practiced as confidence manuevers. The airspace will be cleared before starting, and the chase pilot will maintain a position that allows adequate clearance between aircraft and affords observation of the surrounding airspace.

The minimum airspeed for all confidence maneuvers is 220 KIAS.

Plan the entry to any maneuver so that the aircraft is level or climbing at a minimum altitude of 10,000 feet above the terrain. Enter overhead maneuvers between 10,000 and 15,000 feet at 500 KIAS and use a 4 g pullup. Use afterburner for the first half of the maneuver when fuel weight is 3,500 pounds or more. Enter rolls at an airspeed of 300 to 350 KIAS.

Do not exceed the flight restrictions outlined in section I, part 4.

PARADE AND TACTICAL FORMATION

Note

Refer to section VII for formation visual signals.

PARADE FORMATIONS

Only the four basic parade formations (fingertip, echelon, diamond and column) and free cruise formation are covered. These formations are used for airshows, flybys, weather penetrations, rendezvous practice, nontactical point-to-point flight, and in traffic patterns.

FINGERTIP AND ECHELON

Fly the wing position on a line of bearing 35° to 40° aft the lead aircraft's beam, stepped down 5 to 8 feet, with a wingtip clearance of 5 feet (figures 4–1 and 4–2). When flying through weather, maintain the same wingtip clearance and stepdown, but hold a position 45° aft the lead aircraft's beam (figure 4–3). As visibility decreases, decrease lateral separation and increase stepdown as necessary to maintain visual contact with the lead aircraft.

DIAMOND

Fly the wing position on a line of bearing 45° aft the lead aircraft's beam, stepped down 8 to 10 feet, with a wingtip clearance of 5 feet. Fly the slot position in column on the lead aircraft, stepped down as necessary to avoid excessive jetwash. The slot position is equidistant, and on a 45° bearing, from each wingman (figure 4–4).

COLUMN

Fly directly behind and stepped down from the preceding aircraft. Maintain nose to tail clearance at all times, though distance between aircraft will vary with the type of maneuver being performed. For example, while parade column positions may be as close as 10 to 15 feet during a flyby, a separation of not less than 50 feet is maintained while maneuvering or in tail chase. Maintain sufficient stepdown to avoid excessive turbulence from jetwash (figure 4–5).

FREE CRUISE

The free cruise formation is primarily used for nontactical point-to-point flight for two or more aircraft. This formation facilitates cruise control, permits each pilot to look around, and allows considerable maneuvering. Free cruise positions require nose-to-tail clearance so that each aircraft can slide independently to maintain position (figure 4–6).

CROSS UNDER

When necessary to cross from one side of the leader to the other, adjust power to slide aft until nose-to-tail separation of 5 feet is attained. Maintain lateral separation and descend to obtain a vertical separation of 8 to 10 feet. Maintain vertical and lateral separation and cross under the leader's flight path. When proper horizontal separation is obtained on the opposite side of the leader, move vertically until the proper stepdown is attained and then move forward to the wing position.

TACTICAL FORMATIONS

Tactical formation is not an exact science. Both offensive and defensive techniques are involved, either at the same time or successively, in the overall offensive action. As such, there is not one solution to a specific tactical problem. Tactical formation is of necessity a compromise between maximum flexibility and maximum mutual support. Information concerning specific tactical maneuvers and doctrine may be found in classified Naval Warfare Publications and the F-8 Tactical Manual, NAVAIR 01-45HHA-1T (Confidential).

FORMATION RENDEZVOUS

RUNNING RENDEZVOUS

This type of rendezvous is most effective when aircraft are launched within visual or radar range. Using a predetermined power setting, the leader flies a designated course or TACAN radial at 350 KIAS until the climb schedule is reached. The wingman accelerates to the applicable climb schedule using MRT (CRT only as necessary to expedite the rendezvous). The throttle is retarded when approaching the leader (or desired tactical position) to avoid using the speed brake to prevent overrunning. If tactical conditions dictate a CRT running rendezvous, the leader designates a base course or TACAN radial, uses reduced CRT, and maintains the climb schedule. Trailing aircraft will maintain the base course and use full CRT until rendezvous is effected. When the last aircraft calls "aboard," the leader advances power to full CRT.

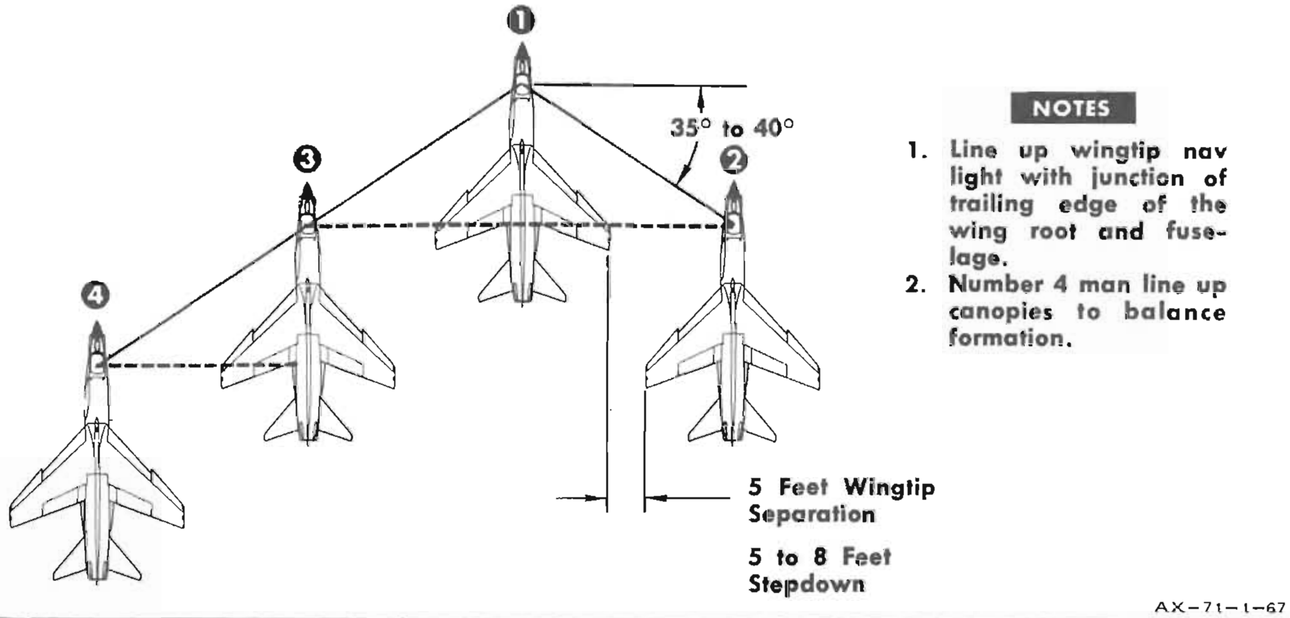
TACAN RENDEZVOUS

This rendezvous is an expeditious method of joining aircraft under all VFR conditions. The flight leader specifies the TACAN facility, channel number, altitude, radial, and distance to be used. This establishes a point in space where the rendezvous is to be effected. The joinup is accomplished as shown in figure 4–7.

ARA-25 RENDEZVOUS

The ARA-25 is useful to join aircraft under all conditions, but is particularly effective for a straight course running rendezvous. Trailing aircraft select ADF position with the UHF control. The flight leader transmits a short count every minute and includes altitude if climbing. Trailing aircraft maneuver as necessary to keep the number one needle 5° left or 5° right of the nose position (the number 2 aircraft holds

FINGERTIP PARADE

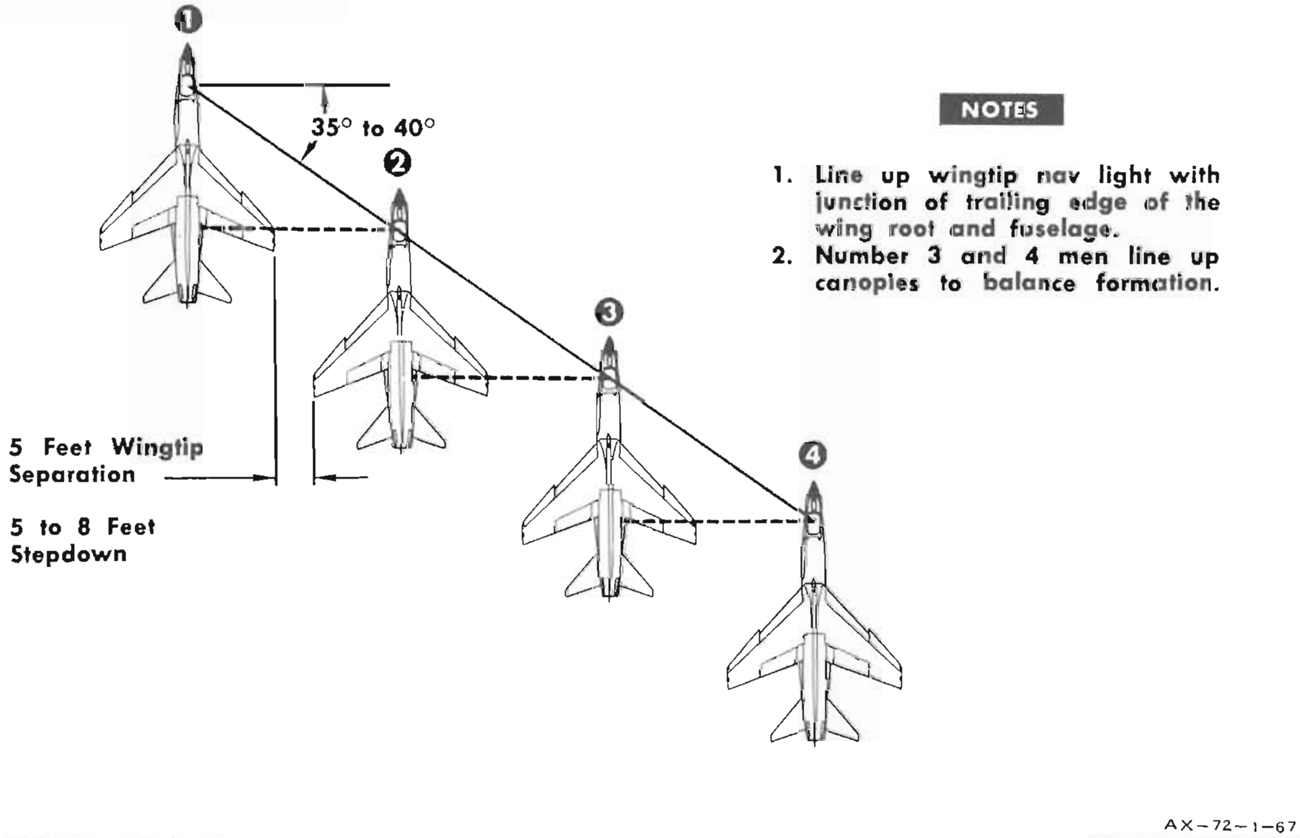


NOTES

1. Line up wingtip nav light with junction of trailing edge of the wing root and fuselage.
2. Number 4 man line up canopies to balance formation.

Figure 4–1

ECHELON PARADE



NOTES

1. Line up wingtip nav light with junction of trailing edge of the wing root and fuselage.
2. Number 3 and 4 men line up canopies to balance formation.

Figure 4–2

INSTRUMENT PARADE

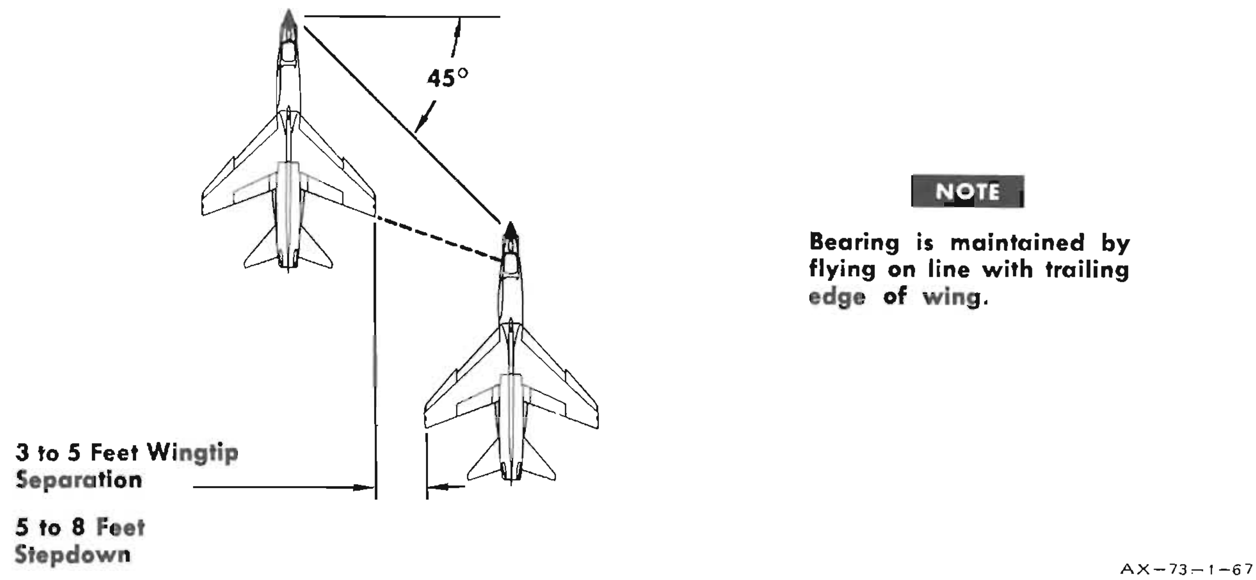


Figure 4-3

DIAMOND PARADE

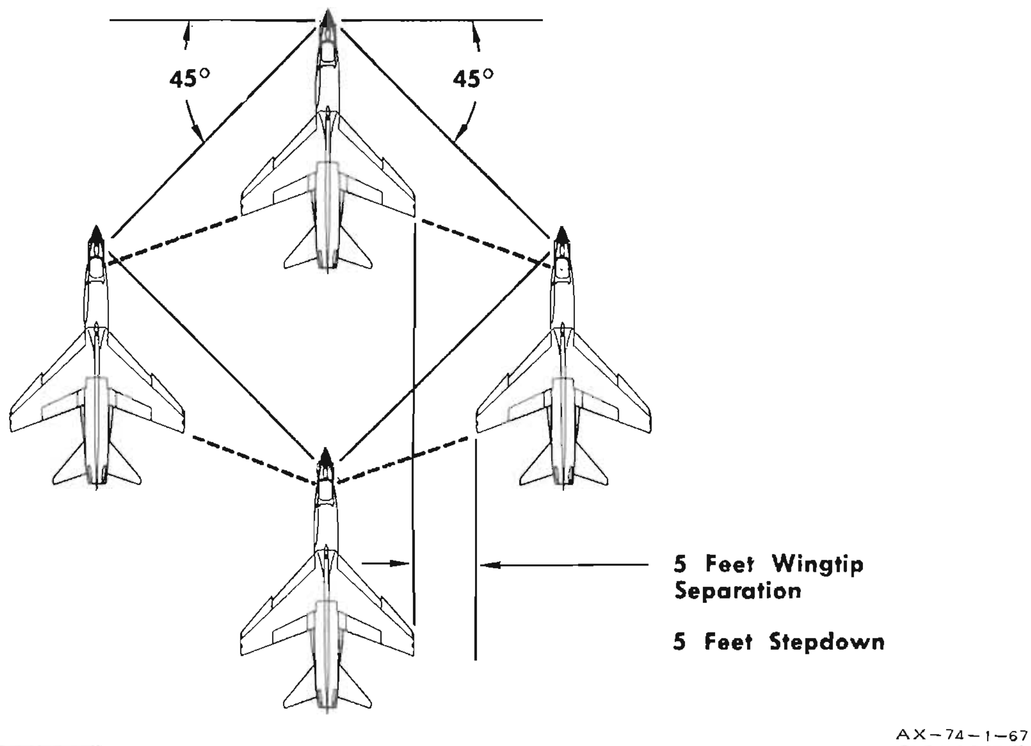


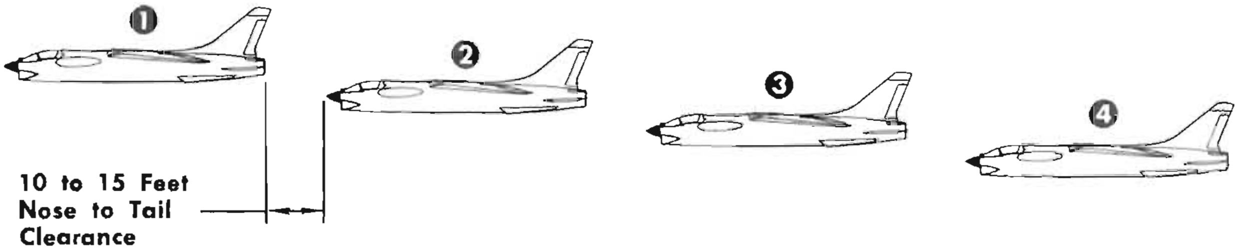
Figure 4-4

PARADE AND TAIL CHASE COLUMN

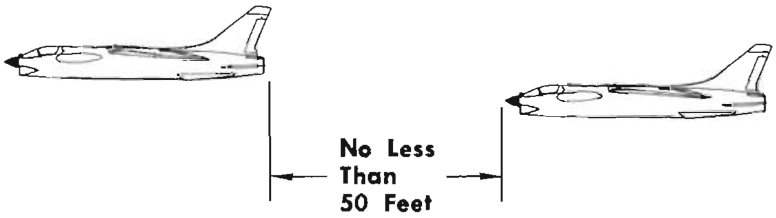
NOTE

Match lead aircraft's wing and stepdown to avoid excessive turbulence.

PARADE COLUMN



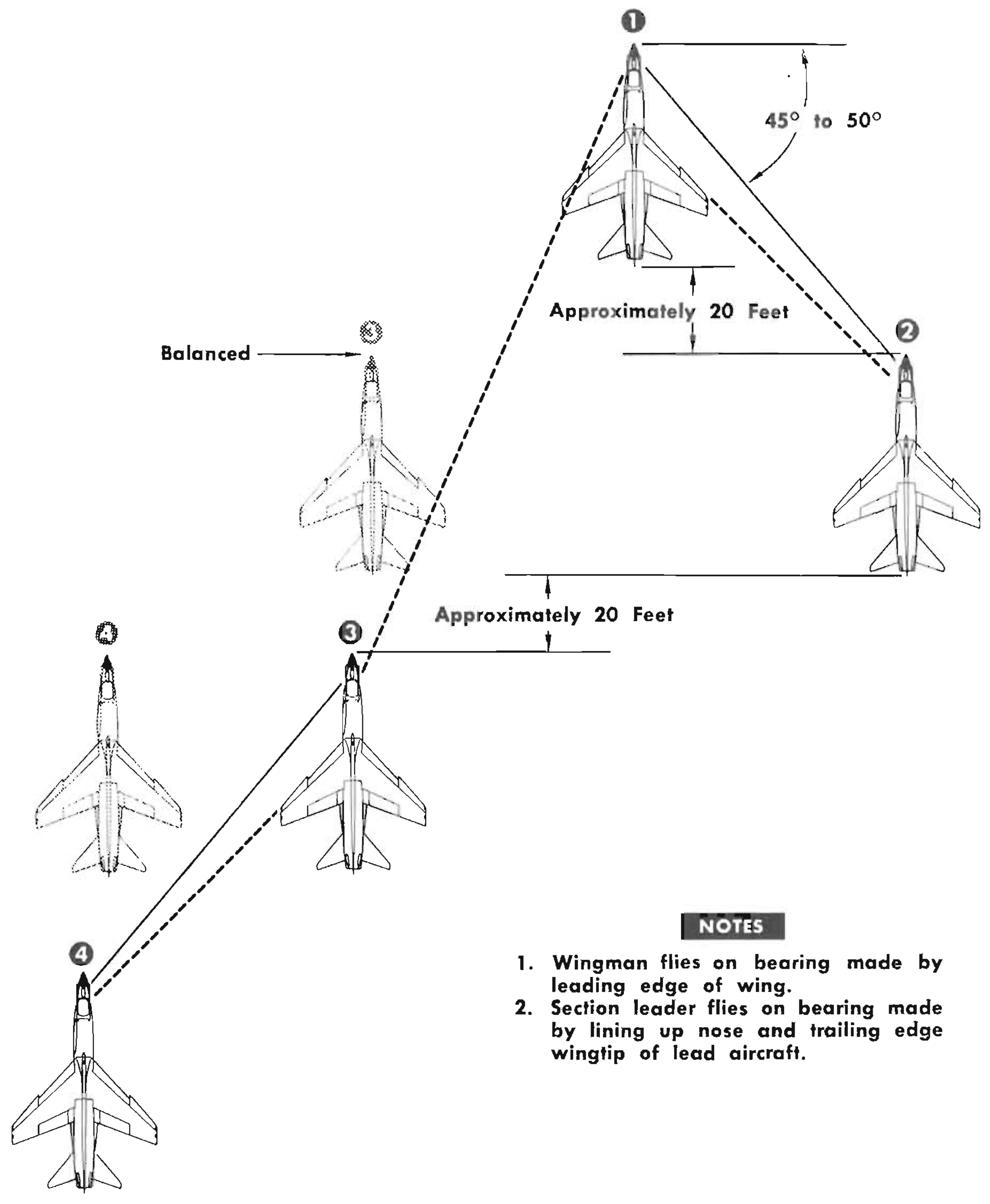
TAIL CHASE COLUMN



AX-75-1-67

Figure 4–5

FREE CRUISE



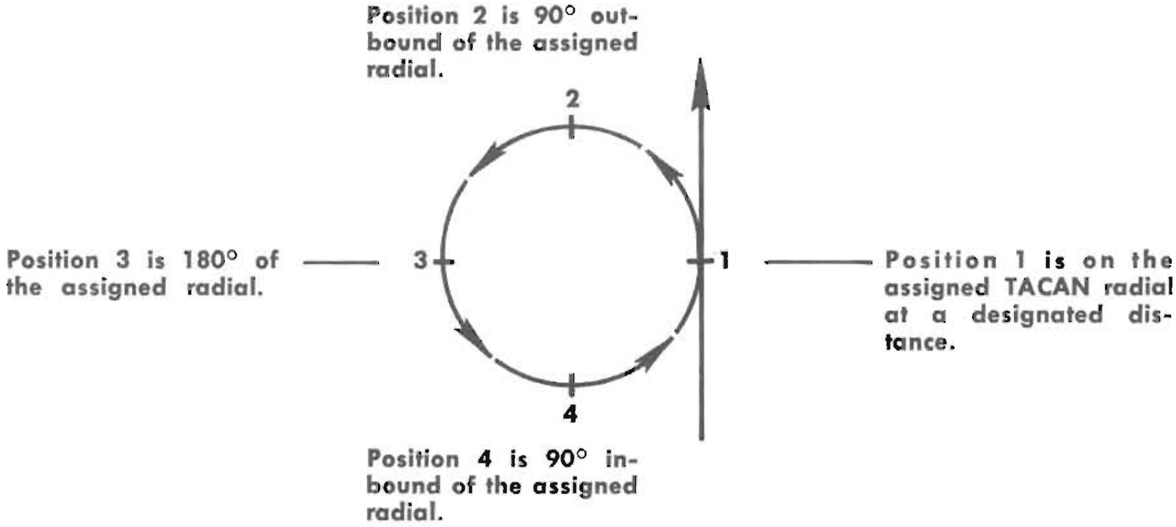
NOTES

1. Wingman flies on bearing made by leading edge of wing.
2. Section leader flies on bearing made by lining up nose and trailing edge wingtip of lead aircraft.

AX-76-1-67

Figure 4-6

TACAN RENDEZVOUS



NOTES

1. Each pilot flies ahead for 1 minute, then turns to take a 30° cut to the assigned radial. Instrument climb schedule must be maintained.
2. Aircraft track outbound on assigned radial using course line indicator.
3. Division leader calls distance at which to begin joinup circle and when passing each position. This informs each pilot of the leader's actual position in the rendezvous circle.
4. All aircraft begin orbit at designated distance and modify orbit as necessary to effect joinup.
5. If not on top by 45,000 feet, leader will assign an altitude to each aircraft, allowing 2000 feet separation between aircraft (if not under positive control).
6. Leader uses 30° bank and 300 knots to 30,000 feet and 0.86 above.

AX-77-1-67

Figure 4-7

the leader 5° left, number 3 aircraft 5° right, etc.) until the leader is visually sighted.

If a circling rendezvous is to be made, the leader maintains a 30° bank at a prebriefed airspeed and altitude, transmitting a short count and heading every minute. Trailing aircraft correct heading as necessary to place the number one needle on the nose position each time the leader transmits. Proximity to the leader can be determined by the degree of change in azimuth of the number one needle. As distance to the leader decreases, the needle will change more degrees between counts, requiring larger corrections to keep the leader on the nose. When the leader is detected visually, a standard rendezvous is accomplished.

LOW VISIBILITY RENDEZVOUS

The initial procedures will be as previously described for standard rendezvous. Accomplish this type of rendezvous only in an emergency, when directed by higher authority, or when the urgency of the mission so dictates. Fly the aircraft at a safe maneuvering airspeed at an altitude that will permit safe ejection. Establish radio contact and determine the indicated airspeed, altitude, and flight path of the aircraft to be joined. Place all lights on bright and the anticollision lights on. Rendezvous first on a position 1,000 feet out, slightly aft the beam (4 or 8 o'clock) of the lead aircraft. Cautiously close while assuring nose-to-tail clearance. Maintain a constant relative bearing since changes in bearing make determination of closure rate difficult. Do not allow a rapid closing situation to develop.

CAUTION

Low visibility rendezvous is conducive to vertigo. A high degree of caution and good judgement must be exercised.

SAFETY DURING RENDEZVOUS

Keep the aircraft ahead in view constantly and join the formation in order. Reduce excess speed before reaching the wing position to avoid overshooting. Abort the rendezvous if necessary by leveling the wings, sighting all aircraft ahead, and moving to the outside of the formation.

Use only enough stepdown to ensure separation on the aircraft ahead.

If "sucked" during rendezvous, move to the outside of the leader and join after all other aircraft are in formation.

Stop all relative motion prior to joining an inside wing position. A cross under to the outside may then be made.

Use caution during the final steps of joinup of a running rendezvous. Relative motion is difficult to discern when approaching from the rear.

INFLIGHT REFUELING

Refer to section I, part 2, for system description. A-1, A-3, A-4, A-5, KC-130F and KC-135 tankers are compatible for inflight refueling to the limits described under LIMITATIONS. The location of the refueling probe, which is 40 inches from the fuselage and abeam the pilot when extended, creates several problems. The probe is not within the pilot's peripheral vision upon engagement; the drogue is influenced by the airflow around the fuselage, tending to drift outboard during run-in; the drogue is in close proximity to the canopy creating a possibility of canopy damage on missed engagements.

LIMITATIONS

KC-135 Tanker

Aircraft limited to maximum internal fuel load of 8,000 pounds JP-4 or 8,500 pounds JP-5 when refueling from the KC-135.

KC-130F Tanker

Aircraft are subject to the following limitation when refueling from the KC-130F:

- After complete system refueling is accomplished, limit hookup to pressurized tanker hose to 15 minutes. If it is required to remain hooked up to the tanker for longer than 15 minutes, ensure that the hose is depressurized, then top off just prior to disconnect.

Airspeed and acceleration limitations applying to the inflight refueling probe are presented in section I, part 4.

PRE-REFUELING CHECK

CAUTION

If the wing tank is empty when inflight refueling is commenced, no stop transfer check (wing cell pressure dump) is possible. Maximum internal fuel load should be limited to 7,000 pounds JP-5 or 6,500 pounds JP-4 if operational considerations permit.

Prior to taking on fuel and depletion of wing transfer fuel, place the transfer switch in PRESS DUMP and note the transfer fuel quantity reading. Fuel transfer should cease immediately. Note the main and transfer quantities for a period of three minutes, allowing main fuel to burn down below the level of the main fuel transfer float (3,100 pounds maximum). Main fuel quantity should decrease and transfer quantity should remain constant. Return the fuel transfer switch to ON. When ready for refueling, place the probe switch in PROBE OUT and note that fuel transfer stops. For this check to be valid, the pressurization system must be functioning and a minimum of 500 pounds of fuel must be retained in the wing tank to accomplish the stop transfer check.

REFUELING PRECAUTIONS

WARNING

If at any time fuel is observed venting from the fuselage vent mast or starboard wing vent in significant amounts, immediately break away and secure inflight refueling. Fuel cell rupture could be imminent.

During inflight refueling, the main fuel quantity gage should increase to a maximum of 3,100 pounds and then continue filling to a full indication at a significantly reduced rate. The pilot should monitor the main fuel quantity gage closely during inflight refueling to ensure that main fuel quantity does not increase through 3,100 pounds without this obvious slowing. If no reduction is observed, cease refueling immediately.

AIR REFUELING TECHNIQUE

When available, another pilot will monitor the refueling and he will call clock position of missed engagements.

Whenever possible, conduct refueling in smooth air at optimum altitude and airspeed and with less than 50% receiver fuel remaining. To prepare the receiver aircraft, place the cruise droop down, turn off unnecessary electrical equipment, and extend the probe. Since canopies have been broken by the drogue during missed approaches, place the helmet visor down for protection.

Note

The permissible acceleration range with the probe extended is –1.0 g to 3.0 g.

Before sliding into position, call "lining up."

Line up behind the tanker with the probe 10 to 15 feet directly behind the drogue and trim the aircraft. The drogue will be slightly forward of the nose of the receiver aircraft. Check that the tanker amber ready light is on or obtain confirmation from the tanker pilot that he is ready for refueling before plugging in.

Execute the approach so that the drogue passes close to the fuselage. Any misalignment, sideways movement or other deviation constituting a haphazard approach, can result in a smashed canopy. Using the tanker and the hose as references, increase power to establish a 3 to 5 knot closure rate. This rate will minimize outboard drogue movement, receiver control problems, and will seat the probe smartly in the drogue coupling. The drogue will have a tendency to move to the left as the nose of the receiver passes it. Do not fence with the probe. Concentrate on flying toward a reference point on the tanker. The gunsight may be used as an aid to alignment.

When engagement is made, a slight ripple of the hose will occur. Adjust power to remain in refueling position and fly formation on the tanker. After engaging the drogue, and the amber light goes out, call "contact."

Note

At high closure rates, hose whip will occasionally follow engagement.

If engagement does not occur, reduce power and move slightly to starboard of normal hose trail position, then down and straight back. Speed brakes may be used, but are generally not required at high altitude.

AIR REFUELING TECHNIQUE LANDING CONFIGURATIONS

Inflight refueling with the wing down, landing gear extended, and EPP deployed has little effect on normal inflight refueling procedures. EPP extension has negligible effect; however, gear extension will increase power requirements approximately 5%. Air refueling procedures remain the same as for a clean aircraft.

Inflight refueling with the wing up, landing gear extended, and EPP deployed changes the aircraft attitude requiring observation of the tanker store through the top of the canopy rather than front wind screen. Drogue positioning prior to plug-in and approach procedures remain the same as for a clean aircraft. An airspeed of 200 KIAS minimum to 220 KIAS maximum is recommended to insure complete engagement of the probe and drogue for proper fuel passage.

BREAKAWAY

To break away from a successful engagement, reduce power and drop back at a rate of 3 to 5 knots. Maintain alignment and altitude. The probe/drogue connection will separate when the hose reaches full extension. After breakaway, when clear of the area behind the hose and drogue, call "clear."

OPERATION OF THE PROBE SWITCH

Extend the probe prior to the initial run and leave the switch in the OUT position until all runs are completed. When retracting the probe, hold the switch IN for 5 seconds after the door light goes out to ensure that the probe door locks.

AIR REFUELING SIGNALS

Refer to section VII.

FLIGHT TEST

Test flights will be conducted in accordance with current BuWeps Instruction 4700.2 series.

PART 2 — FLIGHT CHARACTERISTICS

INTRODUCTION

Note

Refer to section I, part 4, for limitations and restrictions.

The Crusader's operating regime covers an extremely wide band of flight conditions ranging from the low speeds required for carrier operations, through the speeds required for long-range cruising flight, to high speed flight at low and high altitudes. Flight stabilization, stick variable gain, a two-position wing, and fixed ventral fins are utilized to permit satisfactory operation throughout the flight envelope.

DEFINITIONS

The following definitions are of terms employed frequently in this section:

Dynamic pressure (q) — The product of $\frac{1}{2}\rho v^2{}_L$ (sometimes called ram pressure).

Equivalent airspeed (EAS) — Calibrated airspeed corrected for compressibility factors. A constant equivalent airspeed maintains a constant dynamic pressure regardless of altitude. At sea level, true airspeed, calibrated airspeed and equivalent airspeed are all equal. At altitude, equivalent airspeed is always less than true airspeed.

Yaw during roll — The yaw which almost always accompanies any rolling maneuver of any aircraft. It is caused by aileron or spoiler drag and by moments on tail and fuselage caused by rolling velocity and flow effects from the ailerons.

Adverse yaw — During a roll, yaw which causes the nose to move in the direction opposite to the direction of roll.

Favorable yaw — During a roll, yaw which causes the nose to move in the direction of the roll.

Rolling pullout — A maneuver in which g is being pulled while the aircraft is rolling, such as in turn reversals.

Symmetrical pullout — A maneuver in which g is pulled without rolling. A symmetrical pullout may be accomplished in a steady turn.

Trim change — A tendency of the aircraft to pitch, yaw, or roll because of the influence of movable components or of changing flight conditions.

*Spoilers are powered by power control systems No. 2 only.

FLIGHT CONTROLS

GENERAL

All flight controls, ailerons and spoilers,* unit horizontal tail, and rudder, are fully powered through dual power control systems in order to overcome the high airloads encountered in high-speed flight. Artificial feel is provided by springs in the lateral (roll) and directional (yaw) control systems and by springs, viscous dampers, and bobweights in the longitudinal (pitch) control system. This feel system provides a force reference against which the pilot may judge his control motions. Feel forces are kept low to make the aircraft pleasant to fly and easy to maneuver. Variable-gain linkages are provided in the pitch control system to permit very small control adjustments when the aircraft is near trimmed conditions. The ailerons and rudder may also be moved about by signals from the stabilization systems, but this occurs automatically without affecting stick or rudder positions or feel.

UNIT HORIZONTAL TAIL

The unit horizontal tail is effective from the stall to the highest Mach number at the highest altitude. Horizontal tail effectiveness, or the g per degree of tail movement, varies considerably with flight conditions, and is least in the landing configuration and in high-altitude supersonic flight and most in low altitude, high-speed subsonic flight. Adequate effectiveness is present to rotate the aircraft for takeoff or for landing (even to the extent of bumping the tail) and to pull limit g in supersonic flight at altitudes even above 45,000 feet. In the areas of greatest effectiveness, such as near Mach 0.95 at low altitudes, care must be taken to prevent overcontrolling. The variable-gain linkage reduces these tendencies in the areas of greatest horizontal tail sensitivity or effectiveness by introducing a band of insensitive control response near neutral stick. These characteristics are described more fully under MANEUVERING FLIGHT in the Supplemental NATOPS Flight Manual. Longitudinal stick forces are also presented in the Supplemental NATOPS Flight Manual.

AILERONS AND SPOILERS

The ailerons and spoilers work together to provide lateral control. The ailerons are effective through most flight conditions but become completely ineffective at the stall and almost so in high-speed low-altitude flight. The spoilers improve roll performance at high speeds but are ineffective at the stall. However, ailerons are the most effective control in inducing or recovering from a spin. Roll rate is the characteristic that is most affected by the addition of the spoilers, although a slightly greater pitch down is encountered in low-altitude rolls.

Lateral stick forces are light in both the landing and clean configurations. Clean configuration stops provide a reference for observation of roll restrictions.

RUDDER

The rudder becomes effective at about 60 KIAS on the takeoff roll and remains so through all flight conditions. It provides adequate directional control for crosswind landings. Pedal forces are light in the clean configuration and are reduced even more in the landing configuration.

POWER CONTROLS

The loss of either of the power control systems will produce only a slight reduction in maximum longitudinal control. This reduction occurs only at supersonic speeds between 22,000 and 42,000 feet altitude. The greatest reduction occurs at Mach 1.1 at an altitude of approximately 35,000 feet.

The loss of one of the power control systems results in a general decrease in response to maximum control inputs above 400 KIAS. Loss of response will generally not be apparent except at high airspeeds or during extreme maneuvers when PC 2 is inoperative.

The effects of the loss of one power control system on maximum lateral control vary significantly depending upon which system is inoperative, as follows:

- With PC 1 inoperative, there is no decrease in maximum lateral control effectiveness below 400 KIAS, but there is a decrease of up to 50% between 25,000 and 35,000 feet altitude at supersonic speeds. The decrease in effectiveness is less at other altitudes. In addition, roll stabilization is inoperative.
- The loss of PC 2, which is the only system that supplies pressure for operation of the spoilers, results in significant decreases in maximum lateral control effectiveness at speeds above 400 KIAS, but only minor decreases below that speed. At speeds above Mach 0.92 below 9,500 feet altitude, or at very high airspeeds (above 680 KIAS), lateral control may be inadequate to correct for an extreme lateral out-of-trim condition.

Directional control is not appreciably affected by loss of either power control system. However, yaw stabilization and aileron-rudder interconnect are lost with PC 2 inoperative. With loss of PC 2, acceleration restrictions governing loss of yaw stabilization apply.

VENTRAL FINS

The ventral fins increase directional stability throughout the flight envelope, especially at the high Mach end, to permit the flight envelope to be expanded. These fins are fixed and the pilot has no control over them.

SPEED BRAKE

The speed brake, functioning as a controllable high-drag device, provides a quick and effective means of making airspeed adjustments in tactical situations and of limiting airspeed in dives. Precise speed adjustments, such as those desired in formation flying, are difficult to make by use of the speed brake because of its high rate of motion. The brake will open to its full open position of 60° in about 1.5 seconds if the airspeed is below 475 knots EAS. Above this speed, the brake opens only an amount proportional to the speed because ram pressure overcomes the actuator. At 725 knots EAS, the brake will open only about 15° and has lost considerable effectiveness.

Full extension of the speed brake results in moderate buffeting that increases in intensity with increasing airspeed at subsonic speeds. Partially closing the speed brake will decrease or eliminate buffeting without causing an appreciable loss in speed brake effectiveness. No buffeting will be encountered with speed brake operation at supersonic speeds.

Because there is insufficient ground clearance to permit landing with the speed brake extended more than 30°, the brake is automatically closed as the wing is raised unless the speed brake override switch is used.

Refer to the Supplemental NATOPS Flight Manual for additional information.

CRUISE DROOP

The cruise droop position of the wing leading edge provides a means of obtaining a more efficient wing under certain flight conditions. These conditions and the corresponding improvements obtained with the leading edge extended to the cruise droop position are:

Condition	*Improvement*
MRT and CRT climbs	Drag is decreased.
Subsonic turning flight, particularly above 30,000 feet.	Buffet is delayed and diminished.
Maximum cruise and loiter.	Drag is reduced.
Very low speed flight with the wing down, such as inflight refueling and two-position wing transitions.	Stall and buffet speeds decrease, thereby providing a greater safety margin. (To take advantage of this margin, cruise droop should be extended before takeoff and landing.)

Performance will be reduced to varying degrees under all other flight conditions if the leading edge is left extended to the cruise droop position with maximum speed as the most seriously affected item.

Within the operating limitations, there is a mild nose-down trim change when extending the leading edge and a nose-up change when retracting it. Small lateral trim changes also may occur during leading edge operation.

EMERGENCY POWER PACKAGE

Extension of the emergency power package (Marquardt unit) at airspeeds up to approximately 500 KIAS causes practically no trim change. In most cases a very slight vibration is the only indication that the unit is extended although sometimes small directional trim changes may occur as the speed brake is opened or closed with the power package deployed.

Above 500 KIAS, the aircraft tends to yaw left, roll right, and pitch down as the unit is extended. These trim changes increase in severity as the extension speed increases and become quite severe above 690 KIAS, constituting a serious handling problem. For this reason, it is imperative to reduce speed at least to the restriction limit and it is highly desirable to slow considerably more before extending the package in the case of electrical or power control hydraulic system failure. Fortunately, after all such failures (except for failure of both power control systems as in the unlikely case of a frozen engine), control power and basic aircraft stability remain adequate so that there is no immediate necessity to extend the emergency package. The aircraft can be and should be slowed to less than 600 KIAS while deciding whether to extend the package or not. The main consideration in making this choice is the considerable drag increase which results from the extended package and leads to a reduction in specific range of approximately 18%. Whenever possible, slow down first, then extend the package if desired. The unit has been proven structurally and functionally sound to 740 knots EAS.

Extension of the emergency power package in the landing configuration causes no trim changes and has no effect upon handling qualities, stall speed, or stall characteristics.

STABILIZATION

Automatic roll and yaw stabilization systems improve gun platform characteristics, permit greater maneuvering capabilities, and improve general handling qualities. With stabilization systems operative, the Crusader is a smooth, effective, and competitive flying and fighting machine throughout its flight envelope. Without stabilization, it still may be flown successfully through the same speed envelope but is subject to drastic reductions in permissible maneuvering and to a considerable reduction in its ability to track and hit a target.

In other words, flight stabilization improves the performance of the aircraft as a weapon by performing the following significant functions:

- Damping of undesirable roll and yaw motions caused by air turbulence or rough control usage.
- Stiffening the aircraft directionally, making it more prone to fly with zero yaw angle.
- Applying opposite rudder in all rolls so as to reduce the buildup of favorable yaw at high Mach numbers and altitudes. Application of adverse rudder is programmed so as to be at maximum at 45,000 feet and minimum below 13,000 feet. At low altitudes, the buildup of favorable yaw is less and the correction is not required.

Stabilization output is regulated by use of altitude yaw gain changers and by switching between clean configuration and landing configuration roll amplifier gains to give the best performance under all flight conditions. The net result is a steadier aircraft which does not develop excessive yaw angles during maneuvering flight. All stabilization effects are accomplished without effort on the part of the pilot and with no feedback into the controls except for an occasional minute roll "nibble" in the landing configuration.

In the clean configuration, yaw stabilization is the more important function since it is necessary to maintain the yaw angle as near zero as possible at all times. This factor accounts for the reduction in the operating envelope with yaw stabilization inoperative. If a failure should occur at a speed above the restriction speed, avoid abrupt maneuvers or control motions and reduce speed as rapidly as practicable.

In the landing configuration the basic roll damping of the aircraft is poor and roll stabilization accordingly is of major importance. Fortunately, basic damping improves as airspeed decreases so that loss of roll stabilization does not cause a serious approach or landing problem. With roll stabilization inoperative, roll damping will become marginal at airspeeds above 180 KIAS, so avoid abrupt maneuvers, reduce airspeed, or lower the wing.

TRIMMING

Use of trim will reposition any of the control surfaces without changing the neutral position of the stick or rudder pedals because the trim actuators move only the linkage downstream of the feel systems. Because of the variable gain linkage in the longitudinal system, flying the aircraft with force applied to the stick (aircraft not in trim) will cause increased sensitivity the further the control is held from neutral. By keeping the aircraft trimmed under high-speed flight conditions, full benefit is obtained from the variable-gain linkage in maintaining pitch attitude without increased control sensitivity.

Movements of the trim knobs will result in changes of aircraft attitude unless compensating movements of the stick or rudder are made. As trim is applied, relax pressure on the stick or rudder pedals to determine the effect of the amount of trim used. This will avoid overtrimming or unwanted changes of aircraft attitude. Until familiar with trimming, apply trim in small amounts to obtain the desired attitude.

Because of the rapidity with which flight conditions change at low altitudes with afterburner, precise trimming is difficult. Attempt minimum trimming during an afterburner climb below 20,000 feet until familiar with the trimming characteristics in this flight regime.

Since roll and yaw trimming is achieved with the same actuators used for stabilization, normal trimming will be lost if the stabilization system fails or is turned off. Remember that in such a case, any roll or yaw trim already applied will be removed since the actuators automatically return to neutral. Emergency pitch trimming is available if normal pitch trim circuits fail.

LEVEL FLIGHT

MAXIMUM SPEED

Refer to the Supplemental NATOPS Flight Manual.

LANDING CONFIGURATION

Landing configuration characteristics are normal and satisfactory in all respects. The airplane trims fairly easily during the approach when not loaded with wing stores. All controls operate smoothly and effectively. However, with a heavy asymmetrical wing store loading on the airplane, full lateral trim and slight lateral stick force are required to maintain attitude.

Military thrust is sufficient for most wave-offs and enormous extra thrust is available from the afterburner for a desperation-type wave-off.

CLEAN CONFIGURATION — SUBSONIC

The aircraft normally spends most of its flight time in the subsonic region and has quite conventional characteristics there. The afterburner gives it excellent acceleration characteristics under practically all conditions. Trimmability generally is good except in the trim change region of about 0.90 IMN to 1.05 IMN, where attention to control is required if you desire to hold a given altitude. High-speed flight at low altitude in turbulent air is rather uncomfortable and disturbing because of the jostling experienced in the cockpit. Sensitive pitch control will be encountered in low-altitude flight at high subsonic speeds.

With heavy asymmetrical wing stores on the aircraft, enough lateral trim is available for hands-off flight except at the lower speeds in this range, where slight lateral stick force may be required.

CLEAN CONFIGURATION — SUPERSONIC

Supersonic flight characteristics of the Crusader are excellent and enjoyable. Control response is smooth and precise in pitch, yaw and roll, and trimmability is at its best. There is a general reduction in noise and vibration as soon as the aircraft goes supersonic, particularly after the duct bypass door opens. The energy level is very high, enabling the aircraft to be zoomed to high altitudes or turned extensively while maintaining supersonic conditions. Acceleration in level flight is fairly slow as compared to acceleration at subsonic speeds, but in dives airspeed increases very rapidly. Take care to avoid exceeding restrictions. Deceleration is also relatively slow unless a combination of thrust reduction and speed brake is used.

With heavy asymmetrical wing stores on the aircraft, some lateral stick force may be required in this speed range (in addition to full lateral trim) to maintain attitude.

MANEUVERING FLIGHT

Note

> Refer to the Supplemental NATOPS Flight Manual for flight characteristics encountered during pullouts, rolls, rolling pullouts, and climbs.

DIVES

The aircraft picks up speed quite rapidly in dives. Engine thrusts and dive angle are very influential in controlling speed during dives. Thrust reduction and pulling the nose up will be found more effective than speed brake extension when it is desired to reduce speed from very high values. Stability and control characteristics are generally good.

Dives to lower altitudes are required during F-8E attack missions. Be especially cautious about target fixation during these dives.

As indicated under TRIMMING, malfunction of the yaw-stabilization system will result in the rudder immediately returning to neutral and the directional trim system becoming inoperative. If this malfunction occurs at high airspeed or where a large amount of rudder trim is required to maintain balanced flight an abrupt yaw will occur. Poor damping characteristics under these conditions make it easy to set up lateral-directional oscillation if abrupt, large lateral or directional control movements are used. In the event of stabilization failure in high speed dives, reduce speed immediately and effect recovery using small slow aileron or rudder movements if required. Refer to the Supplemental NATOPS Flight Manual for additional dive characteristics.

AEROBATICS

Aerobatics in the Crusader are typical of most contemporary jet aircraft. No special techniques or knowledge are required. Since loops and Immelmann turns develop considerable changes in altitude, start them at altitudes near 10,000 feet with at least 500 KIAS until familiar with the aircraft. Afterburner may be used during these maneuvers either as a means of keeping the airspeed up or of increasing the altitude gain. If the airspeed gets low on top, allow the aircraft to "fly through" at a low g value. Avoid pulling into buffeting throughout the maneuver.

Satisfactory rolls may be performed at most speeds without attempting to coordinate rudder with ailerons, but coordination may be improved by use of rudder if desired. The best and smoothest rolls are obtained by putting in and taking out aileron rather slowly.

ARMAMENT

The following discussions cover flight characteristics during external armament separations. For the flight characteristics while carrying external armament, refer to LEVEL FLIGHT and MANEUVERING FLIGHT in this section.

GUN FIRING

Gunfire vibration in the cockpit varies considerably with airspeed and altitude. At high altitudes the vibration is very light and is not influenced very much by speed. At low altitudes the vibration is higher, and reaches a moderate peak level around 475 KIAS. At higher or lower speeds, the vibration level is light but even under these conditions the instrument board and gunsight will vibrate to a moderate degree during gunfire. Tracking is not hampered even under the heaviest vibration encountered. No adverse engine effects result from gunfiring.

SIDEWINDER MISSILE FIRING

Refer to the Supplemental NATOPS Flight Manual and the F-8 Tactical Manual.

ZUNI FIRING

Firing characteristics of Zuni rockets are similar to those of Sidewinder missiles. Noise level is greater when firing from the fuselage pylons than when firing from the wing pylons. At certain altitudes, firing fuselage Zunis can result in engine flameout if the restrictions in Section II, Part I of F-8 Tactical Manual are not observed.

CAUTION

> Avoid the area behind and below a firing aircraft to prevent the possibility of damage from fragments of LAU-10/A nose caps and unburned Zuni propellant.

BOMB DROPPING

When bombs are released from the Aero 7A and Aero 7A-1 ejector racks, a slight airframe pulse is felt due to the action of the mechanical ejector foot. If a bomb load is released from only one side, the pilot will be aware of a sudden lateral trim change.

ANGLE OF ATTACK

Refer to the Supplemental NATOPS Flight Manual.

AUTOPILOT FLIGHT

Autopilot engagement criteria are presented in section I with the description of the system. Engagement of either the normal mode or the altitude hold mode while in trimmed flight will produce no noticeable effect on the aircraft. The following is based upon flight tests in which the autopilot has been engaged and operated throughout the level-flight operating envelope.

USE OF TRIM

Monitor directional trim while operating with the autopilot engaged, particularly during climbs where the greatest directional trim change occurs. Because of the automatic heading hold function that operates within 5° of wings-level, the autopilot will maintain magnetic heading by flying the aircraft in a slight "slip" when a directional out-of-trim condition develops. If, for example, the autopilot induces a nose-right yaw to maintain magnetic heading, the aircraft will develop a left-wing-down condition. Although the natural tendency is to correct the wing-down condition by using roll trim, autopilot functioning prevents roll trim from making the desired change. Apply left rudder trim instead.

In a similar manner, if autopilot trim controls are used to correct for the left-wing-down condition, use your trim instead of autopilot bank control. The autopilot will oppose the bank control changes while attempting to maintain the reference heading. The two conditions required to break heading hold are a bank control knob displacement greater than 5° and an actual bank angle change greater than 5°. If repeated corrections less than 5° are made with the bank controller, it is possible to build up large amounts of off-neutral bank with the bank control knob while the aircraft is maintained in wings-level flight by the autopilot. If the wings are then rolled more than 5° from level by a gust or by pilot correction, the heading hold function will automatically disengage and the aircraft will immediately bank to the setting built up with the bank control knob. If this occurs, restore normal autopilot operation by returning the bank controller to the wings-level position. This bank controller is an attitude control rather than a rate control. A given position of the control knob commands a bank attitude change of a certain number of degrees, rather than a continued rate of change of attitude as in some autopilot systems. When rolling the aircraft from wings-level, move the bank control knob far enough to roll the aircraft beyond 5° so that heading hold will disengage.

ALTITUDE HOLDING

When the autopilot is being operated in the altitude hold mode, two pitch signals are compared by the autopilot. One signal originates in the altitude controller, which seeks to maintain a constant pressure altitude by commanding nose-up and nose-down attitude changes, and the other originates in the pitch attitude reference gyro, which resists changes in pitch attitude. In flight under stabilized conditions, no disagreement in the two signals exists. However, as an acceleration or deceleration is made, angle-of-attack requirements change and the pitch attitude varies to maintain constant altitude. The change in attitude is resisted by the autopilot pitch attitude reference circuits. As a result, the aircraft gains altitude during accelerations and loses altitude during decelerations. At 40,000 feet, this increase or decrease is less than 500 feet from the autopilot reference altitude when operating between subsonic and high supersonic speeds, but can reach unacceptable levels at low altitudes or low airspeeds. For this reason, make large speed changes at low altitudes or at low speeds in normal autopilot mode only.

While operating in the altitude hold mode, accelerations through Mach 1.0 at any altitude are smooth and entirely satisfactory. However, during decelerations through the Mach number range of approximately 1.1 to 0.95, the rapidly changing position error of the altitude static pressure system causes aircraft pitching. Pitching magnitude increases with decreasing altitude and increasing rate of deceleration, reaching maximum at low altitudes when decelerating at idle thrust, with or without the speed brake extended. Through this Mach number range while in altitude hold mode excursions in pitch will require the pilot to monitor the autopilot with the control stick.

WARNING

Transonic decelerations in "altitude hold" at rates faster than those produced with military thrust are not advised at altitudes of 25,000 feet and below. Decelerations under the same conditions in "normal mode" are satisfactory.

The autopilot altitude controller and pilot's altimeter have different static pressure sensing requirements. The autopilot requires stability in maneuvering flight and the pilot's instrument system requires level-flight accuracy. For this reason, two separate static pressure sources are used. The static reference for the autopilot is the more accurate for angle-of-attack changes and the pilot's altimeter static pressure source is more accurate for speed changes. As a result, there are certain flight conditions which may lead the pilot to believe, because of position error effects, that the altitude hold function is not operating properly. For instance, acceleration and deceleration between subsonic and high supersonic speeds with altitude hold engaged will result in large changes in indicated altitude, of which a portion is a change in the true altitude resulting from autopilot response to its static pressure reference. To fly at a certain true altitude at the new speed condition, disengage altitude hold, fly to the correct altitude considering only the position error of the altimeter, and then reengage altitude hold. Similar effects are observed in turns during supersonic flight because of the effects of angle-of-attack on the static systems. In this case, however, the autopilot reference is more accurate than the pilot's indicator and the autopilot will maintain altitude near the engagement value. Differences between autopilot reference and the pilot's altimeter will not exist upon return to straight and level flight at the engagement airspeed.

WALLOW

At some MA-1 compass headings there is a tendency for aircraft wallow to occur when attitudes higher than 15° nose up are maintained while heading hold is engaged. Even though there are few occasions when such a nose-up attitude would be required for more than 45 seconds it is permissible to disengage the heading hold made until level flight is resumed.

USE OF STICK

The autopilot can be overridden by the application of stick force. However, since the aircraft will immediately return to autopilot engagement attitude when stick force is relaxed, disengage the autopilot before making large pitch attitude changes. With the autopilot disengaged, the stick commands changes in pitch or roll rate, rather than attitude, and the aircraft will not return to the new autopilot engagement attitude when stick force is released.

BLEEDOFF

When the autopilot is in operation, with or without altitude hold engaged, electrical signals that position the horizontal tail consist of signals originated by the pitch trim knob and the autopilot correction signals. If a signal is being supplied by the autopilot at the moment of disengagement, the removal of this signal results in control surface travel to the position commanded by the trim knob position alone. If the autopilot, or the altitude hold function only, is disengaged, the pitch signal difference is bled off slowly so that the horizontal tail runs slowly to the new position. This action appears as a condition requiring a normal trim change easily controlled with the trim knob. To avoid aircraft pitching, allow sufficient time for the signal differences to bleed-off before reengaging the autopilot. If large signal differences exist, allow 20 to 30 seconds for settling.

Roll trim operation with the autopilot engaged in the normal mode differs from operation of the pitch system. The roll trim knob is not effective in making roll attitude changes because the heading hold function opposes such changes in order to maintain a constant magnetic heading. Because of this, abrupt roll attitude changes will occur at autopilot disengagement if the roll trim knob has been rotated with the autopilot engaged, since roll signals are not subjected to slow bleed-off.

SATURATION

The autopilot commands corrections proportional to the deviation from reference attitude. As the deviation (error) gets larger, the amount of correction decreases to a point at which greater deviation produces no additional correction. The autopilot is then said to be "saturated."

Saturation is used to advantage is certain instances. For example, the autopilot commands 3° of bank angle for each degree of heading error when the heading hold function is engaged. At this rate, a 30° heading error would command a 90° bank, which would be excessive. To avoid this situation, the heading error circuits are allowed to saturate at 11° so that bank angles greater than 33° are not commanded as a result of heading error. Since saturation also makes the autopilot less sensitive to disturbances and less effective in handling large deviations, you need to recognize approaching autopilot saturation.

There are three indications:

- Reference attitude is regained more slowly after a disturbance.
- The pitch trim knob becomes more effective in changing the reference attitude.
- A lightly damped long-period pitch oscillation (10 to 30 seconds) may occur.

If any indication of saturation appears, disengage the autopilot, retrim to the new flight conditions, then reengage the autopilot. This action establishes a new set of autopilot neutral reference values. Note that saturation does not occur as a function of the time elapsed since engagement, but occurs because of changing flight conditions. Therefore, it is not necessary to disengage and reengage the autopilot periodically.

STALLS

CHARACTERISTICS

(See figure 4–8 for stall speeds)

NORMAL OR 1g STALLS.

Landing Condition

Stall warning is first evidenced by prestall buffet commencing around 14.5 units indicated angle of attack, increasing in intensity to heavy buffeting, roll oscillations, porpoising or poor response to lateral control at about 17 units. The stall is marked by a definite wing drop, roll, or snap roll. The horizontal tail and rudder remain effective throughout the stall. Ailerons become ineffective as the stall is reached. Recovery is initiated by immediately neutralizing lateral and directional control, positioning the stick slightly forward of neutral (avoiding use of ailerons) and allowing airspeed to increase in whatever bank angle or pitch attitude exists until well out of buffet.

Clean Condition

Clean condition stall behavior is similar to the landing condition, with warnings and stall occurring at higher airspeeds. Buffet onset will occur at least 40 knots above the stall speed and increases to heavy buffet at the stall. At the stall, the wing drop will be more abrupt to approximately 45° but the condition can be aggravated into greater and faster roll departures by maintaining or increasing aft stick at or beyond the stall. With cruise droop extended, stall warnings will occur at airspeeds approximately 10 to 15 knots lower than with leading edge retracted. The stall will occur approximately 5 knots lower with cruise droop extended.

ACCELERATED STALLS.

Stalls in Pullouts or Turning Flight

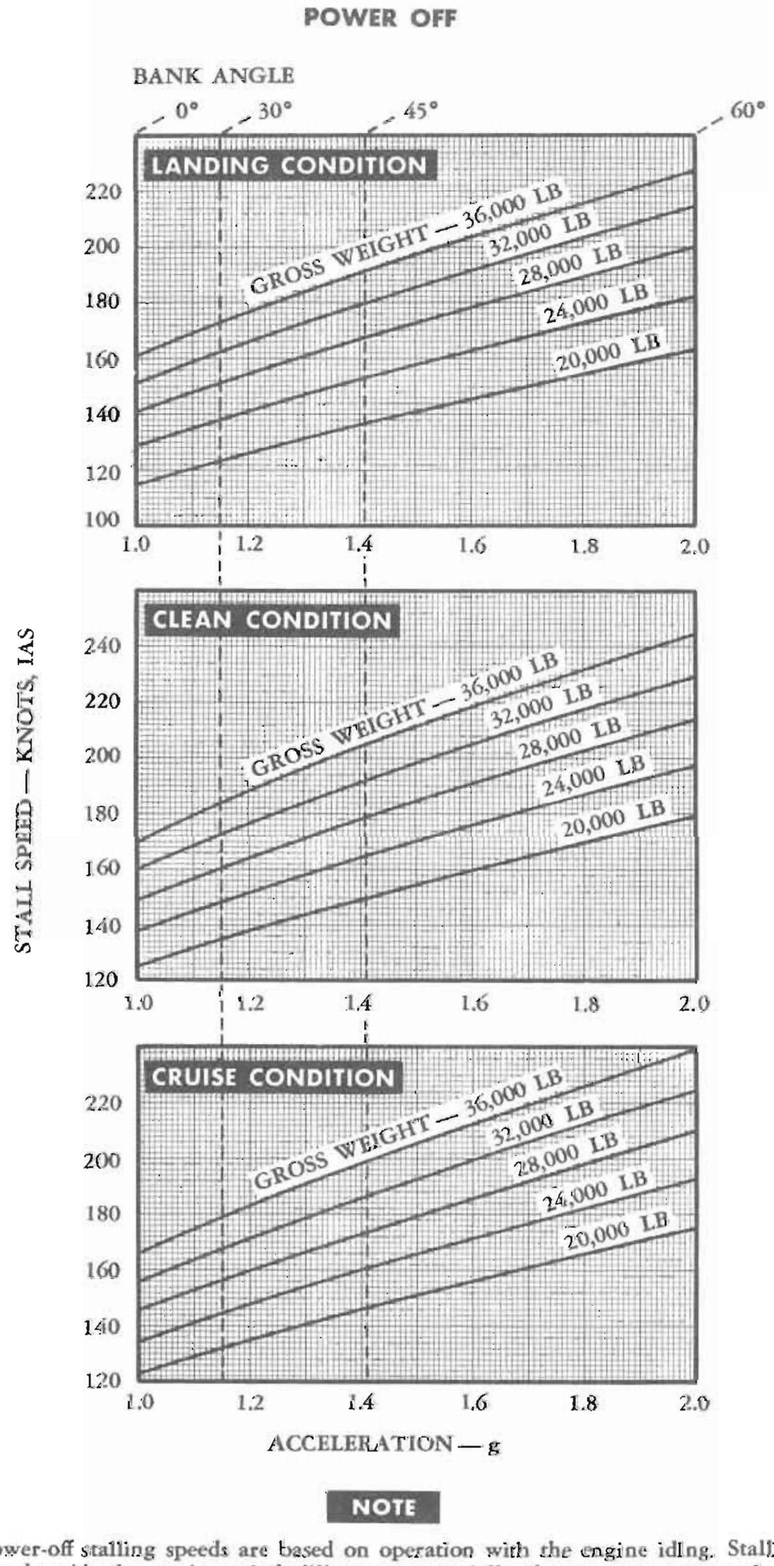
Accelerated stalls will occur whenever excessive aft stick is used for maneuvering at subsonic speeds such as in pullouts or turning flight.

In a gradual approach to an accelerated stall, warning of the stall occurs initially in the form of buffeting, which increases to heavy buffet at the stall. In addition, roll oscillations (up to 30° left and right) and porpoising will occur just prior to reaching the stall. At the stall a very abrupt roll will occur which can reach or exceed 180° of bank angle change. This can be accompanied by a marked increase in nose-up attitude, especially if ailerons are used to oppose the roll.

If the stall is approached rapidly, warning motions of the airplane prior to the stall will be less apparent, and behavior at the stall will be more violent. At low airspeed or Mach numbers, all stall warnings will be less intense, and greater caution must be used to prevent inadvertent stalls.

An accelerated stall may result from holding a high g level while decelerating from supersonic speed. Particular care should be taken to maintain speed with adequate thrust or nose attitude while holding a high g level in turns at low supersonic speeds. The airplane can rapidly decelerate from these speeds to high subsonic speeds at which the stall boundary decreases and the tail effectiveness increases, making it more likely that an accelerated stall would be entered abruptly. During the deceleration, the time between warning (if felt) and actual stall can be as short as 2 seconds. To ensure against an accelerated stall occurring under such conditions, maintain speed while holding g's or reduce the g's before decelerating.

STALL SPEEDS



NOTE

Power-off stalling speeds are based on operation with the engine idling. Stalling speeds with the engine windmilling are essentially the same as presented for power-off. Since power-on stalling speeds are affected more by pilot technique than by thrust effects, power-on stalling speeds are not presented.

AX-148-2-67

Figure 4–8

Stalls in Turn Entries and Reversals

Accelerated stalls may also result from attempting aileron rolls at g loads below but close to the stall boundary, such as in turn entries, turn reversals or turn recoveries.

Rolls attempted under these conditions result in large yaw angles which can cause the airplane to stall. In such cases, the usual warnings of an accelerated stall may not be apparent. The most positive warning of a possible stall entered from a roll is indicated by the roll behavior of the airplane. If response to the ailerons is very sluggish, if the roll appears to be stopping while the ailerons are still deflected, or if there is no response at all to the ailerons, the roll is being attempted at too high a g loading or too low an airspeed. When any of these characteristics occur, ailerons should be neutralized immediately and g loading reduced.

If the ailerons are not neutralized immediately, the airplane may yaw and pitch into a stalled attitude, or an uncontrolled flight maneuver (similar to a snap roll) may occur.

To take advantage of the higher rates of roll and best behavior of the airplane, rolls through large bank angles such as in turn entries or turn reversals should be performed under buffet-free conditions.

Rolls initiated at buffet onset or above should be limited to small lateral stick deflections and small bank angle changes such as occur when tightening a turn or making tracking corrections. To avoid the possibility of entering uncontrolled flight, rolls should not be attempted above moderate buffet levels.

RECOVERY PROCEDURE

Upon first signs that the stall point has been reached or upon recognition from the roll behavior of the airplane that a stall is imminent, the following recovery action should be taken immediately:

1. Relax all stick and rudder forces, allowing controls to return to their neutral positions, then push stick forward of neutral as required to reduce angle of attack or g load.
2. Avoid use of ailerons and allow airspeed to increase in whatever bank angle or pitch attitude exists, even if inverted, until well out of buffet.

Never displace ailerons to raise a wing at or beyond the stall or to stop a snap roll. It is emphasized that the use of ailerons during stall or stall recovery will not produce the expected roll but will develop sufficient yaw to result in a spin.

Even though the airplane may be gyrating (snap rolling, yawing and pitching) or appears to be entering a spin, hold controls in neutral until either recovery or a spin is clearly indicated. Look at stick and rudder pedals to ensure that they are in neutral. *It should not be assumed that the airplane is in a spin until at least one yawing turn (not roll) has occurred without reversing, as described under "Recognition Of The Spin."*

STALL SUMMARY

1. Warning in the form of heavy buffeting, roll oscillations, porpoising, or poor response to ailerons always precedes the stall.
2. The stall is marked by abrupt wing drop, roll, or snap roll.
3. Recovery is initiated by immediately neutralizing controls.
4. Hold neutral controls (stick slightly forward) until either recovery occurs or a spin is clearly indicated.
5. Do not use ailerons to stop roll or correct bank angle at or beyond stall.
6. Do not attempt rapid rolls through large bank angles in buffet conditions.

SPINS

CHARACTERISTICS

GENERAL.

Regardless of the flight conditions, attitudes, gyrations or control manipulations leading to departure from controlled flight, and regardless of those imposed during uncontrolled flight, the airplane will perform only the one type of upright spin described below.

Crusader spins are characterized by large frequent changes in pitch attitude and bank angle in the first 2 to 3 turns. In these initial turns the pitch attitude may rapidly change from a nose-high position near or above the horizon, to 40° or 50° nose down, and then back to the nose-high position again. In the same period, the bank angle may vary 45° wing down to 45° opposite wing down. The nose of the airplane returns to a high position once in each turn. These large motions gradually reduce in magnitude, and during the third turn may reach a level as little as one-half to one-fourth of the initial motions. The behavior of the spin appears considerably smoother to the pilot from this time on. After the third turn, average pitch attitude is relatively flat, with the nose 10° to 20° below the horizon. A complete turn occurs in 4 to 5 seconds. Average altitude loss is 1,400 feet per turn.

Occasionally, while in a spin, the airplane will roll outside wing down to an inverted attitude for a few seconds so that it describes part of a turn (as much as one-half turn) at a negative 1.0g. The airplane will continue to roll, in the same direction that created the inverted attitude, to an upright attitude and will continue in an upright spin regardless of how long the spin is maintained. The general rotation of the spin will remain in the same direction relative to the earth before, during and after the roll through the inverted position. It is possible that while the airplane is inverted, the pilot may have the sensation that a spin reversal has occurred. *However, this is not a reversal.* This inverted condition, when it occurs, usually does so in the latter part of the second turn and the first part of the third turn. However, it is not violent, nor does it affect ability of the pilot to select and apply proper recovery controls. The recovery does not appear to be lengthened or otherwise changed by this phenomenon.

The most violent airplane motion will be encountered in the initial departure from controlled flight at higher airspeeds in accelerated stalls. The airplane cannot be made to enter a spin at speeds in excess of 170 knots IAS; however, above this speed, uncontrolled flight (such as violent snap rolls) can be generated from which it is possible to effect recovery providing controls are immediately neutralized. *During uncontrolled flight, speed can be lost at very high rates up to 40 knots per second, which may result in speed very rapidly dropping below 170 knots.* If recovery from uncontrolled flight has not been effected before this time, the airplane will enter a spin with no break in the motion. In such entries the airplane may initially snap roll over the top or under the bottom before autorotation. Occasionally the airplane will perform, initially, a severe cartwheel type of maneuver in which the nose goes well above and below the horizon to near vertical attitudes. Independently of the manner in which the initial departure occurs, either through a snap roll or cartwheel, the resultant extreme attitudes will be reduced to the typical spin attitudes by the end of the second turn.

Although, the airplane may flip right side up and enter an upright spin as a result of loss of flying speed in inverted flight, it will not perform an inverted spin.

Spin characteristics and spin recovery procedures are not affected by extended landing gear and speed brake, or by fuselage missile pylon installations. Fuselage missiles installed on the airplane have a beneficial effect in that the spin is somewhat milder and recovery is faster. Wind tunnel tests indicate that landing condition spins and recovery procedures are similar to those for the clean condition.

Spin characteristics with wing stores installed have not been flight tested. Studies indicate that the wing stores will not have an adverse effect on spin characteristics. If necessary, the wing stores can be jettisoned for spin recovery.

ENGINE AND ELECTRICAL SYSTEM BEHAVIOR IN SPINS.

Because of the high angle of attack encountered in a spin, the ability of the duct to carry air to the engine is greatly reduced and engine compressor stalls may result. This will be evidenced by loud coughing and banging noises which can lead to excessive engine exhaust temperatures. To reduce the severity of compressor stalls and engine overtemperatures, the throttle must be retarded to IDLE if a spin is encountered. Overtemperatures as high as 770°C have occurred during spins after IDLE was selected. However, in each case engine operation has remained normal.

Severe compressor stalls can also result in complete loss of electrical power if the low pressure compressor rotor speed drops below normal idle values. On some occasions compressor stalls have persisted after idle thrust was selected, until 250 knots IAS and altitudes below 30,000 feet were achieved in the recovery dive.

As compressor stalls cease, engine exhaust temperatures will return to normal and the main generator will automatically return to service. However, yaw and roll stabilization and trim systems will have to be manually reset to regain operation. No engine flameouts occurred during Crusader spin investigations.

RECOVERY CHARACTERISTICS AND PROCEDURES

RECOVERY PROCEDURE.

Recovery from a spin is obtained by using the following technique:

1. Retard throttle to IDLE.

WARNING

When selecting emergency droop to aid spin recovery, do not unlock the wing.

2. Extend leading edge to landing droop by raising emergency droop and wing incidence guard and moving the WING INCIDENCE handle to the full forward position.

3. Place full rudder against spin; apply full aft stick and full lateral stick opposite to rudder (with the spin).

EXAMPLE

Control	*Right Spin*	*Left Spin*
Rudder	Full left	Full right
Stick	Full aft and full right	Full aft and full left

4. Jettison wing stores if spin recovery is not apparent three turns after recovery controls have been applied.

5. As spin rotation stops, promptly neutralize ailerons and rudder, and push stick 2 to 3 inches forward of neutral.

WARNING

Full lateral stick deflection must be applied since as little as ½-inch less than full deflection may add one additional turn to the recovery.

Spin recovery may take as long as 12 seconds, a period that may *seem* considerably longer to the pilot. Concentrated effort must be made to hold correct recovery controls until recovery is indicated.

For this technique to be effective, the pilot must be aware of the behavior of the airplane during recovery from the spin. Incorrect interpretation of these characteristics can result in wrong use of recovery controls and failure to recover from the spin. The following paragraphs describe in more detail the recovery behavior of the airplane and the appropriate actions for obtaining prompt recovery.

USE OF THROTTLE.

WARNING

To avoid inadvertent engine shutdown maintain inboard pressure on the throttle when reducing the throttle toward idle.

Engine operation above IDLE during the period between radical departure from normal flight and entry into true spin rotation can be beneficial in recovery with neutral controls. Once the spin is entered, however, the throttle must be at IDLE to minimize the effects of compressor stall and overtemperature. IDLE power settings will prevent overtemperature below 37,000 feet, but compressor stalls may continue. If neutralizing the controls does not result in immediate arrestment of the departure from controlled flight, the throttle should be retarded to IDLE immediately. *When in doubt as to how far the stall has progressed towards a spin, retard the throttle to IDLE.*

RECOGNITION OF THE SPIN.

Spin recovery procedures should not be attempted until the pilot is certain that a spin exists. In the Crusader a spin differs from other stall gyrations in that the nose of the airplane will continuously yaw in one direction. *A spin should be assumed only if the yaw is continuous in one direction for at least one turn.*

DIRECTION OF ROTATION.

Direction of rotation must be positively established so that the rudder and aileron may be deflected in the proper direction to stop the spin.

Direction of rotation can easily be determined by observing traverse of terrain over the nose of the airplane. Spin direction can also be determined by use of the needle of the turn-and-bank indicator. Needle to the right indicates a right spin, and needle to the left, a left spin.

RECOVERY BEHAVIOR.

When the leading edge is extended to landing droop and controls are placed to stop the spin, continuous rotation in the initial direction will cease within 2½ additional turns. The only positive means of recognizing that rotation has stopped is by closely watching the traverse of the terrain. As the apparent motion of the ground past the nose is stopping or when it has stopped, quickly neutralize rudder and ailerons and push stick 2 to 3 inches forward of neutral. Failure to neutralize controls promptly can cause a spin in the opposite direction.

As the rotation stops, a nose-down pitch will usually occur, followed by an increase in airspeed, and eventual recovery to normal flying speed in a 70° to 90° dive. A rolling tendency usually occurs early in the recovery dive just after controlled flight has been regained. This tendency should not be opposed with aileron as the motion will damp as airspeed increases. The use of aileron at this time may develop another spin.

USE OF LANDING DROOP.

The use of landing droop results not only in more positive spin recovery, but also results in more positive pilot recognition of the recovery phases. Therefore, landing droop should be selected immediately on recognition that a spin exists. The pilot should devote his full attention, if necessary, to actuation of the droop controls. Visually observe droop control actuation, and if need be, release the stick and use both hands to obtain proper actuation. Releasing the stick will not cause the airplane to enter any other type of maneuver or to fall or spin any faster. There are no restrictions with respect to extending leading edge to landing droop *during* a spin. If a reasonable attempt at droop extension is unsuccessful due to buffeting, the pilot should continue the spin recovery sequence, but not beyond altitude limits which would preclude successful ejection. Once recovery controls are applied, additional attempts at droop extension may be made.

TRIM SETTINGS.

Under normal trim usage, trim settings will not have significant effect upon spin and recovery characteristics. Full directional or lateral trim settings will not be noticeable until considerable speed is picked up in the recovery dive. Since the longitudinal trim setting existing may not be known, recovery can be hastened by pushing the stick 2 to 3 inches forward of neutral, as the spin ceases, regardless of trim position. A slightly steeper recovery dive may result from this technique.

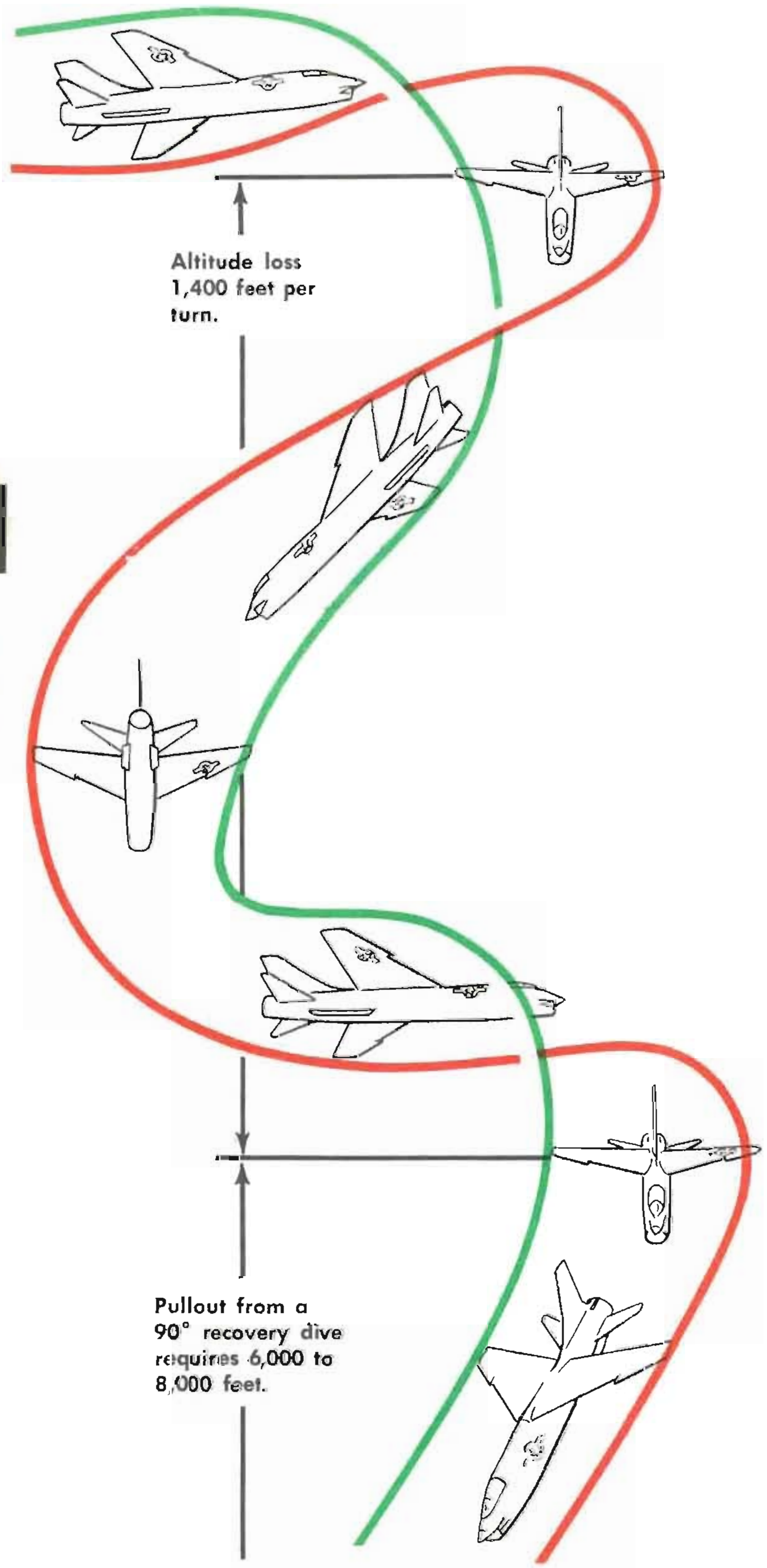
RECOVERY TO LEVEL FLIGHT.

To avoid progressive stalls, do not initiate pullout prior to reaching at least 200 knots IAS. Available g's will not permit rapid round out at low airspeeds, and high drag from a pullout started too early will retard buildup of speed to safer pullout speeds. The altitude loss from the point at which a controlled dive is reached to that at which level flight is achieved will be about 6,000 to 8,000 feet. Speed brake may be extended in the dive, after reaching at least 200 knots IAS, to prevent excessive airspeed buildup. Do not exceed landing droop restrictions in the recovery; the airspeed and g loadings will not exceed these restrictions during the spin.

SPIN SUMMARY

(See figure 4–9)

SPIN



SPIN SUMMARY

1. Initial turns involve large variations in pitch attitude and bank angle.

2. A spin should be assumed only if the yaw is continuous in one direction for one turn.

3. Retard throttle to IDLE.

4. Using emergency pneumatic system, extend leading edge to landing droop immediately.

5. Determine direction of spin by observing traverse of terrain over the nose or observing needle of turn-and-bank indicator.

6. Place full rudder against spin, full aft stick and full lateral stick opposite to the applied rudder (with spin).

EXAMPLE

Control	*Right Spin*	*Left Spin*
Rudder	Full left	Full right
Stick	Full aft and full right	Full aft and full left

7. As continuous rotation in initial direction ceases, promptly neutralize ailerons and rudder and push stick 2 to 3 inches forward of neutral; visually check position of stick.

8. Hold neutral control positions until at least 200 knots IAS is obtained in steep dive. Do not revert to spin recovery control positions unless continuing spin is clearly established.

9. Do not confuse rolling tendency in the recovery dive with a continuous spin or attempt to oppose the tendency.

10. In recovery dive, extend speed brake as required after reaching 200 knots IAS as an aid in preventing excessive airspeed.

AX-79-1-67

Figure 4-9

section V
emergency procedures

CONTENTS

PART 1 — GROUND EMERGENCIES

PART 2 — TAKEOFF EMERGENCIES

PART 3 — INFLIGHT EMERGENCIES

PART 3 — INFLIGHT EMERGENCIES

PART 4 — LANDING EMERGENCIES

PART 1—GROUND EMERGENCIES

ENGINE FIRE ON GROUND

Indications

Fire warning light — ILLUMINATED
Fire observed

Procedures

With external power and starter connected:

1. Throttle — OFF
2. Engine master switch — ON
3. Master generator switch — TEST or ON
4. Throttle — CRANK
   - Continue cranking until fire is out

When fire is out:

5. Master generator switch — OFF RESET
6. Engine master switch — OFF

If impossible to reconnect external power and starter:

1. Throttle — OFF
2. Engine master switch — OFF
   - Before losing aircraft electrical power
3. Master generator switch — OFF RESET
4. Abandon aircraft

BRAKE FAILURE

Procedures

To obtain emergency (pneumatic) braking:

1. Emergency brake handle — PULL AFT SLOWLY
   - Pull handle slowly to avoid locking the brakes. This also allows pressure to be applied evenly to the wheels.
   - Brake pressure is directly proportional to distance handle is moved.
   - Manipulate handle to obtain momentary braking action.
   - Push handle full forward to release brakes.
   - Differential braking is unobtainable.
   - If necessary, shut down the engine to aid stopping.
2. Perform short field arrestment (if possible) or normal carrier arrestment.
   - Refer to FIELD ARRESTMENTS, this section, part 4, for short field arrestment procedure.
   - After carrier arrestment, leave hook down.

HOT BRAKES

Hot brakes can be expected when:

Takeoff aborted
Excessive brakes used after a landing
Brakes dragging

Note

Any of the above conditions could raise temperatures to a point where normal takeoff would heat a wheel enough to produce explosive failure.

Time-temperature histories indicate that normal taxiing using nose gear steering, military and afterburner takeoffs, FMLP and touch-and-go landings do not significantly increase wheel temperature.

Procedures

1. Taxi (or have aircraft towed) to nearest hot brakes area.
   - If hot brakes are discovered on the line, promptly taxi or have aircraft towed to an isolated position, and warn personnel to stay clear.
2. Notify tower to alert crash crew.

3. Park aircraft with wing down and wheel axis pointed in safe direction.
   - Tire/wheel failure usually occurs after returning to the line. This is because maximum transfer of heat from the brake discs to the wheel usually requires 15 to 20 minutes. Therefore, should it become necessary to approach the aircraft, personnel should move toward the aircraft from the front or rear, never from the sides.
   - Where hot brakes result in fire, the use of dry chemicals in preference to CO_2 and foam (as fire extinguishing agents on tires and brakes) is recommended due to metal stresses caused by the cooling action of CO_2.
   - The wheels require 45 to 60 minutes to get rid of 60% of the heat absorbed in a landing rollout or aborted takeoff. If an agent to accelerate cooling is necessary, use water by directing a stream to the brake in 10- to 15-second bursts (3 to 5 applications) with 30 to 60 seconds between applications.

EMERGENCY ENTRANCE

Refer to figure 5–1 for the procedure to be followed when entering the cockpit under emergency conditions.

EMERGENCY EGRESS

Begin egress procedure *immediately* after aircraft comes to rest. Use the following procedure for either water or field emergency egress.

Procedures

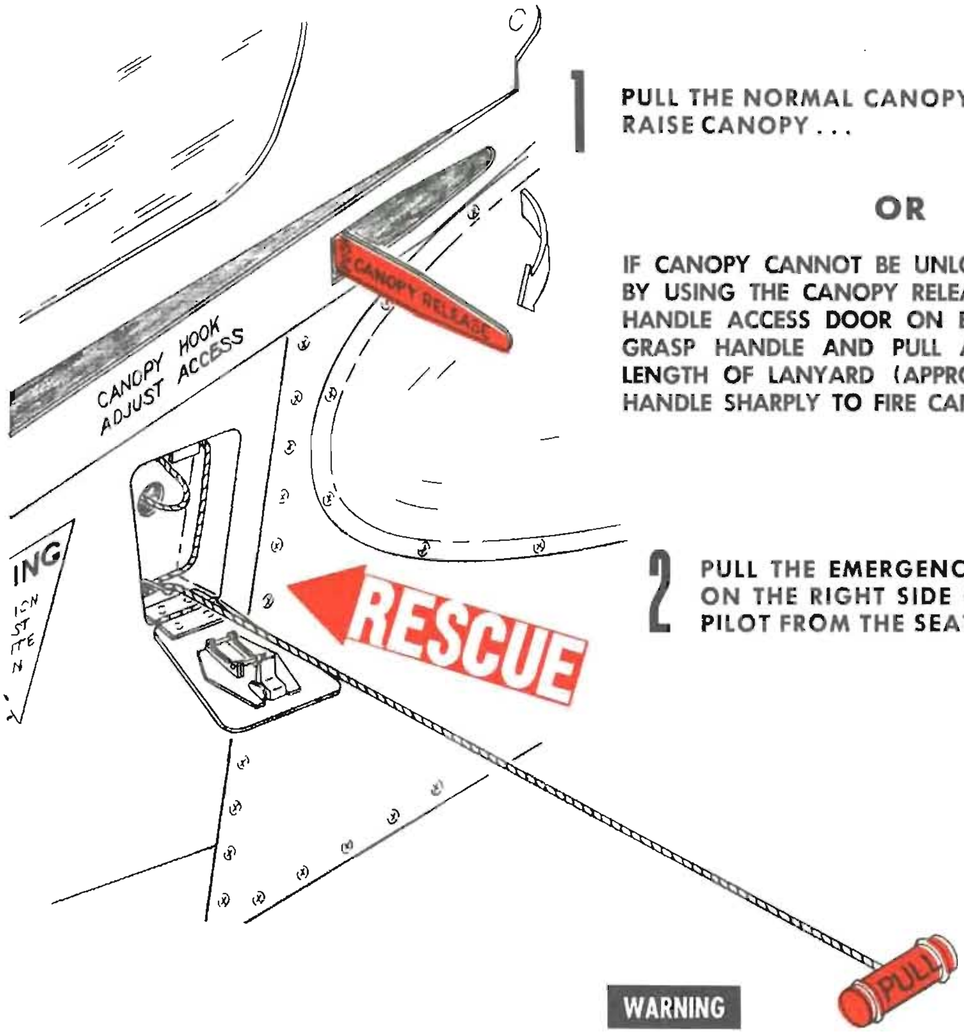
Note

To obtain breathing oxygen supply before actually leaving the aircraft, pull emergency oxygen "green apple."

1. Attempt to open canopy by normal means.
   - If canopy cannot be unlocked and opened normally by using the canopy release handle, use the canopy jettison handle.
2. Shoulder harness fittings — RELEASE
   - Releases parachute.
3. Emergency harness release handle—PRESS BUTTON, ROTATE AFT
   - Releases seat-harness connections.
4. Ensure separation of leg restraint line fittings.
5. Pilot's services connections — DISCONNECT AT CONSOLE
   - Disconnect oxygen and antiblackout lines, and/or lines from antiexposure coverall.
6. Abandon aircraft with survival equipment.
   - As aircraft is abandoned, emergency oxygen bottle activates.
   - If desired, release survival equipment after abandoning by releasing hip harness fittings from suit.

EMERGENCY ENTRANCE

TO OPEN THE CANOPY AND REMOVE PILOT:



1 PULL THE NORMAL CANOPY RELEASE HANDLE AND RAISE CANOPY . . .

OR

IF CANOPY CANNOT BE UNLOCKED AND OPENED NORMALLY BY USING THE CANOPY RELEASE HANDLE, OPEN THE RESCUE HANDLE ACCESS DOOR ON EITHER SIDE OF THE AIRCRAFT — GRASP HANDLE AND PULL AWAY FROM FUSELAGE TO FULL LENGTH OF LANYARD (APPROXIMATELY 6 FEET), THEN PULL HANDLE SHARPLY TO FIRE CANOPY ACTUATOR CARTRIDGE.

2 PULL THE EMERGENCY HARNESS RELEASE HANDLE ON THE RIGHT SIDE OF THE SEAT TO RELEASE THE PILOT FROM THE SEAT.

WARNING

BE EXTREMELY CAREFUL NOT TO INJURE THE PILOT WHEN FORCING ENTRY TO THE COCKPIT. BE EXTREMELY CAREFUL NOT TO PULL THE EJECTION SEAT FACE CURTAIN OR THE SEAT SECONDARY FIRING HANDLE WHEN FORCING ENTRY TO THE COCKPIT AND WHEN REMOVING THE PILOT.

DO NOT USE RESCUE HANDLE IF SPILLED FUEL IS IN THE COCKPIT AREA. PULLING HANDLE FORCIBLY OPENS CANOPY BY FIRING EMERGENCY ACTUATOR CARTRIDGE WHICH CAN IGNITE FUEL. IF FUEL IS IN COCKPIT AREA, USE AXE TO FORCE ENTRY THROUGH CANOPY.

NOTE

IF IMPOSSIBLE TO OPEN CANOPY BY NORMAL OR EMERGENCY METHODS, BREAK CANOPY GLASS WITH FIRE AXE OR SIMILAR INSTRUMENT.

FIRING OF THE EMERGENCY ACTUATOR CARTRIDGE BLOWS OPEN THE CANOPY LOCKS AND FORCIBLY OPENS THE CANOPY. IF CANOPY DOES NOT SEPARATE FROM AIRCRAFT, IT MAY FALL TO CLOSED POSITION BUT WILL NOT LOCK.

AX-80-1-67

Figure 5-1

PART 2—TAKEOFF EMERGENCIES

FIELD

ENGINE FAILURE

Procedures

Before becoming airborne:

1. Abort or eject (MK-F5A or MK-F7 seats only).
   - To abort, retard throttle to OFF and depress brake pedals. If pedal braking is not sufficient, use emergency brake handle. If field is equipped with arresting gear, place arresting hook handle in HOOK DOWN. If aircraft has already run beyond arresting gear and barricade is available, engage the barricade. (Refer to BARRICADE ENGAGEMENT, part 4, for engagement techniques.)
   - Ground-level ejection is possible above 120 KIAS with MK-5FA seat. There is no minimum speed for ground-level ejection with the MK-F7 seat.

Immediately after becoming airborne:

1. Eject (if possible).
   - Refer to EJECTION AND BAILOUT, part 3, to determine safe ejection envelope following takeoff.

If unsafe to eject, land straight ahead. Perform as many of the following operations as possible:

2. Airspeed — 140 KIAS MINIMUM
3. Wing — AS IS
4. Throttle — OFF
5. EPP — EXTEND
6. Canopy — JETTISON
   - Emergency canopy jettison handle — PULL
7. External stores — JETTISON (if practical)
   - Stores cannot be jettisoned unless landing gear handle is in WHLS UP. (Refer to JETTISONING EXTERNAL ARMAMENT, part 3, for jettisoning procedures.)
   - Local directives and operational procedures will govern jettisoning of external stores.
8. Landing gear — DOWN
   - Landing gear handle — WHLS DOWN
   - If this step and step 7 cannot both be performed in the time available (due to requirement for gear handle to be in WHLS UP position for jettisoning), this step shall take precedence.

AFTERBURNER FAILURES

Procedures

If afterburner fails to light:
Abort takeoff.

If afterburner blows out in early stages of takeoff roll:
Immediately abort takeoff using field arresting gear if necessary.

If afterburner blows out shortly before, during, or immediately after lift-off:
Deselect afterburner and continue takeoff in MRT. Do not recycle the afterburner.

BLOWN TIRE

Procedures

1. Abort, conditions permitting.
   - If needed, use nose gear steering for maintaining directional control.
2. Perform short field arrestment.
   - Refer to FIELD ARRESTMENTS, part 4, for short field arrestment techniques.

SUSPECTED HOT BRAKES

Procedure

Leave gear down for approximately 5 minutes following takeoff.

- The 5-minute gear-down time is required for wheel/brake assembly cooling. An exploding wheel assembly can rupture the main fuel line in the wheel well.

CARRIER

CATAPULTING EMERGENCIES

Procedures

If definite loss of catapult thrust is experienced early in the launch and decision is made to remain on deck, take the following actions immediately:

1. Shut down engine.
2. Apply maximum braking.

All Other Catapulting Emergencies

Select afterburner immediately if additional thrust is needed to aid directional control and escape potential.

PART 3—INFLIGHT EMERGENCIES

ENGINE MALFUNCTIONS

FLAMEOUT

Procedures

1. Throttle — OFF

   - To prevent entry of air into the engine fuel system at nose-down attitudes, leave throttle in this position until airstart is begun.

2. Ensure engine master switch ON, fuel transfer switch ON, and emergency generator switch OFF.

   - If flameout occurred because main fuel cell ran dry, turning on transfer fuel system may transfer enough fuel to permit an airstart.
   - Emergency generator switch must be in OFF position to prevent a load from being placed on the emergency generators when the power package is extended. Extending the EPP with a load on the generators could prevent obtaining electrical power for an airstart.

3. Determine cause of flameout.

   - Pilot-induced flameouts are those caused by inadvertently moving engine master switch to OFF, failure to transfer fuel, low-speed high-angle-of-attack flight resulting in compressor stalls, prolonged zero-g flight, and exceeding the recommended nose attitudes or operating limits with partial or complete electrical failure.
   - Troubleshooting the cause:

     a. *Suspect throttle cable breakage* if the throttle loses tension and fuel flow drops to zero. Immediately activate ignition and engage the approach power compensator (APC). The APC must be engaged prior to loss of main generator power as the APC is energized by the secondary bus.

     Note

     With the landing gear in the up position, the APC switch must be held in the ON position.

     b. *Fuel boost pump failure* will be indicated by illumination of the boost pump warning light, unstable engine operation (climbing through 30,000 to 37,000 feet at high power setting), and subsequent flameout. The engine fuel pump light will illuminate as the flameout occurs. After electrical power has been regained by the EPP, the fuel pump light will be out if windmilling rpm is greater than 10%. A relight is highly probable.

     c. *Main fuel exhaustion* may also have the same symptoms as a boost pump failure, but the main fuel quantity indication and fuel flow should be near zero. The engine pump light should remain on with electrical power supplied. A relight is highly improbable.

     d. *Complete engine-driven fuel pump failure* should be typified by the engine fuel pump light coming on and the engine flaming out. Airstart attempts will produce the same indications as main fuel exhaustion with the exception of the fuel quantity indication. A relight will be impossible.

     e. *Normal fuel control failure* will most likely be indicated by unstable engine operation or rpm restriction before the flameout. The engine fuel pump light may also come on. Relights in manual fuel control are highly probable.

     f. *Engine oil system failure* with subsequent bearing failure will most likely be indicated by noticeable vibration, high EGT, loss of oil pressure and perhaps smoke in the cockpit. A relight is impossible.

4. Perform airstart (if practical).

TURBINE FAILURE

Indications

High EGT
Low RPM
Low EPR
Compressor stalls

ENGINE INSTABILITY

Indications

Erratic EGT
Rapid reduction or fluctuation in RPM at constant throttle
No increase in RPM when throttle advanced
EPR not responding to throttle movement
Compressor stall
Physical sensation

(If no physical sensation, verify by at least two engine gage readings.)

Procedures

If engine flames out or must be shut down because limitations exceeded:

Perform FLAMEOUT procedure.

If operation unstable but not exceeding limitations:

1. Throttle setting — IDLE, time permitting

2. Fuel control switch — MANUAL
   - Do not hesitate to select MANUAL at any power setting if necessary.
   - The manual fuel control in the F-8 has proven extremely reliable, but remember, when in MANUAL the main fuel regulating valve is the throttle. Take it easy.
3. Land immediately at the nearest suitable field (precautionary approach recommended).
   - Refer to PRECAUTIONARY APPROACH, part 4.

INCORRECT OR FLUCTUATING OIL PRESSURE

Indications

Oil pressure below 37 psi or above 53 psi

- Engine/hydraulic oil pressure warning light illuminates at or below 34 psi.
- Pressures during zero or negative g operation do not necessarily indicate a failure.

Oil pressure fluctuating more than 10 psi in the normal (37 to 53 psi) range.

- Occasionally, air in the oil transmitting line will cause a pressure fluctuation. This, however, will be a narrow range (3 to 5 psi), rapid fluctuation.
- Pressure fluctuations during zero or negative g operation do not necessarily indicate a failure.

Procedures

1. Throttle — MOVE SLOWLY TO CRUISE SETTING (85% to 87%)
2. Avoid power changes, flight accelerations and abrupt use of speed brakes to reduce possibility of engine seizure.
3. Land immediately at the nearest suitable field (precautionary approach recommended).
   - There have been instances where the engine continued to run for as long as an hour without oil pressure, but the engine has also been known to fail in a matter of minutes. Because of this, it is of the utmost importance to land as soon as possible after an engine oil system malfunction is detected.
   - Refer to PRECAUTIONARY APPROACH, part 4.
   - After landing, shut down as soon as practical to prevent further engine damage.

STUCK THROTTLE OR ENGINE FAILS TO RESPOND TO THROTTLE MOVEMENT

Engine responds to approach power compensator

If the engine fails to respond to throttle movement in either normal or manual fuel, there is a possibility that control may be regained by engaging the APC. Attempt to engage the APC with the fuel control in normal. If successfully engaged, the APC will maintain approximately the optimum angle of attack for either climbing, level, or descending flight. It will be necessary to hold the APC engage switch in ON until the landing gear is extended. Make a normal approach with short field arrestment. Turn off the engine master switch after arrestment.

WARNING

In the event the arrestment is missed, reengage the APC immediately and hold the switch in ON until airborne.

Engine fails to respond to the approach power compensator

If engine fails to respond to the APC, it will be necessary to perform a stuck throttle approach (figure 5-2).

The optimum stuck throttle approach is started from a "hoop" position approximately 4,000 feet from the end of the runway at 300 feet above field elevation and 175 KIAS. These conditions are based upon an aircraft gross weight of 22,000 pounds, a 20-knot headwind, standard day conditions, and a 3½-degree glideslope. Add 5 knots airspeed per 1,000 pounds of fuel above 22,000 pounds aircraft gross weight. Other contingencies such as inability to obtain recommended approach airspeed are covered within the procedure.

Before reaching the hoop:

1. Landing gear — DOWN
2. Wing — RAISE
3. IFR probe — AS DESIRED
   - Extend the inflight refueling probe if level flight speed with full speed brake is above 175 KIAS. This must be done while operating on main generator power.
4. Arresting hook — HOOK DOWN
   - Plan for long field arrestment if gear available.
5. Speed brake override switch — OVERRIDE
6. EPP — EXTEND
   - The emergency power package is used to provide power control hydraulic pressure, speed brake electrical power, and roll and yaw stabilization (above 175 KIAS) after engine shutdown.
   - To extend package:
     a. Master generator — OFF
     b. Emergency power handle — PULL
     c. Emergency generator switch — ON

7. All excess electrical power — OFF
   - To conserve power control hydraulic pressure from the EPP, turn OFF the following:
     a. Exterior and interior lights
     b. TACAN master switch
     c. UHF master switch
8. Roll and yaw stabilization — AS DESIRED
   - Roll and yaw stabilization should be turned off when airspeed drops below 175 KIAS during the approach in order to conserve power control hydraulic pressure from the EPP.
9. Adjust airspeed
   - Use speed brake as necessary to pass through the hoop at 175 KIAS. If level flight speed exceeds 200 KIAS in landing condition with full speed brake, maneuver the aircraft so as to pass through the hoop at 200 KIAS.
   - If impossible to maintain a level flight speed of 160 KIAS in landing condition, an approach can still be made if 160 KIAS can be obtained without exceeding 1,000 fpm rate of descent.

Through the hoop (approximately 4,000 feet from runway, 300 feet above field elevation, 175 KIAS):

10. Intercept glideslope
    - A centered meatball (on an optical landing system set for a 3½-degree glideslope) and an altimeter reading of 300 feet above field elevation indicate aircraft is 5,000 feet from mirror touchdown point. (If the OLS is not set for 3½ degrees, it still may be used as a reference by flying a high or low meatball as dictated by the particular OLS setting.)
11. Engine master switch — OFF
    - Turning the engine master switch to OFF upon passing through the hoop will provide time for the engine to use up available fuel and the aircraft to decelerate to 145 KIAS at touchdown, approximately 1,000 feet down the runway. At higher airspeeds the power required will consume fuel faster and vice versa.
    - With the engine master switch in OFF, the engine will continue to produce thrust for a period of approximately 4 seconds (at MRT) to 24 seconds (at IDLE).
12. Fly proper glideslope approach
    - This approach allows safe ejection prior to reaching 1,500 feet from the end of the runway at 150 feet above ground level. From this point a safe landing can be made with a dead engine.
13. Airspeed — 175 KIAS
    - If level flight speed is above 175 KIAS, use speed brake to maintain as close to 175 KIAS as possible during the approach.
    - If level flight speed is below 175 KIAS, use speed brake only to keep from exceeding 175 KIAS during the approach.

After engine stops:

14. Speed brake — AS IS
    - When the engine stops, do not change the speed brake deflection.

Over the end of the runway:

15. Emergency generator switch — OFF
    - The emergency generator switch is placed in OFF to provide adequate power control hydraulic pressure for landing.
    - Airloads and utility hydraulic pressure from the windmilling engine will retract the speed brake when the emergency generator switch is placed in OFF.
    - With the emergency generator switch in ON (and all excess electrical power OFF) or LAND, the minimum indicated airspeed for adequate power control hydraulic pressure from the EPP is 145 KIAS. With the switch in OFF, the minimum speed is 140 KIAS.

Touchdown:

16. Avoid hitting nosewheel first, which could lead to porpoising.

FAILURE OF APPROACH POWER COMPENSATOR TO DISENGAGE

System cannot be disengaged using 12- to 22-pound throttle force:

1. Turn off engage switch manually.

— OR —

2. Break shear pin by applying 36- to 54-pound force.

Shear pin cannot be broken:

1. Turn off master generator switch.
2. Extend EPP to energize primary and emergency buses.

System fails to disengage upon landing:

1. Apply normal override throttle force.

— OR —

2. Manually turn off engage switch.

— OR —

3. Turn off master generator switch.
   - With master generator off, nose gear steering will not be available.

STUCK THROTTLE APPROACH

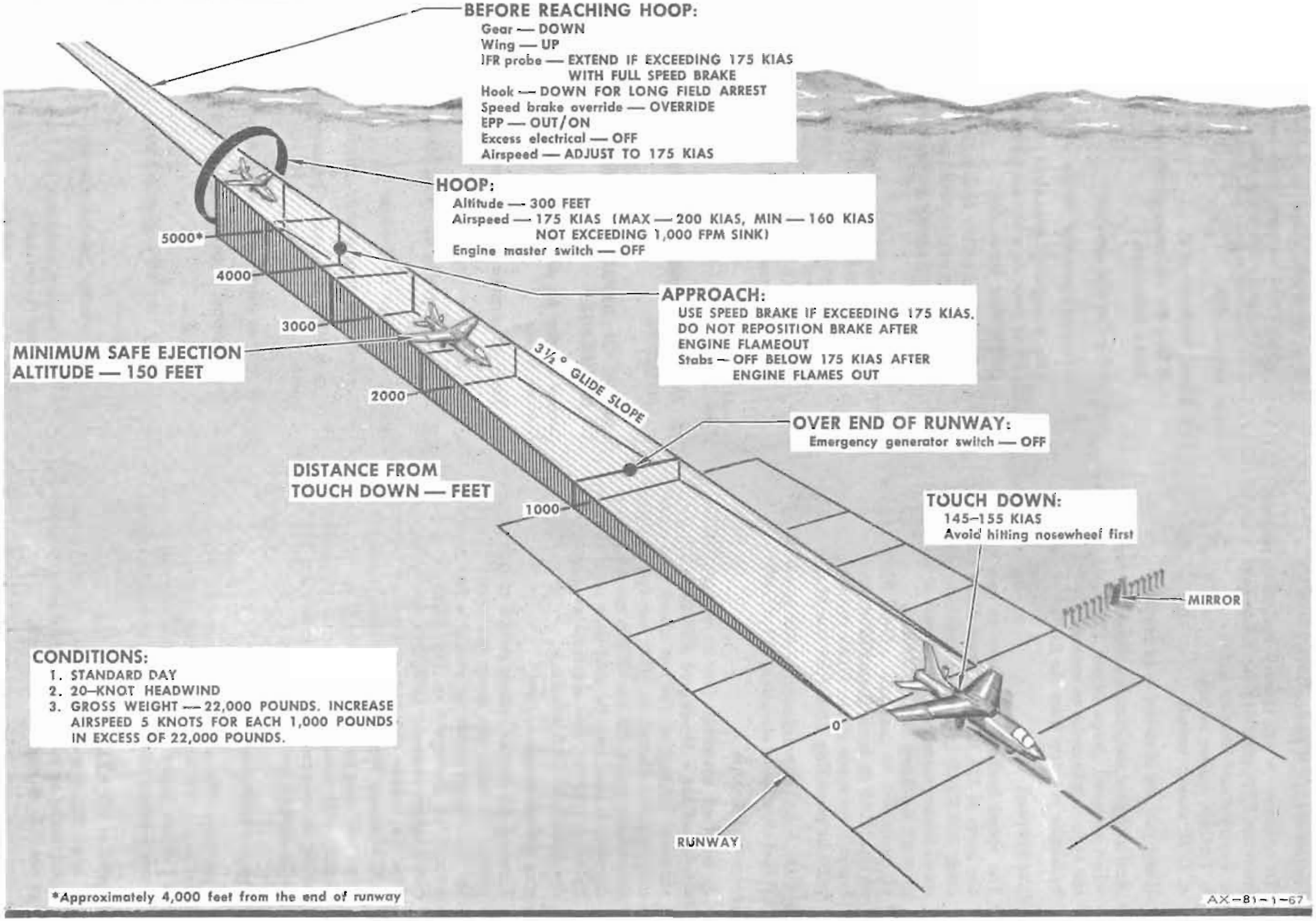


Figure 5–2

AIRSTARTING

FIRST AIRSTART ATTEMPT

The fundamental starting ingredients for any air-breathing engine will always remain the same: air, fuel, and ignition. Be aware of what the engine instruments are reading, and the chances of success will be known in advance.

Procedures

1. Optimum airspeed — 170 TO 250 KIAS (13 UNITS)
   - Airstarts are obtained most consistently below 35,000 feet and with 170 to 250 KIAS and 17% to 30% rpm. However, do not wait to obtain these conditions before proceeding with airstart. Proceed with airstart immediately. Airstarts have been obtained at higher altitudes and engine speeds up to the maximum capability of the aircraft. If a flameout occurs above 35,000 feet, it is necessary to perform airstart procedure quickly to utilize maximum available engine rpm.
2. Electrical power — AVAILABLE (extend EPP if required).
   - The emergency power package is normally used to provide electrical power for airstart ignition. However, it may be possible to obtain an airstart using only aircraft electrical power if engine windmilling rpm is sufficient (the generator drops off the line 8 to 10 seconds after flameout) and main generator indicator shows ON. (Refer to figure 1-9 for engine windmilling speeds.) A high rpm, high-altitude airstart may be attempted by placing the throttle in IGNITE and back to IDLE. A high-rpm, low-altitude airstart may be attempted by thumbing the ignite microswitch and placing the fuel control switch in MANUAL without repositioning the throttle. Both procedures must be accomplished immediately following flameout and prior to generator dropping off the line.
   - If necessary to extend emergency power package, use the following procedure:
     a. Master generator switch — OFF (When selecting power source after extending EPP, master generator switch must be placed in OFF before emergency generator switch placed in ON or LAND to prevent complete loss of electrical power.)
     b. Emergency power handle — PULL (Do not extend the emergency power package with the emergency generator switch in ON or LAND.)
     c. Emergency generator switch — ON
     d. Emergency power indicator light — ON
3. Fuel control switch — NORMAL or MANUAL
   - If MANUAL position used for airstart and switch is left in this position for landing, do not engage approach power compensator during the landing approach. Automatic throttle movements associated with APC operation are rapid and could result in compressor stall and engine flameout.
4. Throttle — IGNITE momentarily, then gradually advance to a maximum point slightly above IDLE.
   - Monitor fuel flow and attempt to meter if flow does not pass through the desired airstart range (700 to 750 pph), which may be above or below the IDLE stop.
   - The ignition timer fires continuously for 30 to 40 seconds. (The ignite switch should not be actuated more than once every 40 seconds since the timer cannot be reset until the cycle is complete.) Therefore, the throttle should be moved to the desired setting in less than 30 seconds. In most cases, firing of the igniters can be verified by noting a clicking sound in the pilot's earphones, especially if the UHF volume control is set at a high level.
   - Do not attempt using continuous engine ignition for an airstart on emergency electrical power. Continuous ignition is obtainable only when the main generator is operating.
5. Engine instruments — INDICATION OF START, WITHIN LIMITS
   - Monitor tachometer and exhaust temperature gages. These gages will give the first indication of a start.
   - Check oil pressure gage for normal indication as rpm approaches idle.
6. Throttle — DESIRED SETTING AFTER ENGINE STABILIZES

- If loss of all fuel boost pumps is suspected as cause of flameout and no pumps are regained following airstart, descend below 30,000 feet before advancing throttle out of idle. Observe limitations described under FUEL BOOST PUMP FAILURE.
- If loss of engine stage of engine fuel pump is suspected as cause of flameout, use afterburner only in an emergency.
- If operating in manual fuel control, move throttle slowly to avoid overtemperature, overspeed or another flameout.

7. Emergency generator switch — OFF
8. Master generator switch — ON
9. Main generator indicator — ON
10. Hydraulic pressure — CHECK
11. Roll and stab switches — OFF RESET, then ON
12. Roll and yaw stab warning lights off

UNSATISFACTORY AIRSTART

Indications

Ignition does not occur within 20 seconds after throttle advanced to maximum point slightly above IDLE

— OR —

Engine does not accelerate to idle speed within 45 seconds after ignition

— OR —

Exhaust temperature exceeding 610°C

Proceed immediately with the second airstart attempt if sufficient time remains in the preceding ignition timer cycle to complete the airstart. If insufficient time remains, delay the second attempt until 40 seconds after the throttle had been placed in IGNITE for the first attempt. This will allow the ignition timer to be reset for an additional 40-second cycle.

SECOND AIRSTART ATTEMPT

Procedures

1. Throttle — OFF
2. Fuel control switch — REPOSITION
   - Move switch to different position than was used for first attempt.
3. Repeat AIRSTART procedure from step 4.
   - If all airstart attempts are unsuccessful, conform to the ejection/bailout doctrine under EJECTION AND BAILOUT. Do not attempt bailout, ditching or dead-engine approach unless the ejection seat malfunctions. If dead landing is to be made, follow the procedure under DEAD-ENGINE LANDING, part 4.
   - Simulated flameout approaches are prohibited.

If start not obtained on second attempt:

4. Depress ignite microswitch and repeat airstart procedure.

AFTERBURNER MALFUNCTIONS

AFTERBURNER FLAMEOUT OR FAILURE TO LIGHT

Indications

If afterburner flames out:

EPR drops

Thrust decreases (below 55,000 feet)

Procedures

1. Throttle — MOVE INBOARD IMMEDIATELY
   - Move throttle inboard to MRT position immediately to stop afterburner fuel flow and to close exhaust nozzle flaps.
2. Verify nozzle closure by noting EPR increase.
   - If JP-4 fuel is being used, before relight allow from one second at sea level to 15 seconds above 40,000 feet for afterburner igniter valve to recycle. If JP-5 fuel is being used, no delay is required.

AFTERBURNER FAILS TO CUT OFF

Indication

Afterburning continues after throttle moved inboard.

Procedures

1. Throttle — RETARD FOR MECHANICAL CUTOFF
   - Mechanical cutoff occurs in the 88% to 92% range (past afterburner aft detent stop).
2. Do not relight afterburner unless necessary.
   - Advancing throttle past aft detent stop will reignite afterburner.

THROTTLE STUCK IN AFTERBURNER POSITION

Procedure

Pull throttle inboard, using both hands, until burner detent pin breaks.

- Approximately 100 pounds of force using both hands is required to shear the afterburner detent pin, moving the throttle out of burner.

NOZZLE REMAINS OPEN

Indications

Abnormal lack of thrust

- Most probably noted during runup to MRT or after deselecting afterburner.
- If desired EPR for present flight condition is known and the nozzle is open, cockpit reading will be much lower than the desired figure.

Observation by wingman

Procedures

1. With sufficient altitude and airspeed (recommended: 5,000 feet, 300 KIAS) reduce power to idle momentarily and then advance throttle to military. Nozzles should close upon advancing the throttle forward from idle and remain closed at all power settings above idle provided afterburner is not reselected.

If in flight and unable to close nozzle:

1. Ensure adequate thrust for landing.
   - With an open nozzle, there is adequate thrust for a normal landing if the aircraft is at a reasonable gross weight. Throttle settings approximately 3% to 5% higher than normal will be required to maintain approach thrust.
   - Afterburner should still be available for recovery from a low and slow situation during the approach.
2. Burn down to a reasonable gross weight (if necessary) before landing.

NOZZLE REMAINS CLOSED

Indications

Upon selecting burner:

Instantaneous increase in EPR and thrust
— FOLLOWED BY —
Rise in EGT
Decrease in RPM (3% to 5%)
Decrease in thrust

Procedures

1. Deselect afterburner.
2. Do not relight afterburner.
   - Do not use afterburner again until engine has been ground checked for damage.

ASYMMETRICAL NOZZLE OPENING

Indication

As lightoff occurs:

Yaw and/or pitch

Procedure

Deselect and discontinue after using afterburner.

FAILURE OF AFTERBURNER FUEL CONTROL MINIMUM PRESSURE SHUTOFF VALVE

Indications

Loss of thrust indicated by low EGT, low EPR and higher-than-normal RPM

- Loss of thrust indicated by low EGT, low EPR and higher-than-normal RPM
- Loss of thrust (approximately 20%) due to failure of exhaust nozzle to close.

Fuel vapor coming out of tailpipe

Procedures

1. Attempt to cycle afterburner.

If attempt to relight fails, or condition remains uncorrected after cycling:

2. Land as soon as practical.
   - Fuel flow may be as much as 10,000 pph.

FUEL SYSTEM MALFUNCTIONS

FUEL CONTROL UNIT FAILURE

Indications

EPR, EGT and RPM erratic at constant throttle
Unusual or no engine response to throttle movement
Excessive decrease in EGT and thrust with gain in altitude

Procedures

1. Throttle — IDLE, time permitting
2. Fuel control switch — MANUAL
   - Changeover to manual fuel metering is not automatic and can only be accomplished in this manner.
3. Throttle — ADVANCE SLOWLY TO DESIRED SETTING
   - Advance throttle slowly to avoid flameout, overtemperature or overspeed.
4. Land as soon as practical.
5. Do not use approach power compensator.
   - Do not engage the approach power compensator for landing approach if still in MANUAL fuel control.

ENGINE FUEL PUMP FAILURE

Indications

Engine fuel pump warning light — ILLUMINATED

- Indicates insufficient fuel pressure from engine stage of fuel pump to sustain engine operation. If engine continues to operate, afterburner stage is delivering fuel to engine.

— AND POSSIBLY —

Engine flameout

Procedures

1. Do not use afterburner, except in an emergency.
2. Land as soon as practical.

If engine flames out and no fuel flow indicated:

Relight improbable

If engine flames out, but fuel flow is indicated:

Perform relight

- If fuel flow indicated, the afterburner stage of the fuel pump is delivering fuel to the engine and a relight may be obtained. When this condition exists, use the afterburner only in an emergency.

FUEL BOOST PUMP FAILURE

Indication

Fuel boost pump warning light — ILLUMINATED

- Warning light comes on when pressure in engine fuel feed line, between main cell boost pumps and engine pumps, has dropped below the pressure required to sustain engine and afterburner operation at high altitudes.
- This warning light is inoperative when aircraft is operated on emergency electrical power. With the emergency generator switch in LAND, the boost pumps are not available and flight operation must be restricted to avoid flameout.

Procedures

To prevent flameout because of loss of boost pump pressure:

1. Retard throttle to IDLE and descend below 30,000 feet.
2. Observe following limitations on return to base:
   - Use lowest possible thrust setting.
   - Do not exceed following nose-down attitudes for specified amount of main system fuel remaining: above 1,200 pounds, −20°; 600 to 1,200 pounds; −10°; less than 600 pounds, maintain level or nose-up attitude.
   - Do not use afterburner above 6,000 feet or 300 KIAS. If afterburner used, obtain 2 g or nose-up attitude before reducing power.
   - Do not fly at negative g loads.

ALL TRANSFER FUEL SYSTEM FAILURES

Indications

Steady illumination of fuel transfer pump caution light with more than 3,500 pounds of transfer fuel remaining indicates failure of aft transfer pump.

Main fuel depleting with transfer fuel quantity remaining constant.

Unusually low transfer rates or unexpected illumination of low-level warning light with transfer fuel remaining may indicate failure of wing to transfer fuel.

- Low transfer rates are indicated by higher-than-expected quantity of transfer fuel remaining.

Main fuel quantity indicator reads in excess of 3,100 pounds when transfer fuel being depleted indicates transfer system shutoff failure. Proceed directly to TRANSFER SYSTEM SHUTOFF FAILURE.

Procedures

In all cases except transfer system shutoff failure:

1. Check proper positioning of fuel transfer, cockpit pressure, air refueling probe and fuel dump switches.
   - Check fuel transfer switch ON or PUMP OFF (as applicable), cockpit pressure switch in CABIN PRESS, inflight refueling probe switch not in OUT position, and fuel dump switch OFF.

If switches correct, but no transfer:

2. Cycle fuel transfer switch
3. Cycle air refueling probe
4. Induce positive and negative g
5. Cycle speed brake, rock wings
6. Cycle fuel dump switch

If fuel still fails to transfer:

7. Proceed to FAILURE OF AFT TRANSFER PUMP or WING FAILS TO TRANSFER FUEL, as applicable.

FAILURE OF AFT TRANSFER PUMP

Procedures

If ALL TRANSFER FUEL SYSTEM FAILURES procedure fails to regain transfer of fuel from aft cells:

1. Plan remainder of flight to allow for unavailable (trapped) fuel
   - When aft transfer pump fails, fuel remaining in aft transfer cells (as much as 1,200 pounds) will not be available.
   - Center of gravity will move aft of normal limits due to the trapped fuel in aft cells.
   - Center-of-gravity (normal) aft limits of the attack aircraft will not be exceeded with full aft transfer fuel trapped if more than 2,000 pounds of fuel remain in the main system.
   - The center-of-gravity (normal) aft limits of the fighter aircraft (with or without fuselage stores) will not be exceeded with full aft transfer fuel trapped if more than 1,000 pounds of fuel remain in the main system.
2. Fuel transfer switch — PUMP OFF.
3. Fuel transfer pump caution light off.

4. Dump wing fuel before landing.
5. Attack aircraft with less than 2,000 pounds of fuel in the main system are restricted to 300 KIAS and normal flying as defined by current BUWEPS Instruction 3710.1 series.
6. If possible, land with at least 1,000 pounds of fuel in the main system.
   - The recommended center-of-gravity aft limits are based on a gradual deterioration of flying qualities. As the center of gravity moves aft of the normal limits at landing approach speeds, less nose-up pitch trim is required. At 3% aft of the limits, the aircraft will not maintain hands-off longitudinal trim and becomes sensitive to longitudinal stick movement. While no severe difficulties have been encountered during simulated mirror approaches and during landings with the center of gravity 3% aft of the limits, there is a tendency to overcontrol. Normal angle-of-attack and approach speeds are recommended.

WING FAILS TO TRANSFER FUEL

Procedures

If ALL TRANSFER FUEL SYSTEM FAILURES procedure fails to regain transfer of fuel from wing:

1. Plan remainder of flight to allow for unavailable wing fuel.
   - Wing fuel *will not transfer by gravity.*
2. Avoid using afterburner except in emergency.

TRANSFER SYSTEM SHUTOFF FAILURE

Procedures

1. Fuel transfer switch — PRESS DUMP
   - Greatest danger of transfer system shutoff failure is that it allows main fuel cell to overpressurize which can result in rupture of main cell and collapse of engine duct.
2. Monitor main cell level and adjust as required with transfer switch and/or cockpit pressure switch.
   - When the cockpit pressure switch is placed in CABIN DUMP, wing pressurization is negligible. Maintain a close visual check on the main fuel quantity indicator and place cockpit pressure switch in CABIN PRESS as necessary to transfer wing fuel.
3. Do not attempt air refueling.

FUEL LEAKS

Indication

High fuel consumption, but no fuel control malfunction indicated. *Visual indication by wingman.*

Procedures

1. Avoid using afterburner except in emergency.

Approach

WARNING

Reverse engine cooling occurs below 205 KIAS. Airspeeds below 205 KIAS could produce an inflight fire as a result of fuel vapor being drawn back into the engine compartment.

2. Maintain a minimum of 220 KIAS clean configuration to the 135° position.
3. Extend EPP with emergency generator switch in OFF.
4. Place wing up and gear down at the 90° position. Maintain 175 KIAS.
5. Final approach point — 1,500 feet from runway end, 175 KIAS, 150 feet altitude. Secure engine.
6. To preclude a possible fire from engulfing the forward fuselage area, do not use a short field arrest.
7. If arrest is necessary, utilize the upwind arresting gear following rollout.

ELECTRICAL SYSTEM MALFUNCTIONS

MAIN GENERATOR FAILURE

Indications

Barberpole in main generator indicator
Loss of all electrical power

Procedures

1. Mechanically stop afterburning (if required).
   - If the afterburner is lit at the time of electrical failure, mechanically stop afterburning by retarding the throttle past the afterburner aft detent stop. Movement of the throttle is then restricted to positions aft of the detent until power from the emergency power package closes the afterburner shuttle valve. Thereafter, do not use afterburner above 6,000 feet or 300 KIAS.
2. Master generator switch — OFF RESET momentarily, then ON
   - Moving the switch to OFF RESET and returning it to ON will reset the main electrical system if the fault was of a transient nature.

If main generator cannot be reset:

3. Extend EPP as needed.
   - Due to the 18% loss in range and limited life of the emergency power package, do not extend package until needed.
   - To prevent complete electrical system failure when selecting a power source with the emer-

gency power package extended, the emergency generator switch must be in the OFF position before placing the master generator switch in the ON position, or the master generator switch must be in the OFF position before placing the emergency generator switch in the ON or LAND position. Simultaneous application of both main and emergency sources of electrical power can cause the emergency ac relay to fail and thereby lose the use of the emergency generator. The inability of the relay to switch to an unsynchronized three phase load is the primary cause of this type failure. If the main generator has failed or been turned off before deployment and use of the EPP, this possibility is eliminated.

- Extend power package, using the following procedure:
  a. Master generator switch — OFF
  b. Emergency generator switch — OFF
     - Do not extend the emergency power package with the emergency generator switch in ON or LAND. Extending the package with a load on the generator could prevent voltage buildup to rated values.
  c. Emergency power handle — PULL
  d. Emergency generator switch — ON
  e. Emergency power indicator light illuminated. Failure of the emergency generator light to come on within approximately three seconds after the EPP is extended is an indication that the generator has not built up. If this should occur, place the emergency generator switch in OFF and allow about three seconds for the generator to build up. Then return the emergency generator switch to ON. The emergency generator light should come on, indicating that the generator is operating. If the generator still fails to operate, residual magnestism is insufficient to allow generator buildup.
  f. Attitude indicator — Power off flag not visible (indication of ac electrical power)
  g. Roll and yaw stab switches — OFF RESET, then ON
  h. Roll and yaw stab warning lights off

4. Return to base and land as soon as practical.
   - The forward and aft transfer fuel pumps and all but the forward main boost pump are lost with main generator failure and cannot be regained with EPP power. (The forward main boost pump will continue to operate with the emergency generator switch in ON.)
   - Do not fly at negative g loads.
   - Main generator reset may be attempted again during the flight even though the emergency power system is in operation. Before attempting to reset the main generator, place the emergency generator switch in the OFF position. If the system is successfully reset, leave the master generator switch in ON and the emergency generator switch in OFF.
   - With the emergency generator switch in ON, the minimum airspeed required to supply adequate electrical power is 175 KIAS. With the switch in LAND, the minimum airspeed to meet electrical power needs is 145 KIAS.
   - Although generator failure is not in itself a cause for immediate landing, some failures have resulted in fires which are not always discernible to the pilot.
5. Be prepared to carry out the EMERGENCY DEPRESSURIZATION procedure.
   - If primary ac bus power is lost, the cockpit air-conditioning temperature will go full cold (temperature control bypass valve will fully close). Fog in the cockpit may obscure vision.

If EPP fails:

6. Perform COMPLETE ELECTRICAL FAILURE procedure.

TRANSFORMER-RECTIFIER FAILURE

Indication

Loss of all dc-powered systems and indicators

Procedure

Proceed as for MAIN GENERATOR FAILURE.
- So few systems will remain in operation that the same procedure as used for main generator failure should be used.

COMPLETE ELECTRICAL FAILURE

If the main system fails and no power is obtained from the EPP with the emergency generator switch in ON, *try the* LAND *position. Even partial restoration of power, such as the emergency dc bus, will provide some useful services. If proper power is not obtained from the EPP:*

1. Throttle — IDLE until below 30,000 feet; then lowest possible thrust setting
   - Only pressure-operated flight instruments, plus the tachometer and tailpipe temperature gages, will function. If this failure occurs above 30,000 feet and at a high power setting, there is a possibility of a flameout occurring due to lack of boost pressure and a relight would be impossible.
2. Observe limitations and return to base.
   - Do not exceed following nose-down attitudes for specified amount of main system fuel remaining: above 1,200 pounds, –20°; 600 to 1,200 pounds, –10°; less than 600 pounds, maintain level or nose-up attitude.

- Do not use afterburner above 6,000 feet or above 300 KIAS. Afterburner will light any time throttle advanced forward of afterburner aft detent stop if burner was in operation at time of failure. If burner used, obtain 2 g or nose-up attitude before reducing power.
- Do not fly at negative g loads.

3. Land as soon as practical.
4. Be prepared to carry out the EMERGENCY DEPRESSURIZATION procedure.
   - With loss of primary ac bus power the cockpit air-conditioning temperature will go full cold (temperature control bypass valve will fully close). Fog in the cockpit may obscure vision.

POWER CONTROL (PC) HYDRAULIC SYSTEM FAILURES

Indications

Engine oil/hydraulic pressure warning light — ILLUMINATED

PC 1 and/or PC 2 hydraulic gages indicate low or zero pressure

— AND POSSIBLY —

Complete loss of control (failure of both PC systems)

FAILURE OF BOTH PC SYSTEMS

Procedures

1. Extend EPP.
   - With PC hydraulic emergencies requiring the EPP, emergency electrical power from the EPP is not needed; therefore, the emergency generator switch should be left in the OFF position to allow the EPP to furnish maximum PC hydraulic pressure.

If EPP fails to restore control:

WARNING

Before Airframe Change 520, complete loss of power control system hydraulic pressure will result in an uncontrollable nose down pitch and high negative g forces. The pitchover effect is more severe with cruise droops extended than with a clean wing. Therefore, as soon as it becomes evident that both pc systems could be lost, retract the droops. Airframe Change 520 installs check valves at the UHT actuators to reduce the violence of the pitchover. ~~This provides the pilot a more favorable g environment for ejection and gives him more time to eject.~~

For the check valves to be effective, aft stick pressure must be maintained. With the pilot following his natural reaction to hold aft stick force against the pitch-over tendency, sufficent aft force is supplied to ensure the protection afforded by the check valves. Once the stick is released to permit grasping the ejection control, ejection must be immediate.

2. Abandon aircraft.
   - If loss of both power control systems is evident and the EPP will not restore PC 1 pressure, abandon the aircraft prior to complete loss of pressure and resulting negative g pitch. Consider placing the left hand on the alternate firing handle if delaying ejection to the last minute. Following uncontrollable pitch, g forces may exceed pilot capability to successfully eject.

FAILURE OF ONE PC SYSTEM

Procedures

1. Return to base immediately or land at nearest suitable field.
2. Determine which PC system has failed.
   - Hydraulic pressure gage of failed system will indicate low or zero pressure.

With PC 1 inoperative:

3. Roll stab is lost. If desired, EPP may be extended any time before landing.
    - Consider approximate 18% reduction in range with power package extended. The package is not retractable in flight. If maximum range performance is required, defer extension of the package until descent and approach at destination.

With PC 2 inoperative:

3. Aileron spoilers and yaw stab are lost. Monitor PC 1 system pressure and extend EPP only if needed.
    - The EPP has been known to cause failure of the PC 1 system due to vibrational effect on connecting lines.
    - Refer to PC 1 INOPERATIVE for range considerations with EPP extended.

Limitations with either system inoperative:

4. Observe flight restrictions:
    - Maximum airspeed — 600 KIAS or 0.92 IMN, whichever is less
    - Maximum permissible airspeed with either stab out in landing condition — 180 KIAS
    - Maximum acceleration — PC 1 out 4.0 g
      — PC 2 out) same as yaw stab out (Refer to Supplemental NATOPS Flight Manual).
    - Bank angle not to exceed 90°
    - No abrupt flight control movements
    - No slipping or skidding
    - Minimum airspeed with EPP extended, emergency generator switch OFF — 140 KIAS
5. Emergency generator — OFF
6. Land immediately at the nearest suitable field.
    - Go easy on the controls during the approach. Due to the greatly reduced volume capacity of the EPP, an approach on EPP PC power should be planned to utilize the least amount of flight control deflection, especially when raising the wing.
    - If operating on EPP PC 1 pressure after failure of both PC systems, a straight-in precautionary approach is recommended. Refer to PRECAUTIONARY APPROACH this section, part 4.

- Refer to section IV for flight characteristics encountered upon failure of one PC system.

UTILITY HYDRAULIC SYSTEM FAILURE

Indications

Engine oil/hydraulic pressure warning light illuminated

— AND —

Utility hydraulic pressure gage indicates low or zero pressure

Procedures

If failure detected before all pressure lost:

1. Attempt to extend gear and raise wing (if practical).
   - If fuel remaining is sufficient to reach base in the landing configuration, immediately attempt to extend the landing gear first and then raise the wing, using normal procedures.
2. Land as soon as practical.

If all pressure lost:

1. Return to base.
   - If the failure is complete, return to base early enough so that sufficient fuel remains to allow for field preparations or in case other difficulties are encountered.
2. Extend landing gear pneumatically.
   - Always extend the landing gear before attempting to raise the wing.
   - Extend landing gear as follows:
     a. Airspeed — 220 KIAS MAXIMUM
     b. Landing gear handle—WHLS DOWN, push in, rotate clockwise, and pull aft (landing gear handle must be placed in WHLS DOWN to provide nose gear mechanical downlock and a wheel indication).
     c. Landing gear position indicators — WHEELS VISIBLE (if nose gear down and locked but main gear indicators show barberpole, accelerate to maximum speed permissible (220 KIAS) to increase the aerodynamic locking force on the main gear. If main gear still not locked, apply positive g.)
3. Extend leading edge and raise wing pneumatically (if leading edge fails to attain at least the cruise droop position, do not raise wing).
   - Extend droops and raise wing as follows:
     a. Airspeed — 220 KIAS MAXIMUM
     b. Down-lock handle — UNLOCK (If landing configuration not achieved or desired prior to complete loss of pressure and unable to unlock wing, reduce speed to 220 KIAS or less and push over to one-half negative g to apply compression load on actuating cylinder and allow wing to unlock. After unlocking, wing can be raised with emergency air while in level flight. However, if all attempts to unlock wing fail, do not attempt to raise wing. Wing cylinder locks will bind and all further attempts to raise wing will be unsuccessful.)
     c. Wing incidence handle — DN (Failure to place the wing incidence handle in DN before the emergency droop and wing incidence guard is raised will result in the detent plate swinging outboard and binding the wing incidence handle. If this occurs, push the detent plate inboard with index finger while pushing the wing incidence handle outboard and forward with palm of hand.)
     d. Emergency droop and wing incidence guard — RAISED
     e. Wing incidence release switch — DEPRESSED
     f. Wing incidence handle — Full forward to extend leading edge droop. Observe extension to the landing droop position; then move handle inboard and aft to EMERG UP position to raise wing. If cruise droop is the maximum droop attainable, the wing still should be raised. Do not, however, raise the wing clean. Raising the wing clean would result in higher-than-normal approach speeds and possible nosewheel-first touchdown. Nosewheel-first touchdowns can lead to porpoising and possible overloading of the nose gear.

     If for any reason the wing is blown up without first obtaining land or cruise droop, then prior to landing, and at a safe altitude, investigate the handling characteristics at and below the speed which gives a donut on the indexer. Complete stalls are not recommended. It is expected that the normal approach angle of attack will provide an approach speed that is satisfactory.
4. Proceed to LANDING WITH UTILITY HYDRAULIC FAILURE.

LATERAL CONTROL MALFUNCTIONS

Indications

Ailerons binding
Rolling tendency
Suspected malfunction due to airframe or system damage

Procedures

Before raising wing:

1. Climb to at least 10,000 feet.

If uncontrollable with wing raised:

2. Lower wing and perform wing-down landing.
   - Refer to LANDING EMERGENCIES for wing down landing procedure.

TRIM AND STABILIZATION SYSTEM FAILURES

Few complications result from stabilization system failures. NO STAB landings present no problem. Observe the clean and wing-up configuration limitations listed for the particular failure.

FAILURE OF YAW TRIM AND STAB SYSTEM

Indications

Inability to trim
Yaw stab warning light illuminated
Loss of autopilot functions
Yaw oscillations

Procedures

1. Yaw stab switch — OFF RESET until out of oscillation speed range, then ON
   - Yaw oscillations of varying intensities are common with a malfunctioning yaw stabilization system, but can be eliminated by turning the stab switch off. These oscillations are often associated with a particular speed area, and if desired, attempts should be made to reset the stab when out of the suspect range.

If warning light remains lit:

2. Yaw stab switch — OFF RESET
   - Yaw trim and stab are inoperative and rudder will return to neutral.
3. Observe applicable limitations.
   - Refer to section I, part 4 for trim and stabilization system operating limitations.

FAILURE OF ROLL TRIM AND STAB SYSTEM

Indications

Inability to trim
Roll stab warning light illuminated
Loss of autopilot functions

Procedures

1. Roll stab switch — OFF RESET, then ON

If warning light remains lit:

2. Roll stab switch — OFF RESET
   - If the EPP is in use and the roll stab switch is inadvertently left in ON, the roll trim and stab system will automatically reset itself when the emergency generator switch is placed in LAND. Energizing a previously malfunctioning system in this situation could produce a dangerous roll maneuver. For more detailed information refer to figure 1–54, sheet 1.
3. Observe applicable limitations
   - With roll stab inoperative, do not exceed 180 KIAS in the landing configuration.

PITCH TRIM FAILURE

Trim malfunctions are relatively rare, but on occasion, certain aircraft may become afflicted with a recurring "pitch oscillation." This oscillation is normally mild, but may increase in intensity if allowed to continue. The following procedure will supply emergency trim and should stop the oscillation.

Indications

Inability to trim
Loss of autopilot functions
Pitch oscillation

Procedures

1. Emergency pitch trim selector switch — Either channel
2. Emergency pitch trim T-handle — RAISE
   - Normal pitch trim is inoperative and emergency pitch trim is available by movement of the emergency pitch trim handle to NOSE DOWN or NOSE UP.
   - Raising the emergency pitch trim emergency T-handle should stop the oscillation. With the handle raised, however, there will be no automatic retrim when wing is raised or lowered.

If emergency pitch trim doesn't respond:

3. Select other channel.
   - Check for response in this channel.

INFLIGHT FIRES/COCKPIT SMOKE AND FUMES

Normally, there is adequate time in the F-8 to analyze a fire warning indication and to take appropriate action.

ENGINE OR ENGINE COMPARTMENT FIRE

Indications

Fire warning light — ILLUMINATED

Other Possible Indications

Rapid rise in EGT
Unusual vibration
Smoke and/or flames emitting from tailpipe
Loss of fuel or hydraulic pressure
Loss of flight controls

Procedures

1. Throttle — IDLE, immediately
   - If in afterburner, simply deselecting the afterburner may cause the fire warning light to go out and indicate a possible afterburner fuel leak.
2. Investigate for further evidence of fire.
   - Conditions permitting, ask wingman to check fuselage thoroughly. If alone, turn aircraft sharply and look for smoke. Look for more positive evidence of fire before deciding to shutdown or eject.
   - Remember, smoke in the cockpit is rarely an indication of fire in the F-8.
   - Failure of the air-conditioning turbine may be mistaken for engine explosion or fire. Failure of this turbine may be accompanied by a muffled explosion, smoke in the cockpit and illumination of the fire warning light. A suspected engine fire under these conditions should be confirmed.

If fire not positively indicated:

3. Return to base using minimum power.

If engine fire does exist:

4. Shut down engine or eject.
   - If fire exists, shutting down the engine is a reasonable course of action. After engine shutdown, the EPP may be extended to reenergize the fire warning system.
   - If fire warning light goes out after engine shutdown, any decision to relight rests strictly with the pilot.
   - If fire persists, eject.

WHEEL WELL FIRE

Indications

Smoke or fire emitting from wheel well
Explosion in wheel well area

Procedure

If wheel well fire does exist:

Eject

- This particular kind of fire is usually caused by overheated wheel assemblies exploding after gear retraction following takeoff with overheated brakes and wheels.
- If fire ensues following a carrier ramp strike/landing and the aircraft bolters, select afterburner, climb to a safe altitude and eject.

ELECTRICAL FIRE

Procedures

1. Isolate fire by deenergizing affected equipment.

If unable to isolate fire:

2. Master generator switch — OFF
3. Emergency generator switch — OFF
4. Perform COMPLETE ELECTRICAL FAILURE procedure.

COCKPIT SMOKE AND FUMES

Procedures

To eliminate smoke and fumes from cockpit:

1. Throttle — RETARD
2. Temperature knob — DECREASE
3. Defogger switch — OFF

If condition persists:

4. Perform emergency depressurization.
   - Emergency depressurization procedure is presented under AIR-CONDITIONING SYSTEM FAILURES.

AIR-CONDITIONING SYSTEM FAILURES

COMPLETE FAILURE

Indications

Loss of cockpit pressurization and temperature control

Loss of windshield defogging and rain removal

Procedures

1. Descend to lower altitude (if possible).
   - In planning remainder of flight, consider the following (in addition to items under preceding INDICATIONS).
   - Electronic compartment is automatically cooled by ram air.
   - Ram air is automatically admitted to maintain pressurization of fuselage fuel cells. An emergency ram air scoop prevents negative pressure in the wing tank and permits wing tank fuel dumping at a reduced rate. Wing tank fuel transfer is negligible.
   - Conditioned air-cooling of the radar set is lost.
2. Perform EMERGENCY DEPRESSURIZATION.

ERRATIC TEMPERATURE CONTROL

Procedures

If air-conditioning system will not maintain desired temperature:

1. Manual override switch — MAN
2. Temperature knob — AS DESIRED
   - Pressure fluctuations when using manual temperature control indicate that the temperature knob is set too high. Move the knob toward COLD to stop the fluctuations.

COCKPIT OVERTEMPERATURE

Procedures

If cockpit temperature goes full hot and cannot be controlled automatically or manually:

1. Throttle — CRUISE POSITION
2. Cockpit pressure switch — CABIN DUMP (on as required to defog canopy)
   - Wing tank fuel transfer will be negligible.
3. Cockpit emergency ventilation knob — AS DESIRED
   - When the emergency ventilation port is open, do not rely on angle-of-attack indications or attempt to use the approach power compensator system. Airflow over the angle-of-attack vane is disturbed by the vent port door, resulting in erroneous angle-of-attack indications and faulty operation of the approach power compensator system.
4. Canopy — JETTISON IF REQUIRED
   - If unable to control cockpit temperature using preceding steps, it may be necessary to jettison the canopy.

If necessary to transfer wing fuel:

5. Antiexposure coverall ventilation switch — COOL
6. Antiexposure coverall ventilation valve — OFF
7. Cockpit pressure switch — CABIN PRESS
   - Monitor fuel transfer. With complete loss of the air-conditioning system, fuel transfer may not occur.
   - Complete fuel transfer as quickly as possible. Extended operation in this condition may cause heat damage to the area around the air-conditioning relief valves in the equipment compartment.
   - If necessary to dump wing fuel, place the cockpit pressure switch in CABIN DUMP before placing the fuel dump switch in DUMP.

EMERGENCY DEPRESSURIZATION

Procedures

When it is necessary to depressurize the cockpit or when the air-conditioning system fails, proceed as follows:

1. Cockpit pressure switch — CABIN DUMP
   - Dumping cockpit pressure above 43,000 feet may lead to adverse physiological effects.
   - Wing tank fuel transfer will be negligible.
2. Defogger switch — OFF
3. Radar power switch — OFF
4. Cockpit emergency ventilation — AS DESIRED
   - When the emergency ventilation port is open, do not rely on angle-of-attack indications or attempt to use the approach power compensator system. Airflow over the angle-of-attack vane is disturbed by the vent port door, resulting in erroneous indications and faulty operation of the approach power compensator system.

If necessary to transfer wing fuel:

5. Antiexposure coverall ventilation switch — COOL
6. Antiexposure coverall ventilation valve — OFF

7. Cockpit pressure switch — CABIN PRESS
   - Monitor fuel transfer. With complete loss of the air-conditioning system, fuel transfer may not occur.
   - Complete fuel transfer as quickly as possible. Extended operation in this condition may cause heat damage to the area around the air-conditioning relief valves in the equipment compartment.
   - If necessary to dump wing fuel, place the cockpit pressure switch in CABIN DUMP before placing the fuel dump switch in DUMP.

OXYGEN SYSTEM EMERGENCIES

LOW OXYGEN PRESSURE OR QUANTITY

If oxygen low pressure warning light illuminated:

Continue flight if positive pressure noticeable and breathing normal.

If low quantity indicated:

Monitor quantity closely and do not allow supply to become exhausted.

- Normal oxygen consumption rate is one liter per hour. Consider rates higher than this a potential emergency.
- If desirable to reduce oxygen consumption, increase cockpit altitude by opening the cockpit emergency air vent. *Do not increase cockpit altitude to more than 25,000 feet* because of the physiological effects.

OXYGEN SYSTEM FAILS OR MAIN SUPPLY EMPTY

Indications

Oxygen warning light — ON
Gage indication
Oxygen delivery fails
Difficulty in breathing experienced when wearing mask with miniature regulators.
Hypoxia symptoms

If hypoxia symptoms become apparent at any time during this procedure:

Engage the autopilot

Procedures

1. Check security of mask mounted regulator.
2. Check hose connections.
3. Check oxygen valve — ON
4. Check oxygen quantity.
5. Activate emergency oxygen bottle.
   - "Green apple" — PULL LANYARD
   - If mask breathing (mask with miniature regulators) continues to be difficult after pulling the lanyard, remove mask.
6. Descend below 10,000 feet (cockpit altitude)
   - Refer to EMERGENCY DESCENT for rapid descent information.

CONTAMINATED OXYGEN

Indication

Peculiar odor in oxygen system
Dizziness
Nausea

Procedures

1. If cockpit altitude is more than 10,000 feet, activate the emergency oxygen bottle. If cockpit altitude is less than 10,000 feet, remove the mask.
2. Oxygen (normal) valve — OFF
3. Engage the autopilot until the danger of pilot disability has passed.
4. Descend to below 10,000 feet MSL (5,000 feet MSL at night).
   - An emergency or operational necessity may require remaining at a cockpit altitude of 10,000 feet (5,000 feet at night) or above after the emergency oxygen supply is depleted. In such cases, descend to below 10,000 feet MSL as soon as possible and continue with the procedure from step 5.
5. Cockpit pressure switch — CABIN DUMP
   - Wing tank fuel transfer will be negligible.
   - To transfer wing fuel, turn antiexposure coverall vent switch to COOL and return cockpit pressure switch to CABIN PRESS.
6. Emergency ventilation port — OPEN
   - Due to the possibility of engine bleed air contamination, depressurize the cockpit. Ram air vent should be open at all times when not on oxygen.
   - When the emergency ventilation port is open, do not rely on angle-of-attack indications or attempt to use the approach power compensator system. Airflow over the angle-of-attack vane is disturbed by the vent port door, resulting in erroneous indications and faulty operation of the approach power compensator system.
7. Remove mask.

EJECTION OR BAILOUT

EJECTION/BAILOUT DOCTRINE

High altitude:

If the aircraft is descending out of control, abandon it at an altitude not lower than 10,000 feet above the terrain. Below 10,000-feet, if uncontrolled flight is entered (from which recovery cannot be effected) don't hesitate; abandon the aircraft. If the aircraft is in controlled flight and you decide to eject, head the aircraft out to sea or away from populated areas and abandon it.

Low altitude:

If power lost, but sufficient time exists before ejection, turn the aircraft away from any populated area and attempt a high-rpm low-altitude airstart (refer to AIRSTARTING procedure this section, part 1). ***In no situation attempt to regain power at less than 1,500 feet above the terrain and 250 KIAS*** — EJECT IMMEDIATELY.

PREPARING TO EJECT

Procedures

1. Pull up, if at low altitude and with sufficient airspeed.
    - A "pull-up" maneuver may be performed as an aid to successful ejection at low altitudes. The pull-up increases the margin of safety in a low-altitude ejection by increasing the time available for seat separation and parachute deployment. However, flight test demonstrations have shown that attempting a power-off "pull-up" outside of certain airspeed limits will result in a loss of altitude rather than a gain. Variations in flight path, weight, and wing position can vary the minimum airspeed required for an effective pull-up from 160 KIAS to 200 KIAS. In gliding flight, the maximum effective airspeed can vary from 210 to 230 KIAS. When above this airspeed in a glide, more altitude is lost during the flare than can be regained during pull-up. See figure 5–3 (MK-F5A seat) or figure 5–3A (MK-F7 seat) for effect of rate of descent on ejection capability.

    Upon loss of power following takeoff with full fuel load, 180 KIAS is required with the wing up and 190 KIAS with the wing down in order to convert airspeed into altitude. This assumes no rate of descent at the time of pullup. If a descent has begun after power loss, a minimum of 210 KIAS and a maximum of 230 KIAS, wing up or down, is required.

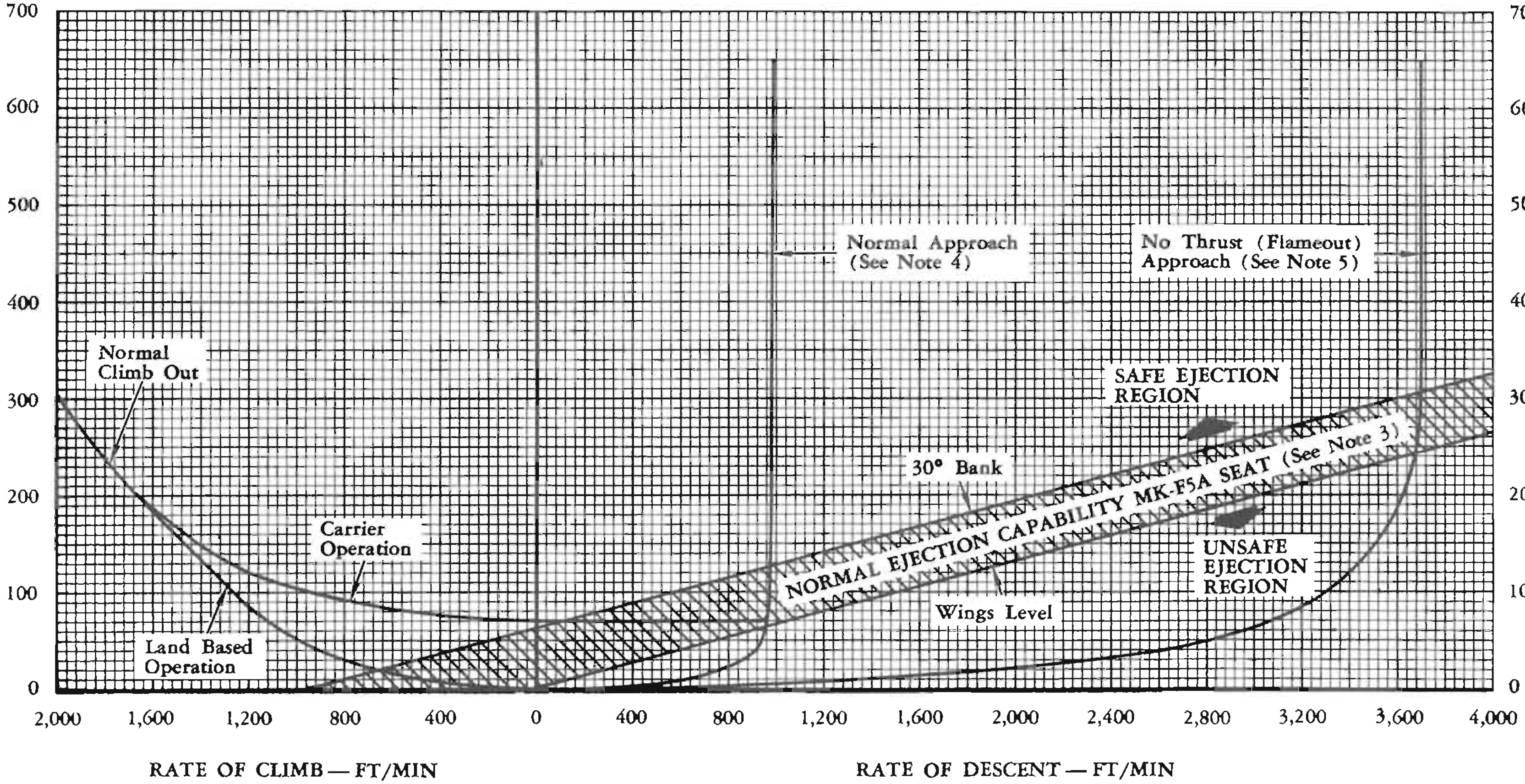
    During landing approach, airspeed will normally be approximately 150 KIAS at the 180° position decreasing to 135 KIAS on final. If power is lost anywhere during the approach, rate of descent will increase rapidly, and a pullup will not be effective. See figure 5–4 (MK-F5A seat) or figure 5–4A (MK-F7 seat) for power-off pullup and ejection capability during takeoff and landing.

    - To perform a power-off pullup, apply light to moderate aft stick force, increasing the pitch attitude steadily until reaching the ejection point 10 to 20 knots above stall speed.
    - Do not pull excessive g. Accelerations above 1.2 g will decrease possible altitude gains by causing the stall to occur earlier (at a higher airspeed).
    - Aircraft pitch attitude and flight path can reach as high as 25° during the pullup. Time for effective completion of a pullup maneuver will be at least 6 seconds at minimum airspeed and can exceed 15 seconds when starting above 220 KIAS.
    - Minimum safe ejection altitudes with zero sink rate are contained in the ejection seat descriptions, section I, part 2.
2. Reduce speed (if necessary).
    - The risk of bodily injury due to airloads or striking the tail increases with airspeed as follows.
        a. From 0 to 400 KIAS — safe — minor forces on body
        b. 400 to 600 KIAS — more hazardous—appreciable forces on body
        c. Above 600 KIAS — extremely hazardous — excessive forces on body, may not clear tail (clearance above tail ensured only up to 600 KIAS for 200-pound pilot)
    - Altitude required for safe ejection increases greatly as dive angle or dive airspeed increases. Figure 5–5 shows these effects for the MK-F5A seat and figure 5–5A shows these effects for the MK-F7 seat.
3. Actuate emergency IFF.
4. Transmit Mayday and give position.
5. Stow loose gear.
6. Manually lock shoulder harness.
7. Place helmet visor down.

EJECTION

The ejection procedure is presented in figure 5–6 and the after-ejection procedure is presented in figure 5–7. The ejection sequence (timed firing of seat, chute, etc) is described and illustrated in figure 1–25. All pilot actions required before pulling the face curtain are presented in detail under PREPARING TO EJECT.

EFFECT OF RATE OF DESCENT ON EJECTION CAPABILITY (MK-F5A SEAT)



NOTES

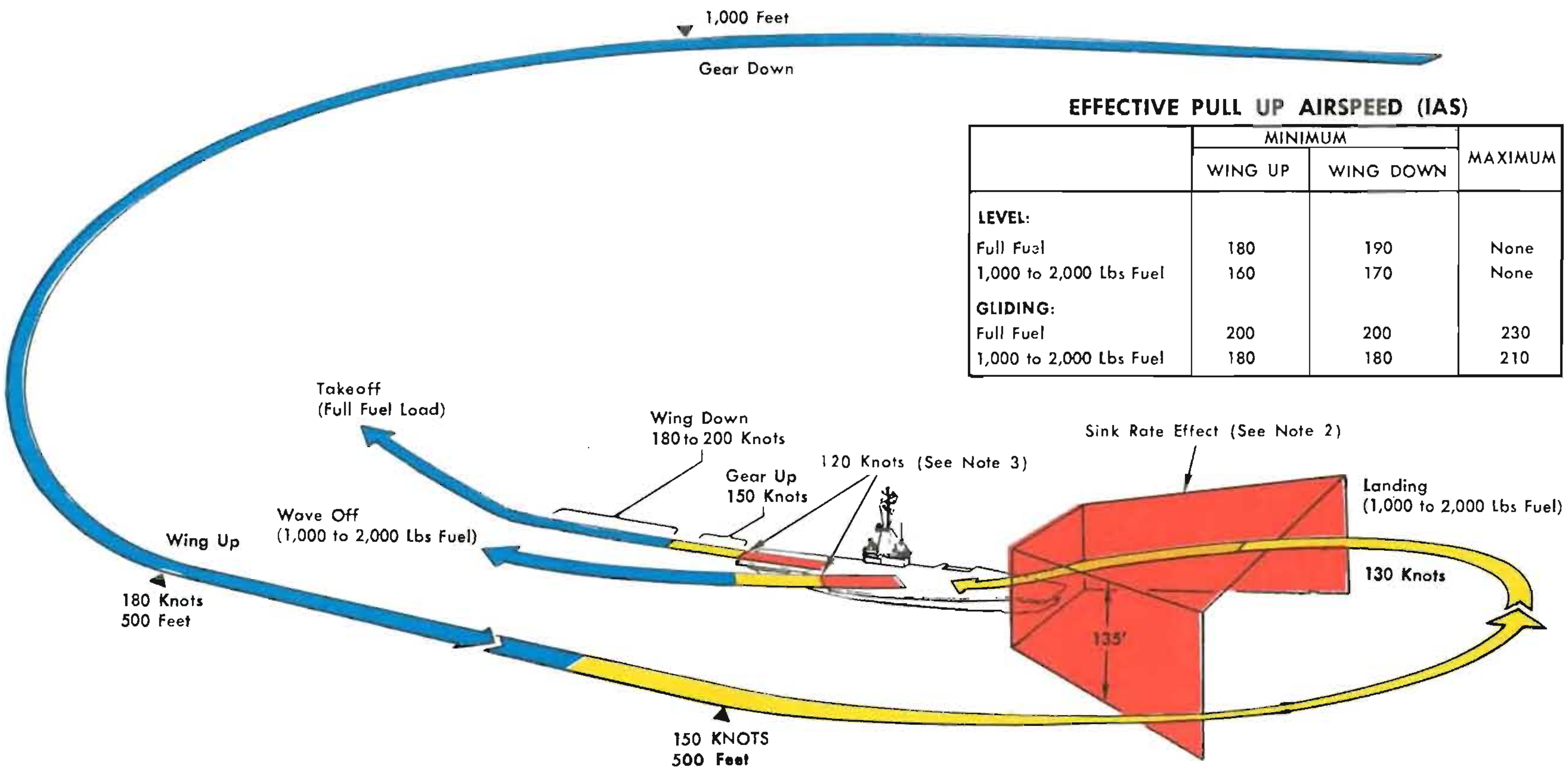
1. For 90° bank, add 200 feet to terrain clearance required for wings level.
2. For inverted flight, add 400 feet to terrain clearance required for wings level.
3. Normal ejection capability based on:
   a. Two-second reaction time.
   b. Normal aircraft pitch for conditions shown (±15°).
   c. Maximum operational ejected weight.
4. Normal approach curve based on 140 KIAS with power.
5. No-thrust (flameout) curve based on 170 KIAS wing up.

AX–82–9–67

Figure 5–3

TAKEOFF AND LANDING EJECTION CAPABILITY (MK-F5A SEAT)

CARRIER



EFFECTIVE PULL UP AIRSPEED (IAS)

	MINIMUM		MAXIMUM
	WING UP	WING DOWN	
LEVEL:			
Full Fuel	180	190	None
1,000 to 2,000 Lbs Fuel	160	170	None
GLIDING:			
Full Fuel	200	200	230
1,000 to 2,000 Lbs Fuel	180	180	210

NOTES

1. Performance based on maximum operational ejected weight.
2. Based on complete power failure. Includes 2-second reaction time.
3. Minimum ejection speed with zero rate of sink (ground level).
4. Pull-up capability based on complete power failure.

Blue	Pull Up Effective
Yellow	Pull Up Not Effective
Red	Ejection Not Recommended

AX-83(1)-1-67

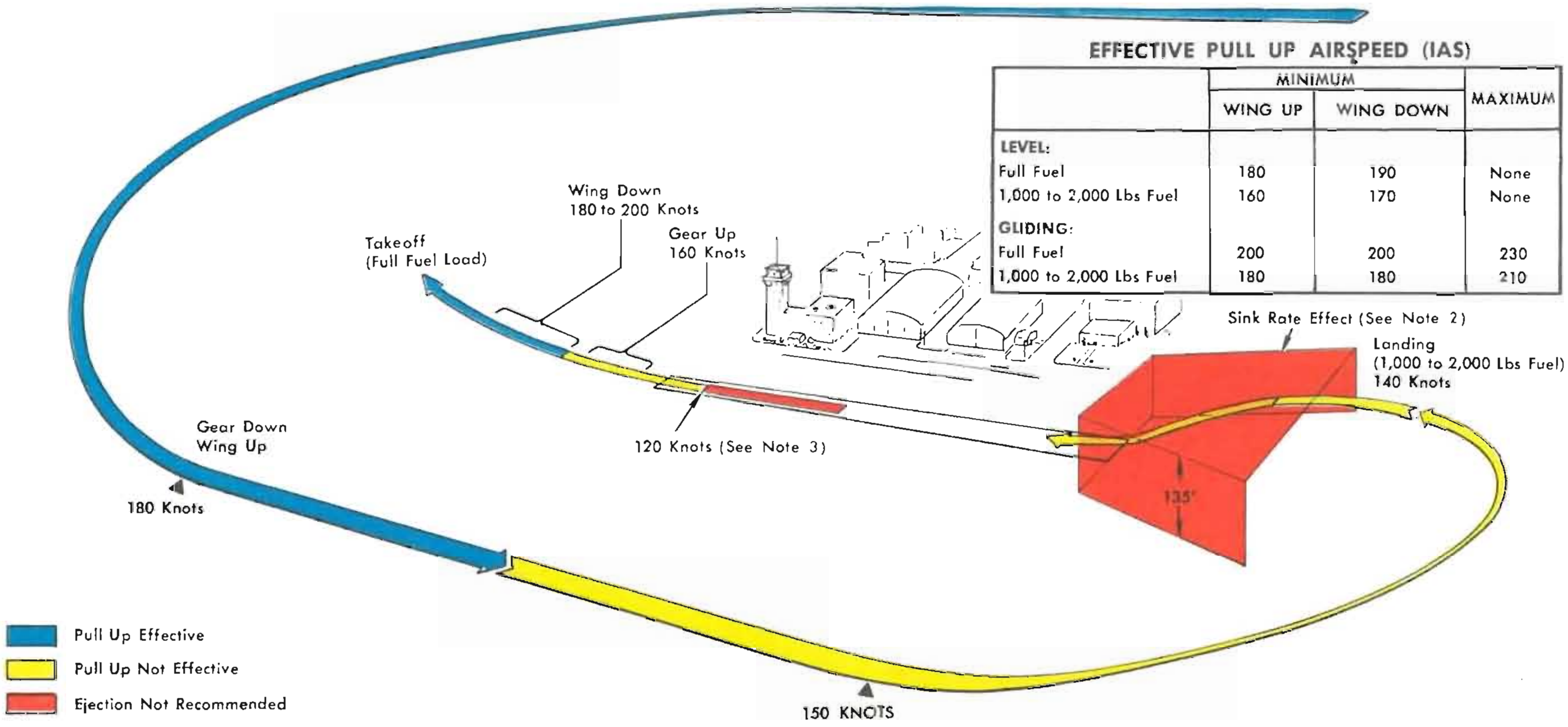
Figure 5-4 (Sheet 1)

TAKEOFF AND LANDING EJECTION CAPABILITY (MK-F5A SEAT)

LAND

EFFECTIVE PULL UP AIRSPEED (IAS)

	MINIMUM		MAXIMUM
	WING UP	WING DOWN	
LEVEL:			
Full Fuel	180	190	None
1,000 to 2,000 Lbs Fuel	160	170	None
GLIDING:			
Full Fuel	200	200	230
1,000 to 2,000 Lbs Fuel	180	180	210



NOTES

1. Performance based on maximum operational ejected weight.
2. Based on complete power failure. Includes 2-second reaction time.
3. Minimum ejection speed with zero rate of sink (ground level).
4. Pull-up capability based on complete power failure.

AX-83(2)-1-67

Figure 5–4 (Sheet 2)

DIVE EJECTION CAPABILITY (MK-F5A SEAT)

NOTES

1. Curves include 2-second pilot reaction time.
2. Curves are based on wings-level bank attitude and appropriate angle of attack.
3. Terrain clearance required is based on 5,000-foot terrain and is conservative for lower terrain.
4. Example: At 600 knots EAS in 30° dive, terrain clearance required is 2,050 feet.
5. Based on maximum operational ejected weight.

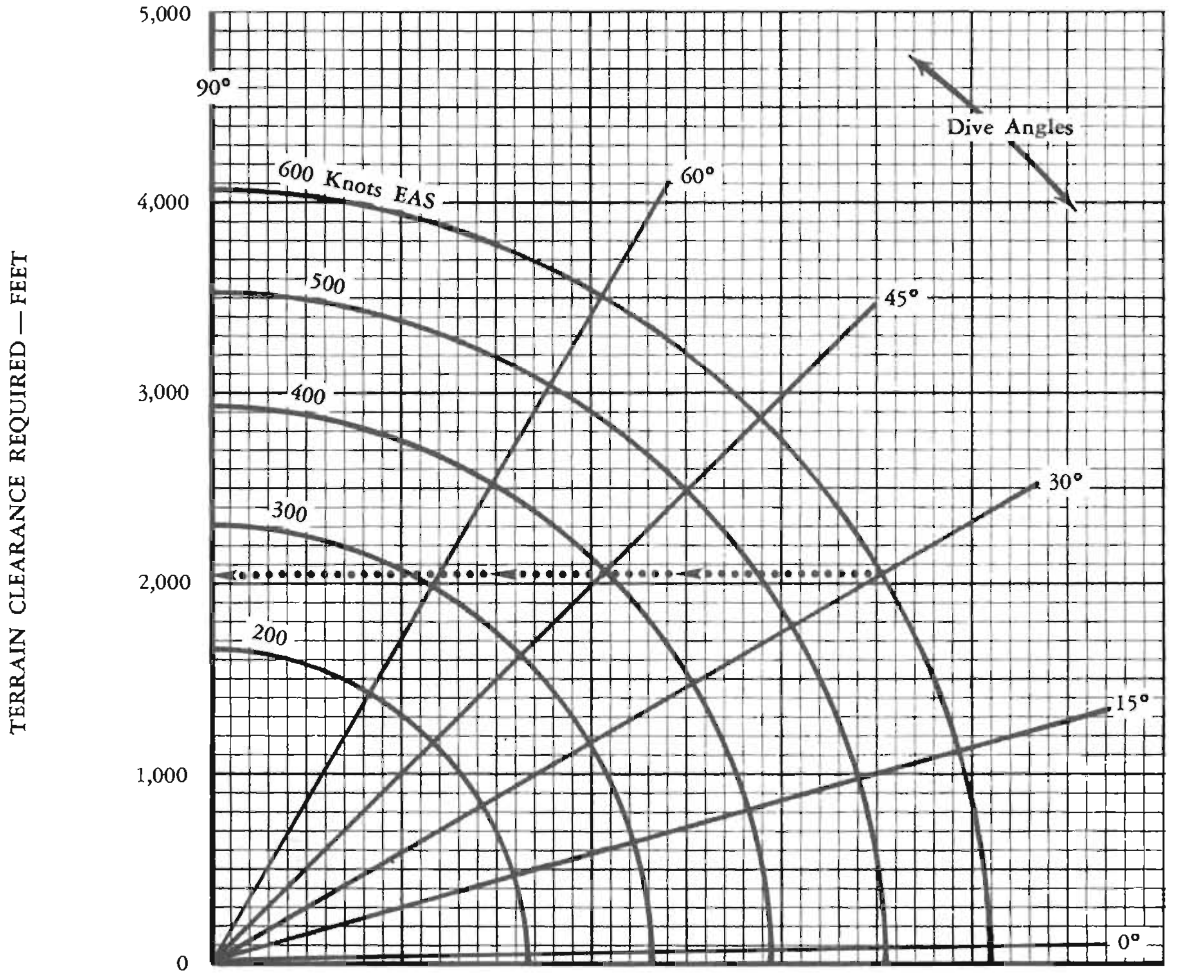


Figure 5-5

EJECTION PROCEDURE

IF TIME AND CONDITIONS PERMIT

- Pull up, if at low altitude.
- Reduce speed.
- Actuate emergency IFF.
- Transmit May Day and give position.
- Stow loose gear.
- Manually lock shoulder harness.
- Place helmet visor down.

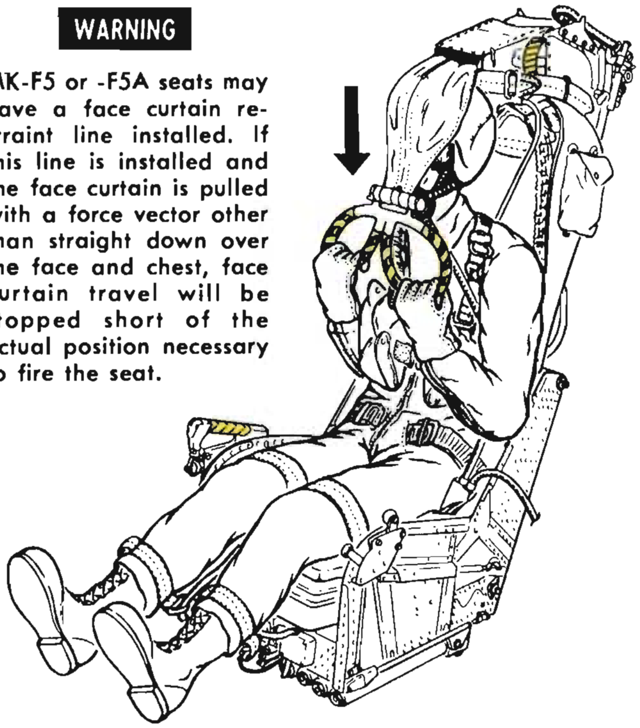
WARNING

Do not pull emergency harness handle before ejection.

1 Sit erect in seat, buttocks against backrest, head firmly against headrest, spine straight, thighs firmly against seat pan, legs extended forward with feet on rudder pedals. Harness properly adjusted and tight. Grasp face curtain with both hands, elbows in, thumbs outboard.

WARNING

MK-F5 or -F5A seats may have a face curtain restraint line installed. If this line is installed and the face curtain is pulled with a force vector other than straight down over the face and chest, face curtain travel will be stopped short of the actual position necessary to fire the seat.



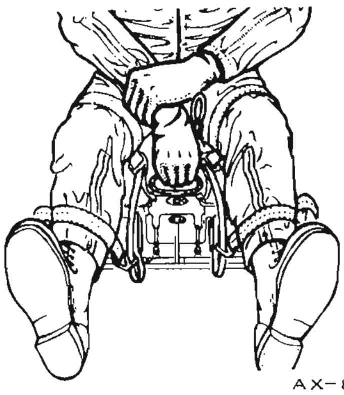
2 Pull face curtain out and downward in one firm, continuous motion. Canopy will be jettisoned. A slight delay in curtain travel might be noticed during canopy jettisoning. Continued pulling on face curtain will eject the seat.

WARNING

If in high positive or negative g flight, it may be impossible to reach or obtain the proper force vector on the face curtain. Use secondary firing handle.

IF IMPOSSIBLE TO USE FACE CURTAIN

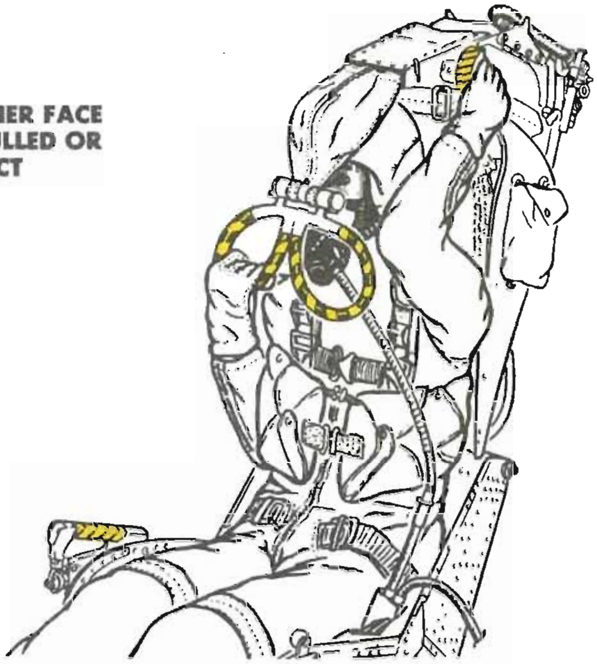
- Grasp secondary firing handle with right hand.
- Grasp right wrist with left hand.
- Pull handle up sharply.



AX-85(1)-9-67

Figure 5-6 (Sheet 1)

EJECTION PROCEDURE



IF CANOPY FAILS TO BE JETTISONED WHEN EITHER FACE CURTAIN OR SECONDARY FIRING HANDLE IS PULLED OR IF CANOPY JETTISONS BUT SEAT FAILS TO EJECT

Hold face curtain or secondary firing handle with right hand.

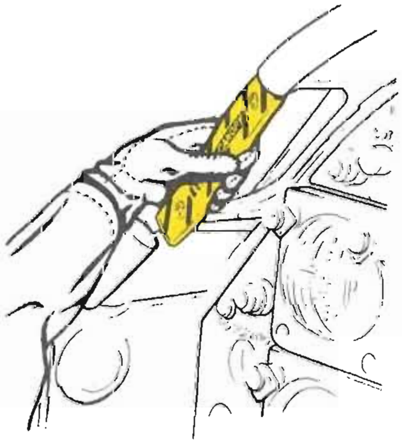
Pull canopy interrupter release handle with left hand.

Continue to pull ejection control with both hands.

WARNING

Do not release the face curtain after it has been pulled. If one hand must be freed to aid ejection, grip face curtain tightly with other hand to prevent curtain from blowing aft over drogue gun firing mechanism. Interference with drogue gun firing can prevent parachute deployment.

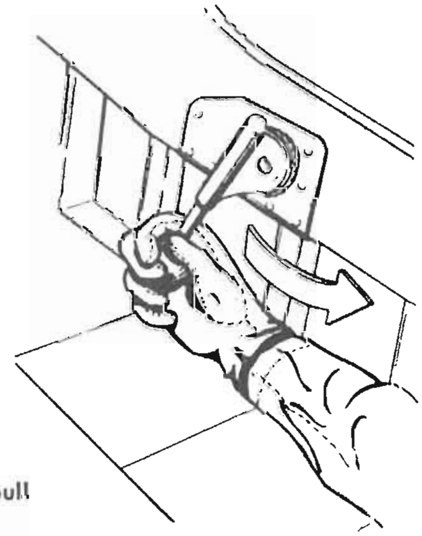
IF CANOPY FAILS TO BE JETTISONED AND UNABLE TO ACTUATE CANOPY INTERRUPTER RELEASE HANDLE



Pull emergency canopy jettison handle

OR

Manually open canopy locks



After canopy separates, continue to pull ejection control to eject from seat.

AX-85(2)-9-67

Figure 5–6 (Sheet 2)

AFTER EJECTION

WARNING

During ejection, the seat is drogue stabilized. If the drogue chute does not deploy (characterized by continuous tumbling of the seat), manually separate from the seat.

When ejecting above 10,000 feet and drogue chute deploys, allow time for the altitude-time-delay-g mechanisms to function. If the personnel chute does not automatically deploy at 10,000 feet, manually separate from the seat. When ejecting below 10,000 feet, be prepared to manually separate from the seat immediately if automatic release fails to occur.

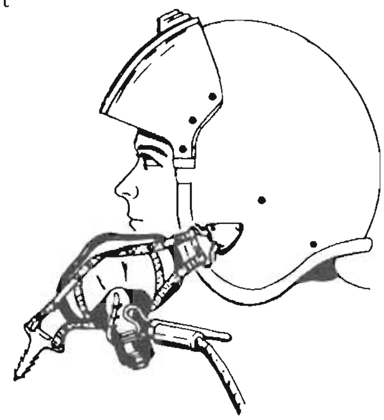
NOTE

With the MK-F7 seat, or with Martin Baker ECP 159 incorporated in MK-F5, -F5A seats, the minimum altitude at which barostatic opening of the parachute occurs is raised to 11,500 feet. Also, with the MK-F7 seat there is no g-limiter and consequently no delay due to high speed ejection.

TO MANUALLY SEPARATE FROM THE SEAT:

- Pull the emergency harness release handle
- Lunge forward to release parachute from support post
- Push free from seat
- Pull the parachute D-handle

Remove the oxygen mask before landing or at any time breathing becomes difficult. This action provides better visibility and reduces the possibility of suffocation following injury or depletion of emergency oxygen supply.



After contact, release the parachute canopy by disconnecting the shoulder fittings. Release the seat pan by disconnecting the hip fittings.

ADDITIONAL PRECAUTIONS — OVERWATER EJECTION

Release left hip fitting before contact with the water. With both hip fittings connected, the buoyancy of the seat pan will tend to cause the pilot to float in a hips-high position. Also before entering the water, inflate the MK-3C flotation vest.

Immediately after entering the water, release the parachute canopy by disconnecting the shoulder fittings. Rapid release is desirable to prevent entanglement with the shroud lines.

Completely release backpad and seat pan before entering a helicopter rescue sling.

AX-86-9-67

Figure 5-7

BAILOUT

Procedures

If all attempts to eject have failed, but canopy jettisoned:

1. Landing gear — UP
2. External stores — JETTISON
3. Wing — LANDING CONDITION PREFERRED
4. Airspeed — MINIMUM WITHOUT STALLING
5. Emergency harness release handle — PRESS BUTTON, ROTATE AFT
6. Ensure separation of leg restraint lines.
7. Pilot services — DISCONNECT AT CONSOLE
8. Full aileron trim in one direction, hold wings level.
   - If surface trim available.
   - Inverted attitudes are not advised for bailout. To maintain inverted flight, the tail must be placed several additional feet below the cockpit, increasing the hazard of striking the aircraft.
9. While holding wings level, crawl into crouching position in seat.
10. Release stick and dive over side opposite low wing trim.
    - If no trim available, dive over either side.
11. Parachute D-handle — PULL (below 10,000 feet)
    - Pull D-handle immediately if below 10,000 feet. If above 10,000 feet, delay until reaching a safe breathing altitude. Remember that the parachute will not open automatically.

JETTISONING EXTERNAL ARMAMENT

Note

Zuni packs carried on fuselage pylons cannot be jettisoned, nor can the rockets be fired in an unarmed condition. Refer to section I, part 4, for jettisoning restrictions.

Electrical power for jettisoning is supplied by the primary dc bus.

Procedures

To salvo:

1. Landing gear handle — WHLS UP
2. Salvo jettison switch — LW/F-U (left wing stores and fuselage upper missiles) then RW/F-L (right wing stores and fuselage lower missiles)
   - Wing stores, along with supporting racks, will be cleared below the Aero 7A or Aero 7A-1 ejector bomb rack.

To jettison stores from a selected station:

1. Landing gear handle — WHLS UP
2. Armament selector switch — DESIRED STATION
3. Selective jettison switch — ON
   - With a wing station selected, jettisons all stores or racks attached to the Aero 7A or Aero 7A-1 ejector bomb rack.

To jettison rocket packs from the MER or TER:

1. Landing gear handle — WHLS UP
2. Armament selector switch — DESIRED STATION
3. Selective jettison switch — MER/TER STORES
4. Stores release button — SQUEEZE ONCE FOR EACH PACK
   - Only the pack will be jettisoned. MER or TER are retained.

FUEL DUMPING

Procedure

To dump fuel from wing:

Fuel dump switch — DUMP

- The fuel dump switch may be actuated at any time in flight to obtain rapid dumping of part or all of the wing tank fuel through the wing tip dump ports.
- An emergency ram air scoop automatically provides sufficient pressure, upon loss of normal

pressurization, to dump wing fuel at a reduced rate.

- There is no provision for dumping fuel from fuselage cells.
- Optimum dumping of wing fuel is obtained with the fuel transfer switch in the PUMP ON or PUMP OFF position, the cockpit pressure switch in CABIN PRESS, and the nose slightly raised.

JETTISONING CANOPY

Procedures

1. Emergency canopy jettison handle — PULL

If canopy fails to jettison:

2. Canopy locks — OPEN MANUALLY

EMERGENCY DESCENT

Procedures

To get aircraft down as rapidly as possible:

1. Throttle — IDLE
2. Speed brake — EXTEND FULLY
3. Cockpit heat — INCREASE
4. Defogger switch — DEFOG
   - Placing the defogger switch in DEFOG upon initiating dive may be helpful in preventing fogging of windshield.
5. Dive aircraft as steeply as desired.
   - Refer to MANEUVERING section IV, part 2, for information on dive recovery.
   - Monitor airspeed and altitude closely during dive and begin pullout with adequate altitude for recovery.

STALLS, SPINS AND UNCONTROLLED FLIGHT

Characteristics and recovery procedures for stalls, spins and uncontrolled flight are contained in section IV, part 2.

It is difficult to recognize uncontrolled maneuvers. First action should be to move the controls to neutral. The three major errors of technique associated with spins in the F-8 are:

- Getting into the spin initially.
- Not using proper recovery technique.
- Not abandoning the aircraft when recovery unsuccessful.

All of these errors are easily avoided by eliminating the first one.

LOSS OF AIRSPEED INDICATOR

In the event of an airspeed indicator failure, the angle-of-attack indicator is sufficient to perform the following maneuvers. The values are accurate only in 1 g flight.

FLIGHT CONDITION	ANGLE OF ATTACK — UNITS
Takeoff	
Start wing down	9.0
Winglocked by	14.0
MRT Climb (cruise droop out)	
0 to 10,000 feet	8.0–9.0
10,000 to 20,000 feet	9.0–9.5
20,000 to 30,000 feet	9.5–10.5
30,000 to 40,000 feet	10.5–11.5
Above 40,000 feet	11.5
Max Endurance	
Cruise droop in (Below 30,000 feet) or out (Above 30,000 feet)	13.0
Max Range	
Sea level	9.5
40,000 feet	11.5
Penetration	
Speed brake down, 82%, 4,000 to 6,000 FPM rate of descent	13.0
Landing	
Gear extension (wing down)	12.0–13.0
Wing raising	14.0
Carrier pattern and approach	13.25
GCA pattern (landing configuration)	11.0
GCA pattern (final)	13.25
Field landing	13.25
Wing down landing (cruise droop out or in):	
Carrier	17.0
Field	16.0
Stall Warning	
Clean (cruise droop in)	15.5
Clean (cruise droop out)	17.0
Clean (land droop out)	20.0
Landing configuration	15.0
Airspeed vs. Angle of Attack (without external pylons)	
Inflight check: Clean, 3,000 pounds fuel, 300 KIAS, cruise droop out (add 7 knots for each additional 1,000 pounds fuel; deduct 7 knots for each 1,000 pounds less)	10.0
Inflight check: Landing configuration, 3,000 pounds fuel, 150 KIAS (add 4 knots for each additional 1,000 pounds fuel; deduct 4 knots for each 1,000 pounds less)	11.0

PART 4—LANDING EMERGENCIES

ALL LANDING EMERGENCIES

Landing emergency information is summarized for ready reference in figure 5-8.

Procedures

Before entering traffic pattern:

1. Dump wing fuel.

Before landing:

2. Expend fuselage transfer fuel.
3. Fuel dump switch — OFF
   - Place fuel dump switch in OFF before touchdown, even if fuel dumping has not been completed, to make sure electrical power is available to close the dump valve.
4. Fuel transfer switch — PRESS DUMP
5. Canopy — JETTISON IF DESIRED
   - Jettison canopy in flight if the seriousness of a specific emergency requires it. Do not jettison the canopy if a barricade engagement is to be made.

After landing:

6. Perform emergency egress if necessary.
   - The EMERGENCY EGRESS procedure is found in part 1 of this section.

LANDING WITH GEAR OUT OF POSITION

In all cases of failure of the landing gear to extend normally, try to extend the gear pneumatically before attempting to land with the gear out of position.

ALL LANDING GEAR UP

Field Procedures

Execute controlled ejection

— OR —

If ideal conditions exist; ie, minimum crosswind, experienced pilot, etc.:

1. Perform normal landing approach using optimum approach angle of attack.
2. Assure minimum sink rate on touchdown.
3. Throttle off at touchdown.
4. Engine master switch — OFF
5. Master generator switch — OFF

Carrier Procedures

Execute controlled ejection

NOSE GEAR TRAILING OR UP

Field Procedures

1. Execute normal landing without arrestment.
   - Use brakes only if necessary to avoid obstacles.
   - Fly nose onto runway before losing pitch control to avoid sudden dropping.
   - Have runway arresting wires removed in landing roll-out area to prevent engagement of aircraft duct by wires.

Just before losing pitch control:

2. Throttle — OFF
3. Engine master switch — OFF
4. Master generator switch — OFF

Carrier Procedures

If unable to divert to suitable field:

1. Extend arresting hook.
2. Avoid high sink rate on landing.
3. Perform barricade arrestment with all wires on deck (normal arrestment optional).
   - Refer to BARRICADE ARRESTMENT for arrestment techniques.

BOTH MAIN GEAR UP

Field Procedures

1. Have runway foamed if time permits.
2. Perform short field arrestment.
   - Refer to FIELD ARRESTMENTS for short field arrestment techniques.

Carrier Procedures

If unable to divert to suitable field:

Execute controlled ejection.

— OR —

1. Extend arresting hook.
2. Perform barricade arrestment with all wires on deck.
   - Refer to BARRICADE ARRESTMENT for arrestment techniques.

Refer to Part IV, Landing Emergencies, for additional information.

Description of Failure	*Recommended Action*	
	Shore	*Ship*
All landing gear up	Controlled ejection; or, if conditions ideal, normal landing with minimum sink rate at touchdown.	Controlled ejection.
Nose gear trailing or up	Normal landing. No arrestment. Fly nose onto runway before losing pitch control.	Barricade arrestment with hook down;** normal arrestment optional.‡**
Main gears up	Short field arrestment.††	Divert to shore for short field arrestment. If unable, execute controlled ejection or place hook down and make barricade arrestment.
One main gear up or trailing	Short field arrestment.††	Barricade arrestment with hook down;** normal arrestment optional.‡**
One main gear and nose gear up or trailing	Short field arrestment.††	Barricade arrestment with hook down.**
Nose gear canted	Normal landing. Turn generator switch off just prior to touchdown.	Normal arrested landing.
Gear barberpole	Treat as corresponding gear up unless determined to be down.	Treat as corresponding gear up unless determined to be down.
Nose wheel missing	Normal landing. No arrestment. Fly nose onto runway before losing pitch control.†	Barricade arrestment with hook down.**
Main gears severed on landing (carrier, aircraft bolters)	Continue rollout attempting to maintain directional control.	Select afterburner and climb. If control lost, eject.

†Remove runway arresting wires in landing roll-out area to prevent engagement of aircraft duct by wires.
‡High sink rates on landing must be avoided.
**Divert to suitable field, if possible, and execute appropriate shorebase emergency landing.
††Runway should be foamed if time permits.

AX-87(1)-1-67

Figure 5–8 (Sheet 1)

LANDING EMERGENCIES

Refer to Part IV, Landing Emergencies, for additional information.

Description of Failure	Recommended Action	
	Shore	*Ship*
One main wheel missing	Short field arrestment.††	Perform a barricade arrestment in accordance with the Barricade Bulletin for the ship class involved.
Any landing gear failure with failure of wing to raise	Landing appropriate to particular gear failure.‡‡	Divert to suitable field and make landing appropriate to particular gear failure.‡‡ If not possible, execute controlled ejection.
Arresting hook failure	Normal landing.	Barricade arrestment.**
Blown tires	Short field arrestment.	Normal arrestment.
Wing down or landing after malfunction precautionary approach (shore)	Long field arrestment. Approach speed for wing-down landing – Corresponding to 16 units (160–175 KIAS)	Normal arrestment without barricade. Approach speed –Corresponding to 17 units (150–160 KIAS).
Utility hydraulic failure	Short field arrestment.	Normal arrestment. Aircraft must be towed out of arresting gear.

**Divert to suitable field, if possible, and execute appropriate shorebase emergency landing.
††Runway should be foamed if time permits.
‡‡Damage to arresting gear can be anticipated due to high engaging speeds.

AX-87(2)-1-67

Figure 5–8 (Sheet 2)

ONE MAIN GEAR UP OR TRAILING

Field Procedures

1. Perform short field arrestment.
   - Refer to FIELD ARRESTMENTS for short field arrestment techniques.

Just before losing roll control:

2. Throttle — OFF
3. Engine master switch — OFF
4. Master generator switch — OFF

Carrier Procedures

1. Extend arresting hook.
2. Perform barricade arrestment with all wires on deck (normal arrestment optional).
   - Refer to BARRICADE ARRESTMENT for arrestment techniques.

ONE MAIN GEAR AND NOSE GEAR UP OR TRAILING

Field Procedures

1. Have runway foamed if time permits.
2. Perform short field arrestment.
   - Refer to FIELD ARRESTMENTS for short field arrestment techniques.

Carrier Procedures

If unable to divert to suitable field:

1. Extend arresting hook.
2. Perform barricade arrestment with all wires on deck.
   - Refer to BARRICADE ARRESTMENT for arrestment techniques.

NOSE GEAR CANTED

Field Procedures

1. Plan normal or arrested landing.

Just before touchdown:

2. Master generator switch — OFF
   - With generator switch off, nose gear is free to caster.

GEAR INDICATOR BARBERPOLE

Field Procedures

1. Attempt to obtain a safe indication of the landing gear by pneumatically actuating the gear.
2. Execute a "minimum rate of descent" touch-and-go landing to determine if the applicable gear is down and locked.
   - Following a minimum descent touch-and-go, repositioning of the main gear could provide a down-and-locked position.
3. Treat as corresponding gear up or trailing emergency regardless of indication.

Carrier Procedures

1. Treat as corresponding gear up or unsafe indication emergency.

LANDING WITH DAMAGED LANDING GEAR/HOOK

NOSEWHEEL MISSING

Field Procedures

1. Execute normal landing without arrestment.
   - Use brakes only if necessary to avoid obstacles.
   - Fly nose onto runway before nose falls through.
   - Have runway arresting wires removed in landing roll-out area to prevent engagement of aircraft duct by wires.

Just before losing pitch control:

2. Fly nose onto runway.
3. Throttle — OFF
4. Engine master switch — OFF
5. Master generator switch — OFF

Carrier Procedures

1. Extend arresting hook.
2. Perform barricade arrestment with all wires on deck.
   - Refer to BARRICADE ARRESTMENT for arrestment techniques.

BOTH MAIN GEAR SEVERED ON LANDING (CARRIER — AIRCRAFT BOLTERS)

Field Procedure

Continue rollout, attempting to maintain control.

Carrier Procedures

1. Do not select afterburner unless necessary to attain or maintain flying speed.
2. Climb.

If loss of control experienced:

3. Eject.

ONE MAIN WHEEL MISSING

Field Procedures

1. Have runway foamed if time permits.
2. Perform short field arrestment.
   - Refer to FIELD ARRESTMENTS for short field arrestment techniques.

Carrier Procedures

If unable to divert to suitable field:

1. Extend arresting hook.
2. Perform a barricade arrestment in accordance with barricade bulletins for the ship class involved.

ANY LANDING GEAR FAILURE WITH FAILURE OF WING TO RAISE

Field Procedure

Use landing procedures appropriate to particular gear failure.

- Anticipate damage to arresting gear due to high engaging speed.

Carrier Procedure

If unable to divert to suitable field:

Execute controlled ejection.

ARRESTING HOOK FAILURE

Field Procedure

Execute normal landing.

Carrier Procedure

If unable to divert to suitable field:

Perform barricade arrestment.

- Refer to BARRICADE ARRESTMENT for arrestment techniques.

BLOWN TIRES

Field Procedure

Perform short field arrestment.

- Refer to FIELD ARRESTMENTS for short field arrestment techniques.

Carrier Procedure

Perform normal arrestment.

LANDING WITH WING DOWN

Emergency wing down carrier landings are feasible under ideal conditions. Such things as adverse weather, pitching deck, darkness, and pilot proficiency must be taken into account in assessing the possibility of a successful wing down carrier landing. If a field landing can be accomplished, a carrier landing should not be attempted with the wing down because of the probability of aircraft damage. Do not use the angle-of-attack indexer or approach power compensator during the approach. The compensator would produce an excessively fast approach if operated with the wing down because it bases the throttle setting on optimum angle of attack with the wing up.

Field Procedure

1. Burn down fuel and expend armament to attain as low a gross weight as possible compatible with the operational situation.
2. Cruise droop — EXTEND IF POSSIBLE
   - If the land droop has not been blown, and if utility hydraulic pressure is still available, use the cruise droop configuration for slower approach speeds; however, any droop setting is acceptable.
3. Approach speed — corresponding to 16 units (160 to 175 KIAS)
4. Perform long field arrestment.

Light buffet may exist in the clean droop position at 16 units. The approach speed corresponding to 16 units with cruise droop extended varies linearly from 160 KIAS at a gross weight of 19,000 pounds to 170 KIAS at a gross weight of 22,000 pounds. With landing droop, the speeds corresponding to 16 units will be approximately 4 knots higher than with cruise droop. Clean droop should give approximately the same speed as with cruise droop.

Carrier Procedure

(To be used only when field landing cannot be accomplished)

1. Wind over deck — HIGHEST POSSIBLE UP TO 45 KNOTS
   - WOD above 45 knots will result in excessive burble.
2. OLS setting — 4° (to give good visibility and hook-to-ramp clearance)
3. No barricades since the airplane has a bolter capability.
4. Reduce aircraft gross weight.
   - Burn down fuel and expend armament to attain as low a gross weight as compatible with the operational situation.
5. Cruise droop — EXTEND IF POSSIBLE
   - If the land droop has not been blown, and if utility hydraulic pressure is still available, use the cruise droop configuration for slower ap-

proach speeds. If cruise droop is not available, extend the emergency landing droop if possible.

6. Fly a wide pattern or a straight-in approach for a comfortable 1½-mile straightaway.
7. Approach speed — CORRESPONDING TO 17 UNITS (150 TO 160 KIAS)

CAUTION

Maximum published engaging speed limit of ship's arresting gear should not be exceeded.

The approach speed at 17 units will be approximately 12 knots less than the speed corresponding to 16 units. At 17 units the visibility is reduced such that the mirror will only be visible through the side windshield panel.

Tail cone damage can be expected during any wing down carrier landing. The flying qualities are satisfactory at 18 units for the cruise or land droop configuration. Buffet commences at 17 units angle of attack for the cruise droop configuration and 20 units for the land droop configuration with stabilized flight possible to 19 and 22 units respectively.

In the event of a bolter, be prepared to rotate the aircraft to the attitude required to maintain level flight as the angled deck bow is passed. (Remember, fuselage attitude will be higher than usual.)

Barricade engagements resulting from the wing down condition alone are not required or recommended. If, however, for other compelling reasons a barricade recovery is required, a successful barricade engagement may be made with the wing down, using the technique described in this procedure.

FIELD ARRESTMENTS

SHORT FIELD ARRESTMENT

Procedures

1. Establish radio contact with LSO.
    - An LSO in radio contact with the pilot and located in the vicinity of the arresting gear will assist all short field emergency arrestments.
    - Have position of arresting gear illuminated if arrestment is to be made at night.
2. Lower arresting hook early enough for full extension.
    - Normal extension time is approximately 8 seconds.
3. Ensure engagement before loss of directional control.
    - Touch down as close to the arresting gear as necessary to ensure that engagement occurs before directional control is affected. This point could be from a few thousand feet before the arresting gear (in the case of brake failure) to touching down in the gear (with one main wheel retracted).
    - Engage gear in center of runway with the nose gear on the deck.
    - Cross the pendants, when possible, with both feet off the brakes and shoulder harness locked.
    - After engagement, the nature of the emergency will dictate whether to keep the engine running or to shut down and abandon the aircraft.

LONG FIELD ARRESTMENT

This arrestment will be made when a stopping problem is known or suspected to exist. Long field arrestments should be considered with wing down, or after a precautionary approach.

Procedures

1. Execute normal touchdown.

After touchdown:

2. Lower arresting hook.
    - Allow enough time for full extension of hook (approximately 8 seconds).
3. Roll out on runway centerline.
    - Ensure nosewheel on runway before engagement.
    - Shut down engine after decision made to remain on deck (to slow engaging speed).

BARRICADE ARRESTMENT

Do not jettison the canopy for barricade arrestment. The nose section and canopy are designed to pass beneath the top cable of the barricade, but it is recommended that the canopy be kept closed as an additional safeguard against injury inflicted by the top cable.

Procedures

1. Burn down fuel as required.
    - Burn down fuel to attain lowest aircraft gross weight compatible with the operating situation.
2. Execute normal approach on meatball.
    - Maintain precise lineup and speed control. A late wave-off cannot be given.
    - On some carriers, the meatball may be lost in the late stages of the approach as the lens passes behind the barricade stanchions. Be under positive control of the LSO and follow his instructions explicitly, including a "cut" if it is given.

Upon engaging the barricade:

3. Throttle — OFF
4. Engine master switch — OFF
5. Master generator switch — OFF RESET
6. Evacuate aircraft as soon as possible.

LANDING WITH UTILITY HYDRAULIC FAILURE

Field Procedure

Perform short field arrestment.

- The brake accumulator may provide enough hydraulic pressure for several normal brake applications. However, when the pressure is lost, the pneumatic brakes (and field arresting gear) must be relied upon for aircraft braking. Refer to BRAKE FAILURE, this section, part 1, for emergency braking techniques.
- Refer to HYDRAULIC EMERGENCIES, this section, part 3, for procedures on emergency (pneumatic) operation of wing incidence and leading edge droop system and landing gear.

Carrier Procedure

1. Execute normal arrestment.
   - Have aircraft towed out of gear.

DEAD-ENGINE LANDING

If impossible to abandon the aircraft, perform the dead-engine landing as described and illustrated in figure 5–9. Figure 5–10 shows the maximum power-off glide distances. Simulated flameout approaches are prohibited.

DITCHING

Procedures

If impossible to abandon the aircraft:

1. Perform radio distress procedure.
2. Wing — AS IS (if down, blow droops)
   - Do not change wing position for ditching. Ditching with the wing in the down position will attain a nose-high attitude at touchdown speed. Normally, the wing will be up only during takeoff or landing. Lowering the wing under these conditions would produce a high rate of sink which could not be arrested prior to touchdown.
   - If wing is down, establish landing droop condition pneumatically.
3. Canopy — JETTISON
   - In any ditching situation, pull emergency canopy release handle before contact.
4. Landing gear — WHLS UP
5. Speed brake — RETRACT
6. Shoulder harness — LOCKED
7. Glide speed — 170 KIAS desirable
   - If EPP is extended and emergency generator switch is in LAND, the minimum indicated airspeed for adequate power control hydraulic pressure from the package is 145 KIAS. With the switch in OFF, the minimum speed is 140 KIAS.

Prior to contact:

8. Engine master switch — OFF
9. Throttle — OFF
10. Touchdown — 145 KIAS, NOSE HIGH
    - Flare the aircraft just before contact. Immediately after the forward motion stops, abandon the aircraft.
    - If the aircraft is ditched in a near-level attitude, it will probably dive violently after contact.

Refer to EMERGENCY EGRESS in part 1 of this section for egress procedures.

ROUGH-FIELD LANDING

Procedures

If aircraft must be landed on an unprepared field:

1. Landing gear — EXTEND
2. Wing — UP
3. Shoulder harness — LOCK

Just before contact:

4. Canopy — JETTISON
5. Engine master switch — OFF
6. Throttle — OFF

DEAD-ENGINE LANDING

(TYPICAL)

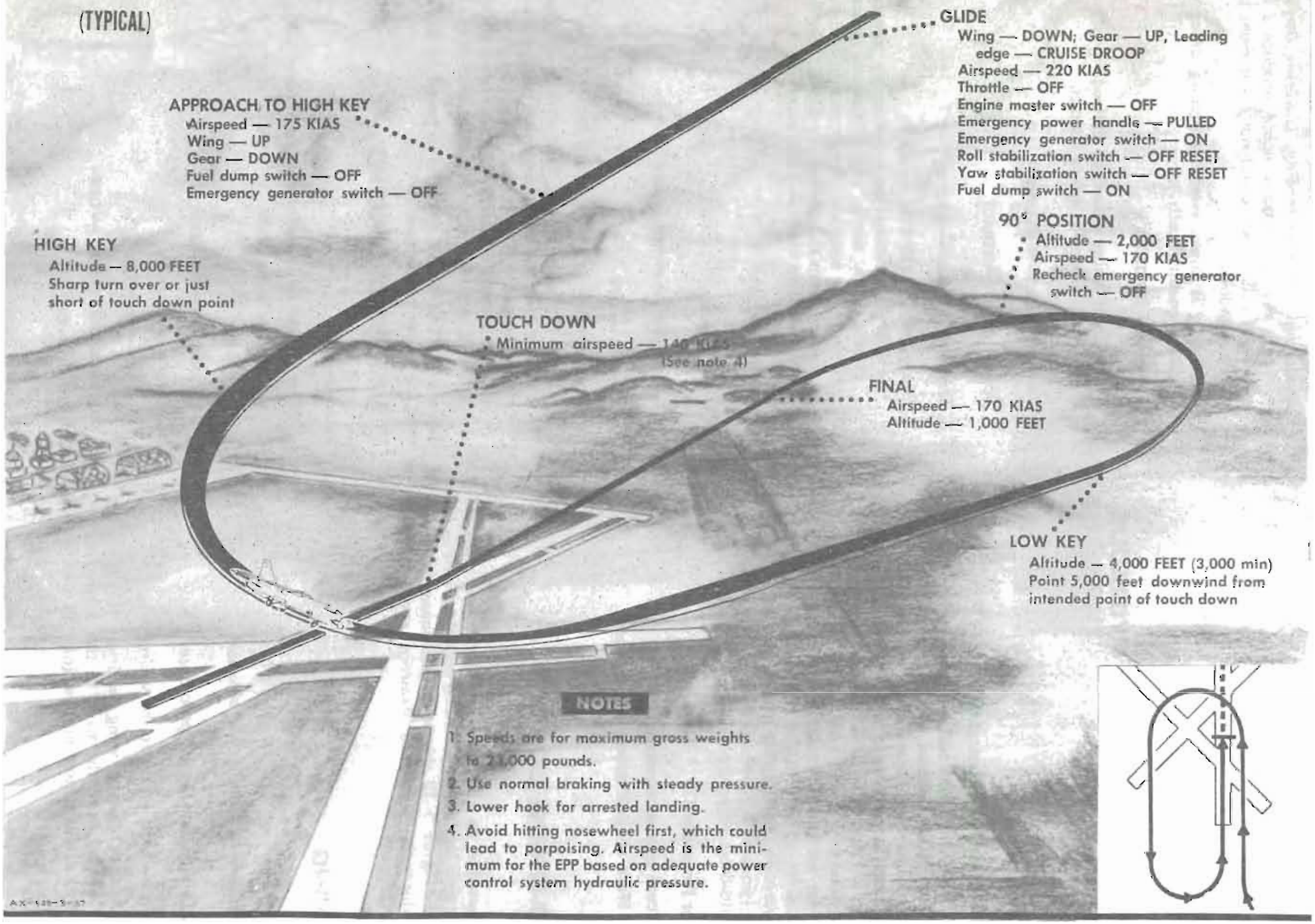


Figure 5–9

GLIDING DISTANCE–NO THRUST

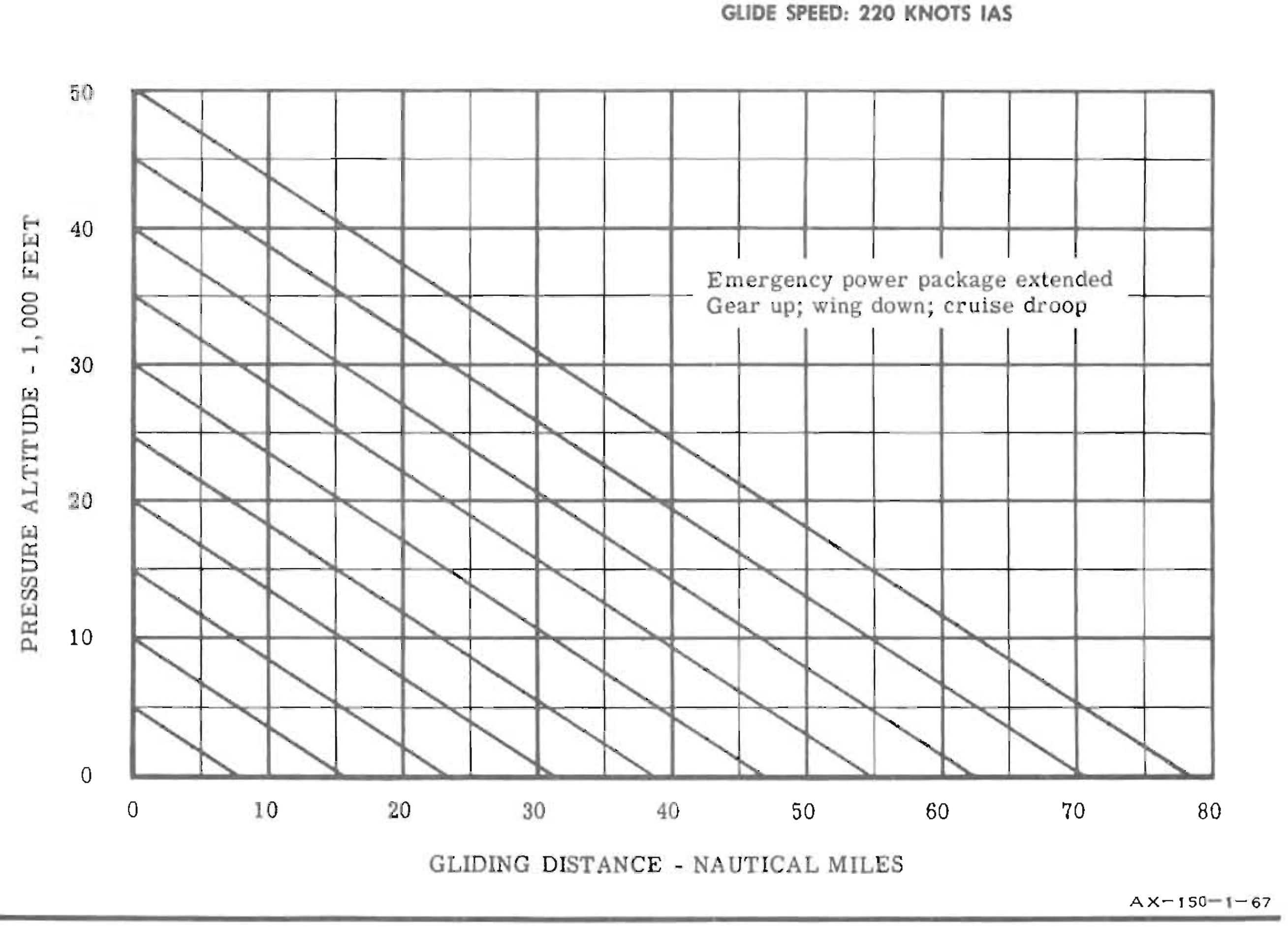


Figure 5–10

PRECAUTIONARY APPROACH

A precautionary approach is recommended when (but not limited to):

Engine oil system malfunctioning
Both PC systems lost; operation on EPP PC 1 pressure alone
- Straight-in approach recommended

Engine persistently unstable

Procedures

1. Extend EPP.
2. Use arresting gear (if available) and consider best approach path.
   - Make approach to runway equipped with arresting gear, if possible, and perform a long field arrestment (refer to FIELD ARRESTMENTS for long-field arrestment techniques). Consider population density, surrounding terrain, weather, runway length, and other associated factors. For maximum stopping effect, shut down engine on touchdown.
3. Final approach point—1,500 feet from runway end, 175 KIAS, 150 feet altitude, approximately 88% rpm
   - The pilot has an alternative of a straight-in or overhead approach to reach the final approach point. At this point, the throttle may be reduced to IDLE. Approximately 3,000 feet will be required to flare and touchdown 1,500 feet down the runway at approximately 140 KIAS.
   - This approach allows the pilot to stay in the ejection envelope until a safe landing on the runway is certain.
   - During an approach necessitated by low or fluctuating oil pressure (oil system malfunction), keep throttle movements and changing g loads to a minimum.
   - It is necessary to maintain a constant rate of descent and proper angle of attack to execute a correct approach to a final landing.
   - If engine flameout or loss of control experienced before reaching final approach point, eject immediately while still within safe ejection envelope.

section VI
all-weather operation

CONTENTS

PART 1 — SIMULATED INSTRUMENT PROCEDURES

PART 2 — ACTUAL INSTRUMENT PROCEDURES

PART 3 — WEATHER PROCEDURES

PART 1—SIMULATED INSTRUMENT PROCEDURES

Practice of simulated instrument patterns and procedures develops and maintains the skills necessary for safe, professional instrument flight. Make good use of the time allotted for this practice.

SAFETY PRECAUTIONS

1. A chase pilot will act as flight monitor and will ensure that the flight is clear of all other aircraft at all times. Chase plane's position is 100 yards on the starboard quarter, level with the lead aircraft. On GCA the chase will fly the position assigned by the controller and will not descend below 300 feet AGL. The lead aircraft will go contact at 500 feet AGL.
2. The lead aircraft will not go hooded until cleared by chase and not before reaching 2,000 feet AGL.
3. Radio checks will be exchanged between aircraft at least once every 5 minutes.
4. If radio contact is lost, go contact immediately and remain so until radio contact is reestablished. If necessary, the chase pilot will pass to the right and pull ahead as a signal to go contact. The afterburner may be lighted when passing to ensure gaining attention.
5. Always establish radio contact immediately before and after any channel or frequency change.
6. Immediately go contact if chase pilot calls for a hard turn or a break maneuver. These are only called when necessary to avoid another aircraft.
7. Unless under positive radar control, call indicated altitudes to the chase pilot at each 5,000-foot interval during descent and at level off.

CONFIDENCE MANEUVERS (INSTRUMENT AEROBATICS)

Vertigo and unusual attitudes caused by turbulence are probably the most disconcerting experiences encountered during instrument flight. A pilot trained to fly through unusual attitudes will more readily believe his instruments and will be better prepared to return his aircraft to normal flight with timely, positive corrections. Aerobatic maneuvers, modified slightly to meet instrument capabilities and limitations, provide the necessary training. Variations of these maneuvers can be performed, but those discussed are considered minimal for indoctrination. Use a routine scan pattern and practice maneuvers to the left and to the right.

AILERON ROLL

Start the maneuver at 350 KIAS at 30,000 feet with the throttle set at 90% rpm. Apply gradual back pressure on the stick until a 15° nose-up attitude (VGI) is attained. Relax stick back pressure and apply aileron. The rate of roll must be slow enough so that the aircraft is inverted as the nose passes through the horizon. Continue the roll without stopping and recover at the starting altitude, airspeed, and heading.

TWO-POINT ROLL

Perform this roll in the same manner as the aileron roll. However, increase the rate of roll slightly so that the aircraft is inverted when the nose is 5° above the horizon. Momentarily stop the roll when the aircraft is inverted, then immediately apply aileron to continue the roll. The nose should be 5° below the horizon when the roll is continued. Hold only enough stick back pressure to remain comfortably seated.

FOUR-POINT ROLL

This roll closely resembles the two-point roll except that momentary stops are made at each 90° of roll. The maneuver requires a good instrument scan, accurate stick control, and a good sense of timing. The major points that determine performance are the rate of roll, wing and nose position at the inverted point, and the heading, airspeed and altitude at the completion of the recovery.

WINGOVER

Start the wingover at 30,000 feet, 350 KIAS, with 90% rpm. Apply gradual stick back pressure until a nose-up attitude of approximately 30° (VGI) is attained. Relax back pressure and at 280 KIAS apply aileron to roll at the rate necessary to obtain a 90° angle of bank and 220 KIAS at the top of the maneuver. At this time, the nose will start to fall through the horizon. Using the attitude gyro for reference, stop the nose-down movement when the high wing of the miniature airplane approaches the horizon bar. Hold the wingtip on the horizon bar and begin a gradual recovery to level flight at the original altitude and airspeed. A heading change of about 120° will occur.

PART 2 — ACTUAL INSTRUMENT PROCEDURES

INTRODUCTION

Aircraft handling characteristics and stability are good and should not present a problem during instrument flight. Most difficulties encountered will be those caused by inadequate preflight planning and preparation. Plan carefully and make allowances, insofar as possible, for unusual circumstances such as unexpected departures, dog-legging to avoid severe weather areas, and en route or terminal holding. Study the instrument approach plates for both destination and alternate before takeoff.

Note

> The anticollision lights should be turned off during flight through clouds when the rotating lights reflect into the cockpit. (The effect can be vertigo-producing.)

BEFORE TAKEOFF

Obtain a complete weather briefing and check NOTAMS before filing clearance. Whenever practical, obtain the ARTC clearance before starting the engine. While monitoring the tower, observe the radio ground operating limitations (section I, part 2). After receiving the clearance, start the engine and thoroughly check the instruments and navigation equipment. If the canopy is covered with frost or ice, turn the cockpit temperature control to full hot and the defog switch to DEFOG. After the canopy is clear, turn the defog switch OFF and readjust the cockpit temperature as desired.

Perform normal pretakeoff checks, ensuring use of pitot heat. Use engine de-icing, and rain removal as necessary.

TAKEOFF

Follow the ARTC clearance exactly as given. If unable to comply, notify the controlling agency immediately.

Do not make an afterburner takeoff when wing transition cannot safely be made below the overcast.

If a formation section makes individual takeoffs, accomplish a prebriefed rendezvous either before entering the weather, or after reaching an altitude on top. The leader will ensure that each pilot checks pitot heat, engine anti-ice, navigation lights, and VGI when possible, before entering actual weather.

When lowering the wing in instrument conditions, maintain a positive rate of climb. Lower the wing at 190 KIAS at an altitude of not less than 300 feet.

If the rain removal system was used during takeoff, turn it off prior to reaching 200 KIAS or the windshield and air-conditioning cooling turbine may overheat.

CLIMB

If climbing through weather in section and you lose sight of the leader immediately turn away from the flight and notify the leader and the controlling agency. After 1 minute, turn to the original heading and parallel the flight until reaching on top unless otherwise directed by the controlling agency.

If necessary to change lead, do so with wings level. When changing lead, the flight leader will advise the wingman of the desired heading, altitude, geographical position, and other pertinent factors.

PRIOR TO DESCENT

Contact approach control at least 5 minutes (or as directed by ARTC) prior to reaching the holding fix. Conform to the provisions of section two, FLIGHT PLANNING DOCUMENT. Three minutes from the holding fix, reduce power to arrive at the fix at 250 KIAS. Enter the holding pattern in the manner prescribed.

Obtain the latest weather information for the destination, and for the alternate if required. If leading a flight and turbulence, low ceiling, inability to attain landing configuration VFR, or runway conditions are such that a successful section penetration is doubtful, break up the flight and make individual penetrations.

Refer to figure 6–1 for illustration of typical jet penetration and TACAN approach.

Prior to the penetration:

- Correct the altimeter setting.
- Check alignment of the BDHI with the magnetic compass in level flight.
- Set desired course in the course line indicator (TACAN penetration).
- Squawk IFF/SIF mode and code as directed by controlling agency.
- Know the missed approach procedure.
- To avoid the consequences of a 40° lock-on, either compare TACAN azimuth and DME with that of a wingman or if a UHF homer is near the TACAN installation, utilize the ARA-25 (ADF) to cross-check TACAN azimuth.

PENETRATIONS

STANDARD

When ready to begin penetration, retard throttle to 82% rpm, extend speed brake fully and lower the nose to maintain 250 KIAS. Make minor throttle adjustments to maintain a 4,000 to 6,000 foot-per-minute rate of descent.

If leading a section, avoid configuration changes (including use of speed brake) when actually in the weather. Whenever possible, attain landing configuration in VFR conditions. Signal or call all power and configuration changes to the wingman. To help the wingman hold position, do not retard the throttle to IDLE with the speed brake fully extended or when changing to the landing configuration.

LANDING CONDITION

If a penetration is to be made with the landing configuration, advise approach control of the nonstandard approach speed.

If leading a section, slow to less than 220 KIAS when approaching the penetration fix and give appropriate signals before lowering the landing gear and raising the wing. As the fix is reached, retard throttle as necessary (it is common to leave too much power on) and lower the nose to maintain 180 KIAS. The attitude will seem extremely nose low. Make throttle adjustments as necessary to maintain approximately a 3,500 foot-per-minute rate of descent. Initiate roundout to reach GCA pickup or TACAN gate altitude at 150 to 160 KIAS.

UHF/ADF

During instrument conditions, use of the UHF/ADF for penetration should be considered an emergency measure. When the ARC-27A (UHF radio) is used for direction information, voice communication is lost. When used for voice communication, direction information is lost. This is a very unsatisfactory arrangement.

If a UHF/ADF penetration must be made, notify approach control that radio communications will not be possible during most of the approach. Tell the controller where during the approach position reports will be made, and explain that during the rest of the approach the homer frequency will be monitored. Complete a radio check on the homer frequency prior to starting the approach.

If the penetration is being made in section, the wingman may either remain on the approach control frequency, or on the homer frequency, as dictated by local policy.

Note

> Refer to section VII for visual signals to be used for penetration/instrument approach in the event of radio failure.

RADAR CONTROLLED

Radar controlled penetrations and approaches are basically the same as those previously described. The controlling activity will normally ask for turns or specific IFF/SIF squawks for positive identification, and will transmit headings and turns which will produce the desired flight path. The controlling activity will provide distance from destination and will direct descent to lower altitudes when traffic and terrain permit.

LOST WINGMAN PROCEDURE

If a wingman loses sight of the leader during a penetration or approach, he should immediately level off, maintain a wings level attitude, and notify the controlling activity. If this situation is compounded by radio failure, he should place the IFF/SIF to EMERGENCY and proceed as briefed or as directed by governing regulations.

GCA (PAR) APPROACH

The aircraft handles exceptionally well in the GCA pattern. It is very stable directionally and is responsive to minor corrections about all axes. Refer to figure 6–2 for illustration of typical ground controlled approach. Do not make approaches with more than 5,000 pounds of fuel remaining, and do not touch down with more than 3,500 pounds unless an emergency exists.

Descend to GCA pickup altitude and establish the landing configuration when directed. Slow to 150 to 160 KIAS, which will require 88% to 90% rpm and approximately 3° to 5° nose-up trim. Fly the donut, adjusting pitch attitude as necessary to maintain the desired airspeed and/or angle of attack.

When advised to begin normal rate of descent, retard power to 82% to 84% rpm. While holding attitude constant, make smooth, but positive, throttle adjustments to hold the desired rate of descent. After starting descent, use a bank angle of not more than 10° for heading corrections. Heading corrections up to 3° may be made with rudder alone. Bring the runway into your instrument scan pattern when approaching minimum. If the runway is not in sight, execute the missed approach procedure, being careful not to go below the published minimums. If the runway is in sight, take over visually and complete the landing.

Use of the approach power compensator for a single aircraft instrument GCA approach is encouraged. If utilized, engage the APC after transitioning to the landing configuration and closely monitor angle of attack and power response to ensure proper operation.

A section GCA will not be attempted when the weather is below minimums unless dictated by operational necessity or an emergency exists (radio, nav-aid, or flight instrument failure). If a section approach is made to a runway not suitable for a safe section landing, the wingman will land and the leader will enter a box pattern for another approach.

If you are leading a section approach, the wingman will assume a position on the side opposite the missed approach turn. The wingman will then follow all your configuration changes. Slow to 145 KIAS on final. When you see the runway or upon reaching one-half mile, whichever occurs last, pass the lead to the wingman. This is the signal for the wingman to commence flying his own approach. After passing the lead, turn away from the wingman, then back to the final approach heading. Observe the wingman's progress. In case of a waveoff or bolter and a VFR pattern is not feasible, the wingman will rejoin you for another approach.

If leading a section approach to a section landing, the leader will not pass the lead. Each aircraft will land and roll out in the middle of his half of the runway. To preclude the danger of a decelerating approach or of flying into the leader's jetwash, no attempt will be made to establish interval on final.

WARNING

> If section landings must be made, or when significant crosswinds exist, extreme caution must be exercised during lineup, touchdown, and rollout.

To enter a GCA pattern from other than a penetration, contact approach control for instructions. Fly the downwind leg at 150 to 160 KIAS and the base leg at 150 KIAS. After completing the turn to final, slow to 145 KIAS (section) or fly the angle-of-attack donut if alone. Normal GCA final approach procedures then apply.

CCA APPROACH

The pattern and procedures for carrier controlled approaches are set forth in the CVA/CVS NATOPS manual.

CCA approaches are normally made by individual aircraft. However, a section approach may occasionally be required to assist an aircraft that has experienced radio, nav-aid, or instrument failure.

If you are leading a section during a CCA approach, the wingman will assume a position on your right wing. If the approach is at night, the position is attained before wing transition. The wingman will follow all your configuration changes. Slow to 145 KIAS on final. When the OLS is sighted or upon reaching one-half mile, whichever occurs last, pass the lead to the wingman. This is the signal for the wingman to commence flying his own approach. After passing the lead, turn away from the wingman, then back to the final approach heading. Observe the wingman's progress. In case of a waveoff or bolter and a VFR pattern is not feasible, the wingman will rejoin you for another approach. If the wingman's landing is successful, execute the normal CCA waveoff procedure and await vectoring and landing instructions.

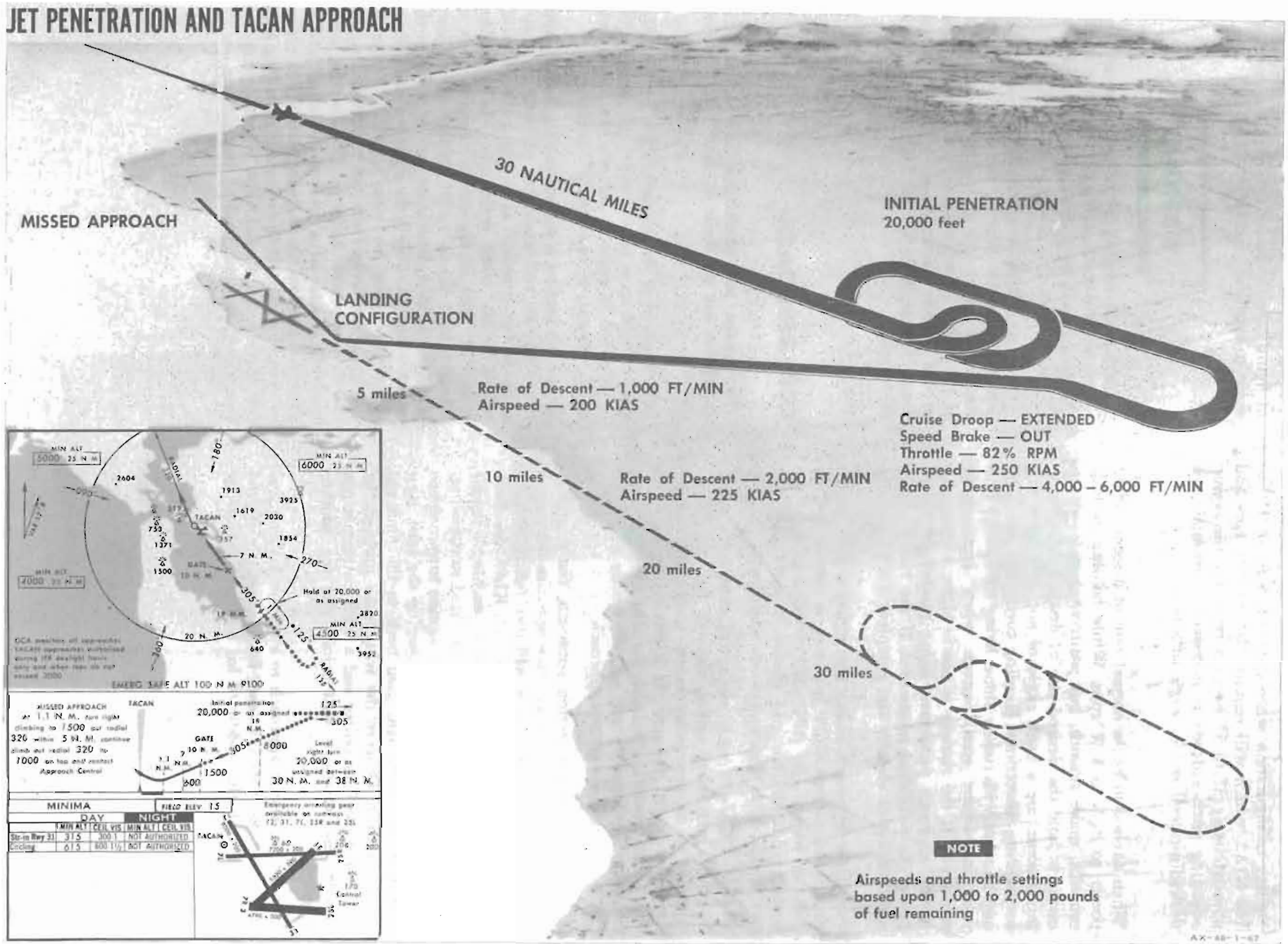

JET PENETRATION AND TACAN APPROACH
30 NAUTICAL MILES
INITIAL PENETRATION
20,000 feet
MISSED APPROACH
LANDING
CONFIGURATION
5 miles
Rate of Descent — 1,000 FT/MIN
Airspeed — 200 KIAS
Cruise Droop — EXTENDED
Speed Brake — OUT
Throttle — 82% RPM
Airspeed — 250 KIAS
Rate of Descent — 4,000 – 6,000 FT/MIN
10 miles
Rate of Descent — 2,000 FT/MIN
Airspeed — 225 KIAS
20 miles
30 miles
MIN ALT 5000 25 N.M.
MIN ALT 6000 25 N.M.
MIN ALT 4000 25 N.M.
MIN ALT 4500 25 N.M.
TACAN
GATE 10 N.M.
7 N.M.
20 N.M.
Hold at 20,000 or as assigned
EMERG SAFE ALT 100 N.M. 9100
MISSED APPROACH
At 1.1 N.M. turn right climbing to 1500 out radial 320 within 5 N.M. continue climb out radial 320 to 1000 on top and contact Approach Control
Initial penetration 20,000 or as assigned
Level right turn 20,000 or as assigned between 30 N.M. and 38 N.M.
MINIMA
FIELD ELEV 15
DAY
NIGHT
Str-in Rwy 31 315 300 1 NOT AUTHORIZED
Circling 615 800 1½ NOT AUTHORIZED
Control Tower
NOTE
Airspeeds and throttle settings based upon 1,000 to 2,000 pounds of fuel remaining

Figure 6–1

GROUND CONTROLLED APPROACH
(TYPICAL)

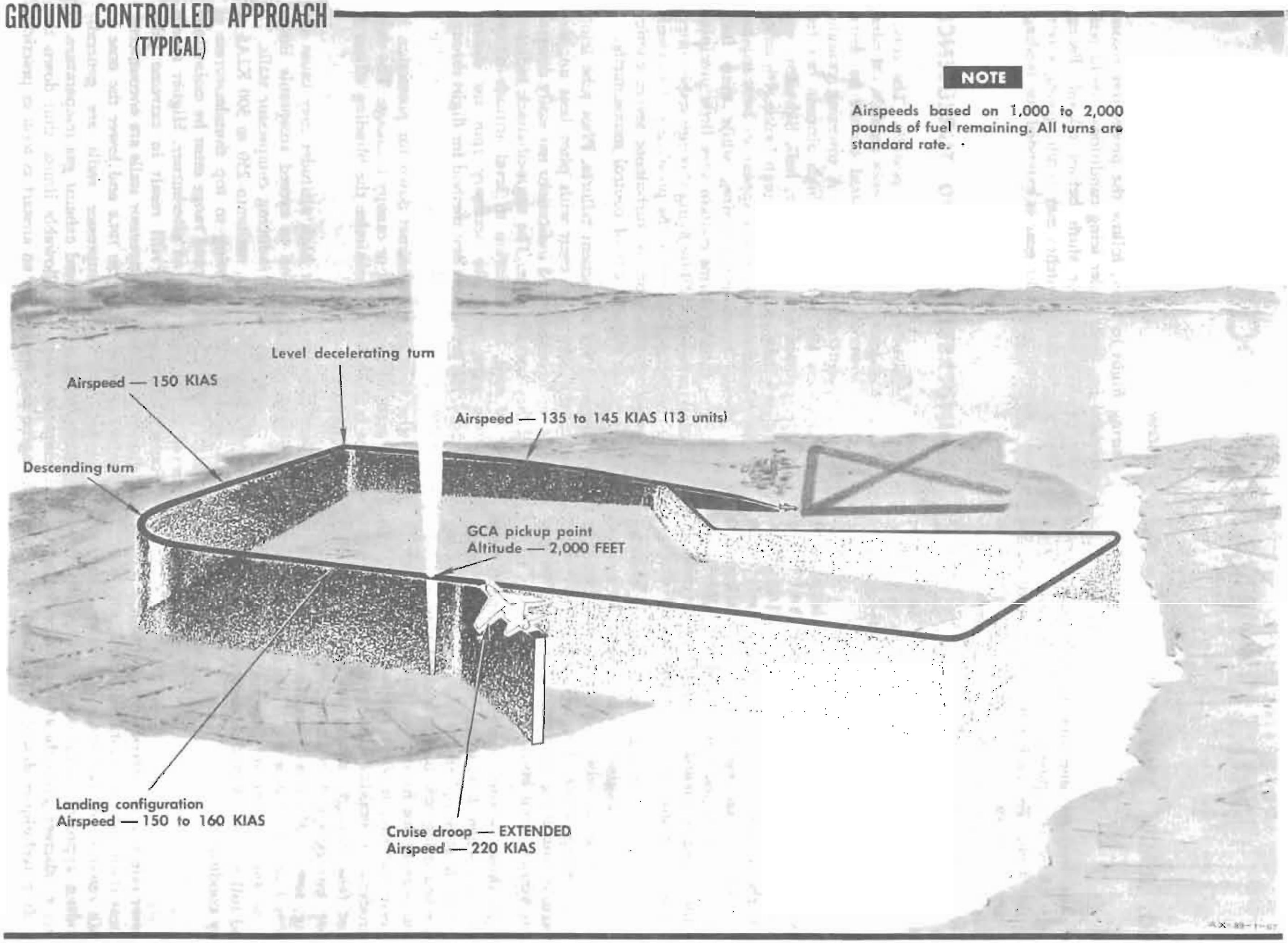


Figure 6-2

PART 3—WEATHER PROCEDURES

ICING, RAIN, AND SNOW

ICING

Turn pitot heat on immediately after starting the engine if there is a possibility of encountering ice during the flight. To combat windshield and canopy icing, turn defog switch on to direct hot airflow to windshield and side panels, and increase the air-conditioning temperature setting to direct hotter air to the canopy. The rain removal system is effective against external ice on the left side and center windshield panels. Refer to section I, part 2, AIR-CONDITIONING SYSTEM for rain removal normal operation.

The aircraft is equipped with engine anti-icing. Use it whenever icing conditions are suspected and during climbs and descents through marginal icing levels. Though the system will de-ice, treat it only as an anti-icer except in an emergency. If ice is allowed to build up on the engine inlet struts and guide vanes before the system is turned on, chunks of ice could be blown into the engine and cause compressor damage.

The first indication of inlet icing during cruising flight is a drop in engine pressure ratio. Be alert to the possibility of a subsequent compressor stall or engine overtemperature. The aircraft does not have a structural anti-icing system, so avoid prolonged flight at known icing levels.

Use high thrust settings (controlling airspeed with speed brake) when descending in severe icing conditions. The heat supplied to the engine anti-icing system when using low power settings may be inadequate to prevent ice formation. When landing on an ice-covered runway, make a normal touchdown and use aerodynamic braking during the roll-out. After the nose falls through, tap brakes lightly (this will dissipate energy/speed without locking wheels or blowing tires). Maintain directional control with rudder and nose gear steering. If necessary, shut down engine to aid stopping or perform field arrestment. Ground roll may be twice that experienced with ideal runway conditions.

RAIN

Whenever rain is encountered, icing is possible. Ensure pitot heat is on and use engine anti-icing as necessary. Use rain removal for takeoffs and landings. Perform the landing approach using mirror OLS if available (rain on windscreen gives the illusion of being high). Use landing techniques described for landing on ice.

SNOW

During flight in snow, follow the procedures recommended for flight under icing conditions. Avoid taxiing in deep snow or slush before takeoff. Frozen landing gear microswitches may result, giving a false gear warning when the gear is extended for landing.

THUNDERSTORMS AND TURBULENCE

Avoid thunderstorms whenever possible. The conditions of precipitation and turbulence inside a thunderstorm or towering cumulus cloud cannot be determined by external appearance. A towering cumulus cloud which has not reached high altitude can frequently contain more severe ice, hail, lightning, and turbulence than an extremely rough looking thunderstorm. Thunderstorms which appear to be dissipated can contain heavy precipitation, while some fully developed thunderstorms contain very little precipitation and turbulence. While flying through stable instrument conditions, be alert to the possibility of suddenly encountering conditions of turbulence severe enough to throw the aircraft out of control momentarily.

Be prepared for instrument failures. Pitot tube icing, which can take place even with pitot heat on, will cause erroneous airspeed indications not easily detected until they become large. The angle-of-attack indicator may be used, but attention to level attitude on the attitude gyro, with the necessary rpm for desired airspeed, has proven the best method for flight through a storm.

Put the visor of your helmet down for protection in the event of windshield or canopy breakage. The dark visor is also useful to minimize the blinding effects of lightning strikes.

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, maintain 250 to 300 KIAS at all altitudes. If attempting to top thunderstorms at high altitudes, this airspeed range must be maintained even if it requires use of afterburner. Higher speeds cause buffeting which will result in extreme pilot discomfort. If severe compressor stalls are encountered, reduce throttle setting to IDLE and lower the nose to increase airspeed. Compressor stalls are generally accompanied by increased exhaust gas temperature. If temperature exceeds allowable limits, shut down the engine and accomplish an airstart as soon as practical.

Radar is useful for avoiding the centers or extreme turbulence of thunderstorms. Set antenna elevation at zero and fly toward the black areas on the scope, avoiding areas of bright return. Call GCI/FAA, if available, to obtain tracking assistance.

Operational instrument flights may require penetration of thunderstorms and areas of extreme turbulence. If necessary to do so, proceed as follows:

1. Lower seat.
2. Maintain 250 to 300 KIAS.
3. Cruise droop — DOWN
4. Pitot heat — ENSURE ON
5. Secure loose equipment.
6. Tighten lap belt, lock shoulder harness, and pull down helmet visor.
7. Turn cockpit lights on bright and place panel lights on. Turn anticollision lights off.
8. Continuous engine ignition — ON
9. Fly the attitude and heading indicators while in extreme turbulence, because airspeed indicator and altimeter will fluctuate. Engage the normal mode of the autopilot, if desired. Do not use the altitude hold function since pressure altitude will vary considerably in thunderstorm areas.

COLD WEATHER

Follow the applicable procedures recommended for flight during icing and snow. With the exception of decreased takeoff roll and an increased initial climb performance, characteristics of the aircraft are not affected by cold weather. Additional ground operating procedures are discussed below.

BEFORE ENTERING AIRCRAFT

1. Check that surfaces are clear of snow, ice, or frost.
2. Check that all overboard vent lines are clear.
3. Check that pitot tube, airstream detector, and static ports are clear.
4. Check that tires are not frozen to the surface.

STARTING ENGINE

No special procedure for cold weather starting is necessary. If the engine fails to accelerate above 55% rpm and a warmup period of 2 to 3 minutes is not possible, proceed as follows:

1. Throttle — IDLE
2. Fuel control switch — MANUAL
3. Throttle — Advance slowly to 80% rpm.
   - Monitor EGT.
4. Fuel control switch — NORMAL

GROUND TESTS

If the engine has cooled to an ambient temperature of −35°C (−31°F) or below, a warmup period of 2 to 5 minutes with the throttle in idle should be allowed before engine runup. Carefully check operation of flight controls and actuate hydraulic systems.

BEFORE LEAVING AIRCRAFT

Shut the engine down in the normal manner. If the aircraft is to be parked for any length of time, ensure that the canopy cover, intake and tailpipe plugs, and proper battens are placed on the aircraft. Make certain that the aircraft is refueled immediately after a flight to minimize condensation in the fuel tanks. The airframe water drains should be drained once every 24 hours or on preflight.

HOT WEATHER AND DESERT

Hot weather operation does not differ appreciably from normal operation except for the items discussed below.

TAKEOFF

Greater runway distance and more acceleration time are required in hot weather, because the air is less dense. A noticeable decrease in thrust will occur at all power settings. The EGT will not increase appreciably due to the higher ambient temperatures. Check takeoff distances carefully. A CRT takeoff will be made at higher elevations, where available thrust for an MRT takeoff is so reduced that the distance required for takeoff may exceed the runway length.

DESCENT AND LANDING

If descending into warm, humid conditions, abrupt canopy fogging can occur. To prevent this condition, turn heat control to increase and the defog switch on before descent. Defog output is dependent upon engine rpm; therefore in areas of high humidity, use higher than normal engine rpm, controlling descent with speed brake, to achieve maximum defogging.

BEFORE LEAVING AIRCRAFT

In desert locations, keep the canopy and all vents and ducts covered to prevent blowing sand from entering. If not located in an area of blowing sand or dust, leave the canopy open during the day for ventilation.

HYDROPLANING ON WET RUNWAYS

At a certain critical speed, hydrodynamic lift resulting from the builtup pressure under the tire will equal the weight of the vehicle riding on the tire. When this occurs, hydroplaning speed has been reached. Any increase in speed above this critical value will lift the tire completely off the pavement leaving it supported by the fluid alone. This is termed total tire hydroplaning.

The velocity at which tire hydroplaning occurs is predictable and has been expressed in a mathematical formula:

$$V_h = 9\sqrt{P}$$

Where V_h is the tire hydroplaning speed in knots and P is the tire inflation pressure in pounds per square inch.

From this formula, the hydroplaning speed of the F-8 with a tire pressure of 300 pounds per square inch, is 156 knots. Since the F-8 has a normal landing speed of 135 to 140 knots and a relatively narrow tire, hydroplaning as defined, is not considered to be a significant problem in a wet runway landing. However, the friction coefficient problem still remains with the wet or slushy runway and it must be realized that stopping distances will be increased considerably. The recommended technique for wet runway landing in the F-8 is:

1. Land at minimum safe approach speed.
2. Make runway contact as early as possible.
3. Power to idle for minimum thrust. In extreme cases, shutting down engine will decrease stopping distance; however, hydraulic boosted brakes and rudder control will be lost.
4. Utilize maximum aerodynamic braking (full nose up trim and full back stick even after nose wheel has made runway contact will produce additional drag which is independent of normal braking action).
5. Do not initiate wheel braking above 90 KIAS. Initial braking should be a light pumping action to preclude locking brakes. Gradually increase braking pressure as aircraft slows.
6. Be aware of last available arresting gear and if it is doubtful that aircraft can safely stop prior to leaving the runway, extend the hook and engage arresting gear.

section VII
communications procedures

CONTENTS

INTRODUCTION

Communications is the process of transmitting and receiving information. Transmission must be clear and concise to be effective, and standardized phraseology, or signals must be used. Communications procedures and terminology are standardized by NWP's 16(A), 32(A), 37(A), and 41(A). Review these publications frequently and adhere to the instructions contained therein.

RADIO COMMUNICATIONS

RADIO DISCIPLINE

Note

AFC 502 installs Speech Security Equipment. Refer to Section I, Supplemental NATOPS Flight Manual for information on this system.

Maintain strict radio discipline at all times. Know what you are going to say before you depress the mike button, and transmit clear, concise, correct information on the first attempt. Use the following operating techniques to ensure the best results from the UHF (ARC-27A) radio:

1. Allow a minimum warmup time of 1 minute prior to pressing the transmitter button.
2. Adjust sensitivity control to assure maximum reception (refer to section I, part 2).
3. After depressing the mike button, pause momentarily before speaking to avoid cutting out the first word.
4. Know the proper procedure for presetting (or resetting) frequencies, refer to section I, part 2.
5. Be careful with the oxygen hose/communications connection. If radio failure occurs, plug the oxygen mask hose directly into the port console oxygen fitting. If the failure was due to a broken lead in the seat pack, radio operation may be regained. If this is done, you must reinsert the oxygen mask hose into the normal receptacle to utilize bailout oxygen. The console oxygen fitting does not have an automatic disconnect; therefore, do not eject with oxygen hose plugged into this fitting.

RADIO PROCEDURES

1. During formation flight, use the following procedure for changing radio channels:
   - The formation leader will call "Graycap (or assigned call sign) Flight, this is Graycap One, go channel six." Division and section leaders will wait until wingmen have made the channel change and are heads up in the cockpit before changing channels.
   - After allowing sufficient time for the change, the leader will call "Graycap Flight, check in." The number 2 aircraft in the formation will respond with "Graycap Two." all other aircraft will similarly acknowledge in sequence. The formation leader will check with those aircraft that do not check in. If contact is not established within 1 minute after a channel change, return to the channel of last contact and attempt to reestablish communication.
2. If the first division relinquishes the lead to any other division the original division call signs will be retained.
3. Flight leaders will ensure that their flights are intact after completion of each attack, either by radio or by visual check.
4. Guard channel (EMERGENCY) will be monitored at all times, but will be used only during an emergency.
5. In close formation, one aircraft will handle IFF/SIF procedures. Other aircraft in the formation will have equipment on STANDBY, but will be prepared to take over the IFF/SIF responsibility (refer to section I, part 2, for IFF/SIF operation).

HAND SIGNALS

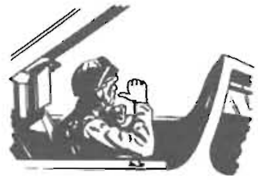
Hand and other visual signals are presented in figures 7-1 through 7-13.

AIRCRAFT STARTING AND PRE-TAXI SIGNALS

1

CONNECT AUXILIARY POWER UNIT — Hold extended index finger of right hand against the flat palm of vertical left hand. Plane captain repeats signal and connects power.

2



MAIN FUEL SHUTOFF VALVE CHECK — Pilot raises fist with thumb extended in drinking position. Plane captain goes to starboard wheel well and checks operation of the main fuel shutoff valve as the pilot turns the engine master switch ON (before starting engine).

3

PITOT HEAT ON/OFF AFTER CHECK — Plane captain grasps index and middle fingers of left hand with right hand at eye level. Pilot operates pitot heat switch as necessary to perform check.

4

CONNECT STARTING AIR UNIT — Pilot holds extended index and middle fingers of right hand against the flat palm of vertical left hand. Plane captain repeats signal and connects air.

5

DISCONNECT AIR STARTING UNIT — Pilot signals reverse of signal #4 at idle rpm.

DISCONNECT AUXILIARY POWER UNIT — Pilot signals reverse of signal #1 at idle rpm.

6

FUEL PUMPS PRESSURES CHECK — Plane captain gives drinking signal (same as #2). Pilot checks master generator switch ON (after starting engine).

7

DOWNLOCKS REMOVED — Plane captain points 3 fingers to removed aircraft downlocks. Pilot observes.

8

EMERGENCY PITCH TRIM "IN" — Plane captain forms "T" with hands at waist level and raises hands smartly in that position. Pilot raises pitch trim handle.

9

PITCH TRIM — Plane captain extends one arm in front with hand held vertically. Moves hand up and down for elevator trim. Pilot actuates "T" handle while monitoring the pitch trim indicator, using both trim channels to obtain full elevator throw in each direction.

10

EMERGENCY PITCH TRIM "OUT" — Plane captain gives reverse of signal #8. Pilot stows "T" handle.

11

RUDDER-AILERON INTERCONNECT — Plane captain moves right hand, with fist clenched, in a rectangular pattern at waist level. Indicates rudder trailing edge motion with open right hand. Pilot moves stick in a rectangular pattern, ensuring that all lateral and longitudinal stops are contacted.

12

CRUISE DROOP EXTEND — Plane captain holds hands facing forward, fists clenched, arms bent 45° at elbows, wrists straight, then bends wrists forward. Pilot extends cruise droop.

AX-90(1)-1-67

Figure 7–1 (Sheet 1)

AIRCRAFT STARTING AND PRE-TAXI SIGNALS

13

RAISE WING — Hands flat, raise arms from extended position. Reverse signal to lower wing.

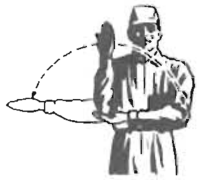
14

FUEL LEAK CHECK — Plane captain signals for hands out of cockpit.

NORMAL PITCH TRIM CHECK — Plane captain gives same signal as #9.

RUDDER-AILERON INTERCONNECT — Plane captain checks for disconnect. Same as signal #11.

15



AILERON TRIM CHECK — Plane captain holds right forearm vertical and grasps elbow with left hand. Swings forearm left, then right to indicate desired aileron trim change. Pilot actuates trim on signal.

16

RUDDER TRIM CHECK — Arm held vertical, elbow cupped in other hand, palm flat. Twist hand left and right to indicate desired trim deflection. Pilot actuates trim on signal.

17

VISCOUS DAMPER CHECK — With opened right hand, strike clenched left fist, held near stomach, two sharp blows. Pilot executes damper check.

18

EXHAUST NOZZLE CHECK—With forearm horizontal and fist closed, extend arm and open fist simultaneously. Fingers are extended and separated.

19

BRAKES CHECK — Both arms extended horizontally, fists clenched. Open and close hands rapidly. Pilot pumps brake pedals, then releases them.

20

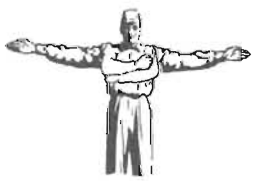
HOOK DOWN — Right fist, thumb extended downward into horizontal palm of left hand.

HOOK UP — Right fist, thumb extended upward, raised suddenly to meet horizontal palm of left hand.

21

AIR REFUELING PROBE OUT — Hold arm straight ahead with fist clenched, then swing 90° to side position. Reverse procedure for probe in. Pilot actuates probe on signal.

22



FOLD WINGS — Arms straight out at sides, then swept forward and hugged around the shoulders.

SPREAD WINGS — Reverse fold wings procedure.

23

WING LOCK CHECK — Plane captain hits right elbow with palm of left hand.

24

ENGAGE NOSE GEAR STEERING — Point to nose with index finger while indicating direction of turn with other index finger.

AX-90(2)-1-67

Figure 7–1 (Sheet 2)

GENERAL SIGNALS

Signal		*Meaning*	*Response*
Day	*Night*		
Thumbs up, or nod of head.	Flashlight moved vertically up-and-down repeatedly.	Affirmative. ("Yes," or, "I understand.")	
Thumbs down, or turn of head from side to side.	Flashlight moved horizontally back-and-forth repeatedly.	Negative. ("No," or, "I do not understand.")	
Hand cupped behind ear as if listening.		Question. Used in conjunction with another signal, this gesture indicates that the signal is interrogatory.	As appropriate
Hand held up, with palm outward.		Wait.	
Hand waved back and forth in an erasing motion in front of face, with palm turned forward.	Letter N in code, given with external lights.	Ignore my last signal.	
Employ fingers held vertically to indicate desired numerals 1 through 5. With fingers horizontal, indicate number which added to 5 gives desired number from 6 to 9. A clenched fist indicates 0. (Hold hand near canopy when signalling.)		Numerals as indicated.	A nod of the head. ("I understand"). To verify numerals, addressee repeats. If originator nods, interpretation is correct. If originator repeats numerals, addressee should continue to verify them until they are understood.
Make hand into cupshape, then make repeated pouring motions.		I am going to dump fuel.	
Slashing motion of index finger across throat.		I have stopped dumping fuel.	

AX-91-1-67

Figure 7-2

TAKEOFF, INFLIGHT, BREAKUP AND LANDING SIGNALS

Signal: Day	Signal: Night	Meaning	Response
1. Section takeoff-leader raises either forearm to vertical position.		1. I have completed my take-off check list and am ready for takeoff.	1. Stands by for reply from wingman, holding arm up until answered.
2. Wingman raises forearm.		2. I have completed my take-off check list and am ready for takeoff.	2. Wingman lowers arm and stands by for immediate takeoff.
3. Leader lowers arm.		3. Takeoff path is clear, I am commencing takeoff.	3. Execute section takeoff.
4. Sharp head nod to left after releasing brakes on takeoff.		4. Select afterburner.	4. Execute.
5. Sharp head nod to right after takeoff.		5. De-select afterburner.	5. Execute.
6. Arm and hand held straight, parallel to, and slightly above canopy rail, pivoted elbow and raised and lowered in short order.		6. Prepare to raise or lower wing (NOTE: Not normally used for takeoff transition).	6. Unlock wing and prepare to move wing handle.
7. Pronounced, smooth, back to front and front to back head nod while airborne.		7. Leader is moving wing incidence handle at the same rate as head nod to lower or raise the wing respectively.	7. Execute.
1. Leader pats self on the head, points to wingman.	2. Lead aircraft switches lights to BRT and flashes them. 3. Wingman places lights on DIM and assumes lead.	Leader shifting lead to wingman.	1. Wingman pats head and assumes lead. 2. Wingman places lights on DIM and assumes lead. 3. Wingman shines flashlight at leader, then on his hard-hat.
Leader pats self on head and holds up two or more fingers.		Leader shifting lead to division designated by numerals.	Wingman relay signal; division leader designated assumes lead.
Pilot blows kiss to leader.		I am leaving formation.	Leader nods ("I understand") or waves goodby.
Leader blows kiss and points to aircraft.		Aircraft pointed out leave formation.	Wingman indicated blows kiss and executes.
Leader points to wingman, then points to eye, then to vessel or object.		Directs plane to investigate object or vessel.	Wingman indicated blows kiss and executes.
Division leader holds up and rotates two fingers in horizontal circle, preparatory to breaking off.		Section break off.	Wingman relays signal to section leader. Section leader nods ("I understand") or waves goodbye and executes.
Leader describes horizontal circle with forefinger.	Series of "I's" in code, given by external lights.	Breakup (and rendezvous).	Wingman take lead, pass signal after leader breaks, and follow.
Landing motion with open hand:		Refers to landing of aircraft, generally used in conjunction with another signal.	
1. Followed by patting head.		1. I am landing.	1. Nods. ("I understand") or waves goodbye.
2. Followed by pointing to another aircraft.		2. Directs indicated aircraft to land.	2. Aircraft indicated repeats signal, blows a kiss and executes.

AX-92-1-67

Figure 7–3

FORMATION SIGNALS

Signal		*Meaning*	*Response*
Day	*Night*		
Open hand held vertically and moved forward or backward, palm in direction of movement.		Adjust wing-position forward or aft.	Wingman moves in direction indicated.
Open hand held horizontally and moved slowly up or down, palm in direction of movement.		Adjust wing-position up or down.	Wingman moves up or down as indicated.
Open hand used as if beckoning inboard or pushing outboard.		Adjust wing-position laterally toward or away from leader.	Wingman moves in direction indicated.
Hand opened flat and palm down, simulating dive or climb.		I am going to dive or climb.	Prepare to execute.
Hand moved horizontally above glareshield, palm down.		Leveling off.	Prepare to execute.
Head moved backward.		Slow down.	Execute.
Head moved forward.		Speed up.	Execute.
Head nodded right or left.		I am turning right or left.	Prepare to execute.
Thumb waved backward over shoulder.	Series of 00's in code, given by external lights.	Take cruising formation or open up.	Execute.
1. Holds up right (or left) forearm vertically, with clenched fist or single wing-dip. 2. Same as above, except with pumping motion or double wing-dip.	1. Single letter R (or K) in code, given by external lights. 2. Series of RR's (or KK's) in code, given by external lights.	1. Wingman cross under to right (or left) echelon or in direction of wing-dips. 2. Section cross under to right (or left) echelon or in direction of wing-dips.	1. Execute. 2. Execute.
Triple wing-dip.		Division cross under.	Execute.
	Series of VV's in code, given by external lights.	Form a Vee or balanced formation.	Execute.
Series of zooms.	Series of XX's in code, given by external lights.	Close up or join up; join up on me.	Execute.
Rocking of wings by leader.		Prepare to attack.	Execute preparation to attack.
Rocking of wings by any other member of flight.		We are being, or are about to be, attacked.	Standby for and execute defensive maneuvers.
Lead plane swishes tail.		All aircraft in this formation form step-down column in tactical order behind column leader.	Execute. Leader speeds up slightly to facilitate formation of column.
Shaking of ailerons.	Long dash, given with external lights.	Execute signal; used as required in conjunction with another signal.	Execute last signal given.

AX-93-1-67

Figure 7—4

ELECTRONIC COMMUNICATIONS AND NAVIGATION SIGNALS

Signal		*Meaning*	*Response*
Day	*Night*		
Tap earphones, followed by patting of head, and point to other plane.		Take over communications.	Repeat signals, pointing to self and assume communications lead.
Tap earphones, followed by patting of head.		I have taken over communications.	Nod ("I understand").
Tap earphones and indicate by finger-numerals, number of channel to which shifting.		Shift to radio frequency indicated by numerals.	Repeat signal and execute.
Tap earphones, extend forearm vertically, and rotate fingers, formed as if holding a grapefruit, followed by 4 numbers.		Manually set up ARC-27 on frequency indicated.	Repeat signal and execute.
Tap earphones, followed by question signal.		What channel (or frequency) are you on?	Indicate channel (or frequency) by finger-numerals.
Tap earphones and point to plane being called, followed by finger-numbers indicating frequency.		You are being called by radio on channel indicated by finger numbers.	Repeat numbers. Check receiving frequency and switch to channel indicated by originator. Dial in manually, if necessary.
Vertical hand, with fingers pointed ahead and moved in a horizontal sweeping motion, with four fingers extended and seperated.		What is bearing and distance to the tacan station?	Wait signal, or give magnetic bearing and distance with finger-numerals. The first three numerals indicate magnetic bearing and the last two or three, distance.
Vertical hand, with 4 fingers extended and separated, pointed ahead in a fore-and-aft chopping motion, followed by a question signal.		What is bearing to tacan station?	Repeat signal and give bearing in three digits.
Arm and vertical hand, with 4 fingers extended and separated, moved ahead in a fore-and-aft circular motion, followed by question signal.		What is distance to tacan station.	Repeat signal and give distance in two or three digits.
Tacan bearing or distance signal, followed by thumbs up or down.		Tacan bearing or distance, up or down.	Thumbs up or nod ("I understand").
Tacan-bearing signal, followed by finger-numerals.		Switch to Tacan station indicated.	Repeat and execute.
Hand held up. First and fourth fingers extended, moved in fore-and-aft chopping motion, followed by: 1. 4 numbers. 2. Question signal. 3. Up or down signal.		1. Set up UHF/ADF on frequency indicated. 2. What is UHF/ADF bearing? 3. My UHF/ADF is up or down.	1. Repeat signal and execute. 2. Repeat chopping motion, followed by wait, or three numerals indicating magnetic bearing. 3. Thumbs up or nod ("I understand").

AX-94(1)-1-67

Figure 7-5 (Sheet 1)

ELECTRONIC COMMUNICATIONS AND NAVIGATION SIGNALS

Signal		*Meaning*	*Response*
Day	*Night*		
Two fingers pointed toward eyes (meaning IFF/SIF signals), followed by: 1. "CUT". 2. 3-digit numerals.		1. Turn IFF/SIF to "STANDBY". 2. Set mode and code indicated: first numeral mode, second and third numerals - code.	Repeat, then execute.
1. Open hand held up, fingers together, moved in fore-and-aft chopping motion (by leader). 2. Followed by question signal. 3. Followed by three-finger numerals.		1. Course to be steered is present compass heading. 2. What is your compass heading? 3. My compass heading is as indicated by finger-numerals.	1. Nod of head ("I understand"). 2. Repeat signal and give compass heading in finger-numerals. 3. Nod or clarify, as appropriate.

AX-94(2)-1-67

Figure 7-5 (Sheet 2)

ARMAMENT SIGNALS

Signal		Meaning	Response
Day	*Night*		
1. Pistol-cocking motion with either hand. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Ready or safety guns, as applicable. 2. How much ammo do you have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Thumbs up- "over half"; thumbs down - "less than half." 3. Nod head ("I understand").
1. Shaking fist. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety bombs, as applicable. 2. How many bombs do I have? 3. I am unable to drop.	1. Repeat signal and execute. 2. Indicate with appropriate finger-numerals. 3. Nod head ("I understand").
1. Shaking hand, with fingers extended downward. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety rockets, as applicable. 2. How many rockets do I have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Indicate with appropriate finger-numerals. 3. Nod head ("I understand").

AX-95-1-67

Figure 7–6

AIRCRAFT AND ENGINE OPERATION SIGNALS

Signal		Meaning	Response
Day	*Night* *		
Raise fist with thumb extended in drinking position.		How much fuel have you?	Repeat signal, then indicate fuel in hundreds of pounds by finger-numbers.
Rotary movement of clenched fist in cockpit as if cranking wheels.	Letter W in code, given by external lights, or rotary motion of flashlight.	Lower or raise landing gear, as appropriate.	Repeat signal. Execute when leader changes configuration.
Leader lowers hook.	Letter H in code, given by external lights.	Lower arresting hook.	Wingman lower arresting hook. Leader indicates wingman's hook is down with thumbs-up signal.
Open and close four fingers and thumb.		Extend or retract speed brakes, as appropriate.	Repeat signal. Execute upon head-nod from leader or when leader's speed brakes extend/retract.

*When using flashlight, turn off anticollision lights. Use white light only.

AX-96-1-67

Figure 7–7

AIR REFUELING SIGNALS

Signal		*Meaning*	*Response*
Day	*Night*		
One finger turn-up signal.		By receiver: start turbine.	Tanker execute. Receiver gives thumbs-up when turbine starts.
Form cone-shape with hand, all fingers extended aft (make signal close to canopy).			Tanker execute. Receiver give thumbs-up if:
1. Cone moved aft. 2. Cone moved forward.		1. By receiver: extend drogue. 2. By receiver: retract drogue.	1. Drogue extends properly. 2. Drogue retracts fully and air turbine feathers.
Make hand into cupshape, then make repeated pouring motions.		By tanker: I am going to dump fuel.	By receiver: Nod. Give thumbs-up when fuel dumping commences.
Slashing motion of index finger across throat.		By tanker: I have stopped dumping fuel.	By receiver: Give thumbs-up if fuel dumping has ceased.

AX-97-1-67

Figure 7-8

EMERGENCY SIGNALS BETWEEN AIRCRAFT

VISUAL EMERGENCY SIGNALS (AIR TO AIR)

General

Signal		Meaning	Response
Day	*Night*		
Arms bent across forehead weeping.	Horizontal motion of flashlight shone at other aircraft.	General emergency signal meaning, I am in trouble.	Carry out squadron doctrine for escort of disabled aircraft.
Landing motion with open hand.	Circular motion of flashlight shone at other aircraft.	I must land immediately.	Assume lead if indicated and return to base or nearest suitable field.
Point to pilot and give series of thumb down movements.	Flash series of dots with exterior lights.	Are you having difficulty?	Thumbs up: I am all right Thumbs down: I am having trouble. Lights off once, then on steady: I am all right Lights flashing: I am having trouble

'HEFOE' SIGNALS
(Preceded by General Emergency Signal)

Signal		Meaning	Response
Day	*Night*		
One Finger	One Flash	Hydraulic Trouble	Nod of Head: I Understand
Two Fingers	Two Flashes	Electrical Trouble	
Three Fingers	Three Flashes	Fuel Trouble	
Four Fingers	Four Flashes	Oxygen Trouble	Series of Flashes: I Understand
Five Fingers	Five Flashes	Engine Trouble	

AX-98-1-67

Figure 7-9

ARMING AND DEARMING SIGNALS

CARRIER TO ARMING AIRCRAFT

Signal		Meaning	Response
Day	Night		
1. Arming supervisor Pistol cocking motion with either hand.	Same	Pilot: Check all armament switches OFF and SAFE.	Pilot: Execute. Raise both hands to view of arming supervisor of checking switch positions. (Hands remain in view during check and hook-up.)
2. Arming supervisor gives pilot: a. Thumbs up b. Thumbs down	Same	a. Aircraft is armed and all personnel and equipment clear of area. b. Aircraft is down for ordinance.	a. Hold until arming crew clear of arming. b. Return to line.
DEARMING			
3. Dearming supervisor: Pistol cocking motion with either hand.	Same	Pilot: Check all armament switches OFF or SAFE.	Pilot: Execute. Raise both hands to view of dearming supervisor after checking switch positions. (Hands remain in view during dearming.)
4. Dearming supervisor gives pilot: Thumbs up.	Same	Pilot: Aircraft is dearmed and crew and equipment clear of aircraft.	Pilot: Hold until arming crew clear of arming area - then return to line.

AX-99-1-67

Figure 7-10

POST FLIGHT GROUND CREW TO PILOT SIGNALS

Signal		Meaning	Response
Day	Night		
1. Drinking signal followed by blowing into open right hand palm.	1. Same except with wand.	Dump wing pressure.	Select fuel transfer PRESS DUMP.

AX-100-3-67

Figure 7-11

EMERGENCY GROUND CREW TO PILOT SIGNALS

Signal		Meaning	Response
Day	Night		
1. Describe a large figure eight with one hand and point to the fire area with the other hand.	1. Same except with wands.	Information signal for external aircraft fire.	Comply with engine cut or continuous turnup signal as appropriate.
2. Emergency hold signal followed by wiping brow then pointing to brakes.	2. Same except with wand.	Your aircraft has hot brakes.	Comply with local hot brakes procedures.

AX-151-3-67

Figure 7-12

FLIGHT SIGNALS BETWEEN AIRCRAFT

PENETRATION / INSTRUMENT APPROACH (NO RADIO)

Signal		Meaning	Response
Day	*Night*		
Open and close 4 fingers and thumb in pinching motion.	3 dashes w/external lights.	Extend speedbrakes, commencing approach.	Execute when leader extends speedbrakes.
Rotary movement of clenched fist in cockpit as if cranking wheels.	2 dashes w/external lights.	Extend wheels and full flaps.	Execute when leader extends wheels, flaps.
Pointing index finger toward runway/ship in stabbing motion, repeatedly, followed by lead change signal.	1 dash w/external lights.	Landing runway/meatball and ship in sight.	Ashore: Take position for landing. Carrier: Break off and land.

Note: Configuration change should be executed promptly after completion of the signal.

AX-101-1-67

Figure 7-13

section VIII

weapon systems

CONTENTS

FIRE CONTROL SYSTEM AN/AWG-4

DESCRIPTION

This system integrates the EX-16 fire control computer group and the AN/APQ-83B fire control radar to provide radar search, ranging and angle tracking for missile firing and for computation of the lead angle required for firing fixed guns. The AN/AWG-4 fire control system uses either radar range data or pilot's estimated firing range data (fixed ranging) to compute lead angle. Lead angle signals from the computer group positions the gyro reticle image (pipper) in the sight unit to enable the pilot to use the required lead angle by keeping the pipper superimposed on the target.

When radar ranging is used for gunfiring, the radar set supplies target range and range rate data to the computer group. The computer group automatically computes the required lead angle for the sight unit presentation. The computer group also furnishes three separate ranging tones to the pilot; a 400-cycle signal to commence smooth tracking, a 1,200-cycle signal when the target is within the range set on the fixed range dial, and a pulsating 400- to 1,200-cycle signal to break off the attack to avoid collision with the target.

For air-to-ground operation, or air-to-air operation in which the radar is incapable of providing reliable range data, the system may be used with a preset firing range selected by the pilot. Effectiveness of fire control is then limited by the accuracy with which the pilot is able to judge firing range. Ranging tones are not furnished when fixed ranging is used.

Note

> Section VIII contains information regarding the addition of 3-position gun switches, a stores release switch (formerly the autopilot switch), and a BAT mode of radar operation. These additions have been included without formal documentation in the interest of getting information to Fleet pilots at the earliest practicable date. Wherever one of these new additions is described, the old configuration is also described to cover unmodified airplanes.

The fire control system sight unit has an antitumbling circuit to prevent the sight gyro from tumbling during violent maneuvers. When the sight gyro pipper reaches maximum deflection, the antitumbling circuit momentarily cages the gyro so that the pipper tends to move toward the center of the optical field. As long as the flight conditions are such that the gyro tends to tumble, and the antitumbling circuit provides an opposing tendency, the pipper will oscillate near the edge of the optical field.

When the radar is tracking, target range, target position and missile envelope are displayed on the radar azimuth-range indicator. Providing the missile tone is heard, missiles may be fired without visual reference to the target; however, the target must be within visual range for a gunnery attack. Lead angle computation for firing missiles is discussed under RADAR DESCRIPTION AND OPERATION, Supplemental NATOPS Flight Manual.

The fire control radar is also employed to illuminate targets (with radar energy) for AIM-9C missiles.

Fire control system components and locations are illustrated in figure 8–1. A block diagram of the fire control system is presented in figure 8–2. Fire control system controls are illustrated and described in figure 8–3.

COMPUTER GROUP EX-16

This part of the fire control system is used to provide a correct sight line for aiming fixed, forward firing guns. Range, range rate, and air resistance are fed into a computer unit. The computer solves the fire control equations and supplies controlled currents to a gyro operated sight unit. The correct sight line is presented to the pilot through the optics of the sight unit.

The system consists of the following components:

1. Control Box Mk 44 Mod 0.
2. Range Unit Mk 26 Mod 1.
3. Sight Unit Mk 11 Mod 7.
4. Computer Mk 101 Mod 0 (with adapter Computer Mk 20 Mod 4).
5. Adapter Computer Mk 20 Mod 3.
6. Caging Switch.
7. Computer Compensator 56975-1.
8. Gun Mode Resistors.

Control Box Mk 44 Mod 0

The control box contains the controls for energizing the computer group, selecting the mode of operation and choosing a firing (fixed) range. The individual controls and their functions are listed in figure 8–3.

FIRE CONTROL SYSTEM AN/AWG-4

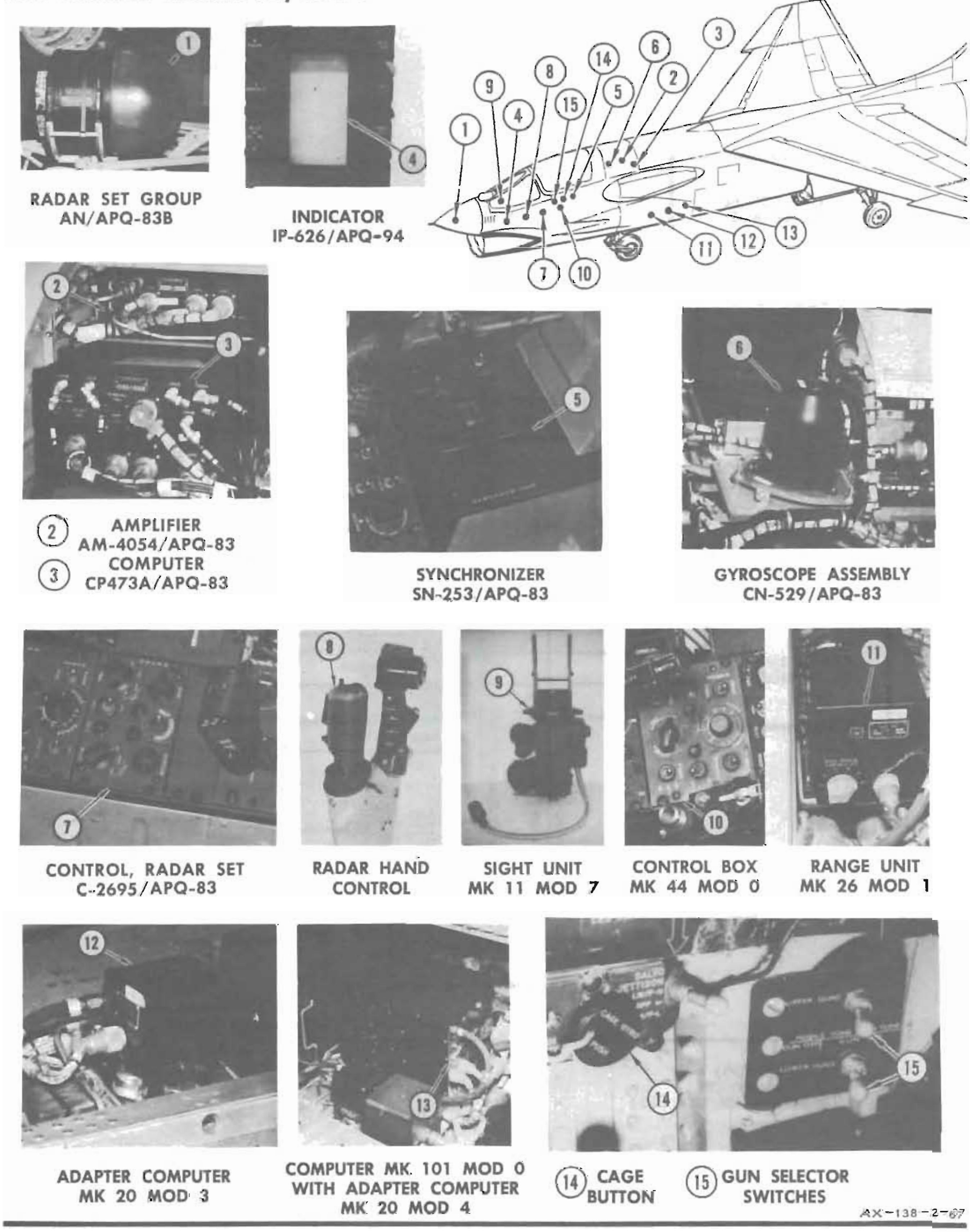


Figure 8–1

FIRE CONTROL SYSTEM BLOCK DIAGRAM

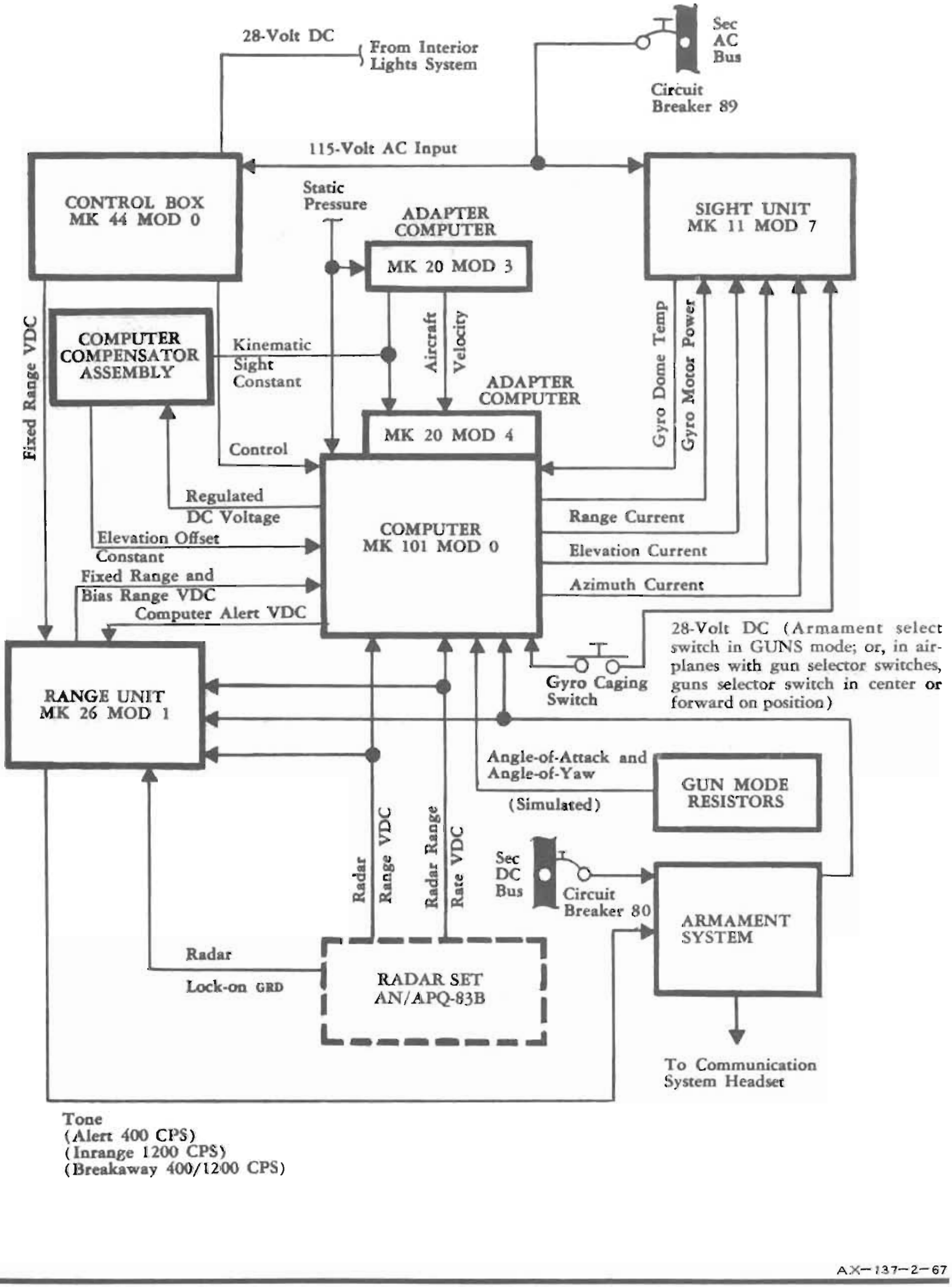


Figure 8–2

FIRE CONTROL SYSTEM CONTROLS

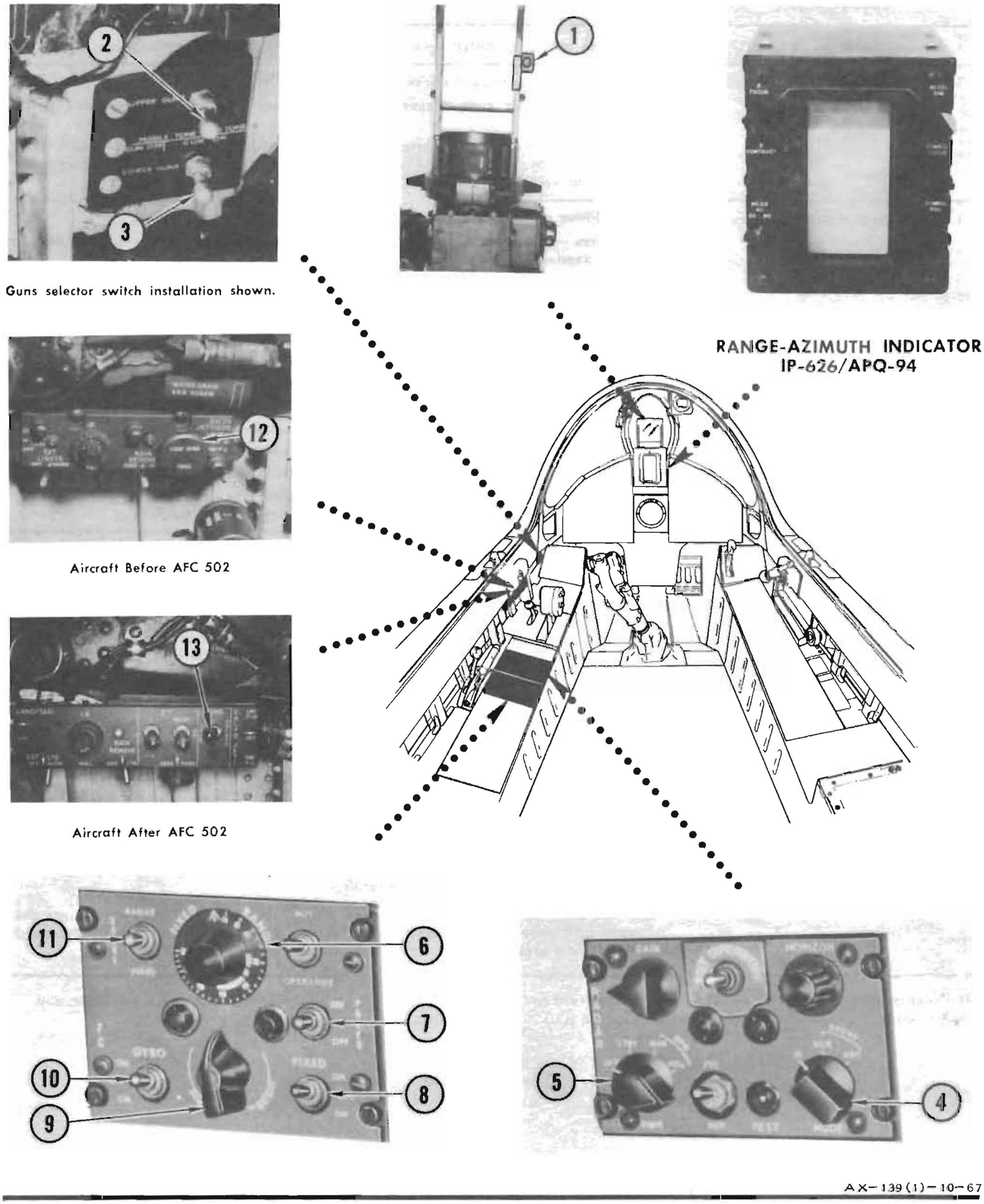


Figure 8–3 (Sheet 1)

FIRE CONTROL SYSTEM CONTROLS

Nomenclature	*Function*
1. Remote radar track lamp	Comes on whenever radar track lamp comes on. Indicates target lock-on.
2. Upper guns selector switch	OFF — upper guns trigger circuit disconnected. Missile tones available. Center ON — upper guns trigger circuit completed to guns trigger switch. Missile tones available. Forward ON* — upper guns trigger circuit completed to guns trigger switch. Gun firing tones available. Missile tones not available. GARO available with radar mode switch in ARO.
3. Lower guns selector switch	OFF — lower guns trigger circuit disconnected. Missile tones available. Center ON — lower guns trigger circuit completed to guns trigger switch. Missile tones available. Forward ON* — lower guns trigger circuit completed to guns trigger switch. Gun firing tones available. Missile tones not available. GARO available with radar mode switch in ARO.
4. Radar mode switch	RADAR, NOR — radar set energized for normal operation. RADAR, ARO — also used to initiate GARO mode with the armament selector switch in GUNS (before AFC 493), or with one of the gun selector switches in forward ON (after AFC 493).
5. Radar power switch	STBY — applies power to maintain radar and IR operation in standby condition. NOR — places radar and IR sets in operation in search mode. HOJ — places radar set in operation in search mode with provision for automatically switching to home on jamming operation if jammed while tracking.
6. Fixed range dial	Permits selection of estimated range for firing guns when FIXED ranging is employed, and of maximum optimum range for firing guns when RADAR ranging is employed.
7. Fire control power switch	ON — supplies power to fixed lamp switch and to the fire control computer circuits through the gyro switch.
8. Sight fixed lamp switch	In either ON position, energizes one of the dual filaments in the fixed reticle lamp.
9. Sight dimming knob	Controls intensity of fixed and gyro reticle (pipper) illumination.
10. Sight gyro switch	In either ON position, energizes one of the dual filaments in the gyro reticle lamp and supplies power to the computer circuits and sight unit gyro motor.
11. Range switch	RADAR — selects radar-supplied ranging information for lead computation. FIXED — selects pilot-estimated ranging information for lead computation.
12. Sight gyro caging button (Aircraft before AFC 502)	Aircraft before AFC 493 — momentarily depressed and released, cages or uncages the sight unit gyro if the armament selector switch is in GUNS position and the sight gyro switch is ON. (Gyro automatically caged when armament selector is out of GUNS position on these aircraft.) Aircraft after AFC 493 — momentarily depressed and released, cages or uncages the sight unit gyro with the sight gyro switch in ON. (Gyro not automatically caged by moving armament selector out of GUNS on these aircraft.)

*If either of the guns selector switches is in the forward ON position, gun tones are available, missile tones not available, and GARO mode is available with radar mode switch in ARO.

AX-139(2)-10-67

Figure 8-3 (Sheet 2)

FIRE CONTROL SYSTEM CONTROLS

Nomenclature	*Function*
13. Sight gyro caging switch (Aircraft after AFC 502)	CAGE — Aircraft before AFC 493 — cages sight unit gyro if armament selector switch in GUNS and sight gyro switch ON. Turns off pipper light if sight gyro switch is in the forward ON position. (Gyro caged automatically when armament selector out of GUNS on these aircraft.) Aircraft after AFC 493 — cages sight unit gyro with sight gyro switch ON. Turns off pipper light if sight gyro switch is in the forward ON position. (Gyro not caged automatically by moving armament selector out of GUNS on these aircraft.) UNCAGE — (switch must be pulled straight out before it can be moved from the CAGE to the UNCAGE position.) Aircraft before AFC 493 — uncages sight unit gyro if armament selector switch in GUNS and sight gyro switch ON. Aircraft after AFC 493 — uncages sight unit gyro if sight gyro switch ON.

AX-139(3)-10-67

Figure 8-3 (Sheet 3)

Range Unit Mk 26 Mod 1

The range unit supplies three tones to the pilot's headphones. These tones are a 400-cycle prefiring tone, 1200-cycle firing or alert tone, and 400/1200-cycle breakaway tone. A switch on the front panel of the range unit is used to select a bias range that determines when the prefiring tone will be heard. The bias ranges that may be selected are 0, 2, 3, 4, 5, and 6 (hundred yards). Breakaway range is selected by making the proper wiring connection on a terminal board inside the range unit. The breakaway ranges that may be selected are 1500, 1200, 900, and 600 feet. Both bias range and breakaway range must be set on the ground. When tracking a target, the 400-cycle prefiring tone is applied to the headphones when the target range equals the firing (fixed) range plus the bias range. The 400-cycle tone informs the pilot that the fire control system has transferred from fixed ranging to radar ranging. When firing range (preset on the fixed range dial) is reached plus one half the range rate, the 1200-cycle tone is heard. When breakaway range is reached plus one half the range rate, the alternating 400/1200-cycle breakaway tone is applied to the headphones, warning the pilot to pull away from the target.

Sight Unit Mk 11 Mod 7 *(Figures 8–4 and 8–5)*

The function of the sight unit is to indicate to the pilot the correct point of aim. This is accomplished by a movable pipper which is positioned according to the turning rate of the aircraft and to information received from the Computer Mk 101. The fixed image is boresighted with the guns and always indicates the gun line. The gyro reticle image, or pipper, is a donut shaped image which is used in sighting the target. The position of the pipper depends upon three variables:

1. The rate of turn of the aircraft.
2. An electrical current into the sight unit called "sensitivity current."
3. An electrical current into the sight unit called "elevation current."

The Gyro Mk 35 Mod 3 is a basic part of the sight unit and contains a motor-driven gyroscope. Gyroscopic action is produced by high speed rotation of the gyro mirror and dome. This assembly is mounted by a universal joint arrangement so that its axis is free to tilt in any direction. Thus when the aircraft turns, the sight unit also turns around the gyro, and the gyro tends to remain pointed in the original direction.

The gyro mirror reflects the pipper image on its optical path. Precession of the gyro with relation to the sight unit housing displaces the pipper on the reflector plate. The pipper indicates the direction the gyro is pointing. As mentioned previously, when the sight unit turns (along with the aircraft) the gyro tends to remain pointing in the original direction. As the axis of the sight unit becomes displaced from the gyro axis, a torque is imposed through the effect of the range current on the gyro attempting to line its axis with the sight unit axis. The range current flows through the coils of wire around the gyro to produce a magnetic field. For an elementary understanding of the sight unit, the range current and coils of wire may be thought of as an electromagnet attached to the sight housing which tends to line up the gyro axis with the airplane. When the airplane turns, and hence the sight unit housing, the magnetic force tends to keep the gyro lined up with the turning aircraft and the gyroscopic effect tends to keep the gyro pointing in the original direction. As a result of the gyro's natural resistance to the magnetic force, the gyro axis will follow the movement of the aircraft but will lag behind it. The angular displacement of the pipper will equal the lead angle required for that particular attack run. If the turning rate is constant, the pipper will lag the fixed image by a constant amount, and the indicated lead angle will be constant. A smaller turning rate (less applied g) generates a corresponding smaller lead angle, all other factors remaining constant.

If the range to the target is very long, the range current will be small, the magnetic force will be small, the gyro lag will be large, and the indicated lead angle will be large. This should seem logical since the farther the projectile must travel, the greater the lead angle must be in order to score a hit. On the other hand, if the range is short and the turning rate of the aircraft is the same as before, the range current will be large and the lead angle will be small. The magnitude of the range current is determined by information supplied to Computer Mk 101.

The lead angle discussed above is due to the relative motion between two aircraft, or kinematic lead. The amount of kinematic lead developed depends upon the rate of turn of the aircraft and the amount of range current in the range coils. There are, however, additional factors for which compensation must be made. For instance, the gun line must be elevated to compensate for the drop of the projectile due to gravity. This gravity lead is generated in the sight unit by

SIGHT UNIT, MK 11 MOD 7

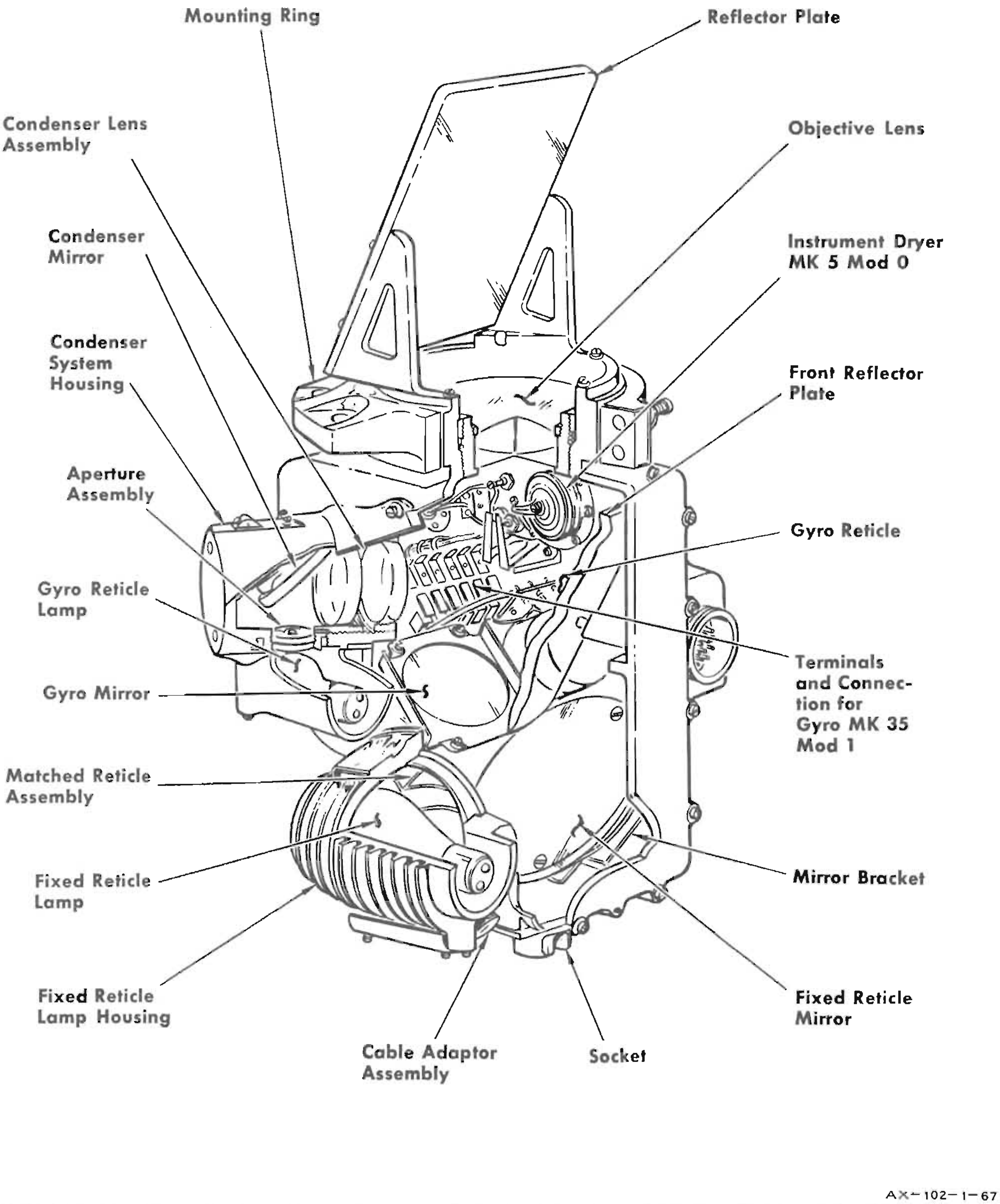


Figure 8–4

SIGHT UNIT DISPLAYS

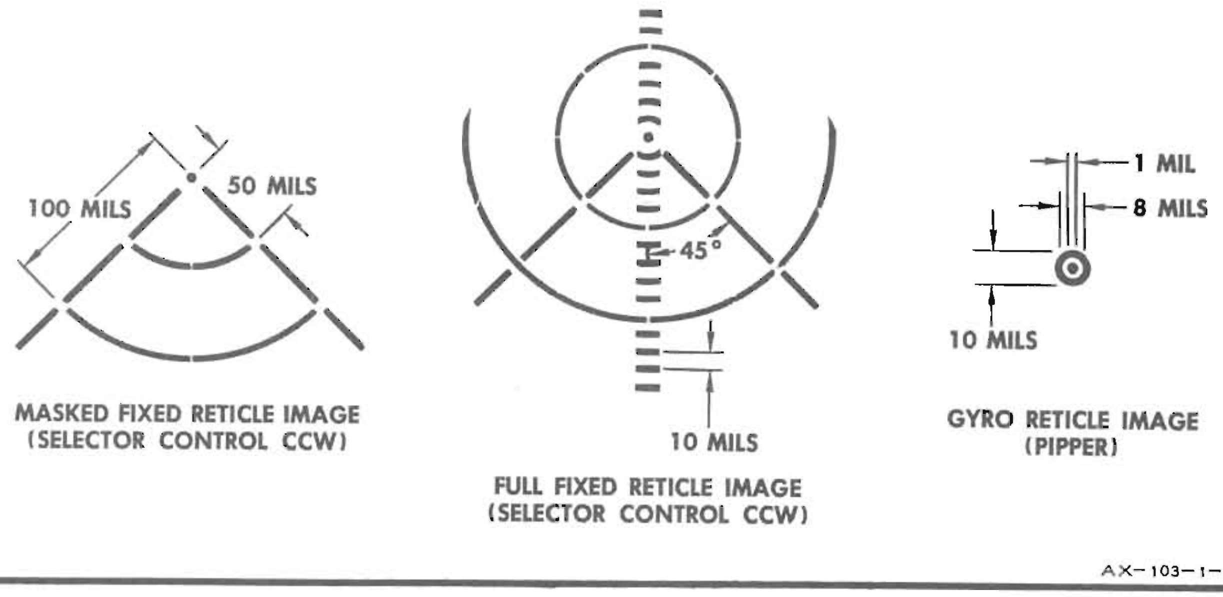


Figure 8–5

means of current supplied to a set of elevation coils. This current is supplied in such a way as to change the effective center of the range electromagnet.

The gravity correction causes the gyro to be offset downward. Kinematic lead is now generated with respect to this new "zero" point. In addition to gravity drop, the elevation current (produced in Computer Mk 101) compensates for other factors such as acceleration (g's).

The azimuth coil current is no longer considered a variable in gyro displacement. Azimuth current is a constant value preset within the computer.

Computer Mk 101 Mod 0

Computer Mk 101 Mod 0 is the brain of the system. It accepts data on the attack conditions, makes the computations for firing guns and causes the sight unit to generate the required lead angle. The computer solves nonlinear algebraic equations from which are derived three output currents. These three currents are supplied to the sight unit to control the sensitivity of the gyro to angular motion and to offset the pipper in elevation and azimuth for gravity drop, acceleration and angle of attack, as applicable.

Performance Data

Range	8,000 to 600 feet
Range rate	0 to minus 2,000 feet per second
Altitude	0 to 50,000 feet*
Acceleration	0 to 6 g's
Aircraft velocity	Rated aircraft velocity
Maximum lead angle	Approx. 10° or 177 mils
Minimum tracking time	1 to 2 seconds (guns)
Ambient temperature for accurate computation	-50 to +65°C
Warmup time	3 minutes minimum
Attack angle	±14° which can be offset
Launcher angle	±180 mils

*This is the limit of the pressure transmitter. Errors caused by higher altitudes will in general be very small.

Acceleration and Gravity-Drop Inputs

The force measured by the accelerometer (the number of g's) is the force perpendicular to the wings of the aircraft. This is the resultant of the force of gravity and the centrifugal force produced when flying a curved path, as shown in figure 8–6. As the bank angle increases, the centrifugal force increases, and the resultant increases. It can be shown mathematically that for level turns, accelerometer force is proportional to the secant of the bank angle. For level turns, therefore, the output from the accelerometer is an indication of bank angle.

FORCES ACTING ON ACCELEROMETER

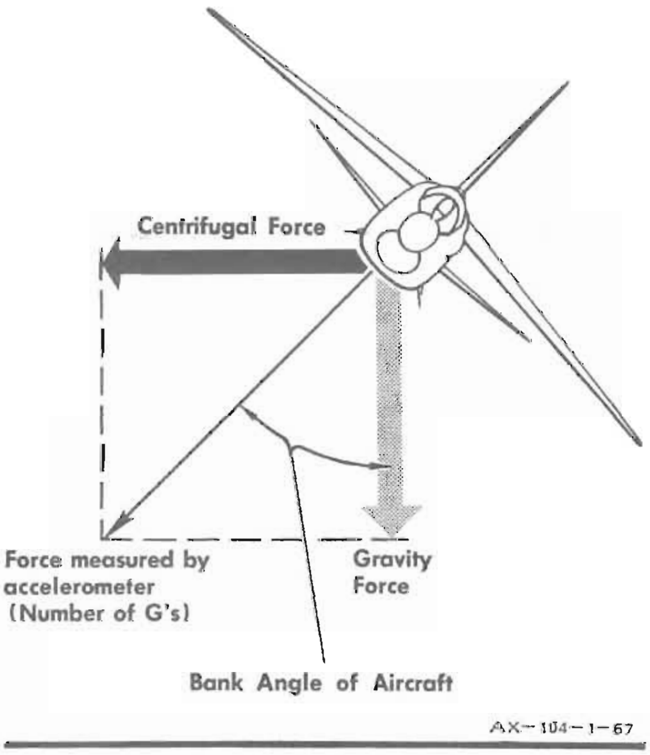


Figure 8–6

The diagram of figure 8–7 shows that the magnitude of the elevation current is made up of two components — the computed gravity drop plus the accelerometer output. This current causes the pipper to be deflected downward along the ladder markings (parallel to the elevation coils). The computed gravity drop causes a 50-mil deflection (the assumed gravity drop for this example), and the accelerometer output increases this deflection until the pipper is 50 mils from the center of the fixed image in a true vertical direction. It can be seen that the required output from the accelerometer will be larger if the bank angle of the aircraft is larger; and since the output of the accelerometer depends upon the bank angle, it is possible to design the accelerometer so that its output will produce the required increase in pipper deflection.

The pipper is now at the correct vertical distance to correct for gravity drop, but it is displaced to the left so that one would expect the kinematic-lead effect to pull the pipper far beyond the desired position for indicating the correct point of aim. Because of this, the kinematic lead is purposely decreased, so that the combination of kinematic lead and accelerometer output will produce the correct point of aim.

Adapter Computer Mk 20 Mod 3

The computer Mk 101 Mod 0 is designed for use with a wide range of weapons and aircraft installations. The Adapter Computer Mk 20 Mod 3 is a plug-in aircraft characteristics unit making the computer compatible with the gun installation.

Caging Switch

The caging switch, located above the left-hand console, permits caging and uncaging of the sight unit gyro. To determine mode of operation of the sight (caged or uncaged) the sight power switch must be ON and the range dial should be set at a range other than minimum. The caging switch is then depressed. If the pipper moves up (2–4 MILS) then slowly down, the sight is uncaged. If the pipper moves down (2–4 MILS) then slowly up, the sight is caged. It can easily be determined if the gyro pipper is caged or uncaged while airborne by applying g's, activating the cage button and observing pipper deflection.

Note

The 3-position gun switches can be in any position while determining the gunsight mode of operation.

Computer Compensator 56975-1

The computer compensator assembly is located on the left-hand side of the equipment compartment adjacent to the MK 101 Mod 0 computer. The compensator is adjusted by maintenance personnel to compensate for the MK 101 Mod 0 computer variations in supplying lead information to the gunsight.

Guns Selector Switches

The guns selector switches greatly simplify the actions required of the pilot when changing from a missile attack to a guns attack and vice versa, and eliminate all gun functions of the armament selector switch located on the armament control panel. The guns selector switches are located on the left side wall of the cockpit.

EFFECT OF THE ACCELEROMETER

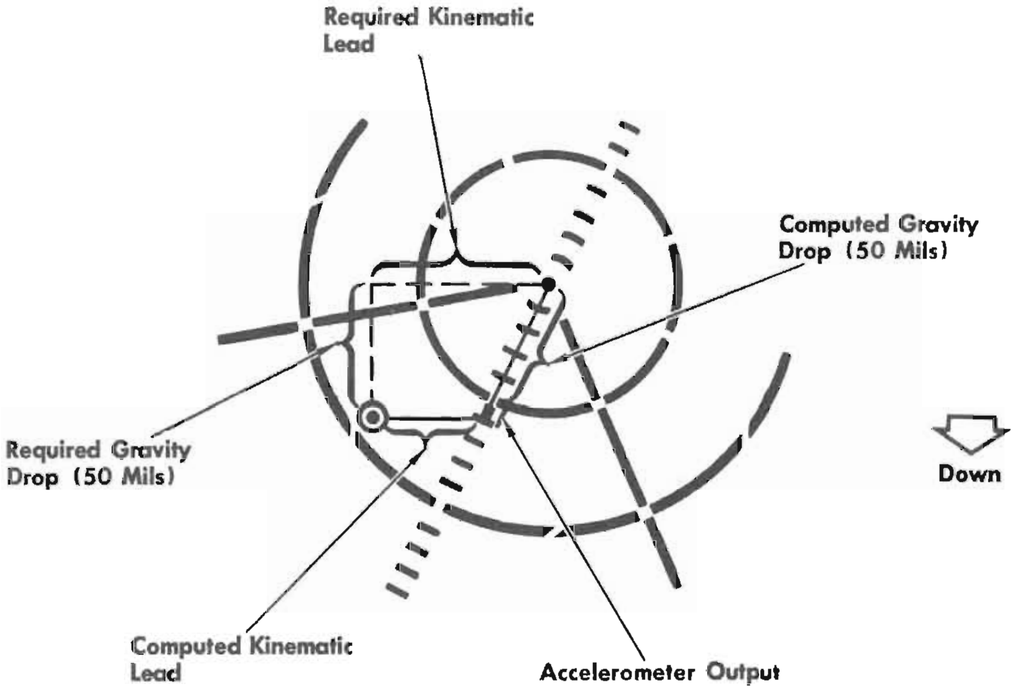


Figure 8–7

The pilot can select either two or four guns to be armed during his missile attack, while retaining missile firing tones. If it becomes necessary to change to a guns attack, the pilot needs only to move either of the gun selector switches to the forward position. This action will cut out the missile firing tones, and allow the gun firing tones to be received.

If it becomes necessary to change to a guns attack in aircraft without the guns selector switches, the armament selector switch must be moved to the GUNS position.

GARO and BAT Modes

The GARO (guns automatic ranging only) mode provides for rapid detection and automatic lock-on of gunfire targets located within the field of view of the slaved radar antenna and within 600 to 2,100 yards of the attacking aircraft.

The GARO scope display is a narrow B scan that remains centered in azimuth with the range strobe sweeping between 600 to 2,100 yards, depending upon the three-position strobe switch located on the radar control panel. The narrow B scan represents the radar beam, approximately 10.5° in diameter and depressed 4° from the aircraft datum line. When the target appears as a blip within the B scan (600 to 2,100 yards range) the radar set automatically locks on the target and switches to the track mode. Lock-on is limited to pure pursuit tracking.

The BAT (Boresight Acquisition Track) radar mode is similar to the GARO mode, but with many improvements. In search mode, the scope display is similar to GARO. The three-position range strobe switch is replaced with a variable range strobe potentiometer to give the pilot the capability of range strobe positioning from 600 yards to 4 miles. The radar antenna is slaved with the aircraft datum line. Following target acquisition, the radar will angle track within the gimbal limits of the radar. A range meter giving target range and missile envelope is also incorporated. The range meter improves the pilot's capability of determining guns/missile envelopes. Refer to Section VIII, Supplemental NATOPS Flight Manual for additional information.

GUNNERY SYSTEM

Description

The gunnery system incorporates four Mk 12 Mod 0 20-millimeter guns located in gun bays on each side of the fuselage, and includes the related systems and equipment necessary for gun operation. The guns are installed two to a bay and mounted one above the other. Access to the bays is provided through a forward hinged door and an aft removable panel. Loading and unloading is accomplished through the forward door. The aft panel must be removed for gun installation and removal, and for boresighting.

The guns are normally installed at a 1 degree depression angle measured from waterline 100, but provisions are included for installation at a 2.5 degree depression angle for ground strafing. A rear mount attached to aircraft structure supports the aft end of the gun and provides the slideway for the gun receiver during gun recoil and counterrecoil. A front mount for each gun retains the gun slide-and-tube assembly during recoil and counterrecoil, and incorporates double eccentrics for boresighting the guns. A retaining ring installed over the end of the slide-and-tube assembly secures the guns to the front mount. The quick-release pin used to clamp the retaining ring is itself safetied with a pin to ensure that the quick-release pin does not disengage during gun firing. A removable panel provides access to each gun front mount for gun installation and removal, and for boresighting. The forward end of the gun slide-and-tube assembly projects through a floating metallic gas seal which is part of the gun blast fitting. The gas seal prevents the gun gases from being blown back into the gun bay during firing.

The guns have a Mk 7 Mod 2 pneumatic gun feed mechanism which draws the ammunition from the boxes, strips it from the belt, and positions it in the throat of the gun receiver to be chambered. A removable ammunition box for each gun is installed in the upper fuselage above the gun bays. A hinged door on each side provides access to the boxes. The ammunition belt is conveyed through a fixed chute which extends into the upper gun bay. A flexible feed chute attaches to the fixed feed chute and to aircraft structure at its upper end, and to the gun feed mechanism at its lower end. A chute for ejected cases and one for links extend from the gun and feeder, respectively, into the expended case and link compartment below the gun bay. A panel at the forward end of each of these compartments provides access for cleaning out the compartments after firing.

The gun bays and expended case and link compartments are ventilated (purged) to remove explosive gases during gunfire by means of two doors on each side of the fuselage. The forward door opens into the airstream to admit purging ram air, which dumps all gun gases out through the rear door. The doors are pneumatically actuated and are automatically controlled through the trigger switch. The source of air pressure for operation of the gun feed mechanism, the gun chargers, and the gun bay vent doors is the 1,100-cubic-inch air bottle. A minimum pressure shutoff valve is installed in the gunnery system line from the air bottle to prevent complete drainage of bottle pressure in the event of gunnery system leak. Pneumatic quick-disconnects are installed within the gun bays in the "feeder," "ready," and "safe" air pressure lines to each gun to permit gun servicing. After AFC 506, two manual loading valves (one in each gun bay) are also installed for gun servicing. These valves (or the quick-disconnects before AFC 506) are used by ground personnel to route pneumatic air for loading and stripping the first ammunition round into the feeder mechanism of each gun. Refer to figure 8–8 for gun system arrangement and to figure 8–9 for gun system controls.

The gunnery system is electrically controlled. The electrical system consists of a circuit for energizing the armament bus (which is also common to the rocket and missile electrical system), a circuit for charging all guns simultaneously, a circuit for energizing the gun vent door system, and a circuit for firing the guns. Power requirements are supplied by the secondary dc bus, the armament bus, and the secondary ac bus phases A and B.

GUN SYSTEM ARRANGEMENT

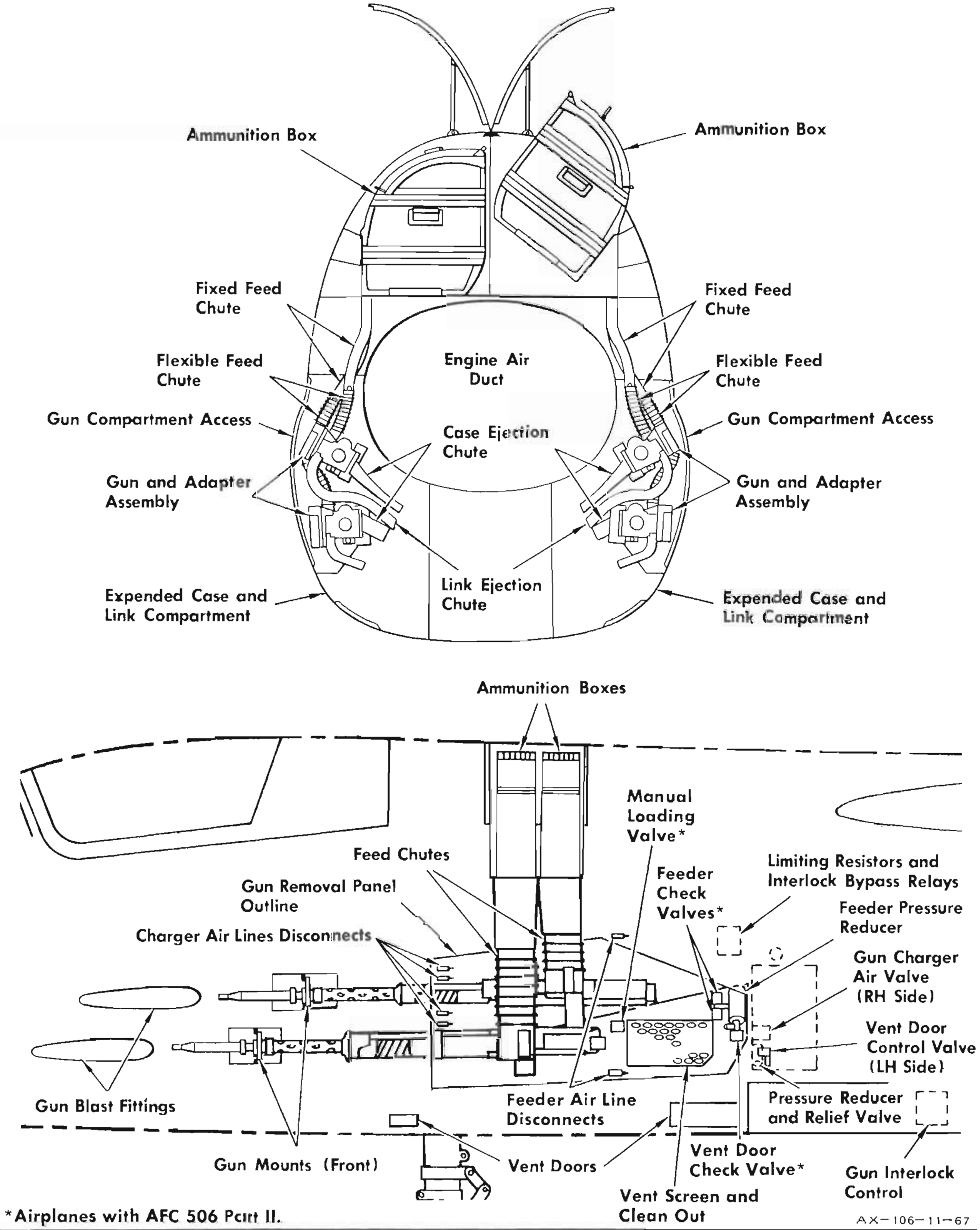
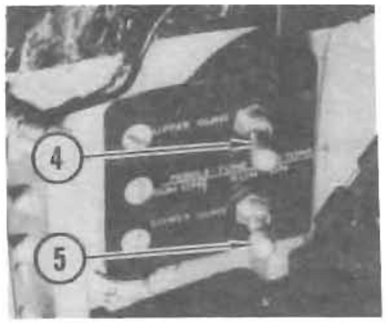
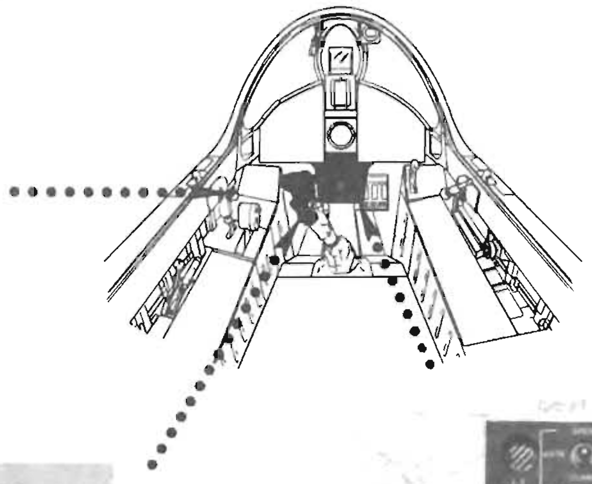


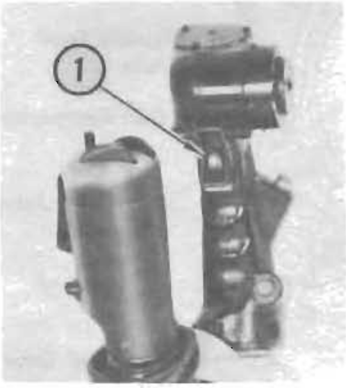
Figure 8–8

GUNNERY SYSTEM CONTROLS



Guns selector switch installation shown.





Nomenclature	*Function*
1. Trigger switch'	Depressed to first detent — starts gunfire cameras and, with guns selected, opens gun vent doors. Depressed to second detent — energizes gun firing circuit with appropriate gun selector switch in ON.†
2. Master armament switch	On – With landing gear retracted, connects secondary dc power through the armament bus and master arm relay to the gun arming switch and the trigger switch. Connects secondary ac bus power to the gun interlock.
3. Guns arming switch	READY — energizes gun charging valve to charge all guns. Connects firing circuit to guns selected (after AFC 493, or all four guns before AFC 493), and connects gun compartment vent circuits. SAFE — returns and holds gun bolts in out-of-battery position.
4. Upper guns selector switch	OFF — upper guns trigger circuit disconnected. Missile tones available. Center ON — upper guns trigger circuit completed to guns trigger switch. Missile tones available. Forward ON† — upper trigger circuit completed to guns trigger switch. Gun firing tones available, missile tones not available. GARO or MARAT available with radar mode switch in ARO.
5. Lower guns selector switch	OFF — lower guns trigger circuit disconnected. Missile tones available. Center ON — lower guns trigger circuit completed to guns trigger switch. Missile tones available. Forward ON† — lower guns trigger circuit completed to guns trigger switch. Gun firing tones available, missile tones not available. GARO available with radar mode switch in ARO.

†If either of the guns selector switches are in the forward ON position, gun tones are available, missile tones are not available, and GARO or MARAT is available with radar mode switch in ARO.

AX-140-11-67

Figure 8–9

GUN FIRING CIRCUIT *(Figure 8–10)*

Placing the guns selector switches in center or forward position (or placing the armament select switch in GUNS in the case of airplanes without guns selector switches) and closing the trigger switch to the second detent connects 28 volts dc through the READY position of the guns ready/safe switch to energize the gun firing relay. Power source is the trigger circuit breaker off the armament bus. Firing voltage for the guns is supplied by the gun interlock control through the closed contacts of the gun firing relay. Power source for the interlock is the guns circuit breaker off the secondary ac bus, phase A. The circuit is completed through the energized gun interlock relay. This relay is energized any time the master armament switch is in ON. The gun interlock control produces two out-of-phase trains which provide desynchronized gun firing.

Note

The master armament switch must be placed in ON at least 1 minute before firing guns to allow the gun control interlock to warm up and deliver firing voltage.

The firing circuit to the guns is interrupted by gun vent door switches until the forward gun vent doors open to admit purging air. This ensures that explosive gun gases will be purged from the gun compartment during firing. A limiting resistor is placed in parallel with each pair of guns (upper and lower) to limit the amount of current any one gun can draw. Thus, if one gun of a pair develops a short circuit due to a jam or grounded firing pin, the other gun of the pair will still fire.

Note

If the forward gun vent door on either side fails to open, the guns on that side will not fire.

An interrupter switch on each gun feed mechanism, operated by the feeder motor shuttle valve, prevents the chambered round from firing until the feeder is on the return stroke. This prevents the feeder from lagging behind the gun during cycling and causing a jam.

SHORTED ROUND FIRING CIRCUIT

A circuit is provided for burning out and firing shorted rounds. The circuit is not energized until a shorted round is encountered. Then the normal firing pulse is bypassed and 115-volt secondary ac bus power is supplied through the bypass relay to fire the round. After the shorted round is fired, normal firing is resumed.

An interlock bypass (current-sensing) relay is provided for each gun. Since the upper and lower pairs of guns are fired by separate pulse trains out of time with each other (to provide desynchronized firing of upper and lower guns), two of the interlock bypass relays are connected in parallel with the firing pulse to each pair of guns. A small resistance is placed in parallel with the coil of each interlock bypass relay. During firing of a normal round the firing pulse will follow the path of least resistance, the shunting resistor, causing insufficient current flow through the relay coil to energize it. The firing pulse is thus routed through the normally closed contacts of the relay to the gun. In the event of a shorted round, the heavy current drain resulting from the short will cause sufficient current flow through the relay coil to energize it. When the relay energizes, 115-volt secondary ac bus power is connected through the normally open contacts of the relay to burn out and fire the shorted round. (This firing voltage will be of a pulsating nature at 20 to 60 volts reading on a voltmeter, ac scale.) As the relay is initially energized, the firing pulse from the gun interlock holds the relay energized with ground supplied through a normally open contact of the relay. Therefore, the relay will remain energized for the duration of that firing pulse, then will deenergize as the pulse is chopped off by the gun interlock. Normal firing is then resumed upon the next pulse of the gun interlock, if the round has fired.

GUN CHARGING CIRCUIT

Armament bus power energizes the gun charging valve when the guns switch is positioned to READY. This position enables 28-volts dc power from the gun charger circuit breaker to energize the solenoid on the gun charging valve. The valve vents the safe air pressure on the gun chargers to atmosphere, enabling the constant ready air pressure to drive the chargers forward, placing all gun bolts in battery position. Returning the guns switch to SAFE reapplies "safe" air line pressure to the gun chargers.

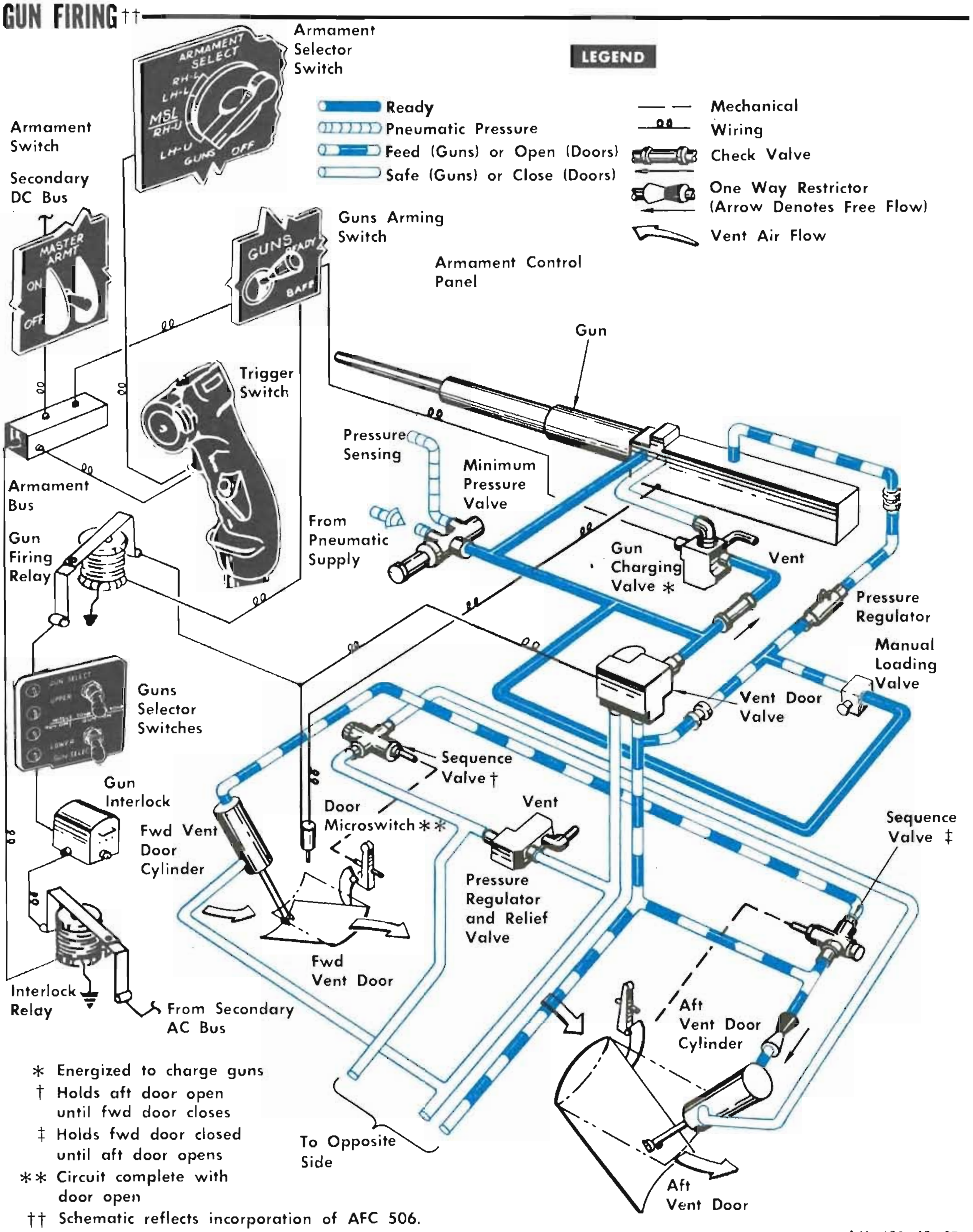
Note

It is recommended that the guns arming switch be placed in READY as soon as feasible after takeoff. (In aircraft with AFC 493, this can be done without arming the trigger switch as long as the gun selector switches remain off. Before AFC 493, the trigger switch is made hot when the arming switch is placed in READY.) Placing the arming switch in READY early in the flight is a precautionary measure to ensure gun charging in the somewhat unlikely event of a slow, undetected pneumatic leak in a gun feeder. Were a leak of this type to occur and the pilot waited until a latter stage of the mission to move the switch to READY, air pressure might be too low to permit gun charging. Airframe Change 506 lessens the chance of such air leaks, and adds check valves so that only one, instead of all four guns would be lost from a leak.

GUN BAY VENT DOOR CIRCUIT

Closing the trigger switch to the first position, with the master armament switch in ON, energizes the

GUN FIRING ††



* Energized to charge guns
† Holds aft door open until fwd door closes
‡ Holds fwd door closed until aft door opens
** Circuit complete with door open
†† Schematic reflects incorporation of AFC 506.

AX–108–10–67

Figure 8–10

camera isolating relay. Secondary dc bus power from the vent doors circuit breaker is then connected through the closed contacts of this relay to energize the solenoid on the vent control valve. The valve then positions to pneumatically open the gun compartment vent doors.

SYSTEM COMPONENT FUNCTIONAL DESCRIPTIONS

Gun Assembly

The gun assembly consists of a Mk 12 Mod 0 20-millimeter gun, a Mk 7 Mod 2 feed mechanism, a Mk 1 Mod 1 synchronizing switch, and other components necessary to adapt the assembly for installation.

Mk 12 Mod 0 Gun

The Mk 12 Mod 0 20-millimeter gun is a combination blow-back, gas-operated weapon designed to fire electrically primed ammunition at a rate of approximately 1,000 rounds per minute. The gun is fitted with a Mk 7 Mod 2 pneumatic gun feed mechanism which draws the ammunition from the ammunition box, strips it from the links, and positions it in the throat of the gun.

The Mk 11 Mod 3 barrel is a 31½-pound, 52½-inch-long, 9-groove unit with a gas port at the midpoint to extract gases for operation of the breech unlocking mechanism. The muzzle is threaded to receive a barrel extension.

The recoil mechanism is a spring mechanism which checks the motion of the recoiling parts of the gun and returns it to battery. The arrangement consists of an external flat helical spring assembly and a housed ring spring assembly. The rear trunnions of the recoil housing provide the attaching point for the airplane front mount adapter. During firing the recoil mechanism is held in position by the front mount adapter (which is secured to airframe structure) while the gun mechanism recoils and counterrecoils with the discharge of each round.

The receiver assembly houses or supports all working parts of the gun mechanism and provides attaching surfaces for the feed mechanism. The receiver body contains lands (at the lower edges) which ride the aft mount slideway during recoil and counterrecoil.

The breechblock is the reciprocating mechanism in the receiver that loads the round into the chamber, closes the breech by means of the bolt, and ejects the empty case after firing. The bolt riding within the breechblock extends a firing pin to contact the electrical primer of the round when the breech is closed. Although a Mk 1 Mod 1 synchronizing switch is incorporated on the gun, the electrical circuit to the round is complete as soon as the bolt extends its firing pin. The breechblock and bolt are locked against a key in the base of the receiver when the gun mechanism is in battery. They are then unlocked by the gas mechanism which starts the breechblock rearward after a round has been fired.

The gas mechanism which unlocks the breechblock and starts it rearward immediately after a round has been fired derives its motion from a piston within the gas bracket. Expanding gases from behind the projectile are ported through a hole at the barrel midpoint into the gas bracket to power the piston. The piston, through a sleeve, piston rod, and yoke, unlocks the breechblock by driving two pushrods rearward.

The buffer, or air spring, is a pneumatic device which buffs and stops the rearward movement of the breechblock and returns it to battery. The assembly is dovetailed into the rear of the receiver and maintained at a 1,000 psi precharged air pressure through a line from the gun charger fitting.

Mk 7 Mod 2 Feed Mechanism

The Mk 7 Mod 2 feeder is a pneumatic piston, motor-type feeder designed to feed the ammunition from the ammunition box, strip it from the links, and position it properly in the throat of the gun receiver. It is equipped with a shuttle-valve-operated switch which interrupts gun fire when the feeder lags behind the gun during firing. The circuit to the firing pin is complete only when the feeder is on the return stroke. The feeder throat assembly contains the cams and pawls to hold the belt of ammunition while rounds are stripped from the link and positioned in the throat of the receiver. The cover drive assembly contains the air motor and feed pawls to move the ammunition and the guides to convey the links over the top of the throat assembly. The cover assembly is secured to the throat by four press-and-turn cover latches. The feeder motor is protected against excessively fast cycling after all ammunition has been fired by a last-round lock. This lock holds the drive slide when no ammunition remains at the pickup point. The mechanism is positioned on the receiver so that the aft end of the throat assembly is indexed to the normal witness marks. The tie bars from the recoil trunnion fitting to the feeder should be adjusted so that the tie bar quick-disconnects can be connected when the feeder is aligned to the receiver. The static air pressure for the feeder is 600 to 700 psi and is regulated by a pressure reducer (regulator) in each gun bay. A feeder motor shuttle valve interrupter switch prevents the chambered round from being fired until the feeder is on the return stroke.

This arrangement prevents the gun from cycling faster than the feeder and thus causing a jam.

RANGE TONE TEST

1. Radar power switch — STBY
   - Observe warmup time restrictions.
2. Radar power switch — OPR NOR
3. Sight gyro switch — ON
4. Sight fixed lamp switch — AS DESIRED
5. Sight dimming knob — AS DESIRED
6. Fire control power switch — ON
7. Range switch — RADAR
8. Fixed range dial — OPTIMUM RANGE
   - Set dial at 1,500 to 2,500 feet.
9. Guns selector switches — FORWARD ON or (for aircraft without guns selector switches), Armament selector switch — GUNS
10. Missile/AFCS volume — AS DESIRED
11. Radar mode switch — NOR or ARO
12. Obtain radar lock-on.
    - Lock on to target while range is greater than the setting of the fixed range dial.
13. Close range to target.
    - The 400-cycle tone will be heard when the target range is equal to the sum of the settings of the fixed range dial and the bias range switch of range unit Mk 26 Mod 1. If the range tone is not heard, recheck setting of the Missile/AFCS volume. Increase volume with care. A marked increase in volume will occur when the system switches the range tone frequency from 400 to 1,200 cycles.
    - If the bias range switch is set at "0," the 400-cycle tone will not be heard but a 1,200-cycle tone will begin when target range has decreased to the value set on the fixed range dial plus one half the range rate.
    - The range tone frequency will change to 1,200 cycles when target range decreases to a value equal to the fixed range dial setting.
    - When target range decreases to the breakaway range, the range tone will alternate rapidly between 400 and 1,200 cycles. Discontinue closure to avoid collision with the targer
    - All ranging tone will cease when radar lock-on is lost.

FIXED RANGING

To utilize fixed ranging for air-to-ground or air-to-air gunnery attacks, make the following control settings:

1. Sight gyro switch — ON
2. Sight fixed lamp switch — AS DESIRED
3. Sight dimming knob — INTERMEDIATE POSITION
4. Fire control power switches — ON
5. Range switch — FIXED
6. Fixed range dial — AT ESTIMATED FIRING RANGE
7. Guns selector switches — CENTER OR FORWARD ON
   - Upper or lower guns may be armed separately by placing appropriate switch into the arming position or (for aircraft without guns selector switches), Armament selector switch — GUNS
8. Sight gyro caging switch — GYRO UNCAGED
9. Guns arming switch — READY
   - To complete arming of all guns, place the master armament switch in ON. Observe precautions for live guns described under Normal Operation.

FUSELAGE STORES SYSTEM

Note

In the following writeup substitute "trigger switch" for "stores release switch" in the case of aircraft not equipped with the stores release switch.

CARRYING EQUIPMENT

Fuselage stores carrying equipment consists of single or dual fuselage pylons and launchers. With single pylons and launchers, two Sidewinders (AIM-9) missiles or four Zuni rockets in two Zuni packs can be carried. With dual pylons, four AIM-9 missiles or eight Zuni's can be carried. The LAU-7/A launcher is used for carriage of rocket packs and AIM-9B, AIM-9C, or AIM-9D missiles. The Aero 3A launcher is used when carrying AIM-9B missiles or Zuni rockets.

Firing circuits, detents, launcher power supplies, and cooling nitrogen for the AIM-9D are contained in the LAU-7/A launcher. The armament circuits provide input signals to cockpit indicators and the missile release computer to identify the type missile mounted on each launcher. Aircraft services required by the launcher are standby and firing power, pilot's headset connection, and coaxial cable from the radar range gate synchronizer to the AIM-9C.

COCKPIT CONTROLS

Cockpit controls used with the fuselage stores system are illustrated and functionally explained in figure 8–11.

SIDEWINDER MISSILE SYSTEM

Refer to the Supplemental NATOPS Flight Manual

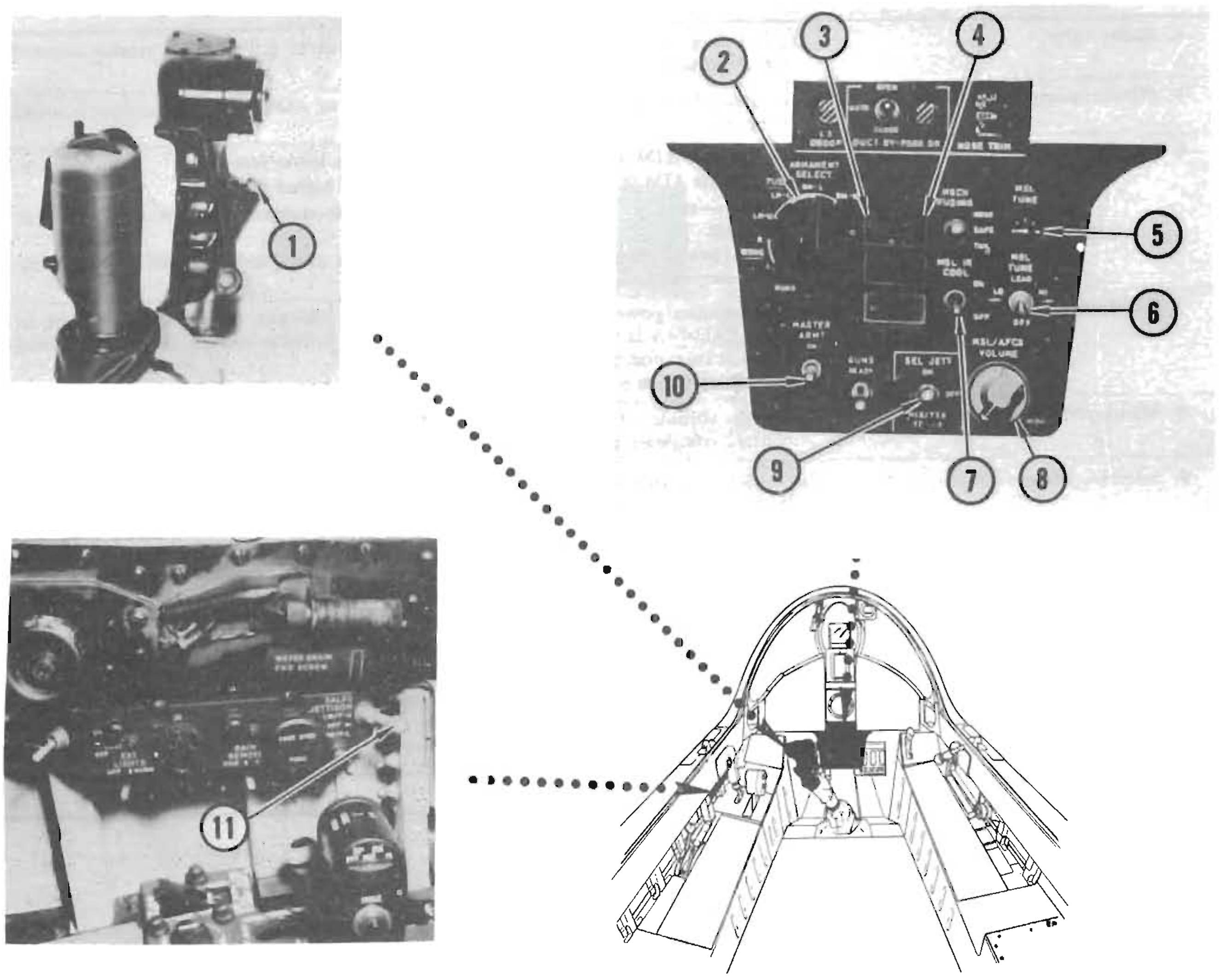
FUSELAGE-MOUNTED ZUNI ROCKETS

CAUTION

For aircraft without AFC 480 (automatic ignition actuator): when firing Zuni missiles above the altitude specified in the External Armament Limitations table (figure 2–1) of the F-8 Tactical Manual (Confidential) place the continuous ignition switch to ON (or manually depress the ignite microswitch) 10 seconds prior to firing to prevent a possible flameout.

Zuni rockets are supersonic, unguided 5.0-inch folding-fin rockets. The rockets are supplied in three sections — motor, warhead, and fuze. A wide variety of

FUSELAGE STORE SYSTEM COCKPIT CONTROLS



Nomenclature	*Function*
1. Stores release button (or trigger switch on aircraft not equipped with the stores release button)	Depressed — fires selected fuselage system store.
2. Armament selector switch	MSL or FUS, LH-U, LH-L, RH-L, RH-U; MSL — Permits selection of one of four fuselage missile stations. Switch automatically steps to next clockwise fuselage position when a missile is fired. Energizes missile release computer for type of missile loaded on selected station. Connects missile acquistion tone signal to headset. Sight unit gyro is automatically caged if fire control computer group is energized. WING, L or R — Permits selection of one of the two wing pylon stations. Switch is manually placed in the position to be fired, and will not step automatically after firing. Sight unit gyro is automatically caged *if fire control combuter group is energized.* OFF — Safe position; disconnects firing circuit. Also permits check of gun mode resistors. Sight unit gyro is automatically caged *if computer group is energized.*
3. IR light	On indicates Sidewinder missile having infrared guidance is loaded on station selected by armament select switch.

AX-141(1)-2-67

Figure 8–11 (Sheet 1)

FUSELAGE STORE SYSTEM COCKPIT CONTROLS

Nomenclature	*Function*
4. Radar light	On indicates Sidewinder missile having radar guidance is loaded on station selected by armament select switch.
5. Missile tuning meter	Maximum clockwise deflection indicates frequency of AIM-9C missile receiver is tuned properly.
6. Missile tuning/lead launch switch	LO — adjusts AIM-9C missile guidance receiver to a lower frequency. HI — adjusts AIM-9C missile guidance receiver to a higher frequency. Centered — tune circuit open and deviated pursuit computer output removed from radar set. LEAD — (lower centered position) — tune circuit open and deviated pursuit computer output applied to radar set.
7. IR Missile cooling switch	ON — Supplies power from secondary dc bus to nitrogen cooling bottle circuit in each LAU-7/A launcher. When MK 29 missile is being carried, should be turned ON at least one minute before firing. OFF — deenergizes cooling system.
8. Missile/AFCS volume knob	Controls volume of missile acquisition tone and tone signals generated by fire control computer group from LOW to HIGH.
9. Selective jettison switch	ON — Jettisons stores selected by armament selector switch with landing gear handle in the WHLS UP position. OFF — deenergizes jettison system.
10. Master armament switch	ON — With landing gear retracted, connects secondary dc power through armament bus and master arm relay to gun arming switch and trigger switch and stores release button. Connects secondary ac bus power to gun interlock.
11. Salvo jettison switch	LW/F-U — Jettisons stores being carried on left wing pylon and upper fuselage pylons with landing gear handle in the WHLS UP position. RW/F-L — Jettisons stores being carried on right wing pylon and lower fuselage pylons with landing gear handle in the WHLS UP position. Centered — deenergizes salvo jettison system.

AX-141(2)-2-67

Figure 8–11 (Sheet 2)

interchangeable warheads is available as well as proximity, contact, and time-delay fuzes.

Zuni rockets are carried in two externally-mounted LAU-33/A rocket launchers (total of four rockets) on airplanes having single pylons or three LAU-33/A rocket launchers and one LAU-35/A rocket launcher (total of eight rockets) on airplanes having dual pylons. The rocket launchers operate electrically with power supplied by the fuselage stores system and are secured to the pylons with Aero 3A or LAU-7/A missile launchers. The Zuni rocket launcher has a mode selector switch (figure 8–13) for single or ripple rocket firing. The mode selector switch is positioned before flight and cannot be changed after takeoff. In SINGLE FIRE position, only one rocket is fired from the launcher when the stores release switch is actuated. In RIPPLE position both rockets are fired approximately 0.1 second apart with only one actuation of the stores release switch.

Fuselage Zuni Rocket Launcher

LAU-33/A or LAU-35/A

The Zuni rocket launcher is a 47.6-pound, 93.5-inch long, dual-tube, single or ripple firing launcher. Two types of rocket launchers are required to maintain safe fin clearance from the fuselage. The LAU-33/A launcher can be installed on any pylon position except the lower left-hand position of the dual pylon. The LAU-35/A launcher is used only on the lower left-hand position of the dual pylon. The rocket launcher can carry two Zuni rockets and is capable, under normal conditions, of twenty-five firings per tube before replacement of the launcher. Illustrations of a typical rocket launcher and an LAU-7/A are presented in figure 8–12.

The Zuni rocket is held in the launcher firing tube by a detent pawl. The detent pawl engages the detent groove in the forward end of the rocket motor. When the Zuni rocket is fired, approximately 2,000 pounds of thrust is required to override the detent pawl.

FUSELAGE ZUNI ROCKET LAUNCHER AND LAU-7/A

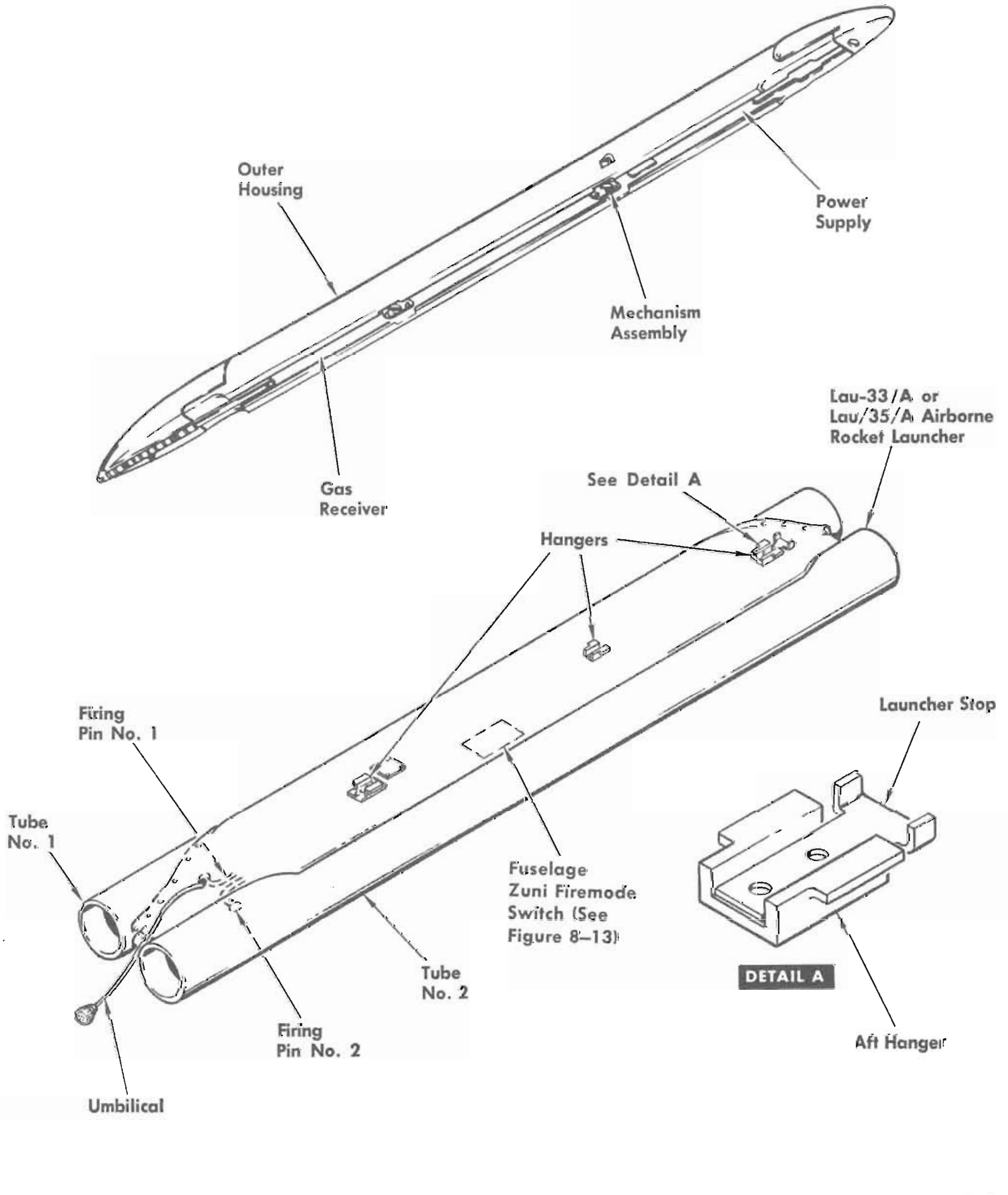


Figure 8–12

WING STORES SYSTEM

Note

In the following writeup substitute "trigger switch" for "stores release switch" in the case of aircraft not equipped with the stores release switch.

Current approved stores and their limitations are presented in the F-8 Tactical Manual, NAVAIR 01-45HHA-1T (Confidential). Stores weight and compatibility information is presented in figure 1–73.

Wing store system cockpit controls are illustrated and described in figure 8–14. Wing store system external controls are illustrated and described in figure 8–13.

CARRYING EQUIPMENT

Wing Pylons

Wing pylons are mounted on the lower center section of the left-hand and right-hand wings. Each pylon includes provisions for installation of an Aero 7A or 7A-1 ejector rack. Internally, the pylon houses a circuit breaker, diode and switch panel, a relay rack and an arming unit. The upper section of the pylon has an airfoil-shaped casting with mounting holes and store mounting provisions. The lower section consists of trailing edge skins and access doors. The left-hand side of the pylon has two access doors, main and aft. The right-hand side has three doors: forward, main, and aft. The pylon weighs 179 pounds, has an overall length of approximately 126 inches, width of approximately 5 inches, and an average height of 17 inches. Figure 8–15 illustrates wing pylon access doors and panels and the Aero 7A-1 rack. Figure 8–13 illustrates pylon electrical switches which must be preset before flight.

AERO 7A-1 Ejector Rack

The Aero 7A-1 four-hook ejector rack assembly consists of a housing containing a dual cartridge breech, four tandem hooks, two pistons, an ejector foot assembly, mechanical linkage connecting the hook sears to the ejector sleeve assembly, and two pairs of adjustable sway braces. The forward and aft hooks are 30 inches apart; the two inner hooks are 14 inches apart. Ejection is accomplished as follows: (a) Electrical detonation of the cartridge creates pressure in the breech (one cartridge and one dummy is installed in the breech); (b) the ejector sleeve moves upward and, through mechanical linkage, raises each hook sear; (c) the hooks open; and (d) the ejector foot, moving downward, forces the store clear. The rack is bolted to the wing pylon by four bolts. Electrical cables connect the rack to aircraft systems.

A/A37B-1 Multiple Bomb Rack Assembly

The Multiple Bomb Rack Assembly (figure 8–14) is divided for descriptive purposes into the following assemblies: adapter assembly, wiring support assembly and bomb rack assembly.

Adapter Assembly

The adapter assembly, a hexagon aluminum extrusion, forms the main support for the multiple bomb rack assembly hardware. Six bomb racks are bolted to the adapter assembly in two groups; three forward and three aft. Attach points on the adapter assembly provide for 30-inch or 14-inch spacing of suspension lugs. Four pads are provided on the adapter assembly as bearing areas for ejection rack sway braces.

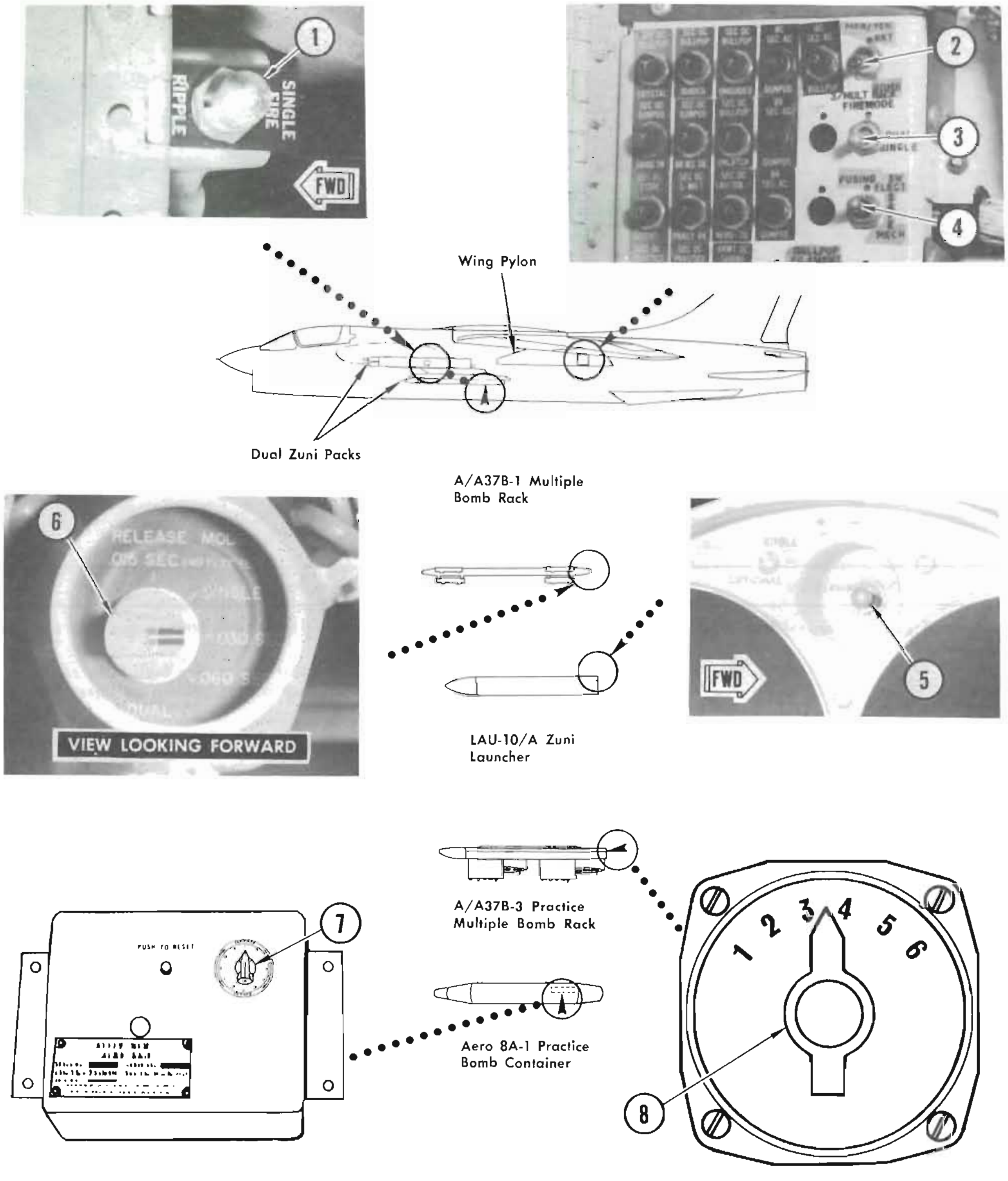
Support Assembly

The support assembly consists of a tail cone assembly, a stepper switch and an electric fuzing harness and wiring assembly. The tail cone assembly at the aft end of the adapter assembly contains the release mode selector switch (figure 8–13), an electrical receptacle for a "homing" test unit attachment and a momentary-on toggle switch for use in conjunction with the "homing" test unit. The release mode selector switch, preset before takeoff, selects single or dual bomb release, or bomb train release with timing intervals of 15, 30, or 60 milliseconds. A "homing" test set (ground support equipment) is used to ensure that the stepper switch is properly homed before takeoff. The electrical harness is coupled to the airplane normal-release electrical lead, the mechanical arming lead and the electrical fuzing lead. Breakaway type disconnects on the harness assembly prevent damage to the aircraft wiring if the multiple bomb rack assembly is jettisoned from the AERO 7A-1 ejector rack.

Bomb Rack Assembly

Each of the six bomb racks has its own integral wiring, a breech mechanism, a nose and tail arming unit for mechanically armed bombs, a electric fuzing unit for electrically fuzed bombs, suspension hooks, and sway braces. Jamscrews are provided for sway bracing. The shoulder-mounted stores rest against the adapter assembly structure and are sway braced on the outboard side only. The two lower bomb racks each have two pairs of sway braces. Hooks on the individual

WING AND FUSELAGE STORE SYSTEMS EXTERNAL CONTROLS

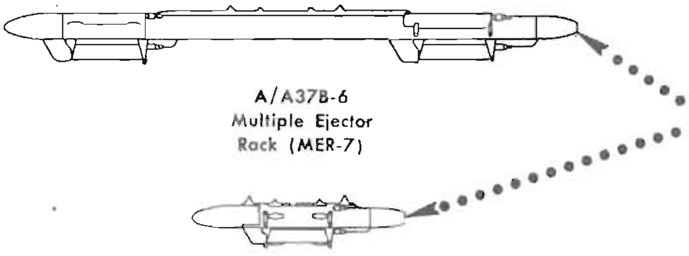


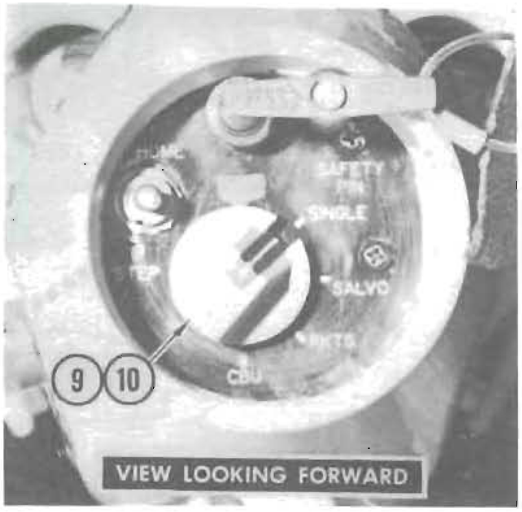
*Switch also appears on opposite side when airplane loaded symmetrically.
†Switch also appears on opposite side.

AX-142(1)-2-67

Figure 8–13

WING AND FUSELAGE STORE SYSTEMS EXTERNAL CONTROLS





Nomenclature	*Function*
1. Fuselage ZUNI fire-mode switch*	SINGLE FIRE — presets electrical firing circuit to fire one ZUNI rocket with each press of the stores release button. RIPPLE — presets electrical firing circuit in ZUNI pack to fire both ZUNI rockets with one press of the stores release button. There is a 95-millisecond interval between rocket firings.
2. Pylon MER/TER switch†	RKT — completes an electrical circuit to fire rockets and pods to be jettisoned from the wing MER or TER. BOMB — completes an electrical circuit to release bombs from the MER or TER.
3. Triple-multiple rack fire-mode switch†	SINGLE — for firing or dropping stores from selected wing pylon only. Either or both pylons set in SINGLE mode will cause both pylons to actuate in SINGLE mode. DUAL — for firing or dropping certain stores from both wing pylons simultaneously. If switch in each pylon is in this position and multiple bomb racks or wing Zuni; (LAU-10/A) launchers are being used, pylons are electrically connected and will be activated together when stores release button is depressed regardless of which wing pylon is selected. (Dual release of single bombs attached directly to ejector racks is not possible even though both switches are in DUAL position.)
4. Fuzing switch†	ELEC — when electrically-fuzed bombs are used. Causes illumination of ELEC FUSING light in armament panel light group when wing pylon is selected. MECH — when mechanically fuzed bombs are used. Causes MECH FUSING light in armament panel light group to illuminate when wing pylon is selected. SAFE — used if any store other than electrically or mechanically fuzed bomb is to be released. No light on armament panel.
5. Wing Zuni fire-mode switch*‡	SINGLE — presets electrical firing circuit of LAU-10/A Zuni launcher to fire one Zuni rocket with each stores release button depression. RIPPLE — presets electrical firing circuit of LAU-10/A Zuni launcher to fire all four Zuni rockets at 95-millisecond intervals with one depression of the stores release button.

*Switch also appears on opposite side when airplane loaded symmetrically.
†Switch also appears on opposite side.
‡The LAU-32B/A and LAU-56/A rocket packs also have the SINGLE/RIPPLE fire option.

AX-142(2)-2-67

WING AND FUSELAGE STORE SYSTEMS EXTERNAL CONTROLS

Nomenclature	*Function*
6. Release mode selector switch*	SINGLE — permits release of one bomb from multiple bomb rack with each depression of the stores release button. DUAL — permits release of two bombs in tandem from the multiple bomb rack with each press of the stores release button. .015 SEC (NO ELEC FUZE) — permits release of all bombs loaded on mutiple bomb rack at 0.015 second intervals with each stores release depression. Only mechanically fuzed bombs can be used in this mode. .030 SEC — permits release of all bombs loaded on multiple bomb rack at .030 second intervals with each stores release depression. .060 SEC — permits release of all bombs loaded on multiple bomb rack at .060 second intervals with one stores release button depression.
7. Stepping switch index knob*	Indicates the bomb release sequence position for the practice bomb container and is used to select the bomb drop sequence.
8. Station selector switch*	Provides for selective release of practice bombs from the practice multiple bomb rack. Before flight, the selector switch must be set at position number one when carrying six bombs, or position number two when carrying three bombs.
9. TER mode switch*	SINGLE — presets TER to release one bomb from the rack in TER firing order (center, left, right) with each stores release button depression. SALVO — presets the TER to release all bombs from the rack in TER firing order with one squeeze of the stores release button. RKTS — presets the TER to fire one rocket pod (single or ripple fire is preset in the pod) with each press of the stores release button. Stepping to the next pod occurs each time the button is released. CBU — position not used with this aircraft.
10. MER mode switch*	SINGLE — presets MER to release one bomb from the rack in MER firing order (aft center, forward center, aft left, forward left, aft right, forward right) with each depression of the stores release button. DUAL — presets MER to release two bombs from the rack in MER firing order (center, left, right) with each depression of the stores release button. SALVO — presets the MER to release all bombs in MER firing order (aft center, forward center, aft left, forward left, aft right, forward right) when stores release button is depressed. RKTS — presets the MER to fire (single or ripple fire is preset in the pod) with each press of the stores release button. Stepping to the next pod in the MER firing sequence occurs each time the stores release button is released. CBU — position not used with this aircraft.

*Switch also appears on opposite side when airplane loaded symmetrically.

AX-142(3)-2-67

Figure 8–13 (Sheet 3)

WING STORES SYSTEM COCKPIT CONTROLS

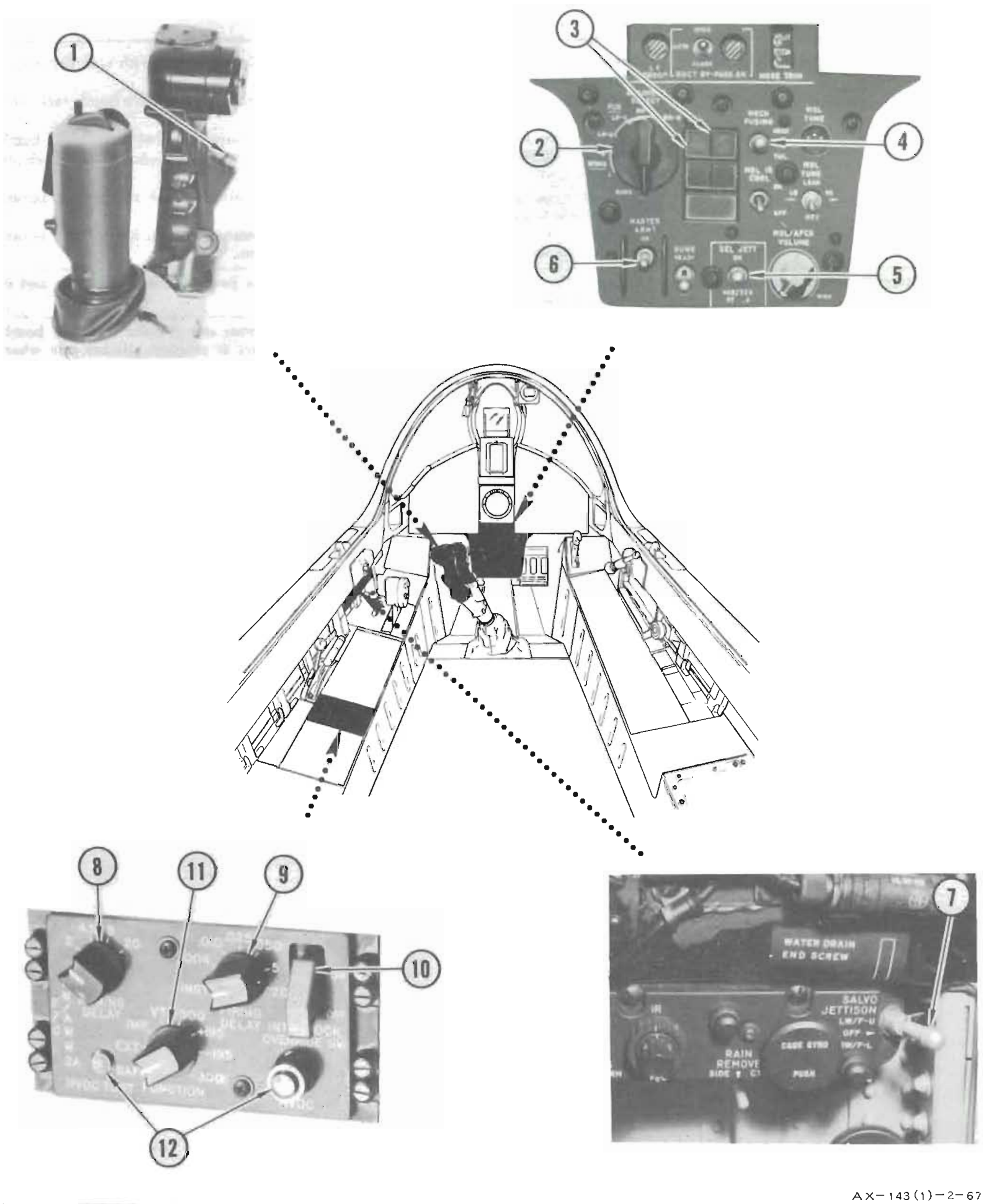


Figure 8-14 (Sheet 1)

WING STORES SYSTEM COCKPIT CONTROLS

Nomenclature	*Function*
1. Stores release switch (or trigger switch on aircraft not equipped with stores release switch)	Depressed — energizes missile or bomb releasing circuit as determined by armament selector switch.
2. Armament selector switch	WING L or R — permits selection of one of the two wing pylon stations. Switch is manually placed in the position to be fired, and will not step automatically after firing. Sight unit gyro is automatically caged if fire control computer group is energized.
3. Armament panel or missile selected lights	MECH FUZING or ELEC FUZING — indicates type of fuzing used on external stores being carried on wing pylon selected.
4. Mechanical fuzing switch	SAFE — normal position of switch. Also used if mechanically fuzed bombs are to be dropped unarmed. Prevents bomb arming wire from being pulled. TAIL — position selected before releasing tail-fuzed bombs. Will cause retention of bomb arming wire and subsequent arming of bombs as they are released. NOSE — position selected before releasing bombs with both nose and tail fuzing. Will cause retention of bomb arming wires and subsequent arming of bombs as they are released.
5. Selective jettison switch	ON — jettisons stores selected by armament selector switch with landing gear handle in the WHLS UP position. With a wing pylon selected, jettisons all stores attached to the AERO 7A-1 ejector bomb rack, including any multiple racks or launchers. MER/TER STORES — placing the switch in this position with the landing gear handle in WHLS UP and the pylon MER/TER mode switch in RKT position, permits one rocket pack to be jettisoned from the MER or TER of the selected wing pylon with each depression of the stores release button. With both triple-multiple rack fire-mode switches in DUAL, simultaneous jettisoning from the left and right pylons occurs. OFF — deenergizes select jettison circuit.
6. Master armament switch	ON — with landing gear retracted, connects secondary dc power through armament bus and master arm relay to gun arming switch, stores release button, and trigger switch. Connects secondary ac bus power to gun interlock.
7. Salvo jettison switch	LW/F-U — jettisons stores being carried on left wing pylon and upper fuselage pylons with landing gear handle in the WHLS UP position. RW/F-L — jettisons stores being carried on right wing pylon and lower fuselage pylons with landing gear handle in the WHLS UP position.
8. Arming delay switch	2, 4.5, 8, 20 — selects one of four arming delay options of 2, 4.5, 8, or 20 seconds. Arming delay is time lapse between bomb release and bomb arming. Options are selectable in flight.
9. Firing delay switch	Inst, .004, .010, .025, .050, 5 and 20 — selects one of seven possible firing delays in seconds. Firing delay is the time to detonation after impact. Options are selectable in flight.
10. Interlock override switch	ON — allows pilot to select the potentially hazardous 2-second arming delay option with the arming delay switch. OFF — normal guarded position of switch. Causes 4.5 second arming to be selected in the event the arming delay switch is inadvertently placed in the 2-second position.
11. Function switch	VT (proximity), IMP (impact), of EXT (external) selection according to type of fuze in use. +300, +195, −195, and −300 (volts) selection according to type dc fuze in use.
12. HV DC test button and light	Functions are described in the text.

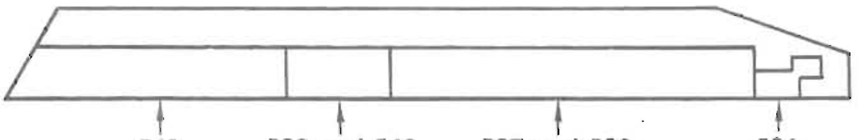
AX-143(2)-2-67

Figure 8–14 (Sheet 2)

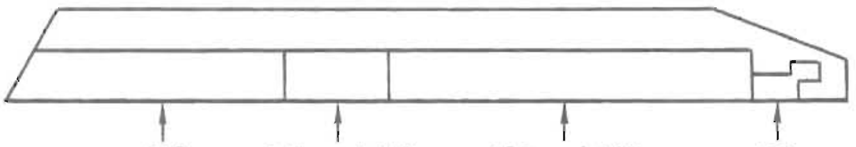
WING PYLON AND EJECTOR BOMB RACK

WING PYLON ACCESS DOORS AND PANELS

LEFT-HAND WING PYLON



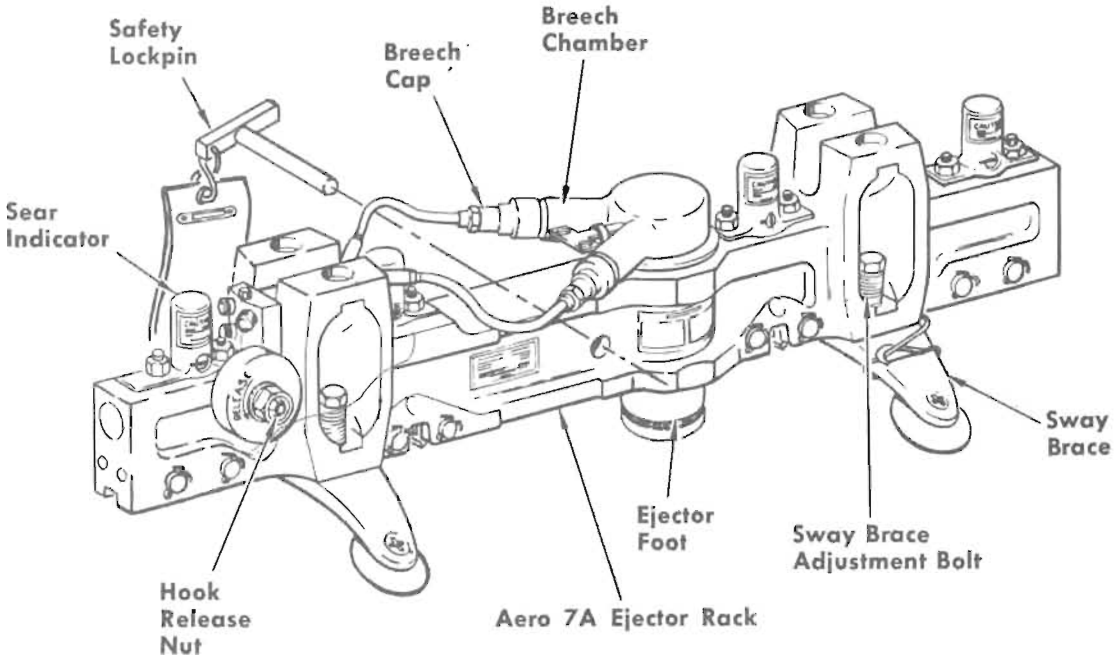
RIGHT-HAND WING PYLON



PANEL NO.	ACCESS	PANEL NO.	ACCESS
536	Electrical Compartment	638	Electrical Compartment
537	Ejector Rack (LH)	639	Ejector Rack (LH)
538	Ejector Rack (RH)	640	Ejector Rack (RH)
539	Circuit Breaker (LH)*	641	Circuit Breaker (LH)
540	Circuit Breaker (RH)	642	Circuit Breaker (RH)*
541	Relay Rack	643	Relay Rack

*Refer to figure 8–13 for pylon-mounted armament switches which are adjacent to the circuit breaker panels.

AERO 7A-1 EJECTOR BOMB RACK



AX-110-1-67

Figure 8–15

MULTIPLE BOMB RACK ASSEMBLY

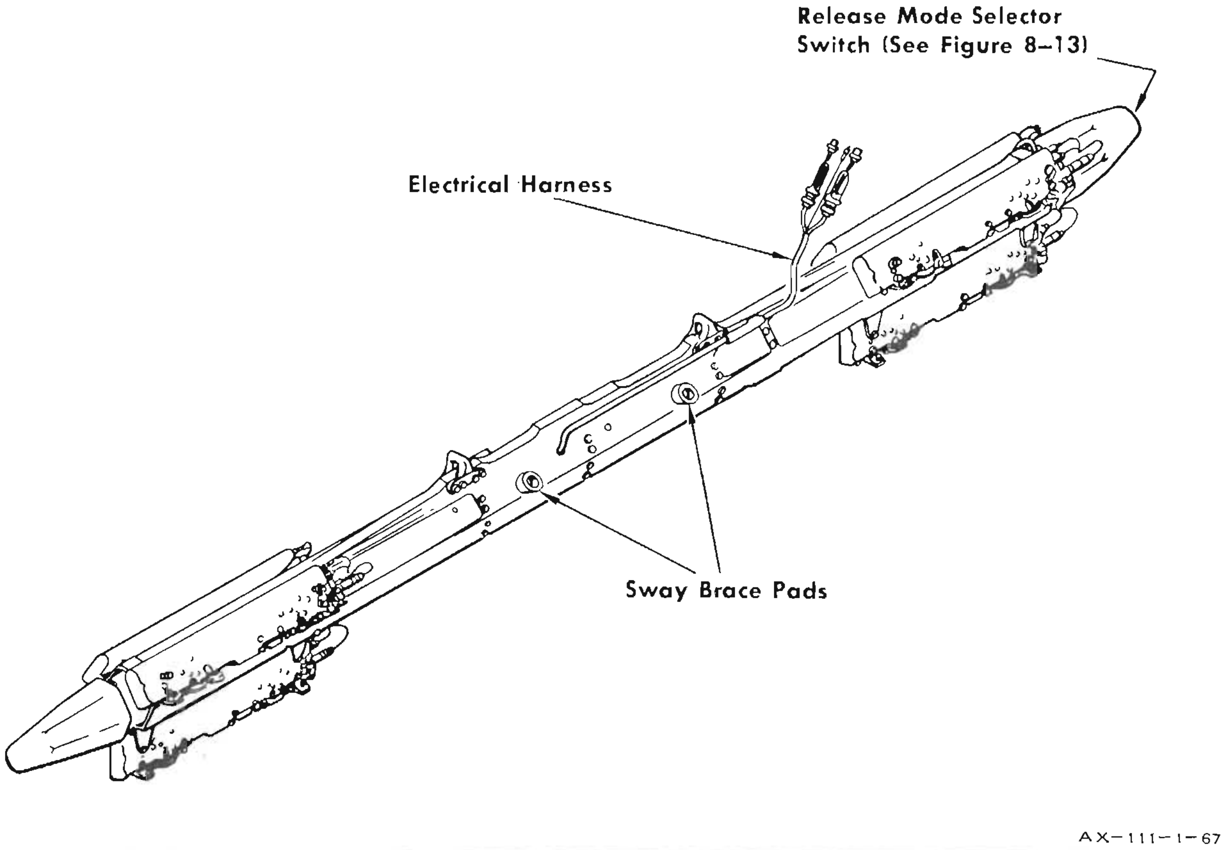


Figure 8–16

racks are spaced 14 inches apart and are independently self latching. For ground operation, a manual release lever at the front of the rack is provided for opening the hooks. Release of the individual bombs during flight is accomplished by the firing of a Mk 17 Mod 0 separation cartridge in each bomb rack. Firing of the cartridge actuates an overcenter toggle to effect release. Safety lockpins are provided to prevent accidental manual or electrical release while the bomb rack is loaded. The safety lockpin must be released and removed from the rack before flight.

The bomb rack fuzing sequence is as follows:

aft center — position 1
forward center — position 2
aft left — position 3
forward left — position 4
aft right — position 5
forward right — position 6

A/A37B-3 (PMBR) Practice Multiple Bomb Rack

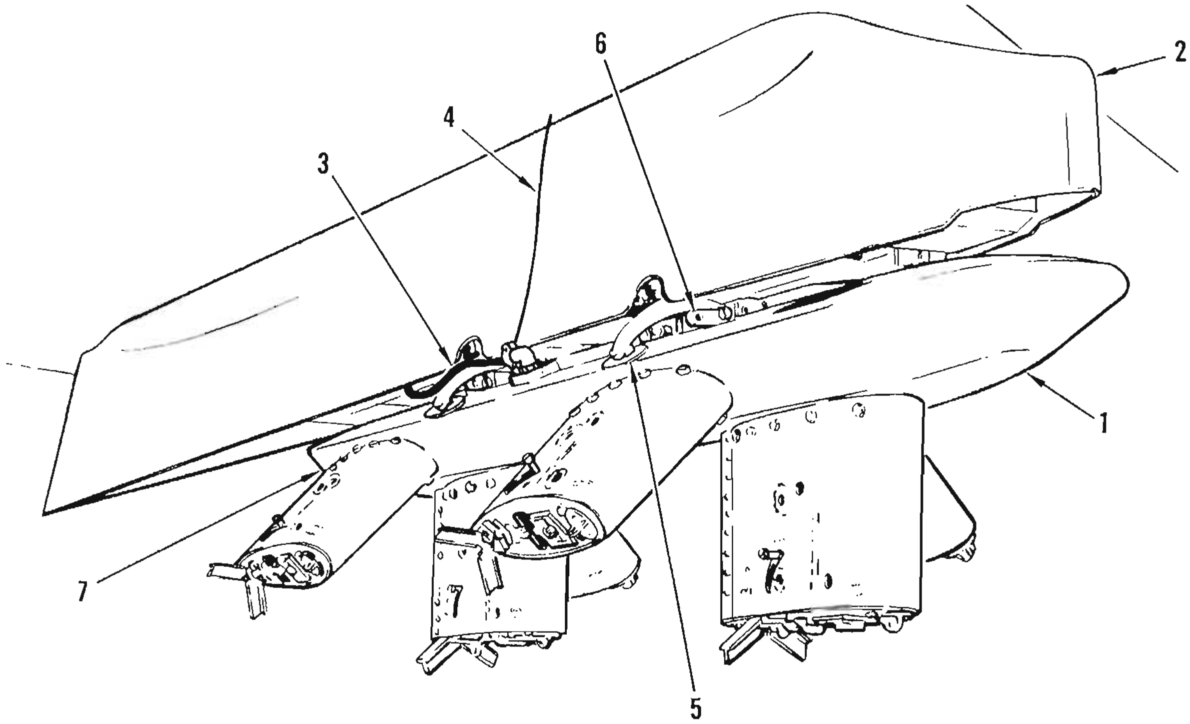
The A/A37B-3 practice multiple bomb rack is designed to carry from one to six practice bombs. The bomb racks are carried on the wing station ejector rack's 14-inch or 30-inch suspension. The A/A37B-3 PMBR (figure 8–17) consists of a body assembly designated MAK-53/A37B-3, and six release assemblies designated SUK-18/A37B-3. The body and release assemblies contain an electrical system providing sequential release of the bombs. The electrical system consists of a station selector (figure 8–13) and intercabling to each of the six release assembly receptacles and to the aircraft cable receptacle. The selector will be set on No. 1 when carrying six bombs or on No. 2 when carrying three bombs.

Triple and Multiple Ejector Racks (MER & TER)

The A/A37B-6 Multiple Ejector Rack provides carriage and individual release and ejection of six stores, three rocket packs, or three CBU dispensers from a single

PRACTICE MULTIPLE BOMB RACK ASSEMBLY

Leading Particulars		Bombs Carried
Length	65.12 inches	6 MK 76
Width	21.6 inches	3 MK 89
Height	14.2 inches	6 MK 106
Weight	87 pounds	
Operating Voltage	28 volts	
Bomb Stations	6	
Suspension Lug Spacing	14 or 30 inches	



LEGEND

1. A/A37B-3 Practice Multiple Bomb Rack
2. Wing Pylon
3. Electrical Cable-Bomb Rack To Aircraft
4. Cable Extraction Lanyard
5. Sway Brace
6. Suspension Lug
7. Station Selector Switch (See Figure 8–13 for details)

AX-112-1-67

Figure 8–17

TRIPLE AND MULTIPLE EJECTOR RACK ASSEMBLIES

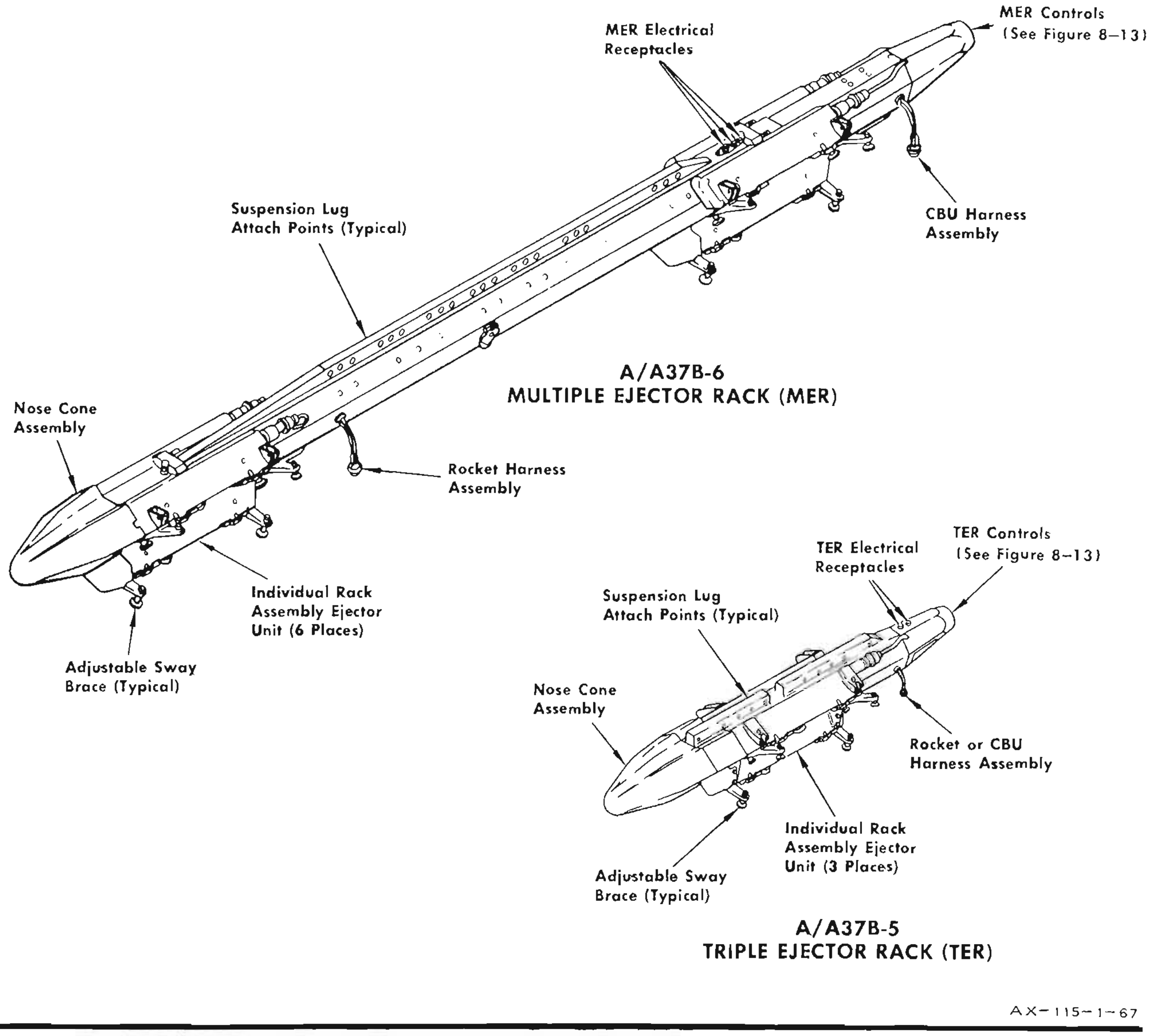


Figure 8–18

wing pylon. The A/A37B-5 Triple Ejector Rack provides carriage and individual release and ejection of three stores from a single wing pylon.

The triple and multiple racks each basically consist of a structural member which attaches to the wing pylon and supports individual ejector unit assemblies (six on the MER and three on the TER). Each ejector unit assembly provides for store carriage, sway bracing, electro-mechanical arming, electric fuzing, store sensing, release and ejection of the stores through an electrically initiated ejection cartridge, and a manual release for removal of stores on the ground. For jettison or emergency release, the racks can be jettisoned with stores from the Aero 7A-1 racks by means of the salvo or selective jettisoning systems. Jettisoning of rocket packs from the MER or TER, with the MER or TER being retained, is possible through the use of a MER/TER STORES position of the select jettison switch. The MER and TER are illustrated in figure 8–18.

WING-MOUNTED ZUNI ROCKETS (LAU-10/A)

LAU-10/A rocket packs can be carried on the Aero 7A or 7A-1 ejector racks, one pack per wing pylon; or on the multiple or triple ejector racks (MER or TER), two packs per MER or TER.

LAU-10/A or Aero 7A, 7A-1 Ejector Rack

The LAU-10/A rocket launcher is a tubular casing capable of carrying and firing four 5-inch Zuni rockets. The rocket launcher is approximately 140 inches long, has a 14-inch diameter, and weighs approximately 533 pounds loaded or 105 pounds empty. One LAU-10/A rocket launcher may be installed on each wing-mounted Aero 7A or Aero 7A-1 ejector rack.

The LAU-10/A rocket launcher has a treated paper frangible fairing installed on the forward end of the launcher. The fairing shatters when the first rocket is fired. The LAU-10/A rocket launcher has two firing modes, single and ripple. In the single-fire mode, one rocket is fired from the rocket launcher each time the stores release switch is depressed. In the ripple-fire mode, all four rockets are fired approximately 100 milliseconds apart. The mode selector switch for single-fire or ripple-fire is located on the aft end of the rocket launcher (see figure 8–13). The mode selector switch is positioned before flight and cannot be changed after takeoff. Refer to figure 8–20 for a wing Zuni preflight checklist.

The LAU-10/A rocket launcher is suspended by suspension lugs from the Aero 7A or Aero 7A-1 ejector rack attached to the wing pylon. The lugs are engaged in retention hooks recessed in the body of the ejector rack. The rocket launcher electrical circuits are connected to the circuits of the wing stores system by an adapter harness. Energizing the firing circuits of the wing stores system provides the power to fire the Zuni rockets.

With the mode selector switch in SINGLE, the 28-volt dc firing voltage from the wing stores system is routed by an intervalometer in the rocket launcher to only one rocket tube. To apply a firing pulse to the other rocket tubes, the firing voltage must be removed by releasing the stores release switch, and then reapplied by actuating the switch again. The intervalometer will then step and apply the firing voltage to the next rocket tube. The sequence must be repeated until all rockets have been fired.

With the mode selector switch in RIPPLE, the firing voltage is routed by the intervalometer to all rocket tubes. The intervalometer then returns to its home position and will not recycle until the firing voltage is first removed and then reapplied. When at rest, the intervalometer shorts the firing pins of all rocket tubes to ground.

The triple-multiple rack firemode switches (3, figure 8–13) control whether rockets will fire from one or both LAU-10/A launchers when the trigger is squeezed. Both switches must be placed in the same position: SINGLE for firing rockets from one LAU-10/A at a time, or DUAL for firing rockets from both LAU-10/A's simultaneously (regardless of which wing pylon is selected with the armament selector switch). If one switch was placed in SINGLE and the other in DUAL, only rockets from the selected LAU-10/A launcher would fire.

A shorting device is provided with the rocket launcher to maintain the firing circuits in a safe condition during the loading operation. The shorting device is installed on the launcher's forward electrical connector. The launcher electrical connectors are wired in parallel and placing the shorting device sliding bar in the safe position shorts all launcher firing circuits to the ground pins of the connector.

When the jettison circuits of the wing stores system are energized, power is applied through an adapter harness to the explosive charge in the ejector rack ejector mechanism to release the hooks and kick the launcher and rockets free of the pylon. The LAU-10/A rocket launcher has no provisions for jettisoning the rockets. If a no-fire occurs, a second attempt may be made to fire the rocket.

Normal Operation

1. Armament select switch — WING R or WING L corresponding to wing station to be actuated.
2. Triple-multiple rack firemode switches — SINGLE or DUAL corresponding to number of stations to be actuated for one setting of armament select switch.
3. Mode selector switch — SINGLE or RIPPLE corresponding to rocket launcher firing sequence desired.
4. Stores release switch — DEPRESS.

Select Jettison Operation

Place select jettison circuit in operation by placing the armament select switch in WING R or WING L corresponding to wing station to be actuated and select jettison switch in ON.

Salvo Jettison Operation

Place jettison system in operation by placing the salvo jettison switch in LW/F-U or RW/F-L corresponding to wing station to be actuated.

LAU-10/A on MER or TER

A maximum of two LAU-10/A packs can be carried on each MER or TER. Limitations preclude loading except on centerline and outboard stations of the MER/TER (forward stations on MER). Several switches must be preset before flight to achieve the desired firing modes. LAU-10/A mode switches are set to SINGLE or RIPPLE, as desired. The triple-multiple rack firemode switch in each wing pylon is set to DUAL or SINGLE to select dual (left and right) or single pylon actuation. The MER/TER mode switch in each pylon is set to RKTS, and the MER/TER mode selector switch on the aft end of the MER or TER is set to RKTS to complete the circuit.

After firing the first pack (SINGLE or RIPPLE), the pilot releases the stores release switch. This causes the stepper switch to step to the next loaded pack in the MER/TER firing order (center, left, right). The next loaded pack will fire when the stores release switch is depressed again.

Rocket pack firing and jettisoning modes are presented in figure 8–19. Cockpit-mounted switches are illustrated and described in detail in figure 8–14. Externally-mounted (MER, TER, and pylon-mounted) switches are illustrated and described in figure 8–13.

Select Jettison Operation

To jettison LAU-10/A packs, along with the MER or TER, the armament selector switch is placed to left or right wing and the selective jettison switch placed in ON. The selected pylon will release MER or TER and packs.

To jettison rocket packs individually from the MER or TER, the retention of the MER or TER, the armament selector switch is placed to left or right wing and the selective jettison switch is placed in MER/TER STORES. Each time the stores release button is squeezed, one pack will be jettisoned from the selected MER or TER. The empty racks must have hooks open and the mechanical fuzing switch in the NOSE position for automatic stepping over the empty racks. Otherwise, the stores release button must be squeezed for each empty rack.

Salvo Jettison Operation

Place jettison system in operation by placing the salvo jettison switch in LW/F–U or RW/F–L corresponding to wing station to be actuated.

2.75-INCH ROCKET SYSTEM

Packs containing 2.75-inch rockets can be carried and fired from wing pylons. Packs can be carried on the Aero 7A or 7A-1 ejector racks, one pack per wing pylon; or on the multiple or triple ejector racks (MER or TER), two packs per MER or TER. The packs presently authorized for carriage on the Aero 7A or 7A-1 ejector racks are the Aero 7D, LAU-3A/A, LAU-32A/A, LAU-32B/A, LAU-56/A and Aero 6A, 6A-1 and 6A-2. Packs presently approved for carriage on the MER or TER are the LAU-3A/A, LAU-32A/A, LAU-32B/A, and LAU-56/A. For current listing, at any time, of packs authorized for use on the aircraft refer to the F-8 Tactical Manual, NAVAIR 01-45HHA-1T (Confidential). Weights of packs are contained in figure 1–73 and the procedure for jettisoning them is presented under JETTISONING MISSILES/WING STORES FROM ATTACK AIRCRAFT.

2.75-Inch Rocket

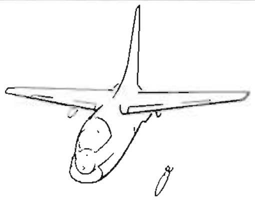
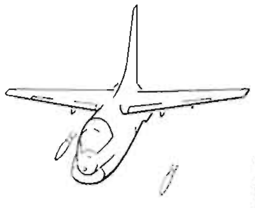
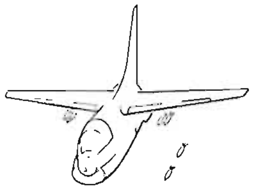
The 2.75-inch FFAR (folding fin aircraft rocket), popularly known as the "Mighty Mouse," weighs 18.5 pounds, is 48.3 inches long, and has available for its use a choice of warheads and fuzes to suit mission requirements.

2.75-Inch Packs on Aero 7A or 7A-1

One 2.75-inch rocket pack can be suspended from the Aero 7A-1 ejector rack on each wing pylon. The LAU-32/A and Aero 6A series packs each carry seven rockets. The Aero 7D and LAU-3A/A packs each carry nineteen rockets. All packs are expendable and are designed to ripple-fire their stores. Electrical power for firing the rockets is supplied by the secondary dc bus.

A LAU-32A/A or Aero 6A series pack consists of seven paper/plastic tubes containing rockets and surrounded by an outside casing which is capped at each end by a streamlined frangible fairing. The firing impulse is distributed to the seven rockets at a rate of 100 rounds per second by an intervalometer attached to the aft bulkhead. The LAU-32B/A is similar, but is constructed of aluminum and has the option of single or ripple fire. Aero 6A series packs are outfitted with KMU-52/A single-fire intervalometers when used on training missions.

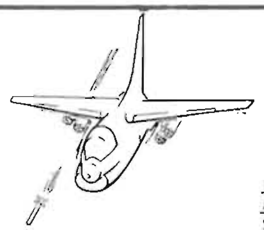
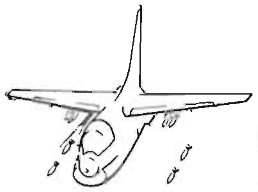
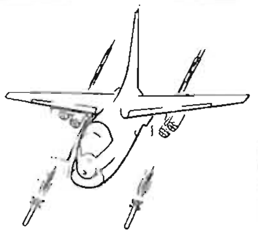
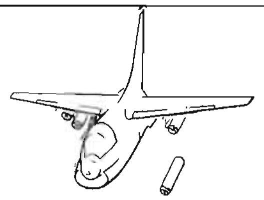
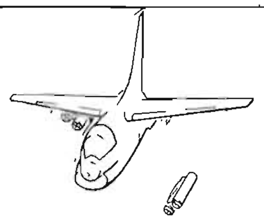
WING STORE RELEASE MODES

(SEE NOTE 1)	STORE SWITCHES (IF ANY)	MER/TER	PYLON SWITCHES		COCKPIT CONTROLS
		MER/TER RELEASE MODE SELECTOR	3/MULT RACK FIREMODE SWITCH	MER/TER PYLON SWITCH	ARMAMENT SELECT SWITCH
 Single Bombs Single Release	—	—	L and R Pylon Switches in SINGLE	—	Select Desired Wing (L or R)
 Single Rkt Packs Single Firing	SINGLE or RIPPLE (See Note 2) SINGLE Shown	—	L and R Pylon Switches in SINGLE	—	Select Desired Wing (L or R)
 Single Bombs Simultaneous Release	—	—	L and R Pylon Switches in DUAL	—	WING — L (Select WING — R for single release option)
 Single Rkt Packs Simultaneous Firing	SINGLE or RIPPLE (See Note 2) SINGLE Shown	—	L and R Pylon Switches in DUAL	—	WING — L or R
 Bombs on MER or TER Single Release	—	SINGLE, DUAL, or SALVO as desired. (DUAL on MER shown)	L and R Pylon Switches in SINGLE	BOMB	WING — L or R
 Bombs on MBR Single Release	—	SINGLE, DUAL, .015, .030, or .060 SEC. as desired. (SINGLE setting shown)	L and R Pylon Switche· in SINGLE	—	WING — L or R

AX-144(1)-2-67

Figure 8–19 (Sheet 1)

WING STORE RELEASE MODES

(SEE NOTE 1)	STORE SWITCHES (IF ANY)	MER/TER	PYLON SWITCHES		COCKPIT CONTROLS
		MER/TER RELEASE MODE SELECTOR	3/MULT RACK FIREMODE SWITCH	MER/TER PYLON SWITCH	ARMAMENT SELECT SWITCH
 **Rkt Packs on MER or TER Single Firing**	SINGLE or RIPPLE (See Note 2) SINGLF Shown	RKTS	L and R Pylon Switches in SINGLE	RKT (See Note 4)	Select Desired Wing (L or R)
 **Bombs on MER or TER Simultaneous Release**	—	SINGLE, DUAL, or SALVO as desired. (DUAL on MER shown — both sides)	L and R Pylon Switches in DUAL	BOMB	WING — L or R
 **Bombs on MBR Simultaneous Release**	—	SINGLE, DUAL, .015, .030, or .060 SEC. as desired. (SINGLE setting shown — both sides)	L and R Pylon Switches in DUAL	—	WING — L or R
 **Rocket Packs on MER or TER Simultaneous Firing**	SINGLE or RIPPLE (See Note 2) SINGLE Shown	RKTS	L and R Pylon Switches in DUAL	RKT (See Note 4)	WING — L or R
 **Individual Pack Jettisoning**	No Effect on Jettisoning	No Effect on Jettisoning	Note 3	No Effect on Jettisoning	1. Select desired pylon 2. Sel Jett Sw — MER/TER STORES position 3. Depress stores release switch to jettison each pack
 **STORES on MBR, MER, or TER Salvo Jettisoning**	No Effect on Jettisoning	No Effect on Jettisoning	No Effect on Jettisoning	No Effect on Jettisoning	Salvo Jett. Sw. — LW/F-U (left MER or TER with packs, upper fuselage stores) RW/F-L (right MER or TER with packs, lower fuselage stores)

AX-144(2)-2-67

Figure 8–19 (Sheet 2)

WING STORE RELEASE MODES

NOTES

1. When a MER/TER station is left empty, the stores hanger must be open and the mechanical fuzing switch on the armament control panel placed in the NOSE position. Otherwise, automatic stepping over the empty station will not occur.
2. Only the LAU-10/A, LAU-56/A and LAU-32B/A rocket packs have the option of SINGLE or RIPPLE fire. All other rocket packs presently approved for the F-8 are RIPPLE-fire only.
3. With the triple-multiple rack firemode switches in DUAL, jettisoning will occur from both pylons simultaneously. In SINGLE, only the selected pylon will jettison.
4. If the switch is inadvertently placed in the BOMB position, rocket pack(s) will be jettisoned when the stores release switch is depressed.

AX-144(3)-2-67

Figure 8–19 (Sheet 3)

WING ZUNI (LAU-10/A) PREFLIGHT CHECK

Intersections of table show necessary external switch positions to obtain desired wing pylon and LAU-10/A firing modes. Before checking modes, make sure that the shorting device in each LAU-10/A is in the safe position and one safety pin is installed in each ejector rack.

WZS — Wing Zuni firemode switch (5, figure 8-13)
TMRS — Triple-multiple rack firemode switch (3, figure 8-13)
FS — Fuzing switch (4, figure 8-13)

LAU-10/A FIRING MODE DESIRED	PYLON MODE DESIRED	
	LH and RH Pylons Actuate Separately	LH and RH Pylons Actuate Together
Single Fire	1. WZS (LH and RH) ------ Single 2. TMRS (LH and RH) ----- Single 3. FS (LH and RH) -------- Safe	1. WZS (LH and RH) ------ Single 2. TMRS (LH and RH) ----- Dual 3. FS (LH and RH) --------- Safe
Ripple	1. WZS (LH and RH) ------ Ripple 2. TMRS (LH and RH) ----- Single 3. FS (LH and RH) -------- Safe	1. WZS (LH and RH) ------ Ripple 2. TMRS (LH and RH) ----- Dual 3. FS (LH and RH) -------- Safe
*Single Fire (LH) and Ripple (RH)	1. WZS (LH) ------------ Single* WZS (RH) ------------ Ripple* 2. TMRS (LH and RH) ------ Single 3. FS (LH and RH) --------- Safe	Not Recommended**

* Reverse switch positions for single fire (RH) and ripple (LH)

**If nonsymmetrical LAU-10/A firing is desired, it should be accomplished by separate actuation of LH and RH pylons.

CAUTION

When using a mixed wing store load consisting of a LAU-10/A launcher on one pylon and a multiple bomb rack on other, make sure the triple-multiple rack firemode switches are placed in SINGLE. Placing the switches in DUAL would result in simultaneously firing Zunis from one side and dropping bombs from the other.

AX-113-1-67

Figure 8-20

LAU-3A/A and Aero 7D packs are similar in construction to the LAU-32A/A, LAU-32B/A and Aero 6A series packs except for the larger number of rockets contained. The nineteen rockets are fired in nine pairs and one single at the rate of 100 firings per second. Before takeoff on a mission utilizing the rocket packs, the triple-multiple rack firemode switch in each pylon (figure 8–13) must be set and checked. With both switches set in SINGLE, or one switch in SINGLE and the other in DUAL, only the selected pylon will fire its rocket pack when the stores release switch is squeezed. With both switches in DUAL, both pylons will fire with either pylon selected.

Note

> Before takeoff and in designated arming area, check that arming switches are safe and keep hands in view of arming personnel while arming is performed.

On training missions utilizing the Aero 6A series packs, the installation of the single-fire intervalometer will require a separate squeeze on the stores release switch to fire each rocket (or pair of rockets in DUAL pylon mode).

Jettisoning is the same as described for the LAU-10/A pack on the Aero 7A or 7A-1 ejector rack.

2.75-Inch Packs on MER or TER

Two packs, mounted centerline and outboard (forward stations on MER), is the maximum number that can be carried on each MER or TER. Several switches must be preset before flight to achieve the desired firing modes. Packs with firemode selector switches are set to SINGLE or RIPPLE, as desired. The triple-multiple rack firemode switch in each wing pylon is set to DUAL or SINGLE to select single or dual pylon actuation. The MER/TER mode switch in the pylon is set to RKTS, and the MER/TER mode selector switch on the aft end of the MER or TER is set to RKTS to complete the circuit.

These firing modes, along with switch settings required to obtain these modes, are presented in figure 8–19. Cockpit-mounted switches are illustrated and described in detail in figure 8–14. Externally mounted (MER, TER, and pylon-mounted) switches are illustrated and described in figure 8–13.

With the release mode properly selected, the stores release button is depressed to fire the rockets.

Jettisoning is the same as described for jettisoning LAU-10/A packs from the MER or TER.

2.75-Inch Rocket Firing Procedure

To fire 2.75-inch rocket packs according to preset modes, proceed as follows:

1. Master armament switch — ON
2. Armament selector switch — WING (L or R)
3. Stores release switch — SQUEEZE

BOMBING SYSTEM

Description

The wing stores system provides the electrical circuits required to select, fuze, monitor, energize, control, and release or jettison bombs. The system accommodates eight conventional bombs in groups of two, four, and eight. The selection of a wing station is made with the armament select switch located on the armament control panel. An identification circuit provides cockpit indications of the type of store loaded at the selected wing station and also indicates the fuzing requirements of the store. Two fuzing circuits provide for arming the bombs. One circuit connects fuze function control system power to electrically fuzed bombs. The other circuit provides an arming unit which pulls the arming wires from mechanically fuzed bombs. A release circuit controls release of the wing pylon stores. When single bombs are loaded, the circuit fires the ejector cartridge which energizes the ejector mechanism in the AERO 7A-1 ejector rack to eject the bomb. When multiple bomb stores are carried, the circuit supplies releasing power to the multiple rack. A jettison circuit is provided for jettisoning bombs individually or simultaneously with the right-hand or left-hand fuselage stores.

Wing Stores System — Bombs

The wing store system — bombs provides the adapter harnesses and bomb racks necessary to adapt the wing stores system to accommodate four 250 pound bombs, four 500 pound bombs, one 1,000 pound bomb, or one 2,000 pound bomb for each wing. Single bombs are loaded on the Aero 7A-1 ejector racks which are secured in the wing pylon by four bolts. Aero 7A ejector racks are used for mechanically fuzed bombs and Aero 7A-1 ejector racks are used for mechanically or electrically fuzed bombs. Multiple bombs are loaded on multiple bomb racks, multiple ejector racks, or triple ejector racks which are attached to Aero 7A or 7A-1 ejector racks. Electrical fuzing power for the bombs is supplied by the fuze function control system. DC voltage is available to charge dc-type bomb fuzes, and rf power is provided to charge rf-dc bomb fuzes. Mechanical fuzing for single bombs is provided by an arming unit in the wing pylon. Mechanical fuzing for bombs loaded on multiple racks is provided by arming units in the rack. The control, monitor and power circuits of the wing stores system are connected to the bomb racks by adapter harnesses.

Bomb Release Modes

The mode of release of any bomb or bombs depends upon the setting of both the cockpit-mounted switches and the externally-mounted switches in the racks and pylons. All modes of bomb release, along with switch settings required to obtain these modes, are presented in figure 8–19. Cockpit-mounted switches are illustrated and described in detail in figure 8–14. Externally-mounted switches are illustrated and described in figure 8–13. A multiple bomb rack preflight check is presented in figure 8–21.

With the release mode properly selected, fuzing controls are set as required. If mechanically-fuzed bombs are loaded, the mechanical fuzing switch is placed in TAIL for bombs with tail fuzes only, or in NOSE for bombs with both nose and tail fuzes. If electrically-fuzed bombs are loaded, the fuze function control panel must be preset as required (refer to Fuze Function Control AN/AWW-2A System). The stores release button is depressed to release the bombs.

If there are empty racks on the multiple bomb rack and SINGLE mode is selected, the stores release switch must be squeezed to step over each empty rack. Automatic stepping over empty racks can be achieved with the multiple and triple ejector racks (MER and TER). Automatic stepping occurs if the hooks of the empty racks are left open and the mechanical fuzing switch is placed in the NOSE position.

Mechanics of Bomb Release

When a single bomb is loaded on an Aero 7A or 7A-1 ejector rack, the bomb is suspended by suspension lugs projecting from the bomb casing. The lugs are engaged in retention hooks recessed in the body of the ejector rack. Bombs requiring electrical fuzing have the molded plug of the Aero 7A-1 ejector rack inserted in the side of the bomb. Bombs requiring mechanical fuzing have arming wires inserted in the arming unit located in the wing pylon. Bomb releasing and fuzing power is connected to the ejector rack by adapter harnesses.

Energizing the wing stores system releasing circuits applies power to the ejector rack. The explosive charges actuate the linkage in the rack to open the hooks and extend an ejector foot to kick the bomb clear of the pylon. When electrically fuzed bombs are dropped, the fuzing umbilical of the ejector rack arming unit is extended with the bomb. The arming unit applies the fuzing voltage to the bomb when the bomb has dropped approximately 3 inches and continues the voltage until the bomb has dropped approximately 5 inches. The umbilical breaks away at approximately 6 inches. When mechanically fuzed bombs are dropped, the arming wires are pulled free of the vane-type bomb fuzes and the bomb is armed by subsequent action of the vane.

The multiple bomb rack or multiple or triple ejector rack (MER or TER) is suspended from the Aero 7A or Aero 7A-1 ejector rack, which is installed in the wing pylon. Bomb releasing and fuzing power is connected to the multiple bomb rack and the Aero 7A or Aero 7A-1 ejector rack is connected to the wing stores system jettison circuits by adapter harnesses.

Energizing the wing stores system jettison circuits applies power through the adapter harness to the explosive charge in the Aero 7A or 7A-1 ejector rack to release the hooks and kick the multiple bomb rack, with the bombs attached, free of the wing pylon. Refer to CARRYING EQUIPMENT for a description of the multiple bomb rack and the MER and TER. Refer to figure 8–21 for the multiple bomb rack preflight check.

Adapter Harnesses

Bomb stores are adapted to the wing stores system by means of the following adapter harnesses:

CV21-907710-1	... Pylon to MER/TER (aft adapter)
CV21-907710-2	... Pylon to MER/TER (rf adapter)
CV21-907710-3	... Pylon to Aero 7A-1 (single bombs, dual release capability)
CV21-207705-6	... Pylon to single LAU-10/A adapter
CV21-207705-10	... Pylon to Aero 7A-1 (single LAU-10/A installed)
CV21-207705-11	... Pylon to Aero 7A-1 (MBR or MER/TER attacher)
CV21-207705-17	... Pylon to Aero 7A-1 (fuzing single bombs)
CV21-207705-18	... Pylon to MBR (MBR power and fuzing)

Jettisoning

Refer to STORES JETTISONING.

Fuze Function Control Set AN/AWW-2A

Description

The AN/AWW-2A set provides high-voltage electrical energy for charging rf (radio frequency) and dc-type bomb fuzes. The set provides 28 possible combinations of arming and firing delays for rf-fuzed bombs. Any one of the 28 combinations can be selected while in flight. Four options of dc voltage of different potentials and polarities are provided for dc-type bomb fuzes.

Control of the set is provided by a Fuze Function Control C-8147/AWW-2A, which is mounted on the left console. The other component of the set is the AM-4708/AWW-2A Amplifier-Power Supply.

Controls are illustrated and described in figure 8–14.

Preflight Test (Either Type Fuze in Use)

Place the master armament switch in ON. Move the function selector switch to any position other than SAFE. Press the HV DC TEST pushbutton. Pressing the pushbutton causes the wheel well interlock to be bypassed, permitting the regulated power supply to function and be checked for normal operation. If the HV DC light comes on, the equipment is operating satisfactorily. If the light fails to come on, the HV DC TEST

MULTIPLE BOMB RACK PREFLIGHT CHECK

The table shows necessary external switch positions to obtain desired pylon and MBR modes. Before checking modes, make sure that one safety pin is installed in each ejector rack and loaded bomb rack. If mechanically-fused bombs are loaded, make sure that two Fahnestock clips are installed on each arming wire and the wire is not kinked or burred.

NOTE

Under present limitations, carriage of bombs on the inboard stations of the bomb rack is not permitted. If only two bombs are loaded, they should occupy stations 1 and 2.

TMRS — Triple-multiple rack firemode switch (3, figure 8-13)
RMS — Release mode selector switch (6, figure 8-13)
FS — Fuzing switch (4 figure 8-13)

BOMB RELEASE MODE DESIRED	*PYLON MODE DESIRED*	
	LH and RH Pylons Actuate Separately	*LH and RH Pylons Actuate Together*
Single (LH and RH)	1. TMRS ----- SINGLE (LH and RH) 2. RMS ------ SINGLE (LH and RH) 3. FS -------- ELECT or MECH**	1. TMRS ----- DUAL (LH and RH) 2. RMS ------ SINGLE (LH and RH) 3. FS -------- ELECT or MECH**
Dual Tandem (LH and RH)	1. TMRS ----- SINGLE (LH and RH) 2. RMS ------ DUAL (LH and RH) 3. FS -------- ELECT or MECH**	1. TMRS ----- DUAL (LH and RH) 2. RMS ------ DUAL (LH and RH) 3. FS -------- ELECT or MECH**
Bomb Train (LH and RH)	1. TMRS ----- SINGLE (LH and RH) 2. RMS ------ .015 SEC, .030 SEC, or .060 SEC (LH and RH) 3. FS -------- ELECT or MECH**	1. TMRS ----- DUAL (LH and RH) 2. RMS ------ .015 SEC, .030 SEC, or .060 SEC (LH and RH) 3. FS -------- ELECT or MECH**
*Single (LH) and Dual Tandem (RH)	1. TMRS ----- SINGLE (LH and RH) 2. RMS ------ SINGLE (LH)* RMS ------ DUAL (RH)* 3. FS -------- ELECT or MECH**	Not Recommended***
*Single (LH) and Bomb Train (RH)	1. TMRS ----- SINGLE (LH and RH) 2. RMS ------ SINGLE (LH)* RMS ------ .015 SEC, .030 SEC, or .060 SEC (RH)* 3. FS -------- ELECT or MECH**	Not Recommended***
*Dual Tandem (LH) and Bomb Train (RH)	1. TMRS ----- SINGLE (LH and RH) 2. RMS ------ DUAL (LH)* RMS ------ .015 SEC, .030 SEC, or .060 SEC (RH)* 3. FS -------- ELECT or MECH**	Not Recommended***

*Left- and right-hand pylon modes can be reversed from those shown.
**ELECT for electrically fused bombs; MECH for mechanically fused bombs.
***If nonsymmetrical bomb release is desired it should be accomplished by separate actuation of LH and RH pylons.

CAUTION

When using a mixed wing store load consisting of a multiple bomb rack on one pylon and a LAU-10/A launcher on the other, make sure the triple-multiple rack firemode switches are placed in SINGLE. Placing these switches in DUAL would result in simultaneously firing Zunis from one side and dropping bombs from the other.

AX-114-1-67

Figure 8-21

pushbutton should be held depressed, and the press-to-test feature of the light used. If the HV DC light still does not come on, the bulb needs replacing. If the light does come on, the equipment is malfunctioning.

Normal Inflight Operation With RF-Type Fuze

Note

> To avoid unnecessary equipment running time, it is advisable to leave the function switch in SAFE until approaching the target. Arming and firing delays can be set when convenient.

Arming and firing delay options are selected by means of two selector switches on the AWW-2A control panel. The options can be safely selected at any time with the function switch in SAFE. The firing delay switch is used to select the time to detonation after impact. Selections available are .004, .010, .025, .050, 5, or 20 seconds, or INST (instantaneous). The arming delay switch is used to select one of four arming delay options of 2, 4.5, 8, or 20 seconds. The arming delay is the time lapse between bomb release and bomb arming.

Note

> An interlock override switch is provided to avoid the potential hazard of inadvertently selecting 2-second arming with a short firing delay. Should the firing delay switch be positioned at the INST, .004, .010, .025, or .050 firing delay options, and 2-second arming should be inadvertently selected in error, the weapon could arm, and fire upon impact in 2.050 seconds or less. This potential hazard is eliminated by an interlock circuit which prevents the selection of 2-second arming unless the operator intentionally places the interlock override switch in ON.

The four arming delay options and seven firing options make for a total of 28 possible combinations of arming and firing combinations. Options are obtained through generation of rf signal frequencies to the rf fuze. The frequency, or combination of frequencies, for a particular option is selected when the arming and firing delay switches on the control panel are set by the pilot. Frequencies are generated by means of eight crystal controlled oscillator modules in the amplifier power supply.

Approaching the target, the pilot turns on the master armament switch and places the AWW-2A function switch in a position corresponding to the type rf fuze in use. Fuze types selectable are VT (proximity), IMP (impact), or EXT (external). With the applicable fuze type selected, the HV DC light should come on to indicate the ready status of the equipment. With the HV DC light on, depressing the stores release switch will arm and fire the bombs in accordance with the selected options. Refer to HV DC LIGHT FAILS TO ILLUMINATE for procedures to be followed if the light does not come on.

When the release button is depressed, a +300 volt dc signal supplies energy for charging the fuze. Superimposed on the signal is the rf frequency or frequencies which selects the arming and firing delay. Rf fuzes contain tuned circuits which sense the presence of their resonant frequencies and actuate, or "blow," rf squibs. The actuated rf squibs apply fixed values of resistance to R-C timing circuits in the fuzes. This establishes the time constants for the selected firing and arming option.

After the bombs have been released, the function switch should be returned to SAFE.

Interlock Override Switch (RF Fuzes Only)

Should the pilot desire 2-second arming, the interlock override switch must be placed in ON. This requires raising a cover guard over the switch, and holding it raised to permit placing the switch in ON. The purpose of the switch is to ensure that a 2-second arming selection is intentional. With the switc hin OFF, 4.5-second arming will be selected regardless of whether the arming delay switch is in the 2 or 4.5 second position. The override switch does not override or bypass the aircraft wheel well interlock that closes when the aircraft is airborne and the landing gear is raised and secured. Lowering the cover guard with the override switch in ON will return the switch to OFF.

Normal Inflight Operation With DC-Type Fuze

Note

> To avoid unnecessary equipment running time, it is advisable to leave the function switch in SAFE until approaching the target.

The four voltage options of the function switch, +300, +195, −195, and −300 volts, are for use strictly with dc-type fuzes. The voltage selected depends on the particular fuze in use. Arming and firing delays are not selectable in flight, as they are through the arming and firing delay switches for rf-type fuzes.

Approaching the target, the pilot turns on the master armament switch and places the function switch to the proper voltage for the dc fuze in use. The HV DC light should come on to indicate the ready status of the equipment. Refer to HV DC LIGHT FAILS TO ILLUMINATE for procedures to be followed if the light does not come on. When the release button is depressed, the selected voltage option is applied to a capacitor in the dc fuze. After the weapon has left the aircraft, the capacitor discharges to supply the energy to charge the fuze.

After the bombs have been released, the function selector switch should be returned to SAFE.

HV DC LIGHT Fails to Illuminate

If the HV DC light fails to illuminate, or illuminates initially and then extinguishes, move the function switch to SAFE, then return it to its previous position. If the light still doesn't come on, depress the press-to-test light feature. If the light still fails to illuminate, try depressing the press-to-test feature and the HV DC TEST button simultaneously. (The HV DC TEST switch is used inflight to determine whether an apparent malfunction of the regulated power supply is caused by failure of the wheel well interlock to close and make proper contact.) If the light still fails to come on, assume proper operation of the equipment and proceed with the mission. If the light comes on when the HV DC TEST button is pressed, but fails to illuminate when the function switch is moved to an operating position, hold the HV DC TEST button depressed as an emergency measure when the stores release button is actuated. If the light comes on when the press-to-test feature and the HV DC TEST button are pressed simultaneously, but fails to illuminate under any other of the preceding conditions, the aircraft has a dead weapon load that cannot be armed and fired.

STORES WEIGHT AND COMPATIBILITY

A weight and compatibility table, figure 1–73, provides information on stores loading. Wing and fuselage configurations are shown for symmetrical and asymmetrical loading. Practice bomb and flare combinations are also included in the table.

MISFIRES

When a misfire occurs on any external store other than a Sidewinder missile, release the stores release switch to disarm the firing circuit.

WARNING

If a Sidewinder missile carried on a LAU-7/A launcher misfires, disarm the firing circuit by placing the master armament switch in OFF. To fire guns or additional missiles, return the switch to ON (the misfired missile firing circuit will not rearm). For a misfired Sidewinder missile on an Aero 3A launcher, release the stores release switch to disarm the firing circuit.

Do not point a Sidewinder missile, including a misfired Sidewinder missile, at any friendly target. If possible, hold misfire 15 minutes before returning to base or ship.

STORES JETTISONING

Note

In the following writeup substitute "trigger switch" for "stores release switch" in the case of aircraft not equipped with the stores release switch.

There are two jettison circuits, salvo and selective. The salvo circuit permits immediate jettisoning of all stores (except fuselage-mounted Zuni rockets) through the movement of a single switch. The selective circuit allows for the selection and jettisoning of individual stations (except fuselage Zuni stations) when time and circumstances are more permitting. (Note that it is impossible to jettison Zunis from fuselage pylons using either of these circuits. If it becomes necessary to get rid of Zuni rockets, they can only be fired armed using the normal firing procedure. The empty Zuni packs must then be retained, for they are nonjettisonable.) Stores jettisoned by these circuits separate in an unarmed and unguided condition. Electrical power for salvo or selective jettisoning is supplied by the emergency dc bus. This permits jettisoning on main generator power or on emergency electrical power supplied by the ram air turbine with the emergency generator switch in ON or LAND. The master armanent switch need not be placed in ON for salvo or selective jettisoning.

CAUTION

Jettisoning of Aero 6A and 6A-1 rocket packs is not recommended. Jettisoning of empty Aero 6A-2 and LAU-32/A rocket packs is not recommended. Safe separation is not assured.

Flight limitations which must be observed when jettisoning stores or firing the fuselage Zunis are presented in the EXTERNAL ARMAMENT LIMITATIONS figure in the Supplemental NATOPS Flight Manual.

PROCEDURES

To salvo:

1. Landing gear — UP
2. Salvo jettison switch — LW/F-U, RW/F-L
   - The salvo jettison switch (figure 8–14) has two positions: LW/F-U for jettisoning stores from the left wing pylon and simultaneously jettisoning (launching unarmed and unguided) Sidewinders from upper fuselage pylons, and RW/F-L for jettisoning stores from the right wing pylon and at the same time jettisoning Sidewinders from lower fuselage pylons.
   - Wing stores, along with supporting racks, will be cleared below the Aero 7A or 7A-1 ejector bomb rack.

Selective jettisoning:

1. Landing gear — UP
2. Armament selector switch — DESIRED STATION
3. Selective jettison switch — ON
   - With a wing station selected, jettisons all stores or racks attached to the Aero 7A or 7A-1 ejector bomb rack.

Jettisoning rocket packs from the MER or TER:

1. Landing gear handle — WHLS UP
2. Armament selector switch — DESIRED STATION
3. Selective jettison switch — MER/TER STORES
4. Stores release button — SQUEEZE ONCE FOR EACH PACK
   - Only the pack will be jettisoned. MER or TER are retained.

Alternate bomb jettisoning (for retention of bomb rack):

Follow BOMB DROPPING PROCEDURE (electrical or mechanical fuzing) with following exception:

Safe-standby-ready or mechanical fuzing switch (as applicable) — SAFE

- If the main electrical generator is operating and there is sufficient time, an alternate method of jettisoning bombs is to follow the applicable BOMB DROPPING PROCEDURE in this part with the following exception: for electrically fuzed bombs, place the safe-standby-ready switch (figure 8–14) in SAFE; or, for mechanically fuzed bombs, place the mechanical fuzing switch (figure 8–14) in SAFE. When the store release button is depressed, the bomb or bombs will be released in an unarmed state according to their preset releasing mode. An advantage of this jettisoning procedure is the retention of any bomb rack below the Aero 7A or 7A-1 ejector bomb rack.

TOW TARGET SYSTEMS

BANNER TOWED TARGET EQUIPMENT

Equipment consists of the banner, armored cable towline, chain, and a release ring which is attached to the standard arresting hook-operated tow release fitting for banner targets prior to takeoff. A drag takeoff method is used to launch the target. The entire length of towline is laid out in a squat "S" pattern along the tow aircraft takeoff run with the center leg of the "S" parallel to takeoff, and the far forward turn of the "S" placed opposite the estimated takeoff point. This procedure reduces the abrasion of the target before becoming airborne. Upon return from the towing mission, the target and towing gear are released over the recovery area by lowering the arresting hook. For additional information concerning takeoff methods of banner targets, refer to section III of current NAVAIR 28-10A-501, "Handbook of Operation and Service Instructions for Aerial Targets and Associated Equipment."

Flight Operations

Optimum operational parameters are outlined in figure 8–22.

CAUTION

Observe cooling flow limitations applicable to target towing as shown in section I, part 4.

CENTER-OF-GRAVITY TOW SYSTEM

The center-of-gravity tow system consists of a tow reel, fuselage sheave fitting, launcher, pilot's control box, and target. Except for the pilot's control box, all components mount externally on existing pylons or on special adapters designed for this purpose. The Delmar Engineering Laboratories 216 Installation Kit and Aircraft Armament Change 398 is required to modify the aircraft for center-of-gravity target towing.

Reels

The Aero 43 or 43M tow reels mount by use of an adapter on the port SIDEWINDER pylon location and are powered by a variable pitch, wind driven turbine. The Aero 43 reel can carry the D-12116-10 stepped-diameter towline which is 25,600 feet in length. The AERO 43M reel can carry the D-12116-9 stepped-diameter towline which is 31,500 feet in length.

Note

These reels may carry other constant or stepped-diameter towlines. Current armament bulletins should be consulted for additional information.

Launcher

The LAU-37/A center-of-gravity launcher is used to lead the towline from the reel and fuselage sheave (trunnion pulley) to the target and hold the target in position on the airplane except when the target is deployed.

Control Box

The pilot's control box may be mounted in the starboard console or other accessible location and has all the instruments and switches required to control and monitor tow reel functions. The instruments indicate turbine pitch and rpm, and a counter indicates feet of towline deployed. Control switches include a master switch which controls electrical power to the reel, a cable drum brake switch, a turbine pitch control switch which is used to control reel-out or reel-in turbine rpm and a target unlatch switch which is used to release the target from the launcher. A cable cutter switch is provided for emergency cutting of the towline at the launcher. On some control boxes, the brake and target unlatch switch may be combined in a 3-position switch.

Targets

The TDU-22/B and TDU-22A/B targets are 6 feet long, nonrotating, center-of-gravity towed shapes consisting of a 7-inch diameter fiber glass body, 4 stabilizing tail fins, and components for radar and infrared augmentation.

BANNER TOWING OPERATIONAL PARAMETERS

Condition	*Wing*	*Gear*	*KLAS*	*Remarks*
Takeoff	Up	Down		Normal takeoff. CRT recommended.
Climb				
Sea level to 10,000	Up	Up	160	Maintain afterburner in a steep climb to the desired altitude.
10,000-20,000	Up	Up	180	
20,000-30,000	Down	Up	225	
Level Off	Down	Up	Stabilize at tow speed	Observe cooling flow limitations (see section 1, part 4).
Letdown				
Above 10,000	Up or down	Up	180 (max)	Maintain power to keep windshield clear and provide power margin for chase pilot maneuvering.
Below 10,000	Up	Up	160	
Banner Drop	Up	Up	150-160	Adhere to local course rules. Minimum aircraft altitude 500 feet AGL. To release banner drop arresting hook. After drop, raise hook.

AX-152-3-67

AERO 43 and AERO 43M Reels, LAU-37/A

Launcher — Operating Procedures

CAUTION

The master switch must be left ON throughout the flight. This switch controls the turbine pitch, reel brake, and in the LAU-37/A, the latch motor. When this switch is turned off, pitch control is inoperative, brake will automatically be OFF, and the LAU-37/A unlatch motor will be inoperative.

To avoid pitch control motor damage, do not overcontrol rpm by constant pitch adjustments. A 400 rpm drift is permissible.

Do not put the brake ON while reel is operating, except in an emergency. If the brake is placed ON with the reel operating, towline breakage and complete reel failure may occur. Stop the rpm with pitch control. If the length counter is not indicating any movement and rpm indicates 0, the brake may be placed ON.

In case of aircraft electrical failure, all systems will remain in the same position as they were prior to the failure, with the exception of the brake, which will automatically be OFF. The system is on the primary electrical bus and will be regained following the deployment of the emergency power package. Emergency generator switch must be in the ON position and left in the ON position for the operation of the tow reel and brake.

Preflight Check

The following operations shall be performed prior to boarding the airplane:

1. Check security and general condition of launcher.
2. Check circuit breaker (LAU-37/A) IN and cable cutter cartridge is installed.
3. Check target security in launcher.
4. Check ignition frequency on side of target (TDU-22A/B).
5. Check security of launcher electrical leads.
6. Check security and alignment of fuselage sheave and that wire is properly routed through the pulleys.
7. Check security of reel and reel electrical leads.
8. Check ground safety pin in place on reel.
9. Check turbine blades in feathered position (0 pitch) and for unrepaired
10. Check towline length on sic

Poststart Check

The following operations shall be performed after aircraft poststart checks with a ground crewman standing by:

1. Master switch ON
2. Check brake ON

3. Check lights on launcher (two) illuminated (LAU-37/A)
4. Check turbine operation as follows:
   (a) Check rpm and pitch indicator at 0.
   (b) Check counter at (00000).
   (c) Crewman will pull ground safety pin. Check operation of pitch control upon signal from crewman.
   (d) After turbine check be sure to set 1½ units IN pitch for AERO 43M reels, 3 units IN pitch for AERO 43 reels.
   (e) Recheck brake ON.

Takeoff and Climb

1. Trim for balanced flight.

Note

For both normal field takeoff and catapult launch, approximate trim settings are: lateral ¼ unit right wing down; directional — rudder 3 o'clock position.

2. Accelerate and climb to launch altitude observing local course rules. Do not exceed 400 KIAS or 0.9 IMN.

Launch and Reel Out

1. Launch straight and level, balanced flight, 255 ±5 KIAS. Launch below 20,000 feet is recommended.
2. Check turbine pitch at 1½ units IN Aero 43M reels, 3 units IN for Aero 43 reels.
3. Reel brake switch OFF.
4. Actuate unlatch switch and observe upper (red) launcher latched light go out.
5. *Immediately* hold OUT pitch until target separates from the launcher saddle and clears the launcher and the airplane. Commence timing. See note under COUNTER FAILURE (EMERGENCY PROCEDURES).

CAUTION

Do not hold the turbine pitch control switch in the OUT position until the upper (red) launcher latched light goes out. If the tow reel drum is permitted to rotate without towline slack being taken up by the target, a loop will form in the towline. This loop can cause mission failure and damage to tow system equipment.

Note

After the target leaves the launcher, the lower (amber) target in light will go out. Approximately 30 seconds after the (amber) target in light goes out, the (red) launcher latched light will come back on indicating that launcher actuator and linkage are in the latch position and ready to automatically engage the target upon recovery.

6. After the target clears the launcher and aircraft (200 feet streamed), establish desired turbine rpm. With the Aero 43, do not exceed 4000 rpm. With the Aero 43M, operations should be confined to a range of 0 to 2700 rpm and 3600 to 4100 rpm to minimize turbine blade fatigue due to vibration. Commence climbing if required.
7. Maintain reel speed by momentary actuation of the turbine pitch switch to IN or OUT position, whichever is needed.

CAUTION

Avoid overcontrol of the rpm. A 400 rpm drift is permissible. Under normal reeling conditions the reel is controlled only by actuation of the turbine pitch control switch. The tow system brake switch must not be placed in the ON position during reel rotation unless emergency conditions necessitate immediate reel stoppage. This precaution is necessary to avoid towline breakage and excessive brake wear.

Note

Turbine rpm is a function of towline length, airspeed, altitude, and turbine pitch. With constant pitch, turbine rpm will slowly change as operating conditions are varied. The tachometer indicator and counter shall be monitored when the brake system is in the OFF position.

8. Maintain 250-to-280 KIAS (optimum) until the full scope of the towline is deployed. Observe towline limitations.

CAUTION

Do not reel-out towline in excess of the maximum permissible length (24,000 feet for D-12116-10; 30,000 feet for D-12116-9 towlines).

9. Within 500 feet of desired towline length, slowly toggle IN pitch to obtain 1,000 rpm and then to obtain 0 rpm as the desired length is reached.
10. Be sure rpm is at 0 (this requires about 2 to 4 units of IN pitch), and the counter indicates no movement.

TOWING LIMITATIONS

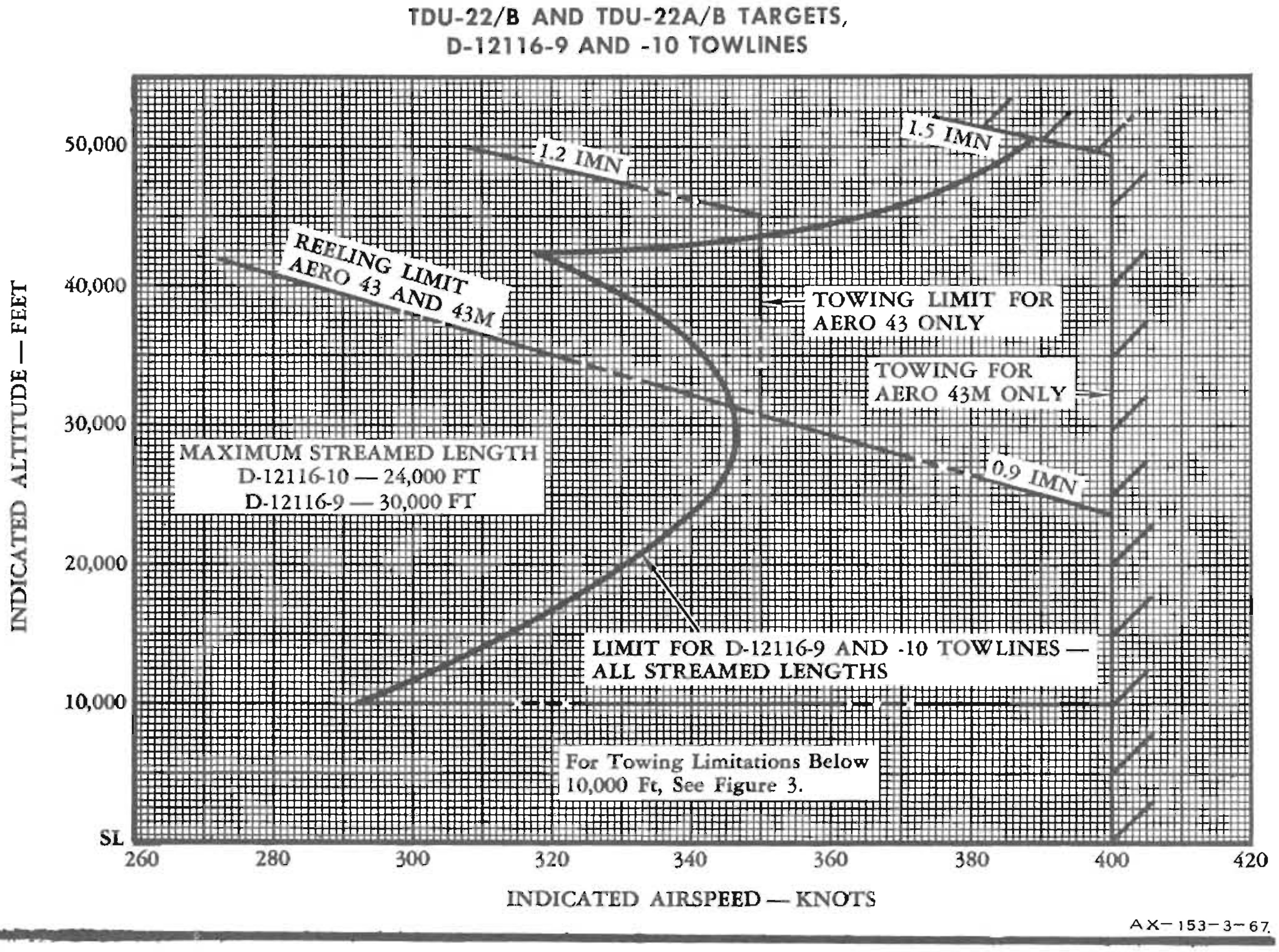


Figure 8–23

11. Note pitch required for 0 rpm and record pitch and airspeed for reference later. See RECOVERY PROCEDURE.

12. Place the brake switch ON.

Note

For towing above 340 KIAS, change pitch to 0 to 1 unit IN.

Towing

CAUTION

Observe cooling flow limitations applicable to target towing as shown in section I, part 4.

1. Observe towing limitations. Tow speed as prescribed by exercise. See figures 8–23 and 8–24.

2. Turns should be held to 20 degrees angle of bank and acceleration of 1.5 G's. Do not make any rapid "S" turns.

3. For low altitude towing (target altitude 1,000 feet or below) a slow rate of descent to towing altitude is necessary. Target overshoot will *approximate* rate of descent.

4. Towline droop varies with airspeed, altitude and the towline used (approximately 7 percent streamed length for *average* conditions).

LOW ALTITUDE TOWING LIMITATIONS

D-12116-9 AND D-12116-10 TOWLINES, SEA LEVEL TO 10,000 FEET TARGET ALTITUDES, TDU-22/B AND A/B TARGETS

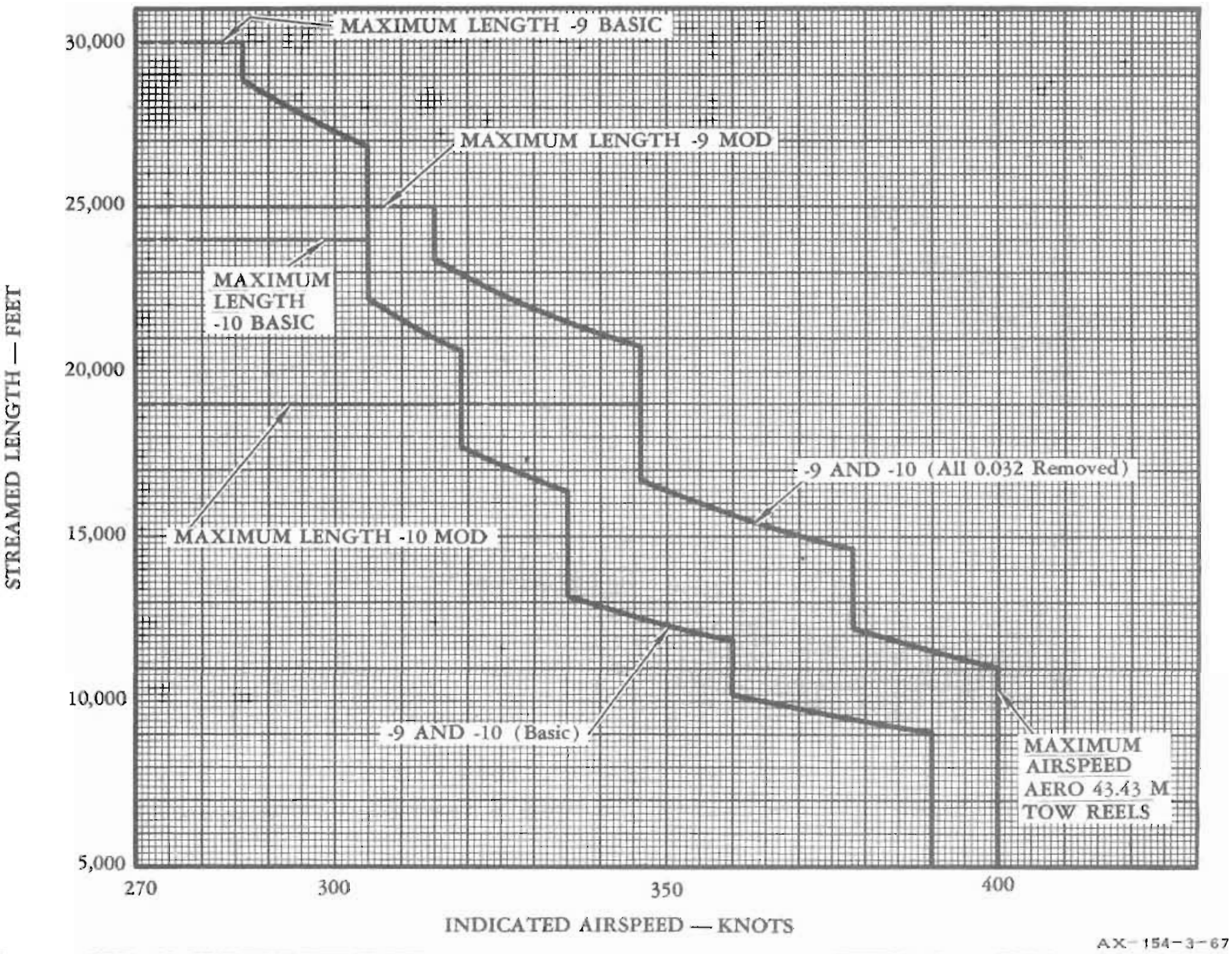


Figure 8–24

Recovery Procedure

Note

pitch was changed, restore pitch setting and rspeed. See item 11 of LAUNCH AND EEL OUT.

1. Brake switch — OFF

Note

First reel-out 50 feet of towline to relieve undercutting on reel spool.

2. Actuate the turbine pitch control switch to IN as required to obtain the desired rpm. See item 6 of LAUNCH AND REEL-OUT.
3. Check upper (red) launcher latched light ON.
4. Before towline length has been reduced to 500 feet, establish 255 (±5) KIAS in level, balanced flight, and 500 rpm.
5. Before towline length has been reduced to 100 feet, establish rpm for a recovery rate of approximately

100 feet per minute and make no further pitch adjustment with length less than 100 feet.

Note

Recovery rate may be determined by timing reel-in of 50 feet of towline (elapsed time of 30 seconds indicates 100 feet per minute). Calculated speed is 260 rpm for the Aero 43 reel and 200 rpm for the Aero 43M reel. Actual values may vary as much as 200 rpm for individual reels due to tachometer inaccuracy at low speed and varying spool load.

CAUTION

Maintain the aircraft in stable flight during final recovery of the target. Moderate maneuvering or air turbulence may cause some oscillation of the target as it approaches the launcher, with possible recovery difficulty or target loss. If severe oscillation of the target occurs during recovery, immediately stop reel-in by actuating the turbine pitch control switch to the OUT position. Let out additional towline and repeat recovery procedures.

Towline angle rapidly increases to approximately 60° as target approaches launcher.

Note

If darkness prevents monitoring of the target, completion of the target recovery will be indicated by an abrupt reduction of turbine rpm to zero and counter stoppage.

The "target in" light may not illuminate due to the slow recovery rpm.

6. Increase IN pitch to fully seat the target in the launcher saddle (5 units maximum). Both lights will be illuminated when the target is secured.
7. Place brake switch in the ON position.
8. Reset PRE-LAUNCH pitch position.

Letdown and Landing

1. Make normal letdown and landing. Hung ordnance entry is recommended if target is not indicating latched.

CAUTION

Do not fold the wings until the target has been removed.

2. Ensure that the ground crew man has reinstalled the tow reel lockpin before turning the reel master switch OFF or securing the engine.

Emergency Procedures

WARNING

If it becomes necessary to eject from the aircraft during towing operations, depress cable cutter button prior to ejection, if possible.

Target Loss on Launching or Towline Failure

1. Brake — ON
2. Turbine — FEATHER

Target Loss From End of Long Towline

1. Use recovery procedure.
2. When towline whipping is observed at launcher, stop reel and cut the remaining towline.

Counter Failure

Note

Squadron experience will determine average reeling times for streaming -9, -10, or other selected towlines. Use this experience for determining reel-out and reel-in times in the event of counter failure.

To Cut Towline

CAUTION

A number of factors should be considered prior to cutting the towline. If the reel is inoperative, or if reel operation is considered hazardous, the only course of action is to cut. Ensure that the target and towline will not fall in areas where personal injury or property damage may result. Attempt to obtain approval from the controlling agency and recheck aircraft location prior to cut.

In the event of cutter failure, with towline streamed, a normal landing may not be made. Consider as follows:

1. Field with unobstructed approach.
2. Drag-off over water or land.

Note

If there are indications that target and/or wire have been dropped after using the cable cutter, attempt to get a definite radar confirmation from Range Control.

1. rpm — ZERO
2. Brake — ON
3. Cable cutter — DEPRESS
4. Turbine — FEATHER

Reel Overspeed

Note

The tow reel contains an overspeed switch set at 6000 rpm (Aero 43) or 6200 rpm (Aero 43M) and a relay which will automatically apply the reel brake when overspeed occurs. As the brake is applied, the tachometer indicator will suddenly drop to zero. The brake will remain engaged until electrical power to the reel has been interrupted.

Reel overspeeds may result from towline breakage during reel-in with a long cable scope and at high aircraft speed, or if the operating rpm is excessively high and the system is not properly monitored.

CAUTION

Step 1 is essential to prevent uncontrolled overspeed during reset of the system.

1. Actuate the turbine pitch control switch to feather turbine blades.
2. Tow system brake — ON

Note

It is recommended that the towline be cut. If continued operation is not intended, delete step 3.

CAUTION

During the period that the master switch is in the OFF position, the tow reel brake will be disengaged. It is essential that the reel master switch be returned to ON as rapidly as possible.

3. Briefly cycle the tow system master switch to OFF and then immediately to ON position.

Inadvertent Flare Ignition (TDU-22A/B)

Spurious flare ignition occasionally occurs due to malfunction of flare command circuitry. If this occurs with the target streamed, no action is required. If flares ignite while the target is in the launcher, jettison of target is required to prevent burning of adjacent aircraft wing panels.

1. Cable cutter — DEPRESS
2. Target unlatch switch — ACTUATE
3. Target will fall from launcher.

Note

If spurious flare ignition occurs prior to takeoff and fire hazard exists, perform steps 1 and 2 and taxi clear of the target.

CAUTION

The above procedure is required to ensure that the target leaves the launcher. Do not attempt a normal target launching.

TDU-22/B Target Operating Procedures

No special procedures are required for this passive type target.

TDU-22A/B Target Operating Procedures

Note

The flight procedures for IR targets do not differ significantly from those prescribed in the preceding paragraphs. However, the "A/B" target is heavier than the "/B" target and incorporates a remote controlled flare firing system, and requires more pilot attention.

The flare firing system utilizes a predetermined UHF frequency, a tone generator, and associated equipment.

Preflight

Obtain flare frequency and check this with the frequency written on the target.

Poststart

Switch ARC 27 to squadron common and check tone generator.

Note

Flares will be installed in the target by the ordnance crewman in the arming area. Ensure that the target safety pin is pulled by the crewman after the flares are installed.

When IR targets are in the launcher a safety switch in the target cuts off all power to the target flare receiver preventing inadvertent flare ignition by transmissions from the tow or other aircraft.

Flight

Note

When the pilot of the missile firing aircraft desires a flare to be ignited, he will transmit for a "Hot Shot." Tow pilot will select the flare firing frequency and transmit the tone for 8–10 seconds. The pilot must wait at least 10 seconds between attempts. If flares are not firing, 12 flare attempts may be made before aborting the mission.

After Landing

Note

After landing, taxi to the de-arming area. The ordnance crewman will remove the target and/or flares and install safety pins in the reel. Do not fold wings until the target has been removed.

CENTER-OF-GRAVITY TOW SYSTEM CHECK LIST AND ESSENTIAL OPERATING PROCEDURES

Preflight Check

Note

For TDU-22A/B Targets, obtain flare firing frequency.

Launcher

1. Mounting — SECURE
2. Circuit breaker — IN
3. Cutter cartridge — INSTALLED
4. Electrical leads — SECURE

Target

1. Mounting — SECURE
2. TDU-22A/B — FREQUENCY

Towline

1. Sheaves — MOUNTING AND ALIGNMENT

Reel

1. Mounting — SECURE
2. Electrical leads — SECURE
3. Safety pin — IN
4. Towline length — NOTE
5. Turbine blades — FEATHERED
6. Turbine blades — CONDITION

Poststart Check

1. Master switch — ON
2. Brake switch — ON
3. Counter — 00000
4. Turbine rpm — ZERO
5. Pitch indicator — 1½ units IN (Aero 43M), 3 units IN (Aero 43)
6. Reel lockpin — OUT
7. Launcher lights — ON
8. Flare tone — TEST
9. Flare target power switch — ON
10. Takeoff trim — SET

Prelaunch Check

1. Airspeed — 225 (±5) KIAS
2. Trim — LEVEL BALANCED FLIGHT
3. Turbine pitch — 1½ units IN (Aero 43M), 3 units IN (Aero 43)
4. Brake switch — OFF

Launch Procedure

1. Launcher unlatch switch — ACTUATE
2. Observe UPPER RED launcher light
3. When light goes out, actuate and hold pitch switch in OUT position. Note time.
4. After target clears launcher control turbine rpm by using the pitch switch. Avoid numerous changes in rpm.

Operating Limitations

Aero 43 Tow Reel

Max stowed — 400 KIAS 0.9 IMN

Airspeed (reeling) — 250 to 280 KIAS (optimum), 400 KIAS, 0.9 IMN (max)

Maximum turbine rpm 4000

Max towing — 400 KIAS, 0.9 IMN below 39,000 ft alt, 350 KIAS, 1.2 IMN above 30,000 ft or towline limit.

Aero 43M Tow Reel

Max stowed — 400 KIAS, 0.9 IMN

Airspeed (reeling) — 250 to 280 KIAS (optimum), 400 KIAS, 0.9 IMN (max)

Turbine rpm — 0 to 2700, 3600 to 4100

Avoid prolonged operation at 2700 to 3600 rpm

Max towing — 400 KIAS, 1.5 IMN or towline limit.

To Stop Reel For Towing

1. Operate pitch control to obtain zero rpm
2. Observe the counter indicating no movement
3. Note indicated pitch
4. Actuate brake switch to ON
5. Set turbine pitch to ZERO units at towing above 340 KIAS
6. Note time
7. Observe towing limitations

Prerecovery Check

1. Airspeed — 250–280 KIAS, 0.9 max IMN
2. Turbine pitch — As used to stop reel
3. Launcher lights — Top red light on
4. Brake switch — OFF

Recovery Procedure

1. Reel out 50 feet of towline.
2. Change pitch to obtain desired recovery rpm observing operating limitations.
3. Before towline length is 500 feet, check:
   (a) Airspeed — 255 (±5) KIAS
   (b) Trim — Level balanced flight
   (c) Turbine rpm — 500
4. Before towline length is 100 feet, establish rpm for recovery rate of 100 feet per minute.
5. Do not make further adjustments in pitch with length less than 100 feet.
6. When target is in launcher, increase pitch until both launcher lights are ON (5 units max).
7. Actuate brake switch ON.
8. Reset prelaunch pitch position.

Postlanding Check

1. Do not fold wings
2. Taxi to dearm area if using TDU 22A/B
3. Reel lockpin — IN
4. Ordnance man remove flares
5. Flare target power switch — OFF
6. Master switch — OFF

Emergency Procedures

WARNING

If it becomes necessary to eject from the aircraft during towing operations, depress cable cutter button prior to ejection, if possible.

Target Loss on Launch or Towline Failure

1. Brake — ON
2. Turbine — FEATHER

Target Loss From End of Towline

1. Recover towline until whipping is observed at launcher
2. Cut towline

Counter Failure

1. Utilize time taken to stream to affect recovery

To Cut Towline

1. RPM — ZERO
2. Brake — ON
3. Cable cutter — DEPRESS
4. Turbine — FEATHER

Reel Overspeed

1. Brake Automatic at 6000 rpm
2. Turbine — FEATHER
3. Brake switch — ON
4. Cut towline. Or, if necessary to continue operations:
5. Briefly cycle master switch to OFF, then *immediately* to ON.

Flare Ignition (Target in Launcher)

1. Cable cutter — DEPRESS
2. Launcher unlatch switch — ACTUATE
3. If on deck, taxi clear of target.

ELECTRONIC COUNTERMEASURES

Note

AFC 490, Part IV, installs Shoehorn India in F-8H aircraft. A description of the chaff dispenser, which is a part of the Shoehorn India installation, follows. Refer to Supplemental NATOPS Flight Manual (Confidential) and the supplement to the F-8 Tactical Manual (Secret) for the remainder of the Shoehorn India writeup.

DESCRIPTION

The AN/ALE-29A Chaff Dispenser System is a countermeasure system for ejecting chaff or other decoys into the atmosphere during flight to decrease the effectiveness of enemy radar. Two chaff dispensers are installed in the aft engine access door on the bottom of the fuselage. Each dispenser contains 30 tubes for individual payload units which are ejected by gas pressure generated by an electrically initiated impulse cartridge.

The system is controlled by a chaff control panel in the right-hand console, a chaff manual fire button on the left-hand longeron, and a chaff programmer in the right main landing gear well. The programmer controls the modes in which the dispenser stores are dispensed. These controls and their functions are presented in figure 8–25. The contents of one dispenser tube is a burst. The number of bursts selected comprise a salvo.

While the aircraft is on the deck, a safety pin is placed in the chaff firing power disable switch located in the right main landing gear well. The system is in a ready status when the chaff firing disable switch pin is removed, the landing gear handle is in "WHLS UP" and the chaff select switch is in FWD, AFT or BOTH. The system is powered by the secondary dc bus.

Chaff Dispenser System Controls and their functions are presented in figure 8–25.

MANUAL OPERATION

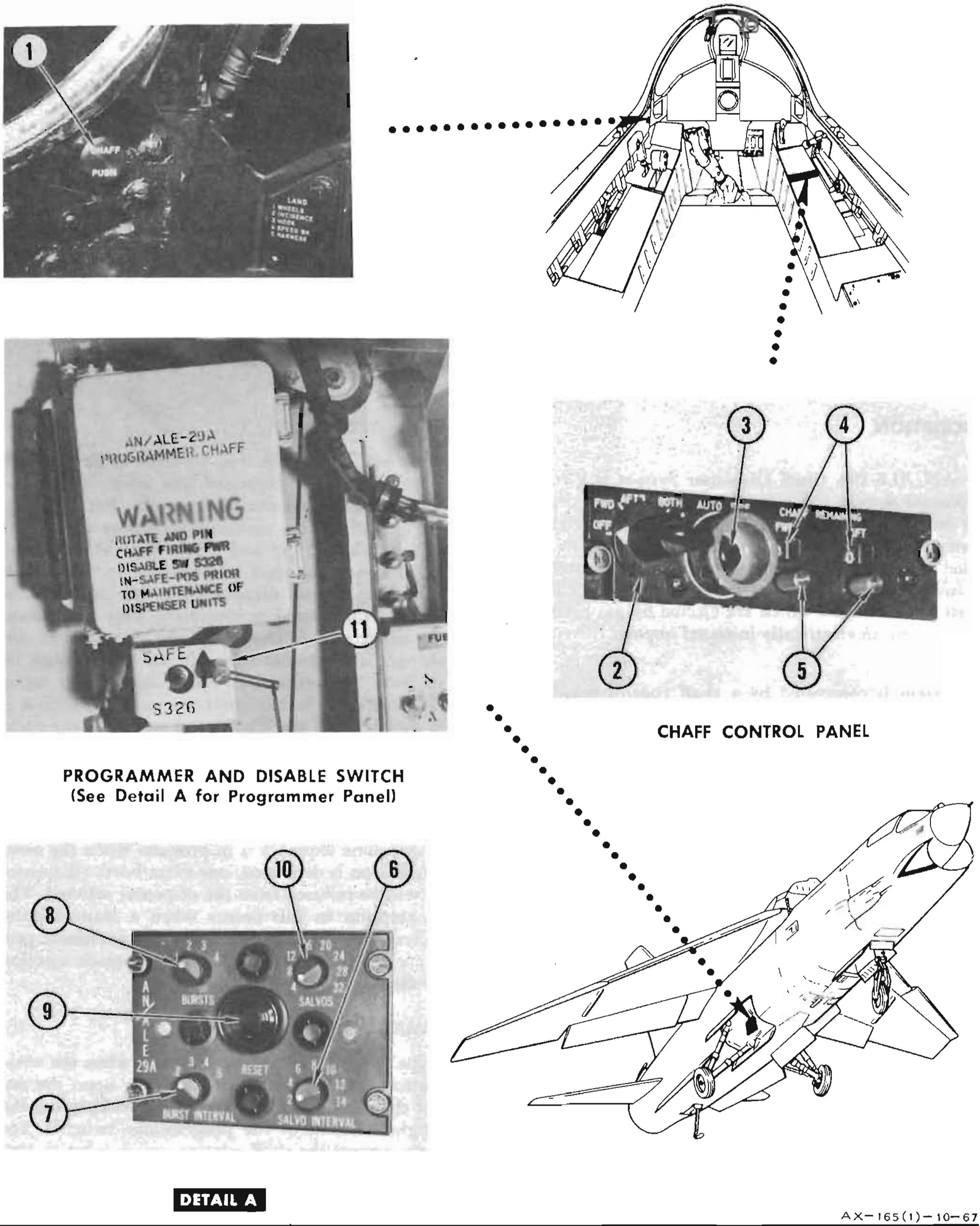
If no automatic sequence is in progress when the chaff manual fire button is depressed, one salvo will be dispensed as selected on the programmer. For example, assume control settings on the programmer as follows: bursts switch set to "4" and bursts interval switch set to "0.3" seconds; the chaff select switch in the cockpit is set to select the AFT dispenser; and the chaff manual fire button is depressed momentarily. This will release one dispenser tube of chaff from the aft dispenser and 0.3 seconds later another tube, etc, until four tubes, or bursts, have been expended. This is termed one salvo. The manual cycle is then complete until the button is again depressed. If the chaff select switch in the cockpit is moved to BOTH, then the previously described cycle will occur in both the forward and the aft dispensers simultaneously when the manual fire button is depressed.

If an automatic sequence is in progress when the manual fire button is depressed, one extra burst (dispenser tube) will be released from the dispenser selected. The only exception to this occurs when a manual pulse coincides exactly with a pulse from the automatic programmer. In such a case, only the automatic ejection will occur.

AUTOMATIC OPERATION

The type of automatic release obtained when the autofire button is depressed depends entirely upon the setting of the chaff selector switch in the cockpit and the (preflight) setting of the programmer switches. For example, assume the chaff selector switch is set to FWD

CHAFF SYSTEM CONTROLS



PROGRAMMER AND DISABLE SWITCH
(See Detail A for Programmer Panel)

CHAFF CONTROL PANEL

DETAIL A

AX-165(1)-10-67

Figure 8–25 (Sheet 1)

CHAFF SYSTEM CONTROLS

Nomenclature	*Function*
1. Chaff manual fire button	Pressed and released when automatic sequence not in progress, dispenses on salvo. Number of bursts comprising salvo and time between bursts is determined by programmer (preflight) settings. Pressed and released when automatic sequences in progress, dispenses one extra burst from dispenser selected. If manual pulse coincides exactly with a pulse from the automatic programming, only one burst will be dispensed.
2. Chaff select switch	OFF — deenergizes chaff system. Stops dispensing in progress. Resets the programmer to the starting position of the automatic dispensing sequence as determined by setting of burst and salvo switches. AFT — selects aft chaff dispenser and arms autofire button and chaff manual fire button. FWD — selects forward chaff dispenser and arms autofire button and chaff manual fire button. BOTH — selection permits simultaneous chaff release dispensions from FWD and AFT dispensers and arms autofire button and chaff manual fire button.
3. Auto fire button	Depressed and released, initiates automatic dispensing as determined by settings on programmer.
4. Subtractive counters	Indicates number of unfired chaff packages remaining in FWD and AFT dispensers.
5. Counter set knobs	Set subtractive counters to number of chaff packages in each dispenser.
6. Salvo interval switch	Selects the interval (in seconds) between salvos. (For automatic dispensing only.)
7. Bursts interval switch	Selects the interval (in tenths of a second) between bursts.
8. Bursts switch	Selects the number of bursts to be fired in each salvo.
9. Reset button	Depressed and held for 6 seconds to reset sequence switches.
10. Salvos switch	Selects the successive number of salvos to be automatically dispensed.
11. Firing power disable switch	Pin installed — prevents inadvertent actuation of chaff system during deck operation. Pin removed — completes chaff system electrical circuitry.

AX-165(2)-10-67

Figure 8–25 (Sheet 2)

and programmer switches are positioned as follows: salvo interval set to 2 seconds, burst interval set to 0.4 seconds, burst switch set to 3, and the salvos switch set to 16.

When the autofire switch is momentarily depressed, automatic release is initiated. Three dispensers tubes will be emptied with a 0.4 second delay between each tube. After a delay of 2 seconds, another salvo of three dispenser tubes will be emptied, etc, until 16 salvos, or 48 dispenser tubes have been emptied. The 30 tubes in the forward dispenser will empty their contents first, then 18 tubes in the aft dispenser go next (when the selected dispenser is empty the programmer automatically switches dispensers).

With the chaff selector switch in BOTH, chaff is dispensed automatically from both dispensers in the manner previously described for one dispenser.

RESETTING

A reset switch (manual) is provided on the programmer panel to reset sequence switches. With electrical power applied to the system and with the ALE-29A function switch in any position except OFF, depressing and holding the reset button for 6 seconds resets the sequence switches to their beginning positions (top of firing order).

Note

When a full load of chaff is installed, the system must be reset. Otherwise, it will be impossible to release all of the chaff packages and there is no way to reset the system in flight. Resetting is unnecessary when a partial load remains from a previous flight and it is desired to fire only the remaining portion.

section IX
flight crew coordination

(not applicable)

section X
standardization evaluation

CONTENTS

PART 1 — STANDARDIZATION EVALUATION PROGRAM

PART 1—STANDARDIZATION EVALUATION PROGRAM

CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating the aircraft. The NATOPS Evaluation is intended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatibility with various operational commitments and missions of both Navy and Marine Corps units. The prime objective of the NATOPS Evaluation program is to assist the unit Commanding Officer in improving unit readiness and safety through constructive comment. Maximum benefit from the NATOPS Evaluation Program is achieved only through the vigorous support of the program by commanding officers as well as the flight crewmembers.

DEFINITIONS

The following terms, used throughout this section, are defined as to their specific meaning within the NATOPS program.

NATOPS EVALUATION

A periodic evaluation of individual flight crewmember standardization consisting of an open book examination, a closed book examination, an oral examination, and a flight evaluation.

NATOPS REEVALUATION

A partial NATOPS Evaluation administered to a flight crewmember who has been placed in an Unqualified status by receiving an Unqualified grade for any of his ground examinations or the evaluation flight. Only those areas in which an unsatisfactory level was noted need be observed during a reevaluation.

QUALIFIED

That degree of standardization demonstrated by a very reliable flight crewmember who has a good knowledge of standard operating procedures and a thorough understanding of aircraft capabilities and limitations.

CONDITIONALLY QUALIFIED

That degree of standardization demonstrated by a flight crewmember who meets the minimum acceptable standards. He is considered safe enough to fly as a pilot in command or to perform normal duties without supervision but more practice is needed to become Qualified.

UNQUALIFIED

That degree of standardization demonstrated by a flight crewmember who fails to meet minimum acceptable criteria. He should receive supervised instruction until he has achieved a grade of Qualified or Conditionally Qualified.

AREA

A routine of preflight, flight or postflight.

SUBAREA

A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

CRITICAL AREA

Any area or subarea which covers items of signifcant importance to the overall mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.

EMERGENCY

An aircraft component, system failure, or condition which requires instantaneous recognition, analysis, and proper action.

MALFUNCTION

An aircraft component or system failure or condition which requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

IMPLEMENTATION

The NATOPS Evaluation program shall be carried out in every unit operating naval aircraft. Pilots desiring to attain/retain qualification in the aircraft shall be evaluated initially in accordance with OPNAV Instruction 3510.9 series, and at least once during the twelve months following initial and subsequent evaluations. Individual and unit NATOPS Evaluations will be conducted annually; however, instruction in and observation of adherence to NATOPS procedures must be on a daily basis within each unit to obtain maximum benefits from the program. The NATOPS Coordinators, Evaluators, and Instructors shall administer the program as outlined in OPNAVINST 3510.9

series. Evaluees who receive a grade of Unqualified on a ground or flight evaluation shall be allowed 30 days in which to complete a reevaluation. A maximum of 60 days may elapse between the date the initial ground evaluation was commenced and the date the evaluation flight is satisfactorily completed.

GROUND EVALUATION

Prior to commencing the flight evaluation, an evaluee must achieve a minimum grade of Qualified on the open book and closed book examinations.

The oral examination is also part of the ground evaluation but may be conducted as part of the flight evaluation. To assure a degree of standardization between units, the NATOPS Instructors may use the bank of questions contained in this section in preparing portions of the written examinations.

OPEN BOOK EXAMINATION

Up to 50% of the questions used may be taken from the question bank. The number of questions on the examination will not exceed 100 or be less than 50. The purpose of the open book examination portion of the written examination is to evaluate the pilot's knowledge of appropriate publications and the aircraft. The maximum time for this examination should not exceed 4 hours.

CLOSED BOOK EXAMINATION

Up to 50% of the closed book examination may be taken from the question bank and shall include questions concerning normal procedures and aircraft limitations. The number of questions on the examination will not exceed 100 or be less than 50. Questions designated critical will be so marked. An incorrect answer to any question in the critical category will result in a grade of unqualified being assigned to the examination.

ORAL EXAMINATION

The questions may be taken from this manual and drawn from the experience of the Instructor/Evaluator. Such questions should be direct and positive and should in no way be opinionated.

OFT/WST PROCEDURES EVALUATION

An OFT may be used to assist in measuring the pilot's efficiency in the execution of normal operating procedures and his reaction to emergencies and malfunctions. In areas not served by the OFT facilities, this may be done by placing the pilot in a cockpit and administering appropriate questions.

GRADING INSTRUCTIONS

Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of Qualified or Unqualified.

Open Book Examination.

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.5.

Closed Book Examination.

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.3.

Oral Examination and OFT Procedure Check. (If conducted).

A grade of Qualified or Unqualified shall be assigned by the Instructor/Evaluator.

FLIGHT EVALUATION

The number of flights required to complete the evaluation flight should be kept to a minimum; normally one flight. The areas and subareas to be observed and graded on an evaluation flight are outlined in the grading criteria with critical areas marked by an asterisk (*). Subarea grades will be assigned in accordance with the grading criteria. These subareas shall be combined to arrive at the overall grade for the flight. Area grades, if desired, shall also be determined in this manner.

FLIGHT EVALUATION GRADING CRITERIA

Only those subareas provided or required will be graded. The grades assigned for a subarea shall be determined by comparing the degree of adherence to standard operating procedures with adjectival ratings listed below. Momentary deviations from standard operating procedures should not be considered as unqualifying provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action.

MISSION PLANNING/BRIEFING

FLIGHT PLAN

Qualified

Completed the flight plan and clearance in accordance with governing instructions. Special factors, if required by the mission or aircraft configuration, are computed and recorded where applicable. Completed flight planning without error. Fuel consumption was properly computed. Ensured that maps and charts were available. Weather factors and NOTAMS were used in planning the mission. LID/IFR departure procedures were obtained if required, and planned accordingly.

Conditionally Qualified

Same as "qualified," but with minor discrepancies which did not adversely affect successful completion of the mission or jeopardize safety.

Unqualified

Flight planning was incomplete or resulted in discrepancies which would possibly prevent successful completion of the mission.

BRIEFING

Qualified

Briefing was conducted in accordance with NATOPS Briefing Guide and/or requirements of the mission. Applicable mission card used. Thorough knowledge of the assigned mission was exhibited. Sufficient time was allowed for the briefing and questions by members of the flight. Flight responsibilities were outlined for each member of the flight.

Unqualified

Briefing not conducted in accordance with the NATOPS Briefing Guide and/or requirements of the mission, and factors affecting mission accomplishment were omitted. Insufficient time allowed for briefing. Flight member responsibilities were not defined.

PERSONAL FLYING EQUIPMENT

Qualified

Had all required items of personal equipment necessary for the mission and area over which the flight was to be conducted.

Unqualified

Did not possess all items of personal flying equipment.

PREFLIGHT/LINE OPERATIONS

AIRCRAFT ACCEPTANCE

Qualified

Checked the ten previous yellow sheets (if available) for previous discrepancies and corrective action taken. Checked fuel load, armament load, pertinent aircraft data, and aircraft status prior to accepting the aircraft.

Conditionally Qualified

Same as "qualified," but omitted checking minor pertinent data and corrective action taken and/or aircraft status data.

Unqualified

Failed to inspect previous yellow sheets for discrepancies and corrective action taken and/or aircraft status data.

PRETAXI PROCEDURES

Qualified

Used correct R/T procedures, standard visual signals, and pretaxi checks with the flight as briefed with no unnecessary deviations, omissions, or delays.

Unqualified

Failed to use correct R/T procedures, standard visual signals, and pretaxi checks with the flight. Deviated and omitted procedures as briefed to extent that misunderstanding resulted in unnecessary delays in departing on the mission.

TAXI

Qualified

Taxi clearance was obtained prior to departing flight line/deck spot area. Taxiing was accomplished as briefed and in accordance with safe speed and interval requirements. Proper positioning on the catapult was accomplished without delay and with proper response to plane director's signals. Aircraft systems were operated at prescribed intervals and manner during normal taxi and extended ground operation.

Conditionally Qualified

Minor difficulties were experienced in obtaining taxi clearance. Taxiing was accomplished as briefed and in accordance with speed and interval requirements. Positioning on the catapult was accomplished with minor delays in responding to plane director's signals. Operation of systems was completed but at greater intervals than recommended.

Unqualified

Departed flight line/deck spot area without taxi clearance and taxied contrary to instructions from controlling agency. Taxi speed unsafe for field/deck conditions. Improper response to catapult director's signals, causing excessive delays in aircraft launching operations. Aircraft systems not operated.

ATC CLEARANCE

Qualified

Required minimum transmissions to understand clearance. Read back correctly.

Conditionally Qualified

Required repeat transmissions to understand clearance. Transmissions required additional questions and calls.

Unqualified

Proceeded without being certain of clearance. Required repeated transmissions. Was unable to communicate and give information without excessive delay and words. Poor radio discipline.

TAKEOFF

Qualified

Received and acknowledged takeoff clearance. Executed engine runup, instrument checks, and necessary visual signals. Brake release was smooth, and good directional control was maintained. For catapult launch, the brakes were released and UHT was properly trimmed prior to launch. Lift-off was accomplished as required by field/WOD conditions, and a smooth transition was accomplished to the clean condition with aircraft in positive climbing attitude and safe separation above the ground/water.

Conditionally Qualified

Same as "qualified," except for minor deviations in procedure and technique not detrimental to flight safety.

Unqualified

Did not receive and acknowledge takeoff clearance. Failed to use signals or used improper signals. Exhibited poor or unsafe technique on directional control, catapult launch, lift-off, transition, and climb attitude.

DEPARTURE

LID/IFR DEPARTURE*

Qualified	Departure was executed in accordance with clearance.
Unqualified	Departure not in accordance with traffic rules and/or traffic clearances.

VFR DEPARTURE

Qualified	Departure executed in accordance with local traffic rules and/or traffic clearance. Level off is accomplished as briefed.
Conditionally Qualified	Same as qualified," except for minor deviations.
Unqualified	Departure not in accordance with traffic rules and/or traffic clearance.

RENDEZVOUS*

Qualified	Executed and facilitated rendezvous in accordance with procedures as briefed or currently prescribed.
Conditionally Qualified	Executed and facilitated rendezvous, except for minor procedural errors and delay. Rendezvous accomplished so as not to be detrimental to mission completion.
Unqualified	Rendezvous executed in a manner that indicated a lack of knowledge of required procedure. Resulting delay caused mission accomplishment as briefed to be adversely affected or delayed.

IFR PROCEDURES EN ROUTE

Qualified	Conducted flight as briefed or as cleared by controlling agency. Observed good radio discipline. Gave position reports clearly and in proper sequence.
Conditionally Qualified	Conducted flight as briefed or cleared, except for minor deviations not affecting limits of clearance.
Unqualified	Did not conduct flight as briefed or cleared.

VFR PROCEDURES EN ROUTE

Qualified	Conducted flight as briefed and/or as dictated by the mission/tactical situation. Formation was maintained to facilitate optimum tactical employment, lookout doctrine and flight progress to the operating area/destination.
Conditionally Qualified	Same as "qualified," except for minor deviations, but not to the extent of precluding successful completion of the mission.
Unqualified	Did not conduct flight as briefed and/or as dictated by the mission tactical situation, resulting in poor tactical employment and/or lookout doctrine to the detriment of mission completion or safety.

*Critical area

MISSION

Those sections of the mission areas which are covered in this manual, Weapons System Tactical Handbook, and NWP/NWIP's will be conducted and evaluated in accordance with the procedures contained in the applicable publications and the criteria outlined below.

Qualified	Performed assigned or alternate mission, as briefed, in accordance with required procedures. Was thorough in the proper selection, conduct and execution of those aspects of the mission or tactical situation, culminating in safe and efficient mission accomplishment.
Conditionally Qualified	Same as "qualified," except for minor deviations, indicating a lack of required knowledge or adherence to required procedures, not adversely affecting successful mission accomplishment.
Unqualified	Lack of knowledge or adherence to required procedures resulted in unsuccessful mission accomplishment.

RECOVERY

IFR HOLDING/MARSHAL PROCEDURES

Qualified	Entered holding/marshal pattern at the assigned altitude and in accordance with published procedures. Slowed to appropriate entry and holding airspeed within prescribed time limitations. Remained within pattern limits.
Conditionally Qualified	Entered holding pattern with minor deviations from published procedures. Slow in reaching prescribed holding airspeed. Minor deviations in pattern, but within limits.
Unqualified	Improper pattern entry. Did not hold as cleared.

EXPECTED APPROACH TIME

Qualified	Made expected approach time within time limits or requested an amended clearance.
Unqualified	Expected approach time was made in excess of time limits and/or an amended clearance was not requested.

PENETRATION (TACAN, RADAR, ADF)*

Qualified	Complied with procedures and instructions received. Completed appropriate checks prior to reaching initial approach fix/marshal point. Used proper power settings and descent attitude and configuration. Intercepted penetration course using correct tracking procedures and leveled off at proper penetration turn, and/or minimum penetration/gate altitude.
Conditionally Qualified	Same as "qualified," except for minor deviations from procedures, and/or instructions received.
Unqualified	Major deviations and omissions from procedures, instructions, and/or checks.

LOW APPROACH*

Qualified	Executed low approach as published and/or instructed. Completed pre-landing checks and executed safe aircraft configuration transition. Reached minimum altitude at or prior to reaching visibility minimums, from which a successful straight-in or a circling approach to a landing could be made.
Conditionally Qualified	Same as "qualified," except for minor deviations from procedures and errors in aircraft control.
Unqualified	Major deviations from procedures and errors in aircraft control.

(Continued)

*Critical area

RECOVERY *(Continued)*

GCA/CCA*

Qualified	Used proper voice procedures and complied with instructions received. Performed landing checks, and transition was completed as prescribed. FINAL: Maintained glide slope and heading. If occasionally off, accomplished appropriate and positive corrections.
Conditionally Qualified	Same as "qualified," except for minor deviations from procedures/instructions and/or checks. FINAL: Same as "qualified."
Unqualified	Major deviations from procedures, instructions and/or checks, requiring a missed approach.

MISSED APPROACH*

Qualified	Followed missed approach/wave-off/ bolter procedures as published or instructed. Did not descend below minimum altitude. Established a positive climb attitude. Airspeed did not fall below final approach speed.
Conditionally Qualified	Same as "qualified," except for minor deviations from procedures and errors in aircraft control.
Unqualified	Major deviation from procedures and errors in aircraft control.

VFR RECOVERY SHORE BASED/SHIP BASED*

Qualified	Pattern entry was made as prescribed by local course rules, and/or instructions received. Landing check list completed. Break pattern and altitude at the 180° position as prescribed. Final approach speed at optimum. Touch down between first 500 and 1,000 feet of runway or on mirror touchdown deck area.
Conditionally Qualified	Same as "qualified," except for minor deviations at break, pattern, or altitude at the 180° position. Final approach speed within limit. Touchdown between first 500 and 1,500 feet of runway or on mirror touchdown deck area.
Unqualified	Exceeded the above limits. Landing gear and wing transitioned above airspeed limits. Did not complete landing check. Touched down before first 500 feet or past 1,500 feet down the runway, or disregarded LSO instructions.

*Critical area

COMMUNICATIONS

R/T PROCEDURES

Qualified	Complied with procedures prescribed by military and FAA regulations. Transmissions were made correctly on the proper frequency in minimum time, and without interruption of other transmissions. Monitored frequencies at appropriate time. Transmissions were received, understood, properly acknowledged and complied with in minimum time. Familiar with communications equipment and facilities. Utilized backup facilities without hesitation.
Conditionally Qualified	Same as "qualified," except for minor deviations or delays which indicated a lack of thorough familiarity with procedures and equipment, but which did not preclude successful completion of mission or jeopardize safety.
Unqualified	Failed to transmit or receive mandatory reports through omission or lack of familiarity with equipment or procedures. Violation of military/FAA regulations, culminating in a flight violation.

VISUAL SIGNALS

Qualified	Used standard visual signals correctly and without confusion. No delay due to questionable signals.
Conditionally Qualified	Same as "qualified," except for minor deviations or delay.
Unqualified	Used improper signals, resulting in misinterpretation and confusion. Excessive delay or noncommunication caused by questionable signals.

IFF/SIF PROCEDURES

Qualified	Used proper route codes facilitating timely compliance with all interrogation instructions.
Unqualified	Failed to use equipment properly, resulting in confusion and undue delay.

EMERGENCY PROCEDURES*

Qualified	Properly analyzed the emergency situation (if any actually occurred) and took appropriate action without deviation, error, or omission.
Conditionally Qualified	Properly analyzed the emergency situation and accomplished all required action safely, but not necessarily in the proper sequence.
Unqualified	Not up to standards of "conditionally qualified."

*Critical area

POSTFLIGHT PROCEDURES AND DEBRIEFING

AIRCRAFT SHUTDOWN, INSPECTION AND RECORDS

Qualified	Aircraft shutdown procedures as prescribed. Aircraft postflight inspection and yellow sheet completed without error or omission.
Conditionally Qualified	Same as "qualified," except for minor deviations and omissions not affecting continued flight safety.
Unqualified	Errors or omissions in shutdown check/inspections or yellow sheet entries that could jeopardize safety of personnel and/or the aircraft.

FLIGHT DEBRIEFING

Qualified	Provided thorough information in chronological order of events occurring during mission. Debriefed the flight and gave error analysis with definite corrective action indicated.
Conditionally Qualified	Same as "qualified," except for minor deviations and omissions not affecting value of mission debriefing. Debriefed the flight with adequate error analysis.
Unqualified	Unfamiliarity with debriefing requirements. Inadequate flight debriefing. No error analysis of corrective action given. Totally inadequate information for other pilots in the flight.

FLIGHT EVALUATION GRADE DETERMINATION

The following procedure shall be used in determining the flight evaluation grade: A grade of Unqualified in any critical area will result in an overall grade of Unqualified for the flight. Otherwise, flight evaluation (or area) grades shall be determined by assigning the following numerical equivalents to the adjective grade for each subarea. Only the numerals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

Unqualified 0.0
Conditionally Qualified 2.0
Qualified 4.0

To determine the numerical grade for each area and the overall grade for the flight, add all the points assigned to the subareas and divide this sum by the number of subareas graded. The adjective grade shall then be determined on the basis of the following scale.

0.0 to 2.19 — Unqualified
2.2 to 2.99 — Conditionally Qualified
3.0 to 4.0 — Qualified

EXAMPLE: (Add Subarea numerical equivalents)

$$\frac{4+2+4+2+4}{5} = \frac{16}{5} = 3.20 \text{ Qualified}$$

FINAL GRADE DETERMINATION

The final NATOPS Evaluation grade shall be the same as the grade assigned to the Evaluation flight. An evaluee who receives an Unqualified on any ground examination or the flight evaluation shall be placed in an Unqualified status until he achieves a grade of Conditionally Qualified or Qualified on a reevaluation.

RECORDS AND REPORTS

A NATOPS Evaluation Report (OPNAV Form 3510-8) shall be completed for each evaluation and forwarded to the evaluee's commanding officer.

This report shall be filed in the individual flight training record and retained therein for 18 months. In addition, an entry shall be made in the pilot flight log book under "Qualifications and Achievements" follows:

Qualification			*Date*	*Signature*	
NATOPS EVAL.	(Aircraft Model)	(Crew Position)	(Date)	(Authenticating Signature)	(Unit which Administered Eval.)

NATOPS EVALUATION QUESTION BANK

The following bank of questions is intended to assist the unit NATOPS Instructor/Evaluator in the preparation of ground examinations and to provide an abbreviated study guide. The questions from the bank should be combined with locally originated questions as well as questions obtained from the Model Manager in the preparation of ground examinations.

CLOSED BOOK

1. To maintain currency in F-8 aircraft, a pilot must meet what requirements?
2. Any pilot not flying the F-8 for a two-week period will be required to complete what prior to any F-8 night flying?
3. How can the operation of the rudder-aileron interconnect be checked from the cockpit?
4. What should the pilot check when stowing the "T" handle after checking emergency trim?
5. What is desired when performing a "VISCOUS DAMPER CHECK"?
6. What should be accomplished prior to folding the wings?
7. In what position should the rudder be prior to actuating nose-gear steering?
8. How often should the wing and control surfaces be cycled to prevent over-heating of hydraulic fluid and pumps?
9. How long does it take for the hook to cycle full down after actuation of the handle?
10. Why should engine be operated at approximately 75% RPM for 20 seconds prior to shutdown?
11. What is the minimum airspeed and altitude for lowering the wing?
12. How many times should the pilot attempt to light the afterburner on takeoff?
13. What procedure should be followed if an uncontrolled lurch in either direction occurs as the nose wheel touches down on landing?
14. What is the maximum recommended speed at which normal braking can be commenced?
15. What is the maximum recommended crosswind component for landing the F-8?
16. What position should the fuel transfer switch be in prior to catapulting?
17. What is the minimum altitude above the terrain, during IFR conditions, that radio channel changes will be made?
18. What is the recommended RPM, airspeed, and rate of descent for penetration?
19. What is the only absolute indication of a locked canopy?
20. What action should be taken if the wing incidence handle moves without depressing the release switch?
21. How can positive determination that wings are locked after spreading be made?
22. What does an illuminated transfer pump light indicate?
23. What indicated airspeed should be used on instrument climbs?
24. Why must the cockpit emergency ventilation port be closed for accurate angle-of-attack indications and proper operation of the approach power compensator system?
25. What is the maximum fuel weight for entering the GCA pattern?
26. What is the minimum refusal speed for all takeoffs?

*27. What is the maximum indicated airspeed that the F-8 will enter a spin condition?

28. The approach power compensator will not retard the throttle below what setting?
29. What actions will override or disengage the approach power compensator?
30. Why should the helmet visor always be down for inflight refueling?

*31. The limiting airspeed for extending or retracting the cruise droop is____________IAS?

*32. The limiting airspeed with the cruise droop extended is____________IAS?

33. What are the operating pressures and limits of the:
    a. PC-1 System________lb________lb.
    b. PC-2 System________lb________lb.
    c. Utility System________lb________lb.
    d. Emergency PC System________lb________lb.
34. Maximum allowable temperature during ground starting is____________?
    For what period of time?____________
35. What speed restrictions must be observed with a loss of the roll stab system? (Landing Configuration)
36. What speed restriction must be observed with loss of stabilization? (Clean configuration)

*37. What is the maximum allowable rolling pullout "G" load?____________

38. What are the limiting airspeeds for actuation of the following:

a. Landing gear________

b. Wing________

c. Wing lock________

d. Marquardt________

*e. Landing droop________

f. Canopy________

*39. What is the maximum allowable airspeed (IMN) at:

a. SL to 10,000 feet________?

b. 25,000 feet________?

c. 35,000 feet________?

d. 45,000 feet________?

*40. What is the maximum allowable symmetrical "G" load at:

a. 30,000 feet________?

b. 40,000 feet________?

c. 50,000 feet________?

*41. What is the negative "G" load limit of the airplane________?

*42. Rolls in excess of________degrees are prohibited.

43. What are the limits of the acceleration range in the landing configuration?

*44. What are the acceleration and airspeed limitations with the landing droop extended________?

45. The normal oil pressure range is________psi to ________psi.

46. Give the maximum gross landing weights and operating weights for the following situations?

a. Field takeoff________

b. Field landing________

c. Catapulting________

d. Arresting________

47. The permissible acceleration range and speed range with the inflight refueling probe extended is________to________"G" and________IAS.

48. What rectriction is placed on continuous negative "G" operation?

*49. Give the following engine speeds:

a. Absolute maximum RPM________

b. Normal RPM at standard day temperature ________

c. Sea level idle RPM________

*50. Temperature limits for maximum thrust and military thrust are:

a. Above 30,000 feet MAXIMUM________ MILITARY________

b. Below 30,000 feet MAXIMUM________ MILITARY________

51. At airspeeds 1.50 IMN or 600 knots IAS what thrust setting should be maintained and why?

52. The minimum oil pressure at idle RPM is ________?

53. What are the RPM and temperature limits for maximum continuous engine operations?

54. What are the EGT and oil pressure limits for zoom climbs above 50,000 feet?

*55. List the fundamental steps for obtaining an airstart under the following conditions. The flameout has just been experienced and was other than pilot induced. Engine windmill RPM too low to sustain main generator operation and altitude may not permit more than one attempt.

56. What constitutes an oil system failure?

57. What is the proper procedure for handling an oil system failure including an approach to a field?

*58. Approximately how long will the engine continue to produce thrust at its established setting, at sea level, after placing the engine master switch to "OFF"? From________seconds at idle power to________seconds at MRT.

59. Why is it more desirable to leave the Emergency Generator Switch in the "ON" position during an attempted airstart even though a given F-8 provides current for ignition in "LAND"?

60. What instrument provides the most rapid indication of an airstart taking place?

61. Illumination of the engine fuel pump light means?

62. Aircraft fuel boost pump failure will likely cause a flameout when using a high power setting above ________feet?

63. How soon should ignition occur during an airstart?

64. The engine should accelerate to idle speed within ________seconds after________during an airstart.

65. After selecting "MANUAL" fuel control, a complete electrical failure is experienced. The fuel control will automatically return to "NORMAL" until electrical power is regained? True________ False________

66. If afterburning continues after the throttle is moved inboard, how may it be secured otherwise?

67. Outline the procedures to be followed upon illumination of the FIRE warning light while airborne, with and without a wingman.

68. The cockpit pressurization switch also controls wing fuel cell pressurization? True__________ False__________

69. If oxygen contamination is suspected, one need only pull the "GREEN APPLE" to utilize bailout oxygen. True__________ False__________

70. Describe the procedure for executing a "No Nose Gear" field landing, with and without arresting gear.

71. Describe the procedure for executing a field landing with one main gear retracted, with or without arresting gear.

72. Aerodynamic braking should be used to the utmost after a wing down field landing where no arresting gear is available. True__________ False__________

73. What is peculiar to a bolter after an attempted wing down carrier landing?

74. Describe the most desirable cockpit emergency egress procedure.

75. List the steps in normal ejection.

76. If the canopy does not jettison when the face curtain is pulled the pilot should then__________?

77. Describe the bailout procedure.

78. Why is it not advisable to roll inverted and fall or drop out of the cockpit vice the recommended bailout method?

79. What is the minimum/maximum airspeed in gliding flight which will permit an effective (altitude gain) power off pullup?

80. Illumination of the engine fuel pump light may be an indication of a fuel control malfunction. True__________ False__________

81. What is the minimum airspeed at which the RAT can be expected to supply both electrical power and power control hydraulic pressure?

82. Outline the procedure for switching to manual fuel control in flight.

83. If the engine fuel pump light comes on in flight and the engine continues to function normally, the likely cause is__________.

84. If the RAT is extended with the Emergency Generator Switch in the "ON" position what must the pilot do to regain proper RAT electrical power?

85. While performing a supersonic dash at 38,000 feet a generator failure is experienced. Outline the procedure for combating the situation and describe the approach and landing if abnormal.

86. If electrical power is being supplied by the RAT, the landing gear may be retracted only if the Emergency Generator Switch is in the "ON" position. True__________ False__________

87. Outline the procedure for extending the landing gear and raising the wing after experiencing a utility hydraulic failure.

*88. If a main landing gear is extended but indicates barberpoled, actuating the emergency pneumatic system is desirable. True__________ False__________

89. The wing should not be raised if the landing droop cannot be extended pneumatically with a utility failure. True__________ False__________

90. When, if at all, should the RAT be extended after experiencing loss of PC-1?

91. A__________% loss of range should be anticipated with the RAT extended.

92. What is the minimum airspeed for adequate hydraulic pressure from the RAT with no electrical load?

93. When Emergency Pitch Trim is in use there will be only__________degrees of automatic retrim when the wing is raised.

*94. List the steps for stall and spin recovery, include spin recognition and recovery recognition.

*95. When should a precautionary type approach be made?

96. What can the pilot do to close the exhaust nozzle if he has determined it has stuck open when afterburner was deselected?

97. What general steps should be taken to correct continuous compressor stalls in flight?

*98. If a nose gear steering malfunction is known to exist and the nose gear is observed cocked well off to one side, the pilot should execute an arrested landing as first recourse. True__________ False__________

*99. During a high speed (0.92 IMN) descent the aircraft commences a tail wagging oscillation which is apparently increasing in intensity. How should this be combated?

*100. What is the desired fuel flow for an airstart?

101. Describe the precautionary landing pattern.

102. After experiencing smoke in the cockpit a pilot elects to dump cockpit pressure by use of the emergency RAM air vent. During a subsequent letdown he encounters icing and his airspeed

indicator fails. Undaunted he switches to his angle-of-attack instruments and continues his approach. He dirties up and he picks up the "Donut" (A/AO). At the top of the glide slope the plane yaws violently and enters a spin. What happened?

103. Serious wheel overheating problems arise after an aborted takeoff or from stopping after a normal landing. Why does the tire/wheel failure not occur until 15 to 20 minutes later?

*104. Explain the landing procedures required for both ship and shore for the following conditions.

a. Main gear tire blown:

(1) SHORE
(2) SHIP

b. One main wheel missing — strut intact:

(1) SHORE
(2) SHIP

c. Nose gear up or trailing:

(1) SHIP
(2) SHORE

d. One main gear up or missing:

(1) SHIP
(2) SHORE

e. All gear up:

(1) SHIP
(2) SHORE

*105. List the preparations, configuration, final speed, fuel weight and roll out procedures for a field wing down landing.

*106. During a carrier landing both main landing gears are lost. What action is required?

*Indicates critical questions.

OPEN BOOK

1. Give maximum range speed (IMN) for the following altitudes:

10,000______ 15,000______ 25,000______

35,000______ 45,000______

2. Give maximum endurance speeds (IMN and CAS) for the following altitudes:

	IMN	CAS
SL		
15,000	______	______
20,000	______	______
30,000	______	______
40,000	______	______

3. Complete the following range and endurance computations:

	(1)	(2)	(3)	(4)	(5)
Altitude	10,000	20,000	35,000	SL	SL
Fuel Remaining (pounds)	____	____	____	____	____
Range this altitude	____	____	____	____	____
Range at optimum altitude	____	____	____	____	____
Endurance at this altitude	____	____	____	____	____
Endurance optimum altitude	____	____	____	____	____
Optimum altitude for range	____	____	____	____	____
Optimum altitude for endurance	____	____	____	____	____

4. Solve the following maximum range problem

Given: Aircraft configuration________, and flight altitude of 30,000.

Find: Flight Mach No. ________

Specific Range ________

True Airspeed ________

Fuel Flow ________

Distance and duration w/3700 lb fuel ______ ______

Fuel required and duration for 50 nmi ______ ______

5. Combat Radius Problem.

Given: The distance to a combat area is 370 nmi. Climb using MRT power under standard conditions. Cruise out and back at maximum range altitude and airspeed. Wind conditions are 45 knots headwind on cruise out and 60 knots tailwind on cruise back. Use no wind for climb and descent. Fuel is full load of JP-5 at 6.8 lb per gallon. Allow 2,500 lb for combat and 250 lb for start and taxi.

Find: Using configuration__________or Standard (photo) find the fuel, distance, time and flight speeds for the flight phases as depicted in the chart below.

6. Combat operations at military thrust? (Use planning data in Supplement Flight Manuals)

Mach No.	*Altitude*	*Time*	*Fuel*
0.90	45,000	______	1,600 lb
0.96	______	24.5 min	2,000 lb
0.80	10,000	______	2,500 lb
0.85	30,000	5.5 min	______

SOLUTION TO COMBAT RADIUS PROBLEM

PHASE	*Config.*	*Alt.*	*Temp.*	*Fuel*	*Fuel Remaining*	*Distance*	*Time*	*Mach No. or CAS*	*TAS*	*Wind*	*GS*
Start Taxi	B (Stand)										
Climb (MRT)	B ( )										
Cruise Out	B ( )										
Combat and Climb	B ( )										
Cruise Back	C										
Descent	C										

7. Combat operations at maximum thrust? (Use planning data in Supplement Flight Manuals)

Mach No.	*Altitude*	*Time*	*Fuel*
0.75	30,000	______	1,500 lb
1.3	30,000	7 min	______
1.05	50,000	______	2,000 lb
1.4	45,000	10.5 min	______

8. Combat radium MRT climb? (Use planning data in Supplement Flight Manuals)

Cruise Out Altitude	*Distance*	*Combat Fuel*
______	450 nmi	2,000 lb
40,000	470 nmi	______
35,000	______	1,000 lb
30,000	370 nmi	______

9. Fighter mission combat radius: (Use planning data in Supplement Flight Manuals)

Given	*Find*
Combat area 400 nmi from base of operations	Fuel
Average MRT combat time of 8 minutes at 40,000 feet and 0.94 IMN	Distance Time
5 minutes at CRT at an average altitude of 35,000 feet, flight speed of 1.2 IMN	Flight speed
Standard day with full load of JP-5 fuel, weight — 6.8 pounds per gallon	(factors as required in chart in question 5)

10. A pitch-up maneuver to attack a high altitude target should use________altitude for optimum performance.

11. On a zoom climb, the droop should be extended at________speed.

12. There are five major factors that determine the envelope of a Sidewinder. What are they?

13. The forward gun vent door on the starboard side failed to open when firing the guns. What limitations are automatically imposed upon gun firing?

14. When speed is increased from 1.0 IMN to 1.7 IMN at a constant altitude, what is the percentage increase in fuel flow?

15. With the landing gear handle in the *up* position, explain the missile jettison sequence. Which bus supplies the power? What is the state of the missile after firing?

16. The sight unit gyro is automatically caged when the armament selector switch is in which position or positions?

17. On a combat mission you lose your generator and subsequently utilize the emergency power package. You are now faced with a substantial loss of effective range and what portion of your armament system?

18. The Mk 12 20mm gun fires at the approximate rate of________rounds per minute.

19. Why is it not advisable to recharge the guns after an apparent jam?

20. Both ac and dc current are necessary to fire the guns. True________False________

21. Is it possible to jettison the missile after a generator failure and subsequent emergency power package operation?

22. Must the master arm switch be *on* to jettison the missiles?

23. The master arm switch must be placed in on at least________before firing the guns to allow the gun control interlock to warm up and deliver firing voltage.

24. The disturbed line of sight system used in the F-8 is designed to solve all factors of the lead-angle problem except trajectory shift. True________ False________

25. The inside dimension of the gyro pipper is________mils.

26. The average wing span of the MIG-15, 17, 19 is 32 feet. At a range of________feet, ½ the wing span of a MIG-15, 17, 19 will fill the inside dimension of the gyro pipper.

27. Insofar as lead-angle solution is concerned, the radar unit furnishes________and________ information to the fire control system.

* * * * *

Items 28, 29, and 30 assume a fixed range dial setting of 1,500 feet, a bias range setting of 900 feet, and a breakaway setting of 600 feet on the range unit.

28. With radar in search, the lead-angle solution is theoretically correct at a range of________feet.

29. Assuming a closure rate of 450 feet per second on the target with radar locked on and range toggle switch in "radar," the prealert (400 cycle) tone should come on at________feet. Firing (1,200 cycle) tone will be heard at________feet and breakaway tone at________feet.

30. After prealert tone is sounded, the gyro pipper will move (toward?) (away from?) the fixed pipper as the range decreases. (Assuming constant G run).

31. For co-speed condition of firing *below* approximately 40,000 feet, S/W maximum range is a function of________.

32. For co-speed condition of firing *above* approximately 40,000 feet, S/W maximum range is a function of________.

33. If you have a positive rate of closure over the target, both minimum maximum firing ranges will decrease. True________False________

34. List the conditions that must be met prior to firing a Sidewinder.

35. Define the following:

    CAP

    DADCAP

    RESCAP

    TAPCAP

    LOCAP

    BARCAP

36. After having been trapped and signaled that you are going down No. 1 elevator, at what point do you open the canopy and remove your helmet?

37. What is the catapult officer's signal to light the burner?

38. On the cat and after turnup, what is the correct "I am down" signal for both day and night?

39. What is the correct pilot procedure after receiving the burner signal from the cat officer? (List the three steps.)

40. What is minimum altitude for lowering the wing after a night cat shot?

41. What is the minimum altitude for switching lights to bright and flashing after a night cat shot?

42. The proper numerical angle-of-attack setting for an F-8 carrier approach is__________units.

43. How many degrees of nose-up attitude are set on the gyro-horizon immediately after a night cat shot?

44. Nosegear steering should not be used in taxiing out of the ship's arresting gear until forward motion is established. Why not?

45. What lights are *off* for a night carrier approach?

46. Following a night shipboard arrestment, at what point are all exterior lights turned off?

47. If the nose gear fails to retract after a catapult shot, return the handle to *wheels down.* What is the probable cause and how is it rectified?

48. A cross check of airspeed and angle of attack should be made at the 180° position to ensure that they coincide. True________False________

49. Give the correct procedure for a carrier wing-down landing.

50. Barricade engagements resulting from a wing-down condition alone are not required or recommended. True__________False__________

51. Should a wing-down landing with the leading edge in the landing droop position be attempted?

52. The F-8 may be completely refueled by using the inflight refueling probe. True________False________

53. Proper operation of the probe switch is: Just prior to the initial run, the probe shall be extended and the switch left in the________position. Upon completion of the runs after the probe is retracted hold the switch in the________position for 5 seconds after door light goes out to ensure that the probe door locks.

54. The prefueling check performed airborne includes placing the fuel transfer switch in the pressure dump position to ensure that transfer ceases immediately. True________False________

55. When ready for air refueling, placing the probe switch to__________position will also stop fuel transfer.

56. In the event the refueling probe will not retract when switch is placed in the *in* position, it will be necessary to place the switch in__________position to begin fuel transfer.

57. To minimize drogue and receiver control problems, it is recommended that the receiver pilot maintain a closure rate of________to________knots.

58. On a number of occasions the drogue has struck and broken the canopy of the receiver aircraft. For this reason, aerial refueling is conducted with the helmet visor__________.

59. Continuous negative *G* flight is limited to______seconds.

60. The oil cooler door automatically opens at______IMN.

61. Describe the function of the oil cooler door switch.

62. The first indication of an air start is usually noted on the______________.

63. During static ground conditions, engine acceleration for idle to *military* should be accomplished within______________.

64. During military thrust check before takeoff, the ______________provides the most reliable indication of proper engine operation.

65. What mil specification engine oil is used in the J57 engine?

66. Over filling of the engine oil system may result in______________and______________.

67. What is the capacity of the engine oil tank?

68. What is the rated thrust of the basic engine? With A/B?

69. The tachometer records______________rpm.

70. Maximum rpm is__________%.

71. Operating in manual fuel control, to what altitude will altitude compensation be provided?

72. For takeoff and ground operation, A/B is limited to______________minutes.

73. When the engine fuel pump warning light is on, engine operation is restricted to______________.

74. The inflight refueling probe switch must be______to take on fuel during aerial refueling.

75. The indication of a fuel transfer shutoff failure is______________.

76. The fuel pump warning light in the cockpit indicates______________________.

77. How is wing fuel transferred?

78. How many fuel booster pumps work on the power package extension electrical power?

79. How may the engine fuel shutoff valve be opened or closed without electrical power?

80. During fuel transfer in flight, the main fuel quantity indicator will normally read between______ and______pounds.

81. How does the cabin pressure switch effect the aircraft fuel system?

82. Utility hydraulic system provides hydraulic power for the operation of what systems?

83. Utility hydraulic pressure may surge to________ pressure when actuating any of the systems.

84. How are hydraulic failures indicated to the pilot?

85. Roll stabilization operates off of what hydraulic system?

86. Yaw stabilization operates off of what hydraulic system?

87. In the event of hydraulic failure, what system is regained by deploying the ram air turbine, assuming no fluid has been lost?

88. Will the low hydraulic pressure warning light go off when the ram air turbine is supplying hydraulic pressure to the PC-1 system?

89. What are the maximum deflections of the aileron and unit horizontal tail that can be obtained by the pilot?

90. What is the maximum deflection of the rudders that can be obtained by the pilot?

91. With the ram air turbine supplying hydraulic pressure to PC-1, what position should the roll stabilization switch be in prior to switching the generator to the land position? Why?

92. With loss of either PC-1 or PC-2, what action should be taken?

93. Can the tail hook be lowered with a utility hydraulic failure?

94. Roll stabilization signals are automatically initiated by____________ ________________ ______________.

95. Yaw stabilization and stiffening signals are initiated by______________________________.

96. With the emergency power package extended, in order to prevent energizing a malfunctioning system, the roll stabilization switch should be placed in the *off* position before the emergency generator switch is placed in land. True__________ False______________ Why?

97. The yaw_____________moves the rudder power control cylinder linkage to reposition the rudder in the direction required to_______________the aircraft or provide yaw_________________and ______________________.

98. In the clean condition, the yaw_______ _______ ______________modifies signals from the accelerometer as altitude changes. Gain is__________ in the landing condition.

99. When is the rudder aileron interconnector actuated?

100. The______ __________________potentiometer initiates signals to the amplifier for rudder aileron interconnect actuation.

101. Does movement of the three trim knobs displace the control stick?

102. Roll trim and damping operate from what electrical bus?

103. Yaw trim and damping operate from what electrical bus?

104. In the event of pitch trim failure, what emergency method may be used to regain pitch trim?

105. What is the maximum speed restrictions with no yaw stab? Roll stab?

106. The V in the window of the generator control panel indicates___________power is connected to the____________bus(es).

107. The *off* flag in the window of the gyro horizon indicates____________power is not connected to the____________bus, or that_____________ has failed.

108. A *barberpole* in the window of the generator control panel indicates that_____________power is not connected to the_____________bus(es) or that_________________has failed.

109. Placing the emergency generator switch in the on position supplies power to the______________and ______________buses (with RAT extended).

110. Placing the emergency generator switch in the land position supplies power to the__________ and___________buses (with RAT extended).

111. The emergency power indicator light on the generator control panel shows that_______________ ______________________________________.
It will be illuminated with the emergency generator switch in the following positions________ ___________only, ___________, ___________, (with RAT extended).

112. Name the buses Emergency, Primary, or Secondary which supply the power for the operation of the following:

(1) Fire control system ______

(2) Transfer fuel pump(s) ______

(3) Roll trim and stabilization ______

(4) IFF ______

(5) Yaw trim and stabilization ______

(6) ARA-25 ______

(7) Engine master switch ______

(8) Wing fuel dump ______

(9) Main fuel quantity ______

(10) Oil cooler door ______

(11) Tacan ______

(12) Missile jettison ______

(13) Tail hook retraction ______

(14) Fuel flow ______

(15) Gyro Horizon ______

(16) Engine ignition and timer ______

(17) A/B electrical operation ______

(18) In-flight refueling capability ______

(19) Wing pressurization ______

(20) Fire detection ______

113. Name the 10 cockpit instruments which will remain operative with no electrical power

(1) ______ (2) ______ (3) ______

(4) ______ (5) ______ (6) ______

(7) ______ (8) ______ (9) ______

(10) ______

114. Actuation of the following controls will produce normal results with no electrical power (up and down, on and off).

	True	*False*
(1) Landing gear handle	______	______
(2) Wing-fold actuating lever	______	______
(3) Hook handle	______	______
(4) Wing incidence handle	______	______
(5) Cockpit pressure and dump switch	______	______
(6) Defog control switch	______	______
(7) Cruise droop switch	______	______
(8) Pressure suit vent control	______	______
(9) G suit control	______	______
(10) Changing preset UHF frequency	______	______

115. When operating on emergency electrical power, what steps must be taken to illuminate external aircraft lights?

116. Explain what occurs when the canopy actuator cartridge fires.

117. Immediately after ejection, the ______ drogue withdraws the ______ drogue.

118. Explain the function of the timed release mechanism.

119. Explain the function of the barometric altitude limiter. What does it activate?

120. Ejection at airspeeds from stalling to ______ results in relatively minor forces exerted on the body.

121. With loss of power from 180° position to landing, would a pull-up prior to ejection be effective?

122. At 175 knots on takeoff and wing-up, you experience a complete power failure. Would a pull-up prior to ejection be effective?

123. On an ejection attempt the canopy fails to jettison. What steps are now necessary to eject?

124. If ejection is not possible, what is the correct bail-out procedure?

125. What are the necessary procedures if the automatic ejection functions do not occur by 10,000 feet?

126. The capacity of the aircraft's LOX system is ______ ______.

127. At what system capacity does the low level warning light illuminate?

128. If it becomes desirable to decrease oxygen consumption, what action is required?

129. If contamination is suspected in the main LOX System, what action should be taken? Why?

130. How is the LOX System capacity checked?

131. What is the relationship between the collapsed B, steering circle, and fine steering dot with respect to target azimuth and elevation?

132. Describe the range rate gap in the steering circle. What speeds are represented by the clock code? What is the difference between clockwise and counterclockwise rotation of the range rate gap?

133. Describe the probable AAS-15 detection cone for a non-afterburning shielded-tailpipe target? An afterburning target?

134. What three indications are necessary to validate an IR lock-on?

135. Define the antenna tilt "thumb rule" for target detection with respect to target distance and relative altitude differential?

136. Describe the calibrated vertical that extends from the steering circle. What does its length represent? What are the two cases in which a successful pitch-up can be made? What maneuvering is allowed for when the calibrated vertical just reaches the gap in the artificial horizon bar? What maneuvering techniques will increase the length of the calibrated vertical?

137. IR controls are parallel to radar controls in operation, what does the radar gain control become? What does the radar B contrast control become? Why is it necessary to retune these controls when switching back and forth between IR and Radar modes of operation?

138. Describe the method to establish pilot commanded lead with the deviated pursuit computer. What parameters are necessary to establish automatic lead? What are teh leads generated and what happens at missile maximum range plus two miles for the following?

    a. Sidewinder 1A (AIM-9B)

    b. Sidewinder IRAH (AIM-9D)

    c. Unshadowed Sidewinder SARAH (AIM-9C)

    d. Shadowed Sidewinder SARAH (AIM-9C)

139. What does the deviated pursuit computer automatically do for Sidewinders AIM-9C and AIM-9D for high closure rate fuzing? What is the closure rate that the fuzing change over occurs?

140. What are the altitude line firing limitations on the AIM-9C SARAH missile?

141. What two cases will cause the collapsed B to be separated from the steering circle?

142. The HOJ mode of Radar operation enables the antenna to track what type jamming sources while the Radar remains in a passive mode?

NATOPS EVALUATION FORMS

In addition to the NATOPS Evaluation Report (figure 10–1), a NATOPS Flight Evaluation Worksheet is/are provided for use by the Evaluator/Instructor during the evaluation flight. All of the flight areas and subareas are listed on the worksheet with space allowed for related notes.

NATOPS EVALUATION REPORT FORM

NATOPS EVALUATION REPORT
OPNAV FORM 3510-8 (8-65) 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	GRADE CQ	GRADE U
OPEN BOOK EXAMINATION				
CLOSED BOOK EXAMINATION				
ORAL EXAMINATION				
*EVALUATION FLIGHT				

FLIGHT DURATION	AIRCRAFT BUNO.	OVERALL FINAL GRADE

REMARKS OF 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).

AX-157-3-67

Figure 10-1

section XI
performance data

Refer to Supplemental NATOPS Flight Manual

INDEX

(Bold-Faced Type Denotes Illustration)

(Bold-Faced Type Denotes Illustration)

F

(Bold-Faced Type Denotes Illustration)

(Bold-Faced Type Denotes Illustration)

(Bold-Faced Type Denotes Illustration)

(Bold-Faced Type Denotes Illustration)

(Bold-Faced Type Denotes Illustration)

(Bold-Faced Type Denotes Illustration)

U

V

W

Y

(Bold-Faced Type Denotes Illustration)

★U.S. GOVERNMENT PRINTING OFFICE: 1967—302-278/Z-185