Preliminary Pilot's Handbook

for

NAVY MODEL

AD-4

AIRPLANES

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

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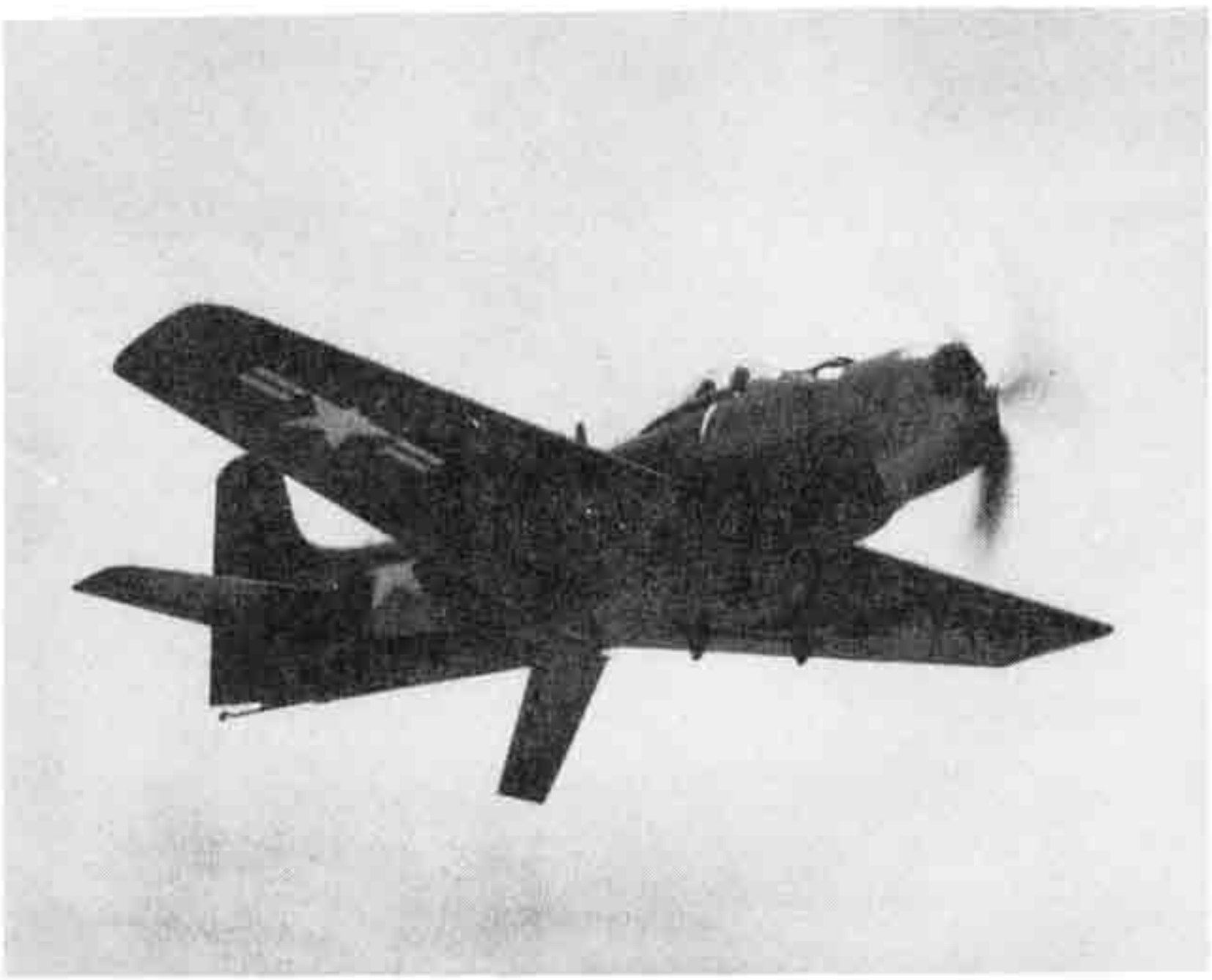

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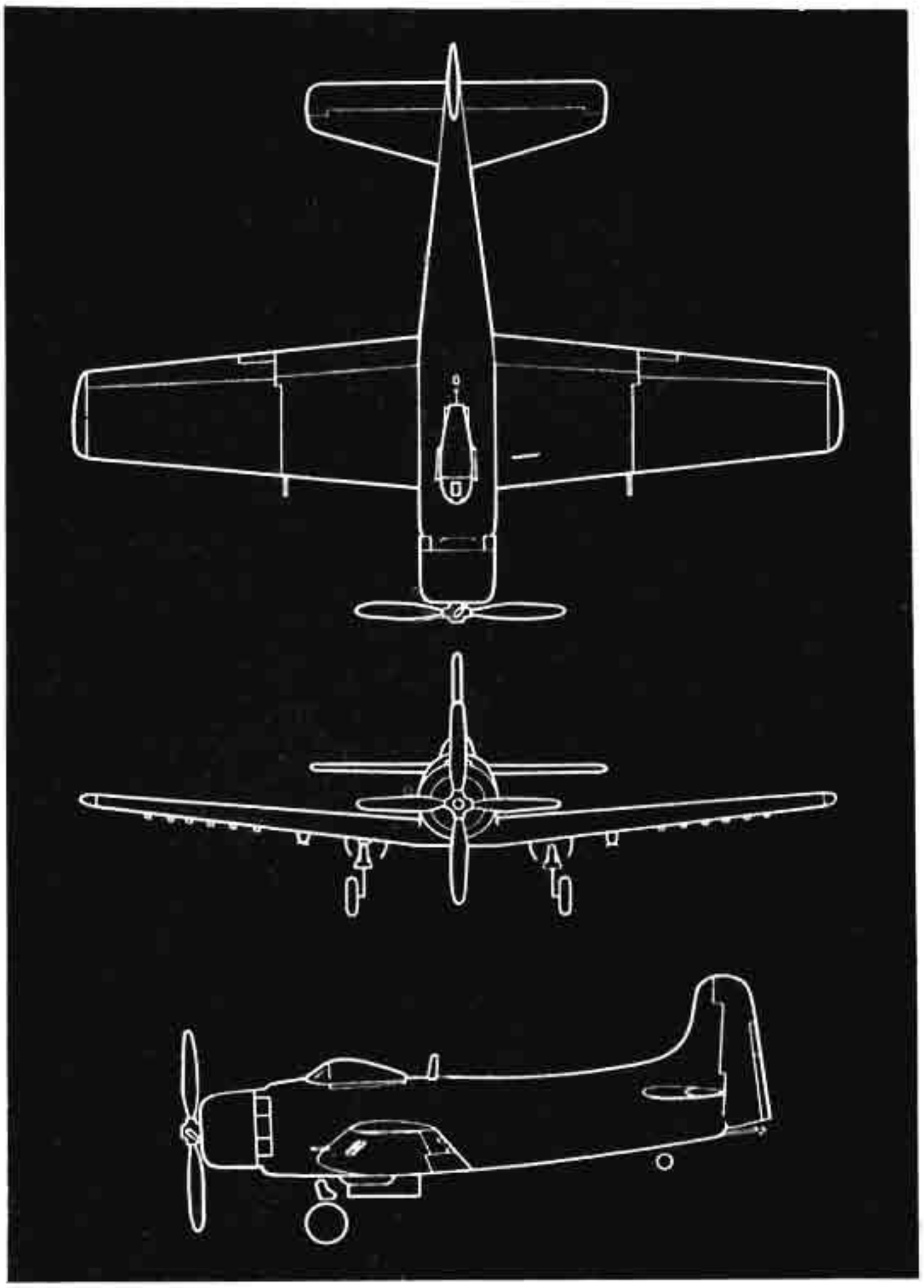
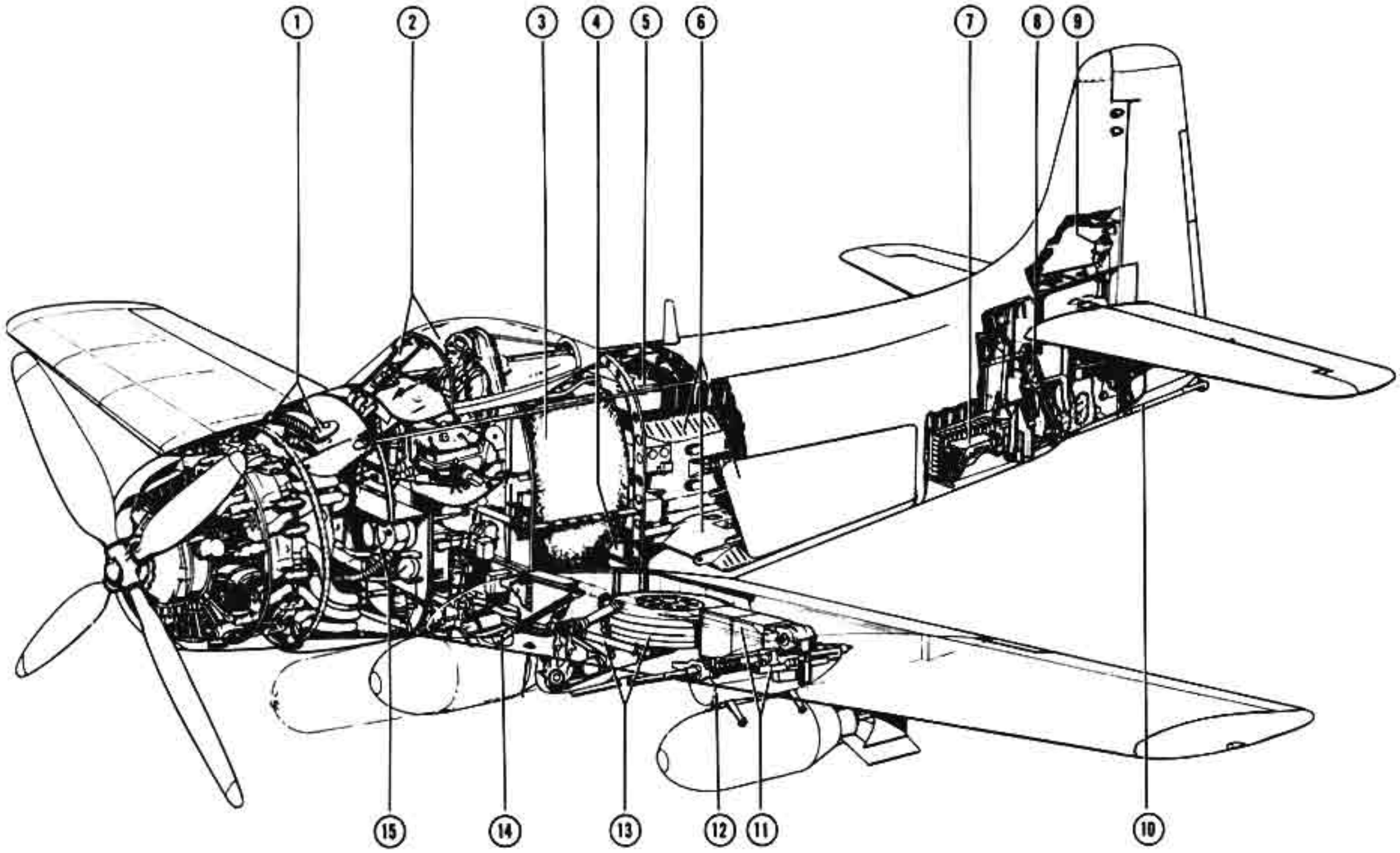


Figure 1-1. Model AD-4 Airplane



Ref	Name
1	Heating and ventilating air intake ducts
2	Cockpit windshield and canopy
3	Main fuel tank
4	Battery
5	Electronic equipment compartment
6	Side and bottom dive brakes
7	Tail gear (retracted)
8	Arresting hook hold-down unit
9	Horizontal stabilizer actuating unit
10	Arresting hook (latched up)
11	20 mm gun and ammunition stowage
12	Wing bomb rack
13	Landing gear (retracted)
14	Catapult take-off hook
15	Hydraulic system accumulator and reservoir

Figure 1-2. General Arrangement Diagram

SECTION I

DESCRIPTION

1–1. AIRPLANE.

1–2. GENERAL. The Model AD-4 airplane is a single place, carrier based landplane manufactured by the Douglas Aircraft Co. Inc., El Segundo Plant. Special gear is provided to permit catapult take-offs and arrested landings when carrier based. An automatic pilot is provided for the pilot. Two 20 mm guns are mounted in the center wing panel, one at each wing fold joint. 200 rounds of ammunition are available for each gun. Six rocket launchers are installed under each outer wing panel. The two wing bomb racks and the fuselage bomb ejector rack are each capable of carrying a maximum capacity of one 2000-pound bomb or one MK 13-3 torpedo. The airplane is designed with side and bottom fuselage dive brakes. For general arrangement, see figure 1–2.

1–3. DIMENSIONS. The principal three-point dimensions and the weight of the airplane are as follows:

Length (ground line level).....38 ft. 10-13/32 in.
Span (wings spread).....50 ft. 3/16 in.
Span (wings folded).....23 ft. 10½ in.
Height (maximum propeller).....15 ft. 7½ in.
Height (over folded wings).....16 ft. 8 in.
Height (maximum during wing folding).....19 ft. 4¼ in.
Weight (normal gross).....16,667 lbs.

Note

The weight as given above is determined with a condition of one 2000-pound bomb installed and 380 gallons (2280 pounds) of fuel aboard.

1–4. POWER PLANT. The engine is a Wright Cyclone R3350-26WA which incorporates a single-stage, two-speed supercharger.

1–5. PROPELLER. The propeller is an Aeroproducts A642-G8/M20A-162-0 which is a constant speed, hydraulically-actuated pitch type propeller, 13 ft. 6 in. in diameter.

1–6. AD SERIES COMPARISON. The AD-4 airplane is basically an improved version of the AD-3 airplane. The primary differences are installation of an automatic pilot, wider bullet-proof glass windshield, increased usable oil capacity, pressurization of the hydraulic fluid reservoir, an improved engine control quadrant, dual generators, AN/APS-19A search radar and a Mark 3 Mod 3 bomb director.

1–7. FLIGHT CONTROLS.

1–8. SURFACE CONTROLS. Conventional control stick and rudder pedals are provided. The position of both rudder pedals may be adjusted simultaneously by means of a crank (figure 1–4, reference 28) located just below the armament panel.

1–9. SURFACE CONTROLS LOCK. The surface controls lock assembly (figure 1–6) consists of a cap, and two short cables and two long cables, each equipped with attaching hook. To install the lock, crank the rudder pedals to the "AFT" position, set the cap over the stick grip, hook the short cables to the rudder pedals and hook the long cables to the brackets at the sides of the cockpit. Cranking the rudder pedals to the "FWD" position will tighten the cables and lock the controls. The lock assembly is stowed in a compartment located in the left-hand console panel and marked "CONTROL LOCK" (figure 1–3, reference 1).

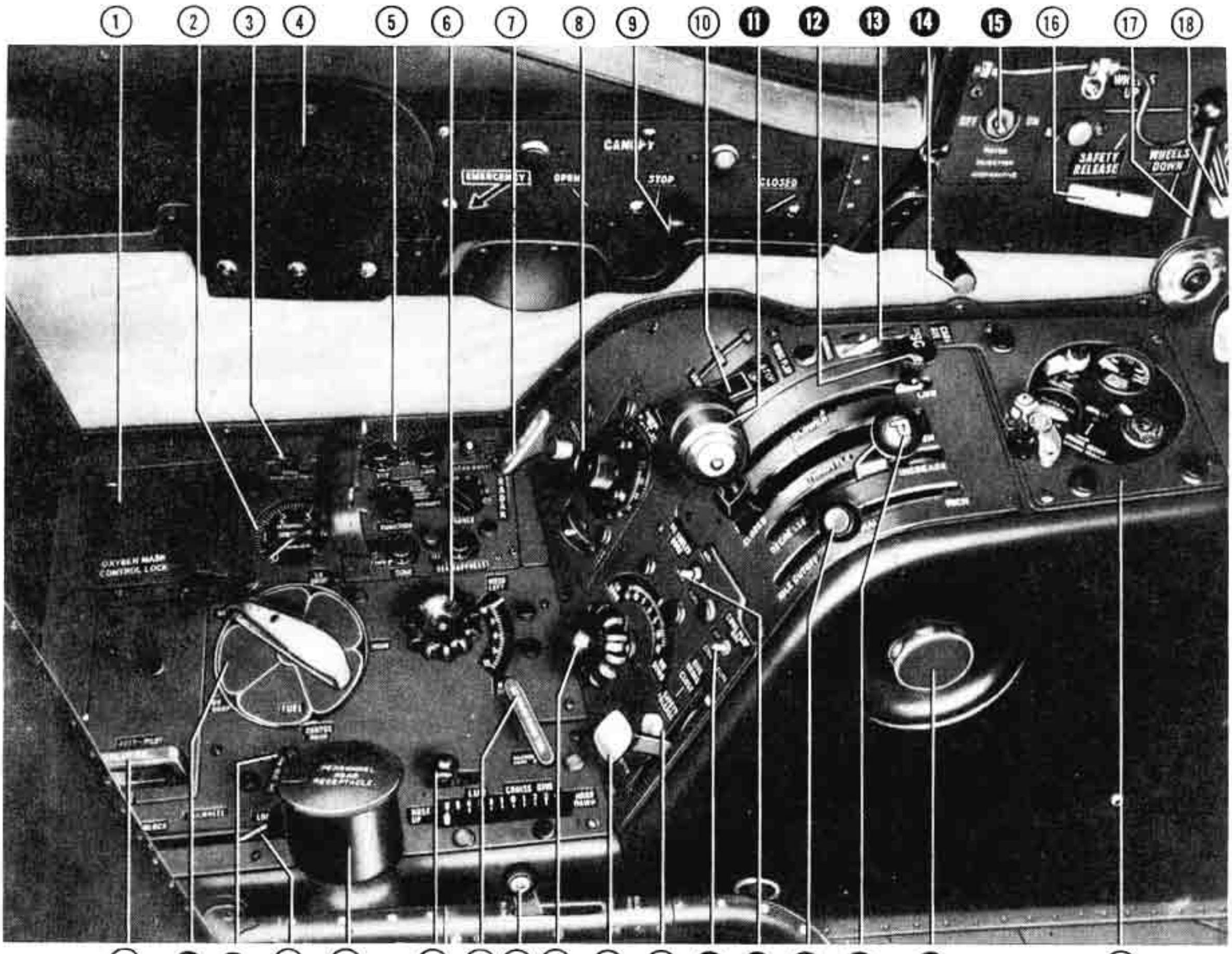
1–10. AILERON POWER BOOST SYSTEM. An hydraulically operated aileron power boost system is provided to reduce stick control forces. The boost system can be mechanically disconnected from the aileron control system by pulling out on the emergency release handle (figure 1–3, reference 29) if the hydraulic system should fail. Once disconnected the boost system cannot be re-engaged during flight.

1–11. TABS. Controllable trim tabs are located on the rudder and the left-hand aileron. The trim tab controls (figure 1–3, references 6 and 28) are located on the left-hand console panel. A fixed trim tab, adjustable on the ground only, is provided on the right-hand aileron. A spring tab, which is linked directly to the surface to reduce control forces, is provided on the rudder.

CAUTION

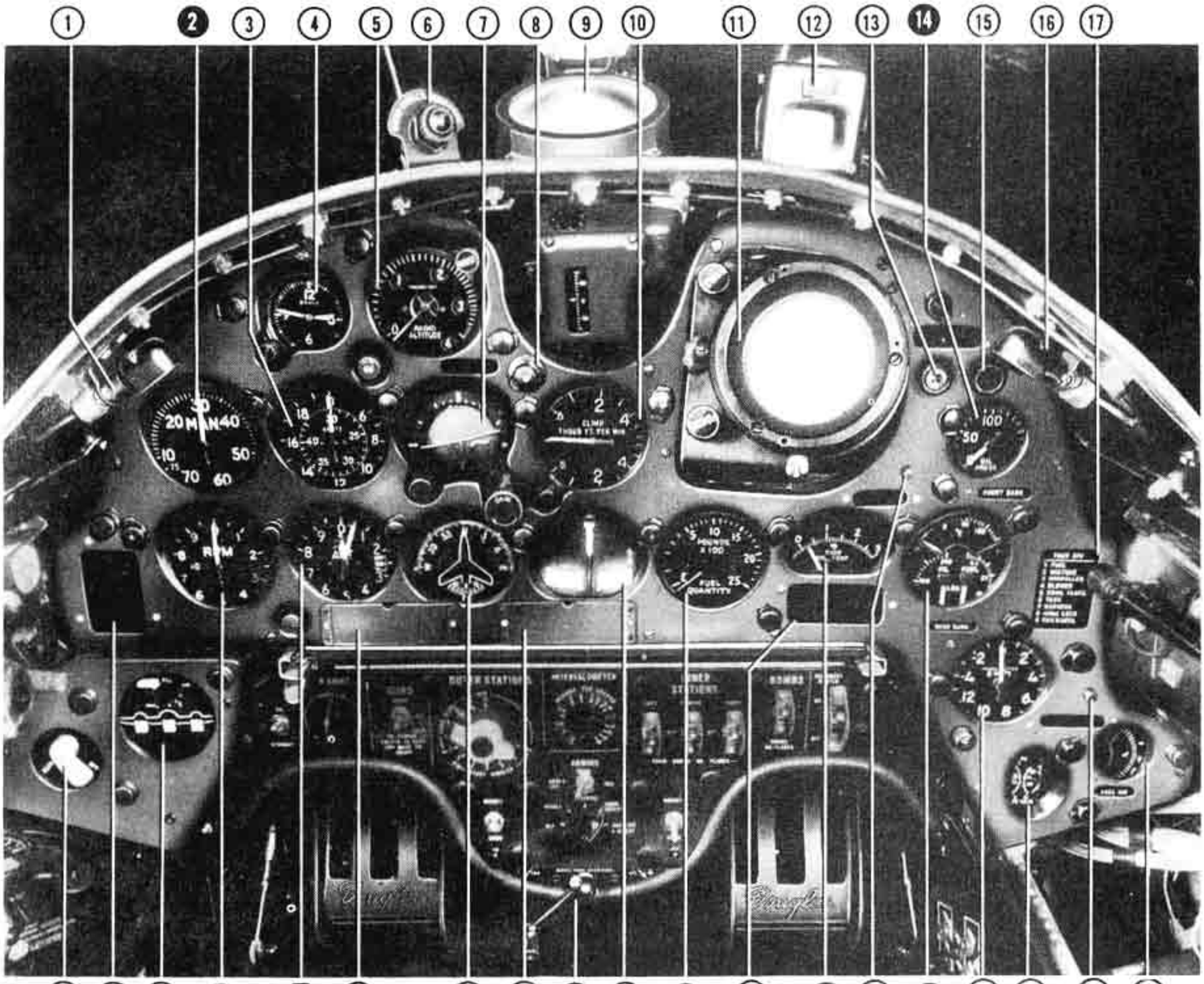
Do not turn the aileron trim tab control when the wings are in the folded position.

1–12. HORIZONTAL STABILIZER. Longitudinal trim is accomplished by an adjustable horizontal stabilizer in lieu of elevator tabs. The stabilizer is electrically operated and is controlled by a switch lever (figure 1–3, reference 30) on the left-hand console panel. A mechanical control is not provided. A position indicator, showing the recommended setting



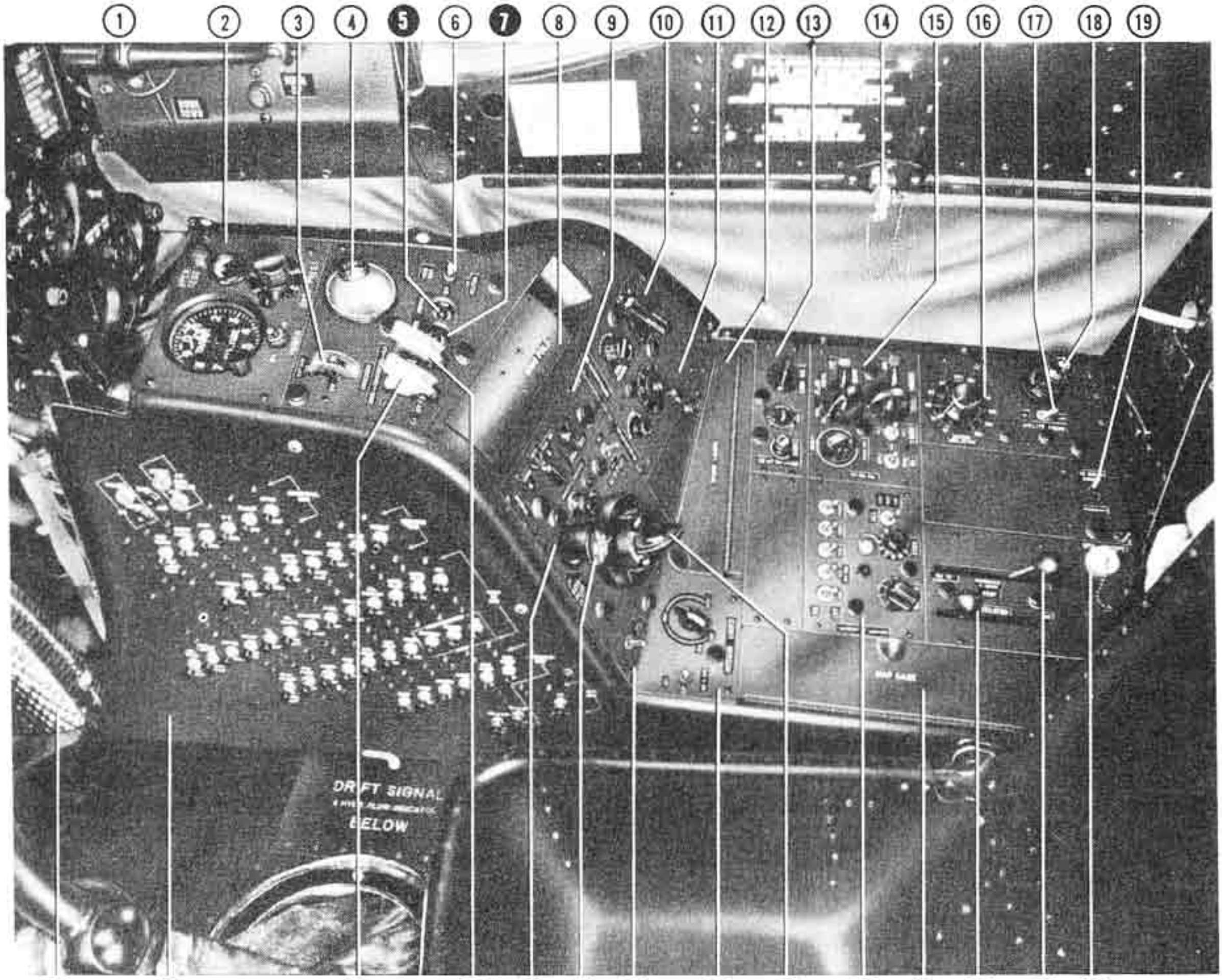
Ref	Name	Ref	Name
1	Stowage—oxygen mask and control lock	19	Oxygen regulator console
2	Hydraulic system pressure gage	20	Throttle and propeller controls friction lock
3	Emergency hydraulic pump switch	21	Propeller pitch control
4	Arm rest	22	Mixture control
5	Search radar control console	23	Oil cooler door control switch
6	Rudder trim tab control	24	Cowl flap control switch
7	Emergency bomb release	25	Dive brake solenoid safety release
8	Gunsight elevation control console	26	Dive brake control
9	Cockpit canopy control	27	Shoulder harness control
10	Wing flap control	28	Aileron trim tab control
11	Throttle control and microphone switch	29	Aileron power boost emergency release
12	Supercharger control	30	Horizontal stabilizer control
13	Carburetor air control switch	31	Personnel gear receptacle
14	Static throttle grip	32	Tail wheel lock control
15	Water injection master switch	33	Fuel booster pump switch
16	Landing gear control safety lock	34	Fuel tank selector
17	Landing gear control	35	Automatic pilot emergency release.
18	Landing gear control release plunger		

Figure 1-3. Pilot's Cockpit — Left Side.



Ref	Name
1	Instrument panel light
2	Manifold pressure gage
3	Airspeed indicator
4	Clock
5	Radio altimeter
6	Bomb director indicator
7	Gyro horizon indicator auto-pilot
8	Radio altimeter warning light
9	Gunsight
10	Rate of climb indicator
11	Search radar scope
12	Standby compass
13	Normal generator warning light
14	Oil pressure gage—front bank
15	Alternate generator warning light
16	Instrument panel light
17	Take-off check-off list
18	Free air temperature indicator
19	Ammeter transfer switch
20	Volt-ammeter
21	Accelerometer
22	Engine gage unit
23	Windshield degrease control
24	Cylinder head temperature indicator
25	Dive check-off list
26	Fuel quantity indicator
27	Bank and turn indicator—auto-pilot
28	Rudder pedal adjustment indicator
29	Compass correction chart
30	Master direction indicator—auto-pilot
31	Airspeed correction chart
32	Altimeter
33	Tachometer indicator
34	Wheel and flap postion indicator
35	Landing check-off list
36	Ignition switch

Figure 1-4. Pilot's Cockpit — Front View.



Ref	Name
1	Arresting hook control
2	Bomb director console
3	Battery switch
4	Ventilating air outlet
5	Engine primer switch
6	Pitot heater and oil dilution switch
7	Engine starter switch
8	Wing fold control
9	VHF radio console
10	Radio master control console
11	Range radio control console
12	Spare lamps stowage
13	Homing radio control console
14	Oxygen filler valve
15	IFF radio control console
16	Radio altimeter control console
17	Utility light switch
18	Utility extension light
19	A-c power switch
20	Utility receptacle
21	Ventilation control
22	Heat control
23	Map case
24	Exterior lights control console
25	Automatic pilot controller
26	Interior lights control console
27	Seat adjustment switch
28	Automatic pilot cluth switch
29	Automatic pilot and inverter control console
30	Alternate generator switch
31	Normal generator switch
32	Circuit breaker panel
33	Control stick

Figure 1-5. Pilot's Cockpit — Right Side.

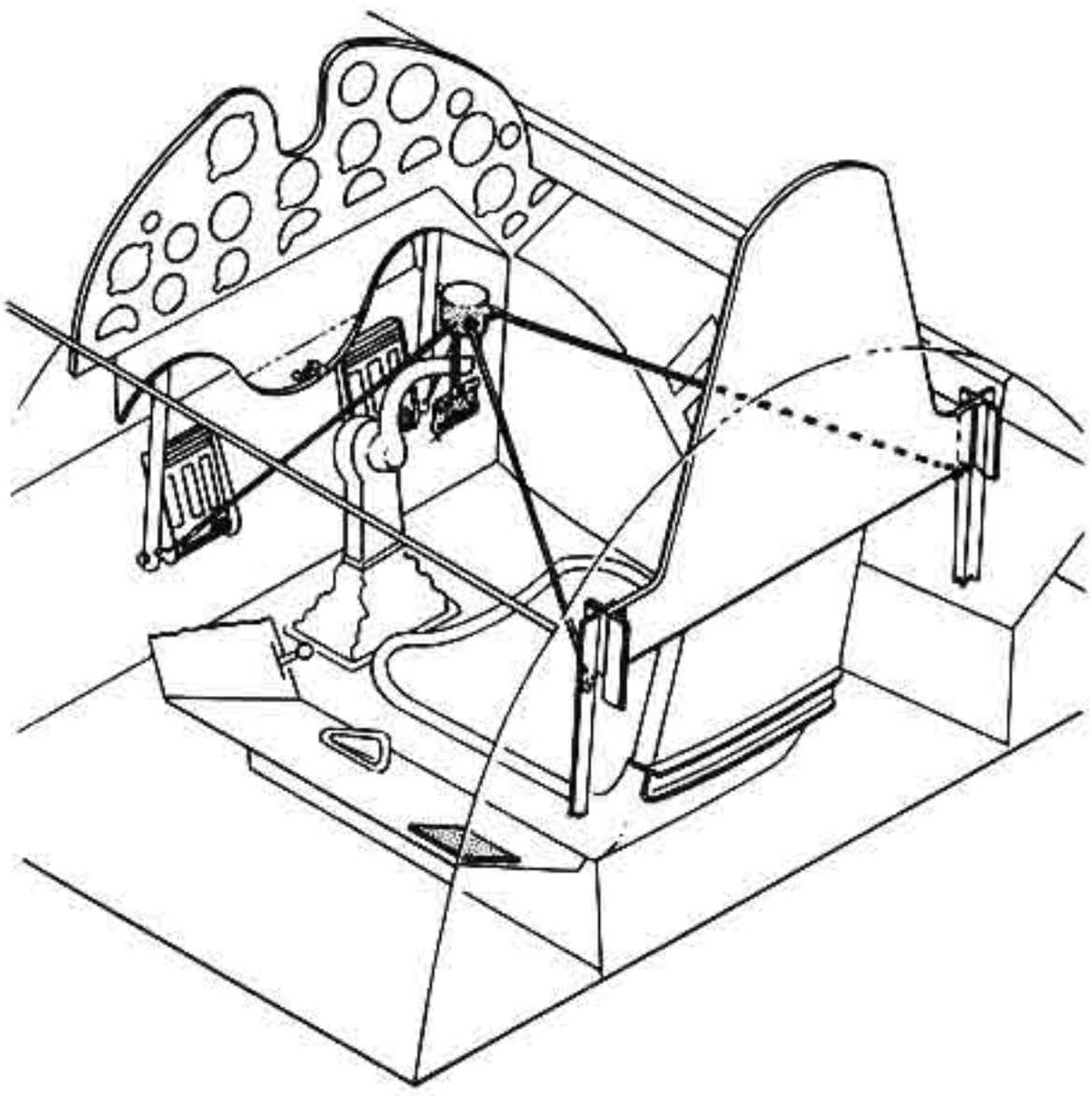


Figure 1-6. Surface Controls Lock

of the stabilizer for various flight conditions, is provided adjacent to the control lever. When the indicated airspeed exceeds 190 knots (200 mph), an air pressure-actuated limit switch will not permit stabilizer adjustment in the nose up range.

1–13. WING FLAPS. The wing flaps are hydraulically operated and are controlled by a lever (figure 1–3, reference 10) located on the left-hand console panel, just outboard of the engine controls. A wing flap position indicator (figure 1–4, reference 34) is provided on the instrument panel. The flaps should not be lowered at speeds in excess of 130 knots (150 mph). The control lever should NOT be placed in the "STOP" position unless an intermediate flap position is desired.

1–14. DIVE BRAKES. Hydraulically operated fuselage side and bottom dive brakes are regulated by a control (figure 1–3, reference 26) on the left-hand console panel. A solenoid safety lock, actuated by the landing gear strut, prevents movement of the dive brake control lever to the "OPEN" position when the airplane is on the ground (shock struts compressed). If the safety lock fails to operate properly in flight, the control lever may be moved to "OPEN" by depressing the solenoid "SAFETY RELEASE" lever (figure 1–3, reference 25) located adjacent to the dive brake control.

1–15. AUTOMATIC PILOT.

1–16. GENERAL. The P–1 electrically powered automatic pilot is controlled in automatic flight, directionally by the gyro fluxgate compass, for rate of turn by the bank and turn gyro, and longitudinally and laterally by the gyro horizon. In addition, the airplane can be controlled manually through the auto-pilot by operating the controller (figure 1–5, reference 25) on the right-hand console panel. Coordinated turns, climbs, dives, or climbing turns and diving turns may be accomplished through use of the controller. The master direction indicator, bank and turn indicator and gyro horizon indicator (figure 1–4, references 7, 27 and 30) provide conventional flight indications when the automatic pilot is either engaged or disengaged, as long as one of the two inverters is operating. The automatic pilot power switch is located on the automatic pilot and inverter control console (figure 1–5, reference 29). The clutch switch (figure 1–5, reference 28) is also located on the automatic pilot and inverter control console and controls mechanical engagement of the auto-pilot into the surface controls system.

CAUTION

The automatic pilot clutch switch is interlocked with the caging mechanisms of the master direction indicator and gyro horizon so that the auto-pilot cannot be engaged whenever either gyro is caged. Also, should either gyro be accidentally caged while the auto-pilot is in operation, the clutches will be automatically disengaged, returning the airplane to manual operation. To prevent damage to the gyro horizon and master direction indicator, they should be caged during maneuvers likely to exceed 70 degrees pitch and 110 degrees bank.

1–17. The auto-pilot can be over-powered by strong application of the manual controls. In emergency, the auto-pilot can be mechanically disengaged from the surface controls by pulling out on the release handle (figure 1–3, reference 35) on the left-hand console panel.

1–18. POWER PLANT CONTROLS.

1–19. THROTTLE. The throttle control lever (figure 1–3, reference 11), located on the left-hand console panel, has adjustment between "OPEN" and "CLOSED." A microphone switch is located on the inboard side of the control lever grip. A post-type static throttle-grip (figure 1–3, reference 14) for catapult take-off is located just forward of the throttle control lever and may be pushed outboard into the side of the fuselage when not in use.

Note

The automatic manifold pressure regulator on the engine will maintain a selected manifold pressure under all flight conditions and will reset manifold pressure when changing supercharger speeds.

1-20. SUPERCHARGER. The supercharger control (figure 1-3, reference 12), located on the left-hand console panel just outboard of the throttle, has "LOW" and "HIGH" blower positions.

1-21. MIXTURE CONTROL. The mixture control lever (figure 1-3, reference 22), located on the left-hand console panel, has "IDLE CUT-OFF," "NORMAL" and "RICH" positions.

1-22. PROPELLER. The propeller pitch control lever (figure 1-3, reference 21), located on the left-hand console panel, has "INCREASE" and "DECREASE" rpm positions.

1-23. FRICTION ADJUSTMENT. A friction adjustment knob (figure 1-3, reference 20), on the inboard side of the left-hand console unit, adjusts the friction on the throttle and propeller pitch control levers.

1-24. WATER INJECTION. The water injection master switch (figure 1-3, reference 15) is located on the left-hand side of the cockpit outboard of the engine controls. The limit switch, which places the system in operation, is controlled by moving the throttle forward past the stop. (See paragraph 2-58.)

1-25. CARBURETOR AIR. The carburetor air door is electrically operated and is controlled by a switch (figure 1-3, reference 13) on the left-hand console panel. Switch positions are "DIRECT" and "ALTERNATE."

1-26. COWL FLAPS. The electrically operated cowl flaps are controlled by a switch (figure 1-3, reference 24) on the left-hand console panel. The switch permits manual or automatic operation through selection of the "AUTO," "OPEN," "CLOSE" and "OFF" positions. With the cowl flap control switch in the "AUTO" position during flight, a control point switch, operated by the propeller governor control linkage, automatically selects a control point temperature of 245°C (473°F) above approximately 2300 rpm and 230°C (446°F) below approximately 2300 rpm.

1-27. Effective on production AD-4 airplane Bu No. 123880 and subsequent airplanes, nose flaps will be installed in addition to the side cowl flaps. The nose flaps further reduce cooling air flow for cold weather operation. The nose and side cowl flaps will operate in a sequence controlled by a limit switch arrangement. The nose flaps will open first and at their full open position, the side flaps will open. Closing of the flaps will be the reverse of the opening sequence. An indicator, mechanically linked to the nose flaps, will extend upward through the anti-drag ring to the right of the top centerline when the nose flaps are closed. The cowl flap switch will control both nose and side cowl flaps.

1-28. The "AUTO" position of the cowl flaps control switch is connected to the landing gear retraction release switch so that whenever the weight of the airplane is on the landing gear, the cowl flaps will go to the full open position, regardless of cylinder head temperature.

1-29. OIL COOLER DOOR. The oil cooler door is electrically operated and may be set for either automatic or manual operation by a switch (figure 1-3, reference 23) on the left-hand console panel inboard of the cowl flap switch. Indicated positions are "AUTO," "OPEN," "CLOSE," and "OFF."

1-30. OIL DILUTION. The oil dilution-pitot heat control switch (figure 1-5, reference 6) is located on the right-hand console panel. Moving the switch to "OIL DILUTION" turns on the fuel booster pump to supply fuel under pressure to the oil dilution system, shifts the oil tank diverter valve to the warm-up compartment, and opens the oil dilution solenoid valve.

1-31. PRIMER. The primer switch (figure 1-5, reference 5) is located on the right-hand console panel.

1-32. STARTER. The starter is of the direct cranking electric type and is controlled by a switch (figure 1-5, reference 7) on the right-hand console panel, just inboard of the primer switch.

1-33. IGNITION. The ignition switch (figure 1-4, reference 36) is located on the lower left-hand corner of the instrument panel.

1-34. FUEL SYSTEM.

1-35. GENERAL. A 380 U.S. gallon (2280 pound capacity) self-sealing fuel cell is provided in the fuselage just behind the cockpit. (See figure 1-2, reference 3.) A 150 U.S. gallon (900 pound) capacity external auxiliary tank may also be carried on each bomb rack. Fuel is selected from any one of the tanks by the tank selector control (figure 1-3, reference 34) on the left-hand console panel. Fuel flow is shown in figure 1-7.

1-36. BOOSTER PUMP. An electrically driven fuel booster pump is provided and is controlled by a switch (figure 1-3, reference 33) on the left-hand console panel, just inboard of the tank selector control. In addition to supplying fuel under pressure to the engine-driven pump, the booster pump also supplies fuel under pressure to the primer and oil dilution systems. The fuel booster pump is turned on automatically by the oil dilution switch.

1-37. QUANTITY INDICATOR. A "capacitance" type fuel quantity indicating system is provided. The gage (figure 1-4, reference 26) is located on the instrument panel and indicates in pounds the quantity of fuel in the main tank. A fuel quantity indicating system is not provided for the external auxiliary tanks.

Note

Gasoline varies in the weight per gallon dependent upon the specific gravity and temperature of the fuel; therefore, the notation

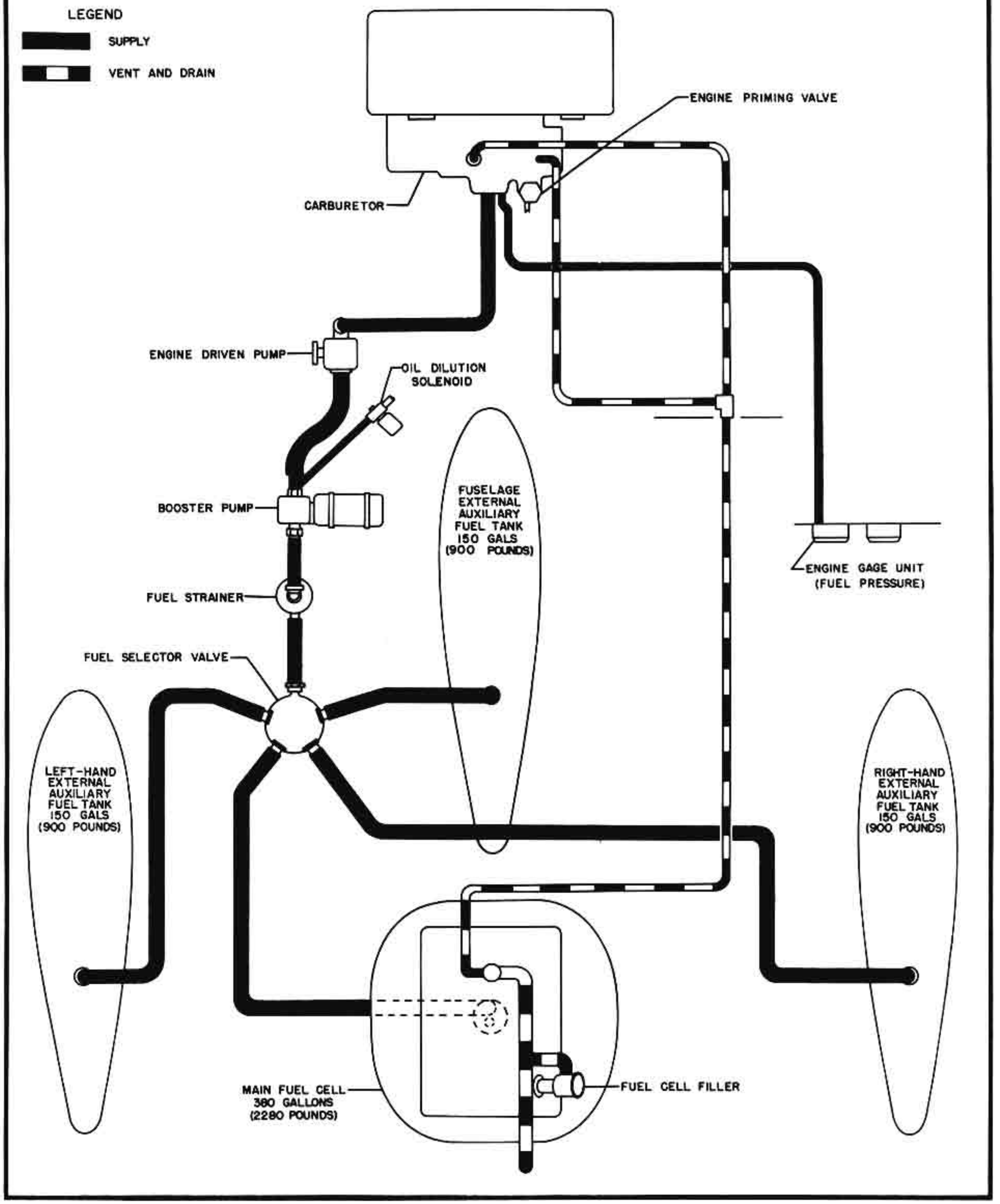


Figure 1-7. Fuel System Diagram

"FULL" does not appear on the indicator dial and the pilot should anticipate variations in the reading when the tank is full.

1–38. OIL SYSTEM.

1–39. GENERAL. The oil tank is located forward of the firewall and has a service capacity of 36 U.S. gallons. The oil system is automatic in operation. Oil dilution controls are provided (see paragraph 1–30). The oil temperature and rear oil pressure are indicated on the engine gage unit (figure 1–4, reference 22). A separate gage (figure 1–4, reference 14) is provided for front oil pressure.

1–40. HYDRAULIC SYSTEM.

1–41. GENERAL. Three hydraulic systems with separate hydraulic pumps are provided; the main 3000 psi system, the auxiliary 3000 psi system and the aileron boost system. One pressurized hydraulic fluid reservoir supplies all three pumps. The reservoir automatically reserves enough fluid for emergency extension of the landing gear by means of the emergency system if fluid loss through line failure upstream from the landing gear selector valve occurs. Hydraulic fuses prevent fluid from being pumped overboard in case of line failure.

1–42. ACCUMULATOR. The main hydraulic system accumulator (figure 1–2, reference 15) and attached air pressure gage are located at the lower left side of the firewall. With all hydraulic system pressure exhausted, the accumulator air pressure should be 1500 to 1900 psi. The accumulator serves to absorb surges and should not be relied upon as an added source of reserve power. After engine pump and emergency pump failure, the accumulator hydraulic pressure will dissipate within a few minutes.

1–43. MAIN HYDRAULIC SYSTEM. The main hydraulic system, operating under a pressure of 2700 to 3050 psi, receives its pressure from two engine-driven hydraulic pumps. The hydraulic system pressure gage (figure 1–3, reference 2) indicates the pressure of only the main system. This system, which incorporates the accumulator, supplies pressure for operation of the power boost wheel brakes, opening and closing the dive brakes, extending and retracting the landing gear and landing flaps, and folding and unfolding the wings.

1–44. AILERON BOOST HYDRAULIC SYSTEM. The aileron boost hydraulic system operates on pressure from a separate engine-driven hydraulic pump. No pressure indication is provided. A manual disconnect, as described in paragraph 1–10, is provided to release the aileron control system from the boost system in the event of failure of the normal hydraulic system.

1–45. EMERGENCY HYDRAULIC SYSTEM. An electric-driven emergency hydraulic pump can be turned on by a switch (figure 1–3, reference 3) to provide pressure to the main hydraulic system in case of main system pump failure. The emergency pump can also be used to check out the main hydraulic system when the engine is not running.

Note

Speed of operation of equipment, when operating on emergency pump pressure alone, is considerably reduced.

1–46. When the landing gear control is moved to the "EMER" position, the landing gear emergency selector valve is shifted from the system position to the landing gear emergency down position. Also, the emergency hydraulic pump is automatically turned on, supplying fluid from the reserve supply in the fluid reservoir to the main landing gear only (see paragraph 1–50). After the emergency hydraulic pump has been turned on in this manner, it cannot be turned off during flight without either retracting the landing gear or turning off the battery switch. The pump can be stopped after landing by turning off the battery switch or by manually resetting the emergency selector valve arm located in the engine accessory compartment.

1–47. LANDING GEAR.

1–48. GENERAL. The landing gear struts automatically telescope upon retraction in order for the wheel to fit into the wheel well between the wing spars.

1–49. LANDING GEAR CONTROLS. The hydraulically operated landing gear is controlled normally by moving the landing gear control handle (figure 1–3, reference 17) to "WHEELS UP" or "WHEELS DOWN." When the airplane is on the ground, the control handle cannot be moved to "WHEELS UP" unless the "SAFETY RELEASE" (figure 1–3, reference 16), located adjacent to the handle, is manually pushed in out of the way. This safety release is automatically pulled out of the way by an electrical solenoid when the airplane is airborne. A red warning light in the landing gear control handle will come on whenever the control handle is moved to either "WHEELS DOWN" or "WHEELS UP," and will remain on until all three gears are locked in their respective positions. The wheels and flaps position indicator (figure 1–4, reference 34), showing the position of all three gears, is on the pilot's instrument panel.

WARNING

When moving the landing gear control to any position, make sure that the control handle stops in its detent by "click and feel" rather than position indication alone. In the "WHEELS DOWN" position, make sure that the handle is forward of the solenoid operated "SAFETY RELEASE" so that when the

safety release comes out into position upon landing, it will not strike the landing gear control handle. If this is not observed, the control handle may work its way aft far enough to shut off hydraulic pressure to the landing gear, in which case the hydraulically operated down lock linkage may break toward the retracted position.

1–50. The landing gear control can be moved to "EMER" by manually depressing the landing gear control release plunger (figure 1–3, reference 18) located between the "WHEELS DOWN" and "EMER" positions. Approximately three times the normal landing gear control force is required to reach "EMER" from "WHEELS DOWN." Moving the landing gear control to "EMER" simultaneously starts the emergency electric-driven hydraulic pump and shifts an automatically controlled emergency selector valve from the system position to the landing gear emergency down position. In this position of the emergency selector valve, the emergency hydraulic pump pressure operates the landing gear and the engine-driven hydraulic pump pressure is completely cut off from the landing gear system. The landing gear control handle can be returned from "EMER" by first depressing the release plunger. To extend the tail gear in an emergency see paragraph 3–26.

WARNING

Do not return landing gear handle directly to the "WHEELS DOWN" position after it has been placed in the "EMER" position. The handle should either be left in "EMER" or returned to "WHEELS UP" and then to "WHEELS DOWN." When the control handle is pulled back from "EMER" into "WHEELS DOWN," pressure to extend the tail wheel and main landing gear doors is shut off.

CAUTION

If the control handle is moved inadvertently to the "EMER" position, under otherwise normal conditions, the control linkage should be reset as soon as possible to prevent overheating the emergency hydraulic pump. This can be done either during flight by moving the control completely to the "WHEELS UP" detent position and then back to the "WHEELS DOWN" detent, or by leaving the control in "EMER" for landing and requesting the ground crew to manually reset the controls immediately after landing. If the control is to be left in the "EMER" position, do not move it out of this position or turn off the battery switch until is is definitely determined that the gear is down and locked.

1–51. The landing approach light operates automatically in conjunction with the landing gear and arresting hook (see paragraph 1–80).

1–52. BRAKES. The power boost brakes operate from the main hydraulic system. The brakes are operated by the pressure on the rudder brake pedals. In case of hydraulic system failure, pressure will be available for braking by exerting approximately three times the normal force on the rudder brake pedals.

1–53. ARRESTING GEAR. The arresting hook control (figure 1–5, reference 1) is located on the right-hand side of the cockpit. The hook may be lowered only from the cockpit and can be raised and latched manually on the ground only, provided the control has been returned to the "HOOK UP" position after the landing has been completed. A red warning light in the arresting hook control will come on when the control is moved to the "HOOK DOWN" position. The light will remain on until the hook reaches the full down position. Normally, the light will come on as the handle is moved to "HOOK DOWN" and will go off almost immediately. The landing approach light operates automatically in conjunction with the hook and landing gear (see paragraph 1–80).

1–54. TAIL WHEEL LOCK. The tail wheel lock control (figure 1–3, reference 32) is located at the after end of the left-hand console panel.

1–55. WING FOLDING.

1–56. WING FOLDING CONTROL. The wing folding control (figure 1–5, reference 8) is located on the right-hand console panel. A door type control marked "WING FOLD," when moved to the normal (flat) position, operates the wing locking pins. The handle controlling the folding operation is located in a recess under the "WING FOLD" handle. Both handles should be kept in the open (unlocked and folded) positions at all times when the wings are folded.

1–57. ELECTRICAL SYSTEM.

1–58. GENERAL.

1–59. BATTERY SWITCH. The battery switch (figure 1–5, reference 3) on the right-hand console panel has "ON" "OFF," and "EMERGENCY" positions.

Note

Always prior to turning battery switch "OFF" on an airplane with engine oil temperature above 55°C (130°F), hold oil dilution switch to "OIL DILUTION" for five seconds, turn battery switch "OFF" and then turn oil dilution switch "OFF." This will position oil diverter valve so that it will not be actuated immediately on a cold start.

WARNING

Should it become necessary to move the battery switch to the "EMER" position, FIRST TURN OFF ALL NON-ESSENTIAL EQUIPMENT.

1–60. GENERATORS. Two a-c/d-c engine-driven generators supply the electrical power. They are identified as "NORMAL" (right-hand engine pad) and "ALTERNATE" (left-hand engine pad). Each generator will deliver 28 volts d-c at 1500 engine rpm to the d-c electrical system if the respective generator switch is "ON." Also at 1500 engine rpm, 115 volts a-c is delivered by each generator to the a-c power switch for distribution to circuits requiring a-c power.

1–61. GENERATOR SWITCHES. Two generator switches (figure 1–5, references 30 and 31) are located on the right-hand console panel. The purpose of each switch is to disconnect the d-c section of its respective generator from the d-c bus system whenever the respective generator warning light indicates a failure.

1–62. GENERATOR WARNING LIGHTS. Two generator warning lights (figure 1–4, references 13 and 15) are located on the right-hand side of instrument panel. A burning generator warning light indicates either that d-c power from the respective generator is absent or low, or that the reverse current relay is defective. The warning lights are of the push-to-test type.

1–63. VOLT-AMMETER. One volt-ammeter (figure 1–4, reference 20) is installed on the instrument panel for both generators. The voltmeter section of the instrument indicates voltage whenever the battery switch is in either the "ON" or "EMERGENCY" position, and/or when the generators are operating. The ammeter section is controlled by a two-position transfer switch (figure 1–4, reference 19) identified as "PUSH FOR ALTERNATE GENERATOR." In the normal (extended) position, amperage from the normal generator is indicated by the instrument.

1–64. EXTERNAL POWER RECEPTACLES. The a-c and d-c external power receptacles are recessed together in the lower surface of the fuselage near the leading edge of the right wing. When the external a-c power plug is connected into the a-c receptacle an internal switch automatically disconnects the generators from the a-c circuit.

CAUTION

The battery switch should be turned "OFF" whenever external d-c power is used to prevent discharge of the battery through momentary power surges.

1–65. INVERTERS. Two inverters, a main and a stand-by, supply some of the a-c power used in the airplane. The main inverter obtains its power from the monitor bus, and the stand-by inverter from the essential bus. An automatic change over relay will automatically start the stand-by inverter if the main inverter should fail or the d-c generator should stop charging. The main inverter is in operation automatically whenever the generator is charging.

1–66. The main inverter supplies a-c power to the following:

Fuel quantity gage.
Master direction indicator.
Turn and bank indicator.
Gyro horizon indicator.
P-1 automatic pilot.

1–67. The stand-by inverter supplies a-c power to the following whenever the main inverter is not functioning:

Fuel quantity gage.
Master direction indicator.
Turn and bank indicator.
Gyro horizon indicator.

1–68. STAND-BY INVERTER TEST SWITCH. The test switch and warning light are on the automatic pilot and inverter control console (figure 1–5, reference 29) on the right-hand console panel. The light will come on when either the test switch is pushed or the main inverter fails.

1–69. D-C POWER SUPPLY SYSTEM.

1–70. GENERAL. The power sources of the d-c electrical system are the d-c section of the a-c/d-c engine-driven generators (see paragraph 1–60) and the 24-volt, 34 ampere-hour battery which is located in the radio compartment in the aft section of the fuselage (figure 1–2, reference 4). Generator warning lights (see paragraph 1–62) and switches (see paragraph 1–61) are provided. Five electrical busses distribute d-c power throughout the airplane. The circuit breakers on the pilot's circuit breaker panel (figure 1–5, reference 32) are arranged so that the upper row are connected to the "ESSENTIAL BUS," the second row to the "MONITOR BUS," the third and fourth rows to the "MAIN BUS," the fifth row and forward portion of the bottom row to the "ARMAMENT BUS," and the aft portion of the bottom row to the "BATTERY BUS." Circuits operated off of the various busses are shown on figure 1–8.

1–71. ESSENTIAL BUS. The essential bus is energized when the battery switch is moved to either the "ON" or "EMER" position. With the generators not operating, only approximately one hour of operation of essential equipment can be expected.

1–72. MONITOR BUS. Circuits connected to the monitor bus are operative only if d-c power is being supplied by the generators.

1–73. MAIN BUS. With the battery switch "ON," the landing gear control handle "UP" and the generators charging, all circuits on the main bus are operable. If both generators fail to generate, all loads operating from the main bus will be without power. Under this condition, the main bus can be re-energized with d-c power from the battery either by moving the landing gear control handle to "DOWN" or by moving the battery switch to "EMER."

WARNING

Turn off all unnecessary equipment before moving battery switch to "EMER."

1–74. ARMAMENT BUS. The armament bus is energized whenever the main bus is energized providing that the master armament switch is "ON."

1–75. BATTERY BUS. The battery bus is always energized when the battery is connected in the airplane.

1–76. A-C POWER SUPPLY SYSTEM.

1–77. GENERAL. The a-c electrical system is provided with power from the a-c side of the a-c/d-c engine-driven generators, and from the inverters (see paragraphs 1–60 and 1–65). With failure of the normal generator, the a-c power transfer switch (figure 1–5, reference 19) located on the right-hand console panel, must be moved to "ALTERNATE" to obtain power for recognition radio from the alternate generator. The radar equipment is then without power and should be shut off. If the alternate generator should fail first, then it is only necessary to shut off the radar equipment. The bus circuits for the a-c operated equipment are shown on figure 1–9.

1–78. LIGHTS.

1–79. EXTERIOR LIGHTS. All exterior lights operate from the main d-c bus. The exterior light console panel (figure 1–5, reference 24) incorporates "ON" – "OFF" switches for the "WING," "FUS (OFF FOR KEY)," "TAIL," "FORM," and "FLOOD" lights. The brilliance switch for all of the light switches has the "DIM," "MED," and "BRT" positions. The "MASTER" switch has the "OFF," "CODE," "FLASH," and "STDY" positions, while the positions on the "CODE" switch are lettered. Coding is possible for all the above lights except the floodlights.

1–80. APPROACH LIGHT. A permanently guarded switch is for the approach light in the left wing is located in the left wheel well. The "ON" position, obtained only by removing the guard, is for manual steady operation of the light whenever only the landing gear is locked down and the arresting hook is not used as for practice ground landings. The normal "OFF" position is for automatic operation of the light for carrier landing as follows:

LANDING WHEELS	ARRESTING HOOK	APPROACH LIGHT
Not locked down	Any position	Off
Locked down	Not down	Flash
Locked down	Down	Steady

1–81. INTERIOR LIGHTS. The cockpit panel lighting operates from the essential bus. The selector switch on the "INTERIOR LIGHTS" control console (figure 1–5, reference 26) on the right-hand console panel has the "ALL," "FLT" and "FLT and ENG" positions. The rheostat to the right of the selector switch has the "OFF," position and when turned in a clockwise direction the selected interior lights are on. The pilot's utility extension light (figure 1–5, reference 18) is on the right console. Two lamps for illuminating the chartboard are located on the glare shield. Extension of the chartboard automatically turns on the lights when the selector switch is in the "ALL" position.

1–82. SPARE LAMPS. Spare lamps are provided in the right-hand console panel (figure 1–5, reference 12.)

1–83. UTILITY RECEPTACLE. A utility receptacle is located on the right-hand console panel (figure 1–5, reference 20).

1–84. MISCELLANEOUS.

1–85. GENERAL. For miscellaneous equipment not covered in the following paragraphs, see figure 1–10.

1–86. SEATS. The pilot's seat will accommodate a seat pad, a back pad, a PK-2 pararaft kit and a seat-type parachute. The seat is electrically adjustable and is controlled by a switch (figure 1–5, reference 27) on the right-hand console panel. The seat moves upward and forward when the switch is moved to "UP" and downward and aft when moved to "DOWN."

Note

It is not possible to adjust the pilot's seat unless an external d-c power source is connected to the airplane or the battery switch is turned "ON."

1–87. SHOULDER HARNESS ADJUSTMENT. The lower two free ends of the harness fit into the safety belt catch and are held securely as long as the catch is closed. To release the harness and safety belt, open the safety belt catch. Clips on the front of the harness permit it to be adjusted. An inertia reel shoulder harness take up mechanism is provided. The harness may be locked in position by pushing forward on the handle (figure 1–3, reference 27) located at the left side of seat to the "LOCK" position. In the "UNLOCK" position, the reel is automatically locked when subjected to an acceleration aft along the thrust line of the airplane (as in a head-on crash) in excess of 2.5 g.

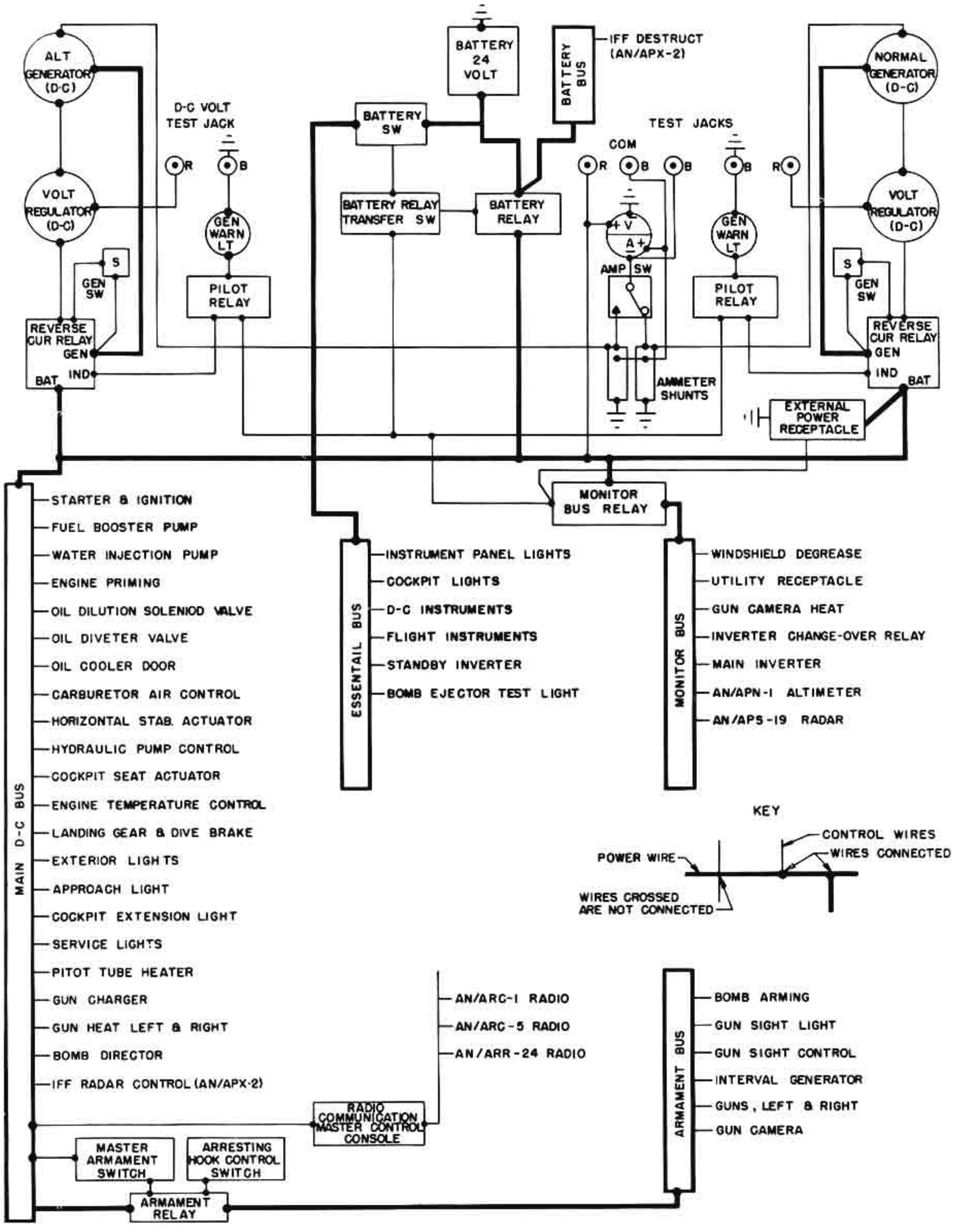


Figure 1-8. D-C Electrical Bus System

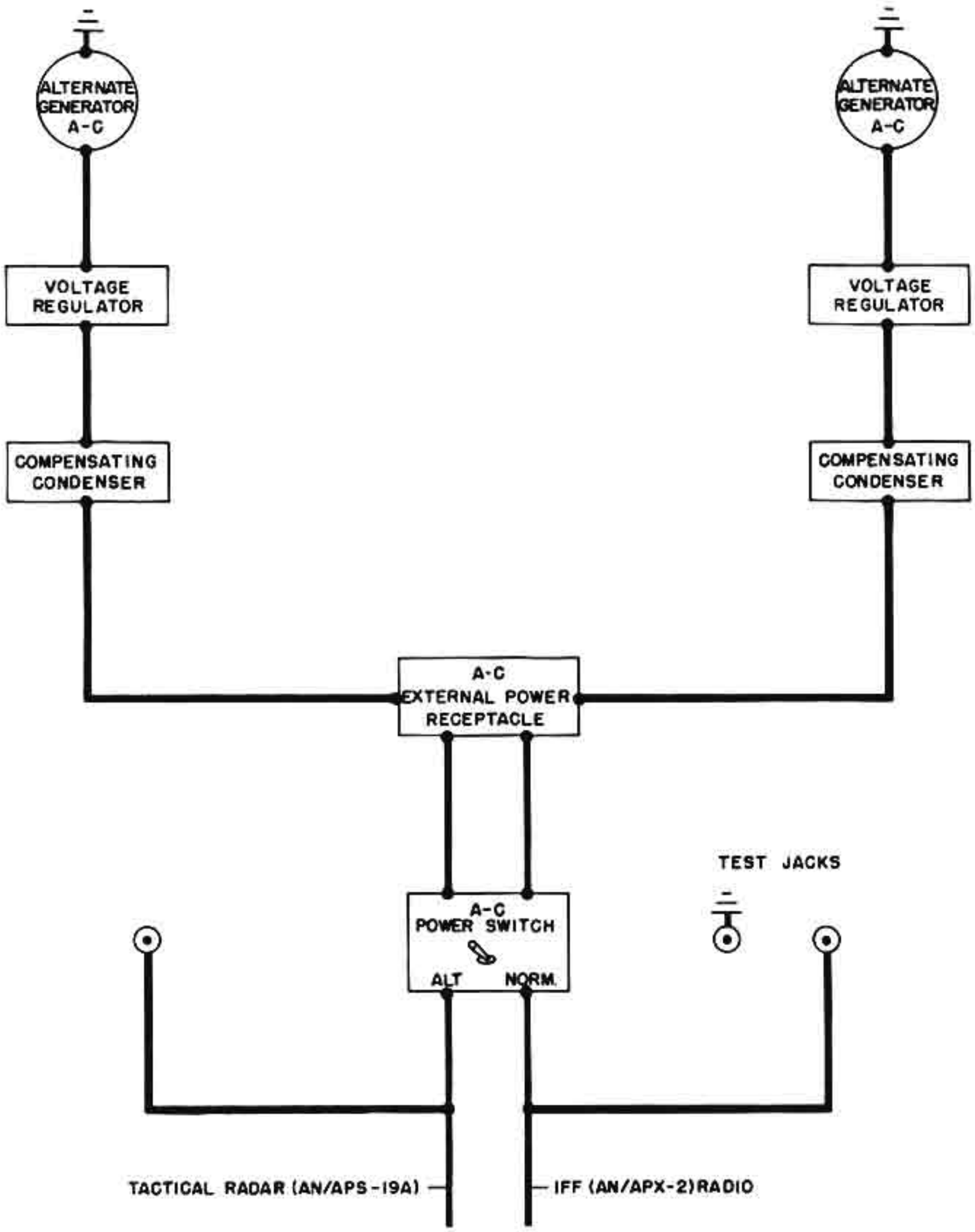


Figure 1-9. A-C Electrical Bus System

1-88. COCKPIT CANOPY CONTROLS. The cockpit canopy is hydraulically operated and is controlled by a lever (figure 1-3, reference 9) on the left-hand side of the cockpit or a handle (figure 3-1, reference 4) accessible from outside the airplane on the left-hand side of the fuselage. When the airplane is on the ground with no pressure in the hydraulic system, the canopy can be operated manually by moving the control to "OPEN" or "CLOSED" and sliding the canopy to the respective position. Handles are provided at the forward end of the canopy. With the hydraulic system functioning, move the control to the desired position. The canopy may be stopped in any intermediate position by moving the control to "STOP." However, the handle should normally be kept in the "CLOSED" or "OPEN" position, since the enclosure may gap open at high speed if the handle is in the "STOP" position.

1-89. If the hydraulic system fails, the canopy can be opened, utilizing an air pressure operated system, by moving the control lever to "EMERGENCY." The emergency system air pressure gage and filler valve (figure 1-10, reference 3) are to the left of the pilot's headrest. Normal air pressure is 1980 psi and satisfactory emergency operation will not be obtained with the pressure below 1750 psi.

Note

Do not place control lever in "EMERGENCY" for routine ground operation since this discharges the air bottle and renders the system inoperative until recharged.

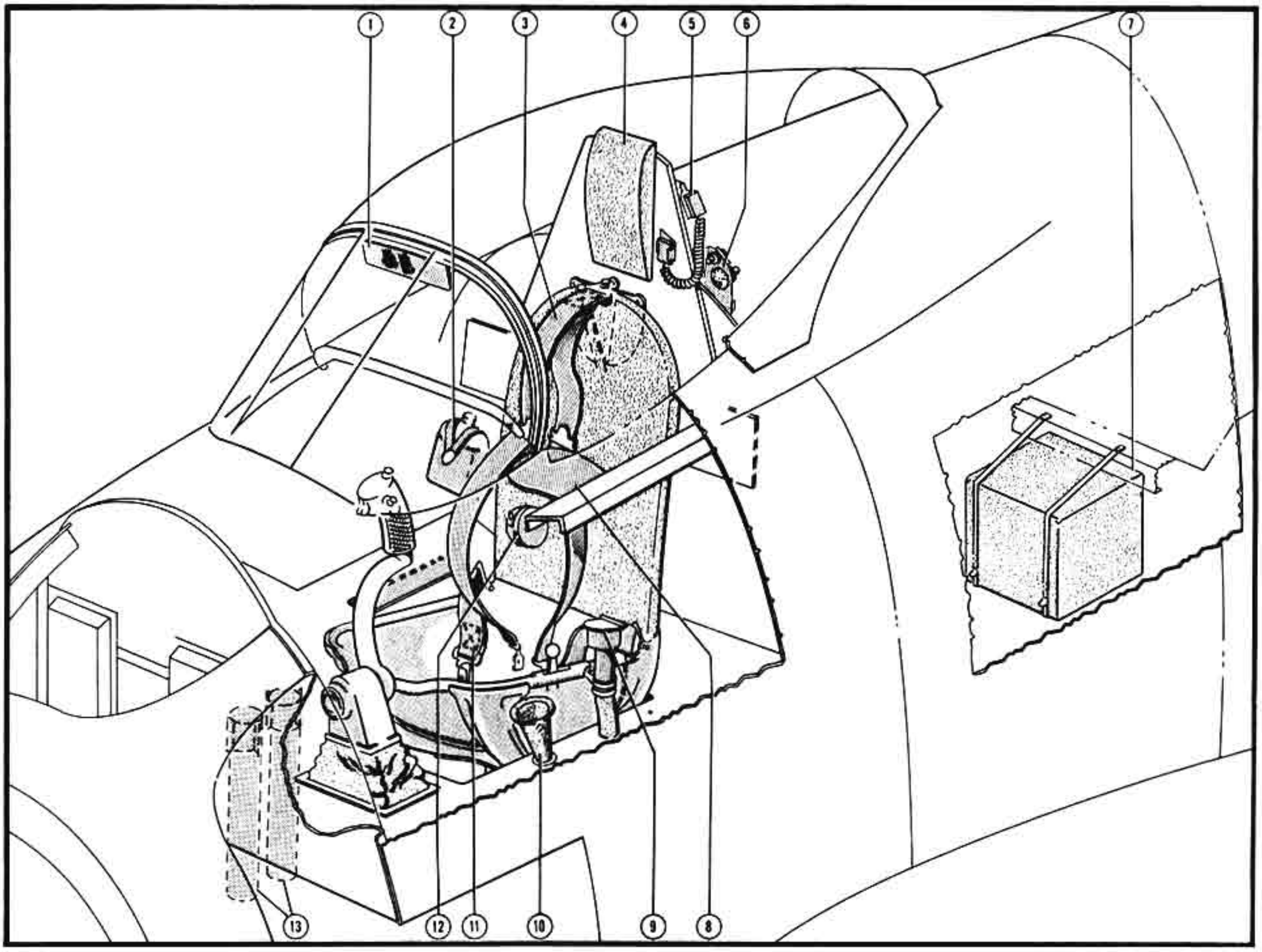
1-90. GEAR RECEPTACLES. A receptacle for plugging in a gear adapter (figure 1-11) is located to the left of the pilot's seat. The receptacle has provisions for connecting simultaneously, the oxygen mask, suit heat, headphones, and microphone cord.

WARNING

If the adapter should become disconnected from the receptacle, radio reception will fail and serve as a warning that the oxygen supply may be cut off.

1-91. OPERATIONAL EQUIPMENT.

1-92. GENERAL. Refer to Section IV for operation of the oxygen, electronic, heating, ventilating and windshield degreasing equipment.



Ref	Name
1	Rear vision mirror
2	Canteen
3	Shoulder harness
4	Headrest
5	Microphone headset extension plug
6	Canopy air bottle pressure gage and filler valve
7	Pilot's kit bag stowage
8	Arm rest
9	Personnel gear receptacle
10	Relief tube
11	Lap belt
12	Ash tray
13	Night drift signals

Figure 1-10. Miscellaneous Equipment Diagram

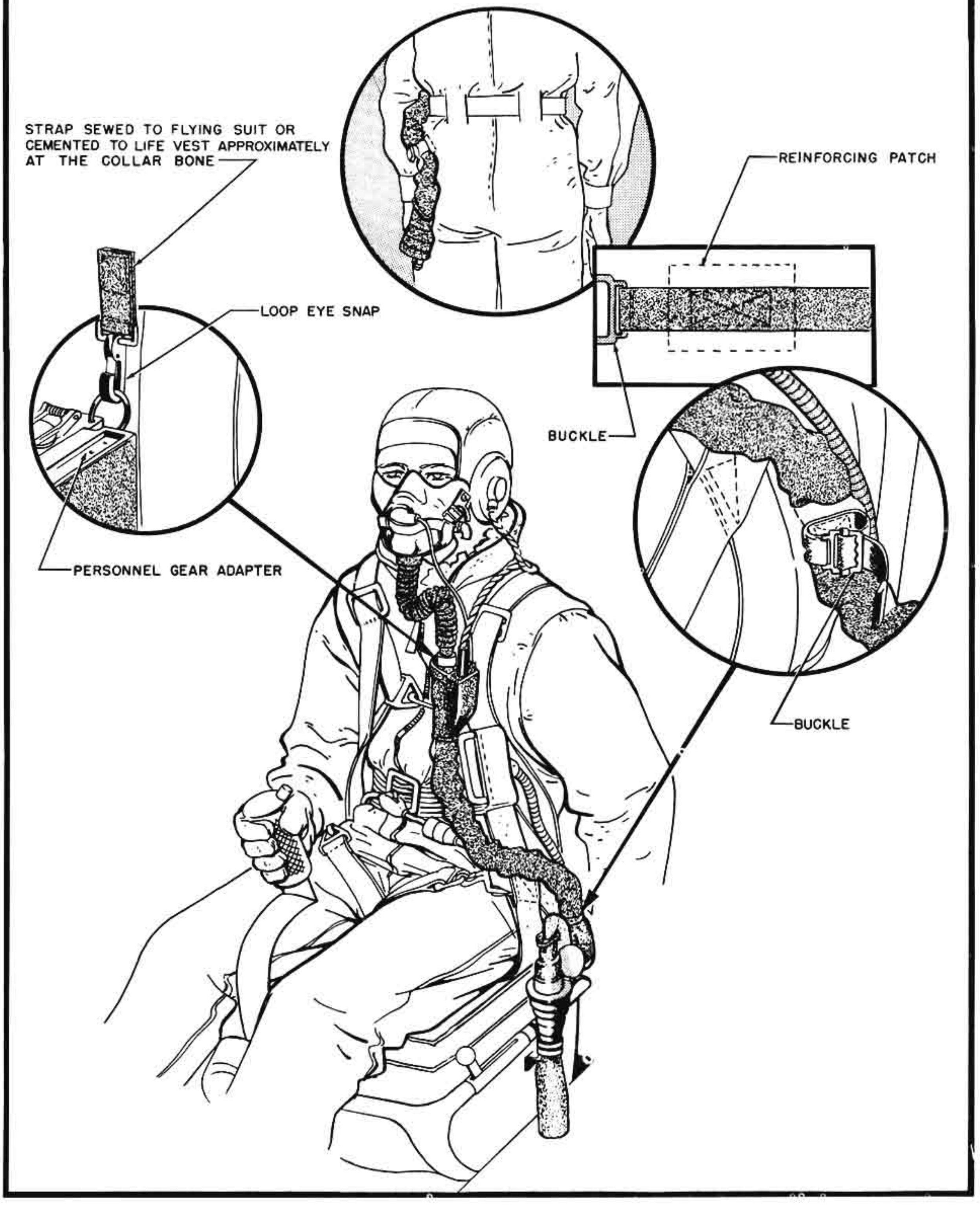


Figure 1-11. Personnel Gear

SECTION II

NORMAL OPERATING INSTRUCTIONS

2–1. BEFORE ENTERING THE COCKPIT.

2–2. THE FOLLOWING RESTRICTIONS ARE TO BE OBSERVED IN THE OPERATION OF THESE AIRPLANES. THESE LIMITATIONS AND RESTRICTIONS ARE SUBJECT TO CHANGE, AND LATEST SERVICE DIRECTIVES AND ORDERS MUST BE CONSULTED.

a. The following maneuvers are permitted when *carrying* external load items:

Vertical turn or Wing over
Aileron roll (only for entering a dive)
Inverted flight (only for entering a dive)

b. The following maneuvers are permitted when *not carrying external load items:*

Loop	Aileron roll
Chandelle	Vertical turn
Immelman turn	Wing over
Normal spin (not over two turns)	
Inverted flight (only for entering a dive)	

c. The maximum recommended gross weights for various operations are as follows:

Landing, smooth paved runways	19,000 lbs.
Landing, rough runways	16,800 lbs.
Catapulting	19,500 lbs.
Arrested landing (pilot's qualified with AD aircraft)	17,000 lbs.
Carrier qualification landing	15,600 lbs.

d. The maximum permissible combinations of airspeed and acceleration at a gross weight of 15,600 pounds or less are shown on figure 2–1. At gross weights above 15,600 pounds, the permissible accelerations are such as to maintain a constant product of acceleration and gross weight. The maximum speeds shown on figure 2–1 correspond to a Mach number of approximately .73. At Mach numbers between .70 and .73 there is an increase in elevator stick force required for pullouts and correspondingly greater altitudes are needed to complete dive recoveries. There is very little tendency for the airplane to "tuck-under" or increase its dive angle. However, with the AN/APS-19A radome on the left-hand wing rack, right wing heaviness is noticeable at Mach numbers over .70. The increase in maneuvering forces is experienced only with the dive brakes closed and at speed near the terminal velocity of the airplane. Pilots should review Bureau of Aeronautics Technical Note Number 20-44 and observe the precautions concerning high speed diving recommended therein.

e. Caution should be exercised, when entering push-over dives, not to exceed an absolute maximum of ten seconds at zero or negative "g," as the engine will not maintain oil pressure under these conditions. Loss of oil pressure for over ten seconds will probably result in engine failure. Likewise, severe yaws or side slips at high speeds may cause a drop in oil pressure.

f. Airspeed limitations for various operations are as follows:

AIRSPEED LIMITATION–(KNOTS-IAS)

OPERATION	10,000 feet or below	20,000 feet	30,000 feet
(1) Opening dive brakes	350	290	235
(2) Lowering landing gear	350	290	235
(3) Lowering landing flaps	130	130	130
(4) Unrestricted use of ailerons	300	245	200

Note

At higher airspeeds the use of the ailerons shall be limited to the same stick force as is required for full throw at airspeed limitation listed opposite item (4) above.

g. The variation of permissible rudder pedal deflection with speed in yawing or skidding maneuvers (in terms of maximum pedal deflection available) is as follows:

AIRSPEED LIMITATION–(KNOTS-IAS)

PEDAL DEFLECTION	10,000 feet or below	20,000 feet	30,000 feet
Full	260	215	175
¾	330	270	220
½	395	335	275

h. Abrupt yawing and skidding maneuvers at speeds greater than 200 knots IAS shall not intentionally be performed; at these higher speeds, the rudder shall be applied and release smoothly and uniformly. The time for such application or release shall not intentionally be less than two seconds. Flight test information and design data for these airplanes indicate that more rapid applications or release will probably damage the structure.

i. When carrying any of the items listed below or similar items of less weight or combinations of these items, the airspeed and acceleration limitations are those given by figure 2–1, corrected for gross weight

as described in paragraph 2–2d, except that with torpedoes on the wing racks, 6.0 g must not be exceeded.

ITEM
One torpedo or 2,000-lb. bomb on fuselage rack.
One 150-gallon external auxiliary fuel tank on fuselage rack.
Two torpedoes or 2,000-lb. bombs on wing racks.
Two 150-gallon external auxiliary fuel tanks on wing racks.
Two Tiny Tims (11.75″ AR) on wing racks.
Up to 12 HVAR on wing launchers (symmetrically loaded).

Note

When carrying a 2000-pound bomb or heavier store on the fuselage rack, release must be restricted to a dive angle of less than 85 degrees between the armament datum line and the horizontal.

j. The maximum recommended unsymmetrical loadings for take-off and landing are as follows:

(With aileron boost system)

Left Wing Rack	Right Wing Rack
TAKE-OFF	
172 lbs. (AN/APS-19A Radar)	1250 lbs.
0	1115 lbs.
540 lbs. (Mk 5, Mod 4 Tank, 69 gals) (Mk 12 Tank, 76 gals)	0
LANDING	
172 lbs. (AN/APS-19A Radar)	1250 lbs.
0	1115 lbs.
540 lbs. (Mk 5, Mod 4 Tank, 69 gals) (Mk 12 Tank 76 gals)	0

In combination with the unsymmetrical loading, a 2000-pound bomb, torpedo, or lesser load may be carried on the fuselage rack. Aileron forces are high with the hydraulic boost system disconnected. It is recommended that unsymmetrical wing loads (with the exception of the radar bomb) be jettisoned in the event carrier landings are necessary with the boost disconnected.

k. Catapulting is permissible (a) with any symmetrical combination of the above listed stores and (b) with the maximum unsymmetrical loadings recommended for take-off in paragraph 2–2j, subject to the gross weight limitations of paragraph 2–2c. Arrested landing is permissible with loads not exceeding one torpedo or 2000-pound bomb on the fuselage rack, or with three 1000-pound bombs, subject to the gross weight limitations of paragraph 2–2c and the unsymmetrical loading limitations of paragraph 2–2j. Arrested landing with one or more auxiliary external fuel tanks is prohibited except when the tanks are empty. (See Flight Safety Bulletin No. 2–46.)

l. In the interest of minimizing the severity of carrier landings from the standpoint of lessening vertical impact loads upon the airframe structure, and to as great an extent as may be practicable and consistent with all other factors that determine the manner in which carrier landings shall be made, it is urged that any combination of conditions resulting in a high "cut" height and a low airspeed at the time of "cut" be avoided. The following conditions for carrier landings are recommended:

(a) The height above the deck at the time of "cut" should not be greater than 25 feet.

(b) The airspeed at the time of "cut" should not be less than 12 knots above power-off stalling speed.

(c) In general, carrier landing approach should be slightly fast and flat. Properly flared landings substantially reduce the severity of landing loads. Fully stalled landing should be avoided.

m. Adherence to the above recommendations and restrictions is mandatory.

2–3. Check gross weight and center of gravity at take-off, and check anticipated loading for landing. Loading data are furnished in the Handbook of Weight and Balance, AN 01-1B-40.

2–4. Check the exterior of the airplane for the following:

a. General condition and cleanliness.

b. Proper inflation of tires and struts. See that the arresting hook is latched up.

c. Security of access door and cover plates.

d. Check to see that pitot tube, air scoop, and any other external covers are removed.

e. Check to see that any external locks or surface control battens are removed.

f. Check quantity of hydraulic fluid, engine oil, water injection fluid, degreasing fluid, fuel and ammunition on board.

2–5. ON ENTERING THE PILOT'S COCKPIT.

a. Check the interior of the cockpit for general condition and for any loose items.

b. Release and stow the surface control lock.

c. Battery switch—"ON." If available, plug in an external d-c power supply source and leave the battery switch "OFF."

d. Adjust the seat and rudder pedals if necessary.

e. Check the surface controls for freedom of movement.

f. Tail wheel—"LOCK."

g. Horizontal stabilizer—"NOSE UP."
h. Trim tabs—as desired.
i. Wing flaps—"UP."
j. Canopy—"OPEN."
k. Dive brakes—"CLOSE."
l. Landing gear—"WHEELS DOWN."
m. Mixture control—"IDLE CUT-OFF."
n. Ignition switch—"OFF."
o. Armament master switch—"OFF."
p. Auto-pilot clutch switch—"DISENGAGED."
q. Uncage gyro instruments.
r. Set altimeter and clock.
s. Check gun sight light.
t. Check oxygen equipment. (See paragraph 4–56.)
u. Check bomb ejector system. (See paragraph 4–44.)
v. If an external a-c power source is available, check special electronic equipment. (See paragraph 4–71.)

Note

If an external a-c power source is not available, the special electronic equipment should not be checked until the engine is running.

w. Canopy emergency system air bottle—1980 psi. Emergency operation may change but bottle should be immediately recharged.

Note

Minimum pressure for safe operation is 1800 psi (refer to paragraph 3–12).

x. Generator switches "ON."
y. Personnel gear adapter—Plug into receptacle.

CAUTION

Fasteners must be provided on the pilot's flying suit or life vest as shown in figure 1–11 to properly support the adapter. It is desirable to keep the free lower end of the adapter as short as will permit satisfactory engagement with the receptacle.

2–6. CHECK FOR NIGHT FLIGHTS. Check the operation of all interior and exterior lights. Spare light bulbs are carried in a container in the right-hand console panel.

Note

The approach light should start flashing as soon as the battery switch is turned on if the gear is locked down and the arresting hook is in any position except full down (See paragraph 1–80.)

2–7. FUEL SYSTEM MANAGEMENT.

2–8. FUEL FLOW. Flow of fuel is controlled by the fuel tank selector valve. The main tank should be used for starting, warm-up, take-off, climb, and landing When cruising altitude is reached switch to one of the Mk 12, 150 gallon external auxiliary tanks, if installed. Fuel from the external auxiliary tanks should be used for level flight only. Switch back to the main tank for combat, manuevers, and landing. The carburetor vapor vent returns to the main tank. Since this tank is used for starting, take-off, and climb, sufficient fuel will be used to avoid the possibility of the tank overflowing due to fuel returning through the vapor vent line. The vapor vent can return fuel from the carburetor at a maximum rate of 10 U.S. gallons per hour, however, normally there is little or no return.

2–9. FUEL BOOSTER PUMP. The fuel booster pump is used during starting, take-off and landing. It is also used to aid the engine-driven fuel pump in maintaining adequate fuel pressure at altitude or when a shift is made from one tank to another, and to serve as an emergency fuel pump in the event that the engine-driven pump fails.

2–10. CHANGING FUEL SELECTION. To change fuel selection from one fuel tank to another, fly the airplane level, turn the fuel booster pump "ON," move the fuel tank selector to the desired tank and turn "OFF" the booster pump. Refer to paragraph 3–20 for directions for regaining suction if a tank runs dry.

Note

A fuel quantity indicator is not provided for the external auxiliary tanks.

2–11. JETTISONING EXTERNAL AUXILIARY FUEL TANKS. The external auxiliary tanks can be jettisoned by means of the electrical or manual release system.

WARNING

The manual release handle salvos all three racks simultaneously. If a bomb is installed on the fuselage rack, the tanks should be jettisoned electrically.

a. Set bomb safety switch to "BOMBS."
b. Set bomb selector switch for the tank to be jettisoned to "LEFT" or "RIGHT." See that the other two switches are in the neutral (off) position.
c. Turn the master armament switch "ON."
d. Depress the bomb release button on top of the control stick to jettison the tank.

2–12. STARTING ENGINE.

a. Check to see that the battery switch is "ON" and the ignition switch is "OFF."
b. Cowl flaps—"AUTO."
c. Oil cooler door—"AUTO."
d. Carburetor air—"DIRECT."
e. Propeller—"INCREASE" (low pitch).

f. Supercharger—"Low" blower.

g. Mixture—"IDLE CUT-OFF."

h. Fuel tank selector—"MAIN."

i. Inch propeller through six blades with engine starter and then turn through five more revolutions at normal starter speed.

CAUTION

The above procedure is necessary to prevent hydraulicing of the engine which may cause extensive damage. If unusually high compression is present, remove the spark plugs from the lower cylinders and drain all liquid. Never turn the propeller opposite to normal rotation, as this may force liquid into the intake pipe from where it is apt to be drawn back into the cylinder when the engine is started.

j. Throttle friction—OFF to be able to easily locate idle throttle stop.

k. Throttle—Set very slightly off the idle throttle stop (approximately one-eighth inch). This position is best for easy starts and should give 900 to 1000 rpm when the engine is running smoothly. If the engine is warm open the throttle a little more.

l. Throttle friction—Set as desired.

m. Fuel booster pump—"ON." Keep pump on until engine-driven pump is supplying sufficient pressure.

n. Energize the starter, prime and turn the ignition switch to "BOTH" in that order in rapid succession. Operate the primer intermittently. In general, cold weather requires more priming, but the particular amount is dictated by the operator's experience.

o. Start and run the engine on the primer until the engine is running smoothly.

p. Should the engine fail to start within 30 seconds, let the starter cool and then repeat the starting procedure.

q. Open the throttle to 1000 rpm and, when operating smoothly on the primer, move the mixture control to "NORMAL" and reduce priming. If the engine runs rough and smokes, reduce priming. If the engine ceases to fire, increase priming.

r. When the engine runs smoothly on normal mixture alone, move the mixture control to "RICH."

CAUTION

Do not start the engine with the mixture control out of "IDLE CUT-OFF" as the engine may "liquid-lock" and cause engine damage which may not be immediately detected.

s. Throttle—Reset for 1200 rpm. Do not allow engine speed to exceed 1400 rpm on start. Do not pump throttle. Operate the throttle smoothly and slowly even after the engine is running smoothly.

t. Check the oil pressure. Stop the engine if the rear oil pressure gage does not register within ten seconds or does not reach 40 psi within 20 seconds. Head the airplane into the wind when ground operation for an extended period of time is anticipated.

u. Refer to paragraph 3–2 for instructions to be followed in case of fire while starting.

v. If the engine does not start, wait a few minutes to allow any excess fuel to drain out of the blower drain. Inspection of the exhaust stack outlets should indicate whether the engine has been over-primed or under-primed. No trace of smoke indicates under-priming. Excessive black smoke indicates over-priming. The use of the primer switch should be governed accordingly. If the engine is over-primed, turn all switches off, open the throttle, put mixture control in "IDLE CUT-OFF" position, and turn the propeller through with the starter six revolutions.

CAUTION

Inch starter through on first six blades.

2–13. WARM UP.

a. Conduct a thorough warm-up at approximately 1200 to 1400 rpm before conducting any performance checks or before taxiing to take-off.

*b. For all ground operation, unless otherwise specified in paragraph 2–14, keep the cowl flaps switch in "AUTO," the propeller in full "INCREASE" (low pitch) position, the mixture in "RICH," and the supercharger control in "LOW" blower.

c. Continue the warm-up until the oil pressures stabilize.

2–14. GROUND TEST.

2–15. IGNITION SWITCH CHECK. At the start of the day's flying, the "OFF" position of the ignition switch should be checked to assure proper connection of the ground wires.

a. Run the engine at approximately 1000 rpm.

b. Turn the ignition switch "OFF" momentarily to see if the engine stops firing.

c. Return the switch to "BOTH."

2–16. MAGNETO CHECK.

a. Open the throttle to obtain 2300 rpm. Differences in carburetor settings, atmospheric conditions, etc. will affect the manifold pressure required to obtain 2300 rpm.

WARNING

In order to preclude the possibility of the airplane nosing over, do not exceed 2400 rpm or 30 in. Hg MAP on the ground unless the tail of the airplane is adequately tied down.

b. Place the ignition switch in the "LEFT" position and observe the rpm.

c. Return the switch to "BOTH" to stabilize the engine speed.

d. Repeat this procedure for the "RIGHT" position.

e. Atmospheric conditions will influence the readings obtained. However, a drop of 75 rpm or less when operating on one magneto is considered satisfactory providing no engine roughness is encountered.

2-17. IDLE MIXTURE CHECK. With the engine idling at 600 rpm and the fuel booster pump "ON," move the mixture control slowly toward "IDLE CUT-OFF" and observe any change in engine speed. Return the mixture control to "RICH" before the engine cuts out. A rise of more than ten rpm indicates too rich an idle mixture, and no rise or drop in engine speed indicates that the idle mixture is too lean. A rise of five to ten rpm is desired for adjustment purposes, however, due to varying atmospheric conditions from day to day a rise of from zero to twenty-five rpm is satisfactory. This will permit idling at low speed without fouling the plugs and also affords good accelerating characteristics.

Note

While making the idle mixture check make sure that the cylinder head temperatures are at least 150°C.

2-18. PROPELLER CHECK.

a. Run the engine at 1500 rpm but do not exceed 25 inches Hg. during the following check.

b. Note rpm reaction as control is placed in full "DECREASE" (high pitch) position.

c. Return the control to the full "INCREASE" (low pitch) position.

d. Check for reduction and full recovery of rpm.

2-19. SUPERCHARGER CLUTCH CHECK.

a. Set the engine speed at 1700 rpm with the throttle and note MAP.

b. Move the supercharger control to the "HIGH" position and lock.

c. Open the throttle to obtain 30 inches Hg. manifold pressure.

CAUTION

Make sure stick is held back to prevent airplane from nosing over.

d. Move the supercharger control to the "LOW" position and lock. A sudden increase in rpm indicates that the two-speed mechanism is working properly.

CAUTION

Do not repeat supercharger clutch shift check at less than five minute intervals.

e. Set engine speed at 1700 rpm and check MAP against that obtained in preceding procedure 2-19, a. The readings should be the same.

Note

The engine is equipped with a roller type cluth which does not need to be desludged.

2-20. OIL SYSTEM CHECK. Run the engine at 1500 to 1800 rpm. At an oil temperature of 85°C, check the front and rear oil pressures against the pressures specified on the Power Plant Chart, figure A-4, and on the engine data plate.

2-21. FUEL SYSTEM CHECK. Run engine at 1500 to 1800 rpm and check the operation of the engine-driven fuel pump by turning the booster pump switch "OFF" for a few minutes. Fuel pressure should be 19 to 21 psi. With the fuel booster pump "ON," fuel pressure may increase as much as two and one-half pounds. If external auxiliary tanks are installed, the engine should be run on each tank long enough to see that all fuel lines are clear.

2-22. HYDRAULIC SYSTEM CHECK. The hydraulic pressure should be 2700 to 3050 psi.

Note

The hydraulic pressure gage installed in the airplane has a tolerance of ± 125 psi. This should be taken into account when checking the hydraulic system. No attempt should be made to reset the regulator or the relief valves with the airplane pressure gage.

2-23. ELECTRICAL SYSTEM CHECK. Check the operation of the electrical system as follows:

a. Disconnect the external power source (if used) and see that the battery switch and generator switches are "ON."

b. With the engine idling, place a light load on the electrical system, such as instrument or cockpit lights.

c. Increase the engine speed gradually until the voltmeter reads approximately 27 volts. If the generator warning light goes off, it is an indication that the reverse-currant relay is functioning properly. Push in on the warning light to test it.

d. Increase the engine speed and check the voltmeter. The voltmeter reading should increase until it reaches 28 volts and remain at that reading regardless of any further increase in engine speed.

e. A take-off should not be made if the generator warning lights are on or if the voltmeter reading is too low (below 26.7 volts) or too high (above 28.7 volts).

2-24. ELECTRONIC EQUIPMENT CHECK. Refer to paragraph 4-61.

2-25. AUTOMATIC PILOT CHECK.

a. With the battery switch "ON," the generators charging and the main inverter operating, allow at

least two minutes for the gyros to come up to speed. Erect the gyros by first caging, then uncaging, by means of the knob on the gyro horizon indicator.

b. With the auto-pilot clutch switch "OFF," turn the auto-pilot power switch "ON." Allow two minutes for the amplifier to warm up.

c. Press clutch switch in to "ON."

d. Operate the surface controls manually. Resistance to movement will indicate an operative auto-pilot.

e. Move the turn control, pitch trim control and bank trim control and observe corresponding surface controls to see that their movement is in proportion to adjustment at the controller.

f. Pull out on the clutch switch. The auto-pilot should release, as indicated by normal manual operation of controls.

g. Turn the auto-pilot power switch "OFF."

2–26. TAXIING.

2–27. The airplane is equipped with a conventional tail wheel type landing gear, and standard taxiing procedures should be followed. The controls should be set as follows for taxiing:

a. Cowl flaps—"AUTO."

b. Wing flaps—"UP."

c. Mixture control—"RICH."

d. Propeller control—"INCREASE" (low pitch).

e. Carburetor air—"DIRECT." If icing conditions prevail, place the control in "ALTERNATE" until just before take-off.

f. Tail wheel—"UNLOCK." Lock the tail wheel for extended cross-wind taxiing to relieve excessive braking action.

2–28. BEFORE TAKE-OFF.

2–29. GROUND AND CARRIER CHECK.

a. Shoulder harness and safety belt—secured and locked.

b. Tail wheel—"LOCK" (for ground take-off only) ("UNLOCK" for carrier take-off).

c. Horizontal stabilizer control—0°.

d. Dive brakes—"CLOSE."

e. Aileron tab—0°.

f. Rudder tab—approximately 3° right.

g. Fuel booster—"ON."

h. Fuel tank selector—"MAIN."

i. Wing flaps—40° (full "DOWN").

j. Supercharger—"LOW" blower.

k. Landing gear—"WHEELS DOWN."

l. Propeller control—"INCREASE" rpm (low pitch).

m. Mixture—"RICH."

n. Cowl flaps—"AUTO."

o. Carburetor air—"DIRECT."

p. Wings—Spread and locked.

q. Battery switch—"ON." Leave battery switch "ON" during take-off, flight, and landing.

r. Cockpit canopy—"OPEN."

CAUTION

Make sure that control is engaged in the "OPEN" detent.

s. Oil cooler door—"AUTO."

t. External auxiliary tanks—Refer to paragraph 2–11 for positioning of controls in case of jettisoning.

u. Run up engine.

WARNING

In order to preclude the possibility of the airplane nosing over, do not exceed 2400 rpm or 30 in. Hg. MAP on the ground unless the tail of the airplane is adequately tied down.

v. Check all instruments for indications within the required limits.

w. Cylinder head temperature—245°C maximum before take-off.

x. Generator switches—"ON."

2–30. CATAPULT CHECK. In addition to the preceding checks, the following should be accomplished:

a. Tail wheel—"LOCK."

b. Throttle static grip—Extended.

c. Tighten engine control friction adjustment knob.

d. Place back and head firmly against back pad and headrest.

e. Place feet against rudder pedals with legs stiff.

f. Brace right arm.

g. Push throttle forward and grasp static grip.

2–31. ENGINE POWER CHECK TABLE. The calibrations below represent the approximate manifold pressure for each given rpm at standard sea level conditions:

Note

These data apply to AD-4 airplanes wherein the propeller low pitch stop is set at 28 degrees.

RPM	MP
1700	23.5
1800	24.5
1900	25.0
2000	26.5
2100	27.5
2200	29.0
2300	31.5
2400	33.5

2–32. TAKE-OFF.

2–33. NORMAL TAKE-OFF.

a. Flaps—40° (full "DOWN").

b. Take-off speed—varies from 65 to 70 knots (75 to 80 mph) at 13,000 lbs. gross weight to 80 to 85 knots (92 to 97 mph) at 18,500 lbs.

c. Stability—The airplane is inherently stable and has no unusual take-off characteristics.

d. Refer to Appendix 1 for engine operating limits and take-off performance data.

e. Refer to paragraph 2–3 for gross weight and loading restrictions.

2–34. MINIMUM RUN TAKE-OFF. For a minimum run take-off, the controls should be set in the same position as for a normal take-off and the airplane may be pulled off at an IAS varying from 63 knots (72 mph) at 13,000 lbs. gross weight to 78 knots (89 mph) at 18,500 lbs.

2–35. ENGINE FAILURE DURING TAKE-OFF. Refer to paragraph 3–9 for procedure to be followed in case of engine failure during take-off.

2–36. AFTER TAKE-OFF.

a. Use brakes lightly to stop wheels from spinning.

b. Retract the landing gear as soon as the airplane reaches a point beyond which a safe landing cannot be made in the field, or in any level space available for landing beyond the field.

Note

The landing gear will retract in a maximum time of seven seconds.

c. Retract the wing flaps. The wing flaps will partially blow back automatically at air speeds above 109 knots (125 mph).

d. The friction knob should be adjusted to keep the engine controls from creeping during take-off.

2–37. CLIMB.

2–38. The characteristics of the airplane in a climb are normal. Refer to figures A–4 and A–7 for climbing speeds and powers.

2–39. Climb with cowl flap switch in "AUTO" if cylinder head temperature does not exceed 245°C above 2300 rpm and 230°C below 2300 rpm. When operating at military power do not exceed 260°C. A material reduction in cylinder head and oil temperatures can be obtained by climbing at an IAS from 15 to 20 knots (17 to 23 mph) faster than best climbing speed. A tendency for oil to over-heat can be checked more quickly by reducing engine speed than by throttling alone.

2–40. Booster pump "OFF" after climb is established unless engine pump alone does not maintain sufficient pressure (19 psi minimum).

2–41. DURING FLIGHT.

2–42. GENERAL. See the "Flight Operation Instruction Chart," figure A–8, Appendix 1, for effects on airplane performance due to changes in gross weight. See the "Power Plant Chart," figure A–4, Appendix 1, for engine operating data.

2–43. AUTOMATIC PILOT OPERATION.

2–44. TO ENGAGE.

a. With the battery switch "ON," the generators charging and the main inverter operating, allow at least two minutes for the gyros to come up to speed. Erect the gyros by first caging, then uncaging the knob on the gyro horizon indicator.

b. With the clutch switch of the automatic pilot "OFF," turn the automatic pilot power switch "ON."

Note

As soon as the battery switch is "ON," the master direction indicator, gyro horizon indicator and bank and turn indicator become operative, providing conventional flight indications. The gyros in the latter two units and in the compass transmitter may, however, not be in a vertical position when the system is engaged. The above caging procedure is therefore necessary.

c. Allow two minutes for the amplifier to warm up.

d. Center the turn-control knob in its detent position; also center the pitch-trim control and the bank-trim adjustment on the controller.

e. Trim the airplane in the desired attitude of flight.

f. Engage the automatic pilot by pressing the clutch switch to the "ON" position.

CAUTION

Do not engage the automatic pilot while in a turn, or in climbs, dives, or banks of more than 10 degrees.

2–45. TO DISENGAGE.

a. The return to manual flight is achieved by pulling out the clutch switch. The power switch of the automatic pilot system may, if desired, be turned to the "OFF" position.

b. In an emergency, the system may be disengaged by pulling the emergency mechanical release, which operates the servo disconnects.

Note

After the emergency release has been pulled, the automatic pilot cannot be re-engaged while in flight.

2–46. OPERATION DURING FLIGHT.

a. To climb, turn the pitch-trim control counterclockwise "UP."

b. To dive, turn the pitch-trim control clockwise "DOWN."

c. To trim bank, turn the bank-trim adjustment clockwise to raise the left wing; counterclockwise to raise the right wing.

d. To turn or to trim course, turn the turn-control knob out of its central detent position, either to the left or right, until the desired heading is obtained. To return to straight flight, the turn-control knob should be centered.

Note

Generally, when flying the automatic pilot, it is well to retrim the airplane in manual flight every hour.

WARNING

Do not adjust trim tabs while the automatic pilot is engaged.

e. The automatic pilot cannot be engaged when the gyro in the vertical gyro control or in the compass transmitter is caged. To erect the gyros, cage and uncage the vertical gyro control after the instruments have been running for at least two minutes. This will also erect the compass transmitter gyro.

WARNING

To prevent damage, the gyros should be caged, during maneuvers likely to exceed 70 degrees in pitch or 110 degrees in bank.

2-47. STABILITY. The airplane performs all ground and flight maneuvers with the normal characteristics of its type. In the cruising condition, the airplane has a high degree of stability at all permissable center of gravity locations.

2-48. USE OF TRIM TABS. The following procedure is recommended for trimming the airplane:

a. Trim to the desired flight attitude **with** the horizontal stabilizer.

WARNING

Do not increase the indicated airspeed above 190 knots (220 mph) as long as the stabilizer is set for an airplane nose-up condition. This restriction is a design limitation.

b. Release the rudder pedals and hold the wings level with the stick. Center the needle of the turn and bank indicator, with the rudder trim tab.

c. Center the ball of the bank and turn indicator with the aileron trim tab.

d If readjustment is necessary, repeat the above procedure.

2-51. OPTIMUM CRUISING AND REDUCED AIRSPEEDS. Refer to "FLIGHT OPERATION CHART," figure A-8, Appendix 1, for the desirable settings of engine controls when the flying distance is predetermined, and for all the alternate cruising conditions.

2-52. POWER PLANT OPERATION. General smoothness, engine speed, manifold pressure, cylinder head temperature, oil temperature, and oil pressures give the most satisfactory indication of engine performance. If any one of these seems irregular, the engine should be throttled down, and if the cause is not apparent, a landing should be made to investigate the trouble.

2-53. POWER CONTROL. When the throttle is positioned to give a desired manifold pressure, the manifold pressure regulator (located between the linkage of the cockpit throttle control lever and the carburetor throttle lever) automatically maintains the selected manifold pressure at all altitudes below the critical altitude for the setting. If the critical altitude of the setting is exceeded, the engine performs in the same manner as any other engine operating at full throttle; pushing the throttle lever further forward will have no effect because the throttle valve in the carburetor is already wide open; power can only be increased by increasing engine speed. When changing power, care must be taken to reduce manifold pressure *before* reducing rpm, and to increase rpm *before* increasing manifold pressure.

WARNING

Pilots must be on the alert for atmospheric conditions that may cause carburetor icing. The normal drop in manifold pressure that occurs when the carburetor starts to ice is concealed because the manifold pressure regulator automatically opens the carburetor throttle to compensate for the loss in manifold pressure. Therefore, the pilot may receive no warning until the carburetor is heavily iced. Use of "ALTERNATE" air must be based on judgment rather than on any definite indication of icing.

2-54. MIXTURE CONTROL. "RICH" position shall be used during all ground operation and during takeoff, approach and landing, "NORMAL" position may otherwise be used, provided cylinder head temperature is not excessive. If the engine shows a tendency to roughness during blower shifts or dives, the tendency will be lessened by shifting to "RICH" before making the shift or entering the dive.

2-55. SUPERCHARGER CONTROL. "HIGH" blower should not be used except at altitudes at which

the desired power is not available in "LOW" blower. When operating at military or normal rated power, do not shift to "HIGH" blower unless not more than 36 inches manifold pressure can be obtained at full throttle in "LOW" blower; otherwise less power will be available in "HIGH" than could be obtained by remaining in "LOW." At lower powers, it is usually advantageous to obtain more power by increasing engine speed up to 2400 rpm in "LOW" blower before shifting to "HIGH."

2–56. To shift from "LOW" blower to "HIGH" blower.

a. Throttle—Reduce manifold pressure 4 inches Hg. to prevent exceeding desired manifold pressure after shifting to "HIGH."

b. Propeller control—Engine speed should be 2400 rpm or less, lower speeds being favorable to long clutch life. When justified by emergencies or tactical requirements, shifts may be made at 2600 rpm, but such shifts should be kept to a minimum.

c. Supercharger control—Shift rapidly to "HIGH." Be prepared to retard throttle to check any tendency of manifold pressure to rise excessively.

d. If engine shows a tendency to run roughly or to cut out during the shift, it is recommended that the mixture control be kept in "RICH" position for the duration of the blower shift.

2–57. To shift from "HIGH" blower to "LOW" blower.

a. Propeller control—Engine speed not over 2400 rpm unless justified by emergency or tactical requirement.

b. Supercharger control—Shift rapidly from "HIGH" to "LOW."

c. Advance throttle to obtain desired manifold pressure.

d. Any tendency of the engine to run roughly or cut out may be lessened by keeping the mixture control in "RICH" position for the duration of the shift.

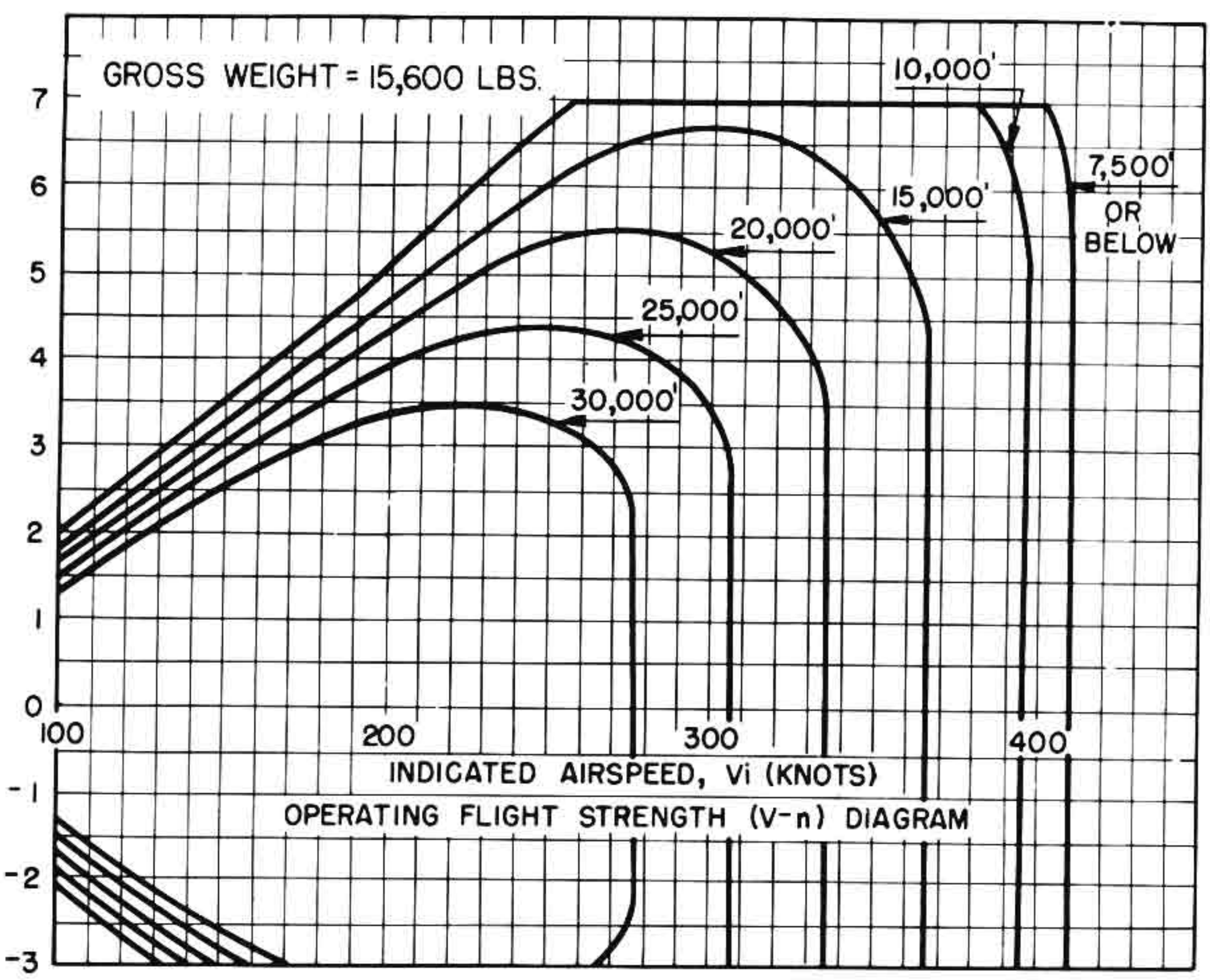


Figure 2-1. Operating Flight Strength Diagram

Note

While the manifold pressure regulator is normally capable of maintaining any selected manifold pressure below critical altitude, it should not be expected to control manifold pressure during a blower shift, because changes occur too rapidly for the regulator to follow, and the shift normally involves transition from full-throttle to part-throttle operation, or the reverse. Manual operation of the throttle is essential to proper control of manifold pressure during blower shifting.

2–58. COMBAT POWER. Although a manifold pressure regulator and other equipment for combat power operation are currently installed in the airplane, the engine has not been cleared for operation at combat rating, and therefore use of water injection is not authorized until tests have been completed and instructions for operation at combat rating have been released. The master switch should be kept in "OFF" position at all times.

2–59. ELECTRICAL SYSTEM CHECK. The electrical system should be checked in flight periodically as outlined in paragraph 2–23.

2–60. STALLS.

2–61. The stalling characteristics of the airplane in both the flaps up and flaps down conditions are normal and the stall is preceded by mild warning which begins two to four knots above the actual stall. With the flaps up the stall warning consists of a slight aileron "nibble" and with flaps down there is usually a general light buffeting of the tail surfaces in addition to the "nibble." At the stall the left wing usually drops and sometimes the nose pitches down at the same time. In power off stalls the airplane may stall without rolling but with power on a definite roll will normally be encountered. The important point is that, regardless of the type of stall experienced, the motion is not violent. Recovery from the stall is normal and is readily effected by use of the elevators and rudder when necessary to raise the low wing. Power-off stalling speeds for various gross weights, landing gear, and flap positions may be found following this paragraph. Also see figure A–3, Stalling Speed vs. Gross Weight Relationships chart. For banked turns corresponding to the normal traffic pattern approaches, the stalling speeds are increased two to five knots over corresponding values for level flight. The stall warning, actual stall, and subsequent recovery characteristics for banked turns are similar to those discussed preceding for stalls in level flight.

POWER-OFF STALLING SPEEDS
APPROX. INDICATED STALLING SPEEDS (Knots)

Gross Wt.	Flaps Up Gear Up	Flaps Down (25°) Gear Down	Flaps Full Down (40°) Gear Down
12,000	76	69	66
14,000	82	75	71
16,000	87	80	76
18,000	93	85	80

2–62. SPINS.

2–63. Spinning characteristics of the airplane are normal and the standard procedure is recommended for best spin recovery. Spins to the right are on the order of steady, steep spins, while spins to the left are not as steep, tending to flatten out, causing oscillation and pitching. Spin recovery in the clean condition (flaps and gear up) is accomplished in less than one-half turn after primary recovery has been initiated. Approximately 1500 feet is required in the clean condition from the start of recovery to complete recovery (level flight). With the flaps and gear down, recovery is more rapid and more positive, with complete recovery being effected in less than one-third turn and a maximum loss in altitude of 1000 feet.

2–64. PERMISSIBLE ACROBATICS.

2–65. The normal maneuvers, as given in paragraph 2–2, are permissible.

2–66. DIVING.

2–67. CONTROL SETTINGS. The controls should be set as follows for diving.

a. Windshield defogger—"ALL TO WINDSHIELD" (at least 30 minutes before entering dive. See paragraph 4–58).
b. Cockpit canopy—"CLOSED."
c. Fuel tank selector—"MAIN."
d. Mixture—"RICH."
e. Supercharger—"LOW."
f. Cowl flaps—"AUTO."
g. Carburetor air—"DIRECT."
h. Oil cooler door—"AUTO."
i. Fuel booster pump—"ON."
j. Horizontal stabilizer—"NOSE DOWN" ("DIVE" position on indicator).
k. Trim tabs—As required (see paragraph 2–70).
l. Propeller—2050 to 2250 rpm.
m. Throttle—15 inches Hg.
n. Dive brakes—"OPEN."
o. Landing gear—"WHEELS DOWN" if desired for additional braking.

CAUTION

Maximum allowable engine speed—3120 rpm (30-second limit).

2-68. ENGINE CONTROL DURING DIVE. To avoid faulty oil scavenging and to prevent the engine nose section from loading up with oil during prolonged dives at low engine speed, it is recommended that, when tactically possible, the propeller governor should be set for maximum cruising rpm plus or minus 100 rpm for all prolonged steep dives. A manifold pressure of 15 inches. Hg. is recommended during prolonged dives. Any manifold pressure above 15 inches Hg. that is within engine limits for the engine speed, mixture control position, and altitude may be used. Higher manifold pressures increase diving speed. If manifold pressures much below 15 inches Hg. are held during a prolonged dive, the engine will foul up in the same manner as it does when the throttle is closed during prolonged glides. Sufficient manifold pressure should be used to keep the engine slightly warm and to burn away any oil that may pass the piston rings. Caution should be observed when diving from high altitude, since manifold pressure will build up rapidly at altitudes above the range within which the manifold pressure regulator can function. The throttle should be opened slowly at the completion of a dive so that the partly cooled engine will not cut out.

2-69. ENGINE OVERSPEEDING. If the engine overspeeds (exceeds the maximum limit of 3120 rpm), the throttle should be closed immediately, the propeller control moved toward the "DECREASE" rpm position, and the air speed reduced to minimum speed for a safe glide. While it is true that during overspeeding a high manifold pressure will cause explosive forces on the pistons, which will partly counteract the increased centrifugal forces on the bearings, closing the throttle will help to reduce the engine speed and thereby reduce the centrifugal forces more than they could be reduced by the explosive forces on the pistons.

2-70. DIVING TECHNIQUE. Before entering a dive, the trim tabs and horizontal stabilizer should be preset to give the desired trim of the airplane at that phase of a dive where the greatest precision and control are desired. It is practically impossible to set the tabs correctly after a dive has been started. In pulling out of a dive at the maximum allowable speed, full aileron action should be avoided. Severe or abrupt use of the ailerons above 300 knots (345 mph) IAS should also be avoided.

CAUTION

High stick forces are encountered in recovering from high angle, high speed dives. Do not use snap pull-outs in recovering from dives. Do not move or release the controls abruptly in any maneuvers at high speeds.

2-71. NIGHT FLYING.

2-72. Lights should be used as required. The proper use of oxygen during night flights is of particular importance. Oxygen should be used on all flights above 5,000 feet. (Refer to paragraph 4-46.)

2-73. APPROACH.

2-74. DESCENT.

a. Landing gross weight—Refer to paragraph 2-2c.
b. Shoulder harness and safety belt—"LOCKED."
c. Tail wheel—"LOCK" (for field)—"UNLOCK" (for carrier).
d. Fuel booster pump—"ON."
e. Fuel selector—"MAIN."
f. Horizontal stabilizer—"NOSE UP" as required.
g. Trim tabs—As desired.
h. Cowl flaps—"AUTO."
i. Check oil cooler door switch—"AUTO."
j. Mixture—"RICH."
k. Supercharger—"LOW" blower and locked.
l. Dive brakes—"CLOSE."
m. Master armament switch—"OFF."
n. Gun charger switch—"OFF."
o. Carburetor air—"DIRECT."
p. Propeller—2150 rpm.
q. Cockpit canopy—Locked "OPEN."
r. Exterior lights—"DIM" for night carrier landings to prevent blinding the landing signal officer.

2-75. FINAL APPROACH.

Note

Lower wheels and flaps when IAS is below 130 knots (150 mph).

a. Landing gear control — "WHEELS DOWN." Check wheels and flaps position indicator for full down and latched position.

Note

A red light in the landing gear control handle will come on and remain on until all three gears are in the latched down position.

b. Wing flaps control—As described for landing conditions (see paragraph 2-76). Note position of flaps on wheels and flaps position indicator. Leave control at "DOWN" for flaps full down; return control from "DOWN" to "STOP" when flaps reach desired partial down position.

c. Make a normal approach at approximately 75 to 80 knots (86 to 92 mph) IAS.

2-76. LANDING.

2-77. NORMAL LANDINGS.

2-78. SHORE LANDINGS. Use flaps as desired. Full flaps (40°) should normally be used. Lesser flap settings will result in increased landing speed, and hence increased ground run.

2-79. CARRIER LANDINGS. Lower the arresting hook. Full flaps (40°) should be used for all carrier landings. Standard carrier approach and landing procedures should be followed.

WARNING

Do not return the arresting hook control to the "HOOK UP" position until the airplane has come to rest on deck.

2-80. AFTER LANDING.

a. Raise the landing flaps immediately upon completion of the landing roll.

b. Cowl flaps—"AUTO."

c. Propeller control—"INCREASE" rpm (low pitch).

Note

All taxiing should be done with the controls in the above positions.

2-81. SPECIAL LANDINGS.

2-82. CROSS WIND LANDINGS. Cross wind landings can best be made by landing with the tail slightly up and somewhat less than normal flap angle. All other controls should be in the same position as for normal landings. Use some downwind rudder just prior to contact with the ground to head the airplane in the direction of motion over the ground. During the run after landing, there will be a tendency for the upwind wing to rise, and the airplane will turn into the wind. Use a little rudder or brake for counter-action.

WARNING

Use brakes cautiously until the tail wheel is on the ground.

2-83. MINIMUM RUN LANDINGS. Use full flaps with the propeller in increase rpm (low pitch) and the throttle slightly open. The approach should be rather flat as in a carrier landing; the nose should be high. Bring the airplane in about ten feet above the runway, close the throttle, and drop the airplane to the runway. Use the brakes as necessary.

2-84. EMERGENCY LANDING PROCEDURES. Refer to paragraph 3-13.

2-85. TAKE-OFF IF LANDING IS NOT COMPLETED.

a. Open the throttle slowly and smoothly.

b. Move propeller to full "INCREASE" rpm (low pitch).

c. Raise the landing gear.

d. Raise the landing flaps after minimum safe altitude has been obtained.

e. Reduce power as required.

2-86. STOPPING THE ENGINE.

a. Idle the engine at 1000 rpm to allow cylinder head temperature to cool below 150°C.

b. Propeller control—"INCREASE" rpm.

c. Booster pump—"OFF."

d. Mixture control—"IDLE CUT-OFF."

e. Engine ignition switch "OFF" after propeller stops rotating.

f. Check cowl flaps—"AUTO." Check to see that they are full open.

g. With engine oil still warm following engine shutdown and battery switch "ON," accomplish the following steps to override thermoswitch and properly position the oil diverter valve for a cold start:

h. Oil dilution switch—"OIL DILUTION" for five seconds.

Note

Manual shut-off valve is kept closed when not diluting oil.

i. Battery switch—"OFF."

Note

If electrical equipment is to be used after engine shut-down, pull out oil dilution circuit breaker.

j. Oil dilution switch—"OFF."

Note

Steps h, i, and j may be accomplished following step a, providing that the engine is idling below generator cut-in rpm.

2-87. OIL DILUTION. If temperatures below ± 2°C (35°F) are anticipated, the oil must be diluted as follows:

Note

Oil dilution is not effective at oil temperatures above 50°C.

a. Request ground crew member to open the oil dilution shut-off cock, located at the bottom of the oil tank (see figure 1-2, reference 14).

Note

The oil dilution shut-off cock must be closed and safety-wired prior to flight.

b. Operate engine at 1000 to 1200 rpm.

c. Maintain oil temperature below 50°C and the oil pressure above 15 psi.

d. Hold oil dilution switch in "OIL DILUTION" position according to the following table:

4°C to −12°C (40° to 10°F)—4 minutes
−12°C to −29°C (10° to −20°F)—6 minutes
−29°C and below (−20°F and below)—9 minutes

Note

A momentary drop in fuel pressure should be noted when switch is first actuated.

e. Mixture control—"IDLE CUT-OFF."

f. Ignition switch—"OFF."

g. Battery switch—"OFF."

h. Oil dilution switch—"OFF." (After propeller stops turning.)

Note

Battery switch must be turned "OFF" before oil dilution switch is turned "OFF" in order to properly position the oil diverter valve for a cold start. If electrical equipment is to be used after engine shut-down, pull out oil dilution circuit breaker.

CAUTION

It is recommended that the throttle be retarded to minimum idle and the warm-up continued if the oil pressure stabilizes at low idle speed. If not, the engine should be stopped and heat applied locally to the oil lines and tanks.

2–88. BEFORE LEAVING THE AIRPLANE.

a. Turn the fuel tank selector "OFF."

b. Turn off all electrical switches.

c. Uncage the gyro instruments.

d. Landing gear—"WHEELS DOWN."

e. Wing flaps—"UP" (0°).

f. Dive brakes—"CLOSE."

2–89. MOORING.

a. Install surface controls lock. (See paragraph 1–9.)

b. Chock wheels.

c. If gusty wind conditions prevail, tie the airplane down. (See figure 2–2.)

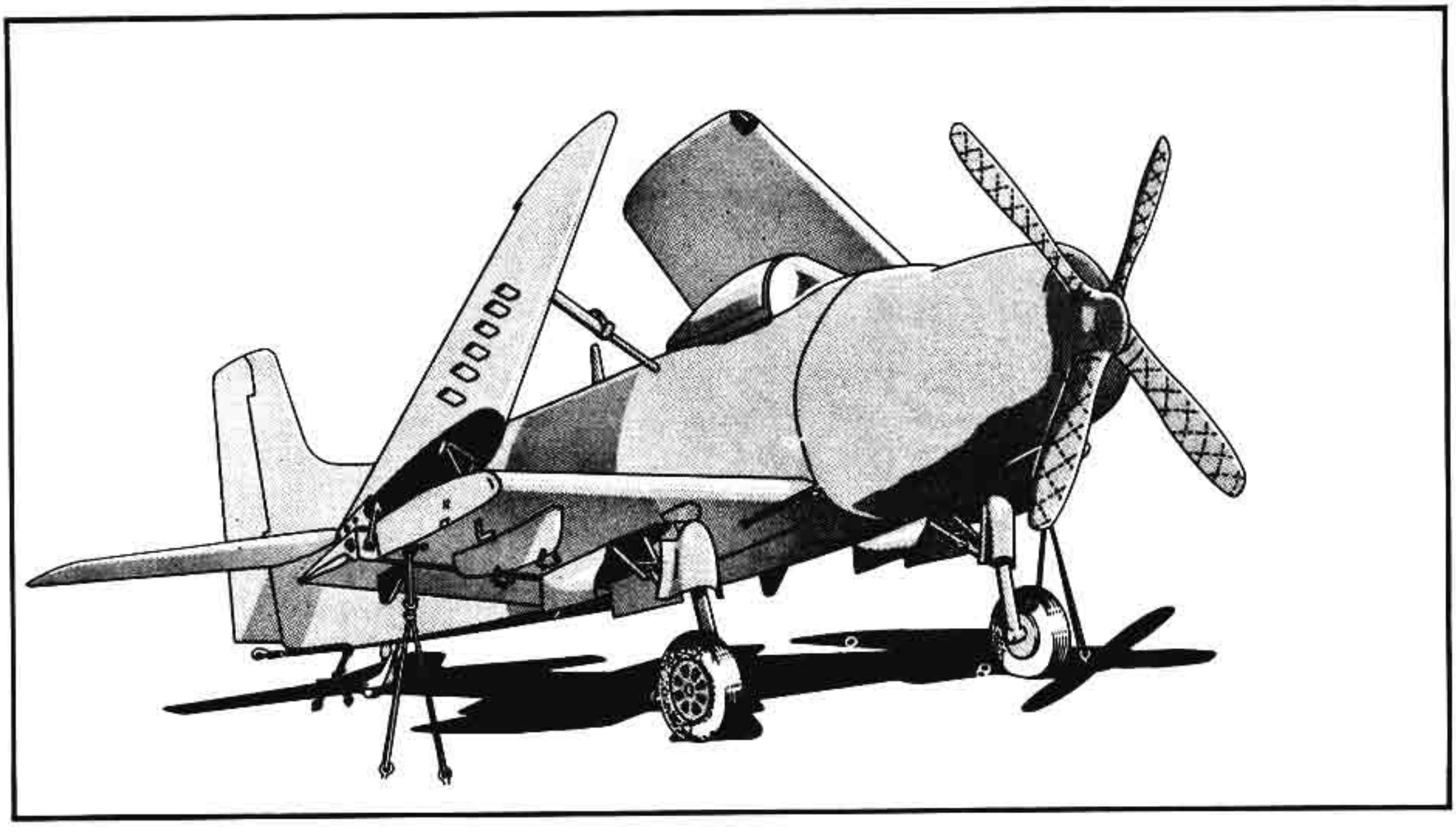


Figure 2-2. Mooring

SECTION III

EMERGENCY OPERATING INSTRUCTIONS

3–1. FIRE.

3–2. FIRE WHILE STARTING ENGINE. Backfiring sometimes causes fire in the induction system as a result of the presence of excessive fuel after priming. Allowing the engine to run will often cause the fire to be drawn out through the engine. If the fire continues, place the mixture control in "IDLE CUT-OFF," turn the ignition switch and fuel tank selector to "OFF" and vacate the airplane. An outside portable fire extinguisher should then be used to quench the fire.

3–3. FIRE DURING TAKE-OFF. If a fire occurs during take-off, a landing should be made as quickly as possible.

3–4. FIRE DURING FLIGHT. The best means of preventing engine fire is through a rigid ground inspection and maintenance of those items which might fail and cause a fire. If altitude and other factors permit, the following steps should be carried out. However, it is left to the pilot's discretion whether to attempt to extinguish the fire or to bail out.

a. Place the propeller in "DECREASE" rpm (high pitch).

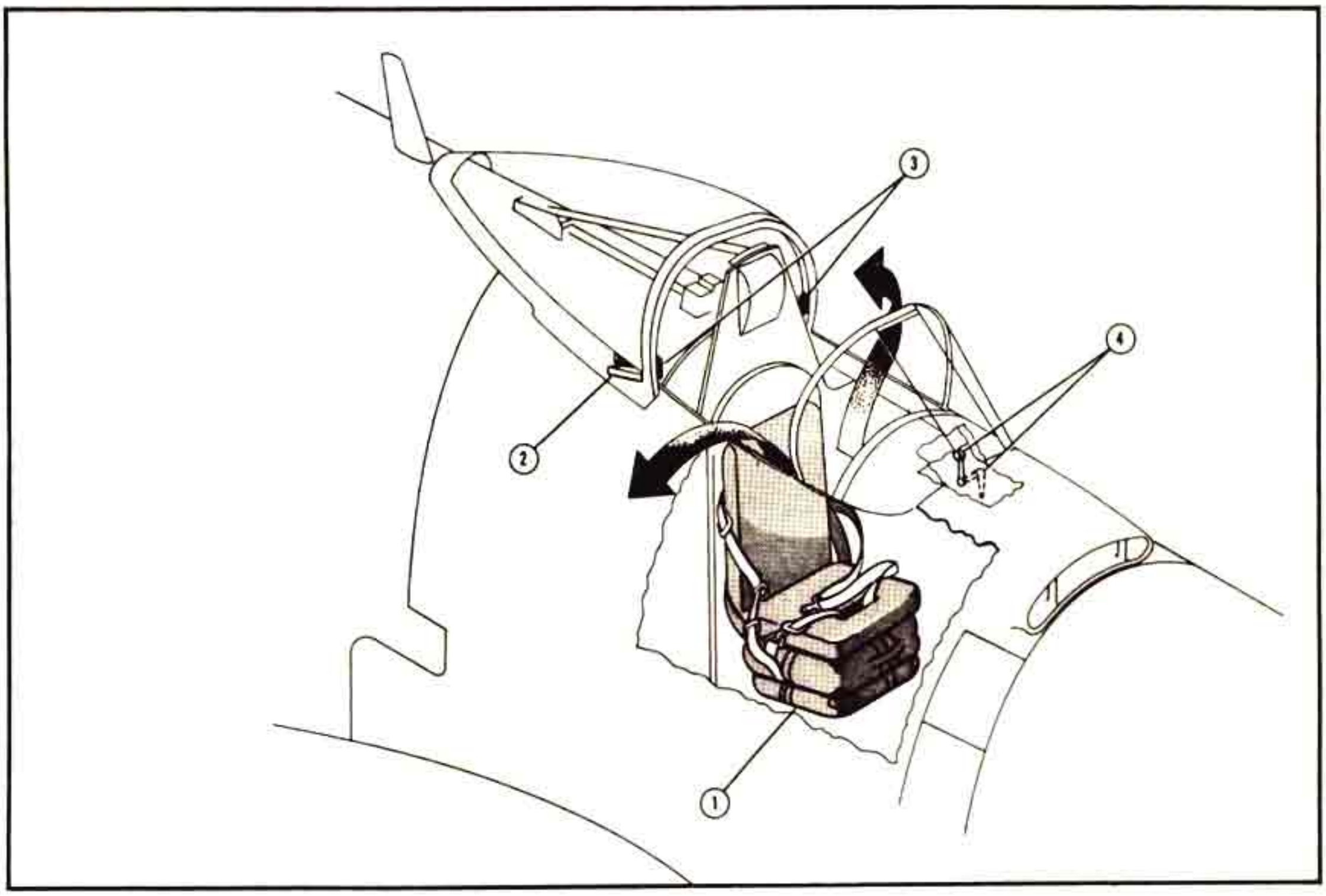
b. Close the throttle (simultaneously with a., above).

c. Turn fuel selector "OFF."

d. "OPEN" cowl flaps.

e. Move mixture control to "IDLE CUT-OFF."

f. Turn off ignition.



1 Pararaft kit
2 Enclosure exterior manual operating handles (Typical both sides)
3 Enclosure interior manual operating handles
4 Enclosure exterior and interior hydraulic locking controls

Figure 3-1. Emergency Equipment and Exits

g. Turn off electrical switches.
h. Lower landing gear if practicable (if the tires are in the path of the flames when retracted).
i. DO NOT RESTART ENGINE.

3–5. ELECTRICAL FIRES. In the event of a fire in the electrical system, the following procedure should be applied:

a. Turn battery switch "OFF."
b. Turn off all other electrical equipment.
c. If the fire is extinguished, turn the circuits on one at a time, starting with the battery switch, and watch for the circuit which causes the fire.

3–6. WING FIRE.

a. Release external auxiliary fuel tank and bombs.
b. If a wing fire occurs during night flight operation, turn the switches which control all the lights within the wing "OFF."
c. Attempt to extinguish the fire by side-slipping the airplane away from the wing fire.

3–7. FUSELAGE FIRE. If the fire is due to a leaking fuel line turn the fuel selector valve to an applicable tank if external auxiliary tanks are carried.

WARNING

If the generators have failed, DO NOT turn battery switch "OFF" as the electrical flight instruments, the oil cooler door, booster pump, cowl flaps and the horizontal stabilizer control will become inoperative.

3–8. ENGINE FAILURE.

3–9. ENGINE FAILURE DURING TAKE-OFF. On the event of engine failure during take-off, LAND STRAIGHT AHEAD. As many as possible of the operations listed below should be performed in the order given.

a. Release external auxiliary tanks or bombs.
b. Landing gear—"WHEELS UP" unless sufficient runway is available STRAIGHT AHEAD for a landing in the normal ("WHEELS DOWN") position.
c. Wing flaps—full "DOWN" (40°).
d. Lower the seat.
e. Battery and ignition switches—"OFF."
f. Fuel selector—"OFF."

3–10. ENGINE FAILURE IN FLIGHT. If altitude permits, attempt to find the cause of engine failure as follows:

a. The selected fuel tank may be empty. Switch to another tank.
b. If it is apparent that the fault does not lie in the fuel system operation and altitude still permits, move the mixture control to "RICH."
c. If, after completing the above operations, the engine does not start, prepare for an emergency landing. See paragraph 3–13 following.

Note

The maximum gliding ratio is 12.6 at approximately 120 knots (138 mph) IAS.

3–11. ESCAPE FROM AIRPLANE.

3–12. An air bottle system is provided for emergency opening of the canopy in case of hydraulic system failure. To operate the canopy emergency system, move the control handle to the "EMERGENCY" position. An air pressure gage is installed to the left and aft of the pilot's armor plate. Normal air pressure is 1980 psi and satisfactory emergency operation will not be obtained with the pressure below 1750 psi. The canopy can be opened three times starting with 1750 psi before the pressure drops too low to open the canopy in a dive at 363 knots (420 mph).

3–13. FORCED LANDING.

3–14. GENERAL. In the event of a forced landing over land, the pilot should consider a number of variables in order to determine his best landing attitude. These include altitude, type of terrain, and the characteristics of the airplane. Landings in terrain such as golf courses, ploughed fields, swamps, mud, or sand should be made with the wheels up. Most nose-overs occur as a result of landing in such territory with the landing gear down, and nearly all serious injuries and fatalities result from nosing over. Landings in rough, rocky, or tree stump terrain should be made with the wheels down so that the landing gear and not the fuselage will make the initial contact. Pilots should remember that ground which appears smooth and level from the air frequently turns out to be rough, crossed with ditches, soft, or full of obstructions when the actual landing is made. All forced landings should be made well above the stalling speed. There will be little or no control of the airplane if an attempt is made to land at or slightly above the stalling speed.

WARNING

In the event of a forced landing, release all bombs or droppable tanks first.

3–15. BELLY LANDINGS.

a. Release tanks or bombs.
b. Landing gear—"WHEELS UP."
c. Wing flaps—full "DOWN" (40°).
d. Shoulder harness and safety belt—locked tight.
e. Mixture control—"IDLE CUT-OFF."
f. Battery and ignition switches "OFF."
g. Fuel selector—"OFF."

3–16. WATER LANDINGS (Ditching). The same procedure as that outlined in the above paragraph for

belly landings is applicable to ditching. Abandon the airplane as soon as possible after landing. The pararaft kit is stowed in the pilot's seat. Refer to paragraph 3–43.

3–17. PROPELLER EMERGENCY OPERATION.

3–18. RUNAWAY PROPELLER. Failure of the governor to operate properly may result in a runaway propeller. A runaway propeller goes to full low pitch and may result in an engine speed as high as 3600 rpm or more. When such a failure occurs, the only method of reducing the engine speed is to throttle back and decrease the airspeed. In doing this, it is highly important to make use of the allowable maximum over-speed of 3120 rpm and to reduce the IAS to approximately 120 knots (138 mph), the practical operating speed at minimum power.

3–19. FUEL SYSTEM EMERGENCY OPERATION.

3–20. REGAINING LOST SUCTION. If suction is lost, proceed as follows:

a. Check position of fuel tank selector and set to tank containing fuel.

b. Turn fuel booster pump "ON."

c. Retard throttle to ¼ position. The engine should never be started at full throttle, since a momentary, but serious, overspeeding of the engine would result.

Note

If suction is only partially lost and is not accompanied by complete engine cut-out, the above steps may be sufficient to re-establish suction. If not, continue as follows:

d. Move mixture control to "IDLE CUT-OFF" until adequate fuel pressure is built up, then move to "RICH" to prevent premature starts and backfiring.

e. Nose the airplane over into a steep glide to provide adequate maximum gravity flow to booster pump and to provide adequate speed for engine-driven fuel pump by windmilling.

f. Use primer as necessary until engine is firing smoothly.

3–21. ENGINE-DRIVEN PUMP FAILURE. In case the engine-driven fuel pump fails, turn the booster pump "ON" to furnish fuel pressure.

3–22. JETTISONING EXTERNAL AUXILIARY FUEL TANKS. See paragraph 2–11.

3–23. COURSES OF FUEL FLOW. (See figure 1–7.)

3–24. SYSTEMS AND CONTROLS EMERGENCY OPERATION.

3–25. MAIN HYDRAULIC SYSTEM OPERATION. In case of engine-driven hydraulic pump failure, the hydraulically controlled units may be operated by the emergency hydraulic pump (see paragraph 1–45).

3–26. LANDING GEAR EMERGENCY EXTENSION. If the engine-driven hydraulic pump has failed, the landing gear may be lowered by putting the control in the "WHEELS DOWN" position and operating the emergency hydraulic pump. If the gear does not extend, it indicates that there is probably not enough fluid in the reservoir. An emergency supply of fluid, available only for lowering the main landing gear, is provided below the standpipe in the main fluid supply line in the reservoir. To extend the gear, place the landing gear control in the "EMER" position. This procedure will extend the main wheels only. The tail wheel may remain retracted or fall half way down by gravity. However, it may be possible to fully extend the tail gear by applying a minimum load factor of approximately four G's. Observe the landing gear position indicator for gear position indication.

WARNING

If the landing gear control has been moved to the "EMER" position, manually reset the landing gear emergency control valve on the ground or automatically reset it on the next flight by moving the landing gear control to the "WHEELS UP" position. When the airplane is on the ground, make sure that the main hydraulic system pressure is zero before resetting or the main landing gear will retract.

3–27. EMERGENCY BRAKE OPERATION. The brakes are operated by a power boost system from the main hydraulic system. In case of loss of hydraulic system pressure, the brakes may be operated by normally depressing the rudder brake pedals; however, approximately three times the normal foot pressure will be required.

3–28. WING FLAP AND DIVE BRAKE EMERGENCY OPERATION. If the engine-driven hydraulic pump fails, the wing flaps or dive brakes may be operated by placing the control in the desired position, and operating the emergency hydraulic pump. If the dive brake control lever cannot be moved to the "OPEN" position, release the safety solenoid (see paragraph 3–34).

3–29. AILERON POWER BOOST EMERGENCY RELEASE. In case of hydraulic system failure and excessive control forces are present, the aileron power boost system may be disconnected by pulling the emergency release handle. It cannot be reconnected in flight.

3–30. AUTOMATIC PILOT EMERGENCY RELEASE. If the auto-pilot malfunctions to the point where it jams the controls, it can be disengaged by pulling the auto-pilot release handle. When disengaged in this manner, the auto-pilot cannot be reengaged while in flight.

3-31. ELECTRICAL SYSTEM EMERGENCY OPERATION.

3-32. In the event of generator failure (voltage below 26 volts), the generator warning light will come on indicating that the reverse current relay is open. To prevent electrical equipment from draining the battery, proceed as follows:

a. Turn generator switch for defective generator (NORMAL or ALTERNATE) "OFF."

b. If normal generator fails first, move a-c power switch to "ALTERNATE" and shut off the alternate generator load.

c. If alternate generator fails first, shut off the alternate generator load.

d. If both generators are defective, proceed as follows:

e. Battery switch—"EMER."

f. Turn both generator switches "OFF."

g. Master armament switch—"OFF."

h. Turn off all non-essential equipment on MAIN and ESSENTIAL busses.

Note

MAIN and ESSENTIAL busses remain energized, and armament bus may be energized by returning master armament switch to "ON." A-c equipment cannot be operated. See figure 1-9.

3-33. If high voltage (over 30 volts) occurs, it indicates a failure in the generator circuit. Proceed as follows:

a. Turn generator switch for defective generator circuit "OFF."

3-34. LANDING GEAR AND DIVE BRAKE SAFETY SOLENOIDS. A safety circuit containing a solenoid for the landing gear and one for the dive brakes keeps the control levers from being moved to the "WHEELS UP" (landing gear) or "OPEN" (dive brakes) positions when the landing gear is extended and the weight of the airplane is on the shock struts (struts compressed). If the circuit fails in flight and it is desired to raise the gear or extend the dive brakes, the solenoid locks may be released by operating the solenoid release lever adjacent to each control lever.

3-35. CIRCUIT BREAKERS. For location of circuit breakers see figure 1-5, reference 32.

3-36. RADIO EQUIPMENT EMERGENCY OPERATION.

3-37. AN/APX-2 EQUIPMENT. In case of a forced landing or an emergency, the AN/APX-2 master control switch on the "IFF" control console should be placed in the "EMERGENCY" position by pushing the guard latch and turning the switch to the extreme clockwise position. This causes the transponder to send out a special emergency or distress signal. In case of a forced landing in questionable territory, the equipment should be destroyed by pushing the guard latch at the "CODE" switch and rotating the switch to "DESTRUCT" which is the extreme clockwise position. In case of a crash landing, an impact switch automatically sets off the destructor circuit; however, as a safety precaution, the "CODE" switch should always be set to "DESTRUCT" if time permits.

3-38. ARMAMENT EQUIPMENT EMERGENCY OPERATION. To salvo the bombs or torpedoes, with the electrical system operative, proceed as follows:

a. Armament master switch—"ON."

b. Bomb safety switches—"LEFT," "CENTER" and "RIGHT."

c. Arming switch—As desired.

d. Inner station selector switch—"BOMB."

e. Depress bomb release button on control stick head.

3-39. MANUAL BOMB AND TORPEDO RELEASE. If the electrical system is inoperative, the bombs or torpedo on all three racks can be salvoed manually by pulling the emergency release lever on the ourboard side of the left-hand control panel. Since the bomb ejector system does not operate when the manual release is used, the airplane must be level flight before the bombs or torpedo are dropped.

3-40. OXYGEN EQUIPMENT EMERGENCY OPERATION.

3-41. OXYGEN REGULATOR. In an emergency, or if the composite diluter-demand regulator becomes inoperative, the emergency valve control (red knob marked "EMER.") can be used to supply a steady flow of 100 percent oxygen. The control should be turned slowly counterclockwise to obtain the minimum flow required.

3-42. MISCELLANEOUS EMERGENCY OPERATION.

3-43. PARARAFT KIT. The seats are designed to accommodate a type PK-2 pararaft kit (figure 3-1, reference 1) and a seat type parachute. After descending to land or into water, the pararaft kit may be separated from the harness by removing the release link on the container and pulling out the kit by the handle provided for that purpose.

Note

During flight, the pararaft should be attached to the life vest or belt by means of the lanyard provided. The pararaft may be lost after the parachute harness is removed if this attachment is not correctly made.

SECTION IV

OPERATIONAL EQUIPMENT

4–1. ARMAMENT EQUIPMENT.

4–2. GENERAL. The airplane is designed to carry two 20-mm guns, twelve rockets, and various combinations of bombs, mines, torpedoes, etc., on the three bomb racks. All armament is controlled from the armament control panel which is located below the instrument panel in the cockpit.

4–3. ARMAMENT MASTER SWITCH. The armament master switch (figure 4–1, reference 12) controls the operation of all armament equipment. Unless this switch is "ON," no armament circuits can be energized. The master armament circuit is automatically opened when the arresting hook is extended.

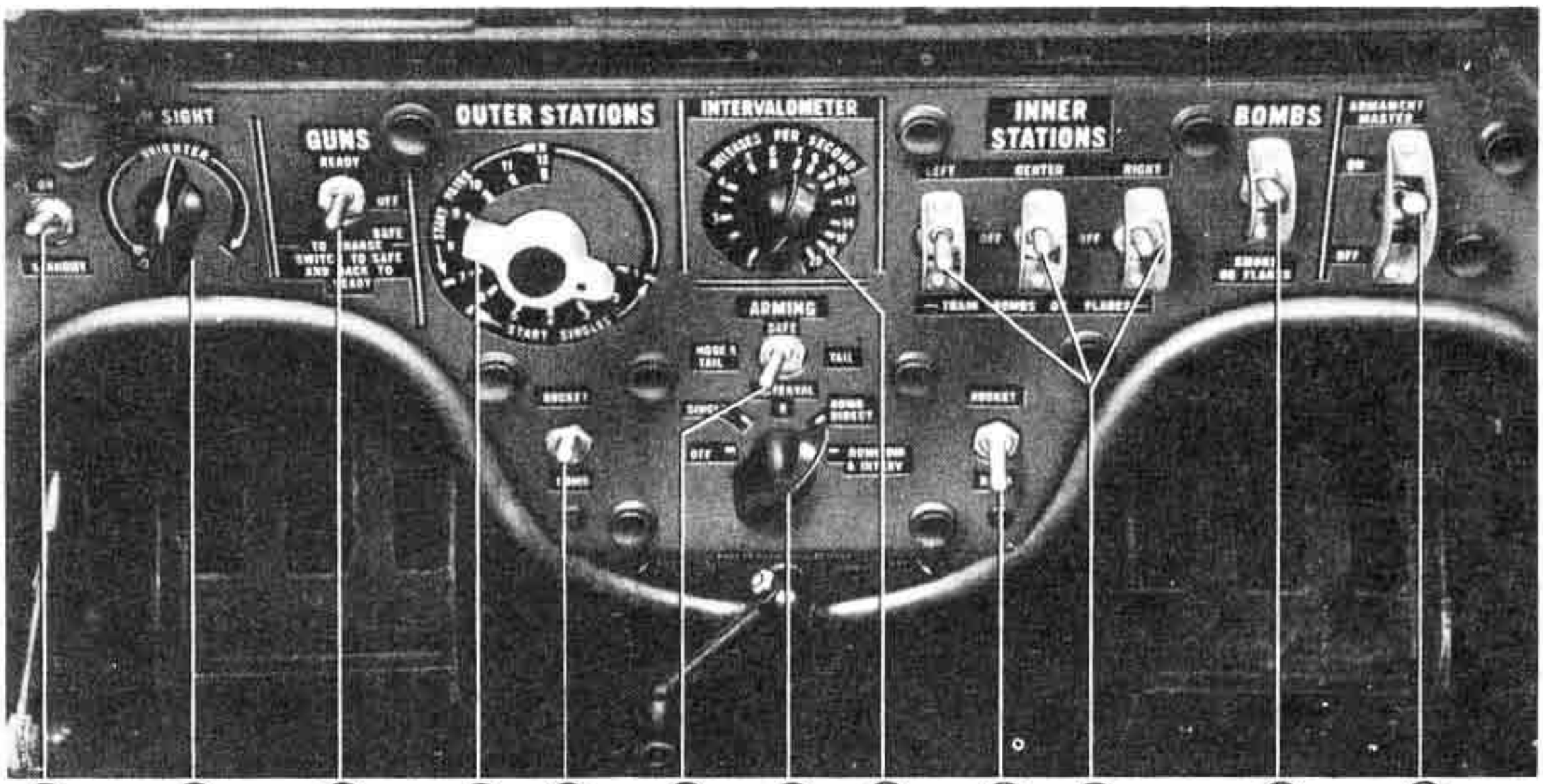
4–4. GUNNERY EQUIPMENT.

4–5. DESCRIPTION. Two forward firing 20-mm guns are mounted in the center wing panel, one at each wing fold joint. A gun sight is provided and may be used as a bomb and torpedo sight. Provisions have been made for mounting a gun camera in the leading edge of the wing, inboard of the right-hand gun. The gun camera is operated automatically whenever the guns or rockets are fired.

4–6. GUNNERY CONTROLS.

4–7. GUN SIGHT LIGHT CONTROLS. The gun sight light selector switch and rheostat (figure 4–1, references 1 and 2) are on the armament panel. Rotating the rheostat clockwise from the "OFF" position turns the light on and increases the intensity of the light in the gunsight. The selector switch is normally left in the "ON" position. If this light burns out or is inoperative, another filament will be turned on by moving the selector switch to "STANDBY."

4–8. GUN SIGHT ELEVATION CONTROLS. A Mark 18, Mod 2 gunsight elevation control console (figure 1–3, reference 8) is on the left-hand console panel. The sight elevation may be adjusted by moving the selector switch on the control console to "MAN-



Ref	Name	Ref	Name
1	Gun sight light selector switch	7	Interval generator output switch
2	Gun sight light rheostat	8	Intervalometer selector switch
3	Gun control switch	9	Inner stations bomb-rocket selector switch
4	Outer stations selector switch	10	Inner stations safety selector switches
5	Outer stations bomb-rocket selector switch	11	Bomb-smoke or flares selector switch
6	Arming switch	12	Armament master switch

Figure 4-1. Armament Control Panel

UAL" and rotating the dial calibrated in mils to the desired setting. When the selector switch is returned to the "GUNS" position, the sight line will automatically return to the normal (bore-sighted) position.

4-9. GUN CONTROL SWITCH. The gun control switch (figure 4-1, reference 3) is on the armament control panel. The indicated positions are "OFF," "SAFE," and "READY."

4-10. OPERATION OF GUNNERY EQUIPMENT.

4-11. TO OPERATE THE GUN SIGHT.

a. Battery switch—"ON."

b. Armament master switch—"ON."

c. Gun sight light switch—"ON."

d. Adjust rheostat to desired brilliance. If light does not come on, move light switch to "STANDBY."

e. Adjust gun sight elevation if required (see paragraph 4-8).

4-12. TO FIRE THE GUNS.

a. Operate gun sight (see paragraph 4-11).

b. Charge guns by moving gun control switch from "OFF" to "SAFE" to "READY."

c. Squeeze gun firing switch on the control stick.

4-13. TO GROUND CHECK GUN CAMERA OPERATION. (ENGINE STOPPED.)

a. Battery switch—"ON."

b. Armament master switch—"ON."

c. Gun control switch—"OFF."

d. Depress the gun firing switch on the control stick.

4-14. BOMBING AND TORPEDO EQUIPMENT.

4-15. DESCRIPTION. One fuselage bomb rack and two wing racks are provided. All bombing operations are controlled by the pilot.

4-16. FUSELAGE BOMB RACK. The fuselage bomb rack is provided with a bomb ejector and has a maximum capacity of a 2000-lb. bomb or a MK 13-3 torpedo. Manual and electrical release is provided.

4-17. BOMB EJECTOR. The bomb ejector provided with the fuselage bomb rack is designed to displace the bomb away from the airplane sufficiently to clear the propeller in steep dives and operates by means of a bomb ejector cartridge. The bomb ejector circuit should be tested prior to each flight (see paragraph 4-44).

4-18. WING BOMB RACKS. The wing bomb racks have a maximum capacity of one 2000-lb. bomb or MK 13-3 torpedo. (The operation of the landing flap is restricted when carrying a torpedo at the wing station.) Each wing bomb rack is also designed to carry a smoke tank, practice bomb rack, parachute flare container, fire bomb, 11.75 inch aircraft rocket or a droppable fuel tank. Provisions are also made for carrying radar equipment on the left-hand rack only. Manual and electrical release is provided for the wing bomb racks.

4-19. BOMB AND ROCKET CONTROLS.

4-20. BOMBS—SMOKE OR FLARES SELECTOR SWITCH. This switch (figure 4-1, reference 11) is a two-position switch. In the "BOMBS" position, the power circuit is completed to all three bomb stations in preparation for bomb release. In the "SMOKE OR FLARES" position, the power circuit is completed only to the wing bomb receptacles for operation of pyrotechnic equipment.

4-21. INNER STATIONS SAFETY SELECTOR SWITCHES. These three switches (figure 4-1, reference 10) are three-position switches. In the "OFF" position, the power circuits are open. In the "TRAIN BOMBS OR FLARES" position, the power circuit is completed for regulated release of bombs or flares by the interval generator. In "LEFT," "CENTER" and "RIGHT" positions, individual or salvo release of the bombs is controlled by the bomb release switch on the control stick.

4-22. INNER STATIONS BOMB-ROCKET SELECTOR SWITCH. This switch (figure 4-1, reference 9) is a two-position switch connected in series between the rocket bomb selector relays and the inner stations release circuit breaker. The type of operation from the inner stations is selected by moving the switch to "BOMB" or "ROCKET."

4-23. ARMING SWITCH. The arming switch (figure 4-1, reference 6) arms all bombs and rockets at inner and outer stations simultaneously. Indicated positions are "SAFE," "NOSE AND TAIL," and "TAIL."

4-24. INTERVAL GENERATOR OUTPUT SWITCH. This selector switch (figure 4-1, reference 7) has the following positions:

a. "OFF"—The power circuit for bomb and rocket operations is open.

b. "SINGLE"—The bomb release button on the control stick must be pressed for each selected bomb or rocket release.

c. "INTERVAL"—Release of bombs or rockets is controlled through the interval generator as set on the intervalometer selector switch.

d. "BOMB DIRECT"—Release of bombs or rockets is controlled through the bomb director.

e. "BOMB DIR & INTERV"—Release of bombs or rockets is controlled through combined use of the bomb director and the interval generator.

4-25. INTERVALOMETER SELECTOR SWITCH. This selector switch (figure 4-1, reference 8) will determine the number of bombs dropped per second or the number of rocket releases singly or in pairs per second.

4-26. OUTER STATIONS BOMB-ROCKET SELECTOR SWITCH. This switch (figure 4-1, reference

5) is a two-position switch connected in series between the rocket bomb selector relays and the outer stations release circuit breaker. The type of operation from the outer stations is selected by moving the switch to "BOMB" or "ROCKET."

4–27. BOMB EJECTOR TEST SWITCH. This switch (figure 4–2) located in the left-hand wheel well, provides a means of checking the bomb ejector circuit.

4–28. BOMB DIRECTOR.

4–29. GENERAL. The Mk 3 Mod 3 bomb director installation provides for electronic regulation of bomb release.

4–30 CONTROLS. The bomb director control console (figure 1–5, reference 2) is on the right-hand console panel. On the console are the "POWER" switch with "OFF" and "ON" positions, a "BARO PRESS" dial which selects barometric pressures between 28.5 and 31.0 inches of mercury, a "TARGET ALTITUDE" indicator and dial control, and the test switch marked "OPER TEST" and null meter.

4–31. PREFLIGHT TEST.

a. On the "TARGET ALTITUDE" indicator, set the altitude above sea level of the equipment.

b. Depress the "BARO PRESS" knob and hold in the depressed position for the remainder of this test.

c. Rotate the "BARO PRESS" knob until the pointer of the null meter reaches the null position.

d. Depress the "OPEN TEST" switch until the pointer of the null meter is deflected to the right-hand side.

e. Release the "OPER TEST" switch and check that the null meter pointer returns to the balance position.

f. Release the "BARO PRESS" knob.

g. Check that the barometric pressure reading obtained in this manner on the "BARO PRESS" dial is within 0.2 inches of mercury of the current barometric pressure corrected for sea level at the location of the equipment. (This reading is the same as the altimeter setting obtainable from the control tower.)

4–32. OPERATION OF BOMB DIRECTOR. Information pertaining to operation of the bomb director will be added when available.

4–33. OPERATION OF BOMBING AND TORPEDO EQUIPMENT.

4–34. TESTING BOMB EJECTOR SYSTEM. Prior to each flight, the bomb ejector circuit with a cartridge installed in the bomb ejector should be checked as follows:

a. Armament master switch—"OFF."

b. Battery switch—"ON."

c. Bomb ejector test switch—"CARTRIDGE." If test lamp lights, the circuit is complete. If it does not light, proceed as follows:

d. Bomb ejector test switch—"LAMP." If the test lamp lights, the cartridge circuit is open and the cartridge should be replaced. If the lamp does not light, the lamp is probably defective and should be replaced.

e. Repeat bomb ejector system check. If the lamp fails to light in the "CARTRIDGE" position, the cartridge circuit is open and should be checked.

4–35. TO RELEASE BOMBS ELECTRICALLY.

a. Armament master switch—"ON."

b. "BOMBS—SMOKE OR FLARES" selector switch —"BOMBS."

c. "INNER STATIONS" safety selector switches—"TRAIN BOMBS OR FLARES," selecting bombs as desired.

Note

With all three selector switches set to "TRAIN BOMB OR FLARES," bombs will be released in the following sequence: right, left, and center. If all three selector switches are set to "LEFT," "CENTER" and "RIGHT," all bombs will be salvoed.

d. "ARMING" switch—Set as desired.

e. Interval generator output selector switch—Set as desired as follows:

f. With interval generator output selector switch at "SINGLE" press the control stick bomb release switch for each selected bomb release.

g. With interval generator output selector switch at "INTERVAL" set the "INTERVALOMETER" selector switch to the desired "RELEASES PER SECOND," and hold control stick bomb release switch depressed until all selected bombs are released.

h. Information pertaining to the use of the "BOMB DIRECT" or the "BOMB DIR & INTERV" positions will be added when available.

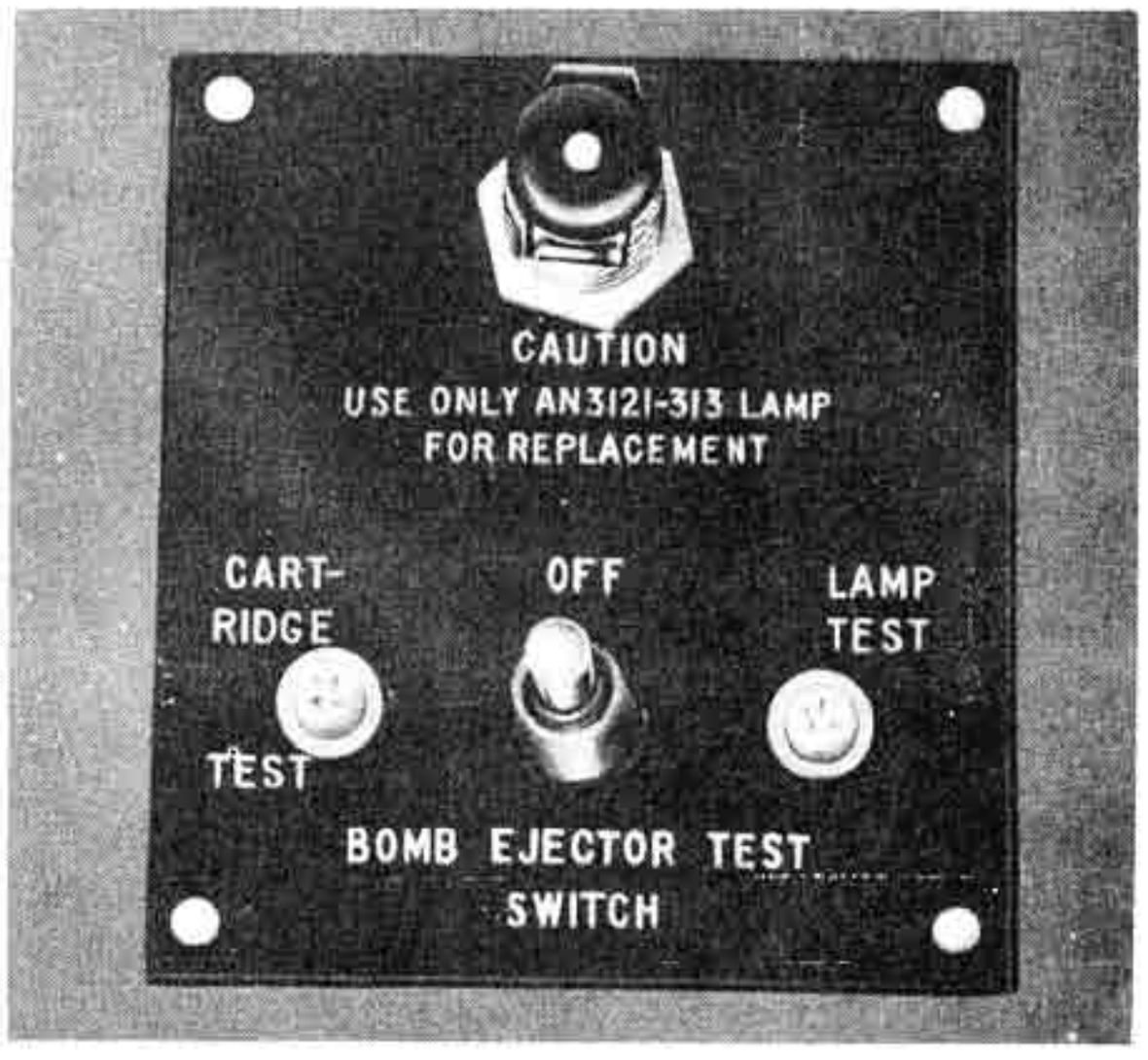


Figure 4-2. Bomb Ejector Test Box

4-36. TO RELEASE BOMBS MANUALLY. Refer to paragraph 3-39.

4-37. TO RELEASE TORPEDOES. Torpedoes are released in the same manner as bombs (see paragraphs 4-35 and 4-36.) No provisions are made for depth setting from the cockpit.

4-38. TO OPERATE SMOKE TANKS.

a. Armament master switch—"ON."

b. "BOMBS—SMOKE OR FLARES" selector switch —"SMOKE OR FLARES."

c. Set either or both wing "INNER STATIONS" safety selector switches to "TRAIN BOMBS OR FLARES."

Note

If a bomb is being carried on the fuselage bomb rack, check to see that the center bomb station safety selector switch is in the "OFF" position.

d. Press the control stick bomb release switch to release smoke.

e. After the smoke tanks are empty, the tanks may be dropped in the same manner as releasing bombs.

4-39. TO RELEASE OTHER EQUIPMENT CARRIED ON BOMB RACKS. Other equipment carried on the bomb racks, such as mines, 11.75-inch rockets, flares, etc., is released in the same manner as bombs (see paragraphs 4-35 and 4-36).

4-40. ROCKET EQUIPMENT.

4-41. DESCRIPTION. Provisions are made for carrying 12 five-inch HVA rockets, six under each outer wing panel.

4-42. ROCKET LAUNCHERS. Mark 9 rocket launchers, designed to carry 5-inch HVA rockets, are installed. The rockets are armed and fired electrically by the pilot.

4-43. ROCKET CONTROLS. The MK 2 "OUTER STATIONS" selector switch (figure 4-1, reference 4) provides for firing rockets singly and in pairs. The selector jumps one position each time the rocket release button is pressed.

4-44. OPERATION OF ROCKET EQUIPMENT.

4-45. TO RELEASE ROCKETS.

a. Armament master switch—"ON."

b. Operate gunsight—see paragraph 4-11.

c. "OUTER STATIONS" selector switch—As desired.

d. "ARMING" switch—As desired.

e. Interval generator output selector switch—As desired as follows:

f. With interval generator output selector switch at "SINGLE," press the control stick rocket release switch for each selected rocket release.

g. With interval generator output selector switch at "INTERVAL," set the "INTERVALOMETER" selector switch to the desired "RELEASES PER SECOND," and hold control stick rocket release switch depressed until all selected rockets are released.

h. Information pertaining to the use of the "BOMB DIRECT" or the "BOMB DIR & INTERV" positions will be added when available.

4-46. OXYGEN EQUIPMENT.

4-47. GENERAL. A composite diluter-demand oxygen regulator panel (figure 1-3, reference 19) is on the left-hand console panel. The oxygen is supplied from a 295 cubic inch capacity cylinder located below the cockpit floor. The oxygen cylinder refill valve (figure 1-5, reference 14) is located just below the canopy on the right-hand side of the cockpit.

4-48. OXYGEN REGULATOR CONTROLS.

4-49. AIR VALVE KNOB. In the "NORMAL OXYGEN" position of the air valve knob, diluted oxygen is supplied upon demand. The amount of dilution depends upon cabin altitude up to 30,000 feet, above which 100% oxygen is supplied. Turning the control to "100% OXYGEN" supplies undiluted oxygen upon demand regardless of altitude.

4-50. SAFETY PRESSURE BUTTON. This button is pulled out for normal operation. When pushed in, a continuous flow of undiluted oxygen is supplied to the mask at a very low pressure. This continuous flow is in addition to and at a greater pressure than the normal demand flow and may tend to supply 100 per cent oxygen at all times even though the air valve knob is set at normal.

WARNING

The safety pressure button must be pulled up whenever the oxygen mask is not in use, otherwise there will be a continuous flow of oxygen from the regulator which will exhaust the supply and in the presence of oil or grease will cause a violent explosion.

4-51. EMERGENCY LEVER. This lever is normally in the full clockwise position. When turned fully counterclockwise, it overrides the other controls and supplies a continuous flow of undiluted oxygen. The flow pressure is considerably greater than that supplied by the "SAFETY PRESSURE" button. Using emergency oxygen exhausts the supply very rapidly.

4-52. PREFLIGHT CHECK. The following items should be checked at regular intervals when the airplane is on the ground, and whenever possible before flights in which oxygen is likely to be used, to assure proper functioning of the oxygen system:

a. Check to see that the regulator emergency valve is closed.

b. On the composite diluter-demand type regulators, check to see that the emergency valve is closed and that the safety pressure valve is up (OFF).

c. Put on the mask. Check the mask fit by placing the thumb over the disconnect at the end of the mask tube and inhale lightly. If there is no leakage, the mask should adhere tightly to the face and a definite resistance to inhalation should be encountered. If the mask leaks, tighten the mask suspension straps and/or adjust the nose wire. DO NOT USE A MASK THAT LEAKS.

d. Fully engage the mating portions of the disconnect coupling to connect the mask to the personnel gear receptacle.

e. Breathe several times with the regulator air valve in both "NORMAL OXYGEN" and "100 PERCENT OXYGEN" positions to check regulator operation and observe the flow indicator for "blink," verifying the positive flow of oxygen.

4–53. OPERATING INSTRUCTIONS. The following procedures should be followed when oxygen is used during flight:

CAUTION

In order to properly support the personnel gear adapter it will be necessary to sew fasteners on the pilot's flying suit or life vest as shown in figure 1–11. Failure to use these fasteners may cause fouling and damage to the adapter.

a. Connect the ring on the upper end of the adapter to the loop eye-snap on the flying suit.

b. Fasten the lower end of the adapter to the flying suit by means of the buckle sewn to the suit. The free lower end of the adapter should be kept as short as will permit satisfactory engagement with the receptacle.

c. Plug the lower end of the adapter into the personnel gear receptacle at the left of the seat.

d. Check to see that the cylinder valve is open. The pressure gage should read 1800± 50 psi if the cylinder is fully charged.

e. Set the air valve to "NORMAL OXYGEN" for all normal flight conditions.

f. Put the mask on. Fully engage the mating portions of the disconnect couplings to connect the mask to the personnel gear connector and plug the connector into the gear receptacle.

g. To check the mask fit, squeeze the mask tube and inhale lightly. If there is no leakage, the mask should adhere tightly to the face and a definite resistance to inhalation should be encountered. If the mask leaks, tighten the mask suspension straps.

CAUTION

Never obstruct free flow of oxygen from the regulator while the emergency valve is open.

4–54. The following should be checked frequently while on oxygen:

a. Cylinder pressure gage for oxygen supply.

b. Oxygen flow indicator for flow of oxygen through regulator.

c. Mask fit for leak tightness.

d. In event of loss of radio communication, check the personnel gear receptacle to see that the connector is plugged in.

WARNING

Oxygen supply is also dependent on this disconnect.

4–55. EMERGENCY CONDITIONS.

a. Should symptoms occur suggestive of the onset of anoxia, or the regulator becomes inoperative, immediately turn on the emergency valve and descend below 10,000 feet.

b. Whenever excessive carbon monoxide or other noxious or irritating gas is present or suspected, regardless of altitude, the air valve should be turned to "OFF" or "100 PERCENT OXYGEN," and undiluted oxygen used until the danger is passed or the flight is completed.

c. Do not exhaust supply cylinder below 300 psi except in an emergency.

d. The following table may be used to determine the amount of oxygen available at various altitudes.

ALTITUDE	DURATION (MAN-HOURS)	
	AIR VALVE "ON" (Normal Flow)	AIR VALVE "OFF" (100% Oxygen)
10,000	5.1	0.65
15,000	4.8	0.80
20,000	3.9	1.03
25,000	2.4	1.35
30,000	1.8	1.75

4–56. Should brief removal of the mask from the face be necessary at high altitude, the following procedure should be used:

a. Take three or four deep breaths of 100 per cent oxygen (air valve set to "OFF" or "100 PERCENT OXYGEN").

b. Hold breath and remove mask from face.

c. As soon as practicable, replace mask to face and take three or four deep breaths of 100 percent oxygen.

d. Reset the air valve lever to the normal operating position.

Note

The emergency valve should be closed at all times except in an emergency, and then it should be opened slowly to minimum flow required.

4–57. HEATING SYSTEM.

4–58. DESCRIPTION. (See figure 4–3.) Air is taken in through an intake duct on top of the fuselage just forward of the cockpit and circulated through a heater muff around the exhaust stacks and then to the distributor valve. The distributor valve control (figure 1–5, reference 22) is located to the right of the pilot and provides for three positions: "OFF," "WINDSHIELD & CABIN" and "ALL TO WINDSHIELD." Intermediate heat can be obtained by placing the control in any desired intermediate position.

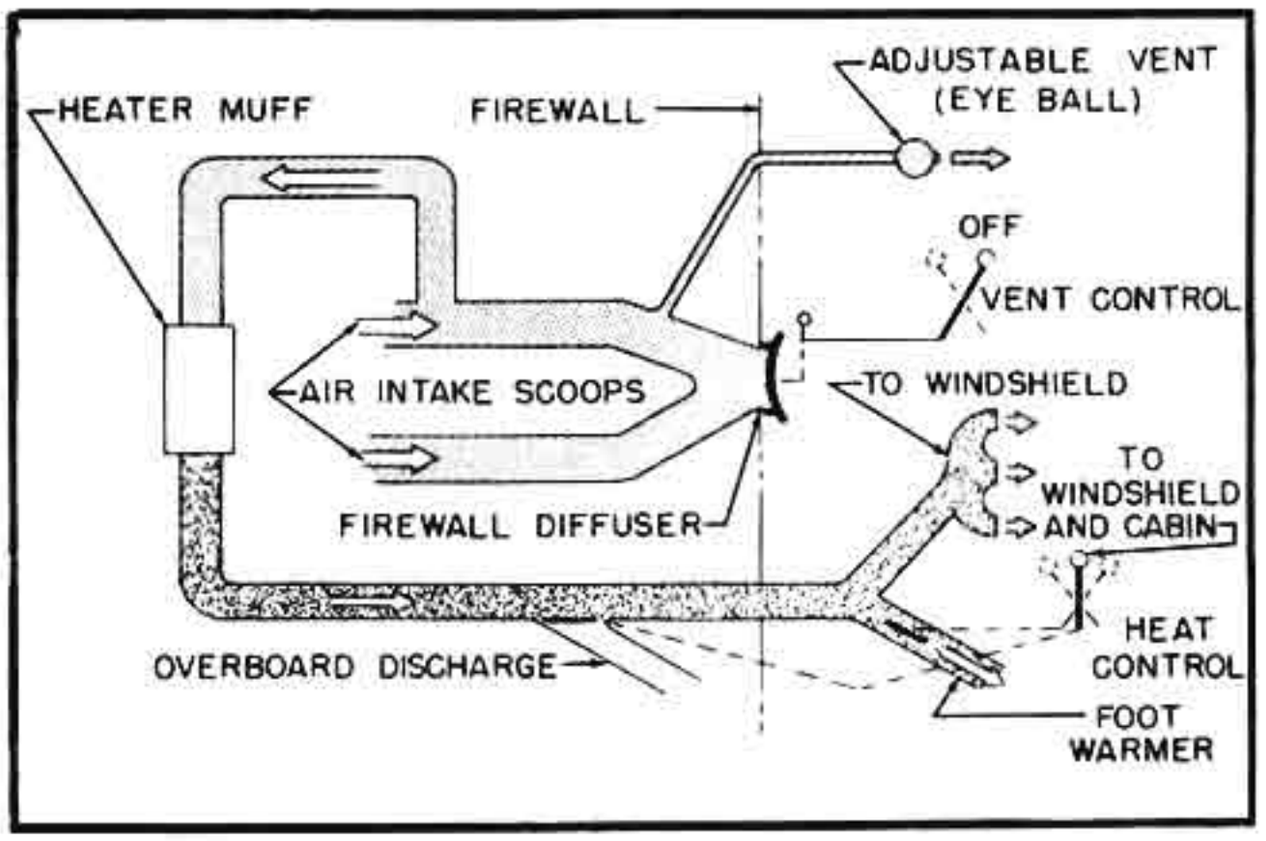


Figure 4-3. Heating System Diagram

4–59. VENTILATION SYSTEM.

4–60. DESCRIPTION. (See figure 4–4.) Air taken in from the intake duct is routed directly to a diffuser outlet at the firewall. The amount of air flow is controlled by the "VENTILATOR" lever (figure 1–5, reference 21) directly to the right of the pilot's seat. An additional air outlet (eyeball) is provided on the right-hand console panel, which may be adjusted to direct the flow of air over the upper portion of the pilot's body (see figure 1–5, reference 4).

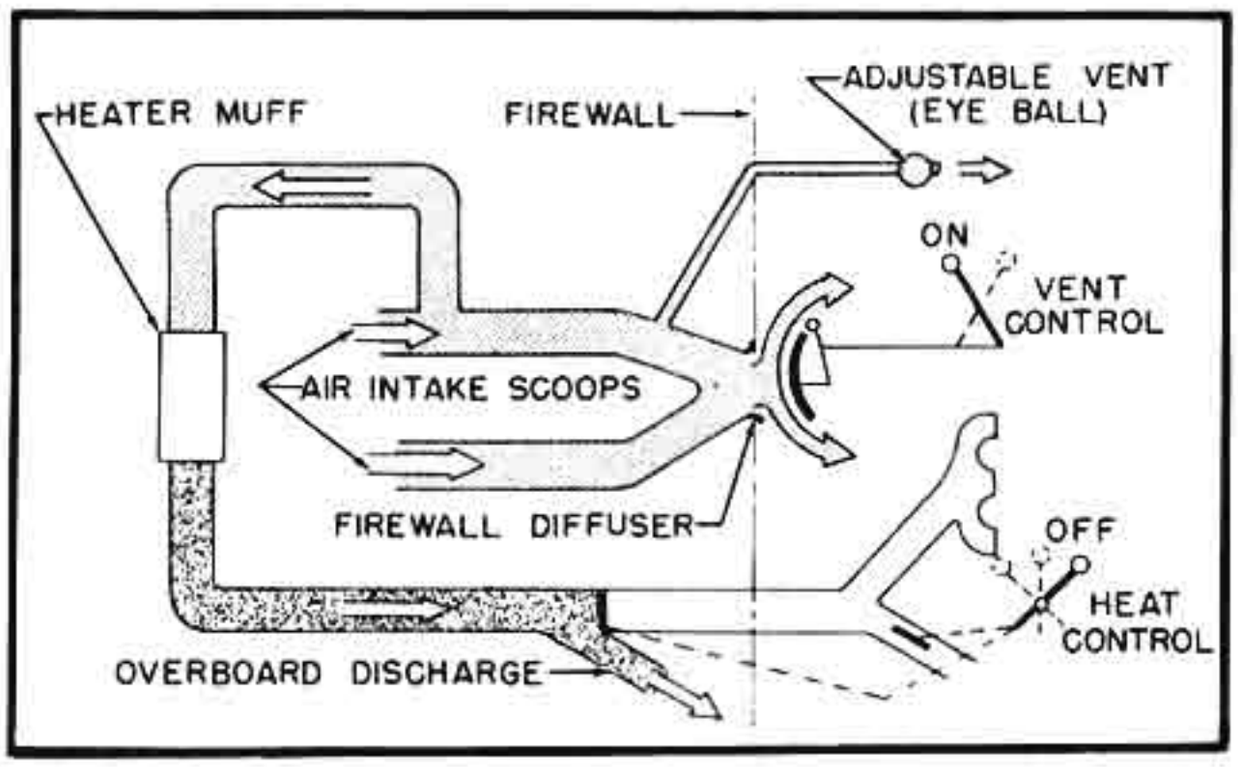


Figure 4-4. Ventilating System Diagram

4–61. ELECTRONIC EQUIPMENT.

4–62. GENERAL. The electronic installations in the airplane are of four types, each of which is listed below with its components of equipment:

EQUIPMENT	DESIGNATION	RANGE (APPROX.)
a. Communication		
VHF radio	AN/ARC-1	*Horizon
b. Navigation		
Range receiver	AN/ARC-5	50 miles
VHF homing	AN/ARR-2A	*Horizon
Radio altimeter	AN/APN-1	0 to 400 feet 0 to 4000 feet
c. Radar		
Search	AN/APS-19A	*Horizon
d. Identification		
IFF radio	AN/APX-2	*Horizon

*These ranges are approximate and depend upon altitude, existing conditions, ground equipment, etc.

4–63. MASTER RADIO CONTROL CONSOLE. The "MASTER" radio control console (figure 1–5, reference 10) is on the right-hand control console panel and contains an on-off switch protected by a guard marked "RADIO-MASTER," and the "COMM VOLUME" control. The switch controls the primary 28-volt d-c input to all of the various units of the electronic equipment.

4–64. OPERATING INSTRUCTIONS.

4–65. ON ENTERING THE COCKPIT.

a. Connect the microphone and headset cord to the personnel gear receptacle (figure 1–3, reference 31). As a secondary provision, it is possible to connect the microphone and headset cord to the CX 922/AR coil cord set on the seat back at the pilot's left shoulder.

WARNING

Make certain that the plugs are fully engaged.

b. After the engine is running and the generators are charging properly (1500 rpm or over) or with an external 24-volt d-c power source connected, turn the radio master switch "ON" to furnish power to all electronic equipment. Adjust the volume control as necessary. Allow approximately one minute for the equipment to warm up.

c. The MK 3 Mod 3 bomb director equipment should be tested before take-off and adjustments made for the type of missile to be released. This should be done by the ground crew in accordance with procedures given in "The Operator's Manual for Bomb Director MK3 Mod 3." All other equipment should be checked as noted in the following paragraphs.

d. The pilot should acquaint himself with all pre-set controls and equipment and not try to readjust them during flight.

4-66. VHF RADIO EQUIPMENT.

4-67. GENERAL. The AN/ARC-1 VHF radio provides two-way voice radio communication between the airplane and other aircraft, ships or ground stations. The RF-18/ARC-1 transmitter-receiver is pretuned for nine main channel frequencies in the 116.1 to 140.58 megacycle band.

4-68. CONTROLS. The C-115/ARC-1 control console (figure 1-5, reference 9) marked "VHF" is on the right-hand control console. It contains a nine-position rotary switch marked "CHAN SEL" and a three-position rotary switch marked "GUARD-BOTH-MAIN T/R." The latter switch permits operation on the guard channel, the selected main channel, or both channels simultaneously.

4-69. OPERATION OF VHF RADIO.

4-70. RECEPTION.

a. Advance the radio volume control on the "MASTER" console for normal reception.

b. Turn the "GUARD-BOTH-MAIN T/R" switch on the "VHF" control console to "BOTH" and rotate the "CHAN SEL" switch to the desired channel.

c. At the conclusion of reception, reduce the volume as necessary by means of the radio volume control.

4-71. TRANSMISSION.

a. Turn the "GUARD-BOTH-MAIN T/R" switch on the "VHF" control console to "MAIN T/R" and rotate the "CHAN SEL" switch for transmission on any one of the nine main channels.

b. Commence transmission by pressing the throttle switch.

4-72. SIMULTANEOUS RECEPTION. For simultaneous reception with the range and homing radios, see paragraph 4-82.

4-73. RANGE RADIO EQUIPMENT.

4-74. GENERAL. The AN/ARC-5 range radio equipment provides radio telephone or MCW (modulated continuous wave) reception in the low frequency range. It is used principally for navigation purposes. The R-23/ARC-5 receiver receives voice or MCW signals in the frequency range from 190 to 550 kilocycles.

4-75. CONTROLS. The range radio control console (figure 1-5, reference 11) marked "RECVR" is on the right-hand control console. The console incorporates a sensitivity control marked "SENS," a dial calibrated for the frequency range, and a crank which rotates the dial. Automatic volume control is an integral part of the range receiver; however, the "SENS" control varies the RF gain and can be used to cutout the range radio audio by turning it to the extreme counterclockwise position.

4-76. OPERATION OF RANGE RADIO.

a. Select desired frequency on the "RECVR" control console.

b. Adjust "SENS" control for normal operation.

CAUTION

This control should be set for the minimum required for reception to avoid incorrect course indications.

c. When operation is concluded, turn the "SENS" control to a minimum.

4-77. SIMULTANEOUS RECEPTION. For simultaneous reception with the VHF and homing radios, see paragraph 4-82.

4-78. HOMING RADIO EQUIPMENT.

4-79. GENERAL. The AN/ARR-2A homing radio provides radio telephone or MCW (modulated carrier wave) reception on any one of the six pre-set frequency-modulated channels for homing purposes. The original signal (at the transmitter) is impressed on another signal in the frequency band between 540 and 830 kilocycles (called the modulation frequency). This in turn modulates a carrier frequency between 234 and 258 megacycles to produce the radiated signal. The R-4A/ARR-2A receiver demodulates the signal in reverse order. The preset channels may be selected by remote control. When the receiver is used for navigation, a beat oscillator produces an audible beat note. When used for reception of the voice modulation, the beat note oscillator is cut out.

4-80. CONTROLS. The homing radio control console (figure 1-5, reference 13) marked "NAVIG" is on the right-hand control console panel. The console contains the sensitivity control marked "SENS," the selector switch marked "PITCH" and the channel selector marked "CHAN SEL." The "SENS" control with the indicated position "INCREASE OUTPUT" adjusts the sensitivity of the receiver by varying the RF gain. The "PITCH" control is used to connect a beat frequency oscillator into the circuit for code reception when the switch is set to "NAV" and to disconnect it from the circuit when the switch is set to "VOICE." The control when set to "NAV" also varies the tone of the beat frequency oscillator.

4-81. OPERATION OF HOMING RADIO.

a. Turn "CHAN SEL" control on the "NAVIG" control console to the assigned channel number.

b. Turn "PITCH" control to "NAV."

c. Adjust the "SENS" control to produce a usable weak signal, or if the desired signal cannot be heard, to a fairly strong background hiss.

d. If a signal is present, adjust the "PITCH" control to produce a pleasing audible tone.

e. Readjust the "SENS" control to keep the signal at the lowest usable level to avoid wrong course indications.

4-82. SIMULTANEOUS RECEPTION. For simultaneous reception of the VHF, range and homing radios, proceed as follows:

a. With all three sets in operation, adjust the controls on the "RECVR" and "NAVIG" consoles.

b. Adjust the "COMM VOLUME" control on the "MASTER" console as required.

c. The "GUARD-BOTH-MAIN T/R" switch on the "VHF" console should be in the "BOTH" position so that the guard and main T/R channels will be monitored simultaneously.

d. The outputs of all three receivers are now being fed into the headphones simultaneously.

4-83. RADIO ALTIMETER EQUIPMENT.

4-84. GENERAL. The AN/APN-1 radio altimeter gives indication of the altitude above the terrain, for navigational purposes.

4-85. RADIO ALTIMETER INDICATOR. The ID-14A/APN-1 radio altimeter indicator (figure 1-4, reference 5) is installed on the cockpit instrument panel. Two control switches are incorporated at the face of the instrument: the power switch marked "ON," which controls the power input to the RT-7A/APN-1 radio altimeter transmitter-receiver located in the radio compartment; and a "RANGE" switch which selects the desired altitude (low or high) range. The numerals 1, 2, 3 and 4, indicating the altitude for the low range in hundreds of feet, and 10, 20, 30, and 40, also in hundreds of feet for the high range, are visible through four windows on the face of the instrument. Therefore, the full scale reading for the low range is 400 feet and the full scale reading for the high range is 4000 feet.

4-86. RADIO ALTIMETER CONTROL CONSOLE. The "ALTITUDE LIMIT SWITCH" (figure 1-4, reference 5) is on the right-hand control console panel. The switch operates in conjunction with the limit indicating light and the range switch on the indicator. The switch is preset to any altitude within range of the indicator; the setting determines the altitudes at which the indicating light will function.

4-87. RADIO ALTIMETER LIMIT INDICATING LIGHT. This limit indicating light (figure 1-4, reference 8) is installed at the center of the instrument panel. This amber light illuminates when the airplane is at a lower altitude than that preset on the limit switch.

4-88. OPERATION OF RADIO ALTIMETER EQUIPMENT.

a. Turn power control switch clockwise.

b. Allow one minute for tubes to heat and observe that the indicator has moved from its sub-zero stop position to some other position indicating that the equipment is energized.

CAUTION

When the airplane is resting on the ground, the indicator pointer may not indicate zero altitude.

c. Set the "RANGE" switch on the indicator to show the desired altitude range.

d. Set the limit switch for the altitude at which the limit indicator light will light.

WARNING

The HIGH RANGE of the altimeter must never be used when flying at altitudes within the LOW RANGE or when landing.

e. To stop the radio altimeter equipment, turn the power control switch counterclockwise.

4-89. SEARCH RADAR EQUIPMENT. Information on the AN/APS-19A search radar equipment will be added when available.

4-90. IFF RADIO EQUIPMENT.

4-91. GENERAL. The AN/APX-2 IFF radio provides a means of receiving interrogation signals and automatically responding or transmitting in answer to the interrogation coded identification signals. In conjunction with the radar equipment installed in the airplane, it provides a means of interrogating other aircraft. A destructor circuit is contained in the IFF unit.

4-92. CONTROLS. The "IFF" radio control console (figure 1-5, reference 15) is on the right-hand console panel. The master control switch places the equipment in operation when turned clockwise from "OFF" to "NORM," "INT ONLY," "ROOSTER," or "EMERGENCY." The interrogation switch marked "INT" is normally left in the "OUT" position. It is moved to "CONT" or held at "TMPRY" when the pilot wishes to interrogate unidentified craft whose presence he suspects or which has been detected by radar. The "G-BAND" switch is also normally in the "OUT" position. It may be thrown to "CONT" in conformity with specific orders governing the use of the "G-BAND" transponder. The switch marked "CODE" selects one of the six code combinations for transmission. A guard latch adjacent to the "CODE" switch is pushed in order to rotate the switch to

"DESTRUCT" for destruction of the unit to prevent the equipment's falling into enemy hands.

4–93. OPERATION OF IFF EQUIPMENT.

4–94. TO START IFF EQUIPMENT. Rotate the master control switch on the "IFF" console clockwise away from the "OFF" position and set it in the desired operating position.

4–95. TO SET SELECTOR SWITCH. Rotate the "CODE" switch to the position designated by the Commanding Officer. Unless otherwise designated, it is set and left in the position "1."

4–96. FOR G-BAND OPERATION. Throw the "G-BAND" switch to the "ON" position.

4–97. FOR INT OPERATION. Throw the "INT" switch to "CONT" or hold it momentarily in the "TMPRY" position.

4–98. FOR ROO OPERATION. Rotate the master control switch to the "ROOSTER" position. (This should be done only by specific direction of the Commanding Officer and only if a specified ROO adjustment has been made inside the transmitter-receiver unit by a maintenance crew.)

4–99. TO DESTROY OPERATION. (See paragraph 3–37.).

4–100. TO DESTROY THE TRANSMITTER-RECEIVER UNIT. (See paragraph 3–37.)

4–101. WINDSHIELD DEGREASING SYSTEM.

4–102. GENERAL. A windshield degreasing system is provided for improved visibility. A momentary contact control switch (figure 1–4, reference 23) is located on the right-hand side of the instrument panel. The one pint of degreasing fluid provided, permits approximately 30 seconds of continuous degreasing. However, for normal degreasing, only a few seconds of operation at a time are required.

APPENDIX I
OPERATING CHARTS

A–1. FLIGHT PLANNING.

A-2. FLIGHT OPERATION CHARTS. The following pages contain charts to be used as a guide to the planning of operations. Charts provided are a Take-off, Climb, and Landing Chart and a set of Flight Operation Instruction Charts which covers the probable gross weight range for the stated configuration.

A-3. GENERAL.

a. The methods of computing flight time, fuel requirements, and range vary, depending on the type of operation and mission planned. These instructions cannot possibly cover all the types of possible operation, but they do cover the more common types likely to be encountered, as for example, simple continuous flight at fairly constant power or a bombing mission with allowances for combat operation.

b. The Flight Operation Instruction Charts have been set up so that ranges in Column I are for Maximum Continuous (Normal Rated) Operation, which gives the maximum airspeed possible with an indefinite time limit on the engine. Progressively greater range is obtained as one moves from Column I toward Column V with a corresponding decrease in airspeed.

c. Within the limits of the chart, airspeed is obtained at a sacrifice in range, and in a like manner, range is increased with a sacrifice in airspeed. It should be noted that the fuel required and the flying time for a given mission depend mainly on the airspeed desired. By selecting a higher altitude, a higher true airspeed is obtained, and the flight time is shortened. This will not affect the range, since all power settings listed within a column are set up to approximately the same air miles per pound of fuel at each altitude.

d. The approximate airspeed desired is determined by weighing the urgency of the mission against the range required.

A-4. MAXIMUM ENDURANCE OPERATION. If it is desired to operate the airplane at the conditions for minimum fuel consumption (maximum endurance) the airplane should be flown at an indicated airspeed of 125 knots for a gross weight of 14,000 lbs. or 110 knots for 12,000 lbs. It is recommended that 1400 rpm be used and the manifold pressure adjusted to provide the power necessary for the above flight speeds. This engine speed may not be sufficient to supply full generator load, therefore, unnecessary electrical loads should be turned off. Endurance is greatest at sea level and diminishes with altitude so that the lowest practical altitude should be used if maximum endurance is required. In the event a higher altitude is specified, the above indicated airspeeds should still be used in order to assure the greatest endurance at the given altitude.

A-5. USE OF THE CHARTS. The simplest type of mission to plan is one in which the flight is continuous at constant altitude, and the desired cruising power and airspeed are reasonably constant. This is known as a "single stage flight." An example of the use of the charts for this type of mission appears at the bottom of each Flight Operation Instruction Chart; however, the following general information may be of value.

a. Assuming the range to be flown is known, choose the altitude at which the flight is to be made. The main factors in the choice of altitude are weather conditions, oxygen requirements, and the approximate true airspeed desired.

b. Enter the Climb Data Chart (figure A-7) at the chosen altitude and the approximate gross weight of the airplane before take-off, and read the fuel used in climb to this operating altitude.

Note

Allowances have been made in the Climb Data Chart for warm-up and take-off as well as fuel used in climb.

c. Determine the fuel reserve desired and add this to the climb allowance. *No allowances have been made in the Flight Operation Instruction Charts for wind, navigational error, or other contingencies. No allowance has been made for combat or formation flight. The allowances to be made for each of these items will be dictated by local doctrine.*

d. Add allowances made in (b) and (c), and subtract this total allowance from the fuel available in the airplane before starting the engines. The result is the value to be used in entering the chart.

e. Select the appropriate Flight Operation Instruction Chart corresponding to the approximate gross weight of the airplane before take-off and to the external load items carried. Alternate external loadings, if applicable, are listed in the notes at the bottom of each chart.

f. Find the figure in the fuel column of the chart equal to (or just below) the amount of fuel determined in (d) to be available for flight.

g. Read horizontally to the right or left and select a range value equal to (or just above) the number of air miles (with no wind) to be flown.

h. Move vertically down the column, and opposite the chosen altitude, read the RPM, M.P., Mixture setting, and Blower setting. The airplane may be flown using values contained under operating data in any column to the right; however, this will result in the mission being accomplished at a sacrifice in airspeed but with an increase in fuel economy.

A-6. A little more complex, but very common, type of operation is one for which the airplane gross weight is considerably higher when cruising out than when cruising back. This is because of bombs dropped, empty drop tanks released, and the large weight of fuel consumed during cruise out on long missions. In such a problem, the following general comments may be helpful.

a. The appropriate Flight Operation Instruction Chart corresponding to the approximate gross weight and external load items for each phase of the mission (cruise out and cruise back) should be for that phase.

b. In making a fuel allowance for climb to cruise back, the value taken from the Climb Chart of the cruise back altitude may be decreased by 316 lb., the amount of the warm-up and take-off allowance.

c. Fuel used in climb from one altitude to another may be obtained by subtracting the "fuel used" entries in the Climb Chart for the two altitudes and at the approximate gross weight.

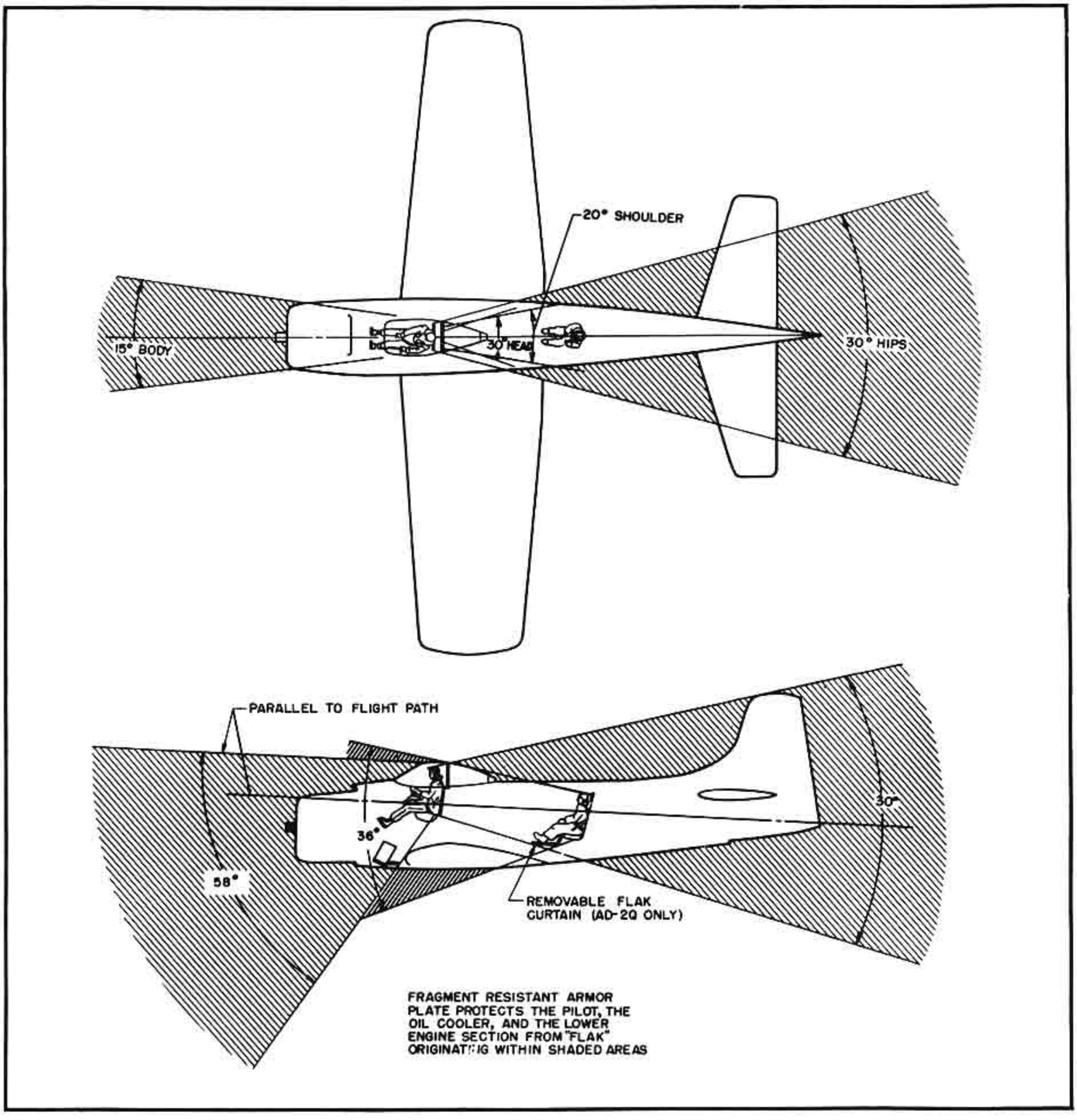


Figure A-1. Protection from Gunfire Diagram

Flaps Down — Gear Down

I.A.S. (Knots)	Power On	Correction (Knots)	Power Off	Correction (Knots)
70	Deduct	3	Add	1
80	Deduct	3	Add	1
90	Deduct	2	Add	0
100	Deduct	2	Add	0
110	Deduct	2	Add	0
120	Deduct	3	Add	0
130	Deduct	5	Add	1

Flaps Up — Gear Up

I.A.S. (Knots)		Correction (Knots)
100	Add	3
150	Add	2
200	Add	3
250	Add	4
300	Add	4
350	Add	5
400	Add	6

NOTE

These calibrations represent the airspeed position error and give the corrected indicated airspeeds for a given reading of the cockpit airspeed indicator assuming zero scale error for the instrument itself.

Figure A-2. Airspeed Installation Correction Table

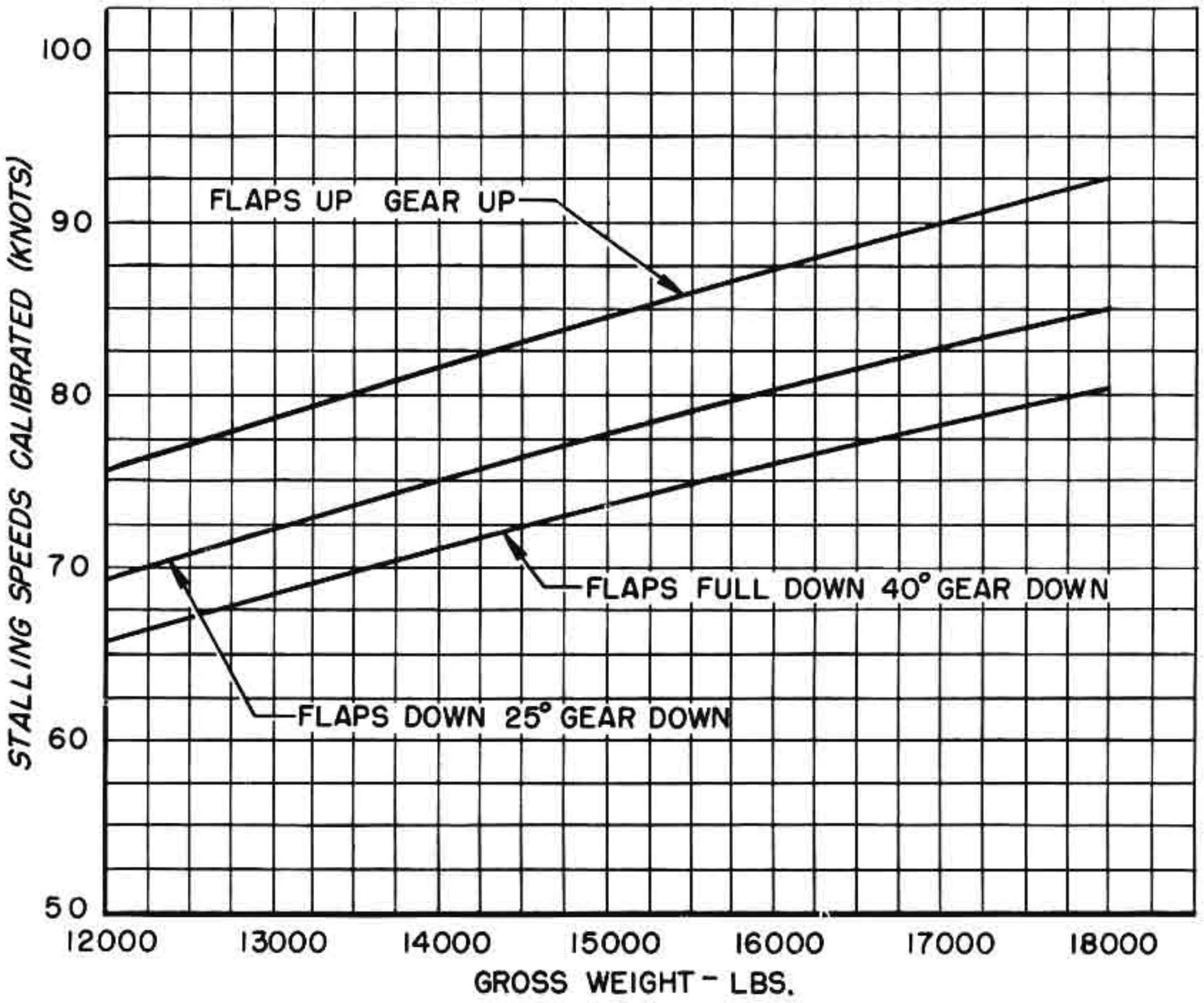


Figure A-3. Stalling Speed vs. Gross Weight Relationships

POWER PLANT CHART

AIRCRAFT MODEL	PROPELLER	ENGINE MODEL
AD-4	AERO PRODUCTS A-642-C8/M20A-162-0	R3350-26WA

GAUGE READING	FUEL PRESS.	OIL PRESS	OIL[5] TEMP. (REAR)	COOLANT TEMP.		OIL[1] CONS.
DESIRED	20	70	85			
MAXIMUM	21	75	95			
MINIMUM IDLING	19 13	65 15				

MAXIMUM PERMISSABLE DIVING RPM: 3120
MINIMUM RECOMMENDED CRUISE RPM: 1400

OIL GRADE: 1120 SPEC AN-O-8
FUEL GRADE: 115/145 SPEC AN-F-48

WAR EMERGENCY (COMBAT EMERGENCY)			MILITARY POWER[6] (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED[7] (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE[8] (NORMAL OPERATION)		
MINUTES			30 MINUTES[4]			TIME LIMIT			UNLIMITED			UNLIMITED		
			260° C			MAX. CYL. HD. TEMP.			245° C			230° C		
			NORMAL 2900 (LOW) 2600 (HIGH)			MIXTURE			NORMAL 2600			NORMAL 2200		
MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Lbs/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Lbs/Min	STD. TEMP. °C	R. P. M. PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL[3] LBS PH	MANIF. PRESS.	SUPER-CHARGER	FUEL[3] LBS PH
						-55.0	40,000 FT.	-67.0						
						-55.0	38,000 FT.	-67.0						
						-55.0	36,000 FT.	-67.0						
						-52.4	34,000 FT.	-62.3						
						-48.4	32,000 FT.	-55.1						
			FT	HIGH	14.3	-44.4	30,000 FT.	-48.0	FT	HIGH	858			
			FT	HIGH	16.5	-40.5	28,000 FT.	-40.9	FT	HIGH	990			
			FT	HIGH	19.2	-36.5	26,000 FT.	-33.7	FT	HIGH	1155			
			FT	HIGH	22.3	-32.5	24,000 FT.	-26.5	FT	HIGH	1347	29	HIGH	705
			FT	HIGH	25.8	-28.6	22,000 FT.	-19.4	FT	HIGH	1547	29	HIGH	690
			FT	HIGH	28.7	-24.6	20,000 FT.	-12.3	45.5	HIGH	1562	FT	LOW	623
			51	HIGH	29.8	-20.7	18,000 FT.	- 5.2	45.5	HIGH	1527	FT	LOW	685
			FT	LOW	31.5	-16.7	16,000 FT.	2.0	FT	LOW	1312	FT	LOW	768
			FT	LOW	34.4	-12.7	14,000 FT.	9.1	FT	LOW	1530	31.5	LOW	877
			FT	LOW	37.8	- 8.8	12,000 FT.	16.2	FT	LOW	1747	31.5	LOW	852
			FT	LOW	38.6	- 4.8	10,000 FT.	23.4	45.0	LOW	1883	31.5	LOW	823
			53.5	LOW	38.8	- 0.8	8,000 FT.	30.5	45.0	LOW	1845	31.5	LOW	797
			53.5	LOW	38.5	3.1	6,000 FT.	37.6	45.0	LOW	1800	31.5	LOW	767
			53.5	LOW	38.2	7.1	4,000 FT.	44.7	45.0	LOW	1753	31.5	LOW	740
			53.5	LOW	37.8	11.0	2,000 FT.	51.8	45.0	LOW	1713	31.5	LOW	714
			53.5	LOW	37.5[9]	15.0	SEA LEVEL	59.0	45.0	LOW	1660	31.5	LOW	688

GENERAL NOTES

(1) OIL CONSUMPTION: MAXIMUM U.S. QUART PER HOUR PER ENGINE.
(2) Lbs/Min: APPROXIMATE U.S. LBS PER MINUTE PER ENGINE.
(3) LBS PH: APPROXIMATE U.S. LBS PER HOUR PER ENGINE.
F.T.: MEANS FULL THROTTLE OPERATION.
VALUES ARE FOR LEVEL FLIGHT WITH RAM.

FOR COMPLETE CRUISING DATA SEE APPENDIX I
NOTE: TO OBTAIN U.S. GALLONS (GPH) DIVIDE FUEL IN LBS (LBS PH) BY 6.

TAKE-OFF CONDITIONS:

53.5 IN. Hg. MP/2900 RPM/RICH MIXTURE/MAX CYLINDER HEAD TEMPERATURE 260°C

CONDITIONS TO AVOID:

NONE

SPECIAL NOTES

(4) THIRTY MINUTES is allowable provided cylinder temperature never exceeds 260°C.
(5) For correct front oil pressure readings refer to data plate on engine nose section.
(6) During military power operation, shift to HIGH blower when manifold pressure drops to 41.0" at full throttle in LOW blower.
(7) During normal rated power operation, shift to HIGH blower when manifold pressure drops to 35.5" at full throttle in LOW blower.
(8) During maximum cruise power operation, shift to HIGH blower when manifold pressure drops to 25.0" at full throttle in LOW blower.
(9) Fuel consumption at take-off conditions.

ALL FUEL CONSUMPTIONS ARE BASED ON FLIGHT TEST AND INCREASED 5%.

DATA AS OF 1 MAY 1949 BASED ON CONTRACTOR'S FLIGHT TEST, AD-1 AIRPLANE NO. 09195, AND BUREAU FLIGHT TEST, XBT2D-1 AIRPLANE NO. 09091

Figure A-4. Power Plant Chart

ALL DATA BASED ON FLIGHT TEST, MAY 22, 1948
R-3350-26W ENGINE NO. 76033
XBT2D-1 AIRPLANE NO. 09091

LOW BLOWER - WITH RAM

HIGH BLOWER WITH RAM

BRAKE HORSEPOWER

TAKE OFF: 56.5
MILITARY POWER
2900 RPM
2900 RPM - 53.5"
49.5"
NORMAL RATED POWER
2600 RPM
2600 RPM - 45.0"
2500 RPM - 40.5"
2400 RPM - 36.5"
2300 RPM - 33.5"
2200 RPM - 31.5" MAXIMUM CRUISE
2100 RPM - 30"
2000 RPM - 30"
1800 RPM - 30"
1600 RPM - 30"
1400 RPM - 30"
M.A.P. - IN HG.
41.0"*
35.5"*
31.5"*
28.5"*
26.0"*
25.0"*
PROP LOAD
FULL THROTTLE
SHIFT ALTITUDE (SEE NOTE)
MANIFOLD ABSOLUTE PRESSURE - IN HG.
STANDARD ALTITUDE - 1000 FT.

53.0"
MILITARY POWER
2600 RPM
2600 RPM - 51.0"
50.0"
NORMAL RATED POWER
2600 RPM
2600 RPM - 45.5"
2500 RPM - 40.0"
2400 RPM - 35.5"
2300 RPM - 31.5"
2200 RPM - 29" MAXIMUM CRUISE
2000 RPM - 29"
1800 RPM - 29"
1600 RPM - 29"
1400 RPM - 29"
M.A.P. - IN. HG.
PROP LOAD
FULL THROTTLE
MAN. ABS. PRESS IN. HG.
STANDARD ALTITUDE - 1000 FT.

R-3350-26W OPERATING CURVE

SUPERCHARGER RATIO - 6.46 & 8.67:1 GRADE 115/145 FUEL SPEC AN-F-48A
RICH MIXTURE FOR TAKE-OFF, APPROACH, LANDING, & ALL GROUND OPERATION.

NORMAL MIXTURE FOR ALL OTHER OPERATION PROVIDED CYLINDER HEAD TEMPERATURE DOES NOT EXCEED LIMITS.

*TO MAINTAIN MAXIMUM POWER AT SAME RPM AND HIGHER ALTITUDE FOR MAXIMUM CRUISE POWERS AND ABOVE SHIFT TO HIGH BLOWER WHEN MANIFOLD PRESSURE DROPS TO THIS VALUE FOR POWERS BELOW MAXIMUM CRUISE, SHIFT AT ALTITUDE INDICATED BY DOT-DASH LINE.

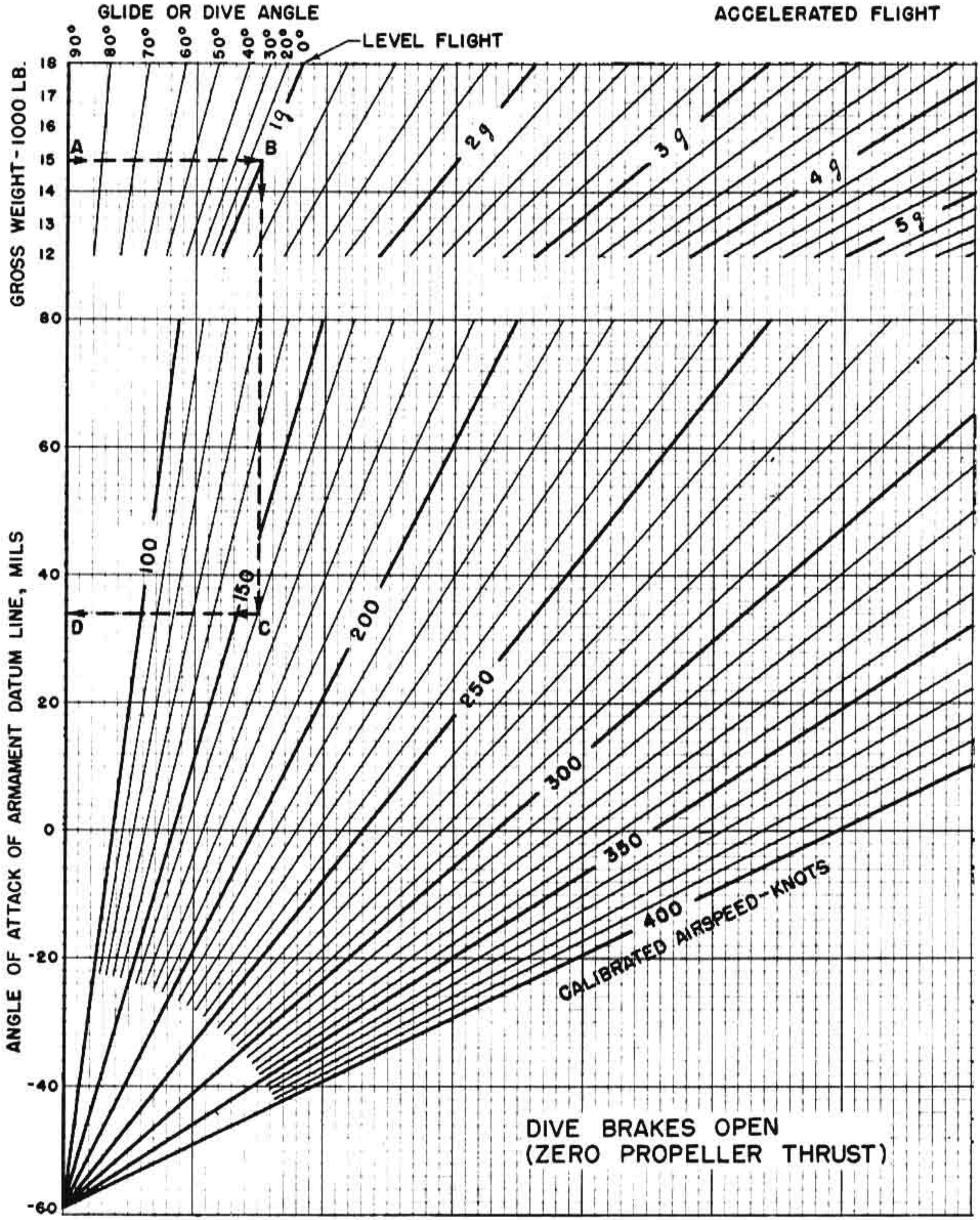


Figure A-6 (Sheet 1 of 2 Sheets). Angle of Attack Relationships (Diving Condition)

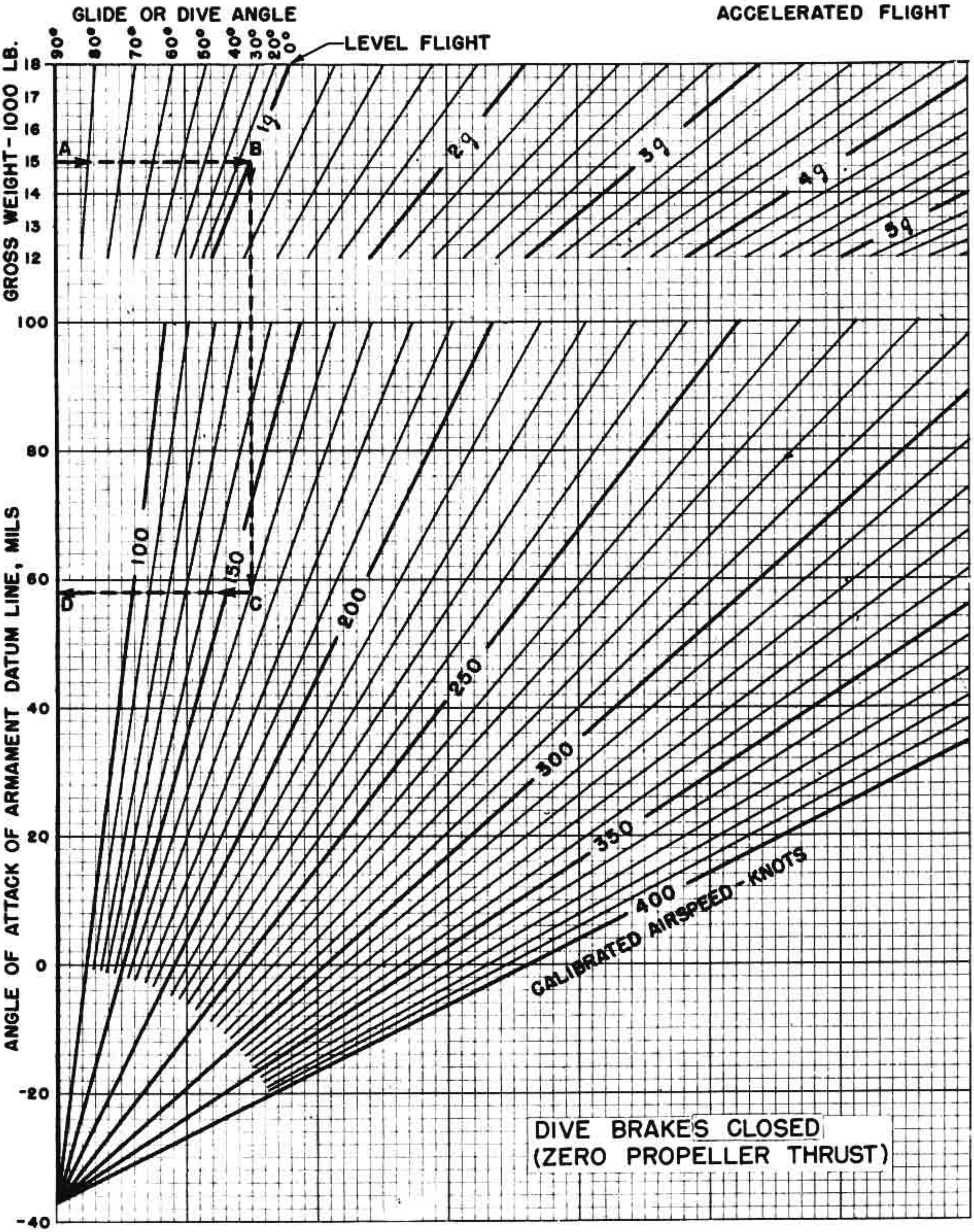


Figure A-6 (Sheet 2 of 2 Sheets). Angle of Attack Relationships (Cruising Condition)

AAFMC-527 6-2-48

AIRCRAFT MODEL
AD-4

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL
R3350-26WA
PROPELLER
AERO PRODUCTS A-642-GB/M20A-162-D

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
20,000		0	1165	1980	1350	2260	1720	2830	1225	2030	1425	2370	1825	2980	1400	2290	1655	2680	2180	3450
		15	810	1490	955	1740	1240	2200	850	1550	1010	1820	1315	2320	975	1730	1170	2060	1575	2680
		25	600	1200	720	1410	915	1810	630	1250	760	1470	970	1900	720	1380	880	1660	1160	2190
		35	420	940	515	1120	705	1450	440	970	545	1170	745	1520	505	1080	635	1320	890	1750
18,000		0	895	1550	1045	1780	1330	2210	935	1600	1095	1850	1405	2310	1050	1750	1240	2040	1625	2610
		15	610	1160	725	1350	940	1700	635	1190	755	1400	995	1770	710	1310	860	1560	1150	2000
		25	440	910	530	1080	700	1380	455	940	555	1120	740	1440	510	1030	630	1230	860	1620
		35	300	700	370	840	505	1090	310	730	385	880	535	1140	350	790	440	989	620	1280
16,000		0	665	1170	780	1350	985	1630	690	1210	810	1390	1035	1700	755	1300	880	1510	1165	1900
		15	435	880	525	1000	675	1250	450	890	545	1030	710	1280	495	950	590	1120	800	1450
		25	305	670	375	790	495	1000	315	690	390	810	520	1020	335	740	420	880	585	1140
		35	195	500	250	600	340	780	205	520	260	620	360	790	225	550	280	670	405	880
14,000		0	480	880	565	1010	720	1240	495	900	585	1030	745	1280	535	980	635	1100	820	1380
		15	300	630	365	730	475	920	310	650	375	750	495	940	335	690	410	800	545	1020
		25	200	480	250	560	335	720	210	490	260	570	350	740	225	520	280	610	385	790
		35	125	350	160	420	220	540	125	360	165	430	230	560	135	380	175	450	255	600

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F & 20%; 100°F & 20%; 125°F & 30%; 150°F & 40%
DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

(1) USE 40° FLAPS (FULL DOWN) FOR CARRIER TAKE-OFF.
(2) USE 25° FLAPS FOR TAKE-OFF OVER OBSTACLE.

NORMAL TAKE-OFF WITH 2900 RPM, 56.5 INCHES. 15-20% OF CHART VALUES.

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	AT SEA LEVEL BEST I.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL LBS. OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	AT 5000 FEET BEST I.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED LBS.	AT 10,000 FEET BEST I.A.S. MPH	AT 10,000 FEET BEST I.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED LBS.	AT 15,000 FEET BEST I.A.S. MPH	AT 15,000 FEET BEST I.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED LBS.	AT 20,000 FEET BEST I.A.S. MPH	AT 20,000 FEET BEST I.A.S. KTS	AT 20,000 FEET RATE OF CLIMB F.P.M.	AT 20,000 FEET FROM SEA LEVEL TIME MIN.	AT 20,000 FEET FROM SEA LEVEL FUEL USED LBS.	AT 25,000 FEET BEST I.A.S. MPH	AT 25,000 FEET BEST I.A.S. KTS	AT 25,000 FEET RATE OF CLIMB F.P.M.	AT 25,000 FEET FROM SEA LEVEL TIME MIN.	AT 25,000 FEET FROM SEA LEVEL FUEL USED LBS.
20,000		145	1540	316		145	1450	3.5	421		145	1040	7.5	545		140	750	13.0	699		135	380	22.0	920					
18,000		140	1970	316		140	1890	2.5	398		140	1470	5.5	486		140	1180	9.5	590		135	800	14.5	713		125	170	26.5	944
16,000		135	2570	316		135	2500	2.0	379		135	2050	4.0	445		135	1780	6.5	517		130	1420	10.0	593		120	770	14.5	684
14,000		135	3150	316		135	3100	1.5	369		135	2620	3.5	423		135	2330	5.5	473		130	1980	7.5	530		120	1300	10.5	590

POWER PLANT SETTINGS: (DETAILS ON FIG. 4-4) NORMAL RATED POWER
DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

FUEL USED INCLUDES WARM-UP & TAKE-OFF ALLOWANCE (316 LBS.)

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	POWER OFF KTS	POWER ON MPH	POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
18,000				100	1390	3000	1520	3240	1670	3520	1570	3170	1710	3440	1880	3730	3860	5470	4220	5940	4620	6470
16,000				90	1240	2700	1350	2920	1480	3170	1390	2840	1520	3090	1670	3350	3430	4900	3750	5320	4110	5790
14,000				85	1080	2410	1190	2600	1300	2810	1220	2550	1330	2750	1460	2980	3000	4330	3280	4700	3590	5110
12,000				80	930	2120	1010	2280	1110	2460	1040	2230	1140	2410	1250	2600	2570	3760	2810	4080	3080	4430

DATA AS OF 1 MAY 1949 BASED ON FLIGHT TEST AND CALCULATIONS

CHART VALUES ARE 100% OF NORMAL CAPABILITIES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN U.S. GALLONS, DIVIDE FUEL IN POUNDS BY 6.

RED FIGURES ARE CALCULATED AND BASED PARTIALLY ON FLIGHT TEST RESULTS

LEGEND

I.A.S. : INDICATED AIRSPEED
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

AAFMC-528 6-1-46

AIRCRAFT MODEL
AD-4
SCOUT CONFIGURATION

ENGINE R3350-26WA

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 14,000 LBS. TO 12,000 POUNDS

EXTERNAL LOAD ITEMS
AN/APS-19A RADAR

LIMITS	RPM	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB. P.H.
WAR EMERG.							
MILITARY POWER	2900	54.3	LOW	NORMAL	30	260°	2346
	2600	51.5	HIGH	NORMAL	30	260°	1800

FOR DETAILS SEE POWER PLANT CHART (FIG. A-2)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1). MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT **RANGE** VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB.) (NO WIND), POUNDS PER HR. (LB. P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). (2) TO OBTAIN U.S. GALLONS (OR G.P.H.): DIVIDE FUEL IN POUNDS (OR LB. P.H.) BY 6.

COLUMN I		FUEL LBS.	COLUMN II		COLUMN III		COLUMN IV		FUEL LBS.	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		2280	←		FULL INTERNAL FUEL				2280		
337	293	1964	588	511	905	786	1221	1060	1964	1332	1157
309	268	1800	539	468	829	720	1119	972	1800	1220	1060
258	224	1500	449	390	691	600	933	810	1500	1017	884
206	179	1200	359	312	553	480	746	648	1200	814	707
155	134	900	269	234	415	360	560	486	900	610	530
103	89	600	180	156	276	240	373	324	600	407	353
52	45	300	90	78	138	120	187	162	300	203	177

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(299 STAT. (.26 NAUT.) MI./LB.)						(461 STAT. (.40 NAUT.) MI./LB.)						(622 STAT. (.54 NAUT.) MI./LB.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2600	FT	NORMAL	1017	362	314	25000			NORMAL				2350	30.0	NORMAL	730	336	292	2170	FT	NORMAL	469	292	254	25000	1890	FT	NORMAL	335	245	213
2600	46.0		1493	371	322	20000	2500	41.0		1208	362	314	2450	28.0		725	334	290	1980	22.0		461	287	249	20000	1720	19.5		326	230	200
2600	47.0		1590	358	311	15000	2580	36.0		1173	351	305	2300	29.0		683	314	273	1860	23.0		417	259	225	15000	1620	20.5		303	213	185
2600	45.0		1796	358	311	10000	2410	36.5		1135	340	295	2140	30.0		640	295	256	1720	26.0		389	242	210	10000	1400	24.0		283	196	170
2600	47.5		1900	345	300	5000	2360	37.0		1073	321	279	2050	31.0		595	274	238	1500	27.5		359	223	194	5000	1400	24.5		272	187	162
2600	49.0		1900	327	284	S.L.	2350	38.0		992	297	258	1970	31.5		553	254	221	1430	29.0		333	207	180	S.L.	1400	25.0		254	173	150

SPECIAL NOTES

(1) SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING, NAMELY ALLOWANCES FOR WARM-UP, TAKE-OFF AND CLIMB (SEE FIGURE A-7) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) USE HIGH BLOWER ABOVE HEAVY LINE ONLY.

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

EXAMPLE

GIVEN: A GROSS WEIGHT OF 13,900 LBS.-WITH 2,280 LBS. OF FUEL.

DESIRED: RANGE OF 800 N.MI. WITH 10% RESERVE CRUISING AT 20,000 FT. ALTITUDE.

PROCEDURE: DETERMINE FUEL AVAILABLE FOR CRUISE BY SUBTRACTING TAKE-OFF AND CLIMB ALLOWANCES (FIGURE A-7) AND RESERVE FROM INITIAL FUEL: I.E. 2280 - 530 - 228 = 1522 LBS. AVAILABLE.
OPPOSITE 1500 LBS. ON TOP OF CHART NOTE THAT COLUMN IV GIVES 810 N.MI. RANGE.
CRUISE SETTINGS ARE GIVEN AT BOTTOM OF COLUMN, NAMELY 1080 RPM AND 22 IN. M.P., NORMAL MIXTURE, LOW BLOWER. THE TRUE AIR SPEED IS 249 KNOTS.

LEGEND

ALT.	PRESSURE ALTITUDE
M.P.	MANIFOLD PRESSURE
LB. P.H.	POUNDS PER HOUR
TAS	TRUE AIRSPEED
KTS.	KNOTS
S.L.	SEA LEVEL
F.T.	FULL THROTTLE

AAFSC-530 4-1-44

AIRCRAFT MODEL
AD-4
BOMBER CONFIGURATION
ENGINE R3350-26WA

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 16,000 LBS. TO 14,000 POUNDS

EXTERNAL LOAD ITEMS
1-2000 LB. BOMB, AN/APS-19A RADAR OR LOADINGS
SHOWN IN NOTE 3 BELOW

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. 4-4)
WAR EMERG.								
MILITARY POWER	2900	53.5	LOW	NORMAL	30	260	2346	
	2600	51.0	HIGH	NORMAL	30	260	1800	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB.) (NO WIND), POUNDS PER HR. (LB. P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND). TO OBTAIN U.S. GALLONS (OR G.P.H.): DIVIDE FUEL IN POUNDS (OR LB. P.H.) BY 6.

COLUMN I RANGE IN AIRMILES		FUEL LBS.	COLUMN II RANGE IN AIRMILES		COLUMN III RANGE IN AIRMILES		COLUMN IV RANGE IN AIRMILES		FUEL LBS.	COLUMN V RANGE IN AIRMILES	
STAUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		4080	← INTERNAL CAPACITY PLUS TWO 150 GALLON (1800 LB.) EXTERNAL DROP TANKS →						4080		
598	519	3764	952	828	1475	1280	1950	1694	3764	2059	1788
572	497	3600	911	792	1411	1224	1865	1620	3600	1969	1710
524	455	3300	835	726	1294	1122	1709	1485	3300	1805	1568
		3180	← INTERNAL FUEL CAPACITY PLUS ONE 150 GALLON (900 LB.) EXTERNAL DROP TANK →						3180		
477	414	3000	759	660	1176	1020	1554	1350	3000	1641	1425
429	373	2700	683	594	1058	918	1399	1215	2700	1477	1283
381	331	2400	607	528	941	816	1243	1080	2400	1313	1140
		2280	← INTERNAL FUEL CAPACITY →						2280		
312	271	1964	497	432	769	668	1017	884	1964	1074	933
286	248	1800	455	396	705	612	932	810	1800	985	855
238	207	1500	380	330	587	510	777	675	1500	820	713
191	166	1200	304	264	470	408	622	540	1200	656	570
143	124	900	228	198	352	306	466	405	900	492	428
95	83	600	152	132	235	204	311	270	600	328	285
48	41	300	76	66	117	102	155	135	300	164	143

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(253 STAT. (.22 NAUT.) MI./LB.)						(392 STAT. (.34 NAUT.) MI./LB.)						(518 STAT. (.45 NAUT.) MI./LB.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2600	FT	NORMAL	1017	333	289	25000			NORMAL				2430	FT	NORMAL	812	318	276	2240	FT	NORMAL	496	257	223	25000			NORMAL			
2600	46.0		1493	343	298	20000	2560	43.0		1339	339	294	2420	27.5		809	317	275	2140	24.0		534	277	240	20000	1920	21.5		424	237	206
2600	47.0		1590	333	289	15000	2550	35.5		1295	328	285	2380	31.0		766	300	260	2020	25.0		487	252	219	15000	1840	23.0		390	219	190
2600	45.0		1796	333	289	10000	2460	38.0		1264	320	278	2240	31.5		722	283	246	1850	27.0		453	235	204	10000	1650	25.5		360	202	175
2600	47.5		1900	320	278	5000	2440	40.0		1191	302	262	2130	32.0		673	264	229	1690	28.0		422	219	190	5000	1430	27.5		337	188	163
2600	49.0		1900	304	264	S.L.	2410	40.0		1114	282	245	2090	32.5		629	246	214	1590	29.5		390	202	176	S.L.	1400	28.5		320	175	152

SPECIAL NOTES

(1) SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING, NAMELY ALLOWANCES FOR WARM-UP, TAKE-OFF AND CLIMB (SEE FIGURE A-7) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) USE HIGH BLOWER ABOVE HEAVY LINE ONLY.

(3) THIS CHART MAY ALSO BE USED FOR OTHER LOADINGS WITHIN THIS WEIGHT RANGE WHICH HAVE APPROXIMATELY THE SAME EXTERNAL DRAG, FOR EXAMPLE:

(3) CONT'D.

(a) ONE 1000# BOMB, AN/APS-19A RADAR, AND ONE 150 GAL. (900 LB.) DROP TANK.
(b) TWO 1000# BOMBS.
(c) TWO 150 GAL. (900#) DROP TANKS AND AN/APS-19A RADAR.
(d) ONE TORPEDO AND AN/APS-19A RADAR.

(4) REFER TO SCOUT CONFIGURATION DIAGRAM FOR EXAMPLE OF CHART USAGE.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB. P.H. : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

AAFMC-528 8-1-48

AIRCRAFT MODEL
AD-4
LONG RANGE CONFIGURATION
ENGINE R-3350-26WA

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 18,000 LBS. TO 16,000 POUNDS

EXTERNAL LOAD ITEMS
1-2,000 LB. BOMB, 2-150 GAL. EXT. TANKS
OR LOADINGS SHOWN IN NOTE 3 BELOW

LIMITS	RPM	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB. P.H.
WAR EMERG.							
MILITARY POWER	2900	53.5	LOW	NORMAL	30	260	2346
	2600	51.0	HIGH	NORMAL	30	260	1800

FOR DETAILS SEE POWER PLANT CHART (FIG. A-5)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN **FUEL** COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT **RANGE** VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN, VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND **MIXTURE** SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB.) (NO WIND), POUNDS PER HR. (LB.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[2] TO OBTAIN U.S. GALLONS (OR G.P.H.), DIVIDE FUEL IN POUNDS (OR LB. P.H.) BY 6.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		LBS.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		LBS.	RANGE IN AIRMILES	
STAUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		4080	← INTERNAL FUEL CAPACITY PLUS TWO 150 GALLON (1800 LB) EXTERNAL DROP TANKS →						4080		
559	486	3764	975	847	1300	1129	1560	1355	3764	1647	1430
535	464	3600	932	810	1244	1080	1492	1296	3600	1576	1368
490	426	3300	355	742	1140	990	1368	1188	3300	1444	1254
		3180	← INTERNAL FUEL CAPACITY PLUS ONE 150 GALLON (900 LB) EXTERNAL DROP TANK →						3180		
446	387	3000	777	675	1037	900	1244	1080	3000	1313	1140
401	348	2700	699	608	933	840	1119	972	2700	1182	1026
356	310	2400	622	540	829	720	995	864	2400	1050	912
		2280	← INTERNAL FUEL CAPACITY →						2280		
312	271	2100	544	472	726	630	870	756	2100	919	798
267	232	1800	466	405	622	540	746	648	1800	788	684
223	194	1500	389	338	518	450	622	576	1500	656	570
178	155	1200	311	270	415	360	497	432	1200	525	456
134	116	900	233	202	311	270	373	324	900	394	342
89	77	600	155	135	207	180	249	216	600	263	228
45	39	300	78	68	104	90	124	108	300	131	114

MAXIMUM CONTINUOUS						PRESS	(.259 STAT. (.225 NAUT.) MI./LB.)						(.346 STAT. (.30 NAUT.) MI./LB.)						(.415 STAT. (.36 NAUT.) MI./LB.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2600	FT	NORMAL	1017	303	263	25000							2480	FT	NORMAL	822	284	246							25000						
2600	46.0	NORMAL	1493	319	277	20000	2520	41.5	NORMAL	1195	310	269	2560	29.5	NORMAL	848	293	254	2310	26.0	NORMAL	631	261	227	20000	2220	25.0	NORMAL	579	246	214
2600	47.0		1590	310	269	15000	2560	35.5		1167	302	263	2420	32.0		813	281	244	2190	27.0		597	248	215	15000	2100	26.0		525	227	197
2600	45.0		1796	311	270	10000	2410	36.0		1131	293	255	2270	32.5		777	268	233	2080	29.0		569	236	205	10000	1940	27.5		489	213	185
2600	47.5		1900	299	260	5000	2360	37.0		1067	276	240	2220	33.5		725	250	218	1960	30.0		533	221	192	5000	1810	28.5		454	199	173
2600	49.0		1900	284	247	S.L.	2340	38.0		995	258	224	2160	33.5		677	234	203	1870	30.5		494	205	178	S.L.	1670	29.5		410	180	156

SPECIAL NOTES

(1) SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING, NAMELY ALLOWANCES FOR WARM-UP, TAKE-OFF AND CLIMB (SEE FIGURE A-7) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) USE HIGH BLOWER ABOVE HEAVY LINE ONLY.

(3) THIS CHART MAY ALSO BE USED FOR OTHER LOADINGS WITHIN THIS WEIGHT RANGE WHICH HAVE APPROXIMATELY THE SAME EXTERNAL DRAG, FOR EXAMPLE:

(3) CONT'D.

(a) ONE 2000# BOMB, TWO 150 GAL. DROP TANKS (EMPTY), TWELVE 5 INCH HVAR ROCKETS.
(b) ONE 2000# BOMB AND TWO 1000# BOMBS.
(c) ONE 2000# BOMB, AN/APS-19A RADAR, ONE 150 GAL. DROP TANK (EMPTY), TWELVE 5 INCH HVAR ROCKETS.
(d) TWO 1000# BOMBS, TWELVE 5 INCH HVAR ROCKETS, ONE 150 GAL. DROP TANK (EMPTY).

(4) REFER TO SCOUT CONFIGURATION DIAGRAM FOR EXAMPLE OF CHART USAGE.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB. P.H. : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

AAFMC-528 8-1-48

AIRCRAFT MODEL
AD-4
LONG RANGE BOMBER CONFIGURATION
ENGINE R3350-26WA

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 20,000 LBS. TO 18,000 POUNDS

EXTERNAL LOAD ITEMS
ONE 2,000 LB. BOMB, SIX 250 LB. BOMBS AND TWO 150 GAL. FUEL TANKS OR LOADINGS SHOWN IN NOTE 3 BELOW.

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB.P.H.
WAR EMERG.							
MILITARY POWER	2900	53.5	LOW	NORMAL	30	260	2346
	2600	51.0	HIGH	NORMAL	30	260	1800

FOR DETAILS SEE POWER PLANT CHART (FIG. A-4).

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./LB.)(NO WIND), POUNDS PER HR. (LB.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[2] TO OBTAIN U.S. GALLONS (OR G.P.H.): DIVIDE FUEL IN POUNDS (OR LB.P.H.) BY 6.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		LBS.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		LBS.	RANGE IN AIRMILES	
STAUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		4080	← FULL INTERNAL FUEL PLUS TWO 150 GAL. EXTERNAL TANKS →						4080		
535	465	3764	867	753	1084	941			3764	1201	1043
512	445	3600	829	720	1036	900			3600	1148	997
469	408	3300	760	660	950	825			3300	1053	914
		3180	← FULL INTERNAL FUEL PLUS ONE 150 GAL. EXTERNAL TANK →						3180		
427	371	3000	691	600	864	750			3000	957	831
384	333	2700	622	540	777	675			2700	861	748
341	296	2400	553	480	691	600			2400	766	665
		2280	← FULL INTERNAL FUEL →						2280		
299	259	2100	484	420	605	525			2100	670	582
256	222	1800	415	360	578	450			1800	574	499
213	185	1500	345	300	432	375			1500	479	416
171	148	1200	276	240	345	300			1200	383	332
128	111	900	207	180	259	225			900	287	249
85	74	600	138	120	173	150			600	191	166
43	37	300	69	60	86	75			300	96	83

MAXIMUM CONTINUOUS						PRESS	(230 STAT. (.20 NAUT.) MI./LB.)						(288 STAT. (.25 NAUT.) MI./LB.)						(STAT. (NAUT.) MI./LB.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40,000																			40,000						
						35,000																			35,000						
						30,000																			30,000						
						25,000																			25,000						
2600	46.0	NORMAL	1515	293	255	20,000	2360	36.0	NORMAL	1243	286	248	2600	F.T.	NORMAL	904	260	226							20,000						
2600	47.0		1587	289	251	15,000	2600	F.T.		1235	284	247	2460	33.0		920	265	230							15,000	2360	30.5	NORMAL	751	240	208
2600	46.0		1772	294	255	10,000	2470	38.5		1220	281	244	2330	34.0		898	258	224							10,000	2220	31.0		695	228	198
2600	47.5		1923	283	246	5,000	2400	38.5		1155	266	231	2270	34.5		846	244	212							5,000	2080	31.0		614	208	181
2600	49.0		1907	270	235	S.L.	2380	39.0		1083	249	216	2260	35.5		788	227	197							S.L.	2000	31.5		572	198	170

SPECIAL NOTES

(1) SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING, NAMELY ALLOWANCES FOR WARM-UP, TAKE-OFF AND CLIMB (SEE FIGURE A-7) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) USE HIGH BLOWER ABOVE HEAVY LINE ONLY.

(3) THIS CHART MAY ALSO BE USED FOR OTHER LOADINGS WITHIN THIS WEIGHT RANGE WHICH HAVE APPROXIMATELY THE SAME EXTERNAL DRAG, FOR EXAMPLE:

(3) CONT'D.

(a) ONE 2 000 LB. BOMB, TWO 150 GAL. FUEL TANKS AND TWELVE 5 IN. HVAR ROCKETS.
(b) THREE 2,000 LB. BOMBS.
(c) ONE 2,000 LB. BOMB, TWO 1,000 LB. BOMBS AND TWELVE 5 IN. HVAR ROCKETS.
(d) THREE 1,000 LB. BOMBS AND TWELVE 250 LB. BOMBS.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
LB. P.H. : POUNDS PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.T. : FULL THROTTLE

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

AIRCRAFT MODEL
AD-4
ENGINE: R-3350-26WA

FLIGHT OPERATION INSTRUCTION CHART

MAXIMUM ENDURANCE

EXTERNAL LOAD ITEM:
AN/APS-19A RADAR

FUEL AVAILABLE LBS.	MAXIMUM ENDURANCE - HRS.						FUEL AVAILABLE LBS.
	14,000 LBS.			12,000 LBS.			
	SEA LEVEL	5000 FT.	10,000 FT.	SEA LEVEL	5000 FT.	10,000 FT.	
2280	← INTERNAL FUEL CAPACITY →						2280
2100	9.6	9.2	8.7				2100
1800	8.2	7.9	7.4				1800
1500	6.9	6.5	6.2				1500
1200	5.5	5.2	4.9	6.4	6.1	5.8	1200
900	4.1	3.9	3.7	4.8	4.6	4.3	900
600	2.7	2.6	2.5	3.2	3.1	2.9	600
300	1.4	1.3	1.2	1.6	1.5	1.4	300

OPERATING INSTRUCTIONS							
ALTITUDE	SEA LEVEL	5000 FT.	10,000 FT.	SEA LEVEL	5000 FT.	10,000 FT.	ALTITUDE
INDICATED AIRSPEED KTS.	125	125	125	110	110	110	INDICATED AIRSPEED KTS.
RPM	1400	1400	1400	1400	1400	1400	RPM
MIXTURE/BLOWER	NORMAL / LOW	NORMAL / LOW	NORMAL / LOW	NORMAL / LOW	NORMAL / LOW	NORMAL / LOW	MIXTURE/BLOWER
MP (APPROX) IN.Hg.	24.0	22.5	21.0	21.5	20.0	18.5	MP (APPROX) IN.Hg.
TOTAL LB. P.H.	218	229	243	188	196	207	TOTAL LB. P.H.

NOTES:

1. SINCE INDICATED AIR SPEED IS THE MOST IMPORTANT FACTOR IN DETERMINING ENDURANCE, IT IS RECOMMENDED THAT THE INDICATED AIR SPEEDS SHOWN BE MAINTAINED AND THE RPM AND MANIFOLD PRESSURE BE ADJUSTED AS NECESSARY TO HOLD THE SPECIFIED SPEEDS.
2. DUE TO THE LOW HORSEPOWER NEEDED FOR THESE FLIGHT CONDITIONS, ROUGH ENGINE OPERATION MAY BE EXPERIENCED AFTER PROLONGED PERIODS. POWER SHOULD THEN BE INCREASED FOR A SHORT TIME TO CLEAR ENGINE AFTER WHICH MAX. ENDURANCE FLIGHT MAY BE RESUMED.
3. MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF, AND CLIMB (SEE FIG. 8-1) PLUS ALLOWANCE FOR WIND AND RESERVE AS REQUIRED.

EXAMPLE:

IF, AFTER A MISSION HAS BEEN PARTIALLY COMPLETED, IT IS DESIRED TO FLY AT MAX. ENDURANCE, THE REQUIRED INFORMATION IS OBTAINED FROM THE CHART IN THE FOLLOWING MANNER. ASSUMING A FLIGHT AT 5000 FT. ALTITUDE, A GROSS WEIGHT OF 13,800 LBS. AND 1500 LBS. OF FUEL REMAINING, SELECT THE 5000 FT. ALTITUDE COLUMN UNDER THE 14,000 LB. WEIGHT COLUMN AT THE TOP OF THE CHART, AND ACROSS FROM 1500 LBS. OF FUEL, READ 6.5 HOURS ENDURANCE. THE PERTINENT OPERATING CONDITIONS ARE LISTED IN THE LOWER PORTION OF THE CHART, NAMELY: FLY AT 125 KNOTS I.A.S. USING 1400 RPM AND APPROXIMATELY 22.5 INCHES Hg. M.P., WHICH WILL RESULT IN A FUEL CONSUMPTION OF 229 LB. P.H.

LEGEND:

M.P. : MANIFOLD PRESSURE
LB. P.H. : POUNDS PER HOUR
IAS : INDICATED AIRSPEED
KTS : KNOTS