NAVAER 01-270KAA-501

Pilot's Handbook

NAVY MODEL

TT-1
AIRCRAFT

PUBLISHED BY DIRECTION OF
THE CHIEF OF THE BUREAU OF AERONAUTICS

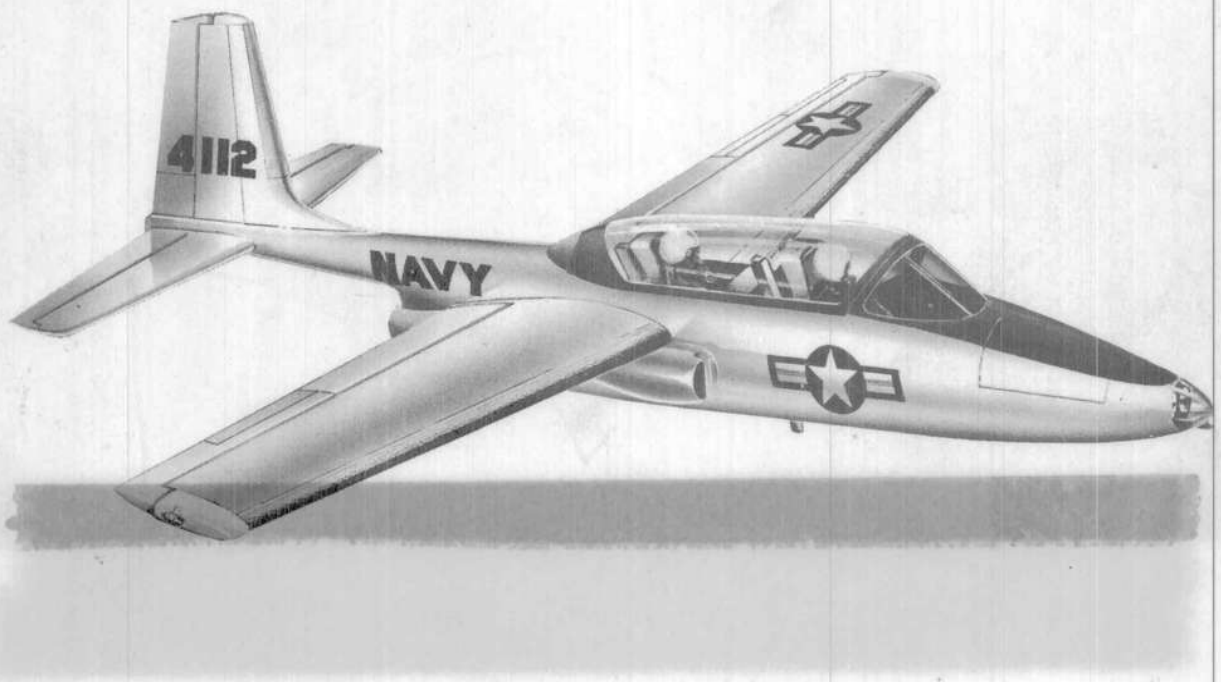
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alphabetical index



Now Hear This!!!

In the early 1800's officers and men of the Navy were required to learn the functions of their equipment by trial and error. Operating manuals were inaccurate and in most cases non-existent. Today a tremendous amount of effort has been put into your handbook to provide you with a general knowledge of the aircraft, its flight characteristics, and specific normal and emergency operating procedures. Once you have learned to use this handbook, you will know how to use them all - closely guarded standardization assures that the scope and arrangement of all Flight Handbooks are identical.

The book is divided into nine sections. Sections I, II and III are closely interrelated and contain information relative to the physical act of flying the aircraft. Section I provides a complete description of the aircraft and its systems, instruments, and controls. Emergency equipment which is not part of an auxiliary system is also described. Section II contains information for the normal operation of the airplane and describes all procedures to be accomplished by the pilot from the time the airplane is approached until it is left parked on the ramp after completing one non-tactical flight under ordinary conditions. Section III describes the procedures to be followed in meeting any emergency, except those in connection with auxiliary equipment, that could reasonably be expected to be encountered.

Section IV contains the description and operation of all auxiliary equipment which does not actually contribute to flight but enables the aircraft to perform specialized functions. All limitations and restrictions which must be observed during normal operation are discussed in Section V. Section VI attempts to evaluate any unusual flight characteristics, both favorable and unfavorable, that the aircraft may possess. In Section VII, operation of the various aircraft systems is discussed. Section

VIII is not applicable to this aircraft. Section IX contains procedures and information pertaining to all-weather operation.

An Appendix, following Section IX, contains all flight operating data charts for the aircraft and other material which is supplementary to this Flight Handbook.

It should be noted that the information in this handbook will be kept current by frequent revisions. Since, however, a slight delay in the dissemination of revision material is to be expected, it is imperative that pilots stay abreast of pertinent technical directives which frequently cover critical flight restrictions or new techniques in operation of the aircraft.

In order to make the text as specific as possible, the nomenclature used to identify controls and other equipment is identical wherever possible to that used in the aircraft itself. Control positions are capitalized as they are identified in the aircraft.

An alphabetical index is included at the end of the book to facilitate reference to the text.

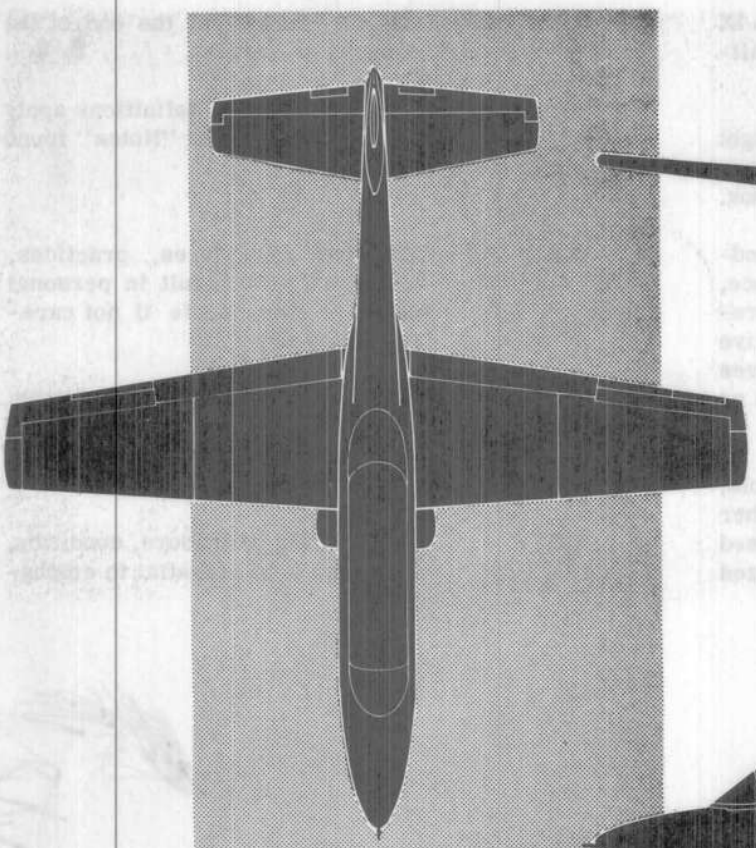
For your information, the following definitions apply to the "Warnings", "Cautions", and "Notes" found throughout the handbook:

WARNING - Operating procedures, practices, etc, which will result in personal injury or loss of life if not carefully followed.

CAUTION - Operating procedures, practices, etc, which if not strictly observed will result in damage to equipment.

NOTE - An operating procedure, condition, etc, which it is essential to emphasize.







THE AIRCRAFT

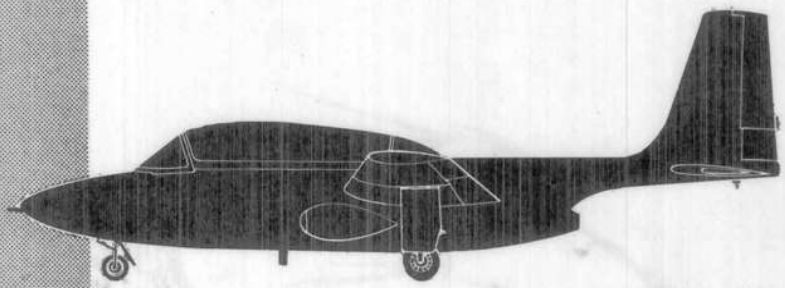






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THE AIRCRAFT

The Navy model TT-1 aircraft is a tandem seating, two-place, turbojet propelled, mid-wing trainer manufactured by Temco Aircraft Corporation. The aircraft was designed to perform within the requirements of the primary military pilot training phase and features a fully retractable tricycle landing gear, wing flaps, and speed brakes, all of which are operated hydraulically. The primary flight controls are operated by means of push-pull mechanical linkages. The trim tabs are actuated electrically. Designed for a maximum altitude of 30,000 feet, a cockpit heat and vent system and a liquid oxygen system are provided. Both seats are standard Navy type single point, face curtain actuated, ballistic charged catapult ejection seats. The single piece, bubble-type canopy is jettisoned by the use of a cartridge actuated device.

CREW

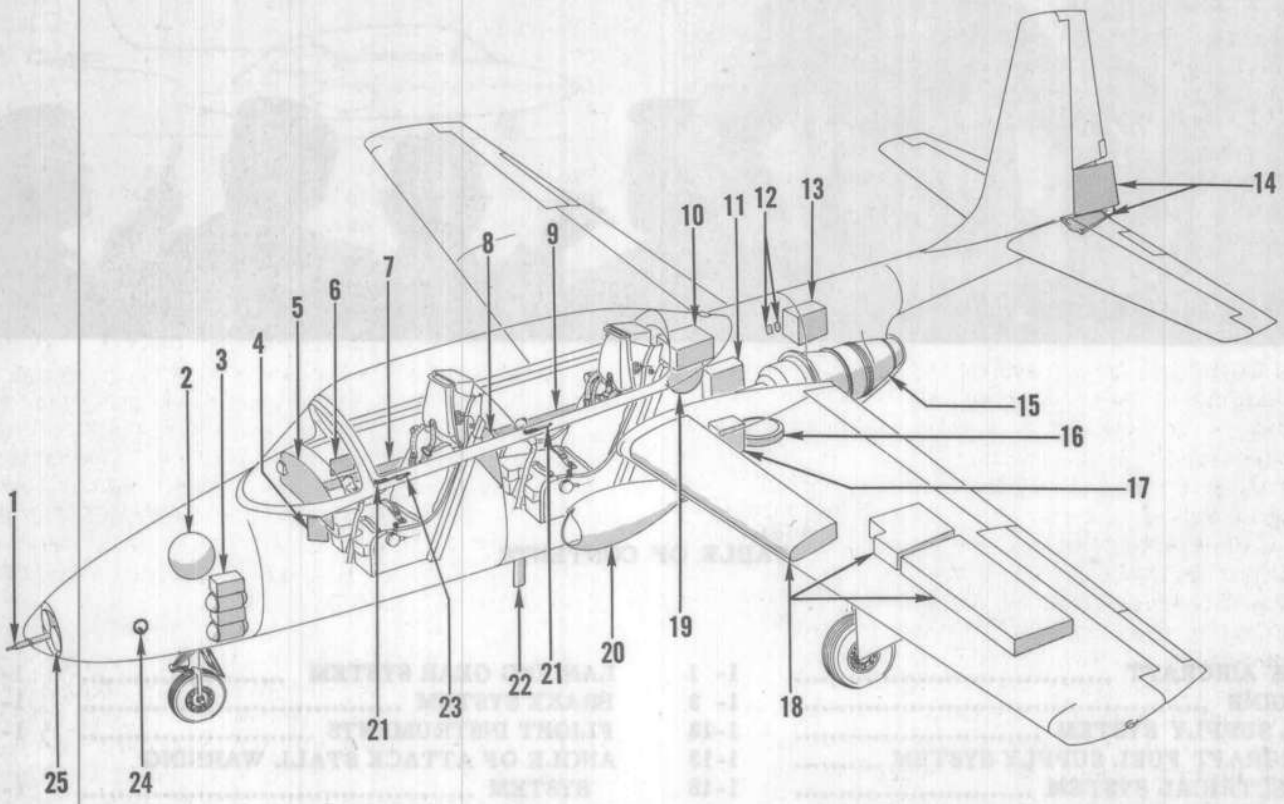
Normal flight crew complement consists of a student pilot with or without an instructor pilot.

DIMENSIONS

The over-all dimensions are:

Wing span	29 feet 10 inches
Fuselage length	30 feet 1 inch
Height (to top of fin)	10 feet 10 inches
Tread	13 feet 4 inches

GENERAL ARRANGEMENT



1. PITOT
2. OXYGEN BOTTLE
3. INVERTERS
4. CIRCUIT BREAKER PANEL
5. FWD INSTRUMENT PANEL
6. FUSE PANEL
7. RIGHT FWD COCKPIT CONSOLE
8. AFT INSTRUMENT PANEL
9. RIGHT AFT COCKPIT CONSOLE
10. ARC-52 TRANSCEIVER
11. SUMP TANK
12. EXTERNAL POWER RECEPTACLES
13. BATTERY
14. SPEED BRAKES
15. ENGINE
16. DIRECTIONAL ANTENNA
17. OIL RESERVOIR
18. LEFT FUEL TANKS
19. HYDRAULIC RESERVOIR
20. INTAKE AIR SCOOP
21. INTERIOR CANOPY RELEASE HANDLE
22. UHF ANTENNA
23. EXTERIOR CANOPY RELEASE HANDLE
24. AIRSTREAM DIRECTION DETECTOR TRANSMITTER PROBE
25. LANDING LIGHTS

Figure 1-1

GROSS WEIGHT

The design gross weight of the aircraft is 4400 pounds.

ENGINE

The aircraft is powered by a single J69-T-2 turbojet engine (15, figure 1-1) manufactured by Continental Aviation and Engineering Corporation. The engine is a centrifugal flow gas turbine having a single entry ram air inlet, a single stage centrifugal compressor, an annular combustor, and a single stage axial flow turbine directly connected to the compressor. The engine is installed in the lower aft section of the fuselage.

ENGINE FUEL CONTROL SYSTEM

The engine fuel control system (figure 1-8) is designed to maintain constant engine speed during normal operation. A manual fuel control system is provided in the event of a malfunction of any automatic feature of the normal system. When operating in the manual system, the pilot must manually compensate, by throttle movement, for the lack of all automatic features provided in the normal system. An engine driven fuel pump, driven by the accessory gear train, contains a centrifugal booster stage to provide boost pressure for the gear pump in the event the aircraft fuel boost pump fails. This centrifugal booster stage feeds both gear driven pressure sections of the fuel pump. Each pressure section is independent of the other and will provide full pressure and flow. Fuel is then directed through a fuel filter which incorporates two separate filtering elements. A fuel filter bypass is incorporated to allow fuel flow in the event both filter elements become clogged.

Fuel Control Selector Switch

A Fuel Control Selector switch is located on the left console in each cockpit, forward of the throttle control quadrant (12, figure 1-6 and 9, figure 1-7). When moved to the PRIMARY position, the FUEL CONTROL valve selects the primary fuel path and allows excess fuel to be returned to the engine driven fuel pump. When moved to the MANUAL position, the switch will energize the system allowing the fuel to be routed through the MANUAL flow path.

Engine Fuel Flow Paths

The engine fuel control unit contains three separate flow paths: starting fuel, primary and manual.

a. STARTING FUEL. Starting fuel is led through a starting fuel filter to a pressure regulator, then to the starting fuel solenoid valve. This valve is actuated by placing either forward or aft throttle outboard to the IGN position. From this valve, starting fuel passes through bleed valves, external piping and to the starting fuel nozzles.

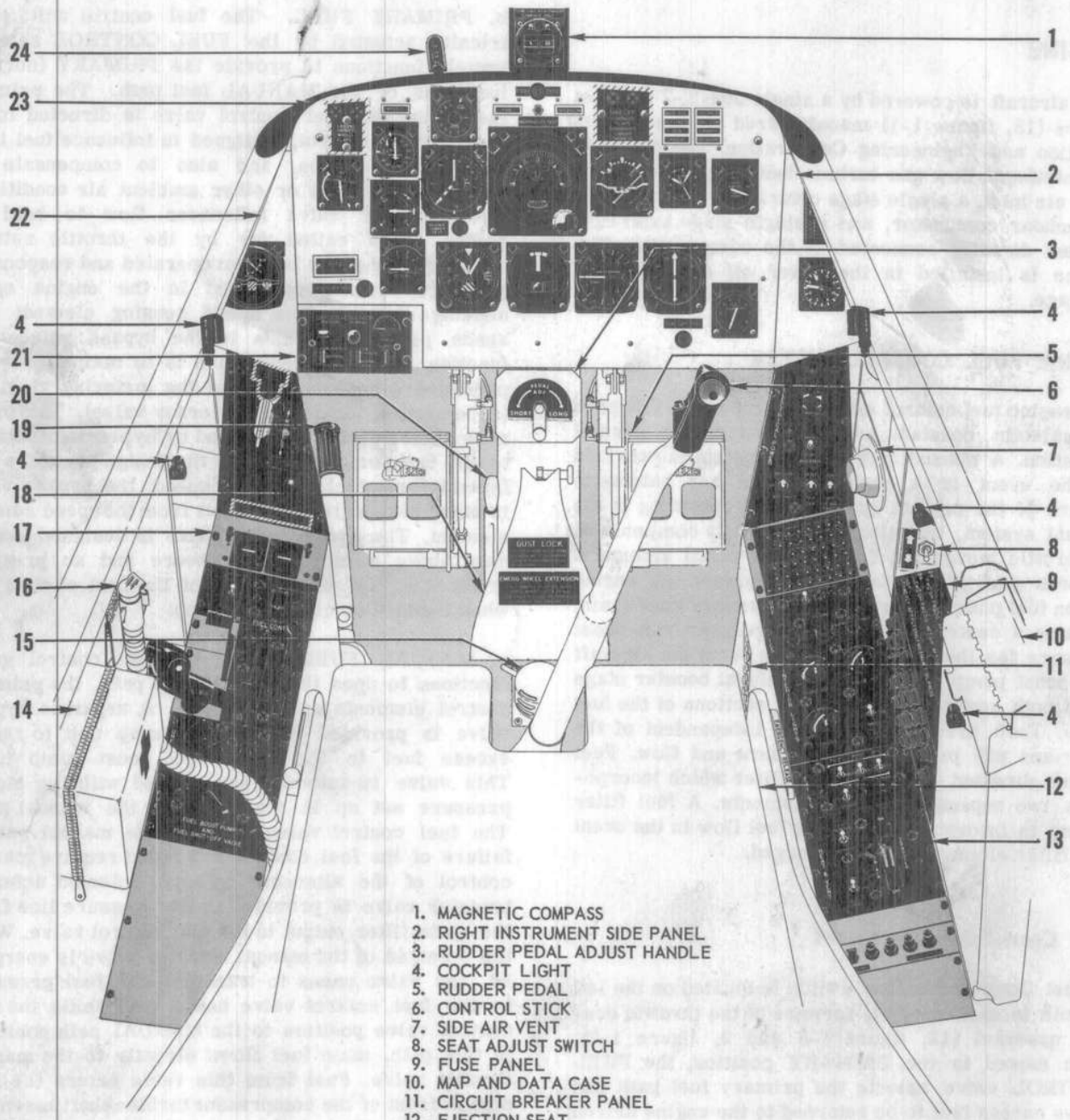
b. PRIMARY FUEL. The fuel control unit, electrically actuated by the FUEL CONTROL selector switch, functions to provide the PRIMARY (normal) fuel path or the MANUAL fuel path. The primary fuel from the fuel control valve is directed to the acceleration control, designed to influence fuel input during acceleration, and also to compensate for changes in altitude or other ambient air conditions. The governor valve influences flow to hold the engine speed called for by the throttle setting. The governor valve is servo operated and responds to pressure signals developed in the engine speed sensing element. The speed sensing element also sends pressure signals to the bypass valve. The function of the bypass valve is to maintain design pressure differential across the metering elements (acceleration control and governor valve). This pressure differential is maintained by bypassing fuel back to the fuel pump inlet. Since the design pressure differential must change with speed, the bypass valve is made responsive to a signal from the speed sensing element. The pressurizing valve is designed to open only above a minimum pressure and so prevents dribble of fuel or drainage of the fuel control unit when the turbine comes to a stop.

c. MANUAL FUEL. When the fuel control valve functions to open the manual fuel path, the primary control elements are bypassed. A separate bypass valve is provided in the fuel pump unit to return excess fuel to the centrifugal boost pump inlet. This valve is automatically opened with the higher pressure set up in the pump in the manual path. The fuel control valve provides the manual path if failure of the fuel control unit would require manual control of the alternate path. A solenoid actuated transfer valve is provided in the pressure line from the main filter output to the fuel control valve. When the solenoid of the manual transfer valve is energized, the valve opens to transmit high fuel pressure to the fuel control valve head. This shifts the fuel control valve position to the MANUAL path position. In this path, main fuel flows directly to the manual throttle valve. Fuel from this valve enters the fuel tube in front of the compressor turbine shaft assembly after passing through the pressurizing valve. With the fuel flow in the manual condition, the throttle valve provides a manual control for metering fuel input to the engine, thus providing an emergency means of continuing operation in the event of failure of the normal fuel path through the fuel control unit.

Engine Fuel Control Unit

The engine fuel control unit is the key element affecting engine control. Provided the proper volume and pressure of fuel are fed into the fuel control unit, it regulates and meters engine fuel input to

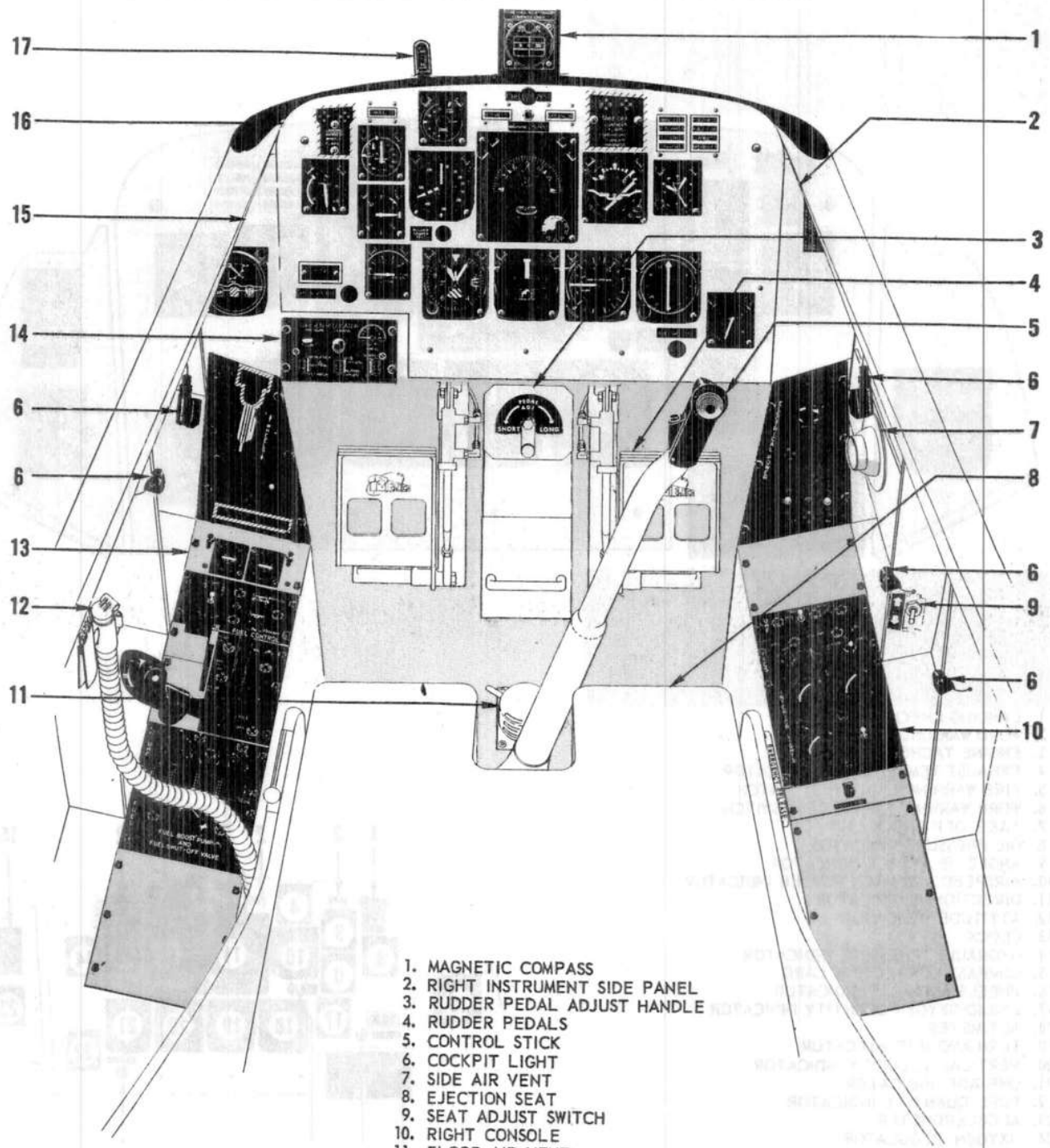
FORWARD COCKPIT ARRANGEMENT



1. MAGNETIC COMPASS
2. RIGHT INSTRUMENT SIDE PANEL
3. RUDDER PEDAL ADJUST HANDLE
4. COCKPIT LIGHT
5. RUDDER PEDAL
6. CONTROL STICK
7. SIDE AIR VENT
8. SEAT ADJUST SWITCH
9. FUSE PANEL
10. MAP AND DATA CASE
11. CIRCUIT BREAKER PANEL
12. EJECTION SEAT
13. RIGHT CONSOLE
14. FIRST AID KIT
15. FLOOR AIR VENT
16. OXYGEN HOSE
17. LEFT CONSOLE
18. GUST LOCK
19. HYDRAULIC HAND PUMP
20. LANDING GEAR EMERGENCY RELEASE HANDLE
21. OXYGEN REGULATOR
22. LEFT INSTRUMENT SIDE PANEL
23. INSTRUMENT PANEL
24. APPROACH INDEX INDICATOR

Figure 1-2

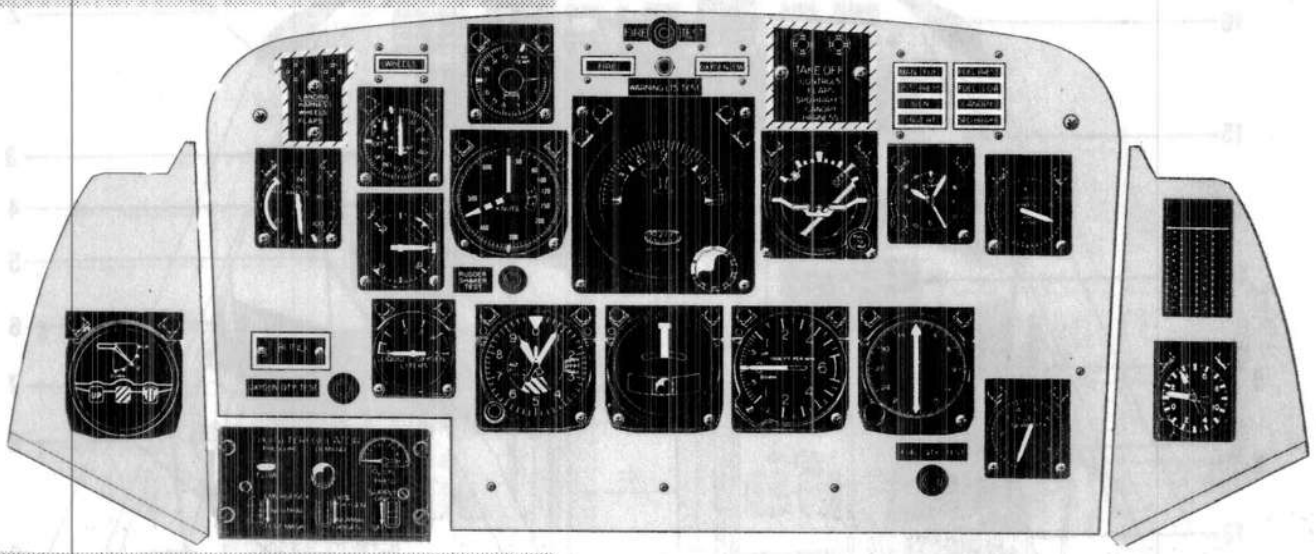
AFT COCKPIT ARRANGEMENT



1. MAGNETIC COMPASS
2. RIGHT INSTRUMENT SIDE PANEL
3. RUDDER PEDAL ADJUST HANDLE
4. RUDDER PEDALS
5. CONTROL STICK
6. COCKPIT LIGHT
7. SIDE AIR VENT
8. EJECTION SEAT
9. SEAT ADJUST SWITCH
10. RIGHT CONSOLE
11. FLOOR AIR VENT
12. OXYGEN HOSE
13. LEFT CONSOLE
14. OXYGEN REGULATOR
15. LEFT INSTRUMENT SIDE PANEL
16. INSTRUMENT PANEL
17. APPROACH INDEX INDICATOR

Figure 1-3

FORWARD INSTRUMENT PANEL



1. LANDING CHECK LIST
2. WORD WARNING LIGHTS
3. ENGINE TACHOMETER
4. EXHAUST TEMPERATURE INDICATOR
5. FIRE WARNING LIGHT TEST SWITCH
6. WORD WARNING LIGHTS TEST SWITCH
7. TAKE-OFF CHECK LIST
8. OIL PRESSURE INDICATOR
9. ANGLE OF ATTACK INDICATOR
10. AIRSPEED AND MACH NUMBER INDICATOR
11. DIRECTIONAL INDICATOR
12. ATTITUDE INDICATOR
13. CLOCK
14. HYDRAULIC PRESSURE INDICATOR
15. COMPASS CORRECTION CARD
16. WHEELS AND FLAP INDICATOR
17. LIQUID OXYGEN QUANTITY INDICATOR
18. ALTIMETER
19. TURN AND SLIP INDICATOR
20. VERTICAL VELOCITY INDICATOR
21. UHF/ADF INDICATOR
22. FUEL QUANTITY INDICATOR
23. ACCELEROMETER
24. OXYGEN REGULATOR
25. OXYGEN QUANTITY TEST SWITCH
26. RUDDER SHAKE TEST SWITCH
27. FUEL QUANTITY TEST SWITCH

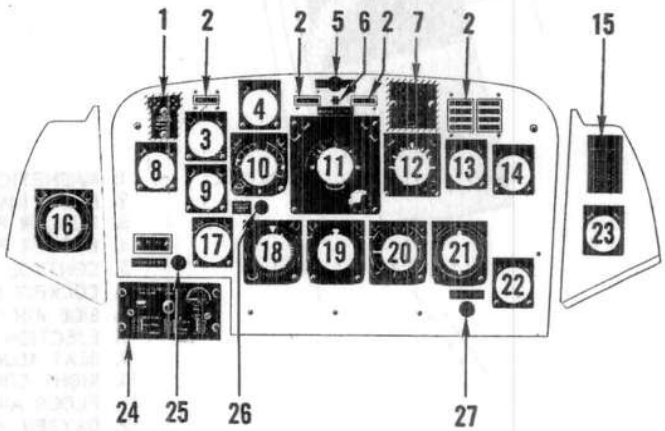
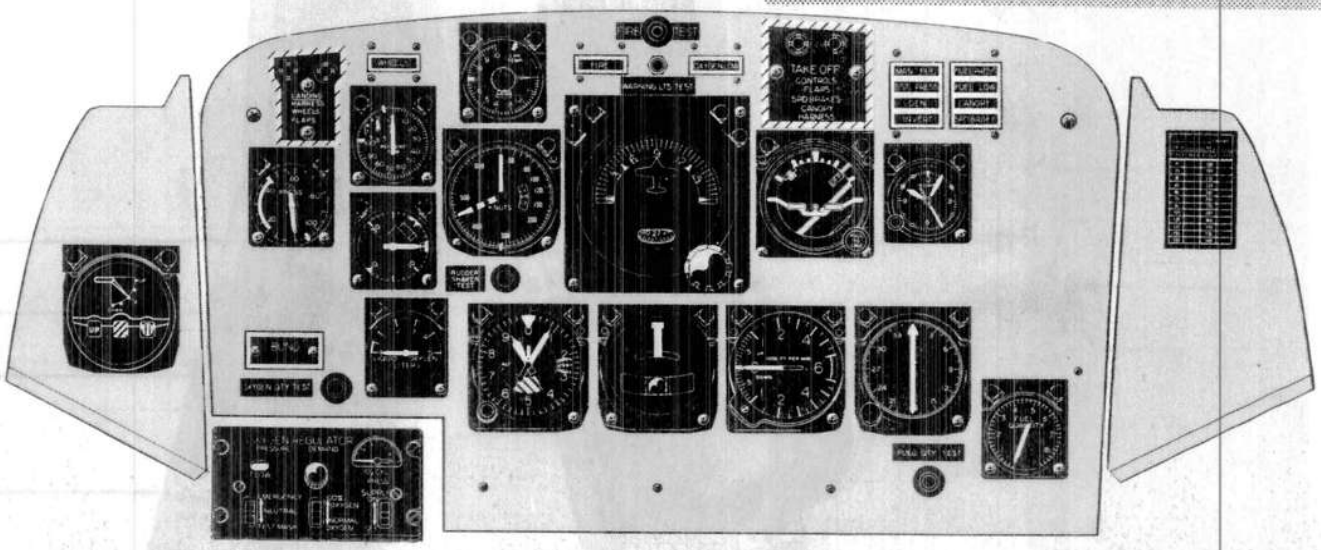
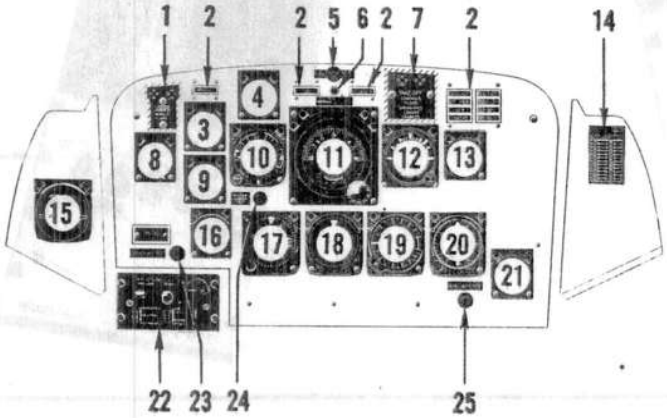


Figure 1-4

AFT INSTRUMENT PANEL

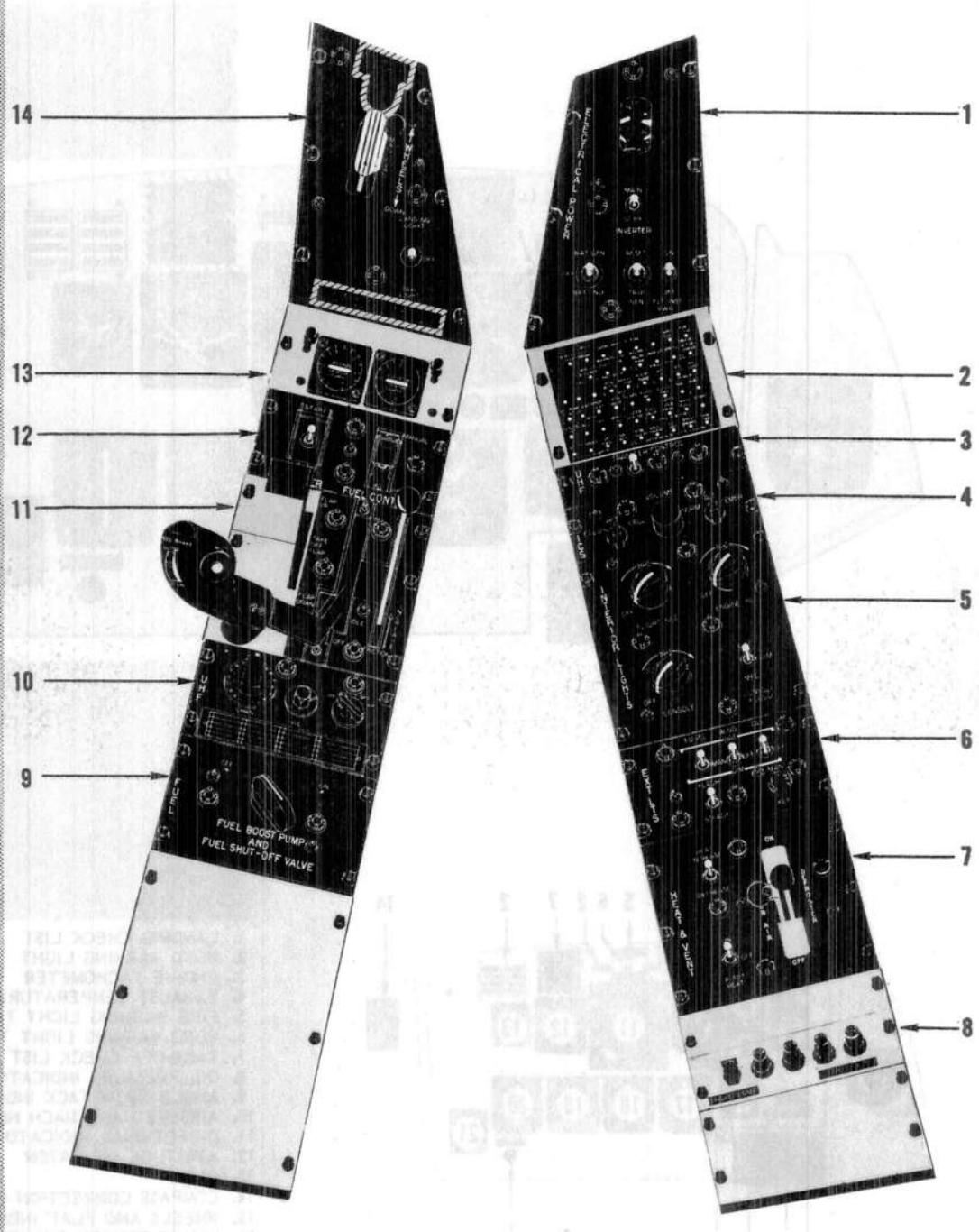




1. LANDING CHECK LIST
2. WORD WARNING LIGHT
3. ENGINE TACHOMETER
4. EXHAUST TEMPERATURE INDICATOR
5. FIRE WARNING LIGHT TEST SWITCH
6. WORD WARNING LIGHT TEST SWITCH
7. TAKE-OFF CHECK LIST
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18. TURN AND SLIP INDICATOR
19. VERTICAL VELOCITY INDICATOR
20. UHF/ADF INDICATOR
21. FUEL QUANTITY INDICATOR
22. OXYGEN REGULATOR
23. OXYGEN QUANTITY TEST SWITCH
24. RUDDER SHAKE TEST SWITCH
25. FUEL QUANTITY TEST SWITCH

Figure 1-5

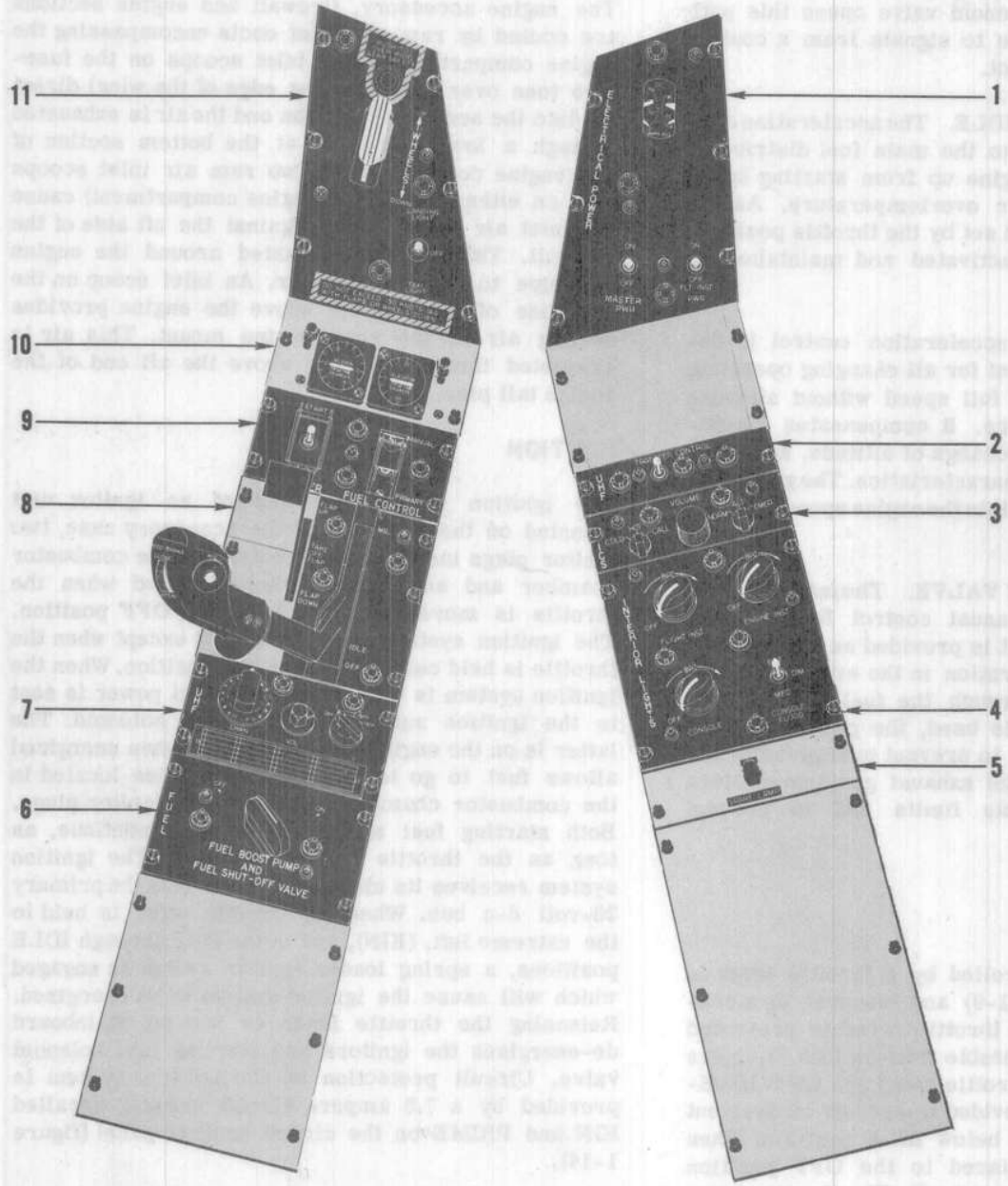
FORWARD COCKPIT CONSOLES



1. ELECTRICAL POWER CONTROL PANEL
2. DECAL CIRCUIT BREAKER PANEL
3. UHF CONTROL PANEL
4. INTERPHONE CONTROL PANEL
5. INTERIOR LIGHTS CONTROL PANEL
6. EXTERIOR LIGHTS CONTROL PANEL
7. HEAT AND VENT CONTROL PANEL
8. SPARE LAMP AND SPARE FUSE PANEL
9. FUEL BOOST PUMP AND FUEL SHUT-OFF CONTROL PANEL
10. UHF CONTROL PANEL
11. THROTTLE CONTROL QUADRANT
12. STARTER AND FUEL CONTROL PANEL
13. AILERON AND RUDDER TRIM TAB INDICATOR PANEL
14. LANDING GEAR CONTROL PANEL

Figure 1-6

AFT COCKPIT CONSOLES



1. ELECTRICAL POWER CONTROL PANEL
2. UHF CONTROL PANEL
3. INTERPHONE CONTROL PANEL
4. INTERIOR LIGHTS CONTROL PANEL
5. SPARE LAMP PANEL
6. FUEL BOOST PUMP AND FUEL SHUT-OFF CONTROL PANEL
7. UHF CONTROL PANEL
8. THROTTLE CONTROL QUADRANT
9. STARTER AND FUEL CONTROL PANEL
10. AILERON AND RUDDER TRIM TAB INDICATOR PANEL
11. LANDING GEAR CONTROL PANEL

Figure 1-7

cover all operating conditions automatically. The following main conditions are controlled:

a. STARTING. The separate starting fuel path sets up fuel flow to the starting fuel nozzles. The fuel control starting fuel solenoid valve opens this path and closes it in response to signals from a control switch actuated by the pilot.

b. ACCELERATION TO IDLE. The acceleration control sets up fuel flow to the main fuel distributor such as to speed the engine up from starting speed to idle without surge or overtemperature. As the engine reaches the speed set by the throttle position, the governor valve is activated and maintains the engine speed.

c. ABOVE IDLE. The acceleration control is designed to control fuel input for all changing operating conditions from idle to full speed without allowing surge or overtemperature. It compensates for acceleration, deceleration, change of altitude, and other changes of ambient air characteristics. The governor, in all cases, acts to maintain the engine speed relative to the throttle position.

d. MANUAL THROTTLE VALVE. The manual throttle valve provides a manual control for metering fuel input to the engine. It is provided as an alternate means of continuing operation in the event of failure of the primary path through the fuel control unit. When the manual path is used, the pilot must then move the throttle slowly to prevent overspeeding the turbine and to prevent the exhaust gas temperature from exceeding allowable limits and to prevent flame-out.

THROTTLE LEVER

The engine rpm is controlled by a throttle lever in each cockpit (4, figure 1-9) and mounted in a conventional quadrant. The throttle lever is prevented from creeping by an adjustable friction lock (3, figure 1-9). Markings of the throttle panel are OFF-IDLE-MIL. Gate stops are provided to prevent inadvertent reduction of the throttle below IDLE position. When the throttle lever is placed to the OFF position all fuel to the engine is cut off. The throttle lever also controls engine ignition and starting fuel during starting and is discussed under IGNITION and STARTING FUEL SYSTEM of this section. Engine starts may be accomplished from either cockpit if the necessary electric switches have been positioned in the cockpits. Engine shut-off with the throttle can be made from the forward cockpit only.

ENGINE INDUCTION

Ram air is inducted through two airscoops (20, figure 1-1), one located on each side of the fuselage forward and below the leading edge of the wing. Air from both airscoops converge into a central duct and is ducted into the engine air inlet.

ENGINE COOLING

The engine accessory, firewall and engine sections are cooled by ram air inlet ducts encompassing the engine compartment. Two inlet scoops on the fuselage (one over each trailing edge of the wing) direct air into the accessory section and the air is exhausted through a louvered panel at the bottom section of the engine compartment. Two ram air inlet scoops (one on either side of the engine compartment) cause the inlet air to be routed against the aft side of the firewall. This air is exhausted around the engine tail pipe to the ambient air. An inlet scoop on the left side of the fuselage above the engine provides cooling air to the rear engine mount. This air is exhausted through louvers above the aft end of the engine tail pipe.

IGNITION

The ignition system consists of an ignitor unit mounted on the left side of the accessory case, two ignitor plugs installed in the bottom of the combustor chamber and an ignitor switch actuated when the throttle is moved outboard from the OFF position. The ignition system is de-energized except when the throttle is held outboard to the IGN position. When the ignition system is energized, electrical power is sent to the ignition unit and starting fuel solenoid. The latter is on the engine fuel control and when energized allows fuel to go to the starting nozzles located in the combustor chamber adjacent to the ignitor plugs. Both starting fuel and ignition spark continue, as long as the throttle is held outboard. The ignition system receives its electrical power from the primary 28-volt d-c bus. When the throttle lever is held to the extreme left, (IGN), and in the OFF through IDLE positions, a spring loaded ignitor switch is engaged which will cause the ignitor system to be energized. Releasing the throttle lever or moving it inboard de-energizes the ignitors and starting fuel solenoid valve. Circuit protection of the ignition system is provided by a 7.5 ampere circuit breaker decalled IGN and PRIME on the circuit breaker panel (figure 1-14).

STARTING FUEL SYSTEM

Starting fuel to the engine during starting is accomplished by moving the throttle lever (4, figure 1-9) outboard to IGN, (any position from OFF through IDLE positions). A switch (spring loaded to OFF) is actuated, energizing the starting fuel solenoid valve, causing starting fuel to be routed from the fuel control unit to the starting nozzles adjacent to ignitor plugs. When the throttle lever is released or moved beyond the IDLE position the starting fuel solenoid is de-energized and starting fuel flow is discontinued. A circuit breaker decalled IGN and PRIME on the circuit breaker panel (figure 1-14) protects the 28-volt d-c electrical starting fuel circuit.

ENGINE FUEL CONTROL SYSTEM

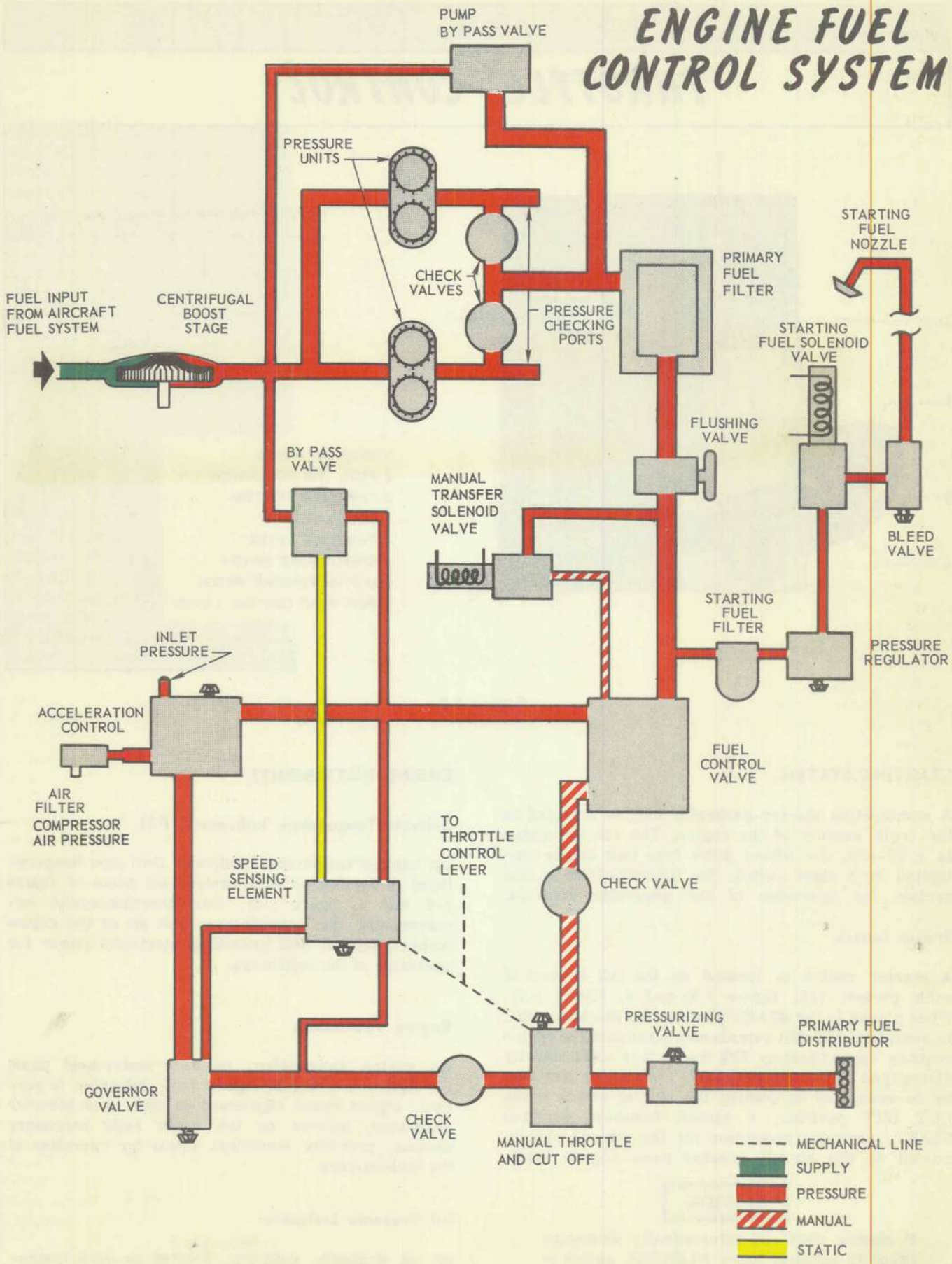
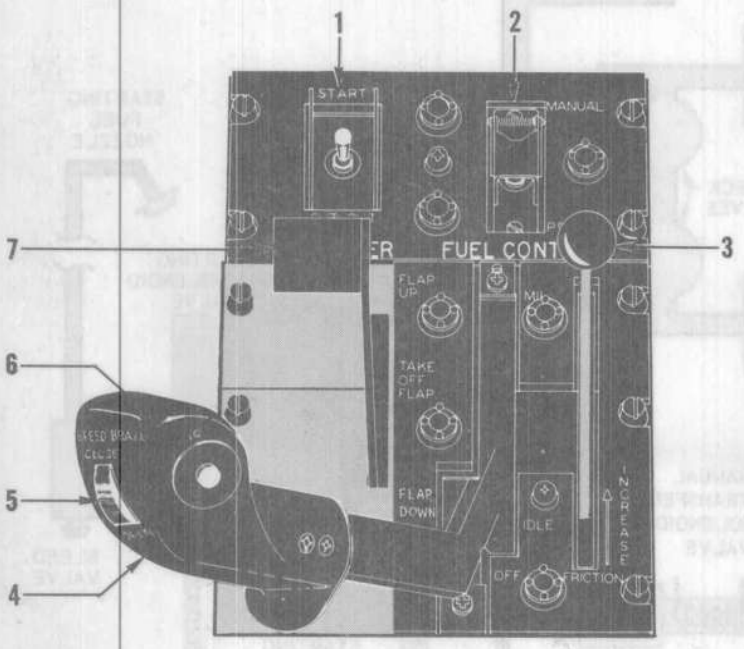


Figure 1-8

THROTTLE CONTROL



1 STARTER SWITCH
2 FUEL CONTROL SWITCH
3 THROTTLE FRICTION LOCK LEVER
4 THROTTLE LEVER
5 SPEED BRAKE SWITCH
6 UHF MICROPHONE SWITCH
7 WING FLAP CONTROL LEVER

Figure 1-9

STARTING SYSTEM

A combination starter-generator unit is mounted on the front section of the engine. The starter motor is a 30-volt, d-c direct drive type unit and is controlled by a start switch. See GENERATOR in this section for operation of the generator controls.

Starter Switch

A starter switch is located on the left console of each cockpit (12, figure 1-6) and 9, figure 1-7). When placed in the START position the starting motor is energized and will remain energized until the engine reaches approximately 22% where it is automatically disengaged by the starter relay. The starter may also be de-energized by placing the starter switch to the CUT OUT position. A circuit breaker, decalled START, provides protection for the starter control circuit on the circuit breaker panel (figure 1-14).

CAUTION

If starter does not automatically disengage after 30 seconds place STARTER switch in CUT OUT position.

ENGINE INSTRUMENTS

Exhaust Temperature Indicator (TPT)

An exhaust temperature indicator (tail pipe temperature) is located on each instrument panel (4, figure 1-4 and 4, figure 1-5). Four thermocouples, encompassing the exhaust area just aft of the engine turbine, furnish self generated electrical power for operation of the indicators.

Engine Tachometer

An engine tachometer, on each instrument panel (3, figure 1-4 and 3, figure 1-5), indicates in percent, engine speed expressed as rpm. A tachometer generator, located on the lower right accessory section, provides electrical signal for operation of the tachometers.

Oil Pressure Indicator

An oil pressure indicator, located on each instrument panel (8, figure 1-4 and 8, figure 1-5) receives

signals from an oil pressure transmitter. The indicators read in psi and operate from a 26-volt, single-phase, a-c source. The circuit is protected by a fuse, decalled OIL PRESS, on the console fuse panel (figure 1-14).

OIL SUPPLY SYSTEM

The engine oil system (figure 1-10) is composed of a seven quart oil tank (two quart expansion space), pressure servicing filler unit, and sight gage. The oil tank (17, figure 1-1) and all components are located forward of the firewall on the left side of the accessory compartment. The oil servicing pressure filler unit (figure 1-26) is accessible through an access door on the left side of the fuselage just below the wing flap. Oil is furnished to the engine from the oil tank and flows to the gear driven pressure section of the oil pump, then through a check valve, past the pressure relief valve to the main oil filter. The system is designed to pass oil beyond the filter element should it become clogged. From the filter, the oil is routed to the accessory gear section of the engine and to the front and rear bearings under pressure. The scavenge section of the oil pump consists of three gear driven units which return the oil to the oil tank. One scavenge unit for the accessory section and front bearings and one for the rear bearings return the oil to the oil tank during normal flight. The third unit, connected to the upper gear housing, serves to return the oil to the oil tank during inverted flight.

OIL TANK

The dual purpose oil tank (17, figure 1-1) acts as a reservoir and a cooling tank. The oil tank is cooled by ram air from an inlet scoop on the lower left side of the fuselage. This air passes around the tank and into the forward engine compartment. A flexible pickup tube is incorporated in the tank. This tube is weighted at one end which will cause the tube to remain in the oil supply during normal or inverted flight of the aircraft. Inlet oil is directed to the right side of the oil tank. The time involved in routing the oil from the inlet connection to the pickup tube provides sufficient dwell time for cooling of the engine oil before returning the oil to the engine. Usable oil capacity of the tank is five U. S. quarts. Separate vents are installed to relieve pressure within the tank during normal and inverted flight.

OIL GRADE AND SPECIFICATION

For oil grade and specification see figure 1-26.

OIL SUPPLY SYSTEM INDICATOR

The oil quantity sight gage is accessible through a spring loaded door in the left side of the fuselage underneath the wing.

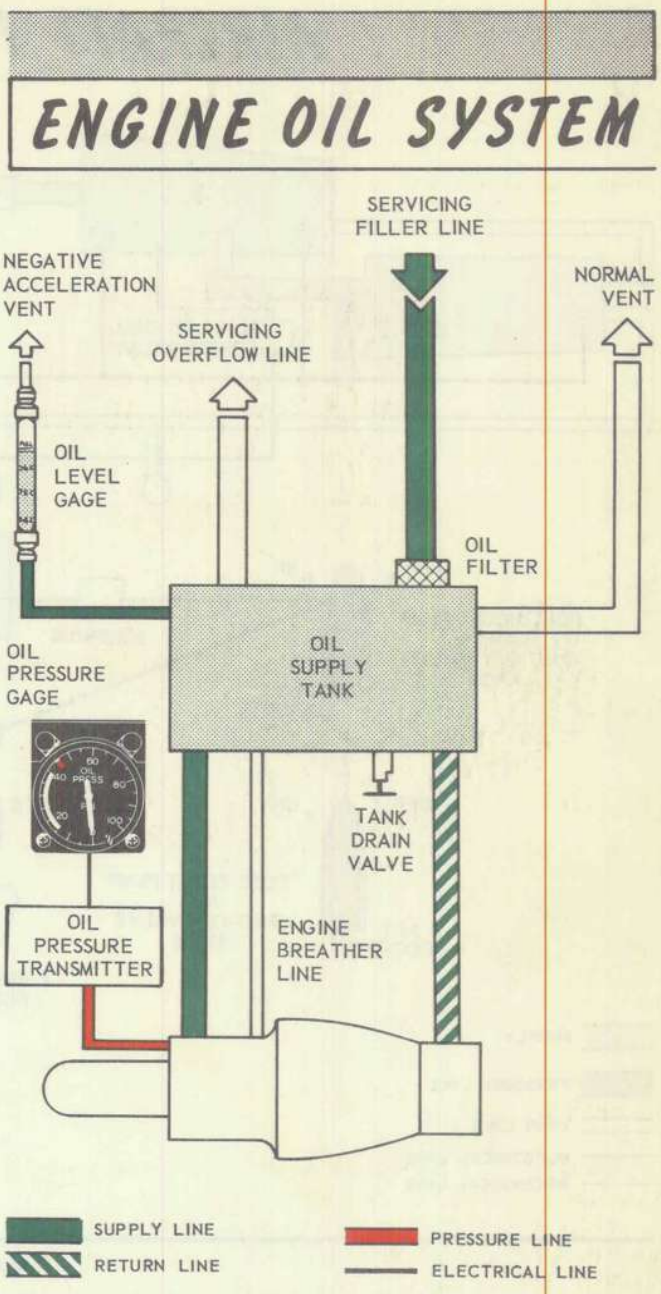


Figure 1-10

AIRCRAFT FUEL SUPPLY SYSTEM

The aircraft fuel system (figure 1-11) is so designed that the pilot is not required to select separate tanks for individual use. The airplane center of gravity is held within allowable limits as the fuel is consumed. Fuel from the wing fuel cells is fed by gravitational forces to the sump tank. The aircraft fuel supply system contains the following:

1. Six fuel tanks.
2. Fuel sump tank.
3. Fuel boost pump.

AIRCRAFT FUEL SYSTEM

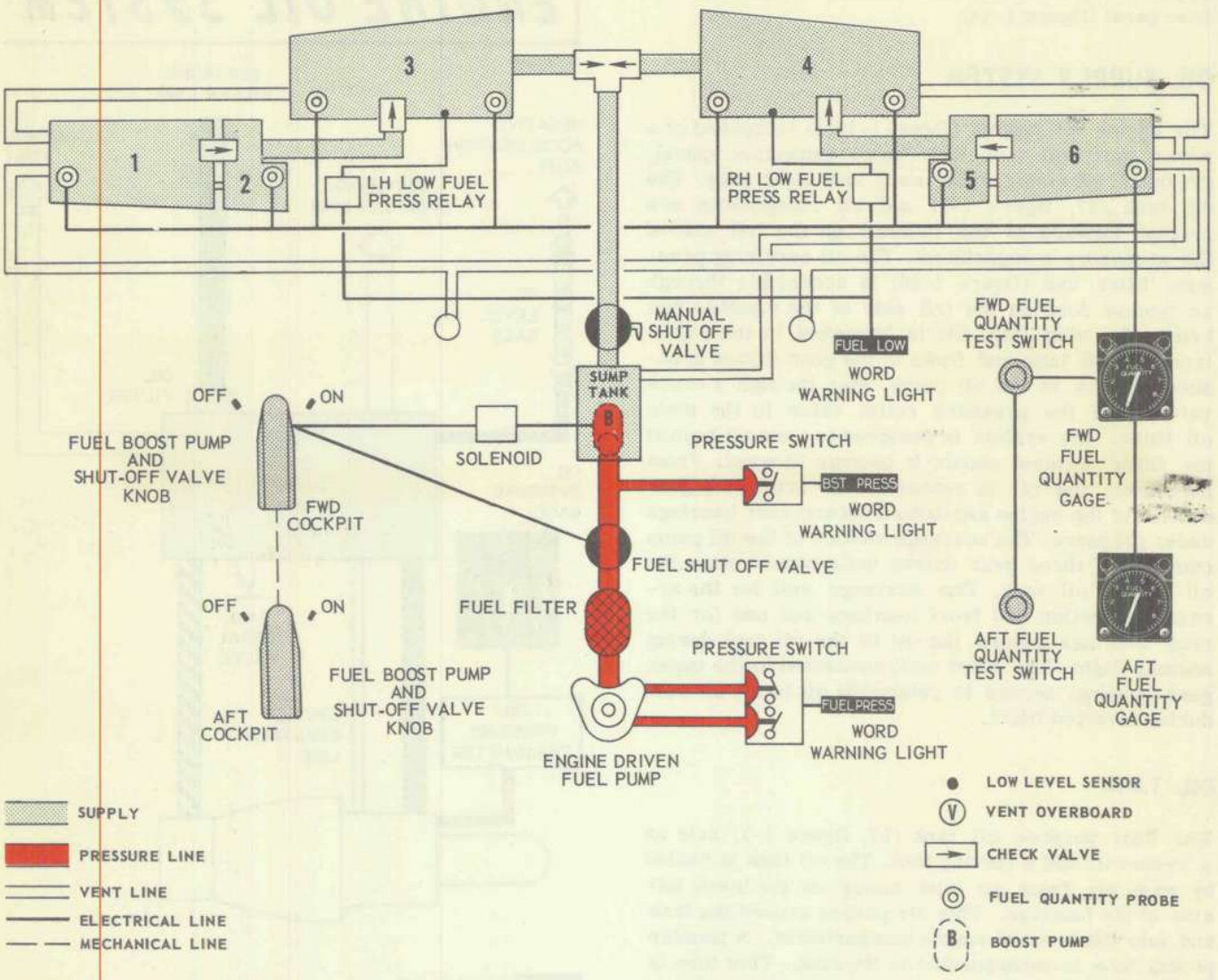


Figure 1-11

4. Two check valves.
5. Fuel shut-off valve.
6. Fuel boost and fuel shut-off valve.
7. Fuel low-level warning light.
8. Manual fuel system warning light.
9. Boost pressure warning light.
10. Fuel pressure warning light.
11. Fuel quantity gage system.

FUEL TANKS

Three integrally connected bladder-type fuel cells or tanks, are located in each wing. Fueling of the three cells in each wing is accomplished through a single filler opening (figure 1-26), located on each outer wing panel. Total usable capacity of the tanks is 124 gallons (806 pounds).

FUEL SUMP TANK

The fuel sump tank (figure 1-11) located in the right side of the engine accessory housing, has a capacity of 2 gallons. The sump tank serves as a reservoir and drain point for the gravity-fed fuel supply. The

sump tank has a fuel sump drain valve and fuel booster pump located integrally.

FUEL BOOSTER PUMP

The fuel booster pump (figure 1-11) is an electrically driven, 28-volt d-c, submerged-type pump installed in the fuel sump tank. This pump provides fuel to the engine driven fuel pump under positive pressure and eliminates any possibility of vapor locking or cavitation of the engine driven fuel pump. A circuit breaker decalled BOOST PUMP, located on the circuit breaker panel (figure 1-14) provides protection for the fuel boost circuit. The boost pump is powered from the 28-volt d-c primary bus. The Fuel Boost Pump and Shut Off Valve Control is powered from the 28 volt d-c secondary bus. See FUEL BOOST PUMP AND SHUT-OFF VALVE CONTROL for electric control.

FUEL SYSTEM CHECK VALVES

Six fuel check valves (figure 1-11) are incorporated in the aircraft fuel system. One check valve, located between each of the fuel cells, and two check valves in a single housing, located in the engine section, prevent reverse flow.

FUEL SHUT-OFF VALVE

The fuel shut-off valve (figure 1-11) is located in the fuel line between the sump tank and the engine. The valve has two positions, open and closed and is electrically controlled by the FUEL BOOST PUMP AND FUEL SHUT-OFF VALVE (9, figure 1-6 and 6, figure 1-7).

Fuel Boost Pump and Fuel Shut-off Valve Control

The Fuel Boost Pump and Fuel Shut-off Valve Control (9, figure 1-6 and 6, figure 1-7) actuates an electrical switch that provides power to both the fuel boost pump and the fuel shut-off valve motor simultaneously. The valve has two positions, decalled ON and OFF. In the ON position the fuel shut-off valve is opened and the boost pump is turned on through the power control relay. When placed in the off position the boost pump power relay is de-energized and the boost pump stops; the fuel valve is closed, preventing the fuel flow to the engine. In the event of complete electrical failure, the fuel shut-off valve will remain in the last selected position. The 28-volt d-c circuit is protected by two circuit breakers decalled BOOST PUMP and FUEL VALVE (figure 1-14).

FUEL SYSTEM WARNING INDICATORS

Fuel Low-Level Warning Light

A fuel low-level warning light, installed on each instrument panel (2, figure 1-4 and 2, figure 1-5) is illuminated when the fuel remaining at either thermal level sensor is 100 pounds or less, or when the total fuel remaining is 200 pounds or less. See Fuel Low Level Warning System in Section VII.

FUEL DATA

TANK	NO.	CAPACITY (EACH)
1 AND 6	2	20.4 U.S. GALLONS
2 AND 5	2	8 U.S. GALLONS
3 AND 4	2	34.1 U.S. GALLONS
SUMP TANK	1	2 U.S. GALLONS

TOTAL USABLE FUEL – 124 U. S. GALLONS
TOTAL FUEL CAPACITY 127 U. S. GALLONS

Figure 1-12

CAUTION

The fuel low-level warning light may become illuminated with 190-220 pounds of fuel remaining, depending on the attitude of the aircraft. A nose down attitude will cause an early illumination and a nose up attitude will cause a delay. Should the warning light become illuminated at a fuel quantity indication of 250 pounds or more in a level attitude, the pilot should assume an unequal transfer condition and make such preparations for landing as would be normal at a 200 pound remaining illumination.

Manual Fuel System Warning Light

The manual fuel system warning light, on each instrument panel (2, figure 1-4 and 2, figure 1-5), illuminates when the manual fuel system solenoid is energized. The system operates from the 28-volt d-c primary bus and is protected by the MAN FUEL circuit breaker on the circuit breaker panel (figure 1-14).

Boost Pressure Warning Light

A low boost pressure warning light, installed on each instrument panel (2, figure 1-4 and 2, figure 1-5), will illuminate any time the fuel pressure between the sump tank and the engine driven fuel pump drops below 18 psi with the electrical system energized.

ELECTRICAL POWER DISTRIBUTION

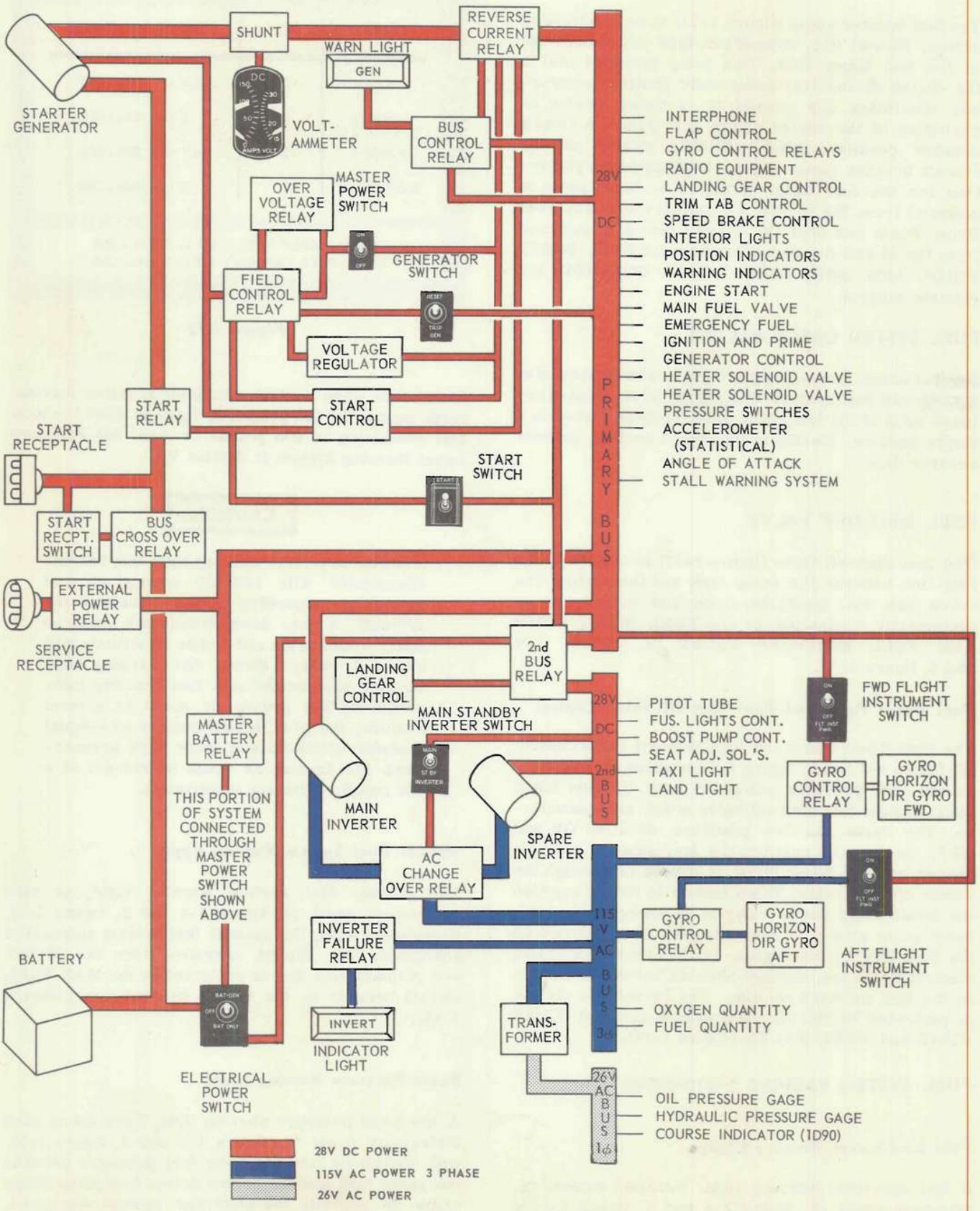
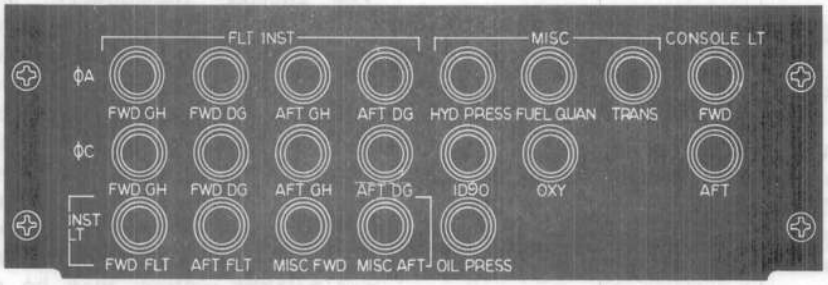
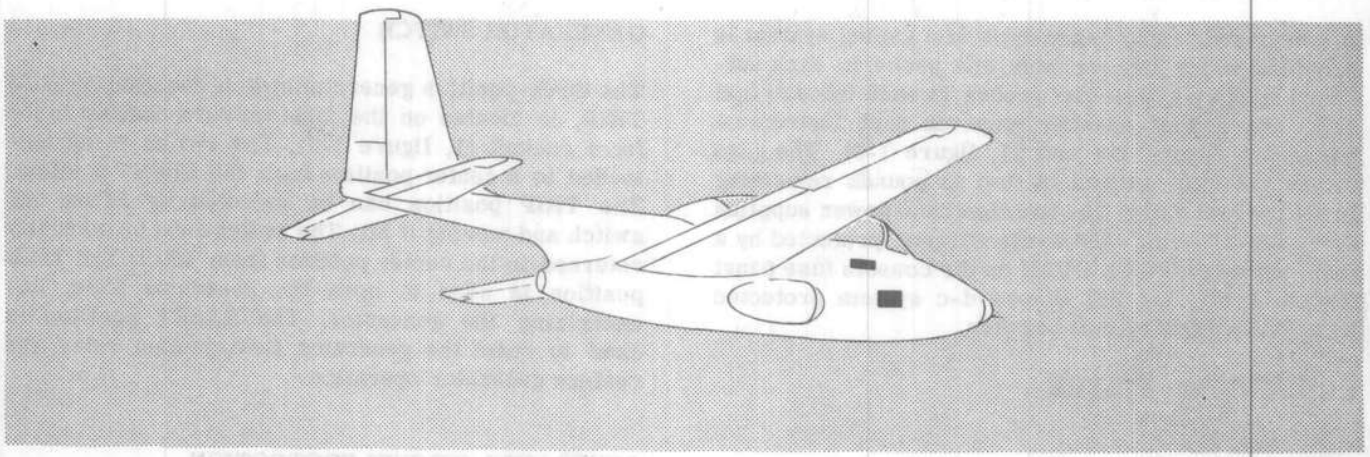


Figure 1-13

FUSE AND CIRCUIT BREAKER PANELS



FUSE PANEL



CIRCUIT BREAKER PANEL

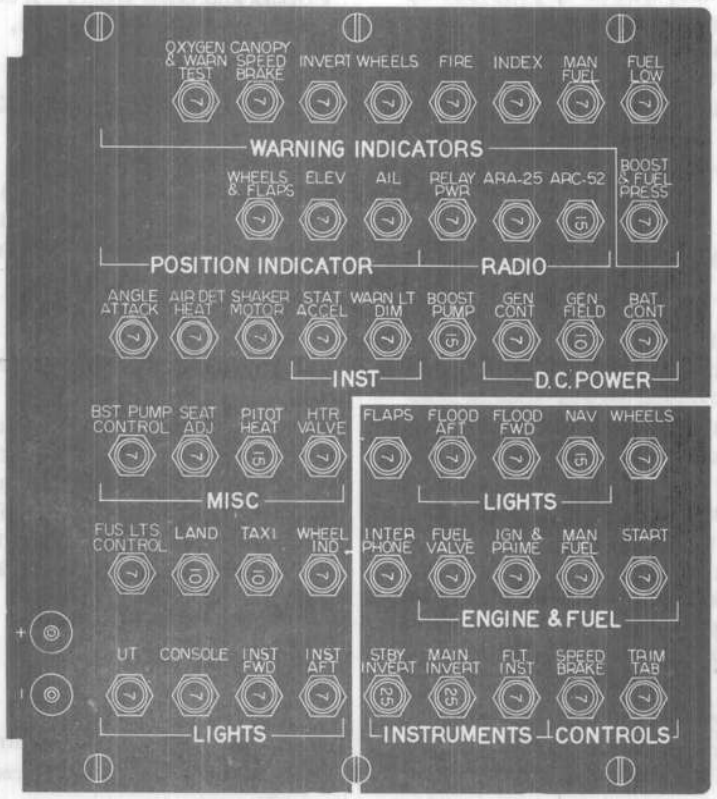


Figure 1-14

The boost pressure warning light circuit is protected by the BOOST AND FUEL PRESS circuit breaker on the circuit breaker panel (figure 1-14).

Fuel Pressure Warning Light

A fuel pressure warning light installed on each instrument panel (2, figure 1-4 and 2, figure 1-5), when illuminated, indicates a fuel pressure drop below 18 psi at either pressure section of the engine driven fuel pump. The fuel pressure warning light circuit is protected by the BOOST AND FUEL PRESS circuit breaker on the circuit breaker panel (figure 1-14).

Fuel Quantity Gage

A linearized, capacitance-type fuel gaging system is provided which incorporates one probe in each outboard fuel cell, and two probes in each inboard fuel cell, and a fuel quantity gage on each instrument panel (22, figure 1-4 and 21, figure 1-5). The gage reads the total amount of fuel in pounds remaining in all the fuel cells. The two electrical power supplies are: the 115-volt 400 cycle system, protected by a fuse, decalled FUEL QUAN on the console fuse panel (figure 1-14), and the 28-volt d-c system protected by a FUEL LOW circuit breaker.

ELECTRICAL SYSTEM

The basic electrical system (figure 1-13) is a 28-volt, direct current, open wire system which uses the aircraft structure for a ground. Power is provided by a combination starter-generator and a battery. These plus a d-c voltage regulator, over voltage relay, reverse current relay, wiring and bus bars, make up the main supply system. A-C power is provided by two 115-volt three-phase inverters and a 26-volt a-c single-phase transformer.

DIRECT CURRENT SYSTEM

The 28-volt d-c system (figure 1-13) is supplied power from the engine-driven starter-generator, and a 24-volt battery. An external power source may be connected to the system through an external power service receptacle (figure 1-26). Power supply from the starter-generator is routed to the primary bus through a reverse current relay. The secondary bus is energized by three methods: when the electrical power switch is positioned to BAT-ONLY, when the landing gear is down, or when the reverse current relay is closed (generator "on the line"). The battery (figure 1-13) supplies power to the 28-volt primary bus only when the ELECTRICAL POWER switch (1, figure 1-6) in the forward cockpit and MASTER PWR switch (1, figure 1-7) in the aft cockpit is ON.

Starter – Generator

The 28-volt, 100-ampere, engine-driven starter-generator (figure 1-13), mounted on the front of the engine, is connected to the primary bus (figure 1-13) through a reverse current relay. The voltage is regulated automatically by a carbon-pile regulator. The starter is controlled by a starter switch, (see STARTING SYSTEM of this section for location and function). The generator has an over-voltage control unit designed to disconnect the generator from the bus in the event of excessive voltage. The generator and battery voltage may be checked on the voltammeter (1, figure 1-6).

GENERATOR SWITCH

The three-position generator switch, decalled RESET-TRIP, is located on the right forward console in the front cockpit (1, figure 1-6). The switch is spring-loaded to a center position from the RESET position. The TRIP position can be selected by lifting the switch and moving it aft. The switch must be manually returned to the center position from TRIP. The TRIP position is used to open the generator field, de-energizing the generator. The RESET position is used to reset the generator field control relay and restore generator operation.

GENERATOR CIRCUIT PROTECTION

The generator control circuit is protected by a GEN FIELD and GEN CONT circuit breakers on the circuit breaker panel, figure 1-14.

GENERATOR WARNING LIGHT

A generator warning light is located on each instrument panel (2, figure 1-4 and 2, figure 1-5). The light illuminates at any time that the generator is "off the line" (reverse current relay open or de-energized).

Voltammeter

The voltammeter is a dual indicating instrument indicating the voltage (generator, battery, or external power) on the primary bus and the total output current of the generator. The voltammeter is located on the electrical power control panel on the right forward console of each cockpit (1, figure 1-6 and 1, figure 1-7).

Battery

A 24-volt, 22-ampere-hour nickel-cadmium battery (13, figure 1-1) is installed in the aft fuselage above

the engine section. The battery is wet-celled and hermetically sealed by the manufacturer. The battery is used as a standby electrical source in the event of starter-generator failure and can be used for starting the engine. The battery, generator, and the external service power source are connected in parallel with the primary bus. The battery is connected through the battery relay, the generator through the reverse current relay and service external power through the external power receptacle and relay.

Alternate Battery

A 24-volt 22-ampere-hour lead acid battery may be installed in an extreme emergency in lieu of the regular battery. Normal ground starts must be made with external power supply only. Pilots should be cautioned to conserve the battery at every opportunity.

Electrical Power Switch

The electrical power switch is located adjacent to the generator switch in the forward cockpit (1, figure 1-6). Positions of the switch are BAT-GEN, OFF and BAT ONLY. In either BAT-GEN or BAT ONLY position the battery relay is energized connecting the battery to the primary bus if the MASTER POWER switch (1, figure 1-7) in the aft cockpit is on. In the BAT-GEN position, the secondary bus can only be energized if the reverse current relay is closed or the landing gear is down. In the BAT ONLY position, the secondary bus is energized. The switch must be in the BAT-GEN position in order to close the reverse current relay, connecting the generator to the primary bus. Power from the service receptacle will energize the primary bus regardless of the position of the electrical power switch. The electrical power switch is protected by a circuit breaker, decalled BAT CONT, on the circuit breaker panel (figure 1-14).

Master Power Switch

The master power switch (1, figure 1-7) is located on the electrical power panel in the aft cockpit. Positions of the switch are ON and OFF. This switch is connected in series with the electrical power switch (in the forward cockpit). Both the electrical power and master power switch must be on to energize the primary bus.

D-C External Power Receptacles

External power receptacles (figure 1-26) are located inside two access doors on the fuselage above the trailing edge of the starboard wing. The forward receptacle is rectangular in shape and is used for connecting external starting power. When external starting power is used, the circuit is isolated from the rest of the aircraft electrical systems. This prevents high voltage surge from damaging electrical equipment. The aft service receptacle is oval in shape and provides a 28-volt d-c power connection. The external starting power receptacle is used for starting the aircraft and the service receptacle is utilized during servicing.

ALTERNATING CURRENT SYSTEM

The 400-cycle alternating current system (figure 1-13) consists of two separate but dependent systems; the 115-volt three-phase system (figure 1-13) and the 26-volt single-phase system (figure 1-13).

115-Volt A-C System

A main and spare inverter (3, figure 1-1) supplies 115-volt, 400 cycle three-phase power to the a-c bus (figure 1-13). Twenty-eight volt d-c power is supplied to the main inverter from the primary bus and to the standby inverter from the secondary bus. In an emergency, when it is desired to turn the inverters off and leave the electrical power switch on, the MAIN INVERT and STBY INVERT circuit breakers must be pulled. The inverter circuit is protected by the STBY INVERT and MAIN INVERT circuit breakers (figure 1-14). In the event of failure of either inverter, the inverter switch may be positioned to the operable inverter. The inverters supply 115-volt three-phase power for the gyro instruments, oxygen, and fuel quantity indicators and 26-volt a-c power, through a transformer, for oil pressure indication, hydraulic pressure indication and UHF/DF indicating equipment.

INVERTER SWITCH

A two-position inverter switch is located on the electrical power control panel on the right forward console (1, figure 1-6). Positions of the switch are: MAIN and STBY. Both inverters operate continuously, but only the inverter selected is connected to the a-c system bus.

INVERTER FAILURE WARNING LIGHT

Failure of either MAIN or STBY inverter (voltage output lower than 90-volts) is indicated by the illumination of the inverter failure warning light located on each instrument panel (2, figure 1-4, and 2, figure 1-5). The light is controlled by a relay which senses inverter output voltages. The INVERT circuit breaker provides protection of the warning circuit and is located on the circuit breaker panel (figure 1-14).

HYDRAULIC POWER SUPPLY SYSTEM

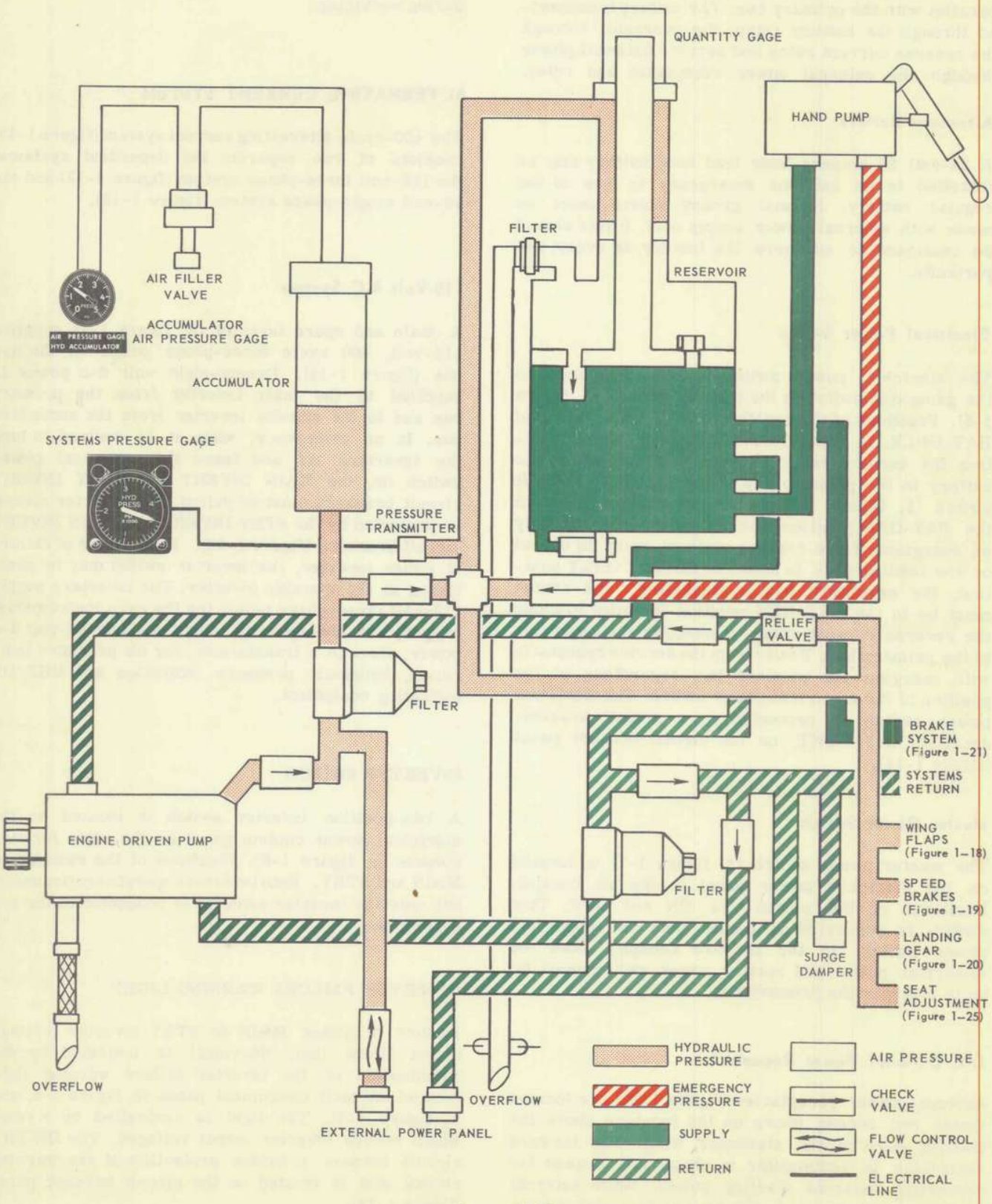


Figure 1-15

26-Volt A-C System

A transformer is provided which supplies 26-volt a-c power (figure 1-13) and is protected by a fuse, decalled TRANS, on the right forward fuse panel (figure 1-14). The transformer circuit is energized by the inverter system and requires no switches.

FUSE AND CIRCUIT BREAKER PANEL

A circuit breaker panel located on the inboard side of the right forward console, and a fuse panel located just above the right forward console furnish protection for the aircraft electrical circuits (figure 1-14).

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic system (figure 1-15) supplies power to operate the following systems: landing gear, wing flap, speed brake, and seat adjustment. A reservoir (capacity 3 U. S. quarts), installed on the right side of the engine accessory compartment, supplies hydraulic fluid to the brake system, engine driven pump, and the hydraulic hand pump. An accumulator assists the pump in pressurizing the system. Two filters are installed to cleanse the fluid. A relief valve, incorporated in the system, relieves pressure at 3400 ± 100 psi. An external power panel, located on the right side of the engine compartment, is provided with two quick disconnect valves for servicing.

HYDRAULIC HAND PUMP

A hydraulic hand pump (19, figure 1-2 and figure 1-15) on the left side of the seat in the forward cockpit provides pressure for operation of the system in the event of engine pump failure or for ground checks. When the hand pump is put into operation fluid is taken from the hydraulic reservoir and directed into the main hydraulic pressure line. A one-way check valve, located in the line on the outlet side of the pump, restricts the fluid from returning to the hand pump.

ACCUMULATOR PRESSURE GAGE

An air pressure gage attached to the accumulator (figure 1-15) is installed in the right wheel well. The air pressure gage is installed for servicing only and indicates the air preload charge within the accumulator.

HYDRAULIC PRESSURE GAGE

A hydraulic pressure gage is located on the instrument panel in the forward cockpit only (14, figure 1-4 and figure 1-15). This instrument indicates hydraulic system pressure in psi and operates from 26-volt alternating current power.

HYDRAULIC SIGHT GAGE

A hydraulic sight gage, located in the right wheel well (figure 1-26), gives a constant indication of hydraulic fluid quantity. The decalled indications of the gage are: REFILL, FULL, OVERFLOW.

FLIGHT CONTROL SYSTEM

The primary flight control surfaces are conventionally operated by a control stick and rudder pedals (figure 1-2) which are mechanically connected to the control surfaces by means of push-pull rods. Aileron control forces are reduced by a spring tab located on each aileron. The stick and rudder pedals are interconnected between the front and rear cockpits by use of a torque tube and push rods. Trim tabs on both elevators and left aileron are electrically operated.

CONTROL STICK

The control stick (figure 1-16) is conventional, incorporating a hand grip with the following controls:

CONTROL STICK GRIP



Figure 1-16

SURFACE CONTROLS LOCK AND RUDDER PEDAL ADJUSTMENT

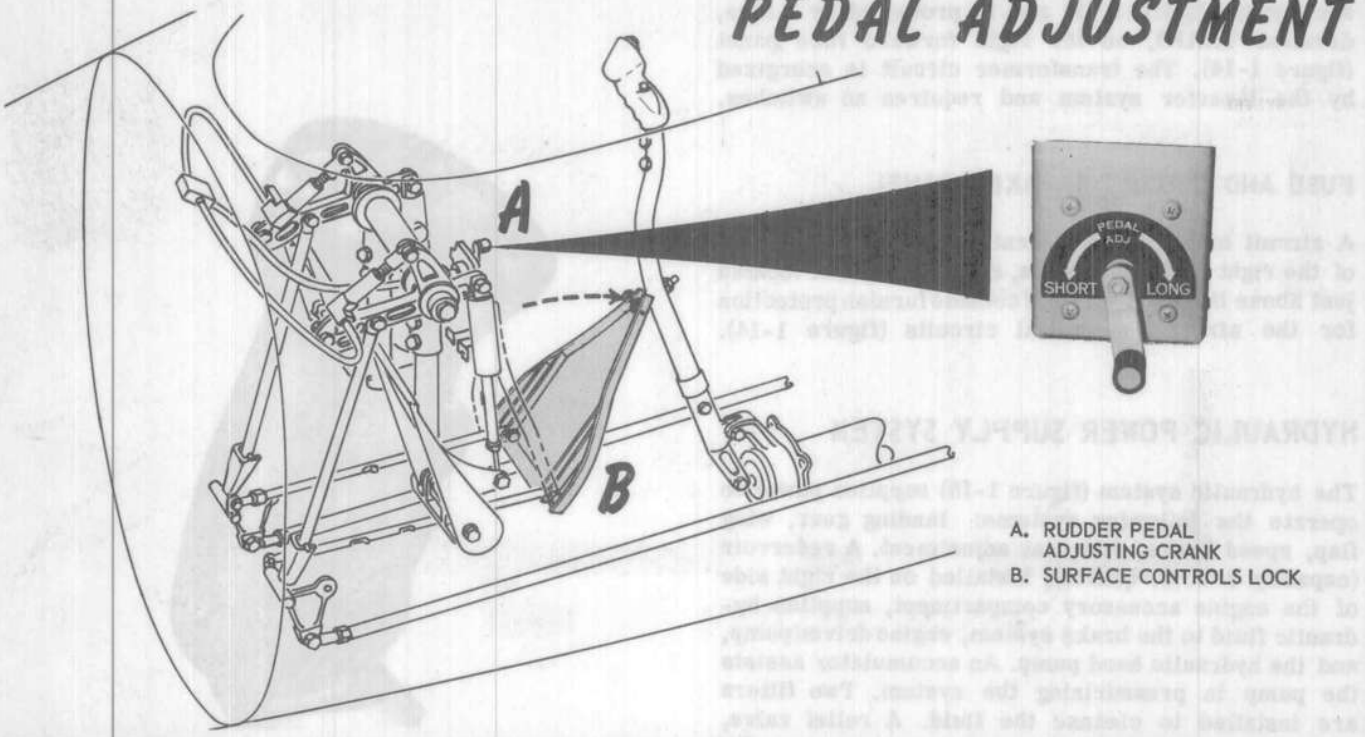


Figure 1-17

trim tab switch on the right upper side, and an interphone control switch on the upper left side. These switches are discussed under their applicable systems.

RUDDER PEDAL ADJUSTMENT

The rudder pedals are adjusted for leg length by turning the rudder pedal adjusting crank (figure 1-17 and 3, figure 1-2) located below each instrument panel. A clockwise rotation moves the pedals forward and a counterclockwise rotation moves the pedals aft.

SURFACE CONTROLS LOCK SYSTEM

The surface controls lock, decalled GUST LOCK, (figure 1-17 and 18, figure 1-2) is located below the instrument panel on the center line of the aircraft and has two positions, LOCK and UNLOCK. The forward position of the control is UNLOCK. Moving the lever aft to LOCK engages the stick and locks all of the control surfaces in their neutral positions. To move the control lock from one position to the other, a pull knob on the right side of the surface control lock at the attaching point must be pulled to release the catch. The control lock is spring loaded to the UNLOCK position.

NOTE

All control surfaces must be in their neutral positions before the gust lock will secure the control surfaces.

Trim Tabs

Controllable trailing edge trim tabs are provided on the left aileron and on each elevator. The left aileron trim tab is operated directly by a 28-volt d-c electrical actuator mounted on the aileron spar. The two elevator trim tabs are electrically operated by one 28-volt d-c motor mounted between the tabs and linked by flexible shafts. The ground adjustable rudder trim tab is installed on the lower trailing edge of the rudder.

TRIM TAB SWITCH

The aileron and elevator tabs are controlled by a switch on each control stick grip (figure 1-16). Positions of the four-way switch are: forward - NOSE DOWN; aft - NOSE UP; left - LWD (left wing down); and right - RWD (right wing down). The switch is spring loaded to off or neutral position. The aileron and elevator tab switch in the aft cockpit

WING FLAP SYSTEM

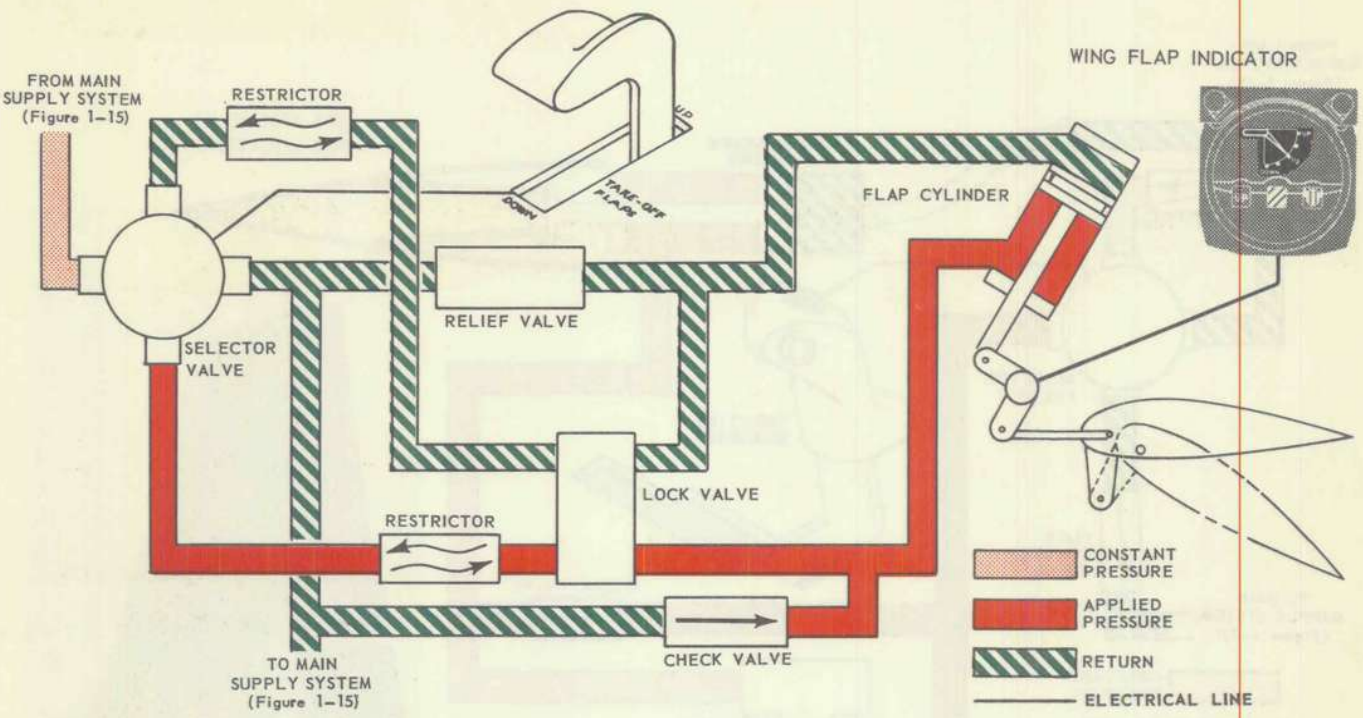


Figure 1-18

has an override feature that will cut-out the front cockpit control at any time that the aft cockpit switch is being used. The electrical circuit is protected by the TRIM TAB circuit breaker on the circuit breaker panel (figure 1-14).

TRIM TAB INDICATORS

Aileron and elevator trim tab indicators are located on the left console forward of the engine power panel (13, figure 1-6 and 10, figure 1-7) in each cockpit. Each instrument indicates the degrees from the streamlined position in either the up or down position. Each trim tab circuit is energized by a position transmitter. The circuit is protected by the ELEV and AIL circuit breaker on the circuit breaker panel (figure 1-14).

WING FLAPS

The aircraft is equipped with mechanically interconnected, all-metal, electrically controlled, hydraulically operated wing flaps (figure 1-18) located on the inboard trailing edge of each wing. The interconnected flaps are positioned by a single hydraulic actuating cylinder and the flaps have a maximum travel of 40° down with the flap control lever in the DOWN position. The flap system normally is operated by pressure from the engine driven hydraulic pump. In the event of engine pump failure the emergency hand pump can be utilized to manually supply the necessary pressure for the flap system. See HAND PUMP in this section for location.

WING FLAP CONTROL LEVER

Two flap control levers (11, figure 1-6 and 8, figure 1-7), one on each power quadrant, electrically operate a selector valve that directs hydraulic pressure to the up or down line of the flap actuating cylinder. Positions of the flap control lever are decalled: FLAP DOWN, TAKE-OFF FLAP, and FLAP UP. With the lever in the FLAP DOWN position the flaps start a downward travel to the full 40° position unless the lever is repositioned. When the lever is placed in the TAKE-OFF FLAP position, the flaps move to a 20° down position. By placing the lever in the FLAP UP position, the flaps at either the 20° or 40° position move upward until the fully retracted position is reached.

WING FLAP POSITION INDICATOR

The wing flap and wheels position indicator is installed on the left instrument sub-panel in each cockpit (22, figure 1-2 and 15, figure 1-3). The instrument indicates flap positions of UP, 1/2, and DOWN and operates from the 28-volt d-c power source. The circuit is protected by the WHEELS and FLAPS

SPEED BRAKE SYSTEM

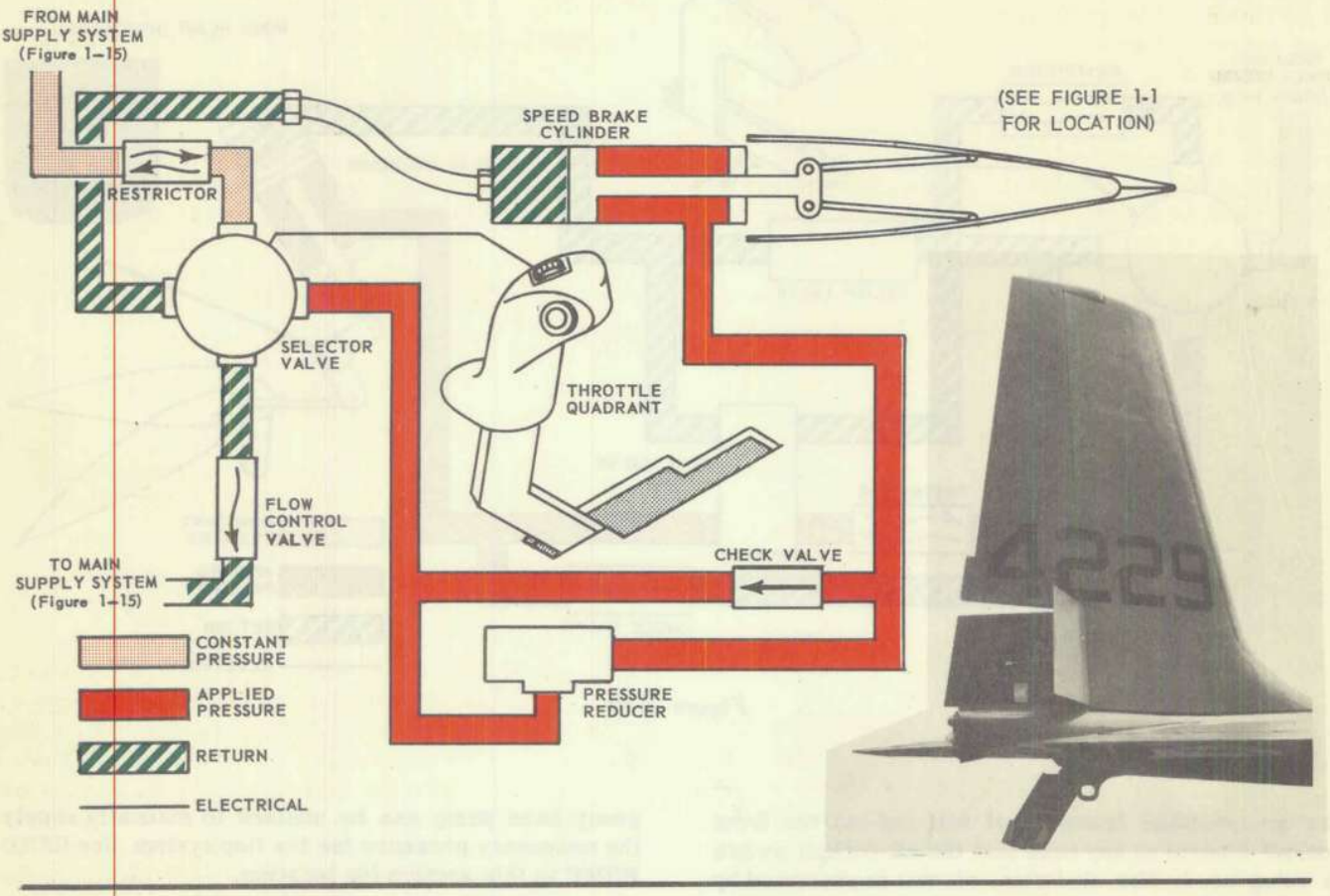


Figure 1-19

circuit breaker on the circuit breaker panel (figure 1-14). See LANDING GEAR WARNING LIGHTS for landing flaps extended operation.

SPEED BRAKES

A three segment mechanically interconnected hydraulically operated, electrically controlled speed brake (figure 1-19) is installed on the trailing section of the vertical fin below the rudder and on the lower section of the tail cone. Extension of these brakes increases the rate of descent during landing or will reduce speed during flight. A single hydraulic actuator extends the trailing edges of the two vertical braking surfaces outboard and extends the trailing edge of the tail cone braking surface.

SPEED BRAKE CONTROL SWITCH

A speed brake control switch, located on each throttle lever (5, figure 1-9), actuates a solenoid valve allowing hydraulic pressure to be routed to the actuating cylinder. Positions of the switch are OPEN and CLOSE. It is spring loaded to a center position from both actuating positions. The length of time the switch is held in the OPEN position determines the degree the speed brakes are opened. The brakes are closed by momentarily moving the switch to the CLOSE position. The speed brake control switch in the aft cockpit has an override feature that will cut out the forward cockpit control switch at any time the rear cockpit switch is used. The electrical circuit is protected by the SPEED BRAKE circuit breaker (figure 1-14).

NOTE

In the event of an electrical failure the speed brake will retract.

LANDING GEAR SYSTEM

The fully retractable tricycle landing gear (figure 1-20) is electrically controlled and hydraulically actuated. Each landing gear strut is of the air-oil type and each main gear wheel is equipped with disc-type brakes. The nose gear swivels 40° left

or right from the aircraft center line and is equipped with a shimmy damper. The landing gear is exceptionally friction free in operation and extends in approximately six and one-half seconds and retracts in approximately four and one-half seconds. The main gear retracts inboard into the wings and the nose gear retracts forward into the nose section of the fuselage. The inboard main gear doors and nose gear doors return to the closed position when the gear is extended. The landing gear is held in the full up or down position by mechanical locks. The gear may be operated by pressure from the engine-driven or hand hydraulic pump. When the landing gear control lever is positioned in either the UP or DOWN position a shuttle valve allows system pressure to be applied to the up or down side of the three landing gear door cylinders. When the landing gear reaches the up and locked or down and locked position, limit switches are energized. These switches de-energize the landing gear selector valve, releasing system pressure, and allowing landing gear doors to return to the up position. The check valves in the landing gear up line allow thermal pressure build-up (due to expansion of trapped fluid) to be returned to the system power supply.

LANDING GEAR CONTROL LEVER

A landing gear control lever is installed on the left console of each cockpit (14, figure 1-6 and 11, figure 1-7). The levers are mechanically interconnected and operate a single landing gear control valve electrically. Positions of the levers are UP and DOWN. A safety switch on the left main gear oleo scissors prevents the gear from being retracted at any time that the aircraft weight is resting on the gear, unless the override switches are used. The electrical circuit is protected by the WHEELS circuit breaker on the lower right section of the circuit breaker panel (figure 1-14).

LANDING GEAR CONTROL OVERRIDE SWITCH

A push-button switch on the forward end of each left console panel (14, figure 1-6 and 11, figure 1-7), when actuated, allows the landing gear handle to be moved to the UP position allowing the landing gear to be retracted when the weight of the aircraft is resting on the gear. This is an emergency switch and may be used to collapse the gear when take-off is aborted and it is impossible to stop the aircraft on the remaining runway. The electrical circuit is protected by the WHEELS circuit breaker on the circuit breaker panel (figure 1-14).

MANUAL OVERRIDE BUTTON

A manual override button, located on the forward cockpit landing gear control panel (14, figure 1-6), is used to manually unlock the landing gear control lever. The manual override button is used in the event the landing gear control override switch malfunctions or if electrical power is not available.

LANDING GEAR EMERGENCY RELEASE HANDLE

A red T handle located below the forward instrument panel (20, figure 1-2), when pulled aft actuates the emergency gear extension system. The aft pull repositions the emergency wheels down valve and relieves the pressure on the up side of the landing gear doors, unlocks the gear and door uplocks and allows the gear to free fall to the down position. See LANDING GEAR EMERGENCY EXTENSION in Section III.

CAUTION

Pitch and yaw the aircraft sufficiently to insure that the gear is in the down and locked position.

LANDING GEAR POSITION INDICATORS

Position of the landing gear is shown on the wheels and flap position indicator located on the left subpanel in each cockpit (22, figure 1-2 and 15, figure 1-3). The indicator shows the position of each wheel. A barber pole indicates that the related gear is in an unlocked position or power is off. The word UP appears if the gear is up and locked and a wheel will show if the gear is down and locked. Power is supplied to the position indicators by the 28-volt d-c primary bus, through a circuit breaker decalled WHEELS and FLAPS, on the circuit breaker panel (figure 1-14).

LANDING GEAR WARNING LIGHTS

The transparent knob on the landing gear control lever (figure 1-20), in each cockpit contains a red light which illuminates when the gear is in any position other than the position selected. A red landing gear word warning light (WHEELS) is located on each instrument panel (2, figure 1-4 and 2, figure 1-5). These lights will flash on and off at any time the throttle is retarded below approximately 60% rpm with the landing flaps not in the full "up" position and any of the landing gear is not in the down and locked position. The warning light circuit is protected by the WHEELS circuit breaker on the upper left portion of the circuit breaker panel (figure 1-14).

LANDING GEAR POSITION LIGHTS

To aid in determining landing gear position from the ground at night, a white light is installed near each landing gear. The main gear position lights are mounted on the forward outboard side of the wheel

LANDING GEAR SYSTEM

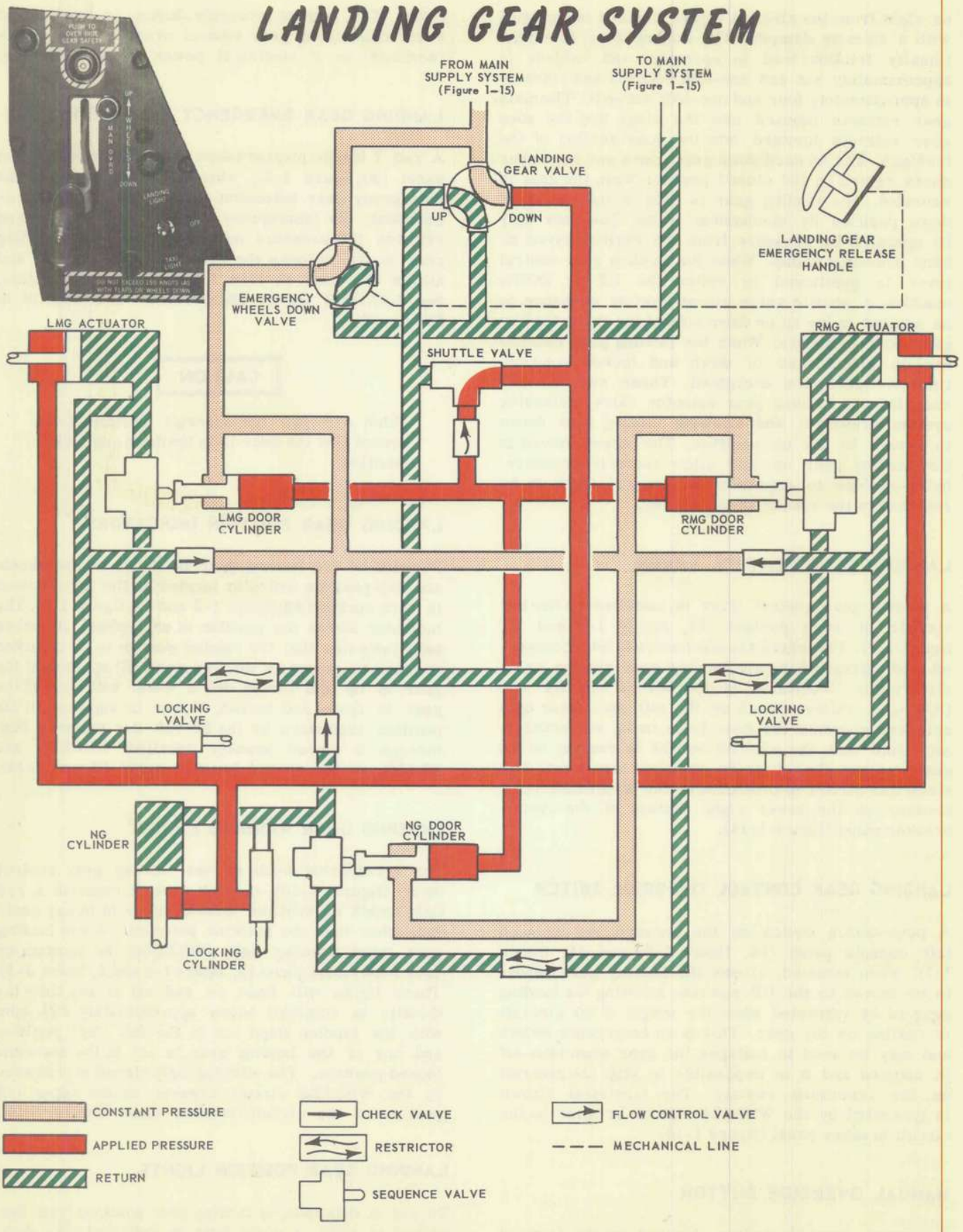


Figure 1-20

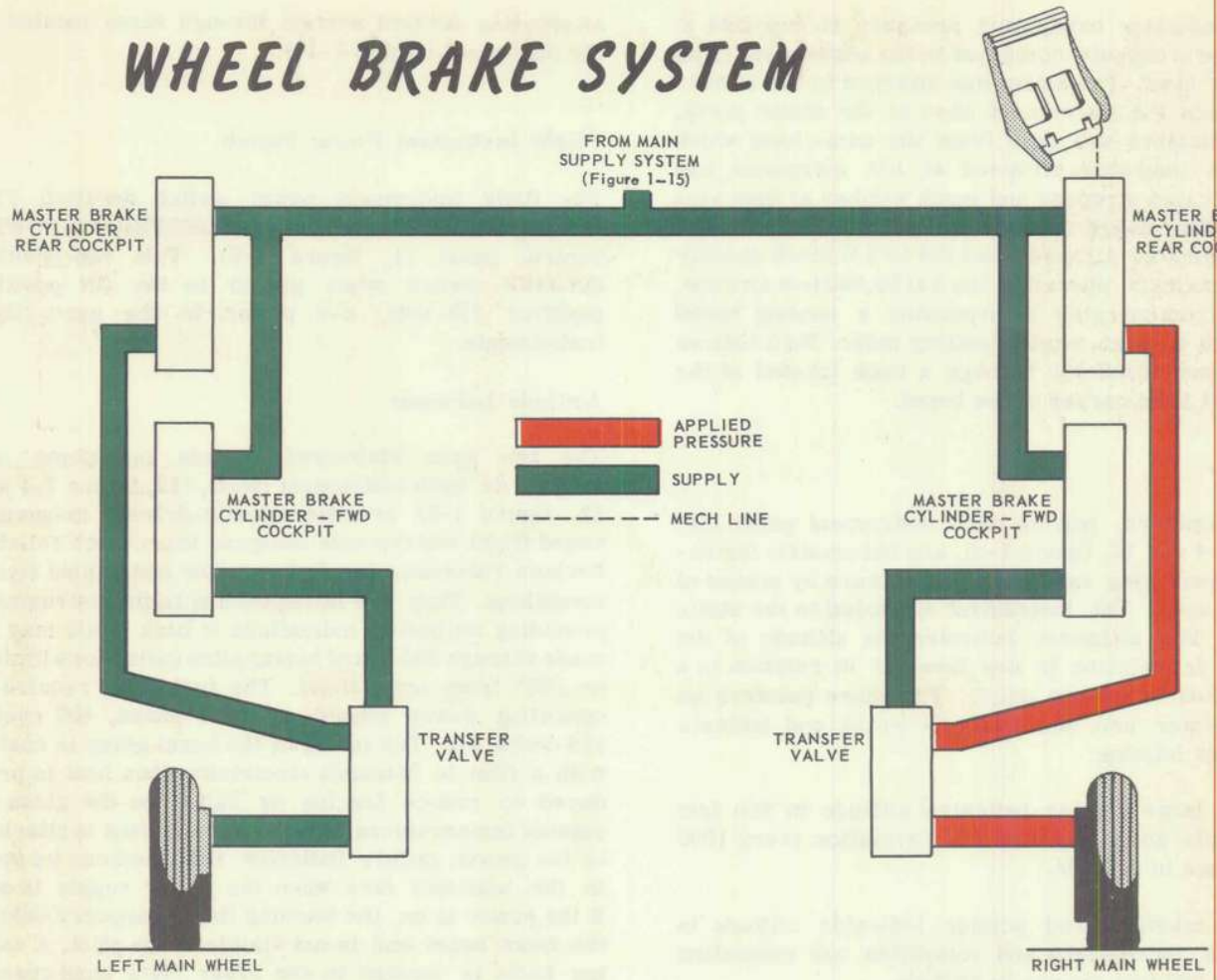


Figure 1-21

wells in each wing and the nose gear light is installed on the nose section of the fuselage just forward of the wheel well. The lights are illuminated when the gear is down and locked. The circuit is protected by the WHEEL IND circuit breaker on the circuit breaker panel (figure 1-14).

BRAKE SYSTEM

The two main landing gear wheels (figure 1-21) are provided with hydraulically operated disc-type brakes. The brakes are actuated individually by a master brake cylinder operated by toe pressure on each rudder pedal in either cockpit. The brake system is supplied hydraulic fluid from the main hydraulic system reservoir (figure 1-15). The brake stand pipe, being lower than the hydraulic hand pump and engine driven pump stand pipe, will have a supply of fluid even though the main hydraulic system fluid is exhausted through broken lines.

FLIGHT INSTRUMENTS

PITOT AND STATIC SYSTEMS

Ram and atmospheric air pressures operate the altimeter, pitot-static airspeed and mach instrument, and the vertical velocity indicator. The pitot head (1, figure 1-1) is mounted on the nose of the fuselage. A static port is located on each side of the fuselage forward of the wing. The instruments discussed in the following paragraphs utilize either pitot and static supplies, or static air supply alone as a source of power.

Airspeed And Mach Number Indicator

The two indicators (10, figure 1-4 and 10, figure 1-5) provide the pilots with a simplified presentation of airspeed and limiting mach number. To operate the

single indicator hand, pitot pressure is supplied to a pressure capsule contained in the instrument from the pitot head. The static line attached to the instrument vents the instrument case to the static ports. Both indicators are read from the same hand which indicates indicated airspeed at low airspeeds and both indicated airspeed and mach number at high airspeed. The range of the instrument is 0 to 650 knots indicated airspeed and 0.5 to 2.0 mach number with a maximum operating limit at 50,000 feet altitude. The instrument also incorporates a landing speed index and a mach number setting index. Both indices can be set manually through a knob located at the lower left hand corner of the bezel.

Altimeter

Two altimeters, one on each instrument panel (18, figure 1-4 and 17, figure 1-5), are barometric instruments measuring variations in pressure by means of aneroid units. The instrument is vented to the static system. The altimeter indicates the altitude of the aircraft in relation to sea level or in relation to a preselected reference point. The three pointers on the altimeter use one common scale and indicate altitude as follows:

1. The large pointer indicates altitude in 100 feet increments and completes one revolution every 1000 feet change in altitude.

2. The middle sized pointer indicates altitude in 1000 feet increments and completes one revolution every 10,000 feet change in altitude.

3. The small pointer indicates altitude in 10,000 feet increments.

When the atmospheric pressure is other than normal (29.92), the correct field elevation correction can be made with an adjustment knob. Rotation can be made in either direction until the desired altimeter setting is centered in the Kollsman window.

Vertical Velocity

The two vertical velocity indicators, one on each instrument panel (20, figure 1-4 and 19, figure 1-5), are differential-pressure-measuring instruments that indicate the rate of change of altitude of the aircraft and have a range from zero to 6000 feet a minute. The vertical velocity indicator is connected to the static line.

ALTERNATING CURRENT INSTRUMENTS

Alternating current instruments include the attitude indicator and directional indicator. The instruments are supplied power from the 115-volt, three-phase, alternating current system through fuses located on the fuse panel (figure 1-14).

Flight Instrument Power Switch

The flight instrument power switch decalled FLT INST PWR, is located on the ELECTRICAL POWER control panel (1, figure 1-6). This two-position ON-OFF switch when placed in the ON position supplies 115-volt, a-c power to the gyro flight instruments.

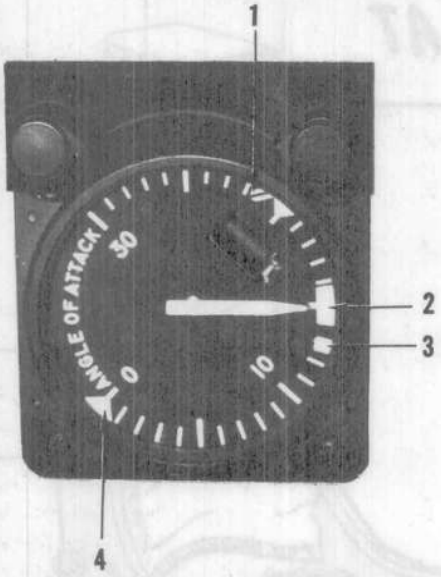
Attitude Indicator

The two gyro stabilized attitude indicators, one located on each instrument panel, (12, figure 1-4 and 12, figure 1-5) are electrically-driven, manually-caged flight instruments designed to provide a reliable horizon reference for flying under instrument flying conditions. They are non-tumbling flight instruments providing unlimited indications in bank (rolls may be made through 360°) and having pitch indications limited to ±27° from level flight. The indicators require an operating power supply of three-phase, 400 cycle, 115-volts a-c. The inside of the bezel glass is coated with a film to transmit electricity, thus heat is produced to reduce fogging or vapor on the glass as outside temperatures vary. A warning flap is attached to the power failure indicator shaft and can be seen in the indicator face when the power supply is off. If the power is on, the warning flag disappears behind the front bezel and is not visible to the pilot. A caging knob is located in the lower right hand corner of the front bezel. Quick erection of the gyro is accomplished by mechanical caging. The pilot erects the gyro immediately after power is supplied to the indicator by pulling out the caging knob. The knob is held in the extended position until the horizontal bar and bank index cease to oscillate at which time the instrument should indicate zero roll and pitch within approximately three degrees.

Directional Indicator

A directional gyro indicator, located on each instrument panel (11, figure 1-4 and 11, figure 1-5), provides a visual indication of aircraft headings during maneuvers or straight flight. The instrument is equipped with one setting knob that provides a means of rotating the dial. The dial can be rotated so that the preselected heading falls under the lubber line. Any deviation of the aircraft from this heading in azimuth will be reflected by the amount indicated in degrees between the preselected heading and the lubber line. The power supply required to operate these instruments is three-phase, 400 cycle, 115-volt a-c. The inside of the bezel glass is coated with a film to transmit electricity which will cause heat to be produced to reduce fogging or vapor within

ANGLE OF ATTACK INDICATOR



1. STALL WARNING INDEX
2. APPROACH BAND INDEX
3. MAXIMUM DISTANCE GLIDE INDEX
4. ZERO ANGLE OF ATTACK

Figure 1-22

the instrument and on the glass as outside temperatures vary. A push-to-cage knob, when pushed in, cages the gyro, and when rotated in this position revolves the dial relative to the lubber line. With the knob pulled out the gyro is uncaged and the dial is allowed to rotate freely in response to changes in aircraft heading. Rotation of the knob in the pulled-out position has no effect on the instrument.

TURN AND SLIP INDICATOR

Two turn and slip indicators, one on each instrument panel (19, figure 1-4 and 18, figure 1-5) are operated by the aircraft's engine compressor bleed air. The turn and slip indicator is used to determine the rate of turn of the aircraft and to enable the pilot to make coordinated turns under instrument conditions. The pilot is able to maintain a laterally level attitude while flying straight and to bank at the proper angle when turning. The turn and slip indictors are supplied pneumatic pressure from the engine bleed orifice. A pressure regulator is located between the indicators and their supply to provide a pressure of two inches of mercury for normal operation.

MAGNETIC COMPASS

Two magnetic compasses, one located above the forward instrument panel and one on the crossbeam of the canopy for the aft cockpit (1, figure 1-2 and 1, figure 1-3), are of the standard "floating card" type that continuously indicate the direction of the plane with respect to magnetic north. This compass operates from attractions of the earths magnetic forces. No other source of power is necessary. A compass deviation card and holder are provided on the right side of each instrument panel.

ACCELEROMETER

The accelerometer is located on the right hand sub-panel in the forward cockpit (2, figure 1-2). The accelerometer is self contained and the dial is calibrated in "g's" so that the readings can be interpreted in units of acceleration of the aircraft along its vertical axis. The dial has a range of minus 5g to plus 10g. The instrument has three pointers; one a continuous reading with changing acceleration; the second pointer records the maximum positive acceleration obtained. The number three pointer records maximum negative acceleration obtained. The second and third pointers remain in the highest ± "g" reading reached in any particular maneuver and record for future reference the highest positive and negative loads to which the aircraft has been subjected. Depressing the knob on the front of the instrument will reset the high and low maximum reading hands to 1g.

CLOCKS

The two clocks, one mounted on the forward instrument panel (13, figure 1-4), one on the aft instrument panel (13, figure 1-5), are standard eight day aircraft clocks.

ANGLE OF ATTACK STALL WARNING SYSTEM

The angle of attack stall warning system provides indication of the aircraft's angle attack (the angle between the flight path and the longitudinal axis of the aircraft) and approaching stalls. The system consists of an airstream direction detector, two angle of attack indicators, two approach index indicators, and a rudder pedal shaker. The system is powered from the 28-volt d-c primary bus. The airstream direction detector probe is provided anti-icing heat through the PITOT HEAT switch. The approach index indicators are powered through the landing gear squat switch and the left landing gear uplock switch. When the aircraft is on the ground or in a landing gear up configuration tne approach index indicators are inoperative. The rudder pedal shaker is powered through the landing gear squat switch and is inoperative when the aircraft is on the ground. The system is protected by the AIR DET HEAT, INDEX, ANGLE ATTACK, and SHAKER MOTOR circuit breakers on the circuit breaker panel (figure 1-14).

EJECTION SEAT

1. FACE CURTAIN HANDLE
2. FACE CURTAIN INTERLOCK MANUAL RELEASE HANDLE
3. PARACHUTE RIPCORD GRIP
4. SHOULDER HARNESS AND PARACHUTE ATTACHMENTS
5. SEAT BELT AND PARACHUTE ATTACHMENTS
6. PERSONAL LEAD DISCONNECT OXYGEN AND RADIO
7. SHOULDER HARNESS INERTIA REEL LOCK
8. PILOT'S EMERGENCY RELEASE HANDLE
9. ESCAPE SYSTEM SAFETY PIN AND STREAMER



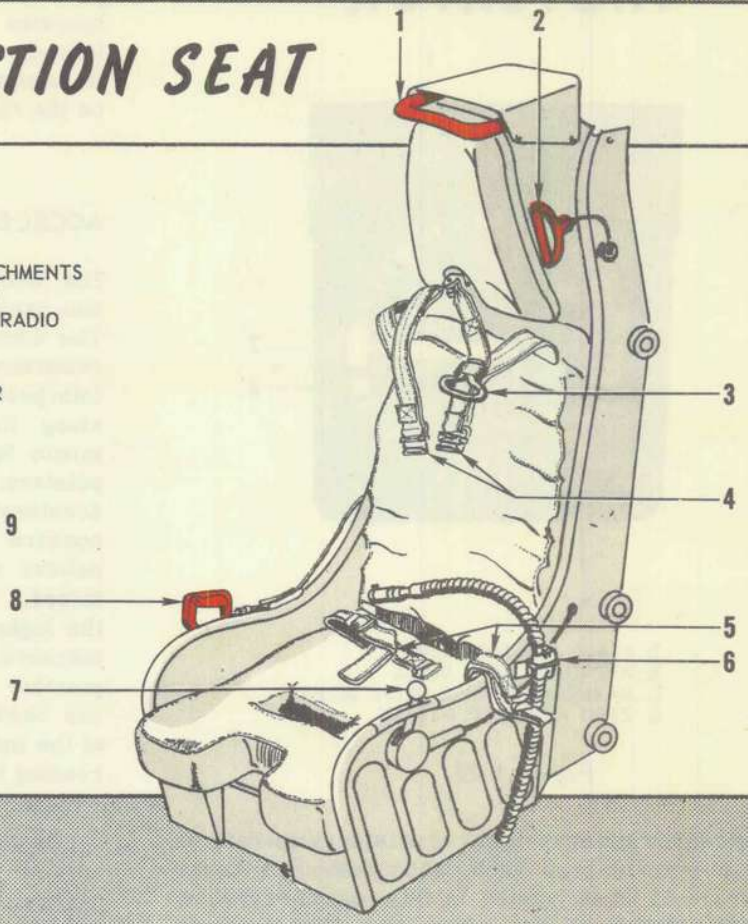


Figure 1-23

APPROACH INDEX INDICATOR

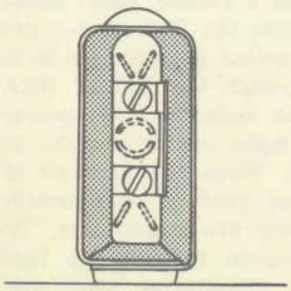


Figure 1-24

ANGLE OF ATTACK INDICATOR

The angle of attack indicator, located on each instrument panel, (9, figure 1-4 and 9, figure 1-5) provides indications of the aircraft's angle of attack. The dial graduations range from 0 to 30 units. A single pointer moves counterclockwise for increasing values of angle of attack. An approach band index, permamently located at three o'clock on the dial, is used to facilitate the pilot's scan for a quick optimum approach angle reference during a landing approach. Three other adjustable indices are located on the dial. These indices are preset to the aircrafts flight characteristics and consist of: stall warning index (1, figure 1-22), maximum distance glide index (3, figure 1-22), and a zero angle of attack index (4, figure 1-22). The zero angle of attack index is not used on this aircraft.

APPROACH INDEX INDICATOR

Two approach index indicators (24, figure 1-2, and

SEAT ADJUSTMENT SYSTEM

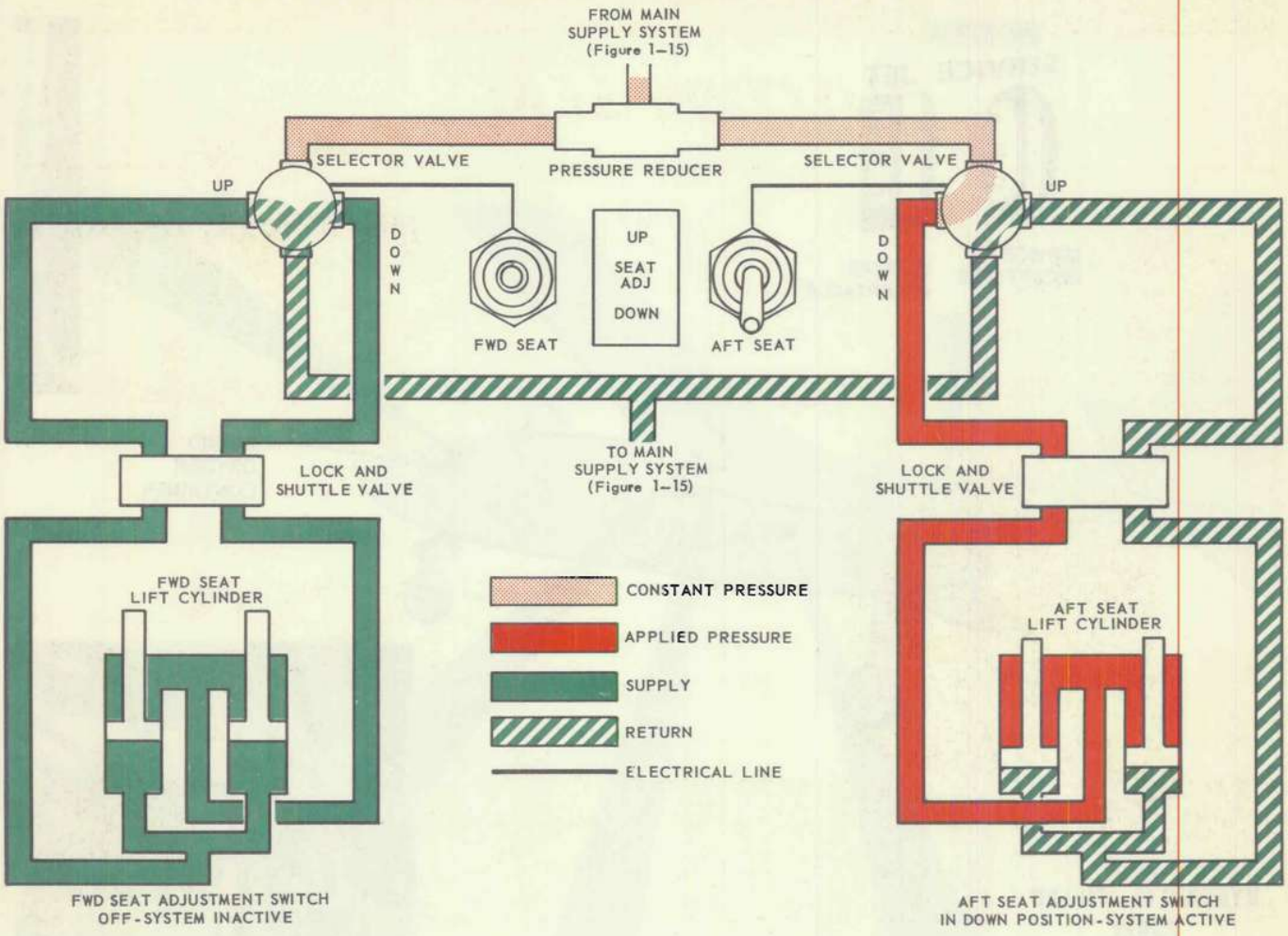


Figure 1-25

17, figure 1-3) are mounted above each instrument panel. These indicators are energized during an in-flight, gear down configuration. The three lights of each index are illuminated independently through cam operated switches in the forward angle of attack indicator. The indicators provide the following quick references for landing approaches:

The top V-shaped light indicates that the nose is very high and a large correction should be made. Illumination of the top V-shaped and center O light indicates that the nose is slightly high and a small correction should be made. The center O light illumination indicates a nose centered attitude for landing approach. The center O light and the lower inverted V-shaped light illumination indicates that the nose is slightly low and a small correction should be made. Illumination of the inverted V-shaped light indicates that the nose is very low and a large correction should be made.

Testing the approach lights is accomplished through the WARNING LTS TEST switch. Dimming of the lights is controlled through the FLIGHT INST lights control. The lights are powered from the 28-volt d-c primary bus through the INDEX circuit breaker (figure 1-14).

RUDDER PEDAL SHAKER

A rudder pedal shaker, mounted on the left forward rudder pedal, functions as a stall warning device. It consists of a d-c motor-driven unbalanced rotary weight that provides a physical indication of an approaching stall. It is actuated by a cam operated switch in the forward angle of attack indicator. It is powered through the landing gear squat switch and is inoperative when the aircraft is on the ground. A RUDDER SHAKER TEST switch (26, figure 1-4 and 24, figure 1-5) is mounted on each instrument

SERVICING DIAGRAM

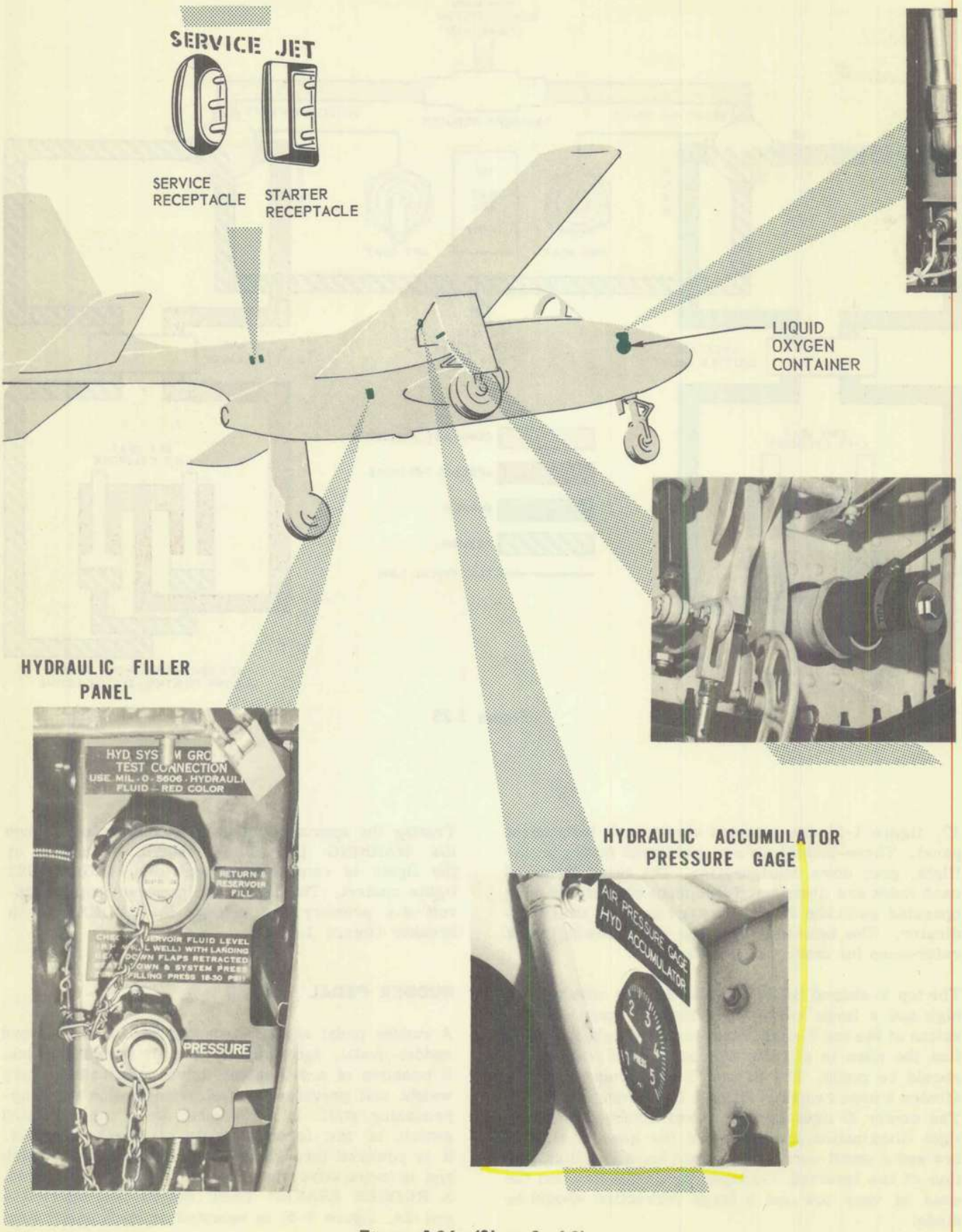
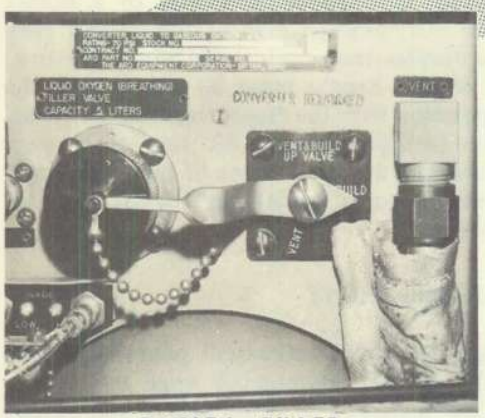
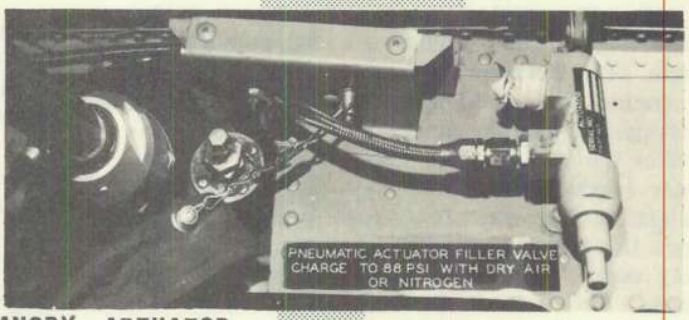


Figure 1-26 (Sheet 1 of 2)

FLUID	SPECIFICATION	GRADE	RECOMMENDED	ALTERNATE
OIL	MIL-L-7808B	1005	MIL-L-7808B	
FUEL	MIL-F-5624B	JP4	MIL-F-5624B	MIL-F-5572-1
OXYGEN	BB-0-925	B-TYPE 2	BB-O-925	
HYDRAULIC	MIL-O-5606-2	AN-VVO-366	MIL-O-5606-2	



OXYGEN FILLER PANEL



CANOPY ACTUATOR FILLER PANEL

HYDRAULIC RESERVOIR QUANTITY GAGE

FUEL FILLER CAP

BATTERY

HYDRAULIC RESERVOIR

FUEL FILLER CAP

OIL QUANTITY GAGE



OIL FILLER PANEL

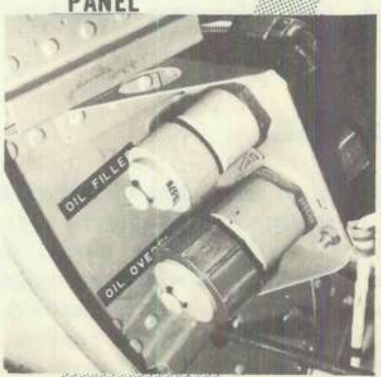


Figure 1-26 (Sheet 2 of 2)

panel. The shaker motor operates from the 28-volt d-c primary bus and is protected by the SHAKER MOTOR circuit breaker on the circuit breaker panel (figure 1-14).

EMERGENCY EQUIPMENT

FIRE WARNING SYSTEM

A fire warning light is located on the upper portion of each instrument panel. See 2, figure 1-4 and 2, figure 1-5. The system uses a continuous cable-type detecting element sensitive at all points along its length. The detector cable is coiled around the entire engine and accessory section. Spring-type cable clamps anchor the detector cable. As the temperature of the cable rises, the resistance between its center conductor and its sheath decreases. When the resistance decreases to a preset value, a system unbalance is created through the fire warning control assembly which causes the fire warning light to be energized.

Test Switch

Two switches, one located on each instrument panel, (5, figure 1-4 and 5, figure 1-5), are used to test the warning light system operation. The system operates from the 28-volt d-c bus and is protected by the FIRE circuit breaker on the circuit breaker panel (figure 1-14).

CANOPY

A one piece plexiglas bubble-type canopy (figure 1-1) is attached to the fuselage at the aft hinge point and by a cylinder which extends upward from the center of the cockpit area. The canopy is normally unlocked manually and raised by the pilot, assisted by the air-spring strut. During an emergency the canopy may be opened and jettisoned by use of explosive cartridges. See SEAT AND CANOPY JETTISON CONTROL in this section for emergency operation.

CANOPY MANUAL CONTROLS

An internal control handle is located on the forward left side of the canopy in each cockpit (21, figure 1-1). Positions are LOCK and OPEN. When moved to the LOCK position, the forward canopy latches engage the fuselage lugs locking it in the closed position. When the control is placed to the OPEN position, the canopy will raise to the open position. A taxi position is obtained by putting the handle in the LOCK position after moving the handle to the OPEN position. The canopy will remain in a part-open condition until the handle is returned to the OPEN position. The canopy may be opened externally by a handle located on the left forward side of the canopy rail. The handle is streamlined against the canopy railing. The aft end of the handle must be pulled from the streamlined position with the finger indents provided. Once the handle is approximately 30° from its stowage position, counterclockwise-rotation of the handle will release the canopy lock, permitting the air cylinder to raise the canopy.

CANOPY WARNING LIGHT

A warning light on each instrument panel (2, figure 1-4 and 2, figure 1-5) illuminates when the canopy handle is in the unlocked position and/or the canopy is not in the fully closed and locked position. The light is energized by a switch which is actuated by the lock mechanism. The canopy warning light circuit operates from the 28-volt d-c bus and is protected by the CANOPY AND SPEED BRAKE circuit breaker.

SEATS

Each seat (figure 1-23) is mounted on a vertical track by the use of rollers and is jettisonable by use of an explosive charge. A shoulder harness cable is provided with each seat. A quick disconnect plug is located on the left side of each seat for oxygen and communication connection. Each seat is adjustable. The seat is primarily designed to be used with an integrated parachute system. In lieu of a conventional safety belt, the pilot is held by a lap belt attached to the parachute unit that, in turn, is fastened by straps to the seat. See PILOT INTEGRATED ESCAPE SYSTEM in Section VII.

SEAT ADJUSTMENT SWITCH

A three-position UP-DOWN seat adjustment switch (8, figure 1-2, and 9, figure 1-3) is provided above the right console in each cockpit. The seat is electrically controlled and hydraulically operated (figure 1-25) for up and down travel. The seat may be operated by use of engine driven or hydraulic hand pump pressure (figure 1-2).

SHOULDER HARNESS LOCK LEVER

A two-position LOCK-UNLOCKED shoulder harness inertia reel lock lever (7, figure 1-23) is located on the left side of each seat. Manual locking of the control may be accomplished during maneuvers and flight in rough air or as an added safety precaution during ditching or crash landings. The lock will be automatically locked if any abrupt longitudinal deceleration of 2.5 g's or more is encountered. After automatic locking, the shoulder harness will remain locked until the lever is moved to lock and returned to UNLOCK.

SEAT EJECTION AND CANOPY JETTISON CONTROL

Canopy jettison and seat ejection are actuated by a face curtain handle (1, figure 1-23), located on the upper section of the headrest of each seat. Pulling the face curtain down initiates ejection as follows:

1. An explosive charge is fired which unlocks the canopy.

2. A second explosive charge is then fired, which jettisons the canopy. A static cable, attached to the canopy, releases the face curtain interlock and allows the face curtain to be pulled further downward.

3. Pulling the face curtain to the extreme down position releases the catapult safety pin and fires an explosive charge, which ejects the seat.

4. As the seat leaves the aircraft, a static cable, attached to the floor of the aircraft, fires an explosive charge within the seat. This charge retracts the harness retaining pins, releasing the pilot with parachute from the seat.

5. A static cable line, attached to the seat, actuates the automatic parachute opener, which opens the parachute after a preset time delay and upon reaching preset altitude.

Escape System Safety Pin

An escape system safety pin, located on the small shelf behind front seat (9, figure 1-23), prevents the seats and canopy from being inadvertently jettisoned. A red streamer is attached to the pin for ease of locating.

Emergency Release Handle

A harness release handle is located on the right arm rest of each seat (8, figure 1-23). This handle is used when a quick release of the seat belt and shoulder harness is desired such as after ditching or crash landing. This handle may also be used in event that the automatic pilot release mechanism does not function during bail-out.

AUXILIARY EQUIPMENT

See Section IV of this handbook for information concerning the following auxiliary equipment:

COMMUNICATION

HEATING AND VENTILATING

PITOT HEAT

LIGHTING

OXYGEN

MISCELLANEOUS

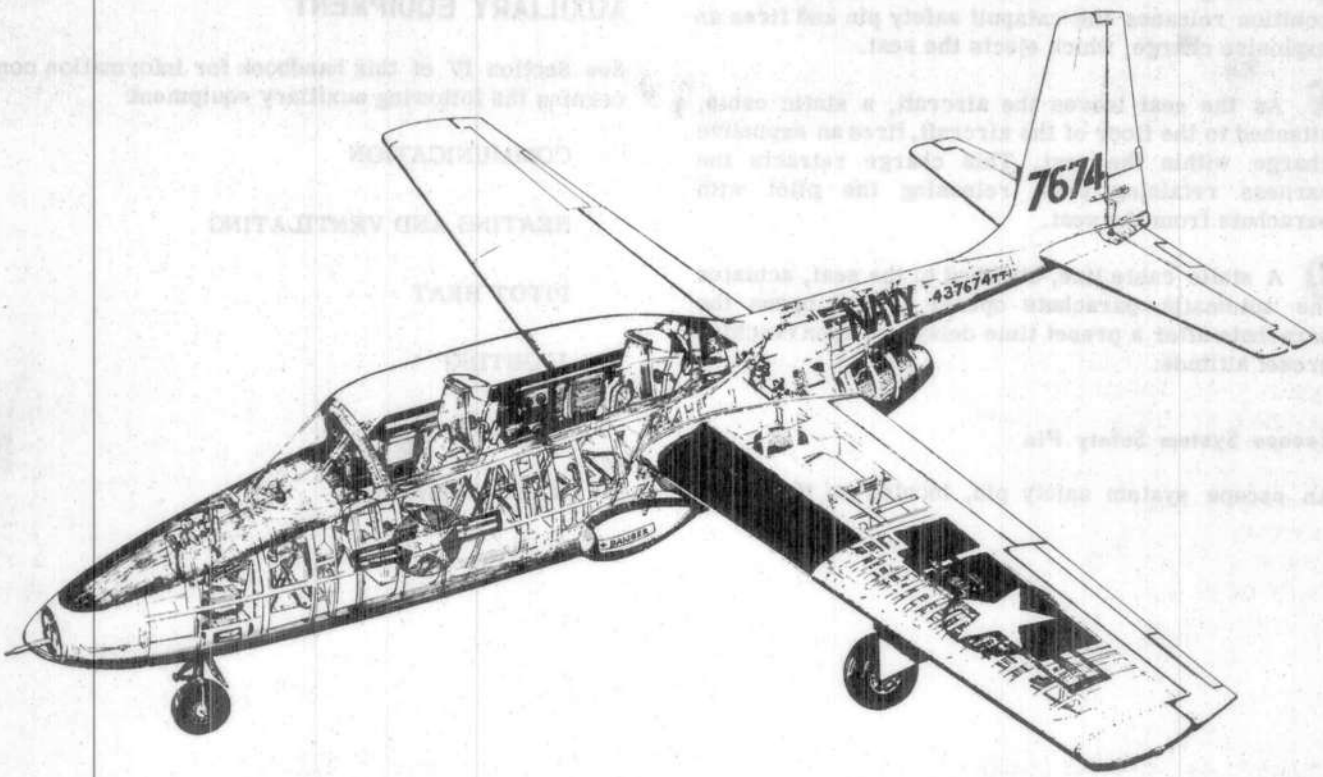

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STATUS OF THE AIRCRAFT

FLIGHT RESTRICTIONS

See Section V, Operating Limitations, for flight restrictions and operating limitations.

FLIGHT PLANNING

Determine the fuel required, airspeeds, power settings, etc., for the complete mission using the operating data contained in the Appendix to this handbook.

CHECK LISTS

For take-off and landing check lists, refer to figure 2-1.

PREFLIGHT INSPECTION

1. Check yellow sheet for status of the aircraft.

2. Note discrepancies listed from previous flights and check corrective action taken.

3. Make a complete inspection of the aircraft. See figure 2-3 for route to be followed.

VISUAL INSPECTION

The exterior procedures (figure 2-3) outlined in this section are predicated on the assumption that maintenance personnel have completed all the requirements of the handbook of Inspections Requirements, NAVAER 01-270KAA-506. Therefore, duplicate inspections and operational checks of systems by the plane captains have been eliminated, except for certain items required in the interest of FLYING

TAKE-OFF AND LANDING CHECK LIST

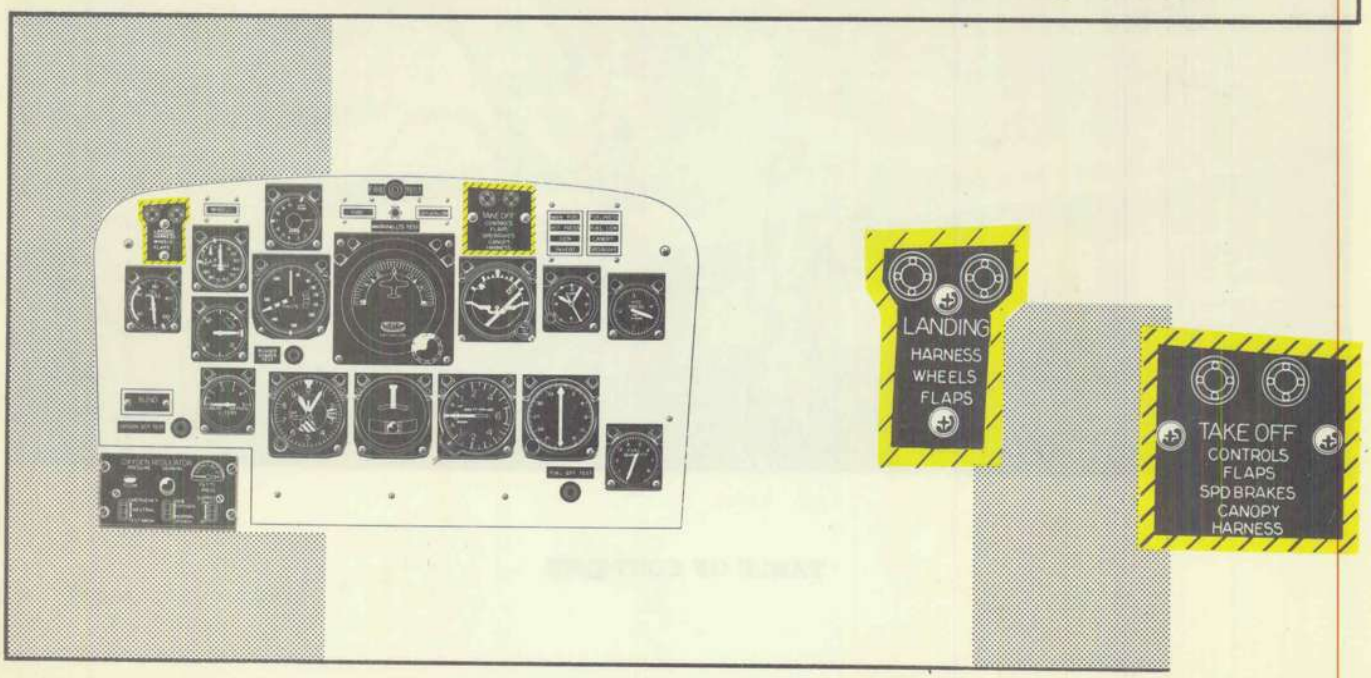


Figure 2-1

SAFETY. Prior to each flight, the following check lists will be used by the pilot as an aid in conducting his inspection. Each item of the check lists will be inspected for the condition and/or position described thereon. Special emphasis as to cleanliness, condition of cockpit area, and security of all cowling and inspection doors will be employed throughout the inspection.

BEFORE EXTERIOR INSPECTION

1. Chocks - IN PLACE.

2. Landing gear safety pins - INSTALLED.

3. Electrical power switch - OFF.

EXTERIOR INSPECTION

1. NOSE SECTION

a. Pitot cover - REMOVED.
Check pitot head for obstructions.

b. Landing and taxi lights - CONDITION.

c. Nose wheel position light - CONDITION.

d. Nose wheel tire - INFLATION AND SLIPPAGE.
Check tire for bruises, cuts, and flat spots.

e. Nose wheel strut - EXTENSION OF APPROXIMATELY 3 INCHES AND CONDITION.
Check scissors for attachment.

f. Nose wheel doors - ATTACHMENT.
Check doors for evidence of rubbing.

g. Shimmy damper - THERMAL RELIEF PISTON EXTENSION OF 1/2 INCH.
Check for evidence of leakage.

h. Static ground wire - GROUND CONTACT.

i. Nose access door and instrument panel access door - SECURE.

2. RIGHT FUSELAGE

a. Static port - FREE FROM OBSTRUCTIONS.

b. Engine air intake - FREE FROM OBSTRUCTION
Check intakes for dents or cracks.

c. Upper and lower navigation lights - CONDITION.

3. RIGHT LANDING GEAR

a. Tire - INFLATION AND SLIPPAGE.
Check for bruises, cuts and flat spots.

b. Strut - EXTENSION OF 3-1/2 INCHES AND CONDITION.

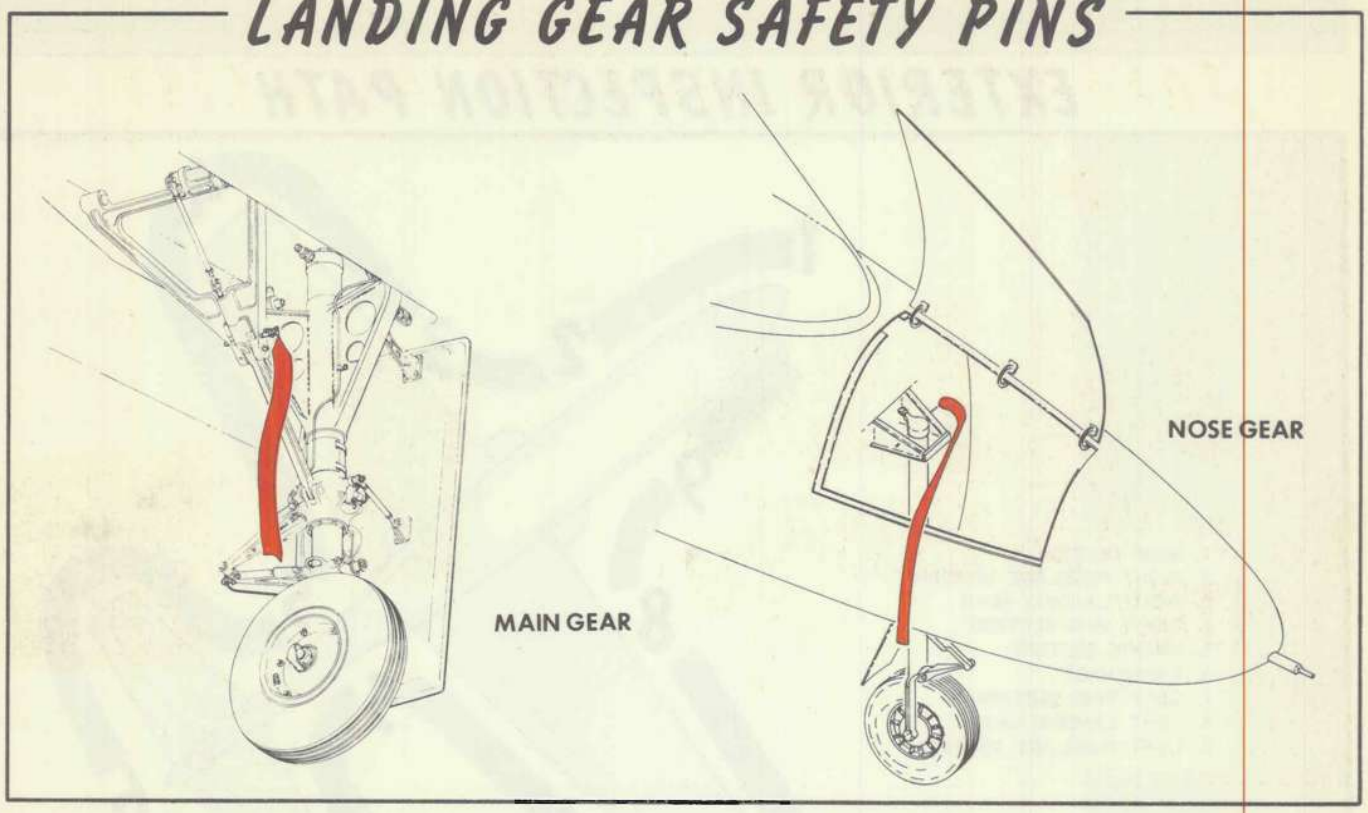


Figure 2-2

c. Wheel well doors - CONDITION AND ATTACHMENT.
Check for evidence of rubbing.

d. Hydraulic sight gage - CHECK LEVEL (IN RIGHT WHEEL WELL).

e. Hydraulic accumulator gage - CHECK 1500 PSI (IN RIGHT WHEEL WELL).

f. Brakes - CHECK FOR SECURITY OF HYDRAULIC LINE AND FOR LEAKS.

4. RIGHT WING SECTION

a. Leading edge - FUEL LEAKS AND CONDITION.

b. Landing gear position light - CONDITION.

c. Fuel tank - FUEL LEVEL AND CAP SECURITY.
Check for evidence of leakage.

d. Navigation light - CONDITION.

e. Aileron - ATTACHMENT.

f. Aileron spring tab - ATTACHMENT.
Check for streamlined position with aileron.

g. Wing flap - CONDITION AND ATTACHMENT.
Check for streamlining with wing surfaces.

5. ENGINE SECTION

a. Tail pipe - OBSTRUCTIONS, DENTS, CRACKS.
Check for evidence of burning and "mice" for attachment (if installed).

b. Turbine wheel - CHECK CONDITION OF ALL TURBINE BLADES.

c. Engine cowling - ATTACHMENT.
Check for evidence of fuel and oil leakage and excessive heat.

6. EMPENNAGE

a. Tail boom - WRINKLES, RIPPLES, CRACKS.

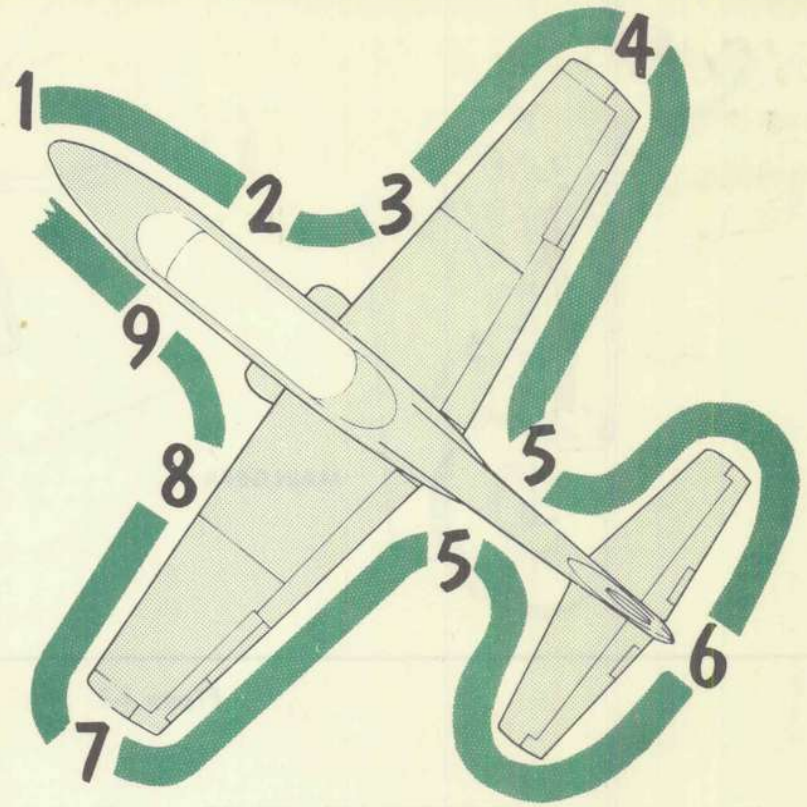
b. Horizontal stabilizers - CONDITION.

c. Elevators - CONDITION AND ATTACHMENT.

d. Elevator trim tabs - POSITION AND ATTACHMENT.

e. Elevator trim tab hinge pin - RAISE ELEVATOR

EXTERIOR INSPECTION PATH



1. NOSE SECTION
2. RIGHT FUSELAGE SECTION
3. RIGHT LANDING GEAR
4. RIGHT WING SECTION
5. ENGINE SECTION
6. EMPENNAGE
7. LEFT WING SECTION
8. LEFT LANDING GEAR
9. LEFT FUSELAGE SECTION

Figure 2-3

MANUALLY AND CHECK FOR SECURITY OF LOCKWIRE.

f. Vertical stabilizer - CONDITION.

g. Rudder - ATTACHMENT.
Check for streamlining with the vertical stabilizer.

h. Rudder tab - CONDITION.

i. Speed brakes - POSITION AND EVIDENCE OF HYDRAULIC LEAK.

j. Tail position lights - CONDITION.

7. LEFT WING SECTION

a. Wing flap - CONDITION AND ATTACHMENT.
Check for streamlining with the wing.

b. Aileron spring tab - ATTACHMENT.
Check for streamlining with aileron.

c. Aileron - ATTACHMENT.

d. Aileron trim tab - POSITION AND ATTACHMENT.

e. Navigation light - CONDITION.

f. Landing gear position light - CONDITION.

g. Fuel tank -FUEL LEVEL AND CAP SECURITY.
Check for evidence of leakage.

h. Leading edge - FUEL LEAKS AND CONDITION.

8. LEFT LANDING GEAR

a. Tire - INFLATION AND SLIPPAGE.
Check for bruises, cuts and flat spots.

b. Strut - EXTENSION OF 3-1/2 INCHES AND CONDITION.

c. Wheel well doors - CONDITION AND ATTACHMENT.
Check for evidence of rubbing.



Figure 2-4

d. Brakes - CHECK FOR SECURITY OF HYDRAULIC LINE AND FOR LEAKS.

9. LEFT FUSELAGE

a. Oil quantity sight gage (under left wing right aft of duct) - CHECK LEVEL.

b. Cockpit heat and vent intake - FREE FROM OBSTRUCTIONS.

c. Engine air intake - FREE FROM OBSTRUCTIONS.
Check for cracks and dents.

d. Static port - FREE FROM OBSTRUCTIONS.

e. Entrance steps - CONDITION AND ATTACHMENT

f. Airstream direction detector probe cover - REMOVED.

ENTRANCE INSTRUCTIONS

Pull external canopy lock handle out and turn counterclockwise (figure 2-4). Canopy will rise with a slight assist from the pilot.

INTERIOR INSPECTION

Accomplish the following checks on entering aircraft.

1. Aft cockpit - CHECK FOR SECURITY AND/OR POSITION OF THE FOLLOWING EQUIPMENT:

a. Radio - OFF.

b. Landing lights - OFF.

c. Oxygen - OFF.

d. Master power switch - ON.

e. Cockpit lights - OFF.

f. Safety belt and shoulder harness - SECURE.

g. Oxygen hose - SECURE.

2. Seat jettison controls - CHECK.
Ascertain that all controls are in the proper position and the escape system safety pin is in place.

3. Parachute - DON AND ADJUST.
Ascertain that all straps are properly adjusted and manual parachute handle is in place. Engage personal leads.

4. Safety belt and shoulder harness - CONNECT.

5. Inertia reel - CHECK.
Place inertia reel lever in the LOCKED position, test by leaning forward, then place the lever in the UNLOCKED position.

6. Landing gear control lever - DOWN.

7. Surface controls lock - RELEASE AND STOW.
Check controls for freedom of movement and proper travel, observing control surfaces for correct response.

8. External start cart - ATTACHED.

9. Electrical power switch - BAT-GEN.

10. Inverter - MAIN.

11. Flight instruments power switch - ON.

12. Fuel boost pump and fuel shut-off valve - OFF.

13. UHF radio control switch - OFF.

JET BLAST DANGER AREAS

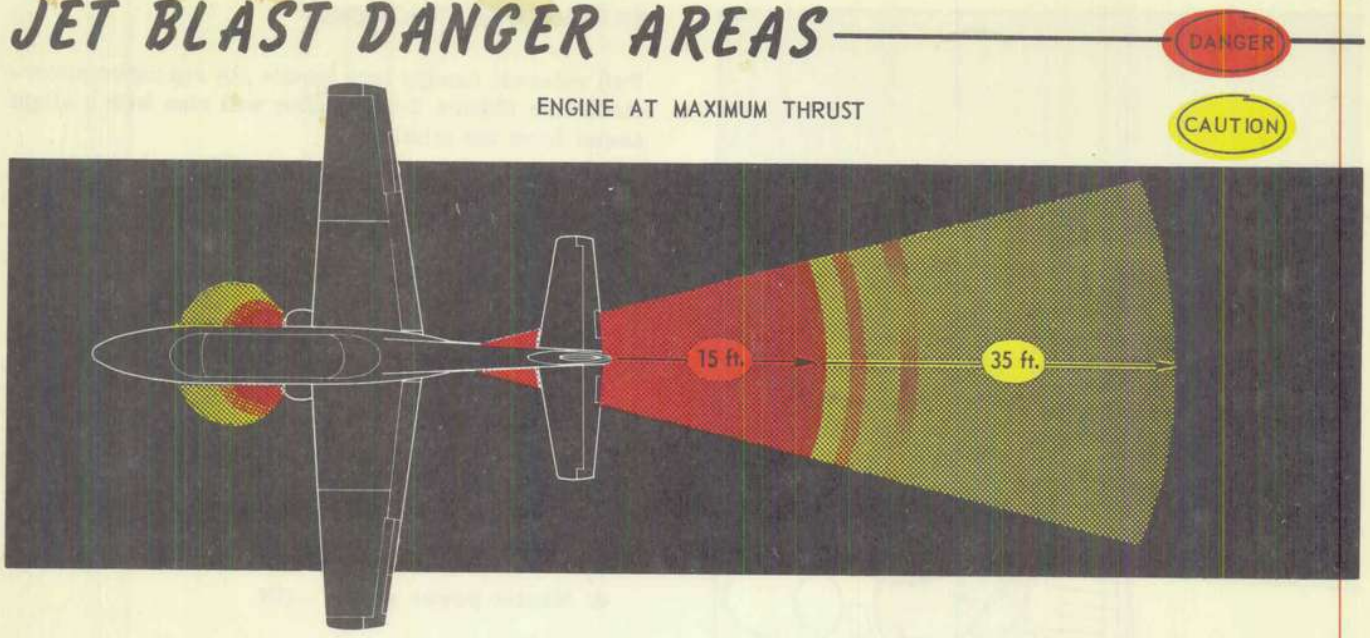


Figure 2-5

14. Throttle - OFF.

15. Speed brake switch - CLOSED.

16. Wing flap control lever - UP.

17. Engine fuel control selector switch - PRIMARY .

18. Aileron and elevator trim tab position indicator - CYCLE AND SET TO TAKE-OFF POSITION (NORMALLY NEUTRAL).

19. Landing lights switch - OFF.

20. Landing gear and flap position indicator - CHECK WHEELS AND FLAP POSITION.

21. Oxygen quantity indicator - CHECK WITHIN LIMITS.
Perform oxygen system and mask checks. See liquid oxygen system, Section IV.

22. Oxygen low indicator light - CHECK.
Depress OXYGEN QTY TEST switch and hold. The oxygen quantity indicating needle will rotate toward the zero quantity indication. As the needle passes 1/2 liter reading the OXYGEN LOW light will illuminate.

23. Word warning indicator lights - CHECK CONTINUITY.
Press WARNING LTS TEST switch to illuminate word warning lights and the approach index lights.

24. Fire warning test switch - PRESS TO CHECK CONTINUITY.

NOTE

With electrical power to the primary bus the boost pressure, generator, fuel pressure and canopy lights will be illuminated.

25. Fuel quantity test switch - DEPRESS.
Depress and hold FUEL QTY TEST switch and observe fuel quantity indicator needle rotating to the zero position.

26. Flight instruments - CHECK AND/OR SET.

27. Voltammeter - CHECK READINGS.

28. UHF transfer switch - AS DESIRED.

29. Intercommunication switches - AS DESIRED.

30. Interior and exterior light switches - OFF.

31. Defroster and master air levers - OFF.

32. Pitot heat switch - OFF.

33. Inverter circuit breakers - PULL (if making battery start).

34. Escape system safety pin - REMOVE.

BEFORE STARTING ENGINE

CAUTION

Before starting engine, make sure intake and exhaust areas are clear of personnel, aircraft, and vehicles (figure 2-5). Although suction is not of sufficient magnitude to seriously injure personnel, clothing or other personal articles may be drawn into the ducts. Danger aft of the aircraft is created by high exhaust velocity and temperature.

Start engine with aircraft headed into, or at right angles to the wind if possible, as a tailwind will lengthen starting time and may cause excessive exhaust temperatures.

STARTING ENGINE

1. Throttle - OFF.

2. Fuel boost pump and fuel shut-off valve - ON.

3. Starter switch - START.
Move to START, hold 2 seconds and release.

4. At 10% rpm - MOVE THROTTLE LEVER OUTBOARD TO IGN AND FORWARD (HOLDING OUTBOARD) TO IDLE AND HOLD.

NOTE

If ignition does not occur within 30 seconds or by the time the engine rpm has reached 15%, close the throttle and move starter switch to CUT OUT position.

5. When TPT indicates light-off - THROTTLE INBOARD TO IDLE DETENT.

6. TPT - MONITOR.

7. Idle rpm - 35% to 40%.
After engine stabilizes at idle rpm, turn generator switch to RESET and depress inverter circuit breakers.

8. Oil pressure - CHECK.

CAUTION

If no oil pressure is indicated wihin 30 seconds, stop engine immediately to prevent internal damage.

9. Engine instruments - CHECK.

10. Throttle - ADVANCE TO GENERATOR CUT-IN SPEED (approximately 50% RPM).

CAUTION

The starter is limited to three starts of one minute duration during any 30 minute period. If more than three starts are required, allow starter to cool 30 minutes before using again.

Do not use the CUT OUT position of the starter switch to disengage the starter during normal starts. The starter will automatically disengage when the engine rpm reaches 22%.

If TPT exceeds 815°C, see HOT STARTS in this Section.

HOT STARTS

A hot start is a condition occuring during a starting attempt wherein the tail pipe temperature exceeds the normal starting temperature. Flaming or torching may occur at the tail pipe exit. It may be caused by a malfunctioning fuel control system or a faulty starting procedure, but it is a direct result of one condition - an excess of fuel in the combustion chamber. When a hot start occurs, observe the following procedure:

CAUTION

If TPT exceeds 815°C a hot start has occured. IMMEDIATELY move throttle to off. The engine must be thoroughly inspected before further operation.

If tail pipe temperature exceeds 790°C but does not reach 815°C the start must be logged. After three starts in the 790°C to 815°C range the engine must be inspected.

a. Throttle lever - OFF.

b. Fuel boost pump and fuel shut-off valve - OFF.

c. If a residual fire persists, clear engine by motoring engine with starter to 10% rpm.

d. Engine - INVESTIGATE FOR DAMAGE.
After investigation, if it has been determined that the hot start has not damaged the engine, another start may be attempted.

FALSE STARTS

If a light-off, indicated by a rapid rise in tail pipe temperature, does not occur within 30 seconds after the throttle lever has been held outboard to IGN, or by the time the engine reaches 15% rpm, proceed as follows:

a. Throttle lever - OFF.

b. Starter switch - CUT OUT position.

c. Fuel boost pump and fuel shut-off valve - OFF.

Clearing Engine

a. Throttle lever - OFF.

b. Starter switch - START.

c. Allow starter to turn engine for 10 seconds or 10% rpm whichever is less.

d. Place the starter switch in the CUT-OUT starter position.

e. After 3 false starts allow 30 minutes for starter to cool before attempting another start.

RUNAWAY STARTS

A runaway start is very rare, but can be encountered if the fuel control malfunctions, or if a section of the throttle linkage is disconnected. In such a case, the engine must be stopped by cutting off the fuel supply from the tanks to the engine. This is done by placing the fuel boost pump and fuel shut-off valve to OFF (electrical power switch must be on for valve to close).

ENGINE GROUND OPERATION

The engine requires no warm-up. As soon as the engine stabilizes at idle rpm (35% to 40%) with normal instrument readings, the throttle lever may be advanced to full power.

NOTE

Rapid acceleration to 100% rpm on a cold engine may result in the exhaust temperature momentarily exceeding the prescribed limits.

After start, advance throttle to approximately 50% or until the GEN warning light goes out to conserve battery.

BEFORE TAXIING

1. Idle rpm - CHECK (35% to 40%).
Outside air temperature and altitude will cause a slight change in idling rpi

2. Hydraulic system - CHECK.
Cycle wing flaps, speed brakes and seat.

3. Voltammeter - CHECK.
Check voltammeter for 27.5 volts indication at approximately 50% rpm.

4. Warning lights - CHECK.

5. Safety pins - REMOVE.
Signal plane captain to remove safety pins from the landing gear.

6. Canopy - LOWER TO TAXI POSITION OR CLOSED.

7. Chocks - REMOVE.

TAXIING

Taxiing is facilitated by the excellent forward visibility. Approximately 60% rpm is required to start roll, but a throttle setting slightly above idle (approximately 45%) is sufficient to maintain taxi speed. The nose wheel will swivel through 40° to either side and is self centering. In order to steer the aircraft, light application of the brakes will be necessary. Restrict taxi time to an absolute minimum, as fuel consumption during ground operation is exceedingly high. Fuel flow while taxiing is approximately 16 pounds per minute. Each minute of taxiing reduces range by approximately five miles.

CAUTION

Maintain sufficient distance from the exhaust blast of other aircraft to prevent damage.

BEFORE TAKE-OFF

1. Safety belt and shoulder harness - LOCKED.

2. Trim tabs - DESIRED TAKE-OFF POSITION (NORMALLY NEUTRAL).

3. Flaps - TAKE-OFF.

4. Speed brake - CLOSE.

5. Canopy - CLOSE AND LOCK.

6. Engine fuel control - CHECK AS FOLLOWS:

a. Advance throttle to 100% rpm with the engine fuel selector switch in the PRIMARY position.

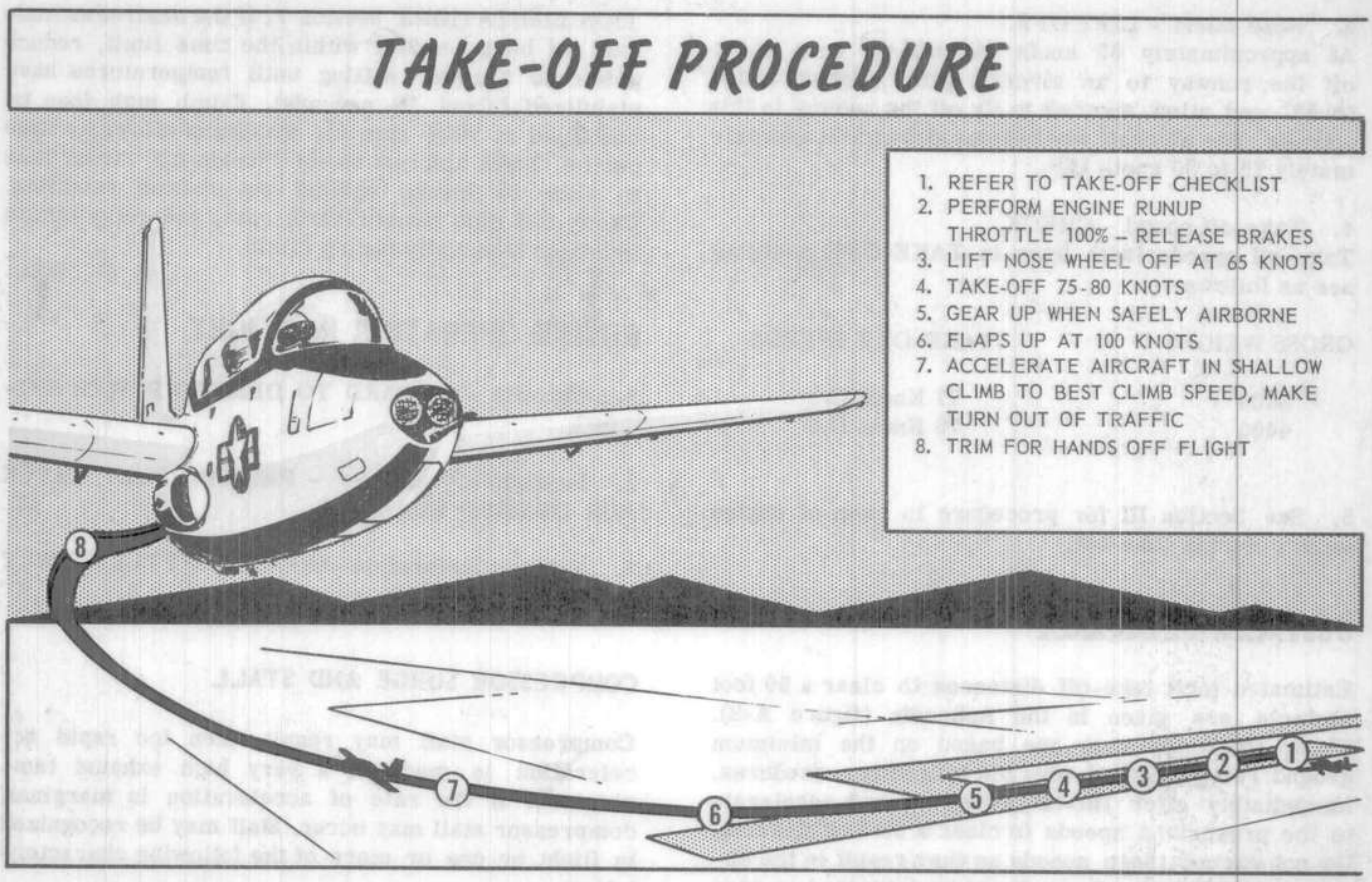


Figure 2-6

CAUTION

Do not exceed maximum allowable TPT. See ENGINE OPERATION LIMITATIONS, Section V.

b. Place the engine fuel selector switch to the MANUAL position. Engine rpm should not drop below 92% and the MAN FUEL warning light will be on.

c. Return throttle to idle with firm movement.

d. Return engine fuel selector switch to PRIMARY as rpm is decelerating through 70%.

CAUTION

Do not return the engine fuel selector switch to the PRIMARY position from MANAUL while engine rpm is above 70%. Doing so may cause damage to the intake ducts.

7. Roll into position on the runway and align aircraft for take-off.

8. Engine instruments - CHECK.

a. RPM - 100%.

b. Tail pipe temperature - 676° MAXIMUM

c. Oil pressure - 15 LBS MINIMUM, 45 LBS MAXIMUM.

d. Hydraulic pressure - 3000 PSI.

e. Voltammeter - 27.5 VOLTS.

TAKE-OFF

NOTE

Refer to Section V for Operation Limitations. See Appendix for minimum take-off distance.

For normal take-off (figure 2-6) proceed as follows:

1. Throttle - 100% RPM.
Release the brakes and begin take-off run.

2. Directional control - MAINTAIN DURING FIRST PART OF TAKE-OFF BY USING BRAKES.
Rudder control becomes effective at approximately 45 knots IAS.

3. Nose wheel - LIFT OFF.
At approximately 65 knots IAS lift the nose wheel off the runway to an aircraft pitch attitude of 10° to 15° and allow aircraft to fly off the runway in this attitude. The aircraft will become airborne at approximately 75 to 80 knots IAS.

4. Take-off speed - CHECK.
Take-off speeds (with flaps in TAKE-OFF position) are as follows:

GROSS WEIGHT	TAKE-OFF SPEEDS
3800	71 Knots IAS
4400	76 Knots IAS

5. See Section III for procedure in case of engine failure during take-off.

OBSTACLE CLEARANCE

Estimated total take-off distances to clear a 50 foot obstacle are given in the Appendix (figure A-8). These total distances are based on the minimum ground run procedure plus the following procedures. Immediately after lift-off, level out and accelerate to the prescribed speeds to clear a 50 foot obstacle. Do not exceed these speeds as they result in the optimum climb angle. Gear should be retracted as soon as safely airborne. After clearing obstacle, retract flaps at 100 knots IAS and accelerate to best climb speed.

AFTER TAKE-OFF

When the aircraft is definitely airborne proceed as follows:

1. Landing gear control lever - UP.

2. Wing flap lever - UP AT 100 KNOTS.

3. Level off and accelerate immediately to best climb speed (175 Knots).

4. Cockpit temperature control - SET FOR COMFORTABLE COCKPIT TEMPERATURE.

CLIMB

Begin initial climb at 175 knots IAS at 100% rpm (maximum allowable TPT - 676°C). See figure A-9 of the Appendix. Maintain 100% rpm, or a power setting to keep TPT within limits (636°C - 676°C) for the remainder of the 15 minutes time limit. Then reduce power to 97% rpm (maximum allowable TPT-636°C) until the desired altitude is reached or for a maximum of 30 minutes. See ENGINE OPERATION LIMITATIONS, Section V. If the desired altitude has not been reached within the time limit, reduce power to a lower setting until temperatures have stabilized (about 10 seconds). Climb may then be continued at 100% rpm for maximum allowable time period. Trim aircraft to fly "hands-off" from time to time to insure against out-of-trim condition. Check tail pipe temperature, rpm, and oil pressure indicator frequently during climb.

ENGINE OPERATION IN FLIGHT

1. Throttle - RETARD TO DESIRED POWER SETTING.

2. Instrument readings - PERIODICALLY CHECK FOR DESIRED READINGS.

3. Engine acceleration - MOVE THROTTLE SLOWLY AND SMOOTHLY.

COMPRESSOR SURGE AND STALL

Compressor stall may result when too rapid acceleration is made at a very high exhaust temperature. If the rate of acceleration is marginal, compressor stall may occur. Stall may be recognized in flight by one or more of the following characteristics:

1. Loss of thrust.

2. Explosive noises.

3. Rapid rise in exhaust temperature.

4. Loss of acceleration, and even possible deceleration.

5. Long flame from tail pipe.

6. Possible flame-out at high altitude.

Whenever these conditions are encountered, retard the throttle until exhaust temperature returns to normal and increase airspeed by diving; then move throttle more slowly to the desired power setting.

ACCELERATION FLAME-OUT

Acceleration flame-out is indicated by loss of thrust, drop in exhaust temperature and deceleration. Acceleration flame-out is most likely to occur between 75% to 90% rpm and can be avoided by moving the throttle at a slower rate.

DESCENT

Circumstances may arise which require a descent

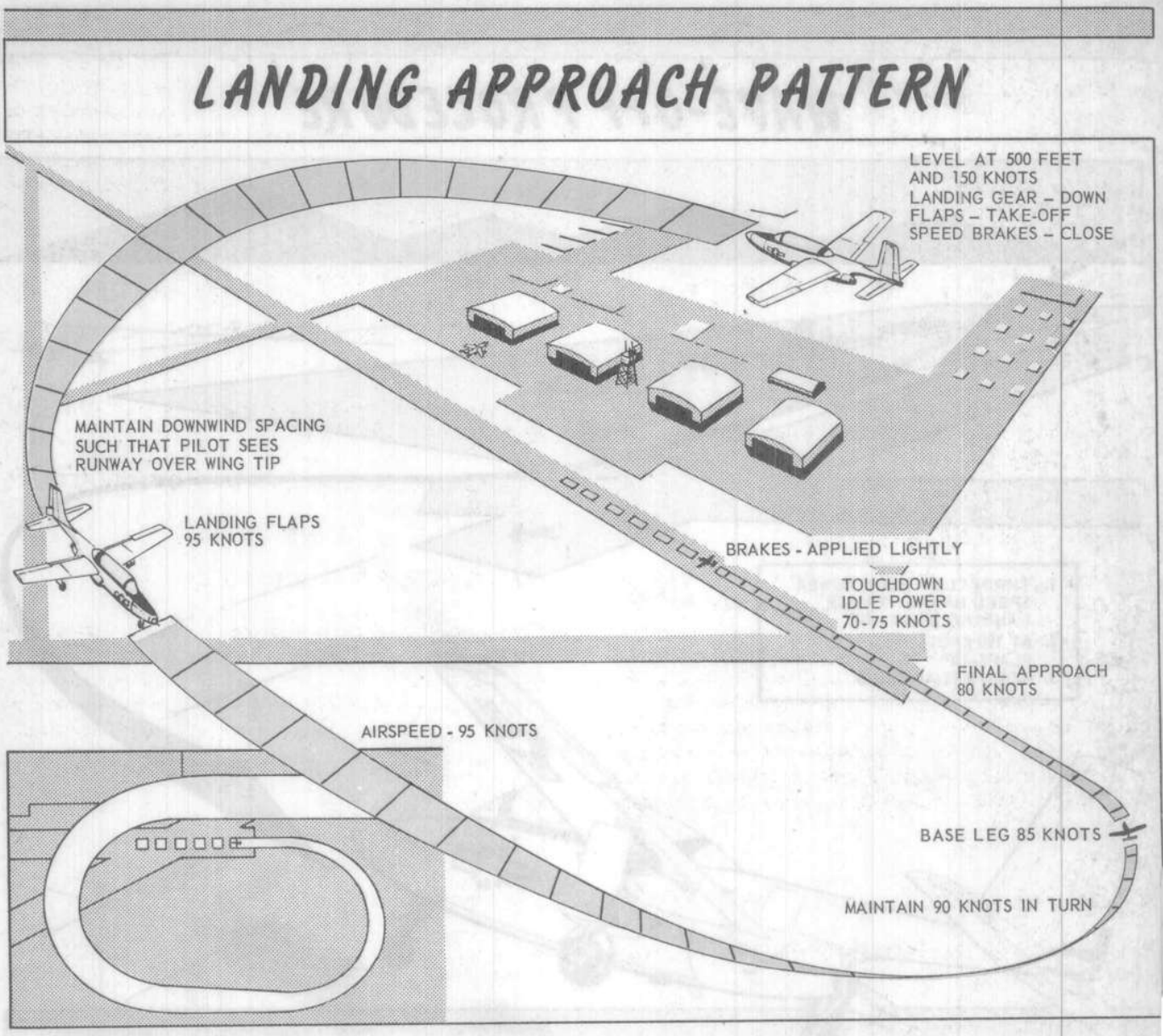


Figure 2-7

from high altitude in the shortest possible time. Refer to Cockpit Heating and Ventilating in Section IV for operation in descent. The maximum rate of descent can be obtained when the dive angle is increased until limit airspeed and/or Mach number is reached with the speed brakes open. Refer to Section V for airspeed and Mach limitations.

1. Throttle - IDLE.
2. Speed brakes - EXTEND.
3. Windshield defroster and master air valve - FULL ON.
4. Maintain specific airspeed - OBSERVE MAXIMUM LIMITING MACH AND AIRSPEED LIMITATIONS.

CAUTION

Prior to rapid descents from altitude, turn on canopy and windhsield defrosting. Heating of the glass prior to descent is necessary to prevent fogging of the surfaces.

OPTIMUM RANGE DESCENT

An optimum range descent gives a maximum distance with minimum fuel consumption. This procedure is useful when a low fuel quantiy condition exists. The procedure is as follows:

1. Throttle - IDLE.

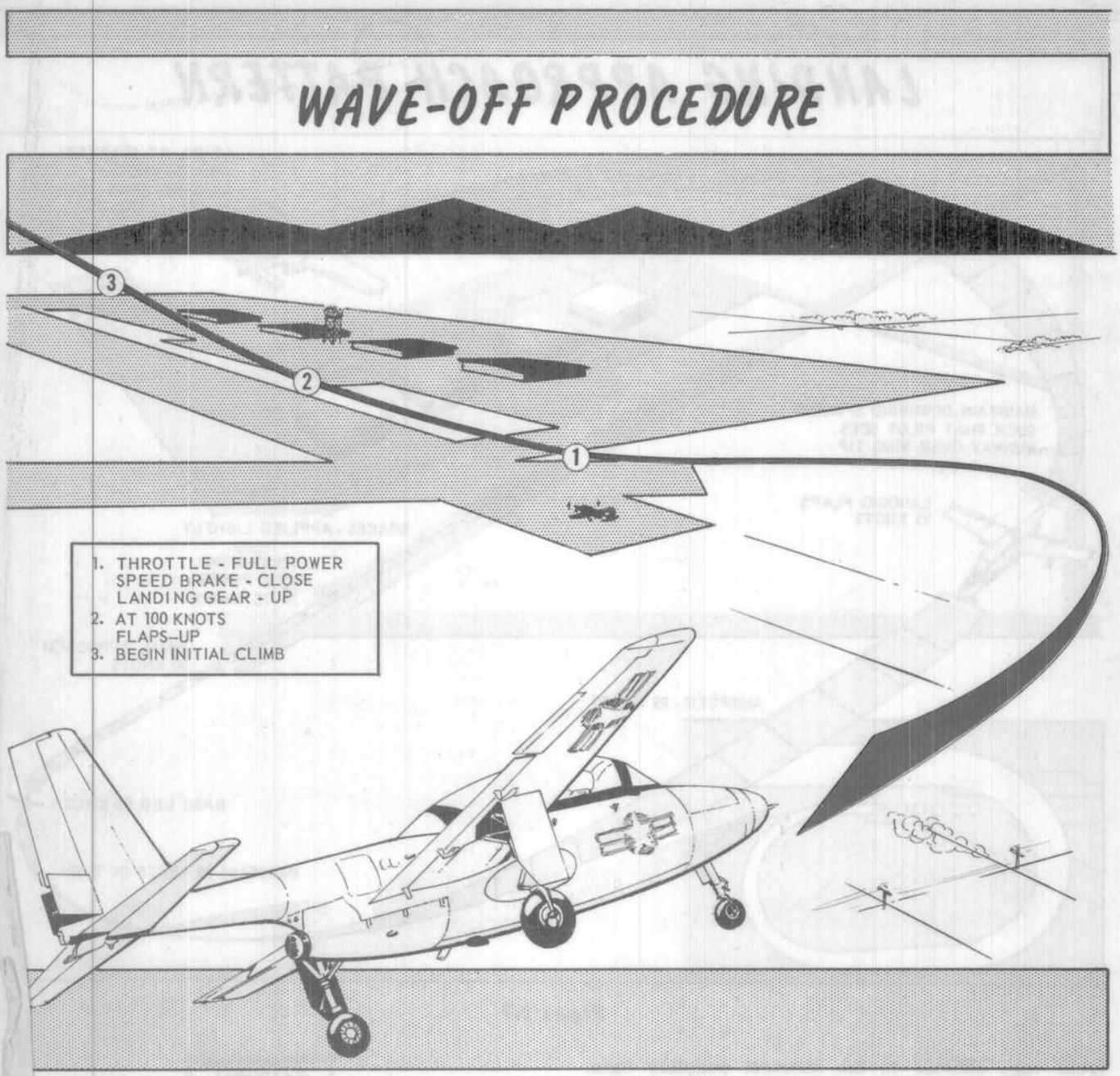


Figure 2-8

2. Speed brake - CLOSE.

3. Windshield defroster and master air valve - FULL ON.

4. Airspeed - MAINTAIN 120 KNOTS.
See Appendix (figure A-21) for Descent - Maximum Range.

APPROACH

During approach (figure 2-7) to the landing field, make the following checks:

1. Safety belt and shoulder harness - ADJUST.

2. Shoulder harness - LOCK.

3. Hydraulic pressure - CHECK.

4. Speed brakes - AS DESIRED.
The speed brakes will provide additional deceleration on approach and a shorter ground run after landing. Use of speed brake permits a steep approach varied by engine rpm.

5. Landing gear control - DOWN AT 150 KNOTS IAS.

6. Wing flaps - FULL DOWN AT 95 KNOTS IAS (150 KNOTS MAXIMUM).

7. Airspeed - 95 KNOTS IAS ON DOWN WIND LEG.

8. Instruments - CHECK WITHIN LIMITS.

9. Angle of attack stall warning indicators - KEEP WITHIN LIMITS.

LANDINGS

NORMAL LANDING

1. Maintain 85 knots on base leg (figure 2-7).

2. On final approach reduce airspeed to 80 knots IAS slowing to 70 knots IAS for touchdown.

3. Landing is made with the tail low, touching down on the main gear and then letting the nose down lightly.

4. After all gear is on the ground solidly, apply brakes lightly.

5. After aircraft slows down, apply more pressure to brakes intermittently until aircraft reaches taxi speed.

CROSS WIND LANDING

Accomplish the NORMAL LANDING procedure except as follows:

1. Crab the aircraft as necessary to align with the runway.

2. If using side slip method, lift wing for touchdown.

3. Immediately before touchdown, remove crab angle with rudder.

4. After touchdown lower nose wheel immediately so that brakes may be used in addition to rudder for directional control.

5. Wing flap lever - UP WHEN AIRCRAFT IS FIRMLY ON GROUND.

6. Speed brake - CLOSE (if used).

NOTE

See Section III for emergency landing.

CAUTION

Because of the slow acceleration characteristics of the jet engine, landing traffic pattern should be made to permit engine operation above 60% until the actual landing field has been reached, followed by a throttle decrease to IDLE. See Landing Charts (figure A-22) in the Appendix.

WAVE-OFF

See Wave-Off Pattern (figure 2-8).

WARNING

Make a decision to take a wave-off as early as possible as engine acceleration is slow in jet propelled aircraft.

1. Throttle - ADVANCE IMMEDIATELY AND SMOOTHLY TO FULL POWER.

2. Speed brake - CLOSE (if used).

3. Landing gear lever - UP.
When assured aircraft will not touch runway.

4. Wing flap lever - FULL UP AT 100 KNOTS.

STOPPING ENGINE

1. Engine - 65% RPM FOR 30 SECONDS.

2. Throttle lever - OFF QUICKLY.

3. All switches - OFF (except electrical power, master power, and generator).

4. Fuel boost pump and fuel shut-off valve - OFF.

5. Electrical power, master power, and generator switches - OFF.

BEFORE LEAVING AIRCRAFT

Make the following checks before leaving the aircraft:

1. Surface controls - LOCKED.

2. Escape system safety pin - INSTALLED.

3. Wheels - CHOCKED.

4. Landing gear safety pins - INSTALLED.

5. Canopy - CLOSED AND LOCKED.

6. Pitot cover, airstream direction detector transmitter probe cover, and intake duct plugs - INSTALLED.

7. Appropriate forms - COMPLETE.



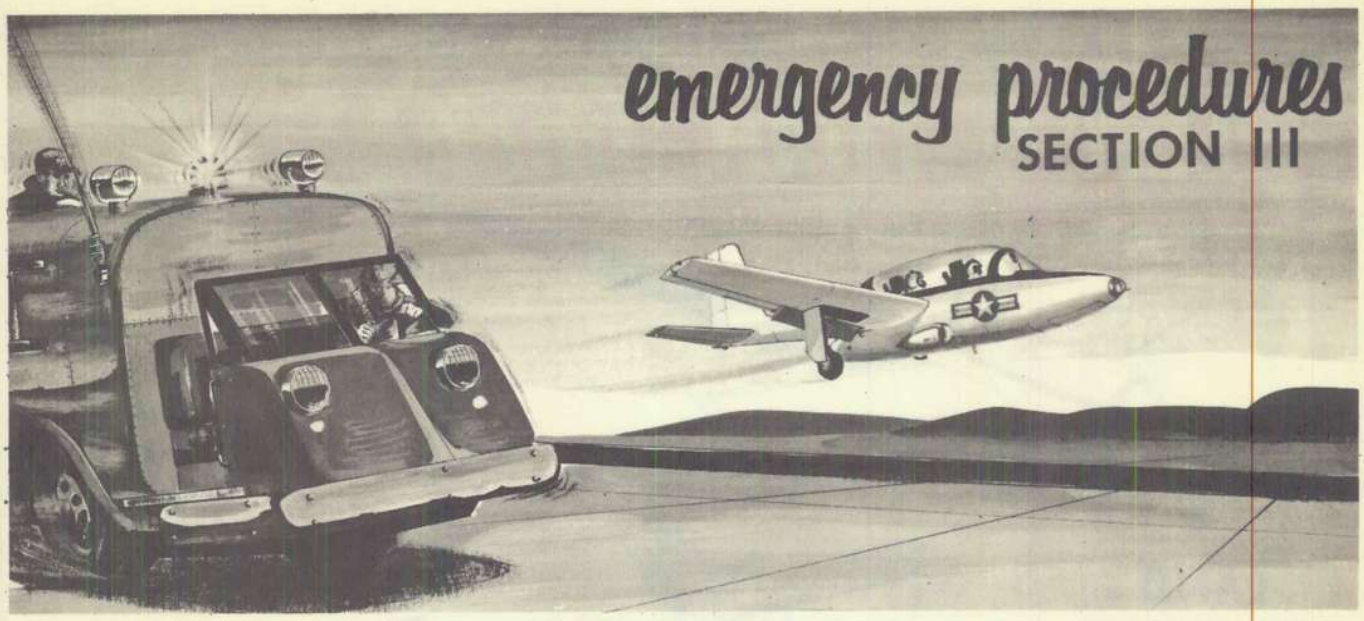


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ENGINE FAILURE

INTRODUCTION

Sudden failure of the engine will normally occur if there is starvation in fuel flow, or insufficient airflow into the engine. Turbine and/or accessory gear case failures may also cause an instantaneous engine failure. Those failures which give ample warning may generally be attributed to the engine control unit, aircraft fuel system or starvation of intake air perhaps due to icing. The following points are provided as an aid to warn the pilot of engine failure at the earliest possible moment. Engine failure or impending failure may produce:

1. A loss of thrust.
2. Rapid drop in engine rpm.
3. A decrease in/or excessive tail pipe temperature.
4. Generator warning light illumination as engine rpm drops blow generator cut-in speed.
5. Fire warning light.
6. Excessive vibration.

ENGINE FAILURE DURING TAKE-OFF

1. Before flying speed is reached with sufficient runway available for braking to stop:
   a. Throttle lever - OFF.
   b. Fuel boost pump and fuel shut-off valve - OFF.
   c. Speed brake switch - OPEN.
   d. Electrical power switch - OFF.
   e. Generator switch - TRIP.



Figure 3-1

f. Brakes - APPLY TO A MAXIMUM WITHOUT SLIDING TIRES UNLESS NECESSARY.

g. Shoulder harness - LOCK.

2. Before flying speed is reached - Inadequate runway available for braking to stop:

a. Throttle lever - OFF.

b. Fuel boost pump and fuel shut-off valve - OFF.

c. Speed brake switch - OPEN.

d. Generator switch - TRIP.

e. Flap control lever - FLAP DOWN.

f. Shoulder harness - LOCK.

g. Landing gear lever - PILOTS DISCRETION.

NOTE

Depress OVERRIDE GEAR SAFETY button as landing gear handle is raised to collapse gear when aircraft weight is on the oleo struts.

h. Electrical power and/or master power switch - OFF.

3. Airborne (Before Reaching Safe Altitude):

a. Engine fuel selector switch - MANUAL.
If an indication is noted that a flameout is imminent, place the engine fuel selector switch in the MANUAL position. There is a possibility that by selecting the manual flow path the engine may continue to operate. If this procedure is not successful, perform the remaining steps.

b. Throttle lever - OFF.

c. Fuel boost pump and fuel shut-off valve - OFF.

d. Flap control lever - FLAP DOWN.

e. Landing gear lever - DOWN.

f. Generator switch - TRIP POSITION.

g. Speed brake switch - AS REQUIRED.
Land straight ahead, turning only to avoid obstacles. Do not attempt to turn back to field (figure 3-1).

h. Electrical power switch - OFF BEFORE GROUND CONTACT.

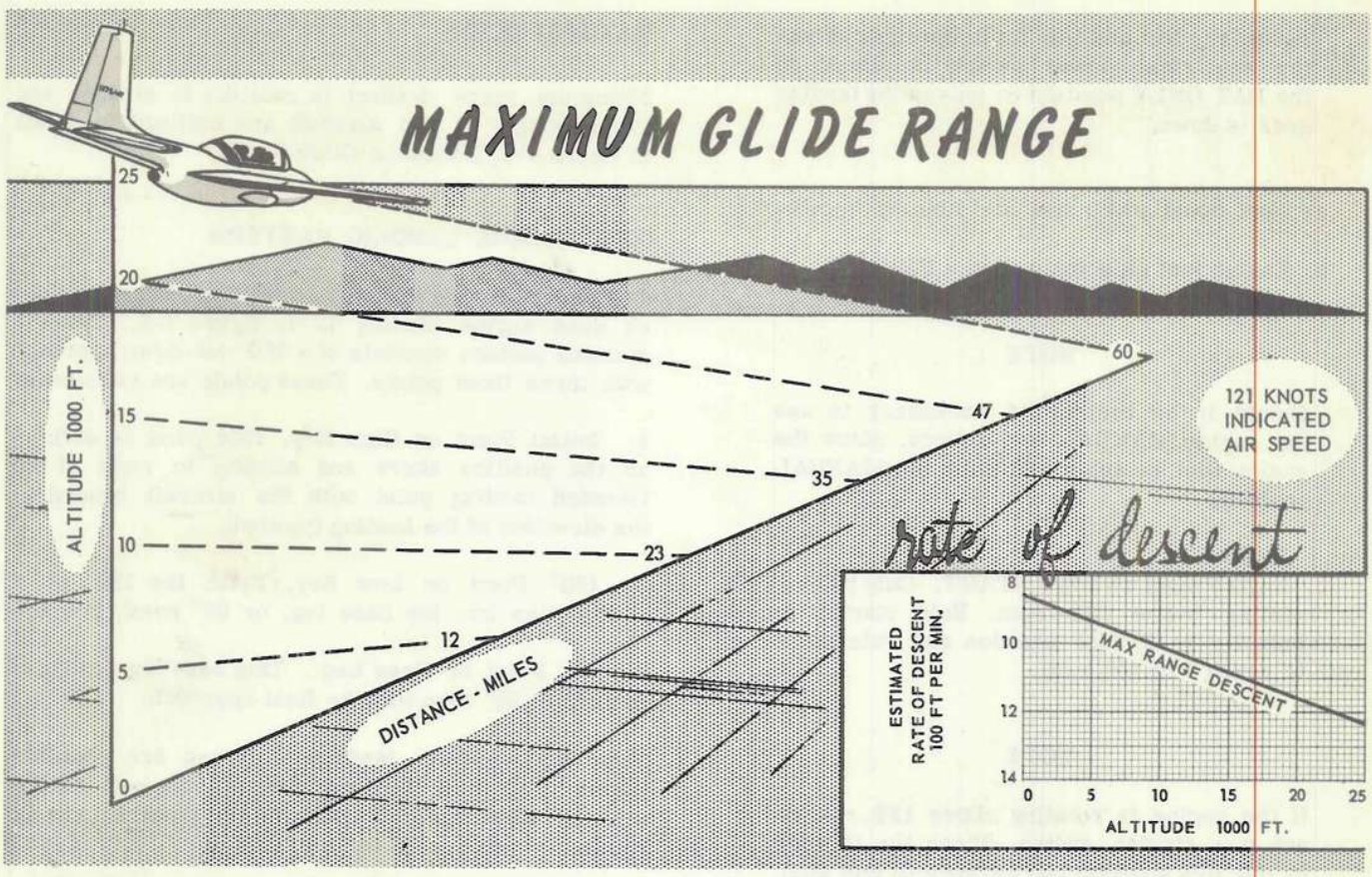


Figure 3-2

ENGINE FAILURE DURING FLIGHT

Engine failure or flame-out will not change the controllability of the aircraft. Slow the aircraft to 121 knots in the gear and flaps up configuration and start a glide toward a suitable landing area, proceeding with the standard airstart procedure. The chances of a relight are excellent. Use the MANUAL engine fuel control source if the normal fuel system is suspected as the cause of flame-out. If the nature of the engine failure is more serious and a relight is unsuccessful, continue, using the dead engine pattern to the landing area. If no landing area is available, eject from the aircraft.

AIRSTART PROCEDURE

NOTE

This procedure applies to aircraft in the clean configuration having an altitude of several thousand feet.

1. Throttle - OFF

2. Inverter circuit breakers - PULL.

3. Electrical load - REDUCE AS MUCH AS POSSIBLE.

NOTE

Most non-essential loads are automatically disconnected as a result of the secondary bus becoming de-energized when the reverse current relay opens.

4. Aircraft - TRIM FOR MAXIMUM RANGE GLIDE (121 KNOTS IAS, Figure 3-2).

5. Airstart - PERFORM AIRSTART AS FOLLOWS:

NOTE

The airstart procedure is identical to the ground start procedure if the rpm is below 12%. The following procedure is applicable to all altitudes below 25,000 feet.

The boost pump control is connected to the

secondary bus and will not be operable unless the electrical power switch is placed to the BAT ONLY position or unless the landing gear is down.

a. Fuel boost pump and fuel shut-off valve - ON.

b. Engine fuel selector switch - PRIMARY.

NOTE

Should it be considered necessary to use the engine MANUAL fuel source, place the engine fuel selector switch to the MANUAL position.

c. Engine start switch - START. Only if the engine is rotating below 12% rpm. Hold starter switch momentarily to START position and release. Allow rpm to reach 8 to 10% rpm.

NOTE

If the engine is rotating above 12% rpm do not use starter switch. Place the throttle to the IGN position and advance to idle stop.

d. Throttle lever - OUTBOARD TO IGN at 8% rpm and move forward and outboard to idle. Note engine rpm and tail pipe temperature rise. After it is assured the engine has ignited, release throttle so that it moves to the right, into idle. As soon as the engine rpm stabilizes, move the throttle smoothly to the desired power setting.

CAUTION

When the engine is operated using the MANUAL fuel source, the engine rpm and tail pipe temperature limits can be easily exceeded at altitude. Move the throttle lever smoothly when making a power change and monitor the rpm and tail pipe temperatures constantly.

LOSS OF THRUST DURING FLIGHT

This type of trouble may be attributed to possible engine icing which will exhibit an increasing tail pipe temperature with decreasing rpm. Icing can usually be eliminated by descending to a lower altitude. However, if this does not eliminate the trouble and the engine will not produce normal thrust without exceeding engine limitations prepare to land as soon as possible using the dead engine landing pattern.

MAXIMUM GLIDE

Maximum range descent in relation to altitude and gross weight of the aircraft are outlined in detail in figure 3-2, Maximum Glide Range.

DEAD ENGINE LANDING PATTERN

The recommended pattern for dead engine or simulated dead engine landing is in figure 3-3. The simulated pattern consists of a 360° let-down approach with three fixed points. These points are as follows:

1. Initial Point or High Key. This point is defined as the position above and slightly to right of the intended landing point with the aircraft headed in the direction of the landing (upwind).

2. 180° Point or Low Key. From the 180° point, a 90° turn into the base leg, or 90° point, is made.

3. 90° Point or Base Leg. This base leg continues in another 90° turn into the final approach.

Two dead engine landing patterns are possible (figure 3-3). The choice of patterns depends on the aircraft altitude. Description of the patterns are as follows:

1. High Altitude Pattern. This pattern executes an approach with landing gear down and flaps in the TAKE-OFF position. Begin the initial point at 3000 feet above terrain and 120 knots. Lower the flaps to the TAKE-OFF position and landing gear upon reaching the inital point and decrease airspeed to 100 knots. This pattern will allow the pilot to stabilize the rate of descent early in the approach, making it easier to judge the glide angle, range, and to plan the approach.

2. Low Altitude Pattern. If there is insufficient altitude to make the approach extend only the gear at Initial Point (1200 feet minimum). Continue the approach and when it is determined that the aircraft can reach the landing point, extend the flaps to the TAKE-OFF position. Upon crossing the end of the runway place flap control lever to FLAPS DOWN position. This low altitude approach is not unduly difficult, but requires more judgement on the pilot's part.

NOTE

When lower than 1200 feet, the landing gear and flaps may be left up until in final approach in order to lengthen the aircraft glide range.

In a dead engine or simulated flame-out approach there is a tendency to undershoot the runway due to the high initial starting point and steep descent. To avoid

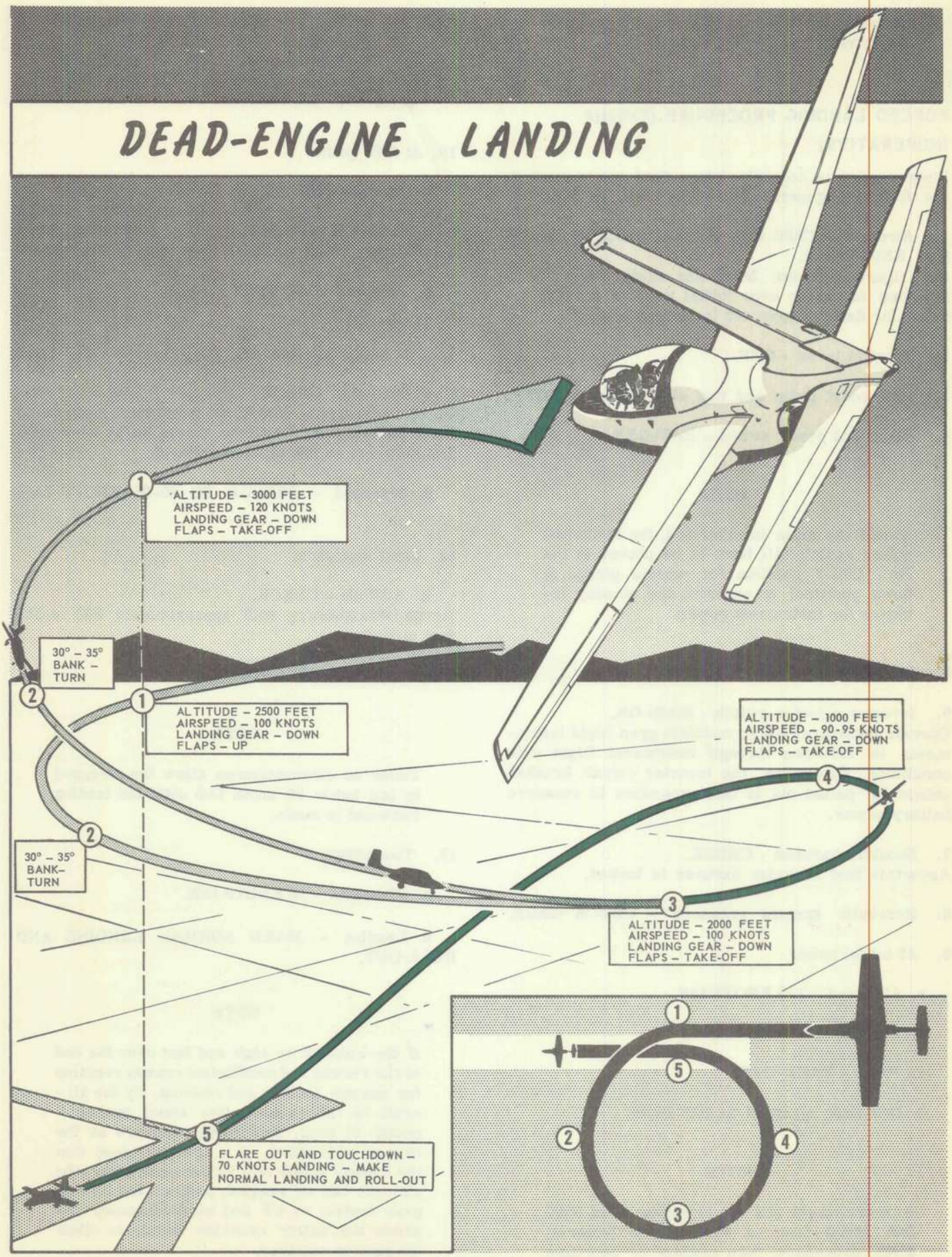

DEAD-ENGINE LANDING
1
ALTITUDE – 3000 FEET
AIRSPEED – 120 KNOTS
LANDING GEAR – DOWN
FLAPS – TAKE-OFF
30° – 35°
BANK –
TURN
2
1
ALTITUDE – 2500 FEET
AIRSPEED – 100 KNOTS
LANDING GEAR – DOWN
FLAPS – UP
ALTITUDE – 1000 FEET
AIRSPEED – 90-95 KNOTS
LANDING GEAR – DOWN
FLAPS – TAKE-OFF
4
2
30° – 35°
BANK–
TURN
3
ALTITUDE – 2000 FEET
AIRSPEED – 100 KNOTS
LANDING GEAR – DOWN
FLAPS – TAKE-OFF
5
FLARE OUT AND TOUCHDOWN –
70 KNOTS LANDING – MAKE
NORMAL LANDING AND ROLL-OUT
1
5
2
4
3

Figure 3-3

confusion, pick a landing point one-third up the runway and fly the aircraft to it.

FORCED LANDING PROCEDURE (ENGINE INOPERATIVE)

When a pilot is committed to a dead engine landing, the following general procedures will be followed:

1. Aircraft - TRIM FOR MAXIMUM GLIDE RANGE (121 KNOTS IAS).
See figure 3-2 for Maximum Glide Range. Plan let-down to arrive over initial point at correct altitude for desired approach to landing point.

2. Throttle lever - OFF.

3. Fuel boost pump and fuel shut-off valve - OFF.

4. Electrical power switch - BAT-GEN.

NOTE

Should the main inverter fail, the electrical power switch will have to be placed in the BAT ONLY position (or wheels placed in down position) to energize the standby inverter for instrument power.

5. Generator switch - TRIP.

6. Inverter selector switch - MAIN ON.
Operate inverters only to maintain gyro flight instruments in let-down through instrument flight rule conditions. Otherwise, the inverter circuit breaker should be pulled out in this procedure to conserve battery power.

7. Shoulder harness - CHECK.
Ascertain that shoulder harness is locked.

8. Hydraulic system pressure - CHECK GAGE.

9. At initial point:

a. Airspeed - 120 KNOTS IAS.

b. Landing gear - DOWN.

c. Flaps - TAKE-OFF.

d. Decrease airspeed to 100 knots.

NOTE

If initial point altitude is higher than 3500 feet (2500 feet on low altitude pattern), delay procedure, turn slightly or decrease bank so that the aircraft may arrive at the 180° position at 2000 feet. In the event of crosswinds, compensate for drift by increasing or decreasing bank from the initial point to the 180° position.

10. At 180° point:

a. Altitude - CHECK.
Check altitude, angle of descent and aircraft position to determine if the preceeding bank may be continued or if angle of bank should be increased or decreased.

b. Airspeed - 100 KNOTS IAS.

11. At 90° point (Base leg):

a. Altitude - CHECK.
Check to determine if aircraft is not too far downwind from landing point. Altitude should be at least 1000 feet (500 feet on low altitude pattern).

b. Airspeed - REDUCE TO 90-95 KNOTS IAS.

12. Final Approach:

a. Altitude - CHECK.
Reach straightaway with approximately 300 to 350 feet altitude.

b. Approach - 90 KNOTS IAS.

NOTE

Under no circumstances allow the airspeed to fall below 90 knots IAS until the landing flare-out is made.

13. Touchdown:

a. Flare-out - 70 KNOTS IAS.

b. Landing - MAKE NORMAL LANDING AND ROLL OUT.

NOTE

If the aircraft is high and fast over the end of the runway and insufficient runway remains for normal landing and roll-out, fly the aircraft to the ground. Use wheel brakes - gently at first, increasing pressure as the brakes take effect. If it is determined that the runway length will be exceeded before the aircraft can be stopped, position the landing gear control to UP and simultaneously depress the safety override button to allow the gear to collapse.

SIMULATED DEAD-ENGINE LANDING PATTERN

By practicing simulated dead engine landings, a pilot will develop sufficient skill and confidence in the maneuver so that an actual dead engine or power-off landing will present no undue hazard. To safely simulate a flame-out, a partial power approach with speed brakes extended may be effected. The following engine rpm's with speed brakes extended will approximate a dead engine:

ALTITUDE	RPM
20,000 feet - 10,000 feet	65% ± 2%
10,000 feet - Sea Level	50% ± 2%

NOTE

The simulated dead engine pattern presents the best method to make an emergency landing when the reliability of the engine is questionable. If the engine quits in the pattern, close the speed brakes and continue the same pattern to a safe landing.

When practicing simulated dead engine landings, the patterns of figure 3-3 should be followed. The pilot may vary the altitude from those recommended to determine the easiest approach to be used. In practicing a simulated dead engine landing, the following precautions should be observed:

1. Normal landing aircraft gross weight.

2. Before landing from a simulated approach, attempt three approaches with a wave-off upon reaching 300 feet altitude for practice.

3. Until thoroughly skilled, simulated dead engine landings should be touch-and-go.

4. Be extra cautious when practicing landings on runways of less than 5000 feet in length.

5. Approach airspeed of 90 knots IAS should be considered as the minimum.

6. Commence flare-out at sufficient altitude for smooth landing.

FIRE

In the event of fire, the course of action depends entirely upon the aircraft location and the nature of the fire. In flight there are no fire extinguishers provided. On the ground the base fire fighting equipment must be utilized (figure 3-4).

GROUND START ENGINE FIRE

If a fire should occur during engine start, proceed as follows:



Figure 3-4

1. Throttle lever - OFF.

2. Fuel boost pump and fuel shut-off valve - OFF.

3. Electrical power and/or master power switch - AFTER 5 SECONDS - OFF.

4. Abandon aircraft.

GROUND SHUTDOWN ENGINE FIRE

If fire is detected in the tail pipe after engine shutdown, proceed as follows:

1. Ground crew - CHECK FOR SPREADING OF FIRE.

2. Pilot - PERFORM ENGINE CLEARING PROCEDURE.
Engine Clearing Procedure is outlined in Section II.

ENGINE FIRE IN FLIGHT

When fire occurs in the engine compartment during flight it may be noted by the following means:

1. Illuminated fire warning indicator.

2. Smoke and fumes present within cockpit.

FIRE IN FLIGHT

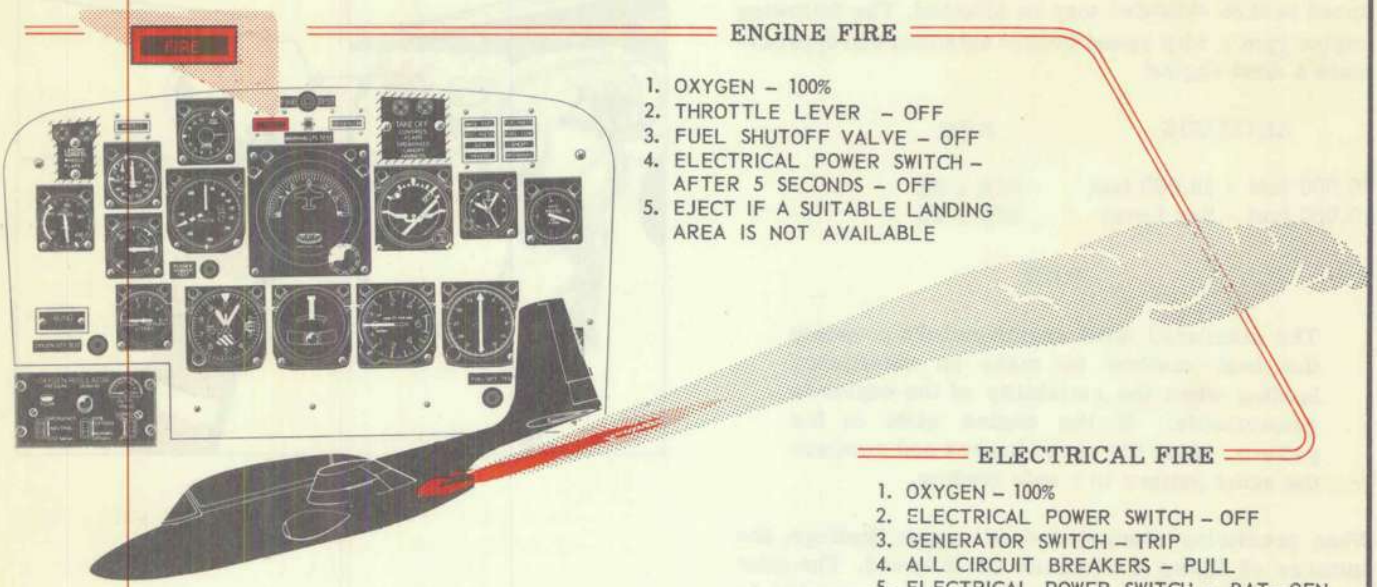


Figure 3-5

3. Smoke and flame usually evident around aircraft and the aircraft leaving excessive smoke trail.

4. Muffled explosions in engine compartment.

5. Excessive tail pipe temperature.

6. Information from anyone in observant position.

7. Fluctuating rpm.

Usually the fire will present itself in more than one of the above indications. Should a single trouble appear, such as fire indicator illumination, fumes and smoke, or engine roughness, the trouble may not necessarily be a fire. Be positive of the presence of fire. Take emergency action as follows (figure 3-5):

1. Oxygen regulator dilutor toggle - 100%.
Position oxygen regulator to 100% to avoid breathing smoke and fumes.

2. Throttle lever - OFF.

3. Fuel boost pump and fuel shut-off valve - OFF.

4. Make a dead engine landing or bail-out.

ELECTRICAL FIRE

The probability of electrical fires has been minimized by the provision of protective circuit breakers and fuses. Should an electrical fire occur, attempt to identify the fire source, then pull the appropriate circuit breaker if it hasn't already "popped" of its own accord. Use the following procedure with an electrical fire (figure 3-5):

1. Oxygen regulator dilutor toggle - 100%.
Use 100% oxygen to avoid breathing smoke and fumes.

2. Electrical power and/or master power switch - OFF.

3. Generator switch - TRIP.

4. All circuit breakers - PULL.

NOTE

The aircraft is capable of remaining in powered flight with all circuit breakers pulled and the electrical power and generator switches turned off. In this condition, caution

should be exercised to observe aircraft attitude, since flight instruments will be inoperative. Move the engine throttle slowly when making changes to prevent engine flameout since an airstart will be impossible.

5. Electrical power switch - BAT-GEN.

6. Master power switch - ON if placed to off position.

7. Faulty circuit - LOCATE.
Push each circuit breaker in one by one to locate faulty circuit.

8. Land at the nearest field.

NOTE

If the fire cannot be controlled, make an emergency landing or bail-out.

SMOKE AND FUME ELIMINATION

When smoke and fumes are present in the cockpit for any reason, proceed as follows:

1. Oxygen regulator dilutor toggle - 100%.
Use 100% to prevent breathing of contaminated cockpit air. Continue to breathe 100% oxygen until canopy can be opened on the ground.

2. Cockpit MASTER AIR control - FULL FORWARD (ON) POSITION.
This is to ventilate the cockpit with fresh air; however, if smoke and fumes are coming through vent system, move MASTER AIR handle to OFF.

BAIL-OUT

Three modes of bail-out are possible (figure 3-6):

1. Normal bail-out. Pull the face curtain. The canopy and seat are automatically jettisoned in sequence when the face curtain is pulled.

2. Emergency bail-out. Unlock canopy and let it blow away, then pull face curtain.

3. Alternate emergency bail-out. Eject with the seat through the canopy, should the canopy fail to be jettisoned either by automatic or manual means (last resort).

PRE-BAIL-OUT PROCEDURES

Before bailing-out, perform the following steps, time permitting:

1. Reduce the airspeed as much as possible.

NOTE

For best bail-out results keep aircraft in slight nose-high attitude, airspeed not to exceed 250 knots IAS and bail-out before descending to altitude of 2000 feet, see figure 3-6.

2. Head the aircraft toward an uninhabited area.

3. Turn all aircraft equipment off before bail-out.

NORMAL BAIL-OUT

Normal bail-out is automatic; therefore, all preejection procedures must be complied with before jettisoning the canopy. To bail-out, proceed as follows:

1. PERFORM PREBAIL-OUT FUNCTIONS

a. Ready the aircraft as instructed in the preceeding paragraph.

b. Lower seat, time permitting, and sit erect with head back against head rest.

c. Tense muscles to absorb ejection forces.

2. PULL FACE CURTAIN FULL-DOWN TO BAIL-OUT.

When the face curtain is pulled down fully it will actuate in two steps before the seat catapult cartridge is fired. The steps and sequence of actions are as follows:

STEP I.

a. Jettisoning of the canopy arms catapult by removing interlock pin.

b. Interlock releases face curtain interlock cable.

c. Curtain extends fully withdrawing catapult safety pin and firing catapult.

STEP II. Catapult Ejects Seat (if pilot continues to pull down on face curtain).

a. Ejecting seat disconnects personal leads and locks shoulder harness inertia reel.

b. Ejecting seat fires 3/4-second time-delay cartridge, releasing pilot's lap belt, and shoulder harness.

3. SEPARATE FROM SEAT

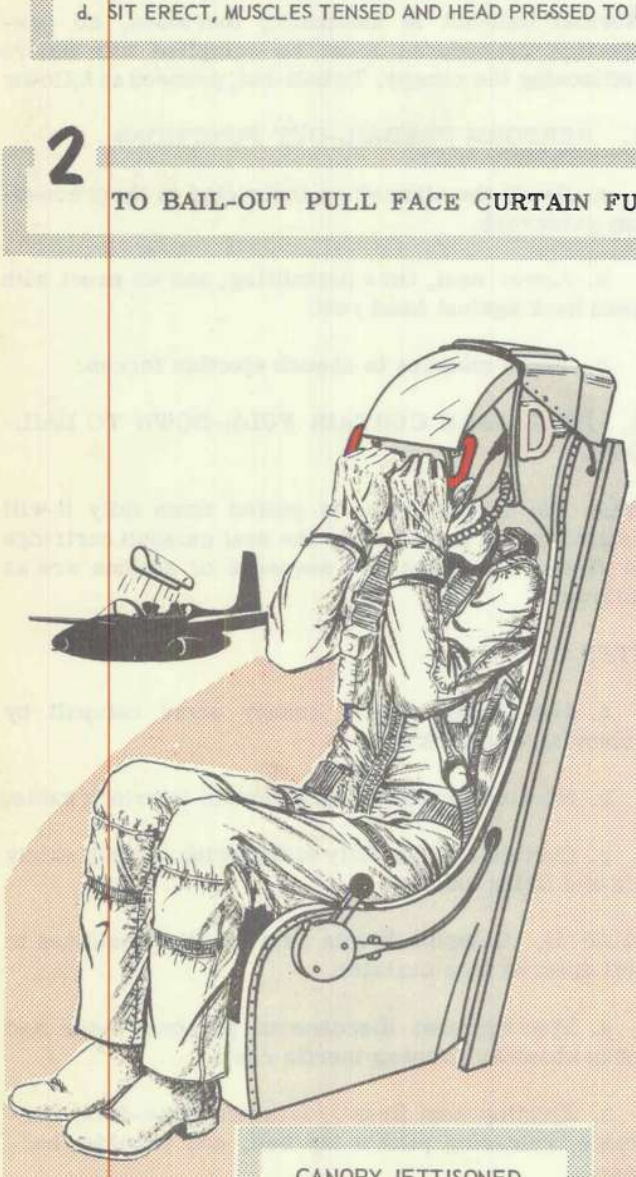
a. Pilot is automatically released from the seat. The slip stream will tend to separate the seat and

BAIL-OUT PROCEDURE

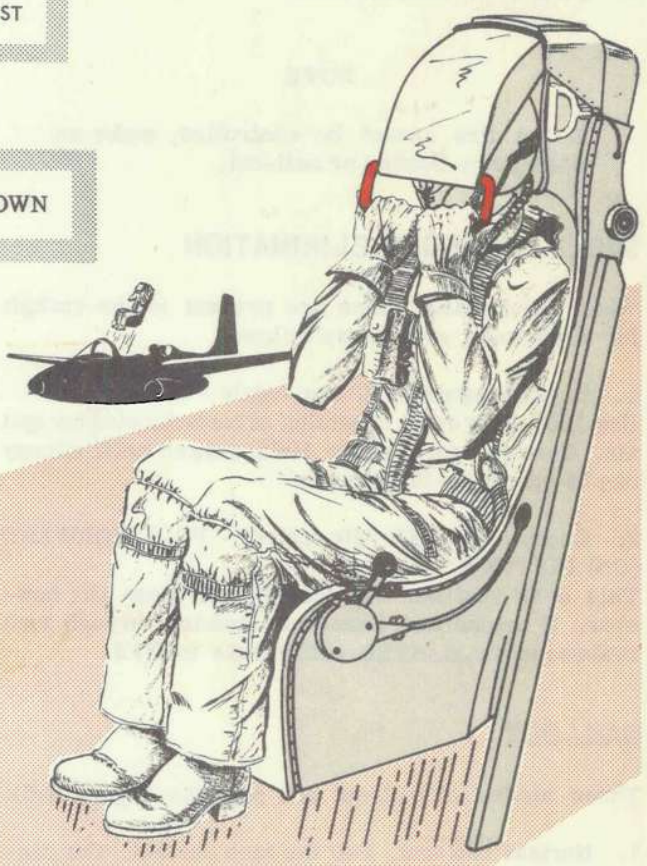
1 PERFORM PRE-BAIL-OUT FUNCTIONS

a. REDUCE AIRSPEED
b. HEAD AIRCRAFT TOWARD UNINHABITED AREA
c. LOCK INERTIA REEL
d. SIT ERECT, MUSCLES TENSED AND HEAD PRESSED TO HEADREST

2 TO BAIL-OUT PULL FACE CURTAIN FULL DOWN

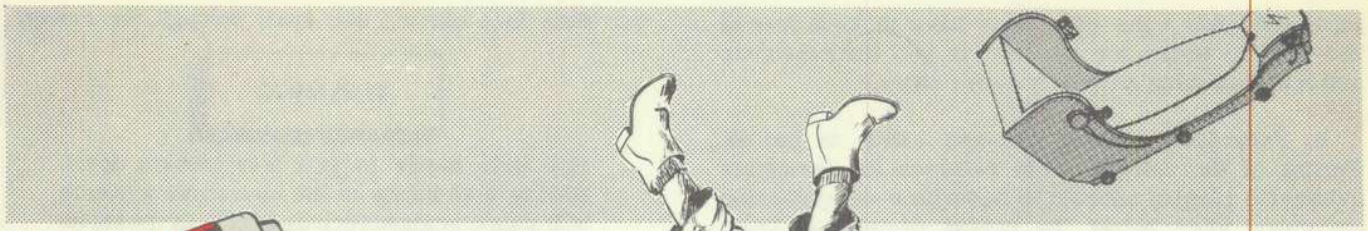


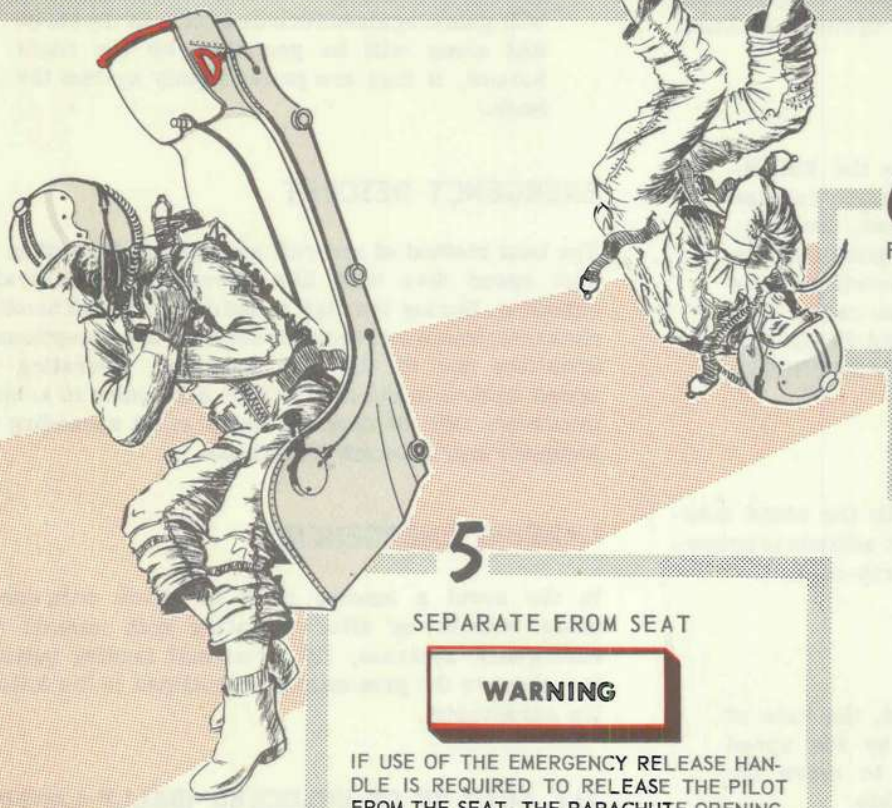
3 CANOPY JETTISONED



4 SEAT CATAPULT FIRED

Figure 3-6 (Sheet 1 of 2)





6

FREE-FALL TO SAFE ALTITUDE

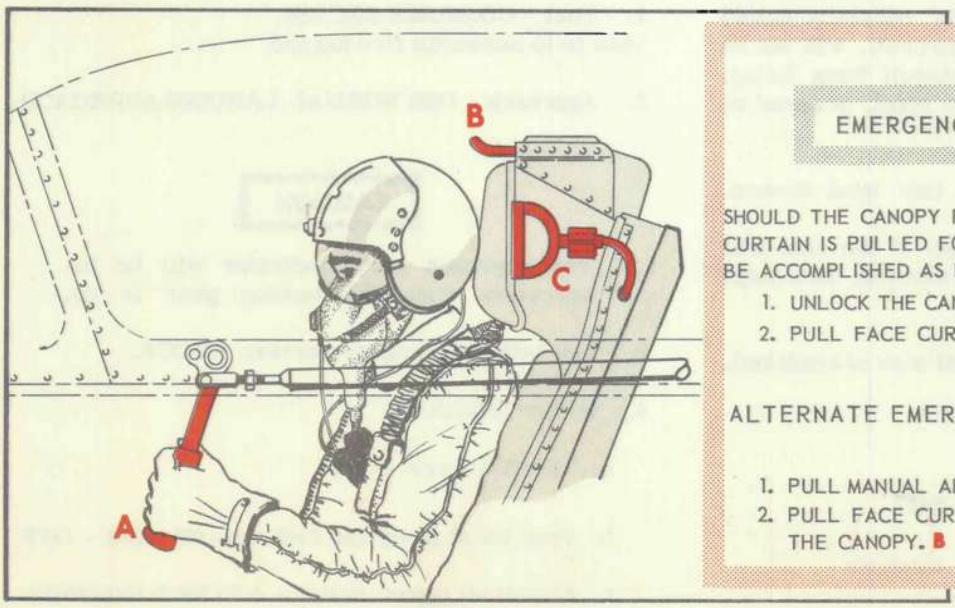
PULL THE PARACHUTE MANUAL RIPCORD AT ALTITUDE DESIRED OR ALLOW PARACHUTE TO OPEN AT PRESET ALTITUDE

5

SEPARATE FROM SEAT

WARNING

IF USE OF THE EMERGENCY RELEASE HANDLE IS REQUIRED TO RELEASE THE PILOT FROM THE SEAT, THE PARACHUTE OPENING ANEROID RELEASE CABLE IS DETACHED; THEREFORE, THE PARACHUTE MANUAL RIPCORD MUST BE PULLED TO OPEN THE PARACHUTE.



EMERGENCY EJECTION BAIL-OUT

SHOULD THE CANOPY FAIL TO JETTISON WHEN THE FACE CURTAIN IS PULLED FOR BAIL-OUT, SEAT EJECTION WILL BE ACCOMPLISHED AS FOLLOWS:

1. UNLOCK THE CANOPY AND FORCE IT INTO WINDSTREAM. **A**
2. PULL FACE CURTAIN HANDLE DOWN TO FIRE SEAT. **B**

ALTERNATE EMERGENCY EJECTION BAIL-OUT

1. PULL MANUAL ARMING HANDLE. **C**
2. PULL FACE CURTAIN HANDLE DOWN TO EJECT THROUGH THE CANOPY. **B**

Figure 3-6 (Sheet 2 of 2)

pilot. However, the pilot may have to kick free of the seat in order for the seat to pull the parachute automatic opening aneroid release cable.

b. Parachute aneroid release cable is pulled. Pulling of the release cable releases the parachute automatic opening aneroid to fire a time-delay opening cartridge when below the preset opening altitude.

NOTE

If the pilot is required to use the EMERGENCY RELEASE handle to manually release the lap belt and shoulder harness, the parachute will not be opened automatically, as the parachute opening firing cable will become detached from the seat. In this case, THE PILOT MUST PULL THE MANUAL RIP CORD D-RING TO OPEN THE PARACHUTE.

4. FREE-FALL

It is recommended to free-fall to the chute automatic opening altitude. If the preset altitude is believed to be exceeded, pull the manual rip-cord.

NOTE

At altitudes below 10,000 feet, the rate of fall is alarmingly noticeable by the speed at which the ground seems to move up; objects become clearly noticeable.

EMERGENCY BAIL-OUT

Should the canopy fail to jettison when the face curtain is pulled, the ejection will be aborted. The canopy face curtain interlock pin, normally pulled by the canopy as it leaves the aircraft, will not be extracted and will prevent the catapult from firing. When the canopy or seat fails to eject, proceed as follows:

1. Unlock canopy and push up into wind stream.

2. Pull face curtain to eject seat. If the seat will not eject after canopy has been removed, then steps 3 and 4 should be followed.

3. Pull manual arming handle (left side of headrest).

4. Pull face curtain to fire seat.

ALTERNATE EMERGENCY BAIL-OUT

An alternate method of emergency ejection:

1. Pull manual arming handle.

2. Pull face curtain and eject through the canopy.

WARNING

Use both hands to pull face curtain down. Having both hands on the face curtain handle will guard against serious injury, as the hands and arms will be protected by the flight helmet, if they are pulled tightly against the body.

EMERGENCY DESCENT

The best method of aircraft emergency descent is the high speed dive with idle power and speed brakes extended. During the high speed dive, aircraft handling characteristics and control reactions are exceptionally sensitive due to the high airspeed. Operating the speed brakes in the dive will be necessary to achieve maximum rate of descent and prevent exceeding the airspeed and/or mach limitations.

LANDING EMERGENCIES

In the event a landing must be made with one or more wheels up after actuating both normal and emergency systems, fly a normal landing pattern, but observe the precautions as outlined in the following paragraphs.

ALL GEAR UP OR UNLOCKED (BELLY LANDING)

When the landing gear is up due to choice or failure of the landing gear system or when the gear is down and unlocked, a wheels-up landing can be made on hard or soft ground as follows:

1. Fuel - CONSUME EXCESS.
This is to minimize fire hazard.

2. Approach - USE NORMAL LANDING APPROACH.

CAUTION

The approach index indicator will be inoperative when the landing gear is up.

3. Lap belt and shoulder harness - LOCK.

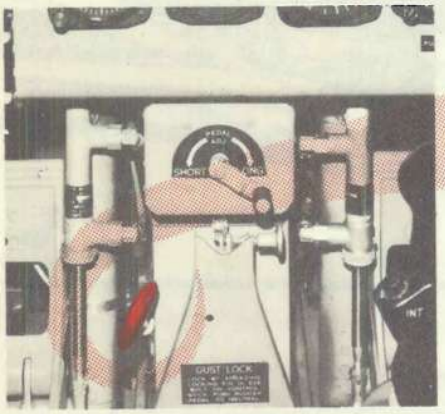
4. Before touchdown:

a. Throttle lever - OFF.

b. Fuel boost pump and fuel shut-off valve - OFF.

c. Electrical power switch - AFTER 5 SECONDS - OFF.

LANDING GEAR EMERGENCY LOWERING



LANDING GEAR EMERGENCY RELEASE HANDLE

CAUTION

The emergency gear extension system should not be used until after attempting to extend the gear by use of the hydraulic hand pump.

NOTE

All hydraulically operated equipment will be operative after extending the landing gear with the emergency lowering system.

Figure 3-7

d. Canopy - JETTISON MANUALLY AT PILOTS DISCRETION.

WARNING

Jettisoning the canopy will arm ejection seat catapult. The canopy may possibly hit the vertical fin.

5. Normal landing - TOUCHDOWN AS LIGHTLY AS POSSIBLE.
Do not stall and drop the aircraft.

6. As soon as aircraft stops:

a. Canopy - OPEN (if not previously jettisoned).

b. EMERGENCY RELEASE handle for lap belt and shoulder harness - PULL.

c. Abandon aircraft.

NOSE WHEEL UP OR UNLOCKED

NOTE

When the nose gear is down but has failed to lock, it will sometimes lock on landing. Touching the nose gear down lightly at intervals on rollout may force the nose gear aft sufficiently to lock.

CAUTION

Touch the aircraft down lightly on the runway. A hard touchdown may pitch the aircraft nose into the ground and cause considerable aircraft damage and possible pilot injury.

1. Fuel - CONSUME EXCESS.
This is to minimize fire hazard.

2. Lap belt and shoulder harness - LOCK.

3. Approach - MAKE NORMAL APPROACH.

4. Before touchdown:

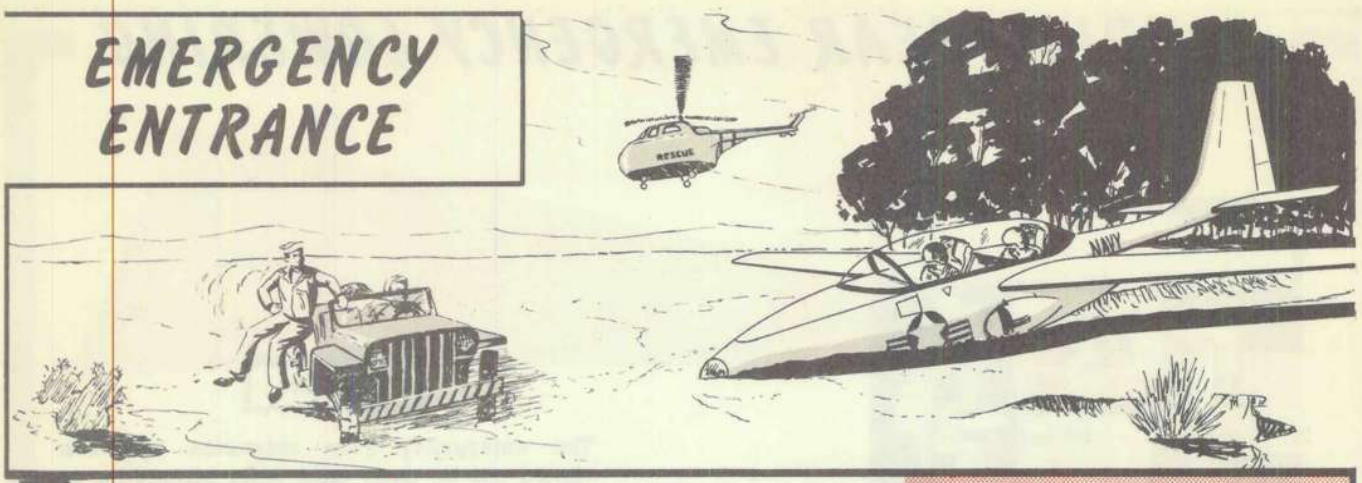
a. Throttle lever - OFF.

b. Fuel boost pump and fuel shut-off valve - OFF.

c. Electrical power and/or master power switch - AFTER 5 SECONDS - OFF.

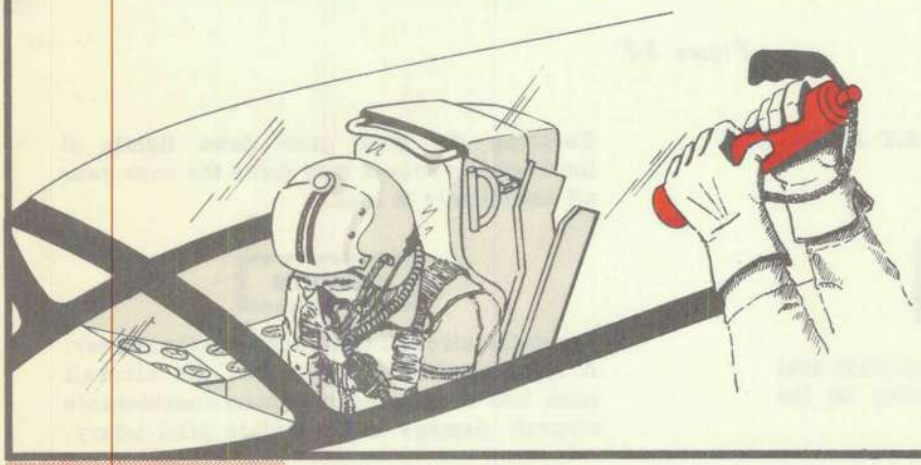
5. Touchdown: Continue to hold aircraft nose up and off nose gear until roll-out speed diminishes; then, ease nose to the ground and apply light braking efforts.

EMERGENCY ENTRANCE





Open the canopy with the EXTERNAL CANOPY HANDLE



NOTE

If external canopy unlocking control handle fails to release canopy to open position, break the canopy glass to provide escape exit. If a CO_2 portable fire extinguisher bottle is available, discharge the CO_2 on canopy glass. The discharging CO_2 will chill the canopy glass making it brittle. The canopy glass will crack and shatter readily if struck while cold.

WARNING

Do not pull handles on headrest. Stay clear of seat catapult ejection area. If the Pilot has jettisoned the canopy in-flight or upon landing, the seat catapult is armed; therefore, exercise care during escape.

Pull EMERGENCY RELEASE handle to free the pilot from the seat

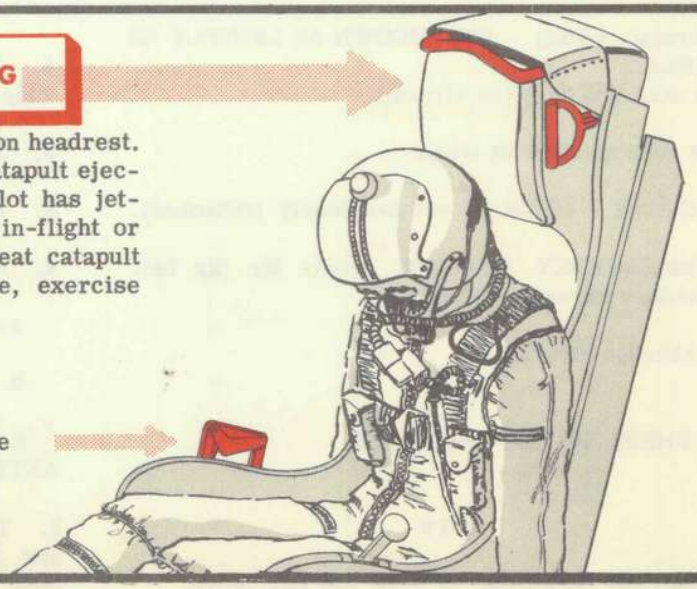


Figure 3-8

DITCHING PROCEDURE

...DITCH ONLY AS LAST RESORT...



APPROACH

1. Oxygen dilutor toggle - 100%
2. Cockpit air controls - CLOSE
3. Lap belt and shoulder harness - LOCK

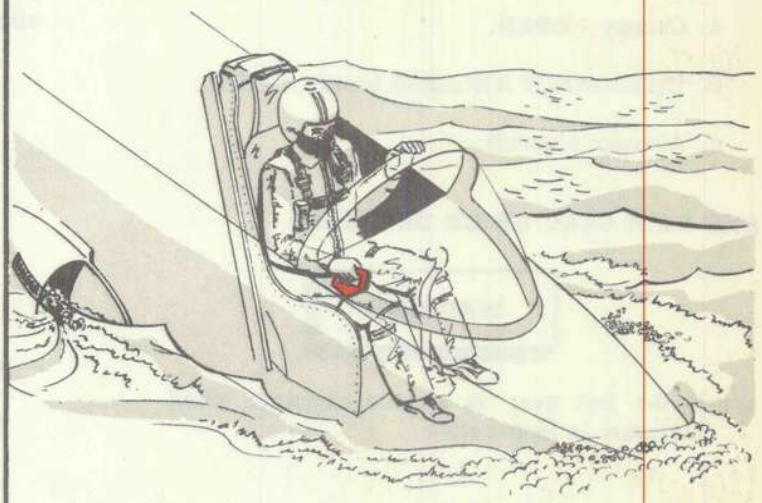
BEFORE TOUCHDOWN

1. Throttle - OFF
2. Electrical Power Switch - OFF
3. Personnel leads - DISCONNECT ALL EXCEPT OXYGEN

WARNING

Do not release oxygen leads until ready to leave the cockpit as the oxygen mask is a suitable underwater breathing device when dilutor toggle is positioned to 100%.

4. Canopy - MANUALLY JETTISON PRIOR TO WATER CONTACT



TOUCHDOWN

1. Touchdown - NORMAL LANDING ATTITUDE

WARNING

Do not stall aircraft into a water contact. With landing gear up, the approach index indicators are inoperative.

2. Emergency release handle - PULL TO ESCAPE AIRCRAFT

NOTE

If submerged, pull flotation equipment lanyards only after clearing cockpit.

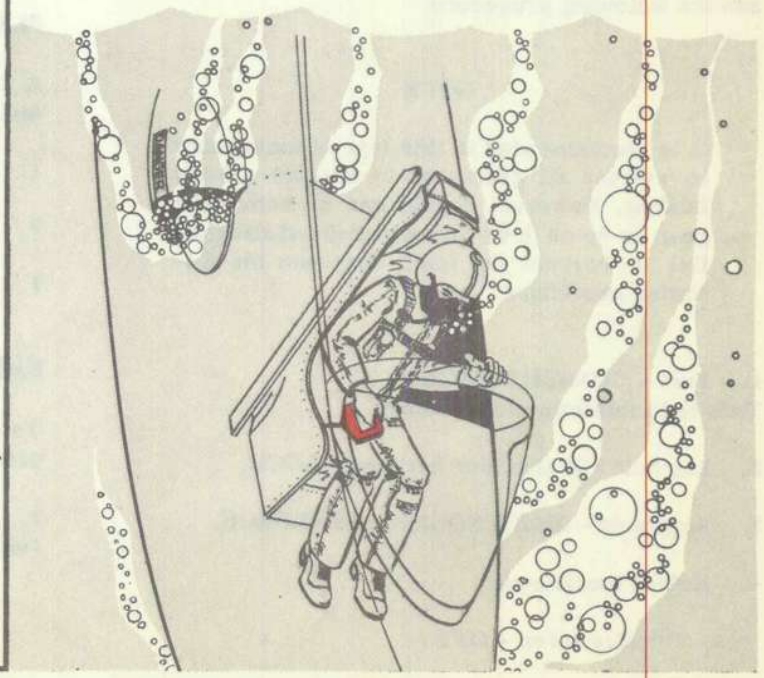


Figure 3-9

CAUTION

Ease the aircraft nose onto the ground before elevator effectiveness is lost. If elevator control is lost, the aircraft nose may drop to the ground and cause considerable damage to the aircraft.

WARNING

Do not use any braking while holding the nose off the ground.

6. When the aircraft stops:

   a. Canopy - OPEN.

   b. EMERGENCY RELEASE handle - PULL.

   c. Abandon aircraft.

ONE MAIN GEAR UP OR UNLOCKED

WARNING

If the left gear is up, the approach index indicator is inoperative.

If one or both main gear are up or down and unlocked use the following procedure:

NOTE

It is recommended in this type of emergency to retract all gear, and to execute a belly landing. However, should one or both main gear be up or down and unlocked and attempts fail to correct the fault, then use the following procedure.

1. Fuel - CONSUME EXCESS.
This is to minimize fire hazard.

2. Lap belt and shoulder harness - LOCK.

3. Approach - MAKE NORMAL APPROACH.

4. Before touchdown:

   a. Throttle lever - OFF.

   b. Fuel boost pump and fuel shut-off valve - OFF.

   c. Electrical power and/or master power switch - AFTER 5 SECONDS - OFF.

5. Land on the side of the runway next to the extended and locked gear to allow for aircraft to swerve to the side where the gear is up or unsafe.

NOTE

If both gears are down but only one is locked, it may sometimes lock if a touch and go landing is made in a very slight skid in the direction that will force the questionable gear outboard.

6. Just prior to touchdown, hold the aircraft level. Hold the wing up to as low an airspeed as possible. Then gradually ease the wing, on the questionable side, down.

CAUTION

Ease the wing with the unlocked main gear down before aileron and rudder effectiveness is lost to prevent unnecessary damage to the aircraft.

7. When the aircraft stops:

   a. Canopy - OPEN.

   b. EMERGENCY RELEASE handle - PULL.

   c. Abandon aircraft.

FLAT TIRE

A flat tire emergency should be treated with as much care as a landing gear failure emergency.

1. Make normal approach.

2. Land on side of runway opposite the flat tire.

3. Maintain directional control with rudder and brake.

EMERGENCY ENTRANCE

To open the canopy from the exterior of the aircraft, proceed as follows:

1. Open the canopy with the normal external canopy release control, (see figure 3-8).

NOTE

If the canopy fails to open by its manual

release control, the canopy glass may be broken to escape the aircraft. If a CO_2 portable fire extinguisher bottle is available, discharge its agent on the canopy glass. The canopy glass will become brittle and will crack and shatter readily if struck while cold.

2. When access to the cockpit is gained, pull the EMERGENCY RELEASE handle on the seat right arm rest to free pilot.

WARNING

Do not pull any of the handles located on the headrest. Stay clear of seat catapult ejection area when possible. IF THE PILOT HAS JETTISONED THE CANOPY BEFORE GROUND CONTACT THE SEAT CATAPULT WILL FIRE IF THE FACE CURTAIN IS EXTENDED; THEREFORE, FREE THE PILOT WITH EXTREME CARE.

DITCHING

Ditch only as a last resort. All emergency and survival equipment is carried by the pilot; consequently, there is no advantage in riding the aircraft down. However, if the altitude is not sufficient for bail-out and ditching is unavoidable, proceed as follows:

1. Follow radio distress procedure.

2. Oxygen diluter toggle - 100%.

NOTE

In the event of ditching and sinking in water where immediate escape is improbable due to a number of factors, it is possible to breathe under water with the oxygen equipment until escape is possible. The liquid oxygen system is a suitable underwater breathing device. It is essential, however, that the mask be secured tightly in place and that the oxygen regulator be set at 100% oxygen.

3. Lap belt and shoulder harness - LOCK.

4. Descent - Use slow rate, flap-down, speed brake open, partial power normal approach if power is available.

NOTE

Carefully analyze the characteristics of the sea, determine wind direction, and wave, or swell pattern. If a regular wave or swell pattern exists, aim the touchdown parallel to the waves. Attempt to land on a crest or falling side of the wave. More often the sea will be irregular with swell patterns intermingled. In this case, the best compromise is to head into whatever wind may be blowing. Examine the sea for areas where intermingling waves cancel out and aim the touchdown for one of these calmer areas.

5. Before touchdown:

a. Throttle lever, fuel boost pump and fuel shutoff valve - OFF.

b. Electrical power and/or master power switch - AFTER 5 SECONDS - OFF.

c. Personal leads - DISCONNECT ALL LEADS EXCEPT OXYGEN.

WARNING

DO NOT DISCONNECT OXYGEN CONNECTION UNTIL READY TO LEAVE COCKPIT.

d. Canopy - JETTISON MANUALLY AT PILOT'S DISCRETION.
Using manual release, jettison the canopy by pushing it into the slip stream just prior to touchdown.

WARNING

Jettisoning the canopy arms the ejection seat catapult. The canopy may hit the vertical fin.

6. Touchdown - MAKE TOUCHDOWN IN NORMAL LANDING ATTITUDE OR A SLIGHTLY HIGHER NOSE ATTITUDE.

WARNING

With the landing gear up, the approach index indicator will be inoperative.

Do not stall the aircraft into a water contact.

NOTE

Expect a violent reaction from the engine compartment when water contact is made. The cold water coming into contact with the hot engine will create steam pressure in

the engine which may explode the engine compartment.

7. When the aircraft stops:

   a. EMERGENCY RELEASE handle - PULL.

   b. Abandon aircraft.

AIRCRAFT SYSTEMS EMERGENCIES

FUEL SYSTEM EMERGENCIES

Fuel Control Failure

If the primary fuel control system fails, as evidenced by abnormal reduction of engine rpm, thrust, and tail pipe temperature, or by the inability to reduce or increase engine rpm; transfer to the manual fuel control system should be accomplished as follows:

1. Move throttle setting to as low an engine rpm as possible.

2. Position engine fuel selector switch to MANUAL.

3. Slowly reposition throttle to desired setting.

CAUTION

Careful monitoring of engine rpm, fuel flow, and tail pipe temperature is mandatory when using the MANUAL fuel control system. Move throttle smoothly to avoid compressor stall, engine overspeed and overtemperature; since the manual system cannot prevent these conditions.

If the MANUAL fuel control system is selected because of in-flight failure of the PRIMARY system, do not transfer back to the PRIMARY system.

Fuel Pump Failure

The sump tank submerged fuel booster pump and the engine-driven fuel pump supply fuel under pressure to the engine. If the fuel booster pump fails, the engine driven fuel pump is capable of supplying fuel to the engine under all power conditions up to 10,000 feet and under restricted conditions up to 15,000 feet.

ELECTRICAL SYSTEM EMERGENCIES

A complete electrical power system failure occurs only when the engine driven generator and the battery have failed or are disconnected from the d-c power bus. When this occurs, (either by pilot choice or by circumstance) the aircraft can remain in powered flight, but the following circumstances will prevail:

Fuel System. The engine selection will automatically return to PRIMARY if it has been operating on MANUAL. If it was on PRIMARY at the time of failure it will continue to operate on this system. However, the system control switches, indicators and warning lights will be inoperative. Air-start and/or transfer from the PRIMARY to the MANUAL fuel system will be impossible.

Hydraulic System. The following hydraulically operated systems which are electrically controlled will be inoperative:

1. Speed brakes.

NOTE

If the speed brakes are open when an electrical failure occurs they will close automatically.

2. Landing gear.

NOTE

Although it will be impossible to operate the landing gear system hydraulically, the gear may be mechanically released and extended by use of the landing gear emergency release handle (figure 3-6). This handle requires approximately 100 pounds pull to release.

3. Wing flaps.

4. Seat adjustment.

Flight Control System. All controls except the trim tabs will function normally.

Instruments. The airspeed, altimeter, vertical velocity, rpm and tail pipe temperature gages will continue to operate. All other indicators will be inoperative.

Communication and Navigation Equipment. Only the magnetic compass will operate.

Generator Failure

Any malfunction that may cause the generator to

disconnect from the d-c power bus will be indicated by the GEN warning light. When the generator fails, all electrically powered and controlled equipment connected to the primary bus will be powered by the battery. Battery life is limited to approximately 25 minutes duration with all circuits energized except those on the secondary bus.

CAUTION

Due to the discharge characteristics of the battery, placing a large electrical load after it is in a low state of charge may suddenly exhaust the battery. Use of communication equipment or flight instruments may be on an emergency basis and should not be used for more than 10 minutes following generator failure.

If overvoltage has caused generator failure, reset the generator by positioning its control switch to RESET and then releasing. This will normally reset the generator (field control) relay and reconnect the generator to the d-c power bus.

Inverter Failure

Failure of the gyro flight instrument inverter is indicated by the INVERT warning light and OFF flag in the gyro horizon indicator. The light indicates an a-c voltage lower than 90 volts. When the light illuminates, the inverter selector switch should be positioned to the alternate inverter. Upon selecting the alternate inverter, the warning light will go out and will re-illuminate only if the alternate inverter fails. Pull the circuit breaker to de-energize the faulty circuit.

CAUTION

If either the main or standby inverter fails, do not attempt to re-energize the faulty inverter.

HYDRAULIC SYSTEM EMERGENCIES

The hydraulic system is the only source of operating power for the landing gear, wing flaps, speed brakes and seat adjustment. When the hydraulic system completely fails these items will be partially inoperative.

Hydraulic Pump Failure

The hydraulic system remains functional if only the engine driven hydraulic pump has failed. However, system operating pressure is obtained by the emergency hand pump, to operate the systems.

FLIGHT CONTROL SYSTEM EMERGENCIES

Duplication of controls (stick and rudder) within the cockpit area provide an alternate means of control in the event of a control malfunction.

LANDING GEAR SYSTEM EMERGENCIES

The landing gear system is powered by the aircraft hydraulic system and controlled electrically. Should the hydraulic system fail completely the gear may be extended through use of the landing gear emergency release handle (figure 3-7) below the forward instrument panel. When the handle is pulled aft, the landing gear will unlock and free-fall to the down position.

CAUTION

The emergency gear extension system should not be used until after attempting to extend the gear by use of the hydraulic hand pump. Whenever the gear is extended by use of the landing gear emergency release handle, the aircraft should be pitched and yawed sufficiently to secure the gear in the down and locked position.

Landing Gear Emergency Extension Procedures

Two types of landing gear failure are possible, electrical or hydraulic. The procedures listed below on emergency lowering of the landing gear are the same in both cases.

1. Aircraft speed - 100 to 120 KNOTS.

2. Landing gear lever - DOWN.
This is to insure that the system is actually inoperative.

3. Emergency release T handle - PULL 100 LBS.
This handle travels approximately six inches. The first 1/3 (two inches) travel repositions the emergency hydraulic selector valve, which releases system pressure on the rod end of the landing gear door actuators to the return lines. A further pull on the T handle, to the lock position, releases the landing gear door locks, and the landing gear uplocks. This allows the landing gear to fall to the down and lock position.

4. Yaw and roll aircraft to insure wheels locking properly.

NOTE

On electrical failure, the landing gear in-

dicator and word warning light will be inoperative. On hydraulic failure, the light and indicator will function.

5. Tower - CONTACT.

Request wheels - down check before landing.

6. Final landing - TOUCHDOWN LIGHTLY. Use brakes sparingly to minimize stress on gear in the event that all wheels are not down and locked.

auxiliary equipment
SECTION IV



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HEATING, VENTILATING, AND DEFROSTING SYSTEM

The heating, ventilating, and defrosting system (figure 4-1) is comprised of a ram air scoop, heat exchanger, bleed air valve, master air valve, defroster and forward floor valves, and ducts. Ram air is used for ventilation and heating. Ventilating air is admitted through the ram air scoop and routed through the heat exchanger into the cockpit. Engine bleed air is ducted from the engine through the bleed air valve, the heat exchanger, and then overboard after supplying heat to the heat exchanger. When the landing gear is down, a bleed air cutoff relay automatically closes the bleed air valve; consequently, no heat is available with the gear extended. A ventilating outlet is on the right side and floor of each cockpit and a defrosting outlet is located just aft of the windshield.

HEATING, VENTILATING, AND DEFROSTING CONTROLS

Heating, ventilating, and defrosting controls are on the heat and vent control panel (figure 4-1) on the right console in the forward cockpit.

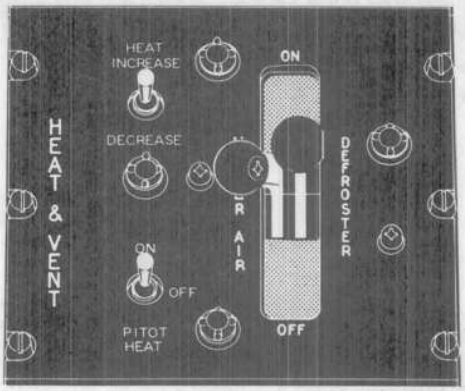
Master Air Handle

The master air handle (figure 4-1), which is mechanically connected to the master air valve, selects the quantity of ram air admitted to the cockpit. The handle may be positioned at any point from OFF to ON with the flow of air increasing to maximum in the ON position.

Cockpit Heat Switch

Cockpit heat is controlled by a three-position INCREASE-OFF-DECREASE switch (figure 4-1) on the heat and vent control panel. The switch, spring loaded to the OFF position, positions the bleed air valve. The position of the bleed air valve, which may be set at any point between open and closed, determines the amount of heat that is directed to the heat exchanger. When the cabin heat switch is positioned to INCREASE, the bleed air valve moves toward the

HEATING, VENTILATING AND DEFROSTING SYSTEM



CONTROL PANEL

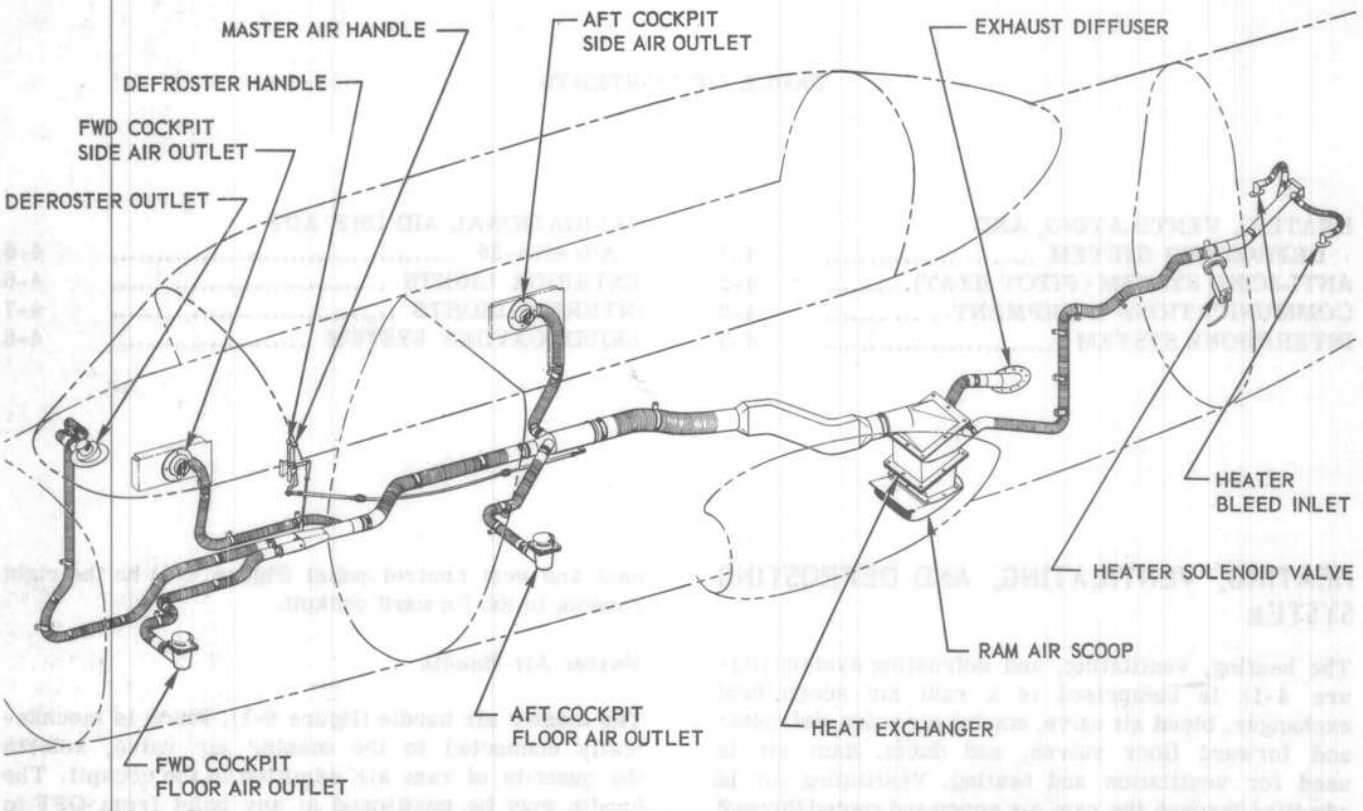


Figure 4-1

open position, and when it is positioned to DECREASE, the bleed air valve moves toward the closed position. This movement may be stopped at any partial position by releasing the switch. The circuit is completed through the landing gear up-lock switches which automatically close the valve when the landing gear is down. The switch is powered from the primary bus and protected by the HTR VALVE circuit breaker (figure 1-14).

Defroster Handle

The defroster handle (figure 4-1) is mechanically connected to the forward floor and defrosting valve. When the handle is in the OFF position, the defroster valve is closed, and the forward floor valve is open. As the handle is moved from OFF to ON, the defroster valve is opened and the forward floor valve is closed. When the handle is in an intermediate position, both

valves are partially open.

HEATING, VENTILATING, AND DEFROSTING SYSTEM OPERATION

When the aircraft is on the ground, ventilation is provided by opening the canopy. In flight ram air is the source of ventilation. No heat is available until the landing gear is retracted. Operating procedures for the system are as follows:

1. Master Air Handle - ON.
2. Heat Switch - INCREASE.
3. Defroster Handle - AS DESIRED.

NOTE

The defroster handle should be positioned to ON prior to descent to prevent frost from forming on the windshield.

ANTI-ICING SYSTEM

Electrical heating elements are installed in the pitot head on the nose of the aircraft and in the airstream direction detector probe on the left side of the nose bay. These heating elements provide anti-icing protection for the pitot system and angle of attack stall warning system respectively.

PITOT HEAT SWITCH

The two-position ON-OFF pitot heat switch (figure 4-1) controls an electrical heating element in the pitot head and a heating element in the airstream direction detector probe. When the switch is positioned to ON, the heating element for the pitot system is energized from the 28-volt d-c secondary bus and the angle of attack stall warning system heating element is energized from the 28-volt d-c primary bus. Protection for the pitot heat circuit is provided through the PITOT HEAT circuit breaker and for the angle of attack stall warning heat circuit through the AIR DET HEAT circuit breaker (figure 1-14).

PITOT HEAT OPERATION

In flight, the pitot heat switch should be positioned to ON when flying in visible moisture. To prevent overheating and possible damage to the heater element, ground operation of the element should be limited to take-offs under possible icing conditions and brief maintenance checks. To prevent burn injury to maintenance personnel, the switch should be turned off immediately after landing.

COMMUNICATION EQUIPMENT

The communications equipment installed in the aircraft provides for UHF transmission and reception, UHF/ADF, and intercockpit communication. A combination headset and microphone receptacle (6, figure 1-24), for interphone and UHF communication, is mounted on the mask connection end of each oxygen hose.

UHF COMMUNICATIONS SYSTEM

The UHF radio set AN/ARC-52 is designed to provide radio-communication in the frequency range between 225.0 and 399.9 megacycles. The RT-424/ARC-52 transceiver, which may be remotely operated from either of the C-2072 control panels, utilizes the AT-256/ARC antenna for transmission and reception. The transceiver incorporates a guard receiver having a frequency range between 238.0 and 248.0 megacycles. The guard receiver is normally preset at 243.0 megacycles. The transceiver is powered from the primary bus through the ARC-52 circuit breaker (figure 1-14).

UHF Radio Controls

All ARC-52 controls, except the transfer switch and microphone buttons, are located on the C-2072 control panels (figure 4-2) on the left console in each cockpit. These control panels receive power through the RT-424/ARC-52 transceiver from the primary bus. Only one panel at a time, as selected by the transfer switches, is energized.

TRANSFER SWITCHES

A transfer switch (figure 4-2) on the right console in each cockpit is provided to transfer control of the radio to either cockpit. These two-position momentary switches are spring-loaded to a position perpendicular to the transfer panels. When the aft switch is actuated, the transfer relay is energized, and control is transferred to the aft C-2072 control. When the forward switch is actuated, the transfer relay is de-energized, and control is transferred to the forward C-2072 control. Constant pressure on the aft transfer switch will override the forward switch. An indicator light (figure 4-2) on the respective transfer panel will illuminate when control is transferred to either cockpit. The transfer switches and indicator lights are powered from the primary bus through the RELAY PWR circuit breaker (figure 1-14).

FUNCTION SWITCH

A four position OFF-T/R-T/R+G-ADF function switch (figure 4-2) on each C-2072 control panel controls

COMMUNICATIONS EQUIPMENT CHART

TYPE	DESIGNATION	USE	RANGE	LOCATION OF CONTROLS
UHF COMMAND	AN/ARC-52	TWO-WAY VOICE COMMUNICATION	LINE OF SIGHT	LEFT CONSOLE IN EACH COCKPIT
INTERPHONE	TEMCO 51-73053-1	INTERCOCKPIT COMMUNICATION	WITHIN THE AIRCRAFT	RIGHT CONSOLE IN EACH COCKPIT
UHF/ADF	AN/ARA-25	NAVIGATIONAL AID	LINE OF SIGHT	LEFT CONSOLE IN EACH COCKPIT

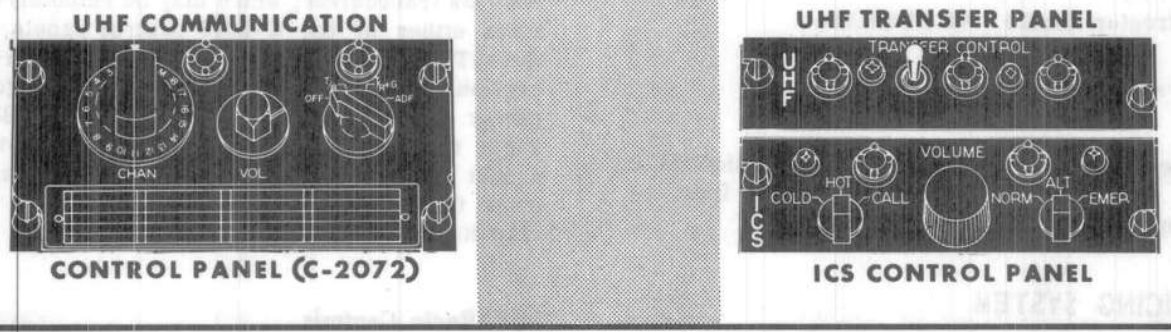


Figure 4-2

the operation of the transceiver. When the function switch is positioned to OFF, all power to the UHF radio is shut off. In the T/R position, the set is activated for radio communication. The receiver portion of the transceiver is normally energized for reception until the microphone button is depressed. When positioned to T/R+G, the guard receiver is energized so that reception on the guard channel is provided in addition to transmission and reception on the frequency selected with the channel selector. The ADF position is covered under UHF/ADF CONTROLS in this section.

CHANNEL SELECTOR

The channel selector (figure 4-2), which may be rotated in either direction, provides a choice of twenty preset frequencies for radio-communication or ADF reception. The emergency frequency 243.0, is normally preset on channel G.

UHF VOLUME CONTROL

The volume control (figure 4-2) on the C-2072 control panel regulates only the volume of the UHF radio set. To increase the volume, the knob is rotated clockwise; to decrease the volume, the knob is rotated counterclockwise. Control of UHF volume is independent in either cockpit when the interphone is in NORM or EMER position.

UHF MICROPHONE BUTTONS

A UHF microphone button, (6, figure 1-9) is mounted on each throttle. When either microphone button is depressed, the transmitter relay is energized, and the receiver is put in a standby condition. If both microphone buttons are depressed simultaneously, an override feature permits transmission from the rear cockpit only. The microphone buttons are powered from the primary bus through the INTERPHONE circuit breaker (figure 1-14).

UHF Radio Operation

1. Headset and Microphone Cord - CONNECTED TO HELMET CORD.

2. Electrical power switch - BAT-GEN.

3. Function Switch - T/R.
If the transfer panel indicator light is not on, actuate the transfer switch. If reception on guard channel is desired, position the function switch to T/R+G. Warm-up time for the set is one minute.

4. Channel Selector - AS DESIRED.

5. Microphone Selector Switch - COLD OR HOT.

6. UHF Volume Control - AS DESIRED.
To transmit, depress the UHF microphone button.

Reception in both cockpits is automatic.

INTERPHONE SYSTEM

The interphone system is comprised of two amplifiers (one for each cockpit), an ICS control panel (figure 4-2) on the right console in each cockpit, and an external interphone jack in the right wheel well. Normally, all interphone communication and UHF reception signals are routed through the interphone amplifiers. The interphone system, which is energized when power is supplied to the primary bus, provides two way voice communication between aircraft occupants. The entire interphone system is powered from the primary bus through the INTERPHONE circuit breaker (figure 1-14).

INTERPHONE CONTROLS

Operation Switches

A three-position normal, alternate and emergency (labeled NORM-ALT-EMER) operation switch (figure 4-2) on each ICS control panel controls the operation of the interphone amplifiers. When an operation switch is positioned to NORM, interphone and UHF reception signals to each cockpit are routed through the amplifier for the respective cockpit, and interphone transmission signals from each cockpit are routed through the amplifier for the opposite cockpit. If either pilot does not hear a side tone when he transmits over the interphone system, it may be assumed that the amplifier for the other cockpit is inoperative. In such a case, the operation switch should be positioned to ALT, and transmission signals from the cockpit in which the switch is so positioned will be routed through the amplifier in that cockpit. UHF and interphone volume will be controlled from the cockpit in which the operation switch is positioned to ALT. In the event ALT is selected in both cockpits, control of UHF and ICS volume will be crossed between the cockpits. When an operation switch is positioned to EMER, the amplifier and interphone volume control for the respective cockpit are bypassed, and UHF audio signals are the only means of communication. If both interphone amplifiers fail, each pilot must position his operation switch to EMER so that he can receive UHF audio signals.

Microphone Selector Switches

A three-position COLD-HOT-CALL microphone selector switch (figure 4-2) on each ICS control panel controls the method of interphone transmissions. When each switch is positioned to HOT, both interphone output relays are energized. If either switch is positioned to COLD, the respective output relay is de-energized until the interphone microphone button is depressed. When either switch is held to the CALL position, the output relay is energized, UHF reception is interrupted and the ICS volume control in the opposite cockpit is bypassed.

Interphone Volume Controls

Normally, the interphone volume control (figure 4-2) on each ICS control panel adjusts the overall volume for the respective cockpit. To increase the volume, the control is rotated clockwise; to decrease the volume, the control is rotated counterclockwise.

Interphone Microphone Buttons

An interphone microphone button (figure 1-16) is mounted on each control stick. If either microphone selector switch is positioned to COLD, the respective interphone microphone button must be depressed in order to energize the interphone output relay.

Normal Interphone Volume Adjustment

Since the interphone volume control has partial control of the UHF volume, the following steps should be followed when adjusting the interphone volume.

1. Power Source - ON.
The interphone system is energized whenever power is supplied to the primary bus.

2. Operation Switch - NORM.

3. Microphone Selector Switch - HOT.

   a. Interphone Volume Control - AS DESIRED.

4. Microphone Selector Swtich - COLD.

   a. UHF Volume Control - AS DESIRED.

Return microphone selector switch to the desired position.

Emergency Interphone Operation

If both interphone amplifiers are inoperative, the side tone of the UHF radio may be used for intercommunication.

1. Channel Selector - AS DESIRED.
Select an unused channel. The presence of sidetone indicates that the transmitter is radiating.

2. Operation Switches - EMER.

3. UHF Microphone Button - DEPRESSED FOR EACH TRANSMISSION.

NAVIGATIONAL AID UHF/ADF AN/ARA-25

The AN/ARA-25 is used in conjunction with the UHF command set as a navigational aid by providing the relative bearing of a signal source transmitted from another UHF facility. The components of the AN/ARA-25 are the relay, antenna, and indicator. The set is powered from the primary bus through the ARA-25 circuit breaker (figure 1-14).

UHF/ADF CONTROLS

The only control for the ARA-25 is the UHF function switch (figure 4-2) on each UHF control panel. When the UHF function switch is positioned to T/R or T/R+G, the AN/ARA-25 is automatically put in a standby condition. When the UHF function switch is positioned to ADF, the relay is energized, power is transferred from the UHF antenna to the ARA-25 antenna, and the transmitter key line is disconnected.

UHF/ADF OPERATION

The AN/ARA-25 is ready for operation as soon as the UHF command set warms up.

1. Channel Selector - AS DESIRED.
2. Function Switch - ADF.

EXTERIOR LIGHTS

The exterior lights consist of seven navigation lights and two landing lights, one of which serves as a taxi light. All controls for the navigation lights are on the EXT LTS control panel (figure 4-3) on the right console in the front cockpit. A landing and taxi light switch is on the left front console in each cockpit. All exterior lights except the fuselage lights are powered from the primary d-c bus and protected by the NAV circuit breaker on the circuit breaker panel (figure 1-14). The fuselage lights are controlled by a relay connected to the secondary bus, which is protected by the FUS LTS CONTROL circuit breaker on the circuit breaker panel (figure 1-14).

EXTERIOR LIGHTS CONTROLS

Fuselage Navigation Lights Switch

The three-position BRT-MAN-DIM fuselage lights switch (figure 4-3) on the EXT LTS control panel operates three clear fuselage navigation lights. Two lights, one bright and one dim located under a single cover are mounted at each of the following locations: on top of the fuselage just aft of the canopy on the canopy fairing, on the lower left side of the fuselage just aft of the air intake, and on the lower right side of the fuselage just aft of the air intake (figure 4-3).

Code Key

The PUSH TO KEY code key (figure 4-3) on the EXT LTS control panel controls the code relay. When the key is depressed, the code relay is energized, and the three bright fuselage lights and the code indicator light (figure 4-3) on the EXT LTS control panel will illuminate.

Wing Navigation Lights Switch

The wing lights switch (figure 4-3) on the EXT LTS control panel controls a red light on the left wing tip and a green light on the right wing tip.

Tail Navigation Lights

The tail lights switch (figure 4-3) on the EXT LTS control panel controls one yellow and one clear light on the tail just below the vertical fin.

Steady-Flash Switch

The two-position STEADY-FLASH switch (figure 4-3) on the EXT LTS control panel controls the exterior lights flasher. When the switch is positioned to STEADY, power is supplied directly to the wing, tail, and fuselage lights switches. When the STEADY-FLASH switch is positioned to FLASH, the exterior lights flasher is energized, and power to the wing, tail, and fuselage lights switches is directed through the flasher relay. The various navigation lights will then flash on and off even if the respective switches are positioned to BRT or DIM.

Landing and Taxi Lights Switch

A landing and taxi light switch (14, figure 1-6 and 11, figure 1-7) on the forward left console of each cockpit is powered through the LAND and TAXI circuit breakers. When the three-position LANDING LIGHTS -OFF - TAXI switch is positioned to TAXI, only the right hand light in the nose of the aircraft is energized. When the switch is positioned to LANDING LIGHTS, both lights are energized. The landing and taxi lights are powered from the secondary bus.

CAUTION

Do not use landing lights while aircraft is standing still. Intense heat radiated from landing lights will melt plastic nose cone.

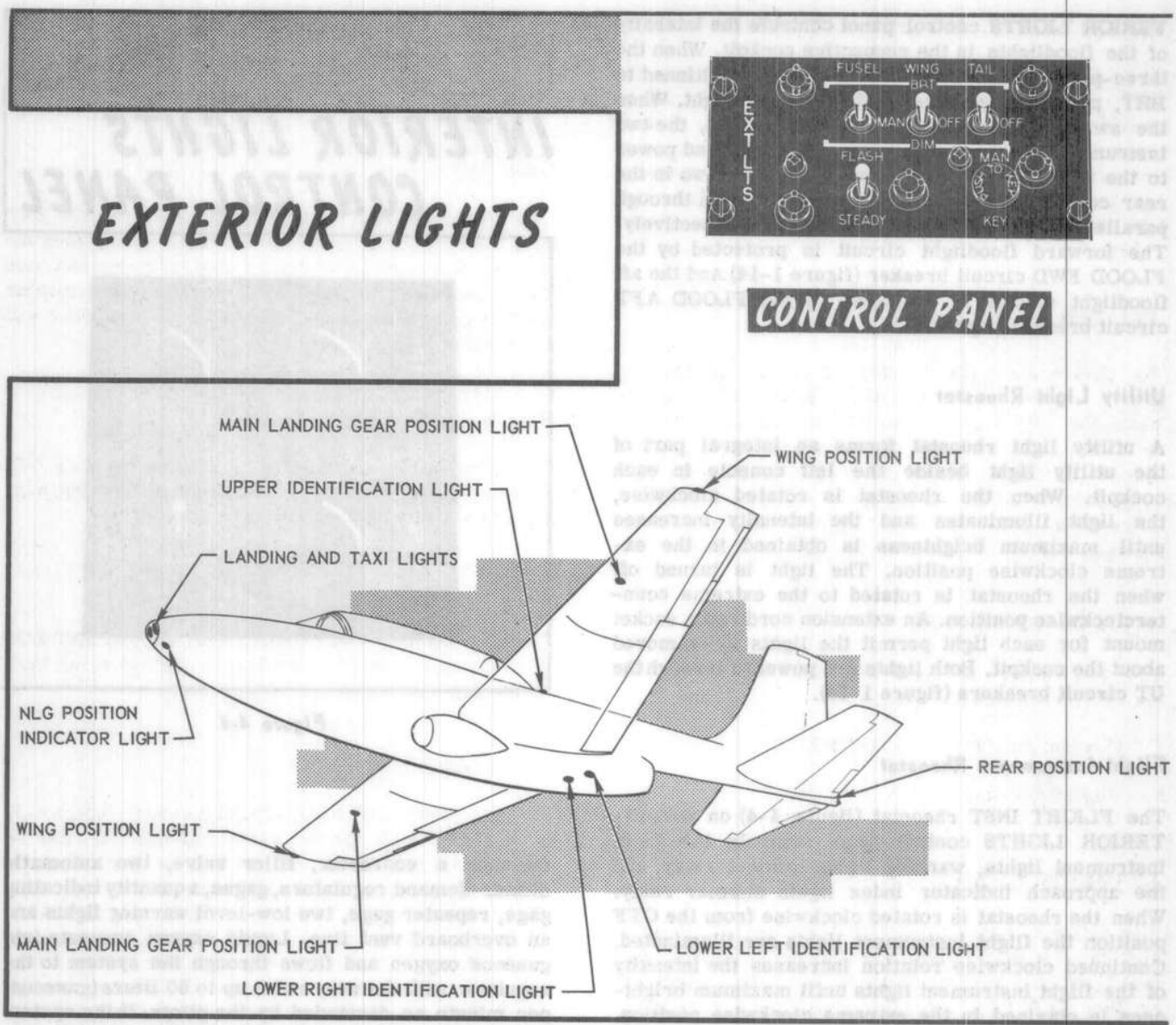


Figure 4-3

INTERIOR LIGHTS

All interior lights are powered from the primary bus. The interior lights consist of console lights, floodlights, flight instrument lights, engine instrument lights, and utility lights. Controls for the various interior lights are duplicated in each cockpit but control only the lights in the respective cockpit. Except for the utility lights, controls for the interior light are on the INTERIOR LIGHTS control panel (figure 4-4) on the right console in each ockpit.

INTERIOR LIGHTS CONTROLS

Console Lights Rheostat

A console lights rheostat (figure 4-4) on each INTERIOR LIGHTS control panel is powered through the CONSOLE circuit breaker. Each rheostat controls the console lights on the left and right consoles and has on-off control of the floodlights. When the rheostat is moved clockwise from the OFF position, the floodlights and console lights are illuminated, and as the clockwise rotation is continued, the intensity of the console lights increases until maximum brightness is obtained in the extreme clockwise position. When the rheostat is rotated counterclockwise to OFF, the floodlights and console lights are turned off. The forward and aft console lights are powered through the CONSOLE LIGHTS circuit breaker (figure 1-14) and the CONSOLE FWD and CONSOLE AFT fuses.

Floodlights Switch

A CONSOLE FLOOD switch (figure 4-4) on each IN-

TERIOR LIGHTS control panel controls the intensity of the floodlights in the respective cockpit. When the three-position BRT-DIM-MED switch is positioned to BRT, power is fed directly to each floodlight. When the switch is positioned to MED or DIM, the two instrument panel floodlights are bypassed, and power to the two left hand and three right hand (two in the rear cockpit) console floodlights is directed through parallel resistors and series resistors, respectively. The forward floodlight circuit is protected by the FLOOD FWD circuit breaker (figure 1-14) and the aft floodlight circuit is protected by the FLOOD AFT circuit breaker (figure 1-14).

Utility Light Rheostat

A utility light rheostat forms an integral part of the utility light beside the left console in each cockpit. When the rheostat is rotated clockwise, the light illuminates and the intensity increases until maximum brightness is obtained in the extreme clockwise position. The light is turned off when the rheostat is rotated to the extreme counterclockwise position. An extension cord and a socket mount for each light permit the lights to be moved about the cockpit. Both lights are powered through the UT circuit breakers (figure 1-14).

Flight Instruments Rheostat

The FLIGHT INST rheostat (figure 4-4) on each INTERIOR LIGHTS control panel controls the flight instrument lights, warning lights dimmer relay, and the approach indicator index lights dimmer relay. When the rheostat is rotated clockwise from the OFF position the flight instrument lights are illuminated. Continued clockwise rotation increases the intensity of the flight instrument lights until maximum brightness is obtained in the extreme clockwise position. As the flight instrument lights are brightened, the clockwise rotation of the rheostat actuates a switch which trips the dimmer relay of both the warning lights and the approach indicator index lights.

Engine Instruments Rheostat

The engine instruments rheostat (figure 4-4) on each INTERIOR LIGHTS control panel control the engine instrument lights and the oxygen regulator panel lights. Operation of this rheostat is identical to the other lights rheostat.

LIQUID OXYGEN SYSTEM

Oxygen (figure 4-5) is supplied in a gaseous form by evaporation of liquid oxygen contained in a double walled, vacuum sealed sphere located in the nose bay on the right side of the fuselage. The system

INTERIOR LIGHTS CONTROL PANEL

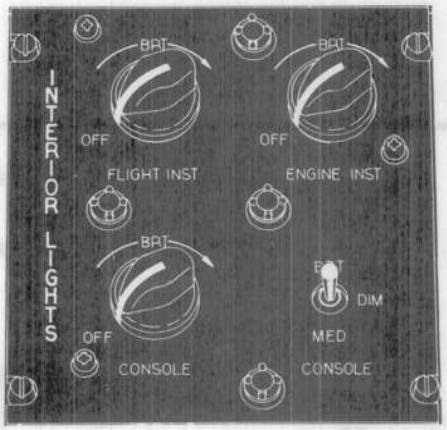


Figure 4-4

includes a converter, filler valve, two automatic diluter-demand regulators, gages, a quantity indicating gage, repeater gage, two low-level warning lights and an overboard vent line. Liquid oxygen converts into gaseous oxygen and flows through the system to the regulator with delivery rates up to 60 liters (gaseous) per minute as demanded by the pilots. If the system pressure is being used the pressure close valve will remain open and supply the system with oxygen pressure until the system pressure rises to 75 psi at which time the valve will close.

WARNING

Liquid oxygen has a static temperature of -297° F at 14.7 psi. Extreme caution must be taken not to touch any uninsulated metal lines, containers or other implements holding liquid oxygen unless special gloves are worn. The eyes and skin should be protected from freezing when exposed to liquid oxygen. Without gloves, the skin will instantly freeze to a metal surface. Liquid oxygen alone will not burn; however, when it is mixed with or splashed on, almost any other material, it becomes highly combustible or explosive.

OXYGEN SYSTEM

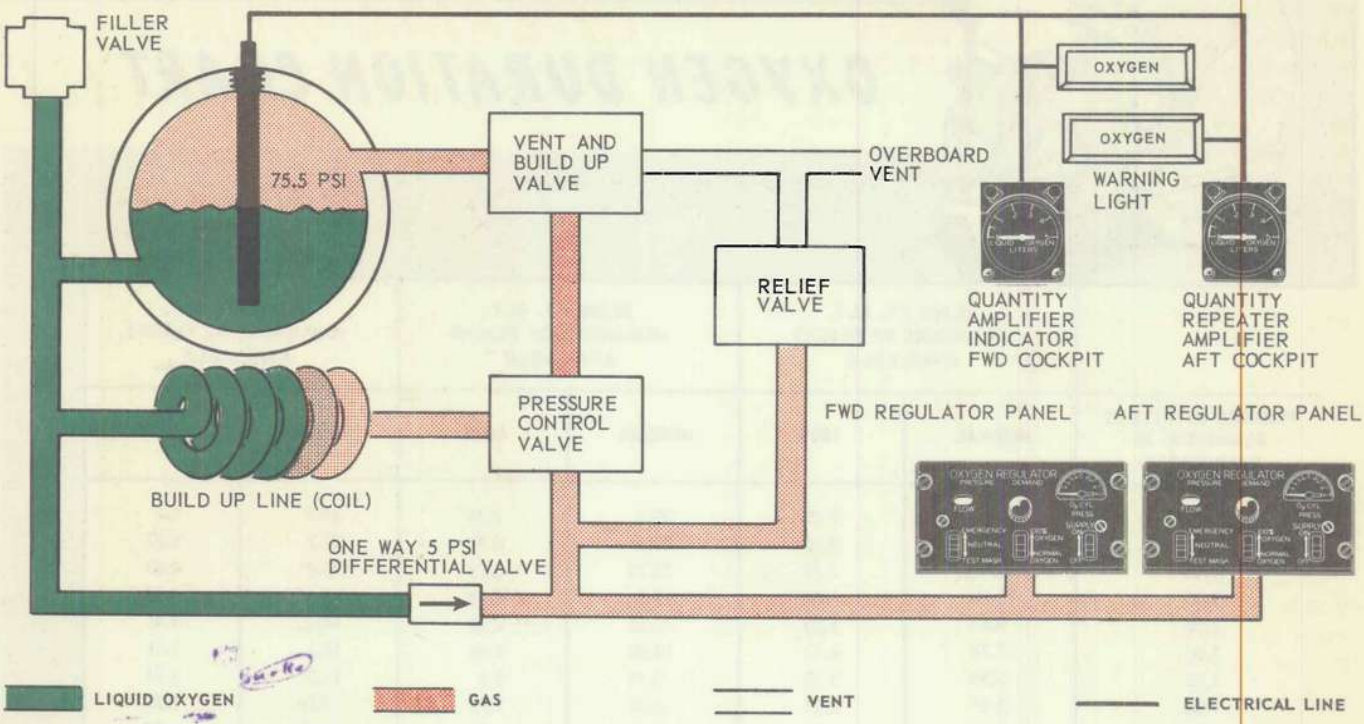


Figure 4-5

OXYGEN CONVERTER

The low pressure liquid oxygen converter (figure 4-5) consists of a five liter spherical container, filler and a build up valve unit located behind the large access door at the right side of the nose section. The system operates at 70 ±5 psi pressure. The filler valve permits pressure filling of the system. The two-position build-up valve manually operates and vents the system during filling or standby and the other position closes the system for automatic build up of operating pressures.

OXYGEN REGULATOR

An oxygen regulator and control panel is installed on the lower left corner of each instrument panel (24, figure 1-4 and 22, figure 1-5). It is a positive pressure diluter demand type regulator for pressure breathing. The regulator automatically mixes varying quantities of air and oxygen, the ratio depending on the altitude, and delivers the quantity demanded on inhalation. The oxygen control panel contains a gage, calibrated from 0 to 500 psi, one 3-position control toggle switch, a flow indicator, and two 2-position control toggle switches (figure 4-5).

NOTE

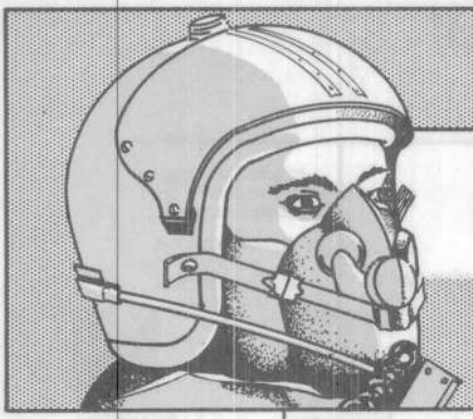
The regulator is used with a pressure type breathing mask, type A-13A or equivalent.

Oxygen Regulator Controls

1. NORMAL - 100% CONTROL TOGGLE SWITCH. The NORMAL -100% control toggle switch located on the regulator panel (figure 4-5) is operated as follows:

a. With the toggle switch placed to NORMAL, the regulator will deliver a mixture of air and oxygen in the quantity demanded by inhalation of the mask. The ratio of air to oxygen varies with the pressure altitude and is automatically regulated by an aneroid assembly. As the altitude increases the ratio of air to oxygen decreases until at an altitude of approximately 34,000 feet 100% oxygen is delivered to the mask.

b. At any time that the NORMAL - 100% control toggle switch is positioned to 100%, the oxygen regulator will deliver undiluted oxygen as demanded by inhalation.



OXYGEN DURATION CHART

NUMBER OF LITERS REMAINING IN CONVERTER	25,000 FT. ALT. MAN-HOURS OF FLIGHT AVAILABLE		20,000 FT. ALT. MAN-HOURS OF FLIGHT AVAILABLE		15,000 FT. ALT. MAN-HOURS OF FLIGHT AVAILABLE	
	NORMAL	100%	NORMAL	100%	NORMAL	100%
4.50	17.31	9.95	29.3	7.78	33.9	6.2
4.00	15.50	8.85	26.0	6.92	30.2	5.52
3.50	13.55	7.72	22.75	6.05	26.4	4.83
3.00	11.60	6.64	19.5	5.19	27.65	4.14
2.50	9.67	5.53	16.25	4.32	18.7	3.45
2.00	7.75	4.41	13.00	3.46	15.1	2.76
1.50	5.80	3.32	9.75	2.6	11.3	2.07
1.00	3.87	2.21	6.51	1.73	7.54	1.38
.50	1.93	1.11	3.25	.86	3.77	.69

Figure 4-6

2. EMERGENCY - TEST CONTROL TOGGLE SWITCH.

The EMERGENCY-TEST control toggle switch, located on the regulator panel (figure 4-5), is operated as follows:

a. With the toggle switch positioned to EMERGENCY flow the regulator will provide a positive pressure to the mask at altitudes where positive pressure is not normally provided. Positioning this toggle switch in the upward or EMERGENCY location will cause an increase of two inches of water pressure (2" H_2O) at the regulator outlet.

b. A downward movement of the toggle switch to the center places it in the neutral position.

3. ON-OFF CONTROL TOGGLE SWITCH

The ON-OFF control toggle switch (figure 4-5) has two positions listed as follows:

a. With the toggle switch pushed up to the ON position the oxygen supply is operable from that particular regulator.

b. With the toggle switch pushed down to the OFF position the regulator is inoperable.

4. Relief Valve: A relief valve on the mask side of the demand valve is provided to relieve excessive pressure to the mask.

Flow Indicator

The flow indicator, located on the left side of the regulator panel (figure 4-5) is illuminated and indicates the flow of oxygen through the regulator by means of a blinking action. The blinker is altitude compensated and will perform above the ceiling of the aircraft.

Oxygen Pressure Indicator

A direct-pressure type indicator is located on the oxygen regulator panel (figure 4-5). The indicator reads in psi of gaseous pressure in the converter.

Oxygen Quantity Indicator

A capacitance-type probe installed in the liquid oxygen container transmits signals to a master quantity gage amplifier indicator located in the front cockpit adjacent to the oxygen regulator panel (figure 4-5). The repeater indicator is located in the rear cockpit adjacent to the oxygen regulator panel. The master indicator and repeater are calibrated from 0 to 5 in liquid liters. The system operates from the aircraft 115-volt, 400 cycle three-phase power. For testing continuity of capacitance system see LOW LEVEL WARNING LIGHT in paragraph below.

LOW LEVEL WARNING LIGHT

The low level word warning light is located on the instrument panel of each cockpit (2, figure 1-4 and 2, figure 1-5). The warning light will illuminate when the 5-liter container has approximately 1/2 liter remaining, thereby indicating there will be sufficient breathing oxygen remaining to make a normal descent to below 10,000 feet, or enough for approximately 30 minutes duration solo or 15 minutes dual on 100% oxygen immediately followed by a high speed let down (figure 4-6). The light and the capacitance system can be tested at any time by depressing the OXYGEN QTY TEST switch . If the system is working properly, the needle will rotate counterclockwise and the warning light will illuminate when the needle reaches and drops below one-half liter. The 28-volt d-c primary bus supplies the power, and a circuit breaker on the circuit breaker panel (figure 1-14) decalled OXYGEN AND WARN TEST protects the circuit.

OXYGEN SYSTEM PREFLIGHT CHECK

1. Oxygen system leakage - A loss of more than one liter in a 24-hour period is excessive and will require a system check for leakage.

2. Pressure gage should read between 70 and 110 psi.

WARNING

Should the pressure gage indicate 45 psi or below with 1/2 liter or more indicated on quantity gage, consider that a malfunction in the oxygen system has occurred and investigate before a flight.

3. Test the regulator for leakage by obstructing the breathing tube outlet. If flow indicator opens in less than 30 seconds, excessive leakage exists and trouble should be remedied.

4. Install and connect the mask and move the EMERGENCY - TEST control toggle to TEST MASK. Inhale deeply and hold breath. If the flow indicator opens, it indicates a leak around the mask. Tighten mask straps until flow indicator closes. Resume breathing and place the control toggle switch to NEUTRAL.

WARNING

Do not use a mask that leaks. If mask adjustment will not stop the leakage, acquire another mask.

OXYGEN SYSTEM INFLIGHT PROCEDURES

Oxygen will be used from take-off to landing on all flights. It is recommeded that 100% be used on take-off and landings.

1. The pressure gage should read from 70 to 110 psi.

2. The oxygen quantity gage should be 5 liters when fully charged.

3. Oxygen low level warning light - OFF.

4. Set the NORMAL - 100% control toggle switch to NORMAL for all normal flight conditions.

5. Make sure the disconnect fittings between the mask and aircraft oxygen hose are fully engaged. (The force required to disconnect this coupling should not be less than 10 pounds.) Put mask on and attach clip of aircraft oxygen hose to nearest strap of the parachute harness, high enough to permit free head movement without stretching the mask tube.

6. Periodically check the mask for leakage during flight. Position the EMERGENCY-TEST toggle switch to the TEST MASK position and if below pressure breathing altitude, inhale deeply and hold breath. If the flow indicator opens, tighten mask straps and repeat deep breath check. At higher altitudes this test cannot be made due to characteristics of the regulator. However, the outward flow of oxygen into the eyes from a leaking mask is readily detectable.

7. The flow indicator blinks upon the intermittent application of 5 to 7 inches of water pressure created by the flow of oxygen. The regulator will deliver this pressure to the mask up to approximately 41,000 feet. Above this altitude, the pressure is likewise transmitted to the flow indicator which will remain open as long as the pressure is applied. Accordingly, the indicator will not blink above this altitude; however, the positive pressure in the mask indicates that oxygen is being delivered to the mask and no apprehension should be felt as long as the flow indicator remains open above 41,000 feet.

8. Periodically during flight, check the quantity, pressure, mask and all fittings.

OXYGEN EMERGENCY CONDITIONS AND PROCEDURES

1. Should symptoms occur which suggest the onset of anoxia, immediately place the EMERGENCY-TEST control toggle (figure 4-5) to the EMERGENCY position. A constant flow of 100% - oxygen, under slight pressure, will immediately be made availabe. If for any reason the regulator should become inoperative and/or a constant flow of oxygen is not obtained by use of the EMERGENCY - TEST toggle switch in the EMERGENCY position, descend immediately to below 10,000 feet.

2. Whenever fumes or noxious gases are present or suspected, regardless of altitude, select 100% OXYGEN (figure 4-5) and maintain this setting. Land as soon as possible.

3. Should removal of the mask become necessary, take three or four deep breaths of 100% oxygen before removing oxygen mask. Hold your breath as long as possible while mask is removed. As soon as practicable, replace the mask and take several more deep breaths of 100% oxygen. Reset the regulator to NORMAL.



operating limitations
SECTION V

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INTRODUCTION

This section includes the engine and aircraft limitations that must be observed during normal operations. Instrument markings form a part of these limitations, therefore, these limitations are not necessarily repeated in the text.

MINIMUM CREW

Solo flight must be accomplished from the front cockpit only. This restriction is due to some controls and instruments not being duplicated in the rear cockpit.

INSTRUMENT MARKINGS

Instruments for all equipment having operating limitations are illustrated in figure 5-1. The minimum and maximum operating limitations are marked. Except in emergencies the operating limitations will not be exceeded.

ENGINE OPERATION LIMITATIONS

OVERSPEED LIMITS

The engine, using JP-4 fuel, is limited to 100% ± 1% for take-off. Ground idle setting is 35% to 40% rpm. Overspeeding of 103% is acceptable during accelerations. The engine will be inspected for possible damage prior to any further flight operation if overspeeding beyond 103% is encountered. Overspeeding in excess of 105% rpm at any time requires an engine change.

OVERTEMPERATURE LIMITS

Any time the tail pipe temperature reaches between 790°C and 815°C three times or exceeds 815°C once during starting, the engine must be inspected prior to any further flight operations. Ground operation of the engine shall be limited to the following conditions:

Maximum Thrust (5 minutes)	676°C MAX TPT
Military Rated Thrust (30 minutes)	636°C MAX TPT
Normal Rated and below (continuous)	576°C MAX TPT

For flight operation, the engine may be operated at temperatures between 636°C and 676°C for periods up to 15 minutes and at temperatures between 576°C and 636°C for an additional 30 minutes. At the

INSTRUMENT MARKINGS



AIRSPEED AND MACH INDICATOR

- 450 KNOTS (MAXIMUM)
  .75 MACH (MAXIMUM)
- 150 KNOTS (MAXIMUM) WITH GEAR AND FLAP DOWN



ENGINE TACHOMETER

- 101.0% MAXIMUM
  35% MINIMUM IDLE



OIL PRESSURE INDICATOR

- 45 PSI MAXIMUM
- 20 PSI TO 40 PSI DESIRED RANGE



EXHAUST TEMPERATURE INDICATOR

- 676°C MAXIMUM OPERATING (15 MINUTES)

Figure 5-1

termination of this maximum time allowable at a given temperature, the engine shall be throttled to a lower power setting until temperatures have stabilized (about 10 seconds) after which it may again be flown at the higher temperature for the maximum allowable time period. The maximum allowable measured transient gas temperature shall not exceed 690°C for more than three seconds, and in no case shall exceed 718°C during flight.

AIRSPEED LIMITATIONS

The airspeed limitations are 450 knots IAS or 0.75 Mach number, whichever is the lowest. Safety of the pilot and aircraft depend on close observance of the limiting airspeed and Mach.

PROHIBITED MANEUVERS

Any maneuver that exceeds the airspeed and structural limitations is prohibited. See figure 5-2, OPERATING FLIGHT LIMITATIONS.

ACCELERATION LIMITATIONS

The structural limitations are 7.5 positive or 3 negative G's (figure 5-2).

OPERATING FLIGHT LIMITATIONS

GROSS WEIGHT 4400 LBS
CLEAN CONFIGURATION
5000 FT

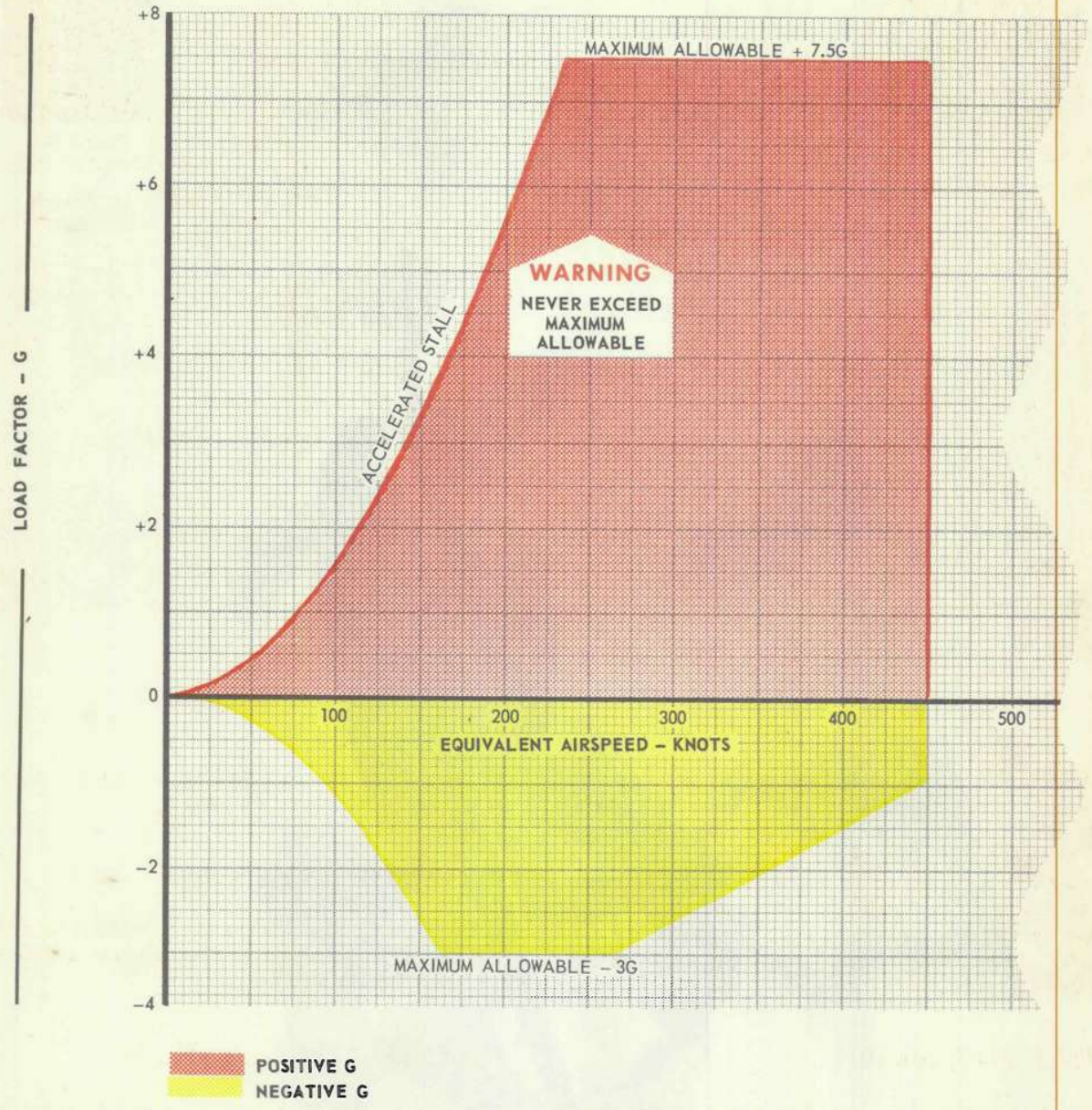


Figure 5-2

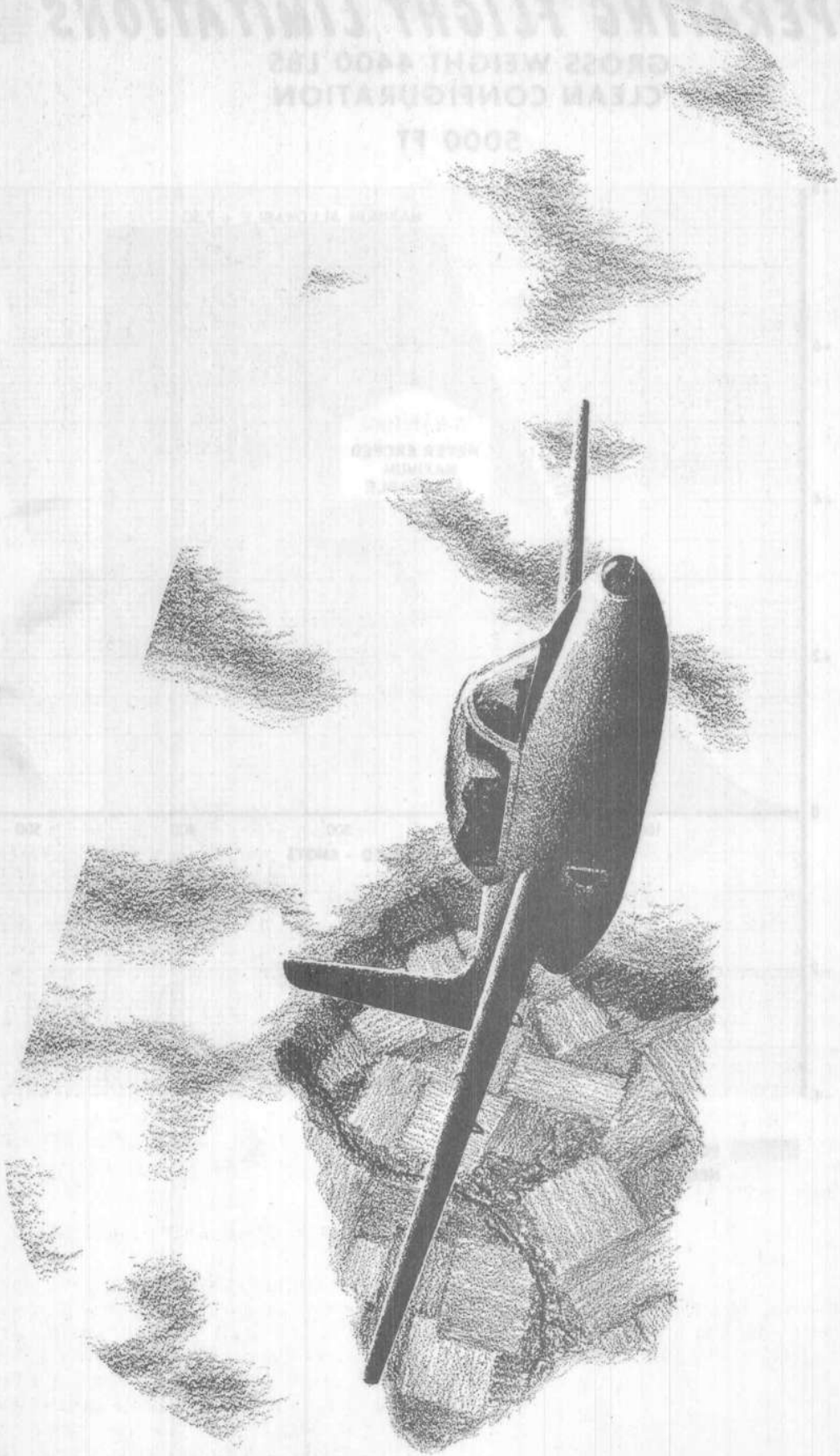




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INTRODUCTION

The flight characteristics and controllability of the TT-1 are very good throughout its speed range from stall to the limit speed. The high lift, medium thin, straight wing and high dorsal fin of the TT-1 produce a clean aerodynamic design. High speed handling characteristics are good. The speed brakes can be used at any speed to provide effective drag to decelerate the aircraft with relatively little trim change. The rudder forces are light and maneuvers require very little rudder control. Elevator forces generally are light. Forces necessary to move the aileron are minimized with the aid of spring tabs. An increase in airspeed will increase the aileron forces slightly.

NOTE

This section reflects the design limitations and characteristics for the aircraft. Refer to Section V for OPERATING LIMITATIONS.

STALLS

The aircraft has satisfactory stall characteristics and can be stalled power-off, or power-on, in the take-off, landing, and clean configurations. The normal stall warning characteristics are satisfactory for all configurations, expecially the landing gear down configuration. A light elevator control and airframe buffet occur as the aircraft nears stall speed and the nose will fall through at the stall. In the case of the landing gear down configuration, when approaching the stall, the angle of attack stall warning system is energized causing the rudder shaker motor to shake the rudder pedals. Visual indications of the nose position and angle of attack can be seen on the respective instruments (see Angle of Attack Stall Warning System in Section VII). The aircraft can be easily controlled by the ailerons if required.

STALLS WITH GEAR AND FLAPS DOWN

The power-off and power-on stalls are similar except that power-on stalls occur at lower airspeeds. The angle of attack stall warning system provides for adequate warning of approaching stalls in this configuration. A slight warning in the form of elevator buffet is also encountered. A definite pitch down tendency occurs at stall speed. Lateral control is adequate to correct the rolling tendencies during the stall and throughout recovery from the stall.

STALLS WITH GEAR AND FLAPS UP

A clean stall is preceded by a very light stick shake and airframe buffet which begins approximately three to five knots above stall speed. The stall is normal with the nose tending to pitch downward at the stall. Adequate control about all three axes is available at all times.

LOW SPEED ACCELERATED STALL

Low speed accelerated stalls, with the airplane in a clean configuration, are always preceded by airframe buffet which increases in proportion to the acceleration or as the stall is approached. The nose will pitch down with no tendency to roll in either direction. In the gear down configuration, the angle of attack stall warning system provides warning indications of approaching low speed accelerated stalls.

HIGH SPEED ACCELERATED STALL

When the aircraft approaches a high speed stall considerable airframe and control buffet will be experienced. There is practically no tendency to roll when approaching a high speed stall. Buffet must be taken as a warning and the back pressure on the stick should be relaxed. To avoid high speed stalls do not pull the stick back abruptly.

STALL RECOVERY

Stall recoveries are made in the normal manner by lowering the nose and increasing the airspeed. Power should be applied as the nose is lowered to prevent the possiblility of entering a secondary stall during recovery. If the gear and flaps are down, care must be exercised to avoid exceeding the maximum gear and flap down limit airspeed during recovery.

SPINS

NORMAL SPINS

Spins are the result of a stalled condition; consequently a thorough knowledge of the stalling speed at a particular weight and the added effect of altitude, angle of bank, and G load is essential to prevent encountering spins. Spins can be entered by stalling the aircraft in level or climbing flight and applying full rudder in either direction with full back stick.

Recovery From Normal Spins

To recover from a normal spin neutralize the rudder, aileron, and elevator positions. Recovery is normal with rotation stopping in one-half to three-fourths of a turn. Approximately 500 feet of altitude is lost per turn in a normal spin. To prevent excessive altitude loss, retard the throttle to idle rpm upon entry into a spin. Following spin recovery hold the nose down momentarily and increase the throttle setting to regain flying speed.

WARNING

If a spin is encountered when the landing gear and/or flaps are down, apply spin recovery technique and retract landing gear and/or flap immediately.

INVERTED SPINS

The inverted spin is a THOROUGH PILOT DISORIENTING MANEUVER due to the varying rates of rotation at various attitudes about the roll, pitch and yaw axes. Entry into the inverted spin may be accomplished by slowing the aircraft to slightly-above-state speed, rolling the aircraft over to the inverted position and applying forward stick with either full right or left rudder. As the aircraft stalls, a roll-off occurs at a slow rate for approximately 1/4 turn. The rotation rate increases from the 1/4 turn to the 3/4 turn position with the nose describing an arc from the entry posiion above the horizon to near vertical at the 1/2 turn position to an attitude of almost level at the one turn position. At the 1-1/4 turn position, the aircraft stops rotating about the roll axis and describes a sudden nose yawing condition (60° to 100°) followed by a severe longitudinal pitch and a change in direction of rotation of the spin. After this maneuver transient, the aircraft tends to spin in a normal manner.

Recovery From Inverted Spins

The recovery technique for inverted spins is exactly the same as for normal spins. After applying normal spin recovery technique the aircraft will cease spinning in approximately three-fourths of a turn. Approximately 1000 feet of altitude is lost per turn in an inverted spin.

CAUTION

Aileron recoveries, as well as full anti-spin control positioning, produces an extremely rapid recovery from spins and is not recommended unless in an extreme emergency.

AILERON CONTROL

Lateral control of the aircraft is exceptionally good. Response to aileron deflection is rapid and the

the maximum rate of roll is obtained in about one second. The rate of roll at slow speeds in the landing configuration is approximately 30° per second with full aileron deflection. In the clean configuration at high speeds the rate of roll is approximately 125° per second with a 25 lb stick force.

ELEVATOR CONTROL

Elevator response is positive throughout all speed ranges. Stick forces are light in normal airspeed maneuvers, becoming slightly heavier in the landing configuration and at the higher airspeeds.

RUDDER CONTROL

The conventional push-pull rod operated rudder provides adequate directional control during take-off, landing and at all airspeeds. At all airspeeds coordinated maneuvers may be made with the use of light rudder forces.

TRIM CONTROL

In the clean configuration the electric trim tabs for aileron and elevator provide adequate trimming of the controls at all speeds. In the landing configuration trim control is adequate; however, almost full nose down trim will be necessary to maintain zero stick forces in the power approach configuration.

RUDDER TRIM TAB CONTROL

The rudder tab is manually adjusted by the maintenance crew only. Any rudder forces needed to maintain a straight and level attitude should be noted on part D of the yellow sheet.

SPEED BRAKES

The speed brakes may be used at any speed and/or configuration. When deceleration is desired, expecially in aerobatics, formation flight or high speed dives, the speed brakes may be used with minimum changes in trim. A slight pitch-up occurs when the speed brake is opened and deceleration is mild.

LEVEL FLIGHT CHARACTERISTICS

SLOW SPEED FLIGHT

The handling characteristics and stalling qualities at low speed are very good.

CRUISE SPEED FLIGHT

In the cruise speed range, level flight handling characteristics are very good about all three axes: roll, pitch and yaw. Visibility is excellent during level flight, as both pilots sit forward of the wings.

HIGH SPEED FLIGHT

As in other speed ranges, control effectiveness at high speeds is quite positive and provides immediate reaction.

MANEUVERING FLIGHT

Maneuvering characteristics of the aircraft are very good. In the cruise speed range of the aircraft, stick forces are light to moderate and give positive reaction when applied. During low speed maneuvering, stick forces are slightly lighter.

DIVING

In high mach number dives and maneuvers the aircraft stability is good. Stick forces are relatively light and the aircraft is easily controlled up to the limiting mach number.

CAUTION

Do not exceed the maximum speed and/or limiting mach of the aircraft. To do so will seriously damage the aircraft structure.

DIVE RECOVERY

The following procedure is recommended for recovering from high mach number dives or maneuvers:

1. Throttle - IDLE.
2. Speed brakes - OPEN.
3. Stick - BACK.

Ease stick back to effect a smooth pull-out, remaining within the allowable G limits of the aircraft.

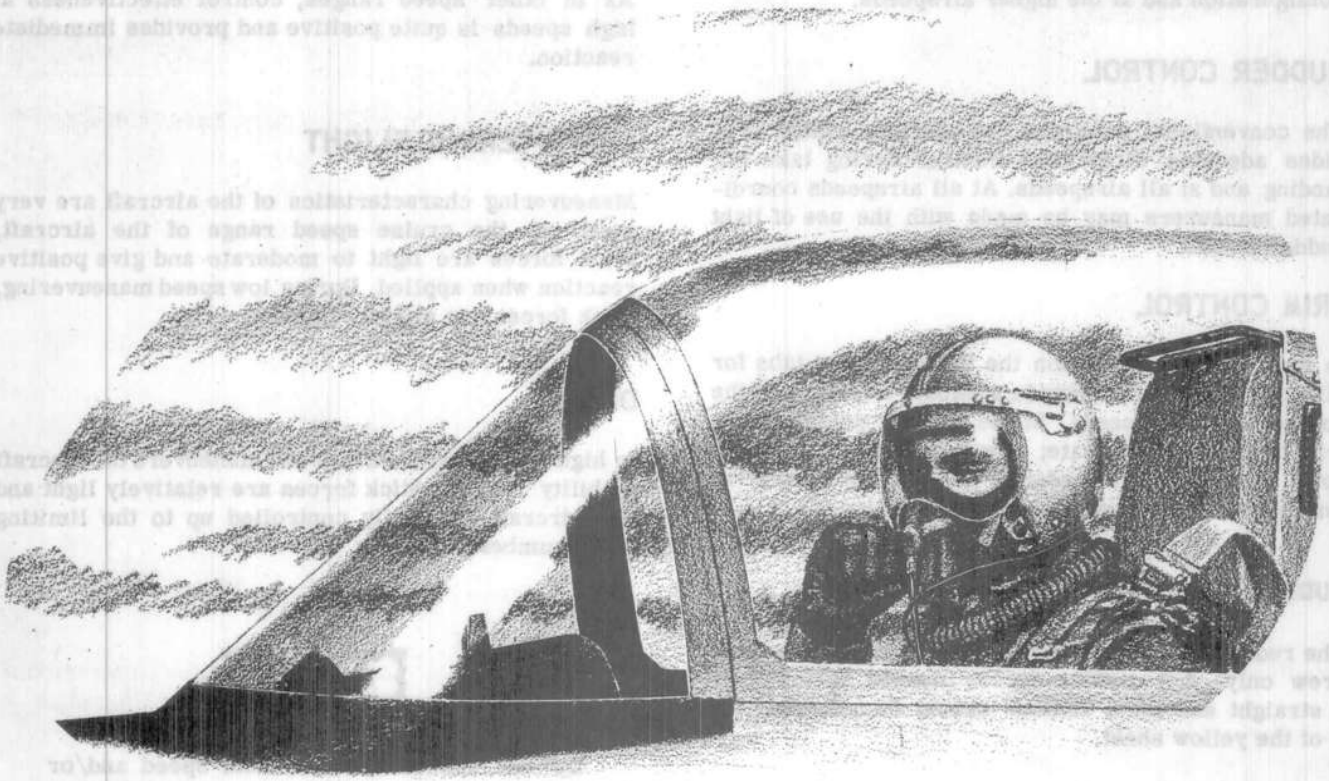




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ENGINE OPERATION – GENERAL FLYING

Tail pipe temperature control is of the utmost importance to the life of the engine; therefore, it is essential that the limiting temperature for any given condition not be exceeded. Due to the fixed area exhaust opening, the tail pipe temperature is a direct indication of thrust output or power at a given rpm. As the exhaust temperature is increased, the velocity of the exhaust jet is increased and consequently, engine thrust is increased. It is apparent that although exhaust temperature must be kept below the maximum operating limit to prevent excessive engine wear, it must be held near the limit to obtain maximum thrust output. When operating with the PRIMARY (normal) fuel system, the following characteristics are present:

1. After making an increase in power setting, the tail pipe temperature increase may lag. After the initial increase is noted, the temperature may continue to rise slowly for as long as five minutes. The stabilized temperature should be within limits established for the various power conditions. See figure 7-1.

2. Rapid deceleration may be made without flameouts.

3. The engine fuel control unit provides compensation to maintain rpm within close limits, throughout a broad range of altitude and airspeeds.

ENGINE ACCELERATING CHARACTERISTICS

At sea level, the time required for engine acceleration is as follows:

Idle to 100% rpm	11 to 19 seconds
60 to 100% rpm	Less than 5 seconds
85 to 100% rpm	Less than 3 seconds

COMPRESSOR SURGE AND STALL

Compressor surge (or stall) may result from too rapid engine acceleration, especially at altitudes above 15,000 feet. If acceleration is made with very high tail pipe temperatures, the surge will be more severe. If the rate of acceleration was exceptionally great, surge may be absent but complete compressor stall may occur. Surge or stall may be recognized in flight by one or more of the following characteristics:

1. Pulsating exploding noises.

2. Loss of thrust.
3. Rapid rise of tail pipe temperature.
4. Loss of acceleration or possible deceleration.
5. Long flame from tail pipe.
6. Possible flame-out at high altitude.

Whenever such conditions are encountered, immediately retard throttle until tail pipe temperature decreases, then accelerate more slowly to desired per cent of rpm.

CAUTION

If compressor stall is encountered, retard the throttle quickly to the idle stop or until the vibration stops and the tail pipe temperature begins to decrease. As soon as the stall has been stopped, the throttle may be advanced to the desired setting, but this should be done at a slow enough rate to prevent a repetition of the stall. It has been found that a stall will not occur at any altitude or any airspeed if the throttle is advanced at a normal rate.

NEGATIVE-G FLAME-OUTS

The sump tank in the aircraft fuel system (figure 1-11) traps approximately two gallons of fuel in the inverted attitude to permit limited negative-G operation. If the limitations of the fuel system are exceeded by negative-G, fuel starvation and flame-out can occur in approximately 45 seconds.

NOTE

Refer to Section V for negative-G operating limitations.

Negative-G operation is time-limited by the capacity of the sump tank.

TURBINE NOISE DURING SHUTDOWN

The light scraping or squealing noise, sometimes heard during engine shutdown, results from interference between engine rotating and stationary parts having dissimilar cooling rates. The scraping is undersirable and may damage parts. To eliminate scraping, it is necessary for the engine to be run at 65% for 30 seconds before shutdown after any high power operation (either ground or flight) to allow internal temperatures to stabilize. If, despite this precaution, heavy scraping still occurs on shutdown, no attempt to restart the engine should be made. The engine must be inspected by maintenance before another operation. A starting attempt might result in destruction of the starter. If a start must be made when interference is suspected, tachometer readings and a listening check should be made. Check engine for turning as soon as the starter is energized. If the engine does not begin turning at starter engagement, the starter should be turned off immediately.

SMOKE FROM TAIL PIPE DURING SHUTDOWN

During engine shutdown, oil or fuel fumes may be noticed coming from the tail pipe or inlet duct, depending on ground wind conditions. These fumes indicate the presence of fuel or oil in the hot section of the engine. Boiling fuel, indicated by the appearance of white vapor, will not damage the engine but is a hazard to personnel, since the vapor may ignite with explosive violence if allowed to accumulate within the engine or fuselage. A CLEAR ENGINE procedure should be performed to clear any excessive fuel or fumes from the engine. All personnel should keep clear of the tail pipe for at least three minutes after engine shutdown and at all times when fuel vapor or smoke comes from the tail pipe. The appearance of black smoke from the tail pipe, after shutdown, indicates burning oil or fuel which will damage the engine and should be eliminated in the following manner:

1. Throttle lever - OFF.
2. Electrical power switch - BAT-GEN.
3. Engine starter switch - START.

Perform CLEAR ENGINE Procedure in Section II.

PILOT INTEGRATED ESCAPE SYSTEM

The pilot integrated escape system (figure 1-23) provides the pilot with means of automatic safe bailout. Components of the system include the aircraft canopy and the pilot ejection seat, parachute unit and flight suit. The system becomes integrated as follows:

1. The pilot dons the escape system flight suit, which contains a torso-fitted parachute harness, enters the aircraft cockpit and seats himself in the ejection seat.

2. A parachute unit, attached to the ejection seat, functions as seat cushion, shoulder harness and lap belt. By the appropriate shoulder strap and lap belt snap-fasteners, the pilot attaches the flight suit D-rings. At this point, the escape system is integrated and the pilot is secured for flight.

The pilot escape system components and related equipment is discussed in the following paragraphs.

FLIGHT SUIT

The flight suit (figure 3-6) is a torso-fitted parachute harness and suit integrated unit. Two styles of suits are issued to the pilot as part of his personal equipment. One style is the summer or torso-brief which is worn over a summer light weight flying suit. The other, the winter or coverall sytle, covers the entire body (except feet, head and hands) and includes a life preserver, utility packets, and a bail-out bottle oxygen supply hose channel assembly. The suit's integrated torso-harness is equipped with four exposed D-rings for attachment of the parachute unit shoulder harness and lap belt fasteners.

PARACHUTE UNIT

The parachute unit (figure 3-6) is installed in the ejection seat and remains so unless released in automatic bailout (or when released manually in an emergency, or for inspection). Installed in the ejection seat, the parachute unit functions as the seat cushion, shoulder harness and lap belt. However, when released from the seat, the parachute unit functions as a complete survival kit. Contents of the parachute unit include a 26-foot diameter automatic opening parachute pack, a PK-2 or PK-3 pararaft, an oxygen bail-out bottle, and a detachable seat pan assembly. Details of the parachute unit fasteners and parachute automatic opening unit are outlined below.

NOTE

If pararafts are not used a styrofoam seat filler must be used.

Parachute Unit Fasteners

All of the parachute unit fasteners are of the quick-disconnect type. The parachute unit-to-suit are wide spring loaded clips. They connect onto the flight suit D-rings by forcible insertion of the D-ring into the clip mouth. Disconnect tabs located on either side of the clip, when squeezed will allow the D-ring to be pulled from the clip. The parachute unit-to-seat fasteners located on the shoulder harness and lap belt ends are eye-type fitting. Retaining pins, which are part of the pilot release mechanism (See Seat Ejection System), insert and hold the parachute unit to the seat. The eye-type fittings provide quick release of the pilot and parachute unit in automatic bail-out or in manual emergency release.

Parachute Automatic Release Unit

The parachute automatic release unit provides automatic actuation of the parachute pack opening rip cord independent of the manual rip cord handle. The unit is a gun powder cartridge operated device; wherein the cartridge supplies rip cord pulling power, which also by means of a powder chain, furnishes a three-second opening time delay. Detonation of the cartridge, which releases the parachute pack, is through a preset altitude aneroid bellows triggering device. A firing cable is connected to the seat EMERGENCY RELEASE handle. The cable is pulled by the seat upon pilot separation during bail-out. This frees the aneroid for operation.

EJECTION SEAT

The pilot ejection seat (figure 1-23) is a standard Naval ejection seat secured by two ejection rails and a catapult ejection cylinder located at the rear of the seat. The pilot seat consists basically of a seat structure, and inertia reel and control, head pad, and face curtain actuated automatic ejection system. The seat is adjustable for elevation by a hydraulically operated electrically controlled jack-type actuator. Seat details are outlined in the following paragraphs.

Seat Elevation and Control

An UP-SEAT ADJ-DN switch, spring loaded to SEAT ADJ position, located (8, figure 1-2) above the right console panel controls the seat elevation actuator. UP and DN positions respectively activate the elevation actuator to position the seat up or down. If the engine driven hydraulic pump fails, the seat may be adjusted by manipulating the hydraulic system emergency hand pump. The UP-SEAT ADJ-DN switch circuit is protected by the SEAT ADJ circuit breaker.

Inertia Reel and Control

A LOCK-UNLOCK inertia reel control (figure 3-6) is located on the left side of the ejection seat and is cable-connected to the reel. LOCK position of the control lever restrains the inertia reel from operation, thereby preventing the pilot from bending his body forward. UNLOCK position frees the inertia reel for operation which allows the pilot freedom of movement. An automatic latching mechanism in the inertia reel is provided as a safety measure when the inertia reel is unlocked. The mechanism automatically locks the reel which prevents forward motion of the pilot's body when a longitudinal deceleration of 2.5G or the acceleration of ejection is encountered. The parachute unit shoulder harness quick disconnect fittings connect to the pilot release mechanism unit incorporated on the inertia reel cable end.

Seat Ejection System

The seat ejection system is a face curtain initiated, canopy jettisoning, seat ejecting, pilot automatic release system. The system consists of a face curtain

and its system of cables (which sets into operation the ejection sequence of events), a canopy unlatch and jettisoning cartridge operated unit, a cartridge operated seat catapult, and a cartridge operated pilot harness release mechanism. The description of these components is best described through their operation; refer to Bail-out in Section III.

Emergency Release Handle

The EMERGENCY RELEASE handle (figure 1-23) located on the right hand side of the seat is provided to manually actuate the automatic pilot release mechanism. Manual release facilitates emergency escape from the seat and aircraft in such events as crash landing or ditching. See Section III for these emergencies and use of the EMERGENCY RELEASE handle. A pin installed on the aft side of the handle is for retention of the parachute aneroid firing cable. The pin retains and pulls the cable, activating the parachute automatic opening mechanism, when the pilot separates from the seat upon bail-out. See Parachute Automatic Release Unit.

CANOPY

A one-piece plexiglas bubble type canopy is attached to the aircraft fuselage by aft hinge points, and a pneumatic canopy opening cylinder which extends upward from the center of the cockpit area between the pilot seats. Opening of the canopy is performed manually. Jettisoning the canopy is accomplished from the closed position by a cartridge operated, unlatch actuator detonated by a firing cable from the seat ejection assembly (See Seat Ejection Assembly). When the canopy is unlatched, expanding gas from the unlatch actuator is directed by a line to the pneumatic cylinder, gas-operated cartridge device. This device, when detonated, will increase the pneumatic charge in the pneumatic cylinder sufficiently to push the canopy into the aircraft slip stream. The slip stream forces the canopy aft breaking the canopy aft hinge brackets and disconnects the cylinder to canopy jettisoning bracket. Seat interlock release cables are attached to the canopy. When the canopy is jettisoned the interlocks are released permitting extension of the face curtain to the seat catapult firing position. See Bail-out in Section III for interlock operation.

Canopy Control

Each cockpit section is provided with a manual control handle (figure 3-6). The LOCK position moves the canopy latches to engage fuselage locking lugs, thereby locking the canopy down. The OPEN position releases the canopy latches from the fuselage locking lugs and allows the canopy opening pneumatic cylinder to raise the canopy. A taxi setting is obtained by placing the handle in the LOCK position after moving the handle to the OPEN position. Access into the cockpit is made possible from the aircraft exterior by a canopy release handle. To open the canopy by the external handle requires that it be pulled out from its streamlined position and be rotated in a counterclockwise direction. The external canopy handle is mechanically connected to the canopy manual control.

STABILIZED TEMPERATURE LIMITS VS POWER CONDITIONS

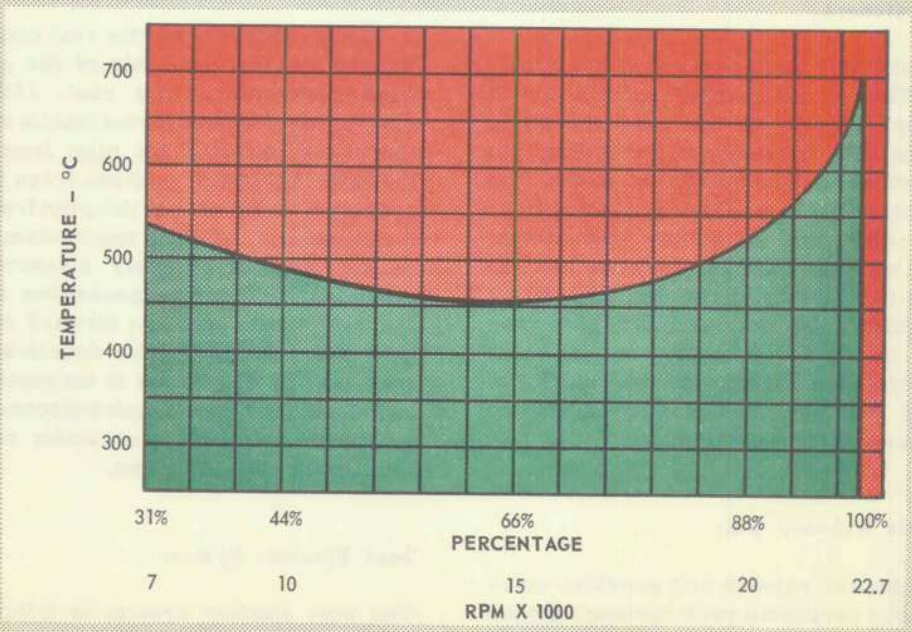


Figure 7-1

Canopy Indicator

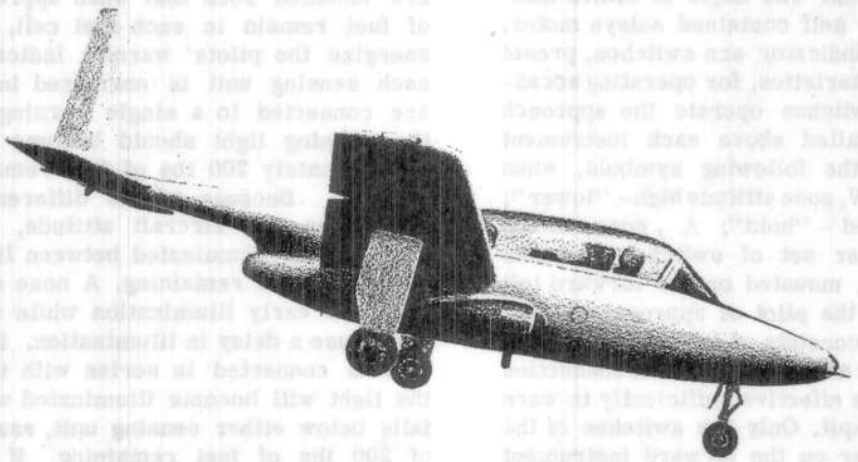
An amber warning light indicator (2, figure 1-4 and 2, figure 1-5) is installed on each pilot instrument panel. Illumination of the light indicates that the canopy is not properly closed and locked. Electrical power for the light is furnished by the 28-volt d-c bus through a switch actuated by the canopy lock mechanism. The CANOPY SPEED BRAKE circuit breaker protects the circuit.

ANGLE OF ATTACK STALL WARNING SYSTEM

The angle of attack stall warning system furnishes three aids to the pilot. These aids are: a physical indication of approaching stall, visual indication of aircraft angle of attack and a visual reference of nose-high, centered, nose-low attitude on approach. The angle of attack stall warning system is a selsyn-type system and is governed by an airstream direction detector which contains an aerodynamic probe and a sensing transmitter. The airstream direction detector is installed on the left side of the forward fuselage nose section. Attack angles sensed by the detector are transmitted to an angle of attack indicator installed on each instrument panel. The angle of attack indicator is operated by a self contained selsyn motor. Also contained in the indicator are switches, preset to the aircraft's characteristics, for operating accessories. One set of switches operate the approach index indicators (installed above each instrument panel) which utilize the following symbols, when illuminated, indicate: V, nose attitude high - "lower"; O, nose attitude centered - "hold"; Λ , nose attitude low - "raise". Another set of switches operates a rudder pedal shaker, mounted on the forward left rudder pedal, to warn the pilot of approaching stall conditions. The shaker consists of a d-c motor-driven unbalance rotary weight and because of interconnection of the rudder control is effective sufficiently to warn the pilot in either cockpit. Only the switches of the angle of attack indicator on the forward instrument panel are utilized to operate the approach index indicators for each cockpit and the one rudder pedal shaker in the forward cockpit. Other features of the angle of attack stall warning system consist of a RUDDER SHAKER TEST switch mounted on each instrument panel and a control panel containing a test relay and a dim relay. Testing the lights for the approach index indicator is accomplished by the WARNING LTS TEST switch and dimming of the lights is controlled through the flight instruments lights control. Anti-icing protection for the detector probe is controlled by the pitot heat switch. The circuits of the angle of attack stall warning system are protected by circuit breakers INDEX, SHAKER MOTOR, ANGLE ATTACK, and AIR DET HEAT. The main landing gear squat switch renders the rudder shaker motor inoperative when the aircraft is on the ground. The left-hand landing gear up-lock switch, in series with the squat switch, de-energizes the approach index lights when the landing gear is up and locked.

FUEL LOW LEVEL WARNING SYSTEM

The Fuel Low Level Warning System consists of two low level sensing units, two small signal relays, and a warning light installed on each instrument panel. The Fuel Low Level Warning System is completely independent of the Fuel Quantity Gaging System. There is one low level sensing unit located in each wing center section fuel cell. These units are mounted such that when approximately 100 lbs of fuel remain in each fuel cell, the sensing units energize the pilots' warning indicator lights. While each sensing unit is energized independently, both are connected to a single warning light; therefore, the warning light should become illuminated when approximately 200 lbs of fuel remain (normal flight attitude). Because of the difference in fuel characteristics and aircraft attitude, the warning light may become illuminated between 190 pounds and 220 pounds of fuel remaining. A nose down attitude will cause an early illumination while a nose up attitude will cause a delay in illumination. Since each sensing unit is connected in series with the warning light, the light will become illuminated when the fuel level falls below either sensing unit, assuring a minimum of 200 lbs of fuel remaining. If the warning light should become illuminated at a fuel quantity indicator reading of 250 lbs or more, while in normal flight attitude, the pilot should assume an unequal transfer condition and make such preparations for landing as would be normal at a 200 lb remaining illumination.





crew duties
SECTION VIII

THIS SECTION NOT APPLICABLE TO THIS BOOK

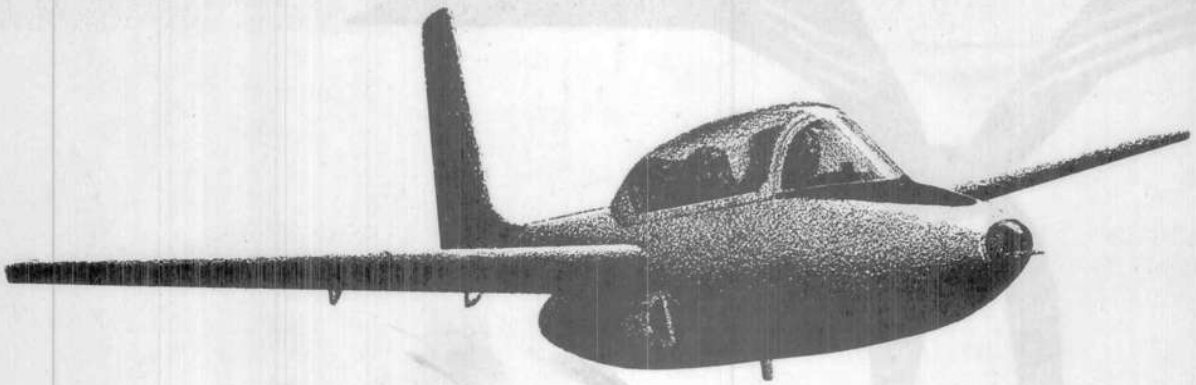




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INTRODUCTION

This section contains only those procedures which differ from, or are in addition to the normal operating instructions outlined in Section II. Therefore, this section is concerned with only those procedures related to instrument flight, turbulent air flight, as well as cold weather, hot weather, and desert operation. Some items of Section II are duplicated in order to establish emphasis, clarity, and continuity of thought.

INSTRUMENT FLIGHT PROCEDURES

The aircraft is designed as a day primary trainer, but may be used for simulated or actual instrument flights. This paragraph is presented to aquaint the pilot with the qualities, capabilities, and limitations of the aircraft under instrument flight conditions. It does not attempt to cover the general techniques of flying in weather. A successfully conducted instrument flight in jet aircraft requires thorough preflight planning, current instrument proficiency on the part of the pilot; and adequate instrumentation for instrument take-off, orientation, approach and landing. The instrument handling characteristics are stable and adequate; instrumentation is adequate for weather flying. UHF receiver-transmitter provides adequate long-range, static-free radio communication and direction finding. Defogging and defrosting is provided for the windshield and canopy. Anti-icing protection is provided for the pitot system and the angle of attack stall warning system. While only basic flight instruments are included in the aircraft, these instruments are adequate for local or short-range cross-country flights. Simulated instrument take-offs may be practiced using the following procedures:

INSTRUMENT TAKE-OFF

1. Engine power - 100% RPM.
2. Brakes - RELEASE.

3. Maintain runway heading with brakes until rudder becomes effective at approximately 43 knots IAS.

4. Lift nose wheel off runway at approximately 65 knots IAS. Fly aircraft off at 80 knots IAS (4400 pounds gross weight).

INSTRUMENT CLIMB

1. Landing gear control - UP AS SOON AS SAFELY AIRBORNE.

2. Landing flaps control - UP AT 100 KNOTS IAS.

3. Level out at 500 feet to accelerate to climb speed.

4. Flight instruments - CHECK.

5. Trim tabs - TRIM FOR "HANDS OFF" FLIGHT.

6. Accelerate to 165 knots IAS and begin climb. Climbing turns should be at standard rate. Do not exceed 30 degrees of bank.

DURING INSTRUMENT CRUISING FLIGHT

Trim the aircraft for "hands-off" cruising flight. The best cruise speed is 195 knots TAS at 20,500 feet altitude which results in a range factor of approximately 0.53 nautical miles per pound of fuel. The maximum range of the aircraft is about 310 nautical air miles with fuel reserve of 100 pounds when flying above 15,000 feet. See Appendix of the handbook for specific cruising data.

INSTRUMENT DESCENT

Instrument descents can be made with or without speed brakes. However, to limit airspeed and distance covered by high speed descents, use of speed brakes is recommended. A slow descent for the purpose of attaining maximum range may be accomplished at 120 knots IAS with the speed brake closed and the engine at idle power. See Descent - Maximum Range (figure A-21) of the Appendix for maximum glide range. The following is recommended for weather or instrument descent:

1. Windshield defrost air - ON.
2. Speed brakes - AS REQUIRED.
3. Landing light switch - OFF.
4. Fuselage light switch - DIM.
5. Navigation light switch - FLASH.
6. Throttle - IDLE.
7. Turns - LIMIT TO 30° - BANK.

INSTRUMENT APPROACHES

Ground Controlled Approach (GCA)

GCA normally consists of a rectangular pattern beginning over the radio range low cone. However, before the pattern is begun, the station GCA controllers, when contacted, will direct the pilot to execute certain turns for positive identification. From then on, the controller will advise the pilot as to course, altitude, turn procedure and approach procedure to be used. Smooth basic instrument flying technique will produce a successful GCA approach.

NOTE

Ground controlled approach will be affected by prevailing weather conditions. Normally the UHF radio will give good static-free communication. The pilot should be cognizant of his altitude at all times. This will allow better co-ordination between pilot and GCA operator in establishing correct elevation in event contact is momentarily lost due to heavy precipitation.

The following is a recommended GCA procedure:

1. Switch to GCA frequency and establish contact.

2. Complete identification turns as requested by GCA.

3. On outboard (down wind) leg, descend as directed to GCA traffic altitude.

4. Speed brakes - OPEN. (Closed to conserve fuel).

5. Prelanding cockpit check:

   a. Flaps - TAKE-OFF.

   b. Gear - DOWN.

   c. Airspeed - 95 KNOTS IAS OR 135 PERCENT STALL SPEED WHICHEVER IS GREATER.

   d. Engine power - AS REQUIRED.

   e. Fuselage lights - BRT.

   f. Navigational lights - STEADY.

NOTE

Maintain partial engine power of approximately 60 percent or more, if possible, to hold aircraft in a stabilized approach. (Acceleration time from 60 to 100 percent is reasonably fast) If a missed approach is en-

countered, power for a go-around is available almost instantaneously.

6. Base leg approach - Turn and descend as directed by GCA.

7. Final approach - Turn and begin glidepath as directed by GCA.

8. Glidepath:

a. Flaps - FULL DOWN.

b. Airspeed - 80 KNOTS IAS.

c. Engine power - AS REQUIRED.

9. Touchdown - 70 to 75 KNOTS IAS (depending on gross weight of aircraft).

MISSED APPROACH GO-AROUND

1. Engine power - INCREASE TO 100%.

2. Speed brake - CLOSED.

3. Gear - UP

4. Flaps - TAKE-OFF AT 95 KNOTS IAS; FULL UP AT 100 KNOTS IAS.

5. Missed approach procedure - EXECUTE.
Execute station missed approach procedure and request further instructions from GCA.

COLD WEATHER PROCEDURES

When in extreme weather conditions ground inspections and operational checks must be thorough since cold weather may cause hidden difficulties such as ice and snow accumulation in control mechanisms, fuel and hydraulic hose brittleness with accompanying lowered resistance to pressure shocks, or plexiglas brittleness. Jet powered aircraft are well suited for cold weather operation and require much less special action for special operation. Arrange preheating periods so that all aircraft equipment will be inspected, warmed and ready at the time of starting engine.

BEFORE ENTERING THE AIRCRAFT

1. Pitot and static openings - CHECK.
Remove accumulation of ice and snow.

2. Landing gear struts and limit switches - CHECK.
Check the struts for leakage and proper inflation. Check limit switches for cleanliness.

3. Canopy and windshield - CHECK FOR CRACKS.
Open the canopy if removing the aircraft from a hangar. This will prevent a rapid uneven temperature drop from causing the plexiglas to crack.

4. Ice, snow and frost on the wings and control surfaces - REMOVE.

5. Ground heating equipment - REMOVE.

ON ENTERING THE AIRCRAFT

1. Controls - CHECK.
Check for freedom of movement and full travel.

2. Canopy - CHECK OPERATION.
Ascertain that the canopy will open and close freely.

3. Electrical systems and radio equipment - CHECK.

STARTING ENGINE

Sufficient moisture from condensation can collect within the engine and freeze the rotor by simply subjecting a cold engine to warm humid air followed by exposure to low temperatures (such as towing an aircraft into a hangar and out again before the engine dries out). The condensed moisture can be blown out of the engine if it is cranked at high speed with the starter before the moisture freezes.

STARTING ENGINE PROCEDURE

1. Engine - START.
Use normal starting procedure.

2. Oil pressure - CHECK.

NOTE

If there is no oil pressure after 30 seconds operation, or if pressure drops after a few minutes ground operation, shut down and check for blown lines or congealed oil.

3. Flight controls - CHECK.
Cycle elevator, and aileron trim tabs, speed brakes and wing flaps to insure proper operation.

TAXIING

When taxiing, avoid deep snow if possible, as it may get into the brakes and freeze. Use only essential electrical equipment while taxiing at low rpm to conserve battery since rpm may be below generator cut-in speed. Maintain sufficient interval between aircraft to permit safe stopping distances and avoid the slush and snow blown back.

CAUTION

Use caution when applying brakes on taxiways partially covered with ice. A locked brake sliding from an ice patch to a bare spot may cause loss of control of the aircraft.

TAKE-OFF

1. Since air is denser in cold weather, thrust will be increased and a shorter take-off run can be made.

WARNING

Never attempt a take-off with snow, ice, or heavy frost on wings. Fatal stalling characteristics may ensue.

AFTER TAKE-OFF

1. After take-off from a snow or slush covered runway, operate the landing gear and landing flaps through several complete cycles to preclude any possibility of freezing in the up position.

2. Cockpit heating system may be used after gear is up. Place heater rheostat, MASTER AIR handle and DEFROSTER handle as desired.

3. Check instruments, particularly those pressure operated, for proper operation.

CLIMB

1. Rate of climb will increase at low altitudes, otherwise cold weather does not affect the flying characteristics of the aircraft.

DESCENT

1. Defroster - ON.
Prior to starting descent turn defrosting system on.

2. Engine instruments - CHECK WITHIN LIMITS.

APPROACH

1. Wheel brakes - CHECK.
Depress brake pedals several times to assure brakes do not leak.

2. Make a normal approach pattern.

LANDING

CAUTION

Cross-winds are particularly dangerous when landing on icy runways.

1. Use brakes as needed, avoiding excessive use.

2. Use only essential electrical equipment while taxiing at low rpm.

3. Pitot heat switch - OFF.

STOPPING OF ENGINE

This engine requires no deviation from standard shut-down procedures.

BEFORE LEAVING AIRCRAFT

1. Park with wheels on a surface cleared of snow, ice or slush.

2. Wheels - CHOCK FIRMLY.
Ascertain that plane captain adequately chocks the wheels and installs tie down cables.

3. Controls - LOCKED.

4. When possible, fully service the fuel tanks to prevent moisture from accumulating in the tanks.

5. Battery - REMOVE.
Remove battery if aircraft is to be parked outside for an extended period of time and temperature is below -29°C (-20°F).

DESERT OR HOT WEATHER PROCEDURES

BEFORE ENTERING AIRCRAFT

Wind-blown [illegible] presents the biggest hazard to desert operation. Ma[illegible] of the flight malfunctions can be avoided by proper ground handling techniques.

1. Intake ducts - CHECK.
Be sure intake ducts are clean.

2. Tires - CHECK INFLATION.
Check tires for proper inflation and any signs of deterioration.

3. Fuel, oil and hydraulic leaks - CHECK.

GROUND TEST

1. Ground checks - PERFORM AS MANY GROUND CHECKS AS POSSIBLE BEFORE STARTING ENGINE.

2. Engine run-up - PERFORM IN AS SHORT A TIME AS POSSIBLE.

TAXIING

1. If in the desert or dusty country, do not take-off in the wake of another aircraft.

2. Ground-roll is considerably increased in hot weather.

AFTER TAKE-OFF

1. Follow normal flight procedures.

2. Be particularly careful to maintain a power setting that will keep exhaust temperatures within the prescribed operating limits.

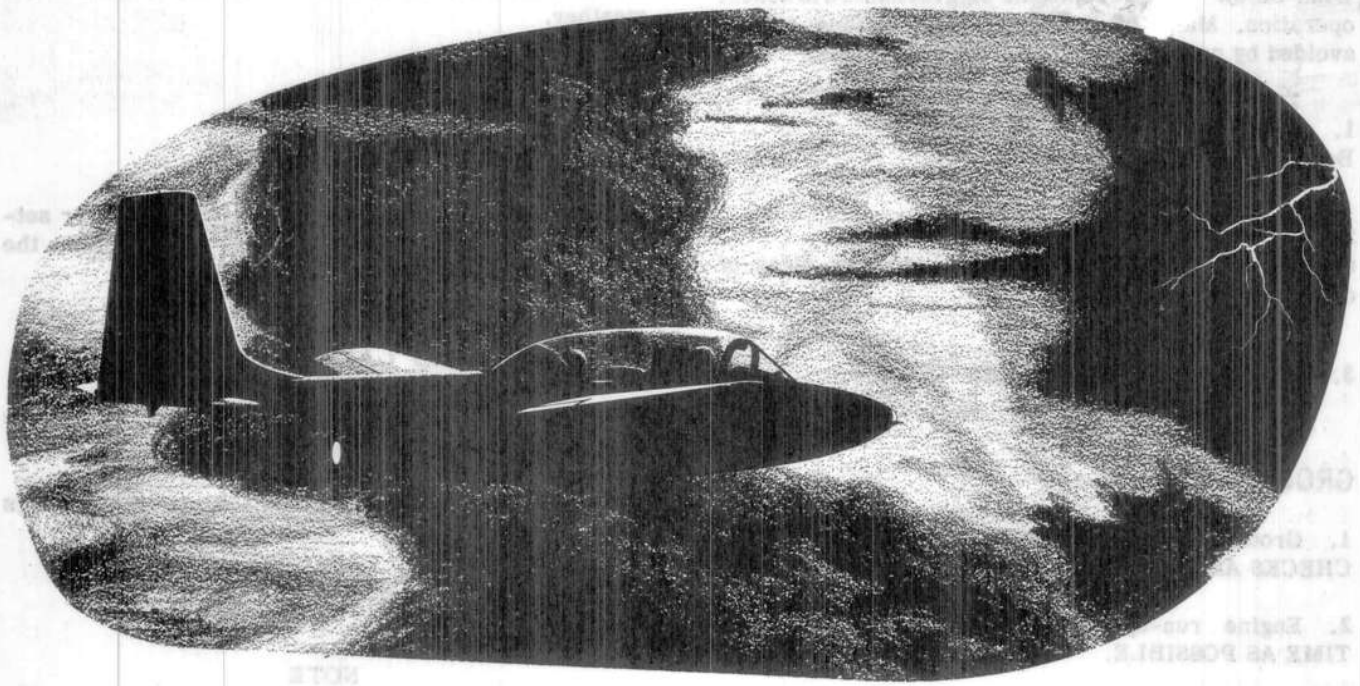
APPROACH AND LANDING

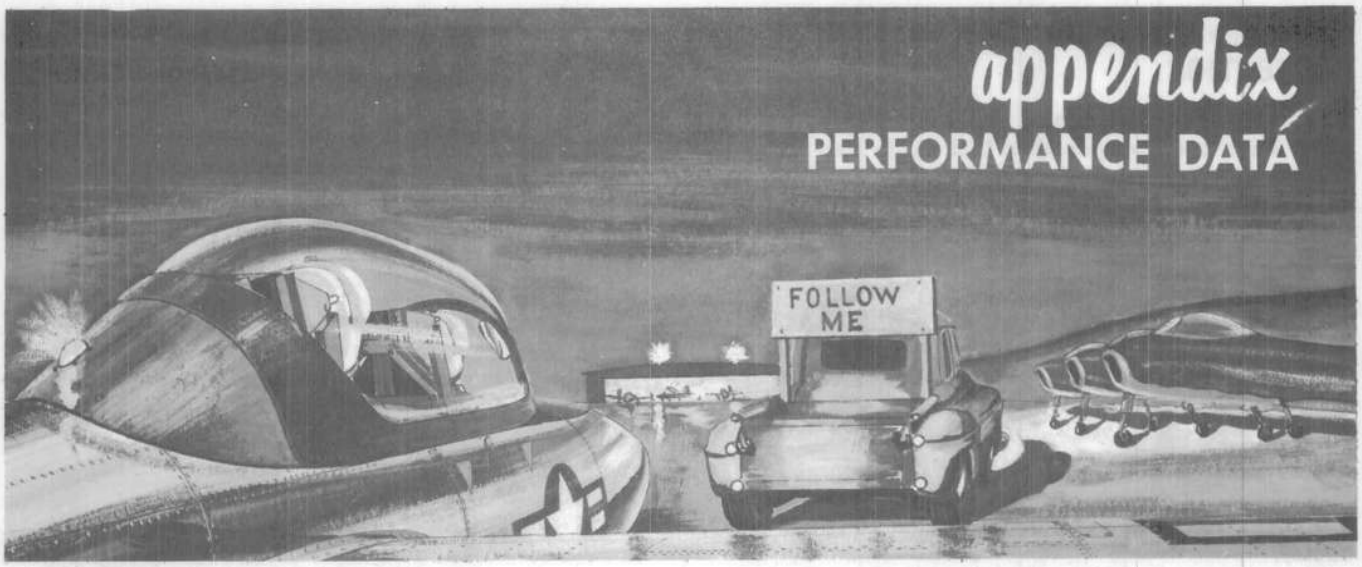
1. True stalling speeds and ground roll will be greater, however, indicated aispeed will be the same.

2. After engine shutdown install all protective plugs and covers.

NOTE

If blowing sand or dust is not a hazard, keep the canopy and access doors open to allow air to circulate.





appendix
PERFORMANCE DATA

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INTRODUCTION

The following information is presented to provide additional operational data which will provide answers for problems not found elsewhere in the handbook. The information found in this appendix covers flight within the operating limits of the aircraft. Data based on flight tests will be so marked and data based on estimates or extrapolations will be labeled ESTIMATED.

NOTE

Indicated airspeed (IAS) is the airspeed indicator reading. Calibrated airspeed (CAS) is indicated airspeed (IAS) corrected for installation error. Equivalent airspeed (EAS) is calibrated airspeed (CAS) corrected for compressibility error. True airspeed (TAS) is equivalent airspeed corrected for density.

AIRSPEED AND ALTIMETER POSITION ERROR CORRECTION

The airspeed and altimeter position error correction plots have been prepared so that calibrated airspeed (CAS) can be determined by correcting indicated airspeed (IAS) for installation error. See figure A-1 and examples below for use of the chart.

EXAMPLE: Indicated airspeed - 180 KNOTS
Configuration - CRUISE
Altitude - SEA LEVEL

TO FIND CALIBRATED AIRSPEED:

1. Enter chart at point A (indicated airspeed - 180 knots).

2. Ascend to point B (sea level configuration - CRUISE).

3. Proceed left horizontally to point C and read +7.5 knots on AIRSPEED CORRECTION - KT scale.

4. Add airspeed correction (+7.5 knots) to indicated airspeed (180 knots) to find a calibrated airspeed of 187.5 knots.

To find correct altitude:

1. Enter chart at point A (indicated airspeed - 180 knots).

2. Ascend to point B (sea level configuration - CRUISE).

3. Proceed left horizontally to point C and read +130 feet on the ALTIMETER CORRECTION - FT scale.

4. Add altimeter correction of +130 feet to the indicated altitude to correct for installation error.

AIRSPEED COMPRESSIBILITY CORRECTION

Above approximately Mach .5 airspeed indicator readings are subject to error because of compressibility effects, and as the speed increases, the effect on the airspeed indicator increases. The airspeed correction for compressibility can be determined by using the sample problem superimposed on figure A-2.

EXAMPLE CAS - 320 knots
Alt - 20,000 ft

1. Enter chart at CAS = 320 knots.

2. Go vertically to altitude curve = 20,000 ft.

3. Proceed left to KNOTS FOR COMPRESSIBILITY CORRECTION scale.

4. Read knots compressiblity correction = -9.5 KNOTS.

5. Subtract 9.5 from 320 to obtain equivalent airspeed (EAS) = 310.5 knots.

TEMPERATURE CORRECTION FOR COMPRESSIBILITY

Temperature readings are affected by compressibility as is the airspeed. The compressiblity effect results in higher temperature indicator reading. Use the sample problem on figure A-3 following these procedures.

EXAMPLE: Temperature reading = 5°C
CAS = 420 knots
Alt = 16,000 ft

1. Enter chart at CAS = 420 KNOTS.

2. Follow vertical line to desired altitude = 16,000 ft.

3. Proceed left to INDICATED AIR TEMPERATURE CORRECTION = -34.5°C.

4. Subtract 34.5° from +5° to obtain free air temperature = -29.5°C.

STANDARD ATMOSPHERE TABLE

The Standard Atmosphere Table (figure A-4) is based on National Advisory Committee for Aeronautics (NACA) technical report No. 3182. The chart is useful in determining data on one thousand foot levels (on a standard day) of density ratio, temperature, speed of sound, and barometric pressures.

CROSSWIND CORRECTION CHART

The crosswind correction chart (figure A-5) is self-explanatory with instructions included on the drawing.

TAKE-OFF SPEED

The take-off speed chart has been prepared so that actual lift-off speed can be determined by using actual gross weight of the aircraft. The chart shows the various lift-off speeds in direct relation to the varying gross weights. Take-off speed can be determined by using the sample problem on figure A-6.

EXAMPLE: Gross wt = 4200 lbs
Power setting = 100% RPM
Configuration = TAKE-OFF FLAPS

1. Enter chart at 4200 lbs; follow arrow up to TAKE-OFF NORMAL DISTANCE line.

2. Proceed left, horizontally to TAKE-OFF SPEED KT - CAS.

3. Read TAKE-OFF SPEED = 81 knots CAS.

TAKE-OFF DISTANCE – HARD SURFACE

For routine take-offs a chart has been prepared to give the total ground roll distance needed and to compensate for these variable factors; outside air temp, pressure altitude, weight and head winds. See figure A-7 for "chase around" sample problem and incorporate example below:

EXAMPLE:
OAT = -6°C
Press alt = 4000 ft
Gross wt = 4400 lbs
Head wind = 20 knots
Power setting = 100% RPM
Configuration = TAKE-OFF FLAPS

1. Start at -6°C on the OAT -°C chart and proceed horizontally to the 4000 foot pressure altitude curve on the DENSITY ALTITUDE - FEET chart.

2. Descend downward to the 4400 pound curve on the GROSS WEIGHT chart.

3. Proceed horizontally to the right edge of the HEADWIND - KT chart and continue, following the guide lines, to the 20 knot headwind point.

4. Continue horizontally to the left edge of the HEADWIND - KT chart and read distance of 1625 feet on the TAKE-OFF DISTANCE - 1000 FEET scale.

TAKE-OFF DISTANCE OVER FIFTY FOOT OBSTACLE – HARD SURFACE

The TAKE-OFF DISTANCE OVER FIFTY FOOT OBSTACLE chart will be used only when conditions require clearance over 50' obstacle. The following procedures outlined below and used in conjunction with the "chase around" example on figure A-8 will determine the total distance required for obstacle clearance.

EXAMPLE:
Oat = -18°C
Gross wt = 4400 lbs
Press alt = 4000 ft
Head wind = 20 knots
Power setting = 100% RPM
Configuration = TAKE-OFF FLAPS

1. Enter chart at OAT = -18°C.

2. Proceed horizontally through conversion scale (C° to F°) to the 4000 ft pressure altitude curve of the DENSITY ALTITUDE - FEET chart.

3. Proceed downward to GROSS WT CURVE = 4400 LBS on the GROSS WEIGHT chart.

4. Proceed horizontally to the HEAD WIND-KT chart.

5. Staying within guide lines, proceed to the HEAD WIND SPEED = 20 KT.

6. Proceed left to the DISTANCE TO CLEAR 50 FT OBSTACLE 1000 FT scale and read distance to clear 50 ft obstacle of 2200 feet.

CLIMB PERFORMANCE AFTER TAKE-OFF

The CLIMB PERFORMANCE AFTER TAKE-OFF (figure A-9) is a summary chart of climb performance after take-off showing three configurations. FLAPS DOWN, GEAR AND FLAPS DOWN and FLAPS UP.

NOTE

The rate of climb differences in the three configurations make it evident that gear retraction should take place as soon as safely airborne. The FLAPS DOWN configuration rate of climb, compared to the FLAPS UP configuration rate of climb, makes it obvious that flap retraction should take place at 120 KT CAS or below for best climb performance after take-off.

See figure A-9 for sample problem.

EXAMPLE:
CAS = 140 knots
OAT = 100° F

1. Enter chart at CAS = 140 KNOTS.

2. Ascend to OAT = 100° F.

3. Proceed left to RATE OF CLIMB FT PER MINUTE scale.

4. Read rate of climb = 1420 FT PER MINUTE.

CLIMB – NORMAL RATED THRUST – DIS – TANCE

The climb prediction curves are plots of gross weight versus range in nautical miles with various altitude lines crossing the range guide lines. The chart (figure A-10) contains a table of recommended air speeds at various altitudes. While distance traveled during climb is the primary purpose of this chart the new gross weight after climb is available. See figure A-10 and examples below, for use of the chart.

EXAMPLE:
Gross wt = 4350 lbs
Desired climb altitude = 15,000 ft

.CE:

chart at point A, GROSS WT = 4350 lbs.

2. Go up, paralleling guide lines, to point B = 15,000 ft.

3. Proceed left horizontally to point C on DISTANCE DURING CLIMB - NAUTICAL MILES scale.

4. Read distance = 58 nautical miles.

TO FIND NEW GROSS WEIGHT:

1. Enter chart at point A, GROSS WEIGHT = 4350 lbs.

2. Follow upward, parallel to guide lines, to point B = 15,000 ft.

3. Proceed vertically downward to point D on GROSS WT scale.

4. Read new gross weight = 4120 lbs.

NOTE

Subtracting new gross wt 4120 lbs from old gross weight 4350 lbs = 230 lbs fuel used in climb to 15,000 ft.

CLIMB – MAXIMUM THRUST – DISTANCE

See preceeding paragraph (CLIMB - NORMAL RATED THRUST - DISTANCE) for description and purpose of climb charts. The two charts (figure A-10 and 11) differ only in the power settings used and the resulting different values involved. To determine DISTANCE and fuel used with MAXIMUM THRUST (100% power), see figure A-11 and follow the superimposed problem and incorporate the following example:

EXAMPLE: Gross wt = 4350 lbs
Desired climb alt = 15,000 ft

TO FIND DISTANCE:

1. Enter chart at point A, GROSS WT = 4350 lbs.

2. Go up, paralleling guide lines, to point B = 15,000 feet.

3. Proceed left horizontally to point C on DISTANCE DURING CLIMB - NAUTICAL MILES scale.

4. Read distance = 31 nautical miles.

TO FIND FUEL USED:

1. Enter chart at point A, GROSS WT = 4350 lbs.

2. Follow upward, paralleling guide lines, to point B = 15,000 ft.

3. Proceed downward, vertically, to point D on GROSS WT scale.

4. Read the new gross weight = 4210 lbs.

5. Subtract the new gross weight 4210 lbs from old gross wt 4350 lbs = 140 lbs fuel used in climb to 15,000 ft.

CLIMB – NORMAL RATED THRUST – TIME

The CLIMB NORMAL RATED THRUST - TIME chart (figure A-12) is designed to give the different times required for climbs to different altitudes at normal rated power (92.5%). The chart contains a table of recommended airspeeds at various altitudes. The fuel used may also be determined on this chart with the same methods used in figure A-10 and A-11. See figure A-12 and the examples below for methods of determining time in climb, and fuel used.

EXAMPLE: Gross wt = 4350 lbs
Desired climb alt = 15,000 ft

TO FIND TIME:

1. Enter chart at point A, GROSS WT = 4350 lbs.

2. Ascend, staying parallel to guide lines, to point B = 15,000 feet.

3. Proceed left to TIME DURING CLIMB - MINUTES scale at point C.

4. Read scale for total time = 21 minutes.

TO FIND FUEL USED IN CLIMB:

1. Enter chart at point A, GROSS WT = 4350 lbs.

2. Go to point B (paralleling the guide lines) = 15,000 ft.

3. Descend vertically to point D GROSS WT scale.

4. Read new gross weight = 4130 lbs.

5. Subtract new gross weight 4130 from old gross of 4350 and difference = 220 lbs fuel used in climb to 15,000 ft.

CLIMB – MAXIMUM THRUST – TIME

See preceeding paragraph (CLIMB - NORMAL RATED THRUST - TIME) for description and purpose of climb versus time charts. The two charts A-12 and A-13 differ only in the power settings used and the

resulting different values involved. To determine TIME and FUEL used with MAXIMUM THRUST (100% power), see figure A-13 and use the superimposed problem and incorporate the following example:

EXAMPLE: Gross wt = 4350 lbs
Desire climb alt = 15,000 ft

FOR TIME:

1. Enter chart at point A, GROSS WEIGHT = 4350 lbs.

2. Move up, staying inside guide lines, to point B = 15,000 ft.

3. Proceed left toward TIME DURING CLIMB - MINUTES scale, to point C.

4. Read scale for total time = 10-1/2 minutes.

FOR FUEL USED:

1. Enter chart at point A, GROSS WT = 4350 lbs.

2. Move up to point B = 15,000 ft.

3. Descend vertically to point D GROSS WEIGHT.

4. Read new gross weight = 4210 lbs.

5. Subtract new gross weight 4210 lbs from old gross weight = 140 lbs, fuel used in climb to 15,000 ft.

ENDURANCE – LEVEL FLIGHT

The ENDURANCE - LEVEL FLIGHT chart, figure A-14, is designed to give minutes per pound of fuel and the calibrated airspeed for maximum endurance at a constant altitude.

EXAMPLE: Gross weight = 3600 pounds
Altitude = 15,000 feet

TO FIND ENDURANCE:

1. Enter chart at point A, gross weight = 3600 pounds.

2. Ascend, staying parallel to guide lines, to point B = 15,000 feet.

3. Proceed left to ENDURANCE - MINUTES PER POUND FUEL scale at point C.

4. Read scale for endurance = .187 minutes per pound of fuel.

TO FIND AIRSPEED:

1. Enter chart at point A, gross weight = 3600 pounds.

2. Ascend, staying parallel to guide lines, to point D = 15,000 ft.

3. Proceed left to the CALIBRATED AIRSPEED - KNOTS scale at point E.

4. Read scale for airspeed = 113 knots CAS.

NAUTICAL MILES PER POUND OF FUEL – SEA LEVEL

The three NAUTICAL MILES PER POUND OF FUEL charts (SEA LEVEL, 15,000 ft and 20,000 ft) are identical in function and scope. Therefore, only one sample problem will be shown and explained on the SEA LEVEL chart to avoid repetition. The three charts (figures A-15, 16, and 17) have been plotted with gross weight curve lines against CAS - KNOTS and air nautical miles per pound of fuel. The charts have dashed curved lines crossing the gross weights and are labeled RECOMMENDED MAXIMUM INDURANCE, and MAXIMUM RANGE. Per cent of engine power lines are also shown and labeled.

TO FIND NAUTICAL MILES AND CAS DURING BEST CRUISE POWER CONDITION:

EXAMPLE: Gross wt = 4100 lbs.

1. Enter chart in upper center on the MAXIMUM RANGE dashed line, where the 4100 lb line (interpolate) intersects maximum range line.

2. Proceed left horizontally to AIR NAUTICAL MILES PER POUND OF FUEL scale.

3. Read scale for answer = .333 air nautical miles per pound of fuel.

4. Interpolate between percent RPM lines and read 80.5% RPM.

TO FIND CAS:

1. Enter chart in upper center on the MAXIMUM RANGE dashed line where the 4100 lb line (interpolate) intersects the MAXIMUM RANGE line.

2. Descend vertically to CAS - KNOTS scale.

3. Read best cruise airspeed = 173 KNOTS CAS.

NOTE

The nautical miles per pound of fuel charts (figures A-15, 16, and 17) have been plotted and marked for easy use in figuring various cruise conditions. The RECOMMENDED MAXIMUM ENDURANCE, MAXIMUM

RANGE, CRUISE POWER, NORMAL RATED and MAXIMUM THRUST lines with the GROSS WT CURVES for various weight configurations, should offer the pilot maximum information for flight planning when properly used.

NAUTICAL MILES PER POUND OF FUEL - 15,000 FEET

For information on the NAUTICAL MILES PER POUND OF FUEL - 15,000 FT chart (figure A-16) see the preceeding paragraph NAUTICAL MILES PER POUND OF FUEL - SEA LEVEL. All pertinent facts and procedure for its use will be found therein.

NAUTICAL MILES PER POUND OF FUEL - 20,000 FEET

For information on the NAUTICAL MILES PER POUND OF FUEL - 20,000 FT chart (figure A-17) see the preceeding paragraph NAUTICAL MILES PER POUND OF FUEL - SEA LEVEL. All facts and procedures for its use will be found therein.

FUEL FLOW - SEA LEVEL

The FUEL FLOW CHARTS (SEA LEVEL, 15,000 ft and 20,000 ft), see figures A-18, 19, and 20, are identical; the only variable being the chart altitude configuration. The fuel flow charts provide fuel flow in pounds per hour for the various power setting curves versus CAS in knots. Engine RPM is also provided on each per cent of engine power curves. To eliminate repetition, only the FUEL FLOW - SEA LEVEL chart will be explained and a sample problem provided. Once the charts use (figure A-18) is understood, the other two charts (figure A-19, 20) may be similarly used.

EXAMPLE: Power setting = 87%
CAS = 220 knots

1. Enter chart at CAS = 220 KNOTS.

2. Ascend vertically to the 87% line (interpolate).

3. Proceed left, horizontally to FUEL FLOW - LBS PER HOUR scale.

4. Read fuel flow = 680 lbs.

FUEL FLOW - 15,000 FEET

For information on FUEL FLOW 15,000 ft (figure A-19) see preceeding paragraph FUEL FLOW -SEA LEVEL.

FUEL FLOW - 20,000 FEET

For information on FUEL FLOW - 20,000 ft (figure A-20) see preceeding paragraph FUEL FLOW - SEA LEVEL.

DESCENT - MAXIMUM RANGE

The DESCENT - MAXIMUM RANGE chart has four separate plots to obtain the following:

FUEL USED IN DESCENT - LBS.
RATE OF DESCENT - 100 FT PER MIN.
TIME TO DESCEND - MIN.
DISTANCE TRAVELED - NAUT. MILES.

The recommended maximum range descent should be 121 knots at idle rpm, clean configuration. With the airspeed held constant, the rate of descent will be variable for different altitudes (see chart for recommended descent at various altitudes) to obtain maximum range for minimum fuel consumption. The FUEL USED, RATE OF DESCENT, TIME TO DESCEND and DISTANCE TRAVELED can be determined by using the sample problems below on figure A-20.

TO DETERMINE FUEL USED:

EXAMPLE: Alt = 20,000 ft
Condition = MAX RANGE

1. Use the upper left plot on figure A-21, marked FUEL USED IN DESCENT - LBS.

2. Enter chart at desired alt = 20,000 ft.

3. Proceed right to MAXIMUM RANGE DESCENT line.

4. Descend downward vertically to FUEL USED IN DESCENT - LBS scale on base line.

5. Read total fuel used in descent from 20,000 ft = 49 lbs.

TO DETERMINE RATE OF DESCENT:

EXAMPLE: Alt = 15,000 ft
Condition = MAX RANGE

1. Find the plot on the upper right portion of figure A-21, marked RATE OF DESCENT - 100 FT PER MIN.

2. Enter chart on right side at PRESSURE ALTITUDE = 15,000 ft.

3. Proceed horizontally left to MAXIMUM RANGE DESCENT line.

4. Descend vertically to RATE OF DESCENT - FT PER MIN scale.

5. Read rate of descent = 1080 ft per min.

TO DETERMINE TIME TO DESCEND:

EXAMPLE: Alt = 10,000 ft
Condition = MAX RANGE

1. Use the lower left plot on figure A-21, marked TIME TO DESCEND MIN.

2. Enter chart at PRESSURE ALTITUDE = 10,000 ft.

3. Proceed right horizontally to MAXIMUM RANGE DESCENT line.

4. Drop vertically to base line TIME scale.

5. Read TIME TO DESCEND - MIN scale = 11 min.

TO DETERMINE DISTANCE TRAVELED:

EXAMPLE: Alt = 17,500 ft
Condition = MAX RANGE

1. Locate the plot on the lower right portion of figure A-21, marked DISTANCE TRAVELED - NAUT MI.

2. Enter chart at PRESSURE ALTITUDE = 17,500 ft.

3. Proceed left to MAXIMUM RANGE DESCENT line.

4. Drop down vertically to DISTANCE TRAVELED - NAUT MI scale.

5. Read total distance traveled = 41.5 miles.

LANDING SPEEDS

The LANDING SPEED chart (figure A-22) in the gear down configuration furnishes the recommended approach and touch down speeds of the aircraft at various gross weights. On the LANDING SPEED chart are two separate plots, FLAPS UP and LANDING FLAPS 40°. By checking the speed of a FLAPS UP - GEAR DOWN configuration against a FLAPS 40° - GEAR DOWN configuration, both using the same gross weight condition, it is quite evident of the desirability of full flaps under any landing condition. The recommended approach and touch down speed with or without flaps can be determined by using the sample problem superimposed on figure A-22 and the example below.

EXAMPLE: Gross weight = 3650 lbs

TO DETERMINE RECOMMENDED APPROACH SPEED WITH FLAPS 40°:

1. Enter chart at GROSS WEIGHT (point A) = 3650 lbs.

2. Ascend vertically to RECOMMENDED APPROACH SPEED curve (point C).

3. Proceed left horizontally to CALIBRATED AIRSPEED - KNOTS scale.

4. Read RECOMMENDED APPROACH SPEED = 74 knots CAS.

TO DETERMINE RECOMMENDED APPROACH SPEED WITH FLAPS UP:

1. Enter chart at GROSS WT (point A) = 3650 lbs..

2. Ascend vertically to RECOMMENDED APPROACH SPEED curve (point E).

3. Move horizontally to CALIBRATED AIRSPEED - KNOTS.

4. Read RECOMMENDED APPROACH SPEED - FLAPS UP = 87 KNOTS CAS.

TO DETERMINE TOUCHDOWN SPEED WITH FLAPS 40°:

1. Enter chart at GROSS WEIGHT (point A on chart) = 3650 lbs.

2. Ascend vertically to TOUCH DOWN SPEED curve (point B).

3. Proceed left horizontally to CALIBRATED AIRSPEED - KNOTS scale.

4. Read TOUCH DOWN SPEED = 68 KT CAS.

TO DETERMINE TOUCHDOWN SPEED WITH FLAPS UP:

1. Enter chart (figure A-21) at GROSS WEIGHT (point A) = 3650 lbs.

2. Ascend vertically to TOUCH DOWN SPEED curve (point D) in FLAPS UP configuration.

3. Move horizontally from point D to CALIBRATED AIRSPEED - KNOTS scale.

4. Read TOUCH DOWN SPEED - FLAPS UP = 80 knots CAS.

LANDING DISTANCE – FLAPS 40°

For routine landings a chart has been prepared to give the total ground roll distance needed and compensating for these variable factors: OAT (outside air temperature), pressure altitude, gross weight and head winds. See figure A-23 for "chase around" sample problem and incorporate the example below:

EXAMPLE:	OAT	=	52° F
	Pressure alt	=	2000 ft
	Gross wt	=	4400 lbs
	Head wind	=	20 knots

1. Enter chart at AIR TEMPERATURE - °F scale = 52° F.

2. Follow arrow up to PRESSURE ALTITUDE = 2000 ft.

3. Proceed right to GROSS WT curve = 4400 lbs.

4. Descend vertically to HEAD WIND - KNOTS.

5. Descend, staying within slanting guide lines, to HEAD WIND SPEED = 20 KNOTS.

6. Descend vertically to GROUND ROLL - 100 FT scale.

7. Read scale to get total landing distance = 800 ft.

NOTE

At this point, total landing distance in ft is known for normal conditions. If the total landing distance over 50 ft obstacle is desired, use steps 8, 9, and 10 to find additional distance needed to clear obstacle.

8. Drop vertically to USE FOR ALL HEAD WINDS curve.

9. Proceed horizontally left to TOTAL DISTANCE OVER 50 FT OBSTACLE - FEET scale.

10. Read new total distance required for landing over 50 ft obstacle = 1350 ft.

LANDING DISTANCE – FLAPS UP

The LANDING DISTANCE - NO FLAPS chart (figure A-24) is prepared to show graphically the large additional runway length needed for landings in the no flap configuration, when compared to the flaps 40° charts (figure A-23) landing distance. This information will be helpful if an emergency no flap landing is necessary. The LANDING DISTANCE - NO FLAPS can be determined by using the sample problem superimposed on figure A-24 and incorporate the example below:

EXAMPLE:	OAT	=	50° F
	Pressure alt	=	1000 ft
	Gross wt	=	4400 lbs
	Head wind	=	20 knots
	Obstacle	=	50 ft

TO DETERMINE LANDING DISTANCE:

1. Enter chart at AIR TEMPERATURE - °F Scale = 50° F.

2. Follow arrow up to PRESSURE ALTITUDE curve = 1000 ft.

3. Proceed horizontally to GROSS WT curve = 4400 lbs.

4. Descend vertically to HEAD WIND - KNOTS.

5. Descend, staying parallel to the slanting guide lines, to HEAD WIND SPEED = 20 KNOTS.

6. Descend vertically to GROUND ROLL - 100 FT scale.

7. Read scale to get total landing distance = 1390 ft.

8. Drop vertically to USE FOR ALL HEAD WINDS curve.

9. Proceed left horizontally to TOTAL DISTANCE OVER 50 FT OBSTACLE scale.

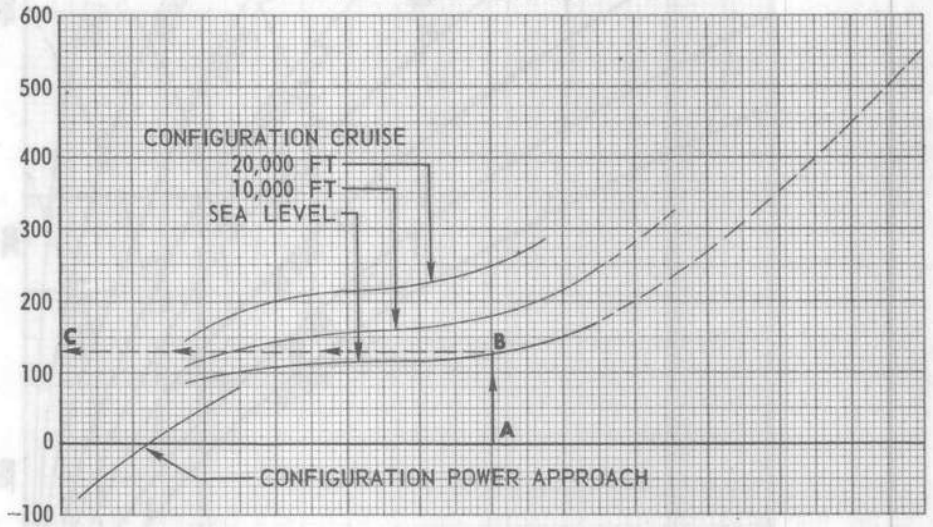
10. Read the new total distance required for landing over 50 ft obstacle = 2200 ft.

AIRSPEED AND ALTIMETER POSITION ERROR CORRECTION

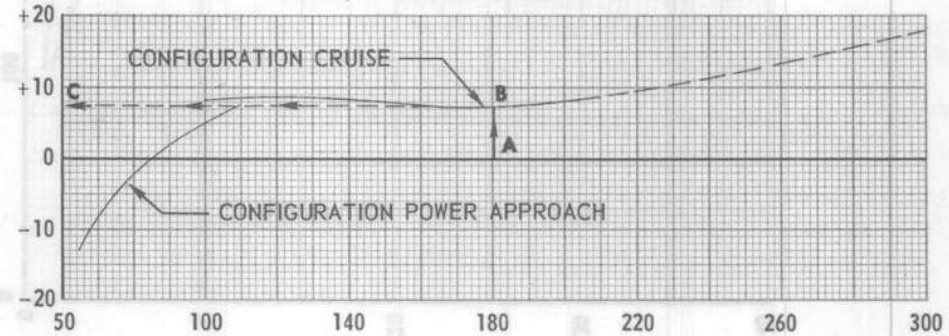
MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT DATA
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

NOTE: ADD CORRECTION TO INDICATED ALTITUDE (INSTRUMENT READING CORRECTED FOR INSTRUMENT ERROR) TO OBTAIN CORRECTED ALTITUDE.



NOTE: ADD CORRECTION TO INDICATED AIRSPEED (INSTRUMENT READING CORRECTED FOR INSTRUMENT ERROR) TO OBTAIN CALIBRATED AIRSPEED.



ALTIMETER CORRECTION, FT.

AIRSPEED CORRECTION, KT

INDICATED AIRSPEED, KT.

Figure A-1

AIRSPEED COMPRESSIBILITY CORRECTION

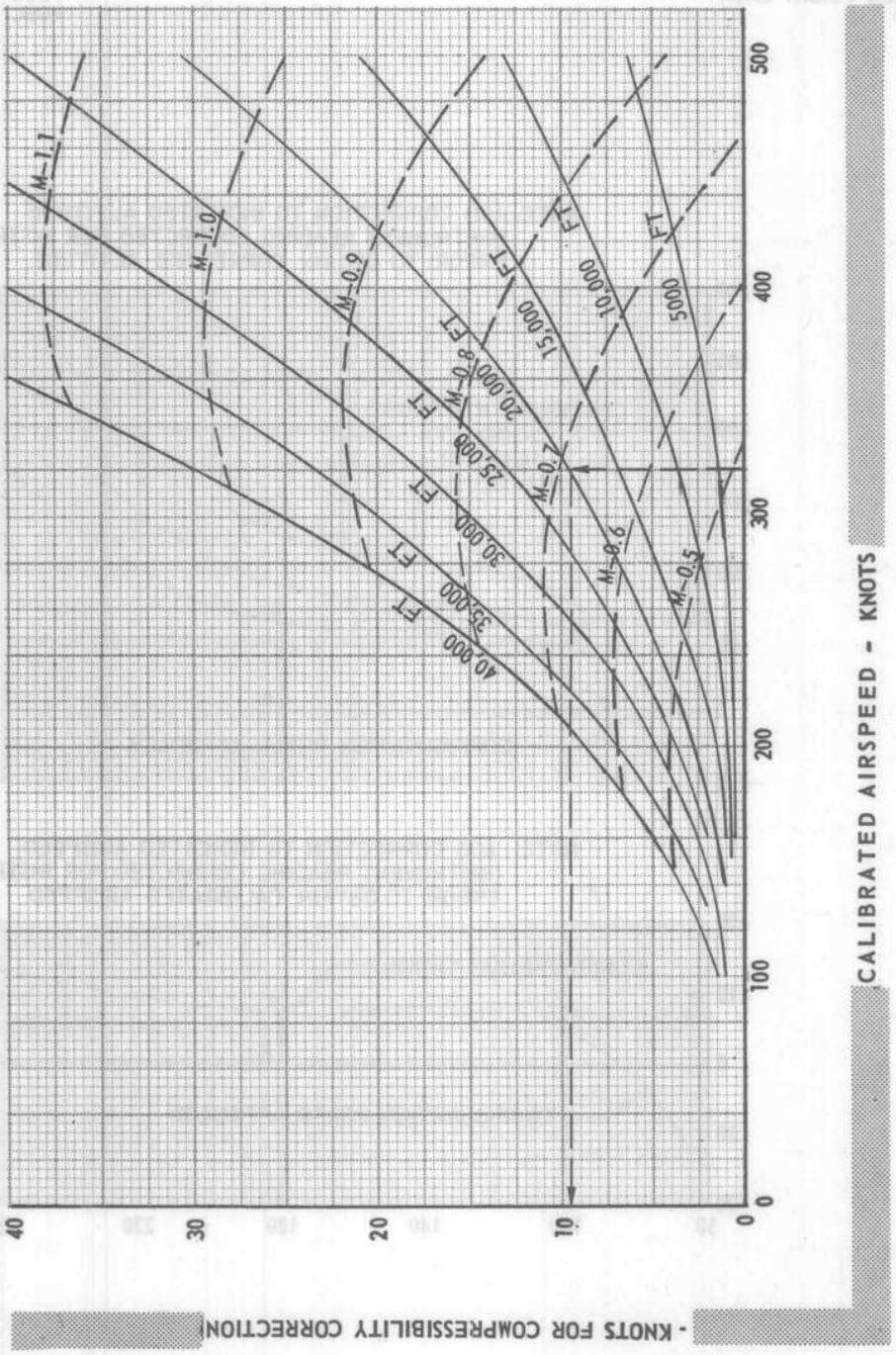


Figure A-2

TEMPERATURE CORRECTION FOR COMPRESSIBILITY

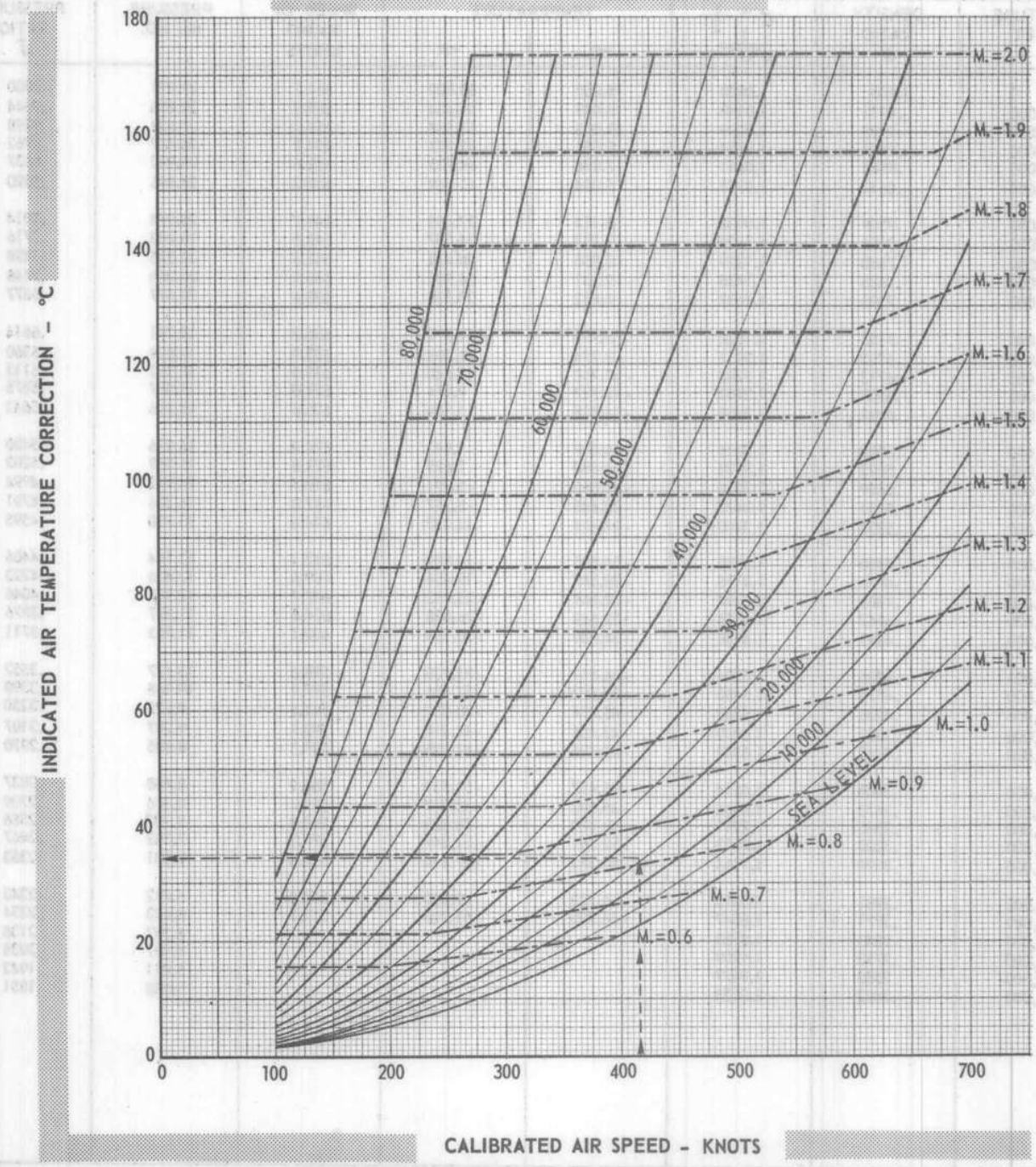


Figure A-3

STANDARD ATMOSPHERE TABLE

THIS TABLE IS BASED ON NACA TECHNICAL REPORT 3182

STANDARD S. L. CONDITIONS:
TEMPERATURE 15°C 59°F
PRESSURE 29.921 IN. HG 2116.216 LB/SQ. FT.
DENSITY .0023769 SLUGS/CU. FT.
SPEED OF SOUND 1116.89 FT/SEC. 661.7 KNOTS

CONVERSION FACTORS:
1 IN. HG 70.727 LB/SQ. FT.
1 IN. HG 0.49116 LB/SQ. IN.
1 KNOT 1.151 M.P.H.
1 KNOT 1.688 FT/SEC.

ALTITUDE FEET	DENSITY RATIO σ	$\sigma^{-\frac{1}{2}}$ $\frac{1}{\sqrt{\sigma}}$	TEMPERATURE °C	TEMPERATURE °F	SPEED OF SOUND KNOTS	PRESSURE IN. HG.	PRESSURE RATIO δ
0	1.000	1.0000	15.000	59.000	661.7	29.921	1.0000
1000	.9711	1.0148	13.019	55.434	659.5	28.856	.9644
2000	.9428	1.0299	11.038	51.868	657.2	27.821	.9298
3000	.9151	1.0454	9.056	48.302	654.9	26.817	.8962
4000	.8881	1.0611	7.076	44.735	652.6	25.842	.8637
5000	.8617	1.0773	5.094	41.169	650.3	24.896	.8320
6000	.8359	1.0938	3.113	37.603	648.7	23.978	.8014
7000	.8106	1.1107	1.132	34.037	645.6	23.088	.7716
8000	.7860	1.1279	-0.850	30.471	643.3	22.225	.7428
9000	.7620	1.1456	-2.831	26.905	640.9	21.388	.7148
10,000	.7385	1.1637	-4.812	23.338	638.6	20.577	.6877
11,000	.7155	1.1822	-6.793	19.772	636.2	19.791	.6614
12,000	.6932	1.2011	-8.774	16.206	633.9	19.029	.6360
13,000	.6713	1.2205	-10.756	12.640	631.5	18.292	.6113
14,000	.6500	1.2403	-12.737	9.074	629.0	17.577	.5875
15,000	.6292	1.2606	-14.718	5.508	626.6	16.886	.5643
16,000	.6090	1.2815	-16.699	1.941	624.2	16.216	.5420
17,000	.5892	1.3028	-18.680	-1.625	621.8	15.569	.5203
18,000	.5699	1.3246	-20.662	-5.191	619.4	14.942	.4994
19,000	.5511	1.3470	-22.643	-8.757	617.0	14.336	.4791
20,000	.5328	1.3700	-24.624	-12.323	614.6	13.750	.4595
21,000	.5150	1.3935	-26.605	-15.889	612.1	13.184	.4406
22,000	.4976	1.4176	-28.587	-19.456	609.6	12.636	.4223
23,000	.4806	1.4424	-30.568	-23.022	607.1	12.107	.4046
24,000	.4642	1.4678	-32.549	-26.588	604.6	11.597	.3876
25,000	.4481	1.4938	-34.530	-30.154	602.1	11.103	.3711
26,000	.4325	1.5206	-36.511	-33.720	599.6	10.627	.3552
27,000	.4173	1.5480	-38.492	-37.286	597.1	10.168	.3398
28,000	.4025	1.5762	-40.474	-40.852	594.6	9.725	.3250
29,000	.3881	1.6052	-42.455	-44.419	592.1	9.297	.3107
30,000	.3741	1.6349	-44.436	-47.985	589.5	8.885	.2970
31,000	.3605	1.6654	-46.417	-51.551	586.9	8.488	.2837
32,000	.3473	1.6968	-48.398	-55.117	584.4	8.106	.2709
33,000	.3345	1.7291	-50.379	-58.683	581.8	7.737	.2586
34,000	.3220	1.7623	-52.361	-62.249	579.2	7.382	.2467
35,000	.3099	1.7964	-54.342	-65.816	576.6	7.041	.2353
36,000	.2981	1.8315	-56.323	-69.382	574.0	6.712	.2243
36,089	.2971	1.8347	-56.500	-69.700	573.7	6.683	.2234
37,000	.2843	1.8753				6.397	.2138
38,000	.2710	1.9209				6.097	.2038
39,000	.2583	1.9677				5.811	.1942
40,000	.2462	2.0155				5.538	.1851

Figure A-4

CROSSWIND CORRECTION CHART

THIS CHART DETERMINES WIND COMPONENTS PARALLEL TO AND ACROSS THE RUNWAY WHEN WIND VELOCITY AND DIRECTION RELATIVE TO THE RUNWAY ARE KNOWN.

EXAMPLE: GIVEN A 27 KT WIND 35° OFF THE RUNWAY HEADING, FIND THE HEADWIND AND CROSSWIND COMPONENTS.

a. ENTER CHART AT POINT A (27 KNOT WIND VELOCITY AND 35° BEARING) AND PROCEED TO POINT C WHERE A HEADWIND COMPONENT OF 22 KNOTS IS FOUND.

b. FROM POINT A PROCEED TO POINT B WHERE A CROSSWIND COMPONENT OF 15-1/2 KNOTS IS FOUND.

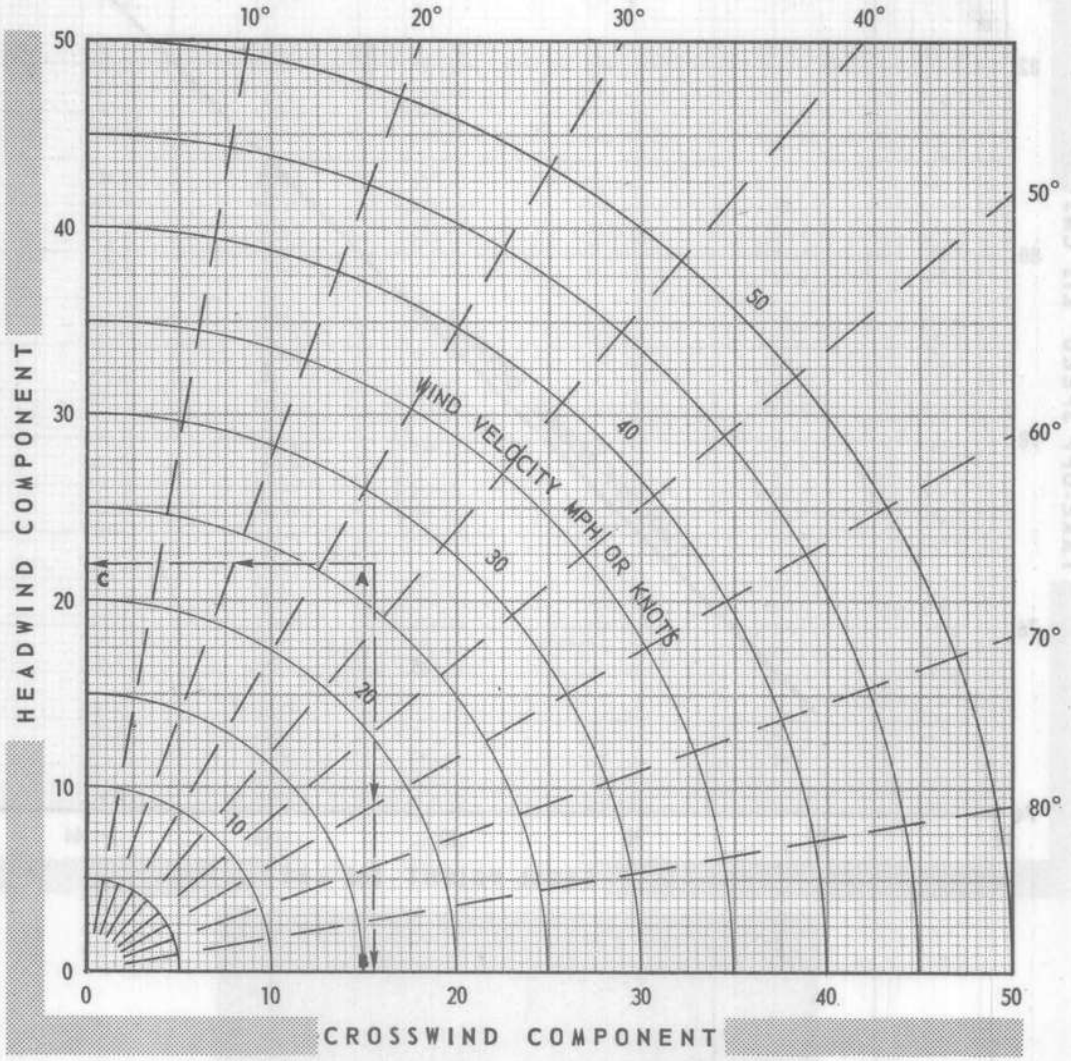


Figure A-5

TAKE-OFF SPEED

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: DATE: 15 AUGUST 1958

TAKE-OFF FLAPS 100 PER CENT RPM

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

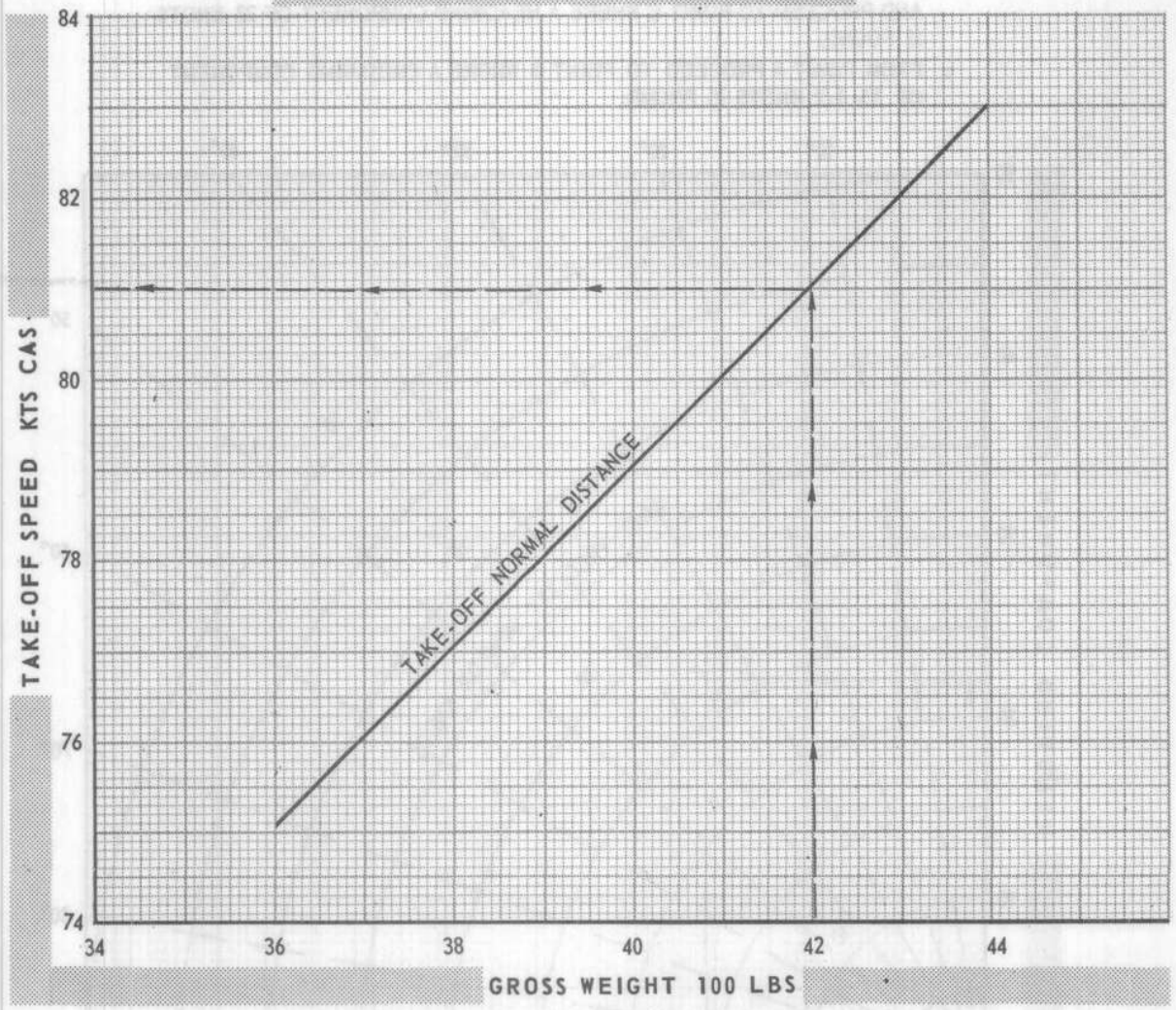


Figure A-6

TAKE-OFF DISTANCE

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

HARD SURFACE RUNWAY
MAXIMUM THRUST 100 PER CENT RPM
TAKE-OFF FLAPS

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

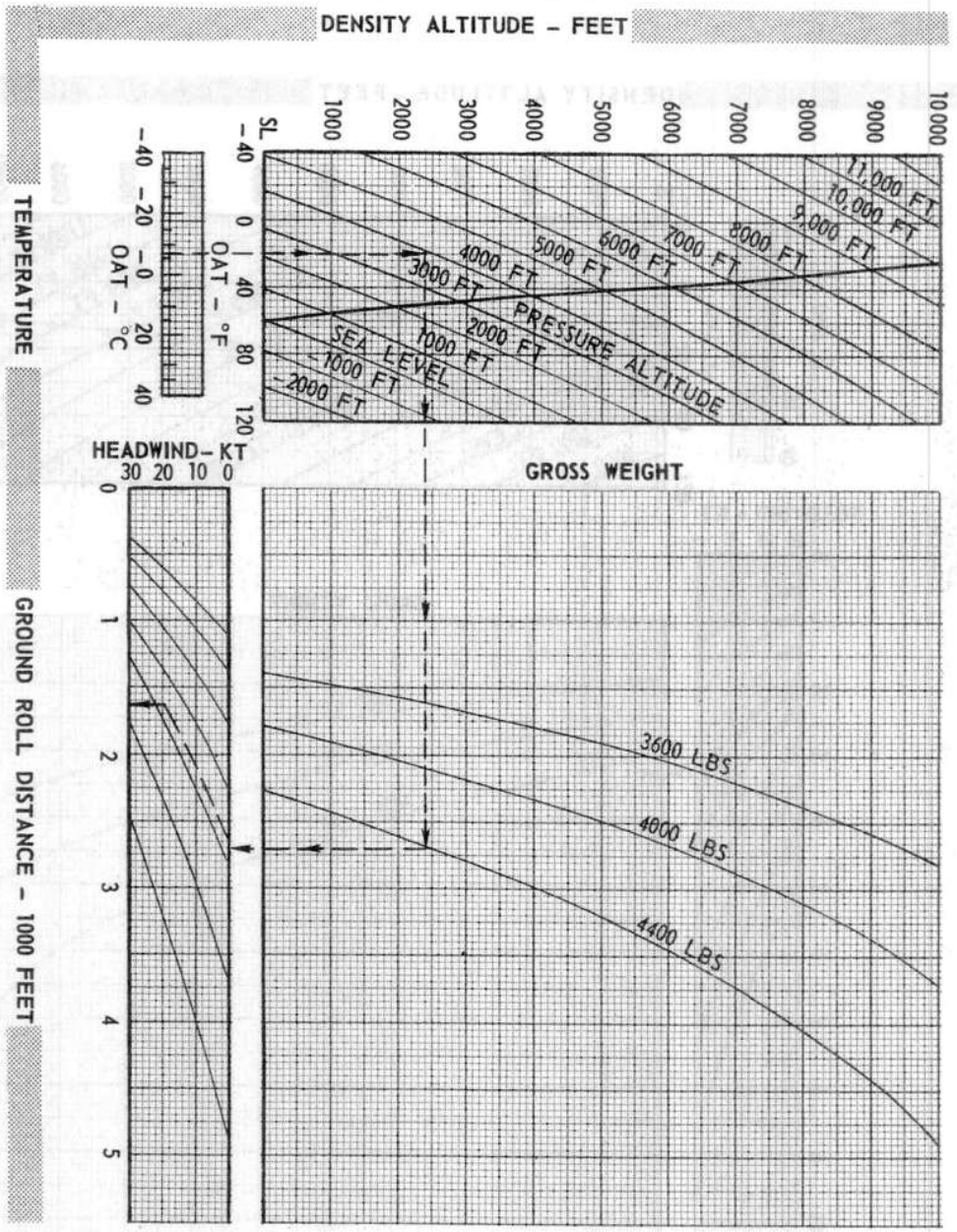


Figure A-7

TAKE-OFF DISTANCE OVER 50' OBSTACLE

HARD SURFACE RUNWAY
MAXIMUM THRUST 100 PER CENT RPM
TAKE-OFF FLAPS

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

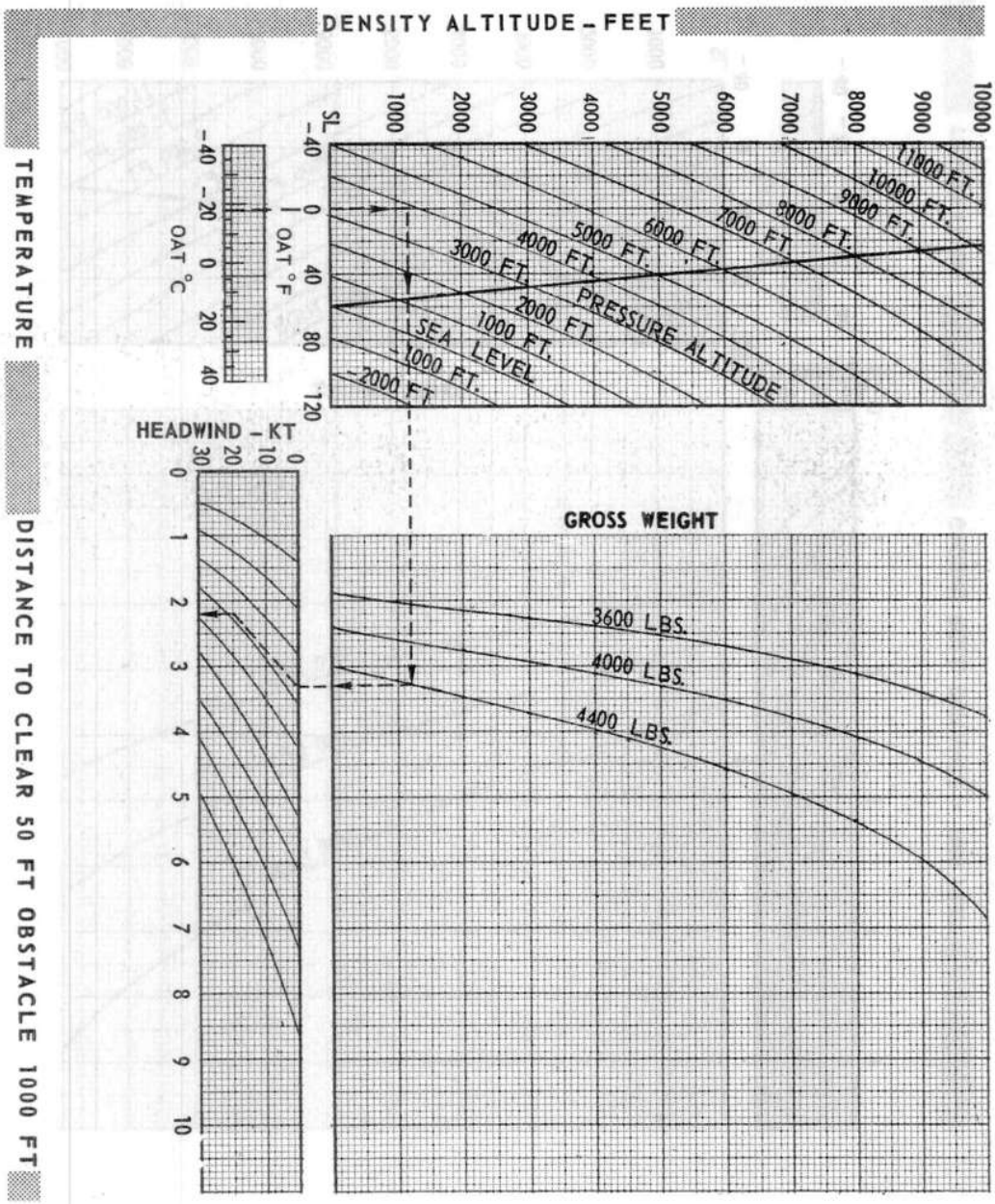


Figure A-8

CLIMB PERFORMANCE AFTER TAKE-OFF

MAXIMUM THRUST 100 PER CENT RPM

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

SEA LEVEL
GROSS WEIGHT 4400 LBS

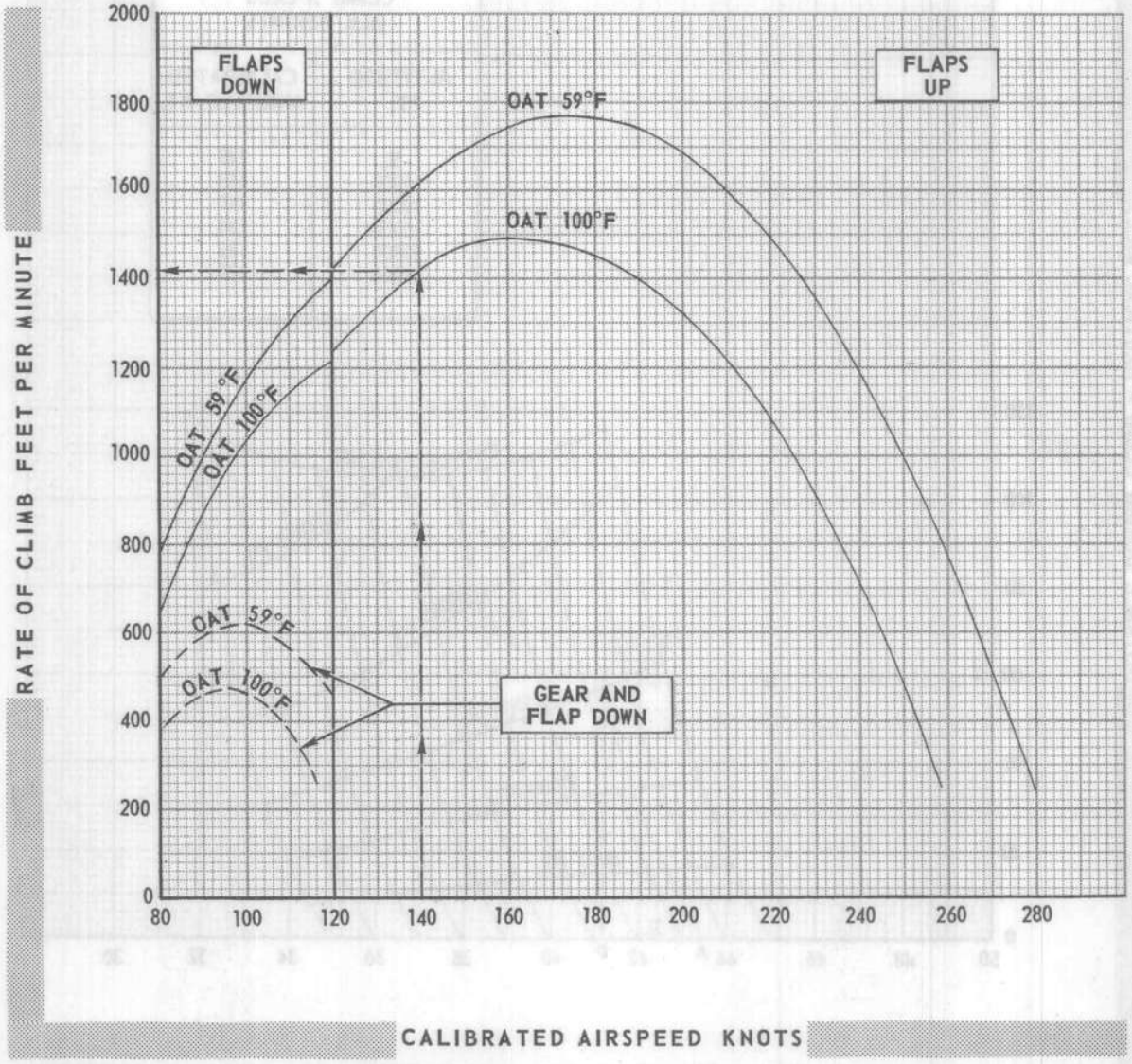


Figure A-9

CLIMB-NORMAL RATED THRUST

92.5 PER CENT RPM

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

DISTANCE

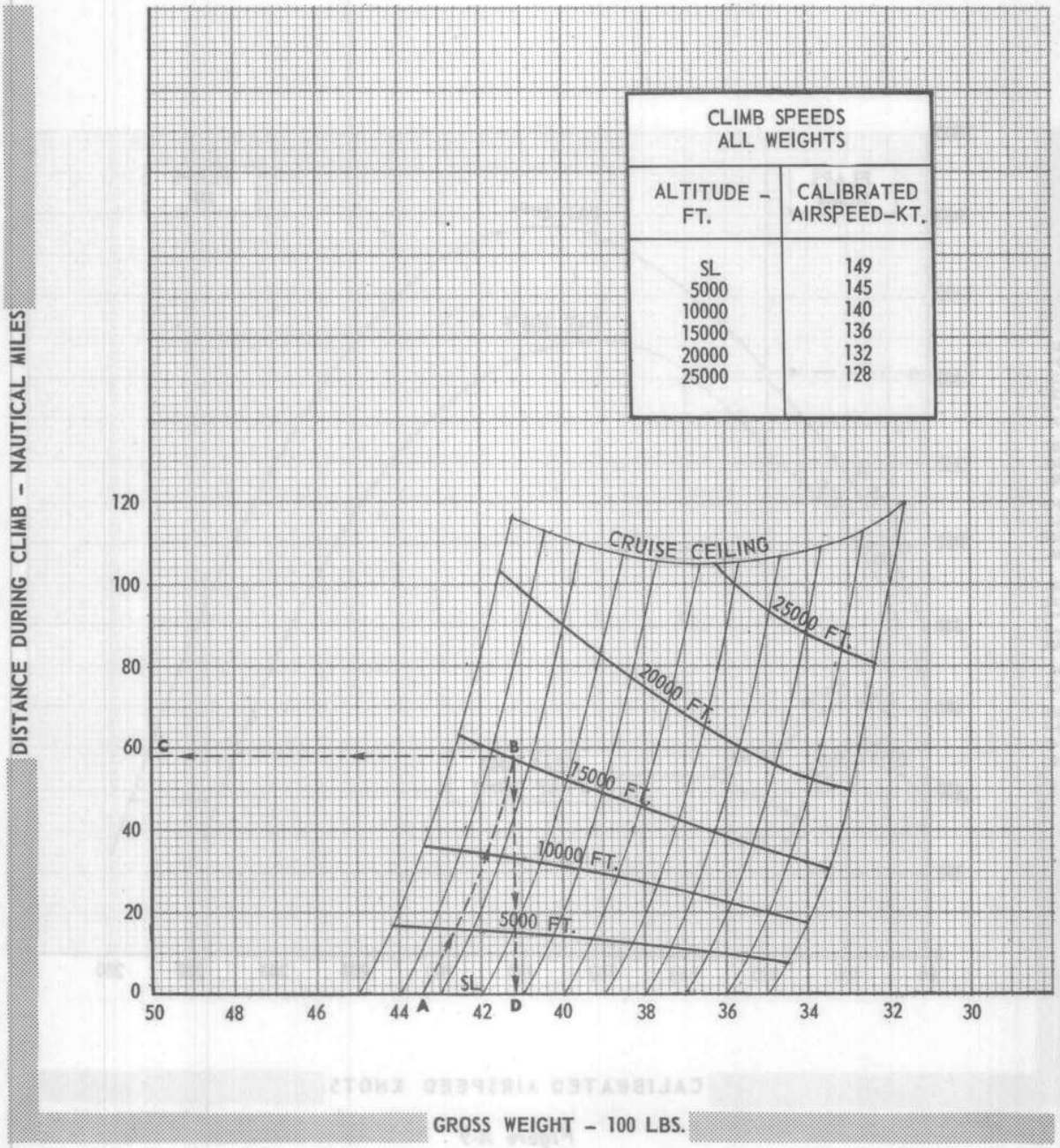


Figure A-10

CLIMB-MAXIMUM THRUST

100 PER CENT RPM

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT DATA
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DESNITY: 6.5 LB/GAL

DISTANCE

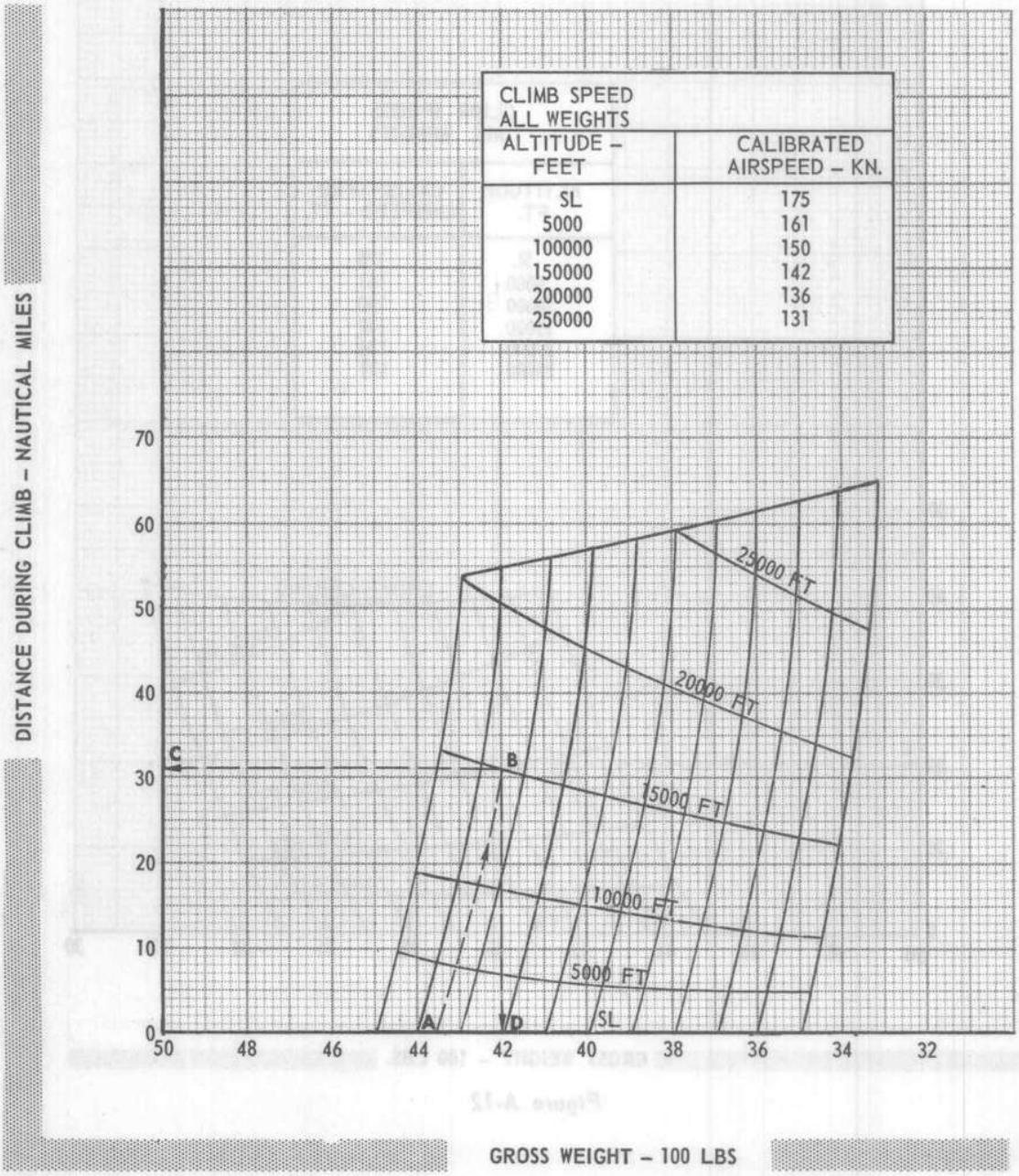


Figure A-11

CLIMB-NORMAL RATED THRUST

92.5 PERCENT RPM

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

TIME

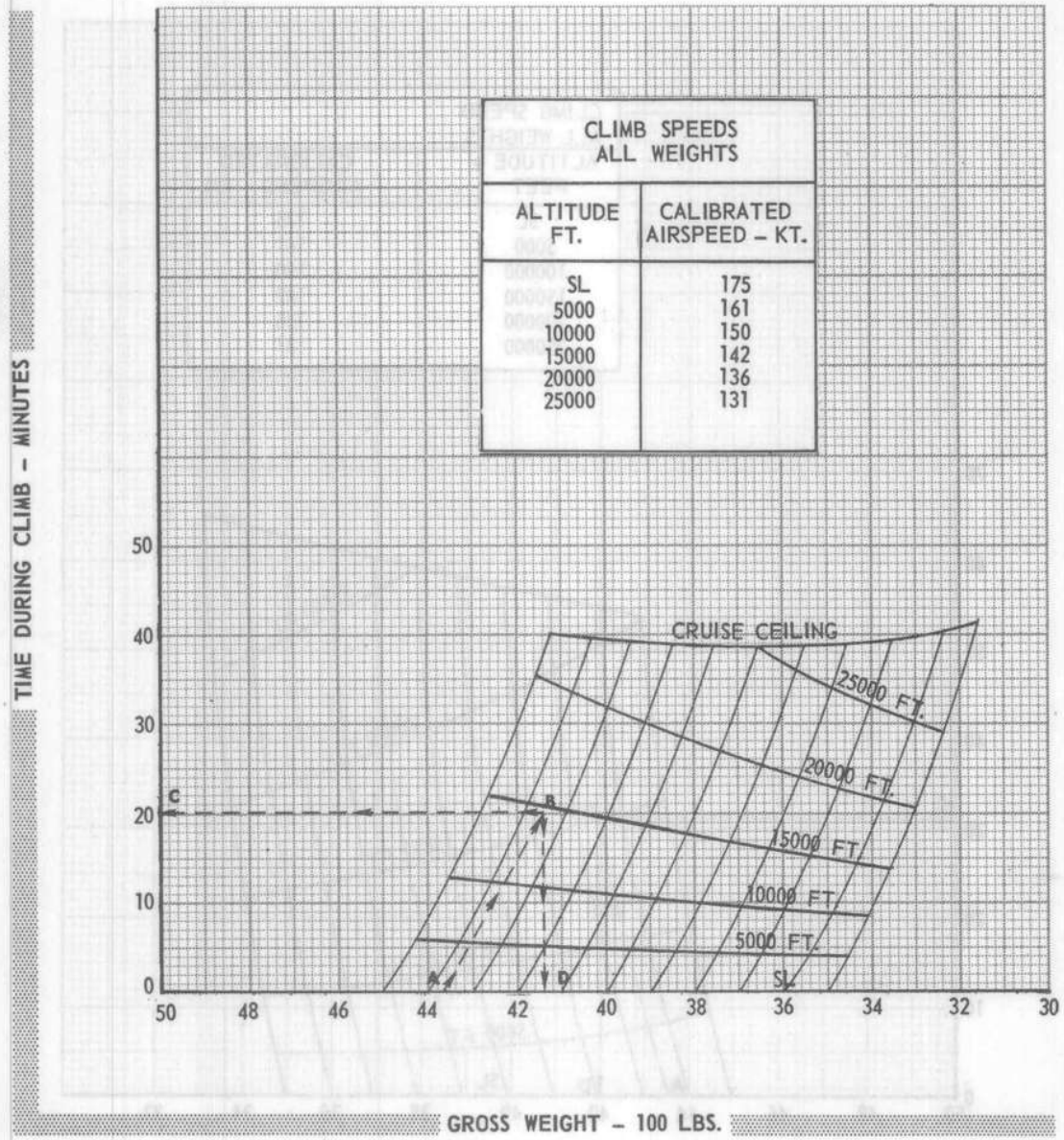


Figure A-12

CLIMB-MAXIMUM THRUST

100 PER CENT RPM

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT DATA
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

TIME

CLIMB SPEEDS ALL WEIGHTS	
ALTITUDE – FT.	CALIBRATED AIRSPEED – KN.
SL	175
5000	161
10000	150
15000	142
20000	136
25000	131

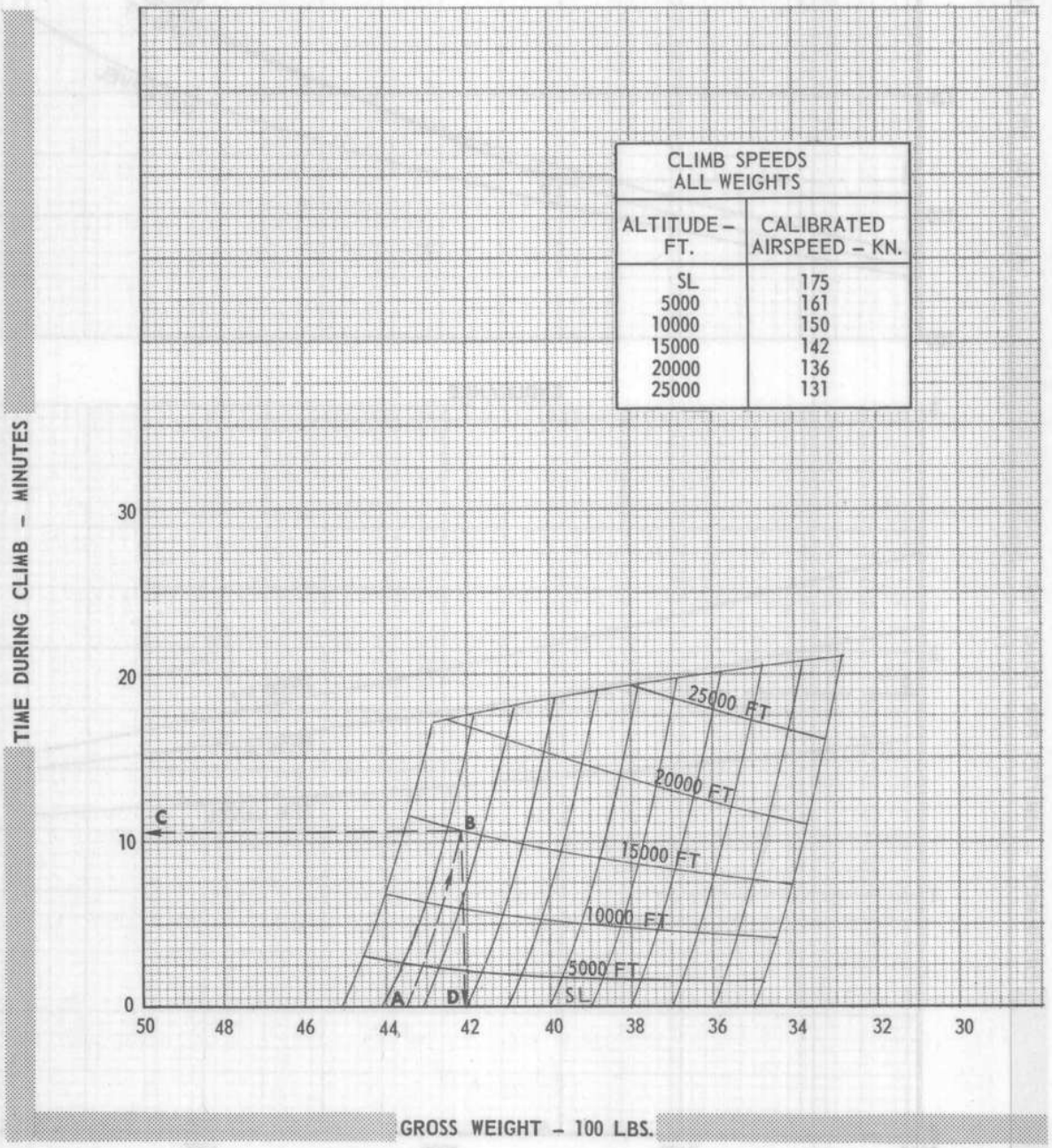


Figure A-13

ENDURANCE-LEVEL FLIGHT

MODEL: TT-1
DATA BASIS: FLIGHT TEST
DATE: 15 AUGUST 1958

STANDARD DAY
CLEAN CONFIGURATION

ENGINE J69-T-2
FUEL GRADE JP-4
FUEL DENSITY 6.5 LB/GAL

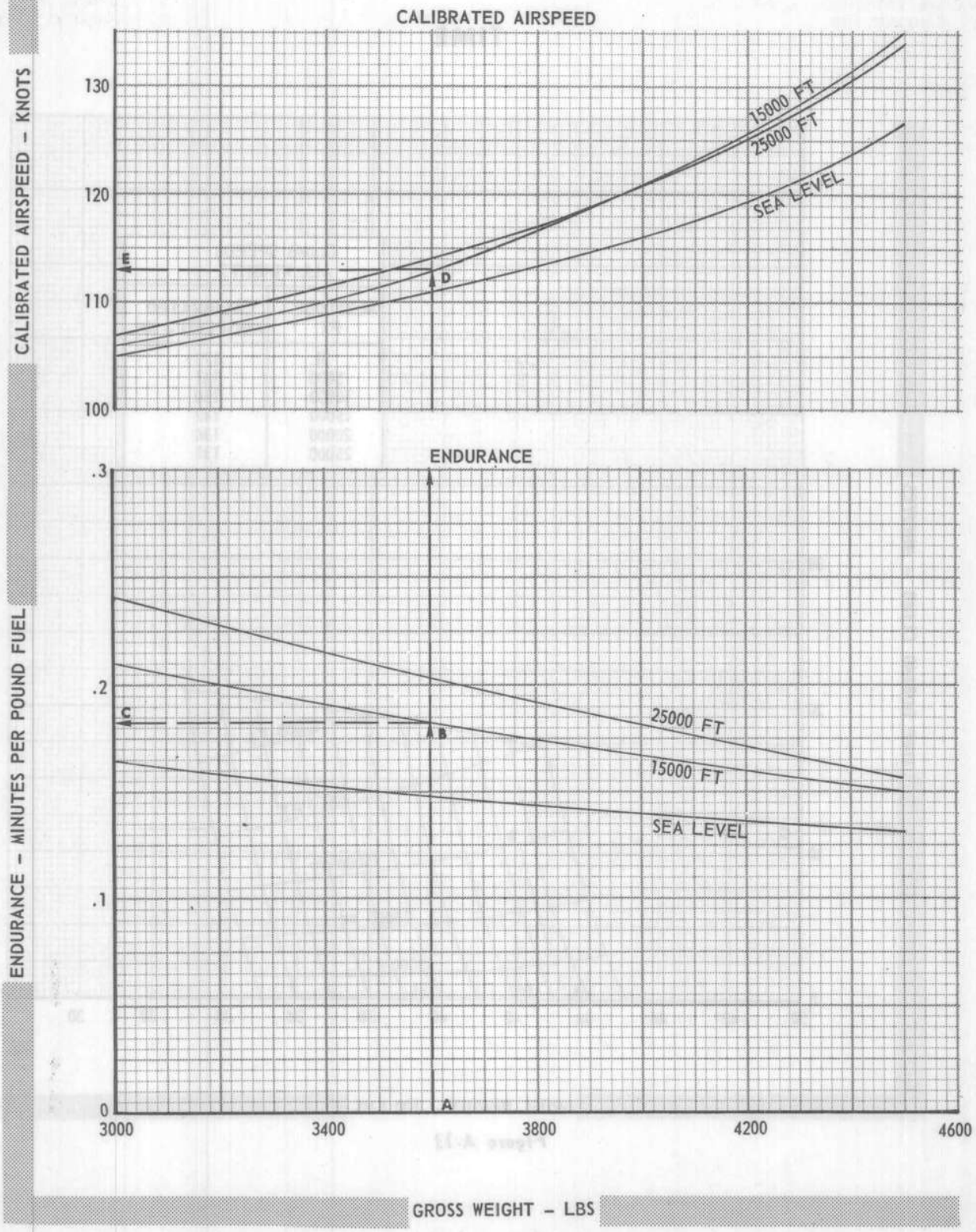


Figure A-14

NAUTICAL MILES PER POUND OF FUEL SEALEVEL

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT DATA
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

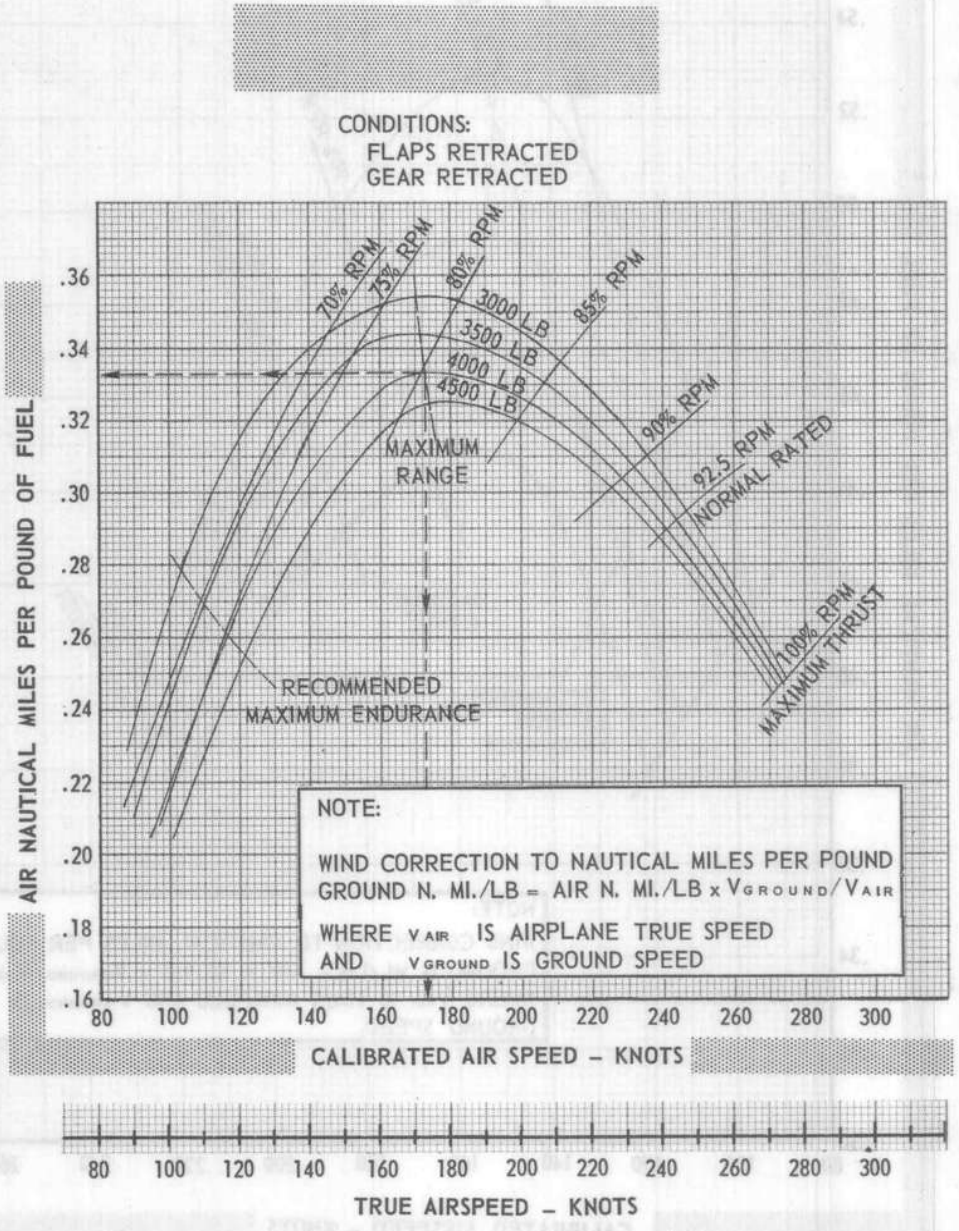


Figure A-15

NAUTICAL MILES PER POUND OF FUEL-15,000 FT

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT
DATA: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

CONDITIONS:
FLAPS RETRACTED
GEAR RETRACTED

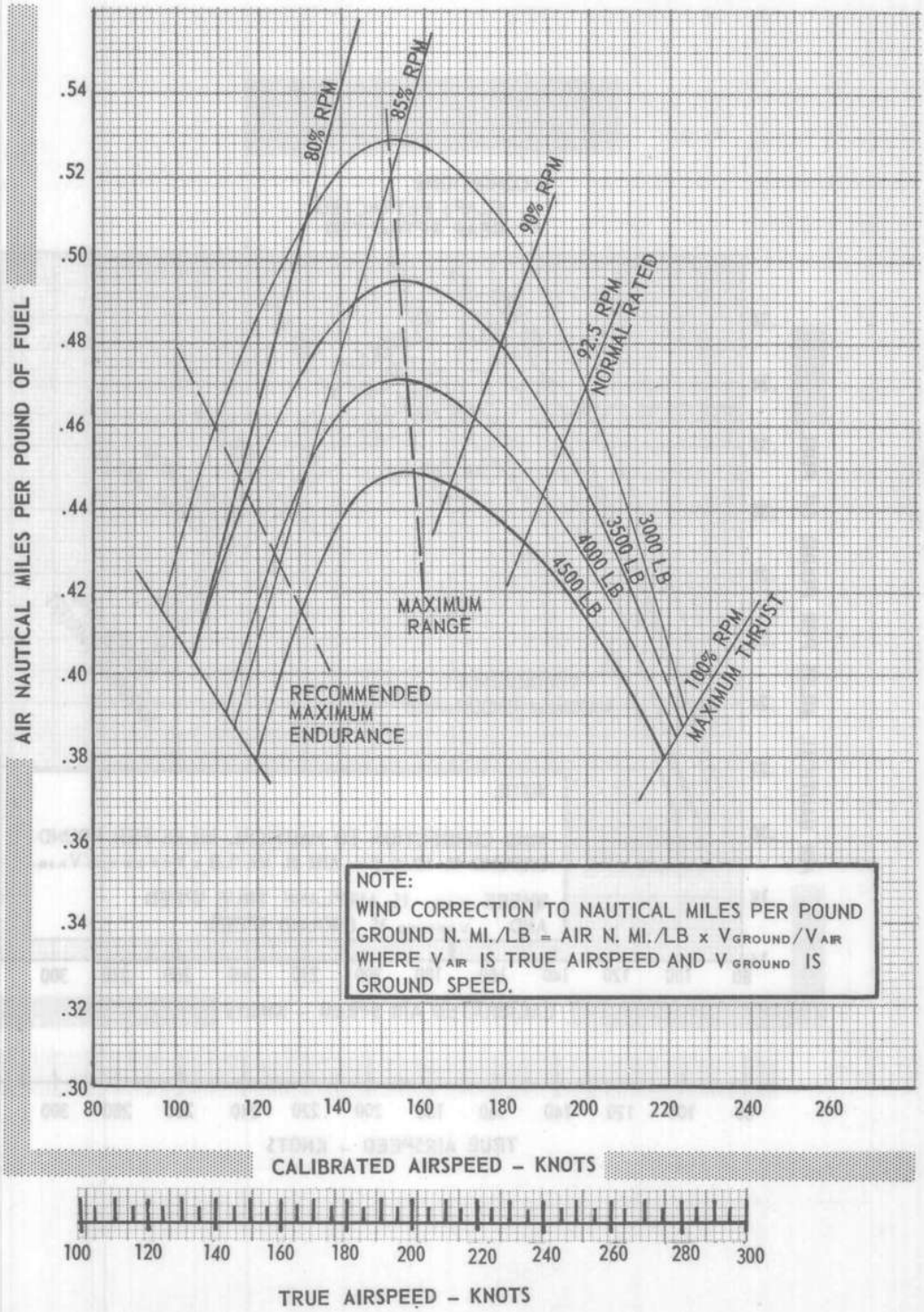


Figure A-16

NAUTICAL MILES PER POUND OF FUEL - 20,000 FT

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT
DATE: 15 AUGUST 1958

CONDITIONS:
FLAP RETRACTED
GEAR RETRACTED

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

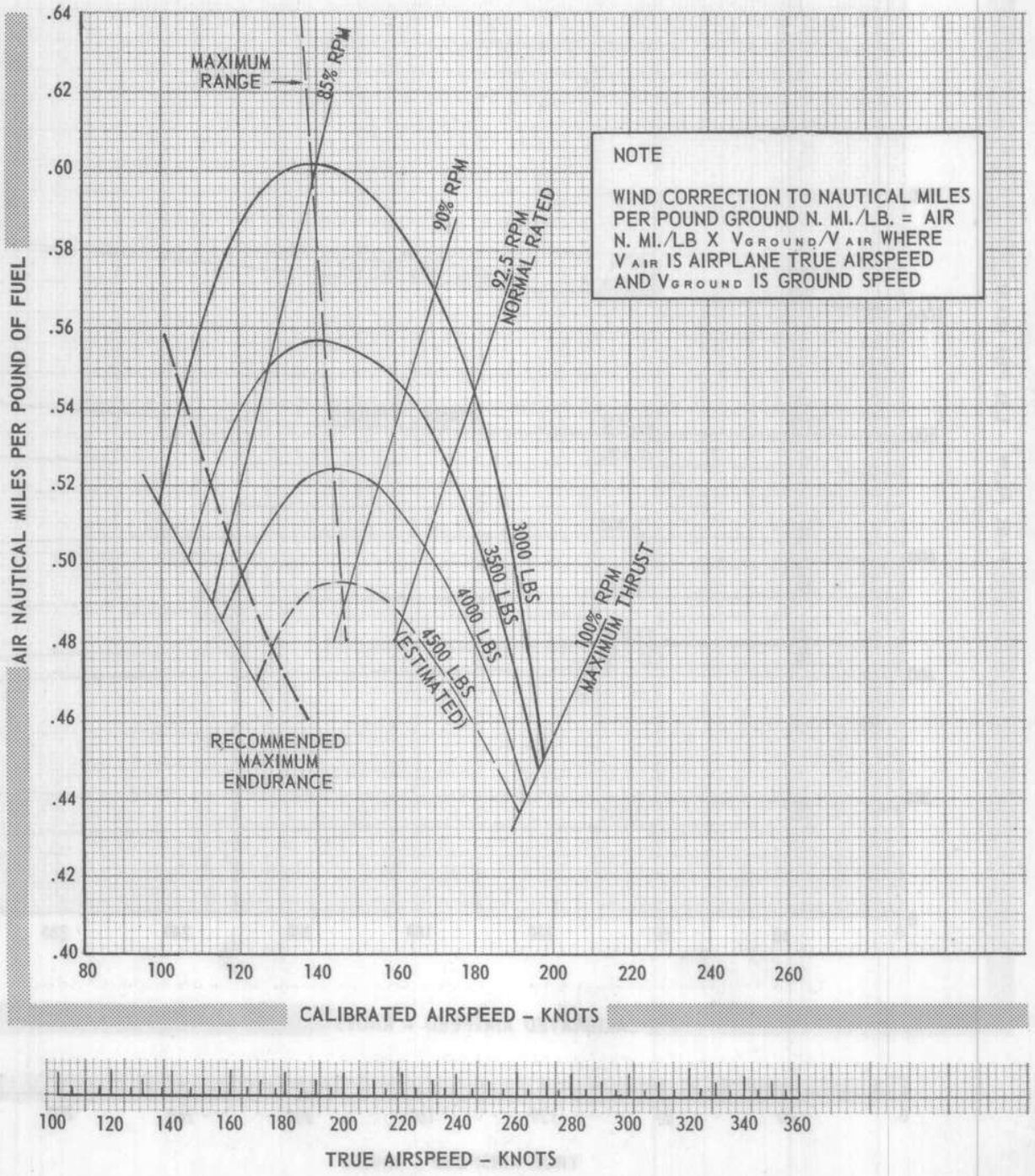


Figure A-17

FUEL FLOW-SEA LEVEL

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY 6.5 LB/GAL

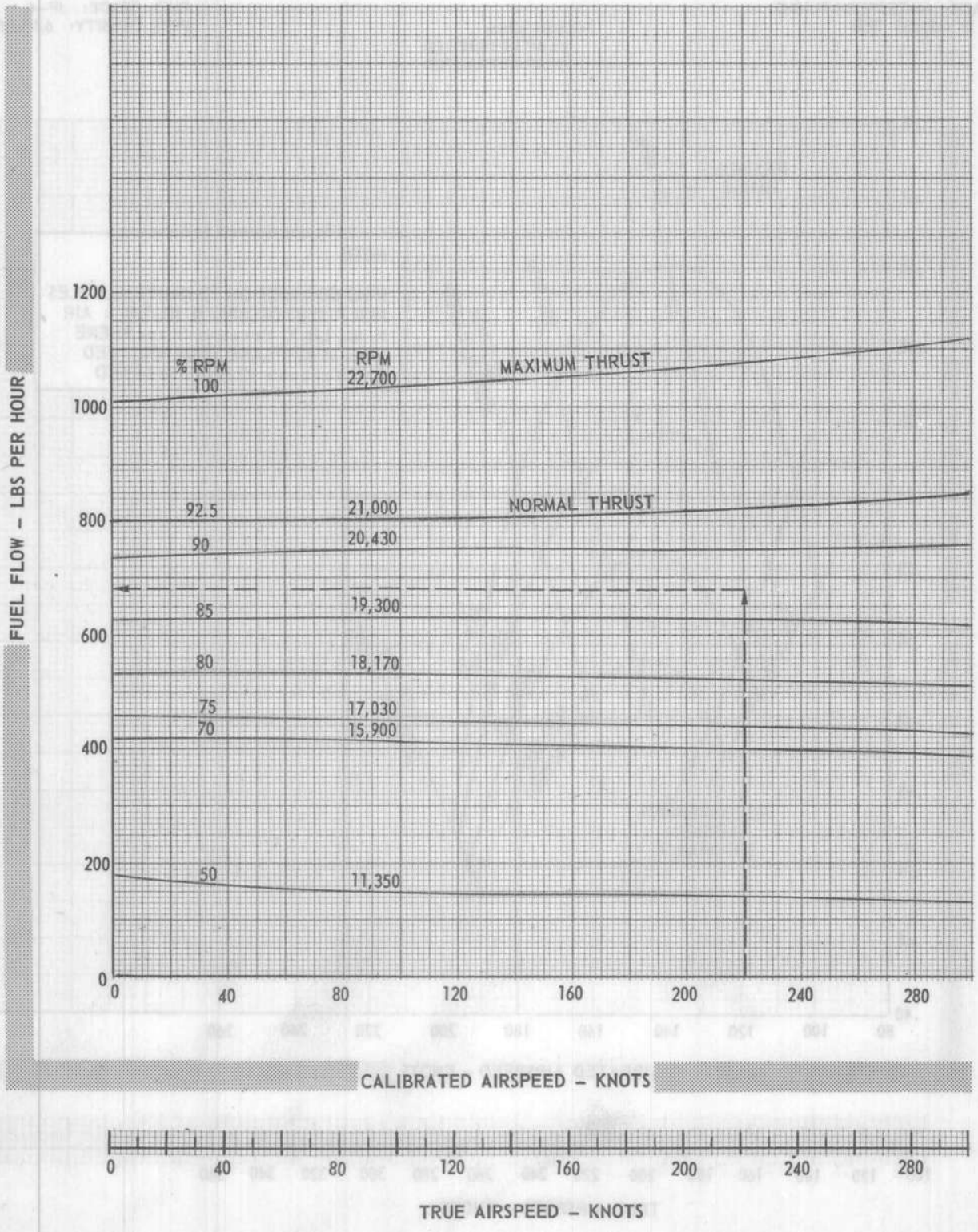


Figure A-18

FUEL FLOW-15,000 FT

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT DATA
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

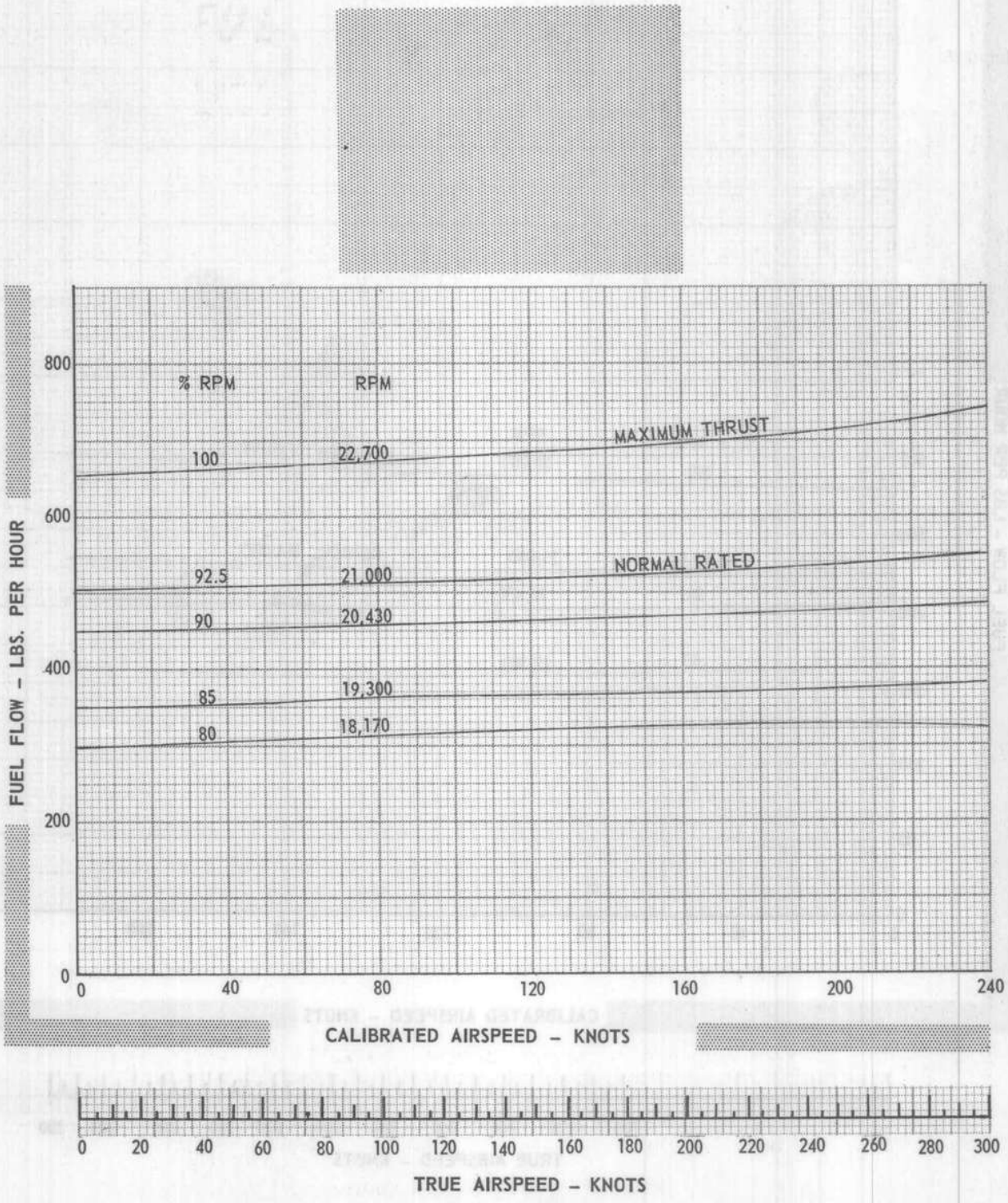


Figure A-19

FUEL FLOW-20,000 FT

MODEL: TT-1
DATA BASIS: NATESTCEN FLIGHT
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

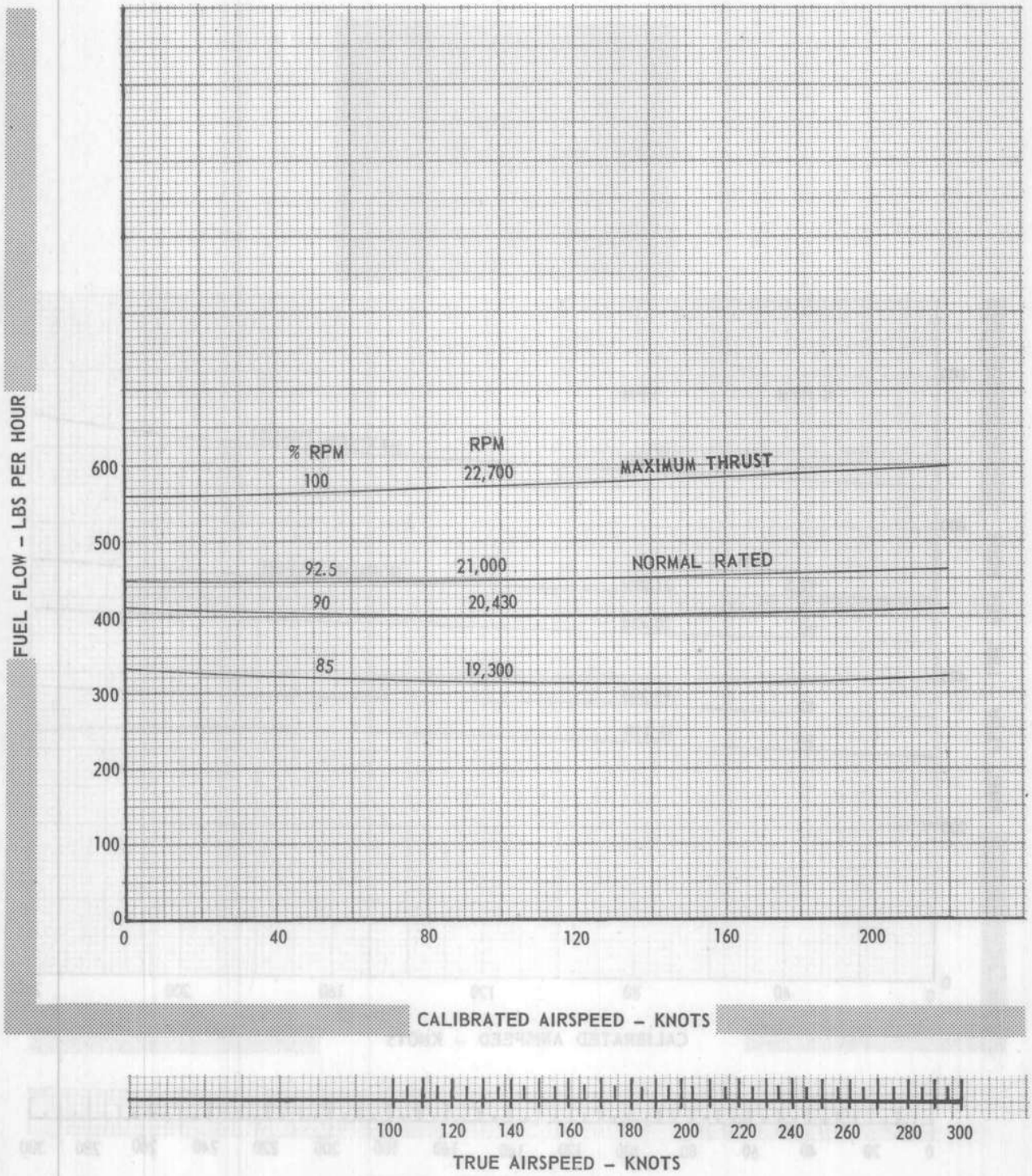


Figure A-20

DESCENT - MAXIMUM RANGE

MODEL: TT-1
DATA BASIS: FLIGHT TEST
DATE: 15 AUGUST 1958

GROSS WEIGHT 4000LBS
CLEAN CONFIGURATION IDLE RPM

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

RECOMMENDED SPEED – 121 KT CAS

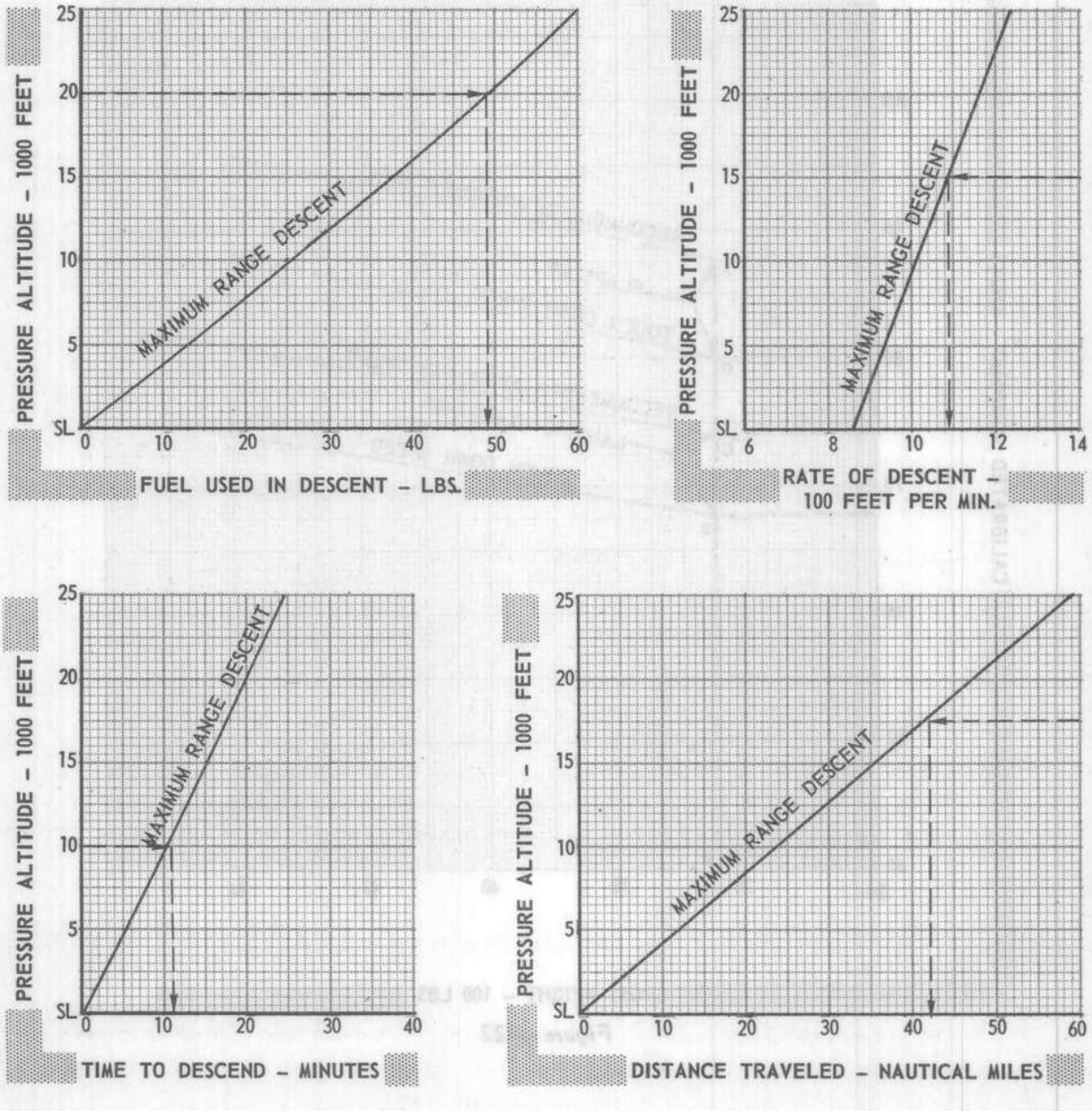


Figure A-21

LANDING SPEEDS

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

GEAR DOWN

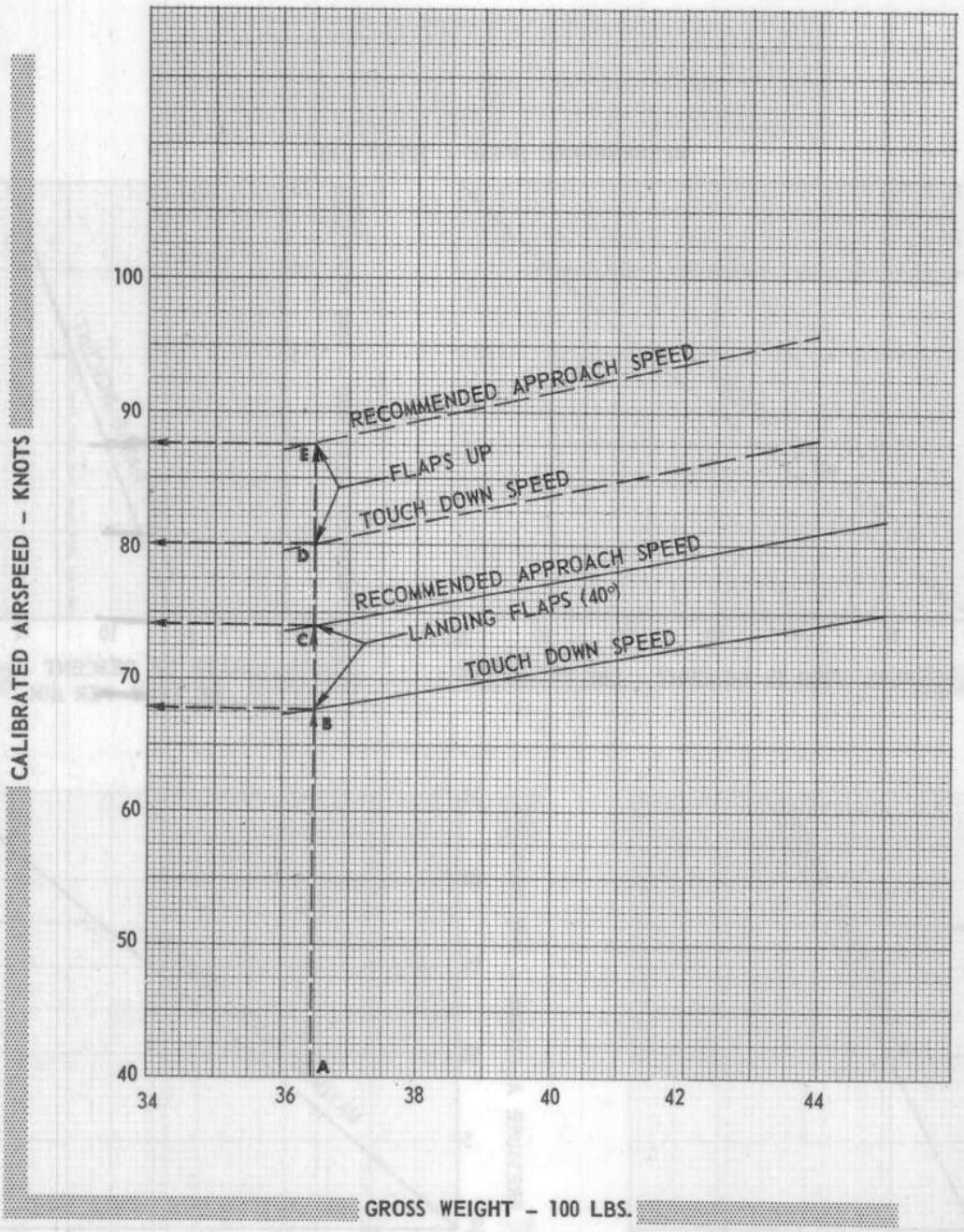


Figure A-22

LANDING DISTANCE

MODEL: TT-1
DATA BASIS: ESTIMATED
DATE: 15 AUGUST 1958

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

FLAP DEFLECTION-40°

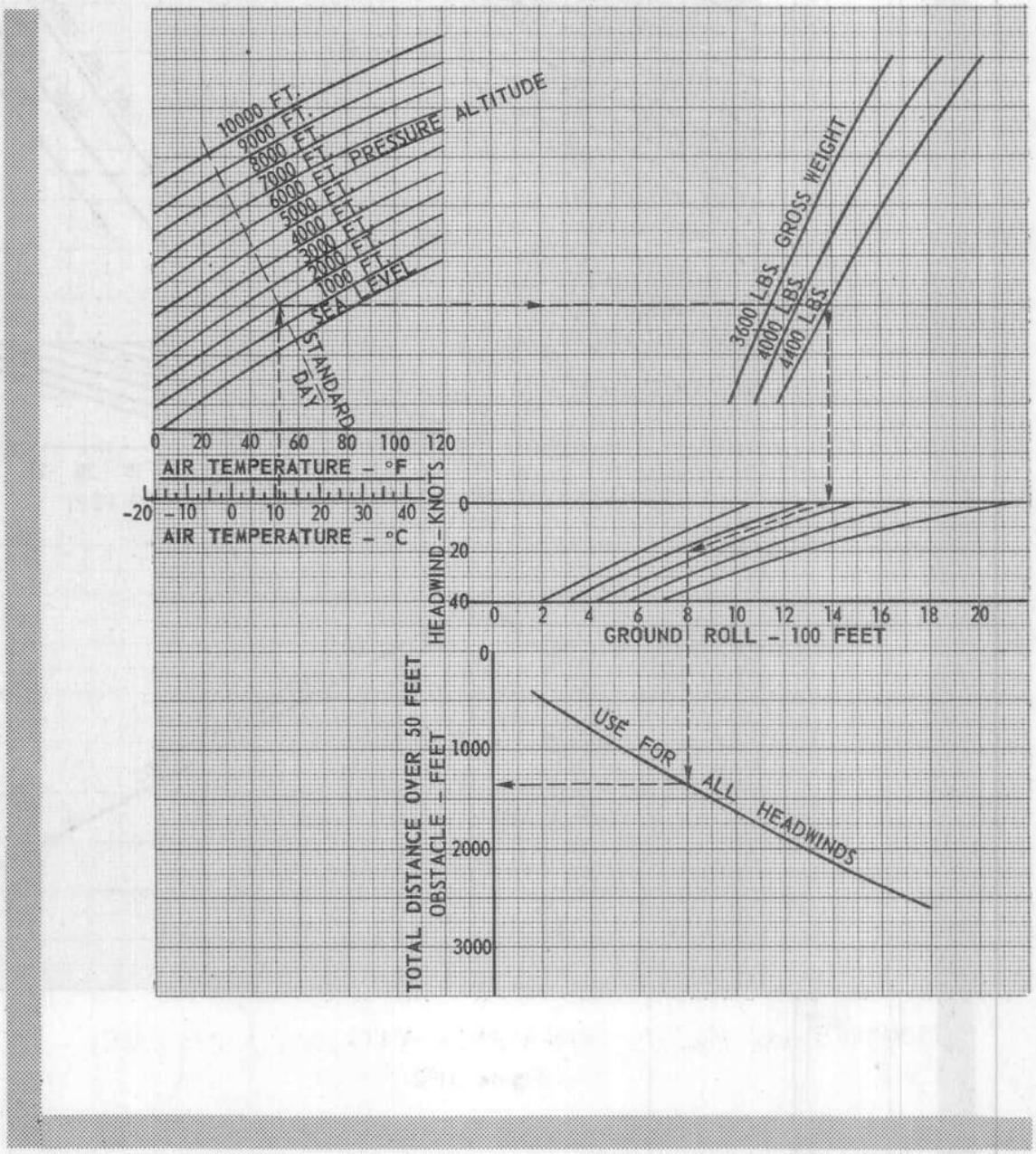


Figure A-23

LANDING DISTANCE

MODEL: TT-1
DATA BASIS: ESTIMATES
DATE: 15 AUGUST 1958

NO FLAPS

ENGINE: J69-T-2
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

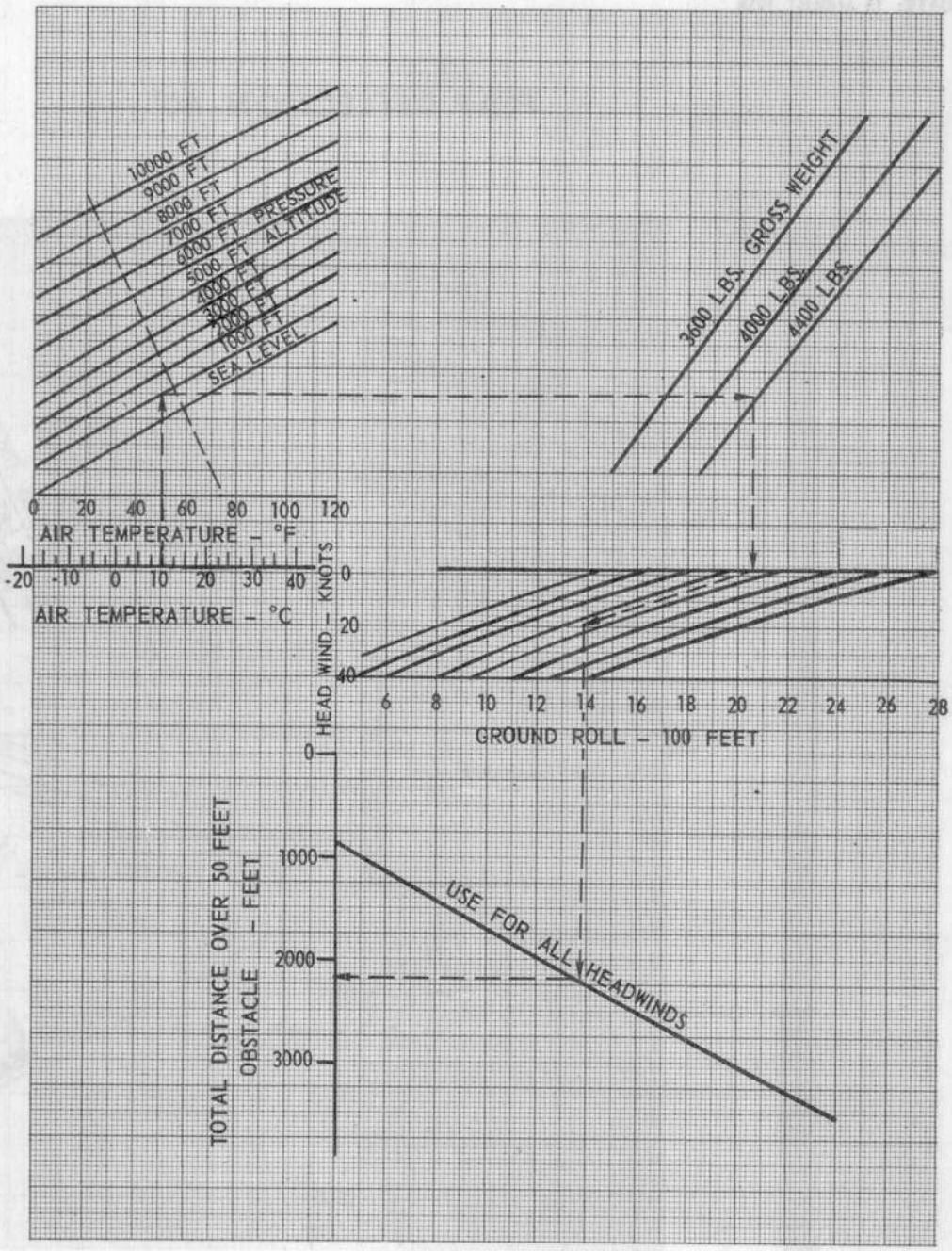


Figure A-24



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