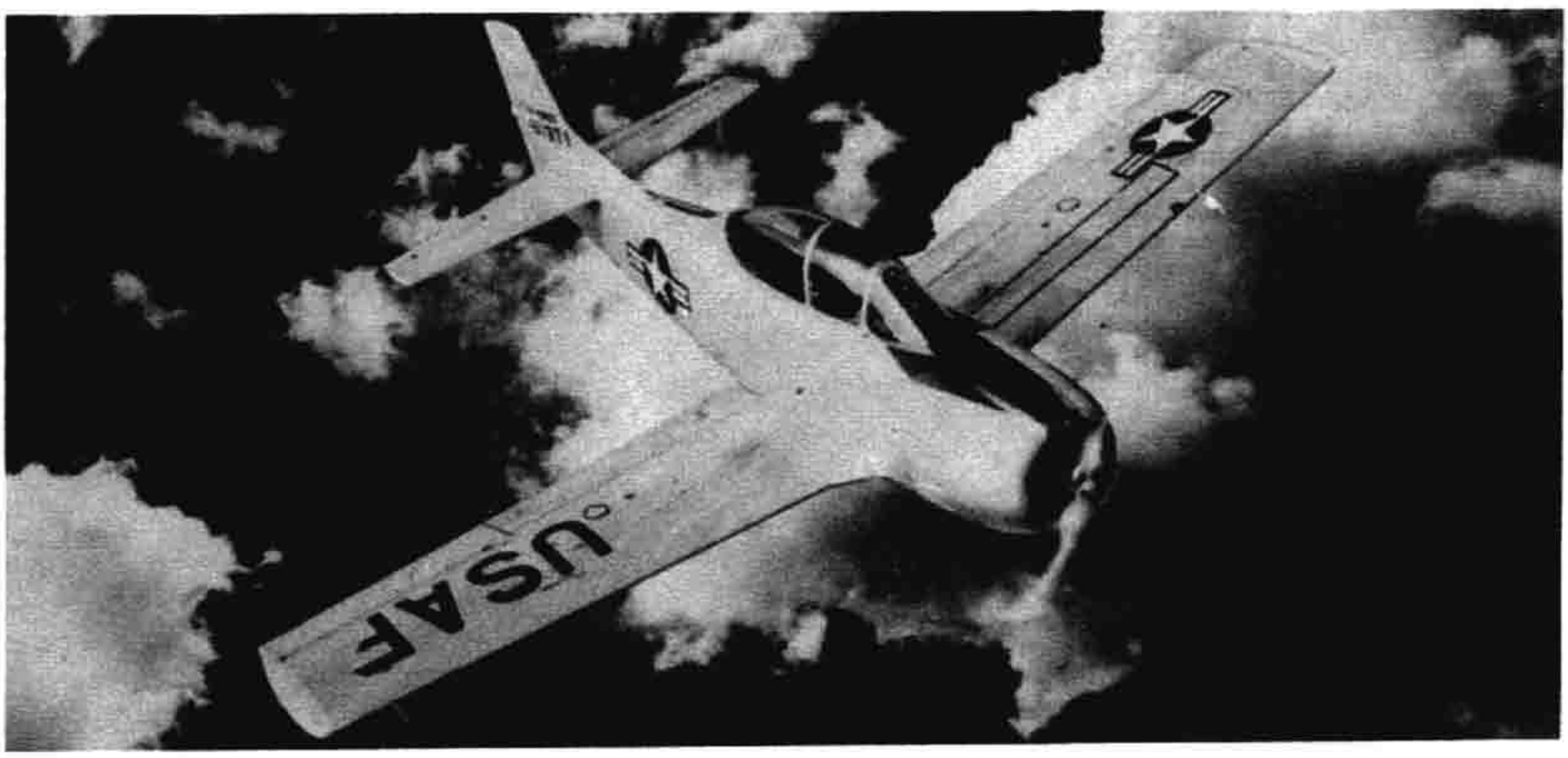
AN 01-60FGA-1

HANDBOOK
FLIGHT OPERATING INSTRUCTIONS

USAF SERIES
T-28A
AIRCRAFT



REVISION NOTICE

LATEST REVISED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE

Insert revised pages into basic publication. Destroy superseded pages.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE
AND THE CHIEF OF THE BUREAU OF AERONAUTICS

Gartner Printing & Litho Co. — 4648 — 12-15-51

10 APRIL 1951
REVISED 25 OCTOBER 1951

LIST OF REVISED PAGES ISSUED

INSERT LATEST REVISED PAGES. DESTROY SUPERSEDED PAGES.

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

Page No.	*Date of Latest Revision*
*i	25 October 1951
*ii	25 October 1951
1	25 June 1951
2	25 June 1951
6A	25 June 1951
6B	25 June 1951
7	25 June 1951
9	25 June 1951
10	25 June 1951
11	25 June 1951
*12A	25 October 1951
*13	25 October 1951
*14	25 October 1951
15	25 June 1951
*21	25 October 1951
22	25 June 1951
23	25 June 1951
*25	25 October 1951
27	25 June 1951
29	25 June 1951
30	25 June 1951
31	25 June 1951
*34	25 October 1951
*34A	25 October 1951
35	25 June 1951
36	25 June 1951
37	25 June 1951
38	25 June 1951
39	25 June 1951
40	25 June 1951
41	25 June 1951
42	25 June 1951
*43	25 October 1951
44	25 June 1951
50	25 June 1951
50A	25 June 1951
50B	25 June 1951
52	25 June 1951
54	25 June 1951
55	25 June 1951
56	25 June 1951
*56A	25 October 1951
*57	25 October 1951
*65	25 October 1951
*66	25 October 1951
*66A	25 October 1951
*67	25 October 1951
*68	25 October 1951
*70	25 October 1951
76	25 June 1951
77	25 June 1951

* The asterisk indicates pages revised, added or deleted by the current revision.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

USAF ACTIVITIES.—In accordance with Technical Order No. 00-5-2.
NAVY ACTIVITIES.—Submit request to nearest supply point listed below, using form NavAer-140: NAS, Alameda, Calif.; ASD, Orote, Guam; NAS, Jacksonville, Fla.; NAS, Norfolk, Va.; NASD, Oahu; NASD, Philadelphia, Pa.; NAS, San Diego, Calif.; NAS, Seattle, Wash.
For listing of available material and details of distribution see Naval Aeronautics Publications Index NavAer 00-500.

USAF

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

This handbook contains all information necessary for safe and efficient operation of the T-28A Airplane. These instructions are not intended to teach basic principles of flight, but are designed to provide you with a general knowledge of the airplane, its flight characteristics, and specific normal and emergency procedures to be used in operating the airplane and its related equipment.

The instructions are based on engineering reports and on flight observations by Air Force and manufacturer's test pilots. Every effort has been made to make the handbook easy to read and assimilate. Read the complete book for an over-all picture of the airplane; use it as a reference manual to answer specific questions. Remember that changes are made on the airplane from time to time, therefore making it necessary to revise the Handbook of Flight Operating Instructions frequently to reflect changes affecting operating procedures. In addition, changes affecting the airplane or flight procedures are issued immediately as short Technical Orders that supersede the handbook. These short Technical Orders are distributed as soon as the change is effective. The short Technical Orders carry the same basic number as the Handbook of Flight Operating Instructions, 01-60FG and 01-60FGA series, and should be used to supplement the handbook regarding late modifications of the airplane. Consult your base Technical Order index to be sure you have the latest issue of the handbook and for effectivity of short Technical Orders. The handbook is divided into six sections and an appendix as follows:

Section I, DESCRIPTION—a detailed picture of the airplane, its equipment, systems, and all controls which are essential to flight and which will be needed for complete contact flight. Also included is a description of all emergency and miscellaneous equipment which is not part of the operational equipment.

Section II, NORMAL OPERATION—operating instructions arranged in proper sequence from the time the airplane is approached by the pilot until it is left parked on the ramp after the completion of a routine flight. Instructions on turbulent air and thunderstorm flying are also included in this section.

Section III, EMERGENCY OPERATION—concise instructions to be followed in meeting any emergency (except those in connection with the operational equipment) that could reasonably be expected.

Section IV, OPERATIONAL EQUIPMENT—description of, and operating instructions for, all equipment not essential for flying the airplane, such as cockpit heating and ventilating, communications, oxygen, and armament. While operational equipment which is interchangeable in many different types of airplanes is not covered in detail, all instructions concerning the operation of auxiliary equipment peculiar to this airplane have been emphasized.

Section V, EXTREME WEATHER OPERATION—proper technique and procedure to follow under extremely cold or hot weather conditions. This section is designed to serve as a supplement to normal operating procedures and provides all necessary instructions to be followed, in conjunction with the procedures contained in section II, for satisfactory extreme weather operation.

Section VI, FLIGHT CHARACTERISTICS—a discussion of flight characteristics based on data compiled from extensive flight test. Complete descriptions of stalls, spins, dives, and recovery techniques are emphasized to cover all phases of basic maneuvers.

Appendix I, OPERATING DATA—all operating data charts for efficient flight planning. Complete data is supplied for obtaining best climb and descent airspeeds and necessary cruise control information with or without external load. Also included are take-off and landing charts for various gross weights and field elevations.

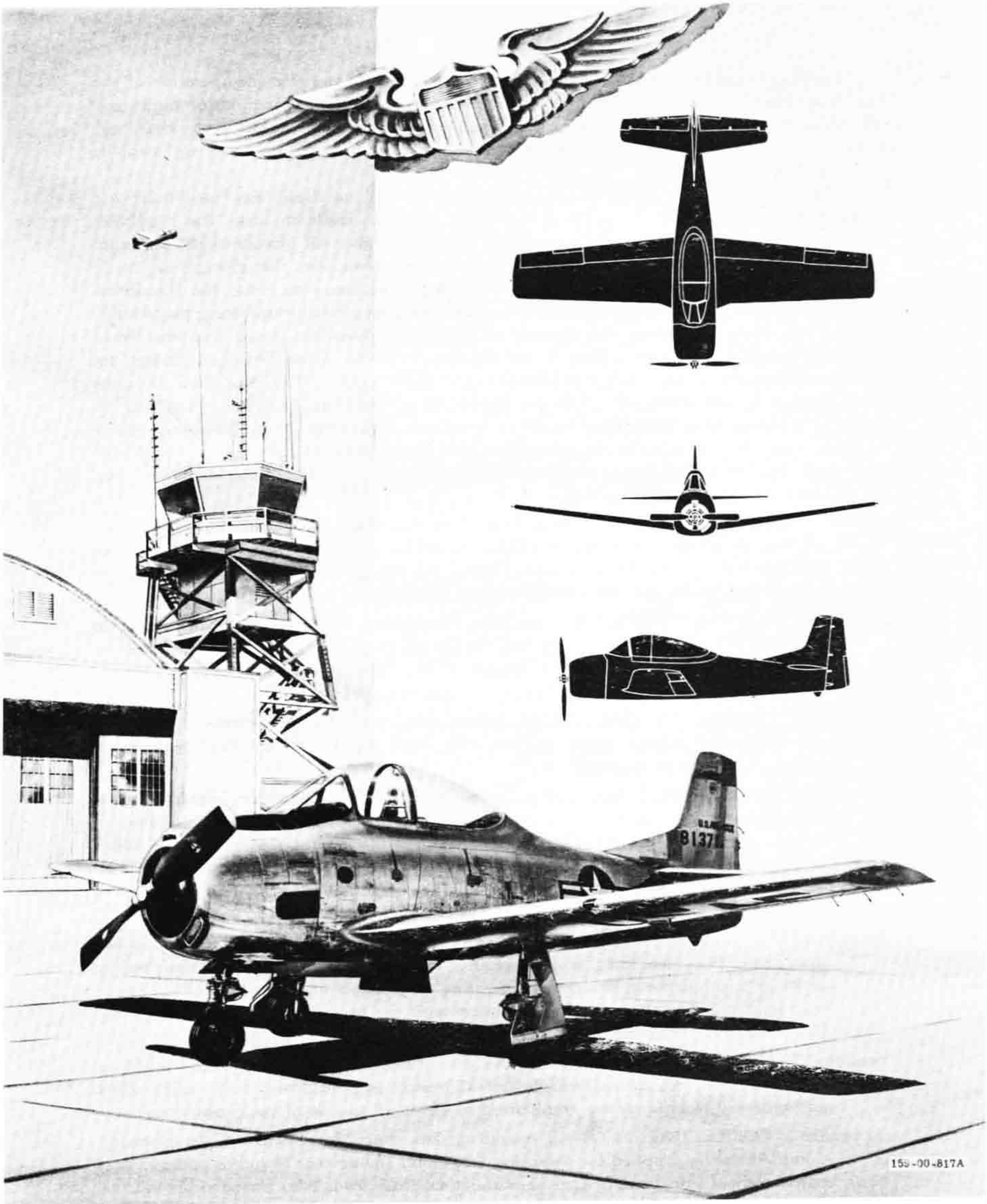


Figure 1-1. T-28A Airplane

DESCRIPTION

159-0-309

1-1. AIRPLANE.

1-2. GENERAL.

1-3. The T-28A, built by North American Aviation, is a two-place trainer equipped with dual controls, tricycle landing gear, and steerable nose wheel, and powered by a Wright Cyclone engine. The student sits in the front cockpit, the instructor in the rear cockpit, but solo flight is permissible only from the front cockpit. For armament training, the airplane may be interchangeably equipped with two machine guns, two bombs (or a cluster of practice bombs), or six rockets, all of which are carried externally under the wings. Whenever armament is carried, an A-1CM sight and an armament control panel are installed in the front cockpit. A speed brake is installed in the bottom of the fuselage on two airplanes (AF48-1371 and AF49-1500), and provisions for the installation are made in all airplanes.

1-4. AIRPLANE DIMENSIONS.

1-5. Over-all dimensions of the airplane are:

Length	32.0 feet
Wing span	41.0 feet
Height (to top of rudder)	12.6 feet

1-6. AIRPLANE GROSS WEIGHT.

1-7. The normal gross weight of the airplane is approximately 6909* (7282†) pounds, with full fuel tanks. Maximum take-off and landing gross weight is approximately 7751 pounds, which includes externally mounted guns and ammunition.

1-8. INTERCOCKPIT CONTROL.

1-9. All instruments essential to flight are duplicated in each cockpit so that the airplane can be flown by either pilot on dual flights. However, to provide independent and complete control of certain systems by one pilot at a time, a spring-loaded control shift switch is installed in each cockpit (fig. 1-18). Momentary actuation of this toggle switch transfers control of the following: battery, generator, inverters, starter, cowl and oil cooler flaps, speed brake, and all external lights. A light adjacent to the switch illuminates when control is obtained in that cockpit, and the units will assume the operating condition of the switches in the cockpit to which control is transferred. The shift switch in the rear cockpit can be held on to override operation of the switch in the front cockpit. The command radio and the range receiver (when installed) are both provided with separate,

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**

†Airplanes AF51-3463 and subsequent

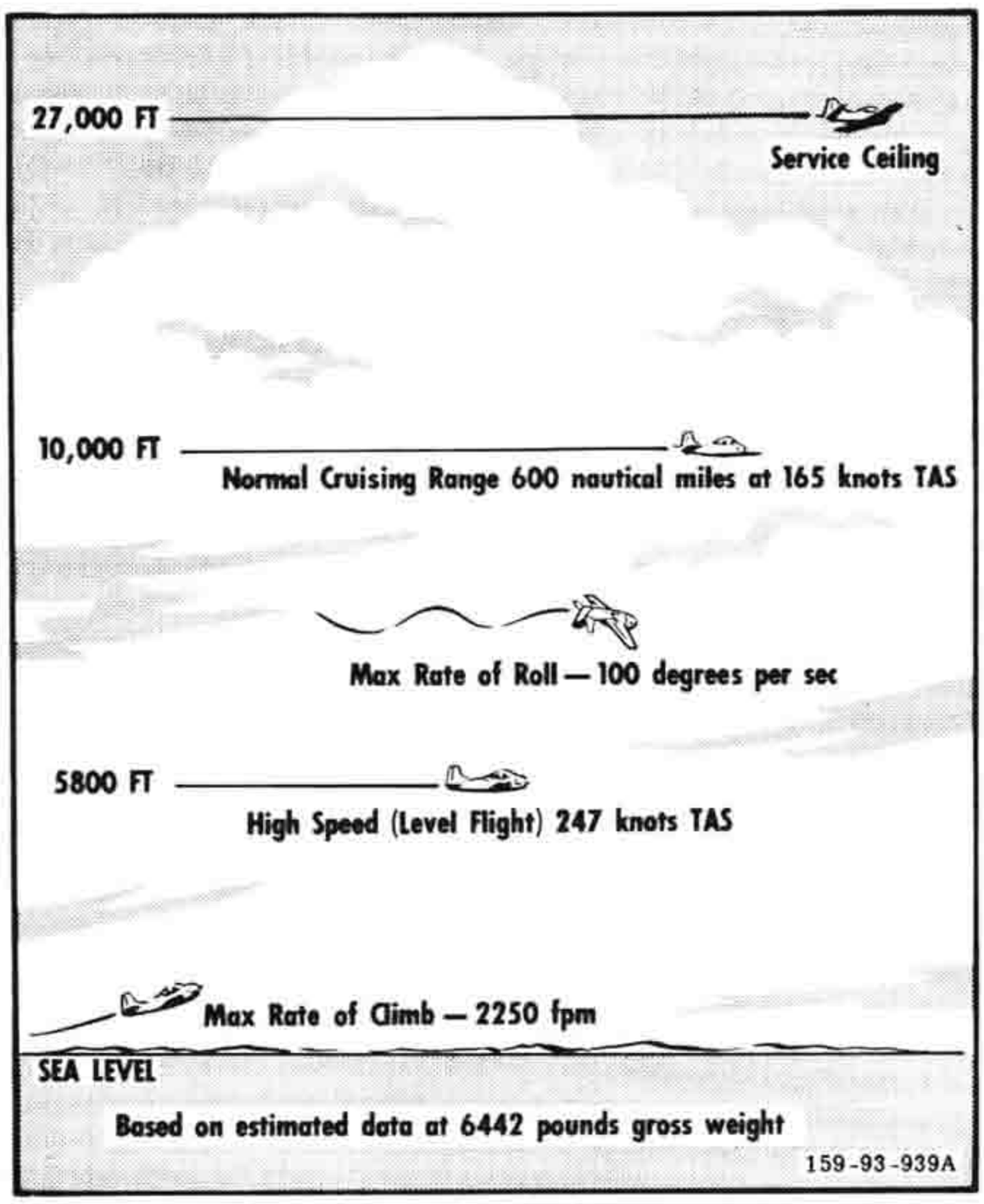


Figure 1-2. Performance

two-position control shift switches and indicator lights for transferring control.

1-10. ENGINE.

1-11. GENERAL.

1-12. The airplane is powered by a Wright Cyclone seven-cylinder, air-cooled, radial engine, Model R-1300-1. The engine develops 800 horsepower and, in addition, engine exhaust ports are connected on both sides of the cowling to utilize the additional thrust available from the jet effect of the exhaust. The engine is equipped with a direct-cranking starter and an injection-type carburetor incorporating an electric primer valve.

1-13. ENGINE CONTROLS.

1-14. Throttle, mixture, and carburetor air controls are on the left side of each cockpit, and are interconnected between cockpits to move simultaneously. Each control handle is shaped differently to permit the pilot to identify it by feel. A friction lock knob on the inboard face of the quadrant in the front cockpit (fig. 1-3) is rotated clockwise to increase friction of the throttle, propeller, and mixture controls. Engine cylinder head and oil temperature are controlled simultaneously by electrically actuated cowl and oil cooler flaps.

1-15. THROTTLE. A throttle is mounted on the quadrant at the left side of each cockpit (fig. 1-3). A take-off stop is provided in the quadrant so that the pilot can feel when the throttle has been advanced to take-off power (at sea level). The throttle can be pushed through the stop at altitudes above sea level to obtain full throttle travel. Incorporated in the throttle grip are an interphone button, a microphone button, and a speed brake switch when the brake is installed. A sight gyro caging button is installed on the throttle grip in the front cockpit, and rotation of the throttle grip operates manual ranging of the sight.

Note

A control lock is provided in the front cockpit which not only locks the surface controls but also locks the throttle in the "CLOSED" position.

1-16. MIXTURE CONTROL. The mixture control on the quadrant in each cockpit (fig. 1-3) provides for selection of two automatic mixture positions, "RICH" or "NORMAL," and an "IDLE CUTOFF" position for shutting off fuel flow at the carburetor to stop the engine. The "RICH" position is used for all ground operation and for take-off and landing. The "RICH" position is also used during any descent to prevent possible engine cutout. The "NORMAL" setting is used for all other flight conditions.

1-17. CARBURETOR AIR CONTROL. The carburetor air control is located below the throttle quadrant in each cockpit (11, fig. 1-7; 9, fig. 1-10). When the control is in the "COLD AIR" position, all carburetor air is admitted through the ram air scoop in the leading

Figure 1-3. Throttle Quadrant

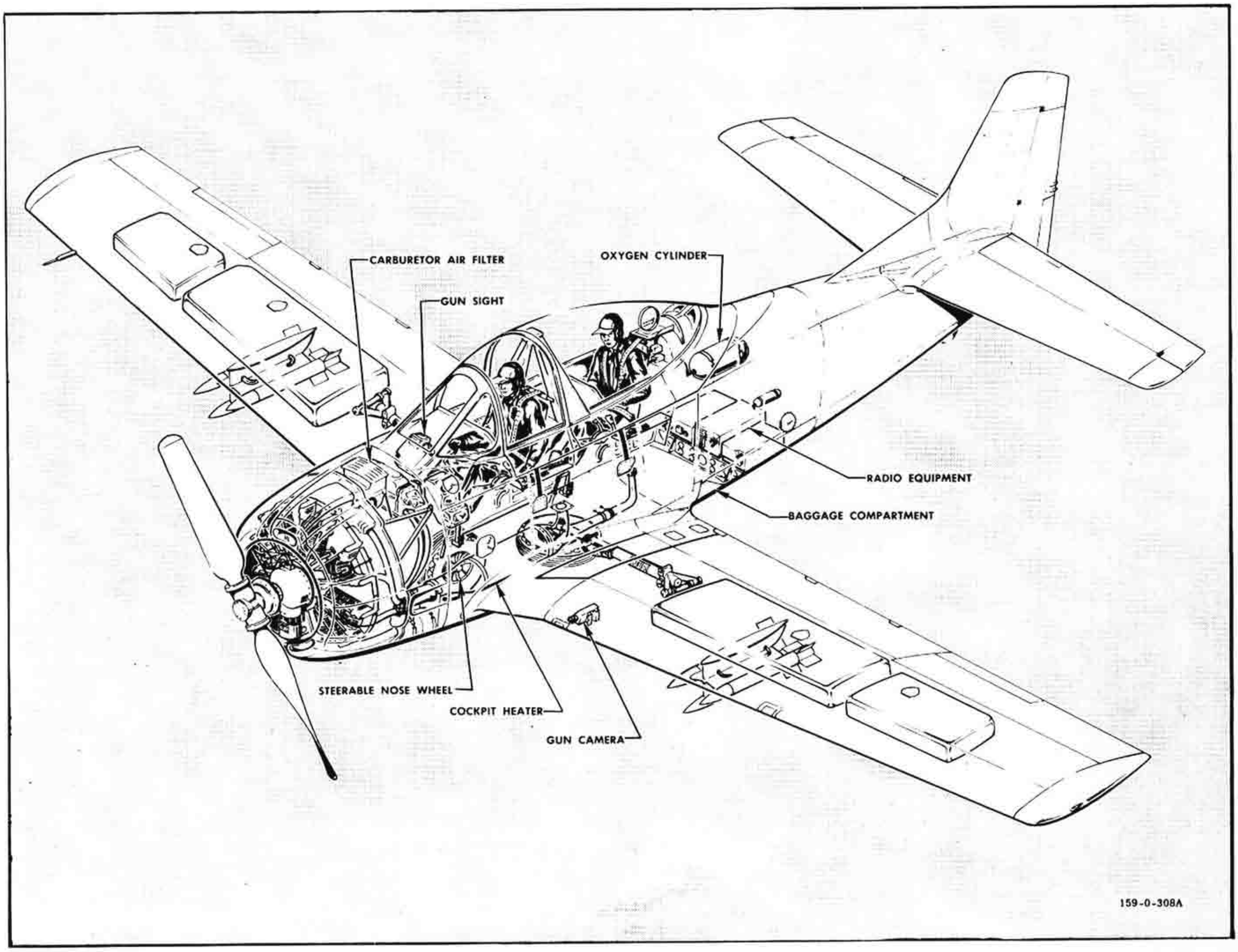


Figure 1-4. General Arrangement

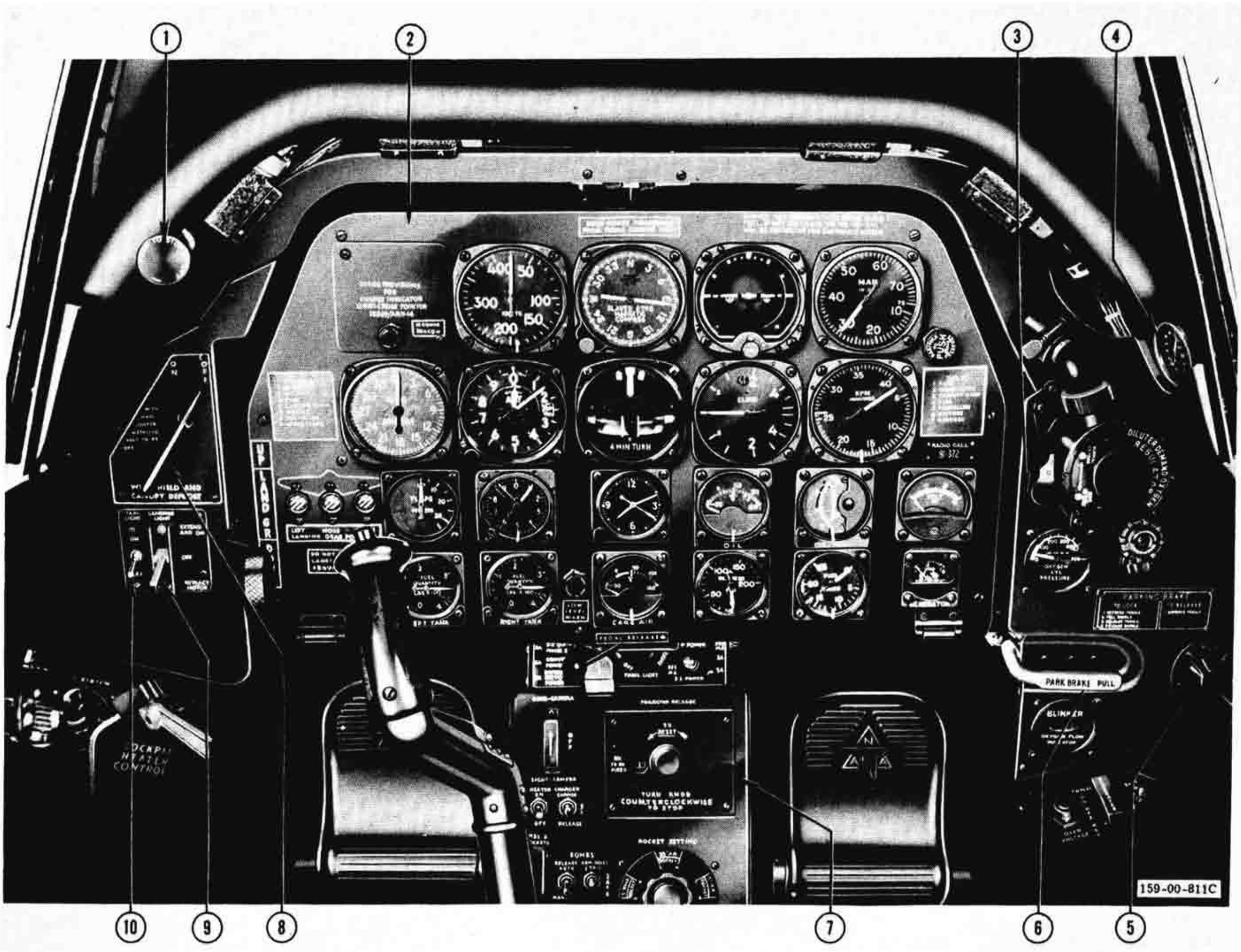
edge of the cowling. As the control is moved through the "WARM" sector, hot air from a muff around the exhaust collector ring is mixed with cold ram air to obtain the desired air inlet temperature. At the full "HOT AIR" position, the ram air duct is closed and hot air only is drawn into the carburetor. Moving the control to "FILTERED AIR" closes the ram- and hot-air ducts, allowing carburetor air to be drawn through a filter in the top of the cowling (fig. 1-13).

1-18. COWL AND OIL COOLER FLAP SWITCH. Both the cowl flaps and oil cooler flap are operated simultaneously by means of a single switch on the left console forward of the throttle quadrant in each cockpit (13, fig. 1-7; 11, fig. 1-10). To operate the flaps, the switch may be positioned at "OPEN" or held at the spring-loaded "CLOSED" position. Intermediate positions are selected by returning the switch to off. The flaps are operable from one cockpit at a time, depending upon which pilot last operated his control shift switch.

1-19. IGNITION SWITCH. A standard ignition switch is located on the right instrument subpanel in both cockpits (5, fig. 1-5; 1, fig. 1-11). Switch positions are "BOTH," "L," "R," and "OFF."

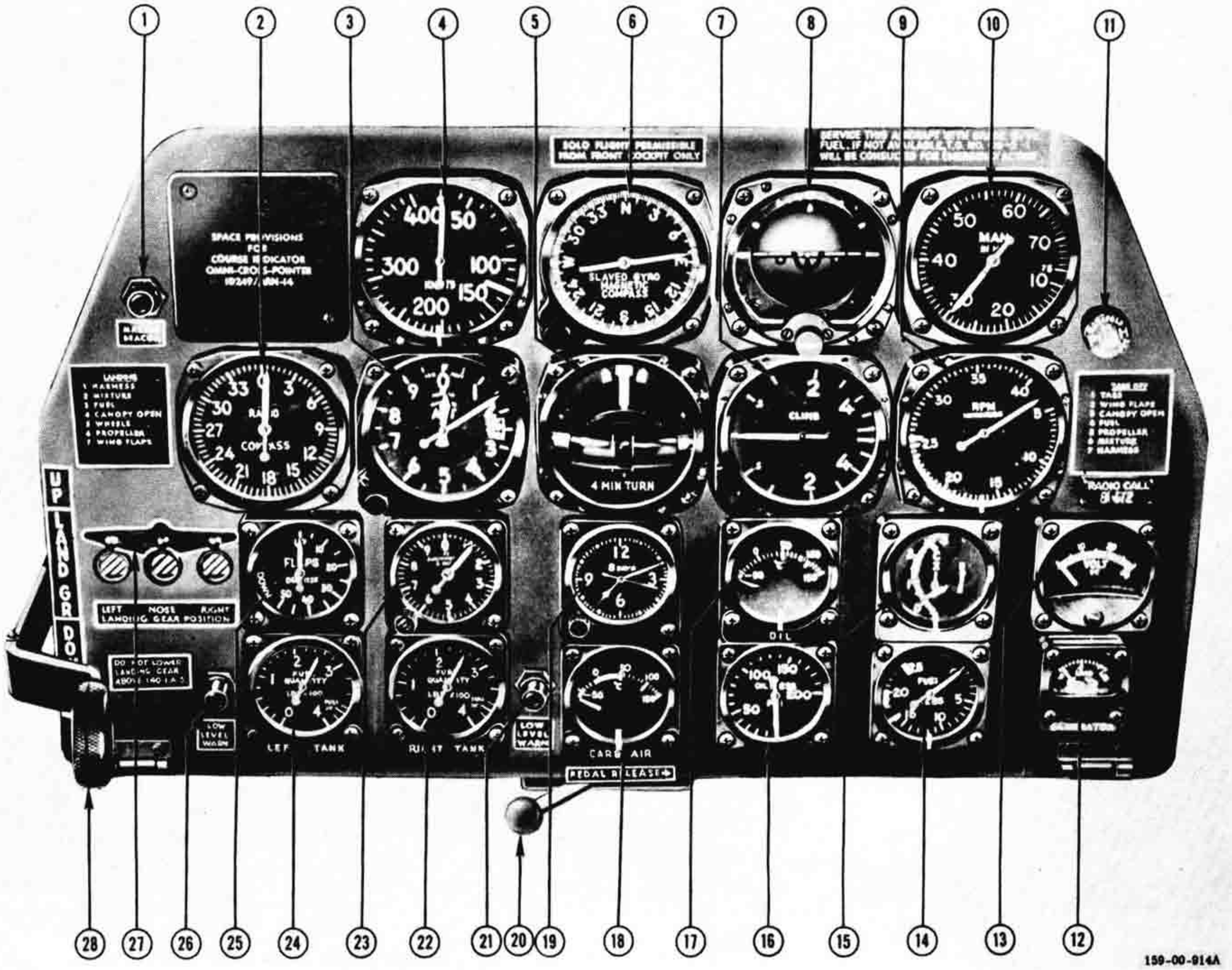
1-20. PRIMER BUTTON. The engine priming system is controlled by a push button on the right forward console (fig. 1-18). Depressing the primer button injects fuel into the engine blower section. Fuel booster pumps must be operating to provide pressure for operation of the primer.

1-21. STARTER BUTTON. The direct-cranking electric starter is controlled by a guarded push button on the right forward console in each cockpit (fig. 1-18). However, only one switch is operative at a time, depending upon which pilot last operated his control shift switch. Holding the starter button down operates the starter. The starter can be powered by the battery for



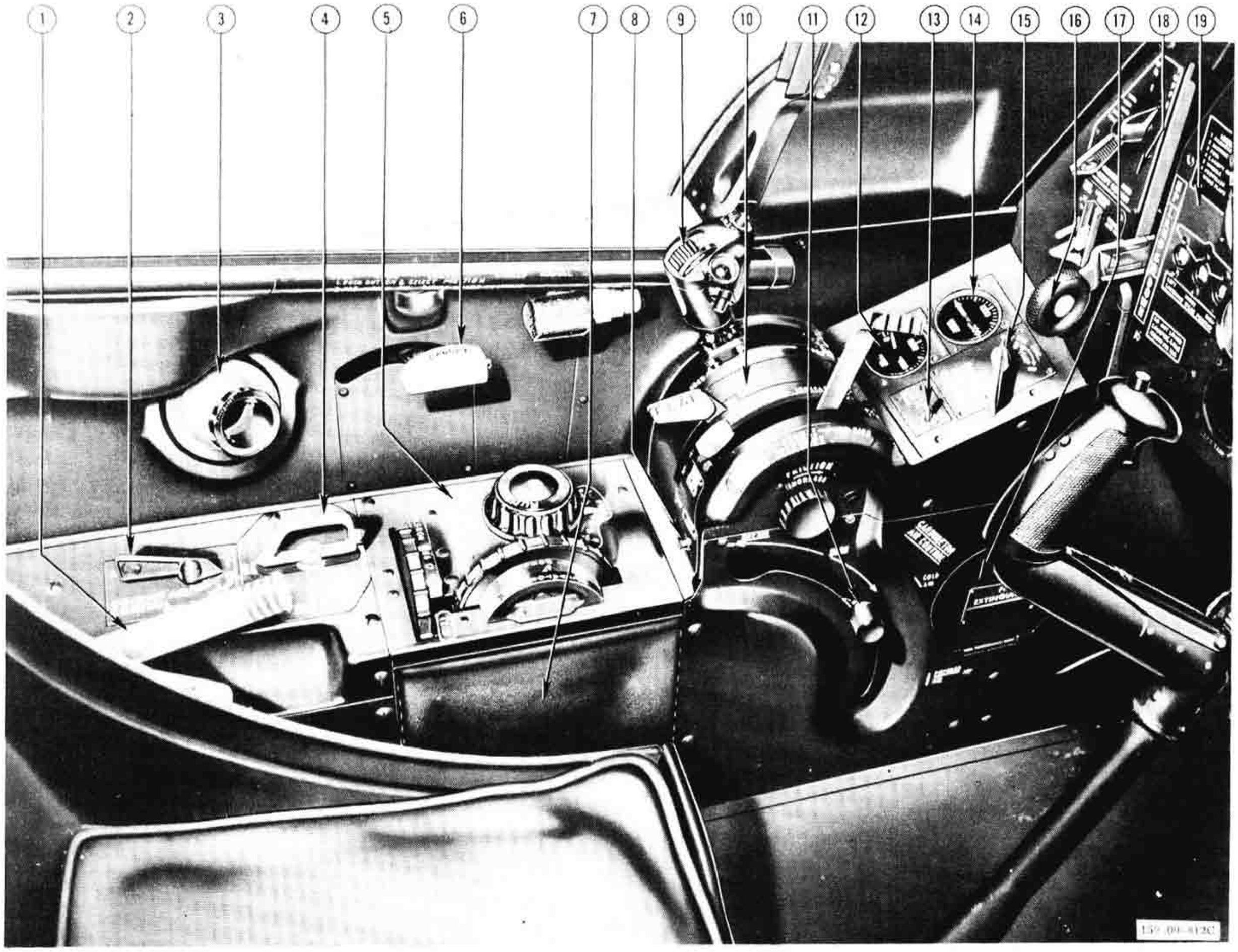
1. Canopy Emergency Stop Button
2. Main Instrument Panel
3. Right Instrument Subpanel
4. Free Air Temperature Gage
5. Ignition Switch
6. Parking Brake Handle
7. Armament Control Panel
8. Windshield and Canopy Defrost Control
9. Landing Light Switch
10. Taxi Light Switch

Figure 1-5. Front Cockpit—Forward View



1. Marker Beacon (AF49-1529 and Subsequent)
2. Radio Compass Indicator
3. Altimeter
4. Airspeed Indicator
5. Turn-and-Bank Indicator
6. Slaved Gyro Magnetic Compass
7. Rate-of-Climb Indicator
8. Attitude Gyro
9. Tachometer
10. Manifold Pressure Gage
11. Manifold Pressure Drain Valve
12. Generator Load Indicator
13. Generator Voltmeter
14. Fuel Pressure Gage
15. Cylinder Head Temperature Gage
16. Oil Pressure Gage
17. Oil Temperature Gage
18. Carburetor Air Temperature Gage
19. Clock
20. Rudder Pedal Release Lever
21. Fuel Low-level Warning Light—Right Tank
22. Fuel Quantity Indicator—Right Tank
23. Accelerometer
24. Fuel Quantity Indicator—Left Tank
25. Wing Flap Position Indicator
26. Fuel Low-level Warning Light—Left Tank
27. Landing Gear Position Indicators
28. Landing Gear Handle

Figure 1-6. Main Instrument Panel—Front and Rear Cockpits



1. Hydraulic Hand-pump
2. Cockpit Air Control
3. Air Outlet
4. Fuel Selector
5. Trim Tab Control Panel
6. Canopy Handle and Control Button
7. Flight Report Holder
8. Horn Silencer Button
9. Speed Brake Control Switch
10. Throttle Quadrant
11. Carburetor Air Control
12. Canopy Emergency Air Pressure Gage
13. Cowl and Oil Cooler Flap Switch
14. Hydraulic System Pressure Gage
15. Cockpit Heater Control
16. Landing Gear Handle
17. Fire Extinguisher Access Door
18. Left Instrument Subpanel
19. Main Instrument Panel

Figure 1-7. Front Cockpit—Left Side

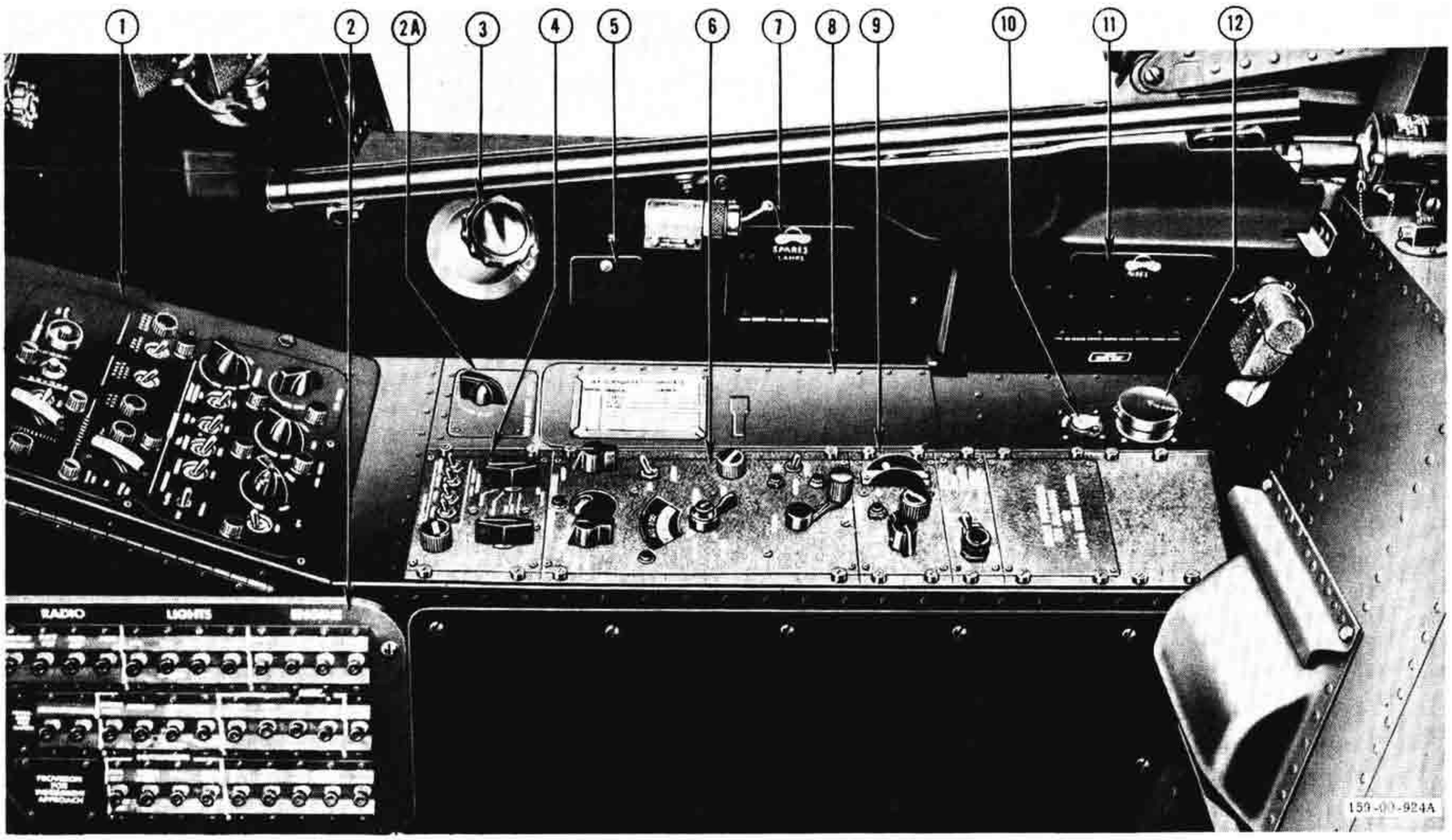
starting when external power is not available; however, this procedure causes an excessive current drain from the battery and should be used only as a last resort.

1-21A. ENGINE INDICATORS.

1-21B. Engine instruments are duplicated in each cockpit. The oil pressure, fuel pressure, and manifold pressure gages indicate pressure directly from the engine. When the engine is inoperative, the manifold pressure gage reading should correspond to barometric pressure. The tachometer and cylinder head temperature gage readings are self-generated, and therefore do not require power from the aircraft electrical system. Oil temperature and carburetor air temperature gages, however, depend upon the 28-volt d-c system. Carburetor air temperature may be regulated by use of the carburetor air control, while oil temperature may be regulated by use of the cowl and oil cooler flap switch.

1-21C. MANIFOLD PRESSURE DRAIN VALVE.

1-21D. A manifold pressure drain valve is provided to clear the manifold pressure instrument lines of moisture or vapors. Depressing the drain valve button (11, fig. 1-6), located adjacent to the manifold pressure gage,



1. Right Forward Console
2. Circuit Breaker Panel
2A. Radio Panel Light Rheostat*
3. Air Outlet
4. Interphone Panel
5. Ash Tray
6. Radio Compass Control Panel
7. Spare Lamps
8. Map Case
9. Command Radio Control Panel
10. Hand-held Microphone Jack
11. Fuse Panel
12. A-1CM Sight Test Plug (for ground maintenance only)

Figure 1-8. Front Cockpit—Right Side

opens the drain valve. The valve should be opened only when the engine is running below 30 inches manifold pressure.

1-22. PROPELLER.

1-23. GENERAL.

1-24. The engine drives a two-blade, constant-speed, Aeroproducts propeller. A propeller governor, controlled from either cockpit, maintains a selected rpm, regardless of varying air loads or flight attitudes. The governor adjusts propeller blade angle by directing oil under pressure to a piston in each blade. The governor, oil pump, and oil supply are all contained within a regulator assembly on the back of the propeller hub. Engine oil is not used for propeller operation.

1-25. PROPELLER CONTROL.

1-26. Engine rpm is determined by the setting of the propeller control located on the throttle quadrant in each cockpit (fig. 1-3). The position of the propeller control determines the setting of the propeller governor.

1-27. OIL SYSTEM.

1-28. GENERAL.

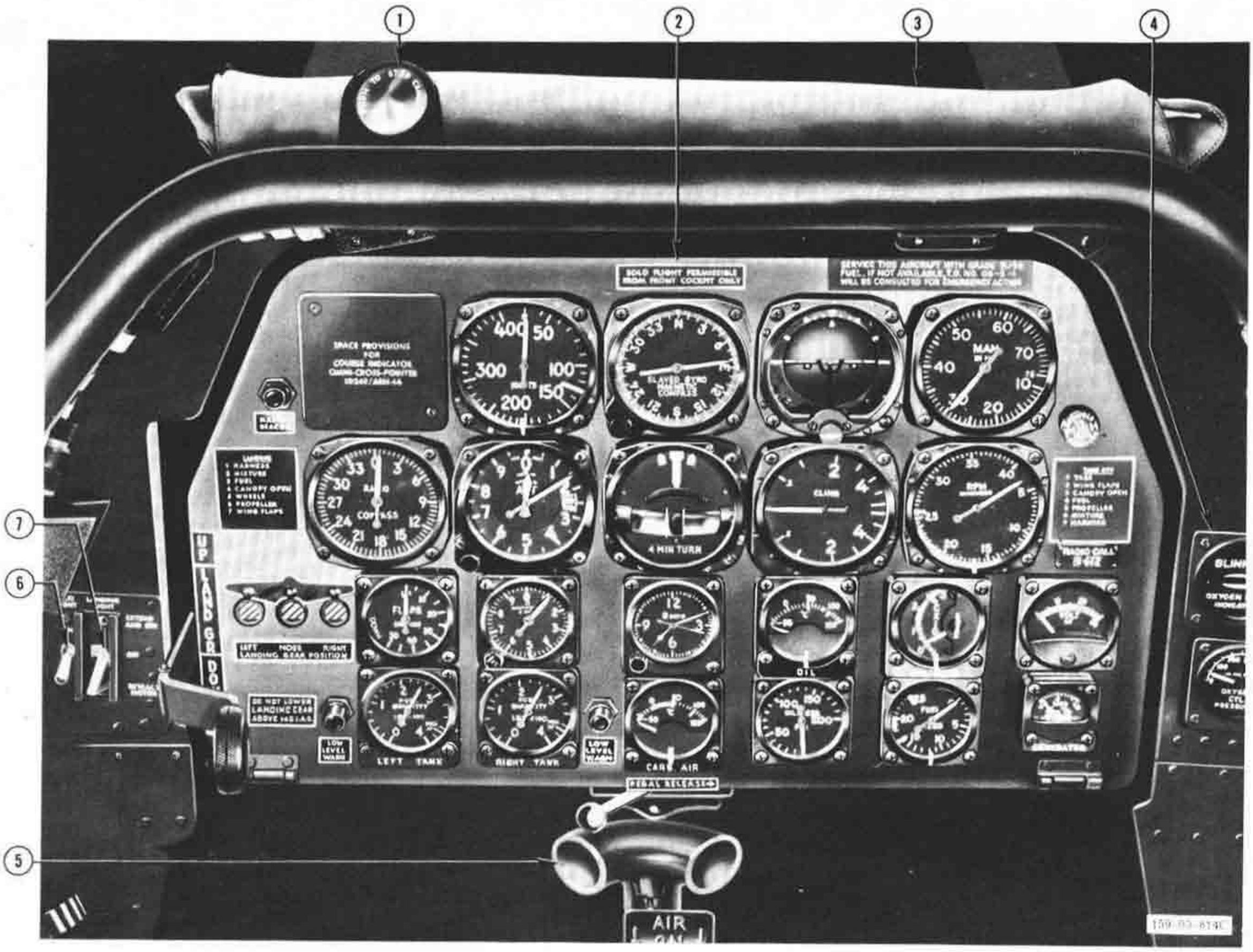
1-29. Oil for engine lubrication is supplied from an 8.8-gallon oil tank. Lubrication is accomplished by a pressure system with a dry sump and scavenge pump return. The oil cooler flap is electrically controlled in conjunction with the cowl flaps from either cockpit. For oil specification, see figure 1-16.

1-30. OIL SYSTEM CONTROLS.

1-31. COWL AND OIL COOLER FLAP SWITCH. Refer to paragraph 1-18.

1-32. OIL DILUTION SWITCH. An oil dilution system

***Airplanes AF50-195 and subsequent**



1. Canopy Emergency Stop Button
2. Main Instrument Panel
3. Instrument-flying View Limiter
4. Right Instrument Subpanel
5. Air Outlet
6. Taxi Light Switch
7. Landing Light Switch

Figure 1-9. Rear Cockpit—Forward View

is provided for diluting the oil with gasoline before engine shutdown, whenever a cold-weather start is anticipated. The oil dilution switch, located on the right forward console in each cockpit (fig. 1-18), is spring-loaded to the "OFF" position and must be held "ON" to dilute the oil.

1-33. FUEL SYSTEM.

1-34. GENERAL.

1-35. A single fuel tank is installed in each wing of early airplanes,* and fuel is supplied to the engine-driven pump by a booster pump in each tank (fig. 1-12). Fuel flow from either or both tanks can be selected as desired. On later airplanes,† two interconnected fuel cells are installed in each wing of the airplane. Fuel flows equally by gravity from each wing to a sump tank in the fuselage, and a single boost pump in the sump tank pumps the fuel to the engine-driven fuel pump. For fuel specification, see figure 1-16.

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**

†Airplanes AF51-3463 and subsequent

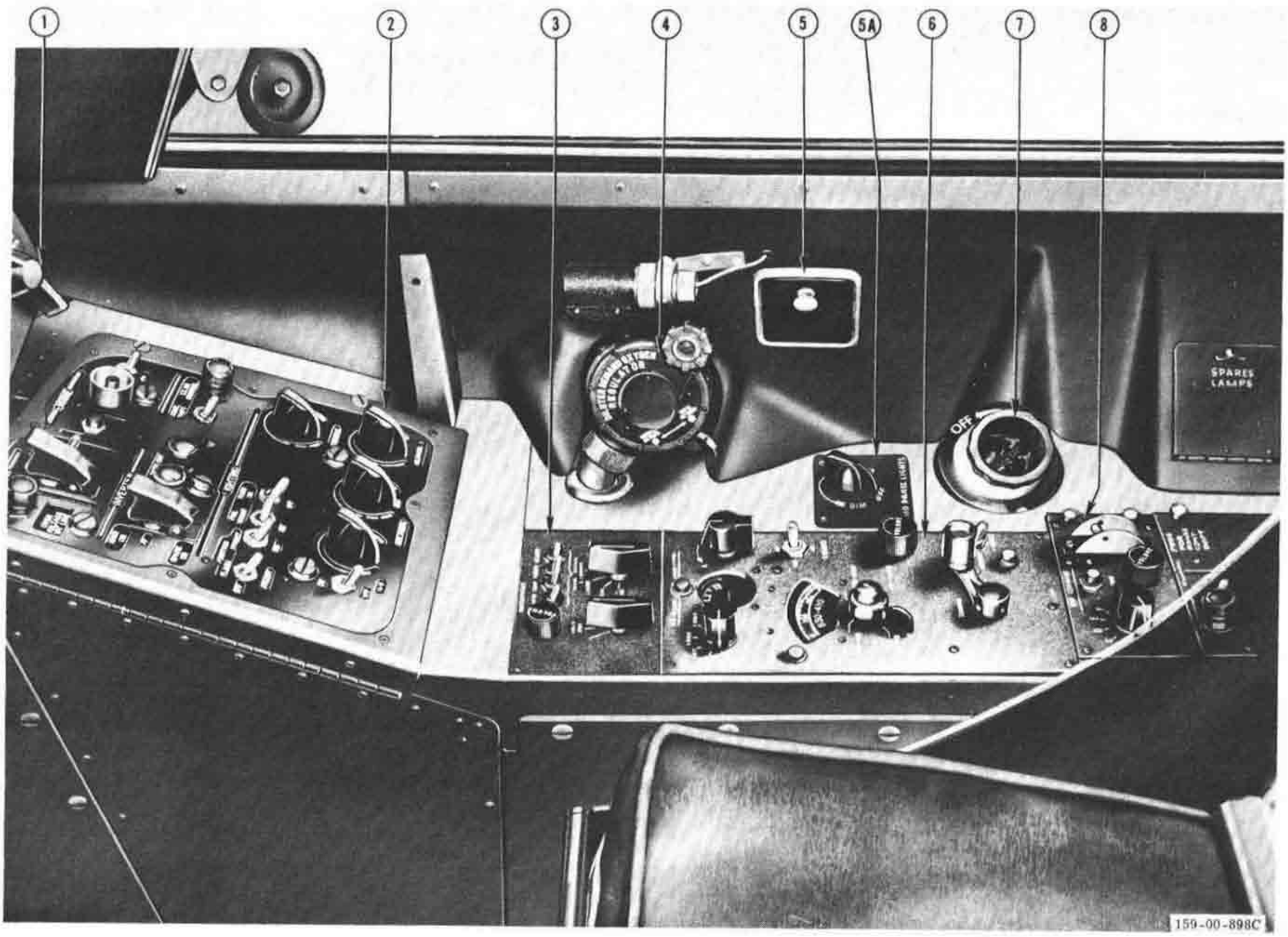
1. Cockpit Air Control
2. Air Outlet
3. Fuel Selector
4. Canopy Handle and Control Button
5. Trim Tab Control Panel
6. Horn Silencer Button
7. Speed Brake Control Switch
8. Throttle Quadrant
9. Carburetor Air Control
10. Canopy Emergency Air Pressure Gage
11. Cowl and Oil Cooler Flap Switch
12. Hydraulic System Pressure Gage
13. Landing Gear Handle
14. Left Instrument Subpanel
15. Main Instrument Panel

Figure 1-10. Rear Cockpit—Left Side

1-36. FUEL SYSTEM CONTROL AND INDICATORS.

■ 1-37. FUEL SELECTOR.* The only control for the fuel system is a fuel selector, located on the left console in each cockpit (4, fig. 7; 3, fig. 1-10). The two selectors ■ are interconnected. The fuel selector controls the booster pumps and a selector valve in the fuel line from the tanks to the engine. With the fuel selector positioned at "BOTH TANKS," both booster pumps operate. Fuel flow from both tanks may not be equal, however, because of slight variations in booster pump output. The fuel selector may be moved to "LH TANK" or "RH TANK" alternately during flight in order to maintain an equal fuel level in each tank. With the selector "OFF," both booster pumps and the selector valve are turned off. ■

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**



1. Ignition Switch
2. Right Forward Console
3. Interphone Panel
4. Oxygen Regulator
5. Ash Tray
5A. Radio Panel Light Rheostat‡
6. Radio Compass Control Panel
7. Air Outlet
8. Command Radio Control Panel

Figure 1-11. Rear Cockpit—Right Side

1-37A. FUEL SHUTOFF CONTROL.† The fuel shutoff control has only two positions, "ON" and "OFF." The "ON" position opens the shutoff valve in the fuel line and turns on the boost pump in the sump tank. The "OFF" position closes the shutoff valve and turns off the boost pump. No action by the pilot is necessary to maintain an equal fuel level in each wing, because the gravity flow system equalizes the fuel flow from the wings.

1-38. FUEL QUANTITY INDICATORS. On early airplanes,* two fuel quantity indicators are located on the main instrument panel in each cockpit (22 and 24, fig. 1-6). The indicator systems measure the total fuel supply in pounds. The system automatically compensates for changes in fuel density so that the quantity indicators will always register the actual number of pounds of fuel in the tanks, regardless of fuel expansion or contraction due to temperature variation. The full mark on each indicator is set at 365 pounds for a 25°C (77°F) fuel temperature. If the tanks are full but the fuel temperature is above 25°C, the indicators will indicate less than

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**
†Airplanes AF51-3463 and subsequent
‡Airplanes AF50-195 and subsequent

CHECK VALVE
FUEL
VENT AND VAPOR RETURN
ELECTRICAL
MECHANICAL

TO CYLINDERS
OIL DILUTION SWITCH
CARBURETOR
TO COCKPIT HEATER
ENGINE-DRIVEN PUMP
STRAINER
Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319
LH WING TANK
RH WING TANK
FUEL SELECTOR VALVE
BOOSTER PUMP
BOOSTER PUMP
BOTH
OVERBOARD OUTLET IN WING FLAP
LH
RH
OFF
FUEL SELECTOR

NOTE

Carburetor vapor return flow approx 2 to 4 qt per hour

TO CYLINDERS
OIL DILUTION SWITCH
CARBURETOR
TO COCKPIT HEATER
ENGINE-DRIVEN PUMP
Airplanes AF51-3463 and subsequent
STRAINER
FUEL SHUTOFF VALVE
SUMP TANK
BOOSTER PUMP
LH WING TANK
RH WING TANK
ON
OFF
OVERBOARD OUTLET IN WING FLAP
FUEL SHUTOFF CONTROL
159-48-1102A

Figure 1-12. Fuel System

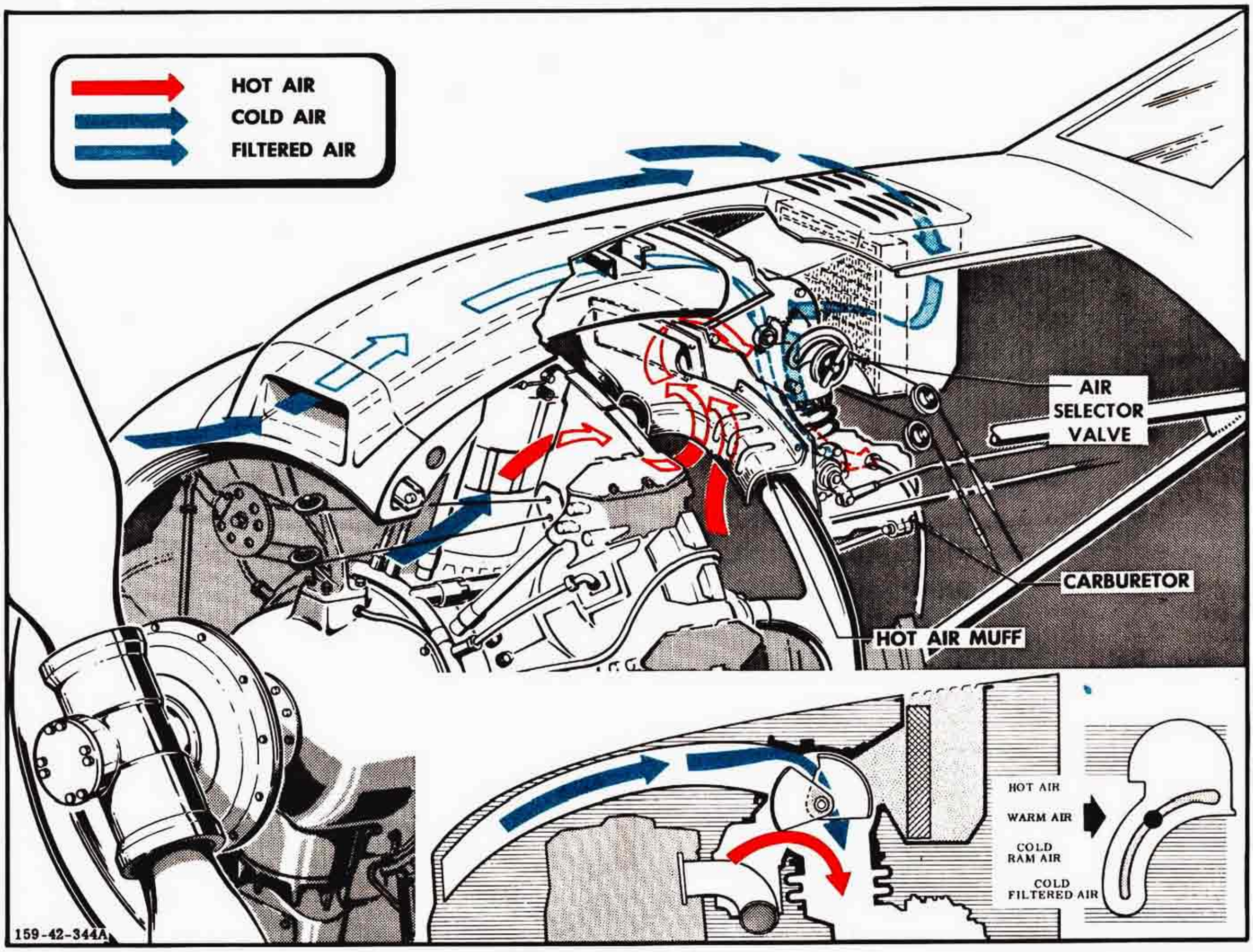


Figure 1-13. Induction System

full; if the tanks are full and the fuel temperature is below 25°C, the indicators will indicate above the full mark. Previously used fuel gage systems, of the non-compensating type, although calibrated in pounds, are based on volume and therefore do not provide an accurate indication of fuel weight. On later airplanes,† one fuel quantity indicator is located on the main instrument panel in each cockpit. The indicator measures the total fuel supply in pounds with the same accuracy as would two indicators on airplanes so equipped. The full mark on the indicator is set at 1040 pounds. Flight Operating Charts in the Appendix refer to fuel quantity by weight for accurate flight planning.

1-39. FUEL LOW-LEVEL WARNING LIGHTS. On early airplanes,* two fuel low-level warning lights, one for each tank, are mounted on the instrument panel in both cockpits (21 and 26, fig. 1-6). If the fuel quantity in a tank falls below approximately 100 pounds, the corresponding light will illuminate. The light can be dimmed by turning it counterclockwise. If a fuel quantity indicator is not operating, the fuel low-level warning light for the related tank should not be interpreted to mean there is exactly 100 pounds of fuel available, since its indication is only approximate. On later airplanes,† a low-level warning light is located on the main instrument panel in each cockpit. If the fuel quantity falls below approximately 200 pounds, the light will illuminate.

1-40. ELECTRICAL SYSTEM.

1-41. GENERAL.

1-42. Electrical energy is supplied by a 28-volt, direct-current system powered by a 200-ampere, engine-driven

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**

†Airplanes AF51-3463 and subsequent

generator. A 24-volt storage battery serves as a stand-by power source, supplying current to the system when the generator is inoperative. The generator will supply more than 24 volts to the system at idling rpm and will develop full rated output (approximately 28 volts) above approximately 910 rpm. A main inverter in the system supplies alternating current for operation of the attitude gyro, slaved gyro magnetic compass, radio compass,* and A-1CM sight.* Should the main inverter fail, a spare inverter is automatically cut into the system, but supplies power to the slaved gyro magnetic compass and attitude gyro only. The main inverter has

***Airplanes AF48-1371, AF48-1372, and AF49-1492 through AF49-1756**

FUEL QUANTITY DATA
US. GALLONS

TANK	NO.	USEABLE FUEL	EXPANSION SPACE	UNAVAILABLE FUEL
LH WING TANK*	1	62.5	4.3	—
RH WING TANK*	1	62.5	4.5	—
TOTAL*	**2**	**125**	**8.8**	**.1**
LH WING TANK†	2	88.5	2	.8
RH WING TANK†	2	88.5	2	.8
TOTAL†	**4**	**177**	**4**	**1.7**

NOTE: Multiply gallons by 6.0 to obtain pounds of gasoline

*Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319

†Airplanes AF51-3463 and subsequent

159-48-1103A

Figure 1-14. Fuel Quantity Data

a capacity of 500 volt-amperes, and the spare inverter has a capacity of 100 volt-amperes. For electrically operated equipment, see figure 1-15.

Note

Some airplanes* are temporarily equipped with a 100 volt-ampere main inverter and a 100 volt-ampere spare inverter.

1-43. EXTERNAL POWER RECEPTACLE. For starting the engine or for electrical ground checks, an external power source may be connected to the external power receptacle, located on the left side of the fuselage aft of the wing (fig. 1-16).

1-44. ELECTRICAL SYSTEM CONTROLS.

1-45. Control of the electrical system (battery, generator, and inverters) is maintained in only one cockpit at a time. Control is obtained by operating the control shift switch.

1-46. BATTERY SWITCH. A battery switch is located on the right forward console of each cockpit (fig. 1-18). All electrical equipment is inoperative when the battery switch is "OFF" unless the generator switch is "ON" and the generator is operating or an external power supply is connected to the airplane.

1-47. GENERATOR SWITCH. A guarded generator switch, located on the right forward console of each cockpit (fig. 1-18), has "ON," "OFF," and "RESET" positions. When the guard cover is down, the switch is held in the "ON" position. The "OFF" position disconnects the generator from the electrical system. The "RESET" position is provided for turning the generator on after it has been automatically disconnected because of an overvoltage condition.

1-48. VOLTAGE REGULATOR RHEOSTAT. The voltage regulator is preset by the ground crew, and ordinarily the pilot has no occasion to adjust it. However, in an emergency, the regulator can be adjusted in flight by means of a rheostat on the regulator. The regulator rheostat can be reached from the front cockpit through an access door on the side of the right console below the instrument panel. Rotating the rheostat clockwise increases the voltage.

1-49. INVERTER SWITCH. An inverter switch on the right forward console of each cockpit (fig. 1-18) controls the main and the spare inverter. The main inverter supplies power for operation of the attitude gyro, slaved gyro magnetic compass, radio compass,† and A-1CM sight. Should the main inverter fail, the spare is automatically connected into the circuit. However, the spare inverter supplies power to the attitude gyro and slaved gyro magnetic compass only. The inverter switch is guarded at "MAIN ON," but may be moved to "SPARE ON" for test purposes or use in case the automatic change-over fails. Moving the switch to "OFF" turns off both inverters.

1-50. CIRCUIT BREAKERS AND FUSES. All d-c circuits are protected from overloads by push-to-reset circuit breakers. A panel mounting the circuit breakers is located in the front cockpit on the lower side of the right forward console (2, fig. 1-8). Alternating-current circuits are protected by fuses. The fuse panel is accessible through an access door in the front cockpit above the right aft console (11, fig. 1-8). Direct-current armament circuits are protected by circuit breakers mounted on the left side of the armament control panel. Alternating-current armament circuits are protected by fuses located on the top of the armament control panel (7, fig. 1-5).

1-51. ELECTRICAL SYSTEM INDICATORS.

1-52. GENERATOR VOLTMETER. A voltmeter is located on the instrument panel in both cockpits (13, fig. 1-6). The voltmeter indicates generator voltage output. Normal voltage indication is approximately 28 volts.

***Airplanes AF50-279 through AF50-319 and AF51-3466 through AF51-3662**
†Airplanes AF48-1371, AF48-1372, and AF49-1492 through AF49-1756

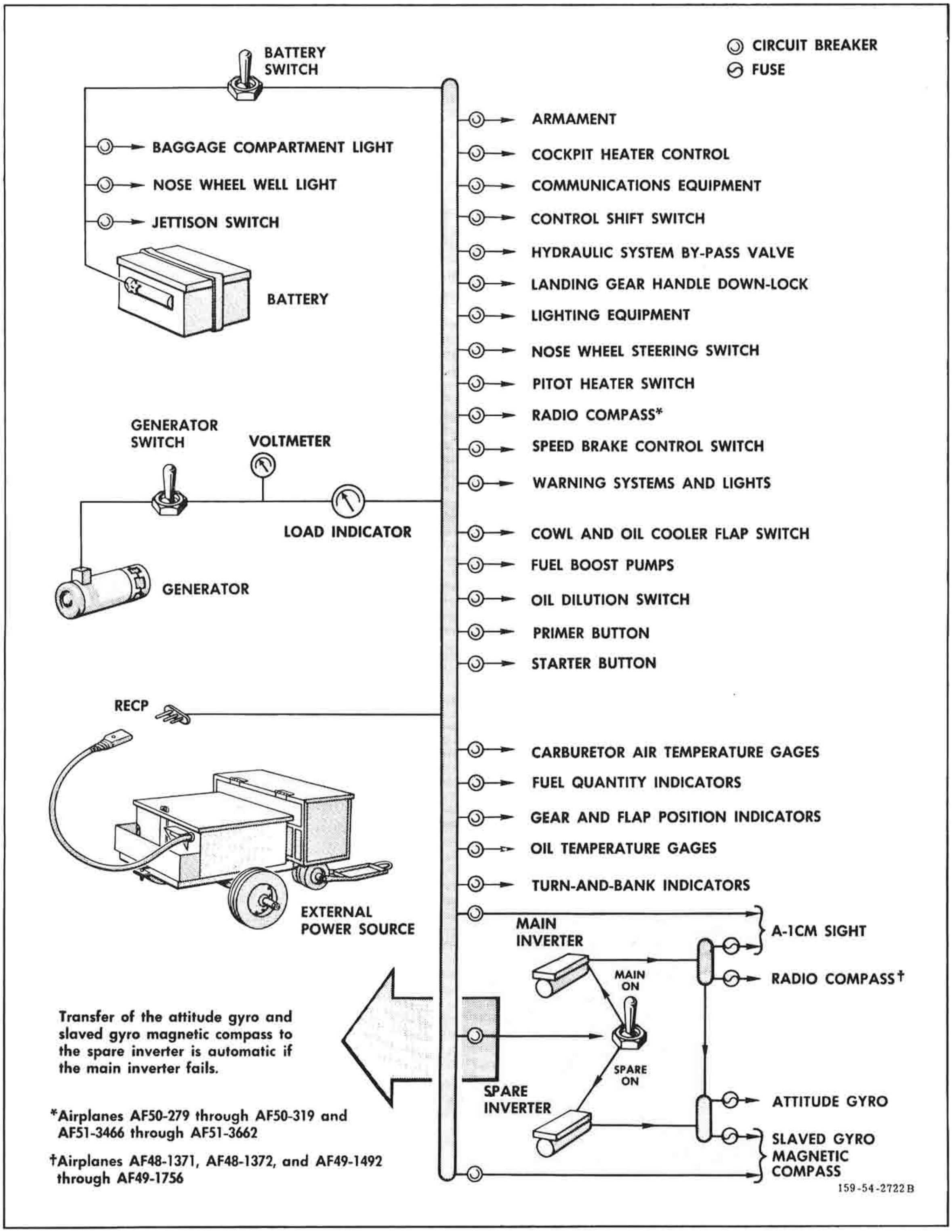


Figure 1-15. Electrically Operated Equipment

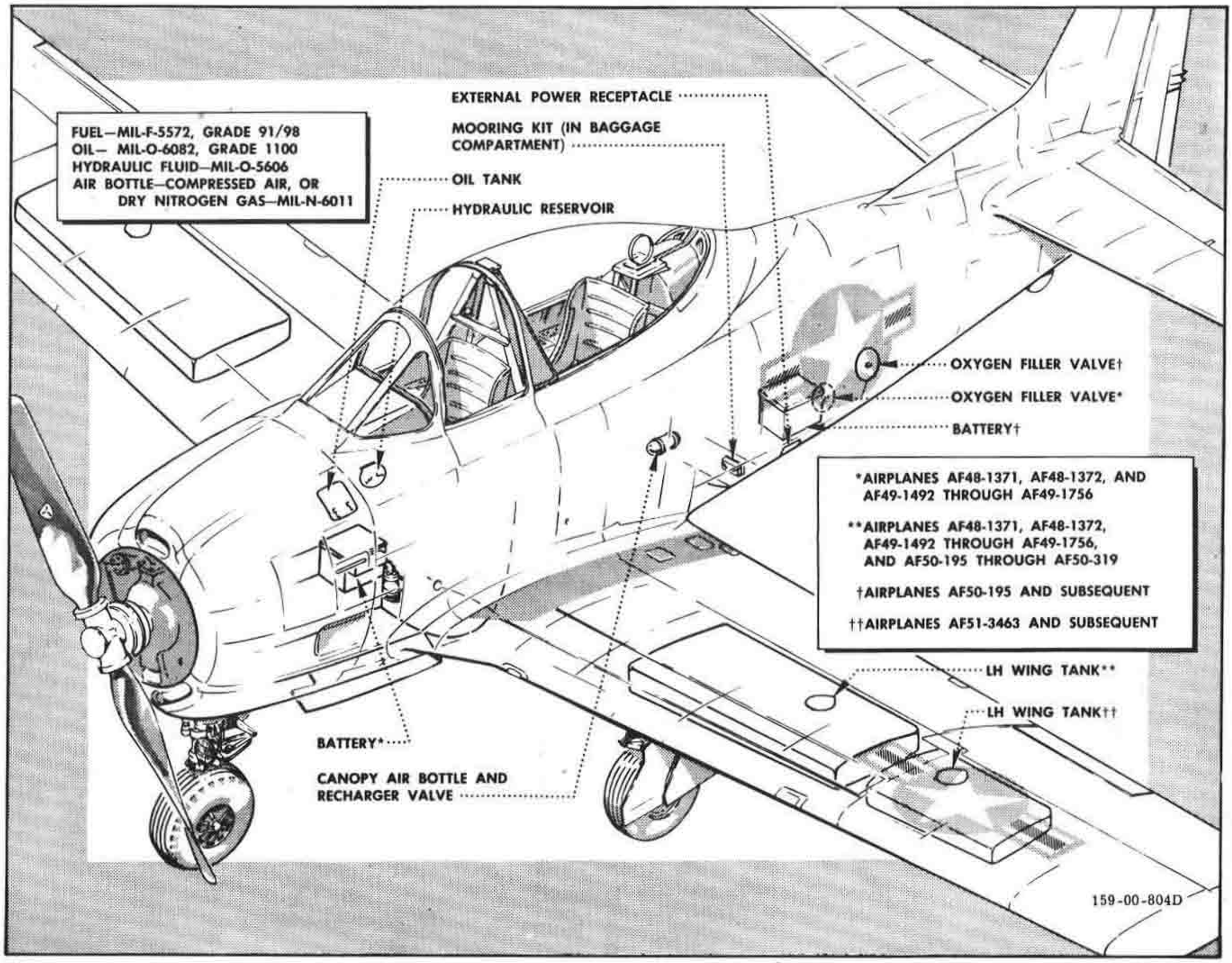


Figure 1-16. Servicing Diagram

1-53. GENERATOR LOAD INDICATOR. A generator load indicator is mounted on the instrument panel in both cockpits (12, fig. 1-6). The load indicator is marked "LOAD" and indicates the percent of generator output being used. The load indicator is graduated in decimal fractions of generator capacity and indicates the portion of this capacity (200 amperes) being delivered to the system and battery. An indication of ".5" means the generator is delivering 100 amperes.

1-54. GENERATOR OVERVOLTAGE LIGHT. A generator overvoltage light is located on the right forward console in each cockpit adjacent to the generator switch (fig. 1-18). Should generator voltage exceed the limit of approximately 31 volts, the generator is automatically disconnected from the electrical circuit and the generator overvoltage light illuminates. An attempt may be made to turn the generator on again by holding the generator switch at "RESET" position momentarily and then returning the switch to "ON." The overvoltage light will go out when the switch is placed at "RESET"; if the light again illuminates when the switch is returned to "ON," the generator is still inoperative. It may be possible to correct an overvoltage condition by use of the voltage regulator rheostat.

1-55. INVERTER WARNING LIGHTS. Two inverter warning lights are located on the right forward console of each cockpit, adjacent to the inverter switch (fig. 1-18). With the switch at "MAIN ON," illumination of the amber light indicates that the main inverter has failed and the spare inverter has automatically taken over. Illumination of both lights (amber and red) indicates failure of both inverters, regardless of whether the switch is at "MAIN ON" or "SPARE ON." If only the red light illuminates with the switch at "MAIN ON," however, it indicates that the main inverter has failed but the spare inverter has not automatically taken over.

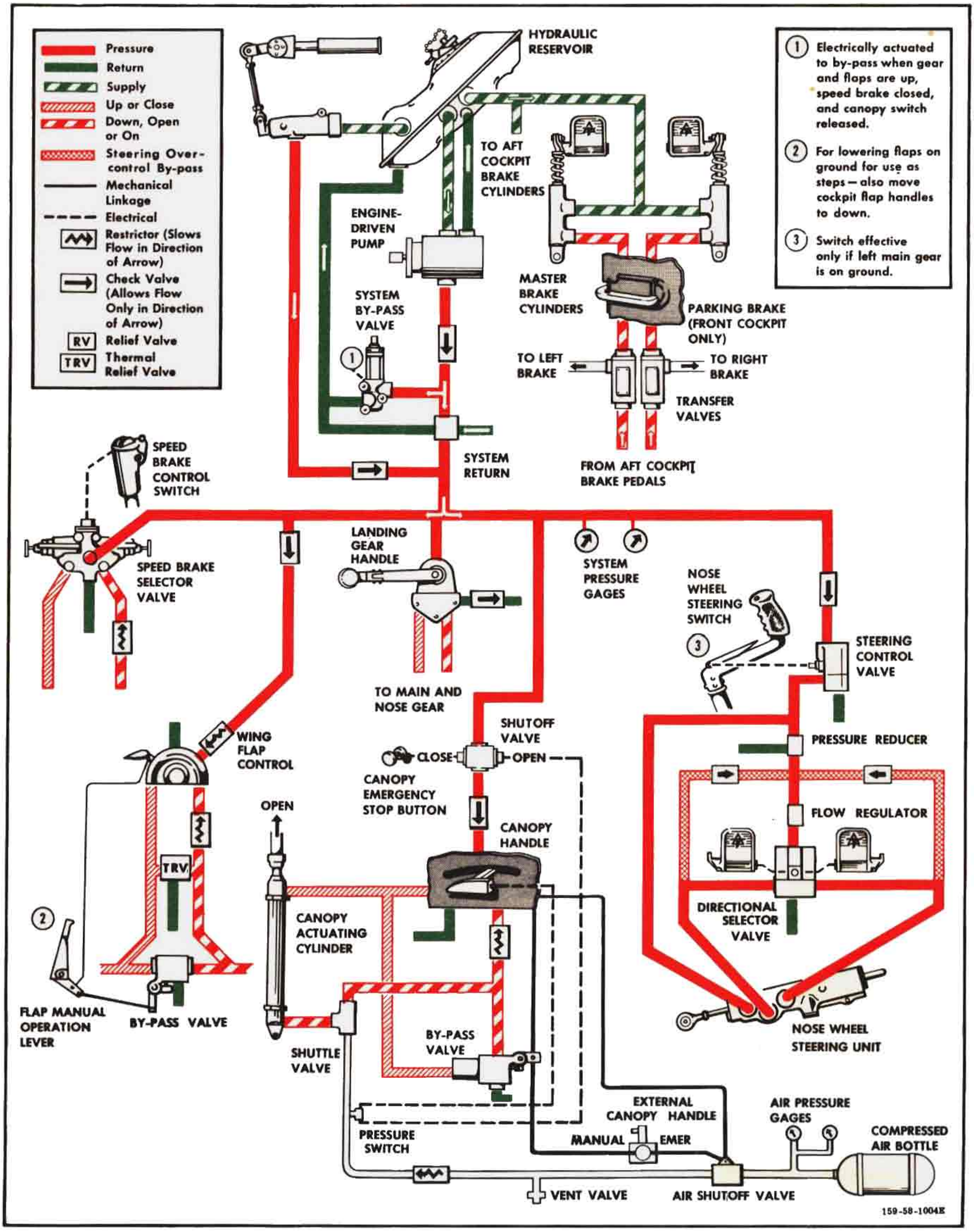


Figure 1-17. Hydraulic System

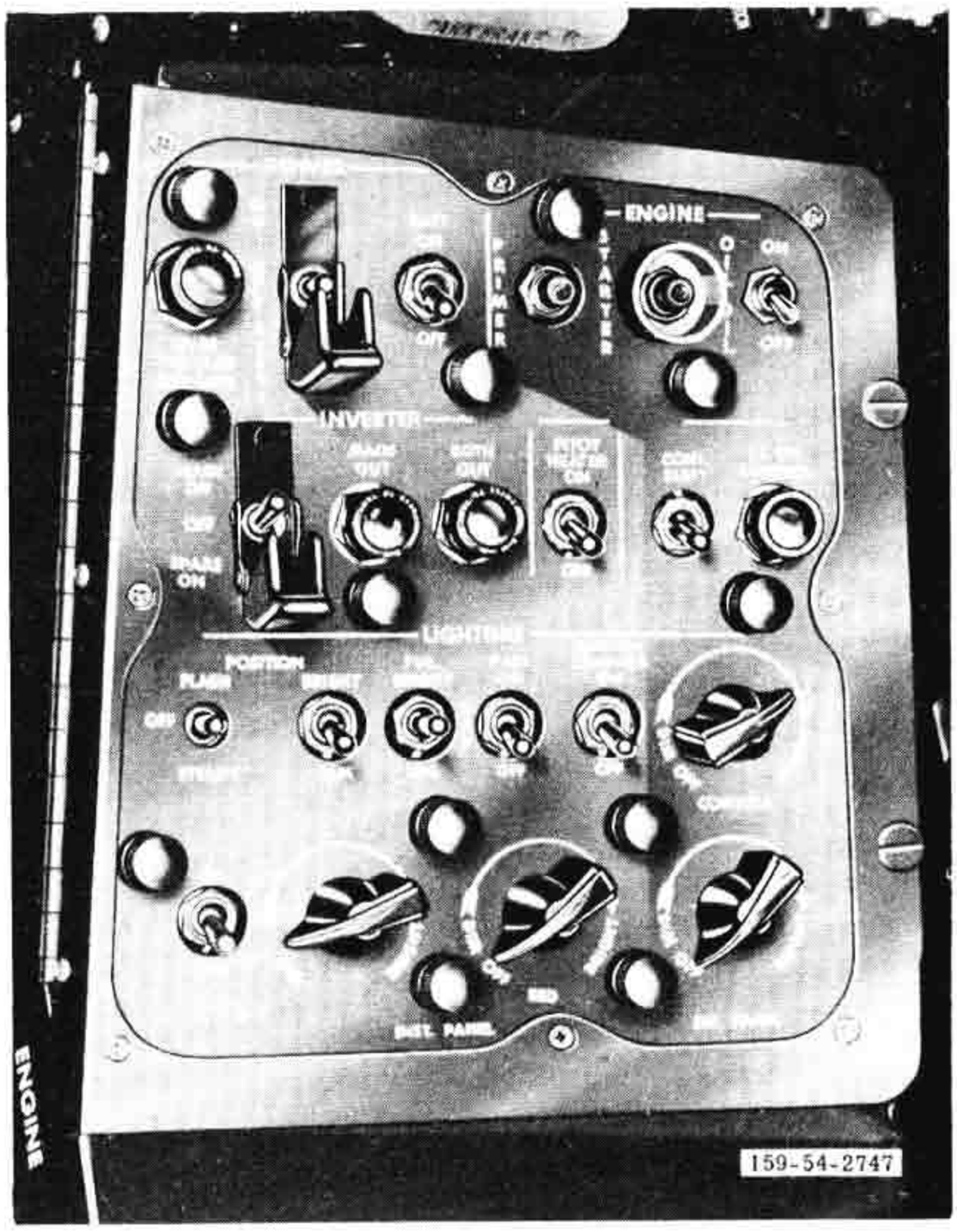


Figure 1-18. Switch Panel—Right Forward Console

When automatic transfer to the spare inverter has failed, the spare inverter can be turned on by placing the switch at "SPARE ON." When the switch is "OFF," only the red light illuminates, indicating that neither inverter is operating. Both lights can be dimmed by turning them counterclockwise.

1-56. HYDRAULIC SYSTEM.

1-57. GENERAL.

1-58. Hydraulic power is used to operate the landing gear, wing flaps, canopy, nose wheel steering, and (when installed) the speed brake (fig. 1-17). A variable-volume, engine-driven pump supplies hydraulic pressure for operation of the units. However, when no hydraulic units are being operated in flight, the entire output of the pump is diverted to the hydraulic reservoir through an electrically actuated by-pass valve. When any hydraulic control is operated, the by-pass valve closes and pressurizes the system for operation of the selected unit. The hydraulic system can also be pressurized in flight by pressing the canopy control button when the canopy handle is in the "LOCKED" position. The by-pass valve automatically reopens and depressurizes the system only when the units are in their normal flight position; that is, gear and flaps up and locked, speed brake closed, and canopy button released. Pressure is maintained in the system whenever the gear or flaps are down or in any position other than up and locked, or whenever the speed brake is open. Consequently, when the airplane is on the ground with the engine running, pressure is always available for operation of nose wheel steering. In the event of an electrical failure, the by-pass valve will automatically close and pressurize the system. Hydraulic brakes on the main wheels receive fluid by gravity from the hydraulic system reservoir. A standpipe in the reservoir will retain enough fluid to supply the brakes if all fluid is lost from the reservoir. A hydraulic pressure gage is located in each cockpit. For hydraulic fluid specification, see figure 1-16.

1-59. HYDRAULIC HAND-PUMP.

1-60. A hand-pump in the front cockpit is provided primarily for ground check of the hydraulic system, but may be used in flight should the engine-driven pump fail. The hand-pump is not considered an emergency system, as it will not supply pressure if hydraulic system failure is caused by any malfunction other than engine-driven pump failure.

1-61. FLIGHT CONTROL SYSTEM.

1-62. GENERAL.

1-63. The primary flight control surfaces (ailerons, rudder, and elevator) may be operated from either cockpit by conventional stick and rudder pedal controls. Trim tabs on the control surfaces are mechanically operated from either cockpit. Wing flaps are provided for use at airspeeds below the gear- and flap-down limit airspeed. A speed brake is installed in Airplanes AF48-1371 and AF49-1500, and provisions for the speed brake installation are included in all airplanes. Use of the speed brake is permissible at any airspeed up to the maximum allowable speed for the airplane. The control stick in the front cockpit incorporates a nose wheel steering switch, a gun trigger, and a bomb-rocket release button. Rudder pedals are adjustable fore and aft. All primary controls can be locked in the neutral position by a mechanical control lock in the front cockpit.

1-64. WING FLAPS.

1-65. Hydraulically operated, semislotted-type wing flaps extend from aileron to fuselage on each wing. The flaps are operable from either cockpit, and a flap position indicator is provided on each instrument panel. No emergency system is provided for operating the flaps. However, in the event the airplane hydraulic system fails, an attempt may be made to lower the flaps by operating the hydraulic hand-pump. The hand-pump will pressurize the system only when initial loss of pressure is caused by failure of the engine-driven pump. The flaps can be lowered on the ground from outside the airplane, and spring-loaded doors in the surface of the flaps may be used as steps up to the wing.

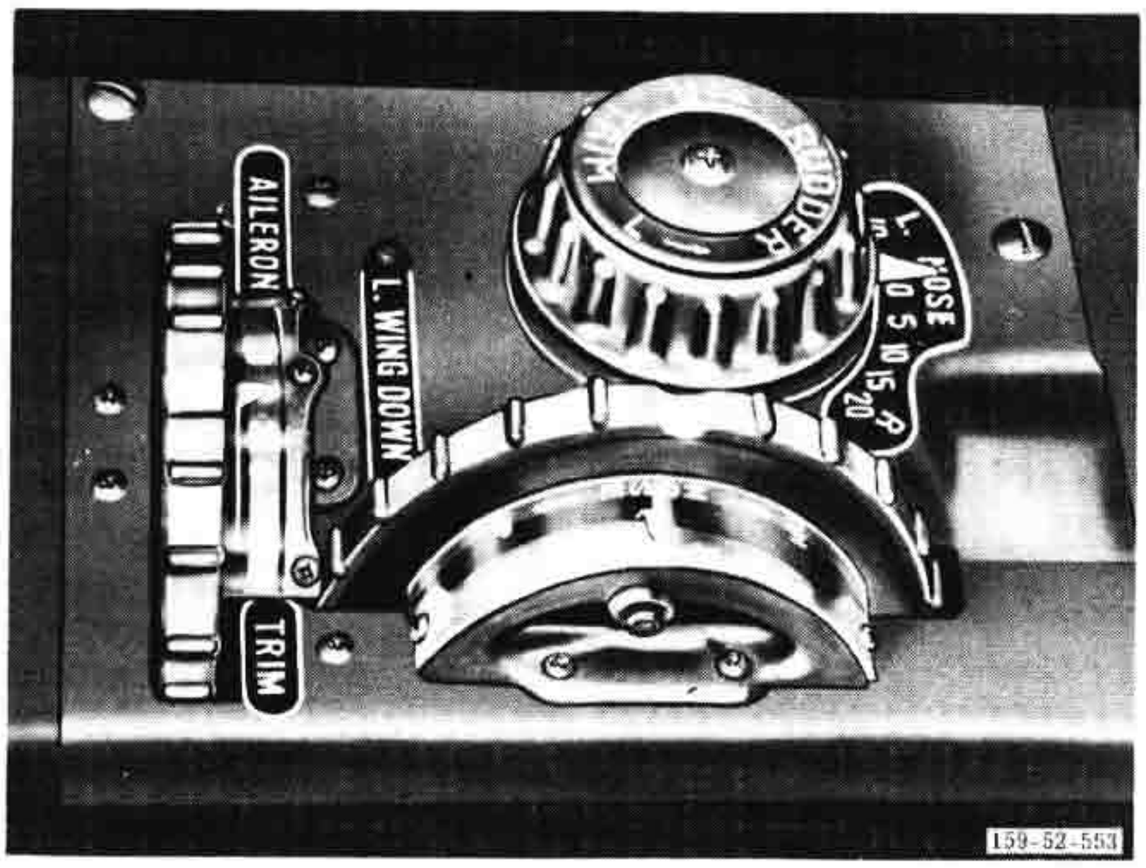


Figure 1-19. Trim Tab Control Panel

1-66. WING FLAP CONTROLS AND INDICATOR.

1-67. WING FLAP CONTROL. The flaps are operated by means of a wing flap control on the throttle quadrant in each cockpit (fig. 1-3). The control handle is shaped in the form of an airfoil for easy recognition by feel. Moving the control to the desired position in the quadrant ("UP," "1/4," "1/2," "3/4," or full "DOWN") pressurizes the hydraulic system to operate the flaps. Detents hold the handle in any selected position. The hydraulic system will be pressurized as long as the flaps are in any position other than up and locked. The flaps are held in the up position by a mechanical overcenter lock and in any selected down position by hydraulic pressure.

1-68. WING FLAP MANUAL OPERATION LEVER. The flap manual operation lever is provided to release the flap up-lock and open a by-pass valve at the cylinder so that the flaps can be pulled down manually where the pilot can reach the steps. If the engine is running, pulling the lever will cause flaps to be lowered by hydraulic power. The flap manual operation lever is located on the left side of the fuselage above the wing trailing edge (fig. 3-4) and is pulled down to release the flaps for lowering. The flaps can be lowered 50 degrees with the flap manual operation lever. Lowering the flaps from outside also moves the flap handles in the cockpits.

1-69. WING FLAP POSITION INDICATOR. A flap position indicator, calibrated in degrees, is located on the instrument panel in each cockpit (25, fig. 1-6). Normal hydraulic flap travel is 37 degrees to the full-down position. The flaps can be lowered manually 50 degrees on the ground for access to the steps in the flaps.

Note

The flaps can be lowered manually 50 degrees on the ground for access to the steps in the flaps.

1-70. SPEED BRAKE.

1-71. A single hydraulically operated speed brake is installed under the fuselage just aft of the wing; when opened, it extends down and forward into the slipstream. At present, the speed brake is installed only on Airplanes AF48-1371 and AF49-1500; however, provisions are made for installation on all airplanes. The brake is held open by hydraulic pressure, and is held closed by mechanical locks.

1-72. SPEED BRAKE CONTROL SWITCH. A switch on top of the throttle grip in each cockpit controls the speed brake (9, fig. 1-7; 7, fig. 1-10). Only one control is operative at a time, however, depending upon which pilot last operated his control shift switch. The speed brake control switch has two fixed positions only, "OUT" and "IN," and no intermediate positions can be selected. When the switch is moved to "OUT," it energizes the speed brake selector valve and pressurizes the hydraulic system. The hydraulic system remains pressurized as long as the brake is open. In event of an electrical failure while the speed brake is open, the speed brake will automatically close. Should a hydraulic failure occur while the brake is open, it will stay open until the speed brake control switch is moved to "IN"; airloads will then force the brake closed.

1-73. TRIM TAB CONTROLS.

1-74. Aileron, rudder, and elevator trim tab controls are located on the left console in each cockpit. Trim tab position is shown by a scale and pointer at each control (fig. 1-19). The left aileron trim tab is mechanically operated by the aileron trim tab control in each cockpit; the tab on the right aileron is adjustable only on the ground.

1-75. CONTROL LOCK (THROTTLE AND FLIGHT CONTROLS).

1-76. All surface controls and the throttle are locked by

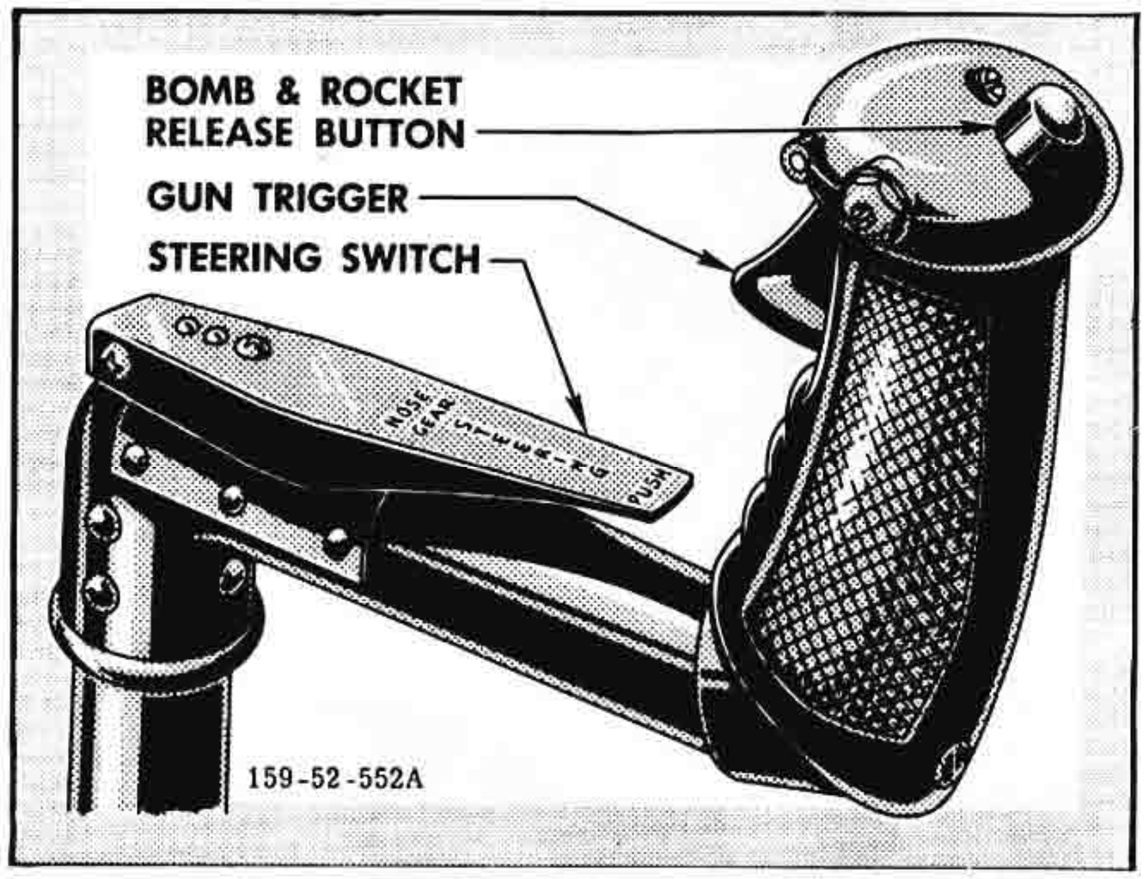


Figure 1-20. Control Stick Grip

means of a control lock which is stowed on the floor of the front cockpit aft of the stick (fig. 2-2). Pulling out the plunger to the right of the lock releases it from the stowed position on the floor. The lock can then be raised to engage the stick, and the plunger is released to slide into a hole in the stick. When the throttle is subsequently closed, it will be locked in that position until the control lock is released.

1-77. RUDDER PEDAL RELEASE LEVER.

1-78. A rudder pedal release lever, located below the center of the instrument panel in each cockpit, is used to unlock the pedals to permit their adjustment for desired leg length (20, fig. 1-6). When a release lever is moved to the right, both rudder pedals in that cockpit are released and snap to the full aft position (toward seat). To adjust the pedals forward, the release lever must be held to the right and the pedals pushed forward until desired position is reached.

1-79. LANDING GEAR.

1-80. GENERAL.

1-81. The retractable tricycle landing gear is hydraulically operated. The main gear retracts inboard into the wing and fuselage; the nose gear retracts aft into the fuselage. Fairing doors cover the wheels in the retracted positions and are mechanically operated by gear movement. All fairing doors remain open when the gear is down. Mechanical locks hold the gear up; it is held down by overcenter side brace lockpins on each gear and also by hydraulic pressure. All up-locks are released by initial movement of the landing gear handle; consequently, in event of hydraulic failure, the gear can be unlocked by the gear handle and will extend by its own weight. A lock in the landing gear control system prevents inadvertent gear retraction when the airplane is on the ground. When the landing gear is in any position other than up-and-locked, it will cause the hydraulic system to be pressurized. A hydraulically operated and electrically controlled steering unit is installed in the nose gear, to provide nose wheel steering by movement of the rudder pedals. Hydraulic brakes on the main wheels are the master cylinder type, and are operated from either cockpit by application of toe pressure on the rudder pedals. A fixed tail skid is installed under the aft section of the fuselage.

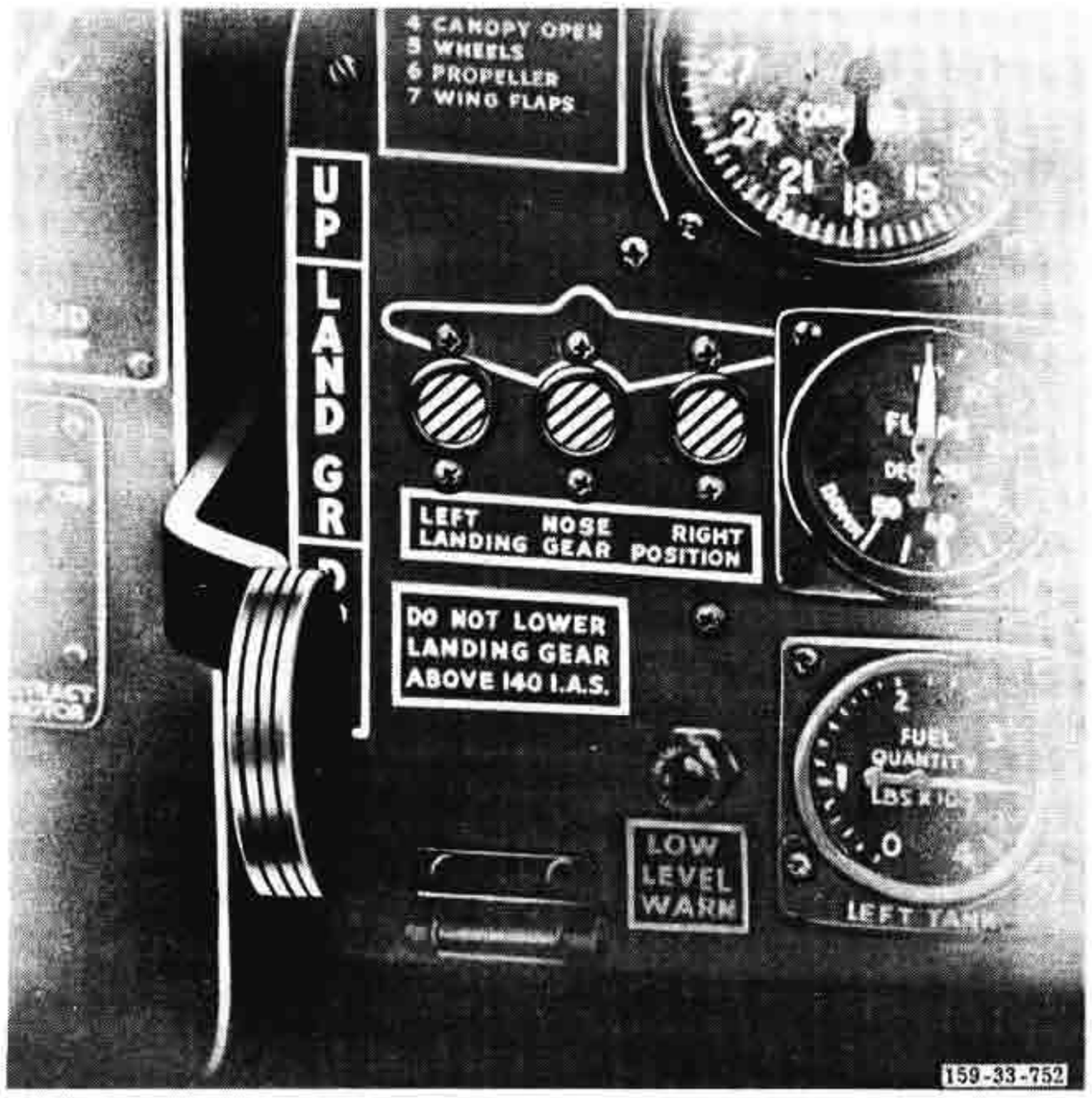


Figure 1-21. Landing Gear Position Indicators

1-82. LANDING GEAR CONTROL AND INDICATORS.

1-83. LANDING GEAR HANDLE. The landing gear handle is located at the left of the instrument panel in each cockpit (28, fig. 1-6). Moving the handle to either "UP" or "DOWN" operates the gear selector valve, pressurizes the hydraulic system, and mechanically positions the gear up-locks. When the airplane is on the ground, an electrically actuated lock prevents moving the gear handle inadvertently out of the "DOWN" position. The lock is automatically disengaged when the airplane is air-borne. However, in an emergency requiring gear retraction before the airplane is off the ground, the down-lock can be overridden by pulling up very sharply on the gear handle. In event of hydraulic failure in flight, the gear can be lowered by merely moving the gear handle to "DOWN," thereby mechanically releasing the up-locks and allowing the main gear to drop. It may be necessary to yaw the airplane to lock the main gear down. The nose gear is forced down and is locked against the air load by springs on the gear.

1-84. LANDING GEAR POSITION INDICATORS. Position of the landing gear is shown by three individual indicators, one for each gear, located on the instrument panel in both cockpits (27, fig. 1-6). Each indicator shows crosshatching if the related gear is in any unlocked condition; the word "UP" appears if the gear is up and locked, or a wheel shows if the gear is down and locked. Crosshatching will also show on the indicators whenever the electrical system is not energized.

1-85. LANDING GEAR WARNING LIGHT AND HORN. Additional warning of unsafe gear position is provided by a red light incorporated in the landing gear handle and a warning horn mounted between the cockpits. The red light illuminates the gear handle whenever the gear is in any unlocked condition. It will also illuminate if the gear is up and locked and the throttle is retarded below cruising rpm. The warning horn sounds if the gear is not down and locked, when the throttle is

retarded below cruising power. A horn silencer button, located at the base of each throttle quadrant (8, fig. 1-7; 6, fig. 1-10), is provided to silence the horn, but the gear handle warning light will remain on. Advancing the throttle resets the warning horn so that it will blow when the throttle is retarded again, if the gear is not down and locked.

1-86. EXTERIOR GEAR POSITION LIGHTS. To aid in determining gear position from the ground at night, a white light is installed on each gear strut. Each light will illuminate only when the related gear is down and locked and the position lights are turned on.

1-87. NOSE WHEEL STEERING.

1-88. GENERAL.

1-89. The nose wheel steering system is hydraulically operated and electrically controlled. Hydraulic pressure is supplied to the steering system through an electrically operated valve, which is controlled from either cockpit. With the steering system engaged and the nose wheel on the ground, the nose wheel can be turned 25 degrees either side of center by moving the rudder pedals. When a short turning radius is desired while taxiing at low speeds, it is possible to override the steering system beyond the 25-degree limit by use of brakes, without damage to the steering system. The steering unit also operates as a shimmy damper. The nose wheel is full-swiveling when the steering switch is not engaged, and the brakes can be used for directional control. As the airplane leaves the ground on take-off, the steering system is automatically disconnected and the nose wheel centers itself.

1-90. NOSE WHEEL STEERING SWITCH.

1-91. Nose wheel steering is controlled by depressing the steering switch located below the control stick grip in each cockpit (fig. 1-20). In order to engage the nose wheel steering unit, the switch must be depressed. If the nose wheel is within the 25-degree steering limit, the wheel will turn to correspond to the direction of the rudder pedals regardless of pedal position. The nose wheel may be turned approximately 25 degrees either side of center by pressure on the corresponding rudder pedal.

Note

The nose wheel steering unit will not engage if the nose wheel is more than 25 degrees either side of center. If the nose wheel is headed more than 25 degrees from center, the nose wheel must be brought within the steering range with the wheel brakes.

1-92. WHEEL BRAKES.

1-93. Hydraulic brakes on the main wheels are the master cylinder type, operated by applying toe pressure on the rudder pedals. No boost is supplied by the hydraulic system of the airplane, but fluid from the airplane hydraulic reservoir supplies the master cylinders. Should all fluid be lost from the reservoir, however, there is adequate fluid remaining in the standpipe and lines to supply the brakes for normal operation. No emergency method of operating the brakes is provided. A parking brake handle is installed in the front cockpit only, to the right of the instrument panel (6, fig. 1-5). Parking brakes are set by depressing the toe brakes, pulling the parking brake handle out, and then releasing the toe brakes. Brakes are subsequently released by depressing the toe brakes.

1-94. INSTRUMENTS.

1-95. GENERAL.

1-96. All instruments are duplicated in both cockpits, with the exception of a free air temperature gage and stand-by compass, which are installed only in the front cockpit. The air temperature gage is located on the right side below the shroud (4, fig. 1-5), and the stand-by compass is mounted at the top of the windshield bow. Other instruments not mounted on the instrument panels are the hydraulic pressure gage (14, fig. 1-7; 12, fig. 1-10) and the canopy emergency air pressure gage (12, fig. 1-7; 10, fig. 1-10), mounted on the left forward console, and the oxygen gages mounted on the right instrument subpanel (3, fig. 1-5; 4, fig. 1-9).

1-97. ATTITUDE GYRO.

1-98. A Type J-3 attitude gyro is installed in Airplanes AF48-1371, AF48-1372, and AF49-1492 through -1498; a Type A-1 gyro is installed in Airplanes AF49-1499 through -1663; a Type J-8 gyro is installed in Airplanes AF49-1664 and subsequent. These instruments provide visual indications of dive, climb, and angle of bank, and they operate on alternating current supplied by either the main or spare inverter. The gyro is enclosed in a sphere, a portion of which is visible through the opening on the face of the instrument. Whenever the airplane approaches a vertical climb or dive attitude, as it would in a loop, the gyro is precessed a controlled 180 degrees; this action is momentary, and does not interfere with the indications. Thus, the pilot is reading the same face of the sphere regardless of attitude. On the A-1 and J-3 gyros, a blinker, appearing in a small opening on the sphere, flashes to indicate that power is being supplied to the unit and that the gyro is up to speed. On the J-8 gyro, an "OFF" indicator flag comes into view whenever

no power is being supplied or when gyro is not up to speed. Operation of these instruments (fig. 1-22) may be confusing, since the climb and dive indications of the A-1 and J-8 gyros are opposite to those of the J-3 gyro.

CAUTION

Before the indications of these instruments can be depended upon, 8 to 13 minutes must be allowed for the gyros to come up to speed and erect. A temporary displacement of the gyro from its normal position will occur during a turn (a maximum of 10 degrees at very high angles of bank). This error will be corrected automatically by an erection mechanism at the rate of about 3 degrees per minute.

1-99. A-1 AND J-8 ATTITUDE GYROS. A horizon bar on the A-1 and J-8 gyros presents a conventional dive and climb indication. The miniature airplane appears above the horizon bar in a climb and below the horizon bar in a dive. However, in a climb (or dive) exceeding 27 degrees, the horizon bar stops at the bottom (or top) of the instrument case and the sphere then becomes the reference.

1-100. J-3 ATTITUDE GYRO. The J-3 gyro differs from conventional attitude indicators in that climb and dive are not shown in relation to a horizon bar but are read directly on a sphere. The upper hemisphere, which is dark in color, indicates a dive; the lower, light hemisphere indicates a climb. Lines similar to latitude markers are painted on the sphere and indicate the degrees of dive or climb. It is important, in interpreting the presentations of this instrument, to realize that: (1) the sphere is stabilized, maintaining its equator parallel to the surface of the earth; (2) the airplane, as well as the miniature airplane, maneuvers around the stabilized sphere. Therefore, when the airplane is in a nose-high attitude, the miniature airplane will be displaced downward on the light portion of the sphere; and in a dive the miniature airplane will be displaced upward into the dark portion of the sphere.

1-101. ELECTRICALLY OPERATED INSTRUMENTS.

1-102. Instruments which operate on d-c power from the electrical system are: carburetor air temperature gage, oil temperature gage, fuel quantity indicators, turn-and-bank indicator, and flap and gear position indicators. Direct current and alternating current are necessary for operation of the slaved gyro magnetic compass. The attitude gyro operates only on alternating current. The tachometer is a self-generated instrument, requiring no power from the electrical system.

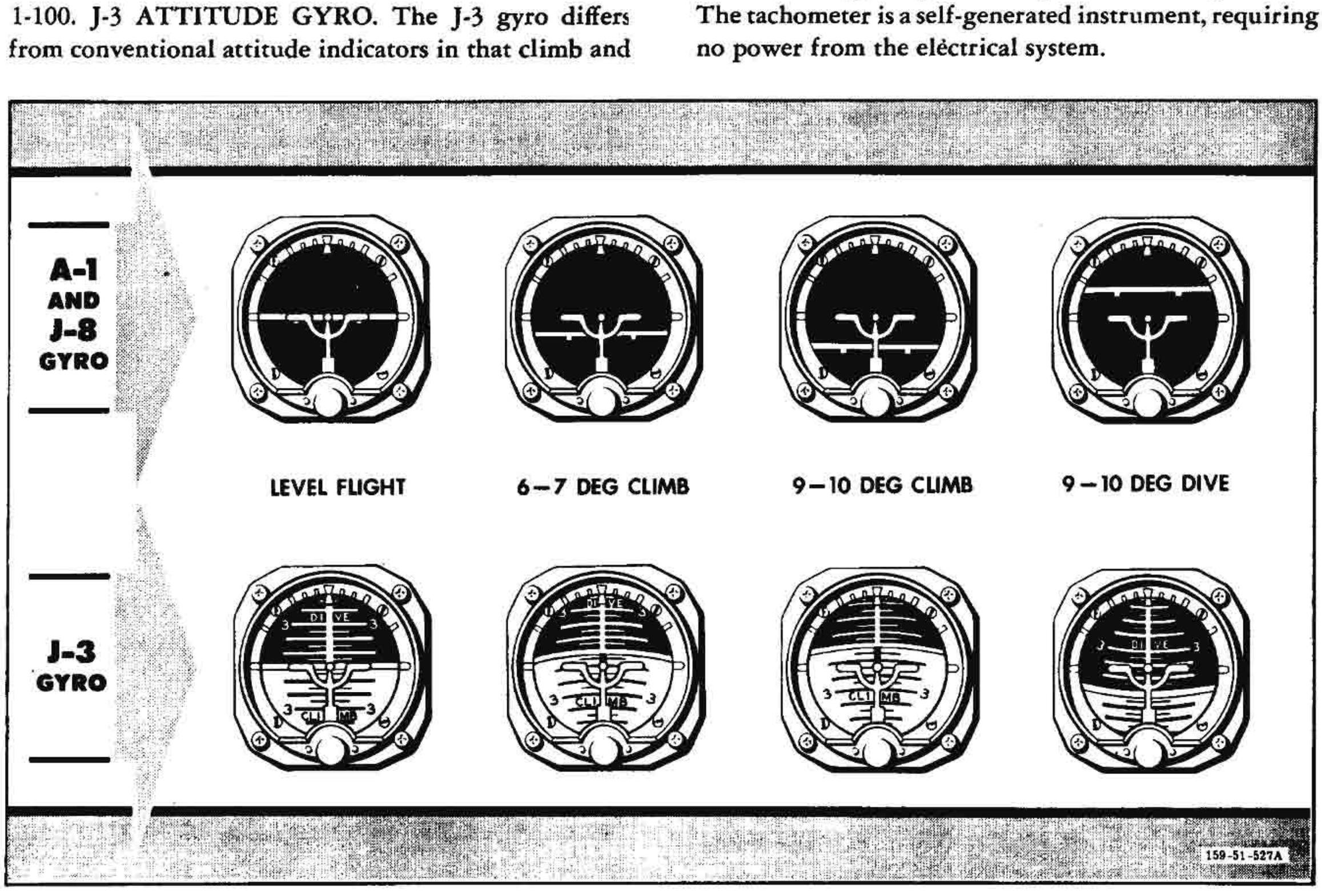


Figure 1-22. Comparison of the J-3 and the A-1 and J-8 Attitude Gyro Indicators

1-103. PITOT-STATIC SYSTEM.

1-104. The airspeed indicator, altimeter, and rate-of-climb indicator are operated by the pitot-static system. This system measures the difference between impact air pressure entering the pitot tube, mounted on the right wing, and static air pressure obtained at static ports on either side of the fuselage, aft of the wings. The airspeed indicator is connected to the pressure and static sides of the system. The altimeter and rate-of-climb indicator are connected to the static ports. To keep the pressure tube opening clean, a cover is placed over the pitot head whenever the airplane is parked.

1-105 and 1-106. (Deleted. Refer to paragraphs 1-21C and 1-21D.)

1-107. MISCELLANEOUS EQUIPMENT.

1-108. SEATS.

1-109. The seats are adjusted by means of a lever at the right side of each seat. Pulling the lever back allows the seat to be raised or lowered approximately 7 inches. When the lever is pulled back, the pilot is assisted in raising the seat by a spring which tends to force the seat up. As the seat is raised, it also moves forward. A seat cushion is provided in each seat, for use when a pararaft is not worn.

1-110. SHOULDER HARNESS LOCK CONTROL. A two-position (locked and unlocked) shoulder harness inertia reel lock control is located on the left side of each seat (5, fig. 3-6). A latch is provided for positively retaining the control handle at either position of the quadrant. By pressing down on the top of the control handle, the latch is released and the control handle may then be moved freely from one position to another. In addition to manually locking the shoulder harness, the inertia reel will automatically lock under a 2 to 3 G load, as in a crash landing. Consequently, it is necessary to manually lock the harness only during manuevers and flight in rough air, or as an added safety precaution in event of a forced landing.

CAUTION

Before a forced landing, all switches not readily accessible with the harness locked should be "cut" before the harness lock control is moved to the locked position.

If the harness is locked while the pilot is leaning forward, as he straightens up, the harness will retract with him, moving into successive locked positions as he moves back against the seat. To unlock the harness, the pilot must be able to lean back enough to relieve the tension on the lock. Therefore, if the harness is locked while the pilot is leaning back hard against the seat, he may not be able to unlock the harness without first releasing it momentarily at the safety belt (or by releasing the harness buckles, if desired). After automatic locking of the harness, it will remain locked until the lock control is moved to the locked position and then back to unlocked.

1-111. CANOPY.

1-112. The hydraulically operated canopy is divided between the cockpits, making two sliding sections which move simultaneously. Normally, the canopy is operated hydraulically, but it may also be operated manually and, in an emergency, pneumatically. Mechanical locks automatically hold the canopy closed or full open; a hydraulic fluid lock is maintained to hold it in any selected intermediate position. The canopy is operable from either cockpit and from the left side outside the airplane by interconnected controls. An external handle is provided on the lower frame of the aft section for moving the canopy manually.

1-113. CANOPY HANDLE AND CONTROL BUTTON. Normal or emergency operation of the canopy is controlled by means of a canopy handle and control button at the left side of each cockpit (fig. 1-23). Positions for each handle are "EMERG OPEN," "OPEN," "LOCKED," "CLOSED," and "MANUAL." For normal hydraulic operation, the control button on the front of the canopy handle must be depressed and the handle moved to the desired operating position, "OPEN" or "CLOSED." Depressing the control button on the canopy handle pressurizes the hydraulic system in flight (system is always pressurized on the ground with engine running) and opens a shutoff valve in the canopy system, thus directing system pressure to the selector valve. Releasing the control button stops movement of the canopy by closing the shutoff valve. To stop and hold

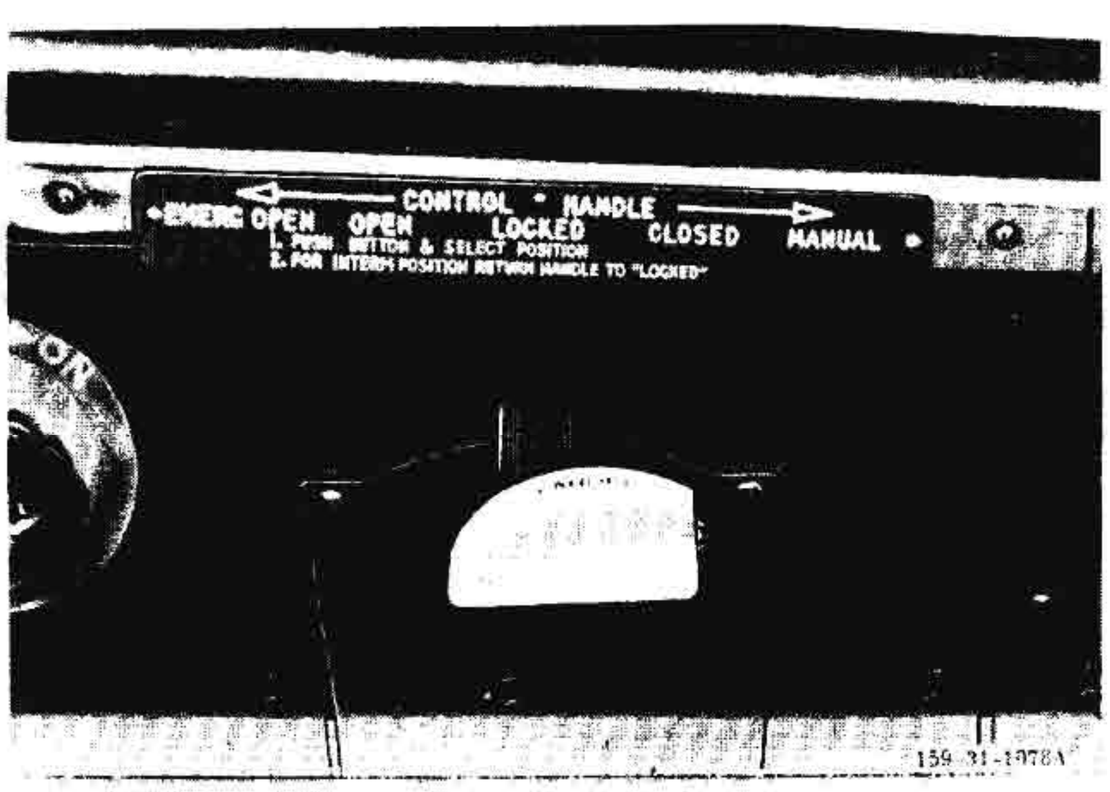


Figure 1-23. Canopy Control

the canopy partially open, the canopy handle must be moved to the "LOCKED" position. For manual operation of the canopy, the canopy handle is moved to "MANUAL," which allows hydraulic fluid in the cylinder to be bypassed when the canopy is moved manually. The canopy can be opened fully in an emergency by pulling the canopy handle all the way back to the "EMERG OPEN" position. It is unnecessary to actuate the control button when the canopy handle is moved to the "EMERG OPEN" or "MANUAL" position. It is necessary to forcibly move the handle through a stop which normally prevents inadvertent operation of the emergency system. When the handle is moved to the emergency position, air pressure from an air bottle is supplied to the canopy actuating cylinder through separate emergency lines. After the emergency air system has been used to open the canopy, the air trapped in the system must be bled by the ground crew before normal operation of the canopy can be resumed. On Airplanes AF50-195 and subsequent, the air is automatically bled from the system by moving the canopy handle from the "EMERG OPEN" position.

1-114. CANOPY EXTERNAL CONTROL HANDLE. An external canopy control handle is provided on the left side of the fuselage above the wing trailing edge (fig. 3-4). Movement of the external handle also positions the canopy handles in the cockpit. However, the canopy cannot be operated hydraulically by means of the external handle. The external canopy control handle must be pulled out from the fuselage to allow it to be turned forward to "MANUAL" for manual operation, or aft to "EMERG" for pneumatic emergency canopy opening. After the handle has been placed in the "EMERG" position, the air trapped in the system must be bled by the ground crew before normal operation of the canopy can be resumed. On Airplanes AF50-195 and subsequent, the air is automatically bled from the system by moving the canopy handle from the "EMERG" position. An external handle is provided on the lower frame of the aft section for moving the canopy manually.

1-115. CANOPY EMERGENCY STOP BUTTON. A canopy emergency stop button is provided on the left side of the instrument panel shroud in each cockpit (1, fig. 1-5; 1, fig. 1-9). In the event it is suddenly necessary to stop movement of the canopy when it is being operated hydraulically, pressing either button while the canopy is moving closes the shutoff valve, thus disrupting flow of hydraulic fluid to the acuating cylinder and stopping canopy immediately. The canopy will operate normally after the button is released unless the canopy handle is moved to the "LOCKED" position.

1-116. CANOPY EMERGENCY AIR PRESSURE GAGE. A canopy emergency air pressure gage is located on the left forward console in each cockpit (12, fig. 1-7; 10, fig. 1-10), to indicate available emergency air pressure in the air bottle.

1-117. CHECK LISTS.

1-118. Take-off and landing check lists are mounted on the instrument panel in each cockpit.

1-119. FLIGHT REPORT HOLDER.

1-120. A canvas flight report holder is located in the front cockpit on the side of the left console next to the seat (7, fig. 1-7).

1-121. MAP CASE.

1-122. A map case is provided in the front cockpit in the right rear console (8, fig. 1-8).

1-123. INSTRUMENT-FLYING VIEW LIMITER.

1-124. The rear cockpit may be used for instrument-flying training by installing close-out panels behind the instrument panel and along each side of the canopy. Three separate panels are stowed in a case on top of the instrument panel shroud in the rear cockpit (3, fig. 1-9). One panel snaps onto fasteners on the overturn brace behind the instrument panel, and the other two panels snap onto fasteners on either side of the canopy.

1-125. ASH TRAY.

1-126. Each cockpit is provided with an ash tray, which is located under the right canopy track (5, fig. 1-8; 5, fig. 1-11).

1-127. REARVIEW MIRROR.

1-128. A rearview mirror is installed at the top center of the windshield in the front cockpit.

1-129. RELIEF TUBE.

1-130. A relief tube is stowed under each seat.

1-131. BAGGAGE COMPARTMENT.

1-132. The baggage compartment is reached through a door in the bottom of the fuselage. Two levers on the door must be pulled down to open the door. The compartment is made of canvas with the bottom of the fuselage as the floor. Zippers in the canvas provide an entrance into the baggage compartment. A baggage tie-down loop is provided on the floor in each corner of the compartment.

1-133. MOORING KIT.

1-134. Equipment for mooring the airplane is contained in a kit, which is stowed in the baggage compartment (fig. 1-16).

1-135. GLARE SHIELDS.

1-136. Two glare shields are installed on top of the instrument shroud in the front cockpit. The shields may be pulled out during night flying to prevent the reflection of instrument lights on the canopy. The glare shields are not installed in Airplanes AF50-195 and subsequent.

1-137. EMERGENCY EQUIPMENT.

1-138. HAND-OPERATED FIRE EXTINGUISHER.

1-139. A hand-operated fire extinguisher, stowed in the front cockpit, can be reached through an access door in the side of the left forward console (17, fig. 1-7). The extinguisher is also accessible from the left side of the fuselage outside of the airplane through an access door above the wing leading edge.

1-140. FIRST-AID KIT.

1-141. A first-aid kit, installed between the cockpits, is mounted on the left side on the overturn brace (8, fig. 3-6).

1-142. OPERATIONAL EQUIPMENT

1-143. Section IV of this handbook contains information on the following operational equipment: cockpit heating and ventilating, defrosting, communications, lighting, oxygen, anti-G suit, and armament (guns, bombs, rockets, and sight).

NORMAL OPERATION

SECTION II

159-00-931A

2-1. RESTRICTIONS.

2-2. Observe the following flight limitations and restrictions:

Note

Additional power plant, airspeed, and acceleration restrictions are shown in figure A-1.

a. Solo flight from the rear cockpit is prohibited.

b. Inverted flying must be limited to 10 seconds in any one maneuver, as there is no means of ensuring a continuous flow of fuel or oil in this attitude. In addition, in Airplanes AF48-1371, -1372, AF49-1492 through -1756, AF50-195 through AF50-214, because of excessive oil loss through the engine breather, the inverted flying done in one flight should be held to a minimum.

c. Inverted spins with gear and flaps down are prohibited.

d. With bombs, rockets, or guns installed, snap rolls and spins are prohibited.

dA. Maximum negative acceleration is not to exceed −2.0 G for speeds up to level flight high speed, and −1.0 G for speeds from level flight high speed to limit dive speed.

e. Maximum permissible engine overspeed is 2900 rpm. To reduce the possibility of overspeeding the engine, avoid rapid throttle openings and, whenever possible, conduct acrobatic maneuvers at rpm settings of 2300 or less.

THESE LIMITATIONS AND RESTRICTIONS ARE SUBJECT TO CHANGE, AND LATEST SERVICE DIRECTIVES AND ORDERS MUST BE CONSULTED.

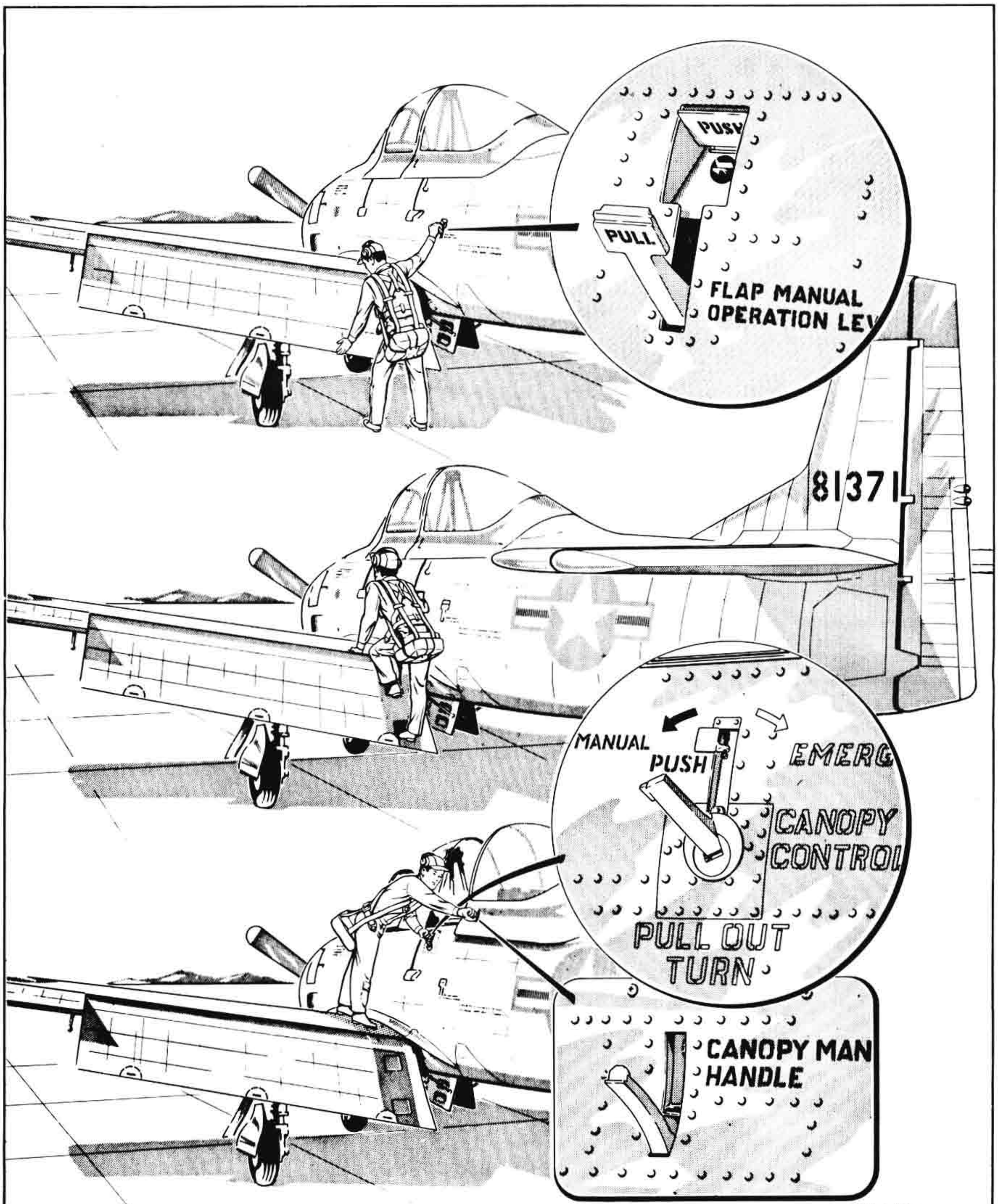


Figure 2-1. Entering Airplane

2-3. BEFORE ENTERING AIRPLANE.

2-4. PREINSPECTION CHECK.

a. Obtain take-off and anticipated landing gross weight.

Note

(Deleted)

b. Check engineering Form 1 and make sure airplane has been serviced with required quantities of fuel, oil, hydraulic fluid, and oxygen. See figure 1-16 for complete servicing diagram.

Note

The canopy can be opened from the left side of the airplane only (fig. 2-1). For access to the cockpits, pull flap manual lever, located in left side of fuselage above wing trailing edge, and push the flap down. Step up on the wing, using steps in flap and the handgrips in the wing and fuselage. To open canopy, pull external canopy handle out and push forward to "MANUAL." Slide canopy back by means of handle on canopy frame. On Airplanes AF49-1499 and subsequent, steps and a handhold are also provided in the right wing and flap.

2-5. EXTERIOR INSPECTION.

2-6. After completing preinspection check, make an exterior inspection, starting at the front cockpit and going clockwise around the airplane. See figure 2-3 for complete inspection procedure.

2-7. MINIMUM CREW REQUIREMENT.

2-8. The airplane can be flown solo, but from the front cockpit only.

2-9. ON ENTERING COCKPITS.

2-10. Make the following checks before starting engine:

a. Unless a pararaft is worn, make sure a seat cushion is installed.

b. Adjust seat and rudder pedals.

c. Unlock flight controls and check for free and proper movement.

d. Fasten safety belt and shoulder harness. Check operation of shoulder harness lock.

e. Set parking brakes.

f. Ignition switch "OFF."

g. Fuel selector (fuel shutoff control*) "OFF."

h. If armament equipment is installed, check armament switches "SAFE" or "OFF."

i. Hold control shift switch on until control light illuminates.

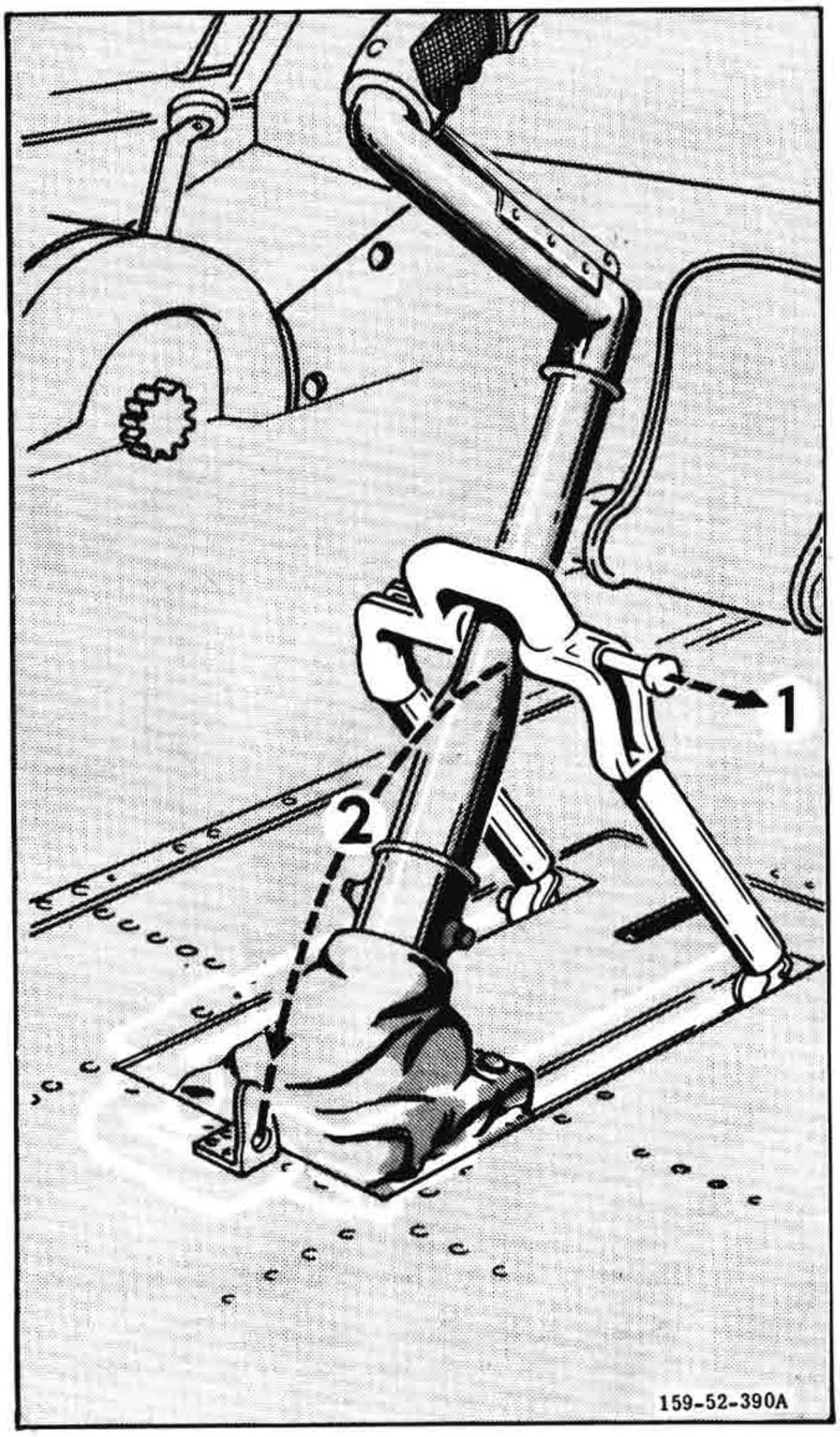


Figure 2-2. Unlocking Controls

j. External power connected. (If not available, battery switch "ON." This is considered an emergency operation.)

k. Wing flap control "UP."

l. Speed brake switch "IN."

m. Throttle cracked approximately ¾ inch.

n. Propeller control full "INCREASE RPM."

o. Mixture control "IDLE CUTOFF."

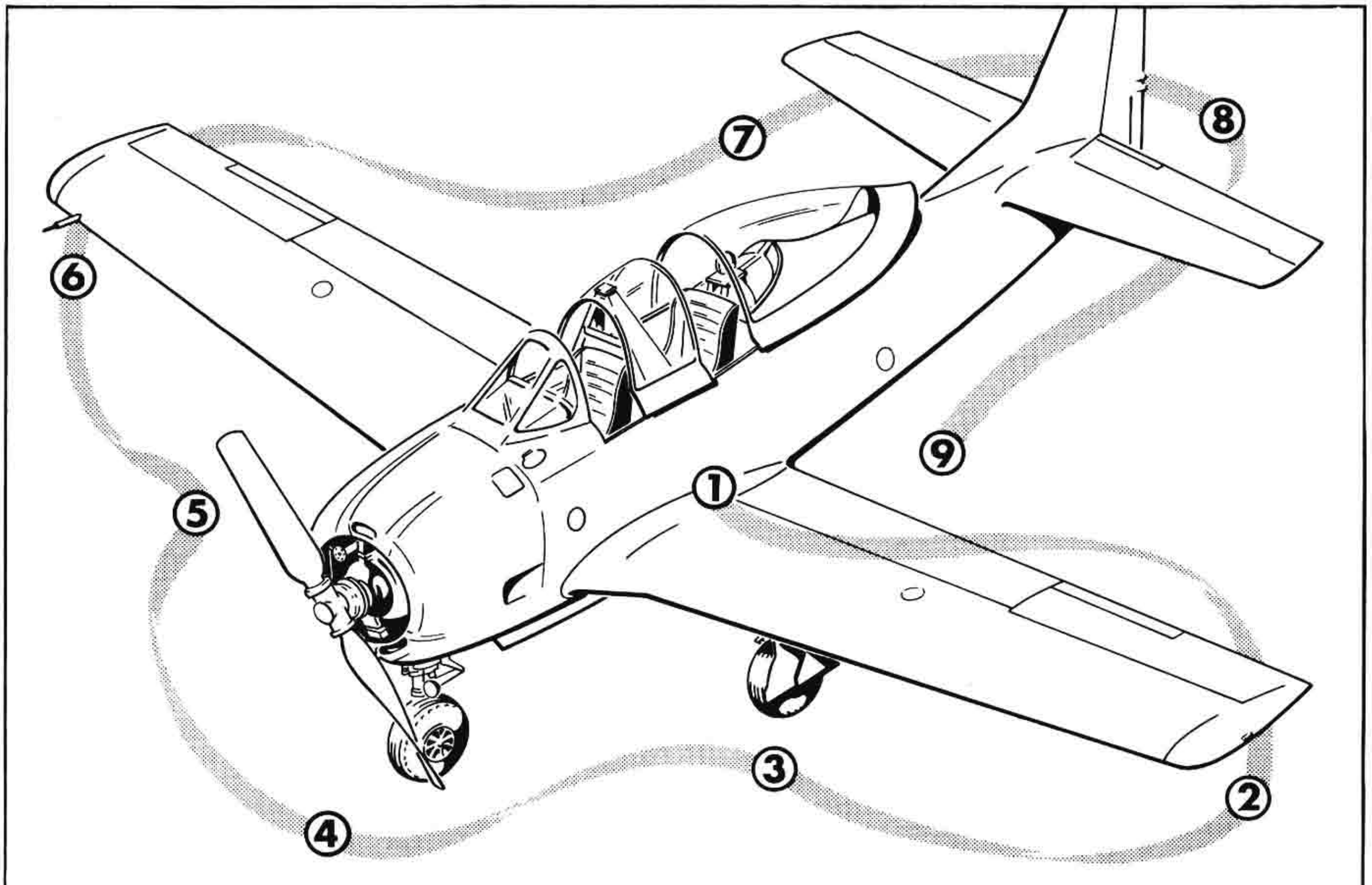
p. Carburetor air control "COLD AIR" (or "FILTERED AIR" if necessary).

q. Cowl and oil cooler flap switch "OPEN."

r. Canopy emergency air pressure checked.

s. Cockpit heater control "OFF"; defrost control "OFF."

*Airplanes AF51-3463 and subsequent



Starting at the front cockpit, make the following checks:

① **COCKPIT.**
- Trim tab controls neutral.
- Engine oil tank and hydraulic fluid caps and covers secure.
- Visually check fuel tank caps secure.
- If flying solo, secure rear seat safety belt, shoulder harness, oxygen equipment, etc.

② **LEFT WING.**
- Aileron trim tab in neutral position.
- Position light for condition.

③ **LEFT LANDING GEAR.**
- Main wheels chocked.
- Ground safety pin removed.
- Gear strut extended approximately 3 inches.
- Tire for proper inflation, cuts, blisters, and slippage.
- Check for hydraulic leaks.
- Heater air intake and exhaust for obstructions.

④ **POWER PLANT SECTION.**
- Cowling and cowling latch handles secure.
- Carburetor and oil cooler air scoops for obstructions.
- Propeller for nicks and hydraulic leaks.
- Propeller regulator oil filler cap safetied.
- Nose wheel gear strut extended approximately 2 inches.
- Nose wheel ground safety pin removed.
- Tow pin safety cap tight.
- Tire for proper inflation, cuts, blisters, and slippage.
- Check for hydraulic leaks.
- Note nose wheel (and taxi light*) position.

⑤ **RIGHT LANDING GEAR.**
- Gear strut extended approximately 3 inches.
- Ground safety pin removed.
- Tire for proper inflation, cuts, blisters, and slippage.
- Check for hydraulic leaks.

⑥ **RIGHT WING.**
- Pitot cover removed and pressure opening in pitot head clear.
- Position light for condition.

⑦ **FUSELAGE RIGHT SIDE.**
- Static port clean.
- Fuselage lights for condition.

⑧ **EMPENNAGE.**
- Elevator trim tab neutral.
- Position lights for condition.

⑨ **FUSELAGE LEFT SIDE.**
- Static port clean.
- Baggage storage for security of lashings if baggage or loose gear is being carried.
- Baggage compartment light off, and baggage compartment locked closed.

NOTE: During this preflight check, inspect all skin for wrinkles, dents, and loose rivets.

*Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1528

159-00-915A

Figure 2-3. Exterior Inspection

t. Landing gear handle "DOWN." Check landing gear position indicators.

u. Check fuel quantity indication.

v. Altimeter, accelerometer, and clock set.

w. Note manifold pressure reading (field barometric pressure), for subsequent use during engine power check.

x. Test operation of oxygen equipment and check for 400 psi.

y. Check generator switch "ON."

z. Check inverter switch "MAIN ON."

aa. Check pitot heater switch "OFF."

ab. Check all light switches and rheostats "OFF."

ac. Circuit breakers in.

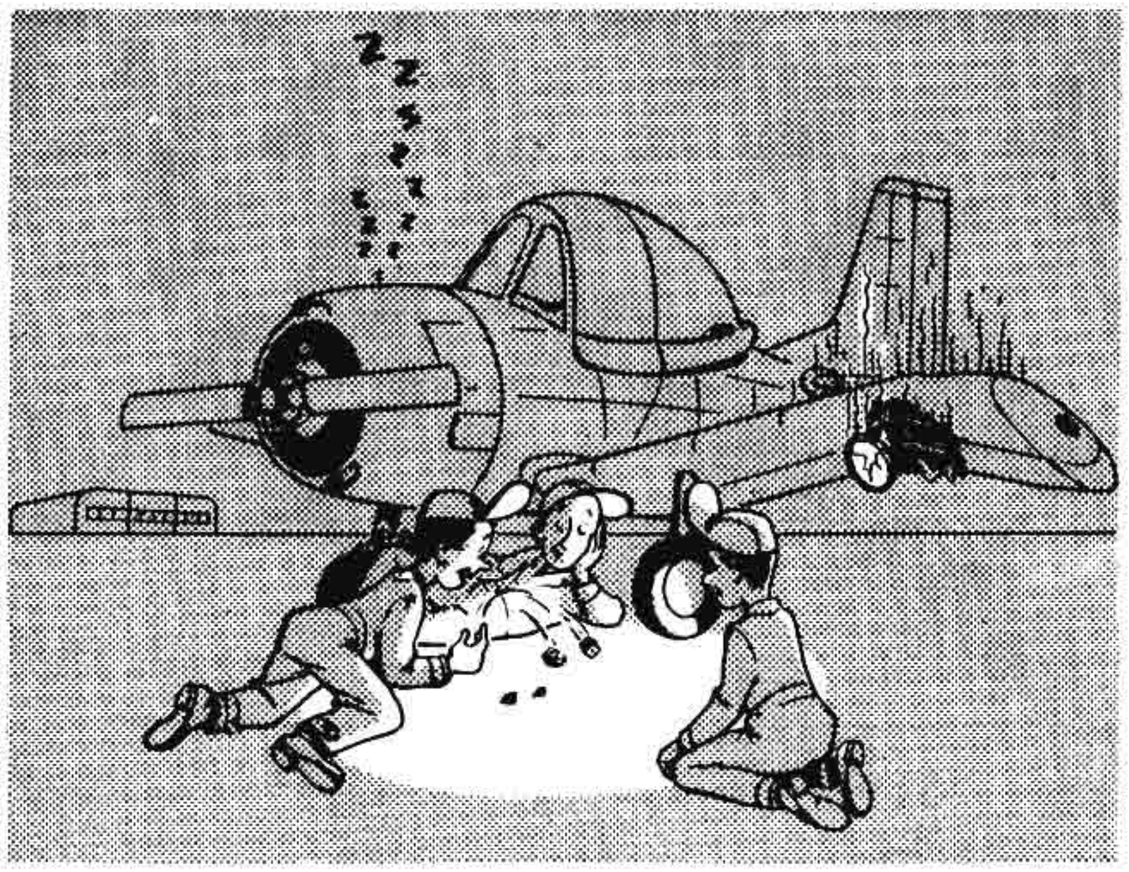
ad. Push to test and adjust intensity of all indicator and warning lights.

ae. Test operation of communications equipment (and A-1CM sight, when installed) if external power is being used; if external power is not being used, make this check after engine is running.

af. Be sure you have a flashlight.

2-11. If night flying is anticipated, the following additional checks should be made:

a. With aid of outside observer, test operation of position, fuselage, passing, landing, exterior gear down lights, and on early airplanes,* the taxi light.



CAUTION

On early airplanes,* do not leave landing light on for longer than 10 seconds when airplane is on ground, as excess heat may seriously damage the light.

b. Check operation of instrument panel lights (ultraviolet and red), console lights, and the extension light.

2-12. STARTING ENGINE.

2-13. Start the engine as follows:

a. On early airplanes,* turn fuel selector to "LH TANK" and "RH TANK," checking for boost pump pressure of 15 to 17 psi at each setting. Turn selector to "BOTH TANKS" for starting. On later airplanes,† with fuel shutoff control at "ON" position, check for boost pump pressure of 15 to 17 psi.

b. Recheck position of throttle, propeller, and mixture controls.

c. Check propeller clear.

d. With ignition switch "OFF," hold starter button down to turn propeller through at least six blades.

CAUTION

If engine has a tendency to stall during propeller rotation, have lower cylinders drained before attempting to start, as fluid in the combustion chambers will cause serious damage to the engine.

e. Continue holding starter button down. Turn ignition switch to "BOTH" and depress primer button simultaneously. Primer is very sensitive. Prime one-half to one second when engine is cold. Just touch the button when the engine is hot.

f. Release starter when engine fires, but prime intermittently until engine is running smoothly; then move mixture control to "RICH."

CAUTION

If engine fails to start after 30 seconds of continuous cranking, let starter cool for 3 minutes before repeating starting procedure.

g. Check oil pressure; if it does not register in 10 seconds or rise to 40 psi in 20 seconds, stop engine and investigate.

h. Adjust throttle to smoothest speed between 1200 and 1400 rpm as soon as oil pressure permits.

i. Have external power disconnected and turn battery switch "ON."

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**

†Airplanes AF51-3463 and subsequent

Note

Refer to paragraph 3-11 for instructions in case of fire during starting.

2-14. WARM-UP.

2-15. Before making any engine performance checks or before taxiing, warm up engine at approximately 1200 to 1400 rpm until oil temperature shows a definite increase and oil pressure remains steady when throttle is advanced. Keep cowl and oil cooler flaps open for warm-up and all ground operation. Do not try to rush engine warm-up. Idling speed is 750 rpm.

2-16. GROUND TESTS.

2-17. While engine is warming up, make the following tests:

a. Hydraulic system—check by operating wing flaps. Check hydraulic pressure.

b. Cowl and oil cooler flaps—with aid of outside observer, check operation from "OPEN" to full "CLOSE." Return flaps to full open position.

c. With manifold pressure below 30 in. Hg, depress manifold pressure drain button for 3 seconds.

d. Instruments—check for readings in desired ranges.

e. Electrical system—

At approximately 1200 to 1400 rpm, check generator load indicator for reading and voltmeter for approximately 28 volts.

Check both inverter warning lights out with inverter switch at "MAIN ON"; then turn inverter switch to "SPARE ON" (only the amber main inverter warning light should illuminate), then to "OFF" (only the red light should illuminate).

Return inverter switch to "MAIN ON."

Note

When returning inverter switch to "MAIN ON," stop at "OFF" for 3 seconds to allow time for change-over relay to operate. It is not necessary to stop at "OFF" when moving inverter switch from "MAIN ON" to "SPARE ON."

f. Communications equipment and A-1CM sight—check operation if not previously accomplished.

g. Ignition switch check—at 750 rpm, turn ignition switch "OFF" momentarily, and note that engine stops firing completely. If engine does not cease firing completely, it indicates the magnetos are not grounded. If magneto ground lead trouble exists, the ignition system check before take-off will not be reliable. Shut down the engine and warn personnel to keep clear of the propeller until the difficulty has been remedied.

CAUTION

Perform this check as rapidly as possible to prevent severe backfire when ignition switch is turned on again.

2-18. TAXIING.

2-19. Observe the following instructions and precautions for taxiing:

a. Chocks removed.

b. Check wing flaps up.

c. With rudder pedals neutral, depress steering switch lever on control stick; then release parking brakes and allow airplane to roll straight ahead.

Note

If airplane is standing still, do not operate rudder pedals with steering switch engaged, as such action will cause undue wear on the nose wheel tire.

d. As soon as airplane is moving straight, apply brakes evenly and firmly to check for adequate braking action. *Never allow taxi speed to build up without checking brakes.*

e. Taxi slowly, using brakes lightly when necessary to slow down or stop. Never ride the brakes, as they will heat rapidly.

f. Whenever you stop the airplane, idle at 1100 rpm. This will prevent plug fouling and create enough propeller blast to help cool the engine.

g. Park a safe distance off end of runway you intend using for take-off, and turn into the wind to provide maximum cooling for engine run-up.

2-20. BEFORE TAKE-OFF.

2-21. PREFLIGHT ENGINE CHECK.

2-22. Before every flight, make the following preflight engine check:

Note

While performing checks requiring rpm reading, it may be necessary to tap instrument panel to prevent tachometer sticking, especially in cold weather.

a. Check propeller control at full "INCREASE RPM."

b. Power check—adjust manifold pressure to field barometric pressure (as read on manifold pressure gage before starting engine) and check for 2100 (±50) rpm.

Note

If rpm is too low for given manifold pressure, engine is not developing sufficient power and should be checked before flight.

c. Ignition system check—with throttle adjusted to 2100 rpm, check "L" and "R" ignition system for maximum drop of 75 rpm. Return ignition switch to "BOTH" between checks to allow speed to stabilize. If drop exceeds 75 rpm, return ignition switch to "BOTH" and run engine up to take-off power for a few seconds; then recheck ignition system at 2100 rpm.

d. Fuel-air mixture check—at 1700 rpm, move mixture control to "NORMAL" and note any change in rpm; return control to "RICH." An increase of over 25 rpm indicates the mixture is too rich; a decrease of over 75 rpm indicates too lean a mixture.

e. Propeller check—at 1800 rpm, pull propeller control back toward "DECREASE RPM" position and note rpm drop of at least 300 rpm; then return control to full "INCREASE RPM" position.

f. Acceleration and deceleration check—with the mixture control at "RICH," advance throttle from idle to 2400 rpm. Repeat this procedure with the mixture control at "NORMAL." Engine should accelerate and decelerate rapidly and smoothly with no tendency to backfire. Return mixture to "RICH" after check.

g. Idle speed check—with throttle closed and cylinder head temperature above 150°C, check for idling speed of 750 rpm.

2-23. PREFLIGHT AIRCRAFT CHECK.

2-24. Before take-off, perform the following additional checks:

a. Surface controls checked for free and proper movement.

b. Canopy handle "CLOSED."

c. On early airplanes,* fuel selector "BOTH TANKS." On later airplanes,† fuel shutoff control "ON."

d. Trim tabs set for take-off. Ailerons, 0 degrees; elevator, 0 degrees; rudder, 5 to 7 degrees "R."

e. Flap control "UP" for take-off.

f. Propeller control full "INCREASE RPM."

g. Mixture control "RICH."

h. Carburetor air control "COLD AIR" or "FILTERED AIR" as required.

Note

Use warm air for take-off only when danger of carburetor icing exists.

i. Cowl and oil cooler flap switch "OPEN."

j. Instruments in desired ranges. Altimeter, accelerometer, slaved gyro magnetic compass, and attitude gyro set.

k. If bombs or rockets are installed, set bomb-rocket selector at "JETTISON" to allow immediate jettisoning, in event of engine failure on take-off, by depressing release button on stick grip.

2-25. TAKE-OFF.

2-26. Only during the initial part of the ground roll does take-off in this airplane vary from that of airplanes with a tail wheel, the principal difference being in attaining the proper angle of attack. On airplanes with a tail wheel, you start from a high positive angle of attack and reduce the angle, whereas in the T-28A you start from almost a zero angle of attack and obtain a positive angle by raising the nose wheel. You will find that take-offs in an airplane with tricycle gear are much easier than in one that has a tail wheel. Plan your take-off according to the following variables affecting take-off technique: gross weight, wind, outside air temperature, type of runway, and height and distance of the nearest obstacles. See figure A-9 for required take-off distances.

2-27. NORMAL TAKE-OFF.

a. Roll into take-off position and align nose wheel with runway.

b. Advance throttle smoothly to take-off power.

*Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319

†Airplanes AF51-3463 and subsequent

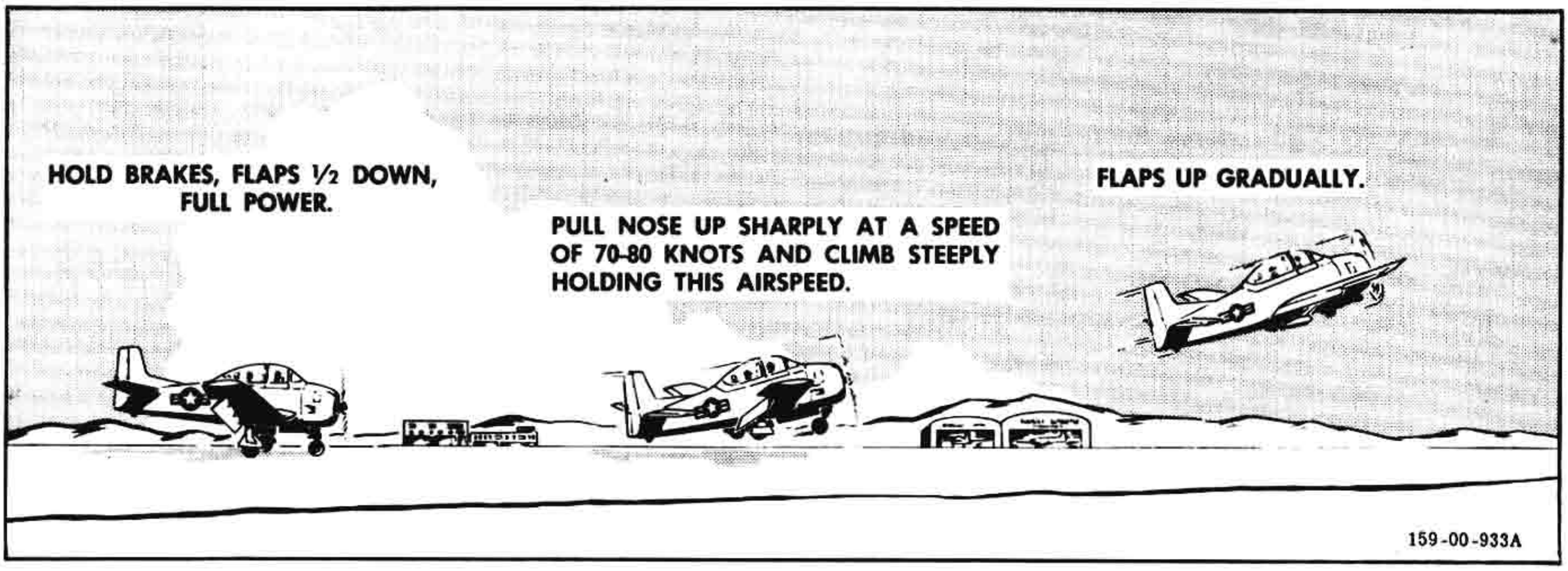


Figure 2-4. Minimum-run Take-off Procedure

c. Use nose wheel steering to maintain directional control during initial portion of ground run. The rudder is effective for directional control above approximately 30 knots IAS.

d. As speed increases and elevator control becomes effective, lift nose wheel slightly; then, as speed builds up, increase back pressure on the stick and allow airplane to fly itself off.

e. Normal take-off speed is approximately 75 to 85 knots IAS.

Note

For procedure to follow in event of engine failure during take-off, refer to paragraphs 3-3 and 3-5.

2-28. MINIMUM-RUN TAKE-OFF.

2-29. A minimum-run take-off is a maximum performance maneuver with the airplane near stalling speed. It is directly related to slow flying and flaps-down stalls; consequently, you should be familiar with these maneuvers before attempting to make a minimum-run take-off. Use nose wheel steering instead of brakes to counteract torque during the initial ground roll. (Use of brakes will increase the ground roll.) Complete all normal "before take-off" checks and follow procedure outlined in figure 2-4 for a minimum-run take-off.

2-30. AFTER TAKE-OFF.

2-31. Following the take-off:

a. When you are definitely air-borne, apply brakes to stop wheels, and then move landing gear handle to "UP." Approximately 6 seconds is required for gear retraction. Check landing gear position indicators.

b. Reduce power to maximum continuous by first retarding throttle, then propeller. Move mixture control to "NORMAL."

c. Hold minimum angle of climb until airspeed builds up to normal climb speed.

d. Adjust cowl and oil cooler flaps as necessary to maintain desired cylinder head and oil temperatures (fig. A-1).

e. Turn bomb-rocket selector to "OFF."

2-32. CLIMB.

2-33. Refer to Take-off, Climb, and Landing Chart (fig. A-9) for climb data—power settings, recommended airspeed for climb, rate of climb, and fuel consumption.

2-34. ENGINE OPERATION IN FLIGHT.

2-35. Make the following engine checks during flight:

a. Set throttle and propeller controls for desired power settings. See figure 2-5 for maximum recommended manifold pressures at various rpm and altitudes. For cruise data, see Flight Operation Instruction Charts in Appendix I.

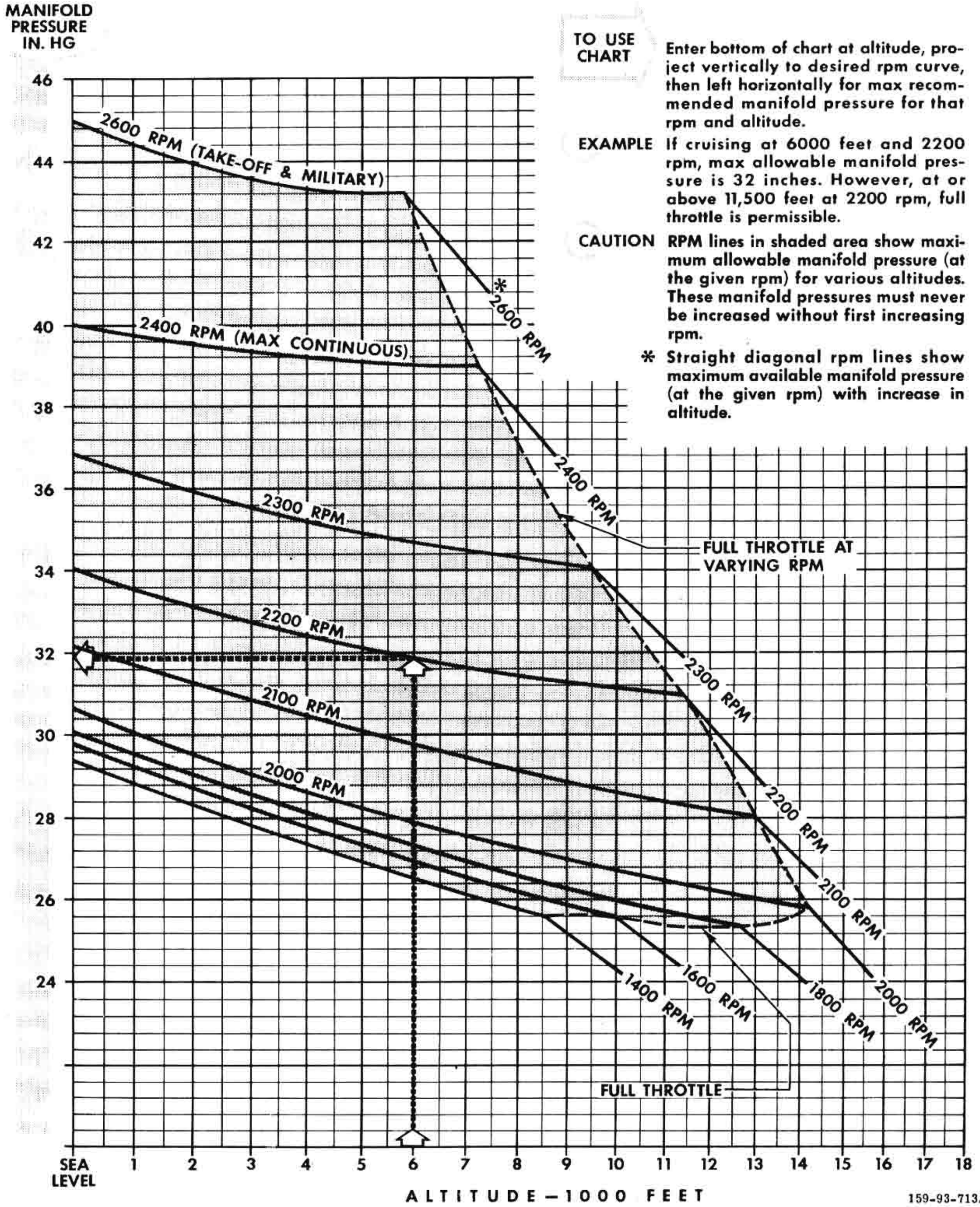
Note

One basic sequence to remember in engine operation is: when increasing power, first advance propeller control, then throttle; to decrease power, first retard throttle, then propeller control. Use of this procedure will help prevent detonation resulting from high manifold pressure and low rpm.

b. Periodically check for desired instrument readings (fig. A-1).

c. Adjust cowl and oil cooler flaps to keep cylinder head and oil temperature within limits.

MAXIMUM RECOMMENDED MANIFOLD PRESSURES



TO USE CHART Enter bottom of chart at altitude, project vertically to desired rpm curve, then left horizontally for max recommended manifold pressure for that rpm and altitude.

EXAMPLE If cruising at 6000 feet and 2200 rpm, max allowable manifold pressure is 32 inches. However, at or above 11,500 feet at 2200 rpm, full throttle is permissible.

CAUTION RPM lines in shaded area show maximum allowable manifold pressure (at the given rpm) for various altitudes. These manifold pressures must never be increased without first increasing rpm.

* Straight diagonal rpm lines show maximum available manifold pressure (at the given rpm) with increase in altitude.

Figure 2-5. Maximum Recommended Manifold Pressures

2-36. ENGINE CUTOUT.

CAUTION

Before starting any descent, always place mixture control in "RICH." Engine cutout may occur at retarded throttle settings, such as are used in glide or landing approach, if mixture control is not in "RICH" position.

2-37. Engine cutout is possible at high altitude with engine at full throttle, low rpm (1600 rpm or less), and mixture control "NORMAL." In event of engine cutout, at any power setting, proceed as follows:

a. Mixture control "RICH."

b. Propeller control full "INCREASE RPM."

c. Advance throttle as necessary.

2-38. FUEL SYSTEM OPERATION IN FLIGHT.

2-39. On early airplanes,* with the fuel selector at "BOTH TANKS," fuel flow from both tanks may not be equal. Maintain equal fuel level in each tank by occasionally moving the fuel selector to "LH TANK" or "RH TANK" as required. On later airplanes,† no action by the pilot is necessary to maintain equal fuel level in the fuel tanks.

Note

To prevent possible engine cutout in early airplanes* during rolls, etc, fuel selector should be positioned to "BOTH TANKS" before acrobatics are performed.

2-40. TURBULENT AIR AND THUNDERSTORM FLYING.

CAUTION

Thunderstorm flying demands considerable instrument experience and should be intentionally undertaken only by a pilot who has qualified for the AF Form 8A (green) instrument card. However, many routine flight operations of the Air Force require a certain amount of thunderstorm flying, since it is not always possible to avoid storm areas. At night it is often impossible to detect individual storms and find the in-between clear areas. A pilot, using modern equipment and possessing a combination of proper experience, common sense and instrument flying proficiency, can safely fly thunderstorms.

2-41. Power setting and pitch attitude are the keys to proper flight technique in turbulent air. The power setting and pitch attitude required for desired penetration airspeed, and established before entering the storm, must, if maintained throughout the storm, result in a constant airspeed, regardless of any false readings of the airspeed indicator. Specific instructions for preparing to enter a storm and flying in it are given in the following paragraphs.

2-42. BEFORE TAKE-OFF.

a. Check turbulent air penetration speed chart (fig. 2-6) for best penetration speeds.

b. Make a thorough analysis of the general weather situation to determine thunderstorm areas and prepare a flight plan which will avoid thunderstorm areas whenever possible.

c. Before undertaking any instrument flight, inspect your airplane to ensure proper operation of all flight instruments, navigation equipment, pitot heater, carburetor heat, panel lights, oxygen, and defrosting systems. Of course, the same check should be made before flight into thunderstorm areas.

2-43. APPROACHING THE STORM.

2-44. It is imperative that you prepare the airplane prior to entering a zone of turbulent air. If the storm cannot be seen, its proximity can be detected by radio crash static. Prepare the airplane as follows:

a. Propeller control 2000 rpm, for gyroscopic stability.

b. Mixture control "RICH."

c. Pitot heater switch "ON."

d. Carburetor air control "WARM" or "HOT AIR" as required.

e. Throttle adjusted as necessary to obtain penetration speed.

f. Check gyro instruments for proper settings.

g. Safety belt tightened.

h. Do not attempt to retune radios or make any other

*Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319

†Airplanes AF51-3463 and subsequent

adjustments. Turn off any radio equipment rendered useless by static. Do not rely on ADF in or near thunderstorms, as the radio compass will be unreliable in the "COMP" position. To reduce static, the "LOOP" position should be used. It may be necessary to rely on aural-null procedure to determine position.

Note

If the radio compass cannot be used, contact the nearest radio facility and request VHF/DF for headings.

i. At night, turn cockpit lights full bright or use dark glasses to minimize blinding effect of lightning.

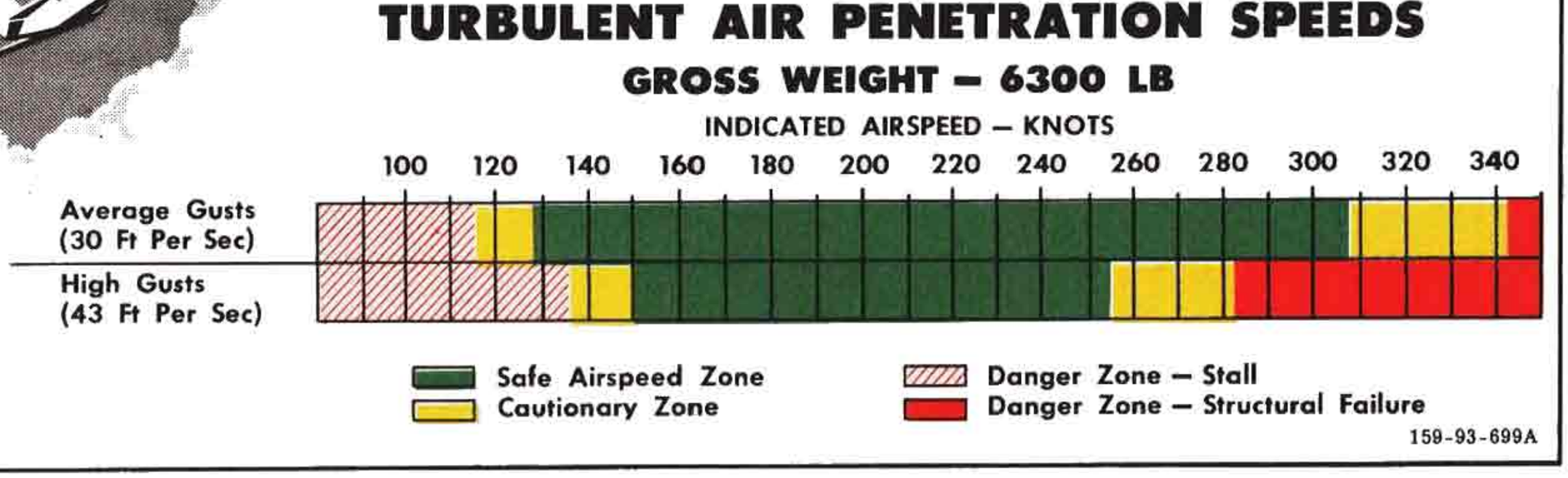


Figure 2-6. Turbulent Air Penetration Speeds

CAUTION

Do not lower gear and flaps, as they merely decrease the aerodynamic efficiency of the airplane and limit your airspeed.

2-45. IN THE STORM.

a. Maintain power setting and pitch attitude (established before entering the storm) throughout the storm. Hold these constant, and your airspeed will be constant, regardless of the airspeed indicator.

b. Maintain attitude. Concentrate principally on holding a level attitude by reference to the artificial horizon.

c. Don't chase the airspeed indicator, since doing so will result in extreme airplane attitudes. If a sudden gust should be encountered while airplane is in a nose-high attitude, a stall might easily result. A heavy rain, by partial blocking of the pitot tube pressure head, may decrease the indicated airspeed reading considerably.

d. Use as little elevator control as possible to maintain your attitude in order to minimize the stresses imposed on the airplane.

e. The altimeter may be unreliable in thunderstorms because of differential barometric pressure within the storm.

Note

Normally, the least turbulent area in a thunderstorm will be at an altitude of 6000 feet above the terrain. Altitudes between 10,000 and 20,000 feet are usually the most turbulent.

2-46. LANDING.

2-47. NORMAL LANDING.

2-48. Approach and landing procedure is shown in figure 2-7. Prior to entering the landing pattern, make the following prelanding checks:

a. Armament switches "SAFE" or "OFF."

b. Carburetor air control "COLD AIR" or "FILTERED AIR" as necessary.

c. Mixture control "RICH."

d. Cowl and oil cooler flaps adjusted as necessary.

WARNING

On early airplanes,* do not extend landing light at airspeeds above 125 knots with gear and flaps down or 110 knots clean. When landing light is extended at higher airspeeds, aileron buffeting accompanied by a rolling tendency will be encountered.

2-49. Observe the following precautions in accomplishing the final approach and landing procedures outlined in figure 2-7. Just before reaching end of runway, start flare. Use smooth, continuous back pressure on the stick to obtain a tail-low attitude for landing. Change attitude evenly and slowly; don't jerk the controls or go down in steps. Note that the attitude for this landing is similar to that attained in a gear- and flaps-down stall. Touch main wheels first, with tail down. Hold nose wheel off; then ease off the back pressure on the stick and lower nose slowly before losing elevator control. Use rudder for directional control and when possible, take advantage of runway length to save brakes. Test brakes carefully before needing them to stop, and apply soon enough to avoid abrupt braking action.

*Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319

TYPICAL LANDING PATTERN

POWER-OFF LANDING AT 6500 LB

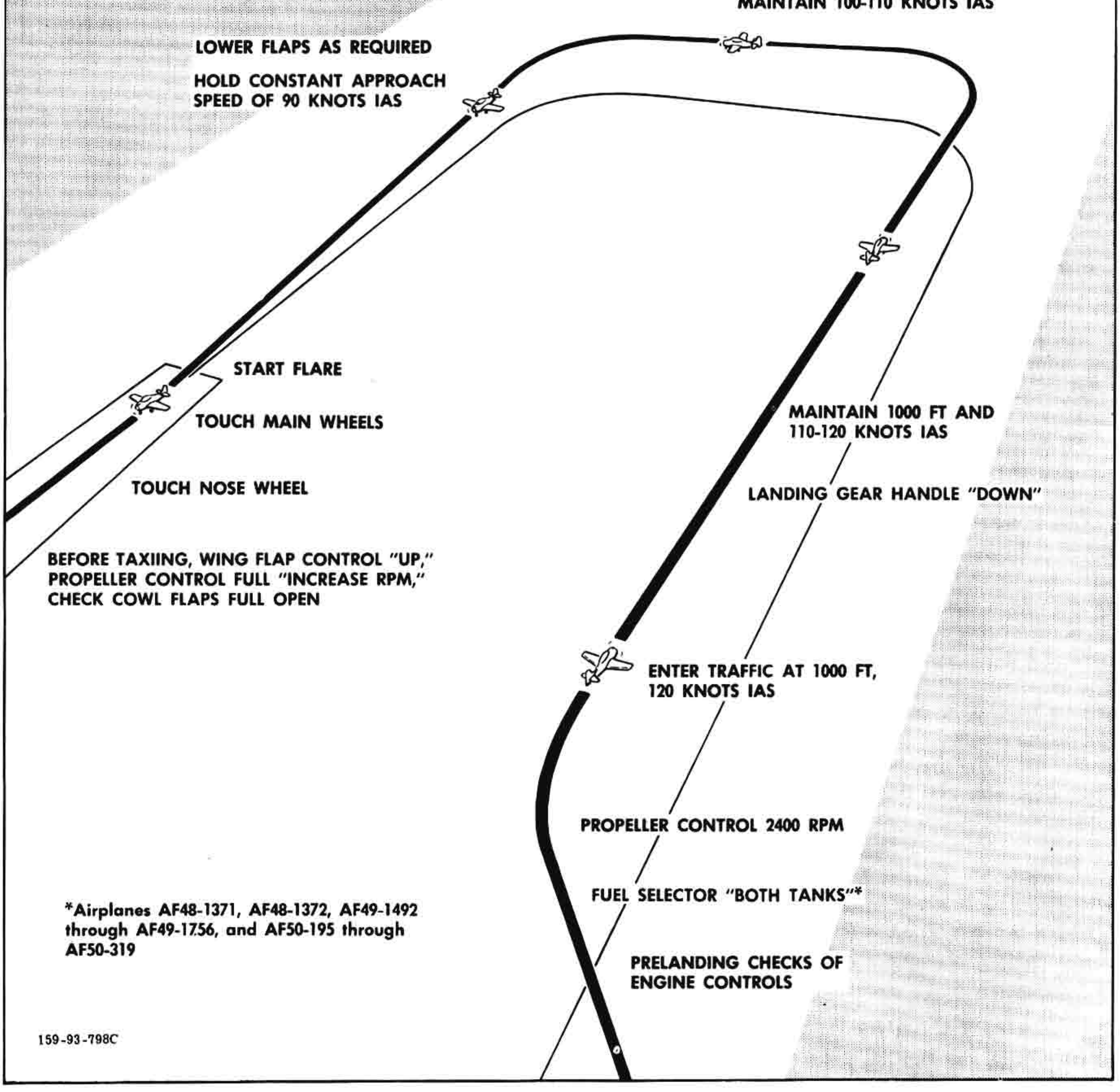


Figure 2-7. Approach and Landing Procedure

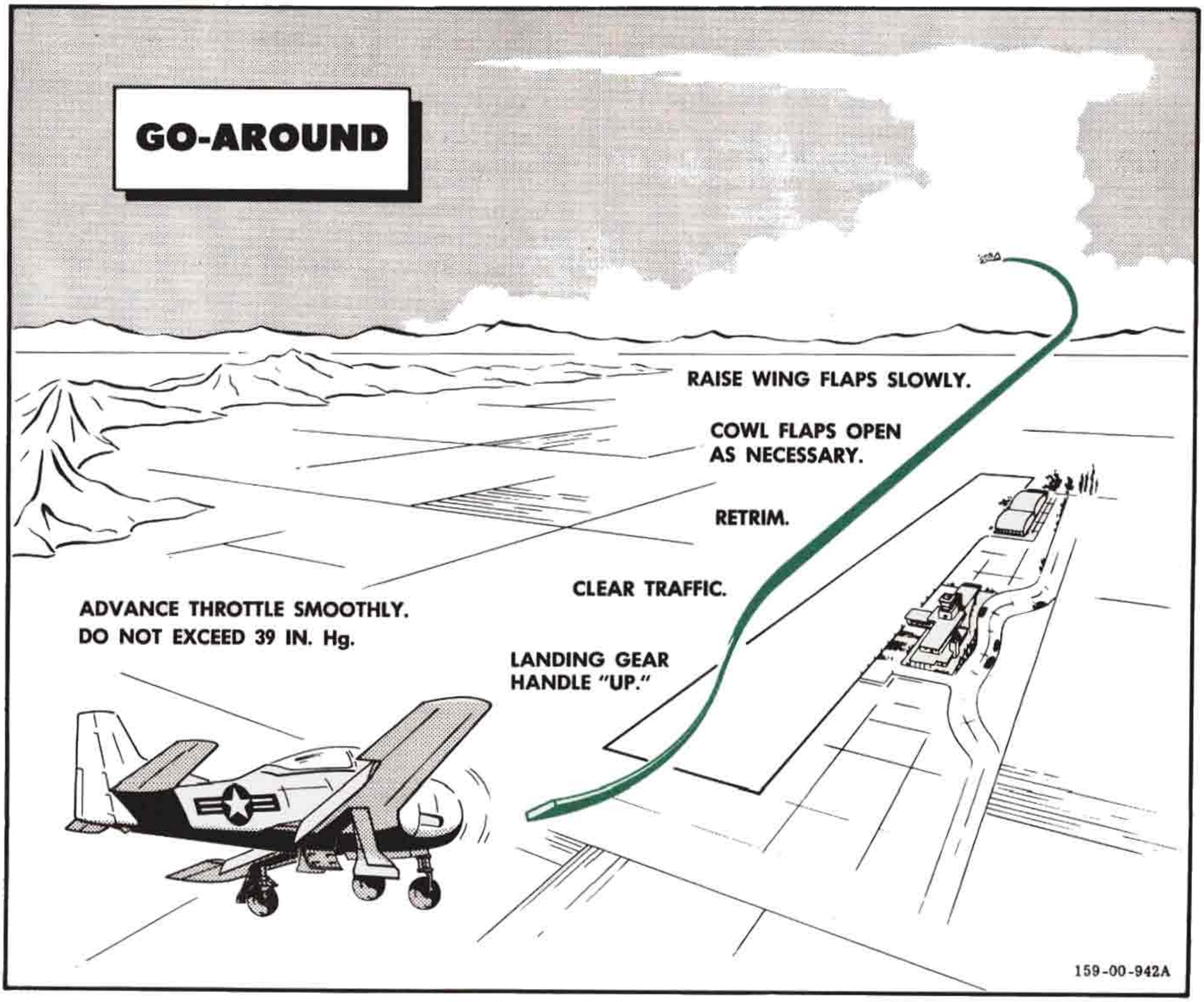


Figure 2-8. Go-around

2-50. GO-AROUND.

2-51. A typical go-around procedure is shown in figure 2-8. Decide early in approach whether it is necessary to go around, and start before you reach too low an altitude and airspeed.

2-52. POSTFLIGHT CHECK (LAST FLIGHT OF DAY ONLY).

2-53. After the last flight of the day, make the following checks:

Note

When checking rpm readings, tap instrument panel to eliminate sticking of the tachometer.

a. Check propeller control at full "INCREASE RPM."

b. Ignition switch check—at 750 rpm, turn ignition switch "OFF" momentarily, and note that engine stops firing completely. If engine does not cease firing completely, it indicates the magnetos are not grounded. If magneto ground lead trouble exists, the ignition system check will not be reliable. Shut down the engine and warn personnel to keep clear of the propeller until the difficulty has been remedied.

CAUTION

Perform this check as rapidly as possible to prevent severe backfire when ignition switch is turned on again.

c. Idle mixture and speed check—close throttle and check for idling speed of approximately 750 rpm. Slowly move mixture control toward "IDLE CUTOFF," and note any change in rpm and manifold pressure; a

momentary decrease in manifold pressure with an increase in rpm indicates that the mixture is too rich. Return mixture contol to "RICH" position before engine ·uts out. At normal idling speed, momentarily press rimer button and note any change in rpm and mani-·old pressure; a momentary decrease in manifold pressure with an increase in rpm indicates that the mixture is too lean.

d. Power check—adjust manifold pressure to field barometric pressure (as read on manifold pressure gage before starting engine) and check for 2100 (±50) rpm.

Note

If rpm is too low for given manifold pressure, engine is not developing sufficient power and should be checked before flight.

e. Ignition system check—at 2100 rpm, check "L" and "R" ignition system for maximum drop of 75 rpm. Return ignition switch to "BOTH" between checks to allow speed to stabilize. If drop exceeds 75 rpm, return ignition switch to "BOTH" and run engine up to take-off power for a few seconds; then recheck ignition system at 2100 rpm.

f. Fuel-air mixture check—at 1700 rpm, move mixture control to "NORMAL" and note any change in rpm; return mixture control to "RICH." An increase of over 25 rpm indicates the mixture is too rich; a decrease of over 75 rpm indicates too lean a mixture.

2-54. ENGINE SHUTDOWN.

2-55. OIL DILUTION.

2-56. When a cold-weather start is anticipated, dilute oil as required by the lowest expected temperature. For oil dilution instructions, refer to paragraph 5-14.

2-57. STOPPING ENGINE.

a. Parking brakes set.

b. Run engine at 1000 rpm for 2 minutes to permit efficient scavenging of crankcase oil.

c. Stop engine by pulling mixture control to "IDLE CUTOFF."

CAUTION

After pulling mixture control to "IDLE CUT-OFF," do not open throttle while propeller is turning, as engine may backfire.

d. After propeller stops turning, turn ignition switch "OFF" and close throttle.

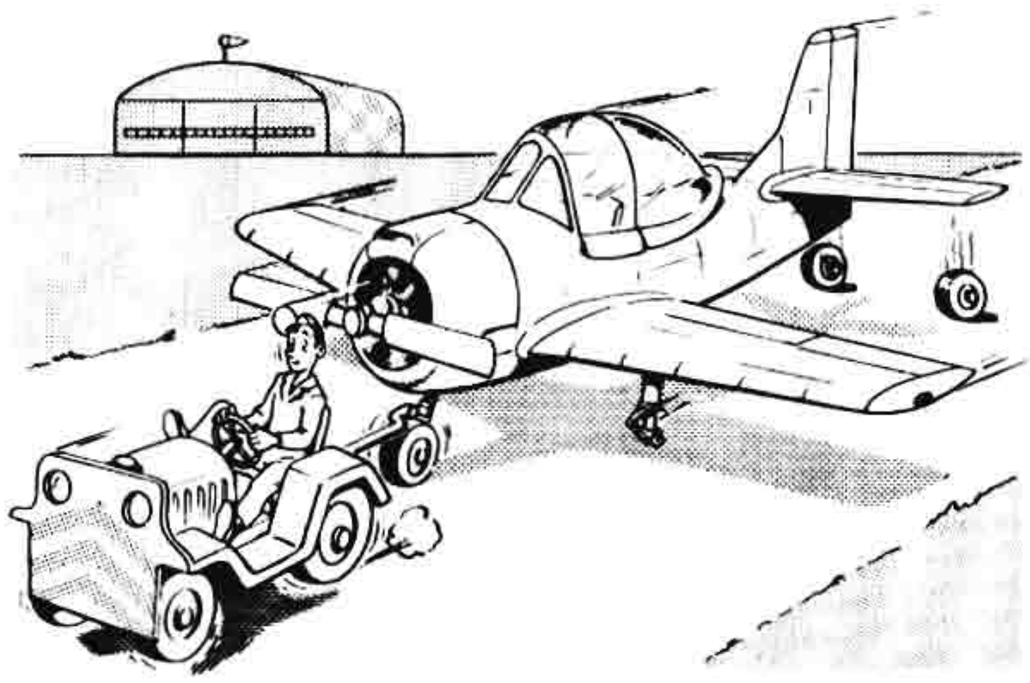
e. Fuel selector (fuel shutoff control*) "OFF."

f. Turn all electrical switches off except generator switch.

2-58. BEFORE LEAVING AIRPLANE.

2-59. Make the following checks before you leave the airplane:

a. Have wheels chocked; then release brakes.



CAUTION

Do not leave parking brakes set, because of possibility of seizure if brakes are overheated.

b. Lock controls (flight controls neutral, throttle closed).

c. Complete Form 1.

d. Close canopy.

*Airplanes AF51-3463 and subsequent

EMERGENCY OPERATION

159-00-935

3-1. ENGINE FAILURE.

3-2. ENGINE FAILURE DURING TAKE-OFF.

3-3. Should the engine fail during the take-off run, immediately close throttle and apply brakes. If remaining runway is insufficient for stopping, and it becomes necessary to collapse the landing gear, proceed as follows:

a. If bombs or rockets are installed, jettison them by pressing bomb-rocket release button on stick grip.

WARNING

Before any take-off when bombs or rockets are installed, bomb-rocket selector should be positioned at "JETTISON" to allow immediate release by pressing button on stick grip, in event of an engine failure.

b. Landing gear handle "UP." (A very hard pull on the handle will be necessary to override the gear handle down-lock.)

c. Ignition, battery, and generator switches and fuel selector (fuel shutoff control*) "OFF." Mixture control "IDLE CUTOFF."

d. Canopy handle "EMERG OPEN."

3-4. ENGINE FAILURE AFTER TAKE-OFF.

3-5. If engine fails after take-off:

a. Immediately lower nose to maintain airspeed above stall.

b. Jettison bombs or rockets, if carried.

c. Landing gear handle "UP." (If there is insufficient time or hydraulic pressure to completely raise the gear, it is better to have it unlocked so that it will collapse on landing.)

d. Ignition, battery, and generator switches "OFF."

e. Fuel selector (fuel shutoff control*) "OFF."

f. Shoulder harness locked and canopy handle "EMERG OPEN."

Figure 3-1. Land Straight Ahead

*Airplanes AF51-3463 and subsequent

FORCED LANDING DEAD ENGINE

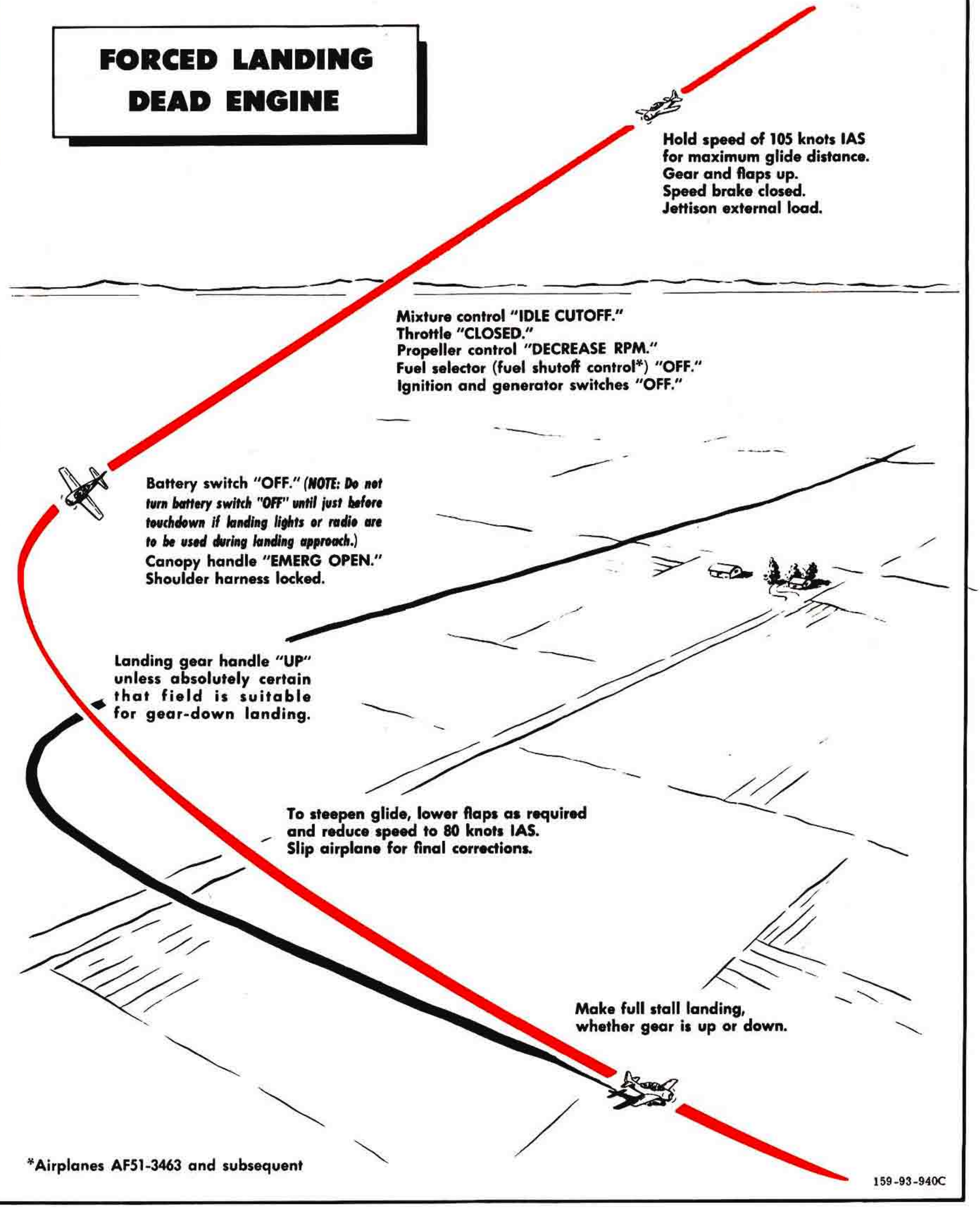


Figure 3-2. Forced Landing—Dead Engine

g. Land straight ahead, changing direction only enough to miss obstacles. Don't try to turn back to the field—making a crash landing straight ahead with the airplane under control is much better than turning back and taking the chance of an uncontrolled roll into the ground.

3-6. ENGINE FAILURE DURING FLIGHT.

3-7. If engine fails in flight, and sufficient altitude is available, attempt to restart the engine as follows:

a. Lower nose of airplane immediately to maintain airspeed well above stall. Maximum gliding distance, gear and flaps up, is obtained at 105 knots IAS.

b. Throttle cracked approximately ¾ inch; propeller control full "INCREASE RPM," and mixture control "RICH."

c. Fuel selector on early airplanes* at "BOTH TANKS." On later airplanes† check fuel shutoff control "ON." Check for fuel pressure of 15 to 17 psi. Should boost pumps be inoperative, check boost pump circuit breakers in. Above approximately 10,000 feet, sufficient fuel will not be supplied to the engine without boost pumps operating.

d. Move carburetor air control to "HOT AIR" if icing conditions exist.

e. Check ignition and battery switches on.

f. If engine does not start, and altitude permits, move mixture control to "IDLE CUTOFF" and advance throttle to full "OPEN" for a few seconds to clear the engine.

g. Readjust throttle to starting position and move mixture control to "RICH."

h. If it is impossible to restart the engine, make a forced landing if possible, or bail out. (Refer to paragraph 3-34 for bail-out procedure.)

3-8. FORCED LANDING.

3-9. If the engine fails during flight, maximum gliding distance can be obtained by maintaining a speed of 105 knots IAS in the clean configuration. See figure 3-2 for forced landing procedure. Glide ratio and rate of sink at best glide speed under varying conditions are as follows:

	KNOTS IAS	GLIDE RATIO	RATE OF SINK
Gear and Flaps Up, Speed Brakes Closed	105	11.7 to 1	1050 fpm
Gear Down, Flaps Up, Speed Brakes Closed	80	8.2 to 1	1000 fpm
Gear Up, Flaps Down, Speed Brakes Closed	80	6.6 to 1	1400 fpm
Gear Down, Flaps Down, Speed Brakes Closed	80	5.8 to 1	1650 fpm

3-10. PROPELLER FAILURE.

3-11. Failure of the constant-speed governor may result in a runaway propeller. When such failure occurs, the propeller goes to full low pitch (high rpm) and engine speed may exceed the allowable limit of 2880 rpm. At first evidence of a runaway propeller:

a. Retard throttle.

b. Manipulate propeller control in an attempt to bring propeller within limits.

c. Pull airplane up into climb to decrease speed and increase load on propeller.

3-12. Should propeller governor failure cause the propeller to go to low governing rpm, a drop to approximately 1300 rpm will result. In event of such a failure, adjust throttle to prevent exceeding the maximum recommended manifold pressure for the low rpm (26 to 29 in. Hg). Sufficient power is available at this power setting to maintain level flight at altitudes below 7000 feet.

3-13. FIRE.

3-14. During starting, engine fire can occur in the induction system or in the exhaust system. However, pilot technique is the same in combating both types of fires —continue cranking to clear or start the engine, as the fire may be drawn through the engine or blown out the exhaust stacks and extinguished. Should a fire occur in the engine accessory section, the engine should be stopped immediately. See figure 3-3 for access to the engine accessory section.

Note

No fire extinguishing system is installed on this airplane.

3-15. ENGINE FIRE DURING STARTING.

3-16. If an engine fire occurs during starting:

a. Leave mixture control in "IDLE CUTOFF" position. Do not prime engine again.

b. Continue cranking in attempt to clear or start engine, as fire may be drawn through engine or blown out the exhaust stacks and extinguished.

c. If engine does not start, continue cranking, turn off ignition and generator switches and fuel selector (fuel shutoff control†). Move carburetor air control to "COLD AIR" and advance throttle to full "OPEN."

d. If fire continues to burn, stop cranking and turn battery switch "OFF." Signal ground crew to use portable fire extinguishing equipment.

e. Get out of airplane.

*Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319

†Airplanes AF51-3463 and subsequent

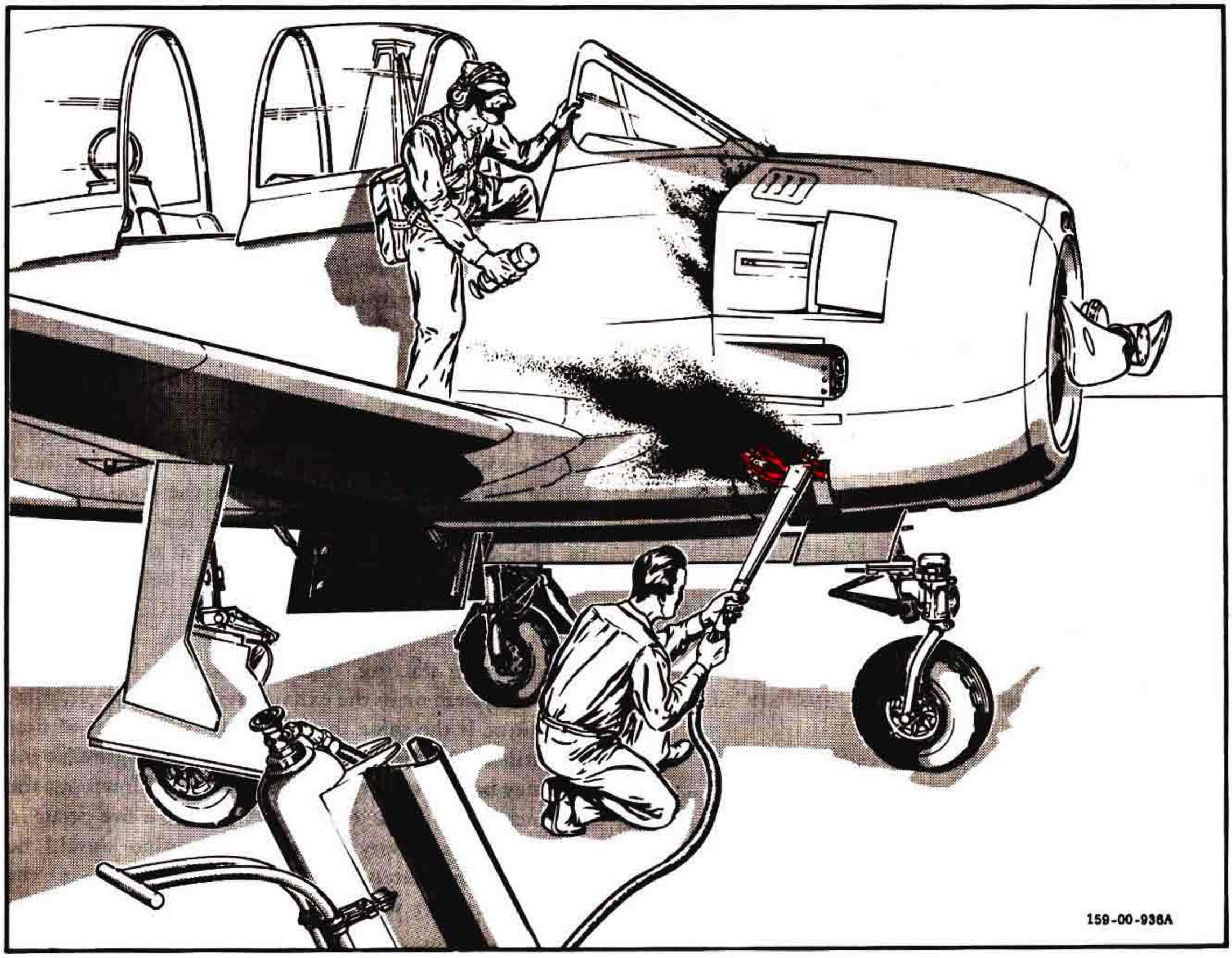


Figure 3-3. Fire-fighting Technique

3-17. ENGINE FIRE AFTER STARTING.

3-18. If an engine fire occurs after the engine has started:

a. Mixture control "IDLE CUTOFF" and throttle full "OPEN." Ignition, battery, and generator switches and fuel selector (fuel shutoff control*) "OFF."

b. If fire continues to burn, signal ground crew to use portable fire extinguishing equipment. Access to the engine accessory section is through an access door on the lower right side of the engine cowl (fig. 3-3).

c. Get out of airplane.

3-19. ENGINE FIRE DURING FLIGHT.

3-20. Depending upon seriousness of fire, either bail out immediately or attempt to extinguish fire as follows:

a. Mixture control "IDLE CUTOFF"; throttle "CLOSED."

b. Fuel selector (fuel shutoff control*) "OFF."

c. Ignition switch "OFF."

d. Cowl and oil cooler flaps open.

e. Battery and generator switches "OFF."

f. Do not attempt to restart engine after fire goes out.

g. If fire is extinguished and a forced landing is possible, leave wheels up unless absolutely sure landing field is suitable for a wheels-down landing.

3-21. FUSELAGE FIRE (DURING FLIGHT).

3-22. If a fuselage fire occurs during flight, proceed as follows:

a. Reduce airspeed immediately.

b. Use oxygen if smoke or fumes enter cockpit.

c. Attempt to determine cause of fire by shutting off (one at a time) the cockpit heater, generator switch, and battery switch.

d. If fire persists, shut down engine.

e. Use hand fire extinguisher, located in the side of the left forward console in the front cockpit.

*Airplanes AF51-3463 and subsequent

f. If fire is not extinguished immediately, bail out.

g. If fire is extinguished but a forced landing is necessary, leave wheels up unless absolutely sure landing field is suitable for a wheels-down landing.

3-23. FUSELAGE FIRE (AIRPLANE ON THE GROUND).

3-24. Access to the fuselage is through the baggage compartment door. In addition, on later airplanes,* the battery access door on the left side of the fuselage can be opened for access to fuselage fire. Should a fire occur while the airplane is on the ground, proceed as follows:

a. Mixture control "IDLE CUTOFF"; throttle "CLOSED."

b. Ignition, battery, and generator switches and fuel selector (fuel shutoff control*) "OFF."

c. Signal ground crew.

d. Get out of airplane.

e. Open baggage compartment to combat fire. On later airplanes,* the battery access door on the left side of the fuselage can also be opened to insert a fire extinguisher nozzle.

3-25. WING FIRE.

3-26. If a fire breaks out in the wing:

a. Turn off all wing light switches (position, passing, and landing), armament switches, and pitot heater switch.

b. Attempt to extinguish fire by sideslipping airplane away from flame.

c. If fire is not extinguished immediately, bail out. (Refer to paragraph 3-34 for bail-out procedure.)

3-27. ELECTRICAL FIRE.

3-28. Fuses and circuit breakers protect most electrical circuits and tend to isolate an electrical fire. If necessary, however, turn generator and battery switches "OFF." All electrical equipment (fig. 1-15) is inoperative when the battery and generator switches are "OFF." To prevent a recurrence of the fire, the switches should be left "OFF" and an emergency landing made as soon as possible.

3-29. EMERGENCY ENTRANCE.

3-30. To open the canopy from the outside in an emergency, pull canopy handle on left side of fuselage out and back to "EMERG." If pneumatic system is ineffective, move handle forward to "MANUAL" and pull canopy open by means of handle on frame of rear section of canopy.

3-31. DITCHING.

3-32. The airplane should be ditched only as a last resort. Since all emergency equipment is carried by the pilots, there is no advantage in riding the airplane down. However, if altitude is insufficient for bail-out and ditching is unavoidable, proceed as follows:

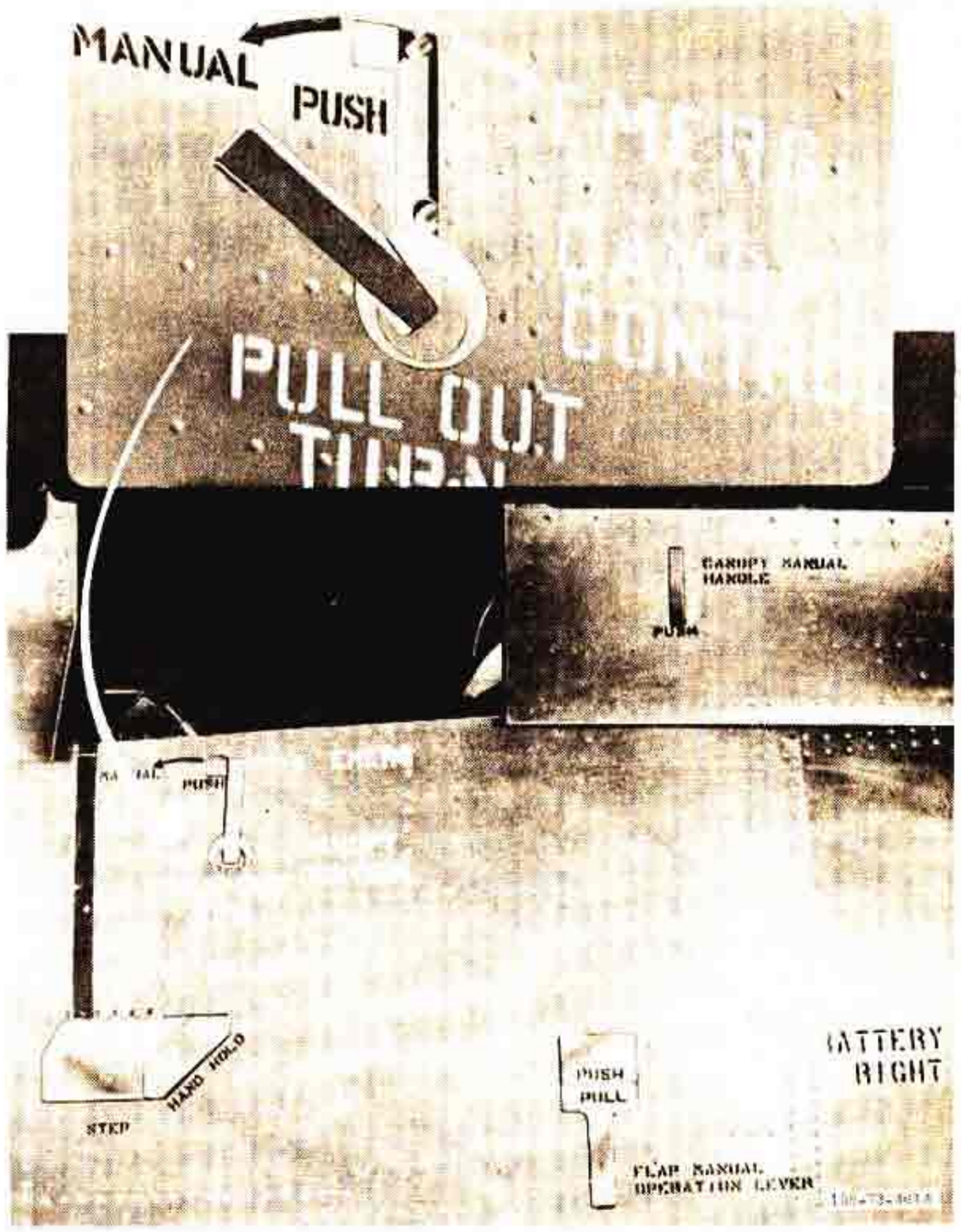


Figure 3-4. Airplane Entrance Controls

a. Follow radio distress procedure.

b. Jettison bombs or rockets, if carried.

c. See that no personal equipment will foul when you leave the airplane. Disconnect radio and oxygen equipment (and anti-G suit, if installed).

d. Unbuckle parachute, but make certain that life raft is still fastened to you; tighten safety belt.

e. Landing gear handle "UP." Speed brake switch "IN," if installed.

f. Canopy handle "OPEN."

g. Battery switch "OFF."

h. Wing flap control "DOWN." Flaps collapse on impact and do not tend to make the airplane dive.

i. Make normal approach with power, if possible, and flare out to normal landing attitude. Approach the stall attitude at a speed at which full control of the airplane can be maintained. Unless wind is high or sea is rough, plan approach heading parallel to any uniform swell pattern and try to touch down along wave crest or just after crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

j. Just before impact, turn ignition switch "OFF" and lock shoulder harness.

***Airplanes AF51-3463 and subsequent**

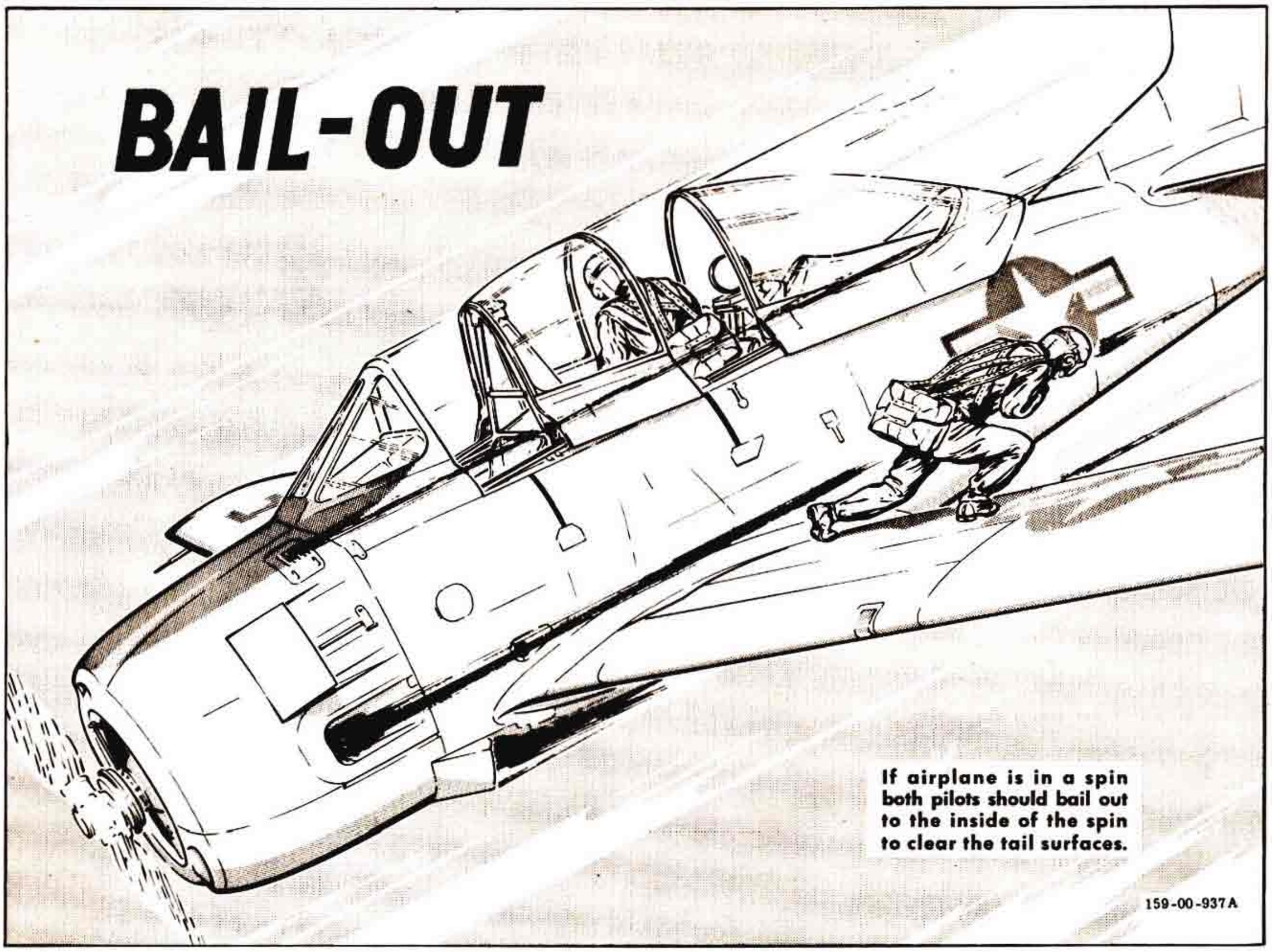


Figure 3-5. Bail-out Procedure

3-33. BAIL-OUT.

3-34. When the decision is made to abandon the airplane, jettison external load (bombs or rockets) if the area below is uninhabited. Jettisoning the bombs or rockets would aid in accident investigation of the wreckage, as fire following a crash could set off the propelling charge in rockets or the small explosive in practice bombs. In event of a bail-out, proceed as follows:

a. Slow airplane down as much as possible, trim it slightly nose-down, and head toward an uninhabited area.

b. Warn other pilot to bail out, and receive his acknowledgement.

c. Raise seat to top position.

d. Disconnect radio and oxygen equipment (and anti-G suit, if installed).

e. Unfasten safety belt and shoulder harness.

f. Canopy handle "EMERG OPEN."

g. From the front cockpit, climb out onto the wing and dive headfirst off the trailing edge. From the rear cockpit, crouch on the seat and dive toward the wing tip.

3-35. FUEL SYSTEM EMERGENCY OPERATION.

3-36. ENGINE-DRIVEN PUMP FAILURE.

3-37. If the engine-driven fuel pump fails, the tank boost pumps will supply fuel to the engine.

3-38. BOOST PUMP FAILURE.

3-39. Should the booster pumps fail, the engine-driven pump will draw sufficient fuel for engine operation up to approximately 10,000 feet. Above that altitude, the low atmospheric pressures tend to vaporize the fuel in the lines. As a result, the pump must handle a combination of vapor and fuel which greatly reduces the pumping capacity, and insufficient fuel will be supplied to the engine. This condition will be aggravated by high outside air temperatures.

3-40. ELECTRICAL SYSTEM EMERGENCY OPERATION.

3-41. If a complete electrical failure should occur, or if it becomes necessary to turn off both the battery and

generator switches, an emergency landing should be made as soon as possible. See figure 1-15 for list of electrically operated equipment.

a. Fuel boost pumps will be inoperative, and it may be necessary to lower your altitude to below 10,000 feet and reduce rpm to maintain satisfactory engine operation.

b. Engine cowl and oil cooler flaps, and oil temperature and carburetor air temperature indicators will be inoperative.

c. Instrument flying is impossible, as all radio communication equipment and essential flight attitude instruments are inoperative.

3-42. GENERATOR OVERVOLTAGE.

3-43. If the generator overvoltage warning light comes on, attempt to bring generator back into the electrical circuit as follows:

a. Hold generator switch at "RESET" momentarily; then return switch to "ON." If overvoltage light remains out and voltmeter shows normal system voltage, it indicates that the overvoltage was temporary.

b. If overvoltage light comes on again, move generator switch to "OFF," and attempt to bring voltage within allowable limit (approximately 28 volts) by adjusting voltage regulator rheostat.

Note

Voltage regulator rheostat is reached through an access plate on side of right console below instrument panel. The rheostat is rotated clockwise to increase voltage, and counterclockwise to decrease voltage.

Hold generator switch momentarily at "RESET" again; then return switch to "ON" and see if warning light remains out. If light remains out, check voltage. Readjust regulator rheostat as necessary to obtain normal system voltage.

c. If voltage cannot be brought within allowable limit, leave generator switch "OFF," move inverter switch to "SPARE ON," and turn off all nonessential electrical equipment to reduce load on battery as much as possible.

Note

With the spare inverter on, there is less drain on the battery, since the spare is a 100 volt-ampere inverter, and the main, a 500 volt-ampere. Remember that when you turn off the main inverter, the A-1CM sight and radio compass will be inoperative.

3-44. INVERTER FAILURE.

3-45. If the spare inverter is not automatically connected into the circuit after failure of the main inverter (as indicated by illumination of red inverter warning light), move the inverter switch from "MAIN ON" to "SPARE ON." The radio compass and A-1CM sight will be inoperative when only the spare inverter is operating.

3-46. HYDRAULIC SYSTEM EMERGENCY OPERATION.

3-47. Should the hydraulic system fail during flight, the hand-pump may be used in an attempt to pressurize the system. The hand-pump is not considered an emergency system, however, as it will not supply pressure if hydraulic system failure is caused by any malfunction other than engine-driven pump failure.

3-48. LANDING GEAR EMERGENCY OPERATION.

3-49. LANDING GEAR EMERGENCY RETRACTION.

3-50. If it is necessary to collapse gear before airplane is off the ground, pull landing gear handle "UP." (A very hard pull is necessary to override the gear handle down-lock.)

3-51. LANDING GEAR EMERGENCY LOWERING.

a. Reduce airspeed to approximately 100 knots IAS.

b. Landing gear handle "DOWN."

c. After gear drops from wheel wells, yaw airplane if necessary to lock main gear down. The nose gear will be forced down by a spring on the gear.

d. Check gear position indicators and landing gear handle light for safe gear indication.

3-52. WING FLAP EMERGENCY OPERATION.

3-53. In event of failure of the normal flap hydraulic system, move wing flap control to desired position and attempt to supply pressure by operating the hand-pump. (Refer to paragraph 3-47 for hydraulic system emergency operation.)

3-54. CANOPY EMERGENCY OPERATION.

3-55. To open the canopy from inside the cockpit in an emergency:

a. Canopy handle "EMERG OPEN."

b. If canopy still fails to open, move canopy handle to "MANUAL" and pull canopy open manually.

3-56. Should you want to stop movement of the canopy when it is being operated hydraulically, depress canopy emergency stop button on instrument shroud. The canopy will resume operation when the emergency stop button is released unless the canopy handle is moved to the "LOCKED" position.

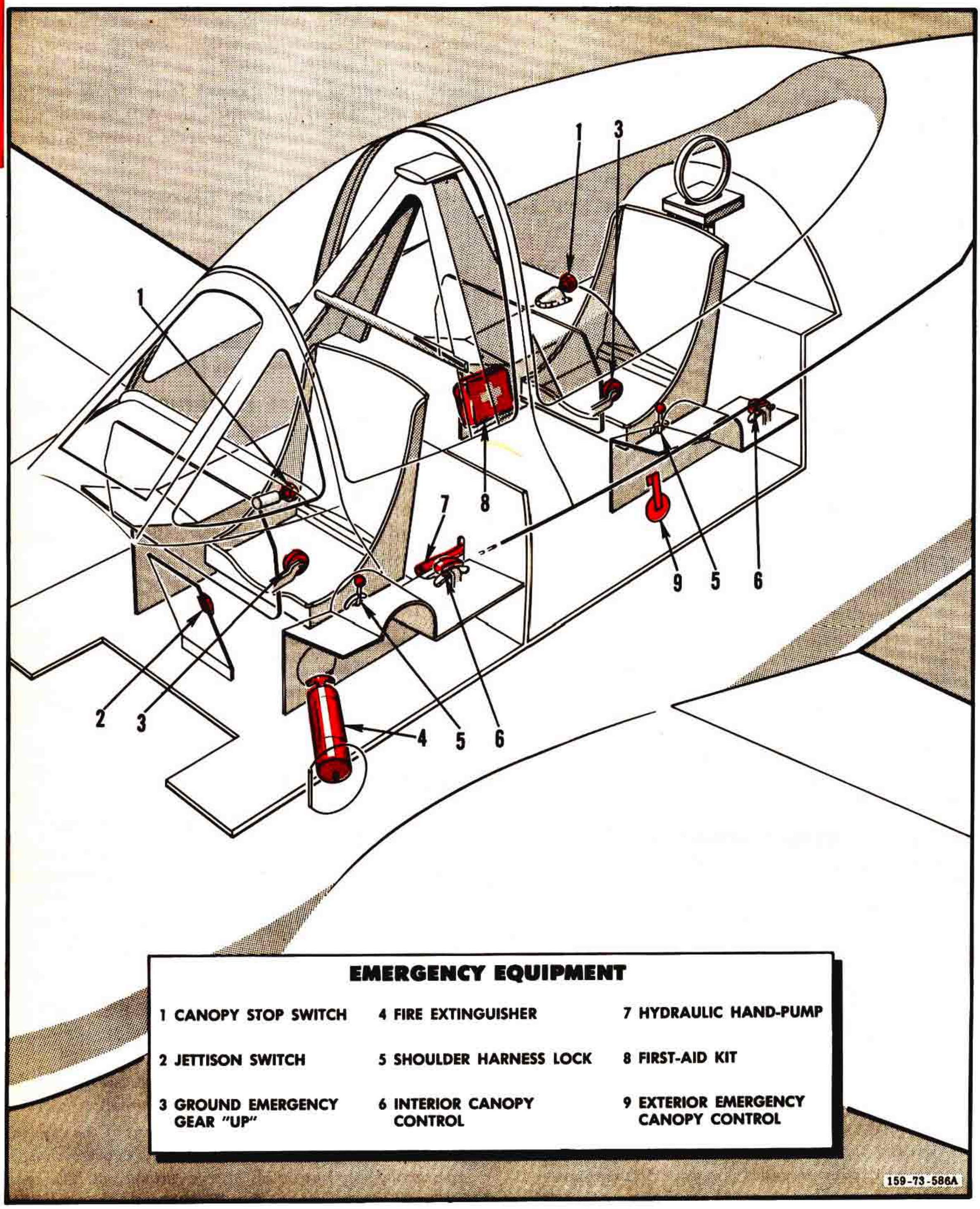


Figure 3-6. Emergency Equipment

3-57. SPEED BRAKE EMERGENCY CLOSING.

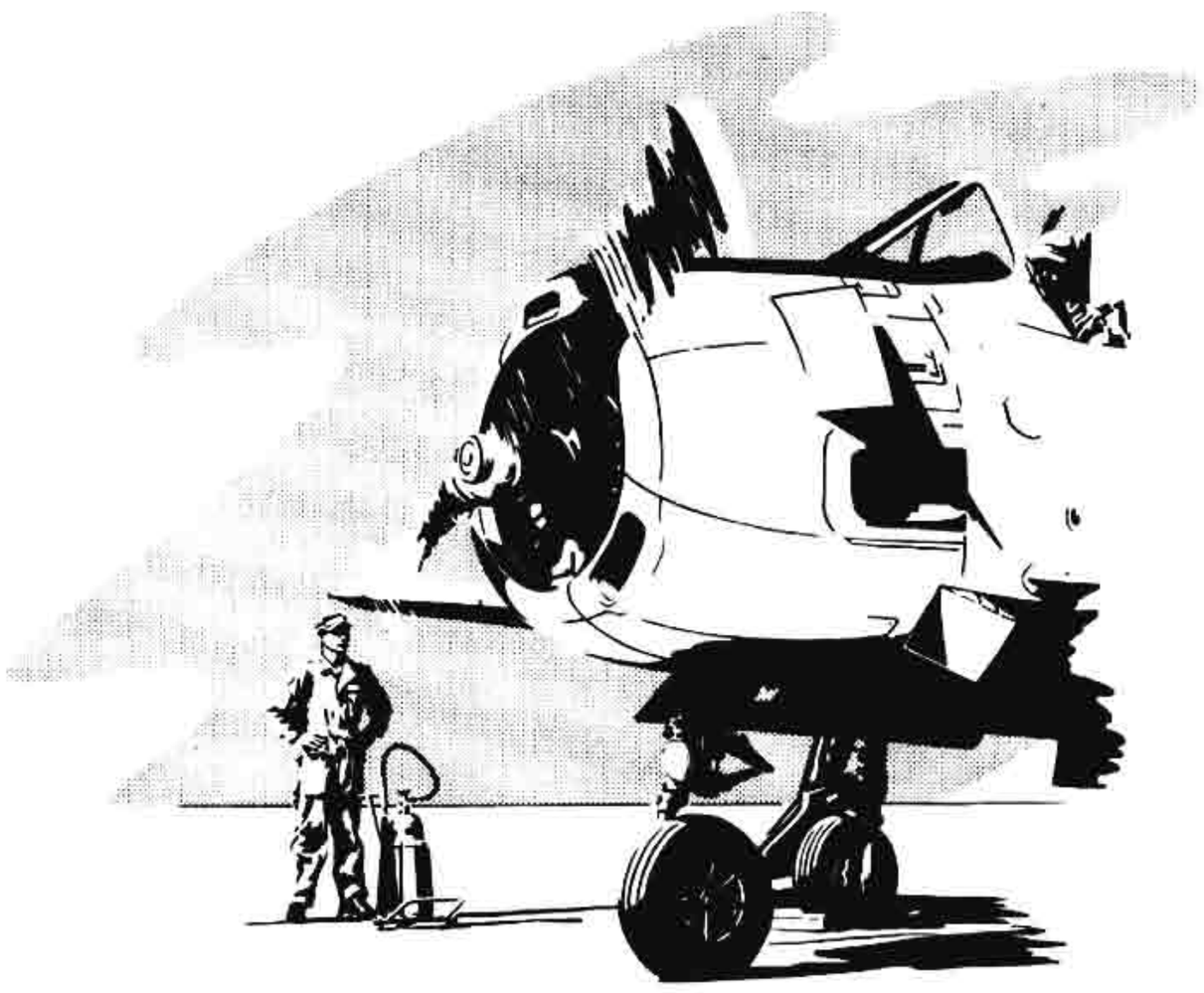
3-58. No provisions are made to open the speed brake in case of electrical or hydraulic failure. However, in event of an electrical failure when brake is open, it will automatically close. Should a hydraulic failure occur with speed brake open, the brake can be closed by positioning speed brake switch to "IN," allowing air loads against the brake to close it to the trail position.

3-59. BOMB AND ROCKET JETTISONING.

3-60. Bombs or rockets can be jettisoned in an emergency by either of the following methods:

a. Lift guard on bomb-rocket jettison switch on armament control panel in front cockpit and actuate switch momentarily; or,

b. Place bomb-rocket selector at "JETTISON" and depress bomb-rocket release button on control stick grip.



OPERATIONAL EQUIPMENT

159-00-930

SECTION IV

4-1. COCKPIT HEATING AND VENTILATING.

4-2. GENERAL.

4-3. Air for heating and ventilating both cockpits is obtained from the oil cooler air duct just forward of the engine oil cooler. The air is heated by a combustion heater for cockpit heat and for windshield and canopy defrosting. Fuel for heater operation is obtained from the carburetor, and combustion air is taken in through an inlet in the left wing leading edge. The heater will operate only when airflow is sufficient to provide combustion in the heater. The heater cycles on and off as necessary to maintain the temperature selected in the cockpit. Should the heater overheat (above 375°F), the heater electrical circuits and fuel supply will be turned off automatically. If this occurs, the heater should not be restarted until the cause of overheating has been determined. There are no provisions for emergency operation of the heating and ventilating system.

4-4. COCKPIT HEATING AND VENTILATING CONTROLS.

4-5. Controls for heating and defrosting are installed in the front cockpit only. However, there is an air control in both cockpits which permits either pilot to select the amount of air entering the cockpits. The cockpit air controls must be partially open for heating operation. Because of this feature, heating can be shut off in an emergency by turning the cockpit air control in either cockpit to "OFF."

4-6. COCKPIT AIR CONTROL. A cockpit air control is located on the left aft console in each cockpit, and both controls are interconnected (2, fig. 1-7; 1, fig. 1-10). Moving either air control toward the "OPEN" position

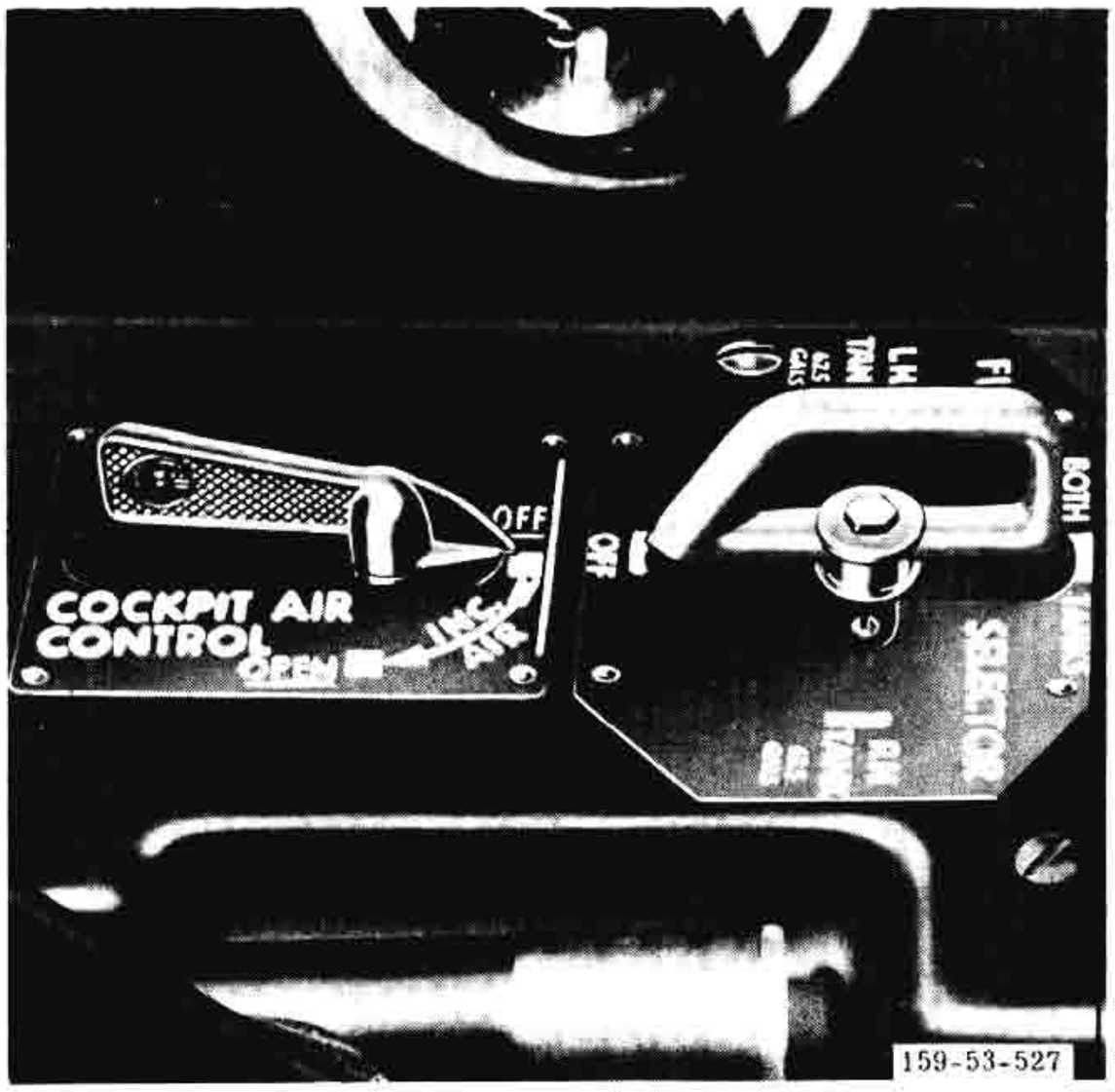


Figure 4-1. Cockpit Air Control and Fuel Selector

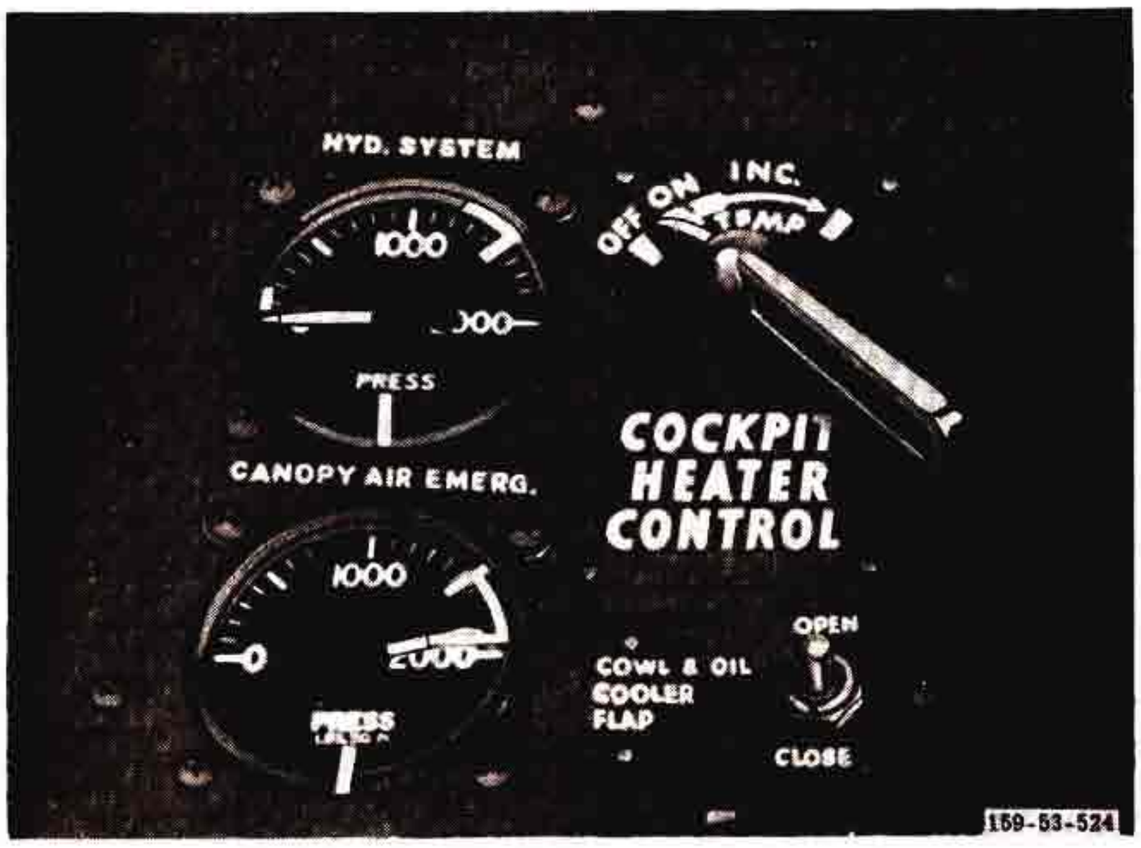


Figure 4-2. Left Forward Console

gradually increases flow of hot or cold air to the air outlets and defrosting system in both cockpits. The air control, when turned "OFF," de-energizes the heater electrical system, and therefore must be partially open for heater operation. Turning an air control to "OFF" also shuts off all air flow to the cockpits.

4-7. COCKPIT HEATER CONTROL. Heater operation is controlled from the front cockpit by means of a cockpit heater control located forward of the throttle quadrant (15, fig. 1-7; fig. 4-2). The heater is started by opening the cockpit air control and turning the cockpit heater control to "ON." To start the heater on the ground, the engine must be running above approximately 1000 rpm to provide sufficient airflow for combustion. Heat output is increased by turning the heater control clockwise.

4-8. AIR OUTLETS. Manually controlled outlets are located on each side of the cockpits at waist level (3, fig. 1-7; 2, fig. 1-10). These side outlets may be adjusted for desired volume of air and direction of airflow. Foot outlets are also provided in each cockpit; one outlet is in the rear cockpit, and two outlets are in the front. The

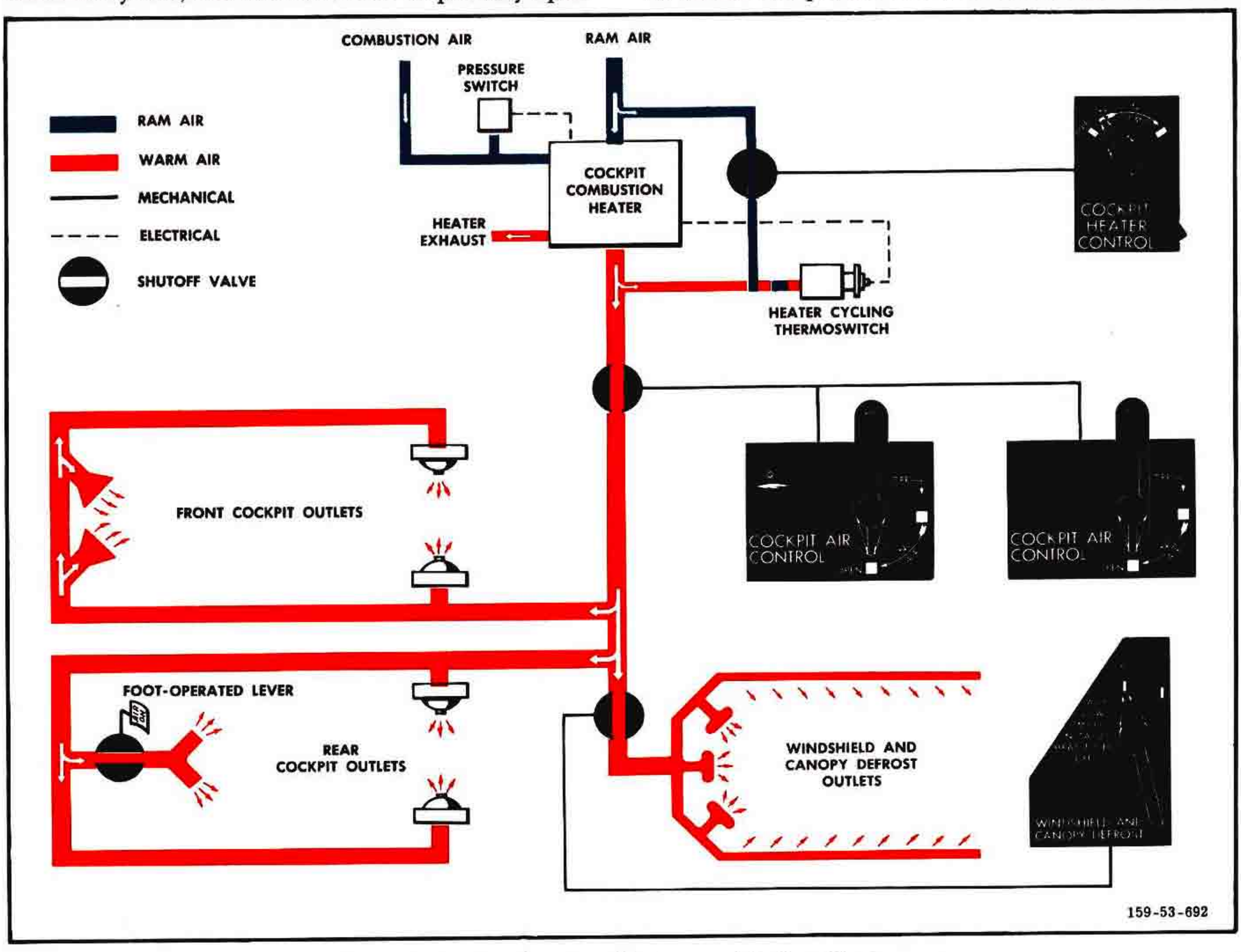


Figure 4-2A. Heating, Ventilating, and Defrost System

rear foot outlet is controlled by a foot-operated valve on the outlet (5, fig. 1-9). Airflow from the front cockpit foot outlets is determined by position of the cockpit air control.

4-9. OPERATION OF COCKPIT HEATING AND VENTILATING SYSTEM.

a. For ventilation, open cockpit air control for desired volume of air, and adjust cockpit outlets as necessary. If additional ventilation is desired, turn windshield and canopy defrost control to "ON."

b. To obtain cockpit heat, open cockpit air control and turn cockpit heater control "ON." The heater will commence operation and maintain the selected temperature. For ground operation of heater, maintain engine speed above approximately 1000 rpm so that propeller will provide sufficient airflow for combustion. To increase heat, rotate heater control toward full "INC TEMP" position.

4-10. DEFROST SYSTEM.

4-11. Air for defrosting the windshield and canopy is obtained from the same source as cockpit heating and ventilating air. The cockpit air control must be open to supply air to the defrost system, and, if necessary, the cockpit heater control can be turned on to heat the air. The defrost system can be used with the cockpit heating and ventilating system, or heating and ventilating air outlets may be closed to direct most of the air to the defrost system. There are no provisions for emergency operation of the defrost system.

4-12. DEFROST SYSTEM CONTROL.

4-13. WINDSHIELD AND CANOPY DEFROST CONTROL. The windshield and canopy defrost control is located on the left instrument subpanel in the front cockpit only (8, fig. 1-5; fig. 4-3). Turning the defrost control "ON" directs air (either hot or cold, depending upon position of heater controls) to outlets at each side of the windshield and canopy.

4-14. OPERATION OF DEFROST SYSTEM. For windshield and canopy defrosting, turn "ON" defrost control in front cockpit (with cockpit air control open). If heated air is necessary for defrosting, turn heater control "ON."

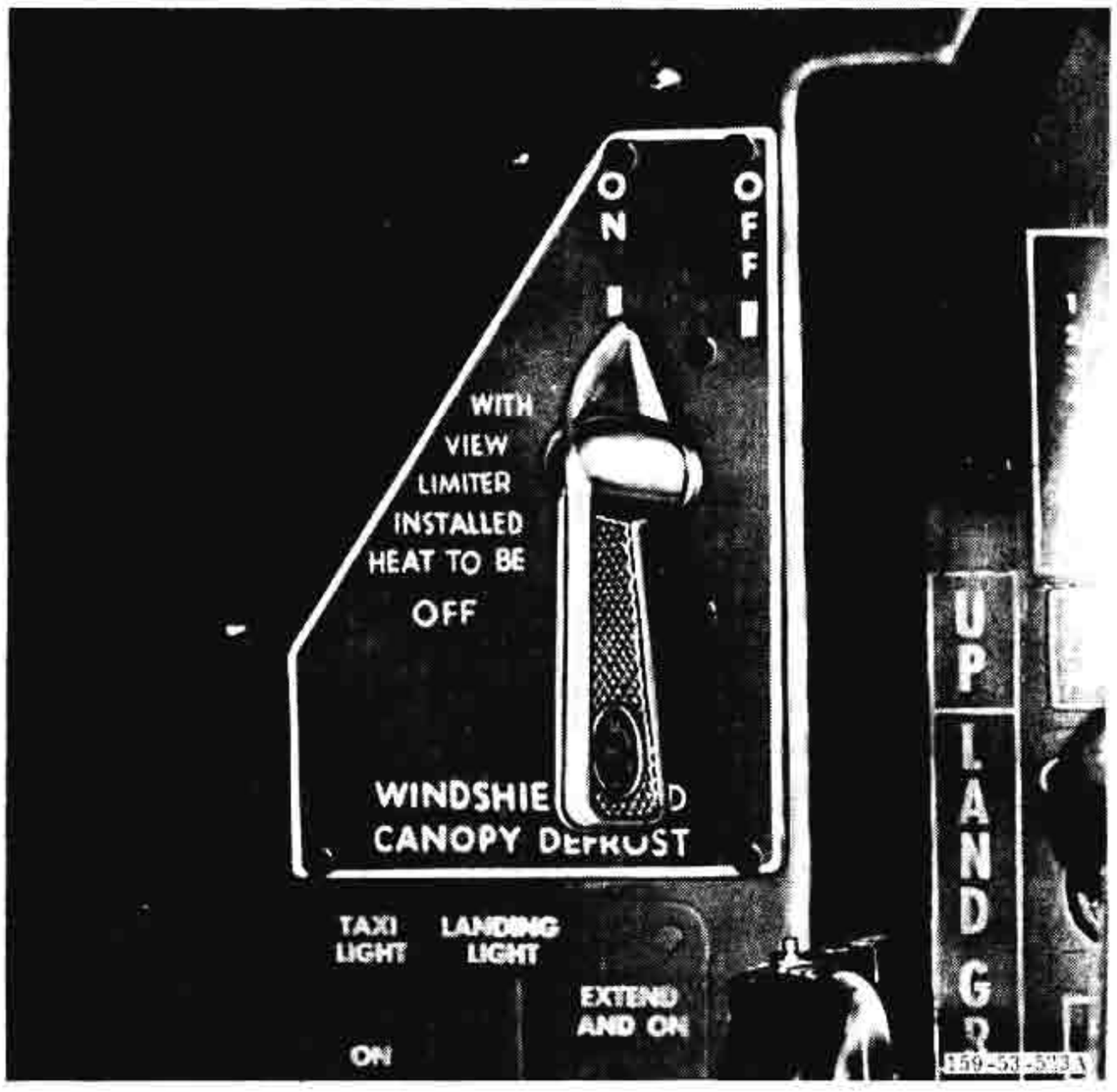
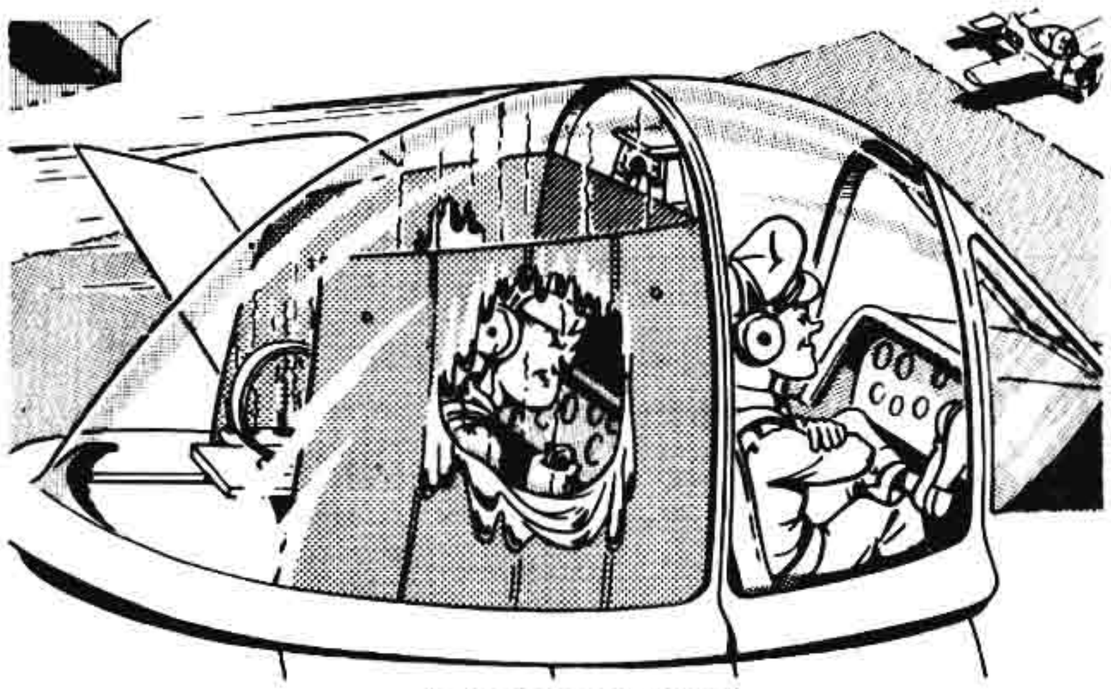


Figure 4-3. Left Instrument Subpanel—Front Cockpit



CAUTION

If instrument flying view limiter panels are installed in rear cockpit, do not turn on canopy defrosting while heater is operating.

4-15. PITOT HEATER.

4-16. A heater in the pitot head is controlled by a pitot heater switch, located on the right forward console in the front cockpit only (fig. 1-18).

CAUTION

To prevent burning out heater elements, the pitot heater switch should be "OFF" when airplane is on the ground.

4-17. COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

4-18. TABLE OF COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

TYPE	DESIGNATION	USE	ILLUSTRATION
VHF Command	AN/ARC-3	Two-way communication	9, fig. 1-8; 8, fig. 1-11.
Radio Compass	AN/ARN-7	Reception of voice and code communication; position finding; homing	6, fig. 1-8; 6, fig. 1-11.
Interphone	USAF Combat Type	Intercockpit communication	4, fig. 1-8; 3, fig. 1-11.
Marker Beacon*	RC-193A	Reception of location marker signals (fan marker)	1, fig. 1-6.
Range Receiver†	BC-453-B	Reception of radio range signals	
Radio Compass‡ (Replaces AN/ARN-7)	AN/ARN-6	Reception of voice and code communication; position finding; homing	
Marker Beacon§ (Replaces RC-193A)	AN/ARN-12	Reception of location marker signals (fan markers)	
SPACE PROVISIONS			
Glide Path Receiver	AN/ARN-18	Instrument approach	

*Airplanes AF49-1529 through AF49-1756, AF50-195 and AF50-196

†Airplane AF48-1372 only

‡Airplanes AF50-195 and subsequent

§Airplanes AF50-197 and subsequent

TYPE	DESIGNATION	USE	ILLUSTRATION
Omnidirectional Receiver	AN/ARN-14	Instrument approach and omnidirectional VHF radio range	
UHF Command	AN/ARC-27	Two-way communications on ultra-high frequency	

4-19. OPERATION OF COMMAND RADIO—AN/ARC-3.

a. Turn on command radio control shift switch and check to see that control light illuminates.

b. Turn on power switch on command radio control panel.

c. Turn radio selector on interphone panel to "COMMAND."

d. Rotate channel selector to desired frequency channel and allow 30 seconds for set to warm up. When audio tone heard in earphones stops, the set is tuned and ready for operation.

e. Adjust volume control for desired output.

f. To transmit, press microphone button on throttle. To permit reception, release button when transmission is complete.

Note

Plug-in provisions for a hand-held microphone are installed on the right console in each cockpit. If a hand-held microphone is connected, transmission may be made by use of the push-to-talk button on the microphone.

4-20. OPERATION OF RADIO COMPASS—AN/ARN-7 OR AN/ARN-6.

a. If AN/ARN-7 radio compass is installed, make sure inverter switch is at "MAIN ON."

b. With radio selector on interphone panel at "MIXED SIGNALS & COMMAND," turn on compass switch on mixer panel.

c. Hold function switch on radio compass control panel at "CONT" to obtain control of the radio (indicated by fluctuation of tuning meter).

d. Turn function switch to "COMP" or "ANT."

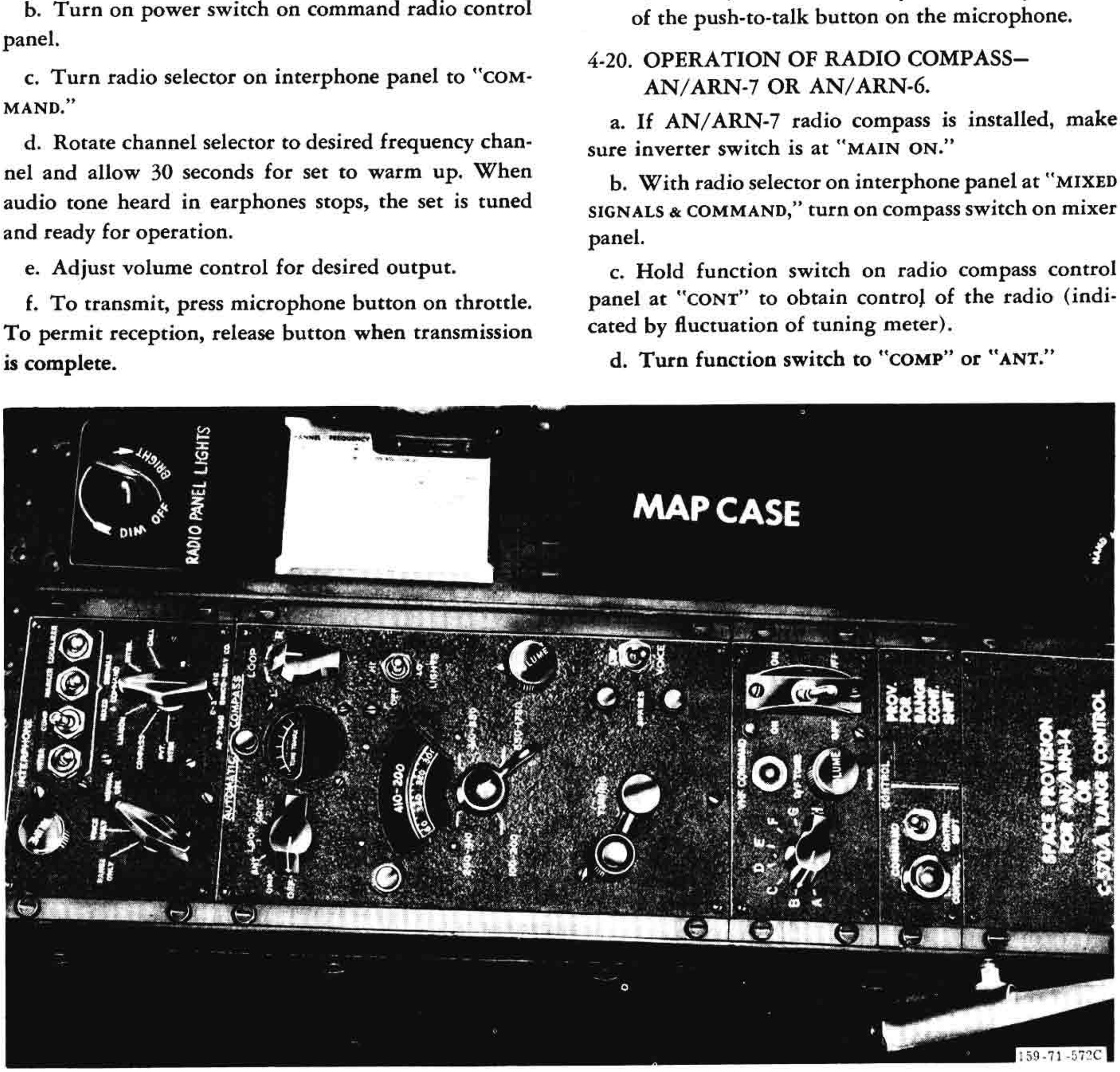


Figure 4-4. Radio Controls—Airplanes AF49-1569 and Subsequent

Note

Marker beacon (RC-193A or AN/ARN-12) is turned on when radio compass function switch is on.

e. Rotate band switch to desired frequency band.

f. Turn tuning crank to desired station frequency in kilocycles, and rotate back and forth until maximum clockwise deflection of tuning meter is obtained, to determine exact setting of the dial. Listen for station identification to be sure correct station is being received.

g. CW switch on "VOICE." (For aural identification of keyed CW stations, switch to "CW.")

h. To stop radio compass equipment (and marker beacon), turn function switch to "OFF."

4-21. OPERATION OF INTERPHONE–USAF COMBAT TYPE.

a. Normally, keep radio selector switch on interphone panel at the "MIXED SIGNALS & COMMAND" position. This allows you to listen on the command set at all times and still be able to operate the other sets when desired by turning on the required switches on the mixer panel.

b. To listen on other radios as well as the command set, turn on desired switches on the mixer panel for interphone, radio compass, marker beacon, or localizer (when installed). The volume control on the interphone panel controls output of all the radios turned on; however, each set can be adjusted individually for volume by controls on each panel.

c. To operate only the radio compass or the interphone, turn radio selector to either the "COMPASS" or "INTER" position. (The "LIAISON" and "PVT INTER" positions on the panel are inoperative in this airplane.)

d. To talk on interphone, depress the interphone button on the throttle (radio selector at "MIXED SIGNALS & COMMAND" or "INTER"). Release interphone button to allow other pilot to respond.

Note

Pushing the interphone button overrides the microphone button, and therefore prevents transmission of interphone conversation over the command radio.

4-22. OPERATION OF MARKER BEACON–RC-193A.

4-23. The marker beacon is turned on whenever the radio compass is put into operation, and the marker beacon light on each instrument panel will illuminate when airplane passes over a marker station. To listen to marker beacon signals, it is necessary to turn on the marker switch on the mixer panel (radio selector at "MIXED SIGNALS & COMMAND").

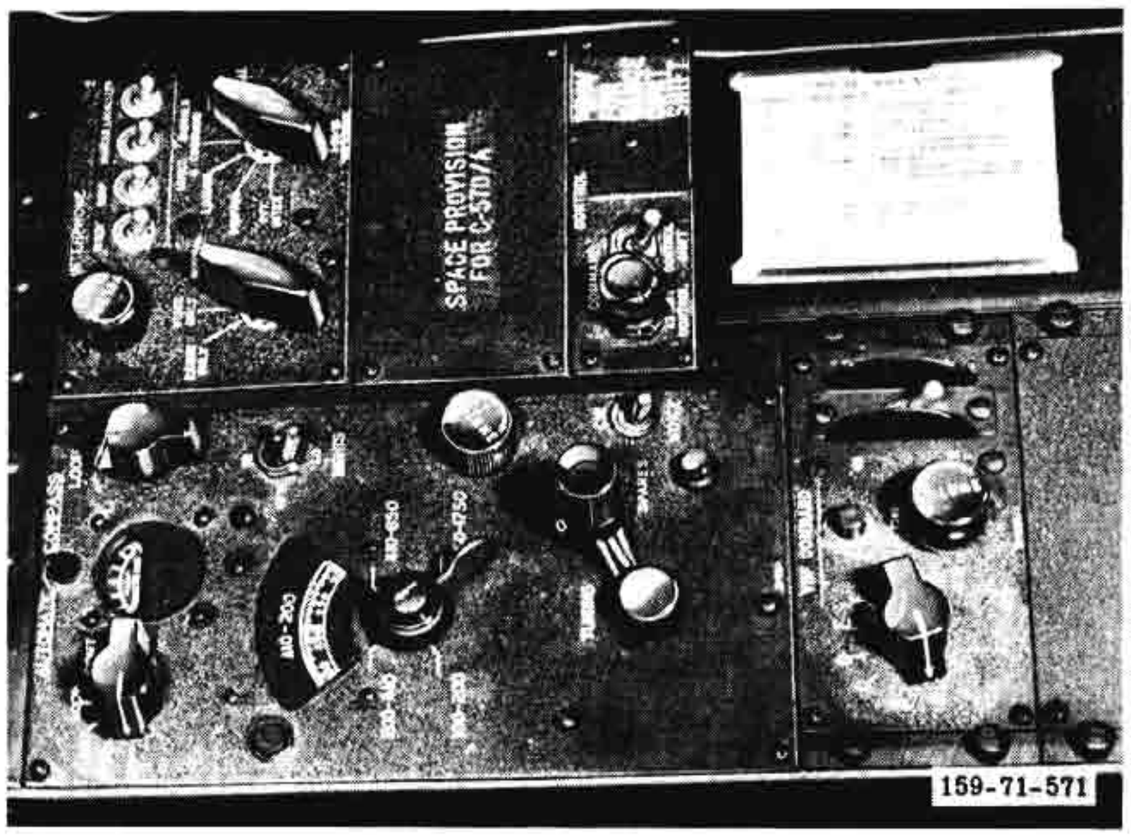


Figure 4-5. Radio Controls — Airplanes AF48-1371, AF48-1372, and AF49-1492 Through AF49-1568

4-24. OPERATION OF RADIO RANGE RECEIVER–BC-453B.

a. Turn on range receiver control shift switch and check to see that control light illuminates.

b. Turn radio selector to "MIXED SIGNALS & COMMAND."

c. Turn cw-mcw switch to desired position.

d. Tune in radio range frequency.

e. Adjust volume control.

f. To turn off receiver, move cw-mcw switch to "OFF."

4-25. OPERATION OF MARKER BEACON–AN/ARN-12.

4-26. The marker beacon is turned on whenever the radio compass is put into operation, and the marker beacon light on each instrument panel will illuminate when airplane passes over a marker station. To listen to marker beacon signals, it is necessary to turn on marker switch on the mixer panel (radio selector at "MIXED SIGNALS & COMMAND").

4-27. LIGHTING EQUIPMENT.

4-28. EXTERIOR LIGHTS.

4-29. All exterior lights (landing, taxi, position, fuselage, and passing) may be controlled from either cockpit, but control is centered in only one cockpit at a time, depending upon which pilot last operated his control shift switch.

4-30. EXTERIOR LIGHT CONTROLS.

4-31. LANDING LIGHT SWITCH. On early airplanes,* a retractable landing light is installed in the left wing and is controlled by a three-position switch located on the left instrument subpanel in each cockpit (9, fig. 1-5; 7, fig. 1-9). A triangular cover over the switch makes it easy to identify the landing light switch at night. Moving the cover up and down operates the switch. Moving the switch to "EXTEND AND ON" causes the light to lower from the wing and illuminate. The light may be stopped before it reaches the full down position by turning the switch "OFF." When the switch is positioned at "RETRACT," the light is retracted into the wing and turned out.

CAUTION

After retracting landing light, turn switch "OFF" to prevent retraction motor from possibly burning out due to defective limit switches.

WARNING

On early airplanes,* do not extend landing light at airspeeds above 125 knots with gear and flaps down or 110 knots clean. When landing light is extended at higher airspeeds, aileron buffeting accompanied by a rolling tendency will be encountered.

4-32. LANDING AND TAXI LIGHT SWITCH. On later airplanes,† the two position landing and taxi light switch, located on the left instrument subpanel, controls two retractable lights installed near the leading edge of each wing. Moving the switch to "EXTEND AND ON" causes the lights to lower from the wing and illuminate. When the switch is positioned at "RETRACT AND OFF," the lights retract into the wing and are turned off.

4-33. TAXI LIGHT SWITCH. On early airplanes,* the taxi light is installed on the left side of the nose gear. The light rotates in conjunction with the nose wheel on Airplanes AF48-1371, AF48-1372, and AF49-1492 through -1528. On Airplanes AF49-1529 and subsequent, the taxi light is fixed to the nose gear and does not rotate. The taxi light switch on early airplanes* is located beside the landing light switch on the left instrument subpanel in both cockpits (10, fig. 1-5; 6, fig. 1-9). On Airplanes AF50-197 through AF50-319 the taxi light will automatically be turned off when the landing gear is retracted.

4-34. FUSELAGE LIGHT SWITCH. Two white lights, one on the top and one on the bottom of the fuselage, are controlled by a fuselage light switch on the right forward console in each cockpit (fig. 1-18). The lights are turned on by moving the fuselage light switch to either "BRIGHT" or "DIM."

4-35. PASSING LIGHT SWITCH. A red passing light, installed in the leading edge of the left wing, is controlled by a passing light switch located on the right forward console (fig. 1-18) in each cockpit.

4-36. POSITION LIGHT SWITCHES. Position lights on each wing tip and tail are controlled by two switches on the right forward console in each cockpit (fig. 1-18). The lights are turned on by moving the position light switch to "STEADY" or (on Airplanes AF49-1550 and subsequent only) "FLASH" as desired. Brilliancy can be selected by turning the position light dimmer switch to "BRIGHT" or "DIM." With the position light switch on, the exterior gear down lights will illuminate when the gear is down and locked.

4-37. WING TIP POSITION LIGHT INDICATOR. An indicator is located on the top surface of each wing tip to enable the pilot to check illumination of the wing tip lights (Airplanes AF49-1569 and subsequent). A ¼-inch lucite rod transmits light from the wing tip light to a point on the top surface of the wing tip. The end of the lucite rod can be seen by the pilot in the front cockpit.

4-38. EXTERIOR GEAR-DOWN LIGHTS. To aid ground observers at night, a small white light on each gear strut automatically illuminates when the gear is down and locked, if the position light switch is on. The gear-down lights burn steadily, whether position light switch is at "STEADY" or "FLASH."

4-39. INTERIOR LIGHTS.

4-40. INTERIOR LIGHT CONTROLS.

4-41. INSTRUMENT PANEL LIGHT SWITCHES AND RHEOSTATS. Two types of instrument panel lights are provided, ultraviolet and red. The ultraviolet lights are turned on by means of a toggle switch on the right forward console (fig. 1-18) and brilliancy of the lights is adjusted by a rheostat to the right of the switch. The red lights are turned on and adjusted for brilliancy by means of a rheostat at the bottom of the right forward console. The light attachment brackets are rigid, and no attempt should be made to readjust them.

4-42. STAND-BY COMPASS LIGHT SWITCH. Illumination of the stand-by compass is controlled by a switch on the right center console in the front cockpit

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**
†Airplanes AF51-3463 and subsequent

on Airplanes AF48-1371, AF48-1372 and AF49-1492 through -1568. On Airplanes AF49-1569 and subsequent, the stand-by compass light switch is on the right forward console in the front cockpit (fig. 1-18).

4-43. CONSOLE LIGHT RHEOSTAT. A console light rheostat is located on the right forward console (fig. 1-18) in each cockpit. The rheostat turns on and regulates for brilliancy the lights above the consoles.

4-44. SWITCH PANEL RHEOSTAT. Indirect lights under the switch panel on the right forward console are turned on and regulated for brilliancy by a rheostat located on the switch panel on the right forward console (fig. 1-18).

4-44A. RADIO PANEL LIGHT RHEOSTAT. On some airplanes,* indirect edge lights under the radio control panels in each cockpit are controlled by a rheostat located on the right console adjacent to the radio controls (2A, fig. 1-8; 5A, fig. 1-11).

4-45. EXTENSION LIGHTS. An extension light is provided in each cockpit and is turned on and adjusted for brilliancy by a rheostat on the light assembly. The light has a coiled cord which allows the light to be pointed in any direction. The red filter may be removed if a white light is desired. The light assembly is normally located on a shelf behind the pilot's right shoulder, but can be removed and placed in a bracket on the right side of the canopy.

CAUTION

Do not leave extension light mounted on canopy when canopy is to be opened.

4-46. BAGGAGE COMPARTMENT LIGHT.

4-47. A light is located in the rear fuselage section to provide illumination of the baggage compartment. The light is controlled by a switch on the light assembly.

4-48. NOSE WHEEL WELL LIGHT.

4-49. A service light is provided in the nose wheel well for use by the ground crew. The light is controlled by a switch on the light assembly.

4-50. OXYGEN SYSTEM.

4-51. GENERAL.

4-52. A low-pressure oxygen system supplied by one Type G-1 oxygen cylinder is installed in the airplane. The oxygen cylinder is installed aft of the rear cockpit. A diluter demand oxygen regulator, flow indicator, and pressure gage are installed in each cockpit. The oxygen system may be refilled through a filler valve located behind the access door on the left side of fuselage aft of the wing (fig. 1-16).

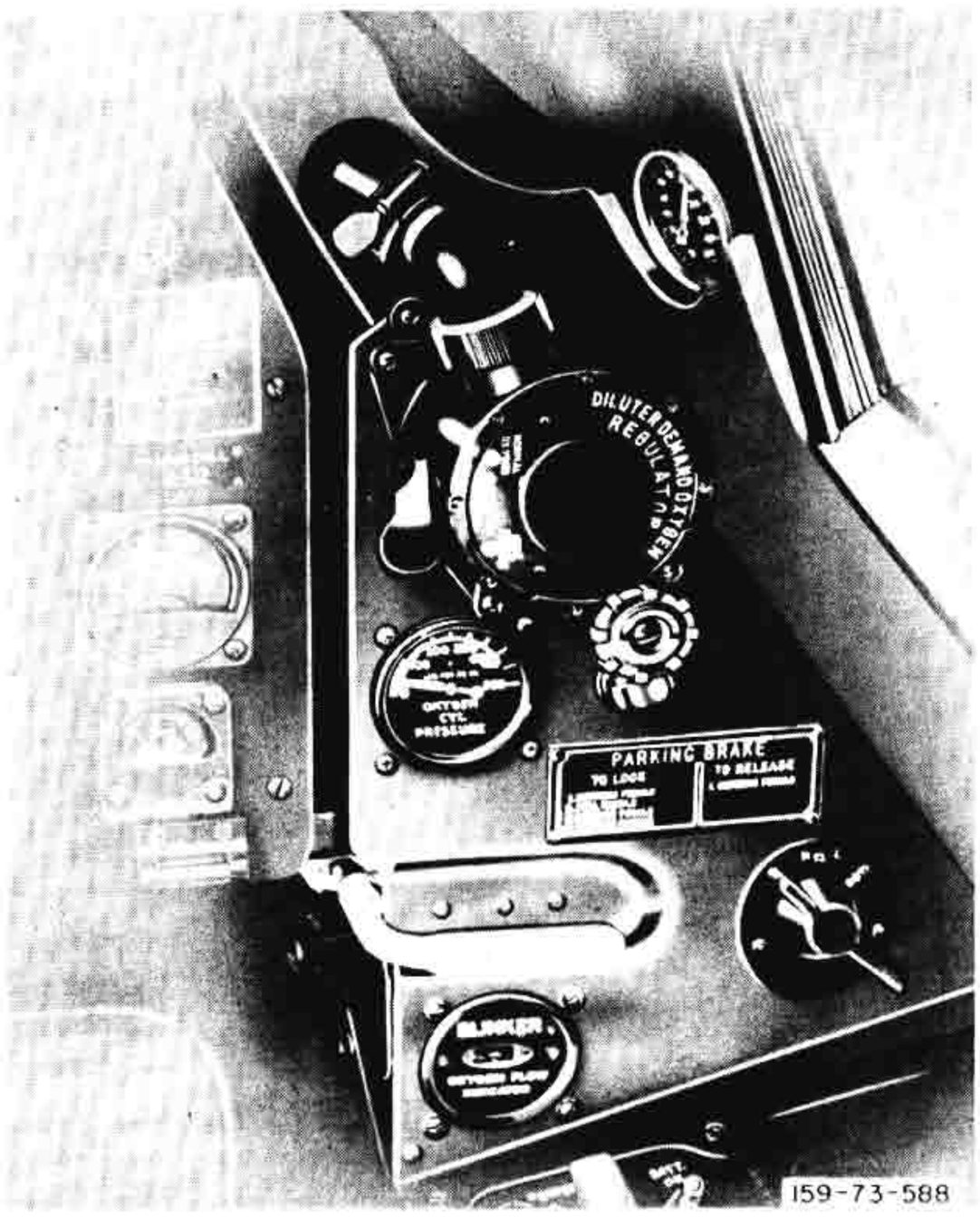


Figure 4-6. Right Instrument Subpanel — Front Cockpit

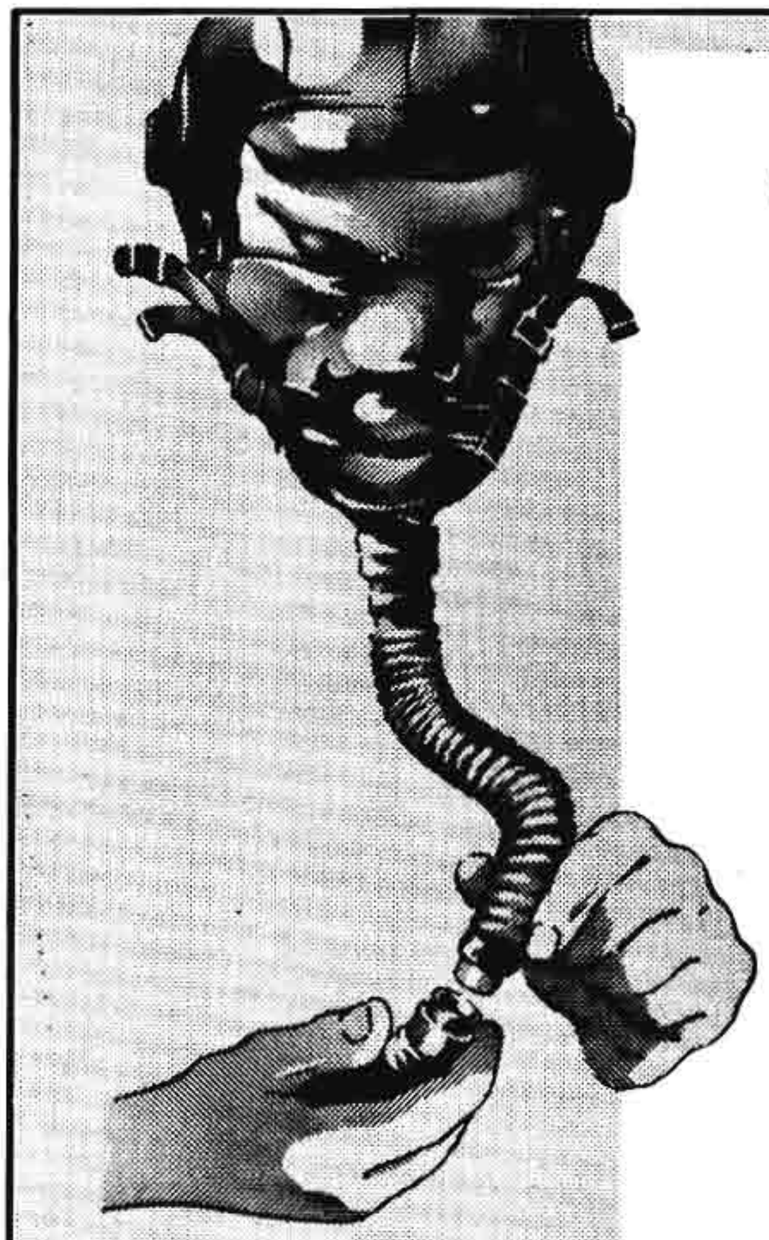
4-53. OXYGEN SYSTEM CONTROL AND INDICATORS.

4-54. OXYGEN REGULATOR. The diluter demand oxygen regulator is located on the right instrument subpanel in the front cockpit (fig. 4-6), and above the right console in the rear cockpit (4, fig. 1-11). The regulator automatically supplies a proper mixture of air and oxygen at all altitudes. The diluter lever of the regulator should always be set at the "NORMAL OXYGEN" position except under emergency conditions. With the diluter lever set at "100% OXYGEN," 100 percent oxygen is supplied at all altitudes, and oxygen system duration will be considerably reduced. The emergency valve of the regulator is always safetied closed with a wire and should be opened only in an emergency. The valve when opened (by turning the knob counterclockwise) directs a steady stream of oxygen into the mask, considerably reducing the oxygen system duration.

4-55. OXYGEN PRESSURE GAGE. The pressure gages are located on the right instrument subpanel in each cockpit (fig. 4-6; 4, fig. 1-9). The pressure gage registers the oxygen cylinder pressure.

4-56. OXYGEN FLOW INDICATOR. The flow indicators are located on the right instrument subpanel in

***Airplanes AF50-195 and subsequent**



159-73-457D

OXYGEN DURATION

(CREW MEMBER OXYGEN DURATION — HOURS)

ALTITUDE	GAGE PRESSURE — PSI							
	400	350	300	250	200	150	100	BELOW 100
25,000	1.8 2.1	1.5 1.8	1.3 1.5	1.0 1.2	0.8 0.9	0.5 0.6	0.3 0.3	DESCEND
20,000	1.4 2.4	1.2 2.0	1.0 1.7	0.8 1.3	0.6 1.0	0.4 0.7	0.2 0.3	BELOW
15,000	1.1 2.9	1.0 2.4	0.8 2.0	0.6 1.6	0.5 1.2	0.3 0.8	0.2 0.4	10,000
10,000	1.0 3.8	0.8 3.3	0.7 2.7	0.5 2.2	0.4 1.6	0.3 1.1	0.1 0.5	FEET

Red figures indicate diluter lever "100% OXYGEN."
Crew – 2
Black figures indicate diluter lever in "NORMAL OXYGEN" position.
Cylinders—One Type G-1

NOTE: Oxygen supply is insufficient to last total time airplane can remain aloft.

Figure 4-7. Oxygen Duration

each cockpit (fig. 4-6; 4, fig. 1-9). The flow indicator shows that oxygen is flowing through the regulator. It does not indicate how much oxygen is flowing. The "eye" of the indicator blinks with each breath of the user. When the emergency valve is opened, the indicator does not blink.

4-57. OXYGEN DURATION TABLE.

4-58. The approximate oxygen duration for each crew member is given in figure 4-7.

4-59. OXYGEN SYSTEM OPERATION.

4-60. PREFLIGHT CHECK. Prior to each flight requiring use of oxygen, check oxygen system as follows:

a. The oxygen pressure gage should read between 400 and 450 psi.

b. Check oxygen mask for fit and leakage.

c. Connect mask tube to regulator tube. Check connection for tightness. Attach tube clip to parachute harness, high enough to permit free movement of head without pinching or pulling hose.

d. Breathe normally on oxygen regulator several times with diluter lever at "NORMAL OXYGEN" and "100% OXYGEN" to check flow from oxygen regulator and to check operation of flow indicator.

e. Check oxygen regulator to see that emergency valve is safety-wired closed and the diluter lever is in "NORMAL OXYGEN" position.

4-61. NORMAL OPERATION. During flight, check oxygen system as follows:

a. Diluter lever at "NORMAL OXYGEN" position.

b. Check connection of mask tube to regulator tube.

c. Check flow indicator frequently for flow of oxygen.

d. Check pressure gage frequently for oxygen system pressure and determine duration.

4-62. EMERGENCY OPERATIONS. With symptoms of the onset of anoxia, or if smoke or fuel fumes should enter the cabin, set the diluter lever of the oxygen regulator to "100% OXYGEN." If the oxygen regulator should become inoperative, open the emergency valve by turning the red emergency knob counterclockwise.

CAUTION

After emergency is over, set diluter lever of oxygen regulator to "NORMAL OXYGEN," and check to ascertain that emergency valve is closed.

4-63. ARMAMENT.

4-64. GENERAL.

4-65. Armament is not included as standard equipment of the basic airplane. For specialized training purposes, however, the airplane may be fitted with an armament

kit consisting of an A-1CM gun-bomb-rocket sight, sight system components, sight reflector glass, armament control panel, gun camera, and either two gun packages or two bomb racks. The A-1CM sight is mounted above the instrument panel shroud in the front cockpit. Sight and armament switches are on the armament control panel, which is added below the front cockpit instrument panel (7, fig. 1-5; fig. 4-9). A panel light, panel light

rheostat, and armament circuit fuses (and spare fuses) are located at the top of the panel. The detachable gun packages or bomb racks are installed on the lower surface of each wing. Each bomb rack accommodates one bomb, one T-1 practice bomb container, or a rocket launcher for three rockets. Combinations of armament cannot be carried simultaneously.

4-66. A-1CM SIGHT.

Note

On some airplanes,* the A-1CM sight cannot be used because of a temporary substitution of a 100 volt-ampere inverter in place of the standard 500 volt-ampere main inverter.

4-67. The A-1CM sight (fig. 4-8) is a lead and ballistic computing sight used for gun and rocket firing and bomb release. Range data, for gunnery, is supplied to the sight system by a manual range control operated by the pilot. Range span of the sight is between 600 and approximately 3000 feet. The sight is operable as a gun sight up to the service ceiling of the airplane. The sight reticle image, consisting of a circle and central dot, is reflected on the reflector glass installed below the windshield and indicates the required lead for gun and rocket firing. When used as a bombsight, the sight is operable up to 10,000 feet and the line of sight is depressed 10 degrees, requiring the pilot to fly with a constantly increasing dive angle toward the target. At the proper release point, as determined by the sight system, bomb release may be accomplished either automatically or manually as desired. The reticle image circle is automatically extinguished when the proper bomb release point is reached, and, at the time of bomb release, a red flashing light is reflected from the sight reflector glass.

A control is provided to operate the sight as a fixed reticle sight. During sighting operations, slight movements of the pilot's head do not cause misalignment between the sight reticle image and the target.

4-68. A-1CM SIGHT CONTROLS AND INDICATOR.

4-69. GUN SELECTOR SWITCH. Electrical power for operation of the sight, guns, and gun camera is selectively controlled by the guarded gun selector switch on the armament control panel. When the switch is at "SIGHT-CAMERA," a-c and d-c power is supplied to the sight system, and power is available to operate the gun camera when the gun trigger is depressed. Setting the gun selector switch at "GUNS-CAMERA-SIGHT" also supplies the sight with a-c and d-c power, in addition to providing power to actuate the guns and gun camera when the trigger is depressed. The switch is "OFF" when the guard is down.

4-70. ROCKET SETTING UNIT. The rocket setting unit, on the right side of the armament control panel, depresses the sight reticle image for rocket firing to correspond to the type of rocket to be used and the intended dive angle of the attack. The unit has dial settings for three types of rockets, but only the "2.25" AR" position is applicable to the type of rockets used on this airplane. At each dial setting are two detents, marked

***Airplanes AF50-279 through AF50-319 and AF51-3466 through AF51-3662**

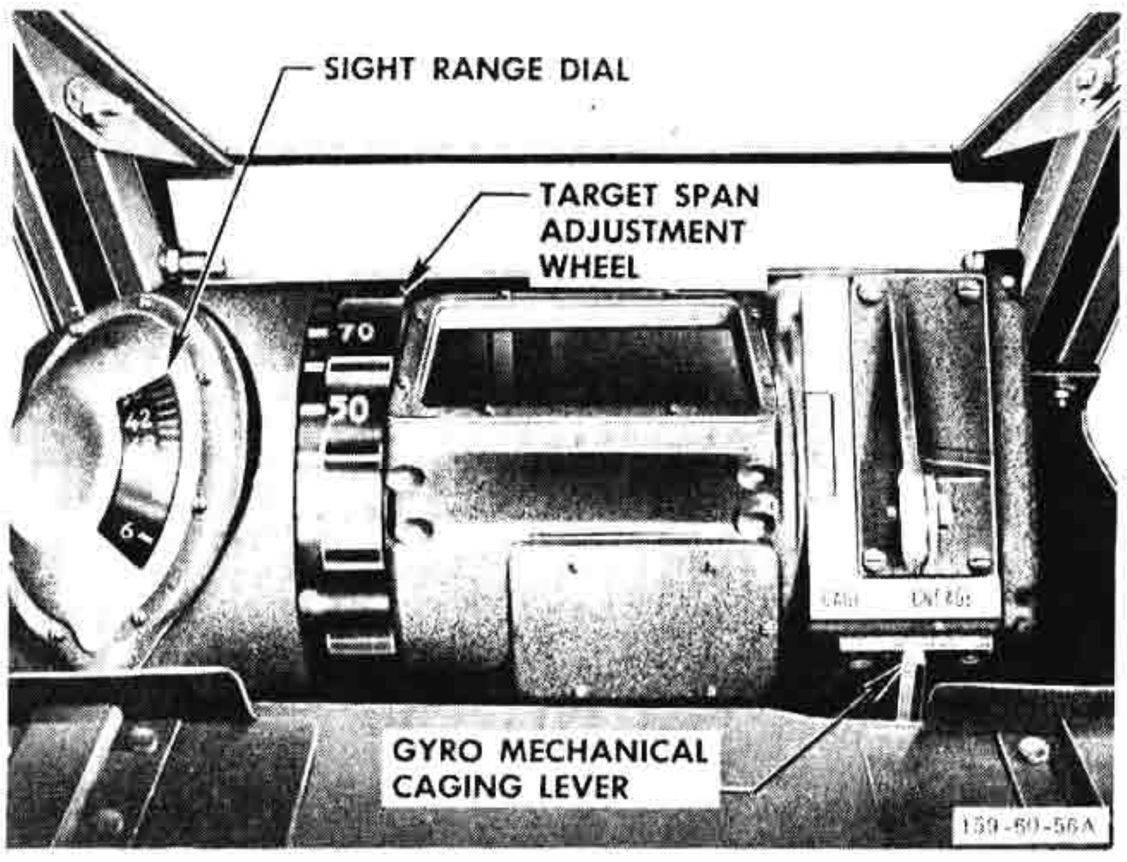


Figure 4-8. A-1CM Sight

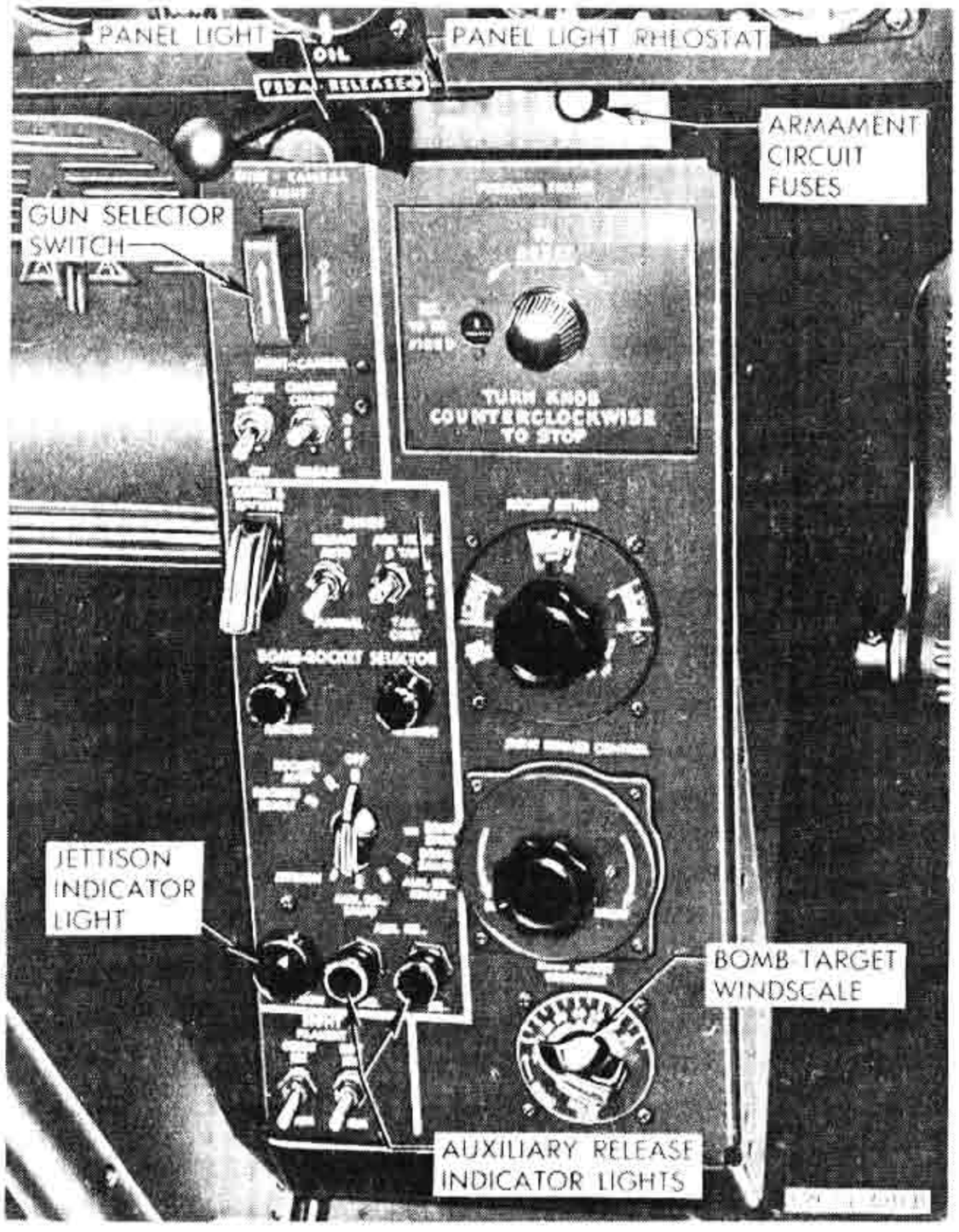


Figure 4-9. Armament Control Panel

"S" and "N," for setting the intended dive angle. For attack angles between 0 and 40 degrees, the control is set at "N" (normal), and for angles between 40 and 60 degrees, it is set at "S" (steep). When the sight is used for gunnery or bomb release, the rocket setting unit must be set at the "GUN-BOMB" position.

4-71. SIGHT DIMMER CONTROL. Intensity of the sight reticle illumination is adjusted, from full brilliance to off, by means of the sight dimmer control located below the rocket setting unit on the armament control panel. When the sight is not in use, the dimmer control should be turned to "DIM."

4-72. BOMB-TARGET WIND SCALE. The bomb-target wind scale, on the armament control panel, sets the sight system for bombing operation. Adjustment of the B-TW control lowers the sight reticle image dot. This requires the bombing attack to be made with a constantly increasing dive angle. If, during attack, the path of the airplane is parallel to the wind or to the direction of a moving target, the B-TW control is used to adjust the sight to compensate for wind or target velocity. For bombing attacks on stationary targets, wind speed corrections are made on the "UPWIND" portion of the scale (when attack is made into a head wind) or on the "DOWNWIND" portion (for attacks made with a tail wind) according to the known or estimated wind velocity. If wind direction is not parallel to the course of the attacking airplane, the amount of wind correction adjustment must be estimated. The correction approaches "0" as the wind direction becomes 90 degrees to the airplane course. Additional corrections must be made for target velocity when attacking moving targets. For approaching target, correction is "DOWNWIND"; for receding target, correction is "UPWIND." No correction is necessary if the target is traveling at right angles to the line of attack. When sight is used for either gun or rocket sighting, the B-TW control must be positioned at "ROCKET GUN."

4-73. SIGHT FILAMENT SELECTOR SWITCHES. Two sight filament selector switches on the armament control panel allow selection of alternate filaments (either primary or secondary) in the lamps which illuminate the sight reticle circle and dot.

4-74. TARGET SPAN ADJUSTMENT WHEEL. The serrated target span adjustment wheel (fig. 4-8) is used during gunnery operations to vary the diameter of the reticle in proportion to the span of the target airplane. Graduated markings (from 30 to 120) on the outer edge of the wheel represent the wing span, in feet, of the target. The span adjustment wheel should be set to correspond to the span of the target airplane.

4-75. GYRO MECHANICAL CAGING LEVER. The gyro mechanical caging lever, on the right side of the sight head, is moved left to "CAGE" and right to "UNCAGE." For normal sight operation, the lever should be at "UNCAGE." When lever is at "CAGE," the sight gyro is caged, the reticle diameter is fixed, and the sight operates as a fixed sight. The "CAGE" position is used in the event of normal sight operation failure.

4-76. SIGHT GYRO CAGING BUTTON. An electrical gyro caging button provided on the throttle grip is depressed prior to an attack, to stabilize the sight reticle. The button is inoperative when the gyro mechanical caging lever is in the "CAGED" position.

4-77. SIGHT RANGE CONTROL. A twist-grip incorporated in the throttle provides range control during gunnery operation. Rotation of the twist-grip varies the diameter of the sight reticle. Clockwise rotation of the grip reduces the range (increases reticle size); counterclockwise movement increases the range (decreases reticle size).

4-78. SIGHT RANGE DIAL. The range dial, visible through a window on the left of the sight head, indicates the target range in hundreds of feet as determined by the sight range control. The dial is graduated from 600 to 6000 feet.

4-79. GUNNERY EQUIPMENT.

4-80. A detachable gun package containing one Type M3 .50-caliber machine gun, 100 rounds of ammunition, and a pneumatic gun charging system may be installed on the lower surface of each wing. The charging systems are controllable from the cockpit, and each has sufficient capacity to charge its respective gun approximately 20 times. When guns are fired, the charging system is inoperative, preventing accidental simultaneous gun firing and charging. A Type AN-N6 gun camera may be mounted in the leading edge of the left wing. The camera can be operated separately or will

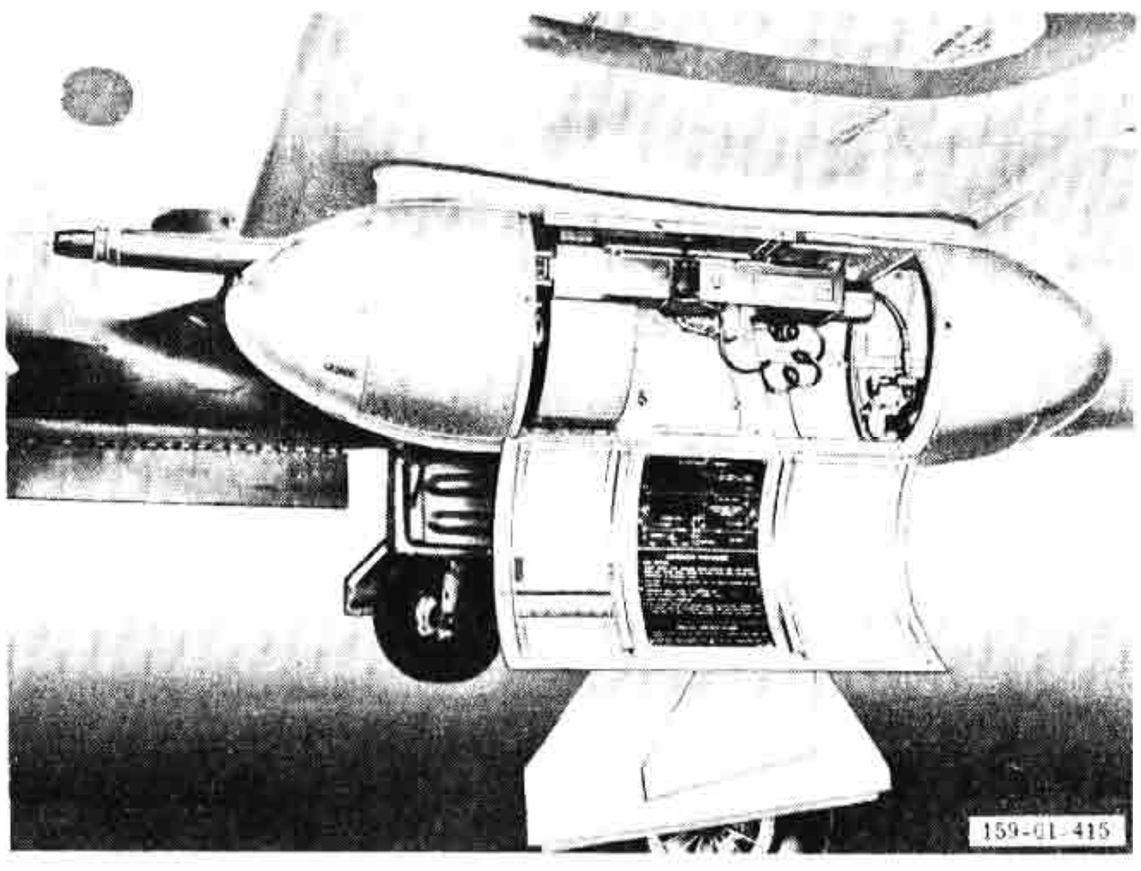


Figure 4-10. Gun Installation

function automatically during gun or rocket firing. The gun package cannot be jettisoned from the airplane.

4-81. GUNNERY EQUIPMENT CONTROLS.

4-82. GUN SELECTOR SWITCH. Refer to paragraph 4-69.

4-83. GUN CHARGER SWITCH. The three-position charger switch on the armament control panel (fig. 4-9) simultaneously controls the two gun charging systems. Spring-loaded to the "OFF" position, the switch is momentarily held at "CHARGE" to bring the gun bolts to the rear. The bolts are held in this position until released by depressing the trigger or moving the charger switch to "RELEASE." The guns are fired when bolt release is accomplished by actuating the trigger. The "CHARGE" position is used for normal gun charging, clearing the guns in event of a jam, or to allow gun barrel cooling. The switch is not moved to "RELEASE" during normal operations, but this position may be used if conditions demand that the bolts be released after a burst to help keep the guns warm.

4-84. GUN HEATER SWITCH. The electric gun heaters, one on each gun, are controlled simultaneously by the gun heater switch on the armament panel. The switch should be moved to "ON" if outside air temperature is 35°F or below.

4-85. GUN TRIGGER. The trigger, incorporated on the control stick grip in the front cockpit (fig. 1-20), fires the guns or operates the gun camera or does both, depending upon the setting of the gun selector switch. With the selector switch at "GUNS-CAMERA-SIGHT" the guns are fired and the gun camera is actuated when the trigger is depressed. Independent camera operation occurs when trigger is depressed with gun selector switch at "SIGHT-CAMERA" position.

4-86. FIRING GUN.

a. Gyro mechanical caging lever on sight head at "UNCAGE."

Note

When firing at stationary ground targets, or in case of sight failure, move caging lever to "CAGE" and use sight as fixed sight.

b. Check inverter switch at "MAIN ON," warning light out.

c. Gun selector switch "GUNS-CAMERA-SIGHT."

d. Gun heater switch "ON" if outside air temperature is 35°F or below.

e. B-TW control "ROCKET GUN"; rocket setting unit "GUN BOMB."

f. Sight filament selector switches at "PRIM" or at "SEC" if primary filament is inoperative.

g. Sight dimmer control adjusted for desired reticle brilliance.

h. Hold gun charger switch momentarily at "CHARGE," if guns have not been charged.

i. Set target span adjustment wheel to span of target airplane.

j. Depress gyro caging button momentarily to stabilize reticle image; then begin tracking.

k. Fly the airplane so that the target is continuously centered in the reticle circle, and rotate throttle twist grip for ranging control until the diameter of the reticle circle corresponds to the size of the target airplane. Sight range dial will indicate target range.

l. Continue operating the range control, keeping target constantly framed within reticle circle.

m. Track target without slipping or skidding for at least one second—then depress trigger.

4-87. BOMBING EQUIPMENT.

4-88. A removable bomb rack, capable of carrying a 100-pound bomb or a practice bomb container, may be installed on the lower surface of each wing. Bomb selection, release, and arming of the 100-pound bombs are accomplished electrically by controls in the front cockpit. The A-1CM sight is used for bomb sighting and can be set to release the bombs automatically at the correct release point. Bombing system controls are on the armament control panel, with the exception of the bomb-rocket release button (fig. 1-20) on top of the control stick grip. The bomb racks are also used for carrying the rocket launchers.

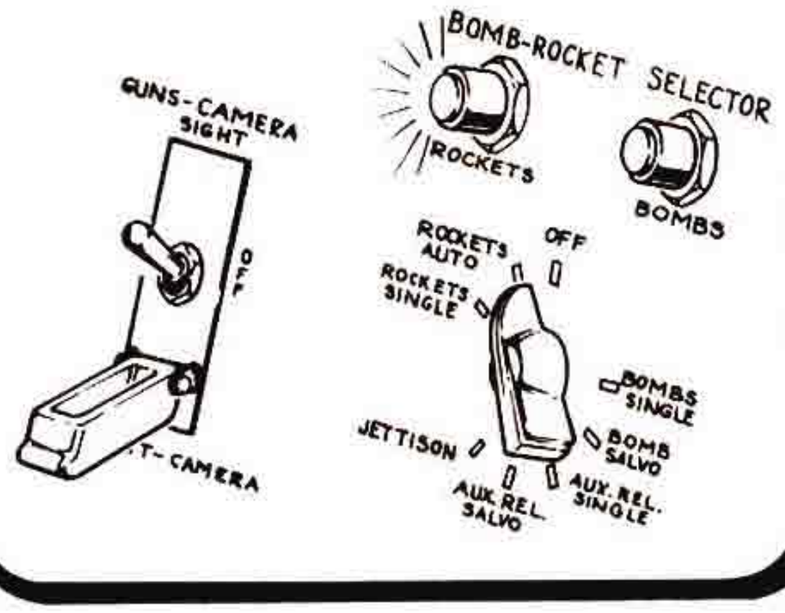
4-89. BOMB RELEASE SELECTOR SWITCH. The two-position bomb release selector switch on the armament control panel (fig. 4-9) provides for manual or automatic bomb release. When the switch is at "MANUAL," bombs are released when the bomb-rocket release button is depressed. Bombs are released automatically by the A-1CM sight system at the correct release point if the release selector switch is set at "AUTO" and the bomb-rocket release button is held down during the bombing run.

4-90. BOMB ARMING SWITCH. Arming of the 100-pound bombs is controlled by the bomb arming switch on the armament control panel (fig. 4-9). (Bombs carried within the practice bomb container contain no explosive, and are therefore not armed.) With the arming switch at "SAFE," the bombs are released unarmed. Setting the switch to "NOSE & TAIL" arms both nose and tail fuses for instantaneous detonation of the bomb on contact. Bombs are released in a tail-fuse-armed condition when the switch is in the "TAIL ONLY" position, providing for delayed detonation.

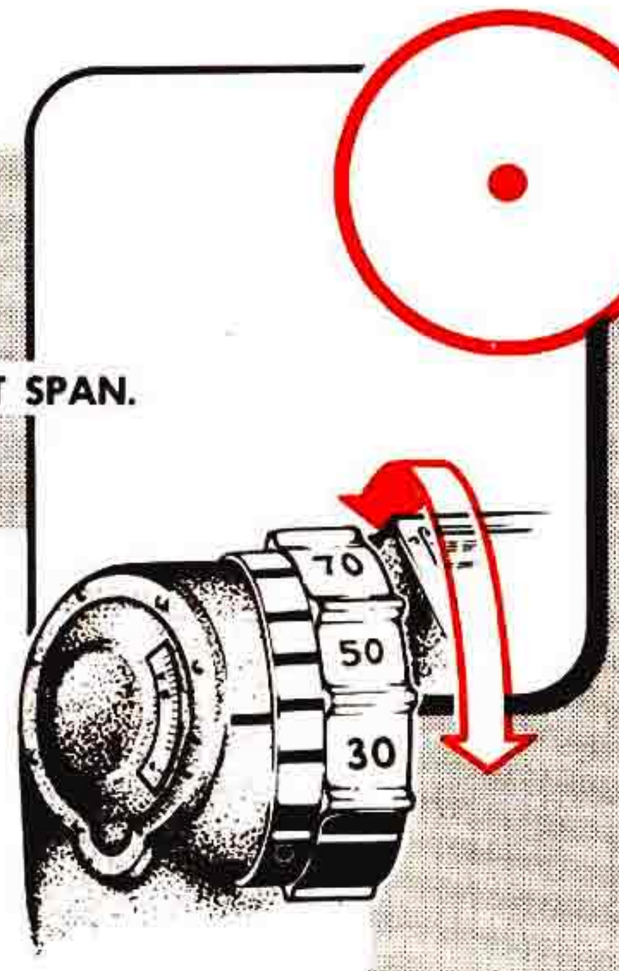
4-91. BOMB-ROCKET SELECTOR SWITCH. The

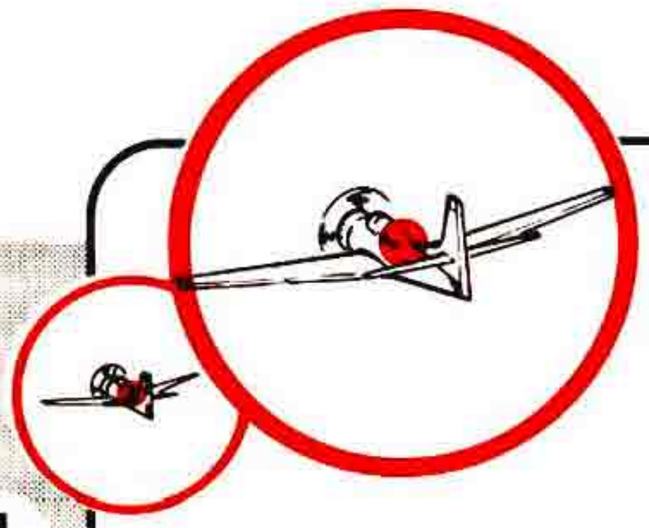
GUNNERY OR ROCKETS

1 SELECT GUNS OR ROCKETS.



2 SET SPAN.

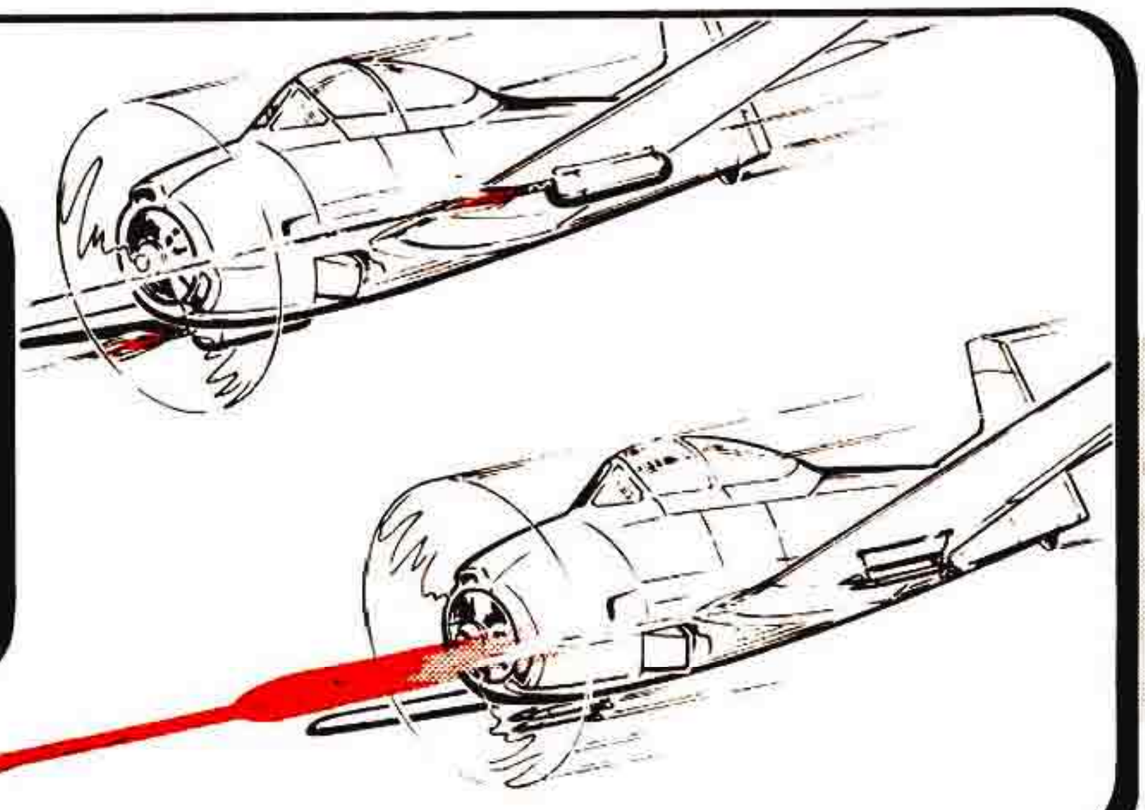




3 DEPRESS SIGHT CAGING BUTTON MOMENTARILY.

4 TRACK TARGET; RANGE BY FRAMING TARGET SPAN WITH RETICLE. (1 SEC MIN)

5 FIRE.



159-60-67

Figure 4-11. A-1CM Sight Ranging Operation

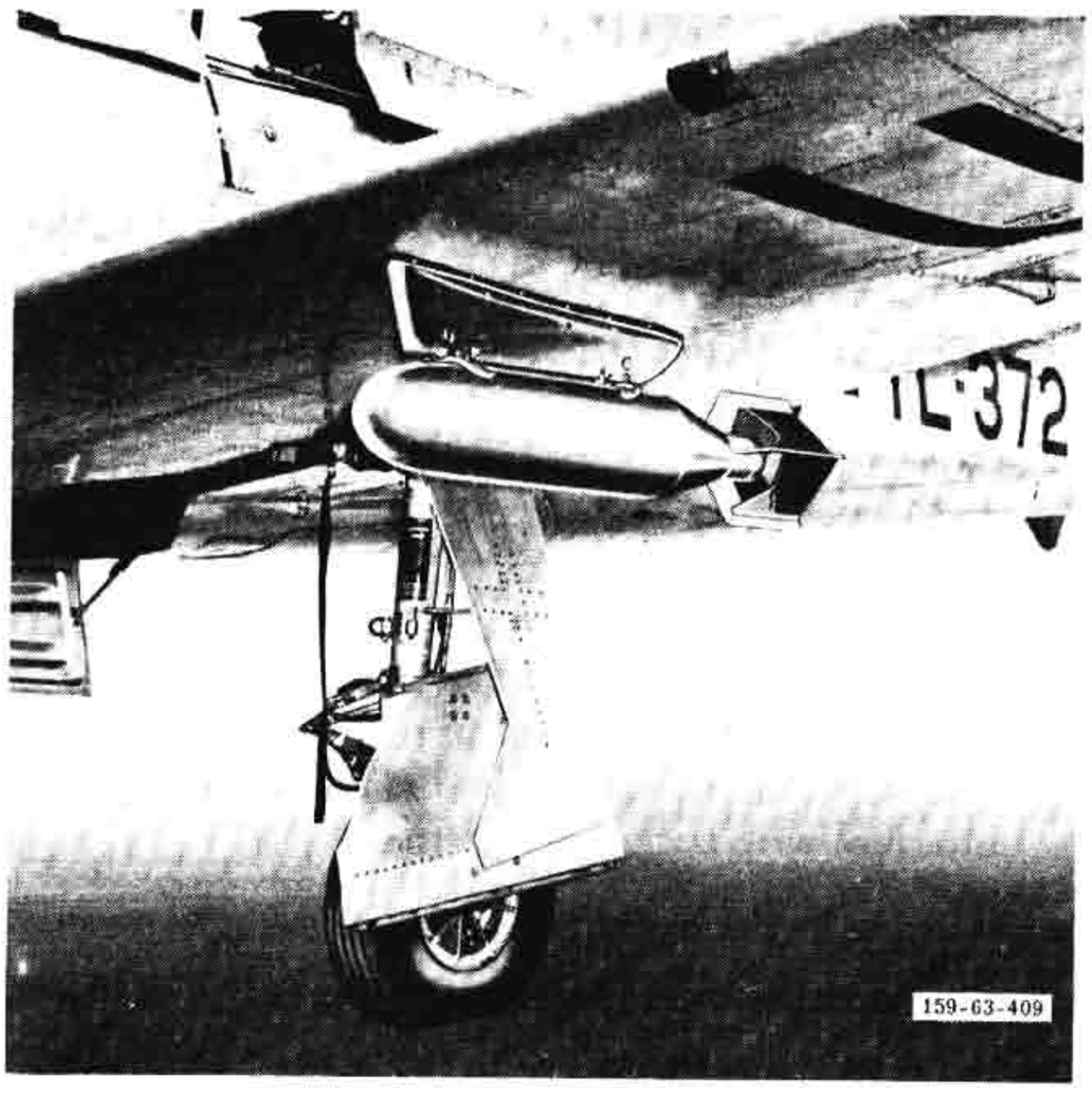


Figure 4-12. Bomb Installation

rotary selector switch on the armament control panel (fig. 4-9) may be positioned for the desired type of bomb (or rocket) release. With the selector at "BOMBS SINGLE," one bomb is released at a time (left bomb first) with each depression of the bomb-rocket release button or automatically through the sight system. When selector is at "BOMB SALVO," both bombs are released simultaneously when the release button is depressed, or through operation of the sight. When practice bombs are carried, the bomb-rocket selector switch may be positioned on either "AUX REL SINGLE" or "AUX REL SALVO," and release is accomplished as for conventional bombs. Regardless of position of bomb arming switch, moving the selector switch to "JETTISON" permits both bombs (or rocket launchers) to be dropped unarmed in an emergency by means of the release button on the stick grip.

4-92. JETTISON SWITCH. A guarded jettison switch on the armament control panel may be used to jettison the bombs (or rocket launchers) in an emergency. Holding the jettison switch on momentarily releases both bombs (or rocket launchers) simultaneously. The jettison switch is wired directly to the battery, permitting release of bombs or rockets regardless of the position of the generator or battery switches.

4-93. BOMB EQUIPMENT INDICATORS.

4-94. BOMB INDICATOR LIGHT. A green bomb indicator light mounted on the armament control panel above the bomb-rocket selector switch illuminates whenever bomb operation is selected.

4-95. AUXILIARY RELEASE INDICATOR LIGHTS. Two auxiliary release indicator lights are located below the selector switch: a green light (marked "SEL") to indicate the selector is positioned for auxiliary release, and an amber light (marked "IND") to indicate when the practice bombs are released. The amber ("IND") light flickers as each practice bomb is released from the rack.

4-96. JETTISON INDICATOR LIGHT. A red jettison light below the selector switch illuminates whenever the switch is placed at the "JETTISON" position.

4-97. RELEASING BOMBS.

a. Sight caging lever "UNCAGE."

b. Inverter switch at "MAIN ON," warning light out.

c. Gun selector switch "SIGHT-CAMERA" (to supply power to sight).

d. Bomb release switch "MANUAL" or, if bombs are to be released through the sight, "AUTO."

e. Bomb-rocket selector "BOMBS SINGLE" or "BOMBS SALVO" as desired; or if practice bombs are installed, place selector at "AUX REL SINGLE" or "AUX REL SALVO."

f. Rocket setting control "GUN BOMB."

g. Sight dimmer control adjusted for desired reticle brilliance.

h. Set B-TW control for wind conditions.

i. Bomb arming switch "NOSE & TAIL" or "TAIL ONLY" as desired.

j. During pushover into dive, momentarily depress caging button on throttle to stabilize reticle image.

k. Keep center dot on target and track target smoothly.

l. For automatic release, hold bomb-rocket release button down during bomb run.

m. On "AUTO" release, bombs will automatically drop as reticle circle disappears. For "MANUAL" release, depress bomb-target release button as reticle circle disappears. A flashing red light is reflected from the windshield at time of release.

4-98. EMERGENCY BOMB RELEASE.

4-99. If it is necessary to jettison the bombs (or rockets), proceed as follows:

WARNING

Before any take-off when bombs or rockets are installed, bomb-rocket selector switch should be positioned at "JETTISON" to allow immediate release by pressing button on the control stick grip.

a. Jettison bombs (or rockets) by pressing bomb-rocket release button on stick grip.

b. If bomb-rocket selector switch has been moved from "JETTISON" position, bombs (or rockets) can be dropped unarmed by momentarily actuating the jettison switch on the armament control panel.

4-100. ROCKET EQUIPMENT.

4-101. Three rockets (2.25-inch aircraft rockets) may be carried under each wing. Rockets are aimed by use of the A-1CM sight, and they are fired by depressing the bomb-rocket release button on the control stick grip. The rockets contain no explosives, only a propelling charge. The gun camera operates automatically during rocket firing (with gun selector switch on "SIGHT-CAMERA").

4-102. ROCKET EQUIPMENT CONTROLS AND INDICATOR.

4-103. BOMB-ROCKET SELECTOR. The rotary selector on the armament control panel (fig. 4-9) is used to select the type of rocket release, as well as bomb release. Positioning the selector at "ROCKETS SINGLE" permits rockets to be fired one at a time with each depression of the release button. At "ROCKETS AUTO," rockets will release in a train, one after another, with only one depression of the release button.

4-104. ROCKET PROJECTOR RELEASE CONTROL. The rocket projector release control on the armament control panel (fig. 4-9) is set by the ground crew at the time rockets are loaded on the airplane. The window on the face of the projector release control indicates which rocket is to be fired and should, therefore, be on position "1" before initial firing to ensure release of all rockets that are carried.

Figure 4-13. Rocket Installation

4-105. JETTISON SWITCH. Refer to paragraph 4-92.

4-106. ROCKET INDICATOR LIGHT. A green rocket indicator light mounted on the armament control panel above the bomb-rocket selector switch illuminates whenever rocket operation is selected.

4-107. FIRING ROCKETS.

CAUTION

Before initial firing of rockets, be sure that rocket projector release control is on position "1." Rockets must be fired in proper sequence to ensure that rockets left on the racks will not interfere with rocket being fired.

a. Caging lever on sight head at "UNCAGE."

b. Inverter switch at "MAIN ON"; warning light out.

c. Gun selector switch "SIGHT-CAMERA" to provide power to sight.

d. Bomb-rocket selector "ROCKETS SINGLE" or "ROCKETS AUTO."

e. Rocket setting control at "2.25" AR" position. Set pointer at "S" if steep dive angle is to be used, at "N" for normal dive angle.

f. Sight dimmer control adjusted for desired reticle brilliance.

g. B-TW control "ROCKET GUN."

h. During pushover into dive, momentarily depress caging button to stabilize reticle image.

i. Track target, keeping center dot on target, and operate throttle ranging control to keep target framed within circle.

j. Track target smoothly, without slipping or skidding, for at least 5 seconds—then fire.

4-108. EMERGENCY ROCKET RELEASE.

4-109. Refer to paragraph 4-99 for emergency rocket release.

4-110. ANTI-G SUIT PROVISIONS.

4-111. An air pressure outlet connection on the left side of each seat in Airplanes AF48-1371 and AF48-1372 provides for attachment of the air pressure intake tube of the anti-G suit. Operation of the G suit is automatic after it is connected to the air pressure outlet. (Provisions for installation of anti-G suit equipment are made on all other airplanes.) Air pressure for inflation of the anti-G suit bladders is supplied by an engine-driven air pump, and the pressure delivered to the suit is controlled by a regulator valve. For every one G acceleration force, a corresponding one psi air pressure is exerted in the anti-G suit.

EXTREME WEATHER OPERATION

159-00-929

SECTION V

5-1. COLD WEATHER OPERATION.

5-2. The normal operating procedures outlined in section II should be followed during cold weather operation with the exceptions and additions made in the following paragraphs.

5-3. BEFORE ENTERING THE AIRPLANE.

a. Remove protective covers from airplane. Leave engine cover on if it is necessary to preheat engine before starting.

Note

At temperatures below −18°C (0°F), heat should be applied to engine and accessories. Below −30°C (−22°F), it may be necessary to apply heat also to battery, cockpit, master brake cylinder, and actuating cylinders.

b. Check "Y" drain and oil tank sump drain, and continue heating if flow is unsatisfactory.

c. Clean gear shock struts of dirt and ice.

d. Remove snow and ice from surfaces, control hinges, propeller, pitot tube, fuel and oil vents, and crankcase breather outlet.

e. Drain moisture from all fuel tank and fuel system drains.

f. Have external power source connected for starting.

g. Remove engine cover and ground heater.

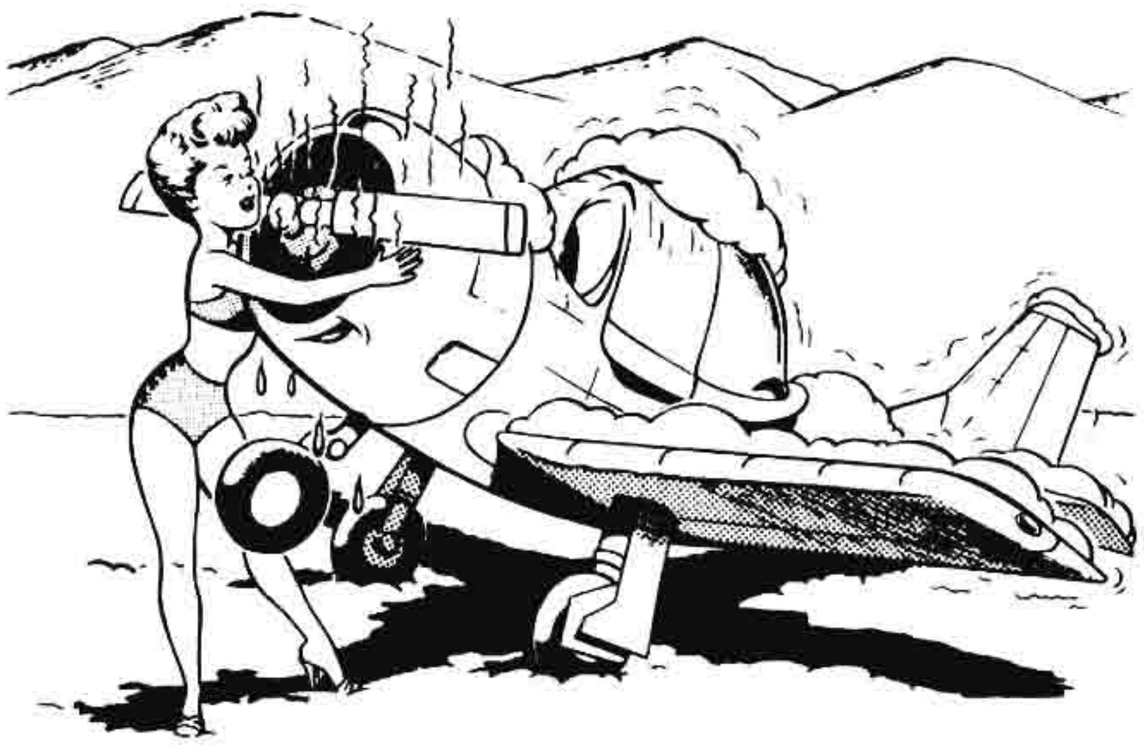
h. Remove oil immersion heater.

Note

An immersion heater should be used in the oil tank when outside air temperature is below −26°C (−15°F).

5-4. STARTING ENGINE.

5-5. Before starting engine, hold starter switch on for a few seconds (with ignition switch "OFF") and make sure engine will turn over at least 50 rpm (one propeller blade per second).



CAUTION

If 50 rpm cannot be attained with starter, insufficient oil dilution is indicated, and it will be necessary to heat the engine.

Use normal starting procedure, supplemented by the following:

a. Hold primer button down continuously while engine is being turned over by starter. More than normal priming will be required. After engine starts, continue priming until it is running smoothly.

b. If there is no indication of oil pressure after 30 seconds running, or if pressure drops after a few minutes ground operation, stop engine and investigate.

c. Use some carburetor heat after starting, to assist vaporization and combustion and to reduce backfiring.

5-6. WARM-UP AND GROUND TESTS.

a. Warm up engine at 1500 rpm, to prevent fouling of spark plugs.

b. Cowl and oil cooler flaps open.

c. Check all instruments for normal operation.

d. After oil temperature and pressure are up to normal, operate propeller control through three complete cycles, and check for drop of approximately 300 rpm.

e. Operate flaps and canopy through one complete cycle.

f. Before disconnecting external power source, perform all ground tests requiring electrical power. Then turn on battery switch.

Note

The battery cannot carry the electrical load imposed by ground operation of heating system and radios. Minimize load on the electrical system until after generator cuts in.

5-7. TAXIING INSTRUCTIONS.

5-8. Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds.

5-9. BEFORE TAKE-OFF.

a. Check controls very carefully for free and proper movement.

b. Hold brakes and run up engine to 2400 rpm until spark plugs have burned clean and engine is operating smoothly. Then check ignition system.

c. Normally, carburetor air control should be at "COLD AIR" for take-off. However, if icing conditions exist, move control to "HOT AIR" prior to take-off, and immediately after take-off, to ensure elimination of ice from induction system. When outside air temperature is below −18°C (0°F), use sufficient carburetor heat to maintain carburetor air temperature near 15°C during take-off to ensure smooth engine operation.

d. Turn pitot heater on just before rolling into position for take-off.

5-10. TAKE-OFF.

a. At start of take-off run, advance throttle rapidly to take-off setting and check that full power is available. If full power is not obtained, immediately discontinue take-off.

b. After take-off from a wet snow- or slush-covered field, operate the landing gear and flaps through several complete cycles to prevent their freezing in the retracted position. Expect considerably slower operation of the landing gear and flaps in cold weather.

5-11. ENGINE OPERATION IN FLIGHT.

a. Use carburetor heat as required to prevent or eliminate icing. Under extremely cold conditions, carburetor icing is less likely to occur than when free air temperature is between −10°C and 15°C (14°F and 59°F). It is a good practice to apply heat for one or two minutes every half-hour during flight to preclude the possibility of icing.

b. During operation in cold, clear (nonicing) air where cylinder head and carburetor air temperatures drop to values sufficiently low to cause rough engine operation, increase the carburetor heat just enough to eliminate roughness. Do not exceed 50°C carburetor air temperature.

c. At low outside air temperatures, especially during low-power cruising operation, the fuel-air mixture may be too cold for proper vaporization and fuel economy. Use carburetor heat as necessary to obtain smooth engine operation and eliminate plug fouling.

d. Turn on cockpit heat and windshield defrosting as necessary.

e. Occasionally increase rpm to 2400-2600 momentarily to throw off ice.

f. Attempt to climb or descend out of icing level.

WARNING

Flight should not be attempted through known or forecast icing conditions, as there is no means of removing ice from the airplane. A reduction in cruising speed and cruising range, and an increase in stalling speed will result from ice forming on the airplane.

5-12. APPROACH AND LANDING.

a. Make sure ice is not jamming the carburetor venturi. Test by moving throttle back and forth several times.

b. Use carburetor heat during approach and landing. Be prepared to turn heat off if go-around should be necessary.

c. Pump brake pedals several times on approach.

d. If ice has formed on the airplane, increase approach airspeed to 115 knots IAS.

5-13. STOPPING ENGINE.

5-14. OIL DILUTION. Information to be supplied when available.

CAUTION

Pending accumulation of actual cold-weather experience on the airplane, do not dilute oil for more than 45 seconds (5 percent), in order to avoid excessive loss of oil from engine breather.

Note

If the ambient air temperature is greater than 40°F at the time of engine start (after dilution has been accomplished), the engine should be operated for 10 minutes at 1500 rpm before take-off is attempted.

5-15. BEFORE LEAVING AIRPLANE.

a. Release brakes.

b. Clean dirt and ice from shock struts.

c. Inspect fuel and oil tank vents and breathers, and remove ice.

d. Leave canopy partially open to prevent cracking of canopy or windshield glass due to differential contraction. Air circulation also retards formation of frost.

e. Install protective covers.

f. Drain oil tank sumps, "Y" drain, and fuel drains of condensate approximately 30 minutes after stopping engine. If airplane is to be idle for several days, oil may be drained.

g. Check specific gravity of battery at least weekly. If it is less than 1.250, remove and service battery. If layover of several days is anticipated, or if temperature is below −29°C (−20°F) and airplane will be idle more than 4 hours, remove battery.

5-16. HOT WEATHER OPERATION.

5-17. For all operation under dusty or sandy conditions, move carburetor air control to "FILTERED AIR." Cover all openings when airplane is on the ground, to prevent entrance of blowing sand.

5-18. OPERATION UNDER INSTRUMENT FLIGHT CONDITIONS.

5-19. GENERAL.

5-20. Flying the T-28A Airplane in instrument weather conditions, as in any airplane, requires proper instrument proficiency on the part of the pilot and thorough preflight planning. The airplane has satisfactory stability and its flight handling characteristics are excellent. The instruments and communication equipment are satisfactory to qualify the airplane as an instrument trainer. Flights should not be attempted through icing conditions, as the airplane does not have deicing equipment.

5-21. BEFORE INSTRUMENT TAKE-OFF.

5-22. Complete all checks required for any normal flight, with the following additions:

a. Check airspeed indicator needle at zero.

b. Check rate-of-climb indicator needle at zero.

c. Check operation of all radio equipment.

d. Check operation of turn-and-bank indicator and gyro compass by observing movement of needles when turns are made during taxiing.

e. Check for freedom from carburetor ice just before take-off.

f. Turn pitot heater switch "ON" if necessary just before rolling into position for take-off.

5-23. INSTRUMENT TAKE-OFF.

a. Align airplane with runway. Hold brakes.

b. Adjust slaved gyro compass to place needle under top index.

c. Adjust attitude gyro miniature airplane to align with reference line.

d. Release brakes and advance throttle slowly to take-off power.

e. Use nose wheel steering to maintain directional control during initial portion of ground run.

f. At 65-70 knots IAS, raise nose to initial climb attitude. (See figure 1-22.)

g. Fly airplane off and maintain initial climb attitude.

h. When definitely airborne, move landing gear handle to "UP." There will be a slight nose-up change of trim caused by landing gear retraction.

5-24. INSTRUMENT CLIMB.

a. Establish a climb speed of 120 knots IAS.

b. Adjust carburetor heat as required.

c. Adjust cowl flaps as required.

d. Limit climbing turns to 30-degree angle of bank for ease of handling. (Standard 3-degree per second turn will normally require a 19 to 20 degree bank.)

5-25. INSTRUMENT FLIGHT.

a. Reduce power to cruise setting, adjust cowl flaps, and retrim airplane.

b. Adjust carburetor heat as required.

c. Normally, limit turns to 30-degree angle of bank for ease and comfort of handling.

5-26. INSTRUMENT DESCENT.

a. Descend in a clean configuration.

b. Mixture control "RICH."

c. Do not retard throttle below 17 in. Hg.

d. Adjust carburetor heat as required.

e. Maintain cruising airspeed.

f. Limit turn to 30-degree angle of bank for ease of handling.

5-27. RADIO RANGE LETDOWN.

5-28. The following procedure is recommended when holding is not anticipated.

a. Move fuel selector* to "BOTH" and mixture control to "RICH" when high cone is reached.

b. Reduce power over the high cone. Landing gear handle "DOWN" when airspeed drops below 140 knots IAS.

Note

If airplane icing is encountered at high cone, descend to low cone in clean configuration at 140 knots IAS.

c. Adjust propeller control to obtain 2400 rpm.

d. Adjust throttle to obtain approximately 22 in. Hg.

e. Descend at 120 knots IAS and 500 fpm.

f. Adjust carburetor heat as required.

g. Adjust cowl flaps as required.

h. Complete procedure turn at 3 degrees per second with 45 seconds on 45-degree leg.

i. Increase power to approximately 26 in. Hg as approach altitude is reached.

j. After passing low cone, decrease power to approximately 20 in. Hg, move wing flap control to "¼," and descend at 100-105 knots IAS.

5-29. HOLDING.

a. Landing gear handle and wing flap control "UP."

b. Throttle approximately 25 in. Hg, propeller control 1800 rpm, and airspeed 140 knots IAS.

c. Limit turns to 30-degree angle of bank.

5-30. GROUND CONTROL LANDING.

5-31. Approximate time for a standard GCA approach with a 28-mile ground pattern is 12 minutes. The average fuel consumption for the approach is 30 pounds (6 gallons). All turns on GCA pattern are standard 3-degree per second turns.

Note

With the airplane in the landing configuration, difficulty will be experienced in maintaining heading and attitude in severe turbulence. If severe turbulence is encountered during a thunderstorm, delay the approach, if possible, until the storm passes.

***Airplanes AF48-1371, AF48-1372, AF49-1492 through AF49-1756, and AF50-195 through AF50-319**

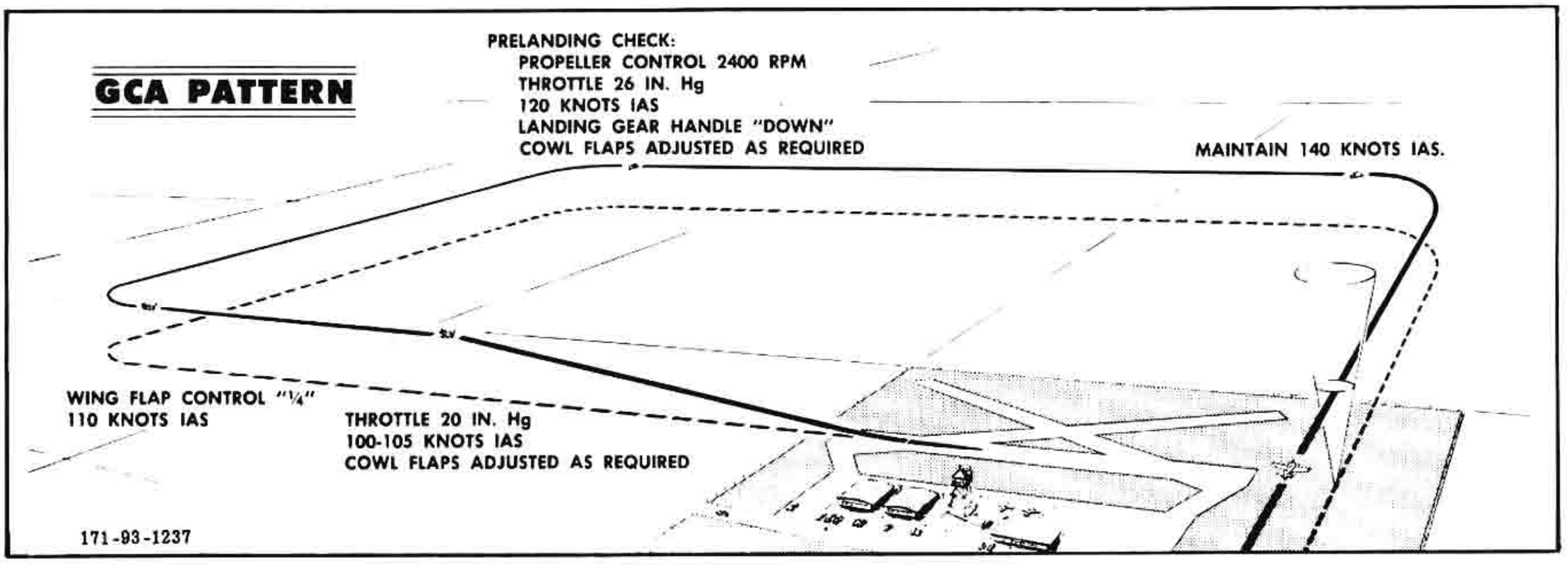


Figure 5-1. GCA Pattern

a. Establish contact (with gear and flaps up) over GCA pickup point at pattern altitude.

b. Maintain 140 knots IAS until time for prelanding check.

c. Make prelanding check as follows: 120 knots IAS, landing gear handle "DOWN," propeller control 2400 rpm, throttle approximately 26 in. Hg, and cowl flaps adjusted as necessary.

d. On final approach prior to reaching glide path, reduce airspeed to approximately 110 knots IAS and move wing flap control to "¼."

e. As glide path is intercepted, reduce power to approximately 20 in. Hg and airspeed to 100-105 knots IAS.

5-32. LOW-VISIBILITY APPROACHES.

a. Fly downwind over landing runway at minimum approach altitude and correct for wind drift.

b. When over downwind end of runway, turn 45 degrees and hold new heading for 45 seconds.

c. Make procedure turn, back to runway heading.

d. Maintain minimum approach altitude until visual contact is made with runway.

FLIGHT CHARACTERISTICS

159-00-940

SECTION VI

6-1. FLIGHT CHARACTERISTICS.

6-2. GENERAL.

6-3. The airplane has excellent stability and control characteristics under all conditions of speed, power, load factor (G), and altitude. The controls are effective throughout the speed range (stall to limit dive speed), and airplane response to control movement is quite rapid. The 100-degree-per-second rate of roll is comparable to that normally found only in fighters. The trim tabs are also effective at all speeds so that the airplane may be easily trimmed to fly "hands off." Operation of gear, flaps, canopy, speed brake and cowl flaps, as well as changes in power setting, affects longitudinal trim (causes airplane to pitch up or down) only slightly, thus requiring a minimum of stick movement to maintain flight attitude.

6-4. STALLS.

6-5. POWER-OFF STALLS.

6-6. Power-off stalls in this airplane are very mild. You will be warned of an approaching stall by a light vibration caused by airplane buffet which begins 2 or 3 knots above the actual stall. Sometimes, mild pitching may accompany the buffet. When the stall occurs with flaps up, the airplane pitches nose down and straight ahead with no tendency to roll. With flaps down, a slight roll to the left may accompany the nose-down pitch.

6-7. POWER-ON STALLS.

6-8. Power-on stalls are also relatively mild. During the approach to a power-on stall, however, you will find it necessary to use a moderate amount of aileron to keep the wings level and rudder as required to maintain desired heading. No appreciable buffeting occurs prior to actual stall. At the stall, the airplane characteristically rolls left, although not violently, and as in the power-off stalls, pitches nose-down.

Note

Gear position produces no noticeable effect on stall characteristics.

6-9. STALL RECOVERY.

6-10. Stall recovery in this airplane is accomplished in the conventional manner as follows:

a. Drop nose immediately by releasing back pressure on the stick.

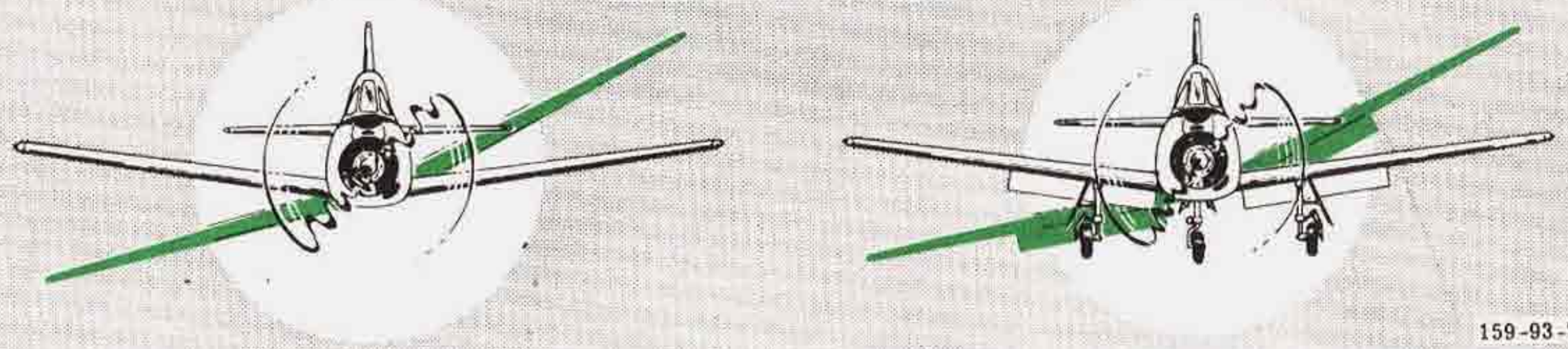
b. Use aileron and rudder as required to regain straight and level attitude.

c. At same time, advance throttle smoothly. Do not

INDICATED STALLING SPEEDS — KNOTS

GROSS WEIGHT LB	GEAR AND FLAPS UP				GEAR AND FLAPS DOWN			
	POWER ON (MAX CONTINUOUS POWER)		POWER OFF (WINDMILLING PROP)		POWER ON (APPROACH POWER)		POWER OFF (WINDMILLING PROP)	
	LEVEL	30° BANK	LEVEL	30° BANK	LEVEL	30° BANK	LEVEL	30° BANK
7500	65	70	75	85	65	70	70	75
7000	60	65	75	80	60	65	70	75
6500	55	60	70	75	55	60	65	70
6000	50	55	65	70	50	55	60	65

BASED ON FLIGHT TEST DATA



159-93-700C

Figure 6-1. Stalling Speeds

exceed recommended manifold pressure for the rpm setting.

d. After the nose has been lowered, speed will increase rapidly. When you attain safe flying speed, raise the nose with steady back pressure.

e. Retard throttle to cruising power.

6-11. PRACTICE STALLS.

6-12. To familiarize yourself completely with the stall characteristics of the airplane under various flight conditions, practice the series of stalls outlined in the following paragraphs 6-13 through 6-18. All practice stalls, except those with gear and flaps down, should be continued past the point of "mushing" to actual stall. Do not aggravate the stall, however, by continuing to pull back on the stick after stall has occurred. Control should be coordinated and ailerons not used to excess at or near the stall; if a wing starts to drop, apply opposite rudder. For both power-off and power-on stalls, set mixture at "RICH" and propeller at 2100 rpm. Retard throttle smoothly for power-off stalls; set it at 26 in. Hg for power-on stalls.

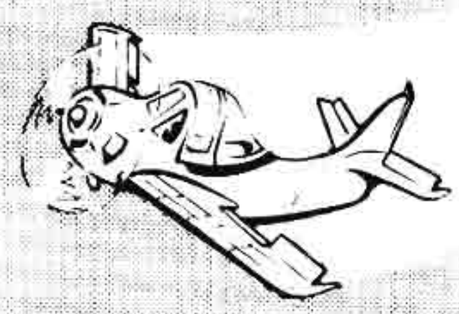
6-13. PRACTICE STALL—GEAR AND FLAPS UP, POWER-OFF, STRAIGHT AHEAD. This stall is least violent and will provide a basic stalling speed for comparison with other stalls. Begin the stall from level flight, ease throttle back to idle, raise nose of airplane to a point above the horizon, and hold that attitude with wings level and nose steady. As the stall approaches, observe the laxity of the controls, attitude of the airplane, and tone of the engine. Notice how the airplane starts to buffet 2 or 3 knots before actual stall. When stall occurs, recover in the normal manner.

6-14. PRACTICE STALL—GEAR AND FLAPS UP, POWER-ON, STRAIGHT AHEAD. Use the same entry and recovery as in preceding practice stall. Notice that the use of power causes a nose-up attitude and a decrease in stalling speed. You will note that no appreciable buffeting occurs prior to actual stall. At the stall, the airplane characteristically rolls left, although not violently, and as in the power-off stalls, pitches nose-down.

6-15. PRACTICE STALL—GEAR AND FLAPS UP, POWER ON OR OFF, 30-DEGREE BANK. Establish a coordinated climbing turn with a bank of approximately 30 degrees. Raise the nose well above the horizon and keep the nose turning at a steady rate until the stall occurs. Make a standard recovery with a coordinated roll out of the turn and dive. Observe the increased stalling speed in a turn. This higher stall speed is the

ITEMS AFFECTING STALLING SPEEDS AND CHARACTERISTICS

ITEM	STALL CHARACTERISTICS	STALL SPEEDS
ABRUPT CONTROL MOVEMENT	✓	✓
ALTITUDE		
CG LOCATION	✓	
COORDINATION	✓	✓
COWL FLAPS	✓	
GROSS WEIGHT		✓
LANDING GEAR		
POWER	✓	✓
SPEED BRAKE	✓	
TURNS	✓	✓
WING FLAPS	✓	✓



159-93-942

Figure 6-2. Items Affecting Stalling Speeds and Characteristics

result of increased wing loading induced by centrifugal force.

6-16. PRACTICE STALL—GEAR DOWN, FLAPS UP, POWER ON OR OFF, STRAIGHT AHEAD. Practice this stall in anticipation of an enforced flaps-up landing. Close throttle and set up a normal glide at 100 knots IAS. Raise nose of airplane into a landing attitude and hold it until the stall occurs. Note that gear-down condition doesn't increase stall speed, but the increased drag of the gear does increase rate of sink and causes the airplane to lose speed more rapidly. Use normal stall recovery.

6-17. PRACTICE STALL—GEAR AND FLAPS DOWN, POWER OFF, STRAIGHT AHEAD. This stall is, in effect, a power-off landing. Simulate a traffic pattern and make standard landing checks. Turn on final approach, make final checks, and set up approach speed of 90 knots IAS. Flare at simulated runway altitude, pull nose up to landing attitude, and hold until stall occurs. At this point, observe the characteristics of the airplane. Notice how use of flaps decreases stalling speed.

6-18. PRACTICE STALL—GEAR AND FLAPS DOWN, POWER ON, STRAIGHT AHEAD. This stall is also used in landing. Simulate a complete traffic pattern as in preceding practice stall. Since this stall occurs at the lowest airspeed of any of the stall series, it effectively demonstrates the slowest airspeed at which the airplane can be flown.

6-19. SPINS.

6-20. The airplane possesses satisfactory spin characteristics with gear and flaps up or down. Spin entry may be accomplished from a stall by applying full rudder in the desired direction of the spin and maintaining full back stick. If the spin is entered with power on, the power should be reduced to idle as soon as possible. Full rudder must be held in the direction of the spin, and the stick must be held full back to maintain the spin; aileron position does not materially affect spin characteristics. You will note that the first two turns of the spin, with gear and flaps either up or down, are somewhat erratic. A stabilized spin develops after approximately the second turn. There is an average loss of approximately 800 feet per turn, from the stall to level flight recovery, in a normal spin. During a five-turn spin, and following recovery, the airplane loses from 4000 to 5000 feet altitude.

6-21. SPIN RECOVERY.

6-22. Rapid spin recovery (less than 1½ turns) may be obtained in the normal manner by briskly applying full opposite rudder immediately followed by forward stick. Apply only sufficient forward stick to regain flying speed in order to prevent assuming too steep a diving attitude. With gear or flaps down, pull back on stick immediately after rotation has stopped and maintain 3.0 G until level flight is attained. Use caution to prevent an accelerated stall (at 120 knots IAS, a stall occurs at approximately 3.5 G). A slightly faster recovery will be effected by holding ailerons against the spin. Recovery from a normal spin may also be obtained by neutralizing the controls; however, recovery will be slower (approximately 1½ turns).

CAUTION

Because of the steep diving attitude assumed by the airplane during recovery, be careful, when gear or flaps are down, to avoid exceeding the gear- and flaps-down limit airspeed of 140 knots IAS.

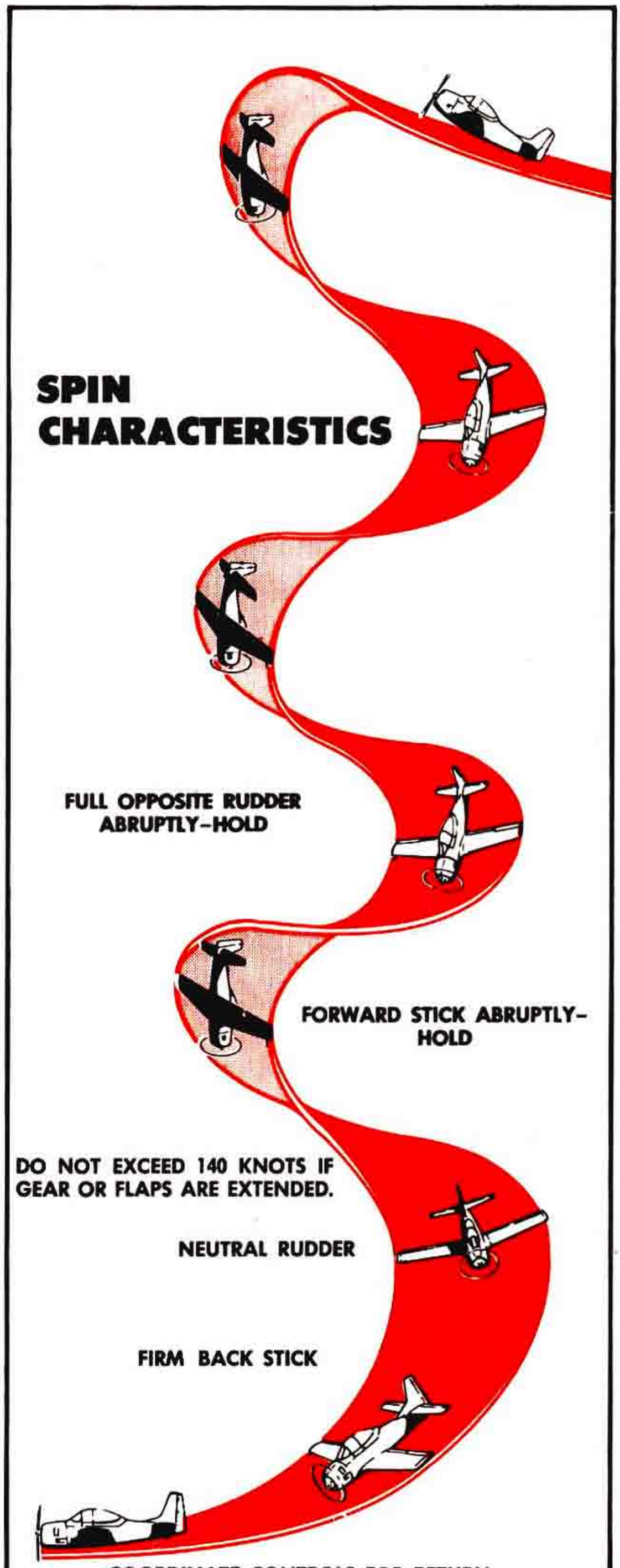


Figure 6-3. Spin Characteristics

6-23. INVERTED SPINS.

6-24. Inverted spins may be safely performed. With the down elevator travel available, it is not possible to obtain a full inverted spin. Spin entry may be accomplished from an inverted level-flight position with power off by holding full forward stick until the airspeed decreases to the minimum obtainable, and then applying full rudder in direction of spin desired. Full rudder and full forward stick must be held in order to maintain the spin. The airplane will recover from the inverted spin when forward pressure on the stick is relaxed and rudder and ailerons are neutralized. An inverted diving attitude is assumed during recovery. Continue the recovery as though completing the last half of a loop or an aileron roll. The altitude loss for a two-turn inverted spin is approximately 3,000 feet.

Note

- If an inverted spin is entered with power on, reduce power to idle rpm immediately.
- Intentional inverted spins with gear or flaps down are prohibited.

6-25. PERMISSIBLE ACROBATICS.

6-26. All normal acrobatics except those prohibited in paragraph 2-2 are permissible. However, during recovery from many normal acrobatic maneuvers, pull-out may be started in a near-vertical attitude. Under this condition, the airplane picks up speed very rapidly; therefore, you must be careful not to exceed the limit airspeed.

6-27. DIVING.

6-28. In dives to limit airspeed, the handling characteristics of the airplane are good. All control movement is easy and effective, and the airplane responds rapidly. The amount of forward stick pressure required to hold the airplane in a dive is relatively small, as is the amount of aileron pressure needed to keep the wings level. If you trim for level flight at maximum continuous power, the tab settings will be satisfactory for diving, although some adjustment of rudder tab may be desired during the dive so that it will not be necessary to hold rudder. In diving the airplane, remember that maximum permissible airspeed varies with altitude and external load. The red line on the airspeed indicator marks the limit for a clean airplane at sea level only. See figures A-1 and 6-5 for complete listing of airspeed limits. Use the following procedure in a dive.

a. Close canopy before starting dive.

b. Adjust cowl and oil cooler flaps to prevent too rapid cooling in dive.

c. Carburetor air control "COLD AIR."

d. Mixture control "RICH."

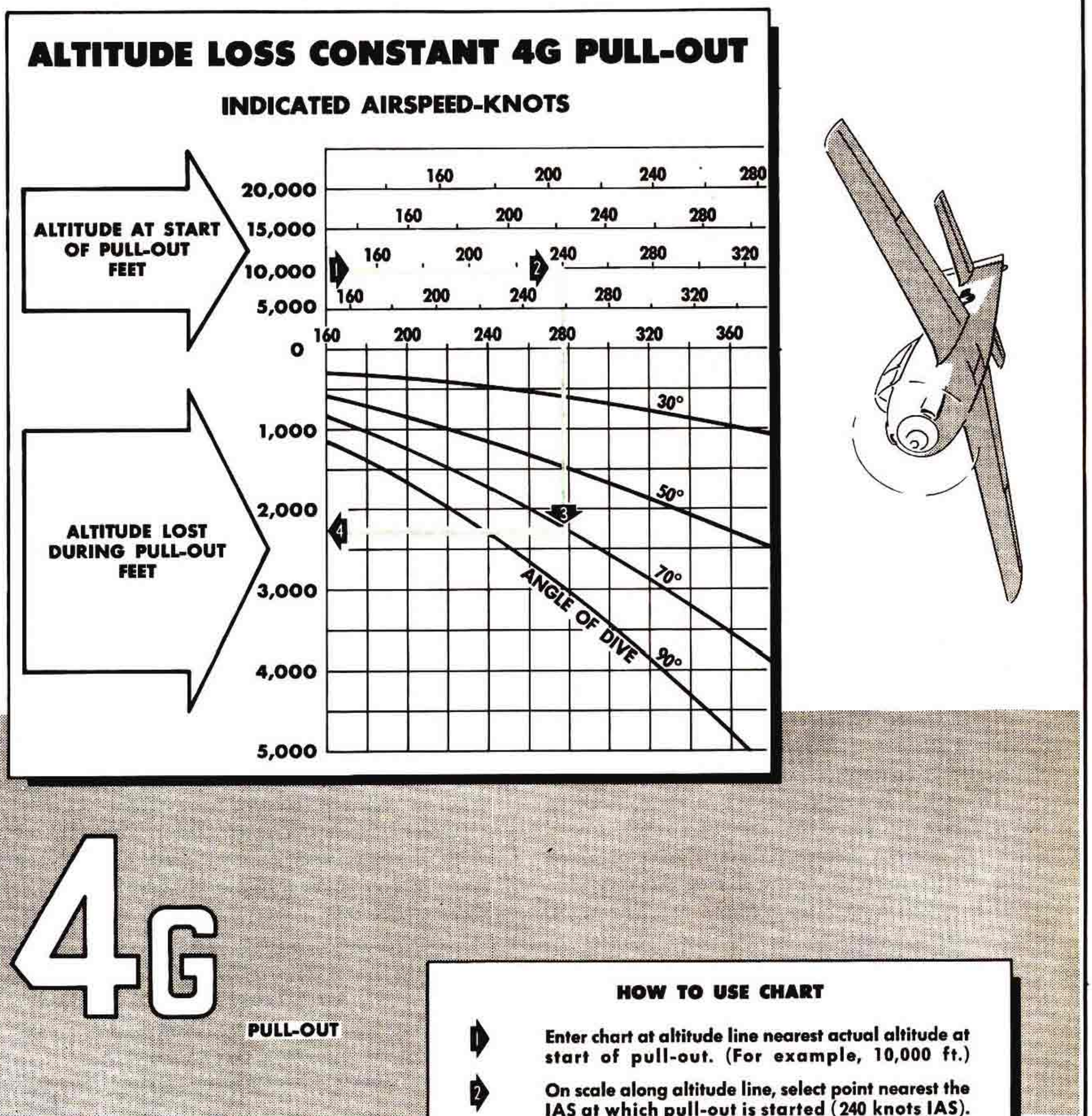


Figure 6-4. Altitude Loss in Dive Recovery—4G

e. Decrease rpm as necessary.

f. If speed brake is installed, open when desired. (Refer to paragraph 6-30 for effect of speed brake on trim.)

g. Do not exceed maximum permissible engine overspeed of 2880 rpm during dive.

CAUTION

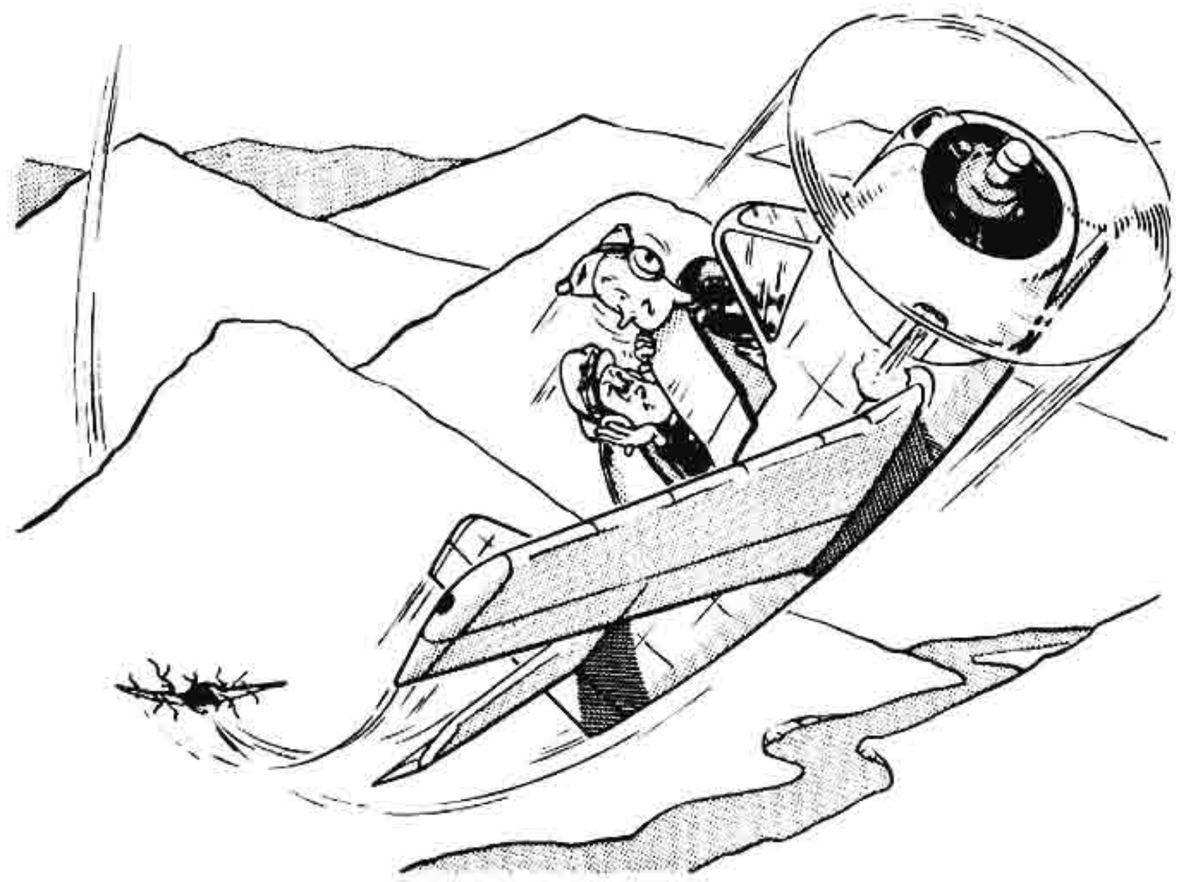
At completion of dive, open throttle slowly to prevent partly cooled engine from cutting out.

6-29. USE OF SPEED BRAKES (AIRPLANES AF48-1371 AND AF49-1500).

6-30. The speed brake is essentially an additional flight control, which you will find particularly useful for making rapid descents or for rapid deceleration from high speed. The brake can be opened at any airspeed up to maximum, and although brake opening causes a nose-up pitch, the forward stick pressure necessary to maintain the desired airplane attitude is moderate. This stick pressure can be trimmed out, even at maximum airspeed, by adjustment of the elevator tab. Closing the brake, of course, causes a nose-down pitch.

6-31. ALTITUDE LOSS IN DIVE RECOVERY.

6-32. The altitude lost during dive recovery is determined by four interdependent factors: (1) angle of dive, (2) altitude at start of pull-out, (3) airspeed at start of pull-out, and (4) acceleration maintained during pull-out. Because these factors must be considered collectively in estimating altitude for recovery from any dive, their relationship is best presented in chart form as shown in figure 6-4. Note that the chart is based on a constant 4 G pull-out. Remember that a value obtained from the chart is the altitude lost during recovery—not the altitude at which recovery is completed. Therefore,



in planning maneuvers which involve dives, consider first the altitude of the terrain, then use the charts to determine the altitude at which recovery must be started for pull-out with adequate terrain clearance.

6-33. DESCENT.

6-34. MAXIMUM GLIDE DISTANCE.

6-35. Maximum gliding distance can be obtained by establishing a glide at 105 knots IAS, with gear and flaps up (fig. 6-6). Maintaining 105 knots IAS, glide ratio and rate of sink under varying conditions are given in paragraph 3-9.

6-36. MAXIMUM-RATE LETDOWN.

6-37. If you should desire to effect a rapid loss of altitude, roll into a dive and reduce throttle to idle. Make sure that the limit airspeed, as indicated in figure 6-5, is not exceeded. A letdown from 25,000 feet altitude to 2500 feet altitude can be effected in 3 minutes with the clean airplane; with external load, a letdown can be made in 4 minutes. Pull-out must be started 2500 feet above the terrain.

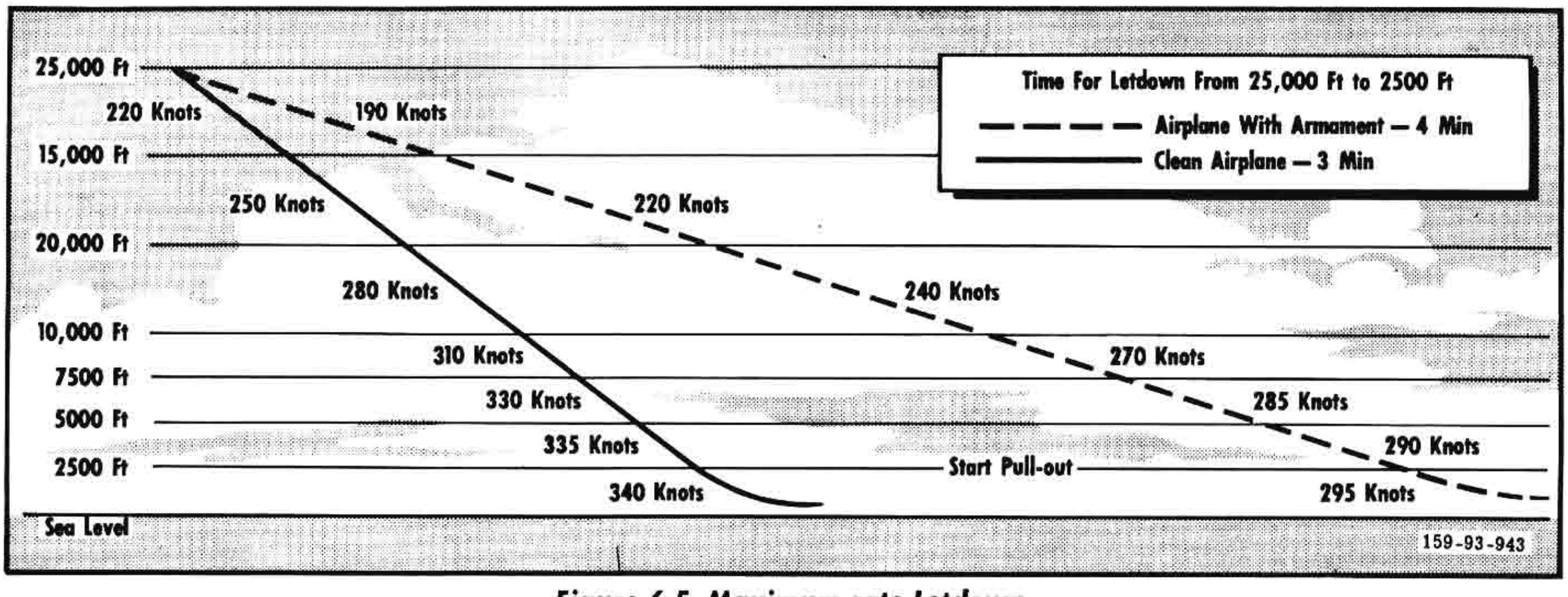


Figure 6-5. Maximum-rate Letdown

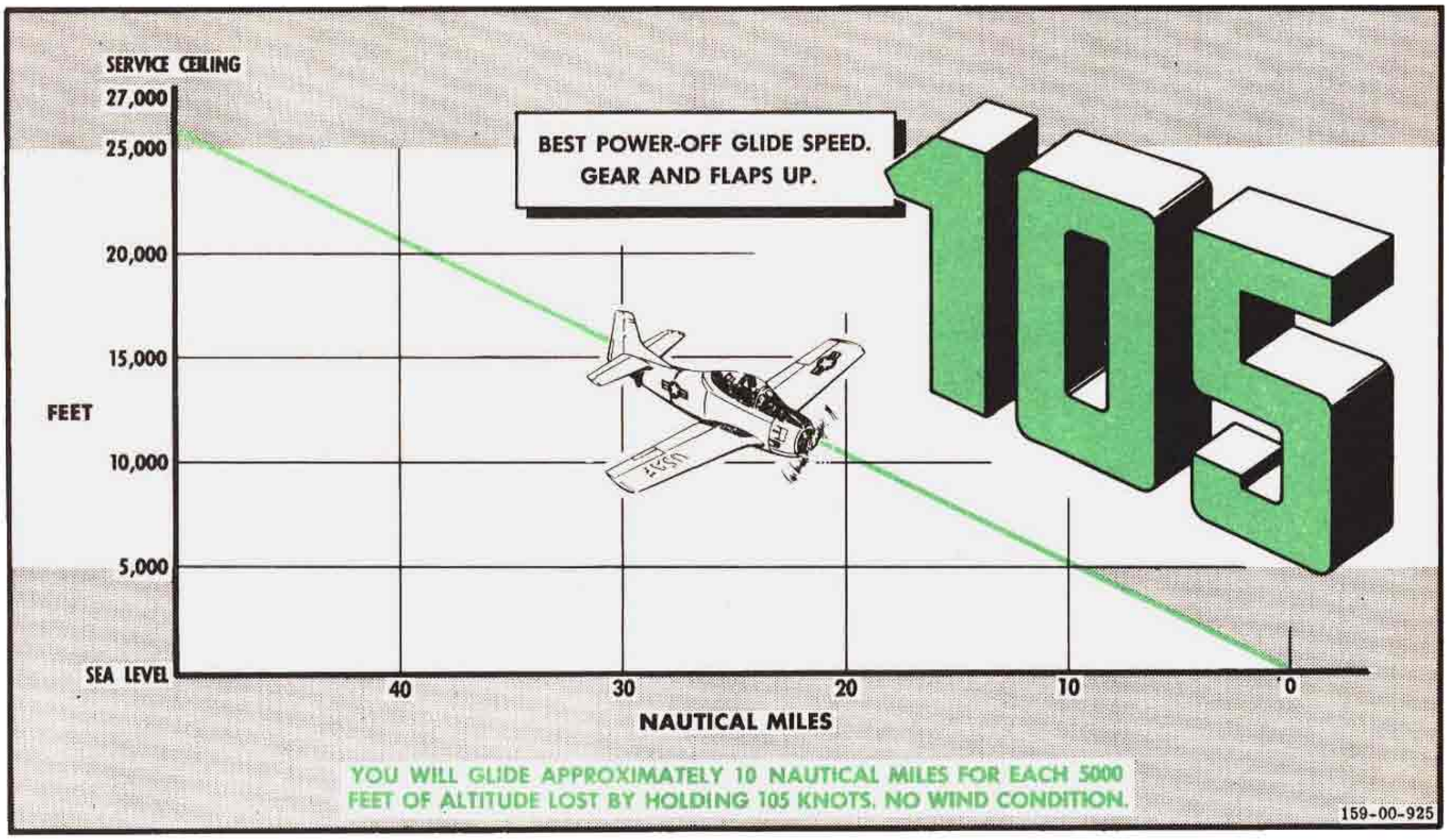
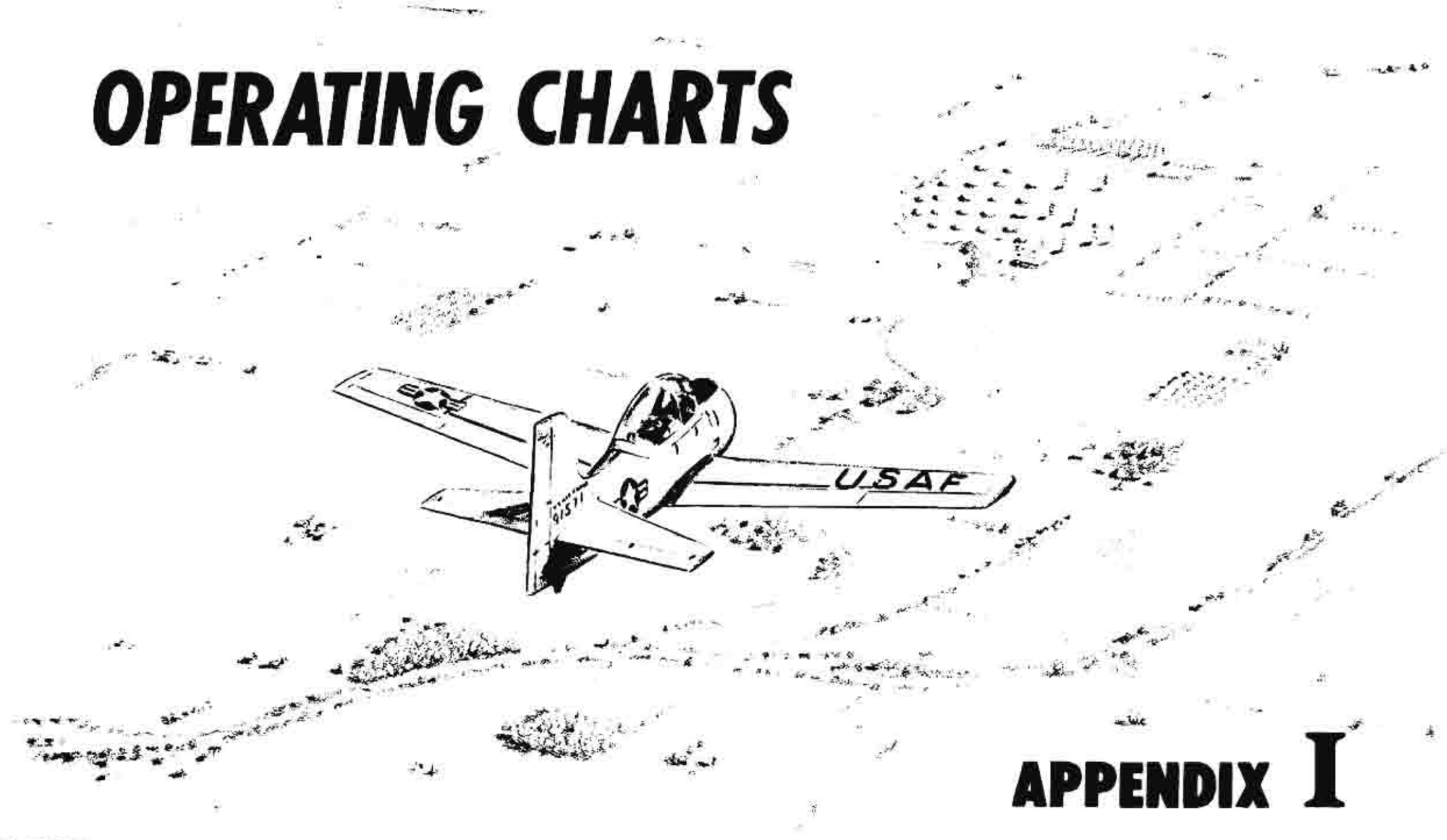


Figure 6-6. Optimum Glide Path

OPERATING CHARTS



159-00-941

APPENDIX I

A-1. AIRSPEED INSTALLATION CORRECTION TABLE.

A-2. An Airspeed Installation Correction Table (fig. A-2) is provided for computing calibrated airspeed (CAS) from indicated airspeed (IAS). Indicated airspeed is the airspeed indicator reading. Calibrated airspeed is indicated airspeed corrected for installation error. Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility error. (Within the airspeed range of the T-28A, the compressibility error is negligible, and CAS may be considered as EAS.) True airspeed is equivalent airspeed corrected for atmospheric density.

A-3. EXAMPLE—USE OF CORRECTION TABLE.

A-4. Airplane is flying at 15,000 feet pressure altitude, free air temperature is −15°C, and airspeed indicator reading is 170 knots. What is the true airspeed?

Airspeed indicator reading	170 knots
Correction for installation error	0
Calibrated airspeed	170 knots

Use this value of CAS with a Type D-4 or Type G-1 airspeed computer, or a Type AN5835-1 dead-reckoning computer to determine the true airspeed of 210 knots.

Note

When the dead-reckoning computer is used, CAS usually must be corrected for compressibility error; however, since this correction is not considered on the T-28A, CAS may be considered as EAS.

A-5. ALTIMETER INSTALLATION CORRECTION TABLE.

A-6. An Altimeter Installation Correction Table (fig. A-3) is provided for obtaining true pressure altitude from the altimeter reading.

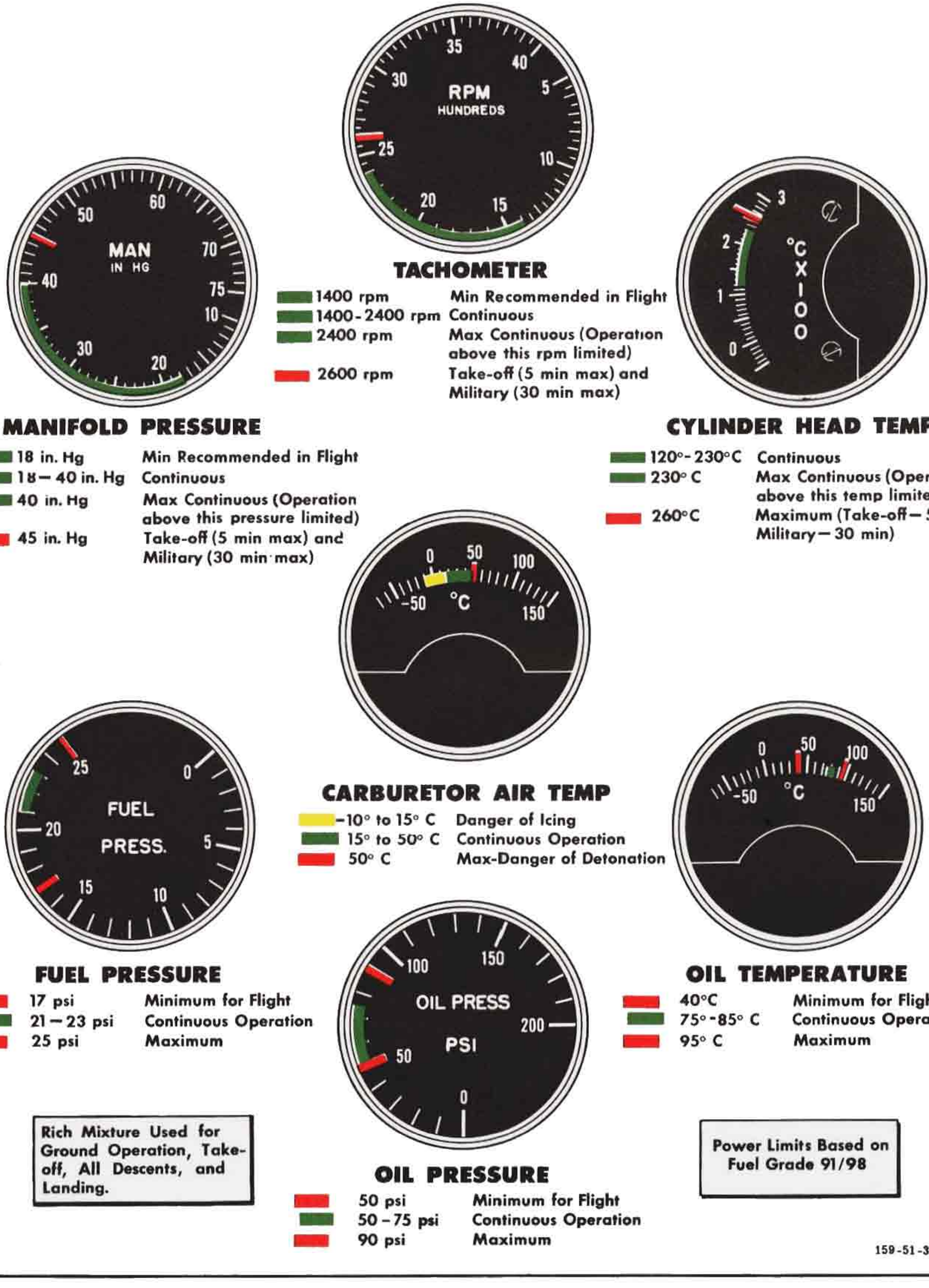
A-7. FLIGHT PLANNING.

A-8. GENERAL.

A-9. To promote efficient operation of the airplane and facilitate flight planning, a group of charts on the following pages presents estimated and flight tested performance data. All charts with estimated data will be replaced by charts calculated from flight test data when available. All charts are based on operation in NACA standard atmosphere.

A-10. MILITARY POWER CHART.

A-11. The Military Power Chart (fig. A-4) shows the variation with altitude in manifold pressure and fuel flow at military power. The fuel flows listed are 15 percent conservative to compensate for variation of individual airplanes from the estimates.



TACHOMETER

1400 rpm	Min Recommended in Flight
1400 - 2400 rpm	Continuous
2400 rpm	Max Continuous (Operation above this rpm limited)
2600 rpm	Take-off (5 min max) and Military (30 min max)

MANIFOLD PRESSURE

18 in. Hg	Min Recommended in Flight
18 – 40 in. Hg	Continuous
40 in. Hg	Max Continuous (Operation above this pressure limited)
45 in. Hg	Take-off (5 min max) and Military (30 min max)

CYLINDER HEAD TEMP

120° - 230° C	Continuous
230° C	Max Continuous (Operation above this temp limited)
260° C	Maximum (Take-off – 5 min; Military – 30 min)

CARBURETOR AIR TEMP

−10° to 15° C	Danger of Icing
15° to 50° C	Continuous Operation
50° C	Max-Danger of Detonation

FUEL PRESSURE

17 psi	Minimum for Flight
21 – 23 psi	Continuous Operation
25 psi	Maximum

OIL PRESSURE

50 psi	Minimum for Flight
50 – 75 psi	Continuous Operation
90 psi	Maximum

OIL TEMPERATURE

40°C	Minimum for Flight
75° - 85° C	Continuous Operation
95° C	Maximum

Rich Mixture Used for Ground Operation, Take-off, All Descents, and Landing.

Power Limits Based on Fuel Grade 91/98

159-51-372D

Figure A-1. Instrument Markings (Sheet 1 of 2)

ACCELEROMETER

(AIRPLANES AF51-3463 AND SUBSEQUENT)

- 6.4G Maximum at 7751 lb, or with any external load regardless of gross weight
- 6.7G Maximum at 7282 lb

ACCELEROMETER

(AIRPLANES AF48-1371, -1372, AF49-1492 THROUGH AF49-1756, and AF50-195 THROUGH AF50-319)

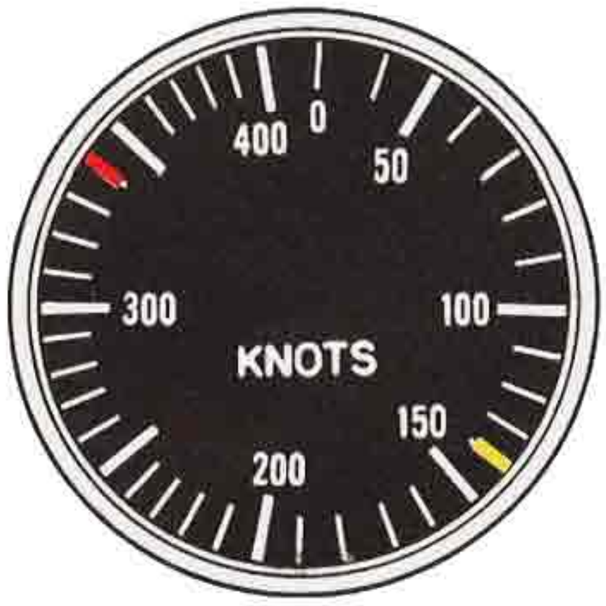
- 6.4G Maximum at 7378 lb, or with any external load regardless of gross weight
- 6.9G Maximum at 6909 lb

HYDRAULIC PRESSURE

- 0 – 100 psi — Normal (System Depressurized)
- 1250 – 1550 psi — Normal (System Pressurized)
- 1550 psi — Maximum

CANOPY EMERG AIR PRESSURE

- 1300 psi — Minimum Air Pressure (One Operation Only)
- 1600 – 1800 psi — Normal
- 1980 psi — Maximum



AIRSPEED

- 140 knots IAS — Full Flaps or Landing Gear
- 340 knots IAS — Maximum (Sea Level–No External Load)

Maximum permissible airspeed varies with altitude and external load as follows:

Pressure Altitude (Feet)	Indicated Airspeed–Knots IAS	
	No External Load (Gross weight not to exceed 7282 lb)	With External Load (Gross weight not to exceed 7751 lb)
0–2500	340	295
2500–5000	335	290
5000–7500	330	285
7500–10,000	310	270
10,000–15,000	280	240
15,000–20,000	250	220
20,000–25,000	220	190

159-51-373F

Figure A-1. Instrument Markings (Sheet 2 of 2)

AIRSPEED INSTALLATION CORRECTION TABLE

APPLY CORRECTION TO CORRECTED INSTRUMENT READING
TO OBTAIN CALIBRATED INDICATED AIRSPEED

GEAR AND FLAPS UP — CANOPY CLOSED		GEAR AND FLAPS DOWN — CANOPY OPEN	
IAS (KNOTS)	CORRECTION (KNOTS)	IAS (KNOTS)	CORRECTION (KNOTS)
80	+3	60	+1
100	0	70	−2
120	0	80	−3
140	0	90	−4
160	0	100	−5
180	0	110	−5
200	0	120	−4
220	+1		
240	+1		

159-93-794B

Figure A-2. Airspeed Installation Correction Table

A-12. TAKE-OFF, CLIMB, AND LANDING CHART.

A-13. Take-off and landing ground run distances and total distances to clear a 50-foot obstacle are tabulated for a dry hard-surface runway at several altitudes. (See fig. A-9.) The distances given are 25 percent greater than those obtainable in high-performance take-offs and landings. The landing chart also includes recommended final approach speeds.

A-14. Best climb speed, fuel consumption, time to climb, and rate of climb can be determined from the climb data. A fuel allowance for warm-up, taxi, and take-off is listed in the column labeled "AT SEA LEVEL." Fuel requirements listed at other altitudes include this allowance plus the fuel required to climb from sea level. Fuel required for an in-flight climb from one altitude to another is the difference between the tabulated fuel required to climb to each altitude from sea level. To compensate for variation of individual airplanes from the estimates, the fuel requirements are 15 percent conservative.

A-15. FLIGHT OPERATION INSTRUCTION CHARTS.

A-16. To assist in selecting the engine operating conditions required for obtaining various ranges, Flight Operation Instruction Charts (figs. A-10 and A-11) are provided for each airplane loading condition, one with external load and one without. Each chart is divided into five main columns. Data listed under Column I is for emergency high-speed cruising at maximum continuous power. Operating conditions in Columns II, III, IV, and V give progressively greater ranges at lower cruising speeds. Ranges shown in any column for a given fuel quantity can be obtained at various altitudes by using the power settings listed in the lower half of the chart in the same column. Some of the charts are based on estimated data, whereas others are based on flight tested data. For the charts based on estimated data, the ranges and fuel flows quoted are 15 percent conservative. In addition, the speeds quoted on any chart are those obtained with gross weight equal to the

ALTIMETER INSTALLATION CORRECTION TABLE

APPLY CORRECTION TO ALTIMETER READING
TO OBTAIN TRUE PRESSURE ALTITUDE

GEAR AND FLAPS UP — CANOPY CLOSED		GEAR AND FLAPS DOWN — CANOPY OPEN	
IAS (KNOTS)	CORRECTION (FT) (BELOW 5000 FT)	IAS (KNOTS)	CORRECTION (FT) (BELOW 5000 FT)
80	−10	60	−20
100	−10	70	−30
120	−10	80	−40
140	−10	90	−50
160	−10	100	−60
180	−10	110	−70
200	−10	120	−70
220	0		
240	+10		

159-93-917A

Figure A-3. Altimeter Installation Correction Table

MILITARY POWER CHART
(2600 RPM - NORMAL MIXTURE)

AIRCRAFT T-28A — **ENGINE** R-1300-1

PRESSURE ALTITUDE - FT	MANIFOLD PRESSURE-IN. Hg	FUEL FLOW PM
25,000	FT	4.0
20,000	FT	5.5
15,000	FT	7.5
10,000	FT	9.5
5,000	43	11.5
SEA LEVEL	45	11.5

Data as of 11-7-49.
Based on estimated data.

FT - Full throttle
PM - Pounds per minute

159-93-708

Figure A-4. Military Power Chart

high limit of the chart weight band. This policy, along with the 15 percent conservatism in the estimated data, allows for variation of individual airplanes. No allowances are made for wind, navigational error, simulated combat, formation flights, etc, and such allowances must be made as required.

A-17. USE OF CHARTS.

A-18. To use the charts, first select the Flight Operation Instruction Chart applicable to your flight plan, determined in this airplane by gross weight at take-off and external load (guns, bombs, or rockets). Then enter the chart at a fuel quantity equal to or less than the total amount in the airplane minus all allowances. (Ranges listed for each fuel quantity are based on using the entire quantity in level flight, cruising at the recommended operating conditions.) Fuel allowance for warm-up, taxi, take-off, and climb is obtained from the Take-Off, Climb and Landing Chart. Other allowances based on the type of mission, terrain over which the flight is to be made, and weather conditions are dictated by local policy. If your flight plan calls for a continuous flight at reasonably constant cruising power and no change in external load items, compute the fuel required and flight time as a single-section flight. Otherwise, the flight must be broken up into sections and each leg of the flight planned separately. The flight plan may be changed at any time en route, and the charts will show the balance of range available at various cruising powers and altitudes if the instructions printed at the top of each chart are followed.

A-19. SAMPLE PROBLEMS. The following sample problems employing actual chart values demonstrate how the charts should be used.

PROBLEM 1—It is required that two 100-pound bombs be dropped on a target 125 nautical miles from the airfield. To simulate antidetection tactics, flight will be made on the deck (sea level) going to the target, with a return on the deck to a point 20 nautical miles from the target. At this point, a climb will be made to 10,000 feet, and the flight completed at this altitude. Maximum continuous power will be used while within 20 nautical miles of the target, and military power will be used for 5 minutes while over the target.

Write down the conditions of the problem.

Required range	250 nautical miles
Weather	CAVU
Winds (outbound)	20-knot effective head wind at sea level
Winds (return)	20-knot effective tail wind at sea level 30-knot effective tail wind at 10,000 feet
Aircraft basic weight	5555 pounds (includes trapped fuel and oil, sight, bomb racks, miscellaneous equipment)
Crew weight (2)	400 pounds
Oil	66 pounds
Two 100-lb bombs	200 pounds
Maximum fuel	750 pounds
Total Gross Weight	6971 pounds

Now that the conditions of the flight are determined, it is necessary to establish a flight plan. Since the charts give only cruise ranges under no-wind conditions and do not include any reserves, it is necessary to first compute all allowances and reserves that will be required to cover warm-up, take-off, climb, maximum continuous power operation, any unexpected difficulties, etc. Determine the fuel available for flight planning by deducting the necessary fuel allowances and reserves from the actual fuel aboard as follows:

General Reserve for Unexpected Difficulties—165 pounds (fig. A-5).

Note in Column V of figure A-10 (Cruise Chart for airplane with no external load), that at 10,000 feet 165 pounds of fuel represent one hour's flying time. A one-hour fuel reserve is considered sufficient for this mission. This allowance is figured for the airplane with no

				90 40	100 50	120 60			100 50		TEO
(AUT.) MI./ LB.)				PRESS	MAXIMUM AIR RANGE						
	APPROX.			ALT.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX.			
	TOT. LB/HR	T.A.S. MPH	T.A.S. KTS.	FEET				TOT. LB/HR	T.A.S. MPH	T.A.S. KTS.	
				40000 35000 30000							
L L L	205 225 225	225 200 235	195 210 205	25000 20000 15000	2000 1950	FT FT	NORMAL NORMAL	170 175	200 205	175 180	
L L L	215 200 185	220 205 190	190 180 165	10000 5000 S. L.	1900 1800 1900	FT 27.5 25.5	NORMAL NORMAL NORMAL	165 155 190	190 180 165	165 155 145	

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE

159-93-999

APP

Figure A-5. Appendix Sample Problem—Step 1

external load because reserve fuel would not be used until after the bombs are dropped. Ten thousand feet is the altitude of the return trip.

Warm-up and Take-off—80 pounds (fig. A-6). The Climb Chart shows that 80 pounds is required for warm-up and take-off.

Maximum Continuous Power Allowance—108 pounds.

This figure is calculated by multiplying the fuel consumption (LB/HR) in Column I on the External Load Chart figure A-11 (weight bracket and external loading going into target) by the time during which maximum continuous power is used. (The time at maximum continuous power is determined by dividing the distance by the ground speed.) This same chart will be used to get the fuel allowance coming away from the target, for simplicity in spite of the conservatism. The fuel allowance for the maximum continuous portion of the outgoing trip is 565 pounds per hour $\times$ 20 nautical miles $\div$ 200 knots = 57 pounds. The 200 knots, which is the ground speed, is determined as follows: 220 (TAS) – 20

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F +
DATA AS OF 11/7/49 BASED ON: WIND TUNNE

TAKE-OFF, CLIMB & LANDING CHART

GROSS WEIGHT LB.	AT SEA LEVEL				AT 500		
	BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	POUNDS OF FUEL USED	BEST I.A.S. MPH	BEST I.A.S. KTS	RA O CLI F.P.
7000 6600 (NO EXTERNAL LOAD)	140 140	120 120	1650 1650	80 80	145 145	125 125	15 17

POWER PLANT SETTINGS: MAX CONTINUOUS POWER
DATA AS OF 11/7/49 BASED ON: WIND TUNN

159-93-1000

Figure A-6. Appendix Sample Problem—Step 2

(head wind) = 200 knots. For the return trip, the ground speed equals 220 knots, as the tail wind is neglected; therefore, the return trip fuel allowance is: 565 pounds per hour $\times$ 20 nautical miles $\div$ 220 knots = 51 pounds. The total maximum continuous power allowance is 57 + 51 = 108 pounds.

Military Power Allowance—58 pounds.

This figure is arrived at by multiplying the military power fuel consumption at sea level (given in the Military Power Chart) by the time spent at that power: 11.5 $\times$ 5 = 58 pounds.

Climb from SL to 10,000 feet—55 pounds.

After the airplane has flown 20 nautical miles from the target on the return trip, it is climbed to 10,000 feet, where the remainder of the flight is flown. Reference to the Climb Chart at 6600 pounds gross weight shows that 135 pounds is required to climb to 10,000 feet, including 80 pounds required to warm up and take off at sea level (fig. A-7). The difference between the two

20%; 125°F + 30%; 150°F+ 40%
L & ESTIMATED DATA

CLIMB DATA

0 FEET			AT 10,000 FEET					AT 15,000 FEET			
FE F MB P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED	BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED	BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA TIME MIN.
0 0	3 3	110 105	135 135	115 115	1200 1400	6.5 6	140 135	125 125	110 110	850 1000	11.5 10

EL & ESTIMATED DATA

LANDING DISTANCE FEET

159-93-1001

Figure A-7. Appendix Sample Problem—Step 3

quantities is 55 pounds, the amount of fuel necessary to climb to 10,000 feet from sea level. Since the weight of the airplane at this climb point on the return trip will probably be less than 6600 pounds, this allowance of 55 pounds is conservative.

Wind Reserve (Outgoing)—21 pounds.

This figure is arrived at as follows: The outgoing trip is a distance of 125 nautical miles, and assuming it will be flown according to instructions in Column IV of the External Load Chart, figure A-11, the true airspeed will be 160 knots (find airspeed opposite the SL entry in Column IV of the External Load Chart). Therefore, the no-wind time of the outgoing trip would be 125 $\div$ 160 = .78 hour. The actual time allowing for a 20-knot head wind is 125 $\div$ (160 – 20) = .89 hour. The fuel required for the head wind at 190 pounds per hour

(from Column IV of the External Load Chart) is (.89 − .78) × 190 = 21 pounds.

Wind Reserve (Return)—0 pounds.

Normally, tail winds are treated as a no-wind condition.

Collecting all the required fuel allowances.

General reserve for unexpected difficulties	165 lb
Warm-up and take-off	80 lb
Maximum continuous power allowance	108 lb
Military Power allowance	58 lb
Climb (SL to 10,000 ft)	55 lb
Wind reserve (outgoing)	21 lb
Wind reserve (return)	0 lb
Total fuel allowance	487 lb

Therefore, the actual fuel available for cruising is 750 − 487 = 263 pounds. In calculating the maximum continuous power allowance, 40 nautical miles of the range (20 nautical miles going to the target and 20 nautical miles coming from the target) was taken care of, so the total range for normal cruising is 250 − 40 = 210 nautical miles. Reference to the External Load Chart, figure A-11, shows that the required flight of 210 nautical miles with 263 pounds of fuel can be flown under Column IV (fig. A-8). This then is a quick solution to the problem.

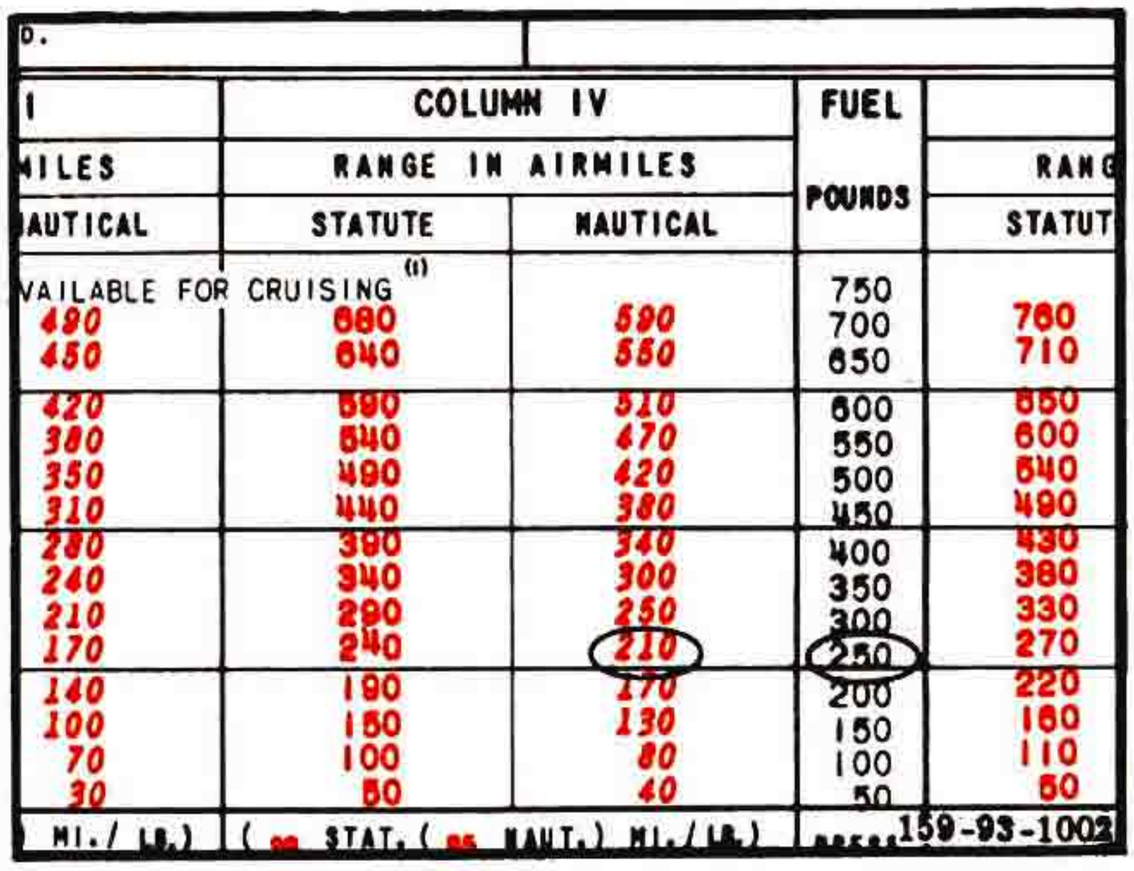


Figure A-8. Appendix Sample Problem—Step 4

A-20. Although Column IV of the External Load Chart, figure A-11, indicates that the mission can be accomplished, note that added conservatism is introduced, since ranges shown on the charts are computed on the basis of constant gross weight and no change in configuration. Changes of weight and configuration due to the disposal of bombs should give longer ranges than those shown. To make sure the mission is actually being flown in the most efficient manner, a more thorough analysis of the problem must be made.

Therefore, it will be necessary to divide the flight into several legs, each leg representing a change in power setting.

LEG	FIGURE	INITIAL GROSS WEIGHT	POUNDS FUEL ABOARD	CONDITION	DISTANCE NAUTICAL GROUND MILES	POUNDS FUEL USED
1	A-9	6971	750	Warm-up, Take-off	0	80

INITIAL WEIGHT:

This item was computed at the beginning of the problem.

FUEL USED:

This item is read directly from the sea level column of the Climb Chart.

The second leg of the flight will be accomplished at sea level in accordance with information contained in the External Load Chart, figure A-11, under Column IV conditions.

LEG	FIGURE AND COLUMN	GROSS WEIGHT	POUNDS FUEL REMAIN-ING	POWER SETTINGS	LB/HR	TAS	GROUND SPEED	HOURS	DISTANCE NAUTICAL GROUND MILES	POUNDS FUEL USED
2	A-11 IV	6891	670	1850 rpm 30" Hg Normal	190	160	140	.75	105	143

GROSS WEIGHT:

Because 80 pounds of fuel was used in warm-up and take-off, weight becomes 6971 − 80 = 6891.

FUEL REMAINING:

80 pounds of fuel was used in Leg 1. (750 – 80 = 670.)

RPM, MP, MIXT, LB/HR, AND TAS:

These items are read directly from the chart as entries opposite SL in Column IV.

GROUND SPEED:

Calculated by subtracting the head wind from TAS. (160 – 20 = 140 knots.)

HOURS:

The time was calculated by dividing the distance by ground speed. (105 ÷ 140 = .75 hours.)

DISTANCE:

The length of Leg 2 is determined by the distance to a point 20 nautical miles from the target.

FUEL USED:

Calculated by multiplying pounds per hour by hours. (190 × .75 = 143 pounds.)

LEG	FIGURE AND COLUMN	GROSS WEIGHT	POUNDS FUEL REMAIN-ING	POWER SETTINGS	LB/HR	TAS	GROUND SPEED	HOURS	DISTANCE NAUTICAL GROUND MILES	FUEL POUNDS USED
3	A-11 I	6748	527	2400 rpm 40" Hg Normal	565	220	200	.1	20	57

GROSS WEIGHT:

Since 143 pounds of fuel were used to fly Leg 2, the weight becomes 6748 pounds. (6891 – 143 = 6748 pounds.)

FUEL REMAINING:

143 pounds of fuel were used in Leg 2. (670 – 143 = 527 pounds.)

RPM, MP, MIXT, LB/HR, AND TAS:

These items are read directly from the chart as entries opposite SL in Column I.

GROUND SPEED:

Obtained by subtracting the head wind from TAS. (220 – 20 = 200 knots.)

HOURS:

Determined by dividing the distance by the ground speed. (20 ÷ 200 = .1 hour.)

DISTANCE:

The length of this leg is determined by the distance remaining to the target, or 20 nautical miles.

FUEL USED:

Determined by multiplying pounds per hour by hours. (565 × .1 = 57 pounds.)

LEG	FIGURE	GROSS WEIGHT	POUNDS FUEL REMAINING	POWER SETTINGS	LB/MIN	MINUTES	POUNDS FUEL USED
4	A-4	6691	470	2600 rpm 45" Hg Normal	11.5	5	58

Note

The conditions of this leg are determined by those stated for the problem—5 minutes over the target at Military Power.

GROSS WEIGHT:

Because 57 pounds of fuel was used to fly Leg 3, the weight becomes 6691 pounds. (6748 – 57 = 6691 pounds.)

FUEL REMAINING:

Fuel was reduced 57 pounds in Leg 3. (527 – 57 = 470 pounds.)

RPM, MP, MIXT, AND LB/MIN:

These items are read directly from the Military Power Chart at sea level.

MINUTES:

Conditions of the problem state that 5 minutes will be the time necessary over the target.

FUEL USED:

Obtained by multiplying pounds per minute by minutes. (11.5 × 5 = 58 pounds.)

By the end of Leg 4, the external load has been released and the gross weight reduced below 6600 pounds. Therefore, the remainder of the flight will be flown on the basis of the information listed on the No External Load Chart, figure A-10.

LEG	FIGURE AND COLUMN	GROSS WEIGHT	POUNDS FUEL REMAIN-ING	POWER SETTINGS	LB/HR	TAS	GROUND SPEED	HOURS	DISTANCE NAUTICAL GROUND MILES	POUNDS FUEL USED
5	A-10 I	6433	412	2400 rpm 40" Hg Normal	565	225	225	.09	20	51

GROSS WEIGHT:

Bombs were dropped during Leg 4, and 58 pounds of fuel was used to fly Leg 4, so the weight becomes 6433 pounds. (6691 – 200 – 58 = 6433 pounds.)

FUEL REMAINING:

Fuel was reduced 58 pounds in Leg 4. (470 – 58 = 412 pounds.)

RPM, MP, MIXT, LB/HR, AND TAS:

These items are read directly from the chart as entries opposite SL in Column I, since this leg is flown at maximum continuous power.

GROUND SPEED:

This figure is the same as TAS, because the tail wind is considered as no wind in this instance.

HOURS:

Determined by dividing distance by ground speed. (20 ÷ 225 = .09 hour.)

DISTANCE:

The length of this leg is the distance from the target to the point of climb, or 20 nautical miles.

FUEL USED:

Calculated by multiplying pounds per hour by hours. (565 × .09 = 51 pounds.)

LEG	FIGURE	GROSS WEIGHT	POUNDS FUEL REMAINING	POWER SETTINGS	CONDITION	POUNDS FUEL USED
6	A-9	6382	361	2400 rpm 40" Hg* Normal	Climb SL to 10,000 ft	55

*During climb, manifold pressure limits for maximum continuous power shown in figure 2-5 should not be exceeded.

GROSS WEIGHT:

In using 51 pounds to fly Leg 5, the weight becomes 6382 pounds. (6433 – 51 = 6382 pounds.)

FUEL REMAINING:

Fuel was reduced 51 pounds in Leg 5. (412 – 51 = 361 pounds.)

FUEL USED:

This is the figure shown on the chart for climb to 10,000 feet, minus the fuel shown on the chart for warm-up and take-off. (135 – 80 = 55 pounds.) The time and distance are neglected in this case.

LEG	FIGURE AND COLUMN	GROSS WEIGHT	POUNDS FUEL REMAIN-ING	POWER SETTINGS	LB/HR	TAS	GROUND SPEED	HOURS	DISTANCE NAUTICAL GROUND MILES	POUNDS FUEL USED
7	A-10 IV	6327	306	2000 rpm 26.5" Hg Normal	215	190	190	.55	105	119

Note

Although the last miles of this flight will be used for descent at lower power than cruising, the fuel used is calculated on the basis of cruising at altitude up to the home base. The extra fuel calculated by this method is considered to be used in the approach and landing pattern.

GROSS WEIGHT:

In using 55 pounds to fly Leg 6, the weight becomes 6327 pounds. (6382 – 55 = 6327 pounds.)

FUEL REMAINING:

Fuel was reduced 55 pounds in Leg 6. (361 – 55 = 306 pounds.)

RPM, MP. MIXT, LB/HR, AND TAS:

These items are read directly from the chart as entries opposite 10,000 feet in Column IV.

GROUND SPEED:

This item is the same as TAS, because the tail wind is considered as no wind.

HOURS:

Calculated by dividing distance by ground speed. (105 ÷ 190 = .55 hour.)

DISTANCE:

Determined by the conditions of the problem, or 125 miles for return from target minus 20 miles flown on the deck.

FUEL USED:

Computed by multiplying pounds per hour by hours. (215 × .55 = 119 pounds.)

Note that the flight will be completed with a 187-pound reserve (306 – 119 = 187). The original allowance for contingencies was 165 pounds, so that an additional excess of 22 pounds (187 – 165 = 22) above requirements is available because of accurate analysis of the flight plan. The additional 22 pounds permits the flight to be replanned around higher powers and speeds on certain legs, if desired. Otherwise, the mission may be flown as originally planned, with the excess fuel constituting an added safety margin.

Upon completion of the flight, a comparison may be made between the actual and computed data. This will give the pilot a better idea of the margin of safety afforded by the charts, and enable more accurate planning on future missions.

A-21. Should an emergency arise during flight, the remainder of the flight would have to be planned in the air. The following problem demonstrates a method for making a quick decision.

PROBLEM 2—Suppose that upon arrival over the home base at the completion of Problem 1, it is found that the field is closed because of bad weather, and an alternate field 130 nautical miles farther must be used. Reference to figure A-10 indicates that the required range may be made in Column III, IV, or V as desired. If Column V is used, the TAS at 10,000 feet will be 165 knots. Ground speed will be the same or dependent on the wind. Time for the flight will be 130 ÷ 165 or .79 hour. Fuel required will be 165 pounds per hour × .79 hour = 130 pounds. Fuel left in the tanks upon arrival at the alternate field will be 57 pounds (187 – 130 = 57).

AAFNC-527
4-1-44

AIRCRAFT MODEL
T-28A

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL
R-1300-1

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
7000		0	1500	2500	1800	2800	2200	3400													
		15	1100	1900	1300	2100	1600	2600													
		30	700	1300	900	1500	1100	1900													
6500		0	1300	2200	1500	2500	1800	2900													
		15	900	1600	1100	1800	1300	2200													
		30	600	1100	700	1300	900	1600													

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%
OPTIMUM TAKE-OFF WITH 2600 RPM. 45 IN.HG., Flaps Up IS 80% OF CHART VALUES
DATA AS OF 11/7/49 BASED ON: WIND TUNNEL & ESTIMATED DATA

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	AT SEA LEVEL BEST I.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL POUNDS OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	AT 5000 FEET BEST I.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED	AT 10,000 FEET BEST I.A.S. MPH	AT 10,000 FEET BEST I.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED	AT 15,000 FEET BEST I.A.S. MPH	AT 15,000 FEET BEST I.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED	AT 20,000 FEET BEST I.A.S. MPH	AT 20,000 FEET BEST I.A.S. KTS	AT 20,000 FEET RATE OF CLIMB F.P.M.	AT 20,000 FEET FROM SEA LEVEL TIME MIN.	AT 20,000 FEET FROM SEA LEVEL FUEL USED	AT 25,000 FEET BEST I.A.S. MPH	AT 25,000 FEET BEST I.A.S. KTS	AT 25,000 FEET RATE OF CLIMB F.P.M.	AT 25,000 FEET FROM SEA LEVEL TIME MIN.	AT 25,000 FEET FROM SEA LEVEL FUEL USED
7000	140	120	1650	80	145	125	1550	3	110	135	115	1200	6.5	140	125	110	850	11.5	175	120	105	450	19	210					
6600 (NO EXTERNAL LOAD)	140	120	1850	80	145	125	1750	3	105	135	115	1400	6	135	125	110	1000	10	160	120	105	600	16.5	195	115	100	200	29	235

POWER PLANT SETTINGS: MAX CONTINUOUS POWER
DATA AS OF 11/7/49 BASED ON: WIND TUNNEL & ESTIMATED DATA
FUEL USED (Pounds) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	POWER OFF KTS	POWER ON MPH	POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
6500	105	90	105	90	1200	1800	1300	2000	1400	2100												
6000	100	85	100	85	1100	1700	1200	1800	1300	2000												

DATA AS OF 9/26/49 BASED ON: WIND TUNNEL & ESTIMATED DATA
OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

159-93-715C

Figure A-9. Take-off, Climb, and Landing Chart – Airplanes AF48-1371, AF48-1372, AF49-1492 Through AF49-1756, and AF50-195 Through AF50-319

AAFWC-527
4-1-48

AIRCRAFT MODEL
T-28A

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL
R-1300-1

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
7000		0	1500	2500	1800	2800	2200	3400												
		15	1100	1900	1300	2100	1600	2600												
		30	700	1300	900	1500	1100	1900												
6500		0	1300	2200	1500	2500	1800	2900												
		15	900	1600	1100	1800	1300	2200												
		30	600	1100	700	1300	900	1600												

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%
OPTIMUM TAKE-OFF WITH 2600 RPM, 45 IN.HG., Flaps Up IS 80% OF CHART VALUES
DATA AS OF 11/7/49 BASED ON: WIND TUNNEL & ESTIMATED DATA

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET					AT 15,000 FEET					AT 20,000 FEET					AT 25,000 FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	POUNDS OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
7000	140	120	1650	80	145	125	1550	3	110	135	115	1200	6.5	140	125	110	850	11.5	175	120	105	450	19	210					
6600 (NO EXTERNAL LOAD)	140	120	1650	80	145	125	1750	3	105	135	115	1400	6	135	125	110	1000	10	160	120	105	600	16.5	195	115	100	200	29	235

POWER PLANT SETTINGS: MAX CONTINUOUS POWER
DATA AS OF 11/7/49 BASED ON: WIND TUNNEL & ESTIMATED DATA
FUEL USED (Pounds) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
6500	105	90	105	90	1200	1800	1300	2000	1400	2100												
6000	100	85	100	85	1100	1700	1200	1800	1300	2000												

DATA AS OF 9/26/49 BASED ON: WIND TUNNEL & ESTIMATED DATA
OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

159-93-715C

Figure A-9. Take-off, Climb, and Landing Chart — Airplanes AF48-1371, AF48-1372, AF49-1492 Through AF49-1756, and AF50-195 Through AF50-319

AAFMC-526-MAY 48-1-1M

AIRCRAFT MODEL T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 6600 POUNDS OR LESS

EXTERNAL LOAD ITEMS
NONE

LIMITS	R.P.M.	M.P. IN.HG.		MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN.	250°C	690 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI/LB) (NO WIND), POUNDS PER HR. (LB/HR) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		750		SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]					750		
320	280	700	480	420	600	520	730	630	700	820	720
300	260	650	450	390	560	490	670	580	650	770	670
270	240	600	410	360	510	450	620	540	600	710	610
250	220	550	380	330	470	410	570	490	550	650	560
230	200	500	340	300	430	370	520	450	500	590	510
210	180	450	310	270	390	340	470	400	450	530	460
180	160	400	280	240	340	300	410	360	400	470	410
160	140	350	240	210	300	260	360	310	350	410	360
140	120	300	210	180	260	220	310	270	300	350	310
110	100	250	170	150	210	190	260	220	250	290	250
90	80	200	140	120	170	150	210	180	200	230	200
70	60	150	100	90	130	110	150	130	150	180	150
50	40	100	70	60	80	70	100	90	100	120	100
20	20	50	30	30	40	40	50	40	50	60	50

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.69 STAT. (.6 NAUT.) MI./LB.)						(.86 STAT. (.75 NAUT.) MI./LB.)						(1.04 STAT. (.9 NAUT.) MI./LB.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2400	FT	NORMAL	205	225	195	25000													2400	FT	NORMAL	205	225	195	25000						
2400	FT	NORMAL	255	250	215	20000							2400	FT	NORMAL	255	250	215	2300	FT	NORMAL	235	240	210	20000	2000	FT	NORMAL	170	200	175
2400	FT	NORMAL	380	255	230	15000	2400	FT	NORMAL	380	285	230	2200	FT	NORMAL	290	250	215	2050	FT	NORMAL	225	235	205	15000	1850	FT	NORMAL	175	205	180
2400	FT	NORMAL	500	275	240	10000	2200	31	NORMAL	365	255	220	2100	28.5	NORMAL	275	235	205	2000	26.5	NORMAL	215	220	190	10000	1600	FT	NORMAL	165	190	165
2400	39	NORMAL	565	270	235	5000	2150	31.5	NORMAL	345	235	205	2100	30	NORMAL	260	225	195	1900	28	NORMAL	200	205	180	5000	1500	27.5	NORMAL	155	180	155
2400	40	NORMAL	565	260	225	S.L.	2150	33	NORMAL	325	225	195	2050	31.5	NORMAL	245	215	185	1800	30	NORMAL	185	190	165	S.L.	1400	29.5	NORMAL	140	165	145

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 6500 LB. GROSS WEIGHT WITH 550 LB. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 LB.) TO FLY 400 NAUT. AIRMILES AT 10,000 FT. ALTITUDE MAINTAIN 2100 RPM AND 28.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR: POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

159-93-717

DATA AS OF 11/7/49 WIND TUNNEL & ESTIMATED DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-10. Flight Operation Instruction Chart — No External Load — Airplanes AF48-1371, AF48-1372, AF49-1492 Through AF49-1756, and AF50-195 Through AF50-319

AAFMC-528 REV 1-48

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 6600 POUNDS OR LESS

EXTERNAL LOAD ITEMS
NONE

LIMITS	R.P.M.	M.P. IN.HG.		MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN.	260°C	690 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI/LB) (NO WIND), POUNDS PER HR. (LB/HR) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		750		SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]					750		
320	280	700	480	420	600	520	730	630	700	820	720
300	260	650	450	390	560	490	670	580	650	770	670
270	240	600	410	360	510	450	620	540	600	710	610
250	220	550	380	330	470	410	570	490	550	650	560
230	200	500	340	300	430	370	520	450	500	590	510
210	180	450	310	270	390	340	470	400	450	530	460
180	160	400	280	240	340	300	410	360	400	470	410
160	140	350	240	210	300	260	360	310	350	410	360
140	120	300	210	180	260	220	310	270	300	350	310
110	100	250	170	150	210	190	260	220	250	290	250
90	80	200	140	120	170	150	210	180	200	230	200
70	60	150	100	90	130	110	160	130	150	180	150
50	40	100	70	60	80	70	100	90	100	120	100
20	20	50	30	30	40	40	50	40	50	60	50

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.69 STAT. (.6 NAUT.) MI./LB.)						(.86 STAT. (.75 NAUT.) MI./LB.)						(1.04 STAT. (.9 NAUT.) MI./LB.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2400	FT	NORMAL	205	225	195	25000													2400	FT	NORMAL	205	225	195	25000						
2400	FT	NORMAL	255	250	215	20000							2400	FT	NORMAL	255	250	215	2300	FT	NORMAL	235	240	210	20000	2000	FT	NORMAL	170	200	175
2400	FT	NORMAL	380	255	230	15000	2400	FT	NORMAL	380	265	230	2200	FT	NORMAL	290	250	216	2050	FT	NORMAL	225	235	205	15000	1850	FT	NORMAL	175	205	180
2400	FT	NORMAL	500	275	240	10000	2200	31	NORMAL	365	255	220	2100	28.5	NORMAL	275	235	205	2000	26.5	NORMAL	215	220	190	10000	1600	FT	NORMAL	165	190	165
2400	39	NORMAL	565	270	235	5000	2150	31.5	NORMAL	345	235	205	2100	30	NORMAL	260	225	195	1900	28	NORMAL	200	205	180	5000	1500	27.5	NORMAL	155	180	155
2400	40	NORMAL	565	260	225	S.L.	2150	33	NORMAL	325	225	195	2050	31.5	NORMAL	245	215	185	1800	30	NORMAL	185	190	165	S.L.	1400	29.5	NORMAL	140	165	145

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 6300 LB. GROSS WEIGHT WITH 550 LB. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 100 LB.) TO FLY 400 NAUT. AIRMILES AT 10,000 FT. ALTITUDE MAINTAIN 2100 RPM AND 28.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR: POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

159-93-717

DATA AS OF 11/7/49 *WIND TUNNEL & ESTIMATED DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-10. Flight Operation Instruction Chart — No External Load — Airplanes AF48-1371, AF48-1372, AF49-1492 Through AF49-1756, and AF50-195 Through AF50-319

AAFMC-528 8-1-44

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 7000 POUNDS OR LESS

EXTERNAL LOAD ITEMS

TWO GUNS OR TWO 100-LB BOMBS
OR SIX 2.25-INCH ROCKETS

LIMITS	R.P.M.	M.P. IN.HG.		MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN	260° C	690 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV, AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB) (NO WIND), POUNDS PER HR. (LB/HR) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1]

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		750	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						750		
310	270	700	440	380	560	490	680	590	700	760	660
290	250	650	410	360	520	450	640	550	650	710	610
270	230	600	380	330	480	420	590	510	600	650	560
240	210	550	350	300	440	380	540	470	550	600	520
220	190	500	320	270	400	350	490	420	500	540	470
200	170	450	290	250	360	310	440	380	450	490	420
180	150	400	250	220	320	280	390	340	400	430	380
150	130	350	220	190	280	240	340	300	350	380	330
130	110	300	190	160	240	210	290	250	300	330	280
110	100	250	160	140	200	170	240	210	250	270	230
90	80	200	130	110	160	140	190	170	200	220	190
70	60	150	90	80	120	100	150	130	150	160	140
40	40	100	60	50	80	70	100	80	100	110	90
20	20	50	30	30	40	30	50	40	50	50	50

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.635 STAT. (.55 NAUT.) MI./LB.)						(.805 STAT. (.7 NAUT.) MI./LB.)						(.98 STAT. (.85 NAUT.) MI./LB.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2400	FT	NORMAL	255	240	210	20000							2400	FT	NORMAL	255	240	210	2350	FT	NORMAL	240	235	205	20000	2050	FT	NORMAL	180	195	170
2400	FT	NORMAL	380	260	225	15000	2400	FT	NORMAL	380	260	225	2250	FT	NORMAL	300	240	210	2100	FT	NORMAL	230	225	195	15000	1900	FT	NORMAL	185	200	175
2400	FT	NORMAL	500	265	230	10000	2200	31.5	NORMAL	390	250	215	2100	29	NORMAL	290	230	200	2000	26.5	NORMAL	215	215	185	10000	1750	26	NORMAL	175	190	165
2400	39	NORMAL	565	265	230	5000	2200	32.5	NORMAL	370	235	205	2100	30.5	NORMAL	275	220	190	1950	28	NORMAL	205	200	175	5000	1650	27.5	NORMAL	165	180	155
2400	38	NORMAL	585	255	220	S.L.	2150	33.5	NORMAL	350	220	190	2100	31.5	NORMAL	260	210	180	1850	30	NORMAL	190	185	160	S.L.	1550	29.5	NORMAL	155	165	145

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 6800 LB. GROSS WEIGHT WITH 400 LB. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 120 LB.) TO FLY 340 NAUT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 1950 RPM AND 28 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR: POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

159-93-718

DATA AS OF 11/7/49 BASED ON: WIND TUNNEL & ESTIMATED DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-11. Flight Operation Instruction Chart — With External Load — Airplanes AF48-1371, AF48-1372, AF49-1492 Through AF49-1756, and AF50-195 Through AF50-319

AAFMC-528 REV 1-48

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 7000 POUNDS OR LESS

EXTERNAL LOAD ITEMS

TWO GUNS OR TWO 100-LB BOMBS
OR SIX 2.25-INCH ROCKETS

LIMITS	R.P.M.	M.P. IN.HG.		MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN	250°C	690 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV, AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB) (NO WIND), POUNDS PER HR. (LB/HR) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1]

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL	POUNDS	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	POUNDS	STATUTE	NAUTICAL
		750	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						750		
310	270	700	440	380	560	490	680	590	700	760	660
290	250	650	410	360	520	450	640	550	650	710	610
270	230	600	380	330	480	420	590	510	600	650	560
240	210	550	350	300	440	380	540	470	550	600	520
220	190	500	320	270	400	350	490	420	500	540	470
200	170	450	290	250	360	310	440	380	450	490	420
180	150	400	250	220	320	280	390	340	400	430	380
150	130	350	220	190	280	240	340	300	350	380	330
130	110	300	190	160	240	210	290	250	300	330	280
110	100	250	160	140	200	170	240	210	250	270	230
90	80	200	130	110	160	140	190	170	200	220	190
70	60	150	90	80	120	100	150	130	150	160	140
40	40	100	60	50	80	70	100	80	100	110	90
20	20	50	30	30	40	30	50	40	50	50	50

MAXIMUM CONTINUOUS						PRESS	(.635 STAT. (.55 NAUT.) MI./LB.)						(.805 STAT. (.7 NAUT.) MI./LB.)						(.98 STAT. (.85 NAUT.) MI./LB.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2400	FT	NORMAL	255	240	210	20000							2400	FT	NORMAL	255	240	210	2350	FT	NORMAL	240	235	205	20000	2050	FT	NORMAL	180	195	170
2400	FT	NORMAL	380	260	225	15000	2400	FT	NORMAL	380	260	225	2250	FT	NORMAL	300	240	210	2100	FT	NORMAL	220	225	195	15000	1900	FT	NORMAL	185	200	175
2400	FT	NORMAL	500	255	230	10000	2200	31.5	NORMAL	390	250	215	2100	29	NORMAL	290	230	200	2000	26.5	NORMAL	215	215	185	10000	1750	26	NORMAL	175	190	165
2400	39	NORMAL	565	255	230	5000	2200	32.5	NORMAL	370	235	205	2100	30.5	NORMAL	275	220	190	1950	28	NORMAL	205	200	175	5000	1650	27.5	NORMAL	165	180	155
2400	98	NORMAL	565	255	220	S.L.	2150	33.5	NORMAL	350	220	190	2100	31.5	NORMAL	250	210	180	1850	30	NORMAL	190	185	160	S.L.	1550	29.5	NORMAL	155	165	145

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 6600 LB. GROSS WEIGHT WITH 400 LB. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 120 LB.) TO FLY 340 NAUT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 1950 RPM AND 28 IN. MANIFOLD PRESSURE WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR: POUNDS PER HOUR
TAS' : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

159-93-718

DATA AS OF 11/7/49 BASED ON: WIND TUNNEL & ESTIMATED DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-11. Flight Operation Instruction Chart — With External Load — Airplanes AF48-1371, AF48-1372, AF49-1492 Through AF49-1756, and AF50-195 Through AF50-319

AAFHC-528 R-1-44

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 7400 POUNDS OR LESS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN	260°C	600 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB) (NO WIND), POUNDS PER HR. LB/HR AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1]

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]							
		1050							1050		
460	*400*	1000	650	*570*	870	*760*	1090	*950*	1000	1200	*1040*
410	*360*	900	590	*510*	780	*680*	980	*850*	900	1080	*930*
360	*320*	800	520	*450*	700	*600*	870	*760*	800	960	*830*
320	*280*	700	460	*390*	610	*530*	760	*660*	700	840	*720*
270	*240*	600	390	*340*	520	*450*	650	*570*	600	720	*620*
230	*200*	500	320	*300*	430	*380*	540	*470*	500	600	*520*
180	*160*	400	260	*220*	350	*300*	430	*380*	400	480	*410*
130	*120*	300	190	*170*	260	*220*	320	*280*	300	360	*310*
90	*80*	200	130	*110*	170	*150*	220	*190*	200	240	*200*
40	*40*	100	60	*50*	80	*70*	110	*90*	100	120	*100*

MAXIMUM CONTINUOUS						PRESS	(.65 STAT. (.57 NAUT.) MI./LB)						(.85 STAT. (.75 NAUT.) MI./LB)						(1.10 STAT. (.95 NAUT.) MI./LB)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2400	FT	NORMAL	210	225	195	25000													2000	FT	NORMAL	190	210	180	25000						
2400	FT	NORMAL	270	245	215	20000													1800	23.0	NORMAL	185	200	175	20000						
2400	FT	NORMAL	410	255	225	15000	2350	FT	NORMAL	390	250	220	2050	FT	NORMAL	260	225	195							15000						
2400	FT	NORMAL	530	265	230	10000	2150	30.5	NORMAL	370	240	210	2050	27.0	NORMAL	250	220	190	1700	25.5	NORMAL	180	195	170	10000	1500	24.0	NORMAL	140	170	150
2400	39.5	NORMAL	560	260	225	5000	2150	32.0	NORMAL	350	230	200	2050	29.0	NORMAL	250	215	185	1750	27.5	NORMAL	170	190	165	5000	1500	27.5	NORMAL	130	155	135
2400	39.5	NORMAL	530	245	215	S.L.	2150	33.0	NORMAL	330	220	190	2000	30.0	NORMAL	240	200	175	1500	30.0	NORMAL	150	170	150	S.L.	1400	28.0	NORMAL	120	145	130

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 7000 LB. GROSS WEIGHT WITH 700 LB. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 350 LB.)
TO FLY 760 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 1800 RPM AND 23 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
FT : FULL THROTTLE

DATA AS OF 3/16/51 BASED ON: *PRELIMINARY FLIGHT TEST*

174-93-1097

Figure A-12. Flight Operation Instruction Chart — No External Load — Airplanes AF51-3463 and Subsequent

AAFHC-525 4-1-44

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 7400 POUNDS OR LESS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN	260°C	600 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB) (NO WIND), POUNDS PER HR. LB/HR AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1].

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		POUNDS	RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]							
		1050							1050		
480	*400*	1000	650	*570*	870	*760*	1090	*950*	1000	1200	*1040*
410	*360*	900	590	*510*	780	*680*	980	*850*	900	1080	*930*
360	*320*	800	520	*450*	700	*600*	870	*760*	800	960	*830*
320	*280*	700	460	*390*	610	*530*	760	*660*	700	840	*720*
270	*240*	600	390	*340*	520	*450*	650	*570*	600	720	*620*
230	*200*	500	320	*300*	430	*380*	540	*470*	500	600	*520*
180	*160*	400	260	*220*	350	*300*	430	*380*	400	480	*410*
130	*120*	300	190	*170*	260	*220*	320	*280*	300	360	*310*
90	*80*	200	130	*110*	170	*150*	220	*190*	200	240	*200*
40	*40*	100	60	*50*	80	*70*	110	*90*	100	120	*100*

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.65 STAT. (.57 NAUT.) MI./LB)						(.85 STAT. (.75 NAUT.) MI./LB)						(1.10 STAT. (.95 NAUT.) MI./LB)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2400	FT	NORMAL	210	225	195	25000													2000	FT	NORMAL	190	210	180	25000						
2400	FT	NORMAL	270	245	215	20000													1800	23.0	NORMAL	185	200	175	20000						
2400	FT	NORMAL	410	255	225	15000	2350	FT	NORMAL	390	250	220	2050	FT	NORMAL	260	225	195							15000						
2400	FT	NORMAL	530	265	230	10000	2150	30.5	NORMAL	370	240	210	2050	27.0	NORMAL	250	220	190	1700	25.5	NORMAL	180	195	170	10000	1500	24.0	NORMAL	140	170	150
2400	39.5	NORMAL	560	280	225	5000	2150	32.0	NORMAL	350	230	200	2050	29.0	NORMAL	250	215	185	1750	27.5	NORMAL	170	190	165	5000	1500	27.5	NORMAL	130	155	135
2400	39.5	NORMAL	530	245	215	S.L.	2150	33.0	NORMAL	330	220	190	2000	30.0	NORMAL	240	200	175	1500	30.0	NORMAL	150	170	150	S.L.	1400	29.0	NORMAL	120	145	130

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 7000 LB. GROSS WEIGHT WITH 700 LB. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 350 LB.)
TO FLY 760 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 1800 RPM AND 23 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
FT : FULL THROTTLE

DATA AS OF 3/16/51 BASED ON: *PRELIMINARY FLIGHT TEST*

174-93-1097

Figure A-12. Flight Operation Instruction Chart — No External Load — Airplanes AF51-3463 and Subsequent

AAFMC-528
4-1-48

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 7900 POUNDS OR LESS

EXTERNAL LOAD ITEMS
TWO GUNS OR TWO 100-LB BOMBS
OR SIX 2.25-INCH ROCKETS
NUMBER OF ENGINES OPERATING: ONE

LIMITS	RPM.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN	260°C	600 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM. MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB) (NO WIND), POUNDS PER HR. (LB/HR) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1].

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL	POUNDS	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	POUNDS	STATUTE	NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]							
430	*380*	1050 1000	600	*520*	740	*660*	930	*800*	1050 1000	1010	*880*
390 350 300	*340* *300* *260*	900 800 700	540 480 420	*470* *410* *360*	670 590 520	*590* *530* *490*	830 740 650	*720* *640* *560*	900 800 700	910 810 710	*790* *700* *610*
260 220 170	*220* *190* *150*	600 500 400	360 300 240	*310* *260* *210*	440 370 290	*400* *330* *260*	550 460 370	*480* *400* *320*	600 500 400	610 500 400	*530* *440* *350*
130 80 40	*110* *70* *30*	300 200 100	180 120 60	*150* *100* *50*	220 140 70	*200* *130* *60*	280 180 90	*240* *160* *80*	300 200 100	300 200 100	*260* *170* *80*

MAXIMUM CONTINUOUS						PRESS	(.60 STAT. (.50 NAUT.) MI./LB)						(.75 STAT. (.65 NAUT.) MI./LB)						(.95 STAT. (.80 NAUT.) MI./LB)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2400 2400 2400	FT FT FT	NORMAL NORMAL NORMAL	210 270 410	195 225 230	170 195 200	25000 20000 15000	2350	FT	NORMAL	390	225	195	2100	FT	NORMAL	270	215	185	2150 1900	FT FT	NORMAL NORMAL	210 210	200 195	175 170	25000 20000 15000						
2400 2400 2400	FT 39.5 39.5	NORMAL NORMAL NORMAL	530 560 530	245 245 230	210 210 200	10000 5000 S.L.	2150 2150 2150	30.5 32.0 33.0	NORMAL NORMAL NORMAL	370 350 330	220 215 200	190 185 175	2050 2050 2050	27.5 29.5 31.0	NORMAL NORMAL NORMAL	270 260 250	205 200 190	180 170 165	1950 1950 1850	25.0 28.0 29.0	NORMAL NORMAL NORMAL	205 200 190	190 185 175	165 160 150	10000 5000 S.L.	1600 1500 1400	25.0 28.0 31.0	NORMAL NORMAL NORMAL	180 165 135	185 150 140	140 130 120

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 7500 LB. GROSS WEIGHT WITH 700 LB. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 350 LB.)
TO FLY 650 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 1900 RPM AND FT IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
FT : FULL THROTTLE

DATA AS OF 3/10/51 BASED ON: PRELIMINARY FLIGHT TEST

174-93-1099

Figure A-13. Flight Operation Instruction Chart — With External Load — Airplanes AF51-3463 and Subsequent

AAFMC-528 (8-1-42)

AIRCRAFT MODEL
T-28A

ENGINE: R-1300-1

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 7900 POUNDS OR LESS

EXTERNAL LOAD ITEMS
TWO GUNS OR TWO 100-LB BOMBS
OR SIX 2.25-INCH ROCKETS
NUMBER OF ENGINES OPERATING: ONE

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB/HR
MILITARY POWER	2600	45 (SL)		NORMAL	30 MIN	260°C	600 (SL)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB) (NO WIND), POUNDS PER HR. (LB/HR) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1]

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL	POUNDS	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	POUNDS	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
430	*380*	1050 1000	600	*520*	740	*660*	930	*800*	1050 1000	1010	*880*
390 350 300	*340* *300* *260*	900 800 700	540 480 420	*470* *410* *360*	670 590 520	*590* *530* *490*	830 740 650	*720* *640* *560*	900 800 700	910 810 710	*790* *700* *610*
260 220 170	*220* *190* *150*	600 500 400	360 300 240	*310* *260* *210*	440 370 290	*400* *330* *260*	550 480 370	*480* *400* *320*	600 500 400	610 500 400	*530* *440* *350*
130 80 40	*110* *70* *30*	300 200 100	180 120 60	*150* *100* *50*	220 140 70	*200* *130* *60*	280 180 90	*240* *160* *80*	300 200 100	300 200 100	*260* *170* *80*

MAXIMUM CONTINUOUS						PRESS	(.60 STAT. (.50 NAUT.) MI./LB)						(.75 STAT. (.55 NAUT.) MI./LB)						(.95 STAT. (.80 NAUT.) MI./LB)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB/HR	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2400 2400 2400	FT FT FT	NORMAL NORMAL NORMAL	210 270 410	185 225 230	170 195 200	25000 20000 15000	2350	FT	NORMAL	390	225	195	2100	FT	NORMAL	270	215	185	2150 1900	FT FT	NORMAL NORMAL	210 210	200 195	175 170	25000 20000 15000						
2400 2400 2400	FT 39.5 39.5	NORMAL NORMAL NORMAL	530 560 530	245 245 230	210 210 200	10000 5000 S.L.	2150 2150 2150	30.5 32.0 33.0	NORMAL NORMAL NORMAL	370 350 330	220 215 200	190 185 175	2050 2050 2050	27.5 29.5 31.0	NORMAL NORMAL NORMAL	270 260 250	205 200 190	180 170 165	1950 1950 1850	25.0 28.0 29.0	NORMAL NORMAL NORMAL	205 200 190	190 185 175	165 160 150	10000 5000 S.L.	1500 1500 1400	25.0 28.0 31.0	NORMAL NORMAL NORMAL	160 145 135	165 150 140	140 130 120

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 7500 LB. GROSS WEIGHT WITH 700 LB. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 350 LB.)
TO FLY 650 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 1900 RPM AND FT IN. MANIFOLD PRESSURE
WITH MIXTURE SET: NORMAL

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB/HR : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
FT : FULL THROTTLE

DATA AS OF 3/10/51 BASED ON: PRELIMINARY FLIGHT TEST

174-93-1099

Figure A-13. Flight Operation Instruction Chart — With External Load — Airplanes AF51-3463 and Subsequent

AAFMC-527 11-1-48

AIRCRAFT MODEL
T-28A

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL
R-1300-1

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
7800		0	1700	2800	2000	3100	2450	3800												
		15	1200	2100	1450	2300	1800	2900												
		30	800	1450	1000	1700	1200	2100												
7500		0	1600	2700	1900	3000	2400	3650												
		15	1200	2000	1400	2250	1700	2800												
		30	750	1400	1000	1600	1200	2000												
7000		0	1500	2500	1800	2800	2200	3400												
		15	1100	1900	1300	2100	1600	2600												
		30	700	1300	900	1500	1100	1900												

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

OPTIMUM TAKE-OFF WITH 2600 RPM, 45 IN. HG. FLAPS UP IS 80% OF CHART VALUES

DATA AS OF 3/16/51 BASED ON: ESTIMATED

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET					AT 15,000 FEET					AT 20,000 FEET					AT 25,000 FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
7800	140	120	1500	90	145	125	1400	4	130	135	115	1050	9	180	125	110	750	15	230	120	105	350	27	290	115	100	---	---	---	---
7500	140	120	1550	90	145	125	1450	4	130	135	115	1100	8	170	125	110	800	14	220	120	105	400	25	280	115	100	130	52	390
7000	140	120	1650	90	145	125	1550	4	130	135	115	1200	8	170	125	110	850	13	210	120	105	450	23	270	115	100	190	43	350

POWER PLANT SETTINGS: MAX CONTINUOUS POWER

DATA AS OF 3/16/51 BASED ON: ESTIMATED

FUEL USED (POUNDS) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
7000	110	95	110	95	1300	1950	1400	2150	1500	2300												
6500	105	90	105	90	1200	1800	1300	2000	1400	2100												

DATA AS OF 3/16/51 BASED ON: ESTIMATED

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

174-93-1098

Figure A-14. Take-off, Climb, and Landing Chart — Airplanes AF51-3463 and Subsequent

AAFMC-527
4-1-50

AIRCRAFT MODEL
T-28A

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL
R-1300-1

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3000 FEET GROUND RUN	AT 3000 FEET TO CLEAR 50' OBJ.	AT 6000 FEET GROUND RUN	AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3000 FEET GROUND RUN	AT 3000 FEET TO CLEAR 50' OBJ.	AT 6000 FEET GROUND RUN	AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3000 FEET GROUND RUN	AT 3000 FEET TO CLEAR 50' OBJ.	AT 6000 FEET GROUND RUN	AT 6000 FEET TO CLEAR 50' OBJ.
7800		0	1700	2800	2000	3100	2450	3800												
		15	1200	2100	1450	2300	1800	2900												
		30	800	1450	1000	1700	1200	2100												
7500		0	1600	2700	1900	3000	2400	3650												
		15	1200	2000	1400	2250	1700	2800												
		30	750	1400	1000	1600	1200	2000												
7000		0	1500	2500	1800	2800	2200	3400												
		15	1100	1900	1300	2100	1600	2600												
		30	700	1300	900	1500	1100	1900												

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

OPTIMUM TAKE-OFF WITH 2600 RPM, 45 IN. HG. FLAPS UP IS 80% OF CHART VALUES

DATA AS OF 3/16/51 BASED ON: ESTIMATED

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL: BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	AT 5000 FEET: BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED	AT 10,000 FEET: BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED	AT 15,000 FEET: BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED	AT 20,000 FEET: BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED	AT 25,000 FEET: BEST I.A.S. MPH	BEST I.A.S. KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FROM SEA LEVEL FUEL USED
7800	140	120	1500	90	145	125	1400	4	130	135	115	1050	9	180	125	110	750	15	230	120	105	350	27	290	115	100	---	---	---
7500	140	120	1550	90	145	125	1450	4	130	135	115	1100	8	170	125	110	800	14	220	120	105	400	25	280	115	100	130	52	390
7000	140	120	1650	90	145	125	1550	4	130	135	115	1200	8	170	125	110	850	13	210	120	105	450	23	270	115	100	190	43	350

POWER PLANT SETTINGS: MAX CONTINUOUS POWER

DATA AS OF 3/16/51 BASED ON: ESTIMATED

FUEL USED (POUNDS) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH: POWER OFF MPH	POWER OFF KTS	POWER ON MPH	POWER ON KTS	HARD DRY SURFACE: AT SEA LEVEL GROUND ROLL	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3000 FEET GROUND ROLL	AT 3000 FEET TO CLEAR 50' OBJ.	AT 6000 FEET GROUND ROLL	AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD: AT SEA LEVEL GROUND ROLL	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3000 FEET GROUND ROLL	AT 3000 FEET TO CLEAR 50' OBJ.	AT 6000 FEET GROUND ROLL	AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY: AT SEA LEVEL GROUND ROLL	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3000 FEET GROUND ROLL	AT 3000 FEET 10 CLEAR 50' OBJ.	AT 6000 FEET GROUND ROLL	AT 6000 FEET TO CLEAR 50' OBJ.
7000	110	95	110	95	1300	1950	1400	2150	1500	2300												
6500	105	90	105	90	1200	1800	1300	2000	1400	2100												

DATA AS OF 3/16/51 BASED ON: ESTIMATED

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.H. : FEET PER MINUTE

174-93-1098

Figure A-14. Take-off, Climb, and Landing Chart — Airplanes AF51-3463 and Subsequent