

NAVAER 01-45HHA-501

Flight Handbook

NAVY MODEL

F8U-1

AIRCRAFT

(BuNo. 141351 and Subsequent)

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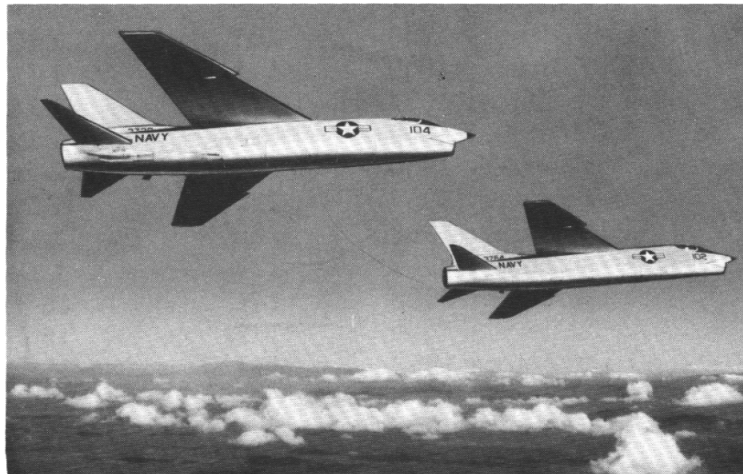
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1 September 1958
Revised 15 February 1959

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IMPORTANT:

TO GAIN THE MAXIMUM BENEFIT
FROM THIS HANDBOOK BE SURE
TO READ THE FOREWORD CAREFULLY

Now Read This!

FOREWORD

This handbook and its Confidential Supplement (NAVAER 01-45HHA-501A) contain all the information necessary for safe, efficient, and effective operation of the F8U-1 airplane. The information is based on engineering data and the results of extensive flight test programs. The instructions are designed to provide you with a general knowledge of the airplane, its flight characteristics, and specific normal and emergency procedures. The book provides the best possible operating instructions under *most* circumstances. Your flying experience and familiarity with these instructions will enable you to exercise sound judgment when multiple emergencies, adverse weather conditions, or other unpredictable circumstances arise.

Note

Information in this handbook and its Confidential Supplement (NAVAER 01-45HHA-501A) will be kept current by regular revisions. Since the incorporation of material by regular revision requires a certain amount of time, changes affecting safety of flight will be dispatched to you immediately in the form of "Interim Revision Sheets," or in the form of regular Navy Messages. The Interim Revision Sheets are to be placed at the front of your copy of the handbook and removed only when the Interim Revision Summary indicates that the information has been incorporated in the main body of the handbook during a regular revision.

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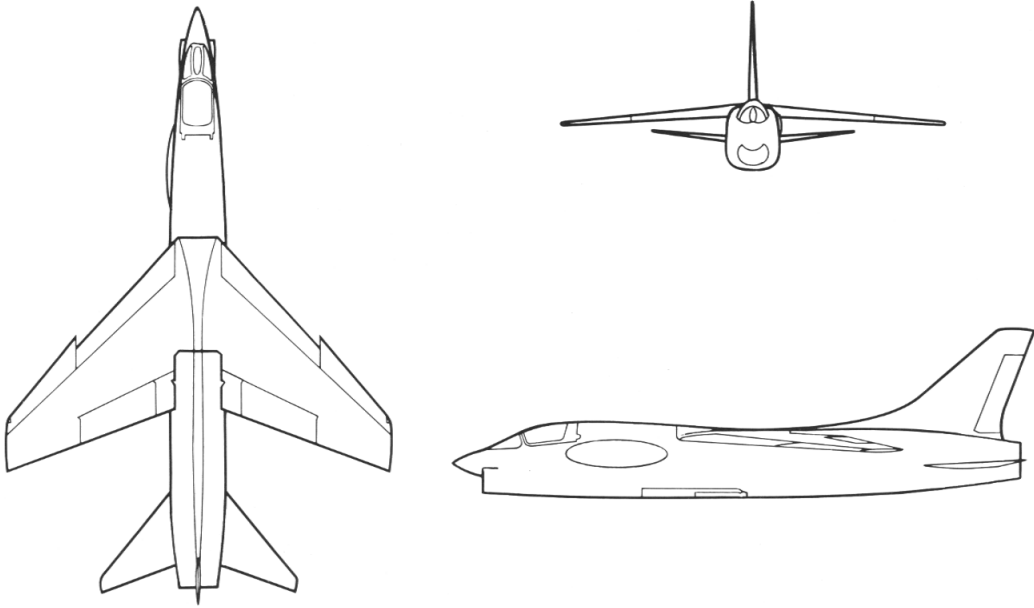
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**APPENDIX I
OPERATING DATA CHARTS**

(Refer to F8U-1 Supplemental Flight Handbook)

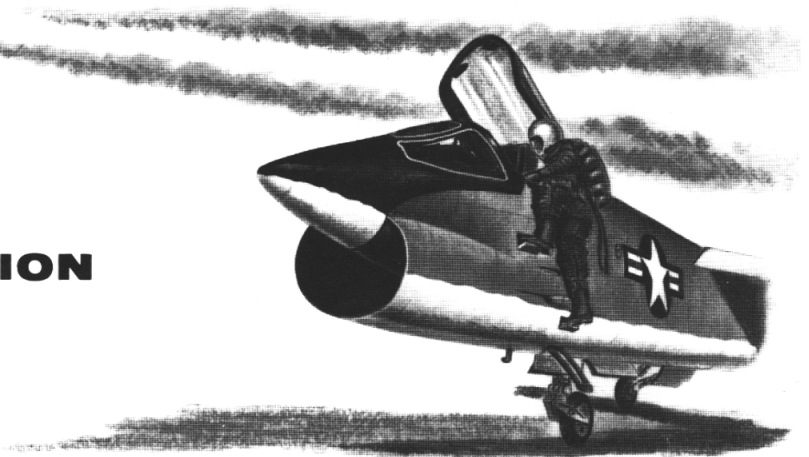


THE F8U-1 CRUSADER



Figure No. 1 - 1. F8U-1 Airplane

SECTION I
DESCRIPTION



INTRODUCTION

This section, under separate headings, states the function, lists the equipment of interest (including the controls and indicators), and describes the operation of each system (or component) that contributes directly to the physical act of flying the F8U-1 airplane. Nothing in this section should be construed as procedures for operating the airplane or any of its systems. For this reason, "caution" and "warning" notices are not included in this section; they are applicable only to procedures and are inserted in procedural sections (II and III) as required.

THE AIRPLANE

FUNCTION

The F8U-1 "Crusader" is a single-place, carrier- or land-based, high-performance, supersonic day fighter.

This airplane (figures 1-1 and 1-2) is identified by a thin, high, sweptback, 2-position variable-incidence wing and a long, slender fuselage with an underslung nose air intake duct. The wing is raised only for take-offs and landings. The wing contains an integral fuel tank and incorporates flaps, ailerons (which also serve as flaps when the wing is raised), and a full-span leading edge droop feature. The entire horizontal tail moves as a flight control surface. The single large speed brake is mounted on the fuselage underside. All major electrical and electronic components are packaged as plug-in units for simplicity of access, removal, and installation.

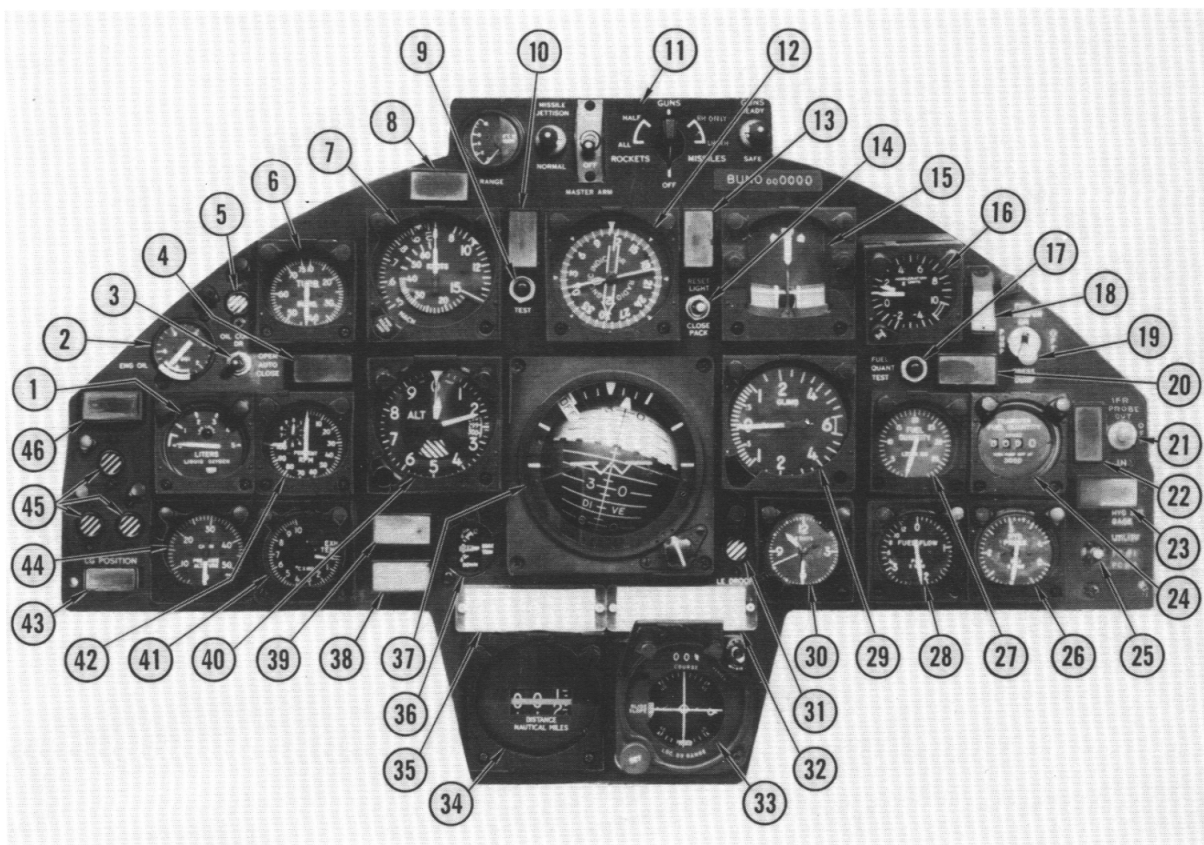
"Crusader" airplanes BuNo. 143702 and subsequent are distinguished by a bulged inflight refueling compartment on the left side of the fuselage just aft of the cockpit. These airplanes are also equipped for launching Sidewinder missiles.

The principal dimensions are:

- Wing span35 feet 8 inches
- Length (overall, static ground position)55 feet 3.2 inches
- Height* (overall, static ground position)15 feet 9.1 inches
- Width (overall, wings folded)22 feet 6 inches

*Overall static ground position height of airplane with wings folded does not exceed that of airplane with wings spread.

INSTRUMENT BOARD



- | | | |
|------------------------------------------------------------------------------|-----------------------------------------|--------------------------------------------|
| 1. LIQUID OXYGEN Gage | 16. Accelerometer | 32. Compass Correction Card |
| 2. ENG OIL Pressure Indicator | 17. FUEL QUANT TEST Switch | 33. COURSE Indicator |
| 3. OIL COOL DR Switch | 18. FUEL DUMP Switch | 34. Range Indicator |
| 4. Fuel Pump Warning Light | 19. FUEL TRANSFER Switch | 35. Airspeed Correction Card. |
| 5. OIL COOL DR Indicator | 20. Transfer Pump Warning Light | 36. NOSE TRIM Indicator |
| 6. TURB Outlet Pressure Indicator
or Engine PRESSURE
RATIO Indicator * | 21. IFR PROBE Switch | 37. Attitude Indicator |
| 7. Airspeed - Mach Number
Indicator | 22. IFR PROBE Light | 38. Neutral Trim Light |
| 8. Radar Tracking Light | 23. Hydraulic Pressure Warning
Light | 39. Wing Position Light |
| 9. Fire Warning Test Switch | 24. Transfer FUEL QUANTITY
Indicator | 40. Altimeter |
| 10. Fire Warning Light | 25. HYD SYS GAGE Switch | 41. EXH TEMP Indicator |
| 11. Armament Panel | 26. HYD PRESS Gage | 42. Tachometer |
| 12. RADIO MAGNETIC
INDICATOR | 27. Main FUEL QUANTITY
Indicator | 43. Oxygen Low Pressure Warning
Light * |
| 13. Rocket Pack Fire Light | 28. FUEL FLOW Indicator | 44. CABIN PRESSURE
ALTITUDE Indicator † |
| 14. Rocket Pack Fire Light Switch | 29. Rate-of-climb Indicator | 45. LG POSITION Indicators ‡ |
| 15. Turn-and-Bank Indicator | 30. Clock | 46. Speed Brake Light † |
| | 31. LE DROOP Indicator | |

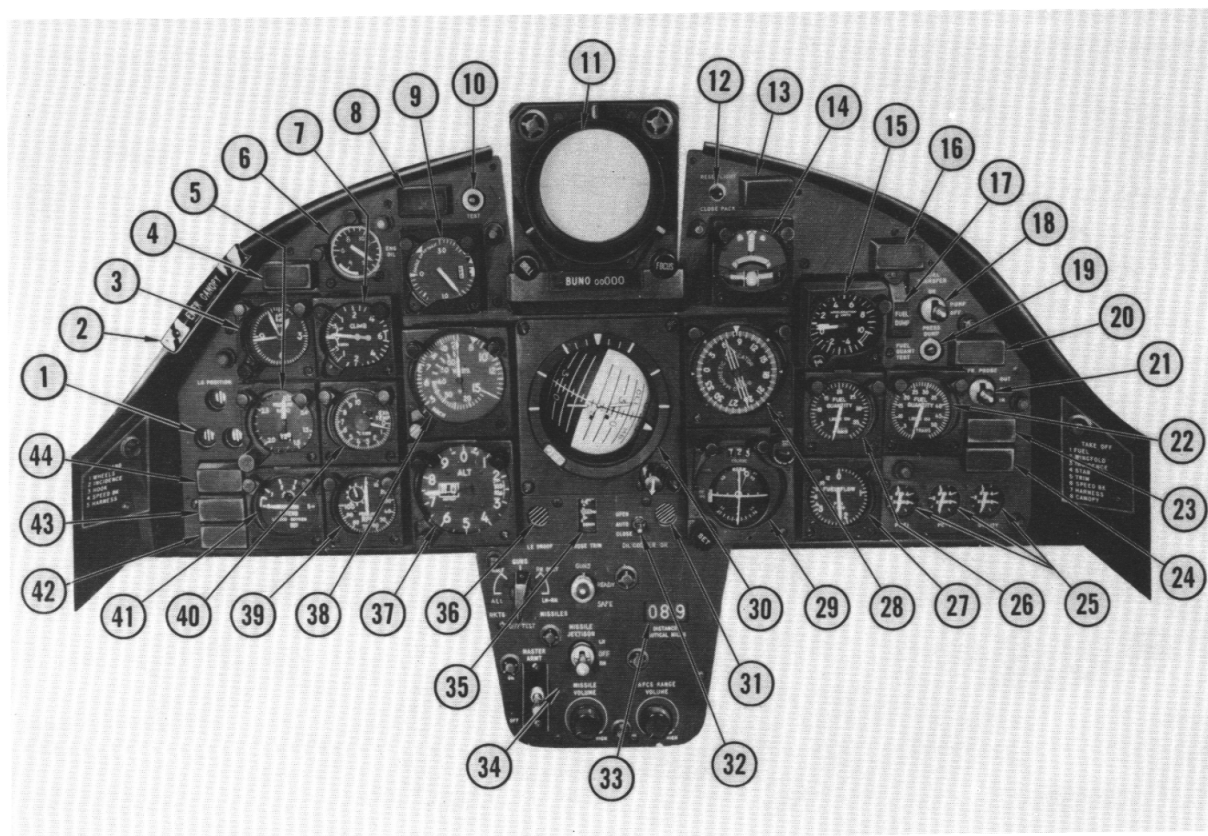
* Some Airplanes (refer to text)

† On right-hand console in some airplanes

‡ On left-hand console in some airplanes

Figure No. 1-3. Instrument Board — Airplanes through BuNo. 145315

INSTRUMENT BOARD

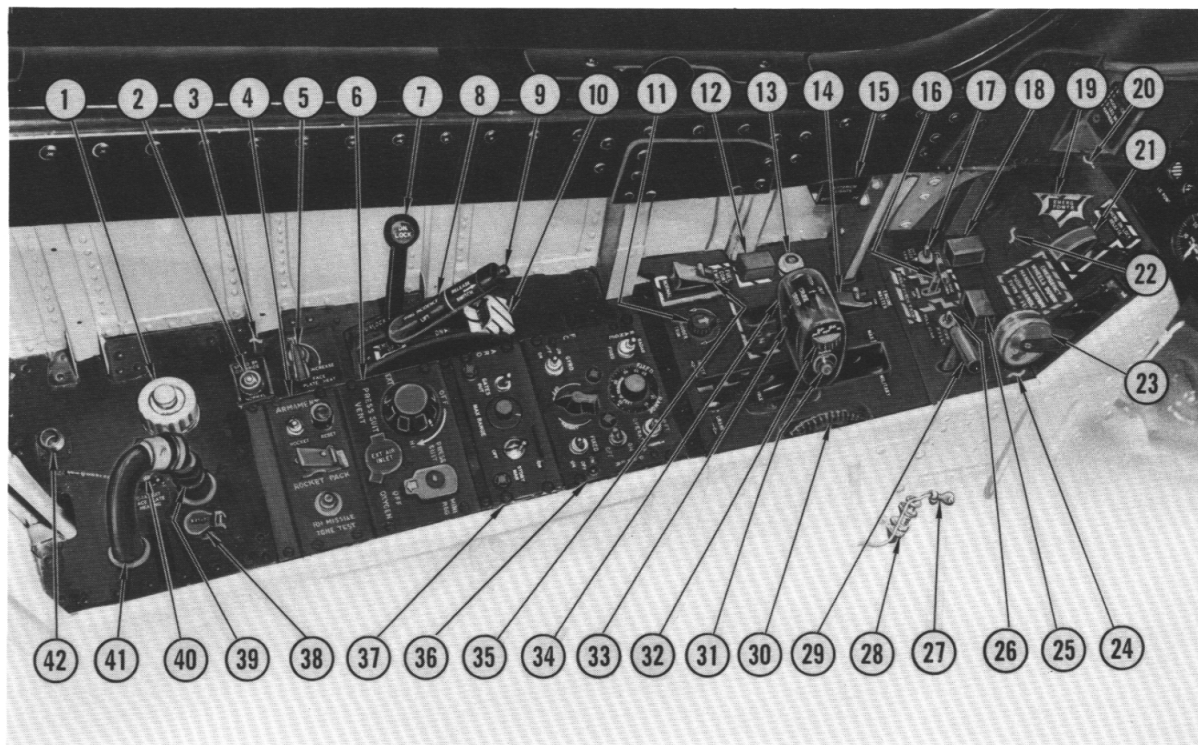


- | | |
|--------------------------------------|---------------------------------------|
| 1. LG POSITION Indicators | 23. IFR Probe Light |
| 2. EMER CANOPY Jettison Handle | 24. Hydraulic Pressure Warning Light |
| 3. Clock | 25. Hydraulic Pressure Gages |
| 4. Fuel Pump Warning Light | 26. Main FUEL QUANTITY Indicator |
| 5. Engine PRESSURE RATIO Indicator | 27. FUEL FLOW Indicator |
| 6. ENG OIL Pressure Indicator | 28. RADIO MAGNETIC INDICATOR |
| 7. Rate-of-Climb Indicator | 29. COURSE Indicator |
| 8. Fire Warning Light | 30. Attitude Indicator |
| 9. Angle-of-Attack Indicator | 31. OIL COOLER DR Indicator |
| 10. Fire Warning Test Switch | 32. OIL COOLER DR Switch |
| 11. AN/APS-67 Radar Scope * | 33. Range Indicator |
| 12. Rocket Pack Fire Light Switch | 34. Armament Panel |
| 13. Rocket Pack Fire Light | 35. NOSE TRIM Indicator |
| 14. Turn-and-Bank Indicator | 36. LE DROOP Indicator |
| 15. Accelerometer Indicator | 37. Altimeter |
| 16. Fuel Low-Level Warning Light | 38. Airspeed-Mach Number Indicator |
| 17. FUEL DUMP Switch | 39. Tachometer |
| 18. FUEL TRANSFER Switch | 40. EXH TEMP Indicator |
| 19. FUEL QUANT TEST Switch | 41. LIQUID OXYGEN Gage |
| 20. Transfer Pump Warning Light | 42. Oxygen Low Pressure Warning Light |
| 21. IFR PROBE Switch | 43. Speed Brake Light |
| 22. Transfer FUEL QUANTITY Indicator | 44. Wing Position Light |

*Airplanes with AN/AWG-3 Fire Control System (refer to text)

Figure No. 1-3A. Instrument Board — Airplanes BuNo. 145316 and Subsequent

LEFT-HAND CONSOLE



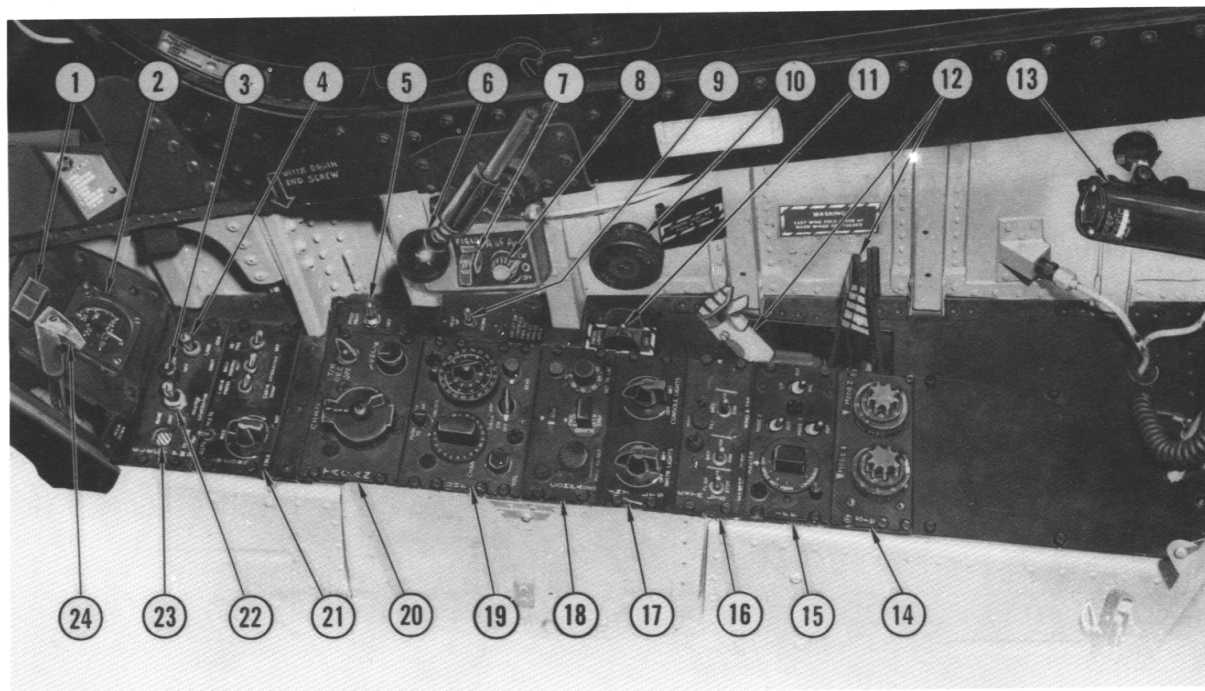
- | | |
|----------------------------------------|-------------------------------------------------------|
| 1. G VALVE | 23. Landing Gear Handle |
| 2. SPEED BRAKE Override Switch | 24. SPEED BRAKE Light† or ROCKET
PACK Switch* |
| 3. EMERG GEAR DOWN Handle* | 25. ROLL STAB Warning Light |
| 4. ARMAMENT Panel | 26. ROLL STAB Switch |
| 5. FACE PLATE HEAT Knob* | 27. Composite Quick-Disconnect Lanyard |
| 6. PRESS SUIT Panel | 28. EMERGENCY OXYGEN CABLE Clip |
| 7. DN LOCK Handle | 29. Throttle Catapult Handle |
| 8. WING INCIDENCE Handle | 30. Throttle Friction Wheel |
| 9. RELEASE SWITCH | 31. MIKE Switch |
| 10. EMERG DROOP & WING INC Guard | 32. Speed Brake Switch |
| 11. RUDDER TRIM Knob | 33. CRUISE DROOP Switch |
| 12. Fuel Control Light* | 34. Throttle |
| 13. EMERG BRAKE Handle | 35. FUEL CONT Switch |
| 14. ENGINE MASTER Switch | 36. Fire Control Panel |
| 15. EXTERIOR LIGHTS Switch | 37. Radar Control Panel |
| 16. EMERG PITCH TRIM Handle | 38. OXYGEN Receptacle and Communication
Connection |
| 17. YAW STAB Switch | 39. Antiblackout Line |
| 18. YAW STAB Warning Light | 40. FACE PLATE HEATING Receptacle* |
| 19. EMERG POWER Handle | 41. Antiblackout Fitting (pressure suit) |
| 20. EMERGENCY CANOPY JETTISON Handle * | 42. Dust Cover Stowage Fitting* |
| 21. Emergency Downlock Release Switch | |
| 22. Landing Gear Indicators* | |

*Some airplanes (refer to text).

†On instrument board in some airplanes.

Figure No. 1-4. Left-Hand Console

RIGHT-HAND CONSOLE



- | | |
|----------------------------------------|----------------------------------|
| 1. Neutral Trim Light † | 13. Emergency Spotlight |
| 2. CABIN PRESSURE ALTITUDE Indicator † | 14. Coder Group Panel |
| 3. Emergency Power Indicator Light | 15. IFF Panel |
| 4. EMER GEN Switch | 16. EXTR LTS Panel |
| 5. PITOT HEAT Switch | 17. INT LTS Panel |
| 6. Canopy Release Handle | 18. COMPASS Panel |
| 7. Approach Light HOOK BYPASS Switch* | 19. UHF Panel |
| 8. APPROACH INDEXER Dimming Knob* | 20. VHF NAV Panel or TACAN Panel |
| 9. SEAT Adjust Switch | 21. AIR COND Panel |
| 10. EMERG VENT AIR Knob | 22. MASTER GENERATOR Switch |
| 11. EMERG LIGHTS Switch | 23. DC PWR IND |
| 12. WINGFOLD Controls | 24. Arresting Gear Handle |

† On instrument board in some airplanes.

* Some airplanes (refer to text).

Figure No. 1-5. Right-Hand Console

ENGINE AND AFTERBURNER

EQUIPMENT OF INTEREST

J57-P-4 (JT3N) or J57-P-12 (interim) twin spool, axial flow gas turbine engine.
 Integral afterburner with two-position exhaust nozzle.
 Oil system and engine fuel system.
 Controls and indicators are listed in table 1-1.
 System operation details are discussed in section VII.

OPERATION.

ENGINE.

Thrust output is controlled by throttle positioning and regulated by automatic fuel metering functions of the fuel control unit for optimum engine operation.

AFTERBURNER. (See figure 1-6.)

Thrust output may be varied in the afterburner range and is controlled by throttle positioning in the afterburner detent. Exhaust nozzle flaps are automatically opened to increase engine exhaust nozzle area for afterburner operation. The flaps are closed when afterburner is not used.

AFTERBURNER EXHAUST NOZZLE

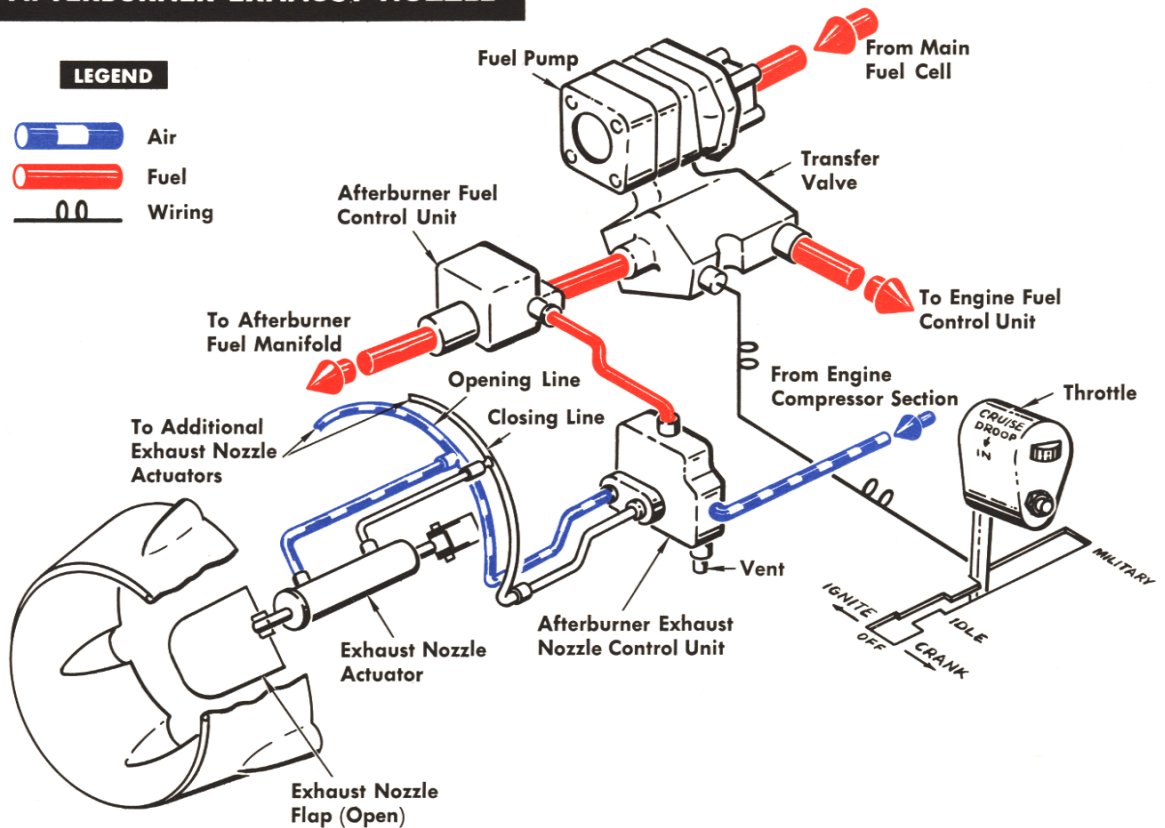


Figure No. 1-6. Afterburner Exhaust Nozzle

Table 1-1. Engine and Afterburner Controls and Indicators

Nomenclature	Function
ENGINE MASTER switch (14, figure 1-4)	<p>"ON" accomplishes the following:</p> <ol style="list-style-type: none"> 1. Admits airplane fuel to engine-driven pump by opening engine fuel shutoff valve. 2. Energizes CRANK and IGNITE switches. 3. Energizes main fuel cell boost pumps. 4. Energizes mercury attitude switch for operation of inverted flight pumps and energizes attitude switch heater element to prevent freezing of mercury. 5. Energizes temperature sensing element of oil cooler door temperature control unit. 6. Energizes FUEL TRANSFER switch (table 1-2).
FUEL CONT switch (35, figure 1-4)	<p>"NORMAL" activates normal automatic fuel metering functions of fuel control unit.</p> <p>"EMERG" bypasses automatic fuel metering functions of fuel control unit, giving manual control by throttle position.</p>
Fuel control light (BuNo. 145416 and subsequent) (12, figure 1-4)	On when operating on emergency (manual) fuel control
Throttle (34, figure 1-4)	<p>"OFF" shuts off fuel flow from fuel control unit.</p> <p>"CRANK," momentary position, initiates engine ground cranking cycle.</p> <p>"IGNITE," momentary position, energizes ignition timer for engine starting.</p> <p>"IDLE" adjustable stop to prevent inadvertent retarding to "OFF."</p> <p>"MILITARY" maximum engine thrust without afterburner.</p> <p>"MAX," placed outboard, maximum engine thrust with afterburner.</p>
Throttle friction wheel (30, figure 1-4)	Rotate to adjust throttle friction.
Fuel pump warning light (4, figure 1-3)	On indicates failure of engine stage of engine-driven fuel pump and engine operating from afterburner stage.
OIL COOL DR switch (BuNo. 143677 and subsequent and airplanes having ASC 58 (ECP 169) incorporated) (3, figure 1-3)	<p>"AUTO" normal position, system automatically controlled.</p> <p>"OPEN" or "CLOSE." Permits positioning of oil cooler door, if automatic control fails.</p>
OIL COOL DR indicator (BuNo. 143677 and subsequent and airplanes having ASC 58 (ECP 169) incorporated) (5, figure 1-3)	<p>"OPEN" indicates oil cooler door open.</p> <p>"CLOSE" indicates oil cooler door closed.</p> <p>Barber pole indicates door in an intermediate position or electrical power not connected.</p>
ENG OIL pressure indicator (2, figure 1-3)	Shows oil pressure in psi.
Tachometer (3, figure 1-3)	Indicates high-pressure rotor speed by percent, based on 9,976 rpm as 100%.
TURB outlet pressure indicator (Airplanes without ASC 4 — ECP 30 incorporated) (6, figure 1-3)	Indicates turbine outlet pressure in inches of mercury.

Table 1-1. Engine and Afterburner Controls and Indicators (Continued)

Nomenclature	Function
Engine PRESSURE RATIO indicator (BuNo. 145345 and subsequent and airplanes with ASC 4—ECP 30 incorporated) (6, figure 1-3)	Indicates ratio of turbine outlet pressure to engine inlet pressure.
EXH TEMP indicator (41, figure 1-3)	Indicates average engine exhaust temperature in degrees centigrade.
FUEL FLOW indicator (28, figure 1-3)	Indicates rate of engine (but not afterburner) fuel flow in pounds per hour.

OIL SYSTEM. (See figure 1-7.)

Operation of the oil system, including temperature and oil cooler door control, is completely automatic. This circuit may be overridden by a manual control circuit, if necessary. (See figure 1-26 for servicing information and section VII "ENGINE OIL" for effectivity differences.)

ENGINE FUEL SYSTEM. (See figure 1-8.)

Fuel from the airplane fuel system is supplied to the engine and afterburner from the dual-stage engine-driven pump. If the engine stage of this pump fails, the afterburner stage will automatically furnish fuel to the engine.

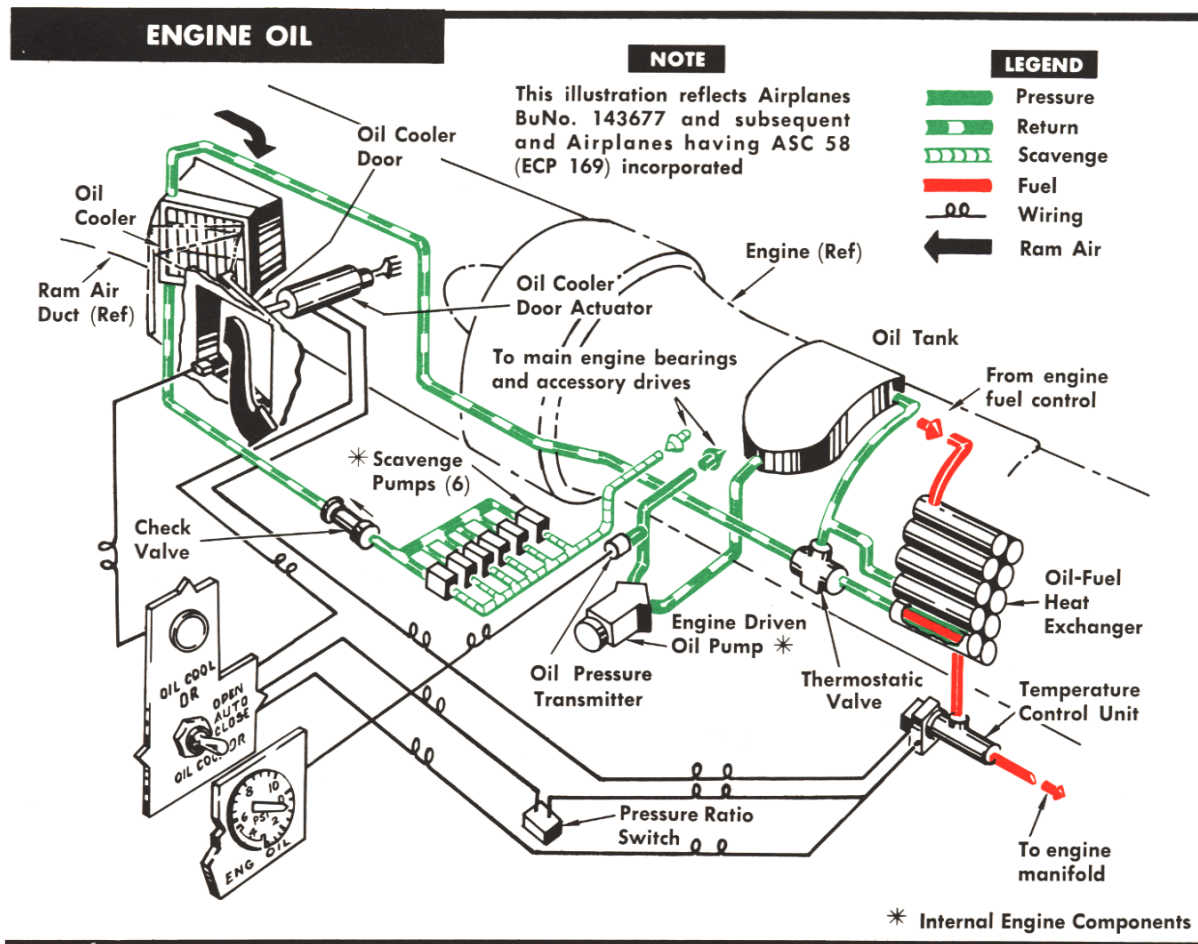








Figure No. 1-7. Engine Oil

ENGINE FUEL

LEGEND

-  Engine Fuel (Normal Flow)
-  Engine Fuel (Emergency Flow)
-  Afterburner Fuel
-  Control Pressure
-  Linkage
-  Wiring

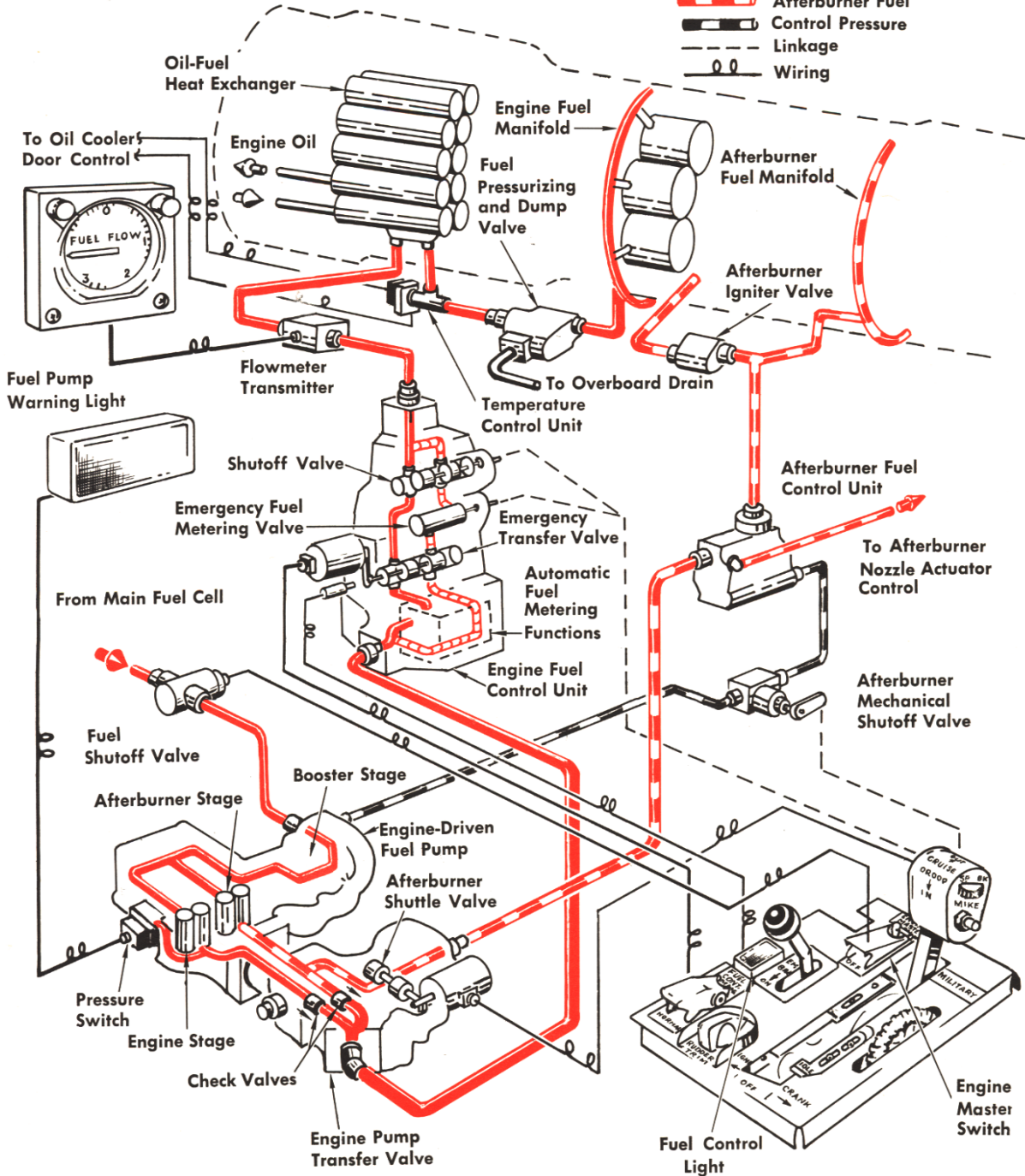


Figure No. 1-8. Engine Fuel

AIRPLANE FUEL**EQUIPMENT OF INTEREST**

Main system cells:
 Main cell
 LH and RH mid-fuselage cell
 Normal-attitude booster pumps
 Inverted-flight booster pumps
 Inflight refueling probe*

Transfer system cells:
 LH and RH fwd cell
 LH and RH aft cell
 Wing tank
 Controls and indicators are listed in table 1-2.
 Servicing information contained in figure 1-26.
 Fuel quantity data listed in F8U-1 Supplemental Flight Handbook.

*Airplanes BuNo. 143702 and subsequent.

OPERATION.

Fuel is supplied to the engine from the main fuel cell. Three booster pumps in this cell operate during normal flight attitudes; the other two pumps in the cell operate when pitch attitude exceeds plus 90° or minus 45° (plus 120° or minus 15° on airplanes BuNo. 144427 and subsequent and airplanes with ASC 195 — ECP 422 incorporated) and when roll attitude exceeds 90°. Only one of the five main cell booster pumps operates when electrical power is being supplied by the emergency power package with the EMER GEN switch in "ON."

FUEL FLOW.

Fuel flows by gravity to the main cell from the other main system fuel cells (figure 1-9). Fuel from the transfer cells flows to the main cell (when the fuel level in the main cell falls below the low-level float valves) as follows: air pressure transfers fuel from the wing tank, and booster pump pressure transfers fuel from the fuselage transfer cells. In airplanes BuNo. 144427 and subsequent and airplanes with ASC 195 (ECP 422) incorporated, the transfer fuel booster pump is shut off during inverted flight and when diving in excess of 15°. (Refer to section VII for additional information regarding the fuel system including inflight and ground refueling procedures.)

Table 1-2. Airplane Fuel System Controls and Indicators





<i>Nomenclature</i>	<i>Function</i>
ENGINE MASTER switch (14, figure 1-4)	"ON" energizes main fuel system booster pumps, mercury attitude switches (which control inverted-flight booster pumps), and FUEL TRANSFER switch.
FUEL TRANSFER switch (19, figure 1-3)	"PRESS DUMP" relieves wing tank pressure and shuts off transfer fuel booster pump. "ON" energizes transfer fuel booster pump and provides wing tank pressure. "PUMP OFF" shuts off transfer fuel booster pump.
FUEL DUMP switch (18, figure 1-3)	"DUMP" jettisons fuel from wing tank.
FUEL QUANT TEST switch (17, figure 1-3)	<i>Airplanes BuNo. 144427 and subsequent and airplanes with ASC 211 (ECP 261) incorporated</i> Depressed momentarily checks continuity of <i>main</i> and <i>transfer</i> fuel quantity indicating circuits. <i>Airplanes without ASC 211 (ECP 261) incorporated</i> Depressed momentarily checks continuity of <i>main</i> fuel quantity indicating circuit only.
Main FUEL QUANTITY indicator (27, figure 1-3)	Shows total weight of fuel in main system cells.
Transfer FUEL QUANTITY indicator (24, figure 1-3)	<i>Airplanes BuNo. 144427 and subsequent and airplanes with ASC 211 (ECP 261) incorporated</i> Pointer indicates total weight of fuel in transfer fuel system cells. <i>Airplanes without ASC 211 (ECP 261) incorporated</i> Counter shows total weight of fuel in transfer fuel system cells.
Wing tank visual quantity indicator (LH wing leading edge)	Appearance of red spherical float indicates wing tank is full.

Table 1-2. Airplane Fuel System Controls and Indicators (Continued)

Nomenclature	Function
Transfer pump warning light (BuNo. 141342 and subsequent) (20, figure 1-3)	Steady light (more than 3,500 pounds transfer fuel remaining, FUEL TRANSFER switch "ON," and airplane in normal flight attitude) indicates transfer system aft cell booster pump failure. Intermittent lighting (FUEL TRANSFER switch "ON") indicates fuselage transfer system pressure drop induced by maneuvers or low fuselage transfer cell fuel levels.
FUEL SELECTOR switch (LH 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 shut-off valve (LH main wheel well)	"OPEN" allows normal operation of fuel system. <i>Engine cannot be started nor fuel transferred from or to wing tank unless valve is in this position.</i> "CLOSE" prevents leakage of fuel from wing to main cell while airplane is secured; also, aids defueling of main system after wing is empty by stopping airflow from wing.
IFR PROBE switch (21, figure 1-3)	"OUT" opens probe door, extends probe, de-energizes the transfer fuel system and relieves wing tank pressure. "IN" retracts probe, closes probe door, energizes the transfer fuel system and repressurizes wing tank. "OFF" deenergizes probe door valve and energizes the transfer fuel system.
IFR probe light (22, figure 1-3)	On when probe door is open. Off when probe door is closed.
Fuel low-level warning light (BuNo. 145416 and subsequent) (16, figure 1-3A)	On when fuel level in main cell drops to approximately 1,000 pounds (JP-5).

AIRPLANE FUEL

LEGEND

-  Fuel Lines
-  Balance Lines
-  Check Valve
-  Wiring

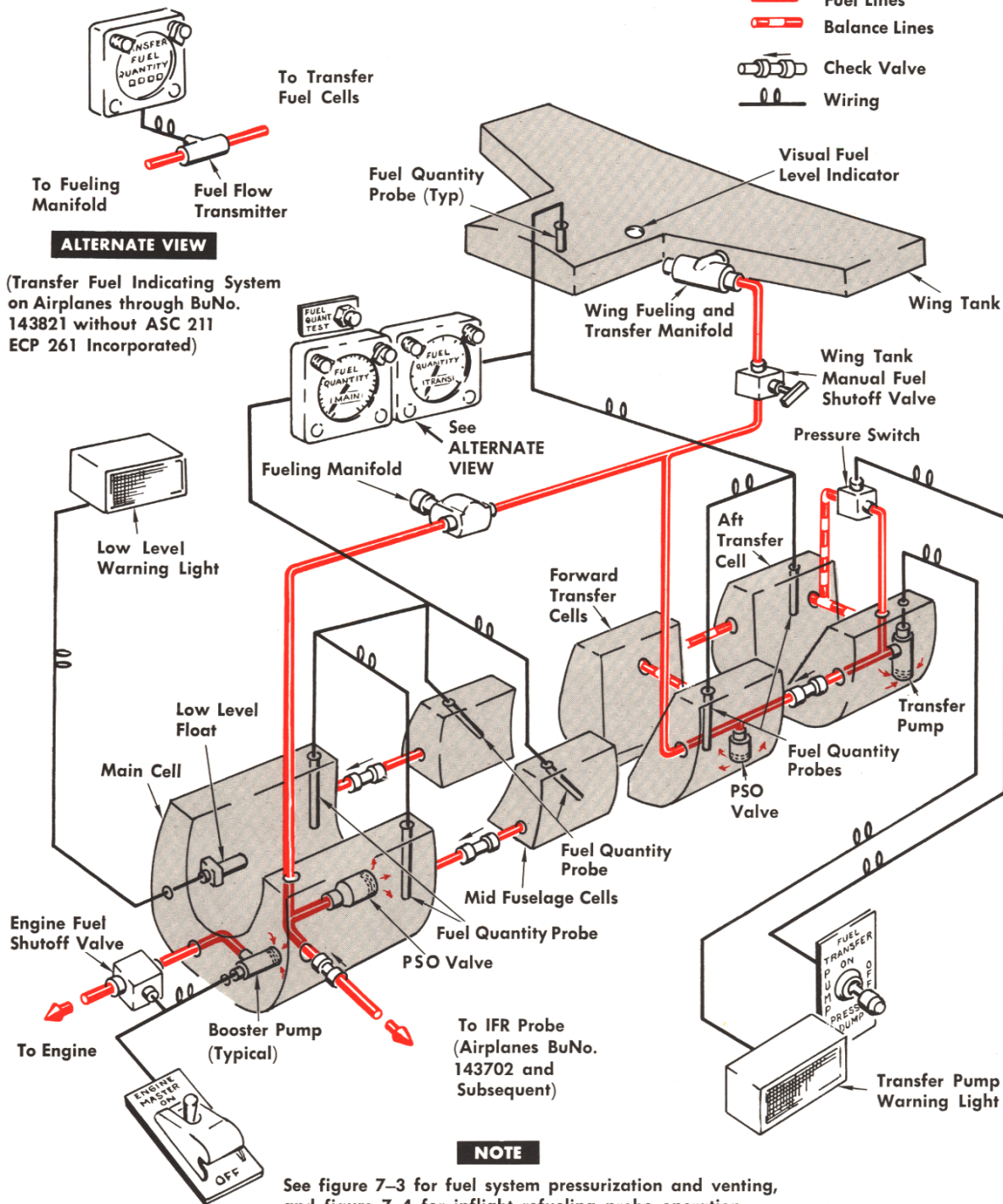


Figure No. 1-9. Airplane Fuel

ELECTRICAL SUPPLY**EQUIPMENT OF INTEREST**

Main generator power package.
 Emergency power package.
 Controls and indicators are listed in table 1-3.

For differences in airplanes BuNo. 141336 through 141340, refer to appendix II.

OPERATION.

This system (figure 1-10) supplies 115/200-volt, 400-cycle, 3-phase ac power and 28-volt dc power for operation of the circuits listed in figure 1-11. Power is supplied by a 9-kva ac generator and a 50-ampere dc generator on airplanes through BuNo. 145415 and a 12-kva ac generator and a 68-ampere dc generator on airplanes BuNo. 145416 and subsequent. The generators, contained in the main generator package, are turbine driven by bleed air from the engine compressor section.

Emergency electrical power is supplied by ram-air-driven generators in the emergency power package.

The a-c generator is rated at 2.5 kva and will deliver 115/200-volt, 360- to 440-cps, 3-phase a-c power. The d-c generator is rated at 10 amperes and will deliver regulated 28-volt d-c power.

If a flameout occurs, engine windmilling will not supply sufficient pressure to drive the main generators to operating speed. Power from the emergency generators must be used for ignition. After an airstart, the main generators (MASTER GENERATOR switch in "MAIN") will supply power to the secondary bus, but will not supply power to the emergency or primary buses until the EMER GEN switch is placed in "OFF."

Table 1-3. Electrical Power Supply System Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
MASTER GENERATOR switch (21, figure 1-5)	"MAIN" connects power from main generators to a-c and d-c buses through the speed-sensing switch. "EXT" connects power from an external source to a-c and d-c buses through external power receptacle. "OFF" disconnects power from buses.
EMER GEN switch (4, figure 1-5)	"ON" (emergency power package extended) connects power from emergency generators to emergency and primary a-c and d-c buses only. Secondary bus circuits are not connected. "LAND" (emergency power package extended) connects power from emergency generators to only the emergency a-c and d-c buses to decrease electrical load on the emergency power package and to improve package performance at low airspeeds. Primary and secondary bus circuits are not connected.
EMERG POWER handle (18, figure 1-4)	Pulled to extend emergency power package. Package cannot be retracted in flight. (Refer to "POWER CONTROL HYDRAULIC SUPPLY" for information on emergency hydraulic pump.)
DC PWR IND (22, figure 1-5)	"V" indicates that d-c power is connected to emergency bus. Barber pole indicates that d-c power is not connected to emergency bus or that d-c power has failed.
Attitude indicator (35, figure 1-3)	"OFF" flag indicates that a-c power is not connected to emergency bus or that a-c power has failed.
Emergency power indicator light (3, figure 1-5)	On (EMER GEN switch in "ON") indicates that power is being supplied by emergency generators and serves as a reminder to place EMER GEN switch in "LAND" prior to landing. Off when EMER GEN switch is placed in "LAND."

ELECTRICAL SUPPLY

MAIN GENERATOR POWER PACKAGE

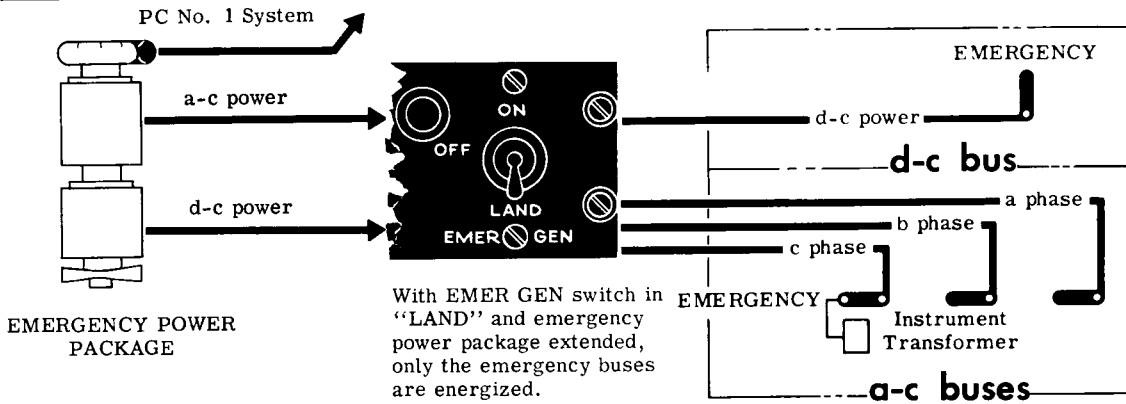
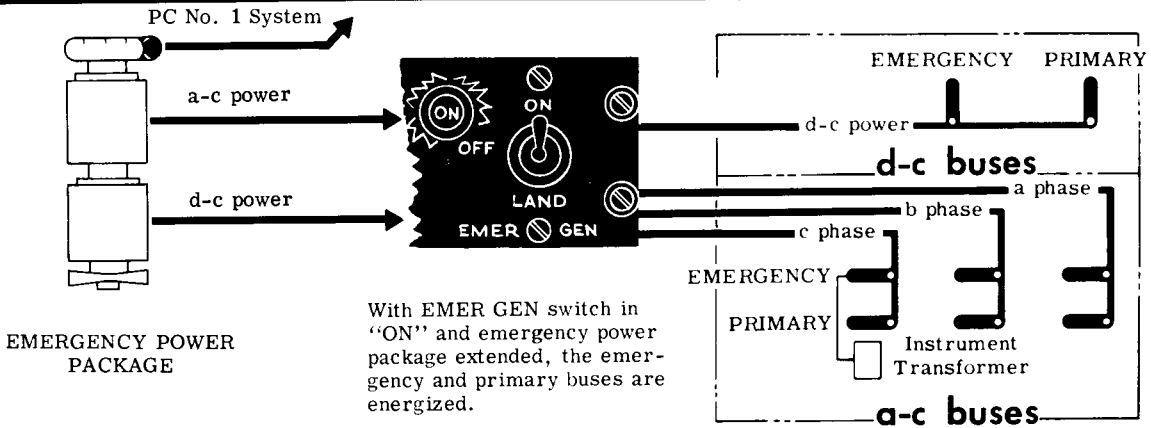
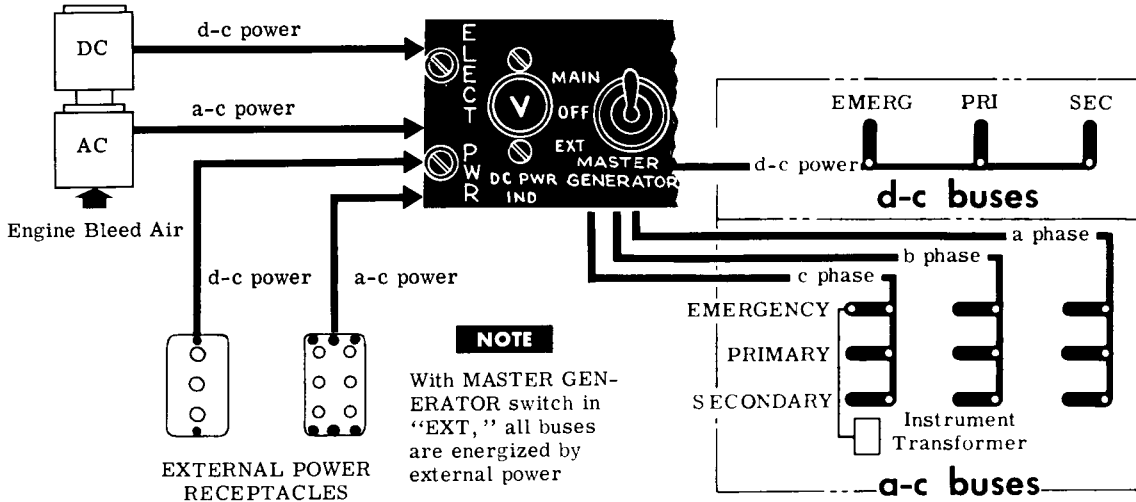


Figure No. 1-10. Electrical Supply System

ELECTRICAL DISTRIBUTION

	EMERGENCY	PRIMARY	SECONDARY
A-C BUSES	Roll Trim and Stabilization Pitch Trim Emergency Pitch Trim Attitude Indicator Interior Lights Engine Pressure Ratio Instrument Transformer Engine Fuel Flow Turbine Outlet Pressure Oil Pressure Hydraulic Pressure MA-1 Compass Radio Magnetic Indicator	MA-1 Compass AN/ARC-27A (UHF) AN/ARA-25 (ADF) IFF Radar Aft Main Fuel Pump (Airplanes through BuNo. 145464) Main Fuel Quantity Transfer Fuel Quantity Forward Main Fuel Pump (BuNo. 145465 and subsequent) Pitot Heater Cabin Temperature Control (BuNo. 143772 and subsequent) Yaw Trim and Stabilization Liquid Oxygen Quantity	Fire Control System AN/ARN-21 TACAN Forward Main Fuel Pump (Airplanes through BuNo. 145464) Center Main Fuel Pump Inverted Flight Fuel Pumps Transfer Fuel Pump Seat Adjust Oil Cooler Door Aft Main Fuel Pump (BuNo. 145465 and subsequent) Cabin Temperature Control (Airplanes through BuNo. 143771) Gun Firing Missile System AN/APG-30A or AN/APS-67 Radar Air Bottle Heaters
D-C BUSES	Liquid Oxygen Warning Light(s) Engine Master Switch Leading Edge Cruise Droop Wing Position Light Wing Pressurization Wing Fuel Dump Roll Trim and Stabilization Stab Warning Lights DC Power Indicator Landing Gear Position Fire Detector Emergency Lights Wing and Tail Lights* Approach Lights* Rocket Pack Fire Detector (Airplanes through BuNo. 145415 without ASC 202 incorporated) Engine Ignition (BuNo. 144427 and subsequent) Ignition Timer (BuNo. 144427 and subsequent)	MA-1 Compass AN/ARC-27A (UHF) AN/ARA-25 (ADF) IFF Radar Speed Brake Yaw Trim and Stabilization Engine Crank Engine Ignition (Airplanes through BuNo. 143821) Ignition Timer (Airplanes through BuNo. 143821) Afterburner Shuttle Valve Inflight Refueling Face Plate Heat Missile Jettison	Fire Control System Armament Bus AN/APG-30A or AN/APS-67 Radar Gun Vent Doors Gun Camera AN/ARN-14E (VOR) or AN/ARN-21 (TACAN) Wing Selector Valve Lock Oil Cooler Door Fuselage Lights Wing and Tail Lights† Approach Lights† Arresting Gear Landing Gear Downlock Solenoid Nose Gear Steering Wingfold Seat Adjust Transfer Fuel Quantity Missile System Inflight Refueling (aft cell control) Fuel Control Light Low Fuel Warning Light Rocket Pack Fire Detector (Airplanes BuNo. 145416 and airplanes with ASC 202 incorporated)

*With Emergency Power Package extended and EMER GEN switch in "LAND."

†Normal Operation

Figure No. 1-11. Electrical Distribution

UTILITY HYDRAULIC SUPPLY**FUNCTION**

Provides hydraulic pressure for all hydraulic circuits except those supplied by the power control hydraulic system.

EQUIPMENT OF INTEREST

Indicators are listed in table 1-4.

OPERATION.

This system supplies 3,000-psi hydraulic pressure for operation of the circuits listed in figure 1-12. There is no utility hydraulic emergency system. Emergency operation of major utility circuits is provided by air pressure from the pneumatic system.

Hydraulic pressure failure will be indicated by illumination of the hydraulic pressure warning light.

Note

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

Table 1-4. Utility Hydraulic Supply Indicators

<i>Nomenclature</i>	<i>Function</i>
HYD SYS GAGE switch (Airplanes through BuNo. 145415) (25, figure 1-3)	"UTILITY" selects utility system pressure reading on hydraulic pressure gage.
Hydraulic pressure gage (26, figure 1-3)	Indicates utility system pressure.
Hydraulic pressure warning light (23, figure 1-3)	On when pressure drops excessively in utility hydraulic system.

PNEUMATIC SUPPLY**FUNCTION**

Supplies emergency pressure for certain utility hydraulic circuits. Extends emergency power package. Supplies power for charging guns and operation of gun vent doors.

OPERATION.

This system (figure 1-13) supplies air from three high-pressure bottles for operation of the circuits listed in table 1-5. There is no cockpit indication of air bottle

pressures. Bottle pressures are checked before flight during the exterior inspection (figure 2-1). (See figure 1-26 for servicing information.)

Table 1-5. Pneumatic System Circuits

<i>Circuit</i>	<i>Function</i>
<p>A. 900-CU-IN. AIR BOTTLE CIRCUITS</p> <p>Gun charging Gun vent doors Landing gear Wheel brakes Emergency power package Leading edge</p>	<p>To arm guns. To open and close doors. For emergency extension of landing gear. For emergency operation of wheel brakes. For extension of package. For emergency extension of cruise droop side of wing leading edge dual-element cylinders.</p>
<p>B. 375-CU-IN. AIR BOTTLE CIRCUITS</p> <p>Leading edge</p>	<p>For emergency extension of landing droop side of wing leading edge dual-element cylinders.</p>
<p>C. 50-CU-IN. AIR BOTTLE CIRCUIT</p> <p>Variable incidence wing</p>	<p>For emergency raising of wing.</p>

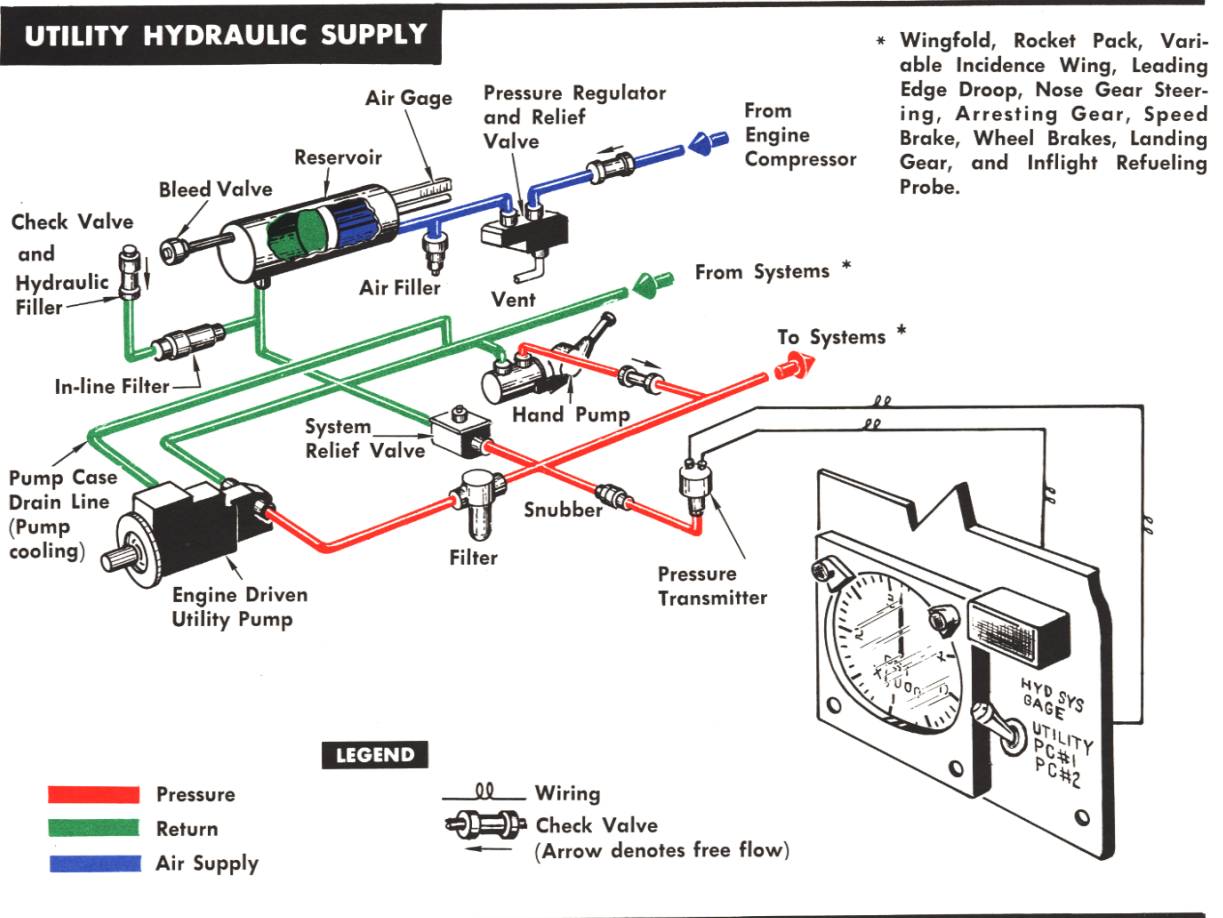


Figure No. 1-12. Utility Hydraulic Supply

PNEUMATIC SUPPLY

- 1 Multiple Fittings
- 2 Check Valve
- 3 Fuse Reset Valve
- 4 Pressure Reducer Valve
- 5 Minimum Pressure Valve
- 6 Emergency Air Valve
- 7 Pressure Gages (one for each bottle)
- 8 Filler Valves (one for each bottle)
- 9 Pressure Relief Valve

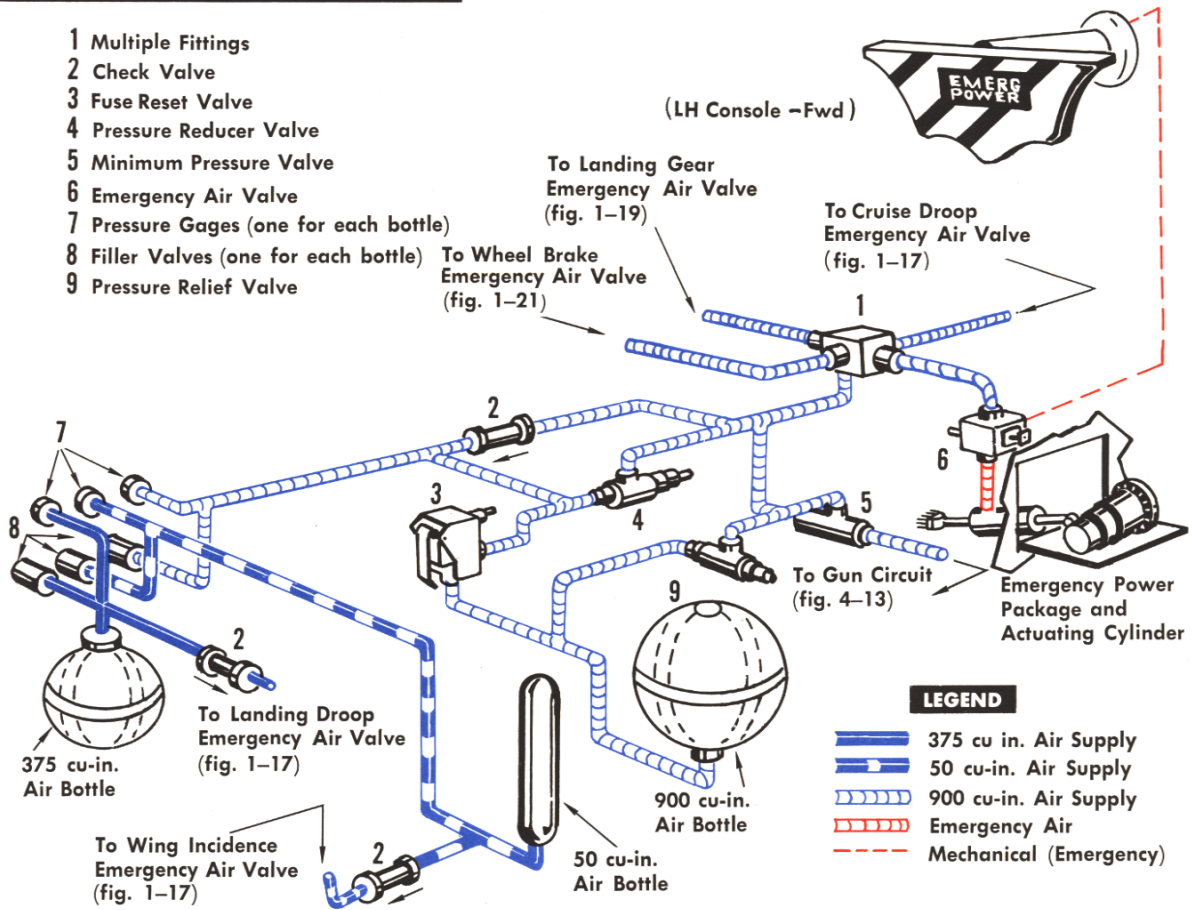


Figure No. 1-13. Pneumatic Supply

POWER CONTROL HYDRAULIC SUPPLY

FUNCTION

Provides hydraulic pressure for flight controls and for certain stabilization purposes.

EQUIPMENT OF INTEREST

Controls and indicators are listed in table 1-6.

OPERATION.

The two power control hydraulic systems, PC 1 and PC 2, each supply hydraulic pressure at 3,000 psi. The systems are completely separate and operate independently of each other (figure 1-14). 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. If either system fails, the other system will provide sufficient pressure for normal flying maneuvers as defined in Technical Note 2-50. If both systems fail, the emergency hydraulic pump in the emergency power package can

POWER CONTROL HYDRAULIC SUPPLY

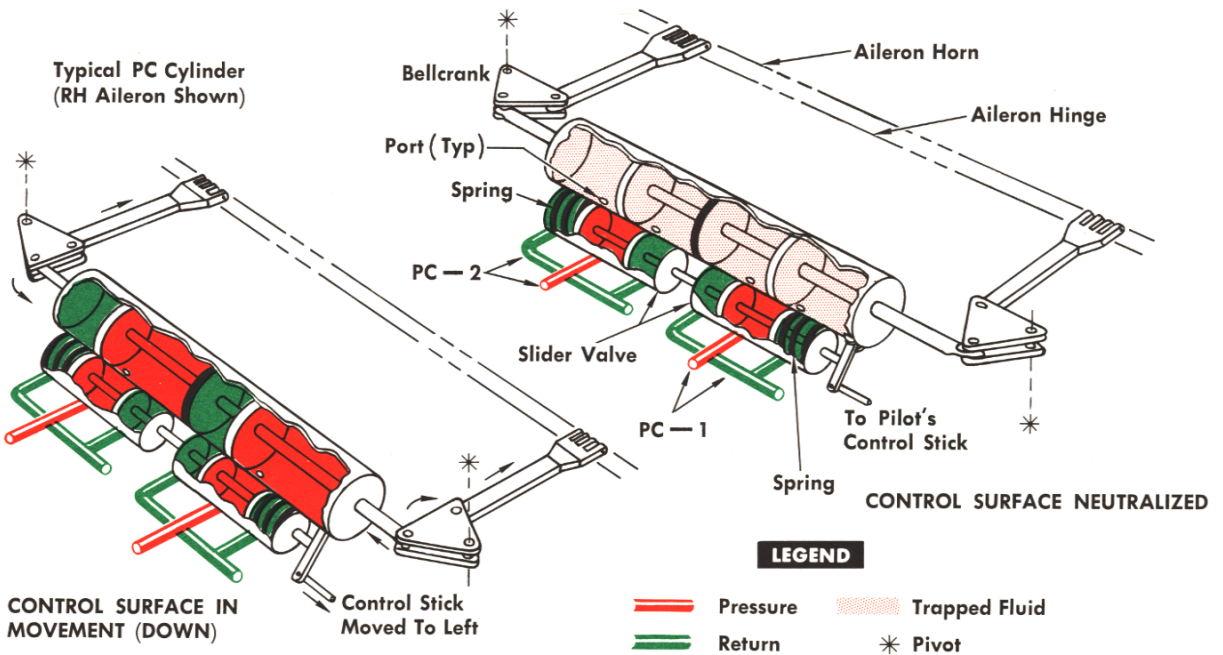
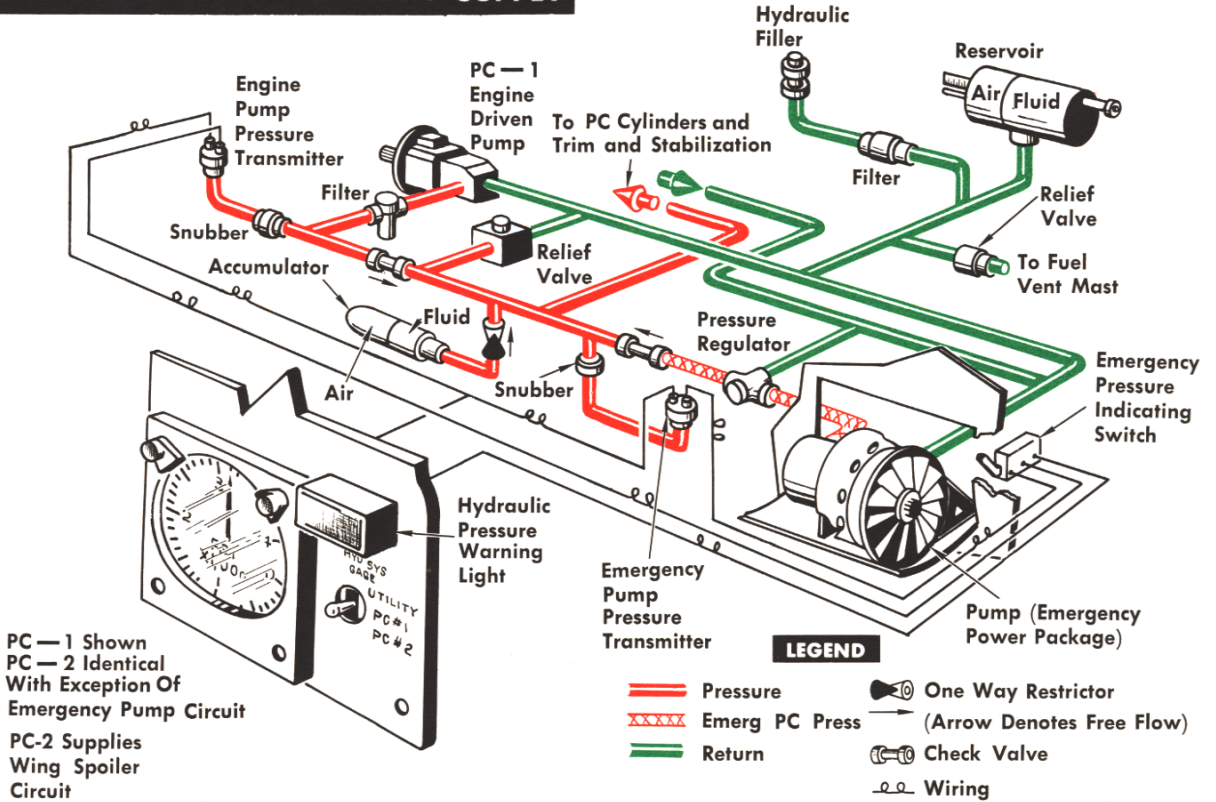


Figure No. 1-14. Power Control Hydraulic Supply

be used to supply pressure through the PC 1 system. If the emergency power package is extended to supply electrical power, the emergency hydraulic pump operation does not interfere with normal hydraulic system operations. (See figure 1-26 for servicing information.)

STABILIZATION FUNCTION.

Hydraulic power is supplied to the yaw stabilization circuit from the PC 2 system and to the roll stabilization circuit from the PC 1 system.

Table 1-6. Power Control Hydraulic Supply Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
HYD SYS GAGE switch (Airplanes through BuNo. 145415) (26, figure 1-3)	"PC-1" selects PC 1 system pressure reading or emergency pump pressure reading (emergency power package extended and PC 1 system inoperative) on hydraulic pressure gage. "PC-2" selects PC 2 system pressure reading on hydraulic pressure gage.
Hydraulic pressure gage(s) (27, figure 1-3)	Indicates pressure in hydraulic system(s).
Hydraulic pressure warning light (25, figure 1-3)	On when pressure drops excessively in either power control hydraulic system. Light will not go out when emergency pump is supplying adequate PC 1 pressure.
EMERG POWER handle (18, figure 1-4)	Pulled to extend emergency power package and connect emergency hydraulic pump to PC 1 system. (Refer to "ELECTRICAL SUPPLY" for information on emergency generators.)

FLIGHT CONTROLS

EQUIPMENT OF INTEREST

Ailerons, rudder, and horizontal tail controls are listed in table 1-7.

OPERATION.

The flight control system uses the control stick and rudder pedal 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.

VARIABLE GAIN LINKAGE.

An assembly of links and levers in the aileron and horizontal tail pushrod systems 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 or roll corrections at high airspeeds.

AILERONS AND FLAPS.

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.

SPOILERS.

On airplanes BuNo. 143772 and subsequent, and airplanes having ASC 116 (ECP 178) incorporated, a wing spoiler control surface is installed flush with the upper surface of the wing forward of each aileron. The spoilers increase rate of roll at low altitudes and high airspeed. The spoilers are slaved directly to aileron control and function in both the clean condi-

tion 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.

Table 1-7. Flight Controls

<i>Nomenclature</i>	<i>Function</i>
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°. (Refer to section V of F8U-1 Supplemental Flight Handbook for operating limitations.) Controls horizontal tail deflection between 20°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.

TRIM AND STABILIZATION

FUNCTION

Provides *manual* roll, yaw, and pitch trimming. Provides *automatic* roll and yaw damping. Provides *emergency* pitch trimming.

EQUIPMENT OF INTEREST

PITCH

Amplifier
Electromechanical actuator
Wing-incidence potentiometer

YAW

Amplifier
Electrohydraulic actuator
Yaw accelerometers
Aileron-rudder interconnect
Gain changer potentiometer

ROLL

Amplifier
Electrohydraulic actuator
Controls and indicators are listed in table 1-8.

OPERATION.

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 trim on the control knob.

Pressure on the flight controls cannot be trimmed out as movement of the trim knobs does not affect the position or feel of the control stick. (See figure 1-15 for operational schematics of the pitch, roll and yaw functions of the trim and stabilization system.)

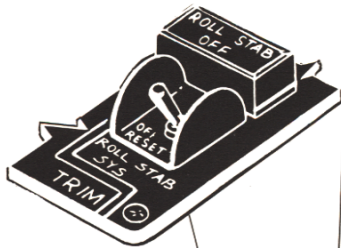
TRIM AND STABILIZATION

ROLL TRIM AND DAMPING

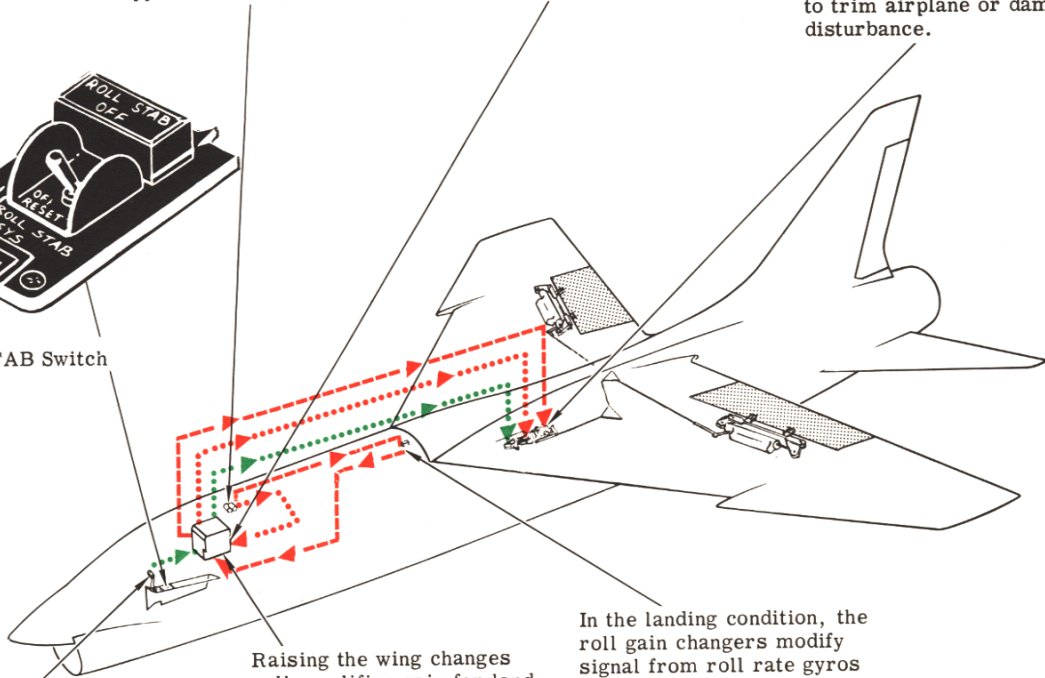
1 Roll rate gyros detect roll motions and signal amplifier to oppose these motions.

2 Amplifier relays signals from roll trim potentiometer and/or gyros to roll actuator.

3 Roll actuator moves control system linkage to reposition ailerons in direction required to trim airplane or damp disturbance.



ROLL STAB Switch



Raising the wing changes roll amplifier gain for landing condition and adds control stick gain changer to circuit.

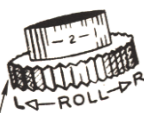
In the landing condition, the roll gain changers modify signal from roll rate gyros as stick position changes.

Roll trim potentiometer signals amplifier that surface trim is needed.

Pitch Trim Potentiometer (See Sheet 3)



Roll Trim Potentiometer



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 EMER GEN switch in "LAND," the roll monitor is overridden. If the monitor had previously shut off the system because of a malfunction and the system could not be reset, the ROLL STAB switch should be in "OFF" before the EMER GEN switch is placed in "LAND."
4. No emergency roll trim is provided because the electrohydraulic actuator will lock at neutral if electrical or hydraulic power is lost.

LEGEND

- Damping Signals (Landing Condition)
- Damping Signals (Clean Condition)
- Trim Signals

Figure No. 1-15. Trim and Stabilization (Sheet 1)

TRIM AND STABILIZATION

YAW TRIM AND DAMPING

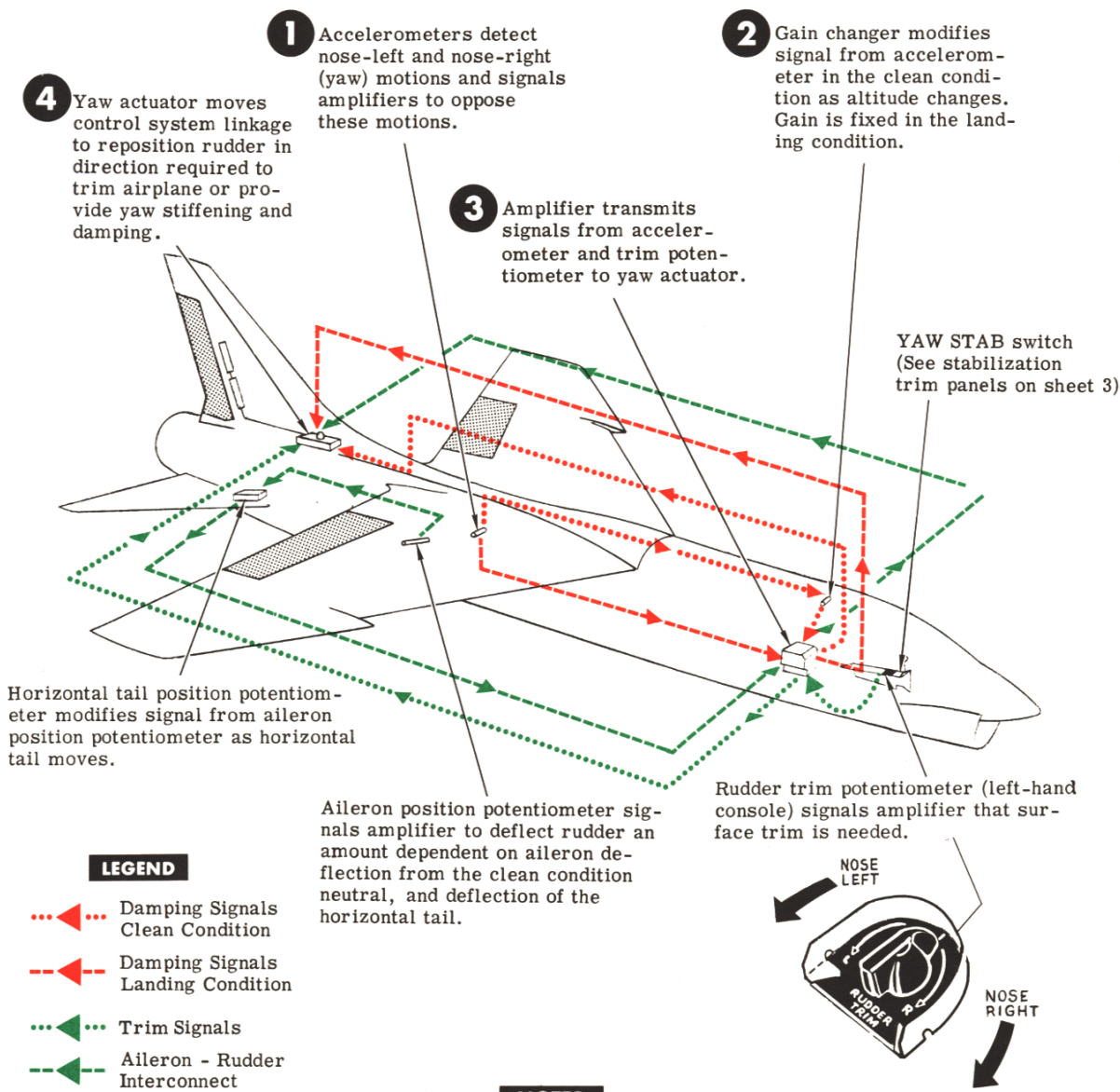
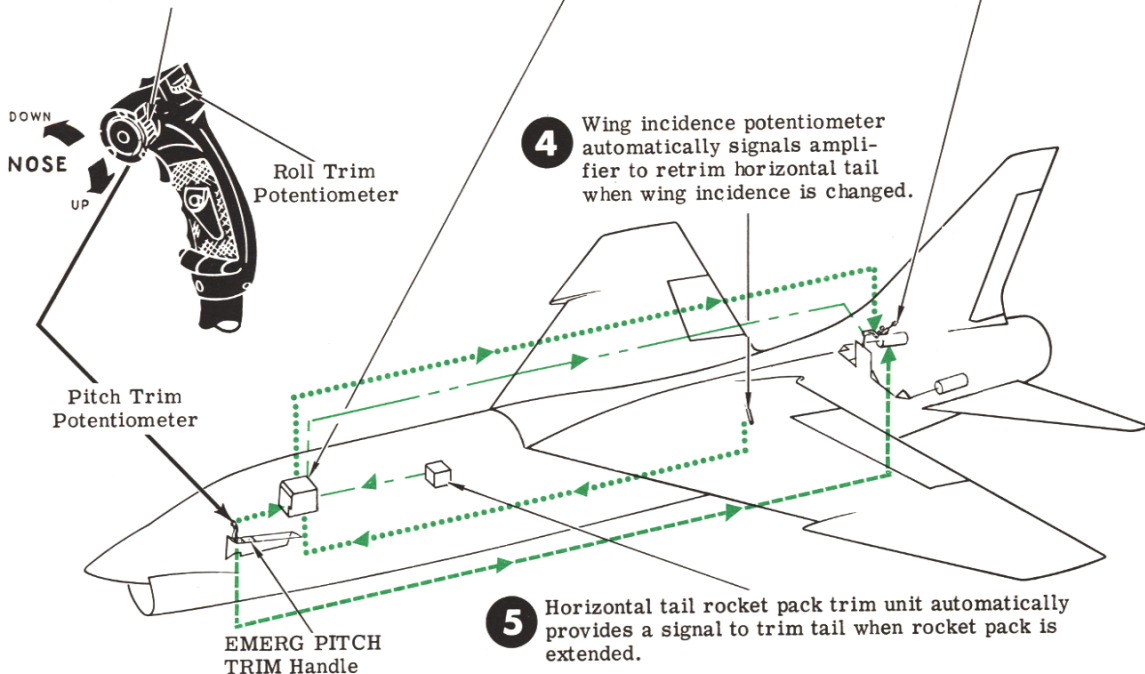


Figure No. 1-15. Trim and Stabilization (Sheet 2)

TRIM AND STABILIZATION

PITCH TRIM

- 1** Pitch trim potentiometer signals amplifier that surface trim is needed.
- 2** Amplifier transmits trim signals to pitch trim actuator.
- 3** Pitch trim actuator moves control system linkage to reposition horizontal tail.



- 4** Wing incidence potentiometer automatically signals amplifier to retrim horizontal tail when wing incidence is changed.

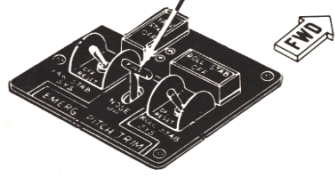
- 5** Horizontal tail rocket pack trim unit automatically provides a signal to trim tail when rocket pack is extended.

LEGEND

- Normal Trim Signals
- Emer Trim Signals
- Rocket Pack Signals

NOTES

- 1. Emergency trim is connected to emergency buses. Normal trim is connected to emergency buses.
- 2. The pitch actuator is a single electro-mechanical screwjack which acts as an extendible link in the control linkage.
- 3. No pitch damping is provided because inherent damping is satisfactory.



STABILIZATION TRIM PANEL

Figure No. 1-15. Trim and Stabilization (Sheet 3)

Table 1-8. Trim and Stabilization Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
ROLL	
ROLL trim knob (On control stick grip)	Rotated left or right, adds corresponding roll trim.
ROLL STAB switch (26, figure 1-4)	"OFF-RESET" shuts off roll damping and trim circuits, and resets system after cutout by comparator circuit. "ON" makes hydraulic power available for roll damping and trim.
ROLL STAB warning light (25, figure 1-4)	Light on indicates system not operating. Light off indicates system operating.
Neutral trim light (38, figure 1-3)	<i>Airplanes through BuNo. 143701</i> Light does not indicate aileron trim neutral. <i>Airplanes BuNo. 143702 and Subsequent</i> "ALL NEUT" (left side of light) illuminated indicates ailerons in neutral (0° trim). Light off indicates ailerons not in neutral. Light inoperative with weight off landing gear.
YAW	
RUDDER TRIM knob (11, figure 1-4)	Rotated left or right adds corresponding yaw trim.
YAW STAB switch (15, figure 1-4)	"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 and damping.
YAW STAB warning light (17, figure 1-4)	Light on indicates yaw stabilization system not operating. Light off indicates system operating.
Neutral trim light (38, figure 1-3)	<i>Airplanes through BuNo. 143701</i> Light on indicates rudder in neutral (0° trim). Light off indicates rudder not in neutral. Light inoperative with landing gear retracted. <i>Airplanes BuNo. 143702 and Subsequent</i> "RUD NEUT" (right side of light) illuminated indicates rudder in neutral (0° trim). Light off indicates rudder not in neutral. Light inoperative with weight off landing gear.
PITCH	
Pitch trim knob (On control stick grip)	Rotated forward (nose down) or aft (nose up) adds pitch trim. (Calibrated in degrees of trim for wing up position).
NOSE TRIM indicator (36, figure 1-3)	"OFF" indicates instrument inoperative. (Deenergized with weight off landing gear.) Degrees UP or DOWN indicates amount of pitch trim with stick in neutral and wing up.
EMERG PITCH TRIM handle (14, figure 1-4)	Pulled, cuts off normal pitch trim and places emergency trim circuit in standby. "NOSE DOWN" or "NOSE UP" adds corresponding trim to horizontal tail.

VARIABLE-INCIDENCE WING

FUNCTION

Permits relatively low takeoff and landing speeds with increased visibility by increasing wing angle of attack without increasing fuselage angle.

EQUIPMENT OF INTEREST

Controls and indicators are listed in table 1-9.

OPERATION.

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 (figure 1-17). If hydraulic pressure is lost, the wing can be raised and the leading edge extended to the landing droop position by pneumatic system pressure.

The wing actuating cylinder has both a mechanical down-lock, controlled by the DN LOCK handle, and an internal locking mechanism. The DN LOCK handle must be fully engaged in the "UNLOCK" detent be-

fore the WING INCIDENCE handle is actuated. Positioning the WING INCIDENCE handle with the DN LOCK handle out of detent will cause misalignment of wing cylinder mechanical down-lock and binding of handles. During subsequent wing "DN" selection, mechanical interference between retracting cylinder and mechanical down-lock 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 sufficient-

Table 1-9. Variable-Incidence Wing System Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
DN LOCK handle (7, figure 1-4)	"UNLOCK" unlocks wing cylinder mechanical down-lock and permits movement of the WING INCIDENCE handle. "LOCK," with WING INCIDENCE handle in "DN," locks wing in down position and turns out WING POS light with gear retracted.
RELEASE SWITCH (9, figure 1-4)	Held depressed, unlocks wing hydraulic selector valve to permit positioning of WING INCIDENCE handle.
WING INCIDENCE handle (8, figure 1-4)	"UP" and "DN" position wing and leading edge selector valves for raising or lowering of wing and simultaneous extension or retraction of leading edge when related controls are positioned as follows: <i>To raise wing and extend leading edge</i> 1. DN LOCK handle — "UNLOCK" 2. RELEASE SWITCH — Held depressed 3. WING INCIDENCE handle — "UP" 4. RELEASE SWITCH — Released <i>To lower wing and retract leading edge</i> 1. RELEASE SWITCH — Held depressed 2. WING INCIDENCE handle — "DN" 3. RELEASE SWITCH — Released 4. DN LOCK handle — "LOCK" "EMERG UP" raises wing pneumatically when related controls are positioned as follows: 1. DN LOCK handle — "UNLOCK" 2. WING INCIDENCE handle — "DN" 3. EMERG DROOP & WING INC guard — Raised 4. RELEASE SWITCH — Held depressed 5. WING INCIDENCE handle — Full forward to extend leading edge, then inboard and aft to "EMERG UP" 6. RELEASE SWITCH — Released

Table 1-9. Variable-Incidence Wing System Controls and Indicators (Continued)

Nomenclature	Function
EMERG DROOP & WING INC guard (10, figure 1-4)	Raised permits moving WING INCIDENCE handle to "EMERG UP."
L.E. DROOP indicator (31, figures 1-3 and 1-3A)	"UP" indicates leading edge is fully retracted. "DN" indicates leading edge is in landing or cruise droop position. Barber pole indicates leading edge is in an intermediate position or that electrical power is not connected.
Wing position light (39, figures 1-3 and 1-3A)	On when relationship between wing incidence and landing gear positions is not correct. Also on in clean configuration with DN LOCK handle not in "LOCK."

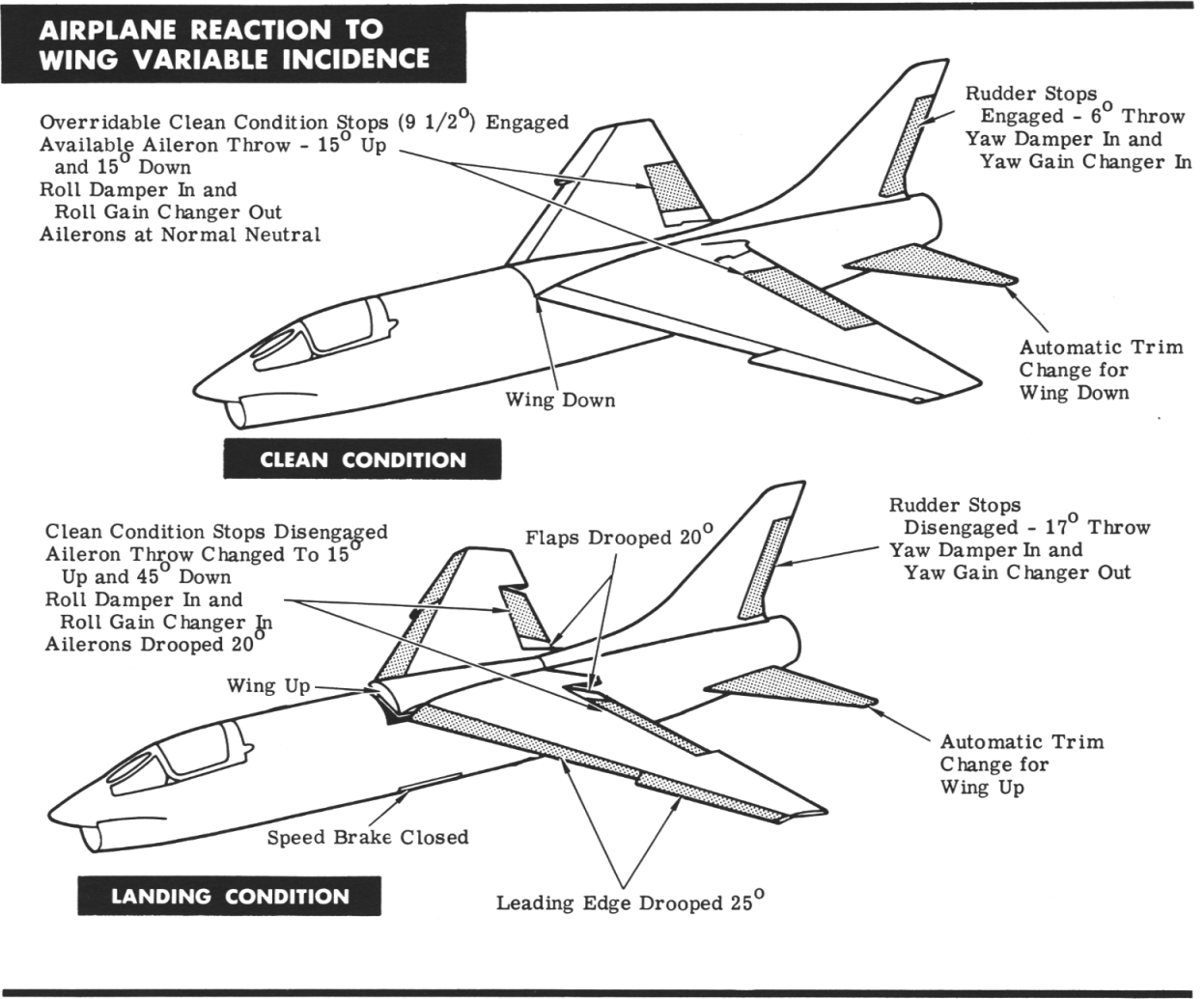


Figure No. 1-16. Airplane Reaction to Wing Variable Incidence

ly so as to engage the detent. When the DN LOCK 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.

If pneumatic system pressure is to be used to extend the leading edge or raise the wing, the WING INCI-

DENCE handle must be placed in "DN" before the EMERG DROOP & WING INC guard is raised, or the handle will bind as the detent plate is released and swings outboard. If this should occur, push detent plate inboard with index finger while pushing WING INCIDENCE handle outboard and forward with heel of hand, or lower the EMERG DROOP & WING INC guard, then place WING INCIDENCE handle in DN.

The wing leading edge is actuated to the landing droop (25°) position by dual-element cylinders. Both elements of the cylinders are used for landing droop position and only one element is used for cruise droop position. One element of the cylinder is controlled by the wing incidence selector valve and the other element is controlled by an electrically operated droop selector valve. The WING INCIDENCE handle positions both selector valves for simultaneous operation of the wing and leading edge.

Figure 1-16 illustrates changes automatically effected by raising or lowering the wing.

WING LEADING EDGE	
FUNCTION	EQUIPMENT
Provides increased lift and stability during takeoff and landing and decreases drag during cruise and maneuvering flight.	Controls and indicators are listed in table 1-10.

OPERATION.

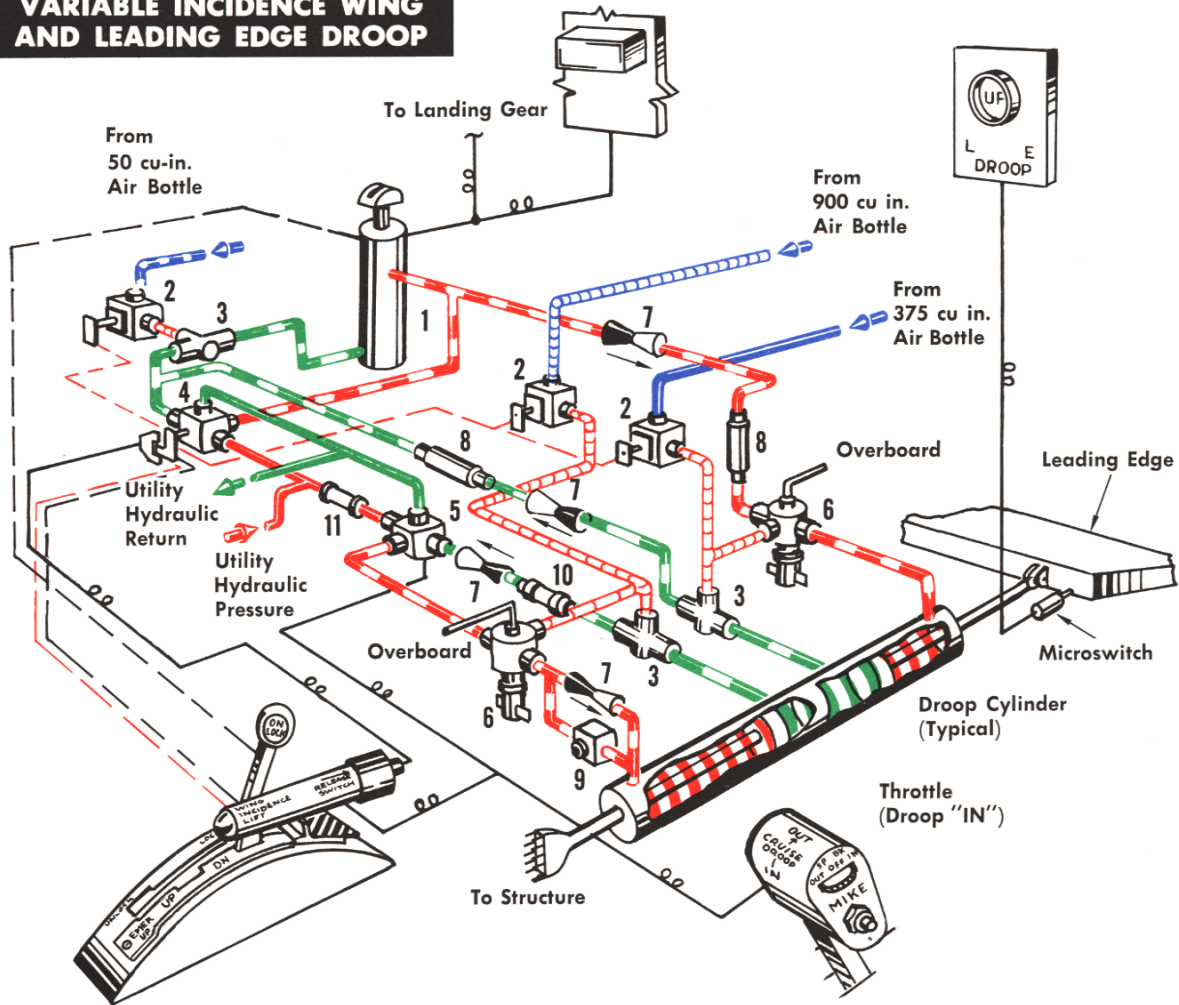
The wing leading edge is drooped to the cruise position (6.8°) by an electrically operated selector valve which directs utility hydraulic system pressure to the cruise droop element of the leading edge droop dual-

element cylinders (figure 1-17A). There is no emergency provision for placing the leading edge in the cruise droop position. The landing droop position is discussed in relation to the variable-incidence wing system.

Table 1-10. Cruise Droop Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
CRUISE DROOP switch (33, figure 1-4)	"OUT" extends leading edge to cruise droop position. "IN" retracts leading edge from cruise droop to "clean" position.
L.E. DROOP indicator (31, figure 1-3)	"UP" indicates leading edge is fully retracted. "DN" indicates leading edge in cruise droop or landing droop position. Barber pole indicates that leading edge is in intermediate position or that electrical power is not connected.

VARIABLE INCIDENCE WING AND LEADING EDGE DROOP



- 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)
- 0 0 — Wiring

Figure No. 1-17. Variable Incidence Wing and Leading Edge Droop

CRUISE DROOP

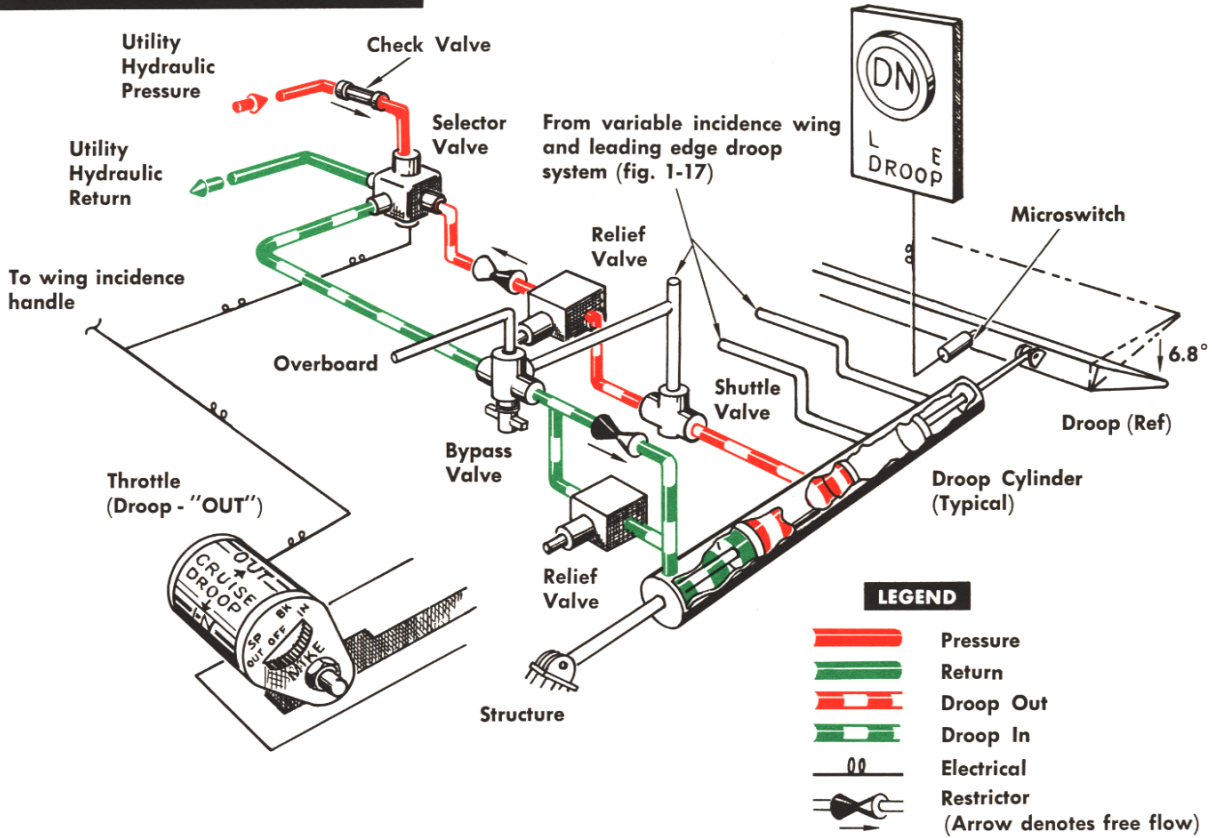


Figure No. 1-17A. Cruise Droop

SPEED BRAKE

FUNCTION

To permit speed regulation.

EQUIPMENT OF INTEREST

Controls and indicator are listed in table 1-11.

OPERATION.

The speed brake is operated by utility hydraulic pressure (figure 1-18) 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 for simulated or actual emergencies.

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 air-speed decreases the brake can be further extended. The speedbrake will open slightly with rocket pack extension, through hydraulic interconnection of the rocket pack and speedbrake hydraulic systems, and will automatically close with rocket pack retraction.

With loss of main generator electrical power the speed brake is inoperative until power from the emergency power package is connected. During ground operations, a safety circuit prevents opening of the speed brake when weight of the airplane is on the main gear.

Table 1-11. Speed Brake System Controls and Indicator

Nomenclature	Function
Speed brake switch (32, figure 1-4)	"OUT" extends speed brake. "OFF" holds speed brake in any extended intermediate position. "IN" closes and holds speed brake closed.
SPEED BRAKE override switch (2, figure 1-4)	"OVERRIDE" permits extension of speedbrake (by use of speedbrake switch) with wing raised. "NORMAL" is normal flight position.
Speed brake light (24, figure 1-4)	Light on indicates speedbrake is open.

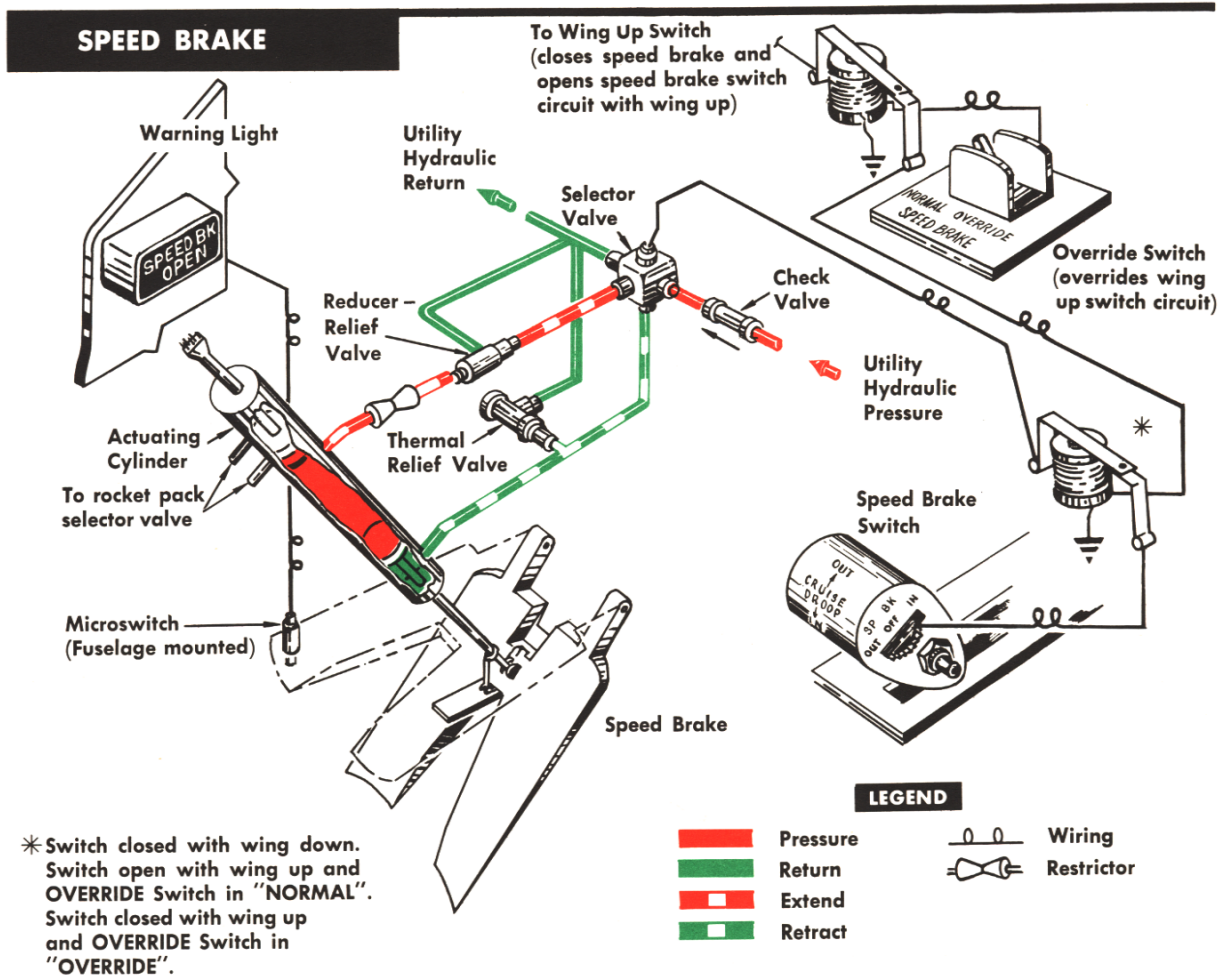


Figure No. 1-18. Speed Brake

LANDING GEAR**EQUIPMENT OF INTEREST**

Controls and indicators are listed in table 1-12.

OPERATION.

Normal operation is accomplished by means of utility hydraulic system pressure (figure 1-19). 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 the hydraulically operated doors 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 LH main gear. This circuit can be overridden to permit emergency retraction.

On airplanes that do not have ASC 146 (ECP 321) incorporated, a nose gear centered switch will keep the down-lock solenoid engaged after takeoff if the nose gear is not centered. In this condition the landing gear handle cannot be raised, and the nose gear steering switch must be depressed to center the nose gear

and disengage the down-lock solenoid. With the nose gear cocked, use of the emergency down-lock release switch to retract the gear would result in structural damage in the nose gear wheel well area.

On airplanes BuNo. 143732 and subsequent and on airplanes having ASC 146 (ECP 321) incorporated, nose gear retraction will be mechanically restrained after takeoff if the nose gear is not centered. In this condition the landing gear handle can be raised and the main gear will retract, but the nose gear will remain extended. 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.

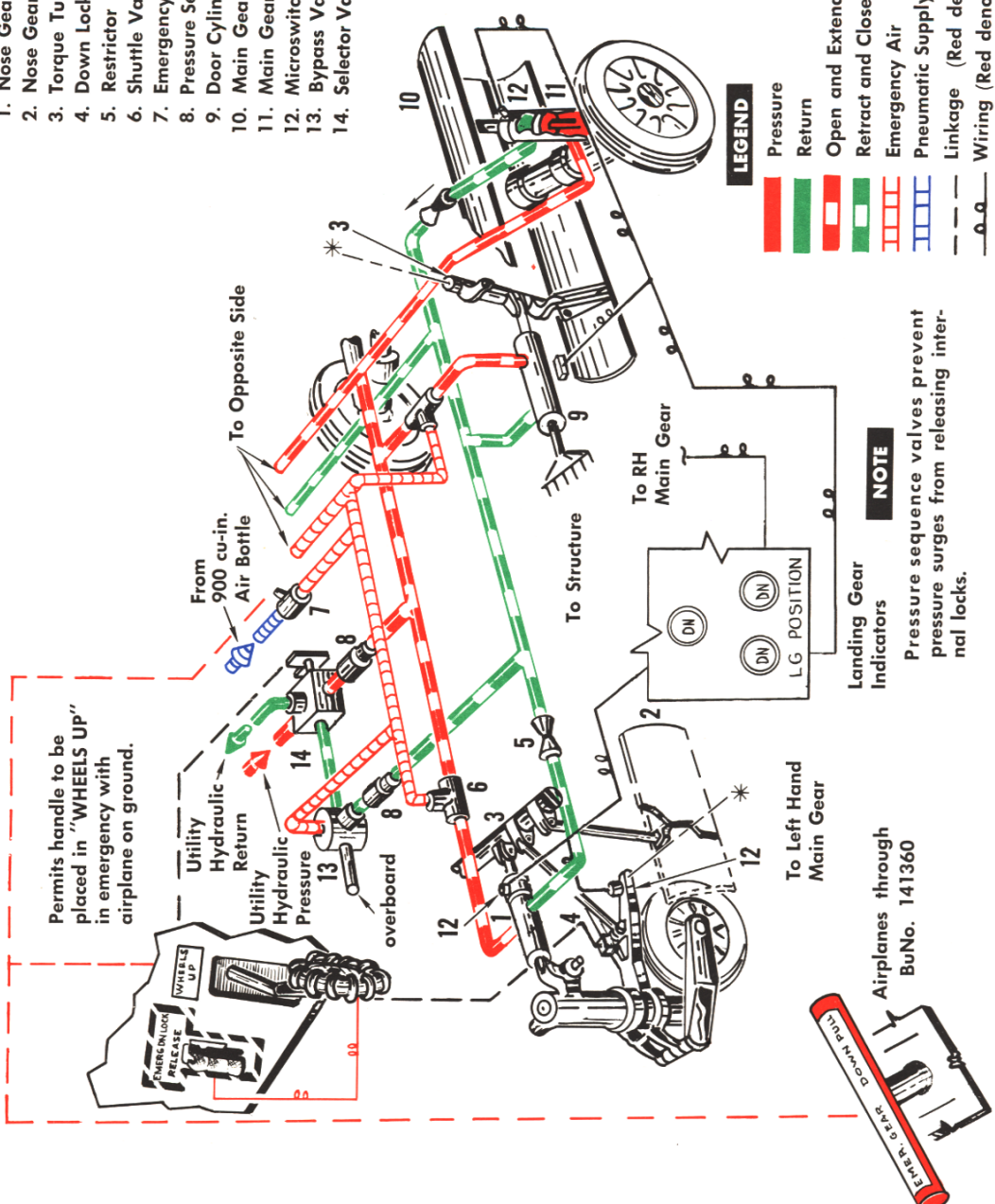
Extension of the landing gear energizes the approach light and disarms the armament system. Upon extension of the emergency power package, the landing gear warning light will glow slightly with the gear retracted. This is normal and no action is required. The light will operate normally when the gear is extended.

Table 1-12. Landing Gear System Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
Landing gear handle (24, figure 1-4)	<p>"WHEELS UP," with airplane airborne and nose gear centered, retracts and locks gear in up position.</p> <p>"WHEELS DOWN" extends and locks gear in down position.</p> <p>On airplanes BuNo. 141361 and subsequent, gear is extended pneumatically by placing handle in "WHEELS DOWN," pushing in, rotating clockwise, and pulling aft. Landing gear handle must be placed in "WHEELS DOWN" for nose gear down lock and indication.</p>
Emergency down lock release switch (21, figure 1-4)	<p><i>For Emergency Use Only.</i> Up permits moving landing gear handle to "WHEELS UP" while airplane is on ground (nose gear need not be centered).</p>
EMERG GEAR DOWN handle (Airplanes through BuNo. 141360) (3, figure 1-4)	<p>"PULL" extends gear pneumatically. Landing gear handle must first be placed in "WHEELS DOWN" for nose gear down lock and indication.</p>
LG position indicators (three) (22, figure 1-4)	<p>"UP" indicates corresponding gear up and locked.</p> <p>Wheel or "DN" indicates corresponding gear down and locked.</p> <p>Barber pole indicates corresponding gear position differs from selected position, gear moving to selected position, or electrical power not connected.</p>
Landing gear warning light (in landing gear handle)	<p>On indicates position of one or more gears differs from selected position, or gear moving to selected position.</p> <p>Off indicates all gears locked in position indicated by handle position.</p>

LANDING GEAR

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. Pressure Sequence Valve
9. Door Cylinder
10. Main Gear Door
11. Main Gear Cylinder
12. Microswitch
13. Bypass Valve
14. Selector Valve



Permits handle to be placed in "WHEELS UP" in emergency with airplane on ground.

From 900 cu-in. Air Bottle

To Opposite Side

To Structure

To RH Main Gear

To LH Main Gear

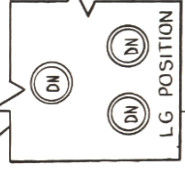
LEGEND

- █ Pressure
- █ Return
- █ Open and Extend
- █ Retract and Close
- █ Emergency Air
- █ Pneumatic Supply
- Linkage (Red denotes emergency)
- Wiring (Red denotes emergency)
- Pivot

NOTE

Pressure sequence valves prevent pressure surges from releasing internal locks.

Landing Gear Indicators



Airplanes through BuNo. 141360

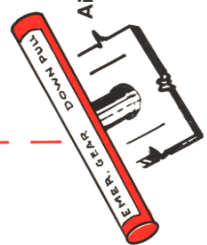


Figure No. 1 -19. Landing Gear

NOSE GEAR STEERING

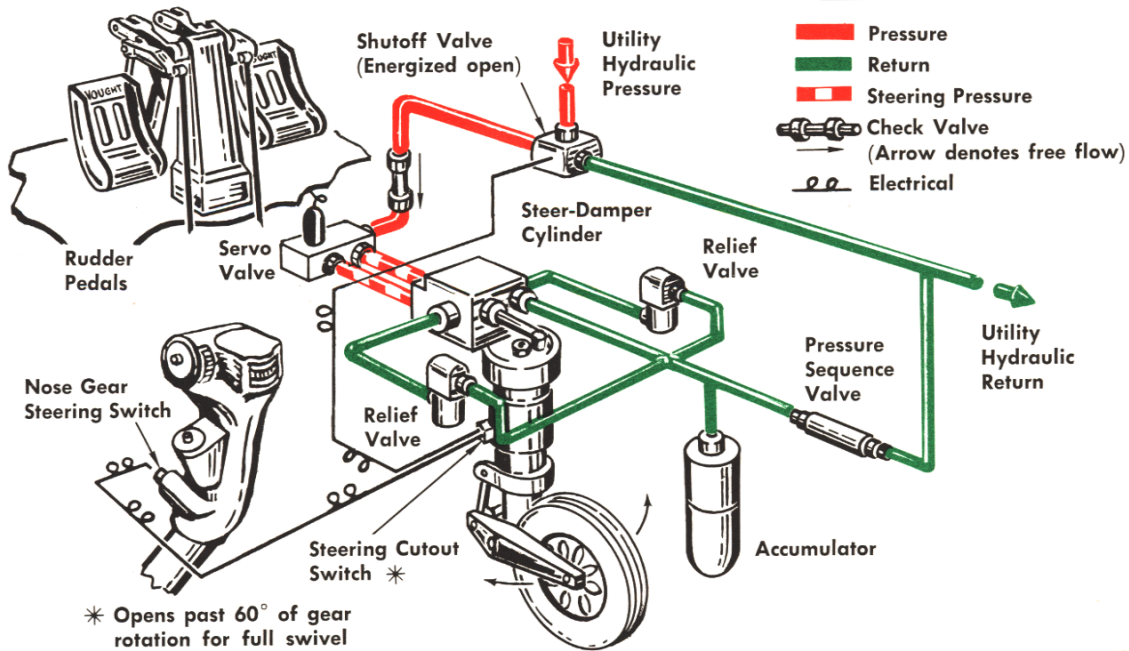


Figure No. 1-20. Nose Gear Steering

NOSE GEAR STEERING

EQUIPMENT OF INTEREST

Controls are listed in table 1-13.

OPERATION.

Depressing the nose gear steering switch and pushing the appropriate rudder pedal causes the steer-damper cylinder to hydraulically rotate the nose gear. Utility hydraulic system pressure is used for nose gear steering. Steering is limited to 60° right or left by a steering cutout switch which is actuated when the nose gear rotates past 60°. Because of rudder stop engagement, the full nose gear steering range is not available with the wing down. The normal 360° nosewheel rotation

during taxiing and ground handling is available when the steering system is not actuated. Steering is possible only when airplane weight is on the landing gear. On airplanes that do not have ASC 146 (ECP 321) incorporated, the landing gear handle can be placed in "WHEELS UP" only if the nose gear is centered. On airplanes BuNo. 143732 and subsequent and on airplanes having ASC 146 (ECP 321) incorporated, the main gear will retract and the nose gear will remain extended if not centered. (See figures 1-19 and 1-20.)

Table 1-13. Nose Gear Steering System Controls

Nomenclature	Function
Nose gear steering switch (LH side of pilot's control stick)	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.
Rudder pedals	Control steering with steering switch depressed.

WHEEL BRAKES

NOTE

This illustration reflects Airplanes BuNo. 143772 and subsequent and Airplanes having ECP 303 incorporated.

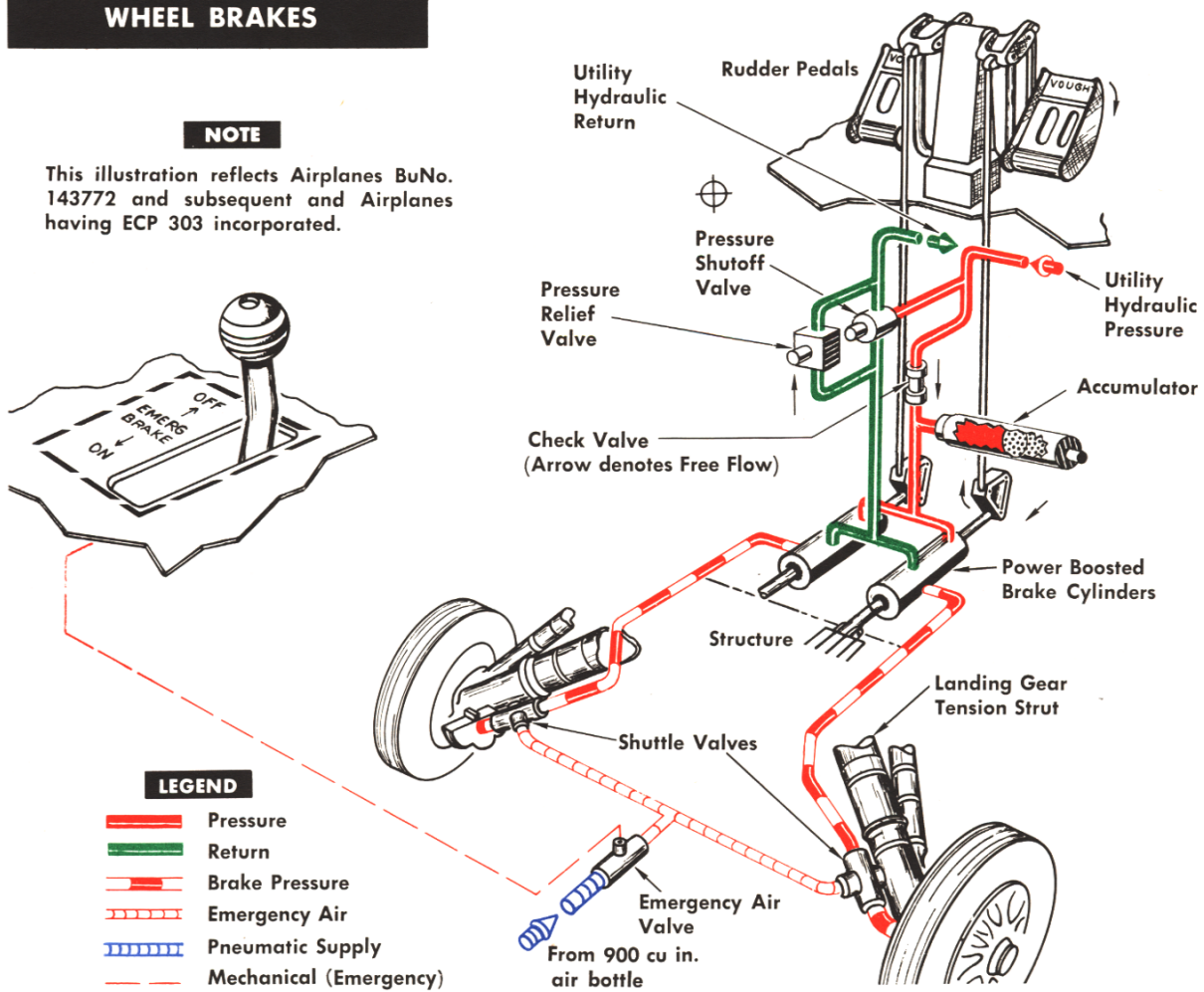


Figure No. 1-21. Wheel Brakes

WHEEL BRAKES

EQUIPMENT OF INTEREST

Controls are listed in table 1-14.

OPERATION.

The self-adjusting wheel brakes are normally actuated by utility hydraulic system pressure (figure 1-21). 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. On airplanes BuNo. 143772 and subsequent and on airplanes having ECP 303 incorporated,

a brake accumulator provides hydraulic pressure for approximately six to twelve "boosted" brake applications when utility system pressure is not available. 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.

Table 1-14. Wheel Brake System Controls

<i>Nomenclature</i>	<i>Function</i>
Rudder pedals	Depressing tips directs hydraulic pressure to wheel brake cylinders in proportion to amount of force applied.
EMERG BRAKE handle (13, figure 1-4)	Pulling 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.) "OFF" shuts off pneumatic pressure and releases brakes.

ARRESTING GEAR**EQUIPMENT OF INTEREST**

Controls and indicator are listed in table 1-15.

OPERATION.

The arresting hook is retracted by utility hydraulic pressure and extended by pressure from an accumulator (figure 1-22). The hook is normally held retracted by hydraulic pressure, and with loss of hydraulic pressure, by a mechanical uplock latch. The hook is held extend-

ed by overcenter locking-gear linkage which is connected to a spring-loaded linkage unlocking cylinder. If accumulator pressure is lost, the hook is extended by releasing the uplock latch which permits the hook to drop of its own weight and lock extended with the aid of the unlocking cylinder spring action forcing the linkage overcenter.

Table 1-15. Arresting Gear System Control and Indicator

<i>Nomenclature</i>	<i>Function</i>
Arresting gear handle (1, figure 1-5)	"HOOK DOWN" relieves hydraulic pressure, retracts uplock latch, and extends hook. "HOOK UP" energizes selector valve, positions uplock latch, and retracts hook.
Arresting gear warning light (in arresting gear handle)	On when arresting gear handle and hook positions do not agree.

ARRESTING GEAR

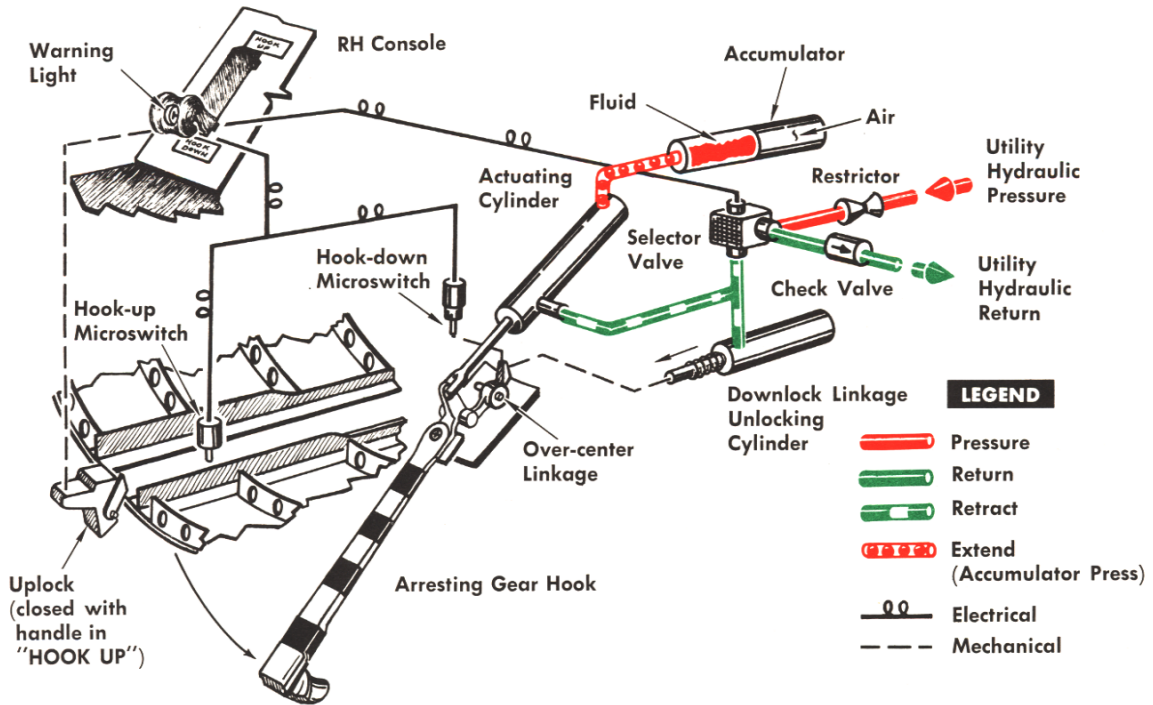


Figure No. 1-22. Arresting Gear

WINGFOLD

EQUIPMENT OF INTEREST

Controls and indicators are listed in table 1-16.

OPERATION.

The wing outer panels are folded or spread by utility hydraulic pressure (figure 1-23). They may be folded or spread with the wing raised or lowered. When the wings are folded, red warning flags 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 lock cylinders and the wingfold cylinders. The lock cylinders

retract, releasing the wing hinge interlocks. The wingfold cylinders are not actuated until the retracting lock cylinders 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 interlocks and the lock safety latches. The warning flags will be visible any time the lock safety latches are not locked.

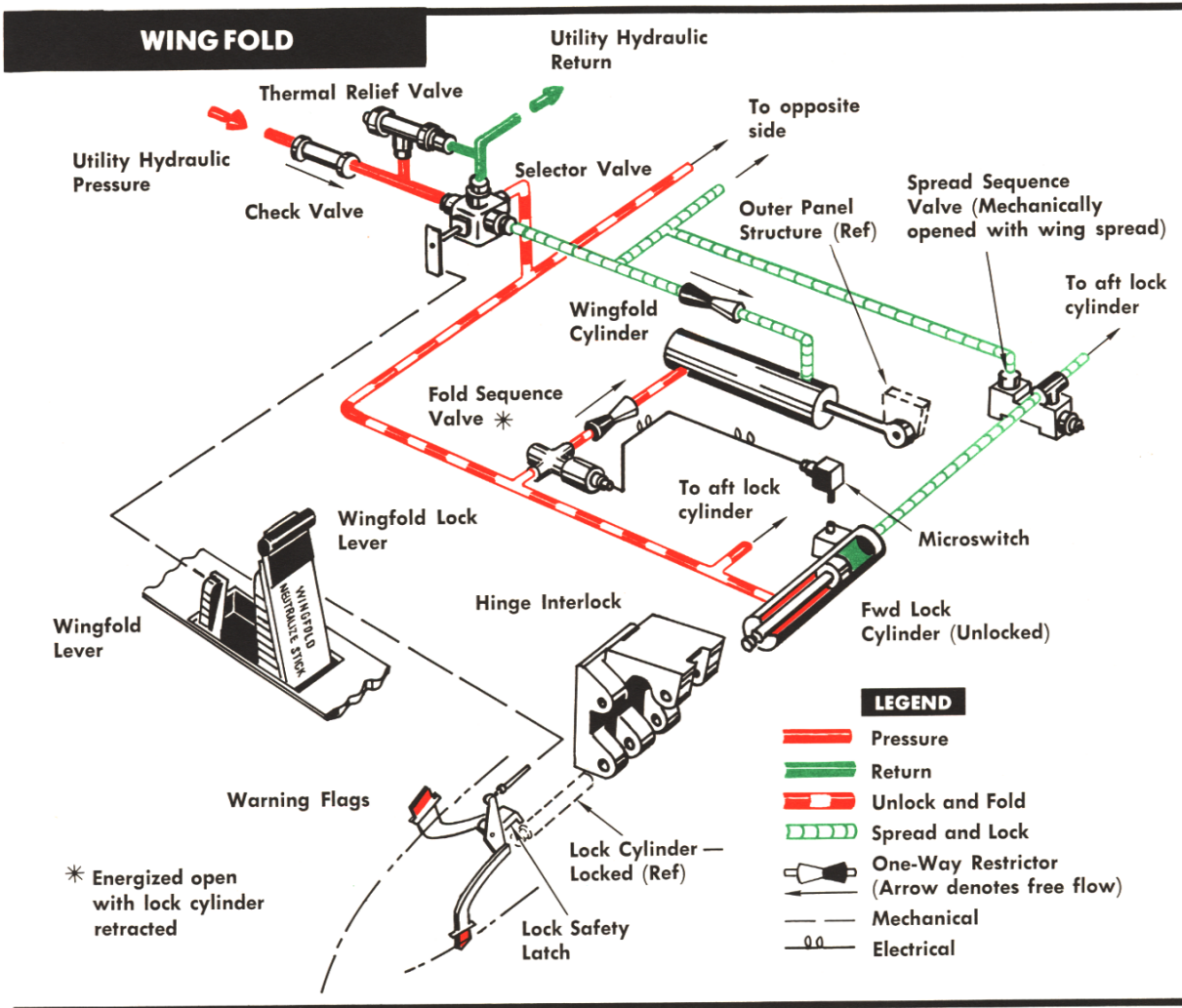


Figure No. 1-23. Wingfold

Table 1-16. Wingfold System Controls and Indicators

Nomenclature	Function
Wingfold lock lever (10, figure 1-5)	Up (depress tab, squeeze latch and pull) mechanically releases lock safety latches and extend warning flags. Down (only after wings fully spread by placing wingfold lever in down position) mechanically positions lock safety latches to lock the lock cylinders and to retract warning flags.
Wingfold lever (under wingfold lock lever)	<i>Ailerons must be neutral. Do not deflect stick during folding.</i> Up (press inboard and pull up) hydraulically folds wings. Down hydraulically spreads wings.
Warning flags (top and bottom wing leading edge — wingfold area)	Extended indicates lock cylinders are not locked. Retracted indicates lock cylinders are locked.

FLIGHT INSTRUMENTS**EQUIPMENT OF INTEREST**

Attitude indicator
Turn-and-bank indicator
Accelerometer

Airspeed — Mach number indicator
Rate-of-climb indicator
Altimeter
Angle-of-attack indicator

Navigation instruments are described in section IV.

OPERATION.**ATTITUDE INDICATOR.** (See figure 1-3.)

This indicator indicates angle-of-bank and angle-of-pitch. The indicator gyro is operative any time the airplane electrical system is energized. The "OFF" flag will appear when a-c power is not connected.

TURN-AND-BANK INDICATOR. (See figure 1-3.)

The gyro of this conventional indicator is operated by bleed air from the engine compressor section.

ACCELEROMETER. (See figure 1-3.)

This conventional indicator is self-contained and indicates continuously the existing g-load on the airplane during flight. It also indicates the maximum positive and negative loads that were imposed on the airplane during any particular flight period.

AIRSPEED-MACH NUMBER INDICATOR. (See figure 1-3.)

This conventional pitot-static pressure indicator provides indicated airspeed and indicated Mach number readings. An airspeed correction card (37, figure 1-3)

provides calibrated airspeed data. Conventional pitot tube anti-icing is provided.

RATE-OF-CLIMB INDICATOR. (See figure 1-3.)

This conventional indicator, operated by static pressure, provides rate-of-climb and rate-of-descent information in feet-per-minute.

ALTIMETER. (See figure 1-3.)

This instrument, 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.

ANGLE-OF-ATTACK INDICATOR.* (See figure 1-3A.)

This indicator 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 SYSTEM" in section VII for details of system operation.

Table 1-17. Deleted.

FIRE DETECTOR**FUNCTION**

Provides an automatic visual warning of fire in the engine and afterburner compartments and in the area above the rocket pack.

EQUIPMENT OF INTEREST

Heat-sensing element consisting of a shielded wire with an insulated conductor routed through the engine compartment and rocket pack well.
Test switches and indicators are listed in table 1-18.

OPERATION.

Abnormally high temperature, such as that produced by a fire, is sensed by the system, resulting in illumina-

tion of the fire warning light. The system is operated by emergency dc bus power.

*Airplanes BuNo. 145509 and subsequent and airplanes with ASC 202 (ECP 278) incorporated.

Table 1-18. Fire Detector System Controls and Indicator

<i>Nomenclature</i>	<i>Function</i>
Fire warning test switch (9, figure 1-3)	Depressed checks system circuit continuity and operation of fire warning light.
Fire warning light (10, figure 1-3)	Light on indicates fire in engine or afterburner area or in area above rocket pack.

CANOPY**EQUIPMENT OF INTEREST**

Rear-hinged canopy
Four hook-type canopy locks

Jettison cartridge
Controls are listed in table 1-19.

OPERATION.

The canopy (figure 1-24) can be opened or closed manually from inside or outside the cockpit by actuating the interior or exterior canopy release handle. Both of these handles mechanically release the canopy locks through movement of the same linkage. An emergency canopy actuator is provided for jettisoning the canopy. This actuator is automatically fired when the face curtain handle is pulled, as a step in the ejection sequence, when the EMERGENCY CANOPY JETTISON handle is pulled, or when an external emergency

canopy jettison handle is pulled by the crash crew. When the actuator fires, it releases the canopy locks and jettisons the canopy.

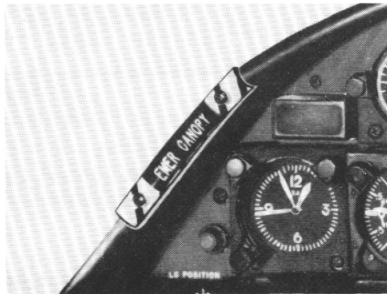
When ditching or making a crash landing, the canopy can be jettisoned without ejecting the seat by pulling the EMERGENCY CANOPY JETTISON handle. This handle actuates the same linkage as the face curtain (figure 1-24).

Check that the canopy actuator safety pin has been removed prior to flight.

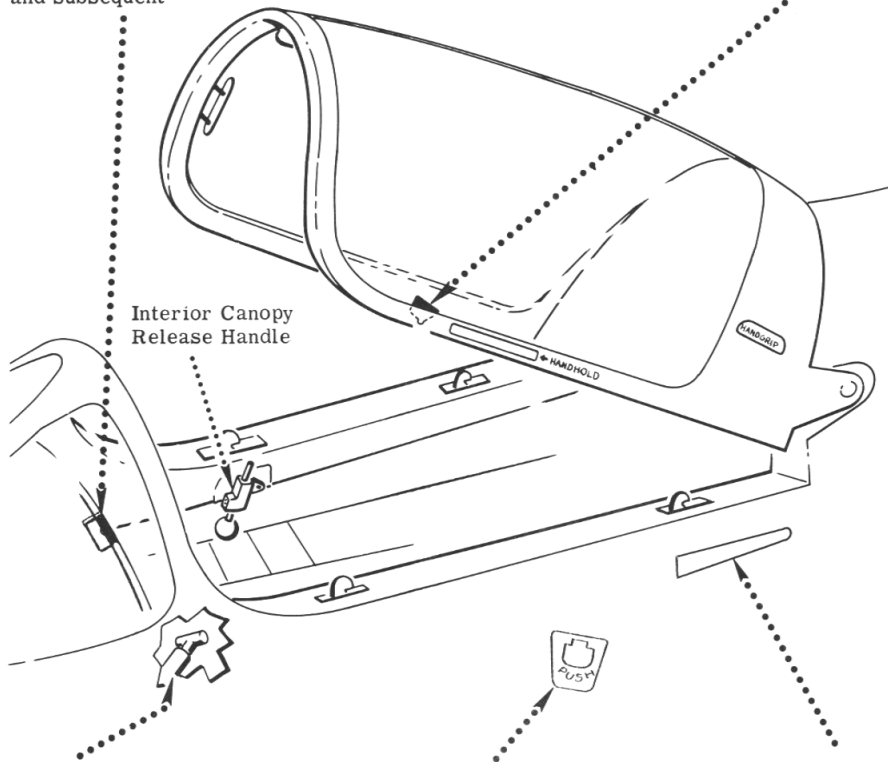
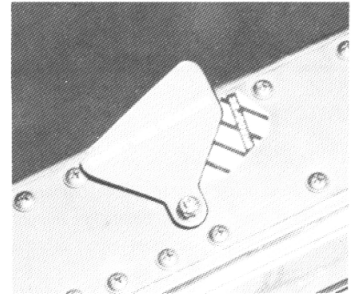
Table 1-19. Canopy System Controls and Indicator

<i>Nomenclature</i>	<i>Function</i>
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.
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.
EMERGENCY CANOPY JETTISON handle	Pulling out fully, releases canopy locks and jettisons canopy.
Face curtain handle	Pulling down fully, jettisons canopy and ejects seat.
CANOPY lock indicator (Airplanes through BuNo. 143701)	Indicates positioning of canopy locks by canopy release handles.
CANOPY LOCK INDICATOR (Airplanes BuNo. 143702 and subsequent)	Indicates canopy down and locked.
External emergency canopy jettison handle (On each side of fuselage in BuNo. 145483 and subsequent and airplanes with ASC 185 (ECP 246) incorporated)	Pulled out to full length of lanyard, releases canopy locks and jettisons canopy.

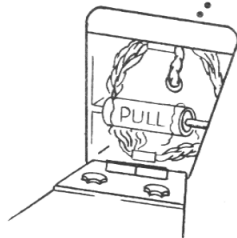
CANOPY



Airplanes BuNo. 145416 and subsequent



Airplanes through BuNo. 145415



External Emergency Canopy Jettison Handle (both sides of fuselage)

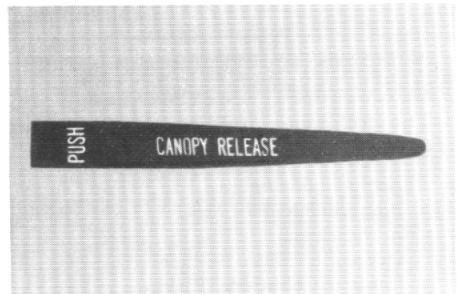


Figure No. 1-24. Canopy

EJECTION SEAT**EQUIPMENT OF INTEREST**

The seat is illustrated in figure 1-25; controls are listed in table 1-20.

OPERATION.

Pulling the face curtain to its full-down position initiates the seat automatic ejection sequence. The shoulder harness locks, the canopy is jettisoned, and the seat is ejected. As the seat moves upward, the oxygen line, antiblackout line, and electrical lines are separated from the airplane and the bailout oxygen bottle is activated. Separation of the seat from the airplane pulls a lanyard to fire the integrated harness time delay actuator to release the pilot from the seat. On airplanes equipped with the low-level ejection system,* unlocking of the variable-incidence wing automatically modifies the ejection sequence to provide forcible separation of the seat and pilot. The low-level system

permits escape at altitudes as low as 50 feet from level or climbing flight. (See figure 1-25A for a detailed description of the ejection sequence.) In all ejections, separation of the pilot and seat arms the automatic parachute opener.

If the canopy fails to be jettisoned when the face curtain is pulled, curtain travel will stop approximately at eye level. Pulling the emergency seat arming handle permits the curtain to be pulled to full-down position to eject the seat through the canopy.

When the seat catapult cartridge is installed, a cartridge indicator marked "LOADED" will be visible on the catapult cap.

*Airplanes BuNo. 145465 and subsequent and airplanes with ASC 131 (ECP 191) incorporated.

Table 1-20. Ejection Seat System Controls

<i>Nomenclature</i>	<i>Function</i>
SEAT adjust switch (7, figure 1-5)	"UP" or "DOWN" raises or lowers seat.
Headrest adjust lever	Pulled forward, allows headrest to be placed manually in one of three positions.
Shoulder harness lever	Pulled aft, unlocks shoulder harness inertia reel so that pilot may lean forward. Pushed forward, locks inertia reel, holding pilot against seat.
EMERG HARNESS REL handle	Trigger squeezed and handle pulled upward releases integrated harness from seat and frees parachute arming cable to permit emergency exit from airplane after ditching or crash landing, or separation from seat if automatic harness actuation fails following ejection.
Face curtain handle	Pulled down firmly with continuous movement initiates ejection sequence.
Emergency seat arming handle	Pulled fully forward, permits face curtain to be pulled down fully, ejecting seat through canopy if canopy fails to be jettisoned.

AUXILIARY EQUIPMENT

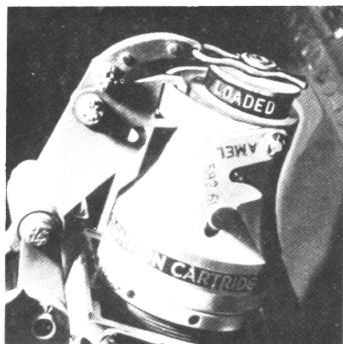
The following auxiliary equipment is discussed in section IV:

Air-Conditioning	Radio Navigation (VOR) AN/ARN-14E
Pressure Suit	Radio Navigation (TACAN) AN/ARN-21
Antiblackout	Navigation Equipment
Oxygen	Exterior Lights
Integrated Electronic Package	Interior Lights
Command Radio Set AN/ARC-27A	Armament Control System
Identification Set AN/APX-6B and Coder Group AN/APA-89	Gunnery
Direction Finder (ADF) Group AN/ARA-25	Rockets
	Missiles
	Miscellaneous Equipment

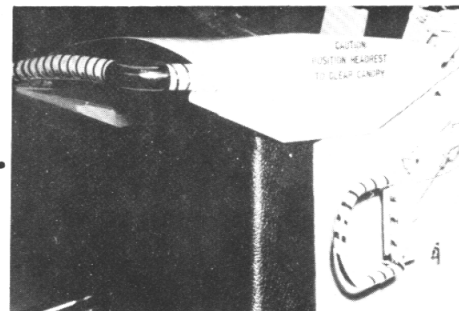
EJECTION SEAT

NOTE

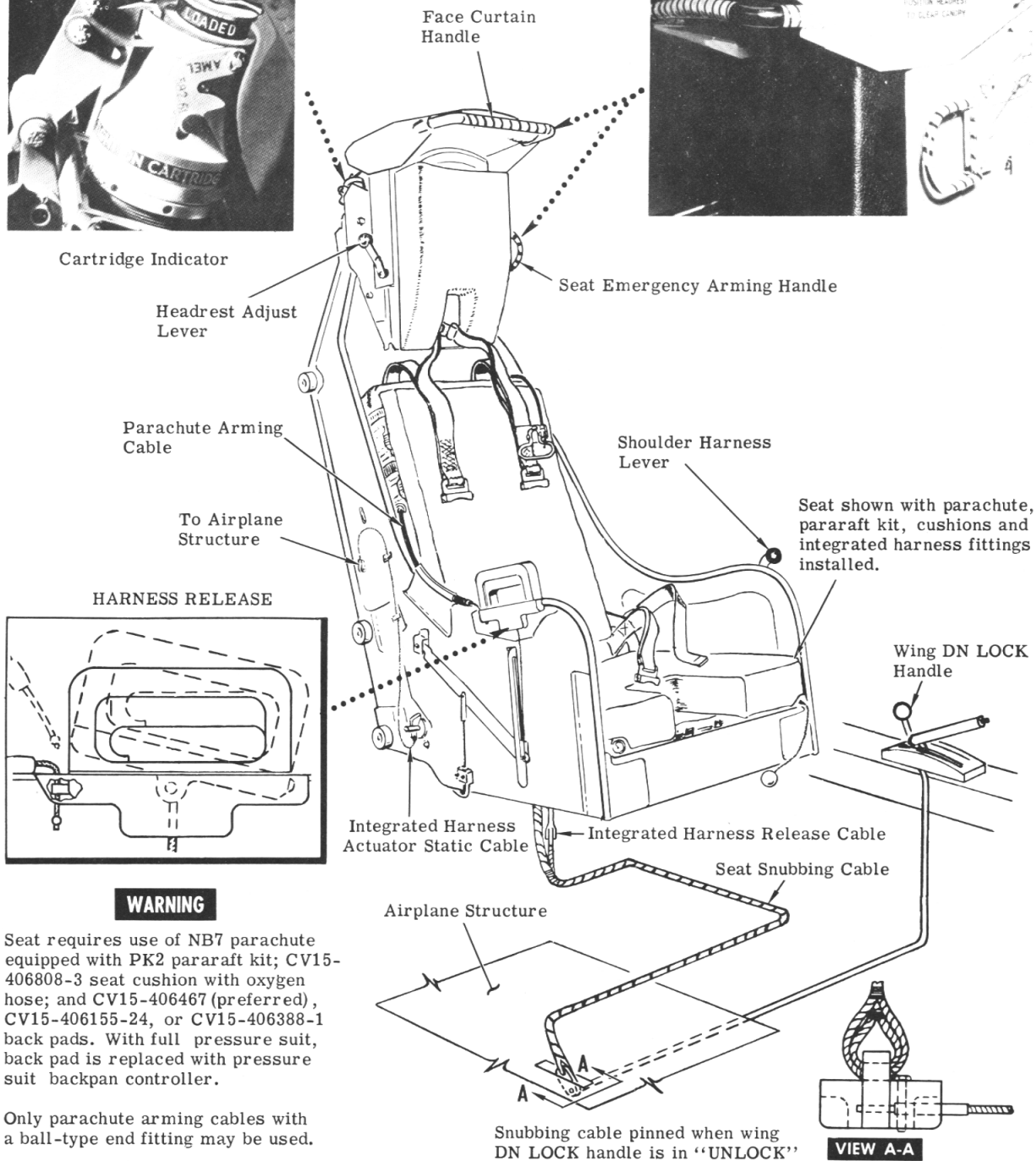
This illustration shows low-level escape provisions on airplanes BuNo. 145465 and subsequent and airplanes with ASC 131(ECP 191) incorporated.



Cartridge Indicator

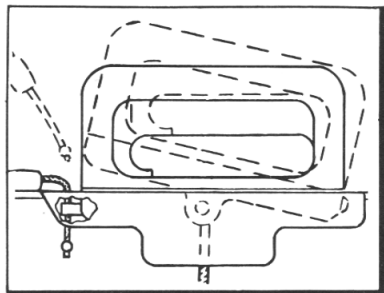


Seat Emergency Arming Handle



Seat shown with parachute, paraft kit, cushions and integrated harness fittings installed.

HARNES RELEASE



WARNING

Seat requires use of NB7 parachute equipped with PK2 paraft kit; CV15-406808-3 seat cushion with oxygen hose; and CV15-406467 (preferred), CV15-406155-24, or CV15-406388-1 back pads. With full pressure suit, back pad is replaced with pressure suit backpan controller.

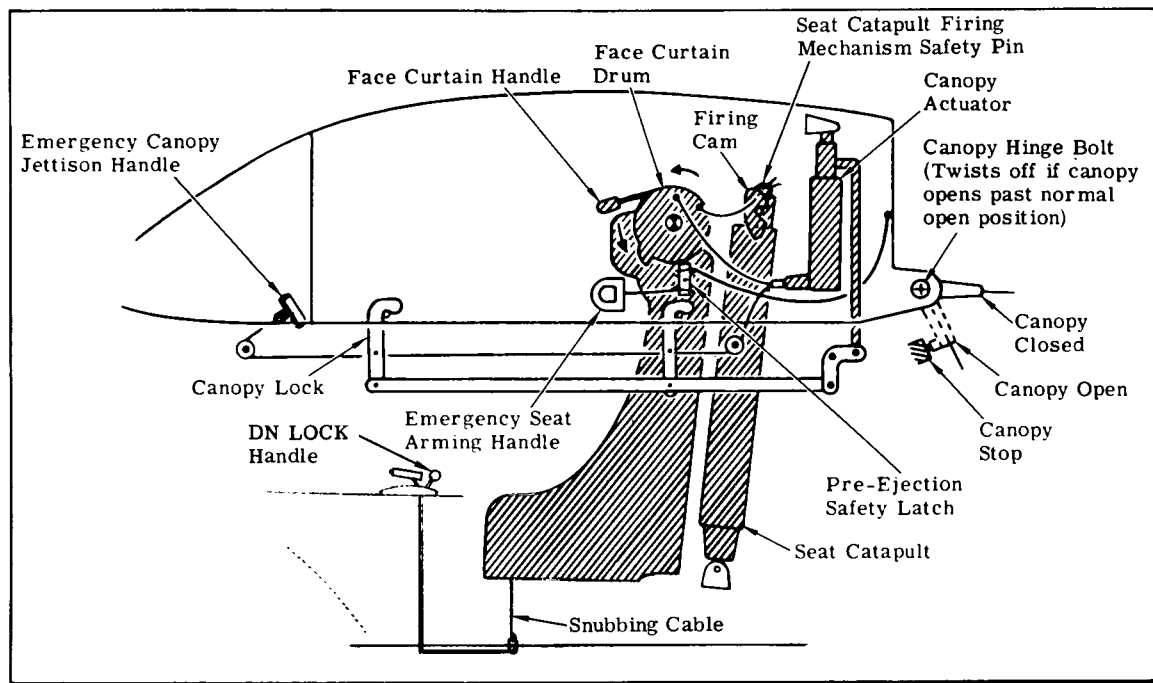
Only parachute arming cables with a ball-type end fitting may be used.

Snubbing cable pinned when wing DN LOCK handle is in "UNLOCK"

VIEW A-A

Figure No. 1-25. Ejection Seat

EJECTION SEQUENCE



NOTE

On airplanes that do not have ASC 131 (ECP 191) incorporated the ejection sequence under all conditions is similar to the sequence presented here for high-altitudes and high-speed except that the face curtain does not pull away from the seat.

LOW-LEVEL EJECTION

The low-level ejection sequence is automatically selected whenever the wing DN LOCK handle is in the "UNLOCK" position. With the handle in the "UNLOCK," the end of the seat snubbing cable is pinned to the airplane structure.

When the face curtain is pulled with a continuous movement, the shoulder harness is locked and mechanical linkage fires the emergency canopy actuator cartridge. Firing of the cartridge releases the canopy locks and allows the canopy to open beyond its normal limits so that the canopy hinge bolts are sheared. As the canopy leaves the airplane, a cable releases the pre-ejection safety latch allowing further travel of the face curtain.

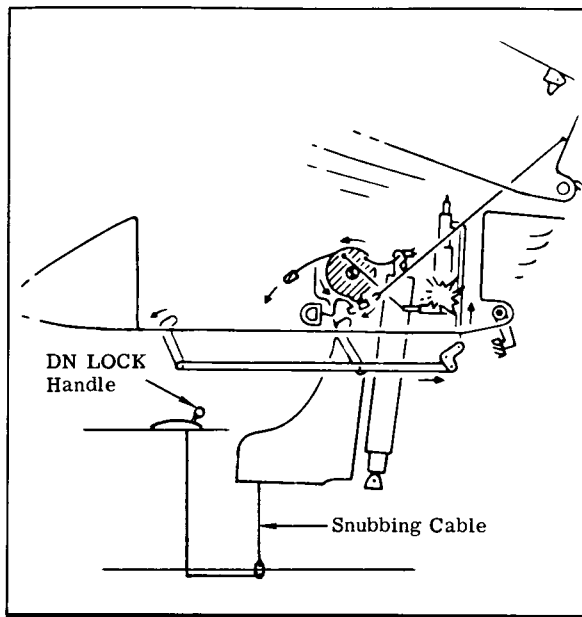
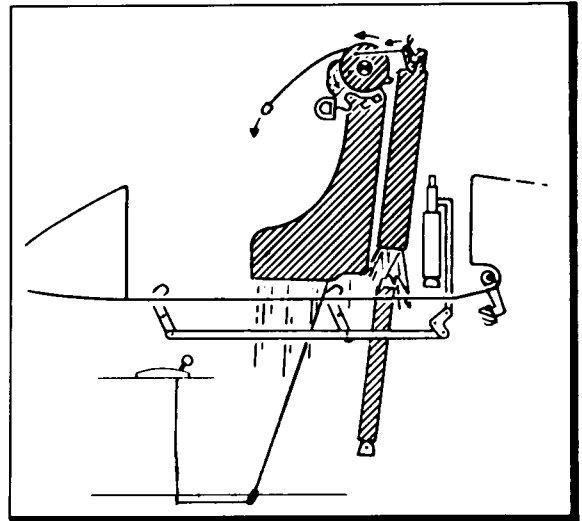


Figure No. 1-25A. Ejection Sequence (Sheet 1)

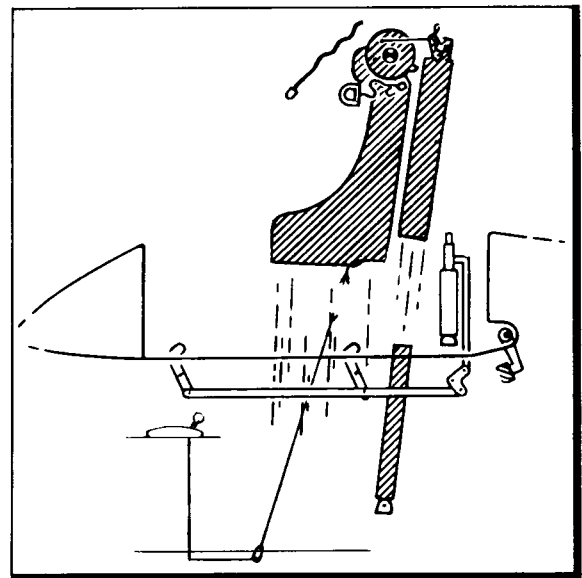
EJECTION SEQUENCE

2 Continued motion of the face curtain pulls the seat catapult safety pin. With the safety pin pulled, the firing cam actuates the firing pin to detonate the cartridge and eject the seat.

As the seat begins to move upward, the pilot's services are disconnected and the bailout bottle lanyard activates the bailout oxygen supply.



3 Just as the seat clears the catapult rails, the snubbing cable is pulled taut and actuates the harness release mechanism to free the integrated harness fittings and the breakaway face curtain. As the snubbing cable begins to stretch, the retarding force applied to the seat causes the pilot, who is no longer restrained by the harness, to be forcibly separated from the seat. Separation of the pilot and seat pulls the parachute arming cable to actuate the automatic parachute opener.



HIGH-ALTITUDE HIGH-SPEED EJECTION

When the wing DN LOCK handle is in "LOCK," the seat snubbing cable is not pinned to the airplane structure and the ejection sequence is modified for higher altitudes and speeds.

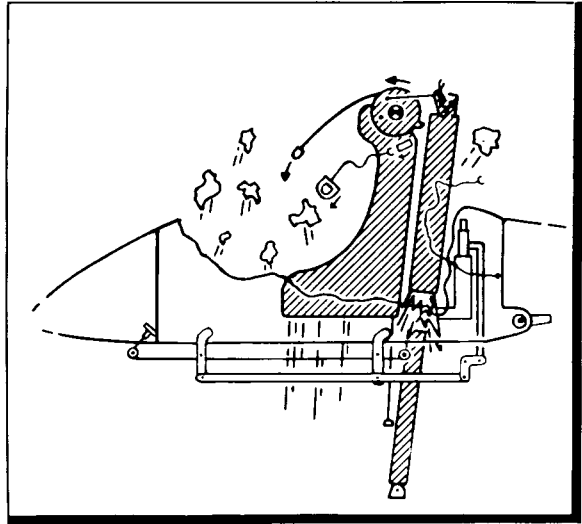
The canopy is jettisoned and the seat is fired by pulling the face curtain handle just as for a low-level ejection.

As the seat begins to move upward, the pilot's services are disconnected, the bailout oxygen supply is activated, and the integrated harness time delay cartridge is fired. When the harness is released from the seat, the breakaway face curtain is released to facilitate separation of the pilot and the seat. Separation from the seat arms the automatic parachute opener.

Figure No. 1-25A. Ejection Sequence (Sheet 2)

EJECTION THROUGH CANOPY

If the canopy fails to be jettisoned, the face curtain will be stopped at eye level by the pre-ejection safety latch. Pulling the seat emergency arming "D" handle releases the safety latch to permit face curtain motion to continue. The seat is then ejected through the canopy.



CANOPY JETTISONING

The canopy can be jettisoned for a crash landing or ditching by pulling the EMER CANOPY jettison handle, which fires the canopy actuator cartridge and jettisons the canopy without initiating seat ejection.

Pulling the RESCUE handle on either on either side of the fuselage fires the canopy actuator to facilitate emergency entrance to the cockpit.

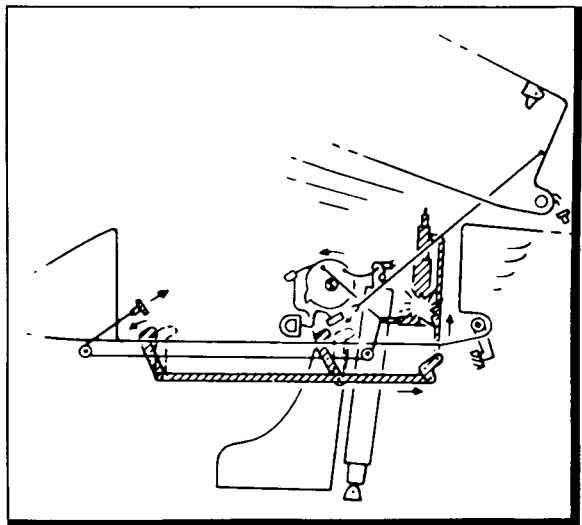


Figure No. 1-25A. Ejection Sequence (Sheet 3)

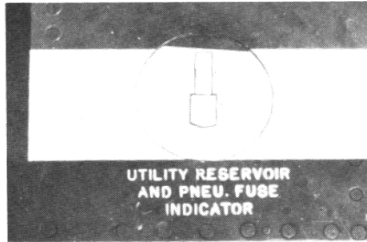
SERVICING DIAGRAM

UTILITY HYDRAULIC SYSTEM

Servicing Access

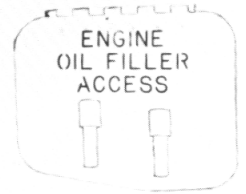
Indicator Access

FUSE RESET INSTRUCTIONS
 TO RESET FUSE, TURN FUSE RESET INDICATOR OFF AND PRESS FUSE RESET INDICATOR. INDICATOR WILL TURN OFF AFTER FUSE IS RESET. FUSE RESET INDICATOR WILL NOT BE CONTROLLED BY FUSE RESET INDICATOR.
REMOVAL RESTRICTED
ACCESS TO
 TO RESET FUSE, FILLER AND DRAIN AND SUPPLY SHUT OFF VALVE, FUSE RESET INDICATOR AND TURBINE CYL. CONTROLLED BY FUSE RESET INDICATOR.

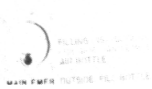
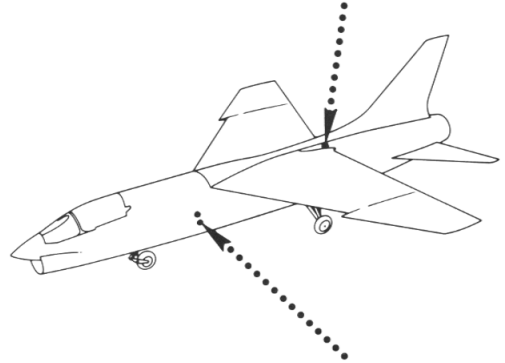
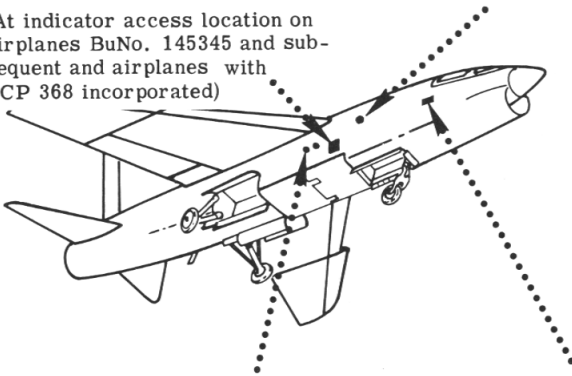


ENGINE OIL

PC 2 RESERVOIR
 NEEDLE
 PC 1 RESERVOIR
 NEEDLE

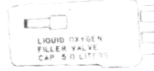


(At indicator access location on airplanes BuNo. 145345 and subsequent and airplanes with ECP 368 incorporated)



WAR STAY CLEAR

LIQUID OXYGEN
 NEVER HEAT OR BE EXPOSED TO FLAME
 FILL WITH LIQUID OXYGEN AT ROOM TEMP
 OVERHEATING DUE TO EXCESSIVE HEAT
 DURING USE OF LIQUID OXYGEN
 KEEP CLEAN AND FREE OF OIL



ACCESS RESTRICTED



PNEUMATIC SYSTEM

Indicator and Servicing Access
 (Airplanes BuNo. 145416 and subsequent)

OXYGEN

PNEUMATIC SYSTEM

Indicator and Servicing Access
 (Airplanes through BuNo. 145415)

NOTES

- 1 Use only hydraulic fluid manufactured by one of the following companies:
 Standard Oil Company of California or New Jersey,
 Socony Vacuum Oil Company, Bray Oil Company
 or Golden Bear Oil Company.
- 2 Approved fuels: Ashore, JP-4; Afloat, JP-5
 Emergency fuels: JP-3 and AVGAS

WARNING

When using emergency fuels observe limitations in section V of Supplemental Flight Handbook.

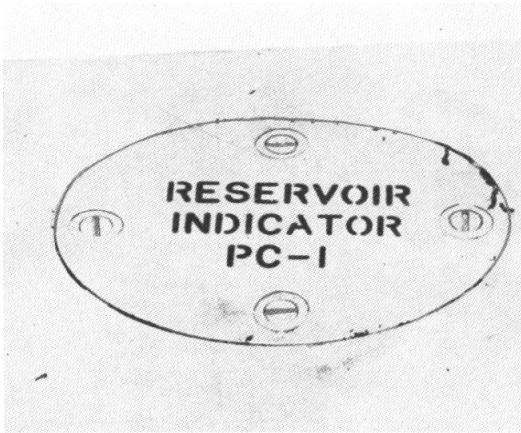
- 3 Refer to the F8U-1 Handbook of Maintenance Instruction for permissible access panel removal combinations and for servicing procedures.

Figure No. 1-26. Servicing (Sheet 1)

SERVICING DIAGRAM

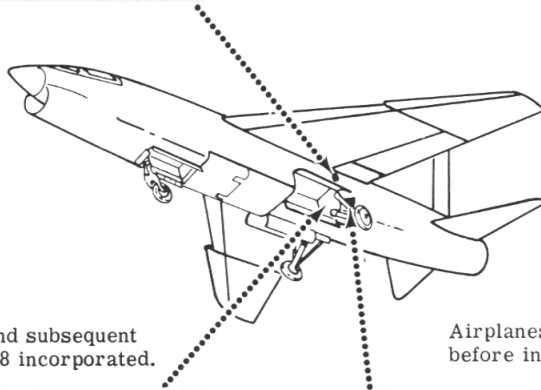
POWER CONTROL SYSTEMS

Indicator Access



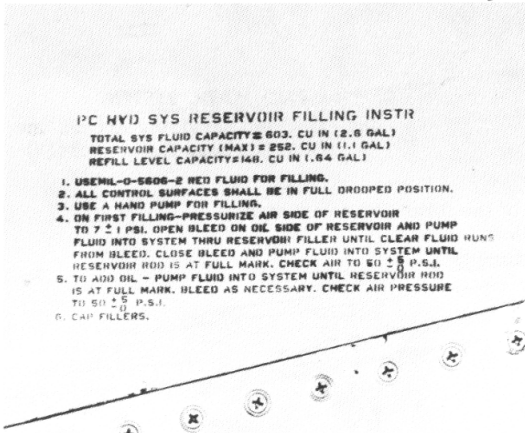
NOTE

Illustration shows servicing provisions for power control system No. 1. System No. 2 is identical on right-hand side of airplane.

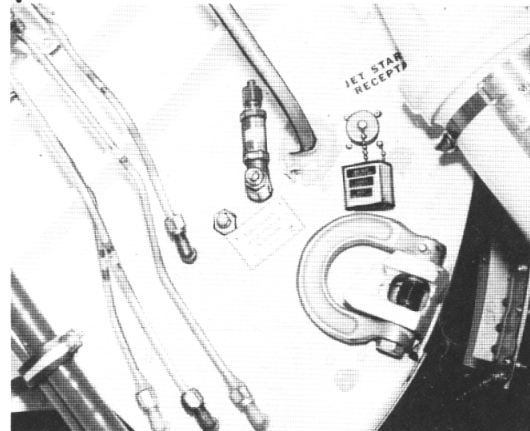


Airplanes BuNo. 145345 and subsequent and airplanes with ECP 368 incorporated.

Airplanes through BuNo. 145344 before incorporation of ECP 368.



Servicing Access



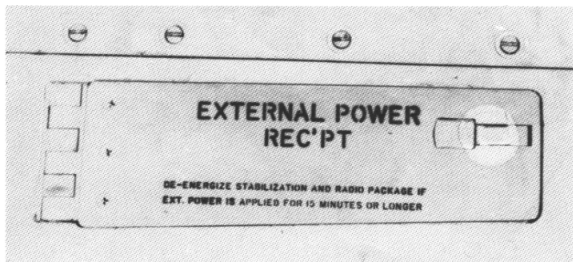
Servicing Access

Figure No. 1-26. Servicing (Sheet 2)

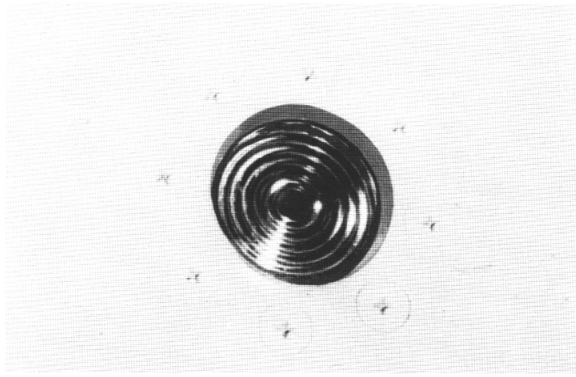
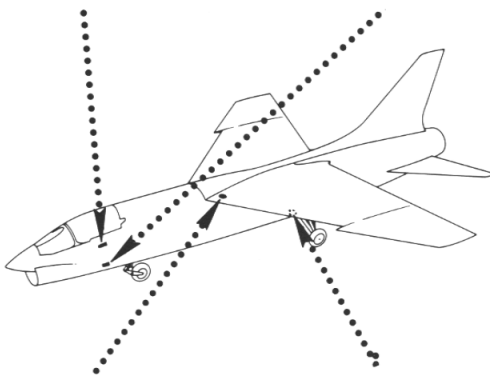
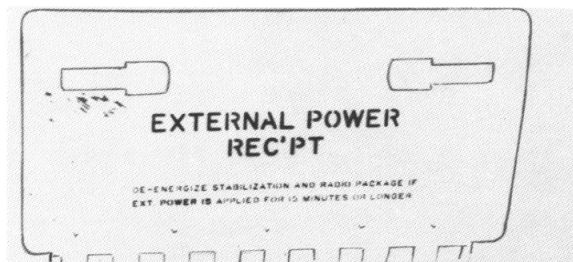
SERVICING DIAGRAM

EXTERNAL ELECTRICAL POWER

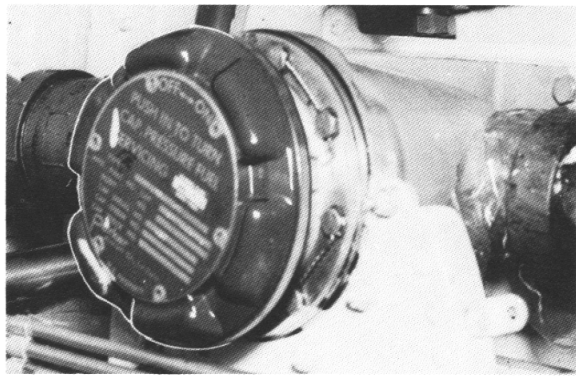
Airplanes through BuNo. 143701



Airplanes BuNo. 143702 and Subsequent



Wing Tank Visual Indicator



FUEL

Central Point Fueling Adapter
(In LH Wheel Well)

SERVICING MATERIALS

- ENGINE OIL: Gas turbine lubricating oil, MIL-L-7808
- HYDRAULIC SYSTEMS: Red hydraulic fluid, MIL-O-5606,(see note 1) and dry air or nitrogen
- PNEUMATIC SYSTEM AND TIRES: Dry air or nitrogen
- FUEL SYSTEM: Jet fuel (see note 2)
- OXYGEN SYSTEM: Liquid oxygen, BB-0-925 (Type I, grade A; and type II)
- EXTERNAL ELECTRICAL POWER: 28-volt dc; 115-volt, 400-cycle, 3-phase ac

Figure No. 1-26. Servicing (Sheet 3)

Figure No. 1-27. Deleted

SECTION II

NORMAL PROCEDURES



INTRODUCTION.

This section prescribes the recommended procedures for operating the essential systems of the airplane *under normal conditions*. Each phase of operation, from the time you approach the airplane before a flight to the time you leave the airplane after a flight, is prescribed under a separate heading. (Procedures concerning the normal operation of *auxiliary* equipment are prescribed in section IV.)

BEFORE ENTERING AIRPLANE.

a. Flight Restrictions and Characteristics — Refer to sections V and VI of the F8U-1 Supplemental Flight Handbook.

b. Flight Planning and Cruise Control Data — Refer to appendix I of the F8U-1 Supplemental Flight Handbook.

c. Takeoff and Anticipated Landing Gross Weight and Balance — Refer to "Weight Limitations," section V of the F8U-1 Supplemental Flight Handbook and to the Handbook of Weight and Balance (AN 01-1B-40). Check Form F of the latter handbook.

d. Engine Thrust Check Data — Determine correct TURB outlet pressure indicator reading or engine PRESSURE RATIO indicator* reading from figure 7-1 for performing "MILITARY THRUST CHECK."

e. Status and Servicing of Airplane and Ordnance Loading — Determine from yellow sheet and from ordnance placard.

f. Exterior Visual Inspection — Perform as directed in figure 2-1.

g. Overwater and Night Flights — Check personal gear and include a flashlight for night flights.

ENTRANCE. (See figure 2-2.)

The canopy is opened manually by depressing the forward part of the CANOPY RELEASE handle (figure 1-24), marked "PUSH," to release the handle arm. Grasp the handle arm and pull forward to unlock the canopy. On airplanes BuNo. 143732 and subsequent and airplanes with ASC 150 (ECP 301) incorporated, a handle is provided on the canopy frame as an aid in raising the canopy.

COCKPIT CHECKS (ALL FLIGHTS).

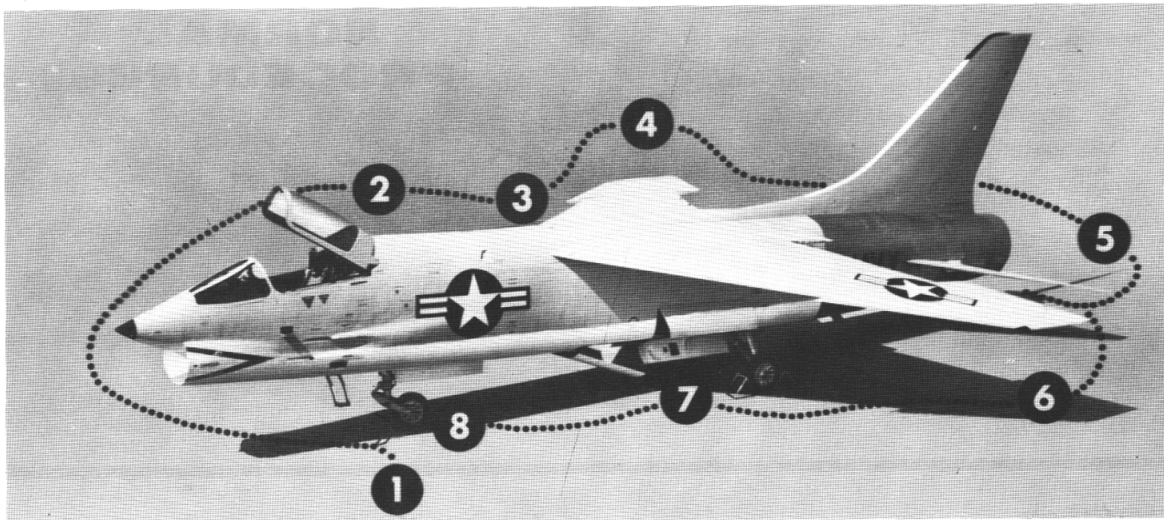
Ejection system.....	Inspect as prescribed in figure 2-2A
MASTER ARM switch.....	"OFF"
Missile jettisoning switch†.....	"NORMAL"
Armament selector switch.....	Off (neutral)
GUNS arming switch(es).....	"SAFE"
ROCKETS switch‡.....	Off (neutral)
ENGINE MASTER switch.....	"OFF"
Landing gear handle.....	"WHEELS DOWN"
Rudder pedals	Adjusted
Antiblackout line	Connected
External electrical power.....	Connected
MASTER GENERATOR switch.....	"EXT"
DC PWR IND.....	"V" showing
Attitude indicator	"OFF" not showing

*Airplanes BuNo. 145345 and subsequent and airplanes with ASC 4 (ECP 30) incorporated.

†Airplanes BuNo. 143702 and subsequent.

‡Airplanes through BuNo. 143701.

EXTERIOR INSPECTION



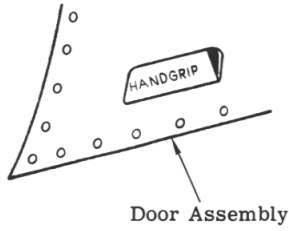
- 1 NOSE SECTION**
 External electrical power unit and gas-turbine compressor starter unit - standing by
 Access doors and panels — secured
 Pitot tube — cover removed
 Nose cone — secured
 Intake duct — clear
 Airstream detector vanes — covers removed
 Liquid oxygen valve — positioned in “BUILD-UP”
- NOSE WHEEL WELL**
 Check for general condition and hydraulic leaks
 ARMAMENT DISABLE switch — neutral and guard down
 Nose gear — check strut extension, tire inflation and condition
 Nose gear ground lock — removed
- 2 RIGHT-HAND FORWARD FUSELAGE**
 Static ports — clear
 Utility hydraulic reservoir — check fluid level
 Fuselage lights — undamaged
 Underside of fuselage — check for fluid leaks
 Access doors and panels — secured
 Speed brake and rocket pack — check for condition and hydraulic leaks
- 3 RIGHT-HAND MAIN WHEEL WELL**
 Check for general condition and hydraulic leaks
 Main gear — check strut extension, tire inflation and condition
 PC hydraulic accumulator — check for hydraulic leaks
 Main gear ground lock — removed
- 4 RIGHT-HAND WING**
 Check for general condition and fuel leaks,
 Access doors and panels — secured
 *Airplanes BuNo. 143772 and subsequent and airplanes having ECP 178 incorporated
- Leading edge — check for condition and hydraulic leaks
 Position light — undamaged
 Auxiliary approach light — undamaged
 Aileron — check for condition, hydraulic leaks
 Wing spoiler - check condition, hydraulic leaks*
 Flap — check for condition and security
- 5 AFT FUSELAGE AND EMPENNAGE**
 Access doors and panels — secured
 Fuel cell cavity vent ports — clear
 Underside of fuselage — check for fluid leaks
 Horizontal tail — check for condition and security
 Vertical tail — check for condition
 Position light — undamaged
 Tailpipe cover — removed; check tailpipe for wrinkles or cracks
 Afterburner exhaust nozzle flaps — check general condition and freedom of linkage
 Fuel vent mast — check for obstruction
- 6 LEFT-HAND WING**
 Repeat checks for step 4.
- 7 LEFT-HAND MAIN WHEEL WELL**
 Repeat checks in step 3.
 Wing fuel manual shutoff valve — “OPEN”
 FUEL SELECTOR switch — “POWER OFF”
 PRESSURE FUEL CAP — secured
 Rocket pack fire test switches — neutral
 Approach light — undamaged
 JET STARTING receptacle — lead from pneumatic starter probe connected
- 8 LEFT-HAND FORWARD FUSELAGE**
 Pneumatic pressure gages — check pressures
 Access doors and panels — secured
 Static ports — clear

Figure No. 2-1. Exterior Inspection

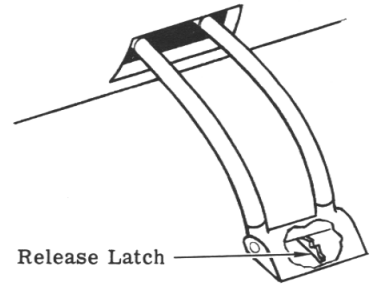
CABIN ENTRY



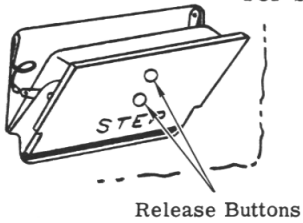
HANDGRIP



BOTTOM STEP



TOP STEP



CENTER STEP

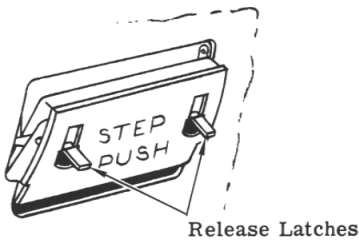
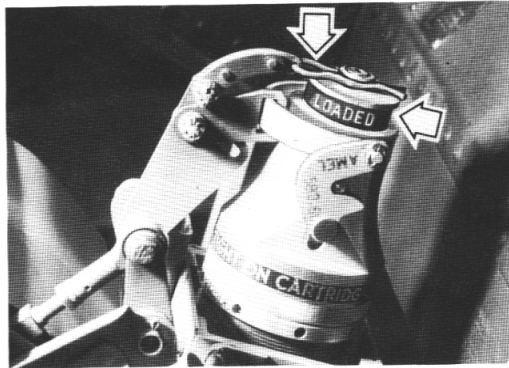
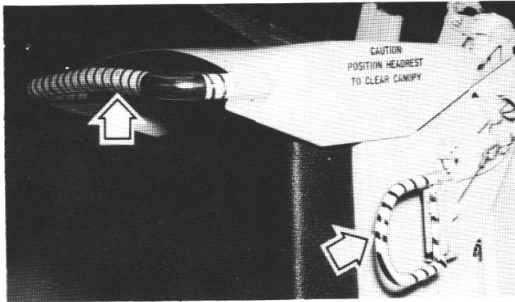


Figure No. 2-2. Cabin Entry

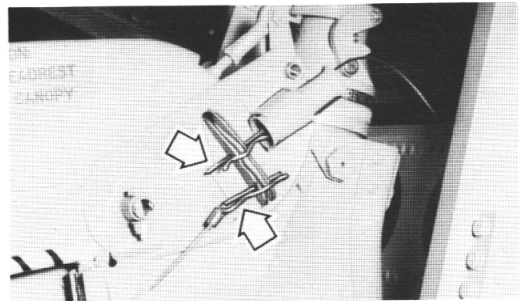
EJECTION SYSTEM INSPECTION



1 Seat cartridge indicator showing "LOADED" and catapult safety pin inserted in firing mechanism.



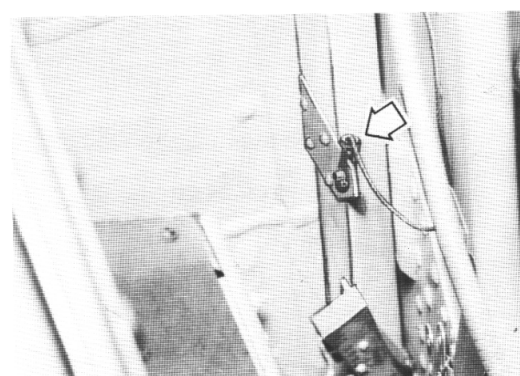
2 Face curtain handle and emergency seat arming handle stowed.



3 Seat arming pins inserted in pre-ejection safety latch.



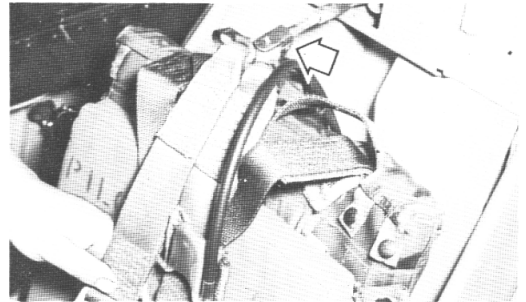
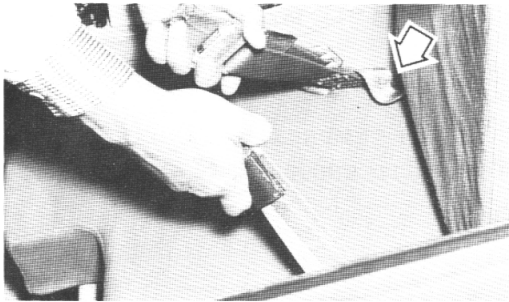
4 Canopy actuator safety pin removed.



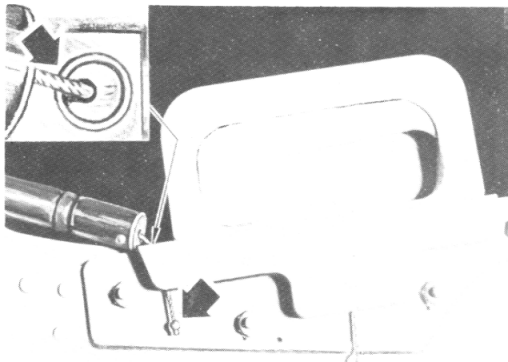
5 Lap belt actuator static cable or integrated harness actuator static cable connected to airplane structure.

Figure No. 2-2A. Ejection System Inspection (Sheet 1)

EJECTION SYSTEM INSPECTION



6 Verify harness fittings secured to seat by pulling straps.

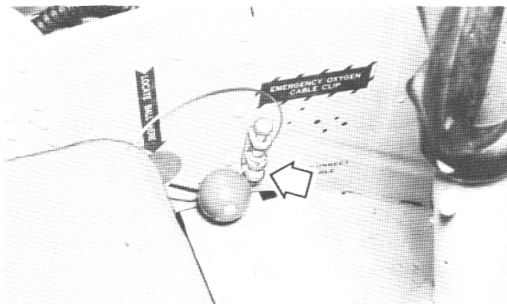


7 Parachute arming cable inserted through hole at aft end of EMERG HARNESS REL handle. Visually check through hole that harness handle slotted plunger is properly engaged. Feel arming cable terminal fitting protruding beneath handle housing.

NOTE

The following cartridges must be used in the ejection system:

	Before ASC 131 (ECP 191)	After ASC 131 (ECP 191)
Parachute	TD-1C-3	MK4 MOD O
Integrated Harness	MK3 MOD O	EX23 MOD O



8 Bailout bottle lanyard attached to EMERGENCY OXYGEN CABLE CLIP.



9 EMERGENCY CANOPY JETTISON handle stowed.

10 Check oxygen system as prescribed in section IV.

Figure No. 2-2A. Ejection System Inspection (Sheet 2)

DANGER AREAS—MAXIMUM POWER

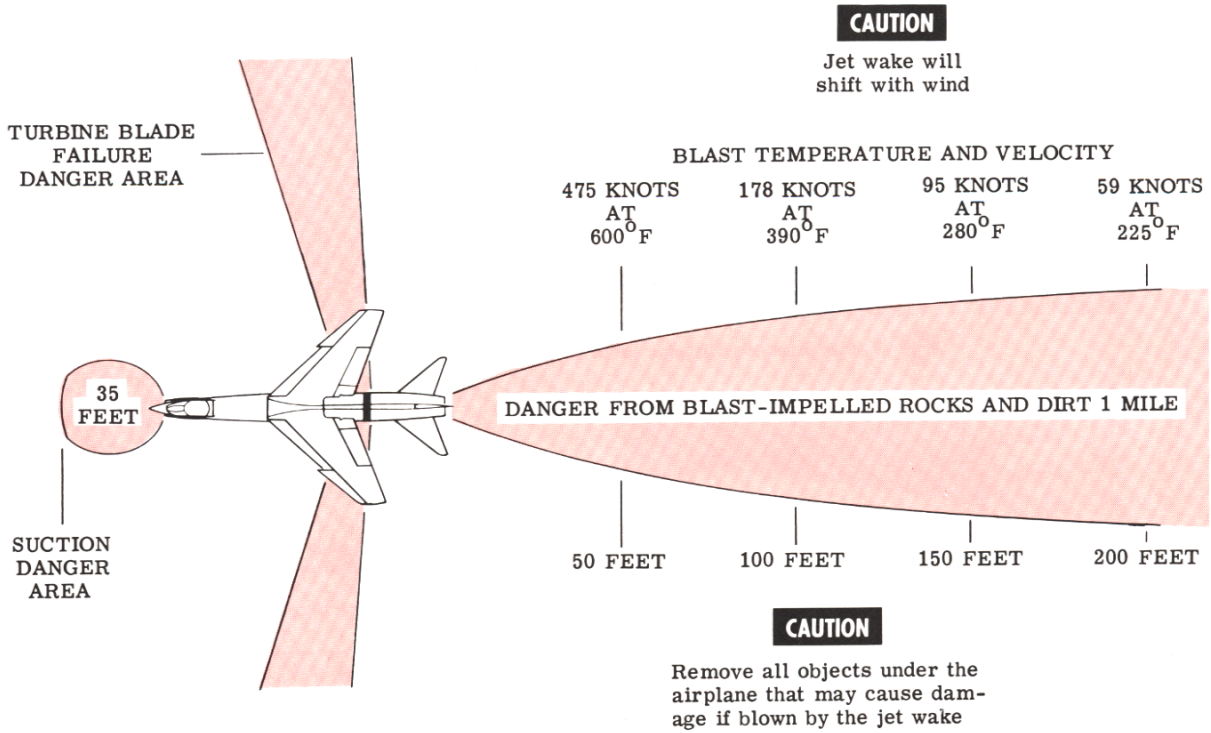


Figure No. 2-3. Danger Areas — Maximum Power

- Headrest and seat..... Adjusted
- Interior and exterior lights..... As desired
- G VALVE knob..... As desired
- SPEED BRAKE override switch..... "NORMAL"
- ROCKET PACK switch..... "UP"
- EMERG GEAR DOWN handle*..... Stowed
- VENT AIR valve..... As desired
- EMERG DROOP & WING INC guard..... Down
- WING INCIDENCE handle..... Match wing position
- Radar power switch..... "OFF"
- OFF-BRIGHT knob..... "OFF"
- RUDDER TRIM knob..... Neutral
- Throttle..... "OFF"
- Throttle friction wheel..... Adjusted
- CRUISE DROOP switch..... Match leading edge position
- Speed brake switch..... "IN"
- EMERG BRAKE handle..... "OFF"

- FUEL CONT switch..... "NORMAL"
- EMERG TRIM handle..... Down
- YAW STAB switch..... "OFF RESET"
- ROLL STAB switch..... "OFF RESET"
- EMERG POWER handle..... Stowed and safety pin removed
- Emergency down lock release switch..... Off
- Fuel pump warning light..... On
- Check and set all flight and navigation instruments.
- Check all PUSH TO TEST lights.
- FUEL QUANT TEST switch..... Push to check fuel quantity indicators
- Fuel low level warning light..... Off
- FUEL TRANSFER switch..... "PRESS DUMP"
- IFR PROBE switch†..... "OFF"
- IFR probe light†..... Off

* Airplanes through BuNo. 141360.

† Airplanes BuNo. 143702 and subsequent.

Hydraulic pressure warning light	On
Arresting gear handle	"HOOK UP"
EMER GEN switch	"OFF"
Cabin temperature controller knob	As desired
Cabin pressure switch	"CABIN PRESS"
Rain removal switch	"OFF"
Defogger switch	"OFF"
PITOT HEAT switch	"OFF"
EMERG VENT AIR knob	Closed
Pitch and ROLL trim knobs	Neutral

BEFORE STARTING ENGINE.

Check operation of communication equipment as prescribed in section IV and return switches to off.

Fire guard	Standing by
Danger areas (figure 2-3)	Clear
Throttle	"OFF"
ENGINE MASTER switch	"ON"
FUEL CONT switch	"NORMAL"

Engine starting should be controlled by the pilot with the starter electrical circuit connected to the ground power unit to ensure automatic shutoff of starter air supply. Ground controlled starts or the use of hand signals to control starting may cause delay in shutting off the air supply which will result in damage to the starter from overspeeding.

WARNING

Failure of the starter because of overspeeding could result in injury to operating personnel. If automatic shutoff fails, starter air supply must be shut off manually before engine speed exceeds 50% rpm.

STARTING ENGINE.

Refer to "FIRE," section III, for procedure to be used if a fire occurs during starting.

Note

Fuel control light* will be on regardless of FUEL CONT switch position until idle rpm is obtained.

Signal to ground crew that airplane is ready for starting. Await connection of external starter probe assembly and all-clear signal by ground crew.

Throttle	"CRANK" momentarily
	At 5% rpm, "IGNITE"
	At 12% rpm, "IDLE"

Note

The ignition circuit is energized for 30 seconds; ignition normally occurs within 3 seconds and acceleration to idle rpm is attained in about 15 to 20 seconds after throttle is placed in "IDLE."

EXH TEMP indicator ...630°C maximum. 340°C or below after engine stabilizes at "IDLE."

ENG OIL pressure indicator.....30 psi minimum
Tachometer55% to 58% rpm
(64% to 69% rpm on engines with "pop-open" exhaust nozzles)

Fuel pump warning light	Off
Hydraulic pressure warning light	Off
Fuel control light*	Off
MASTER GENERATOR switch	"MAIN" (after engine stabilizes)

Signal to ground crew to withdraw external starter probe assembly, secure engine starter access door, and disconnect external electrical power.

Note

Use of early model starters requires connection of an electrical jumper harness from starter cart to JET STARTING receptacle in left wheel well. With harness installed, the ENGINE MASTER switch must be "ON" before starting in order to prevent operation with fuel shutoff valve closed. Separate jumper wires must not be installed on JET STARTING receptacle. If jumper wires were used and not removed before flight, overloading of emergency power package would prevent obtaining an airstart.

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 and repeat "STARTING ENGINE" procedure.

UNSATISFACTORY ENGINE STARTS.

HOT START.

If the exhaust temperature exceeds the starting temperature limit of 630°C, proceed as follows:

Throttle	"OFF"
MASTER GENERATOR switch	"OFF"

*Airplanes BuNo. 145416 and subsequent.

Investigate for damage and cause of difficulty.

Perform "PURGING ENGINE" procedure before attempting another start.

FAILURE TO START.

If the engine does not ignite within 20 seconds after throttle is placed in "IDLE" or after ignition the engine does not stabilize to idle conditions, proceed as follows:

Throttle "OFF"

MASTER GENERATOR switch "OFF"

Investigate for damage and cause of difficulty.

Perform "PURGING ENGINE" procedure before attempting another start.

PURGING ENGINE.

To clear engine of trapped fuel or vapors accomplish the following:

External electrical power Connected

MASTER GENERATOR switch "EXT"

DC PWR IND "V" showing

Attitude indicator "OFF" not showing

Throttle "OFF"

FUEL CONT switch "NORMAL"

ENGINE MASTER switch "ON"

External starter probe assembly Connected

Throttle "CRANK" momentarily

MASTER GENERATOR switch After 15 to 20 seconds, "OFF"

ENGINE MASTER switch "OFF"

Allow a 30-second fuel drainage period before starting engine.

CAUTION

Do not attempt another start until a check has been made to ensure that all excess fuel has drained from the afterburner section.

Note

Operation of the external starter probe assembly is limited to 2 minutes in any 13-minute period, as follows: 1 minute operation, 1 minute idle; 1 minute operation, followed by a 10-minute cooling period.

ENGINE GROUND OPERATION.

Normally, no engine warmup period 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.

CAUTION

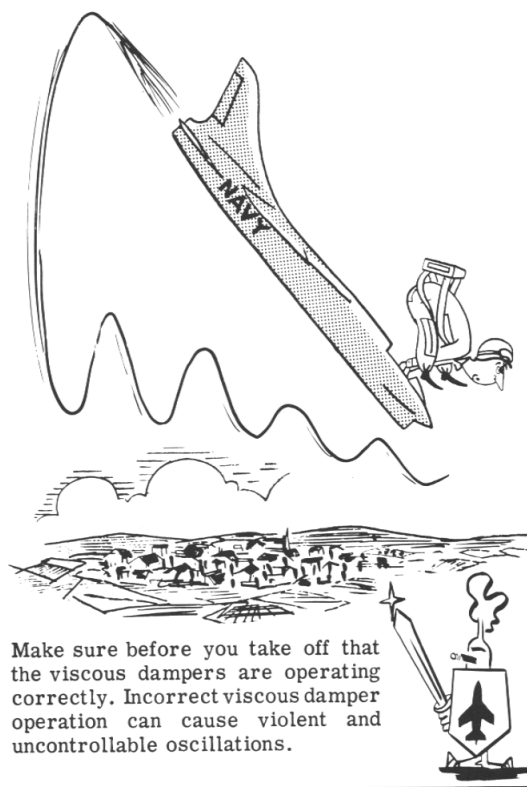
Retard throttle to "OFF" immediately if engine flames out. If afterburner blows out, move throttle out of afterburner detent immediately.

GROUND TESTS.

Note

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

In airplanes that have engines with "pop-open" exhaust nozzles, advance throttle out of "IDLE" and check that nozzle closes.



Make sure before you take off that the viscous dampers are operating correctly. Incorrect viscous damper operation can cause violent and uncontrollable oscillations.

- DC PWR IND....."V" showing
- Attitude indicator....."OFF" not showing
- Hydraulic pressure gage.....3,000 (± 200) psi
all systems
- Flight controlsNeutral
- WingsSpread and locked (red
warning flags not showing)
- YAW STAB warning light.....On
- YAW STAB switch....."OFF RESET" momentarily,
then to "ON"
- YAW STAB warning light.....Off
- ROLL STAB warning lightOn
- ROLL STAB switch"OFF RESET" momentarily,
then to "ON"
- ROLL STAB warning lightOff

Raise wing and check droop operation of leading edge and ailerons, lowering of flaps, and trim change of horizontal tail.

Rotate trim knobs through full range and check for proper control response.

Place RUDDER and ROLL trim knobs to full left or right trim, then place MASTER GENERATOR switch in "OFF" and check that rudder and ailerons return to neutral.

Place MASTER GENERATOR switch in "ON," return RUDDER and ROLL trim knobs to neutral and re-engage yaw and roll systems.

Pull EMERG PITCH TRIM handle, move full forward and aft, and check for proper horizontal tail response. Return handle to stowed position.

Move flight controls and check for proper response.

Lower wing and check operation of leading edge, ailerons, flaps, and horizontal tail.

Rotate trim knobs through full range and check for proper control response, then return knobs to neutral.

Check aileron-rudder interconnect by moving control stick full left and check for right rudder movement, then move stick full right and check for left rudder movement.

Check rocket pack pitch trim correction by placing ROCKET PACK switch in "OPEN" and watching for slight nose up horizontal tail trim as pack is extended. Place switch in "CLOSE" and check for retrimming of horizontal tail and closing of rocket pack.

Move flight controls and check for proper response.

Check cruise droop operation and leave CRUISE DROOP switch in "OUT."

Turn on communication and navigation equipment as desired.

Perform the preflight procedure for armament control system as prescribed in section IV.

If Sidewinder missiles are installed, perform the preflight procedure for missile system as prescribed in section IV.

Place arresting gear handle in "HOOK DOWN" and check hook operation. Return handle to "HOOK UP." Raise wing and check:

Neutral trim light.....On

Note

Rotate RUDDER and ROLL trim knobs away from neutral, then slowly turn knobs toward neutral. When neutral trim lights come on, rudder and ailerons are at neutral. Depending upon climatic conditions, RUDDER trim knob may be in any position between 30° left or right of center when the neutral trim light is on.

Wing position light.....Off
LE DROOP indicator....."DN"

Check operation of the viscous damper by pushing stick forward rapidly and checking for slow, smooth return of stick to neutral. If stick snaps back toward neutral, the airplane should not be flown. An incorrectly serviced viscous damper can result in violent or uncontrollable pitch oscillations in flight.

TAXIING.

Signal to ground crew to remove chocks and close cockpit entry steps.

Lower seat to full down position, then close and lock canopy. With the canopy locked, adjust the headrest so



Do not attempt to take off with the wing down. Takeoff speed and distance will be excessive.

that the face curtain handle is accessible above helmet. Raise seat to the desired position and check clearance between canopy and face curtain housing.

Note

If difficulty is encountered in closing the canopy, retard the throttle to "IDLE" and turn temperature control knob to "COLD." Selecting "CABIN DUMP" to close the canopy will result in a pressure surge when "CABIN PRESS" is again selected.

Taxi with the wing up to obtain full nose gear steering range.

Advance throttle to approximately 75% to 80% rpm and release brakes. As airplane moves forward, retard throttle to "IDLE" and use nose gear steering for turn. Thereafter, idle rpm will be sufficient.

Note

In airplanes that have engines with "pop-open" exhaust nozzles, failure of the nozzle to open may result in excessive taxi speed.

Check nose gear steering during initial taxiing. If steering action is sluggish, depress nose gear steering switch and cycle rudder pedals to build up accumulator pressure.

Aileron "jitter" may occur when folding or spreading wings during taxiing. This "jitter," if annoying, may be eliminated by placing ROLL STAB switch in "OFF RESET."

Maximum wind velocity for safe operation of the canopy is 60 knots.

Check operation of instruments.

BEFORE TAKEOFF.

MILITARY THRUST CHECK.

Advance throttle smoothly and rapidly to "MILITARY" and obtain peak reading of TURB outlet pressure indicator or engine PRESSURE RATIO indicator. In airplanes with PRESSURE RATIO indicator, follow pointer to peak value with movable index, then read value from counter on instrument face. Reading should be within tolerance of value determined from figure 7-1. If the indicator reading does not fall within tolerance, the engine is not acceptable for flight.

Tachometer 92% to 96% rpm
(at standard day temperature)

Note

If ambient temperature is higher than for standard day, the normal tachometer range will be slightly higher. At temperatures lower than for standard day, the range will be slightly lower.

EXH TEMP indicator 620°C maximum

ENG OIL pressure indicator 37 to 53 psi

MANUAL FUEL CHECK.

This check must be performed with external electrical power connected and MASTER GEN switch in "EXT" as the main generator may drop off the line.

Throttle "IDLE"

Cycle FUEL CONT switch three times to bleed system

FUEL CONT switch "EMERG"

Note

The fuel flow must be between 650 and 1,100 pph and the engine should remain alight regardless of drop in rpm. Engine should be capable of acceleration without exceeding temperature limits.

Fuel control light On

Throttle Advance slowly to "MILITARY"

CAUTION

Do not exceed 620° EXH TEMP indicator reading, or engine PRESSURE RATIO indicator reading as previously determined from figure 7-1.

Proper engine pressure ratio or turbine outlet pressure should be reached before the throttle is in "MILITARY." If not, check for FUEL FLOW indicator reading between 5,525 and 7,125 pph at sea level.

To correct reading of FUEL FLOW indicator for field elevation, subtract 150 pph from indicated value for each 1,000 feet above sea level.

Throttle "IDLE"

FUEL CONT switch "NORMAL"

Fuel control light Off

AIRCRAFT CHECK.

A brief takeoff checklist is located at the right-hand side of the instrument board (figure 2-4).

- Wing Raised
- Canopy "CLOSED"
- CRUISE DROOP switch "OUT"
- FUEL CONT switch "NORMAL"
- Pilot's oxygen valve On
- Fuel pump warning light Off
- FUEL TRANSFER switch "PRESS DUMP"
- Rain removal switch As desired
- PITOT HEAT switch As desired
- Instruments Checked and set
- Neutral trim light On
- Pitch trim 0° to 4° "NOSE UP"
- Flight controls Checked

FIELD TAKEOFF.

Refer to "TAKEOFF CHARTS" in appendix I of F8U-1 Supplemental Flight Handbook for takeoff ground roll distance. Refer to section III for takeoff emergencies. To prevent tires from skidding, release brakes before igniting afterburner. Maximum overshoot exhaust temperature (cold engine) is 670°C for 2 minutes.

Throttle Advance to "MILITARY" or "MAX"

CAUTION

If, after igniting afterburner, a rapid rise in exhaust temperature and a decrease of approx-

imately 4% rpm are observed, stop afterburner immediately as exhaust nozzle flaps failed to open. Do not use afterburner with fuel pump warning light on.

- ENG OIL pressure indicator 37 to 53 psi
- EXH TEMP indicator 630°C maximum
- Tachometer 92% to 96% rpm
(at standard day temperature)
- TURB outlet pressure indicator or engine PRESSURE RATIO indicator Value determined from figure 7-1 or, with afterburner, outlet pressure from 1 inch lower to 3 inches higher, or pressure ratio 0.05 lower to 0.15 higher.

During initial takeoff roll, maintain directional control by use of brakes and nose gear steering. Rudder control will become effective at about 60 knots. Using a light pulling force, raise nosewheel off runway at 130 to 140 knots IAS and "sweep" airplane off at 150 knots IAS.

CAUTION

Use nose gear steering only to correct poor line up at start of takeoff roll.

If the tachometer indication exceeds 102.2%, reduce power to the minimum required for flight and land as soon as possible.



Figure No. 2-4. Takeoff Checklist

CROSSWIND TAKEOFF. (See figure 2-4A.)

The airplane tends to roll into the downwind wing and turn into the wind because of its narrow wheel tread and high vertical fin. However, the ailerons become effective at low speed to reduce the heel angle. During takeoff, maintain directional control by use of brakes and rudder while opposing rolling tendency by use of ailerons. Hold nose gear on runway until 135 knots IAS is obtained before lifting airplane off runway.

CATAPULT LAUNCHING.

Note

Refer to applicable aircraft launching bulletin for off-center spotting and launching limitations and minimum permissible end speeds.

SPOTTING.

Catapult spotting characteristics and pilot's field of view during spotting are satisfactory. A straight-on approach from directly astern of the catapult is recommended in lieu of the angle approach utilizing a spotting chock. This procedure will expedite spotting and require less braking and lower engine thrust settings. Nose gear steering eliminates the need for a nosewheel steering bar.

TRIM SETTINGS.

The recommended trim settings for military thrust launching at 5 to 15 knots above minimum end air-

speed are pitch trim 6° nose up, roll trim neutral, and rudder trim neutral.

Slightly less nose up trim should be used for launches at end airspeeds in excess of 15 knots above minimum. Slightly more nose up trim, 7° to 8°, should be used for launches at or near minimum end airspeed.

LAUNCHING PROCEDURE.

When the airplane is tensioned on the catapult and upon signal from the catapult officer:

Throttle— Advance to "MILITARY" or "MAX" as required.

Throttle friction wheel— Adjust as required.

Check all instruments and lights for proper indication. Check engine instruments as for "FIELD TAKEOFF."

Raise catapult handgrip and grasp handgrip and throttle.

Place head firmly back against headrest, grasp control stick and anchor right elbow on hip or stomach, keeping feet against lower portion of rudder pedals.

Signal the catapult officer when ready for launching.

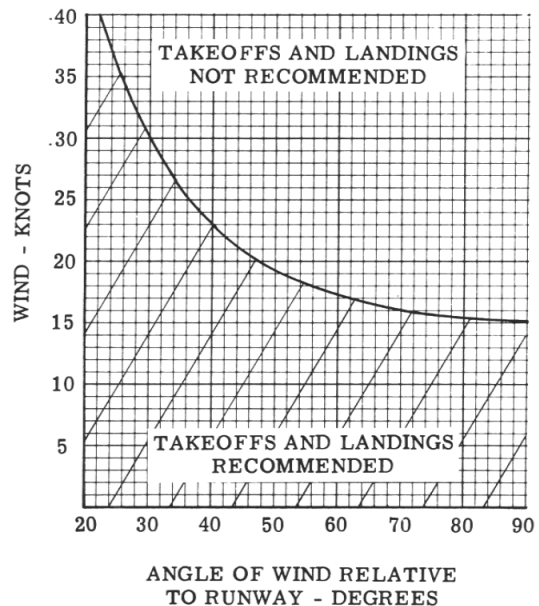


Figure No. 2-4A. Allowable Crosswinds

LAUNCHING CHARACTERISTICS.

*Normal Launching
(10 to 15 knots excess end airspeed)*

When spotted on-center, the airplane exhibits no unusual launching characteristics. The pilot should hold the stick in the neutral position during the power stroke and should be careful not to move the stick until he has recovered from acceleration forces.

When spotted off-center, the airplane exhibits catapult tracking divergence. At 6 inches off-center, using minimum catapult pressures, yaw and yaw rate at pendant release require approximately one-half lateral stick deflection in the direction opposite to yaw to prevent excessive roll.

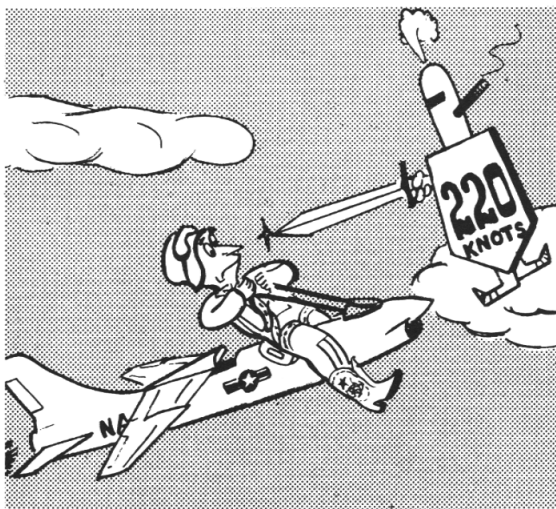
*Launching at Minimum End Speed
(0 to 5 knots excess end airspeed)*

Under these conditions the following characteristics may be expected (when not carrying external stores):

- Sink off bow — 10-foot sink with optimum rotation. Moderate rotation required to prevent excessive sink.
- Buffet onset — Light buffet during rotation.
- Poor acceleration — 5 to 8 seconds of level flight will be required for acceleration before climb-out.

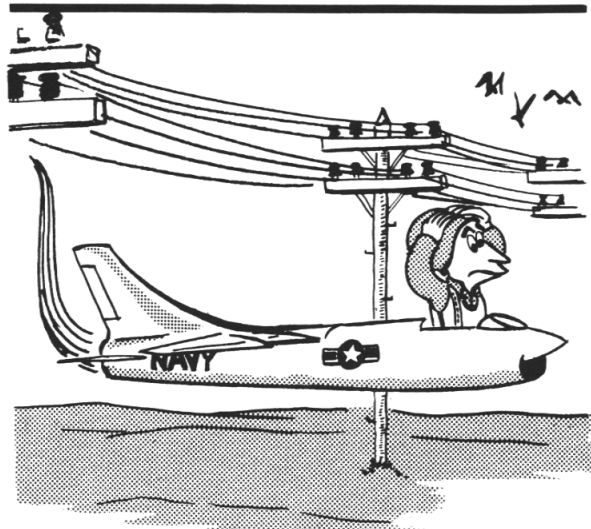
AFTER TAKEOFF.

Airspeed restrictions require landing gear retraction and wing lowering before reaching 220 knots IAS. Because of rapid acceleration when the afterburner is used, the time available for completion of gear and wing positioning is greatly reduced.



CAUTION

Do not exceed 220 knots IAS unless wing is down and locked and wing position light out.



Ease stick back smoothly while wing is lowering to prevent sinking (a reaction similar to that encountered during retraction of conventional flaps)

Retraction of the gear will take about 6 seconds and cause almost no trim change.

Lowering of the wing will take approximately 4 to 6 seconds and should be started at approximately 180 knots IAS and at an altitude of 200 feet or above. Although lowering of the wing and partial retraction of leading edge droop (CRUISE DROOP switch in "OUT") will cause the nose to rotate up, a slight aft stick force will still be required to prevent sink and maintain normal rate-of-climb.

CAUTION

Airspeeds above 220 knots IAS are not permitted until the wing is down and locked (DN LOCK handle in "LOCK" and wing position light out).

If the DN LOCK handle cannot be placed in "LOCK," or the wing position light remains on, recycle wing.

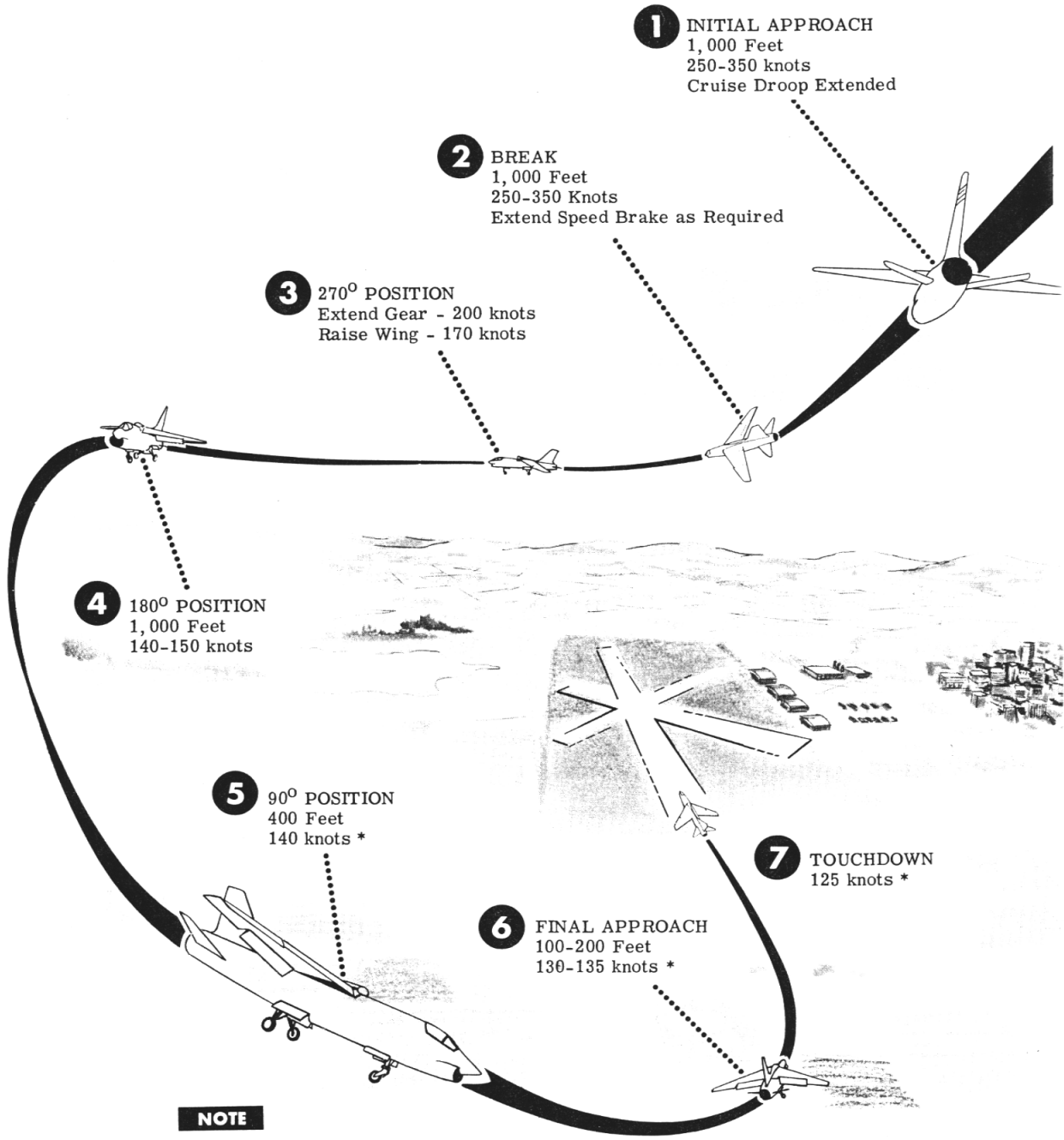
Landing gear handle....."WHEELS UP"

CAUTION

Do not depress nose gear steering switch to center nose gear.

LG position indicators....."UP"

FIELD LANDING



NOTE

*Airspeed for 1,000 pounds of fuel remaining. Add 3 knots for each additional 1,000 pounds of fuel

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Figure No. 2-5. Field Landing

If the landing gear handle cannot be positioned to "WHEELS UP," or the nose gear fails to retract fully, return the handle to "WHEELS DOWN." With gear fully extended, depress the nose gear steering switch to center nose gear, then place landing gear handle in "WHEELS UP."

CAUTION

Do not use emergency down lock release switch to raise gear as damage will result from retracting a cocked nose gear.

RELEASE SWITCH Held depressed
 WING INCIDENCE handle "DN"
 RELEASE SWITCH Released
 DN LOCK handle "LOCK"
 Wing position light Off
 LE DROOP indicator "DN"
 FUEL TRANSFER switch "ON"
 CRUISE DROOP switch "IN"
 LE DROOP indicator "UP"

CLIMB.

Refer to "CLIMB CHARTS" in appendix I of F8U-1 Supplemental Flight Handbook for climb data.

DESCENT.

Refer to "MAXIMUM RANGE DESCENT CHART" in appendix I of F8U-1 Supplemental Flight Handbook for data on maximum range descent with engine at "IDLE" thrust.

Refer to figure 3-1 for data on maximum range descent with a dead engine.

To prevent fogging during rapid descents, place defogger switch in "DEFOG" 5 minutes prior to descent and position cabin temperature controller knob as required.

Refer to "DIVES" in section VI of F8U-1 Supplemental Flight Handbook for dive recovery during rapid descents. On airplanes not having ASC 92 (ECP 203) incorporated, maximum rates of descent are 30,000 feet per minute with idle thrust or 10,000 feet per minute with a dead engine.

BEFORE ENTERING TRAFFIC PATTERN.

HYD PRESS gage 3,000 (± 100) psi all systems
 DC PWR IND "V" showing
 Attitude indicator "OFF" not showing
 Instruments Set and checked



Figure No. 2-6. Landing Checklist

Main FUEL QUANTITY indicator Quantity remaining
 FUEL FLOW indicator Checked
 FUEL TRANSFER switch "PRESS DUMP"
 Fuel pump warning light Off
 ENG OIL pressure indicator 37 to 53 psi
 SPEED BRAKE override switch "NORMAL"
 Defogger switch As necessary
 Rain removal switch As necessary
 EMER GEN switch "OFF"
 Shoulder harness Locked

TRAFFIC PATTERN. (See figure 2-5.)

Refer to "WEIGHT LIMITATIONS" in section V of F8U-1 Supplementary Flight Handbook for maximum recommended landing gross weights.

A brief checklist is located at the left-hand side of the instrument board (figure 2-6).

Maximum speed to extend gear and raise wing is 220 knots IAS.

CRUISE DROOP switch "OUT"
 Landing gear handle "WHEELS DOWN"
 LG position indicators Wheels showing
 DN LOCK handle "UNLOCK"
 RELEASE SWITCH Held depressed
 WING INCIDENCE handle "UP"
 RELEASE SWITCH Released
 Wing position light Off
 LE DROOP indicator "DN"
 Arresting gear handle (if carrier landing) "HOOK DOWN"
 Speed brake switch "IN"

Wing position light.....Off
 LE DROOP indicator....."DN"
 Arresting gear handle
 (if carrier landing)....."HOOK DOWN"
 HOOK BYPASS switch.....Appropriate position
 Speed brake switch....."IN"

FIELD LANDING.

Refer to appendix I of Supplemental Flight Handbook for landing ground roll distances. Refer to section III for landing emergencies.

When making familiarization landings, accomplish landings using 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.

Airspeed can be accurately controlled in the landing condition and forward visibility is excellent. Establish landing attitude on final approach. Use a flat, power-on approach and a low rate of sink to provide greater pitch control with minimum control corrections. A low cut with very little sink and little or no flare will allow the airplane to be held off briefly before contact.

WARNING

Descending approaches which combine a high cut, fast sink speed, and a flare-out will be difficult to control and may result in hitting the tail. Abrupt, moderate power applications together with aft stick movement may cause over-rotation when attempting to check an excessive sink rate. Power application alone should be sufficient.

Note

Aerodynamic braking will greatly reduce landing ground roll. However, use caution with aft stick movement as horizontal tail effectiveness could cause overrotation and result in tail scraping.

Rudder control will be effective down to about 60 knots, then use brakes and nose gear steering to maintain directional control.

WARNING

Neutralize rudder pedals before depressing nose gear steering switch. The use of nose gear steering is not recommended above normal taxi speed as steering sensitivity in-

creases with speed and above normal taxi speeds there is a tendency to over-control thus producing pilot induced oscillations.

Note

In airplanes that have engines with "pop-open" exhaust nozzles, failure of the nozzle to open may result in excessive runout and high taxi speed.

CROSSWIND LANDING. (See figure 2-4A.)

Adequate directional control can be maintained in crosswind landings by means of rudder alone. Use caution when making landings in 90° crosswinds when the wind velocity exceeds 10 knots. The airplane tends to roll into the downwind wing and turn into the wind because of its narrow wheel tread and high vertical fin. The ailerons are effective in reducing the heel angle, down to quite low speeds.

Apply a combination of crabbing and sideslipping in the approach; execute a touchdown at approximately 130 to 135 knots IAS; perform a rapid transition to 3-point attitude and maintain directional control by means of rudder while opposing rolling tendency by means of ailerons.

Nose gear steering will aid in maintaining directional control and at lower speeds near the end of "roll-out," braking action may also be used.

CARRIER LANDING - MIRROR. (See figure 2-7.)

PATTERN.

The mirror approach pattern is initiated by a 15° to 20° angle of bank turn from the downwind leg 4 to 5 seconds after passing the ship's stern at an altitude of 500 feet. Proper airspeed corresponding to existing airplane gross weight should be established before reaching the 90° position. When making qualification landings, it is recommended that speed control be simplified by making the pattern deep enough astern to allow lineup with the deck centerline at 500 feet in stabilized level flight prior to interception of the glide path. After rollout from the turn, a thrust reduction of 4% to 6% rpm, depending upon gross weight, will hold airspeed.

Upon picking up the "meatball," maintain approach airspeed and use throttle to obtain initial rate of descent and to keep meatball centered. Recommended approach airspeeds for various gross weights are shown in figure 2-7. Relatively large throttle adjustments are required to correct small changes in rate of sink and slight changes in airspeed. Airplane response to small thrust changes is slow and requires constant attention.

Large stick movements are required to achieve small attitude changes and it is difficult for the pilot to trim

to the exact stick neutral force position. This usually results in holding a stick control pressure above that necessary in other airplanes. The angle-of-attack system, if installed, should be used as the primary reference for airspeed control. This system is preset to give proper approach airspeeds at optimum angle of attack throughout the airplane landing gross weight range without reference to the airspeed indicator.

FINAL APPROACH.

During final approach, the pilot may have to move his head and shift his field of view several times to avoid interference by the windshield frame members. The mirror is first viewed through the center panel and then through the right panel. The pilot should shift his field of view to the right panel as early in the straightaway as practical to avoid this move when the airplane is near the ship's stern.

CAUTION

Precise airspeed control is mandatory for successful carrier operation.

Particular care must be taken to avoid slow or fast approaches. In a slow approach in which sink speed has become too high, attempting to arrest the sink speed by making a nose-up attitude correction will only increase the sink speed. A hard landing will occur with probable damage to the airplane. Proper sink speed should be maintained through throttle corrections while stick movement is employed to control airspeed (with reference to angle-of-attack indications, if available). A fast approach will result in developing high airplane energies with probable damage to the ship's arresting gear.

Wave-off characteristics are good and the engine accelerates from approach thrust (about 84% rpm) to military thrust in approximately 2.5 seconds. With a slow approach, full military or maximum thrust may be required at wave-off.

ARRESTED LANDING.

The airplane should be flown on the glide slope all the way to touchdown and a flare should not be attempted. An abrupt increase in angle of attack will only increase the sink speed if the approach is slow or, if the approach is fast, will result in a free-flight engagement with probable damage to the airplane nose gear or tail section. The airplane's arrested landing runout characteristics are good. Thrust should not be reduced until the forward motion of the airplane in the arresting gear has ceased.

BOLTER.

The pilot should be mentally prepared to add military thrust, plus afterburner if needed, from the moment of touchdown until the arrestment is complete. At F8U-1

engaging speeds, there is no time for indecision. If at any time after touchdown there is doubt in the pilot's mind that he has other than a secure arrestment, he should commence engine acceleration.

WARNING

During a bolter takeoff, do not rotate prematurely to an extreme tail low attitude because damage to the arresting hook and reduction in ability to accelerate may result.

CARRIER LANDING — LSO.

This pattern is similar to landing signal officer guidance patterns for other current jet airplanes except that the pattern is wider and deeper. A 20° banked turn from the downwind leg is started abeam of the ship's stern. The turn is then shallowed to about 15° when entering the straightaway. Normally, the ship's wake is crossed just prior to entering the straightaway. Optimum pilot landing technique is to lower the nose slightly at the cut and set up a rate of descent which is held until touchdown. Approach, arrested landing, bolter, and wave-off techniques and characteristics are the same as described under "CARRIER LANDING — MIRROR."

AFTER LANDING.

CanopyOpen

Note

If CABIN PRESSURE ALTITUDE indicator indicates that the cockpit is pressurized (indicator showing a negative reading), open EMERG VENT AIR knob to permit cockpit pressure to be relieved before opening canopy.

Trim knobsNeutral
Defogger switch "OFF"
Rain removal switch "OFF"
PITOT HEAT switch "OFF"
YAW STAB switch "OFF" or "OFF RESET"
ROLL STAB switch "OFF RESET"

BEFORE SHUTDOWN.

RELEASE SWITCH Held depressed
WING INCIDENCE handle "DN"
RELEASE SWITCH Released
DN LOCK handle "LOCK"
Wing position light On
CRUISE DROOP switch "IN"
Wings Folded

CAUTION

Ailerons must be in neutral before folding wings to prevent damage to ailerons.

Communication and navigation switches Off

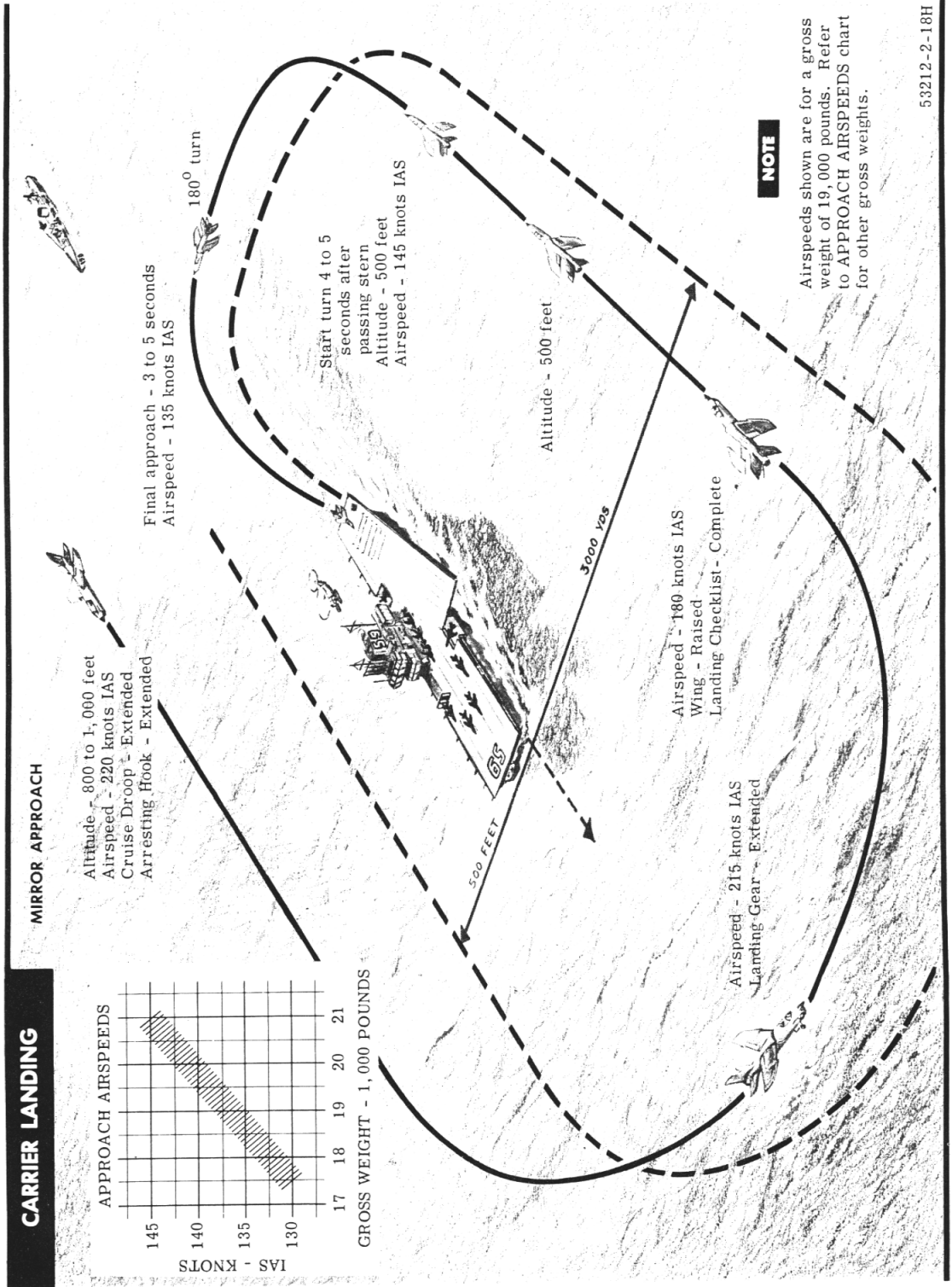


Figure No. 2-7. Carrier Landing

STOPPING ENGINE.

When the engine has been operated at high power settings for an appreciable length of time, operate the engine at "IDLE" for 3 to 5 minutes to allow it to cool and prevent seizure of the rotors.

Before stopping engine, advance throttle to operate engine at 75% rpm for 30 seconds (when conditions permit), then retard throttle to "OFF." This will scavenge residual oil to provide a true oil level for servicing and to reduce oil leakage from the engine bearing cavities.

After placing the throttle in "OFF," check the tachometer for free engine deceleration indication.

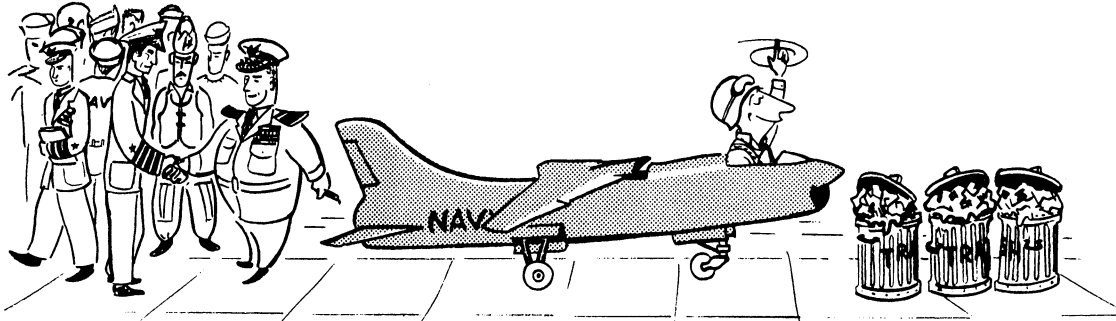
CAUTION

Do not shut down engine by use of the ENGINE MASTER switch except in an emergency, because damage to engine-driven fuel pump will result from cavitation.

BEFORE LEAVING AIRPLANE.

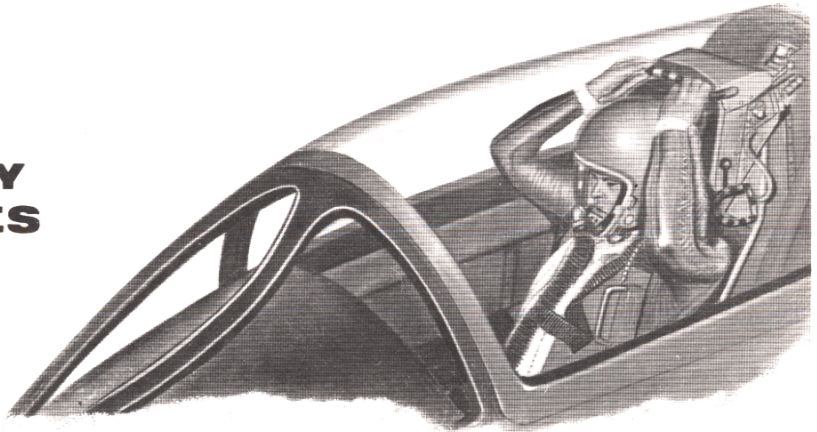
Interior and exterior light switches.....	Off
EMER GEN switch.....	"OFF"
MASTER GENERATOR switch.....	"OFF"
Speed brake switch.....	"OFF"
ENGINE MASTER switch.....	"OFF"
All other switches.....	Off
Wheels	Chocked

Make sure intake and exhaust areas are clear before starting engine.



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SECTION III EMERGENCY PROCEDURES



INTRODUCTION.

This section prescribes procedures for operating the essential systems of the airplane under specific emergency conditions. (Procedures concerning emergencies affecting *auxiliary* equipment are prescribed in section IV.)

ENGINE FAILURE.

INDICATIONS.

Unstable engine operation or a flameout usually occurs as a result of a malfunction in the engine or in the fuel control unit, or as a result of exceeding operating limitations.

Engine *failure* will be indicated by:

- a. Tachometer showing reduction in engine speed.
- b. TURB outlet pressure indicator showing reduction or increase.
- c. EXH TEMP indicator changing temperature.
- d. Fuel pump warning light may be on.
- e. DC PWR IND may show "barber pole."
- f. Attitude indicator may have "OFF" flag showing.

Turbine *failure* will be indicated by:

- a. EXH TEMP indicator indicating excessive temperature.
- b. Tachometer indicating low rpm.
- c. Compressor stalls.

Unstable operation of engine will be indicated by:

- a. EXH TEMP indicator showing erratic readings.
- b. Tachometer showing a rapid reduction or a fluctuation at a constant throttle setting.
- c. Tachometer showing no increase after throttle is advanced.

- d. TURB outlet pressure indicator failing to respond to throttle movement.
- e. Compressor stall.

ENGINE FAILURE DURING TAKEOFF.

If the engine fails during the takeoff run (before the airplane becomes airborne), proceed as follows:

- Throttle "OFF"
 Brake pedals Depress as required; if pedal braking is insufficient, use EMERG BRAKE handle.

If the engine fails late in the takeoff run and there is insufficient runway to stop the airplane, the landing gear may be collapsed, if desired, as follows:

- Emergency down lock release switch Up
 Landing gear handle "WHEELS UP"

WARNING

Electrical power for unlocking the landing gear handle may be available for only 6 to 10 seconds after engine failure.

If the engine fails *immediately* after becoming airborne and the airplane is unable to zoom to ejection altitude, land straight ahead. Perform as many of the following operations as possible:

- Variable incidence wing As is
 Throttle "OFF"
 EMERG POWER handle Pull
 EMERGENCY CANOPY JETTISON handle Pull
 Landing gear handle "WHEELS DOWN"

With emergency power package supplying only hydraulic pressure, the minimum airspeed for adequate control response is 145 knots IAS.

Note

In airplanes with low-level ejection system, a successful ejection can be made from level or climbing flight at altitudes as low as 50 feet.

In airplanes without low-level ejection system, a successful ejection can be made from level or climbing flight at altitudes as low as 500 feet.

ENGINE FAILURE DURING FLIGHT.

WARNING

To prevent entry of air into the engine fuel system at nose-down attitudes, place the throttle in "OFF" immediately after failure and leave it there until "AIRSTART PROCEDURE" is established.

- a. Perform "FLAMEOUT PROCEDURE."
- b. Perform "AIRSTART PROCEDURE."
- c. If an airstart is not possible, perform "DEAD ENGINE LANDING PROCEDURE" or "EJECTION" procedure.

FLAMEOUT PROCEDURE.

Throttle "OFF"
 EMERG POWER handle Pull

WARNING

Do not extend the emergency power package with the EMER GEN switch in "ON" or "LAND." Extending package with a load on the generators may prevent obtaining electrical power for an airstart.

UHF function switch....."OFF" above 27,500 feet

After incorporation of ASC 174 (ECP 279), the UHF function switch need not be placed in "OFF" for three minutes. If an airstart is not obtained within three minutes, place switch in "OFF" or descend below 27,500 feet.

EMER GEN switch "ON"
 DC PWR IND..... "V" showing
 Attitude indicator..... "OFF" not showing
 Landing gear warning light will glow slightly with gear retracted.

AIRSTART PROCEDURE.

Airstarts, which should not be attempted after a fire,

explosion, or severe engine vibration, can be obtained only with the EMER GEN switch in the "ON" position.

Airstarts are obtained most consistently below 35,000 feet and with 170 to 250 knots IAS and 17% to 30% rpm. However, since airstarts have been obtained at higher airspeeds and engine speeds, they should be attempted without waiting to reach these recommended values. Proceed as follows:

Cabin pressure switch "CABIN DUMP"
 Defogger switch "OFF"
 FUEL CONT switch "NORMAL" or "EMERG"
 Throttle "IGNITE" momentarily then "IDLE"

Since the booster pump that supplies fuel for an airstart is at the aft end of the main cell on airplanes through BuNo. 145464, it may be uncovered if excessive nose-down attitudes are established. For all fuel loads, a clean condition glide speed of 190 to 220 knots IAS will ensure that fuel is available. If for some reason speed cannot be maintained in this range, fuel will be available as long as the following nose-down attitudes are not exceeded for the specified amount of main system fuel remaining:

Above 1,200 pounds -20°
 600 to 1,200 pounds -10°

On airplanes BuNo. 145465 and subsequent, the booster pump that supplies fuel for an airstart is at the forward end of the main cell and the above restrictions do not apply.

EXH TEMP indicator 630° maximum
 ENG OIL pressure indicator 30 psi minimum
 Throttle Desired setting after engine stabilizes

Note

If loss of all booster pumps is suspected as cause of flameout, do not use high thrust settings above 30,000 feet.

Instruments..... Check for proper indications

Note

The tachometer provides the most rapid indication of an airstart.

MASTER GENERATOR switch..... "MAIN"
 EMER GEN switch "OFF"
 DC DWR IND "V" showing
 Attitude indicator "OFF" not visible
 Hydraulic pressure gage(s)..... Check for pressure
 ROLL STAB switch "OFF RESET" momentarily, then "ON"
 ROLL STAB warning light..... Off

YAW STAB switch..... "OFF RESET"
momentarily, then "ON"
YAW STAB warning light Off

If a flameout occurs above 35,000 feet and an extreme emergency exists, such as being in combat, perform the airstart procedure as quickly as possible to utilize maximum available engine rpm. Under these conditions, throttle positioning after "IGNITE" is critical. After placing throttle in "IGNITE," advance to "IDLE" momentarily, then retard below "IDLE," watching EXH TEMP indicator to avoid exceeding starting temperature limit. As temperature decreases, advance throttle to "IDLE."

Idle rpm will increase with altitude; idle speeds as high as 75% will not be unusual for high altitudes.

UNSATISFACTORY AIRSTART.

Indications are as follows:

- Ignition not occurring within 20 seconds after placing throttle in "IDLE."
- Engine not accelerating to idling speed within 45 seconds after ignition occurs.
- EXH TEMP indicator reading exceeding starting temperature limit (630°C).
- ENG OIL pressure indicator not showing 30 psi minimum after engine stabilizes.

Proceed as follows:

- Place throttle in "OFF."
- If FUEL CONT switch was in "NORMAL," make next attempt with switch in "EMERG."
- Perform "AIRSTART PROCEDURE" again after ignition timer has completed its 30-second cycle. No fuel drainage period is necessary. The ignition timer fires continuously for 30 seconds after the throttle is placed in "IGNITE." Placing the throttle back to "IGNITE" before the 30-second ignition timer cycle period is over will not recycle the timer.
- If a start is not obtained on the second attempt, manually depress the "IGNITE" switch in the throttle quadrant and repeat "AIRSTART PROCEDURE."

AFTERBURNER FLAMEOUT.

- Immediately place throttle inboard to military range to stop fuel flow and close exhaust nozzle flaps.
- Before relight, allow from one second at sea level to 15 seconds above 40,000 feet for afterburner igniter valve to recycle.
- For best reliability, a relight should be made above 0.85 IMN and below 40,000 feet. Above 40,000 feet, a relight should be obtained within three attempts with a normally operating engine.

AFTERBURNER CUTOFF FAILURE.

If afterburning continues after the throttle is moved inboard, the afterburner can be cut off mechanically by retarding the throttle smartly past the afterburner aft detent stop. Advancing the throttle past the aft detent stop will re-ignite afterburner. Do not re-ignite afterburner unless necessary.

MAXIMUM GLIDE.

Figure 3-1 shows the best power-off glide speed at various altitudes for maximum range.

FIRE.

ENGINE FIRE ON GROUND.

If the fire warning light is illuminated or fire is observed while external power and the starter probe assembly are still connected to the airplane, proceed as follows:

Throttle "OFF"
ENGINE MASTER switch..... "ON"
MASTER GENERATOR switch "EXT"
Throttle "CRANK"

Allow cranking to continue until fire has been extinguished.

MASTER GENERATOR switch..... "OFF"
(To stop cranking)
ENGINE MASTER switch "OFF"

If external power and starter probe assembly have been disconnected and it is not possible to connect them, proceed as follows:

Throttle "OFF"
ENGINE MASTER switch..... "OFF"
MASTER GENERATOR switch..... "OFF"

Leave the airplane as soon as possible.

ENGINE FIRE DURING FLIGHT.

If the fire warning light is illuminated or if other indications of engine fire are observed, proceed as follows (situation permitting):

Throttle "IDLE"

If the fire warning light goes off, advance the throttle and resume normal operations, taking care to avoid further overheat conditions.

If the fire warning light remains on or if it goes off and then comes on again, perform "FLAMEOUT PROCEDURE."

Perform "DEAD ENGINE LANDING PROCEDURE" or "EJECTION" procedure.

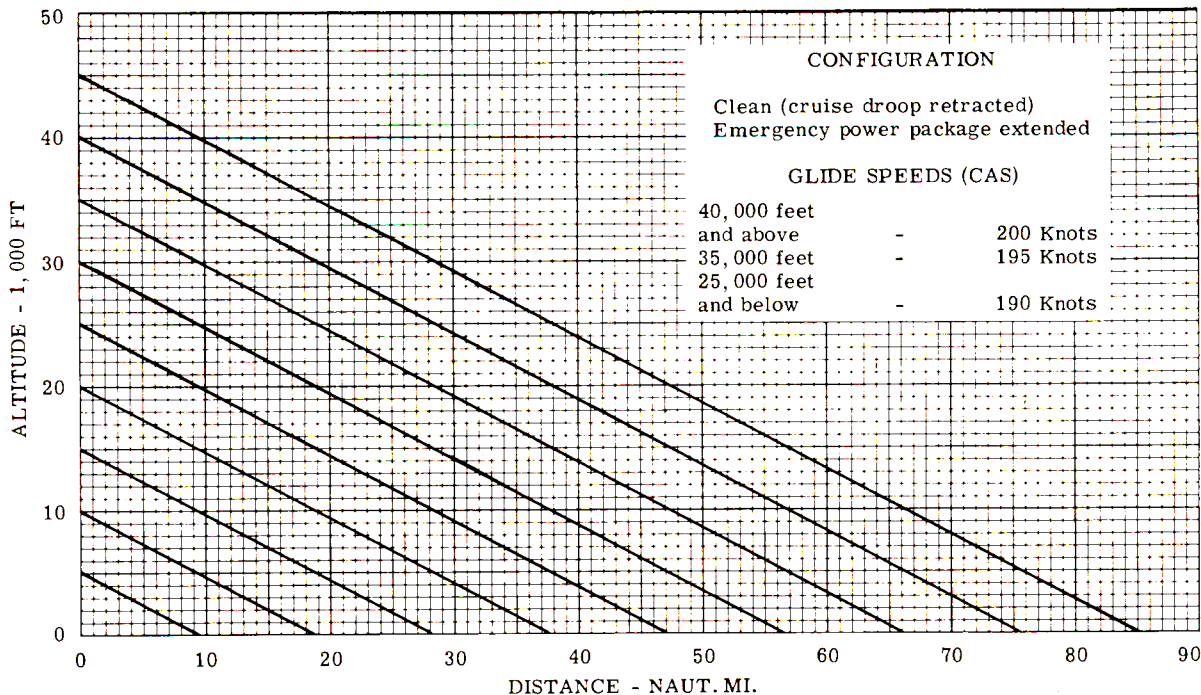
GLIDING DISTANCE - NO THRUST

Figure No. 3-1. Gliding Distance - No Thrust

WARNING

If rocket pack fire light comes on immediately followed by fire warning light coming on, retard throttle to "IDLE." If fire warning light is still on, perform "EJECTION" procedure.

ELECTRICAL FIRE.

If an electrical fire occurs, attempt to isolate the fire by de-energizing the individual related system or systems. If unable to isolate the fire, place MASTER GENERATOR switch and the EMER GEN switch in "OFF." Then perform "COMPLETE ELECTRICAL FAILURE" procedure.

CABIN SMOKE AND FUMES.

To eliminate smoke and fumes from the cabin, perform the following:

Cabin pressure switch....."CABIN DUMP"

CAUTION

When cabin pressure is dumped above 27,500 feet, immediately place UHF function switch in "OFF." Loss of integrated electronic package pressurization may result in arcing, causing loss of UHF, ADF, and IFF operation. If radio transmission is desired, place cabin pressure switch in "CABIN PRESS" for period of transmission.

Defogger switch....."OFF"
EMERG VENT AIR knob "OPEN" as desired

Note

Dumping cabin pressure above 43,000 feet may be injurious if a pressure suit is not being worn.

LANDING EMERGENCIES.

If Possible

FUEL DUMP switch....."DUMP"

Maximum fuel dumping will be obtained by maintaining a positive or near level wing attitude. Expend fuselage transfer fuel.

Before Landing

FUEL DUMP switch....."OFF"

Note

The FUEL DUMP switch must be placed in "OFF" before touchdown, even if fuel dumping has not been completed, to insure that electrical power is available to close the dump valve.

FUEL TRANSFER switch....."PRESS DUMP"

DEAD ENGINE LANDING PROCEDURE. (See figure 3-2.)

The landing should be made with the wing down and the leading edge extended pneumatically to the landing droop position. With the wing down, a lower hydraulic flow rate is required by the roll stabilization system and a greater margin of hydraulic pressure is available for the flight controls. With the wing up, a nose-wheel-first landing is likely to occur since the minimum operating airspeed of the emergency power package is 145 knots IAS; this will result in a rebound with subsequent loss of airspeed and hydraulic pressure for the flight controls.

Yaw trim and stabilization will not be operative. Arresting hook can be extended.

LANDING WITH GEAR UP.

If gear cannot be extended and it becomes necessary to "belly in," use normal landing technique, modified as follows:

Just Before Contact

Throttle "OFF"

ENGINE MASTER switch....."OFF"

EMERGENCY CANOPY JETTISON

handle (figure 3-2A)..... Pull

MASTER GENERATOR switch....."OFF"

ROUGH FIELD LANDING.

If the decision is made to land the airplane on other than a prepared field, *extend gear* and follow procedures for "LANDING WITH GEAR UP."

FIELD LANDING WITH NOSE GEAR UP.

If it becomes necessary to land with the nose gear retracted or extended but not locked, proceed as follows:

After Touchdown

Hold nose off as long as possible.

Use brakes only if necessary to avoid obstacles.

CAUTION

Before losing pitch control, ease the nose down to avoid a sudden dropping of the nose.

Just Before Losing Pitch Control

Throttle "OFF"

ENGINE MASTER switch "OFF"

MASTER GENERATOR switch....."OFF"

LANDING WITH ONE MAIN GEAR DOWN.

If it becomes necessary to land with one main gear down, proceed as follows:

Touch down on the side of the runway corresponding to extended gear.

Just Before Losing Roll Control

Throttle "OFF"

ENGINE MASTER switch "OFF"

MASTER GENERATOR switch....."OFF"

LANDING WITH MAIN GEAR TIRE FAILURE.

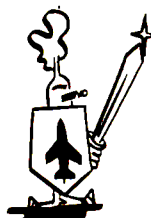
If main gear tire failure is suspected, proceed as follows:

Touch down on the side of the runway corresponding to undamaged tire.

Maintain directional control with nose gear steering.

CAUTION

Neutralize rudder pedals before engaging nose gear steering to avoid skidding.



On fields with arresting gear available, make an arrested landing.

DEAD ENGINE LANDING

NOTES

Flameout landings have not been demonstrated. Information presented is based on simulated flameout landings.

Airplane configuration for a dead engine landing is as follows:

- Wing down
- Leading edge in landing droop
- Landing gear down

1 CLEAN CONDITION GLIDE

- Airspeed 190 knots
- Throttle "OFF"
- ENGINE MASTER switch "OFF"
- EMERG POWER handle pulled
- EMER GEN switch "ON"
- ROLL STAB switch "OFF RESET" momentarily then "ON"
- FUEL DUMP switch "DUMP"

2 INITIAL POINT (HIGH KEY)

- Airspeed 190 to 210 knots
- 7,000 to 8,000 feet
- FUEL DUMP switch "OFF"
- Extend landing gear pneumatically

3 Approximately 30° Bank Throughout Turn

- ### 4 180° POSITION
- 190 to 200 knots
 - 4,500 to 5,000 feet

- ### 7 Touch down at 155 to 160 knots, 1/4 to 1/3 down runway

- ### 6 Flare 150 to 200 feet

- ### 5 90° POSITION
- 190 to 200 knots
 - 2,500 to 3,000 feet
 - EMER GEN switch in "LAND"

- ### 8 EMER GEN switch "OFF"

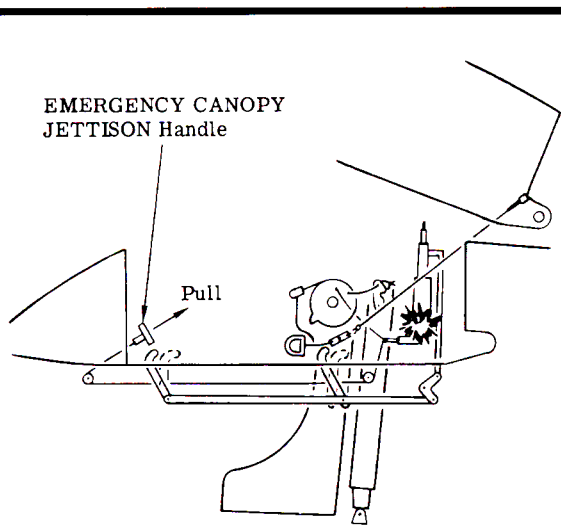
NOTES

Airspeeds shown are for 50% or less fuel remaining. With full fuel add 15 knots to approach airspeed shown. Altitudes are above terrain.

After touch down use normal braking or use EMERG BRAKE handle as necessary.

ROLL STAB will be operative
YAW STAB will be inoperative
EMERG PITCH TRIM will be available

Figure No. 3-2. Landing with Dead Engine



Pull the EMERGENCY CANOPY JETTISON Handle which fires the Emergency Canopy Acuator and jettisons the canopy without need for pulling the Face Curtain handle.

Figure No. 3-2A. Canopy Jettison Without Seat Ejection

LANDING WITH UTILITY HYDRAULIC SYSTEM FAILURE.

Refer to "UTILITY HYDRAULIC SYSTEM FAILURE" for procedure on emergency operation of wing incidence and leading edge droop system, landing gear, and wheel brakes.

Note

On touchdown, placing throttle in "OFF" will reduce engine thrust, increase drag and allow more efficient braking.

CARRIER LANDING WITH WING DOWN.

If it becomes necessary to make a wing-down carrier landing, proceed as follows:

- CRUISE DROOP switch....."OUT"
- FUEL DUMP switch....."DUMP"

Burn down fuel to attain lowest gross weight compatible with the operating situation.

Use the normal carrier approach and landing techniques with the emergency mirror settings published in current Recovery Bulletins for Landing Mirror Aids.

Final approach speed varies linearly from 140 knots IAS at a gross weight of 18,500 pounds to 150 knots IAS at a gross weight of 21,000 pounds.

The speeds listed above are the minimum satisfactory approach airspeeds under normal operating conditions. At lower airspeeds under turbulent conditions, control becomes marginal for performing a satisfactory carrier approach and landing.

Observe current published arresting gear engaging speed limitations.

CAUTION

In the event of a "bolter," the pilot should be prepared to rotate the airplane to the attitude required to maintain level flight as he passes over the angled deck bow. The fuselage attitude will be higher than the usual attitude with the wing up.

Barricade engagements resulting from a 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 above technique.

Wing-down carrier landings with the leading edge in the landing droop position should not be attempted because of the excessive engaging speeds required, marginal to inadequate pilot visibility, and insufficient longitudinal trim. Wing-down carrier landings with the leading edge fully retracted may be accomplished with approach airspeeds approximately 5 to 8 knots higher than those listed for the cruise droop condition, but are not recommended because of the excessive airspeeds required and resulting high engaging speeds. Damage to the tail cone may be expected during any wing-down carrier landing.

Note

Attempts to raise the wing pneumatically when the DN LOCK handle is in the "LOCK" position will result in obtaining leading edge landing droop without raising the wing, and further attempts to raise the wing will not be possible.

CARRIER LANDING WITH NOSE GEAR RETRACTED OR TRAILING.

If it becomes necessary to make a carrier landing with the nose gear retracted or trailing, a barricade engagement with arresting hook retracted is recommended using a normal carrier approach and touchdown. Use of the arresting hook during a barricade engagement will result in a strong nose-down moment and resulting high nose-section contact velocity if an arresting wire is engaged. Barricade test results show that after normal barricade engagement, the nose gear is held clear of the deck during runout and that after forward



When a malfunction of the nose gear is suspected, ease the nose down before losing horizontal tail control to avoid a sudden dropping of the nose.

motion is stopped, the nose section of the aircraft is lowered gently during roll back.

Note

The aircraft shows no strong tendency to pitch nose down after main gear contact during carrier landings unless an arresting wire is engaged. The pilot should avoid applying significant nose-down pitching moments when landing with nose gear up or trailing.

EMERGENCY ENTRANCE.

On airplanes BuNo. 145465 and subsequent and airplanes with ASC 185 (ECP 246) incorporated, either of the exterior emergency canopy jettison handles (figure 1-24) may be used to jettison the canopy. Pull the handle away from the fuselage to the full length of the lanyard. A sharp pull will then fire the canopy actuator cartridge. On other airplanes, the canopy may be opened using the exterior CANOPY release handle (figure 1-24).

If it becomes necessary to enter the cockpit under emergency conditions and it is impossible to gain entry by means of the emergency canopy jettison handles or the exterior CANOPY release handle (figure 1-24), use a fire ax or a similar instrument to break the plastic surface.

WARNING

Rescue personnel must be extremely cautious so as not to injure the pilot when forcing entry.

DITCHING.

The chances of successful ejection are much greater than the chances for successful ditching and should always be selected when a choice is possible.

Note

In airplanes with low-level ejection system, a successful ejection can be made from level or climbing flight at altitudes as low as 50 feet.

In airplanes without low-level ejection system, a successful ejection can be made from level or climbing flight at altitudes as low as 500 feet.

To ditch the airplane, perform radio distress procedure and proceed as follows:

Wing incidence.....As is

If wing is down, establish landing droop condition pneumatically.

WARNING

Do not change wing position for ditching. It is preferable to ditch with the wing in the down position in order to 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.

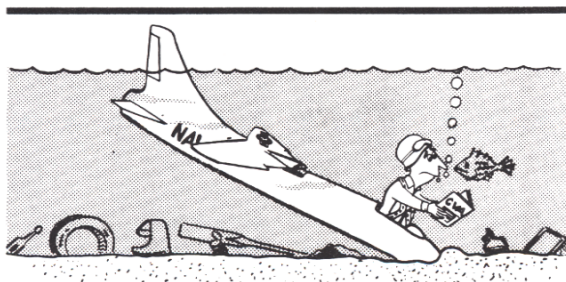
EMERGENCY CANOPY JETTISON

- handle (figure 3-2A).....Pulled
- Landing gear handle....."WHEELS UP"
- Shoulder harnessLocked
- Throttle "OFF"
- ENGINE MASTER switch....."OFF"

A glide speed of approximately 170 knots IAS is desirable. If the emergency power package is extended, the minimum indicated airspeed for adequate control power from the package is 145 knots IAS with EMER GEN switch in "LAND."

WARNING

If the airplane is ditched in a near level attitude, it may dive violently after contact.



Avoid ditching if you have enough altitude to eject. If you must ditch, keep the nose up. Because of the intake scoop location, this airplane will probably dive violently if ditched in a near-level attitude.

Touchdown should be made at approximately 145 knots IAS in a nose-high attitude. Flare the airplane just before contact. Immediately after the forward motion stops, abandon the airplane by squeezing the EMERG HARNESS REL handle trigger and pulling the handle sharply upward with a forward rotating motion to release the integrated harness.

Disconnect oxygen hose and antiblackout line or release the full-pressure suit disconnect. Use extreme caution not to arm the automatic parachute opener when leaving the airplane.

EJECTION.

The ejection procedure is described and illustrated in figure 3-3.

FUEL SYSTEM FAILURE.

FUEL CONTROL UNIT FAILURE.

Fuel control unit failure will be indicated by:

- a. TURB outlet pressure, EXH TEMP, and tachometer indicators showing erratic readings at a constant throttle setting.
- b. Unusual engine response to throttle movement.

Changeover to manual fuel metering is not automatic. When fuel control unit failure is suspected, proceed immediately as follows:

- a. Retard throttle to "IDLE" (if possible).
- b. Place FUEL CONT switch in "EMERG" and maintain minimum of 56% rpm.
- c. Advance throttle to desired setting slowly to avoid flameout, overtemperature, or overspeed.

Afterburner can be used, if necessary, if fuel pump warning light is not on.

Land as soon as possible.

FUEL PUMP FAILURE.

Failure of the engine stage of the engine-driven fuel pump will be indicated by illumination of the fuel pump warning light. Upon failure of the engine stage, fuel is automatically delivered to the engine by the afterburner stage of the pump.

No action is required, other than not using afterburner and landing as soon as is practicable.

TRANSFER FUEL SYSTEM FAILURE.

The illumination of the transfer pump warning light with more than 3,500 pounds of transfer fuel remaining indicates that the fuselage transfer fuel pump has failed; thus, the fuel in the aft transfer cells will not be available. To prevent CG travel beyond the aft limit, a landing must be made with at least 1,200 pounds of fuel in the main system.

If wing tank pressurization is lost, wing fuel will not gravity-feed and should be dumped before landing.

Note

In airplanes BuNo. 145416 and subsequent when cabin pressure switch is placed in "CABIN DUMP," wing tank pressurization is lost. To transfer wing fuel, place cabin pressure switch in "CABIN PRESS" for short periods of time.

ELECTRICAL SYSTEM FAILURE.

INDICATIONS.

A failure of the electrical system will be indicated as follows:

- DC failure....."Barber pole" in
DC PWR IND
- AC failure (one or more phases) - "OFF" flag visible
in attitude indicator

MAIN GENERATOR FAILURE.

Refer to "ELECTRICAL DISTRIBUTION" (figure 1-11) for loss of circuits controlled by secondary ac and dc buses.

If afterburner is in use at time of electrical failure, stop afterburner mechanically by retarding throttle smartly past the afterburner aft detent stop. Throttle movement is then restricted to below the detent stop until power from the emergency power package closes the afterburner shuttle valve. Do not use afterburner above 6,000 feet or 300 knots IAS.

EJECTION PROCEDURE

Ejection at airspeeds from stall speed to 525 knots results in relatively minor forces exerted on the body. Ejection at airspeeds from 525 knots to 600 knots results in appreciable forces and escape is more hazardous. Ejection above 600 knots is extremely hazardous because of excessive forces exerted on the body.

On airplanes that do not have ASC 131 (ECP 191) incorporated the ejection sequence under all conditions is similar to the sequence presented here for high altitudes and high speeds except that the face curtain does not pull away from the seat.

The low-level ejection sequence is automatically selected when the wing DN LOCK handle is in "UNLOCK." Ejection can then be made from level or climbing flight at altitudes above 50 feet. The margin of safety in an ejection at low altitude is increased by making a "zoom" maneuver, which will increase the time available for seat separation and parachute deployment.

Clearance above the tail is ensured at speeds up to 550 knots for total ejected weights up to 355 pounds.

The EMERG HARNESS REL handle must not be pulled prior to ejection.

1 If circumstances permit, reduce air-speed to 400 knots or less by extending speed brake, retarding throttle, and/or pulling up.



2 Sit erect with head braced firmly against headrest, legs extended, and feet resting against rudder pedals.

Grasp face curtain handle with both hands, elbows in, and thumbs out-board.

Pull face curtain handle downward in one continuous firm movement. Shoulder harness will lock, canopy will jettison, and seat will eject.

If the canopy fails to jettison when the face curtain handle is pulled, pull the seat emergency arming "D" handle, then continue to pull the face curtain downward to eject the seat through the canopy.



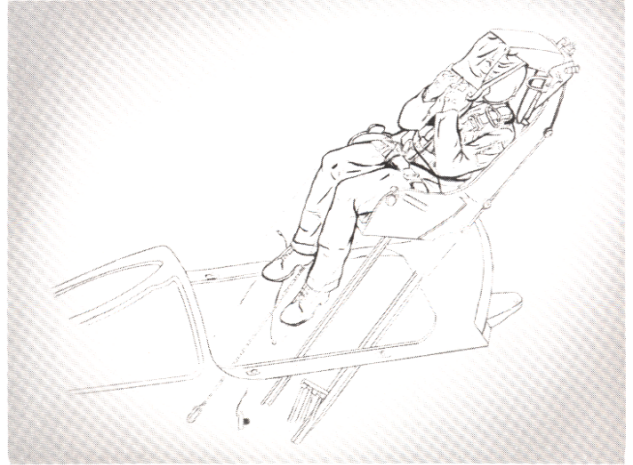
Figure No. 3-3. Ejection Procedure (Sheet 1)

EJECTION PROCEDURE

3

In a low-level ejection (wing DN LOCK handle in "UNLOCK"), the integrated harness and the break-away face curtain are released and seat snubbing begins just as the seat leaves the catapult. The pilot is forcibly separated from the seat. Separation of the seat and pilot actuates the automatic parachute opener to deploy the parachute.

In a high-altitude, high-speed ejection (wing DN LOCK handle in "LOCK"), the integrated harness actuator is fired as the seat leaves the airplane. The harness and the break-away face curtain are released after a 2-second delay. Separation of the pilot and seat actuates the automatic parachute opener.



4

Allow time for automatic parachute opener to function. Rate of free fall at high altitude is about 200 feet per second. The automatic parachute opener is normally set to open the parachute at 10,000 feet.

If the EMERG HARNESS REL handle is used to release the integrated harness, the automatic opening parachute will not be armed, and the parachute "D" handle must be pulled for chute deployment.

Manually opening parachute at high altitude will produce a greater opening shock and greatly increase the time required to descend below the altitude at which oxygen is required.



5

If spinning develops during free fall, it may be arrested by extending arms and legs simultaneously. In some instances, rapidly extending and retracting arms and legs will be more effective. In any case, the rate of rotation will slow down or stop as lower altitudes are reached.



Figure No. 3-3. Ejection Procedure (Sheet 2)

EJECTION PROCEDURE

6 Before contact, the parachute "D" handle should be pulled sufficiently to clear the handle from the harness strap. This would then require disconnecting only the shoulder fittings instead of both hip and shoulder fittings in order to release the parachute canopy after landing.

Remove oxygen mask or open pressure suit face plate before touchdown or if breathing becomes difficult. This provides better visibility and reduces the possibility of suffocation in case of injury or depletion of bailout oxygen.



7 After contact, release the parachute canopy by disconnecting the shoulder fittings. Release the seat pan by disconnecting the hip fittings.



8 If over water, one hip fitting should be released prior to contact. With both fittings connected, the buoyancy of the seat pan will tend to cause the pilot to float in a hips-high position.

Immediately after entering water, release parachute canopy by disconnecting shoulder fittings to prevent entanglement with shroud lines.

Release back pack and seat pan prior to entering helicopter rescue sling.

Figure No. 3-3. Ejection Procedure (Sheet 3)

EMERG POWER handle Pull

WARNING

Do not extend the emergency power package with the EMER GEN switch in "ON" or "LAND." Extending package with a load on the generators may prevent obtaining electrical power.

- EMER GEN switch "ON"
- Emergency power indicator light On
- DC PWR IND "V" showing
- Attitude indicator "OFF" not visible
- ROLL STAB switch "OFF RESET" momentarily, then "ON"
- ROLL STAB warning light Off
- YAW STAB switch "OFF RESET" momentarily, then "ON"
- YAW STAB warning light Off

Note

Minimum airspeed to supply adequate electrical power with EMER GEN switch in "ON" is 175 knots IAS and 145 knots IAS with switch in "LAND."

To avoid uncovering the one operating fuel booster pump on airplanes through BuNo. 145464 and thereby causing a flameout, do not exceed the following nose-down attitudes for the specified amount of main system fuel remaining:

- Above 1,200 pounds -20°
- 600 to 1,200 pounds -10°

With less than 600 pounds remaining, maintain a level or nose-up attitude. In any case, do not extend the speedbrake above 250 knots IAS and if in afterburning, obtain either 2g or a nose-up attitude before reducing power.

Do not fly at negative g loads.

On airplanes BuNo. 145465 and subsequent, the booster pump that supplies fuel for an airstart is at the forward end of the main cell and the above restrictions do not apply.

COMPLETE ELECTRICAL FAILURE.

- a. To prevent flameout because of loss of fuel booster pump pressure, retard throttle to "IDLE" and descend below 30,000 feet. Use less than "MILITARY" thrust for return to base.

*Airplanes through BuNo. 141360.
 †Airplanes BuNo. 141361 and subsequent.

- b. Do not exceed the following nose-down attitudes for the specified amount of main system fuel remaining:

- Above 1,200 pounds -20°
- 600 to 1,200 pounds -10°
- Less than 600 pounds Maintain a level or nose up attitude

- c. Do not extend the speedbrake above 250 knots IAS and if in afterburner, obtain either 2g or a nose-up attitude before reducing power.

- d. Do not fly at negative g loads.

- e. If afterburner was in use at time of failure, do not advance throttle above afterburner aft detent stop as afterburner will re-ignite.

- f. Do not use afterburner above 6,000 feet or above 300 knots IAS.

UTILITY HYDRAULIC SYSTEM FAILURE.

There is no emergency utility hydraulic system. However, extension of leading edge, raising of wing, extension of landing gear, and operation of wheel brakes are made possible by the pneumatic system.

If a system is actuated pneumatically, do not reposition controls or attempt to actuate the system hydraulically until necessary maintenance is performed.

LANDING GEAR.

- Airspeed 220 knots IAS maximum
- Landing gear handle* "WHEELS DOWN"
- EMERG GEAR DOWN handle* PULLED
- Landing gear handle† "WHEELS DOWN," push in, rotate clockwise, and pull aft
- LG position indicators "DN"

If main gear indicators show barber pole, rock airplane or dive and climb until "DN" appears.

CAUTION

Landing gear handle must be placed in "WHEELS DOWN" to provide nose gear mechanical down lock and a wheel indication.

LEADING EDGE AND WING.

- Airspeed 220 knots IAS maximum
- DN LOCK handle "UNLOCK"
- WING INCIDENCE handle "DN"
- EMERG DROOP & WING INC guard Raised
- RELEASE SWITCH Held depressed

WING INCIDENCE handle Full forward, then
inboard and aft to "EMERG UP"

WARNING

If unable to position DN lock handle in "UNLOCK," do not attempt to raise the wing pneumatically. Wing cylinder locks will bind and further attempts to raise the wing will not be possible.

RELEASE SWITCH Released

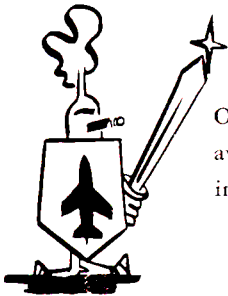
LEADING EDGE.

To obtain leading edge landing droop condition only (wing remains down) proceed as follows:

WING INCIDENCE handle "DN"
EMERG DROOP & WING INC guard Raised
RELEASE SWITCH Held depressed
WING INCIDENCE handle Full forward
RELEASE SWITCH Released

WHEEL BRAKES.

Emergency pneumatic braking action is obtained by use of the EMERG BRAKE handle. The handle should be moved slowly toward "ON" to avoid locking the brakes. Momentary braking action is obtained by manipulation of the handle.



On fields with arresting gear available, make an arrested landing.

POWER CONTROL HYDRAULIC SYSTEM FAILURE.

An emergency hydraulic pump, in the emergency power package, will provide sufficient pressure for operation of the flight controls with failure of both engine-driven pumps. Pressure from the emergency pump is delivered through the lines of power control system No. 1 and does not affect system No. 2. The emergency power package is extended by pulling the EMERG POWER handle. Emergency pump pressure will be indicated by the hydraulic pressure gage.

The position of the EMER GEN switch will affect the hydraulic output pressure of the emergency power package. With the EMER GEN switch in "LAND," the electrical load is reduced; the "OFF" position (no electrical failure) will eliminate all electrical load thus increasing the hydraulic pressure. The minimum air-speed for adequate hydraulic pressure with no electrical load is 145 knots IAS.

TRIM AND STABILIZATION SYSTEM FAILURE.

INDICATIONS.

A failure of the trim and stabilization system will be indicated by inability to trim, undesirable oscillations, or illumination of a STAB warning light.

YAW TRIM AND STABILIZATION FAILURE.

YAW STAB warning light On
YAW STAB switch "OFF RESET" momentarily,
then "ON"

If warning light is still lit

YAW STAB switch "OFF RESET"

Yaw trim and stabilization is inoperative and rudder will return to neutral.

ROLL TRIM AND STABILIZATION FAILURE.

ROLL STAB warning light On
ROLL STAB switch "OFF RESET" momentarily,
then "ON"

If warning light is still lit

ROLL STAB switch "OFF RESET"

Roll trim and stabilization will automatically reset itself if the ROLL STAB switch is left in "ON" when the EMER GEN switch is placed in "LAND" while using the emergency power package. If roll stabilization is not desired for landing, the ROLL STAB switch must be placed in "OFF RESET."

Roll trim and stabilization is inoperative and ailerons will return to neutral.

PITCH TRIM FAILURE.

EMERG PITCH TRIM handle "PULL"

Normal pitch trim is inoperative and emergency pitch trim is available by movement of the EMERG PITCH TRIM handle to "NOSE DOWN" or "NOSE UP."



SECTION IV

AUXILIARY EQUIPMENT DESCRIPTION AND OPERATION

INTRODUCTION

This section provides section I, II, and III information for auxiliary equipment (defined as equipment that *does not* contribute directly to the physical act of flying the airplane). Under separate headings for each auxiliary equipment group, this section states the function, lists the equipment of interest, describes the operation, and prescribes the normal and emergency procedures.

AIR-CONDITIONING

FUNCTION

Furnishes heating, cooling, ventilation, and pressurization requirements of the airplane.

EQUIPMENT OF INTEREST

Air-conditioning unit
Cabin air pressure regulator
Cabin dump valve
Manifold pressure regulator valve
Cabin temperature controller
Pressure suit
Controls and indicator are listed in table 4-1

OPERATION.

GENERAL. (See figure 4-2.)

Bleed air from the engine compressor section is directed through the air-conditioning unit and routed to provide:

- Cabin temperature control and pressurization.
- Pressure suit ventilation and pressurization.
- Windshield defogging and rain removal.
- Automatic pressurization and cooling of integrated electronic package.
- Automatic cooling of electronic compartment.
- Automatic cooling of armament control components in nose cone.
- Automatic pressurization of fuselage cells and wing tank.

AIR-CONDITIONING UNIT.

This unit cools hot engine compressor bleed air

through a heat exchanger and an expansion-turbine refrigeration unit. The heat exchanger supplies hot and warm air by transferring heat from the engine bleed air through coils to ram bleed air from the engine intake duct. The refrigeration unit supplies cool air by further cooling of some of the warm air from the heat exchanger.

CABIN AIR PRESSURE REGULATOR.

This regulator provides automatically regulated pressurization of the cabin at altitudes above 8,000 feet. (See figure 4-3 for cabin pressurization schedule.)

CABIN DUMP VALVE.

This valve automatically relieves excess positive and negative cabin pressure differentials if the cabin air pressure regulator fails. The valve limits negative cabin pressure to 0.25 psi maximum and limits positive cabin

Table 4-1. Air-Conditioning System Controls

<i>Nomenclature</i>	<i>Function</i>
Cabin temperature controller knob (8, figure 4-1)	"COLD" to "HOT" range regulates temperature of conditioned air entering cabin and full pressure suit.
Manual override switch (9, figure 4-1)	"AUTO" permits cabin inlet air temperature to be automatically controlled to the cabin temperature controller knob setting. "MAN" permits cabin inlet air temperature to be controlled manually by the pilot.
Cabin pressure switch (7, figure 4-1)	"CABIN PRESS" allows cabin pressurization and cooling of nose cone armament control components. "CABIN DUMP" dumps cabin pressure and stops conditioned air flow to cabin with subsequent loss of nose cone cooling. Does not stop airflow to pressure suit and integrated electronic package. In airplanes BuNo. 145416 and subsequent, bleed air from engine is shut off; thus stopping all air flow from the air-conditioning unit.
Defogger switch (5, figure 4-1)	"DEFOG" directs hot airflow to windshield and side panels through windshield manifolds.
Rain removal switch (6, figure 4-1)	"RAIN REMOVE" directs high velocity stream of warm air across left-hand side panel to deflect rain.
EMERG VENT AIR knob (4, figure 4-1)	Pulled and rotated to control volume of ram air flow into cabin for emergency ventilation.
CABIN PRESSURE ALTITUDE indicator (3, figure 4-1)	Indicates cabin pressure altitude when pressure suit is not used or suit pressure altitude when suit is used.

pressure to 5.35 psi maximum. The valve can also be opened to depressurize the cabin under emergency flight conditions.

MANIFOLD PRESSURE REGULATOR VALVE.

This valve automatically controls pressure and airflow to the cabin and maintains proper balance of pressure between the cabin and full pressure suit. When cabin pressure is dumped, the valve is closed and stops the airflow to the cabin. This provides and maintains a positive air flow to the pressure suit and to the integrated electronic package.

Note

In airplanes BuNo. 145416 and subsequent, airflow to the heat exchanger is shut off when the cabin pressure switch is placed in "CABIN DUMP," resulting in loss of all air-conditioning and pressurization functions.

CABIN TEMPERATURE CONTROLLER.

In airplanes BuNo. 145416 and subsequent a manual override switch is incorporated in the air-conditioning system to provide automatic or manual temperature control. With the manual override switch in the "AUTO" position, temperature of the air entering the cockpit is automatically controlled, for changes in

flight conditions, by the cabin temperature controller. The controller regulates operation of the temperature control bypass valve to provide the temperature selected by the pilot with the cabin air temperature controller knob. With the switch in the "MAN" position, the pilot controls the bypass valve directly by adjusting the cabin temperature controller knob for each change in flight conditions. Pressure fluctuations occurring when manual temperature control is in use are an indication that the temperature controller knob is set too high. Repositioning the knob toward "COLD" will stop the fluctuations.

NORMAL PROCEDURES.

- Cabin pressure switch "CABIN PRESS"
- G VALVE As desired
- Cabin temperature controller knob As desired

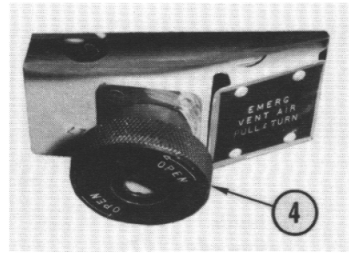
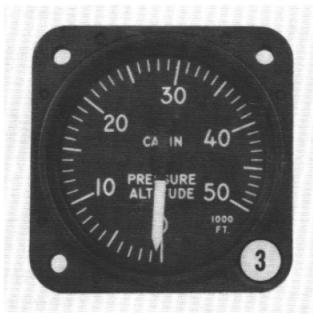
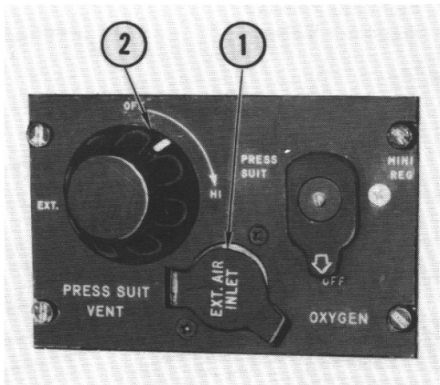
Note

The defogging system may be operated continuously to provide additional cockpit heat during loiter or cruise above 30,000 feet.

If fogging occurs during long periods of high altitude loiter, proceed as follows:

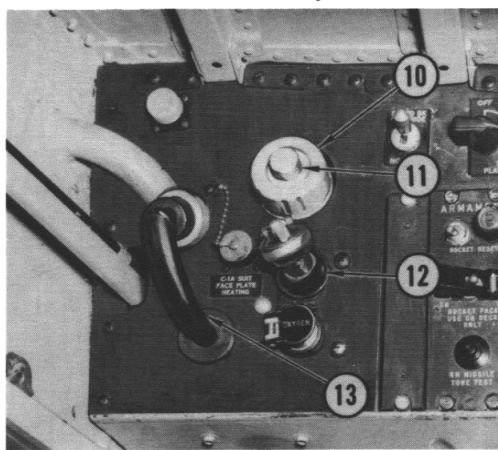
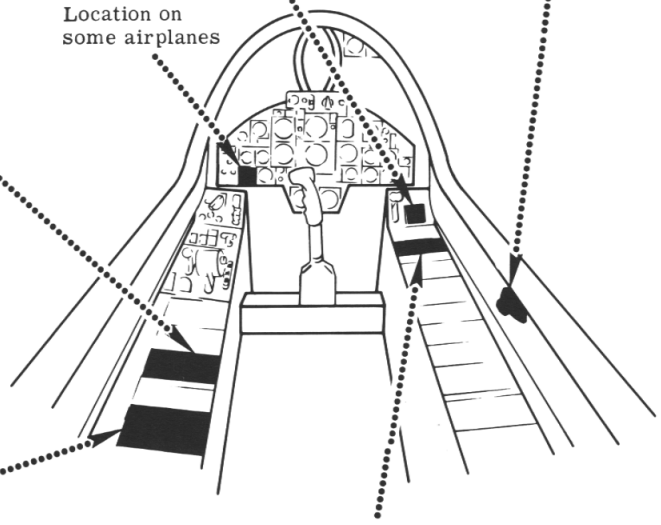
- Defogger switch "DEFOG"
- Cabin temperature controller knob "HOT"
- Throttle 90% rpm minimum

AIR CONDITIONING AND PRESSURIZATION



- 1. EXT AIR INLET Receptacle
- 2. PRESS SUIT VENT Valve
- 3. CABIN PRESSURE ALTITUDE Indicator
- 4. EMERG VENT AIR Knob
- 5. Defogger Switch
- 6. Rain Removal Switch
- 7. Cabin Pressure Switch
- 8. Cabin Temperature Controller Knob
- 9. Manual Override Switch*
- 10. G VALVE
- 11. G VALVE Button
- 12. Antiblackout Line
- 13. Antiblackout Fitting

Location on some airplanes



*Airplanes BuNo. 145416 and subsequent.

Figure No. 4-1. Air-Conditioning and Pressurization Controls

AIR CONDITIONING SYSTEM

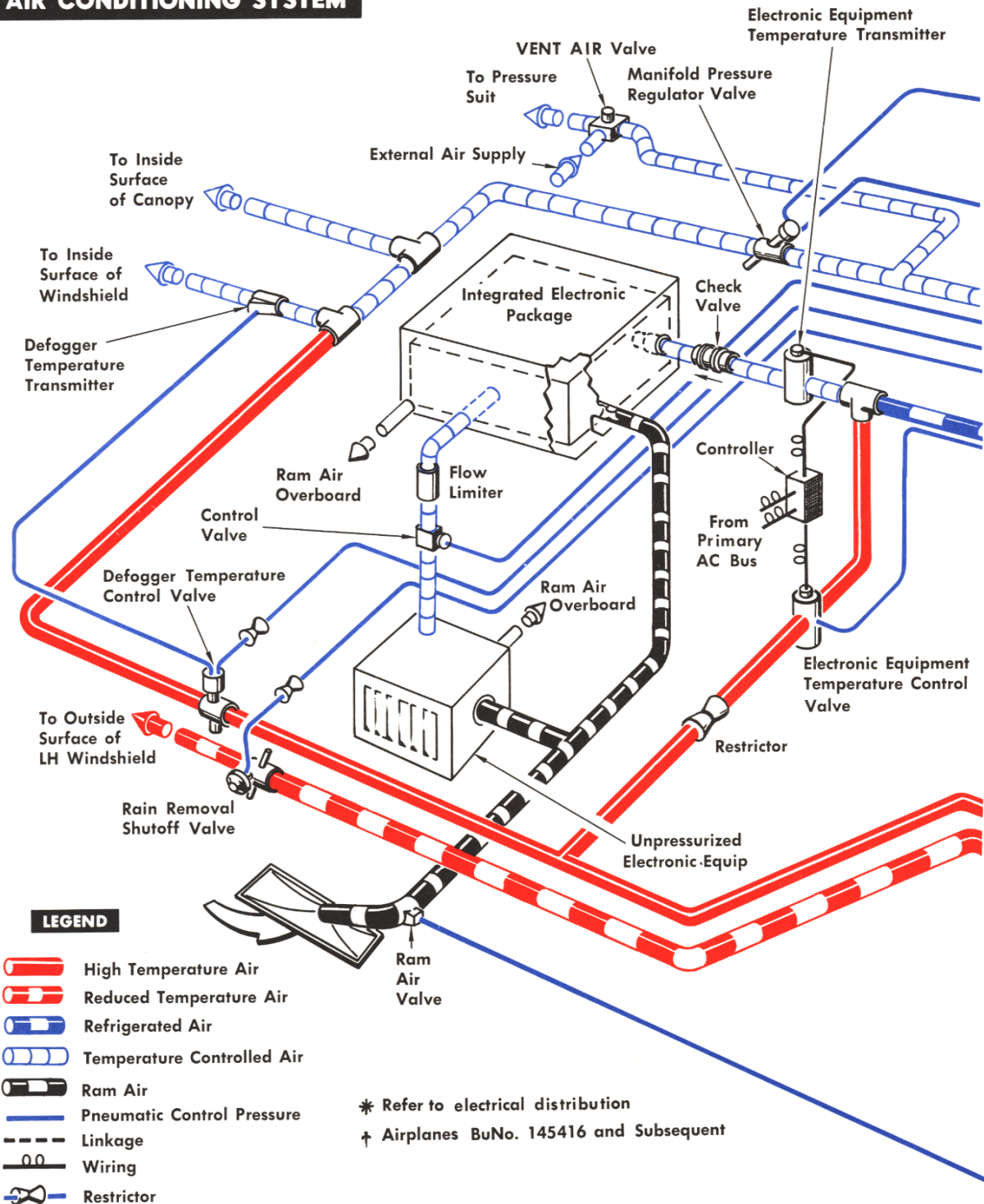


Figure No. 4-2. Air-Conditioning System (Sheet 1)

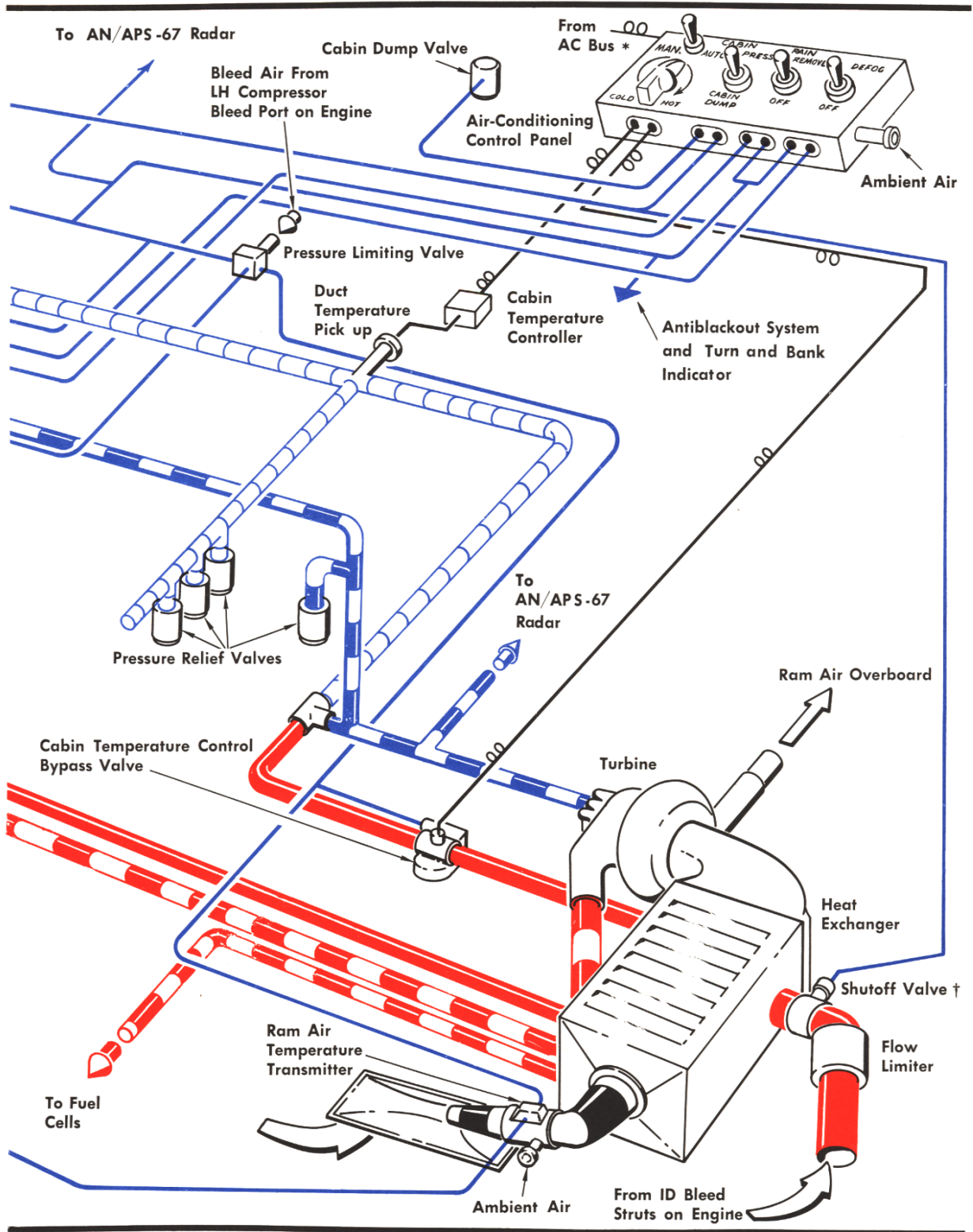


Figure No. 4-2. Air-Conditioning System (Sheet 2)

CABIN PRESSURIZATION

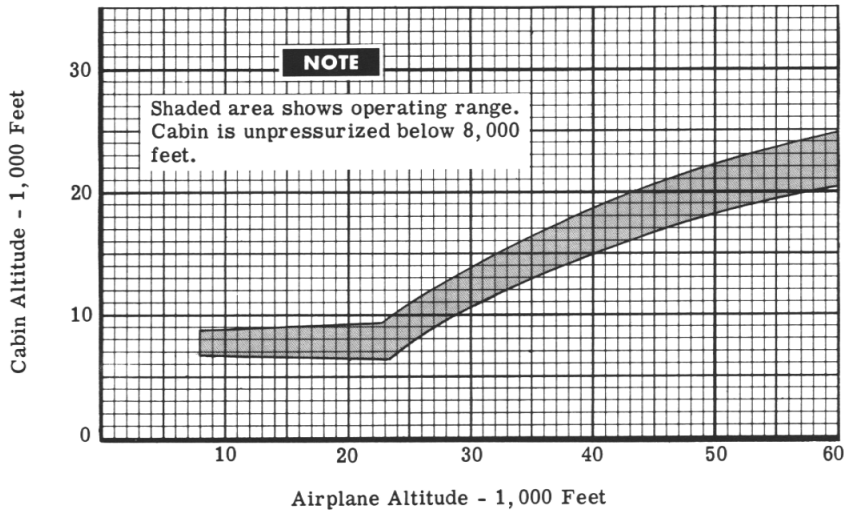


Figure No. 4-3. Cockpit Pressurization Schedule

After fog clears, reduce throttle to desired position and adjust cabin temperature as desired.

Note

Fogging may be prevented during high altitude loiter by continuous use of defogging system above 30,000 feet.

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. This oil vapor may deposit a thin film of oil on the windshield and canopy, which will not be detrimental to the pilot's vision during day operation. However, prior to night operation the windshield and canopy should be cleaned.



When full pressure suit is not worn and a flame-out occurs, the cabin pressure switch should be placed in "CABIN DUMP" before attempting an air start or sudden pressurization of cabin will result in discomfort to the pilot as a relief is obtained. Descend to 8,000 feet before placing switch in "CABIN PRESS."

EMERGENCY PROCEDURES.

When it is necessary to depressurize the cabin, or when cabin pressurization is lost, proceed as follows:

CAUTION

If the air-conditioning system *fails* at an altitude above 27,500 feet, immediately place UHF function switch in "OFF." Operating the radio equipment without integrated electronic package pressurization may result in arcing, causing loss of UHF, ADF, and IFF operation. The switch also must be placed in "OFF" when cabin pressure is *dumped* at altitudes above 27,500 feet on airplanes BuNo. 145416 and subsequent. On these airplanes, the cabin pressure switch may be placed in "CABIN PRESS" for short periods if radio transmission is desired.

Oxygen system is supplying pressure suit pressurization. Plan flight accordingly and make continual check of oxygen pressure gage.

Cabin pressure switch....."CABIN DUMP"

Note

Dumping cabin pressure above 43,000 feet may lead to adverse physiological effects if pressure suit is not being worn.

Defogger switch "OFF"
 Radar power switch "OFF"
 EMERG VENT AIR knob As desired

If cabin temperature goes to full-hot and cannot be controlled either automatically or manually, proceed as follows:

Throttle Cruise position
 Cabin pressure switch "CABIN DUMP"
 EMERG VENT AIR knob Open as desired

Do not advance throttle above cruise setting and land as soon as possible.

In all air-conditioning emergencies, descend to lower altitude if possible.

Depressurization of cabin on airplanes BuNo. 145416 and subsequent or failure of the air-conditioning system has the following effects:

- a. Cabin pressurization and temperature control are lost.
- b. Nose cone cooling for armament control components is lost.
- c. Windshield defogging and rain removal are lost.
- d. Oxygen system automatically provides pressurization for pressure suit.
- e. Integrated electronic package pressurization is lost. Ram air is admitted to cool package if airspeed is low enough to prevent ram air from overheating.
- f. Ram air is automatically admitted to maintain pressurization of fuel cells and wing tank.
- g. Cabin ventilation is obtained by means of EMERG VENT AIR scoop.

PRESSURE SUIT

FUNCTION

Provides the pilot with emergency pressurization equivalent to an altitude of 35,000 feet or less upon loss of cabin pressurization or suit ventilation.

EQUIPMENT OF INTEREST

Composite quick-disconnect
 Pressure suit controller
 Controls and indicators are listed in table 4-2.

OPERATION.

The full pressure suit is connected to the airplane systems by engaging the suit quick-disconnect to the composite quick-disconnect on the left-hand side of the pilot's seat. This connects the oxygen supply line, the suit ventilating air line, suit pressure sensing line, antiblackout line, and communication connections. The pressure suit oxygen regulator receives 100% oxygen from the pilot's oxygen valve. The suit normally receives ventilating and pressurizing air from the air-conditioning system. Suit ventilation on the ground, with the engine not operating, is supplied by connecting an external air supply into the EXT AIR INLET connection (1, figure 4-1).

PRESSURE SUIT CONTROLLER.

During normal operation this unit, which is part of the pressure suit, maintains suit pressure slightly above

cabin pressure. With loss of cabin pressurization above 35,000 feet, the controller automatically provides suit pressurization by trapping the ventilating air in the suit and maintaining the suit pressure equivalent of 35,000-foot altitude. At altitudes below 35,000 feet, the controller will maintain the suit pressure equivalent of the altitude at which normal pressurization is lost. Sufficient ventilating air will still flow through the suit to maintain pilot safety and comfort.

If suit ventilating airflow is lost while above 35,000 feet, the controller automatically admits oxygen system pressure to pressurize the suit. Suit pressure will be maintained at the pressure equivalent of 35,000 feet but suit ventilation will be lost. When the airplane oxygen supply is depleted, the emergency oxygen system in the backpan supplies oxygen for breathing and maintaining suit pressurization. The pilot is then safe only to the extent of his oxygen supply.

Figure No. 4-4. through 4-7. Deleted

Table 4-2. Pressure Suit Controls

<i>Nomenclature</i>	<i>Function</i>
VENT AIR valve (2, figure 4-1)	"LOW" to "HIGH" range regulates volume of ventilating air entering suit from air-conditioning system. "EXT AIR" permits ground ventilation of suit with external air supply hose inserted into EXT AIR INLET connection.
Cabin temperature controller knob (8, figure 4-1)	"COLD" to "HOT" range regulates temperature of ventilating air entering suit.
CABIN PRESSURE ALTITUDE indicator (3, figure 4-1)	Reflects suit pressure altitude.
Cabin pressure switch (7, figure 4-1)	"CABIN PRESS" normal position. "CABIN DUMP" maintains positive suit ventilating airflow by closing conditioned airflow to cabin upon loss of cabin pressurization. On airplanes BuNo. 145416 and subsequent suit ventilation is lost.

(Refer to "ANTIBLACKOUT" for G VALVE operation.)

PARTIAL PRESSURE SUIT

FUNCTION

To provide the pilot with emergency pressurization upon loss of cabin pressurization above 43,000 feet or when ejecting from the airplane.

EQUIPMENT OF INTEREST

C-1 Assembly
Seat cushion assembly
T-block

Miniature oxygen regulator
Controls are listed in table 4-4.

OPERATION.

The partial pressure suit helmet face plate incorporates oxygen inhalation and exhalation valves and a heating element for face plate defogging. The face plate heating cord is connected to the C-1A SUIT FACE PLATE HEATING receptacle (40, figure 1-4) on the left-hand console, and temperature is controlled by positioning the FACE PLATE HEAT knob (5, figure 1-4) on the left-hand console in the "OFF" to "INCREASE" range as required. During normal operation, the helmet is supplied with oxygen from the airplane supply through a miniature regulator in the T-block, and the suit capstans are not pressurized. If cabin pressurization is lost above 43,000 feet the emergency bailout bottle inflates the suit capstans with oxygen. When ejecting, the bailout bottle automatically supplies breathing oxygen and inflates the suit capstans regardless of altitude. The sudden change in breathing cycle will produce a sensation of suffocation. If altitude permits, this may be overcome by disconnecting the helmet oxygen hose at the T-block and opening the face plate. When the oxygen in the bailout bottle is depleted, atmospheric air is available for breathing through a port in the T-block. The suit pressure may be relieved by dis-

connecting the hose from the C-1 assembly. Antiblackout pressure is supplied directly to the suit by the antiblackout line. When a chest bladder is incorporated in the partial pressure suit, the T-block is replaced with a four-way valve.

NORMAL PROCEDURES.

The partial pressure suit is connected to the airplane system in the following manner:

- Connect hose from seat cushion to oxygen receptacle on left-hand console (5, figure 4-8).
- Connect hose from seat cushion to hose from T-block.
- Connect antiblackout line to fitting on suit.
- Connect bailout bottle lanyard to EMERGENCY OXYGEN cable clip with green "apple" aft.
- Connect hoses from C-1 assembly to T-block and suit hose.
- Connect oxygen hose from helmet to the T-block.
- Connect face plate heat cord to FACE PLATE HEATING receptacle on left-hand console. Stow receptacle cover on stowage fitting (42, figure 1-4).

ANTIBLACKOUT**FUNCTION**

Provides the pilot with automatic protection against blackout due to high g-forces.

EQUIPMENT OF INTEREST

Controls are listed in table 4-3.

OPERATION.

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. When the full pressure suit is worn, the

antiblackout line (12, figure 4-1) must be connected to the antiblackout fitting (13, figure 4-1) to connect the system to the full pressure suit through the composite quick-disconnect on the left-hand side of the pilot's seat. When a partial pressure suit is worn, the antiblackout line is connected directly to the antiblackout fitting on the partial pressure suit.

Table 4-3. Antiblackout System Controls

<i>Nomenclature</i>	<i>Function</i>
G VALVE (10, figure 4-1)	"HI" supplies a pressure of 1.5 psi for each g over 1.75 g's up to 10 psi. "LO" supplies a pressure of 1 psi for each g over 1.75 g's up to 10 psi.
G VALVE button (11, figure 4-1)	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.

OXYGEN**FUNCTION**

Provides an automatically regulated source of oxygen for breathing and for emergency pressurization of the full pressure suit.

EQUIPMENT OF INTEREST

Pilot's oxygen valve
Liquid oxygen converter†
Controls and indicators are listed in table 4-4.
Oxygen duration charts are presented in figure 4-4.

OPERATION.

Pure gaseous oxygen is supplied to the full pressure suit regulator or the miniature regulator by a 5-liter vacuum-insulated liquid oxygen converter at approximately 70 psi through the pilot's oxygen valve. These regulators, in turn, automatically deliver positive pressure flow (pressure breathing) at all altitudes, with flow varying slightly with altitude change. The oxygen system automatically pressurizes the full pressure suit when normal suit pressurization is lost above 35,000 feet. When the full pressure suit is used, an emergency oxygen supply contained in the backpan will deliver oxygen, either while in the cockpit or following ejection, upon actuation of a green apple located on the chest portion of the suit. The bailout bottle in the seat cushion is not used and the seat cushion connections are stowed. When the miniature regulator is used, the two flexible hoses extending from the seat connections must be connected. One hose is inserted into the

OXYGEN receptacle (3, figure 4-7) and the other hose is connected to the miniature regulator end fitting. This connects the aircraft oxygen system and the bailout bottle in the seat cushion to the face mask.

The bailout bottle lanyard (green "apple") is connected to the EMERGENCY OXYGEN CABLE clip (27, figure 1-4) to trip the bailout bottle automatically upon ejection.

NORMAL PROCEDURES.

Before each flight, check the following:

- a. Before entering plane check that vent and build-up valve is in "BUILD-UP." (Access panel cannot be secured unless valve is in "BUILD-UP.")
- b. Check system quantity. With fully serviced system, gage should indicate 5 liters. Do not take off with less than 3½ liters indicated.

Table 4-4. Oxygen System Controls and Indicators

Nomenclature	Function
Pilot's oxygen valve (5, figure 4-8)	<p><i>Airplanes BuNo. 145416 and subsequent and airplanes with ASC 213 (ECP 333) incorporated.</i></p> <p>"PRESS SUIT" supplies oxygen to full pressure suit oxygen regulator through composite disconnect.</p> <p>"MINI REG" supplies oxygen to pilot's miniature regulator through OXYGEN receptacle.</p> <p>"OFF" closes oxygen supply.</p> <p><i>Airplanes without ASC 213 (ECP 333) incorporated</i></p> <p>"ON" supplies oxygen to full pressure suit oxygen regulator or miniature regulator.</p> <p>"OFF" closes oxygen supply.</p>
Vent and build-up valve (In area behind liquid oxygen filler valve access panel on RH side of nose section)	<p>"BUILD-UP" is normal position. Closes system for automatic build-up of operating pressure.</p> <p>"VENT" opens system to allow venting during filling.</p>
LIQUID OXYGEN gage (2, figure 4-8)	Reflects quantity of liquid oxygen in converter.
Oxygen low level warning light (1, figure 4-8)	On when liquid oxygen level is at or below ½ liter.
Oxygen low pressure warning light (Airplanes BuNo. 145345 and subsequent and airplanes with ECP 410 incorporated) (4, figure 4-8)	On if oxygen pressure drops in line to pressure suit composite disconnect or OXYGEN receptacle, whichever is in use.
OXY QUANT GAGE TEST switch (3, figure 4-8)	"PUSH TO TEST" checks indicating circuit continuity.
Bailout bottle pressure gage	Indicates bailout bottle pressure.

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.

- c. Check that pilot's oxygen valve is in "OFF."
- d. If not wearing a full pressure suit, depress oxygen connection plunger in composite disconnect to relieve trapped oxygen pressure. Check that low-pressure warning light* is lighted.
- e. Don pressure suit helmet with face plate open and engage composite quick-disconnect to mating portion on left-hand outboard side of seat or put on modified face mask and connect hoses from seat cushion.

Close face plate, turn pilot's oxygen valve on and observe that low-pressure warning light* goes out, then check oxygen flow by breathing several times. If difficulty is experienced in breathing, the pressure suit helmet or modified face mask is not functioning properly. Check connections.

WARNING

Do not permit oxygen to flow freely from face mask or oxygen receptacle on left-hand console because liquid oxygen may enter supply line and pilot's personal equipment.

- f. Bailout bottle pressure should be checked before each flight when personal gear is inspected. When fully charged, the gage should read 1,800 (± 50) psi.
- g. Secure bailout bottle lanyard to EMERGENCY OXYGEN CABLE clip.

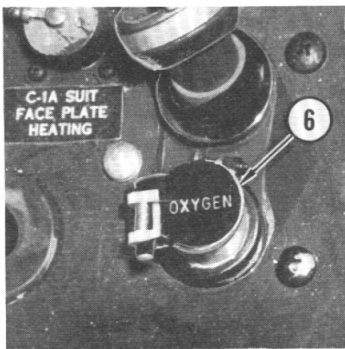
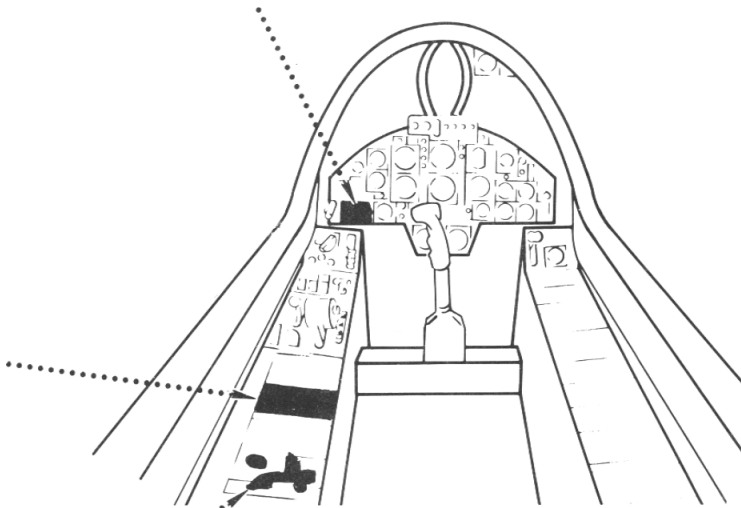
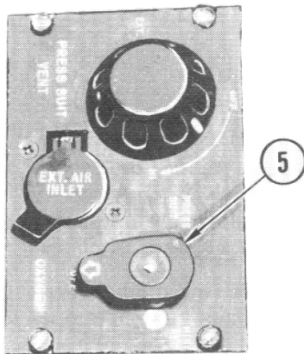
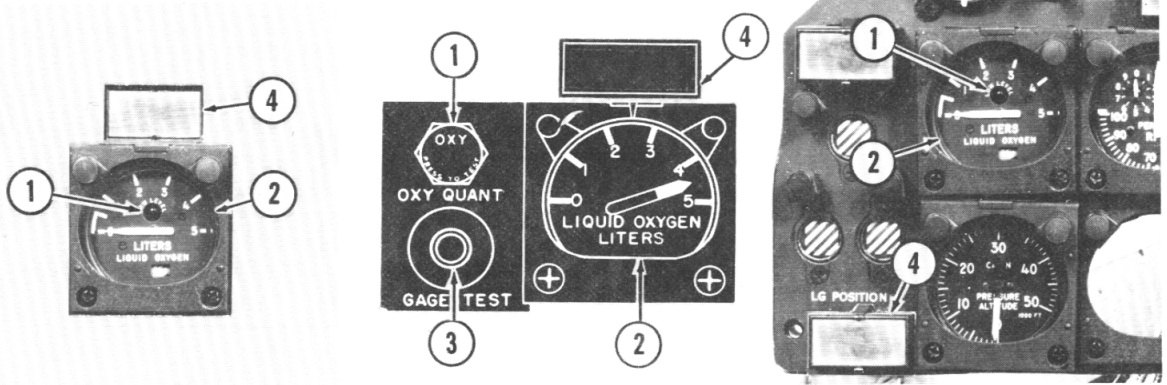
*Airplanes BuNo. 145345 and subsequent and airplanes with ECP 410 incorporated.

OXYGEN CONTROLS

Airplanes through BuNo. 142415 with ECP 410 incorporated.

Airplanes BuNo. 143677 through 143701 with ECP 410 incorporated.

Airplanes BuNo. 145345 and subsequent and airplanes BuNo. 143702 through 145344 with ECP 410 incorporated.



- 1. Oxygen Low Level Warning Light*
- 2. LIQUID OXYGEN Gage
- 3. OXY QUANT GAGE TEST Switch*
- 4. Oxygen Low Pressure Warning Light (Airplanes BuNo. 145345 and subsequent and airplanes through BuNo. 145344 with ECP 410 incorporated)
- 5. Pilot's Oxygen Valve
- 6. OXYGEN Receptacle

*Test switch and separate low level warning light on airplanes BuNo. 143677 through 143701 may be replaced by indicator with integral light and "OFF" flag.

Figure No. 4-8. Oxygen Controls and Indicators

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	

BASED ON:

1. One 5-liter liquid oxygen converter.
2. 800 liters of gaseous oxygen per liter of liquid oxygen.
3. Consumption data per Specification MIL-I-19326 (AER) taken from NAVAER 03-50-517.
4. Use of a properly fitted face mask.

Figure No. 4-9. Oxygen Duration

Note

Install green "apple" aft of the EMERGENCY OXYGEN CABLE clip.

During flight, frequently check the following:

- a. Gage indication to determine remaining oxygen supply.
- b. Mask fit for leak tightness.
- c. Breathing tube coupling to ensure it is fully engaged.

Note

Complete or intermittent loss of radio communication or oxygen system leakage may indicate that oxygen disconnects are not fully engaged.

After completion of flight, turn pilot's oxygen valve to "OFF" before disconnecting mask.

CAUTION

If flow continues from mask after shutoff, check for possible inadvertent actuation of bailout system. If the system has been actuated, do not disconnect mask until bailout oxygen supply is depleted.

EMERGENCY PROCEDURES.

Note

If symptoms of hypoxia occur, or oxygen delivery fails, immediately begin a descent to below 10,000 feet and follow the applicable procedure below.

If difficulty in breathing is experienced when wearing a full pressure suit, the emergency oxygen supply in the suit backpack may be obtained by manual activation of the green apple on the chest portion of the suit. If actuation of the emergency oxygen supply fails to alleviate the condition, and providing that the cockpit is pressurized, dump helmet pressure, raise the helmet visor, and descend to below 10,000 feet.

If difficulty in breathing is experienced when wearing the full pressure suit at a cockpit altitude above 35,000 feet, where the suit would be pressurized, breathe from the suit by moving the face away from the face seal, then descend to below 10,000 feet. Helmet pressure may then be dumped and the visor raised.

If using a mask with miniature regulator, pull the bailout bottle lanyard. If difficulty in breathing is experienced after pulling the bailout bottle lanyard, remove mask and continue descent.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

Table 4-5. Communications and Associated Electronic Equipment

Type	Designation	Function	Range	Location of Controls
UHF Command Radio Set	AN/ARC-27A (modified)	Two-way voice communication	Line of sight	UHF panel (RH console) and throttle grip
Direction Finder (ADF) Group	AN/ARA-25 (modified)	Indicates bearing of received r-f signals	Line of sight	UHF panel (RH console)
Radio Navigation* (VOR) Set	AN/ARN-14E	1. Receives signals for direction homing and bearing 2. Furnishes azimuth glide path	Line of sight	VHF NAV panel (RH console)
Radio Navigation (TACAN) Set	AN/ARN-21	Provides range and bearing information in reference to a selected surface beacon	Line of sight	NAV panel (RH console)
Radar Identification (IFF) Set	AN/APX-6B (modified)	Identification of airplane as friendly when challenged	Line of sight	IFF panel (RH console)
	AN/APA-89	Coder group for IFF	Line of sight	Coder group panel (RH console)

*AN/ARN-14E is an alternate installation for AN/ARN-21.

INTEGRATED ELECTRONIC PACKAGE

EQUIPMENT OF INTEREST

UHF command radio receiver-transmitter
IFF receiver-transmitter
ADF electronic control amplifier

CAUTION

OPERATION.

The integrated electronic package is used to house a modified UHF receiver-transmitter, IFF receiver-transmitter, and an ADF electronic control amplifier. Primary a-c and d-c bus power is connected to the package through the UHF function switch (figure 4-10). This package is pressurized and cooled by conditioned air from the air-conditioning system.

If the air-conditioning system *fails* at an altitude above 27,500 feet, immediately place UHF function switch in "OFF." Operating the radio equipment without integrated electronic package pressurization may result in arcing, causing loss of UHF, ADF, and IFF operation. The switch also must be placed in "OFF" when cabin pressure is *dumped* at altitudes above 27,500 feet on airplanes BuNo. 145416 and subsequent. On these airplanes, the cabin pressure switch may be placed in "CABIN PRESS" for short periods if radio transmission is desired.

GROUND OPERATING TIME.

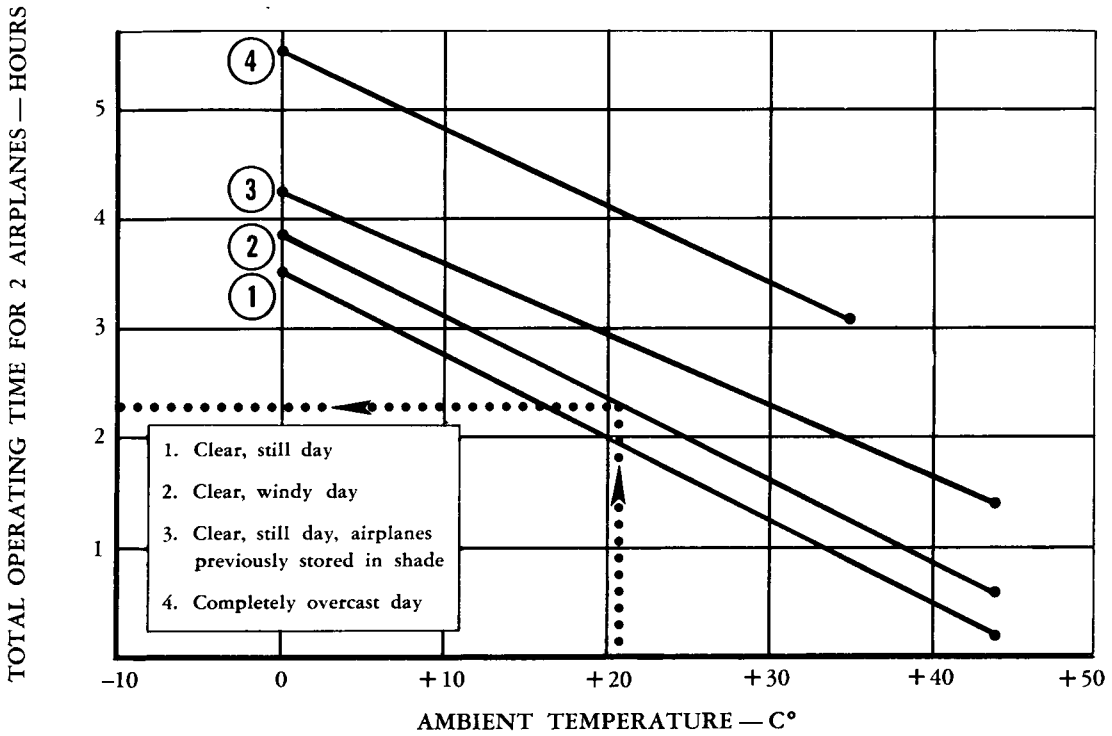
Lack of forced air cooling for the electronic package during ground operation with the engine not running, as in a strip alert, limits package (UHF command set) operating time as shown in figure 4-9A.

For example, assuming an ambient temperature of 21° C on a clear, windy day, enter the chart at 21° on the temperature scale and read vertically to the curve for clear, windy weather. Then read horizontally to the

operating time scale to obtain approximately 2 hours 15 minutes, the total time during which operation may be alternated between two airplanes. In the example, operation must be alternated *at least* twice, since in no case is the continuous operating time for one airplane to exceed 30 minutes. Each additional airplane used permits a 50% increase in the total operating time, but does not alter the 30-minute limitation for continuous operation in one airplane.

ELECTRONIC PACKAGE OPERATING TIME

GROUND OPERATION



NOTES

Chart applies to alert condition with radio operation alternated between two airplanes at least four times with maximum continuous operating period for each airplane of 30 minutes.

AN/APX-6 (IFF) must be off

Total operating time increases 50% for each additional airplane used.

1-minute warmup time permitted in addition to operating time.

Figure No. 4-9A. Integrated Electronic Package Ground Operating Time

COMMAND RADIO SET AN/ARC-27A

FUNCTION

Provides 1,750 frequency channels, of which twenty and a guard channel can be preset for automatic selection, for radio-telephone communication in the ultra-high-frequency range (225.0 to 399.9 mc).

*Part of integrated electronic package.

EQUIPMENT OF INTEREST

Receiver-transmitter*
 Frequency separation filter*
 Controls are located on the UHF panel and are listed in table 4-6.

NORMAL PROCEDURES.

Function switch "T/R" or "T/R+G."
 (Allow one minute warmup.)
 CHAN selector switch Desired channel
 UHF VOL control knob Adjusted

CHANNEL PRESET PROCEDURES.

Function switch "T/R" or "T/R+G"
 CHAN selector switch Desired channel
 Frequency selector dials Frequency to be preset
 PUSH-TO-SET button One-quarter turn clockwise, depress and release. (If index line assumes vertical position, channel is correctly preset.)

Table 4-6. Command Radio Set AN/ARC-27A Controls

<i>Nomenclature</i>	<i>Function</i>
Function switch (18, figure 4-10)	"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.
CHAN selector switch (19, figure 4-10)	"M" permits manual selection of frequency channels. "G" permits monitoring of guard channel. At all other positions, permits selection of 20 preset channels.
Frequency selector dials (10, figure 4-10)	Used for selecting frequency when CHAN selector switch is at "M" or for presetting frequencies in channels selected by CHAN selector switch.
PUSH-TO-SET CHAN button (20, figure 4-10)	Locks preset frequencies in related channels for automatic channel selection.
SENS trim switch (11, figure 4-10)	Adjusts receiver sensitivity.
UHF VOL control knob (17, figure 4-10)	Controls headset volume.
Microphone switch (throttle grip)	Puts receivers in standby and operates transmitter.

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

EQUIPMENT OF INTEREST

IFF receiver-transmitter*
 IFF frequency separation filter*
 Controls are located on IFF and coder group panels and are listed in table 4-7.

*Part of integrated electronic package.

OPERATION.

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:

- a. To identify the airplane in which it is installed as friendly when correctly challenged by friendly shore, shipboard, and airborne radars.
- b. To permit surface tracking and control of aircraft in which it is installed.

Table 4-7. AN/APX-6B and AN/APA-89 Controls

<i>Nomenclature</i>	<i>Function</i>
MASTER switch (5, figure 4-10)	"OFF" position de-energizes set. "STDBY" energizes receiver-transmitter for immediate operation if UHF function switch is in a position other than "OFF." "LOW" provides partial receiver sensitivity when 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 any mode of interrogation is received, regardless of the settings of the MODE switches. A push-button guard (located immediately adjacent to the MASTER switch) prevents accidental switching of the AN/APX-6B into emergency operation.
MODE switches (5, figure 4-10)	Permit selection of reply signals and codes.
I/P switch (5, figure 4-10)	Permits activation of the mode features of the AN/APX-6B in conjunction with the AN/ARC-27A radio transmitter.

NORMAL PROCEDURES.

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

IFF MASTER switch....."NORM"
MODE switches (IFF and coder).....Normal
IFF I/P switch.....Normal

Note

AN/APX-6B should be energized during every flight to minimize the possibility of integrated electronic package failure due to moisture condensation.

DIRECTION FINDER (ADF) GROUP AN/ARA-25**FUNCTION**

Provides a continuous indication of the relative bearing of received r-f signals.

EQUIPMENT OF INTEREST

Electronic control amplifier (part of integrated electronic package)
Control and indicator are listed in table 4-8.

OPERATION.

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.

NORMAL PROCEDURES.

To start operation —
UHF function switch....."ADF"
CHAN selector switch.....Desired channel
To stop operation —
UHF function switch.....Any position except "ADF"

Table 4-8. Direction Finder (ADF) Group AN/ARA-25 Control and Indicator

<i>Nomenclature</i>	<i>Function</i>
UHF function switch* (18, figure 4-10)	"ADF" starts direction finder group operation.
RADIO MAGNETIC INDICATOR† (3, figure 4-10)	Pointer No. 1 indicates magnetic bearing of UHF station in relation to airplane.

*Refer to table 4-6 for other functions.

†Refer to tables 4-9 and 4-11 for other functions.

RADIO NAVIGATION (VOR) AN/ARN-14E		(alternate for AN/ARN-21 radio navigation)
<p>FUNCTION</p> <p>Provides VOR-localizer radio aids to navigation in the very-high-frequency range.</p>	<p>EQUIPMENT OF INTEREST</p> <p>Receiver Course indicator Radio magnetic indicator Controls and indicators are listed in table 4-9.</p>	

OPERATION.

During VHF omni-range operation, the receiver feeds a variable phase signal and a reference phase signal to a phase-comparing circuit. The resulting output is routed to the course indicator for visual display of on-course information. The variable phase and reference phase signals are also fed to the radio indicator in the hydraulics compartment. The resulting signal is mixed with the heading signal from the MA-1 compass and is fed to the radio magnetic indicator for visual display of the magnetic bearing of the omni-range station with relation to the airplane. During tone localizer operation, the receiver feeds a composite

signal through filters to a comparing circuit. The resulting output is routed to the course indicator for a visual display of on-course information.

NORMAL PROCEDURES.

- Power switch..... "ON"
- FREQUENCY selector..... At frequency of desired station
- VOLUME control knob..... Desired volume
- RADIO MAGNETIC INDICATOR... Read magnetic bearing (pointer 2)
- COURSE indicator..... Set desired course and read bearing

Table 4-9. Radio Navigation (VOR) AN/ARN-14E Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
FREQUENCY selector switch (22, figure 4-10)	Selects desired station frequency.
VOLUME control (24, figure 4-10)	Controls headset volume.
POWER switch (23, figure 4-10)	On and off positions control power to VHF NAV receiver.
COURSE indicator (2, figure 4-10)	Vertical bar provides azimuth localizer information. TO-FROM window indicates direction of airplane with relation to received station. Course SET knob permits setting of course heading in course window. Relative heading indicator displays heading of airplane in reference to received station. Warning flags show in case of power failure or loss of signal. (Horizontal bar not used.)
RADIO MAGNETIC INDICATOR (3, figure 4-10)	Pointer No. 2 indicates magnetic bearing of VOR range station with relation to airplane.

RADIO NAVIGATION (TACAN) AN/ARN-21	
<p>FUNCTION</p> <p>Supplies continuous range and bearing information between the airplane and a selected surface beacon station within line-of-sight.</p>	<p>EQUIPMENT OF INTEREST</p> <p>Receiver-transmitter Range indicator Course indicator Radio magnetic indicator Controls and indicators are discussed in table 4-10.</p>

OPERATION.

The signal transmitted by the surface beacon contains reference (fixed) and variable bearing information, the range reply signal, and the station identification signal. The airplane's receiver-transmitter compares the difference between the fixed and the variable bearing signals, and transmits the resulting heading signal to the radio magnetic indicator.

The slant range in nautical miles from the airplane 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 on the range indicator.

Station identification signals are received in the headset in the form of Morse code identifying characters.

NORMAL PROCEDURES.

Function switch....."REC" (bearing only)
 Function switch....."T/R" (bearing and range)
 (After 90-second warmup in the "REC" position, the switch may be placed in the "T/R" position.)
 CHAN selector knobs.....Desired channel
 VOL control.....Midpoint of range

Radio magnetic indicator should stop and indicate bearing of beacon station with relation to airplane. If "T/R" position was selected, flag on range indicator will hunt for a short period, then move behind meter face to display slant range of station from airplane.

Table 4-10. Radio Navigation (TACAN) AN/ARN-21 Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
CHAN selector knobs (21, figure 4-10)	Combined settings of both knobs selects desired channel.
VOL control (9, figure 4-10)	Controls volume of audible signal to headset.
FUNCTION switch (8, figure 4-10)	"OFF" de-energizes radio set. "REC" energizes bearing circuit only. "T/R" energizes both bearing and range circuits.
Range indicator (1, figure 4-10)	Displays slant range in nautical miles to surface beacon.
COURSE indicator (2, figure 4-10)	Refer to table 4-9.
RADIO MAGNETIC INDICATOR (3, figure 4-10)	Refer to table 4-9.

NAVIGATION EQUIPMENT**FUNCTION**

Furnishes positive heading data by means of a gyro-magnetic compass system and a standby magnetic compass.

EQUIPMENT OF INTEREST

Remote compass transmitter (MA-1)
 Amplifier (MA-1)
 Directional gyro (MA-1)
 Radio magnetic indicator
 Standby magnetic compass
 Controls and indicators are listed in table 4-11.

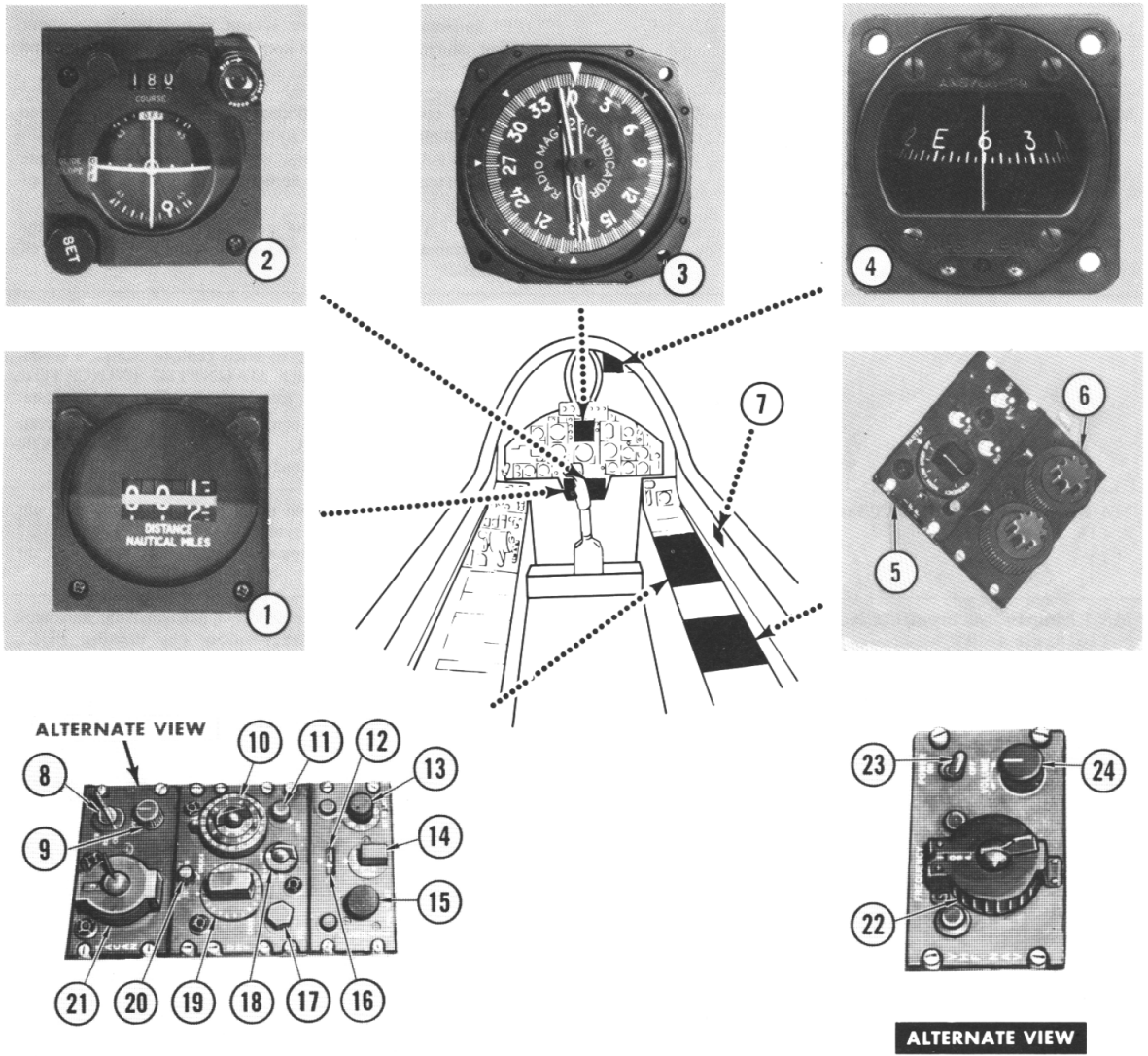
OPERATION.**MA-1 COMPASS SYSTEM.**

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 RADIO MAGNETIC 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 RADIO MAGNETIC 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 disturbances for more than one or two 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 RADIO MAGNETIC INDICATOR should be reset whenever an accurate heading can be obtained.

RADIO AND NAVIGATION



- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> 1. Range Indicator 2. COURSE Indicator 3. RADIO MAGNETIC INDICATOR 4. Magnetic Standby Compass 5. IFF Panel 6. Coder Group Panel 7. UHF Function Switch Decal 8. TACAN Master Switch 9. TACAN VOL Control Knob 10. UHF Frequency Selector 11. UHF SENS Trim Switch 12. MA-1 Compass Power Failure Flag | <ol style="list-style-type: none"> 13. MA-1 Compass SET TO LAT Knob 14. MA-1 Compass Selector Switch 15. MA-1 Compass PULL TO SET Knob 16. MA-1 Compass Synchronizing Indicator 17. UHF VOL Control Knob 18. UHF Function Switch 19. UHF CHAN Selector Switch 20. UHF PUSH TO SET CHAN Button 21. TACAN CHAN Selector Switch 22. VHF FREQUENCY Selector Switch 23. VHF POWER Switch 24. VHF VOLUME CONTROL |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure No. 4-10. Radio and Navigation Controls and Indicators

Table 4-11. Navigation Equipment Controls and Indicators

<i>Nomenclature</i>	<i>Function</i>
MA-1 compass power failure indicator flag (12, figure 4-10)	"OFF" indicates that power is not connected to system. (Flag disappears 5 to 10 seconds after power is turned on.)
MA-1 compass selector switch (14, figure 4-10)	"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.
MA-1 compass PULL TO SET knob (15, figure 4-10)	Pulling and turning (clockwise or counterclockwise as applicable) when operating system by "slaved method," synchronizes directional gyro with remote compass transmitter and aligns RADIO MAGNETIC INDICATOR compass card with exact magnetic heading of airplane. Pulling and turning when operating system by "free gyro method" adjusts RADIO MAGNETIC INDICATOR compass card to any desired heading.
MA-1 compass SET TO LAT knob (13, figure 4-10)	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.
MA-1 compass synchronizing indicator (16, figure 4-10)	Alignment of the white bar of the synchronizing indicator with the arrow above the window (by turning PULL TO SET 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.
RADIO MAGNETIC INDICATOR (3, figure 4-10)	Top index indicates airplane magnetic heading on compass card.
Magnetic standby compass (4, figure 4-10)	Indicates magnetic bearing.

NORMAL PROCEDURES.**MA-1 COMPASS — SLAVED METHOD.**

Power failure indicator flag.....Not showing
Selector switch.....After 2-minute warmup,
place in "SLAVED."
PULL TO SET knob...Pull out and turn until white
bar of synchronizing indicator
is centered under arrow.

CAUTION

If the white bar does not move to the right with clockwise rotation or to the left with counterclockwise rotation of the PULL TO SET knob, the RADIO MAGNETIC INDI-

CATOR compass card will reflect an erroneous indication. Continue rotation of knob until white bar moves in correct direction and is centered.

MA-1 COMPASS — FREE GYRO METHOD.

Power failure indicator flag.....Not showing
Selector switch.....After 2-minute warmup, place in
"FREE N. LAT" or "FREE S. LAT"
(depends on hemisphere you are flying in)
PULL TO SET knob.....Pull out and turn until
RADIO MAGNETIC INDICATOR reads
desired heading (ignore synchronizing
indicator)
SET TO LAT knob.....Turn to latitude at which
you are flying.

EXTERIOR LIGHTS**EQUIPMENT OF INTEREST**

Controls and indicators are listed in table 4-12.

OPERATION.

The exterior light system is comprised of the conventional position lights, one on each wing tip and one on the vertical stabilizer, and two fuselage lights (one on the top and one on the bottom). The approach light and auxiliary approach light are operated in conjunction with the exterior light system.

On airplanes that have the angle-of-attack indicating system installed,** three separate approach lights are

mounted on the nose gear flipper door. The green, amber, and red lights are operated by the angle-of-attack indicating system to signal high, optimum, and low angle of attack with reference to the angle-of-attack indicator setting. (Refer to "ANGLE-OF-ATTACK INDICATING SYSTEM" in section VII.) The approach lights will operate only when the landing gear handle is placed in "WHEELS DOWN" and weight is off the gear. The HOOK BYPASS switch permits selection of approach light operation for either

Table 4-12. Exterior Lights System Controls and Indicator

<i>Nomenclature</i>	<i>Function</i>
EXTERIOR LIGHTS switch (figure 4-11)	"ON" energizes MASTER light switch circuit.
MASTER light switch (5, figure 4-11)	"STEADY"* energizes all exterior light circuits for steady operation. "FLASH"* energizes fuselage light circuit for intermittent operation and all other circuits for steady operation.
FUS light switch (4, figure 4-11)	"BRT"*† causes fuselage lights to burn brightly. "DIM"*† causes fuselage lights to burn dimly. "MAN"*‡ permits manual keying (coding) of fuselage lights.
MAN KEY switch (2, figure 4-11)	Operated as required*‡ (FUSEL light switch in "MAN" or "DIM") to transmit code signals through bright filaments of fuselage lights.
Code indicator light (6, figure 4-11)	Provides pilot with visual indication of code transmitted by MAN KEY.
WING and TAIL light switches†† (9 and 10, figure 4-11)	"BRT"*† causes navigation lights to burn brightly. "DIM"*† causes navigation lights to burn dimly.
HOOK BYPASS switch** (7, figure 1-5)	"CARRIER" causes approach light to flash if arresting hook is not down. The light will not flash when operating on emergency electrical power. "FIELD" permits approach light to burn steadily with arresting hook up for field carrier landing practice.

*With EXTERIOR LIGHTS switch in "ON."

†With MASTER light switch in "STDY" or "FLSH."

‡With MASTER light switch in "STDY."

**Airplanes BuNo. 145509 and subsequent and airplanes with ASC 202 (ECP 278) incorporated.

††Single switch on airplanes through BuNo. 145464 without ASC 171 (ECP 204) incorporated.

EXTERIOR, INTERIOR LIGHTS

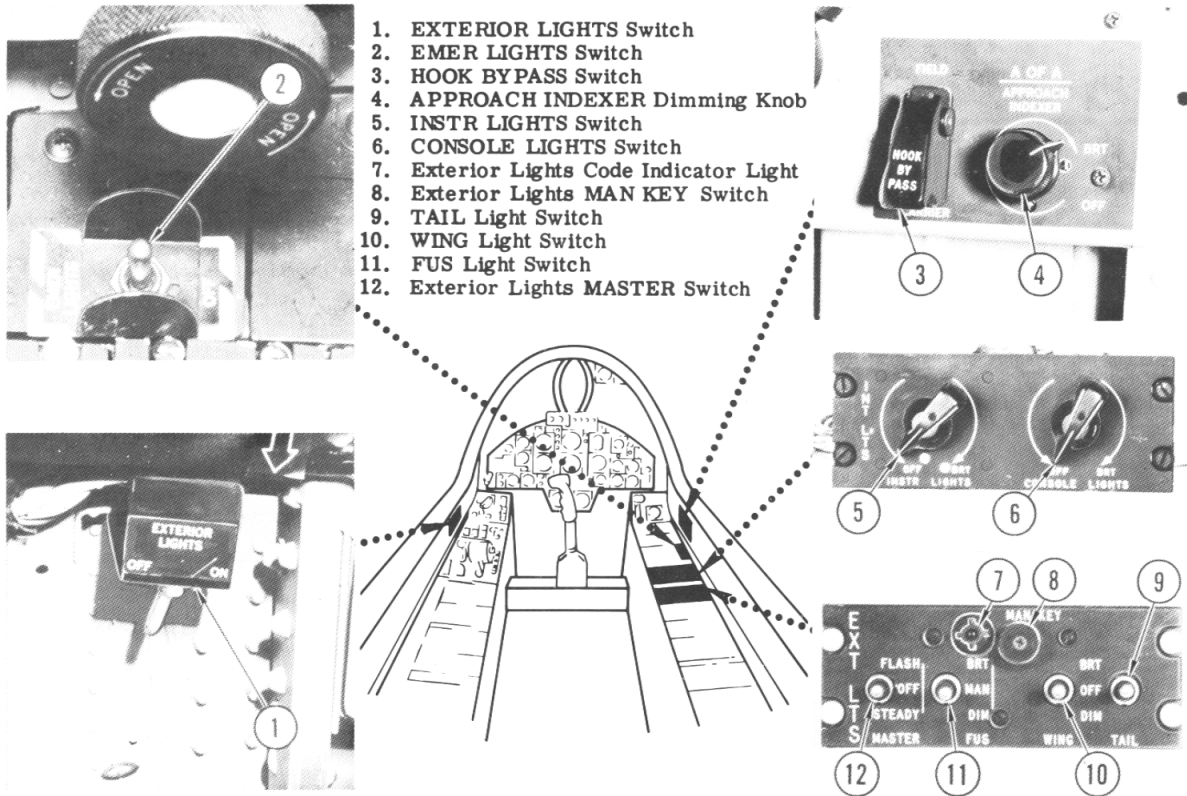


Figure No. 4-11. Exterior and Interior Lights Controls

carrier landings or field carrier landing practice. The auxiliary approach light (on the right wing) will be on to provide the landing signal officer with an indication of bank angle whenever the landing gear handle is placed in "WHEELS DOWN."

On airplanes without the angle-of-attack indicating system, a single approach light is mounted on the outboard left main landing gear door. The light which contains red, amber, and green filters to indicate airplane attitude will come on when exterior lights are on, all landing gear is down and locked, and the arresting hook is down. On these airplanes, the APPROACH LIGHT BYPASS switch in the nosewheel well may be closed to permit approach light operation with the

arresting hook up for field carrier landing practice. The auxiliary approach light on the right wing comes on when exterior lights are on and the landing gear is down and locked.

The fuselage lights will not operate when the emergency power package is supplying electrical power. The wing and tail lights can be operated on emergency power when the EMER GEN switch is in "LAND." On airplanes with the angle-of-attack indicating system, the approach lights will operate on emergency power with the EMER GEN switch in either "ON" or "LAND." On airplanes without the angle-of-attack indicating system, the EMER GEN switch must be in "LAND" to permit approach light operation.

INTERIOR LIGHTS**EQUIPMENT OF INTEREST**

Controls are listed in table 4-13.

OPERATION.

The interior light system is comprised of console lights and instrument lights with both groups controlled separately. The interior light system receives power

from the emergency a-c bus. Two emergency instrument lights, mounted one on each side of the instrument board and a movable spotlight, mounted above the right-hand console, receive emergency d-c power.

Table 4-13. Interior Lights System Controls

<i>Nomenclature</i>	<i>Function</i>
CONSOLE LIGHTS switch (1, figure 4-11)	Rotating from "OFF" to "BRT" illuminates and controls intensity of following lights: light above each console, cabin altimeter light, landing gear position indicator light, takeoff checklist light, landing checklist light.
INSTR LIGHTS switch (7, figure 4-11)	Rotating from "OFF" to "BRT" illuminates all instrument lights. Controls intensity of all instrument lights except fire, hydraulic pressure, and fuel pump warning lights.
EMERG LIGHTS switch (8, figure 4-11)	"EMERG LIGHTS" illuminates an additional light on each side of instrument board.

ARMAMENT CONTROL SYSTEM**FUNCTION**

Provides automatic lead angle and accurate range information.

EQUIPMENT OF INTEREST

Armament Control System Aero 10L-1
Aircraft Fire Control System AN/A WG-3
Armament Control System Aero 27
Directional Reference System
Controls and indicators are listed in table 4-14.

OPERATION.

AERO 10L-1 (*Airplanes through BuNo. 145415*).

The Aero 10L-1 Armament Control System, powered by the secondary a-c bus, consists of the AN/APG-30A radar ranging system, the MK 16 Mod 12 Aircraft Fire Control system, and the airstream directional reference system. The armament control system cannot be operated when electrical power is being supplied by the emergency power package.

The radar ranging system will lock on any target within range, and furnish target range information to the fire control system for gun or rocket firing. Radar ranging may also be used in conjunction with AAM-N-7 (Sidewinder) missile launching. In this case, the fire control system is not used and the pilot employs range information from the radar to determine when to launch missiles. (When ASC 237 and Electronic

Modification Kit MK 414/APG-30 is installed, missile launching information is provided in a readily usable form.)

The fire control system receives a variety of data signals, computes the total lead angle, and presents the information to the pilot as a point of aim by the displacement of a "pipper" in a sight unit. The fire control system can be used without radar ranging if it is not practical to use radar or if the radar system is inoperative.

AN/AWG-3 (*Airplanes BuNo. 145445 and subsequent*).

The AN/AWG-3 Fire Control System, powered by the secondary ac and dc buses, consists of the AN/APS-67 radar ranging system, a computer group, and an airstream directional reference system.

The AN/APS-67 radar is capable of both search and range-tracking operation. In the search mode of opera-

Table 4-14. Armament Control System Controls and Indicators

Nomenclature	Function
FIRE CONTROL SYSTEM	
Sight gyro caging button (25, figure 4-12)	Momentarily depressed and released, uncages sight gyro.
AFCS RANGE-VOLUME knob (23, figure 4-12)	Controls volume of fire control system ranging tone.
GYRO lamp switch (4, figure 4-12)	Energizes sight unit gyro reticle lamp and controls power to computer circuits.
FIXED lamp switch (9, figure 4-12)	Energizes sight unit fixed retical lamp.
RANGE switch (5, figure 4-12)	"RADAR" supplies radar range information to fire control system. "FIXED" provides for supplying pilot-estimated range information to fire control system.
Gunsight dimming knob (10, figure 4-12)	<i>Airplanes through BuNo. 145415</i> In positions between "OFF" and "BRIGHT" controls fire control system power and sight unit reticle lamp intensity. <i>Airplanes BuNo. 145416 and Subsequent</i> In positions between "DIM" and "BRIGHT," controls sight unit reticle lamp intensity.
FIXED RANGE knob (6, figure 4-12)	Permits selection of estimated range for fire control system when "FIXED" ranging is employed, and controls ranging tone for both "FIXED" and "RADAR" ranging.
POWER switch* (8, figure 4-12)	"ON" supplies power to GYRO and FIXED lamp switches.
Armament selector switch (9, figure 4-12)	<i>Airplanes through BuNo. 143701</i> "GUNS" selects fire control for gun firing. "ROCKETS" selects fire control for rocket firing. Neutral is safe position; also permits fire control system angle-of-attack tests. <i>Airplanes BuNo. 143702 and Subsequent</i> "GUNS" selects fire control for gun firing. "ROCKETS — ALL" or "ROCKETS — HALF" selects fire control for rocket firing. "MISSILES — RH ONLY" or "MISSILES — LH — RH" selects missile launching. "OFF" is safe position; also permits fire control system angle-of-attack tests.
GUNS-TEST-ROCKETS switch	Not operative.
AN/APG-30A RADAR	
Radar power switch (3, figure 4-12)	"OFF" deenergizes radar set. "STDBY MAN" places radar set on standby. "ON" places radar set in operation.
MAX RANGE knob (2, figure 4-12)	Sets maximum radar range.
GATES OUT switch (1, figure 4-12)	Jogged selects next farthest target.
RANGE meter (16, figure 4-12)	Indicates approximate range, in hundreds of feet, or target being tracked by radar.
Radar tracking light (15, figure 4-12)	Light off indicates radar set locked-on target. Light on indicates radar set searching.
AN/AP5-67 RADAR	
BRILL knob (12, figure 4-12)	Regulates brilliance of radar scope presentation.
FOCUS knob (14, figure 4-12)	Regulates sharpness of trace on radar scope.

*Airplanes BuNo. 145416 and subsequent.

Table 4-14. Armament Control System Controls and Indicators (Continued)

Nomenclature	Function
FUNCTION switch (31, figure 4-12)	"STBY" applies power to maintain radar operation in standby condition. "SRCH" selects search mode of operation. "RANGE" selects range mode of operation. "OFF" deenergizes radar system.
GAIN knob (32, figure 4-12)	Regulates radar, receives gain when FUNCTION switch is in "SRCH." In the range mode, gain is controlled automatically.
MIN RANGE knob (35, figure 4-12)	Adjusts "at rest" position of tracking range strobe on radar scope. "PRESS TO UNLOCK" releases range strobe from target lock-on, (range tracking), permitting acquisition of another target.
FTC/NORMAL switch (36, figure 4-12)	"FTC" position limits the amount of ground clutter indicated on the scopes when in search mode of operation. "NORMAL" position allows all echos to be indicated on the scope. In the range mode, the clutter-limiting circuit is operational regardless of switch position.
TUNE knob (33, figure 4-12)	"AUTO" provides automatic radar receiver tuning. Range clockwise from "AUTO" permits manual tuning.
TEST button (34, figure 4-12)	Depressed, provides signals to test radar system operation.

tion, the antenna scans a sector ahead of the airplane to provide initial detection of airborne targets. When the target selected is within range, the MIN RANGE knob is adjusted to position the range line just below the target echo and the pilot changes from the search mode of operation to the range mode. An acquisition display will appear on the scope momentarily, followed immediately by a lock-on display as the radar locks on the target.

The computer group accepts data on the attack conditions, makes the computations for firing the guns or rockets, and causes the sight unit to generate the lead angle for a hit. This information is presented to the pilot by the displacement of the pipper in the sight unit. The sight unit incorporates 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 tend to tumble the gyro and the antitumbling circuit provides an opposing tendency, the pipper will oscillate near the edge of the optical field. For air-to-ground operation, or air-to-air operation where the radar does not provide reliable range data,

the system can be used with a fixed range input. However, to provide effective fire control the system must be supplied with radar range and range-rate inputs whenever possible during air-to-air operations.

AERO-27 (Interim installation on airplanes BuNo. 145416 through 145444).

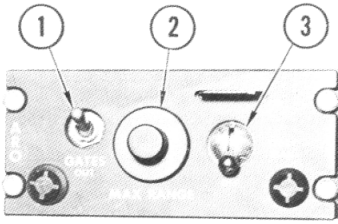
The Aero 27 armament control system, powered by the secondary ac and dc buses, consists of the AN/APG-30A radar ranging system, a computer group, and an airstream directional reference system. The operation of this system is similar to that of the Aero 10L-1 system and, with the exception of the computer group, the same equipment is used in both systems. The computer group is essentially a modified version of the MK 16 Mod 12 Aircraft Fire Control System in which some of the components have been combined. The sight unit used in the Aero 27 system is equipped with an antitumbling circuit as described for the AN/AWG-3 system.

DIRECTIONAL REFERENCE SYSTEM.

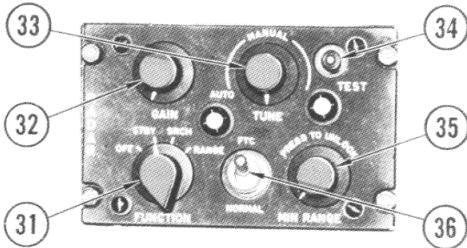
The directional reference system furnishes information concerning the true angle of attack and the true angle

ARMAMENT CONTROLS

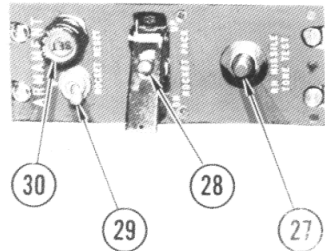
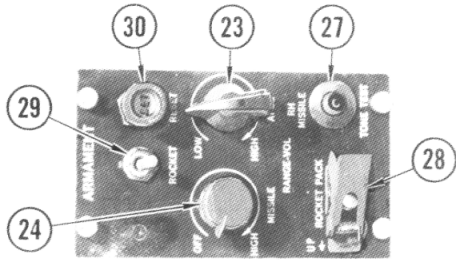
Airplanes through BuNo. 145415



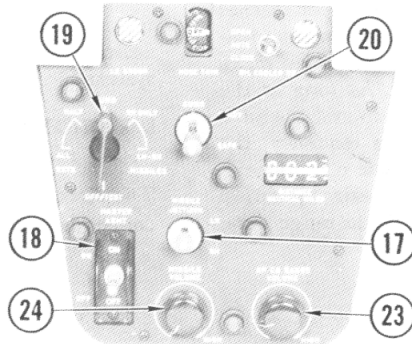
Airplanes BuNo. 145416 and subsequent



Airplanes through BuNo. 145415



Airplanes BuNo. 145416 and subsequent



Airplanes BuNo. 145416 and subsequent

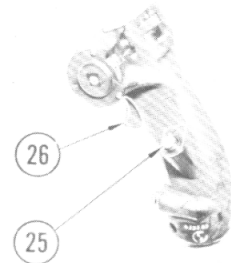
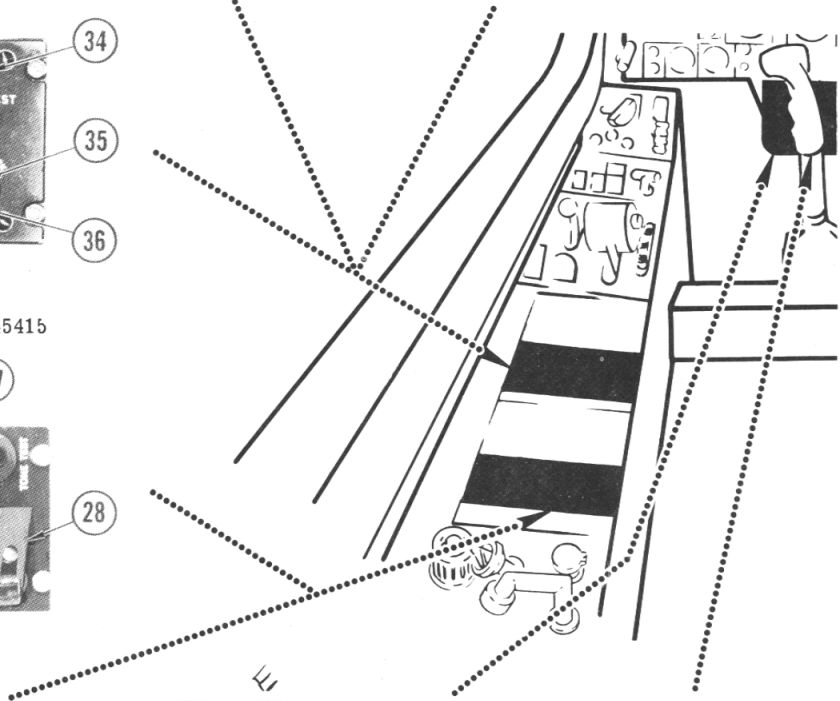
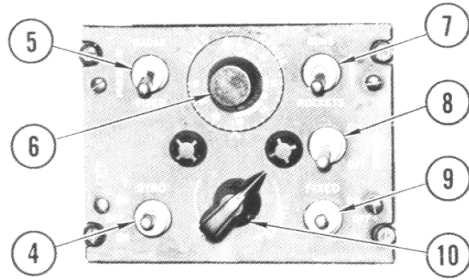
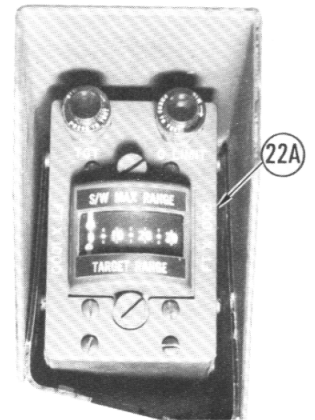
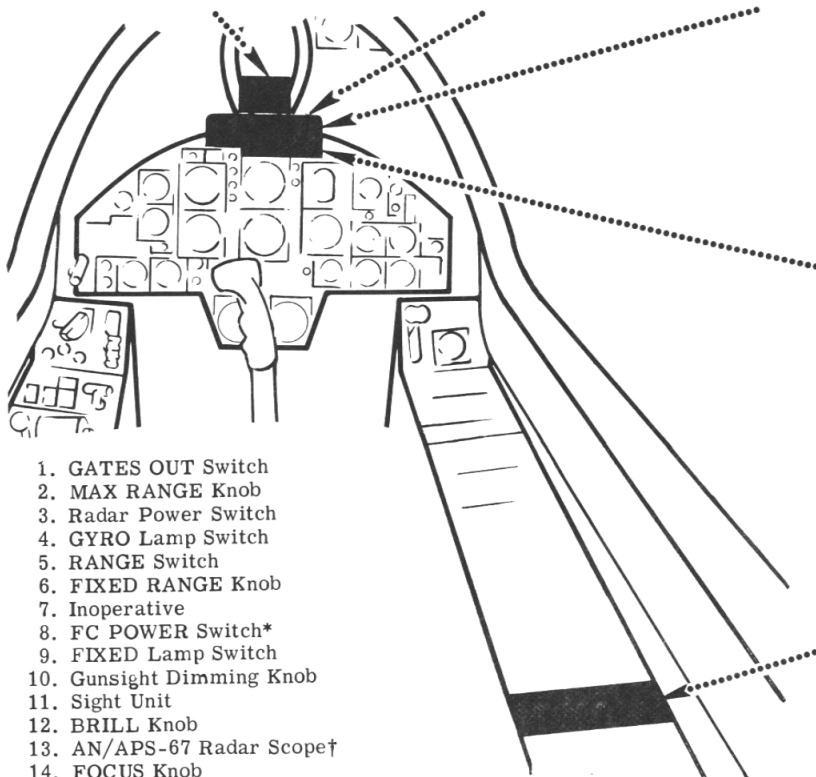
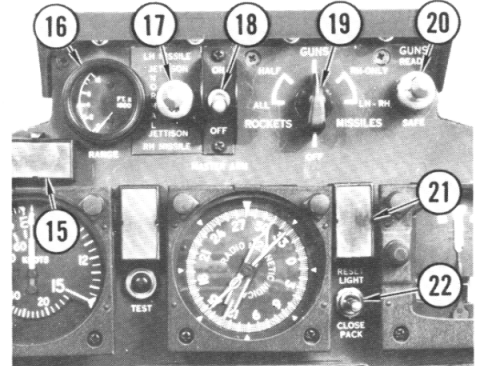
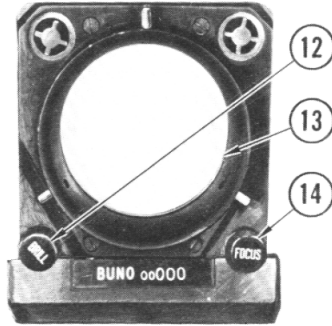
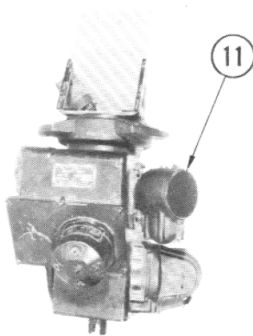


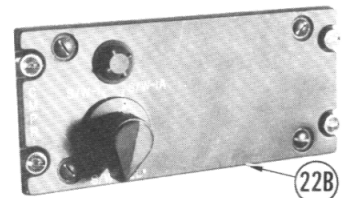
Figure No. 4-12 Armament Controls and Indicators (Sheet 1)

Airplanes BuNo. 145416 and subsequent

Airplanes through BuNo. 145415



Airplanes with ASC 237 incorporated



Airplanes with ASC 237 incorporated

1. GATES OUT Switch
2. MAX RANGE Knob
3. Radar Power Switch
4. GYRO Lamp Switch
5. RANGE Switch
6. FIXED RANGE Knob
7. Inoperative
8. FC POWER Switch*
9. FIXED Lamp Switch
10. Gunsight Dimming Knob
11. Sight Unit
12. BRILL Knob
13. AN/APS-67 Radar Scope†
14. FOCUS Knob
15. Radar Tracking Light
16. RANGE Meter
17. Missile Jettisoning Switch
18. MASTER ARM Switch
19. Armament Selector Switch
20. GUNS Arming Switch
21. Rocket Pack Fire Light
22. Rocket Pack Fire Light Switch

- 22A. Missile Release Indicator
- 22B. Missile Release Computer
23. AFCS RANGE VOL Knob
24. MISSILE RANGE VOL Knob
25. Sight Gyro Caging Button
26. Trigger Switch
27. RH MISSILE TONE TEST Button
28. ROCKET PACK Switch **

29. ROCKET RESET Switch
30. ROCKET RESET Light
31. Radar FUNCTION Switch
32. Gain Knob
33. TUNE Knob
34. TEST Button
35. MIN RANGE Knob
36. FTC/NORMAL Switch

*Airplanes BuNo. 145416 and subsequent.

†Replaced by panel containing RANGE meter and radar tracking light in AERO 27 system.

** On forward LH console in airplanes BuNo. 145465 and subsequent.

Figure No. 4-12 Armament Controls and Indicators (Sheet 2)

of yaw to the fire control system. The angle-of-attack relative wind transducer vane is located on the right-hand side of the fuselage. The angle-of-yaw relative wind transducer vane is located on top of the nose cone.

PREFLIGHT PROCEDURE.

This warmup procedure is performed by the pilot before takeoff. It is recommended that the fire control system be energized with the sight gyro caged during takeoff, while in flight, and during landing. Before takeoff, position controls as follows:

Radar power switch....."STDBY MAN"
or
FUNCTION switch....."STDBY"
Gunsight dimming knob.....Intermediate position
FC POWER switch*....."ON"
GYRO lamp switch....."ON"
FIXED lamp switch....."ON" (optional)
RANGE switch....."RADAR"
FIXED RANGE knob.....As determined
Sight gyro caging button.....Not depressed
(gyro caged)

RANGE TONE TEST.

Perform the range tone test, if time permits, during flight to the target to ensure proper operation of the system ranging function. Proceed as follows:

a. Perform warmup procedure at least 4 minutes before starting test, and place controls in following positions:

Radar power switch....."ON"
or
FUNCTION switch....."RANGE"
GYRO lamp switch....."ON"
FIXED lamp switch....."ON"
Gunsight dimming knob.....Intermediate position
FC POWER switch†....."ON"
RANGE switch....."RADAR"
FIXED RANGE knob.....Refer to section IV
of F8U-1 Supplemental
Flight Handbook for
optimum range limits.
Armament selector switch....."GUNS"
MISSILE RANGE-VOL knob‡....."OFF"

b. Obtain radar lock-on on airplane whose range from testing airplane is greater than 4,500 feet. On airplanes with AN/APG-30A radar, a lock-on is indicated by the radar tracking light going off as the RANGE meter ceases to sweep and indicates the range of the target. On airplanes with AN/APS-67 radar, a lock-on is indicated by the appearance of a target range circle and a steering dot that shows the position of the target on the scope.

c. Close range on target airplane; when the ranging tone is first heard, the range to the target should

coincide with the range set on the FIXED RANGE knob. The ranging tone will cease* or pulsate† when the range to the target airplane is decreased to the minimum range for guns. (Refer to section IV of F8U-1 Supplemental Flight Handbook for optimum range limits.)

d. Repeat steps a, b, and c with armament selector switch placed at "ROCKETS" ("ROCKETS-ALL" or "ROCKETS-HALF"). The same signal is provided at the minimum range for rockets as is provided at the minimum range for guns. (Refer to section IV of F8U-1 Supplemental Flight Handbook for optimum range limits.)

TOTAL LEAD ANGLE TEST.

Perform the total lead angle test, if time permits, during flight to the target area to check the lead computing functions of the fire control system. Avoid turbulent air when performing the test. Altitude, bank angle and airspeed must be held constant so that the piper will be stabilized at the desired offset. Proceed as follows:

a. Perform warmup procedure at least 4 minutes before starting test.

b. Flight conditions should be as follows:

Altitude.....20,000 ($\pm 5,000$) feet
Airspeed.....300 (± 50) knots IAS

c. Place the following controls in the designated positions:

GYRO lamp switch....."ON"
FIXED lamp switch....."ON"
Gunsight dimming knob.....Intermediate position
FC POWER switch*....."ON"
RANGE switch....."FIXED"
FIXED RANGE knob.....MAX RANGE for guns
Armament selector switch....."GUNS"
Sight gyro caging button.....Depressed
(gyro uncaged)

d. Fly the airplane in a constant-rate turn so that the piper is deflected 50 mils from center of the fixed image. The airplane will pull approximately 1.5 g's.

Note

On the fixed image of the sight unit the circle is on a 50-mil radius from the center, and the outer arc is on a 100-mil radius.

e. Obtain time necessary to complete a 360° turn with the piper stabilized in the 50-mil offset position. The time should be between 105 and 146 seconds.

f. Make several right-hand and left-hand turns using the 50-mil offset and record time required to complete each 360° turn. The average time should be between 105 and 146 seconds.

*Airplanes through BuNo. 145415.

†Airplanes BuNo. 145416 and subsequent.

‡Airplanes BuNo. 143702 and subsequent.

ANGLE-OF-ATTACK TEST.

Perform the angle-of-attack test frequently to check the alignment of the angle-of-attack transducer. Accuracy of rocket firing is affected by misalignment. Proceed as follows:

a. Flight conditions required for the test are good ocean horizon visibility and smooth air.

b. Place the following controls in the designated positions:

- Gunsight dimming knob..... Intermediate position
- FC POWER switch*..... "ON"
- GYRO lamp switch..... "ON"
- FIXED lamp switch..... "ON"
- Armament selector switch..... "OFF" (center position on airplanes through BuNo. 143701)

c. Fly the airplane smoothly on a straight and level course at a constant altitude. Maintain the airspeed approximately at that which is used when tracking and firing rockets.

d. The center of the pipper should settle to a position above the horizon by the amount shown below:

<i>Altitude (feet)</i>	<i>Pipper displacement above horizon (mils)</i>
50	2
100	3
200	4½
300	5½
400	6
500	7

Repeat this procedure at various combat speeds and record the amount of error in pipper displacement for each pass. The amount of error should be the same at all airspeeds.

Under conditions in which the ocean horizon is obscured, or over land, the following procedure may be used to test the angle-of-attack system. Smooth air is required in order to obtain suitable results to this test.

a. Flight conditions required for the test are as follows:

- Altitude..... 20,000 feet
- Airspeed..... 400 knots CAS
- Wing leading edge..... Retracted (clean)
- Rocket pack..... Extended

b. Place the following controls in the designated positions:

- GYRO lamp switch..... "ON"
- FIXED lamp switch..... "ON"
- Gunsight dimming knob..... Intermediate position
- FC POWER switch*..... "ON"
- Armament selector switch..... "OFF" (center position on airplanes through BuNo. 143701)

*Airplanes BuNo. 145416 and subsequent.

† Airplanes BuNo. 143702 and subsequent.

c. Fly the airplane smoothly on a straight and level course at a constant altitude. When the gunsight pipper has settled, its downward deflection, as measured along the elevation axis between the center of the pipper and the center of the fixed sight reticle, should equal the value obtained from figure 4-12A for the amount of fuel remaining at the time of the test.

RADAR RANGING — GUNS AND ROCKETS.

AERO 10L-1 and AERO 27.

Radar ranging should be used for all air-to-air targets whenever possible. A target lock-on will be indicated by the RANGE meter's showing an actual range reading and by the radar tracking light's being off. After the target has been sighted, the airplane is maneuvered into position with an estimated target lead. The sight gyro is uncaged during the approach run and the pipper is aligned on the target. The target must be smoothly tracked for 1 to 2 seconds for gun firing and 2 to 4 seconds for rocket launching. When the target is within the range set by the FIXED RANGE knob, the ranging tone will be heard in the headset. When the ranging tone ceases, the pilot should immediately begin his breakaway, to avoid collision with the target, and cage the gyro. For system operation a 5-minute warmup period is necessary. Better results will be obtained from a 15-minute warmup period. To fire guns or rockets using radar ranging, recheck and position switches as follows:

- Radar power switch..... "ON" after warmup
- GYRO lamp switch..... "ON"
- OFF-BRIGHT knob..... Adjust image brightness
- FIXED lamp switch..... "ON"
- RANGE switch..... "RADAR"
- FIXED RANGE knob..... Desired range
- MAX RANGE knob..... As desired
- AFCs RANGE-VOL control..... Adjusted
- MISSILE RANGE-VOL knob*..... "OFF"

Check RANGE meter and radar tracking light for indications of searching or tracking.

AN/AWG-3.

The AN/APS-67 radar set is used both to provide initial detection of the target (search) and to supply range and range rate information (ranging) to the computer group. The computer group uses this information to generate lead angle which is presented to the pilot as gunsight pipper displacement. To operate the system either for radar search or for making a firing run with visual contact, recheck and position switches as follows:

- GYRO lamp switch..... "ON"
- FIXED lamp switch..... "ON"

PIPPER DEFLECTIONS

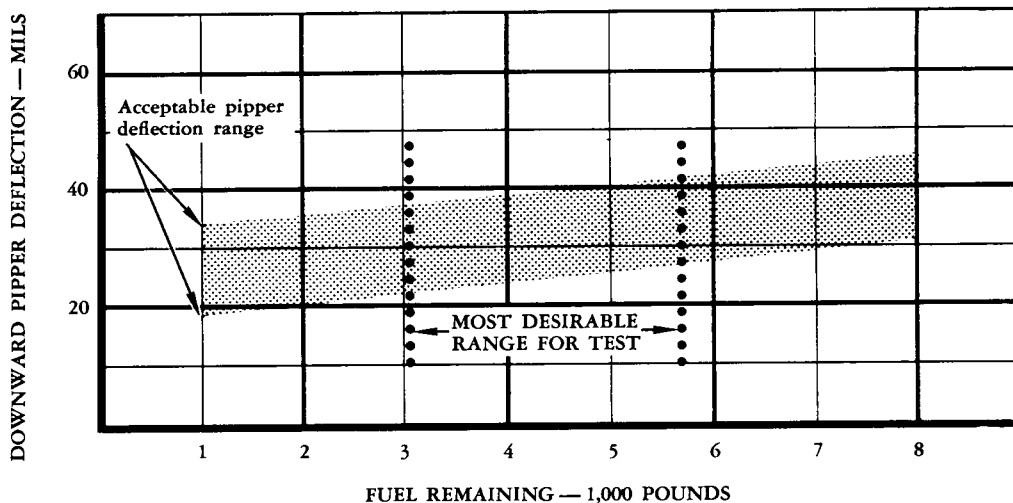


Figure No. 4-12A. Piper Deflections for Directional Reference System Tests

Gunsight dimming knob	As desired
FC POWER switch	"ON"
RANGE switch	"RADAR"
FIXED RANGE knob	Desired range
BRILL knob	As desired
FOCUS knob	Adjusted for clear sharp presentation
TUNE knob	"AUTO"
FTC/NORMAL switch	"NORMAL"
GAIN knob	Adjusted for best target contrast
AFCS RANGE VOL knob	As desired
MISSILE RANGE VOL knob	"OFF"

If radar search is desired, place the radar FUNCTION switch in "SRCH." When a target echo appears on the scope, maneuver the airplane to position the echo in the azimuth center of the scope. When the target is within 8 miles, adjust the MIN RANGE knob to position the range line on the scope just below the target echo. The radar FUNCTION switch is then positioned to "RANGE." The scope will momentarily indicate a target acquisition display as the radar antenna locks up straight ahead, followed immediately by a lock-on display if the range line was positioned within 2 miles of the target echo. The radar lock-on display consists of a steering dot and a dotted circle the diameter of which corresponds to the target range. Maneuver the airplane to center the steering dot in the steering circle (firing range circle) on the scope reticle. Continue to decrease the range to the target, as indicated by the shrinking of the range circle, keeping the steering dot in the center of the steering circle. When the range has decreased sufficiently so that the target can be located visually through the gunsight reflector plate,

maneuver the airplane to attack position and continue the attack as described below for the case in which initial contact is made visually.

Note

If at any time during a lock-on the angle-off exceeds the radar capabilities, the error dot will drift outward then back to the center with radial lines appearing on the scope. This indicates that in 3 to 4 seconds the radar scope presentation will revert to the acquisition phase.

If initial contact is made visually, place radar FUNCTION switch in "RANGE" and turn MIN-RANGE knob almost to the minimum range. At the start of the tracking run, depress the PRESS TO UNLOCK control to eliminate any lock-on that may have occurred while obtaining an attack position. The radar will automatically lock on the target again. The sight gyro is then uncaged and the piper aligned on the target. The target must be smoothly tracked for 1 to 2 seconds for gun firing and 2 to 4 seconds for rocket launching to ensure accurate results. When the target is within the range set on the FIXED RANGE knob, the ranging tone will be heard in the headset. When the range has decreased to the minimum range for selected armament, the ranging tone will begin to pulsate; immediately begin a breakaway and cage the sight gyro.

RADAR RANGING - MISSILES.

AERO 10L and AERO 27.

Radar ranging may be elected for launching Sidewinder missiles. In this type of operation, the fire control and directional reference systems are not used

and the pilot reads radar range information directly from the RANGE meter. Since missile range exceeds radar range, the pilot may elect to launch missiles before radar range information is available, providing the missile has acquired the target. The fixed reticle image of the gunsight is used to track the target and the missiles are launched when they have acquired the target and range is at optimum value. To obtain radar range information and illuminate the fixed sight reticle for missile launching, proceed as follows:

- Radar power switch....."ON" after warmup
- GYRO lamp switch....."OFF"
- OFF-BRIGHT knob.....Adjust image brightness as desired
- FIXED lamp switch....."ON"
- RANGE switch....."FIXED" to eliminate radar range tone from headset
- MAX RANGE knob.....Set for maximum range

For missile launching procedure, refer to "LAUNCHING PROCEDURE" for the "MISSILES" system.

AN/AWG-3.

Radar search and ranging may be used as an aid for launching Sidewinder missiles. The ranging procedure used for missile launching is the same as that for gun and rocket firing except as follows:

- GYRO lamp switch....."OFF"
- AFCS RANGE-VOL knob....."LOW" to eliminate radar ranging tone from headset.

After obtaining a lock-on, continue to decrease the range keeping the steering dot in the center of the steering circle. The missiles may be launched when they have acquired the target and the range is at optimum value. If the missile release computer-indicator group is installed, missile launching information is provided in a readily usable form. For missile launching procedure, refer to "LAUNCHING PROCEDURE" for the "MISSILES" system.

FIXED RANGING.

Fixed ranging should be used for air-to-ground targets and can be used for air-to-air gun and rocket targets if the radar system fails. The pilot is required to estimate target range, when within firing range, and when breakaway range is reached. The ranging tone will not be heard in the headset. An estimated firing range must be set on the FIXED RANGE knob for the computers. The procedure for fixed ranging is the same as used for radar ranging except as follows:

- RANGE switch....."FIXED"
- FIXED RANGE knob.....As determined
- Armament switches.....Guns or rockets

During air-to-ground firing an estimated lead is not necessary unless the target is moving.

During air-to-air firing after the airplane has been maneuvered into position and the gyro is uncaged, range can be estimated by the size of the pipper as superimposed upon the target. The smaller the pipper appears on the target, the closer is the range.

GUNNERY	
FUNCTION	EQUIPMENT OF INTEREST
Provides a means of firing conventional 20-mm projectiles.	Four guns, two on each side of fuselage front section. Controls are listed in table 4-15.

OPERATION.

The guns are pneumatically charged and electrically fired (figure 4-13). Air pressure is supplied by the pneumatic system and electrical power is supplied by secondary bus. The system is inoperative when the landing gear is extended or the emergency power package is supplying electrical power.

The MASTER ARM switch must be placed in "ON" two minutes before firing to allow warmup of the gun interlock by connecting a-c secondary bus power to the unit. The gun interlock maintains firing de-synchronization to prevent accumulative shock of all guns

firing at the same time. Refer to section IV of F8U-1 Supplemental Flight Handbook for ammunition load.

NORMAL PROCEDURES.

Refer to ranging procedures for the "ARMAMENT CONTROL" system and proceed as follows:

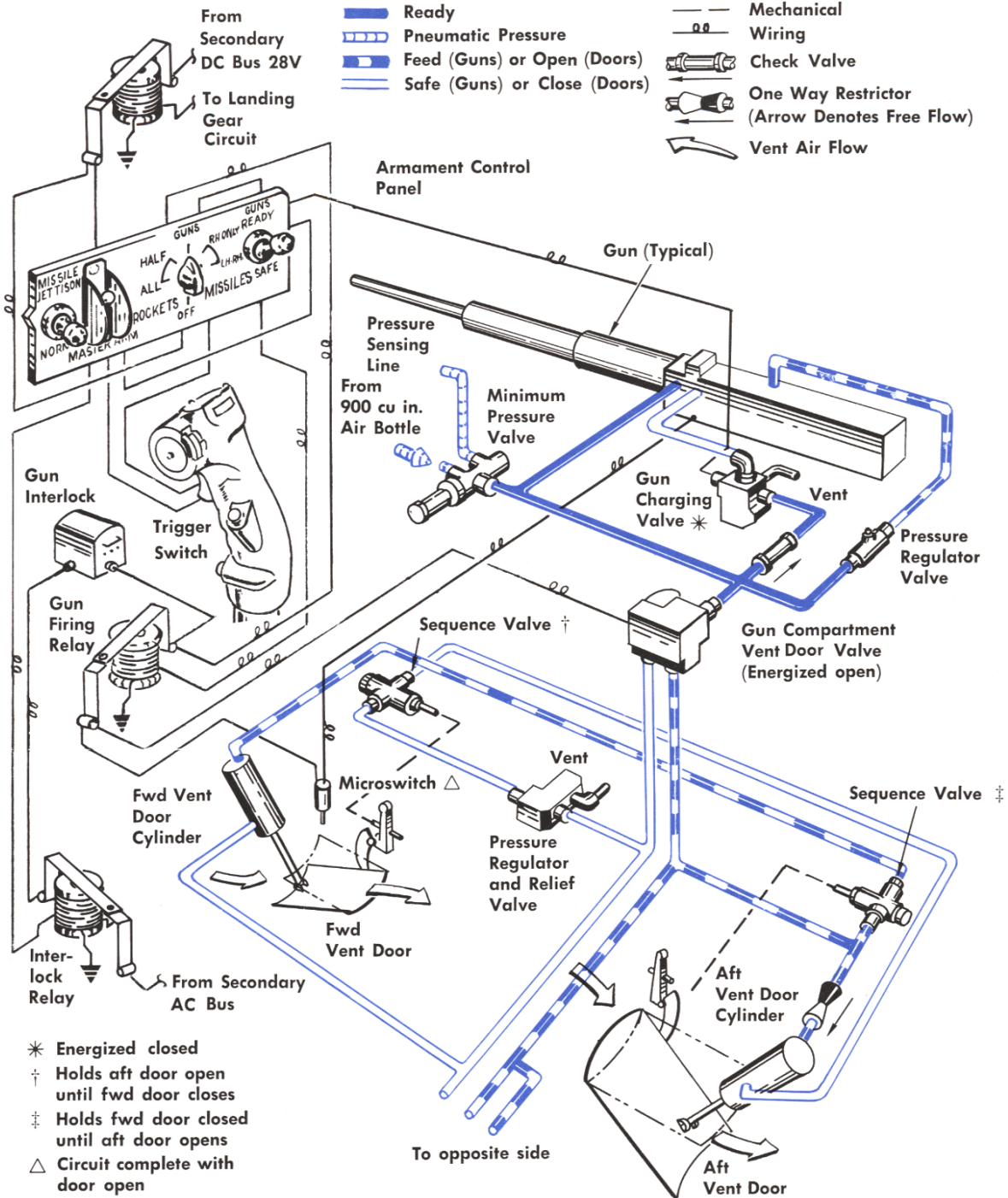
- MASTER ARM switch....."ON"
- Armament selector switch....."GUNS"
- GUNS arming switch(es)....."READY"

The trigger switch is "hot" and the system is ready for firing.

GUNNERY

LEGEND

- Ready
- Pneumatic Pressure
- Feed (Guns) or Open (Doors)
- Safe (Guns) or Close (Doors)
- Mechanical Wiring
- Wiring
- Check Valve
- One Way Restrictor (Arrow Denotes Free Flow)
- Vent Air Flow



- * Energized closed
- † Holds aft door open until fwd door closes
- ‡ Holds fwd door closed until aft door opens
- Δ Circuit complete with door open

Figure No. 4-13. Gunnery System

Table 4-15. Gunnery System Controls

Nomenclature	Function
MASTER ARM switch (18, figure 4-12)	"ON" (landing gear retracted) connects secondary d-c bus power through armament bus to GUNS arming switches, trigger switch, and secondary a-c bus power to gun interlock.
Armament selector switch (19, figure 4-12)	"GUNS" connects firing circuit to gunnery system. Neutral (safe position) disconnects firing circuit ("OFF" position on airplanes BuNo. 143702 and subsequent).
GUNS arming switch(es) (20, figure 4-12)	"READY" energizes gun charging valve to charge all guns, connects firing circuit to guns selected, and connects gun compartment vent circuit. "SAFE" returns and holds gun bolts out of battery position. (airplanes through BuNo. 143701, both switches must be in "SAFE").
Trigger switch (26, figure 4-12)	Depressed closes gun firing circuit and energizes gun camera circuit.

ROCKETS		
	FUNCTION	EQUIPMENT OF INTEREST
	Provides a means of firing rockets.	Rocket pack (extended from lower fuselage). Controls and indicator are listed in table 4-16.

OPERATION.

The rockets are electrically fired and are carried in a rocket pack which is extended and retracted by utility hydraulic system pressure (figure 4-14). Electrical power is supplied by secondary d-c bus. If main generator power is lost while pack is extended, the pack will remain open. The system is inoperative when the landing gear is extended or the emergency power package is supplying electrical power. As the rocket pack extends, the speed brake automatically opens slightly (speed brake warning light comes on) to prevent interference with the fuselage. The speed brake closes after pack retraction. Safety switches prevent rocket firing unless the pack is fully extended. Pitch trim is automatically adjusted as the rocket pack is extended. Refer to section IV of F8U-1 Supplemental Flight Handbook for number of rockets and firing order.

ROCKET PACK FIRE DETECTOR.

Four Fireye detectors, in the rocket pack, are heat-sensitive units and when actuated, initiate a signal to indicate a hangfire or fire in the rocket pack. The signal also results in automatic extension of the rocket pack and holds the pack extended as long as the detectors transmit a signal. A fire in the area above the rocket pack will be indicated by the engine fire warning lights coming on.

NORMAL PROCEDURES.

To ready the armament system for rocket firing, follow the ranging procedures for "ARMAMENT CONTROL" system and proceed as follows:

- MASTER ARM switch "ON"
- Armament selector switch* "ROCKETS — ALL"
- or
- ROCKETS switch† "SALVO"
- ROCKET RESET switch Hold outboard
until ROCKET
RESET light
comes on
- ROCKET RESET light ON
- Armament selector switch* "ROCKETS — ALL"
- or
- "ROCKETS — HALF"
- ROCKETS switch† "SALVO" or "HALF"
- ROCKET PACK switch "OPEN"

The trigger switch is "hot," the rocket pack is extended, and the system is ready for firing. After firing, close pack by placing ROCKET PACK switch in "CLOSE."

EMERGENCY PROCEDURES.

If the rocket pack fire light comes on during rocket firing, place the ROCKET PACK switch (LH console)

* Airplanes BuNo. 143702 and subsequent.

† Airplanes through BuNo. 143701.

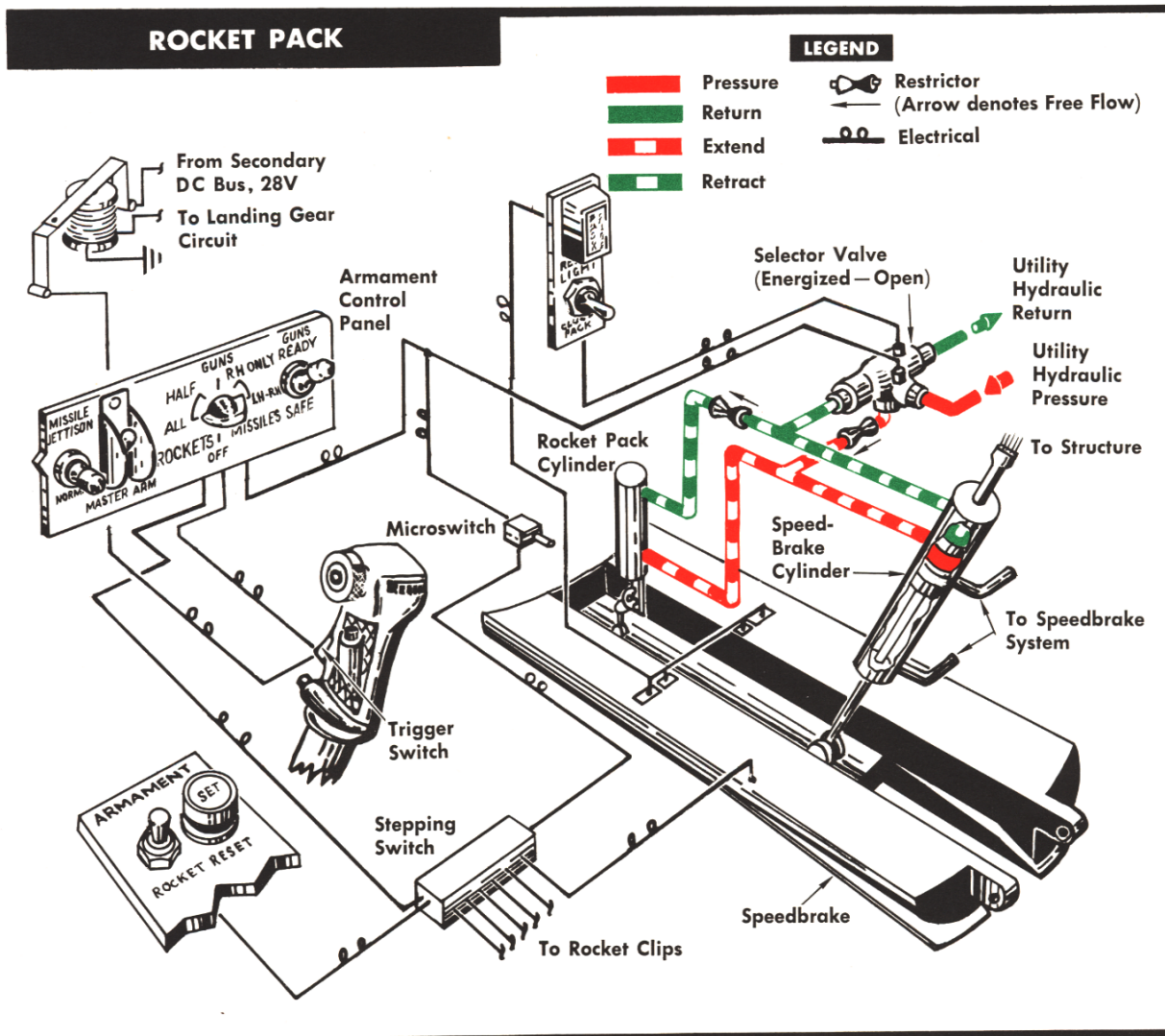


Figure No. 4-14. Rockets System

in "OPEN," to ensure rocket pack extension. A hang-fire will burn out in about 1.7 seconds. To check if a fire is still present in the rocket pack, place the rocket pack fire light switch momentarily in "RESET." If the rocket pack fire light goes out, close the pack (after 2 minutes) by placing ROCKET PACK switch and the rocket pack fire light switch in "CLOSE." After pack closes place fire light switch in neutral. If the pack fire light does not go out, wait a few seconds and try again.

WARNING

When the rocket pack fire light comes on, check the engine fire warning light. If the engine fire warning light comes on, retard throttle to "IDLE" and check if fire warning light goes out. If light does not go out, abandon the airplane.

Table 4-16. Rocket System Controls and Indicator

<i>Function</i>	<i>Nomenclature</i>
MASTER ARM switch (18, figure 4-12)	"ON" (landing gear retracted) connects secondary d-c bus power through armament bus to trigger switch.
Armament selector switch (19, figure 4-12)	<i>Airplanes through BuNo. 143701</i> "ROCKETS" connects firing circuit to rocket system. Neutral (safe position) disconnects firing circuit. <i>Airplanes BuNo. 143702 and subsequent</i> "ROCKETS — ALL" connects firing circuit to all rockets. "ROCKETS — HALF" connects firing circuit to half of rockets. "OFF" disconnects firing circuits.
ROCKETS switch*	"SALVO" connects circuit to all rockets. "HALF" connects circuit to half of rockets.
ROCKET RESET switch (29, figure 4-12)	Placed momentarily outboard, prior to firing, checks if stepping switch is at No. 1 rocket firing position as indicated by ROCKET RESET light coming on. Held outboard cycles stepping switch to No. 1 rocket position and then lights ROCKET RESET light.
ROCKET RESET light (30, figure 4-12)	On, with ROCKET RESET switch positioned outboard, indicates stepping switch is at No. 1 rocket firing position.
Trigger switch (26, figure 4-12)	Depressed closes rocket firing circuit and energizes gun camera circuit.
Rocket pack fire light (21, figure 4-12)	On indicates a rocket pack hangfire and rocket pack automatically extended. (Check fire warning light.)
Rocket pack fire light switch (22, figure 4-12)	Neutral is normal position. "RESET" will turn out rocket pack fire light to check for indication of fire still present. "CLOSE" used only after rocket pack fire light has been out for a minimum of 2 minutes to close rocket pack.
ROCKET PACK switch (28, figure 4-12)	"OPEN" extends rocket pack. "CLOSE" retracts rocket pack.

*On instrument board in airplanes through BuNo. 143701.

MISSILES

FUNCTION

On airplanes BuNo. 143702 and subsequent, provides a means of launching AAM-N-7 (Sidewinder) missiles.

EQUIPMENT OF INTEREST

Controls are listed in table 4-17.

OPERATION.

Sidewinder missiles are carried on launcher-pylon combinations attached to the sides of the fuselage. Electrical power to operate the missile system is supplied by the secondary ac bus and primary and secondary dc buses. Airborne equipment for the missile system comprises only power supply and launching circuits, and an acquisition tone circuit. Power is supplied

to the missiles at all times when the airplane electrical system is energized. The launching circuits are inoperative when the landing gear is down or the emergency power package is supplying electrical power. The jettisoning circuit is inoperative when the landing gear handle is in "WHEELS DOWN" or

Table 4-17. Missile System Controls

Nomenclature	Function
MASTER ARM switch (18, figure 4-12)	"ON" (landing gear retracted) connects secondary dc bus power through armament bus to trigger switch. Arms missile launching circuits.
Armament selector switch (19, figure 4-12)	"MISSILES — RH ONLY" permits only right missile to be launched. "MISSILES — LH-RH" permits left and right missiles to be launched successively. "OFF" disconnects firing circuits.
Missile jettisoning switch (17, figure 4-12)	<p><i>Airplanes BuNo. 143702 through 143821 without ASC 202 (ECP 278) incorporated</i></p> <p>"MISSILE JETTISON" launches both missiles in unarmed and unguided condition (landing gear handle in "WHEELS UP").</p> <p>"NORMAL" disconnects jettisoning circuit.</p> <p><i>Airplanes BuNo. 144427 and subsequent and airplanes with ASC 202 (ECP 278) incorporated</i></p> <p>"LH MISSILE JETTISON" launches left missile in unarmed and unguided condition (landing gear handle in "WHEELS UP").</p> <p>"RH MISSILE JETTISON" launches right missile in unarmed and unguided condition (landing gear handle in "WHEELS UP").</p> <p>"NORMAL" disconnects jettisoning circuit.</p>
Trigger switch (26, figure 4-12)	Depressed energizes missile launching circuits as selected with armament selector switch.
MISSILE RANGE-VOL knob (24, figure 4-12)	"OFF" disconnects missile acquisition tone circuit. Range from "OFF" to "HIGH" controls intensity of missile acquisition tone.
RH MISSILE TONE TEST button (27, figure 4-12)	Depressed permits monitoring of acquisition tone from right missile when missiles remain on both launching circuits. Released permits monitoring of acquisition tone from left missile. (When left missile is launched, tone monitored is automatically shifted to right missile.)
Missile release indicator (22A, figure 4-12)	S/W MAX RANGE needle indicates maximum Sidewinder firing range for indicated altitude. TARGET RANGE needle indicates range to target. TGT light off indicates radar lock-on has been obtained. G LIMIT light on indicates g's are being pulled in excess of missile capabilities.
S/W SEL switch (22B, figure 4-12)	S/W-1 permits computer to make computations for Sidewinder I missile. S/W-1A permits computer to make computations for Sidewinder IA missile.

MISCELLANEOUS EQUIPMENT**CATAPULT PROVISIONS.**

A catapult pin on the underside of the fuselage front section transmits the thrust of the catapult to the airplane structure. The holdback pin on the underside of the fuselage aft section restrains the airplane 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.

TOW TARGET.

Banner-type targets may be towed and released when the arresting gear control system is supplemented by the tow target controls kit ASC 46 (ECP 389). The

tow target release mechanism is then connected to the arresting gear linkage so as to permit the tow target release hook to unlock and release the tow target when the arresting gear is extended.

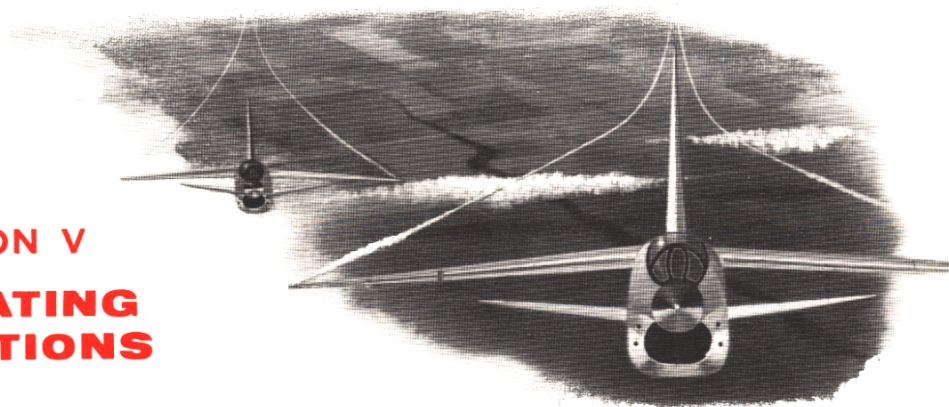
REAR VISION MIRRORS.

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.

SECTION V
OPERATING
LIMITATIONS



Refer to F8U-1 Supplemental Flight Handbook.



SECTION VI
FLIGHT
CHARACTERISTICS

Refer to F8U-1 Supplemental Flight Handbook.



SECTION VII

SYSTEMS OPERATION

INTRODUCTION.

This section presents information supplementing sections I and II on engine, afterburner, and fuel system operation. An understanding of this additional information will be helpful to pilots during flight.

ENGINE AND AFTERBURNER.

DESCRIPTION.

The Pratt and Whitney J57-P-4 or -12 is a continuous-flow gas-turbine engine incorporating split axial flow compressors. Splitting the compressors into two mechanically separate rotors provides greater flexibility for starting and permits part load coasting operation. Each rotor is driven by separate turbines. During starting the external starter is connected to the high-pressure rotor as it is the smaller and requires less torque. With the high-speed, high-pressure rotor turning at governed speed, the low-speed, low-pressure 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 which is varied by a hydromechanical fuel control unit. The engine incorporates an afterburner that produces approximately a 50% increase in thrust available at sea level static conditions.

ENGINE OPERATION. (See figure 1-8.)

GENERAL. Fuel is pumped from the main (forward) fuel cell 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 is then directed 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.

FUEL PUMP. The engine-driven fuel pump serves both the engine and the afterburner. The pump consists of a centrifugal booster stage and separate gear-type 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. When the afterburner is selected, an electrically operated shuttle valve in the transfer valve directs afterburner stage output to the afterburner fuel control unit and transmits a fuel flow signal to the afterburner exhaust nozzle control unit. If the engine stage of the pump fails, the transfer valve automatically transfers afterburner stage output to the engine fuel control unit. Failure of the engine stage will be indicated by illumination of the fuel pump warning light.

FUEL CONTROL UNIT. This 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 a flameout. The unit automatic metering functions may be bypassed by placing the FUEL CONT switch in "EMERG" if a malfunction occurs. Fuel flow is then manually controlled by throttle movement and the only metering function in effect is altitude compensation up to 30,000 feet. In airplanes BuNo. 145416 and subsequent, the fuel control light will be on when the fuel control unit is operating in emergency. During engine starting, the light will be on regardless of FUEL CONT switch position until idle rpm is obtained.

AFTERBURNER OPERATION. (See figure 1-6.)

Afterburner operation is initiated when a switch in the throttle quadrant is actuated by placing the throttle outboard in the afterburner detent. The switch energizes a motor actuated afterburner shuttle valve to direct afterburner fuel from the fuel pump to the afterburner fuel control unit. Simultaneously a fuel pressure signal is sent to the afterburner exhaust nozzle control unit to open the exhaust nozzle. The afterburner fuel control unit automatically meters fuel for changes in burner pressure as effected by throttle movement and altitude changes. The metered fuel is directed to the afterburner fuel nozzles and to the afterburner igniter valve. The igniter valve directs a charge of fuel into a burner to cause a flame streak through the turbines into the afterburner section where it ignites fuel discharged by the afterburner fuel nozzles. The afterburner is normally brought in at "MILITARY" thrust; however, it can be brought in at any point above the afterburner aft detent stop.

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.

AFTERBURNER EXHAUST NOZZLE.

The exhaust nozzle area is automatically increased for afterburner operation by a fuel pressure signal transmitted from the fuel pump to the afterburner exhaust nozzle control unit. The signal positions the control unit to direct engine compressor bleed air to the open ports of 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 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, throttling 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 waveoff.

Some engines have a "pop-open" exhaust nozzle feature incorporated. In these engines, the exhaust nozzle flaps open automatically whenever the throttle is at the "IDLE" stop and close when the throttle is advanced out of "IDLE." Even though these engines have a higher idle speed (64% to 69% rpm) than engines without pop-open nozzles, turbine outlet temperature and pressure and idle thrust with the nozzle open will be lower than for other engines (idle 55% to 58% rpm). Pop-open nozzle engines also have faster engine acceleration times.

ENGINE OIL. (See figure 1-7.)

Oil is supplied from the 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 caused by pump cavitation may be apparent. The fluctuations are normal and should damp out within approximately 30 seconds after resuming positive "g" conditions.

The oil is drawn from the engine by six gear-type scavenge pumps, cooled by a radiator-type oil cooler and an oil-fuel heat exchanger, and then returned to the oil tank. Oil temperature is automatically stabilized by a thermal-sensing temperature control unit and a thermostatic regulator valve. The temperature control unit electrically controls the oil cooler door and prevents fuel from being overheated in the heat exchanger.

The thermostatic regulator valve senses oil temperature and permits the oil to flow through or bypass the heat exchanger depending upon oil temperature. The oil cooler is inoperative unless the oil cooler door is opened. When the door is opened, bleed air from the engine intake passes through the radiator and overboard. On airplanes BuNo. 141347 and subsequent, a pressure ratio switch is installed to automatically open the door at speeds between Mach No. 1.0 and 1.2 to relieve ram pressure in the intake duct. At lower speeds door operation is returned to the temperature control unit. On airplanes BuNo. 143677 and subsequent, and airplanes with ASC 58 (ECP 169) incorporated, a 3-position switch and an oil cooler door position indicator are installed. The indicator reflects door position. The switch is normally in "AUTO." The "OPEN" and "CLOSE" positions are used only if the pressure ratio switch fails to position the door.

ENGINE ACCELERATION AND DECELERATION CHARACTERISTICS.

The following data are based on static ground conditions:

Engines *without* "pop-open" exhaust nozzles should accelerate to military thrust in approximately 10 seconds, when the throttle is rapidly advanced from "IDLE" to "MILITARY." The engine should decelerate to idle thrust within 15 seconds when the throttle is rapidly retarded from "MILITARY" to "IDLE."

Engine *with* "pop-open" exhaust nozzles should accelerate to military thrust in approximately 7 seconds, when the throttle is rapidly advanced from "IDLE" to "MILITARY." The engine should decelerate to idle thrust within 20 seconds when the throttle is rapidly retarded from "MILITARY" to "IDLE."

The EXH TEMP indicator should not exceed 670°C and should not remain between 620°C and 670°C for more than 2 minutes on either type engine.

THRUST CHECK CHARTS.

These charts (figure 7-1) are used to obtain engine thrust check values for use during the "MILITARY THRUST CHECK" under "BEFORE TAKEOFF" procedures in section II.

If the airplane is equipped with a TURB outlet pressure indicator*, use sheets (1) or (2) as in the following example: Assuming a station barometric pressure of 29.25 in. Hg and a station temperature of 20° C, enter the chart at 29.25 in. Hg on the station barometric pressure scale and read vertically to the intersection of the 20° C temperature curve. Read horizontally to the left to obtain a turbine outlet pressure value of 59.5 in. Hg for a normal rated engine or 57.9 in. Hg for a down-rated engine.

If the airplane is equipped with an engine PRESSURE RATIO indicator†, use sheet (3) as in the following example: Assuming a station temperature of 20° C, enter the chart at 20° C on the temperature scale and read vertically to the thrust check curve. Read horizontally to the left from both edges of the curve to obtain an engine pressure ratio range of 2.27 to 2.43.

COMPRESSOR STALLS.

A compressor stall is the result of reduced airflow through the compressor blades which may be caused by low temperature at high altitudes when operating with high power settings, by improper fuel flow, or by stalling the airplane. The severity of the stall depends on the number of compressor stages that are stalled. Several types of compressor stalls may be encountered in varying degrees during normal operation of the J-57 engine.

The "steady state" stall, rarely encountered in the F8U-1, is characterized by a drop in rpm, a rapid rise in exhaust temperature and a rapid banging sound that resembles gunfire. Recovery should be started at the first indication of a "steady state" stall by retarding the throttle to "IDLE," to reduce the amount of fuel admitted to the engine, and increasing airspeed by losing altitude, to admit more air into the engine. (It may be necessary to sacrifice as much as 10,000 feet altitude to obtain a recovery at high altitudes.) If the stall continues the engine should be shut down. "AIRSTART PROCEDURE" should then be followed.

*Airplanes without ASC 4 (ECP 30) incorporated.

†Airplanes BuNo. 145345 and subsequent and airplanes with ASC 4 (ECP 30) incorporated.

If engine operation is not normal following a severe stall, land as soon as possible. Cabin pressurization may fluctuate and electrical power may be lost during compressor stalls.

"Acceleration" or "chug" stalls are frequently encountered during rapid acceleration from idle. This type of stall usually occurs from 58% rpm through 66% rpm. The engine will usually recover from a mild stall of this type without any pilot action. Should a severe "chug" stall occur, the throttle should be retarded and the engine allowed to stabilize. The throttle may then be advanced to desired setting.

If unstable engine conditions persist and exhaust temperature does not return to normal following a stall, land as soon as possible. Continued engine operation under unstable engine conditions is dangerous.

FUEL CELL PRESSURIZATION AND VENTING. (See figure 7-3.)

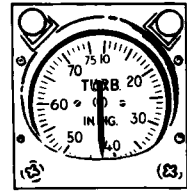
Pressurization and venting maintain a constant pressure in the fuel cells and cell cavities during climbs, dives, fueling, defueling, and fuel transfer. Air pressure is used to transfer wing tank fuel. Pressure in all the cells prevents excessive fuel loss due to boiling at high altitude.

Pressurized air is bled from the engine compressor section and cooled through 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, a vacuum relief system automatically admits ram air through an emergency air scoop if the pressure regulators fail in the closed position or the air-conditioning system is shut off.

The fuselage fuel cells are vented overboard through interconnected lines to a vent mast on the fuselage left-hand mid section. The common vent line is connected to a pressure relief valve which relieves cell pressure above 1.0 (± 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.

THRUST CHECK CURVE

**AIRPLANES WITH TURBINE OUTLET
PRESSURE INDICATOR**



ENGINE: J57-P-4

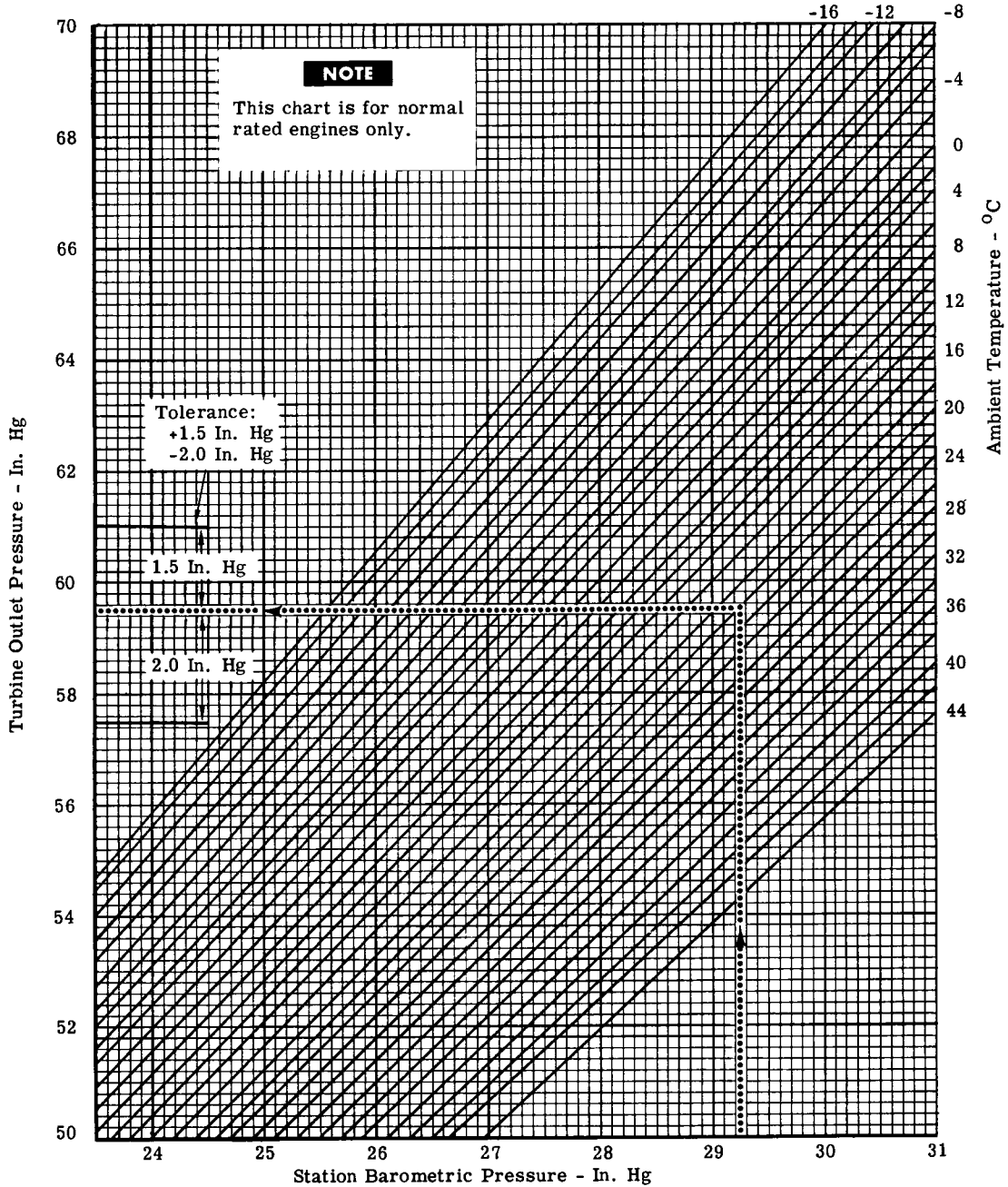
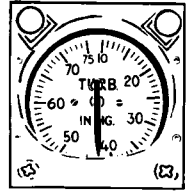


Figure No. 7-1. Thrust Check Curve (Sheet 1)

THRUST CHECK CURVE

**AIRPLANES WITH TURBINE OUTLET
PRESSURE INDICATOR**



ENGINE J57-P-4

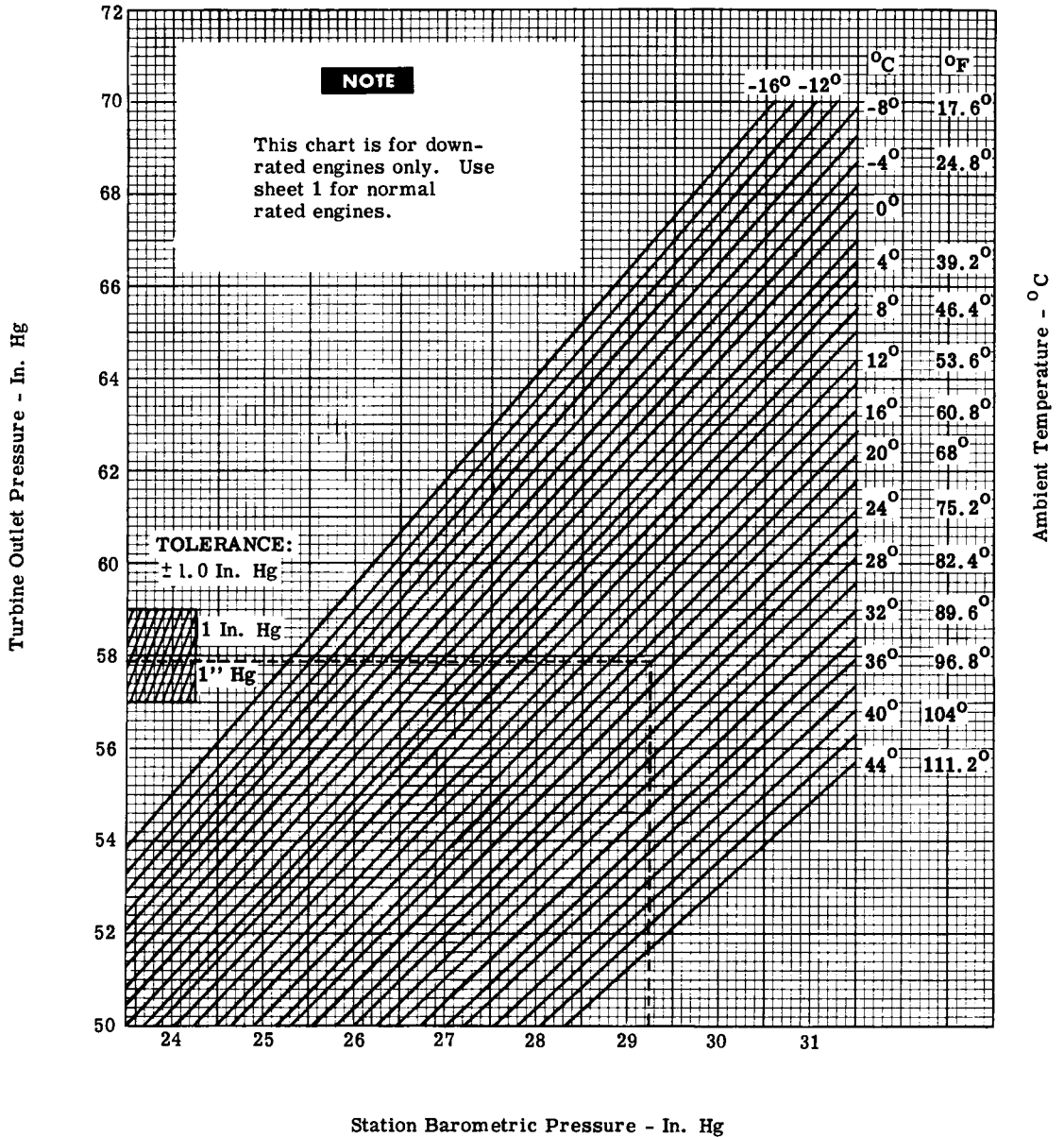
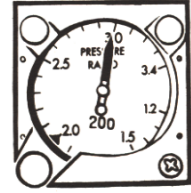


Figure No. 7-1. Thrust Check Curve (Sheet 2)

THRUST CHECK CURVE

AIRPLANES WITH ENGINE PRESSURE RATIO INDICATOR



ENGINE: J57-P-4

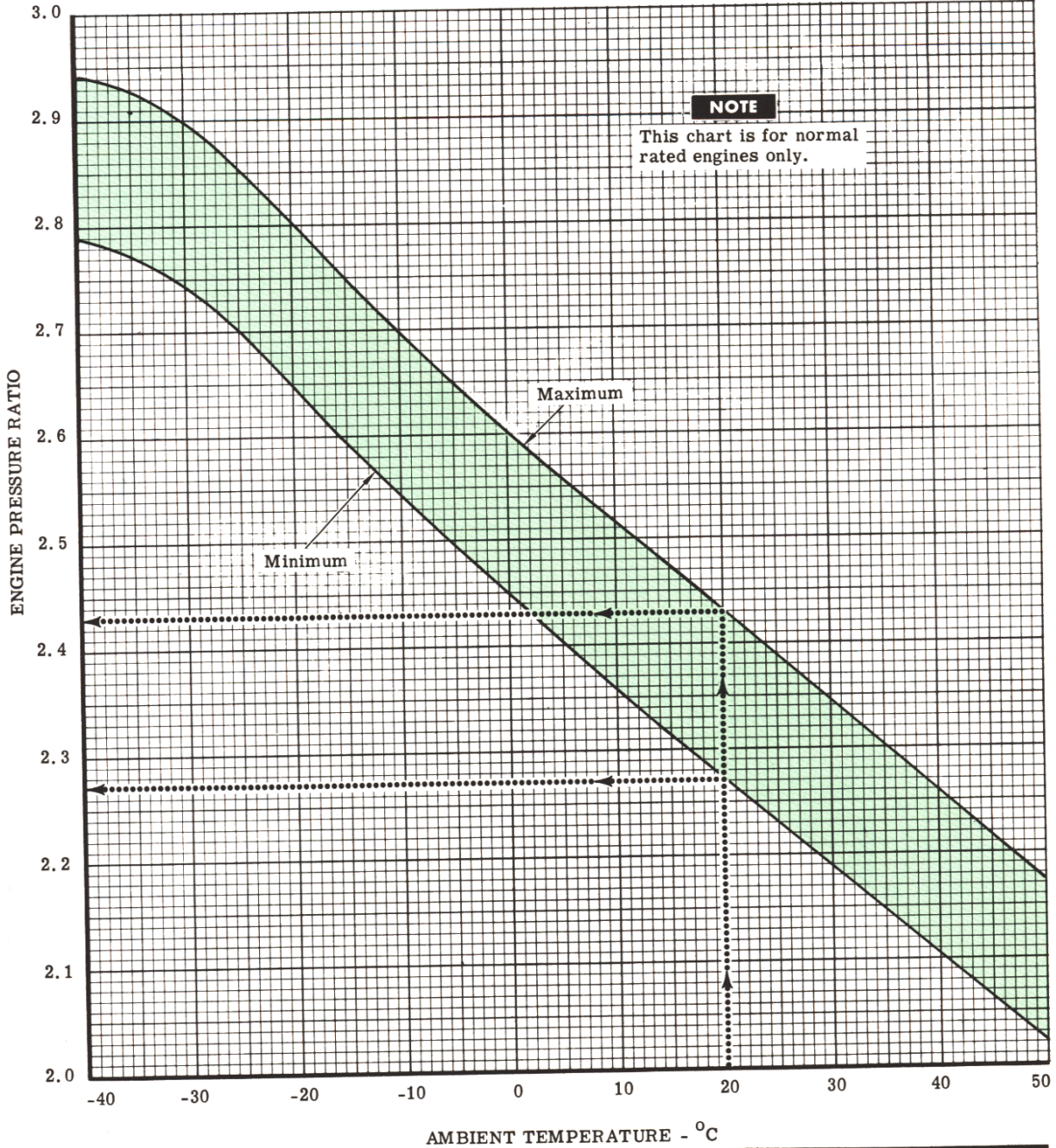


Figure No. 7-1. Thrust Check Curve (Sheet 3)

FUEL SYSTEM MANAGEMENT. (See figure 7-2.)

For takeoff and landing, the transfer fuel pump should be inoperative and the wing tank depressurized. This is accomplished by placing the FUEL TRANSFER switch in "PRESS DUMP."

After takeoff, the FUEL TRANSFER switch is placed in "ON" which energizes the transfer boost pump and permits pressurizing the wing tank. The transfer fuel system is now operative and fuel is being transferred automatically to the main fuel cell. Fuel transferred from the fuselage transfer cells and fuel from the wing tank join in a common line to the main cell. Fuel line sizes and the higher relative pressure from the transfer boost pump mechanically sequence fuel transfer to maintain center-of-gravity control.

The transfer fuel pump warning light does not give a usable indication of fuselage transfer fuel level; therefore, the *fuselage* transfer cells should be considered empty when the transfer FUEL QUANTITY indicator indicates 2,000 pounds of fuel remaining. The transfer fuel pump and the fuel pump warning light circuit should then be de-energized by placing the FUEL TRANSFER switch in "PUMP OFF." Wing fuel transfer will continue and, under some flight conditions, may continue for a time even after the transfer FUEL QUANTITY counter indicates zero. Two pressure shutoff valves in the wing fueling manifold are automatically closed when the wing tank is empty or a fuel outlet is uncovered, to prevent wing tank air pressure from entering the fueling line.

In airplanes without ASC 211 (ECP 261) incorporated, the transfer fuel system is gaged by a TRANSFER FUEL QUANTITY counter. When wing fuel is dumped, the counter returns to zero and there is no indication of fuselage fuel remaining.

Note

If the counter fails to return to zero after the transfer fuel system is empty, place the FUEL DUMP switch in "DUMP" until counter reflects zero, then return switch to "OFF." This procedure is necessary to prevent an erroneous counter reading after refueling.

In airplanes BuNo. 144427 and subsequent and airplanes with ECP 261 incorporated, transfer fuel is gaged by a capacitance system that is designed for use in cruise control. This system will only indicate accurately in steady wings-level flight between 10° nose-up and 4° nose-down. Maneuvering will cause high or low erroneous indications that quickly return to

normal when smooth flight is regained. On these airplanes the indicator will correctly indicate fuselage transfer fuel remaining after wing fuel has been dumped.

In flight, the main FUEL QUANTITY indicator will normally read 2,500 to 2,600 pounds until the transfer fuel system is completely empty; however, during nose-down attitudes of 10° or more, the main fuel system mid cells will gravity feed to the main cell and the main FUEL QUANTITY indicator reading will drop to approximately 2,300 pounds when level flight is regained. The fuel low-level warning light on airplanes BuNo. 145416 and subsequent will be on when the fuel in the main cell is at 1,000 (+200, -0) pounds (JP-5). The light will indicate accurately at airplane 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 sustained "IDLE" power setting, advancing the throttle momentarily to obtain a higher fuel flow rate may restore proper indication.

WARNING

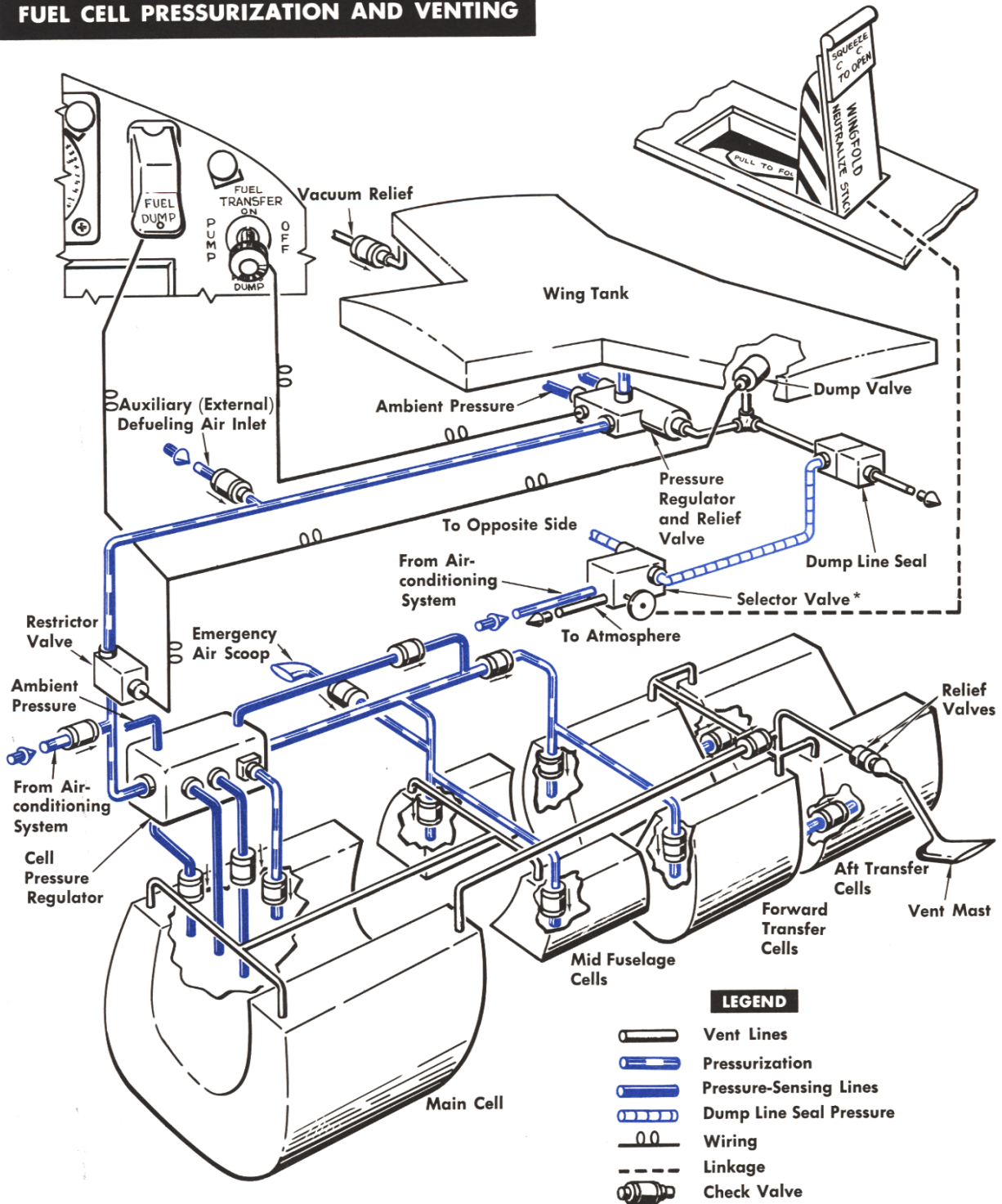
The descent for landing shall be initiated with a minimum of 500 pounds of fuel remaining. The downwind leg of the traffic pattern must be entered with a minimum of 400 pounds of fuel remaining. This will provide enough fuel for one wave-off and go-around with a maximum of 5 seconds of afterburner operation.

WING TANK FUEL DUMPING. (See figure 7-3.)

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."

Figure No. 7-2. Deleted

FUEL CELL PRESSURIZATION AND VENTING



*Relieves dump line seal pressure when wings are folded.

Figure No. 7-3. Fuel Cell Pressurization and Venting — Airplanes BuNo. 141342 and Subsequent

IFR PROBE CONTROL

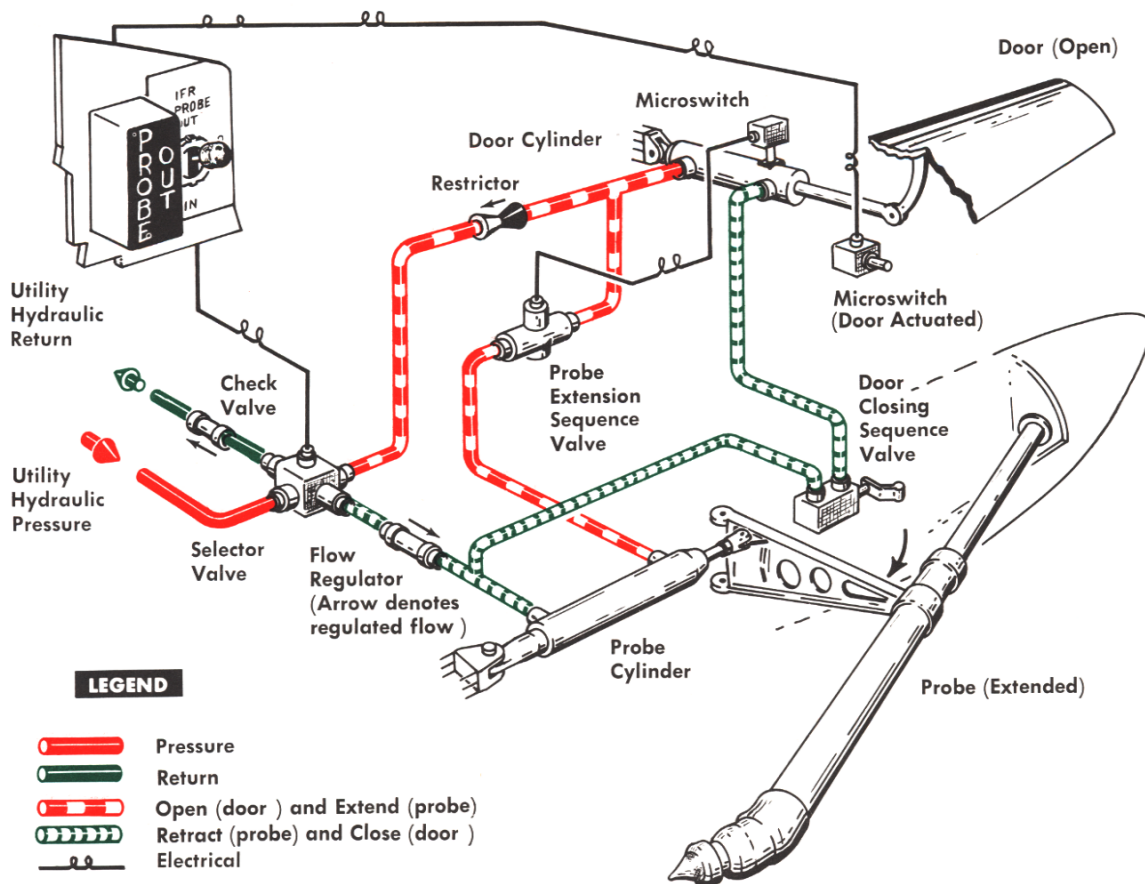


Figure No. 7-4. Inflight Refueling Probe Control — Airplanes BuNo. 143702 and Subsequent

In airplanes BuNo. 145416 and subsequent, when cabin pressure switch is in "CABIN DUMP," wing tank fuel dumping may be accomplished at a reduced rate by gravity feed. Placing cabin pressure switch in "CABIN PRESS" for a short time will increase the fuel dumping rate.

INFLIGHT REFUELING. (Airplanes BuNo. 143702 and Subsequent.)

This system permits refueling of the entire airplane fuel system to increase the mission radius. A retractable probe, mounted in a well on the left-hand side of the fuselage, is extended and retracted by utility hydraulic pressure (figure 7-4). Placing the IFR PROBE switch in "OUT" de-energizes the transfer fuel

pump, depressurizes the wing tank, positions the fuel valves to accept fuel, opens the probe fairing door and extends the probe. The IFR probe 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 airplane fuel system at a rate of approximately 1,340 pounds per minute. Total system refueling may be accomplished in 5 to 7 minutes. When the desired amount of fuel has been taken aboard, as indicated by the fuel quantity gages, a slight reduction in airspeed will disengage the probe. Holding the IFR PROBE switch in the "IN" position will reenergize the transfer fuel system and reposition the fuel valves for normal operation, retract the probe, and close the fairing door. The IFR probe light will remain on until the door is completely closed. When the probe light goes off, releasing the switch to "OFF" will deenergize the door selector valve.

If a malfunction occurs and it is impossible to retract the probe, placing the switch in "OFF" will permit normal operation of the fuel transfer system. Refueling can be accomplished only with the IFR PROBE switch in the "OUT" position.

The system is connected to the primary dc bus to permit refueling all but the aft cells when electrical power is being supplied by the emergency power package. Fuel from the aft cells is not available when using emergency electrical power.

Note

Prior to inflight refueling, turn off all unnecessary electrical equipment to reduce electrical load and fire hazard.

Inflight refueling is best accomplished with wing down, leading edge in cruise droop position and less than 50% fuel remaining. A slight trim change will accompany extension of the probe depending upon indicated airspeed. At very low airspeeds trim changes will increase. Below approximately 280 knots IAS, the airplane will exhibit a tendency to yaw right. Between 280 knots and 350 knots IAS, a right yaw then a left yaw is experienced. A slight nose-up trim change is present at most airspeeds.

Note

It is recommended that inflight refueling be conducted with helmet visor down.

The approach to the drogue is made from a position approximately one plane length directly astern. Using the tanker and hose as a reference, increase engine speed by approximately 2% rpm to establish a closing speed of 2 to 3 knots. When the drogue passes the nose, it has a tendency to move to the left. As the drogue will be at about eye level, small corrections may be made to align the probe with the drogue. As the engagement is made, the refueling hose will ripple slightly. After the engagement is made, the receiver pilot remains in the refueling position and flies formation on the tanker. Some pilots may prefer to trim the airplane slightly nose down so that approximately 5 pounds of back force is required. This will preclude operation in the flat portion of the curve for stick position versus unit horizontal tail position.

Inflight refueling should be accomplished with an observer airplane in a position to aid the receiver in making corrections and to inform him of a miss so that he may promptly retard the throttle.

Once refueling is complete, a slight reduction in power or extending the speed brake will effect release of the drogue.

GROUND REFUELING.

Standard high pressure fueling equipment is used to refuel the airplane through a single point fueling manifold. The FUEL SELECTOR switch, in the left-hand wheel well, can be positioned to select three different fuel loads: "TOTAL" position completely refuels both the main and transfer systems, "PARTIAL" position refuels the main system to the transfer level and completely refuels the transfer system, "FWD CELL" position refuels only the main fuel cell. To refuel the airplane proceed as follows:

- a. Ground airplane and check that fuel truck is grounded.
- b. Connect external 115-volt, 400-cycle, 3-phase ac and 28-volt dc power.
- c. Check that ENGINE MASTER switch is in "OFF," FUEL DUMP switch is in "OFF," and all radio and radar switches are in "OFF."
- d. Place MASTER GENERATOR switch in "EXT" and check altitude indicator and DC PWR IND for electrical power connected.
- e. Allow a 5-minute warmup period for transfer quantity indication system (airplanes with transfer fuel counters).
- f. Remove pressure fuel cap, discharge static electricity from fueling nozzle by grounding, and connect fueling nozzle to fueling manifold.
- g. Place wing tank manual shutoff valve in "OPEN."
- h. Rotate FUEL SELECTOR switch to "TOTAL."
- i. Pump 100 gallons of fuel to prime system. Stop pump.

CAUTION

Check for continuous flow of air from vent mast.

- j. Rotate FUEL SELECTOR switch to "PRIMARY." Start pump and check that fuel flow stops after about 25 to 30 gallons have been pumped. Stop pump.
- k. Rotate FUEL SELECTOR switch to "SECONDARY" and repeat step j.
- l. Rotate FUEL SELECTOR switch to fuel load desired and fuel airplane. Allow pump to run for at least 1 minute after fuel flow stops.
- m. Check cockpit fuel quantity indicators and wing tank visual quantity indicator.
- n. Rotate FUEL SELECTOR switch to "POWER OFF," disconnect fueling nozzle, and replace pressure fuel cap.
- o. Place MASTER GENERATOR switch in "OFF" and disconnect external power.

CAUTION

On airplanes through BuNo. 141360, the wing must be in the down position for ground

refueling. On airplanes BuNo. 141362 and subsequent, the wing may be in the up or down position for refueling.

ANGLE-OF-ATTACK INDICATING SYSTEM.*

The angle-of-attack indicating system and the approach lights provide the pilot and the landing signal officer with visual indications of airplane 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 attitudes. For convenience in controlling airspeed in landing approaches, indicator readings are supplemented by lights on an angle-of-attack approach indexer.

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 about 1.5° of angle of attack or 5 knots airspeed.

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 (wing up). 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. A recommended indicator setting that will provide for attaining the approach speeds listed in figure 2-7 will be published at a later date. (Refer to EXTERIOR LIGHTS in section IV for operation of approach lights.)

The approach indexer lights function only when the landing gear handle is in "WHEELS 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 (8, figure 1-5) 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 approach by making a slight porpoising maneuver and observing that all of the indexer lights operate in the proper sequence.

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. As angle of attack goes high or low, with resulting decrease or increase in airspeed, the indexer upper or lower chevron will come on to point the direction in which the nose should be moved to return to the optimum attitude. The throttle is manipulated to control rate of descent so as to establish the desired glide path. The relationships of the various indications to attitude and airspeed are shown in figure 7-5.

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 marker. Indications above and below the index marker indicate that the approach is being made more than 5 knots slow or fast.

*Airplanes BuNo. 145509 and subsequent and airplanes with ASC 202 (ECP 278) incorporated.

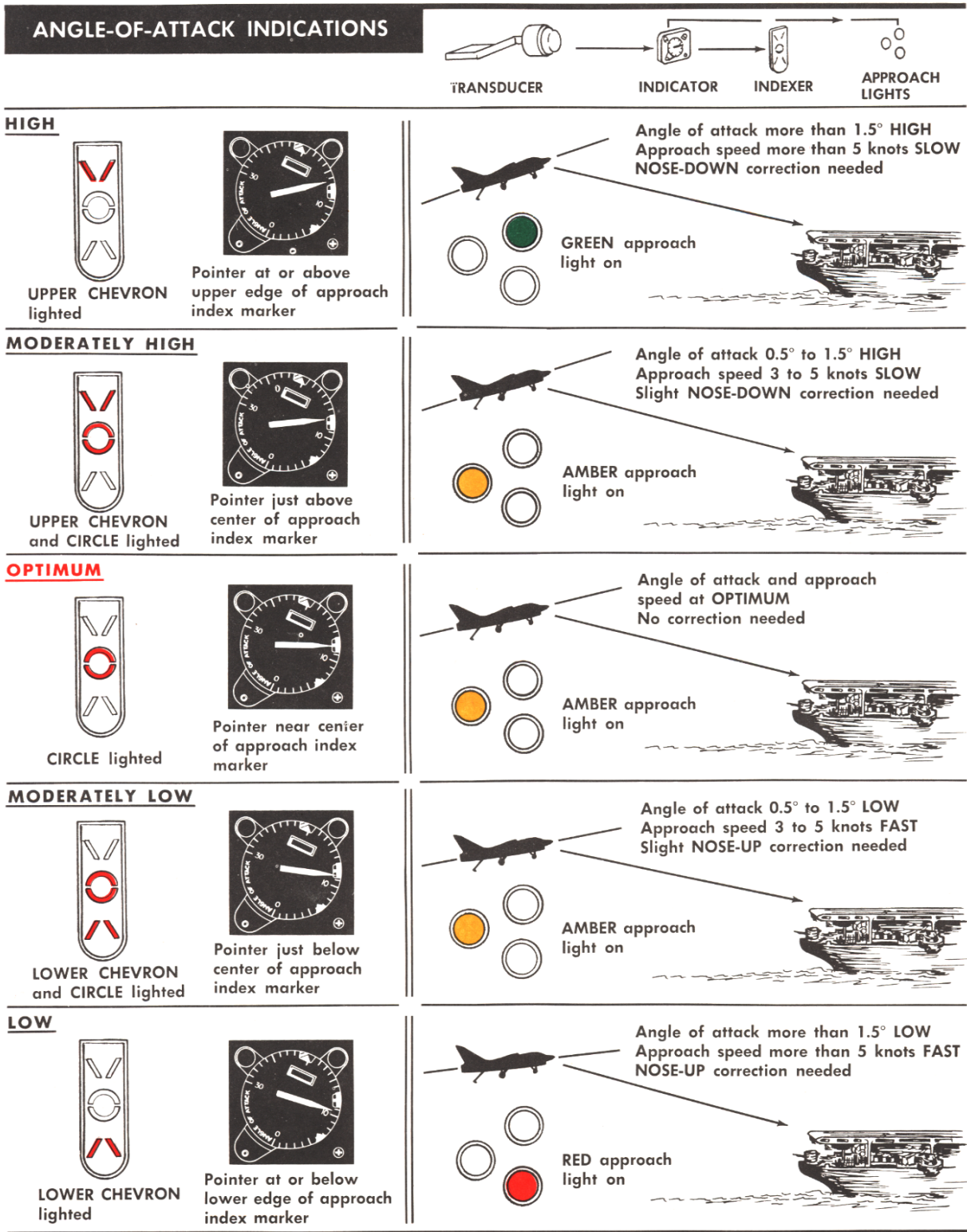


Figure No. 7-5. Angle-of-Attack Indications

SECTION VIII
CREW DUTIES

(NOT APPLICABLE)

SECTION IX

ALL-WEATHER OPERATION



INTRODUCTION.

This section sets forth proper techniques and procedures to be employed under conditions of instrument flight (including snow, ice, and rain), ground control approach, turbulent air flight, and for operation under various extremes of weather and climate. Some information contained in section II is repeated in this section for emphasis, clarity or continuity of thought in procedures that differ from or are supplementary to the normal operating instructions contained in section II. Discussions relative to systems operations are included in section VII.

NIGHT FLYING.

Exterior lighting consists of fuselage lights and navigation lights. No landing lights or formation lights are installed. During night operation, oil film on the windshield and canopy, which was not evident during day operation, may be annoying to the pilot. Therefore, the windshield and canopy should be cleaned prior to night flight.

INSTRUMENT FLIGHT CONDITIONS.

General handling characteristics and stability of the airplane are good and instrument flight should not present any problems. For planning instrument flight, reserve fuel should include possible holding and missed-approach phases. These phases with let-down procedures and instrument approaches will greatly reduce range and should be taken into consideration while planning flight.

INSTRUMENT TAKEOFF.

- a. Line up airplane with runway heading and check reading of RADIO MAGNETIC INDICATOR.
- b. Use pitot heat and rain removal as necessary.
- c. Use RADIO MAGNETIC INDICATOR as primary directional control instrument.
- d. After takeoff, establish a safe rate-of-climb and use attitude indicator as primary pitch and bank control instrument at this time.
- e. Retract landing gear when altimeter reflects climb.
- f. Lower wing below 220 knots IAS.
- g. Turn off rain removal system.
- h. Use rate-of-climb indicator as primary pitch control instrument until climb speed is reached.

INSTRUMENT CLIMB.

- a. Refer to "CLIMB CHARTS" in appendix I of F8U-1 Supplemental Flight Handbook for best climb speeds.
- b. Limit turns to a bank angle of 30°.
- c. Use airspeed Mach number indicator as primary pitch control instrument as climb is reached.

INSTRUMENT CRUISING FLIGHT.

- a. After leveling off, establish cruising airspeed as determined from cruise data in appendix I of F8U-1 Supplemental Flight Handbook and trim airplane.
- b. Readjust miniature airplane in attitude indicator.

c. Use standard rate turns providing angle of bank does not exceed 30°; if angle exceeds 30°, use one-half standard rate turns. A constant 30° angle of bank for turns instead of rate turns is optional.

SPEED RANGE.

The best speed range for instrument flight will depend upon flight planning and weather encountered. In heavy turbulent weather instrument flight will be difficult at high speeds. In smooth air the speed range will depend on cruise data.

NAVIGATIONAL EQUIPMENT.

No difficulties should be encountered in the manipulation and operation of the navigational equipment as all controls are readily accessible on the right-hand console and the RADIO MAGNETIC INDICATOR is mounted on the top center of the instrument board. The reliability of the equipment will not be seriously affected by high static-producing elements such as storms, haze or dust layers, or thin overcasts.

DESCENT.

Type of descent used will depend upon altitude and approach clearance. Maximum range enroute descent data may be obtained from "MAXIMUM RANGE DESCENT" chart in appendix I of F8U-1 Supplemental Flight Handbook. (Refer to figure 9-1 for penetration descent data.)

HOLDING.

Best airspeed for minimum fuel consumption at various altitudes for a specific gross weight may be obtained from "MAXIMUM LEVEL FLIGHT ENDURANCE" chart in appendix I of F8U-1 Supplemental Flight Handbook. Leading edge cruise droop should be extended to improve stability and handling characteristics of the airplane at this low speed.

INSTRUMENT APPROACH.

Refer to published procedures for desired type of approach. (Refer to figure 9-1 for instrument approach and figure 9-2 for GCA.)

ICING.

Icing conditions should be avoided whenever possible. Before flight, check freezing levels and areas of probable icing from weather service. If ice starts to form on the windshield or wing leading edge, proceed as follows:

- Place pitot heat switch in "PITOT HEAT."
- Place defogger switch in "DEFOG."
- Climb to a higher altitude where temperature is below freezing or if a climb is impractical descend to a lower altitude where temperature is above freezing.
- Carefully watch tachometer and EXH TEMP indicators as a reduction of rpm and/or an increase of

exhaust temperature with a loss of thrust is an indication of engine icing.

WARNING

If exhaust temperature increases with loss of thrust, the throttle should be retarded as a low airspeed and high engine speed are conducive to engine icing.

- Control exhaust temperature by use of throttle.

FLIGHT IN TURBULENCE AND THUNDERSTORMS.

Clear air turbulence at approximately 12,000 feet or below may lead to pilot discomfort at high indicated airspeeds. It is recommended that airspeed be maintained below 600 knots in light turbulence, 500 knots in moderate turbulence and 400 knots in heavy turbulence. Flight in turbulence or thunderstorms may result in compressor stalls. If a stall occurs, the throttle should be retarded and minimum thrust used to leave the area of turbulence. Thunderstorms should be avoided if possible. If necessary to penetrate proceed as follows:

- Below 35,000 feet obtain 250 to 300 knots indicated airspeed. Above 35,000 feet obtain 0.88 indicated Mach number.
- Leading edge cruise droop may be extended for extra stability at high altitudes.
- Place pitot heat switch in "PITOT HEAT."
- Secure loose equipment.
- Tighten lap belt and lock shoulder harness.
- Turn cockpit lights toward "BRT."
- Maintain attitude and throttle setting and let altitude vary.
- Maintain original heading as much as possible.

COLD WEATHER PROCEDURES.

GENERAL.

Cold weather procedures are similar to normal operating procedures, as contained in section II, with particular emphasis on specific items. Icing conditions are not considered as they are covered under paragraph "ICING."

BEFORE ENTERING AIRPLANE.

- Check that all covers and plugs are removed.
- Check that all flight controls are free and that no ice, snow, or frost is on surfaces.
- Check that all overboard vent lines are clear.
- Check that pitot tube, airstream detectors, and static ports are clear.
- Check that tires are not frozen to surface.

ON ENTERING AIRPLANE.

Check canopy seals and make certain canopy can be closed.

STARTING ENGINE.

No special procedures for cold weather starting are necessary; use normal starting procedures in section II.

WARMUP AND GROUND TESTS.

If the engine has cooled to an ambient temperature of -35°C (-31°F) or below, a warmup period of 2 minutes with throttle in "IDLE" should be allowed before engine runup.

Check operation of flight controls and actuate hydraulic systems.

TAXIING.

Taxi slowly to prevent slush from being splashed into the wheel wells and onto the flight controls as it can freeze on takeoff.

HOT WEATHER PROCEDURES.

Hot weather procedures do not ordinarily differ from those used during normal weather conditions except for one possibility. During hot weather at higher elevations, available thrust for takeoff can be so reduced that required distance for takeoff may exceed runway length.

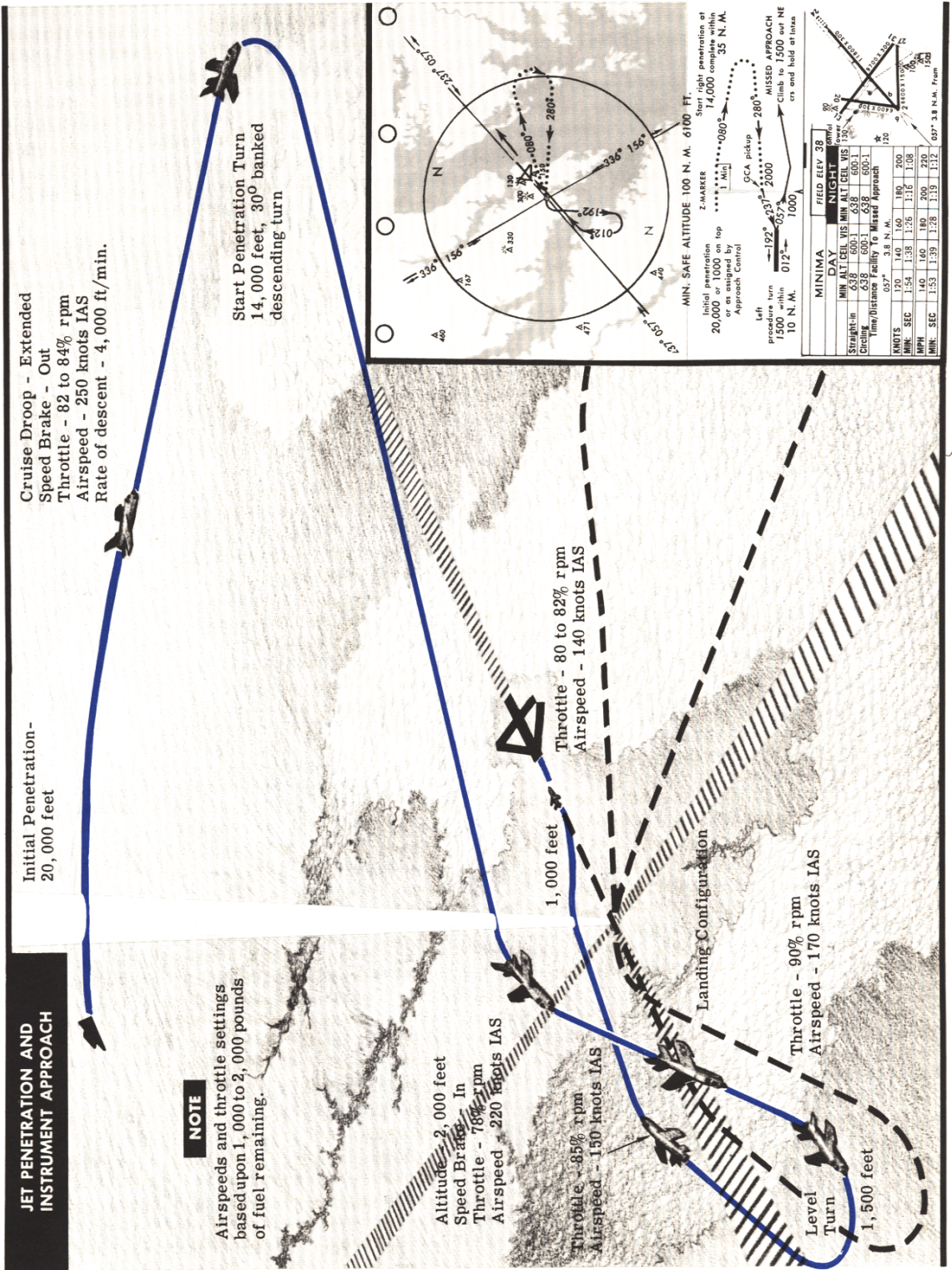


Figure No. 9-1. Jet Penetration and Instrument Approach

GCA APPROACH

NOTE

Throttle settings and airspeeds based on 1,000 to 2,000 pounds of fuel remaining. All turns are standard rate.

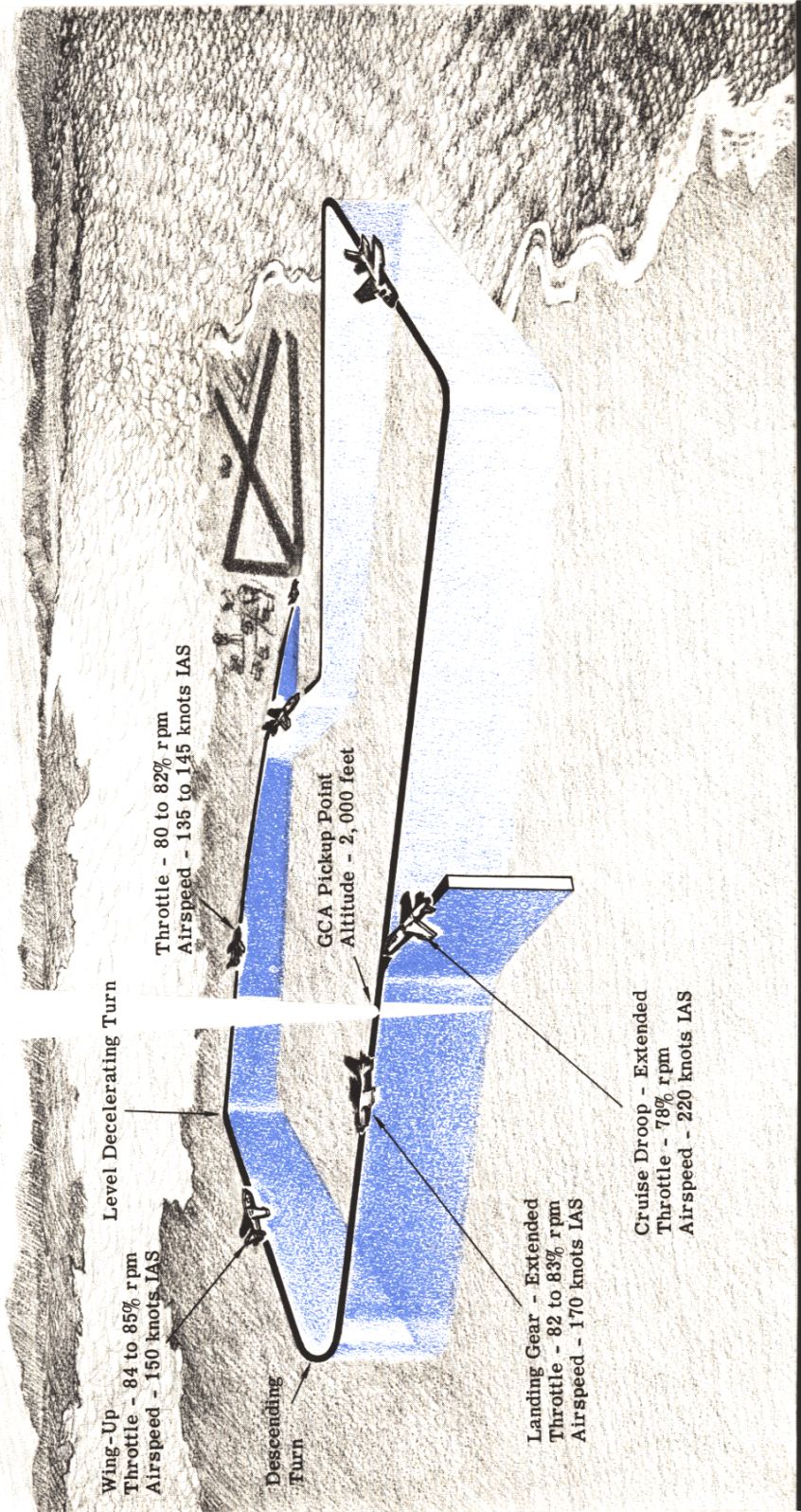


Figure No. 9-2. GCA Approach



APPENDIX I
OPERATING DATA CHARTS

Refer to F8U-1 Supplemental Flight Handbook.

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