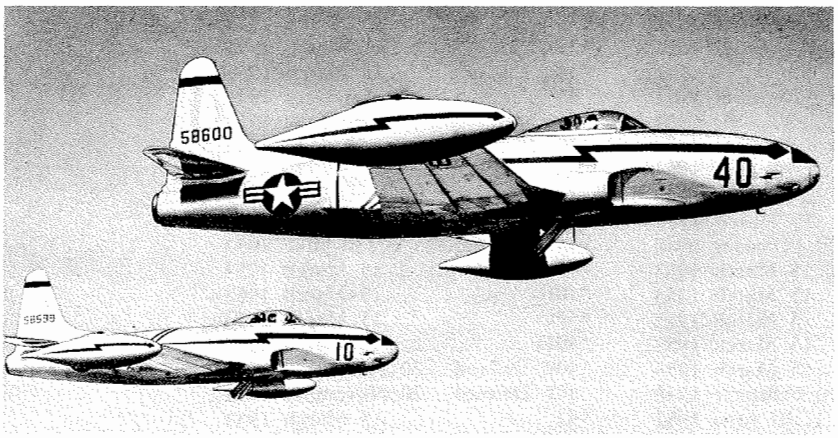
AN 01-75FJA-1

HANDBOOK
FLIGHT OPERATING INSTRUCTIONS

USAF SERIES

F-80A-1, -5, -10
RF-80A-5, -10, -15, -20, -25
AIRCRAFT



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AN 01-75FJA-1G

SAFETY OF FLIGHT SUPPLEMENT

FLIGHT HANDBOOK
USAF SERIES
F-80A-1, -5, -10
RF-80A-5, -10, -15, -20, -25
AIRCRAFT

This publication supplements AN 01-75FJA-1. Reference to this supplement will be made on the title page of the basic handbook by personnel responsible for maintaining the publication in current status.

NOTE COMMANDING OFFICERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AF PERSONNEL CLEARED FOR OPERATION OF SUBJECT AIRCRAFT.

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30 SEPTEMBER 1953

1. PURPOSE.

This supplement contains information on the effect of 230-gallon tip tanks on the take-off distances and flying characteristics of the subject aircraft.

2. INSTRUCTIONS.

a. For subject aircraft using 230-gallon tip tanks, the take-off distances may be determined by multiplying the values contained in the TAKE-OFF DISTANCES chart of the Flight Handbook by a factor of 1.15.

b. The 230-gallon tip tanks have very little effect on the aircraft's flying characteristics. Uneven transfer of fuel from the tip tanks causes wing heaviness, but this can usually be trimmed out with the aileron tab. However, if the fuel differential is more than 150 gallons, the wings can not be kept level for landings and the tip tanks should be dropped. If uneven feeding of the tanks is suspected, the aircraft should be stalled (at about 15,000 feet) to determine whether or not it is safe to land. If in doubt, jettison the tip tanks.

END

SAFETY OF FLIGHT

AN 01-75FJA-1F

SAFETY OF FLIGHT SUPPLEMENT

FLIGHT HANDBOOK
USAF SERIES
F-80A-1, -5, -10
RF-80A-5, -10, -15, -20, -25
AIRCRAFT

This publication supplements AN 01-75FJA-1 and supersedes the information contained in T. O. No. 01-75F-54, dated 4 February 1952. Reference to this supplement will be made on the title page of the basic handbook by personnel responsible for maintaining the publication in current status.

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10 SEPTEMBER 1953

1. PURPOSE.

This supplement outlines the procedure to be followed if a split flap is experienced i.e., one flap extended and the other in the up position.

2. INSTRUCTIONS.

In the event of split flap operation, the aircraft cannot be controlled with aileron boost off. If difficulty is experienced after actuating the flap switch to the "extend" position, insure that aileron boost is on and immediately place the flap switch in the up position.

SAFETY OF FLIGHT

AN 01-75FJA-1D

SAFETY OF FLIGHT SUPPLEMENT

FLIGHT HANDBOOK

USAF SERIES

F-80A-1, -5, -10
RF-80A-5 -10, -15, -20, -25

AIRCRAFT

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10 JULY 1953

1. PURPOSE.

This supplement restricts use of the ejection seat unless the canopy is separated from the aircraft.

2. GENERAL.

On aircraft with interrelated seat ejection and canopy jettison controls, no attempt should be made to eject through the canopy. Because of this interrelation of the controls, there is too great a danger that the seat will not go through the canopy or that it will go through in such a way as to injure the pilot.

3. INSTRUCTIONS.

The seat ejection control will not be operated unless the canopy has been jettisoned. If the canopy fails to separate from the aircraft, effect a bail out procedure without the actuation of the ejection seat.

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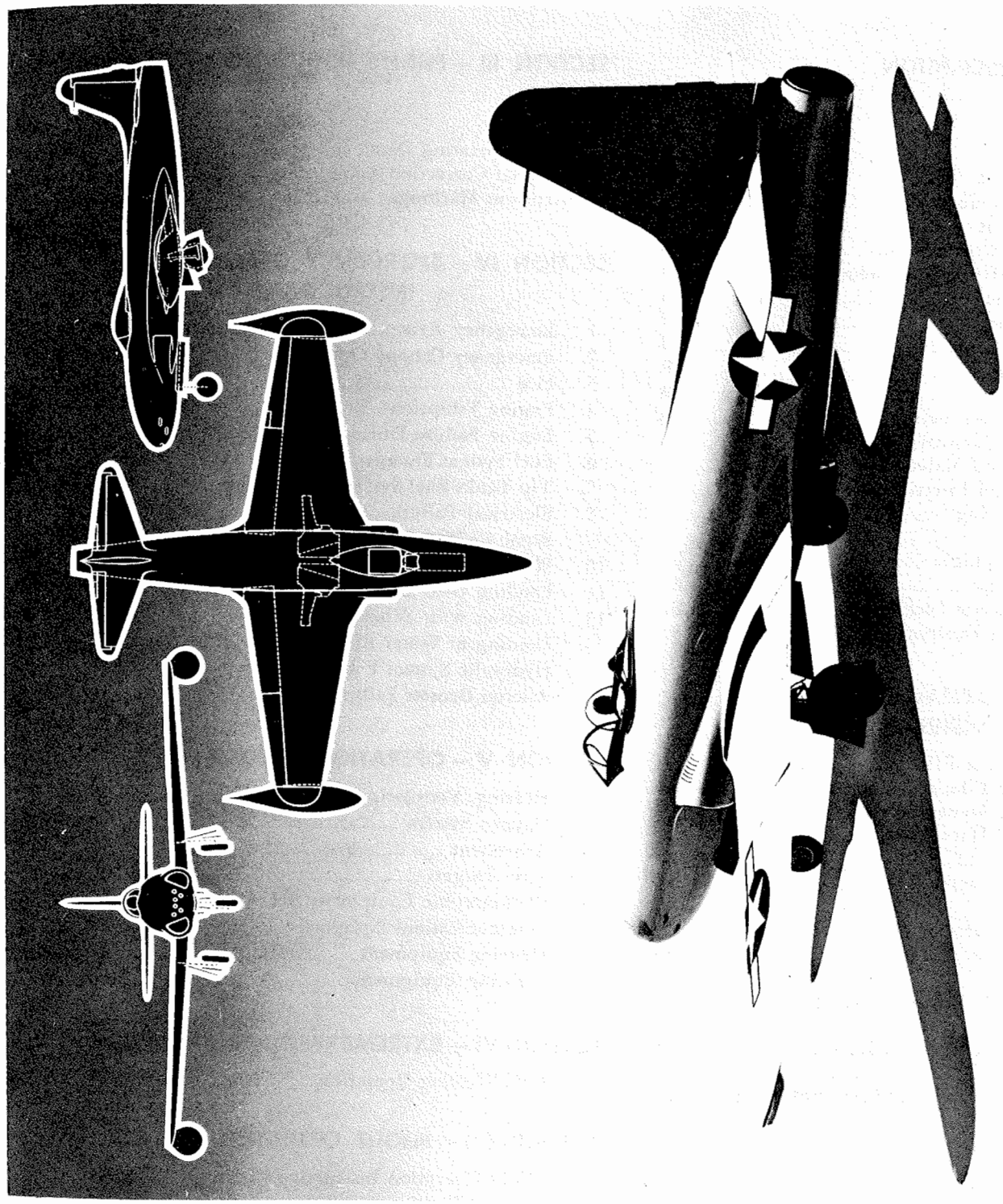


Figure 1 — The Airplane

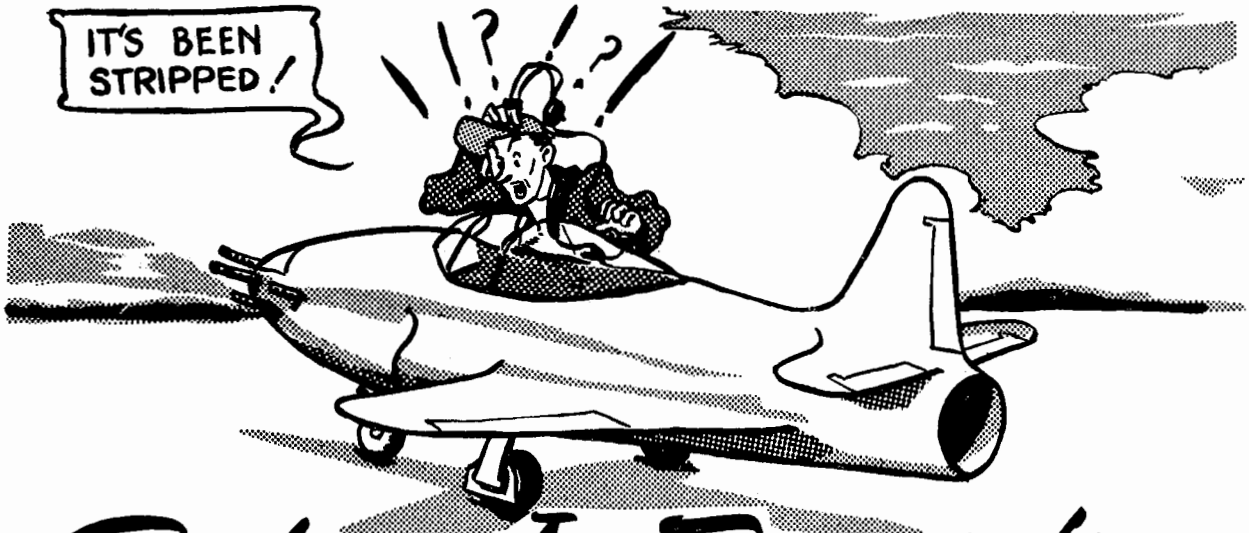
IMPORTANT

In order that you will gain maximum benefits from this handbook it is important that you read this page carefully.

This handbook contains all the information necessary for safe and efficient operation of F-80A and RF-80A series airplanes. These instructions do not teach basic flight principles, 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. Your flying experience is recognized, and elementary instructions have been avoided.

Each pilot is provided with his own personal copy of the handbook, which will be his source of technically accurate and currently revised information. However, it takes a certain amount of time to get new data into the handbook. When flight or personal safety is involved, the "Immediate Attention" technical order system is employed. It is therefore essential that you arrange to be on automatic distribution for the following series of technical orders:

01-75FJ covers all F-80 models
01-75FJA covers F-80A and RF-80A aircraft only



Section I - Description

1. GENERAL.

a. TYPE.—The F-80A airplane is a single place jet propelled fighter airplane provided with six .50 calibre machine guns mounted in the nose. The RF-80A is the photographic version of the F-80A on which the entire armament nose section is replaced by a camera nose section. Airplanes referred to as "modernized" airplanes are F-80-A-1, F-80A-5, F-80A-10, RF-80A-5 or RF-08A-10 airplanes which have been modernized in accordance with applicable technical orders and directives. In addition, some F-80A airplanes have been converted for photographic use and designated RF-80A-15 and some RF-80A airplanes have been equipped with later series engines and designated RF-80A-20 and RF-80A-25.

b. MAIN DIFFERENCE TABLE

Item	*F-80A-1*	*F-80A-5* *RF-80A-5*	*F-80A-10* *RF-80A-10, -15*	*RF-80A-20* *RF-80A-25*
Engine	*J-33-A-9A *J-33-GE-11A *J-33-A-17	*J-33-A-9A *J-33-GE-11A *J-33-A-17	*J-33-A-9B *J-33-GE-11B *J-33-A-17A *J-33-A-21	J-33-A-35
Automatic Starting Sequence	No	No	No	Yes
Water Injection	No	No	Yes	Yes
Provision for Jato	No	No	Yes	Yes
Eng. Shut-off Valve Control	Yes	No	No	No
Hydraulic Fuse	No	Yes	Yes	Yes
Cabin Cooler	No	No	Yes	Yes
Aux. Windshield Defrost. Provisions	No	No	Yes	Yes
Emer. Fuel Pump Sw. Overrides Battery and Generator Switch	Yes	Yes	No	No
Radio Equipment**	Beacon Receiver BC-1206	BC-1206 or Radio Compass AN/ARN-6or-7	Radio Compass AN/ARN-6or-7	Radio Compass AN/ARN-6or-7
Radar Equipment	No	No	No	AN/APW-11 with AN/APA-90
Max. Gross Weight (Approx.)	14,500 lb.	14,500 lb.	15,300 lb.	15,300 lb.

* All these engines are interchangeable with each other. However if a water injection engine (J-33-A-9B, J-33-GE-11B, J-33-A-17A, or J-33-A-21) is installed in an F-80A-1, F-80A-5, or RF-80A-5, the water injection system is made inoperative.

**This equipment in addition to basic AN/ARC-3 (or AN/ARC-27) and SCR-695 (or AN/APX-6).

2. FLIGHT CONTROLS.

a. CONTROL SURFACES.

(1) Operation of ailerons, elevator, and rudder controls is conventional. The aileron forces are reduced by a hydraulic aileron booster unit. This control force reduction is effective about two degrees on either side of the neutral stick position. This system does not destroy the "feel" of the aileron control as it supplies only a fixed portion of the total force required. The remaining force applied by the pilot changes normally with changes in speed and rate of roll.

(*a*) A manually operated shut-off valve is provided for shutting off hydraulic pressure to the aileron booster in an emergency. The valve is controlled by a lever on the left hand shelf (24A, figure 6A). The forward position shuts off hydraulic pressure to the aileron booster system, whereas the aft position allows the aileron boost system to be operative.

(2) The elevator forces are reduced by the elevator spring tab and the elevator servo tab.

(*a*) A spring in the elevator control system acts to assist holding the elevator in either the "UP" or the "DOWN" position. This arrangement gives a peculiar feel to the control on the ground only. That is, considerable force will be required to move the elevator. After it has passed approximately the 35 degrees "UP" position, the elevator will stay "UP" of its own accord. The presence of the spring is not noticeable in flight.

(*b*) The spring-loaded elevator tab acts to assist the pilot whenever the force on the control stick exceeds approximately five pounds.

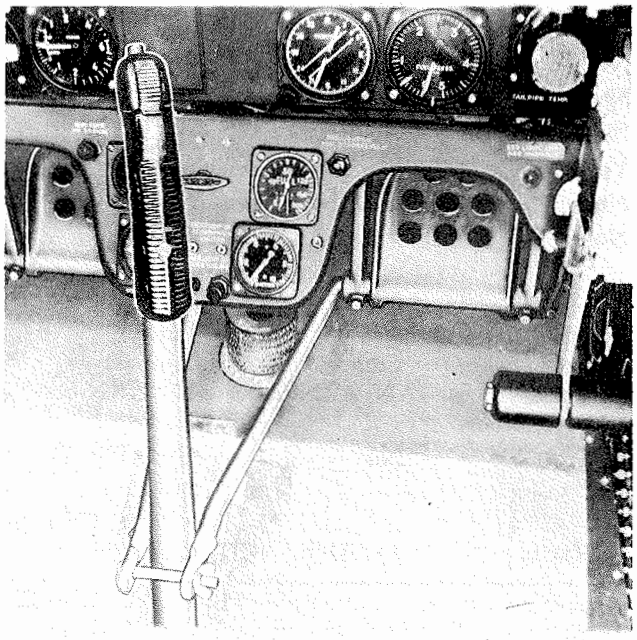
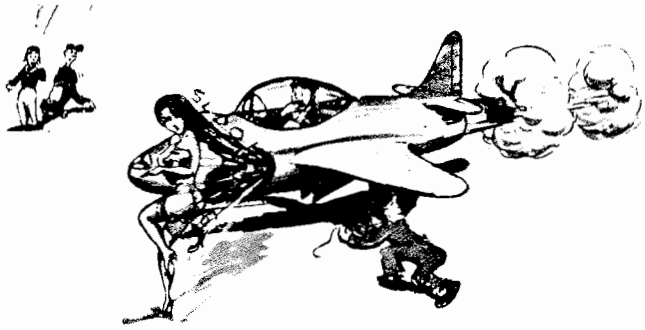


Figure 2 — Control Surface Lock



KEEP FOREIGN OBJECTS OUT OF INTAKE DUCTS

(3) The rudder is spring loaded toward the neutral position.

b. CONTROL SURFACE LOCK — The surface control lock consists of a bracket to the rudder pedals and the control stick by means of a thumbscrew (figure 2).

c. TRIM TABS.

(1) Trim tabs on the left aileron and on the elevator are electrically operated. The electric motors are controlled by switches in the cockpit.

(*a*) Aileron tab switch (2, figure 6 and 6A).

(*b*) Elevator tab switch (20, figure 7 and 30, figures 7, 7A, and 7A-1).

Note

Some airplanes have aileron and elevator trim tab controls in a combination switch on the top of the control stick.

CAUTION

Although spring loaded to the OFF position, the elevator and aileron trim tabs switch must be actuated and returned to neutral by the use of thumb pressure to insure return of switch to neutral.

(2) An indicator light (29, figures 7, 7A, and 7A-1) glows when the elevator tabs are in the neutral position.

(3) The rudder tab is not controllable from the cockpit.

Note

The tab motors and the wing flap motors coast for about 3 seconds after the switches are turned off. The lift of these motors will be increased if they are allowed to stop rotating before being reversed.

d. WING FLAPS.

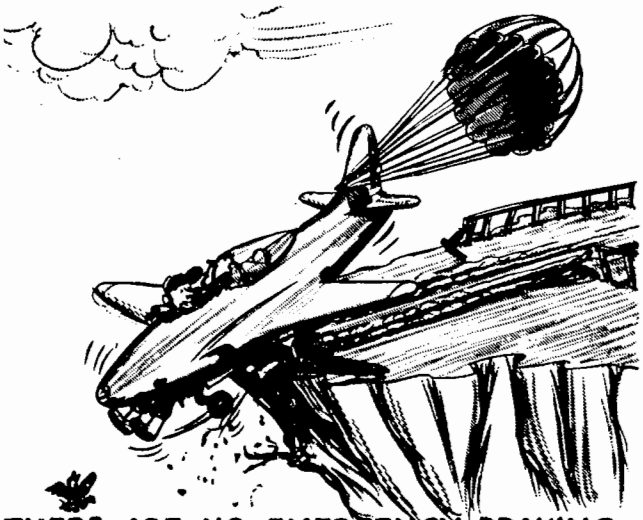
(1) The wing flaps are operated by a switch (10, figures 6 and 6A), which control two electric motors, one for each flap. The wing flap position indicator (11, figure 6 and 6A) shows the positions of the flaps at all times.

(2) The left and right wing flaps are interconnected so that either motor may operate both flaps if the other motor should fail. There is no emergency mechanical wing flap extension system on this airplane.

3. LANDING GEAR CONTROLS.

a. The landing gear is controlled by a lever (29, figures 6 and 6A) and is actuated by normal or emergency hydraulic pressure. The button on the end of the lever must be pushed in before the lever can be moved. While the airplane is resting on the landing gear an automatic downlock device prevents moving the landing gear lever out of the "DOWN" position. This downlock can be disengaged in an emergency, when it is desired, by simultaneously pushing down the release control (27, figures 6 and 6A) and moving the landing gear lever to "UP."

b. The main and nose landing gears are equipped with uplocks and downlocks. The operation of these locks is completely automatic.



THERE ARE NO EMERGENCY BRAKING PROVISIONS ON THIS AIRPLANE!

c. Two lights (26, figure 7 and 5, figures 7A and 7A-1) indicate the landing gear position. The green light is on whenever the landing gear is in "DOWN" and "LOCKED." The red light comes on and a warning horn sounds if the throttle is closed when the landing gear is *NOT* "DOWN" and "LOCKED." The horn may be silenced by pushing the switch (16, figures 6 and 6A). The switch is automatically reset when the throttle is opened.

d. A "stiff knee" clip is provided for installation, by ground personnel, on the spring cartridge located between the parallel drag struts on each leg of the landing gear to prevent accidental retraction when the airplane is on the ground.

4. BRAKE CONTROLS.

The brakes are operated by conventional toe brake pedals. A parking brake (25, figure 7, and 26, figures 7A and 7A-1) locks the brakes for extended periods. There are no emergency braking provisions on this airplane.

5. HYDRAULIC SYSTEM CONTROLS.

a. The hydraulic pump is driven by the engine.

b. Hydraulic power is used to operate the aileron booster, the landing gear, and the dive flaps.

c. A hydrofuse has been installed in the hydraulic systems of late airplanes. The purpose of this fuse is to automatically shut off hydraulic fluid to the landing gear and dive flaps in the event of a serious leak in either system. The aileron booster is not affected by the hydrofuse. A handle (35, figures 7, 7A and 7A-1) is installed to permit manual resetting of the fuse; however, it has been safety-wired to the open position.

6. EMERGENCY HYDRAULIC SYSTEM.

a. An emergency hydraulic system is provided for lowering the landing gear. The emergency system reservoir contains enough fluid for only one complete extension of the gear. Return fluid from this system is dumped into the main system making it impossible to accomplish more than one extension without refilling the reservoir.

b. A hand pump (13, figures 8 and 8A) provides pressure for the emergency system.

c. The emergency selector valve (12, figures 8 and 8A) opens and closes the line between the hand pump and the landing gear cylinders. The landing gear selector valve (12, figures 8 and 8A) must be used in conjunction with the emergency selector valve to permit the fluid trapped in the cylinders to return to the main reservoir.

7. DIVE FLAP CONTROLS.

The dive flaps are controlled by a switch (9, figures 6 and 6A) which operates an electrically actuated hydraulic valve. It is not possible to stop the dive flaps in any intermediate position; they must be either "full up" or "full down."

8. ELECTRICAL CONTROLS.

a. GENERAL.

(1) The electrical system is in operation whenever the battery switch (3, figures 8 and 8A) and the generator switch (4, figures 8 and 8A) are in the "ON" position.

Note

(Early Airplanes Only)

Operation of the emergency fuel pump automatically bypasses the generator switch and causes the generator to operate whenever the emergency fuel pump is "ON."

b. CIRCUIT BREAKERS.

(1) Each electrical circuit in the airplane is protected by a thermal circuit breaker (8, figures 6 and 6A and 16, figures 8 and 8A). The circuit breakers may be reset by pushing the button for the circuit that has failed. The generator and hydraulic pump circuit breaker is not accessible to the pilot in flight.

(2) On photographic airplanes, circuit breakers for the blinker lights, vacuum pumps, camera bays, radio compass, inverter, and VHF radio are not accessible to the pilot in flight.

c. EXTERNAL POWER SUPPLY CONNECTION. The external power supply plugs into a socket in the aft end of the right wing fuselage fillet. A double socket is provided to permit attaching two battery carts, if necessary, on some airplanes.

d. EMERGENCY BATTERY DISCONNECT. The emergency battery disconnect switch handle (figure 17) is located behind and to the right of the pilot's seat. Operation of the switch disconnects all the electric circuits from the battery. After operation, the switch cannot be reset in flight.

9. FUEL SYSTEM CONTROLS.

a. GENERAL.

(1) All the fuel is carried in four groups of tanks, the drop tanks (attached to the wing tips), the wing leading edge tanks (commonly called "leading edge tanks"), the main wing tanks (called "wing tanks"), and the fuselage tank. JP-4 fuel in accordance with MIL-F-5624 will be used for all normal operation (including starting) and gasoline in accordance with MIL-F-5572, lowest grade available gas, as an alternate in those airplanes converted for JP-4 fuel.

FUEL QUANTITY DATA (GALS.)

Tanks	No.	Usable Fuel (each)	Fully Serviced	*Expansion Space (each)	Total Volume (each)
FUSELAGE	1	207	207.5**	0	207.5
LEADING EDGE	2	44	47.0	0	47
WING	2	65	65.5	0	65.5
DROP	2	165	165.5	0	165.5
	2	230	230.5	0	230.5

* All tanks have the usual expansion space; however, this is not available for stuffing purposes since fuel in this space drains overboard.

** The unuseable fuel may increase to approximately 10 gallons during a Wave-off and to higher values during a zoom.

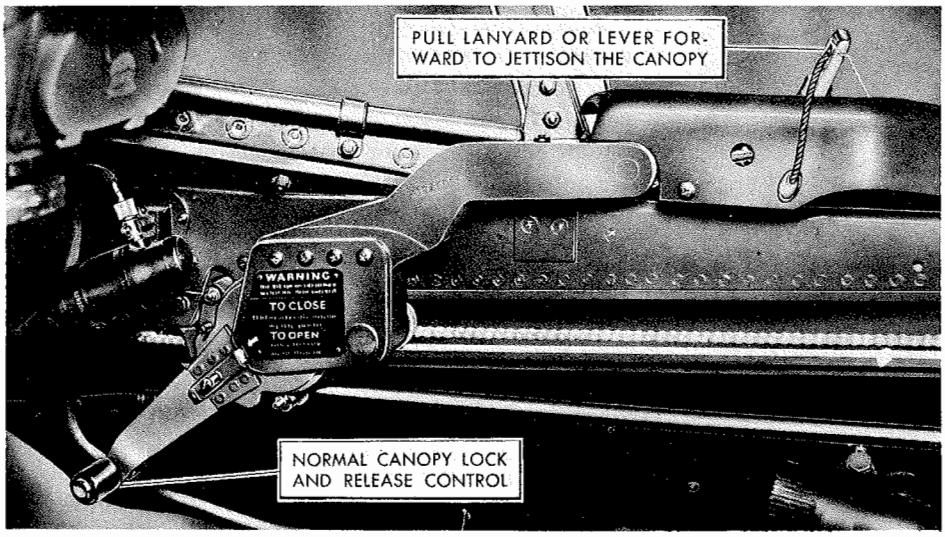


Figure 3— Canopy Controls (MANUAL CANOPY ONLY)

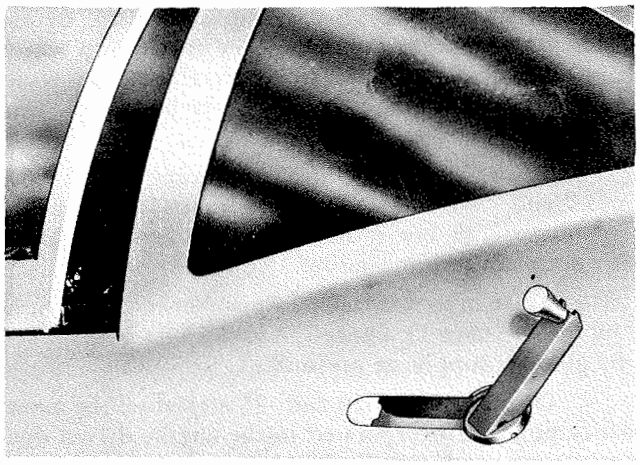


Figure 4—External Canopy Crank
(MANUAL CANOPY ONLY)

(2) Under normal operating conditions, all fuel is transferred to the fuselage tank before being fed to the engine. This fuel transfer is automatically controlled by three float valves within the fuselage tank. The leading edge tank float valve and the wing tank float valve are located one and two inches, respectively, below the drop tank float valve. Whenever the fuel level of the fuselage tank is above any of the floats, the respective tank valve will close. The fuselage tank fuel level is maintained at each float valve level until the corresponding group of tanks is empty.

CAUTION

(Except RF-80A-20 and -25)
In order to avoid damage to the transfer pumps in the leading edge tanks, the automatic operation as described above will not be used. The procedure listed in Section II will be used at all times.

(3) Under emergency operating conditions, fuel from the leading edge and wing tanks (not the drop tanks) may be made to bypass the fuselage tank. This bypass condition is controlled by a switch (30, figure 6) on some airplanes and by the fuselage tank switch on other airplanes.

(4) In case of complete electrical failure, fuel will be available only from the fuselage tank except in the case of late airplanes. On late airplanes, fuel will automatically feed from the drop tanks.

(*a*) If the fuselage tank bypass system is operating at the time electrical failure occurs, fuel will continue to be drawn through this system until one of the wing tanks (or leading edge tanks) is empty. At this time the engine driven fuel pump will probably draw air through the empty tank and engine flame-out will occur.

(*b*) On late airplanes, electrical system failure during fuselage tank bypass operation will automatically cause a change from bypass to normal operation.

(5) On winterized airplanes, the fuel system has been modified to permit the use of gasoline, Specification MIL-F-5572 (AN-F-48), in the left leading edge tank for starting purposes.

b. FUEL TANK SELECTOR SWITCHES.

(1) DROP TANKS.—The drop tank selector switch operates a valve which admits air pressure from the engine into the drop tanks. This air pressure forces fuel from the drop tanks into the fuselage tank when the drop tank float valve is open.

(2) LEADING EDGE TANKS.—The leading edge tank switch turns on a transfer pump in each leading edge tank. These pumps force fuel into the fuselage tank when the float valve is open. On winterized airplanes, a separate switch has been added to the left side of the cockpit between the oxygen regulator and the emergency fuel pump switch for the purpose of controlling the transfer pump in the left leading edge tank. The present leading edge tank switch controls the transfer pump in the right leading edge tank only and operates in the normal manner.

Note

F-80A and RF-80A aircraft, serial numbers 44-84992 thru 44-85466, which have been service modified to incorporate winterization changes, will vary from other winterized aircraft in that the gasoline starting switch will not actuate the fuel bypass control. Therefore, on these airplanes the bypass control must be placed in the bypass position for all gasoline operation.

(3) WING TANKS.—The wing tank switch turns on a transfer pump in each wing tank. These pumps force fuel into the fuselage tank when the wing tank float valve is open.

(4) FUSELAGE TANK (except RF-80A-20 and RF-80A-25).—The fuselage tank switch turns on the fuselage tank boost pump which supplies fuel pressure to the engine driven fuel pump. On late airplanes, this switch is also used to bypass the fuselage tank. On these airplanes, downward motion of the switch bypasses the fuselage tank and turns off the fuselage tank booster pump. Upward motion reverses this procedure.

(5) FUSELAGE TANK (RF-80A-20 and RF-80A-25 only).—The fuselage tank switch (20, figure 9B) has three positions. In the upward "FUS" position of the switch, the fuselage tank booster pump is turned on to supply fuel under pressure to the engine driven fuel pump. In the downward "BYPASS" position of the switch, the fuselage tank booster pump is shut off and the electrically operated bypass valves are reset, causing fuel in the wing tanks and leading edge tanks to bypass the fuselage tank. In the center "OFF" position of the switch, the fuselage tank bypass valves are set for normal operation but the fuselage tank booster pump is off.

c. FUEL TANK INDICATOR LIGHTS.

(1) An indicator light (19, figure 9B) for each group of tanks is located above the respective switch. The drop tank, leading edge tank and the wing tank indicator lights glow whenever the respective switches are "ON" and the fuel pressure in the lines is below the minimum. This drop in pressure occurs when the tank runs dry or when the source of transfer pressure fails.

(2) The fuselage tank indicator light is on whenever the fuselage tank boost pump is in operation.

(3) On winterized airplanes, an additional indicator light is located on the left side of the cockpit to indicate when the gasoline starting system is in operation and to prevent inadvertent take-off on gasoline.

d. FUEL QUANTITY INDICATORS.

(1) FUEL GAGE.—A fuel gage (23, figures 7, 7A and 7A-1) indicates the quantity of fuel in the fuselage tank only.

(2) LOW LEVEL WARNING LIGHT.—A low level light (22, figures 7, 7A and 7A-1) comes on when the fuselage tank level goes below approximately 100 U.S. gallons (83 Imperial gallons).

(3) FUEL QUANTITY COUNTER (RF-80A-20 and -25).—A fuel quanity counter (6, figure 9A) operates from a flow-meter in the main fuel line to the engine (see figure 5A). The counter dial must be set to read the total amount of fuel in the airplane each time the tanks are filled. The reading on the counter dial is in gallons of fuel remaining in the airplane.

Note

Serious error in calculating aircraft range may be made by pilots who rely on the fuel remaining counter system and are not familiar with its limitations. To enable the pilot to use the system with intelligence, the following information is given:

1. Accumulative errors in the instrument itself. These errors may assume considerable proportions.

2. The meter measures only fuel passing thru it. It does not measure fuel lost thru evaporation, leakage upstream, rapid climb, released with tip tanks, or bypassed during automatic starting or emergency operation.

3. Performance charts and the flowmeter calibration are based on JP4 fuel at standard atmospheric conditions. It is necessary to compensate for other values. Jet fuels can vary considerably in chemical makeup, temperature, and density.

4. Fuel Counters must be set to accurately reflect the fuel on board and all factors must be taken into consideration to determine range performance.

e. EMERGENCY FUEL PUMP.
(Except RF-80A-20 and -25)

The emergency fuel pump switch (5, figures 6 and 6A) turns on the emergency fuel pump which supplies operating fuel pressure directly to the throttle valve without regulation by either the barometric control or the overspeed governor.

The red indicator light (30, figures 7 and 32, figures 7 and 7A-1) burns when the pump is not supplying pressure, or not turned on, if the landing gear is down for take-off or landing.

The emergency fuel pump amber indicator light (30, figure 7 and 32, figures 7A and 7A-1) burns when the pump is supplying pressure.

On the RF-80A-20 and -25 airplanes, the emergency pump is incorporated in the engine driven dual fuel pump and supplies fuel pressure through the Rochester control. The emergency fuel system is controlled by the emergency fuel switch (see paragraph *10Cd).*

10. THROTTLE CONTROL.
(Except RF-80A-20 and -25)

a. The throttle (12, figures 6 and 6A) is the only power control on this airplane. The throttle regulates the fuel pressure to the burner fuel jets of the engine, and the resulting fuel pressure determines the rpm of the engine.

b. To obtain constant rpm engine operation at all altitudes, the burner ring fuel pressure must be decreased as the altitude is increased. A barometric control is installed in the airplane which automatically accomplishes the reduction in fuel pressure *except when the engine is operating on the emergency fuel pump.* The throttle, however, must be retarded slightly to prevent overspeeding the engine during a climb.

c. On late airplanes, the throttle lever also serves to shut off fuel to the engine burner ring. This shut-off is effective when the throttle is full aft in the position marked "OFF."

10A. STARTER SWITCH.
(Except RF-80A-20 and -25)

The starter switch (2, figures 8 and 8A) is a momentary contact switch with a center "OFF" position. Actuating the switch energizes an electric starter through a time delay circuit. The starter switch must be held in the start position until approximately 17% rpm is reached.

10B. IGNITION BOOSTER SWITCH
(Except RF-80A-20 and -25)

The ignition booster switch (1, figures 8 and 8A) has "ON," "OFF," and "NORMAL" positions. The "ON" position energizes the ignition system, as for air starting. The "OFF" position (center) permits starter operation without ignition. The "NORMAL" position provides for ignition coil operation when the starter motor is energized, as for ground starting.

10C. POWER PLANT CONTROLS.

(RF-80A-20 and -25 only)

a. GENERAL. The engine in these airplanes incorporates two separate fuel control systems, (figure 5A) with a dual engine driven fuel pump. One side of the pump supplies the normal fuel system, the other supplies the emergency fuel system. The pump is so designed that in the event one system fails, the other will continue supplying fuel to the engine. The normal fuel system control is known as the Bendix Control. The emergency system control is known as the Rochester Control. A pressure switch is installed to sense fuel pressure supplied by the normal fuel system control and a starting fuel sequence control is installed for automatic starting.

b. THROTTLE. The throttle (13, figure 9B) is the only power control on these airplanes. The throttle regulates the fuel pressure to the burner fuel jets of the engine, and the resulting fuel pressure determines the engine rpm. When the throttle is full aft in the position marked "OFF" it shuts off fuel to the engine burner ring, except that which goes thru the automatic starting fuel control.

c. The throttle is connected directly to the Bendix Control which attempts to maintain constant engine rpm for any throttle setting, regardless of altitude or airspeed. The Bendix Control is an all speed governor and a maximum throttle position stop is provided, which protects the engine from overspeeding whenever the engine is operating on the Bendix system alone. A throttle linkage is provided on the engine between the Bendix Control and the Rochester Control. The Rochester Control consists of a throttle, an altitude compensated relief valve (or Barometric), and a solenoid operated bypass valve. There is no overspeed governor in the emergency fuel system. The relief valve in the emergency fuel control is adjusted to provide approximately 100% engine rpm on a 100°F day. If the temperature is less than 100°F, less than 100% engine rpm will be available on the emergency system. On days 100°F or over, overspeeding may be possible on the ground. The altitude compensation in the emergency fuel control attempts to maintain constant engine rpm for a given throttle setting, regardless of changes in airplane altitude. However, in flight, overspeeding will generally be possible while operating on the emergency system. The solenoid operated bypass is normally open. Closing this valve puts the emergency fuel control into operation.

d. EMERGENCY FUEL SWITCH (5, figure 9B). This switch has three positions, "EMERGENCY," "OFF," and "TAKE-OFF and LAND." When this switch is placed in the "TAKE-OFF and LAND" position, the circuit is alerted so that if a *complete failure* of the main fuel system occurs, and the pressure on the normal system falls below the pressure switch setting (approximately 45 lbs.), automatic transfer to the emergency system is accomplished. This is the only condition under which automatic protection is realized. The setting of the switch is low enough so that with the throttle in the idle position, the emergency system is not actuated unless there is a definite failure in the normal system. When a *partial failure* in the normal system occurs, it may be necessary to manually position the switch to "EMERGENCY" since the pressure sensing incorporated in the system is set for pressures below idle, and consequently will not be energized until the fuel pressure drops below the idle range. Placing of the emergency fuel pressure switch in the "EMERGENCY" position will cause the emergency fuel system to override the main fuel system regardless of fuel pressure or engine speed, and it is necessary to switch to the "OFF" position to return control to the normal system. Throttle position and/or manipulation is necessary to reduce as much as possible the sudden power surge and temperature increase that will be encountered when the emergency system takes over, due to the parallel linkage between the main fuel control and the emergency control. Positioning the trottle as close as possible to the RPM indicated, will greatly reduce the power surge and temperature rise.

CAUTION

Accidental positioning of the emergency fuel pressure switch in the "EMERGENCY" position will result in reducing the life of the engine, and will possibly cause engine failure. To prevent this, a guard must be lifted in order to position the switch.

e. EMERGENCY FUEL SYSTEM INDICATOR LIGHTS (12, figure 9A). Three indicator lights are provided; one red, one green, and one amber. The red light comes on when the gear is down and the emergency fuel switch is in the "OFF" position. The green light turns on and the red light turns off when the emergency fuel switch is placed in the "TAKE-OFF and LAND" position. The amber light turns on, the green light continues to stay on, if the emergency fuel switch is in the "TAKE-OFF and LAND" position and the emergency fuel control is in operation. When the emergency fuel switch is placed in the "EMERGENCY" position, the green and amber lights come on and the red light goes out.

f. EMERGENCY FUEL CHECKOUT SWITCH (11, figure 9C). This switch, located on the right-hand shelf near the radio panel is provided to permit a complete ground check of the emergency fuel system. When this switch is actuated the main fuel pump supply is bypassed and at the same time power is supplied to operate the emergency fuel control *provided* the pressure switch closes as it should. This switch simulates a fuel system failure and demonstrates proper operation of the pressure switch. Unless the emergency fuel switch is in the "OFF" position this switch is inoperative.

g. STARTING FUEL SWITCH (2, figure 9B). These airplanes incorporate an automatic and a manual engine starting system. The automatic starting system

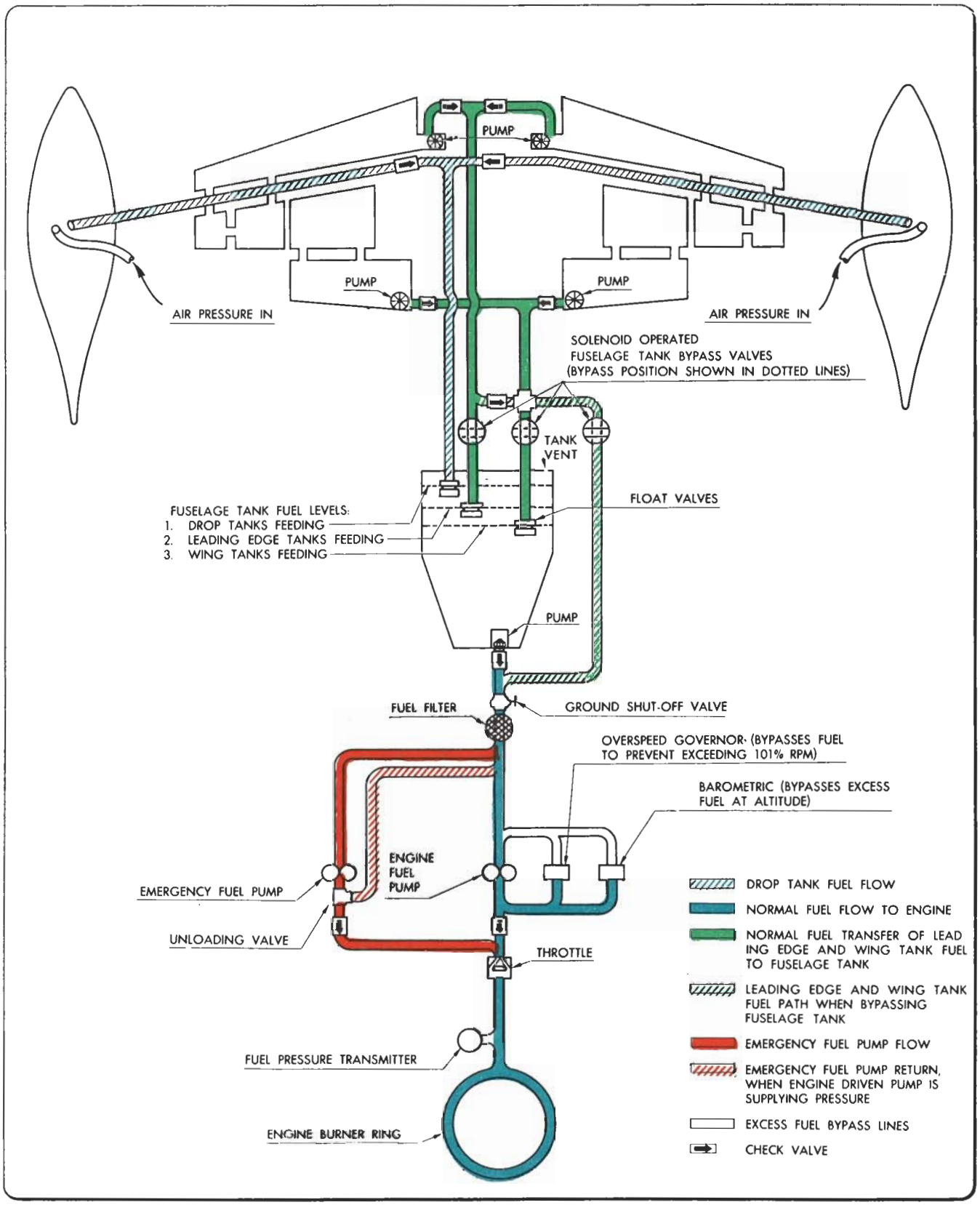


Figure 5 — Fuel Flow Diagram

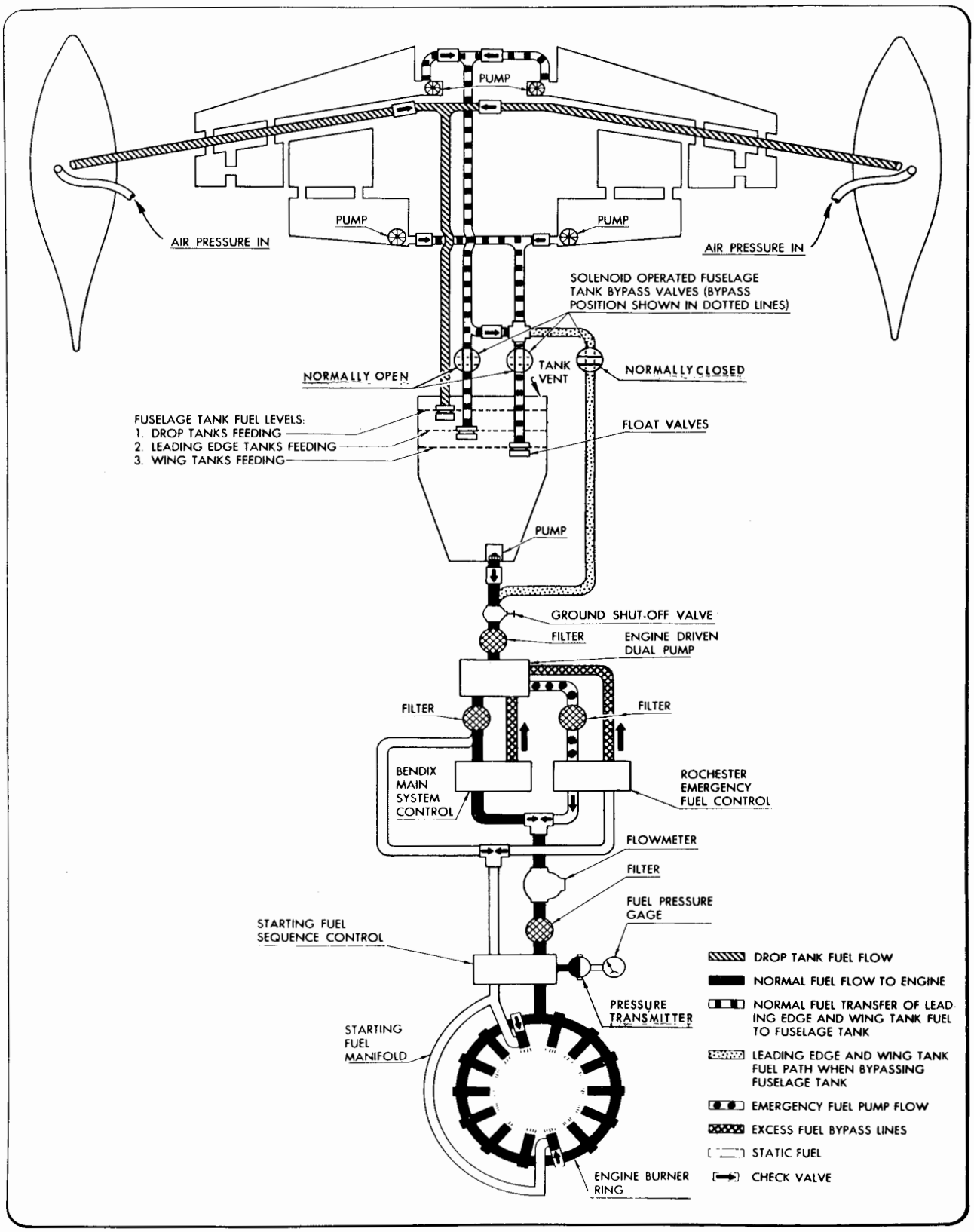


Figure 5A — Fuel Flow Diagram (RF-80A-20 and RF-80A-25)

is to be used as the normal starting procedure. When the switch is placed in the "MANUAL" position, the solenoid valve in the emergency fuel control is closed, causing the emergency fuel system to build up pressure. The bypass valve in the normal side of the main fuel pump remains closed allowing the normal system pressure to build up. When the switch is placed in "AUTO," the same changes take place as in the "MANUAL" position and in addition, the starting fuel control is energized allowing fuel to go first to the two burners which have ignitor plugs installed and then as the pressure biulds up to all other fuel nozzles. In the "OFF" position no fuel is available to the burners. It is necessary to return the switch to the "OFF" position when its function is completed.

CAUTION

If the starting fuel switch is left in "AUTO" when the engine is static or coasting and the electrical system is energized, fuel will drain or be pumped through the engine into the tailpipe or out of the manifold drain onto the ground. This can create a fire hazard.

h. AIR START IGNITION SWITCH (3, figure 9B). This switch is used to control the ignitor plugs during air starts. The ignition is turned on automatically whenever the starter is operated. In flight, ignition is accomplished by operating the air start ignition switch. Since the ignitor plug life is materially shortened by operation of the ignition, a time delay switch is incorporated to automatically limit the duration of the ignition to approximately 45 seconds. When the air start ignition switch is pushed to "START" and released, the ignition will continue for the duration of the time delay or until the guarded "NORMAL-OFF" ignition switch is turned to "OFF."

i. IGNITION "NORMAL-OFF" SWITCH (1, figure 9C). This switch is provided to permit operation of the starter without ignition and must be kept in the "NORMAL" position at all other times. When this switch is in the "OFF" position the air start ignition switch will not operate.

j. AUTOMATIC STARTER SWITCH (2, figure 9C). The starter switch operates automatically in that it does not have to be held in the "START" position but will continue to run until the engine reaches approximately 15% rpm and will then automatically shut off. If it is desired to stop the starter before it automatically cuts off, as in a false start, the switch must be pushed to the "STOP, START" position. The center position is "OFF."

11. ENGINE SHUT-OFF VALVE CONTROL.

On early airplanes, an engine shut-off valve (15, figure 6) is provided to shut off the flow of fuel to the engine burner ring.

On late airplanes, the separate shut-off control has been removed and its function has been incorporated in the throttle control.

12. WATER-ALCOHOL INJECTION AND FUEL FILTER DE-ICING.

a. WATER INJECTION SYSTEM. The system is independent and consists of two tanks of 30 U.S. gallons capacity each, an electrically driven pump, a combination filter and shut-off valve, a pressure transmitter and a ring of spray nozzles. Also included is an actuating cylinder which automatically shuts off pressurizing air to the cockpit while the water injection system is operating. This is to prevent noxious fumes from entering the cockpit.

b. Use of water injection will give increased thrust for short periods and is especially useful for short field take-offs or emergencies in warm weather. The use of fluid injection is prohibited at ground temperatures below +32°F.

CAUTION

If water injection is attempted shortly after the airplane is exposed to air temperatures colder than 10°F, the engine may become rough or the fluid may not flow at all. Therefore, complete water-alcohol supply must be used during take-off and initial climb if any part of the flight is to be conducted under that temperature.

WARNING

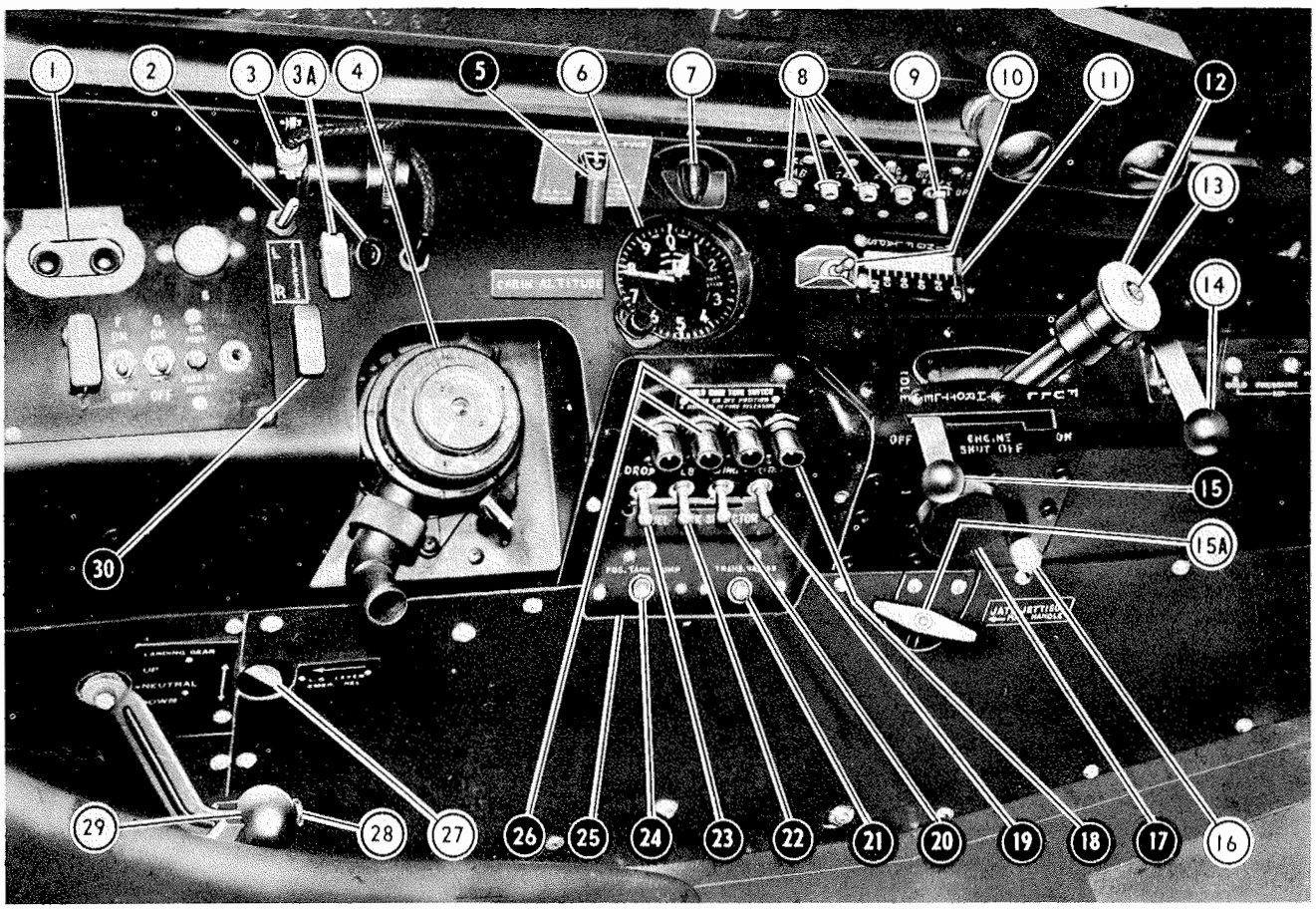
Never turn water injection switch on below 200 psi fuel pressure or above 10,000 feet altitude due to the possiblity of flame-out and engine damage.

c. WATER INJECTION SWITCH. The water injection switch on the left hand shelf (10B, figures 8 and 8A), turns on the electrically driven water injection pump, provided the throttle is almost fully advanced. The throttle is linked to another switch in series with the water injection switch which automatically opens the water pump circuit, if the trottle is retarded while water injection is in use. This second switch is provided to help prevent flame-outs caused by injecting water at low engine rpm.

d. FUEL FILTER DE-ICING. Provisions for alcohol de-icing of the low pressure fuel filter are included. The filter de-icing system utilizes components of the water injection system; therefore, if the airplane is serviced for filter de-icing, water injection will not be available and vice versa. For information on fuel filter de-icing see Section V.

13. JATO CONTROLS.

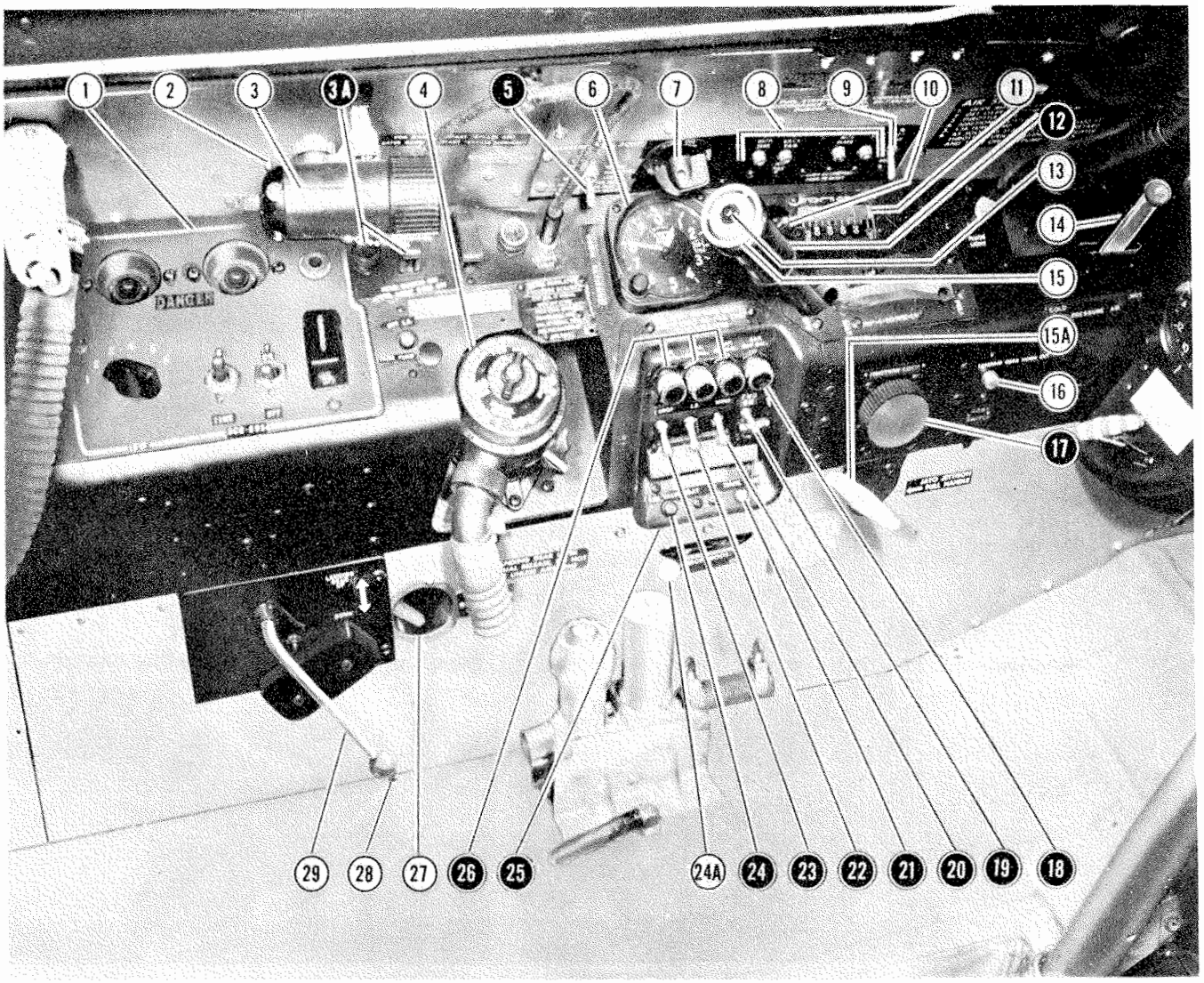
JATO CONTROLS (late airplanes)—Jato firing is controlled electrically by a "JATO-GUNS" transfer switch ("JATO-CAMERA" switch on RF-80 airplanes) on the RH Shelf. When the switch is in the "JATO" position the indicator above the switch glows and the units may be fired by pressing the gun trigger switch on



1. SCR 695 Radio control panel
2. Aileron tab switch
3. Spotlight
3A. Filter de-icing switch and indicator
4. Oxygen regulator
5. Emergency fuel pump switch
6. Cabin altimeter
7. Fluorescent light switch
8. Circuit breaker reset buttons
9. Dive flap switch
10. Wing flap switch
11. Wing flap position indicator
12. Throttle
13. Microphone button
14. Cabin heat control
15. Engine shut-off valve control (Early Airplanes only)
15A. Jato jettison control
16. Throttle warning horn shut-off switch
17. Throttle friction control
18. Fuselage tank booster pump indicator light
19. Fuselage tank booster pump switch
20. Wing tank selector switch
21. Emergency bypass transfer valve circuit breaker reset button
22. Wing leading edge tank selector switch
23. Drop tank selector switch
24. Fuselage tank booster pump circuit reset button
25. Fuel control panel
26. Fuel tank indicator lights
27. Landing gear lever down lock release
28. Landing gear lever release button
29. Landing gear lever
30. Fuselage tank bypass switch (Early Airplanes only)

00 Indicates power plant and fuel system controls and instruments.

Figure 6 — Cockpit, Left-hand Side (Early Airplanes)



1. SCR 695 Radio or AN/APX-6 radar control panel
2. Aileron tab switch.
3. Spotlight.

3A. Fuel Filter De-icing Switch

4. Oxygen regulator
5. Emergency fuel pump switch
6. Cabin altimeter
7. Fluorescent light switch
8. Circuit breaker reset buttons
9. Dive flap switch
10. Wing flap switch
11. Wing flap position indicator
12. Throttle
13. Microphone button
14. Cabin heat control
15. Gunsight reset for rockets, switch

15A. Jato jettison control

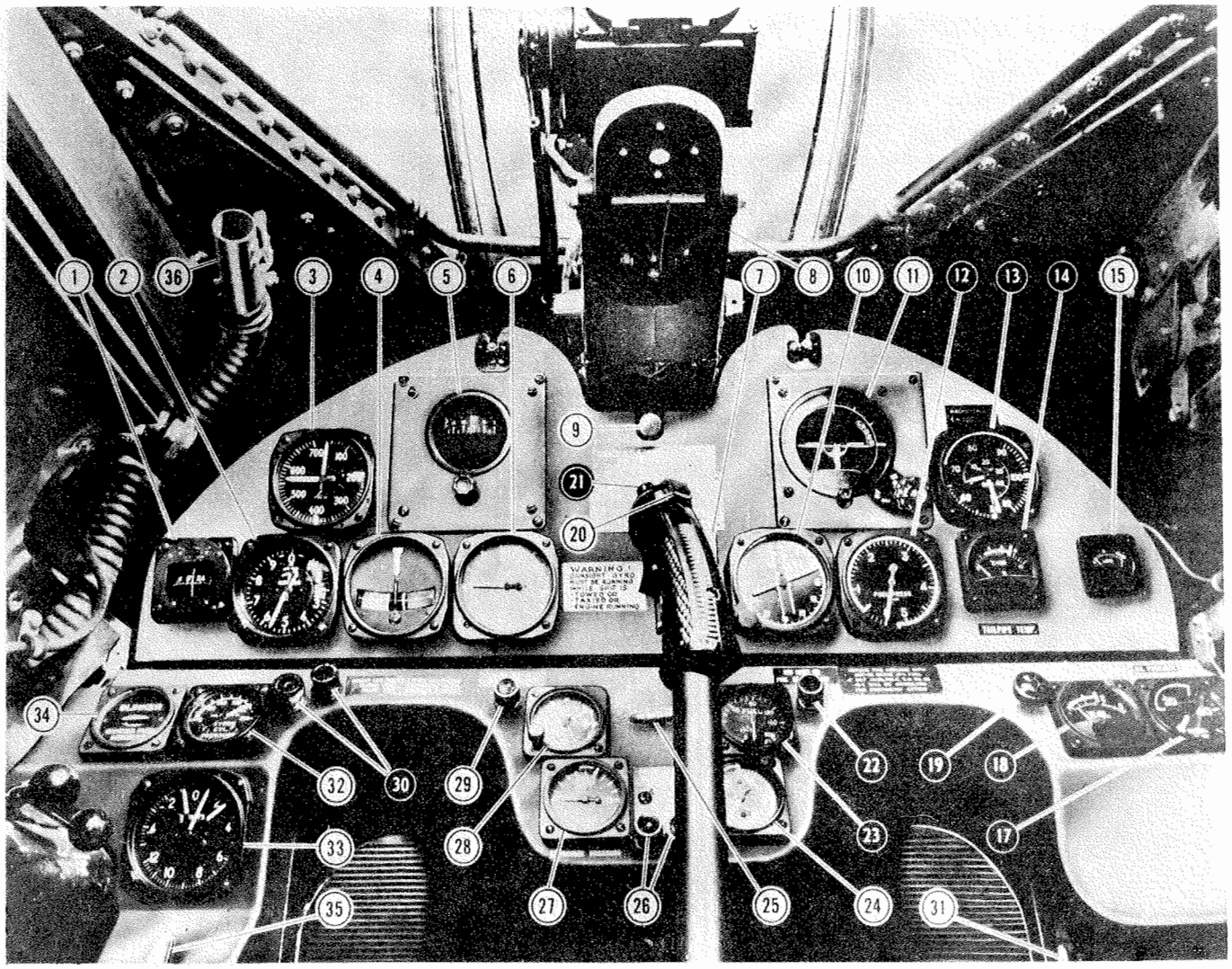
16. Throttle warning horn shut-off switch
17. Throttle friction control
18. Fuselage tank booster pump indicator light
19. Fuselage tank booster pump switch
20. Wing tank selector switch
21. Emergency bypass transfer valve circuit breaker reset button
22. Wing leading edge tank selector switch
23. Drop tank selector switch
24. Fuselage tank booster pump circuit reset button

24A. Aileron boost valve lever

25. Fuel control panel
26. Fuel tank indicator lights
27. Landing gear lever down lock release
28. Landing gear lever release button
29. Landing gear lever

(00) Indicates power plant and fuel system controls and instruments.

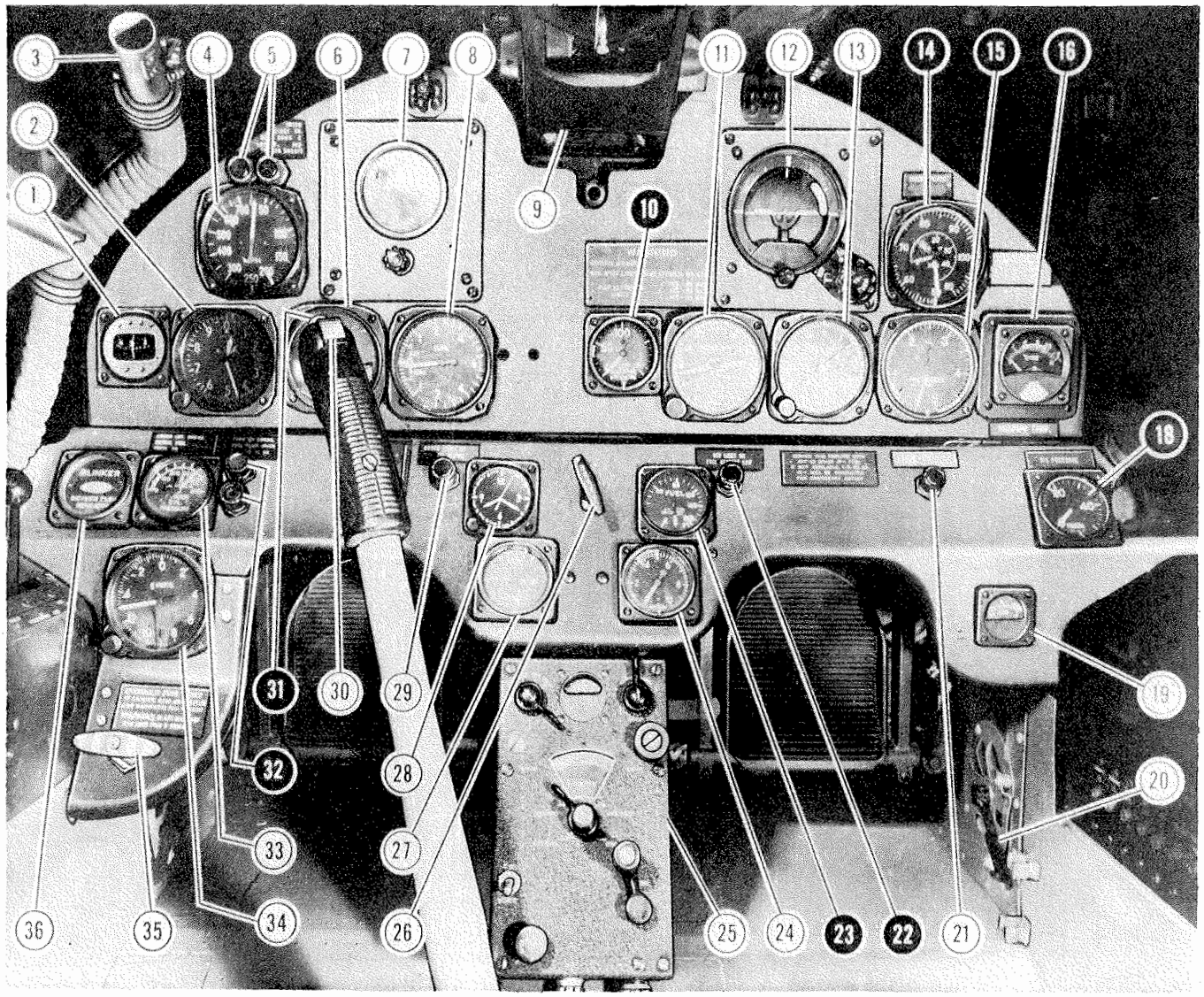
Figure 6A — Cockpit, Left-hand Side, Modernized F-80A



1. Stand-by compass
2. Altimeter
3. Air speed
4. Turn and bank
5. Directional gyro
6. Rate of climb
7. Compass correction card
8. Gun sight mount
9. Landing light position control
10. Remote compass indicator
11. Gyro-horizon
12. Burner ring fuel pressure
13. Engine tachometer
14. Tail pipe temperature
15. Ammeter
16. Deleted
17. Engine oil pressure
18. Rear bearing temperature
19. Fire warning light
20. Elevator tab switch
21. Drop tank (bomb) release
22. Fuselage tank low level warning light
23. Fuselage tank fuel quantity
24. Instrument pressure
25. Parking brake handle
26. Landing gear position lights
27. Hydraulic pressure
28. Clock
29. Elevator tab neutral light
30. Emergency fuel pump indicator lights
31. Rudder pedal ratchet release
32. Oxygen pressure gage
33. Accelerometer
34. Oxygen flow indicator
35. Hydrofuse reset handle
36. Ventilator

PP Indicates power plant and fuel system controls and instruments.

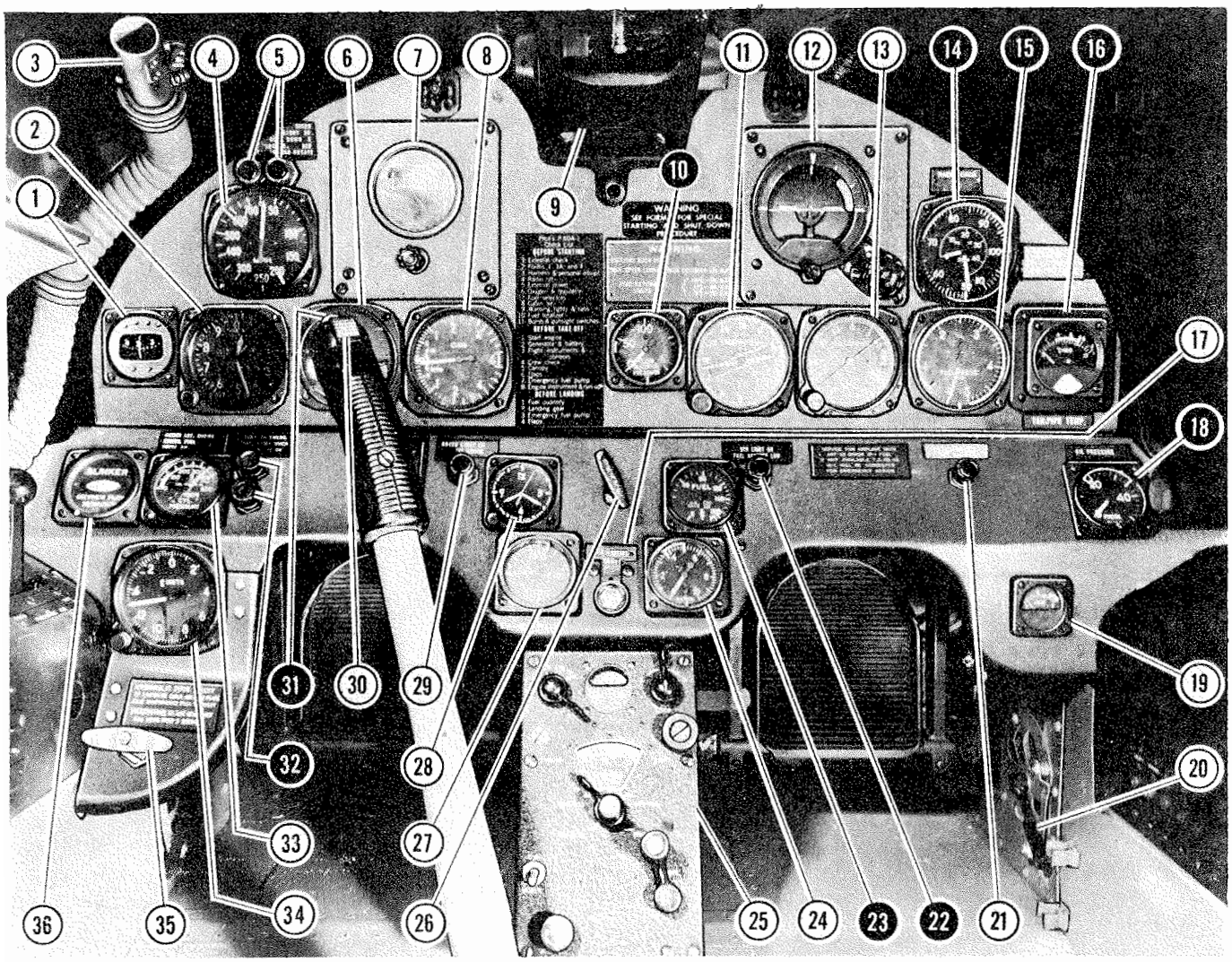
Figure 7 — Instrument Panel (Early Airplanes)



1. Standby compass
2. Altimeter
3. Ventilator
4. Airspeed indicator
5. Landing gear position lights
6. Turn and bank
7. Directional gyro
8. Rate of climb
9. Gunsight mount
10. Water injection pressure
11. Remote compass indicator
12. Gyro horizon
13. AN/ARN-6 Radio compass indicator
14. Engine tachometer
15. Burner ring fuel pressure
16. Tailpipe temperature
17. Deleted
18. Engine oil pressure
19. Ammeter
20. Pressurization grill shut-off
21. Fire warning light
22. Fuselage tank low level warning light
23. Fuselage tank fuel quantity
24. Instrument pressure
25. AN/ARN-6 Radio compass controls
26. Parking brake
27. Hydraulic pressure
28. Clock
29. Elevator tab neutral light
30. Elevator tab switch
31. Drop tank (bombs) release
32. Emergency fuel pump warning lights
33. Oxygen cylinder pressure gage
34. Accelerometer
35. Hydrofuse reset handle
36. Oxygen flow indicator

(00) Indicates power plant and fuel system controls and instruments.

Figure 7A --Instrument Panel (Late Airplanes)



1. Standby compass
2. Altimeter
3. Ventilator
4. Airspeed indicator
5. Landing gear position lights
6. Turn and bank
7. Directional gyro
8. Rate of climb
9. Gunsight mount
10. Water injection pressure
11. Remote compass indicator
12. Gyro horizon
13. AN/ARN-6 Radio compass indicator
14. Engine tachometer
15. Burner ring fuel pressure
16. Tailpipe temperature
17. Bomb salvo switch
18. Engine oil pressure
19. Ammeter
20. Pressurization grill shut-off
21. Fire warning light
22. Fuselage tank low level warning light
23. Fuselage tank fuel quantity
24. Instrument pressure
25. AN/ARN-6 Radio compass controls
26. Parking brake
27. Hydraulic pressure
28. Clock
29. Elevator tab neutral light
30. Elevator tab switch
31. Drop tank (bombs) release
32. Emergency fuel pump warning lights
33. Oxygen cylinder pressure gage
34. Accelerometer
35. Hydrofuse reset handle
36. Oxygen flow indicator

(POH) Indicates power plant and fuel system controls and instruments.

Figure 7A-1 --Instrument Panel (Modernized Airplanes)

the control stick. After the units are fired the "JATO-GUNS" (or "JATO-CAMERA") transfer switch must be returned to the "GUNS" (or "CAMERA") position to restore the function of the gun trigger switch and the jato units jettisoned by the jettison handle (15A, figures 6 and 6A).

14. FIRE WARNING LIGHT.

The fire warning light (19, figures 7 and 21, figures 7A and 7A-1) is controlled by several thermal switches located in the engine section and in the tail pipe section of the fuselage. Operation of this light may indicate either exhaust leakage at the tail pipe, a fuel fire, or possibly a short in the warning system electrical circuit.

14A. ELECTRIC CANOPY.

a. The original manually operated canopy is being replaced with an electrically operated canopy. Provisions are made for manual operation in case of electrical power failure, and for explosive jettison in an emergency. All canopy operations can be accomplished from inside or outside of the airplane. The exterior canopy control switch operates independently of the position of the battery switch. For canopy operating instructions, refer to Section II.

b. CANOPY "OPEN-CLOSE" SWITCH. Two canopy operating switches are provided, one for interior operation (3A, figure 8), and one for exterior operation (2, figure 7C).

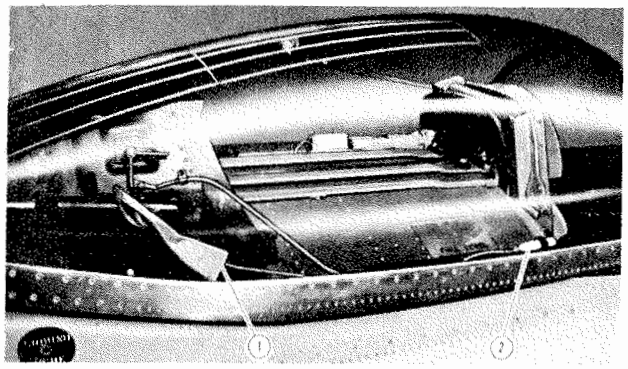
c. CANOPY MANUAL RELEASE. A manual release is provided for interior operation on the right hand canopy rail (2, figure 7B). The exterior manual release ring is flush mounted on the aft canopy cone.

d. EXPLOSIVE JETTISON CONTROL. The interior jettison control is located at the right side of the cockpit near the floor (15, figures 8A and and 15A, figure 8). The exterior jettison control is located in a well in the exterior skin (3, figure 7C).

e. GROUND SAFETY PIN. A safety pin (1, figure 7B) with red streamer attached is installed in the canopy jettison mechanism while the airplane is on the ground.

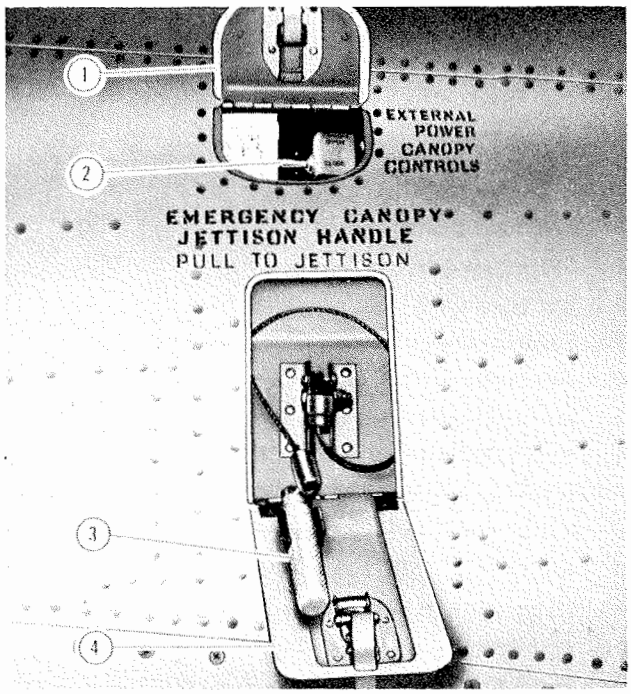
14B. SHOULDER HARNESS LOCK CONTROL.

Late airplanes are provided with an inertia reel type shoulder harness. A two position (locked-unlocked) shoulder harness inertia reel lock control is located on the left side of the pilot's seat. A latch is provided for postively 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. When the control is in the unlocked position, the reel harness cable will extend to allow the pilot to lean forward in the cockpit; however, the reel harness cable will automatically lock when an impact force of 2 to 3 g's is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to the locked and then returned to the unlocked position. When the control is in the locked position, the reel harness cable is manually locked so that the pilot is prevented from bending forward. The locked position is used only when a crash landing is anticipated. This position provides an added safety precaution over and above that of the automatic safety lock.



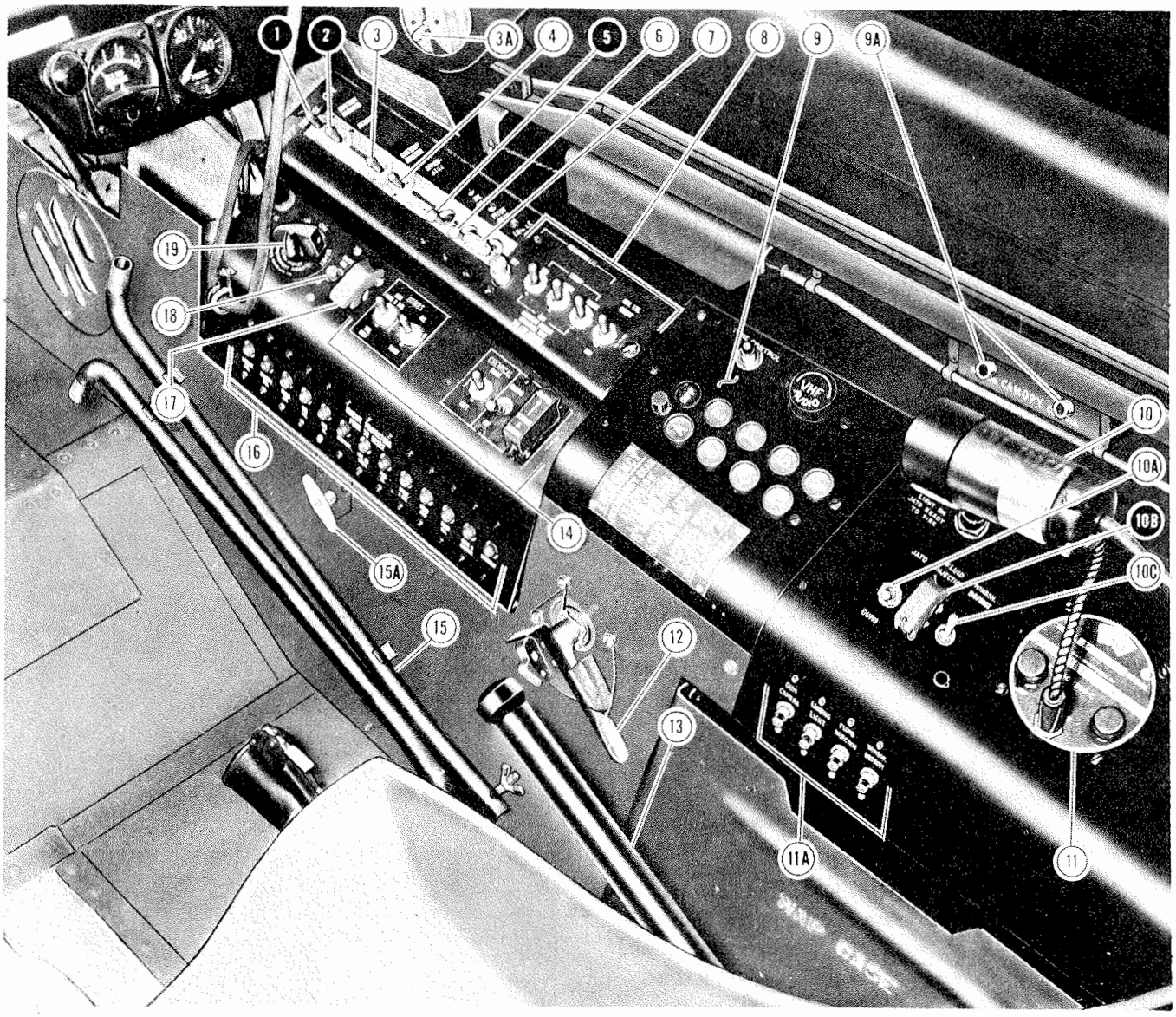
1. Canopy Ground Safety Pin
2. Canopy Manual Release

Figure 7B — Electric Canopy



1. Access Door
2. "OPEN-CLOSE" Switch
3. Explosive Jettison Control
4. Access Door

Figure 7C — External Controls — Electric Canopy



1. Ignition booster switch
2. Starter switch
3. Battery switch
3A. Electric canopy "Open-Close" switch
4. Generator switch
5. Oil heat switch (Inoperative)
6. Pitot heat switch
7. Landing light switch
8. Recognition and navigation light switches
9. AN/ARC-3 radio control panel
9A. Electric canopy circuit breakers
10. Spotlight
10A. Jato-guns transfer switch
10B. Water injection switch
10C. Auxiliary windshield defroster switch
11. Radio range receiver controls (Some airplanes)
11A. Circuit breakers
12. Landing gear emergency selector valve
13. Emergency hydraulic hand pump handle
14. Armament control panel
15. Controls lock (stowed)
15A. Electric canopy jettison control
16. Circuit breakers
17. Aileron boost shut-off switch
18. Range receiver circuit breaker
19. Fluorescent light rheostat

00 Indicates power plant and fuel system controls and instruments.

Figure 8 — Cockpit, Right-hand Side (Early Airplanes)

15. MISCELLANEOUS EQUIPMENT.

a. A free-air thermometer and a cabin-air temperature indicator have been installed as additional equipment on winterized airplanes.

b. ATTITUDE GYROS. A type J-3 attitude gyro is installed in some airplanes and a type A-1(A-2) or J-8 indicator in others. These instruments provide visual indication of any pitch and roll attitude. They operate on 115V phase AC power supplied by the inverters. In these instruments the gyro is inclosed in a sphere, a portion of which is visible through the opening of the face of the instrument.

The indications of these instruments may be confusing since the presentation of pitch differs.

(1) A horizon bar on the A-1 and the J-8 present a conventional pitch indication with the miniature airplane appearing above the horizon bar in a climb and below the horizon bar in a dive. However, in a climb (or dive) exceeding 27 degrees of pitch, the horizon bar stops at the bottom (or top) of the instrument case and the sphere then becomes the reference.

Note

The main difference between the A-1 (A-2) and J-8 attitude gyros is that the J-8 has a manual caging control.

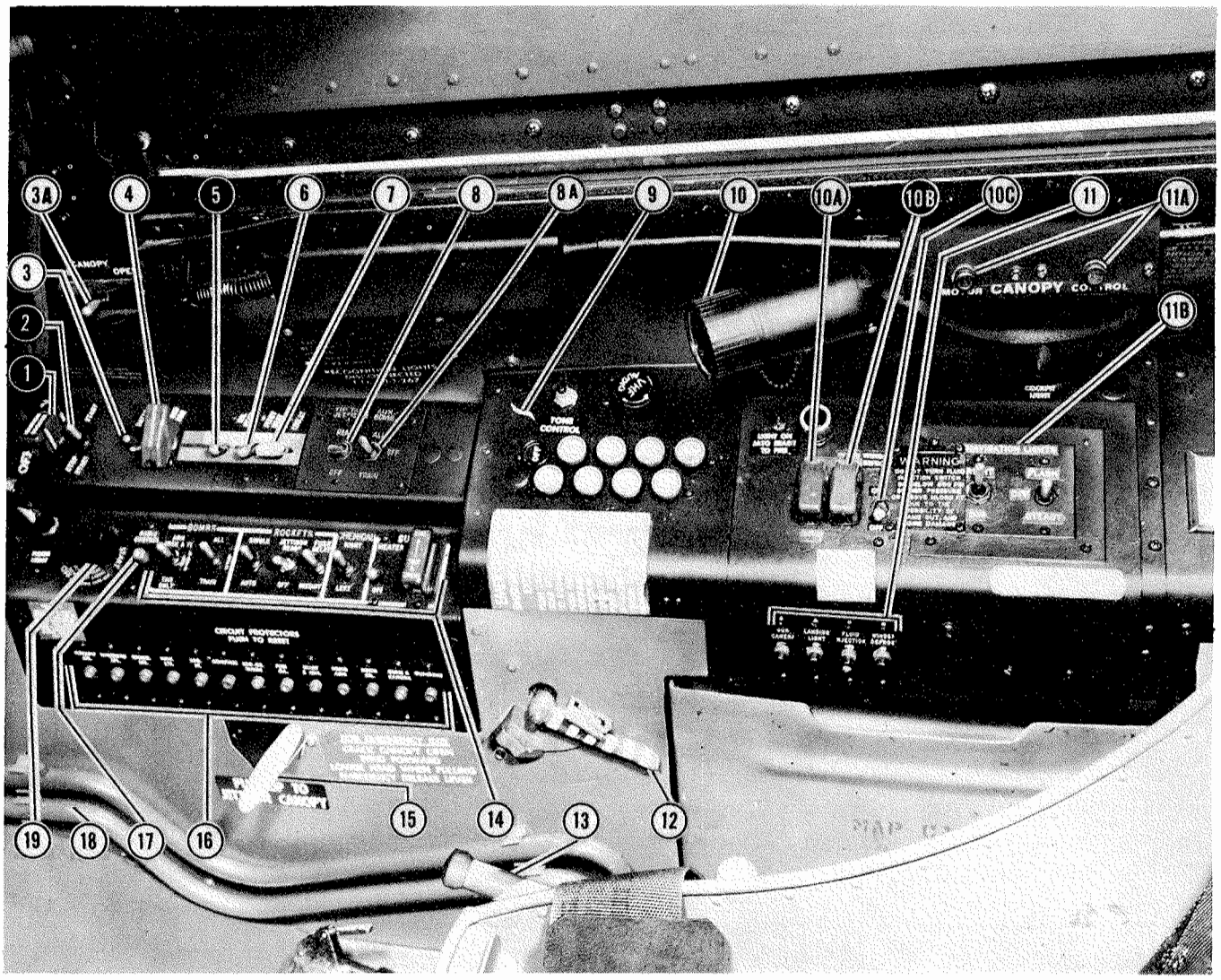
(2) The J-3 indicator differs from conventional attitude indicators in that climb and dive are not shown in relation to a horizon bar but are read directly on a sphere. The upper hemisphere, which is dark in color, indicates a dive; the lower light hemisphere indicates a climb. Lines similar to latitude markers are painted on the sphere and indicate the amount (degrees) of pitch. In addition a sensitive pitch indicator furnishes readings of climb or dive up to 10 degrees in one degree increments.

Note

The sphere is stabilized maintaining its equator parallel to the earth's surface and the aircraft (and miniature airplane) maneuvers around the stabilized sphere. Therefore when the aircraft is in a nose-high attitude, the miniature airplane will be displaced downward on the light portion of the sphere and in a dive, onto the dark portion of the sphere.

CAUTION

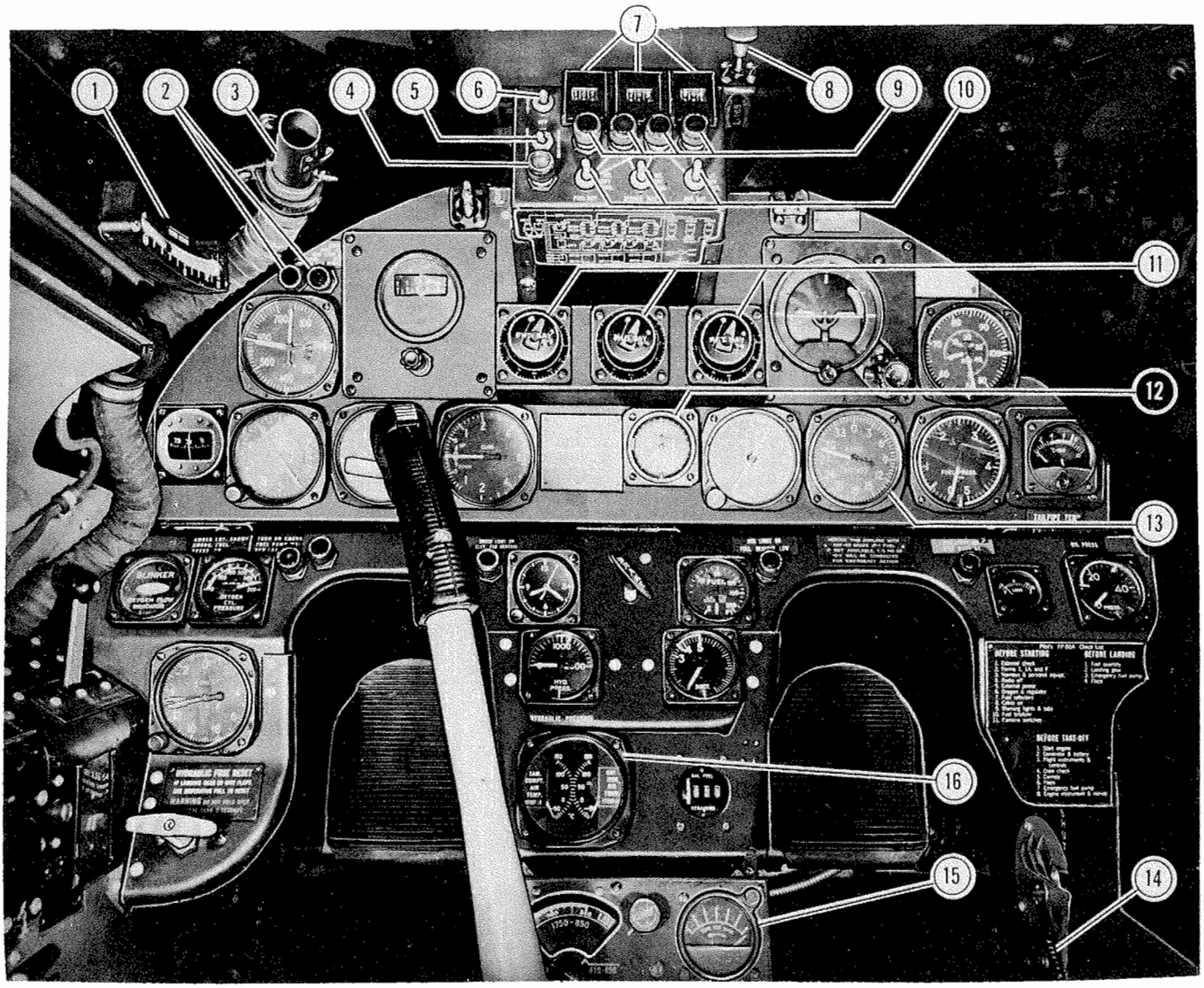
In some instances the A-1 (A-2) and J-3 attitude gyros may take as much as 13 minutes to erect itself.



1. Ignition booster switch
2. Starter switch
3. Battery switch
3A. Electric canopy "Open-Close" switch
4. Generator switch
5. Oil heat switch (Inoperative)
6. Pitot heat switch
7. Landing light switch
8. Tip tank jettison switch (airplanes with 230 gallon center line tanks)
8A. Auxiliary bomb switch (airplanes with R3 bomb shackles)
9. AN/ARC-3 Radio control panel
10. Spotlight
10A. Jato-guns transfer switch
10B. Water injection switch
10C. Auxiliary windshield defroster switch
11. Circuit breakers
11A. Electric canopy circuit breakers
11B. Navigation lights switch
12. Landing gear emergency selector
13. Emergency hydraulic hand pump handle
14. Armament control panel
15. Electric canopy jettison controls
16. Circuit breakers
17. Range receiver circuit breaker
18. Controls lock (stowed)
19. Fluorescent light rheostat

(00) Indicates power plant and fuel system controls and instruments.

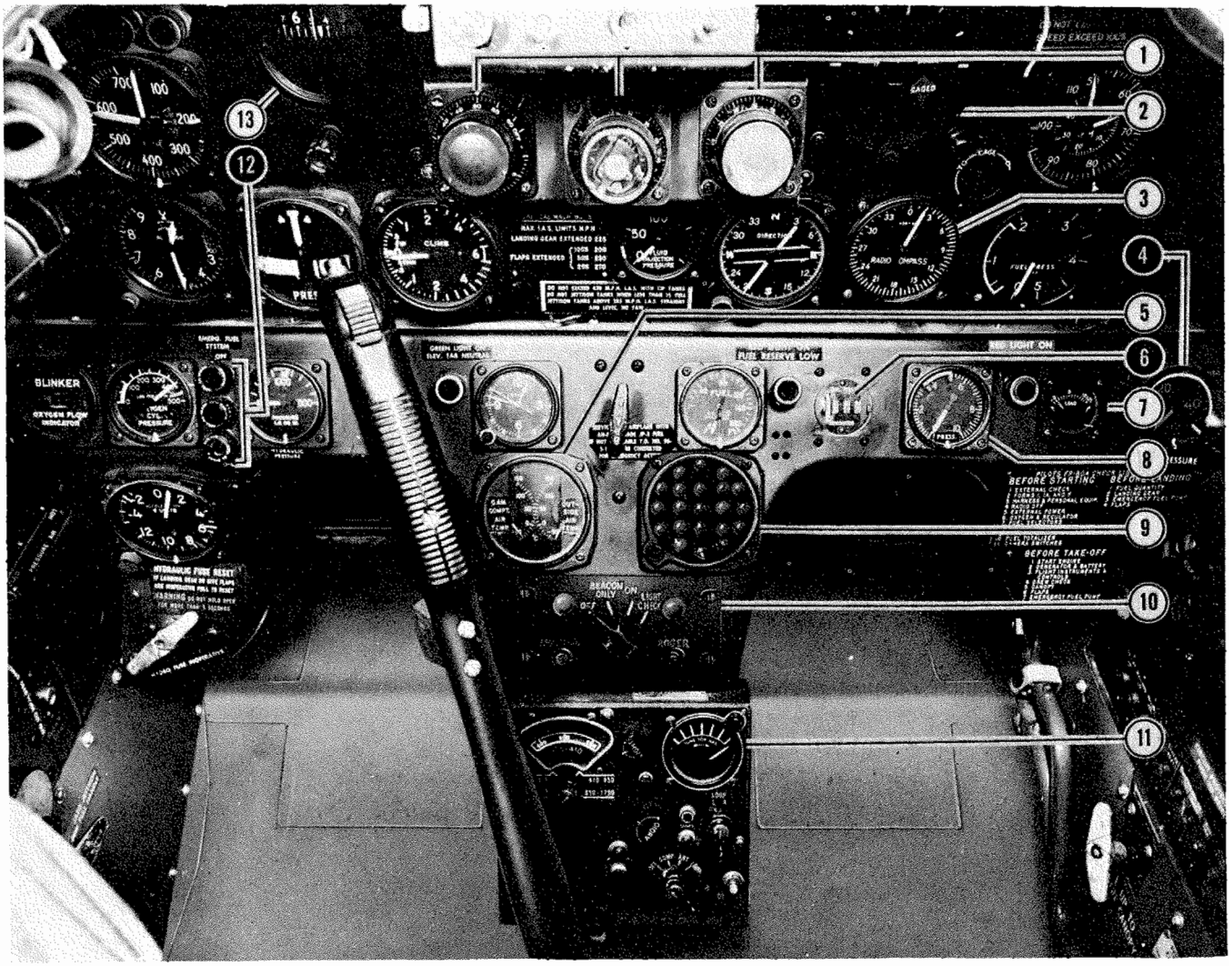
Figure 8A — Cockpit, Right-hand Side (Modernized Airplanes)



1. Pitch indicator
2. Landing gear position lights
3. Ventilator
4. Camera power indicator light
5. Camera master switch
6. Camera compartment heat switch
7. Exposure counter
8. Windshield defroster button
9. Camera blinker lights
10. Camera switches
11. Intervalometer
12. Water injection pressure (Late airplanes only)
13. AN/ARN-7 Radio compass indicator
14. Pressurization grill shut-off (Late airplanes only)
15. AN/ARN-7 Radio compass controls
16. Outside air and camera compartment temperature indicator

(00) Indicates power plant and fuel system controls and instruments.

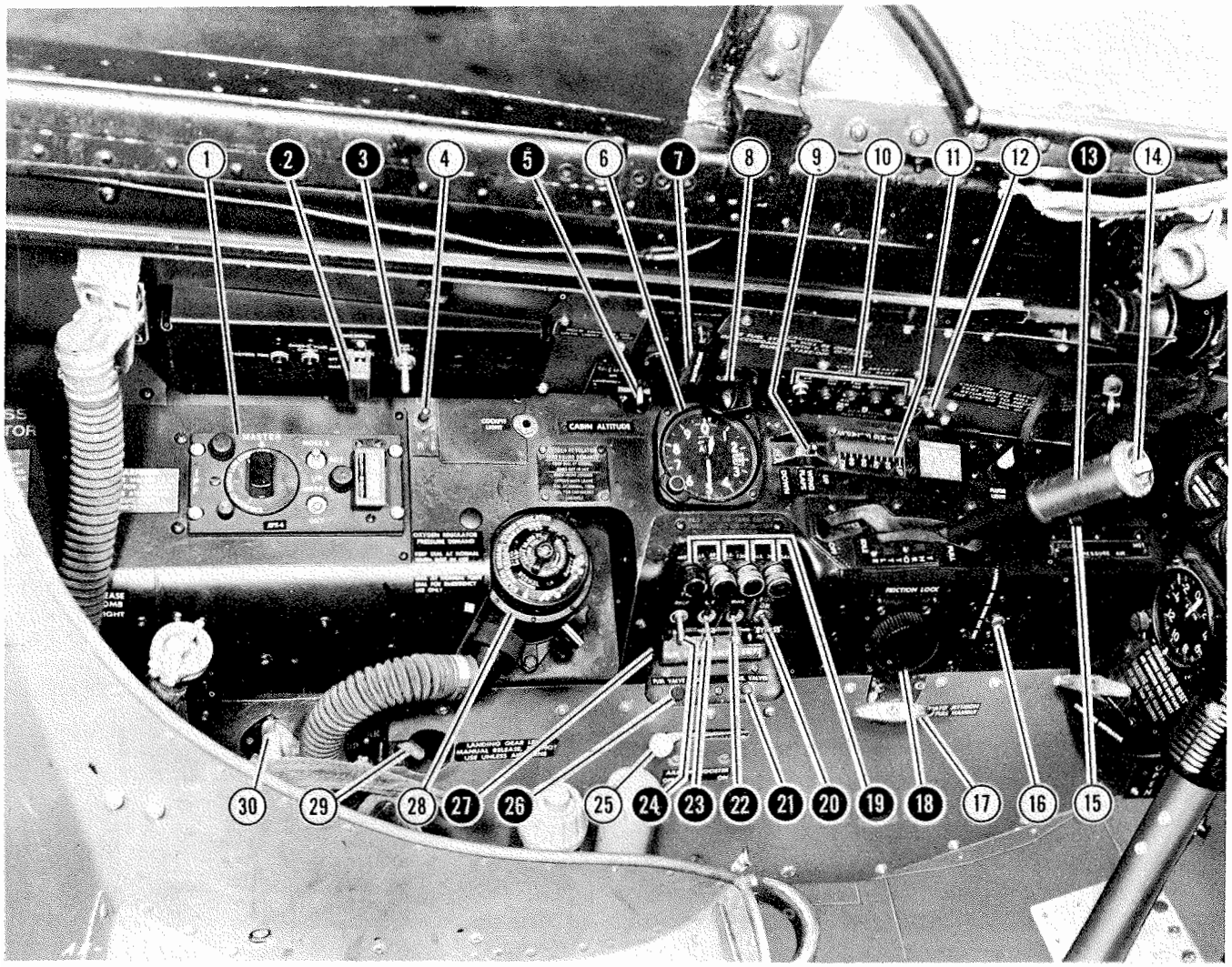
Figure 9 — Instrument Panel (FP-80A)



1. Intervalometer
2. Attitude Gyro
3. AN/ARN-6 (or AN/ARN-7) Compass Indicator
4. Oil Pressure Gage
5. Outside Air and Camera Compartment Temperature Indicator
6. Fuel Counter
7. Ammeter
8. Instrument Air Pressure
9. AN/APA-90 Indicator
10. AN/APA-90 Control Panel
11. AN/ARN-6—Radio Compass Controls (RF-80A-25)
    AN/ARN-7—Radio Compass Controls (RF-80A-20)
12. Emergency Fuel System Warning Lights
13. Directional Gyro

(00) Indicates power plant and fuel system controls and instruments.

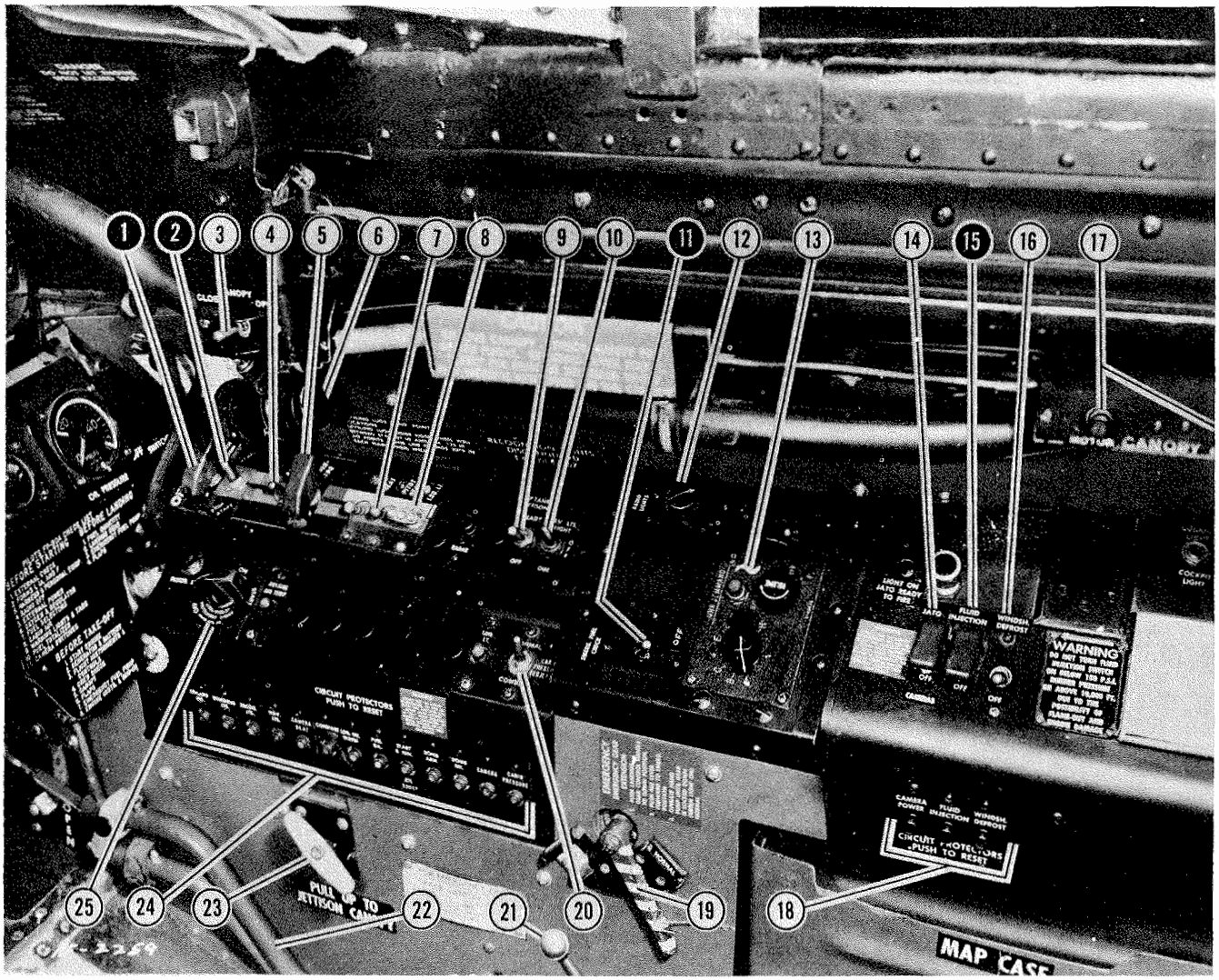
Figure 9A — Instrument Panel (RF-80A-20 and RF-80A-25)



1. SCR 695 Radio (or AN/APX-6 Radar) Control Panel
2. Starting Fuel Switch
3. Air Start Switch
4. Aileron Tab Switch
5. Emergency Fuel Switch
6. Cabin Altimeter
7. Fuel Filter De-icing Switch
8. Fluorescent Light Switch
9. Wing Flap Switch
10. Circuit Breaker Reset Buttons
11. Wing Flap Position Indicator
12. Dive Flap Switch
13. Throttle
14. Microphone Button
15. Cabin Heat Control
16. Landing Gear Horn Shut-off Switch
17. Jato-Jettison Control
18. Throttle Friction Control
19. Fuel Tank Indicator Lights
20. Fuselage Fuel Tank and By-Pass Switch
21. Emergency By-Pass Transfer Valve Circuit Breaker Reset Button
22. Wing Fuel Tank Selector Switch
23. Leading Edge Fuel Tank Selector Switch
24. Drop Tank Selector Switch
25. Aileron Boost Valve Lever
26. Fuselage Tank Pump Circuit Breaker Reset Button
27. Fuel Control Panel
28. Oxygen Regulator
29. Landing Gear Down Lock Release
30. Landing Gear Lever and Release Button

(00) Indicates power plant and fuel system controls and instruments.

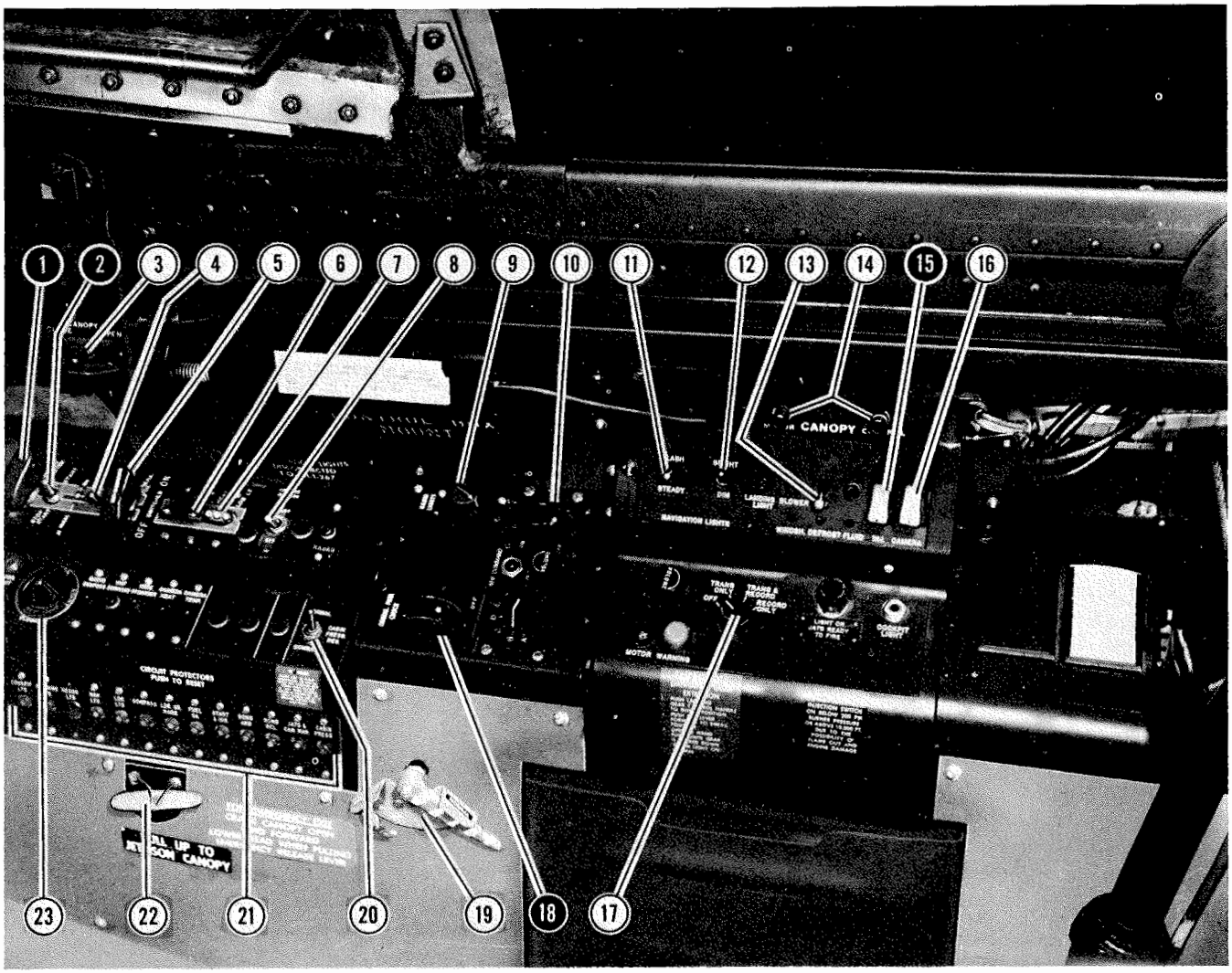
Figure 9B — Cockpit, Left-hand Side (RF-80A-20 and RF-80A-25)



1. Ignition "NORMAL-OFF" Switch
2. Automatic Starter Switch
3. Canopy "OPEN-CLOSE" Switch
4. Battery Master Switch
5. Generator Switch
6. Spotlight
7. Pitot Heat Switch
8. Landing and Taxi Light Switch
9. Drop Tank "READY" Switch
10. Navigation Lights "DIM-BRIGHT" Switch
11. Emergency Fuel Checkout Switch
12. Panel Light Control
13. AN/ARC-3 (or AN/ARC-27) Radio Control Panel
14. Jato-Camera Switch
15. Fluid Injection Switch
16. Auxiliary Windshield Defroster Switch
17. Canopy Circuit Breakers
18. Circuit Breakers
19. Landing Gear Emergency Selector
20. Cabin Pressure Selector Switch
21. Emergency Hydraulic Pump Handle
22. Controls Lock (Stowed)
23. Canopy Jettison Control
24. Circuit Breakers
25. Fluorescent Light Rheostat

(00) Indicates power plant and fuel system controls and instruments.

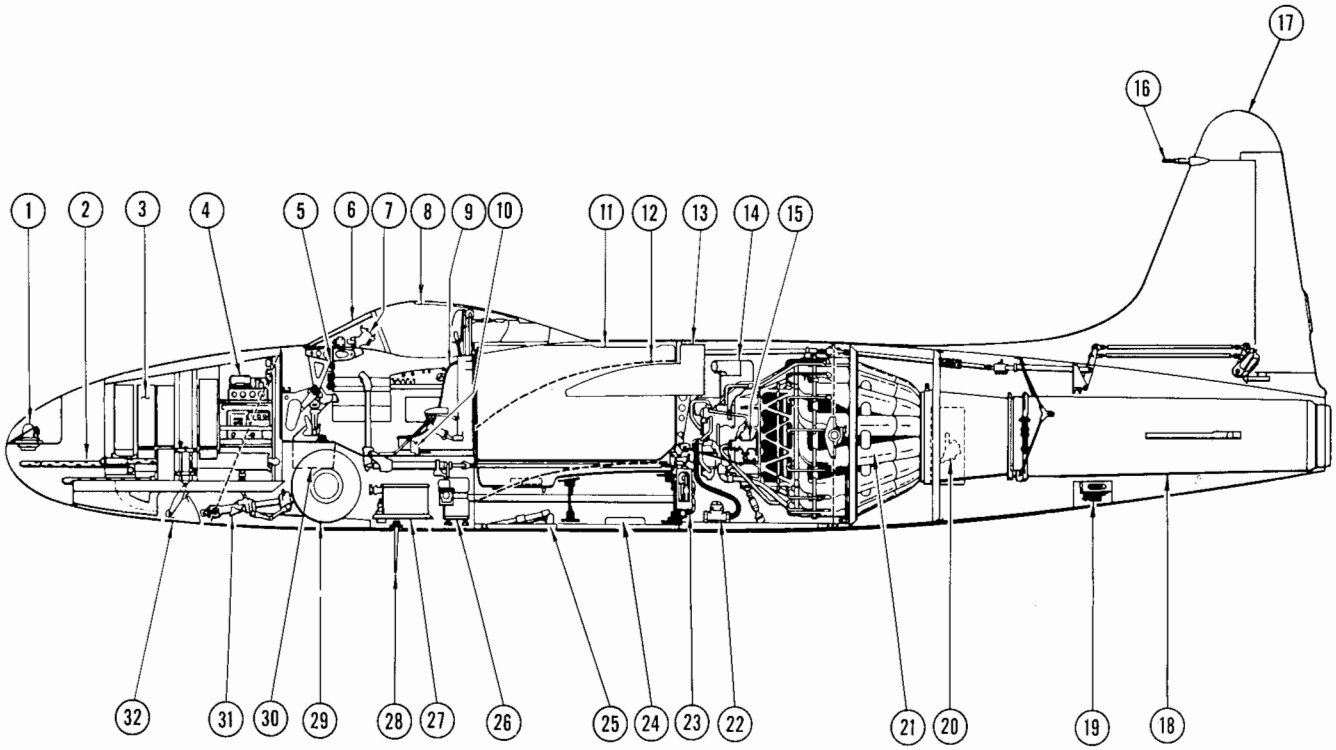
Figure 9C — Cockpit, Right-hand Side (RF-80A-20)



1. Ignition "NORMAL-OFF" Switch
2. Automatic Starter Switch
3. Canopy "OPEN-CLOSE" Switch
4. Battery Master Switch
5. Generator Switch
6. Pitot Heat Switch
7. Landing and Taxi Light Switch
8. Drop Tank "READY" Switch
9. Panel Light Control
10. AN/ARC-3 (or AN/ARC-27) Radio Control Panel
11. Navigation Lights "STEADY-FLASH" Switch
12. Navigation Lights "DIM-BRIGHT" Switch
13. Auxiliary Windshield Defroster Switch
14. Canopy Circuit Breakers
15. Fluid Injection Switch
16. Jato-Camera Switch
17. Recorder Selector Switch
18. Emergency Fuel Check-out Switch
19. Landing Gear Emergency Selector
20. Cabin Pressure Selector Switch
21. Circuit Breakers
22. Jato-Jettison Controls
23. Fluorescent Light Rheostat

(00) Indicates power plant and fuel system controls and instruments.

Figure 9D — Cockpit, Right-hand Side (RF-80A-25)



1. AN/ARN-6 Radio Compass Loop Antenna
2. 50 Calibre Machine Guns (6)
3. Ammunition Boxes (6)
4. AN/ARC-3 (or AN/ARC-27) and AN/ARN-6 Radio
5. Instrument Panel
6. Bullet Proof Windshield Panel
7. Gun Sight
8. AN/ARN-6 Radio Sense Antenna
9. Pilot's Seat
10. "G" Valve
11. Fuselage Fuel Tank
12. Intake Air Duct
13. Water Tank
14. Turbo-Refrigerator
15. Engine Control Valve (Throttle)
16. Air Speed Pitot
17. AN/ARC-3 (or AN/ARC-27) Radio Antenna
18. Tailpipe
19. Gyrosyn Compass Flux Valve
20. Elevator Tab Motor
21. Engine
22. Fuel Flowmeter
23. Aileron Booster Unit
24. AN/APX-6 Antenna (some airplanes)
25. Dive Recovery Flaps
26. SCR-695-A Radio (or AN/APX-6 Radar)
27. Battery
28. SCR-695-A Radio Antenna (some airplanes)
29. Nose Landing Gear
30. AN/APW-11 Radar
31. Landing and Taxi Lights
32. Case Ejection Door

Figure 10 — Fuselage Contents Arrangement

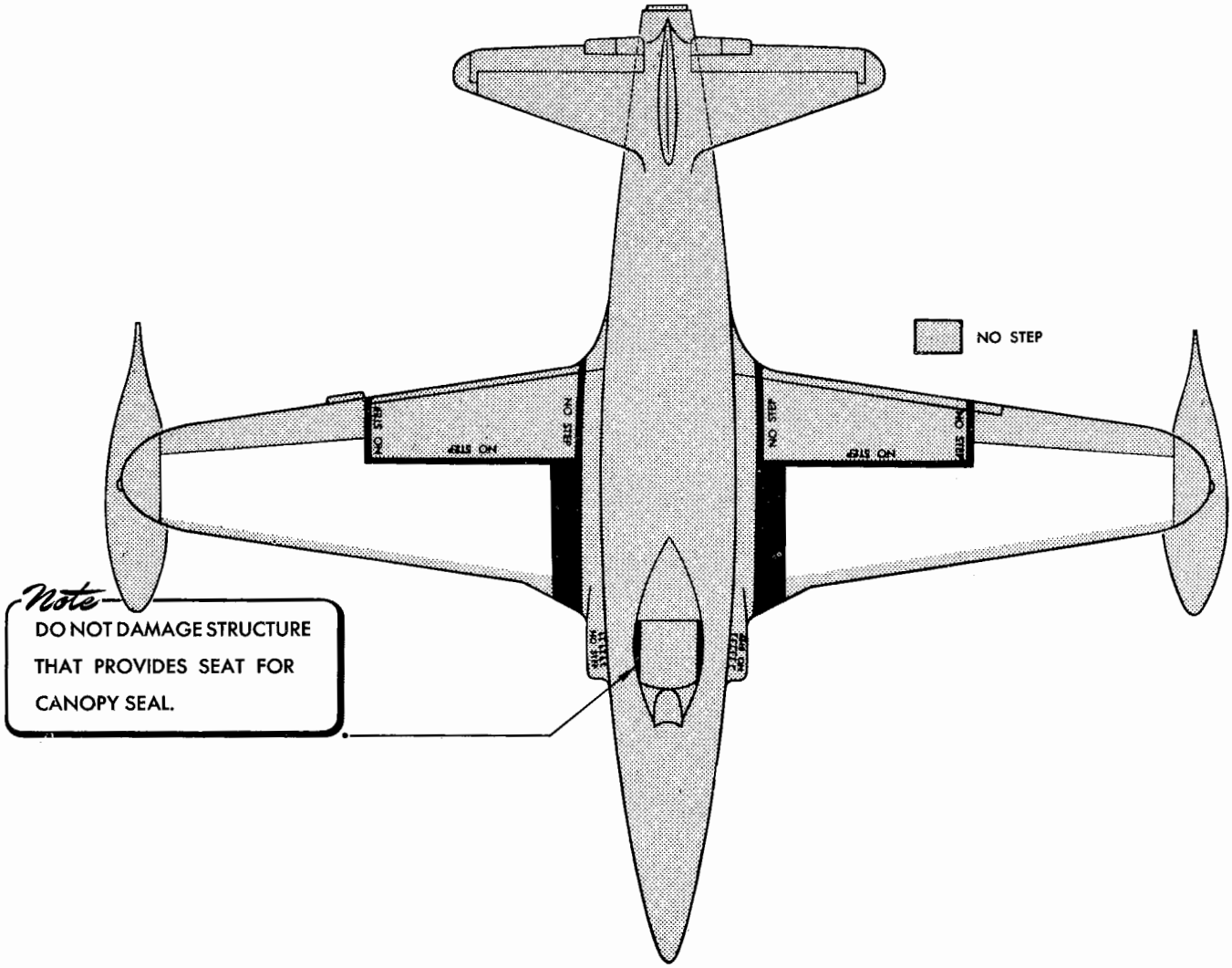
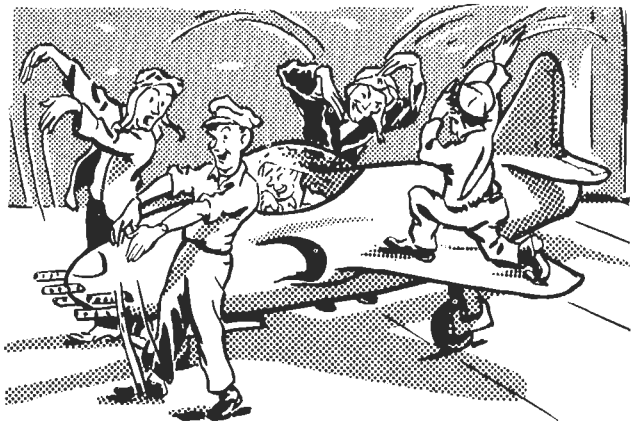
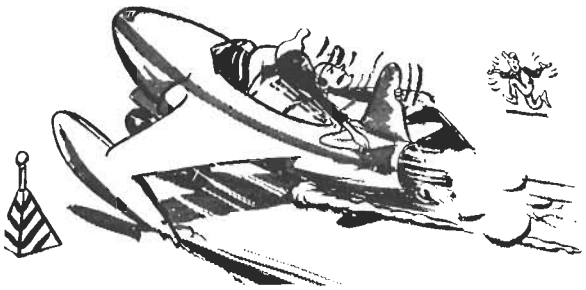


Figure 11 — No Step Diagram

Section II - Normal Operating Instructions



1. BEFORE ENTERING PILOT'S COMPARTMENT.



DON'T ATTEMPT TO TAKE OFF WITH DROPPABLE TANKS FULL, AND AMMUNITION BOXES EMPTY!

a. RESTRICTIONS.

(1) FLIGHT RESTRICTIONS.

(a) Inverted flight, vertical flight with less than 150 gallons of fuel in fuselage tank, or any maneuver resulting in extended negative acceleration, will result in probable engine burner flame-out since there is, at present, no means of insuring a continuous flow of fuel in this attitude.

Note

Whenever engine flame-out occurs, move the engine shut-off valve (throttle on late airplanes) to "OFF" immediately to avoid the danger which might result from attempting a restart with the engine and tailpipe flooded with fuel.

(b) Do not attempt to take off with full drop tanks unless there is sufficient equipment or ballast in the nose compartment.

In F-80A airplanes, ammunition or ballast (about 175 pounds or 600 rounds) will bring the C.G. far enough forward.

In RF-80A airplanes at least one camera in each camera bay (or 50 pounds of ballast in each bay) is required.

WARNING

Without proper ballast, it is possible to obtain a center of gravity position far aft of the rear limit.

(c) Vertical stalls are prohibited as recovery may require more than 10,000 feet.

(d) Do not exceed +7.3 or −3 "G."

(e) The following restrictions affect those aircraft having a non-reinforced aft fuselage section (part number 171689) installed. Avoid acrobatics and maneuvers involving:

i. Violent pull-outs at all speeds.

ii. Large yaw angles at all speeds.

iii. Uncoordinated turns and steep spirals.

iv High rates of roll.

(f) Flaps should not be used in any amount at airspeeds greater than 220 mph.

(2) TAXIING RESTRICTIONS. Brakes must be used for steering as there is no slip stream over the rudder.

(3) AIR-SPEED LIMITATIONS. *(Indicated.)*

(a) Maximum allowable air-speed —.8 Mach number or 580 mph indicated, whichever is slower.

Note

Mach number is defined as the ratio of the airplane true speed to the speed of sound in the undisturbed air through which it passes.

IF THE MACH NUMBER INDICATOR IS NOT INSTALLED OBSERVE THE FOLLOWING MAXIMUM INDICATED SPEEDS.

Altitude (feet)	*Max. Dive Speed (IAS) (mph)*
S.L.	580
5000	570
10000	520
15000	475
20000	430
25000	390
30000	350
35000	310
40000	275

Note

If aileron compressibility buzz (see section II, paragraph 14) occurs below .8 Mach number, limit speed to that at which the buzz occurs.

(b) Wing flaps extended 100%—200 mph.

(c) Wing flaps extended 50%—230 mph.

(d) Wing flaps extended 25%—270 mph.

(e) Landing gear extended—225 mph.

(3A.) OPERATIONAL LIMITATIONS WITH DROP TANKS.

(a) Do not attempt to land with one drop tank full and one empty. Drop the heavy tank at least.

(b) Aircraft with tip tanks installed will not be spun at any altitude.

(c) Aircraft with full 165 gallon tanks will not exceed 5.33 "G" in pull-ups nor —2.0 "G" in nose down or inverted maneuvers.

(d) Removal of drop tank fairings will lower "G" limitations.

(e) For aircraft with 230 gallon centerline mounted tip-tanks:

1. Aircraft will not be stalled or side slipped.

2. Do not jettison tanks when less than half full.

3. In emergencies jettison (½-full or more) above 288 mph IAS in straight and level flight (no yaw). In emergencies during or immediately after takeoff, jettison if necessary regardless of speed or altitude.

Note

The 230 gallon centerline mounted tip tank equipped with jettison spring ejection cartridge may be jettisoned at any speed up to 450 mph (IAS). Above 450 mph (IAS), tip tanks should only be jettisoned in cases of extreme emergencies. At speeds above 450 mph there is a possibility of minor damage to the wing tip and aileron during tip tank jettisoning.

4. If one tank fails to feed, jettison that tank only.

5. Do not exceed 375 mph IAS.

6. Avoid high-speed climbs or steep angles and/or zooming climbs until fuel in tip tanks is exhausted.

7. Aircraft acceleration limits are reduced to +6.0 "G."

(f) Aileron rolls are not recommended with full drop tanks. Aileron rolls, with full drop tanks, at rates faster than 45 degrees per second (one complete roll of 360 degrees in eight seconds) are prohibited.

(g) Release empty tanks one at a time, in a skid, with the tank to be released on the trailing wing (left tank first).

To release tanks individually, place the bomb switch (14, Figures 8 and 8A) to "TRAIN," then press the button on top of the control stick grip. The left tank will drop first and the right tank will drop when the button is pressed a second time.

Note

Aircraft with 230-gallon center line tanks may drop tanks individually only by manual jettison. Both tanks may be dropped at one time electrically by placing tip tank jettison switch in "READY" position and pressing the button on top of control stick grip.

(4) FUEL PRESSURE RESTRICTIONS.

WARNING

Do not allow the burner ring fuel pressure to go below 50 psi at any altitude. At pressures below 50 psi, the engine fire may go out partially, causing a gradual loss of rpm and, if corrective action is not taken, complete flame-out will occur.

(5) ENGINE RESTRICTION. (Except RF-80A-20,-25). Operation above 100% engine rpm and/or 700°C tailpipe temperature is prohibited because of danger of turbine wheel failure.

(6) OVERSPEEDING. Engine RPM in excess of 101% for -A-21 and earlier engines, and 101.5% for -35 engines, is considered overspeeding.

Overspeeding up to 105% for *not more* than 15 seconds will require normal pre-flight inspection, but overspeeding for *more* than 15 seconds will require a 25-hour inspection to determine engine serviceability.

Overspeeding from 105% to 110% for any period of time will require a 25-hour inspection to determine engine serviceability.

When overspeeding not in excess of 110% is encountered, the cause for overspeeding will be corrected prior to further flight.

Overspeeding in excess of 110% for any period of time will require removal of engine for overhaul.

b. TAKE-OFF GROSS WEIGHT AND BALANCE.

(1) On early airplanes the normal take-off gross weight is approximately 12,000 lbs. The maximum gross weight (with drop tanks on and full) is approximately 14,500 lbs. On late airplanes these weights are increased by approximately 800 lbs. See T.O. AN 01-1B-40 Handbook of Weight and Balance.

(2) The center of gravity position will be near the forward limit at take-off unless the drop tanks are on and full. That is, approximately 24% MAC without drop tanks, 27% MAC with full drop tanks, assuming that a full ammunition load is being carried. With the expenditure of ammunition, the center of gravity position moves rearward.

c. EXTERNAL CHECK.

(1) Guns.—Charged. There are no charging provisions in the cockpit.

(2) Armament Doors.—Locked.

(3) Engine Access Doors.—Fastened.

(4) L.G. Down Safety Clips.—Removed.

(5) Pitot Tube Cover.—Removed.

(6) Check the alcohol supply line is connected for fuel filter de-icing if the de-icing system is to be used.

(7) Fuselage fuel tank filler cap for security. — Check.

d. HOW TO GAIN ENTRANCE.

e. MANUAL CANOPY OPERATION.

(1) Release the external hand crank and crank the canopy open.

(2) If a ladder is not available, get on the wing over the wing leading edge and enter the cockpit from the right-hand side.

Note

Do not use the gun sight as a hand hold.

f. ELECTRIC CANOPY OPERATION.

WARNING

Remove and stow the ground safety pin before flight.

Do not open the canopy in flight above 250 mph IAS.

(1) NORMAL OPERATION. Open or close the canopy by means of the interior or exterior "OPEN-CLOSE" switch. The exterior switch will operate the canopy regardless of the position of the battery switch.

(2) CANOPY MANUAL OPERATION (Without Electrical Power).

Note

Operation of the manual release renders jettison mechanism inoperative.

CAUTION

When canopy is opened manually so that open position retainer pin is engaged, the pilot will not be able to close the canopy in flight. Any attempt to operate the canopy electrically while pin is engaged will result in damage to equipment.

(a) FROM INSIDE THE AIRPLANE — pull yellow handle release lanyard (2, figure 7B) and then pull back hard on the canopy.

(b) FROM OUTSIDE THE AIRPANE — pull ring on aft canopy cone and pull back canopy.

2. ON ENTERING THE PILOT'S COMPARTMENT.

a. CHECK FOR ALL FLIGHTS.

(1) Weight and balance Form F.—Check.

(2) Forms 1 and 1A—Check.

(3) Landing gear lever—DOWN.

(4) Parking brakes—Set.

(5) Surface control lock—Remove and stow.

(6) Diluter lever (4, figures 6 and 6A)—"NORMAL OXYGEN."

(7) Oxygen regulator altitude dial—"NORMAL."

(8) Fuel selector switches—"OFF."

(9) Fuel valve circuit breaker—Reset.

(10) Emergency fuel pump switch. (Emergency fuel switch RF-80A-20 and -25)—"OFF."

(11) Air start ignition switch (3, figure 9B) RF-80A-20 and -25—"OFF."

(12) Starting fuel switch (2, figure 9B) RF-80A-20 and -25—"OFF."

(13) Ignition Booster Switch. (Ignition "NORMAL-OFF" switch (1, figures 9C and 9D) RF-80A-20 and -25)—"OFF."

(14) Cabin pressurization control (14, figures 6 and 6A)—"OFF." (Early airplanes only.)

(15) Cabin pressure selector switch — as desired. (RF-80A only.)

(16) Oxygen pressure (32, figure 7 and 33, figures 7A and 7A-1)—400 to 450 psi.

(17) Clock and altimeter—Set.

(18) Fuel Counter (6, figure 9A) RF-80A-20 and -25—Check for proper setting.

(19) Aileron Boost Emergency Shut-off valve lever, "ON" (push forward).

(20) Battery switch (3, figures 8 and 8A)—"OFF."

(21) Generator switch (4, figures 8 and 8A) — check "ON."

(22) Pitot heat switch (6, figures 8 and 8A) — "OFF."

(23) Communication equipment—"OFF."

(24) Water injection switch (10B, figures 8 and 8A)—"OFF."

(25) Gun-camera switch (14; figures 8 and 8A)—"SIGHT AND CAMERA" (F-80A only).

(26) Circuit breaker—Reset.

(27) Camera heat switch—"OFF" (RF-80A only).

(28) Camera switch—"OFF" (RF-80A only).

(29) Cabin pressurization inlet grill and rear duct (Late airplanes)—"OFF."

WARNING

(Early Airplanes Only)
Hold the fuselage tank bypass switch to "NORMAL" for 2 seconds if seal on guard is broken.

(30) External power supply—Connected.

Note

Connect both cables from an adequate auxiliary power source to the dual connection (some airplanes) to insure that on starting at least 9% rpm will be obtained.

(31) De-icing Switch—Check.

(32) Check leading edge tank fuel booster pumps for proper operation with pump switch in "ON" (UP) position. If pumps are operating satisfactorily, the red warning light immediately above the pump switch will remain off. As an added check, ground personnel may determine whether the pump motor is operating by placing a finger on the exposed end of the armature shaft at the inboard end of the pump motor. The pump motor is accessible through the dive flap opening for this check. Return pump switch to "OFF" (DOWN) position.

b. SPECIAL CHECK FOR NIGHT FLYING.

(1) Landing light (7, figures 8 and 8A)—Test. *(Five seconds maximum.)*

(2) Fluorescent lights (7, figures 6 and 6A and 19, figures 8 and 8A)—Test.

(3) Deleted.

(4) Navigation lights (8, figure 8)—Test.

(5) Portable spotlight—Test.

3. FUEL SYSTEM MANAGEMENT
(except RF-80A-20 and -25)
(See figure 12.)

a. NORMAL SEQUENCE OF FUEL TANK USE.

(1) Fuselage tank (only for starting through completion of take-off).

(2) Drop tanks.

(3) Wing tanks.

(4) Fuselage tank to 100 gallon level.

(5) Leading edge tanks.

(6) Fuselage tank to empty.

b. The procedure for accomplishing automatic transfer of fuel from the drop tanks, the wing tanks, and the leading edge tanks, during normal operation of the system, is as follows:

(1) When starting the engine, the fuselage fuel tank switch (19, figures 6 and 6A) only will be placed in the "ON" (UP) position.

(2) After take-off is completed and the wing flaps have been returned to the "UP" position, all fuel switches with the exception of the leading edge fuel tank switch are "ON" (UP) position.

(3) The completion of the transfer of drop tank fuel will be indicated by the warning light immediately above the drop tank switch. In order to lessen the possibility of drop tanks collapsing because of differential air pressures, leave the drop tank switch "ON."

(4) Upon completion of the transfer of the wing tank fuel, as indicated by the warning light over the wing tank switch, the switch will be placed in "OFF" (DOWN) position.

(5) At this time, only the fuselage and the drop tank switches will remain in "ON" (UP) position. This switch will remain in "ON" (UP) position at all times during normal operation of the system. In the event that use of the by-pass system becomes necessary, the instructions contained in Section I, paragraph 9. *b.* (4), are applicable.

(6) When fuselage tank fuel has been consumed to a level of 100 gallons, place the leading edge tank switch in "ON" (UP) position.

(7) When all leading edge tank fuel has been transferred, as indicated by the warning light above the leading edge tank switch, place the switch in "OFF" (DOWN) position.

3A. FUEL SYSTEM MANAGEMENT
(RF-80A-20 and -25 only)
(See figure 12)

a. NORMAL SEQUENCE OF FUEL TANK USE.

(1) Fuselage tank (only for starting thru completion of take-off).

(2) After take-off, turn on all tanks (except drop tanks if not installed). Fuel will be transferred to the fuselage tank automatically in the following sequence:

(a) Drop tanks

(b) Leading edge tanks

(c) Wing tanks

4. STARTING THE ENGINE

WARNING

After any ten hot starts on the J33-A-9, -A-17, -A-21, -A-23, -A-35 and -GE-11 engines, the engines shall be inspected. A hot start is one in which the exhaust temperature exceeds 1000°C (1832°F).

The 10 hot starts constitute an inspection requirement regardless of the time between the starts and therefore all over temperature operation must be entered in Form 1A.

WARNING

When operating without blast deflectors, observe dangerous exhaust blast areas aft of the airplane. For danger zones see Figure 11A. The suction effect at the intake duct entrances is not dangerous, but loose clothing or small articles may be drawn in if a person stands close to the entrance.

a. STARTING PROCEDURE.
(except RF-80A-20 and -25)

Note

All ground starts will be accomplished whenever possible with the aircraft *heading into* the wind.

(1) Throttle—"OFF."

(2) Engine shut-off valve (15, figure 6)—"OFF" (early airplanes only).

(3) Ignition booster switch—"OFF."

(4) Fuselage fuel tank switch (19, figures 6 and 6A) in "ON" (up) position. Leading edge, drop and wing tank switches "OFF" (down).

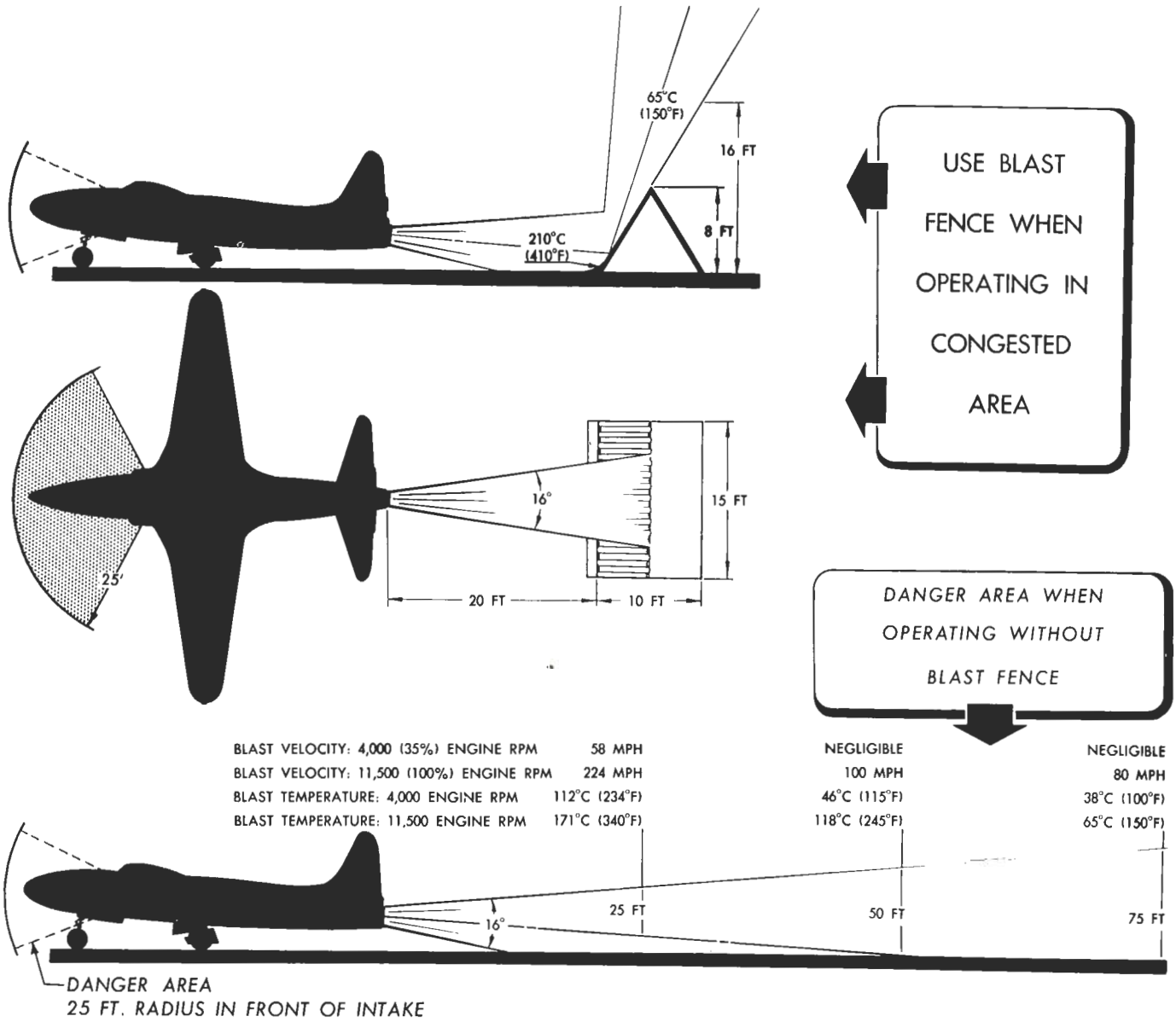
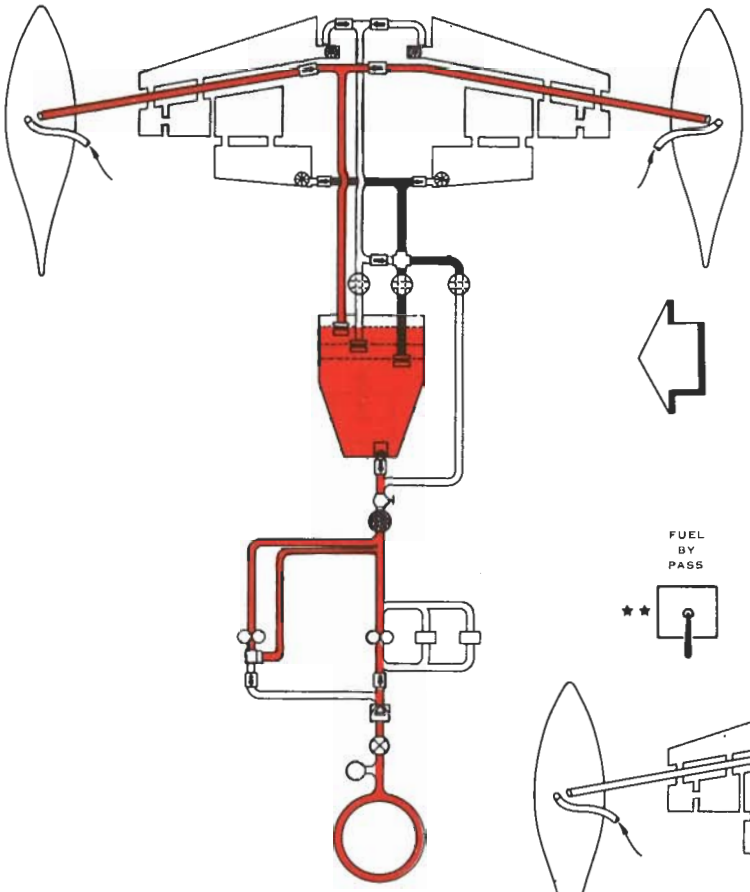


Figure 11A — Exhaust Blast Danger Areas

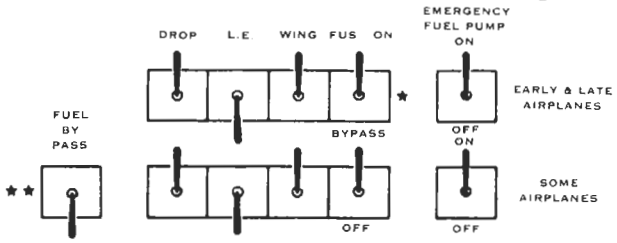


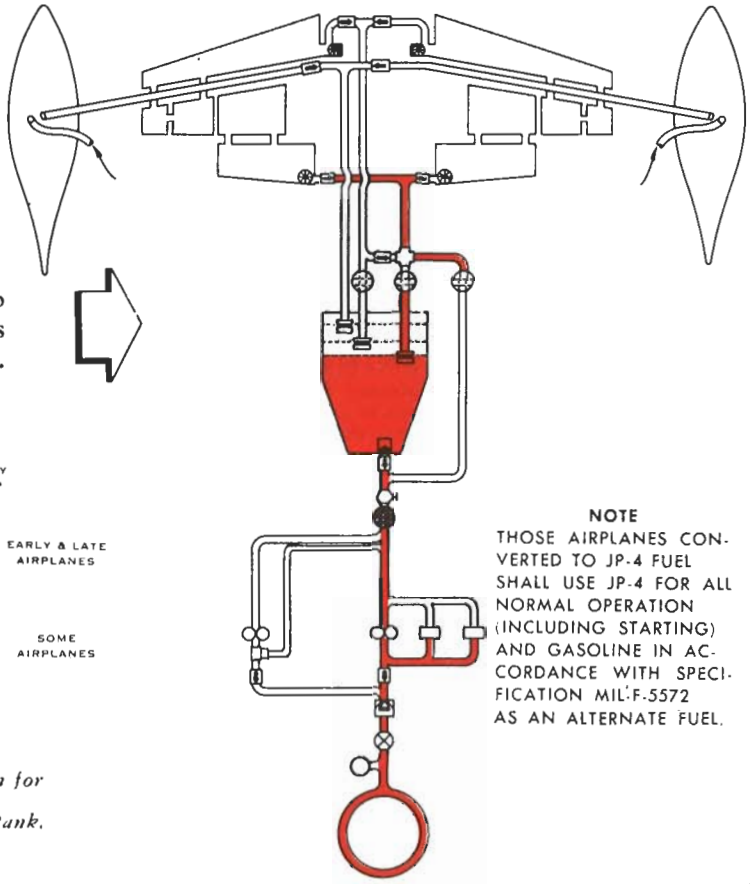
NORMAL OPERATION

Drop tanks and wing tanks full and feeding pressure to the fuselage tank. Wing leading edge and wing tank float valves closed while drop tanks supply fuel.

Emergency fuel pump *"ON"* for take-off and landing. Fuel passing through the emergency pump does not go to the engine unless the engine fuel pump pressure fails.

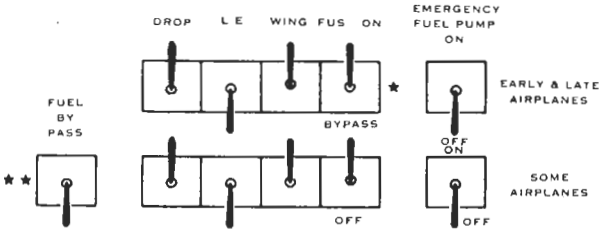
Note: Only the fuselage tank switch will be *"ON"* from the time the engine is started until take-off is completed.





NORMAL OPERATION

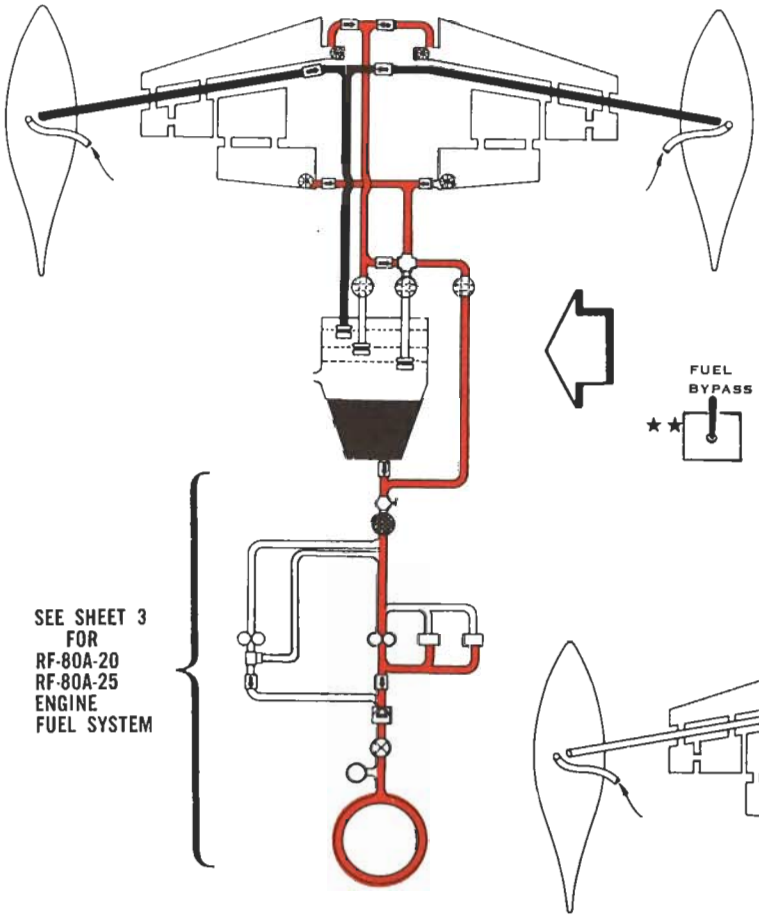
Turn each tank *"OFF"* (except the drop tank) as the lights over the tank switches indicate that that group of tanks is empty.



NOTE
THOSE AIRPLANES CONVERTED TO JP-4 FUEL SHALL USE JP-4 FOR ALL NORMAL OPERATION (INCLUDING STARTING) AND GASOLINE IN ACCORDANCE WITH SPECIFICATION MIL-F-5572 AS AN ALTERNATE FUEL.

★*Spring loaded switch, hold in desired position for two seconds (early airplanes only).*
★★*Spring loaded switch, to bypass fuselage fuel tank, hold in down position for two seconds.*

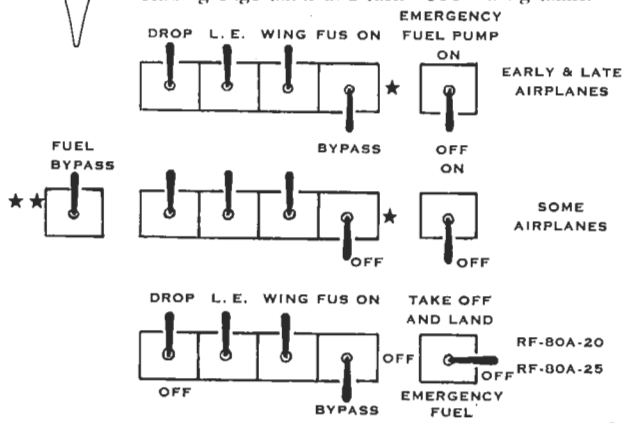
Figure 12 (Sheet 1 of 3 Sheets)—Fuel System Management

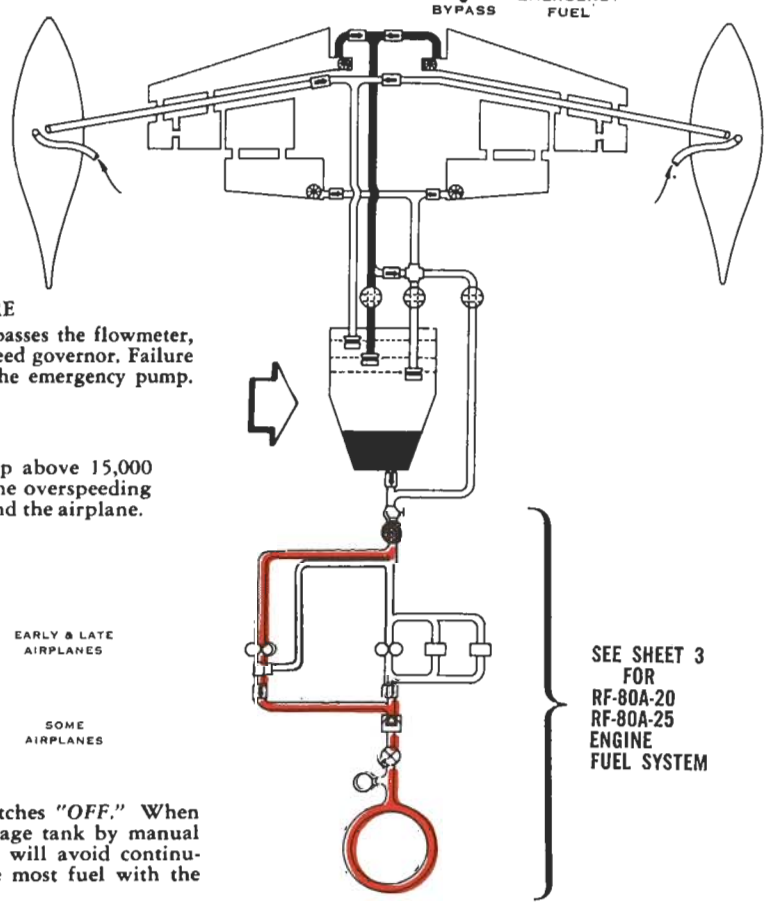


FUSELAGE TANK LEAKAGE

If fuel remains in the drop tanks, turn wing tanks *"OFF"* and maintain fuel in the fuselage tank below the level of the leak by manual operation of the drop tank switch. (See black line.)

When the drop tanks and the fuselage tank are empty, turn wing tank switches *"ON"* and turn the fuselage tank bypass switch to *"BYPASS."* Turn the fuselage tank pump switch *"OFF."* (See red lines.) After wing tanks are empty, turn *"ON"* leading edge tanks and turn *"OFF"* wing tanks.



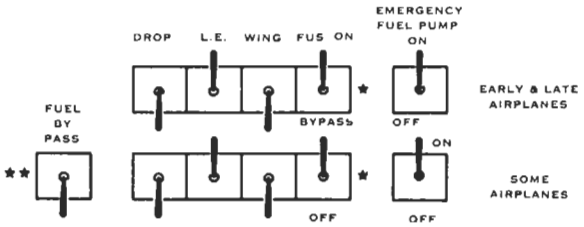


ENGINE ACCESSORY FAILURE

Turn the emergency fuel pump *"ON."* Fuel bypasses the flowmeter, the engine fuel pump, the barometric and the overspeed governor. Failure of any of these units will not affect operation of the emergency pump. (See red line.)

WARNING

When operating on the emergency fuel pump above 15,000 feet extreme care must be taken to avoid engine overspeeding which will result in destruction of the engine and the airplane.



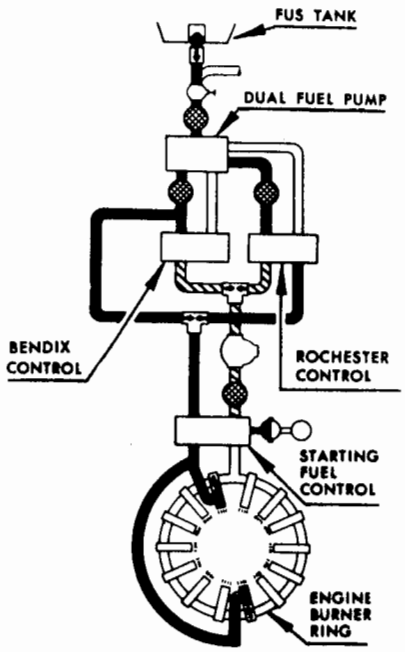
GENERATOR FAILURE

Turn wing leading edge and wing tank switches *"OFF."* When the drop tanks are empty, feed fuel into the fuselage tank by manual operation of the transfer system. This precaution will avoid continuous operation of the pumps and will transfer the most fuel with the least power. (See black line.)

When the battery power is gone, prepare to land before the fuselage tank is empty.

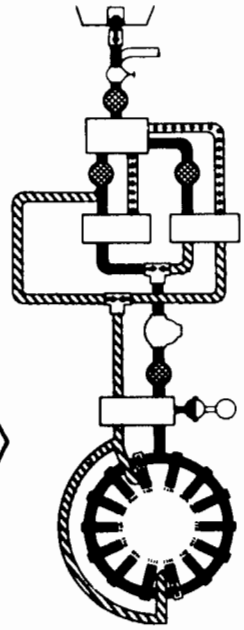
★*See footnote, Figure 12, Sheet 1 of 3.*
★★*See footnote, Figure 12, Sheet 1 of 3.*

Figure 12 (Sheet 2 of 3 Sheets) — Fuel System Management



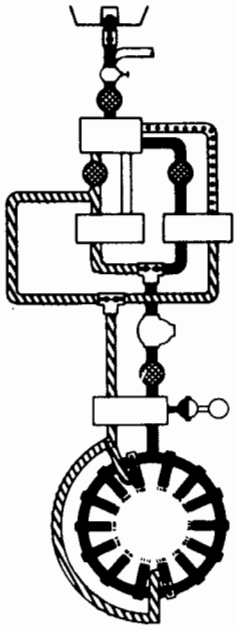
STARTING FUEL FLOW (AUTOMATIC)

Fuel is directed to burners number 7 and 14 until ignited and then to all burners automatically by the Starting Fuel Control.



NORMAL FUEL FLOW

Main fuel pump pressure is directed through the Bendix Control to main burner ring. Emergency pump pressure is bypassed.



EMERGENCY FUEL FLOW

Emergency fuel pump pressure is directed through Rochester Control to main burner ring.

WARNING

When operating on emergency fuel system use extreme care to avoid engine overspeeding.

FUEL FLOW STATIC FUEL BYPASS FUEL

Figure 12 (Sheet 3 of 3 Sheets) — Fuel System Management (RF-80A-20 and -25)

(5) Starter switch (2, figures 8 and 8A)—push to "START" and hold.

(6) At 9% rpm, place ignition switch in "NORMAL" position.

(7) Emergency fuel pump switch—"ON".

CAUTION

A defective fuel control valve will permit fuel under pressure to enter the engine. Therefore, turning on the ignition before turning on the emergency fuel pump lessens the possibility of high tail pipe temperature and excessive combustion rumble when starting.

(8) Engine shut-off valve (early airplanes) "ON," and move throttle to approximately one-half open and immediately return hand to emergency fuel pump switch.

WARNING

To avoid tail-pipe fire do not turn ignition booster switch "NORMAL" *after* moving throttle to one-half open position.

(9) At the instant combustion rumble is heard, or the instant the tail-pipe temperature starts to rise, turn the emergency fuel pump "OFF" and immediately retard the throttle to the idle position.

Note

Do not release the starter switch at this time.

(10) Adjust the throttle as required to keep the tail-pipe temperature at 700°C until the engine reaches 17% rpm. At approximately 17% rpm release the starter switch, then maintain tail-pipe temperature between 500°C and 600°C until the engine reaches idling speed (35% rpm).

Note

In the above step the reaction of each airplane will be different. With some engines, it will be necessary to pull the throttle to idle immediately to prevent the tail-pipe temperature from exceeding the starting temperature limit.

WARNING

If the tailpipe temperature reaches 1000°C, release the starter switch and close the shut-off valve immediately (on late airplanes move the throttle to "OFF"). Repeat the starting operation after pulling the tail down in order to drain all fuel from the tailpipe before restarting.

CAUTION

If the starter should be accidentally released before 17% rpm is reached, and the engine does not continue to accelerate, shut down engine. A restart will not be attempted until engine and aft section have been completely drained of any accumulated fuel.

CAUTION

When the engine shut-off valve is moved to "ON" (throttle open on late airplanes) in starting and ignition does not occur within three seconds after fuel pressure comes up, release the starter switch and pull the engine shut-off valve (or throttle on late airplanes) to "OFF." *Always release the starter switch first.*

(11) At idling speeds (about 35% rpm) check:

(a) Tailpipe temperature—600°C maximum.

(b) Fuel pressure—within limits.

(c) Oil pressure—2 to 6 psi.

(12) Disconnect external power supply and turn the battery switch "ON."

(13) Communication equipment—"ON."

b. AUTOMATIC START — RF-80A-20 and -25 ONLY.

Note

Ground starts will be accomplished whenever possible with aircraft *heading into* the wind.

(1) Throttle — "OFF."

(2) Ignition "NORMAL-OFF" switch — "OFF."

(3) Starting fuel switch — "OFF."

(4) Emergency fuel switch in "OFF" position.

(5) Automatic starter switch—push to "START" position, hold for three seconds and release.

(6) At 9 to 10% speed place ignition "Normal-Off" switch in "NORMAL" position and then place starting fuel switch in "AUTO" position. Do not attempt to start the engine below 9% speed as it will cause serious damage to the engine. In any instance that 9% speed cannot be obtained, push the automatic starter switch to "STOP-START" position and release. Then secure an adequate source of auxiliary power prior to attempting a restart of the engine.

(7) Allow the engine to stabilize at 25-35% on automatic starting control before opening throttle. This stabilized speed varies with ambient air temperature. Position fuel tank switches as required.

WARNING

If tail-pipe temperature reaches 900°C and stays there for five seconds, shut down the engine. If cause is known for the high temperature start, correct it. Repeat start. If 900°C, five second limit is exceeded shut down the engine. The engine should be checked for malfunction before any further starts.

Note

In the event a false start or flame-out is experienced, a restart will not be attempted until engine and aft section have been completely drained of any accumulated fuel.

Note

If ignition does not occur within 10 seconds after the starting fuel switch is turned to the "AUTO" position and released, push starter switch to the "STOP-START" position and then check the ignition system before attempting to make another start.

(8) Place automatic starter switch in "OFF" position after the throttle has been opened to "idle."

Note

Do not disconnect the auxiliary power source dual cables until the throttle is moved out of the "OFF" position (with the battery switch in the "OFF" position), or the engine fuel supply will be cut off. If the engine stops when the throttle is opened there is something wrong with the normal engine fuel system. Investigate the difficulty and correct.

Note

It is recommended that the starting fuel switch be turned off by pushing the guard down to avoid the possibility of turning to the "MANUAL" position instead of the "OFF" position. This switch must be in the "OFF" position at all times, except during actual starting and stopping operations. If this switch is left in the "AUTO" position the automatic starting system would be energized whenever the throttle was placed in the "OFF" position, and fuel would be supplied to the engine. If it is left in the "MANUAL" position both the normal and emergency fuel systems would be supplying fuel. Under these conditions there is no governor protection and overspeeding is very likely to occur.

(9) With the throttle in the "IDLE" position, check that instruments are in desired ranges.

(10) Disconnect the external power source and turn the battery switch "ON."

c. MANUAL START—RF-80A-20 and -25 ONLY. The engine will normally be started on the automatic system. The manual system will be used only in the event the automatic system fails to function properly.

Note

Ground starts will be accomplished whenever possible with the aircraft *heading into* the wind.

(1) Throttle—"OFF."

(2) Ignition switch in "OFF" position.

(3) Automatic starting control switch in "OFF" position.

(4) Fuselage fuel tank switch—"ON" (up) position.

(5) Emergency fuel switch — "EMERGENCY."

(6) Starter switch push to "START" and release.

(7) Turn starting fuel switch to "MANUAL."

(8) At maximum obtainable rpm (not less than 9% rpm), move the throttle rapidly to the wide open position, and as soon as the fuel pressure starts to build up, retard the throttle quickly to "IDLE." As soon as combustion rumble is heard or the tailpipe temperature starts to rise, turn the starting fuel switch "OFF."

Note

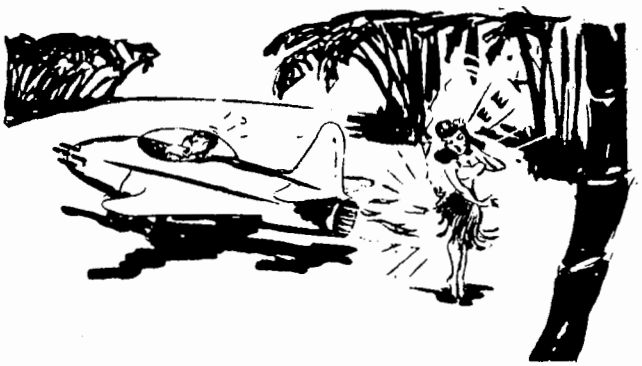
It is recommended that the starting fuel switch be turned "OFF" by pushing the guard down to avoid the possibility of accidentally turning to the "AUTO" position.

Note

If ignition does not occur within three seconds after the throttle is opened, return the throttle to "OFF" and push the starting switch to the "STOP-START" position and release.

CAUTION

A restart will not be attempted until engine and aft section have been completely drained of any accumulated fuel.



(9) After the engine starts, adjust the throttle as required to keep the tailpipe temperature below 900°C. Attempt to maintain the temperature between 800°C and 900°C until the engine reaches idle rpm.

Note

It may be necessary to pull throttle back beyond the idle position to keep from overheating during the start.

(10) Accelerate engine to about 68% rpm.

(11) Retard throttle rapidly and at the same time turn emergency fuel switch "OFF" in order to return engine to main fuel system.

CAUTION

Switching from emergency to normal fuel system at low rpm will cause an undesirable surge.

Note

Do not disconnect cart plug until emergency fuel switch is in the "OFF" position (with battery switch off) or a hot surge may occur in the changeover to the main fuel system.

(12) At idling speed (34% rpm) check that instruments are in desired ranges.

(13) Disconnect external battery cart and turn the battery switch "ON."

d. INSTRUCTIONS IN CASE OF FIRE.—There are no fire extinguishers on this airplane. If fire does occur during the starting operation,

(1) Release the starter switch.

(2) Pull the engine shut-off valve "OFF." (Throttle to "OFF" on late airplanes.)

(3) Turn all the tank selector switches "OFF."

5. GROUND TEST.

Note

No warm-up is required. If the oil pressure is up and the engine will turn up to 100% rpm, take-off may be made immediately. Gyro instruments may not be up to speed and will not give proper indications until the engine has been running five minutes. On airplanes equipped with an electrically-driven hydraulic pump, the hydraulic pump is not operative until the generator is charging, which is indicated by the ammeter.

a. Aileron tab (2, figure 6)—Check operation and set in neutral position. Left aileron only.

b. Elevator tab (20, figure 7 and 30, figures 7A and 7A-1)—Check operation and set in neutral (green light on).

Note

Late airplanes have aileron and elevator trim tab controls combined in one switch on the top of control stick.

c. Dive flap (9, figures 6 and 6A)—Check operation (be sure the ground crew is clear of the flaps) and place in "UP" position.

d. Wing flap (10, figures 6 and 6A)—Check operation.

e. Surface controls—Check for freedom.

f. Landing gear "Stiff knee" clip—Removed by ground personnel.

g. EMERGENCY FUEL SYSTEM CHECK. (RF-80A-20 and -25 only)

(1) Set engine speed at 55% while operating on main fuel system.

(2) Starting Fuel Switch—"OFF."

(3) Place emergency fuel switch in "TAKE-OFF AND LAND." Check that emergency system remains inoperative under normal conditions and return emergency fuel switch to "OFF."

(4) Push the emergency fuel check switch and hold. (When the engine changes over to the emergency fuel system, the green and amber emergency fuel indicator lights will come on. The red emergency fuel indicator light will stay on.)

Note

Engine speed will drop momentarily but should return to speed near the original setting.

Note

From this point, the pilot can return to the normal fuel system as explained in step (5) following, or advance the throttle to determine the maximum power available, if he so desires. However, the tailpipe temperature must be maintained within limits by means of the throttle as the Bendix control is not operating.

(5) Release the emergency fuel check switch while rapidly retarding the throttle. This must be done to return the engine to the normal fuel system. (When the engine returns to the normal fuel system the green and amber lights will go out, the red light will stay on.)

Note

If a flame out occurs when the emergency fuel check switch is turned on, repeat the above procedure at a different engine speed until a satisfactory change-over is accomplished.

6. TAXIING INSTRUCTIONS.

a. The airplane will start to move when the engine speed is increased to about 60% rpm. Speed should be maintained in turns of short radius. It is difficult to start moving with the nose wheel turned sharply or on soft ground. Brakes must be used for steering.

b. Taxi time should be cut to the absolute minimum. The fuel consumption while taxiing is about the same, in gallons per hour, as the fuel consumption during maximum range cruising at 35,000 feet.

Note

A good rule to remember here is: *Every minute spent on the ground taxiing requires between three and four gallons of fuel or subtracts about 7 miles from the cruising range of the airplane*

6A. JATO TECHNIQUE.

The effect of jato on airplane trim is very slight and no special technique is required. However, jato performance will depend somewhat upon the firing point. Minimum ground roll will be obtained when the jatos are fired shortly after the start of the take-off run, but the best performance in clearing a 50-foot obstacle will be obtained by firing the jatos later in the take-off run. The distances required to break ground or clear a 50-foot obstacle and the firing points are shown on the take-off chart in Appendix I.

7. TAKE-OFF.

a. BEFORE TAKE-OFF.

Note

The take-off center of gravity of this airplane, with full ammunition load, is near the forward limit unless the drop tanks are on and full. It is important that this condition be present at take-off so that the center of gravity with ammunition gone will not be too far aft for landing.

WARNING

Do not attempt to take off with full drop tanks unless there is sufficient equipment or ballast in the nose compartment. (See Section II, paragraph 1*a*.)

(1) Shoulder harness and safety belt tightened and inertia reel lock control (late airplanes) unlocked.

(2) Wing flaps (10, figures 6 and 6A) *down* 70%.

WARNING

Do not attempt take-off except at this flap setting or the speed required for take-off and the length of runway necessary will be greatly increased.

(3) Tab position during take-off is important. It is best to use neutral tab (green light on) if the drop tanks are on and full; slightly nose up if the drop tanks are off or empty.

(4) Taxi a few feet straight down the runway so that the nose wheel will be centered.

(5) Hold the brakes.

(6) Close and lock the canopy. Push the canopy forward and swing the locking handle up.

CAUTION

To preclude inadvertently jettisoning the canopy when opening or closing it, keep all foreign objects clear of the canopy jettison bar located inboard and below the canopy rail along the right side of the cockpit.

(7) Turn bomb arming switch to "SAFE" and bomb switch to "ALL."

(8) Emergency fuel switch (RF-80A-20 and -25)—"TAKE-OFF and LAND."

WARNING

Check that green emergency fuel indicator light is on and red and amber lights are out.

(9) Check fuselage tank by-pass switch "OFF" (some airplanes).

CAUTION

To avoid an excessive rpm drop, do not use the fuel filter de-icing system below 50% rpm except in an emergency.

(10) Open the throttle slowly to 100% rpm, and check:

(a) Instrument pressure (24, figures 7, 7A and 7A-1)—Check within limits.

(b) Hydraulic pressure (27, figures 7, 7A and 7A-1)—Check within limits.

(c) Ammeter (15, figures 7 and 19, figures 7A and 7A-1)—Check for charge.

(d) Oil pressure—Check within limits.

(11) Advance the throttle to full "OPEN" and check to see that the engine does not exceed 101% rpm (101.5% for -35 engines).

CAUTION

Open throttle slowly to prevent flame-out.

(12) Start emergency fuel pump. Three to four psi pressure drop will indicate normal operation of the emergency fuel system.

WARNING

Take -off is prohibited unless the fuel pressure is higher than the minimum indicated pressures listed in the chart at the bottom of this page.

b. NORMAL TAKE-OFF TECHNIQUE.

(1) Release the brakes.

(2) If using water injection for take-off, turn on the water injection switch and check cockpit air for absence of noxious fumes.

(3) Maintain directional control by a minimum use of the brakes until the rudder becomes effective. Rudder control will begin to be effective at about 75 mph indicated air speed.

(4) As elevator control becomes effective (about 80 mph) lift the nose of the airplane until the nose wheel just clears the runway. In this attitude the total drag is minimized and the acceleration will be most rapid.

(5) Pull the airplane off the ground at 125 mph with no drop tanks and at 135 mph with drop tanks (140 mph with 230 gallon drop tanks).

Note

To clear an obstacle in the minimum distance do not allow the airspeed to increase more than 10 mph above take-off airspeed.

(6) Landing gear (29, figures 6 and 6A)—"UP" only when definitely airborne.

(7) Wing flaps (10, figures 6 and 6A)—"UP" between 160 and 200 mph.

(8) Climb at about 180 mph to a safe altitude, then accelerate to best climbing speed for the remainder of the climb.

(9) Drop tank, L. E. tank, and wing tank fuel switches "ON" for RF-80A-20 and -25; drop tank and wing tank switches "ON" for other airplanes.

MINIMUM INDICATED FUEL PRESSURE AT 100% RPM
(Does not apply to aircraft with J-33-A-35 engines)

	AIR TEMPERATURE					
Altitude	17.8°C	−6.7°C	4.4°C	15.6°C	26.7°C	37.8°C
S.L.	390	370	350	330	310	290
1000′	369	349	330	309	289	269
2000′	350	330	310	290	270	250
3000′	330	310	290	270	250	230
4000′	308	288	268	248	228	208
5000′	290	270	250	230	210	190
6000′	271	251	231	211	191	171

(10) Turn the emergency fuel pump switch (5, figures 6 and 6A) "OFF."

WARNING

(Airplanes except RF-80A-20 and -25)

It is not always possible to know whether the engine is running on the main or the emergency fuel pump. Unless a fuel system malfunction is experienced, turn "OFF" the emergency fuel switch at 5000 ft. Check the fuel pressure simultaneously with turning the emergency fuel pump switch "OFF." If a drop in fuel pressure is noted, immediately turn the emergency fuel pump switch "ON." If a flame-out has occurred make a normal air start leaving the emergency fuel pump switch "ON" and land as soon as possible.

(RF-80A-20 and -25 only)

Check to see that the amber emergency fuel indicator light is out before putting the emergency fuel switch in the "OFF" position. If the amber light is on, leave the switch in the "T.O. & LAND" position and circle the field and land.

(11) Turn bomb selector switch "OFF."

(12) Gun-camera switch—"OFF" if normal. (2.75 psi) cabin pressure differential is desired.

CAUTION

Although it is possible to take off at five to ten mph slower than noted above, taking off at too low an air speed will cause the airplane to settle back on the ground. It must be remembered that sufficient airspeed is important when taking off in this airplane because there is no propeller slip stream to increase the lift of the wing. Also, failure to extend the flaps on take-off will probably cause the airplane to settle back on the ground unless the speeds recommended above are definitely increased.

8. ENGINE FAILURE DURING TAKE-OFF.

a. If the engine power should fail before leaving the ground, move the fuel shut-off valve to "OFF" (on late airplanes, move throttle to "OFF") immediately and use the brakes as required. If there is insufficient runway for braking, jettison the drop tanks and retract the landing gear.

b. If total power failure occurs soon after leaving the ground, pull the engine shut-off valve to "OFF," (on late airplanes, move throttle to "OFF), release the tanks or bombs by pushing the button on the control stick (See Section V, par. 3*b*) and land *straight ahead.* Leave the landing gear up if it is not possible to land on the runway. Leave the wing flaps extended. Pull the battery emergency disconnect switch before contact with the ground.

c. If the engine rpm should drop to about 90% at any time during a take-off, the first thing to do is to make a decision whether to go around or to stop the airplane on the ground.

Note

This sudden drop from 100% rpm to about 90% rpm usually indicates that one of the engine fuel system parts has failed. In this condition, the engine will continue to run at not less than 200 psi burner pressure (if the throttle is full "OPEN") on the emergency fuel pump alone and this power is enough to maintain flight without the drop tanks (no excessive climb).

(1) If the partial power failure occurs on the ground, stop the airplane on the runway. If the stopping distance is not sufficient, retract the landing gear and slide. *If the airplane is on the ground, it will be necessary to push down on the landing gear lever downlock release (27, figures 6 and 6A) before the gear lever can be moved.*

(2) If the airplane is already airborne:

(a) Throttle — wide open. (Not over 100% rpm.)

(b) Water injection switch—"ON" after engine has accelerated above 90% rpm (if water is available).

Note

The take-off throttle setting will usually be less than wide open, in which case increased power will be available at the wide open setting.

(c) Release the drop tanks.

(d) Landing gear—"UP."

(e) Push the nose of the airplane down as much as necessary to obtain a constant increase in air speed.

(f) Start to milk the flaps up at 135 mph.

(g) When sufficient speed and altitude have been obtained, circle the field and land.

Note

It is suggested that pilots practice flying the airplane under simulated partial power failure conditions at a safe altitude, (i.e.) gear down, flaps 80%, airspeed approximately 120 mph indicated with the drop tanks off. Set the power at 210 psi burner pressure, and check the loss of altitude which is necessary to obtain level flight. Under the above conditions, it will be possible to maintain level flight without loss of altitude. At heavier weights (with drop tanks installed) some sacrifice in altitude must be made to maintain flying speed of about 135 mph until the gear and flaps can be retracted.

9. CLIMB.

a. The speeds for best climb are given in the Take-off, Climb, and Landing charts (Appendix I).

b. The most economical climb can be obtained at 100% rpm. Do not operate at this power for more than 30 minutes at any one time.

c. Water injection switch—"OFF," after supply is consumed.

9A. OPTIONAL FUEL TRANSFER CHECK DURING FLIGHT

If the pilot desires, the following fuel availability and transfer check may be made during flight:

a. Place all switches to the "OFF" position except the fuselage and tip tank switches.

b. Make a positive check with the fuselage fuel gage and tip tank indicator light to assure fuel transfer.

c. Place the tip tank switch to the "OFF" position.

d. Place leading edge tank switch in the "ON" position and check for fuel transfer with fuselage fuel gage and leading edge tank indicator light.

e. Place leading edge tank switch to "OFF" position.

f. Place wing tank switch to "ON" and check as before with fuselage fuel gage and indicator light.

g. Place tip tank switch to "ON" and proceed with normal automatic fuel transfer.

10. GENERAL FLYING CHARACTERISTICS.

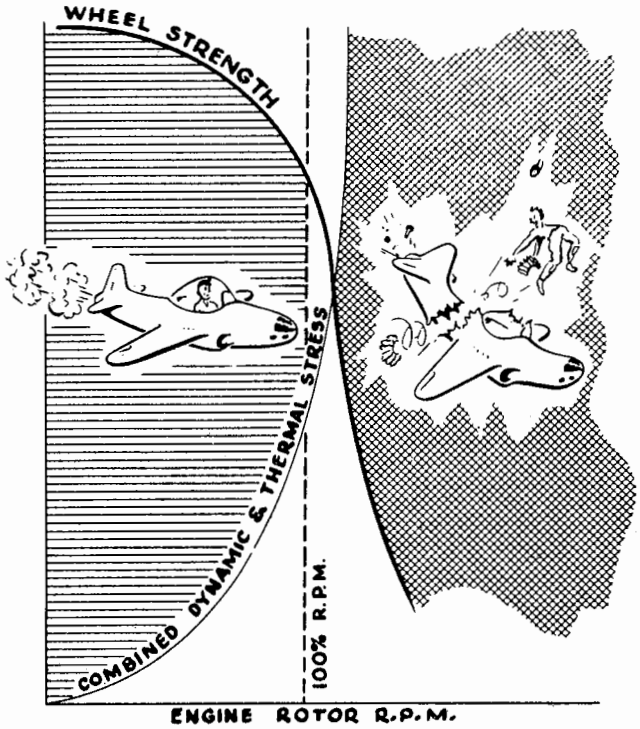
The advantage of this airplane lies in its speed. At altitude, its best climbing speed is greater than the top speed of most conventional fighters. The maximum range cruising speed at altitude is also greater than the top speed of some conventional equipment.

The disadvantage of this airplane lies in its slow acceleration from low speeds at altitude. However, once the airplane is in the air, there is ordinarily no reason to allow the speed to go below the best climbing speed or the maximum range cruising speed until approaching the field for landing. Below 300 mph, the acceleration is lower than in conventional fighters. Above this speed, the acceleration of the F-80A is greater. The zooming ability is superior above 250 mph.

The airplane has a very high rate of roll at any altitude.

WARNING

Maximum permissible engine rpm of 100% and tailpipe temperature of 700°C must not be exceeded since turbine wheel failure may result. Small increases in rpm above 100% and/or increase in tailpipe temperature above 700°C result in a large increase of turbine wheel stress and a rapid decrease of turbine wheel strength. Thus slight increases of rpm or tailpipe temperature above 100% or 700°C respectively result in a rapid increase of the possibility of turbine wheel failure.



a. STABILITY.

(1) The airplane is directionally and longitudinally stable at all approved center of gravity positions.

(2 Laterally, the airplane is neutrally stable; therefore, attention is required to hold the wings level, particularly when flying in rough air.

Note

With drop tanks installed, the airplane has a reverse rolling tendency when attempting to lift a wing with the rudder. That is, a bank cannot be corrected for by using opposite rudder, but should be corrected for by use of the ailerons.

WARNING

Avoid side-slipping the airplane with 230-gallon centerline tanks since the airplane will lose longitudinal stability in this condition.

b. TRIM CHANGES.

(1) Since there is no torque effect from the power plant of this airplane, the rudder forces are zero for all speed and power conditions if the rudder tab is properly adjusted on the ground. It may be found more convenient to fly with feet off the rudder pedals most of the time.

(2) The elevator tab should be used with caution, especially at high speeds. Failure of the tab mechanism resulting in excessive trim can be manually overcontrolled by reducing speed.

(3) The trim change due to lowering the landing gear or flaps or changing engine power is negligible.

(4) When the dive flaps are extended at high speeds, there is a tendency for the nose to come up rapidly. At low speeds, this tendency is comparatively slight.

c. CHANGING POWER IN FLIGHT.—Move the throttle forward or aft.

WARNING

Always operate the throttle as slowly as conditions will permit. If the throttle is opened too rapidly, excess fuel will be supplied to the engine which may cause flame-out or cause the tailpipe temperature to exceed the limit. If the throttle is retarded too rapidly at high altitude, flame-out may result due to rapidly diminished fuel supply and large air mass flow through engine.

d. CRUISING. (See appendix I.)

CAUTION

The oil pressure may show a tendency to increase somewhat with altitude. This is a function of the oil pressure gauge venting. If the oil pressure is questioned, it should be checked at sea level to determine if it falls within the specified limits.

e. WATER-ALCOHOL INJECTION IN FLIGHT.—Water-alcohol injection that is retained for use as thrust augmentation below 10,000 feet during flight or landing will be utilized as follows:

(1) If used when operating on the emergency fuel system, as in the case of a main fuel pump failure, advance throttle and obtain maximum rpm prior to turning on the water injection switch, then adjust the throttle to obtain 100 percent rpm.

(2) If used when operating on main fuel system, as in case of combat training, familiarization, etc., advance throttle to obtain 98 percent rpm, turn on the water injection switch, then adjust the throttle to obtain 100 percent rpm.

11. STALLS.

a. NORMAL.

(1) The stall is preceded by noticeable mushing and by buffeting which gives at least 10 mph warning. In a complete stall with power on or off, one wing may drop. If the stick is held back after the stall, the airplane will fall into a steep spiral and will probably spin.

Recovery from a stall is made by releasing the back pressure on the stick and lifting the down wing *with the ailerons.* The rudder is not effective in lifting a dropping wing.

(2) The stall will occur near the following indicated air speed at the gross weight noted but since it is improbable that a pilot will know his exact gross weight at any time and since the actual stall speed also depends upon the technique used, it is recommended that stalls be practiced so that they may be anticipated

STALLING SPEEDS

Gear and Flaps	Gross Weight (Pounds)				
	10,000	12,000	14,000	15,000	16,000
UP	110	120	130	130	135
DOWN	96	105	115	120	125

through the feel of the airplane rather than through reference to the air speed indicator alone.

CAUTION

Aircraft with 230 gallon centerline tip tanks will not be stalled.

b. ACCELERATED.

Accelerated stalls should be avoided when drop tanks are carried as high loads are imposed on the attachments at high "Gs" and because some airplanes tend to roll concurrently with the stall.

CAUTION

Abrupt rearward movement of the control stick during an accelerated stall will cause severe buffeting and must be avoided. Such abrupt stick movements during accelerated stalls may result in enough buffet loads to cause complete structural failure of the stabilizer.

11A. TURBULENT AIR AND THUNDERSTORM FLYING.

Note

Flight through a thunderstorm should be avoided if it is at all possible. However, since circumstances may force you at some time to enter a zone of severe turbulence, you should be familiar with the techniques recommended for flying the airplane under such conditions. Power setting and pitch attitude are the keys to proper flight technique in turbulent air. The power setting and pitch attitude required for the desired penetration airspeed (figure 12A) 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.

a. APPROACHING THE STORM. 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:

(1) Adjust power controls as necessary to obtain safe penetration speed.

(2) Pitot heater—On.

(3) Check gyro instruments for proper settings.

(4) Safety belt tightened.

(5) Turn off any radio equipment rendered useless by static.

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

CAUTION

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

b. IN THE STORM.

(1) 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.

(2) Devote all attention to flying the airplane.

(3) Expect turbulence, precipitation, and lightning, and don't allow them to cause undue concern.

(4) Maintain attitude. Concentrate principally on holding a level attitude by reference to the artificial horizon.

(5) 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

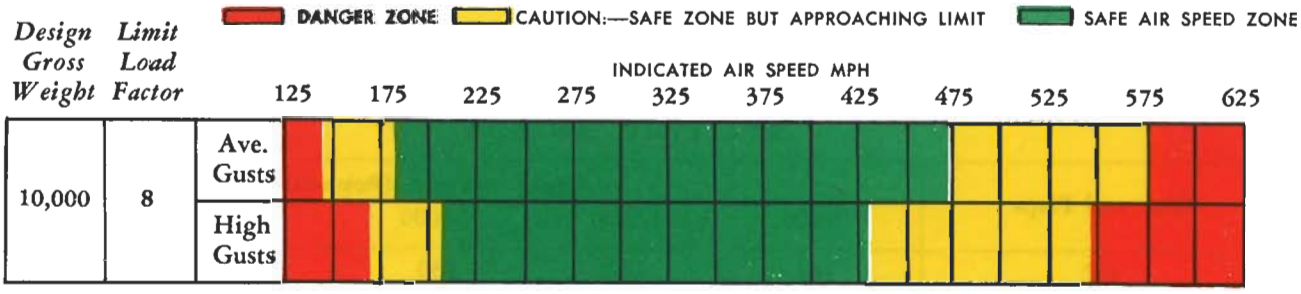


Figure 12A—Penetration Speeds

heavy rain, by partial blocking of the pitot tube pressure head, may decrease the indicated airspeed reading by as much as 70 mph.

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

(7) The altimeter is unreliable in thunderstorm flying because of differential barometric pressures within the turbulent area. A gain or loss of several thousand feet may be expected. Make allowances for this error in determining minimum safe altitude.

Note

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

c. RECOGNITION OF ICING CONDITIONS.

(Refer to Section VI 1.)

Icing occurs because of supercooled water in fog clouds, or rain. Normally the heaviest icing takes place in clouds with strong vertical currents (cumulus clouds, projections above strato-cumulus clouds, etc.). Icing conditions as found in stratus clouds are generally light to moderate. However, severe icing conditions may occur in this type of cloud. Prolonged flights through moderate icing can build up as much ice as a short flight through severe icing conditions. The most severe type of ice formation will generally occur above —5°C (23°F).

12. SPINS.

WARNING

Do not start an intentional spin below 15,000 feet. At least 1,000 feet will be lost during each turn of the spin, and approximately 1,000 feet will be required for the recovery. As speed increases, more altitude will be required for recovery.

WARNING

Do not spin this airplane with drop tanks installed. Jettison the tanks if a spin accidentally develops.

a. DESCRIPTION.

(1) It is not probable that a spin will occur unless the stick is held full back after the stall, and full rudder is applied.

(2) The spin is erratic and rather violent and may tend to reverse direction. A definite pause occurs between each turn and each turn is made with a whipping action accompanied by considerable buffeting and snatching at the controls. The attitude of the airplane becomes steeper and the speed of rotation increases as the spin progresses.

(3) In a spin with rearward CG (32%) the control forces are lighter and the spin is less steep than in the spin with forward CG.

(4) Full rudder and up-elevator must be held in order to keep the airplane in the spin.

b. RECOVERY.

(1) CHARACTERISTICS.

(a) The spin recovery characterictics of this airplane are excellent. Recovery can be effected in from ¼ to ¾ of a turn. If recovery is started during a pause it is more rapid than if started during a turn.

(b) With rearward center of gravity (32%) approximately one full turn is required to stop rotation.

(2) PROCEDURE.

(a) For all forward and normal center of gravity positions apply full opposite rudder and push the control stick to neutral.

(b) For a rearward CG position (32%) apply full opposite rudder and push the control stick full forward. As the rotation stops, alternate left and right rudder must be applied, until the air speed increases, to prevent falling into a spin in the opposite direction.

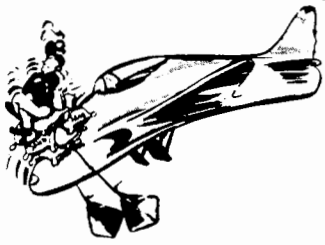
13. PERMISSIBLE ACROBATICS.

CAUTION

Cage all gyro instruments before engaging in acrobatics.

a. All acrobatics, except those requiring extended negative acceleration, are permissible. Under negative acceleration conditions, fuel will not be fed to the engine and flame-out will occur if the inverted condition is maintained for more than a few seconds.

b. The pilot is cautioned to use extreme care in maneuvers which require a downward recovery as the loss of altitude in downward recovery is very rapid. In general, acrobatics should not be attempted below 10,000



BE PREPARED FOR A DEFINITE **NOSE UP** MOMENT WHEN DIVE FLAPS ARE EXTENDED AT HIGH SPEED!

feet until the pilot becomes familiar with the speed at which the airplane can gain and lose altitude.

WARNING

Recovery from a vertical stall may require more than 10,000 feet altitude. This maneuver is not recommended at *any* altitude.

c. Ten quarts of oil are required in the engine reservoir to provide sufficient lubrication during acrobatics. Inverted flight may be maintained as long as it is possible to hold a positive accelleration. Negative accelleration will prevent fuel flow and cause almost immediate flame-out.

14. DIVING

a. The airplane is controllable up to a Mach number of .8 and it is strongly recommended that this limit be observed.

b. At the critical Mach number, lateral control is very difficult and uncertain but longitudinal control is still good. Aileron buzz may occur slightly before, or at, the speed at which lateral instability is noticed.

If use of the trim tab is neglected, considerable push on the control stick will be required to hold the airplane in the dive. This stick force increases up to a Mach number of about .75 and will remain approximately constant between Mach numbers of .75 and .8.

c. When the dive flaps are extended at high speed, there will be a definite nose-up tendency; however the acceleration will not be excessive even with hands off. This nose-up tendency may be counteracted by applying nose down trim tab at the same time the dive flaps are started out.

Caution must be observed when retracting the dive flaps at high speed, as this creates a sudden nose-down tendency which must be resisted if flying close to the ground.

CAUTION

Aileron compressibility "buzz" is a low amplitude vibration of the ailerons which can best be detected by watching for a fuzzy outline at the trailing edge of the aileron. This buzz will occur at about .8 Mach number in "one G" flight; slower under accelerated flight conditions. Operation within the buzz region should be avoided whenever possible.

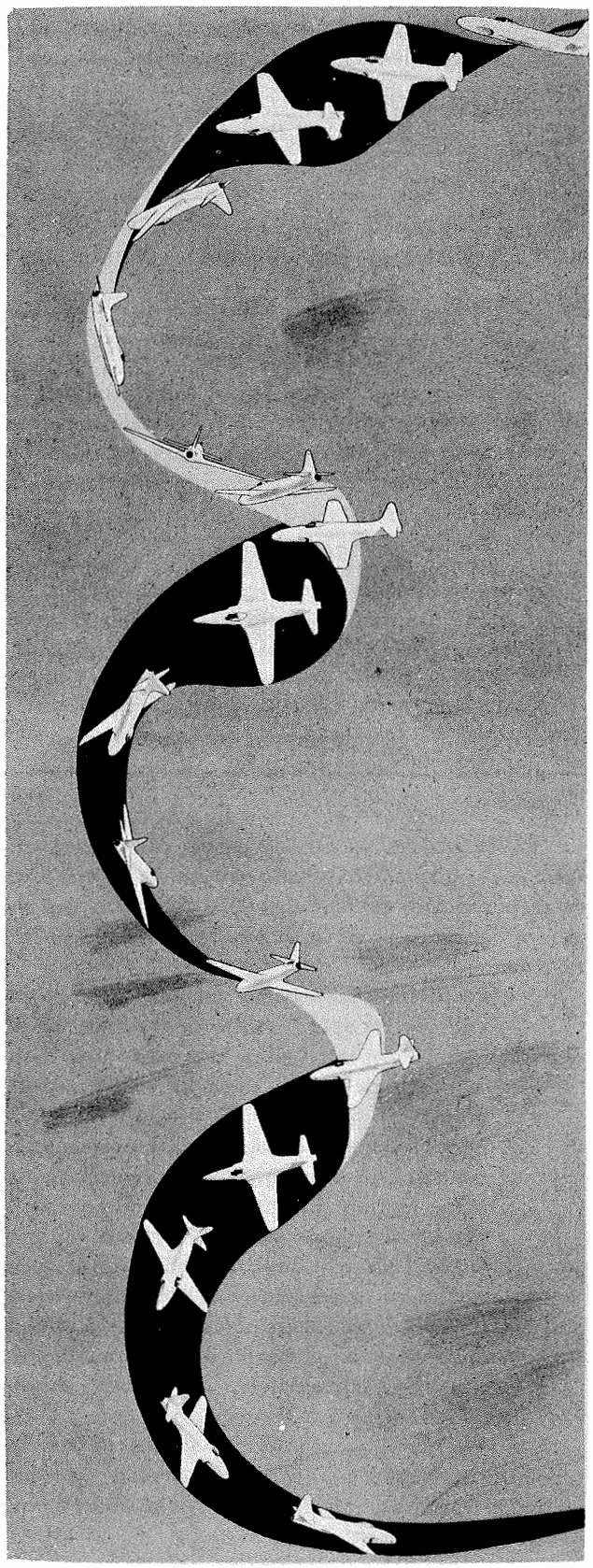


Figure 13 — Spin Pattern

d. The dive flaps may be extended at any time and at any speed. It is suggested that dives be conducted with the dive flaps up so that they will be in reserve to aid in slowing the speed when, and if, trouble is encountered.

15. NIGHT FLYING.

a. For night take-off and landing, push the landing light control (9, figure 7) in. Pull the control out for spotlight use. The landing lights on late airplanes are located on the nose gear and are not adjustable.

b. Cockpit and navigation lights are conventional.

16. APPROACH AND LANDING.

WARNING

Accumulation of mud, snow, or ice on leading edge of wing will adversely affect stall characteristics and, therefore, special precautions should be observed during landing under such conditions.

CAUTION

If wing heaviness due to uneven fuel transfer from the drop tanks should be encountered it is strongly recommended that the heavy tank be dropped before landing. The airplane has been landed with one tank full and one tank empty but full aileron was required and the airplane was very difficult to manage on the landing.

a. PORPOISING — On occasions, pilots inexperienced in the airplane have encountered difficulties with severe porpoising on landings. The following suggestions are made to avoid or minimize the effects of this condition:

(1) Porpoising may occur on fast touchdowns with excess speed and with the nose wheel making contact before the main gear. Consequently do not fly the nose wheel into the ground.

(2) If porpoising is encountered, move the control stick in a manner to counteract the airplane motion; in other words, if the nose is coming up, move the stick forward and vice versa. This will probably not stop a severe case of porpoising but will lessen the severity.

(3) If porpoising is encountered on fields of sufficient length to permit a safe go-around, elect to do this immediately.

*a*1. GENERAL.

(1) The landing technique is similar to that for conventional tricycle landing geared airplanes, and the landing attitude is about the same; that is, main wheels first, tail slightly down.

Note

When landing with flaps up, care should be exercised to avoid an extreme tail-low attitude which will cause the tail to drag on the runway.

(2) With the landing gear down and wing flaps 50% extended, start the approach at 150 mph indicated air speed. When the landing is assured, extend full flaps and start flaring off. Come over the end of the runway at 110 mph and wait for contact. If the landing is being made with an appreciable load of fuel or ammunition, the above air speeds should be increased in proportion to the load.

CAUTION

Landing with full tip tanks is permissible only in an emergency. If such a landing is necessary make a flat power-on approach in order to avoid a possible stall.

Keep the engine at 50% to 60% rpm during the approach so that power may be applied more quickly if it should become necessary to go around. Approximately 20 gallons of fuel will be required for a tight pattern on the go-around for landing.

(3) If, for some reason, the flaps cannot be lowered, land approximately 20 mph faster and allow for more flare-off and a *much flatter gliding angle.*

(4) Dive flaps may be used as desired during the approach and landing. Their use will increase the glide angle and reduce the length of roll after landing.

b. NORMAL LANDING.

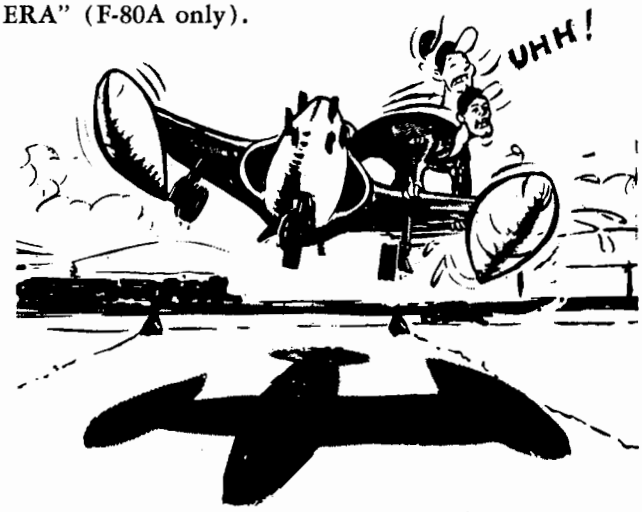
(1) Shoulder harness and safety belt tightened and inertia reel lock control (late airplanes) unlocked.

(1A) Emergency fuel pump "ON."

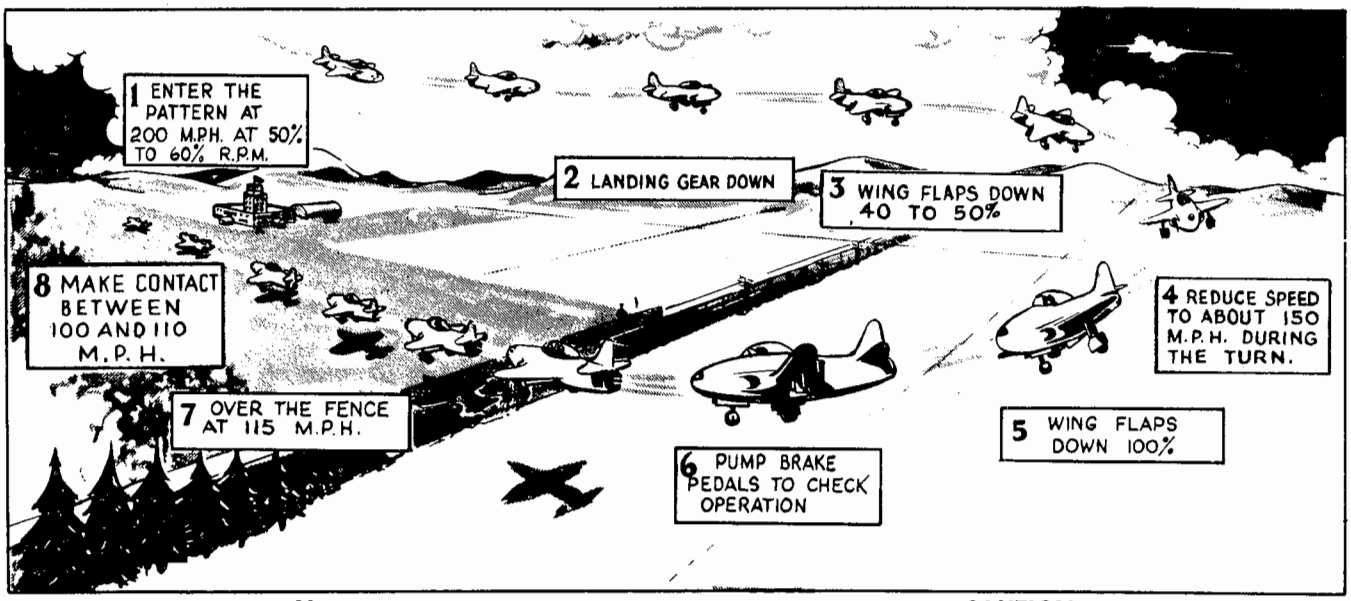
(1B) Emergency fuel switch (RF-80A-20 and -25)—"TAKE-OFF and LAND."

(2) Landing gear (29, figure 6 and 6A) *"DOWN"* (not over 225 mph).

(2A) Gun-camera switch "SIGHT AND CAMERA" (F-80A only).



IT HAS BEEN LANDED WITH ONE TANK FULL, BUT IT'S TOUGH.



Note

Side slips, fish tailing, and "S" turns may be used as desired. These maneuvers should be practiced in normal landings so that they may be used more effectively in case of an emergency "dead-stick" landing.

CAUTION

Excessive use of the brakes must be avoided. As a rule, braked landings should not be made oftener than once every 15 minutes. Heat generated by too much braking will cause tire failure.

Figure 14 — Approach Diagram

Due to the drop in hydraulic pressure while the landing gear or dive flaps are in motion, the aileron booster may not operate until their operation is completed.

Note

Particular attention should be paid to the operation of the landing gear and dive flaps on airplanes which are equipped with a hydrofuse. The fuse is apt to shut off the hydraulic pressure under certain conditions, such as low engine rpm or air in the system. When this occurs, there is no hydraulic pressure to the gear or dive flaps even though the aileron boost will remain effective. Therefore, particular note should always be made that the gear is fully extended and locked as shown by the indicator lights. If the hydrofuse does shut off hydraulic pressure, it should be re-set by pulling the reset handle; however, handle (35, figures 7, 7A and 7A-1) has been safety-wired open so that hydrofuse cannot be reset.

(3) Wing flaps (10, figures 6and 6A) *"DOWN"* (not over 200 mph). (Dive flaps down if desired.)

(4) Engine speed—50% to 60% rpm.

c. AFTER LANDING.

(1) Wing and dive flaps "UP" before taxiing.

(2) Emergency fuel pump "OFF".
Emergency fuel switch (RF-80A-20 and -25) — "OFF."

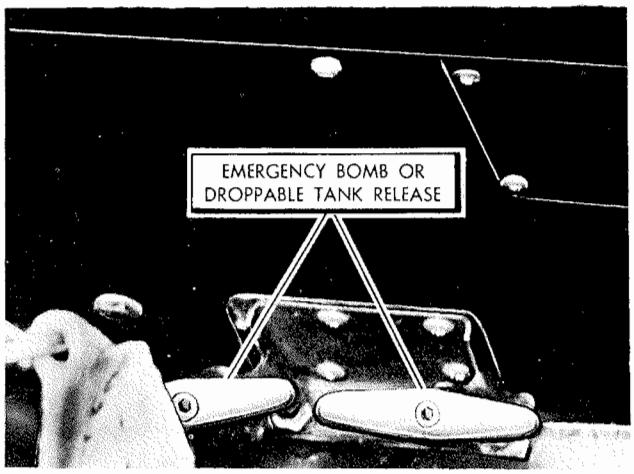


Figure 15 — Left Cockpit Floor

d. CROSS WIND LANDING.

Same as a normal landing. If the drift appears excessive, the upwind wing may be lowered until just before contact.

e. TAKE-OFF IF LANDING IS NOT COMPLETED.

The ability of this airplane to take off in the event the landing is not completed is definitely inferior to that of conventional single engine fighters. If the landing cannot be completed, the decision to go around should be made as early as possible.

Proceed as follows:

(1) Open the throttle to 100% power as slowly as circumstances will allow.

CAUTION

Open throttle slowly to prevent flame-out.

(2) Water injection switch "ON" (at not less than 90% rpm) if water—alcohol is available and ground temperature exceeds 32°F.

(3) Retract the landing gear immediately, as soon as safe flying speed is reached.

(4) Milk the flaps to 50% until the air speed indicates over 140 mph, then retract them all the way.

(5) Accelerate to approximately 165 mph before starting to climb.

17. STOPPING THE ENGINE.

a. Parking brakes—set.

b. Idle the engine between 35% and 50% rpm.

c. Pull the engine shut-off valve to "OFF." (On late airplanes, pull throttle to "OFF.")

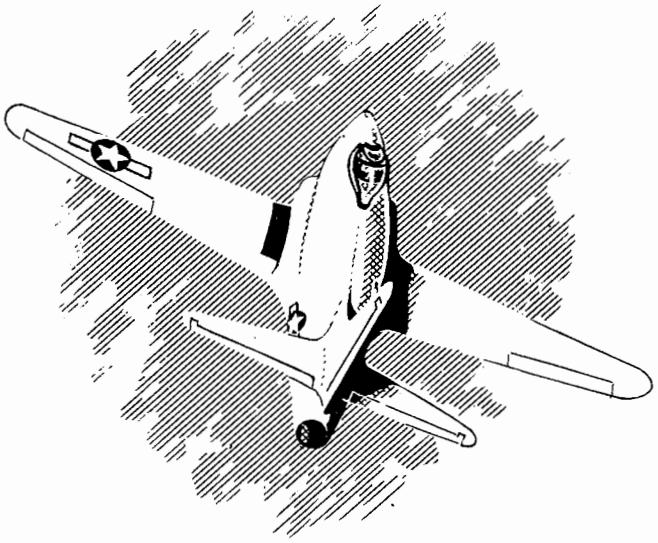
d. Turn all switches "OFF" except generator switch.

18. BEFORE LEAVING THE PILOT'S COMPARTMENT.

a. Lock the surface controls.

b. Release parking brakes after wheels are chocked.

c. Install ground safety pin in electric canopy bungee.



SECTION III—FLIGHT OPERATING DATA

AIRPLANE MODELS
F-80A-1, -5, -10
RF-80A-5, -10, -15, -20, -25

FUEL SPEC.
MIL-F-5624—JP-4
MIL-F-5572 GASOLINE — LOWEST AVAILABLE GRADE

ENGINE MODELS
J-33-A-9A, -9B, -11A, -11B, -21, -35
J-33-GE-17, -17A

OIL SPEC.
MIL-L-6081 — GRADE 1010

ENGINE OPERATING DATA

CONDITION	R. P. M.	TIME LIMIT	*OIL PRESS. PSI	*TAIL PIPE TEMP. °C
TAKE-OFF OR MILITARY	100%	30 MINUTE LIMIT	35 (TAKE-OFF)	700
MAX. CONTINUOUS	96%	NO LIMIT	—	—
MINIMUM	—	—	2 (IDLE)	300

*Except airplanes with J-33-A-35 engine (see Fig. 16A)

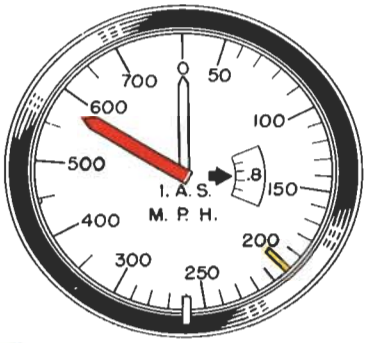
F-80A AIR SPEED CORRECTION TABLE RF-80A

INSTR. I.A.S.	CORRECT I.A.S. (gear and flaps up or down)				
	S.L.	10,000	20,000	30,000	40,000
100	98				
125	123				
150	148	148	147	146	144
175	173	172	171	170	168
200	198	197	196	194	191
225	223	221	220	217	213
250	247	245	243	240	235
275	272	270	267	263	256
300	296	294	290	285	266
325	320	317	313	306	
350	345	341	336	328	
375	369	365	358		
400	393	388	380		
425	417	411	402		
450	442	434			
475	466	457			
500	490	480			
525	515				
550	545				
575	564				

INSTR. I.A.S.	CORRECT I.A.S. (gear and flaps up or down)				
	S.L.	10,000	20,000	30,000	40,000
100	97				
125	122				
150	147	146	146	145	143
175	172	171	170	169	167
200	196	195	194	193	190
225	220	219	217	215	211
250	244	242	240	237	232
275	268	266	263	259	253
300	292	289	285	280	
325	315	312	308	302	
350	339	335	330	322	
375	363	358	352		
400	387	382	376		
425	411	405	396		
450	435	428			
475	459	450			
500	483	473			
525	507	496			
550	531				
575	555				

NOTE: Figures shown in S.L. column equal calibrated air speed (CAS).

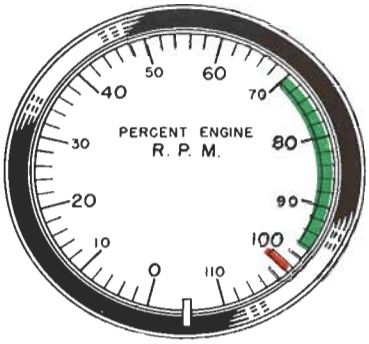
AIR SPEED



200 MPH—MAXIMUM WING FLAPS EXTENDED
(225 MPH—MAXIMUM LANDING GEAR EXTENDED)

THE INSTRUMENT SETTING IS SUCH THAT THE RED POINTER WILL MOVE TO INDICATE THE LIMITING STRUCTURAL AIR SPEED OF 580 MPH, OR THE AIR SPEED REPRESENTING THE LIMITING MACH NUMBER OF .8, WHICHEVER IS LESS.

* TACHOMETER



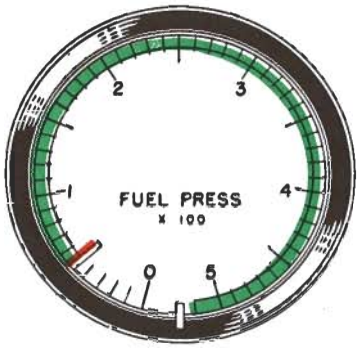
70-90% rpm — MAXIMUM ENDURANCE CRUISE

90-96% rpm — MAXIMUM RANGE CRUISE

100% rpm — MAXIMUM (30 MINUTES DURATION ONLY)

NOTE: SEE PARAGRAPH 4-SECTION II

* FUEL PRESSURE

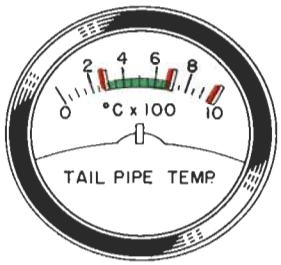


50 psi — MINIMUM

520 psi (OFF SCALE) MAXIMUM

50-250 psi — NORMAL

* TAILPIPE TEMPERATURE



300°C—MINIMUM (Except on Landing Approach)

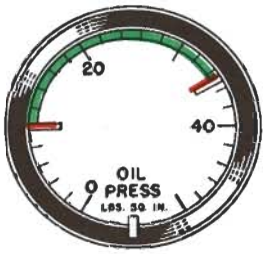
300°-700°C—CONTINUOUS OPERATION

700°C—MAXIMUM FOR FLIGHT

1000°C—MAXIMUM DURING STARTING

NOTE: SEE WARNING PARAGRAPH 4-SECTION II

* OIL PRESSURE



10 psi—MINIMUM DURING FLIGHT (PRESSURE BELOW 10 psi MAY BE EXPECTED WHEN ENGINE IS IDLING)

10-35 psi—CONTINUOUS OPERATION

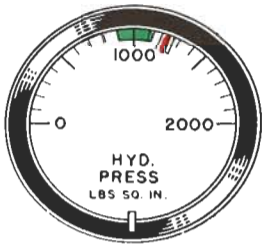
35 psi—MAXIMUM (AT SEA LEVEL)

INSTRUMENT AIR PRESSURE

5" Hg — MAXIMUM

3.5" to 5" Hg — OPERATING RANGE

* HYDRAULIC PRESSURE



900-1175 psi—NORMAL

1250psi—MAXIMUM

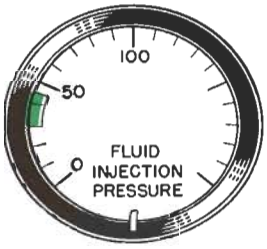
ACCELEROMETER

5.33 G MAXIMUM WITH DROP TANKS

7.33 G MAXIMUM WITHOUT DROP TANKS

-2 G MAXIMUM WITH DROP TANKS

FLUID INJECTION PRESSURE



30 - 45 psi—NORMAL

FUEL GRADE — JP-4

** Except RF-80A-20, -25. (For RF-80A-20, -25 markings and limits see Figure 16A.)*

Figure 16 — Instrument Markings
F80A-1, -5, -10, and RF80A-5, -10, -15, -20, -25

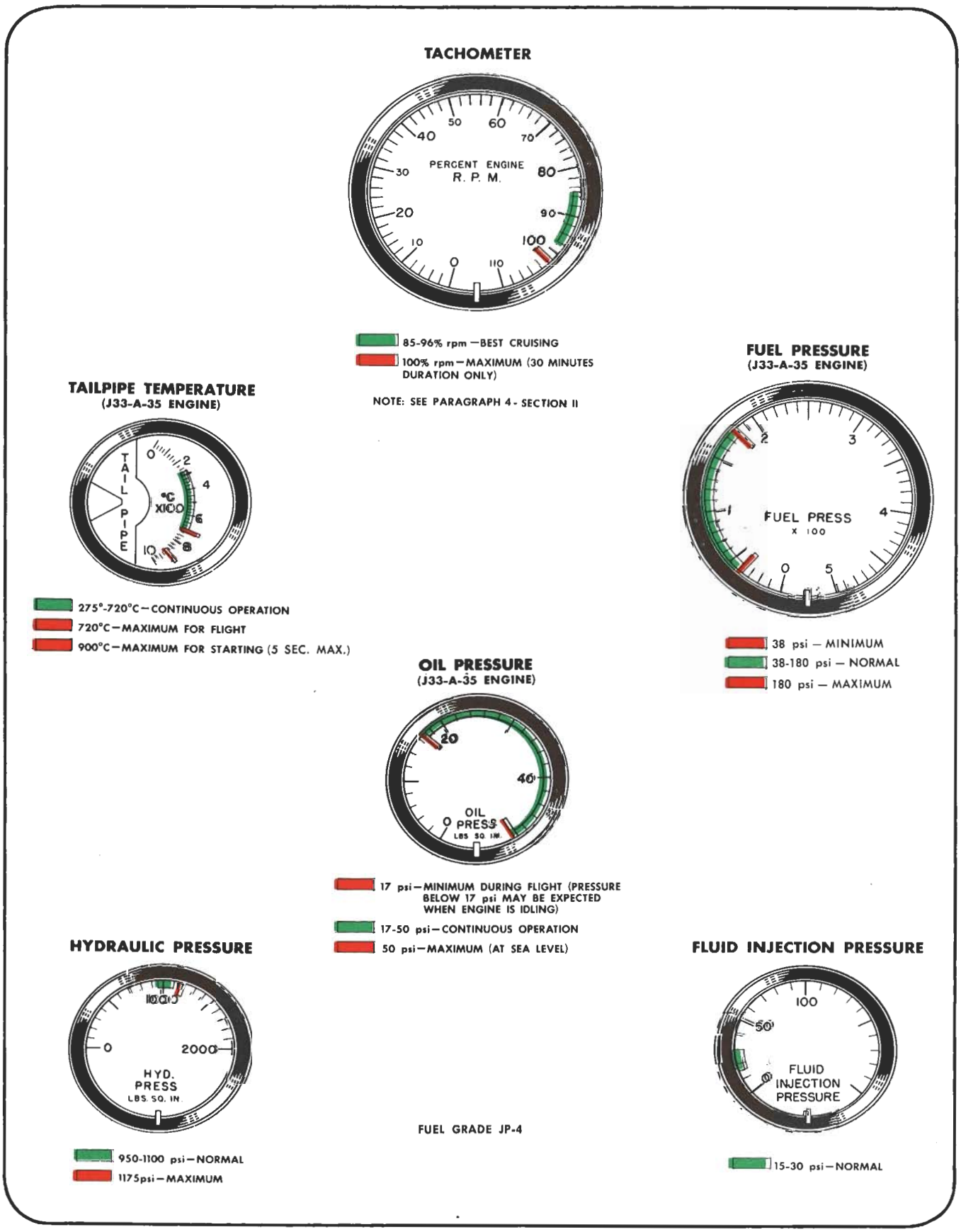
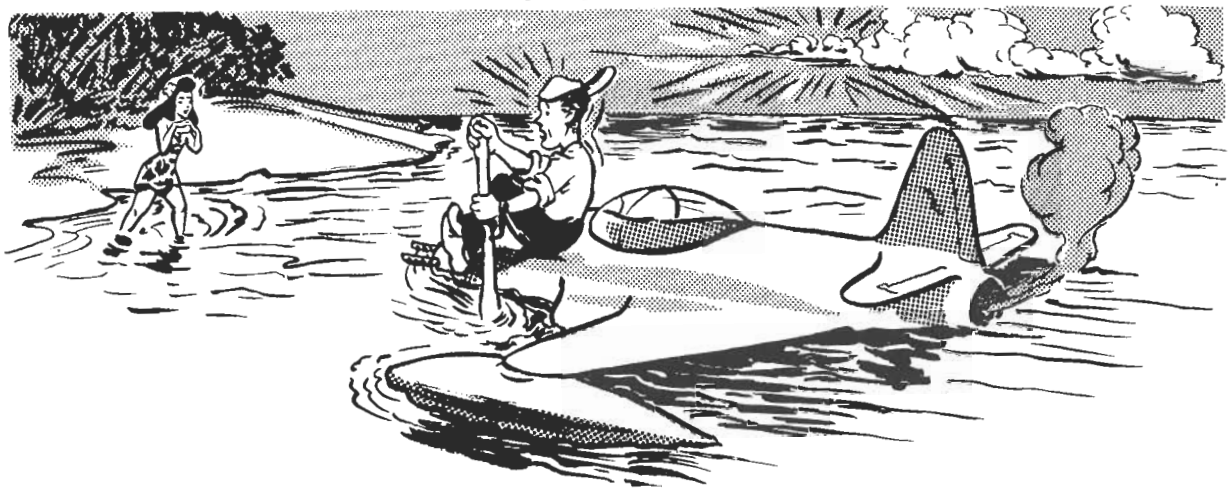


Figure 16A — Instrument Markings — RF-80A-20, -25



Section IV - Emergency Operating Instructions

1. EMERGENCY EXIT.

a. If the airplane is still controllable:

(1) Reduce air speed to less than 200 mph.

(2) Disconnect oxygen and radio equipment.

CAUTION

If bail-out is made at high altitude, remain connected to the regular airplane oxygen supply while all other preparations for leaving the airplane are being made. Just before leaving the airplane, disconnect oxygen mask from mask-to-regulator tubing and place the Type H-2 emergency oxygen cylinder in operation by pulling the rip cord cable of the oxygen cylinder (the caution tag and pin assembly having been removed prior to take-off).

(3) Jettison canopy. — With manually operated canopy, crack the canopy open about two inches before jettisoning.

(4) Roll airplane over on its back and trim to inverted climb.

(5) Clear "G" suit, oxygen and communication connections, then release safety belt and clear shoulder straps.

WARNING

Bend forward and lower the head when jettisoning the canopy to avoid injury from the released canopy.

b. If the airplane is not controllable, jettison the canopy and bail out.

2. EMERGENCY CANOPY OPERATION.

a. FROM INSIDE THE AIRPLANE. — Lower head and pull hard on jettison handle (15A, figure 8).

b. FROM OUTSIDE THE AIRPLANE.—Open jettison access door and pull yellow handle (3, figure 7C).

Note

Do not use the gun sight as a hand hold.

3. FIRE.

a. There is no fire extinguishing system on this airplane. If the fire warning light comes on, reduce power to see if the warning light will go out, especially if the engine was operating at high power.

b. If the light goes out, when power is reduced, exhaust leakage or improper positioning of the tailpipe clamp is the probable cause and flight may be continued at reduced power.

c. If the light does not go out, tailpipe temperature does not exceed maximum (700°C), and there are no external indications such as smoke, flame or blistering of the paint, continue operation at reduced power until light goes out. Even if the light goes out, it is recommended that the airplane be landed as soon as possible and thoroughly examined prior to further operation.

d. If the light does not go out, tailpipe temperature exceeds maximum (700°C) and external indications of fire are noted, shut the engine down completely and turn the fuselage tank boost pump "OFF" (on late airplanes, move the fuselage tank switch to the neutral position). If a dead stick landing is not practical, allow the engine to cool for a few seconds before restarting and operating at reduced power. Even if the light stays out after the engine is started again, it is recommended that the airplane be landed as soon as possible.

e. Make reasonably sure that fire is actually present before abandoning the airplane, as described in paragraph 1 preceding.

4. ENGINE VIBRATION.

a. In the event engine vibration is detected, reduce engine speed sufficiently to obtain lowest possible engine vibration and still maintain sufficient thrust for normal flight. Closely watch the tailpipe temperature gage. If the temperature rises above 700°C (720°C,-RF-80A-20, -25) shut down the engine and close cockpit air vents. Check for presence of fire in the aft section and land as soon as possible.

5. ENGINE FAILURE DURING FLIGHT.

a. GENERAL.—Engine flame-out in flight is usually due to one of the following causes:

(1) Fuel pressure too low at altitude.

(2) Temporary loss of fuel supply due to inverted flight or running out of fuel in the fuselage tank.

(3) Failure of one of the fuel system units.

(4) Flame-out due to too rapid opening or closing of the throttle, usually at high altitude.

(5) Wing tanks empty and fuselage tank being bypassed.

b. In the above cases, a restart may be accomplished after making sure that there is sufficient fuel in the fuselage tank and holding the fuselage tank bypass switch to "NORMAL" for at least 2 seconds (on late airplanes, turn the fuselage tank switch "ON") or, in general, making sure that fuel is available to the engine.

(1) As soon as the flame-out occurs, pull the engine shut-off valve to "OFF" (on late airplanes, move throttle to "OFF") to prevent flooding the engine and the tailpipe with fuel.

c. AIR STARTS (except RF-80A-20 and -25). Consistent restarts may be made by the following method:

(1) Correct condition causing failure, if possible.

(2) Glide down below 20,000 feet before making the first starting attempt and keep the airspeed high so that a windmill speed of over 9% will be available for starting.

(3) Throttle—one-third "OPEN" ("OFF" if engine shut-off is not installed).

(4) Pull up sharply to permit drainage of fuel from the combustion chambers and tailpipe.

(5) Reduce air speed to less than 300 mph. (Do this as quickly as possible before the windmill speed falls off excessively.)

(6) Ignition booster—"ON."

(7) Emergency fuel pump "ON" when start is made below 10,000 feet. When start is made above 10,000 feet, leave emergency fuel pump "OFF" to prevent supplying excess fuel to engine which will result in excessive tailpipe temperature.

Note

In case of an unsuccessful start above 10,000 feet, actuate the emergency fuel pump switch momentarily to build up fuel pressure.

(8) Engine shut-off valve "ON." Throttle one-third "OPEN" if shut-off is not installed.

(9) As soon as the burners light, manipulate the throttle to keep the rpm and temperature within limits.

WARNING

If the tailpipe temperature reaches 1000°C and stays there for about 4 seconds, close the shut-off valve immediately and repeat the starting operation.

DON'T GET CAUGHT AT LOW SPEED!

(10) Ignition booster—"OFF."

(11) Attempt to operate with the emergency fuel pump turned "OFF."

Note

If the engine will not start or will not accelerate from low windmill rpm, normal ground starting procedure may be used. As a rule, this should not be attempted above 9% rpm windmill speed because the starter pawls may be damaged.

WARNING

When flying on the emergency fuel system, the barometric control and the overspeed governor are not in operation. Great care must be exercised to prevent engine overspeeding as overspeeding will result in almost certain destruction of the engine and the airplane. Watch for

Figure 17—Emergency Battery Disconnect Switch

overspeeding during a climb or when starting the engine on the emergency fuel system in flight. IF THE ENGINE CANNOT BE HELD BELOW 100% rpm, SHUT IT OFF (engine shut-off "CLOSED") (or throttle "OFF") AND GLIDE TO A LOWER ALTITUDE BEFORE RESTARTING.

d. AIR START—RF-80A-20 and -25.

(1) GENERAL

(a) As soon as flame-out occurs, place throttle in "OFF" position. Immediately determine if fuselage tank contains fuel. If not, start transfer of fuel if it is available.

(b) Glide down to 25,000 feet (at higher altitudes, poor flame propagation makes air start very uncertain) before attempting an air start. If circumstances permit, keep engine windmilling speed up to 10% or more. Engine speed should stay above 10% if the air speed is maintained within about 35 mph of the red needle. If circumstances make a fast descent undesirable, the starter may be used as explained in the starting procedure.

(c) Turn off unnecessary electrical equipment to conserve battery power for starting.

(d) Air starts should be accomplished by use of the automatic fuel starting system. The manual system should be used only in case of failure of the automatic system.

Note

In case the recommended procedure has been forgotten, the normal ground start procedure will work if the flame-out was due to anything other than a failure of the normal engine pump or engine fuel control.

(2) AIR START — AUTOMATIC.

(a) Pull up for 5 to 10 seconds at 1 G to permit drainage of fuel from tailpipe and combustion chambers. Then hold air speed at about 200 to 225 mph for the start.

(b) If engine speed is below 10% rpm, push starter switch to "START" and release. If rpm is 10% or more, omit this step.

(c) Air start ignition switch—"START" (and release). Ignition will continue for approximately 45 seconds.

(d) Starting fuel sequence switch—"AUTOMATIC" at not less than 10% rpm.

(e) Emergency fuel switch — "TAKE-OFF and LAND."

(f) After burners light and engine has stabilized on the starting control, open throttle with smooth positive force to idle detent.

(g) Turn starting fuel sequence switch "OFF" immediately after setting throttle in idle. If the rpm starts to drop off, open throttle sufficiently to maintain a speed equal to the stable speed on the starting control.

WARNING

1. If the tailpipe temperature reaches 1000°C and stays there for more than three seconds, turn starting fuel switch "OFF" immediately and then move the throttle to the "OFF" position.

2. If the amber emergency fuel indicator light remains on after the throttle is opened, the engine is running on the emergency fuel system. Therefore, leave the emergency fuel switch in the "TAKE-OFF and LAND" position until the airplane is landed. Use extreme care in throttle manipulation to prevent engine overspeeding, engine blowouts, or excessively low engine idle speeds as there is no governor in the emergency fuel system. If the amber light is out, the emergency fuel switch may be returned to the "OFF" position after the throttle has been opened.

(h) Accelerate to desired rpm. Note Warning (2).

(3) AIR START — MANUAL.

(a) Pull up for 5 to 10 seconds at 1 G to permit drainage of fuel from tailpipe and combustion chambers. Then hold air speed at about 200 to 225 mph for the start.

(b) If engine speed is below 10% rpm, push starter switch to "START" and release. If rpm is 10% or more, omit this step.

(c) Air start ignition switch—"START" (and release). Ignition will continue for approximately 45 seconds.

(d) Starting fuel sequence switch—"MANUAL" at not less than 10% rpm.

(e) Emergency fuel switch—"EMERGENCY."

(f) Rapidly open throttle to approximately the three-quarters open position. As soon as the fuel manifold pressure begins to rise from zero, rapidly retard the throttle to approximately one inch below the idle detent and place hand on the starting fuel system switch.

(g) At indication of flame (sound or temperature), turn the starting fuel system switch to "OFF" and allow engine speed to stabilize.

WARNING

1. If the tailpipe temperature reaches 1000°C and stays there for more than three seconds, move the throttle into "OFF" immediately.

2. Since the engine is operating on the emergency system, use extreme care in throttle manipulation to prevent engine overspeeding, engine blowouts or excessively low engine idle speeds.

(h) After engine speed stabilizes (at approximately 25%), slowly advance throttle lever to obtain desired rpm.

(i) If engine flame-out was not due to failure of the main engine pump or main fuel control, engine operation may be returned to the main system by advancing the rpm to about 90 to 100% and then retarding the throttle (quite rapidly) at the same time the emergency fuel switch is moved to the "OFF" position.

6. FUEL SYSTEM EMERGENCY OPERATION.

a. ENGINE FAILURE.

If the engine fails for no apparent reason, it is probable that the engine fuel pump, the barometric, or the governor has failed. The engine will run on the emergency fuel pump after a normal air start.

b. LEAKING FUEL TANKS.

It is not probable that leaking tanks will be detected during flight. If a serious leak is suspected, use the fuel from the leaking tank as rapidly as possible (by turning all other tanks "OFF"). If the leak is in the fuselage tank, go on "fuselage tank by-pass" operation after the fuel in the drop tanks and the fuselage is gone.

7. TIP TANKS FUEL SYSTEM MALFUNCTION.

a. Due to malfunction of the wing tip tank fuel system, it is possible for one tip tank to be empty and one tank to remain full. If this occurs, it will result in wing heaviness which will become more apparent as airspeed is reduced and below 114 mph IAS full aileron control and trim will not hold the wing level. Therefore, whenever wing heaviness is encountered and wing tip tanks are installed observe the following instructions:

b. Retract wing flaps just to determine whether this will correct the control difficulty.

c. Jettison the tip tanks.

d. In event landing with one full and one empty tip tank becomes absolutely necessary, attain at least 10,000 feet altitude above the surrounding terrain and accomplish a simulated landing to determine the lateral control characteristics of the aircraft. Descent from altitude will be accomplished with landing gear extended and the landing will be made at least 10 mph in excess of the airspeed at which loss of lateral control was noted during the simulated landing.

e. If at any time when carrying tip tanks, lateral control and trim becomes difficult and erratic, reduce airspeed immediately. If the difficulty persists at approximately 200 mph IAS, jettison the wing tip tanks before further investigating the trouble. When lateral control difficulties are encountered, the aileron boost must not be turned off while the tip tanks are still on the aircraft. In the event the wing tip tanks fail to release, reduce the airspeed to 150 mph and if satisfactory lateral control cannot be maintained, abandon the aircraft. Also abandon the aircraft if satisfactory lateral control cannot be maintained after jettisoning the wing tip tanks and shutting off the aileron boost.

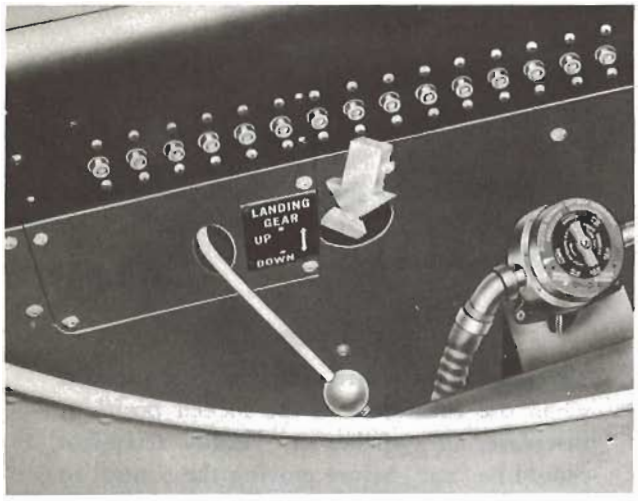
8. ELECTRICAL FAILURE.

a. GENERAL. — Complete electrical system failure results in partial fuel system failure on all airplanes. If only the generator fails, and battery power is available, the fuel system may be made to deliver its entire supply as explained in paragraph *b*(2), following. In order to conserve the battery as much as possible for manual fuel transfer, turn off all unnecessary electrical equipment, and use the necessary equipment sparingly.

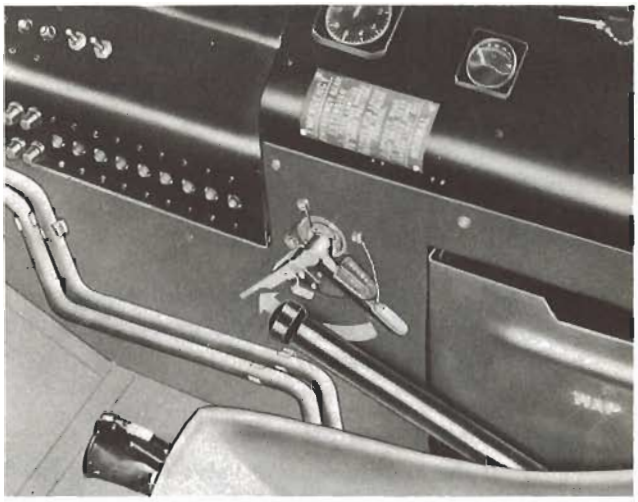
b. FUEL SYSTEM.

(1) Complete Electrical Failure. — If the electrical system should fail completely, fuel will be available only from the fuselage tank, except in the case of late airplanes. On late airplanes, fuel will also transfer from the drop tanks to the fuselage tank automatically.

(2) Partial Electrical Failure (All Airplanes). — If only the generator fails, and battery power is still available, fuel may be transferred manually from all of the tanks as follows:



NORMAL



EMERGENCY

Figure 18 — Landing Gear Controls

(a) Turn the wing leading edge and wing tanks "OFF" and allow fuel to transfer from the drop tanks.

(b) When the drop tanks are empty and the fuselage tank quantity gage reaches 160 gallons, turn "ON" the leading edge tanks intermittently to maintain this level. Repeat this manual transfer process until the leading edge tanks are emptied if maximum battery economy is desired.

(c) Transfer fuel manually, as explained in paragraph *(b)* preceding, from the wing tanks.

9. BOMB OR DROP TANK EMERGENCY RELEASE.

Two manual controls (figure 15) are connected directly to the wing tip bomb shackles. If the electric release mechanism fails, pull the manual controls out hard.

10. WING FLAP EMERGENCY OPERATION.

Either of the two wing flap motors will extend the flaps. If both motors should fail, or in case of electrical failure, the airplane must be landed with flaps up. Refer to section II, paragraph 16 *a*1(3).

11. LANDING GEAR EMERGENCY OPERATION.

a. Put the landing gear control (29, figure 6) in the "DOWN" position.

b. Break the safety wire and turn the emergency landing gear selector (12, figure 8) to "EMERGENCY."

c. Operate the hand pump (13, figure 8) until the landing gear is down and locked (approximately 60 strokes).

Note

Do not operate the hand pump until the emergency landing gear control is placed in the "EMERGENCY" position, since the fluid will only be pumped back to the emergency tank. Recheck the position of the selector lever if results are not obtained.

WARNING

If the gear has been extended using the emergency hydraulic system, it must not be retracted again except in case of an emergency. If the gear is retracted after an emergency extension, it cannot be extended again.

12. LANDING WITH WHEELS RETRACTED.

a. Release the tip tanks; bomb switch (14, figure 8) to "ALL" and depress control stick button.

Note

The decision concerning the retention of the tip tanks should be based on a consideration of whether there is fuel in the tip tanks and the type of terrain available for landing. In smooth terrain, the retention of the tip tanks will alleviate damage to the aircraft, for they act as skids and also tend to preclude cartwheeling due to a wing tip digging in.

b. Slide the cockpit canopy open, or if in any doubt, jettison.

c. Make sure that the shoulder harness and safety belt are safely secured, the inertia reel lock control (late airplanes) is locked, and the parachute is unbuckled.

CAUTION

The pilot is prevented from bending forward when the control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

CAUTION

Extend full wing flaps (full flaps will prevent wing tip from digging into the ground with resultant ground loops).

d. Before contact with the ground:

(1) Pull the engine shut-off valve to "CLOSED." (On late airplanes, throttle "OFF.")

(2) Pull the emergency battery disconnect switch to "OFF."

(3) Turn the generator switch "OFF."

(4) Move dive flap switch to "UP."

e. Make a normal approach at 10 to 15 mph above the stalling speed and let the airplane touch the ground slightly before the stall is reached.

13. LANDING IN WATER (ditching).

a. When anticipating an emergency due to lack of fuel, do not descend near the water to check conditions. The fuel remaining in the airplane will give at least 2½ times more range at 35,000 feet than it will at sea level. Stay at altitude until the fuel is gone, then glide down to a reasonable altitude and bail out.

WARNING

In all cases, it is recommended that the pilot bail out rather than attempt a water landing, if sufficient altitude is available.

b. If there is insufficient altitude for a safe bail-out, ditch as follows:

(1) Release drop tanks unless empty or nearly empty and sea is calm.

Note

Empty or nearly empty tanks will hold ducts out of water until initial speed is lost and provide additional buoyancy.

(2) Jettison the cockpit canopy.

(3) Make sure the landing gear is up.

WARNING

Do not attempt a water landing with the landing gear extended.

(4) Make sure the shoulder harness and safety belt are safely secured and that the inertia reel lock control (late airplanes) is locked.

CAUTION

The pilot is prevented from bending forward when the control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

(5) Unbuckle the parachute harness.

(6) Throttle closed.

(7) Set the dive brakes full down. Set flaps ½ to ⅔ down. (The flaps and dive brakes will not cause the airplane to dive. Extended dive brake will aid in keeping the jet intakes up.)

(8) Select heading parallel to wave crests if possible. Attempt to touch down on crest or on falling side of wave, never on rising side.

(9) After the airplane comes to rest, get out of the cockpit immediately. Don't forget the life raft.

14. HYDRAULIC SYSTEM EMERGENCY OPERATION.

Use the following emergency procedures on late airplanes equipped with hydrofuses.

a. If the hydraulic pressure on the gage drops and the aileron boost continues to operate, pull and release the hydrofuse reset lever (35, figure 7) and observe the reaction of the gage.

(1) If the pressure indication returns to normal, proceed with normal operation of the landing gear or dive flaps.

(2) If the pressure does not rise, or falls as soon as the reset handle is released, take no further action until the hydraulic system is needed.

When the hydraulic system is needed for operation of the landing gear or dive flaps, select as desired and reset the hydrofuse; however, hydrofuse handle has been safety-wired open.

If no results are obtained, use the emergency procedure for extending the gear; do not use the dive flaps unless absolutely necessary.

If the emergency extension system will not extend the gear, replace the emergency landing gear selector lever in its normal position and place the landing gear control in the down position. After these settings are made, hold the hydrofuse reset handle out until either the gear is down and locked as indicated by the green light, or until all the hydraulic fluid is pumped overboard as indicated by failure of the aileron booster.

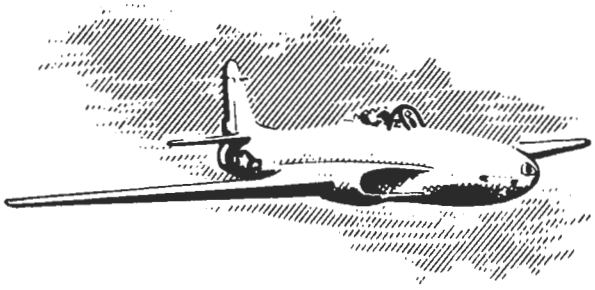
If the landing gear still fails to extend, try the emergency system again before making a belly landing or bailing out.

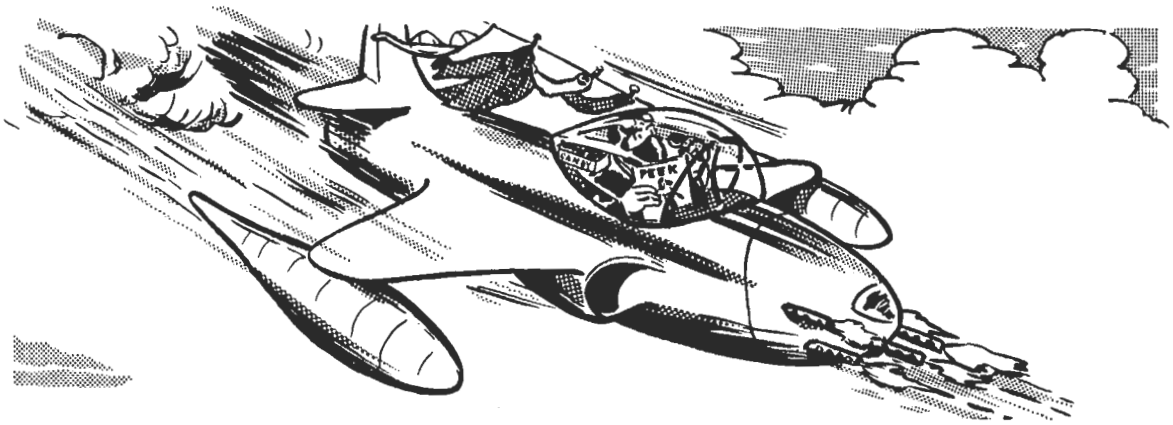
15. AILERON BOOST FAILURE.

Turn the aileron boost shut-off lever to "OFF" at altitude if necessary and at low altitude at all times.

WARNING

A roll tendency with the landing gear or landing flaps extended may not necessarily indicate aileron boost failures; therefore, do not disconnect aileron boost. First, retract gear and flaps. If this does not correct roll, and if there is an indication of an unbalanced fuel load condition, drop all external load. If the roll tendency is still felt, climb to above 12,000 feet, reduce airspeed to approximately 20% above stall speed and disconnect aileron boost.





Section V - Operational Equipment

1. HEATING, VENTILATING, AND PRESSURIZING.

a. VENTILATING.

Outside air is supplied to the cockpit through a scoop in the left engine intake duct. The air enters the cockpit through grills located near the rudder pedals when the pressurization control is in the "OUTSIDE AIR" position on early airplanes. On late airplanes, outside air enters the cockpit through a tube which directs it to the pilot's face. A butterfly shut-off valve controls the flow and a swivel fitting on the end of the tube directs the flow.

b. PRESSURIZATION AND HEATING.

(1) Air under pressure, taken from the compressor section of the engine, is used to pressurize the cockpit.

(2) On early airplanes a lever located on the forward end of the left hand shelf controls the pressurizations and heating. This lever has two usable positions ("OFF" and "COLD") and one position ("HOT") that is blocked off. When the lever is in the "OFF" position, the pressure air valve is closed and outside air is admitted through the grills. When moved to the "COLD" position, the lever opens the pressure air valve and shuts off the outside air.

(3) On late airplanes a lever on the forward end of the LH shelf controls the temperature of the pressurizing air by diverting part of it through a turbo refrigerator. The pressurizing air is turned on or off by the control levers on the grills located adjacent to the rudder pedals, and at the shut-off at the rear duct adjacent to the pilot's left shoulder.

(4) Cockpit pressure is automatically maintained by the pressure regulator at the normal differential of 2.75 psi or at the combat differential of 1.5 psi above outside air pressure. The setting of the pressure regulator is controlled by the gun camera switch or on the FP-80, by the cabin pressure selector switch. When the switch is in the "OFF" position ("NORMAL" on the FP-80) normal pressure differential is maintained. When the switch is placed in the "GUNS" or "SIGHT AND CAMERA" position ("COMBAT" on the FP-80), the regulator setting changes slowly. (to avoid the effects of rapid decompression) to the combat differential at 1.5 psi. It is recommended that operation above 38,000 feet be conducted in the combat setting to avoid the possibility of rapid decompression in event of damage by gunfire, accidental release of the canopy or any other sudden leakage.

(5) Cockpit altitude is indicated on the altimeter (6, figure 6).

(6) On FP-80A airplanes camera compartment temperature is controlled by a thermostat when the camera compartment heat switch (6, figure 9) is turned "ON." Camera compartment temperature and outside air temperature are indicated on a dual instrument (16, figure 9) on the lower center instrument panel.

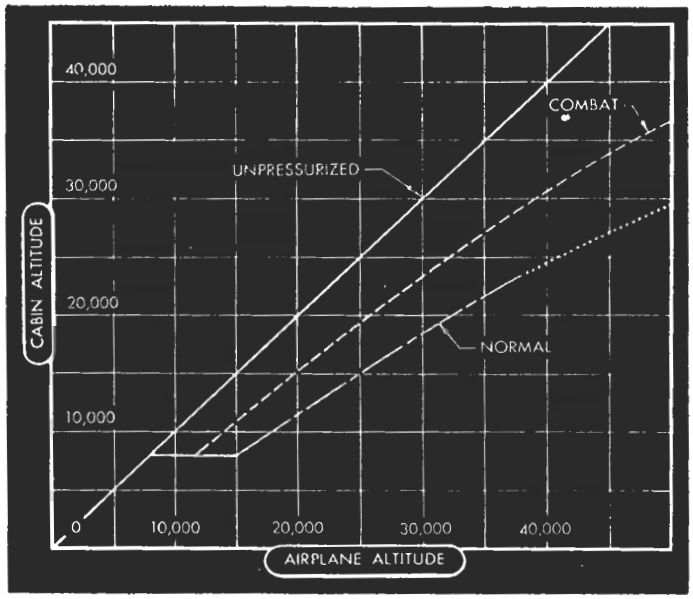


Figure 19 — Cockpit Pressurization Chart

c. DEFROSTING.

A defroster tube is located around the base of the three front windshield panels. A supply of warm air is taken from the cockpit pressurization line. To defrost, place the pressurization control lever in the "COLD" position. On late airplanes push and turn the control button to the right of the gun sight mount.

Late airplanes include provisions for an auxiliary electrically operated windshield defroster for cold weather operation and descent with low power. This defroster has a high current drain and should be used only when the normal hot air system is insufficient.

For emergency defrosting, such as may be necessary when descending with a dead engine, slide the canopy part way open and keep the air speed below 250 mph I.A.S.

PILOT OXYGEN DURATION — HOURS

Cabin Altitude Feet	Gage Pressure — P.S.I. 400	350	300	250	200	150	100	Below 100
40,000	5.7 5.7	4.9 4.9	4.1 4.1	3.2 3.2	2.4 2.4	1.6 1.6	0.8 0.8	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
35,000	5.7 5.7	4.9 4.9	4.1 4.1	3.2 3.2	2.4 2.4	1.6 1.6	0.8 0.8	
30,000	4.2 4.2	3.6 3.6	3.0 3.0	2.4 2.4	1.8 1.8	1.2 1.2	0.6 0.6	
25,000	3.4 4.0	2.9 3.4	2.4 2.8	1.9 2.3	1.4 1.7	1.0 1.1	0.5 0.6	
20,000	2.7 4.5	2.3 3.9	1.9 3.2	1.5 2.6	1.2 1.9	0.8 1.3	0.4 0.6	
15,000	2.1 5.4	1.8 4.6	1.5 3.9	1.2 3.1	0.9 2.3	0.6 1.5	0.3 0.8	
10,000	1.8 7.2	1.5 6.2	1.3 5.2	1.0 4.1	0.7 3.1	0.5 2.1	0.3 1.0	

RED FIGURES INDICATE DILUTER LEVER IN "100%" POSITION.
BLACK FIGURES INDICATE DILUTER LEVER IN "NORMAL" POSITION.
CYLINDERS—4 EACH. D-2.
CREW—ONE MAN.

2. OXYGEN SYSTEM.

a. GENERAL. — A low pressure oxygen system, consisting of four Type D-2 oxygen cylinders properly check valved for combat safety, is installed in the aircraft. The four cylinders are installed in the wings (two in each wing) and may be refilled through a single filler valve which is located in a box in the nose wheel well. The oxygen pressure gage (32, figure 7 and 33, figure 7A) and flow indicator (34, figure 7 and 36, figure 7A) are installed on the lower left side of the instrument panel. A Type A-14 pressure breathing diluter demand oxygen regulator (4, figures 6 and 6A) is located on the left console. Only a pressure breathing demand oxygen mask should be used.

b. REGULATOR. — The diluter lever of the oxygen regulator should always be set at the "NORMAL OXYGEN" position except under emergency conditions. The pressure dial of the oxygen regulator should be set as follows:

(1) For cabin altitudes below 30,000 feet, leave dial at "NORMAL" position.

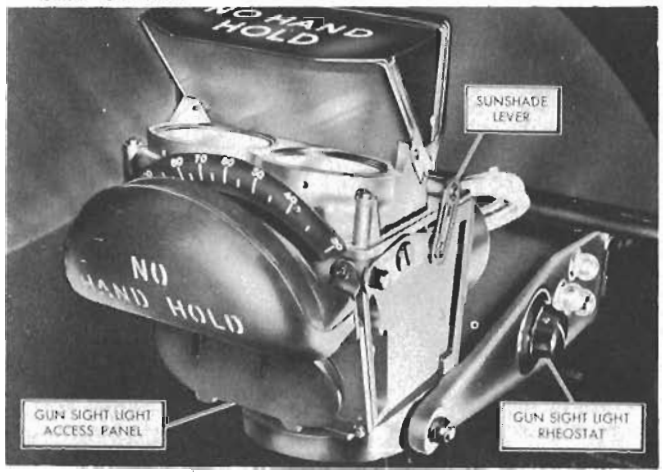
(2) For cabin altitudes between 30,000 feet and 40,000 feet, set the pressure dial at "SAFETY" position.

(3) For cabin altitudes above 40,000 feet, set the pressure dial to the cabin altitude.

c. EMERGENCY OPERATION. — With symptoms of the onset of anoxia, set the dilutter lever to "100% OXYGEN." If the oxygen regulator becomes inoperative, pull the cord of the H-2 emergency oxygen cylinder. If smoke or fuel fumes should enter the cabin, proceed as follows:

(1) Set the cabin pressurization lever at the ram air position.

(2) Set oxygen regulator diluter lever to "100% OXYGEN" position.



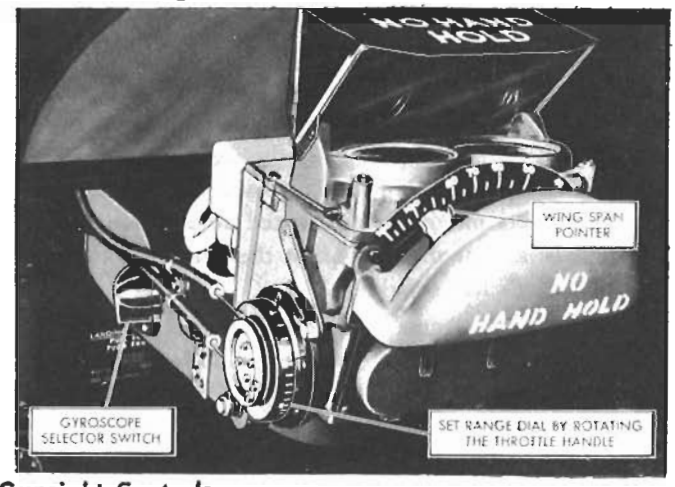


Figure 20 — K-14 Gunsight Controls

(3) Set pressure dial of oxygen regulator as required by cabin altitude. (See paragraph 2*b* above.)

3. ARMAMENT.

a. GUNNERY EQUIPMENT.

(1) The six .50 caliber guns each carry 300 rounds of ammunition when fully loaded.

(2) A gun camera, mounted in the lip of the right engine intake duct, operates with the guns or separately.

(3) To operate the guns and the camera, set the gun-camera switch (14, figure 8) to "GUNS" and operate the control stick trigger.

(4) To operate the camera alone, set the gun-camera switch to "SIGHT AND CAMERA" and operate the control stick trigger.

CAUTION

The gun sight should be in operation at full speed during take-off and landing to reduce the possibility of damage resulting from shocks.

(a) Turn the gun sight on (by turning the gun-camera switch to "GUNS" or "SIGHT AND CAMERA") before starting the engine and leave it in operation until after take-off. Turn on again before landing.

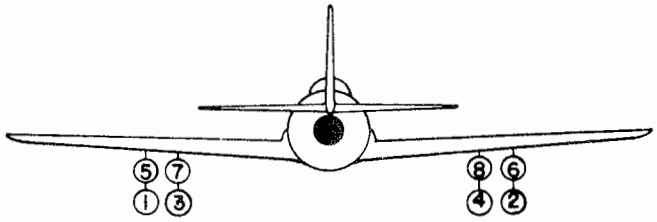
Note

Approximately 15 minutes are required for the gun sight gyro to reach its operating rpm. It must be turned on at least 15 minutes before using.

(5) On winterized airplanes, all guns are equipped with gun heaters.

b. BOMBING EQUIPMENT.

The bombs are carried on two shackles located one under each wing tip. To release the bombs individually, place the bomb switch (14, figure 8 and 8A) or auxiliary bomb switch (8A, figure 8A) to "TRAIN" and press the button on top of the control stick grip (left bomb drops first). To release the right bomb, press the button again. To release the bombs simultaneously, place the bomb switch to "ALL" and press the button on the control stick grip. A bomb salvo switch (17, figure 7A-1) is provided on some airplanes to permit release of bombs simultaneously in an emergency.



ALTERNATE ROCKET LOADING	
NO. OF ROCKETS	POSITION
2	5 and 6
4	5, 6, 7, and 8

Figure 20-A — Rocket Loading

c. CHEMICAL TANKS. — The chemical tank installation has not yet been flight tested.

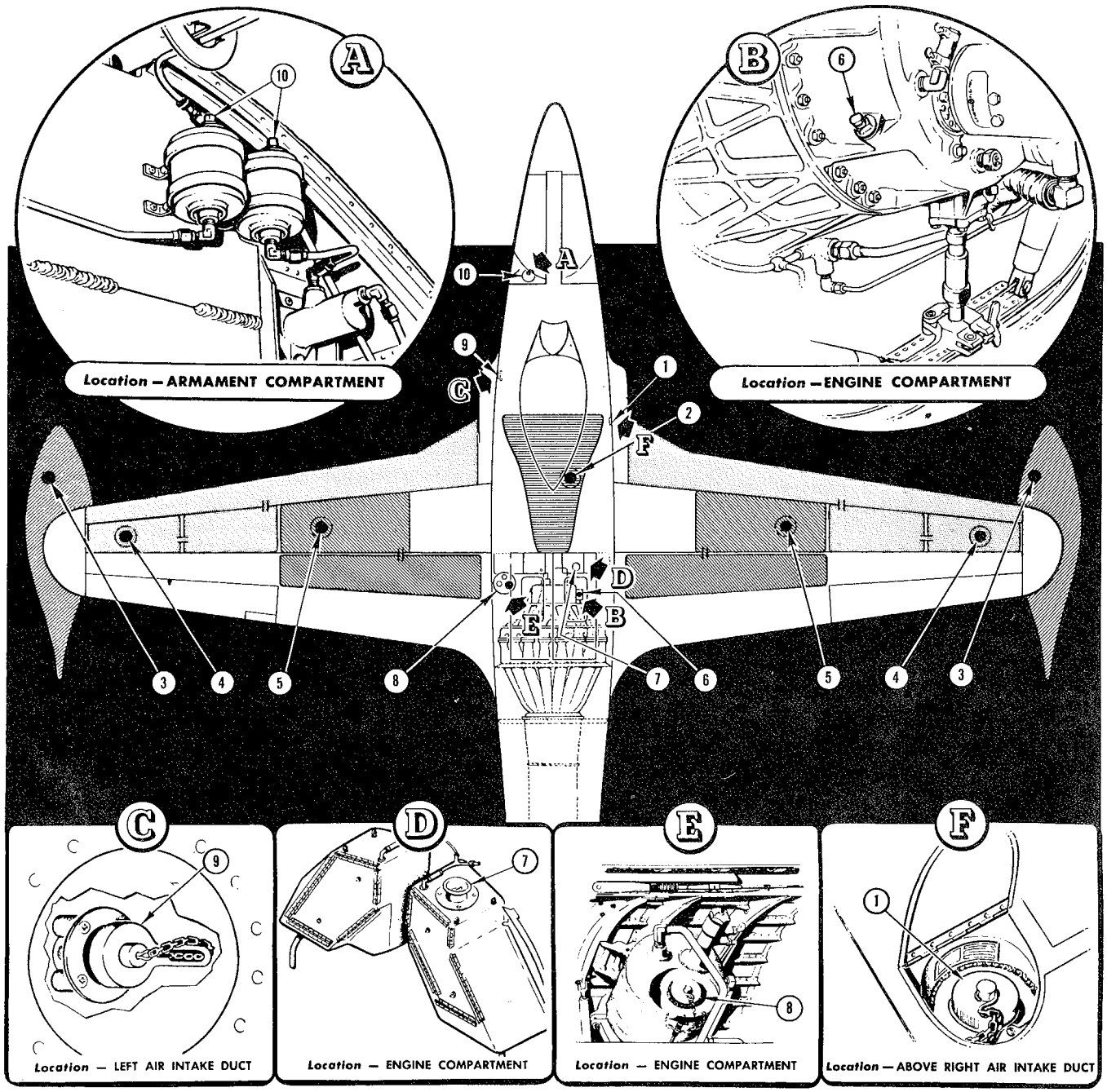
d. ROCKETS. — Some airplanes are equipped to carry up to four rockets under each wing. Rocket firing is controlled through an A-3 projector release and the rocket selector, arming and jettison switches on the right hand shelf (14, figure 8A). The rockets are fired by pressing the bomb release button on the top of the control stick. Rocket jettison circuits are energized through a scissors switch on the main gear; and therefore, will not operate unless the airplane is airborne. The gunsight is set for rocket firing by pressing the ring (15, figure 6A) on the top of the throttle.

The A-3 projector release contains a "RESET" switch and an indicator marked "RX TO BE FIRED." The reset switch selects the station number of the rocket to be fired, and the indicator shows the station selected. When the rocket selector switch is in the "SINGLE" position, only the rocket in the station selected will be fired when the bomb release switch is pressed. When the rocket selector switch is in the "AUTO" position, the rocket in the station selected and all subsequent will be fired at 1/10 second intervals as long as the bomb release button is held down. The rockets are armed by placing the arming switch in the "INSTANT" position; the "OFF" and "FUSE DELAY" positions are not wired. Rockets are jettisoned with bombs or drop tanks when the emergency bomb salvo switch is pressed, regardless of the position of the rocket jettison switch. When the rocket jettison selector switch is in the "JETTISON READY" position, rockets only, may be jettisoned by pressing the bomb release button.

CAUTION

The lower rocket must always be fired first. When it is known that the lower rocket has misfired during single round firing, the upper rocket on the same launcher must not be fired. If the upper rocket is fired with the lower rocket attached, both rockets will release with an immediate nose-over trajectory causing

(PAGE 38A DELETED.)



1.	EMERGENCY HYDRAULIC SYSTEM RESERVOIR	6.	ENGINE OIL FILLER PLUG
2.	FUSELAGE TANK FILLER CAP	7.	WATER INJECTION TANKS FILLER CAP (1)
3.	DROP TANK FILLER CAP	8.	MAIN HYDRAULIC SYSTEM RESERVOIR
4.	LEADING EDGE AND OUTBOARD WING TANK FILLER CAP	9.	OXYGEN SYSTEM FILLER CONNECTION
5.	INBOARD WING TANK FILLER CAP	10.	BRAKE RESERVOIR

Figure 21 — Replenishment Diagram

damage to the wing surface. Therefore, all the unfired rockets should be jettisoned in a safe area or returned to the base. Note that the jettisoning is not selective but that all rocket stations jettison simultaneously. If a misfire should occur during automatic firing and if the upper rocket is fired with the lower rocket still attached and if the fins are secured properly, only slight damage will occur to the airplane.

3A. TOW TARGETS.

a. Either the fuselage type installation or the jato latch type installation may be used. With either type of installation a banner type A-6B target is used.

b. RELEASE OF JATO LATCH TOW TARGETS.

(1) To accomplish release of the target when attached to the jato latch, the tow plane should be flown at minimum safe flying speed. This procedure reduces the target drag load and facilitates operation of the manual release.

(2) In case of failure to release the target, a landing should be made at an adequate distance from the end of the runway in order that the target may clear all obstacles short of the runway. The glide angle should be planned accordingly with an increase in prescribed approach and landing speed of approximately 10 miles per hour IAS.

4. PHOTOGRAPHIC EQUIPMENT (RF-80A).

a. CAMERA MASTER SWITCH.

The camera master switch (5, figure 9) energizes the entire camera electrical system.

b. INDIVIDUAL CAMERA SWITCHES.

The individual camera switches (10, figure 9) determine which cameras will be operated and whether they will operate from the intervalometer or from the manual (trigger switch) control.

c. INDICATOR LIGHTS.

The amber indicator light (4, figure 9) burns when the camera master switch is "ON."

The green blinker lights (9, figure 9) burn while film is winding for the next picture, except when Type A-5A, A-7, A-8B or A-14 film magazines are installed and the cameras are being operated manually.

d. EXPOSURE COUNTERS.

The exposure counters (7, figure 9) show the cumulative total of exposures made except when pictures are being taken "runway" Type A-5A, A-7, A-8B or A-14 magazines are installed.

e. INTERVALOMETERS.

The intervalometers are used to automatically regulate the time interval at which pictures are taken. To operate a camera on the intervalometer, set the intervalometer dial (11, figure 9) to the desired time between exposures and set the individual camera switch to "INT." To stop the intervalometer, turn the indicator through "60" to the "OFF" position.

CAUTION

Do not set an intervalometer for a shorter period than the cycling time of the equipment being used.

f. RECORDER.

A selector switch (17, figure 9D) installed on the right hand switch panel allows recorder to operate during voice transmission or separately as desired. This switch has four positions: "OFF," "TRANSMIT ONLY," "TRANSMIT & RECORD," and "RECORD ONLY."

5. COMMUNICATIONS EQUIPMENT.

a. An AN/ARC-3 (or AN/ARC-27) Radio receiver-transmitter is standard equipment in this airplane. The controls for this set are shown in figures 8 and 8A.

(1) On some airplanes the radio is turned on by pressing a frequency selector push button, on others the radio switch is closed and the selector is turned to the desired frequency. Wait about one minute for the set to warm up.

(2) To transmit, press the microphone button (13, figures 6 and 6A) and speak.

(3) To transmit code, use the tone control button as a key.

(4) To turn the equipment off, press both the off buttons simultaneously.

b. Deleted.

c. IFF is standard equipment. Early airplanes use an SCR695 radio (1, figure 6); late airplanes use an AN/APX-6 radar (1, figure 6).

d. Deleted.

e. A radio compass (AN/ARN-6 or AN/ARN-7) is installed in the RF-80A airplanes.

f. Some airplanes are equipped with AN/APW-11 Radar and AN/APA-90 controls.

6. DE-ICING EQUIPMENT.

a. FUEL FILTER DE-ICING SYSTEM. — The fuel filter de-icing system utilizes the right-hand fluid injection tank and pump. In addition a warning light and de-icing switch are located on the left-hand shelf (3A, figure 6 and 2, figure 6A). The warning light is operated by a differential pressure switch which senses the fuel pressure drop across the low pressure fuel filter. If the filter pressure drop reaches approximately 2 psi, the warning light comes on, indicating the possibility of icing. When the airplane is serviced for filter de-icing, the right-hand fluid injection tank is filled with 100% alcohol in accordance with Specification AN-A-18. In addition the tank is connected through the fluid injection pump and a solenoid shut-off valve to the low pressure fuel filter. Holding the de-icing switch in the "ON" position opens the solenoid valve and pumps alcohol into the filter. If the filter is iced, the alcohol will dissolve the ice accumulation, reducing the pressure drop, and the warning light will go out.

WARNING

If the filter icing warning light comes on, hold the de-icing switch in the "ON" position until the warning light goes out. If the warning light does not go out after holding the de-icing switch on for 20 to 30 seconds, the filter may be clogged with dirt and should therefore be inspected as soon as possible.

Note

Since the airplane may be serviced for either water injection or fuel filter de-icing, the choice will depend on ambient ground air temperatures. Operation of water-alcohol injection system is permissible only when the ambient ground air temperatures are not lower than 0°C (+32°F).

7. LIGHTING EQUIPMENT.

a. LANDING LIGHT. — The landing light located in the nose (on unmodified F-80A airplanes) normally points down at an angle suitable for landing but may also be used as a spotlight. By pulling the landing light lever (9, figure 7), the angle of the light is changed so that it points straight ahead along the flight path of the airplane. On late airplanes there are two landing lights attached to the nose landing gear shock strut. These light are not adjustable. The lights are controlled by the landing light switch (7, figures 8 and 8A) located on the right-hand cockpit shelf.

CAUTION

These lights will burn when the gear is retracted. Be sure the lights are turned off when not in use as they will burn out very rapidly.

b. RECOGNITION LIGHTS. — Red, green and amber lights for aircraft recognition are located on the bottom of the fuselage on the fuel compartment access door. The lights may be controlled individually by switches (8, figure 8) located on the right shelf, or keyed by a keying switch adjacent to the individual switches.

Some planes have recognition lights disconnected.

c. NAVIGATION LIGHTS. —A conventional navigation light system is employed, incorporating wing tip light and position lights on the vertical stabilizer. The navigation lights are controlled by the "DIM-BRIGHT" switch and the "STEADY-OFF-FLASH" switch on the right hand shelf.

d. COCKPIT LIGHTS. — Cockpit lighting is provided by two fluorescent lights and two spotlights. One fluorescent light and one spotlight are mounted on each side of the cockpit. The fluorescent lights are controlled by rheostats (7, figures 6 and 6A, and 19, figures 8 and 8A) mounted on the left and right cockpit shelves. Spotlights (3, figures 6 and 6A, and 10, figures 8 and 8A) are controlled by an integral switch.

e. FUSELAGE AND SIGNAL LIGHTS. — 6 watt and 100 watt lights are mounted in integral fixture on top and bottom of fuselage. The "DIM" position of the "DIM-BRIGHT" switch controls the 6 watt lights; the "BRIGHT" position controls the 100 watt lights.

SECTION VI
EXTREME WEATHER OPERATION

1. COLD WEATHER OPERATION.

a. GENERAL. — The success of low temperature operation depends primarily on preparations made during the engine shut-down and post-flight inspection in anticipation of the requirements for operation on the following day.The procedure outlined in"BEFORE LEAVING THE AIRPLANE" must be followed to expedite the preflight inspection and insure satisfactory operation of the aircraft and its systems during the next flight.

b. BEFORE ENTERING THE AIRPLANE.

(1) Remove all protective covers and dust plugs.

(2) Check entire aircraft for freedom from frost, snow and ice. Brush off all light snow or frost. Remove all ice by direct flow of air from a portable ground heater. Do not chip or scrape away ice as this may cause damage to the airplane. The collection of snow, frost and ice on aircraft surfaces constitutes one of the major flight hazards in low temperature operation and will result in loss of lift and treacherous stalling characteristics.

(3) Check that fuel tank vents, fuel filters and drain cocks are free from ice and drain condensate. The presence of ice in the fuel system can result in ruptured filters and collapsed screens and ultimate engine failure.

(4) Check shock strut oleos and actuating cylinders for ice and dirt and clean with a hydraulic oil-soaked rag. Check shock struts for proper inflation.

(5) No pre-heat or oil dilution is required to insure crankability down to —54°C (—65°F). Pre-heat of the accessory section and oil crankcase through the air intake ducts will decrease the starting loads, but is not necessary to accomplish starts.

(6) Check that engine fuel lines are filled with gasoline when required.

(7) Check that the fluid injection system has been serviced with alcohol for fuel filter de-icing.

(8) At temperatures below —26°C (—15°F), use pre-heat in the cockpit and on the canopy seal.

c. ON ENTERING THE AIRPLANE.

(1) Check flight controls for proper operation.

(2) Insure that canopy can be closed and locked.

(3) Use an external power source to operate and check electrical and radio equipment.

d. BEFORE STARTING ENGINE.

(1) A C-21 power unit or its equivalent is required for starting. If minimum starting rpm (9%) cannot be obtained, shut down engine and connect an "adequate" power unit. Pre-heat through the intake ducts and use the aircraft batteries as a boost if a start is necessary with an inadequate power source.

e. STARTING THE ENGINE.

Note

Ground starts will be accomplished whenever possible with aircraft *heading into* the wind.

CAUTION

Airplane serial numbers 44-84992 through 44-85466 which have been modified to incorporate winterization changes differ from other winterized aircraft in that the gasoline starting switch will not actuate the fuel by-pass control. Therefore, for these airplanes, the fuselage tank switch must be placed in the "BY-PASS" position for all starting operations.

f. WARM-UP AND GROUND CHECK.

WARNING

If there is no indication of oil pressure after 30 seconds running, or if the pressure drops to 0 after a few minutes of ground operation, stop engine and investigate.

Note

No warm-up is required if oil pressure remains below 100 psi, and 100% rpm or full throttle can be obtained. If the aircraft is equipped with the 0-50 psi gage, take-off must be delayed until the indicator has dropped below 50 psi. If the aircraft is equipped with

the later 0-100 or 0-200 psi gages, a high reading is not dangerous. However, the pressure must be allowed to drop below 100 psi before take-off. If the oil pressure reading on these higher reading gages remains at 100 psi or higher, this is an indication of an oil system malfunction and the airplane should not be flown.

(1) Turn on cabin heat and windshield defrosting system as required immediately after engine start.

(2) Check surface controls, dive flaps, and aileron and elevator trim tabs for proper operation.

(3) Check wing flap and flap indicator operation. If questionable readings result, cycle flaps three to four times to correct indicator operation.

(4) Check instruments for proper operation. Electric gyro instruments will require approximately two minutes for warm-up from the time the battery switch is turned on.

WARNING

Make sure all instruments have warmed up sufficiently to insure normal operation. Check for sluggish instruments during taxiing.

(5) Because of low ambient temperatures, the thrust developed at all engine speeds is noticeably greater than normal.

WARNING

Use firmly anchored wheel chocks for all engine run-ups. The aircraft should be tied down securely before attempting a full power run-up.

g. TAXIING INSTRUCTIONS.

(1) Avoid taxiing in deep snow as taxiing and steering are extremely difficult and frozen brakes are likely to result.

(2) Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds.

(3) Increase taxi interval at subfreezing temperatures to insure safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice in the jet blast of a preceding airplane.

(4) Minimize taxi time to conserve fuel and reduce amount of ice fog generated by jet engines.

h. BEFORE TAKE-OFF.

(1) Check that fluid injection and fuel filter de-icing switches are "OFF."

(2) Check that canopy is locked.

(3) Brakes will not hold aircraft on snow covered or icy runways at full throttle. Final instrument check must be made during the first part of take-off roll.

i. TAKE-OFF.

(1) Open throttle to 100% rpm or full open position, whichever occurs first. Maximum engine speed of 100% rpm may not be available due to increased air density. However, the thrust developed at extremely low temperatures at full throttle is equal to or higher than the thrust developed at maximum rpm at normal temperatures although the available engine speed may be less than 100%. However, do not attempt to take-off if full throttle does not give at least 95% rpm.

j. AFTER TAKE-OFF.

(1) After take-off from a wet snow or slush covered field, operate the landing gear and flaps through several complete cycles to preclude their freezing.

(2) Turn on gun and gun camera heaters immediately after take-off.

k. OPERATION OF THE AIRCRAFT SYSTEMS DURING FLIGHT.

(1) Use cockpit heat and defroster as required. Adjust cockpit temperature to desired value by reference to cockpit temperature gage.

(2) Operate fuel filter de-icing system as required.

l. OPERATION UNDER ICING CONDITIONS.

(1) Aircraft which do not incorporate air intake anti-icing equipment will observe the following:

(a) Air intake icing may occur when jet aircraft are operated in areas when atmospheric conditions are such that icing is possible. Ice will form readily when air temperature and dew point are in proximity at or near freezing temperatures, due to air ram effect or the air striking solid objects. Air intake icing can occur when no visual evidence of ice can be detected on the aircraft. The effect of air intake icing on jet aircraft at a fixed throttle setting causes a reduction in air flow to the combustion chamber with a corresponding loss in thrust. This condition is not accompanied by any discernible change in fuel flow but results in a rapid increase of indicated exhaust gas temperatures.

(b) Avoid flying into known icing conditions. Under certain conditions icing can occur in the induction system which will not be observed until a reduction of air flow to the combustion chambers results.

(c) The initial symptom of engine icing is increased tail-pipe temperatures with a decrease in thrust.

(d) If icing conditions are encountered and tail-

pipe temperatures increase, the throttle will be immediately retarded and an effort made to leave the icing area. (If the throttle is not immediately retarded to maintain normal tailpipe temperatures, engine failure may result due to overheating of the turbine and exhaust system. *This may occur very rapidly.* Advance of the throttle in an effort to maintain thrust will aggravate the overheating condition and accelerate engine failure.)

(e) If, under suspected icing conditions engine overheating and "explosion" denoting turbine bucket failure occurs, with resultant engine failure, an air restart should not be attempted.

m. DESCENT.

(1) Operate auxiliary defroster to clear bulletproof panel of frost usually formed during rapid descent from altitude.

(2) Check engine operating temperatures during descents and in the traffic pattern as low temperatures are common at low altitudes due to frequent temperature inversions.

n. APPROACH.

(1) Make normal patterns and landings but allow for flatter glide due to thrust augmentation caused by extremely low ambient temperatures.

(2) Turn off all electrical equipment possible at least one minute before final approach to reduce battery load when rpm is lowered and generator cuts out.

(3) Pump brakes to check operation.

o. BEFORE LEAVING AIRPLANE.

(1) Release brakes after wheels are chocked.

(2) Leave canopy partly open to allow circulation within the cockpit to prevent canopy cracking from differential contraction and decrease windshield and canopy frosting.

(3) Inspect and wipe shock struts and actuating cylinders with a hydraulic oil-soaked rag. It is advisable to keep shock struts exceptionally clean as any scarring of the seals will result in excessive hydraulic leakage at low temperatures.

(4) Install protective covers and dust plugs.

(5) Drain fuel pump within 30 minutes after stopping engine.

(6) Whenever possible, leave aircraft parked with full fuel tanks. Every effort should be made during servicing to prevent moisture from entering the fuel system.

(7) Remove batteries when aircraft is parked outside at temperatures below —29°C (—20°F) for more than four hours or for any extended period of time.

Pages 40E and 40F Deleted.

APPENDIX I

FLIGHT OPERATING DATA

1. FLIGHT OPERATION INSTRUCTION CHARTS.

a. The purpose of the Flight Operation Instruction Chart is to show the range remaining in the airplane and the procedure required to obtain this range. The main variables affecting range have been incorporated in an effort to give the most usable and most accurate information consistent with simplicity.

(1) The chart may be used at any point in flight or preflight planning. The initial conditions are the actual altitude of the airplane and the fuel remaining on board. In the Flight Operation Instruction Chart, the main columns across the top are initial altitude conditions. On line opposite fuel quantities, ranges are shown for each initial altitude. In general, two range values are given for each altitude and fuel quantity, one for level flight at that altitude, and one for the maximum range obtainable by climbing to a higher altitude. Distances covered in let-down are included, and for range figures indicating a cruise at higher altitude, climb distance is included.

b. Fuel quantities tabulated on the chart represent fuel that is available for cruising and landing. Allowances must be made for extra items such as combat and endurance reserves. Landing reserve allowance must also be made. Additional allowances must be made for evaporation losses when using gasoline and JP4 fuels and for fuel "slugging" losses when using JP4 fuel under adverse conditions. During fuel "slugging" large quantities of liquid fuel are carried overboard through the vent system by violent foaming of the fuel. The fuel quantities to allow for these losses cannot be simply presented as they vary from zero to considerable amounts depending upon atmospheric temperatures, fuel temperature at take-off, individual fuel shipments, the length of time since the fuel was refined (amount of weathering) and the rate of change of altitude during flight.

c. Under different wind conditions ranges are varied by the effect of wind on ground speed. Let-down distances are affected for the same reason. Recommended rpm to obtain long range may also change with different headwinds in order to maintain the most favorable miles-per-gallon ratio. The lower half of the Flight Operation Instruction Chart contains operating instructions for different wind conditions. These cruising data are presented for the same altitudes that head the upper half of chart.

(1) Since the wind may be from any direction with respect to the airplane course, some question may rise as to the method of handling winds other than straight headwinds or tailwinds. For purposes of cruise control, all winds may be expressed as effective winds. This reduces the wind to one which would have the same effect of the airplane's ground speed if it were a straight head or tailwind. In other words, it is the component of wind in the direction of the airplane heading. For example, a 100 mph wind at 45 degrees to the course will be an effective headwind of about 75 mph for an airplane whose air cruising speed is 400 mph. The ground speed along the course will be about 325 mph.

2. TAKE-OFF CHART.

a. The new type Take-Off Chart lists take-off distances for various pressure altitudes and air temperatures.

b. Set airplane altimeter to 29.92 and read pressure altitude. With air temperature in degrees Fahrenheit as obtained from the field weather station and pressure altitude, enter chart and determine required take-off distances.

c. Take-off procedures:

(1) Without tip tanks—12,000 lb.
Set flaps at 70%.
Run engine up to 100% rpm.
Release brakes.
At 80 IAS lift nose wheels slightly off runway.
Allow airplane to accelerate to 120 IAS.
Lift airplane off runway and allow airspeed to increase gradually to 130 IAS.
Hold 130 IAS until any obstacle is cleared.

(2) With tip tanks—14,500 lbs.
Set flaps at 70%.
Run engine up to 100% rpm.
Release brakes.
At 105 IAS lift nose wheel slightly off runway.
Allow airplane to accelerate to 130 IAS.
Lift airplane off runway and allow airspeed to increase gradually to 140 IAS.
Hold 140 IAS until any obstacle is cleared.

d. Take-off Charts in previous issues of the F-80A "Handbook, Flight Operating Instructions" included a 25% conservatism factor. The data listed on the Take-off Charts contains no conservatism factor and is based on an average airplane and engine with an average pilot.

3. USE OF THE FLIGHT OPERATION INSTRUCTION CHARTS.

a. To use the chart in flight, the pilot refers to the upper half, and under the present altitude column reads range opposite fuel quantity. For cruising at that altitude the operating instructions are listed directly below. Entering on the line according to effective wind, read the range factor, cruising rpm, and let-down distances. Multiplying still air range by the range factor results in ground miles that can be flown. Approximate values of indicated airspeed, gallons per hour, and ground miles per hour are given for reference.

b. If it is desirable to increase range enter the same altitude column as before. Under the second and third subheadings are shown the optimum altitude to which a climb should be made to obtain best range, and the range at that optimum altitude. To obtain this range climb immediately (according to the recommended climb procedure) to the altitude shown. For cruising instructions refer to the lower half of the chart in the column according to the new altitude. Calculation of range in a wind and cruising procedure are as described above for the level flight cruise. Note that at any time during the flight, the pilot may refer to the chart with actual conditions of altitude and fuel to obtain range remaining in the same manner as previously discussed.

4. EXAMPLES OF USE OF CHARTS.

a. Maximum range on internal fuel (420 gallons) at 35,000 feet altitude against an 80 mph headwind. Take-off weight 12,000 lb. Reserve is decided to be 40 gallons.

(1) From the climb chart (Fig. 26) it is seen that the take-off and climb to altitude will use 137 gallons of fuel. The still air range covered in climb will be about 114 miles. The fuel remaining at 35,000 feet will be 243 gallons (420 — 137 — 40).

(2) By referring to the 35,000 foot section of the Flight Operation Instruction Chart (Fig. 28 sheet 2) opposite 240 gallons, it can be seen that 555 additional still air miles can be flown, including allowances for let-down and landing. The total still air range is then 114 plus 555 or 669 miles.

(3) In the lower half of the chart it is seen that the range factor for an 80 mph headwind is .8. Multiplying the still air range by this factor gives about 535 miles actual range.

(4) Cruising at 35,000 feet with a headwind of 80 mph, according to the lower half of the Flight Operation Instruction Chart, is at 91% rpm and the let-down is begun 120 miles from the destination.

b. Illustration of the use of the chart in flight. The airplane is at 5,000 feet altitude and, after subtracting reserve, with 400 gallons of available fuel and distance to destination is 580 miles.

(1) Reference to the 5,000 column of the Flight Operation Instruction Chart (Fig. 28 sheet 1) opposite 400 gallons shows that by cruising at 5,000 feet range will be only 380 miles. By climbing to 40,000 feet a flight of 875 miles can be made. In order to fly 580 miles it is evident that it is necessary to climb and cruise at an altitude higher than 5,000 feet, but not necessarily as high as 40,000 feet. A linear interpolation (which in all cases will be close to the actual values) between the differences in range (875 — 380 = 495) and altitude (40,000 — 5,000 = 35,000)provides a quick guess that for the 200 additional miles of range needed (580 — 380 = 200) an increase of at least 15,000 feet of altitude will be necessary (or a minimum cruising altitude of 20,000 feet).

(2) Take 20,000 feet as the cruising altitude and climb to that altitude immediately, according to recommended climb procedure. A distance of 42 miles will be covered with an expenditure of 48 gallons of fuel. This means that there are only (580 — 42) or 538 miles to go from that point and 352 gallons are available. With these as the initial conditions enter the Flight Operation Instruction Chart in the 20,000 feet column. The distance which can be flown at 20,000 feet opposite 360 gallons is 545 miles. This shows that a climb to 20,000 feet will provide sufficient range (42 + 545 = 587) to reach destination. (Cruising CAS at 20,000 feet is 281 mph.) However, by climbing to 40,000 feet a flight of about 875 miles instead of 587 miles could be made with 400 gallons or with a resultant inrease in range of 288 miles.

c. ESCORT MISSION.

(1) It is desired to escort bombers at 25,000 feet, tip tanks to be carried and dropped when empty. 15 minutes' combat at 100% rpm at 25,000 feet to be included. How far can the bombers be escorted?

(2) The take-off fuel will be 750 gallons. The combat allowance chart indicates that 105 gallons (15 minutes at 7 gallons per minute) will be required for combat. 50 gallons are desired for reserve.

(a) The climb chart (Fig. 26)shows 146 gallons will be used and 100 miles will be covered in climb to altitude (Fuel for take-off included in the 146 gallons.)

(b) After 25,000 feet is reached 750 — 146 = 604 gallons will be available for level flight, combat, descent, and 50 gallons landing reserve. Subtracting the 105 gallon allowance for combat and 50 gallons landing reserve leaves 449 gallons. Reference to Fig. 30

sheet 2 shows that at 25,000 feet 775 miles can be flown with 450 gallons of fuel. With the 100 miles covered in climb 775 + 100 = 875 miles can be covered. The bombers can be escorted 435 statute miles.

(c) The operating insructions on the lower half of Fig. 30 sheet 2 shows that at 25,000 feet 268 mph CAS is required and the true airspeed or ground speed for no wind is approximately 408 mph. Fig. 28 sheet 2 (to be used after tip tanks are dropped) shows at 25,000 feet 263 mph CAS is required and the true airspeed or ground speed for no wind is approximately 400 mph.

(d) Reference to Fig. 28 sheet 2 shows that at 25,000 feet approximately 250 gallons will be required for the return trip. If a climb is made to 40,000 feet for the return trip, 595 miles can be covered with 250 gallons. This would provide a reserve of approximately 160 miles (595-435).

d. MAXIMUM FERRY RANGE

(1) Take-off fuel with tip tanks = 750 gallons. Tip tanks to be carried all the way.

(2) Reference to Fig. 29 shows that the optimum altitude for any fuel quantity over 400 gallons is 40,000 feet.

(a) The climb chart (Fig. 26) shows that 303 gallons and 335 miles will be covered in warm-up, take-off, and climb to 40,000 feet.

(b) After 40,000 feet is reached, 750 — 303 = 447 gallons will be available for level flight, let-down, landing, and reserve.

(c) For 397 gallons (447-50 gal. reserve) at 40,000 feet about 900 miles are available.

(d) With the 335 miles covered in climb a total flight of 900 + 335 = 1235 miles can be made.

(3) Reference to Fig. 30 sheet 2 (tip tanks dropped when empty) shows that at 40,000 feet 397 gallons will permit a flight of 1045 miles. With the 335 miles covered in climb the total range with a 50 gallon landing reserve is 1045 + 335 = 1370 miles.

TAKE-OFF DISTANCES

WITH TWO 1000 LB. THRUST JATO UNITS

SEA LEVEL — STANDARD DAY — ZERO WIND

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5

ENGINE MODELS
J33-A-9A, -GE-11A, -A-17

CONFIGURATION	GROSS WEIGHT POUNDS	OPTIMUM BREAK GROUND DISTANCE		OPTIMUM DISTANCE TO CLEAR 50′ OBSTACLE	
		TAKE-OFF DISTANCE FEET	JATO FIRING POINT DISTANCE FROM START	TOTAL DISTANCE OVER 50′ OBSTACLE	JATO FIRING POINT DISTANCE FROM START
Without Tip Tanks With Fluid Injection	12300	1225	50	1750	225
Without Tip Tanks Without Fluid Injection	12300	1475	300	2150	550
With Tip Tanks With Fluid Injection	14800	1850	325	2625	800
With Tip Tanks Without Fluid Injection	14800	2275	750	3350	1500

DATA AS OF: 1 Jan. 49

DATA BASED ON: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 22 — Take-off Distances with Jato Units (F-80A-1, -5 and RF-80A-5)

COMBAT ALLOWANCE CHART
CLEAN CONFIGURATION
STANDARD DAY

AIRCRAFT MODELS
F-80A-1, -5, -10
RF-80A-5, -10, -15, -20, -25

ENGINE MODELS
J33-A-9A, -9B, -17, -17A, -21, -35
J33-GE-11A, -11B

AT ALTITUDE FEET	FUEL REQUIRED — GALLONS PER MINUTE	
	96% RPM (NORMAL POWER) MAXIMUM CONTINUOUS	100% RPM (MILITARY POWER) 30 MINUTE LIMIT
SEA LEVEL	12 (13)	15
5,000	11 (12)	12 (14)
10,000	9 (11)	11 (13)
15,000	8	9 (10)
20,000	7	8 (9)
25,000	6	7 (8)
30,000	5	6 (7)
35,000	4	5 (6)
40,000	3	4

REMARKS
1. Fuel values in parentheses are for airplanes with J33-A-35 engines.

DATA AS OF: 1 Jan. 48 DATA BASED ON: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 23 — Combat Allowance Chart

LANDING DISTANCE — FEET
STANDARD DAY

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5

ENGINE MODELS
J33-A-9A, -GE-11A, -A-17

GROSS WEIGHT LBS.	BEST IAS FOR APPROACH		70% FLAPS — HARD SURFACE — NO WIND							
	POWER OFF	POWER ON	AT SEA LEVEL		AT 2000 FT.		AT 4000 FT.		AT 6000 FT.	
	MPH	MPH	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′
8000	120	120	1400	2900	1470	3050	1540	3200	1600	3350
12000	145	145	2050	4150	2150	4350	2275	4575	2400	4800

LEGEND
IAS: INDICATED AIRSPEED
MPH: STATUTE MILES PER HOUR

DATA AS OF: 1 Dec. 47 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 24 — Landing Distance Chart (F-80A-1, -5 and RF-80A-5)

TAKE-OFF DISTANCES — FEET

70% FLAPS, HARD SURFACE RUNWAY

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5

ENGINE MODELS
J33-A-9A, -GE-11A, -A-17

CONFIGURATION AND GROSS WEIGHT	PRESSURE ALTITUDE FT.	60°F				80°F				100°F				120°F			
		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
		GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′
CLEAN 12,000 LBS.	S. L.	2800	3350	1512	1810	3150	3675	1702	1985	3425	4125	1850	2230	3875	4575	2092	2310
	1,000	3000	3575	1620	1931	3375	3975	1822	2150	3800	4425	2000	2390	4175	4925	2255	2660
	2,000	3275	3825	1768	2065	3625	4275	1958	2310	4075	4750	2200	2564	4525	5275	2282	2850
	3,000	3500	4100	1890	2215	3900	4575	2105	2470	4350	5100	2350	2755	4850	5650	2620	3050
	4,000	3750	4425	2025	2390	4200	4925	2270	3660	4700	5500	2538	2970	5225	6025	2822	3255
	5,000	4050	4700	2190	2590	4550	5300	2458	2862	5025	5875	2715	3175	5625	6525	3040	3525
2 X 165 GALLON TIP TANKS 14,500 LBS.	S. L.	3975	4725	2285	2715	4350	5100	2500	2930	4775	5600	2745	3220	5200	6075	2990	3492
	1,000	4325	5075	2485	2917	4675	5500	2690	3160	5150	6125	2960	3520	5600	6550	3220	3765
	2,000	4625	5425	2660	3118	5050	5900	2904	3390	5525	6475	3175	3723	5625	7000	3235	4025
	3,000	5000	5825	2875	3348	5425	6325	3118	3635	5950	6925	3420	3980	6475	7500	3720	4310
	4,000	5375	6250	3090	3592	5825	6775	3350	3895	6400	7375	3680	4240	6950	8020	4000	4620
	5,000	5775	6725	3320	3870	6275	7300	3610	4190	6900	8000	3970	4600	7475	8650	4290	4970

DATA AS OF: 1 Dec. 47 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 25 — Take-off Distance Chart (F-80A-1, -5 and RF-80A-5)

CLIMB CHART FOR MAXIMUM POWER
HOT DAY

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5

ENGINE MODELS
J33-A-9A, -GE-11A, -A-17

CONFIGURATION: 2 X 165 GALLON TANKS
WEIGHT: 14,500 LBS.

CONFIGURATION: CLEAN
WEIGHT: 12,000 LBS.

APPROXIMATE							APPROXIMATE			
RATE OF CLIMB (3)	FROM SEA LEVEL			CAS MPH	PRESSURE ALTITUDE FEET	CAS MPH	FROM SEA LEVEL			RATE OF CLIMB (3)
	DISTANCE	TIME	FUEL				FUEL	TIME	DISTANCE	
2000	—	—	31 (2)	313	SEA LEVEL	337	21 (2)	—	—	2500
1850	14	3	52	304	5,000	328	37	2	11	2450
1650	30	6	73	294	10,000	318	52	4	24	2350
1450	49	9	99	284	15,000	309	68	6	38	2200
1250	72	13	120	276	20,000	294	85	9	53	2000
1000	100	17	146	266	25,000	280	101	11	70	1750
750	140	22	178	250	30,000	259	119	14	90	1500
400	195	30	230	236	35,000	240	137	18	114	1200
100	335	50	303	217	40,000	217	155	22	147	850

REMARKS

1. Climb at recommended CAS.
2. Taxi and take-off allowance.
3. Climb values based on hot day operation.
   These values will be exceeded on a standard day.

LEGEND

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: STATUTE MILES
TIME: MINUTES
FUEL: U.S. GALLONS
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

DATA AS OF: 1 Dec. 47 DATA BASIS: Flight Test

Figure 26 — Climb Chart — F-80A-1, -5 and RF-80A-5

DESCENT CHART
STANDARD DAY

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5

ENGINE MODELS
J33-A-9A, -GE-11A, -A-17

CONFIGURATION: 2 X 165 GALLON TANKS
WEIGHT: 14,500 LBS.

CONFIGURATION: CLEAN
WEIGHT: 12,000 LBS.

APPROXIMATE							APPROXIMATE			
RATE OF DESCENT	TO SEA LEVEL			CAS MPH	PRESSURE ALTITUDE FEET	CAS MPH	TO SEA LEVEL			RATE OF DESCENT
	DISTANCE	TIME	FUEL				FUEL	TIME	DISTANCE	
1200	110	18	34	187	40,000	197	66	27	175	800
1450	85	14	27	207	35,000	216	56	21	135	900
1700	70	11	22	227	30,000	235	47	16	100	1050
2000	50	9	18	245	25,000	255	40	12	70	1250
2300	40	7	14	264	20,000	275	32	8.5	50	1550
2750	30	5	9	284	15,000	294	26	5.5	35	2000
3050	15	3	6	304	10,000	312	16	3.0	20	2500
3500	5	1.5	2	323	5,000	332	7	1.5	10	3000
4000	—	—	—	342	SEA LEVEL	351	—	—	—	3600

REMARKS

1. Maintain 50-60 PSI burner pressure and recommended CAS.
2. Descend at 177 CAS for maximum range without power.

LEGEND

RATE OF DESCENT: FEET PER MINUTE
DISTANCE: STATUTE MILES
TIME: MINUTES
FUEL: U.S. GALLONS
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

DATA AS OF: 1 Dec. 47 DATA BASIS: Flight Test

Figure 27 — Descent Chart — F-80A-1, -5 and RF-80A-5

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5
ENGINES: J33-A-9A, -GE-11A, -A-17

FLIGHT OPERATION INSTRUCTION CHART
STANDARD DAY
CHART WEIGHT LIMITS 12,000 TO 8000 POUNDS

EXTERNAL LOAD ITEMS
NONE
NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
335	40	895	420	(395)	40	(930)	(460)	40	(955)	(535)	40	(980)	420	(650)	40	(1010)
320	40	845	400	(380)	40	(875)	(440)	40	(900)	(510)	40	(925)	400	(595)	40	(955)
290	40	740	360	340	40	770	395	40	795	(460)	40	(825)	360	(545)	40	(850)
255	40	635	320	305	40	665	355	40	690	410	40	720	320	480	40	745
225	40	530	280	265	40	560	310	40	585	360	40	615	280	420	40	640
190	40	425	240	230	40	455	265	40	480	305	40	510	240	360	40	535
160	40	320	200	190	40	350	220	40	380	255	40	405	200	300	40	430
125	30	220	160	155	35	245	180	35	265	205	40	300	160	240	40	325
95	25	140	120	115	25	155	135	30	180	155	30	195	120	180	35	220
65	15	80	80	75	20	90	90	20	100	105	25	115	80	120	25	130

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW																			120 HW						
						80 HW													336	90	355	354	.8	30	80 HW	308	90	295	351	.8	46
378	87	481	348	.9	0	40 HW	361	87	428	358	.9	9	340	87	378	364	.9	18	318	88	329	370	.9	33	40 HW	295	88	280	373	.9	50
366	85	466	374	1.0	0	0	342	86	403	377	1.0	10	321	86	353	381	1.0	24	300	86	303	386	1.0	35	0	281	87	263	393	1.0	53
334	82	418	382	1.1	0	40 TW	310	82	361	382	1.1	11	294	82	319	390	1.1	26	279	83	277	398	1.1	37	40 TW	264	83	242	408	1.1	56
						80 TW													254	80	251	406	1.3	40	80 TW	244	82	221	420	1.2	59
						120 TW																			120 TW						

Figure 28 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-1, -5 and RF-80A-5)

AIRCRAFT MODELS

F-80A-1, -5 RF-80A-5

ENGINES: J33-A-9A, -GE-11A, -A-17

HIGH ALTITUDE

CHART WEIGHT LIMITS 12,000 TO 8000 POUNDS

EXTERNAL LOAD ITEMS

NONE

NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000′ RANGE IN AIRMILES: BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES: BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	IF YOU ARE AT 35,000′ RANGE IN AIRMILES: BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	IF YOU ARE AT 40,000′ RANGE IN AIRMILES: BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES: BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
(730)	40	(1035)	420	(850)	40	(1060)	(975)	40	(1085)	(1100)	—	—	420			
(695)	40	(980)	400	(810)	40	(1010)	(925)	40	(1030)	(1045)	—	—	400			
(625)	40	(875)	360	(725)	40	(905)	(835)	40	(925)	(940)	—	—	360			
(555)	40	(770)	320	(645)	40	(800)	(740)	40	(820)	(835)	—	—	320			
485	40	665	280	565	40	695	650	40	720	(730)	—	—	280			
415	40	560	240	485	40	590	555	40	615	630	—	—	240			
345	40	455	200	405	40	485	465	40	510	525	—	—	200			
280	40	355	160	325	40	380	370	40	405	420	—	—	160			
210	40	250	120	245	40	280	280	40	305	315	—	—	120			
140	30	150	80	165	35	175	190	35	190	210	—	—	80			

CRUISING AT 25,000′ CAS	APPROXIMATE % RPM	GAL/HR	G.S.	R.F.	Let Down Dist.	EFFECTIVE WIND MPH	CRUISING AT 30,000′ CAS	APPROXIMATE % RPM	GAL/HR	G.S.	R.F.	Let Down Dist.	CRUISING AT 35,000′ CAS	APPROXIMATE % RPM	GAL/HR	G.S.	R.F.	Let Down Dist.	CRUISING AT 40,000′ CAS	APPROXIMATE % RPM	GAL/HR	G.S.	R.F.	Let Down Dist.	EFFECTIVE WIND MPH	CRUISING AT 45,000′ CAS	APPROXIMATE % RPM	GAL/HR	G.S.	R.F.	Let Down Dist.
293	91	272	328	.7	60	120 HW	269	91	237	328	.7	85	245	91	209	328	.7	110	233	96	193	358	.7	150	120 HW						
281	90	251	348	.8	63	80 HW	263	90	223	358	.8	90	245	91	209	368	.8	120	228	95	188	388	.8	160	80 HW						
273	88	241	376	.9	67	40 HW	253	89	213	381	.9	98	234	90	188	386	.9	128	226	94	183	424	.9	165	40 HW						
263	87	230	400	1.0	70	0	248	88	205	413	1.0	104	234	90	188	426	1.0	135	219	93	172	450	1.0	175	0						
249	86	215	418	1.1	74	40 TW	233	87	190	427	1.1	108	217	88	172	436	1.1	142	215	92	167	482	1.1	175	40 TW						
234	84	199	434	1.2	77	80 TW	220	86	178	446	1.2	114	207	87	162	458	1.2	150	207	91	162	502	1.2	185	80 TW						
215	82	188	446	1.4	84	120 TW	211	85	174	472	1.3	120	207	87	162	498	1.3	155	207	91	162	542	1.3	195	120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.

EXAMPLE

If you are at 25,000 ft. with 200 gallons of available fuel, you can fly 345 statute airmiles by holding 263 MPH CAS. However, you can fly 455 statute airmiles by immediately climbing to 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 219 MPH CAS and start let down 175 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.80 × 455 or 364 statute miles. Cruise at 228 MPH CAS with this wind and start let down 160 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 12-1-47 BASED ON: Flight Test

Figure 28 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-1, -5 and RF-80A-5)

AIRCRAFT MODELS	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS
F-80A-1, -5 RF-80A-5	**STANDARD DAY**	2 × 165 GALLON EXTERNAL TIP TANKS CARRIED ALL THE WAY
ENGINES: J33-A-9A, -GE-11A, -A-17	CHART WEIGHT LIMITS 14,500 TO 8000 POUNDS	NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
530	40	1295	700	(635)	40	(1325)	(750)	40	(1355)	(880)	40	(1395)	700	(1000)	40	(1420)
455	40	1080	600	545	40	1110	645	40	1140	755	40	1175	600	860	40	1200
380	40	865	500	455	40	895	540	40	925	635	40	960	500	720	40	985
345	40	755	450	410	40	785	485	40	815	570	40	855	450	650	40	880
305	40	650	400	365	40	680	430	40	705	510	40	745	400	580	40	770
265	40	540	350	320	40	570	380	40	600	450	40	635	350	510	40	660
230	30	445	300	275	30	465	325	40	495	390	40	530	300	440	40	555
190	30	355	250	230	30	375	270	30	395	325	30	425	250	370	40	450
150	30	265	200	185	30	290	220	30	305	265	30	335	200	300	30	350
115	25	175	150	140	30	200	165	30	220	200	30	250	150	230	30	265
75	15	110	100	95	20	125	110	20	135	140	30	160	100	160	30	175

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW																			120 HW						
						80 HW													331	91	356	346	.8	27	80 HW	313	92	329	359	.8	36
386	89	533	356	.9	0	40 HW	368	89	455	366	.9	4	344	89	397	370	.9	18	321	89	340	374	.9	28	40 HW	301	90	308	382	.9	37
369	89	497	378	1.0	0	0	348	87	424	384	1.0	5	328	87	376	390	1.0	20	309	88	329	397	1.0	30	0	288	89	294	402	1.0	40
352	85	471	400	1.1	0	40 TW	331	85	403	404	1.1	6	308	85	350	406	1.1	21	286	85	298	408	1.1	31	40 TW	271	87	272	418	1.1	41
						80 TW													266	83	277	422	1.2	34	80 TW	253	84	256	434	1.2	44
						120 TW																			120 TW						

Figure 29 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-1, -5 and RF-80A-5)

AIRCRAFT MODELS

F-80A-1, -5 RF-80A-5

ENGINES: J33-A-9A, -GE-11A, -A-17

HIGH ALTITUDE

CHART WEIGHT LIMITS 14,500 TO 8000 POUNDS

EXTERNAL LOAD ITEMS

2 × 165 GALLON EXTERNAL TIP TANKS CARRIED ALL THE WAY
NUMBER OF ENGINES OPERATING: ONE

(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)

IF YOU ARE AT 25,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES			IF YOU ARE AT 35,000′ RANGE IN AIRMILES			IF YOU ARE AT 40,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES		
BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(1125)	40	(1445)	700	(1270)	40	(1475)	(1400)	40	(1530)	(1550)	—	—	700			
970	40	1225	600	(1095)	40	(1255)	(1205)	40	(1315)	(1330)	—	—	600			
810	40	1010	500	915	40	1040	1015	40	1100	(1115)	—	—	500			
730	40	905	450	825	40	930	915	40	990	(1010)	—	—	450			
650	40	795	400	740	40	825	815	40	880	900	—	—	400			
570	40	690	350	650	40	715	720	40	775	795	—	—	350			
495	40	580	300	560	40	610	620	40	665	685	—	—	300			
415	40	470	250	475	40	500	525	40	560	575	—	—	250			
335	30	365	200	375	40	395	425	40	450	470	—	—	200			
255	30	280	150	295	—	—	325	40	340	360	—	—	150			
175	30	195	100	210	—	—	230	—	—	255	—	—	100			

CRUISING AT 25,000′						EFFECTIVE WIND MPH	CRUISING AT 30,000′						CRUISING AT 35,000′						CRUISING AT 40,000′						EFFECTIVE WIND MPH	CRUISING AT 45,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
306	94	319	346	.7	42	120 HW	282	95	280	340	.7	57	258	96	241	334	.7	72	203	96	194	297	.7	95	120 HW						
295	93	303	372	.8	45	80 HW	269	94	266	367	.8	60	244	95	230	362	.8	76	203	96	194	337	.8	100	80 HW						
282	91	277	390	.9	47	40 HW	258	92	248	389	.9	64	234	94	219	388	.9	81	203	96	194	377	.9	105	40 HW						
268	90	262	408	1.0	50	0	248	92	235	412	1.0	67	229	93	209	417	1.0	85	203	96	194	417	1.0	110	0						
256	88	246	428	1.1	52	40 TW	240	90	225	437	1.1	70	223	92	204	446	1.1	89	203	96	194	457	1.1	115	40 TW						
241	86	235	446	1.2	55	80 TW	227	88	219	458	1.2	74	213	91	194	470	1.2	93	203	96	194	497	1.2	120	80 TW						
223	85	220	458	1.3	58	120 TW	214	87	204	477	1.3	78	206	90	188	496	1.3	98	203	96	194	537	1.3	125	120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.

EXAMPLE

If you are at S. L. with 600 gallons of available fuel, you can fly 455 statute airmiles by holding 369 MPH CAS. However, you can fly 1080 statute airmiles by immediately climbing to 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 203 MPH CAS and start let down 110 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.80 × 1080 or 864 statute miles. Cruise at 203 MPH CAS with this wind and start let down 100 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 12-1-47 BASED ON: Flight Test

Figure 29 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-1, -5 and RF-80A-5)

AIRCRAFT MODELS
F-80A-1, -5 RF-80A-5
ENGINES: J33-A-9A, -GE-11A, -A-17

FLIGHT OPERATION INSTRUCTION CHART
STANDARD DAY
CHART WEIGHT LIMITS 14,500 TO 12,000 POUNDS

EXTERNAL LOAD ITEMS
2 × 165 GALLON TIP TANKS DROPPED WHEN EMPTY
NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
550	40	1455	700	735	40	1485	760	40	1515	(880)	40	(1550)	700	(1015)	40	(1575)
510	40	1355	650	675	40	1385	705	40	1415	820	40	1445	650	945	40	1470
475	40	1255	600	615	40	1280	650	40	1310	755	40	1340	600	875	40	1370
435	40	1150	550	555	40	1180	600	40	1210	695	40	1235	550	805	40	1265
395	40	1050	500	500	40	1080	545	40	1105	635	40	1135	500	735	40	1160
360	40	950	450	440	40	975	490	40	1000	570	40	1030	450	665	40	1055
320	40	845	400	380	40	875	440	40	900	510	40	925	400	595	40	955
DROP EXTERNAL TIP TANKS WHEN EMPTY (REFER TO FIG. 28 FOR OPERATING INSTRUCTIONS)																

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE				
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
					(5)	120 HW						(5)						(5)						(5)	120 HW						(5)
						80 HW													331	91	356	346	.8		80 HW	313	92	329	359	.8	
386	89	533	356	.9		40 HW	368	89	455	366	.9		344	89	397	370	.9		321	89	340	374	.9		40 HW	301	90	308	382	.9	
369	89	497	378	1.0		0	348	87	424	384	1.0		328	87	376	390	1.0		309	88	329	397	1.0		0	288	89	294	402	1.0	
352	85	471	400	1.1		40 TW	331	85	403	404	1.1		308	85	350	406	1.1		286	85	298	408	1.1		40 TW	271	87	272	418	1.1	
						80 TW													266	83	277	422	1.2		80 TW	253	84	256	434	1.2	
						120 TW																			120 TW						

Figure 30 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-1, -5 and RF-80A-5)

AIRCRAFT MODELS

F-80A-1, -5 RF-80A-5

ENGINES: J33-A-9A, -GE-11A, -A-17

HIGH ALTITUDE

CHART WEIGHT LIMITS 14,500 TO 12,000 POUNDS

EXTERNAL LOAD ITEMS

2 × 165 GALLON TIP TANKS DROPPED WHEN EMPTY

NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES			IF YOU ARE AT 35,000′ RANGE IN AIRMILES			IF YOU ARE AT 40,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES		
BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
(1170)	40	(1605)	700	(1345)	40	(1635)	(1520)	40	(1680)	(1700)	40	—	700			
(1090)	40	(1500)	650	(1255)	40	(1530)	(1420)	40	(1570)	(1590)	40	—	650			
1010	40	1395	600	1165	40	1425	(1320)	40	(1465)	(1480)	40	—	600			
930	40	1290	550	1075	40	1325	1220	40	1355	(1375)	40	—	550			
850	40	1190	500	990	40	1220	1125	40	1245	(1265)	40	—	500			
775	40	1085	450	900	40	1115	1025	40	1140	1155	40	—	450			
695	40	980	400	810	40	1010	925	40	1030	1045	40	—	400			
DROP EXTERNAL TIP TANKS WHEN EMPTY (REFER TO FIG. 28 FOR OPERATING INSTRUCTIONS)																

CRUISING AT 25,000′						EFFECTIVE WIND MPH	CRUISING AT 30,000′						CRUISING AT 35,000′						CRUISING AT 40,000′						EFFECTIVE WIND MPH	CRUISING AT 45,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
306	94	319	346	.7	(5)	120 HW	282	95	280	340	.7	(5)	258	96	241	334	.7	(5)	203	96	194	297	.7	(5)	120 HW						
295	93	303	372	.8		80 HW	269	94	266	367	.8		244	95	230	362	.8		203	96	194	337	.8		80 HW						
282	91	277	390	.9		40 HW	258	92	248	389	.9		234	94	219	388	.9		203	96	194	377	.9		40 HW						
268	90	262	408	1.0		0	248	92	235	412	1.0		229	93	209	417	1.0		203	96	194	417	1.0		0						
256	88	246	428	1.1		40 TW	240	90	225	437	1.1		223	92	204	446	1.1		203	96	194	457	1.1		40 TW						
241	86	235	446	1.2		80 TW	227	88	219	458	1.2		213	91	194	470	1.2		203	96	194	497	1.2		80 TW						
223	85	220	458	1.3		120 TW	214	87	204	477	1.3		206	90	188	496	1.3		203	96	194	537	1.3		120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.
5. Refer to fig. 28 for let down without external tip tanks.

EXAMPLE

If you are at 15,000 ft. with 650 gallons of available fuel, you can fly 820 statute airmiles by holding 309 MPH CAS. However, you can fly 1445 statute airmiles by immediately climbing to 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 203 MPH CAS and start let down 175 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.80 × 1445 or 1155 statute miles. Cruise at 203 MPH CAS with this wind and start let down 160 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 12-1-47 BASED ON: Flight Test

Figure 30 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-1, -5 and RF-80A-5)

TAKE-OFF DISTANCES — FEET

70% FLAPS, HARD SURFACE RUNWAY

AIRCRAFT MODELS
F-80A-10 RF-80A-10, -15

ENGINE MODELS
J33A-9B, -GE-11B, -A-17A, -A-21

CONFIGURATION AND GROSS WEIGHT	PRESSURE ALTITUDE FT.	60°F				80°F				100°F				120°F			
		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
		GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′	GROUND RUN	CLEAR 50′
CLEAN 12,300 LBS.	S. L.	2900	3400	1610	1888	3225	3675	1790	2040	3575	4175	1985	2320	3950	4595	2190	2550
	1,000	3125	3650	1735	2025	3475	4050	1929	2250	3850	4475	2137	2483	4250	4925	2360	2732
	2,000	3350	3925	1860	2180	3725	4350	2070	2413	4150	4825	2305	2675	4575	5400	2540	3000
	3,000	3625	4225	2010	2345	4025	4675	2233	2595	4475	5175	2483	2870	4950	5700	2747	3162
	4,000	3900	4525	2165	2510	4325	5000	2400	2775	4800	5550	2663	3080	5300	6100	2430	3382
	5,000	4210	4870	2335	2705	4675	5400	2595	3000	5200	5975	2885	3320	5725	6575	3178	3650
2 X 165 GALLON TIP TANKS 14,800 LBS.	S. L.	4150	4850	2445	2858	4525	5275	2665	3108	4925	5750	2900	3385	5350	6200	3150	3650
	1,000	4450	5200	2620	3063	4875	5650	2872	3330	5300	6150	3122	3623	5750	6650	3385	3918
	2,000	4800	5600	2825	3300	5250	6050	3090	3562	5700	6600	3357	3890	6200	7150	3650	4210
	3,000	5200	6025	3063	3550	5650	6500	3330	3830	6150	7100	3623	4180	6675	7700	3930	4540
	4,000	5575	6450	3284	3800	6075	6975	3580	4110	6600	7625	3890	4490	7175	8250	4225	4860
	5,000	6000	6925	3530	4080	6550	7525	3858	4430	7150	8200	4210	4835	7750	8875	4565	5230

DATA AS OF: 1 Jan. 48 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 31 — Take-off Distance — F-80A-10 and RF-80A-10, -15

LANDING DISTANCE — FEET
STANDARD DAY

AIRCRAFT MODELS
F-80A-10 RF-80A-10, -15

ENGINE MODELS
J33-A-9A, -GE-11A, -A-17

GROSS WEIGHT LBS.	BEST IAS FOR APPROACH		70% FLAPS — HARD SURFACE — NO WIND							
	POWER OFF	POWER ON	AT SEA LEVEL		AT 2000 FT.		AT 4000 FT.		AT 6000 FT.	
	MPH	MPH	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′
10,000	130	130	1750	3550	1825	3725	1900	3900	2000	4100
12,000	145	145	2050	4150	2150	4350	2275	4550	2400	4800

LEGEND
IAS: INDICATED AIRSPEED
MPH: STATUTE MILES PER HOUR

DATA AS OF: 1 Jan. 48 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 32 — Landing Distance — F-80A-10 and RF-80A-10, -15

CLIMB CHART FOR MAXIMUM POWER
STANDARD DAY

AIRCRAFT MODELS
F-80A-10 RF-80A-10, -15

ENGINE MODELS
J33-A-9B, -GE-11B, -A-17A, -A-21

CONFIGURATION: 2 X 165 GALLON TANKS
WEIGHT: 15,050 LBS.

CONFIGURATION: CLEAN
WEIGHT: 12,700 LBS.

APPROXIMATE				CAS MPH	PRESSURE ALTITUDE FEET	CAS MPH	APPROXIMATE			
RATE OF CLIMB (3)	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB (3)
	DISTANCE	TIME	FUEL				FUEL	TIME	DISTANCE	
2500	—	—	31 (2)	310	SEA LEVEL	310	21 (2)	—	—	3350
2100	13	2	55	306	5,000	301	38	1.5	9	3100
1900	27	5	80	301	10,000	291	54	3.0	19	2800
1700	44	8	102	286	15,000	277	70	5	29	2500
1450	65	11	127	272	20,000	257	87	7	42	2150
1200	89	14	153	257	25,000	242	106	10	58	1800
900	119	19	179	237	30,000	223	123	13	76	1450
600	164	26	210	213	35,000	203	142	17	101	1050
200	255	40	274	193	40,000	183	173	23	137	700

REMARKS

1. Climb at recommended CAS.
2. Taxi and take-off allowance.
3. Climb values based on hot day operation.
   These values will be exceeded on a standard day.

LEGEND

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: STATUTE MILES
TIME: MINUTES
FUEL: GALLONS
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR

DATA AS OF: 1 Jan. 48 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 33 — Climb Chart for Maximum Power — F-80A-10 and RF-80A-10, -15

DESCENT CHART
STANDARD DAY

AIRCRAFT MODELS
F-80A-10 RF-80A-10, -15

ENGINE MODELS
J33-A-9B, -GE-11B, -A-17A, -A-21

CONFIGURATION: 2 X 165 GALLON TANKS
WEIGHT: 15,050 LBS.

CONFIGURATION: CLEAN
WEIGHT: 12,700 LBS.

APPROXIMATE				CAS MPH	PRESSURE ALTITUDE FEET	CAS MPH	APPROXIMATE			
RATE OF DESCENT	TO SEA LEVEL						TO SEA LEVEL			RATE OF DESCENT
	DISTANCE	TIME	FUEL				FUEL	TIME	DISTANCE	
1200	110	18	33	188	40,000	198	66	27	175	800
1450	85	14	27	208	35,000	218	56	21	135	900
1700	70	11	22	228	30,000	237	47	16	100	1050
2000	50	9	18	247	25,000	257	40	12	70	1250
2300	40	7	14	267	20,000	277	32	8.5	50	1550
2750	30	5	9	286	15,000	296	26	5.2	35	2000
3050	15	3	6	306	10,000	315	16	3.0	20	2500
3500	5	1.5	2	325	5,000	335	7	1.5	10	3000
4000	—	—	—	345	SEA LEVEL	355	—	—	—	3600

REMARKS

1. Maintain 50-60 PSI burner pressure and recommended CAS.
2. Descend at 180 CAS for maximum range without power.

LEGEND

RATE OF DESCENT: FEET PER MINUTE
DISTANCE: STATUTE MILES
TIME: MINUTES
FUEL: GALLONS
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR

DATA AS OF: 1 Jan. 48 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 34 — Descent Chart — F-80A-10 and RF-80A-10, -15

AIRCRAFT MODELS
F-80A-10 . RF-80A-10, -15
ENGINES: J33-A-9B, -GE-11B, -A-17A, -A-21

FLIGHT OPERATION INSTRUCTION CHART
STANDARD DAY

CHART WEIGHT LIMITS 12,700 TO 9250 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
325	40	860	420	(387)	40	(884)	(468)	40	(918)	(550)	40	(957)	420	(650)	40	(985)
311	40	808	400	368	40	832	(444)	40	(870)	(526)	40	(909)	400	(616)	40	(936)
272	40	679	350	325	40	702	392	40	731	459	40	774	350	540	40	803
234	35	526	300	277	40	574	335	40	607	392	40	645	300	464	40	674
191	35	406	250	234	35	430	277	35	468	325	40	507	250	382	40	536
153	35	296	200	186	35	316	225	35	344	263	35	373	200	306	35	402
115	25	177	150	139	25	196	167	25	225	196	35	253	150	229	35	282
76	15	96	100	96	15	110	110	20	124	129	25	143	100	148	25	167
38	—	—	50	48	—	—	53	—	—	62	—	—	50	72	—	—

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE				
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW																			323	89	295	312	.7	43
						80 HW							365	89	398	340	.8	18	332	88	329	332	.8	30	311	88	280	336	.8	45
400	89	549	360	.8	0	40 HW	384	89	466	372	.9	9	346	87	370	360	.9	19	322	87	314	360	.9	33	301	87	270	364	.9	48
374	86	492	374	1.0	0	0	357	86	418	382	1.0	10	336	86	356	388	1.0	20	310	86	303	386	1.0	35	293	86	259	392	1.0	50
338	80	424	378	1.1	0	40 TW	323	82	366	387	1.1	11	311	83	314	398	1.2	22	290	83	267	400	1.1	37	283	85	249	420	1.1	53
						80 TW							306	82	309	342	1.3	23	273	80	256	420	1.2	39	274	84	240	448	1.2	55
						120 TW																			264	83	230	476	1.3	58

Figure 35 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-10 and RF-80A-10, -15)

AIRCRAFT MODELS

F-80A-10 RF-80A-10, -15

ENGINES: J33-A-9B, -GE-11B, -A-17A, -A-21

HIGH ALTITUDE

CHART WEIGHT LIMITS 12,700 TO 9250 POUNDS

EXTERNAL LOAD ITEMS

NONE

NUMBER OF ENGINES OPERATING: ONE

(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)

IF YOU ARE AT 25,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES			IF YOU ARE AT 35,000′ RANGE IN AIRMILES			IF YOU ARE AT 40,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES		
BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(751)	40	(1018)	420	(865)	40	(1046)	(980)	40	(1080)	(1113)	—	—	420			
(712)	40	(965)	400	(817)	40	(995)	(927)	40	(1028)	(1100)	—	—	400			
(621)	40	(832)	350	(717)	40	(865)	(813)	40	(899)	(932)	—	—	350			
536	40	703	300	617	40	731	(698)	40	(765)	(798)	—	—	300			
444	40	569	250	511	40	597	583	40	626	665	—	—	250			
354	35	430	200	411	35	459	478	40	492	531	—	—	200			
263	35	311	150	301	—	—	354	—	—	397	—	—	150			
172	35	196	100	201	—	—	234	—	—	263	—	—	100			
81	—	—	50	—	—	—	—	—	—	—	—	—	50			

CRUISING AT 25,000′						EFFECTIVE WIND MPH	CRUISING AT 30,000′						CRUISING AT 35,000′						CRUISING AT 40,000′						EFFECTIVE WIND MPH	CRUISING AT 45,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
297	89	251	312	.7	60	120 HW	285	91	234	330	.7	85	266	92	204	338	.7	110	234	93	173	336	.7	150	120 HW						
292	88	241	344	.8	63	80 HW	279	90	224	360	.8	90	258	91	194	365	.8	120	234	93	173	376	.8	160	80 HW						
284	87	230	374	.9	67	40 HW	272	89	214	390	.9	95	258	91	194	405	.9	128	234	93	173	416	.9	165	40 HW						
275	86	220	400	1.0	70	0	263	88	205	416	1.0	100	248	90	188	430	1.0	135	229	92	167	445	1.0	175	0						
261	85	209	420	1.1	74	40 TW	253	87	197	442	1.1	105	248	90	188	470	1.1	142	220	91	157	470	1.1	185	40 TW						
249	84	204	444	1.2	77	80 TW	244	86	188	468	1.2	110	242	89	178	498	1.2	150	220	91	157	510	1.2	195	80 TW						
238	83	189	470	1.3	80	120 TW	244	86	188	508	1.3	115	233	88	173	524	1.3	155	220	91	157	550	1.3	200	120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.

EXAMPLE

If you are at 15,000 ft. with 350 gallons of available fuel, you can fly 459 statute airmiles by holding 310 MPH CAS. However, you can fly 774 statute airmiles by immediately climbing 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 229 MPH CAS and start let down 175 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.8 × 774 or 681 statute miles. Cruise at 234 MPH CAS with this wind and start let down 160 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 12-1-48 BASED ON: Flight Test

Figure 35 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-10 and RF-80A-10, -15)

AIRCRAFT MODELS

F-80A-10 RF-80A-10, -15

ENGINES: J33-A-9B, -GE-11B, -A-17A, -A-21

FLIGHT OPERATION INSTRUCTION CHART
STANDARD DAY

CHART WEIGHT LIMITS 15,050 TO 9250 POUNDS

EXTERNAL LOAD ITEMS

2 × 165 GALLON EXTERNAL TIP TANKS
CARRIED ALL THE WAY
NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
540	40	1500	750	(636)	40	(1530)	(755)	40	(1568)	(880)	40	(1610)	750	(1022)	40	(1635)
502	40	1386	700	597	40	1410	707	40	1442	(822)	40	(1491)	700	(956)	40	(1520)
468	40	1272	650	554	40	1290	660	40	1333	765	40	1377	650	889	40	1405
430	40	1147	600	511	40	1180	607	40	1220	707	40	1262	600	822	40	1285
392	40	1032	550	468	40	1060	559	40	1105	650	40	1148	550	755	40	1170
358	40	918	500	426	40	943	506	40	985	593	40	1027	500	688	40	1051
325	40	794	450	382	40	831	459	40	870	540	40	908	450	621	40	937
287	35	645	400	339	35	679	406	35	731	478	40	788	400	554	40	817
253	35	545	350	296	35	578	358	35	616	421	35	659	350	487	35	693
215	35	444	300	258	35	478	311	35	516	368	35	559	300	421	35	588
182	35	344	250	215	35	382	258	35	421	306	35	458	250	354	35	468
143	25	239	200	172	25	277	210	25	316	248	35	354	200	287	35	368
110	15	153	150	129	25	191	158	25	220	191	35	253	150	220	35	268
72	—	—	100	86	15	124	110	15	134	134	25	148	100	153	25	167
—	—	—	50	43	—	—	57	—	—	76	—	—	50	86	—	—

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE				
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW																			120 HW	320	92	341	308	.7	34
						80 HW							348	90	416	320	.8	13	326	90	361	324	.8	27	80 HW	310	91	324	334	.8	36
388	89	549	348	.9	0	40 HW	364	89	466	350	.9	4	341	89	398	352	.9	14	315	89	345	350	.9	28	40 HW	290	89	295	348	.9	38
377	88	528	377	1.0	0	0	354	88	450	379	1.0	5	330	88	385	380	1.0	15	310	88	329	385	1.0	30	0	286	89	295	385	1.0	40
351	85	481	391	1.1	0	40 TW	319	84	387	382	1.1	6	312	86	356	400	1.1	16	290	86	303	400	1.1	31	40 TW	271	87	270	404	1.1	42
						80 TW							295	84	328	420	1.3	17	270	84	282	414	1.3	34	80 TW	255	86	260	424	1.2	44
						120 TW																			120 TW	246	85	249	452	1.4	48

Figure 36 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-10 and RF-80A-10, -15)

AIRCRAFT MODELS

F-80A-10 RF-80A-10, -15

ENGINES: J33-A-9B, -GE-11B, -A-17A, -A-21

HIGH ALTITUDE

CHART WEIGHT LIMITS 15,050 TO 9250 POUNDS

EXTERNAL LOAD ITEMS

2 × 165 GALLON EXTERNAL TIP TANKS CARRIED ALL THE WAY
NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES			IF YOU ARE AT 35,000′ RANGE IN AIRMILES			IF YOU ARE AT 40,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES		
BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
(1166)	40	(1663)	750	(1342)	40	(1692)	(1520)	40	(1721)	(1778)	—	—	750			
(1090)	40	(1548)	700	(1258)	40	(1578)	(1424)	40	(1606)	(1662)	—	—	700			
(1012)	40	(1432)	650	(1170)	40	(1462)	(1329)	40	(1491)	(1549)	—	—	650			
937	40	1314	600	1080	40	1344	(1223)	40	(1378)	(1433)	—	—	600			
860	40	1200	550	994	40	1223	1128	40	1262	(1315)	—	—	550			
784	40	1080	500	908	40	1108	1032	40	1142	1195	—	—	500			
707	40	965	450	823	40	994	937	40	1028	1080	—	—	450			
631	40	851	400	731	40	879	837	40	908	965	—	—	400			
554	40	731	350	645	40	760	736	40	793	846	—	—	350			
477	40	616	300	559	40	646	645	40	674	736	—	—	300			
401	35	483	250	473	35	521	545	40	564	616	—	—	250			
325	35	382	200	382	—	—	444	—	—	497	—	—	200			
248	35	287	150	301	—	—	354	—	—	382	—	—	150			
172	35	191	100	210	—	—	248	—	—	268	—	—	100			
96	—	—	50	124	—	—	153	—	—	158	—	—	50			

CRUISING AT 25,000′						EFFECTIVE WIND MPH	CRUISING AT 30,000′						CRUISING AT 35,000′						CRUISING AT 40,000′						EFFECTIVE WIND MPH	CRUISING AT 45,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
303	93	309	320	.7	42	120 HW	279	94	267	320	.7	60	259	96	235	326	.7	72	227	96	188	320	.7	95	120 HW						
284	91	277	334	.8	45	80 HW	273	93	259	352	.8	63	253	95	230	356	.8	76	227	96	188	360	.8	100	80 HW						
272	90	262	358	.9	47	40 HW	264	92	247	378	.9	66	246	93	214	385	.9	81	227	96	188	400	.9	105	40 HW						
264	89	251	385	1.0	50	0	257	91	234	406	1.0	70	236	92	204	410	1.0	85	222	95	183	430	1.0	110	0						
254	88	241	412	1.1	52	40 TW	247	90	224	432	1.1	74	236	92	204	450	1.1	89	222	95	183	470	1.1	115	40 TW						
243	87	230	436	1.2	55	80 TW	247	90	224	472	1.2	77	236	92	204	490	1.2	93	222	95	183	510	1.2	120	80 TW						
232	86	220	460	1.3	57	120 TW	236	89	214	496	1.3	81	225	91	194	512	1.3	98	222	95	183	550	1.3	125	120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.

EXAMPLE

If you are at S. L. with 600 gallons of available fuel, you can fly 430 statute airmiles by holding 377 MPH CAS. However, you can fly 1147 statute airmiles by immediately climbing to 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 222 MPH CAS and start let down 110 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.8 × 1147 or 917 statute miles. Cruise at 227 MPH CAS with this wind and start let down 100 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 12-1-48 BASED ON: Flight Test

Figure 36 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-10 and RF-80A-10, -15)

AIRCRAFT MODELS	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS
F-80A-10 RF-80A-10, -15	**STANDARD DAY**	2 × 165 GALLON EXTERNAL TIP TANKS DROPPED WHEN EMPTY
ENGINES: J33-A-9B, -GE-11B, -A-17A, -A-21	CHART WEIGHT LIMITS 15,050 TO 12,700 POUNDS	NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
564	40	1588	750	(664)	40	(1630)	(793)	40	(1670)	(932)	40	(1701)	750	(1080)	40	(1735)
526	40	1472	700	622	40	1520	746	40	1554	(875)	40	(1592)	700	(1013)	40	(1625)
492	40	1354	650	578	40	1405	693	40	1438	818	40	1482	650	952	40	1510
454	40	1242	600	540	40	1290	645	40	1329	760	40	1368	600	884	40	1396
421	40	1100	550	497	40	1180	597	40	1213	703	40	1252	550	823	40	1281
382	40	1028	500	454	40	1071	549	40	1100	646	40	1142	500	755	40	1167
349	40	927	450	411	40	956	497	40	990	583	40	1032	450	688	40	1052
325	40	860	420	387	40	884	468	40	918	550	40	956	420	650	40	985
				DROP EXTERNAL TIP TANKS WHEN EMPTY				(REFER TO FIG. 35 FOR OPERATING INSTRUCTIONS)								

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW																			120 HW	320	92	341	308	.7	
						80 HW							348	90	416	320	.8	(5)	326	90	361	324	.8	(5)	80 HW	310	91	324	334	.8	(5)
388	89	549	348	.9	(5)	40 HW	364	89	466	350	.9	(5)	341	89	398	352	.9		315	89	345	350	.9		40 HW	290	89	295	348	.9	
377	88	528	377	1.0		0	354	88	450	379	1.0		330	88	385	380	1.0		310	88	330	385	1.0		0	286	89	295	384	1.0	
351	85	481	391	1.1		40 TW	319	84	387	382	1.1		312	86	356	400	1.1		290	86	303	400	1.1		40 TW	271	87	270	404	1.1	
						80 TW							295	84	327	420	1.3		270	84	282	414	1.3		80 TW	255	86	259	424	1.2	
						120 TW																			120 TW	246	85	249	452	1.4	

Figure 37 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-10 and RF-80A-10, 15)

AIRCRAFT MODELS

F-80A-10 RF-80A-10, -15

ENGINES: J33-A-9B, -GE-11B, -A-17A, -A-21

HIGH ALTITUDE

CHART WEIGHT LIMITS 15,050 TO 12,700 POUNDS

EXTERNAL LOAD ITEMS

2 × 165 GALLON EXTERNAL TIP TANKS
DROPPED WHEN EMPTY
NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000' RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 30,000' RANGE IN AIRMILES			IF YOU ARE AT 35,000' RANGE IN AIRMILES			IF YOU ARE AT 40,000' RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 45,000' RANGE IN AIRMILES		
BY CRUISING AT 25,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 30,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 40,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 45,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
(1252)	40	(1769)	750	(1439)	40	(1803)	(1639)	40	(1826)	(1890)	—	—	750			
(1175)	40	(1654)	700	(1353)	40	(1688)	(1539)	40	(1718)	(1769)	—	—	700			
(1100)	40	(1540)	650	(1267)	40	(1572)	(1439)	40	(1607)	(1653)	—	—	650			
1022	40	1429	600	1176	40	1462	(1339)	40	(1492)	(1535)	—	—	600			
946	40	1315	550	1090	40	1343	1242	40	1378	(1420)	—	—	550			
870	40	1199	500	1004	40	1232	1138	40	1262	1300	—	—	500			
794	40	1090	450	918	40	1118	1037	40	1147	1185	—	—	450			
751	40	1018	420	865	40	1052	980	40	1080	1114	—	—	420			
			DROP EXTERNAL TIP TANKS WHEN EMPTY				(REFER TO FIG. 35 FOR OPERATING INSTRUCTIONS)									

CRUISING AT 25,000'						EFFECTIVE WIND MPH	CRUISING AT 30,000'						CRUISING AT 35,000'						CRUISING AT 40,000'						EFFECTIVE WIND MPH	CRUISING AT 45,000'					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
303	93	309	320	.7	(5)	120 HW	279	94	267	320	.7	(5)	259	96	235	326	.7	(5)	227	96	188	320	.7	(5)	120 HW						
284	91	277	334	.8		80 HW	273	93	259	352	.8		253	95	230	356	.8		227	96	188	360	.8		80 HW						
272	90	262	358	.9		40 HW	264	92	247	378	.9		246	93	214	385	.9		227	96	188	400	.9		40 HW						
264	89	251	385	1.0		0	257	91	234	406	1.0		236	92	204	410	1.0		222	95	183	430	1.0		0						
254	88	241	412	1.1		40 TW	247	90	224	432	1.1		236	92	204	450	1.1		222	95	183	470	1.1		40 TW						
243	87	230	436	1.2		80 TW	247	90	224	472	1.2		236	92	204	490	1.2		222	95	183	510	1.2		80 TW						
232	86	220	460	1.3		120 TW	236	89	214	496	1.3		225	91	194	512	1.3		222	95	183	550	1.3		120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.
5. Refer to fig. 35 for let down without external tip tanks.

EXAMPLE

If you are at 5000 ft. with 650 gallons of available fuel, you can fly 578 statute airmiles by holding 354 MPH CAS. However, you can fly 1405 statute airmiles by immediately climbing to 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 222 MPH CAS and start let down 175 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.8 × 1405 or 1123 statute miles. Cruise at 227 MPH CAS with this wind and start let down 160 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 12-1-48 BASED ON: Flight Test

Figure 37 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (F-80A-10 and RF-80A-10, 15)

TAKE-OFF DISTANCES — FEET

70% FLAPS, HARD SURFACE RUNWAY

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE MODELS
J33-A-35

CONFIGURATION AND GROSS WEIGHT	PRESSURE ALTITUDE FT.	60°F				80°F				100°F				120°F			
		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
		GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'	GROUND RUN	CLEAR 50'
CLEAN 12,900 LBS. WITHOUT FLUID INJECTION	S. L.	2075	3025	1245	1815	2750	4025	1650	2415	3150	4600	1890	2760	3600	5300	2160	3180
	1,000	2275	3300	1365	1980	3025	4425	1815	2655	3450	5075	2070	3045	3950	5825	2370	3495
	2,000	2475	3600	1485	2160	3325	4850	1995	2910	3800	5550	2280	3330	4350	6425	2610	3855
	3,000	2675	3900	1605	2340	3625	5300	2175	3180	4150	6100	2490	3660	4750	7025	2850	4215
	4,000	2925	4250	1755	2550	3950	5800	2370	3480	4550	6675	2730	3995	5225	7750	3135	4650
	5,000	3200	4650	1920	2790	4325	6350	2595	3810	5000	7350	3000	4410	5775	8575	3465	5145
CLEAN 12,900 LBS. WITH FLUID INJECTION	S. L.	1750	2650	1050	1590	2325	3500	1395	2100	2650	3975	1590	2385	3025	4575	1815	2745
	1,000	1925	2875	1155	1725	2550	3825	1530	2295	2925	4375	1755	2625	3350	5050	2010	3030
	2,000	2075	3125	1245	1875	2775	4200	1665	2520	3200	4800	1920	2880	3675	5525	2205	3315
	3,000	2275	3400	1365	2040	3050	4575	1830	2745	3500	5250	2100	3150	4025	6050	2415	3630
	4,000	2475	3700	1485	2220	3325	5000	1995	3000	3825	5750	2295	3450	4400	6625	2640	3975
	5,000	2700	4025	1620	2415	3625	5450	2175	3270	4175	6275	2505	3765	4800	7275	2880	4365
TIP TANKS 15,350 LBS. WITHOUT FLUID INJECTION	S. L.	2800	4275	1735	2650	3700	5650	2295	3565	4225	6475	2620	4015	4800	7400	2980	4590
	1,000	3050	4650	1890	2885	4050	6175	2510	3830	4625	7100	2870	4400	5275	8100	3270	5020
	2,000	3350	5075	2078	3145	4425	6775	2745	4200	5075	7800	3145	4840	5800	8900	3595	5520
	3,000	3650	5525	2262	3425	4850	7400	3010	4590	5575	8550	3455	5300	6375	9800	3950	6075
	4,000	3950	6000	2450	3720	5300	8125	3290	5040	6100	9400	3780	5830	6975	10800	4325	6695
	5,000	4300	6550	2665	4060	5800	8850	3600	5490	6700	10275	4155	6370	7675	11875	4760	7360
TIP TANKS 15,350 LBS. WITH FLUID INJECTION	S. L.	2325	3675	1442	2280	3025	4850	1875	3010	3450	5575	2140	3455	3925	6350	2435	3940
	1,000	2525	4000	1565	2480	3325	5300	2060	3285	3800	6100	2355	3780	4300	6975	2665	4325
	2,000	2750	4350	1705	2700	3625	5825	2250	3610	4150	6700	2575	4155	4700	7675	2915	4760
	3,000	3000	4750	1860	2945	3975	6375	2465	3950	4525	7350	2805	4560	5150	8450	3195	5240
	4,000	3250	5150	2015	3195	4325	6950	2680	4300	4950	8050	3070	4990	5650	9300	3505	5765
	5,000	3525	5600	2185	3470	4700	7600	2915	4710	5375	8825	3330	5470	6175	10225	3830	6340

REMARKS

1. No conservation factor included.
2. Distances are based on normal take-off procedure. (See Paragraph 7, Sec. 11.)

DATA AS OF: 1 Jan. 49 DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 38 — Take-off Distances — RF-80A-20, -25

LANDING DISTANCE — FEET
STANDARD DAY

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE MODELS
J33-A-35

GROSS WEIGHT LBS.	BEST CAS FOR APPROACH		70% FLAPS — HARD SURFACE — NO WIND							
	POWER OFF	POWER ON	AT SEA LEVEL		AT 2000 FT.		AT 4000 FT.		AT 6000 FT.	
	MPH	MPH	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′	GROUND ROLL	CLEAR 50′
10,000	125	125	2350	3275	2500	3450	2650	3625	2800	3800
12,500	140	140	2950	3950	3100	4150	3300	4400	3500	4625

REMARKS
1. No conservatism factor included.

DATA AS OF: 1 Jan. 49 DATA BASIS: Flight Test

LEGEND
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 39 — Landing Distance — RF-80A-20, -25

DESCENT CHART
STANDARD DAY

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE MODELS
J33-A-35

CONFIGURATION: 2 X 165 GALLON TANKS
WEIGHT: 10,400 LBS.

CONFIGURATION: CLEAN
WEIGHT: 10,100 LBS.

APPROXIMATE				CAS MPH	PRESSURE ALTITUDE FEET	CAS MPH	APPROXIMATE			
RATE OF DESCENT	TO SEA LEVEL						TO SEA LEVEL			RATE OF DESCENT
	DISTANCE	TIME	FUEL				FUEL	TIME	DISTANCE	
1200	85	12.5	20	200	40,000	200	26	15.2	98	1000
1700	63	8.7	15	230	35,000	230	20	9.6	70	1500
2400	46	6.4	12	260	30,000	260	16	7.0	51	2150
3200	34	4.7	8	285	25,000	285	12	5.2	37	2850
4100	24	3.3	6	315	20,000	315	8	3.7	27	3700
5150	16	2.2	4	350	15,000	350	6	2.5	18	4650
6300	9	1.4	3	385	10,000	385	3	1.5	11	5750
7550	4	0.6	1	420	5,000	420	2	0.8	5	6850
8900	—	—	—	455	SEA LEVEL	455	—	—	—	8050

REMARKS
1. Descend at .6 mach number.
2. Use dive flaps down to 35,000 ft. Idle RPM is too great to allow descent at .6 mach number.
3. Multiply statute units by .87 for conversion to nautical units.

DATA AS OF: 1 Jan. 49 DATA BASIS: Flight Test

LEGEND
RATE OF DESCENT: FEET PER MINUTE
DISTANCE: STATUTE MILES
TIME: MINUTES
FUEL: GALLONS
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 40 — Descent Chart — RF-80A-20, -25

CLIMB CHART FOR MAXIMUM POWER
STANDARD DAY

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE MODELS
J33-A-35

CONFIGURATION: CLEAN
WEIGHT: 12,900 LBS.

APPROXIMATE				CAS MPH	PRESSURE ALTITUDE FEET
RATE OF CLIMB	FROM SEA LEVEL				
	DISTANCE	TIME	FUEL		
4950	—	—	21 (2)	310	SEA LEVEL
4450	5	1	38	300	5,000
3900	12	3	51	290	10,000
3350	20	4	67	280	15,000
2800	30	6	82	270	20,000
2250	42	8	94	260	25,000
1750	58	10	111	250	30,000
1350	79	13	129	240	35,000
650	116	19	152	230	40,000

CONFIGURATION: CLEAN
WEIGHT: 10,900 LBS.

CAS MPH	APPROXIMATE			
	FROM SEA LEVEL			RATE OF CLIMB
	FUEL	TIME	DISTANCE	
310	21 (2)	—	—	5900
300	32	1	5	5300
290	44	2	11	4700
280	56	3	16	4100
270	68	4	25	3500
260	82	6	35	2900
250	94	8	46	2300
240	108	10	63	1750
230	123	14	89	1100

CONFIGURATION: 2 X 165 GALLON TIP TANKS
WEIGHT: 15,350 LBS.

APPROXIMATE				CAS MPH	PRESSURE ALTITUDE FEET
RATE OF CLIMB	FROM SEA LEVEL				
	DISTANCE	TIME	FUEL		
4000	—	—	31 (2)	310	SEA LEVEL
3500	8	2	50	300	5,000
3000	18	3	69	290	10,000
2500	27	5	88	280	15,000
2000	40	7	108	270	20,000
1500	60	10	129	260	25,000
1000	85	14	156	250	30,000
600	131	20	188	240	35,000
—	—	—	—	—	40,000

CONFIGURATION: 2 X 165 GALLON TIP TANKS
WEIGHT: 12,350 LBS.

CAS MPH	APPROXIMATE			
	FROM SEA LEVEL			RATE OF CLIMB
	FUEL	TIME	DISTANCE	
310	31 (2)	—	—	5000
300	47	1	5	4400
290	63	2	11	3850
280	75	4	20	3250
270	91	5	30	2700
260	107	7	44	2150
250	123	10	61	1600
240	145	14	88	1050
230	178	24	141	350

REMARKS

1. Climb at recommended CAS.
2. Taxi and take-off allowance.
3. Temp. correction — subtract 30 FPM from standard day rate of climb for each °F. above standard day temp.
4. Multiply statute units by 0.87 for conversion to nautical units.

DATA AS OF: 1 Jan. 49 DATA BASIS: Flight Test

LEGEND

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: STATUTE MILES
TIME: MINUTES
FUEL: GALLONS
CAS: CALIBRATED AIRSPEED
MPH: STATUTE MILES PER HOUR

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 41 — Climb Chart — RF-80A-20, -25

MAXIMUM ENDURANCE
STANDARD DAY

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE MODELS
J33-A-35

CONFIGURATION: 2 X 165 EXTERNAL TIP TANKS WEIGHT: 10,400 LBS.			CONFIGURATION: CLEAN WEIGHT: 10,100 LBS.	
APPROXIMATE FUEL FLOW GAL/MIN	CAS MPH	PRESSURE ALTITUDE FEET	CAS MPH	APPROXIMATE FUEL FLOW GAL/MIN
3	185	40,000	185	2
3	185	35,000	185	3
3	185	30,000	185	3
3	185	25,000	185	3
4	185	20,000	185	3
4	185	15,000	185	4
4	185	10,000	185	4
5	185	5,000	185	5
6	185	S. L.	185	5

LEGEND
CAS: CALIBRATED AIRSPEED
GAL/MIN: FUEL CONSUMPTION
MPH: STATUTE MILES PER HOUR

DATA AS OF: 1 Jan. 49
DATA BASIS: Flight Test

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL

Figure 42 — Maximum Endurance Chart — RF-80A-20, -25

AIRCRAFT MODELS	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS
RF-80A-20, -25	**STANDARD DAY**	NONE
ENGINE: J33-A-35	CHART WEIGHT LIMITS 12,860 TO 9,000 POUNDS	NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
325	40	864	425	382	40	888	435	40	912	526	40	932	425	612	40	946
306	40	808	400	358	40	832	406	40	855	497	40	874	400	574	40	888
277	40	717	360	320	40	741	368	40	764	449	40	779	360	516	40	798
244	40	621	320	287	40	650	325	40	674	397	40	688	320	463	40	707
215	40	530	280	253	40	560	288	40	583	349	40	597	280	406	40	616
182	40	440	240	215	40	468	249	40	492	301	40	506	240	349	40	526
153	40	349	200	182	40	378	205	40	397	253	40	416	200	296	40	435
124	40	258	160	143	40	287	167	40	306	205	40	325	160	239	40	344
91	30	167	120	110	35	196	124	40	215	158	40	234	120	182	40	249
62	25	91	80	76	30	115	86	30	129	110	35	143	80	129	35	158

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE				
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW							369	88	426	305	.7	9	346	88	366	309	.7	15	120 HW	325	88	314	316	.7	23
420	89	581	340	.8	0	80 HW	371	86	454	317	.8	4	356	87	409	330	.8	10	336	87	350	337	.8	16	80 HW	325	88	314	356	.8	24
396	86	520	356	.9	0	40 HW	358	85	438	344	.9	5	346	86	392	358	.9	10	327	86	335	366	.9	17	40 HW	311	87	298	377	.9	26
375	84	485	375	1.0	0	0	352	84	423	377	1.0	5	333	84	363	384	1.0	11	318	85	320	395	1.0	18	0	303	86	286	407	1.0	27
362	82	456	402	1.1	0	40 TW	348	83	409	413	1.1	5	325	83	350	412	1.1	12	308	84	307	423	1.1	19	40 TW	292	85	272	433	1.1	29
353	81	447	433	1.2	0	80 TW	338	82	398	442	1.2	6	312	82	339	440	1.2	12	297	83	298	450	1.2	20	80 TW	282	84	260	459	1.2	30
						120 TW							302	81	330	468	1.4	13	285	82	282	475	1.4	21	120 TW	267	83	249	480	1.4	32

Figure 43 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (RF-80A-20, -25)

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE: J33-A-35

HIGH ALTITUDE
CHART WEIGHT LIMITS 12,860 TO 9,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000′ RANGE IN AIRMILES: BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES: BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	IF YOU ARE AT 35,000′ RANGE IN AIRMILES: BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	IF YOU ARE AT 40,000′ RANGE IN AIRMILES: BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES: BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
712	40	956	425	817	40	975	927	40	994	1008	—	—	425			
669	40	903	400	764	40	917	874	40	936	951	—	—	400			
602	40	812	360	693	40	827	788	40	841	860	—	—	360			
535	40	722	320	616	40	736	702	40	750	769	—	—	320			
473	40	631	280	545	40	645	621	40	659	679	—	—	280			
406	40	540	240	468	40	550	535	40	568	588	—	—	240			
444	40	449	200	497	40	459	449	40	478	497	—	—	200			
277	40	358	160	320	40	368	368	40	387	402	—	—	160			
215	40	268	120	244	40	277	282	40	296	311	—	—	120			
148	40	172	80	172	40	186	196	40	205	220	—	—	80			

CRUISING AT 25,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	EFFECTIVE WIND MPH	CRUISING AT 30,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CRUISING AT 35,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CRUISING AT 40,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	EFFECTIVE WIND MPH	CRUISING AT 45,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
312	90	295	333	.7	31	120 HW	297	91	264	348	.7	44	270	91	222	338	.7	60	216	93	193	300	.7	83	120 HW						
307	89	281	366	.8	33	80 HW	288	90	251	377	.8	46	270	91	222	378	.8	64	211	92	183	332	.8	88	80 HW						
300	88	268	396	.9	35	40 HW	281	89	241	405	.9	48	260	90	210	402	.9	67	204	91	175	360	.9	92	40 HW						
288	87	256	420	1.0	37	0	275	88	229	435	1.0	51	260	90	210	442	1.0	70	204	91	175	400	1.0	98	0						
288	87	256	460	1.1	39	40 TW	259	87	219	452	1.1	54	260	90	210	482	1.1	74	200	90	167	432	1.1	104	40 TW						
275	86	244	481	1.2	41	80 TW	259	87	219	492	1.2	56	255	89	200	514	1.2	77	200	90	167	472	1.2	109	80 TW						
263	85	232	505	1.3	43	120 TW	252	86	207	521	1.3	59	255	89	200	554	1.3	80	200	90	167	512	1.3	115	120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.

EXAMPLE

If you are at 15,000 ft. with 320 gallons of available fuel, you can fly 397 statute airmiles by holding 318 MPH CAS. However, you can fly 688 statute airmiles by immediately climbing to 40,000 ft. using 100% RPM. At 40,000 ft. cruise at 204 MPH CAS and start let down 98 statute miles from home. With an 80 MPH headwind the range at 40,000 ft. would be 0.8 × 688 or 550 statute miles. Cruise at 211 MPH CAS with this wind and start let down 88 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 7-1-49 BASED ON: Flight Test

Figure 43 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (RF-80A-20, -25)

AIRCRAFT MODELS
RF-80A-20, -25
ENGINE: J33-A-35

FLIGHT OPERATION INSTRUCTION CHART
STANDARD DAY

CHART WEIGHT LIMITS 15,000 TO 9,250 POUNDS

EXTERNAL LOAD ITEMS
2 × 165 GALLON EXTERNAL TIP TANKS
CARRIED ALL THE WAY
NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
535	35	1228	755	616	35	1242	702	35	1270	808	35	1285	755	927	35	1300
497	35	1137	700	569	35	1160	654	35	1175	750	35	1195	700	865	35	1208
425	35	965	600	487	35	989	559	35	1004	645	35	1022	600	741	35	1036
354	35	793	500	406	35	817	468	35	832	540	35	855	500	621	35	865
320	35	707	450	368	35	736	421	35	745	388	35	769	450	559	35	779
287	35	621	400	325	35	650	373	35	660	435	35	683	400	497	35	698
249	35	535	350	287	35	564	325	35	574	382	35	597	350	440	35	612
215	35	454	300	244	35	478	282	35	488	330	35	511	300	378	35	526
177	35	368	250	205	35	392	234	35	401	277	35	425	250	315	35	440
139	35	282	200	167	35	306	191	35	315	225	35	339	200	258	35	354
105	35	191	150	124	35	215	143	35	229	172	35	258	150	196	35	268
72	25	100	100	86	30	129	100	30	143	120	35	172	100	139	35	182

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW							340	90	463	271	.6	7	320	90	398	277	.7	13	120 HW	302	91	361	285	.7	20
360	87	528	280	.7	0	80 HW	340	87	471	285	.7	3	321	88	426	290	.7	8	301	88	366	294	.8	14	80 HW	287	89	327	306	.8	21
338	84	485	298	.9	0	40 HW	317	84	423	300	.9	4	306	86	392	313	.9	8	287	87	350	317	.9	15	40 HW	273	88	314	328	.9	23
317	81	447	317	1.0	0	0	286	81	385	317	1.0	4	294	84	363	340	1.0	9	273	85	320	340	1.0	16	0	261	86	286	352	1.0	24
301	78	429	341	1.1	0	40 TW	276	78	364	336	1.1	4	285	83	350	369	1.1	10	262	83	298	367	1.1	17	40 TW	251	85	272	380	1.1	26
286	76	396	366	1.3	0	80 TW	262	75	346	362	1.3	5	277	82	339	400	1.3	10	254	82	282	397	1.3	18	80 TW	243	84	260	408	1.3	27
						120 TW							271	81	330	433	1.4	11	247	81	272	429	1.4	19	120 TW	235	83	249	438	1.4	28

Figure 44 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (RF-80A-20, -25)

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE: J33-A-35

HIGH ALTITUDE
CHART WEIGHT LIMITS 15,000 TO 9,250 POUNDS

EXTERNAL LOAD ITEMS
2 × 165 GALLON EXTERNAL TIP TANKS
CARRIED ALL THE WAY
NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000′ RANGE IN AIRMILES: BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	FUEL U. S. GAL.	IF YOU ARE AT 30,000′ RANGE IN AIRMILES: BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	IF YOU ARE AT 35,000′ RANGE IN AIRMILES: BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	IF YOU ARE AT 40,000′ RANGE IN AIRMILES: BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	FUEL U. S. GAL.	IF YOU ARE AT 45,000′ RANGE IN AIRMILES: BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
1050	35	1314	755	1205	35	1319	1324						755			
975	35	1219	700	1118	35	1228	1233						700			
841	35	1050	600	960	35	1055	1060						600			
702	35	946	500	807	35	908	889						500			
635	35	793	450	726	35	803	808						450			
569	35	708	400	650	35	717	722						400			
492	35	622	350	574	35	631	636						350			
430	35	535	300	497	35	545	550						300			
363	35	449	250	421	35	459	464						250			
296	35	368	200	339	35	373	378						200			
225	35	282	150	263	35	287	296						150			
158	35	196	100	186	35	201	210						100			

CRUISING AT 25,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	EFFECTIVE WIND MPH	CRUISING AT 30,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CRUISING AT 35,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CRUISING AT 40,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	EFFECTIVE WIND MPH	CRUISING AT 45,000′ CAS	APPROXIMATE % RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
288	92	324	300	.7	28	120 HW	270	95	316	308	.7	39	288	93	246	278	.7	53							120 HW						
274	90	295	320	.8	30	80 HW	265	94	302	340	.8	41	224	92	233	311	.8	56							80 HW						
262	89	281	343	.9	32	40 HW	260	93	289	374	.9	44	224	92	233	351	.9	60							40 HW						
251	88	268	368	1.0	34	0	257	92	276	409	1.0	46	216	91	222	377	1.0	63							0						
241	87	256	394	1.1	36	40 TW	254	91	264	444	1.1	48	216	91	222	417	1.1	67							40 TW						
233	86	244	422	1.3	38	80 TW	254	91	264	484	1.2	51	201	90	210	443	1.2	70							80 TW						
227	85	232	453	1.4	41	120 TW	249	90	251	517	1.3	53	201	90	210	483	1.3	74							120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.

EXAMPLE

If you are at S.L. with 600 gallons available fuel, you can fly 425 statute airmiles by holding 317 MPH CAS. However, you can fly 965 statute airmiles by immediately climbing to 35,000 ft. using 100% RPM. At 35,000 ft. cruise at 216 MPH CAS and start let down 63 statute miles from home. With a 40 MPH tailwind the range at 35,000 ft. would be 1.1 × 965 or 1061 statute miles. Cruise at 216 MPH CAS with this wind and start let down 67 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 7-1-49 BASED ON: Flight Test

Figure 44 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (RF-80A-20, -25)

AIRCRAFT MODELS	FLIGHT OPERATION INSTRUCTION CHART	EXTERNAL LOAD ITEMS
RF-80A-20, -25	**STANDARD DAY**	2 × 165 GALLON EXTERNAL TIP TANKS DROPPED WHEN EMPTY
ENGINE: J33-A-35	CHART WEIGHT LIMITS 15,000 TO 12,860 POUNDS	NUMBER OF ENGINES OPERATING: ONE

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figure in fuel column equal to or less than fuel available for cruise (fuel on board minus allowance for reserve, combat, navigational error, formation flight, etc.). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instructions in appropriate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distances to range values.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (due to external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA BELOW CONTAIN NO FUEL RESERVE FOR LANDING

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 5000′ RANGE IN AIRMILES			IF YOU ARE AT 10,000′ RANGE IN AIRMILES			IF YOU ARE AT 15,000′ RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 20,000′ RANGE IN AIRMILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
559	35	1462	**755**	650	35	1486	741	35	1505	874	35	1520	**755**	1014	35	1534
516	35	1362	**700**	602	35	1386	688	35	1405	817	35	1424	**700**	946	35	1438
483	35	1271	**650**	564	35	1295	645	35	1319	765	35	1334	**650**	884	35	1347
449	35	1180	**600**	521	35	1205	597	35	1228	712	35	1242	**600**	822	35	1257
411	35	1090	**550**	483	35	1114	550	35	1137	660	35	1156	**550**	764	35	1171
378	35	998	**500**	445	35	1023	507	35	1046	607	35	1066	**500**	702	35	1080
344	35	908	**450**	402	35	932	459	35	960	554	35	980	**450**	645	35	994
325	40	865	**425**	382	40	889	435	40	912	526	40	932	**425**	612	40	946
				DROP EXTERNAL TIP TANKS WHEN EMPTY					(REFER TO FIG. 43 FOR OPERATING INSTRUCTIONS)							

CRUISING AT S. L.						EFFECTIVE WIND MPH	CRUISING AT 5000′						CRUISING AT 10,000′						CRUISING AT 15,000′						EFFECTIVE WIND MPH	CRUISING AT 20,000′					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE					
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
						120 HW							340	90	463	271	.6		320	90	398	277	.7		**120 HW**	302	91	361	285	.7	
360	87	538	280	.7	(5)	**80 HW**	340	87	471	285	.7	(5)	321	88	426	290	.7	(5)	301	88	366	294	.8	(5)	**80 HW**	287	89	327	306	.8	(5)
338	84	485	298	.9		**40 HW**	317	84	423	300	.9		306	86	392	313	.9		287	87	350	317	.9		**40 HW**	273	88	314	328	.9	
317	81	447	317	1.0		**0**	286	81	385	317	1.0		294	84	363	340	1.0		273	85	320	340	1.0		**0**	261	86	286	352	1.0	
301	78	429	341	1.1		**40 TW**	276	78	364	336	1.1		285	83	350	369	1.1		262	83	298	367	1.1		**40 TW**	251	85	272	380	1.1	
286	76	396	366	1.3		**80 TW**	262	75	346	362	1.3		277	82	339	400	1.3		254	82	282	397	1.3		**80 TW**	243	84	260	408	1.3	
						120 TW							271	81	330	433	1.4		247	81	272	429	1.4		**120 TW**	235	83	249	438	1.4	

Figure 45 (Sheet 1 of 2 Sheets) — Flight Operation Instruction Chart (RF-80A-20, -25)

AIRCRAFT MODELS
RF-80A-20, -25

ENGINE: J33-A-35

HIGH ALTITUDE

CHART WEIGHT LIMITS 15,000 TO 12,860 POUNDS

EXTERNAL LOAD ITEMS
2 × 165 GALLON EXTERNAL TIP TANKS DROPPED WHEN EMPTY
NUMBER OF ENGINES OPERATING: ONE

IF YOU ARE AT 25,000' RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 30,000' RANGE IN AIRMILES			IF YOU ARE AT 35,000' RANGE IN AIRMILES			IF YOU ARE AT 40,000' RANGE IN AIRMILES			FUEL U. S. GAL.	IF YOU ARE AT 45,000' RANGE IN AIRMILES		
BY CRUISING AT 25,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 30,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 35,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	BY CRUISING AT 40,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.		BY CRUISING AT 45,000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)																
1161	35	1544	755	1334	35	1554	1491	35	1558				755			
1090	35	1448	700	1247	35	1457	1395	35	1462				700			
1017	35	1357	650	1166	35	1371	1309	35	1381				650			
951	35	1271	600	1089	35	1281	1228	35	1295				600			
884	35	1180	550	1013	35	1195	1142	35	1209				550			
812	35	1094	500	937	35	1108	1056	35	1123				500			
746	35	1004	450	856	35	1023	970	35	1037				450			
712	40	961	425	817	40	975	927	40	994				425			
DROP EXTERNAL TIP TANKS WHEN EMPTY				(REFER TO FIG. 43 FOR OPERATING INSTRUCTIONS)												

CRUISING AT 25,000'						EFFECTIVE WIND MPH	CRUISING AT 30,000'						CRUISING AT 35,000'						CRUISING AT 40,000'						EFFECTIVE WIND MPH	CRUISING AT 45,000'					
	APPROXIMATE							APPROXIMATE						APPROXIMATE						APPROXIMATE						APPROXIMATE				
CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.	CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.		CAS	% RPM	GAL /HR	G.S.	R.F.	Let Down Dist.
288	92	324	300	.7	(5)	120 HW	270	95	316	308	.7	(5)	228	93	246	278	.7	(5)							120 HW						
274	90	295	320	.8		80 HW	265	94	302	340	.8		224	92	233	311	.8								80 HW						
262	89	281	343	.9		40 HW	260	93	289	374	.9		224	92	233	351	.9								40 HW						
251	88	268	368	1.0		0	257	92	276	409	1.0		216	91	222	377	1.0								0						
241	87	256	394	1.1		40 TW	254	91	264	444	1.1		216	91	222	417	1.1								40 TW						
233	86	244	422	1.3		80 TW	254	91	264	484	1.2		207	90	210	443	1.2								80 TW						
227	85	232	453	1.4		120 TW	249	90	251	517	1.3		207	90	210	483	1.3								120 TW						

SPECIAL NOTES

1. Climb at 100% RPM.
2. Multiply statute units by 0.87 to obtain nautical units.
3. Read lower half of chart opposite effective wind only.
4. Make additional allowances for landing, navigational errors, combat, formation flight, etc., as required.
5. Refer to fig. 43 for letdown without external tanks.

EXAMPLE

If you are at 5,000 ft. with 650 gallons of available fuel, you can fly 564 statute airmiles by holding 286 MPH CAS. However, you can fly 1295 statute airmiles by immediately climbing to 35,000 ft. using 100% RPM. At 35,000 ft. cruise at 216 MPH CAS and start let down 70 statute miles from home. With an 120 MPH headwind the range at 35,000 ft. would be 0.7 × 1295 or 906 statute miles. Cruise at 228 MPH CAS with this wind and start let down 60 statute miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — MPH
R.F. — RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIRMILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN MPH
CAS — CALIBRATED AIRSPEED IN MPH
GAL/HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — STATUTE MILES
( ) RANGE IN PARENTHESES FOR INTERPOLATION PURPOSES ONLY

FUEL GRADE — JP-4
FUEL DENSITY — 6.5 LBS/GAL

DATA AS OF: 7-1-49 BASED ON: Flight Test

Figure 45 (Sheet 2 of 2 Sheets) — Flight Operation Instruction Chart (RF-80A-20, -25)