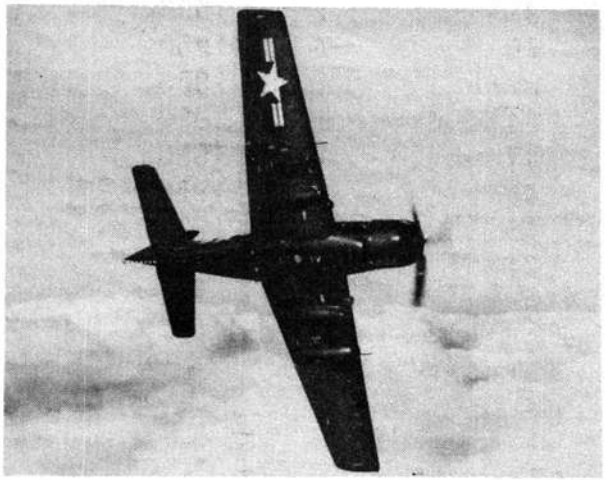
Pilot's Handbook

for

NAVY MODELS

AD-2, -2Q
AD-3, -3Q
AIRCRAFT



THIS PUBLICATION SUPERSEDES AN 01-40ALA-1
DATED 1 OCTOBER 1949

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

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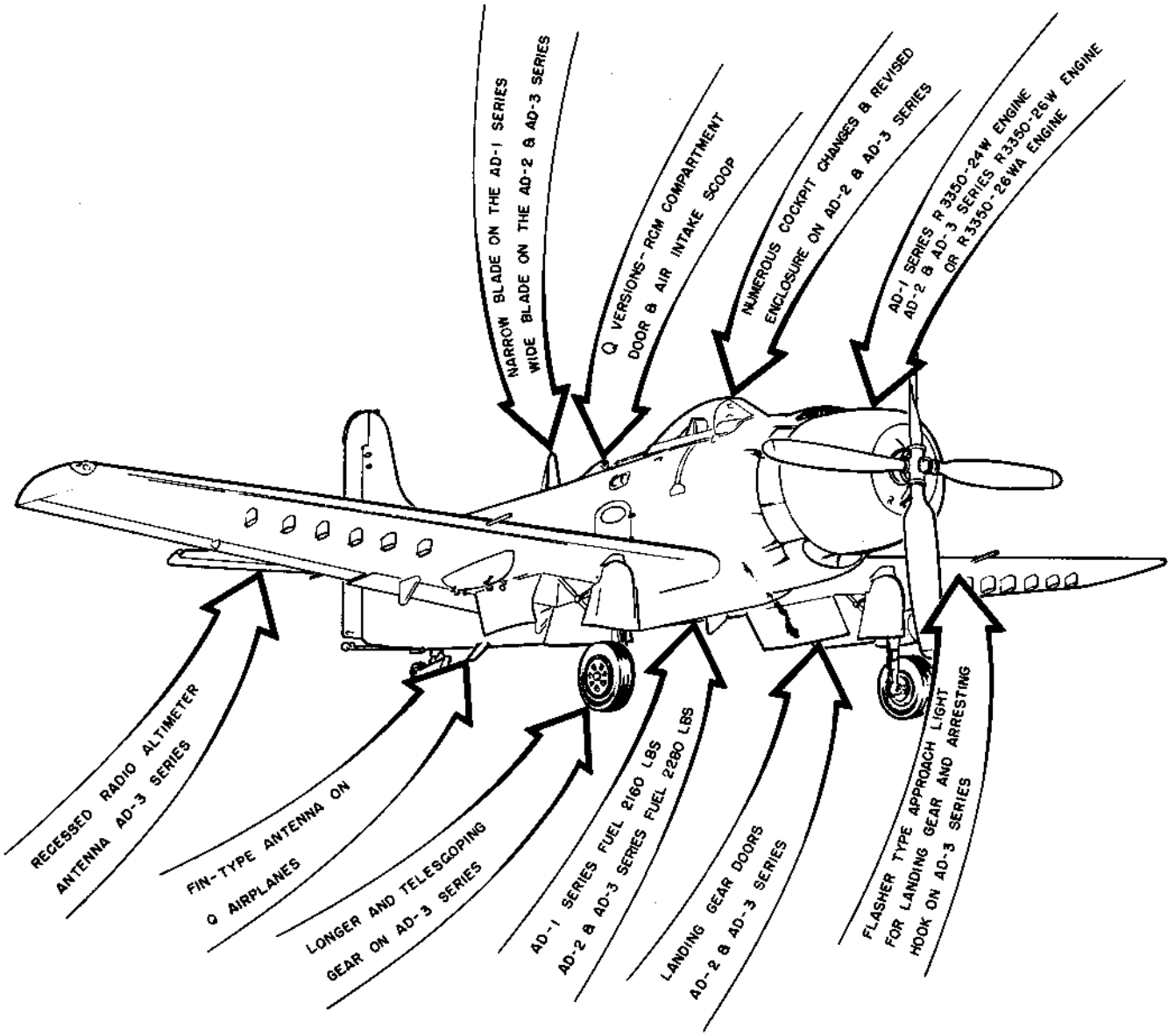
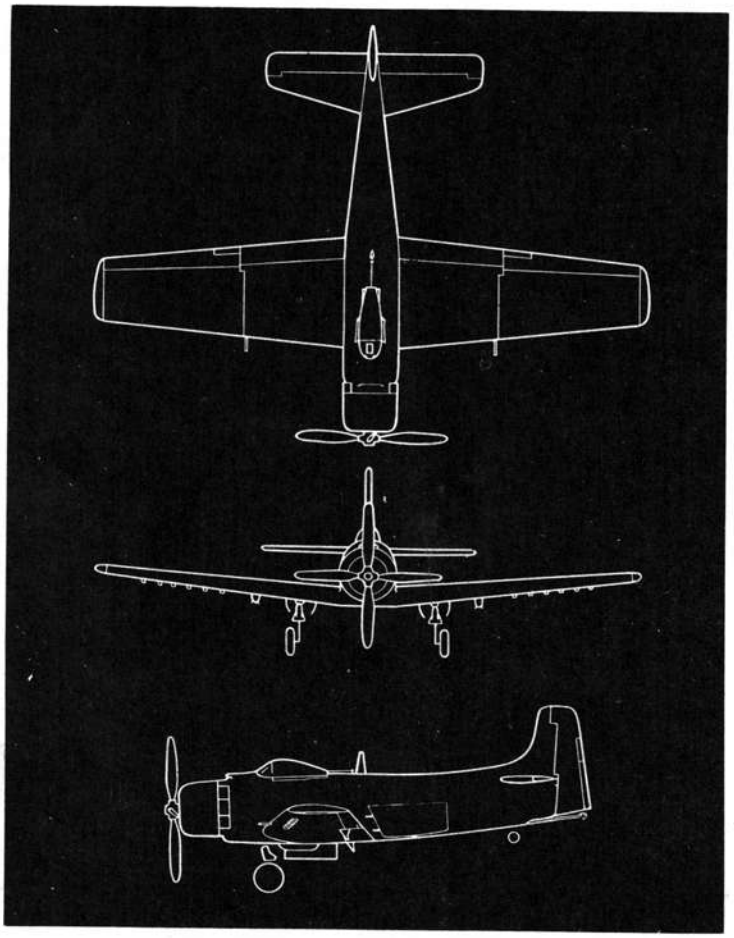
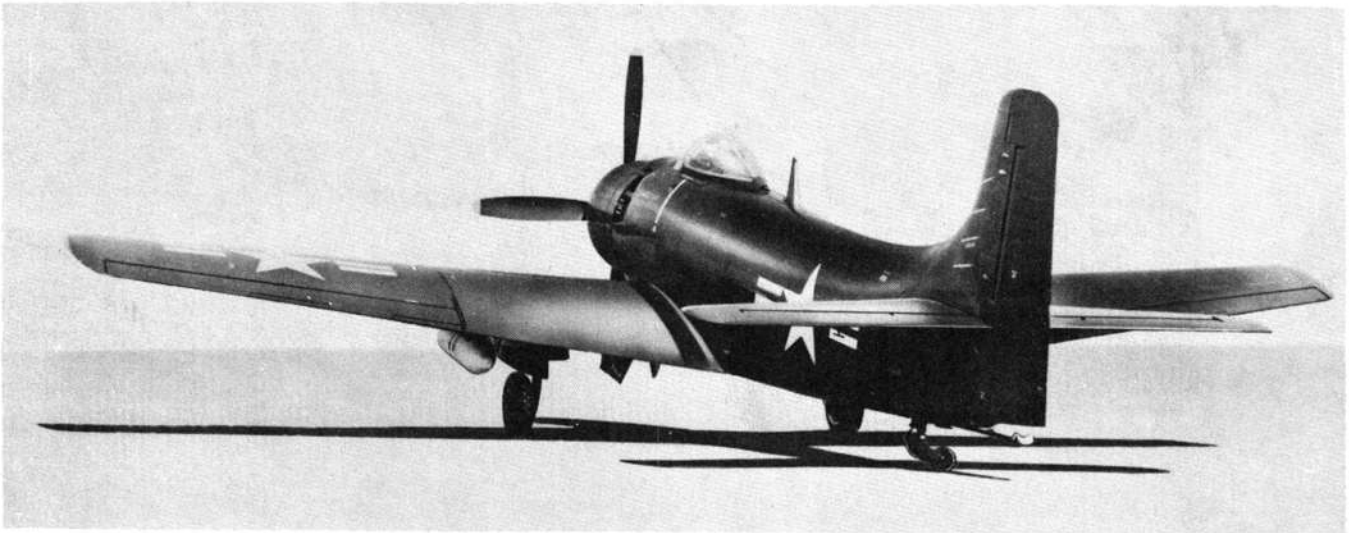
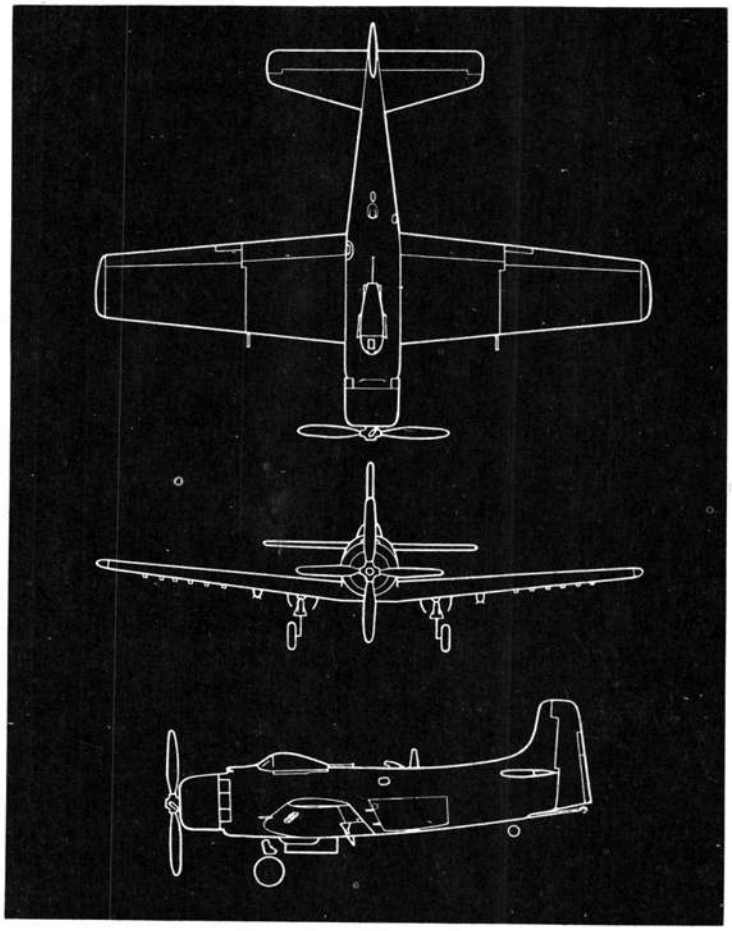


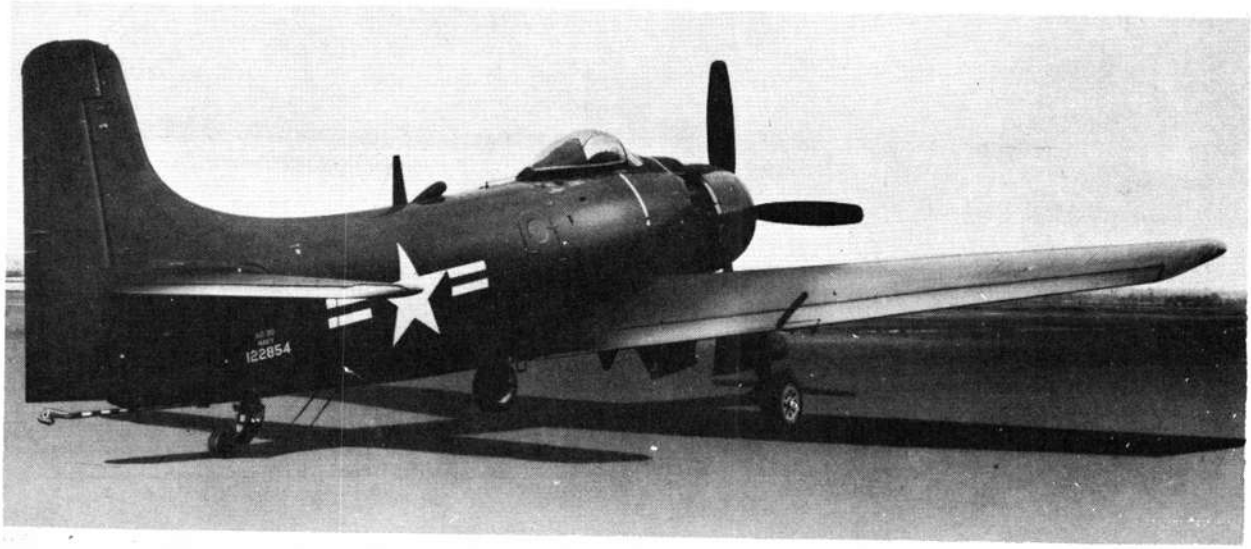
Figure 1-1. Comparison Diagram for Models AD-2 and AD-3 Series Airplanes



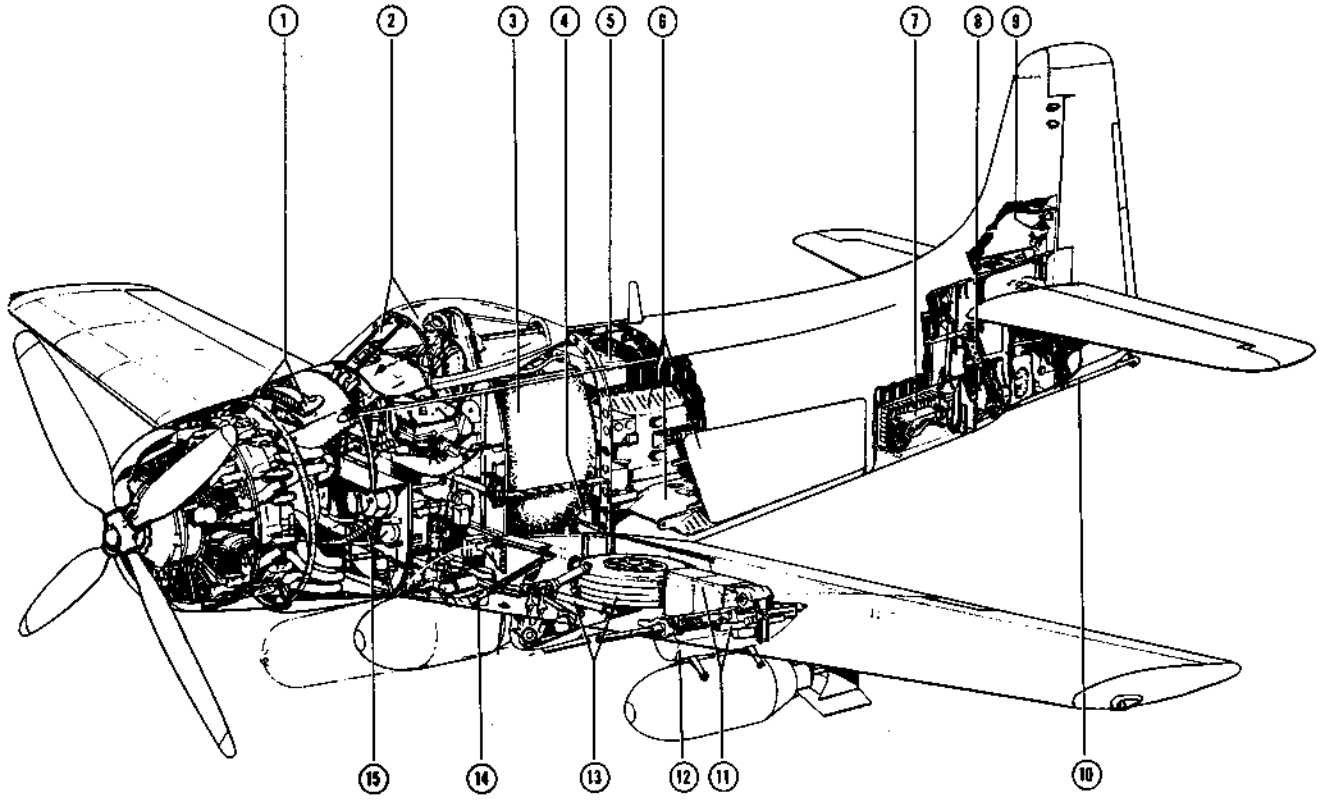


Model AD-2 or AD-3 Airplane
Figure 1-2 (Sheet 1 of 2 Sheets). Airplane Recognition



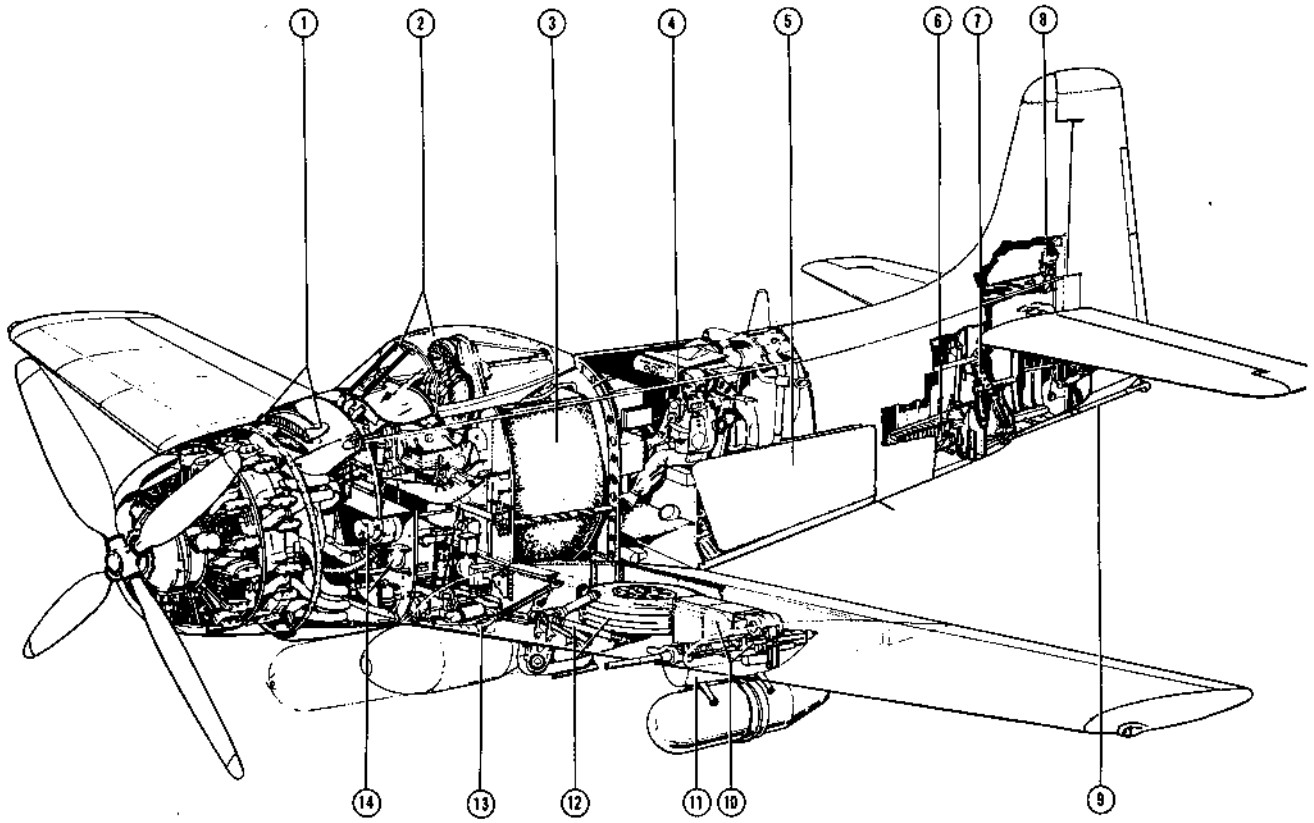


Model AD-2Q or AD-3Q Airplane
Figure 1-2 (Sheet 2 of 2 Sheets). Airplane Recognition



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

Model AD-2 or AD-3 Airplane
Figure 1-3 (Sheet 1 of 2 Sheets). General Arrangement Diagram



1. Heating and ventilating air intake ducts
2. Cockpit windshield and canopy
3. Main fuel tank
4. RCM operator's compartment
5. Dive brake
6. Tail gear (retracted)
7. Arresting hook hold-down unit
8. Horizontal stabilizer actuating unit
9. Arresting hook (latched up)
10. 20 mm gun and ammunition stowage
11. Wing bomb rack
12. Landing gear (retracted)
13. Catapult take-off hook
14. Hydraulic system accumulator and reservoir

Model AD-2Q or AD-3Q Airplane
Figure 1-3 (Sheet 2 of 2 Sheets). General Arrangement Diagram

SECTION I
DESCRIPTION

1-1. AIRPLANE.

1-2. GENERAL. The models AD-2 and AD-3 are single-place airplanes used for attack purposes. The models AD-2Q and AD-3Q are two-place airplanes used for effective search and jamming of enemy radar. All models are carrier-based landplanes 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. Two 20-mm guns are mounted in the center wing panel, one inboard of each 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. Dive brakes are installed at the sides and bottom of the fuselage. The AD-2Q and AD-3Q airplanes are primarily AD-2 and AD-3 airplanes, respectively, with a compartment added just aft of the fuselage fuel tank to accommodate radar countermeasures (RCM) equipment and an operator. For general arrangement, see figure 1-3.

1-3. DIMENSIONS. The principal three-point dimensions and the weight of the airplanes 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. 10½ in.
Height (over folded wings).....16 ft. 8 in.
Height (maximum during wing folding).....19 ft. 4¼ in.
Weight (normal gross)
AD-2 airplanes.....16,332 lbs.
AD-2Q airplanes.....17,384 lbs.
AD-3 airplanes.....16,526 lbs.
AD-3Q airplanes.....17,785 lbs.

Note

The above weights are determined with a condition of one 2000-pound bomb installed and 380 gallons (2280 pounds) of fuel.

1-4. AD SERIES COMPARISON. (Refer to Table 1, page 6.) The AD-2 and AD-2Q airplanes are basically improved versions of the AD-1 and AD-1Q airplanes, respectively. The RCM operator's station in the AD-1Q and AD-2Q are identical. The AD-3 and AD-3Q airplanes are improved versions of the AD-2 and AD-2Q airplanes, respectively. The primary changes in Model AD-3 and AD-3Q airplanes over AD-2 and AD-2Q airplanes are as follows:

1. Increased structural strength for landing loads.
2. Telescoping main landing gear. Stroke increased to 14 in.
3. Improved castering tail wheel.
4. Revised armament and electrical circuits.
5. Warning light on landing gear and arresting hook handles.
6. Flush (double-slot type) radio altimeter antennas.
7. Improved wing jury struts.
8. Re-arranged countermeasure operation compartment (AD-3Q only).
9. AN/APR-9, AN/APA-64, AN/APA-70 countermeasures gear (AD-3Q only).
10. Revised countermeasures antenna system (AD-3Q only).

1-5. FLIGHT CONTROLS.

1-6. SURFACE CONTROLS. Conventional control stick and rudder pedals are installed. Position of both rudder pedals may be adjusted simultaneously by means of a crank (figure 4-1, reference 6) located at the bottom of the armament panel.

1-7. SURFACE CONTROLS LOCK. The surface controls lock assembly (figure 1-7) consists of a cap, two short (forward) cables and two long (after) cables equipped with attaching hooks. To install the lock, crank the rudder pedals to the "AFT" position, set the cap over the stick grip, hook the forward cables to the rudder pedals and hook the aft cables to the brackets on the sides of the cockpit. Cranking the rudder pedals to the "FWD" position will tighten the cables and lock the controls. The lock assembly may be stowed in the "CONTROL LOCK" compartment (figure 1-4, reference 2) in the left-hand console.

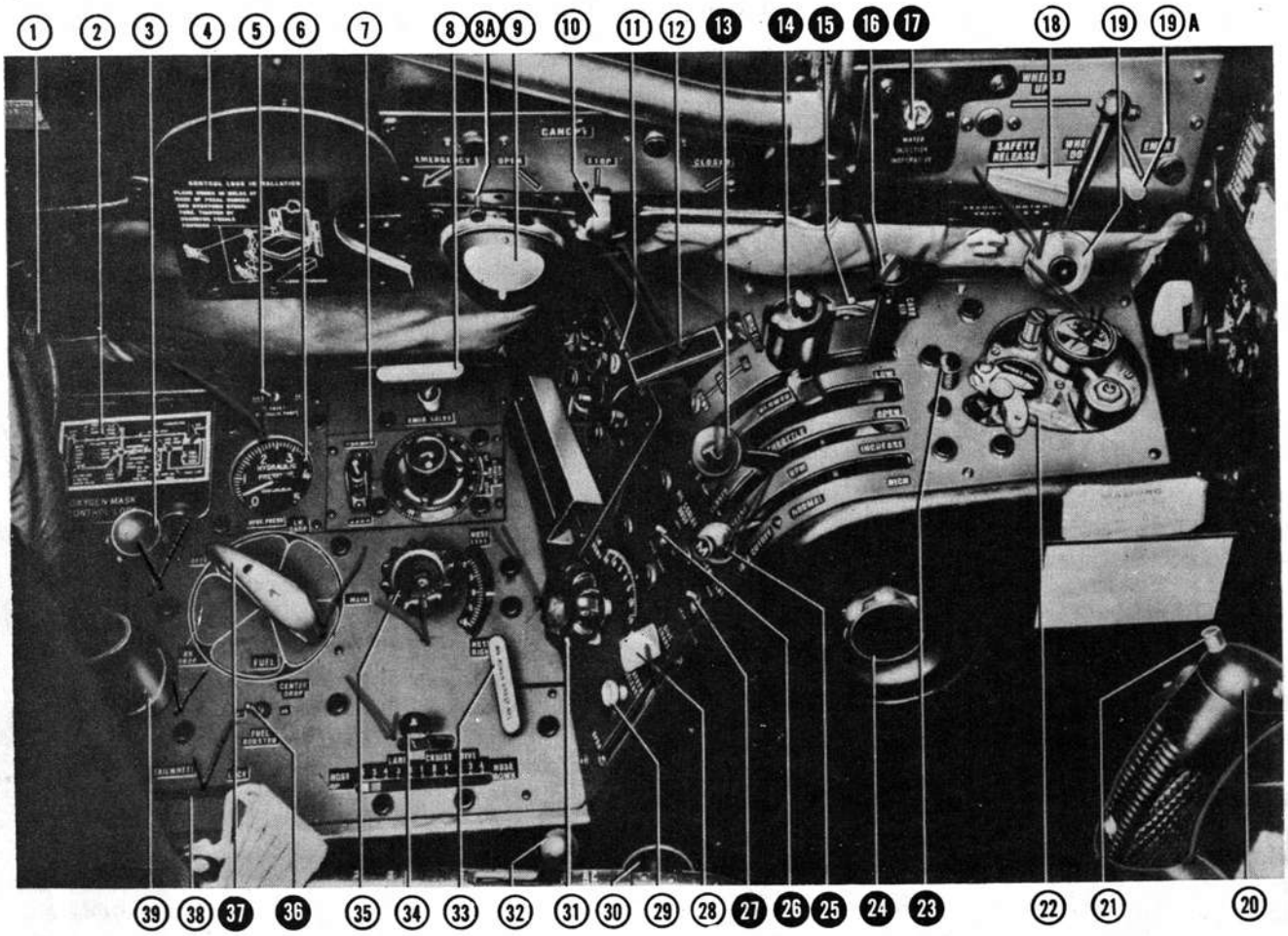
1-8. TABS. Controllable trim tabs are located on the rudder and the left-hand aileron. The trim tab controls (figure 1-4, references 31 and 35) are located on the left-hand console. Fixed trim tabs, adjustable on the ground only, are provided on the right-hand aileron and on each elevator. The spring tab on the rudder is linked directly to the control surface to reduce rudder control forces.

CAUTION

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

Note

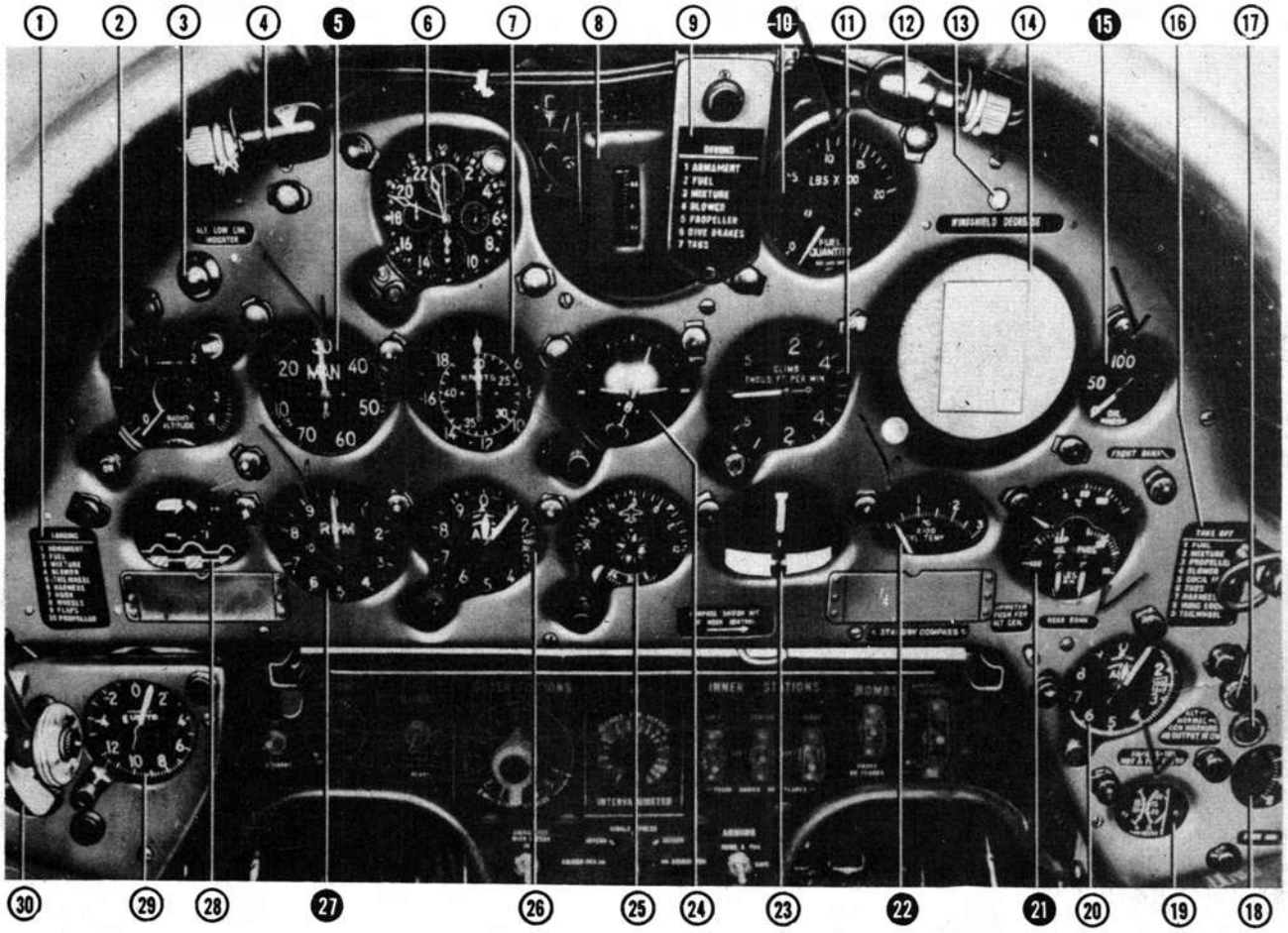
After any elevator or stabilizer change, care should be taken to note any longitudinal unbalance in flight and to ensure that adjustment of the elevator trim tabs within allowable limits is effected. The desired level flight trim of the airplane, as indicated on the horizontal stabilizer indicator, should be 1½ ± ½ degree nose down at 230 knots IAS.



*1. Diluter-demand oxygen regulator
2. Oxygen mask and control lock stowage
*3. Oxygen shut-off valve
4. Armrest
5. Emergency hydraulic pump switch
6. Hydraulic system pressure gage
7. Gunsight elevation control console
8. Emergency bomb release
8A. Canopy control release plunger
9. Ash tray
10. Cockpit enclosure control
**11. AN/APS-4 radar control console
12. Wing flap control
13. Propeller pitch control
14. Throttle control and microphone switch
15. Carburetor air switch
16. Supercharger control
17. Water injection master switch
18. Landing gear safety release
19. Landing gear control
19A. Landing gear control release plunger
20. Control stick
21. Bomb release switch
*22. Oxygen pressure gage and flowmeter
***22. Composite diluter demand oxygen regulator
23. Static throttle grip
24. Throttle and propeller pitch friction lock
25. Mixture control
26. Oil cooler door switch
27. Cowl flap switch
28. Dive brake control
29. Dive brake safety solenoid control
30. Relief tube
31. Aileron trim tab control
32. Shoulder harness control
33. Aileron boost emergency release
34. Horizontal stabilizer control
35. Rudder trim tab control
36. Fuel booster pump switch
37. Fuel tank selector valve
38. Tail wheel lock control
39. Personnel gear receptacle

*AD-2 and AD-2Q
**AD-2, AD-2Q and AD-3
***AD-3 and AD-3Q

AD-2, AD-2Q, AD-3 and AD-3Q Airplanes
Figure 1-4. Pilot's Cockpit—Left Side

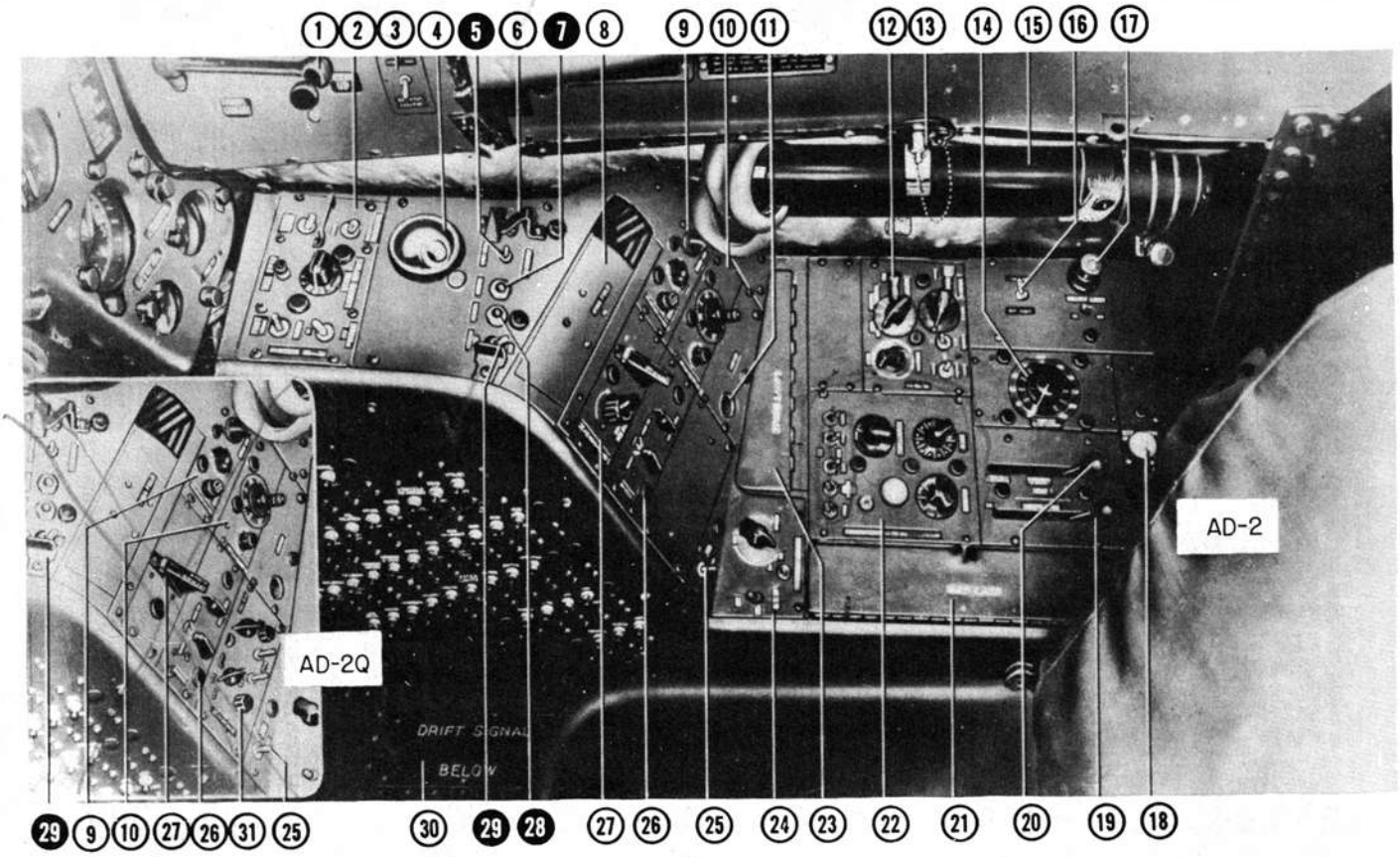


1. Landing check-off list
2. Radio altimeter
3. Radio altimeter low limit warning light
4. Chartboard light
5. Manifold pressure gage
6. Elapsed time clock
7. Airspeed indicator
8. Gunsight
9. Diving check-off list
10. Fuel quantity indicator
11. Rate of climb indicator
12. Chartboard light
13. Windshield degrease control
14. AN/APS-4 radar scope
15. Front bank oil pressure gage
16. Take-off check-off list
*17. Generator warning light (1)
**17. Generator warning lights (2)
18. Free air temperature indicator
19. Volt-ammeter
20. AN/ASG-10A altimeter
21. Engine gage unit
22. Cylinder head temperature indicator
23. Turn and bank indicator
24. Attitude gyro indicator
25. Directional gyro indicator
26. Altimeter
27. Tachometer indicator
28. Wheel and flap position indicator
29. Accelerometer
30. Ignition switch

*AD-2, AD-2Q and AD-3

**AD-3Q

AD-2, AD-2Q, AD-3 and AD-3Q Airplanes
Figure 1-5. Pilot's Cockpit—Front View



1. Arresting hook control
2. AN/ASG-10A bombing control console
3. G-2 compass switch
4. Ventilating air outlet
5. Pitot heater and oil dilution switch
* 6. Approach light manual switch
7. Engine primer switch
8. Wing fold control
9. AN/ARR-2A navigation radio control
10. AN/ARC-5 range radio control
**11. Cigarette lighter
12. AN/APX-2 IFF radio control
13. Oxygen filler valve
14. AN/APN-1 radio altimeter light switch
15. Radar scope visor
***16. RCM alternator circuit breaker switch
17. Utility light
18. Utility outlet receptacle
19. Ventilating control
20. Heating control
21. Map case
22. Exterior lights control console

AD-2 and AD-2Q Airplanes
Figure 1-6 (Sheet 1 of 2 Sheets). Pilot's Cockpit—Right Side

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

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	19,700 lbs.
Arrested landing (pilots 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 2–2. At gross weights 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 2–2 correspond to a Mach number of approximately .73. Elevator stick forces are excessive for high Mach number and high IAS 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-4 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 pushover 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 2–2, corrected for gross weight as described in paragraph 2–2d, except that with torpedoes on the wing rack, 6.0g 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.

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:

Models AD-2 and AD-3 Series
(With aileron boost system)

Left Wing Rack	Right Wing Rack
TAKE-OFF	
135 lbs. (AN/APS-4 Radar)	1250 lbs.
0	1115 lbs.
540 lbs. (MK 5, Mod 4 Tank, 69 gals.) (MK 12 Tank, 76 gals.)	0
LANDING	
135 lbs. (AN/APS-4 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 landings should be avoided.

m. Adherence to the above recommendations and restrictions is mandatory if the recent high attrition rate incident to landing operations is to be reduced, since, even with all practicable changes incorporated, the airplanes still have insufficient strength to eliminate the need for very careful observance of the proper landing technique. It has been shown conclusively by actual operation aboard active carriers that, by observance of the recommended techniques, these airplanes can be operated without serious difficulty.

n. Minimum engine rpm on AD-2Q airplanes is limited, while the RCM equipment is in operation, to the speed which will produce a generator output of 200 amperes and 28-volts. This should be around 1550 rpm.

o. Model AD-2 and AD-3 series airplanes are delivered with reinforced ailerons (Douglas part numbers 5256013-500 and 5256013-501) which are satisfactory for rocket launching operations. If either of the reinforced ailerons is replaced with original production ailerons (Douglas part numbers 5256013 and 5256013-1), the airplane shall be inspected after each firing flight, except those in which only 2.25-inch SCAR's are fired, for possible damage to the under surface of the ailerons. If any indication of damage is discovered, the ailerons shall be replaced. This inspection shall continue as long as the airplane bears an original production aileron.

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.

c. See that the arresting hook is latched up.

d. Security of access door and cover plates.

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

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

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

2-5. ON ENTERING THE COCKPIT.

a. Personnel gear adapter—plug into receptacle.

CAUTION

Fasteners must be provided on the 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 possible as will permit satisfactory engagement with the receptacle.

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

c. Release and stow the surface control lock.

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

e. Adjust the seat and rudder pedals if necessary.

f. Check the surface controls for freedom of movement.

g. Tail wheel—"LOCK."

h. Fuel tank selector—"MAIN."

i. Dive brakes—"CLOSE."

j. Cowl flaps—"AUTO."

k. Oil cooler door—"AUTO."

l. Wing flaps—"UP."

m. Canopy—"OPEN."

n. Canopy emergency system air bottle 1750 to 1980 psi. Emergency operation may be checked but bottle should be recharged immediately.

o. Mixture—"IDLE CUT-OFF."

p. Propeller pitch—"INCREASE" (low pitch).

q. Supercharger control—"LOW" blower.

r. Carburetor air—"DIRECT."

s. Landing gear—"WHEELS DOWN."

t. Check oxygen equipment (see paragraph 4-56).

u. Ignition switch—"OFF."

v. Set altimeter and clock.

w. Gyro instruments—"UNCAGED."

x. Armament master switch—"ON."

y. Check gun sight light, then turn armament master switch "OFF."

z. Check bomb ejector system (see paragraph 4-38).

aa. If external a-c power source is available, check special electronic equipment (see paragraph 4-75).

Note

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

ab. Generator switch(es) (AD-3 series)—"ON."

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 on AD-2 and AD-2Q airplanes may be checked by lowering the arresting hook. On AD-3 series airplanes, the approach light should start flashing as soon as the battery switch is turned on if the gear is locked down, the arresting hook is in any position except full down (see paragraph 1-58) and the exterior lights "MASTER" switch is set at "CODE," "FLASH" or "STDY."

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, maneuvers, and landing. The carburetor vapor vent connects to the main tank and can return fuel from the carburetor at a maximum rate of 10 U.S. gallons per hour. Normally, there is little or no return. However, since the main 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 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. SWITCHING FUEL TANKS. To switch from one fuel tank to another, fly the airplane level, turn the fuel booster pump "ON," switch the fuel tank selector to the desired tank and turn the booster pump "OFF." Refer to paragraph 3-21 for directions for regaining pressure 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. For electrical release on AD-2 series airplanes proceed as follows:

b. Set bomb safety switch for the tank to be jettisoned to "BOMBS." See that the other two switches are "OFF."

c. Set bomb selector switch to the "ALL" position.

d. Turn the master armament switch "ON."

e. Depress the bomb release button on top of the control stick to jettison the tank.

f. For electrical release on AD-3 series airplanes proceed as follows:

g. Set bomb safety switch to "BOMBS."

h. 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.

i. Turn the master armament switch "ON."

j. Depress the bomb release button on top of the control stick to jettison the tank.

2–12. STARTING ENGINE.

a. To clear the engine, inch propeller through four revolutions (16 blades) with engine starter.

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.

b. Throttle friction—As desired to be able to easily locate idle throttle stop.

c. 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.

d. Fuel booster pump—"ON."

e. Energize the starter, and after the propeller has turned one revolution, 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.

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

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

h. When operating smoothly on the primer, move the mixture control to "RICH" and reduce priming. If the engine runs rough and smokes, reduce priming. If the engine ceases to fire, increase priming.

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.

i. 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.

j. Check the oil pressure. Stop the engine if the rear bank 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.

CAUTION

For cold weather starting, 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.

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

l. 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.

m. Fuel booster pump—"OFF."

2–13. WARM-UP.

a. Warm-up at approximately 1200 to 1400 rpm.

b. For all ground operation, unless otherwise specified in paragraphs 2–15 through 2–23, 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.

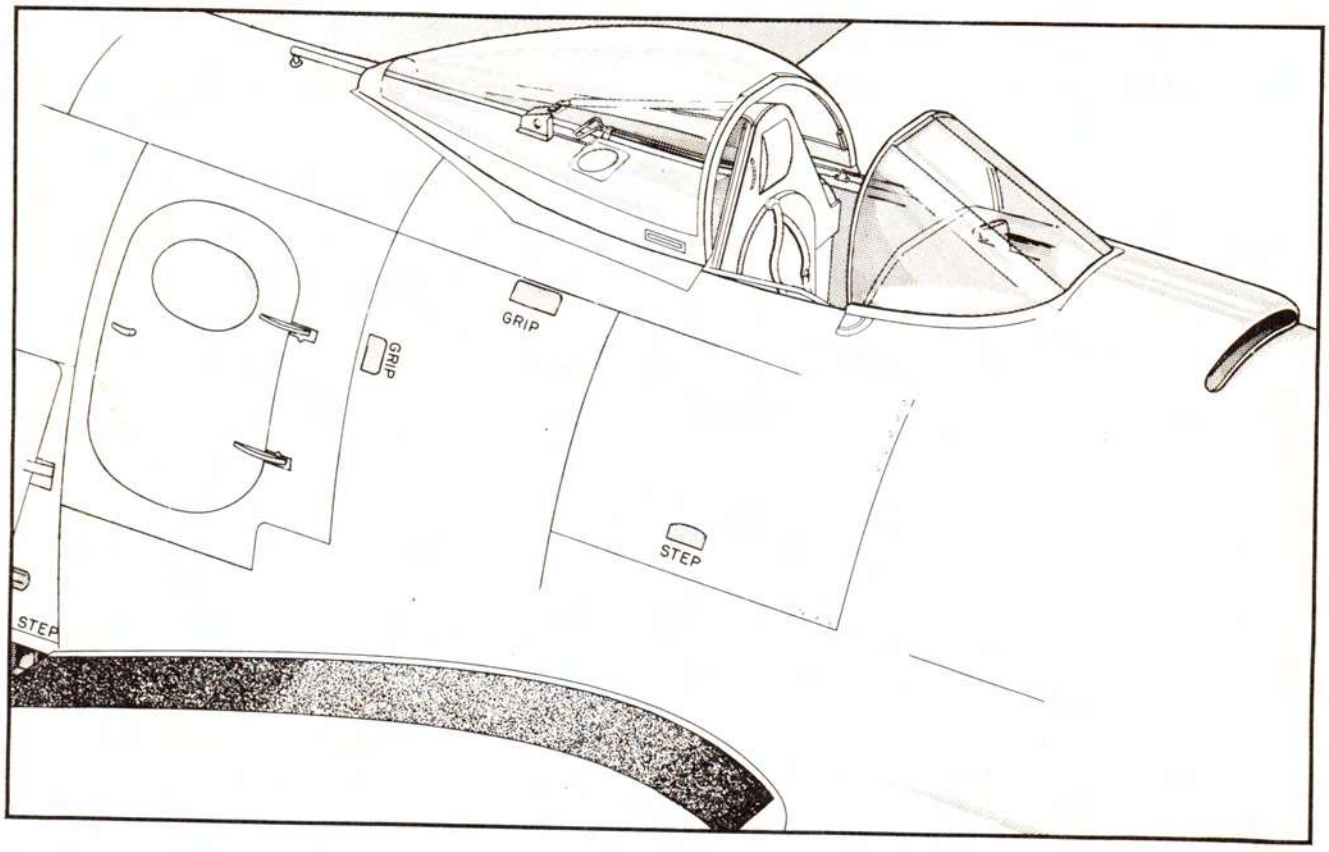


Figure 2-1. Entrance to Airplane

2–14. GROUND TEST.

2–15. 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 rpm is satisfactory. This will permit idling at low speed without fouling the plugs and also affords good accelerating characteristics. A momentary drop in manifold pressure may be used as an indication of a slight rise in rpm.

2–16. 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 700 rpm.

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

c. Return the switch to "BOTH."

2–17. 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. The high pitch stop is set at 71° on AD-2 series airplanes and at 68° on AD-3 series airplanes.

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

d. Check for reduction and full recovery of rpm.

2–18. OIL SYSTEM CHECK. Run the engine at 1500 to 1800 rpm. 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.

Note

Front oil pressure limits will depend upon the engine being used according to serial number. Proper limits are indicated in figure A–4 and on the engine data plate.

2–19. FUEL SYSTEM CHECK. Run engine at 1500 to 1800 rpm and with the booster pump switch "OFF" check the operation of the engine-driven fuel pump 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.

2-20. 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 procedure 2-20a. The readings should be the same.

Note

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

2-21. MAGNETO CHECK.

a. Open the throttle to obtain 2300 rpm. Differences in pitch 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.

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

Note

The hydraulic pressure gages installed in the airplane have 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 is "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-current relay is functioning properly. On AD-3 series airplane, 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 light is on or if the voltmeter reading is too low (below 27.5 volts) or too high (above 28.5 volts).

2-24. ELECTRONIC EQUIPMENT CHECK. Refer to paragraph 4-75.

2-25. TAXIING.

2-26. 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 or if cold weather exists, place the control in "ALTERNATE."

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

2-27. BEFORE TAKE-OFF.

2-28. GROUND AND CARRIER CHECK.

a. Cockpit enclosure—"OPEN."

CAUTION

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

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

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

d. Fuel booster—"ON."

e. Fuel tank selector—"MAIN."

f. External auxiliary tanks—refer to paragraph 2-11 for positioning of controls in case of jettisoning.

g. Horizontal stabilizer control—0°.

h. Rudder tab—approximately 3° right.

i. Aileron tab—0°.

j. Dive brakes—"CLOSE."

k. Cowl flaps—"AUTO."

l. Oil cooler door—"AUTO."

m. Wing flaps—40° (full "DOWN").

n. Carburetor air—"DIRECT" unless icing conditions prevail.

o. Supercharger—"LOW" blower.

p. Propeller control—'INCREASE" rpm (low pitch).

q. Mixture—"RICH."

r. Check controls for free movement.

s. Wings—spread and locked.

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

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. Generator switch(es) (AD-3 series)—"ON."

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

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

2-29. CATAPULT CHECK. In addition to the preceding checks, the following should be accomplished:

a. Tail wheel—"UNLOCK."

b. Tighten engine control friction adjustment knob.

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

d. Place feet against rudder pedals with legs stiff.

e. Brace right arm.

f. Push throttle forward and grasp static grip.

2-30. ENGINE POWER CHECK TABLE. The calibrations below represent the approximate manifold pressure for each given rpm at standard sea level conditions.

AD-2 SERIES

Note

These data apply only to those AD-2 series airplanes wherein the propeller low pitch stop has been set at 31 degrees.

RPM	MP
1700	23.5
1800	24.0
1900	25.0
2000	26.0
2100	27.0
2200	28.5
2300	30.0
2400	32.0

AD-3 SERIES

Note

These data apply to AD-3 series 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

2-31. TAKE-OFF.

2-32. 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 2-2 for gross weight and loading restrictions.

2-33. 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.

2-34. ENGINE FAILURE DURING TAKE-OFF. Refer to paragraph 3-9 for procedure to be followed in case of engine failure during take-off.

2-35. AFTER TAKE-OFF.

a. 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.

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

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

2-36. CLIMB.

2-37. The characteristics of the airplane in a climb are normal. Refer to figures A-4 and A-7 for climbing speeds and powers.

2-38. 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.

2-39. Booster pump "OFF" after climb is established unless engine pump alone does not maintain sufficient pressure (19 psi minimum).

2-40. DURING FLIGHT.

2-41. GENERAL. See the "Flight Operation Instruction Charts, "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.

2-42. 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 permissible center of gravity locations.

2-43. 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 turn and bank indicator with the aileron trim tab.

d. If readjustment is necessary, repeat the above procedure.

2-44. ATTITUDE GYRO INDICATOR. This instrument, (figure 1-5, reference 24) is gyro stabilized and indicates the attitude of the airplane in pitch and bank. The gyro is universal, that is, it will not tumble regardless of the airplane's attitude at all times. Since it is universal, the gyro does not require caging. Approximately three minutes are required for the gyro to reach normal operating speed after the battery switch is turned on.

2-45. G-2 COMPASS. This compass consists of a compass controlled directional gyro indicator (figure 1-5, reference 25) an amplifier and a remote compass transmitter. The gyro should be caged and set to correspond with the indication of the miniature dial in the center of the indicator face prior to take-off. To correctly operate the reset adjustment, depress the knob firmly and rotate the main dial to the desired heading. Keep the knob fully depressed at the new heading for at least two seconds and then release the knob straight out, avoiding any twisting motion. A switch (figure 1-6, reference 3) which controls the compass system is located on the right side of the cockpit aft of the hook control. When the switch is in the "Free Directional Gyro" position, the gyro will have to be caged and reset periodically to maintain heading. In this position the gyro is not subject to compass control. When the switch is in the "Compass Control" position, the amplifier will control the gyro so that periodic resetting of the gyro is not necessary. Approximately three minutes are required for the gyro to reach operating speed, after the battery switch has been turned on. The compass will reflect heading changes of the airplane at the rate of 3° per minute. The compass is non-tumbling and does not require caging before or after maneuvers. The miniature dial on the center of the instrument face gives a remote indication of the heading of the compass transmitter. This dial is unstabilized and will be subject to swinging as a result of turns and maneuvers of the airplane. When on "Compass Control" the gyro will be stabilized by the compass transmitter and amplifier and provide a continuous indication of the magnetic heading of the airplane.

2-46. OPTIMUM CRUISING AND REDUCED AIRSPEEDS. Refer to "FLIGHT OPERATION CHARTS," 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.

2-47. 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.

2-48. 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.

2-49. CARBURETOR AIR CONTROL. The "ALTERNATE" air position should be used as a normal operation when flying in any conditions conducive to the formation of induction system ice, and when cruising under cold weather conditions to improve fuel vaporization. Because of its low temperature rise, the shift to alternate air should be made before carburetor icing conditions are encountered. When making the shift to or from alternate air, it is desired to use "RICH" carburetor mixture during the shift. The manifold pressure lost in use of alternate air may be regained at low altitude by increasing throttle opening. The loss of ram has no effect on airplane performance as long as the desired engine power can be maintained by increased throttle setting. Take-off in alternate air is not recommended for ambient air temperature above—20°C unless the take-off is made in actual icing conditions.

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.

2-50. MIXTURE CONTROL. "RICH" position shall be used during all ground operation and during take-off, 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.

2-51. 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."

2-52. 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.

2-53. 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.

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.

2-54. COMBAT POWER. Combat ratings are based on engine structural limitations, water injection being used to suppress detonation. To obtain combat power, set controls as follows:

a. Mixture—"RICH" or "NORMAL."

b. Propeller—Full "INCREASE" (2900 rpm in low blower, 2600 rpm in high blower).

c. Master water injection switch—"ON."

d. Throttle—Full "OPEN" (past throttle stop).

e. Fuel selector—Select fullest tank.

2-55. ELECTRICAL SYSTEM CHECK. The electrical system should be checked in flight periodically as outlined in paragraph 2-23.

2-56. STALLS.

2-57. The stalling characteristics of the airplane in both the flaps up and flaps down conditions are normal and the stall is preceded by weak 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, the 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.

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

CAUTION

If sufficient altitude is not available for stall recovery, ample margin of speed above the stall should be maintained. In the approach and landing, the aerodynamic stall warning may not occur enough above the stalling speed to warn against reaching a speed so low that settling of the airplane results in a severely hard landing or that application of sufficient power to maintain flight causes a torque roll which cannot be controlled with the ailerons and rudder.

2-58. SPINS.

2-59. Spins with ailerons either neutral or with the spin are normal. The standard recovery technique yields recoveries within one-half turn with altitude losses during recovery ranging from 1000 to 1500 feet. Use of aileron against the spin tends to flatten the spin and to make recovery very difficult. Intentional spins should not be entered unless adequate terrain clearance is available. In case of an unintentional spin, apply full aileron with the spin, apply full rudder against the spin, and be prepared to apply power if the spin is not terminated within one turn.

2-60. PERMISSABLE ACROBATICS.

2-61. The normal maneuvers, as given in paragraph 2-2, are permissible.

2-62. DIVING.

2-63. CONTROL SETTINGS. The controls should be set as follows for diving.

a. Windshield defogger — "WINDSHIELD AND CABIN" (at least 30 minutes before entering dive).

b. Cockpit enclosure—Closed.

c. Fuel tank selector—"MAIN."

d. Fuel booster pump—"ON."

e. Horizontal stabilizer—"NOSE DOWN" ("DIVE" position on indicator).

f. Trim tabs—As required (see paragraph 2-66).

g. Cowl flaps—"AUTO."

h. Oil cooler door—"AUTO."

i. Carburetor air—"DIRECT" unless icing conditions prevail.

j. Supercharger—"LOW."

k. Throttle—15 inches Hg.

l. Propeller—2050 to 2250 rpm.

m. Mixture—"RICH."

n. Dive brake—"OPEN."

o. Landing gear—"WHEELS DOWN" if desired for additional braking.

CAUTION

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

2-64. 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.

2-65. 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 a 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.

2-66. 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. However, the stabilizer may be adjusted during a dive *but not during a pull-out.* 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.

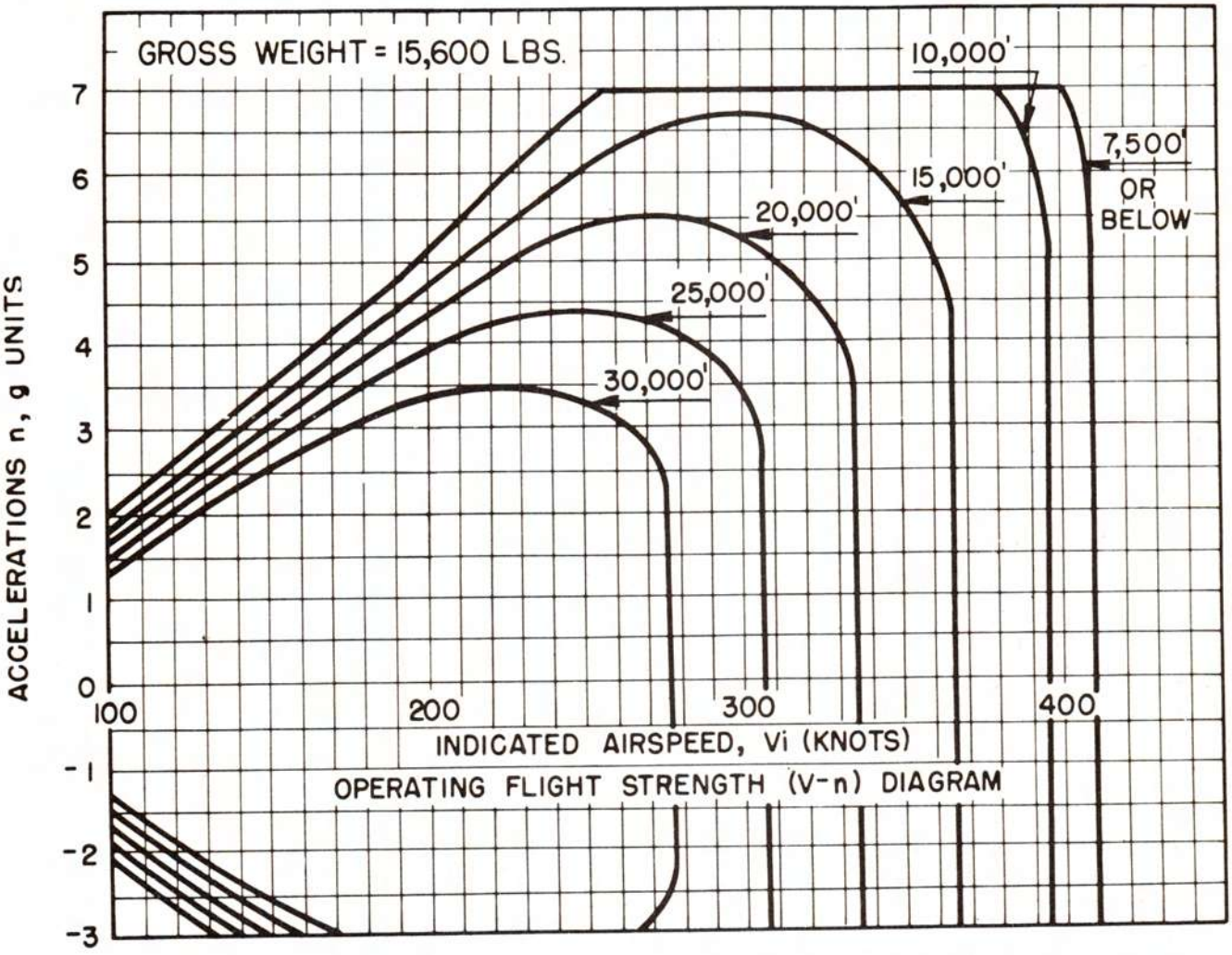


Figure 2-2. Operating Flight Strength Diagram

CAUTION

Excessive 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.

2-67. NIGHT FLYING.

2-68. 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 4-56.)

4-69. APPROACH.

4-70. DESCENT.

a. Landing gross weight—Refer to paragraph 2-2c.

b. Shoulder harness and safety belt—Locked.

c. Exterior lights—"DIM" for night carrier landings to prevent blinding the landing signal officer.

d. Master armament switch—"OFF."

e. Gun charger switch—"OFF."

f. Tail wheel—"LOCK" (for field)—"UNLOCK" (for carrier).

g. Fuel selector—"MAIN."

h. Fuel booster pump—"ON."

i. Horizontal stabilizer—"NOSE UP" as required.

j. Trim tabs—As desired.

k. Dive brake—"CLOSE."

l. Cowl flaps—"AUTO."

m. Oil cooler door—"AUTO."

n. Carburetor air—"DIRECT" unless icing conditions prevail.

o. Supercharger—"LOW" blower and locked.

p. Propeller—2400 rpm.

q. Mixture—"RICH."

r. Cockpit enclosure—"OPEN."

2-71 FINAL APPROACH.

Note

Lower wing 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

On AD-3 series airplanes, 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 flap control—As described for landing conditions (see paragraph 2-72). 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 80 to 85 knots (92 to 97 mph) IAS.

CAUTION

If sufficient altitude is not available for stall recovery, ample margin of speed above the stall should be maintained. In the approach and landing, the aerodynamic stall warning may not occur enough above the stalling speed to warn against reaching a speed so low that settling of the airplane results in a severely hard landing or that application of sufficient power to maintain flight causes a torque roll which cannot be controlled with the ailerons and rudder.

2-72. LANDING.

2-73. NORMAL LANDINGS.

2-74. 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.

2-75. 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.

2-76. AFTER LANDING.

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

b. Cowl flaps—"AUTO." Check for open position.

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

Note

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

2-77. SPECIAL LANDINGS.

2-78. 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.

2-79. 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.

2-80. EMERGENCY LANDING PROCEDURES. Refer to paragraph 3-14.

2-81. 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.

2-82. 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 shut-down 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 diverter valve circuit breaker.

j. Oil dilution switch—"OFF."

Note

Steps 2-82 h, i, and j may be accomplished following step 2-82 a, providing that the engine is idling below generator cut-in rpm.

2-83. OIL DILUTION. If temperatures below +2°C (35°F) are anticipated, the oil must be diluted as follows:

a. Request ground crew member to open the oil dilution shut-off cock, located at the bottom of the oil tank.

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 the oil pressure above 15 psi.

d. Hold oil dilution switch in "OIL DILUTION" position for six 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 the oil diverter valve circuit breaker.

i. Generator switch(es) (AD-3 series)—"OFF."

2-84. 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."

2-85. MOORING.

a. Install surface controls lock (see paragraph 1-7).

b. Chock wheels.

c. If gusty wind conditions prevail, tie the airplane down (see figure 2-3).

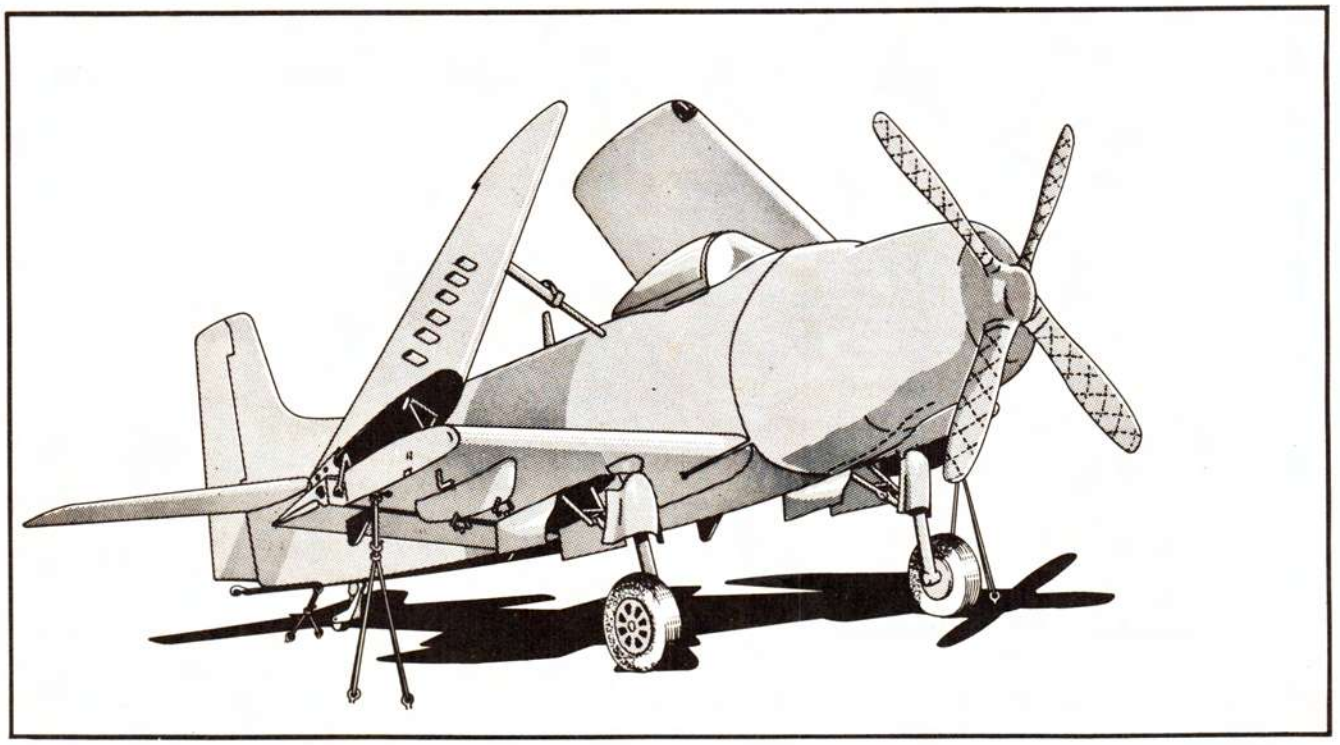


Figure 2-3. Mooring

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 3–4, a.).

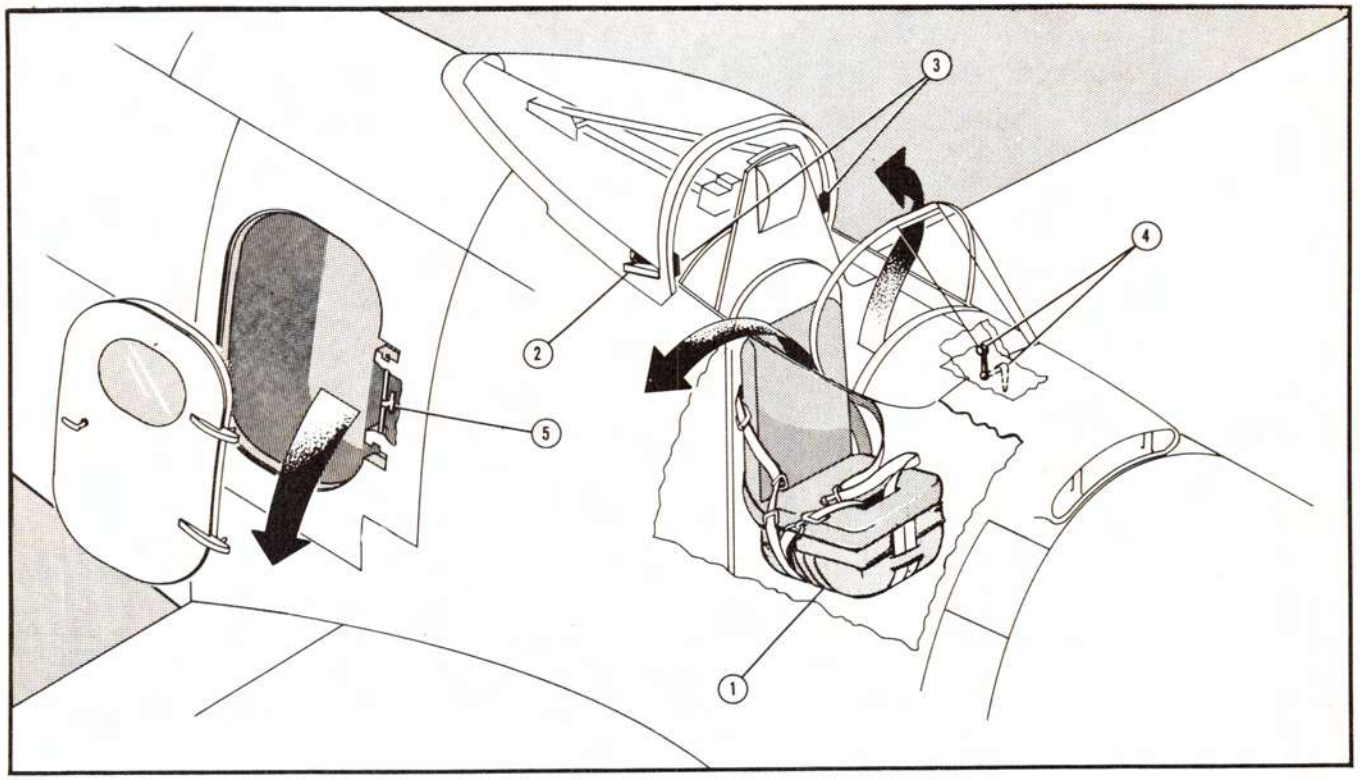
c. Turn fuel selector "OFF."

d. "OPEN" cowl flaps.

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

f. Turn off ignition.

g. Turn off electrical switches.



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
5. Door jettison handle

Figure 3-1. Emergency Equipment and Exits

h. Lower landing gear if practicable (if the tires are in the path of the flames when retracted).

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

a. Turn the 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 generator has 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. If engine is popping and loosing power during take-off, the trouble is probably fouled plugs. The engine will often run normally at a reduced manifold pressure.

3–11. ENGINE FAILURE IN FLIGHT. If altitude permits, attemp 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 3–14.

Note

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

3–12. ESCAPE FROM AIRPLANE.

3–13. An accumulator is provided in the enclosure hydraulic system for emergency opening of the enclosure in case of hydraulic system failure. To operate the enclosure emergency system, press the canopy control release plunger (figure 1–3, reference 8A) located between the "OPEN" and "EMERGENCY" positions, and move the control handle to "EMERGENCY." AD-2 airplanes serial numbers 122330 to 122365 inclusive and AD-2Q airplanes serial numbers 122378 to 122387 inclusive and all AD-3 series airplanes have an emergency air bottle system instead of using a separate hydraulic accumulator for opening the canopy in case of an emergency. The canopy controls remain the same but an air pressure gage is added to the left and aft of the pilot's seat. Normal air pressure is 1980 psi and minimum air pressure for satisfactory emergency operation is 1750 psi. With minimum air pressure available, it is possible to open the canopy three times in a dive at 363 knots (420 mph) before the air pressure drops to low for canopy operation. The RCM operator's door is equipped with an emergency mechanical door release handle located just forward of the door.

3–14. FORCED LANDING.

3–15. 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.

3–16. 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. Lower pilot's seat to bottom position.

g. Battery and ignition switches—"OFF."

h. Fuel tank selector—"OFF."

3–17. 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 para-raft kit is stowed in the pilot's seat. Refer to paragraph 3–43.

3–18. PROPELLER EMERGENCY OPERATION.

3–19. 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 overspeed of 3120 rpm and to reduce the IAS to approximately 120 knots (138 mph), the practical operating speed at minimum power.

3–20. FUEL SYSTEM EMERGENCY OPERATION.

3–21. REGAINING LOST PRESSURE. If pressure 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, over-speeding of the engine would result.

Note

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

3–22. ENGINE-DRIVEN PUMP FAILURE. In case the engine-driven fuel pump fails, turn the booster pump "ON" to furnish fuel pressure.

3–23. JETTISONING EXTERNAL AUXILIARY FUEL TANKS. See paragraph 2–11.

3–24. COURSES OF FUEL FLOW. See figure 1–8.

3–25. HYDRAULIC SYSTEMS EMERGENCY OPERATION.

3–26. 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 1–44.)

3–27. 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.

3-28. 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 twice the foot pressure will be required.

3-29. 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.)

3-30. AILERON POWER BOOST EMERGENCY RELEASE. In case of hydraulic system failure and high control forces are present, the aileron power boost system may be disconnected by pulling the emergency release handle. It cannot be reconnected in flight.

3-31. ELECTRICAL SYSTEMS EMERGENCY OPERATION.

3-32. In the event of generator failure, 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:

AD-2 and AD-2Q Airplanes:

a. Master armament switch—"OFF."

b. Turn off all non-essential equipment on MAIN bus.

Note

Main bus remains energized and armament bus may be energized by returning master armament switch to "ON." See figure 1-9.

AD-3 Airplanes:

a. Battery switch—"EMER."

b. Generator switch—"OFF."

c. Master armament switch—"OFF."

d. 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." See figure 1-9.

AD-3Q Airplanes:

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:

AD-2, AD-2Q and AD-3 Airplanes:

a. Battery switch—"OFF."

b. Turn off all non-essential equipment.

AD-3Q Airplanes:

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 paragraph 1-49.

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 switch should be placed in the EMERGENCY position by pushing the stop 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 raising the guard and closing the destructor switch. In case of a crash landing, an impact switch automatically sets off the destructor circuit; however, as a safety precaution, the destructor switch should always be closed 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—"BOMBS."
c. Arming switches—As desired.
d. Bomb selector switch—"ALL."
e. Depress release buttons on control stick head.

3–39. MANUAL BOMB AND TORPEDO RELEASE. If the electrical system is inoperative, the bombs or torpedoes on all three racks can be salvoed manually by pulling the emergency release handle at the outboard edge of the left-hand control console. Make certain that handle is pulled to its extreme travel position. 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. Should symptoms occur which suggest the onset of anoxia, proceed as follows: on AD-2 and AD-2Q airplanes having a straight diluter-demand type regulator, slowly rotate the "EMER" valve control counterclockwise to obtain the minimum flow of 100 percent oxygen required and descend below 10,000 feet. On all airplanes having composite diluter-demand type regulators, immediately depress the "SAFETY PRESSURE" button and descend below 10,000 feet. If for any reason a constant flow of oxygen is not obtained by "EMER" or "SAFETY PRESSURE," activate the oxygen bailout equipment and descend below 10,000 feet.

3–42. MISCELLANEOUS EMERGENCY EQUIPMENT.

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.

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 folding 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.

4-6. GUNNERY CONTROLS.

4-7. GUN SIGHT CONTROLS. The gun sight switch and rheostat (figure 4-1, references 1 and 2) are located on the left-hand side of the armament console panel. A Mark 18, Mod. 1 control box (figure 1-4, reference 7) is installed on the left-hand console panel.

4-8. GUN CHARGING SWITCH. This switch is located on the armament control panel (figure 4-1, reference 3).

4-9. OPERATION OF GUNNERY EQUIPMENT.

4-10. TO OPERATE THE GUN SIGHT.

a. Battery switch—"ON."

b. Armament master switch—"ON."

c. Gun sight switch—"ON."

d. Adjust rheostat to desired brilliance.

e. If light burns out or is inoperative, move gun sight switch to "STAND-BY" position.

f. The sight elevation may be adjusted in flight by moving the selector switch on the control box to "MANUAL" and rotating the dial to the desired setting. When the selector switch is placed in the "GUNS" position, the sight line will return to the normal (boresighted) position.

4-11. TO CHARGE THE GUNS. The wing guns may be charged by moving the arming switch from "OFF" to "SAFE" and then back to "READY."

4-12. TO FIRE THE GUNS.

a. Operate gun sight (see paragraph 4-10.)

b. Charge guns (see paragraph 4-11).

c. Squeeze gun trigger on control stick.

4-13. TO OPERATE THE GUN CAMERA. On all airplanes, the gun camera is operated whenever guns or rockets are fired, and on AD-2 and AD-2Q airplanes when bombs are dropped. Preparations for these armament operations automatically prepare the camera for use. On AD-2 and AD-2Q airplanes, the camera may be operated independently of any armament equipment by use of the camera control switch (figure 4-1, reference 13) located on the armament control panel. Manual camera control is possible only when the monitor bus is energized (a-c/d-c generator operating).

4-14. TO GROUND CHECK GUN CAMERA OPERATION. (ENGINE STOPPED.)

a. Battery switch—"ON."

b. Armament master switch—"ON."

c. Gun charging switch—"OFF."

d. Depress the gun trigger on the control stick.

4-15. BOMBING AND TORPEDO EQUIPMENT.

4-16. DESCRIPTION. One fuselage bomb rack and two wing racks are provided. All bombing operations are controlled by the pilot.

4-17. 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.

4-18. 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 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.

4-20. BOMBING AND TORPEDO CONTROLS.

4-21. BOMB SELECTOR SWITCHES. One switch on AD-2 series airplanes and individual toggle switches on AD-3 series airplanes (figure 4-1, reference 10)

will select the bombs to be released. On AD-2 series airplanes it is possible to select only one bomb at a time or "ALL." On AD-3 series airplanes it is possible to select either one, two or all three bombs by turning on the respective toggle switch.

4-22. BOMB ARMING SWITCH. On AD-2 series airplanes the bomb arming switch (figure 4-1, reference 9) arms only the bombs (inner stations). On AD-3 series airplanes, the same switch (figure 4-1, reference 9) arms both the bombs (inner stations) and the rockets (outer stations) simultaneously.

4-23. BOMB SAFETY SWITCHES. Three indepenent bomb rack safety switches (figure 4-1, reference 11) on AD-2 series airplanes and only one switch for all three racks on AD-3 series airplanes must be turned on before bombs can be released electrically.

4-24. INTERVALOMETER SELECTOR SWITCH. This selector switch (figure 4-1, reference 8), located on the armament control panel will determine the number of bombs per second or rocket releases per second singly or in pairs.

4-25. STATION SELECTOR SWITCH. This selector switch (figure 4-1, reference 7), located on the armament control panel, has the following positions:

a. "SINGLE PULSE"—The bomb release button on the control stick must be pressed for each selected bomb release.

b. "INTER" ("INTERV")—(Right-hand position—"INNER STATIONS.") Release of bombs is controlled through the intervalometer as set on the intervalometer selector switch. This position also provides single pulse for rocket release.

c. "INTER" ("INTERV")—(Left-hand position—"OUTER STATIONS.") Release of rockets is controlled through the intervalometer as set on the intervalometer selector switch. This position also provides single pulse for bomb release.

d. "AN/ASG-10A WITH INTERVALOMETER" (AD-2 series) and "AN/ASG-10A" (AD-3 series). The left-hand position is for firing rockets and the right-hand position for releasing bombs. On AD-2 series, the intervalometer is automatically cut in when this position is selected. However, on AD-3 and AD-3Q airplanes the intervalometer is cut in or cut out by positioning a separate switch (see paragraph 4-35).

4-26. AN/ASG-10A BOMBING EQUIPMENT.

4-27. GENERAL. AN/ASG-10A equipment is a device that determines the time at which a bomb, rocket, or torpedo is to be released from an airplane as it pulls out of a dive. The dive must be aimed at the target. The factors from which the computer works out a solution are: (1) altitude, (2) airspeed, (3) dive-angle, (4) pull-out acceleration, and (5) ballistic coefficient of the missile. The control console (figure 1-6, reference 2) is on the right-hand control console.

4-28. PREFLIGHT CHECK. Adjustments to be made before take-off when bombs or torpedoes are to be released.

a. The Bomb M.P.I. Adjustment Control located on the computer is set to compensate for the ballistic coefficient of the bomb used.

b. The Stick Length Offset Control located on the Control Box is set to "ZERO" if a single bomb or a salvo is to be released. If a stick of bombs is to be released the Stick Length Offset Control is rotated to the left so that the first bomb will strike short by one-half the stick length. If a torpedo is to be released, the Control knob is set at "TORP."

c. The Transfer Switch, located on the Control Box, is set to "UNCAGE."

d. Change the sight system setting to the bombing position.

e. Set the airspeed dial on the computer at the most probable speed of attack.

4-29. Adjustments to be made before take-off when rockets are to be released.

a. The Temperature and Lanyard Control on the Computer is set from tabular data.

b. The Rocket Calibration—Course and the Rocket Calibration—Fine Controls, both on the Computer, are set from tabular data.

c. The Transfer Switch on the Control Box is set to the "ROCKET" position.

d. The Gyro Switch on the Control Box is set to "UNCAGE."

e. The Stick Length Offset Control Knob is set to "ZERO."

4-30. TO START EQUIPMENT. Turn the Power Switch on the Control Box to "ON" 15 minutes before the equipment is to be used to allow the tubes to stabilize.

4-31. TO STOP EQUIPMENT. Turn the Power Switch on the Control Box to "OFF" position.

4-32. CHECK-OFF LIST.

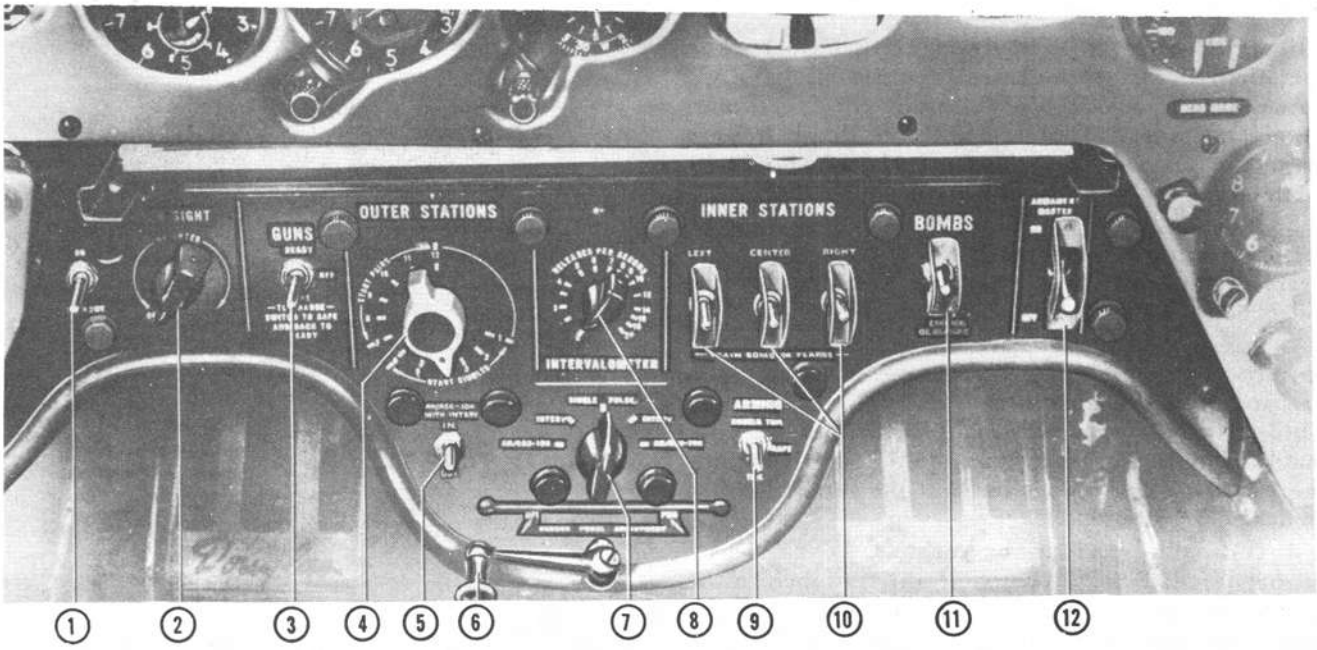
a. Set Altimeter (figure 1-5, reference 20) to read "ZERO" at the altitude of the target.

b. Cage and uncage the gyro in level flight at least five minutes prior to entering the dive and make no sustained turns after uncaging the gyro. This procedure is desirable to enable the gyro to erect to the vertical prior to entering the dive and to ensure that it has not tumbled.

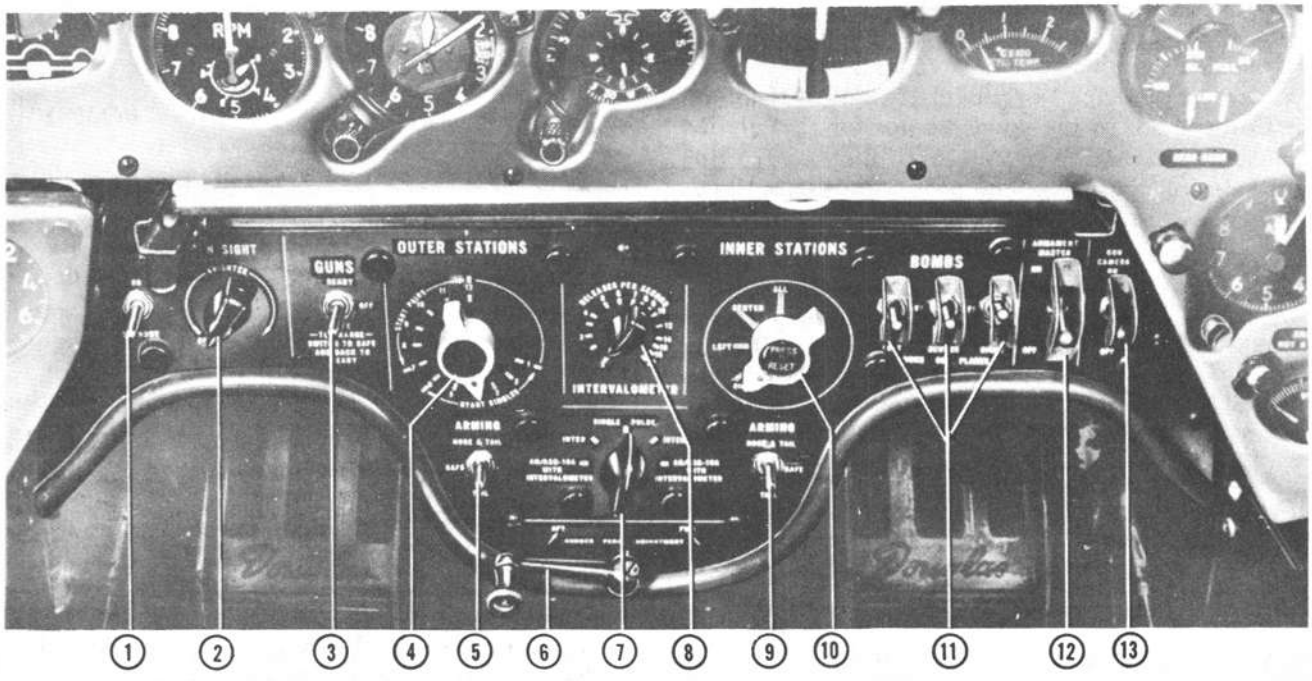
c. On AD-3 and AD-3Q airplanes, set the AN/ASG-10A WITH INTERV switch at "IN" or "OUT" depending upon whether or not the intervalometer is desired with the AN/ASG-10A equipment.

4-33. MAKING THE BOMBING RUN, WHEN BOMBS, ROCKETS, OR TORPEDOES ARE TO BE RELEASED.

a. The target is approached and the dive made toward it with offset allowance for wind or target motion using the fixed gunsight reticule for reference. The dive is initiated several thousand feet above the



AD-2 and AD-2Q Airplanes



AD-3 and AD-3Q Airplanes

1. Gun sight switch
2. Gun sight rheostat
3. Gun charging switch
4. Rocket selector switch
* 5. Rocket arming switch
*** 5. AN/ASG-10A with interv. selector switch
6. Rudder pedal adjustment crank
7. Station selector switch
8. Intervalometer selector switch
* 9. Bomb arming switch
** 9. Bomb and rocket arming switch
10. Inner stations selector switch(es)
11. Bombs—smoke or flares safety switch(es)
12. Armament master switch
*13. Gun camera switch

* AD-2 series only.
** AD-3 series only.
*** AD-3 and AD-3Q only.

Figure 4-1. Armament Control Panel

altitude at which the Bomb Release switch (located on the stick) is closed and may be made at any angle between 15° and 60°. The Indicated Air Speed must be greater than 250 knots before the Bomb Release switch is pressed, and constant velocity should be attained as nearly as possible.

b. When the point of aim and the air speed are satisfactorily established, the Bomb Release switch is pressed and held. The dive is continued toward the target until the Indicator Lamp lights.

c. After the Indicator Lamp is lighted the pull-out is initiated sharply, in such a manner that the target disappears in a path parallel to the vertical line of the sight reticule. Bombs, rockets or torpedoes are automatically released during the pull-out at which time the Indicator Lamp goes out and the Bomb Release switch may be released.

d. If the pilot decides not to release he may let up on the Bomb Release switch at any time before the projectile is released and all circuits will be cleared and ready for another run.

4-34. For the case of an aircraft carrying a mixed load the correct adjustments for both types of missiles are made by the ground crews before take-off. The pilot can then select either bombs or rockets by:

a. Setting the Stick Length Offset Control Knob on the Control Box at the correct place for the missile.

b. Setting the Transfer switch on the Control Box to the desired position. The procedure then follows as noted in paragraph 4-33.

4-35. AN/ASG-10A WITH INTERVALOMETER SWITCH (AD-3 and AD-3Q ONLY.) The "AN/ASG-10A WITH INTERV" switch (figure 4-1, reference 5) has two positions "IN" and "OUT" indicating whether or not the intervalometer is used with the AN/ASG-10A equipment. These positions are not to be confused with INNER and OUTER stations.

4-36. 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.

4-37. OPERATION OF BOMBING AND TORPEDO EQUIPMENT.

4-38. 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.

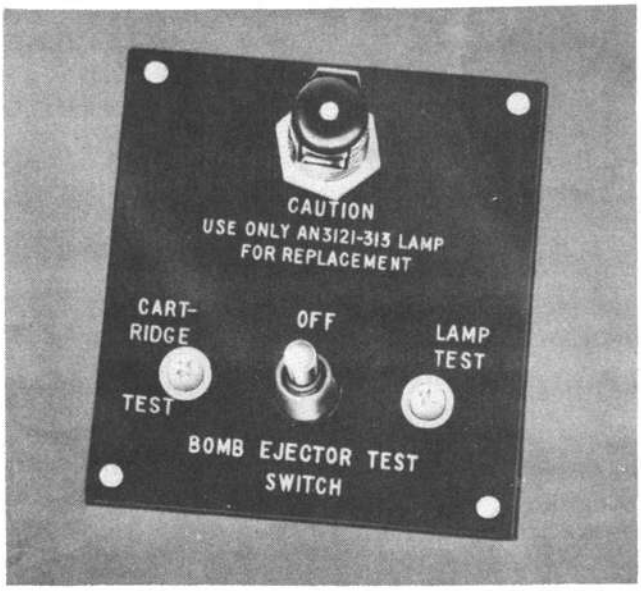


Figure 4-2. Bomb Ejector Test Box

4-39. TO RELEASE BOMBS ELECTRICALLY. (AD-2 SERIES AIRPLANES.)

a. Armament master switch—"ON."

b. Bomb safety switches—Set to "BOMBS" for bombs to be released.

c. Bomb selector switch—Select bombs as desired.

Note

With all three safety switches set to "BOMBS," the bomb selector switch will release bombs in the following sequence: right, left and center, unless set to "ALL" to salvo all bombs being carried.

d. Bomb arming switch—Set as desired.

e. Station selector switch—Set as desired—(INNER STATIONS)—and proceed as follows:

f. With station selector switch at "SINGLE PULSE," press the control stick bomb release switch for each selected bomb release.

g. With station selector switch at "INTER," 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. With station selector switch at "AN/ASG-10A WITH INTERVALOMETER," set the intervalometer selector switch to the desired "RELEASES PER SECOND," and after indicated airspeed is greater than 250 knots, hold control stick bomb release switch depressed until after completion of pull-out (see paragraph 4-33.)

4-40. TO RELEASE BOMBS ELECTRICALLY (AD-3 SERIES AIRPLANES).

a. Armament master switch—"ON."

b. Bomb safety switch—"BOMBS."

c. Bomb selector switches—"TRAIN.BOMB 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. Station selector switch—Set as desired—(INNER STATIONS)—and proceed as follows:

f. With station selector switch at "SINGLE PULSE" press the control stick bomb release switch for each selected bomb release.

g. With station selector switch at "INTERV" 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. With station selector switch at "AN/ASG-10A" and AN/ASG-10A selector switch at "OUT," depress control stick bomb release switch after indicated airspeed is greater than 250 knots and hold depressed until after completion of pull-out (see paragraph 4-33).

i. With station selector switch at "AN/ASG-10A" and AN/ASG-10A selector switch at "IN," set the intervalometer selector switch to the desired "RELEASES PER SECOND," and after indicated airspeed is greater than 250 knots, hold control stick bomb release switch depressed until after completion of pull-out (see paragraph 4-33).

4-41. TO RELEASE BOMBS MANUALLY. Refer to paragraph 3-39.

4-42. TO RELEASE TORPEDOES. Torpedoes are released in the same manner as bombs (see paragraphs 4-39, 4-40 and 4-41). No provisions are made for depth setting from the cockpit.

4-43. TO OPERATE SMOKE TANKS. (AD-2 SERIES AIRPLANES.)

a. Armament master switch—"ON."

b. Set either or both wing bomb safety switches to "SMOKE OR FLARES."

c. Set the bomb selector switch to "LEFT," "RIGHT" or "ALL" (to release smoke simultaneously from both tanks).

Note

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

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.

4-44. TO OPERATE SMOKE TANKS. (AD-3 SERIES AIRPLANES.)

a. Armament master switch—"ON."

b. Bomb safety switch—"SMOKE OF FLARES."

c. Set either or both wing bomb selector switches to "TRAIN BOMB OR FLARES."

Note

If a bomb is being carried on the fuselage bomb rack, check to see that the center bomb selector switch is in the center (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.

4-45. 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 4-39, 4-40 and 4-41).

4-46. ROCKET EQUIPMENT.

4-47. DESCRIPTION. Provisions are made for carrying 12 five-inch HVAR rockets, six under each outer wing panel.

4-48. ROCKET LAUNCHERS. Mark 9 rocket launchers, designed to carry 5-inch HVAR rockets, are installed. The rockets are armed and fired electrically by the pilot.

4-49. The MK 2 station selector provides for firing rockets singly and in pairs. The selector jumps one position each time the rocket release button is released after firing.

4-50. ROCKET CONTROLS.

4-51. ROCKET SELECTOR SWITCH. The rocket selector switch is located on the left-hand side of the armament control panel (figure 4-1, reference 4).

4-52. ROCKET ARMING SWITCH. On AD-2 series airplanes, the arming switch (figure 4-1, reference 5) is located below the rocket selector switch. On AD-3 series airplanes, the bomb and rocket arming switch (figure 4-1, reference 9) arms both the rockets (outer stations) and the bombs (inner stations) simultaneously.

4-53. OPERATION OF ROCKET EQUIPMENT.

4-54. TO RELEASE ROCKETS. (AD-2 SERIES AIRPLANES.)

a. Armament master switch—"ON."

b. Operate gunsight—See paragraph 4-10.

c. Rocket selector switch—As desired.

d. Rocket arming switch—As desired.

e. Station selector switch—As desired—(OUTER STATIONS)—and proceed as follows:

f. With station selector switch at "SINGLE PULSE," press the control stick rocket release switch for each selected rocket release.

g. With station selector switch at "INTER," 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. With station selector switch at "AN/ASG-10A WITH INERVALOMETER," set the intervalometer selector switch to the desired "RELEASES PER SECOND," and after indicated airspeed is greater than 250 knots, hold control stick rocket release switch depressed until after completion of pull-out see paragraph 4-33).

4-55. TO RELEASE ROCKETS. (AD-3 SERIES AIRPLANES.)

a. Armament master switch—"ON."
b. Operate gunsight—See paragraph 4-10.
c. Rocket selector switch—As desired.
d. Bomb and rocket arming switch—As desired.
e. Station selector switch—As desired—(OUTER STATIONS)—and proceed as follows:
f. With station selector switch at "SINGLE PULSE," press the control stick rocket release switch for each selected rocket release.
g. With station selector switch at "INTERV," 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. With station selector switch at "AN/ASG-10A" and AN/ASG-10A selector switch at "OUT," depress control stick rocket release switch after indicated airspeed is greater than 250 knots and hold depressed until after completion of pull-out (see paragraph 4-33).
i. With station selector switch at "AN/ASG-10A" and AN/ASG-10A selector switch at "IN," set the intervalometer selector switch to the desired "RELEASES PER SECOND," and after indicated airspeed is greater than 250 knots, hold control stick rocket release switch depressed until after completion of pull-out (see paragraph 4-33).

Note

The setting of the interval selector switch indicates the number of releases per second singly or in pairs when the intervalometer is used.

The MK 2 Station Selector has no provision for salvo.

4-56. OXYGEN EQUIPMENT.

4-57. GENERAL. Oxygen is supplied from one oxygen cylinder located below the cockpit floor. In AD-2 and AD-3 airplanes oxygen is supplied to the pilot by a cylinder of 295 cubic inches capacity, while in AD-2Q and AD-3Q airplanes oxygen is supplied to the crew from a cylinder of 514 cubic inches capacity. The oxygen cylinder refill valve is located just below the enclosure on the right-hand side of the airplane. AD-2 airplanes 122210 thru 122294 and AD-2Q airplanes 122366 thru 122370 incorporate a remote cylinder shut-off valve control (figure 1-4, reference 3) and a diluter-demand regulator (figure 1-4, reference 1) to the left and aft of the pilot's seat. A composite diluter-demand regulator panel (figure 1-4, reference 22) is provided on AD-3 series airplanes on the left-hand control console. On AD-2 series airplanes, a blinker flow indicator and the oxygen system pressure gage (figure 1-4, reference 22) is provided on the left-hand console panel. On AD-2Q airplanes the diluter-demand oxygen regulator with blinker flow indicator attached is installed to the left of the RCM operator. On AD-3Q airplanes a composite diluter-demand oxygen regulator is located to the left of the RCM operator.

4-58. OXYGEN REGULATOR CONTROLS.

4-59. 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.

4-60. SAFETY PRESSURE BUTTON. By manually depressing the button marked "Safety Pressure," a pressure of $1\frac{3}{4} \pm \frac{1}{4}$ inches of water is delivered to the mask. Safety pressure shall be used at all times, when above 35,000 feet. Safety pressure should not be used routinely at lower altitudes since the use of safety pressure reduces the effectiveness of the air diluter and causes increased oxygen consumption.

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.

4-61. EMERGENCY LEVER. This lever is installed only on the diluter-demand type regulator (see paragraph 4-57) and 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.

4-62. 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. On the diluter-demand type regulators, check to see that the regulator emergency valve is closed.
b. On the composite diluter-demand type regulators, check to see that the safety pressure button is up (OFF).
c. Connect the lower end of the composite disconnect into the personnel gear console receptacle at the left of the seat. Check leak tightness of the oxygen connections as follows:
d. Insert a spare mask tube connector, AN 6043, into the breathing tube connector at the personnel gear receptacle.

e. Blow gently into the open end of the disconnect. If the system is tight a definite resistance should be felt.

f. If the blowing pressure dissipates, leakage exists. Check the disconnect, regulator outlet elbow and breathing tube hose clamps for tightness. If leakage still persists, replace the regulator.

g. 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. DO NOT USE A MASK THAT LEAKS. The characteristics of the A-13A mask are such that with the breathing tube sealed by the thumb, after the first inhalation, the exhalation valve may remain open. In testing, release the thumb after each inhalation.

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

i. 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.

4–63. 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 and RCM operator's flying suits or life vests as shown in figure 1–8. 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. On AD-2 and AD-2Q airplanes noted in paragraph 4–57, check to see that the cylinder valve is open. The pressure gage on all airplanes should read 1980 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 light. 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

With diluter-demand type regulator, never obstruct free flow of oxygen from the regulator while the emergency valve is open.

4–64. 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.

4–65. EMERGENCY CONDITIONS.

a. Should symptoms occur which suggest the onset of anoxia, proceed as follows: on AD-2 and AD-2Q airplanes having a straight diluter-demand type regulator, slowly rotate the "EMER" valve control counterclockwise to obtain the minimum flow of 100 percent oxygen required and descend below 10,000 feet. On all airplanes having composite diluter-demand type regulators, immediately depress the "SAFETY PRESSURE" button and descend below 10,000 feet. If for any reason a constant flow of oxygen is not obtained by "EMER" or "SAFETY PRESSURE," activate the oxygen bailout equipment 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.

	DURATION (MAN-HOURS)			
	AIR VALVE "ON" (Normal Flow)		AIR VALVE "OFF" (100% Oxygen)	
ALTITUDE	AD-2 AD-3	AD-2Q AD-3Q	AD-2 AD-3	AD-2Q AD-3Q
10,000	5.1	8.8	0.65	1.13
15,000	4.8	8.3	0.80	1.43
20,000	3.9	6.6	1.03	1.80
25,000	2.4	4.1	1.35	2.33
30,000	1.8	3.1	1.75	3.03

4–66. 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 percent 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 on diluter-demand regulators should be closed at all times except in an emergency, and then it should be opened slowly to minimum flow required.

4–67. HEATING SYSTEM.

4–68. PILOT'S COMPARTMENT. 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 (see figure 4–3). The distributor valve control (figure 1–6, reference 20) is located to the right of the pilot and provides for three positions: "OFF," "WINDSHIELD & CABIN" and the auxiliary position "ALL TO WINDSHIELD." Intermediate heat can be obtained by placing the control in any desired intermediate position.

4–69. RCM COMPARTMENT. The RCM operator's compartment is provided with a separate heating system (figure 4–3). The heater wiring system is safetied through a switch on the left landing gear so that whenever the airplane is resting on the gear, the heater circuit is inoperative. Fuel for the heater is supplied by the engine-driven fuel pump. The heater control knob is located on a panel above the RCM equipment and incorporates the following positions: "VENT AIR," "HEATER ON," and "HEAT." The control knob should be on the "VENT AIR" side of "HEATER ON" whenever heated air is not required. Within 90 seconds after the control knob is moved to "HEATER ON" position, during flight, heat will be supplied to the RCM operator's compartment. Moving the control knob towards "HEAT" progressively increases the amount of heat being delivered to the heater outlets. An automatic thermoswitch serves to prevent excessive outlet temperature by stopping the fuel flow to the heater.

4–70. VENTILATING SYSTEM.

4–71. PILOT'S COMPARTMENT. Air taken in from the intake duct is routed directly to a diffuser outlet at the firewall (see figure 4–4). The amount of air flow is controlled by the "VENTILATOR" lever (figure 1–6, reference 19) 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 1–6, reference 4).

4–72. RCM COMPARTMENT. Ventilating air from an air scoop (see figure 4–4) flows to a diffuser to cool the electronic equipment and the RCM operator. The amount of air flow is controlled by the heat and vent control knob. An auxiliary air outlet (eyeball) is provided on the heat and vent control panel, to direct additional air to the upper portion of the RCM operator. Full ventilation is obtained by moving the heat and vent control knob to "VENT AIR." Progressively less ventilation is obtained as the control knob is moved toward the "HEATER ON" position where all air is shut-off except for a small quantity required to prevent accumulation of carbon monoxide in the compartment.

4–73. WINDSHIELD DEGREASING SYSTEM.

4–74. GENERAL. A windshield degreasing system is provided for improved visibility. A momentary contact control switch (figure 1–4, reference 17) 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 at a time are required. Yawing the airplane will assist the degreasing operation.

WARNING

Close canopy before degreasing windshield. Fluid will enter the cockpit area with the canopy open.

4–75. ELECTRONIC EQUIPMENT.

4–76. GENERAL. The electronic equipment in these airplanes is listed in the Electronic Equipment Chart, figure 4–5.

4–77. RADIO CONTROLS. Console controls for all radio equipment are installed on the right-hand console panel (figure 1–6) except for the AN/APS-4 radar equipment (figure 1–4, reference 11), which is located on the left-hand console. The master switch and volume control (figure 1–6, reference 27) for various units of communcation and navigation equipment is also on the right-hand console.

4–78. OPERATING INSTRUCTIONS.

4–79. ON ENTERING THE COCKPIT.

a. Insert the microphone and headset plugs into the personnel gear adapter (figure 1–11). As a secondary provision, it is possible to connect the microphone and headset to the CX922/AR coil cord jack on the seat back at the pilot's left shoulder.

Note

Make certain that the plugs are fully engaged.

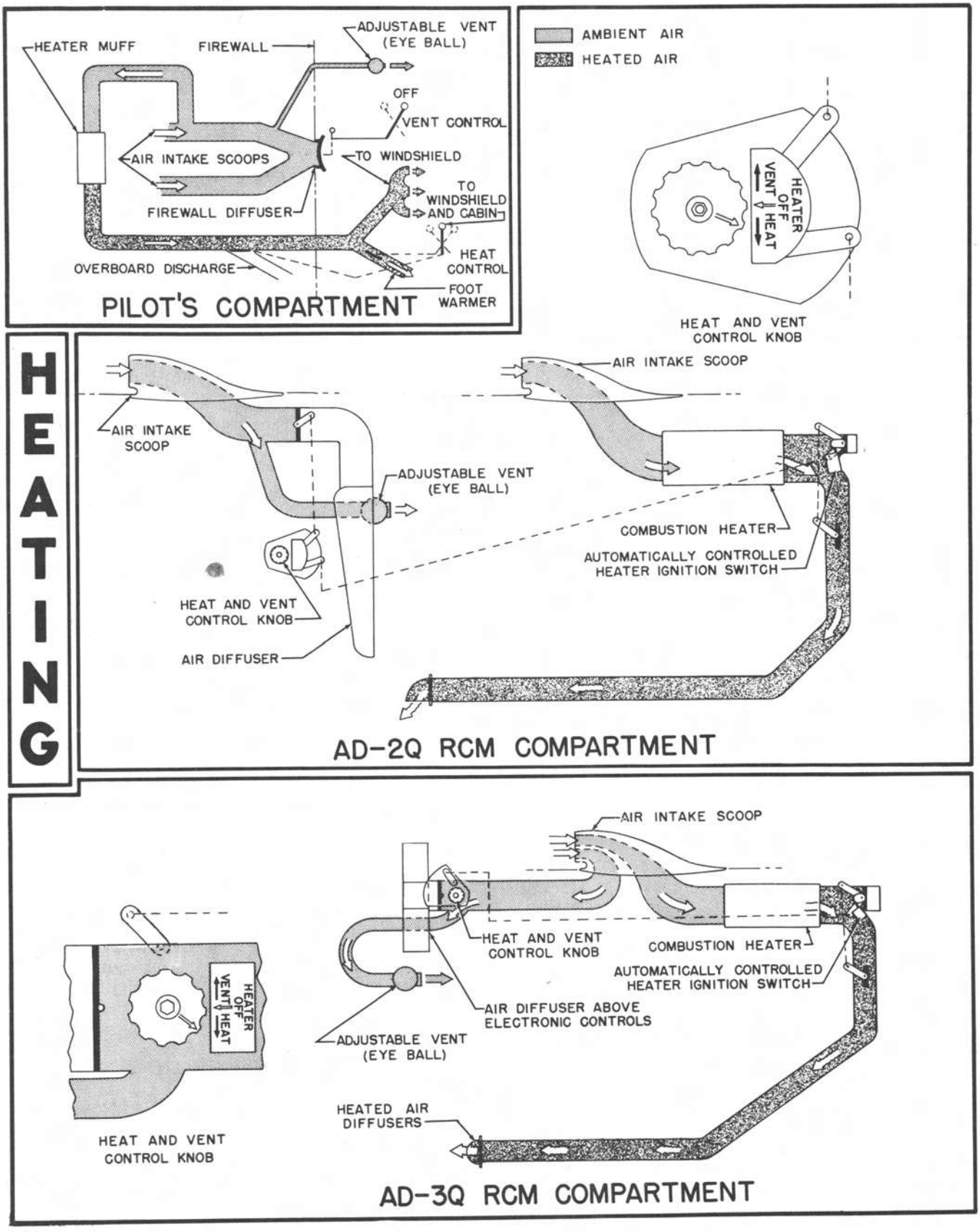


Figure 4-3. Heating System Diagram

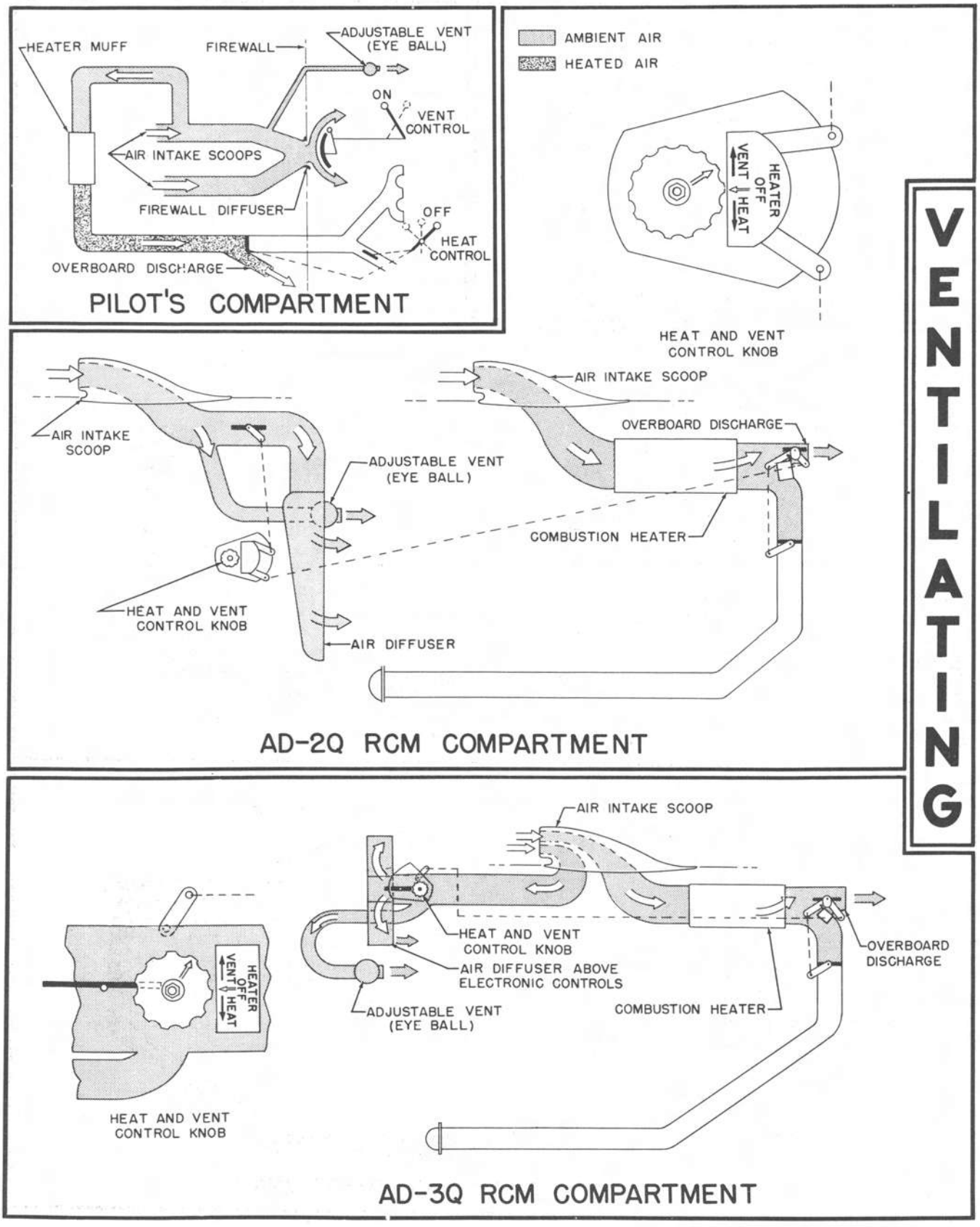


Figure 4-4. Ventilating System Diagram

AD-2	AD-2Q	AD-3	AD-3Q	Designation	Type	Range	Operator	Paragraph Covering Operation
x	x	x	x	AN/ASG-10A	Electric bombing	—	Pilot	4-26
x	x	x	x	AN/ARC-1	VHF	Horizon	Pilot	4-80
–	–	–	x	AN/ARA-8	Homing adapter	8 to 32 miles	Pilot	4-84
x	x	x	x	AN/ARC-5	Range receiver	75 miles	Pilot	4-89
x	x	x	x	AN/ARR-2A	Navigation receiver	Horizon	Pilot	4-91
x	x	x	x	AN/APX-2A	IFF	Horizon	Pilot	4-94
x	x	x	x	AN/APS-4	Radar search	Indicated on equipment	Pilot	4-98
x	x	x	x	AN/APN-1	Radio altimeter	0-400 feet or 0-4000 feet	Pilot	4-106
–	x	–	x	AN/AIC-4	Intercommunication	—	Crew	4-110
–	x	–	–	AN/APR-1	Search receiver	Horizon	RCM	4-112
–	x	–	–	AN/APA-11	Pulse analyzer	—	RCM	4-115
–	x	–	–	AN/APA-38	Panoramic adapter	—	RCM	4-121
–	x	–	–	MX/356A	Electric window dispenser	—	RCM	4-125
–	–	–	x	Chute	Manual window dispenser	—	RCM	4-127
–	–	–	x	AN/APR-9	Search receiver	Horizon	RCM	4-129
–	–	–	x	AN/APA-70	Radar homing	—	RCM	4-142
–	–	–	x	AN/APA-64	Pulse analyzer	—	RCM	4-147

Figure 4-5. Electronic Equipment Chart

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

c. The AN/ASG-10A electronic bombing 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 MK 1 Mod. 2, AN/ASG-10A" CO NAVAER 16-5S-524. All other equipment should be checked as noted in the following paragraphs.

4-80. AN/ARC-1 EQUIPMENT.

4-81. TO RECEIVE. Advance the radio volume control on the "MASTER" unit for normal reception. Turn the guard-main switch on the "VHF" control unit, to the "BOTH" position and rotate the channel selector switch to the desired channel. At the conclusion of reception reduce the volume as necessary by means of the radio volume control on the "MASTER" unit.

4-82. TO TRANSMIT. Rotate the guard-main switch on the "VHF" unit to "MAIN T/R" and rotate the channel selector switch for transmission on any one of the nine channels. Commence transmission by pressing the throttle switch and talking into the microphone.

4-83. PRECAUTIONS. The pilot should acquaint himself with all pre-set controls and equipment and not try to readjust them in flight.

4-84. AN/ARA-8 (HOMING ADAPTER) RADIO EQUIPMENT—AD-3Q ONLY.

4-85. GENERAL. The AN/ARA-8 homing adapter is used in conjunction with the AN/ARC-1 (VHF) radio equipment to provide the pilot with a means of homing on any transmitted carrier wave within the frequency range of 120 to 140 megacycles. The equipment consists of the MD-34/ARA-8 modulator keying unit, control console, NAF216341-1 antenna relay and NAF49984-1 junction box.

4-86. HOMING ADAPTER MODULATOR KEYING UNIT. The MD-34/ARA-8 modulator keying unit contains a 28-volt motor, a coaxial double-leaf switch, and a rocker-arm-and-cam assembly. The cam, which is geared to the motor to turn at approximately 50 rpm, is double cut to key to character D (— – –) on one side of the coaxial switch and the character U (— —) on the other side of the switch. The unit is supplied with power from the main d-c bus, and is controlled by a manual switching arrangement in the control console.

4-87. HOMING ADAPTER CONTROL CONSOLE. The control console for the AN/ARA-8 radio is mounted in the pilot's right-hand control console. It contains a three-position toggle switch marked "HOMING-COMM-TRANS," a two-position toggle switch marked "CW-MCW" and a volume control knob. A guard on the "HOMING-COMM-TRANS" switch prevents accidental movement of the switch to "TRANS."

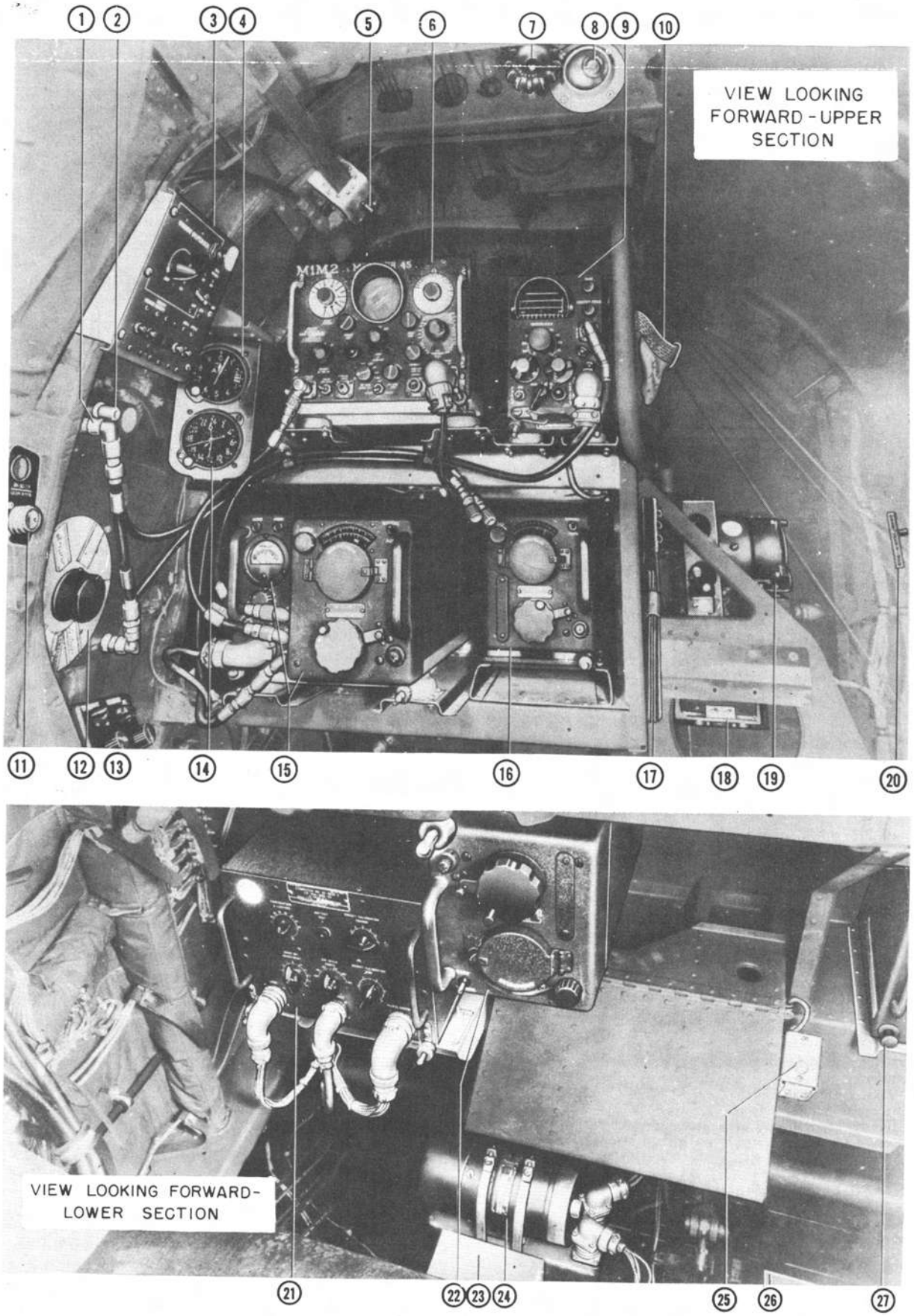
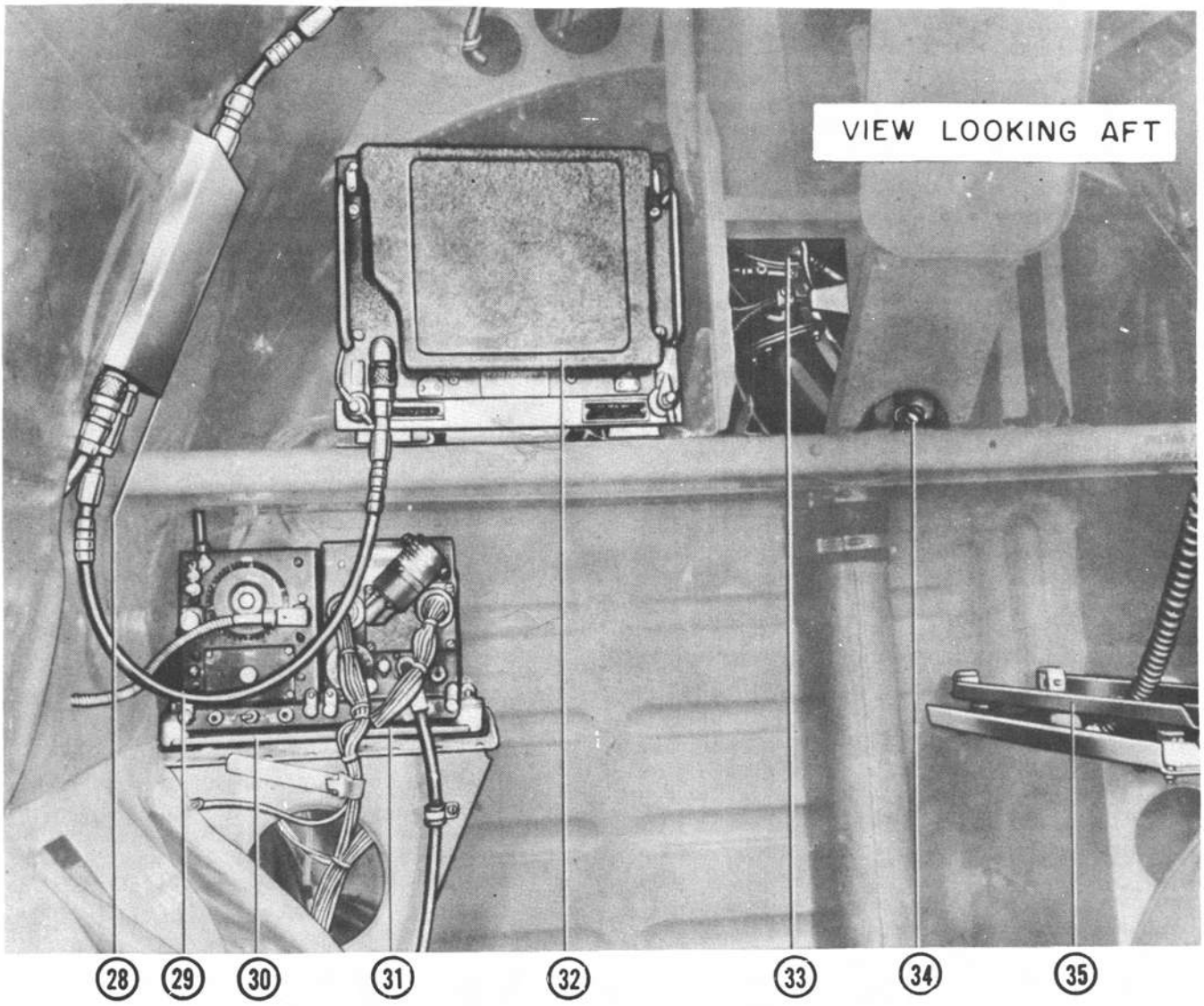


Figure 4-6 (Sheet 1 of 2 Sheets). RCM Compartment—AD-2Q



1. Receiver antenna socket
2. Transmitter antenna socket
3. Window dispenser and circuit breaker panel
4. Altimeter
5. F-27/UPR wave trap
6. AN/APA-11 unit
7. Heating and ventilation control knob
8. Ventilator (Eyeball)
9. AN/APA-38 unit
10. Canteen stowage
11. Utility receptacle and cigarette lighter
12. Receiving antenna switch and patch panel
13. ICS control box
14. Civil date clock
15. AN/APR-1 with tuning unit
16. AN/APR-1 spare tuning unit
17. Data case
18. AM-40/AIC-4 amplifier
19. AN/ASG-10A gyros
20. RCM door jettison control handle
21. AN/ASG-10A computer
22. AN/APR-1 spare tuning unit
23. Condenser
24. A-c motor alternator
25. Microphone foot-switch
26. Battery
27. AN/APN-1 radio altimeter
28. Filter F-65/A
29. Filter F-66/A
30. AN/ARC-5 radio
31. AN/ARR-2A radio
32. AN/ARC-1 radio
33. RCM compartment heater
34. Inertia reel cable
35. AN/APQ-2A alternate power supply

Figure 4-6 (Sheet 2 of 2 Sheets). RCM Compartment—AD-2Q Airplanes

4-88. HOMING ADAPTER ANTENNA RELAY. The RE-13/ARA-8 (modified) antenna relay is located on the right-hand side of the radio compartment. It connects the antenna cable of the AN/ARC-1 radio equipment to either the composite blade antenna or the modulator keying unit depending on whether "COMM" or "HOMING" is selected at the control console.

4-89. AN/ARC-5 EQUIPMENT.

4-90. TO RECEIVE. Turn the tuning knob on the "RECVR" unit to the desired frequency and adjust the "SENS" control for normal operation. THIS CONTROL SHOULD BE SET FOR THE MINIMUM REQUIRED FOR RECEPTION TO AVOID INCORRECT COURSE INDICATIONS. When operation is concluded turn the "SENS" control to a minimum.

4-91. AN/ARR-2A NAVIGATION RECEIVER.

4-92. Turn the "CHAN SEL" knob on the "NAVIG" unit to the assigned channel number. Turn the "NAV-VOICE" switch to "NAV." Adjust the "SENS" knob to produce a usable weak signal or, if the desired signal cannot be heard, to a fairly strong background hiss. If a signal is present, adjust the pitch control for a pleasing, audible tone. Readjust the "SENS" knob to keep the signal rather weak. When the operation is completed turn the "SENS" knob to its lowest output.

4-93. SIMULTANEOUS RECEPTION. With the navigation receiver in operation as described, adjust the controls on the "RECVR" and "NAVIG" units and adjust the "COMM VOLUME" control on "MASTER" panel as required. The "GUARD-BOTH-MAIN T/R" switch on the "VHF" units should be in the "BOTH" position so that the guard channel and the main T/R channel will be monitored simultaneously. The outputs of all three receivers are now being fed simultaneously into the headphones.

4-94. AN/APX-2 IFF EQUIPMENT.

4-95. TO START EQUIPMENT. Rotate the master control switch, on the IFF control unit, clockwise away from the "OFF" position and set it in the desired operating position.

4-96. TO STOP EQUIPMENT. Rotate the master control switch, on the IFF control unit, to the extreme counterclockwise position marked "OFF."

4-97. CHECK-OFF LIST.

a. SELECTOR SWITCH. Move to a designated position, which is usually position "1."

b. FOR G-BAND OPERATION. Throw the "G-BAND" switch, on the IFF console unit, to the "CONT" position or flip it to the "TMPRY" position.

c. FOR INT OPERATION. Throw the "INT" switch on the IFF console control unit, to the "INT" position or hold it momentarily in the "TMPRY" position.

d. FOR ROO OPERATION. Rotate the master control switch, on the IFF console control unit, to the "ROOSTER" position. (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.)

e. FOR DISTRESS OPERATION. Push the guard latch, on the IFF console control unit, to the right (tilting it up) and rotate the master control switch to the "EMERGENCY" (extreme clockwise) position. See paragraph 3-37.

f. TO DESTROY THE TRANMITTER-RECEIVER UNIT. (See paragraph 3-37.)

4-98. AN/APS-4 RADAR EQUIPMENT.

4-99. INITIAL CHECK OF SETTINGS.

a. "RADAR-BEACON" switch—"RADAR."

b. "SEARCH-INTERCEPT" switch—"SEARCH."

c. "RANGE" switch—Second position from the left.

d. "TILT" switch—Zero tilt position.

e. "GAIN" switch—Full counterclockwise.

f. "OFF-HOLD 1 MIN-RUN" switch—"OFF."

g. "INTENSITY" knob—Full counterclockwise.

h. "TUNE" knob—Center.

4-100. TO START EQUIPMENT. Throw the "OFF-HOLD 1 MIN-RUN" switch to the "HOLD 1 MIN" position. After an interval of at least one minute (two to three minutes in extreme cold), throw the switch to the "RUN" position.

4-101. TO STOP EQUIPMENT.

a. "OFF-HOLD 1 MIN-RUN" switch to "OFF."

b. "INTENSITY" control—Full counterclockwise.

c. "GAIN" control—Full counterclockwise.

4-102. CHECK-OFF LIST.

4-103. IF SURFACE TARGETS ARE SOUGHT.

a. "OFF-HOLD 1 MIN-RUN" switch—"HOLD 1 MIN."

b. "RADAR-BEACON" switch—"RADAR."

c. "SEARCH-INTERCEPT" switch—"SEARCH."

d. "RANGE" switch—Second position from the left.

e. "TILT" control—One position to the left of the zero tilt position.

f. "GAIN" control—45° to the left of vertical.

g. "TUNE" control—Center.

h. One minute after turning the "OFF-HOLD 1 MIN-RUN" switch to "HOLD 1 MIN" (two or three minutes in extreme cold), turn it to "RUN."

i. Turn the INTENSITY control to illuminate moderately the indicator screen.

j. Adjust "TUNE" and "GAIN" controls.

4-104. IF AIR TARGETS ARE SOUGHT.

a. "OFF-HOLD 1 MIN-RUN" switch to "HOLD 1 MIN."

b. "RADAR-BEACON" switch—"RADAR."

c. "SEARCH-INTERCEPT" switch—"INTERCEPT."

d. "RANGE" switch—First position from the left.

e. "TILT" control—Zero tilt position.

f. "GAIN" control—45° to the left of vertical.

g. "TUNE" control—Center.

h. One minute after turning the "OFF-HOLD 1 MIN-RUN" switch to "HOLD 1 MIN" (two or three minutes in extreme cold), turn it to "RUN."

i. Turn the INTENSITY control to a position to illuminate moderately the indicator screen.

j. Adjust "TUNE" and "GAIN" control.

k. Operate the "TILT" control for optimum results.

4-105. IF BEACON HOMING IS DESIRED.

a. "OFF-HOLD 1 MIN-RUN" switch to "HOLD 1 MIN."

b. "RADAR-BEACON" switch—"BEACON."

c. "SEARCH-INTERCEPT" switch—"SEARCH."

d. "RANGE" switch—Extreme right position or the next position to the left.

e. "TILT" control—Zero tilt position.

f. "GAIN" control—45° to the left of vertical.

g. "TUNE" control—Center.

h. One minute after turning the "OFF-HOLD 1 MIN-RUN" switch to "HOLD 1 MIN" (two or three minutes in extreme cold), turn it to "RUN."

i. Turn the INTENSITY control to illuminate moderately the indicator screen.

j. Adjust "TUNE" and "GAIN" control.

4-106. AN/APN-1 RADIO ALTIMETER SET.

4-107. TO START EQUIPMENT. To commence operation turn the power switch located on the radio altitude indicator to "ON."

4-108. TO STOP EQUIPMENT. Turn the power switch counterclockwise.

4-109. CHECK-OFF LIST.

a. Allow one minute for the 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.

b. Set range switch located on the radio altitude indicator to the desired altitude range.

c. Set limit switch located on the AN/APN-1 console panel for the altitude at which the limit indicator light, which is installed adjacent to the indicator, will operate.

WARNING

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

4-110. AN/AIC-4 INTERPHONE EQUIPMENT.

4-111. Interphone equipment is provided on AD-2Q and AD-3Q airplanes only. The pilot's interphone console (figure 1-6, reference 31) is on the right-hand console panel. The interphone equipment is in operation whenever the master radio switch is "ON" and the interphone control switch is at "NORMAL." In case of interphone failure, the interphone switch should be turned to "ALTERNATE." This by-passes the interphone completely and gives receiver audios directly to the pilot without amplification at reduced level.

4-112. AN/APR-1 SEARCH RECEIVER.

4-113. OPERATING PROCEDURE.

a. See that the tuning unit covering the frequency range desired is in position, that the headphones are plugged in, and that all the power and antenna cables are properly connected.

b. See that the R-F switch, located on the left-hand side of the fuselage adjacent to the RCM operator's seat, is set for operation for the antenna covering the range of the tuning unit in use.

c. Turn the PWR-OFF switch to the "PWR" position. Allow a ten minute warm-up period. An audible hiss will be noted in the absence of a signal. This is an indication that the unit is in operation.

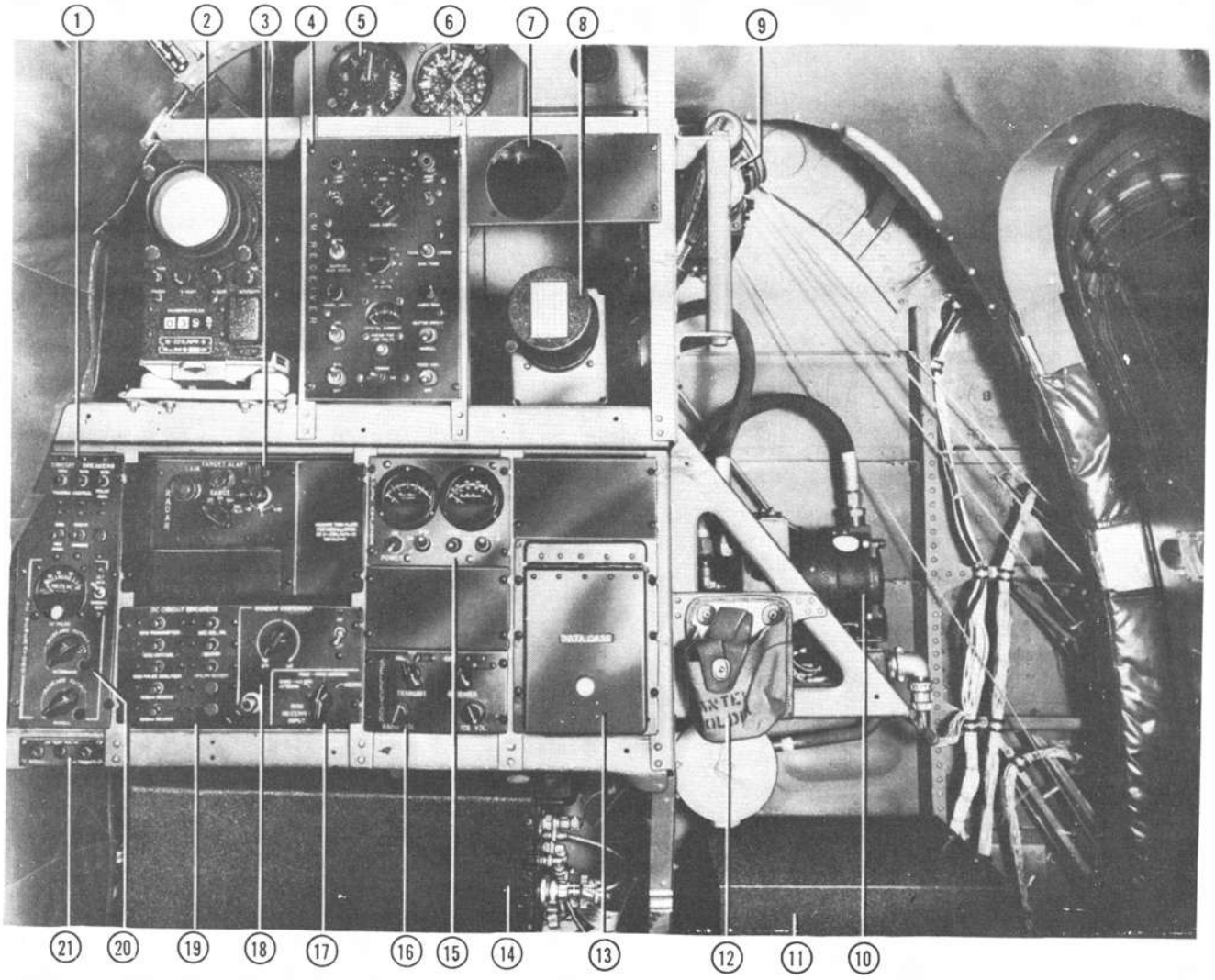
d. The HET-OFF switch should be in the "OFF" position, unless it is desired to receive unmodulated CW signals.

e. The I.F. GAIN control should be at the maximum clockwise position with the AVC switch in the "AVC" (or "ON") position. This will automatically control the output of the receiver, and maintain that output constant, while the input may vary in strength. In certain cases, it is desirable to remove this function and resort to manual gain control. This is accomplished by turning the AVC switch to the "OFF" position, and operating the I.F. GAIN control.

Note

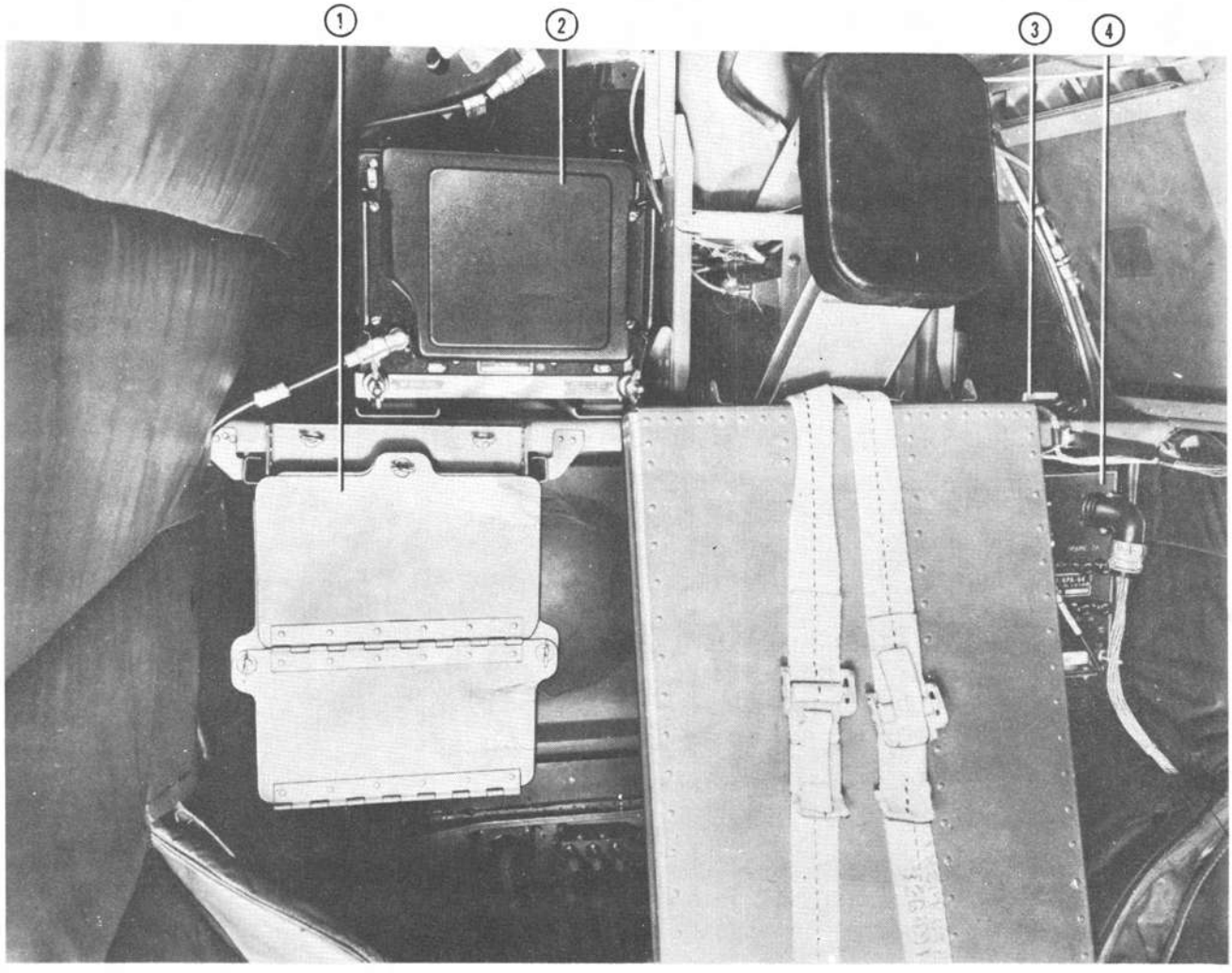
Extreme care should be used while receiving a signal to keep the manual gain control at as low a setting as possible, so that the tuning meter will not read over half scale. If this is not done, overloading will take place in the receiver which may give false indications, and false information, as to the characteristics of the received signal.

f. When using manual tuners, turn the tuning knob until the signal is received. Frequency of the received



1. RCM equipment circuit breaker panel.
2. ID-226/APR-9 indicator panel
3. C-122A/APS-4 radar control console
4. C-426/APR-9 remote control unit
5. Altimeter
6. Elapsed time clock
7. AN/APA-70 indicator panel
8. ID-11/APS-4 indicator panel
9. AM-5/APS-4 indicator panel
10. AN/ASG-10A gyros
11. AN/ASG-10A computor
12. Canteen holder
13. Data case
14. CV-43/APR-9 mixer amplifier
15. ID-228A/APA-64 indicator panel
16. C-387/AIC-4 interphone control panel
17. RCM receiver input selector switch
18. Window dispenser control unit
19. D-c circuit breaker panel
20. Generator control panel
21. A-c test jacks

Figure 4-7 (Sheet 1 of 2 Sheets). RCM Compartment—AD-3Q



1. Window package stowage
2. RT-18/ARC-1 transmitter-receiver modified for AN/ARA-8
3. CX-922/AR microphone headset extension
4. RF-38A/APA-64 pulse analyzer

Figure 4-7 (Sheet 2 of 2 Sheets). RCM Compartment—AD-3Q

signal can be read directly on the dial. To check the signal for the correct frequency, see paragraph 4–106.

g. When using the sector sweep tuners, set the AUTO-MANUAL switch to the "AUTO" position. The tuner will automatically tune through the range selected, reversing itself when reaching its end frequency. The possibility of missing a weak signal can be reduced by regulating the SPEED control. As soon as a signal is detected, switch the tuner to the "MANUAL" position and tune the signal in manually.

WARNING

Do not operate the tuner manually with the MANUAL-AUTO switch in the "AUTO" position.

4–114. USE OF F-27/UPR WAVE TRAP TO DETERMINE EXACT SIGNAL FREQUENCY OF INCOMING SIGNAL. Some trouble has been experienced in determining the exact frequency of incoming signals because of spurious responses generated in the equipment in the presence of strong signals. By the use of a wave trap, which is located on the left-hand side of the fuselage adjacent to the RCM operator's seat, and which is inserted between the antenna and the receiver, the exact frequency of the signal is determined.

a. The switch on the wave trap must be kept in the "OUT" position until a signal is received. When it is desired to measure the carrier frequency of a signal, the switch must be in the "IN" position.

b. Move the tuning slider downward from the high frequency end of the stub. If no null is encountered before reaching the 700 mc. calibration point, the

[illegible] below 600 mc. and [illegible] scale.

c. If a null is encountered above 700 mc. calibration, the frequency is above 700 mc. and must be [illegible] on the sliding scale as follows:

d. [illegible] slider down [illegible] the top end of the scale until a null is found.

e. [illegible] references on the sliding scale [illegible] the [illegible] slider.

f. [illegible] slider downward until the next null is found.

g. Read the frequency on the sliding scale directly [illegible].

h. When checking [illegible] signals on the sliding scale, the [illegible] of the null should be used, as it is difficult to [illegible] the "bottom" of the null. Establish a convenient reference point on the pulse analyzer, where the signal amplitude just begins to dip. Moving the [illegible] toward the next null until the [illegible] pulse analyzer is obtained [illegible] second [illegible].

i. A definite null will be observed for any signal within the range of 3,000 to 3,400 mc., provided that the signal is being received through the antenna. Direct pick-up from equipment in the vicinity of the receiver is occasionally possible, and should immediately be suspected if a sharp null cannot be found. This may be checked readily by disconnecting the antenna input cable.

j. Always start at the high frequency (top) end of the scale [illegible] move the tuning slider downward when [illegible] the frequency of an unknown signal.

[illegible] AN/APA-11 PULSE ANALYZER.

[illegible]. STARTING AND STOPPING EQUIPMENT. To start the equipment, place the POWER SWITCH in the "ON" position. To stop the equipment, place the switch in the "OFF" position.

[illegible]. TO MEASURE PULSE DURATION TIME.

a. Turn the MODE OF OPERATION switch to [illegible].

b. Adjust the associated equipment to supply the indicator with negative and/or positive pulsated voltage. Throw the PULSE POLARITY switch to left or right for required signal.

c. Adjust the TRIGGER GAIN control to obtain a stationary pattern on the screen of the cathode-ray tube.

d. Turn the INTENSITY CONTROL until the beam is of suitable brilliancy. Avoid blooming of spot at the [illegible] of the trace.

[illegible] VIDEO GAIN to give a convenient vertical [illegible] between ¼ and ¾ inch.

f. Turn the PULSE DURATION dial to set the left edge of the trace near the left side of the screen of the cathode-ray tube.

g. Turn the MULTIPLY SEC. BY switch to 1, 5 or 50, separate the start and finish of the pulse, keeping each well on the screen.

h. Using the PULSE DURATION dial, set the point on the right side of the pulse 3 db. down (approximately 30 percent) from the peak to the vertical index line. Read the microsecond setting on this dial.

i. Using the PULSE DURATION dial, set the point on the left side of the pulse 3 db. down (approximately 30 percent) from the peak of the vertical index line. Again read the microsecond setting. The difference between the readings of (h.) and (i.) multiplied by the indicated multiplying factor of (g.) above is the pulse duration time in microseconds.

[illegible]. TO DETERMINE REPETITION FREQUENCY. Adjust the associated equipment to supply the indicator with negative and/or positive pulsated voltage. Throw the PULSE POLARITY switch to the left or right for the required signal.

a. Turn the MODE OF OPERATION switch to "P.R.F."

b. Set the MULTIPLY SEC. BY switch to "5."

c. Adjust the TRIGGER GAIN control to near maximum.

d. Set the INTENSITY control to obtain suitable brilliance. Avoid too much brilliancy.

e. Turn the P.R. FREQUENCY (K.C.) control and the INCREMENT P.R. FREQUENCY control to ".20 K.C." and "0%" respectively.

f. Adjust the VIDEO GAIN control to separate the multiple traces.

g. Starting at the extreme counterclockwise positions as mentioned in (e.) above, turn the P.R. FREQUENCY (K.C.) control step-by-step to the right and watch the pattern of the moving horizontal or near-horizontal lines on the screen. Look for (1) a mass of lines that are nearly indistinguishable from each other; or (2) four, three, two or one line. In general, when condition (1) exists, the equipment is operating near condition (2). Condition (2) gives a close indication of the true pulse repetition frequency.

h. When a position of the P.R. FREQUENCY (K.C.) control is found giving condition (1), turn the INCREMENT P.R. FREQUENCY control to the left and to the right slowly enough to bring the pattern into a stationary position, if this is possible, and see if the pattern fulfills condition (2) of paragraph (g) above. If it does not, continue turning the P.R. FREQUENCY (K.C.) control to the right and adjusting the INCREMENT P.R. FREQUENCY switch until condition (2) does exist.

i. The first point at which a single stationary trace may be found, while carefully turning the P.R. FREQUENCY (K.C.) control from the extreme left toward the right and at the same time slowly adjusting the INCREMENT P.R. FREQUENCY control, is the one indicating the true pulse repetition frequency. Other single stationary traces will be found beyond this point, but these may be neglected except as indicated in paragraph (l.) below.

j. To determine the actual pulse repetition frequency when the correct single trace is found, multiply the frequency indicated at the P.R. FREQUENCY (K.C.) control by 1000 and increase or decrease the resulting number by the percentage indicated by the INCREMENT P.R. FREQUENCY control. Determine the actual pulse repetition frequency as illustrated in the following example.

Example

The P.R. FREQUENCY (K.C.) control points to 1.90 and the INCREMENT P.R. FREQUENCY control indicates + 2 percent. The correct P.R.F. may be determined as follows: 1.90 × 1000 = 1900 pulses per second. Two percent of 1900 is 38. 1900 + 38 = 1938 pulses per second, which is the correct P.R.F. within plus or minus 5 percent.

k. The number of stationary traces seen on the screen always has some definite relationship to the P.R.F. However, the usable traces in determining P.R.F. are one, two, three and four. The following table gives the relationship between the stationary lines and the ratio of actual P.R.F. to the indication at the P.R. FREQUENCY control as well as the number of steps required to reach the actual P.R.F.

Oscilloscopic Pattern Stationary Lines	Radio Actual P.R.F. to Indication on P.R. FREQUENCY (K.C.)	Turn Switch to Right For One Less Line	Turn Switch to Right For P.R.F.*
1	1:1	0	This is P.R.F. except as noted in (1) below
2	2:1	7 or 8	7 or 8
3	3:1	4 or 5	12 or 13
4	4:1	2 or 3	15 or 16

* The relationships as shown in the two columns to the right are only approximate and adjusting the INCREMENT P.R. FREQUENCY control to actually find the desired trace requires care.

l. Other single traces may be found when the P.R. FREQUENCY (K.C.) control is adjusted to the right of the true indicating single trace so that if a single trace is found quickly without going through the sequence of operations outlined in paragraphs (g.) through (k.) above it will be necessary to make a check to find if it is true or spurious. This check consists of turning the P.R. FREQUENCY (K.C.) control seven or eight steps to the left. If proper adjustment of the INCREMENT P.R. FREQUENCY control at either of these two steps shows two tracks, then the frequency indicated when the single trace was obtained was the true P.R.F.

m. The method of checking back eight or nine steps from a single trace to a double trace to be sure the single trace is correct may not be applied below a P.R.F. of 400 because of limitations of the indicator. When a single trace appears with the P.R. FREQUENCY (K.C.) control adjusted between ".20" and ".41," it will have to be assumed that this is the true trace and the P.R.F. established accordingly.

4-119. TO OPERATE AS A CATHODE-RAY OSCILLOSCOPE.

a. Attach Cord CG-259/AP to "–PULSE INPUT." Throw the PULSE POLARITY swith to "—" (left position).

b. Turn the MODE OF OPERATION switch to "OSC."

c. Turn the TRIGGER GAIN control to minimum.

d. Adjust the INTENSITY control to obtain the required trace brilliance.

e. Adjust the PULSE DURATION control for horizontal centering.

f. Connect the test probe to the point where the signal is to be checked. Adjust the VIDEO GAIN control.

g. Select the sweep frequency. Set the SW. FREQ. RANGE (CY) switch pointer to approximate the frequency desired. Turn the SW. FREQ. FINE control to select the frequency required to stabilize the pattern on the screen. (With this control, frequencies above and below those indicated by the SW. FREQ. RANGE (CY) switch position may be obtained and overlapping of frequencies between the switch positions is thereby provided.)

4-120. TO ADJUST THE PILOT LAMP. Rotate the lens assembly slightly clockwise or counterclockwise to obtain the desired brightness.

4-121. AN/APA-38 PANORAMIC ADAPTER.

4-122. STARTING AND STOPPING EQUIPMENT.

a. To start the equipment, place the POWER switch in the "ON" position.

b. Turn on the search receiver (paragraph 4-100) and rotate its gain controls to their minimum positions.

c. Adjust the vertical position of the baseline so that it appears adjacent to, and slightly above, the calibrated line on the screen.

d. Adjust the focus of the adapter for the sharpest possible line.

e. Center the baseline horizontally so that it projects equally beyond both sides of the screen.

f. Adjust the intensity so that the trace is brilliant, yet not so brilliant as to produce halation on the screen.

CAUTION

Do not tamper with the semi-adjustable controls on the chassis. Adjustment of these controls is to be handled only by maintenance personnel.

g. To stop the equipment, place the POWER switch in the "OFF" position.

4–123. NORMAL PANORAMIC OPERATION.

a. Turn on the equipment. (See paragraph 4–122.) Wait about 20 seconds for the panoramic baseline to appear.

b. Turn the adapter GAIN control up about halfway, rotate the SWEEP control fully clockwise, and rotate the PAN-P.R.F. switch to the "PAN" position.

c. If the band to which the receiver is tuned is fairly well "POPULATED," signal deflections of various amplitudes should now be visible on the cathode-ray tube screen. If not, rotate the tuning dial of the receiver until signals appear.

d. Tune in any station on the receiver, using phones or the pulse analyzer. This station will produce a deflection that should be located DIRECTLY OVER THE ZERO MARKER ON THE PANORAMIC SCREEN. If the deflection is not centered, proceed as follows (steps e. through i.):

Note

Steps (e.) through (i.) must be accomplished in the order given.

e. Tune in the station on the receiver as accurately as possible.

f. Rotate the adapter SWEEP control almost fully counterclockwise.

g. Center the "spread out" peak by manipulating the CENTER FREQUENCY control.

h. Rotate the adapter SWEEP control fully clockwise.

i. If the peak is not centered above the ZERO on the screen, rotate the HORIZONTAL POSITION control until it is centered.

j. Always use as low a gain setting on the panoramic adapter as possible while still being able to see the weak stations heard on the receiver. If high gain is used, the noise level, as evidenced by random, jumpy deflections all over the screen, will also be high. Noise deflections produce confusion since it is sometimes difficult to differentiate between noise and signal.

k. The panoramic adapter is now ready for normal panoramic reception. Signals may be interpreted in terms of frequency, single strength, interference, modulation, etc.

4–124. P.R.F. DETERMINATION OPERATION.

a. Turn on the equipment. (See paragraph 4–122.) Wait about 20 seconds for the panoramic baseline to appear.

b. Turn the adapter GAIN control up about halfway and rotate the PAN-P.R.F. switch to the P.R.F.-1 position. If no pulses appear on the trace, tune the receiver slightly until they appear.

c. The pulses should appear as fairly pointed deflections moving across the screen.

d. Rotate the PAN-P.R.F. switch to the "PAN" position, reduce the sweep to ZERO, and center the received signal accurately as described in paragraph 4–123. Return the switch to the P.R.F.-1 position.

e. Slight retuning of the receiver or the CENTER FREQUENCY control of the adapter may be necessary to return the pulse pattern to the center.

f. Slowly rotate the SWEEP-P.R.F. control until a steady pattern of pulses is obtained. If there are a large number of pulses, rotate the switch to the "P.R.F.-2" position. Always endeavor to get a pattern of few pulse peaks rather than many.

g. Count the pulses. The SWEEP-P.R.F. control must be adjusted so that the baseline under each of the pulses is OPEN. Spurious results if counts are taken when the baseline is closed under the pulses. Furthermore, if a pulse deflection appears on the return trace, it MUST be counter.

h. Read the dial of the SWEEP-P.R.F. Find this reading on the horizontal axis (abscissa) of the calibration charts provided with the instrument. Follow the vertical axis (ordinate) to the curve which applied to the setting of the switch, either P.R.F.-1 or P.R.F.-2 and read the frequency from the ordinate axis. NOW MULTIPLY THIS FREQUENCY BY THE NUMBER OF PULSES COUNTED IN (g.) above. The figure thus obtained is the pulse-rate frequency (P.R.F.) of the received signal.

Note

The panoramic screen gives no indication of pulse width and should not be used for this purpose.

4–125. MX-356/A AUTOMATIC WINDOW DISPENSER.

Note

Installed on AD-2Q only.

4–126. OPERATING PROCEDURE. The MX-356/A window dispenser is mounted on the right-hand wing bomb rack. On AD-2Q airplanes, the window dispenser controls are located on the left-hand side of the fuselage adjacent to the RCM operator's seat. On AD-3Q airplanes, the controls are located on the window dispenser and circuit breaker control panel in front of the RCM operator's seat. The dispenser is operated by placing the switch in the "ON" position and advancing the rheostat from the "OFF" position until the signal light blinks on, indicating that the packages are being dispensed. The rheostat may then be set at the desired speed to dispense the window packages in accordance with the mission to be performed. The following table gives the approximate rate of packages dispensed at the various settings of the rheostat. A check of the dispensing rate may be made by counting the flashes on the signal light over an interval of 15 seconds and multiplying the count by four to ascertain the rate per minute.

PACKAGE DISPENSING RATES

Approximate Rheostat Setting	Approximate Rate in Packages per Minute
OFF	0
¼ on	15
½ on	25
¾ on	35
Full on	45

4-127. MANUAL WINDOW DISPENSER.

4-128. Packages may be dispensed manually on AD-3Q airplanes through a chute located adjacent to the RCM operator's seat. The packages are stowed to the right and aft of the RCM operator's seat.

4-129. RCM EQUIPMENT.

4-130. GENERAL. The AN/APR-9 RCM equipment is a superheterodyne radio receiver used to detect and determine the frequency of radar and radio signals within the frequency range from 1,000 to 10,750 megacycles. The received signals are presented aurally by means of a headset, and visually by means of a panoramic oscilloscope which displays a 20-megacycle band of frequencies. Provisions are made for remote operation. This frequency range is covered by means of four R-F tuners, only one of which can be used at a time. The equipment consists of six major units: mixer-amplifier CV-43/APR-9, indicator ID-226/APR-9, remote control C-426/APR-9, power supply PP-336/APR-9, power supply PP-337/APR-9, and one of the following R-F tuners:

Tuner	Frequency Range
R-F tuner TN-128/APR-9	1000 to 2600 m-c
R-F tuner TN-129/APR-9	2300 to 4450 m-c
R-F tuner TN-130/APR-9	4300 to 7350 m-c
R-F tuner TN-131/APR-9	7050 to 10,750 m-c

4-131. The range covered by each of the tuners overlaps the range of its neighboring tuner by 300 megacycles. The signals received are displayed on the cathode-ray oscilloscope in indicator ID-226/APR-9 or may be heard through the head phones. In addition, two video outputs are available for connection to Direction Finding and Signal Analysis equipment should further analysis of the signals be necessary. The frequency and type of modulation of the received signals may be accurately determined, and characteristics such as pulse repetition rate, pulse width, scanning rate and warble may be estimated.

4-132. CONTROLS. All controls necessary for the operation of the equipment are located on the C-426/APR-9 remote control panel and ID-226/APR-9 indicator panel (figure 4-7, references 2 and 4) located in the radar operator's compartment.

CAUTION

Operating personnel are cautioned against attempting to make adjustments of control points within the units. Changing the settings will result in misalignment and faulty operation of the equipment.

4-133. REMOTE CONTROL C-426/APR-9. The function of the controls and indicating devices and their markings on the panel of remote control C-426/APR-9 are as follows:

a. "POWER OFF-ON."—Switch controls application of power to the entire equipment.

b. "SECTOR SWEEP-MANUAL."—Switch permits selection of manual tuning or automatic sector-sweep tuning.

c. "MAN. TUNE RAISE-LOWER."—Switch manually controls the raising or lowering of the receiver tuned frequency.

d. "BAND SWITCH."—Indicates the band of frequencies covered by the R-F tuner in use.

e. "SECTOR SWEEP—HIGH LIMIT."—Moves the upper pointer along the KMC dial to select the upper frequency limit for automatic sector-sweep tuning.

f. "SECTOR SWEEP—LOW LIMIT."—Moves the lower pointer along the KMC dial to select the lower frequency limit for automatic sector-sweep tuning.

g. "I-F ATT'N."—Varies the gain of the i-f amplifier of the receiver. It is calibrated in approximate decibels (db) below maximum gain.

h. "BANDWIDTH WIDE-NARROW."—Selects either "WIDE" bandwidth with panoramic presentation, or "NARROW" bandwidth which permits separation of closely spaced signals for direction-finding or pulse analysis.

i. "FIXED OSC.—OFF."—Turns the fixed oscillator on or off. The fixed oscillator is used as an aid in accurate tuning, and as an attention-directing device for emphasizing the presence of a signal when searching.

j. "CRYSTAL CURRENT" meter.—Normally reads mixer crystal current (full scale reading is 4 ma).

k. "PRESS FOR LINE VOLTS."—Switch when pressed causes "CRYSTAL CURRENT" meter to read the a-c power line voltage.

l. "AGC-OFF SWITCH."—Turns on or off the automatic gain control.

m. "AUDIO GAIN."—Varies the audio output of the receiver.

n. "PANEL LIGHTS."—Varies the brilliance of the lights on the panel, KMC dial and meter.

o. "BFO-OFF."—Turns the beat frequency oscillator "ON" or "OFF."

4-134. INDICATOR ID-226/APR-9. The function of the controls and indicating devices, together with their markings on the panel of indicator ID-226/APR-9 are as follows:

a. "H. GAIN."—Varies the gain of the horizontal-deflection amplifier and hence the length of the trace on the cathode-ray tube screen.

b. "FOCUS."—Adjusts the focus of the trace on the screen.

c. "V. CENT."—Adjusts the vertical centering of the trace.

d. "H. CENT."—Adjusts the horizontal centering of the trace.

e. "INTENSITY."—Adjusts the brightness of the trace on the scope.

f. "INT. MOD."—Adjusts the amount by which signals brighten the trace.

g. "KILOMEGACYCLES" indicator.—Provides a direct reading of the frequency to which the receiver is tuned.

h. "PANEL LIGHT."—Adjusts the brilliance of the light which illuminates the "KILOMEGACYCLES" indicator.

i. "RESET" Switch, Reset Control and Synchronizing Lamp.—These controls, which are located under the cover marked "RESET," provide means for properly aligning the "KILOMEGACYCLES" indicator with the R-F tuner in use.

4-135. OPERATING PRECAUTIONS.

WARNING

Application of power to radar set AN/APR-9 results in voltages which are dangerous to life. Adjustments or repairs which necessitate removal of the unit dust covers should be attempted only by qualified maintenance personnel, who must observe all safety regulations at all times.

4-136. If the equipment fails to operate normally, turn the "POWER" switch to "OFF," and replace the defective unit with a new unit.

4-137. STARTING AND PREFLIGHT CHECKING THE EQUIPMENT.

4-138. PRELIMINARY CONTROL SETTINGS.

a. See that the Controls on remote control C-426/APR-9 are set as follows:

Control	Setting
"POWER"	"OFF"
"SECTOR SWEEP-MANUAL"	"MANUAL"
"FIXED OSC."	"OFF"
"I-F ATT'N"	Maximum clockwide (0 db)
"BANDWIDTH"	"WIDE"
"BAND SWITCH"	Set to frequency range corresponding to R-F tuner in use.
"AGC"	"OFF"
"AUDIA GAIN"	Maximum clockwise
"PANEL LIGHTS"	Maximum clockwise
"BFO"	"OFF"

b. See that "PANEL LIGHT" control on indicator ID-226/APR-9 is in its maximum (clockwise) position.

4-139. STARTING THE EQUIPMENT. After setting the controls as indicated in the preceding paragraph, throw the "POWER" switch to "ON." Allow about one minute for warm-up time.

WARNING

The application of power to the equipment results in very high voltages which are dangerous to life. Personnel must observe all safety regulations at all times.

4-140. PREFLIGHT CHECKS. The operator should make the following preflight checks before placing the equipment in tactical operation:

a. Depress the "PRESS FOR LINE VOLTS" switch. The line voltage as indicated on the "CRYSTAL CURRENT" meter should be approximately 115 volts.

b. See that the panel lights on both indicator ID-226/APR-9 and remote control C-426/APR-9 are lit. These lights in the remote control C-426/APR-9 indicate the presence of d-c supply voltages in the equipment, while the light in indicator ID-226/APR-9 shows the presence of a-c. Adjust the lights for the desired brilliance by means of the "PANEL LIGHTS" controls on each unit.

c. Plug headphones into the "AUDIO OUTPUT" receptacle on the panel of mixer-amplifier CV-43/-APR-9, or wherever it may appear in the intercommunication system, and check for the presence of noise.

d. Turn the "AUDIO GAIN" control on remote control C-426/APR-9 until the noise is at a satisfactory level.

e. About one minute after the application of power to the equipment, check for the presence of a trace on the oscilloscope.

f. Adjust the "INTENSITY" and "FOCUS" controls on the indicator ID-226/APR-9 panel to obtain a well-defined horizontal trace of reasonable brilliance.

g. Adjust the "V. CENT." control so that the oscilloscope trace is about ½ inch below the center of the screen.

h. Adjust the "H. GAIN" and "H. CENT." controls until the oscilloscope trace occupies nearly the whole width of the tube and is centered in the tube.

i. Set the "BAND SWITCH" so that the range of frequencies exposed is correct for the R-F tuner in use as listed in paragraph 4-177, l.

j. Open the cover marked "RESET" on the indicator ID-226/APR-9, and hold the "MAN. TUNE" switch in the "LOWER" position until the synchronizing lamp on indicator ID-226/APR-9 lights.

k. Set the remote frequency indicator ("KILOMEGACYCLES") to the proper reading as follows:

l. Determine which of the four R-F tuners is in use and select the corresponding alignment frequency from the following list:

R-F Tuner	Frequency Range	Alignment Frequency
TN-128/APR-9	1.00 to 2.60 kmc	1.00 kmc
TN-129/APR-9	2.30 to 4.45 kmc	2.30 kmc
TN-130/APR-9	4.30 to 7.35 kmc	4.30 kmc
TN-131/APR-9	7.05 to 10.75 kmc	7.05 kmc

m. Hold the "RESET" switch in the "COARSE" position and rotate the "RESET" control until "KILO-MEGACYCLES" dial indicates approximately the alignment frequency selected. Then hold the "RESET" switch to the "FINE" position and rotate the "RESET" control until the dial indicates the alignment frequency. Release the "RESET" switch and close the "RESET" cover.

n. Hold the "MAN. TUNE" switch in the "RAISE" position and observe the "CRYSTAL CURRENT" meter reading as the receiver is continuously tuned over its tuning range. The meter indication should remain above 10 throughout the range.

o. Throw the "SECTOR SWEEP-MANUAL" switch to "SECTOR SWEEP" and, by watching the "KILO-MEGACYCLES" indicator, check to see that the receiver frequency is swept back and forth approximately between the frequencies indicated by the pointers on the KMC dial.

p. Return the "SECTOR SWEEP-MANUAL" switch to "MANUAL."

q. Tune in a signal from an external source to check operation of the antenna and preselector circuits. The equipment is now ready for operation.

4-141. STOPPING THE EQUIPMENT. To stop the equipment at any time, throw the "POWER" switch on remote control C-426/APR-9 to "OFF."

4-142. HOMING EQUIPMENT.

4-143. GENERAL. The purpose of the AN/APA-70A homing equipment is to provide a visual indication by means of which an aircraft pilot can direct his aircraft toward a radar or other signal source operating in the frequency range of 1000 to 4500 mc. The equipment is so designed that signals picked up by the antennas are fed through the AN/APR-9 receiver operating in conjunction with the switching unit SA-148/APA-70 and ultimately appear as visual information on the approach indicator ID-24/ARN-9. The correct interpretation of the position of the cross pointers of this meter gives the pilot accurate information in azimuth for homing on the source of the received signal.

4-144. STARTING AND STOPPING THE EQUIPMENT.

4-145. GENERAL. Make sure that the "ON-OFF" switch located on the front panel of the switching unit SA-148/APA-70, is in the "ON" position. The complete equipment is then turned "ON" or "OFF" by the switch which operates at the extreme counterclockwise position of the "SENSITIVITY" control located on the control unit C-473/APA-70 (figure 4-4, reference 22) located in the radar operator's compartment.

4-146. STARTING PROCEDURE.

a. Allow eight to twelve minutes for warm-up before expecting accurate indications.

b. Set the left-hand selector switch of control unit C-473/APA-70 to "HOMING."

c. Set the right-hand selector switch of control unit C-473/APA-70 to "OFF."

d. Turn "SENSITIVITY" knob to the clockwise limit.

e. Plug headset into audio output receptacle on the C-643/APR-9 or into the intercommunication system if RCM receiver output is selected therefrom.

f. Tune receiver AN/APR-9 until a signal is heard, and note frequency.

g. Tune the signal using the signal strength pointer as a tuning indicator.

h. If the signal is subject to side variation in signal strength and direction, change the heading of the aircraft to obtain a steady signal.

i. If the signal strength pointer goes above the horizontal reduce the "SENSITIVITY" setting on the C-426/APR-9 control box to bring it down to about one-quarter deflection and then readjust tuning for accurate setting; tune for maximum signal.

j. Turn the "AVC" switch on control unit C-426/APR-9 to the "AVC" position and proceed to homing operation. Fly to maintain zero indication on the "RIGHT-LEFT" meter pointer.

4-147. PULSE ANALYZER EQUIPMENT.

4-148. GENERAL. Pulse analyzer equipment AN/APA-64A is used to indicate directly, by means of individual meters, the pulse width (PW) and pulse repetition frequency (PRF) of received radar transmissions. The indicators are capable of retaining the PW and PRF of the radar pulse bursts for an interval sufficient to enable recording of the information presented. Successive pulse bursts automatically clear the indicators and indicate the new PW and PRF of the received signals. The meters may be reset manually at any time by the operator to erase stored readings. If two simultaneous pulse bursts are received, proper readings may be obtained by use of the radar receiver sensitivity control, provided one of the bursts has a greater amplitude. The equipment consists of two major units, the RF-38A/APA-64 analyzer, and the ID-228A/APA-64 indicator. The pulse analyzer, used with the AN/APR-9 radar receiver, will operate from positive or negative pulses. An input switch enables adjustment for pulse polarity.

4-149. CONTROLS.

4-150. GENERAL. To increase the accuracy of readings, range switches are provided for both the "PW" and "PRF" meters. These multiply the indications by factors of four for "PW," and of two or ten for "PRF." The scales overlap and cover the following ranges:

a. "PW"—0.5 to 5.0 microseconds (X1)
2.0 to 20 microseconds (X4)
b. "PRF"—50 to 500 p.p.s. (X1)
100 to 1000 p.p.s. (X2)
500 to 5000 p.p.s. (X10)

4-151. The "PW" and "PRF" meters are provided with scales which correspond to the "RANGE" switch settings. The switches on the indicator front panel have the following functions:

a. Power switch.—Energizes the complete equipment.

b. "PW" range switch.—Selects proper range scale on PW meter.

c. "PRF" range switch.—Selects proper range scale on PRF meter.

d. Reset switch.—Manually clears both "PW" and "PRF" meters of stored readings. To operate, press down and release.

4-152. OPERATION OF PULSE ANALYZER EQUIPMENT.

a. Set the "POWER" switch to "ON" and allow approximately five minutes for the tubes to reach stable operating temperatures.

b. Clear the "PW" and "PRF" meters by means of the "RESET" switch.

c. Operate the range switches to the proper scales to provide the greatest accuracy of reading. If the meter indication is off scale, use the highest range. If no readings are obtained under known conditions of pulse burst reception, check the operation of the radar receiver and adjust the sensitivity if necessary. Care should be taken in adjusting the receiver sensitivity to prevent receiver noise from producing erroneous reading. Receiver gains should be adjusted to a point just below a point required to produce meter readings when no signal is present.

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 as indicated on the Maximum Endurance Flight Operating Instruction chart, figure A–8. It is recommended that 1400 rpm be used and the manifold pressure adjusted to provide the power necessary for the flight speeds. This engine speed may not be sufficient to supply full generator load, therefore, unnecessary electrical loads should be turned off.

A–5. 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–6. 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 approximately 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. Mover 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–7. 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 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 320 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.

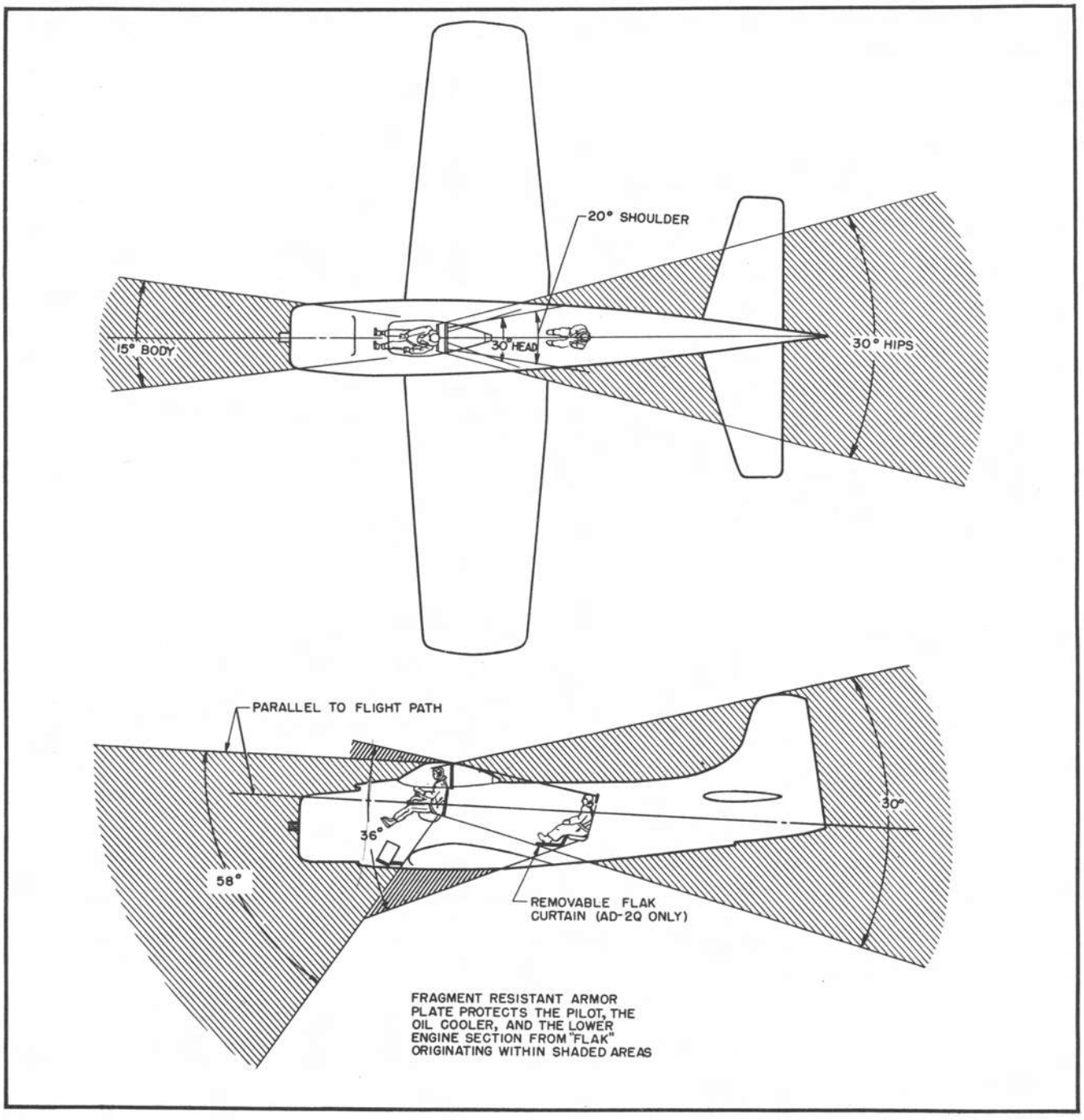


Figure A-1. Protection from Gunfire Diagram

FLAPS DOWN—GEAR DOWN			FLAPS UP—GEAR UP		
	Power ON	Power OFF		Dive Brakes Closed	Dive Brakes Open
I.A.S. (Knots)	Correction (Knots)	Correction (Knots)	I.A.S. (Knots)	Correction (Knots)	Correction (Knots)
70	Deduct 3	Add 1	100	Add 3	
80	Deduct 3	Add 1	150	Add 2	Deduct 6
90	Deduct 2	Add 0	200	Add 3	Deduct 8
100	Deduct 2	Add 0	250	Add 4	Deduct 10
110	Deduct 2	Add 0	300	Add 4	Deduct 12
120	Deduct 3	Add 0	350	Add 5	
130	Deduct 5	Add 1	400	Add 6	

Notes

1. 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.
2. In steep dives with the brakes open, the altimeter can read as much as 500 feet too HIGH due to position error and lag. The pilot should make allowance for this error if the altimeter is being used to determine terrain clearance.

Figure A-2. Airspeed Installation Correction Table

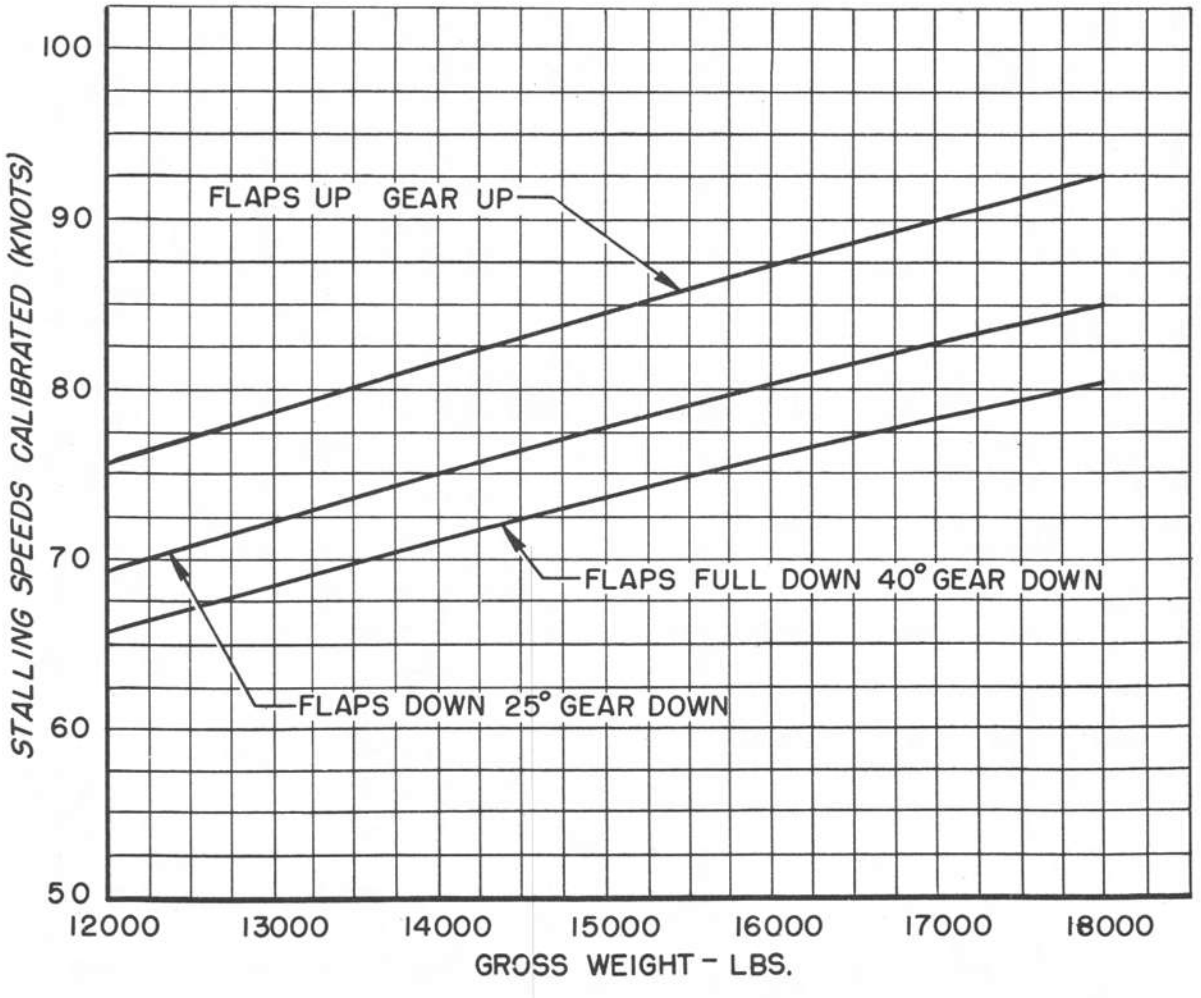


Figure A-3. Stalling Speed vs. Gross Weight Relationships

AIRCRAFT MODEL(S)

AD-2 SERIES
AD-3 SERIES
AD-4 SERIES

POWER PLANT CHART

PROPELLER (S)
AEROPRODUCTS A-642-G5/M20B-162-0
OR A-642-G8/M20A-162-0

ENGINE MODEL (S)

R3350-26W OR
R3350-26WA

GAUGE READING	FUEL PRESS.	OIL PRESS (REAR)	OIL PRESS (FRONT)	OIL TEMP. °C
DESIRED MAXIMUM	20 21	70 75	35(3) 40	85 95
MINIMUM IDLING	19 13	65 15	30	30

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

OIL GRADE: (S)1120 (W)1100
FUEL GRADE: 115/145(4)

WAR EMERGENCY (COMBAT EMERGENCY)			MILITARY POWER (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE (NORMAL OPERATION)		
5 MINUTES 260°C			30 MINUTES 260°C			TIME LIMIT MAX. CYL. HD. TEMP.			UNLIMITED 245°C			UNLIMITED 230°C		
NORMAL OR RICH 2900(LOW) 2600(HIGH)			NORMAL (5) 2900(LOW) 2600 (HIGH)			MIXTURE R. P. M.			NORMAL 2600			NORMAL (5) 2200		
MANIF. PRESS.	SUPER-CHARGER	FUEL (1) LBS./MIN.	MANIF. PRESS.	SUPER-CHARGER	FUEL (1) LBS./MIN.	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL (2) LBS./HR.	MANIF. PRESS.	SUPER-CHARGER	FUEL (2) LBS./HR.
						-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						
			F. T.	HIGH	15.8	-44.4	30,000 FT.	-48.0	F. T.	HIGH	915	F. T.	HIGH	480
			F. T.	HIGH	17.0	-40.5	28,000 FT.	-40.9	F. T.	HIGH	1000	F. T.	HIGH	540
			F. T.	HIGH	19.2	-36.5	26,000 FT.	-33.7	F. T.	HIGH	1090	F. T.	HIGH	590
			F. T.	HIGH	21.2	-32.5	24,000 FT.	-26.5	F. T.	HIGH	1270	F. T.	HIGH	650
			F. T.	HIGH	23.4	-28.6	22,000 FT.	-19.4	F. T.	HIGH	1510	32.0	HIGH	680
			F. T.	HIGH	25.5	-24.6	20,000 FT.	-12.3	F. T.	HIGH	1525	32.0	HIGH	670
			F. T.	HIGH	27.4	-20.7	18,000 FT.	- 5.2	46.5	HIGH	1580	32.0	HIGH	660
			51.5	HIGH	30.0	-16.7	16,000 FT.	2.0	46.5	HIGH	1615	F. T.	LOW	655
F. T.	HIGH	24.5	F. T.	LOW	28.2	-12.7	14,000 FT.	9.1	F. T.	LOW	1265	30.5	LOW	670
F. T.	HIGH	26.5	F. T.	LOW	30.4	- 8.8	12,000 FT.	16.2	F. T.	LOW	1500	30.5	LOW	680
F. T.	HIGH	28.6	F. T.	LOW	32.4	- 4.8	10.000 FT.	23.4	F. T.	LOW	1720	30.5	LOW	680
F. T.	LOW	26.8	F. T.	LOW	34.5	- 0.8	8.000 FT.	30.5	45.5	LOW	1780	30.5	LOW	625
F. T.	LOW	28.8	54.5	LOW	37.0	3.1	6.000 FT.	37.6	45.5	LOW	1760	30.5	LOW	595
F. T.	LOW	30.8	54.5	LOW	37.4	7.1	4,000 FT.	44.7	45.5	LOW	1700	30.5	LOW	575
61.5	LOW	32.5	54.5	LOW	37.4	11.0	2,000 FT.	51.8	45.5	LOW	1700	30.5	LOW	555
61.5	LOW	32.5 (6)	54.5(4)	LOW	37.2 (6)	15.0	SEA LEVEL	59.0	45.5(4)	LOW	1640(6)	30.5 (4)	LOW	540(6)

GENERAL NOTES

(1) LBS/MIN: APPROXIMATE POUNDS PER MINUTE PER ENGINE
(2) LBS/HR: APPROXIMATE POUNDS 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 DETERMINE CONSUMPTION IN GPH DIVIDE FUEL IN LBS/HR BY 6.

TAKE-OFF CONDITIONS: 56.0 IN HG. MP, 2900 RPM, RICH MIXTURE, CYL. TEMP. 260°C.

CONDITIONS TO AVOID: NONE

SPECIAL NOTES

(3) FOR ENGINES WHICH HAVE NOT BEEN MODIFIED TO INCORPORATE THE LOWER PRESSURES, CORRECT PRESSURES ARE: MINIMUM - 50, MAXIMUM - 60. ENGINE DATA PLATE ON NOSE SECTION GIVES APPLICABLE PRESSURES.

(4) FOLLOWING LIMITS ARE TO BE OBSERVED WHEN USING GRADE 100/130 FUEL:

TAKE OFF: 46.0 IN. HG., 2900 RPM, RICH MIXTURE
MILITARY: 46.0 IN. HG., 2900 RPM, NORMAL MIXTURE
NORMAL: 40.5 IN. HG., 2600 RPM, NORMAL MIXTURE
MAX. CRUISE: 29.0 IN. HG., 2200 RPM, NORMAL MIXTURE
LOW BLOWER ONLY.

(5) IF CYLINDER TEMPERATURES LIMITS CANNOT BE MAINTAINED IN NORMAL, MOVE MIXTURE TO RICH POSITION.
(6) FUEL CONSUMPTION HAS NOT BEEN INCREASED ABOVE TEST DATA.

DATA AS OF 12 DEC 49 BASED ON CONTRACTOR'S FLIGHT TEST REPORT 26 SEP 49 AND NATC COMBAT EVALUATION REPORT 15 NOV 49.

Figure A-4. Power Plant Chart

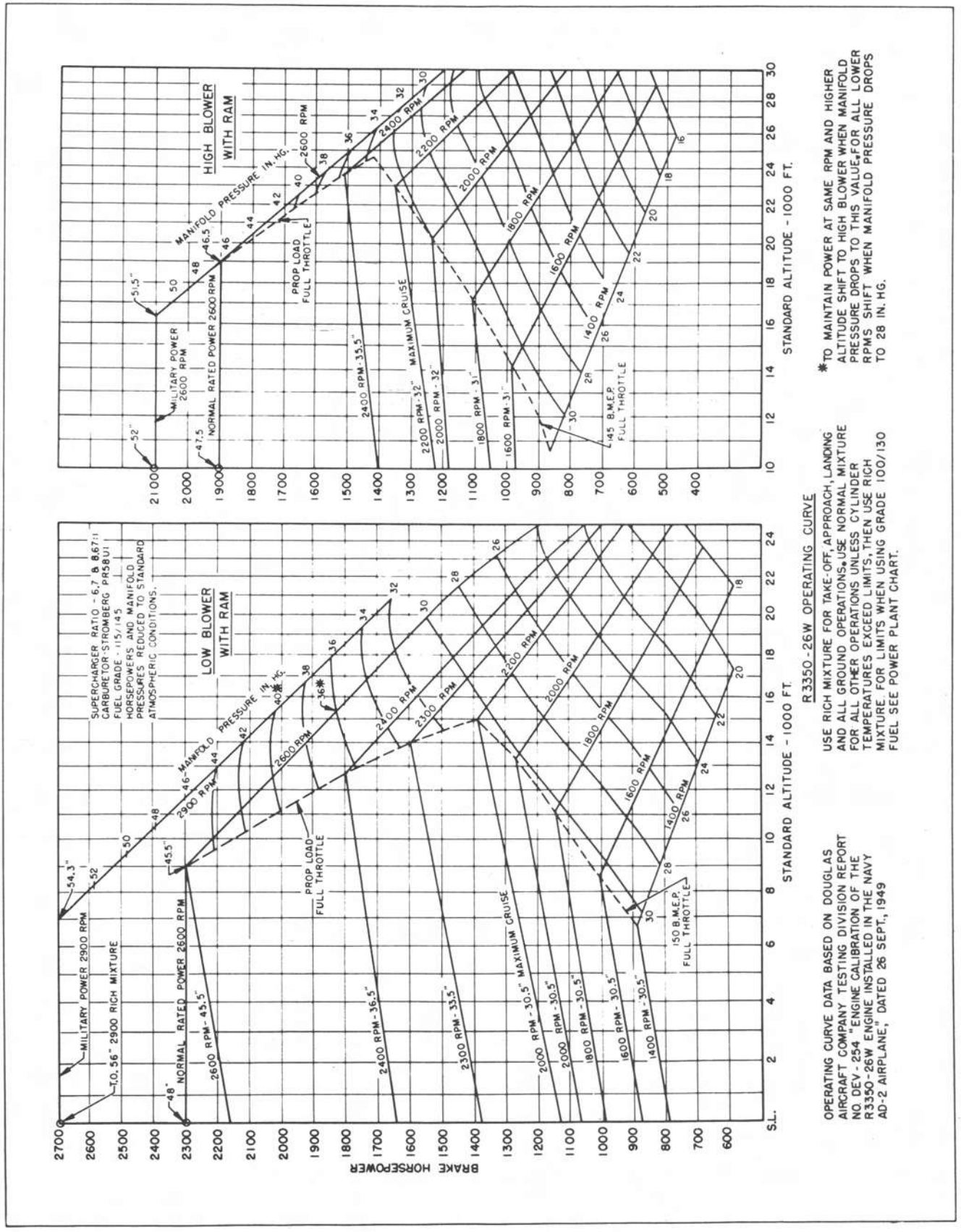
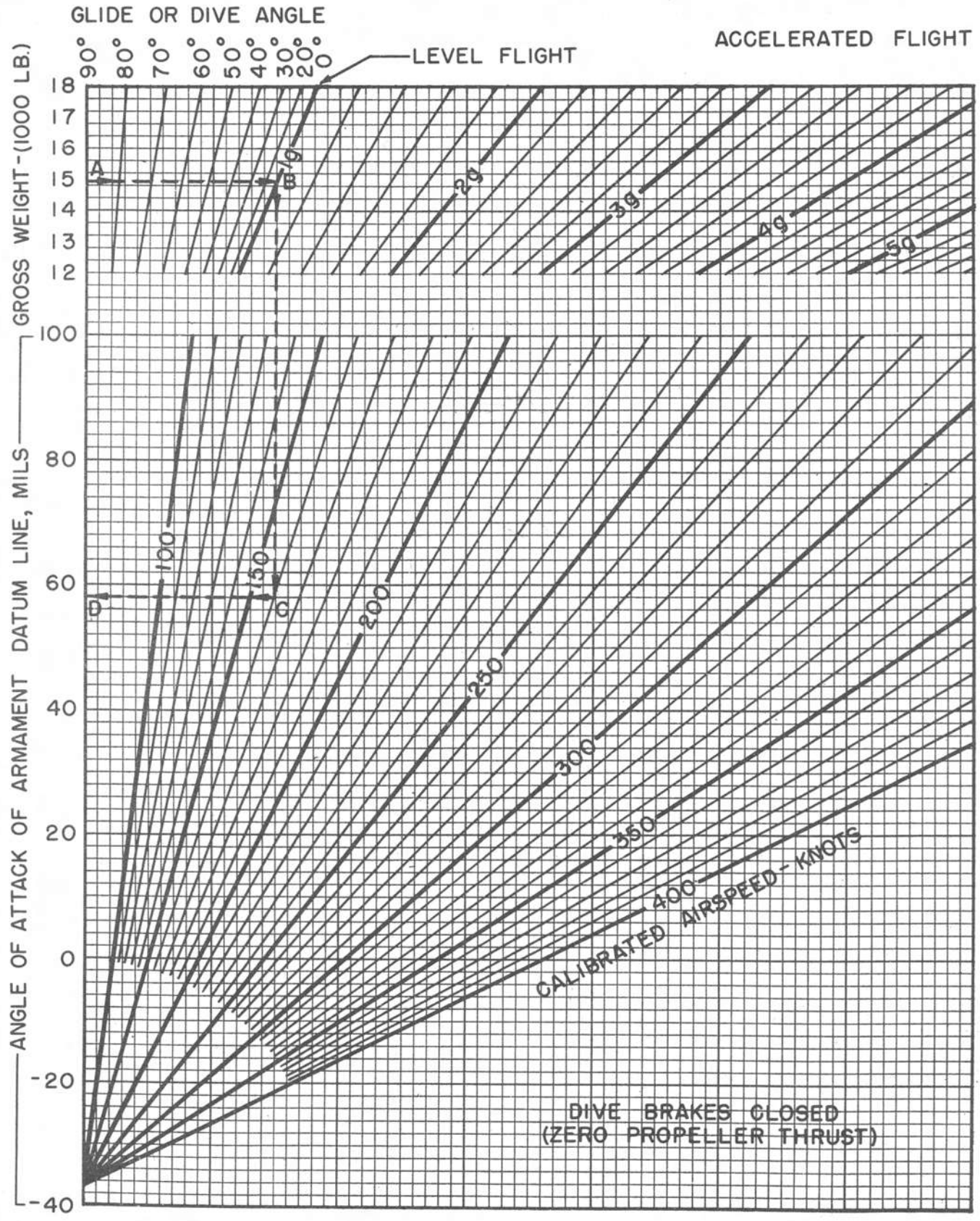
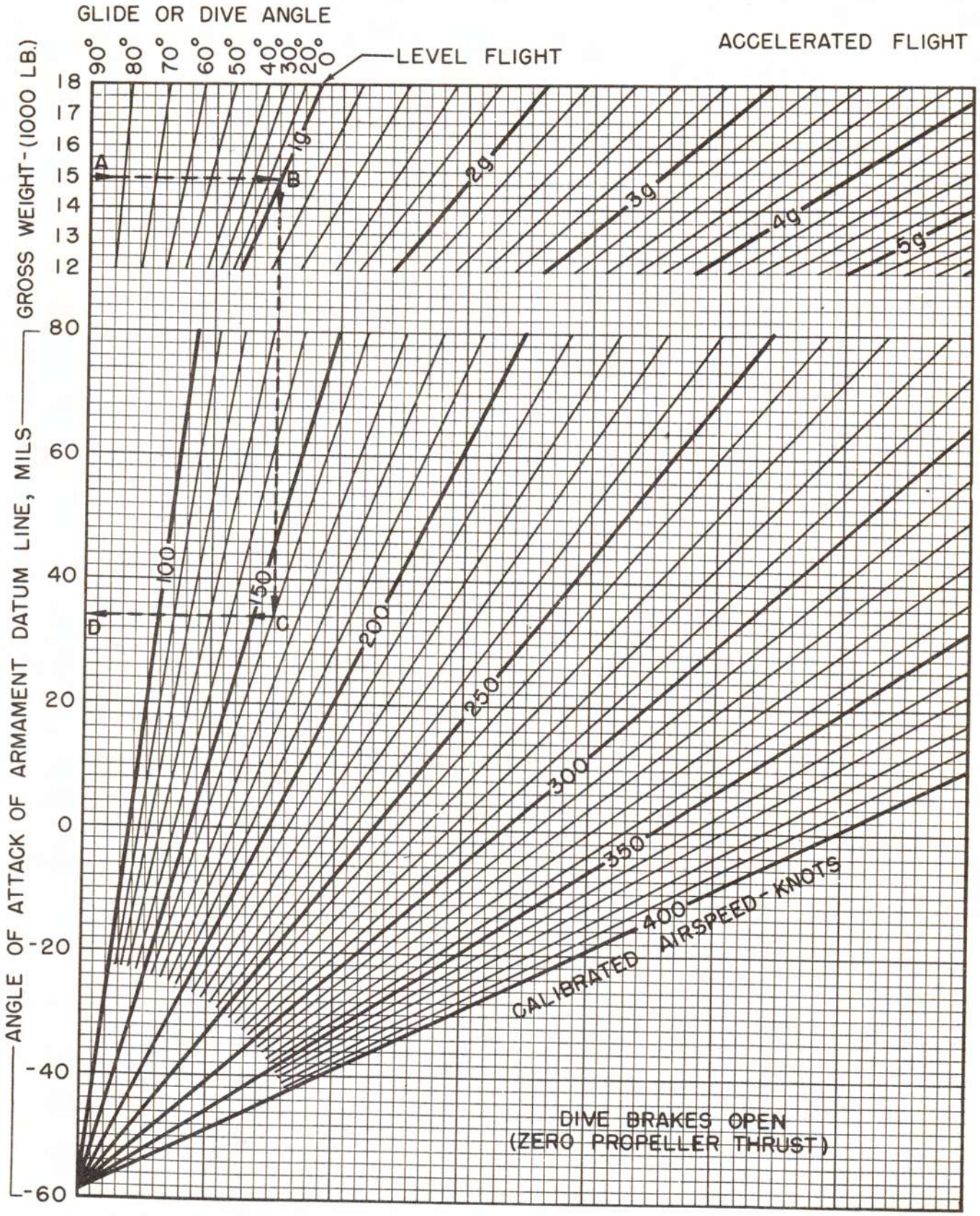


Figure A-5. Engine Calibration Curve



Cruising Condition

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

AAFRC-527
8-1-48

AIRCRAFT MODEL(S)
AD-2, AD-2Q

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
R3350-26W OR R3350-26WA
PROPELLER
A642-G5/M20B-162-0

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	1285	2160	1440	2550	1785	3120	1360	2260	1530	2690	1915	3300	1890	2570	1825	3110	2340	3900
		15	895	1640	1010	1970	1280	2430	950	1720	1075	2070	1370	2570	1310	1940	1280	2380	1680	3020
		25	660	1320	750	1590	970	2000	700	1370	800	1680	1040	2110	970	1560	955	1930	1270	2480
		35	485	1040	535	1270	710	1600	515	1080	570	1330	760	1690	715	1220	680	1530	945	1980
18,000		0	990	1700	1160	2000	1435	2420	1040	1760	1215	2090	1505	2540	1460	1950	1415	2350	1800	2920
		15	675	1370	800	1520	1010	1860	705	1310	845	1580	1071	1950	1035	1460	975	1780	1270	2330
		25	485	1000	585	1220	755	1510	510	1040	620	1270	801	1580	780	1150	715	1420	950	1800
		35	330	770	410	950	540	1190	335	800	430	990	574	1250	560	880	500	1100	680	1420
16,000		0	740	1290	905	1520	1115	1820	778	1330	950	1570	1170	1900	1140	1450	1065	1730	1340	2120
		15	485	950	615	1130	770	1370	510	980	640	1160	810	1430	780	1060	720	1280	925	1590
		25	340	740	440	890	555	1090	355	760	460	920	591	1140	570	820	520	1000	680	1260
		35	220	560	300	680	395	850	230	570	310	700	415	880	410	620	350	760	475	980
14,000		0	535	970	685	1130	845	1360	555	990	710	1160	875	1400	850	1060	775	1250	975	1540
		15	335	690	450	820	555	1000	350	710	465	840	550	1030	1010	750	510	900	655	1130
		25	225	530	315	630	405	780	235	540	325	650	430	810	790	570	355	690	470	880
		35	140	390	205	470	270	590	145	390	210	480	280	610	570	420	230	510	315	660

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

(1) USE 40° FLAPS (FULL DOWN) FOR MINIMUM GROUND RUN TAKE-OFF.

(2) USE 25° FLAPS FOR TAKE-OFF OVER OBSTACLE.

NORMAL TAKE-OFF WITH 2900 RPM, 56.5 IN.HG. IS 100% OF CHART VALUES

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST AND CALCULATION

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	780	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		138	1760	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		138	2330	6.5	473		130	1980	7.5	530		120	1300	10.5	590

POWER PLANT SETTINGS: (DETAILS ON FIG. A-4) NORMAL RATED POWER

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

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

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	2860	1520	3090	1670	3350	3430	4900	3750	5320	4110	5790
14,000				85	1080	2410	1180	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

Figure A-7 (Sheet 1 of 2 Sheets). Take-Off, Climb and Landing Chart

AIRCRAFT MODEL(S)
AD-3, AD-3Q,

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
R3350-26WA

PROPELLER
AERO PRODUCTS A-642-08/M20A-162-0

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	0	1165	1960	1330	2260	1520	2630	1225	2050	1415	2370	1625	2780	1400	2290	1595	2680	1830	3150
	15	15	810	1490	935	1740	1070	2040	850	1550	1010	1820	1175	2120	970	1730	1170	2060	1345	2480
	25	25	600	1200	720	1410	815	1810	630	1250	760	1470	870	1900	710	1380	880	1680	1010	2190
	35	35	420	940	515	1120	705	1450	440	970	545	1170	745	1520	505	1080	630	1320	850	1750
18,000	0	0	895	1550	1045	1780	1220	2210	935	1600	1095	1850	1405	2310	1050	1750	1240	2040	1615	2610
	15	15	610	1160	725	1350	840	1700	635	1190	755	1400	895	1770	710	1310	860	1540	1150	2000
	25	25	440	910	530	1080	700	1380	455	940	555	1120	740	1440	510	1030	630	1230	860	1620
	35	35	300	700	370	840	505	1090	310	730	385	880	535	1140	350	790	440	960	620	1280
16,000	0	0	685	1170	780	1350	915	1630	690	1210	810	1390	1035	1700	755	1300	880	1510	1165	1900
	15	15	435	860	515	1000	695	1250	450	890	545	1030	710	1280	495	950	610	1120	805	1430
	25	25	305	670	375	790	485	1000	315	690	390	810	520	1020	355	740	440	880	585	1140
	35	35	195	500	250	600	340	780	205	520	260	620	360	790	225	550	280	670	405	880
14,000	0	0	480	880	595	1010	710	1240	495	900	595	1030	745	1280	535	960	655	1100	820	1380
	15	15	300	630	355	730	475	920	310	650	375	750	495	940	335	690	410	800	545	1020
	25	25	200	480	250	560	335	720	210	490	260	570	350	740	225	520	280	610	385	790
	35	35	125	350	160	420	210	540	135	360	165	430	230	560	135	380	175	450	255	600

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

(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 IN.HG. IS 100% OF CHART VALUES

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

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		148	1040	7.5	545		140	780	13.0	699		138	380	22.0	920					
18,000		140	1970	316		140	1890	2.5	398		140	1470	5.5	486		140	1180	9.5	590		138	800	14.5	713		135	170	26.5	944
16,000		135	2570	316		135	2500	2.0	379		135	2080	4.0	445		135	1780	6.5	517		130	1420	10.0	593		130	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	1080	7.5	530		130	1300	10.5	590

POWER PLANT SETTINGS: (DETAILS ON FIG. A-4) NORMAL RATED POWER

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

DATA AS OF 1 MAY 1949 BASED ON: FLIGHT TEST

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	2860	1520	3090	1670	3350	3430	4900	3750	5320	4110	5790
14,000				85	1080	2410	1180	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

Figure A-7 (Sheet 2 of 2 Sheets). Take-Off, Climb and Landing Chart

AAFMC-528 8-1-44

AIRCRAFT MODEL(S)
AD-2, AD-2Q, AD-3, AD-3Q
SCOUT CONFIGURATION

ENGINE(S): R3350-26W OR R3359-26WA

FLIGHT OPERATION INSTRUCTION CHART

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

EXTERNAL LOAD ITEMS
AN/APS-4 RADAR

LIMITS	RPM	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB. P.H.
WAR EMERG.	2900	61.5	LOW	RICH	5	260°	1950
	2600	F.T.	HIGH	RICH	5	260°	1716
MILITARY POWER	2900	54.5	LOW	NORMAL	30	260°	2244
	2600	51.5	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							COLUMN II							COLUMN III							COLUMN IV							COLUMN V					
RANGE IN AIRMILES						FUEL LBS.	RANGE IN AIRMILES						FUEL LBS.	RANGE IN AIRMILES						FUEL LBS.	RANGE IN AIRMILES						FUEL LBS.	RANGE IN AIRMILES					
STAUTE		NAUTICAL					STATUTE		NAUTICAL					STATUTE		NAUTICAL					STATUTE		NAUTICAL					STATUTE		NAUTICAL			
						2280	← FULL INTERNAL FUEL →						2280																					
337		293				1964	588		511				1964	905		786				1964	1221		1060				1964	1332		1157			
309		268				1800	539		468				1800	829		720				1800	1119		972				1800	1220		1060			
258		224				1500	449		390				1500	691		600				1500	933		810				1500	1017		884			
206		179				1200	359		312				1200	553		480				1200	746		648				1200	814		707			
155		134				900	269		234				900	415		360				900	560		486				900	610		530			
103		89				600	180		156				600	276		240				600	373		324				600	407		353			
52		45				300	90		78				300	138		120				300	187		162				300	203		177			
MAXIMUM CONTINUOUS						PRESS ALT. FEET	(299 STAT. (.26 NAUT.) MI./LB.)						PRESS ALT. FEET	(.461 STAT. (.40 NAUT.) MI./LB.)						PRESS ALT. FEET	(.622 STAT. (.54 NAUT.) MI./LB.)						PRESS ALT. FEET	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.		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.		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							40000							40000						
						35000							35000							35000							35000						
						30000							30000							30000							30000						
2600	F.T.	NORMAL	1013	362	314	25000			NORMAL					2400	31.5	NORMAL	746	343	298		2190	F.T.	NORMAL	474	295	256	25000	1890	FT	NORMAL	347	242	210
2600	F.T.	NORMAL	1490	371	322	20000	2530	42.0	NORMAL	1208	362	314		2440	28.0	NORMAL	728	335	291		2030	22.5	NORMAL	461	287	249	20000	1690	19.0	NORMAL	326	230	200
2600	46.5		1590	358	311	15000	2570	35.5		1169	350	304		2300	29.0		685	316	274		1880	23.0		419	260	226	15000	1620	20.5		300	211	183
2600	F.T.		1796	358	311	10000	2420	36.5		1131	339	294		2170	30.5		638	294	255		1670	25.5		389	242	210	10000	1400	24.0		283	196	170
2600	45.5		1900	345	300	5000	2370	37.5		1069	320	278		2070	31.0		595	274	238		1510	27.5		359	223	194	5000	1400	24.5		274	187	162
2600	45.5		1900	327	284	S.L.	2350	38.0		992	297	258		1990	31.5		555	256	222		1430	29.0		333	207	180	S.L.	1400	25.0		259	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 1980 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

Figure A-8 (Sheet 1 of 5 Sheets). Flight Operating Instruction Charts

AAFMC-528 4-1-48

AIRCRAFT MODEL(S)
AD-2, AD-2Q, AD-3, AD-3Q
BOMBER CONFIGURATION
ENGINE(S): R3350-26W OR 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-4 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.
WAR EMERG.	2900	61.5	LOW	RICH	5	260°	1950
	2600	F.T.	HIGH	RICH	5	260°	1716
MILITARY POWER	2900	54.5	LOW	NORMAL	30	260°	2244
	2600	51.5	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). 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			
						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	F.T.	NORMAL	1013	333	289	25000			NORMAL				2470	F.T.	NORMAL	824	322	280	2270	FT	NORMAL	509	264	229	25000			NORMAL			
2600	F.T.	NORMAL	1490	343	298	20000	2560	43.0	NORMAL	1339	339	294	2520	28.9	NORMAL	806	316	274	2170	24.5	NORMAL	534	277	240	20000	1920	21.5	NORMAL	424	237	206
2600	46.5		1590	333	289	15000	2600	F.T.		1295	328	285	2380	31.0		766	300	260	2020	25.0		484	251	218	15000	1830	22.5		393	218	189
2600	F.T.		1796	333	289	10000	2460	38.0		1259	319	277	2250	32.0		722	283	246	1850	27.0		453	235	204	10000	1600	25.0		363	202	175
2600	45.5		1900	320	278	5000	2400	38.5		1191	302	262	2170	32.5		673	264	229	1700	28.0		422	219	190	5000	1430	27.5		337	188	163
2600	45.5		1900	304	264	S.L.	2380	39.0		1114	282	245	2110	33.0		629	246	214	1610	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-4 RADAR, AND ONE 150 GAL. (900#) DROP TANK.
(b) TWO 1000# BOMBS.
(c) TWO 150 GAL. (900#) DROP TANKS AND AN/APS-4 RADAR.
(d) ONE TORPEDO AND AN/APS-4 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

Figure A-8 (Sheet 2 of 5 Sheets). Flight Operating Instruction Charts

AAFMC-528 6-1-48

AIRCRAFT MODEL(S)
AD-2, AD-2Q, AD-3, AD-3Q
LONG RANGE BOMBER CONFIGURATION
ENGINE(S): R3350-26W OR R3350-26WA

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.	FOR DETAILS SEE POWER PLANT CHART (FIG. A-4).
WAR	2900	61.5	LOW	RICH	5	260°	1950	
EMERG.	2600	F.T.	HIGH	RICH	5	260°	1716	
MILITARY	2900	54.5	LOW	NORMAL	30	260°	2244	
POWER	2600	51.5	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).(2) TO OBTAIN U.S. GALLONS (OR G.P.H.): DIVIDE FUEL IN POUNDS (OR LB. P.H.) BY 6.

COLUMN I RANGE IN AIRMILES STAUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL LBS.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II RANGE IN AIRMILES NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III RANGE IN AIRMILES NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL LBS.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES 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	855	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 R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(.259 STAT. (.225 NAUT.) MI./LB.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(.346 STAT. (.30 NAUT.) MI./LB.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(.415 STAT. (.36 NAUT.) MI./LB.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. LB.P.H	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	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.
						40000																				40000						
						35000																				35000						
						30000																				30000						
2600	F.T.	NORMAL	1013	303	263	25000			NORMAL				2480	FT	NORMAL	833	288	250			NORMAL					25000			NORMAL			
2600	F.T.		1490	319	277	20000	2520	41.5		1195	310	269	2560	29.5		848	293	254	2310	26.0		631	261	227	20000	2240	25.5		574	244	212
2600	46.5		1590	310	269	15000	2570	35.5		1164	302	262	2340	30.0		813	281	244	2200	27.5		600	249	216	15000	2100	26.0		525	227	197
2600	F.T.		1796	311	270	10000	2420	36.5		1128	292	254	2280	32.5		773	267	232	2080	29.0		569	236	205	10000	1940	27.5		489	213	185
2600	45.5		1900	299	260	5000	2370	37.5		1067	276	240	2200	33.0		723	250	217	1950	29.5		533	221	192	5000	1770	28.5		454	198	172
2600	45.5		1900	284	247	S.L.	2340	38.0		991	257	223	2170	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. **EXAMPLE**

(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-4 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

Figure A-8 (Sheet 3 of 5 Sheets). Flight Operating Instruction Charts

AAFHC-528 6-1-48

AIRCRAFT MODEL (S)
AD-2, AD-2Q, AD-3, AD-3Q
LONG RANGE BOMBER CONFIGURATION
ENGINE (S): R3350-26W OR 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	RPM	M.P. IN. HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL LB.P.H.
WAR EMERG.	2900	61.5	LOW	RICH	5	260°	1950
	2600	F. T.	HIGH	RICH	5	260°	1716
MILITARY POWER	2900	54.5	LOW	NORMAL	30	260°	2244
	2600	51.5	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							RANGE IN AIRMILES						RANGE IN AIRMILES						RANGE IN AIRMILES							RANGE IN AIRMILES					
STAUTE		NAUTICAL				LBS.	STATUTE		NAUTICAL				STATUTE		NAUTICAL				STATUTE		NAUTICAL				LBS.	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 ALT. FEET	(230 STAT. (.20 NAUT.) MI./LB.)						(288 STAT. (.25 NAUT.) MI./LB.)						(STAT. (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.
						40,000																			40,000						
						35,000																			35,000						
						30,000																			30,000						
			1013			25,000																			25,000						
2600	F. T.	NORMAL	1490	293	255	20,000	2530	42.0	NORMAL	1225	282	245	2600	F. T.	NORMAL	904	260	226							20,000						
2600	46.5		1590	289	251	15,000	2580	36.0		1225	282	245	2470	33.0		920	265	230							15,000	2360	30.5	NORMAL	744	237	206
2600	F. T.		1796	294	255	10,000	2430	37.0		1205	278	241	2350	34.5		900	259	225							10,000	2220	31.0		667	228	198
2600	45.5		1900	283	246	5,000	2390	38.0		1140	262	228	2280	35.0		846	244	212							5,000	2080	31.0		604	207	180
2600	45.5		1900	270	233	S.L.	2370	39.0		1070	246	214	2250	35.5		788	227	197							S.L.	2000	31.5		560	192	167

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

Figure A-8 (Sheet 4 of 5 Sheets). Flight Operating Instruction Charts

AIRCRAFT MODEL(S) AD-2, AD-20, AD-3 AND AD-3Q ENGINE: R-3350-26W OR -26WA	**FLIGHT OPERATION INSTRUCTION CHART** MAXIMUM ENDURANCE	EXTERNAL LOAD ITEM: AN/APS-4 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. A-7) 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

Figure A-8 (Sheet 5 of 5 Sheets). Flight Operating Instruction Charts