T.O. 1B-57(R)A-1

USAF SERIES

RB-57A AIRCRAFT

FLIGHT HANDBOOK

This publication replaces safety of flight supplements T.O. 1B-57(R)A-E, H, K, L, M, N, P, Q, S, T, U and Y. Supplements C, D, G, J, W, X, CC, CH and CF remain active as well as any new ones issued subsequent to CF.

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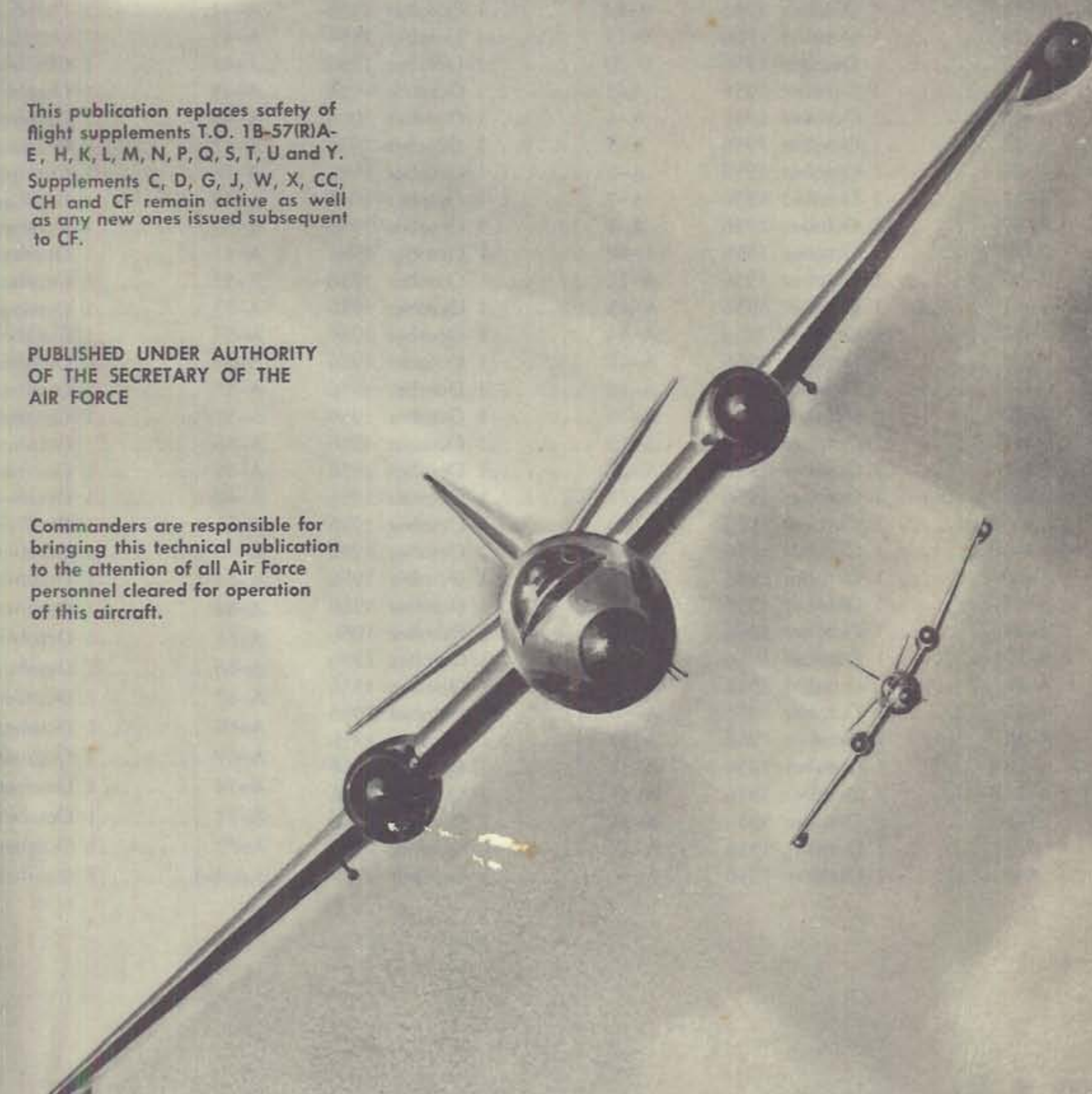

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NOTE

Paragraphs NOT covering all the airplane series in this handbook are identified by code letters which appear at the top right corner of the affected paragraph. The code letters assigned to airplanes are as follows:

GROUP A. All airplanes up to and and including 52-1460

GROUP B. All airplanes from 52-1461 and higher

Paragraphs which are applicable to all airplanes are not coded.

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IMPORTANT

THIS IS YOUR BOOK. READ IT CAREFULLY

To gain maximum benefit from this handbook, it is imperative that you read this page CAREFULLY.

FOREWORD

THIS handbook contains all the information necessary for safe and efficient operation of the RB–57A airplane. These instructions do not teach basic flight principles, but are designed to give you a general knowledge of the airplane, its flight characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and elementary instructions have been avoided.

The instructions in this handbook are prepared to answer the needs of a crew inexperienced in the operation of this aircraft. Although this book contains the best possible operating instructions for most circumstances, it is a poor substitute for sound judgment. Multiple emergencies, adverse weather, and terrain may require modification of the procedures contained herein.

Once you have learned to use one Flight Handbook, you will know how to use them all. The scope and arrangement of all Flight Handbooks are the same. Regular Flight Handbooks are kept up to date through an extremely active revision program. Frequent conferences with operating personnel and constant review of UR's, accident reports, and flight test reports, assure inclusion of the latest data. In this regard, it is essential that you do your part. If you find anything you don't like about the book, let us know right away. We cannot correct an error we don't know about.

All flight crew members, except those attached to an administrative base, are entitled to a personal copy of the Flight Handbook. Air Force Regulation 5–13 specifically makes that provision. Flexible loose-leaf tabs and binders have been provided to hold your personal copy of the Flight Handbook. These simulated-leather binders will make it much easier for you to revise your handbook as well as to keep it in good condition. Secure them through your local contracting officer.

To be sure of getting your handbooks on time, order them before you need them. Early ordering will assure that enough copies are printed to cover your requirements.

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IMPORTANT! READ THESE

FOREWORD (Cont)

Technical Order 0-5-2 explains how to order Flight Handbooks so that you will automatically get all revisions, reissues, and Safety of Flight Supplements. Basically, all you have to do is order the required quantities in the Publication Requirements Table (T.O. 0-3-1). Talk to your base supply officer—it is his job to fulfill your Technical Order requests. Make sure to establish some system that will rapidly get the books to the flight crews once they are received on the base.

For your information, the warnings, cautions, and notes found throughout the handbook bear the following connotation:

WARNING	Injury to personnel
CAUTION	Damage to equipment
NOTE	Information requiring emphasis

Comments and questions regarding any phase of the Flight Handbook program are invited and should be addressed to the Directorate of Systems Management Headquarters, Air Research and Development Command, Wright-Patterson AF Base, Ohio, Attention: RDZ STH.

The Flight Handbook is divided into nine sections and an appendix as follows.

SECTION I **DESCRIPTION** This section describes the aircraft and all its systems and controls which are essential to flight. Included is a description of all emergency equipment not part of an auxiliary system.

SECTION II **NORMAL PROCEDURES** This section outlines the procedures to be followed from the time the aircraft is approached by the pilot until it is left parked after completing one non-tactical flight under normal conditions.

SECTION III **EMERGENCY PROCEDURES** This section presents the procedures to be followed to cope with any emergency (except those in connection with the auxiliary equipment) that could reasonably be expected.

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PAGES CAREFULLY

SECTION IV **DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT** This section includes a description and the normal and emergency operation of all equipment not directly contributing to flight; e.g., armament, communication equipment, pressurization, etc. Instructions concerning the operation of auxiliary equipment peculiar to this airplane have been emphasized.

SECTION V **OPERATING LIMITATIONS**
This section lists all operating limitations of the aircraft.

SECTION VI **FLIGHT CHARACTERISTICS**
This section describes the flight characteristics of the aircraft.

SECTION VII **SYSTEMS OPERATION** This section discusses special characteristics and factors involved in some of the airplane systems under various conditions.

SECTION VIII **CREW DUTIES** This section includes the primary and alternate functions of each crew member and the responsiblities of each member to complete a successful mission.

SECTION IX **ALL-WEATHER OPERATION** This section discusses procedures and techniques required for safe and efficient operation under instrument flight and extreme weather conditions.

APPENDIX I **PERFORMANCE DATA** This section contains all operating data necessary for pre-flight and in-flight mission planning, including explanatory text on the use of the data presented.

ALPHABETICAL INDEX A complete list of all material in this handbook, including illustrations.

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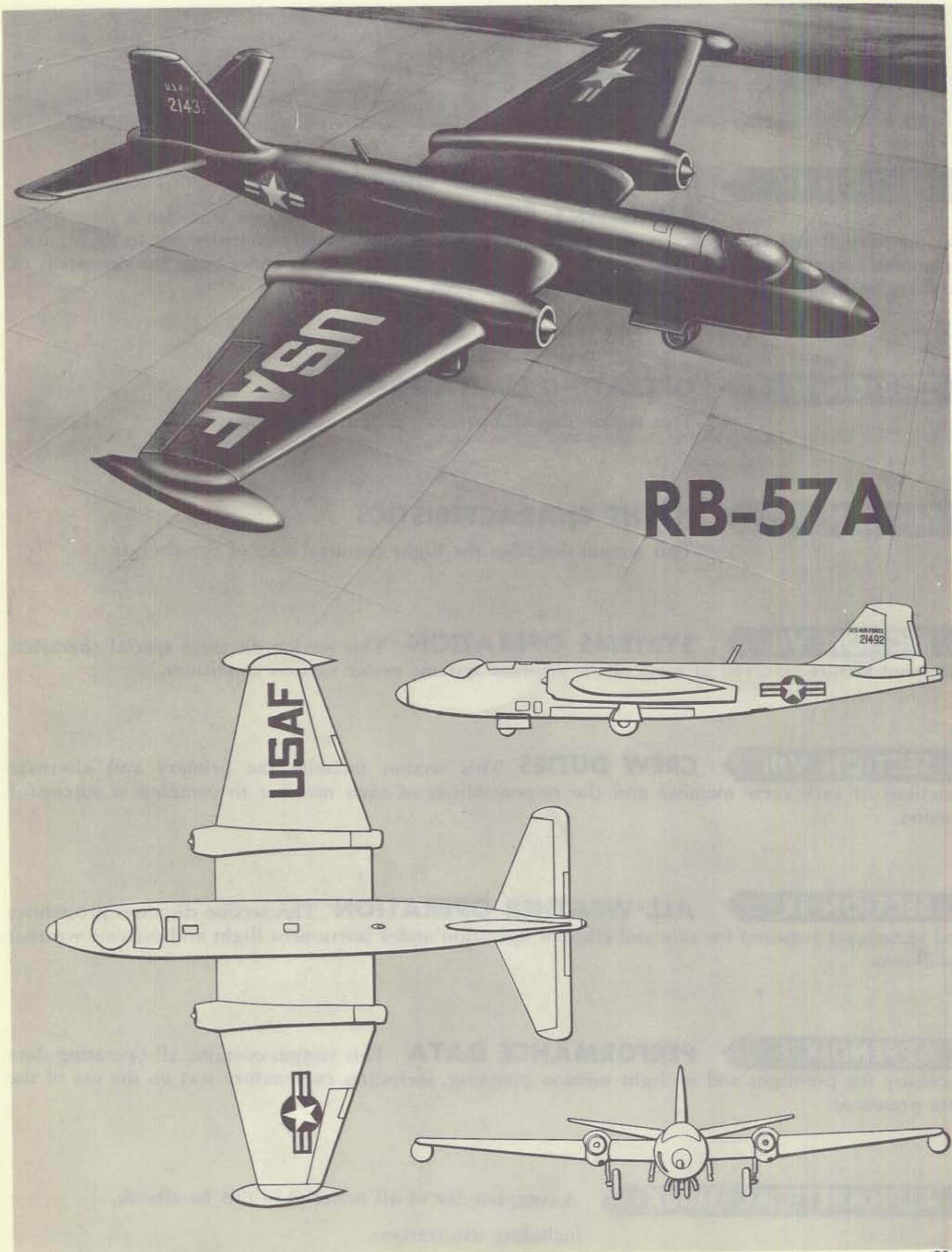
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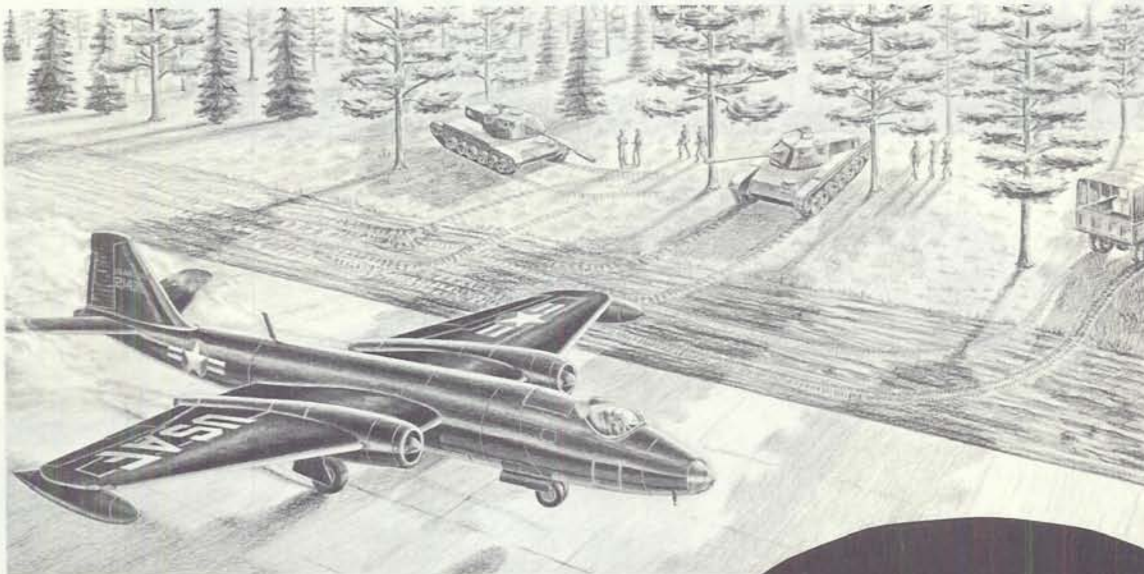
SECTION I



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DESCRIPTION

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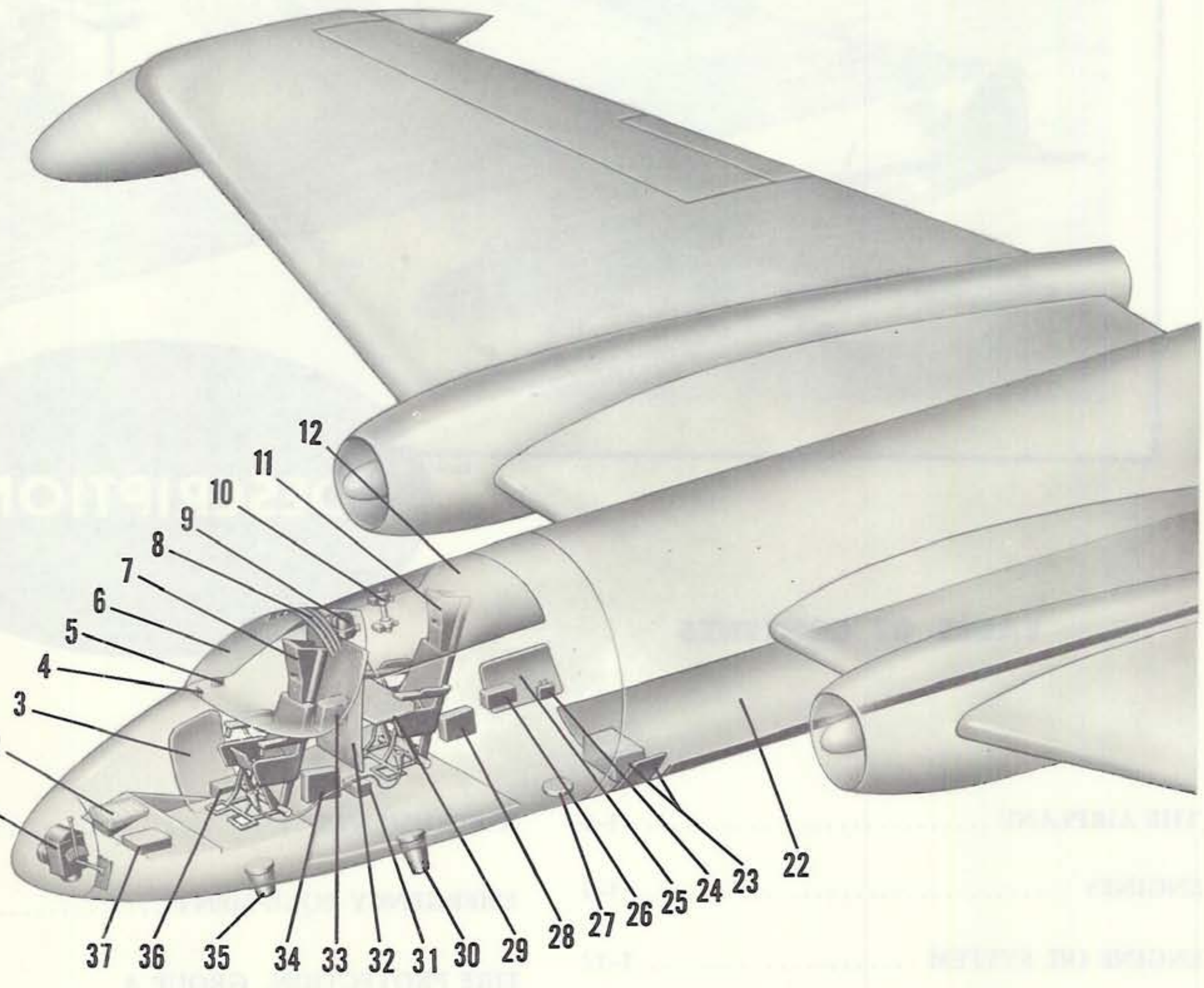
GENERAL ARRANGEMENT DIAGRAM



1. Driftmeter
2. Observer's chest cushion
3. Entrance hatch
4. Compass correction cards
5. Radio frequency card
6. Pilot's canopy
7. Pilot's ejection seat
8. Sense antenna (grid type)
9. Loop antenna
10. Periscopic sextant
11. Observer's ejection seat
12. Observer's hatch
13. Sense antenna (Mast type)
14. Spare engine cartridges
15. Stowage bag, control surfaces ground locks, landing gear extender valves, and mooring lugs.

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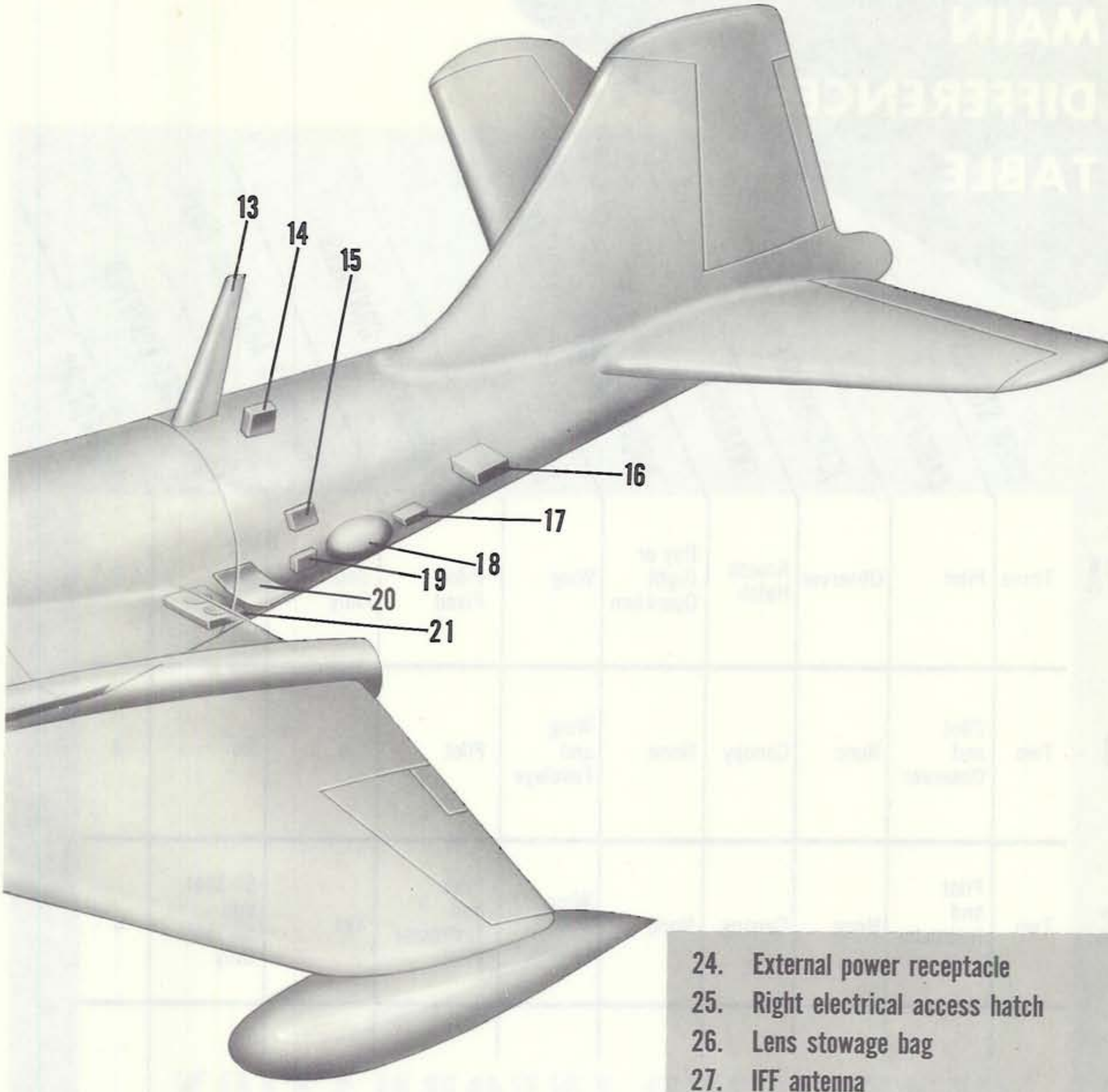
Figure 1-1. (Sheet 1 of 2)



16. Radio altimeter antenna
17. Marker beacon antenna
18. Shoran flush antenna
19. Airplane data case
20. Aft compartment access hatch
21. Radar beacon antenna
22. Bomb door
23. Battery, battery hatch and landing gear lock pin stowage
24. External power receptacle
25. Right electrical access hatch
26. Lens stowage bag
27. IFF antenna
28. Spare lamps and fuses stowage
29. Observer's table (extended)
30. Shoran antenna
31. Relief box and tubes
32. Observer's curtain
33. Observer's data case
34. Pilot's data case
35. UHF antenna
36. Periscopic sextant stowage
37. Sound recorder

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Figure 1-1. (Sheet 2 of 2)

MAIN DIFFERENCES TABLE

	CREW STATIONS	CANOPY	JETTISONABLE HATCH	ENTRANCE	PHOTOGRAPHIC EQUIPMENT	DIVE BRAKES	PROPULSION CONTROLS	ARMAMENT AND BOMB DOOR	TOW-TARGET EQUIPPED	GENERATORS
RB-57A	Three	Pilot	Observer	Access Hatch	Day or Night Operation	Wing	Pilot Fixed	Bomb Door Only	No	3
B-57B	Two	Pilot and Observer	None	Canopy	None	Wing and Fuselage	Pilot	Yes	No	4
B-57C	Two	Pilot and Instructor Pilot	None	Canopy	None	Wing and Fuselage	Pilot and Instructor Pilot	Yes	53-3844 and 53-3845 Only	4
B-57D	CLASSIFIED INFORMATION									
B-57E	Two	Pilot and Tow-Target Operator	None	Canopy	None	Wing and Fuselage	Pilot and Tow-Target Operator	Provisions For	Yes Tow-Target Canisters On Aft Fuselage	4

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THE AIRPLANE.

The RB-57A, manufactured by the Glenn L. Martin Company, is primarily a night reconnaissance airplane. It can also be used for low-, medium-, and high-altitude photography and for daylight combat mapping. An all-metal, turbo-jet-propelled monoplane with a retractable landing gear and a rotary bomb door, the airplane is characterized by the large chord of its wing from the root to the engine nacelle. A significant feature is the movable horizontal stabilizer, called the variable-incidence stabilizer.

The fuselage is of semi-monocoque construction and contains a cabin which may be pressurized at altitudes above 10,000 feet. In the nose section there are three crew stations for the two crew members: the pilot and the observer. The additional station is a forward observation post which the observer may occupy by leaving his normal station. The pilot's station contains all equipment and controls necessary to flight; the observer's station, behind and to the right of the pilot, contains navigation equipment and photographic controls. Covering the pilot's station is a transparent canopy and above the observer's station is a hatch, both of which are jettisonable in an emergency to make way for the crew's ejection seats. In the center section of the fuselage are the main fuel tanks, the rotating bomb door, the battery compartment, and electrical and photographic equipment. In the aft section of the fuselage are electrical and electronic equipment and stowage areas for miscellaneous ground handling equipment. A tail skid on the lower surface of the aft section prevents damage to the rear of the airplane. The wing is of the full-cantilever type, containing leading-edge fuel tanks, inboard and outboard split-type flaps, dive brakes, and provisions for wing tip tanks. The airplane has no anti-icing equipment.

AIRPLANE DIMENSIONS.

Approximate overall dimensions of the airplane are:

Wing span	64.0 ft.
Length	65.5 ft.
Height (to top of fin)	15.6 ft.
Tail span	27.8 ft.
Fuselage ground clearance at lowest point at maximum gross weight	19.2 in.
Tip tank to ground clearance at maximum gross weight	5.4 ft.

AIRPLANE GROSS WEIGHTS.

Approximate gross weights of the airplane are:

Average landing weight	29,000 lbs.
Normal take-off (day)	45,060 lbs.
Normal take-off (night)	49,000 lbs.

PHOTOGRAPHIC EQUIPMENT.

The airplane is equipped for night reconnaissance with Type K-37 cameras and with facilities for dropping photoflash bombs and firing photoflash cartridges. Two Type K-38 cameras for detail photography and a Type T-11 topographic mapping camera are provided for daylight combat mapping.

ARMAMENT.

There are fittings for two external stores pylons capable of carrying 1100 pounds each under each wing.

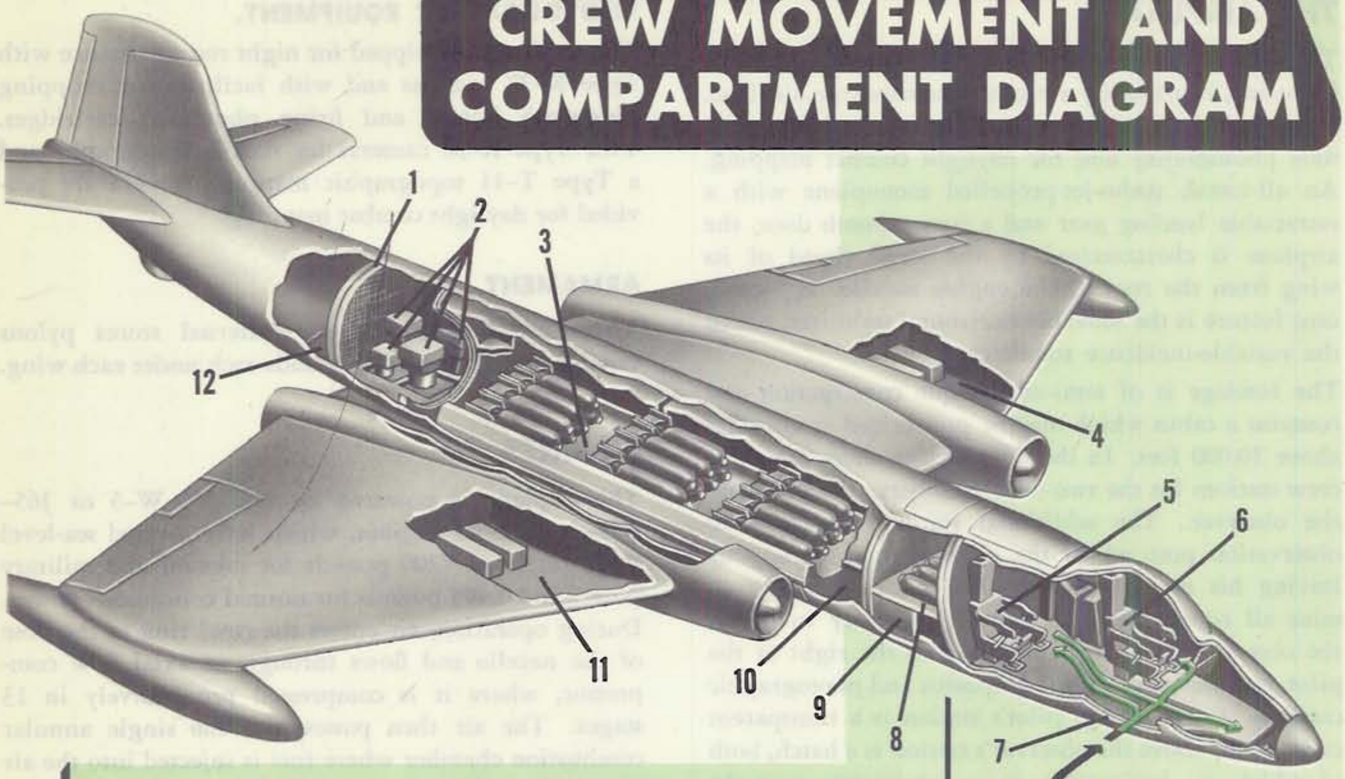
ENGINES.

The airplane is powered by two J65-W-5 or J65-BW-5 turbo-jet engines, which have a rated sea-level static thrust of 7200 pounds for take-off and military power and 6,400 pounds for normal continuous power. During operation, air enters the cowl ring at the nose of the nacelle and flows through an axial flow compressor, where it is compressed progressively in 13 stages. The air then passes into the single annular combustion chamber where fuel is injected into the air and ignited. The exhaust gases flow from the combustion chamber to the two-stage turbine. The turbine drives the compressor. The exhaust gases then pass through and out of the tailpipe. The gas expansion that takes place from this area provides the high-velocity jet thrust. The engines contain no inlet screens or anti-icing equipment.

ENGINE FUEL CONTROL SYSTEM.

The engine fuel control system (figure 1-4) maintains constant, steady-state speed control for normal operation, but will not maintain constant rpm for all conditions under emergency operation. This is because many of the compensating units incorporated in the normal system are not in the emergency system. The engine fuel control system consists essentially of an engine-driven, dual-element gear pump with an integral boost pump and a power control unit. The boost pump is a centrifugal impeller that supplies boost pressure to both elements of the fuel pump. The two gear elements of the fuel pump are arranged in parallel. If either one of the gear elements fails, the other will continue to operate but the fuel pump capacity will be reduced by approximately 50 percent. However, this will not affect engine operation, because during normal operation the pump capacity is more than twice the consumption requirements of the engine, regardless of altitude. Failure of the centrifugal impeller boost section of the engine-driven pump does not have any serious effect, unless the booster pump of the fuel tank being used is also inoperative.

CREW MOVEMENT AND COMPARTMENT DIAGRAM



1. ACCESS CURTAIN
2. CAMERA EQUIPMENT
3. ROTARY TYPE BOMB CARRIER DOOR
4. PHOTO FLARE BAY
5. OBSERVER'S EJECTION SEAT
6. PILOT'S EJECTION SEAT
7. ENTRANCE DOOR
8. EQUIPMENT COMPARTMENT
9. ELECTRICAL ACCESS COMPARTMENT
10. BATTERY COMPARTMENT
11. PHOTO FLARE BAY
12. AFT FUSELAGE ACCESS DOOR

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Figure 1-2.

An electrically controlled emergency fuel system, under emergency conditions, bypasses and directs the normally governed fuel supply to the engine without governing. An indicator light on the fuel control panel indicates when the emergency system is operating.

ENGINE NORMAL FUEL CONTROL.

Normal fuel control is maintained automatically by means of a speed governor which incorporates engine air inlet pressure and exhaust temperature compensation. (See figure 1-4.) This governing device permits most rapid and surge-free acceleration without excessive exhaust temperatures, and rapid engine deceleration without flame-out. In addition, the governor controls idle speed in accordance with altitude by maintaining a fixed fuel flow to the engine above a predetermined altitude. The engine fuel control system includes switches for selecting the emergency fuel control system whenever a failure occurs in the normal engine fuel control system.

ENGINE EMERGENCY FUEL CONTROL.

Each engine has an electrically controlled emergency fuel system powered by the pilot's 28-volt d-c circuit breaker bus. (See figure 1-4.) Two emergency fuel control switches on the fuel control panel enable the pilot to select emergency operation of the engine fuel system. Under emergency conditions, the normally governed fuel supply to the engine is bypassed so that a larger amount of fuel can be supplied directly to the engine without regulation. The emergency control system consists essentially of a simple throttle valve linked mechanically to the throttle (power control). The emergency system does not compensate for variations in fuel flow due to changes in inlet pressures and temperatures.

THROTTLES (POWER CONTROLS).

The throttles are mounted on a quadrant located on the pilot's console. (See figure 1-3.) Three positions are marked on the quadrant: **OFF, IDLE**, and FULL.

Figure 1-3.

A detent at the IDLE position requires a vertical pull force on the throttle to bypass the handle to the OFF position. Each throttle control is mechanically linked to actuate the engine fuel control unit and various microswitches. The switches close the circuits to the starting and ignition circuit, a warning horn, and the landing gear control lever warning light. The throttles are prevented from creeping by an adjustable friction knob on the side of the console. (See figure 1-4.) When this knob is turned clockwise, the throttles may be locked in any desired position. When the knob is turned counterclockwise, the throttles are released. The maximum force required to overcome the throttles when locked by the friction knob does not exceed 17 pounds. Also incorporated in the throttles is a switch for microphone operation.

EMERGENCY FUEL CONTROL SWITCHES. The emergency fuel control system is controlled by the two emergency fuel control switches, one for each engine, on the fuel control panel. (See figure 1-5.) The panel is located immediately in front of the pilot, below the pilot's main instrument panel. When a switch is in the OFF position, the emergency fuel system for that engine is inoperative and fuel is supplied to the engine by means of the normal fuel control system. Placing the control switch in the EMERGENCY position operates the system for an emergency. When the switch is in this position, the three engine solenoid valves and one engine compressor isolator valve close and the emergency fuel valve opens, causing the engine to operate on the emergency fuel control system until the control switch is returned to the OFF position.

CAUTION

In the event of primary fuel system failure on takeoff or up to an altitude of 6000 feet, it is permissible to transfer to the emergency fuel system with throttle FULL position provided the engine speed has not dropped below 85% (7050 rpm) at the time of the transfer. Under all other conditions the throttle lever must be retarded to idle prior to the transfer. Failure to do so will result in excessive exhaust gas temperatures and rich flame-out and/or compressor stall.

EMERGENCY FUEL CONTROL INDICATOR LIGHTS. There are two amber indicator lights on the fuel control panel immediately above the emergency fuel control panel switches. (See figure 1-5.) When the emergency fuel control switch is placed in the EMERGENCY position, its respective indicator light illuminates. Power to operate the lights is supplied from the pilot's 28-volt d-c circuit breaker bus.

ENGINE COOLING SYSTEM.

During flight, cooling ram air comes from the four small circular openings and two flush air scoops located on the inside surface of the engine air intake duct. (See figure 1-6.) On the ground, cooling air comes through flush slots in the outer surface of the nose ring cowling forward of the firewall and from a door which is mechanically opened by action of the landing gear extension. Reverse air flow on the ground is caused by the low-pressure region located at the entrance to the compressor section of the engine.

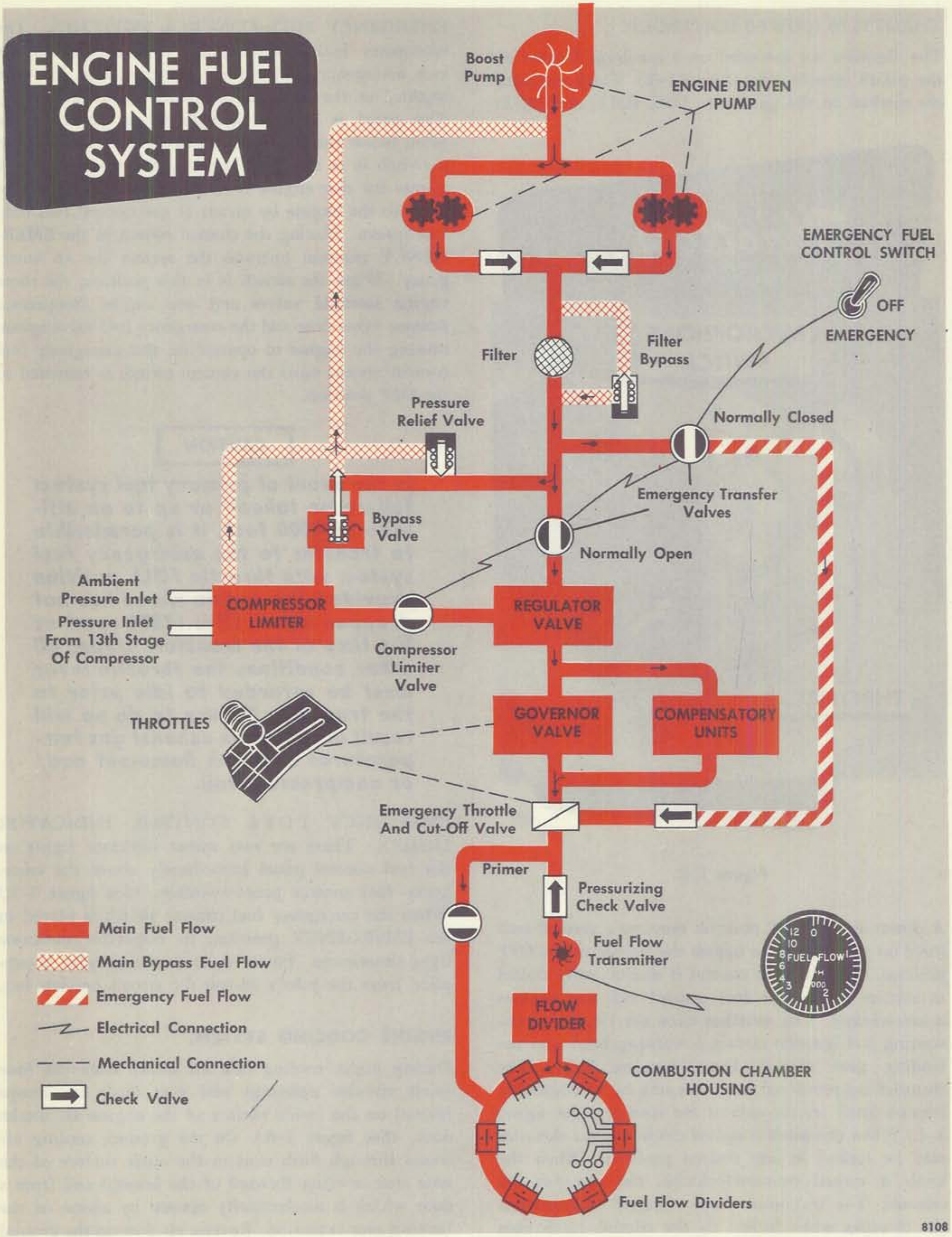

ENGINE FUEL CONTROL SYSTEM
Boost Pump
ENGINE DRIVEN PUMP
EMERGENCY FUEL CONTROL SWITCH
OFF
EMERGENCY
Filter
Filter Bypass
Pressure Relief Valve
Normally Closed
Emergency Transfer Valves
Bypass Valve
Normally Open
Ambient Pressure Inlet
Pressure Inlet From 13th Stage Of Compressor
COMPRESSOR LIMITER
REGULATOR VALVE
Compressor Limiter Valve
THROTTLES
GOVERNOR VALVE
COMPENSATORY UNITS
Emergency Throttle And Cut-Off Valve
Primer
Pressurizing Check Valve
Fuel Flow Transmitter
FUEL FLOW
FLOW DIVIDER
COMBUSTION CHAMBER HOUSING
Fuel Flow Dividers
Main Fuel Flow
Main Bypass Fuel Flow
Emergency Fuel Flow
Electrical Connection
Mechanical Connection
Check Valve
8108

Figure 1–4.

Note

If either engine ground cooling door remains open in flight, premature airframe buffet will generally occur considerably below the normal buffet limits, and a moderate yaw will be noticeable above or about 350 knots.

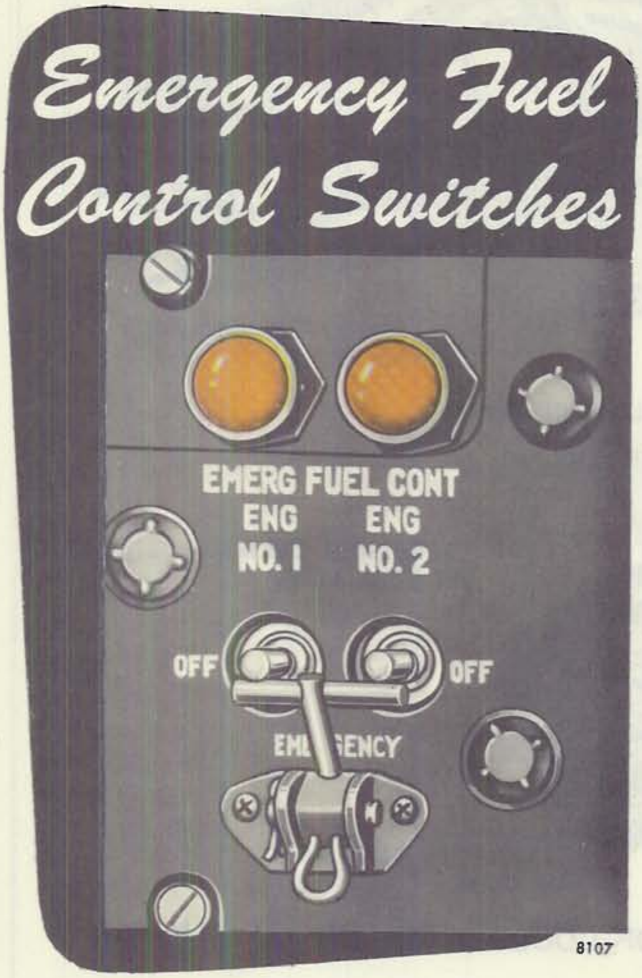


Figure 1–5.

STARTING AND IGNITION SYSTEM.

Each engine has its own starting and ignition system. The systems consist of two high tension igniters, a timer-box assembly, a fuel-primer solenoid, and an explosive-cartridge starter.

Note

The safety clip must be removed from the starter cartridge before insertion in the starter breech.

WARNING

Make sure the starting and ignition switch is in the OFF position before a cartridge is loaded in the starter breech. Take additional precautions by turning off all electrical power on the airplane. Do not load the cartridge into the starter until just prior to starting the engine. Before the engines are started, all personnel must be clear of the engine intake and exhaust areas. The high-velocity intake air can draw personnel into or against the duct, causing death or serious injury. The high exhaust temperatures and blast create danger aft of the airplane. Also, all personnel must be at least 25 feet from the starter turbine wheel before starting, in case the wheel should break loose from its bearings.

Placing the throttle in the IDLE position closes the throttle-actuated microswitch. Placing the STARTING AND IGNITION switch in the START position completes the circuit to the timer, igniters, fuel primer solenoid, and the explosive cartridge. When energized, the explosive cartridge in the starter breech (figure 1–7) starts the engine. After 15 ± 3 seconds, the timer automatically de-energizes the fuel primer solenoid and igniters. At the end of the timing cycle, engine temperature and acceleration are sufficiently high; therefore, the engine no longer requires ignition and fuel priming. For ground testing, the engine may be motored without combustion. Retaining the throttle in the OFF position stops the flow of fuel to the engine. The cranking circuit bypasses the throttle microswitch and energizes the timer, the igniters, and the cartridge.

Note

Distinct clicks over the interphone system or from outside the airplane indicate proper functioning of the ignition system.

The 28-volt d-c circuit breaker bus supplies the power to operate the system through a 15-ampere circuit breaker.

CAUTION

Make only two consecutive starting attempts. For a third attempt wait 20 minutes for engine starter cooling. If necessary, repeat this cycle after a 40-minute waiting period.

ENGINE COOLING SYSTEM

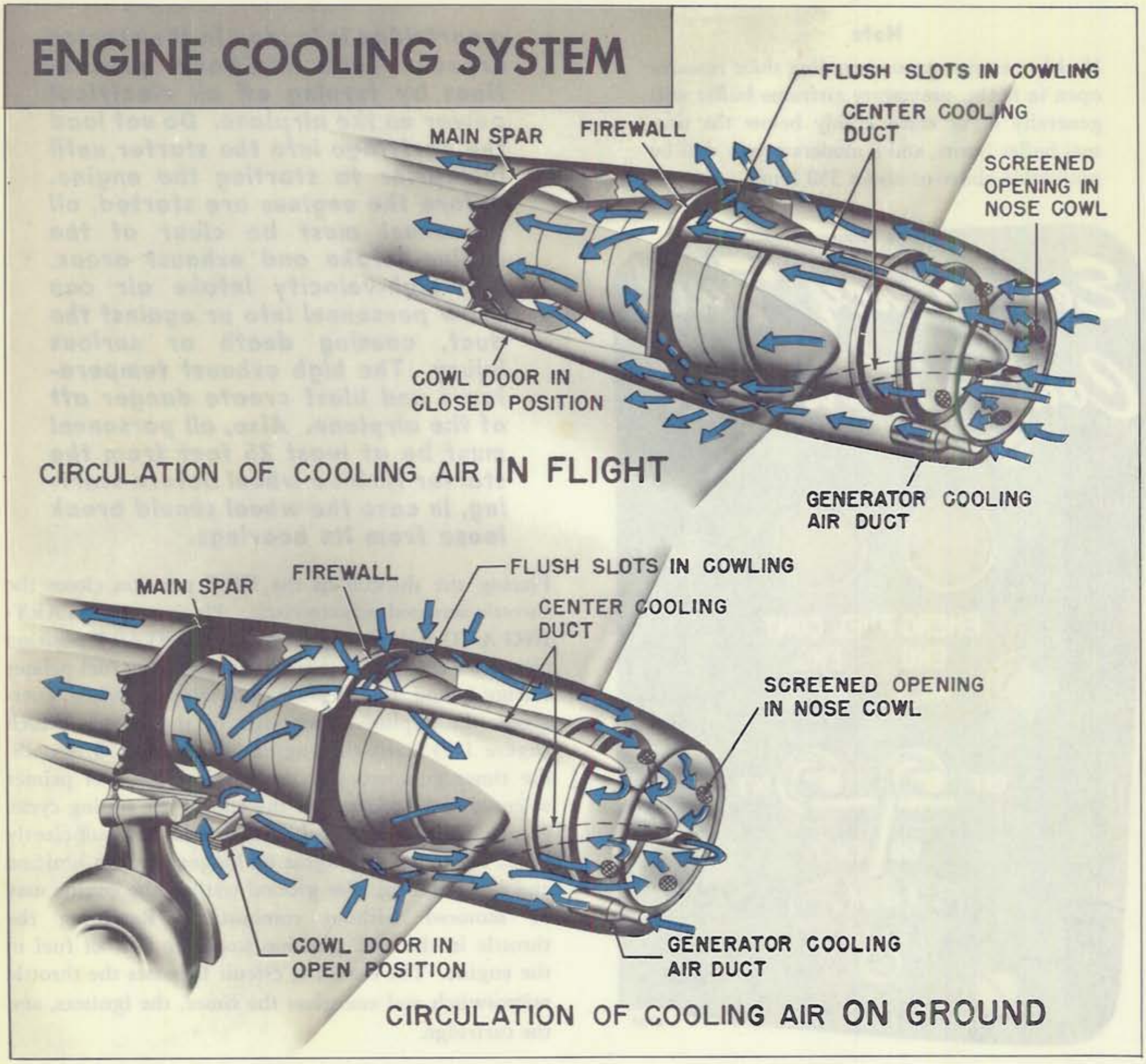


Figure 1–6.

STARTING AND IGNITION SWITCHES.
(See figure 1–8.)

Two starting and ignition switches and a throttle microswitch control the starting and ignition system. The starting and ignition switches are on the inverter control panel on the pilot's right vertical console. The switch positions are START (up), OFF (center), and CRANK ONLY (down). The switch is spring-loaded in the OFF position.

FUNCTION.

Placing the throttle in the IDLE position and the starting switch in the START position completes the starting and ignition circuit. Placing the switch in the CRANK ONLY position bypasses the throttle microswitch to complete the starting and ignition circuit. Leaving the throttle in the OFF position prevents fuel flow to the engine. Use the CRANK ONLY position for engine restarts in flight. Refer to ENGINE RESTART IN FLIGHT in Section III.

STARTER OVER-PRESSURE PROTECTION. Although the starter is designed to withstand some excess pressure, a safety device guards against dangerously high pressures. The pressure-relief device, which is an integral part of the breech, consists of a blowout disc which ruptures at approximately 1-1/2 times normal operating pressure and an over-pressure indicator pin. When the disc is sheared, the gas bypasses the turbine wheel and flows into the turbine ducting, and the indicator pin is released, detonating the sheared disc.

STARTER CARTRIDGE BREECH

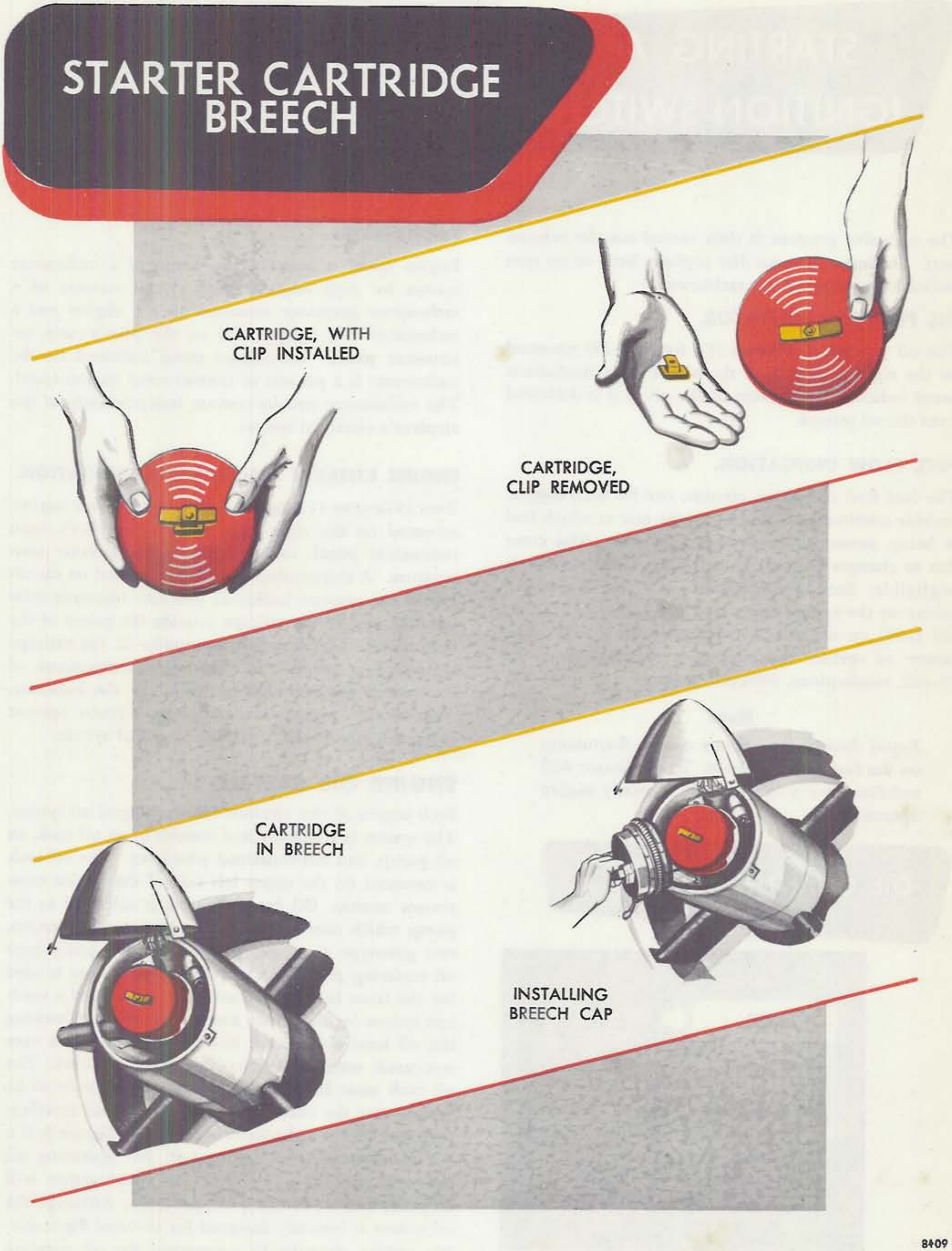


Figure 1–7.

STARTING AND IGNITION SWITCHES

Figure 1–8.

The excessive pressure is then vented out the exhaust port. During a blowout disc rupture, little or no rpm indication appears on the tachometer.

OIL PRESSURE INDICATOR.

The oil pressure indicators (12, figure 1–28) mounted on the right-hand side of the pilot's main instrument panel indicate the pressure of the oil as it is delivered from the oil pumps.

FUEL FLOW INDICATION.

The fuel flow indication circuits, one for each engine, provide continuous indication of the rate at which fuel is being consumed in pounds per hour. The error due to changes in density, temperature and altitude is negligible. Each circuit consists of a fuel flow transmitter on the engine and a fuel flow indicator (13, figure 1–28) on the pilot's main instrument panel. The power to operate the circuits is supplied from the 28-volt, single-phase, 400-cycle a-c bus.

Note

Rapid throttle movements cause a fluctuation on the fuel flow indicator. The indicator will stabilize after a few seconds of steady engine operation.

OIL QUANTITY DATA

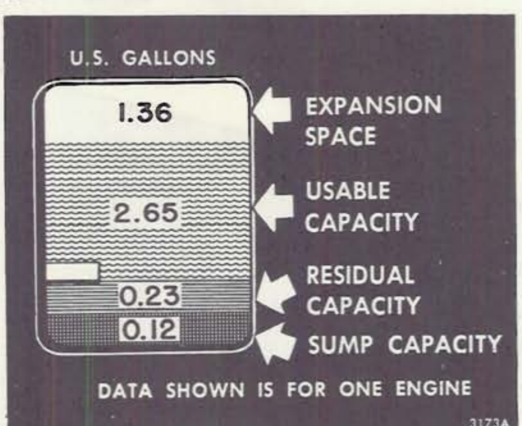


Figure 1–9.

TACHOMETER.

Engine speed is indicated by means of a tachometer system for each engine. Each circuit consists of a tachometer generator mounted on the engine and a tachometer (10, figure 1–28) on the pilot's main instrument panel. The engine speed indicated on the tachometer is a percent of normal rated output speed. The tachometer circuits operate independently of the airplane's electrical system.

ENGINE EXHAUST TEMPERATURE INDICATION.

Two indicators (11, figure 1–28), one for each engine, mounted on the right-hand side of the pilot's main instrument panel, indicate the engine exhaust temperature. A thermocouple resistor, mounted on the aft side of the pressure bulkhead, and four thermocouples installed around the tailpipe provide the source of the indications. The four thermocouples in the tailpipe are wired in parallel so the highest temperature of any one of the four will be shown on the indicator. The exhaust temperature indication circuits operate independently of the airplane's electrical system.

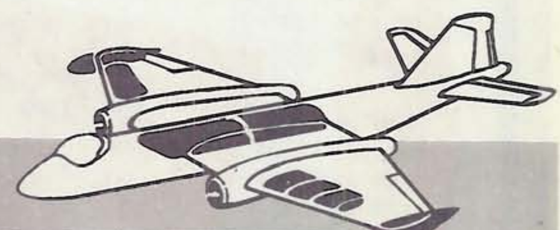
ENGINE OIL SYSTEM.

Each engine of this airplane has an integral oil system. The system is automatic and consists of an oil tank, an oil pump, and self-contained plumbing. The oil tank is mounted on the upper left side of the engine compressor section. Oil from the tank is delivered to the pump which consists of one gear-type pressure pump, two gear-type scavenger pumps, and two piston-type oil metering pumps. A circulating oil system is used for the front bearing and accessory drives and a total-loss system for the center and rear bearings. Checking the oil level by looking into the standpipe is a very inaccurate method of determining the oil level. The oil tank must be filled to overflowing in order to be certain that the tank is full. Oil grade and specifications are listed on the servicing diagram (figure 1–37). For oil capacities, see figure 1–9. For operating oil pressure, refer to figure 5–1. Oil consumption will normally run about one quart per hour. Although the oil system is basically designed for inverted flight during sudden negative G maneuvers, the oil pressure may drop to very low values and several seconds may be required to recover normal pressures. For engine oil-pressure failure, refer to Section VII.

AIRPLANE FUEL SYSTEM.

The airplane is basically equipped with four internal fuel tanks (see figure 1-11), two in the fuselage and one in the leading edge of each wing. In addition to the internal fuel tanks, an external fuel tank may be carried under each wing tip. The fuel system also includes fuel booster pumps, a shut-off valve, a transfer valve, and a fuel-level shut-off valve. The system is manually controlled by means of knobs and switches on the fuel control panel. The fuselage lines and components are arranged for a minimum vulnerability. The internal tanks are equipped with booster pumps which are installed at their outlets. The No. 1 fuselage tank booster pumps are controlled by a switch located on the fuel control panel at the pilot's station. The No. 2 fuselage tank and wing tank booster pumps operate automatically when their respective tank is selected by the fuel selector knobs on the fuel control panel. The wing tip tanks transfer fuel by means of compressed air from the engine compressors instead of booster pump pressure. The compressed air from the engine compressors is supplied continuously whenever the engines are running. This pressure is controlled by a pressure-setting check valve. However, if the pressure in the tanks exceeds five psi, the air is discharged overboard through a relief valve. The wing tip tanks also contain explosive bolts for jettisoning. Electrically operated shut-off valves, located throughout the system, control fuel flow from the tanks to the engines. During normal operation of the fuel system, fuel flows from the No. 2 fuselage tank, the wing tanks, and the wing tip tanks through the auxiliary manifold (collector) to the No. 1 fuselage tank and then through the main manifold (collector) to the engines. If necessary, the No. 1 fuselage tank may be

FUEL QUANTITY DATA IN U.S. GALLONS AND POUNDS



TANKS	CONSTRUCTION	TOTAL FUEL		TRAPPED FUEL		TOTAL USEABLE FUEL*	
		GALLONS	POUNDS	GALLONS	POUNDS	GALLONS	POUNDS
NO. 1 FUS TANK	SPLINTER PROOF SELF-SEALING	1040	6760	30	195	1010	6565
NO. 2 FUS TANK	FLEXIBLE NON-SELF-SEALING	662	4303	8	52	654	4251
R WING TANK	FLEXIBLE NON-SELF-SEALING	319	2073.5	29	188.5	290	1885
L WING TANK	FLEXIBLE NON-SELF-SEALING	319	2073.5	29	188.5	290	1885
R TIP TANK	METAL (ALU)	320	2080	NONE		320	2080
L TIP TANK	METAL (ALU)	320	2080	NONE		320	2080
BOMB DOOR FERRY	METAL	564	3666	14	91	550	3575
	TOTAL	3,544	23,036	110	715	3,534	22,321

NOTE: NO EXPANSION SPACE IS PROVIDED AS EXPANSION SPACE IS ABOVE THE VENT OUTLET, THEREFORE, ANY EXPANSION WOULD DRAIN THROUGH THE VENT OUTLET. THE ABOVE FIGURES ARE FOR GROUND (STATIC) POSITION 0.9° NOSE UP.

*THESE QUANTITIES REPRESENT THE FUEL WHICH CAN ACTUALLY BE USED. QUANTITIES SHOWN ON THE FUEL CONTROL PANEL ARE SLIGHTLY LOWER TO AFFORD A SAFETY FACTOR.

ONE GALLON OF JP-4 FUEL IS EQUAL TO 6.5 LBS.

*DATA BASIS FLIGHT TEST AS OF 9-30-55

8111

Figure 1-10.

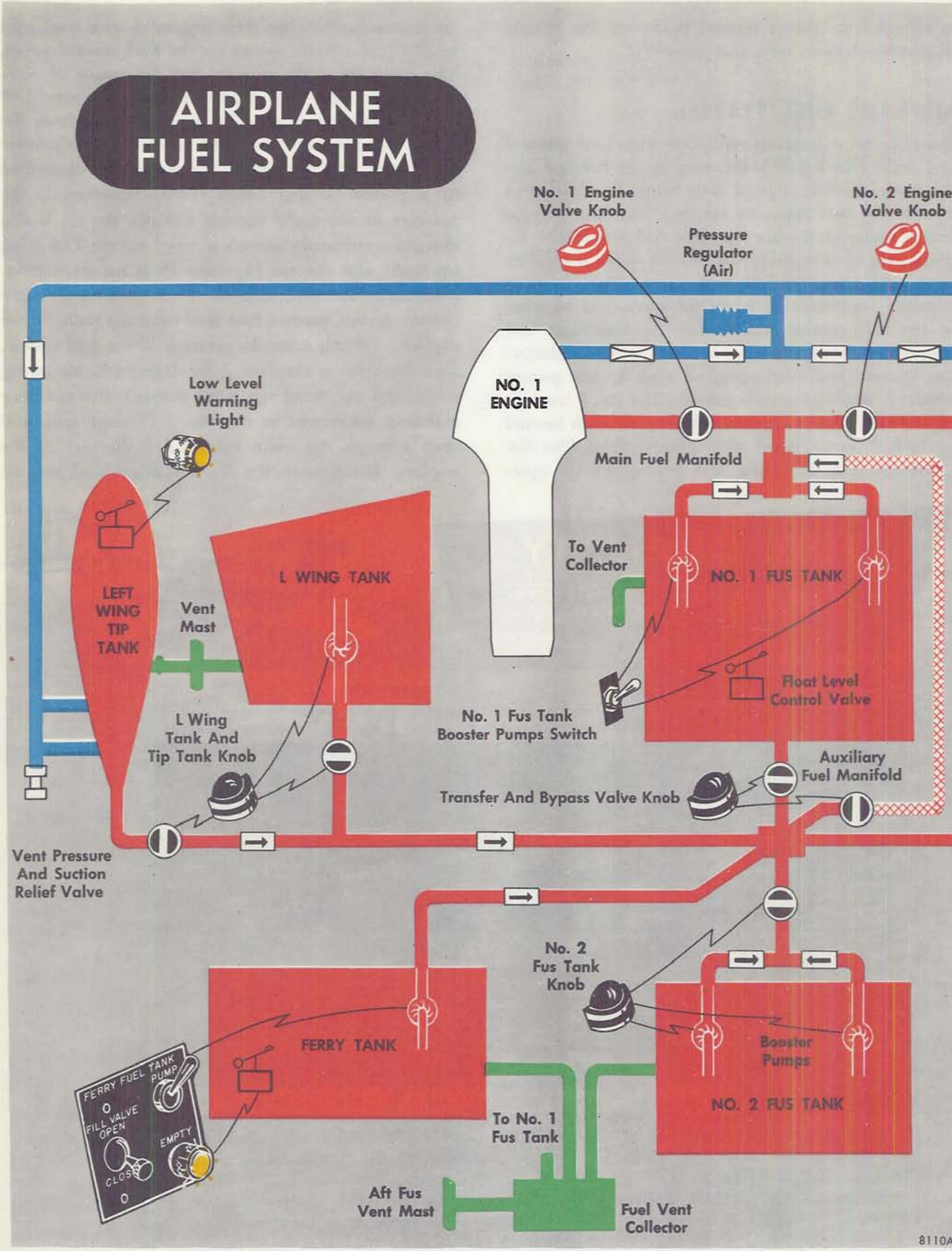


Figure 1–11. (Sheet 1 of 2)

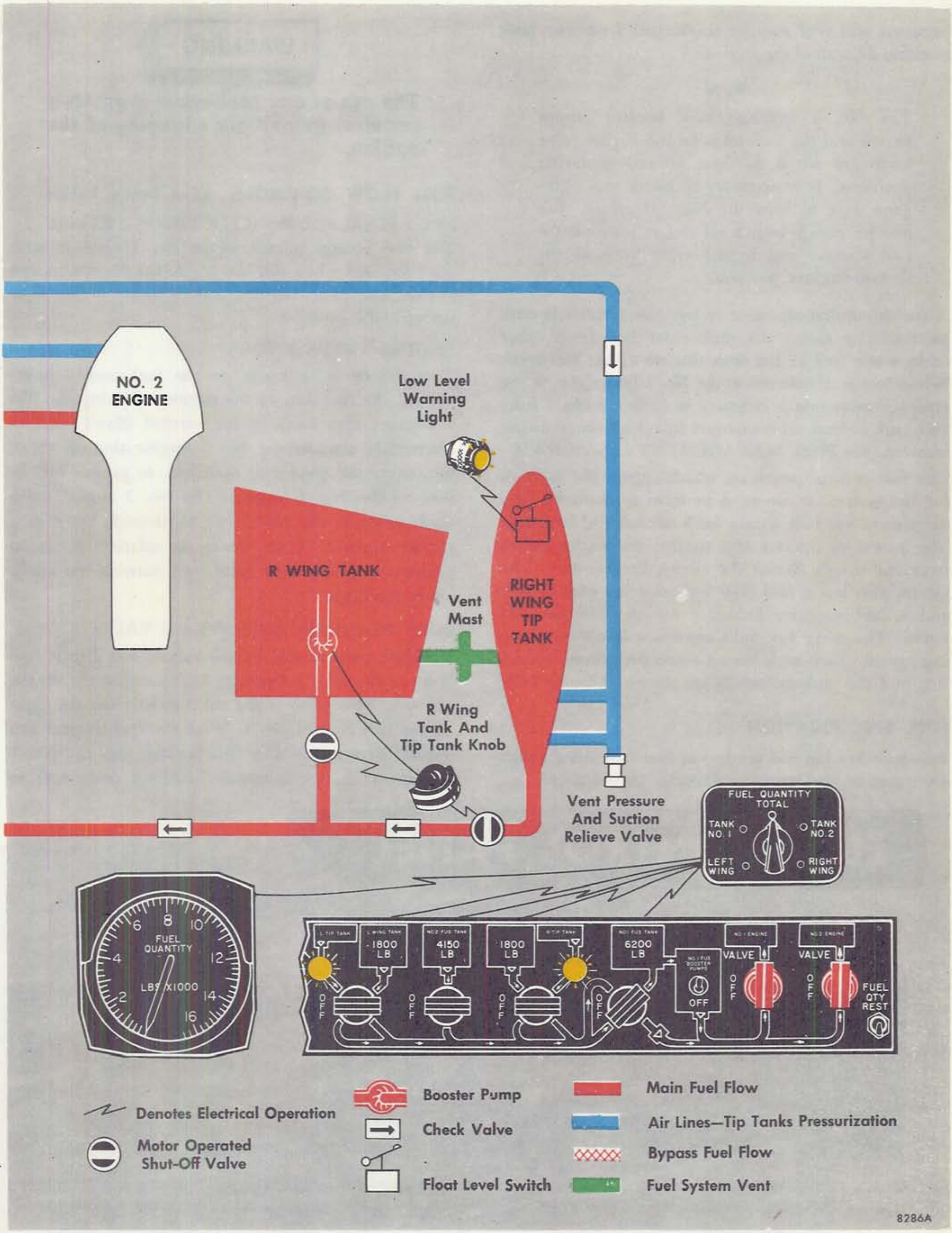


Figure 1-11. (Sheet 2 of 2)

bypassed and fuel may be transferred from any tank to either or both of the engines.

Note

The No. 1 fuselage tank booster pumps switch and the fuel transfer and bypass valve knob are wired to their normal operating positions. It is necessary to break this light-gage wire to turn the No. 1 fuselage tank booster pumps switch off and to position the fuel transfer and bypass valve knob to the flow-to-engines position.

A fuel-level shut-off valve in the No. 1 fuselage tank mechanically closes the tank inlet line from other tanks when fuel in the tank reaches a near full level. When fuel is transferred to the No. 1 fuselage tank the replenishment rate is sufficient to keep the No. 1 fuselage tank at least three-quarters full at all times during transfer. See FUEL MANAGEMENT in Section VII.

The fuel control panel, on which appear the controls for the system, is arranged to form a schematic flow diagram of the fuel system, both normal and auxiliary. The power to operate and control the system comes from the pilot's 28-volt d-c circuit breaker bus. The system also has a fuel flow indicator for each engine and a fuel quantity indicator for the internal fuel tanks. The wing tip tanks contain a low-level warning system. Each tank has an access for ground refueling, and the tank quantities are shown in figure 1–11.

FUEL SPECIFICATION.

Fuel specification and grade and fuel tank filler points are noted on the servicing diagram (figure 1–16).

WARNING

The use of any fuel other than JP–4 requires immediate changing of the engine.

FUEL FLOW CONTROLS. (See figure 1–12.)

NO. 1 FUSELAGE BOOSTER PUMPS SWITCH. The two booster pumps in the No. 1 fuselage tank are energized when the No. 1 fuselage booster pumps switch, located on the fuel control panel, is placed in the up (ON) position.

ENGINE VALVE KNOBS. Two engine valve knobs on the fuel control panel control the fuel flow to the engines. Placing the No. 1 engine valve knob in the vertical (flow) position electrically actuates the No. 1 engine shut-off valve, located at the main fuel manifold, to permit fuel to flow to the No. 1 engine. The No. 2 engine valve knob controls the No. 2 engine shut-off valve in a similar manner. These valves are safetied to the on position to prevent the pilot from turning the knobs off during flight.

FUEL TRANSFER AND BYPASS VALVE KNOB. The fuel transfer and bypass valve knob directs fuel flow to the No. 1 fuselage tank or directly to the engines. This knob is the third knob from the right on the fuel control panel. With the fuel transfer and bypass valve set to flow line leading into the No. 1 fuselage tank, the auxiliary manifold (collector) to

FUEL CONTROL PANEL

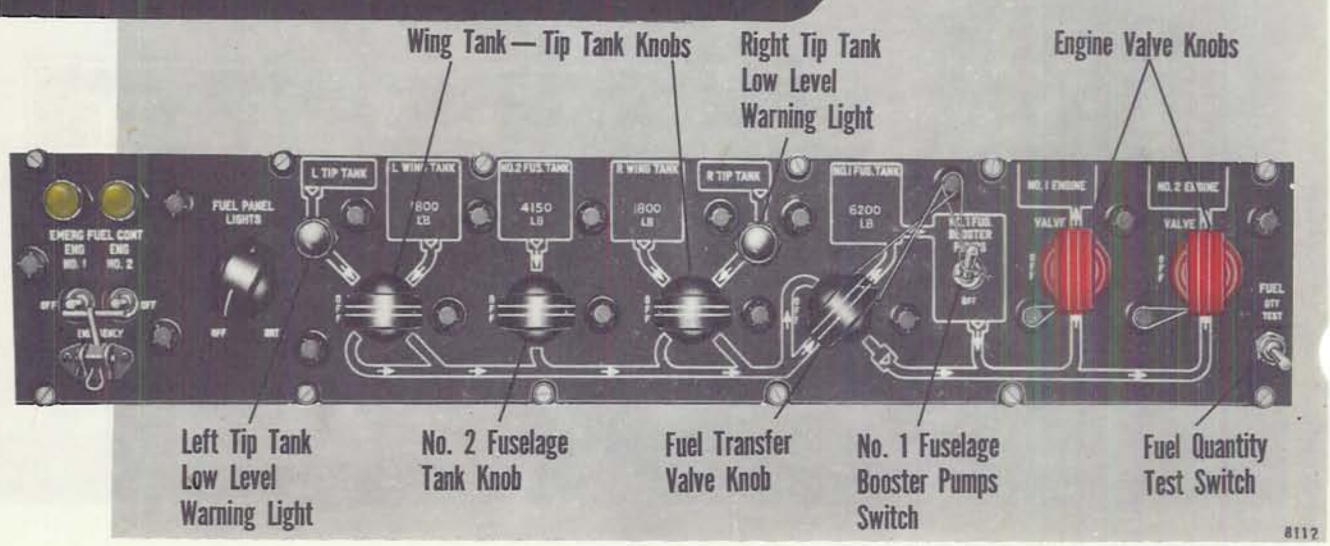


Figure 1–12.

No. 1 fuselage tank transfer valve is opened and the auxiliary manifold (collector) to main manifold (collector) transfer valve is closed. With the fuel transfer and bypass valve knob set to the flow line leading to the engines, the auxiliary manifold to main manifold transfer valve will be opened and the auxiliary manifold to No. 1 fuselage tank transfer and bypass valve will be closed. The OFF position closes both valves.

NO. 2 FUSELAGE TANK KNOB.

The No. 2 fuselage tank knob simultaneously controls the operation of the fuel shut-off valve and the two booster pumps for the No. 2 fuselage tank. With the knob in the flow position, the shut-off valve is opened and the booster pumps operate to supply fuel to the auxiliary manifold. With the knob in the OFF position, the booster pumps are de-energized and the shut-off valve is closed.

WING-TANK—TIP-TANK KNOBS.

When the left-wing-tank—left-tip-tank knob is in line with the left tip tank flow line, the left tip tank shut-off valve opens to supply fuel to the auxiliary manifold. Also when the knob is in this position, the left wing tank shut-off valve closes and its corresponding booster pump is inoperative. When the left-wing-tank—left-tip-tank knob is in line with the left wing tank flow lines, the left wing tank shut-off valve will be open, the left wing tank booster pump will be energized, and fuel will be supplied to the auxiliary manifold. With the knob in this position the left tip tank shut-off valves close. With the switch in the OFF position, both shut-off valves close and the booster pump becomes inoperative. The right-wing-tank—right-tip-tank knob selects fuel from the right wing and wing tip tanks in the same manner as the left-wing-tank—left-tip-tank knob.

WING TIP TANK JETTISON SWITCH.

The wing tip tanks are jettisoned by detonators installed in the explosive bolts which secure the tip tanks to the wings. The jettisoning is controlled by a spring-loaded switch which is protected by a red guard marked TIP TANK JETTISON. The switch on the pilot's main switch panel (panel 7, figure 1–30), when held momentarily in the jettison position, fires the explosive bolts, thus releasing both tip tanks simultaneously. Electrical power for firing the detonators comes from the 28-volt d-c distribution bus. A resistor is installed in series with each detonator to prevent a short in any one detonator from affecting the other detonators. The tip tanks may also be jettisoned by the master jettison switch. The switch is discussed under MASTER JETTISON SWITCH in Section IV.

FUEL QUANTITY INDICATOR.

The fuel quantity indicator (15, figure 1–28), mounted on the pilot's main instrument panel, is a capacitance-type fuel gage which provides visual indication of the fuel quantity in each internal fuel tank, individually, or the total of all the internal tanks. The indicator reflects the fuel quantity in pounds and compensates for temperature, density, and airplane attitude so that the reading is always a true indication of the fuel quantity. The fuel quantity indicator is dependent upon the operation of the fuel quantity selector switch and will reflect readings which are selected by the switch. The only means of checking the quantity of fuel in the wing tip tanks is the low-level warning system as described under TIP TANK LOW-LEVEL WARNING LIGHTS below. If the indicator is sticking, it can be checked by using the fuel quantity test switch. Power for the indicator is supplied from the No. 1 inverter.

FUEL QUANTITY SELECTOR SWITCH. The fuel quantity selector switch (9, figure 1–28), on the pilot's main instrument panel, selects the tank or tanks whose fuel quantity will be reflected on the fuel quantity indicator. Positioning of the switch reveals the quantity of fuel in any internal tank or the total fuel in all the internal tanks. Power for the switch comes from the No. 1 inverter.

Figure 1–13.

FUEL QUANTITY TEST SWITCH. The fuel quantity test switch, on the fuel control panel, is of the momentary type and checks any "sticking" condition of the fuel quantity indicator. (See figure 1-12.) Holding the test switch in the up position will cause the indicator pointer to rotate counterclockwise and thus relieve any sticking condition.

Note

The action of the fuel quantity test switch is slow and it must be held in the FUEL QTY TEST position for a few moments to ensure relieving any sticking condition.

TIP TANK LOW-LEVEL WARNING LIGHTS. Two tip tank low-level warning lights, one for each tip tank, are on the fuel control panel. (See figure 1-12.) As the quantity of fuel in the wing tip tanks cannot be checked by the fuel quantity indicator, the low-level warning lights are provided. When the wing-tank—tip-tank knob for one of the tip tanks is placed in the TIP TANK flow position, a circuit is completed to a float switch in the respective tank. When the quantity of fuel in the tank decreases to 30 gallons or less, the switch closes and energizes the circuit to the warning light, causing the light to come on. Power for the lights comes from the 28-volt d-c distribution bus.

Note

The tip tank low-level warning lights may come on during rapid descent or when the airplane is placed under a negative G load. After a few seconds of level flight, the fuel will settle down and the warning lights will go out.

FUEL TANK VENT SYSTEM.

The fuel tank vent system maintains a regulated pressure within the fuel tanks so that combustible fuel vapors will discharge overboard, and excessive pressure within the tanks will be relieved. Whenever fuel tank pressure reaches 0.5 psi, the corresponding vent-regulating valve opens and exhausts the vent pressure overboard through the vent masts. When the fuel tank pressure drops below 0.4 psi, the vent-regulating valve will close. The vent system services the fuselage and wing leading edge tanks only. The fuel tank vent system is electrically operated and automatically controlled whenever the fuel vent circuit breakers, located on the pilot's circuit breaker panel, are pushed in. Power for the system comes from the 28-volt d-c pilot's circuit breaker bus.

Note

Venting of the fuel from the wing vent mast when the wing tanks are full is common during the early stages of the flight. This occurs because the wing tanks have less than normal expansion space. On missions where fuel supplies are critical, be aware of this fact and use fuel out of the wing tanks during the early stages of flight.

FUEL PURGE SYSTEM.

The fuel purge system clears fuel vapors from the fuel tanks as fuel is consumed. The system is normally used on a combat mission as a safety measure to counter possible explosions or fire hazards from the fuel tanks in the event they should be damaged. The operation of the system is automatic and requires no further action by the pilot after the initial actuation. The system services all the tanks except the wing tip tanks. Power to operate the system comes from the 28-volt d-c distribution bus.

FUEL PURGE SYSTEM SWITCH.

The fuel purge system is controlled by the fuel purge switch on the pilot's auxiliary switch panel (panel 1, figure 1-30). The switch should be placed in the FUEL PURGE position prior to take-off on a combat mission to allow nitrogen to flow into the fuel tanks. Power to control the system comes from the 28-volt d-c distribution bus.

CAUTION

The switch should be placed in the FUEL PURGE position prior to take-off because some air may remain in the tanks, presenting a potential fire hazard in the event of damage.

FUEL PURGE DISCHARGE INDICATORS.

Three overboard discharge indicators are mounted in the fuselage skin just forward of the bomb bay on the right side. When the pressure in the nitrogen cylinders becomes excessive, the nitrogen discharges overboard, and this discharge is indicated by the absence of red discs in the discharge indicators.

ELECTRICAL POWER SUPPLY SYSTEM.

The 28-volt d-c system (figure 1–14) receives power from three (with provisions for a fourth) engine-driven, 300-ampere, 28-volt generators, two of which are mounted on the right engine; one 24-volt, 36-ampere hour battery; and an external power source. The external source is connected during ground service or starting through an external power receptacle. The a-c power requirements are filled by four inverters. A majority of the electrical equipment is installed in the electrical distribution center and the electrical access compartments, and the equipment is readily identified by decals adjacent to the equipment. The battery and main (No. 1) inverter are located in the forward portion of the fuselage center section. The electrical distribution center, located to the left of the observer's station, contains various power busses, relay panels, and fuse panels. The left electrical access compartment, located in the lower left portion of the nose section, aft of the pressure bulkhead, contains the No. 2 inverter, the standby instrument inverter, the battery bus, and various relays and fuses. The right electrical access compartment, located in the lower right portion of the nose section aft of the pressure bulkhead, contains the normal instrument inverter, generator control panels, the external power receptacle, and various relays, fuses, and circuit breakers. Spare lamps and fuses are provided in a kit stowed on the right side of the observer's seat immediately forward of the pressure bulkhead. Circuit breaker panels are located in the pilot's station (panel 3, figure 1–30) and on the main radio distribution box (panel 1, figure 4–19) to the left of the observer.

CAUTION

Holding a circuit breaker in the closed position creates a fire hazard.

D-C POWER SYSTEM.

The d-c power system (figure 1–14) is a 28-volt multiple-distribution system that uses the structure of the airplane for a ground return. The system is designed for single or parallel operation of the generators. Whenever the generator bus is energized, the distribution bus, the circuit breaker bus, and the d-c radio bus are also energized. In addition, the camera bus and the armament bus may also be energized. All of the circuits required for emergency conditions receive power from the battery bus. This bus is connected directly to the battery and is also connected with the generator bus from which it is energized under normal conditions. In all cases, the individual circuits and bus feeders are connected at the main busses through suitably sized limiters, or circuit breakers to protect the circuit.

GENERATOR REGULATOR AND CONTROL PANEL.

Three generator control panels, two in the right electrical access compartment and the third (with provisions for a fourth) in the equipment compartment, protect the 28-volt d-c electrical system. The panels regulate the system voltage, control the load division between generators, initiate protection against generator overvoltage, prevent connecting a generator to an energized bus when polarity of the generated voltage is reversed, and incorporate reverse-current protection by means of a reverse-current relay.

BATTERY.

The battery is in the left forward portion of the fuselage center section and is connected to the battery bus which is interconnected with the 28-volt d-c generator bus. This interconnection is controlled by a battery switch in the pilot's compartment. The snatch unit, canopy, hatch detonators, and the jettison circuit connect to the battery bus and are dependent on the battery for activation. These emergency circuits operate regardless of the position of the battery switch. When the generators are operating and are connected to the generator bus, the generator bus feeds power to the battery bus for battery bus loads and also for charging the battery. Battery bus voltage can be determined by the voltmeter on the pilot's console. The battery contains a vent system, and if the electrolyte in the battery should boil at high altitudes, the system will vent any overflow into a jar in the battery compartment.

BATTERY SWITCH. The battery switch, located on the armament and generator control panel (figure 1–31), controls the interconnection between the battery bus and the generator bus. Placing this switch in the up (on) position energizes the battery contactor and completes the circuit between the battery bus and the generator bus. Under this condition and with the generators not operating, the battery bus will supply power to take care of necessary generator bus loads in addition to battery bus loads. It is not necessary to have the battery switch on in order to energize the battery bus or operate the emergency circuits. However, the switch must be on for battery recharging.

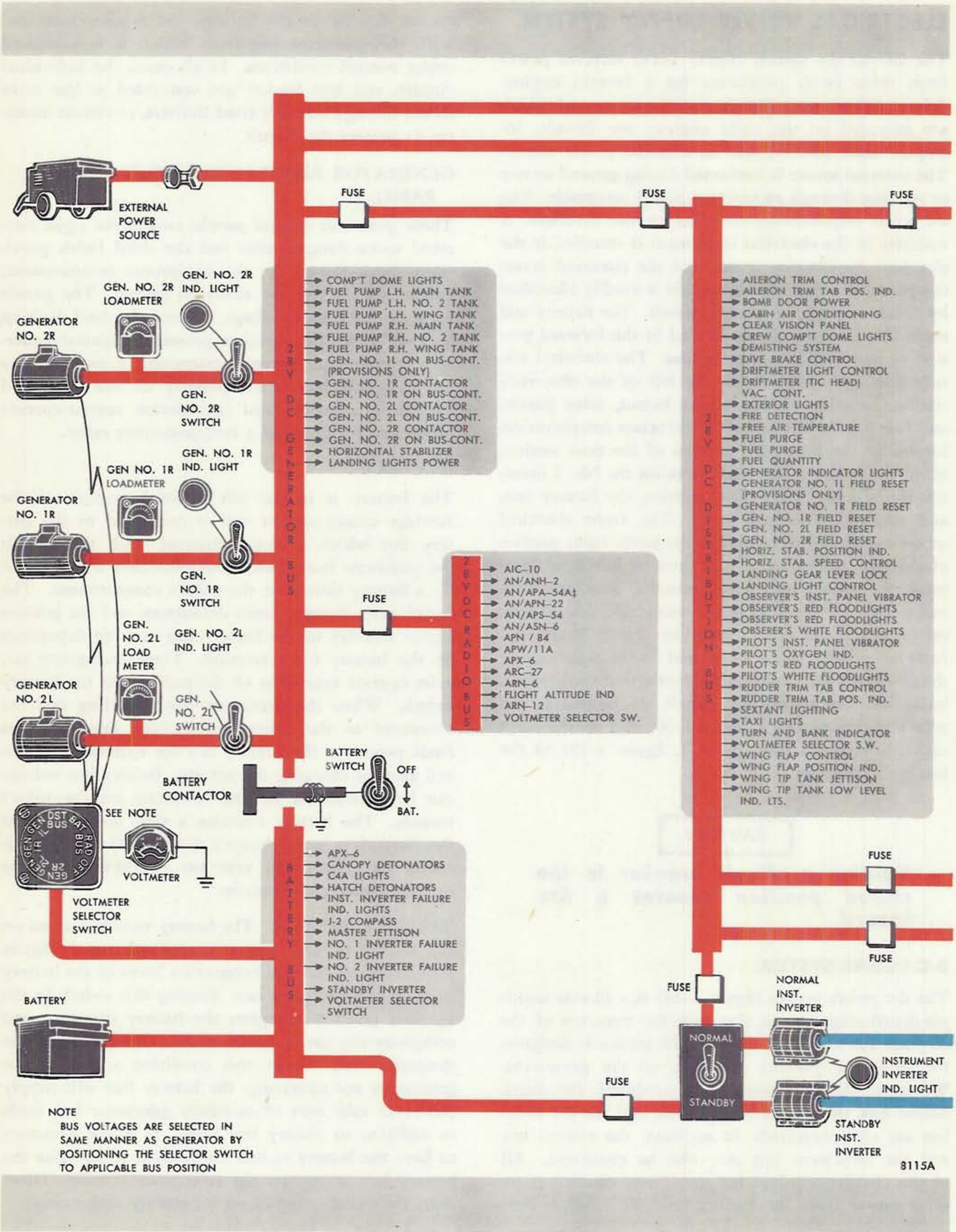


Figure 1–14. (Sheet 1 of 2)

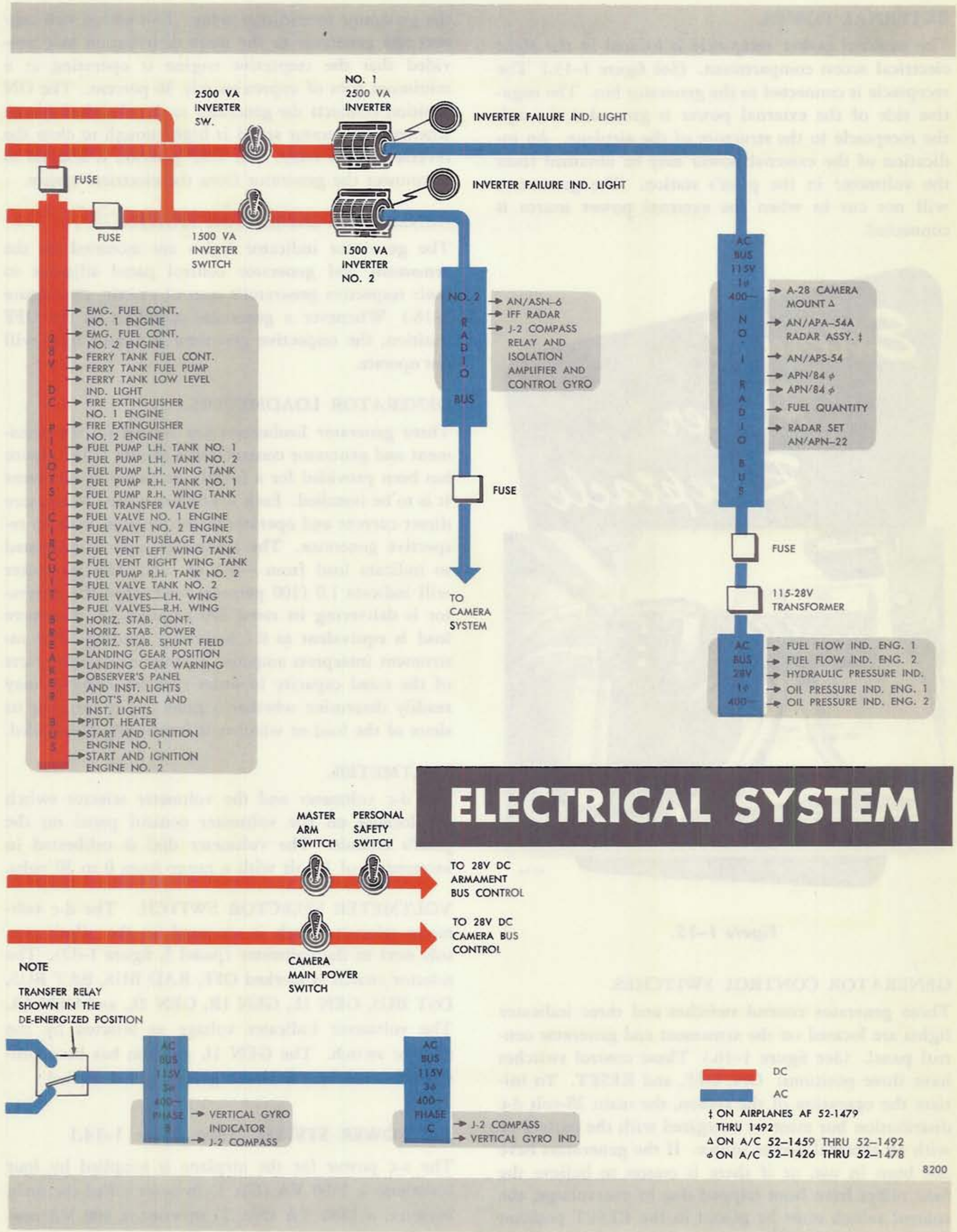


Figure 1–14. (Sheet 2 of 2)

EXTERNAL POWER.

The external power receptacle is located in the right electrical access compartment. (See figure 1–15.) The receptacle is connected to the generator bus. The negative side of the external power is grounded through the receptacle to the structure of the airplane. An indication of the external power may be obtained from the voltmeter in the pilot's station. The generators will not cut in when the external power source is connected.

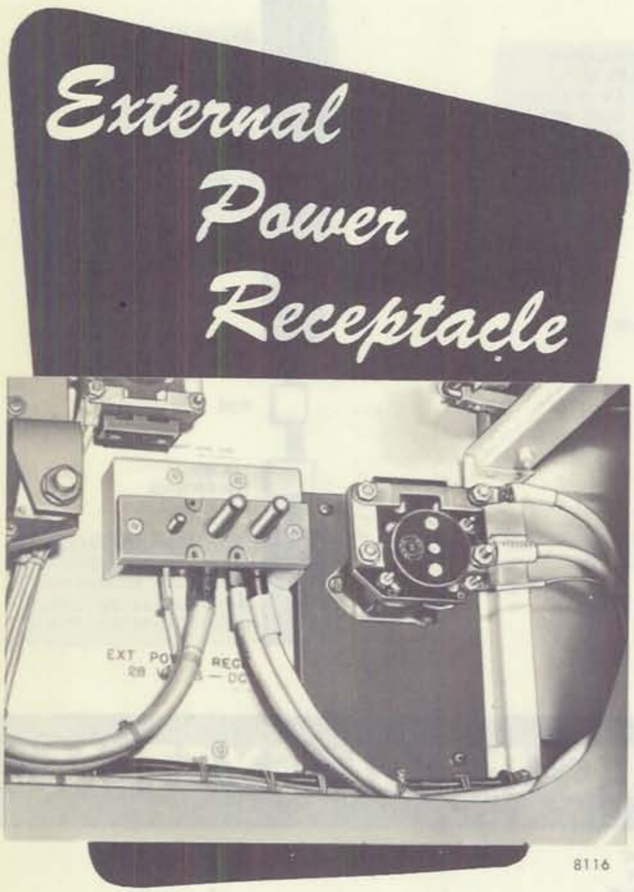


Figure 1–15.

GENERATOR CONTROL SWITCHES.

Three generator control switches and three indicator lights are located on the armament and generator control panel. (See figure 1–16.) These control switches have three positions: ON, OFF, and RESET. To initiate the operation of the system, the main 28-volt d-c distribution bus must be energized with the battery or with an external power source. If the generators have not been in use, or if there is reason to believe the field relays have been tripped due to overvoltage, the control switch must be placed in the RESET position for three seconds and then turned to the ON position. This allows the field to be re-energized and/or resets the generator overvoltage relay. This action will connect the generator to the main distribution bus, provided that the respective engine is operating at a minimum rpm of approximately 36 percent. The ON position connects the generator to the electrical system whenever generator speed is high enough to close the reverse current relay. The OFF position is selected to disconnect the generator from the electrical system.

GENERATOR INDICATOR LIGHTS.

The generator indicator lights are mounted on the armament and generator control panel adjacent to their respective generator's control switch. (See figure 1–16.) Whenever a generator switch is in the OFF position, the respective generator indicator light will not operate.

GENERATOR LOADMETERS.

Three generator loadmeters are located on the armament and generator control panel (figure 1–16). Space has been provided for a fourth loadmeter in the event it is to be installed. Each loadmeter is used to measure direct current and operates in conjunction with its respective generator. The loadmeter scale is calibrated to indicate load from —0.1 to 1.25. The loadmeter will indicate 1.0 (100 percent) load when the generator is delivering its rated 300 amperes. A 30-ampere load is equivalent to 0.1 loadmeter reading. The instrument interprets amperes in terms of decimal parts of the rated capacity in order that the observer may readily determine whether a generator is carrying its share of the load or whether it is seriously overloaded.

VOLTMETER.

The d-c voltmeter and the voltmeter selector switch are located on the voltmeter control panel on the pilot's console. The voltmeter dial is calibrated in increments of 1 volt with a range from 0 to 30 volts.

VOLTMETER SELECTOR SWITCH. The d-c voltmeter selector switch is mounted on the pilot's console next to the voltmeter (panel 3, figure 1–32). The selector switch is marked OFF, RAD BUS, BAT BUS, DST BUS, GEN 1L, GEN 1R, GEN 2L, and GEN 2R. The voltmeter indicates voltage as selected by the selector switch. The GEN 1L position has been provided in the event a fourth generator is installed.

A-C POWER SYSTEM. (See figure 1–14.)

The a-c power for the airplane is supplied by four inverters: a 2500 VA (No. 1) inverter called the main inverter, a 1500 VA (No. 2) inverter, a 100 VA normal instrument inverter, and a 100 VA standby instrument inverter. The a-c power distribution system consists of one 115-volt, single-phase, a-c bus, two 115-volt, 3-phase, a-c busses, one 28-volt single-phase, a-c bus, and two 115-volt, single-phase, a-c radio busses. The radio busses are in the radio junction box, and the others are in the electrical distribution center.

The 115-volt, single-phase bus is energized directly from the main inverter. This bus in turn supplies power to the No. 1 radio bus and to the fuel quantity system.

In addition, the 115-volt bus energizes the 28-volt, single-phase bus through a stepdown transformer. The 28-volt bus supplies power for fuel flow and oil pressure indication. The No. 1 radio bus supplies power to various a-c operated electronic equipments. The No. 2 radio bus is energized by the 1500 VA inverter and supplies power to electronic and gyro compass circuits. This inverter also supplies power to the camera system. The 115-volt, 3-phase, a-c bus is energized through a transfer relay by either the normal instrument inverter or the standby instrument inverter. This bus supplies power to the gyro compass, the attitude gyro, and the inverter failure indicator and transfer relay circuits.

MAIN INVERTER SWITCHES.

The 2500 VA (No. 1) and the 1500 VA (No. 2) inverters are controlled by the No. 1 and No. 2 inverter switches located on the pilot's main switch panel. (See figure 1–17.) Placing these switches in the on position completes a circuit to supply 28-volt d-c power from the generator bus to the inverters. The 2500 VA inverter will supply power to the 115-volt single-phase bus, and the 1500 VA inverter will supply power to the No. 2 radio bus. Power to operate the inverters comes from the pilot's circuit breaker bus through the inverter control circuit breakers on the pilot's circuit breaker panel.

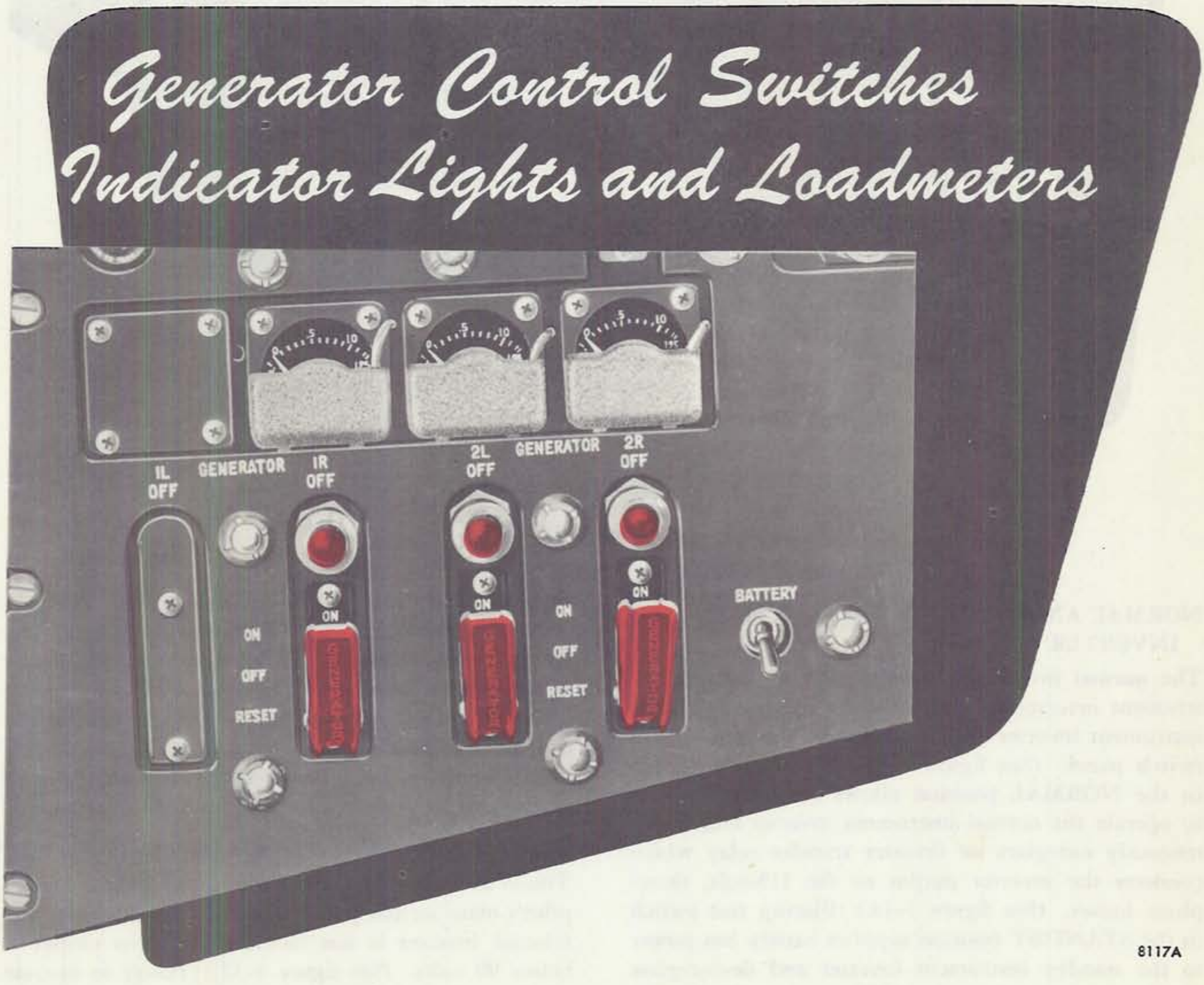


Figure 1–16.

Figure 1–17.

NORMAL AND STANDBY INSTRUMENT INVERTER SWITCH.

The normal instrument inverter and the standby instrument inverter are controlled by the three-position instrument inverter switch located on the pilot's main switch panel. (See figure 1–17.) Placing the switch in the NORMAL position allows 28-volt d-c power to operate the normal instrument inverter and simultaneously energizes an inverter transfer relay which connects the inverter output to the 115-volt, three-phase busses. (See figure 1–14.) Placing this switch in the STANDBY position supplies battery bus power to the standby instrument inverter and de-energizes the inverter transfer relay. When the relay is de-energized, it connects the output power of the standby inverter to the 115-volt, three-phase busses. The neutral (off) position of the switch also de-energizes the transfer relay. However, at the same time, the circuit to the standby inverter will be opened and the inverter will not operate. Power to operate and control the normal instrument inverter is supplied by the 28-volt d-c distribution bus. Power to operate the standby instrument inverter is supplied from the battery bus.

INVERTER FAILURE INDICATOR LIGHTS.

Three red inverter failure indicator lights on the pilot's main switch panel will come on whenever the selected inverter is not functioning or its output is below 90 volts. (See figure 1–17.) Power to operate the inverter failure indicator lights comes from the battery bus.

HYDRAULIC SYSTEM.

The airplane has a hydraulic system (figure 1–19) of the closed-center type. The system is pressurized whenever the engines are running and supplies the power for normal operation of the nose and main landing gear, the landing gear doors, the wing flaps, the bomb door, the dive brakes, the wheel brakes, and the camera doors. The storage tank for the system is a reservoir of the pressurized, integral-filter type. Located in the right wing, the tank can be serviced through an access door in the upper surface of the wing. The tank cannot be filled in flight. The fluid specification is shown in the servicing diagram, (figure 1–37). The tank contains an isolated supply of emergency fluid which can supply the hand pump with fluid in the event of failure of the main hydraulic system. The emergency supply is of sufficient volume only to open both the bomb door and to extend the landing gear. The reservoir is pressurized by means of a line connected to high-pressure ducting supplied from the engine compressor bleed line. This pressurized line is equipped with a pressure regulator which maintains constant pressure on the reservoir, thereby assuring a supply of fluid to the two engine-driven pumps at all times. A restrictor minimizes the amount of air that will enter the reservoir in case the regulator should fail. Hydraulic pressure is supplied to the system by two engine-driven, constant-displacement pumps. There is one pump mounted on the auxiliary gear box of each engine. The pump pressure is controlled by a regulator which is set to cut out at 3000 +100 −0 psi. The main accumulator is attached to the common pressure line, and another accumulator, smaller in volume than the main accumulator, is isolated from the system and stores fluid under pressure for operation of the wheel brakes. The control valves in the various sub-circuits do not have a neutral position. The valves are always positioned so that there is pressure on one side or the other of the operating cylinder at all times. Hydraulic fuses protect against fluid loss in the event of hydraulic line rupture. If a line protected by these fuses ruptures, the fuse stops the flow of fluid into the ruptured line. A manual bypass valve in the right wheel well allows the ground crew to close the gear door to facilitate bomb loading. A bomb door shut-off valve is installed in the bomb bay for safety of ground personnel and ground positioning of the bomb door. This valve must be opened prior to flight, otherwise the pilot will have no control over bomb door operation. Emergency provisions for the hydraulic system are fuses, a wheel brake accumulator isolated from the main system by a check valve, and a hand pump with a duplicate pressure line to the control valves for landing gear and bomb door operation. A manual ground shut-off valve insulates the hand pump circuit from the main system. There are two hydraulic pressure gages, one to indicate the pressure in the common line and the other to indicate the pressure in the wheel brake circuit.

HYDRAULIC HAND PUMP.

The hydraulic hand pump, located at the right-hand side of the pilot's seat, is used for emergency in-flight operation of the bomb door and landing gear and for ground operation by the ground crew. (See figure 1–18.) In rare cases, the hand pump may also be used for other sub-circuits in the system as described under BRAKE SYSTEM FAILURE in Section III. The hand pump obtains fluid directly from the reservoir. A branch line connects the hand pump to the main system through a ground shut-off valve. An emergency branch line connects the hand pump to the landing gear control valve and then to the bomb door supply line. With the landing gear lever in the UP position, the emergency section of the control valve is connected to the emergency pressure line routed to the bomb door control valve. Approximately 30 to 50 strokes on the hand pump are necessary to open the bomb

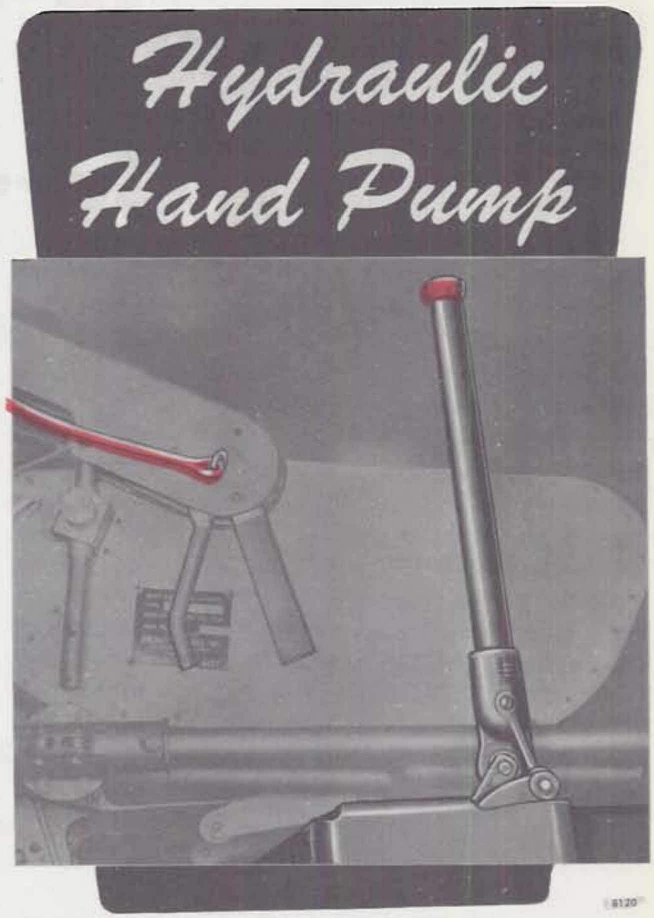


Figure 1–18.

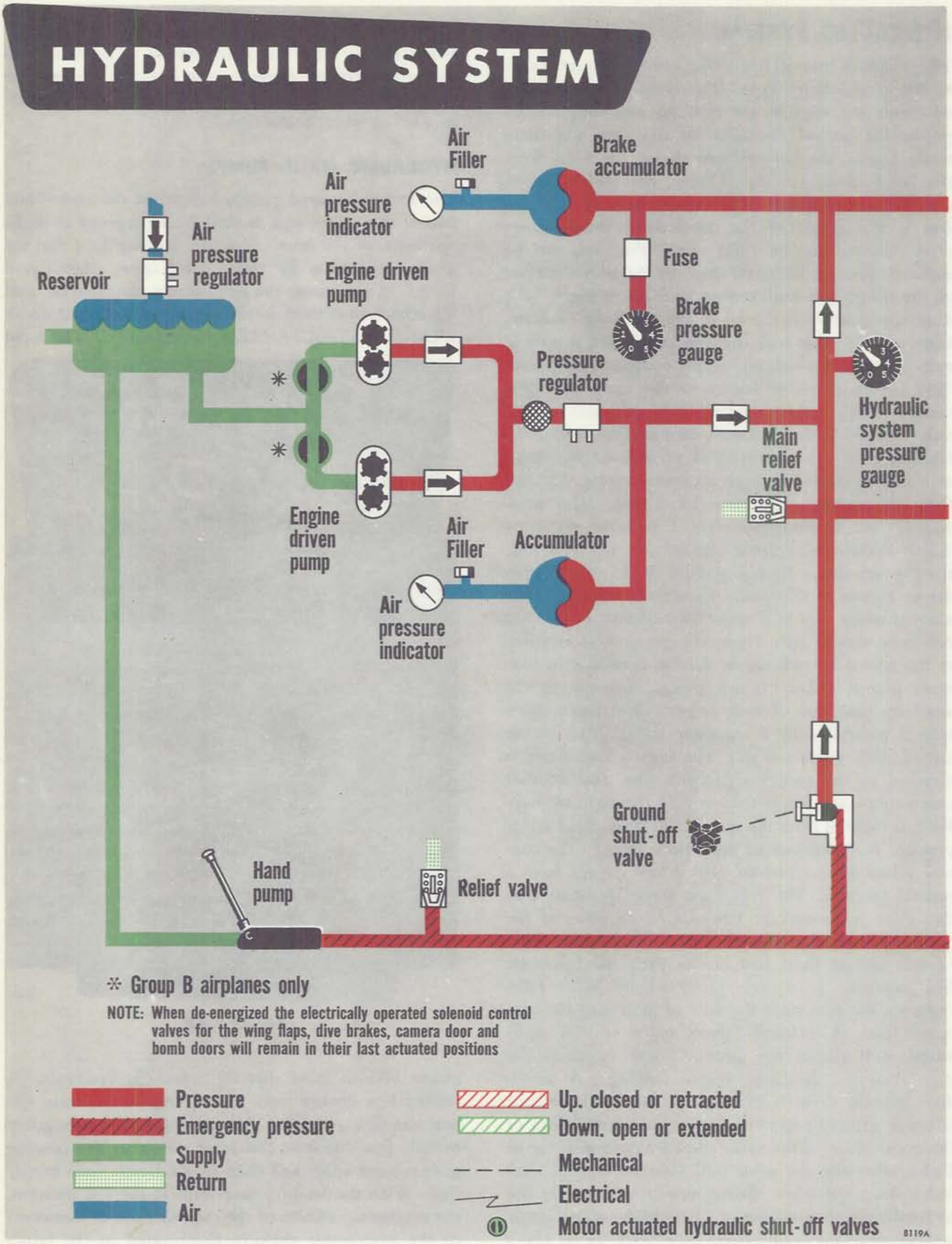


Figure 1–19. (Sheet 1 of 2)

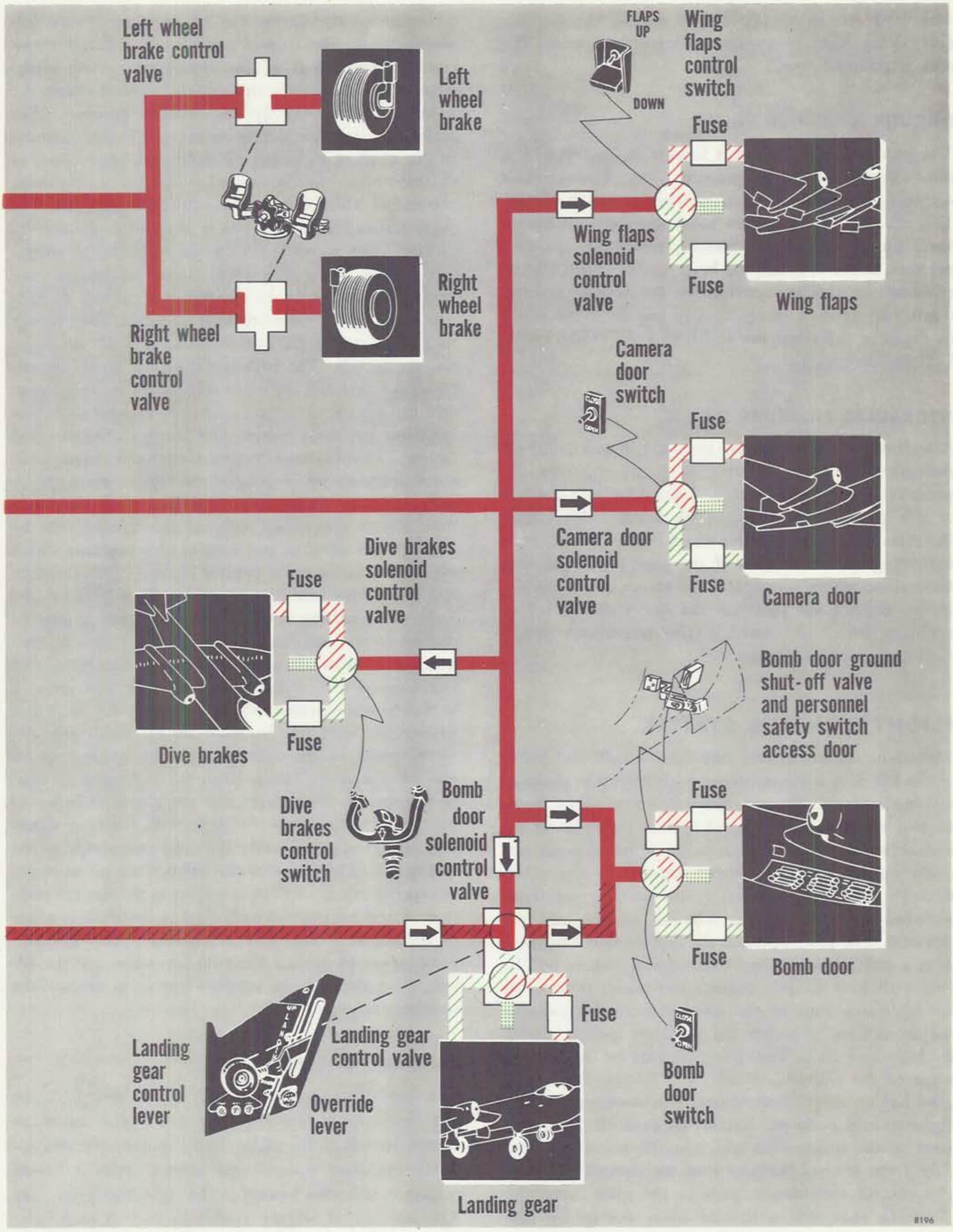


Figure 1-19. (Sheet 2 of 2)

door, and 100 to 150 strokes to extend the landing gear. Very light resistance is encountered when the gear is pumped down.

GROUND SHUT-OFF VALVE.

The ground shut-off valve is located to the left of the pilot's seat on the compartment floor. This valve is manually operated and is safety-wired closed for flight. The shut-off valve is used to connect the hydraulic hand pump into the common pressure line so that pressure in the line may be built up for ground operation of the various sub-circuits. In the event of extreme emergencies, the pilot may use the valve while in flight as described under BRAKE SYSTEM FAILURE in Section III.

HYDRAULIC PRESSURE GAGES.

A hydraulic system pressure gage (11, figure 1–29) on the pilot's auxiliary instrument panel indicates the pressure in the common line. Immediately to the left of this gage is another gage (9, figure 1–29) which indicates the pressure in the wheel brake circuit. Each indicating system consists of the gage and a pressure transmitter which is connected to its respective circuit. If the engines are running, the gages should reflect readings which fall within the instrument range markings given in Sectnon V.

FLIGHT CONTROL SYSTEM.

The flight control system (see figures 1–20 and 1–21) of the RB-57A is conventional with respect to the control surfaces and unique with respect to other flight control systems. The control system incorporates no hydraulic boost system. System operation depends entirely upon twisting moments applied by the pilot, through control movements to torque-tube-and-blowback-rod assemblies in the ailerons, rudder, and left elevator. The pilot operates the flight control surfaces with a control wheel and column and rudder pedals. Push-pull rods directly connect the pilot's controls to the blowback rods of the torque-tube-and-blowback-rod assemblies. Another rod connects spring tabs to the blowback rods. The spring tabs are on the trailing edges of the ailerons, rudder, and left elevator. The pilot has no *direct* control over the movement of the flight control surfaces. Rather, he controls the movement of the spring tabs which aerodynamically force ("fly") the control surfaces into the desired position. The control movements made by the pilot rotate the blowback rods, which in turn move the spring tabs in the opposite direction from which the pilot desires to move the control surface. For example, an upward deflection of the spring tab causes a downward displacement of the control surface. The aerodynamic reaction resulting from placing the spring tabs in the airstream passing over the control surfaces causes the control surfaces to "fly" to another position. The amount of control surface movement is proportional to the amount of spring-tab deflection. Movement of the blowback rod also loads (twists) the torque tube, one end of which is attached to the blowback rod. The other end of the torque tube is attached to the control surface. The twisting action spring-loads the torque tube which, in an attempt to regain its normal position, gives an assist in moving the control surface. The torque tube gives an assist only, and the primary force that moves the control surface is the action of the spring tab. The trim-actuating system of the airplane acts through the flight control system for aileron and rudder trim, and through the variable-incidence stabilizer for the elevator. Operating the aileron and rudder trim switches energizes electrically driven jack-screw actuators which preload the flight control system and cause the spring tabs to deflect. This deflection then allows the spring tabs to act as trim tabs by "flying" the ailerons and rudder to a position which overcomes undesirable control forces. The variable-incidence stabilizer allows longitudinal trim of the airplane by raising and lowering the trailing edge of the horizontal stabilizer thus providing nose-up and nose-down trim changes. Actuating the horizontal stabilizer-aileron trim control switch energizes a motor-driven actuator which operates the incidence adjustment unit. A balance tab on the right elevator works in conjunction with the spring tab on the left elevator. The balance tab is hinged so that, as the spring tab deflects and the elevators begin to move, the balance tab also deflects in the same direction and at approximately the same magnitude as the spring tab. The action of the balance tab serves to aid the spring tab to "fly" the elevator to the desired position. Fixed trim tabs are attached to the trailing edges of the ailerons. The 28-volt d-c distribution bus supplies power to operate the trim actuators, and the 28-volt d-c generator bus supplies power to operate the stabilizer actuator.

CONTROL COLUMN.

The control column contains a thumb switch in the left handgrip of the wheel for dive brake control, a thumb switch in the right handgrip for variable-incidence stabilizer control and aileron trim, a bomb-release switch, also located in the right handgrip. (See figure 1–22.) A trigger is also located in each grip. The trigger in the left handgrip is a roger switch for the AN/APW–11A Radar Set, but the trigger in the

FLIGHT CONTROL SYSTEM

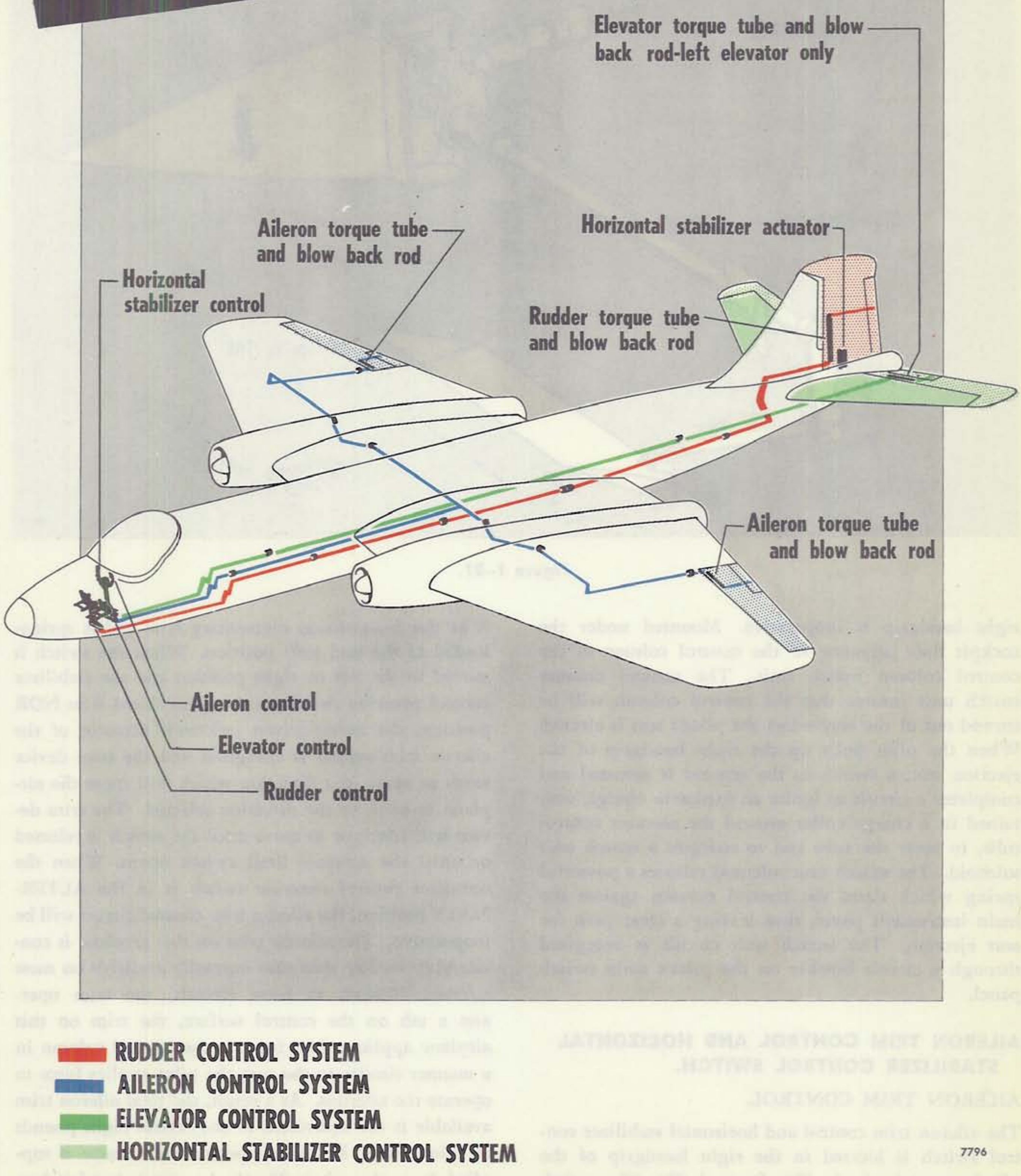


Figure 1–20.

TORQUE TUBE AND BLOWBACK ROD OPERATION

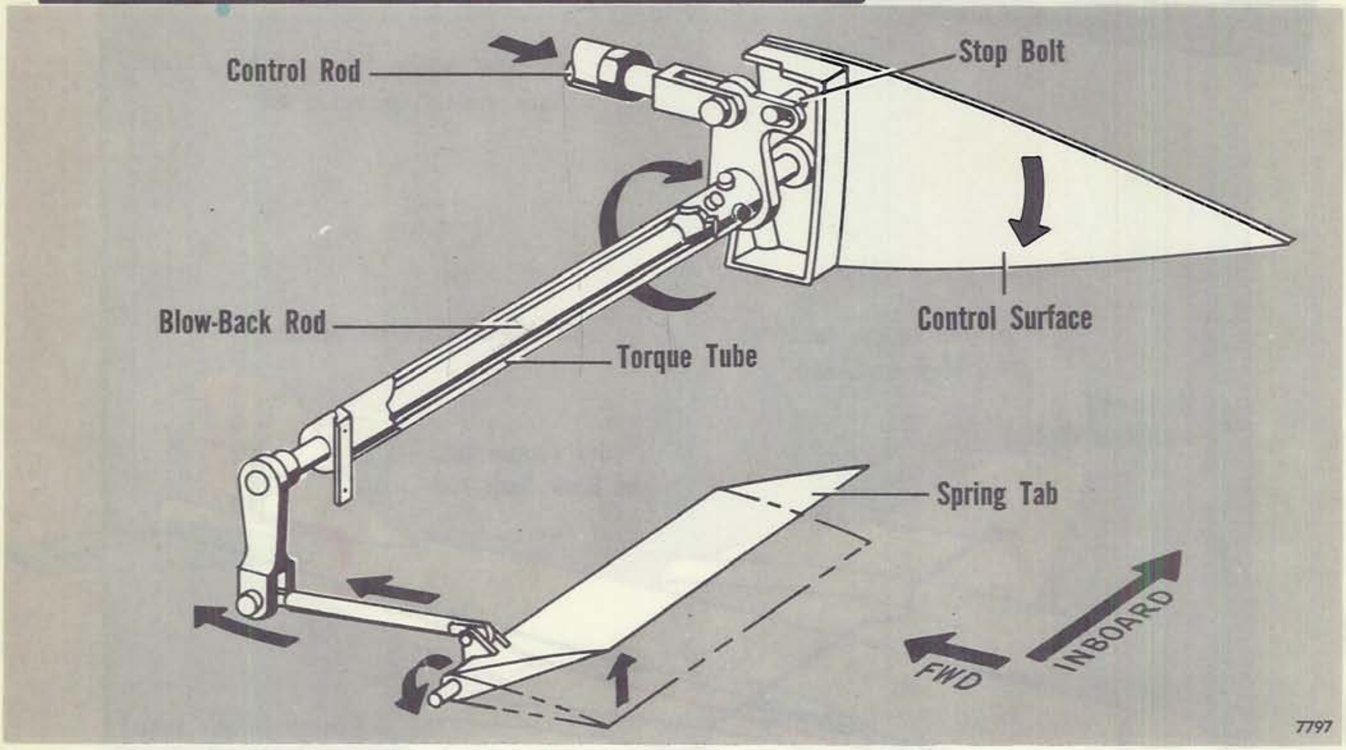


Figure 1–21.

right handgrip is inoperative. Mounted under the cockpit floor adjacent to the control column is the control column snatch unit. The control column snatch unit insures that the control column will be stowed out of the way when the pilot's seat is ejected. When the pilot pulls up the right handgrip of the ejection seat, a switch in the armrest is actuated and completes a circuit to ignite an explosive charge, contained in a charge collar around the elevator control tube, to sever the tube and to energize a snatch unit solenoid. The snatch unit solenoid releases a powerful spring which slams the control column against the main instrument panel, thus leaving a clear path for seat ejection. The snatch unit circuit is energized through a circuit breaker on the pilot's main switch panel.

AILERON TRIM CONTROL AND HORIZONTAL STABILIZER CONTROL SWITCH.

AILERON TRIM CONTROL.

The aileron trim control and horizontal stabilizer control switch is located in the right handgrip of the pilot's control wheel. (See figure 1–22.) The switch is of the five-position momentary type and is spring-loaded to the mid (off) position. When the switch is moved to the left or right position and the stabilizer control override switch on the glare shield is in NOR position, the motor-driven jackscrew actuator of the aileron trim system is energized and the trim device tends to move in a direction which will cause the airplane to bank in the direction selected. The trim device will continue to move until the switch is released or until the actuator limit switch opens. When the stabilizer control override switch is in the ALTERNATE position, the aileron trim control circuit will be inoperative. The aileron trim on this airplane is considerably weaker than that normally available on most aircraft. Where, in most aircraft, the trim operates a tab on the control surface, the trim on this airplane applies a bias force at the control column in a manner similar to the way the pilot applies force to operate the ailerons. As a result, the total aileron trim available is the equivalent of only about eight pounds of pilot effort. Power to operate the actuator is supplied from the pilot's 28-volt d-c circuit breaker bus.

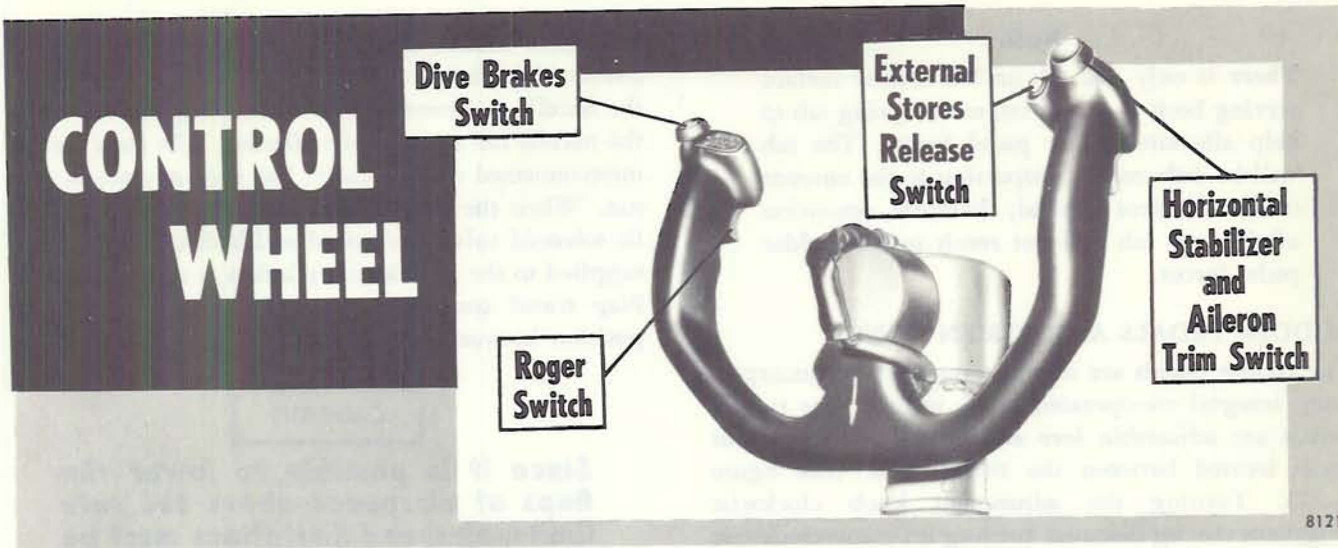


Figure 1–22.

HORIZONTAL STABILIZER TRIM CONTROL.

Movement of the horizontal stabilizer and aileron trim control switch in a vertical direction gives control of the variable-incidence horizontal stabilizer. Holding the switch in its down (aft) position energizes a motor-driven, jackscrew actuator, causing the aft portion of the stabilizer to move upward and the nose of the airplane to rise. Conversely, holding the switch in the up (forward) position causes the aft portion of the stabilizer to move down and the nose of the airplane to drop. When the stabilizer control override switch is in the alternate (ALT) position, stabilizer control through the switch on the control wheel will be inoperative.

CAUTION

Although this switch is spring-loaded to the neutral (off) position, it should always be moved manually to the neutral position. Longitudinal trim at high airspeeds should be used with care since the actuating speed of the horizontal stabilizer makes small trim corrections difficult.

The switch supplies power from the pilot's 28-volt d-c circuit breaker bus through two circuit breakers on the pilot's circuit breaker panel.

STABILIZER CONTROL OVERRIDE SWITCH.

The stabilizer control override switch on the pilot's glare shield (figure 1–29) has two positions, NORMAL and ALTERNATE. In the event of stabilizer control failure, the stabilizer control override switch is placed in the ALTERNATE position. This action isolates the aileron trim control and horizontal stabilizer control switch circuit and connects the stabilizer actuator with the stabilizer emergency control switch circuit. Control of the stabilizer may now be obtained by means of the emergency control switch.

Note

When the override switch is in the ALTERNATE position, control of aileron trim cannot be effected.

STABILIZER EMERGENCY CONTROL SWITCH.

The stabilizer emergency switch on the pilot's glare shield (figure 1–29) is provided so that in the event of failure of the normal stabilizer circuit, control of the stabilizer can still be maintained. When normal stabilizer control power fails, control can be effected by placing the stabilizer control override switch in the ALTERNATE position. This isolates the normal control circuit and connects the stabilizer actuator to the stabilizer emergency control switch circuit. Movement of the stabilizer can then be controlled by the emergency switch in exactly the same manner as the normal control switch; that is, the forward position both of the normal and of the emergency switch will produce identical movement of the stabilizer, as will the aft position of both switches.

RUDDER TRIM CONTROL SWITCH.

The rudder trim control switch is located on the flap and trim control panel immediately aft of the throttles. (See figure 1–23.) When the switch is held in the NOSE LEFT or NOSE RIGHT position, a motor-driven jackscrew actuator is energized, and the trim device tends to move in a direction which causes the airplane to yaw in the direction selected. The trim device will continue to move until the switch is released or until the actuator limit switch opens. Power to operate the actuator is obtained from the 28-volt d-c distribution bus.

Note

There is only one tab on the rudder surface serving both as a trim tab and a spring tab to help alleviate rudder pedal forces. The tab will be deflected in proportion to the amount of rudder force applied; therefore, operation of the trim tab will not result in less rudder pedal forces.

RUDDER PEDALS ADJUSTMENT KNOB.

The rudder pedals are of the common type, incorporating integral toe-operated brake pedals. The rudder pedals are adjustable fore and aft by an adjustment knob located between the two pedals. (See figure 1–24.) Turning the adjustment knob clockwise lengthens the leg distance; turning it counterclockwise shortens the leg distance. The pilot's seat is vertically adjustable and, when operated in conjunction with the rudder pedal adjustment, it allows the pilot to find a comfortable position.

TRIM POSITION INDICATORS.

The aileron and rudder trim position indicators (6, figure 1–32) are located on the pilot's main switch panel. Because of the design of the rudder and aileron trim control systems, the indications appearing on the indicators represent movement of the actuator jackscrews and not the actual movement of the trim devices themselves. The rudder trim indicator reflects the true position of the device only when the rudder is against its mechanical stops or when it is subject to an airload. The aileron trim indicator will reflect the true position of the device only when the ailerons are subject to an airload. Power for the indicators comes from the 28-volt d-c distribution bus.

VARIABLE-INCIDENCE HORIZONTAL STABILIZER POSITION INDICATOR.

The variable-incidence horizontal stabilizer position indicator (5, figure 1–32) is located on the pilot's main switch panel. A transmitter, integral with the actuator, picks up changes in the actuator position and relays them to the indicator. Unlike the other trim indicators in this airplane, the stabilizer position indicator reflects the true movement of the stabilizer, and approximately 1.5° of nose-up trim and 2.5° of nose-down trim is available. The indicator is calibrated to show the relative position of the stabilizer from neutral to up or down. Power for the indicator is supplied from the 28-volt d-c distribution bus.

WING FLAP SYSTEM.

The wing flap system consists of two inner and two outer split-type flaps hinged to the trailing edges of the wings, an actuating cylinder for each flap, control linkage, a control circuit, and flap-position-indication circuit. The inner flaps extend from the fuselage to the nacelle tail cones, and the outer flaps extend from the nacelle tail cones to the ailerons. The flaps are not interconnected mechanically, but they operate in unison. When the control circuit is energized, a hydraulic solenoid valve is actuated and hydraulic pressure is supplied to the individual cylinders at each flap panel. Flap travel cannot be stopped at any intermediate position between the full up or full down positions.

CAUTION

Since it is possible to lower the flaps at airspeeds above the safe limits, airspeed limitations must be observed when operating the flaps.

Power to operate the circuit is supplied by the 28-volt d-c distribution bus. The hydraulic actuation of the flaps is shown schematically in figure 1–18.

Note

On rare occasions, the flaps will have a tendency to operate slightly out of unison and this can be detected by a moderate tendency to roll that will last for not more than a second or two. This tendency is easy to control.

CAUTION

Do not operate the flaps with the ground locks in place.

WING FLAPS CONTROL SWITCH.

The two-position wing flap control switch is on the flap and trim control panel which is located immediately aft of the throttles. (See figure 1–23.) When the switch is placed in the UP position, the circuit energizes the up side of a hydraulic double-acting solenoid valve. The valve directs pressure to move the flaps to the full up position. When the flaps reach the full up position, hydraulic pressure will still remain on the cylinders to keep the flaps in the full up position. When the control switch is placed in the DOWN position, a similar action takes place. When the flaps reach the full down position (60 degrees) the cylinders bottom, thus preventing further lowering. Power to operate this circuit is supplied by the 28-volt d-c distribution bus.

WING FLAP POSITION INDICATOR.

The wing flap position indicator provides continuous indication of the flaps position when the 28-volt d-c distribution bus is energized. The indicator is located

Figure 1–23.

on the pilot's left auxiliary switch panel. (See figure 1–25.) The limit switches are used to indicate the flaps position. The indicator shows a small cross-section of a miniature flap in two positions: up or down. If the flaps are in any intermediate position, the indication will be a cross hatching which will indicate a malfunctioning within the system. Power for the circuit comes from the 28-volt d-c distribution bus.

DIVE BRAKES SYSTEM.

The dive brakes fingers emerge vertically from the upper and lower surfaces of each wing outboard of the engine nacelles. The brakes are hydraulically actuated and electrically controlled by a switch on the control wheel. There is no intermediate position for the brakes. They are either fully extended or fully retracted. The time necessary to extend or retract the brakes is one second. There are nine drag fingers in the upper surface of the wing, and twelve in the lower. All the dive brake fingers in each wing are interconnected by a common torque tube which is actuated by a hydraulic cylinder. These dive brakes have no extension or retraction airspeed limitations imposed upon them.

DIVE BRAKES CONTROL SWITCH.

The two-position dive brakes control switch is located on the left handgrip of the control wheel. (See figure

Figure 1–24.

1-22.) When the switch is placed in the CLOSE position, the close side of the double-acting solenoid-operated control valve is energized. When the close side is energized, the valve allows hydraulic pressure to close the brakes. Placing the switch in the OPEN position energizes the open side of the solenoid valve, and the valve allows pressure to extend the brakes. The power to operate the circuit is supplied by the 28-volt d-c distribution bus.

LANDING GEAR SYSTEM.

The tricycle landing gear consists of two main gears and one nose gear. The gear is mechanically controlled, hydraulically operated, and is fully retractable within the wing and fuselage contours. The main gear retracts inboard and up into wheel wells in the wings, inboard of the engine nacelles. When the main gear is fully retracted, it is enclosed by doors. Each main gear consists of an air-oil shock strut with a cantilevered axle, an actuating cylinder, a wheel-and-brake assembly, up-and-down locks, position switches, a fixed-fairing door, and a gear-operated sequence valve. The nose wheel retracts aft and up into the fuselage nose wheel well and is enclosed by doors. The nose gear consists of an air-oil shock strut with a self-centering device, dual rotating wheels, a drag brace, an actuating cylinder, up-and-down locks, and position switches. The main and nose gear doors are hydraulically operated and sequence-controlled by their respective landing gears. Hydraulic pressure on the actuating cylinders keeps the gears in the up position. If hydraulic pressure fails, mechanical locks will retain the gears in the up position. These locks do not have a mechanical release and must be unlocked by

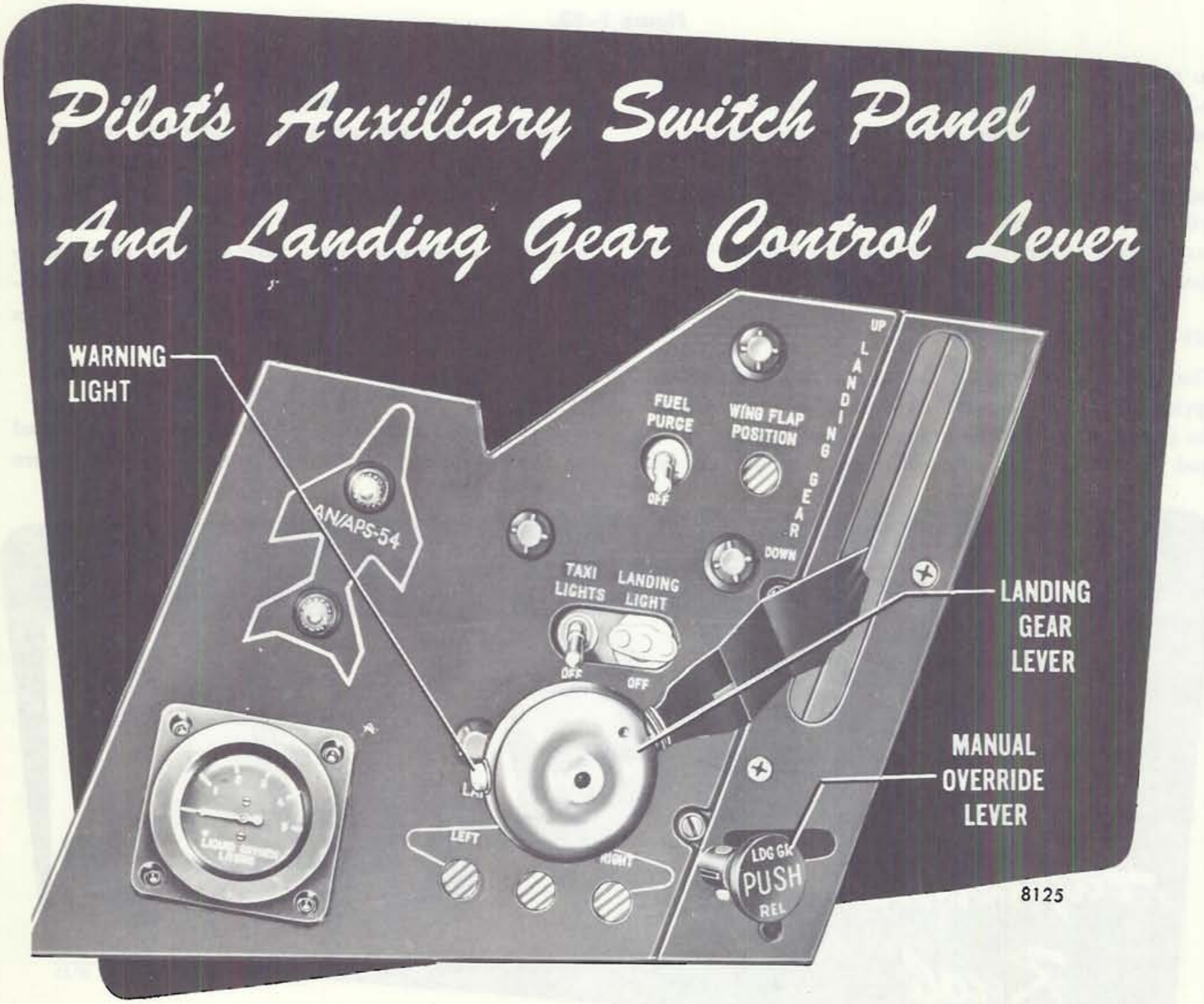


Figure 1-25

hydraulic pressure. Hydraulic pressure on the actuating cylinders and mechanical down locks keeps the gear in the down position. However, ground locking pins must be installed when the airplane is on the ground. (See figure 1-26.)

CAUTION

Be sure that the ground lock pins are removed before flight.

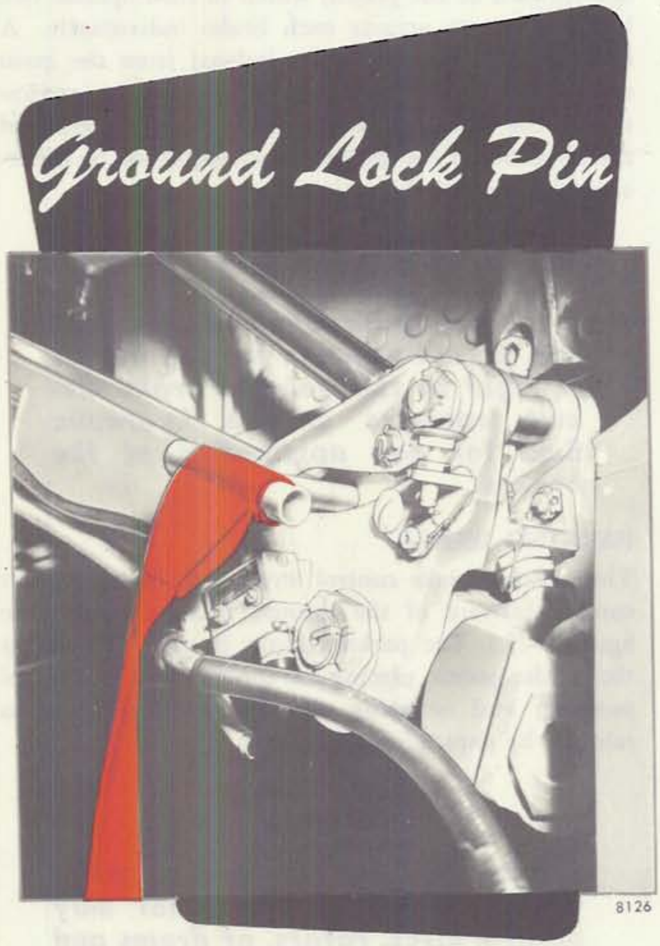


Figure 1-26

Inadvertent retraction of the gear when the airplane is on the ground is prevented by a solenoid-operated lock pin which, when in the de-energized position, locks the landing gear control lever in the DOWN position until the single-acting solenoid is energized. The solenoid becomes energized through the actuation of a microswitch on the left main gear oleo strut. The microswitch is actuated only when the strut extends as a result of the airplane being airborne. An integral self-centering device in the nose landing gear centers the wheels whenever the weight of the airplane is off the gear, so that the wheels are aligned for either extension or retraction. When the weight of the airplane has compressed the nose gear strut, the wheels are free to caster.

LANDING GEAR CONTROL LEVER.

The landing gear operation is controlled by a two-position lever, located on the left of the pilot's main instrument panel forward of the throttles. (See figure 1-25.) The handle of the lever has a wheel-shaped knob for identification and must be pulled aft to disengage it from a detent in the DOWN position.

Note

The lever is held in the UP position by a spring, and the detent must be passed when the handle is put in the DOWN position or the lever may spring up.

When the landing gear control lever is in the UP position, hydraulic pressure passes in the retract direction to the actuating cylinders of the gears and doors. In addition, this up position allows the landing gear control valve to route available emergency pressure to the bomb door control valve. When retraction is completed, the actuating cylinder remains pressurized as long as the main hydraulic system is pressurized. If the system pressure fails, the up-lock hooks will hold the gear in the retracted position. Placing the landing gear control lever in the DOWN position permits hydraulic pressure to extend the doors, release the up locks, and extend the gears.

CAUTION

Since it is possible to lower the gear at airspeeds above the safe limits, be sure to observe airspeed limitations when operating the gear.

The final extending movement of the gear cylinder locks the gear down and actuates the down lock position-indicating switch. The extension of the gear also opens the nacelle cowl door to permit ground cooling of the engine. The gear-actuating cylinder remains pressurized as long as the main hydraulic system is pressurized. Ground lock pins must be inserted following engine shutdown as an added safety precaution. (See figure 1-26.)

LANDING GEAR MANUAL OVERRIDE LEVER.

A retract safety switch, located on the left main gear, automatically opens a circuit which de-energizes a solenoid at the landing gear control lever and locks the control lever in the DOWN position whenever the weight of the airplane is on the gears and when the left main shock strut is compressed. A manual override lever just below the landing gear control lever may be pushed in, in emergencies, thus closing a circuit and energizing the solenoid lock pin to unlock the control lever and permit retraction of the gears. (See figure 1–25.)

LANDING GEAR WARNING HORN CUT-OUT SWITCH.

A landing gear warning system is provided so that if the throttles are retarded below the cruising position and the landing gear is not down and locked, a warning horn blows and a red light in the landing gear control lever lights to warn the pilot of this condition. The warning horn may be silenced by momentarily depressing the warning horn cut-out switch just aft of the parking brake lever. (See figure 1–27.) Power is supplied to the circuit from the pilot's circuit breaker bus.

LANDING GEAR WARNING LIGHT.

Whenever the landing gear control lever is moved from the UP to the DOWN position or vice versa, the red indicator light comes on and stays on until all the gears are locked in the selected position. (See figure 1–25.) If any one of the gears fails to reach the full up or down position, the light remains lit until the condition is corrected. Also, if the throttles are retarded below the cruising position and the landing gear is in any position other than down and locked, the light will illuminate. Power to the circuit comes from the pilot's circuit breaker bus.

LANDING GEAR WARNING LIGHT TEST SWITCH.

A test switch (3, figure 1–28) on the pilot's main instrument panel tests the operation of the red warning light in the knob of the landing gear control lever. If the switch is placed in the TEST position and the light is functioning, it will illuminate. Power to operate the circuit comes from the pilot's circuit breaker bus.

LANDING GEAR POSITION INDICATION.

Three position indicators on the pilot's auxiliary switch panel indicate the position of the landing gear. (See panel 1, figure 1–25.) Each of the these indicators, one for each gear, has three indications which represent the position of its respective gear. The indications are: cross-hatching, if the gear is in an unlocked condition; the word UP, if the gear is up and locked, and a miniature wheel, if the gear is down and locked. Each indicator is energized through position-indicating switches located on the gear. Power for the indicators is supplied from the 28-volt d-c pilot's circuit breaker bus.

BRAKE SYSTEM.

The hydraulic pressure for the brakes on the main landing gear wheels is metered by toe action on the rudder pedals. Toe action on the pedals operates linkage forward of the pedals, which in turn operate two brake valves to actuate each brake individually. A brake accumulator, which is isolated from the main system by a check valve, supplies pressure for application of the brakes. In addition to braking, steering of the airplane on the ground is accomplished by differential braking of the main wheels.

CAUTION

If the main hydraulic system should fail, do not depress the toe pedals in flight as the isolated brake circuit contains enough hydraulic fluid for one application of the brakes.

PARKING BRAKE.

The parking brake control lever is on the pilot's left console forward of the throttle friction knob. (See figure 1–27.) The parking brake is set by depressing the rudder pedals, placing the control lever in the ON position, and releasing the pedals. The brake is released by depressing the pedals.

CAUTION

Setting the parking brakes while wheels and brakes are hot may deform discs, rotors, or drums and could cause the brakes to drag.

BRAKE PRESSURE GAGE.

A brake pressure gage on the pilot's auxiliary instrument panel indicates the pressure in the brake accumulator. It is discussed under HYDRAULIC PRESSURE GAGES in this section.

INSTRUMENTS.

The flight and engine instruments are located on shock-mounted panels in full view of the pilot and observer. The majority of the instruments are electrical, receiving their power from the a-c and d-c electrical systems. The engine tachometer and exhaust temperature indicators are self-generated instruments

Figure 1–27.

which do not require power from the airplane electrical systems. The slaved-gyro compass indicators and the B1A attitude gyro indicator are powered by the a-c electrical system. The OFF flag of the attitude indicator appears only in case of complete a-c or d-c power failure. Partial failure of either electrical system does not cause the flag to appear.

WARNING

To determine if the attitude indicator is malfunctioning, check it with the slaved gyro magnetic compass and the turn-and-bank indicator.

The airspeed indicators, Machmeter, altimeters, and rate-of-climb indicator operate by means of air pressure from the pitot-static system. A vibrator on the pilot's and observer's main instrument panels prevents instrument lag or sticky pointer indications. Lighting for the various panels and their instruments is discussed in Section IV. Instrument range markings are covered in Section V.

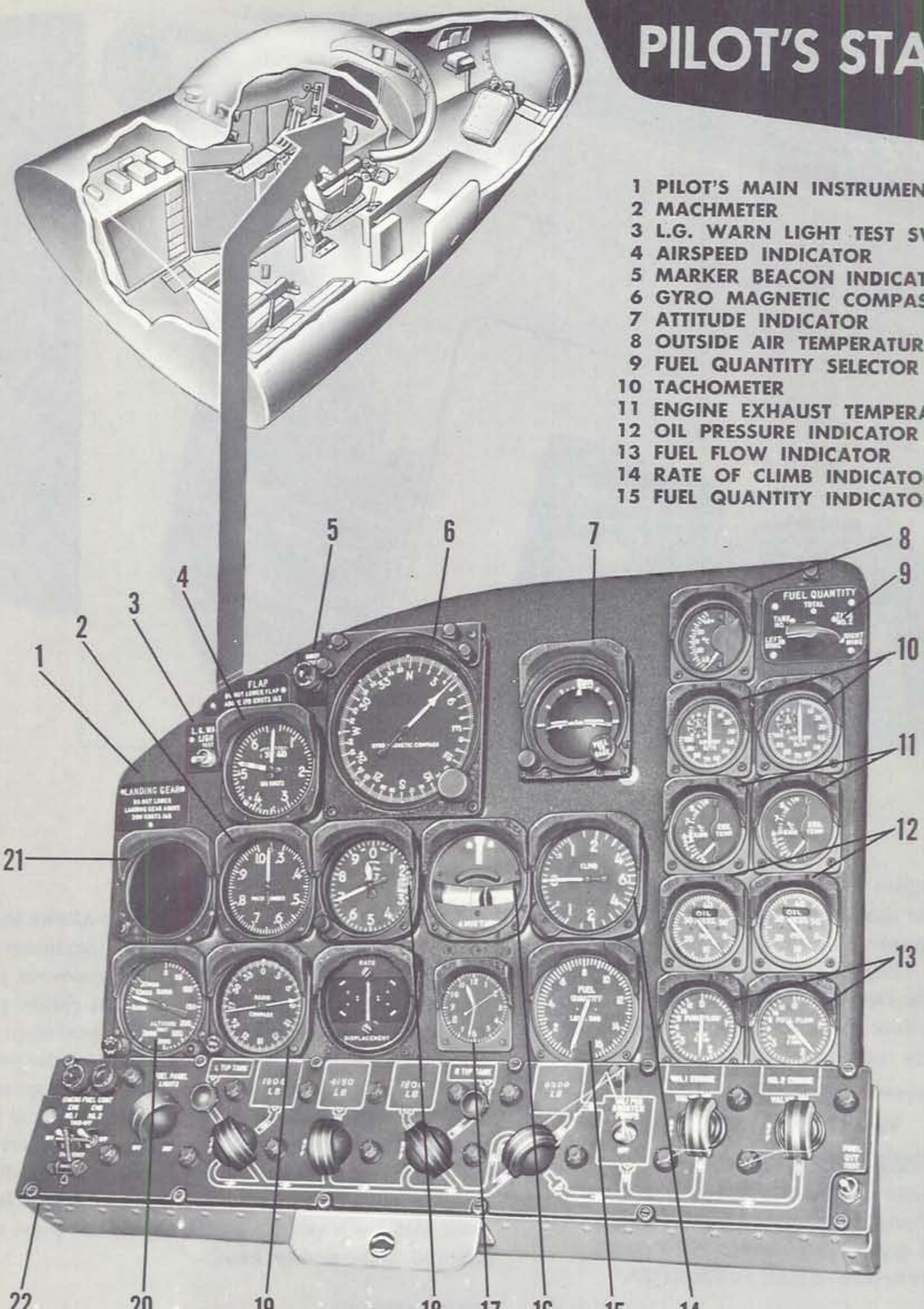
AIRSPEED INDICATOR.

The airspeed indicator (4, figure 1–28) allows the pilot to observe the actual airspeed and the maximum allowable airspeed at the same time. The fluorescent pointer registers indicated airspeed; the red and yellow pointer is adjustable and is set to indicate the maximum allowable airspeed. From the angle formed by the pointers, the pilot can ascertain how near the flying speed is to the speed where he will approach the structural limitations of the airplane. When the two pointers meet, the airplane is flying at its maximum allowable airspeed or maximum allowable Mach number. The indicator also has a vernier which allows the pilot to read airspeed to the nearest knot.

MACHMETER.

The Machmeter (2, figure 1–28) indicates speed and altitude in terms of a Mach number. The Machmeter is a truer index to the flight characteristics of the airplane at various speeds and altitudes than is the indicated airspeed. The machmeter is actuated by a combination of the ambient atmospheric (static) pressure and the impact (pitot) pressure.

PILOT'S STATION



1 PILOT'S MAIN INSTRUMENT PANEL
2 MACHMETER
3 L.G. WARN LIGHT TEST SWITCH
4 AIRSPEED INDICATOR
5 MARKER BEACON INDICATOR
6 GYRO MAGNETIC COMPASS
7 ATTITUDE INDICATOR
8 OUTSIDE AIR TEMPERATURE INDICATOR
9 FUEL QUANTITY SELECTOR SWITCH
10 TACHOMETER
11 ENGINE EXHAUST TEMPERATURE INDICATOR
12 OIL PRESSURE INDICATOR
13 FUEL FLOW INDICATOR
14 RATE OF CLIMB INDICATOR
15 FUEL QUANTITY INDICATOR
16 TURN AND BANK INDICATOR
17 CLOCK
18 ALTIMETER
19 RADIO COMPASS INDICATOR
20 HEIGHT INDICATOR
21 FLIGHT COMMAND INDICATOR
22 FUEL FLOW CONTROL PANEL

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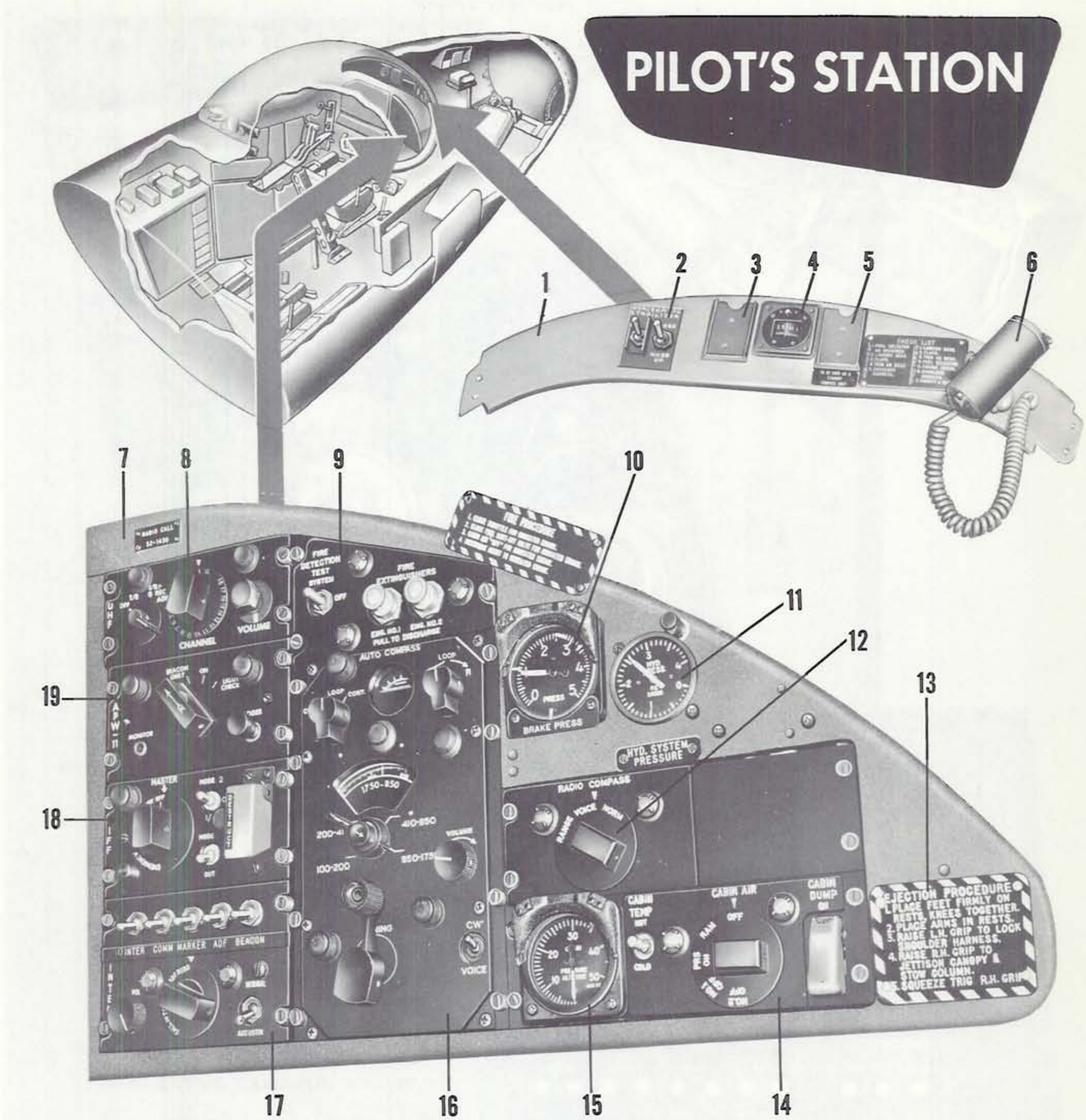
Figure 1-28.



1 PILOT'S GLARE SHIELD
2 HORIZONTAL STABILIZER OVERRIDE SWITCHES
3 J-2 COMPASS CORRECTION CARD HOLDER
4 STANDBY COMPASS
5 STANDBY CORRECTION CARD HOLDER
6 C-4A LIGHT
7 AUXILIARY INSTRUMENT PANEL
8 UHF COMMAND PANEL
9 FIRE DETECTION AND EXTINGUISHING PANEL
10 BRAKE PRESSURE GAGE
11 HYDRAULIC SYSTEM PRESSURE GAGE
12 RADIO COMPASS SELECTOR SWITCH
13 EJECTION PROCEDURE
14 CABIN CONDITIONING PANEL
15 CABIN PRESSURE ALTITUDE GAGE
16 RADIO COMPASS PANEL
17 INTERPHONE PANEL
18 IFF PANEL
19 RADAR BEACON PANEL

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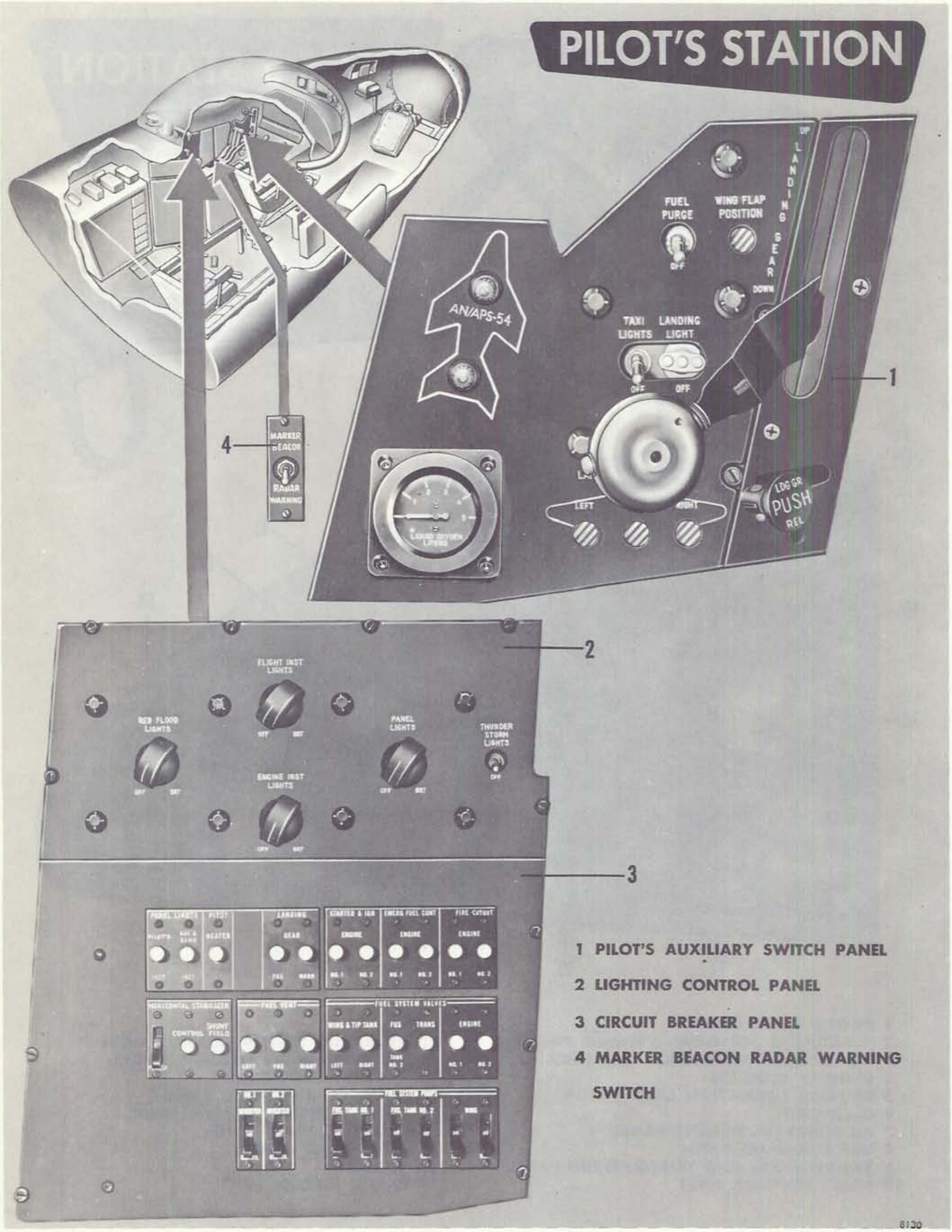
Figure 1-29.



1 PILOT'S AUXILIARY SWITCH PANEL
2 LIGHTING CONTROL PANEL
3 CIRCUIT BREAKER PANEL
4 MARKER BEACON RADAR WARNING SWITCH

Figure 1–30.

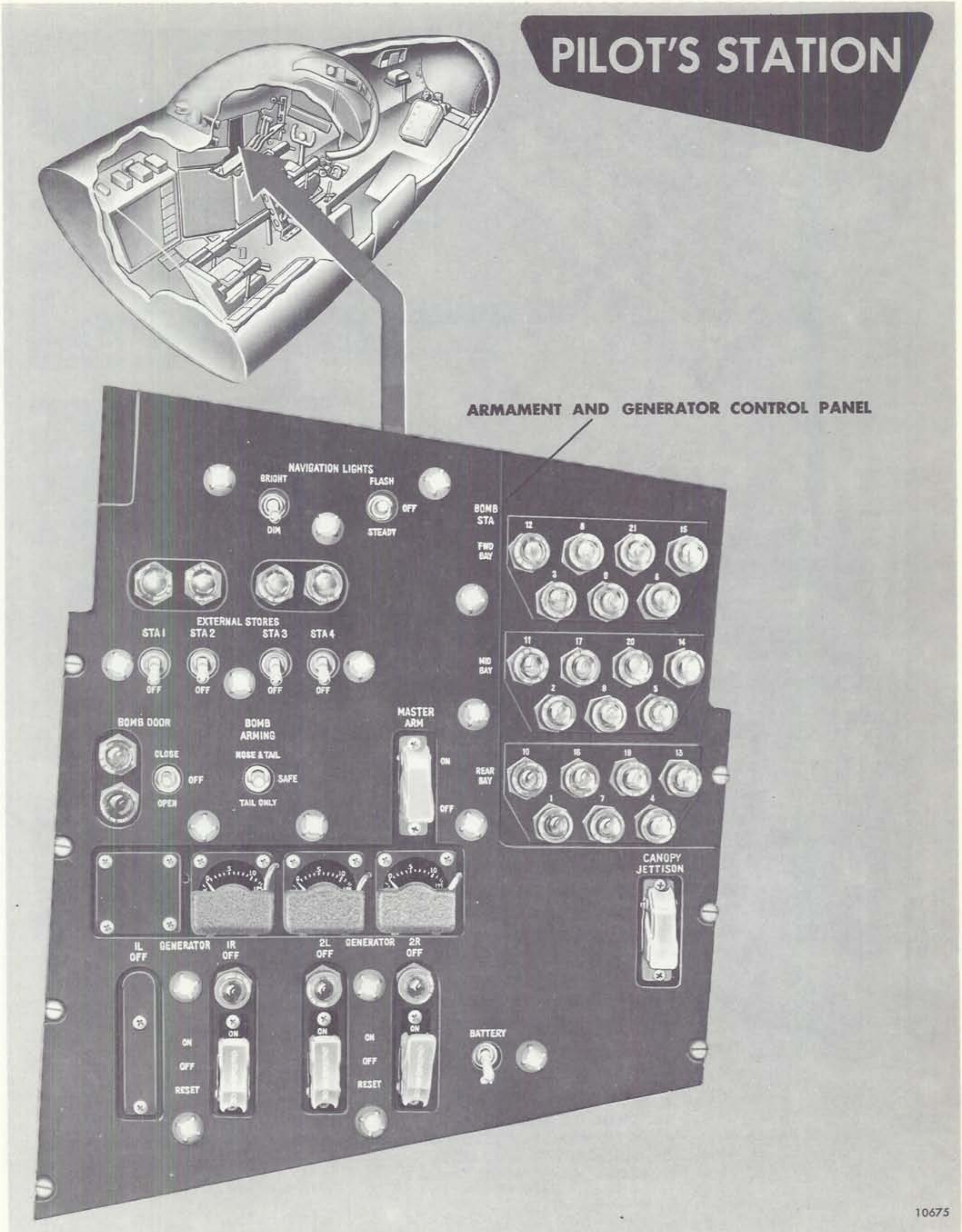
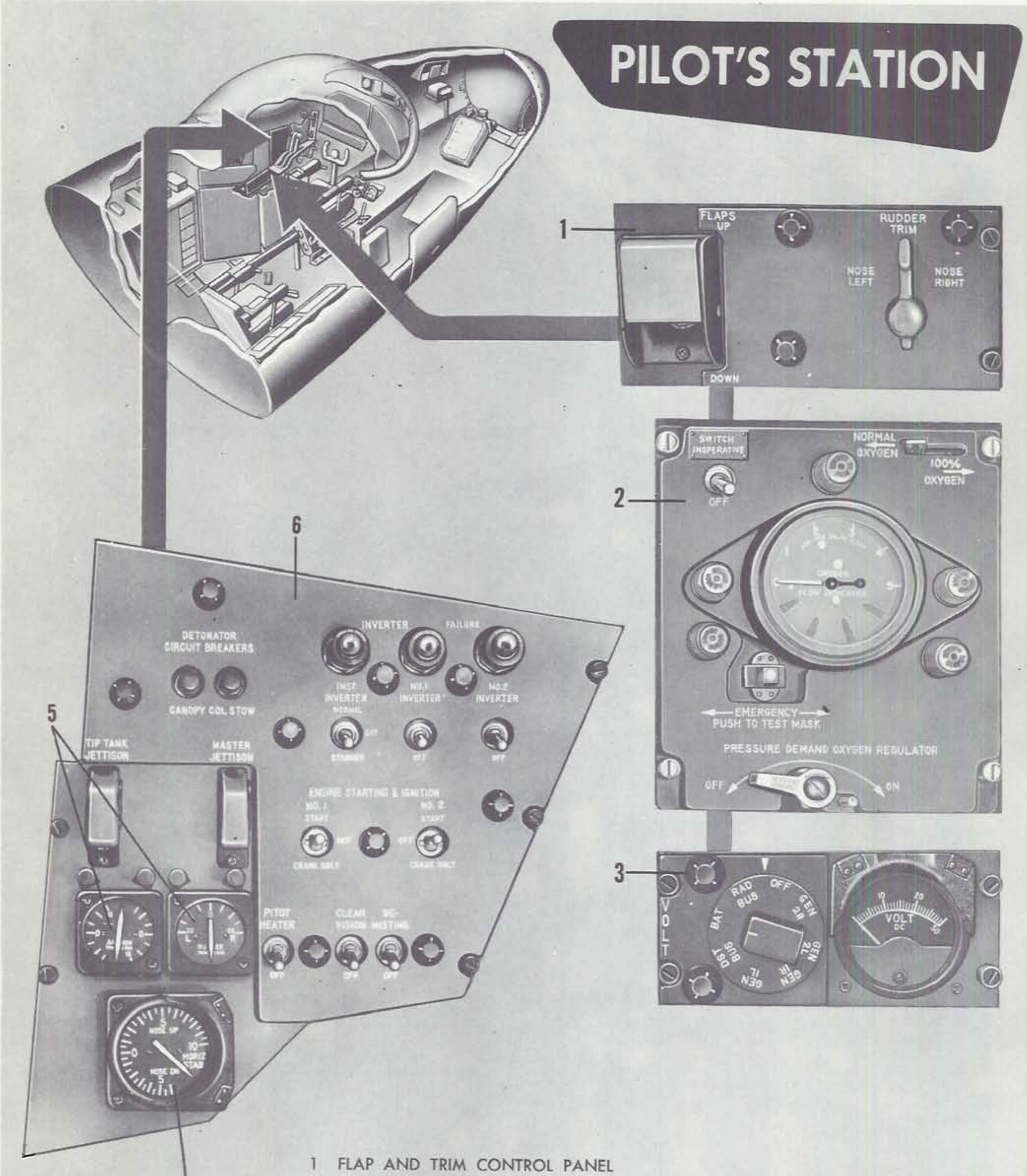

PILOT'S STATION
ARMAMENT AND GENERATOR CONTROL PANEL
NAVIGATION LIGHTS
BRIGHT
DIM
FLASH
OFF
STEADY
BOMB STA
FWD BAY
MID BAY
REAR BAY
EXTERNAL STORES
STA 1
STA 2
STA 3
STA 4
OFF
BOMB DOOR
CLOSE
OFF
OPEN
BOMB ARMING
NOSE & TAIL
SAFE
TAIL ONLY
MASTER ARM
ON
OFF
CANOPY JETTISON
1L OFF
GENERATOR
1R OFF
2L OFF
GENERATOR
2R OFF
ON
OFF
RESET
BATTERY
10675

Figure 1-31.



1 FLAP AND TRIM CONTROL PANEL
2 PILOT'S OXYGEN REGULATOR
3 VOLTMETER AND VOLTMETER SWITCH
4 HORIZONTAL STABILIZER INDICATOR
5 TRIM POSITION INDICATORS
6 PILOT'S MAIN SWITCH PANEL

Figure 1–32.

INSTRUMENT PANEL VIBRATORS.

The pilot's and observer's main instrument panels are each equipped with a vibrator to aid in overcoming sticking or lag of the instruments due to friction. Each vibrator furnishes its instrument panel with a continuous vibration whenever the 28-volt d-c distribution bus is energized.

INSTRUMENTS.

The engine tachometer and exhaust temperature indicators are self-generated instruments which do not require power from the airplane's electrical systems. The slaved-gyro compass indicators and the attitude gyro indicator are powered by the a-c electrical system. The airspeed indicators, Machmeter, altimeters, and rate-of-climb indicator operate by air pressure from the pitot-static system. A vibrator is on the pilot's and observer's main instrument panels prevents instrument lag or sticky pointer indications. Lighting for the various panels and their instruments is discussed in Section IV. Instrument range markings are covered in Section V.

EMERGENCY EQUIPMENT.

One bromochloromethane (CB) hand fire extinguisher, one first aid kit, and one fire axe are stowed on the right side of the nose section, aft of the forward entrance door. (See figure 3-2.)

FIRE PROTECTION. GROUP A

Each engine contains a separate fire detection system (figure 1-33) and a fire extinguishing system. The fire detection system detects the presence of fire by means of thermocouples in the compressor, turbine, and exhaust sections of each engine. The system relays this information to the pilot's compartment, where it is indicated by means of warning lights. The fire extinguishing system routes bromochloromethane to the engine area, thereby reducing the oxygen content of the air and smothering the fire.

WARNING

Avoid repeated or prolonged exposure to high concentrations of bromochloromethane (CB) or decomposition products. CB is considered to be less toxic than carbontetrachloride, methyl bromide, or other usual fire extinguishing agents. Therefore, it is safer to use than previous fire extinguishing agents but normal precautions should be taken.

FIRE DETECTION. GROUP A

The fire detector system includes thermocouples, located in each engine area, and two red warning indicator lights, located in the fire extinguisher pull knobs on the pilot's auxiliary instrument panel. (See figure 1-33.) A fire in either engine area rapidly heats up the detectors located there and causes the thermocouples to generate a signal to the corresponding warning light in the fire extinguisher knob. When one or both of these warning lights (one for each engine area) is on, it indicates that fire control action is necessary. Power to operate the fire detection circuit comes from the 28-volt d-c distribution bus, through a fuse in the electrical distribution center.

FIRE DETECTION TEST SWITCH. GROUP A

A fire detection test switch located on the fire detection and extinguishing panel (panel 8, figure 1-29) permits testing the fire detector system and checking the warning lights in the fire extinguisher knobs. This switch is a momentary, three-position switch, spring-loaded to the neutral (off) position. Momentarily holding the switch in the LIGHTS position causes both lights to come on, indicating that the lights are in working order. Momentarily holding the switch in the SYSTEM position energizes two thermal test units simulating a fire at both engine areas. This action causes both warning lights in the knobs of the fire extinguisher switches to operate within 15 seconds, indicating that the system is functioning properly. Power comes from the 28-volt d-c distribution bus.

FIRE EXTINGUISHING. GROUP A

The fire extinguisher system sprays bromochloromethane into either of the engine areas in case of a fire. (See figure 1-33.) This bromochloromethane spray expands into a dense gas when in the presence of high heat or flame and smothers the fire. The bromochloromethane comes from two fire extinguisher bottles, one in each center wing, just inboard of the engine. Each bottle discharges its contents in two seconds into its corresponding engine area only. The fire extinguisher system is manually controlled and electrically operated. Power for the system comes from the pilot's circuit breaker bus.

FIRE EXTINGUISHER KNOB. GROUP A

Two fire extinguisher knobs on the fire detection and extinguishing panel (panel 8, figure 1-29) controls

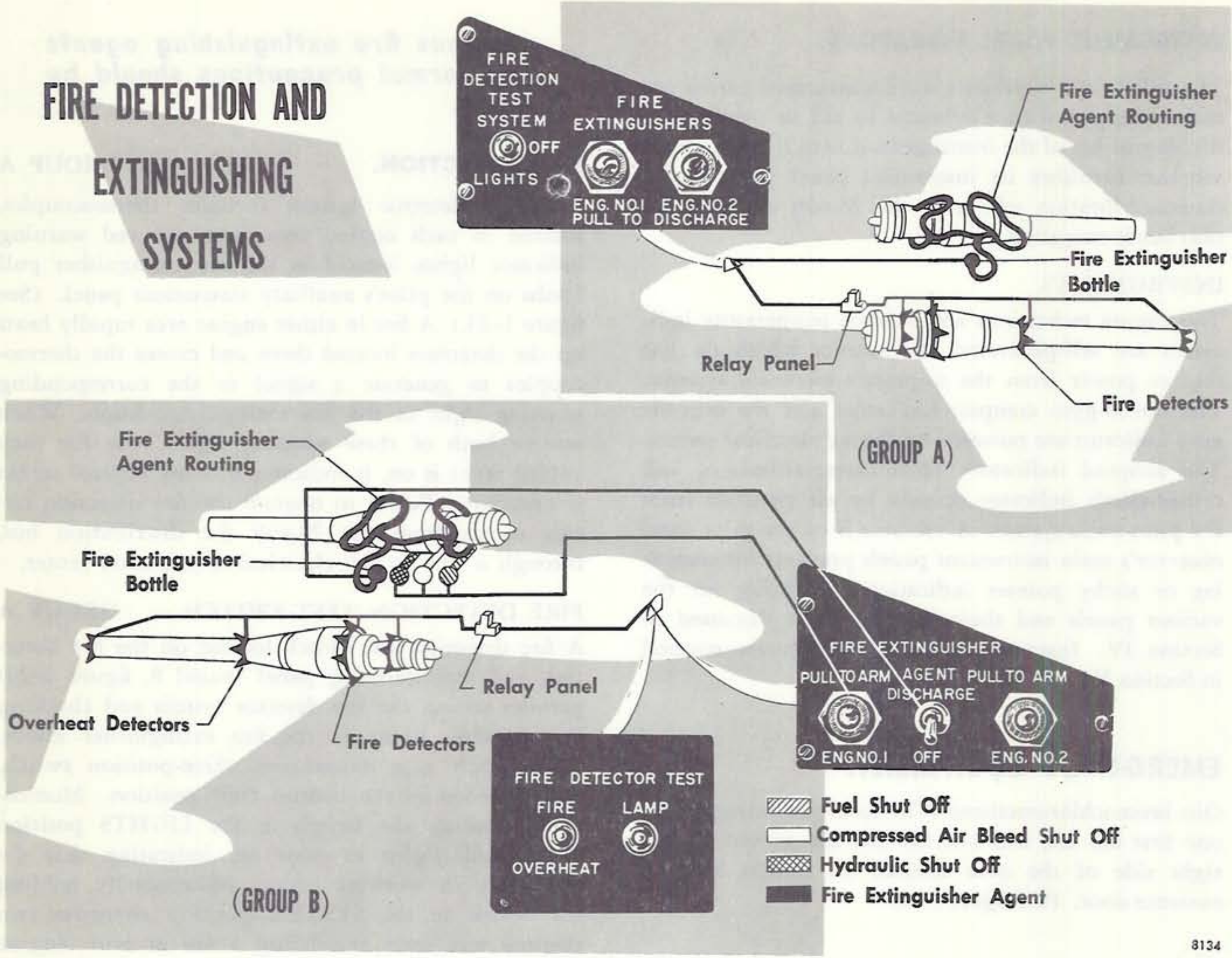


Figure 1–33.

the fire extinguishing system. One switch is provided for each engine. In the event of an engine fire, a red warning light in the center of the corresponding knob will light. The knob must then be pulled out manually to release bromochloromethane in the engine area to smother the fire. This action completes an electrical circuit to the bonnet on the corresponding fire extinguisher bottle, firing a cartridge in the bonnet which breaks a seal and allows the bottle to discharge into the corresponding engine area. If the fire is successfully extinguished, the warning light will go off within two seconds after the bromochloromethane has been discharged.

CAUTION

Once the knob has been pulled out, the discharge of bromochloromethane cannot be stopped and the fire extinguisher bottle will exhaust itself.

FIRE PROTECTION. GROUP B

Each engine contains a separate fire and overheat detection system, and a fire extinguisher and hydraulic shut-off system. (See figure 1–33.) The fire and overheat detection system detects the presence of fire by means of fire detectors in the engine area and relays this information to the pilot's station where it is indicated by a warning light. The fire extinguishing system routes bromochloromethane to the engine area to smother the fire, shuts off the supply of hydraulic fluid to the engine area, and also closes the fuel and compressor air bleed shut-off valves.

FIRE AND OVERHEAT DETECTION SYSTEM. GROUP B

The fire and overheat detection system includes fire detectors located in each engine area forward of the firewall and two indicator lights, one detector test switch, and one lamp test switch located at the pilot's station. In the event of a fire in the engine area, the affected detectors complete a circuit to the respective light. The overheat detection system includes overheat detectors in each engine area aft of the firewall, a blinker relay, a flasher unit, and also utilizes the same components as the fire detector system. Overheated conditions in the detector area cause the flasher unit to operate and the respective indicator light to blink. The overheat detection system lights and continuity are checked in the same manner as the fire detector system. Power for the system comes from the 28-volt d-c distribution bus.

FIRE EXTINGUISHING. GROUP B

The fire extinguishing system sprays bromochloromethane into either of the engine areas in case of fire, shuts off the supply of hydraulic fluid to the affected area, and closes the engine fuel shut-off valve and compressor air bleed shut-off valve. The bromochloromethane spray expands into a dense gas when in the presence of high heat or flame and tends to smother the fire. The bromochloromethane comes from two "one-shot" fire extinguisher bottles, one in each center wing, just inboard of the engine. Each bottle discharges its contents in two seconds into its corresponding engine area only. The fire extinguishing system is manually controlled and electrically operated by two pull-to-arm knobs and an agent release switch, all at the pilot's station. Electrical power for the fire extinguishing system is supplied from the pilot's circuit breaker bus through two circuit breakers. Power to operate the hydraulic shut-off valves is supplied from the 28-volt d-c distribution bus.

FIRE EXTINGUISHER PULL-TO-ARM KNOBS. GROUP B

Two fire extinguisher pull-to-arm knobs located on the pilot's auxiliary instrument panel, energizes the fire extinguisher system. Each of the knobs contains a red warning light for the indication of fire or overheat in its respective engine area. When the pull-to-arm knob is pulled all the way out, the agent release switch, located between the pull-to-arm knobs, is energized and the hydraulic fluid, fuel, and compressor air bleed shut-off valves for the affected engine close. When the knob is pushed in, the hydraulic fluid, fuel, and compressor air bleed shut-off valves open.

FIRE EXTINGUISHER AGENT RELEASE SWITCH. GROUP B

The fire extinguisher agent release switch, located on the pilot's auxiliary instrument panel, actuates the fire extinguisher system. When this switch is placed in the AGENT RELEASE position after one of the pull-to-arm knobs has been pulled all the way out, the corresponding fire extinguisher system will be energized. When this circuit is energized, an explosive cartridge is fired to break a seal on the fire extinguisher bottle, and the bottle discharges into its engine area.

CAUTION

Once the agent release switch has been actuated, the discharge of bromochloromethane cannot be stopped and the fire extinguisher bottle will exhaust itself.

FIRE AND OVERHEAT DETECTION TEST SWITCH. GROUP B

The fire and overheat detection test switch is of the three-position, momentary type and is located on the pilot's auxiliary instrument panel. The switch checks the continuity of the fire and overheat detection circuits. When the switch is placed in the FIRE position, it causes the indicator lights in the pull-to-arm knobs to glow steadily if the fire detection system is functioning properly. When the switch is placed in the OVERHEAT position, it causes the indicator lights in the pull-to-arm knobs to blink intermittently if the overheat system is functioning properly.

FIRE AND OVERHEAT DETECTION INDICATOR LIGHTS. GROUP B

Two red warning lights in the fire extinguisher pull-to-arm knobs warn the pilot of fire or overheat conditions in the engine areas. If a light glows steadily, it indicates a fire in the respective engine area; if it blinks intermittently, it indicates an overheat condition. If the indicator light has come on because of fire in the engine area and if the fire has been successfully extinguished, the light will go off approximately 30 seconds after discharge of the bromochloromethane. Power for the lights comes from the 28-volt d-c distribution bus.

FIRE AND OVERHEAT DETECTION LAMPS TEST SWITCH. GROUP B

The fire and overheat detection lamps test switch, located on the pilot's instrument panel, of the three-position, momentary types, check the operation of the indicating lights in the pull-to-arm knobs. Placing the switch in the LAMP position causes the lamps to light unless they are burned out.

GROUND FIRE PROTECTION.

Two access doors are provided in the accessory cowling of each engine for the insertion of portable fire extinguisher nozzles in the event of a ground fire. The doors are merely veneer panels which are easily pushed in to gain access to the engines.

PILOT'S CANOPY AND OBSERVER'S HATCH.

The canopy above the pilot is a one-piece, double-walled, plexiglas bubble attached to the fuselage by explosive bolts. A clear-vision panel containing a heating element and a temperature-sensing element embedded in the glass is in the left forward area of the canopy. The purpose of this panel is to provide the pilot with a windshield area which is defogged on the inner surface and de-iced on the outer surface for clear vision at all times. The inside of the double-walled canopy is demisted by circulating dry air through the interspace between the canopy walls. See Section IV for DEMISTING. A section of the fuselage crown structure above the observer's station is built as a hatch which is also attached to the fuselage by explosive bolts. The canopy and hatch provide the crew members with an emergency exit for their ejection seats. To jettison the canopy and hatch, the explosive bolts are sheared by simultaneously exploding electrically ignited detonators installed in each bolt. A fixed metal deflector installed in front of the pilot protects against air blast when the canopy is jettisoned. The detonators and the canopy jettison circuit receive power from the battery bus. It is not necessary to have the battery switch on in order to energize the battery bus, but the switch must be on for battery recharging.

CANOPY AND HATCH JETTISON SYSTEM.

Control of the canopy and hatch jettison system is identical, working in conjunction with electromechanical controls which lock the seat harness, stow the control column, and catapult the ejection seats. The canopy and hatch are jettisoned by shearing explosive bolts which secure the canopy and hatch to the fuselage. When the bolts have been sheared, the combination of air pressure within the airplane and suction from the outside airstream will remove the canopy and/or the hatch.

CANOPY JETTISON CONTROL (PILOT'S RIGHT HANDGRIP).

When the detonators circuit breakers are closed, a 28-volt circuit is completed to a switch incorporated in the right handgrip (13, figure 1-37) of the pilot's ejection seat. When the grip is raised, the switch in the grip is actuated. This supplies power to the detonators, exploding them simultaneously, jettisoning the canopy, and stowing the control column. The control column stowage switch, when actuated, explodes the control tube detonator and simultaneously energizes the snatch unit solenoid, and the control column is pulled against the main instrument panel.

WARNING

Since there are no other safety measures, make sure the circuit breaker is pushed in at the start of each flight and pulled out immediately upon completion of the flight to prevent inadvertent jettisoning of the canopy.

CANOPY JETTISON SWITCH.

The pilot may also jettison the canopy alone by actuating the guarded canopy jettison switch, located on the armament and generator control panel (figure 1-31).

HATCH JETTISON CONTROL (OBSERVER'S RIGHT HANDGRIP).

When the detonators circuit breaker is closed, a 28-volt circuit is completed to a switch incorporated in the observer's right handgrip. When the grip is raised, the switch in the grip is actuated. This supplies power to the detonators, exploding them simultaneously thereby jettisoning the hatch.

EJECTION SEATS. (See figure 1-34.)

The pilot's and observer's seats are of the ejection type, designed to forcibly catapult the seat and occupant clear of the airplane in an emergency. The seats consist of an outer frame and guide rail to which are attached a fixed headrest, an inertia reel, a seat bucket, footrests, a personnel equipment quick-disconnect, an initiator, right and left handgrips, and a seat belt delay initiator. The seats also have holes for the insertion of three safety pins to prevent inadvertent firing. The ejection seats may be ejected even though the hatch and canopy have not been jettisoned. This is due primarily to the fact that the seats are fired mechanically, whereas the hatch, canopy, and control column stowage are fired electrically. The seat bucket accommodates a life raft attached to the occupant's parachute harness. A lap-type safety belt is attached to the seat, and an inertia reel-type harness and cable are provided.

WARNING

Be certain that the three safety pins in each seat are inserted before the crew leaves the airplane.

This must be done to prevent inadvertent firing when the airplane is on the ground. The safety pins must be removed before flight.

SHOULDER HARNESS LOCK CONTROL.

A two-position (locked-unlocked) shoulder harness inertia reel lock control (7, figure 1-34) is located on the left side of the pilot's and observer's seats. A latch retains the control handle at either position. By pulling up on top of the control handle, the latch is released, allowing the control handle to be moved from one position to the other. When the control is in the unlocked position, the reel harness cable will extend to allow the occupant to lean forward. However, if any impact force exceeding 2 to 3 G's is encountered, the reel harness cable will automatically lock. When the cable is locked in this manner, it will remain locked until the control handle is moved to the locked position, and then returned to the unlocked position. When the control lock is in the locked position, the inertia reel harness cable is manually locked so that the occupant is prevented from bending forward. The locked position is used when a crash landing is anticipated. This is an added safety precaution over and above that of the automatic safety lock.

Note

When the left handgrip is raised, the inertia reel harness cable is also locked.

LEFT HANDGRIP.

When raised, the left handgrips on the pilot's (10, figure 1-34) and the observer's seats lock the shoulder harnesses if they have been left unlocked. The left handgrip also provides support for the occupant's hand during ejection.

Note

In order to unlock and lower the left handgrips of the pilot's and observer's seats, it is necessary to depress the two spring-load buttons on each side of the armrest aft of the handgrip.

RIGHT HANDGRIP (PILOT'S AND OBSERVER'S).

The pilot's right handgrip (13, figure 1-34) is the control for canopy and seat ejection. The observer's right handgrip is the control for hatch and seat ejection. The initial movement, raising the grip to the up position, actuates a switch that fires the canopy explosive bolt detonators, in the case of the pilot, and the hatch explosive bolt detonators, in the case of the observer. On the pilot's seat only, the right handgrip also actuates a switch that ignites the explosive collar around the elevator control tube and energizes the control column snatch unit. The charged collar severs the elevator control tube and allows the snatch unit to slam the control column into the instrument panel to allow a free path during ejection.

WARNING

During flight the right handgrip should not be raised unless it is definitely determined that bail-out is to be effected, since the elevator control tube will be severed, causing longitudinal control of the airplane to be lost, and control cannot be regained. The canopy can be jettisoned without losing longitudinal control by means of the canopy jettison switch.

EJECTION TRIGGER (PILOT'S AND OBSERVER'S).

In order to eject their seats, the pilot and observer must raise their right handgrips and then squeeze the ejection trigger.

Note

The seat ejection trigger cannot be moved unless the right handgrip has been raised to the up position.

Squeezing the trigger mechanically fires an M-3 catapult initiator which in turn fires the M-5 seat catapult to eject the seat.

MA-3 OR MA-4 AUTOMATIC BELT.

The MA-3 (or MA-4) automatic belt (figure 1-35) consists of two adjustable webbed belts, an eye buckle, a latch buckle, a latch buckle key, and a flexible hose. The occupant fastens the belt by inserting the eye buckle through the loops of the shoulder harness and placing the eye buckle on the stud of the latch buckle. The occupant then presses the key into the spring-loaded receptacle on the side of the latch buckle and depresses the latch lever. A finger moves into position to retain the eye buckle to the stud of the latch buckle. After ejection, gas pressure through the flexible hose moves the finger out of the locked position to free the occupant from the seat. The key remains in the receptacle of the latch buckle and as the occupant separates from the seat the parachute


EJECTION SEAT
Initiator hose connection
Inertia reel shoulder harness
Armrest (Non-adjustable, LH)
Safety belt
Right hand grip
Shoulder harness lock control
Oxygen, radio and initiator disconnects
Left hand grip
Vertical seat adjustment
Footrests
Ground safety lanyard
Armrest (Adjustable, RH)
Initiator
Armrest lock
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Figure 1-34.

lanyard actuates the aneroid-release device of the parachute. See AUTOMATIC OPENING SEAT BELT AND PARACHUTE in Section VII.

WARNING

Use the latch key attached to the lanyard of the automatically opening parachute. When using a manually opened parachute, insert the latch key attached to the MA-4 webbed belt.

For normal release, the occupant lifts the latch lever. This causes the spring-loaded receptacle to release the key, moving the finger out of the locked position.

MA-5 OR MA-6 AUTOMATIC BELT.

The MA-5 (or MA-6) automatic belt (figure 1-36) consists of two adjustable webbed belts, a manual release buckle, a swivel link, an automatic release buckle, and a flexible hose. The occupant fastens the belt by inserting the swivel link through the loops of the shoulder harness and parachute lanyard. The occupant then places the swivel link into the manual release buckle and locks the link in position with the manual release lever. After ejection, gas through the flexible hose moves a locking finger in the automatic release buckle to the unlocked position to free the occupant from the seat. A shoulder on the swivel link retains the loop of the parachute lanyard and as the occupant separates from the seat the parachute lanyard actuates the aneroid-release device of the parachute. See AUTOMATIC OPENING SEAT BELT AND PARACHUTE in Section VII.

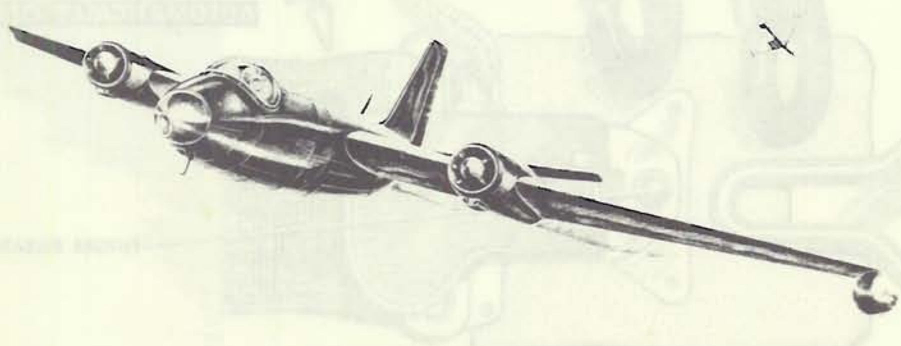
SEAT BELT AUTOMATIC RELEASE MECHANISM. During ejection, as the seat rises along the guide rails, a telescopic tube fixed to the frame of the airplane pulls a pin to fire a slow-burning initiator. Gas from the initiator operates the release mechanism of the belt 2.5 seconds after the pin fires the initiator.

SEAT ADJUSTMENT.

Only the pilot's seat is vertically adjustable, and it may be ejected from any position of adjustment. Also on the pilot's seat only, the right armrest (3, figure 1-34) may be lowered to facilitate getting in and out. This right armrest must be in the up position to operate the handgrips. The vertical seat adjustment lever is located on the right side of the pilot's seat (15, figure 1-36). Pressing in the button on the lever releases the seat so that it may be raised or lowered to any desired height. The footrests (11, figure 1-34) will remain in contact with the floor at all times. When the seat is at the desired height, the adjustment lever is released. The lever is spring-loaded to automatically engage the locking pins. Jiggling the seat is recommended to permit the locking pins to seat properly. During ejection, the seat will rise approximately one inch above the full up position before the footrests follow.

AUXILIARY EQUIPMENT.

Information concerning the following equipment will be found in Section IV of this handbook: cabin air-conditioning and pressuring system, de-misting and clear vision systems, communications and associated electronic equipment, lighting equipment, armament equipment, oxygen system, photographic equipment, and miscellaneous equipment.



MA-3 OR 4 AUTOMATIC OPENING BELT

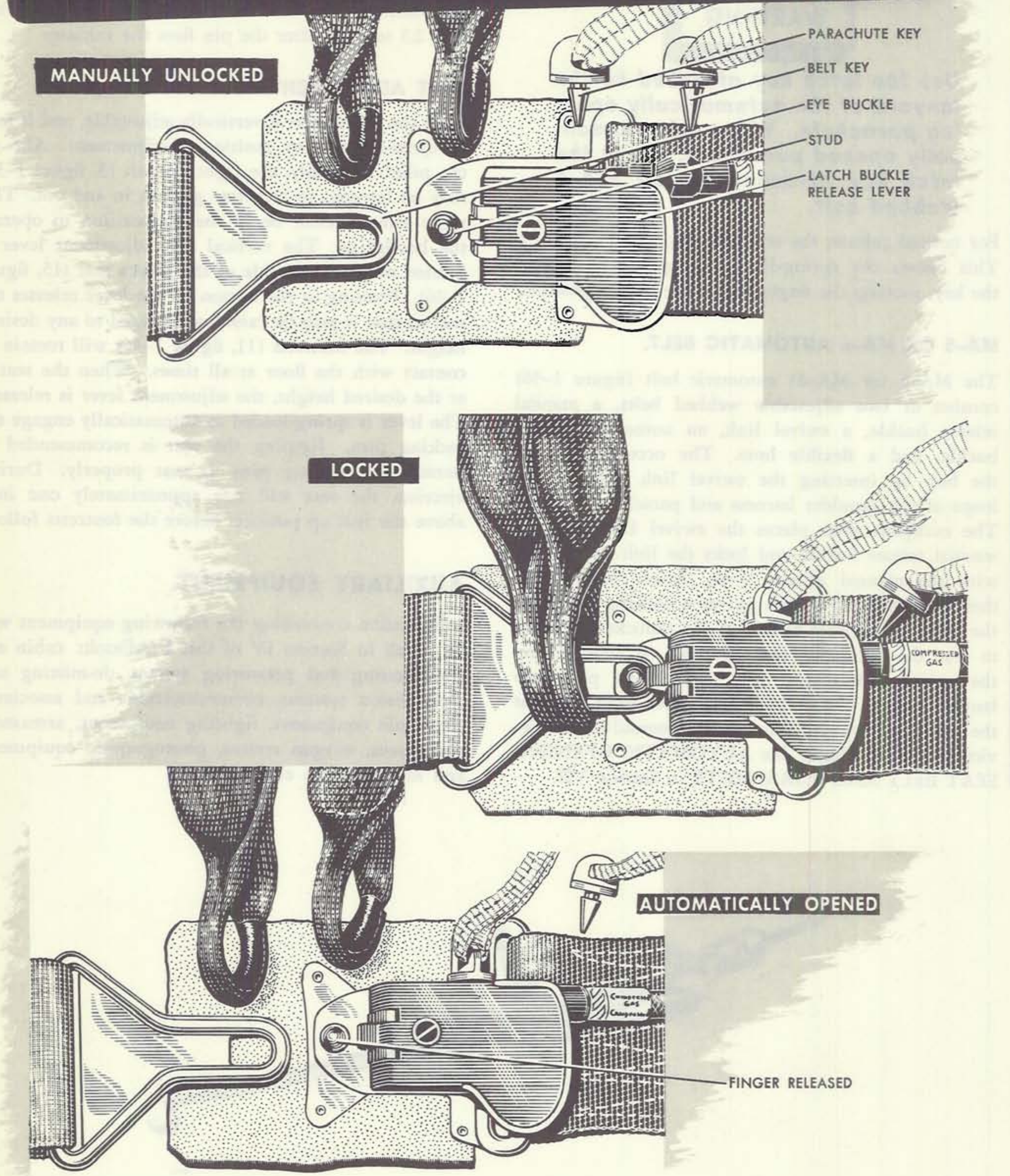


Figure 1-35.

MA-5 OR 6 AUTOMATIC OPENING BELT

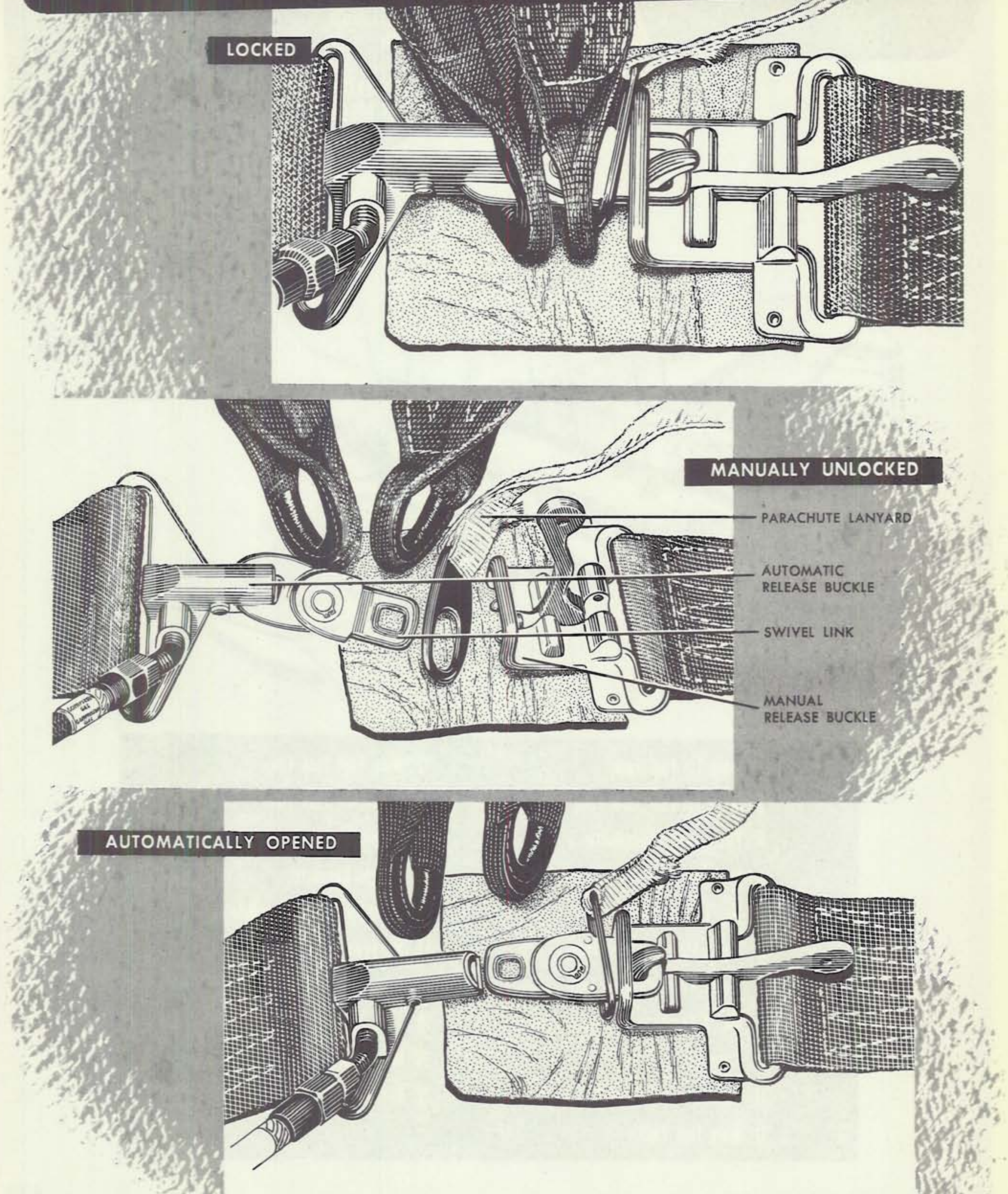
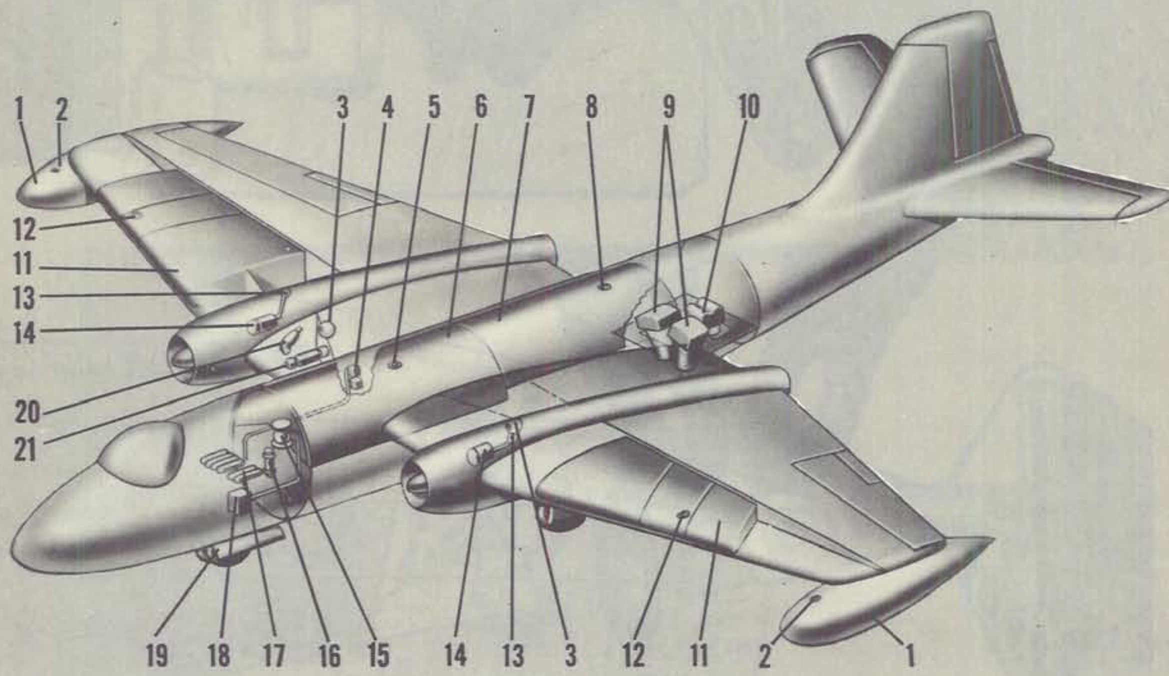


Figure 1-36.

SERVICING DIAGRAM

SPECIFICATIONS	
FUEL GRADE JP-4	MIL-F-5624A
OIL	MIL-L-7808
HYDRAULIC FLUID	MIL-O-5606
OXYGEN	AN-O-1c GRADE B TYPE II (LIQUID)
FIRE EXTINGUISHER	BROMOCHLOROMETHANE (CB)
NITROGEN	MIL-N-6011



1. Wing Tip Fuel Tank
2. Wing Tip Fuel Tank Filler
3. Fire Extinguisher Bottle
4. Nitrogen Purge System Filler
5. No. 1 Fuselage Fuel Tank Filler
6. No. 1 Fuselage Fuel Tank
7. No. 2 Fuselage Fuel Tank
8. No. 2 Fuselage Fuel Tank Filler
9. Cameras
10. Camera and Shutter Trip Control
11. Wing Fuel Tank
12. Wing Fuel Tank Filler
13. Engine Oil Tank Filler
14. Engine Oil Tank
15. Oxygen Converter
16. Hydraulic Brake Accumulator
17. Nitrogen Supply Bottles
18. Oxygen Filler
19. Tires Air Filler Stem
20. Main Hydraulic Accumulator
21. Hydraulic Reservoir and Filler

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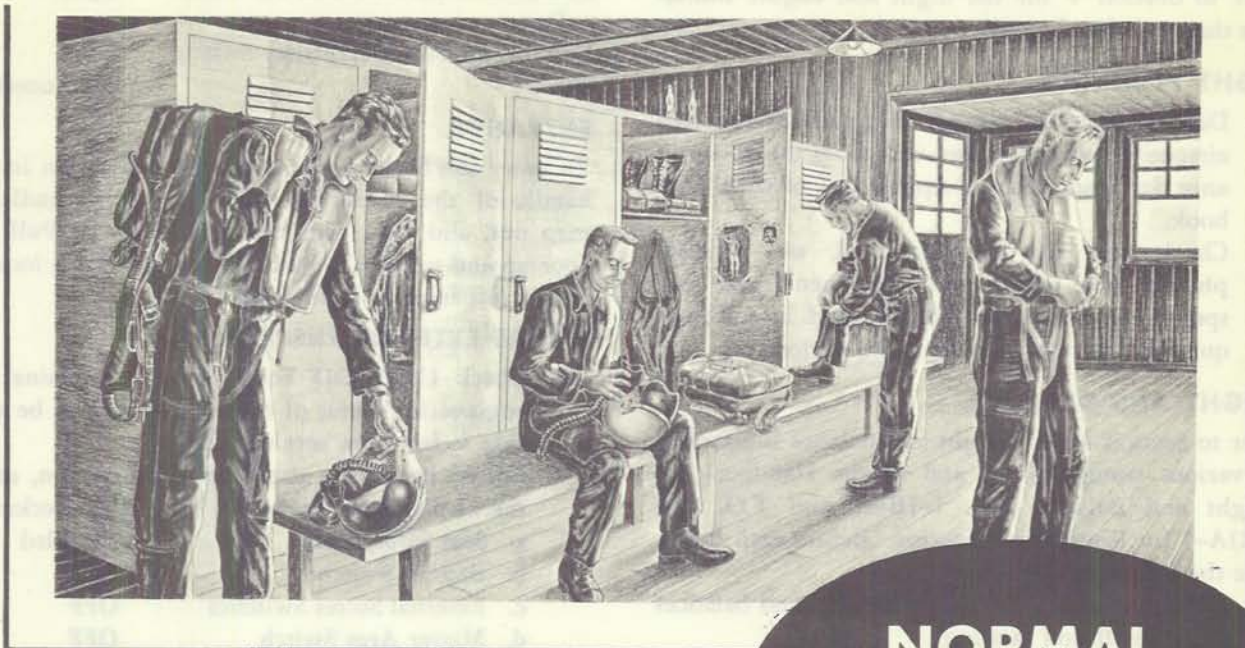
Figure 1–37.

SECTION II



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NORMAL PROCEDURES

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BEFORE ENTERING THE AIRPLANE.

FLIGHT RESTRICTIONS.

Refer to Section V for the flight and engine limitations that must be observed.

FLIGHT PLANNING.

1. Determine cruise control data such as required airspeeds, power settings, etc., from the performance data contained in Appendix I of this handbook.
2. Check that the required fuel, oil, oxygen, photographic equipment, armament, and any special equipment are suitable and in sufficient quantity for the mission to be performed.

WEIGHT AND BALANCE.

Refer to Section V for weight and balance limitations for various configurations and to the Handbook of Weight and Balance T.O. 1-1B-40 and T.O. 1B-57(R)A-5 for loading information. Before each flight, make the following checks:

1. Check the anticipated gross weights and balances for take-off and landing.
2. Check that Weight and Balance Clearance Form DD365F is satisfactorily completed. The airplane is stable when the center of gravity is within the published limits.

The control stick forces-per-G characteristics of the airplane vary over a wider range than normal, being high with the center of gravity at the forward limit and low with the center of gravity at the aft limit. However, it must be remembered that under most normal conditions, when the aircraft is loaded for takeoff, the center of gravity will normally be very close to the published aft stability limit. The pilot should be aware of this fact to insure that he does not inadvertently exceed the stability limits, since variation in the center of gravity in the aircraft is primarily a result of fuel consumption. Considerable emphasis at all times must be placed on fuel managements. Also, care must be exercised in adding extra baggage or equipment to the aircraft for any flight.

PRIOR TO ENTRANCE.

WARNING

Prior to entering the airplane, make the following checks to prevent possible injury to personnel during the pre-flight inspection. While personnel are in the area of the bomb door, the battery switch and the bomb door ground safety access door should never be actuated or moved since serious injury to personnel might result.

Bomb Door Ground Shut-Off Valve Door	Open
Bomb Door Personnel Safety Switch	SAFE
Battery	Disconnected

ENTRANCE.

To enter the flight stations, depress the button in the handle of the access door, allowing the handle to snap out, and then turn the handle down. Pull the door up and support it with the brace which is located on the left interior of the door.

BEFORE EXTERIOR INSPECTION.

1. Check USAF DD Form 781 to determine the engineering status of the airplane and to be sure that it has been serviced properly.
2. Before beginning the exterior inspection, enter the airplane and make the following checks:

a. Seat Safety Pins	Installed
b. Battery Switch	OFF
c. External Stores Switches	OFF
d. Master Arm Switch	OFF
e. Bomb Door Switch	OFF
f. Bomb Panel Switches	OFF
g. Bomb Arming Switch	SAFE
h. Canopy and Control Column Stowage Detonator Circuit Breakers	In

Note

Make sure the canopy and control column stowage detonator circuit breakers are in the *in* position to reduce the possibility of severe injuries if the seat is accidently ejected while occupied and while the airplane is on the ground.

i. Canopy Jettison Switch	OFF
j. Tip Tank Jettison Switch	OFF
k. Master Jettison Switch	OFF
l. Landing Gear Lever	DOWN and Locked
m. Main System Hydraulic Pressure Gage.	Zero Pressure

EXTERIOR INSPECTION.

Perform a complete preflight inspection of the airplane. (See figure 2-1.)

Note

At each of the following inspection points, check the condition of the surrounding area of the airplane for miscellaneous damage, dents, etc. Also check the security of all access doors, and be sure that all control surface locks have been removed.


EXTERIOR INSPECTION
Walk around inspection
Top surface inspection
Fuel caps
Oil caps
Hydraulic filler cap
USAF
1 Nose section
2 Nose wheel
3 Electrical access compartment
4 Bomb bay — RH
5 Wheel well — RH
6 Engine — RH
7 Outer wing tip — RH
8 Wing tip and tank — RH
9 Wing trailing Edge — RH
10 Aft fuselage — RH
11 Empennage
12 Aft fuselage — LH
13 Camera compartment
14 Wing trailing edge — LH
15 Wing tip and tank — LH
16 Outer wing — LH
17 Engine — LH
18 Wheel well — LH
19 Bomb bay — LH
20 Nose section — LH
21 Top surface inspection
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Figure 2–1.

1. NOSE SECTION.

a.	Pitot Tube Cover	Removed
b.	UHF and Shoran Antennas	Condition
c.	Static Air Vents	Open
d.	Transparent Nose	Condition
e.	Canopy	Condition
f.	Main Entrance Door	Condition
g.	Nitrogen Purge Discharge Discs	Intact

2. NOSE WHEEL WELL.

a.	All Hydraulic Lines	Check for leakage
b.	Gear Lock Safety Pin	Removed
c.	Shock Strut	Condition and proper extension
d.	Nose Gear Tires	Condition and check for slippage and proper inflation
e.	Nose Gear Doors	Condition
f.	Nose Wheel Locking Nut	Secured and safetied
g.	Ground Static Wire	Grounded

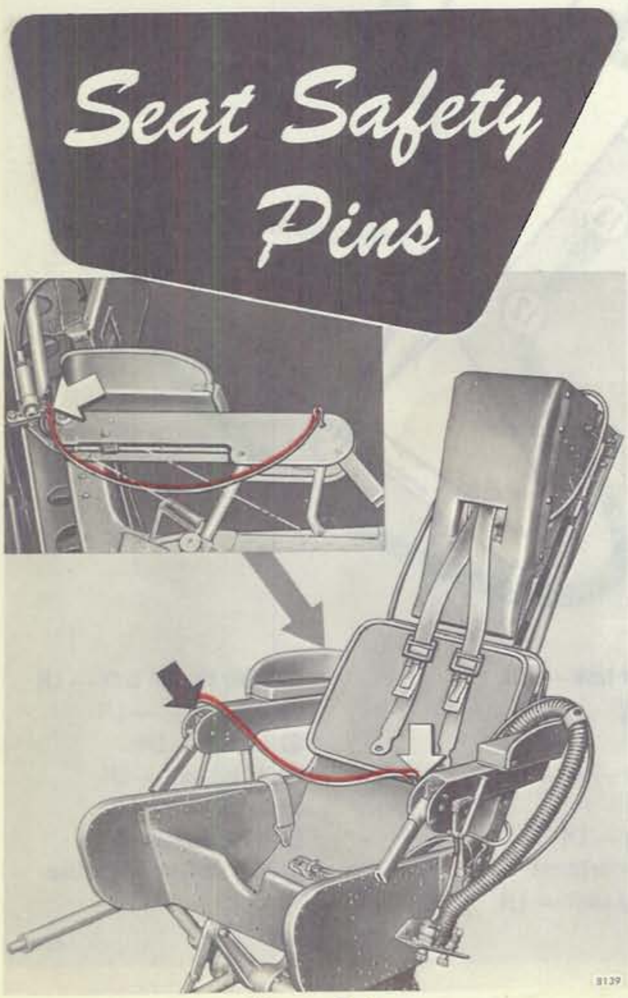

Figure 2-2.

3. ELECTRICAL ACCESS COMPARTMENT.

Check for Condition and Door Secure

4. BOMB BAY—RIGHT HAND.

a.	All Fuel Lines and Collectors	Condition, check for security and leakage
b.	Throttle Linkage	Condition and no binding
c.	Bomb Door	Security of bomb storage and shackles
d.	Actuating Cylinders	No leaks

5. WHEEL WELL—RIGHT HAND.

a.	Gear Lock Pin	Removed
b.	Low Pressure Fuel Strainer	Check for security and leakage
c.	Main System Hydraulic Accumulator Pressure	1000 psi minimum
d.	Hydraulic Reservoir Sight Gage	Checked
e.	Fire Extinguisher Pressure Gage	450 psi minimum
f.	Gear Extender Valve	Attachment removed and port covered
g.	Microswitches	Checked
h.	Actuating Cylinder	Clean and no leaks
i.	Main Gear Bearing Plate	Check for slippage
j.	Hydraulic Lines	Check for security and leakage
k.	Fuel Lines	Check for security and leakage
l.	Main Gear Doors	Condition and security of hinge and uplock pins and rods
m.	Ground Cooling Door and Cable	Checked and secured
n.	Tires	Proper inflation, slippage and condition
o.	Brakes	Condition
p.	Shock Strut	Condition and proper extension
q.	Wheel Chocks	In Place

6. ENGINE—RIGHT HAND.

a.	Cowling	Condition and secure
b.	Dust Covers	Removed
c.	Generator Ducts	Clear
d.	Air Intake Duct	Clear of foreign objects
e.	Compressor Blades	Checked

f. Cartridge Starter Breech and Lock	Cartridge installed with clip removed and lock secured
g. Front Main Bearing	Oil seepage
h. Cartridge Starter Exhaust	Condition
i. Starter Shock Absorber Lever	Check for movement
j. Nose Cap	Secured

CAUTION

If oil seepage is evident, the front main bearing seal must be checked prior to flight.

7. OUTER WING—RIGHT HAND.

a. Wing, Aileron,	Condition
b. Mooring Lug	Removed
c. Dive Brakes	Condition
d. Fuel Vent	Condition
e. Photoflash Cartridge Chutes	Clear

8. WING TIP AND TANK—RIGHT HAND.

Navigation Lights and Taxi Lights	Condition

9. WING TRAILING EDGE—RIGHT HAND.

a. Wing Leading Edge Flaps	Condition and aileron ground locks removed
b. Tail Pipe	Accumulation of fuel, oil, hot spots and clearances
c. Low Points in Underside of Nacelle	Check for accumulation of fuel or oil

10. AFT FUSELAGE—RIGHT HAND.

a. Navigation Lights	Condition
b. Fuel Vent	Condition

11. EMPENNAGE.

a. Navigation Lights	Condition
b. Rudder and Elevator Ground Locks	Removed
c. Rudder, Elevator, and Stabilizer	Condition and correct movement
d. Electrical Power	Battery connected and electrical power on
e. Trim Actuation	Correct travel
f. Electrical Power	Battery disconnected and electrical power off

12. AFT FUSELAGE—LEFT HAND.

a. Tail Skid	Condition
b. Mooring Lugs	Removed

13. CAMERA COMPARTMENT.

a. Camera Doors and Window	Checked
b. Spare Starter Cartridges	Available and stowed
c. Entrance Door	Secured

14. WING TRAILING EDGE—LEFT HAND.

a. Wing, Aileron and Flaps	Condition and aileron ground locks removed
b. Tail Pipe	For accumulation of fuel, oil, hot spots and clearances
c. Low Points in Underside of Nacelle	Check for accumulation of fuel or oil

15. WING TIP AND TANK—LEFT HAND.

Navigation Lights and Taxi Lights	Condition

16. OUTER WING—LEFT HAND.

a. Leading Edge	Condition
b. Mooring Lug	Removed
c. Landing Light	Condition
d. Dive Brakes	Condition
e. Fuel Vent	Condition
f. Photoflash Cartridge Chutes	Clear

17. ENGINE—LEFT HAND.

a. Cowling	Condition and secure
b. Dust Cover	Removed
c. Generator Ducts	Clear
d. Air Intake Duct	Clear of foreign objects
e. Compressor Blades	Checked
f. Cartridge Starter Breech and Lock	Cartridge installed with clip removed and lock secured
g. Front Main Bearing (See CAUTION under ENGINE—RIGHT HAND in this section.)	Oil seepage
h. Cartridge Starter Exhaust	Condition
i. Starter Shock Absorber Lever	Check movement
j. Nose Cap	Secured

k. Cabin Ram Air Inlet	Clear

18. WHEEL WELL—LEFT HAND.

a. Gear Lock Pin	Removed
b. Low Pressure Fuel Strainer	Check for security and leakage
c. Fire Extinguisher Pressure Gage	450 psi minimum
d. Microswitches	Checked
e. Actuating Cylinder	Clean and no leaks
f. Main Gear Bearing Plate	Check for slippage
g. Hydraulic Lines	Check for security and leakage
h. Fuel Lines	Check for security and leakage
i. Main Gear Doors	Checked
j. Ground Cooling Door and Cable	Secured
k. Tires	Proper inflation, slippage and condition
l. Brakes	Condition
m. Shock Strut	Condition and proper extension
n. Wheel Chocks	In place

19. BOMB BAY—LEFT HAND.

a. Bomb Door and Actuating Cylinders	Condition
b. Booster Pumps	Condition
c. Throttle Linkage	Condition and no binding
d. Push-Pull Control Rods	Condition and no binding
e. Landing Gear Control Cable	Condition
f. Hydraulic Lines, Valves and Connections	Condition and no leakage

20. NOSE SECTION—LEFT SIDE.

a. Personnel Safety Switch	Flight position
b. Bomb Door Ground Shut-Off Valve Door	Closed and locked
c. Battery Compartment	Connect battery, check jar security and residue
d. Brake Accumulator	Minimum 850 psi
e. Oxygen Valve	Build-up lever safetied and door closed
f. Free Air Bulb	Clear

21. TOP SURFACE INSPECTION.

a. Fuel and Oil Tanks	Quantity and caps secured

Note

Checking the oil level by looking into the standpipe is a very inaccurate method of determining the quantity of oil in the tank. The oil tank must be filled to overflowing in order to be certain that the tank is full.

b. Hydraulic Filler Cap	Secured
c. Equipment Compartment Hatch	Secured

ON ENTERING THE AIRPLANE.

INTERIOR CHECK (ALL FLIGHTS).

1. Hydraulic Ground Shut-off Valve (star valve)	Closed and safetied
2. First Aid Kit	Stowed
3. Crash Axe	Stowed
4. Fire Extinguisher	Stowed
5. Emergency Hyd. Hand Pump Handle	In position and locked
6. Observer Compartment	Secured
7. Observer Circuit Breaker Panel	All circuit breakers in
8. Seat and Rudder Pedals	Adjusted
9. Seat Belt, Harness and Oxygen Hose	Adjusted and inertia reel unlocked
10. Control Column	Unstowed
11. Light Panel	All lights off
12. Circuit Breaker Panel	All circuits breakers in
13. Publications	Checked
14. All Light Switches	Off
15. Navigation Lights	OFF
16. Generator Switches	Check ON
17. Canopy Jettison Switch	OFF and safetied
18. Pilot's Canopy and Column Stowage Circuit Breakers	In
19. Tip Tank Jettison Switch	OFF and safetied
20. Master Jettison Switch	OFF and safetied
21. Inverters	OFF
22. Pitot Heat Switch	OFF
23. Clear Vision Switch	OFF
24. Demist Switch	OFF

25.	Liquid Oxygen Gage	Check for quantity
26.	Voltmeter Selector Switch	BAT
27.	Pilot Oxygen System	Check for operation

Check the following items on the oxygen equipment: Pressure gage, mask, connection at mask, quick disconnect fitting, regulator, indicator, and bail-out bottle available. Refer to Section IV for blow-back test.

28.	Flaps Switch	UP
29.	Throttles	OFF
30.	Fuel Purge	OFF
31.	Taxi and Landing Lights Switches	OFF
32.	Landing Gear Handle	DOWN and locked
33.	Parking Brake Lever	ON
34.	Inst. Panel	Checked
35.	Emergency Fuel Control Switches	OFF
36.	All Radios and IFF	OFF
37.	Cabin Air Selector Switch	RAM
38.	Cabin Dump Switch	OFF
39.	Camera Main Power Switch	OFF

Note

When available, an external power source should be used for power before starting the engines. The engine may be started from the battery, provided the electrical loads are properly monitored. See STARTING ENGINES WITH BATTERY in this section when battery is to be used.

INTERIOR CHECK (NIGHT FLIGHT).

For night operation make the preceding checks in addition to the following:

Navigation Lights	ON
All Other Lights	As necessary

Note

Spare light bulbs are carried in a kit which is located above and to the right of the observer's seat.

BEFORE STARTING ENGINES.

WARNING

Be sure that all personnel are at least 25 feet from the starter before starting, in case the turbine wheel should break loose from its bearings.

See figure 2–3 for danger areas resulting from engine intake and exhaust.

1.	Fire Detection System and Lights (Group A)	Check operation
2.	Fire Detection Lights and Overheat System (Group B)	Check operation
3.	Landing Gear Warning Horn and Warning Light	Check operation
4.	Ground Personnel	Clear of danger areas

Note

It is considered good practice to head the airplane into the wind when starting the engines.

CAUTION

Before starting engines, place the voltmeter selector switch in BAT position to check battery voltage. The snatch unit, canopy, and hatch detonators are connected to the battery bus and are dependent on the battery for activation. The detonators will not fire and the snatch unit cannot be actuated if the battery voltage is below 11.5 volts. If the battery voltage is below 18 volts, the battery will not recharge with engines running because a minimum of 18 volts are required to energize the battery contactor, which completes the circuit between the battery and the 28-volt d-c generator bus.

STARTING ENGINES.

The presence of carbon monoxide in the flight compartments of jet aircraft has been suspected in numerous instances. Some of these instances have been brought to light through accident investigations. There are various means by which carbon monoxide may enter a flight compartment during ground operation; however, as yet, neither the exact concentration nor the exact sources have been determined.

If the aircraft is to be operated on the ground under possible conditions of carbon monoxide contamination, such as during "runup" or taxiing directly behind another operating jet aircraft, or during "runup" with its tail into the wind, the following procedure shall be used:

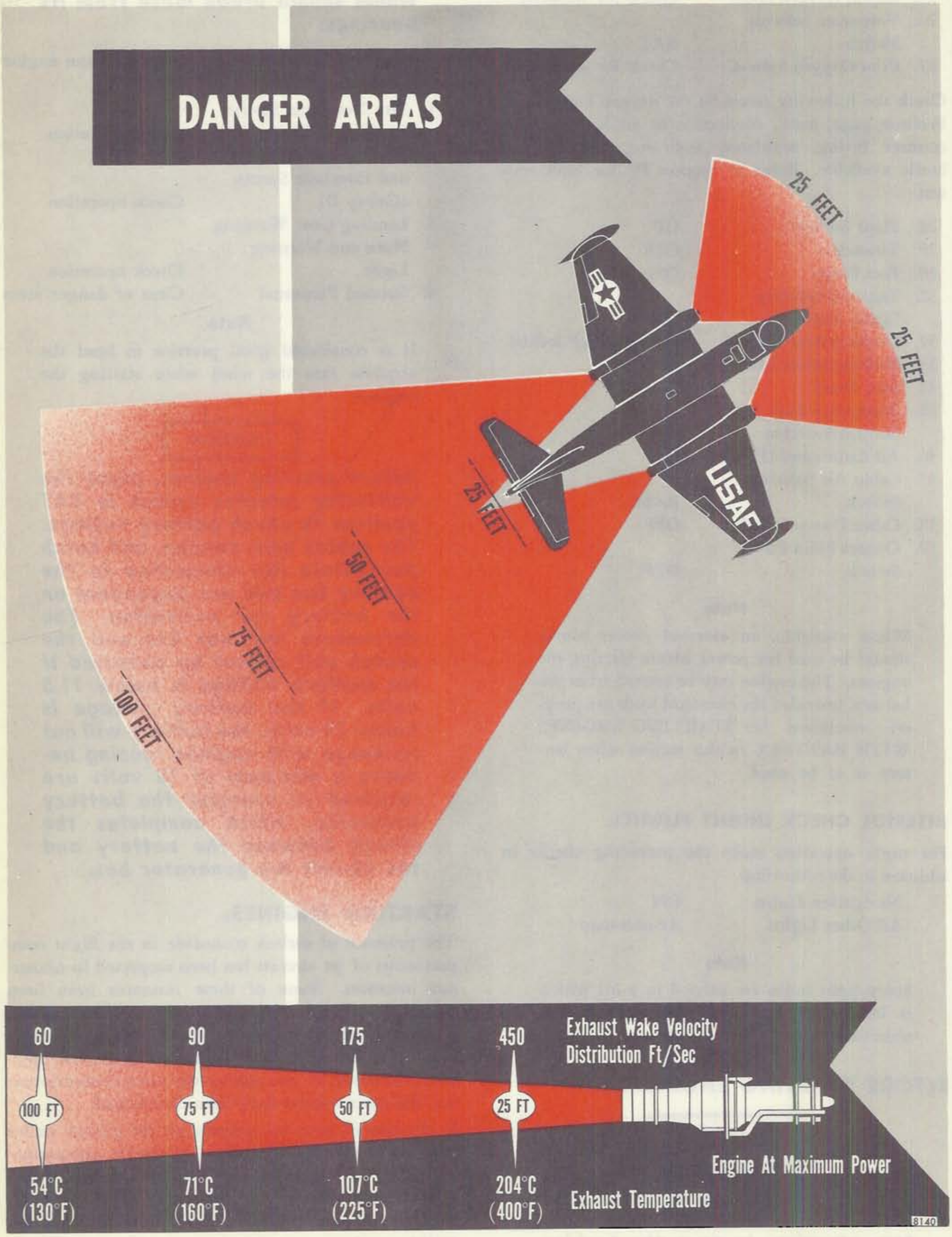
DANGER AREAS
25 FEET
25 FEET
USAF
25 FEET
50 FEET
75 FEET
100 FEET
60
90
175
450
Exhaust Wake Velocity
Distribution Ft/Sec
100 FT
75 FT
50 FT
25 FT
Engine At Maximum Power
54°C
(130°F)
71°C
(160°F)
107°C
(225°F)
204°C
(400°F)
Exhaust Temperature
8140

Figure 2–3.

1. Before starting engines, all crew members will don oxygen masks, connect hoses to oxygen regulator, and place the diluter lever at the 100% OXYGEN position.
2. Whenever contamination is suspected, use 100% OXYGEN during ground operation and take-off.
3. After contamination is no longer suspected, place the diluter lever of the oxygen regulator at the NORMAL OXYGEN position.

WARNING

The oxygen diluter lever must be returned to the NORMAL OXYGEN position as soon as possible because the use of 100 percent oxygen throughout a long mission will so deplete the oxygen supply as to be hazardous to the flight crew.

STARTING ENGINES WITH EXTERNAL POWER.

1.	Engine Fuel Valve Knobs	Flow and safetied
2.	No. 1 Fuselage Tank Booster Pumps Switch	Safetied ON
3.	Fuel Transfer and By-Pass Valve Knob	Safetied to flow-to-No. 1 fuselage tank

Note

The No. 1 fuselage tank booster pumps switch and the fuel transfer and bypass valve knob are safetied in their normal operating positions as a safety precaution. The switch and knob are safetied with a light gage wire to permit manual overriding in an emergency and bypassing of the No. 1 fuselage tank.

4.	Wing Tank-Tip Tank Knobs	OFF
5.	No. 2 Fuselage Tank Fuel Valve Knob	Flow
6.	No. 1 Inverter Switch	ON, check lights
7.	Interphone	Check
8.	No. 1 Engine Throttle	IDLE
9.	No. 1 Engine Starting and Ignition Switch	START
10.	Hydraulic System Pressure Gage	Check for pressure build-up

Note

When a starting and ignition switch is placed in the START position, ignition will be provided for approximately 15 seconds, during which time the primer valve is opened. At the end of the ignition cycle the timer automatically cuts out, closing the primer valve and breaking the circuit to the ignition coils. Firing the cartridge starter should accelerate the engine to 18 to 22 percent rpm. After the engine has stabilized at 36 to 42 percent rpm (idling speed), check the oil pressure, which should be 10 to 20 psi with fuel flow about 1000 pounds per hour. The normal tail pipe temperature at idling speed is about 500°C. Refer to ENGINE LIMITATIONS in Section V for maximum limits during starting and idling.

Repeat the above procedure for the No. 2 engine.

11.	Remove External Power Source	
12.	Battery Switch	BATTERY

STARTING ENGINES WITH BATTERY.

Note

Use an external power source for pre-start checks of electrical or electronic equipment.

The engines may be started on the battery alone, provided the electrical loads are properly monitored. This means all the electrical equipment must be OFF until after the start is made. On a battery start, only one engine should be started at a time, in order to reduce the electrical loads imposed by the ignition switch and starting timer. If the engine fails to start or the starter cartridge misfires, all electrical loads must be shut off immediately.

Note

All warnings and cautions and notes listed under STARTING ENGINES WITH EXTERNAL POWER are also applicable under this procedure.

1.	Voltmeter Selector Switch	BAT and check voltage
2.	Battery Switch	BATTERY
3.	Voltmeter Selector Switch	Gen. 2L or 2R
4.	No. 2 Engine Fuel Valve Knob	Flow—Safetied
5.	Fuel Transfer and Bypass Valve Knob	Safetied to flow-to-No. 1 tank
6.	No. 1 Fuselage Tank Booster Pumps Switch	Flight position safetied ON
7.	Interphone	Check
8.	No. 1 Engine Throttle	IDLE

9. No. 1 Engine Start and Ignition Switch — START
10. No. 2 Fuselage Tank — Flow
11. No. 1 Inverter Switch — ON at 25% rpm

When the No. 2 engine rpm has stabilized, proceed with normal cockpit preparation prior to starting the No. 2 engine.

ENGINE HOT START.

An engine hot start is caused by a greater than normal amount of fuel being delivered to the engine during the starting cycle, thereby causing higher than normal starting temperatures. If five starts are made in which the exhaust gas temperature reaches the recommended limits listed in Section V, or if one start exceeds 900°C, a special inspection is required prior to flight as outlined in the Inspection Requirements Handbook for the airplane.

ENGINE FALSE START.

If the exhaust gas temperature does not commence to rise before the engine decelerates to 17 percent rpm:

1. Close the throttle to the OFF position.
2. Eliminate the cause of the false start before making further starting attempts.
3. Be sure that surplus fuel is completely drained from the combustion chamber before attempting another start.

CAUTION

Because of the excessive heat generated by the ignition coils during the starting cycle, only two consecutive starting attempts may be made. A 20-minute cooling period is required before making a third attempt. After 40 minutes or longer, this cycle may be repeated.

ENGINE LIMITS.

The maximum exhaust temperatures allowed for steady-state operation and during acceleration are listed in Section V. If the exhaust gas temperature exceeds these limits, retard the throttle immediately. If the engine rpm exceeds the limits given in Section V during acceleration or steady-state operation, the engine must be shut down immediately and corrective action taken.

ENGINE OIL PRESSURE FAILURE.

Refer to Engine Oil Pressure Failure in Section VII.

ENGINE GROUND OPERATION.

GROUND CHECKS.

1. No. 2 Inverter Switch — ON
2. Instrument Inverter Switch — NORMAL
3. Generator Switches — All ON and check load output
4. Voltmeter Selector Switch — Each generator and check voltage
5. Cabin Air Selector Switch — RAM
6. Clear Vision Switch — ON
7. Demist Switch — ON

Check the instrument readings with the throttles in the IDLE position.

BEFORE TAXIING.

1. Repeat the check of the fire detection system and lights on Group A airplanes.
2. Repeat the check of the fire and overheat detection system and lights on Group B airplanes.

Note

Check to see that all applicable gages are indicating properly and that the positions of the switches given below coincide with their respective controls.

3. Aileron Trim — 0°
4. Rudder Trim — 0°
5. Horizontal Stabilizer — 3/4 division nose down (see figure 2-4)
6. Flight Instruments — Checked
7. Radios — Checked
8. IFF — As required
9. Fuel Quantity Check — Each tank and leave at No. 1 tank position
10. Fuel Quantity Test Switch — Test position
11. Cabin Air Selector Switch — As required
12. Check With Ground Crewman on Position of Bomb Door Dive Brakes and Flaps — Set for take-off position
13. Entrance Door — Closed and locked
14. Armrest — Up
15. Seat Pins — Removed
16. Chocks — Removed

17. Parking Brake	OFF
18. Brake Pressure	Check

Note

Check the wheel brakes by alternately holding one brake pedal down and releasing it, meanwhile observing the brake pressure dropping and building up again. Check the other brake in the same manner. If the brake is inoperative, the gage will not show a drop in pressure when the pedal is depressed.

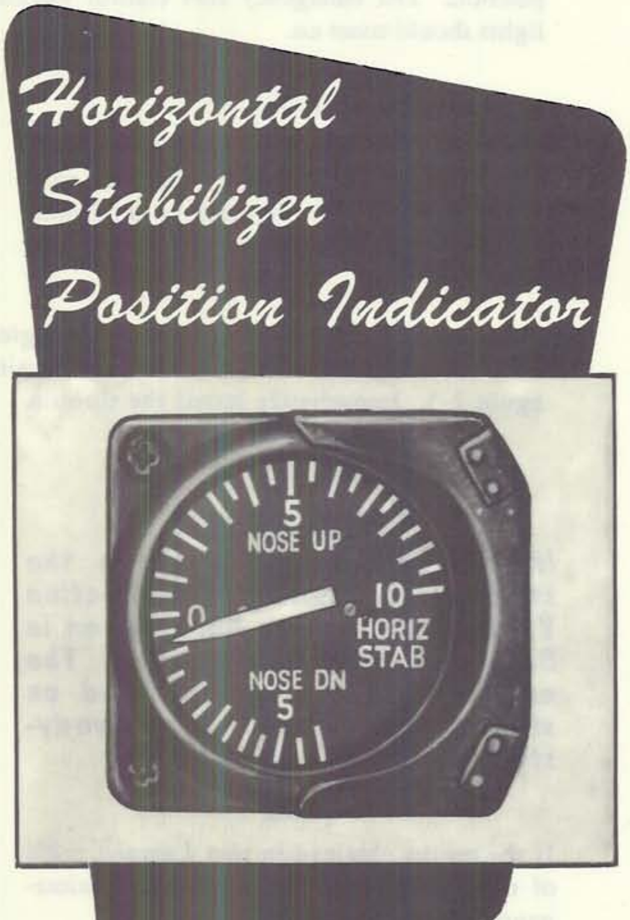

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Figure 2–4.

CAUTION

The main system hydraulic pressure gage is a good indication of the proper functioning of the hydraulic system. Normally, the gage will show an imperceptible amount of movement and will indicate only an occasional recharge of the system at about 2-1/2 minute intervals. When no hydraulic component is being operated and the main system gage shows a continual oscillation, or a constant value of approximately 3,500 psi, these are indications of a malfunction of the hydraulic system. It is good pilot practice to check this after the gear has been retracted during the initial climb out after take-off. Discovery of a hydraulic malfunction at this stage of the flight may make possible a normal immediate landing without recourse to emergency procedures. Rapid continued fluctuation of this gage will indicate a malfunctioning or bypassing control valve which will generate excessive heat in the hydraulic lines. Rapid continued fluctuation of the gage will also indicate hydraulic leak in a pressure line or certain failures of the accumulator.

If the pilot or observer desires to check the operation of the camera doors before take-off, proceed as follows:

1. Camera Main Power Switch	CAMERA MAIN PWR position
2. Master Control Panel Power and Ready Switches	POWER and READY positions
3. Vertical or Split Vertical Camera Station Mode Selectors	Any position except OFF

With these switches in the proper position, the door will start to open. The flickering amber power indicator light indicates the door is opening. When the door is fully open, the amber light will go out, and the green indicator lights illuminate. Close the door by reversing the above cycle.

TAXIING.

The airplane is steered by braking of the toe-operated rudder pedals. *Approximately 8 gallons (52 pounds) of fuel are consumed for each minute of normal taxiing.*

1. Brakes and Pressure	Checked
2. Needle and Ball	Checked

CAUTION

If the pilot believes that the air charge in the nose gear oleo has been lost by reason of excessive noise, obvious bottoming, and hard riding, he should immediately stop

taxiing and ask for assistance. If air is lost and the nose gear turned more than 20 degrees, the nose gear and airplane structure will be damaged.

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

After taxiing to take-off position, hold the brakes and check the following:

1. Clear Vision Panel	Closed
2. Clear Vision Switch	ON
3. Demist Switch	Demisting
4. Pitot Heat Switch	As required
5. Flight Controls	Checked for full freedom of movement
6. Trim Devices Indicators	
a. Aileron Trim	0 degrees
b. Rudder Trim	0 degrees
c. Horizontal Stabilizer	NOR
7. Horizontal Stabilizer Override Switch	3/4 division nose down
8. Wing Flaps Switch	UP
9. Dive Brakes Switch	CLOSE
10. Canopy Jettison and Control Column Stowage Detonator Circuit Breakers	In
11. Seat Belt and Shoulder Harness	Adjusted
12. Inertia Reel	Unlocked
13. All Circuit Breakers	Check in

WARNING

Check that all seat safety pins have been removed, otherwise serious injury or death may result if ejection is attempted with safety pin still installed.

PREFLIGHT ENGINE CHECK.

Refer to Section VII for fuel system management procedures, and to figure 1-10 for airplane fuel system schematic.

Check that the fuel controls are in the following positions:

1. Wing Tanks	Off
2. Engine Fuel Valve Knobs	Safetied—Flow
3. No. 1 Fuselage Tank Booster Pumps Switch	Safetied—ON
4. Fuel Transfer and Bypass Valve Knob	Safetied to flow-to-No. 1 fuselage tank
No. 2 Fuselage Tank Knob	Flow

5. Advance the throttles for No. 1 and No. 2 engines to 90 percent rpm.
6. Place the emergency fuel control switches for No. 1 and No. 2 engines in the EMERGENCY position. The emergency fuel control warning lights should come on.

Note

The engine rpm will increase or decrease immediately if the ambient conditions vary from a standard day. If ambient conditions are near standard, no apparent change will occur.

7. Advance the throttle for No. 1 and No. 2 engines to the FULL position and check the rpm against figure 2-5. Immediately retard the throttle.

WARNING

If the engine rpm exceeds the steady-state limits given in Section V, the acceleration limits given in Section V must be observed. The engine must not be operated on steady-state above the steady-state limits.

Note

If the results obtained in step 4 exceed ±2% of the value specified in figure 2-5, maintenance will be required.

8. If the results obtained are satisfactory, set the engine rpm at 90 percent; retard the throttle slowly to IDLE; and place the emergency fuel control switch in the OFF position at 60 percent rpm or less during deceleration. This will return the engine to the normal fuel control system and the emergency fuel control lights should go out.
9. It is recommended that the demisting switch be in the DEMISTING position, and remain so during taxi, take-off, flight, and landing. Hot air may be used as required to prevent fog from entering the cabin.
10. Have the observer place the slaved gyro compass switch to the IN position.

TAKE-OFF.

1. Check the engine instruments for satisfactory readings.
2. Throttles 100% desired
3. Instruments Checked

Note

On take-off, the rpm should be 99 to 100.7 percent; tail pipe temperature, 590° to 640°C; oil pressure, 30 to 40 psi; and fuel flow, 6200 to 7200 pounds per hour per engine.

4. Partially tighten the throttle friction knob to prevent "creep back" during take-off.
5. Release the brakes and commence the take-off. The brakes may be used for directional control until there is positive rudder response. Refer to Appendix I for best take-off speeds.

Note

When the brakes are released, the control column must be held well forward of neutral to prevent the airplane from assuming the take-off attitude before the optimum take-off speed.

6. Upon attaining optimum take-off speed, raise the nose and the airplane will fly itself off the ground and accelerate rapidly.

Note

A compressor discharge pressure limiter is incorporated in the fuel control system to automatically reduce the fuel flow to the engines whenever the compressor discharge pressure exceeds its limits. This will occur at high speeds, low altitude conditions, and on cold days. The condition should be recognized by the pilot to avoid unnecessary concern on his part regarding the proper functioning of the fuel control system.

AFTER TAKE-OFF.

When the airplane is definitely airborne and has gained sufficient altitude, the following operations must be performed:

1. Apply brakes lightly to prevent the wheels from spinning.
2. Place landing gear lever in the UP position.

Note

The landing gear retraction time is four to six seconds.

CAUTION

When take-offs are made with light gross weights, a high initial rate of climb or a reduction in power will be necessary to prevent exceeding the placarded limitation speed for the extended landing gear.

3. No. 2 Fuselage Tank Feeding

Note

The aileron and rudder trim device indicators do not reflect the true movement of the trim devices, but only a relative movement.

4. Position the cabin air selector switch as required.

CLIMB.

Refer to the Climb Charts, Appendix I, for climb speed of airplanes with varied gross weights and configurations.

CAUTION

The maximum time allowed for maximum or military power is 30 minutes.

EMERGENCY FUEL CONTROL AND DE-CONTROL.

If, for any reason, you decide to change to emergency fuel control, follow the procedure given under PARTIAL POWER FAILURE in Section III. To transfer from emergency fuel control back to normal fuel control, use the following procedures:

1. Set throttle at 90 percent rpm.
2. Retard the throttle slowly toward the IDLE position and place the emergency fuel control switch in the OFF position at 60 percent or less during the deceleration.
3. Accelerate slowly to desired rpm.

FLIGHT CHARACTERISTICS.

See Section VI for information regarding flight characteristics.

DESCENT.

See the descent charts in Appendix I for descent data.

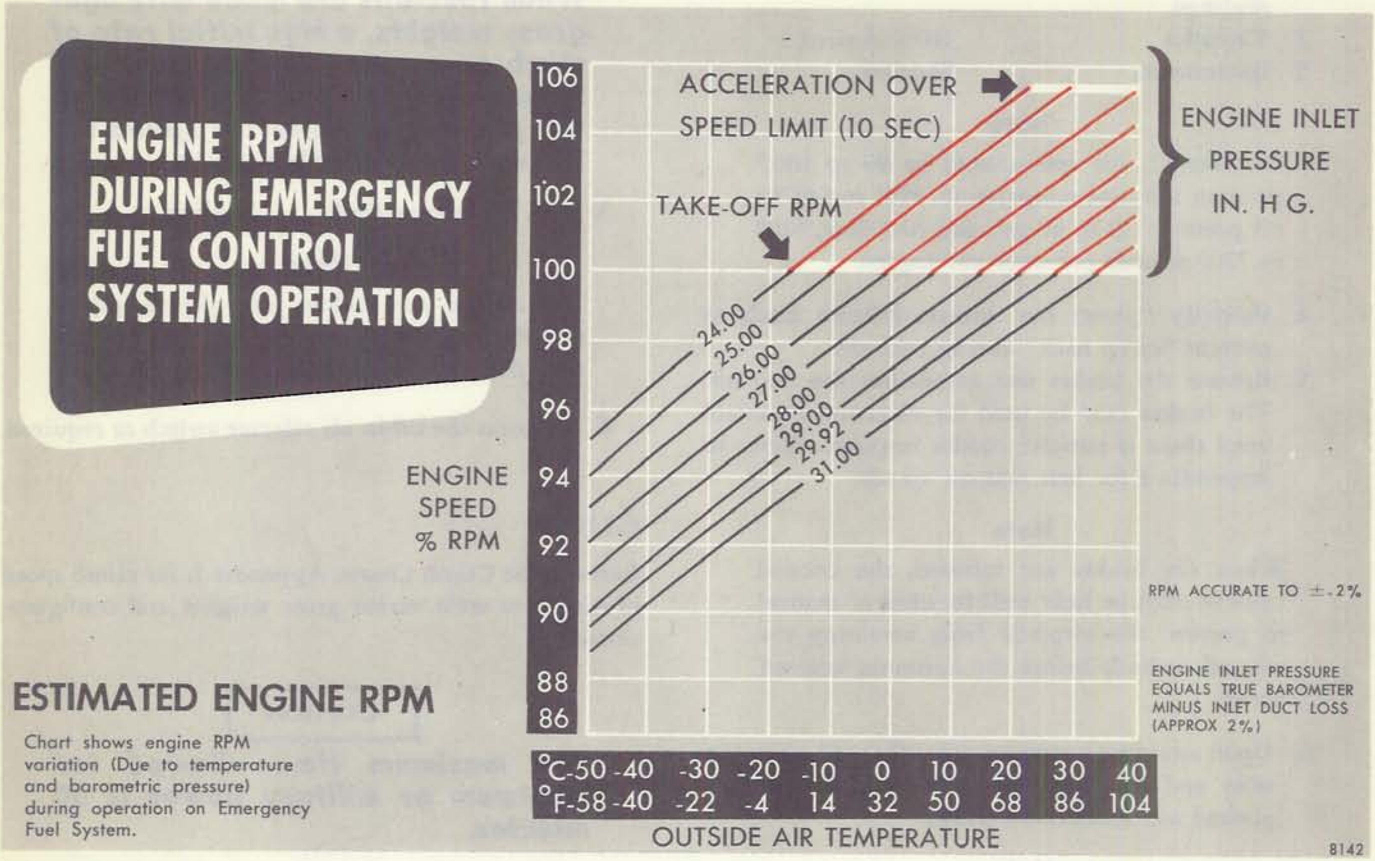


Figure 2-5.

TRAFFIC PATTERN CHECK LIST.

1. Alert crew for landing.

CAUTION

If a landing must be made with the emergency fuel control switches in the EMERGENCY position, use the throttles slowly and smoothly to avoid compressor stall or overspeed.

2. Armament Switches	OFF
3. Fuel Transfer and Bypass Valve Knob	Safetied to flow-to-No. 1 fuselage tank
4. No. 1 Fuselage Tank Booster Pumps Switch	Safetied ON
5. Applicable Fuel Tank (Containing Fuel) Knobs	Flow
6. Safety Belt and Shoulder Harness	Adjusted and tight
7. Inertia Reel	Unlocked

The remaining operations, the places at which they are to be performed, and the safe approach speeds are shown on the Landing Pattern Diagram (figure 2-6).

Note

The landing gear extension time is approximately six seconds, and operation of two or more hydraulic sub-circuits at the same time will not lengthen the normal operating time.

8. Dive Brakes	As desired
9. Landing Gear Handle	DOWN and locked
10. Landing Gear Position Indicators	Down
11. Landing Gear Warning Light	Out
12. Main Hydraulic System Pressure Gage	Within limits
13. Brake Pressure Gage	Check pressure

WARNING

Do not attempt to check the brake pressure by depressing the pedals after emergency landing gear extension.

LANDING.

Landings are to be normal semi-stall. The full length of the runway should be used during the landing roll in order that the brakes be used as little as possible when bringing the airplane to a stop.

Note

When approaching for landings with the landing gear and flaps extended and a center of gravity aft of 25 percent MAC, a push force is required to maintain desired airspeed. This push force will decrease with decrease in speed, and a pull force will be required at touchdown. See Section III for emergency procedures.

CAUTION

To allow adequate cooling time between brake applications, allow 15 minutes between landings if the gear remains extended or 30 minutes if the gear is retracted. When a high energy stop is completed, a brake inspection for serviceability must be made.

GO-AROUND.

WARNING

Make the decision to go around as soon as possible, and keep in mind that a jet powered airplane does not accelerate nearly as rapidly as a propeller driven airplane.

1. Open throttles smoothly commensurate with increase in engine rpm.

Note

Under adverse conditions, engine acceleration from idle to maximum thrust may take from twelve to fourteen seconds. Asymmetrical acceleration of the engines must be expected and will be accompanied by a yawing tendency but the yaw will be controllable.

2. Place the flaps control switch in the UP position.

CAUTION

The flaps must be retracted before attaining a speed of 170 knots IAS or structural damage may result.

3. When a definite rate of climb has been established and contact with the ground will not be made, place the landing gear control lever in the UP position.

CAUTION

The landing gear must be retracted before attaining a speed of 200 knots IAS or structural damage may result.

4. Retract the dive brakes.

AFTER CLEARING RUNWAY.

1.	Flaps Switch	UP
2.	Dive Brakes Switch	Close
3.	Trim Tabs	Checked and set

STOPPING ENGINES.

1.	Parking Brakes	Set
2.	Throttle No. 1	OFF
3.	Hydraulic Pressure	Checked
4.	Clear Vision and Demisting Switches	OFF
5.	All Radios and IFF	OFF
6.	Inverters	OFF
7.	Oxygen System	OFF
8.	Throttle No. 1	OFF
9.	All Fuel System Valves and Switches	All OFF except those which are safetied

Note

If the engines are being shut down from 95% rpm or above, pause for at least one minute at IDLE to allow temperature conditions in the engines to stabilize, and when they are stabilized, place the throttle in the OFF position. If the engines are being shut down from below 95% rpm, the throttles may be closed immediately to the OFF position.

10.	Bomb Bay Doors	As desired
11.	Battery Switch	OFF
12.	Wheel Chocks	In place
13.	Brakes	OFF
14.	All Seat Safety Pins	Installed

Figure 2–6. (Sheet 1 of 2)

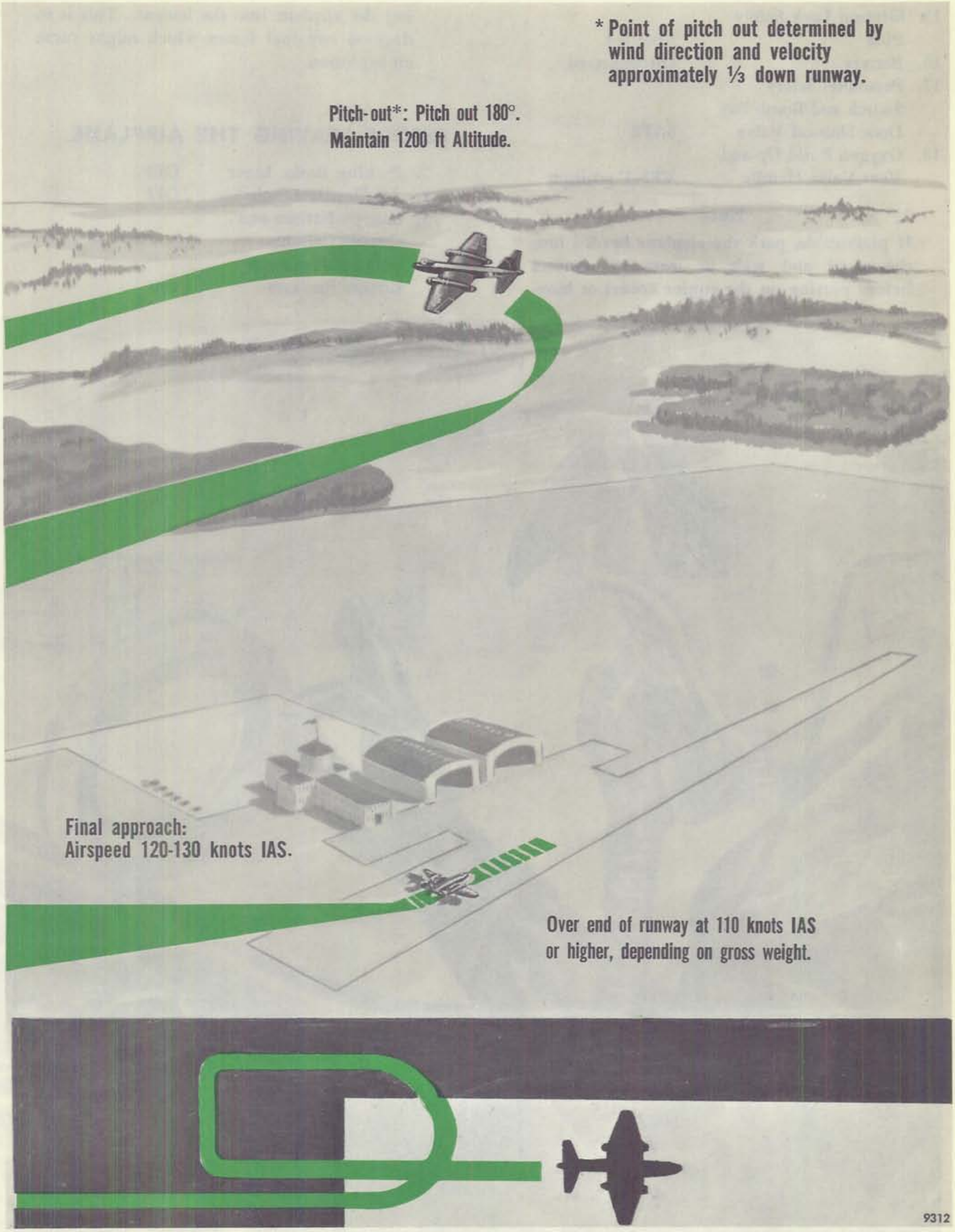


Figure 2–6. (Sheet 2 of 2)

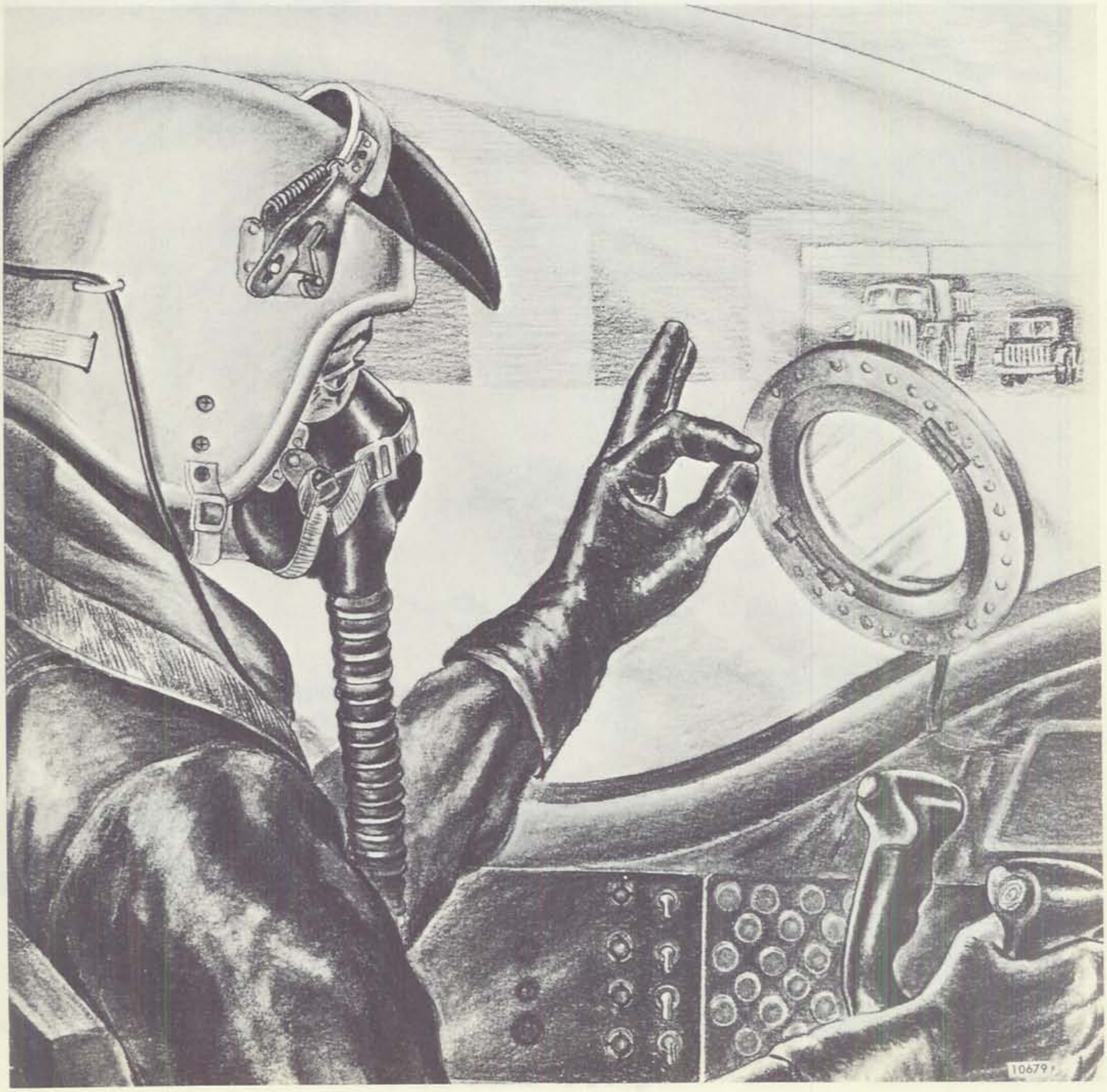
15.	Ground Lock Safety Pins	Installed
16.	Battery	Disconnected
17.	Personnel Safety Switch and Bomb Bay Door Shut-off Valve	SAFE
18.	Oxygen Build Up and Vent Valve Handle	VENT position

Note

If practicable, park the airplane headed into the wind and wait at least 15 minutes before putting on the engine covers or moving the airplane into the hangar. This is to disperse any fuel fumes which might cause an explosion.

BEFORE LEAVING THE AIRPLANE.

1.	Parking Brake Lever	OFF
2.	All Electrical Switches	OFF
3.	Canopy Jettison and Control Column Stowage Detonator Circuit Breakers	Out



CUT ON BLACK LINE

RB-57A CONDENSED CHECK LIST

BEFORE ENTERING AIRPLANE.

Flight Restrictions	Checked

FLIGHT PLANNING.

1. Cruise Control Data	Checked
2. Fuel	Checked
3. Oil	Checked
4. Oxygen	Checked
5. Photo Equipment	Checked
6. Armament	Checked
7. Special Equipment	Checked
8. Weight and Balance	Checked

PRIOR TO ENTRANCE.

1. Bomb Door Ground Shut-off Valve Door	Open
2. Bomb Door Personnel Safety Switch	SAFE
3. Battery	Disconnected

BEFORE EXTERIOR INSPECTION.

1. DD Form 781	Status today
2. Battery Switch	OFF
3. Seat Safety Pins	Installed
4. External Stores Switches	Off
5. Master Arm Switch	Off
6. Bomb Door Switch	OFF
7. Bomb Panel Switches	Off
8. Bomb Arming Switch	SAFE
9. Canopy and Control Column Stowage Detonator Circuit Breakers	IN
10. Canopy Jettison Switch	OFF
11. Tip Tank Jettison Switch	OFF

1

CUT ON BLACK LINE

2

12. Master Jettison Switch	OFF
13. Landing Gear Lever	DOWN and locked
14. Main System Hydraulic Pressure Gage	Zero Pressure

EXTERIOR INSPECTION.

1. NOSE SECTION.

a. Pitot Tube Cover	Removed
b. UHF and Shoran Antennas	Condition
c. Static Air Vents	Open
d. Transparent Nose	Condition
e. Canopy	Condition
f. Main Entrance Door	Condition
g. Nitrogen Purge Discharge Discs	Intact

2. NOSE WHEEL WELL.

a. All Hydraulic Lines	Check of leakage
b. Gear Lock Safety Pin	Removed
c. Shock Strut	Condition and proper extension
d. Nose Gear Tires	Condition and check for slippage and proper inflation
e. Nose Gear Doors	Condition
f. Nose Wheel Locking Nut	Secured and safetied
g. Ground Static Wire	Grounded

3. ELECTRICAL ACCESS COMPARTMENT.

Check for Condition and Door Secure

4. BOMB BAY—RIGHT HAND.

a. All Fuel Lines and Collectors	Condition check for security and leakage
b. Throttle Linkage	Condition and no binding
c. Bomb Door	Security of bomb storage and shackles
d. Actuating Cylinders	No leaks

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5. WHEEL WELL—RIGHT HAND.

a. Gear Lock Pin	Removed
b. Low Pressure Fuel Strainer	Check for security and leakage
c. Main System Hydraulic Accumulator Pressure	1000 psi minimum
d. Hydraulic Reservoir Sight Gage	Checked
e. Fire Extinguisher Pressure Gage	450 psi minimum
f. Gear Extender Valve	Attachment removed and port covered
g. Microswitches	Checked
h. Actuating Cylinder	Clean and no leaks
i. Main Gear Bearing Plate	Check for slippage
j. Hydraulic Lines	Check for security and leakage
k. Fuel Lines	Check for security and leakage
l. Main Gear Doors	Condition and security of hinge and uplock pins and rods
m. Ground Cooling Door and Cable	Checked and secured
n. Tires	Proper inflation slippage and condition
o. Brakes	Condition
p. Shock Strut	Condition and proper extension
q. Wheel Chocks	In place

6. ENGINE—RIGHT HAND.

a. Cowling	Condition and secure
b. Dust Covers	Removed
c. Generator Ducts	Clear
d. Air Intake Duct	Clear of foreign objects
e. Compressor Blades	Checked
f. Cartridge Starter Breech and Lock	Cartridge installed with clip removed and lock secured

3

CUT ON BLACK LINE

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g. Front Main Bearing	Oil seepage
h. Cartridge Starter Exhaust	Condition
i. Starter Shock Absorber Lever	Check for movement
j. Nose Cap	Secured

7. OUTER WING—RIGHT HAND.

a. Wing Leading Edge	Condition
b. Mooring Lug	Removed
c. Dive Brakes	Condition
d. Fuel Vent	Condition
e. Photoflash Cartridge Chutes	Clear

8. WING TIP AND TANK—RIGHT HAND.

Navigation Lights and Taxi Lights	Condition

9. WING TRAILING EDGE—RIGHT HAND.

a. Wing, Aileron, Flaps	Condition and aileron ground locks removed
b. Tail Pipe	Check for accumulation of fuel, oil, hot spots and clearances
c. Low Points in Underside of Nacelle	Check for accumulation of fuel and oil

10. AFT FUSELAGE—RIGHT HAND.

a. Navigation Lights	Condition
b. Fuel Vent	Condition

11. EMPENNAGE.

a. Navigation Lights	Condition
b. Rudder and Elevator Ground Locks	Removed
c. Rudder, Elevator, Stabilizer	Condition and correct movement
d. Electrical Power	Battery connected and electrical power on

CUT ON BLACK LINE

e. Trim Actuation	Correct travel
f. Electrical Power	Battery disconnected and electrical power off

12. AFT FUSELAGE—LEFT HAND.

a. Tail Skid	Condition
b. Mooring Lugs	Removed

13. CAMERA COMPARTMENT.

a. Camera Doors and Window	Checked
b. Spare Starter Cartridges	Available and stowed
c. Entrance Door	Secured

14. WING TRAILING EDGE—LEFT HAND.

a. Wing, Aileron, and Flaps	Condition and aileron ground locks removed
b. Tail Pipe	Check for accumulation of fuel, oil, hot spots and clearances
c. Low Points in Underside of Nacelle	Check for accumulation of fuel and oil

15. WING TIP AND TANK—LEFT HAND.

Navigation Lights and Taxi Lights	Condition

16. OUTER WING—LEFT HAND.

a. Leading Edge	Condition
b. Mooring Lug	Removed
c. Landing Light	Condition
d. Dive Brakes	Condition
e. Fuel Vent	Condition
f. Photoflash Cartridge Chutes	Clear

17. ENGINE—LEFT HAND.

a. Cowling	Condition and secure
b. Dust Cover	Removed

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c. Generator Ducts	Clear
d. Air Intake Duct	Clear of foreign objects
e. Compressor Blades	Checked
f. Cartridge Starter Breech and Lock	Cartridge installed with clip removed and lock secured
g. Front Main Bearing	Oil seepage
h. Cartridge Starter Exhaust	Condition
i. Starter Shock Absorber Lever	Check movement
j. Nose Cap	Secured
k. Cabin Ram Air Inlet	Clear

18. WHEEL WELL—LEFT HAND.

a. Gear Lock Pin	Removed
b. Low Pressure Fuel Strainer	Checked, security and no leakage
c. Fire Extinguisher Pressure Gage	450 psi minimum
d. Microswitches	Checked
e. Actuating Cylinder	Clean and no leaks
f. Main Gear Bearing Plate	Check for slippage
g. Hydraulic Lines	Check for security and leakage
h. Fuel Lines	Check for security and leakage
i. Main Gear Doors	Checked
j. Ground Cooling Door and Cable	Secured
k. Tires	Proper inflation, slippage and condition
l. Brakes	Condition
m. Shock Strut	Condition and proper extension
n. Wheel Chocks	In place

19. BOMB BAY—LEFT HAND.

a. Bomb Door and Actuating Cylinders	Condition

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	b. Booster Pumps	Condition
	c. Throttle Linkage	Condition and no binding
	d. Push-Pull Control Rods	Condition and no binding
	e. Landing Gear Control Cable	Condition and no obstruction
	f. Hydraulic Lines, Valves and Connections	Condition and no leakage
20.	NOSE SECTION—LEFT SIDE.	
	a. Personnel Safety Switch	FLIGHT position
	b. Bomb Door Ground Shut-off Valve Door	Closed and locked
	c. Battery Compartment	Connect battery, check jar security and residue
	d. Brake Accumulator	Minimum 850 psi
	e. Oxygen Valve	Build-up lever safetied and door closed
	f. Free Air Bulb	Clear
21.	TOP SURFACE INSPECTION.	
	a. Fuel and Oil Tanks	Quantity and cap secured
	b. Hydraulic Filler Cap	Secured
	c. Equipment Compartment Hatch	Secured

ON ENTERING THE AIRPLANE.

INTERIOR CHECK (ALL FLIGHTS).

1.	Hydraulic Ground Shut-off Valve (Star Valve)	Closed and Safetied
2.	First Aid iKt	Stowed
3.	Crash Axe	Stowed
4.	Fire Extinguisher	Stowed
5.	Emergency Hyd. Hand Pump Handle	In position and locked
6.	Observer Compartment	Secured

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7. Observer Circuit Breaker Panel	All circuit breakers IN
8. Seat and Rudder Pedals	Adjusted
9. Seat Belt, Harness and Oxygen Hose	Adjusted and inertia reel UNLOCKED
10. Control Column	Unstowed
11. Light Panel	All lights off
12. Circuit Breaker Panel	All circuit breakers in
13. Publications	Checked
14. All Light Switches	As required
15. Navigation Lights	OFF
16. Generator Switches	Check ON
17. Canopy Jettison Switch	OFF and safetied
18. Pilot's Canopy and Column Stow Circuit Breakers	IN
19. Tip Tank Jettison Switch	OFF and safetied
20. Master Jettison Switch	OFF and safetied
21. Inverters	OFF
22. Pitot Heat Switch	OFF
23. Clear Vision Switch	OFF
24. Demist Switch	OFF
25. Liquid Oxygen Gage	Check for quantity
26. Voltmeter Selector Switch	BAT
27. Pilot Oxygen System	Check for operation
28. Flaps Switch	UP
29. Throttles	OFF
30. Fuel Purge	OFF
31. Taxi and Linding Lights Switches	OFF
32. Landing Gear Handle	DOWN and locked
33. Parking Brake Lever	ON
34. Instrument Panel	Checked
35. Emergency Fuel Control Switches	OFF

CUT ON BLACK LINE

36.	All Radios and IFF	OFF
37.	Cabin Pressure Switch	RAM
38.	Cabin Dump Switch	OFF
39.	Camera Main Power Switch	OFF
40.	Navigation Lights (Night Flight)	ON
41.	All Other Lights (Night Flight)	Check

BEFORE STARTING ENGINES.

1.	Fire Detection System and Lights (Group A)	Check operation
2.	Fire Detection and Overheat Systems and Lights (Group B)	Check operation
3.	Landing Gear Warning Horn and Light	Check operation
4.	Ground Personnel	Clear of danger areas

STARTING ENGINES.

STARTING ENGINES WITH EXTERNAL POWER.

1.	Engine Fuel Valve Knobs	Flow (safetied)
2.	No. 1 Fuselage Booster Pump Switch	ON (safetied)
3.	Fuel Transfer and Bypass Valve Knob	Flow to No. 1 fuselage tank (safetied)
4.	Wing Tank—Tip Tank Fuel Valve Knobs	OFF
5.	No. 2 Fuselage Tank Fuel Valve Knob	Flow
6.	No. 1 Inverter Switch	ON (check lights)
7.	Interphone	Check
8.	No. 1 Throttle	IDLE
9.	No. 1 Engine Starting and Ignition Switch	START
10.	Hydraulic System Pressure Gage	Check for pressure build-up

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11. Repeat above procedure for starting No. 1 Engine	
12. Remove External Power Source	
13. Battery Switch	BATTERY
14. Repeat above steps as required to start the No. 2 Engine	

STARTING ENGINES WITH BATTERY.

1. Voltmeter Selector Switch	BAT and check voltage
2. Battery Switch	BATTERY
3. Voltmeter Selector Switch	Gen 2L or 2R
4. No. 2 Engine Fuel Valve Knob	Flow (safetied)
5. Fuel Transfer and Bypass Valve Knob	Flow to No. 1 fuselage tank (safetied)
6. No. 1 Fuselage Booster Pump Switch	ON (safetied)
7. Interphone	Check
8. No. 1 Engine Throttle	IDLE
9. No. 1 Engine Starting and Ignition Switch	START
10. No. 2 Fuselage Tank	Flow
11. No. 1 Inverter Switch	ON (at 25% rpm)
12. Repeat above procedure for starting No. 2 Engine	

ENGINE GROUND OPERATION.

GROUND CHECKS.

1. No. 2 Inverter Switch	No. 2 INVERTER
2. Instrument Inverter Switch	NORMAL
3. Generator Switches	All ON and check load output
4. Voltmeter Selector Switch	Each generator and check voltage
5. Cabin Air Selector Switch	RAM
6. Clear Vision Switch	ON

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7. Demist Switch	ON
8. Throttles	IDLE (check all instruments readings)

BEFORE TAXIING.

1. Fire Detection System and Lights (Group A)	Recheck
2. Fire and Overheat Detection Systems and Lights (Group B)	Recheck
3. Aileron Trim	0 degrees
4. Rudder Trim	0 degrees
5. Horizontal Stabilizer	3/4 division nose down
6. Flight Instruments	Checked
7. Radios	Checked
8. IFF	As required
9. Fuel Quantity Check	Each tank
10. Fuel Quantity Test Switch	Test position
11. Cabin Air Selector Switch	As desired
12. Check with Ground Crewman on Position of Bomb Door, Dive Brakes, and Flaps	Set for take-off position
13. Entrance Door	Closed and locked
14. Armrest	UP
15. Seat Pins	Removed
16. Chocks	Removed
17. Parking Brake	OFF
18. Brake Pressure	Check

CAMERA DOOR CHECK—WHEN APPLICABLE.

1. Camera Main Power Switch	CAMERA MAIN PWR
2. Master Control Panel Power and Ready Switches	POWER and READY
3. Vertical or Split Vertical Camera Station Mode Selectors	Any position except OFF

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CUT ON BLACK LINE

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TAXIING.

1. Brakes and Pressure	Checked
2. Needle and Ball	Checked

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

1. Clear Vision Panel	Closed
2. Clear Vision Switch	ON
3. Main Entrance Hatch	Closed and locked
4. Demisting Switch	DEMISTING
5. Pitot Heat Switch	PITOT HEATER
6. Flight Controls	Check for correct freedom of movement
7. Trim Devices Indicators	
a. Ailerons	0 degrees
b. Rudder	0 degrees
c. Horizontal Stabilizer	3/4 division nose
8. Horizontal Stabilizer Override Switch	NORMAL down
9. Wing Flaps Switch	UP
10. Dive Brakes Switch	CLOSE
11. Canopy Jettison and Control Column Stowage Detonator Circuit Breakers	IN
12. Seat Belt and Shoulder Harness	Adjusted
13. Inertia Reel	UNLOCKED
14. All Circuit Breakers	Check IN

PREFLIGHT ENGINE CHECK.

Fuel Controls:

1. Wing Tanks Fuel Valve Knobs	OFF
2. Engine Fuel Valve Knobs	Flow (safetied)
3. No. 1 Fuselage Tank Booster Pumps Switch	ON (safetied)

CUT ON BLACK LINE

4. Fuel Transfer and Bypass Valve Knob	Safetied to flow to No. 1 fuselage tank
5. No. 2 Fuselage Tank Knob	Flow
6. Advance No. 1 and No. 2 Engine Throttles	90% rpm
7. No. 1 and No. 2 Engine Emergency Fuel Control Switch	Emergency (check light)
8. No. 1 and No. 2 Engine Throttles Retard Throttle to Idle	Full (check rpm)
9. No. 1 and No. 2 Emergency Fuel Control Switches	Off (60% rpm or less)
10. No. 1 and No. 2 Engine Throttles	Full RPM
11. Check Engine Instruments and Retard Throttles To Idle	
12. Slaved Gyro Compass Switch	IN

TAKE-OFF.

1. Throttles	100% desired
2. Instruments	Checked
3. No. 2 Fuselage Tank	Feeding
4. Throttle Friction Knob	As required

AFTER TAKE-OFF.

1. Brakes	Applied
2. Landing Gear Lever	UP position
3. Climb	As required
4. Trim Controls	As necessary
5. Cabin Air Selector Switch	As required

TRAFFIC PATTERN CHECK LIST.

1. Crew	Alerted
2. Armament Switches	Off

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3. Fuel Transfer and Bypass Valve Knob	Flow to No. 1 fuselage tank (safetied)
4. No. 1 Fuselage Tank Booster Pumps Switch	ON (safetied)
5. Applicable Fuel Tank Knobs	Flow
6. Safety Belt and Shoulder Harness	Adjusted and tight
7. Inertia Reel	Unlocked
8. Dive Brakes	As desired
9. Landing Gear Handle	DOWN and locked
10. Landing Gear Positions Indicator	
11. Landing Gear Warning Light	Out
12. Main Hydraulic System Pressure Gage	Down Within limits
13. Brake Pressure Gage	Check pressure

TYPICAL APPROACH AND LANDING.

DOWN WIND.

Landing Gear	Down (200 kts)

BASE.

Flaps	Down (170 kts)
IAS	160-170 kts

TURN ON FINAL.

IAS	155 kts min.

FINAL.

IAS.	120-130 kts

AFTER CLEARING RUNWAY.

1. Flaps	UP
2. Dive Brakes	Closed
3. Trim Tabs	Checked and set

CUT ON BLACK LINE

STOPPING ENGINES.

1.	Parking Brakes	Set
2.	Throttle No. 1	Off
3.	Hydraulic Pressure	Checked
4.	Clear Vision and Demisting Switches	Off
5.	All Radios and IFF	Off
6.	Inverters	Off
7.	Oxygen System	Off
8.	Throttle No. 1	Off
9.	All Fuel System Valves and Switches	All OFF (except those which are safetied)
10.	Bomb Bay Doors	As desired
11.	Battery Switch	OFF
12.	Wheel Chocks	In place
13.	Brakes	OFF
14.	All Seat Safety Pins	Installed
15.	Ground Lock Safety Pins	Installed
16.	Battery	Disconnected
17.	Personnel Safety Switch and Bomb Bay Door Shut-off Valve	Safe
18.	Oxygen Build-up and Vent Valve Handle	Vent position

BEFORE LEAVING THE AIRPLANE.

1.	Parking Brake Lever	Off
2.	All Electrical Switches	Off
3.	Canopy Jettison and Control Column Stowage Detonator Circuit Breakers	Out

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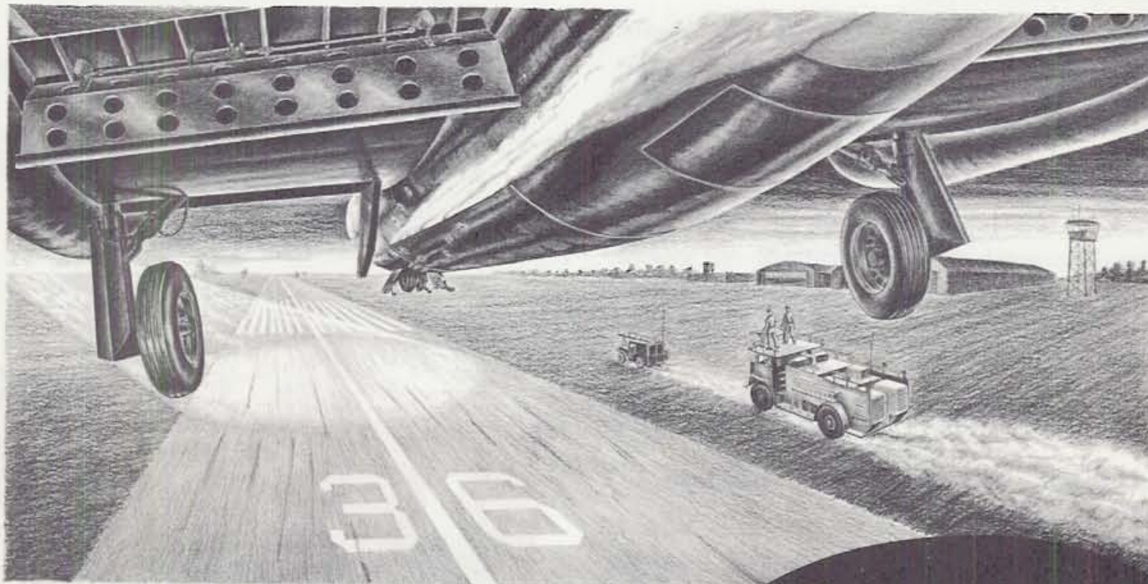
SECTION III



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EMERGENCY PROCEDURES

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ENGINE FAILURE.

FLIGHT CHARACTERISTICS WITH ONE ENGINE INOPERATIVE.

The normal cruise characteristics with one engine inoperative are very satisfactory, and the airplane may be trimmed to fly "hands-off" at normal cruising power. However, the single-engine flight characteristics are closely related to the high rudder force characteristics because, as airspeed reduces, high rudder forces limit the minimum speed at which there is adequate directional control. Although one engine is capable of providing sufficient hydraulic and electrical power for all basic flight requirements, the pilot must monitor all electrical loads.

CAUTION

Minimum single engine control speed is 155 knots IAS.

During take-off, accelerate the aircraft to a speed in excess of the minimum control speed (155 knots IAS) as quickly as possible to insure that in the event of an engine failure, adequate directional control is available.

WARNING

Should an engine fail on take-off, exercise the utmost care in the manipulation of the throttle controlling the operating engine. Rapid application of the throttle may result in uncontrollable yaw forces at any speed, particularly when below the minimum single engine control speed of 155 knots IAS. (See ENGINE FAILURE ON TAKE-OFF in this section.)

During single-engine landings, the landing gear and flaps are not to be extended until a safe landing is assured. The airplane will not maintain level flight on one engine while the gear and flaps are extended. Despite the best pilot techniques, there will be a loss of about 500 feet during a go-around while the gear and flaps retract.

WARNING

Do not attempt a go-around below 500 feet, when the airplane is flying on one engine and the gear and flaps are extended.

PROCEDURE WHEN ENCOUNTERING ENGINE FAILURE.

If an engine fails in flight, perform the following operations immediately:

1. Adjust the throttle on the operating engine to maintain directional control.
2. Retard the throttle on the malfunctioning engine to the OFF position to prevent flooding the engine with fuel.
3. Retrim the airplane for flight.

Figure 3-1.

4. Break the safety wire and place the engine valve knob for the inoperative engine in the OFF position.
5. Check for possible engine fire.
6. Reset the cabin air-conditioning and pressurizing system to the operating engine.
7. If extended operation is required, adjust the operating engine to give the desired airspeed.

ENGINE RESTART IN FLIGHT.

Air starts can be made consistently up to 16,000 feet if the normal restart procedures are followed.

CAUTION

Do not attempt to restart the inoperative engine until it is reasonably safe to do so. When attempting to restart an engine using battery power only, turn off all electrical loads except those necessary

for the restart before the battery switch is placed in the ON position.

1. Place the throttle in the OFF position and descend to below 20,000 feet.
2. Check that the FUEL SYSTEM VALVES, and FUEL SYSTEM PUMPS circuit breakers are all in the ON position.
3. Place the airplane in a nose-high attitude to drain any excess fuel from the combustion chamber.
4. Adjust the attitude of the airplane to attain a speed between 155 knots and 220 IAS or from 14 to 22 percent rpm.
5. Place the engine valve knob in the flow position.
6. Battery switch in BATT position.
7. Momentarily place the start and ignition switch in the CRANK ONLY position.
8. Immediately move the throttle to IDLE or slightly above. This will open the fuel shut-off valve and the throttle valve. An increase in exhaust gas temperature and rpm indicate the engine has started.

CAUTION

Any delay in moving the throttle will waste a portion of the 15 ± 3 second ignition cycle. The ignition timer cannot be recycled until the 15 ± 3 second period has run out.

9. If the exhaust gas temperature does not increase within five or ten seconds after the throttle is open, the throttle should be immediately closed to the OFF position to prevent flooding the engine with fuel.

A restart should then be attempted at a lower altitude. Although air starts can be obtained above 20,000 feet, the chances of a successful air start increase with lower altitudes. Occasionally, when normal air start methods fail, it is possible to obtain a start by placing the emergency fuel control switch in the EMERGENCY position and following the standard air start procedure. Careful monitoring of the start should be made under these circumstances and after the start has been obtained and the engine is idling normally, operation should be continued on the emergency system and landing made as soon as possible.

ENGINE FAILURE DURING TAKE-OFF.

ENGINE FAILURE DURING TAKE-OFF BEFORE LEAVING GROUND.

If an engine should fail before leaving the ground proceed as follows:

1. Retard both throttles immediately to the OFF position.
2. Apply full braking to stop.

If the landing gear must be retracted because of insufficient remaining clearance, proceed as follows:

1. Actuate the wing tip tanks jettison switch if tip tanks contain fuel.
2. Actuate the canopy jettison switch to jettison the canopy.
3. Push the landing gear manual override lever and pull the landing gear lever to the UP position.
4. Actuate the fire extinguisher knobs for both engines.
5. Place the battery switch in the OFF position.

ENGINE FAILURE DURING TAKE-OFF AFTER LEAVING GROUND.

If an engine fails after the airplane is airborne, perform the following:

CAUTION

Single engine minimum control speed is 155 knots IAS.

1. Place the landing gear lever in the UP position.
2. Place the throttle for the malfunctioning engine in the OFF position.
3. Break the safety wire and place the engine valve knob for the inoperative engine in the OFF position.
4. Place the cabin air selector switch in the off position for the inoperative engine.
5. Check that the fire warning lights are out.
6. Gain sufficient altitude before atempting to restart the malfunctioning engine. Refer to ENGINE RESTART IN FLIGHT in this section.

If a rapid drop in fuel flow occurs during take-off, place the emergency fuel control switch for the malfunctioning engine in the EMERGENCY position.

CAUTION

In the event of primary fuel system failure on take-off or up to an altitude of 6000 feet, it is permissible to transfer to the emergency fuel system with throttle FULL position provided the engine rpm has not

dropped below 85% (7050 rpm) at the time of the transfer. Under all other conditions the throttle lever must be retarded to idle prior to the transfer. Failure to do so will result in excessive exhaust gas temperatures and rich flame-out and/or compressor stall.

If the engine rpm returns to the approximate take-off power, operation should be continued in the emergency condition and normal precaution for emergency fuel control procedures should be observed.

ENGINE FAILURE DURING FLIGHT.

To determine the cruise control conditions for single-engine operation, see the Single Engine Cruise Control Charts in Appendix I. Refer to the paragraph on PROCEDURE WHEN ENCOUNTERING ENGINE FAILURE, in this section, for shutting down one engine. Also, for information concerning engine oil pressure failure and engine noise and roughness, refer to ENGINE OIL PRESSURE FAILURE and ENGINE NOISE AND ROUGHNESS, in Section VII.

PARTIAL POWER FAILURE.

Partial power failure of these engines can be caused by icing conditions or malfunctioning of the normal fuel control system. For failure due to icing conditions, refer to ICE, SNOW, AND RAIN in Section IX. A partial power failure which is due to improper fuel flow will be shown by a drop in fuel flow indication and should be corrected as follows:

1. Place the emergency fuel control switch for the malfunctioning engine in the EMERGENCY position.

CAUTION

In the event of primary fuel system failure on take-off or up to an altitude of 6000 feet, it is permissible to transfer to the emergency fuel system with throttle FULL position provided the engine rmp has not dropped below 85% (7050 rpm) at the time of the transfer. Under all other conditions throttle lever must be retarded to idle prior to the transfer, failure to do so will result in excessive exhaust gas temperatures and rich flame-out and/or compressor stall.

2. If power is not recovered when the emergency fuel control switch is placed in the EMERGENCY position, it may be assumed that the fuel control unit metering element or the engine-driven fuel pump is not operating correctly. If this condition should occur, nothing can be done to correct the condition as the metering element and the pump affect both the normal and emergency fuel control systems. However, partial power is better than none and continued operation on the affected engine is permissible.
3. Trim the airplane accordingly and adjust the normal operating engine to obtain the desired cruising conditions. Refer to FLIGHT CHARACTERISTICS WITH ONE ENGINE INOPERATIVE in this section.

MAXIMUM GLIDE.

The maximum glide ranges for various altitudes are given in figure 3–2. To obtain maximum range during descent without engine power, observe the speeds given in figure 3–2.

Note

For maximum glide distance, keep gear and flaps up and the dive brakes retracted.

LANDING WITH ONE ENGINE INOPERATIVE.

WARNING

When making a single engine approach with the gear and flaps extended, the airplane is committed to land when at an altitude of less than 500 feet. Under these conditions a go-around must not be attempted.

If a landing is to be made with one engine inoperative, the airspeed should never be permitted to decrease below 155 knots IAS until on final approach. The landing gear may be lowered on the downwind or base leg if 155 knots IAS airspeed can be maintained and should always be lowered in time to insure that gear will be down and locked prior to touchdown. After completing the turn on final approach, decrease the airspeed to 130 knots IAS but do not use flaps or dive brakes until landing is assured.

MISSED APPROACH WITH SINGLE ENGINE.

WARNING

When making single-engine approaches with flaps and landing

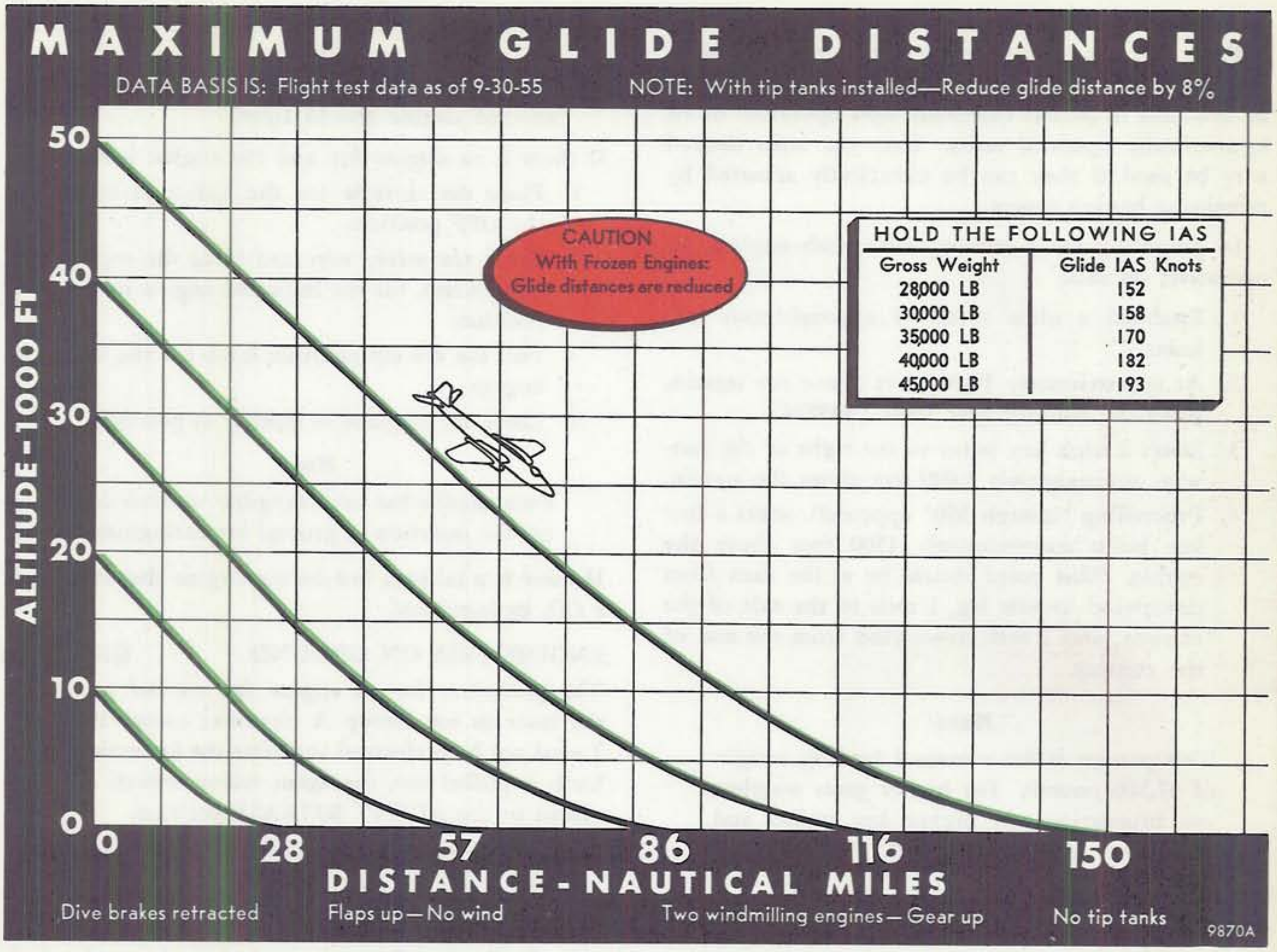


Figure 3–2.

gear extended, the airplane is committed to land when at an altitude of less than 500 feet. Under these conditions a go-around is not to be attempted. The decision to go around must be made before the flaps are extended.

If it is necessary to make a go-around, perform these operations:

1. Apply power gradually to maintain positive control.

WARNING

Advance the throttle slowly or an uncontrollable yaw could result.

2. Place the flaps switch in the UP position before 170 knots IAS is reached.
3. Place the landing gear control lever in the UP position before 200 knots IAS is reached.

WARNING

This airplane has a minimum single-engine control speed of 155 knots IAS. Single engine maneuvers should be made only at safe altitudes and care should be taken with low speeds and high engine power.

4. Dive brakes retracted.

LANDING WITH BOTH ENGINES INOPERATIVE. (See figure 3–2.)

Landing with both engines inoperative is mechanically feasible. All flight control systems operate normally, although trim may not be available because of the loss of electrical power. The engine windmilling rpm at normal glide speeds is below rpm required to produce electrical power from the generators. Therefore, because only battery power remains, plan to land without the use of trim, wing flaps, or dive brakes. However, sufficient hydraulic pressure will probably be available to permit extremely slow operation of all hydraulically operated units. Thus the units desired may be used if they can be electrically actuated by remaining battery power.

In preparing for a landing with both engines inoperative, do this:

1. Establish a glide speed of approximately 160 knots.
2. At approximately 10,000 feet above the terrain, place the landing gear lever DOWN.
3. Select a high key point to the right of the runway, approximately 5,000 feet above the terrain.
4. Proceeding through 360° approach, select a low key point approximately 1500 feet above the terrain. This point should be at the turn from downwind to base leg, 1 mile to the side of the runway, and 1 mile downwind from the end of the runway.

Note

This pattern is for a normal landing weight of 37,500 pounds. For higher gross weights, use proportionately higher key points and airspeeds.

This pattern is recommended for headwinds under 10 knots. For headwinds of greater velocity, reduce the turning radius between the high and low key point so that the low key point is closer to the runway.

5. Turn base leg and establish an airspeed between 140 and 150 knots.
6. Turn on final approach, establish an airspeed between 120 and 130 knots, and S-turn, fishtail, or sideslip to lose excessive altitude.
7. When positive of correct position relative to the runway, lower the flaps for the landing, provided that enough battery power remains to actuate the flap system.

Note

If the flap system can be electrically actuated with remaining battery power, flap operation will be extremely slow as hydraulic pressure is being produced only by the windmilling engines at low rpm.

FIRE.

ENGINE FIRE.

ENGINE FIRE ON GROUND. GROUP A

Note

The fire detection warning light for the affected engine should light.

If there is an engine fire and the engine is running:

1. Place the throttle for the indicated engine in the OFF position.
2. Break the safety wire and place the engine fuel valve knob, for the indicated engine in the OFF position.
3. Pull the fire extinguisher knob for the indicated engine.
4. Leave the airplane as quickly as possible.

Note

Each nacelle has two frangible wooden doors for the insertion of ground fire extinguishers.

If there is a tailpipe fire during engine shutdown, use a CO_2 extinguisher.

ENGINE FIRE ON GROUND. GROUP B

The procedure for an engine fire on the ground is the same as for Group A airplanes except that step 2 need not be performed and after the fire extinguisher knob is pulled out, the agent release switch must be placed in the AGENT RELEASE position.

ENGINE FIRE IN FLIGHT. GROUP A

1. Place the throttle for the indicated engine in the OFF position.
2. Break the safety wire and place the engine fuel valve knob for the indicated engine in the OFF position.
3. Place the cabin air selector switch for the indicated engine in the OFF position.
4. If the indicator light for the affected engine does not go out immediately, pull the fire extinguisher knob for the indicated engine.

WARNING

Once the agent release switch is actuated to the on position, the discharge of the fire extinguisher supply for the indicated engine cannot be stopped and the entire supply of extinguishing agent will be depleted.

ENGINE FIRE IN FLIGHT. GROUP B

The procedure for engine fire in flight is the same as for Group A except that step 2 need not be performed and after the fire extinguisher knob has been pulled out, the agent release switch must be placed in the AGENT RELEASE position.

FUSELAGE FIRE.

In the event of a fire in the flight compartment:

1. Connect oxygen masks.
2. Set the oxygen regulator diluter lever to 100% OXYGEN.
3. Use the hand fire extinguisher.
4. Place the cabin air selector switch in the RAM position.
5. Descend to a safe altitude.

WING FIRE.

In the event of a wing fire, determine the cause and:

1. If it is a system fire, shut down the system that may be feeding the fire.
2. If it is an engine fire, see ENGINE FIRE IN FLIGHT, above.
3. If the fire is out of control, abandon the airplane.

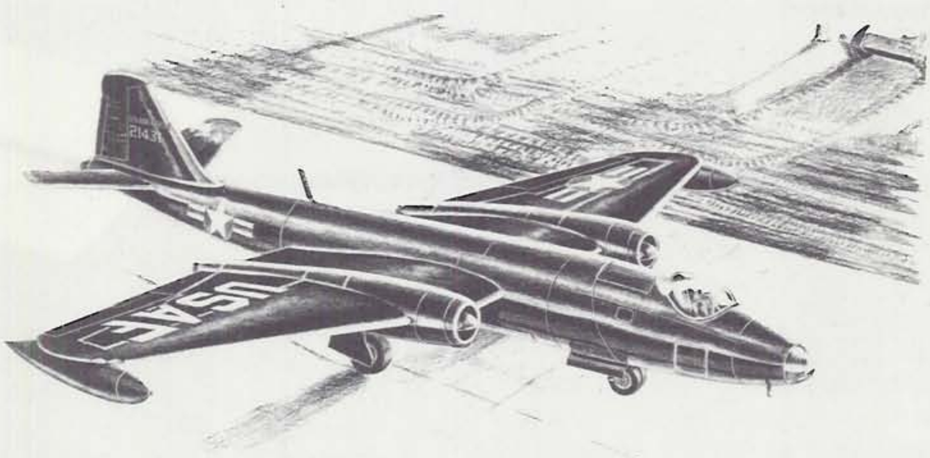
ELECTRICAL FIRE.

Circuit breakers and fuses protect most of the circuits and tend to isolate an electrical fire. However, if the source of the fire cannot be determined, all electrical equipment not absolutely essential for flight must be turned off in order to isolate the fire. If the source of the fire can be determined by this procedure, gradually restore all circuits to operation except those causing or affected by the fire. If smoke or fumes are present during or after the fire proceed as follows:

1. Cabin Air Selector Switch — As required
2. Oxygen Mask — Connected
3. Oxygen Diluter Lever — 100% OXYGEN
4. Hand Fire Extinguisher — As necessary
5. Gradually restore electrical equipment to airplane's electrical system until source of fire is determined.

Note

To prevent rapid blow-off of cabin air at high altitude, place the cabin air selector switch in the OFF position.



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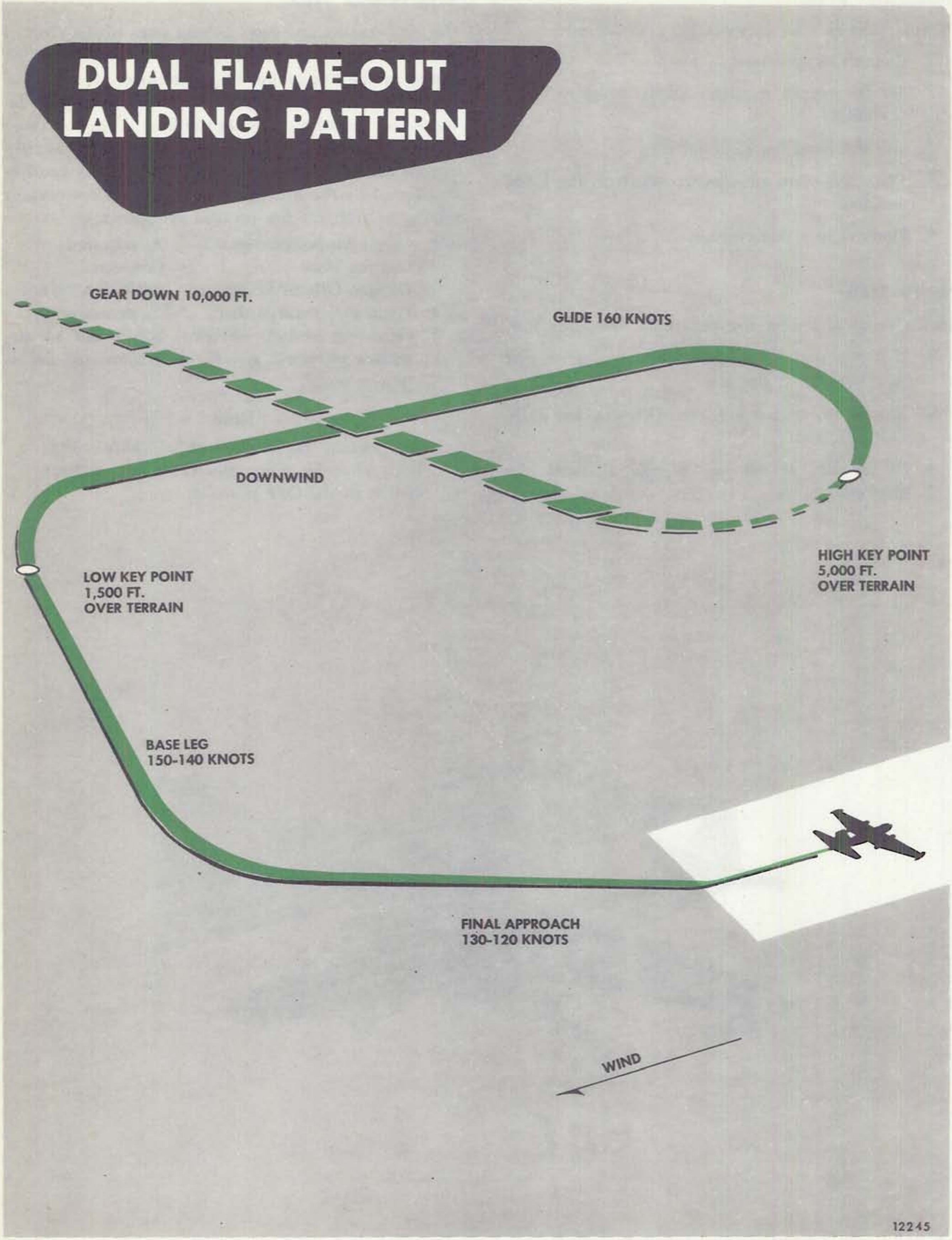

DUAL FLAME-OUT
LANDING PATTERN
GEAR DOWN 10,000 FT.
GLIDE 160 KNOTS
DOWNWIND
HIGH KEY POINT
5,000 FT.
OVER TERRAIN
LOW KEY POINT
1,500 FT.
OVER TERRAIN
BASE LEG
150-140 KNOTS
FINAL APPROACH
130-120 KNOTS
WIND
12245

Figure 3–2A.

CAUTION

Make sure that the electrical circuit involved is isolated before restoring power.

If the source of the electrical fire is not determined, descend to a safe altitude and land as soon as possible.

SMOKE OR FUMES ELIMINATION.

In the event of heavy smoke or toxic fume concentration in the flight compartment, perform the following operations:

1. Determine which engine might be causing the smoke or fumes by placing the cabin pressure selector switch in the NO. 1 OFF and then to the NO. 2 OFF position. If it can be determined by this method that the engines are the source of the smoke or fumes, then proceed with step 2 or 3.
2. If below 42,000 feet cabin altitude:

Oxygen Mask	Connected
Oxygen Regulator Diluter Lever	100% OXYGEN
Cabin Air Selector Switch	RAM

3. If above 42,000 feet cabin altitude, make a rapid descent to 42,000 feet or below and purge the cabin air by placing the cabin air selector switch in the RAM position.

Oxygen Mask	Connected
Oxygen Regulator Diluter Lever	100% OXYGEN
Cabin Air Selector Switch	OFF

CAUTION

Ram air at high altitudes may be extremely cold. Do not leave the cabin air selector switch in the RAM position too long.

If the smoke is not due to malfunctioning of the air conditioning system, heat can be retained in the cabin by placing the cabin dump switch in the ON position and leaving the cabin pressure selector switch in the PRES ON position.

LANDING WITH GEAR RETRACTED.

WARNING

Whenever the terrain is unknown or unsuited for forced landing, use the ejection seat system to bail out rather than attempt a forced landing. The probability of receiving vertebral or other severe injuries from a forced landing under adverse conditions is very high. The minimum safe ejection altitude in level flight for upward ejection seats with automatic seat belt and manual chute is 1,000 feet. The minimum safe ejection altitude with an automatic seat belt and automatic parachute is 500 feet.

If it should be necessary to land with the landing gear retracted, proceed as follows:

Note

If wing tip tanks are installed and they contain fuel, actuate the tip tank jettison switch. If the tip tanks are empty, retain them; they will act as skids and will prevent a wing tip from digging in especially on soft surfaces, and causing the airplane to cartwheel.

Bomb Door Switch	CLOSE
Canopy and Control Column Stowage	In
Detonator Circuit Breakers	
Dive Brakes Switch	EXTEND
Flaps Switch	DOWN
Seat Belt and Shoulder Harness	Secure
Pilot Right Armrest Safety Pin (Notify observer to insert safety pin in his seat catapult initiation and to jettison his hatch by raising his right handgrip.)	Installed
Fuel Selector Knobs and Switches	OFF
Canopy Jettison Switch	Actuated
Generator Switches	OFF
Fire extinguishing knobs for both engines	Actuate
Battery Switch	OFF
Throttles	OFF
Inertia Reel	Locked

CAUTION

The pilot is prevented from bending forward when the inertia reel is locked; therefore, all switches not accessible from the locked position must be cut before locking the reel. Jettison the pilot's canopy and observer's hatch before contact with the ground. Do not jettison the canopy until the

airspeed is reduced to 150 knots or less because the pilot will not be able to maintain contact flight above this airspeed.

WARNING

Before actuating the canopy jettison switch, bottom the ejection seat to avoid any possibility of being struck by the canopy. After jettisoning, raise the seat.

LANDING WITH FLAPS UP.

When landing without the use of wing flaps, add approximately 10 knots to speeds used during a normal landing.

EMERGENCY EXIT.

Turn the exit release knob located above the entrance door clockwise four turns to open the door.

EMERGENCY ENTRANCE.

If the main entrance door cannot be opened break into the airplane with an axe. Yellow broken lines around the pilot's canopy, the observer's hatch, and the nose blister (figure 3-4) indicate where the skin can be chopped through to rip off the hatch, canopy, or blister to gain access to the interior of the airplane.

DITCHING.

Ditching is a last resort. Since all survival equipment is carried by the crew on their persons, there is no advantage to be gained in riding the airplane down. However, if altitude is not sufficient for bail-out and ditching is unavoidable, proceed as follows:

1. Notify the observer to prepare for ditching.
2. Place the IFF switch in the EMERGENCY position.
3. Actuate the master jettison switch if it is desirable to jettison stores and tip tanks.

Note

The construction of the rotary bomb door is such that the presence of bombs on the closed door may tend to reduce the cave-in of the door. If the tip tanks are empty and the sea is calm, do not jettison the tanks; they will provide additional buoyancy.

4. If stores were jettisoned, place the bomb door switch in the CLOSE position.
5. Check that the landing gear lever is in the UP position.

WARNING

The landing gear must be in the retracted position. If the gear is extended, the airplane will dive into the water upon contact.

6. Place the dive brakes switch in the OPEN position.
7. Place the wing flaps switch in the DOWN position.

Note

The flaps will collapse on impact but will not make the airplane dive.

8. When the airspeed has dropped to 150 knots IAS or less, actuate the canopy jettison switch.
9. Notify the observer to jettison hatch upon contact with water.

WARNING

Before actuating the canopy jettison switch, bottom the ejection seat to avoid being struck by the canopy. After jettisoning, raise the seat.

10. Check that the seat belt and shoulder harness are secure and lock the inertia reel.

CAUTION

The pilot is prevented from bending forward when the inertia reel is locked. Therefore, he must cut all switches not accessible before locking the inertia reel.

11. Make the landing into the wind. If the sea is rough, land in a direction parallel to the waves and on top of a wave crest if possible.
12. Place the throttles in the OFF position.
13. Make the touchdown as slowly as possible with a slightly nose-high attitude.
14. After the airplane has stopped, abandon it immediately; the airplane may sink rapidly.

Note

In the event of ditching and sinking in water

EMERGENCY EXITS AND EMERGENCY EQUIPMENTS

1. OBSERVER'S JETTISONABLE HATCH
2. OBSERVER'S EJECTION SEAT PROCEDURE PLACARD
3. PILOT'S EJECTION SEAT
4. PILOT'S JETTISONABLE CANOPY
5. CANOPY JETTISON CONTROL AND COLUMN STOWAGE
6. INERTIA REEL CONTROL
7. SEAT EJECTION CONTROL
8. PILOT'S EJECTION SEAT PROCEDURE PLACARD
9. EMERGENCY EXIT
10. MAIN ENTRANCE DOOR
11. FIRE AXE
12. FIRST AID KIT
13. HAND FIRE EXTINGUISHER (CB)
14. OBSERVER'S EJECTION SEAT

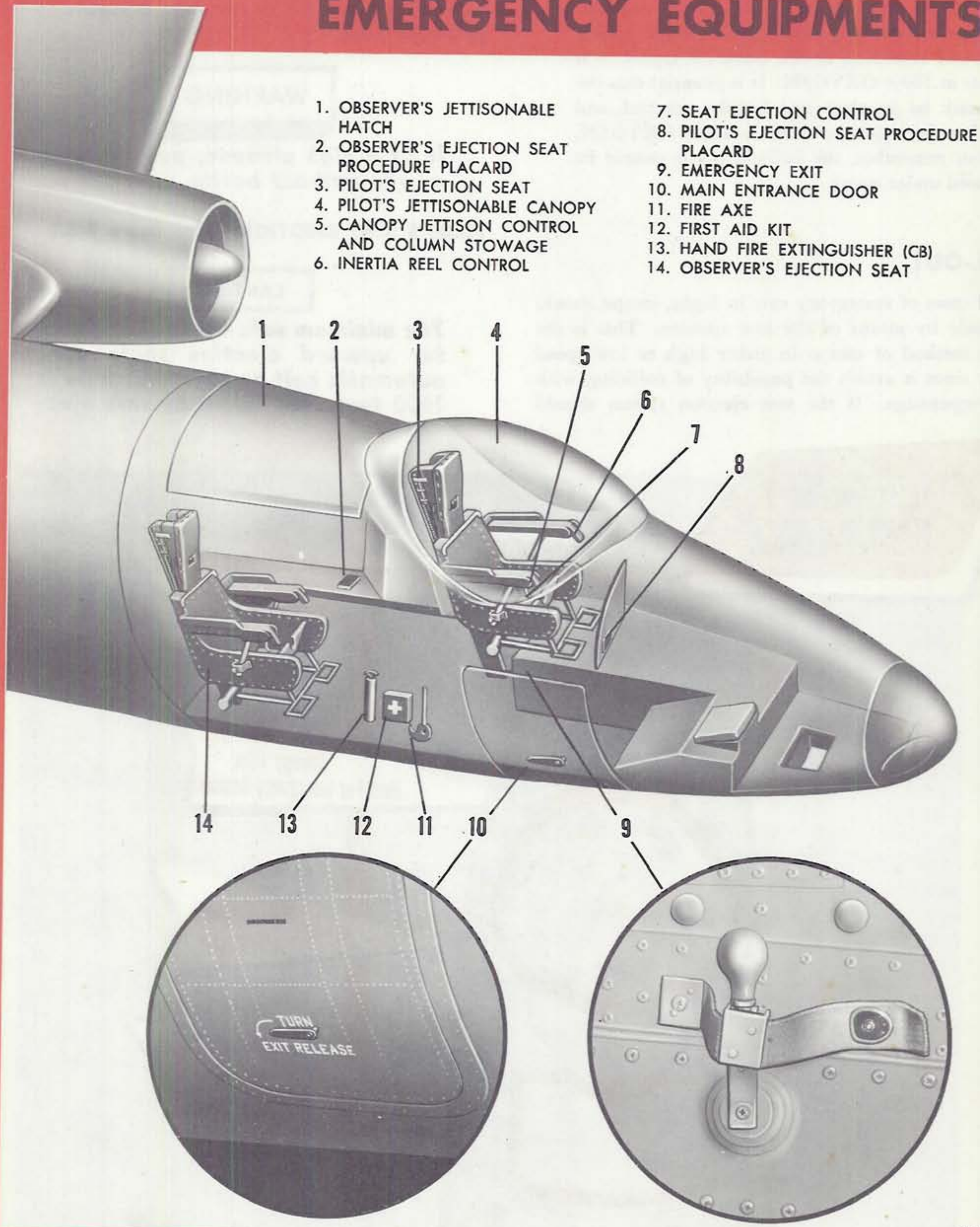


Figure 3-3.

where you find yourself unable to escape immediately, it is possible to survive under water with your oxygen equipment until you can free yourself. The diluter demand-type oxygen regulator is a suitable underwater breathing device when the regulator is set at 100% OXYGEN. It is essential that the mask be in place and lightly strapped, and that the regulator be set at 100% OXYGEN, but remember, the bail-out bottle cannot be used under water.

BAIL-OUT.

In all cases of emergency exit in flight, escape should be made by means of the seat ejection. This is the safest method of escape in either high or low speed flight since it avoids the possibility of colliding with the empennage. If the seat ejection system should malfunction, use the entrance door for exit. If the conditions necessitating a bail-out afford ample time, stow all loose equipment and disconnect the oxygen tube. Check that the oxygen hose is clipped to the parachute harness.

WARNING

If at a high altitude, pull the plug on the bail-out bottle.

PILOT'S SEAT EJECTION. **(See figure 3-5.)**

CAUTION

The minimum safe ejection altitude for upward ejection seats with automatic belt and manual chute is 1000 feet. The minimum safe ejec-

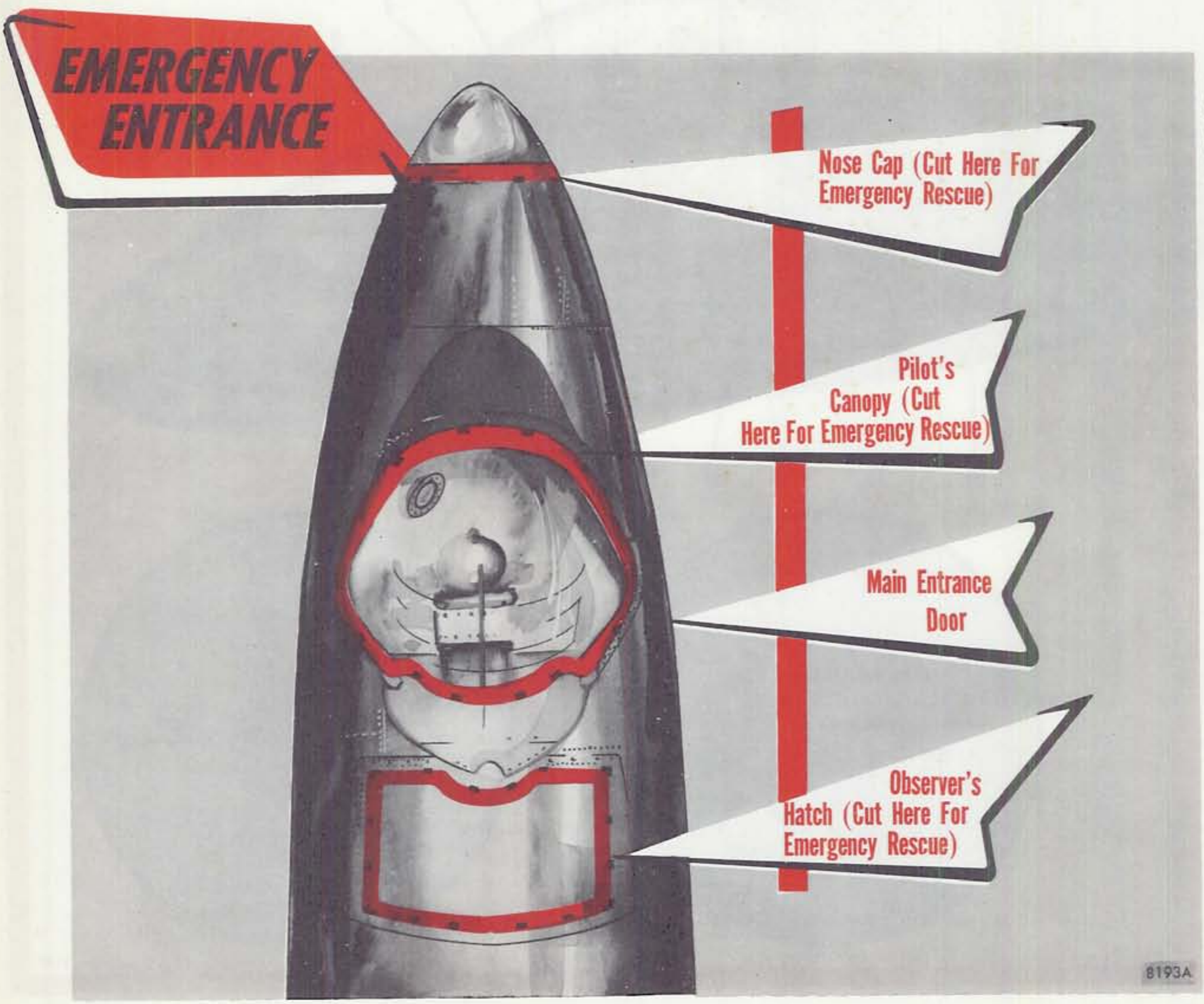


Figure 3-4.

tion altitude with an automatic seat safety belt and automatic parachute is 500 feet.

Note

If the canopy does not jettison by raising the right handgrip, actuate the canopy jettison switch. If the canopy still fails to jettison and the airplane is under control, slow the airplane down and exit through the entrance door. If the airplane is not under control, eject through the canopy.

Push away from the seat, make a free fall as far as altitude will permit, and pull the ripcord.

OBSERVER'S SEAT EJECTION.

WARNING

Be sure that the observer's table is in the stowed position before commencing the ejection procedure.

1. Place feet firmly on the footrests with the knees together.
2. Place elbows in rests.
3. Raise the right handgrip to jettison the hatch and to expose the trigger.
4. Raise the left handgrip to lock the inertia reel.
5. Squeeze the righ handgrip trigger to eject the seat.
6. Push away from the seat.
7. Make a free fall as far as possible and pull the ripcord.

WARNING

If the hatch does not jettison, the observer's must not eject through the hatch. He has no alternative but to exit through the entrance door.

ENGINE FUEL CONTROL SYSTEM FAILURE.

If the normal engine fuel control system should fail, as evidenced by a loss of power and a drop in fuel flow indication, fuel can be supplied to the engines by placing the emergency fuel control switches in the EMERGENCY position.

CAUTION

In the event of primary fuel system failure on take-off or up to an altitude of 6000 feet, it is permissible to transfer to the emergency fuel system with throttle FULL position provided the engine rpm has not dropped below 85% (7050 rpm) at the time of the transfer. Under all other conditions the throttle lever must be retarded to idle prior to the transfer, failure to do so will result in excessive exhaust gas temperatures and rich flame-out and/or compressor stall.

Note

If the emergency fuel control does not correct the condition, the engine-driven fuel pump or the fuselage tank booster pumps are malfunctioning or have failed. Refer to ENGINE-DRIVEN FUEL PUMP FAILURE or NO. 1 OR NO. 2 FUSELAGE TANK BOOSTER PUMP FAILURE in this section.

AIRPLANE FUEL SYSTEM FAILURE.

CAUTION

Above an altitude of about 26,000 feet, engine flame-out will almost certainly occur if there is not at least one fuel tank booster pump feeding fuel directly to the engine. Since fuel is normally fed from the No. 1 tank to the engines, this means that if both the booster pumps in that tank are inoperative, normal flight above approximately 26,000 feet cannot be done. Under these conditions and just prior to flame-out, a rapid fluctuation of the fuel flow will be evident.

NO. 1 OR NO. 2 FUSELAGE TANK BOOSTER PUMP FAILURE.

The No. 1 and No. 2 fuselage tanks each have two booster pumps and it is unlikely that all four pumps would fail simultaneously. In the event of failure of both booster pumps in the No. 1 fuselage tank:

1. Position the fuel transfer and bypass valve knob to feed fuel directly to the engines from the No. 2 fuselage tank, the wing tanks, or the wing tip tanks.

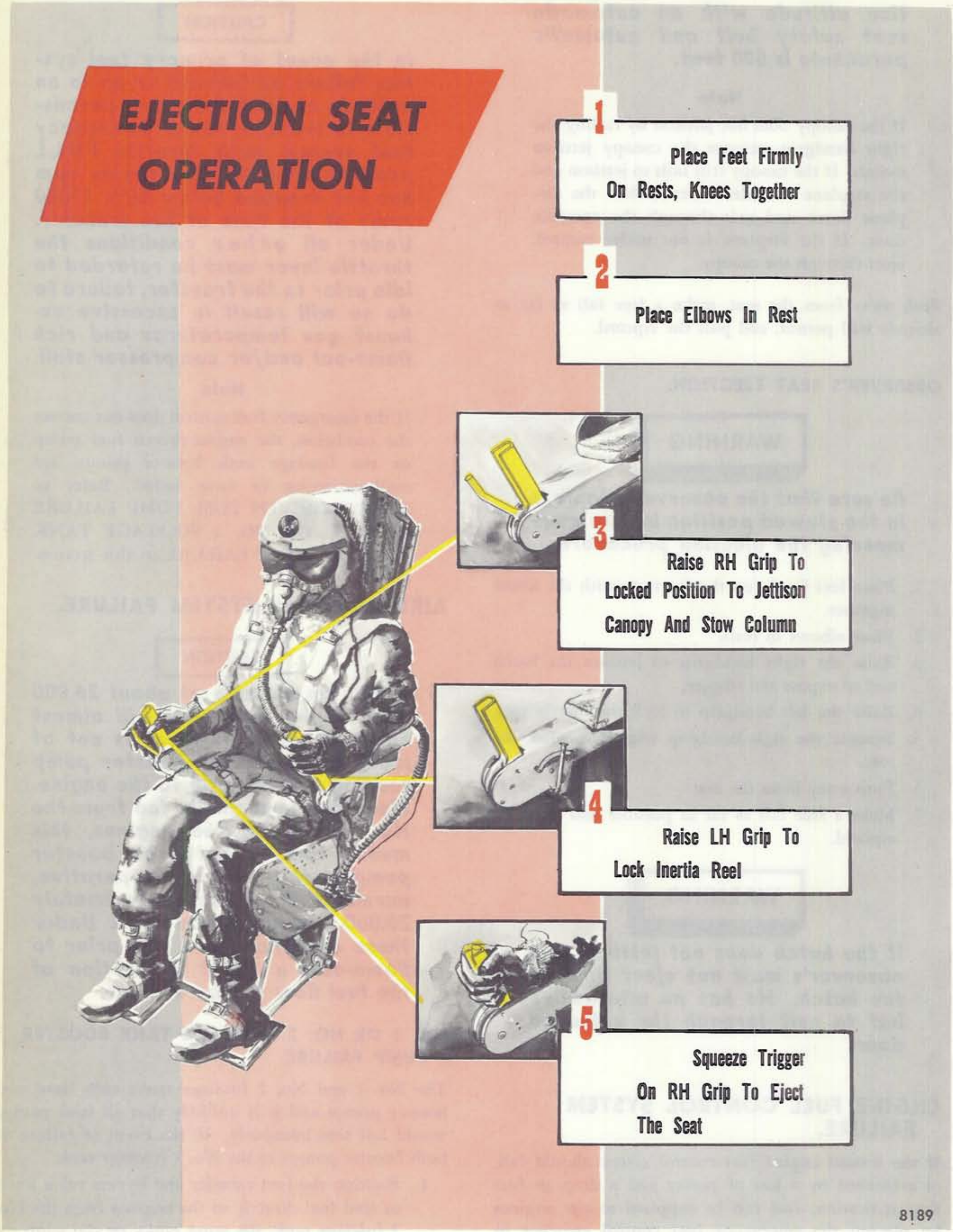

EJECTION SEAT OPERATION
1
Place Feet Firmly On Rests, Knees Together
2
Place Elbows In Rest
3
Raise RH Grip To Locked Position To Jettison Canopy And Stow Column
4
Raise LH Grip To Lock Inertia Reel
5
Squeeze Trigger On RH Grip To Eject The Seat
8189

Figure 3–5.

2. Break the safety wire and turn No. 1 fuselage booster pumps switch to the OFF position. If necessary, fuel may be recovered from the No. 1 tank even though the booster pumps have failed but continued flight is limited to altitudes below 26,000 feet due to the limited suction action of the engine-driven fuel pumps.
3. To avoid over-taxing the engine-driven fuel pumps, recover the fuel in the No. 1 fuselage tank only if the other tanks have been exhausted.

CAUTION

When drawing fuel from the No. 2 fuselage tank or the wing tanks directly to the engines, observe the fuel quantity indicator to avoid flame-out. Wing tip tank delivery rates are sufficient for satisfactory engine operation only at low power and at low altitudes.

If both No. 2 fuselage tank booster pumps fail below 26,000 feet:

1. Recover fuel by positioning the fuel transfer and bypass valve knob to the flow to engines position and by placing the No. 2 fuselage tank knob in the flow position.
2. Under these conditions the No. 1 fuselage tank boost pumps should be off.

NO. 1 FUSELAGE TANK FUEL LEVEL SHUT-OFF VALVE FAILURE.

Malfunctioning of the No. 1 tank fuel level shut-off valve causes large quantities of fuel to be dumped overboard out of the fuselage vent mast. This is generally noticeable prior to take-off. However, during flight, if the aircraft is apparently consuming abnormally large amounts of fuel, transfer of fuel to the No. 1 tank should be temporarily halted and a check made to see that the fuel consumption is normal from the No. 1 tank to the engines and from all other tanks to the No. 1 fuselage tank. If fuel consumption is abnormally high from the No. 1 fuselage tank, this will indicate malfunction of this valve and fuel should be transferred intermittently to the No. 1 tank as needed without relying on the automatic shut-off valve.

WING TANK BOOSTER PUMP FAILURE.

If the booster pump in either wing tank fails, set the respective wing tank knob to the OFF position. Fuel in these tanks cannot be recovered if the booster pump fails.

ENGINE-DRIVEN FUEL PUMP FAILURE.

Failure of the engine-driven fuel pump is indicated by a loss of power and a decrease in fuel flow. However, malfunctioning of the hydromechanical units of engine fuel control system will give the same indications. Therefore, to correct this condition, proceed as follows:

1. Retard the throttle to the IDLE position and place the emergency fuel control switch for the affected engine in the EMERGENCY POSITION.

CAUTION

The emergency fuel control does not incorporate the compensatory features of the normal fuel control; therefore, unless care is exercised, rpm exhaust temperature, and compressor discharge pressure limits may be exceeded. Accelerations and decelerations must be made slowly and smoothly.

2. If placing the engine on emergency fuel control does not correct the malfunctioning and flame-out has occurred, attempt to start the engine as described under ENGINE RE-START IN FLIGHT in this section.
3. If placing the engine on emergency fuel control does not correct the malfunctioning but the engine is still running, proceed as described under PARTIAL POWER FAILURE in this section.

WING TIP TANK FUEL SYSTEM FAILURE.

If one tip tank is empty and the other is full, check the aileron control above 10,000 feet with the aircraft in landing configuration. If more than two-thirds wheel travel is necessary to trim the airplane, do not land without emptying or jettisoning the heavy tank. (See TIP TANK JETTISON in this section). If the heavy tip tank cannot be emptied or jettisoned, empty the wing tank on the heavy side and leave the wing tank on the light side full to create the best landing situation. Though landings have been made with one empty tip tank, they should not be attempted unless it is absolutely necessary, and then only under the best conditions. It will be necessary to touchdown at approximately 30 knots above the normal touchdown speed, in order to maintain lateral control, and approximately three-fourths of available trim will be required.

TIP TANK JETTISON.

To jettison the tip tanks, actuate the tip tank jettison switch. The tip tanks will also be jettisoned if the master jettison switch is actuated, and the tip tank jettison switch is in the NORMAL position; however, all internal and external stores will also be jettisoned. It is not necessary to turn the wing tip tank fuel selector knob to the OFF position when jettisoning, as a flapper valve will close the line if the knob is in the flow position.

ENGINE OIL PRESSURE FAILURE.

GROUND OPERATION.

One minute of continuous engine operation with zero oil pressure is satisfactory for continued service. Over one minute but less than two and one-half minutes is satisfactory for continued service, provided that:

1. No abnormal engine noise exists.
2. The oil pressure pump strainer and the oil scavenge pump are checked and found free of metallic particles.
3. No indication of damage or metallization exists. No oil pressure for a period exceeding two and one-half minutes will require engine removal.

IN FLIGHT.

One minute of continuous engine operation with zero oil pressure is permissible. Over one minute but less than two and one-half minutes of engine operation may be continued at the pilot's discretion; after landing, inspection should be made as in items No. 1 to No. 3 of ENGINE OIL PRESSURE FAILURE, GROUND OPERATION, this section.

ELECTRICAL POWER SUPPLY SYSTEM FAILURE.

1. If a generator fails (assuming both engines are operating), as indicated by zero voltage reading, zero loadmeter reading, illumination of the generator failure indicator light and the remaining two generator indications being normal:
   a. Place the indicated generator switch momentarily in the RESET position and return it to the on position.
   b. If the generator failure indicator light is out and the loadmeter indication is normal, leave the generator switch in the ON position.
   c. If the generator failure indicator light remains on and the loadmeter indicates a zero reading, place the generator switch in the OFF position.
   d. Turn off non-essential electrical equipment if necessary to lower loads on operating generators. Refer to figure 3-6 for recommended loadmeter readings or operating conditions.
2. If a generator fails (assuming both engines are operating), as indicated by a zero voltage reading, zero loadmeter reading, illumination of the generator failure indicator light and the remaining two generators indicating normal or high loadmeter readings:
   a. Place the indicated generator switch in the OFF position.
   b. If operating generators, loadmeters indicate too high a load being required from the generators, turn off all non-essential electrical equipment.
3. If the left generator is lost due to a left engine failure:
   a. Place the indicated generator switch in the OFF position.
   b. Check the operating generator loadmeters for a normal or overloaded indication.
   c. If an overloaded condition exists, turn off all non-essential electrical equipment. Refer to figure 3-6 for recommended loadmeter readings for operating conditions.
4. If both right generators are lost due to a right engine failure:
   a. Place the indicated generator switches in the OFF position.
   b. Check the operating generator loadmeter for a normal or overloaded indication.
   c. And if an overloaded condition exists, turn off all non-essential electrical equipment. Refer to figure 3-6 for recommended loadmeter readings or operating conditions.
5. If any two generators fail (assuming both engines are operating as indicated in paragraphs 1 and 2):
   a. Place the indicated generator's switch in the OFF position.
   b. Check the operating generator loadmeter for a normal or overloaded condition.
   c. And if an overloaded condition exists, turn off all non-essential electrical equipment. Refer to figure 3-6 for recommended loadmeter readings for operating conditions.
6. If all three generators should fail:
   a. Immediately place the battery switch in the OFF position.

ELECTRICAL FAILURE CHART

DAY OR NIGHT MISSION

NO. OF GENERATORS OPERATING	NO. OF ENGINES OPERATING	BATTERY POWER AVAILABLE	MAXIMUM ALLOWABLE LOADMETER READING PER GENERATOR	GENERATING SYSTEM OUTPUT (AMPERES)	REMARKS
3	2	yes	.7*	594	Normal operation, 50,000 ft. altitude.*
2	2	yes	.7*	396	Normal operation, 50,000 ft. altitude.* No monitoring required.
1	2	yes	.7*	220	Unnecessary loads must be monitored so loadmeter readings do not exceed .7 when operating at 50,000 ft. altitude.
0	2	yes	0	Depends upon condition of battery	Since fuel booster pumps are necessary at altitudes above 20,000 ft., the battery can be used to operate necessary fuel booster pumps during let down to 20,000 ft. It is imperative all loads except fuel booster pumps and standby inverter be turned off.
0	2	no	0	0	Canopy and hatch cannot be jettisoned. No power available to relite in case of flameout. Engine will probably flameout when operating above 20,000 ft. with no power for booster pumps.
2	1	yes	1.0*	540	During single-engine operation the altitude is limited to 36,500 ft. No monitoring of loads is necessary.
1	1	yes	1.0*	300	Altitude limited to 36,500 ft. All electrical loads except 2 fuel pumps shall be monitored so load meter reading of remaining generator does not exceed 1.0.
0	1	yes	0	Depends upon condition of battery	Altitude limited to 36,500 ft. Supply loads on battery bus only. Preserve battery for relite attempts in case of flameout. (Battery switch in OFF position.)
0	1	no	0	0	Altitude limited to approximately 20,000 ft. No electrical power available. Engine cannot be relit and canopy and hatch cannot be jettisoned.
0	0	yes	0	Depends upon condition of battery	For airplane maneuverability refer to glide distance chart. Only battery bus should be energized. (Battery switch in OFF position.)
0	0	no	0	0	Canopy and hatch cannot be jettisoned. No power available.

***MAXIMUM ALLOWABLE LOAD READINGS AT DIFFERENT ALTITUDES**

MAXIMUM ALLOWABLE LOAD PER GENERATOR

ALTITUDE FEET	AMPERES	AIRCRAFT LOADMETER READING
GROUND OPERATION	110	.35
SL TO 35,000	300	1.0
40,000	280	.9
45,000	245	.8
50,000	220	.7

9318

Figure 3–6.

b. Turn off all non-essential electrical loads.

c. Place the battery switch in the ON position and, one at a time, place each generator switch in the RE-SET position, note the voltage, and place the switch in the OFF position.

d. After checking all the generators, place the battery switch in the OFF position. Refer to figures 3–6 for recommended loadmeter readings or operating conditions.

e. And if normal voltage was indicated by any or all generators, place the switches for all generators which indicate normal voltage in the ON position, one at a time.

f. And if the electrical system is functioning properly, place the battery switch in the ON position and turn on needed electrical equipment.

CAUTION

Be careful not to overload the generator or generators now supplying the system.

g. If none of the generators can be returned to the electrical system, leave the generator switches in the OFF position, leave the battery switch in the OFF position, and land as soon as possible. The life expectancy of the battery under this condition depends upon the state of charge, its temperature, and the rate of discharge.

Note

If it is necessary and a minimum charge of 11.5 volts remains, the battery will operate the hatch and canopy jettison circuit, the control column tube detonator, the snatch unit solenoid circuit, master jettison circuit, standby instrument inverter control and power circuits, and the C–4A lighting circuits, even though the battery switch is in the OFF position.

CIRCUIT BREAKERS.

If a circuit breaker opens, disconnecting power to any circuit, it indicates an overload or short in that circuit. If the circuit breaker reopens after being reset, do not use that circuit unless the safety of the airplane and crew depends upon its continued operation.

CAUTION

Holding a circuit breaker in the closed position creates a fire hazard.

NO. 1 AND NO. 2 INVERTER FAILURE.

If the No. 1 or No. 2 inverter should fail during flight, it will be indicated by the No. 1 or No. 2 inverter failure indicator light. If one of these lights should operate, place its respective inverter switch in the OFF position. As there are no emergency provisions for No. 1 or No. 2 inverter failure, all circuits supplied by the inoperative inverter will be out.

Note

When the No. 1 inverter fails during flight, the following instruments probably will retain the same readings as were reflected immediately prior to the No. 1 inverter failure. Fuel quantity gauge, No. 1 and No. 2 engine oil pressure indicators, the No. 1 and No. 2 engine fuel flow indicators, and the hydraulic pressure indicator.

INSTRUMENT INVERTER FAILURE.

If the instrument inverter should fail in flight, as indicated by the inverter failure light, place the instrument inverter switch in the STANDBY position. In the STANDBY position, the standby inverter operates from the battery bus.

Note

When the instrument inverter fails during flight, the J–2 compass will retain the same reading as was reflected immediately before the inverter failed. The vertical gyro indicator will assume an erratic position.

COMPLETE ELECTRICAL FAILURE.

Note

As a general rule, during complete electrical failure, all a-c instruments will retain the same readings as were reflected immediately before the electrical failure occurred. All d-c instruments will generally assume a zero or off scale position.

If the entire electrical system should fail or if it should become necessary to turn off the battery and generators, bear in mind that a great many of the equipment and controls will be inoperative. Flight under these circumstances will be limited and should be conducted as follows:

1. If it is at all possible, before turning off the electrical power, reduce airspeed and adjust trim. Trim control is not available without electrical power and the trim devices will continue to

assume the positions they had at the time of electrical failure.

2. The normal fuel control system will continue to operate if electrical power is gone. However, all fuel booster pumps, except the engine-driven fuel booster pump, will cease operation. Therefore, a reduction in altitude and rpm may be necessary for satisfactory engine operation.

CAUTION

Loss of booster pump pressure may cause erratic engine operation.

WARNING

Above an altitude of about 26,000 feet, engine flame-out will almost certainly occur if there is not at least one fuel tank booster pump feeding fuel directly to the engines. Since fuel is normally fed from the No. 1 tank to the engines, this means that if both the booster pumps in that tank are inoperative, normal flight above 26,000 feet is not possible. Under these conditions and just prior to flame-out, a rapid fluctuation of the fuel flow will be evident.

CAUTION

When electrical power has been lost, the emergency fuel control system will not operate.

3. If possible, before turning off electrical power, check that the fuel transfer and bypass valve knob is in the flow to No. 1 tank position. Since this tank has a large capacity, more fuel can be drawn from it, than from any other and all other tanks normally feed to it.

CAUTION

If all electrical power is lost, the fuel quantity indicator will be inoperative. However, the pointer will remain in position if power is lost and will give a false reading.

4. Land as soon as possible. The landing gear will operate satisfactorily, but the flaps, dive brakes, and bomb door will be inoperative.

CAUTION

The external stores, internal stores, and wing tip tanks cannot be released if electrical power fails, as both the normal release system and the jettison systems are electrically controlled.

WARNING

In the event of complete electrical failure, it is necessary to bail out, escape will have to be made by means of the access door, because the canopy, hatch jettison and control column snatch systems will be inoperative.

HORIZONTAL STABILIZER SYSTEM FAILURE.

When normal stabilizer electrical control power fails, control can be obtained by placing the stabilizer control override switch in the ALTERNATE position. Movement of the stabilizer can then be controlled by placing the emergency switch in either the NOSE UP or NOSE DOWN position as required. With a runaway stabilizer, the maximum speed at which safe flight can be maintained is approximately 250 knots. Aileron trim control is not available when the override switch is in the ALT position.

Note

If stabilizer failure occurs at full nose-down trim, a normal full-flaps landing can be safely made; with the stabilizer at full nose-up trim, a normal flaps-up landing can be safely made.

HYDRAULIC SYSTEM FAILURE.

If the hydraulic system should fail, emergency provisions for hydraulic operation are limited to a wheel brake accumulator, which is isolated from the main system by a check valve, and a hydraulic hand pump with a duplicate pressure line to the control valves for the landing gear and bomb door operation. There is enough fluid in the emergency portion of the hydraulic reservoir for opening the door and extending the landing gear. If the bomb door is closed at the time of hydraulic system failure and it is necessary to open the door before landing in order to release the bomb load, the landing should be made with the door open. If, after approximately 50 strokes of the hand pump, there is no indication of pressure build-up or bomb door operation, make no further attempt to operate the bomb door. For other hydraulic system failures, see BRAKE SYSTEM FAILURE and LANDING GEAR EMERGENCY EXTENSION in this section.

EXCESSIVE HYDRAULIC FLUID TEMPERATURES.

Loss of accumulator pre-charge pressure is a major factor in attaining a high frequency of pressure oscillation and excessive hydraulic fluid temperatures. The temperature of the hydraulic fluid will become excessive when a high pressure drop is combined with high fluid flow over an extended period of time. This condition can also be the result of pressure regulator failure in the cut-in position requiring the output of both pumps to be passed through the main relief valve and will be evident by a continuous 3500 psi indication on the main hydraulic system pressure gage. High temperatures will occur in approximately 20 minutes. This may cause hydraulic system failure due to pump failure or loss of fluid through leakage induced by the high temperatures. Use of the emergency procedures described in this section will then be required for bomb door and landing gear operation. Excessive fluid temperatures can also be caused by very rapid continuous oscillation of system pressure, when the sub-circuits are not being operated, between the normal cut-in pressure of $2600 {}^{+100}_{-0}$ psi and the normal cut-out pressure of $3000 {}^{+100}_{-0}$ psi. Rapid fluctuation of system pressure is the result of considerable increase in the system internal leakage rate. Fluctuation of system pressure will be indicated by the main hydraulic system pressure gage. Operation of each sub-circuit may stop the internal leakage and fluctuation. The operation of one sub-circuit should be completed before actuating another. This will assist in determining the circuit in which internal leakage existed.

LANDING GEAR SYSTEM FAILURE.

MAIN LANDING GEAR EMERGENCY EXTENSION.

If the landing gear fails to extend in the normal manner, proceed as follows:

CAUTION

Do not attempt to extend the landing gear until the airspeed is below 200 knots IAS.

1. Place the landing gear lever in the DOWN position.
2. Operate the hydraulic hand pump.

Note

It requires approximately 100 to 150 strokes of the hand pump to extend the landing gear, and landing gear extension may require as much as three minutes.

CAUTION

If the bomb door is closed at the time of the hydraulic system failure and it is necessary to open the door before landing to release the bomb load, land with the door open. The emergency portion of the hydraulic reservoir contains only enough fluid for opening the bomb door and extending the landing gear.

NOSE LANDING GEAR EMERGENCY EXTENSION.

If the nose gear fails to extend normally, it is probably because of previous damage to the nose gear door locking mechanism. The airspeed should be reduced well below the 200-knot limitation and sufficient engine power applied while attempting to extend the gear. If repeated cycling of this type fails to obtain extension of the nose gear, have the observer open the hydraulic ground shut-off valve to the left of the pilot's seat and operate the hand pump with the gear in the extended position. The forces on the hand pump will be exceedingly high but in some cases it will be possible to obtain slightly more pressure on the nose gear lock mechanism than by the normal system.

BRAKE SYSTEM FAILURE.

In the event the main hydraulic system fails, the wheel brake accumulator has sufficient pressure for two or three applications of the brakes. However, only one continued application is recommended when the main hydraulic system has failed.

CAUTION

If the main system has failed, do not depress the pedals while in flight, since all brake system pressure will be lost. Save the brakes for landing. Although the brake circuit contains enough fluid for two or three applications of the brakes, after touchdown is made,

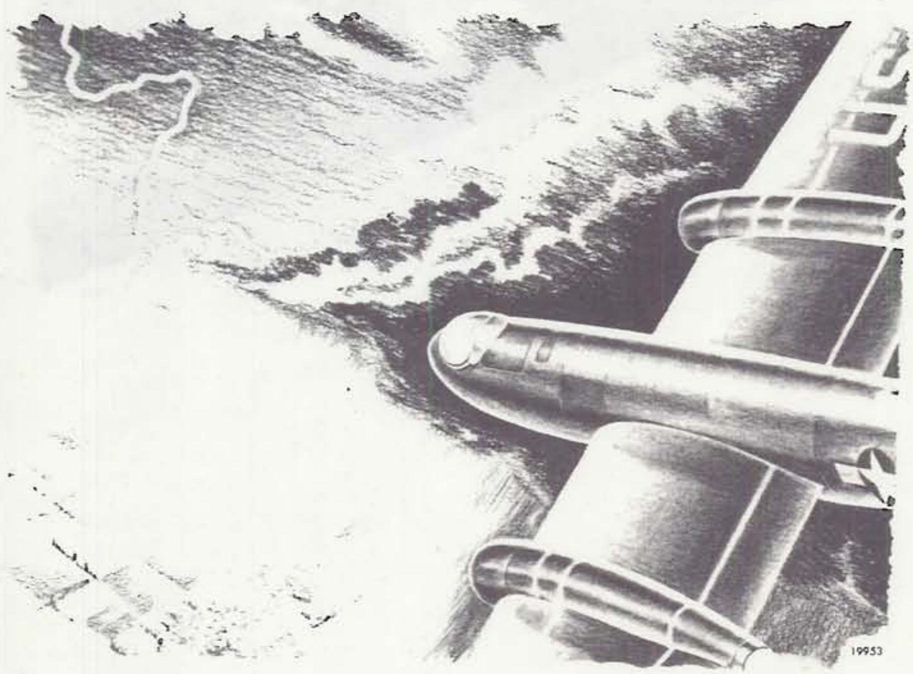
apply the brakes gradually and do not let up until stopped. After the airplane has been brought to a complete stop on the runway, do not attempt taxiing under any conditions because total brake failure will occur in a very short period of time.

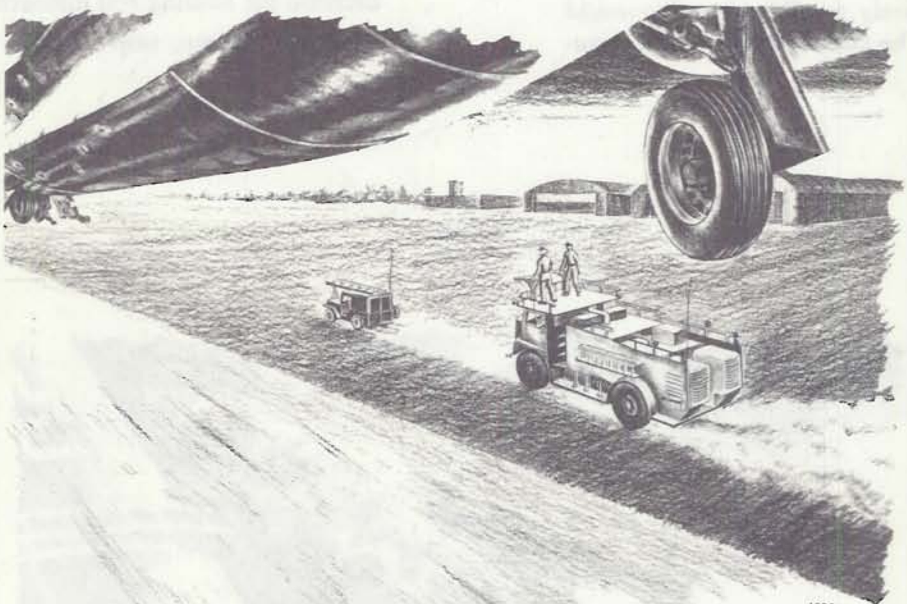
Note

In the event pressure has been lost in the brake system and the landing gear is down and locked, open the ground shut-off valve and use the hydraulic hand pump to charge the brake accumulator. Do not use this method to lower the flaps or operate any other system. If the flaps are lowered by this means, it is entirely possible that they could not be raised. The possibility of both hydraulic pumps malfunctioning at the same time is highly improbable. However, if this should happen, the valve and hand pump may be used as a last resort to lower the flaps.

If the brake system has failed and pressure cannot be built up by emergency means, it is recommended that the following procedure be used on a hard surface:

1. If there is at least 10,000 feet landing clearance, including the runway and clear area beyond, land with the landing gear extended.
2. If there is less than 10,000 feet landing clearance, land with the gear extended and retract the gear when it becomes apparent that insufficient roll-out distance remains. Raising the nose-wheel and leaving the flaps down after touchdown decrease the landing roll distance.
3. After touchdown, stop-cock the engines.





SECTION IV

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DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT

TABLE OF CONTENTS

CABIN AIR-CONDITIONING SYSTEM.

The cabin air-conditioning system, (see figure 4–1 and 4–2) provides heat, ventilation, and pressurization for the crew in the cabin by conditioning hot air under pressure from either one or both engine compressors. High-pressure lines direct the hot air from the engines to an air-cooling unit and low-pressure ducts pass the air from the cooling unit to the cabin. Two mufflers installed in series and connected to the distribution duct leading to the cabin absorb any undesirable noise from the air cooling unit or engine compressors. The electrically operated modulating hot air shut-off valve, which controls the amount of air delivered to, or diverted around, the air cooling unit controls the cabin temperature. A pressure regulator and safety valve automatically maintain cabin pressurization. From sea level to 10,000 feet altitude, the cabin is unpressurized; from 10,000 to 20,500 feet, a 10,000 foot pressure altitude is maintained. Above 20,500 feet, the differential between cabin and atmospheric pressure is constant at 3.5 psi. A dump valve, which may be electrically operated to relieve all cabin pressure in case of emergency, automatically relieves excessive pressure. Ventilation is available to the cabin in the event of operational failure of the air-conditioning equipment. The 28-volt d-c distribution bus provides power to operate and control the system.

CABIN CONDITIONING AIR DISTRIBUTION.

Six outlets distribute conditioned air throughout the cabin. The outlet tube behind the pilot's head contains three adjustable outlets. Two adjustable outlets on either side of the pilot's head discharge air forward into the upper section of the pilot's area, and the third discharges air aft toward the observer. An adjustable outlet at floor level delivers air laterally in front of the observer. The remaining two outlets in the forward part of the nose discharge air at the forward observer's window and the visual observation window.

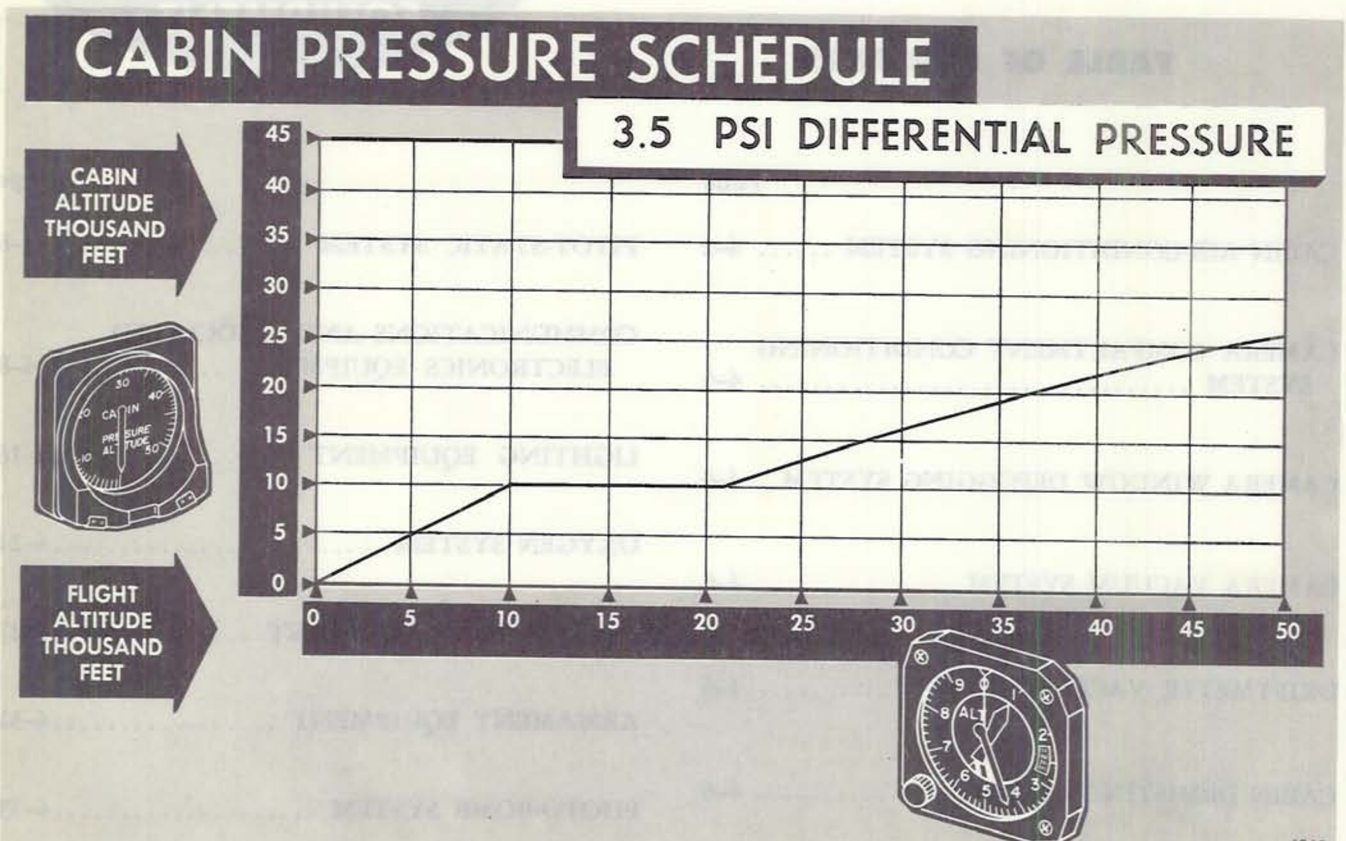


Figure 4–1.

HEATING, VENTILATION, VACUUM AND PRESSURIZING SYSTEMS

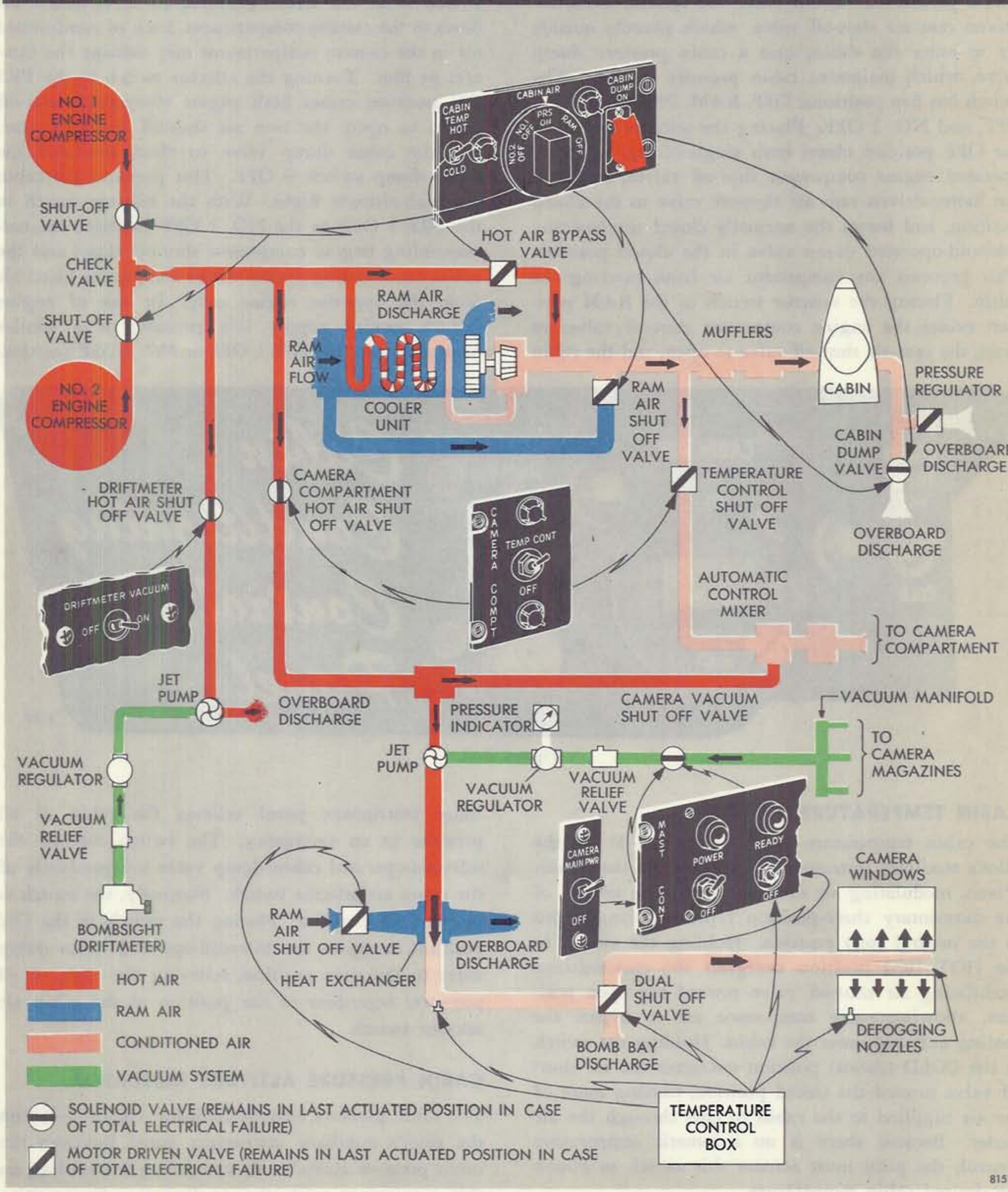


Figure 4–2.

CABIN AIR SELECTOR SWITCH.

The cabin air selector switch (figure 4-3) on the pilot's auxiliary instrument panel controls the operation of the two engine compressor shut-off valves, which permit hot air to enter the system; a motor-driven ram air shut-off valve, which permits outside air to enter the cabin; and a cabin pressure dump valve, which maintains cabin pressure altitude. The switch has five positions: OFF, RAM, PRS ON, NO. 1 OFF, and NO. 2 OFF. Placing the selector switch in the OFF position closes both single-acting, solenoid-operated engine compressor shut-off valves, energizes the motor-driven ram air shut-off valve to the closed position, and leaves the normally closed single-acting solenoid-operated dump valve in the closed position. This prevents any compressor air from entering the cabin. Placing the selector switch in the RAM position causes the engine compressor shut-off valves to close, the ram-air shut-off valve to open, and the cabin pressure dump valve to open. This allows ram air from the atmosphere to circulate through the cabin.

This position is used when outside or emergency ventilation is required. When the cabin air selector switch is in the RAM position, no conditioned air flows to the camera compartment. Lack of conditioned air in the camera compartment may damage the cameras or film. Turning the selector switch to the PRS ON position causes both engine compressor shut-off valves to open, the ram air shut-off valve to close, and the cabin dump valve to close, provided the cabin dump switch is OFF. This prepares the cabin for high-altitude flight. With the selector switch in the NO. 1 OFF or the NO. 2 OFF position, the corresponding engine compressor shut-off closes and the cabin conditioning system draws compressor bleed air from the opposite engine only. In case of engine failure, engine supply line rupture, or a similar emergency, use the NO. 1 OFF or NO. 2 OFF position.

Figure 4-3.

CABIN TEMPERATURE SWITCH.

The cabin temperature switch (figure 4-3) on the pilot's auxiliary instrument panel operates the motor-driven, modulating air shut-off valve. The switch, of the momentary three-position type, is spring-loaded to the neutral (off) position. Holding the switch in the HOT (up) position energizes the motor-driven modulating air shut-off valve toward the open position, allowing more compressor air to bypass the cooling unit and enter the cabin. Holding the switch in the COLD (down) position energizes the air shut-off valve toward the closed position, causing more of the air supplied to the cabin to pass through the air cooler. Because there is no automatic temperature control, the pilot must actuate this switch to obtain the desired cabin temperature.

CABIN DUMP SWITCH.

The guarded cabin dump switch on the pilot's auxiliary instrument panel relieves the cabin of all pressure in an emergency. The switch controls the solenoid-operated cabin dump valve independently of the cabin air selector switch. Normally, the switch is in the OFF position. Placing the switch in the ON position energizes the solenoid-operated cabin dump valve to the open position, relieving the cabin of all pressure, regardless of the position of the cabin air selector switch.

CABIN PRESSURE ALTITUDE INDICATOR.

The cabin pressure altitude indicator (figure 1-29) on the pilot's auxiliary instrument panel indicates the cabin pressure altitude. By comparing the reading on this instrument with the reading on the sensitive altimeter, the pilot can determine if the cabin pressure schedule is being maintained.

CAMERA COMPARTMENT CONDITIONING SYSTEM.

The camera compartment conditioning system (see figure 4–2) supplies conditioned air from the cabin conditioning system to the camera compartment; therefore, the cabin conditioning system must be operating before the camera conditioning system can operate. The camera conditioning system maintains the camera compartment temperature at 24° ± 5°C (75° ± 9°F) after 25 minutes of flight, provided the camera compartment temperature was between 1°C (35°F) and 37°C (100°F) before flight. The camera compartment conditioning system does not provide ground air conditioning. (See CAMERA COMPARTMENT GROUND AIR CONDITIONING in this section.) An automatic control mixes the hot and conditioned air from the cabin conditioning system, and the distribution outlet box passes the conditioned air from the automatic control mixer to the camera compartment. An air shut-off valve in the conditioned air duct and a hot-air shut-off valve in the high pressure line control the temperature of the conditioned air supply. Compartment temperature regulation is automatic after electrical operation of the shut-off valves. The 28-volt d-c camera bus supplies electrical power to operate and control this system.

CAMERA COMPARTMENT GROUND AIR CONDITIONING.

Since continuous operation of the engines is necessary, the in-flight camera compartment conditioning system cannot maintain the proper compartment temperature while on the ground. Ambient temperatures below 1°C (35°F) or above 37°C (100°F) require the use of ground air-conditioning equipment. Two ground air-conditioning couplings, one on each side of the fuselage, provide attaching points for the flexible ducts from the ground air-conditioning equipment. These ducts permit preheating or precooling of the camera compartment.

CAMERA COMPARTMENT TEMPERATURE CONTROL SWITCH.

The two-position camera compartment temperature control switch (figure 4–4) on the camera compartment conditioning panel operates the electrically actuated air shut-off valves. Placing the switch in TEMP CONT automatically positions the air shut-off valves to allow conditioned air to flow to the camera compartment, the camera window defogging system, and the camera vacuum system. (See CAMERA WINDOW DEFOGGING SYSTEM and CAMERA VACUUM SYSTEM in this section.) The camera main power switch must be in the POWER position for this system to operate because the 28-volt d-c camera bus supplies power for this system. Placing this switch in the OFF position closes the air shut-off valves.

CAMERA COMPARTMENT TEMPERATURE INDICATOR.

The camera compartment temperature indicator (figure 4–4) on the camera compartment conditioning control panel provides the observer with a direct reading of the camera compartment temperature. A temperature bulb in the camera compartment serves as a temperature-sensing element and electrically provides a reading for the indicator.

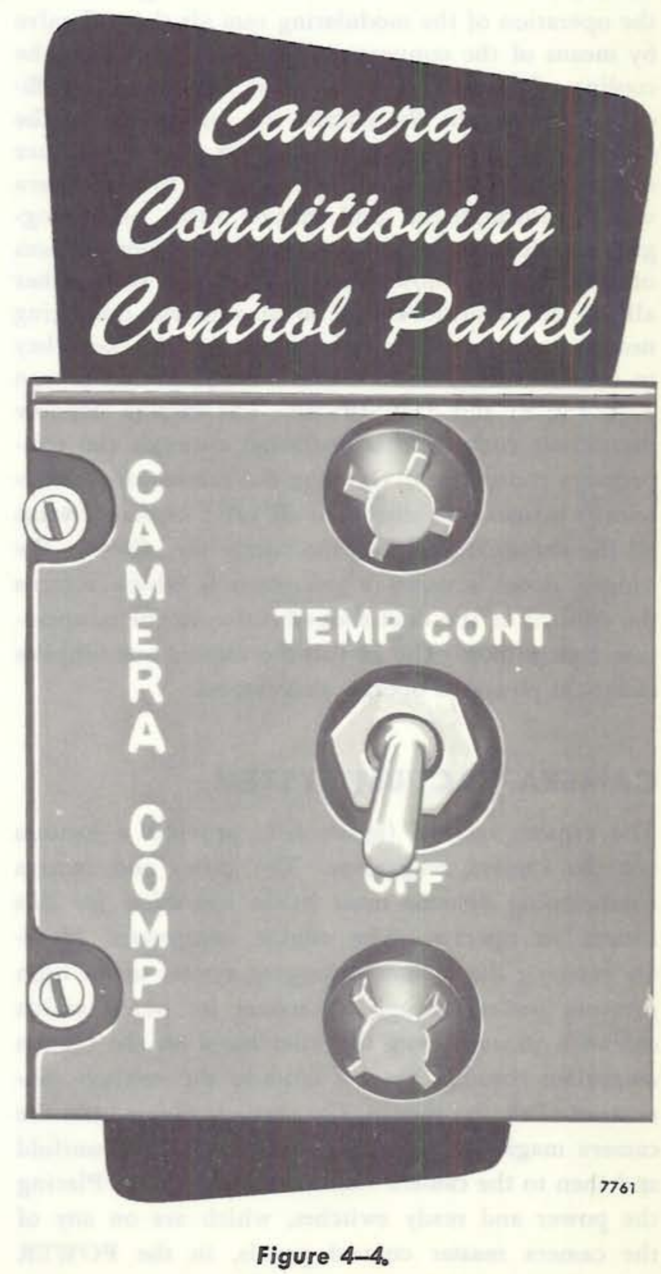


Figure 4–4.

CAMERA WINDOW DEFOGGING SYSTEM.

The camera window defogging system supplies conditioned air to the outside surfaces of the camera windows and maintains the temperature of the camera windows. A high-pressure line from the cabin conditioning system supplies engine compressor hot air; therefore, the cabin conditioning system must be in operation for the defogging system to function. Also, the camera compartment temperature control switch must be in the TEMP CONT position and the camera main power switch must be in the POWER position. The hot air flows aft through a jet pump to a heat exchanger which reduces the temperature by means of ram air cooling. An electrically operated air duct thermostat downstream of the heat exchanger controls the operation of the modulating ram air shut-off valve by means of the temperature control box, so that the cooling airflow through the heat exchanger is sufficient to maintain the correct air temperature. The camera main power switch energizes the temperature control box. The conditioned air flows to the camera window through the dual shut-off valve, and defogging nozzles distribute the air over the outer surfaces of the camera windows. The dual shut-off valve either allows the conditioned air to flow to the defogging nozzles or vents the conditioned air into the bomb-bay to maintain the camera window temperature between 27°C (80°F) and 35°C (95°F). The camera window thermostat controls this operation through the temperature control box. Opening the camera doors electrically actuates the dual shut-off valve so that it vents all the defogging air into the bomb bay. Closing the camera doors actuates a microswitch which returns the control of the dual shut-off valve to the temperature control box. The 28-volt d-c camera bus supplies electrical power to operate this system.

CAMERA VACUUM SYSTEM.

The camera vacuum (figure 4-2) provides a vacuum for the camera magazines. The cabin and camera conditioning systems must be in operation for this system to operate. The engine compressor bleed-air entering the camera defogging system under high pressure passes through a vacuum jet pump which creates a vacuum from the inlet hoses on the camera magazines through various units to the vacuum connection of the jet pump. The vacuum passes from the camera magazine inlet hoses to the vacuum manifold and then to the camera vacuum shut-off valve. Placing the power and ready switches, which are on any of the camera master control panels, in the POWER and READY positions respectively opens the camera vacuum shut-off valve. This will make suction available to the camera magazines whenever one or both of the vertical or split vertical station control panel mode selector switches is operated. Placing these switches in the OFF position shuts off the camera vacuum system. (See CAMERA MASTER CONTROL PANEL in this section.) From the shut-off valve, the vacuum passes to the vacuum relief valve, which limits the vacuum to 4.5 inches of mercury; then to the vacuum regulator, which maintains the vacuum at 4.0 inches of mercury; and then to the jet pump. The 28-volt d-c camera bus supplies electrical power to operate this system.

CAMERA VACUUM INDICATOR.

The camera vacuum indicator on a bracket in the camera compartment indicates the amount of vacuum in the system in inches of mercury.

DRIFTMETER VACUUM SYSTEM.

The driftmeter vacuum system creates a vacuum for the gyro in the bombsight sighting head, which also serves as a driftmeter. The cabin conditioning system must be operating for this system to function. Engine compressor hot air from the cabin conditioning system passes through the driftmeter hot-air shut-off valve to the vacuum jet pump which vents the hot air overboard. The jet pump draws the vacuum through the bombsight optical head (driftmeter), the bombsight vacuum relief valve, the bombsight vacuum regulator, and into the vacuum side of the pump. The vacuum regulator maintains the system at 4.0 inches of mercury, and the vacuum relief valve limits the system to 4.5 inches of mercury. The 28-volt d-c distribution bus supplies electrical power to operate this system.

DRIFTMETER VACUUM SWITCH.

The driftmeter vacuum switch on the observer's visual observation station control panel (figure 4-5) controls the operation of the driftmeter vacuum system. Placing the switch in the ON position opens the driftmeter hot air shut-off valve which places the system in operation. To turn the system off, place the driftmeter vacuum switch in the OFF position.

CABIN DEMISTING SYSTEM.

The cabin demisting system consists of two separate systems: the pilot's canopy and observer's window demisting system and the visual observation station demisting system. Their purpose is to eliminate any fog or mist which may form on the double-walled transparent areas of the cabin. The pilot's canopy and observer's window system circulates cabin air through an air filter and dehydrator into the canopy interspace by means of an electric blower and, through a dehydrator and a pressure-vacuum relief valve, vents the canopy and observer's window interspaces to cabin air. The dehydrators dry the cabin air as it enters or leaves the interspaces as governed by increases or decreases in cabin air pressure. The visual observation station demisting system vents the interspaces of the transparent nose enclosure and the visual observation window to cabin air through a dehydrator demisting unit. The 28-volt d-c distribution bus supplies power to operate this system.

Figure 4–5.

DEMISTING SWITCH.

The demisting switch (figure 4–6) on the pilot's main switch panel controls the operation of the demisting blower. Placing the switch in the DEMISTING position energizes the blower which circulates cabin air through the canopy interspace. The demisting switch should be in the DEMISTING position at all times from take-off to landing. Placing the switch in the OFF position de-energizes the blower. Additional care should be taken during operation under extremely moist or humid conditions to ascertain that the dehydrator units have a fresh supply of dehydrating agent.

CLEAR-VISION PANEL SYSTEM.

The clear-vision panel system provides an ice- and mist-free area of the canopy for forward vision. The clear-vision panel, an area six inches in diameter on the left forward part of the pilot's canopy, contains heating and temperature-sensing elements embedded in the glass. The temperature control box on the aft end of the cabin radio rack controls the operation of the heating element through the sensings of the temperature-sensing element. The clear-vision switch operates the system. The 28-volt d-c distribution bu supplies power to operate this system.

Figure 4–6.

CLEAR-VISION SWITCH.

Placing the clear-vision switch, which is on the pilot's main switch panel, in the CLEAR VISION position energizes the system to maintain the temperature of the clear vision panel between 37°C (100°F) and 43°C (110°F). To de-energize the system, place the switch in the OFF position. The clear vision switch should be in the CLEAR VISION position at all times from take-off to landing.

PITOT-STATIC SYSTEM.

The pitot-static system supplies dynamic and static pressure to the sensitive elements of the airspeed indicators, machmeter, and rate-of-climb indicator.

PITOT HEATER SWITCH.

The pitot heater switch on the pilot's main instrument panel controls the heating element in the pitot head. Placing the switch in the PITOT HEATER position energizes the heating element. To de-energize the heater, the pilot places the switch in the OFF position. The pilot's circuit breaker bus supplies electrical power to control the system.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

The plastic, edge-lighted control panels in the consoles and instrument panels at the pilot's station, observer's station, and the visual observation station contain controls for the communications and associated electronic equipment. All indicators have luminescent dials and indicator pointers which obtain photo-energy from mask light housing at the top of each indicator. All antennas, except the sense and loop antennas are mounted on the underside of the airplane fuselage. The main radio distribution box at the observer's station supplies power for the communications and associated electronic equipment and mounts all circuit breakers for the equipment.

RADIO SET AN/ARC-27 (UHF COMMAND).

Radio set AN/ARC-27 provides two-way radio-telephone communications in the uhf spectra from 225.0 to 399.9 megacycles. The pilot controls this radio through a C-628/ARC-27 remote radio control unit on the radio and radar control panel. (See figure 4-7.) A C-626-/ARC-27 radio set control in the equipment compartment allows the presetting of 18 channels and a guard frequency, any one of which may be selected by use of the C-628/ARC-27 remote control unit on the pilot's station. The inaccessability of the C-626/ARC-27 control unit prevents the use of the ARC-27 MCW capabilities for emergency or DF purposes. The 28-volt d-c radio bus supplies power to operate the radio and controls.

NORMAL OPERATION.

STARTING.

1. Place the function selector switch in the T/R position.
2. Place either the mixer toggle switch or the function selector switch of the AN/AIC-10 interphone set in the COMM position.
3. Allow approximately one minute for transmitter-receiver to warm-up.
4. Select desired channel with channel selector.
5. Select desired function with function selector switch.
6. Adjust volume to desired level with volume control.

STOPPING.

Place the function selector switch in the OFF position.

EMERGENCY OPERATION.

There are no provisions for emergency operation of the AN/ARC-27. In case of interphone amplifier failure, there is no uhf command reception or transmission.

Figure 4-7.

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	FUNCTION	PRIMARY OPERATOR	LOCATION OF CONTROLS
Uhf Command Receiver-Transmitter	Radio Set AN/ARC–27	Radio telephone communication on preselected uhf channels.	Pilot	RH Auxiliary Control Panel, Equipment Compartment.
Radio Compass	AN/ARN–6 with Remote Tuning Group AN/ARA–19	Receiver communications for automatic direction finding and general reception of 1-f and m-f, c-w and a-m, signals.	Pilot, Observer	RH Auxiliary Control Panel, Observer's RH Console.
Marker Beacon Receiver	Marker Beacon Receiving Set AN/ARN–12	Aural and visual indications of course and cone of silence markers.	Pilot	Pilot's Left Console.
Radar Altimeter	Radar Altimeter AN/APN–22	Constant absolute height indication of airplane up to 20,000′.	Pilot	None.
Interphone	Intercommunication Set AN/AIC–10	Talking and listening control between airplane stations and other communications equipment.	Pilot, Observer Maintenance Personnel	RH Auxiliary Control Panel, Observer's RH Console, Observation Station, Right Wheel Well.
Sound Recorder	Wire Recorder AN/ANH–2	Records voice conversation on wire.	Observer	Observer's Right Console.
IFF	Radar Identification Set AN/APX–6	Automatically identifies airplane as friendly when challenged by properly equipped radars.	Pilot	RH Auxiliary Control Panel.
Radar Beacon	Radar Set AN/APW–11A with Indicating Group AN/APA–90	Navigational and bombing-aid radar guidance system.	Pilot	RH Auxiliary Control Panel.
Range Indicator	IP–186/APN–84	Navigational radar system.	Observer	Shoran Indicator.
Shoran with Recorder (Airplanes AF No. 52–1459 to –1492)	AN/APA–54A AN/APN–84	Navigational radar guidance system with recording provisions and synchronization with camera equipment.	Observer	Observer's Station.
Gyro Compass	Type J–2 Slaved-Gyro Magnetic Compass	Provides stabilized magnetic heading of airplane.	Pilot	Indicators on Pilot's and Observer's Instrument Panels.
Radar Warning	Radar Receiving Set AN/APS–54	Visual and aural warning of airborne interception or airborne gun laying radar.	Observer (Visual) Pilot (Aural)	Observer's Left Vertical Panel Pilot's Left Console.

AN/AIC-10 INTERPHONE.

Intercommunication set AN/AIC-10 (interphone) provides intercommunication between aircraft stations, monitoring of the other radio and radar receiving equipment, and HOT-MIC facilities. (See figure 4-8.) The set permits interphone communication between the pilot's station, observer's station, visual observation station, and ground maintenance (right wheel well) station. Mixing switches at the pilot's station allow the crew members to hear simultaneously various interphone inputs as selected by the individual mixing switches. The C-824/AIC-10 control panel (INTER) on the pilot's auxiliary control panel provides volume control, mixing switches, rotary function-selector switch, and an emergency switch to use in case of interphone amplifier failure. The rotary function-selector switch selects the radio or radar facility heard through the interphone amplifier by individual unit. The interphone amplifier is energized whenever the battery and generator switches are in the operating positions. Placing this switch in the CALL position allows the pilot to talk or listen by interrupting all other talking or listening stations in the aircraft. Placing the switch in the HOT-MIC position allows the pilot to talk through the interphone system without pressing the microphone switch. Placing the function switch in the INTER (interphone), COMM (uhf command radio), ADF (radio compass), or RCRD (wire recorder) position allows these units to function through the interphone amplifier system. The five toggle-type mixer switches allow selected radio and radar equipment to operate simultaneously through the interphone amplifier system regardless of the position of the function selector switch. Actuating the switches downward to the INTER (interphone), COMM (uhf command radio), MARKER (marker beacon), ADF (radio compass), and BEACON (radar beacon) positions mixes the audio outputs of these units. The NORMAL-AUX. LISTEN switch is in the NORMAL position for normal operation of the interphone set. If the interphone amplifier fails, place the switch in the AUX LISTEN position. When the normal-aux listen switch is in the AUX LISTEN position and all of the mixing switches are in the up (off) position, the crew hears the facility selected by the function selector switch. If any of the mixing toggle switches are in the down (on) position, the crew hears the facility selected by

Figure 4-9.

Figure 4-8.

the extreme left switch that is in the down (on) position. In case of interphone amplifier failure there is no uhf command (AN/ARC-27) transmission or reception.

NORMAL OPERATION.

STARTING.

1. Place either the interphone mixing switch or the function selector switch in the INTER position.
2. Adjust the volume to the desired level with the volume control.

STOPPING.

1. Place the interphone mixing switch in the up (off) position and rotate the function selector switch to any position other than INTER.

EMERGENCY OPERATION (INTERPHONE AMPLIFIER FAILURE).

1. Place the NORMAL-AUX LISTEN switch in the AUX LISTEN position.

Note

There is no uhf command transmission, or reception with the NORMAL-AUX LISTEN switch in the AUX LISTEN position.

Figure 4-10.

AN/ARN-6 RADIO COMPASS.

Radio Compass AN/ARN-6 is an airborne navigational and general communications receiver, and Remote Tuning Group AN/ARA-19 provides electro-nechanical tuning for the receiver. By individual or ombined use of a loop and non-directional sensing ntenna controls, the radio compass can be used for

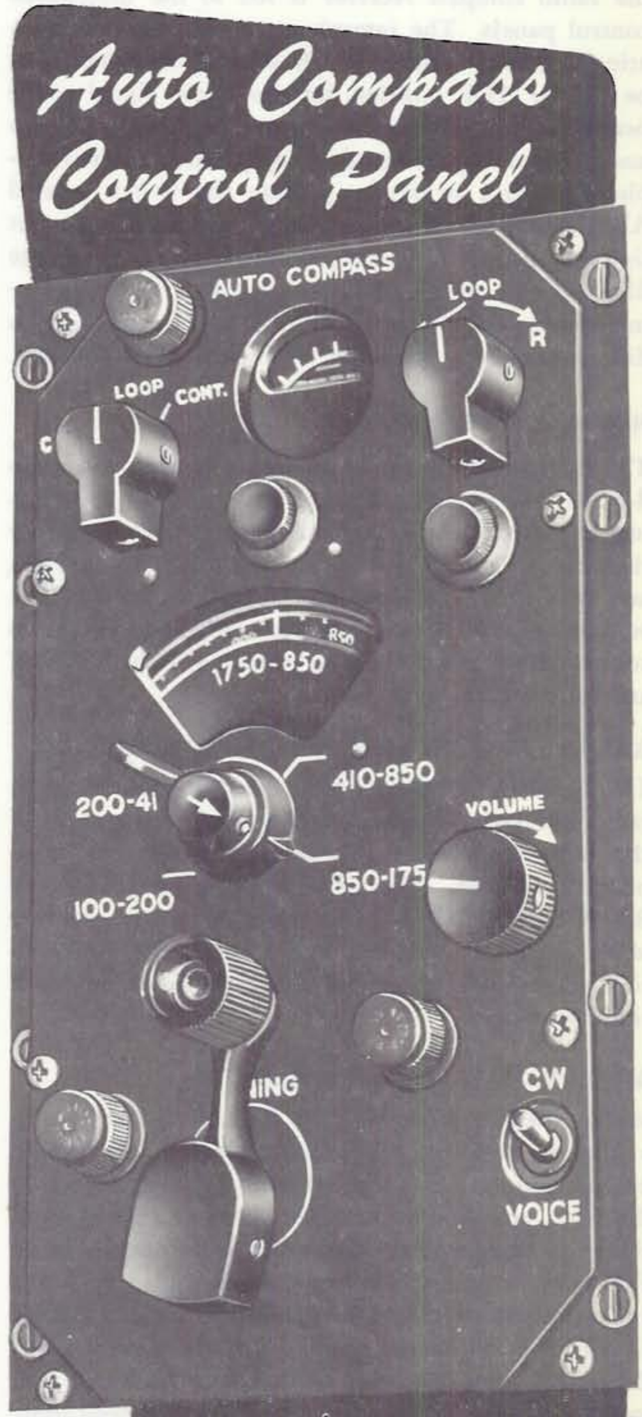


Figure 4-11.

position-finding, homing, and weather report reception from low-frequency radio range stations. (See figure 4-11.) Control of the equipment is such that intelligence may be obtained from MCW, C-W, and A-M transmissions. Although the equipment can be controlled at the pilot's or observer's station, only one control panel is active at a time. Audio output from the radio compass receiver is fed to the interphone control panels. The interphone system must be operating and the control panels selector switches must be in the ADF position for the audio signal to be heard. At the pilot's interphone control panel, the audio signal may be heard in any position of the interphone control switch by placing the switch labeled ADF downward. Further control of the audio output signal is provided at the pilot's station by the range filter selector switch. Power is supplied to the equipment from the 28-volt d-c radio bus in the main radio distribution box through a 10-ampere circuit breaker.

NORMAL OPERATION.

The equipment is turned on by energizing the radio d-c bus (battery and generator switches ON) and placing the auto compass control panel switch at either the observer's or pilot's station to the CONT position and then back to the mode of operation desired. The equipment may be stopped from either auto compass control panel by placing the control switch to CONT and back to OFF.

RADIO COMPASS FILTER SELECTOR SWITCH.

The RADIO COMPASS filter selector switch on the radio and radar control panel selects the function of the radio compass that is heard through the interphone amplifier. Placing the rotary switch in the RANGE or VOICE position allows only that function to be heard. Placing the switch in the NORM position allows both voice and range audios to be heard simultaneously.

AN/ARN-12 MARKER BEACON.

Marker Beacon Receiving Set AN/ARN-12 serves as a marker indicator. Signals transmitted by ground beacon stations produce aural and visual indications to the pilot, enabling an accurate check of aircraft position with respect to the particular radio range station. Fan markers (course markers) are identified by coded audio signals or flashes of an amber indicator lamp (5, figure 1-28) on the pilot's main instrument panel. Z-markers (cone-of-silence markers) are indicated by a steady tone in the headset and by a continuous glow of the indicator lights. For the pilot to receive aural intelligence, the interphone system must be operating, and the switch coded MARKER on the pilot's interphone control panel must be placed downward. (See figure 4-8.) Indicator power is supplied to the receiver from the 28-volt d-c radio bus in the main distribution box through a 5-ampere circuit breaker. The indicator light gets its power from the 28-volt d-c distibution bus.

AN/APN-22 RADAR ALTIMETER.

The AN/APN-22 Radar Altimeter (21, figure 1-28) provides altitude information to the pilot. Radar pulses transmitted from the airplane are reflected by the terrain and received by the airplane. The time required for the radar pulse to reflect from the ground is measured electronically to determine the exact altitude. The radar altimeter system will cease indicating altitude, or "drop out," when the reflected signal arriving at the receiver is too weak to overcome system static. When drop-out occurs, a reliability circuit within the equipment automatically disables the indication and sets the pointer behind a mark to prevent the pilot from using the indication. Drop-out should not occur at altitudes below 10,000 feet when flying over land or at altitudes up to 20,000 feet when flying over water. Inverted flight will also cause drop-out. A climb or dive at 70 degrees and banks of 60 degrees or more reduces the drop-out altitude somewhat. The return to normal operation following drop-out is indicated by the resumption of normal pointers operation. The only operating control to turn the equipment off and on and to select the limit altitude is the ON-LIMIT knob on the lower left of the height indicator. The height indicator is a synchro-drive device which receives altitude indications in the form of stator voltages from the electronic control amplifier. The amplifier receives sensings from the sense antenna. The height indicator presents the airplane altitude on a single turn-type dial. The single indicator pointer indicates the altitude of the airplane in feet. The pointer advances linearly over the dial range from 0 to 200 feet as the dial rotates 120 degrees. Above 200 feet, the range indication is compressed inasmuch as the pointer advances 191 degrees to reach the range indication of 2,000 feet. The pointer advances a total of 311 degrees for the complete range readings from 0 to 20,000 feet. A mask covers most of the off-scale dial position between 20,000 and 0 feet. D-c and a-c electrical power is supplied to the electronic control amplifier for AN/APN-22 system operations through two circuit breakers on the main radio distribution panel. Both the a-c and d-c circuit breakers are placarded ALTIMETER. The 28-volt d-c radio bus supplies power through the 5-ampere trip-free d-c circuit breaker and the No. 1 radio bus supplies 115-volt single- phase a-c power through the 5-ampere trip-free a-c circuit breaker. The accuracy of indication is plus or minus 2 feet from 0 to 40 feet and plus or minus 5 percent of the indicated altitude from 40 to 20,000 feet.

NORMAL OPERATION.

Through use of the ON-LIMIT control knob, an adjustable bug pointer at the outside of the calibrated scale can be preset to any desired altitude and used as a reference for flying at fixed altitudes. The altitude of the airplane is then easily observed by noting the position of the indicator with respect to the bug without considering the actual scale calibrations. The red indicator light remains out when the aircraft is above the preset altitude, and the light illuminates when the aircraft is at or below the preset altitude. The illuminating mask lights are controlled by the FLIGHT INST. LIGHTS rheostat on the pilot's circuit breaker and lighting control panel.

1. Start the equipment by turning the on-limit control knob clockwise.

CAUTION

Although the equipment will begin operating approximately 3 minutes after it is turned on, allow at least 12 minutes after starting to insure final accuracy. If the temperature is below —40°C (—40°F), allow 25 minutes to insure final accuracy.

2. Set the preset bug on the indicator to the desired altitude by means of the on-limit control knob.

Note

When the equipment is operating with the airplane on the ground, the indicator pointer will be behind the mask. If drop out of the equipment occurs, level out from the maneuvers that caused drop out to restore normal operation of the system. A period of several seconds (10 seconds max) will elapse between the time of recovery from the maneuver that caused drop out and the resumption of normal system operation.

3. To stop the equipment, turn the on-limit control knob fully counterclockwise.

AN/ANH–2 WIRE RECORDER.

Wire Recorder AN/ANH–2 records conversation through control connections with intercommunications set AN/AIC–10 whenever the recording equipment is energized. The equipment is controlled by a panel (panel 2, figure 4–18) at the observer's station only, but all interphone operators except the ground maintenance station can record by actuating their press-to-talk switches. Playback of recordings is made by associated reproducing equipment at the ground station. A warning light on the recorder control panel indicates when recording time has elapsed within five minutes of the end of the wire. Power is supplied through a 5-ampere circuit breaker from the 28-volt d-c radio bus.

OPERATION.

1. Place the observer's wire recorder switch in the ON position.
2. Place the interphone function selector switch in the RCRD position.
3. Depress any press-to-talk switch.

AN/APX–6 IFF.

Radar Identification Set AN/APX–6 enables the aircraft to identify itself automatically whenever challenged by suitably equipped friendly surface and airborne radars. The equipment can also provide two separate channels for identification of specific friendly aircraft among many friendly aircraft, and a means of transmitting a specially coded emergency reply when the aircraft is in distress. The receiver-transmitter can be completely demolished by the firing of the destructors mounted in the unit, controllable from the pilot's radar set control. (See figure 4–12.) The receiver-transmitter receives its power through a 5-ampere circuit breaker from the 28-volt d-c radio bus, and 115-volt, single-phase, a-c through a 5-ampere circuit breaker from the No. 2 radio bus.

NORMAL OPERATION.

The equipment is started by energizing the d-c radio bus (battery and generator switches ON) and by turning the master switch on the pilot's radar set control from OFF to any of the other positions except EMER-

Figure 4–12.

GENCY. (See figure 4-4.) The equipment is stopped by turning the master switch to OFF.

EMERGENCY OPERATION.

The master switch on the pilot's radar set control has an EMERGENCY position to the left of the OFF position. (See figure 4-12.) A dial stop prevents inadvertent actuation of the switch to this position. When tactical conditions warrant its use, the red dial-stop button must be pushed and the master switch rotated in the extreme clockwise direction to the EMERGENCY position. When tactical instructions are to fire the destructors, the safety wire on the toggle switch cover labeled DESTRUCT must be broken, the cover lifted, and the switch actuated.

AN/APW-11 RADAR BEACON.

Radar Set AN/APW-11A, used in conjunction with the Indicating Group AN/APA-90, serves as a navigational and bombing-aid radar guidance system. In navigational operations, intelligence is obtained from a ground station from which aircraft speed, heading, and altitude can be determined. In bomb aid operations, tactical instructions are electronically provided to the pilot. Radar beacon operations are also performed with suitably equipped ground radar stations. Control of the equipment is provided with the radar set control at the pilot's station, and listening to radar beacon signals is accomplished at the pilot's interphone control panel by actuating the mixing switch labeled BEACON. (See figure 4-13.) The tactical instructions to the pilot are provided at the pilot's main instrument panel by the flight command indicator (22, figure 1-28). The trigger in the left handgrip of the control wheel is connected in parallel with the roger switch on the AN/APW-11A control panel. (See figure 1-22.) Either of these switches cancels all previous indications on the flight command indicator and acknowledges the receipt of all indications. Power is supplied to the equipment from the 28-volt d-c radio bus through a 10-ampere circuit breaker.

7764

Figure 4-13.

NORMAL OPERATION.

The equipment is started by energizing the d-c radio bus (generator switches ON) and placing the four-position switch on the pilot's radar set control to ON. The equipment is stopped by turning the four-position switch to off.

RADIO SET AN/APN-84 (AIRPLANES AF52-1426 THROUGH 52-1478).

Radio Set AN/APN-84 with its unit composition is a highly accurate short range navigational device. The equipment is used to provide a fix on the position of the airplane. Control of the system is accomplished by the observer, and all indications are received by him. Power for the system comes from the No. 1 radio bus, and the 28-volt d-c radio bus through three circuit breakers on the main radio distribution panel.

RANGE INDICATOR IP-186/APN-84.

The AN/APN-84 range indicator is located on the left side of the observer's compartment. (See figure 4-20.) A transmitter in the airplane sends out radar signals which are received by two Shoran ground stations and retransmitted. The range indicator receives these transmitted signals and indicates them visually on the range indicator scope. The observer must then superpose the return video signals upon reference marker pulses on the scope to reveal the distances to each station. The distances are indicated on each station, MILES dial and VERNIER counter. This locates the point on the earth's surface directly below the airplane. Prior to receiving video pulses, the indicator must be preset by use of the various controls and indicators located on the indicator panel.

RADAR ASSEMBLY AN/APA-54A (AIRPLANES AF52-1459 THROUGH 52-1492).

Radar assembly AN/APA-54A is used in conjunction with the AN/APN-84 radio set to provide the pilot and observer with drift and late information and provide shoran data for recording on film. Gyro compass information is supplied from the J2 Slave gyro compass for recorder dial readings. An additional feature is synchronization of the AN/APA-54A equipment with the camera control system. When pictures are taken with either the night or day camera configura-

Figure 4–14.

tions, data recording is made simultaneously at the AN/APN–54A equipment. D-c power for the AN/APA–54A indicator assembly comes from the 28-volt d-c radio bus through a 5-ampere circuit breaker. A-c power is applied to the indicator assembly from the No. 1 radio bus.

AN/APS–54.

Radar Receiving Set AN/APS–54 provides visible and audible warning when an airborne interception or an airborne gunlaying radar system is in a position to offer a potential threat to the airplane. The visible warning is displayed by indicator lights on the pilot's auxiliary switch panel (1, figure 1–31) and the observer's AN/APS–54 control panel (8, figure 4–21). These lights indicate whether radar signals are arriving from the direction of the nose, tail, or both. Control of the equipment is effected by the observer. Selection can be made to delay indication of a signa for two seconds after the signal has been detected by placing the delay switch in the IN position. Signals will be indicated instantly if the delay switch is in the OUT position. The audible warning information are audio-frequency tones corresponding to the pulse repetition frequency of the intercepted signals. The audio switch permits selecting tones from the nose direction, tail direction, or both. The audio gain control governs the amplitude of the signals. The audible tones are monitored through the AN/AIC–10 Intercommunication Set. The MARKER mixing switch on the pilot's interphone control panel must be placed in the ON position and the MARKER BEACON-RADAR WARNING switch on the pilot's left console must be placed in the RADAR-WARNING position. The test switch provides a quick method for testing the operation of the visible and audible warning systems before or during flight. D-c power for the equipment is supplied from the 28-volt d-c radio bus through a circuit breaker on the main radio distribution panel. A-c power comes from the No. 1 radio bus through a circuit breaker on the main radio distribution panel.

NORMAL OPERATION.

The equipment is turned on by energizing the 28-volt d-c generator bus (battery and generator switches ON), energizing the No. 1 radio bus (No. 1 inverter switch ON), and placing the AN/APS-54 power switch to the ON position. To complete a check of the equipment, the pilot's interphone marker switch must be placed in on position and the marker beacon-radar warning switch must be in the RADAR WARNING position. Then set the equipment controls as follows: delay switch OUT, audio switch BOTH, and audio gain maximum (fully clockwise). The test switch is then placed in the up position. If the equipment is operating properly, an audio tone will be heard in the headset, both red nose and tail warning lights will come on, and the green light pilot will be out. Continue to hold the test switch in the up position and rotate the gain control. The amplitude of the audio tone should vary with changes in setting of the gain control. Return the gain control to the maximum position and operate the audio switch to the NOSE, BOTH, and TAIL positions. The audio tone should continue to be heard at the three switch positions and the respective indicator lights should come on at these positions.

LIGHTING EQUIPMENT.

NAVIGATION LIGHTS.

The navigation lights consist of clear dual lights on top and bottom of the center section, yellow and white lights on the upper and lower surfaces of the tail cone, red lights on the left wing tip and wing tip tank, and green lights on the right wing tip and wing tip tanks. The two navigation light switches operate these lights. The 28-volt d-c distribution bus supplies electrical power for this system.

NAVIGATION LIGHT SWITCHES. (See figure 1-31.)

The navigation light switches on the armament and generator control panel consist of one two-position switch and one three-position switch. The switch on the right has three positions: FLASH, OFF, and STEADY. Placing the switch in the FLASH position causes all navigation lights to flash except the clear lights on the top and bottom of the fuselage, which glow steadily. Placing the switch in the OFF position turns the lights off. With the switch in the STEADY position, all navigation lights glow steadily. Placing the left switch in the BRIGHT or DIM position controls the intensity of the lights.

LANDING LIGHT.

A high-intensity lamp on the lower surface of the left wing illuminates night take-offs and landings. The landing light switch controls the illumination, extension, and retraction of the light. The 28-volt d-c generator bus supplies power for illumination, and the 28-volt d-c distribution bus supplies power for extension and retraction.

LANDING LIGHT SWITCH.

The landing light switch on the pilot's auxiliary switch panel controls the operation of both the illumination and the extension and retraction of the lamp. (See figure 1-25.) Placing the switch in the LANDING LIGHT position energizes the landing light assembly. A motor acts to extend the light and the light automatically illuminates while traveling toward the extended position. Placing the switch in the OFF position turns the light off and energizes the motor to retract the light.

TAXI LIGHTS.

Taxi lights, one mounted in the leading edge of each wing tip, provide limited illumination for night ground operation. The taxi lights switch controls this circuit. The 28-volt d-c distribution bus supplies power for operation.

TAXI LIGHTS SWITCH.

Placing the taxi lights switch, which is on the pilot's auxiliary switch panel, in the TAXI LIGHTS position turns the lights on. (See figure 1-30.) Placing the switch in the OFF position turns the lights off.

CREW COMPARTMENT DOME LIGHTS.

The crew compartment dome lights illuminate the observer's station, the observer's visual observation station, and the working area of the observer's table. The circuit consists of three lights and three switches. The 28-volt d-c distribution bus supplies power for operation.

CREW COMPARTMENT DOME LIGHT SWITCHES. (See figure 4-18.)

The switch on the visual observation station dome light panel controls the dome light. Placing the switch in the DOME LIGHT position turns the light on, and placing the switch in the OFF position turns the light off. Two switches on the observer's lighting control panel control the observer's dome light and the observer's table light. Placing the switches in the DOME LIGHT AND TABLE LIGHT position turns the corresponding light on. Placing the switches in the OFF position turns the lights off.

C-4A LIGHTS.

Two C-4A lights, one on the pilot's glare shield and one on the main radio junction box, provide portable cabin illumination for the pilot and observer. Each light has a rheostat and push-button switch for control. Red lenses are provided for use when white light is prohibited. The 28-volt d-c battery bus supplies power for these lights.

Figure 4–15.

C–4A LIGHT SWITCHES.

Each C–4A light has a rheostat to control light intensity and a push-button switch for momentary lighting. Rotate the rheostat knob clockwise to increase the light intensity, and counterclockwise to the OFF position to turn the light off. Depress the push button to turn the light on, and release it to turn the light off.

PILOT'S PANEL AND INSTRUMENT LIGHT SYSTEM.

The pilot's panel and instrument light system provides red illumination for the pilot's station. Five groups of lights with both lucite panel lights and masked instrument panel lights comprise the system. A rheostat controls the light intensity of each system. Three rheostats on the pilot's lighting control panel (figure 4–15) operate the flight instrument lights, engine instrument lights, and the panel lights. Rheostats on the fuel control panel and the hinged photo panel operate the lights for these panels. The 28-volt d-c pilot's circuit breaker bus supplies power for this system.

PILOT'S PANEL AND INSTRUMENT LIGHT RHEOSTATS.

Clockwise rotation (OFF to BRT) of the rheostat knobs of the pilot's flight instrument, engine instrument, and panel lights and the fuel control and hinged photo panel lights increases the light intensity. To turn the lights off, rotate the knobs counterclockwise to the OFF position.

OBSERVER'S PANEL AND INSTRUMENT LIGHT SYSTEM.

The observer's panel and instrument light system provides red illumination for the observer's station by means of lucite panel lights and masked instrument lights. A rheostat on the observer's lighting control panel varies the light intensity of the system. The 28-volt d-c circuit breaker bus supplies power for this system.

OBSERVER'S PANEL AND INSTRUMENT LIGHT RHEOSTAT.

Clockwise rotation (OFF to BRT) of the panel light rheostat knob on the observer's lighting control panel increases the panel light intensity. To turn the lights off, rotate the knob counterclockwise to the OFF position.

OBSERVER'S VISUAL OBSERVATION STATION PANEL LIGHT SYSTEM.

The observer's visual observation station panel light system provides red illumination of the visual observation station console. A rheostat on the visual observation station control panel varies the light intensity of the system. The 28-volt d-c circuit breaker bus supplies power for this system.

OBSERVER'S VISUAL OBSERVATION STATION PANEL LIGHT RHEOSTAT.

Clockwise rotation (OFF to BRT) of the panel light rheostat knob on the light, vacuum, and switch panel increases panel light intensity. To turn the lights off, rotate the rheostat knob counterclockwise to the OFF position.

COMPARTMENT DOME LIGHTS.

Compartment dome lights in the right electrical access compartment, the bomb bay, the electronic compartment, and the camera compartment furnish illumination for the work area. Switches on the dome light panels operate the lights. The 28-volt d-c generator bus supplies power for these lights.

Figure 4–16.

COMPARTMENT DOME LIGHT SWITCHES.

Place the switches which are on the compartment dome light panels in the DOME LIGHT position to turn the lights on. To turn the lights off, place the switches in the OFF positions.

PILOT'S RED FLOODLIGHTS AND THUNDERSTORM LIGHTS.

Red floodlights and white floodlights furnish general illumination of the pilot's station. A rheostat controls the intensity of the red floodlights and a switch operates the thunderstorm (white) lights. The red floodlight rheostat also controls the intensity of the hinged photo panel red floodlight. (See RED FLOODLIGHT SELECTOR SWITCH in this section.) The 28-volt d-c distribution bus supplies power to operate these lights.

PILOT'S RED FLOODLIGHT RHEOSTAT.

Clockwise rotation (OFF to BRT) of the red floodlight rheostat knob on the pilot's lighting control panel increases floodlight intensity. To turn the lights off, rotate the knob counterclockwise to the OFF position.

PILOT'S THUNDERSTORM LIGHT SWITCH.

The pilot's thunderstorm light switch on the pilot's lighting control panel operates the white thunderstorm lights. Placing the switch in the THUNDERSTORM LIGHTS position turns the lights on. To turn the lights off, place the switch in the OFF position.

OBSERVER'S RED AND WHITE FLOODLIGHTS.

Red floodlights and white floodlights provide general illumination of the observer's station. A rheostat controls the intensity of the red floodlights and a switch operates the white lights. The red floodlight rheostat also controls the intensity of the hinged photo panel red floodlight. (See RED FLOODLIGHT SELECTOR SWITCH in this section.) The 28-volt d-c distribution bus supplies power to operate these lights.

OBSERVER'S RED FLOODLIGHT RHEOSTAT.

Clockwise rotation (OFF to BRT) of the red floodlight rheostat knob on the observer's lighting control panel increases floodlight intensity. Counterclockwise rotation of the knob to the OFF position turns the lights off.

OBSERVER'S WHITE FLOODLIGHT SWITCH.

The white floodlights switch on the observer's lighting

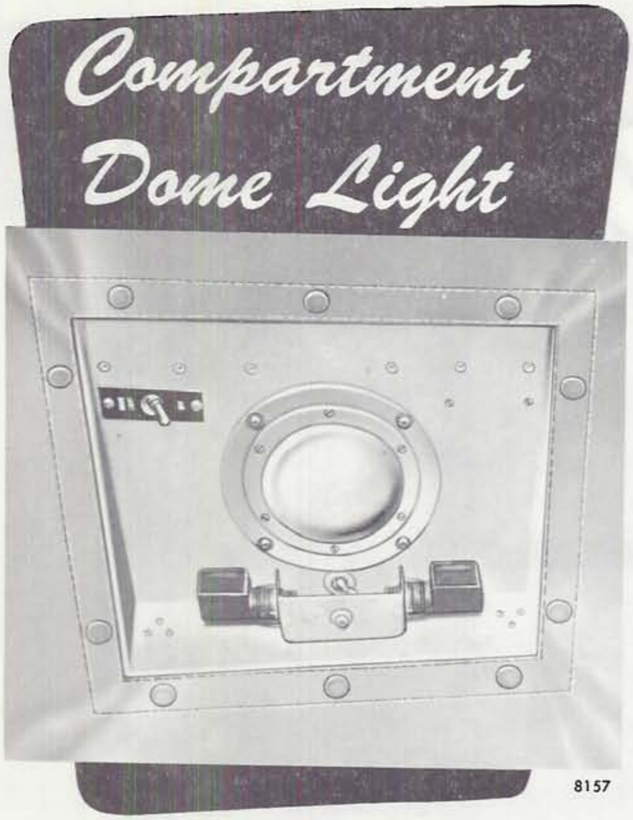


Figure 4-17.

control panel operates the white floodlights. Placing the switch in the WHITE FLOODLIGHTS position turns the lights on, and placing the switch in the OFF position turns the lights off.

VISUAL OBSERVATION STATION RED FLOODLIGHTS.

Red floodlights at the visual observation station provide general illumination of the panels, instruments, and controls in that area. The 28-volt d-c distribution bus supplies power to operate this system.

VISUAL OBSERVATION STATION RED FLOODLIGHTS SWITCH.

The floodlight switch on the light, vacuum and switch panel at the visual observation station operates the red floodlights. Placing the switch in the ON position turns the lights on, and placing the switch in the OFF position turns the lights OFF.

HINGED PHOTO PANEL LIGHTS.

Red floodlights provide general illumination of the hinged photo panel when it is positioned for either pilot or observer use. The pilot's or observer's red floodlight rheostat controls the floodlight intensity. (See RED FLOODLIGHT SELECTOR SWITCH in this section.) Panel lights provide illumination of the photo panel units. A rheostat on top of the hinged photo panel controls these lights. The 28-volt d-c distribution bus provides power to operate and control these lights.

RED FLOODLIGHT SELECTOR SWITCH.

The red floodlight selector switch on the hinged photo panel selects the red floodlight to illuminate the hinged photo panel depending upon whether the panel is in position for the pilot or observer. The switch has three positions: PILOT, OFF, and NAV. Placing the switch in the PILOT or NAV position allows the pilot's or observer's red floodlight rheostats to control the operation of the red floodlights which illuminate the hinged photo panel. (See PILOT'S

RED FLOODLIGHTS AND THUNDERSTORM LIGHTS and OBSERVER'S RED AND WHITE FLOODLIGHTS in this section.) Placing the switch in the OFF position turns the hinged photo panel red floodlights off regardless of the position of the pilot's observer's red floodlight rheostat.

HINGED PHOTO PANEL LIGHTS RHEOSTAT.

The hinged photo panel lights rheostat on top of the panel controls the intensity of the panel lights. Clockwise rotation of the rheostat knob (OFF to BRT) increases the light intensity, and counterclockwise rotation of the knob towards the OFF position decreases light intensity and turns the lights off.

DRIFTMETER LIGHTS.

Lights in the sighting head illuminates the drift scale and the collimator. The driftmeter lighting control panel mounts the switch and rheostat to control the lights. The 28-volt d-c distribution bus supplies power to operate this system.

DRIFTMETER LIGHTING CONTROL PANEL.

The driftmeter lighting control panel in the left forward portion of the visual observation station contains two rheostats and a switch to control the driftmeter lights. Two rheostats marked DRIFT SCALE LIGHT and COLLIMATOR LIGHT turn their respective lights on and off and control the intensity of the lights. Rotating the rheostat knobs clockwise (OFF to ON) turns the lights on and increases light intensity. Rotating the knobs counterclockwise (ON to OFF) decreases light intensity and turns the lights off. For the lights to operate, the switch between the rheostats must be in the ON (down) position. Placing this switch in the up (OFF) position turns out both the drift scale and collimator lights regardless of the rheostats' positions.

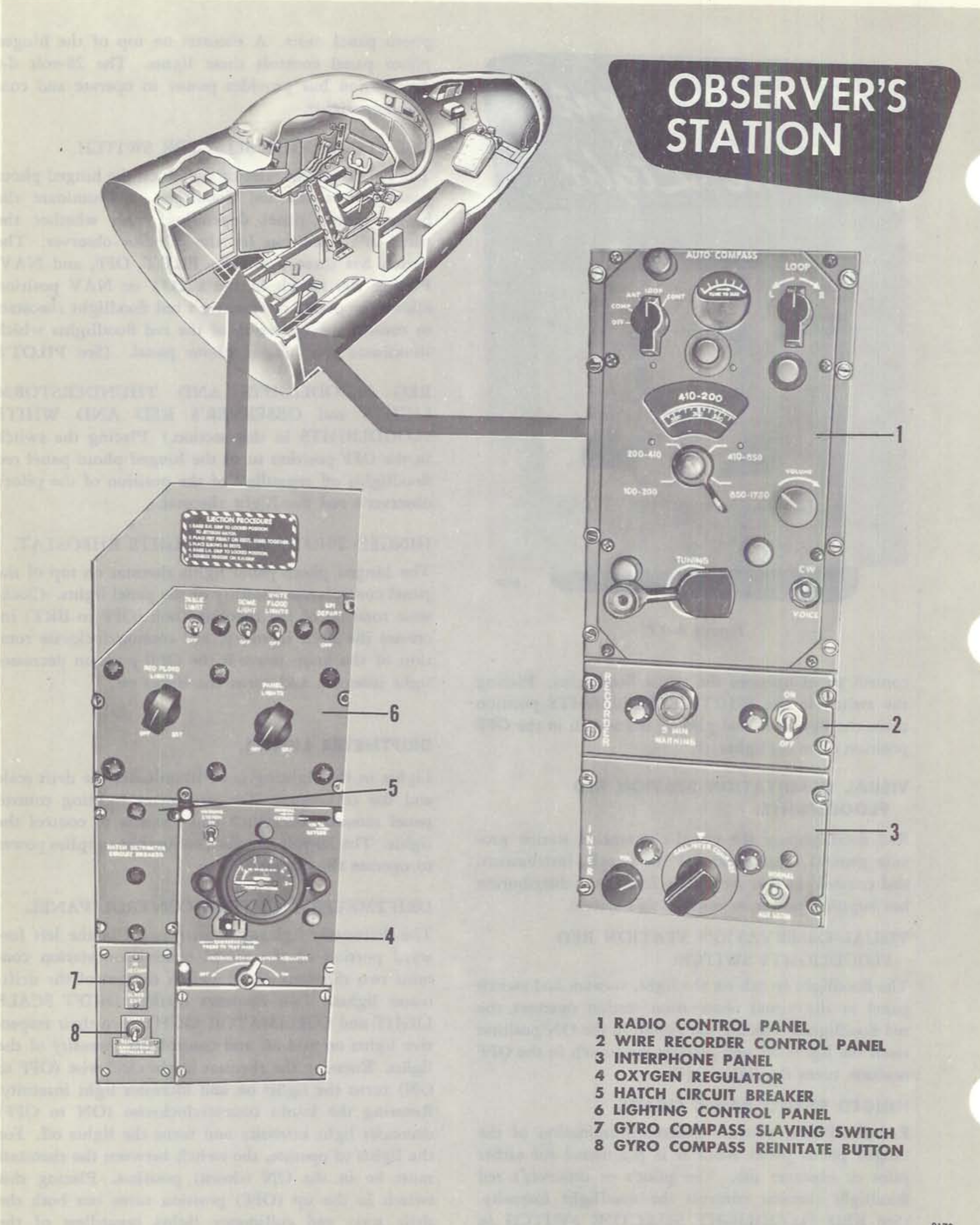

OBSERVER'S STATION
AUTO COMPASS
LOOP
410-200
200-410
410-850
100-200
850-1750
TUNING
CW
VOICE
RECORDER
5 MIN WARNING
ON
OFF
INTER
EJECTION PROCEDURE
TABLE LIGHT
DOME LIGHT
WHITE FLOOD LIGHTS
RED FLOOD LIGHTS
PANEL LIGHTS
1
2
3
4
5
6
7
8
1 RADIO CONTROL PANEL
2 WIRE RECORDER CONTROL PANEL
3 INTERPHONE PANEL
4 OXYGEN REGULATOR
5 HATCH CIRCUIT BREAKER
6 LIGHTING CONTROL PANEL
7 GYRO COMPASS SLAVING SWITCH
8 GYRO COMPASS REINITATE BUTTON
8170

Figure 4–18.

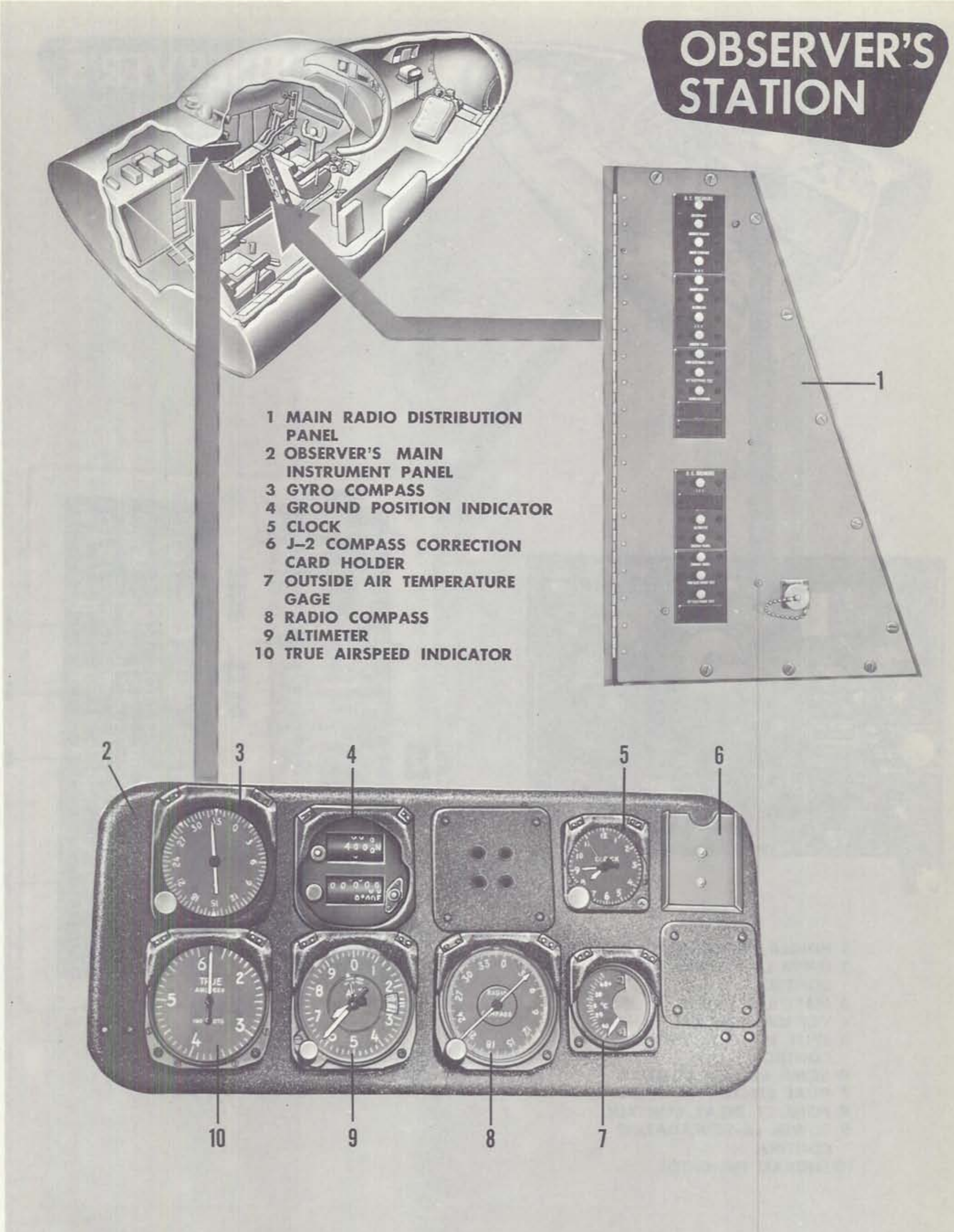

OBSERVER'S STATION
1 MAIN RADIO DISTRIBUTION PANEL
2 OBSERVER'S MAIN INSTRUMENT PANEL
3 GYRO COMPASS
4 GROUND POSITION INDICATOR
5 CLOCK
6 J-2 COMPASS CORRECTION CARD HOLDER
7 OUTSIDE AIR TEMPERATURE GAGE
8 RADIO COMPASS
9 ALTIMETER
10 TRUE AIRSPEED INDICATOR
1
2
3
4
5
6
10
9
8
7

Figure 4–19.

1 HINGED PHOTO PANEL
2 UPPER LA-12 MAGAZINE CONTROL
3 MASTER CONTROL
4 VERTICAL STATION CONTROL
5 SPLIT VERTICAL STATION CONTROL
6 BOMB RELEASE CONTROL
7 DUAL EJECTOR CONTROL
8 MEMORY DELAY CONTROL
9 LOWER LA-12 MAGAZINE CONTROL
10 SHORAN INDICATOR

Figure 4-20.

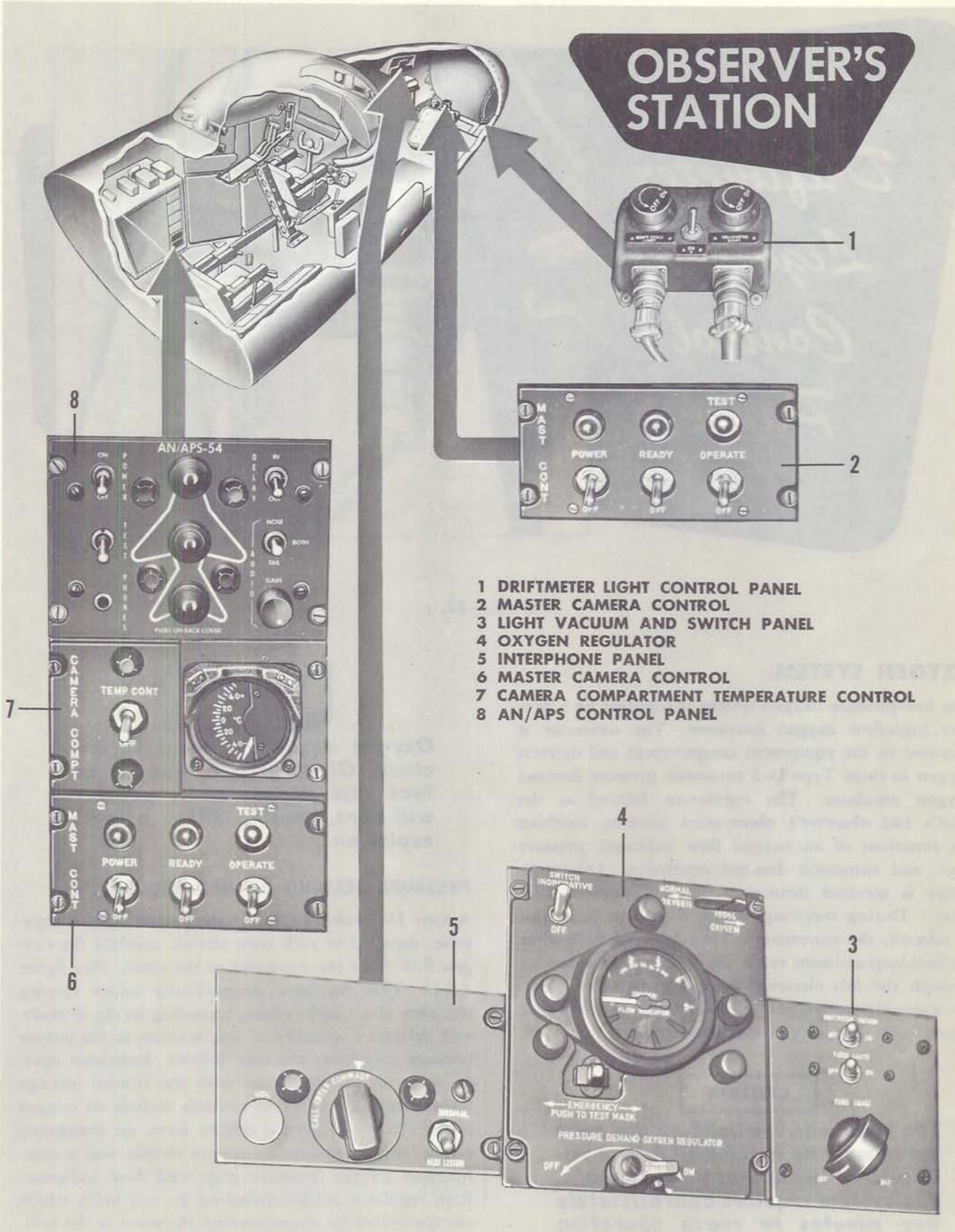

OBSERVER'S STATION
1
2
3
4
5
6
7
8
AN/APS-54
MAST CONT
TEST
POWER
READY
OPERATE
OFF
CAMERA COMPT
TEMP CONT
PRESSURE DEMAND OXYGEN REGULATOR
EMERGENCY
PUSH TO TEST MASK
1 DRIFTMETER LIGHT CONTROL PANEL
2 MASTER CAMERA CONTROL
3 LIGHT VACUUM AND SWITCH PANEL
4 OXYGEN REGULATOR
5 INTERPHONE PANEL
6 MASTER CAMERA CONTROL
7 CAMERA COMPARTMENT TEMPERATURE CONTROL
8 AN/APS CONTROL PANEL
8173

Figure 4–21.

8160

Figure 4–22.

OXYGEN SYSTEM.

The low-pressure oxygen system is supplied by a five-liter high-flow oxygen converter. The converter is mounted in the equipment compartment and delivers oxygen to three Type D–2 automatic pressure demand oxygen regulator. The regulators, located at the pilot's and observer's observation stations, combine the functions of an oxygen flow indicator, pressure gage, and automatic demand regulation. (The converter is serviced through a quick-disconnect filler valve.) During servicing, which should be just prior to take-off, the converter is vented to atmosphere by the build-up-and-vent valve. Both valves are accessible through the left electrical compartment access door. An approximate oxygen duration table is shown in figure 4–23. For oxygen specification, see figure 1–36.

CAUTION

The handle on the build-up and vent valve must be in the BUILD-UP position 10 to 15 minutes prior to flight. The system requires approximately five minutes to reach operating pressure.

WARNING

Oxygen equipment must be kept clean. Oil or grease, when in contact with oxygen under pressure, will burn, causing either a fire or explosion.

PRESSURE DEMAND OXYGEN REGULATOR.

A type D–2 automatic pressure demand oxygen regulator, installed at each crew station, controls the oxygen flow from the converter to the mask. (See figure 4–24.) This regulator automatically mixes varying amounts of air and oxygen, according to the altitude, and delivers a quantity of this mixture at the proper pressure each time the user inhales. Regulator operation varies in accordance with the control settings on its front panel. These controls include an oxygen supply lever, an oxygen diluter lever, an emergency toggle switch, a warning system switch, and a combination oxygen pressure gage and flow indicator. Each regulator is illuminated by five red bulbs which are controlled by corresponding rheostats at the individual crew stations.

OXYGEN REGULATOR SUPPLY LEVER.

The oxygen supply lever, located at the bottom of the regulator panel, controls the oxygen supply shut-off valve. (See figure 4-24.) When the lever is turned to the ON position, oxygen at 70 psi normal passes through the shut-off valve to the regulator. The oxygen supply is cut off when the lever is turned to the OFF position.

Note

When oxygen is not used by the crew, the pressure, will increase from 70 psi normal to 100 psi, at which time a relief valve will open and vent to atmosphere. With the system in operation, the pressure will decrease to and remain at 70 psi as long as there is oxygen in the converter.

CAUTION

Due to the automatic pressure breathing features of the regulator, a continuous flow of oxygen at altitude will result if the regulator is not being used and the supply lever is left on. This condition will cause a rapid loss of oxygen.

OXYGEN REGULATOR DILUTER LEVER.

The oxygen diluter lever, located at the top right corner of the regulator panel, is a manual control for selecting the proper oxygen-air ratio. (See figure 4-24.) When the diluter lever is at NORMAL OXYGEN, the regulator will automatically provide the proper oxygen air mixture, at varying pressures, for changes in altitude, and above approximately 32,000

OXYGEN DURATION
hours for each crew member

CABIN ALTITUDE FEET	Diluter lever	GAGE QUANTITY — LITERS 5	4	3	2	1
40,000	100% OXYGEN (red)	12 hr 00 min	9 hr 36 min	7 hr 12 min	4 hr 48 min	2 hr 24 min
	NORMAL OXYGEN (white)	12 hr 00 min	9 hr 36 min	7 hr 12 min	4 hr 48 min	2 hr 24 min
35,000	100% OXYGEN (red)	12 hr 00 min	9 hr 36 min	7 hr 12 min	4 hr 48 min	2 hr 24 min
	NORMAL OXYGEN (white)	12 hr 00 min	9 hr 36 min	7 hr 12 min	4 hr 48 min	2 hr 24 min
30,000	100% OXYGEN (red)	8 hr 42 min	6 hr 48 min	5 hr 12 min	3 hr 30 min	1 hr 48 min
	NORMAL OXYGEN (white)	8 hr 54 min	7 hr 06 min	5 hr 18 min	3 hr 36 min	1 hr 48 min
25,000	100% OXYGEN (red)	6 hr 42 min	5 hr 18 min	4 hr 00 min	2 hr 42 min	1 hr 24 min
	NORMAL OXYGEN (white)	8 hr 24 min	6 hr 42 min	5 hr 00 min	3 hr 24 min	1 hr 42 min
20,000	100% OXYGEN (red)	5 hr 12 min	4 hr 12 min	3 hr 12 min	2 hr 00 min	1 hr 00 min
	NORMAL OXYGEN (white)	9 hr 30 min	7 hr 36 min	5 hr 42 min	3 hr 48 min	1 hr 54 min
15,000	100% OXYGEN (red)	3 hr 54 min	3 hr 06 min	2 hr 48 min	1 hr 36 min	0 hr 48 min
	NORMAL OXYGEN (white)	11 hr 30 min	9 hr 12 min	6 hr 54 min	4 hr 36 min	2 hr 18 min
10,000	100% OXYGEN (red)	3 hr 18 min	2 hr 42 min	2 hr 00 min	1 hr 18 min	0 hr 42 min
	NORMAL OXYGEN (white)	11 hr 30 min	9 hr 12 min	6 hr 54 min	4 hr 36 min	2 hr 18 min

Red Boxes indicate diluter lever set at 100% OXYGEN

White Boxes indicate diluter lever set at NORMAL OXYGEN

Figure 4-23.

feet, the regulator will supply 100% oxygen. When the diluter lever is moved to the 100% OXYGEN position, the regulator will deliver undiluted oxygen regardless of the altitude. The pressure is controlled by a pressure aneroid and a pressure-breathing aneroid. At high altitude, a relief valve vents oxygen to the outside air, protecting crew members from pressure above the normal maximum.

REGULATOR EMERGENCY TOGGLE SWITCH.

The emergency toggle switch, located just above the supply lever on the regulator panel, controls pressure increases to the mask for emergency purposes. (See figure 4–24.) Deflecting the switch to either the right or left side brings in a supply of oxygen at a fixed pressure increase over that being supplied automatically. The switch is spring-loaded to the neutral (OFF) position, and when pushed in will deliver maximum pressure regardless of altitude, as long as it is held in this position. Upon release, it returns to the OFF position, and the oxygen flow will be automatically controlled by the regulator. The center position is usually used to test the mask for leakage.

Figure 4–24.

OXYGEN REGULATOR PRESSURE GAGE AND FLOW INDICATOR.

A combination pressure gage and flow indicator is provided in the center of the regulator panel. The normal reading of the pressure gage is 70 psi during system operation, and the maximum is 100 psi. The flow indicator incorporates a blinker dial which operates each time the wearer of the mask breathes. The dial exposes black and luminescent printed segments alternately in four tear-shaped windows.

LIQUID-OXYGEN CONTENTS INDICATOR.

The liquid-oxygen contents indicator (4, figure 1–32) is mounted on the pilot's auxiliary switch panel. It indicates the quantity of liquid oxygen in the converter. The liquid oxygen contents indicator should read between four and four and one-half liters when the system is fully charged. Do not be alarmed that the indicator does not read five liters. It is impossible to charge the liquid oxygen converter to five liters. Use the oxygen duration chart (figure 4–23) to determine oxygen duration for the indicated supply.

Note

The indicator will fluctuate during the build-up cycle until the system pressure reaches 70 psi, and during flight maneuvers. Readings should be taken during level flight.

OXYGEN SYSTEM BLOW BACK TEST.

The oxygen regulator contains a demand diaphragm and a diluter air valve. The diaphragm operates a demand valve and controls the flow of oxygen according to the suction created in the regulator by the user. The diluter air valve controls the flow of air into the regulator, decreasing the flow with increases in altitude so that the suction in the regulator creates a greater load on the diaphragm, thus giving more oxygen. A damaged diaphragm will allow air to enter the regulator during inhalation, thus decreasing the oxygen-air ratio. Therefore, a damaged diaphragm or faulty diluter air valve will allow oxygen to leak out of the regulator at all times during positive pressure breathing. To check the operation of the regulator before take-off on each flight, conduct a blow-back test as follows:

1. Remove the oxygen mask, place the regulator diluter lever in the NORMAL OXYGEN position, and blow into the end of the oxygen regulator hose. If there is a resistance to blowing, it indicates that the demand diaphragm and diluter air valve are satisfactory. Little or no resistance to blowing indicates a faulty demand diaphragm or diluter air valve, a leaking mask-to-regulator tube, or a faulty quick-disconnect.

CAUTION

Be careful not to blow too hard during the test as the force may tend to seat a leaky diluter air valve. Blow gently into the regulator as during normal respiration.

2. If the regulator operation was satisfactory with the diluter lever in the NORMAL OXYGEN position, place the lever in the 100% OXYGEN position and repeat the test.
3. If the test was satisfactory with the diluter lever in the 100% OXYGEN position, place the lever back in the NORMAL OXYGEN position, replace the tube in the mask, and don the mask.

After performing the blow back test with the diluter lever in the NORMAL OXYGEN position and 100% OXYGEN position:

1. With the regulator supply valve ON, the oxygen mask connected to regulator, the diluter lever in 100% OXYGEN position, and normal breathing, conduct the following checks:
   a. Deflect the emergency toggle switch to left or right. A positive pressure should be supplied to the mask. Now return the emergency toggle switch to the off (center) position.
   b. Depress the emergency toggle switch straight in. A positive pressure should be applied to the mask. Hold breath to determine if there is leakage around the mask. Then release the emergency toggle switch, and positive pressure should cease.
2. Return diluter lever to the NORMAL OXYGEN position.
3. Check the mask hose attachment to the parachute harness in accordance with the instructions on figure 4-24A.

OXYGEN SYSTEM—NORMAL OPERATION.

Normal operation of the oxygen system begins at cabin altitude of 10,000 feet and above. The oxygen regulator supply lever is turned ON and the oxygen regulator diluter lever is set at NORMAL OXYGEN.

OXYGEN SYSTEM—EMERGENCY OPERATION.

With symptoms of the onset of hypoxia, or if smoke or fuel fumes should enter the cabin, the diluter lever of the oxygen regulator must be set at 100% OXYGEN. In event of accidental loss of cabin pressure, the diluter lever should be set to 100% OXYGEN and the oxygen regulator emergency toggle switch actuated to the right or left.

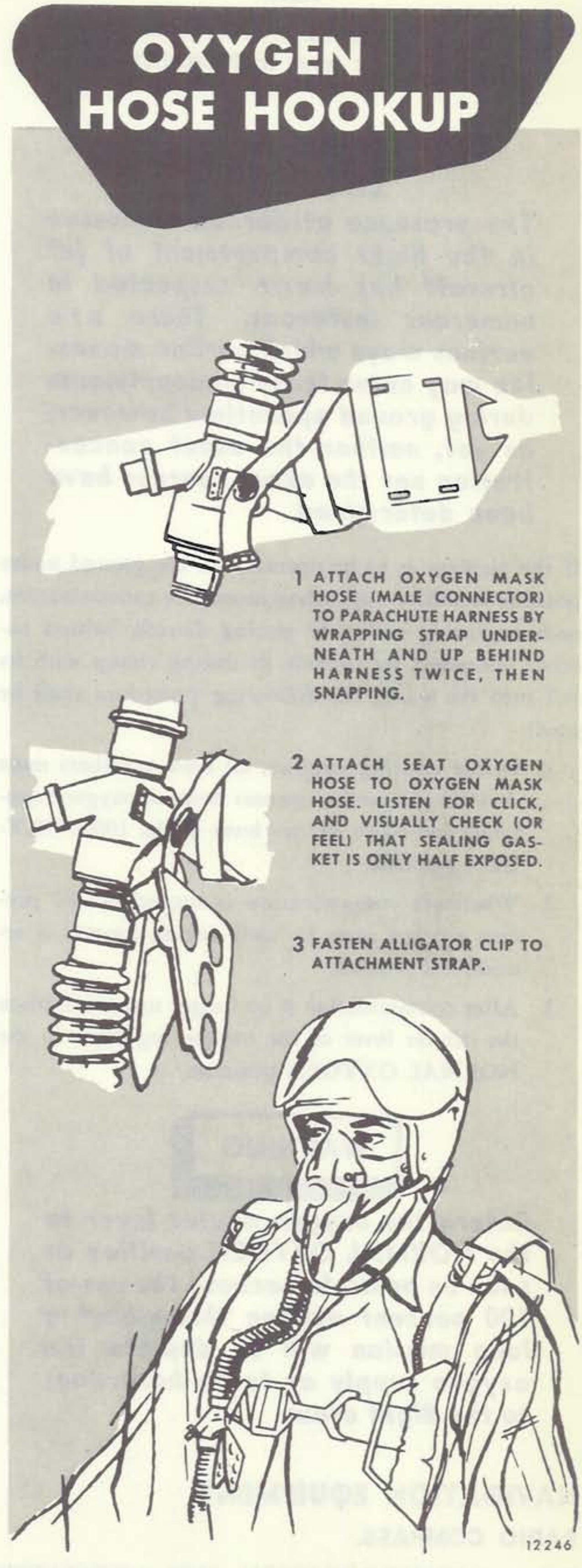


Figure 4-24A.

Note

When the emergency is over, set the oxygen regulator diluter lever to NORMAL OXYGEN.

CAUTION

The presence of carbon monoxide in the flight compartment of jet aircraft has been suspected in numerous instances. There are various ways which carbon monoxide may enter these compartments during ground operation; however, as yet, neither the exact concentration nor the exact sources have been determined.

If the airplane is to be operated on the ground under possible conditions of carbon monoxide contamination, such as during runup or taxiing directly behind another operating jet aircraft, or during runup with its tail into the wind, the following procedure shall be used:

1. Before starting engines, all crew members must don oxygen masks, connect hoses to oxygen regulator, and place diluter lever at the 100% OXYGEN position.
2. Whenever contamination is suspected, 100 percent oxygen must be used during ground operation and take-off.
3. After contamination is no longer suspected, place the diluter lever of the oxygen regulator in the NORMAL OXYGEN position.

WARNING

Return the oxygen diluter lever to the NORMAL OXYGEN position as soon as possible because the use of 100 percent oxygen throughout a long mission will so deplete the oxygen supply as to be hazardous to the flight crew.

NAVIGATION EQUIPMENT.

RADIO COMPASS.

Refer to COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT in this section.

SLAVED GYRO MAGNETIC COMPASS.

A type J-2 slaved gyro magnetic compass is installed in the airplane to provide visual indication of the magnetic heading of the airplane. The indication is read on two indicators, one of which is mounted on the pilot's main instrument panel (8, figure 1-29) and the other on the observer's instrument panel (7, figure 4-18). The indicators provide magnetic headings that are without northerly turning error, oscillation, or swinging. The gyro is free to operate within 85 degrees from level flight in climbs, dives, and banks. At these limits, it strikes mechanical stops which render the indications inaccurate. After returning to level flight, errors up to five degrees in heading may be introduced, but the gyro will recover its erect and slaved positions automatically in a period of five minutes or less and will continue to furnish correct indications until the limits are again exceeded. The compass requires both a-c and d-c power. The a-c power is supplied from the 115-volt phase B and phase C busses, and the No. 2 radio bus. The d-c power is supplied from the 28-volt d-c battery bus. A slaved gyro compass correction card it adjacent to each indicator.

GYRO COMPASS DE-SLAVING SWITCH.

The gyro compass de-slaving switch, located on the observer's left console has two positions: IN and OUT. (See figure 4-18.) The IN position supplies power to the heating, leveling, and slaving systems. The OUT position cuts off the power supply to the control field of the slaving torque motor and is used when the horizontal lines of force dip at 84 degrees or more.

SLAVE REINITIATE BUTTON.

The slave reinitiate button is a push button located on the observer's left console. (See figure 4-18.) The button provides a means for fast slaving by momentarily pressing the button. This action supplies high voltage for a limited time to the leveling and slaving torque motors. The motors will then accelerate the erection and slaving of the gyro. The high voltage is controlled by a thermal time switch and after two or three minutes, the thermal switch will cause a relay to operate. The relay then establishes circuits to transformers to reduce the voltage.

CAUTION

Ten-minute intervals must be allowed between uses of the switch to permit the thermal time switch to return to its normal temperature. Too frequent use of the switch may result in inadequate slaving time.

SLAVED GYRO COMPASS OPERATION.

STARTING.

The compass will operate if the engines are running and the instrument inverter switch is in the NORMAL or STANDBY position, if the engines are shut down and the instrument inverter switch is in the STANDBY position, or if external power is supplied and the instrument inverter switch is in the NORMAL position. After turning on the equipment, allow three minutes to elapse so that the gyro in the directional gyro control comes up to operating speed, levels, and aligns the indication on the slaved gyro compass indicator with the remote compass transmitter.

SETTING INDICATOR.

By using the knob at the bottom of the indicator, set the dial index for the heading at which it is desired to fly.

STANDBY COMPASS.

A conventional magnetic compass (3, figure 1–29), located on the pilot's glare shield, is provided for navigation in the event of instrument or electrical system failure.

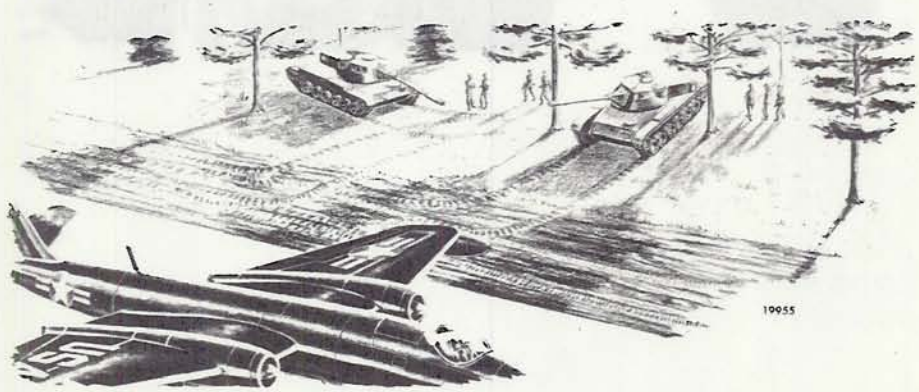
DRIFTMETER.

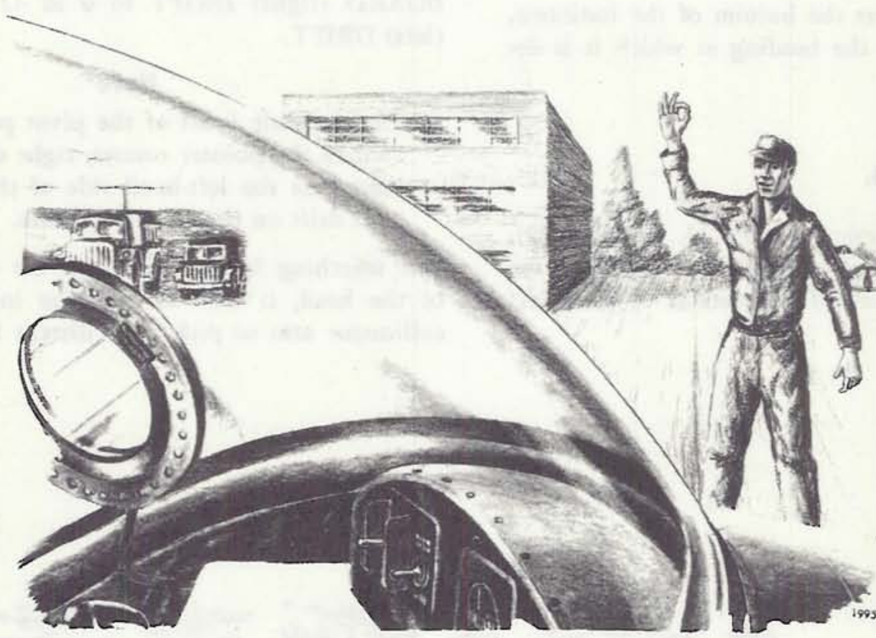
A T–1C Sighting Head is installed in the observer's observation station for use as a driftmeter. (See figure 4–25.) The head is secured to a mounting bracket in such a position that the observer can conveniently view the terrain through the reflector glass. Although the sighting head is equipped with various knobs, levers, and indicators, the only ones which need be used when operating the head as a driftmeter are the LIFT-TO-FREE lever, the drift scale, the searching knob, and the lighting control rheostats. The LIFT-TO-FREE lever, the "L" shaped lever at the right side of the base, permits the rotating portion of the sighting head to be swung through an arc when the lever is raised. The drift scale is located on the aft end of the fixed portion of the sighting head, and the pointer is secured to the rotating portion. The scale is graduated in 1-degree markings from 42 degrees STARBOARD (right) DRIFT to 0 to 42 degrees PORT (left) DRIFT.

Note

As the scale is aft of the pivot point around which the pointer rotates, right drift is indicated on the left-hand side of the scale and left drift on the right-hand side.

The searching knob, located on the top left portion of the head, is used to vary the inclination of the collimator arm to pick up a distant target. Lighting





control for the sighting head is described under DRIFTMETER LIGHTS in this section.

DRIFTMETER OPERATION.

1. Place the driftmeter vacuum switch in the ON position, place the driftmeter lighting control panel switch in the ON position, and adjust the brilliancy of the drift scale and a collimator lights as desired with the rheostats on the panel.
2. Raise the LIFT-TO-FREE lever, and rotate the sighting head by hand until objects on the terrain appear to move parallel with the drift line of the reticle.

Note

The searching knob may be used to move the collimator to any convenient location. However, greatest accuracy is obtained when the line of sight is as near the vertical as possible.

3. Note the reading on the drift scale.
4. With two or three drifts found on different courses (preferably 60 degrees apart), wind force and direction may be computed in the usual manner.
5. Lower the LIFT-TO-FREE lever and rotate the sighting head until the head engages in the secured position.

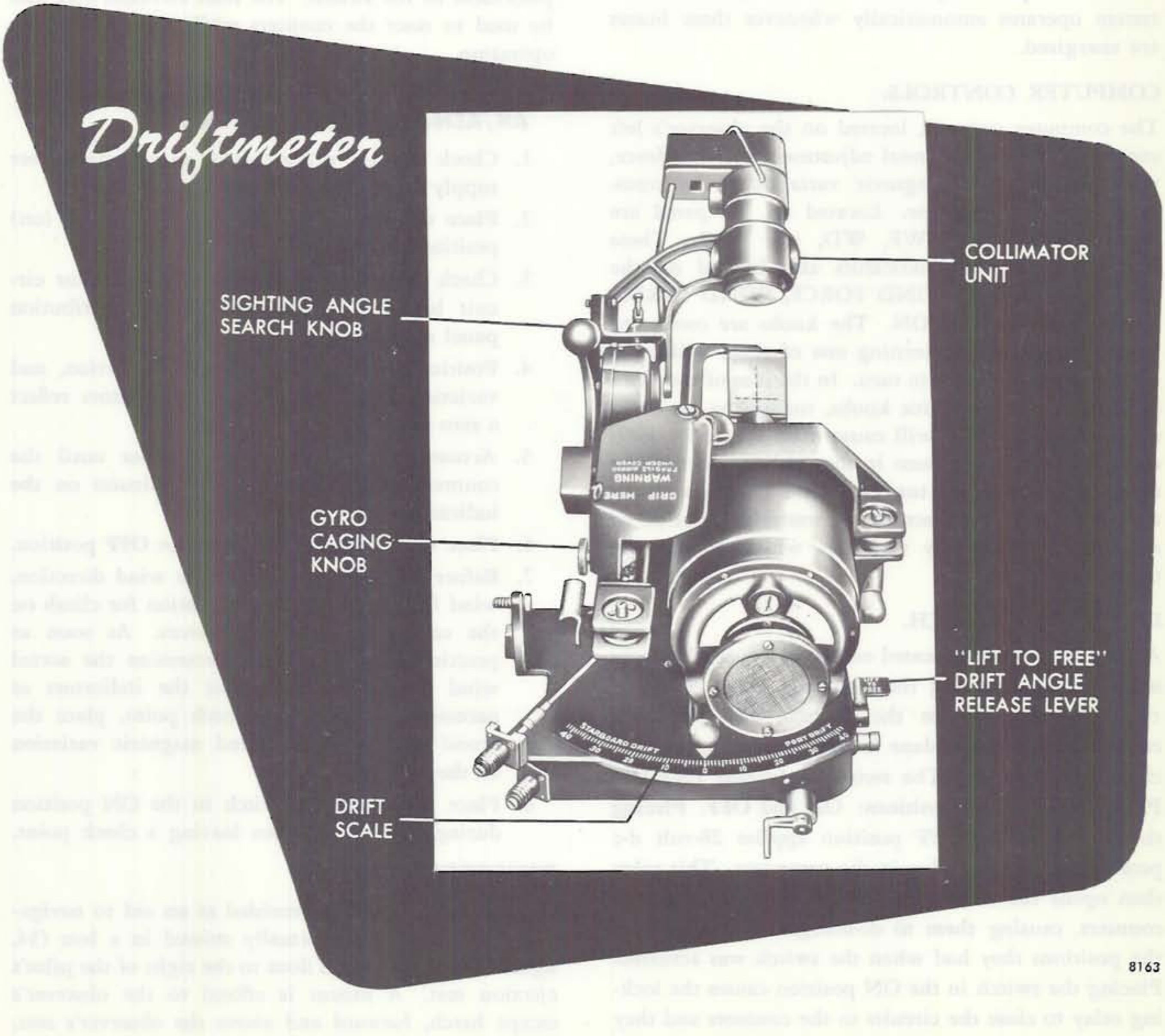


Figure 4–25.

LATITUDE AND LONGITUDE COMPUTER SET AN/ASN-6.

Latitude and Longitude Computer Set AN/ASN-6 (ground position indicator) is a dead-reckoning navigation system. The system continuously solves for and indicates the ground position of the airplane in degrees and minutes of latitude and longitude, regardless of the speed of the airplane. Both manual and automatic inputs are fed to the system. The automatic inputs are provided by the J-2 compass system for magnetic heading and by the pitot-static system through a transmitter for true airspeed. The observer supplies manual inputs for wind direction, wind force, and magnetic variation. Indications generated by the system are observed at the observer's station. A-c power for the system is supplied by the No. 2 radio bus and d-c power by the 28-volt d-c radio bus. The system operates automatically whenever these busses are energized.

COMPUTER CONTROLS.

The computer controls, located on the observer's left console, permit the manual adjustment of wind force, wind velocity, and magnetic variation to be transmitted to the computer. Located on the panel are three knobs labeled WF, WD, and VAR. These knobs control three indicators also located on the panel and labeled: WIND FORCE, WIND DIRECTION, and VARIATION. The knobs are connected to the indicators and turning one of them will cause its respective indicator to turn. In the case of the wind direction and wind force knobs, turing the knobs in a clockwise direction will cause their respective indicators to show an increase in the reading. In the case of the variation knob, turning it in a clockwise direction will indicate a decrease in westerly variation or an increase in easterly variation, whichever may be the presetting.

DEPARTURE SWITCH.

A departure switch, located on the observer's left console, permits retaining the airplane's point of departure position data on the latitude and longitude counters until the airplane is airborne and generating change of position. The switch is labeled LAT-DEPART and has two positions: ON and OFF. Placing the switch in the OFF position applies 28-volt d-c power to a locking relay in the computer. This relay then opens the circuits to the latitude and longitude counters, causing them to de-energize and remain at the positions they had when the switch was actuated. Placing the switch in the ON position causes the locking relay to close the circuits to the counters and they will then begin indicating change in positions.

GROUND POSITION INDICATOR.

The ground position indicator (figure 4-19), located on the observer's instrument panel, continuously indicates the ground position of the airplane. The ground position is indicated by a latitude counter and a longitude counter on the face of the indicator. The counters automatically indicate whether the latitude is north or south and whether the longitude is east or west.

GROUND POSITION INDICATOR COUNTER RESET SWITCHES.

On the front of the ground position indicator are two counter-reset switches which permit setting the initial coordinates of the point of departure or any other point desired. Each switch controls a motor, and the direction of rotation depends upon the displacement of the switch. The reset switches may also be used to reset the counters while the system is in operation.

LATITUDE AND LONGITUDE COMPUTER SET AN/ASN-6, NORMAL OPERATION.

1. Check that the generators or an external power supply is supplying d-c power.
2. Place the No. 2 inverter switch in the up (on) position.
3. Check that both ground position indicator circuit breakers on the main radio distribution panel are pushed in.
4. Position the wind force, wind deflection, and variation knobs so that their indicators reflect a zero reading.
5. Actuate the counter reset switches until the counters reflect the correct coordinates on the indicator.
6. Place the departure switch in the OFF position.
7. Before take-off, place the mean wind direction, wind force, and magnetic variation for climb on the computer control indicators. As soon as practicable after take-off, determine the actual wind conditions and adjust the indicators as necessary. If leaving a check point, place the actual wind conditions and magnetic variation on the indicators.
8. Place the departure switch in the ON position during take-off or when leaving a check point.

PERISCOPIC SEXTANT.

A periscopic sextant is provided as an aid to navigation. The sextant is normally stowed in a box (34, figure 1-1) on the cabin floor to the right of the pilot's ejection seat. A mount is affixed to the observer's escape hatch, forward and above the observer's seat. When the sextant is not in use, the mount is sealed by a shutter which is flush with the contour of the airplane. When the sextant is to be used, the sealing shutter is drawn aside and the sextant positioned so that the tip of the sextant tube is exposed outside of the fuselage.

ARMAMENT EQUIPMENT.

EXTERNAL STORES.

Note

For airspeed limitations when external stores are being carried, refer to INTERNAL AND EXTERNAL STORES in Section V.

Since the bombing system in this airplane serves as an aid to photography, the armament is restricted to four external stores pylons, two under each wing outboard of the engine nacelles. The pylons are attached to the bottom surface of the wing with four fittings. An electrical lead completes the connection for the pylon to a receptacle within the wing. The stores are retained by bomb racks and chocks. A hoist fitting is inserted through access doors in either side of the pylon when stores are to be hoisted. Controls for the external stores system are completely electrical and provide for the arming of the stores and releasing them by normal or jettison means. Circuits also furnish indication of system status by means of indicating lights. The master arm and master jettison switches are also used for the photoflash bombing system. Power is supplied from the 28-volt d-c armament bus for normal release of the external stores. Power for jettison release of the stores comes from the 28-volt d-c battery bus.

MASTER ARM SWITCH.

The bombs are armed whenever power is on the 28-volt d-c armament bus. The guarded master arm switch is located on the armament and generator control panel on the left side of the pilot's compartment. (See figure 4–26.) The master arm switch is wired in series with the personnel safety switch which is placed in the FLIGHT position prior to flight. Thus, when the master arm switch is placed in the ON position, the 28-volt d-c armament bus is energized by the 28-volt d-c distribution bus. The arming circuit is completed through contacts of a jettison safe relay. During jettison release, the jettison safe relay acts to de-energize the arming circuit, and the bombs will be dropped in an unarmed condition.

BOMB ARMING SWITCH.

The bomb-arming switch on the armament and generator control panel arms the bomb fusing units of the external stores. (See figure 4–26.) The switch has three positions: SAFE, NOSE & TAIL, and TAIL ONLY. In the SAFE position, neither of the fusing units is energized. Placing the switch in the NOSE & TAIL position energizes both nose and tail fusing units on all external stores bomb racks. The TAIL ONLY position energizes the fusing unit in the tail. Power for the arming switch is supplied from the 28-volt d-c armament bus through the normally closed contacts of the jettison safe relay so that the arming circuit will be de-energized whenever the jettison system operates and the stores will drop in an unarmed condition.

EXTERNAL STORES SELECTOR SWITCHES.

The four external stores selector switches on the armament and generator control panel permit pre-selecting any or all of the external stores to be dropped by normal release. (See figure 4–26.) Each selector switch has an OFF position. The on positions are as follows: STA 1 closes the power circuit to the No. 1 left outboard pylon bomb rack; STA 2, to the No. 2 left inboard rack; STA 3, to the No. 3 right inboard rack; and STA 4, to the No. 4 right outboard rack. Thus, when the external stores release switch on the pilot's control wheel is depressed, a circuit is completed through any closed external stores selector switch, causing the release of its corresponding external store.

EXTERNAL STORES RELEASE SWITCH.

The external stores release switch is located on the right handgrip of the pilot's control wheel. (See figure 1–22.) Power for normal release of the preselected external stores is supplied from the 28-volt d-c armament bus when the switch is depressed.

MASTER JETTISON SWITCH.

The guarded master jettison switch is located on the pilot's main switch panel (panel 7, figure 1–32). Two power circuits are closed when the switch is momentarily actuated to the ON position. One circuit from the 28-volt d-c battery bus will open the bomb door and jettison all the bombs, external stores, and photoflash cartridges unarmed. The second power circuit from the 28-volt d-c distribution bus jettisons the wing tip tanks.

EXTERNAL STORES INDICATOR LIGHTS.

The four amber-colored external stores indicator lights on the pilot's armament and generator control panel correspond to each external stores pylon station. (See figure 4–26.) Loading stores at any or all pylon stations and manually cocking the racks will connect the corresponding indicator light circuits to ground.

When power is on the 28-volt d-c armament bus, the lights will illuminate. When an external store is dropped, its rack will actuate to the released condition and the corresponding indicator light will go out.

EXTERNAL STORES RELEASE-NORMAL.

The external stores normal release system receives power from the 28-volt d-c armament bus. A circuit supplies power to the external stores release switch on the right handgrip of the pilot's control wheel. Depressing this switch completes another circuit to the four external stores selector switches located on the armament and generator control panel. By preselecting any or all of these selector switches, the pilot can determine the stores to be dropped and power is applied to the release solenoid of the corresponding shackle.

EXTERNAL STORES RELEASE-JETTISON.

When the guarded master jettison switch on the pilot's main switch panel is momentarily actuated, a circuit energizes the jettison safe relay. When energized, the jettison safe relay opens the arming circuit to the external stores and allows the stores to be dropped safely. The release sequence of the external stores by jettisoning is as follows: No. 1 left outboard, No. 4 right outboard, No. 3 right inboard, No. 2 left inboard.

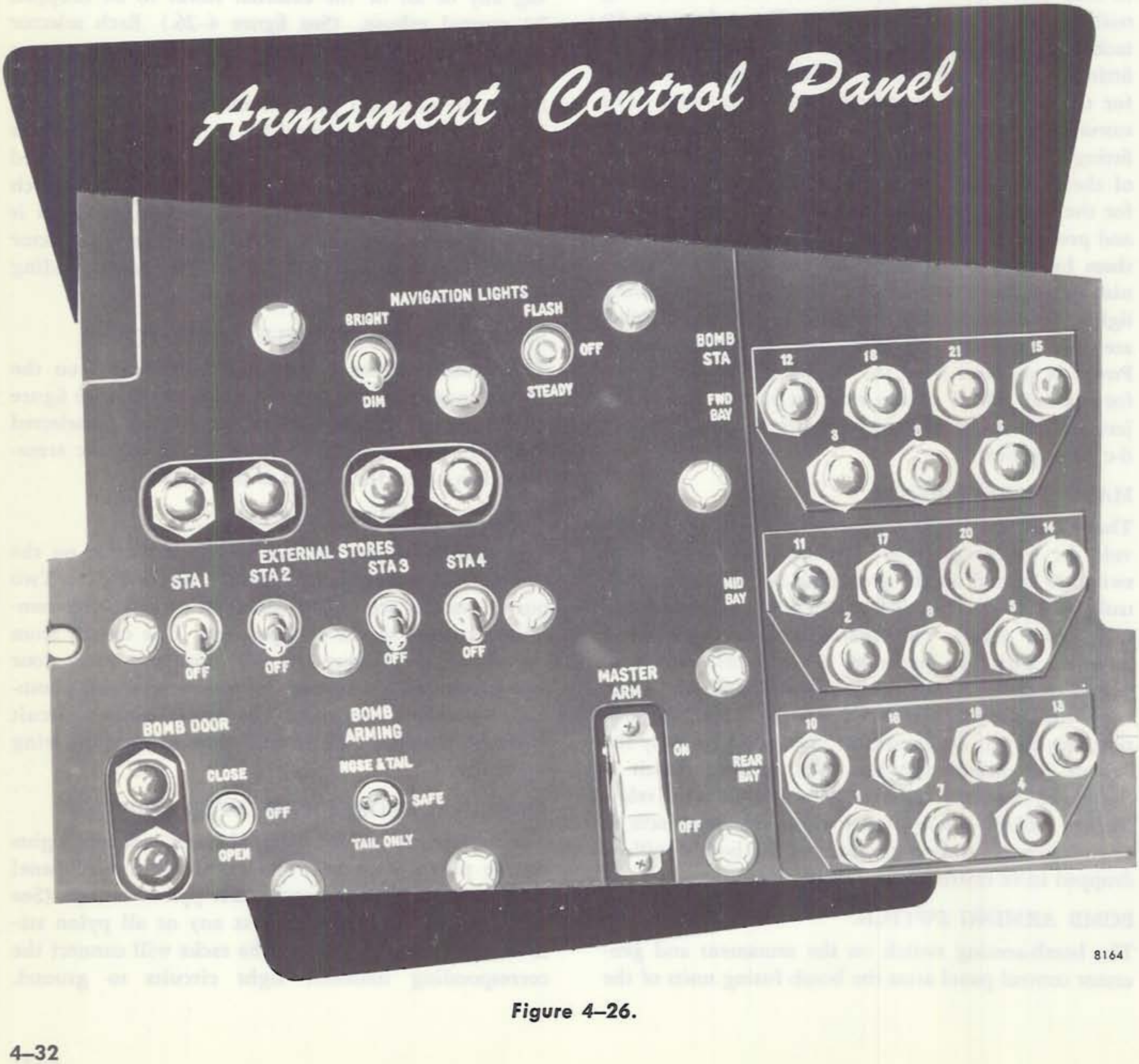


Figure 4–26.

PHOTO-BOMB SYSTEM.

PHOTOGRAPHIC EQUIPMENT. (See figure 4-14.)

The airplane can be equipped with photographic equipment for either day or night missions. These are two separate systems for night photography: One night camera system synchronizes operation of two cameras with photoflash cartridges, and the other operates a single camera photoelectrically with photoflash bombs. Refer to PHOTOFLASH BOMBING SYSTEM in this section. The day camera configuration is capable of taking detailed mapping photographs at high altitudes through operation of three synchronized cameras. The camera equipment is contained in a temperature-regulated camera compartment in the aft fuselage and must be of the explosive-proof type. Electrohydraulically operated doors open automatically to expose the camera lenses to the terrain through two, clear, moisture-sealed windows. Automatic remote control of all configurations is possible through an integrated system of control panels and junction boxes. A hinged photo panel mounts all necessary camera control panels and can be positioned to allow either the pilot or the observer to control the system. However, the pilot has only limited control due to being out of reach of the panel extremities. Once the camera system is set up at the hinged photo panel, the camera may be set into operation by any one of three master control panels. One master control panel is mounted on the hinged photo panel and the other two are located at the observer's station and the observer's observation station. Power is supplied to the camera equipment from the 28-volt d-c camera bus, which is energized by the 28-volt d-c distribution bus when the camera main power switch is closed. In airplanes AF 52-1479 through 52-1492, the cameras synchronize shoran recorder equipment operation. Refer to LIGHTING EQUIPMENT in this section for camera control illumination.

NIGHT CAMERA EQUIPMENT. (See figure 4-28.)

The night camera equipment consists of a Type K-37 aircraft camera with its associated shutter trip control arranged as a vertical station, and two Type K-37 aircraft cameras without shutter trip controls arranged as a split-vertical station. Type M-120 photoflash bombs, carried on the rotary bomb door, are used for the vertical camera at altitude. Type M-112 photoflash cartridges, carried in ejectors in the right wing, are used for the split-vertical cameras at low altitudes. Type M-123 flash cartridges, carried in ejectors in the left wing, are used for the split-vertical cameras as low altitudes. Type LA-12 magazines, used with each K-37 camera, permit Image Motion Compensation (IMC) for photographs. Image Motion Compensation produces the effects of "still" photography over a wide range of altitudes and ground speeds, and is accomplished by transporting the film in synchronism with the image at the focal plane. In vertical camera operation, the upper magazine control panel in the hinged photo panel is used, and in split-vertical camera operation both controls panels are used, one for each camera.

DAY CAMERA EQUIPMENT. (See figure 4-28.)

The day camera equipment consists of a Type T-11 aircraft mapping camera arranged as a vertical station, and two Type K-38 aircraft cameras arranged as a split-vertical station. Intervalometer pulses trip the shutters of the vertical and split-vertical cameras. Each pulse will trip the shutter of the split-vertical camera, and every fourth pulse is relayed to trip the shutter of the vertical camera. The system therefore provides one T-11 photograph with every fourth K-38 photograph. The split-vertical K-38 cameras provide supplemental detail photographs to those of the vertical camera.

A-28 GYRO STABILIZED CAMERA MOUNT.

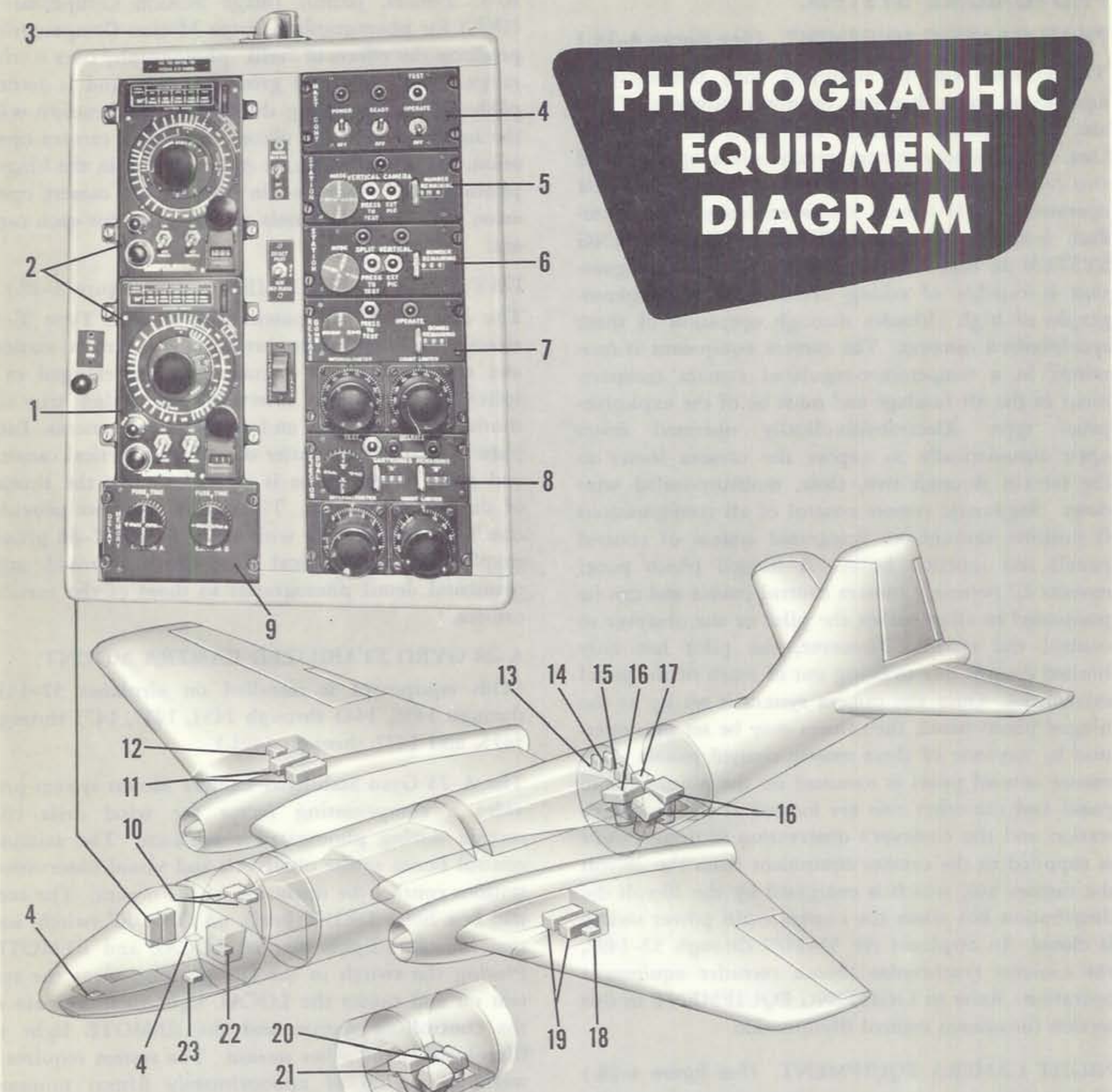
(This equipment is installed on airplanes 52-1434 through 1438, 1443 through 1451, 1457, 1473 through 1475, and 1477 through 1491.)

The A-28 Gyro Stabilized Camera Mount system provides a compensating factor for wind drift correction during photographic missions. The azimuth control boxes at the observer's and visual observation stations control the operation of the mount. The control box has a DRIFT knob, on ON-OFF switch, and two indicator lights marked LOCAL and REMOTE. Placing the switch in the ON position turns the system on and causes the LOCAL light to illuminate at the controlling station and the REMOTE light to illuminate at the other station. The system requires a warm-up period of approximately fifteen minutes. Rotating the DRIFT knob to the left or right the number of units indicated by the driftmeter compensates for drift and aligns the cameras so that the camera photographs the terrain parallel to the ground track rather than parallel to the aircraft heading. A gyro-stabilized universal camera mounting serves as a stable camera platform which corrects for aircraft pitch and roll.

MASTER CAMERA CONTROL PANEL.

A master control panel labeled MAST CONT, located at each of the three airplane stations, initiates camera operation when other controls are properly preset.

PHOTOGRAPHIC EQUIPMENT DIAGRAM



1. PHOTO CONTROL PANEL (HINGED)
2. LA–12 MAGAZINE CONTROLS
3. PANEL LIGHTS CONTROL
4. MASTER CONTROL
5. VERTICAL STATION CONTROL
6. SPLIT VERTICAL STATION CONTROL
7. BOMB RELEASE CONTROL
8. DUAL EJECTOR CONTROL
9. MEMORY DELAY CONTROL
10. LA–12 MAGAZINE AMPLIFIERS
11. TYPE A–6 PHOTOFLASH CARTRIDGE EJECTORS
12. RIGHT EJECTOR JUNCTION BOX
13. MEMORY DELAY JUNCTION BOX
14. CAMERA JUNCTION BOX
15. VERTICAL STATION RELAY AND JUNCTION BOX
16. TYPE K–37 AIRCRAFT CAMERA
17. SHUTTER TRIP CONTROL
18. LEFT EJECTOR JUNCTION BOX
19. TYPE B–4 PHOTOFLASH CARTRIDGE EJECTOR
20. TYPE T–11 AIRCRAFT MAPPING CAMERA
21. TYPE K–38 AIRCRAFT CAMERA
22. MASTER RELAY AND JUNCTION BOX
23. SINGLE DOOR RELAY JUNCTION BOX

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Figure 4–27.

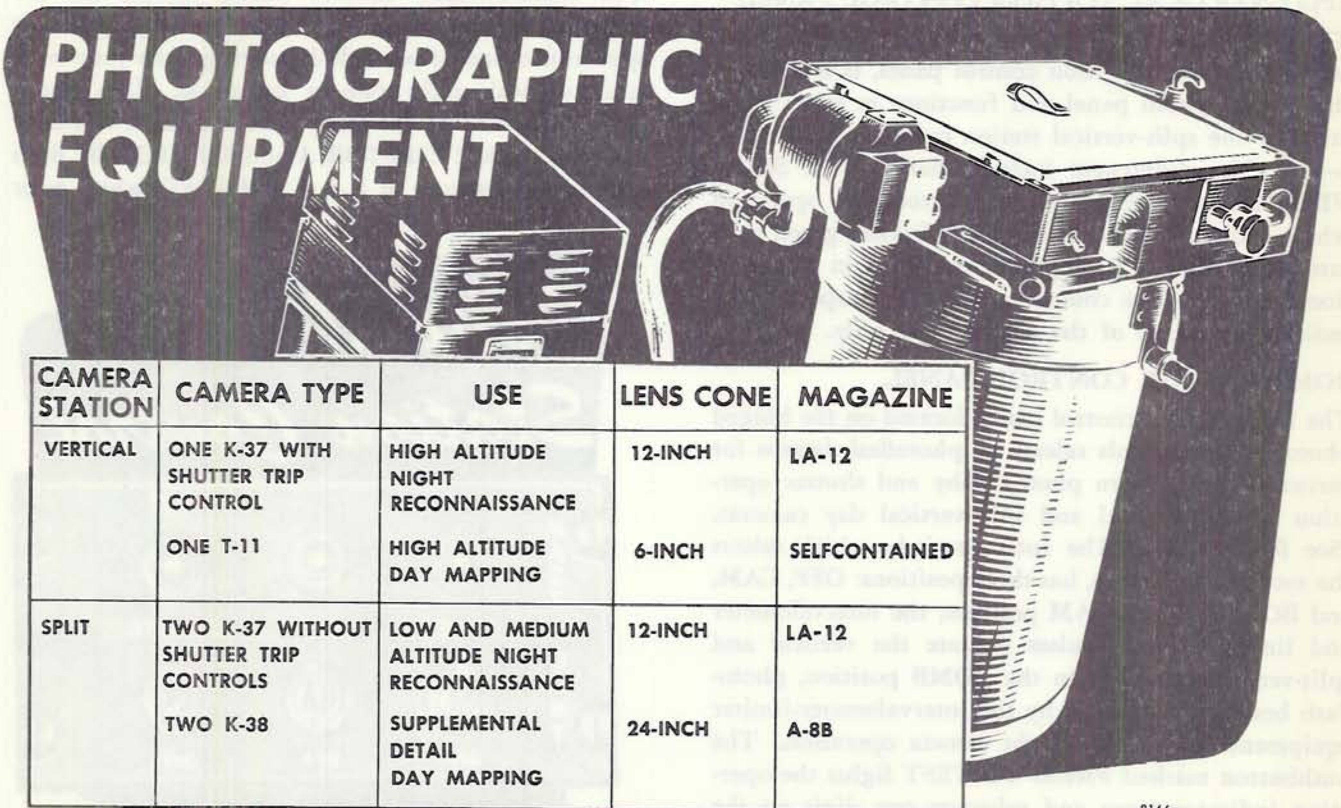
The control panels are located at the observer's station, the observer's observation station, and at the hinged photo panel. (See figure 4-29.)

MASTER CAMERA CONTROL PANEL OPERATION.

The power switch, when actuated to the POWER position on any one of the three control panels, supplies primary power to the camera controls and illuminates the amber power indicator lights on all three master control panels. When the ready switch of any control panel is placed in a READY position, the camera and camera controls is prepared for operation, and the camera vacuum shut-off valve will open. At least one minute is needed after actuation to READY before the system is ready for taking photographs. During this time, the three amber power indicator lights flash off and on, and the camera door opens. When the system is ready for photography, the amber power lights go out, and the green indicator lights on the control panels illuminate. The operating switch on any one of the panels is then actuated to OPERATE to initiate camera operation. The test push-button is depressed to light both green and amber lamps on the panel for testing purposes.

VERTICAL STATION CONTROL PANEL.

The vertical station control with panel markings of STATION and VERTICAL CAMERA, on the hinged photo panel, selects operation of the vertical station camera. (See figure 4-30.) The rotary switch is marked MODE and has four positions: OFF, INTV. COMP, and CONT. In the OFF position, the vertical camera station cannot operate. In the INTV position, an intervalometer-limiter operates the vertical camera station or releases illuminants. The COMP position indicates that computer operation of the vertical camera is possible, but it is not used in day missions with this photographic equipment. The COMP position, however, is used for night operation of the equipment. The CONT position indicates that continuous operation of the vertical station is possible but it is not normally used in missions with this photographic equipment. The pushbutton marked PRESS TO TEST is depressed to light the indicator lamp and operate the counter for testing purposes. The push button marked EXT. PIC. is depressed to take extra pictures between preset exposures. In day operation with the mode selector switch in the INTV position, the button must be depressed four times for



CAMERA STATION	CAMERA TYPE	USE	LENS CONE	MAGAZINE
VERTICAL	ONE K-37 WITH SHUTTER TRIP CONTROL	HIGH ALTITUDE NIGHT RECONNAISSANCE	12-INCH	LA-12
	ONE T-11	HIGH ALTITUDE DAY MAPPING	6-INCH	SELFCONTAINED
SPLIT	TWO K-37 WITHOUT SHUTTER TRIP CONTROLS	LOW AND MEDIUM ALTITUDE NIGHT RECONNAISSANCE	12-INCH	LA-12
	TWO K-38	SUPPLEMENTAL DETAIL DAY MAPPING	24-INCH	A-8B

Figure 4-28.

Figure 4–29.

one photograph as against one time for the split vertical station control, since the day vertical station operates at one-quarter the rate of the split vertical station. The three-digit subtractive counter, when properly set, indicates remaining exposures in the vertical day camera only. The green indicator light indicates film transport in the vertical day camera only.

SPLIT-VERTICAL STATION CONTROL PANEL.

The split-vertical station control panel, which is similar to the vertical station control panel, is located on the hinged photo panel and functions to select operation of the split-vertical station cameras. (See figure 4–31.) The differences include markings of SPLIT VERTICAL; the extra picture button, the operation which is discussed above; and an additional green indicator light for indicating film transport in the additional camera. The counters and film transport lights indicate operation of the day cameras only.

BOMB RELEASE CONTROL PANEL.

The bomb release control panel, located on the hinged photo panel, controls release of photoflash bombs for vertical night camera photography and shutter operation of the vertical and split-vertical day cameras. (See figure 4–32.) The rotary switch, which selects the mode of operation, has three positions: OFF, CAM, and BOMB. In the CAM position, the intervalometer and limiter control pulses operate the vertical and split-vertical cameras. In the BOMB position, photoflash bombs are released by the intervalometer-limiter equipment for vertical night camera operation. The pushbutton marked PRESS TO TEST lights the operating indicator lamp and subtracts one digit on the counter for testing purposes. With each bomb release, the green operating indicator lights, and the counter subtracts one digit. The intervalometer controls bomb release intervals with a range of one release every one-half second to one release every 60 seconds, and is calibrated in half-second increments. The limiter controls the number of intervalometer pulses, with a maximum range of 120.

DUAL EJECTOR CONTROL PANEL.

The dual-ejector control panel, located on the hinged photo panel, selects and operates the photoflash cartridge ejectors in the left and right wings. (See figure 4–33.) The ejector selector switch has four positions: OFF, EJ"A", OFF and EJ"B". In the EJ"A" position, the B–4 ejectors (for type M–123 cartridges) in the left wing are selected, and in the EJ"B" position, the A–6 ejectors (for type M–112 cartridges) in the right wing are selected. The intervalometer controls cartridge release in the same manner as bomb release, described under BOMB RELEASE CONTROL PANEL in this section. The two counters subtract one digit when their respective ejector releases an illuminant. The green operating indicator lamp illuminates when either cartridge ejector releases an illuminant. The red warning indicator lamp illuminates when the cartridges are not secured properly in their racks.

MEMORY DELAY CONTROL PANEL.

The memory-delay control panel, located on the hinged photo panel, sets the delay time required for synchronization of photoflash cartridge fuse time with split vertical night camera operation. (See figure 4–34.) Controls on the front panel include two rotary switches marked EJECTOR A and EJECTOR B. Each switch has positions of 1, 2, 4, and 6 SEC, which refer

Figure 4–30.

Figure 4-31.

to fuse delay time in seconds for cartridges installed in the cartridge ejectors. When EJ"A" position of the selector switch at the dual ejector control is selected, the rotary switch marked EJECTOR A is active, and the fuse delay time setting in seconds is sent to the cartridges installed in the left wing. When EJ"B" position of the selector switch at the dual ejector control is selected, the rotary switch marked EJECTOR B is active and sends the fuse delay time setting to the cartridges installed in the right wing. Fuse time of photoflash cartridges must be determined before flight.

LA-12 MAGAZINE CONTROL PANEL.

Two magazine control panels, located on the hinged photo panel, provide IMAGE MOTION COMPENSATION (IMC) for successful night photography. (See figure 4-35.) At the top of each unit is an altitude range cylinder which functions as a computer for determining the orperating ranges of various focal length lengths in terms of altitude and ground speed. Arranged about the focal-length dial are an angle-of-obliquity dial, an altitude dial, a ground speed dial, all of which compromise the computer. When these dials are compared and set against each other to correspond with the equipment installed and existing flight conditions, the correct amount of compensation is applied to film speed in the magazines for the night cameras. A green film-transport lamp indicates movement of the film across the focal plane of the cameras. A neon lamp flickers when the film speed in the magazine is synchronized with the control settings. The power switch turns power on and off to the magazine drive motor and the camera switch starts and stops film transportation. Both magazine controls are used with the split-vertical cameras but only the upper control is used with the vertical camera.

CAMERA MAIN POWER SWITCH.

The camera main power switch, located in the center of the hinged photo panel, has two positions, labeled CAMERA MAIN PWR and OFF. (See figure 4-27.) When the switch is in the OFF position, no power is supplied to any of the cameras or to the camera control equipment. When the switch is placed in the CAMERA MAIN PWR position, power flows from the 28-volt d-c distribution bus, through closed contacts of the energized camera main power relay to the 28-volt d-c camera bus. The camera bus supplies power to operate the cameras and camera control system. The switch also energizes the camera window defogging system temperature control box.

PHOTOFLASH CARTRIDGE SALVO SWITCH.

The guarded photoflash cartridge salvo switch, placarded CAMERA CARTRIDGE SALVO, is on the hinged photo panel. (See figure 4-27.) The switch is of the two-position momentary type and is spring-loaded to the off position. The switch is provided so that the photoflash cartridges may be jettisoned without jettisoning stores or wing tip tanks. When the switch is actuated, a circuit is energized from the 28-volt d-c battery bus to the cartridge ejectors in the

Figure 4-32.

Figure 4–33.

wing and the ejectors will then release all cartridges in an unarmed condition. When the switch is in the off position, the circuit from the master jettison switch to the cartridge ejectors is complete and actuating the matter jettison switch will also energize the ejectors and all cartridges will be released in an unarmed condition.

GENERAL OPERATING INSTRUCTIONS FOR PHOTOGRAPHIC EQUIPMENT.

For low- and medium-altitude night photography, the split-vertical station is operated with photoflash cartridges as illuminants. For high-altitude night photography, the vertical station is operated with photoflash bombs as illuminants. The following altitudes are defined: up to 4,000 feet, low altitude: from 4,000 to 13,000 feet, medium altitude; and from 13,000 to 30,000 feet, high altitude. In high-altitude day mapping photography, both the vertical and split vertical stations are operated. For either night or day photographic missions, a three-step pre-flight procedure is performed as follows:

1. Place all camera and station controls in their off or inactive positions.
2. Place the camera main power switch in the CAMERA MAIN PWR position.
3. Place the camera compartment tempertaure control switch in the TEMP CONT position.

In night photographic missions, the preceding three-step procedure must be performed and, in addition, the following preflight adjustment is to be made on the LA–12 magazine controls:

1. For the high-altitude night photographic mission, adjust the LA–12 magazine control for the vertical K–37 camera by loosening three screws securing the altitude dial and rotating the dial until the yellow lubber line is set at 0 on the degrees from vertical scale.
2. For the low-altitude night photographic mission, adjust both LA–12 magazine controls by loosening the three screws securing the altitude dial and rotating the dial until the yellow lubber line is set midway between 0 and 45 on the degrees from vertical scale. Tighten the screws to secure the altitude dial after making any adjustment.

IN-FLIGHT OPERATING PROCEDURE FOR HIGH-ALTITUDE NIGHT PHOTOGRAPHY.

Before entering the target area make the following control adjustments:

1. On vertical station control panel, place the mode selector switch in COMP position.
2. At the upper LA–12 magazine control panel, set the knurled knob at the upper right-hand corner of the control to indicate 12″ in the focal length window. Set movable pointer under center control knob to 12″. By turning the lower right-hand knob, set the lubber line of the ground

Figure 4–34.

7770

Figure 4–35.

speed dial to the altitude to be flown on the altitude dial. Set the lubber line of the center focal length dial to the proposed ground speed on the yellow dial by turning the center knob. Place the power and camera switches to the POWER and CAMERA MAIN PWR positions. Set the exposures counter to 485 if the magazines have been loaded with 400-foot roll film.

3. On the bomb release control panel, place the selector switch in the BOMB position. Set the intervalometer head dial as required for the altitude, ground speed, and overlap. Set the limiter head dial as required by mission.
4. Check that all of the remaining controls are in OFF or inactive positions.

Upon entering the target area make the following control adjustments:

1. The pilot must place the master arm switch in the ON position. Refer to ARMAMENT EQUIPMENT in this section.
2. The pilot must place the bomb door switch in the OPEN position. Refer to PHOTOFLASH BOMBING SYSTEM in this section.
3. Place the power switch at any master control panel to POWER position. The amber light will illuminate.
4. Place the ready switch at any master control panel to READY position. The amber light will flash on and off for approximately one minute. When the green ready indicating lamp flashes on and the amber light goes out, the system is ready for photography.
5. Place the operating switch at any master control panel in OPERATE position to initiate camera operation.

Note

Check that the neon light on the upper LA-12 magazine control panel is flickering. This signifies that the film speed in the magazine is synchronized with the control settings. Do not operate the system if the light glows steadily.

6. Extra pictures may be taken by dropping extra photoflash bombs between preset releases. This is accomplished by depressing the pushbutton marked EXT. PIC. on the vertical station control panel.
7. After photography, turn all master control switches to their OFF or inactive positions.

IN-FLIGHT OPERATING PROCEDURE FOR LOW AND MEDIUM ALTITUDE NIGHT PHOTOGRAPHY.

Before entering the target area, make the following control adjustments:

1. On the split-vertical station control panel, place the mode selector switch in the INTV position.
2. On both LA-12 magazine control panels, set the knurled knob at upper right-hand corner of the control to read 12″ in focal length window. Set the movable pointer under center control knob to 12″. By turning the lower right-hand knob, set the lubber line of the ground speed dial to the altitude to be flown on the altitude dial. Set the lubber line of the center focal length dial to the proposed ground speed on the yellow dial by

turning the center knob. Place the power and camera switches to CAMERA and CAMERA MAIN PWR positions. Set the exposures counter to 485 if the magazines have been loaded with 400-foot roll film.

3. On the dual ejector control panel, place the ejector selector switch to the EJ"A" position for the left wing ejectors or to the EJ"B" for the right wing ejectors. Set the intervalometer head dial as required for altitude, ground speed, and overlap. Set the limiter head dial as required for the mission.
4. On the memory delay control panel, set the fuse delay time by positioning the respective ejector selector switch to the fuse time of the cartridge to be dropped.
5. Check that all remaining controls are in OFF or inactive positions.

Upon entering the target area, make the following control adjustments:

1. The pilot must place the master arm switch in the ON position. Refer to ARMAMENT EQUIPMENT in this section.
2. The pilot must place the bomb door switch in the OPEN position. Refer to PHOTOFLASH BOMBING SYSTEM in this section.
3. Place the power switch at any master control panel in the POWER position. The amber light will illuminate.
4. Place the ready switch at any master control panel in the READY position. Amber light will flash on and off for approximately one minute. When the green ready indicating lamp flashes on and the amber light goes out, the system is ready for photography.
5. Place the operate switch at any master control panel in the OPERATE position to intiate camera operation.

Note

Check that the neon light on each LA-12 magazine control panel is flickering. This signifies that the film speeds in the magazines are synchronized with the control settings. Do not operate the system if a steady glow is indicated.

6. Extra pictures may be taken with the split-vertical cameras, between preset exposures, by depressing the pushbutton marked EXT. PIC. on the split-vertical station control.
7. After photography has been accomplished, turn all master control switches to their off or inactive positions.

IN-FLIGHT OPERATING PROCEDURE FOR HIGH ALTITUDE DAY MAPPING PHOTOGRAPHY.

Before entering the target area, make the following control adjustments:

1. On the vertical station control panel, place the mode selector switch in the INTV position.
2. On the split-vertical station control panel, place the mode selector switch in the INTV position.
3. On the bomb release control panel, place the selector switch in the CAM position. Set the intervalometer head dial as required for altitude, ground speed, and overlap. Set the limiter head dial as required by mission.
4. Set the counters on vertical and split-vertical station control panels to 485 for a 400-foot roll of film.
5. Check that all remaining controls are in the OFF or inactive positions.

Upon entering target area make the following control adjustments:

1. The pilot must place master arm switch in ON position. Refer to ARMAMENT EQUIPMENT in this section.
2. The pilot must place bomb door switch in OPEN position. Refer to PHOTOFLASH BOMBING SYSTEM in this section.
3. Place the power switch at any master control panel to the POWER position. The amber light will illuminate.
4. Place the ready switch at any master control panel to the READY position. The amber light will flash on and off for approximately one minute. When the green ready indicating lamp flashes on and the amber light goes out, the system is ready for photography.
5. Place the operate switch at any master control panel in the OPERATE position to initiate camera operation.
6. Extra pictures may be taken with the split-vertical cameras, between preset exposures, by depressing the pushbutton marked EXT. PIC. on the split-vertical station control. Extra pictures may be taken with the vertical station control, between pre-set exposures, by pressing the EXT. PIC. button on the vertical station control four times or less for each exposure depending on what setting the stepping relay is in. The counter on the vertical station control will show when an exposure has been made.

7. After photography has been accomplished, turn all master control switches to their OFF or inactive positions.

Note

With the camera control system set up for low altitude day operation and with any master control panel operate switch in the OPERATE position and the mode selector switch in the CAMERA position, pressing the extra picture switch on the vertical station control panel or on the split-vertical station control panel will cause the K-38 camera to operate once. The T-11 vertical station camera will operate one each fourth closure of the external picture switch.

PHOTOFLASH BOMBING SYSTEM.

The airplane is equipped with a horizontal, rotary-type bomb carrier door. Bombs can be released in the armed condition by the normal bomb release system or in an unarmed condition by means of the jettison release system. Release of the bombs can be made from the pilot's and observer's stations or from the observer's visual observation station. The pilot can observe the status of the bombing system by means of indicator lights on the armament and generator control panel. There are provisions for two external stores pylons on each wing. Refer to ARMAMENT EQUIPMENT in this section. Selector switches and associated status indicator lights are located on the armament and generator control panel. A T-1C bomb sight optical head is installed in the nose for computing drift and overlap. Power for control and operation of the normal bombing system is supplied by the 28-volt d-c armament bus. Power for the jettison circuit is supplied by the 28-volt d-c battery bus.

BOMB DOOR.

The removable bomb carrier door is in the center section of the fuselage and has a capacity for carrying various size photoflash bombs in various configurations. (See figure 4-36.) An electrical control circuit actuates the hydraulically operated door, which pivots on its horizontal axis and rotates 180 degrees to expose the bombs for release. Power for the bomb door control is supplied from the 28-volt d-c armament bus. The lower surface of the door seals the cavity of the bomb bay area, maintaining sufficient clearance to insure free-dropping without interference from the door or airplane structure. The door is divided into three armament bays: forward, middle, and rear, each having seven bomb stations. Three stations are so arranged and electrically interconnected that any number of bomb racks up to 21 may be installed to accommodate various bomb loadings. Two alternate bomb racks are incorporated between the middle and rear bays to carry larger stores. All stores are retained by bomb racks, chocks, and a second-layer suspension assembly of racks and chocks. A hinged flap on the right side of the center section, extending the entire length of the bomb bay, is used to obtain clearance when loading larger bombs or second layer stores.

BOMB DOOR CONTROL—NORMAL.

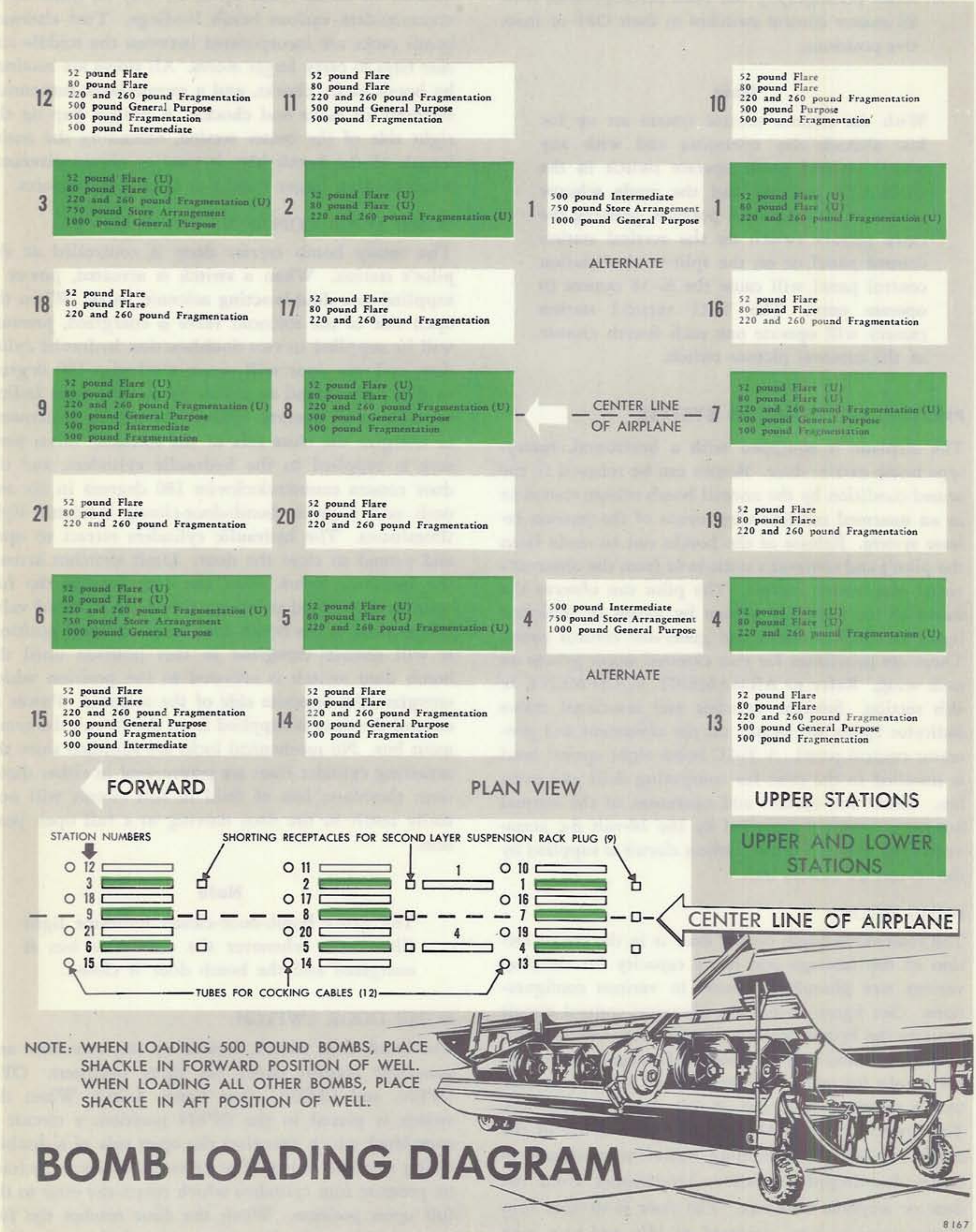
The rotary bomb carrier door is controlled at the pilot's station. When a switch is actuated, power is supplied to a double-acting solenoid valve. When the open side of the solenoid valve is energized, pressure will be supplied to two double-action hydraulic cylinders, and the door will rotate clockwise 180 degrees in four seconds and an amber bomb-door-open indicator light will operate. When the switch is actuated to energize the close side of the solenoid valve, pressure is supplied to the hydraulic cylinders, and the door rotates counterclockwise 180 degrees in six seconds and a green bomb-door-closed indicator light illuminates. The hydraulic cylinders retract to open and extend to close the door. Limit switches actuate the indicator lights when the door reaches the full open or full closed position. When the solenoid valve is energized to the bomb door open or closed position, it will remain energized in that position until the bomb door switch is actuated to the position which energizes the opposite side of the solenoid. Power to control the door is supplied from the 28-volt d-c armament bus. No mechanical locks are supplied since the actuating cylinder lines are pressurized in either direction; therefore, loss of fluid in this circuit will normally result in the door moving to a full open position.

Note

The green bomb-door-closed indicator light illuminates whenever the armament bus is energized and the bomb door is closed.

BOMB DOOR SWITCH.

The bomb door switch, located on the armament and generator control panel has three positions: OFF, OPEN, and CLOSE. (See figure 4-26.) When the switch is placed in the OPEN position, a circuit is completed which energizes the open side of a double-acting solenoid valve. The valve then directs hydraulic pressure into cylinders which rotate the door to the full open position. When the door reaches the full open position, the door open side of the soelnoid is energized and the amber bomb-door-open indicator light illuminates. The door is closed by placing the



12
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
500 pound General Purpose
500 pound Fragmentation
500 pound Intermediate
11
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
500 pound General Purpose
500 pound Fragmentation
10
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
500 pound Purpose
500 pound Fragmentation
3
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
750 pound Store Arrangement
1000 pound General Purpose
2
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
1
500 pound Intermediate
750 pound Store Arrangement
1000 pound General Purpose
1
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
ALTERNATE
18
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
17
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
16
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
9
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
500 pound General Purpose
500 pound Intermediate
500 pound Fragmentation
8
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
500 pound General Purpose
500 pound Fragmentation
CENTER LINE OF AIRPLANE
7
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
500 pound General Purpose
500 pound Fragmentation
21
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
20
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
19
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
6
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
750 pound Store Arrangement
1000 pound General Purpose
5
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
4
500 pound Intermediate
750 pound Store Arrangement
1000 pound General Purpose
4
52 pound Flare (U)
80 pound Flare (U)
220 and 260 pound Fragmentation (U)
ALTERNATE
15
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
500 pound General Purpose
500 pound Fragmentation
500 pound Intermediate
14
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
500 pound General Purpose
500 pound Fragmentation
13
52 pound Flare
80 pound Flare
220 and 260 pound Fragmentation
500 pound General Purpose
500 pound Fragmentation
FORWARD
PLAN VIEW
UPPER STATIONS
UPPER AND LOWER STATIONS
STATION NUMBERS
SHORTING RECEPTACLES FOR SECOND LAYER SUSPENSION RACK PLUG (9)
12 3 18 9 21 6 15
11 2 17 8 20 5 14
10 1 16 7 19 4 13
1
4
CENTER LINE OF AIRPLANE
TUBES FOR COCKING CABLES (12)
NOTE: WHEN LOADING 500 POUND BOMBS, PLACE SHACKLE IN FORWARD POSITION OF WELL. WHEN LOADING ALL OTHER BOMBS, PLACE SHACKLE IN AFT POSITION OF WELL.
BOMB LOADING DIAGRAM
8167

Figure 4–36.

bomb door switch in the CLOSE position. A completed circuit energizes the close side of the solenoid. Hydraulic pressure is directed from the valve to the cylinders which rotate the door to the closed position. When the door reaches the full closed position, the green bomb-door-close indicator light illuminates. Power to control the door is supplied from the 28-volt d-c armament bus.

PERSONNEL SAFETY SWITCH.

The guarded personnel safety switch is a ground handling safety feature located at the left forward end of the bomb bay area. (See figure 4–37.) When placed in the SAFE position, the switch opens the bomb circuits as a precaution against inadvertent operation of the bombing equipment when ground personnel are working in the bomb bay. This switch must be placed in the FLIGHT position prior to all flights.

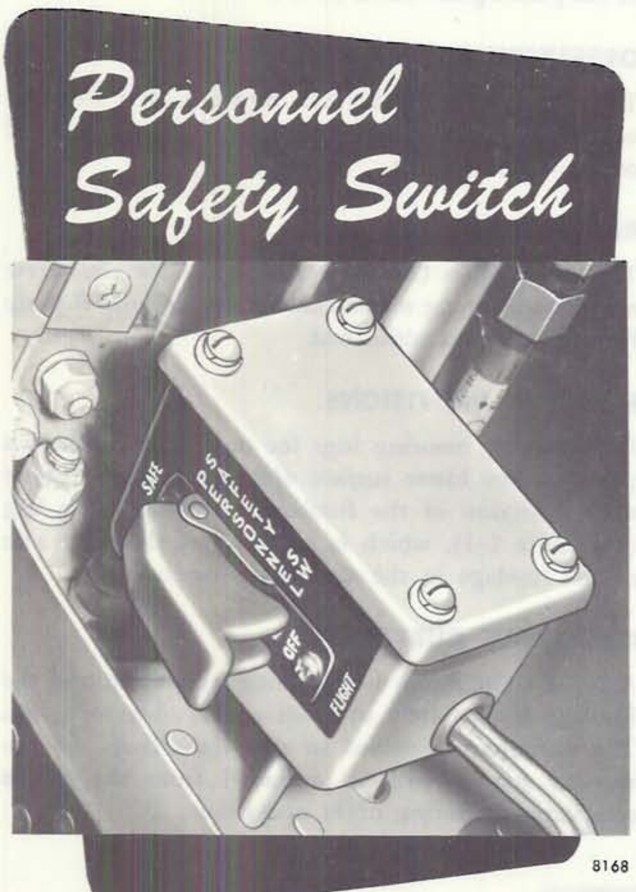


Figure 4–37.

BOMB DOOR GROUND SHUT-OFF VALVE.

The manually operated bomb door ground shut-off valve in the bomb door hydraulic line locks the bomb door position during ground servicing operations. A linkage attached to an access door at the left, forward end of the bomb bay operates the valve. Opening the access door causes the valve to shut-off the flow of hydraulic fluid in the bomb-door-closed circuit. The door stays in the open position through the action of an off-center type linkage. Lifting the off-center linkage and closing the access door positions the bomb door ground shut-off valve to allow the bomb-door-close hydraulic circuit to function.

WARNING

If the bomb door is open and the battery switch is turned to the BATTERY position or auxiliary power is applied to the aircraft, the bomb door will close without warning if the bomb door ground shut-off valve access door is closed

BOMB STATION INDICATORS.

Each bomb station has a corresponding bomb station indicator light mounted on the armament and generator control panel. (See figure 4–26.) These indicator lights are arranged in three groups to correspond to the three bays of the bomb door. The indicator lights circuit is completed through the loaded and cocked bomb racks when the 28-volt d-c armament bus is energized by placing the master arm switch in the ON position. The lights will remain on until the bombs are released. When a bomb is released, the bomb rack actuates to a released condition and the corresponding light will go out.

BOMB DOOR POSITION INDICATORS.

Whenever the bomb door is closed, a green bomb-door-close indicator light remains illuminated on the armament and generator control panel. (See figure 4–26.) When the bomb door is in the full open position, an amber bomb door open indicator light will illuminate. Power for the lights is supplied from the 28-volt d-c armament bus.

BOMB RELEASE—NORMAL.

The normal bomb release system operates in conjunction with the vertical night camera control system. Refer to the IN-FLIGHT OPERATING PROCEDURE FOR HIGH ALTITUDE NIGHT PHOTOGRAPHY in this section for configuration of switches on the hinged photo panel. The personnel safety switch, in the left forward end of the bomb bay area, must be in the FLIGHT position. The master arm switch, on the armament and generator control panel, wired in series with the personnel safety switch, is placed ON. Refer to MASTER ARM SWITCH in this section. The action energizes an armament relay in the electrical distribution center causing power to be supplied from the 28-volt d-c distribution bus through closed contacts of the energized armament relay to the 28-volt d-c armament bus. The bomb door switch on the armament and generator control panel is then placed in the OPEN position, allowing hydraulic pressure to open the door. An amber bomb-door-open indicator light, next to the bomb door switch, illuminates when the door reaches the full open position. With the above switch arrangement used in conjunction with the in-flight operating procedure for high altitude night photography, the normal bomb release system will operate with each impulse supplied from the intervalometer. The first intervalometer impulses will cause the release of the bomb located in the first loaded bomb rack of the rear bay. The second impulse will release the bomb in the first loaded bomb rack of the middle bay, and the third impulse will release the bomb in the first loaded bomb rack of the forward bay. The next series of impulses will repeat the sequence described on the next set of bomb racks. This action will continue until the selected number of bombs has been dropped.

BOMB RELEASE--JETTISON.

Jettison bomb release is accomplished by momentarily actuating the guarded master jettison switch on the pilot's main switch panel to the ON position. Refer to MASTER JETTISON SWITCH in this section. The bomb door will open and all bombs, external stores, and photoflash cartridges will be jettisoned in an unarmed condition. The wing tip tanks will also be jettisoned during the above operation. Upon completion of the jettison operation, the system must be returned to normal and the bomb door closed. This is done by placing the bomb door switch, located on the armament and generator control panel, in the CLOSE position.

PHOTOFLASH CARTRIDGES—JETTISON.

The photoflash cartridges jettison release operates in conjunction with the bomb jettison release, external stores jettison release, and the wing tip tanks jettison release. When the guarded master jettison switch on the pilot's main switch is actuated, a power circuit is closed to the salvo relays in the right and left ejection junction boxes, causing the salvo relays to energize and close the power circuits to the right and left ejector units. The photoflash cartridges will be ejected from all units in rapid succession.

MISCELLANEOUS EQUIPMENT.

PILOT'S DATA CASE.

The pilot's data case (32, figure 1–1) is mounted on the pilot's console, slightly behind the pilot.

AIRPLANE CHECK LIST.

An airplane check list is mounted on the right side of the pilot's glare shield (1–29).

OBSERVER'S DATA CASE.

The observer's data case (31, figure 1–1) is mounted on the side of the fuselage to the right and forward of the observer's seat.

RELIEF TUBES.

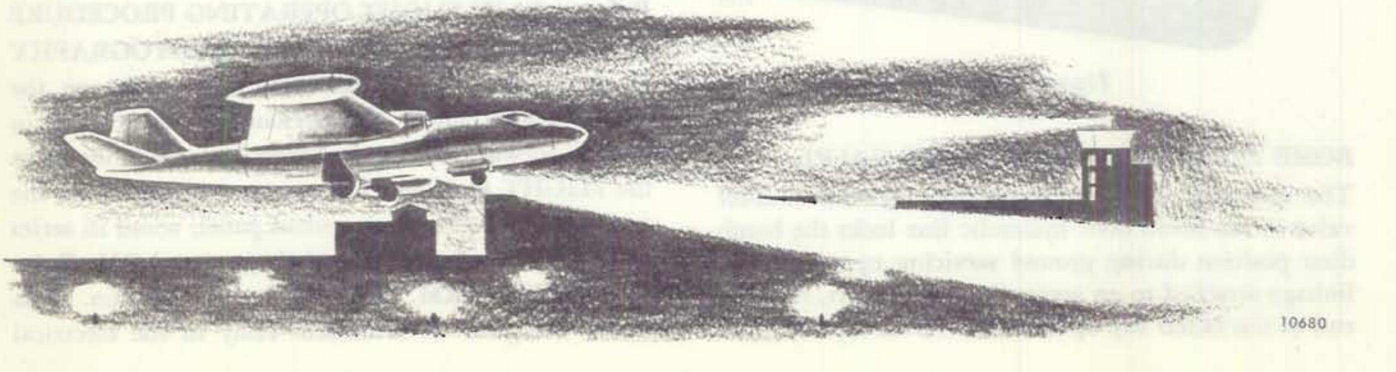
The relief tubes (29, figure 1–1), one for each crew member, are hung on brackets to the left and slightly forward of each ejection seat.

MOORING PROVISIONS.

Demountable mooring lugs for providing a tie-down point on the lower surface of each wing and under the aft section of the fuselage are stowed in a bag (14, figure 1–1), which is mounted on the right side of the fuselage in the aft compartment.

OBSERVER'S CURTAIN.

A curtain (30, figure 1–1) is hung from the top of the fuselage immediately in front of the observer's seat. The curtain is provided so that light from the observer's station will be excluded from the pilot's compartment during night operation.



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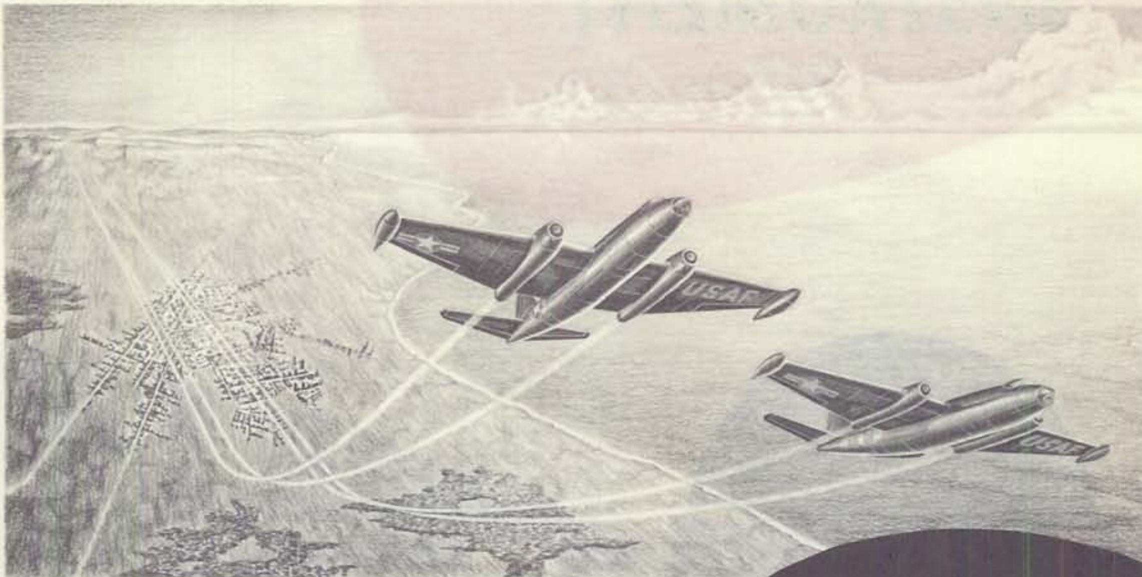
SECTION V



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OPERATING LIMITATIONS

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INTRODUCTION.

This section includes the engine and aircraft limitations that must be observed during normal operation. For instrument markings, refer to (figure 5-1) as these represented limitations are not necessarily repeated in the text of this or other sections.

MINIMUM CREW REQUIREMENTS.

The minimum crew required for this airplane is the pilot. Additional crew members can be added at the discretion of the Commanding Officer.

ENGINE LIMITATIONS.

All normal engine limitations are shown in figure 5-2. If the limits for steady state, acceleration, or starting are reached or exceeded, an entry of magnitude and duration of the operation at or above the limitations should be made; during steady state, only operation above the limitations should be noted.

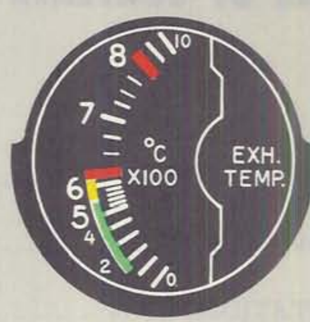
Note

If the engines are being shut down from 95% rpm or above, pause for at least one minute at IDLE to allow temperature conditions in the engines to stabilize, and then place the throttles in the OFF position. If the engines are being shut down from below 95% rpm, the throttles may be closed immediately.

INSTRUMENT *Markings*

AIRSPEED

- 170 Knots IAS—Flap extension
- 200 Knots IAS—Landing gear extension
- 444 Knots IAS—Airspeed limit with tip tanks
- 513 Knots IAS—Airspeed limit without tip tanks



EXHAUST GAS TEMPERATURE

- 150°C to 585°C
- 585°C to 620°C—Maximum continuous
- 620°C—Maximum during take-off and military thrust (30 min. limit)
- 800°C—Maximum during starting and acceleration only.

TACHOMETER

- 72% to 96%—Normal continuous
- 96.5% to 100%—Maximum continuous
- 100% Take off and military power

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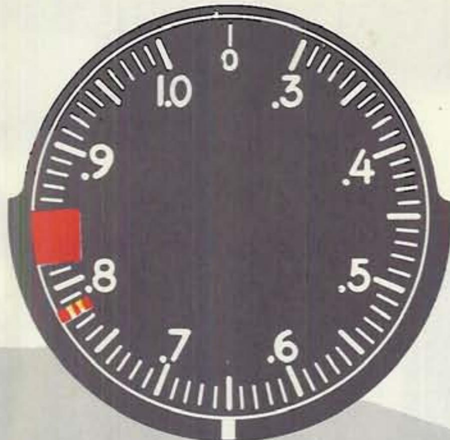
Figure 5–1. (Sheet 1 of 2)

FUEL GRADE-JP4



MACHMETER

- .78 Mach limit with tip tanks
- .82 to .85 Buffet area

OIL PRESSURE

- 10 PSI—Minimum
- 20 PSI to 35 PSI—Normal
- 40 PSI—Maximum

BRAKE PRESSURE

- 1000 PSI—Minimum
- 2600 PSI to 3000 PSI—Normal
- 3500 PSI—Maximum

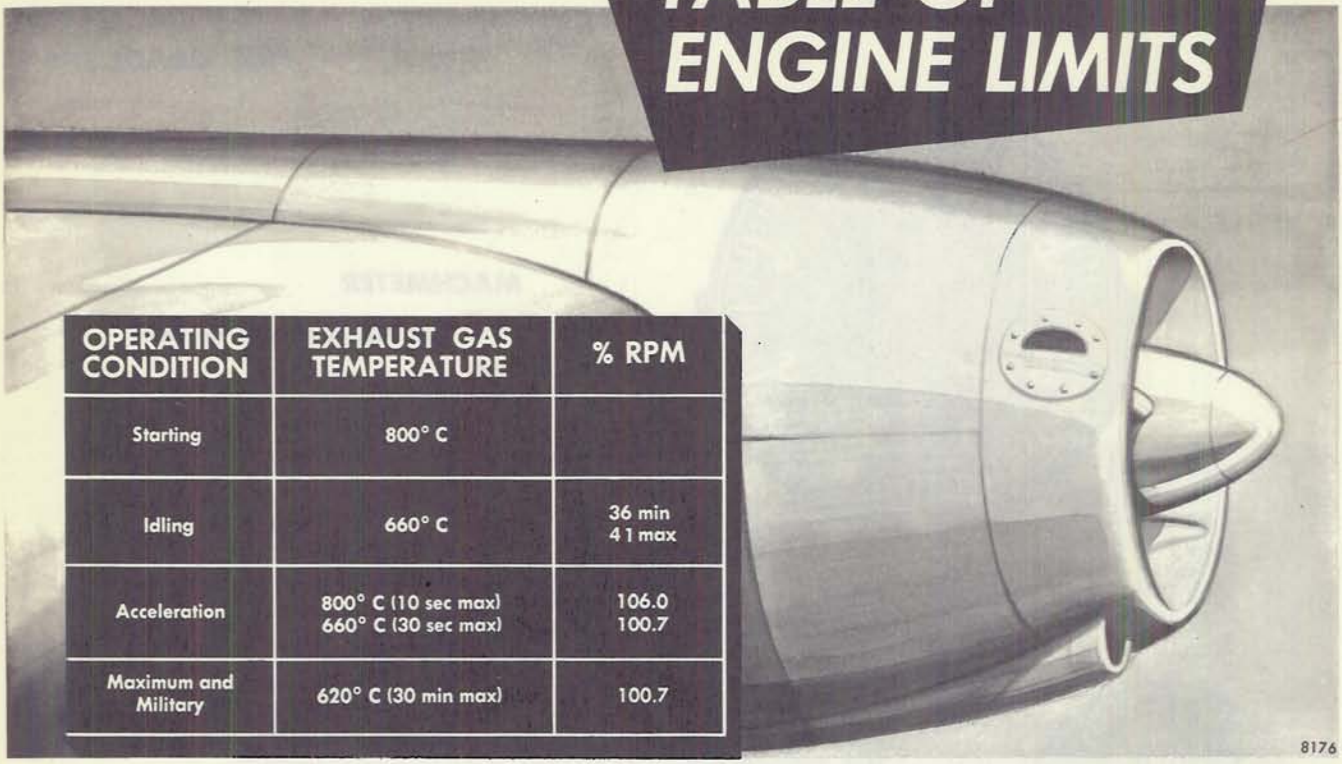
HYDRAULIC SYSTEM PRESSURE

- 2500 to 3000 PSI
- 3500 PSI

9301

Figure 5-1. (Sheet 2 of 2)

TABLE OF ENGINE LIMITS



OPERATING CONDITION	EXHAUST GAS TEMPERATURE	% RPM
Starting	800° C	
Idling	660° C	36 min 41 max
Acceleration	800° C (10 sec max) 660° C (30 sec max)	106.0 100.7
Maximum and Military	620° C (30 min max)	100.7

Figure 5-2.

WARNING

The steady state exhaust gas temperature should never exceed 620°C (1148°F) except during starting or acceleration. If necessary, throttle the engine back to keep within the limit. If the temperature cannot be controlled by this method, stop the engine and do not attempt a restart until an inspection can be made.

Note

Never operate the engine if the engine air inlet air temperature reaches 93°C (200°F).

WARNING

If five starts are made in which the exhaust gas temperature is between 800°-900°C (1472-1652°F) or one start exceeding 900°C (1652°F), stop the engine and perform an immediate inspection. If airborne and unable to determine the cause of malfunction, stop the engine and do not attempt a restart.

WARNING

Should the engine rpm exceed 105.5% during acceleration or 102.5% rpm during steady state flight, retard the throttle to keep below these limits. If the engine continues to overspeed, shut it down immediately. Refer to PARTIAL POWER FAILURE, Section III.

CAUTION

Operating the engines without a nose cowl or bellmouth and without a starter fairing installed causes compressor failure due to improper airflow distribution.

WARNING

Should the engine overspeed to 106% rpm, perform an inspection before restarting.

AIRSPEED LIMITATIONS.

LANDING GEAR EXTENSION SPEED.

The limiting airspeed for extending the landing gear is 200 knots IAS. If the gear is lowered at speeds in excess of this value, the fairing, doors, or operating mechanism may be damaged.

WING FLAP LOWERING SPEED.

The limiting airspeed for lowering the wing flaps is 170 knots IAS. Flap distortion or damage to the operating mechanism may result at speeds in excess of the limiting value.

DIVE BRAKES.

There is no airspeed limitation imposed on the operation of the dive brakes.

CAUTION

Do not extend the dive brakes when the airplane is equipped with external wing stores, as this action results in severe buffeting.

MAXIMUM ALLOWABLE AIRSPEEDS. (See figures 5-3 and 5-4.)

Whenever wing tip tanks are carried, the maximum allowable airspeed at any altitude is 444 knots IAS or Mach number .78, whichever is less. Without wing tip tanks the maximum allowable airspeeds up to 5,000 feet is 513 knots IAS; from 5,000 to 20,000 feet the limit is Mach .82. From Mach .83 to Mach .85 at 20,000 feet and higher altitudes the buffet limit is encountered.

INTERNAL AND EXTERNAL STORES.

When flare pods, bombs, or chemical tanks are carried under the wings as external stores, the high speed buffet limits without tip tanks are as follows:

Configuration	Mach Number at Altitude (Feet)		
	10,000	20,000	30,000
Clean Airplane	.82	.83	.83
4 Bomb Pylons	.82	.83	.83
4 Flare Pods, T-54 Bombs, or E-26 Chemical Tanks	.79	.81	.82

Completely filled E-74 series 750-pound napalm tanks should not be dropped at speeds in excess of 200 knots. These tanks should not be released at any speed in a partly filled or empty condition except in case of emergency.

The maximum allowable airspeed at which empty wing tip tanks can be jettisoned is 365 knots.

General purpose, 500-pound box fin bombs should not be jettisoned at speeds greater than 400 knots IAS except in an emergency.

Externally mounted T-54 series 750-pound bombs should not be dropped at speeds in excess of 300 knots IAS.

M-26 paraflares should not be carried in the airplane.

NO EXTERNAL LOAD.

The proven limits of normal control are shown in figures 5-3 and 5-4. Exceeding these values will result in extremely heavy buffeting at low altitudes and in severe longitudinal trim changes at high altitudes.

BOMB DOOR OPERATION.

There is no airspeed limitation imposed on the operation of the bomb door.

PROHIBITED MANEUVERS.

The following maneuvers must not be performed:

1. Intentional spins.
2. Snap rolls or any other snap maneuvers.
3. Inverted flying or any maneuvers resulting in extended negative acceleration.
4. Abrupt rudder-induced maneuvers.

CAUTION

Inverted flying or any maneuver resulting in extended negative acceleration may result in engine flame-out since there are no means of insuring a continuous flow of fuel in this attitude.

No maneuvers should be accomplished solely by use of trim devices. Trim devices increase the pilot's apparent strength by reducing the required stick force. The high stick forces experienced during maneuvers without the use of trim serve to protect the crew and the airplane. Trim devices should only be used to reduce the maneuvering stick forces to tolerable values, and not to zero. The use of trim in anticipation of a maneuver or to reduce maneuvering stick forces to very small values may result in airloads sufficient to cause complete structural failure of the airplane.

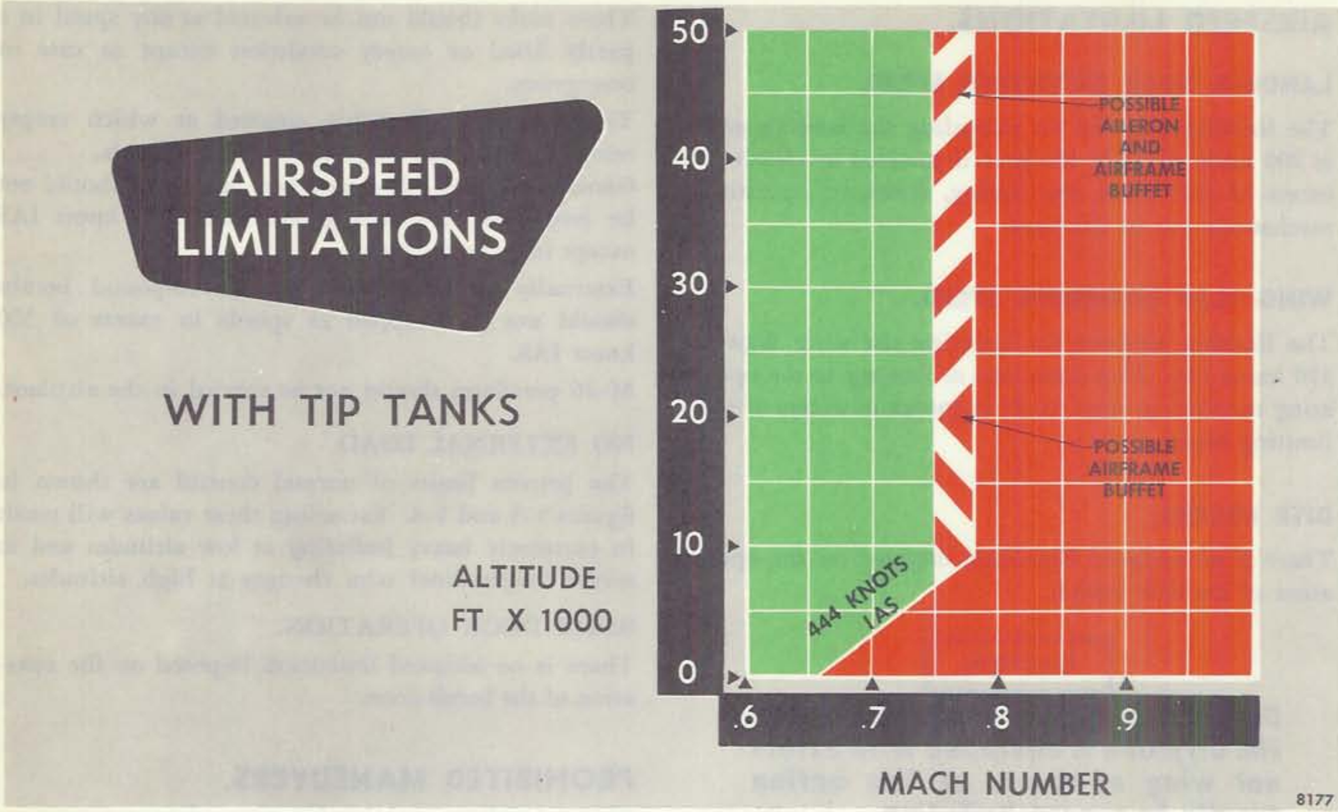


Figure 5–3.

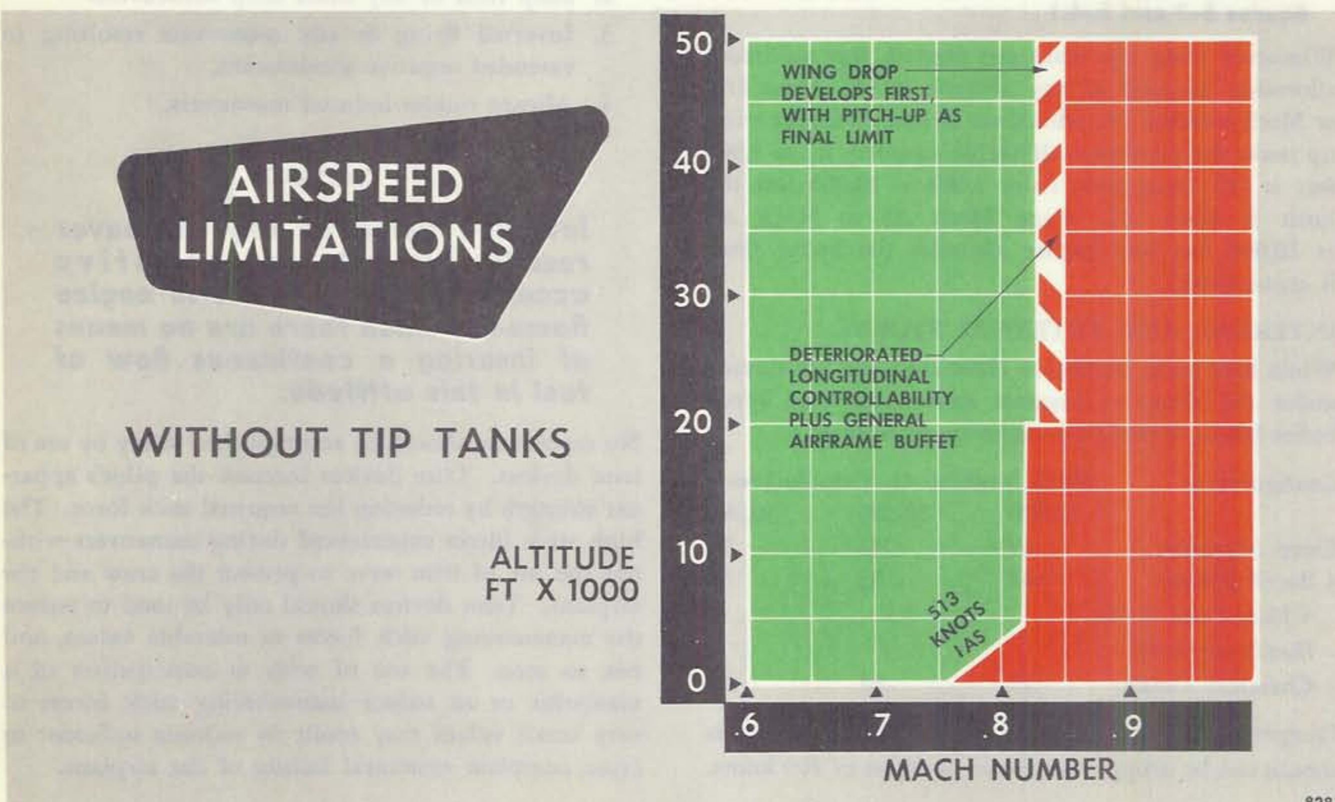


Figure 5–4.

ACCELERATION LIMITATIONS.

The maximum allowable G for different conditions is graphically illustrated in the operating flight strength diagrams. (See figures 5-5 and 5-6.) These flight strength (V-G) diagrams define the flight speed and load factor limits at various altitudes for a given airplane gross weight. The speeds quoted are indicated readings exactly as observed during flight.

MAXIMUM ACCELERATION.

NO EXTERNAL LOAD. (See figure 5-5.)

The maximum allowable positive acceleration for the airplane with no external load is 5 G's and the maximum negative limit is —2.5G's.

WING TIP TANKS INSTALLED. (See figure 5-5.)

A maximum +4G acceleration is allowed when tip tanks are installed. This acceleration limit is for both the full or empty tip tanks. The negative limit varies with the full or empty tip tanks. The maximum negative limit with tip tanks full is —1.33G, while a —2.05G acceleration is allowable with tip tanks empty.

CENTER-OF-GRAVITY LIMITATIONS.

The CG limitations of the airplane are: forward 21.0 percent MAC, with or without wing tip tanks; aft 28.3 percent MAC, with wing tip tanks; and aft 28.8 percent MAC, without wing tip tanks. The location of all equipment (see figures 5-7, 5-8, and 5-9) has been carefully controlled to provide a satisfactory center of gravity position at all times. The greatest single effect on CG travel is the distribution of the fuel load being carried. The normal system of fuel sequencing to the engines, as outlined in Section VII, will keep the airplane well within the CG limits.

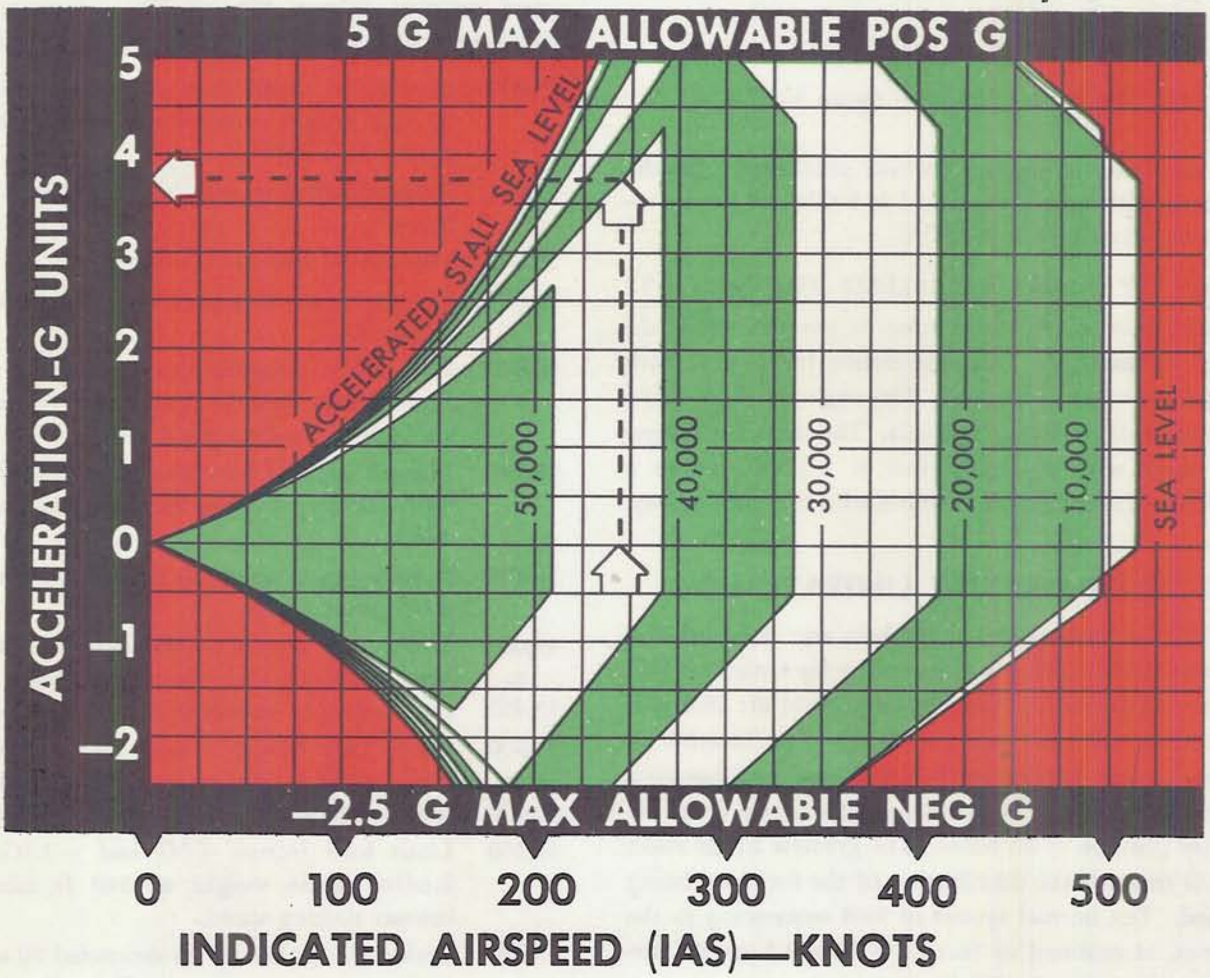
GROSS-WEIGHT LIMITATIONS.

The limiting factor of maximum gross weight of the airplane is its available loading capacity of 56,000 pounds, with the cargo and stores loaded as specified in T.O. 1-1B-40. There are certain limitations affecting service life, strength, and performance associated the gross weights. The following is a tabulation of these limitaitons, including some theoretical limiting gross weights (above the available capacity gross weights), which are shown for reference purposes.

61,000	Limited to 10,000 feet take-off distance over 50 foot height at sea level, hot day take-off thrust, no wind.
59,000	Brakes limited to one emergency stop at 100 knots.
59,400	Limited by tire static rating.
58,000	Limited by landing gear strength at aft center of gravity.
56,000	This is the extreme maximum gross weight based upon available capacity. (All weights above this are theoretical only.)
55,000	Limited to 5000 feet take-off ground distance with 100% rpm at sea level, standard day, no wind.
53,400	Landing gross weight at 300 ft/min limit contact sinking speed.
49,000 to 53,400	Limit load factors +4G and —1.33G constant with tip tanks installed. Space limitations will put required deadweight in wing.
44,000 to 49,000	Limit load factors +4.1G and —2.0G constant without tip tanks. Space limitations will put required deadweight in wing.
37,500	Limit load factors +5G and —2.5G. Also landing gross weight at 540 ft/min limit contact sinking speed.
37,000	Brake life limited to an estimated 80 stops at 80 knots and 20 stops at 110 knots.

OPERATING FLIGHT STRENGTH DIAGRAM

SYMMETRICAL FLIGHT
WITHOUT WING-TIP TANKS GROSS WEIGHT=37,600 LBS



HOW TO USE CHART

1. Select your indicated airspeed.
2. Trace vertically your flight altitude.
3. Move horizontally to the left and find the maximum G you can pull at that airspeed and altitude before stalling. NOTE: Any G in excess of 5G is prohibited.

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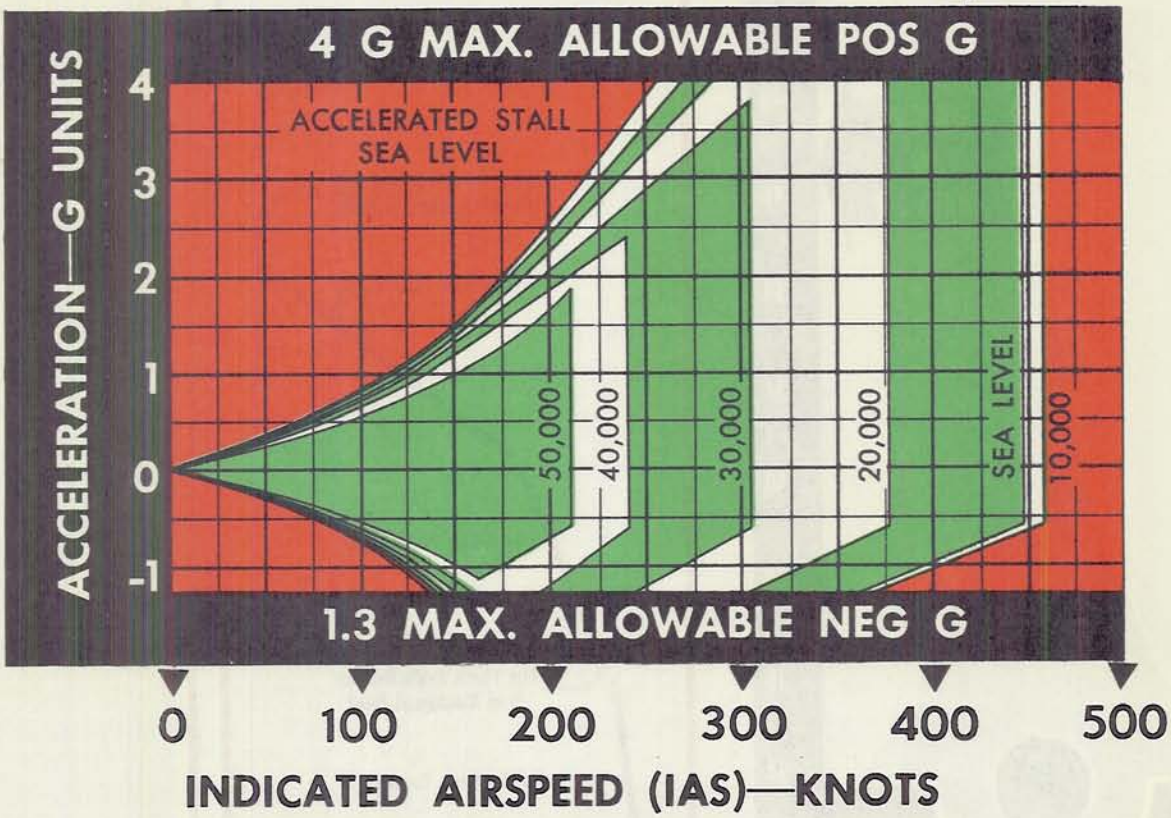
Figure 5-5.

OPERATING FLIGHT STRENGTH DIAGRAM

SYMMETRICAL FLIGHT
WITH WING-TIP TANKS GROSS WEIGHT—53,400 LB



HOW TO USE CHART

1. Select your indicated airspeed.
2. Trace vertically your flight altitude.
3. Move horizontally to the left and find the maximum G you can pull at that airspeed and altitude before stalling. NOTE: Any G in excess of 4G is prohibited.

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Figure 5-6.

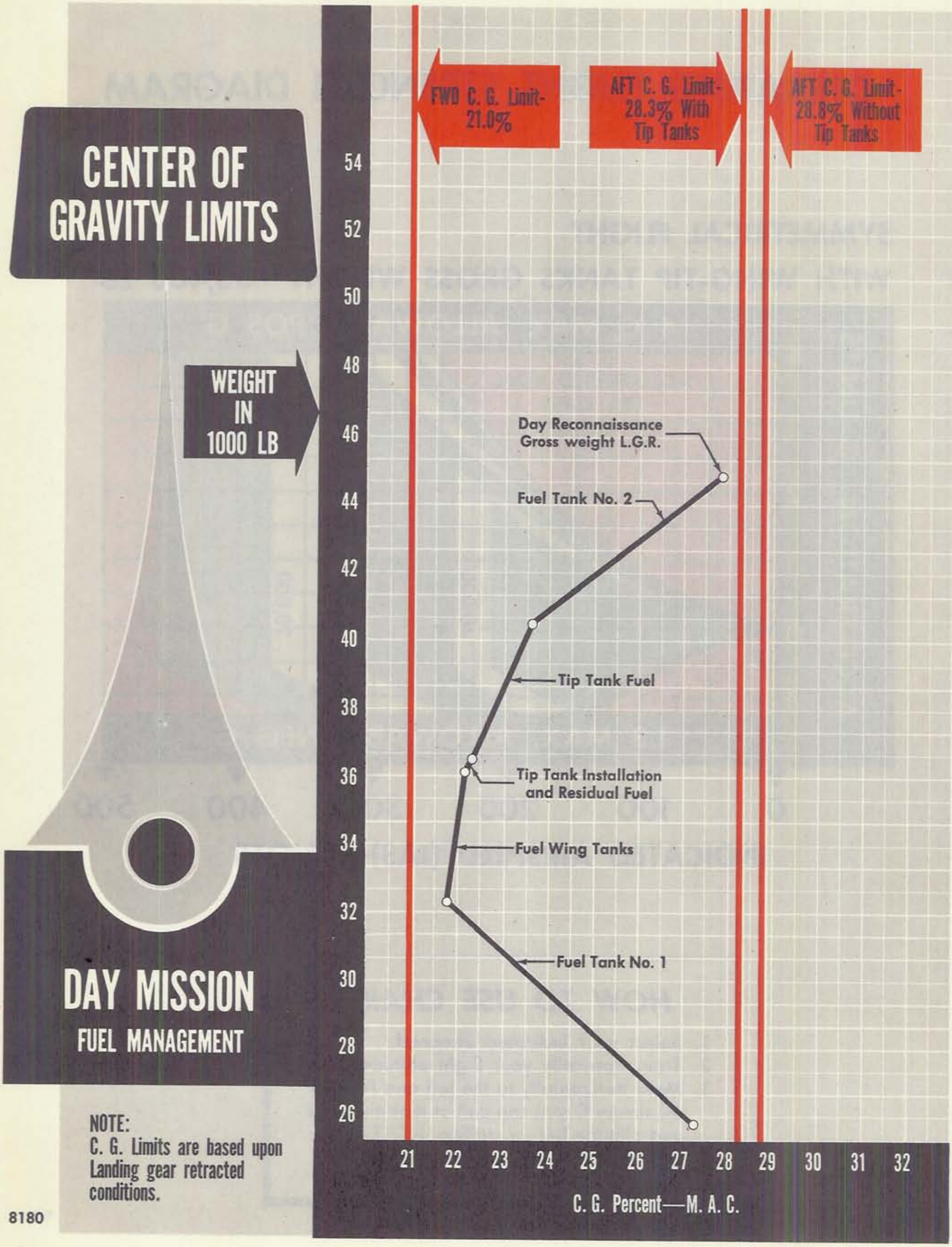
CENTER OF GRAVITY LIMITS
DAY MISSION
FUEL MANAGEMENT
WEIGHT IN 1000 LB
FWD C. G. Limit- 21.0%
AFT C. G. Limit- 28.3% With Tip Tanks
AFT C. G. Limit- 28.8% Without Tip Tanks
Day Reconnaissance Gross weight L.G.R.
Fuel Tank No. 2
Tip Tank Fuel
Tip Tank Installation and Residual Fuel
Fuel Wing Tanks
Fuel Tank No. 1
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
21 22 23 24 25 26 27 28 29 30 31 32
C. G. Percent—M. A. C.
NOTE:
C. G. Limits are based upon Landing gear retracted conditions.
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Figure 5–7.

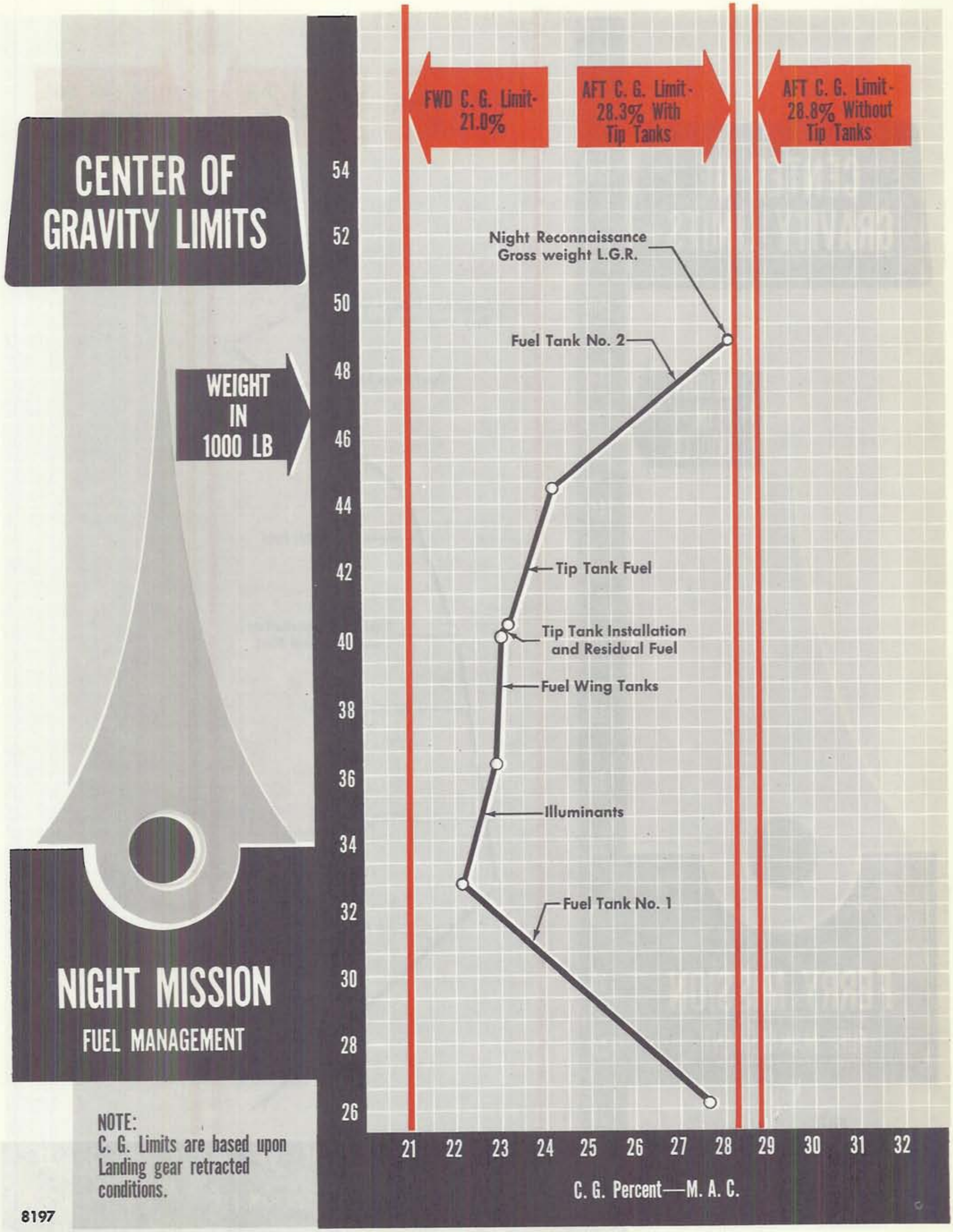
CENTER OF GRAVITY LIMITS
NIGHT MISSION
FUEL MANAGEMENT
WEIGHT IN 1000 LB
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
FWD C. G. Limit- 21.0%
AFT C. G. Limit- 28.3% With Tip Tanks
AFT C. G. Limit- 28.8% Without Tip Tanks
Night Reconnaissance Gross weight L.G.R.
Fuel Tank No. 2
Tip Tank Fuel
Tip Tank Installation and Residual Fuel
Fuel Wing Tanks
Illuminants
Fuel Tank No. 1
21 22 23 24 25 26 27 28 29 30 31 32
C. G. Percent—M. A. C.
NOTE:
C. G. Limits are based upon Landing gear retracted conditions.
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Figure 5–8.

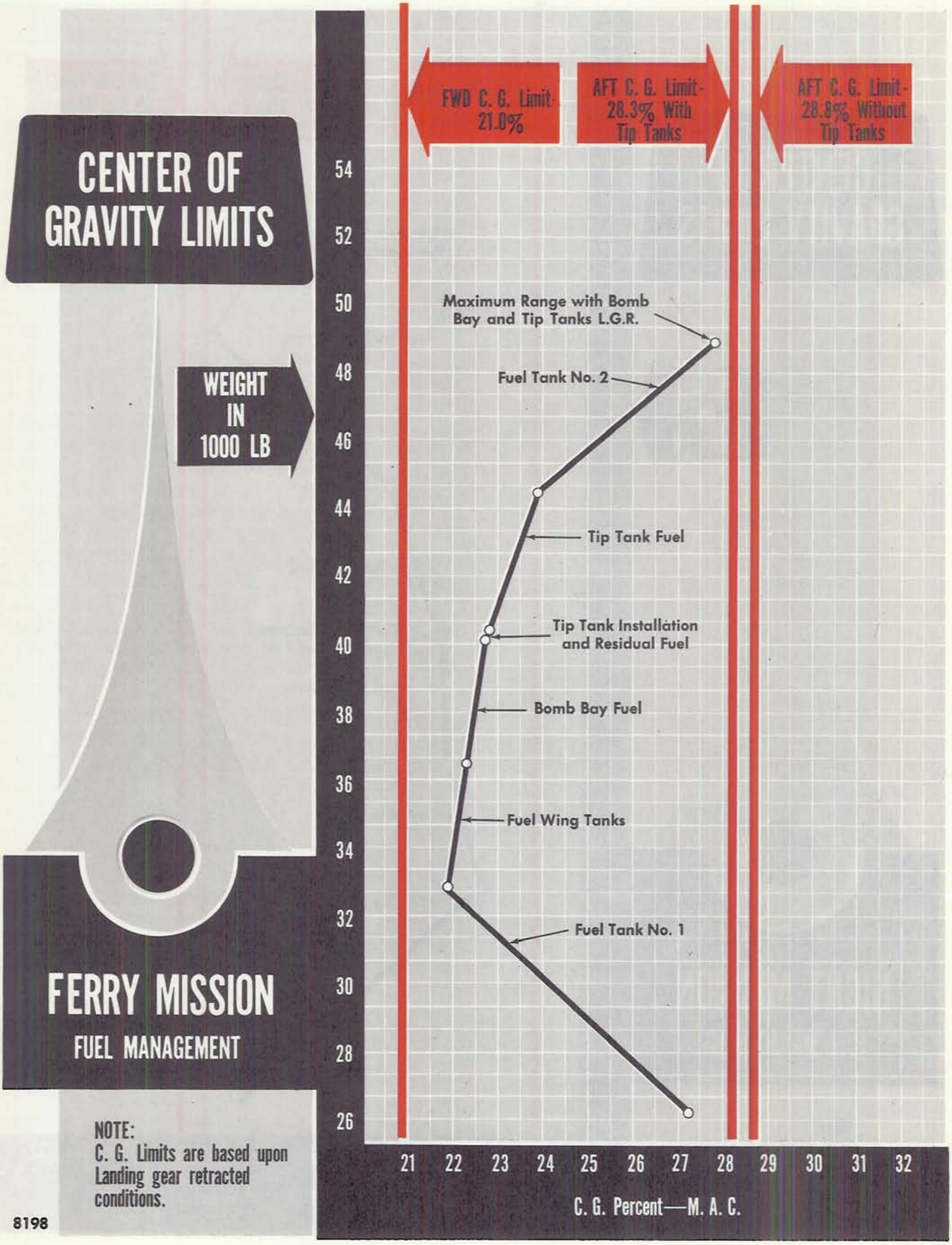
CENTER OF GRAVITY LIMITS
WEIGHT IN 1000 LB
FERRY MISSION
FUEL MANAGEMENT
NOTE:
C. G. Limits are based upon Landing gear retracted conditions.
FWD C. G. Limit- 21.0%
AFT C. G. Limit- 28.3% With Tip Tanks
AFT C. G. Limit- 28.8% Without Tip Tanks
Maximum Range with Bomb Bay and Tip Tanks L.G.R.
Fuel Tank No. 2
Tip Tank Fuel
Tip Tank Installation and Residual Fuel
Bomb Bay Fuel
Fuel Wing Tanks
Fuel Tank No. 1
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
21 22 23 24 25 26 27 28 29 30 31 32
C. G. Percent—M. A. C.
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Figure 5–9.

SECTION VI

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FLIGHT CHARACTERISTICS

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GENERAL FLIGHT CHARACTERISTICS.

The combination of clean design, relatively light wing loading and high load factor strength makes the RB–57A a highly maneuverable airplane throughout most of the operating speed and altitude range. The major control surfaces are of the conventional type. Hydraulically operated finger-type dive brakes extend from the upper and lower wing surfaces to increase the rate of the descent and reduce speed. Split-type flaps covering approximately 40% of the wing span are used for landing only.

Handling characteristics of the aircraft are essentially unchanged throughout the normal speed range, with the exception of longitudinal control. Longitudinal control depends largely on the aircraft center of gravity position. Loops, rolls, and Immelmans may be performed, but care should be taken to maintain a positive load on the aircraft at all times since there are no provisions for engine or component operation under negative load factor conditions. Only through complete familiarization with the aircraft can full advantage of its high performance and special features be gained. To aid in familiarization, a dive recovery chart (figure 6–3) and an angle-of-attack relationship curve (figure 6–4) are furnished.

STALLS.

Stall warning in the cruise configuration (see figure 6–1) is initially felt in the form of general aircraft roughness from 10-15 knots above the stalling speed. As speed is reduced the roughness becomes more pronounced and the elevator control column "jumps". At the stall a mild aileron snatch and gentle rolling tendency is present. Center-of-gravity position, stabilizer setting, speed brake extension, power setting and landing gear extension have no noticeable effect on the stall warning characteristics. The aileron snatching increases with the addition of wing tip tanks but is easily controllable. Stall characteristics in the flaps down configuration are similar to those needed above

STALL SPEED CHART

All airspeeds are in (IAS)	FLAP DEFLECTION DEGREES	GROSS WEIGHT—POUNDS				
		53,400	49,000	43,000	36,000	*28,000
TAKE-OFF—GEAR DOWN	0	130	123	115	105	88
LANDING 0° BANK-GEAR DOWN	60	112	107	101	92	85
15° BANK—GEAR DOWN	60	113	109	102	93	85
30° BANK—GEAR DOWN	60	119	114	107	98	88
45° BANK—GEAR DOWN	60	130	124	117	106	95
60° BANK—GEAR DOWN	60	151	145	136	125	111

Data Basis: Flight Test

Data as of: 9-30-55

*Average landing weight with reserve fuel only

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Figure 6-1.

with the primary exception of stall warning speeds which occur at only 3 to 5 knots above the stalling speed.

PRACTICE STALLS.

It is suggested that practice stalls be performed at altitudes above 10,000 feet. Entry to the stall should be made in the normal manner. The entry rate to obtain stalling IAS as shown in figure 6-1 is approximately one knot per second.

ACCELERATED STALLS.

The accelerated stall is characterized by heavy airframe buffeting as the limiting load factor is approached, otherwise salient characteristics are similar to those already noted for the unaccelerated stalls.

STALL RECOVERY.

In all instances recovery from the stall is straight forward and is easily effected by allowing the aircraft nose to drop and airspeed to increase. Lateral and directional control is easily maintained and there is little loss of altitude during recovery. Recovery can be made with or without increased power.

SPINS.

Intentional spins are prohibited. At least two unintentional spins have been reported, with satisfactory recovery effected. Both spins were inadvertently entered at speeds approaching the stall. Normal recovery technique proved satisfactory. Additional information will be supplied when available.

STICK FORCES.

During normal aircraft missions, practically the entire center-of-gravity range is used as shown in figures 5-7, 5-8, and 5-9. Elevator control maneuvering forces change considerably during flight as the center of gravity position varies. Diagrams showing stick forces versus load factor for various airspeeds. Altitudes and center of gravity positions are shown in figure 6-2. A 4.0G maneuver with CG at 21.0% MAC, 385 knots IAS, and at 10,000 feet altitude would require 190 pounds elevator control force (above limit pilot effort). However, this same maneuver with the CG at 28.8% MAC would require only 70 pounds elevator control force. Careful consideration of the data shown in figure 6-4 should be made before attempting any maneuvers requiring high control forces to avoid overstressing the aircraft.

STICK FORCES
MANEUVERING FLIGHT CHARACTERISTICS WITHOUT TIP TANKS

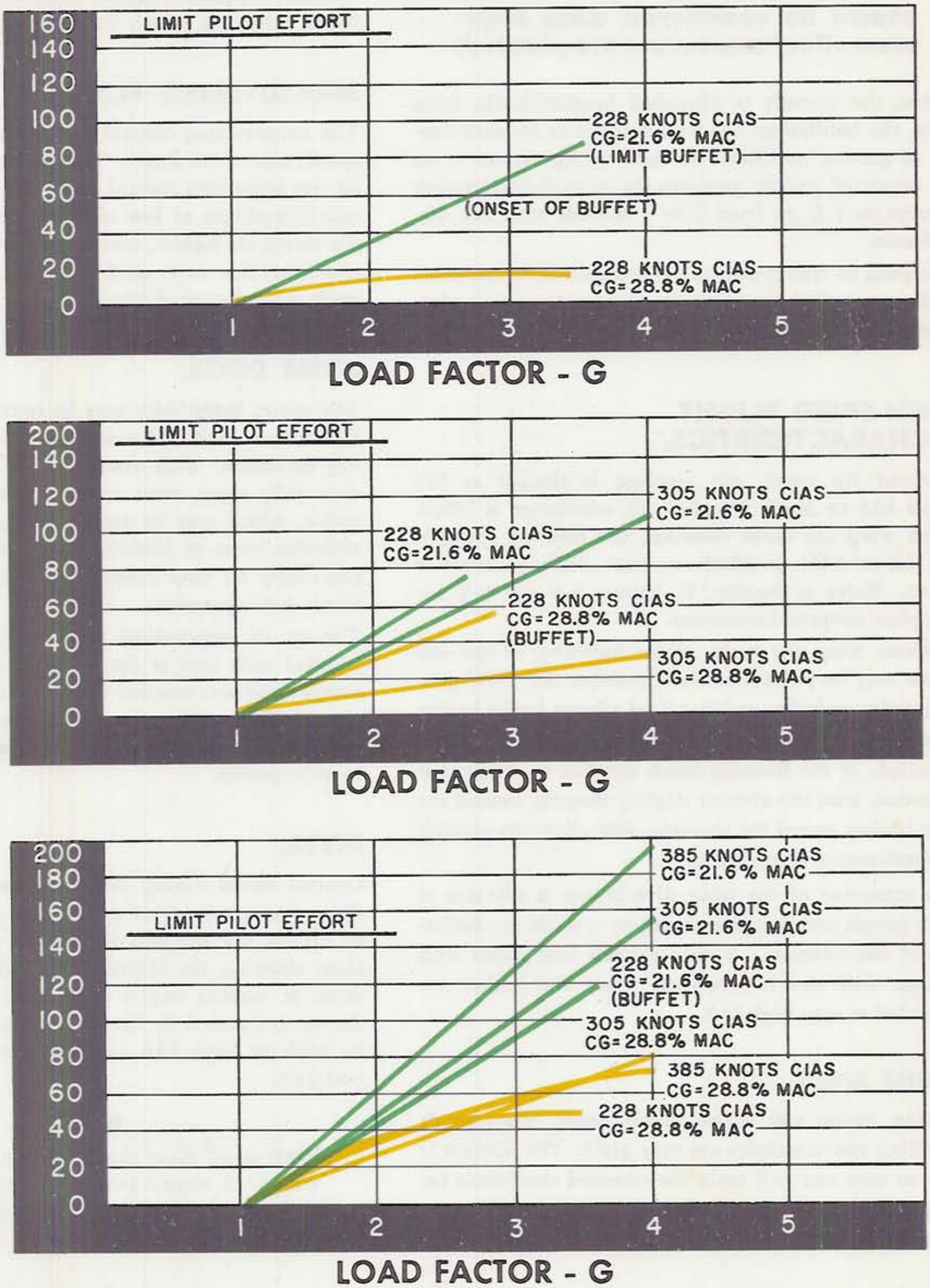


Figure 6-2.

WARNING

The effect of CG position on elevator control forces is significant and should be considered when maximum effort maneuvers are planned.

When the aircraft is disturbed longitudinally from trim, the oscillations are well damped at forward center of gravity positions. In most configurations at an aft center of gravity position the normal acceleration returns to 1 G in from 1 to 3 seconds after the disturbance.

Damping of lateral-directional oscillations in marginal under some flight conditions. However, a stable platform can easily be maintained.

HIGH-SPEED FLIGHT CHARACTERISTICS.

Without tip tanks, the airplane is limited at 513 knots IAS or Mach Number .82, whichever is lower. With wing tip tanks installed, the limiting speed is 444 knots IAS, or Mach number .78, whichever is lower. Refer to Section V, figures 5–3 and 5–4 for complete airspeed limitations.

Without wing tip tanks, slight buffeting of the airframe may be present at Mach number .82. Mild general airframe buffet and localized aileron buffet begins at somewhat lower speeds with the wing tip tanks installed. If the limiting Mach number or airspeed is exceeded, trim the aircraft slightly nose-up, extend the dive brakes, retard the throttles, and allow the aircraft to decelerate to a safe speed.

The extension of the wing dive brakes is effective at high speeds and is accompanied by a moderate buffeting of the airframe. A mild aircraft nose down trim change will also be apparent when the brakes are extended at very high IAS.

CRUISE SPEED.

During cruise and cruise climb flight, the aircraft handling characteristics are very good. The aircraft is easy to trim and will maintain trimmed conditions for long periods. Recommended airspeeds are given in Appendix I.

LOW SPEED.

Recommended speeds for take-off, approach, and landing are given in Section II. Flight characteristics are conventional, with good control and response characteristics. Extension of the flaps causes a general airframe buffeting which decreases as speed is reduced.

MANEUVERING FLIGHT.

The maneuvering control forces are high at indicated speeds above 350 knots. Thus, pilot effort limitations on the individual control surfaces will restrict aircraft maneuverability at low altitudes. At higher altitudes the forces are lighter, making the overall maneuvering characteristics very good. No maneuvers should be made solely by use of trim devices.

BOMB DOOR.

The rotary bomb door may be operated at any speed. However, at high IAS a moderate pitch-up occurs during transition, with some aircraft buffet. With the door fully open, some nose up pitching moment remains, which may be readily trimmed out. At high altitudes, even at limiting Mach numbers, there are practically no trim changes or buffet associated with bomb door operation.

The use of longitudinal trim at high IAS should be handled with care as the actuating speed of the horizontal stabilizer, coupled with high stabilizer effectiveness, make small trim corrections tedious. Until experience is gained there will probably be a tendency to over control.

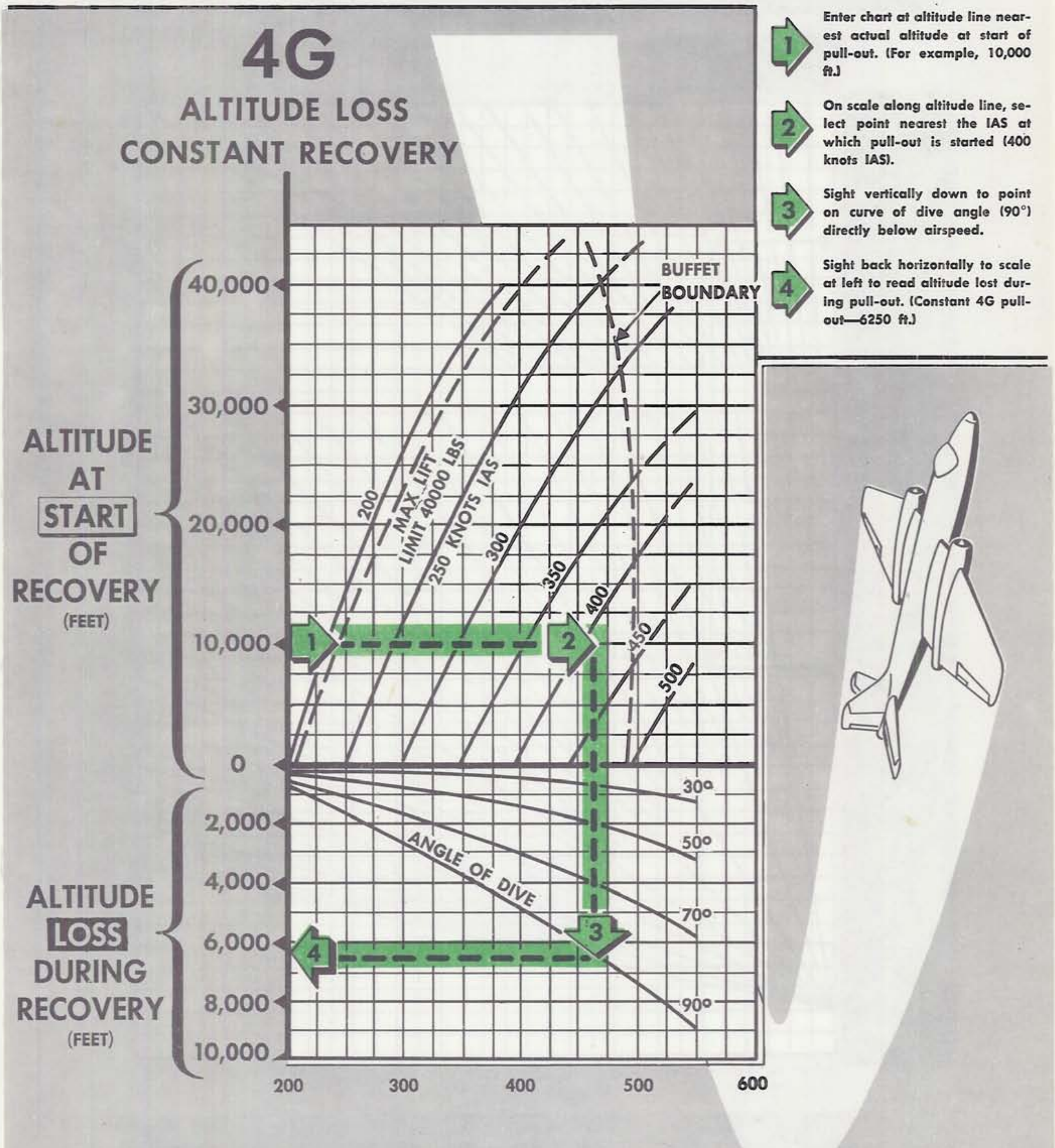
DIVES.

Control forces during dives are reasonable and handling characteristics are good. Care must be taken not to exceed the airspeed limitations of Section V. A chart showing the altitude required to recover from dives at various angles of descent and airspeeds is shown in figure 6–3. Control forces for recovery will be high at high IAS and forward center-of-gravity positions.

Note

High speed dives should not be entered into with high engine power. Excess acceleration will occur and frequent trim changes will be required.

DIVE RECOVERY

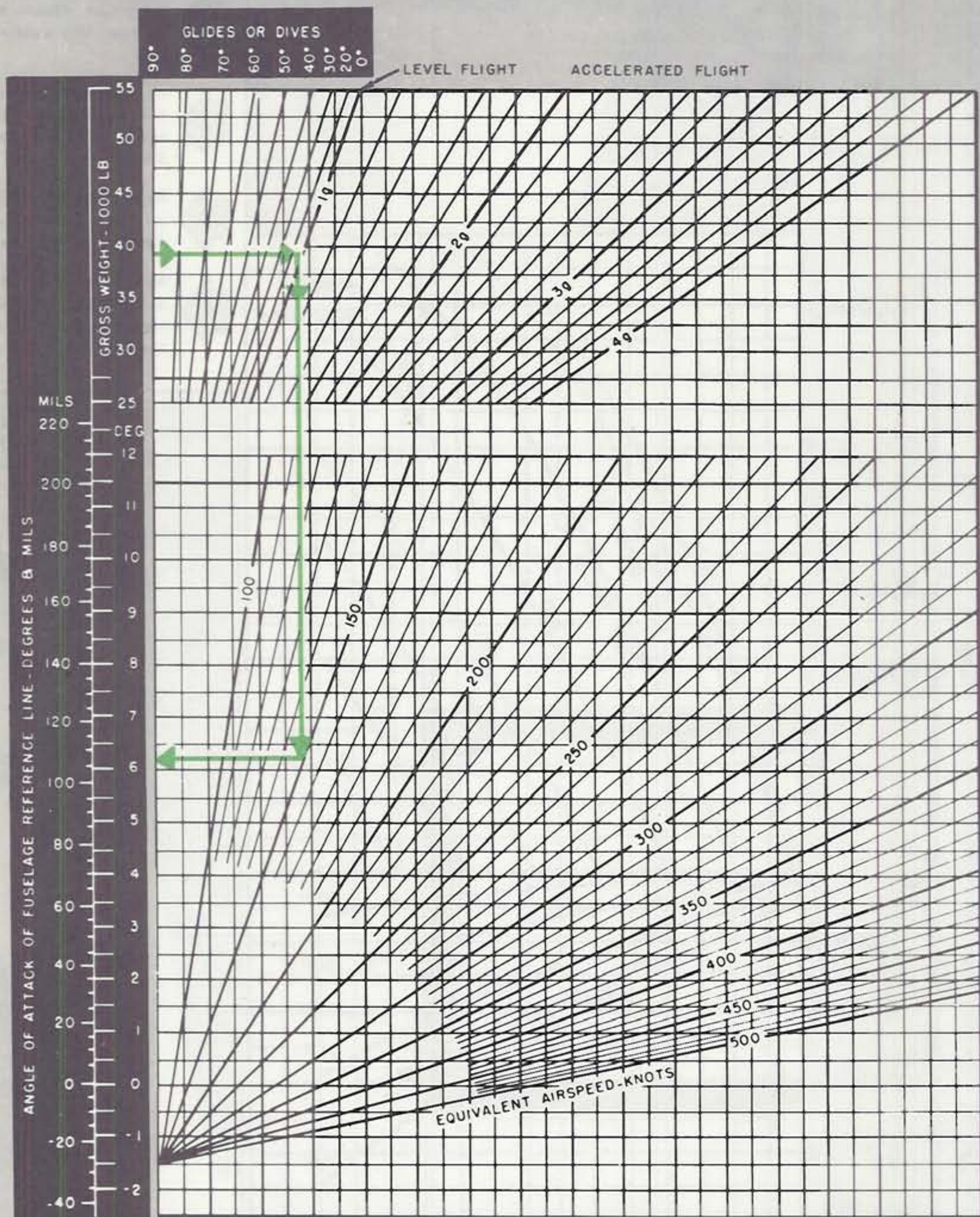


HOW TO USE CHART

1. Enter chart at altitude line nearest actual altitude at start of pull-out. (For example, 10,000 ft.)
2. On scale along altitude line, select point nearest the IAS at which pull-out is started (400 knots IAS).
3. Sight vertically down to point on curve of dive angle (90°) directly below airspeed.
4. Sight back horizontally to scale at left to read altitude lost during pull-out. (Constant 4G pull-out—6250 ft.)

Figure 6-3.

ANGLE OF ATTACK RELATIONSHIP CURVE



NOTE! (1) FUSELAGE REFERENCE LINE IS A WATER LINE
(2) SUBTRACT 1.0° (17.5 NAVY MILS) TO OBTAIN ARMAMENT DATUM LINE

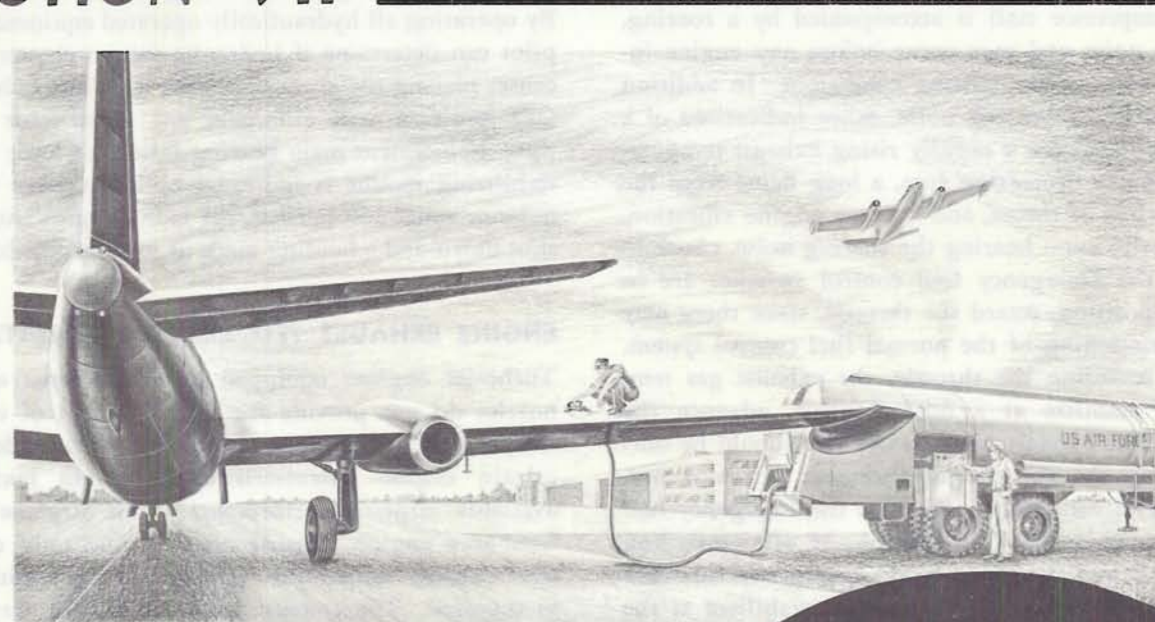
EXAMPLE

IF YOU ARE FLYING LEVEL AT 150 KNOTS EAS AT SEA LEVEL AND WITH A GROSS WEIGHT OF APPROXIMAMATELY 40,000 POUNDS, THE ANGLE OF ATTACK IS 6.35 DEGREES

3243A

Figure 6–4.

SECTION VII



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SYSTEMS OPERATION

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ENGINE.

ENGINE ACCELERATION.

The maximum permissible exhaust gas temperatures during an acceleration are given in Section V under ENGINE LIMITATIONS. If any of these limitations are exceeded during an acceleration, retard the throttle until the temperature has dropped below the steady-state limit. Then accelerate the engine slowly by advancing the throttle gradually so that the acceleration temperature limit is not exceeded.

FUEL FLOW FLUCTUATION.

In the event of fuel flow fluctuation accompanied by engine surge and tail pipe temperature fluctuations at approximately 80% engine rpm, the surge may be reduced by changing the engine power setting and/or turning off the generator on the affected engine.

COMPRESSOR STALL.

The possibility of compressor stall is practically eliminated by the acceleration control unit during operation of the normal fuel control. Compressor stall may occur after any rapid advancement of the throttle if one of the following conditions prevails: a malfunction in the normal fuel control system or the emergency fuel control system in manual operation. If the emergency fuel control system is in manual operation, rapid throttle advancements inject more fuel into the combustion chamber than the engine can utilize for acceleration at the existing rpm. As this additional fuel burns, the combustion pressures increase. Due to these increases in pressure, there is a corresponding increase in the pressures against the compressor discharge air. This increase of compressor discharge air pressure results in a breakdown of the airflow through the last stages of the compressor. This condition is known as a compressor stall. As a result of this stall, the mass airflow through the compressor is reduced and causes a reduction in airflow through the turbine, thereby decreasing the energy available to the turbine wheel. If the engine is allowed to maintain operation in this stalled condition, the temperatures of the burning gases will increase until engine failure occurs as a result of damage to the turbine. Compressor stall is accompanied by a roaring, pulsating noise and may occur before any engine instrument reflects the existing conditions. In addition to the roaring, pulsating noise, other indications of a compressor stall are a rapidly rising exhaust temperature, steady or decreasing rpm, a long flame from the tail pipe, loss of thrust, and a heavy engine vibration. Immediately, upon hearing the roaring noise, check to see that the emergency fuel control switches are in the OFF position, retard the throttle, since there may be malfunctioning of the normal fuel control system. If, after retarding the throttle, the exhaust gas temperatures stabilize at a normal value, advance the throttle. The exhaust temperature rise should be normal during the throttle advancement. If is is not, retard the throttle again and place the emergency fuel control switch to the ON position. If, after retarding the throttle and switching to the emergency fuel control system, the exhaust temperature stabilizes at the normal value, slowly advance the throttle. If the exhaust temperature continues to drop off after retarding the throttle, flame-out has occurred and an air start should be attempted.

FLAME-OUT.

Flame-out is exactly what the name implies and can occur during acceleration or deceleration of the engine. Acceleration flame-out, like compressor stall, results when more fuel is injected into the combustion chamber than the engine can utilize for acceleration at the existing rpm. The difference is that the mixture which is ejected into the combustion chamber is so excessively rich that it cannot burn, thereby extinguishing the flame. Flame-out may also occur during rapid engine decelerations when the amount of fuel injected into the combustion chamber may be too lean to sustain combustion at the existing rpm. Flame-out is indicated by loss of thrust, drop in exhaust temperature, and possibly by loud noise similar to engine torching. If flame-out occurs, the throttle should be placed in the OFF position and an air start attempted.

ENGINE NOISE AND ROUGHNESS.

Any unusual noise or roughness noticed in flight that can be attributed to the engine and cannot be eliminated by variations in engine speed or altitude, indicate that some mechanical failure is present. Certain flight checks can be performed to ascertain the ailing element by a process of elimination. If the roughness is magnified by placing a 2-to-4-G load upon the aircraft, a main bearing failure is in process. If the roughness disappears when the G-load is imposed but returns when the aircraft is in straight and level flight, a loose engine stabilizing mount is indicated. By operating all hydraulically operated equipment, the pilot can determine if hydraulic system chatter is the cause; placing the gun compressor toggle switch in the OFF position will eliminate any compressor vibration. If incipient main bearing failure or loose engine stabilizing mount is indicated or if excessive engine noise or roughness persists, the faulty engine should be shut down and a landing made as soon as possible.

ENGINE EXHAUST TEMPERATURE VARIATION.

Turbo-jet engines equipped with fixed-area exhaust nozzles do not provide for direct control of exhaust temperature. Therefore, the pilot must understand certain engine characteristics to obtain maximum available airplane performance. This airplane has a fixed-area engine exhaust nozzle. The only control over exhaust temperature is to adjust the engine rpm as required. The exhaust temperature will vary with changes in the temperature and density of the engine inlet air, as well as with changing thermal conditions within the engine. Generally an increase in outside temperature or a decrease in altitude causes an increase in the exhaust temperature, while an increase in airspeed decreases the exhaust temperature. As all three factors can change singly or together, the effect on exhaust temperature will not be consistent for any given rpm. Exhaust temperature may be expected to be relatively high at 100 percent rpm when the airplane is not moving, but as the airspeed increases during a take-off run, the exhaust temperature will drop well below the maximum operating limit. Since take-offs are made with unstabilized engines, the exhaust temperature will remain below the maximum until it stabilizes at steady-state operation. If the exhaust temperature should rise above the maximum after the engine has stabilized, it will be necessary to retard the throttle to bring the temperature down to normal.

SMOKE FROM TURBINES DURING SHUTDOWN.

During engine shutdown, fuel may accumulate in the turbine housing where the heat of the turbine section may cause the fuel to boil. Although drains are provided for this accumulated fuel, some fuel may remain. The presence of this residual fuel in the engine will be indicated by emission of fuel vapor or smoke from the tail pipe or the intake duct, depending on the ground wind conditions. Boiling fuel, which is indicated by the presence of white fuel vapor, is not injurious to the engine but does create a hazard to personnel since the vapor may ignite with explosive violence if allowed to accumulate. Therefore, all personnel should keep clear of the tail pipe for at least

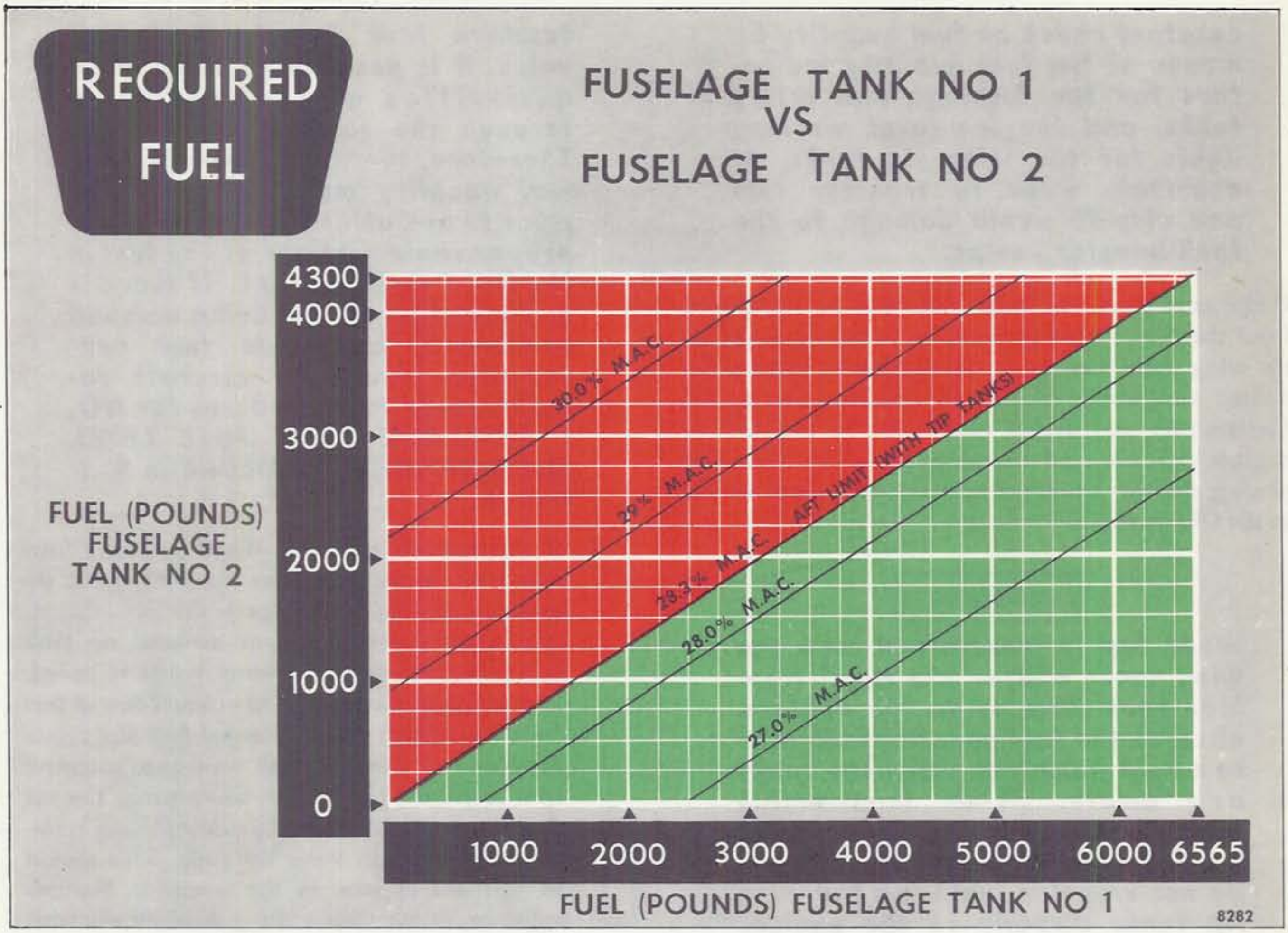


Figure 7-1.

three minutes after shutting down the engine and keep away at all times when fuel vapor or smoke issues from the engine. The appearance of black smoke coming out of the tail pipe indicates that fuel is burning and should be eliminated immediately by means of a CO_2 extinguisher since the burning fuel may cause serious damage to the engine.

FUEL MANAGEMENT.

CAUTION

Observe strict adherence to the fuel management procedures in this section in order to maintain the most favorable and safest flight condition. Refer to CENTER-OF-GRAVITY LIMITATIONS in Section V.

The No. 1 fuselage tank is the main service tank to which fuel is normally transferred. Under normal conditions, fuel is transferred to the No. 1 fuselage tank from all other tanks and then supplied to the engine. This is done for two reasons: first, to insure that the most favorable CG conditions exist at all times; and second, to assure that the No. 1 fuselage tank is as full as possible at all times since this is the only tank that supplies fuel to the engines in the event of total electrical failure. See figure 7-1 for fuel required in the NO. 1 fuselage tank versus the NO. 2 fuselage tank. When transferring fuel to the No. 1 fuselage tank, the No. 1 fuselage tank fuel level shutoff valve controls the tank fuel level and prevents overfilling. As a safety precaution, the fuel transfer and bypass valve knob, the No. 1 fuselage tank booster pumps switch, and the engine valve knobs are safetied in the operating positions, with light gage safety wire to permit breaking the wire and using these controls under emergency conditions.

CAUTION

Since the fuel system is controlled manually, the pilot must keep a

constant check on fuel quantity by means of the fuel quantity indicators for the fuselage and wing tanks, and the low-level warning lights for the wing tip tanks, to ascertain when to transfer fuel and also to avoid damage to the tank booster pumps.

Under emergency conditions, fuel may be transferred from the No. 2 fuselage tank, the wing tip tanks, or the wing tanks directly to the engines by placing the desired tank knobs in the flow position, placing the fuel transfer and bypass valve knob in the flow to engines position, and breaking the safety wire and placing the No. 1 fuselage tank booster pumps switch in the OFF position.

CAUTION

When fuel is transferred from the wing tanks and/or the No. 2 fuselage tank directly to the engines, observe the fuel quantity indicator to avoid flame-out when the tanks are empty. When transferring from the wing tip tanks watch for low level warning light to come on. Do not transfer fuel from the wing tip tanks directly to the engines except in cases of extreme emergency. The tip tanks delivery rate is sufficient for satisfactory engine operation only at low power and at low altitudes.

For a normally loaded airplane with full fuel tanks proceed as follows:

1. Supply fuel to both engines from the No. 1 fuselage tank for the entire mission.
2. Transfer the fuel in No. 2 fuselage tank to the No. 1 fuselage tank. Start the transfer of fuel from the No. 2 fuselage tank to the No. 1 fuselage tank as part of the engine starting procedure and assure prior to take-off that the No. 2 fuselage tank is replenishing fuel being used from the No. 1 fuselage tank. (See STARTING ENGINES in Section II.) The fuel transfer continues until the fuel supply in No. 2 fuselage tank is exhausted. This insures that the most favorable CG conditions exist at all times.

CAUTION

In the event of failure of the No. 1 fuselage tank fuel level shut-off valve, it is possible to dump large quantities of fuel overboard through the fuselage vent mast. Therefore, the No. 1 fuselage tank fuel quantity must be monitored prior to and after take-off to insure proper replenishment of the fuel in the No. 1 fuselage tank. If there is an indication of fuel being dumped overboard (excessive fuel consumption, tower or aircraft report), refer to procedures for NO. 1 FUSELAGE TANK FUEL LEVEL SHUT-OFF VALVE FAILURE in Section III.

3. If tip tanks are installed. When the No. 2 fuselage tank is empty transfer the fuel in the tip tanks to the No. 1 fuselage tank. An inherent characteristic of air pressure actuated tip tank fuel transfer systems is a sensitiveness to out-of-level attitude which causes an unequal flow of fuel from the two tip tanks. Unequal flow also causes out-of-lateral trim and may necessitate extensive trim correction to raise the heavy wing. Correct the out-of-trim condition by discontinuing transfer from the light wing tip tank. This should be initiated as soon as the condition becomes apparent, rather than waiting until all available trim is used. If trim does not return to neutral in five minutes, a failure of the fuel transfer system on the heavy side is indicated. Check that the fuel system circuit breakers and controls are in the proper position. If no fuel flow from the tip tanks is indicated after this check, follow the procedures for WING TIP TANK FUEL SYSTEM FAILURE in Section III.
4. Transfer the fuel in the bomb-bay tanks (if installed) to the No. 1 fuselage tank.
5. When the wing tip tanks (if installed, otherwise the No. 2 fuselage tank) are empty transfer the fuel in the wing tanks to the No. 1 fuselage tank.
6. Use fuel remaining in No. 1 fuselage tank.

Note

The above procedure may result in the loss of not more than 70 gallons of fuel from the wing tank vents during take-off and climb. For maximum range, it may be desirable to avoid any loss of fuel by transferring fuel from the wing tanks before take-off. However, this procedure is not recommended for normal operation.

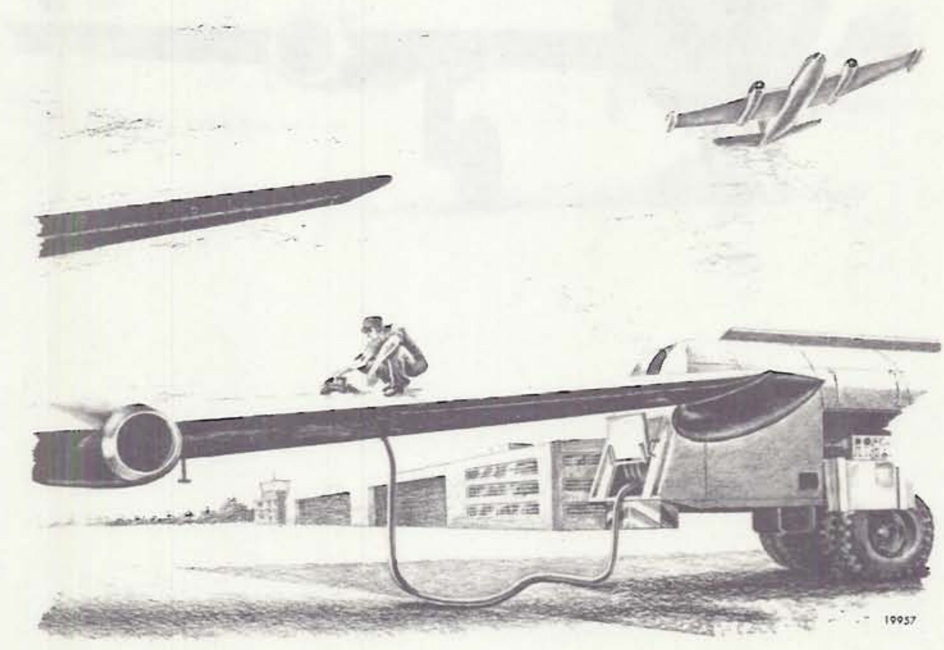
AUTOMATIC OPENING SEAT BELT AND PARACHUTE.

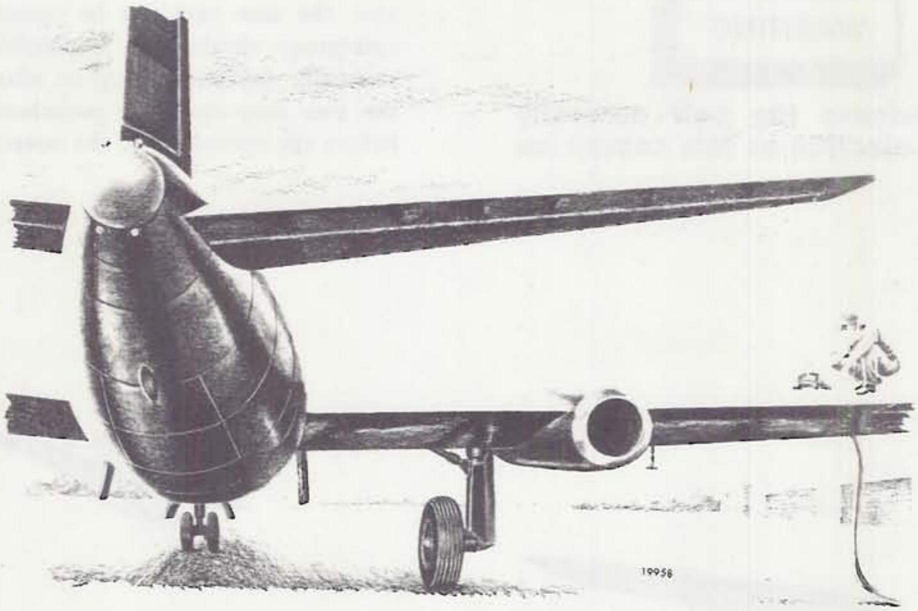
The purpose of the automatic opening seat belt and parachute is to extend the maximum and minimum altitudes for successful escape with the ejection seat. During a low altitude ejection, the use of the automatic belt reduces the time required for separation from the seat and the opening of an automatically opening parachute. During a high altitude ejection, using the automatic belt and parachute avoids the opening of the parachute at an altitude where the lack of oxygen would reduce the possibility of a safe descent. Also, the automatic belt retains the occupant in the seat for a sufficient length of time (2.5 seconds) to take advantage of the slower rate of deceleration caused by the combined weight of the seat and occupant.

WARNING

Never release the belt manually prior to ejection as this causes immediate separation of the seat and occupant. At high speed without the protection of the seat, the parachute could open inadvertently: and the opening shock of the parachute may cause fatal injuries. If the belt fails to open automatically after ejection, the occupant can manually release the belt and, under these circumstances, the occupant MUST open the parachute manually.

There may be a tendency for the user to distrust the automatic equipment; however, the automatic belt and parachute have been tested thoroughly and are completely reliable. The best human reaction is slower than the operation of the automatic belt; also, the user may not be conscious after an actual emergency ejection. It is possible to releae the belt manually anytime during or after ejection; likewise, the user may open the parachute manually anytime before the operation of the aneroid-release device.

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SECTION VIII

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CREW DUTIES

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CREW DUTIES.

Each crew member has primary and alternate duties. The primary duties of the crew member are explained by his title. Each member has additional duties which must performed to insure proper flight of the airplane and to support crew safety during ground operation and flight.

It is your individual responsibility to be familiar with each item of equipment and to be able to inspect it thoroughly for any irregularities. Don't let this inspection become so routine that you check it off as completed without doing a thorough job of it. Remember it is not just your life that is at stake but also the life of your crew member and the success of your mission.

PILOT.

The pilot is responsible for the issuance of all instructions governing flight operation. His duties and functions are given in NORMAL PROCEDURES, Section II. His responsibilities with regard to formal crew briefing are discussed in the following paragraphs.

PILOT'S RESPONSIBILITIES.

A formal crew briefing should be conducted by the pilot as soon as possible after detailed mission planning. The first item that the pilot should cover in his crew briefing is a recapitulation of the mission plan to insure that the observer is completely familiar with the requirements. In case there is any doubt in the observer's mind, the pilot should completely review that phase of the mission. He should discuss personal equipment that will be carried, and before dismissing the observer he should once again check to make certain that the observer is aware of the schedule for reporting to the airplane and of take-off time. If the pilot has paid close attention to the pre-mission planning and has conducted his briefing well, one of the most difficult phases of flying a mission will have been accomplished successfully.

PERSONAL EQUIPMENT REQUIREMENTS.

Personal equipment plays such an important part in the safety and comfort of the crew that the pilot must never assume that the observer is adequately equipped. It is his responsibility prior to flight to make certain that the observer knows what equipment he must carry, and he will perform a formal inspection before boarding the aircraft. In the briefing that will be attended prior to flight, either the operations officer or the pilot will specify the equipment that will be needed for the flight.

Common sense will tell you that if you are scheduled for any altitude work you will need heavy clothing, oxygen equipment, and bail-out bottles plus your normal gear. Keep the cabin heat down when flying over cold regions so that the crew may wear their heavy clothing in comfort. In this manner, if an emergency occurs, the crew will be properly clothed for survival.

OBSERVER.

The primary duties of the observer are photography and navigation. A complete discussion of the photographic equipment is given under PHOTOGRAPHIC EQUIPMENT in Section IV.

MAIN ELECTRICAL DISTRIBUTION CENTER FUSE PANEL.

The main electrical distribution center is to the left of the observer's seat. The observer may gain access to the distribution center by opening the side panel which is held in place by a number of wing-type dzus fasteners. The side panel opens as a door or is completely removable. In the distribution center there are approximately 95 fuses which are replaceable in the event of an emergency or failure of an electrical circuit. Figure 8-1 is a general layout of the fuse panel. A spare fuse bag to the right of the observer contains approximately 50 fuses. The spare fuses cover all types and values that are installed in the distribution center. On the inside of the removable panel of the distribution center is a fuse index (figure 8-2). The index gives the location and name of each circuit on the fuse panel. Figure 8-2 shows only a representative type as the index in each aircraft will vary with the modifications incorporated.

OBSERVER'S RESPONSIBILITIES.

The photographic controls are located in the observer's station, the visual observation station, and on the hinged photo panel, located on the right side of the flight station. The navigation equipment consists of AN/APN-84 Shoran equipment, mounted on the left side of the observer's compartment; a periscopic sextant, mounted in the observer's escape hatch; and a driftmeter, located in the visual observation station. Those duties of the observer which are in addition to his primary duties are given below.

ON ENTERING AIRPLANE.

INTERIOR CHECK (ALL FLIGHTS).

Fire Extinguisher	Stowed
Crash Axe	Stowed
First Aid Kit	Stowed
Driftmeter	Installed and check lights
Periscopic Sextant	Stowed and inspected
Hatch Detonator Circuit Breaker	In
Hinged Photo Panel All Controls	OFF
Master Camera Control Switches	OFF
Camera Compartment Temperature Control Switch	OFF
Main Radio Distribution Box Circuit Breakers	In
Observer's Altimeter	Set
Observer's Clock	Wound and set
Seat Safety Pins	Removed and stowed
Radio and Interphone	OFF
Seat Belt and Harness	Adjusted

INTERIOR CHECK (NIGHT FLIGHTS).

For night operation, the same preceding checks must be performed and the following are to be added.

All Lights	
Observer's Station	Check
Visual Observation Station	Check

Note

Spare bulbs are carried in a kit which is located above and to the right of the observer's ejection seat.

BEFORE TAXIING.

Radio and Interphone	On

Camera Compartment Temperature Control Switch	TEMP CONT

BEFORE TAKE-OFF.

Inertia Reel	Unlocked

DURING FLIGHT.

It is assumed that the observer fully understands his duties as a photographer and a navigator. All photographic equipment and its controls peculiar to this airplane are described under PHOTOGRAPHIC EQUIPMENT in Section IV.

The observer is also responsible for the operation of the wire recorder. When he wants to record the conversation on the interphones, he places the switch on the wire recorder panel, located on his right console, to the ON position.

TRAFFIC PATTERN CHECK LIST.

Hinged Photo Panel All Controls	OFF
Master Camera Control Switches	OFF
Safety Belt and Harness	Secure
Inertia Reel	Unlocked

BEFORE LEAVING AIRPLANE.

Periscopic Sextant	Stowed
Camera Compartment Temperature Control Switch	OFF
Radio and Interphone	OFF
All Lights	
Observer's Station	OFF
Visual Observation Station	OFF
Seat Safety Pins	Installed

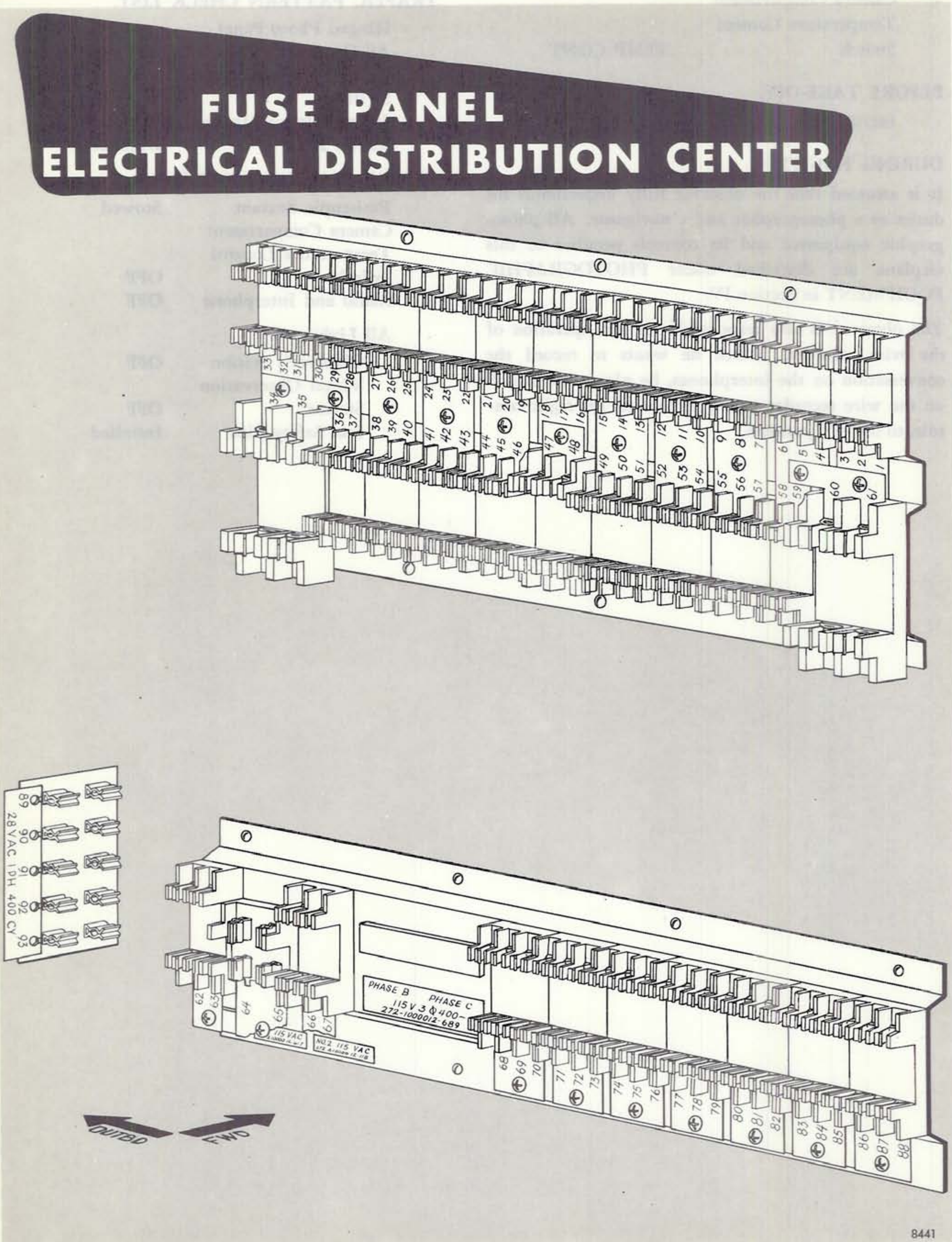
FUSE PANEL
ELECTRICAL DISTRIBUTION CENTER
28 VAC 1 PH 400 CY
PHASE B PHASE C
115 V 3 Φ 400~
272-100012-689
OUTBD
FWD
8441

Figure 8-1.

FUSE INDEX

FUSE INDEX

1	5 AMP ARMAMENT CONTROL
2	30 AMP ARMAMENT POWER
3	5 AMP BOMB DOOR POWER
4	5 AMP WING FLAP CONTROL
5	10 AMP RUDDER TRIM TAB CONTROL
6	
7	5 AMP DIVE BRAKE CONTROL
8	5 AMP LANDING GEAR LEVER LOCK
9	5 AMP FREE AIR TEMPERATURE
10	5 AMP HORIZONTAL STAB INDICATOR
11	5 AMP RUDDER TRIM TAB INDICATOR
12	5 AMP AILERON TRIM TAB IND
13	5 AMP WING FLAP POS INDICATOR
14	20 AMP CAMERA DOOR
15	5 AMP TURN & BANK INDICATOR
16	5 AMP DRIFTMETER VACUUM CONT
17	5 AMP FIRE & OVERHEAT DET
***18	5 AMP HYD SHUT-OFF VALVE ENG 1
***19	5 AMP HYD SHUT-OFF VALVE ENG 2
20	5 AMP CABIN AIR CONDITIONING
21	5 AMP DEMISTING SYSTEM
22	5 AMP CLEAR VISION PANEL
23	5 AMP SEXTANT LIGHTS
24	10 AMP EXTERIOR LIGHTS
25	5 AMP LANDING LIGHT CONTROL
26	5 AMP TAXI LIGHTS
27	5 AMP CREW COMPT DOME LIGHTS
28	5 AMP PILOT'S RED FLOODLIGHTS
29	10 AMP PILOT'S THUNDERSTORM LT
30	5 AMP OB'S RED FLOODLIGHTS
31	5 AMP OB'S WHITE FLOODLIGHTS
32	5 AMP VIS. OB'S RED FLOODLIGHTS
33	5 AMP DRIFTMETER LIGHT CONT
34	80 AMP DISTRIBUTION BUS POWER
35	80 AMP DISTRIBUTION BUS POWER
36	10 AMP CARTRIDGE EJECTOR LEFT
37	10 AMP CARTRIDGE EJECTOR RIGHT
38	5 AMP FUEL QUANTITY
*39	5 AMP GEN 1L FIELD RESET
40	5 AMP GEN 1R FIELD RESET
41	5 AMP GEN 2L FIELD RESET
42	5 AMP GEN 2R FIELD RESET
43	5 AMP VM & GEN INDICATOR LT
44	5 AMP RADIO INDICATOR LT TEST
45	10 AMP FUEL PURGE
46	10 AMP FUEL PURGE
47	50 AMP PILOT'S CKT BREAKER BUS

48	50 AMP CAMERA MAIN POWER
49	5 AMP TIP TANK LOW LEVEL IND LT
50	10 AMP WING TIP TANK JETTISON
51	5 AMP PILOT'S OXYGEN INDICATOR
52	5 AMP OB'S & VIS OB'S OXYGEN IND
53	5 AMP INSTRUMENT INVERTER CONT
54	5 AMP CAMERA MAIN CONTROL
55	5 AMP OB'S INST PANEL VIBRATOR
56	5 AMP PLT INST PANEL VIBRATOR
57	5 AMP HOR STAB SPEED CONTROL
58	
59	
60	80 AMP DISTRIBUTION BUS POWER
61	80 AMP DISTRIBUTION BUS POWER
62	5 AMP FUEL QUANTITY
63	5 AMP A-28 CAMERA MOUNT **
64	1 AMP 115V TO 28V TRANS
65	
66	5 AMP NIGHT CAMERA POWER
67	
68	5 AMP CAMERA COMPT TEMP IND
69	20 AMP NIGHT CAMERA POWER
70	20 AMP SPLIT VERT DAY CAMERA
71	
72	10 AMP VERTICAL DAY CAMERA
73	10 AMP CAMERA CONTROL
74	
75	
76	10 AMP CAMERA COMPT TEMP CONT
77	5 AMP CAMERA COMPT VACUUM CONT
78	
79	
80	5 AMP EXT STORES RELEASE CONT
81	20 AMP EXT STORES & BOMB ARMING
82	5 AMP BOMB RELEASE POWER
83	5 AMP BOMB INDICATOR LIGHTS
84	5 AMP BOMB DOOR CONTROL
85	20 AMP EXT STORES RELEASE PWR
86	
87	5 AMP EXT STORES INDICATOR LT
88	
89	1 AMP OIL PRESSURE IND ENG 1
90	1 AMP OIL PRESSURE IND ENG 2
91	1 AMP FUEL FLOW IND ENG 1
92	1 AMP FUEL FLOW IND ENG 2
93	1 AMP HYDRAULIC PRESSURE IND

NOTES

*Provisions only

**On airplanes AF 1459 thru 1492

***Group B airplanes

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Figure 8-2.


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SECTION IX

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Flying the RB–57A type aircraft in instrument weather conditions requires instrument proficiency and thorough preflight planning. In planning for instrument flight, remember that fuel requirements for completion of an instrument letdown and approach procedures must be taken into consideration. Therefore, maximum range and endurance are reduced accordingly. The airplane has good stability characteristics and flight handling qualities for bad-weather flying. The limitations on the aircraft result primarily from the lack of navigational aids and anti-icing provisions. Except for some repetition necessary for emphasis or continuity of thought, this section contains only those procedures that differ from, or are in addition to, the normal operating instructions covered in Section II.

INSTRUMENT FLIGHT PROCEDURES.

ON ENTERING THE AIRCRAFT.

1. External Power—ON.
2. Inverters—ON.
3. Clear Vision Panel Heat—ON.
4. APX-6 IFF Beacon—STANDBY, if use is anticipated.
5. Radio Compass—Check all positions. Set to first enroute station frequency or to local approach radio fix station frequency.
6. UHF Radio—Check all channels pertinent to instrument flight.
7. Pitot Heater—Check operation (with crew chief).
8. Delay engine start until immediate take-off is assured. It is advantageous to perform as many operations as possible, including ARTC approval and clearance, before starting engines in order to conserve fuel.

TAXIING.

Turn-and-Bank Indicator—Check operation during taxi turns.

BEFORE TAKE-OFF.

1. Attitude Indicator—Check operation and adjust the miniature airplane to align with the zero indices.
2. Set the runway heading to the top of the heading indicator.
3. Pitot Heater—ON, if required.

TAKE-OFF AND INITIAL CLIMB PROCEDURE.

1. At approximately 90K during take-off roll, raise the nose one bar width above the horizon bar and allow the airplane to fly off (130 to 140K).
2. Gear UP, when the upward trend of both the altimeter and rate-of-climb indicator indicates that the aircraft is definitely climbing.

CAUTION

Maintain airspeed below 200K until the gear locks up (approximately 7 to 10 seconds).

3. Maintain take-off attitude until the airplane accelerates to best climb speed and anticipate a rate of climb of approximately 4,000 feet per minute at 96% rpm.

TURNS.

To keep control forces down and reduce pilot's workload, the maximum angle of bank in climbing and level turns should be limited to 30°.

COMMUNICATION AND NAVIGATION EQUIPMENT.

The AN/ARN-6 radio compass is susceptible to precipitation static. Switching to the loop position and rotating the needle 90° to the station, and/or reducing IAS, and/or changing altitude usually improve the reception. Compass installations with the internal sense antenna do not present a reliable indication of station passage above 10,000 feet. The final needle swing may not occur until approximately 22 nautical miles after passing over the station at 40,000 feet. Station passage information is greatly improved on those airplanes with the external blade sense antenna.

DESCENTS.

The optimum power setting for fuel economy during descent is IDLE. The recommended descent airspeed is 300K or .78 Mach (whichever is lower), with a clean configuration and dive brakes extended. Increasing the descent airspeed for a higher rate of descent through icing layers slightly reduces the handling characteristics. Decreasing the descent airspeed for more comfortable turbulence penetration results in a small penalty in fuel consumption. Normally, 45° of bank is the limit for high-speed descending turns.

INSTRUMENT LOITERING AND HOLDING (MAXIMUM ENDURANCE).

For airspeeds, refer to the maximum endurance charts in Appendix I. When making turns during instrument loiter, add power as necessary to hold the recommended IAS.

INSTRUMENT APPROACHES.

The stability and handling characteristics for instrument flight are excellent in all configurations; however the dive brakes are not effective at low airspeeds and their use is not recommended for approach patterns. The use of wing flaps is not recommended for instrument approaches other than GCA final, due to the fuel penalty and buffeting encountered. Visibility in moderate precipitation is good. Letdowns and approaches on a single engine can be made satisfactorily. Normal penetrations can be made from initial penetration altitude. Instrument final approaches must be done at speeds above 155 knots with flaps retracted. Go-around characteristics are satisfactory in this configuration. Refer to Radio Range, GCA approach and Go-around, and Single-Engine GCA Approach diagrams (figures 9-1, 9-2, and 9-3).

CAUTION

An indicated airspeed of 155 knots must be maintained on GCA final approach and glide slope to improve go-around characteristics in the event of an engine failure. A power increase of approximately 4% rpm is required to maintain the higher airspeed. Refer to figure 9-4 for approximate increase in roll-out.

For minimum landing roll, lower the nose and brake immediately. See figure 9-4 for landing roll distances.

RADAR RECOVERY.

The handling characteristics and stability of the aircraft in instrument conditions facilitate satisfactory radar recovery procedures. By using radar control for the letdown and the turn onto final approach (GCA), maximum economy of fuel and time can be realized. (See figures 9-5 and 9-6.)

RADIO RANGE AND JET PENETRATIONS.

If descending through icing layers, increase penetration speed to 350K to decrease time in icing conditions. If turbulence is anticipated, decrease penetration speed to 250K. (See figure 9-1.)

Penetration Turn—Use 90° turn method.

CAUTION

Actual altitude during high rate descents may be as much as 1000 feet lower than indicated altitude.

MISSED APPROACH GO-AROUND PROCEDURE.

Acceleration characteristics of the aircraft are excellent, and go-around procedure presents little difficulty.

1. Advance throttles to 100% rpm, level off, and check for acceleration. Be alert for asymmetrical power conditions resulting from uneven engine acceleration.
2. Retract flaps below 170K IAS and gear below 200K IAS.
3. Execute missed-approach procedure for the particular field.
4. Go-around on single engine can be made without loss of altitude at 155 knots IAS. At slower speeds, accelerate to at least 155 knots before attempting to hold altitude. From 135K, you will need approximately 400 feet to accelerate to 155 knots. Advance the throttle to at least 90 rpm as soon as possible and retract flaps and gear. As rudder control becomes more effective with increasing airspeed, advance the throttles to 100% rpm for climb.

GROUND CONTROL APPROACH (GCA).

The airplane has good handling qualities during ground control approaches. However, keep in mind that during heavy precipitation, the GCA controller may have some difficulty in keeping the airplane on the scope and this condition should be anticipated.

ICE, SNOW, AND RAIN.

Normally, the heaviest icing takes place in clouds with strong vertical currents (cumulus clouds, projections above strato-cumulus clouds, etc.). Icing conditions in stratus clouds are generally light to moderate; however, heavy icing conditions may occur in this type of cloud. Prolonged flights through moderate icing can build up as much ice as a short flight through heavy icing conditions. Icing may be expected when the temperature is between approximately −10°C (14°F) and 5°C (41°F) if fog is present or the dew point is within 4°C (7°F) of the ambient temperature. From 0°C (32°F) to approximately 5°C (41°F) and the dew point within 4°C (7°F) of the ambient temperature, conditions exist under which jet engine icing can occur without wing icing. The heaviest type of ice formation generally occurs about −5°C (23°F). There is no anti-icing equipment on this airplane except for the glass panel in the pilot's canopy. Therefore, if flight through icing conditions can be avoided, every effort should be made to do so. Ice can build up on the engine compressor inlet guide vanes when the airplane is flown through areas where icing conditions prevail and may occur when no evidence of ice can be visually detected on the airplane. Icing on the guide vanes restricts the flow of inlet air thus causing a loss of thrust and a rapid rise in exhaust gas temperature. The fuel control system attempts to control the loss in engine rpm by adding more fuel to the engine, thereby worsening the condition. Under severe icing conditions, engine failure can occur in four minutes or less. Therefore, to avoid engine icing proceed as follows:

1. Avoid flying into areas where icing conditions may prevail if at all possible.
2. If the ambient temperature is within the approximate range of 0°C (32°F) to 5°C (41°F) and sufficient moisture is present in the atmosphere, the speed of the airplane should be maintained at 250 knots TAS or above to prevent inlet duct icing due to the suction effect.
3. If actual icing is encountered (visible on the surface of the airplane), immediately proceed as follows:

a. Reduce airspeed, if practicable, to minimize the rate of ice build-up.
b. Change altitude rapidly by climb or descent in layer clouds or vary course as necessary to avoid cloud formation.
c. Maintain a close watch of exhaust gas temperature and reduce engine rpm as necessary to prevent excessive tailpipe temperature.

FLIGHT IN TURBULENCE AND THUNDERSTORMS.

WARNING

Do not attempt flight through thunderstorms unless there is no alternative.

Of course, there are occasions when flight through a thunderstorm cannot be avoided; however, a pilot who possesses the proper experience, common sense, and instrument flying proficiency can safely fly through a thunderstorm.

BEFORE TAKE-OFF.

1. Make a complete analysis of the existing and forecast weather conditions in order to determine thunderstorm areas and prepare a flight plan which will permit avoiding flight through thunderstorms.
2. Check the proper operation of all flight instruments, navigation equipment, pitot heater, instrument panel lights, and the clear vision and de-misting systems before undertaking any instrument flight and before attempting to fly through a thunderstorm area.

APPROACHING THE STORM.

Power settings and the attitude of the airplane are the keys to the proper flight technique in turbulent air. The power settings and airplane attitude required for desired penetration airspeed should be established before entering the storm. If these power settings and attitude are maintained throughout the storm, the result will be a constant airspeed regardless of any false reading of the airspeed indicator.

WARNING

When approaching a thunderstorm prepare the airplane to enter a zone of turbulent air.

The most turbulent area in a thunderstorm is generally found at altitudes between 10,000 and 20,000 feet. The least turbulence will usually be found above 30,000 feet or below 10,000 feet, and the recommended procedure is the penetration of a thunderstorm above or below these altitudes. Icing conditions are very common near the top of these storms and reference to such conditions will be found under ICE, SNOW, AND SLEET in this section. If the storm cannot be seen, its proximity can be approximately determined by radio crash static.

Use the following procedure to prepare the airplane for entry into the turbulent area:

1. Adjust throttles as necessary to obtain an airspeed derived from the extremely gusty air chart (figure 9-8).
2. Pitot heat switch ON.
3. Trim airplane.
4. Check gyro instruments.
5. Safety belt and shoulder harness tight, seat properly adjusted.
6. Turn off any radio equipment which may be rendered useless due to static.
7. Notify the crew.
8. Turn on the thunderstorm lights.

CAUTION

Do not lower the landing gear or flaps, as they will merely decrease the aerodynamic efficiency of the airplane.

IN THE STORM.

To maintain safe flight after entering the storm, follow the procedure given below:

1. Expect turbulence, precipitation, and lightning; do not allow them to cause undue concern.
2. Maintain power settings and attitude throughout the storm. If they are held constant, airspeed will remain constant regardless of the reading of the airspeed indicator.
3. Devote all attention to flying the airplane.
4. Concentrate principally on holding a level attitude by using the attitude gyro.
5. Maintain the original heading. Do not make any turns unless it is absolutely necessary.
6. Use as little elevator control as possible to maintain attitude in order to minimize stress on the airplane.

Note

The altimeter may be unreliable in thunderstorms due to differential barometric pressures. Therefore, allowance should be made for this error when determining minimum safe altitude, as it may amount to several thousand feet. The rate-of-climb indicator is of practically no value during periods of high turbulence.

NIGHT FLYING.

Night flying poses no particular problem except that the landing light must be used to supplement taxi lights for taxiing in dark areas.

COLD-WEATHER PROCEDURES.

Most cold-weather difficulties will be encountered on the ground. The following instructions are added to the normal operating procedures in Section II, and should be followed when operating in regions of extremely cold weather. Icing conditions in flight will not be covered here. They are discussed under ICE, SNOW, AND RAIN in this section.

BEFORE ENTERING THE AIRPLANE.

1. If the temperature is −29°C (−20°F), a normal start should be attempted and if unsuccessful, a second starting attempt should be made. Heat from the initial starting attempt should then allow a satisfactory start. If at all possible, cartridges which have been stored in a warm place should be used.
2. If the ambient temperature is −40°C (−40°F) or less, use a portable heater to blow hot air into the engine intake duct for 20-30 minutes to ensure a successful start and to prevent the starter from being damaged if ice has seized the compressor rotor.
3. Check that the pressurized cabin has been preheated if the temperature is below −18°C (0°F).
4. Inspect the fuel tank vents and the pitot tube and remove any ice which may be present.
5. Check the entire surface and landing gear of the airplane for freedom from frost, snow or ice. Brush off light snow or frost, and remove any ice which may have formed by using a direct flow of hot air from a portable heater.

CAUTION

Chipping or scraping ice may damage the airplane.

6. Check all visible hydraulic lines and fittings for signs of leakage.

ON ENTERING THE AIRPLANE.

1. Carefully check surface controls and trim devices for proper operation.
2. Operate the surface controls several times to insure that no ice has formed in the hinges.

STARTING ENGINES.

1. Start the engines in a normal manner.
2. If there is no oil pressure within 30 seconds after starting, or if the pressure drops after a few minutes of ground operation, shut down the engines and check for clogged oil lines.

Note

During cold weather starts, the oil pressure may temporarily exceed the maximum limits until the oil temperature approaches normal.

WARM-UP AND GROUND TESTS.

1. Inspect all instruments for normal operation.

CAUTION

Do not turn on unneeded electrical equipment until the generators show output.

2. Operate all the hydraulic circuits except the bomb door to check for proper operation.

TAXIING.

1. Keep the engines running at a high enough rpm to keep up the generator output while taxiing, as low temperatures decrease the battery output.
2. Increase the normal taxi interval between airplanes and reduce taxiing speed when approaching, or on ice or snow-covered area.

Note

Take extreme care when maneuvering near other aircraft, as the blast and heat may blow snow and slush which will freeze into ice on contact.

CAUTION

Do not taxi in deep snow or slush as steering will be more difficult and brakes, landing gear, and flaps are apt to freeze after take-off. Use extreme caution when taxiing on ice-covered taxi strips or runways as excessive speeds or cross-

winds can start a skid, and remember that brakes are ineffective on ice.

Note

Taxi time on snow and ice will be longer than under normal conditions; therefore, plan the shortest route to take-off to reduce fuel consumption.

BEFORE TAKE-OFF.

Note

The demisting system is to be on during take-off, flight, and landing.

CAUTION

Make sure that all snow is removed from the runway or is firmly packed. If snow has been removed from the runway, be sure that the banks are piled far enough from the runway to permit a safe take-off.

WARNING

Do not attempt a take-off with a badly frosted canopy and clear vision panel, or with snow, ice, or frost on the wings or control surfaces.

TAKE-OFF.

1. If precipitation is present or if icing conditions are expected during or immediately following take-off, place the pitot heat switch to ON.
2. Apply the brakes and advance the throttles to take-off power. If the airplane begins to slide before take-off power is reached, immediately release the brakes and commence the take-off.

Note

Continue the engine check during the early part of the take-off run. If any portion of the engine check is not satisfactory, retard the throttles and bring the airplane to a normal stop.

AFTER TAKE-OFF.

1. After take-off from a snow- or slush-covered field, operate the flaps and the landing gear several times to prevent their freezing in the up position.
2. Watch closely for icing on critical areas, and if ice begins to form, attempt flight in a more suitable area, if possible.

DURING FLIGHT.

CAUTION

Flight through icing areas should be avoided if it is possible, as the engines have no de-icing provisions and ice forming in the air intake ducts may cause engine failure due to the rise in exhaust gas temperatures.

1. Adjust cabin air selector switch to give the desired cabin temperature.
2. Under certain conditions, fog may form in the cabin and restrict visibility. If this should happen, turn the cabin air selector switch to the PRS ON position and place the cabin temperature switch in the HOT position until the fog clears.

DESCENT.

Note

Be sure the clear vision and demisting systems are on when beginning descent to avoid frost or ice from forming.

LANDING.

The landing will be performed in the same manner as a normal landing but because of thrust augmentation caused by extremely low temperatures, the approach must be made with a flatter glide than usual.

STOPPING ENGINES.

The engines are stopped in the normal manner.

BEFORE LEAVING AIRPLANE.

1. Have the shocks put in place so that the parking brake can be released. If moisture has entered the brake assembly around the brake shoe, leaving the parking brake released will forestall the possibility that the brakes will freeze in position.
2. Be sure that the airplane is serviced with fuel and oil and that the sumps are drained before the condensates reach the freezing point.
3. Have all engine, pitot tube, and landing gear covers installed if there is the slightest possibility of drifting snow.

4. If a layover of several days is anticipated, have the battery removed. If the temperature is −7°C (20°F), the battery should be removed if a layover of four hours or more is expected.

HOT-WEATHER PROCEDURES.

Successful hot weather operation will require attention and preparation other than the normal operating instructions covered in Section II.

CAUTION

Metal surfaces exposed to the sun will be burning hot to touch. Wear gloves to prevent burns.

1. Check tires and shock struts carefully to assure proper inflation. Overinflation is often encountered during high temperatures.
2. Check that all electrical equipment is completely dry. In areas where high humidity is encountered, equipment is subject to corrosion, fungus, and moisture absorption by non-metallic materials.
3. Check carefully for hydraulic leaks because heat and moisture can cause valves and packing to swell.

ON ENTERING AIRPLANE.

1. Place the cabin air selector switch in the RAM position for cabin ventilation.
2. If high humidity has caused moisture to form on the instruments and controls, direct a flow of warm air from a portable ground heater, if available, on the instruments and controls to dry them.

BEFORE STARTING ENGINES.

Check the take-off distances for the existing atmospheric conditions by using the charts in the Appendix.

STARTING ENGINES.

Start the engines in the normal manner.

Note

The engines will accelerate to idle rpm much more slowly on a hot day than on a normal or cold day.

TAXIING.

CAUTION

Use the brakes as little as possible, as high temperatures will retard cooling.

TAKE-OFF.

WARNING

Take-off distances in hot weather will show a considerable increase over the distance required during normal operation.

CLIMB.

Follow the normal climb pattern for the existing conditions.

Note

When the fuel in the tanks is warm, it is more susceptible to vaporization losses when climbing rapidly to altitude. To avoid this, the rate of climb should be held as low as possible.

DURING FLIGHT.

Under high temperature conditions, it will be necessary to increase rpm to obtain the desired Mach number-altitude combination for the best range performance.

DESCENT.

Use the normal descent procedure.

LANDING.

Use the normal landing technique, and remember that the ground roll will be longer than usual.

WARNING

During extremely high temperature it is essential that more strict adherence to the normal landing procedures be observed than at other times. This is due to the fact that the true airspeed is much higher than the indicated airspeed, thus causing the stall and touchdown speeds to be higher.

STOPPING ENGINES.

1. Stop the engines by using the normal procedure. release the parking brakes. This is to avoid releases the parking brakes. This is to avoid possible damage to the brake assemblies due to excessive heat generated during taxiing.

BEFORE LEAVING AIRPLANE.

1. Have the engine, canopy, and tire covers installed for protection from the sun.
2. Leave the cabin access door open for ventilation.
3. Have the fuel and oil tanks serviced.

DESERT PROCEDURES.

Desert operation with its high temperatures, blowing sand, and dust is considerably more difficult than the normal operation covered in Section II. Damage can occur to both the airplane and the engines if the extra precautions presented here are not observed.

BEFORE ENTERING AIRPLANE.

1. Check tires and shock struts for proper inflation. Overinflation is encountered often during high temperature conditions.

WARNING

If necessary, position the airplane so that the jet blast will not blow sand toward other airplanes or personnel. Sand blown by the engines can severely damage other airplanes and can also harm personnel.

2. Inspect all control surface hinges for sand and/or excess dust and, if present, have it removed.
3. Check the shock struts for sand and have it removed if present.
4. Remove all protective covers before entering the airplane.

ON ENTERING AIRPLANE.

1. Check all dials, flight controls, and switches for sand accumulation, and have them cleaned.
2. Place the cabin air selector switch in the RAM position for cabin ventilation.

BEFORE STARTING ENGINES.

1. Operate all control surfaces several times to be sure that they move freely and easily.
2. Check take-off distances in the Appendix for the existing conditions.

STARTING ENGINES.

1. Complete as much of the pre-flight as possible before starting the engines so that ground operation will be held to a minimum.
2. Start the engines by using the normal procedure.

Note

The engines will accelerate to idle rpm much more slowly on a hot day than on a cold one.

CAUTION

Get the airplane into the air as soon as possible after starting the engines so that dust and sand will not be drawn into the engines.

WARM-UP AND GROUND TESTS.

1. Be sure the airplane is clear of other airplanes and personnel before accelerating the engines.
2. The only warm-up period required is for the exhaust gas temperatures to stabilize.

TAXIING.

1. Use the brakes as little as possible, as cooling will be retarded by high temperatures.
2. Keep a sufficient taxi interval between other airplanes to prevent blowing sand into other engines.

TAKE-OFF.

Note

The take-off distance will be increased appreciably in high temperatures.

WARNING

It is necessary to adhere strictly to the suggested take-off and climbing speeds during hot weather operation since stalling speeds increases with temperature.

CLIMB.

Follow the normal climb procedure.

Note

Warm fuel is more susceptible to vaporization losses with rapid climbs. To avoid this condition, hold the rate of climb low.

CAUTION

Avoid flying through dust or sand storms as grit or dust will cause damage to the engines.

Under high temperature conditions it will be necessary to increase rpm to obtain desired Mach number-altitude combination for the best range performance.

DESCENT.

Use the normal descent procedure.

LANDING.

WARNING

During extremely high temperatures, it is more essential that strict adherence to the normal landing procedures be observed than at other times. This is due to the fact that the true airspeed is much higher than the indicated airspeed, thus causing the stalling and touchdown speeds to be higher.

Use the normal landing technique and remember that the ground roll will be longer than usual.

STOPPING ENGINES.

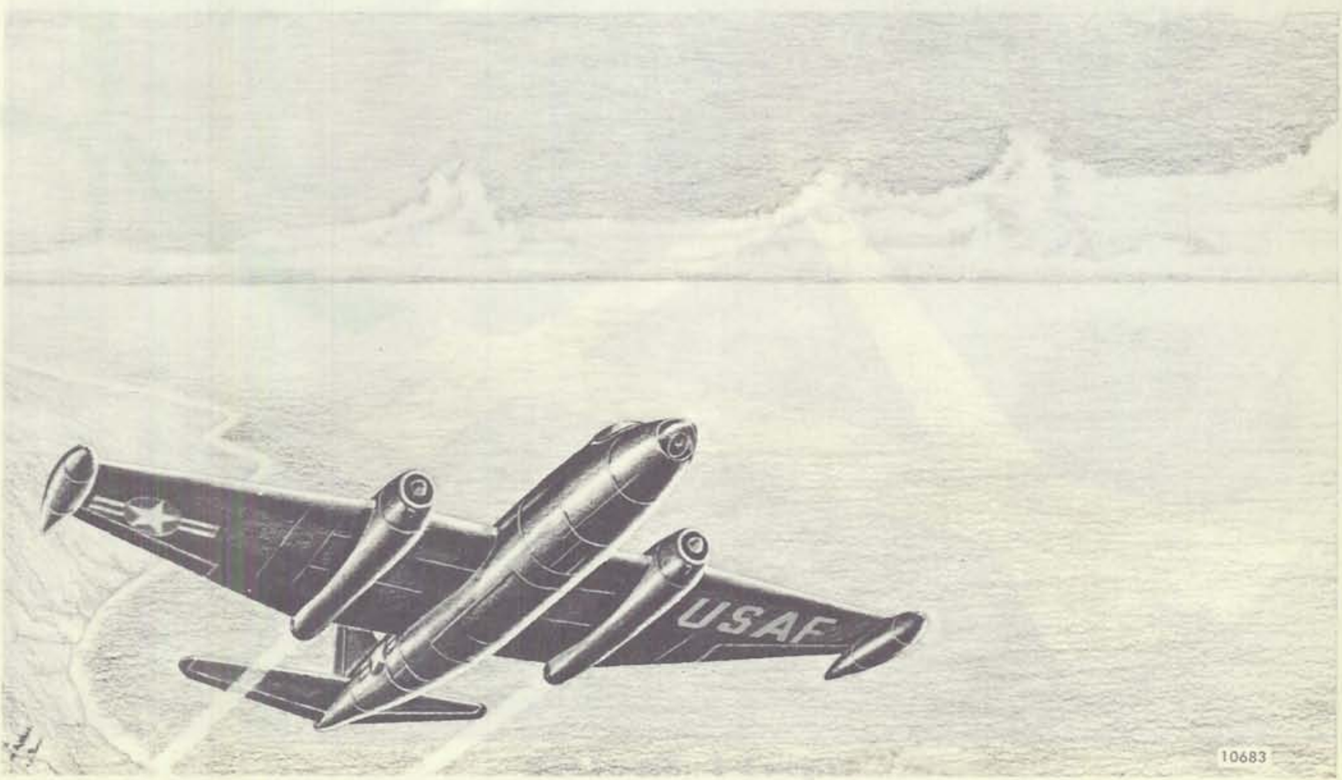
1. When the airplane is taxied to a parking position, shut down the engines at once.
2. Have the shocks put in place and release the parking brakes as soon as possible, as the brake assemblies may be damaged due to excess heat generated by taxiing.
3. Have the engine, wheel, pitot tube and canopy covers installed immediately.

BEFORE LEAVING AIRPLANE.

1. Check that all covers are installed.
2. Leave the access door to the flight compartment partially open for ventilation.

Note

In extremely dusty locations where it is necessary to leave the access door open for ventilation purposes, all equipment in the cabin should be protected with dust covers.



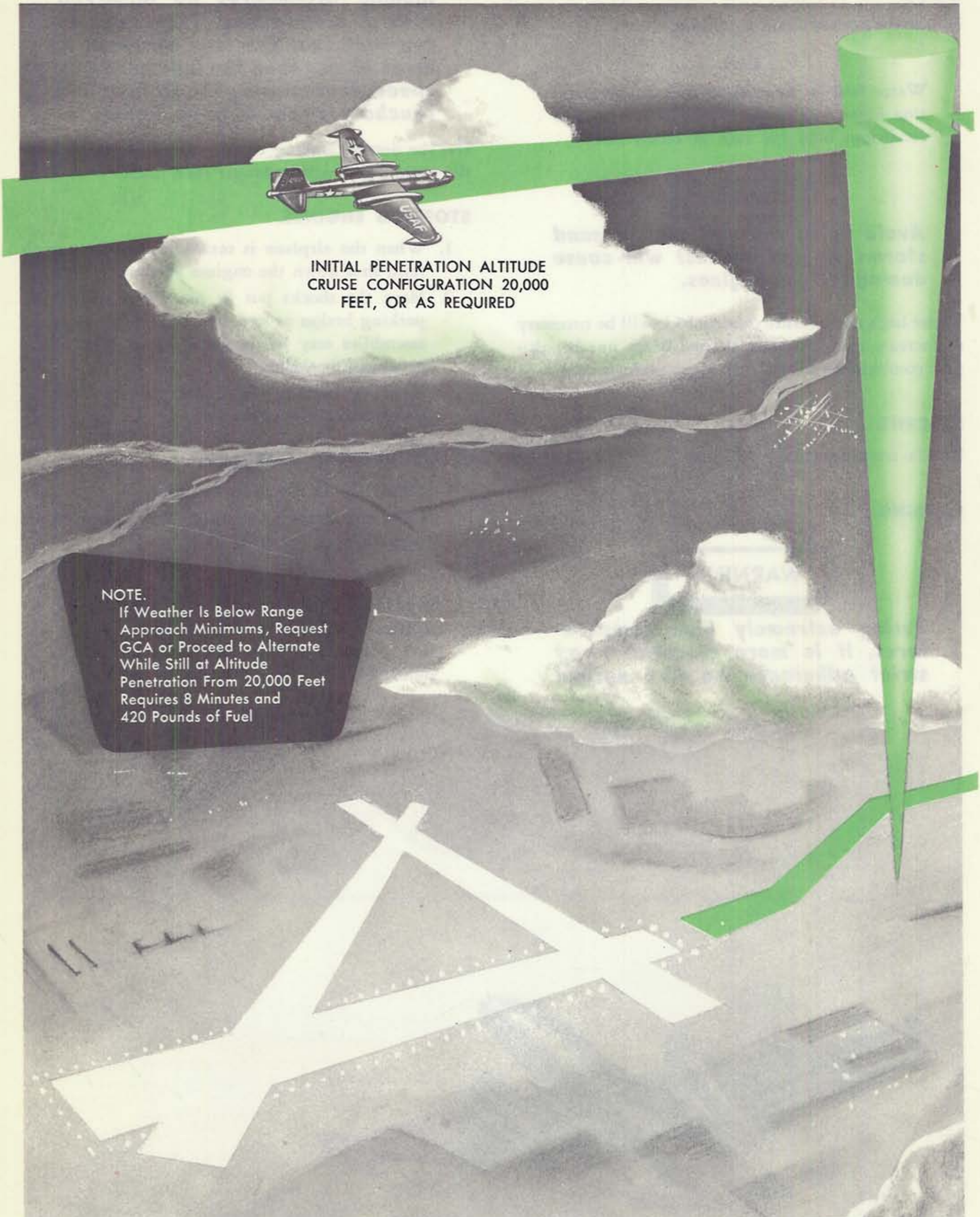


Figure 9-1. (Sheet 1 of 2)

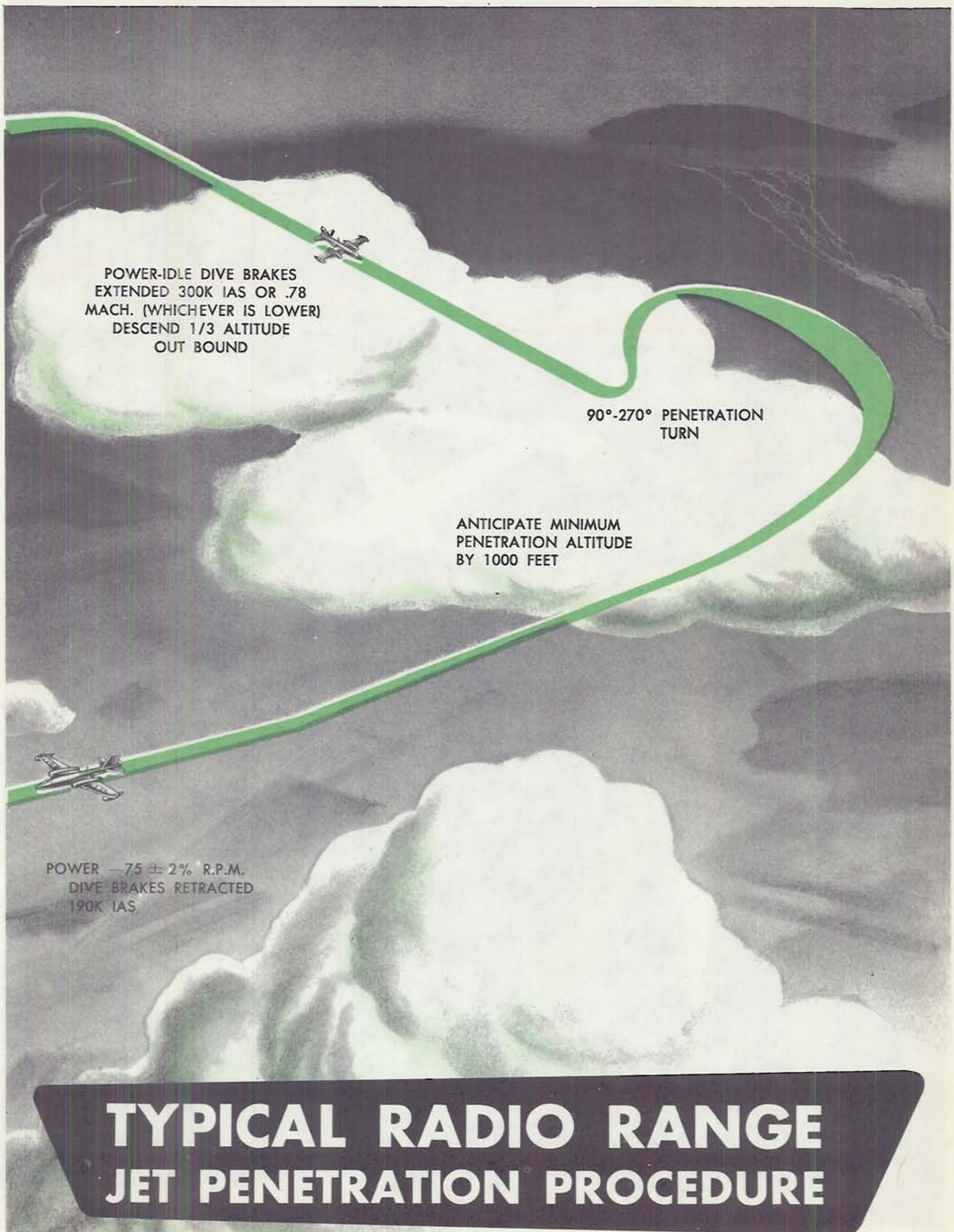


Figure 9–1. (Sheet 2 of 2)

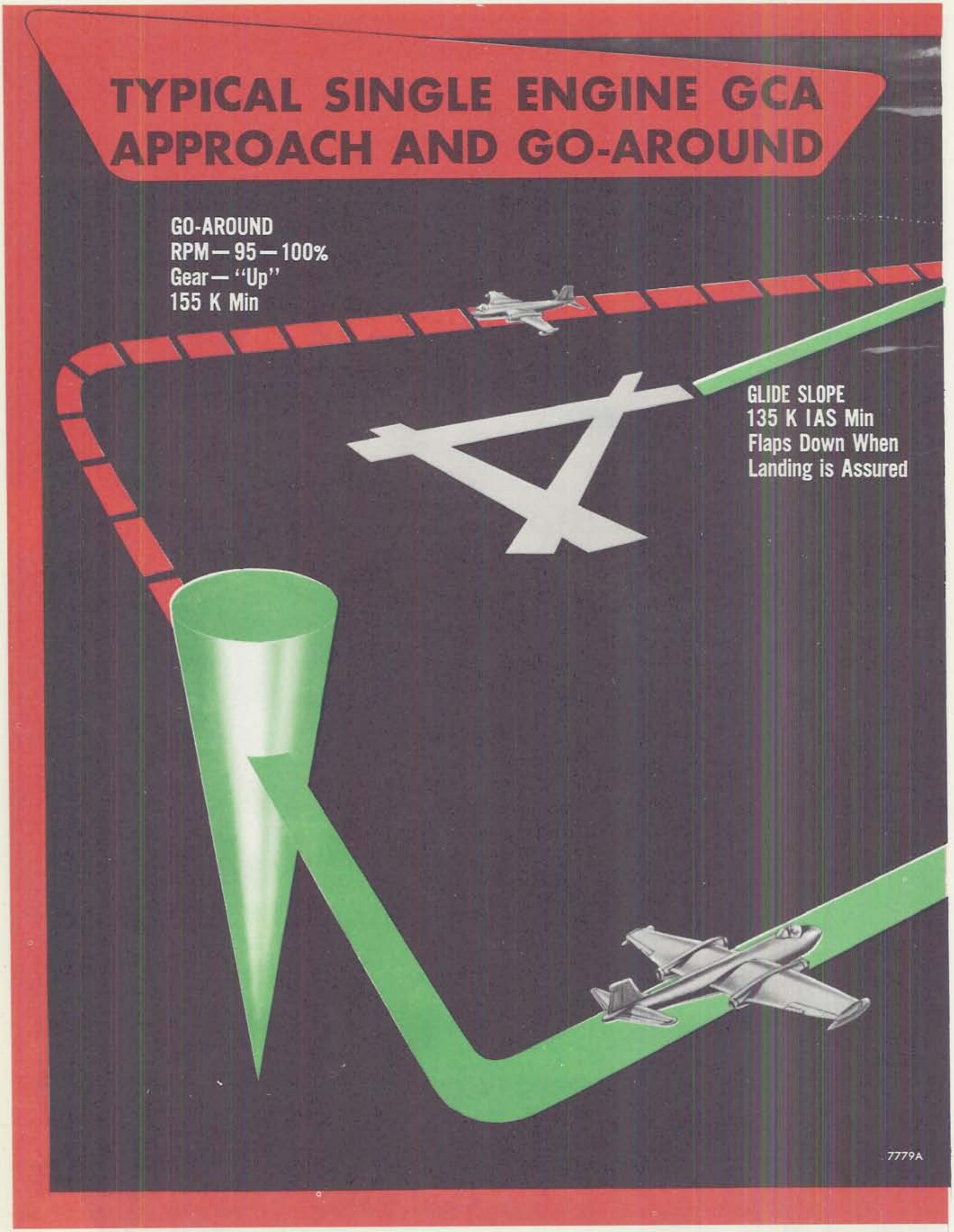


Figure 9–2. (Sheet 1 of 2)

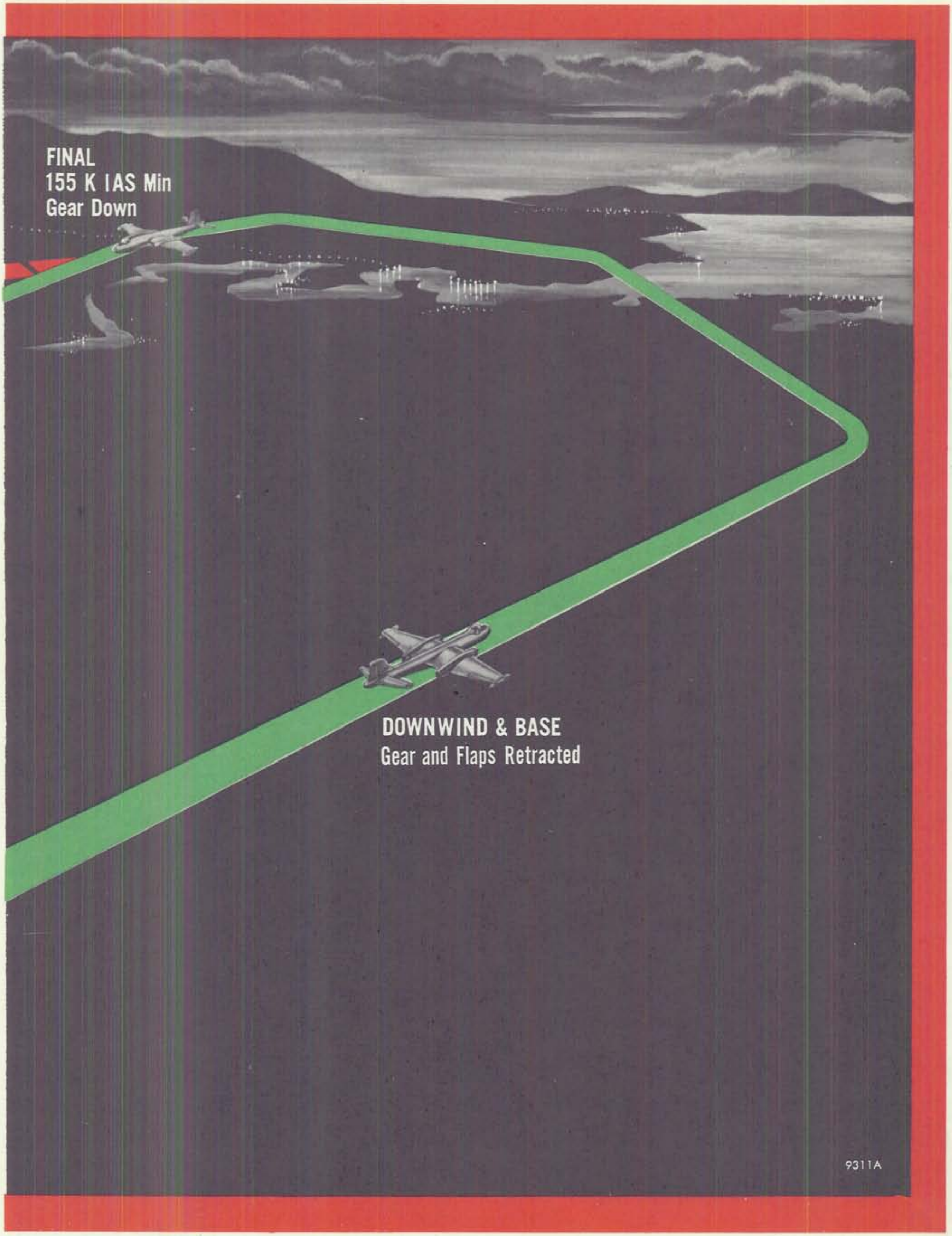


Figure 9–2. (Sheet 2 of 2)

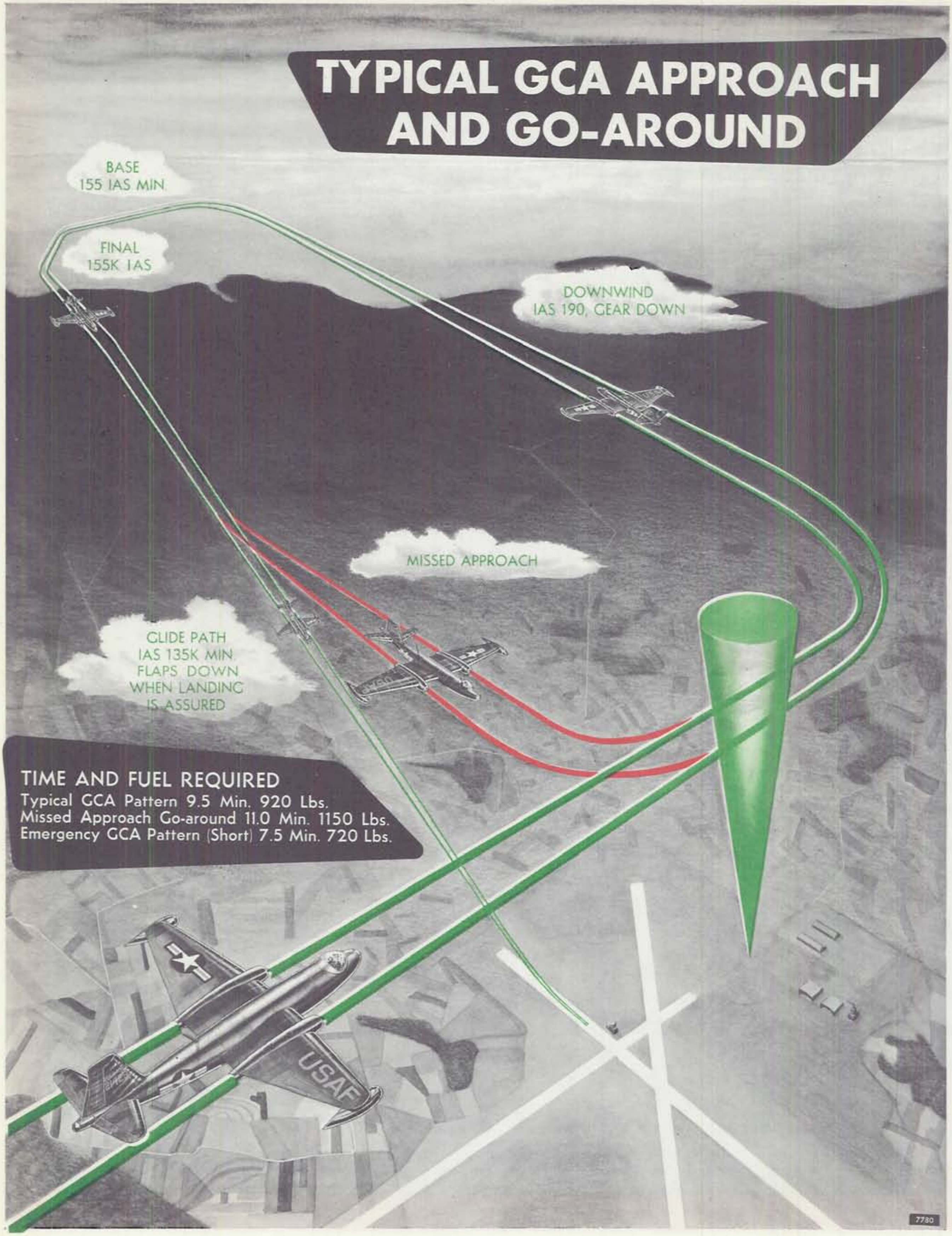

TYPICAL GCA APPROACH AND GO-AROUND
BASE
155 IAS MIN
FINAL
155K IAS
DOWNWIND
IAS 190, GEAR DOWN
MISSED APPROACH
GLIDE PATH
IAS 135K MIN
FLAPS DOWN
WHEN LANDING
IS ASSURED
TIME AND FUEL REQUIRED
Typical GCA Pattern 9.5 Min. 920 Lbs.
Missed Approach Go-around 11.0 Min. 1150 Lbs.
Emergency GCA Pattern (Short) 7.5 Min. 720 Lbs.
USAF
7780

Figure 9–3.

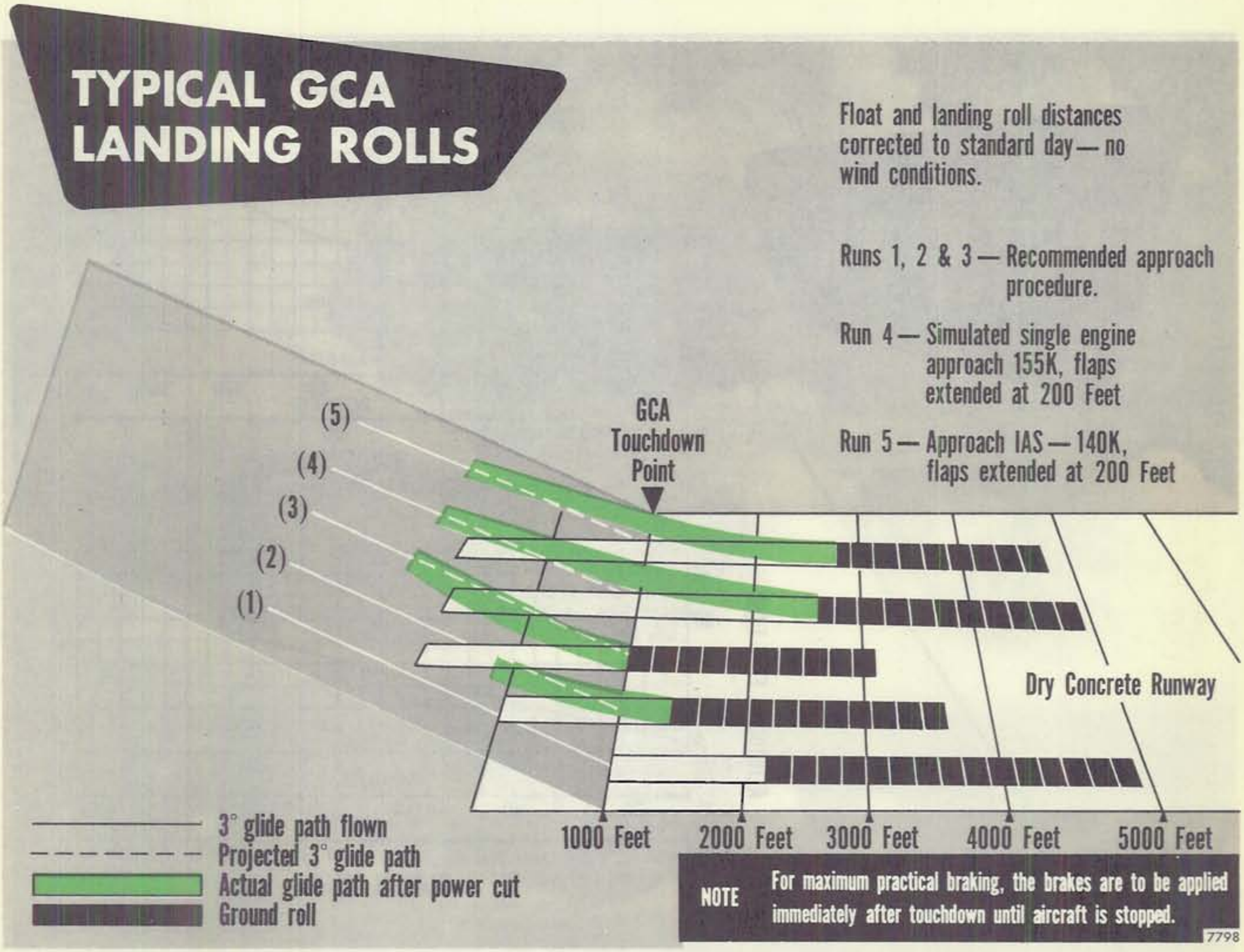

TYPICAL GCA LANDING ROLLS
Float and landing roll distances corrected to standard day—no wind conditions.
Runs 1, 2 & 3—Recommended approach procedure.
Run 4—Simulated single engine approach 155K, flaps extended at 200 Feet
Run 5—Approach IAS—140K, flaps extended at 200 Feet
GCA Touchdown Point
(5)
(4)
(3)
(2)
(1)
Dry Concrete Runway
1000 Feet
2000 Feet
3000 Feet
4000 Feet
5000 Feet
3° glide path flown
Projected 3° glide path
Actual glide path after power cut
Ground roll
NOTE For maximum practical braking, the brakes are to be applied immediately after touchdown until aircraft is stopped.
7798

Figure 9–4.

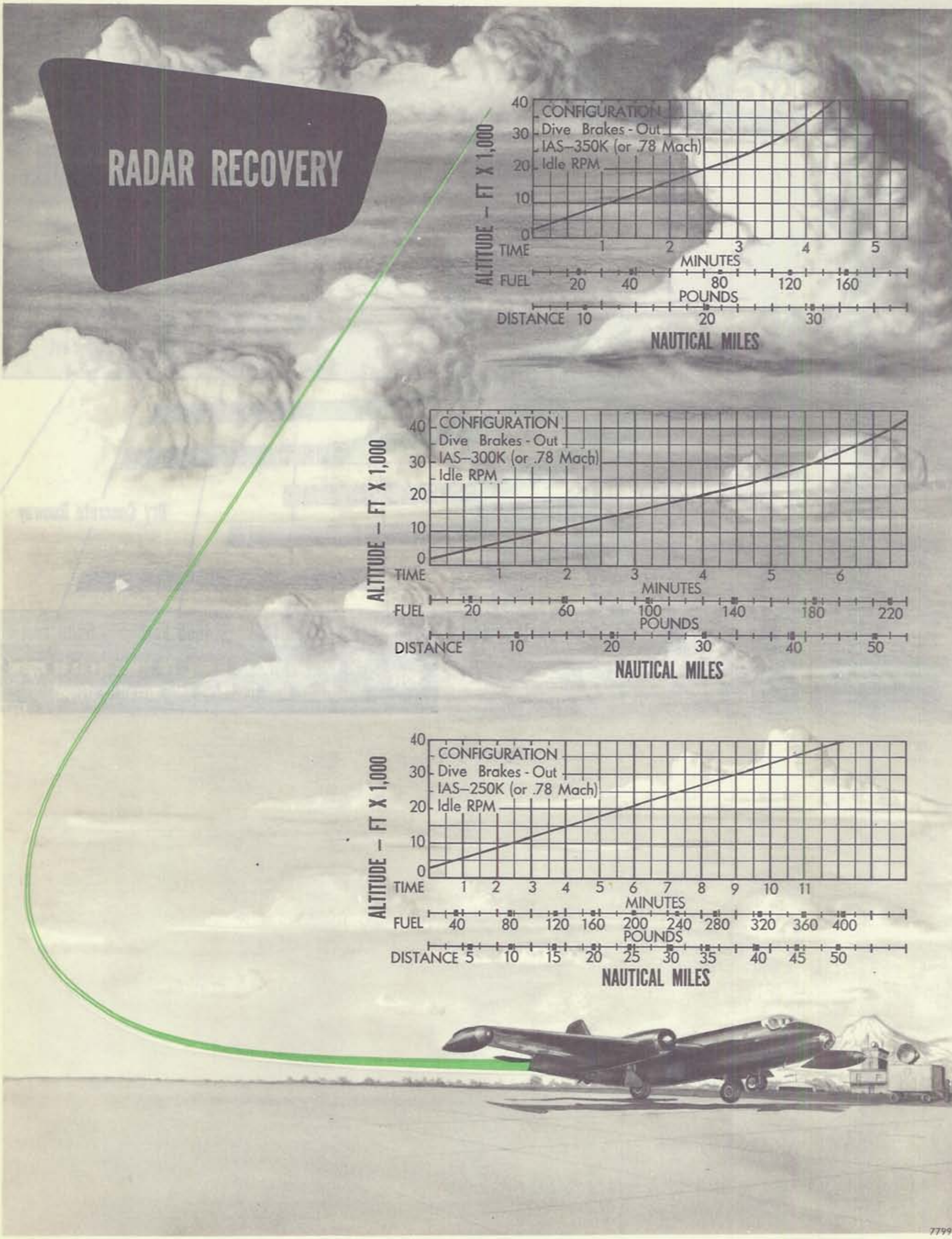

RADAR RECOVERY
CONFIGURATION
Dive Brakes - Out
IAS–350K (or .78 Mach)
Idle RPM
ALTITUDE – FT X 1,000
40
30
20
10
0
TIME
1 2 3 4 5
MINUTES
FUEL
20 40 80 120 160
POUNDS
DISTANCE 10 20 30
NAUTICAL MILES
CONFIGURATION
Dive Brakes - Out
IAS–300K (or .78 Mach)
Idle RPM
ALTITUDE – FT X 1,000
40
30
20
10
0
TIME
1 2 3 4 5 6
MINUTES
FUEL
20 60 100 140 180 220
POUNDS
DISTANCE
10 20 30 40 50
NAUTICAL MILES
CONFIGURATION
Dive Brakes - Out
IAS–250K (or .78 Mach)
Idle RPM
ALTITUDE – FT X 1,000
40
30
20
10
0
TIME
1 2 3 4 5 6 7 8 9 10 11
MINUTES
FUEL
40 80 120 160 200 240 280 320 360 400
POUNDS
DISTANCE 5 10 15 20 25 30 35 40 45 50
NAUTICAL MILES
7799

Figure 9–5.

TYPICAL RADAR RECOVERY PENETRATIONS

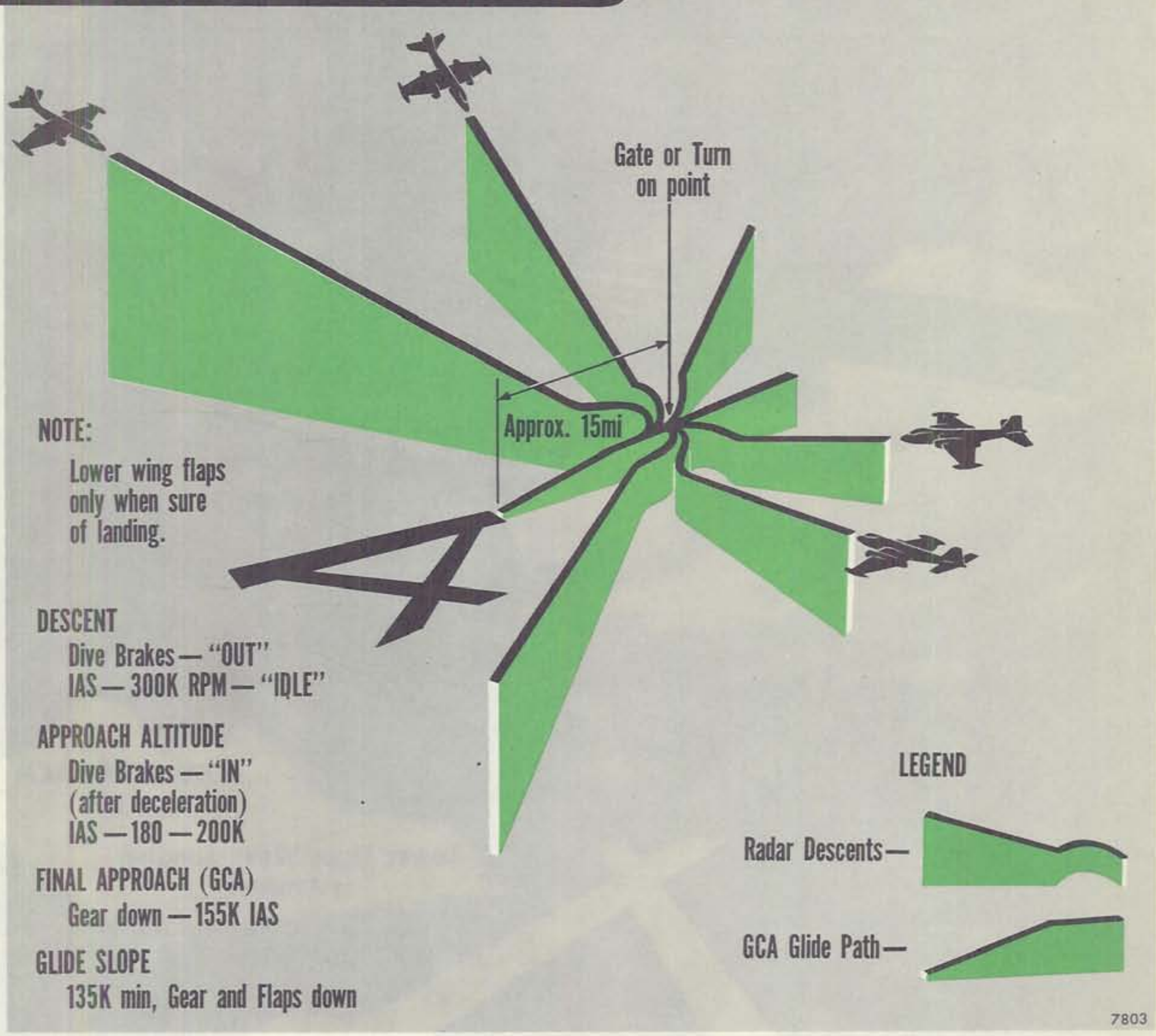


Figure 9–6.

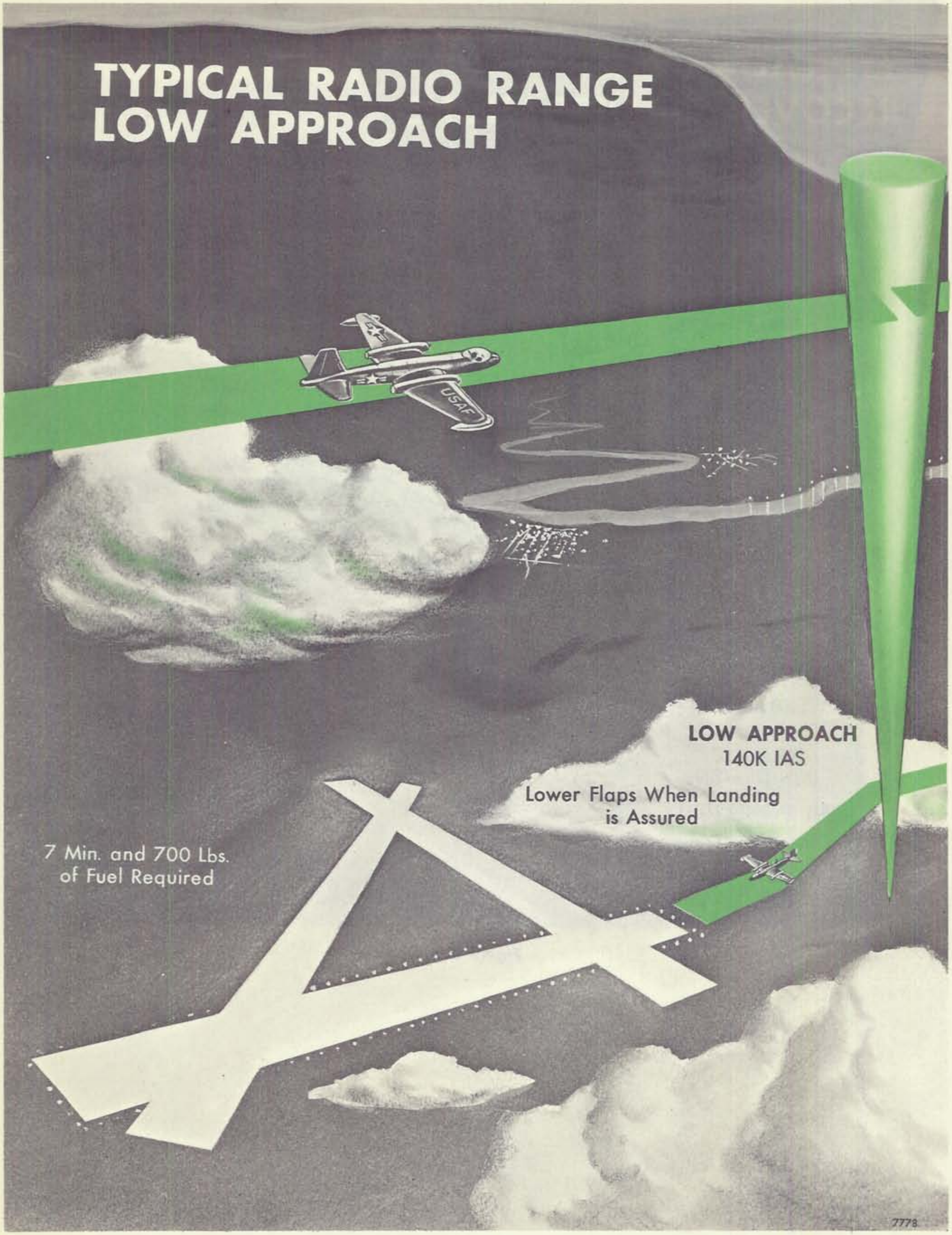


Figure 9–7. (Sheet 1 of 2)

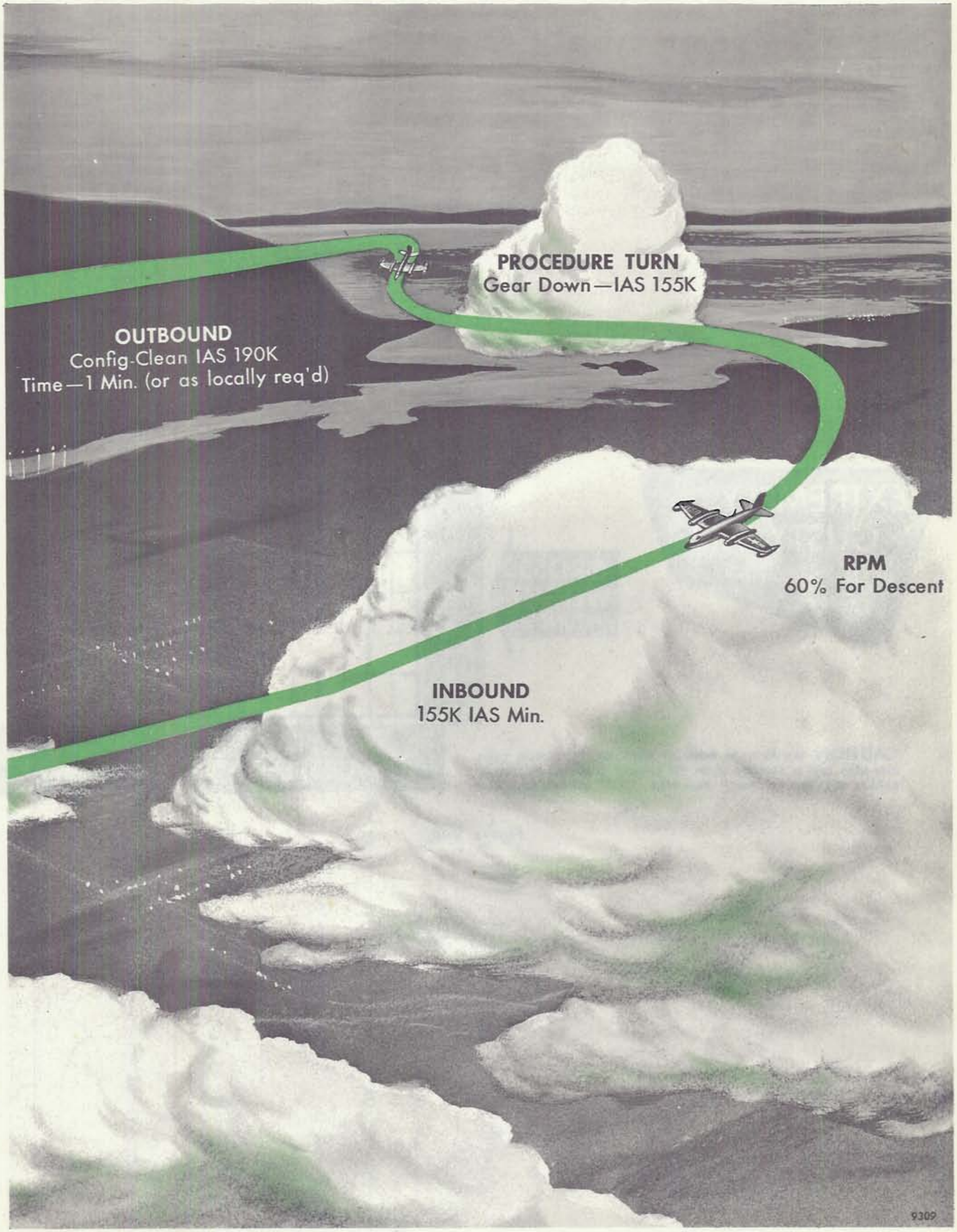


Figure 9-7. (Sheet 2 of 2)

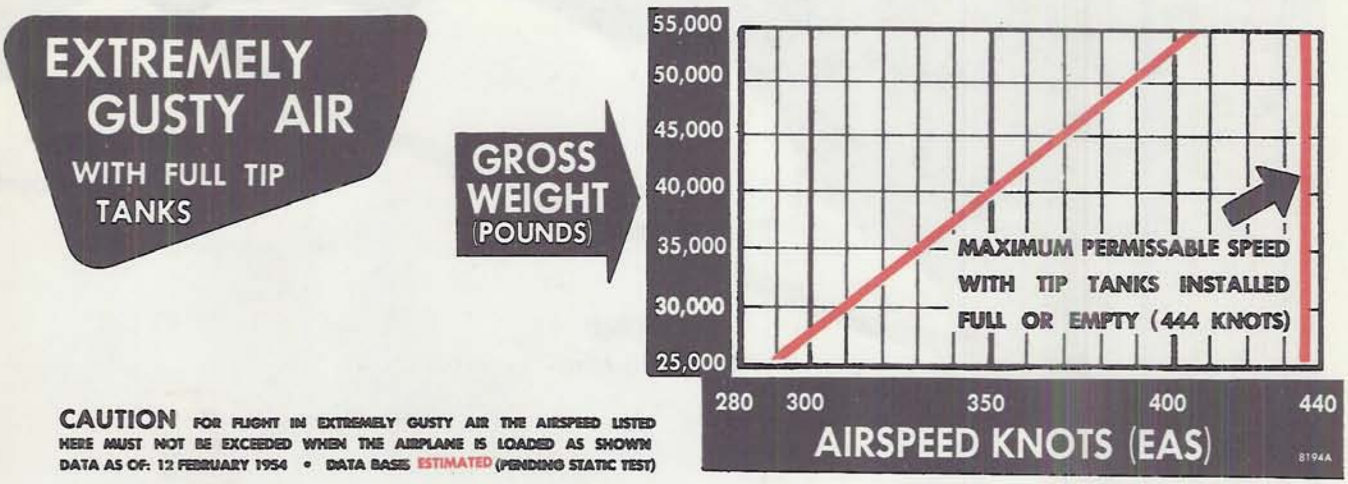

EXTREMELY
GUSTY AIR
WITH FULL TIP
TANKS
GROSS
WEIGHT
(POUNDS)
55,000
50,000
45,000
40,000
35,000
30,000
25,000
MAXIMUM PERMISSABLE SPEED
WITH TIP TANKS INSTALLED
FULL OR EMPTY (444 KNOTS)
280 300 350 400 440
AIRSPEED KNOTS (EAS)
CAUTION FOR FLIGHT IN EXTREMELY GUSTY AIR THE AIRSPEED LISTED
HERE MUST NOT BE EXCEEDED WHEN THE AIRPLANE IS LOADED AS SHOWN
DATA AS OF: 12 FEBRUARY 1954 • DATA BASIS ESTIMATED (PENDING STATIC TEST)

Figure 9–8.

ALPHABETICAL INDEX

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS

INDEX OF PERFORMANCE DATA CHARTS

PAGE NUMBERS IN BOLDFACE DENOTE ILLUSTRATIONS